6　すばる FITS ヘッダ統一案 (観測装置開発者に向けて)

「すばる」立ち上げを控え、「すばる」に関連した FITS データの共通ヘッダー、観測装置固有ヘッダー、サンプルヘッダー案が改訂されたので、それをここに紹介する。(この項目は改訂が頻繁に行なわれているので最新情報は Web 上を参照のこと (7.4.4 節参照。ただしアクセス制限あり)。)

(この節は「すばる FITS 検討会」(小杉、市川、濱部、水本、矢動丸、金光、高田、洞口、泉浦、渡辺、青木 (賢、和) 他すばる各観測装置開発者の協力による。)

6.1　すばる FITS ヘッダールール (Ver.1.0.2(May 20, 1998))

すばるの観測装置で取得されたデータは、全て観測装置から FITS 形式で出力される。これらの FITS データはハワイ島ヒロの山麓施設（ハワイ観測所）でアーカイブされ、将来公開される予定である。アーカイブの検索項目は、基本的に全て FITS ヘッダーに含まれていなければならない。また、いくつもの観測装置のデータを一括して検索できるようにするためにも、FITS キーワードは可能な限り観測装置間で共通化すべきである。データ解析に関しては、解析に必要なパラメータは FITS ヘッダーから抽出される場合が多い。解析処理ソフトウェアの共通化による開発作業の省力化を図るためにも FITS キーワードの共通化が望まれる。　そこで、すばるでは以下の FITS ヘッダールールを定める。

- 基本的に FITS のルール（NOST Standard、 この手引き第 3 章参照）に従う。
- ヘッダー辞書（次節参照）で定義されたのキーワードを、定義した意味以外では使用しない。また、ヘッダー辞書内で Common と分類されたキーワードは必ず使用しなければならない。(なぜこれらのキーワードがすばる FITS データで重要なのか、は下の注を参照。)
- 観測装置固有ヘッダー一覧は共通ヘッダーキーワードと同様に観測装置グループが辞書を作成し、公開しなければならない（装置固有ヘッダー辞書参照)。
- 観測装置固有キーワードは、以下に例示するような'COMMENT' で始まる行を挿入することによりブロック化する。
  COMMENT Subaru Device Dependent Header Block for FOCAS
- 観測装置固有のヘッダーは、頭２文字を装置ＩＤとして与え、残り 6 文字を装置開発者が自由に使用する。その際可能な限り略号表に従った記述を行う。装置 ID は 'A_', 'B_', 'C_' のような形式とし、重複は許されない。現在、'C_': CIAO、'F_': FOCAS、'H_': HDS、'M_': MIRTOS、'O_': OHS、'S_': Suprime-Cam, が予約されている。
- キーワード作成時の略号の組み合わせ順序は、キーワードのカテゴリーを参照して
  Image,Instrument,Telescope / Time / Environment / Statistics,Unit / Action
  とする（略号表 (6.4 節) 参照、各略号はさらに短縮可能)。例えば、露出開始時のスリットポジションアングルは、スリット: SLT、ポジションアングル: P/PA、露出開始時: STR を組み合わせて作成するが、その順序は、SLT (Category = Instrument)、P/PA (Statistics / Unit)、STR (Action) となり、キーワードは SLT_PSTR となる。
- 撮像観測の場合は WCS を記述する。
- Extension については ASCII Table Extention のみが使用可能である。
- 天体名は可能な限り IAU 表記に従う。

- 値の単位は辞書の記述に従うが、基本的に SI 単位系とする。
- インラインコメントにはキーワードの意味、及び、値の単位が明示される。
- ピクセルの座標値はピクセル中央を基準とし、ピクセル番号は 1 から始まる。

(注: なぜ COMMON キーワードがすばる FITS データで重要なのか)

Keyword Name	**Reason**
AIRMASS	Roughly estimated one is convenient in archival search
BIN-FCT1	The basic keyword for image features
BIN-FCT2	The basic keyword for image features
BITPIX	The basic keyword for image features
BLANK	The basic keyword for image features
BSCALE	The basic keyword for image features
BUNIT	The basic keyword for image features
BZERO	The basic keyword for image features
CDELT1	The basic keyword for image features
CDELT2	The basic keyword for image features
CRPIX1	The basic keyword for image features
CRPIX2	The basic keyword for image features
CRVAR1	The basic keyword for image features
CRVAR2	The basic keyword for image features
CTYPE1	The basic keyword for image features
CTYPE2	The basic keyword for image features
CUNIT1	The basic keyword for image features
CUNIT2	The basic keyword for image features
DATASET(*)	Only needed to OBJECT type data. Needed by DASH.
DATA-TYP	Used as an key for archival search and essential for data alalysis.(DASH etc)
DATE-OBS	The basic keyword for image features
DEC	The basic keyword for image features (origin of RA2000 & DEC2000)
DEC2000	DEC may not be written in J2000.0. The key for archival search by coordinate.
DETECTOR	The basic keyword for image features
DET-TMP	The basic keyword for image features
DISPAXIS(S)	Convenient in spectrum plotting of raw data.
DISPERSR(S)	The basic keyword for image features
END	Essential for FITS data
EQUINOX	Essential for knowing RA and DEC eposh, and calculating RA2000 & DEC2000
EXP-ID	For the grouping of data by simultaneous exposure.
EXPTIME	The basic keyword for image features
EXTEND	Essential for FITS data with ASCII Table Extensions.
FOC-POS	The basic keyword for observation description
FOC-VAL	Needed by QDAS in ficusing task.
FRAMEID	This is the unique key for archival system.
GAIN	The basic keyword for image features
HST	The basic keyword for observation description
INSTRUME	This is used in online data registration at Hilo.
LONGPOLE(I)	The basic keyword for image features
LST	The basic keyword for observation description
MJD	This is used in data search as a unique key for time.
NAXIS	Essential for FITS data
NAXIS1	Essential for FITS data with 2-d image
NAXIS2	Essential for FITS data with 2-d image
NAXIS3	Essential for FITS data with 3-d image as those from MIRTOS
OBJECT	The basic keyword for observation description
OBS-ALOC	Can identify the control mode and where the instrument was.
OBSERVAT	The basic keyword for observation description
OBSERVER	The basic keyword for observation description
OBS-MOD	The key for selecting data in data search in archival system
PCnnnmmm(I)	Essential for setting control comamnd to telescope (moving object onto the slit etc)
POLARIZn(P)	The basic keyword for observation description
PROP-ID	Essential for setting view parameter in archival system
RA	The basic keyword for observation description (origin of RA2000 & DEC2000)
RA2000	RA may not be written in J2000.0. Key for archival search by coordinate.
RADECSYS	RA and DEC may not be written in FK5.
RET-ANGn(P)	Essential in data analysis of polarimetric data.
RETPLATn	The basic keyword for observation description
SIMPLE	Essential for FITS data
SLIT(S)	The basic keyword for observation description
SLTCPIX1(S)	Convenient in making plot of raw data spectrum
SLTCPIX2(S)	Convenient in making plot of raw data spectrum
SLT-LEN(S)	The basic keyword for observation description
SLT-PA(S)	The basic keyword for observation description
SLT-WID(S)	The basic keyword for observation description
TELESCOP	Essential for knowing the origin of data
TELFOCUS	Can be one of the key for identifying the causarity of empty image.
TIMESYS	Essential for knowing time system used in the data
UT	The basic keyword for observation description
WAVELEN(S)	Convenient in making plot of raw data spectrum.
WAV-MAX(S)	Convenient in making plot of raw data spectrum.
WAV-MIN(S)	Convenient in making plot of raw data spectrum.
WCS-ORIG(I)	Used for identifying WCS is written by toolkit or not.

6.2 基本ヘッダー辞書

6.2.1 基本ヘッダー辞書各項目の説明

観測装置間で共通化できるキーワードは、基本ヘッダー辞書に記述される。基本ヘッダー辞書内の各項目の意味は以下の通りである。

Header Key Word： FITS ヘッダーキーワード

Revised: 最終更新日付

Importance： 重要度。以下の値をもつ

Common： 必須キーワード

Imaging： 撮像データに必須なキーワード

Spectroscopy： 分光観測データに必須なキーワード

Polarimetry： 偏光観測データに必須なキーワード

Object: 天体フレームに必須なキーワード

Optional： キーワードの定義のみで、必須ではない。ただし、装置固有キーワードの中で基本ヘッダー (Optional) と同じ意味のものがある場合には、基本ヘッダーを優先する。

Alias: ツールキットの Status Distribution Service を利用して OBS からステータスを取得する場合の指定キーワード。ここに Toolkit と書かれていれば、(FITS 化)Toolkit により入力が可能である。また、Next Toolkit となっていれば、次バージョンのツールキットで計算ツールを提供予定。全観測装置に共通なものは、"FITS.SBR.????" の形式をとり、観測装置ごとに参照ステータスが変化するものは、"FITS.#Inst.????" の形式をとる。ただし、'#Inst' は観測装置の 3 文字略称で、以下の通り。

- IRCS − > IRC
- AO − > AOS
- CIAO − > CIA
- OHS − > OHS
- FOCAS − > FCS
- HDS − > HDS
- COMICS − > COM
- Suprime-Cam − > SUP
- MIRTOS − > MIR

Value Format： キーワード値の記述形式 (C 言語と違い例えば `%7.5f` は最大 7 桁)

Type： キーワード値のデータ型

Unit： キーワード値の単位。キーワード値の単位は基本的にこの単位で記述するものとする。ただし、どうしても問題が生ずる場合には、別途すばる側担当者と相談のこと。

Recommend： すばるが推奨する規定値。矛盾が生じない限りこの値を使用する。SIMPLE, OBSERVAT については必ずこの値を使用する。

Comment： FITS ヘッダー内に記述されるインラインコメントの内容。値に単位が必要な場合は、単位の記述もおこなう。

Description： キーワードの意味定義

6.2.2 基本ヘッダー辞書 (1998/07/02)

紙面の都合により、上記項目の内 Header Key Word 〜 Comment の中の 8 つの項目を ABC 順の辞書に収録し、残りは Importance 順の辞書に収録した。

● Key Word の ABC 順基本辞書

[Dictionary = Basic] (Key Word の ABC 順、その 1(1/3): A ～ DET)

Header Key Word	importance	Value Format	Type	Unit (Recommend)	Revised	Comment
ADC	Optional	%7.3f	double	degree	98/07/30	ADC PA during exposure(degree)
ADC-END	Optional	%7.3f	double	degree	98/06/30	ADC PA at exposure end(degree)
ADC-STR	Optional	%7.3f	double	degree	98/06/30	ADC PA at exposure start(degree)
ADC-TYPE	Optional	%30s	string		98/08/12	ADC name/type if used
AIRMASS	Common	%9.5f	double		98/06/30	Averaged Air Mass
AIRM-END	Optional	%9.5f	double		98/06/30	Air Mass at end
AIRM-STR	Optional	%8.5f	double		98/06/30	Air Mass at start
ALT-END	Optional	%8.5f	double	degree	98/06/30	Altitude at exposure end (degree)
ALTITUDE	Optional	%8.5f	double	degree	98/06/30	Altitude of telescope pointing(degree)
ALT-STR	Optional	%8.5f	double	degree	98/06/30	Altitude at start exposure(degree)
AO-FREQ	Optional	%3d	integer	Hz	98/06/30	frequency of AO loop (Hz)
AO-TIP	Optional	%3s	string		98/06/30	AO tip-tilt on/off
AO-WFS	Optional	%9.5f	double		98/06/30	sigma of deformable mirror
APERTURE	Optional	%30s	string		98/06/30	Identifier of the entrance aperture
APTC-DEC	Optional	%.8f	double	degree	98/06/30	DEC of the aperture center(degree)
APTCPIX1	Optional	%.3f	double	pixel	98/06/30	Aperture center projected on det.(pix)
APTCPIX2	Optional	%.3f	double	pixel	98/06/30	Aperture center projected on det.(pix)
APTC-RA	Optional	%.8f	double	degree	98/06/30	RA of the aperture center(degree)
APT-SIZE	Optional	%.3f	double	arcsec	98/06/30	Diameter of the aperture (arcsec)
AUTOGUID	Optional	%3s	string		98/06/30	Auto Guide on/off
AZ-END	Optional	%9.5f	double	degree	98/06/30	Azimuth angle at exposure end (degree)
AZIMUTH	Optional	%9.5f	double	degree	98/06/30	Azimuth of telescope pointing (degree)
AZ-STR	Optional	%9.5f	double	degree	98/06/30	Azimuth angle at exposure start(degree)
BIN-FCT1	Common	%2d	integer	pixel	98/06/30	Binning factor of X axis (pixel)
BIN-FCT2	Common	%2d	integer	pixel	98/06/30	Binning factor of Y axis (pixel)
BITPIX	Common	%3d	integer		98/04/09	# of bits storing pix values
BLANK	Common	%d	integer		98/06/30	Value used for NULL pixels
BSCALE	Common	%.1f	double	(1.0)	98/06/30	Real=fits-value*BSCALE+BZERO
BUNIT	Common	%30s	string		98/06/30	Unit of original pixel values
BZERO	Common	%.1f	double	(0.0)	98/06/30	Real=fits-value*BSCALE+BZERO
C2ELT1	Optional	%13.8f	double		98/04/09	Size projected on detector X-axis(deg)
C2ELT2	Optional	%13.8f	double		98/04/09	Size projected on detector Y-axis(deg)
C2NIT1	Optional	%10s	string	(degree)	98/04/09	Units used in both C2VAL1 and C2ELT1
C2NIT2	Optional	%10s	string	(degree)	98/04/09	Units used in both C2VAL2 and C2ELT2
C2PIX1	Optional	%+6.1f	double	pixel	98/08/24	Reference pixel X on detector(pixel)
C2PIX2	Optional	%+6.1f	double	pixel	98/08/24	Reference pixel Y on detector
C2VAL1	Optional	%13.8f	double		98/04/09	Physical value of the ref. pixel X (deg)
C2VAL2	Optional	%13.8f	double		98/04/09	Physical value of the ref. pixel Y (deg)
C2YPE1	Optional	%16s	string	(RA---TAN)	98/04/09	Pixel coordinate system
C2YPE2	Optional	%16s	string	(DEC--TAN)	98/04/09	Pixel coordinate system
CDELT1	Common	%13.8f	double		98/06/30	X Scale projected on detector(#/pix)
CDELT2	Common	%13.8f	double		98/06/30	Y scale projected on detector(#/pix)
COADD	Optional	%2d	integer		98/06/30	Frame is created by # of sub-exposures
COMMENT	Optional	%s	string		98/06/30	Comment
CRPIX1	Common	%+6.1f	double	pixel	98/08/24	Reference pixel in X (pixel)
CRPIX2	Common	%+6.1f	double	pixel	98/08/24	Reference pixel in Y (pixel)
CRVAL1	Common	%13.8f	double		98/06/30	Physical value of the reference pixel X
CRVAL2	Common	%13.8f	double		98/06/30	Physical value of the reference pixel Y
CTYPE1	Common	%16s	string	(RA---TAN)	98/06/30	Pixel coordinate system
CTYPE2	Common	%16s	string	(DEC--TAN)	98/06/30	Pixel coordinate system
CUNIT1	Common	%10s	string	(degree)	98/06/30	Units used in both CRVAL1 and CDELT1
CUNIT2	Common	%10s	string	(degree)	98/06/30	Units used in both CRVAL2 and CDELT2
DATASET	Object	%20s	string		98/06/30	ID of an observation dataset
DATA-TYP	Common	%15s	string		98/06/30	Type / Characteristics of this data
DATE-OBS	Common	%10s	string	UTC	98/06/30	Observation start date (yyyy-mm-dd)
DEC	Common	%12s	string		98/06/30	+/-DD:MM:SS.SS DEC (J2000) pointing
DEC2000	Common	%12s	string		98/06/30	+/-DD:MM:SS.SS DEC (J2000) pointing
DET-Ann	Optional	%.3f	double	degree	98/06/30	Relative angle of nn-th detector (deg)
DETECTOR	Common	%10s	string		98/06/30	Name of the detector/CCD
DET-ID	Optional	%d	integer		98/06/30	ID of the detector used for this data
DET-NSMP	Optional	%2d	integer		98/06/30	# of multiple sample in each exposure
DET-P1nn	Optional	%.5f	double	arcsec	98/06/30	Relative X pos of nn-th detector(arcsec)
DET-P2nn	Optional	%.5f	double	arcsec	98/06/30	Relative Y pos of nn-th detector(arcsec)
DETPXSZ1	Optional	%.4f	double	mm	98/06/30	Detector pixel size in axis1 (mm)
DETPXSZ2	Optional	%.4f	double	mm	98/06/30	Detector pixel size in axis2 (mm)
DET-RST	Optional	%2d	integer		98/06/30	reset number before exposure
DET-SMPL	Optional	%15s	string		98/06/30	sampling method
DET-TAVE	Optional	%6.2f	double	K	98/06/30	Average of the detector temperature (K)
DET-TMAX	Optional	%6.2f	double	K	98/06/30	Max temperature among detectors (K)
DET-TMED	Optional	%6.2f	double	K	98/06/30	Median of the detector temperature (K)

[Dictionary = Basic] (Key Word の ABC 順、その 2(2/3): DET 〜 OUT)

Header Key Word	importance	Value Format	Type	Unit (Recommend)	Revised	Comment
DET-TMIN	Optional	%6.2f	double	K	98/06/30	Min temperature among Detectors (K)
DET-TMP	Common	%6.2f	double	K	98/06/30	Detector temperature (K)
DET-TSD	Optional	%6.2f	double	K	98/06/30	Standard Dev. of the detector temp (K)
DET-VER	Optional	%30s	string		98/06/30	Detector control comannd script name
DISPAXIS	Spectroscopy	%1d	integer		98/06/30	Dispersion axis in frame
DISPERSR	Spectroscopy	%10s	string		98/06/30	Identifier of the disperser used
DOM-HUM	Optional	%5.1f	double		98/06/30	Humidity measured in the dome
DOM-PEND	Optional	%7.2f	double	hPa	98/06/30	Dome atm. pressure at exposure end (hpa)
DOM-PRS	Optional	%7.2f	double	hPa	98/06/30	Atmospheric pressure in the Dome (hpa)
DOM-PSTR	Optional	%7.2f	double	hPa	98/06/30	Dome Atm. pressure at exp.start (hpa)
DOM-TMP	Optional	%6.2f	double	K	98/06/30	Temperature measured in the dome (K)
DOM-WND	Optional	%5.2f	double	m/s	98/06/30	Wind speed in the dome (m/s)
EFP-MIN1	Optional	%d	integer	pixel	98/07/31	Start X pos. of overscan area (pix)
EFP-MIN2	Optional	%d	integer	pixel	98/07/31	Start Y pos. of overscan area (pix)
EFP-RNG1	Optional	%d	integer	pixel	98/07/31	X Range of overscan area (pix)
EFP-RNG2	Optional	%d	integer	pixel	98/07/31	Y Range of overscan area (pix)
END	Common	-	-		98/04/07	End of the header records
EQUINOX	Common	%6.1f	double	year (2000.0)	98/06/30	Standard FK5 (years)
EXP-ID	Common	%16s	string		98/06/30	ID of the exposure this data was taken
EXPTIME	Common	%7.1f	double	sec	98/06/30	Total integration time of the frame(sec)
EXTEND	Common	%c	logical		98/04/01	Presence of FITS Extention
FILTERnn	Optional	%30s	string		98/06/30	Filter name/ID
FLT-Ann	Optional	%.2f	double	degree	98/06/30	Inclination of nn-th Filter (degree)
FOC-LEN	Optional	%.3f	double	mm	98/06/30	Focal length of the telescope (mm)
FOC-POS	Common	%12s	string		98/06/30	Focus where the instrument is attached
FOC-VAL	Common	%10.3f	double	mm	98/06/30	Encoder value of the focus unit (mm)
FRAMEID	Common	%16s	string		98/06/30	Image sequential number
F-RATIO	Optional	%.2f	double		98/06/30	Monochromatic F-Ratio of the camera
GAIN	Common	%5.2f	double	e/ADU	98/06/30	AD conversion factor (electron/ADU)
HISTORY	Optional	%s	string		98/06/30	History
HST	Common	%10s	string	HST	98/06/30	HH:MM:SS.S Typical HST at exposure
HST-END	Optional	%10s	string	HST	98/06/30	HH:MM:SS.S at the end of exposure
HST-STR	Optional	%10s	string	HST	98/06/30	HH:MM:SS.S HST at the beginning of exp.
IMGROT	Optional	%+8.3f	double	degree	98/08/24	Angle of the Image Rotator (degree)
IMR-END	Optional	%+8.3f	double	degree	98/08/24	Image rotator angle at end (degree)
IMR-STR	Optional	%+8.3f	double	degree	98/08/24	Image rotator angle at start (degree)
IMR-TYPE	Optional	%20s	string		98/06/30	Identifire of the image rotator
INR-END	Optional	%+8.3f	double	degree	98/08/24	Instrument Rotator angle at End (deg)
INR-STR	Optional	%+8.3f	double	degree	98/08/24	Instrument Rotator angle at Start (deg)
INSROT	Optional	%+8.3f	double	degree	98/08/24	Angle of the instrument rotator (deg)
INST-PA	Optional	%7.3f	double	degree	98/06/30	P.A. of the Instrument flange (degree)
INSTRUME	Common	%20s	string		98/06/30	Name of instrument
INS-VER	Optional	%30s	string		98/06/30	Version of the instrument soft/hard
LONGPOLE	Imaging	%6.1f	double	degree (180.0)	98/04/09	The North Pole of standard system (deg)
LST	Common	%12s	string	LST	98/06/30	HH:MM:SS.S Typical LST at exposure
LST-END	Optional	%12s	string	LST	98/06/30	HH:MM:SS.S at the end of exposure
LST-STR	Optional	%12s	string	LST	98/06/30	HH:MM:SS.S at the beginning of exposure
M2-TIP	Optional	%8s	string		98/07/02	Tip/Tilt of the Secondary Mirror(on/off)
M2-TYPE	Optional	%8s	string		98/07/02	Type of the Secondary Mirror (Opt/IR)
MJD	Optional	%14.8f	double	day	98/08/12	Modified Julian Day at typical time
MJD-END	Optional	%14.8f	double	days	98/08/12	Modified Julian Day at the end of exp.
MJD-STR	Optional	%14.8f	double	days	98/08/12	Modified Julian Day of the start exp.
N2XIS	Optional	%1d	integer	(2)	98/04/09	# of axes in the slit projection
N2XIS1	Optional	%5d	integer	pixel	98/04/09	# of pixels/row for slit projection
N2XIS2	Optional	%5d	integer		98/04/09	# of scan lines for slit projection
NAS-TAVE	Optional	%.2f	double	K	98/06/30	Averaged Temperature in Nas.enclosure(K)
NAS-TMAX	Optional	%.2f	double	K	98/06/30	Max temperature in Nasmyth enclosure (K)
NAS-TMIN	Optional	%.2f	double	K	98/06/30	Min temperature in Nasmyth enclosure (K)
NAS-TSD	Optional	%.1f	double	K	98/06/30	Standard Dev. of the Nas. room Temp. (K)
NAXIS	Common	%1d	integer		98/04/09	# of axes in frame
NAXIS1	Common	%5d	integer	pixel	98/04/09	# of pixels/row
NAXIS2	Common	%5d	integer		98/04/09	# of rows (also # of scan lines)
NAXIS3	Optional	%5d	integer		98/05/14	# of the 3rd axis
OBJECT	Common	%30s	string		98/06/30	Target Description
OBS-ALOC	Common	%12s	string		98/06/30	Allocation mode for Instrument
OBSERVAT	Common	%30s	string	(NAOJ)	98/06/30	Observatory
OBSERVER	Common	%64s	string		98/06/30	Name of observers
OBS-MOD	Common	%20s	string		98/06/30	Observation Mode
OUT-HUM	Optional	%5.1f	double		98/06/30	Humidity measured outside the dome
OUT-PRS	Optional	%7.2f	double	hPa	98/06/30	Atmospheric pressure outside dome (hPa)
OUT-TMP	Optional	%6.2f	double	K	98/06/30	Temperature measured outside dome (K)

[Dictionary = Basic] (Key Word の ABC 順、その 3(3/3): OUT ～ Z)

Header Key Word	importance	Value Format	Type	Unit (Recommend)	Revised	Comment
OUT-WND	Optional	%5.2f	double	m/s	98/06/30	Wind speed outside (m/s)
P2iiijjj	Optional	%12.8f	double		98/04/09	Pixel Coordinate translation matrix
P2OJP1	Optional	%5.1f	double	(0.0)	98/05/13	Projection type of the first axis
P2OJP2	Optional	%5.1f	double	(0.0)	98/05/13	Projection type of the second axis
PCiiijjj	Imaging	%12.8f	double		98/04/09	Pixel Coordinate translation matrix
POL-ANG	Optional	%6.2f	double	degree	98/06/30	Position Angle of the Polarizer (deg)
POLARIZn	Polarimetry	%30s	string		98/06/30	Identoifier of n-th Polarizer
PRD-MIN1	Optional	%d	integer	pixel	98/07/31	Start X pos. of partialy read out (pix)
PRD-MIN2	Optional	%d	integer	pixel	98/06/30	Start pos Y of partialy readout (pix)
PRD-RNG1	Optional	%d	integer	pixel	98/06/30	X Range of the partialy read out (pix)
PRD-RNG2	Optional	%d	integer	pixel	98/06/30	Y range of the partialy readout (pix)
PROJP1	Optional	%5.1f	double	(0.0)	98/05/13	Projection type of the first axis
PROJP2	Optional	%5.1f	double	(0.0)	98/05/13	Projection type of the second axis
PROP-ID	Common	%20s	string		98/06/30	Proposal ID
RA	Common	%12s	string		98/06/30	HH:MM:SS.SSS RA (J2000) pointing
RA2000	Common	%12s	string		98/06/30	HH:MM:SS.SSS RA (J2000) pointing
RADECSYS	Common	%8s	string	(FK5)	98/06/30	The equatorial coordinate system
RET-ANG	Polarimetry	%6.2f	double	degree	98/06/30	P.A. of n-th Retarder Plate (deg)
RETPLATn	Polarimetry	%30s	string		98/06/30	Identifier of n-th Retarder Plate
SECZ	Optional	%6.3f	double		98/06/30	SEC(Zenith Distance) at typical time
SECZ-END	Optional	%6.3f	double		98/06/30	SEC(ZD) at the end of exposure
SECZ-STR	Optional	%6.3f	double		98/06/30	SEC(ZD) at exposure start time
SEEING	Optional	%.2f	double	arcsec	98/06/30	StarSize FWHM at telescope focus (arcsec)
SIMPLE	Common	T	logical	(T)	98/04/07	Standard FITS format
SLIT	Spectroscopy	%10s	string		98/06/30	Identifier of the entrance slit used
SLTC-DEC	Optional	%9.5f	double	degree	98/06/30	slit center DEC at the EQUINOX (degree)
SLTCPIX1	Spectroscopy	%6.1f	double	pixel	98/06/30	Slit center projected on detector (pix)
SLTCPIX2	Spectroscopy	%6.1f	double	pixel	98/06/30	Slit center projected on detector (pix)
SLTC-RA	Optional	%9.5f	double	degree	98/06/30	slit center RA at the EQUINOX (degree)
SLT-LEN	Spectroscopy	%7.3f	double	arcsec	98/06/30	Length of the slit used (arcsec)
SLT-OBJP	Optional	%9.5f	double	acsec	98/06/30	Object position on the slit (arcsec)
SLT-PA	Spectroscopy	%5.1f	double	degree	98/06/30	Slit Position Angle (degree)
SLT-PEND	Optional	%5.1f	double	degree	98/06/30	Slit PA at exposure end (degree)
SLT-PSTR	Optional	%5.1f	double	degree	98/06/30	Slit PA at exposure start (degree)
SLT-WID	Spectroscopy	%6.3f	double	arcsec	98/06/30	Width of the slit used (arcsec)
TELESCOP	Common	%30s	string		98/06/30	Telescope/System which Inst.is attached
TELFOCUS	Common	%30s	string		98/06/30	Focus where a beam is reachable
TIMESYS	Common	%5s	string	(UTC)	98/06/30	Time System used in the header. UTC fix.
TRAN-END	Optional	%5.3f	double		98/06/30	Sky transparency at the end of exposure
TRANSP	Optional	%5.3f	double		98/06/30	Sky transparency
TRAN-STR	Optional	%5.3f	double		98/06/30	Sky transparency at beginning of exp.
UT	Common	%10s	string	UTC	98/06/30	HH:MM:SS.S typical UTC at exposure
UT1-UTC	Optional	%+8.5f	double		98/06/30	difference between UT1 and UTC
UT-END	Optional	%10s	string	UTC	98/06/30	HH:MM:SS.S UT at end of the exposure
UT-STR	Optional	%10s	string	UTC	98/06/30	HH:MM:SS.S UTC at start exposure time
WAVELEN	Spectroscopy	%10.4f	double	nm	98/06/30	Wavelength at detector center (nm)
WAV-MAX	Spectroscopy	%10.4f	double	nm	98/06/30	Longest wavelen. focused on detector(nm)
WAV-MIN	Spectroscopy	%10.4f	double	nm	98/06/30	Shortest wavelen.focused on detector(nm)
WCS-ORIG	Imaging	%20s	string		98/06/30	Origin of the WCS value
WEATHER	Optional	%30s	string		98/06/30	Weather condition
ZD	Optional	%8.5f	double	degree	98/07/28	Zenith Distance at typical time (degree)
ZD-END	Optional	%8.5f	double	degree	98/07/28	Zenith Distance at exposure end (deg)
ZD-STR	Optional	%8.5f	double	degree	98/07/28	Zenith Distance at exposure start (deg)

● Importance 順基本辞書

[Dictionary = Basic] (Importance 順、その 1-1: Common)

Header Key Word	Category	Alias(Distribution Service)	Description
AIRMASS	Time	FITS.SBR.AIRMASS	Average airmass for the optical axis during the exposure computed for the time while the shutter is open.
BIN-FCT1	Instrument		Binning factor of X axis (pixel).
BIN-FCT2	Instrument		Binning factor of Y axis (pixel).
BITPIX	FITS		Number of bits used to store pixel value
BLANK	File		Value used to specify the absence of pixel values. BLANK is normally used to fill out regions of the frame that have not been exposed e.g. because of windowing.
BSCALE	File		Scale to be applied to values in the frame to obtain original pixel values.

[Dictionary = Basic] (Importance 順、その 1-2: Common(続))

Header Key Word	Category	Alias (Distribution Service)	Description
BUNIT	File		Unit of original pixel values. real(unit)=fits-value* BSCALE+BZERO
BZERO	File		Offset to be applied to values in the frame to obtain original pixel values.
CDELT1	File	Toolkit	Increment of X_Coordinate for each pixel step.
CDELT2	File	Toolkit	Increment of Y_Coordinate for each pixel step.
CRPIX1	File	Toolkit	Pixel position of the reference point. By convention the center of the pixel is pix.0,pix.5 gives the right edge of the pixel and (pix-1).6 its left edge.
CRPIX2	File	Toolkit	Pixel position of the reference point. By convention the center of the pixel is pix.0,pix.5 gives the bottom edge of pixel and (pix-1).6 its top edge.
CRVAL1	File	Toolkit	Coordinate value at reference pixel (CRPIX1).
CRVAL2	File	Toolkit	Coordinate value at reference pixel (CRPIX2).
CTYPE1	File	Toolkit	Type of projection used for X axis. RA---TAN or DEC--TAN for imaging mode, and WAVELENGTH for dispersion axis of spectroscopy mode.
CTYPE2	File	Toolkit	Type of projection used for Y axis. RA---TAN or DEC--TAN for imaging mode, and WAVELENGTH for dispersion axis of spectroscopy mode.
CUNIT1	File	Toolkit	Units used in both CRVAL1 and CDELT1. 'nm'is recommended for spectroscopy mode.
CUNIT2	File	Toolkit	Units used in both CRVAL2 and CDELT2. 'nm'is recommended for spectroscopy mode.
DATA-TYP	Object		It'll be used for automatic data analysis. /OBJECT/BIAS /DARK/FLAT/COMP/STANDARD_STAR/...
DATE-OBS	Time	Toolkit	UTCdate in which this file was written.Format:yyyy-mm-dd
DEC	Object	FITS.SBR.DEC	DD:MM:SS.SS, Declination of telescope pointing (J2000)
DEC2000	Object	Toolkit	+/-DD:MM:SS.SS DEC(J2000) pointing
DETECTOR	Instrument		Name/Identification of the detector/CCD.
DET-TMP	Instrument		Detectors' averaged temperature
END	FITS	Toolkit	End of the header records
EQUINOX	Object	FITS.SBR.EQUINOX	Epoch of the mean equator and equinox of the coordinate system used to express the WCS mapping. Should always be 2000.0 (FK5).
EXP-ID	Instrument		ID of the exposure this data was taken. This ID is used for the Multi detectors. Format: nnnEmmmmmmmm; nnn: instrument name, mmmmmmmm: sequential number.
EXPTIME	Time		Total exposure time of the frame, possibly the sum of sub-integrations. (sec)
EXTEND	FITS		If Extention is presence, EXTEND='T', else 'F'.
FOC-POS	Origin	FITS.#Inst.FOC-POS	Focus name where the instrument is attached. /PRIME /CASSEGRAIN/NASMYTH-IR/NASMYTH-OPT/COUDE/
FOC-VAL	Origin	FITS.#Inst.FOC-VAL	Encoder value of the instrument focus unit.
FRAMEID	Instrument		Sequential number identifying the frame.
GAIN	Instrument		AD conversion factor of the detector. (electron/ADU)
HST	Time		HH:MM:SS.S, Hawaii Standard Time at the middle of the exposure.
INSTRUME	Instrument		Name of instrument used.
LST	Time	Toolkit	HH:MM:SS.S, Local Sidereal Time at the middle of the exposure.
MJD	Time	Toolkit	Modified Julian Day at typical time during the exposure. MJD=JD-2400000.5 (JD:Julian Date)
NAXIS	FITS	Toolkit	Dimension of this frame.
NAXIS1	FITS	Toolkit	Number of pixels along the X axis (rows).
NAXIS2	FITS	Toolkit	Number of pixels along the Y axis (columns).
OBJECT	Object	FITS.#Inst.OBJECT	Identification of object observed.
OBS-ALOC	Telescope	FITS.#Inst.OBS-ALOC	Allocation mode for Instrument
OBSERVAT	Origin	Toolkit	'NAOJ' or 'Natl.Astr.Obs.Japan'
OBSERVER	Origin	FITS.#Inst.OBSERVER	Initials, family name of observers.
OBS-MOD	Instrument		Observation Mode. (Spectroscopy, Imaging, Imaging-Polarimetry, Spectro-Polarimetry)
PROP-ID	Origin	FITS.#Inst.PROP-ID	Proposal ID.
RA	Object	FITS.SBR.RA	HH:MM:SS.SSS, right ascension of telescope pointing (J2000)
RA2000	Object	Toolkit	HH:MM:SS.SSS RA(J2000) pointing
RADECSYS	Object	Toolkit	specify the frame of reference for the equatorial co-ordinate system.
SIMPLE	FITS	Toolkit	SIMPLE must be equal to 'T' to conform to FITS.
TELESCOP	Origin	FITS.SBR.TELESCOP	Subaru / Hilo Software Simulator / Hilo Optical Software Simulator / Mitaka Optical Simulator
TELFOCUS	Telescope	FITS.SBR.TELFOCUS	Focus where a beam is reachable. /PIME/CASSEGRAIN/ NASMYTH-IR/NASMYTH-OPT/COUDE/
TIMESYS	Time	Toolkit	Time System used in the header. Fixed in UTC.
UT	Time	Toolkit	HH:MM:SS.S, Coordinated Universal Time at middle time of exposure.

