Subaru Telescope Instrument Plan toward 2020s

2015/01/15 I. Iwata for Subaru Users Meeting
Instrument Planning Task Force Members:
H. Fujiwara, T. Hattori, M. Imanishi, N. Kashikawa, Y. Minowa, N. Narita,
N. Takato, Masaomi Tanaka, I. Iwata

- Instrument Planning 2015 web page
  - http://www.naoj.org/Projects/newdev/instplan2015/
- Instrument Planning Task Force web page
  - http://www.naoj.org/Projects/newdev/instplan2015/TF/

Timeline to Establish the Plan

- Subaru Advisory Committee 12/23 HST, 2014
- Subaru Users Meeting 1/14 HST, 2015
- PFS funding status and plan update: Early summer 2015?
- Feedbacks and Revisions
- Another community meeting in Early summer 2015?
  - PFS (community agreement required for the updated plan)
  - HSC queue (starting from S16A)
  - Instrument Plan
  - ULTIMATE

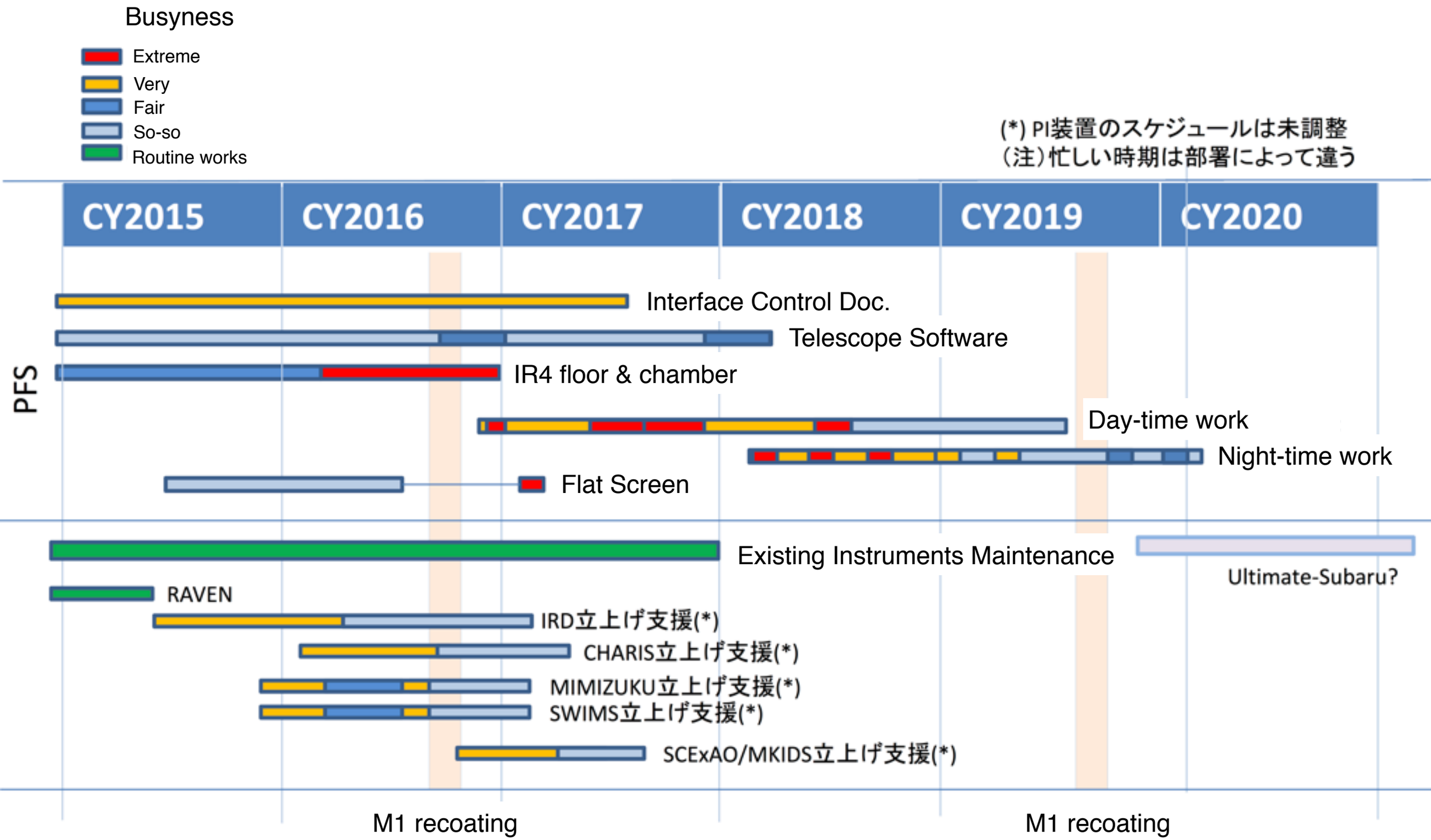
Background

Why Instrument Planning is necessary Now

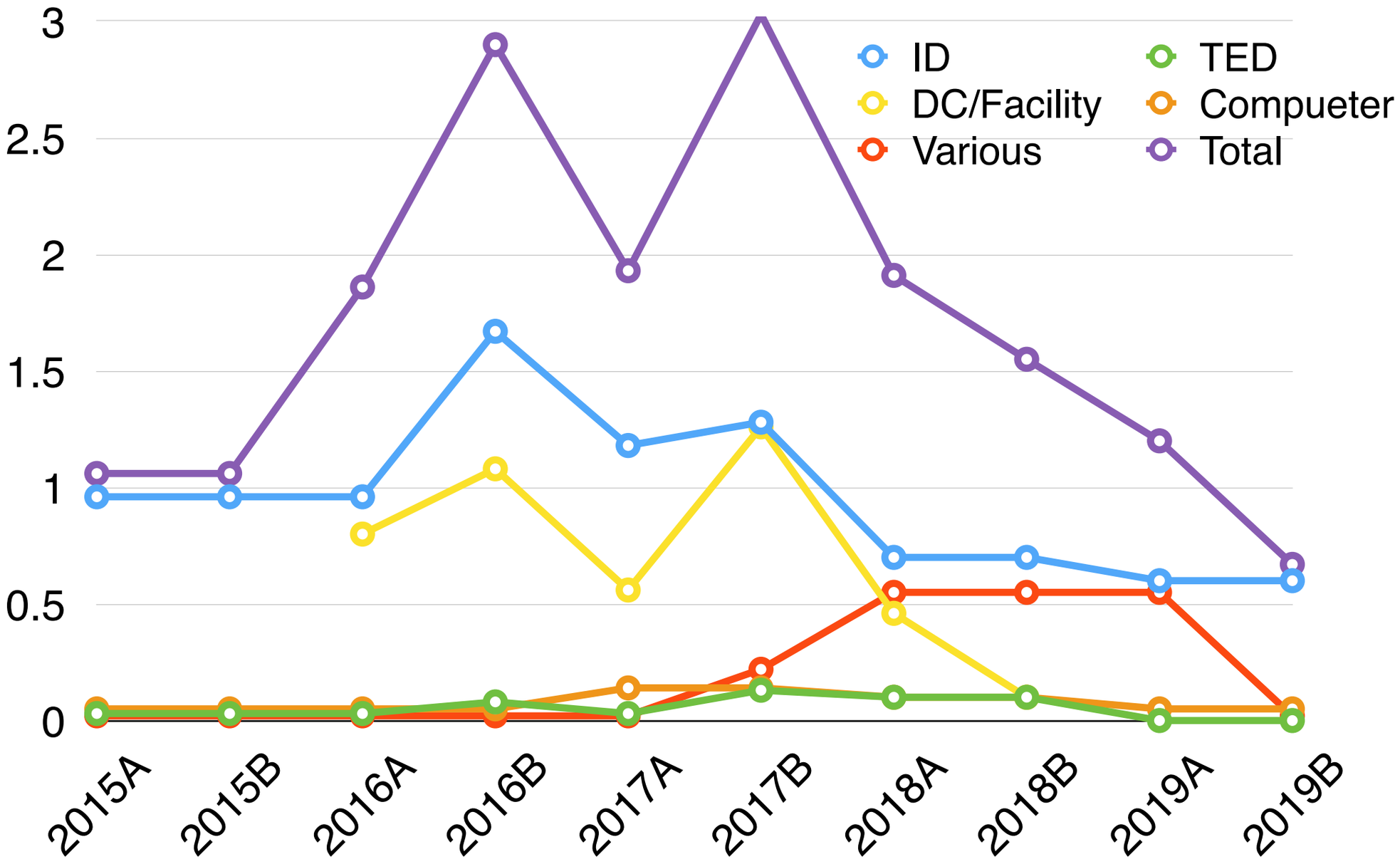
- Two Major Milestones
  - PFS commissioning - EFL in 2017
    - HSC + PFS operations
  - TMT operations from 2024
- Carry-out PFS commissioning while operating Subaru open-use
- Carry-out HSC + PFS operations, including SSPs
- Enforcement of Infrared Facility Instrument(s)
  - Competitive among 8-10m telescopes
  - ULTIMATE-SUBARU

Commissioning Schedule of PFS and PI-type Instruments

Takato-san



FTE Required for PFS commissioning



* This does not include Takato-san
and one person for data pipeline.

