Subaru Telescope Instrument Plan toward 2020s

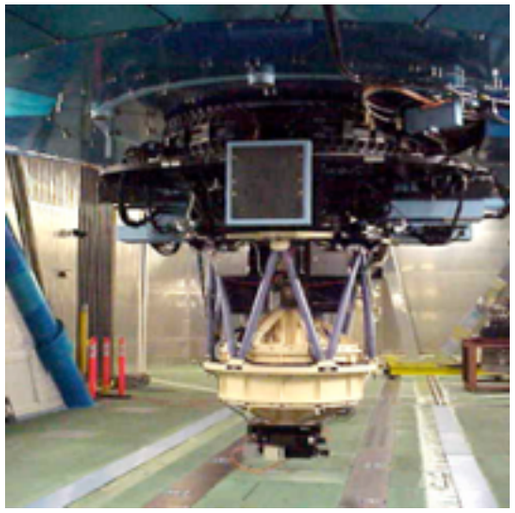
2014/09/18 I. Iwata for SA meeting

References

- Internal Meeting on 2013/10/08
  - http://www1.subaru.nao.ac.jp/newdev/intmtg/20131008/index.html
    - Decommission overview, TMT, Keck, Gemini instruments, Open-use statistics, publications, instrument troubles
- Internal Meeting on 2013/11/15
  - http://www1.subaru.nao.ac.jp/newdev/intmtg/20131115/index.html
    - PFS and ULTIMTE-S plans, FMOS decommission
- Subaru UM FY2013
  - http://www.naoj.org/Science/SubaruUM/SubaruUM2013/index_E.html
    - Instrument Plan http://www.naoj.org/Science/SubaruUM/SubaruUM2013/Proceedings/Discussions_Iwata.pdf