[Dictionary = Basic] (Importance 順、その 2: Imaging と Object)

Header Key Word	Category	Alias (Distribution Service)	Description
LONGPOLE	WCS	Toolkit	the native system of the North Pole of the standard system: fixed to 180 if PROJPn=TAN.
PCiiijjj	WCS	Toolkit	Pixel Coordinate translation matrix: iii and jjj are the axis numbers, 1 or 2.
WCS-ORIG	WCS	Toolkit	Origin of WCS value. Specify 'SUBARU toolkit' if using toolkit.
DATASET	Object	FITS.#Inst.DATASET	ID of an observation dataset

[Dictionary = Basic] (Importance 順、その 3-1: Optional)

Header Key Word	Category	Alias (Distribution Service)	Description
ADC	Telescope	FITS.SBR.ADC	ADC position angle during the exposure.
ADC-END	Telescope	FITS.SBR.ADC	ADC position angle at the end of the exposure.
ADC-STR	Telescope	FITS.SBR.ADC	ADC position angle at the start of the exposure.
ADC-TYPE	Telescope	FITS.SBR.ADC-TYPE	ADC name/type if it is used. (BLUE, RED, NONE)
AIRM-END	Time	FITS.SBR.AIRMASS	Air Mass at the end of the exposure
AIRM-STR	Time	FITS.SBR.AIRMASS	Air Mass at the start of the exposure
ALT-END	Telescope	FITS.SBR.ALTITUDE	Altitude at the end of the exposure
ALTITUDE	Telescope	FITS.SBR.ALTITUDE	Altitude of telescope pointing (degree).
ALT-STR	Telescope	FITS.SBR.ALTITUDE	Altitude at the start of the exposure
AO-FREQ	Telescope		frequency of AO loop (Hz)
AO-TIP	Telescope		AO tip-tilt on/off
AO-WFS	Telescope		sigma of deformable mirror
APERTURE	Spectroscopy		Identifier of the entrance aperture used
APTC-DEC	Spectroscopy		DEC of the aperture center
APTCPIX1	Spectroscopy		Aperture center position projected on the detector (X) at 'WAVELENGTH'.
APTCPIX2	Spectroscopy		Aperture center position projected on the detector (Y) at 'WAVELENGTH'.
APTC-RA	Spectroscopy		RA of the aperture center
APT-SIZE	Spectroscopy		Diameter of the aperture in arcsec.
AUTOGUID	Instrument		Auto Guide on/off
AZ-END	Telescope	FITS.SBR.AZIMUTH	Azimuth angle at the end of the exposure.
AZIMUTH	Telescope	FITS.SBR.AZIMUTH	Azimuth angle of telescope pointing S:0, W:90.
AZ-STR	Telescope	FITS.SBR.AZIMUTH	Azimuth angle at the start of the exposure.
C2ELT1	WCS	Toolkit	Increment of X_Coordinate(Spatial)for each pixel step.
C2ELT2	WCS	Toolkit	Increment of Y_Coordinate(Spatial)for each pixel step.
C2NIT1	WCS	Toolkit	Units used in both C2VAL1 and C2ELT1.
C2NIT2	WCS	Toolkit	Units used in both C2VAL2 and C2ELT2.
C2PIX1	WCS	Toolkit	Slit projected pixel position of the reference point. The center of the pixel is pix.0,pix.5 gives the right edge of the pixel and (pix-1).6 its left edge.
C2PIX2	WCS	Toolkit	Slit projected pixel position of the reference point. The center of the pixel is pix.0,pix.5 gives the right edge of the pixel and (pix-1).6 its left edge.
C2VAL1	WCS	Toolkit	Coordinate value at reference pixel (C2PIX1).
C2VAL2	WCS	Toolkit	Coordinate value at reference pixel (C2PIX2).
C2YPE1	WCS	Toolkit	Type of projection used for slit projected X axis.
C2YPE2	WCS	Toolkit	Type of projection used for slit projected Y axis.
COADD	Instrument		This frame is ceated by # of sub-exposures.
COMMENT	Comment		Used for describing the comments about what can not be described by Keyword and parameters.
DET-Ann	Instrument		Angle between nn-th detector and instrument's standard line
DET-ID	Instrument		ID of the detector used for this fits data. The detector can be identified by the number when the instrument equips multi detectors.
DET-NSMP	Instument		number of multiple sample in each exposure
DET-P1nn	Instrument		X Position of the nn-th detector relative from the field center or instrument standard position
DET-P2nn	Instrument		Y Position of the nn-th detector relative from the field center or instrument standard position
DETPXSZ1	Instrument		Detector pixel size in axis1.
DETPXSZ2	Instrument		Detector pixel size in axis2.
DET-RST	Instrument		reset number before exposure
DET-SMPL	Instrument		Sampling method
DET-TAVE	Instrument		Average of the detector temperature.
DET-TMAX	Instrument		Maximum temperature among the detectors.
DET-TMED	Instrument		Median of the detector temperature
DET-TMIN	Instrument		Minimum temperature among the detectors.
DET-TSD	Instrument		Standard Deviation of the detector temperature.
DET-VER	Instrument		Detector control command script name
DOM-HUM	Environment	FITS.SBR.DOM-HUM	Humidity measured in the dome.
DOM-PEND	Environment	FITS.SBR.DOM-PRS	Atmospheric pressure in the dome at the end of the exposure.

[Dictionary = Basic] (Importance 順、その 3-2: Optional(続))

Header Key Word	Category	Alias (Distribution Service)	Description
DOM-PRS	Environment	FITS.SBR.DOM-PRS	Atmospheric pressure in the Dome.
DOM-PSTR	Environment	FITS.SBR.DOM-PRS	Atmospheric pressure in the dome at the start of the exposure.
DOM-TMP	Environment	FITS.SBR.DOM-TMP	Temperature measured in the dome/enclosure.
DOM-WND	Environment	FITS.SBR.DOM-WND	Wind speed measured in the dome/enclosure.
EFP-MIN1	Instrument		Start X pos. of partialy read out (pix)
EFP-MIN2	Instrument		Start Y pos. of partialy read out (pix)
EFP-RNG1	Instrument		X Range of overscan area (pix)
EFP-RNG2	Instrument		Y Range of overscan area (pix)
EXP1TIME	Time		Exposure time of a frame (sec)
FILTERnn	Instrument		Filter name/ID.
FLT-Ann	Instrument		Inclination of the nn-th filter. 0.0:normal
FOC-LEN	Origin		Focal length of the telescope.
F-RATIO	Origin		Monochromatic F-Ratio of the instrument camera.
HISTORY	Comment		Used for describing the histoy of data analysis and performed to the data
HST-END	Time		HH:MM:SS.S, Hawaii Standard Time at the end of the exposure.
HST-STR	Time		HH:MM:SS.S, Hawaii Standard Time at the start of the exposure.
IMGROT	Telescope	FITS.SBR.IMGROT	Identifire of the image rotator used.
IMR-END	Telescope	FITS.SBR.IMGROT	Image rotator angle at the end of the exposure.
IMR-STR	Telescope	FITS.SBR.IMGROT	Image rotator andle at the start of the exposure.
IMR-TYPE	Telescope	FITS.SBR.IMR-TYPE	Identifier of the image rotator used
INR-END	Telescope	FITS.SBR.INSROT	Instrument Rotator angle at the end of the exposure.
INR-STR	Telescope	FITS.SBR.INSROT	Instrument Rotator angle at the start time of the exposure.
INSROT	Telescope	FITS.SBR.INSROT	Angle of the instrument rotator
INST-PA	Instrument	FITS.#Inst.INST-PA	Position Angle of the instrument flange. This value will be used for calculating the Slit P.A. and CCD P.A. (N:0, E:90 degree)
INS-VER	Instrument		Version of the instrument soft/hardware.
LST-END	Time	Toolkit	HH:MM:SS.S, Local Sidereal Time at the end of the exposure.
LST-STR	Time	Toolkit	HH:MM:SS.S, Local Sidereal Time at the start of the exposure.
M2-TIP	Telescope	FITS.SBR.M2-TIP	Tip/Tilt of the Secondary Mirror (on/off)
M2-TYPE	Telescope	FITS.SBR.M2-TYPE	Type of the secondary Mirror (Opt/IR)
MJD-END	Time	Toolkit	Modified Julian Day of the end of the exposure. MJD=JD -2400000.5 (JD:Julian Day)
MJD-STR	Time	Toolkit	Modified Julian Day of the start of the exposure. MJD= JD-2400000.5 (JD:Julian Day)
N2XIS	WCS	Toolkit	Dimension of the slit projection.
N2XIS1	WCS	Toolkit	Number of pixels along the X axis for slit projection (rows).
N2XIS2	WCS	Toolkit	Number of pixels along the Y axis (columns) for slit projection.
NAS-TAVE	Environment		Averaged Temperature in Nasmyth enclosure.
NAS-TMAX	Environment		Maximum temperature in Nasmyth enclosure.
NAS-TMIN	Environment		Minimum temperature in Nasmyth enclosure.
NAS-TSD	Environment		Standard Deviation of the Nasmyth room temperature.
NAXIS3	FITS		Number of pixels along the Z (3rd) axis.
OUT-HUM	Environment	FITS.SBR.OUT-HUM	Humidity measured outside the dome/enclosure.
OUT-PRS	Environment	FITS.SBR.OUT-PRS	Atmospheric pressure outside the dome
OUT-TMP	Environment	FITS.SBR.OUT-TMP	Temperature measured outside the dome/enclosure.
OUT-WND	Environment	FITS.SBR.OUT-WND	Wind speed measured outside dome/enclosure.
P2iiijjj	WCS	Toolkit	Pixel Coordinate translation matrix for spectroscopy: iii and jjj are the axis numbers, 1 or 2.
P2OJP1	WCS	-	Projection type of the first axis for slit projection: fixed to 0.0
P2OJP2	WCS	-	Projection type of the second axis for slit projection : fixed to 0.0
POL-ANGn	Polarimetry		Position Angle of the Polarizer. NORTH:0, EAST:90
PRD-MIN1	Instrument		Starting X position of partialy readout.
PRD-MIN2	Instrument		Starting position Y of partialy readout.
PRD-RNG1	Instrument		X Range of the partialy readout.
PRD-RNG2	Instrument		Y range of the partialy readout.
PROJP1	WCS	-	Projection type of the first axis: fixed to 0.0
PROJP2	WCS	-	Projection type of the second axis: fixed to 0.0
SECZ	Time	FITS.SBR.SECZ	SEC(Zenith Distance) at typical time in exposure.
SECZ-END	Time	FITS.SBR.SECZ	SEC(Zenith Distance) at exposure end time.
SECZ-STR	Time	FITS.SBR.SECZ	SEC(Zenith Distance) at exposure start time.
SEEING	Environment	FITS.SBR.SEEING	FWHM of the stellar image size at telescope focus. It'll be measured with autoguider.
SLTC-DEC	Spectroscopy		DEC of the slit center at the EQUINOX specified in this header (degree)
SLTC-RA	Spectroscopy		RA of the slit center at the EQUINOX specified in this header (degree)
SLT-OBJP	Spectroscopy		Object position on the slit (arcsec)

[Dictionary = Basic] (Importance 順、その 3-3: Optional(続))

Header Key Word	Category	Alias (Distribution Service)	Description
SLT-PEND	Spectroscopy		Slit position angle at the end of the exposure.
SLT-PSTR	Spectroscopy		Slit position angle at the start of the exposure.
TRAN-END	Environment	FITS.SBR.TRANSP	Sky transparency at the enf of exposure
TRANSP	Environment	FITS.SBR.TRANSP	Sky transparency
TRAN-STR	Environment	FITS.SBR.TRANSP	Sky transparency at the beginning of the exposure
UT1-UTC	Time	FITS.SBR.UT1-UTC	Difference between UT1 and UTC. This value is used for calculating LST
UT-END	Time	Toolkit	HH:MM:SS.S, Coordinated Universal Time at the end of the exposure.
UT-STR	Time	Toolkit	HH:MM:SS.S, Coordinated Universal Time at start of the exposure.
WEATHER	Environment	FITS.SBR.WEATHER	Weather condition. CLEAR/FINE/nn%CLOUD...?
ZD	Time	FITS.SBR.ZD	Zenith Distance at typical time in exposure.
ZD-END	Time	FITS.SBR.ZD	Zenith Distance at exposure end time.
ZD-STR	Time	FITS.SBR.ZD	Zenith Distance at exposure start time.

[Dictionary = Basic] (Importance 順、その 4: Polarimetry)

Header Key Word	Category	Alias (Distribution Service)	Description
POLARIZn	Polarimetry		Identifier of n-th Polarizer for Polarimetry
RET-ANGn	Polarimetry		Position angle of n-th Retarder Plate
RETPLATn	Polarimetry		Identifier of n-th Retarder Plate for Polarimetory

[Dictionary = Basic] (Importance 順、その 5: Spectroscopy)

Header Key Word	Category	Alias (Distribution Service)	Description
DISPAXIS	Spectroscopy		Dispersion axis in the frame.
DISPERSR	Spectroscopy		Identifier (Name,grooves,etc.) of the disperser used.
SLIT	Spectroscopy		Identifier (Name, etc.) of the entrance slit used.
SLTCPIX1	Spectroscopy		Slit center position (X) projected on the detector at 'WAVELENGTH'.
SLTCPIX2	Spectroscopy		Slit center position (Y) projected on the detector at 'WAVELENGTH'.
SLT-LEN	Spectroscopy		Length of the slit used. (arcsec)
SLT-PA	Spectroscopy		Slit Position Angle. NORTH:0, EAST:90. Slit direction vector is defined as the decreasing direction of the slit projected axis pixels.
SLT-WID	Spectroscopy		Width of the slit used. (arcsec)
WAVELEN	Spectroscopy		Wavelength at detector center.
WAV-MAX	Spectroscopy		The longest wavelength focused on the detector.
WAV-MIN	Spectroscopy		The shortest wavelength focused on the detector.

6.3 装置固有ヘッダー辞書

観測装置固有なキーワードは、観測装置毎のヘッダー辞書を作って公開する。ヘッダー辞書内の項目は、基本ヘッダー辞書に準ずるが、紙面の都合で一部項目は省略してある。

6.3.1 CIAO

Header Key Word	Value Format	Type	Unit	Comment
C_OMASK	%15s	string		Identifier of the Occulting Mask
C_LYOTST	%15s	string		Identifier of the Lyot Stop
C_LYOANG	%5.1f	double	degree	Lyot stop position angle
C_CAMERA	%15s	string		Camera mode
C_BNCTMP	%6.2f	double	K	Optical bench temperature
C_COLX	%6.2f	double	um	Collimetor lens x position
C_COLY	%6.2f	double	um	Collimetor lens y position
C_VACUUM	%8.3f	double	torr	Vacuum inside dewar
C_SHUTTR	%3s	string		Shutter above CIAO on/off
C_DETPOS	%5d	integer	um	Detector stage position
C_WATER1	%5.2f	double	1/min	Water flow to rack1
C_WATER2	%5.2f	double	1/min	Water flow to rack2

6.3.2 COMICS

COMICS は FITS ヘッダールールの項では２文字の略号が割り当てられていないが、ここではサンプルヘッダーに含まれる Q_ の部分を該当するものとして抜き出しておく。

Header Key Word	Value Format	Type	Unit	Comment
Q_DTYPE	%10s	string		type of this file spec/img/slitview
Q_OBSID	%8d	integer		Observation ID of COMICS
Q_WINDOW	%10s	string		Entrance Window
Q_M1MOTA	%8d	integer		Pulse count of 1st mir. para to bench
Q_M1MOTB	%8d	integer		Pulse count of 1st mir. vert to bench
Q_SLTVEW	%8s	string		Slit Viewer on/off
Q_SPFILE	%20s	string		File name of spectroscopy
Q_SVWMIN	%10.4f	double	nm	Observed Wavelength of S Viewer min
Q_SVWMAX	%10.4f	double	nm	Observed Wavelength of S Viewer max
Q_DETTP1	%10.5f	double	K	Temperature of the detector spec-1
Q_DETTP2	%10.5f	double	K	Temperature of the detector spec-2
Q_DETTP3	%10.5f	double	K	Temperature of the detector spec-3
Q_DETTP4	%10.5f	double	K	Temperature of the detector spec-4
Q_DETTP5	%10.5f	double	K	Temperature of the detector spec-5
Q_DETTPI	%10.5f	double	K	Temperature of the detector img
Q_CFTP1	%6.2f	double	K	Temp. of the cooled finger spec
Q_CFTP2	%6.2f	double	K	Temp. of the cooled finger img
Q_OPTTP1	%6.2f	double	K	Temp. of the optics spec-A
Q_OPTTP2	%6.2f	double	K	Temp. of the optics spec-B
Q_OPTTP3	%6.2f	double	K	Temp. of the optics spec-C
Q_OPTTP4	%6.2f	double	K	Temp. of the optics img-A
Q_OPTTP5	%6.2f	double	K	Temp. of the optics img-B
Q_OPTTP6	%6.2f	double	K	Temp. of the optics img-C
Q_COHTP1	%6.2f	double	K	Temp. of the cooler head spec
Q_COHTP2	%6.2f	double	K	Temp. of the cooler head img
Q_SHDTP1	%6.2f	double	K	Temp. of the shield A
Q_SHDTP2	%6.2f	double	K	Temp. of the shield B
Q_ABTTP1	%6.2f	double	K	Temperature of Ambient thermometer
Q_ABTTP2	%6.2f	double	K	Temperature of Ambient thermometer
Q_ABTTP3	%6.2f	double	K	Temperature of Ambient thermometer
Q_CLKVER	%30s	string		Clock version
Q_CLKFL	%30s	string		Clock macro file name
Q_CLKMCC	%30s	string		Comment on clock pattern macro
Q_CLKNM	%30s	string		Clock pattern name
Q_CLKCLC	%30s	string		Comment on each clock pattern
Q_PIXTIM	%6.2f	double	microsec	Clock duration for a pixel
Q_FRRATE	%8.4f	double	Hz	Detector Framerate
Q_READTM	%12.8f	double	sec	Time for reading out 1 exp
Q_NDRATE	%3d	integer	1/243	N.D. rate of the detector
Q_NDEFF	%10.8f	double		efficiency of the integ by using N.D.
Q_CHOP	%8s	string		Chopping on/off
Q_CPWTP	%8s	string		Tip-tilt with chopping on/off
Q_CPBMST	%16s	string		Chopping beam at the 1st exp.
Q_CPFREQ	%8.4f	double	Hz	Chopping Frequency
Q_CPTIME	%10.6f	double	sec	CHopping period per 1 beam
Q_CPEXP	%d	integer		Number of exp of 1 chopping beam
Q_CPEXAD	%d	integer		Number of coadded exp.
Q_CPFRAM	%d	integer		Number of frame of 1 chopping beam
Q_CPNUM	%d	integer		Number of chopping in this file
Q_INT1BM	%.6f	double	sec	Integration time per 1 position
Q_CPTHRW	%10.4f	double	arcsec	Chopping throw
Q_CPPA	%8.4f	double	deg	Chopping P.A.
Q_NDTIME	%.2f	double	sec	Nodding period
Q_NDOFRA	%10.4f	double	arcsec	Nodding offset R.A.
Q_NDOFDE	%8.4f	double	arcsec	Nodding offset Dec
Q_NDBEM	%12s	string		Nodding Beam main/offset
Q_NDCOM	%30s	string		Comment about Nodding
Q_GRTMOT	%d	integer		Pulse count of grating motor
Q_GRTANG	%10.6f	double	deg	Grating Tilt Angle
Q_WVMIN1	%10.4f	double	nm	Observed Wavelen on Spec Det-1 min
Q_WVMAX1	%10.4f	double	nm	Observed Wavelen on Spec Det-1 max
Q_WVMIN2	%10.4f	double	nm	Observed Wavelen on Spec Det-2 min
Q_WVMAX2	%10.4f	double	nm	Observed Wavelen on Spec Det-2 max
Q_WVMIN3	%10.4f	double	nm	Observed Wavelen on Spec Det-3 min
Q_WVMAX3	%10.4f	double	nm	Observed Wavelen on Spec Det-3 max
Q_WVMIN4	%10.4f	double	nm	Observed Wavelen on Spec Det-4 min
Q_WVMAX4	%10.4f	double	nm	Observed Wavelen on Spec Det-4 max
Q_WVMIN5	%10.4f	double	nm	Observed Wavelen on Spec Det-5 min
Q_WVMAX5	%10.4f	double	nm	Observed Wavelen on Spec Det-5 max

6.3.3 FOCAS 固有ヘッダー辞書

Header Key Word	Value Format	Type	Unit	Comment
F_TMP-A	F6.2	double	K	Temperature of MOS unit(K)
F_TMP-B	F6.2	double	K	Temperature of lens unit (K)
F_TMP-C1	F6.2	double	K	Temperature of collimator beam unit-1 (K)
F_TMP-C2	F6.2	double	K	Temperature of collimator beam unit-2 (K)
F_TMP-C3	F6.2	double	K	Temperature of collimator beam unit-3 (K)
F_TMP-D	F6.2	double	K	Temperature of Camera lens unit (K)
F_TMP-E1	F6.2	double	K	Temperature of VME-1 (K)
F_TMP-E2	F6.2	double	K	Temperature of VME-2 (K)
F_TMP-F1	F6.2	double	K	Temperature of driver-unit A-1 (K)
F_TMP-F2	F6.2	double	K	Temperature of driver-unit A-2 (K)
F_TMP-G1	F6.2	double	K	Temperature of driver-unit B-1 (K)
F_TMP-G2	F6.2	double	K	Temperature of driver-unit B-2 (K)
F_TMP-H1	F6.2	double	K	Temperature of driver-unit C-1 (K)
F_TMP-H2	F6.2	double	K	Temperature of driver-unit C-2 (K)
F_TMP-I1	F6.2	double	K	Temperature of driver-unit D-1 (K)
F_TMP-I2	F6.2	double	K	Temperature of driver-unit D-2 (K)
F_TMP-J1	F6.2	double	K	Temperature of driver-unit E-1 (K)
F_TMP-J2	F6.2	double	K	Temperature of driver-unit E-2 (K)
F_DEWERX	SP,F8.2	double	um	X-position of dewer stage (micron meter)
F_DEWERY	SP,F8.2	double	um	Y-position of dewer stage (micron meter)
F_DEWERZ	SP,F8.2	double	um	Z-position of dewer stage (micron meter)
F_HOLANG	F3.1	double	degree	angle of mask holder (degree)
F_MSK-ID	A9	string		ID of mask (for all mode)
F_CAD-ID	A9	string		ID of CAD data for mask cutting
F_CADREF	A50	string		ID/name of image/catalog data for mask design
F_DISPER	F5.3	double	nm/pixel	dispersion of grism (nm / pixel)
F_SLT-NO	I3	integer		total # of slit on mask
F_POSANG	F6.2	double	degree	PA of cross-dispersion axis (degree)

6.3.4 HDS 固有ヘッダー辞書

(エシェルフォーマットを記述する場合は末尾に ASCII TABLE EXTENSION を付け加えること。)

[HDS Dictionary 1/2]

Header KeyWord	Value Format	Type	Unit	Comment
H_INPOWR	f6.2	double	Volt	Input power for the flat lamp
H_IMSLCR	a8	string		Image slicer (ON, OFF)
H_ISTYPE	a10	string		Type of the image slicer
H_S-MSK1	f6.3	double	mm	Upper mask position from the center
H_S-MSK2	f6.3	double	mm	Lower mask position from the center
H_S-INCL	f7.2	double		Slit inclination angle at the horizontal plane
H_D-UNIT	i1	integer		ID number of the detector unit
H_D-OTHR	a10	string		Use of the other CCD in this mosaic
H_SHUTTR	a10	string		Entrance shutter (OPEN, CLOSE)
H_HARTMN	a10	string		Hartmann shutter (U-OPEN,L-OPEN,ALL-OPEN,ALL-CLOSE)
H_COLLIM	a10	string		Collimator (BLUE, RED)
H_CLPSTN	f6.2	double	mm	Collimetor position (mm)
H_CLFOCL	f10.5	double	mm	Collimator focal length (mm)
H_CLOFFA	f10.5	double	degree	Collimator offset angle (degree)
H_ECHELL	a10	string		Echelle (BLUE, RED, NIR)
H_ECONST	f7.3	double	grooves/mm	Ruling pitch (grooves/mm)
H_EBLAZE	f7.3	double	degree	Blaze Angle (degree)
H_EEPSRN	f7.3	double	degree	Offset Angle of the Incident Beam (degree)
H_EGAMMA	f7.3	double	degree	Echelle Gamma Angle (constant)
H_EROTAN	f10.5	double	degree	Echelle Rotation Angle (degree)
H_CROSSD	a10	srting		Cross Disperser (BLUE, RED, MIRROR, NIR)
H_CCONST	f7.3	double	grooves/mm	Ruling pitch (grooves/mm)
H_CBLAZE	f7.3	double	degree	Blaze Angle (degree)
H_CEPSRN	f7.3	double	degree	Offset Angle at Blaze Wavelength (degree)
H_CGAMMA	f7.3	double	degree	Cross Disperser Gamma Angle (constant)
H_CTABAN	f10.5	double	degree	Rotation angle of the turn table (degree)
H_CROTAN	f10.5	double	degree	Cross Disperser Rotation Angle (degree)
H_CMRFL	f10.5	double	mm	Camera focal length (mm)
H_FOCUS	f10.5	double	mm	Focusing unit position (mm)
H_PITCH	f9.5	double	degree	Focusing unit pitching angle (degree)
H_YAWING	f9.5	double	degree	Focusing unit yawing angle (degree)
H_F-DRV1	f9.5	double	mm	Focusing driver1 position (mm)
H_F-DRV2	f9.5	double	mm	Focusing driver2 position (mm)
H_F-DRV3	f9.5	double	mm	Focusing driver3 position (mm)

[HDS Dictionary 2/2]

Header KeyWord	Value Format	Type	Unit	Comment
H_DETROT	f9.5	double	degree	Rotaiton angle of the detector unit (degree)
H_ET1AVE	f6.2	double	K	Average (Kelvin)
H_ET1MIN	f6.2	double	K	Minimum (Kelvin)
H_ET1MAX	f6.2	double	K	Maximum (Kelvin)
H_ET1DEV	f6.2	double	K	Standard Deviation (Kelvin)
H_AO-TYP	a20	string		Type of correction (Tip-Tilt)
H_AO-ORD	i3	integer		Maximum order included
H_AO-OBJ	a20	string		star used for wavefront correction
H_AO-RA	a20	string		RA of star used for wavefront correction
H_AO-DEC	a20	string		Dec of star used for wavefront correction
H_ZAXIS1	a20	string		Axis1 of zero'th order light monitor of Echelle (Along slit/Cross slit/None)
H_ZAXIS2	a20	string		Axis2 of zero'th order light monitor of Echelle (Along slit/Cross slit/None)
H_ZA1POS	f7.2	double	pixel	peak position in axis1
H_ZA2POS	f7.2	double	pixel	peak position in axis2
H_ZWID1	f7.2	double	pixel	Width in axis1 of the stellar image (pixel)
H_ZWID2	f7.2	double	pixel	Width in axis2 of the stellar image (pixel)
H_ZDELT	f6.4	double	mm	Pixel size (mm)
H_ZSCALE	f8.5	double	mm/pixel	Physical length on the slit plane projected into one pixel
H_ZTMP	f5.1	double	K	Detector temperature (Kelvin)
H_SUPER	a10	string		Super Resolution Mode (POS1, POS2, NONE)
H_AG-OBJ	a20	string		Guide object name
H_AG-ORA	a20	string		RA of the guide object
H_AG-ODE	a20	string		Dec of the guide object
H_AG-RA	a20	string		RA of the tracked pos. on the slit guide pos.
H_AG-DEC	a20	string		Dec of the tracked pos. on the slit guide pos.
H_AG-EQN	f6.1	double		Equinox of H_AG-RA and H_AG_DEC

6.3.5 CISCO/OHS

CISCO/OHS では O_ が略号として割り当てられているがサンプルヘッダーには O_ が見当たらないので、OH で始まる部分だけ抜き出してある。

Header Key Word	Value Format	Type	Unit	Comment
OHMSK	%30s	string		MASK name of OH Suppression
OHSLT	%30s	string		OHS slit
OHSLTLEN	%7.3f	double	arcsec	OHS slit length (arcsec)
OHSLTWID	%7.3f	double	arcsec	OHS slit width (arcsec)
OHFOCVAL	%7.3f	double		OHS FOCUS Value

6.3.6 SuprimeCam

Header Key Word	Value Format	Type	Unit	Comment
S_UFNAME	A40	CAHARCTER		User assigned file name
S_FRMPOS	A4	CHARACTER		Frame position (IIJJ)
S_BCTAVE	F9.3	REAL	ADU	Average count outside effective data
S_BCTSD	F9.3	REAL	ADU	S.D. of the count outside the eff. data
S_AG-OBJ	A40	CHARACTER		Name of the guide-star
S_AG-RA	A12	CHARACTER		R.A. of the guide-star
S_AG-DEC	A12	CHARACTER		Dec. of the guide-star
S_AG-EQN	F6.1	REAL	y	Equinox of the guide-star position
S_AG-X	F7.2	REAL	mm	Position of the guiding probe (X)
S_AG-Y	F7.2	REAL	mm	Position of the guiding probe (Y)
S_AG-R	F7.2	REAL	mm	Position of the guiding probe (R)
S_AG-TH	F7.2	REAL	degree	Position of the guiding probe (theta)
S_ETMED	F6.2	REAL	K	Averaged temp. in Camera enclosure (Kelvin)
S_ETMAX	F6.2	REAL	K	Maximum temp. in Camera enclosure (Kelvin)
S_ETMIN	F6.2	REAL	K	Minimum temp. in Camera enclosure (Kelvin)

6.3.7 MIRTOS

Header Key Word	Value Format	Type	Unit	Comment
M_CHID				ID of camera channel of MIRTOS
M_TWID				ID of two-wavelength simultaneous file
M_FLATID				ID of the most recent flat field file
M_DARKID				ID of the most recent dark exposure file
M_DETO1			pixel	Rel X pos of NIR from MIR on sky (pixel)
M_DETO2			pixel	Rel Y pos of NIR from MIR on sky (pixel)
M_CHOPTM			sec	CHopping period (sec)
M_CHOPTH			arcsec	CHopping throw (arcsec)
M_CHOPPA			deg	Chopping P.A. origin:source/pointing (deg)
M_NODTM			sec	Nodding period (sec)
M_NODTH			arcsec	Nodding throw (arcsec)
M_NODPA			deg	Nodding P.A. origin:source/pointing (deg)
M_O-TMP			K	Temperature of Optics (K)
M_A-TMP1			K	Temperature of Ambient thermometer (K)
M_A-TMP2			K	Temperature of Ambient thermometer (K)
M_A-TMP3			K	Temperature of Ambient thermometer (K)
M_A-TMP4			K	Temperature of Ambient thermometer (K)
M_CLKFL				Clock file name
M_CLKMR				Clock pattern macro name
M_CLKMC				Comment on clock pattern macro
M_BNDWTH			us	NIR band width 00:15K 01:150K 10:1.5M 11:3MHz
M_PIXTIM			us	Clock duration for a pixel (us)
M_FRTIME			ms	Time to sweep one frame (ms)
M_JPORT				Jump port value at the time of getting data
M_REFSUB				Subtraction of reference column T:done
M_ARRANG				Data arrangement T:FITS F:raw
M_BANK				Bank name where the data was stored
M_BBPOS				Black Body Position T:In F:Out
M_BBTMP			K	Temperature of Black Body (K)

6.4 略号表 (1998/05/10)

次ページ参照

Abbreviation	meaning	Category
END	END	Action
MID	MIDdle	Action
STR	STaRt	Action
HUM	HUMidity	Environment
PRS	PReSsure	Environment
TMP	TeMPerature	Environment
WND	WiND	Environment
BIN	BINning	Image
PRD	Partly ReaD out	Image
AO	Adaptive Optics	Instrument
APT	APerTure	Instrument
DET	DETector	Instrument
FLT	FiLTer	Instrument
PIX	PIXel	Instrument
PX	PiXel	Instrument
RET	RETarder	Instrument
SLT	SLiT	Instrument
ANG	ANGle	Statistics/Unit
AVE	AVErage	Statistics/Unit
CEN	CENter	Statistics/Unit
DIR	DIRection	Statistics/Unit
DISP	DISPersion	Statistics/Unit
FCT	FaCTor	Statistics/Unit
LEN	LENgth	Statistics/Unit
MAX	MAXimum	Statistics/Unit
MED	MEDian	Statistics/Unit
MIN	MINimum	Statistics/Unit
MOD	MODe	Statistics/Unit
PA	Position Angle	Statistics/Unit
RES	RESolution	Statistics/Unit
RNG	RaNGe	Statistics/Unit
SD	Standard Deviation	Statistics/Unit
SPC	SPaCial/SPaCe	Statistics/Unit
SPD	SPeeD	Statistics/Unit
SZ	SiZe	Statistics/Unit
TYP	TYPe	Statistics/Unit
VAL	VALue	Statistics/Unit
WAV	WAVelength	Statistics/Unit
WID	WIDth	Statistics/Unit
ADC	Atmospheric Dispersion Corrector	Telescope
AE	Absolute Encoder	Telescope
AG	AutoGuider	Telescope
AIRM	AIR Mass	Telescope
AZ	AZimuth	Telescope
CAL	CALibration source	Telescope
CS	CaSsegrain focus	Telescope
DEC	DEClination	Telescope
DOM	DOMe / enclosure	Telescope
EL	ELevation	Telescope
ELBX	ELectric terminal BoX	Telescope
FOC	telescope FOCus	Telescope
FV	Field Viewer	Telescope
IE	Incremental Encoder	Telescope
IMR	IMage Rotator	Telescope
INR	INstrumental Rotator	Telescope
M2	2-ndary Mirror	Telescope
M3	Tertiary Mirror	Telescope
NS	NaSmith focus	Telescope
PF	Primary Focus	Telescope
PM	Primary Mirror	Telescope
PMA	Primary Mirror Actuator	Telescope
POS	POSition	Telescope
RA	Right Ascension	Telescope
SECZ	SECant of Zenith distance	Telescope
TEL	TELescope	Telescope
ZD	Zenith Distance	Telescope
HST	Hawaii Standard Time	Time
JD	Julian Date	Time
LST	Local Siderial Time	Time
MJD	Modified Julian Date	Time
UT	Universal Time	Time