Why Instrument Planning is necessary Now

- Subaru Telescope's primary objective is to produce excellent scientific results by itself.
- We cannot expect significant increase of HR and budget
- Shifts toward Survey-oriented Observations
  - Dark nights will be mostly occupied with HSC and PFS
- Under these circumstances, we should try to keep scientific outputs from Subaru Telescope as high as possible.

Why Instrument Planning is necessary Now

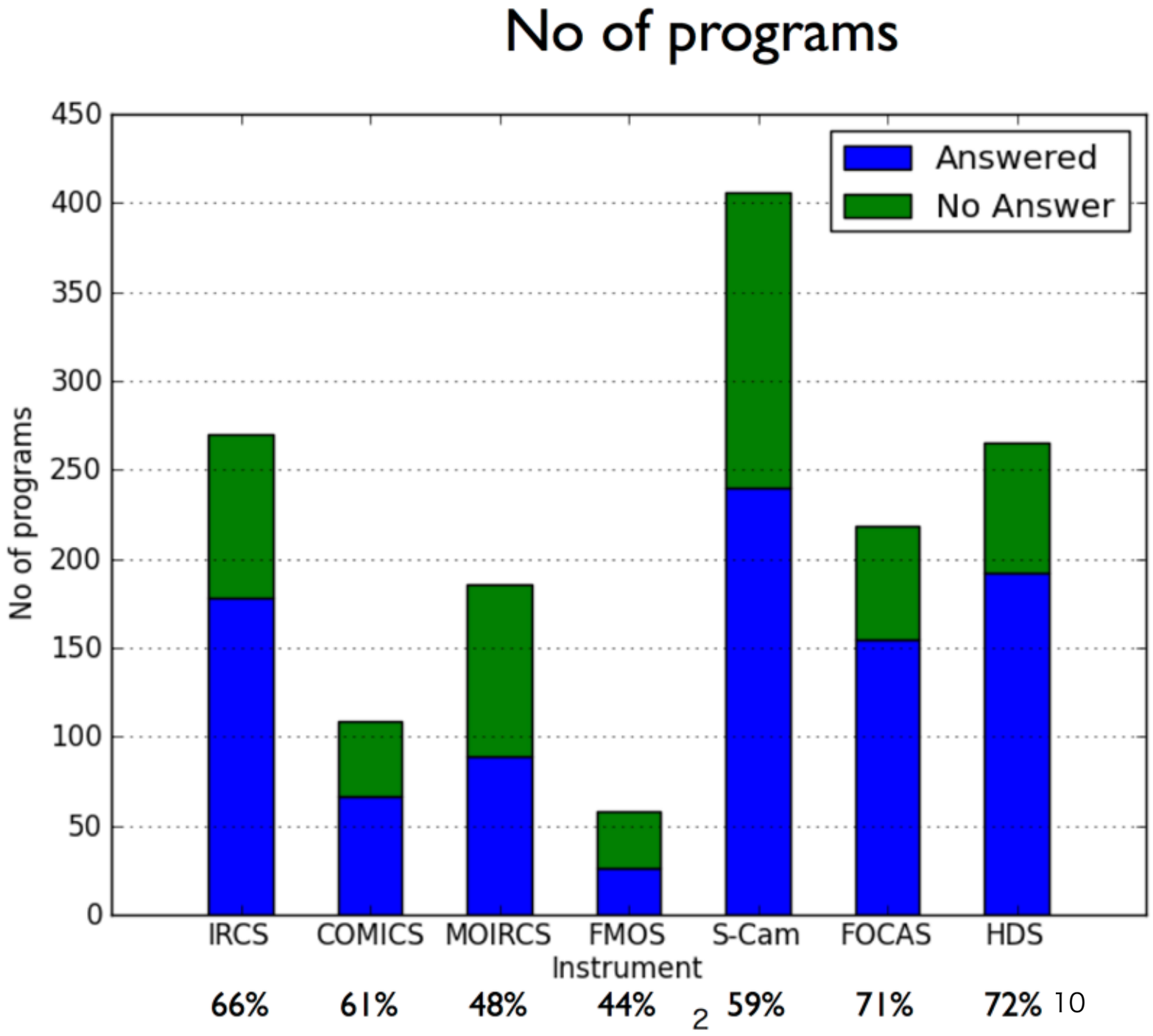
- For stable operations in parallel to the commissioning of PFS, we need:
  - To establish plans to reduce work loads
  - To have optimum science operations
- Workload required for PFS is still unclear, and Instrument Troubles are unpredictable. Given those uncertainties, we should have plans in advance to the beginning of PFS commissioning.