Subaru Telescope Current Instrument Line-Up

- Nine Facility Instruments



FOCAS

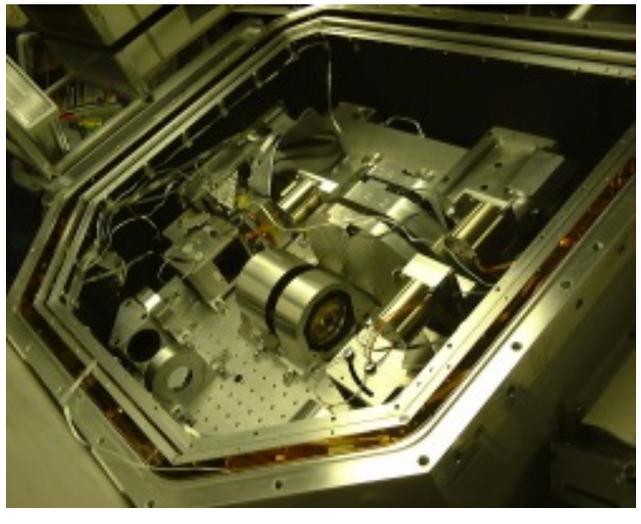
Suprime-Cam

HDS

Hyper Suprime-Cam

FMOS

MOIRCS



IRCS

COMICS

AO188

Subaru Telescope Current Instrument Line-Up

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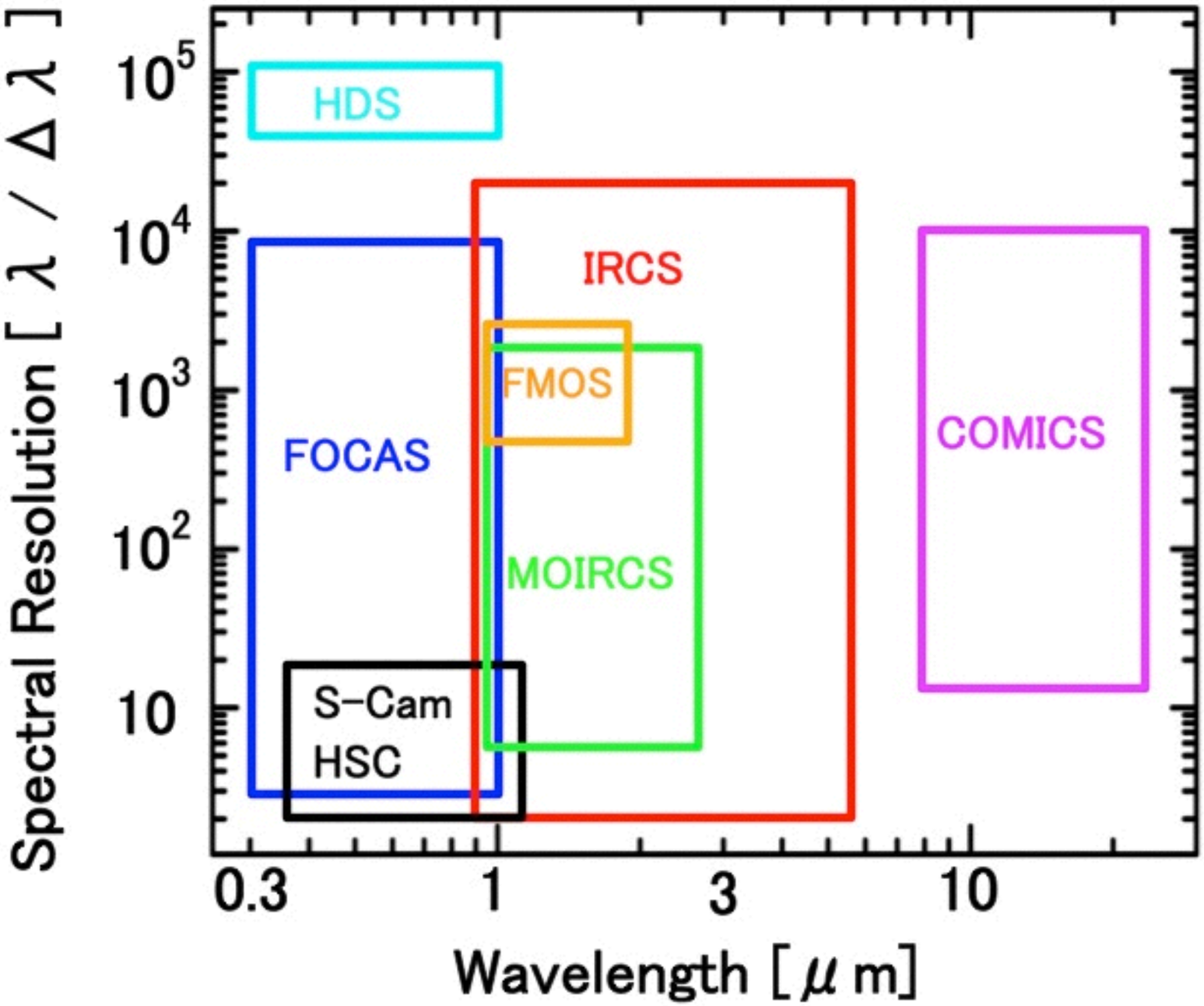


Subaru's Three Pillars

PFS

HSC

ULTIMATE-
SUBARU

ULTIMATE-SUBARU: (Optimistic) Schedule (1/2)