表 18: 略号

6.5 FITS ヘッダーサンプル

現時点ではすばる *FITS* ヘッダールールに反する箇所も見受けられるが、鋭意整備中であり、最新情報を参照願いたい (7.4.4 節参照)。

6.5.1 CIAO(1998/07/17)

● CIAO の Imaging mode

```
         1         2         3         4         5         6         7
12345678901234567890123456789012345678901234567890123456789012345678901234567890
--------------------------------------------------------------------------------
SIMPLE  =                    T / Must be 'T' for confirming FITS file
BITPIX  =                   16 / # of bits storing pix values
NAXIS   =                    2 / # of axes in frame                          %1d
NAXIS1  =                 1024 / # of pixels/row                             %5d
NAXIS2  =                 1024 / # of rows (also # of scan lines)            %5d
OBSERVER= 'Tamura,Suto,Itoh '  / Name of observer                            %30s
PROP-ID = 'P19970025-0001'     / Proposal ID                                 %20s
FRAMEID = 'CIAA00002347'       / Image sequential number                     %16s
EXP-ID  = 'CIAE00001174'       / ID of the exposure this data was taken      %16s
OBS-MOD = 'Imaging '           / Observation Mode                            %25s
DATA-TYP= 'OBJECT  '           / Type / Characteristics of  this data        %10s
DISPAXIS=                    1 / Dispersion axis in frame                     %1d
CRPIX1  =                512.0 / Reference pixel in X                      %6.1f
CRPIX2  =                512.0 / Reference pixel in Y                      %6.1f
CRVAL1  =         275.10837500 / Physical value of the reference pixel X  %13.8f
CRVAL2  =         -16.17306000 / Physical value of the reference pixel Y  %13.8f
CDELT1  =           0.00002778 / Size projected into a detector pixel X   %13.8f
CDELT2  =           0.00002778 / Size projected into a detector pixel Y   %13.8f
CTYPE1  = 'RA--TAN'            / Pixel coordinate system                     %16s
CTYPE2  = 'DEC--TAN'           / Pixel coordinate system                     %16s
CUNIT1  = 'degree  '           / Units used in both CRVAL1 and CDELT1        %10s
CUNIT2  = 'degree  '           / Units used in both CRVAL2 and CDELT2        %10s
PROJP1  =                  0.0 / Projection Type of the first axis          %5.1f
PROJP2  =                  0.0 / Projection Type of the second axis         %5.1f
LONGPOLE=                180.0 / The North Pole of the standard system      %6.1f
PC001001=           1.00000000 / Pixel Coordinate translation matrix      %12.8f
PC001002=           0.00000000 / Pixel Coordinate translation matrix      %12.8f
PC002001=           0.00000000 / Pixel Coordinate translation matrix      %12.8f
PC002002=           1.00000000 / Pixel Coordinate translation matrix      %12.8f
DATE-OBS= '1998-12-22'         / Observation start date  (yyyy-mm-dd)       %10s
UT      = '12:34:56.7'         / HH:MM:SS.S typical UTC at exposure         %10s
UT-STR  = '12:34:56.7'         / HH:MM:SS.S UTC at start                    %10s
UT-END  = '13:04:56.7'         / HH:MM:SS.S UT at end                       %10s
HST     = '02:34:56.7'         / HH:MM:SS.S Typical HST at exposure         %10s
LST     = '23:53:10.6'         / HH:MM:SS.S Typical LST at exposure         %20s
MJD     =       5.03965242E+04 / Modified Julian Day at typical time      %20.8f
TIMESYS = 'UTC     '           / Time System used in this header             %3s
INSTRUME= 'CIAO    '           / The name of instrument                      %4s
OBJECT  = 'GG Tau  '           / Target Description                         %30s
RA      = '18:20:26.010'       / HH:MM:SS.SSS RA pointing                   %12s
DEC     = '-16:12:07.06'       / +/-DD:MM:SS.SS DEC pointing                %12s
EQUINOX =               2000.0 / Standard FK5 (years)                      %6.1f
RADECSYS= 'FK5     '           / The equatorial coordinate system            %8s
RA2000  = '18:20:26.010'       / HH:MM:SS.SSS RA (J2000) pointing           %12s
DEC2000 = '-16:12:07.06'       / +/-DD:MM:SS.SS DEC (J2000) pointing        %12s
FOC-POS - 'CASSEGRAIN'         / Focus where the instrument is attached     %12s
FOC-VAL =                2.531 / Encoder value of the focus unit          %10.3f
FILTER01= 'J       '           / Filter name/ID                             %10s
FILTER02= 'NONE    '           / Filter name/ID                             %10s
AIRMASS =              1.24352 / Averaged Air Mass                         %9.5f
ZD      =                36.47 / Zenith Distance at typical time           %5.2f
ZD-STR  =                36.47 / Zenith distance at start                  %5.2f
ZD-END  =                36.52 / Zenith distance at end                    %5.2f
AZIMUTH =             120.3400 / Azimuth of telescope pointing             %9.5f
AUTOGUID= 'On      '           / Auto guider on/off                          %3s
M2-TIP  = 'Off     '           / 2nd mirror tip-tilt on-off                  %3s
INSROT  =               68.231 / Angle of instrument rotator               %7.3f
DETECTOR= 'Alladin '           / Name of the detector/CCD                   %10s
DET-TMP =               132.5 / Detector temperature                       %5.1f
GAIN    =                1.26 / AD conversion factor                       %5.2f
BIN-FCT1=                   1 / Binning factor of X axis                    %2d
BIN-FCT2=                   1 / Binning factor of Y axis                    %2d
DET-RST =                   2 / Reset number before exposure                %2d
DET-SMPL= 'destructive'        / Sample method                             %15s
DET-NSMP=                   2 / # of multiple sample in each exposure       %2d
DET-VER = 'dest-1  '           / Array control command script name         %30s
```

```
DET-TSD =                0.12 / Standard deviation of detector temp.(K)  %6.2f
PRD-MIN1=                   1 / Start x pos. of partialy read out          %5d
PRD-MIN2=                   1 / Start y pos. of partialy read out          %5d
PRD-RNG1=                1024 / x range of partialy read out               %5d
PRD-RNG2=                1024 / y range of partialy read out               %5d
EXPTIME =                60.0 / Exposure time          (sec)              %7.1f
COADD   =                   2 / # of coadd  EXP1TIMExCOADD=EXPTIME         %2d
EXP1TIME=               120.0 / Total integration time (sec)              %8.1f
SLIT    = 'None     '         / Identifier of the entrance slit used      %10s
SLT-LEN =               0.000 / Length of the slit used                   %7.3f
SLT-WID =               0.000 / Width of the slit used                    %6.3f
SLT-PA  =                 0.0 / Slit Position Angle                       %5.1f
WAVELEN =                0.00 / Wavelength at detector center             %6.2f
WAV-MIN =                0.00 / Shortest wavelength focused on detector   %6.2f
WAV-MAX =                0.00 / Longest wavelength focused on detector    %6.2f
SLTC-RA =                0.00 / RA of slit center (degree)                %9.5f
SLTC-DEC=                0.00 / DEC of slit center (degree)               %9.5f
SLTCPIX1=                 0.0 / Pixel of slit center (AXIS1)              %6.1f
SLTCPIX2=                 0.0 / Pixel of slit center (AXIS2)              %6.1f
RETPLAT1= 'None   '           / Identifier of the retarder plate1         %30s
RETPLAT2= 'None   '           / Identifier of the retarder plate2         %30s
RET_ANG1=                0.00 / Position angle of retarder1               %6.2f
RET_ANG2=                0.00 / Position angle of retarder2               %6.2f
POLARIZR= 'None   '           / Name of the Polarizer                     %10s
POL-ANG =                 0.0 / Position Angle of the Polarizer           %6.2f
AO      = 'On     '           / On or Off of Adaptive Optics              %3s
AO-WFS  =              0.3263 / Sigma of deformable mirror                %9.5f
AO-TIP  = 'On     '           / AO tip-tilt on/off                        %3s
AO-FREQ =                 150 / Frequency of AO loop (Hz)                 %3d
C_OMASK = 'CIAO #001'         / Identifier of the Occulting Mask          %15s
C_LYOTST= 'CIAO ##01'         / Identifier of the Lyot Stop               %15s
C_LYOANG=                30.1 / Lyot stop position angle  (degree)        %5.1f
C_CAMERA= 'HRM      '         / Camera mode                               %15s
C_BNCTMP=                70.02 / Optical bench temperature (K)            %6.2f
C_COLX  =               125.34 / Collimator lens x position (um)          %6.2f
C_COLY  =                20.98 / Collimator lens y position (um)          %6.2f
C_VACUUM=             1.236e-7 / Vacuum inside dewar (torr)               %8.3f
C_SHUTTR= 'OFF      '         / Shutter above CIAO  on/off                %3s
C_DETPOS=                54732 / Detector stage position (um)             %5d
C_WATER1=                 1.34 / Water flow to rack1 (l/min)              %5.2f
C_WATER2=                 0.23 / Water flow to rack2 (l/min)              %5.2f
INS-VER = 'ver9812  '         / Version of the instrument soft/hard       %30s
DOM-HUM =                 32.7 / Dome humidity       (%)                 %5.1f
OUT-HUM =                 36.5 / Outside humidity    (%)                 %5.1f
DOM-TMP =                  4.2 / Dome temperature    (C)                 %6.2f
OUT-TMP =                  6.4 / Outside temperature (C)                 %6.2f
DOM-WND =                 2.35 / Dome wind speed     (m/sec)             %5.2f
OUT-WND =                 4.50 / Outside wind speed                      %5.2f
DOM-PRS =               667.42 / Dome pressure       (hpa)               %7.2f
OUT-PRS =               664.67 / Outside pressure    (hpa)               %7.2f
SEEING  =                 0.46 / Seeing size         (arcsec)            %4.2f
WEATHER = 'excellent'         / Weather condition                         %30s
TELESCOP= 'SUBARU  '          / The name of telescope data obtained       %6s
OBSERVAT= 'NAOJ    '          / Observatory Name                          %4s
BLANK   =                65536 / Value used for NULL pixels               %5d
BSCALE  =                 1.00 / Real = fits-value*BSCALE+BZERO          %4.2f
BUNIT   = 'ADU     '          / Unit of original pixel values             %3s
BZERO   =                42.00 / Real = fits-value*BSCALE+BZERO          %5.2f
DATASET = 'DTSET-CIAO-12123 '  / Dataset Identification Number           %30s
END
```

● CIAO の Polarimetry mode

```
         1         2         3         4         5         6         7
1234567890123456789012345678901234567890123456789012345678901234567890123456789
--------------------------------------------------------------------------------
SIMPLE  =                    T / Must be 'T' for confirming FITS file
BITPIX  =                   16 / # of bits storing pix values
NAXIS   =                    2 / # of axes in frame                        %1d
NAXIS1  =                 1024 / # of pixels/row                           %5d
NAXIS2  =                 1024 / # of rows (also # of scan lines)          %5d
OBSERVER= 'Tamura,Suto,Itoh '  / Name of observer                          %30s
PROP-ID = 'P19970025-0001'     / Proposal ID                               %20s
FRAMEID = 'CIAA00002347'       / Image sequential number                   %16s
EXP-ID  = 'CIAE00001174'       / ID of the exposure this data was taken    %16s
OBS-MOD = 'Imaging Polarimetry'/ Observation Mode                          %25s
DATA-TYP= 'OBJECT  '           / Type / Characteristics of  this data      %10s
DISPAXIS=                    1 / Dispersion axis in frame                   %1d
CRPIX1  =                512.0 / Reference pixel in X                     %6.1f
CRPIX2  =                512.0 / Reference pixel in Y                     %6.1f
CRVAL1  =         275.10837500 / Physical value of the reference pixel X %13.8f
CRVAL2  =         -16.17306000 / Physical value of the reference pixel Y %13.8f
```

```
CDELT1  =           0.00002778 / Size projected into a detector pixel X  %13.8f
CDELT2  =           0.00002778 / Size projected into a detector pixel Y  %13.8f
CTYPE1  = 'RA--TAN '           / Pixel coordinate system                   %16s
CTYPE2  = 'DEC--TAN'           / Pixel coordinate system                   %16s
CUNIT1  = 'degree  '           / Units used in both CRVAL1 and CDELT1      %10s
CUNIT2  = 'degree  '           / Units used in both CRVAL2 and CDELT2      %10s
PROJP1  =                  0.0 / Projection Type of the first axis         %5.1f
PROJP2  =                  0.0 / Projection Type of the second axis        %5.1f
LONGPOLE=                180.0 / The North Pole of the standard system     %6.1f
PC001001=           1.00000000 / Pixel Coordinate translation matrix      %12.8f
PC001002=           0.00000000 / Pixel Coordinate translation matrix      %12.8f
PC002001=           0.00000000 / Pixel Coordinate translation matrix      %12.8f
PC002002=           1.00000000 / Pixel Coordinate translation matrix      %12.8f
DATE-OBS= '1998-12-22'         / Observation start date  (yyyy-mm-dd)      %10s
UT      = '12:34:56.7'         / HH:MM:SS.S typical UTC at exposure        %10s
UT-STR  = '12:34:56.7'         / HH:MM:SS.S UTC at start                   %10s
UT-END  = '13:04:56.7'         / HH:MM:SS.S UT at end                      %10s
HST     = '02:34:56.7'         / HH:MM:SS.S Typical HST at exposure        %10s
LST     = '23:53:10.6'         / HH:MM:SS.S Typical LST at exposure        %20s
MJD     =       5.03965242E+04 / Modified Julian Day at typical time      %20.8f
TIMESYS = 'UTC     '           / Time System used in this header            %3s
INSTRUME= 'CIAO    '           / The name of instrument                     %4s
OBJECT  = 'GG Tau  '           / Target Description                        %30s
RA      = '18:20:26.010'       / HH:MM:SS.SSS RA pointing                  %12s
DEC     = '-16:12:07.06'       / +/-DD:MM:SS.SS DEC pointing               %12s
EQUINOX =               2000.0 / Standard FK5 (years)                      %6.1f
RADECSYS= 'FK5     '           / The equatorial coordinate system           %8s
RA2000  = '18:20:26.010'       / HH:MM:SS.SSS RA (J2000) pointing          %12s
DEC2000 = '-16:12:07.06'       / +/-DD:MM:SS.SS DEC (J2000) pointing       %12s
FOC-POS - 'CASSEGRAIN'         / Focus where the instrument is attached    %12s
FOC-VAL =                 2.531 / Encoder value of the focus unit         %10.3f
FILTER01= 'J       '           / Filter name/ID                             %10s
FILTER02= 'NONE    '           / Filter name/ID                             %10s
AIRMASS =              1.24352 / Averaged Air Mass                        %9.5f
ZD      =                36.47 / Zenith Distance at typical time          %5.2f
ZD-STR  =                36.47 / Zenith distance at start                 %5.2f
ZD-END  =                36.52 / Zenith distance at end                   %5.2f
AZIMUTH =             120.3400 / Azimuth of telescope pointing            %9.5f
AUTOGUID= 'On      '           / Auto guider on/off                         %3s
M2-TIP  = 'Off     '           / 2nd mirror tip-tilt on-off                 %3s
INSROT  =               68.231 / Angle of instrument rotator              %7.3f
DETECTOR= 'Alladin '           / Name of the detector/CCD                  %10s
DET-TMP =                132.5 / Detector temperature                      %5.1f
GAIN    =                 1.26 / AD conversion factor                      %5.2f
BIN-FCT1=                    1 / Binning factor of X axis                  %2d
BIN-FCT2=                    1 / Binning factor of Y axis                  %2d
DET-RST =                    2 / Reset number before exposure              %2d
DET-SMPL= 'destructive'        / Sample method                            %15s
DET-NSMP=                    2 / # of multiple sample in each exposure     %2d
DET-VER = 'dest-1  '           / Array control command script name         %30s
DET-TSD =                 0.12 / Standard deviation of detector temp.(K)  %6.2f
PRD-MIN1=                    1 / Start x pos. of partialy read out         %5d
PRD-MIN2=                    1 / Start y pos. of partialy read out         %5d
PRD-RNG1=                 1024 / x range of partialy read out              %5d
PRD-RNG2=                 1024 / y range of partialy read out              %5d
EXP1TIME=                 60.0 / Exposure time for one readout (sec)      %7.1f
COADD   =                    2 / # of coadd  EXP1TIMExCOADD=EXPTIME        %2d
EXPTIME =                120.0 / Total integration time (sec)             %8.1f
SLIT    = 'None    '           / Identifier of the entrance slit used      %10s
SLT-LEN =                0.000 / Length of the slit used                  %7.3f
SLT-WID =                0.000 / Width of the slit used                   %6.3f
SLT-PA  =                  0.0 / Slit Position Angle                      %5.1f
WAVELEN =                 0.00 / Wavelength at detector center            %6.2f
WAV-MIN =                 0.00 / Shortest wavelength focused on detector  %6.2f
WAV-MAX =                 0.00 / Longest wavelength focused on detector   %6.2f
SLTC-RA =                 0.00 / RA of slit center (degree)               %9.5f
SLTC-DEC=                 0.00 / DEC of slit center (degree)              %9.5f
SLTCPIX1=                  0.0 / Pixel of slit center (AXIS1)             %6.1f
SLTCPIX2=                  0.0 / Pixel of slit center (AXIS2)             %6.1f
RETPLAT1= '1/2     '           / Identifier of the retarder plate1         %30s
RETPLAT2= 'None    '           / Identifier of the retarder plate2         %30s
RET-ANG1=                45.00 / Position angle of retarder1              %6.2f
RET-ANG2=                 0.00 / Position angle of retarder2              %6.2f
POLARIZR= 'wiregridA'          / Name of the Polarizer                     %10s
POL-ANG =                  4.2 / Position Angle of the Polarizer          %6.2f
AO      = 'On      '           / On or Off of Adaptive Optics               %3s
AO-WFS  =               0.3263 / Sigma of deformable mirror               %9.5f
AO-TIP  = 'On      '           / AO tip-tilt on/off                         %3s
AO-FREQ =                  150 / Frequency of AO loop (Hz)                 %3d
C_OMASK = 'CIAO #001'          / Identifier of the Occulting Mask          %15s
C_LYOTST= 'CIAO ##01'          / Identifier of the Lyot Stop               %15s
C_LYOANG=                 30.1 / Lyot stop position angle  (degree)        %5.1f
C_CAMERA= 'HRM      '          / Camera mode                               %15s
C_BNCTMP=                70.02 / Optical bench temperature (K)            %6.2f
```

```
C_COLX  =               125.34 / Collimator lens x position (um)          %6.2f
C_COLY  =                20.98 / Collimator lens y position (um)          %6.2f
C_VACUUM=             1.236e-7 / Vacuum inside dewar (torr)               %8.3f
C_SHUTTR= 'OFF      '          / Shutter above CIAO  on/off                %3s
C_DETPOS=                54732 / Detector stage position (um)            %5d
C_WATER1=                 1.34 / Water flow to rack1 (l/min)             %5.2f
C_WATER2=                 0.23 / Water flow to rack2 (l/min)             %5.2f
INS-VER = 'ver9812  '          / Version of the instrument soft/hard      %30s
DOM-HUM =                 32.7 / Dome humidity       (%)                 %5.1f
OUT-HUM =                 36.5 / Outside humidity    (%)                 %5.1f
DOM-TMP =                  4.2 / Dome temperature    (C)                 %6.2f
OUT-TMP =                  6.4 / Outside temperature (C)                 %6.2f
DOM-WND =                 2.35 / Dome wind speed     (m/sec)             %5.2f
OUT-WND =                 4.50 / Outside wind speed                      %5.2f
DOM-PRS =               667.42 / Dome pressure       (hpa)               %7.2f
OUT-PRS =               664.67 / Outside pressure    (hpa)               %7.2f
SEEING  =                 0.46 / Seeing size         (arcsec)            %4.2f
WEATHER = 'excellent'          / Weather condition                       %30s
TELESCOP= 'SUBARU   '          / The name of telescope data obtained      %6s
OBSERVAT= 'NAOJ     '          / Observatory Name                         %4s
BLANK   =                65536 / Value used for NULL pixels               %5d
BSCALE  =                 1.00 / Real = fits-value*BSCALE+BZERO          %4.2f
BUNIT   = 'ADU      '          / Unit of original pixel values            %3s
BZERO   =                42.00 / Real = fits-value*BSCALE+BZERO          %5.2f
DATASET = 'DTSET-CIAO-12123 '  / Dataset Identification Number           %30s
END
```

● CIAO ∅ SpectroPolarimetry mode

```
         1         2         3         4         5         6         7
1234567890123456789012345678901234567890123456789012345678901234567890123456789
--------------------------------------------------------------------------------
SIMPLE  =                    T / Must be 'T' for confirming FITS file
BITPIX  =                   16 / # of bits storing pix values
NAXIS   =                    2 / # of axes in frame                        %1d
NAXIS1  =                 1024 / # of pixels/row                           %5d
NAXIS2  =                 1024 / # of rows (also # of scan lines)          %5d
OBSERVER= 'Tamura,Suto,Itoh '  / Name of observer                          %30s
PROP-ID = 'P19970025-0001'     / Proposal ID                               %20s
FRAMEID = 'CIAA00002347'       / Image sequential number                   %16s
EXP-ID  = 'CIAE00001174'       / ID of the exposure this data was taken    %16s
OBS-MOD = 'Spectropolarimetry' / Observation Mode                          %25s
DATA-TYP= 'OBJECT  '           / Type / Characteristics of  this data      %10s
DISPAXIS=                    1 / Dispersion axis in frame                   %1d
CRPIX1  =                512.0 / Reference pixel in X                     %6.1f
CRPIX2  =                512.0 / Reference pixel in Y                     %6.1f
CRVAL1  =         275.10837500 / Physical value of the reference pixel X %13.8f
CRVAL2  =         -16.17306000 / Physical value of the reference pixel Y %13.8f
CDELT1  =           0.00002778 / Size projected into a detector pixel X  %13.8f
CDELT2  =           0.00002778 / Size projected into a detector pixel Y  %13.8f
CTYPE1  = 'RA--TAN '           / Pixel coordinate system                   %16s
CTYPE2  = 'DEC--TAN'           / Pixel coordinate system                   %16s
CUNIT1  = 'degree  '           / Units used in both CRVAL1 and CDELT1      %10s
CUNIT2  = 'degree  '           / Units used in both CRVAL2 and CDELT2      %10s
PROJP1  =                   0.0 / Projection Type of the first axis        %5.1f
PROJP2  =                   0.0 / Projection Type of the second axis       %5.1f
LONGPOLE=                 180.0 / The North Pole of the standard system    %6.1f
PC001001=            1.00000000 / Pixel Coordinate translation matrix     %12.8f
PC001002=            0.00000000 / Pixel Coordinate translation matrix     %12.8f
PC002001=            0.00000000 / Pixel Coordinate translation matrix     %12.8f
PC002002=            1.00000000 / Pixel Coordinate translation matrix     %12.8f
DATE-OBS= '1998-12-22'         / Observation start date  (yyyy-mm-dd)      %10s
UT      = '12:34:56.7'         / HH:MM:SS.S typical UTC at exposure        %10s
UT-STR  = '12:34:56.7'         / HH:MM:SS.S UTC at start                   %10s
UT-END  = '13:04:56.7'         / HH:MM:SS.S UT at end                      %10s
HST     = '02:34:56.7'         / HH:MM:SS.S Typical HST at exposure        %10s
LST     = '23:53:10.6'         / HH:MM:SS.S Typical LST at exposure        %20s
MJD     =       5.03965242E+04 / Modified Julian Day at typical time     %20.8f
TIMESYS = 'UTC     '           / Time System used in this header            %3s
INSTRUME= 'CIAO    '           / The name of instrument                     %4s
OBJECT  = 'GG Tau  '           / Target Description                        %30s
RA      = '18:20:26.010'       / HH:MM:SS.SSS RA pointing                  %12s
DEC     = '-16:12:07.06'       / +/-DD:MM:SS.SS DEC pointing               %12s
EQUINOX =                2000.0 / Standard FK5 (years)                    %6.1f
RADECSYS= 'FK5     '           / The equatorial coordinate system           %8s
RA2000  = '18:20:26.010'       / HH:MM:SS.SSS RA (J2000) pointing          %12s
DEC2000 = '-16:12:07.06'       / +/-DD:MM:SS.SS DEC (J2000) pointing       %12s
FOC-POS - 'CASSEGRAIN'         / Focus where the instrument is attached    %12s
FOC-VAL =                2.531 / Encoder value of the focus unit         %10.3f
FILTER01= 'J       '           / Filter name/ID                            %10s
FILTER02= 'NONE    '           / Filter name/ID                            %10s
AIRMASS =              1.24352 / Averaged Air Mass                        %9.5f
```

```
ZD      =                36.47 / Zenith Distance at typical time          %5.2f
ZD-STR  =                36.47 / Zenith distance at start                 %5.2f
ZD-END  =                36.52 / Zenith distance at end                   %5.2f
AZIMUTH =             120.3400 / Azimuth of telescope pointing            %9.5f
AUTOGUID= 'On      '           / Auto guider on/off                         %3s
M2-TIP  = 'Off     '           / 2nd mirror tip-tilt on-off                 %3s
INSROT  =               68.231 / Angle of instrument rotator              %7.3f
DETECTOR= 'Alladin '           / Name of the detector/CCD                  %10s
DET-TMP =                132.5 / Detector temperature                     %5.1f
GAIN    =                 1.26 / AD conversion factor                     %5.2f
BIN-FCT1=                    1 / Binning factor of X axis                  %2d
BIN-FCT2=                    1 / Binning factor of Y axis                  %2d
DET-RST =                    2 / Reset number before exposure              %2d
DET-SMPL= 'destructive'        / Sample method                            %15s
DET-NSMP=                    2 / # of multiple sample in each exposure     %2d
DET-VER = 'dest-1  '           / Array control command script name        %30s
DET-TSD =                 0.12 / Standard deviation of detector temp.(K)  %6.2f
PRD-MIN1=                    1 / Start x pos. of partialy read out         %5d
PRD-MIN2=                    1 / Start y pos. of partialy read out         %5d
PRD-RNG1=                 1024 / x range of partialy read out              %5d
PRD-RNG2=                 1024 / y range of partialy read out              %5d
EXP1TIME=                 60.0 / Exposure time for one readout (sec)     %7.1f
COADD   =                    2 / # of coadd  EXP1TIMExCOADD=EXPTIME        %2d
EXPTIME =                120.0 / Total integration time (sec)            %8.1f
SLIT    = 'longslit    '       / Identifier of the entrance slit used     %10s
SLT-LEN =              360.000 / Length of the slit used                 %7.3f
SLT-WID =                0.200 / Width of the slit used                  %6.3f
SLT-PA  =                  0.0 / Slit Position Angle                     %5.1f
WAVELEN =              1100.00 / Wavelength at detector center (nm)      %6.2f
WAV-MIN =              1056.93 / Shortest wavelength focused on detector %6.2f
WAV-MAX =              1170.07 / Longest wavelength focused on detector  %6.2f
SLTC-RA =            275.10838 / RA of slit center (degree)              %9.5f
SLTC-DEC=            -16.20196 / DEC of slit center (degree)             %9.5f
SLTCPIX1=                512.0 / Pixel of slit center (AXIS1)            %6.1f
SLTCPIX2=                512.0 / Pixel of slit center (AXIS2)            %6.1f
RETPLAT1= '1/2     '           / Identifier of the retarder plate1        %30s
RETPLAT2= 'None    '           / Identifier of the retarder plate2        %30s
RET-ANG1=                45.00 / Position angle of retarder1             %6.2f
RET-ANG2=                 0.00 / Position angle of retarder2             %6.2f
POLARIZR= 'wiregridA'          / Name of the Polarizer                    %10s
POL-ANG =                  4.2 / Position Angle of the Polarizer         %6.2f
AO      = 'On      '           / On or Off of Adaptive Optics              %3s
AO-WFS  =               0.3263 / Sigma of deformable mirror              %9.5f
AO-TIP  = 'On      '           / AO tip-tilt on/off                        %3s
AO-FREQ =                  150 / Frequency of AO loop (Hz)               %3d
C_OMASK = 'CIAO #001'          / Identifier of the Occulting Mask         %15s
C_LYOTST= 'CIAO ##01'          / Identifier of the Lyot Stop              %15s
C_LYOANG=                 30.1 / Lyot stop position angle  (degree)      %5.1f
C_CAMERA= 'HRM     '           / Camera mode                              %15s
C_BNCTMP=                70.02 / Optical bench temperature (K)          %6.2f
C_COLX  =               125.34 / Collimator lens x position (um)        %6.2f
C_COLY  =                20.98 / Collimator lens y position (um)        %6.2f
C_VACUUM=             1.236e-7 / Vacuum inside dewar (torr)             %8.3f
C_SHUTTR= 'OFF     '           / Shutter above CIAO  on/off                %3s
C_DETPOS=                54732 / Detector stage position (um)            %5d
C_WATER1=                 1.34 / Water flow to rack1 (l/min)             %5.2f
C_WATER2=                 0.23 / Water flow to rack2 (l/min)             %5.2f
INS-VER = 'ver9812  '          / Version of the instrument soft/hard      %30s
DOM-HUM =                 32.7 / Dome humidity       (%)                %5.1f
OUT-HUM =                 36.5 / Outside humidity    (%)                %5.1f
DOM-TMP =                  4.2 / Dome temperature    (C)                %6.2f
OUT-TMP =                  6.4 / Outside temperature (C)                %6.2f
DOM-WND =                 2.35 / Dome wind speed     (m/sec)            %5.2f
OUT-WND =                 4.50 / Outside wind speed                     %5.2f
DOM-PRS =               667.42 / Dome pressure       (hpa)              %7.2f
OUT-PRS =               664.67 / Outside pressure    (hpa)              %7.2f
SEEING  =                 0.46 / Seeing size         (arcsec)           %4.2f
WEATHER = 'excellent'          / Weather condition                        %30s
TELESCOP= 'SUBARU  '           / The name of telescope data obtained       %6s
OBSERVAT= 'NAOJ    '           / Observatory Name                          %4s
BLANK   =                65536 / Value used for NULL pixels               %5d
BSCALE  =                 1.00 / Real = fits-value*BSCALE+BZERO          %4.2f
BUNIT   = 'ADU     '           / Unit of original pixel values             %3s
BZERO   =                42.00 / Real = fits-value*BSCALE+BZERO          %5.2f
DATASET = 'DTSET-CIAO-12123 '  / Dataset Identification Number            %30s
END
```

- CIAO ∅ Spectroscopy mode

```
        1         2         3         4         5         6         7
12345678901234567890123456789012345678901234567890123456789012345678901234567890123456789
--------------------------------------------------------------------------------
```

```
SIMPLE  =                    T / Must be 'T' for confirming FITS file
BITPIX  =                   16 / # of bits storing pix values
NAXIS   =                    2 / # of axes in frame                         %1d
NAXIS1  =                 1024 / # of pixels/row                            %5d
NAXIS2  =                 1024 / # of rows (also # of scan lines)           %5d
OBSERVER= 'Tamura,Suto,Itoh '  / Name of observer                            %30s
PROP-ID = 'P19970025-0001'     / Proposal ID                                 %20s
FRAMEID = 'CIAA00002347'       / Image sequential number                     %16s
EXP-ID  = 'CIAE00001174'       / ID of the exposure this data was taken      %16s
OBS-MOD = 'Spectroscopy'       / Observation Mode                            %25s
DATA-TYP= 'OBJECT  '           / Type / Characteristics of  this data        %10s
DISPAXIS=                    1 / Dispersion axis in frame                     %1d
CRPIX1  =                512.0 / Reference pixel in X                       %6.1f
CRPIX2  =                512.0 / Reference pixel in Y                       %6.1f
CRVAL1  =         275.10837500 / Physical value of the reference pixel X   %13.8f
CRVAL2  =         -16.17306000 / Physical value of the reference pixel Y   %13.8f
CDELT1  =           0.00002778 / Size projected into a detector pixel X    %13.8f
CDELT2  =           0.00002778 / Size projected into a detector pixel Y    %13.8f
CTYPE1  = 'RA--TAN '           / Pixel coordinate system                     %16s
CTYPE2  = 'DEC--TAN'           / Pixel coordinate system                     %16s
CUNIT1  = 'degree  '           / Units used in both CRVAL1 and CDELT1        %10s
CUNIT2  = 'degree  '           / Units used in both CRVAL2 and CDELT2        %10s
PROJP1  =                  0.0 / Projection Type of the first axis          %5.1f
PROJP2  =                  0.0 / Projection Type of the second axis         %5.1f
LONGPOLE=                180.0 / The North Pole of the standard system      %6.1f
PC001001=           1.00000000 / Pixel Coordinate translation matrix       %12.8f
PC001002=           0.00000000 / Pixel Coordinate translation matrix       %12.8f
PC002001=           0.00000000 / Pixel Coordinate translation matrix       %12.8f
PC002002=           1.00000000 / Pixel Coordinate translation matrix       %12.8f
DATE-OBS= '1998-12-22'         / Observation start date  (yyyy-mm-dd)        %10s
UT      = '12:34:56.7'         / HH:MM:SS.S typical UTC at exposure          %10s
UT-STR  = '12:34:56.7'         / HH:MM:SS.S UTC at start                     %10s
UT-END  = '13:04:56.7'         / HH:MM:SS.S UT at end                        %10s
HST     = '02:34:56.7'         / HH:MM:SS.S Typical HST at exposure          %10s
LST     = '23:53:10.6'         / HH:MM:SS.S Typical LST at exposure          %20s
MJD     =       5.03965242E+04 / Modified Julian Day at typical time       %20.8f
TIMESYS = 'UTC     '           / Time System used in this header             %8s
INSTRUME= 'CIAO    '           / The name of instrument                      %8s
OBJECT  = 'GG Tau  '           / Target Description                          %30s
RA      = '18:20:26.010'       / HH:MM:SS.SSS RA pointing                    %12s
DEC     = '-16:12:07.06'       / +/-DD:MM:SS.SS DEC pointing                 %12s
EQUINOX =               2000.0 / Standard FK5 (years)                       %6.1f
RADECSYS= 'FK5     '           / The equatorial coordinate system            %8s
RA2000  = '18:20:26.010'       / HH:MM:SS.SSS RA (J2000) pointing            %12s
DEC2000 = '-16:12:07.06'       / +/-DD:MM:SS.SS DEC (J2000) pointing         %12s
FOC-POS - 'CASSEGRAIN'         / Focus where the instrument is attached      %12s
FOC-VAL =                2.531 / Encoder value of the focus unit           %10.3f
FILTER01= 'J       '           / Filter name/ID                              %10s
FILTER02= 'NONE    '           / Filter name/ID                              %10s
AIRMASS =              1.24352 / Averaged Air Mass                         %9.5f
ZD      =                36.47 / Zenith Distance at typical time           %5.2f
ZD-STR  =                36.47 / Zenith distance at start                  %5.2f
ZD-END  =                36.52 / Zenith distance at end                    %5.2f
AZIMUTH =             120.3400 / Azimuth of telescope pointing             %9.5f
AUTOGUID= 'On      '           / Auto guider on/off                          %3s
M2-TIP  = 'Off     '           / 2nd mirror tip-tilt on-off                  %3s
INSROT  =               68.231 / Angle of instrument rotator               %7.3f
DETECTOR= 'Alladin '           / Name of the detector/CCD                    %10s
DET-TMP =                132.5 / Detector temperature                       %5.1f
GAIN    =                 1.26 / AD conversion factor                       %5.2f
BIN-FCT1=                    1 / Binning factor of X axis                    %2d
BIN-FCT2=                    1 / Binning factor of Y axis                    %2d
DET-RST =                    2 / Reset number before exposure                %2d
DET-SMPL= 'destructive'        / Sample method                              %15s
DET-NSMP=                    2 / # of multiple sample in each exposure       %2d
DET-VER = 'dest-1  '           / Array control command script name          %30s
DET-TSD =                 0.12 / Standard deviation of detector temp.(K)   %6.2f
PRD-MIN1=                    1 / Start x pos. of partialy read out           %5d
PRD-MIN2=                    1 / Start y pos. of partialy read out           %5d
PRD-RNG1=                 1024 / x range of partialy read out                %5d
PRD-RNG2=                 1024 / y range of partialy read out                %5d
EXP1TIME=                 60.0 / Exposure time for one readout (sec)       %7.1f
COADD   =                    2 / # of coadd  EXP1TIMExCOADD=EXPTIME          %2d
EXPTIME =                120.0 / Total integration time (sec)              %8.1f
SLIT    = 'longslit    '       / Identifier of the entrance slit used       %10s
SLT-LEN =              360.000 / Length of the slit used                   %7.3f
SLT-WID =                0.200 / Width of the slit used                    %6.3f
SLT-PA  =                  0.0 / Slit Position Angle                       %5.1f
WAVELEN =              1100.00 / Wavelength at detector center (nm)        %6.2f
WAV-MIN =              1056.93 / Shortest wavelength focused on detector   %6.2f
WAV-MAX =              1170.07 / Longest wavelength focused on detector    %6.2f
SLTC-RA =            275.10838 / RA of slit center (degree)               %9.5f
SLTC-DEC=            -16.20196 / DEC of slit center (degree)              %9.5f
SLTCPIX1=                512.0 / Pixel of slit center (AXIS1)            %6.1f
```

```
SLTCPIX2=                512.0 / Pixel of slit center (AXIS2)             %6.1f
RETPLAT1= 'None    '           / Identifier of the retarder plate1         %30s
RETPLAT2= 'None    '           / Identifier of the retarder plate2         %30s
RET-ANG1=                  0.00 / Position angle of retarder1              %6.2f
RET-ANG2=                  0.00 / Position angle of retarder2              %6.2f
POLARIZR= 'None    '           / Name of the Polarizer                     %10s
POL-ANG =                   0.0 / Position Angle of the Polarizer          %6.2f
AO      = 'On      '           / On or Off of Adaptive Optics               %3s
AO-WFS  =                0.3263 / Sigma of deformable mirror               %9.5f
AO-TIP  = 'On      '           / AO tip-tilt on/off                         %3s
AO-FREQ =                   150 / Frequency of AO loop (Hz)                 %3d
C_OMASK = 'CIAO #001'          / Identifier of the Occulting Mask          %15s
C_LYOTST= 'CIAO ##01'          / Identifier of the Lyot Stop               %15s
C_LYOANG=                  30.1 / Lyot stop position angle  (degree)       %5.1f
C_CAMERA= 'HRM      '          / Camera mode                               %15s
C_BNCTMP=                 70.02 / Optical bench temperature (K)            %6.2f
C_COLX  =                125.34 / Collimator lens x position (um)          %6.2f
C_COLY  =                 20.98 / Collimator lens y position (um)          %6.2f
C_VACUUM=              1.236e-7 / Vacuum inside dewar (torr)               %8.3f
C_SHUTTR= 'OFF      '          / Shutter above CIAO  on/off                 %3s
C_DETPOS=                 54732 / Detector stage position (um)              %5d
C_WATER1=                  1.34 / Water flow to rack1 (l/min)              %5.2f
C_WATER2=                  0.23 / Water flow to rack2 (l/min)              %5.2f
INS-VER = 'ver9812  '          / Version of the instrument soft/hard       %30s
DOM-HUM =                  32.7 / Dome humidity       (%)                  %5.1f
OUT-HUM =                  36.5 / Outside humidity    (%)                  %5.1f
DOM-TMP =                   4.2 / Dome temperature    (C)                  %6.2f
OUT-TMP =                   6.4 / Outside temperature (C)                  %6.2f
DOM-WND =                  2.35 / Dome wind speed     (m/sec)              %5.2f
OUT-WND =                  4.50 / Outside wind speed                       %5.2f
DOM-PRS =                667.42 / Dome pressure       (hpa)               %7.2f
OUT-PRS =                664.67 / Outside pressure    (hpa)               %7.2f
SEEING  =                  0.46 / Seeing size         (arcsec)            %4.2f
WEATHER = 'excellent'          / Weather condition                         %30s
TELESCOP= 'SUBARU  '           / The name of telescope data obtained        %6s
OBSERVAT= 'NAOJ    '           / Observatory Name                           %3s
BLANK   =                 65536 / Value used for NULL pixels               %5d
BSCALE  =                  1.00 / Real = fits-value*BSCALE+BZERO           %4.2f
BUNIT   = 'ADU     '           / Unit of original pixel values              %3s
BZERO   =                 42.00 / Real = fits-value*BSCALE+BZERO           %5.2f
DATASET = 'DTSET-CIAO-12123 '  / Dataset Identification Number             %30s
END
```

6.5.2 COMICS(1998/08/19)

● COMICS の Imaging mode

```
         1         2         3         4         5         6         7
1234567890123456789012345678901234567890123456789012345678901234567890123456789
--------------------------------------------------------------------------------
SIMPLE  =                    T / Standard FITS format
BITPIX  =                   32 / # of bits storing pix values
NAXIS   =                    4 / # of axis in frame                          %1d
NAXIS1  =                  240 / # of pixels/row                             %5d
NAXIS2  =                  336 / # of rows                                   %5d
NAXIS3  =                    1 / # of detectors                              %5d
NAXIS4  =                  100 / # of frames                                 %5d
EXTEND  =                    F / ASCII Table for Z-frame description         %c
COMMENT ++++++++++++++++++++++++++ ???
DATASET = 'DSET-COMICS-123456' / Dataset Identification Number              %20s
FRAMEID = 'COM1234567890123'   / FITS File sequential number                %16s
EXP-ID  = 'COME123456789012'   / ID of the exposure this data was takenA    %16s
OBS-ALOC= '             '      / Allocation Mode for Instrument             %12s
COMMENT ++++++++++++++++++++++++++ Observatory/Instrument
OBSERVER= 'Ktz,Ymst,Myt,Okmt ' / Name of observers                          %64s
PROP-ID = 'P1999-0709-1    '   / Proposal ID                                %20s
OBSERVAT= 'NAOJ            '   / Observatory                                %30s
TELESCOP= 'Subaru          '   / Telescope name                             %30s
INSTRUME= 'COMICS          '   / Name of instrument                         %20s
INS-VER = '1.0.0  assembled 990701 '   / Version of the instrument          %30s
DETECTOR= 'Si:As IBC 320x240  x6   '   / Name of the detector/CCD           %10s
DET-ID  =                    1 / ID of the detector used for this data       %d
COMMENT ++++++++++++++++++++++++++ Fixed Parameters in COMICS data (img)
DETPXSZ1=               0.0500 / Detector pixel size in axis1 (mm)          %.4f
DETPXSZ2=               0.0500 / Detector pixel size in axis2 (mm)          %.4f
CDELT1  =           0.00003611 / X Scale projected on detector(#/pix)     %13.8f
CDELT2  =           0.00003611 / Y scale projected on detector(#/pix)     %13.8f
CTYPE1  = 'RA---TAN        '   / Pixel coordinate system                    %16s
CTYPE2  = 'DEC--TAN        '   / Pixel coordinate system                    %16s
CUNIT1  = 'degree    '         / Units used in both CRVAL1 and CDELT1       %10s
```

```
CUNIT2  = 'degree    '         / Units used in both CRVAL2 and CDELT2      %10s
CRPIX1  =                 120.0 / Reference pixel in X (pixel)            %-6.1f
CRPIX2  =                 160.0 / Reference pixel in Y (pixel)            %-6.1f
PROJP1  =                   0.0 / Projection type of the first axis        %5.1f
PROJP2  =                   0.0 / Projection type of the second axis       %5.1f
PC001001=           1.00000000 / Pixel Coordinate translation matrix     %12.8f
PC001002=           0.00000000 / Pixel Coordinate translation matrix     %12.8f
PC002001=           0.00000000 / Pixel Coordinate translation matrix     %12.8f
PC002002=           1.00000000 / Pixel Coordinate translation matrix     %12.8f
BSCALE  =                   1.0 / Real=fits-value*BSCALE+BZERO             %.1f
BZERO   =                   0.0 / Real=fits-value*BSCALE+BZERO             %.1f
BUNIT   = 'ADU             '   / Unit of original pixel values            %30s
BLANK   =                 32768 / Value used for NULL pixels                %d
COMMENT +++++++++++++++++++++++++ Date
TIMESYS = 'UTC     '           / Time System used in the header. UTC fix.   %8s
DATE-OBS= '1999-07-09'         / yyyy-mm-dd UTC obs start date            %10s
UT      = '09:12:00.0'         / HH:MM:SS.S UTC at typical time(=start)   %10s
HST     = '23:12:00.0'         / HH:MM:SS.S HST at typical time(=start)   %10s
LST     = '12:34:56.789'       / HH:MM:SS.S LST at typical time(=start)   %12s
MJD     =       12345.67890123 / Modified Julian Day at typ time(=start) %14.8f
COMMENT +++++++++++++++++++++++++ Object
DATA-TYP= 'OBJECT          '   / Type / Characteristics of this data       %15s
RADECSYS= 'FK5     '           / The equatorial coordinate system          %8s
OBJECT  = 'HR 4796 '           / Target Description                       %30s
EQUINOX =                2000.0 / Standard FK5 year                       %6.1f
RA      = '12:36:01.270'       / HH:MM:SS.SSS RA (J2000) pointing         %12s
RA2000  = '12:36:01.270'       / HH:MM:SS.SSS RA (J2000) pointing         %12s
DEC     = '-39:52:09.40'       / +/-DD:MM:SS.SS DEC (J2000) pointing      %12s
DEC2000 = '-39:52:09.40'       / +/-DD:MM:SS.SS DEC (J2000) pointing      %12s
AZIMUTH =              12.34000 / Azimuth of telescope pointing (degree)  %9.5f
ALTITUDE=              12.34000 / Altitude of telescope pointing(degree)  %8.5f
CRVAL1  =         189.00529167 / Physical value of the reference pixel X %13.8f
CRVAL2  =         -39.86927778 / Physical value of the reference pixel Y %13.8f
AIRMASS =              1.23456 / Averaged Air Mass                        %9.5f
ZD      =             77.66000 / Zenith Distance at typical time          %8.5f
SECZ    =                1.234 / SEC(Zenith Distance) at typical time     %6.3f
LONGPOLE=                180.0 / The North Pole of standard system (deg)  %6.1f
COMMENT +++++++++++++++++++++++++ Subaru Parameters
FOC-POS = 'Cassegrain  '       / Focus where the instrument is attached   %12s
TELFOCUS= 'Cassegrain      '   / Focus where a beam is reachable          %30s
FOC-LEN =           100000.000 / Focal length of the telescope (mm)       %.3f
FOC-VAL =                2.531 / Encoder value of the focus unit (mm)   %10.3f
INSROT  =               12.345 / Instrument Rotator angle (deg)          %-8.3f
AUTOGUID= 'off     '           / Auto Guider on/off                        %8s
M2-TYPE = 'IR      '           /Type of the Secondary Mirror (Opt/IR)      %8s
M2-TIP  = 'on      '               / 2nd Mirror tip-tilt on/off           %8s
COMMENT +++++++++++++++++++++++++ COMICS Parameters OPTICS
OBS-MOD = 'spectroscopy    '   / Observation Mode                         %20s
FILTER01= 'Through         '   / Filter name/ID (pre-opt filter-1)        %30s
FILTER02= 'Nwide           '   / Filter name/ID (pre-opt filter-2)        %30s
FILTER03= '12um            '   / Filter name/ID (img-opt filter)          %30s
FILTER04= 'N-obj           '   / Lens  name/ID (img-opt)                  %30s
DISPERSR= 'N-mid grt '         / Identifier of the disperser used         %10s
SLIT    = '0.33arcsec'         / Identifier of the entrance slit used     %10s
SLT-LEN =               39.600 / Length of the slit used (arcsec)         %7.3f
SLT-PA  =                  0.0 / Slit Position Angle (degree)             %5.1f
SLT-WID =               0.3300 / Width of the slit used                   %6.3f
SLTCPIX1=                120.0 / Slit center projected on detector(pix)   %6.1f
SLTCPIX2=                160.0 / Slit center projected on detector(pix)   %6.1f
COMMENT +++++++++++++++++++++++++ COMICS Parameters DETECTOR
EXPTIME =                0.080 / Total integration time per frame(sec)    %7.3f
DET-TMP =                 6.01 / Detector temperature (K)                 %6.2f
GAIN    =               330.90 / AD conversion factor (electron/ADU)      %5.2f
PRD-MIN1=                    1 / Start X pos. of partialy read out (pix)     %d
PRD-MIN2=                    1 / Start Y pos. of partialy read out (pix)     %d
PRD-RNG1=                  320 / X Range of partialy read out (pix)          %d
PRD-RNG2=                  240 / Y Range of partialy read out (pix)          %d
BIN-FCT1=                    1 / Binning factor of X axis (pixel)           %2d
BIN-FCT2=                    1 / Binning factor of Y axis (pixel)           %2d
COMMENT +++++++++++++++++++++++++ Condition at the observation
WEATHER = 'rainstorm '         / Weather condition                        %30s
SEEING  =                 0.45 / Long integ PSF FWHM (arcsec)              %.2f
DOM-WND =                 4.61 / Wind speed in the dome (m/s)             %5.2f
OUT-WND =                 7.79 / Wind speed outside (m/s)                 %5.2f
DOM-TMP =               273.51 / Temperature measured in the dome (K)     %6.2f
OUT-TMP =               273.72 / Temperature measured outside dome (K)    %6.2f
DOM-HUM =                 90.1 / Humidity measured in the dome            %5.1f
OUT-HUM =                101.1 / Humidity measured outside the dome       %5.1f
DOM-PRS =               670.00 / Atmospheric pressure in the Dome (hpa)   %7.2f
OUT-PRS =               670.00 / Atmospheric pressure outside dome (hPa)  %7.2f
COMMENT
COMMENT ------------------------------------------------
COMMENT Subaru Device Dependent Header Block for COMICS
COMMENT ------------------------------------------------
```

```
COMMENT          'Q_' provisionally means COMICS header
COMMENT
COMMENT  +++++++++++++++++++++ Type of this data
Q_DTYPE = 'slitview  '          / type of this file spec/img/slitview       %10s
Q_OBSID =             12345678 / Observation ID of COMICS                   %8d
COMMENT  +++++++++++++++++++++ Pre-Optics
Q_WINDOW= 'Ge10um    '          / Entrance Window                          %10s
Q_M1MOTA=                   224 / Pulse count of 1st mir. para to bench     %8d
Q_M1MOTB=                   339 / Pulse count of 1st mir. vert to bench     %8d
COMMENT  +++++++++++++++++++++ Slit Viewer/Imager
Q_SLTVEW= 'on      '            / Slit Viewer on/off                        %8s
Q_SPFILE= 'COMA00000001'        / File name of spectroscopy                %20s
Q_SVWMIN=           11650.0000 / Observed Wavelength of S Viewer min(nm) %10.4f
Q_SVWMAX=           12490.0000 / Observed Wavelength of S Viewer max(nm) %10.4f
COMMENT  ++++++++++++++++++ Temperature
Q_DETTP1=              4.95000 / Temperature of the detector spec-1 (K)  %10.5f
Q_DETTP2=              4.85000 / Temperature of the detector spec-2 (K)  %10.5f
Q_DETTP3=              4.95000 / Temperature of the detector spec-3 (K)  %10.5f
Q_DETTP4=              4.88000 / Temperature of the detector spec-4 (K)  %10.5f
Q_DETTP5=              4.95000 / Temperature of the detector spec-5 (K)  %10.5f
Q_DETTPI=              6.95000 / Temperature of the detector img (K)     %10.5f
Q_CFTP1 =                 4.22 / Temp. of the cooled finger  spec (K)     %6.2f
Q_CFTP2 =                 3.99 / Temp. of the cooled finger  img  (K)     %6.2f
Q_OPTTP1=                30.00 / Temp. of the optics spec-A (K)           %6.2f
Q_OPTTP2=                30.00 / Temp. of the optics spec-B (K)           %6.2f
Q_OPTTP3=                30.00 / Temp. of the optics spec-C (K)           %6.2f
Q_OPTTP4=                30.00 / Temp. of the optics img-A (K)            %6.2f
Q_OPTTP5=                30.00 / Temp. of the optics img-A (K)            %6.2f
Q_OPTTP6=                30.00 / Temp. of the optics img-A (K)            %6.2f
Q_COHTP1=                 3.99 / Temp. of the cooler head spec (K)        %6.2f
Q_COHTP2=                 3.89 / Temp. of the cooler head img (K)         %6.2f
Q_SHDTP1=                67.99 / Temp. of the shield A (K)                %6.2f
Q_SHDTP2=                67.99 / Temp. of the shield B (K)                %6.2f
Q_ABTTP1=               300.14 / Temperature of Ambient thermometer (K)   %6.2f
Q_ABTTP2=               350.32 / Temperature of Ambient thermometer (K)   %6.2f
Q_ABTMP3=               280.41 / Temperature of Ambient thermometer (K)   %6.2f
COMMENT  +++++++++++++++++++++ Detector Drive
Q_CLKVER= 'Q_CLK0001-990701'    / Clock version                            %30s
Q_CLKFL = 'Q_031_022_039_001_010   ' / Clock macro file name               %30s
Q_CLKMCC= 'This is preliminary clk ' / Coment on clock pattern macro       %30s
Q_CLKNM = 'GETRAW  '            / Clock pattern name                       %30s
Q_CLKCLC= 'Not coadded     '    / Coment on each clock pattern             %30s
Q_PIXTIM=                 5.00 / Clock duration for a pixel (microsec)    %6.2f
Q_FRRATE=              40.0000 / Detector Framerate (Hz)                  %8.4f
Q_READTM=           0.02500000 / Time for reading out 1 exp (sec)        %12.8f
Q_NDRATE=                  100 / N.D. rate of the detector (1/243)         %3d
Q_NDEFF =           0.41142300 / efficiency of the integ by using N.D.   %10.8f
COMMENT  +++++++++++++++++++++ Chopping and Nodding
Q_CHOP  = 'on      '            / Chopping on/off                          %8s
Q_CPWTP = 'on      '            / Tip-tilt with chopping on/off            %8s
Q_CPBMST= 'origin          '    / Chopping beam at the 1st exp.           %16s
Q_CPFREQ=               2.5000 / Chopping Frequency (Hz)                  %8.4f
Q_CPTIME=             0.200000 / Chopping period per 1 beam (sec)        %10.6f
Q_CPEXP =                    8 / Number of exp of 1 chopping beam           %d
Q_CPEXAD=                    1 / Number of coadded exp.                     %d
Q_CPFRAM=                    7 / Number of frame of 1 chopping beam         %d
Q_CPNUM =                  120 / Number of chopping in this file            %d
Q_INT1BM=           21.000000 / Integration time per 1 position (sec)     %.6f
Q_CPTHRW=              90.0000 / Chopping throw (arcsec)                 %10.4f
Q_CPPA  =               0.0000 / Chopping P.A.  (deg)                    %8.4f
Q_NDTIME=                10.00 / Nodding period (sec)                     %.2f
Q_NDOFRA=              20.0000 / Nodding offset R.A. (arcsec)            %10.4f
Q_NDOFDE=                -10.8 / Nodding offset Dec (arcsec)              %8.4f
Q_NDBEM ='main       '          / Nodding Beam main/offset                %12s
Q_NDCOM ='Normal 2beam nodding    ' / Comment about Nodding               %30s
END
```

● COMICS ∅ Spectroscopy mode

```
        1         2         3         4         5         6         7
12345678901234567890123456789012345678901234567890123456789012345678901234567890123456789
--------------------------------------------------------------------------------
SIMPLE  =                    T / Standard FITS format
BITPIX  =                   32 / # of bits storing pix values
NAXIS   =                    4 / # of axis in frame                         %1d
NAXIS1  =                  336 / # of pixels/row                            %5d
NAXIS2  =                  240 / # of rows                                  %5d
NAXIS3  =                    5 / # of detectors                             %5d
NAXIS4  =                   10 / # of frames                                %5d
EXTEND  =                    F / ASCII Table for Z-frame description        %c
COMMENT +++++++++++++++++++++++++ ???
DATASET = 'DSET-COMICS-123456' / Dataset Identification Number             %20s
```

```
FRAMEID = 'COM1234567890123'   / FITS File sequential number               %16s
EXP-ID  = 'COME123456789012'   / ID of the exposure this data was takenA   %16s
OBS-ALOC= '            '       / Allocation Mode for Instrument            %12s
COMMENT ++++++++++++++++++++++++++ Observatory/Instrument
OBSERVER= 'Ktz,Ymst,Myt,Okmt ' / Name of observers                         %64s
PROP-ID = 'P1999-0709-1    '   / Proposal ID                               %20s
OBSERVAT= 'NAOJ            '   / Observatory                               %30s
TELESCOP= 'Subaru          '   / Telescope name                            %30s
INSTRUME= 'COMICS          '   / Name of instrument                        %20s
INS-VER = '1.0.0  assembled 990701 '   / Version of the instrument         %30s
DETECTOR= 'Si:As IBC 320x240  x6   '   / Name of the detector/CCD          %10s
DET-ID  =                    1 / ID of the detector used for this data       %d
COMMENT ++++++++++++++++++++++++++ Fixed Parameters in COMICS data (spec)
DETPXSZ1=               0.0500 / Detector pixel size in axis1 (mm)         %.4f
DETPXSZ2=               0.0500 / Detector pixel size in axis2 (mm)         %.4f
CDELT1  =           0.00004583 / X Scale projected on detector(#/pix)    %13.8f
CDELT2  =           0.00004583 / Y scale projected on detector(#/pix)    %13.8f
CTYPE1  = 'RA---TAN        '   / Pixel coordinate system                   %16s
CTYPE2  = 'DEC--TAN        '   / Pixel coordinate system                   %16s
CUNIT1  = 'degree    '         / Units used in both CRVAL1 and CDELT1      %10s
CUNIT2  = 'degree    '         / Units used in both CRVAL2 and CDELT2      %10s
CRPIX1  =                160.0 / Reference pixel in X (pixel)            %-6.1f
CRPIX2  =                120.0 / Reference pixel in Y (pixel)            %-6.1f
PROJP1  =                  0.0 / Projection type of the first axis        %5.1f
PROJP2  =                  0.0 / Projection type of the second axis       %5.1f
PC001001=           1.00000000 / Pixel Coordinate translation matrix     %12.8f
PC001002=           0.00000000 / Pixel Coordinate translation matrix     %12.8f
PC002001=           0.00000000 / Pixel Coordinate translation matrix     %12.8f
PC002002=           1.00000000 / Pixel Coordinate translation matrix     %12.8f
BSCALE  =                  1.0 / Real=fits-value*BSCALE+BZERO              %.1f
BZERO   =                  0.0 / Real=fits-value*BSCALE+BZERO              %.1f
BUNIT   = 'ADU             '   / Unit of original pixel values            %30s
BLANK   =                32768 / Value used for NULL pixels                 %d
COMMENT ++++++++++++++++++++++++++ Date
TIMESYS = 'UTC     '           / Time System used in the header. UTC fix.   %8s
DATE-OBS= '1999-07-09'         / yyyy-mm-dd UTC obs start date             %10s
UT      = '09:12:00.0'         / HH:MM:SS.S UTC at typical time(=start)    %10s
HST     = '23:12:00.0'         / HH:MM:SS.S HST at typical time(=start)    %10s
LST     = '12:34:56.789'       / HH:MM:SS.S LST at typical time(=start)    %12s
MJD     =       12345.67890123 / Modified Julian Day at typ time(=start) %14.8f
COMMENT ++++++++++++++++++++++++++ Object
DATA-TYP= 'OBJECT          '   / Type / Characteristics of this data       %15s
RADECSYS= 'FK5     '           / The equatorial coordinate system           %8s
OBJECT  = 'HR 4796 '           / Target Description                        %30s
EQUINOX =              2000.0 / Standard FK5 year                        %6.1f
RA      = '12:36:01.270'       / HH:MM:SS.SSS RA (J2000) pointing          %12s
RA2000  = '12:36:01.270'       / HH:MM:SS.SSS RA (J2000) pointing          %12s
DEC     = '-39:52:09.40'       / +/-DD:MM:SS.SS DEC (J2000) pointing       %12s
DEC2000 = '-39:52:09.40'       / +/-DD:MM:SS.SS DEC (J2000) pointing       %12s
AZIMUTH =             12.34000 / Azimuth of telescope pointing (degree)   %9.5f
ALTITUDE=             12.34000 / Altitude of telescope pointing(degree)   %8.5f
CRVAL1  =         189.00529167 / Physical value of the reference pixel X %13.8f
CRVAL2  =         -39.86927778 / Physical value of the reference pixel Y %13.8f
AIRMASS =              1.23456 / Averaged Air Mass                        %9.5f
ZD      =             77.66000 / Zenith Distance at typical time          %8.5f
SECZ    =                1.234 / SEC(Zenith Distance) at typical time     %6.3f
LONGPOLE=                180.0 / The North Pole of standard system (deg)  %6.1f
COMMENT ++++++++++++++++++++++++++ Subaru Parameters
FOC-POS = 'Cassegrain  '       / Focus where the instrument is attached    %12s
TELFOCUS= 'Cassegrain      '   / Focus where a beam is reachable           %30s
FOC-LEN =           100000.000 / Focal length of the telescope (mm)        %.3f
FOC-VAL =                2.531 / Encoder value of the focus unit (mm)    %10.3f
INSROT  =               12.345 / Instrument Rotator angle (deg)          %-8.3f
AUTOGUID= 'off     '           / Auto Guider on/off                         %8s
M2-TYPE = 'IR      '           /Type of the Secondary Mirror (Opt/IR)       %8s
M2-TIP  = 'on      '               / 2nd Mirror tip-tilt on/off            %8s
COMMENT ++++++++++++++++++++++++++ COMICS Parameters OPTICS
OBS-MOD = 'spectroscopy    '   / Observation Mode                          %20s
FILTER01= 'Through         '   / Filter name/ID (pre-opt filter-1)         %30s
FILTER02= 'Nwide           '   / Filter name/ID (pre-opt filter-2)         %30s
FILTER03= '12um            '   / Filter name/ID (img-opt filter)           %30s
FILTER04= 'N-obj           '   / Lens  name/ID (img-opt)                   %30s
DISPERSR= 'N-mid grt '         / Identifier of the disperser used          %10s
SLIT    = '0.33arcsec'         / Identifier of the entrance slit used      %10s
SLT-LEN =               39.600 / Length of the slit used (arcsec)         %7.3f
SLT-PA  =                  0.0 / Slit Position Angle (degree)             %5.1f
SLT-WID =               0.3300 / Width of the slit used                   %6.3f
SLTCPIX1=                160.0 / Slit center projected on detector(pix)   %6.1f
SLTCPIX2=                120.0 / Slit center projected on detector(pix)   %6.1f
DISPAXIS=                    1 / Dispersion Axis  in frame                 %1d
WAV-MIN =            7510.0000 / Shortest wavelen. focused on det (nm)   %10.4f
WAV-MAX =           13500.0000 / Longest wavelen. focused on det (nm)    %10.4f
WAVELEN =           10505.0000 / Wavelength at center (nm)               %10.4f
COMMENT ++++++++++++++++++++++++++ COMICS Parameters DETECTOR
```

```
EXPTIME =                0.080 / Total integration time per frame(sec)    %7.3f
DET-TMP =                 6.01 / Detector temperature (K)                 %6.2f
GAIN    =               330.90 / AD conversion factor (electron/ADU)      %5.2f
PRD-MIN1=                    1 / Start X pos. of partialy read out (pix)     %d
PRD-MIN2=                    1 / Start Y pos. of partialy read out (pix)     %d
PRD-RNG1=                  320 / X Range of partialy read out (pix)          %d
PRD-RNG2=                  240 / Y Range of partialy read out (pix)          %d
BIN-FCT1=                    1 / Binning factor of X axis (pixel)           %2d
BIN-FCT2=                    1 / Binning factor of Y axis (pixel)           %2d
COMMENT ++++++++++++++++++++++++++ Condition at the observation
WEATHER = 'rainstorm '           / Weather condition                       %30s
SEEING  =                 0.45 / Long integ PSF FWHM (arcsec)             %.2f
DOM-WND =                 4.61 / Wind speed in the dome (m/s)             %5.2f
OUT-WND =                 7.79 / Wind speed outside (m/s)                 %5.2f
DOM-TMP =               273.51 / Temperature measured in the dome (K)     %6.2f
OUT-TMP =               273.72 / Temperature measured outside dome (K)    %6.2f
DOM-HUM =                 90.1 / Humidity measured in the dome            %5.1f
OUT-HUM =                101.1 / Humidity measured outside the dome       %5.1f
DOM-PRS =               670.00 / Atmospheric pressure in the Dome (hpa)   %7.2f
OUT-PRS =               670.00 / Atmospheric pressure outside dome (hPa)  %7.2f
COMMENT
COMMENT -------------------------------------------------
COMMENT Subaru Device Dependent Header Block for COMICS
COMMENT -------------------------------------------------
COMMENT          'Q_' provisionally means COMICS header
COMMENT
COMMENT  ++++++++++++++++++++ Type of this data
Q_DTYPE = 'slitview  '           / type of this file spec/img/slitview       %10s
Q_OBSID =             12345678 / Observation ID of COMICS                    %8d
COMMENT  ++++++++++++++++++++ Pre-Optics
Q_WINDOW= 'Ge10um    '           / Entrance Window                          %10s
Q_M1MOTA=                  224 / Pulse count of 1st mir. para to bench      %8d
Q_M1MOTB=                  339 / Pulse count of 1st mir. vert to bench      %8d
COMMENT  ++++++++++++++++++++ Slit Viewer/Imager
Q_SLTVEW= 'on      '             / Slit Viewer on/off                       %8s
Q_SVFILE= 'COMA00000002'         / Image file name obtained slit viewer     %12s
Q_SVWMIN=           11650.0000 / Observed Wavelength of S Viewer min(nm) %10.4f
Q_SVWMAX=           12490.0000 / Observed Wavelength of S Viewer max(nm) %10.4f
COMMENT  ++++++++++++++++++++ Spectrometer
Q_GRTMOT=               330843 / Pulse count of grating motor               %d
Q_GRTANG=             0.123456 / Grating Tilt Angle (deg)                 %10.6f
Q_WVMIN1=            7510.0000 / Observed Wavelen of Spec Det-1 min (nm) %10.4f
Q_WVMAX1=            8510.0000 / Observed Wavelen of Spec Det-1 max (nm) %10.4f
Q_WVMIN2=            9010.0000 / Observed Wavelen of Spec Det-2 min (nm) %10.4f
Q_WVMAX2=            9510.0000 / Observed Wavelen of Spec Det-2 max (nm) %10.4f
Q_WVMIN3=           10000.0000 / Observed Wavelen of Spec Det-3 min (nm) %10.4f
Q_WVMAX3=           10900.0000 / Observed Wavelen of Spec Det-3 max (nm) %10.4f
Q_WVMIN4=           11500.0000 / Observed Wavelen of Spec Det-4 min (nm) %10.4f
Q_WVMAX4=           12200.0000 / Observed Wavelen of Spec Det-4 max (nm) %10.4f
Q_WVMIN5=           12800.0000 / Observed Wavelen of Spec Det-5 min (nm) %10.4f
Q_WVMAX5=           13500.0000 / Observed Wavelen of Spec Det-5 max (nm) %10.4f
COMMENT  ++++++++++++++++++++ Temperature
Q_DETTP1=              4.95000 / Temperature of the detector spec-1 (K)  %10.5f
Q_DETTP2=              4.85000 / Temperature of the detector spec-2 (K)  %10.5f
Q_DETTP3=              4.95000 / Temperature of the detector spec-3 (K)  %10.5f
Q_DETTP4=              4.88000 / Temperature of the detector spec-4 (K)  %10.5f
Q_DETTP5=              4.95000 / Temperature of the detector spec-5 (K)  %10.5f
Q_DETTPI=              6.95000 / Temperature of the detector img (K)     %10.5f
Q_CFTP1 =                 4.22 / Temp. of the cooled finger  spec (K)     %6.2f
Q_CFTP2 =                 3.99 / Temp. of the cooled finger  img  (K)     %6.2f
Q_OPTTP1=                30.00 / Temp. of the optics spec-A (K)           %6.2f
Q_OPTTP2=                30.00 / Temp. of the optics spec-B (K)           %6.2f
Q_OPTTP3=                30.00 / Temp. of the optics spec-C (K)           %6.2f
Q_OPTTP4=                30.00 / Temp. of the optics img-A (K)            %6.2f
Q_OPTTP5=                30.00 / Temp. of the optics img-A (K)            %6.2f
Q_OPTTP6=                30.00 / Temp. of the optics img-A (K)            %6.2f
Q_COHTP1=                 3.99 / Temp. of the cooler head spec (K)        %6.2f
Q_COHTP2=                 3.89 / Temp. of the cooler head img (K)         %6.2f
Q_SHDTP1=                67.99 / Temp. of the shield A (K)                %6.2f
Q_SHDTP2=                67.99 / Temp. of the shield B (K)                %6.2f
Q_ABTTP1=               300.14 / Temperature of Ambient thermometer (K)   %6.2f
Q_ABTTP2=               350.32 / Temperature of Ambient thermometer (K)   %6.2f
Q_ABTMP3=               280.41 / Temperature of Ambient thermometer (K)   %6.2f
COMMENT  ++++++++++++++++++++ Detector Drive
Q_CLKVER= 'Q_CLK0001-990701'     / Clock version                           %30s
Q_CLKFL = 'Q_031_022_039_001_010   ' / Clock macro file name              %30s
Q_CLKMCC= 'This is preliminary clk ' / Coment on clock pattern macro      %30s
Q_CLKNM = 'GETRAW  '             / Clock pattern name                      %30s
Q_CLKCLC= 'Not coadded     '     / Coment on each clock pattern            %30s
Q_PIXTIM=                 5.00 / Clock duration for a pixel (microsec)    %6.2f
Q_FRRATE=              40.0000 / Detector Framerate (Hz)                  %8.4f
Q_READTM=           0.02500000 / Time for reading out 1 exp (sec)        %12.8f
Q_NDRATE=                  100 / N.D. rate of the detector (1/243)         %3d
Q_NDEFF =           0.41142300 / efficiency of the integ by using N.D.   %10.8f
```

```
COMMENT  ++++++++++++++++++++ Chopping and Nodding
Q_CHOP  = 'on      '           / Chopping on/off                              %8s
Q_CPWTP = 'on      '           / Tip-tilt with chopping on/off                %8s
Q_CPBMST= 'origin          '  / Chopping beam at the 1st exp.                %16s
Q_CPFREQ=               2.5000 / Chopping Frequency (Hz)                     %8.4f
Q_CPTIME=             0.200000 / Chopping period per 1 beam (sec)           %10.6f
Q_CPEXP =                    8 / Number of exp of 1 chopping beam             %d
Q_CPEXAD=                    1 / Number of coadded exp.                       %d
Q_CPFRAM=                    7 / Number of frame of 1 chopping beam           %d
Q_CPNUM =                  120 / Number of chopping in this file              %d
Q_INT1BM=            21.000000 / Integration time per 1 position (sec)      %.6f
Q_CPTHRW=              90.0000 / Chopping throw (arcsec)                    %10.4f
Q_CPPA  =               0.0000 / Chopping P.A.  (deg)                        %8.4f
Q_NDTIME=                10.00 / Nodding period (sec)                        %.2f
Q_NDOFRA=              20.0000 / Nodding offset R.A. (arcsec)               %10.4f
Q_NDOFDE=                -10.8 / Nodding offset Dec (arcsec)                 %8.4f
Q_NDBEM ='main        '        / Nodding Beam main/offset                    %12s
Q_NDCOM ='Normal 2beam nodding    ' / Comment about Nodding                  %30s
END
```