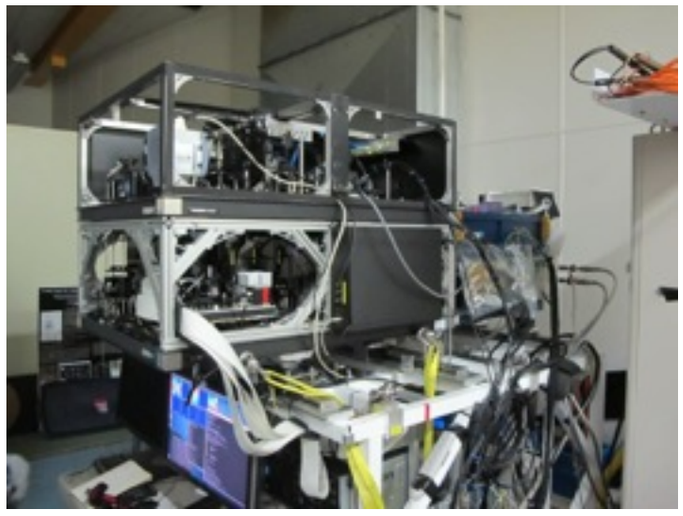
- 2014: Grant-in-aid proposal submission (New Froniter with biology group)
  - LGS and WFS in five years
- Jan. 2015: Subaru UM
- Early 2015: CoDR
- *Phase-0.25 (2015)*
  - Starbugs concept design and prototyping
  - Grant-in-aid proposal submission (Kiban-S)
- *Phase-0.5 (2016-2018):*
  - Multi-IFU Spectroscopy using Starbugs + MOIRCS (2 x H2RG)
  - no GLAO

ULTIMATE-SUBARU: (Optimistic) Schedule (2/2)

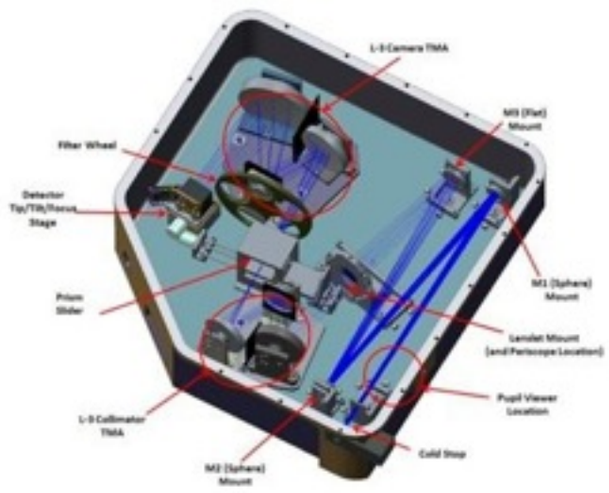
- *Phase-1: < 2020*
  - Multi-IFU Spectroscopy using Starbugs + MOIRCS (2 x H2RG)
  - GLAO - 13'Φ FoV
- *Phase-2: > 2020*
  - New Spectrograph optimized for Starbugs (2 x H4RG?)
    - More bundles
    - OH-suppression Fibres?
  - New Wide-field Imager at Cs focus
    - ~10'Φ FoV?
- *Beyond:*
  - K-band extension?

PI-type Instruments for Exoplanets

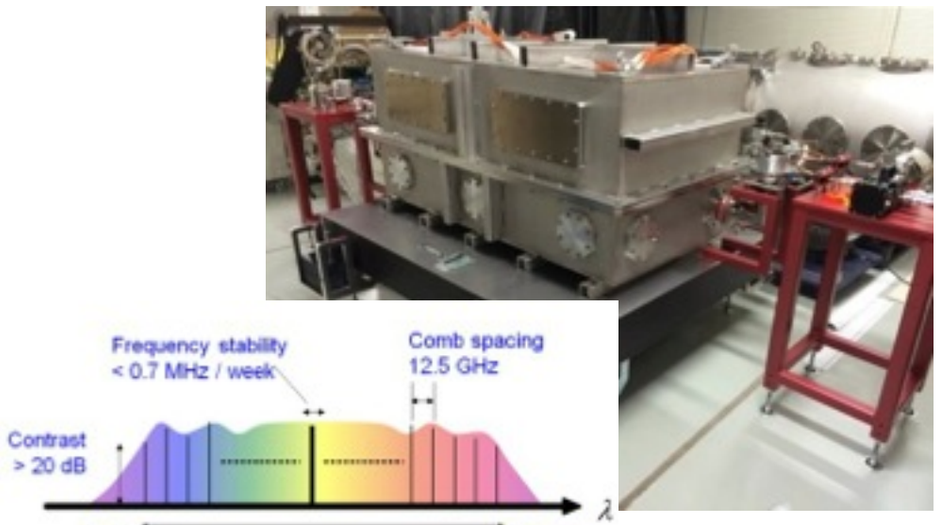
- SCExAO: Coronagraphic Extreme-AO (direct imaging)
- CHARIS: Integral Field Spectrograph (discover and characterization)
- IRD: Near-IR High-dispersion Spectrograph (Earth-mass planets around M-dwarfs)
- Short time-scale of Cycles (Development-Commissioning-Science) to catch-up this rapidly evolving research field