6.5.3 FOCAS(1998/09/08)

● FOCAS の Imaging mode

```
         1         2         3         4         5         6         7
1234567890123456789012345678901234567890123456789012345678901234567890123456789
--------------------------------------------------------------------------------
SIMPLE  =                    T / Standard FITS format
BITPIX  =                   16 / # of bits storing pix value
NAXIS   =                    2 / # of axes in frame
NAXIS1  =                 4096 / # of pixels/row
NAXIS2  =                 2048 / # of rows (also # of scan lines)
EXTEND  =                    T / Extension FITS format
OBSERVER= 'Y.Yadoumaru, K.Aoki, T.Ozawa, night-staff and WG' / Name of observer
PROP-ID = 'P19970025-0001'     / Proposal ID
INSTRUME= 'FOCAS   '           / Name of instrument
FRAMEID = 'FSCA000023471234'   / Image sequential number
EXP-ID  = 'FSCE000011741234'   / ID of the exposure this data was taken
OBS-MOD = 'Imaging '           / Observation Mode
DATA-TYP= 'OBJECT  '           / Type / Characteristics of this data
OBSERVAT= 'NAOJ    '           / Observatory
TELESCOP= 'SUBARU  '           / Telescope name
TIMESYS = 'UTC     '           / Time System used in the header. UTC fix.
RADECSYS= 'FK5     '           / The equatorial coordinate system
OBS-ALOC= 'OBSEVING'           / Allocation mode for Instrument
DATASET = 'FOCAS-12345'        / ID of an observation dataset
WCS-ORIG= 'SUBARU toolkit'     / Origin of the WCS value
CRPIX1  =              +2048.0 / Reference pixel in X
CRPIX2  =              +1024.0 / Reference pixel in Y
CRVAL1  =        +0.275108E+03 / Physical value of the reference pixel X
CRVAL2  =        -0.161769E+02 / Physical value of the reference pixel Y
CDELT1  =        +0.277778E-04 / Size projected into a detector pixel X
CDELT2  =        +0.277778E-04 / Size projected into a detector pixel Y
CTYPE1  = 'RA---TAN'           / Pixel coordinate system
CTYPE2  = 'DEC--TAN'           / Pixel coordinate system
CUNIT1  = 'degree  '           / Units used in both CRVAl1 and CDELT1
CUNIT2  = 'degree  '           / Units used in both CRVAL2 and CDELT2
LONGPOLE=            180.00000 / The North Pole of the standard system
PC001001=        +0.100000E+01 / Pixel Coordinate translation matrix
PC001002=        +0.000000E+00 / Pixel Coordinate translation matrix
PC002001=        +0.100000E+01 / Pixel Coordinate translation matrix
PC002002=        +0.000000E+00 / Pixel Coordinate translation matrix
COMMENT
C2PIX1  =              +2048.0 / Reference pixel in X
C2PIX2  =              +1024.0 / Reference pixel in Y
C2VAL1  =        +0.275108E+03 / Physical value of ref pix X for WCS
C2VAL2  =        -0.161769E+02 / Physical value of ref pix Y for WCS
C2ELT1  =        +0.277778E-04 / Size projected into a detector pixel X
C2ELT2  =        +0.277778E-04 / Size projected into a detector pixel Y
C2YPE1  = 'RA---TAN'           / Pixel coordinate system
C2YPE2  = 'DEC--TAN'           / Pixel coordinate system
C2NIT1  = 'degree  '           / Units used in both C2VAl1 and C2ELT1
C2NIT2  = 'degree  '           / Units used in both C2VAL2 and C2ELT2
BSCALE  =                  1.0 / Real=fits_value*BSCALE+BZERO
BZERO   =              32768.0 / Real=fits_value*BSCALE+BZERO
BUNIT   = 'ADU     '           / Unit of original pixel values
BLANK   =                -32768 / Value used for NULL pixels
DATE-OBS= '1998-05-06'         / Observation start date (yyyy-mm-dd)
UT      = '12:34:56.78'        / HH:MM:SS.SS typical UTC at exposure
UT-STR  = '12:34:56.78'        / HH:MM:SS.SS UTC at exposure start
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UT-END  = '13:04:56.78'        / HH:MM:SS.SS UTC at exposure end
HST     = '02:34:56.78'        / HH:MM:SS.SS typical HST at exposure
HST-STR = '02:34:56.78'        / HH:MM:SS.SS HST at exposure start
HST-END = '03:04:56.78'        / HH:MM:SS.SS HST at exposure end
LST     = '23:53:10.67'        / HH:MM:SS.SS typical LST at exposure
LST-STR = '23:53:10.67'        / HH:MM:SS.SS LST at exposure start
LST-END = '24:23:20.63'        / HH:MM:SS.SS LST at exposure end
MJD     =       50396.52420000 / Modified Julian Day at typical time
MJD-STR =       50396.52420000 / Modified Julian Day at exposure start
MJD-END =       50396.54500000 / Modified Julian Day at exposure end
EXPTIME =              1800.00 / Total integration time (sec)
OBJECT  = 'M17     '           / Target Description
RA      = '18:20:26.010'       / RA of telescope pointing (HH:MM:SS.SSS)
RA2000  = '18:20:26.010'       / RA (J2000) pointing (HH:MM:SS.SSS)
DEC     = '-16:12:07.1'        / DEC of telescope pointing (+/-DD:MM:SS.SS)
DEC2000 = '-16:12:07.1'        / DEC (J2000) pointing (+/-DD:MM:SS.SS)
EQUINOX =               2000.0 / Standard FK5 (years)
AZIMUTH =           -16.625000 / Azimuth angle of telescope pointing (degree), S
ALTITUDE=             36.47000 / Altitude angle of telescope pointing (degree)
TELFOCAS= 'CASSEGRAIN'         / Focus where a beam is reachable
FOC-POS = 'CASSEGRAIN'         / Focus where the instrument is attached
FOC-VAL =                +2.513 / Encoder value of the focus unit
F-RATIO =                  12.2 / F-ratio of each telescope-focus.
ADC-TYPE= 'RED     '           / ADC name if used
ADC     =              +21.123 / ADC PA during exposure (degree)
ADC-STR =              +19.059 / ADC PA at exposure start (degree)
ADC-END =              +25.897 / ADC PA at exposure end (degree)
FILTER01= 'NONE    '           / Filter name/ID
FILTER02= 'NONE    '           / Filter name/ID
FILTER03= 'NONE    '           / Filter name/ID
FLT-A01 =                  5.00 / Inclination of n-th Filter (degree)
FLT-A02 =                  5.00 / Inclination of n-th Filter (degree)
FLT-A03 =                  5.00 / Inclination of n-th Filter (degree)
AIRMASS =                  1.24 / Averaged Air Mass
AIRM-STR=                  1.21 / Air Mass at exposure start
AIRM-END=                  1.28 / Air Mass at exposure end
ZD      =                 36.47 / Zenith Distance at typical time (degree)
ZD-STR  =                 34.28 / Zenith Distance at exposure start (degree)
ZD-END  =                 38.63 / Zenith Distance at exposure end (degree)
SECZ    =                 1.243 / SEC(Zenith Distance) at typical time
SECZ-STR=                 1.210 / SEC(ZD) at exposure start
SECZ-END=                 1.280 / SEC(ZD) at exposure end
DAQ-VER = 'DAQ-1.0.3'          / Version of the DAQ-soft
INS-VER = 'FCS-1.2-1.0'        / Version of the instrument/control-soft
DETECTOR= 'MIT_001 '           / Name of the detector/CCD
DET-ID  =                    1 / ID of the detector used for this data
DET-A01 =                0.000 / Relative angle of the nn-th detector (degree)
DET-P101=               -103.5 / Relative X-Position of nn-th detector (nm)
DET-P201=                 12.5 / Relative Y-Position of nn-th detector (nm)
DET-TMP =               132.50 / Detector temperature (K)
DET-TMED=               132.50 / Median of the detector temperature (K)
DET-TMIN=               132.40 / Minimun temperature of the detector (K)
DET-TMAX=               132.55 / Maximun temperature of the detector (K)
GAIN    =                 1.26 / AD conversion factor (electron/ADU)
EFP-MIN1=                   10 / Start X position of effective data region
EFP-MIN2=                   10 / Start Y position of effective data region
EFP-RNG1=                 4046 / X range of effective data region
EFP-RNG2=                 2028 / Y range of effective data region
PRD-MIN1=                    1 / Start X position of partialy read out
PRD-MIN2=                    1 / Start Y position of partialy read out
PRD-RNG1=                 4096 / X range of the partialy read out
PRD-RNG2=                 2048 / Y range of the partialy read out
BIN-FCT1=                    1 / Binning factor of X axis
BIN-FCT2=                    1 / Binning factor of Y axis
WEATHER = 'CLEAR   '           / Weather condition (selected by observer)
SEEING  =                 0.45 / FWHM of star size at telescope focus (arcsec)
DOM-WND =                 4.61 / Wind speed in the dome (m/sec)
OUT-WND =                 7.79 / Wind speed outside the dome (m/sec)
DOM-TMP =               273.53 / Temperature in the dome (K)
OUT-TMP =               273.72 / Temperature outside the dome (K)
DOM-HUM =                45.00 / Humidity in the dome (%?)
OUT-HUM =                58.00 / Humidity outside the dome (%?)
SLIT    = 'LONGSLIT'           / Identifier of the entrance slit used
COMMENT ---  Subaru Device Dependent Header Block for FOCAS  ---
F_TMP-A =               275.33 / Temperature of MOS unit (K)
F_TMP-B =               272.45 / Temperature of lens unit (K)
F_TMP-C1=               272.15 / Temperature of collimator beam unit-1 (K)
F_TMP-C2=               272.20 / Temperature of collimator beam unit-2 (K)
F_TMP-C3=               272.10 / Temperature of collimator beam unit-3 (K)
F_TMP-D =               273.29 / Temperature of Camera lens unit (K)
F_TMP-E1=               275.29 / Temperature of VME-1 (K)
F_TMP-E2=               275.30 / Temperature of VME-2 (K)
F_TMP-F1=               275.31 / Temperature of driver-unit A-1 (K)
F_TMP-F2=               275.28 / Temperature of diver-unit A-2 (K)
```

```
F_TMP-G1=               275.29 / Temperature of drive-unit B-1 (K)
F_TMP-G2=               275.27 / Temperature of driver-unit B-2 (K)
F_TMP-H1=               275.29 / Temperature of driver-unit C-1 (K)
F_TMP-H2=               275.27 / Temperature of drive-unit C-2 (K)
F_TMP-I1=               275.35 / Temperature of driver-unit D-1 (K)
F_TMP-I2=               275.38 / Temperature of driver-unit D-2 (K)
F_TMP-J1=               275.25 / Temperature of driver-unit E-1 (K)
F_TMP-J2=               275.22 / Temperature of driver-unit E-2 (K)
F_DEWERX=                27.00 / X-position of dewer stage (micron meter)
F_DEWERY=                10.00 / Y-position of dewer stage (micron meter)
F_DEWERZ=               152.94 / Z-position of dewer stage (micron meter)
F_HOLANG=                 -5.2 / angle of mask holder (degree)
F_MSK-ID= 'MSK300151'          / ID of Mask (for all mode)
F_CAD-ID= 'CAD005235'          / ID of CAD data for mask cutting
F_CADREF= 'FSCA00002345'       / ID/name of image/catalog data for mask design
F_SLT-NO=                    3 / total # of slit on mask
F_POSANG=                 0.00 / PA of cross-dispersion axis (degree)
END
```

● FOCAS の ImagingPolarimetry mode

```
         1         2         3         4         5         6         7
1234567890123456789012345678901234567890123456789012345678901234567890123456789
--------------------------------------------------------------------------------
SIMPLE  =                    T / Standard FITS format
BITPIX  =                   16 / # of bits storing pix value
NAXIS   =                    2 / # of axes in frame
NAXIS1  =                 4096 / # of pixels/row
NAXIS2  =                 2048 / # of rows (also # of scan lines)
EXTEND  =                    T / Extension FITS format
OBSERVER= 'Y.Yadoumaru, K.Aoki, T.Ozawa, night-staff and WG' / Name of observer
PROP-ID = 'P19970025-0001'     / Proposal ID
INSTRUME= 'FOCAS    '          / Name of instrument
FRAMEID = 'FSCA000023471234'   / Image sequential number
EXP-ID  = 'FSCE000011741234'   / ID of the exposure this data was taken
OBS-MOD = 'Imaging-Polarimetry' / Observation Mode
DATA-TYP= 'OBJECT   '          / Type / Characteristics of this data
OBSERVAT= 'NAOJ     '          / Observatory
TELESCOP= 'SUBARU   '          / Telescope name
TIMESYS = 'UTC      '          / Time System used in the header. UTC fix.
RADECSYS= 'FK5      '          / The equatorial coordinate system
OBS-ALOC= 'OBSEVING'           / Allocation mode for Instrument
DATASET = 'FOCAS-12345'        / ID of an observation dataset
WCS-ORIG= 'SUBARU toolkit'     / Origin of the WCS value
CRPIX1  =              +2048.0 / Reference pixel in X
CRPIX2  =              +1024.0 / Reference pixel in Y
CRVAL1  =        +0.275108E+03 / Physical value of the reference pixel X
CRVAL2  =        -0.161769E+02 / Physical value of the reference pixel Y
CDELT1  =        +0.277778E-04 / Size projected into a detector pixel X
CDELT2  =        +0.277778E-04 / Size projected into a detector pixel Y
CTYPE1  = 'RA---TAN'           / Pixel coordinate system
CTYPE2  = 'DEC--TAN'           / Pixel coordinate system
CUNIT1  = 'degree  '           / Units used in both CRVAl1 and CDELT1
CUNIT2  = 'degree  '           / Units used in both CRVAL2 and CDELT2
LONGPOLE=            180.00000 / The North Pole of the standard system
COMMENT
C2PIX1  =              +2048.0 / Reference pixel in X
C2PIX2  =              +1024.0 / Reference pixel in Y
C2VAL1  =        +0.275108E+03 / Physical value of ref pix X for WCS
C2VAL2  =        -0.161769E+02 / Physical value of ref pix Y for WCS
C2ELT1  =        +0.277778E-04 / Size projected into a detector pixel X
C2ELT2  =        +0.277778E-04 / Size projected into a detector pixel Y
C2YPE1  = 'RA---TAN'           / Pixel coordinate system
C2YPE2  = 'DEC--TAN'           / Pixel coordinate system
C2NIT1  = 'degree  '           / Units used in both C2VAl1 and C2ELT1
C2NIT2  = 'degree  '           / Units used in both C2VAL2 and C2ELT2
C3PIX1  =              +2048.0 / Reference pixel in X for Ordinary light
C3PIX2  =              +1124.0 / Reference pixel in Y for Ordinary light
C3VAL1  =        +0.275108E+03 / Physical value of ref pix X for Ordinary light
C3VAL2  =        -0.161769E+02 / Physical value of ref. pix Y for Ordinary light
C3ELT1  =        +0.277778E-04 / Size projected into a detector X for Ordinary
C3ELT2  =        +0.277778E-04 / Size projected into a detector Y for Ordinary
C3YPE1  = 'RA---TAN'           / Pixel coordinate system for Ordinary light
C3YPE2  = 'DEC--TAN'           / Pixel coordinate system for Ordinary light
C3NIT1  = 'degree  '           / Units in both C3VAl1 and C3ELT1 for Ordinary
C3NIT2  = 'degree  '           / Units in both C3VAL2 and C3ELT2 for Ordinary
C4PIX1  =              +2048.0 / Reference pixel in X for Extraordinary light
C4PIX2  =               +924.0 / Reference pixel in Y for Extraordinary light
C4VAL2  =        -0.161769E+02 / Physical value of ref. pix Y for Extraordinary
C4ELT1  =        +0.277778E-04 / Size projected into a detector X for E-light
C4ELT2  =        +0.277778E-04 / Size projected into a detector Y for E-light
C4YPE1  = 'RA---TAN'           / Pixel coordinate system for Extraordinary light
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C4YPE2  = 'DEC--TAN'           / Pixel coordinate system for Extraordinary light
C4NIT1  = 'degree  '           / Units in both C4VAl1 and C4ELT1 for E-light
C4NIT2  = 'degree  '           / Units in both C4VAL2 and C4ELT2 for E-light
BSCALE  =                   1.0 / Real=fits_value*BSCALE+BZERO
BZERO   =               32768.0 / Real=fits_value*BSCALE+BZERO
BUNIT   = 'ADU     '           / Unit of original pixel values
BLANK   =                -32768 / Value used for NULL pixels
DATE-OBS= '1998-05-06'         / Observation start date (yyyy-mm-dd)
UT      = '12:34:56.78'        / HH:MM:SS.SS typical UTC at exposure
UT-STR  = '12:34:56.78'        / HH:MM:SS.SS UTC at exposure start
UT-END  = '13:04:56.78'        / HH:MM:SS.SS UTC at exposure end
HST     = '02:34:56.78'        / HH:MM:SS.SS typical HST at exposure
HST-STR = '02:34:56.78'        / HH:MM:SS.SS HST at exposure start
HST-END = '03:04:56.78'        / HH:MM:SS.SS HST at exposure end
LST     = '23:53:10.67'        / HH:MM:SS.SS typical LST at exposure
LST-STR = '23:53:10.67'        / HH:MM:SS.SS LST at exposure start
LST-END = '24:23:20.63'        / HH:MM:SS.SS LST at exposure end
MJD     =       50396.52420000 / Modified Julian Day at typical time
MJD-STR =       50396.52420000 / Modified Julian Day at exposure start
MJD-END =       50396.54500000 / Modified Julian Day at exposure end
EXPTIME =              1800.00 / Total integration time (sec)
OBJECT  = 'M17     '           / Target Description
RA      = '18:20:26.010'       / RA of telescope pointing (HH:MM:SS.SSS)
RA2000  = '18:20:26.010'       / RA (J2000) pointing (HH:MM:SS.SSS)
DEC     = '-16:12:07.1'        / DEC of telescope pointing (+/-DD:MM:SS.SS)
DEC2000 = '-16:12:07.1'        / DEC (J2000) pointing (+/-DD:MM:SS.SS)
EQUINOX =               2000.0 / Standard FK5 (years)
AZIMUTH =           -16.625000 / Azimuth angle of telescope pointing (degree), S
ALTITUDE=             36.47000 / Altitude angle of telescope pointing (degree)
TELFOCAS= 'CASSEGRAIN'         / Focus where a beam is reachable
FOC-POS = 'CASSEGRAIN'         / Focus where the instrument is attached
FOC-VAL =               +2.513 / Encoder value of the focus unit
F-RATIO =                 12.2 / F-ratio of each telescope-focus.
ADC-TYPE= 'RED     '           / ADC name if used
ADC     =              +21.123 / ADC PA during exposure (degree)
ADC-STR =              +19.059 / ADC PA at exposure start (degree)
ADC-END =              +25.897 / ADC PA at exposure end (degree)
WAVELEN =               600.00 / Typical wavelength on detector (nm)
RETPLAT1= '1/2     '           / Identifier of the Retarder Plate
RET-ANG =              45.0000 / Position Angle of the Retarder Plate
FILTER01= 'NONE    '           / Filter name/ID
FILTER02= 'NONE    '           / Filter name/ID
FILTER03= 'NONE    '           / Filter name/ID
FLT-A01 =                 5.00 / Inclination of n-th Filter (degree)
FLT-A02 =                 5.00 / Inclination of n-th Filter (degree)
FLT-A03 =                 5.00 / Inclination of n-th Filter (degree)
AIRMASS =                 1.24 / Averaged Air Mass
AIRM-STR=                 1.21 / Air Mass at exposure start
AIRM-END=                 1.28 / Air Mass at exposure end
ZD      =                36.47 / Zenith Distance at typical time (degree)
ZD-STR  =                34.28 / Zenith Distance at exposure start (degree)
ZD-END  =                38.63 / Zenith Distance at exposure end (degree)
SECZ    =                1.243 / SEC(Zenith Distance) at typical time
SECZ-STR=                1.210 / SEC(ZD) at exposure start
SECZ-END=                1.280 / SEC(ZD) at exposure end
DAQ-VER = 'DAQ-1.0.3'          / Version of the DAQ-soft
INS-VER = 'FCS-1.2-1.0'        / Version of the instrument/control-soft
DETECTOR= 'MIT_001 '           / Name of the detector/CCD
DET-ID  =                   1 / ID of the detector used for this data
DET-A01 =               0.000 / Relative angle of the nn-th detector (degree)
DET-P101=              -103.5 / Relative X-Position of nn-th detector (nm)
DET-P201=                12.5 / Relative Y-Position of nn-th detector (nm)
DET-TMP =              132.50 / Detector temperature (K)
DET-TMED=              132.50 / Median of the detector temperature (K)
DET-TMIN=              132.40 / Minimun temperature of the detector (K)
DET-TMAX=              132.55 / Maximun temperature of the detector (K)
GAIN    =                1.26 / AD conversion factor (electron/ADU)
EFP-MIN1=                  10 / Start X position of effective data region
EFP-MIN2=                  10 / Start Y position of effective data region
EFP-RNG1=                4046 / X range of effective data region
EFP-RNG2=                2028 / Y range of effective data region
PRD-MIN1=                   1 / Start X position of partialy read out
PRD-MIN2=                   1 / Start Y position of partialy read out
PRD-RNG1=                4096 / X range of the partialy read out
PRD-RNG2=                2048 / Y range of the partialy read out
BIN-FCT1=                   1 / Binning factor of X axis
BIN-FCT2=                   1 / Binning factor of Y axis
WEATHER = 'CLEAR   '           / Weather condition (selected by observer)
SEEING  =                0.45 / FWHM of star size at telescope focus (arcsec)
DOM-WND =                4.61 / Wind speed in the dome (m/sec)
OUT-WND =                7.79 / Wind speed outside the dome (m/sec)
DOM-TMP =              273.53 / Temperature in the dome (K)
OUT-TMP =              273.72 / Temperature outside the dome (K)
DOM-HUM =               45.00 / Humidity in the dome (%?)
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OUT-HUM =                58.00 / Humidity outside the dome (%?)
SLIT    = 'LONGSLIT'           / Identifier of the entrance slit used
COMMENT ---  Subaru Device Dependent Header Block for FOCAS  ---
F_TMP-A =               275.33 / Temperature of MOS unit (K)
F_TMP-B =               272.45 / Temperature of lens unit (K)
F_TMP-C1=               272.15 / Temperature of collimator beam unit-1 (K)
F_TMP-C2=               272.20 / Temperature of collimator beam unit-2 (K)
F_TMP-C3=               272.10 / Temperature of collimator beam unit-3 (K)
F_TMP-D =               273.29 / Temperature of Camera lens unit (K)
F_TMP-E1=               275.29 / Temperature of VME-1 (K)
F_TMP-E2=               275.30 / Temperature of VME-2 (K)
F_TMP-F1=               275.31 / Temperature of driver-unit A-1 (K)
F_TMP-F2=               275.28 / Temperature of diver-unit A-2 (K)
F_TMP-G1=               275.29 / Temperature of drive-unit B-1 (K)
F_TMP-G2=               275.27 / Temperature of driver-unit B-2 (K)
F_TMP-H1=               275.29 / Temperature of driver-unit C-1 (K)
F_TMP-H2=               275.27 / Temperature of drive-unit C-2 (K)
F_TMP-I1=               275.35 / Temperature of driver-unit D-1 (K)
F_TMP-I2=               275.38 / Temperature of driver-unit D-2 (K)
F_TMP-J1=               275.25 / Temperature of driver-unit E-1 (K)
F_TMP-J2=               275.22 / Temperature of driver-unit E-2 (K)
F_DEWERX=                27.00 / X-position of dewer stage (micron meter)
F_DEWERY=                10.00 / Y-position of dewer stage (micron meter)
F_DEWERZ=               152.94 / Z-position of dewer stage (micron meter)
F_HOLANG=                 -5.2 / angle of mask holder (degree)
F_MSK-ID= 'MSK300151'          / ID of Mask (for all mode)
F_CAD-ID= 'CAD005235'          / ID of CAD data for mask cutting
F_CADREF= 'FSCA00002345'       / ID/name of image/catalog data for mask design
F_SLT-NO=                    3 / total # of slit on mask
F_POSANG=                 0.00 / PA of cross-dispersion axis (degree)
END
```

● FOCAS の Spectroscopy mode

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         1         2         3         4         5         6         7
12345678901234567890123456789012345678901234567890123456789012345678901234567890123456789
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SIMPLE  =                    T / Standard FITS format
BITPIX  =                   16 / # of bits storing pix value
NAXIS   =                    2 / # of axes in frame
NAXIS1  =                 4096 / # of pixels/row
NAXIS2  =                 2048 / # of rows (also # of scan lines)
EXTEND  =                    T / Extension FITS format
OBSERVER= 'Y.Yadoumaru, K.Aoki, T.Ozawa, night-staff and WG' / Name of observer
PROP-ID = 'P19970025-0001'     / Proposal ID
INSTRUME= 'FOCAS   '           / Name of instrument
FRAMEID = 'FSCA000023471234'   / Image sequential number
EXP-ID  = 'FSCE000011741234'   / ID of the exposure this data was taken
OBS-MOD = 'Spectroscopy'       / Observation Mode
DATA-TYP= 'OBJECT  '           / Type / Characteristics of this data
OBSERVAT= 'NAOJ    '           / Observatory
TELESCOP= 'SUBARU  '           / Telescope name
TIMESYS = 'UTC     '           / Time System used in the header. UTC fix.
RADECSYS= 'FK5     '           / The equatorial coordinate system
OBS-ALOC= 'OBSEVING'           / Allocation mode for Instrument
DATASET = 'FOCAS-12345'        / ID of an observation dataset
DISPAXIS=                    1 / Dispersion axis in frame
WCS-ORIG= 'SUBARU toolkit'     / Origin of the WCS value
CRPIX1  =              +2048.0 / Reference pixel in X
CRPIX2  =              +1024.0 / Reference pixel in Y
CRVAL1  =       +0.275108E+03 / Physical value of the reference pixel X
CRVAL2  =       -0.161769E+02 / Physical value of the reference pixel Y
CDELT1  =       +0.277778E-04 / Size projected into a detector pixel X
CDELT2  =       +0.277778E-04 / Size projected into a detector pixel Y
CTYPE1  = 'RA---TAN'           / Pixel coordinate system
CTYPE2  = 'DEC--TAN'           / Pixel coordinate system
CUNIT1  = 'degree  '           / Units used in both CRVAl1 and CDELT1
CUNIT2  = 'degree  '           / Units used in both CRVAL2 and CDELT2
LONGPOLE=            180.00000 / The North Pole of the standard system
COMMENT
C2PIX1  =              +2048.0 / Reference pixel in X
C2PIX2  =              +1024.0 / Reference pixel in Y
C2VAL1  =       +0.275108E+03 / Physical value of ref pix X for WCS
C2VAL2  =       -0.161769E+02 / Physical value of ref pix Y for WCS
C2ELT1  =       +0.277778E-04 / Size projected into a detector pixel X
C2ELT2  =       +0.277778E-04 / Size projected into a detector pixel Y
C2YPE1  = 'RA---TAN'           / Pixel coordinate system
C2YPE2  = 'DEC--TAN'           / Pixel coordinate system
C2NIT1  = 'degree  '           / Units used in both C2VAl1 and C2ELT1
C2NIT2  = 'degree  '           / Units used in both C2VAL2 and C2ELT2
BSCALE  =                  1.0 / Real=fits_value*BSCALE+BZERO
BZERO   =              32768.0 / Real=fits_value*BSCALE+BZERO
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BUNIT   = 'ADU     '           / Unit of original pixel values
BLANK   =                -32768 / Value used for NULL pixels
DATE-OBS= '1998-05-06'          / Observation start date (yyyy-mm-dd)
UT      = '12:34:56.78'         / HH:MM:SS.SS typical UTC at exposure
UT-STR  = '12:34:56.78'         / HH:MM:SS.SS UTC at exposure start
UT-END  = '13:04:56.78'         / HH:MM:SS.SS UTC at exposure end
HST     = '02:34:56.78'         / HH:MM:SS.SS typical HST at exposure
HST-STR = '02:34:56.78'         / HH:MM:SS.SS HST at exposure start
HST-END = '03:04:56.78'         / HH:MM:SS.SS HST at exposure end
LST     = '23:53:10.67'         / HH:MM:SS.SS typical LST at exposure
LST-STR = '23:53:10.67'         / HH:MM:SS.SS LST at exposure start
LST-END = '24:23:20.63'         / HH:MM:SS.SS LST at exposure end
MJD     =       50396.52420000 / Modified Julian Day at typical time
MJD-STR =       50396.52420000 / Modified Julian Day at exposure start
MJD-END =       50396.54500000 / Modified Julian Day at exposure end
EXPTIME =              1800.00 / Total integration time (sec)
OBJECT  = 'M17     '            / Target Description
RA      = '18:20:26.010'        / RA of telescope pointing (HH:MM:SS.SSS)
RA2000  = '18:20:26.010'        / RA (J2000) pointing (HH:MM:SS.SSS)
DEC     = '-16:12:07.1'         / DEC of telescope pointing (+/-DD:MM:SS.SS)
DEC2000 = '-16:12:07.1'         / DEC (J2000) pointing (+/-DD:MM:SS.SS)
EQUINOX =               2000.0 / Standard FK5 (years)
AZIMUTH =           -16.625000 / Azimuth angle of telescope pointing (degree), S
ALTITUDE=             36.47000 / Altitude angle of telescope pointing (degree)
TELFOCAS= 'CASSEGRAIN'          / Focus where a beam is reachable
FOC-POS = 'CASSEGRAIN'          / Focus where the instrument is attached
FOC-VAL =              +2.513 / Encoder value of the focus unit
F-RATIO =                12.2 / F-ratio of each telescope-focus.
ADC-TYPE= 'RED     '            / ADC name if used
ADC     =             +21.123 / ADC PA during exposure (degree)
ADC-STR =             +19.059 / ADC PA at exposure start (degree)
ADC-END =             +25.897 / ADC PA at exposure end (degree)
WAVELEN =              600.00 / Typical wavelength on detector (nm)
WAV-MIN =              468.93 / Shortest wavelength focused on detector (nm)
WAV-MAX =              731.07 / Longest wavelenght focused on detector (nm)
FILTER01= 'NONE    '            / Filter name/ID
FILTER02= 'NONE    '            / Filter name/ID
FILTER03= 'NONE    '            / Filter name/ID
FLT-A01 =                5.00 / Inclination of n-th Filter (degree)
FLT-A02 =                5.00 / Inclination of n-th Filter (degree)
FLT-A03 =                5.00 / Inclination of n-th Filter (degree)
AIRMASS =                1.24 / Averaged Air Mass
AIRM-STR=                1.21 / Air Mass at exposure start
AIRM-END=                1.28 / Air Mass at exposure end
ZD      =               36.47 / Zenith Distance at typical time (degree)
ZD-STR  =               34.28 / Zenith Distance at exposure start (degree)
ZD-END  =               38.63 / Zenith Distance at exposure end (degree)
SECZ    =               1.243 / SEC(Zenith Distance) at typical time
SECZ-STR=               1.210 / SEC(ZD) at exposure start
SECZ-END=               1.280 / SEC(ZD) at exposure end
DAQ-VER = 'DAQ-1.0.3'           / Version of the DAQ-soft
INS-VER = 'FCS-1.2-1.0'         / Version of the instrument/control-soft
DETECTOR= 'MIT_001 '            / Name of the detector/CCD
DET-ID  =                   1 / ID of the detector used for this data
DET-A01 =               0.000 / Relative angle of the nn-th detector (degree)
DET-P101=              -103.5 / Relative X-Position of nn-th detector (nm)
DET-P201=                12.5 / Relative Y-Position of nn-th detector (nm)
DET-TMP =              132.50 / Detector temperature (K)
DET-TMED=              132.50 / Median of the detector temperature (K)
DET-TMIN=              132.40 / Minimun temperature of the detector (K)
DET-TMAX=              132.55 / Maximun temperature of the detector (K)
GAIN    =                1.26 / AD conversion factor (electron/ADU)
EFP-MIN1=                  10 / Start X position of effective data region
EFP-MIN2=                  10 / Start Y position of effective data region
EFP-RNG1=                4046 / X range of effective data region
EFP-RNG2=                2028 / Y range of effective data region
PRD-MIN1=                   1 / Start X position of partialy read out
PRD-MIN2=                   1 / Start Y position of partialy read out
PRD-RNG1=                4096 / X range of the partialy read out
PRD-RNG2=                2048 / Y range of the partialy read out
BIN-FCT1=                   1 / Binning factor of X axis
BIN-FCT2=                   1 / Binning factor of Y axis
WEATHER = 'CLEAR   '            / Weather condition (selected by observer)
SEEING  =               0.45 / FWHM of star size at telescope focus (arcsec)
DOM-WND =               4.61 / Wind speed in the dome (m/sec)
OUT-WND =               7.79 / Wind speed outside the dome (m/sec)
DOM-TMP =             273.53 / Temperature in the dome (K)
OUT-TMP =             273.72 / Temperature outside the dome (K)
DOM-HUM =              45.00 / Humidity in the dome (%?)
OUT-HUM =              58.00 / Humidity outside the dome (%?)
DISPERSR= 'HG600   '            / Identifier of the disperser used
SLIT    = 'LONGSLIT'            / Identifier of the entrance slit used
COMMENT ---  Subaru Device Dependent Header Block for FOCAS  ---
F_TMP-A =              275.33 / Temperature of MOS unit (K)
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F_TMP-B =               272.45 / Temperature of lens unit (K)
F_TMP-C1=               272.15 / Temperature of collimator beam unit-1 (K)
F_TMP-C2=               272.20 / Temperature of collimator beam unit-2 (K)
F_TMP-C3=               272.10 / Temperature of collimator beam unit-3 (K)
F_TMP-D =               273.29 / Temperature of Camera lens unit (K)
F_TMP-E1=               275.29 / Temperature of VME-1 (K)
F_TMP-E2=               275.30 / Temperature of VME-2 (K)
F_TMP-F1=               275.31 / Temperature of driver-unit A-1 (K)
F_TMP-F2=               275.28 / Temperature of diver-unit A-2 (K)
F_TMP-G1=               275.29 / Temperature of drive-unit B-1 (K)
F_TMP-G2=               275.27 / Temperature of driver-unit B-2 (K)
F_TMP-H1=               275.29 / Temperature of driver-unit C-1 (K)
F_TMP-H2=               275.27 / Temperature of drive-unit C-2 (K)
F_TMP-I1=               275.35 / Temperature of driver-unit D-1 (K)
F_TMP-I2=               275.38 / Temperature of driver-unit D-2 (K)
F_TMP-J1=               275.25 / Temperature of driver-unit E-1 (K)
F_TMP-J2=               275.22 / Temperature of driver-unit E-2 (K)
F_DEWERX=                27.00 / X-position of dewer stage (micron meter)
F_DEWERY=                10.00 / Y-position of dewer stage (micron meter)
F_DEWERZ=               152.94 / Z-position of dewer stage (micron meter)
F_HOLANG=                -5.2 / angle of mask holder (degree)
F_MSK-ID= 'MSK300151'          / ID of Mask (for all mode)
F_CAD-ID= 'CAD005235'          / ID of CAD data for mask cutting
F_CADREF= 'FSCA00002345'       / ID/name of image/catalog data for mask design
F_DISPER=                0.546 / Dispersion of grism (nm / pixel)
F_SLT-NO=                    3 / total # of slit on mask
F_POSANG=                 0.00 / PA of cross-dispersion axis (degree)
END
```

● FOCAS ∅ SpectroPolarimetry mode

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         1         2         3         4         5         6         7
1234567890123456789012345678901234567890123456789012345678901234567890123456789
--------------------------------------------------------------------------------
SIMPLE  =                    T / Standard FITS format
BITPIX  =                   16 / # of bits storing pix value
NAXIS   =                    2 / # of axes in frame
NAXIS1  =                 4096 / # of pixels/row
NAXIS2  =                 2048 / # of rows (also # of scan lines)
EXTEND  =                    T / Extension FITS format
OBSERVER= 'Y.Yadoumaru, K.Aoki, T.Ozawa, night-staff and WG' / Name of observer
PROP-ID = 'P19970025-0001'     / Proposal ID
INSTRUME= 'FOCAS   '           / Name of instrument
FRAMEID = 'FSCA000023471234'   / Image sequential number
EXP-ID  = 'FSCE000011741234'   / ID of the exposure this data was taken
OBS-MOD = 'Spectro-Polarimetry' / Observation Mode
DATA-TYP= 'OBJECT  '           / Type / Characteristics of this data
OBSERVAT= 'NAOJ    '           / Observatory
TELESCOP= 'SUBARU  '           / Telescope name
TIMESYS = 'UTC     '           / Time System used in the header. UTC fix.
RADECSYS= 'FK5     '           / The equatorial coordinate system
OBS-ALOC= 'OBSEVING'           / Allocation mode for Instrument
DATASET = 'FOCAS-12345'        / ID of an observation dataset
DISPAXIS=                    1 / Dispersion axis in frame
WCS-ORIG= 'SUBARU toolkit'     / Origin of the WCS value
CRPIX1  =              +2048.0 / Reference pixel in X
CRPIX2  =              +1024.0 / Reference pixel in Y
CRVAL1  =        +0.275108E+03 / Physical value of the reference pixel X
CRVAL2  =        -0.161769E+02 / Physical value of the reference pixel Y
CDELT1  =        +0.277778E-04 / Size projected into a detector pixel X
CDELT2  =        +0.277778E-04 / Size projected into a detector pixel Y
CTYPE1  = 'RA---TAN'           / Pixel coordinate system
CTYPE2  = 'DEC--TAN'           / Pixel coordinate system
CUNIT1  = 'degree  '           / Units used in both CRVAl1 and CDELT1
CUNIT2  = 'degree  '           / Units used in both CRVAL2 and CDELT2
LONGPOLE=            180.00000 / The North Pole of the standard system
COMMENT
C2PIX1  =              +2048.0 / Reference pixel in X
C2PIX2  =              +1024.0 / Reference pixel in Y
C2VAL1  =        +0.275108E+03 / Physical value of ref pix X for WCS
C2VAL2  =        -0.161769E+02 / Physical value of ref pix Y for WCS
C2ELT1  =        +0.277778E-04 / Size projected into a detector pixel X
C2ELT2  =        +0.277778E-04 / Size projected into a detector pixel Y
C2YPE1  = 'RA---TAN'           / Pixel coordinate system
C2YPE2  = 'DEC--TAN'           / Pixel coordinate system
C2NIT1  = 'degree  '           / Units used in both C2VAl1 and C2ELT1
C2NIT2  = 'degree  '           / Units used in both C2VAL2 and C2ELT2
C3PIX1  =              +2048.0 / Reference pixel in X for Ordinary light
C3PIX2  =              +1124.0 / Reference pixel in Y for Ordinary light
C3VAL1  =        +0.275108E+03 / Physical value of ref pix X for Ordinary light
C3VAL2  =        -0.161769E+02 / Physical value of ref. pix Y for Ordinary light
C3ELT1  =        +0.277778E-04 / Size projected into a detector X for Ordinary
```

```
C3ELT2  =        +0.277778E-04 / Size projected into a detector Y for Ordinary
C3YPE1  = 'RA---TAN'           / Pixel coordinate system for Ordinary light
C3YPE2  = 'DEC--TAN'           / Pixel coordinate system for Ordinary light
C3NIT1  = 'degree  '           / Units in both C3VAl1 and C3ELT1 for Ordinary
C3NIT2  = 'degree  '           / Units in both C3VAL2 and C3ELT2 for Ordinary
C4PIX1  =               +2048.0 / Reference pixel in X for Extraordinary light
C4PIX2  =                +924.0 / Reference pixel in Y for Extraordinary light
C4VAL2  =        -0.161769E+02 / Physical value of ref. pix Y for Extraordinary
C4ELT1  =        +0.277778E-04 / Size projected into a detector X for E-light
C4ELT2  =        +0.277778E-04 / Size projected into a detector Y for E-light
C4YPE1  = 'RA---TAN'           / Pixel coordinate system for Extraordinary light
C4YPE2  = 'DEC--TAN'           / Pixel coordinate system for Extraordinary light
C4NIT1  = 'degree  '           / Units in both C4VAl1 and C4ELT1 for E-light
C4NIT2  = 'degree  '           / Units in both C4VAL2 and C4ELT2 for E-light
BSCALE  =                  1.0 / Real=fits_value*BSCALE+BZERO
BZERO   =              32768.0 / Real=fits_value*BSCALE+BZERO
BUNIT   = 'ADU     '           / Unit of original pixel values
BLANK   =                -32768 / Value used for NULL pixels
DATE-OBS= '1998-05-06'         / Observation start date (yyyy-mm-dd)
UT      = '12:34:56.78'        / HH:MM:SS.SS typical UTC at exposure
UT-STR  = '12:34:56.78'        / HH:MM:SS.SS UTC at exposure start
UT-END  = '13:04:56.78'        / HH:MM:SS.SS UTC at exposure end
HST     = '02:34:56.78'        / HH:MM:SS.SS typical HST at exposure
HST-STR = '02:34:56.78'        / HH:MM:SS.SS HST at exposure start
HST-END = '03:04:56.78'        / HH:MM:SS.SS HST at exposure end
LST     = '23:53:10.67'        / HH:MM:SS.SS typical LST at exposure
LST-STR = '23:53:10.67'        / HH:MM:SS.SS LST at exposure start
LST-END = '24:23:20.63'        / HH:MM:SS.SS LST at exposure end
MJD     =       50396.52420000 / Modified Julian Day at typical time
MJD-STR =       50396.52420000 / Modified Julian Day at exposure start
MJD-END =       50396.54500000 / Modified Julian Day at exposure end
EXPTIME =              1800.00 / Total integration time (sec)
OBJECT  = 'M17     '           / Target Description
RA      = '18:20:26.010'       / RA of telescope pointing (HH:MM:SS.SSS)
RA2000  = '18:20:26.010'       / RA (J2000) pointing (HH:MM:SS.SSS)
DEC     = '-16:12:07.1'        / DEC of telescope pointing (+/-DD:MM:SS.SS)
DEC2000 = '-16:12:07.1'        / DEC (J2000) pointing (+/-DD:MM:SS.SS)
EQUINOX =               2000.0 / Standard FK5 (years)
AZIMUTH =           -16.625000 / Azimuth angle of telescope pointing (degree), S
ALTITUDE=             36.47000 / Altitude angle of telescope pointing (degree)
TELFOCAS= 'CASSEGRAIN'         / Focus where a beam is reachable
FOC-POS = 'CASSEGRAIN'         / Focus where the instrument is attached
FOC-VAL =                +2.513 / Encoder value of the focus unit
F-RATIO =                  12.2 / F-ratio of each telescope-focus.
ADC-TYPE= 'RED     '           / ADC name if used
ADC     =              +21.123 / ADC PA during exposure (degree)
ADC-STR =              +19.059 / ADC PA at exposure start (degree)
ADC-END =              +25.897 / ADC PA at exposure end (degree)
WAVELEN =               600.00 / Typical wavelength on detector (nm)
WAV-MIN =               468.93 / Shortest wavelength focused on detector (nm)
WAV-MAX =               731.07 / Longest wavelenght focused on detector (nm)
RETPLAT1= '1/2     '           / Identifier of the Retarder Plate
RET-ANG =              45.0000 / Position Angle of the Retarder Plate
FILTER01= 'NONE    '           / Filter name/ID
FILTER02= 'NONE    '           / Filter name/ID
FILTER03= 'NONE    '           / Filter name/ID
FLT-A01 =                 5.00 / Inclination of n-th Filter (degree)
FLT-A02 =                 5.00 / Inclination of n-th Filter (degree)
FLT-A03 =                 5.00 / Inclination of n-th Filter (degree)
AIRMASS =                 1.24 / Averaged Air Mass
AIRM-STR=                 1.21 / Air Mass at exposure start
AIRM-END=                 1.28 / Air Mass at exposure end
ZD      =                36.47 / Zenith Distance at typical time (degree)
ZD-STR  =                34.28 / Zenith Distance at exposure start (degree)
ZD-END  =                38.63 / Zenith Distance at exposure end (degree)
SECZ    =                1.243 / SEC(Zenith Distance) at typical time
SECZ-STR=                1.210 / SEC(ZD) at exposure start
SECZ-END=                1.280 / SEC(ZD) at exposure end
DAQ-VER = 'DAQ-1.0.3'          / Version of the DAQ-soft
INS-VER = 'FCS-1.2-1.0'        / Version of the instrument/control-soft
DETECTOR= 'MIT_001 '           / Name of the detector/CCD
DET-ID  =                    1 / ID of the detector used for this data
DET-A01 =                0.000 / Relative angle of the nn-th detector (degree)
DET-P101=               -103.5 / Relative X-Position of nn-th detector (nm)
DET-P201=                 12.5 / Relative Y-Position of nn-th detector (nm)
DET-TMP =               132.50 / Detector temperature (K)
DET-TMED=               132.50 / Median of the detector temperature (K)
DET-TMIN=               132.40 / Minimun temperature of the detector (K)
DET-TMAX=               132.55 / Maximun temperature of the detector (K)
GAIN    =                 1.26 / AD conversion factor (electron/ADU)
EFP-MIN1=                   10 / Start X position of effective data region
EFP-MIN2=                   10 / Start Y position of effective data region
EFP-RNG1=                 4046 / X range of effective data region
EFP-RNG2=                 2028 / Y range of effective data region
```

```
PRD-MIN1=                    1 / Start X position of partialy read out
PRD-MIN2=                    1 / Start Y position of partialy read out
PRD-RNG1=                 4096 / X range of the partialy read out
PRD-RNG2=                 2048 / Y range of the partialy read out
BIN-FCT1=                    1 / Binning factor of X axis
BIN-FCT2=                    1 / Binning factor of Y axis
WEATHER = 'CLEAR   '           / Weather condition (selected by observer)
SEEING  =                 0.45 / FWHM of star size at telescope focus (arcsec)
DOM-WND =                 4.61 / Wind speed in the dome (m/sec)
OUT-WND =                 7.79 / Wind speed outside the dome (m/sec)
DOM-TMP =               273.53 / Temperature in the dome (K)
OUT-TMP =               273.72 / Temperature outside the dome (K)
DOM-HUM =                45.00 / Humidity in the dome (%?)
OUT-HUM =                58.00 / Humidity outside the dome (%?)
DISPERSR= 'HG600   '           / Identifier of the disperser used
SLIT    = 'LONGSLIT'           / Identifier of the entrance slit used
COMMENT ---  Subaru Device Dependent Header Block for FOCAS  ---
F_TMP-A =                275.33 / Temperature of MOS unit (K)
F_TMP-B =                272.45 / Temperature of lens unit (K)
F_TMP-C1=                272.15 / Temperature of collimator beam unit-1 (K)
F_TMP-C2=                272.20 / Temperature of collimator beam unit-2 (K)
F_TMP-C3=                272.10 / Temperature of collimator beam unit-3 (K)
F_TMP-D =                273.29 / Temperature of Camera lens unit (K)
F_TMP-E1=                275.29 / Temperature of VME-1 (K)
F_TMP-E2=                275.30 / Temperature of VME-2 (K)
F_TMP-F1=                275.31 / Temperature of driver-unit A-1 (K)
F_TMP-F2=                275.28 / Temperature of diver-unit A-2 (K)
F_TMP-G1=                275.29 / Temperature of drive-unit B-1 (K)
F_TMP-G2=                275.27 / Temperature of driver-unit B-2 (K)
F_TMP-H1=                275.29 / Temperature of driver-unit C-1 (K)
F_TMP-H2=                275.27 / Temperature of drive-unit C-2 (K)
F_TMP-I1=                275.35 / Temperature of driver-unit D-1 (K)
F_TMP-I2=                275.38 / Temperature of driver-unit D-2 (K)
F_TMP-J1=                275.25 / Temperature of driver-unit E-1 (K)
F_TMP-J2=                275.22 / Temperature of driver-unit E-2 (K)
F_DEWERX=                 27.00 / X-position of dewer stage (micron meter)
F_DEWERY=                 10.00 / Y-position of dewer stage (micron meter)
F_DEWERZ=                152.94 / Z-position of dewer stage (micron meter)
F_HOLANG=                  -5.2 / angle of mask holder (degree)
F_MSK-ID= 'MSK300151'          / ID of Mask (for all mode)
F_CAD-ID= 'CAD005235'          / ID of CAD data for mask cutting
F_CADREF= 'FSCA00002345'       / ID/name of image/catalog data for mask design
F_DISPER=                0.546 / Dispersion of grism (nm / pixel)
F_SLT-NO=                    3 / total # of slit on mask
F_POSANG=                 0.00 / PA of cross-dispersion axis (degree)
END
```