SCExAO



CHARIS



IRD

Laser frequency comb

Change of Subaru Operations

Current

Wide variety of instruments
Classical observations
<5 nights per program
Frequent instrument exchange

Future

Emphasis on surveys
Queue observations
Large programs
Smaller number of instruments

Change of Subaru Operations

- Synergy with TMT - Subaru will conduct large surveys to feed targets to TMT
  - TMT's sensitivity for single object and spatial resolution are much higher.
- New generation of instruments are very large and expensive. We cannot keep whole suite of instruments competitive to newer generation instruments in other telescopes.
  - We only have limited resources (electricity, weight, manpower, time, etc.)
- Strong pressure to reduce budget in the era of TMT operation

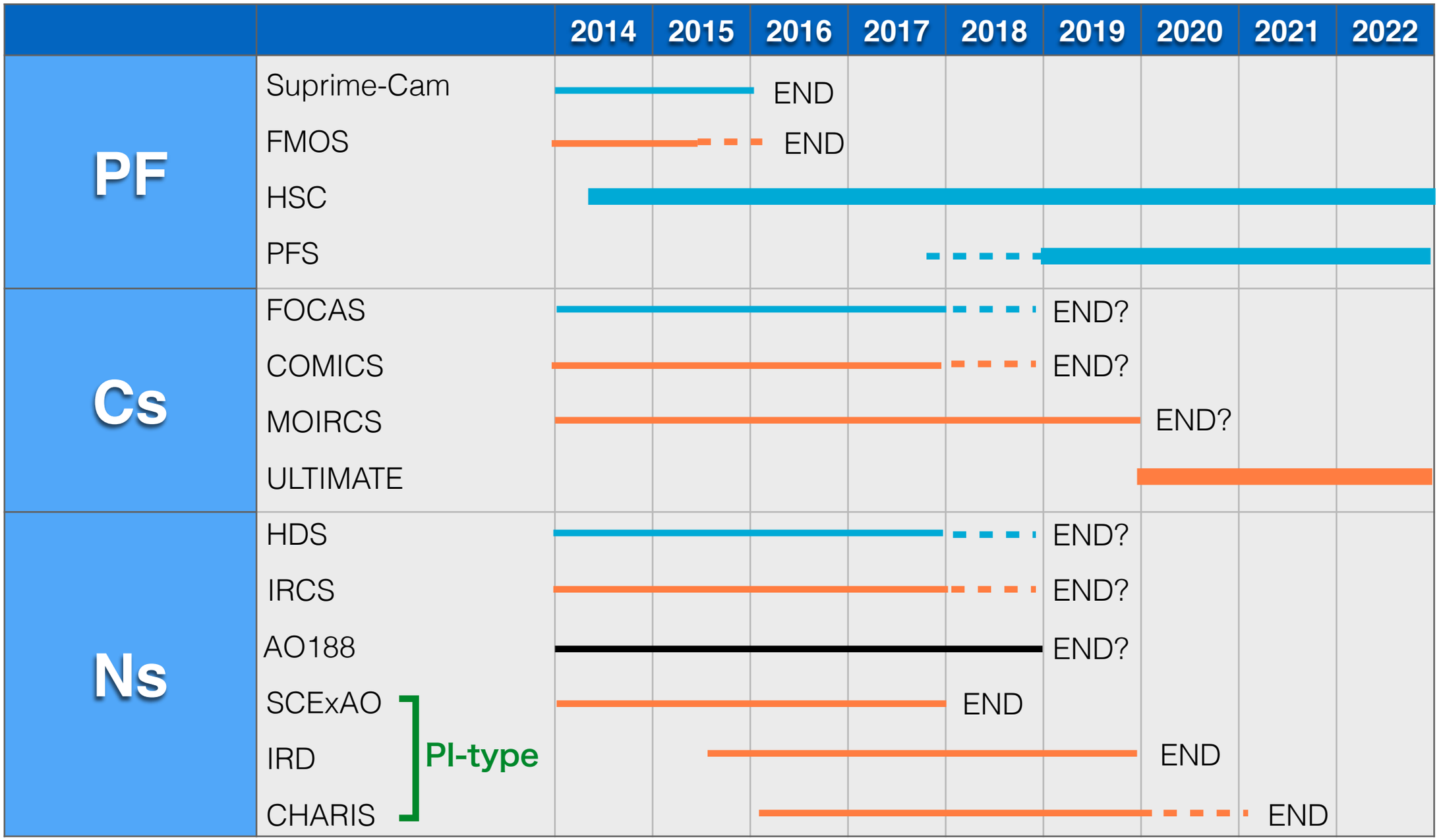
- Accepting PI-type instruments
  - Subaru as a development platform
  - Cutting-edge technologies, sharp science cases
- Development platform for TMT and other telescopes?