● FOCAS の ASCII Table Extension sample header とデータ (Imaging and Spectroscopy mode)

```
        1         2         3         4         5         6         7
12345678901234567890123456789012345678901234567890123456789012345678901234567890123456789
--------------------------------------------------------------------------------
XTENSION= 'TABLE   '           / Table extension
BITPIX  =                    8 / # of bits storing pix value
NAXIS   =                    2 / simple 2-D matrix
NAXIS1  =                  107 / # of characters per row
NAXIS2  =                    3 / # of rows
PCOUNT  =                    0 / No "random" parameters
GCOUNT  =                    1 / Only one group
TFIELDS =                   11 / # of fields in one row
EXTNAME = '         '          / Name of this table
TTYPE1  = 'SLT-ID  '           / Slit ID of mask design in CAD data
TBCOL1  =                    1 / start column of this field (= 1)
TFORM1  = 'I4      '           / integer
TTYPE2  = 'SLTCPIX1'           / X-position of slit center
TBCOL2  =                    6 / start column of this field (= 6)
TFORM2  = 'F7.2    '           / float
TUNIT2  = 'pixel   '           / unit of 2nd column
TTYPE3  = 'SLTCPIX2'           / Y-position of slit center
TBCOL3  =                   14 / start column of this field (= 14)
TFORM3  = 'F7.2    '           / float
TUNIT3  = 'pixel   '           / unit of 3rd column
TTYPE4  = 'SLTC-RA '           / RA of slit center
TBCOL4  =                   22 / start column of this field (= 22)
TFORM4  = 'A12     '           / character (format is HH:MM:SS.SSS)
TTYPE5  = 'SLTC-DEC'           / DEC of slit center
TBCOL5  =                   35 / start column of this field (= 35)
TFORM5  = 'A12     '           / character (format is +/-DD:MM:SS.SS)
TTYPE6  = 'SLT-LEN '           / Slit length (Semi-major-axis for ELLIPSE)
TBCOL6  =                   48 / start column of this field (= 48)
```

```
TFORM6  = 'F5.1    '           / float
TUNIT6  = 'arcsec  '           / unit of 6th column
TTYPE7  = 'SLT-WID '           / Slit width (Semi-minor-axis for ELLIPSE)
TBCOL7  =                   54 / start column of this field (= 54)
TFORM7  = 'F5.1    '           / float
TUNIT7  = 'arcsec  '           / unit of 7th column
TTYPE8  = 'SLT-PA  '           / Position angle of slit
TBCOL8  =                   60 / start column of this field (= 60)
TFORM8  = 'F5.1    '           / float
TUNIT8  = 'degree  '           / unit of 8th column
TTYPE9  = 'SLT-SHP '           / Shape of cutting slit
TBCOL9  =                   66 / start column of this field (= 66)
TFORM9  = 'A9      '           / character (ELLIPSE, RECTANGLE)
TTYPE10 = 'SLT-OPEN'           / Cutting shape is open or not, open is T(rue).
TBCOL10 =                   76 / start column of this field (= 76)
TFORM10 = 'A1      '           / logical (T or F)
TTYPE11 = 'OBJECT  '           / Name of observed
TBCOL11 =                   78 / start column of this field (= 78)
TFORM11 = 'A30     '           / character
TNULL11 = '                               '/ null data for this column
END

         1         2         3         4         5         6         7         8         9
123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345
-----------------------------------------------------------------------------------------------------------
   1  102.10  110.79 12:35:39.940 +42:05:30.82  13.8   0.2   0.0 RECTANGLE T
  52 1053.05 2090.23 12:35:44.555 +42:08:09.56 150.0   0.2   0.0 RECTANGLE T FOCAS123545+4208
1894 3179.93 3565.33 12:35:59.109 +42:11:12.74  18.0   0.2   0.0 RECTANGLE T
```

● FOCAS の ASCII Table Extension sample header とデータ (ImagingPolarimetry and SpectroPolarimetry mode)

```
         1         2         3         4         5         6         7
12345678901234567890123456789012345678901234567890123456789012345678901234567890123456789
-----------------------------------------------------------------------------------------
XTENSION= 'TABLE   '           / Table extension
BITPIX  =                    8 / # of bits storing pix value
NAXIS   =                    2 / simple 2-D matrix
NAXIS1  =                  139 / # of characters per row
NAXIS2  =                    3 / # of rows
PCOUNT  =                    0 / No "random" parameters
GCOUNT  =                    1 / Only one group
TFIELDS =                   15 / # of fields in one row
EXTNAME = '        '           / Name of this table
TTYPE1  = 'SLT-ID  '           / Slit ID of mask design in CAD file
TBCOL1  =                    1 / start column of this field (= 1)
TFORM1  = 'I4      '           / integer
TTYPE2  = 'SLTCPIX1'           / X-position of slit center
TBCOL2  =                    6 / start column of this field (= 6)
TFORM2  = 'F7.2    '           / float
TUNIT2  = 'pixel   '           / unit of 2nd column
TTYPE3  = 'SLTCPIX2'           / Y-position of slit center
TBCOL3  =                   14 / start column of this field (= 14)
TFORM3  = 'F7.2    '           / float
TUNIT3  = 'pixel   '           / unit of 3rd column
TTYPE4  = 'SL2CPIX1'           / X-position of Ordinary-ray slit center
TBCOL4  =                   22 / start column of this field (= 22)
TFORM4  = 'F7.2    '           / float
TUNIT4  = 'pixel   '           / unit of 4th column
TTYPE5  = 'SL2CPIX2'           / Y-position of Ordinary-ray slit center
TBCOL5  =                   30 / start column of this field (= 30)
TFORM5  = 'F7.2    '           / float
TUNIT5  = 'pixel   '           / unit of 5th column
TTYPE6  = 'SL3CPIX1'           / X-position of Extraordinary-ray slit center
TBCOL6  =                   38 / start column of this field (= 38)
TFORM6  = 'F7.2    '           / float
TUNIT6  = 'pixel   '           / unit of 6th column
TTYPE7  = 'SL3CPIX2'           / Y-position of Extraordinary-ray slit center
TBCOL7  =                   46 / start column of this field (= 46)
TFORM7  = 'F7.2    '           / float
TUNIT7  = 'pixel   '           / unit of 7th column
TTYPE8  = 'SLTC-RA '           / RA of slit center
TBCOL8  =                   54 / start column of this field (= 54)
TFORM8  = 'A12     '           / character (format is HH:MM:SS.SSS)
TTYPE9  = 'SLTC-DEC'           / DEC of slit center
TBCOL9  =                   67 / start column of this field (= 67)
TFORM9  = 'A12     '           / character (format is +/-DD:MM:SS.SS)
TTYPE10 = 'SLT-LEN '           / Slit length (Semi-major-axis for ELLIPSE)
TBCOL10 =                   80 / start column of this field (= 80)
TFORM10 = 'F5.1    '           / float
```

```
TUNIT10 = 'arcsec  '           / unit of 10th column
TTYPE11 = 'SLT-WID '           / Slit width (Semi-minor-axis for ELLIPSE)
TBCOL11 =                   86 / start column of this field (= 86)
TFORM11 = 'F5.1    '           / float
TUNIT11 = 'arcsec  '           / unit of 11th column
TTYPE12 = 'SLT-PA  '           / Position angle of slit
TBCOL12 =                   92 / start column of this field (= 92)
TFORM12 = 'F5.1    '           / float
TUNIT12 = 'degree  '           / unit of 12th column
TTYPE13 = 'SLT-SHP '           / Shape of slit
TBCOL13 =                   98 / start column of this field (= 98)
TFORM13 = 'A9      '           / character (eclipse, rectangle)
TTYPE14 = 'SLT-OPEN'           / Cutting shape is open or not, open is T(rue)
TBCOL14 =                  108 / start column of this field (= 108)
TFORM14 = 'A1      '           / logical (T or F)
TTYPE15 = 'OBJECT  '           / Name of observed
TBCOL15 =                  110 / start column of this field (= 110)
TFORM15 = 'A30     '           / character
TNULL15 = '                               '/ null data for this column
END

        1         2         3         4         5         6         7         8         9         0         1         2
12345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901
-------------------------------------------------------------------------------------------------------------------------------
   1  102.10  110.79  102.10   10.99  102.10  210.49 12:35:39.940 +42:05:30.8213.8   0.2   0.0 RECTANGLE T
  52 1053.05 2090.23 1053.05 1990.43 1053.05 2189.93 12:35:44.555 +42:08:09.5620.0   0.2   0.0 RECTANGLE T FOCAS123545+4208
1893 3179.93 3565.33 3179.93 3465.53 3179.93 3665.03 12:35:59.109 +42:11:12.7418.0   0.2   0.0 RECTANGLE T
```

6.5.4 HDS(1998/08/19)

```
         1         2         3         4         5         6         7         8         9
123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890
--------------------------------------------------------------------------------------------
SIMPLE  =                    T / Standard FITS format
BITPIX  =                   16 / Number of bits for each pixel
NAXIS   =                    2 / Number of axes in frame                               i1
NAXIS1  =                 4096 / Number of pixels per row                              i5
NAXIS2  =                 2048 / Number of rows                                        i5
EXTEND  =                    T / There is a standard extension 1 (ASCII table)
BSCALE  =              1.00000 / Real = (fits pixel value)*BSCALE+BZERO
BZERO   =           1355.00000 / Real = (fits pixel value)*BSCALE+BZERO
BUNIT   = 'ADU     '           / Unit of original pixel value
BLANK   =                    0 / Value used for NULL pixels
DISPAXIS=                    1 / Main dispersion axis in frame
CTYPE1  = 'RA---TAN'           / Pixel coordinate system                             a16
CTYPE2  = 'DEC--TAN'           / Pixel coordinate system                             a16
CUNIT1  = 'degree  '           / Units used in both CRVAl1 and CDELT1                a10
CUNIT2  = 'degree  '           / Units used in both CRVAL2 and CDELT2                a10
CRPIX1  =               2048.0 / Reference pixel in axis1                            f6.1
CRVAL1  =            190.00000 / Physical value of the reference pixel               f13.8
CDELT1  =             0.000200 / Size projected into a detector pixel in axis1       f13.8
CRPIX2  =               1024.0 / Reference pixel in axis2                            f6.1
CRVAL2  =             45.00000 / Physical value of the reference pixel               f13.8
CDELT2  =             0.000200 / Size projected into a detector pixel in axis2       f13.8
PROJP1  =                  0.0 /                                                     f5.1
PROJP2  =                  0.0 /                                                     f5.1
LONGPOLE=                180.0 / The North Pole of the standard system               f6.1
PC001001=           1.00000000 / Pixel Coordinate translation matrix                 f12.8
PC001002=           0.00000000 / Pixel Coordinate translation matrix                 f12.8
PC002001=           0.00000000 / Pixel Coordinate translation matrix                 f12.8
PC002002=           1.00000000 / Pixel Coordinate translation matrix                 f12.8
BIN-FCT1=                    1 / Binning factor in axis1                             i2
BIN-FCT2=                    1 / Binning factor in axis2                             i2
N2XIS   =                    2 / Number of axes for the slit projection              i1
N2XIS1  =                 4096 / Number of pixels per row for slit spectroscopy      i5
N2XIS2  =                 2048 / Number of scan lines for slit projection            i5
C2YPE1  = 'WAVELENGTH'         / (nm)                                                a16
C2PIX1  =               2048.0 / Reference pixel in X                                f6.1
C2VAL1  =               344.53 / Physical value of ref pix X for WCS                 f13.8
C2ELT1  =              0.00117 / Size projected into a detector pixel X              f13.8
C2NIT1  = 'nm      '           / for C2VAL1 and C2ELT1                               a10
C2YPE2  = 'DEC--TAN'           /                                                     a16
C2PIX2  =               1024.0 / Reference pixel in Y                                f6.1
C2VAL2  =             45.00000 / Physical value of ref pix Y for WCS                 f13.8
C2ELT2  =             0.000200 / Size projected into a detector pixel Y              f13.8
C2NIT2  = 'degree  '           / for C2VAL2 and C2ELT2                               a10
P2OJP1  =                  0.0 /                                                     f5.1
P2OJP2  =                  0.0 /                                                     f5.1
P2001001=           1.00000000 /                                                     f12.8
P2001002=           0.00000000 /                                                     f12.8
P2002001=           0.00000000 /                                                     f12.8
P2002002=           1.00000000 /                                                     f12.8
```

```
PRD-MIN1=                    1 / Start X position of partialy read out               i4
PRD-MIN2=                    1 / Start Y position of partialy read out               i4
PRD-RNG1=                 4096 / X range of the partialy read out                    i4
PRD-RNG2=                 2048 / Y range of the partialy read out                    i4
EFP-MIN1=                    1 /                                                     i4
EFP-RNG1=                 4096 /                                                     i4
EFP-MIN2=                    1 /                                                     i4
EFP-RNG2=                 2048 /                                                     i4
OBJECT  = 'Q1245+4542'         /  Target Description                                 a30
DATA-TYP= 'OBJECT  '           /                                                     a15
RA      = '12:45:42.700'       / RA of the tracked pos. on the slit guide pos.       a12
DEC     = '+45:42:30.00'       / Dec of the tracked pos. on the slit guide pos.      a12
RADECSYS= 'FK5     '           /                                                     a12
EQUINOX =               2000.0 /                                                     f6.1
RA2000  = '12:45:42.700'       /                                                     a12
DEC2000 = '+45:42:30.00'       /                                                     a12
PROP-ID = 'P1999-A135.HIZUMIUR'/                                                     a20
OBSERVER= 'H.Izumiura, S.Kawanomoto, W.Aoki' /                                       a30
OBS-MOD = 'MULTIPLE-ORDER'     / SINGLE-ORDER, MULTIPLE-ORDER                        a30
DATE-OBS= '2000-03-14'         / Date of observation                                 a10
EXPTIME =               1800.0 / Exposure time in second                             f8.1
UT      = '08:22:22.2'         / Universal Time                                      a10
UT-STR  = '08:22:22.2'         /                                                     a10
UT-END  = '10:44:44.4'         /                                                     a10
HST     = '22:22:22.2'         / Hawaii Standard Time                                a10
HST-STR = '22:22:22.2'         /                                                     a10
HST-END = '00:44:44.4'         /                                                     a10
LST     = '11:11:11.1'         / Local SideReal Time                                 a10
LST-STR = '11:11:11.1'         /                                                     a10
LST-END = '13:33:50.0'         /                                                     a10
TIMESYS = 'UTC     '           / Time System
MJD     =        51617.3488681 / Modified Julian Day                                f14.8
MJD-STR =        51617.3488681 /                                                    f14.8
MJD-END =        51617.4477361 /                                                    f14.8
SECZ    =                1.138 /                                                    f6.3
SECZ-STR=                1.130 /                                                    f6.3
SECZ-END=                1.147 /                                                    f6.3
AIRMASS =               1.1388 /                                                    f6.4
AIRM-STR=               1.1300 /                                                    f6.4
AIRM-END=               1.1472 /                                                    f6.4
ALTITUDE=              61.4510 / Altitude of the telescope pointing (degree)        f9.5
ALT-STR =              62.2461 /                                                    f9.5
ALT-END =              60.6553 /                                                    f9.5
AZIMUTH =              78.1000 / Azimuth of the telescope pointing (degree)         f9.5
AZ-STR  =              75.0000 / 0:North, 90:East                                   f9.5
AZ-END  =              80.0000 /                                                    f9.5
OBSERVAT= 'NAOJ    '           /
TELESCOP= 'SUBARU  '           /
OBS-ALOC= '            '
TELFOCUS= 'NASMYTH-OPT'        /
FOC-POS = 'NASMYTH-OPT'        / Focus                                               a12
FOC-VAL =             1234.567 / Focus position of the telescope                    f10.3
FOC-LEN =             104207.0 / Focal length of the telescope (mm)                 f8.1
F-RATIO =                12.71 / F-ratio of incident beam                           f5.2
INSTRUME= 'HDS     '           /
FRAMEID = 'HDS00001001'        / Frame ID number issued by OBS                       a16
EXP-ID  = 'HDS00000501'        / Exposure ID number locally defined                  a16
DISPERSR= 'echelle '           / Identifier of the disperser used
WAVELEN =               344.53 / Center wavelength of the center order (nm)          f7.2
WAV-MAX =               298.71 / Maximum wavelength recorded (nm)                   f7.2
WAV-MIN =               390.02 / Minimum wavelength recorded (nm)                   f7.2
FILTER01= 'CN603   '           / Filter wheel No.1                                   a10
FILTER02= 'R60     '           / Filter wheel No.2                                   a10
SLIT    = 'SHORT'              / Identifier of the entrance slit used (SHORT/LONG)
SLT-WID =                 0.200 / Slit width (mm)                                    f6.3
SLT-LEN =                 3.500 / Slit length (mm)                                   f6.3
SLT-PA  =                 60.25 / Slit position angle (degree)                       f6.2
SLTCPIX1=              2056.04 / Slit center position in axis1 at WAVELEN            f7.2
SLTCPIX2=              1028.70 / Slit center position in axis2 at WAVELEN            f7.2
SLT-PSTR=                 56.2 / Slit position angle at start (degree)              f6.2
SLT-PEND=                 64.3 / Slit position angle at end (degree)                f6.2
SLT-OBJP=                -0.05 / Object position on the slit (arcsec)               f6.2
DET-ID  =                    1 / ID number of the CCD in the detector unit          i1
DETECTOR= 'SITe    '           / Detector used to take this frame                    a10
DETPXSZ1=               0.0150 / pixel size in axis1 (mm)                          f6.4
DETPXSZ2=               0.0150 / pixel size in axis2 (mm)                          f6.4
DET-A01 =               -8.003 / Rotation angle of the 1st detector (degree)       f7.3
DET-A02 =               -7.998 / Rotation angle of the 2nd detector (degree)       f7.3
GAIN    =                 2.00 / Readout gain                                      f5.2
DET-TMP =                158.2 / Nominal detector temperature (Kelvin)             f6.2
DET-TAVE=                158.2 / Average detector temperature (Kelvin)             f6.2
DET-TMAX=                159.2 / Maximum detector temperature (Kelvin)             f6.2
DET-TMIN=                157.2 / Minimum detector temperature (Kelvin)             f6.2
DET-TSD =                 0.07 / Detector temperature fluctuation (Kelvin)         f5.3
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WEATHER = 'CLEAR   '           / Weather condition                                   a10
SEEING  =                 0.57 / FWHM of the star observed with Slit Viewer (arcsec) f6.3
NAS-TAVE=               286.25 / Average Nasmyth encl. temp. (Kelvin)               f6.2
NAS-TMIN=               287.07 / Minimum Nasmyth encl. temp. (Kelvin)               f6.2
NAS-TMAX=               285.64 / Maximum Nasmyth encl. temp. (Kelvin)               f6.2
NAS-TSD =                 0.25 / Fluctuation of Nasmyth encl. temp. (Kelvin)        f5.3
DOM-WND =                  4.2 / Wind speed inside dome (m/s)                       f4.1
DOM-TMP =                276.2 / Atmospheric temperature inside dome (Kelvin)       f6.2
DOM-HUM =                  3.0 / Humidity inside dome (hPa)                         f5.1
OUT-WND =                  5.3 / Wind speed outside dome (m/s)                      f4.1
OUT-TMP =                277.1 / Atmospheric temperature outside dome (Kelvin)      f6.2
OUT-HUM =                  3.0 / Humidity outside dome (hPa)                        f5.1
DOM-PRS =                654.0 / Nominal atmospheric pressure (hPa)                 f6.1
DOM-PSTR=                653.8 / Pressure at start (hPa)                           f6.1
DOM-PEND=                654.2 / Pressure at end (hPa)                             f6.1
IMR-TYPE= 'BLUE    '           /Image Rotator (BLUE, RED, NONE)                    a8
IMGROT  =               153.22 / IMR position during exposure (degree)             f7.2
IMR-STR =               153.22 / IMR position angle at start (degree)              f7.2
IMR-END =               162.91 / IMR position angle at end (degree)                f7.2
ADC-TYPE= 'BLUE    '           /Atm. Disp. Compensator (BLUE,RED,NONE)             a8
ADC     =               348.99 / ADC position during exposure (degree)
ADC-STR =               348.99 / ADC position angle at start (degree)              f7.2
ADC-END =               361.23 / ADC position angle at end (degree)                f7.2
DAQ-VER = '1.0.0 '             / Data Aquisition System                            a10
INS-VER = 'HDS-1.00/HDS-1.00'  / hardware/software version                         a20
COMMENT
COMMENT Sample header for HDS revised on 7 July 1998 by W. Aoki
COMMENT Sample header for HDS revised on 6 May 1998 by W. Aoki
COMMENT Sample header for HDS written on 27 November 1997
COMMENT by H.Izumiura, S. Kawanomoto, W. Aoki.
COMMENT
COMMENT   ---------------------------------
COMMENT      HH   HH   DDDDDD     SSSSSS
COMMENT      HH   HH   DD  DDD   SSS    S
COMMENT      HHHHHHH   DD   DD     SSSS
COMMENT      HH   HH   DD  DDD   S    SSS
COMMENT      HH   HH   DDDDDD     SSSSSS
COMMENT   ---------------------------------
COMMENT  Keywords specific to HDS
COMMENT
COMMENT /Calibration Lamp Unit
H_INPOWR=                10.3 / Input power for the flat lamp (Volt)               f6.2
COMMENT /Image Slicer          /
H_IMSLCR= 'OFF     '           / Image slicer (ON, OFF)                            a8
H_ISTYPE= 'FMOS    '           / Type of the image slicer                          a10
COMMENT /SLIT
H_S-MSK1=                1.499 / Upper mask position from the center (mm)          f6.3
H_S-MSK2=               -1.505 / Lower mask position from the center (mm)          f6.3
H_S-INCL=                31.50 / Slit inclination angle wrt the horizontal plane   f7.2
COMMENT /Detector
H_D-UNIT= '1       '           / ID number of the detector unit                    i1
H_D-OTHR= 'YES     '           / Use of the other CCD in this mosaic               a10
COMMENT /SHUTTERS
H_SHUTTR= 'OPEN    '           / Entrance shutter (OPEN, CLOSE)                    a10
H_HARTMN= 'ALL-OPEN'           / Hartmann shutter (U-OPEN,L-OPEN,ALL-OPEN,ALL-CLOSE) a10
COMMENT /COLLIMATOR MIRROR
H_COLLIM= 'BLUE    '           / Collimator (BLUE, RED)                            a10
H_CLPSTN=              -10.00 / Collimator position (mm)                          f6.2
H_CLFOCL=             3396.51 / Collimator focal length (mm)                      f10.5
H_CLOFFA=                5.00 / Collimator offset angle (degree)                  f10.5
COMMENT /ECHELLE GRATING
H_ECHELL= 'RED     '           / Echelle (BLUE, RED, NIR)                          a10
H_ECONST=                31.60 / Ruling pitch (grooves/mm)                         f7.3
H_EBLAZE=                70.30 / Blaze Angle (degree)                              f7.3
H_EEPSRN=                 6.00 / Offset Angle of the Incident Beam (degree)        f7.3
H_EGAMMA=                 0.00 / (degree)                                          f7.3
H_EROTAN=             53.13743 / Echelle Rotation Angle (degree)                   f10.5
COMMENT /CROSS DISPERSER GRATING
H_CROSSD= 'BLUE    '           / Cross Disperser (BLUE, RED, MIRROR, NIR)          a10
H_CCONST=                400.0 / Ruling pitch (grooves/mm)                         f7.3
H_CBLAZE=                 4.76 / Blaze Angle (degree)                              f7.3
H_CEPSRN=                 0.00 / Offset Angle at Blaze Wavelengths (degree)        f7.3
H_CGAMMA=                45.00 / (degree)                                          f7.3
H_CTABAN=             127.4367 / Rotation angle of the turn table (degree)         f10.5
H_CROTAN=              34.1244 / Cross Disperser Rotation Angle (degree)          f10.5
COMMENT /CAMERA
H_CMRFL =               770.85 / Camera focal length (mm)                         f10.5
COMMENT /Detector Focusinig Unit
H_FOCUS =               -1.244 / Focusing unit position (mm)                      f10.5
H_PITCH =               0.0001 / Focusing unit pitching angle (degree)            f9.5
H_YAWING=               0.0001 / Focusing unit yawing angle (degree)              f9.5
H_F-DRV1=               -1.234 / Focusing driver1 position (mm)                   f9.5
H_F-DRV2=               -1.220 / Focusing driver2 position (mm)                   f9.5
H_F-DRV3=               -1.195 / Focusing driver3 position (mm)                   f9.5
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H_DETROT=               -8.000 / Rotation angle of the detector unit (degree)         f9.5
COMMENT /Nasmyth Enclosure Temperature at n-th position
H_ET1AVE=               +13.25 / Average (Kelvin)                                     f6.2
H_ET1MIN=               +14.07 / Minimum (Kelvin)                                     f6.2
H_ET1MAX=               +12.64 / Maximum (Kelvin)                                     f6.2
H_ET1DEV=                 0.25 / Standard Deviation (Kelvin)                          f5.3
COMMENT /Subaru Adaptive Optics
H_AO-TYP= 'Tip-Tilt'           / Type of correction                                   a20
H_AO-ORD=                    0 / Maximum order included                              i3
H_AO-OBJ= 'Nearby bright star' / star used for wavefront correction                  a20
H_AO-RA = '12:45:40.000'       /                                                     a20
H_AO-DEC= '+45:42:20.00'       /                                                     a20
COMMENT /Zero-th order light monitor of the echelle                                  a20
H_ZAXIS1= 'Along Slit'         /                                                     a20
H_ZAXIS2= 'Cross Slit'         /                                                     a20
H_ZA1POS=                254.3 / peak position in axis1 (pixel)                     f7.2
H_ZA2POS=                232.9 / peak position in axis2 (pixel)                     f7.2
H_ZWID1 =                 3.25 / Width in axis1 of the stellar image (pixel)        f7.2
H_ZWID2 =                 5.43 / Width in axis2 of the stellar image (pixel)        f7.2
H_ZDELT =               0.0240 / Pixel size (mm)                                    f6.4
H_ZSCALE=               0.0100 / physical length on the slit plane projected        f8.5
COMMENT                        into one pixel (mm/pixel)                            f6.2
H_ZTMP  =                200.0 / Detector temperature (Kelvin)                      a10
COMMENT /Super Resolution Mode
H_SUPER = 'NONE    '           / Super Resolution Mode (POS1, POS2, NONE)           a10
COMMENT /Auto Guider (offset guider)
H_AG-OBJ= 'Tycho1245+4542'     /                                                     a20
H_AG-ORA= '12:45:42.000'       / RA of the guide object                              a20
H_AG-ODE= '+45:42:26.00'       / Dec of the guide object                             a20
H_AG-RA = '12:45:42.800'       / RA of the tracked pos. on the slit guide pos.       a20
H_AG-DEC= '+45:42:31.00'       / Dec of the tracked pos. on the slit guide pos.      a20
H_AG-EQN=               2000.0 /                                                    f6.1
COMMENT
COMMENT
END

XTENSION= 'TABLE   '           / Talbe extension
BITPIX  =                    8 / 8-bits per "pixel"
NAXIS   =                    2 / simple 2-D matrix
NAXIS1  =                   72 / No. of characters per row
NAXIS2  =                   45 / The number of rows (= )
PCOUNT  =                    0 / No "random" parameters
GCOUNT  =                    1 / Only one group
TFIELDS =                   12 / There are 12 fields per row
TTYPE1  = 'ORDER   '           / Order number
TBCOL1  =                    1 / starting column
TFORM1  = 'I3      '           / Data format
TTYPE2  = 'X-MIN   '           / X-position of the blue-end of the order (pixel)
TBCOL2  =                    5 /
TFORM2  = 'I4      '           /
TUNIT2  = 'PIXEL   '           /
TTYPE3  = 'Y-MIN   '           / Y-position of the blue-end of the order (pixel)
TBCOL3  =                   10 /
TFORM3  = 'I4      '           /
TUNIT3  = 'PIXEL   '           /
TTYPE4  = 'WL-MIN  '           / Blue-end wavelength of the order (nm)
TBCOL4  =                   15 /
TFORM4  = 'F8.3    '           /
TUNIT4  = 'nanometer'          /
TTYPE5  = 'X-CEN   '           / X-position of the center of the order (pixel)
TBCOL5  =                   24 /
TFORM5  = 'I4      '           /
TUNIT5  = 'PIXEL   '           /
TTYPE6  = 'Y-CEN   '           / Y-position of the center of the order (pixel)
TBCOL6  =                   29 /
TFORM6  = 'I4      '           /
TUNIT6  = 'PIXEL   '           /
TTYPE7  = 'WL-CEN  '           / Center wavelength of the order (nm)
TBCOL7  =                   34 /
TFORM7  = 'F8.3    '           /
TUNIT7  = 'nanometer'          /
TTYPE8  = 'X-MAX   '           / X-position of the red-end of the order (pixel)
TBCOL8  =                   43 /
TFORM8  = 'I4      '           /
TUNIT8  = 'PIXEL   '           /
TTYPE9  = 'Y-MAX   '           / Y-position of the blue-end of the order (pixel)
TBCOL9  =                   48 /
TFORM9  = 'I4      '           /
TUNIT9  = 'PIXEL   '           /
TTYPE10 = 'WL-MAX  '           / Red-end wavelength of the order (nm)
TBCOL10 =                   53 /
TFORM10 = 'F8.3    '           /
TUNIT10 = 'nanometer'          /
TTYPE11 = 'SLIT INCLINATION'   / Slit inclination wrt the main dispersion direc.
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TBCOL11 =                   62 /
TFORM11 = 'F5.5    '           /
TUNIT11 = 'degree  '           /
TTYPE12 = 'DISPERSION'         / Nominal dispersion at the center of the order
TBCOL12 =                   68 /
TFORM12 = 'F5.3    '           /
TUNIT12 = 'nm/pixel'           /
END

197    1    5  298.714 2048   52  300.812 4096   98  302.910 0.000 0.003
196    1   39  300.238 2048   86  302.347 4096  133  304.456 0.000 0.003
195    1   73  301.778 2048  120  303.897 4096  167  306.017 0.000 0.003
194    1  108  303.333 2048  155  305.464 4096  202  307.595 0.000 0.003
193    1  143  304.905 2048  190  307.047 4096  238  309.188 0.000 0.003
192    1  178  306.493 2048  226  308.646 4096  274  310.799 0.000 0.003
191    1  214  308.098 2048  262  310.262 4096  310  312.426 0.000 0.003
190    1  250  309.719 2048  298  311.895 4096  346  314.070 0.000 0.003
189    1  286  311.358 2048  335  313.545 4096  383  315.732 0.000 0.003
188    1  323  313.014 2048  372  315.213 4096  421  317.411 0.000 0.003
187    1  360  314.688 2048  409  316.898 4096  458  319.109 0.000 0.003
186    1  398  316.380 2048  447  318.602 4096  496  320.824 0.000 0.003
185    1  436  318.090 2048  485  320.324 4096  535  322.559 0.000 0.003
184    1  474  319.819 2048  524  322.065 4096  574  324.312 0.000 0.003
183    1  513  321.566 2048  563  323.825 4096  613  326.084 0.000 0.003
182    1  552  323.333 2048  603  325.604 4096  653  327.875 0.000 0.003
181    1  592  325.120 2048  643  327.403 4096  693  329.687 0.000 0.003
180    1  632  326.926 2048  683  329.222 4096  734  331.519 0.000 0.003
179    1  673  328.752 2048  724  331.061 4096  775  333.371 0.000 0.003
178    1  714  330.599 2048  765  332.921 4096  817  335.243 0.000 0.003
177    1  755  332.467 2048  807  334.802 4096  859  337.137 0.000 0.003
176    1  797  334.356 2048  849  336.705 4096  902  339.053 0.000 0.003
175    1  840  336.267 2048  892  338.629 4096  945  340.991 0.000 0.003
174    1  883  338.199 2048  935  340.575 4096  988  342.950 0.000 0.003
173    1  926  340.154 2048  979  342.543 4096 1032  344.933 0.000 0.003
172    1  970  342.132 2048 1024  344.535 4096 1077  346.938 0.000 0.003
171    1 1015  344.133 2048 1068  346.550 4096 1122  348.967 0.000 0.003
170    1 1060  346.157 2048 1114  348.588 4096 1168  351.020 0.000 0.003
169    1 1105  348.205 2048 1159  350.651 4096 1214  353.097 0.000 0.004
168    1 1151  350.278 2048 1206  352.738 4096 1261  355.198 0.000 0.004
167    1 1198  352.375 2048 1253  354.850 4096 1308  357.325 0.000 0.004
166    1 1245  354.498 2048 1300  356.988 4096 1356  359.478 0.000 0.004
165    1 1293  356.646 2048 1348  359.152 4096 1404  361.657 0.000 0.004
164    1 1341  358.821 2048 1397  361.341 4096 1453  363.862 0.000 0.004
163    1 1390  361.022 2048 1446  363.558 4096 1503  366.094 0.000 0.004
162    1 1439  363.251 2048 1496  365.802 4096 1553  368.354 0.000 0.004
161    1 1490  365.507 2048 1547  368.075 4096 1604  370.642 0.000 0.004
160    1 1540  367.792 2048 1598  370.375 4096 1655  372.958 0.000 0.004
159    1 1592  370.105 2048 1650  372.704 4096 1707  375.304 0.000 0.004
158    1 1644  372.447 2048 1702  375.063 4096 1760  377.679 0.000 0.004
157    1 1697  374.820 2048 1755  377.452 4096 1814  380.085 0.000 0.004
156    1 1750  377.222 2048 1809  379.872 4096 1868  382.521 0.000 0.004
155    1 1804  379.656 2048 1863  382.323 4096 1923  384.989 0.000 0.004
154    1 1859  382.121 2048 1919  384.805 4096 1978  387.489 0.000 0.004
153    1 1914  384.619 2048 1974  387.320 4096 2035  390.022 0.000 0.004
```