Subaru Instrument Decommissions

- We have started serious discussions of decommission plan.
- I would like to establish the plan in this FY.

Diversity of instruments	Time exchange programs
Unique capabilities	Transfer of instruments
Back-up for troubles	Workload profiles for new instruments
‘Workhorse’ instruments	Loads of operations / maintenance
←	→
More instruments	Less instruments

Timeline (draft)



This timeline has been shown to Japanese community at Gopira meeting on 2014/09/08.
Essentially the same figures have been presented in Subaru UM FY2013 as well.

PI-type Instrument Schedule

https://docs.google.com/a/naoj.org/spreadsheets/d/19Befrc3jQHfCbsw70lNpv0MiAxWNHw2Ah3klB6piP6s

Instrument	PI	PI institute	08A	08B	09A	09B	10A	10B	11A	11B	12A	12B	13A	13B	14A	14B	15A	15B	16A	16B	17A	17B	18A	18B	19A	19B	20A	20B	
Cs Instruments																													
K3D2 (Cs)	H. Sugai	IPMU																											
MIMIZUKU	T. Miyata	U. Tokyo																											
SWIMS	K. Motohara	U. Tokyo																											
Ns/Other Instruments																													
HiCIAO	M. Tamura	U. Tokyo																											EFL: 2008/12/21
K3D2+AO188	H. Sugai	IPMU																											EFL: 2012/04/02
SCExAO	O. Guyon	Subaru																											EFL: 2011/08/09
RAVEN	C. Bradley	U. Victoria																											EFL: 2014/05/13
IRD	M. Tamura	U. Tokyo																											
GIGMICS	Y. Hirahara	Nagoya U.																											
CHARIS	N. J. Kasdin	Princeton U.																											

cf. Facility Instrument

PFS	H. Murayama	IPMU																											

Science Operation Phase
Engineering Phase
TBD

Publication survey

- Publications from Open-use, time exchange, UH programs from year 2000
- Relate observing programs (proposal-ID) with publications
- Missing:
  - GTO, staff-time, observatory projects
  - Citation information
  - Completeness
- Nights required for a paper for each instruments
  - How these numbers change over 15 years
- To be presented in SAC and Subaru UM FY2014

Questions / Discussion Items

- Shift toward more emphasis on surveys has been discussed within Subaru (e.g., future instrument planning meetings) and among community (Subaru Users Meeting, Subaru Advisory Committee)
- From operational point of view, just adding HSC, PFS, ULTIMATE to existing facility instruments won't be possible.
- How many instruments should we / can we keep?
  - Balance between scientific values / diversity and operational loads
  - How much we should share roles among partner telescopes (Keck, Gemini, etc.)
- PI-type instruments
  - How to promote instrument development activities, especially in Japan?