6.5.5 CISCO/OHS (1998/07/16)

● CISCO の Imaging mode

```
        1         2         3         4         5         6         7         8         9
123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678
--------------------------------------------------------------------------------------------------------------
SIMPLE  =                    T / SIMPLE must be 'T' for confirming FITS         %1s     固定
BITPIX  =                   16 / # of bits storing pix values                   %2d     固定
NAXIS   =                    2 / # of axes in frame                             %1d     固定
NAXIS1  =                 1024 / # of pixels/row                                %5d     固定
NAXIS2  =                 1024 / # of rows (also # of scan lines)               %5d     固定
DISPAXIS=                    2 / # of axis describing dispersion direction      %1s
                                 grism 分光時以外は 2 で固定
OBSERVER= 'Iwamuro et al.'     / Name of observer                               %30s
                                 Messia 立ち上げ時設定
PROP-ID = 'P19970025-0001'     / Proposal ID                                    %20s    toolkit
FRAMEID = 'OHSA00002347'       / Image sequential number                        %16s    toolkit
EXP-ID  = 'OHSA00002347'       / ID of the exposure this data was taken         %16s
                                 FRAME-ID と同じ？
OBS-MOD = 'imaging '           / Observation Mode                               %30s
                                 grism/prism の有無で判断 (prism の場合 slitless-spectroscopy)
DATA-TYP= 'OBJECT  '           / Type / Characteristics of  this data           %10s
                                 OBJECT と同時入力
```

```
RA      = '18:20:26.010'       / HH:MM:SS.SSS RA pointing                       %12s
                                 RA2000 と同じ
DEC     = '-16:12:07.06'       / +/-DD:MM:SS.SS DEC pointing                    %12s
                                 DEC2000 と同じ
EQUINOX =               2000.0 / Standard FK5 (years)                           %6.1f   固定
RADECSYS= 'FK5     '           / The equatorial coordinate system               %8s     固定
RA2000  = '18:20:26.010'       / HH:MM:SS.SSS RA (J2000) pointing               %12s    toolkit
DEC2000 = '-16:12:07.06'       / +/-DD:MM:SS.SS DEC (J2000) pointing            %12s    toolkit
CRPIX1  =                512.0 / Reference pixel in X                           %6.1f   固定
CRPIX2  =                512.0 / Reference pixel in Y                           %6.1f   固定
CRVAL1  =         275.10837500 / Physical value of the reference pixel X        %13.8f  toolkit
CRVAL2  =         -16.17306000 / Physical value of the reference pixel Y        %13.8f  toolkit
CDELT1  =           0.00003194 / Size projected into a detector pixel X         %13.8f  固定
CDELT2  =           0.00003194 / Size projected into a detector pixel Y         %13.8f  固定
CTYPE1  = 'RA--TAN '           / Pixel coordinate system                        %16s    固定
CTYPE2  = 'DEC--TAN'           / Pixel coordinate system                        %16s    固定
CUNIT1  = 'degree  '           / Units used in both CRVAL1 and CDELT1           %10s    固定
CUNIT2  = 'degree  '           / Units used in both CRVAL2 and CDELT2           %10s    固定
PROJP1  =                  0.0 / Projection Type of the first axis              %5.1f   固定
PROJP2  =                  0.0 / Projection Type of the second axis             %5.1f   固定
LONGPOLE=                180.0 / The North Pole of the standard system          %6.1f   固定
PC001001=           1.00000000 / Pixel Coordinate translation matrix           %12.8f  固定
PC001002=           0.00000000 / Pixel Coordinate translation matrix           %12.8f  固定
PC002001=           0.00000000 / Pixel Coordinate translation matrix           %12.8f  固定
PC002002=           1.00000000 / Pixel Coordinate translation matrix           %12.8f  固定
C2PIX1  =                512.0 / Reference pixel in X                           %6.1f   固定
C2PIX2  =                512.0 / Reference pixel in Y                           %6.1f   固定
C2VAL1  =         275.10837500 / Physical value of the reference pixel Y        %13.8f  toolkit
C2VAL2  =        2120.00000000 / Physical value of the reference pixel X        %13.8f
                                 filter によって変更
C2ELT1  =           0.00003194 / Size projected into a detector pixel Y         %13.8f  固定
C2ELT2  =          22.00000000 / Size projected into a detector pixel X         %13.8f
                                 filter によって変更
C2YPE1  = 'DEC--TAN'           / Pixel coordinate system                        %16s    固定
C2YPE2  = 'WAVELENGTH'         / Pixel coordinate system                        %16s    固定
C2NIT1  = 'degree  '           / Units used in both CRVAL2 and CDELT2           %10s    固定
C2NIT2  = 'nm      '           / Units used in both CRVAL1 and CDELT1           %10s    固定
P2001001=           1.00000000 / Pixel Coordinate translation matrix           %12.8f  固定
P2001002=           0.00000000 / Pixel Coordinate translation matrix           %12.8f  固定
P2002001=           0.00000000 / Pixel Coordinate translation matrix           %12.8f  固定
P2002002=           1.00000000 / Pixel Coordinate translation matrix           %12.8f  固定
SLIT    = 'NONE    '           / Identifier of the entrance slit used 'NONE' if Prism Sp %10s
                                 slit-x,slit-y の値で判断 (NONE/Longslit/Pinhole)
SLT-LEN =              120.000 / Length of the slit used  0.000 if Prism Sp     %7.3f   slit-y 値
SLT-WID =              120.000 / Width of the slit used   0.000 if Prism Sp     %6.3f   slit-x 値
SLT-PA  =                  0.0 / Slit Position Angle 0.0 if Prism Sp            %5.1f
                                 InR/ImR の値が必要？
SLTC-RA =         275.10837500 / RA of slit center (degree)                     %12.8f  toolkit
SLTC-DEC=         -16.17306000 / DEC of slit center (degree)                    %12.8f  toolkit
SLTCPIX1=                512.0 / Slit center projected on detector (pixel)      %7.1f   固定
SLTCPIX2=                512.0 / Slit center projected on detector (pixel)      %7.1f   固定
DISPERSR= 'NONE    '           / Name of disperser used                         %15s
                                 prism 使用時は Prism
WAVELEN =           2120.00000 / Wavelength at detector center (nm)            %10.5f
                                 filter によって変更
WAV-MIN =           1950.00000 / Shortest wavelength focused on detector (nm)  %10.5f
                                 filter によって変更
WAV-MAX =           2290.00000 / Longest wavelength focused on detector (nm)   %10.5f
                                 filter によって変更
DATE-OBS= '1997-08-22'         / Observation start date  (yyyy-mm-dd)           %10s    toolkit
UT      = '12:34:56.7'         / HH:MM:SS.S typical UTC at exposure             %10s    toolkit
UT-STR  = '12:34:56.7'         / HH:MM:SS.S UTC at start                        %10s    toolkit
UT-END  = '13:04:56.7'         / HH:MM:SS.S UT at end                           %10s    toolkit
HST     = '02:34:56.7'         / HH:MM:SS.S Typical HST at exposure             %10s
                                 露出開始時の時間＋露出時間の半分
LST     = '23:53:10.6'         / HH:MM:SS.S Typical LST at exposure             %20s    toolkit
MJD     =       5.03965242E+04 / Modified Julian Day at typical time            %20.8f  toolkit
TIMESYS = 'UTC     '           / Time system used in this header                %3s     固定
EXPTIME =                 20.0 / Total integration time (sec)                   %8.1f   露出時間
OBJECT  = 'M17     '           / Target Description                             %30s    コメント
AZIMUTH =                -16.6 / Azimuth angle of telescope pointing           %5.1f   toolkit
ALTITUDE=                 36.4 / Altitude angle of telescope pointing          %5.1f   toolkit
FOC-POS = 'NASMYTH-IR'         / Focus where the instrument is attached         %12s
                                 Messia 立ち上げ時設定
FOC-VAL =                2.531 / Encoder value of the focus unit               %10.3f  toolkit
M2-TYPE = 'IR      '           / Type of Secondary mirror Opt/IR(chop)          %6s
M2-TIP  = 'Off     '           / Secondary Mirror Tip-Tilt Switch (On/Off)      %3s
```

```
FILTER01= 'K-prime '           / Filter name/ID                                  %10s
                                 z/J/H/K-prime/K/H+K/N204/NONE
FILTER02= 'NONE    '           / Filter name/ID                                  %10s
                                 H2(1-0)/H2(2-1)/K-cont/Prism/zJ-Grism/JH-Grism/wK-Grism/NONE
AIRMASS =              1.24352 / Averaged Air Mass                               %9.5f   toolkit
ZD      =                36.47 / Zenith Distance at typical time                 %5.2f   toolkit
DAQ-VER =                 1.00 / Version of the instrument control soft          %10s
                                 Messia Version
INS-VER =                 1.00 / Version of the instrument                       %10s
                                 Control Board
DETECTOR= 'HAWAII  '           / Name of the detector                            %10s    固定
DET-TMP =                77.0 / Detector temperature                            %5.1f
                                 Detector 温度
DET-NSMP=                   12 / The number of multi-sampling                    %2d    1 - 12
GAIN    =                 4.60 / AD conversion factor                            %5.2f   固定
PRD-STR1=                  449 / Start X position of partialy read out           %4d     固定
PRD-STR2=                  449 / Start position Y of partialy readout            %4d     固定
PRD-RNG1=                   64 / X Range of the partialy read out                %4d     固定
PRD-RNG2=                   64 / Y range of the partialy readout                 %4d     固定
BIN-FCT1=                    1 / Binning factor of X axis                        %2d     固定
BIN-FCT2=                    1 / Binning factor of Y axis                        %2d     固定
NAS-TAVE=               273.00 / Average Value of Nasmyth Enclosure             %6.2f
                                 ナスミス温度
INSTRUME= 'CISCO   '           / Name of Instrument                              %10s
                                 Messia 立ち上げ時設定
TELESCOP= 'SUBARU  '           / Telescope Name                                  %6s     固定
OBSERVAT= 'NAOJ    '           / Observatory Name                                %4s     固定
BLANK   =              32768.00 / Value used for NULL pixels                     %8.2f   固定
BSCALE  =                 1.00 / Real = fits-value*BSCALE+BZERO                  %12.2f  固定
BUNIT   = 'ADU     '           / Unit of original pixel values                   %3s     固定
BZERO   =                 0.00 / Real = fits-value*BSCALE+BZERO                  %12.2f  固定
EXTEND  =                    F / The existence of extension or not  (T or F)    %1s     固定
END
```

● CISCO の Spectroscopy mode

```
        1         2         3         4         5         6         7         8         9
123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678
--------------------------------------------------------------------------------------------------------------
SIMPLE  =                    T / SIMPLE must be 'T' for confirming FITS         %1s     固定
BITPIX  =                   16 / # of bits storing pix values                   %2d     固定
NAXIS   =                    2 / # of axes in frame                             %1d     固定
NAXIS1  =                 1024 / # of pixels/row                                %5d     固定
NAXIS2  =                 1024 / # of rows (also # of scan lines)               %5d     固定
DISPAXIS=                    1 / # of axis describing dispersion direction      %1s     固定
OBSERVER= 'Iwamuro et al.'     / Name of observer                                %30s
                                 Messia 立ち上げ時設定
PROP-ID = 'P19970025-0001'     / Proposal ID                                     %20s    toolkit
FRAMEID = 'OHSA00002347'       / Image sequential number                         %16s    toolkit
EXP-ID  = 'OHSA00002347'       / ID of the exposure this data was taken          %16s
                                 FRAME-ID と同じ？
OBS-MOD = 'spectroscopy'       / Observation Mode                                %30s
                                 grism/prism の有無で判断
DATA-TYP= 'OBJECT  '           / Type / Characteristics of  this data            %10s
                                 OBJECT と同時入力
RA      = '18:20:26.010'       / HH:MM:SS.SSS RA pointing                        %12s
                                 RA2000 と同じ
DEC     = '-16:12:07.06'       / +/-DD:MM:SS.SS DEC pointing                     %12s
                                 DEC2000 と同じ
EQUINOX =               2000.0 / Standard FK5 (years)                            %6.1f   固定
RADECSYS= 'FK5     '           / The equatorial coordinate system                %8s     固定
RA2000  = '18:20:26.010'       / HH:MM:SS.SSS RA (J2000) pointing                %12s    toolkit
DEC2000 = '-16:12:07.06'       / +/-DD:MM:SS.SS DEC (J2000) pointing             %12s    toolkit
CRPIX1  =                512.0 / Reference pixel in X                           %6.1f   固定
CRPIX2  =                512.0 / Reference pixel in Y                           %6.1f   固定
CRVAL1  =         275.10837500 / Physical value of the reference pixel X        %13.8f  toolkit
CRVAL2  =         -16.17306000 / Physical value of the reference pixel Y        %13.8f  toolkit
CDELT1  =           0.00003194 / Size projected into a detector pixel X          %13.8f  固定
CDELT2  =           0.00003194 / Size projected into a detector pixel Y          %13.8f  固定
CTYPE1  = 'RA--TAN '           / Pixel coordinate system                         %16s    固定
CTYPE2  = 'DEC--TAN'           / Pixel coordinate system                         %16s    固定
CUNIT1  = 'degree  '           / Units used in both CRVAL1 and CDELT1            %10s    固定
CUNIT2  = 'degree  '           / Units used in both CRVAL2 and CDELT2            %10s    固定
PROJP1  =                  0.0 / Projection Type of the first axis              %5.1f   固定
PROJP2  =                  0.0 / Projection Type of the second axis             %5.1f   固定
LONGPOLE=                180.0 / The North Pole of the standard system          %6.1f   固定
```

```
PC001001=           1.00000000 / Pixel Coordinate translation matrix            %12.8f  固定
PC001002=           0.00000000 / Pixel Coordinate translation matrix            %12.8f  固定
PC002001=           0.00000000 / Pixel Coordinate translation matrix            %12.8f  固定
PC002002=           1.00000000 / Pixel Coordinate translation matrix            %12.8f  固定
C2PIX1  =                512.0 / Reference pixel in X                           %6.1f   固定
C2PIX2  =                512.0 / Reference pixel in Y                           %6.1f   固定
C2VAL1  =        1425.72191000 / Physical value of the reference pixel X        %13.8f
                                 grism によって変更
C2VAL2  =         -16.17306000 / Physical value of the reference pixel Y        %13.8f  toolkit
C2ELT1  =           0.72880318 / Size projected into a detector pixel X         %13.8f
                                 grism によって変更
C2ELT2  =           0.00003194 / Size projected into a detector pixel Y         %13.8f  固定
C2YPE1  = 'WAVELENGTH'         / Pixel coordinate system                        %16s    固定
C2YPE2  = 'DEC--TAN'           / Pixel coordinate system                        %16s    固定
C2NIT1  = 'nm      '           / Units used in both CRVAL1 and CDELT1           %10s    固定
C2NIT2  = 'degree  '           / Units used in both CRVAL2 and CDELT2           %10s    固定
P2001001=           1.00000000 / Pixel Coordinate translation matrix            %12.8f  固定
P2001002=           0.00000000 / Pixel Coordinate translation matrix            %12.8f  固定
P2002001=           0.00000000 / Pixel Coordinate translation matrix            %12.8f  固定
P2002002=           1.00000000 / Pixel Coordinate translation matrix            %12.8f  固定
SLIT    = 'Longslit'           / Identifier of the entrance slit used 'NONE' if
Prism Sp %10s
                                 slit-x,slit-y の値で判断 (NONE/Longslit/Pinhole)
SLT-LEN =              120.000 / Length of the slit used  0.000 if Prism Sp     %7.3f   slit-y 値
SLT-WID =                0.500 / Width of the slit used   0.000 if Prism Sp     %6.3f   slit-x 値
SLT-PA  =                  0.0 / Slit Position Angle 0.0 if Prism Sp            %5.1f
                                 InR/ImR の値が必要？
SLTC-RA =         275.10799000 / RA of slit center (degree)                     %12.8f  toolkit
SLTC-DEC=         -16.20307900 / DEC of slit center (degree)                    %12.8f  toolkit
SLTCPIX1=                524.0 / Slit center projected on detector (pixel)     %7.1f   固定
SLTCPIX2=                547.0 / Slit center projected on detector (pixel)     %7.1f   固定
DISPERSR= 'JH-Grism'           / Name of disperser used                         %15s
                                 zJ-Grism/JH-Grism/wK-Grism
WAVELEN =           1425.72191 / Wavelength at detector center (nm)            %10.5f
                                 grism によって変更
WAV-MIN =           1067.82460 / Shortest wavelength focused on detector (nm)  %10.5f
                                 grism によって変更
WAV-MAX =           1814.05960 / Longest wavelength focused on detector (nm)   %10.5f
                                 grism によって変更
DATE-OBS= '1997-08-22'         / Observation start date  (yyyy-mm-dd)           %10s    toolkit
UT      = '12:34:56.7'         / HH:MM:SS.S typical UTC at exposure             %10s    toolkit
UT-STR  = '12:34:56.7'         / HH:MM:SS.S UTC at start                        %10s    toolkit
UT-END  = '13:04:56.7'         / HH:MM:SS.S UT at end                           %10s    toolkit
HST     = '02:34:56.7'         / HH:MM:SS.S Typical HST at exposure             %10s
                                 露出開始時の時間＋露出時間の半分
LST     = '23:53:10.6'         / HH:MM:SS.S Typical LST at exposure             %20s    toolkit
MJD     =       5.03965242E+04 / Modified Julian Day at typical time            %20.8f  toolkit
TIMESYS = 'UTC     '           / Time system used in this header                %3s     固定
EXPTIME =                 20.0 / Total integration time (sec)                   %8.1f   露出時間
OBJECT  = 'M17     '           / Target Description                             %30s    コメント
AZIMUTH =                -16.6 / Azimuth angle of telescope pointing           %5.1f   toolkit
ALTITUDE=                 36.4 / Altitude angle of telescope pointing          %5.1f   toolkit
FOC-POS = 'NASMYTH-IR'         / Focus where the instrument is attached         %12s
                                 Messia 立ち上げ時設定
FOC-VAL =                2.531 / Encoder value of the focus unit               %10.3f  toolkit
M2-TYPE = 'IR      '           / Type of Secondary mirror Opt/IR(chop)          %6s
M2-TIP  = 'Off     '           / Secondary Mirror Tip-Tilt Switch (On/Off)      %3s
FILTER01= 'NONE    '           / Filter name/ID                                 %10s
                                 z/J/H/K'/K/H+K'/N204/NONE
FILTER02= 'JH-Grism'           / Filter name/ID                                 %10s
                                 H2(1-0)/H2(2-1)/K-cont/Prism/zJ-Grism/JH-Grism/wK-Grism/NONE
AIRMASS =              1.24352 / Averaged Air Mass                             %9.5f   toolkit
ZD      =                36.47 / Zenith Distance at typical time               %5.2f   toolkit
DAQ-VER =                 1.00 / Version of the instrument control soft        %10s
                                 Messia Version
INS-VER =                 1.00 / Version of the instrument                     %10s
                                 Control Board
DETECTOR= 'HAWAII  '           / Name of the detector                           %10s    固定
DET-TMP =                 77.0 / Detector temperature                          %5.1f
                                 Detector 温度
DET-NSMP=                   12 / The number of multi-sampling                  %2d     1 - 12
GAIN    =                 4.60 / AD conversion factor                          %5.2f   固定
PRD-STR1=                  449 / Start X position of partialy read out         %4d     固定
PRD-STR2=                  449 / Start position Y of partialy readout          %4d     固定
PRD-RNG1=                   64 / X Range of the partialy read out              %4d     固定
PRD-RNG2=                   64 / Y range of the partialy readout               %4d     固定
BIN-FCT1=                    1 / Binning factor of X axis                      %2d     固定
BIN-FCT2=                    1 / Binning factor of Y axis                      %2d     固定
NAS-TAVE=               273.00 / Average Value of Nasmyth Enclosure            %6.2f
```

```
                                  ナスミス温度
INSTRUME= 'CISCO   '           / Name of Instrument                             %10s
                                  Messia 立ち上げ時設定
TELESCOP= 'SUBARU  '           / Telescope Name                                 %6s     固定
OBSERVAT= 'NAOJ    '           / Observatory Name                               %4s     固定
BLANK   =              32768.00 / Value used for NULL pixels                     %8.2f   固定
BSCALE  =                  1.00 / Real = fits-value*BSCALE+BZERO                 %12.2f  固定
BUNIT   = 'ADU     '           / Unit of original pixel values                  %3s     固定
BZERO   =                  0.00 / Real = fits-value*BSCALE+BZERO                 %12.2f  固定
EXTEND  =                    F / The existence of extension or not  (T or F)    %1s     固定
END
```

● OHS の Spectroscopy mode

```
         1         2         3         4         5         6         7         8         9
123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678
--------------------------------------------------------------------------------------------------------------
SIMPLE  =                    T / SIMPLE must be 'T' for confirming FITS         %1s     固定
BITPIX  =                   16 / # of bits storing pix values                   %2d     固定
NAXIS   =                    2 / # of axes in frame                             %1d     固定
NAXIS1  =                 1024 / # of pixels/row                                %5d     固定
NAXIS2  =                 1024 / # of rows (also # of scan lines)               %5d     固定
DISPAXIS=                    1 / # of axis describing dispersion direction      %1s     固定
OBSERVER= 'Iwamuro et al.'     / Name of observer                               %30s
                                  Messia 立ち上げ時設定
PROP-ID = 'P19970025-0001'     / Proposal ID                                    %20s    toolkit
FRAMEID = 'OHSA00002347'       / Image sequential number                        %16s    toolkit
EXP-ID  = 'OHSA00002347'       / ID of the exposure this data was taken         %16s
                                  FRAME-ID と同じ？
OBS-MOD = 'spectroscopy'       / Observation Mode                               %30s
                                  grism/prism の有無で判断
DATA-TYP= 'OBJECT  '           / Type / Characteristics of  this data           %10s
                                  OBJECT と同時入力
RA      = '18:20:26.010'       / HH:MM:SS.SSS RA pointing                       %12s
                                  RA2000 と同じ
DEC     = '-16:12:07.06'       / +/-DD:MM:SS.SS DEC pointing                    %12s
                                  DEC2000 と同じ
EQUINOX =               2000.0 / Standard FK5 (years)                           %6.1f   固定
RADECSYS= 'FK5     '           / The equatorial coordinate system               %8s     固定
RA2000  = '18:20:26.010'       / HH:MM:SS.SSS RA (J2000) pointing               %12s    toolkit
DEC2000 = '-16:12:07.06'       / +/-DD:MM:SS.SS DEC (J2000) pointing            %12s    toolkit
CRPIX1  =                512.0 / Reference pixel in X                          %6.1f   固定
CRPIX2  =                512.0 / Reference pixel in Y                          %6.1f   固定
CRVAL1  =         275.10837500 / Physical value of the reference pixel X       %13.8f  toolkit
CRVAL2  =         -16.17306000 / Physical value of the reference pixel Y       %13.8f  toolkit
CDELT1  =           0.00003194 / Size projected into a detector pixel X         %13.8f  固定
CDELT2  =           0.00003194 / Size projected into a detector pixel Y         %13.8f  固定
CTYPE1  = 'RA--TAN '           / Pixel coordinate system                        %16s    固定
CTYPE2  = 'DEC--TAN'           / Pixel coordinate system                        %16s    固定
CUNIT1  = 'degree  '           / Units used in both CRVAL1 and CDELT1           %10s    固定
CUNIT2  = 'degree  '           / Units used in both CRVAL2 and CDELT2           %10s    固定
PROJP1  =                  0.0 / Projection Type of the first axis              %5.1f   固定
PROJP2  =                  0.0 / Projection Type of the second axis             %5.1f   固定
LONGPOLE=                180.0 / The North Pole of the standard system          %6.1f   固定
PC001001=           1.00000000 / Pixel Coordinate translation matrix           %12.8f  固定
PC001002=           0.00000000 / Pixel Coordinate translation matrix           %12.8f  固定
PC002001=           0.00000000 / Pixel Coordinate translation matrix           %12.8f  固定
PC002002=           1.00000000 / Pixel Coordinate translation matrix           %12.8f  固定
C2PIX1  =                512.0 / Reference pixel in X                          %6.1f   固定
C2PIX2  =                512.0 / Reference pixel in Y                          %6.1f   固定
C2VAL1  =        1425.72191000 / Physical value of the reference pixel X       %13.8f
                                  grism によって変更
C2VAL2  =         -16.17306000 / Physical value of the reference pixel Y       %13.8f  toolkit
C2ELT1  =           0.72880318 / Size projected into a detector pixel X         %13.8f
                                  grism によって変更
C2ELT2  =           0.00003194 / Size projected into a detector pixel Y         %13.8f  固定
C2YPE1  = 'WAVELENGTH'         / Pixel coordinate system                        %16s    固定
C2YPE2  = 'DEC--TAN'           / Pixel coordinate system                        %16s    固定
C2NIT1  = 'nm      '           / Units used in both CRVAL1 and CDELT1           %10s    固定
C2NIT2  = 'degree  '           / Units used in both CRVAL2 and CDELT2           %10s    固定
P2001001=           1.00000000 / Pixel Coordinate translation matrix           %12.8f  固定
P2001002=           0.00000000 / Pixel Coordinate translation matrix           %12.8f  固定
P2002001=           0.00000000 / Pixel Coordinate translation matrix           %12.8f  固定
P2002002=           1.00000000 / Pixel Coordinate translation matrix           %12.8f  固定
SLIT    = 'Longslit'           / Identifier of the entrance slit used 'NONE' if
Prism Sp %10s
```

```
                                slit-x,slit-y の値で判断 (NONE/Longslit/Pinhole)
SLT-LEN =               120.000 / Length of the slit used  0.000 if Prism Sp     %7.3f   slit-y 値
SLT-WID =                 0.500 / Width of the slit used   0.000 if Prism Sp     %6.3f   slit-x 値
SLT-PA  =                   0.0 / Slit Position Angle 0.0 if Prism Sp            %5.1f
                                ImR の値が必要？
SLTC-RA =          275.10799000 / RA of slit center (degree)                     %12.8f  toolkit
SLTC-DEC=          -16.20307900 / DEC of slit center (degree)                    %12.8f  toolkit
SLTCPIX1=                 524.0 / Slit center projected on detector (pixel)      %7.1f   固定
SLTCPIX2=                 547.0 / Slit center projected on detector (pixel)      %7.1f   固定
DISPERSR= 'JH-Grism'            / Name of disperser used                        %15s
                                zJ-Grism/JH-Grism
WAVELEN =           1425.72191 / Wavelength at detector center (nm)             %10.5f
                                grism によって変更
WAV-MIN =           1067.82460 / Shortest wavelength focused on detector (nm)   %10.5f
                                grism によって変更
WAV-MAX =           1814.05960 / Longest wavelength focused on detector (nm)    %10.5f
                                grism によって変更
DATE-OBS= '1997-08-22'          / Observation start date  (yyyy-mm-dd)          %10s    toolkit
UT      = '12:34:56.7'          / HH:MM:SS.S typical UTC at exposure            %10s    toolkit
UT-STR  = '12:34:56.7'          / HH:MM:SS.S UTC at start                       %10s    toolkit
UT-END  = '13:04:56.7'          / HH:MM:SS.S UT at end                          %10s    toolkit
HST     = '02:34:56.7'          / HH:MM:SS.S Typical HST at exposure            %10s
                                露出開始時の時間＋露出時間の半分
LST     = '23:53:10.6'          / HH:MM:SS.S Typical LST at exposure            %20s    toolkit
MJD     =       5.03965242E+04 / Modified Julian Day at typical time            %20.8f  toolkit
TIMESYS = 'UTC     '            / Time system used in this header               %3s     固定
EXPTIME =                  20.0 / Total integration time (sec)                   %8.1f   露出時間
OBJECT  = 'M17     '            / Target Description                            %30s    コメント
AZIMUTH =                 -16.6 / Azimuth angle of telescope pointing           %5.1f   toolkit
ALTITUDE=                  36.4 / Altitude angle of telescope pointing          %5.1f   toolkit
FOC-POS = 'NASMYTH-IR'          / Focus where the instrument is attached        %12s
                                Messia 立ち上げ時設定
FOC-VAL =                 2.531 / Encoder value of the focus unit               %10.3f  toolkit
M2-TYPE = 'IR      '            / Type of Secondary mirror Opt/IR(chop)         %6s
M2-TIP  = 'Off     '            / Secondary Mirror Tip-Tilt Switch (On/Off)     %3s
FILTER01= 'NONE    '            / Filter name/ID                                %10s
                                z/J/H/K'/K/H+K'/N204/NONE
FILTER02= 'JH-Grism'            / Filter name/ID                                %10s
                                H2(1-0)/H2(2-1)/K-cont/Prism/zJ-Grism/JH-Grism/wK-Grism/NONE
AIRMASS =               1.24352 / Averaged Air Mass                           %9.5f   toolkit
ZD      =                 36.47 / Zenith Distance at typical time             %5.2f   toolkit
DAQ-VER =                  1.00 / Version of the instrument control soft      %10s
                                Messia Version
INS-VER =                  1.00 / Version of the instrument                   %10s
                                Control Board
DETECTOR= 'HAWAII  '            / Name of the detector                          %10s    固定
DET-TMP =                  77.0 / Detector temperature                         %5.1f
                                Detector 温度
GAIN    =                  4.60 / AD conversion factor                         %5.2f   固定
PRD-STR1=                   449 / Start X position of partialy read out        %4d     固定
PRD-STR2=                   449 / Start position Y of partialy readout         %4d     固定
PRD-RNG1=                    64 / X Range of the partialy read out             %4d     固定
PRD-RNG2=                    64 / Y range of the partialy readout              %4d     固定
BIN-FCT1=                     1 / Binning factor of X axis                     %2d     固定
BIN-FCT2=                     1 / Binning factor of Y axis                     %2d     固定
NAS-TAVE=                273.00 / Average Value of Nasmyth Enclosure          %6.2f
                                ナスミス温度
OHMSK   = 'JH      '            / MASK Name of OH Suppression                   %30s
                                Messia 立ち上げ時設定 (O_MSK？)
OHSLT   = '1x30    '            / OHS slit                                      %30s
                                1x30/0.5x30/30x30/Blank/Mirror/Pinhole/Test (O_SLT？)
OHSLTLEN=                30.000 / OHS slit length (arcsec)                     %7.3f
                                OHS slit によって変更 (O_SLTLEN？)
OHSLTWID=                 1.000 / OHS slit width (arcsec)                      %7.3f
                                OHS slit によって変更 (O_SLTWID？)
OHFOCVAL=                108.240 / OHS FOCUS Value                            %7.3f
                                Camera 位置 (O__FOCVAL？)
INSTRUME= 'OHS     '            / Name of Instrument                            %10s
                                Messia 立ち上げ時設定
TELESCOP= 'SUBARU  '            / Telescope Name                                %6s     固定
OBSERVAT= 'NAOJ    '            / Observatory Name                              %4s     固定
BLANK   =              32768.00 / Value used for NULL pixels                    %8.2f   固定
BSCALE  =                  1.00 / Real = fits-value*BSCALE+BZERO                %12.2f  固定
BUNIT   = 'ADU     '            / Unit of original pixel values                 %3s     固定
BZERO   =                  0.00 / Real = fits-value*BSCALE+BZERO                %12.2f  固定
EXTEND  =                     F / The existence of extension or not  (T or F)   %1s     固定
END
```

6.5.6 Suprime-Cam (1998/08/19)

```
         1         2         3         4         5         6         7         8         9
123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890
--------------------------------------------------------------------------------------------
SIMPLE  =                    T / file does conform to FITS standard             L1
BITPIX  =                   16 / number of bits per data pixel                  I3
NAXIS   =                    2 / number of data axes                            I1
NAXIS1  =                 2048 / length of data axis 1                          I5
NAXIS2  =                 4096 / length of data axis 2                          I5
EXTEND  =                    T / FITS dataset may contain extensions            L1
BZERO   =              32768.0 / offset data range to that of unsigned short    F6.1
BSCALE  =                  1.0 / default scaling factor                         F6.1
BUNIT   = 'ADU     '           / Unit of original pixel value                   A3
BLANK   =                -32768 / Value used for NULL pixels                   I6
DATE-OBS= '1999-04-01'         / Observation start date  (yyyy-mm-dd)          A10
UT      = '09:15:04.5'         / HH:MM:SS.S typical UTC at the exposure (middle) A10
UT-STR  = '09:12:34.5'         / HH:MM:SS.S UTC at the start exposure time      A10
UT-END  = '09:17:34.5'         / HH:MM:SS.S UTC at the end of the exposure      A10
HST     = '23:15:04.5'         / HH:MM:SS.S Typical HST at exposure             A10
HST-STR = '23:12:34.5'         / HH:MM:SS.S HST at the beginning of exp.        A10
HST-END = '23:17:34.5'         / HH:MM:SS.S HST at the end of exposure          A10
LST     = '11:33:21.345'       / HH:MM:SS.SSS Typical LST at exposure           A12
LST-STR = '11:30:50.912'       / HH:MM:SS.SSS LST at the beginning of exposure  A12
LST-END = '11:35:51.723'       / HH:MM:SS.SSS LST at the end of exposure        A12
MJD     =          51635.385469 / [d] Mod. Julian Date at typical time          F12.6
TIMESYS = 'UTC     '           / Time System used in the header                 A3
MJD-STR =          51635.383733 / [d] Mod.Julian Date at the start of exposure  F12.6
MJD-END =          51635.387205 / [d] Mod.Julian Date at the end of exposure    F12.6
ZD-STR  =                10.050 / [degree] Zenith Distance at exposure start time F6.3
ZD-END  =                 9.740 / [degree] Zenith Distance at exposure end time  F6.3
SECZ-STR=                 1.017 / SEC(Zenith Distance) at exposure start time   F6.3
SECZ-END=                 1.015 / SEC(Zenith Distance) at exposure end time     F6.3
AIRMASS =                1.0160 / Average airmass during exposure              F6.4
AZIMUTH =               319.320 / [degree] Azimuth of tel-pointing. 0:S->90:W   F7.3
ALTITUDE=                79.880 / [degree] Altitude ang. of telescope pointing  F7.3
PROP-ID = 'P19990025-0001'     / Proposal ID                                    A20
OBSERVER= 'Shimasaku, Yagi, Hamabe' / Names of the Observers                    A64
FRAMEID = 'SUPA00000001'       / Image sequential number                        A16
EXP-ID  = 'SUPE00000001'       / ID of exposure (shot) this data were taken     A16
OBS-MOD = 'Imaging '           / Observation Mode                               A20
DATA-TYP= 'OBJECT  '           / Characteristics of this data                   A10
OBJECT  = 'artificial sky'     / Identification of object observed              A30
RA      = '12:00:00.000'       / Right ascension of telescope pointing (J2000)  A12
DEC     = '+12:00:00.00'       / Declination of telescope pointing (J2000)      A12
RADECSYS= 'FK5     '           / The equatorial coordinate system               A8
EQUINOX =                2000.0 / [y] Equinox                                  F6.1
CTYPE1  = 'RA---TAN'           / Pixel coordinate system in axis 1              A8
CRPIX1  =                  1.0 / Reference pixel coordinate system in axis 1   F8.1
CRVAL1  =          180.1802512 / [degree] Physical value of the reference pixel F11.7
CDELT1  =      -5.55555556E-05 / [degree] Pixel size in axis 1                  E15.8
CUNIT1  = 'degree  '           / Unit used in both CRVAL1 and CDELT1            A10
CTYPE2  = 'DEC--TAN'           / Pixel coordinate system in axis 2              A8
CRPIX2  =                  1.0 / Reference pixel coordinate system in axis 2   F8.1
CRVAL2  =           12.0006534 / [degree] Physical value of the reference pixel F10.7
CDELT2  =       5.55555556E-05 / [degree] Pixel size in axis 2                  E15.8
CUNIT2  = 'degree  '           / Unit used in both CRVAL2 and CDELT2            A10
LONGPOLE=                180.0 / The native system of the N.P. in the std. sys. F6.1
PC001001=           1.00000000 / Pixel coordinate translation matrix           F12.8
PC001002=           0.00000000 / Pixel coordinate translation matrix           F12.8
PC002001=           0.00000000 / Pixel coordinate translation matrix           F12.8
PC002002=           1.00000000 / Pixel coordinate translation matrix           F12.8
PROJP1  =                  0.0 / Projection type of the axis 1                  F5.1
PROJP2  =                  0.0 / Projection type of the axis 2                  F5.1
WCS-ORIG= 'ROUGH estimation'   / Origin/quality of the WCS values              A20
OBSERVAT= 'NAOJ    '           / Observatory                                    A4
TELESCOP= 'Subaru  '           / Telescope name                                 A6
FOC-POS = 'PRIME   '           / Position of the instrument focus unit          A8
FOC-VAL =             1234.567 / [mm] Encoder value of the focus unit          F10.3
FILTER01= 'SDSS-R1 '           / Filter name/ID                                 A30
EXPTIME =                300.0 / [sec] Total integration time                  F7.1
INSTRUME= 'SuprimeCam'         / Name of instrument                             A15
DETECTOR= 'Hektro_CCD_XY1230Z' / Name of the detector/CCD                       A40
DET-ID  =                    1 / ID of the detector used for this data          I2
DET-A01 =                0.000 / [degree] Relative angle of the nn-th detector F7.3
DET-P101=              126.880 / [mm] Relative X-position of the nn-th detector F7.3
DET-P201=               62.440 / [mm] Relative Y-position of the nn-th detector F7.3
DET-TMP =               153.25 / [Kelvin] Detector temperature                 F6.2
DET-TMED=               153.24 / [Kelvin] Median of the detector temperature   F6.2
DET-TMIN=               153.11 / [Kelvin] Minimum of the detector temperature  F6.2
DET-TMAX=               153.37 / [Kelvin] Maximum of the detector temperature  F6.2
GAIN    =                3.456 / AD conversion factor (electron/ADU)           F6.3
EFP-MIN1=                   21 / Start position of effective frame in axis-1    I5
EFP-RNG1=                 2008 / Range of effective frame in axis-1             I5
```

```
EFP-MIN2=                   21 / Start position of effective frame in axis-2     I5
EFP-RNG2=                 4056 / Range of effective frame in axis-2              I5
PRD-MIN1=                    6 / Start X position of partialy read out          I5
PRD-RNG1=                 2048 / X range of the partialy readout                I5
PRD-MIN2=                    6 / Start Y position of partialy read out          I5
PRD-RNG2=                 4096 / Y range of the partialy readout                I5
BIN-FCT1=                    1 / Binning factor of axis 1                       I2
BIN-FCT2=                    1 / Binning factor of axis 2                       I2
DET-VER = 'V.1.0.0 '           / Version of the detector control command        A30
INS-VER = 'SC1.000/MS1.201'    / Version of the instrument (hard/soft)          A30
WEATHER = 'Clear   '           / Weather condition                              A50
SEEING  =                 0.60 / [arcsec] FWHM of the star at telescope focus   F5.2
ADC-TYPE= 'RED     '           / ADC name if it is used. (BLUE, RED, NONE)      A30
ADC-STR =              12.345 / [degree] ADC pos. ang. at the start of exposure F7.3
ADC-END =              23.456 / [degree] ADC pos. ang. at the end of exposure   F7.3
INR-STR =              23.456 / [degree] Inst. rotator angle at start           F8.3
INR-END =              34.567 / [degree] Inst. rotator angle at end             F8.3
DOM-WND =                0.10 / [m/s] Wind speed in the dome/enclosure          F5.2
OUT-WND =                1.30 / [m/s] Wind speed outside dome/enclosure        F5.2
DOM-TMP =              274.23 / [Kelvin] Atm. temp. in the dome/enclosure       F6.2
OUT-TMP =              274.37 / [Kelvin] Atm. temp. outside the dome/encl.      F6.2
DOM-HUM =                32.3 / [%] Humidity in the dome                       F5.1
OUT-HUM =                27.9 / [%] Humidity outside the dome/encl.            F5.1
DOM-PRS =             1013.12 / [hPa] Atm. pressure in the dome                 F7.2
OUT-PRS =             1013.12 / [hPa] Atm. press. outside the dome/encl.       F7.2
COMMENT   ------------------------------------------------------------
COMMENT   --------------- PARAMETERS FOR SUPRIME_CAM -----------------
COMMENT   ------------------------------------------------------------
S_UFNAME= 'test_field_1'       / User assigned file name                        A40
S_FRMPOS= '0101    '           / Frame position (IIJJ)                          A4
S_BCTAVE=             5319.300 / [ADU] Average count outside effective data     F9.3
S_BCTSD =               12.300 / [ADU] S.D. of the count outside the eff. data  F9.3
S_AG-OBJ= 'HD12345 '           / Name of the guide-star                         A40
S_AG-RA = '12:34:56.789'       / R.A. of the guide-star                         A12
S_AG-DEC= '+12:34:56.78'       / Dec. of the guide-star                         A12
S_AG-EQN=              2000.0 / [y] Equinox of the guide-star position         F6.1
S_AG-X  =               12.34 / [mm] Position of the guiding probe (X)         F7.2
S_AG-Y  =               12.34 / [mm] Position of the guiding probe (Y)         F7.2
S_AG-R  =               34.56 / [mm] Position of the guiding probe (R)         F7.2
S_AG-TH =               12.34 / [degree] Position of the guiding probe (theta) F7.2
S_ETMED =              275.59 / [Kelvin] Averaged temp. in Camera enclosure    F6.2
S_ETMAX =              275.81 / [Kelvin] Maximum temp.  in Camera enclosure    F6.2
S_ETMIN =              275.41 / [Kelvin] Minimum temp.  in Camera enclosure    F6.2
END
```

6.5.7 MIRTOS (1998/07/09)

● MIRTOS の MIR mode

```
        1         2         3         4         5         6         7
12345678901234567890123456789012345678901234567890123456789012345678901234567890123456789
--------------------------------------------------------------------------------
SIMPLE  =                    T / Standard FITS format
BITPIX  =                   32 / # of bits storing pix values
NAXIS   =                    3 / # of axis in frame
NAXIS1  =                  336 / # of pixels/row
NAXIS2  =                  240 / # of rows
NAXIS3  =                   10 / # of frames
EXTEND  =                    T / ASCII Table for Z-frame description
COMMENT Sample Primary header for MIRTOS written by Tomono on 1998/7/6
OBSERVER= 'D.Tomono, Y.Doi, T.Nishimura  ' / Name of observers
PROP-ID = 'P1998-0430-1                  ' / Proposal ID
DATASET = 'Used for DASH                 ' /
INSTRUME= 'MIRTOS                        ' / Name of instrument
INS-VER = '1.1 980701                    ' / Version of the instrument
FRAMEID = 'MTOS000000001   '   / FITS File sequential number
EXP-ID  = 'MT_M000000001   '   / ID of the exposure this data was taken
OBS-MOD = 'imaging                       ' / Observation Mode
DATA-TYP= 'object          '   / Type / Characteristics of this data
OBSERVAT= 'National Astronomical Observatory of Japan' / Observatory
TELESCOP= 'Subaru                        ' / Telescope name
CRPIX1  =                160.0 / Reference pixel in X (pixel)
CRPIX2  =                120.0 / Reference pixel in Y (pixel)
CRVAL1  =          189.00529167 / Physical value of the reference pixel X
CRVAL2  =          -39.86927778 / Physical value of the reference pixel Y
CDELT1  =          0.0000186328 / X Scale projected on detector(#/pix)
CDELT2  =          0.0000186328 / Y scale projected on detector(#/pix)
CTYPE1  = 'RA--TAN         '   / Pixel coordinate system
CTYPE2  = 'DEC--TAN        '   / Pixel coordinate system
CUNIT1  = 'degree    '         / Units used in both CRVAL1 and CDELT1
```

```
CUNIT2  = 'degree    '         / Units used in both CRVAL2 and CDELT2
TIMESYS = 'UTC     '           / Time System used in the header. UTC fix.
RADECSYS= 'FK5     '           / The equatorial coordinate system
PROJP1  =                  0.0 / Projection type of the first axis
PROJP2  =                  0.0 / Projection type of the second axis
LONGPOLE=            180.00000 / The North Pole of standard system (deg)
PC001001=           1.00000000 / Pixel Coordinate translation matrix
PC001002=           0.00000000 / Pixel Coordinate translation matrix
PC002001=           0.00000000 / Pixel Coordinate translation matrix
PC002002=           1.00000000 / Pixel Coordinate translation matrix
BSCALE  =                    1 / Real=fits-value*BSCALE+BZERO
BZERO   =                    0 / Real=fits-value*BSCALE+BZERO
BUNIT   = 'ADU             '   / Unit of original pixel values
BLANK   =                32768 / Value used for NULL pixels
DATE-OBS= '1998-04-30                    ' / yyyy-mm-dd UTC obs start date
UT      = '09:12:00.0'         / HH:MM:SS.S UTC at typical time(=start)
HST     = '23:12:00.0'         / HH:MM:SS.S HST at typical time(=start)
LST     = '12:34:56.7'         / HH:MM:SS.S LST at typical time(=start)
MJD     =       12345.67890000 / Modified Julian Day at typical time(=start)
EXPTIME =               0.0800 / Total integration time per frame(sec)
OBJECT  = 'HR 4796                       ' / Target Description
RA      = '12:36:01.270'       / HH:MM:SS.SSS RA (J2000) pointing
RA2000  = '12:36:01.270'       / HH:MM:SS.SSS RA (J2000) pointing
DEC     = '-39:52:09.40'       / +/-DD:MM:SS.SS DEC (J2000) pointing
DEC2000 = '-39:52:09.40'       / +/-DD:MM:SS.SS DEC (J2000) pointing
EQUINOX =              2000.0 /
AZIMUTH =             12.34000 / Azimuth of telescope pointing (degree)
ALTITUDE=             12.34000 / Altitude of telescope pointing(degree)
FOC-POS = 'Cassegrain      '   / Focus where the instrument is attached
FOC-LEN =           100000.000 / Focal length of the telescope (mm)
FOC-VAL =                2.531 / Encoder value of the focus unit (mm)
M2-TYPE = 'IR      '           / Type of the secondary miror (Opt/IR)
M2-TIP  = 'on      '           / Tip/Tilt of the Secondary Mirror (on/off)
APERTURE= '21x16           '   / Field stop ID
INR-STR =               12.345 / Instrument Rotator angle at Start (deg)
INR-END =               12.345 / Instrument Rotator angle at End (deg)
AIRMASS =              4.67918 / Averaged Air Mass
ZD      =               77.660 / Zenith Distance at typical time
SECZ    =                4.679 / SEC(Zenith Distance) at typical time
M_WINDOW= 'ZnSe            '   / MIRTOS dewar entrance window
M_M1MOT1=                  224 / Beam Stearing Mirror Position (count)
M_M1MOT2=                  339 / Beam Stearing Mirror Position (count)
M_M2MOT1=                  224 / Beam Splitter Position (count)
M_M2MOT2=                  339 / Beam Splitter Position (count)
FILTER01= 'Through         '   / Filter name/ID
FILTER02= 'Q               '   / Filter name/ID
FILTER03= '30mm-phi        '   / Lyot Stop name/ID
DETECTOR= 'Ratheon Si:As IBC 320x240     ' / Name of the detector/CCD
DET-ID  =                    1 / ID of the detector used for this data
DETPXSZ1=                0.050 / Detector pixel size in axis1 (mm)
DETPXSZ2=                0.050 / Detector pixel size in axis2 (mm)
DET-A00 =                0.100 / Relative angle of nn-th detector (deg)
DET-TMP =                 6.01 / Detector temperature (K)
GAIN    =               330.90 / AD conversion factor (electron/ADU)
PRD-MIN1=                    1 / Start X pos. of partialy read out (pix)
PRD-MIN2=                    1 / Start Y pos. of partialy read out (pix)
PRD-RNG1=                  320 / X Range of partialy read out (pix)
PRD-RNG2=                  240 / Y Range of partialy read out (pix)
BIN-FCT1=                    1 / Binning factor of X axis (pixel)
BIN-FCT2=                    1 / Binning factor of Y axis (pixel)
WEATHER = 'Sunny                         ' / Weather condition
SEEING  =                 0.45 / Long integ PSF FWHM (arcsec)
DOM-WND =                 4.61 / Wind speed in the dome (m/s)
OUT-WND =                 7.79 / Wind speed outside (m/s)
DOM-TMP =                273.5 / Temperature measured in the dome (K)
OUT-TMP =                273.7 / Temperature measured outside dome (K)
DOM-HUM =                0.050 / Humidity measured in the dome
OUT-HUM =                0.060 / Humidity measured outside the dome
DOM-PRS =               670.00 / Atmospheric pressure in the Dome (hpa)
OUT-PRS =               670.00 / Atmospheric pressure outside dome (hPa)
COMMENT
COMMENT (: Subaru Device Dependent Header for MIRTOS :)
COMMENT
COMMENT === ID
M_CHID  = 'MIR             '   / ID of camera channel of MIRTOS
M_TWID  = '19980430-0001   '   / ID of two-wavelength simultaneous file
M_FLATID= 'NA              '   / ID of the most recent flat field file
M_DARKID= 'NA              '   / ID of the most recent dark exposure file
M_DET01 =             12.30000 / Rel X pos of NIR from MIR on sky (pixel)
M_DET02 =             45.60000 / Rel Y pos of NIR from MIR on sky (pixel)
COMMENT === Chopping and Nodding
M_CHOPTM=                0.200 / Chopping period (sec)
M_CHOPTH=                90.00 / Chopping throw (arcsec)
M_CHOPPA=                 0.00 / Chopping P.A. origin:source/pointing (deg)
```

```
M_NODTM =                 10.0 / Nodding period (sec)
M_NODTH =                90.00 / Nodding throw (arcsec)
M_NODPA =                90.00 / Nodding P.A. origin:source/pointing (deg)
COMMENT === Temperature
M_O-TMP =                 35.6 / Temperature of Optics (K)
M_A-TMP1=                300.1 / Temperature of Ambient thermometer (K)
M_A-TMP2=                350.3 / Temperature of Ambient thermometer (K)
M_A-TMP3=                280.4 / Temperature of Ambient thermometer (K)
M_A-TMP4=                300.1 / Temperature of Ambient thermometer (K)
COMMENT === Clock
M_CLKFL = '/home/mirtos/clock/mir/980430/twsaa1' / Clock file name
M_CLKMR = 'chop02nod10_1   '   / Clock pattern marco name
M_CLKMC = 'This is only preliminary' / Coment on clock pattern macro
M_BNDWTH=                   00 / NIR band width 00:15K 01:150K 10:1.5M 11:3MHz
M_PIXTIM=                  5.0 / Clock duration for a pixel (us)
M_FRTIME=                 32.3 / Time to sweep one frame (ms)
COMMENT === FMC
M_JPORT =                    0 / Jump port value at the time of getting data
M_REFSUB=                    T / Subtraction of reference column T:done
M_ARRANG=                    T / Data arrangement T:FITS F:raw
M_BANK  = 'A       '           / Bank name where the data was stored
COMMENT == BlackBody
M_BBPOS =                    F / Black Body Position T:In F:Out
M_BBTMP =                270.0 / Temperature of Black Body (K)
END

XTENSION= 'TABLE   '           / ASCII Table extension
BITPIX  =                    8 / # of bits storing pix values
NAXIS   =                    2 / # of axis in frame
NAXIS1  =                   17 / # of characotors in a row
NAXIS2  =                   10 / # of rows = # of frames
PCOUNT  =                    0 / No random parameters
GCOUNT  =                    1 / Only one group
TFIELDS =                    4 / # of fields in a row
EXTNAME = 'Beams   '           / Name

TTYPE1  = 'Chop    '           / Chop beam: +/-
TBCOL1  =                    1 / start column of this field
TFORM1  = 'A1      '           / 1 charactors

TTYPE2  = 'Nod     '           / Nod beam: +/-
TBCOL2  =                    2 / start column of this field
TFORM2  = 'A1      '           / 1 charactors

TTYPE3  = 'NumReads'           / Number of read outs
TBCOL3  =                    3 / start column of this field
TFORM3  = 'I6      '           / 6 digit integer
TUNIT3  = 'Samples '           / untis: ADC Samplings for a pixel

TTYPE4  = 'WaitTime'           / Wait time for secondry stabilization
TBCOL4  =                    9 / start column of this field
TFORM4  = 'F9.4    '           / 9 digit floating down to 1us
TUNIT4  = 'ms      '           / units: milli-second

TTYPE5  = 'NDRate  '           / Integration Duty Cycle x/243 only MIR
TBCOL5  =                   18 / start column of this field
TFORM5  = 'I3      '           / 3 digit integer
TUNIT5  = 'rows    '           / units: milli-second

COMMENT Sample ASCII Extension header for MIRTOS written by Tomono on 1998/7/6
END
```

● MIRTOS の NIR mode

```
         1         2         3         4         5         6         7
1234567890123456789012345678901234567890123456789012345678901234567890123456789
--------------------------------------------------------------------------------
SIMPLE  =                    T / Standard FITS format
BITPIX  =                   32 / # of bits storing pix values
NAXIS   =                    3 / # of axis in frame
NAXIS1  =                  256 / # of pixels/row
NAXIS2  =                  256 / # of rows
NAXIS3  =                   10 / # of frames
EXTEND  =                    T / ASCII Table for Z-frame description
COMMENT Sample Primary header for MIRTOS written by Tomono on 1998/7/6
OBSERVER= 'D.Tomono, Y.Doi, T.Nishimura  ' / Name of observers
PROP-ID = 'P1998-0430-1                  ' / Proposal ID
DATASET = 'Used for DASH                 ' /
INSTRUME= 'MIRTOS                        ' / Name of instrument
INS-VER = '1.1 980701                    ' / Version of the instrument
FRAMEID = 'MTOS000000002   '   / FITS File sequential number
EXP-ID  = 'MT_N000000001   '   / ID of the exposure this data was taken
```

```
OBS-MOD = 'imaging                        ' / Observation Mode
DATA-TYP= 'object          '   / Type / Characteristics of this data
OBSERVAT= 'National Astronomical Observatory of Japan' / Observatory
TELESCOP= 'Subaru                         ' / Telescope name
CRPIX1  =                128.0 / Reference pixel in X (pixel)
CRPIX2  =                128.0 / Reference pixel in Y (pixel)
CRVAL1  =         189.00529167 / Physical value of the reference pixel X
CRVAL2  =         -39.86927778 / Physical value of the reference pixel Y
CDELT1  =         0.0000076860 / X Scale projected on detector(#/pix)
CDELT2  =         0.0000076860 / Y scale projected on detector(#/pix)
CTYPE1  = 'RA--TAN         '   / Pixel coordinate system
CTYPE2  = 'DEC--TAN        '   / Pixel coordinate system
CUNIT1  = 'degree    '         / Units used in both CRVAL1 and CDELT1
CUNIT2  = 'degree    '         / Units used in both CRVAL2 and CDELT2
TIMESYS = 'UTC     '           / Time System used in the header. UTC fix.
RADECSYS= 'FK5     '           / The equatorial coordinate system
PROJP1  =                  0.0 / Projection type of the first axis
PROJP2  =                  0.0 / Projection type of the second axis
LONGPOLE=             180.00000 / The North Pole of standard system (deg)
PC001001=           1.00000000 / Pixel Coordinate translation matrix
PC001002=           0.00000000 / Pixel Coordinate translation matrix
PC002001=           0.00000000 / Pixel Coordinate translation matrix
PC002002=           1.00000000 / Pixel Coordinate translation matrix
BSCALE  =                    1 / Real=fits-value*BSCALE+BZERO
BZERO   =                    0 / Real=fits-value*BSCALE+BZERO
BUNIT   = 'ADU             '   / Unit of original pixel values
BLANK   =                32768 / Value used for NULL pixels
DATE-OBS= '1998-04-30                     ' / yyyy-mm-dd UTC obs start date
UT      = '09:12:00.0'           / HH:MM:SS.S UTC at typical time(=start)
HST     = '23:12:00.0'           / HH:MM:SS.S HST at typical time(=start)
LST     = '12:34:56.7'           / HH:MM:SS.S LST at typical time(=start)
MJD     =       12345.67890000 / Modified Julian Day at typical time(=start)
EXPTIME =               0.0800 / Total integration time per frame(sec)
OBJECT  = 'HR 4796                        ' / Target Description
RA      = '12:36:01.270'         / HH:MM:SS.SSS RA (J2000) pointing
RA2000  = '12:36:01.270'         / HH:MM:SS.SSS RA (J2000) pointing
DEC     = '-39:52:09.40'         / +/-DD:MM:SS.SS DEC (J2000) pointing
DEC2000 = '-39:52:09.40'         / +/-DD:MM:SS.SS DEC (J2000) pointing
EQUINOX =              2000.0 /
AZIMUTH =            12.34000 / Azimuth of telescope pointing (degree)
ALTITUDE=            12.34000 / Altitude of telescope pointing(degree)
FOC-POS = 'Cassegrain      '   / Focus where the instrument is attached
FOC-LEN =          100000.000 / Focal length of the telescope (mm)
FOC-VAL =               2.531 / Encoder value of the focus unit (mm)
M2-TYPE = 'IR      '           / Type of the secondary miror (Opt/IR)
M2-TIP  = 'off     '           / Tip/Tilt of the Secondary Mirror (on/off)
APERTURE= '21x16           '   / Field stop ID
INR-STR =              12.345 / Instrument Rotator angle at Start (deg)
INR-END =              12.345 / Instrument Rotator angle at End (deg)
AIRMASS =             4.67918 / Averaged Air Mass
ZD      =              77.660 / Zenith Distance at typical time
SECZ    =               4.679 / SEC(Zenith Distance) at typical time
M_WINDOW= 'ZnSe            '   / MIRTOS dewar entrance window
M_M1MOT1=                 224 / Beam Stearing Mirror Position (count)
M_M1MOT2=                 339 / Beam Stearing Mirror Position (count)
M_M2MOT1=                 224 / Beam Splitter Position (count)
M_M2MOT2=                 339 / Beam Splitter Position (count)
FILTER01= 'K               '   / Filter name/ID
FILTER03= '13mm-phi        '   / Lyot Stop name/ID
DETECTOR= 'Ratheon InSb 256x256           ' / Name of the detector/CCD
DET-ID  =                   1 / ID of the detector used for this data
DETPXSZ1=               0.030 / Detector pixel size in axis1 (mm)
DETPXSZ2=               0.030 / Detector pixel size in axis2 (mm)
DET-A00 =              -0.100 / Relative angle of nn-th detector (deg)
DET-TMP =               30.12 / Detector temperature (K)
GAIN    =              123.40 / AD conversion factor (electron/ADU)
PRD-MIN1=                   1 / Start X pos. of partialy read out (pix)
PRD-MIN2=                   1 / Start Y pos. of partialy read out (pix)
PRD-RNG1=                 256 / X Range of partialy read out (pix)
PRD-RNG2=                 256 / Y Range of partialy read out (pix)
BIN-FCT1=                   1 / Binning factor of X axis (pixel)
BIN-FCT2=                   1 / Binning factor of Y axis (pixel)
WEATHER = 'Sunny                          ' / Weather condition
SEEING  =                0.45 / Long integ PSF FWHM (arcsec)
DOM-WND =                4.61 / Wind speed in the dome (m/s)
OUT-WND =                7.79 / Wind speed outside (m/s)
DOM-TMP =               273.5 / Temperature measured in the dome (K)
OUT-TMP =               273.7 / Temperature measured outside dome (K)
DOM-HUM =               0.050 / Humidity measured in the dome
OUT-HUM =               0.060 / Humidity measured outside the dome
DOM-PRS =              670.00 / Atmospheric pressure in the Dome (hpa)
OUT-PRS =              670.00 / Atmospheric pressure outside dome (hPa)
COMMENT
COMMENT (: Subaru Device Dependent Header for MIRTOS :)
```

```
COMMENT
COMMENT === ID
M_CHID  = 'NIR             '   / ID of camera channel of MIRTOS
M_TWID  = '19980430-0001   '   / ID of two-wavelength simultaneous file
M_FLATID= 'NA              '   / ID of the most recent flat field file
M_DARKID= 'NA              '   / ID of the most recent dark exposure file
M_DETO1 =             12.30000 / Rel X pos of NIR from MIR on sky (pixel)
M_DETO2 =             45.60000 / Rel Y pos of NIR from MIR on sky (pixel)
COMMENT === Chopping and Nodding
M_CHOPTM=                0.200 / Chopping period (sec)
M_CHOPTH=                90.00 / Chopping throw (arcsec)
M_CHOPPA=                 0.00 / Chopping P.A. origin:source/pointing (deg)
M_NODTM =                 10.0 / Nodding period (sec)
M_NODTH =                90.00 / Nodding throw (arcsec)
M_NODPA =                90.00 / Nodding P.A. origin:source/pointing (deg)
COMMENT === Temperature
M_O-TMP =                 56.7 / Temperature of Optics (K)
M_A-TMP1=                300.1 / Temperature of Ambient thermometer (K)
M_A-TMP2=                350.3 / Temperature of Ambient thermometer (K)
M_A-TMP3=                280.4 / Temperature of Ambient thermometer (K)
M_A-TMP4=                300.1 / Temperature of Ambient thermometer (K)
COMMENT === Clock
M_CLKFL = '/home/mirtos/clock/nir/980430/twsaa1' / Clock file name
M_CLKMR = 'chop02nod10_1   '   / Clock pattern marco name
M_CLKMC = 'This is only preliminary' / Coment on clock pattern macro
M_BNDWTH=                   11 / NIR band width 00:15K 01:150K 10:1.5M 11:3MHz
M_PIXTIM=                  6.1 / Clock duration for a pixel (us)
M_FRTIME=                 32.3 / Time to sweep one frame (ms)
COMMENT === FMC
M_JPORT =                    0 / Jump port value at the time of getting data
M_ARRANG=                    T / Data arrangement T:FITS F:raw
M_BANK  = 'A       '           / Bank name where the data was stored
COMMENT == BlackBody
M_BBPOS =                    F / Black Body Position T:In F:Out
M_BBTMP =                270.0 / Temperature of Black Body (K)
END

XTENSION= 'TABLE   '           / ASCII Table extension
BITPIX  =                    8 / # of bits storing pix values
NAXIS   =                    2 / # of axis in frame
NAXIS1  =                   17 / # of characotors in a row
NAXIS2  =                   10 / # of rows = # of frames
PCOUNT  =                    0 / No random parameters
GCOUNT  =                    1 / Only one group
TFIELDS =                    4 / # of fields in a row
EXTNAME = 'Beams   '           / Name

TTYPE1  = 'Chop    '           / Chop beam: +/-
TBCOL1  =                    1 / start column of this field
TFORM1  = 'A1      '           / 1 charactors

TTYPE2  = 'Nod     '           / Nod beam: +/-
TBCOL2  =                    2 / start column of this field
TFORM2  = 'A1      '           / 1 charactors

TTYPE3  = 'NumReads'           / Number of read outs
TBCOL3  =                    3 / start column of this field
TFORM3  = 'I6      '           / 6 digit integer
TUNIT3  = 'Samples '           / untis: ADC Samplings for a pixel

TTYPE4  = 'WaitTime'           / Wait time for secondry stabilization
TBCOL4  =                    9 / start column of this field
TFORM4  = 'F9.4    '           / 9 digit floating down to 1us
TUNIT4  = 'ms      '           / units: milli-second

TTYPE5  = 'MIR_ND  '           / Integration Duty Cycle x/243 only MIR
TBCOL5  =                   18 / start column of this field
TFORM5  = 'I3      '           / 3 digit integer
TUNIT5  = 'rows    '           / units: milli-second

COMMENT Sample ASCII Extension header for MIRTOS written by Tomono on 1998/7/6
END
```

6.6 FITS 規約に反する悪い例

次のような間違いはよくあるものだが、*FITS* 規約には抵触するので、注意すること。

ヘッダーキーワードの文字種違反 ヘッダーキーワードは大文字でなければならない。

```
simple  =                    T
```

はだめ。(3.3.1 節参照)

EQUINOX の値違反 EQUINOX の値は浮動小数点数でなければならない。

```
EQUINOX =               2000
```

はだめ。また EPOCH は使うべきではない。(3.3.2 節参照)

キーワードの順序違反 例えば EXTEND は NAXIS より前ではいけない。(3.3.2 節参照)

```
SIMPLE  =                    T
BITPIX  =                   32
EXTEND  =                    T
NAXIS   =                    3
```

ヘッダの文字値が長さ制限違反 ヘッダの文字値は 8 文字以上 (正確には閉じ側の引用符が 20 カラムより前ではいけない)。ただし、この制限は NOST-1.1 での制限であり、draft 1.2 にある Free Format が正式に認められると違反でなくなる。(3.3.3 節参照) 例えば、

```
XTENSION  = 'TABLE'
```

は現規約では違反だが draft 1.2 では可。

ヘッダの文字値の引用符違反 ヘッダの文字値を囲むのは single quote であり、double quote ではない。(3.3.3 節参照)

```
XTENSION  = "TABLE   "
```

はだめ。

ヘッダの数値の位置違反 ヘッダの数値は 11-30 桁めに右詰めで表示されなくてはならない。ただし、 draft 1.2 の Free Format ではこの制限はない。例えば、

```
EXPTIME = 0.0800
```

は現規約では違反だが、draft 1.2 では合法。(3.3.3 節参照)

データ部の値の制限違反 データ部では unsigned integer は使えない。例えば、

```
BITPIX  =                   16
```

のような場合は使える値は、-32768 〜 32767 である。3.4.1 節参照。(実際に世の中に流通しているソフトの中には符号なし整数を吐き出すものも存在するようなので、FITS ブラウザの中には、それらも表示できるものもあるようだが。)

ASCII Table Extension の TFORMn のフォーマット記法違反 ASCII Tabele Ext. の TFORMn では、FORTRAN-77 の記法で書かなければならず、C フォーマットではだめ。例えば、

```
TFORM1  = '%6d      '
```

はだめ。(3.6.1 節参照)

などなど。他にも似たような例はあると思われるので注意されたい。