Results from Subaru Publication Survey

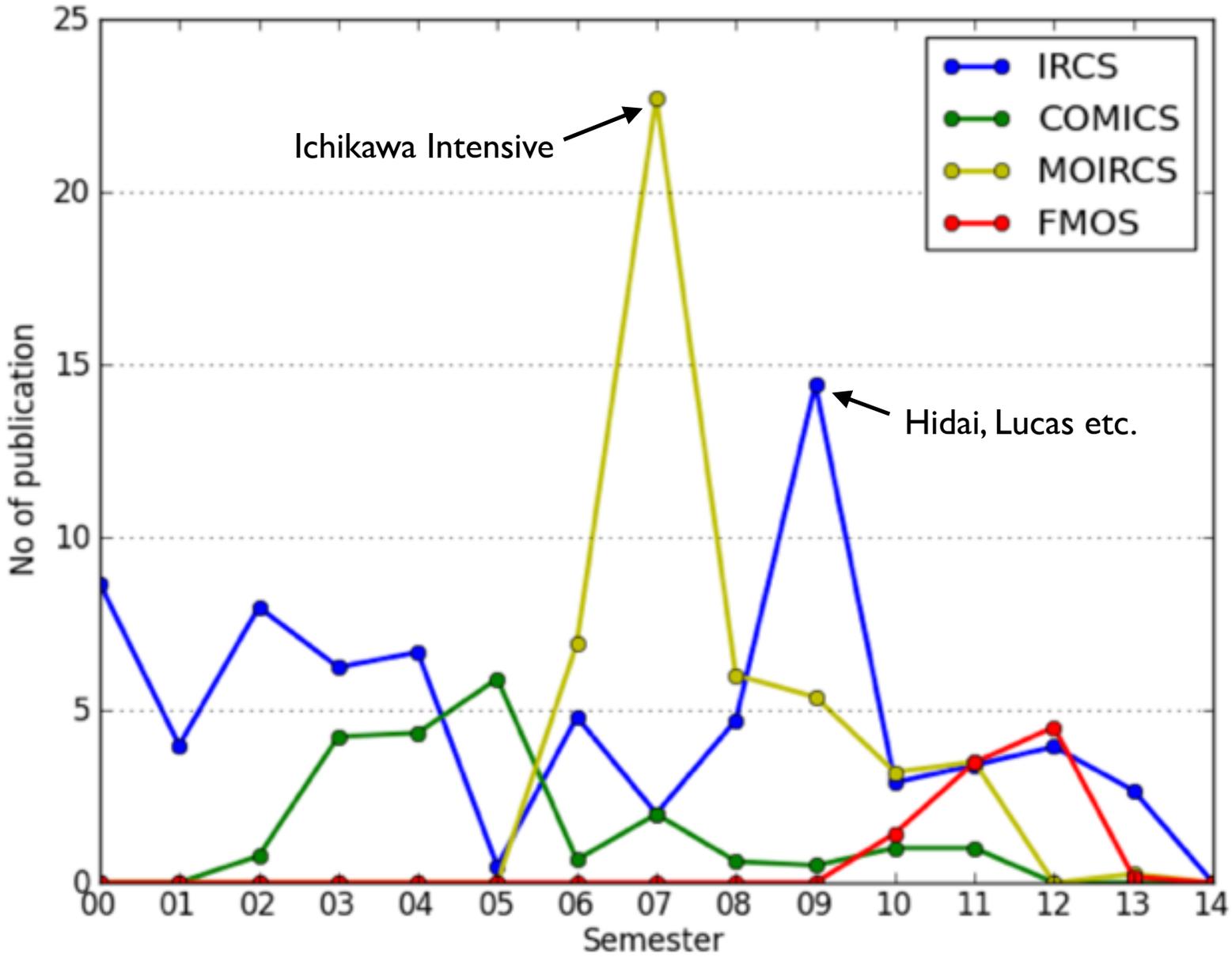
Ikuru Iwata, Masaomi Tanaka, Chie Yoshida (NAOJ)

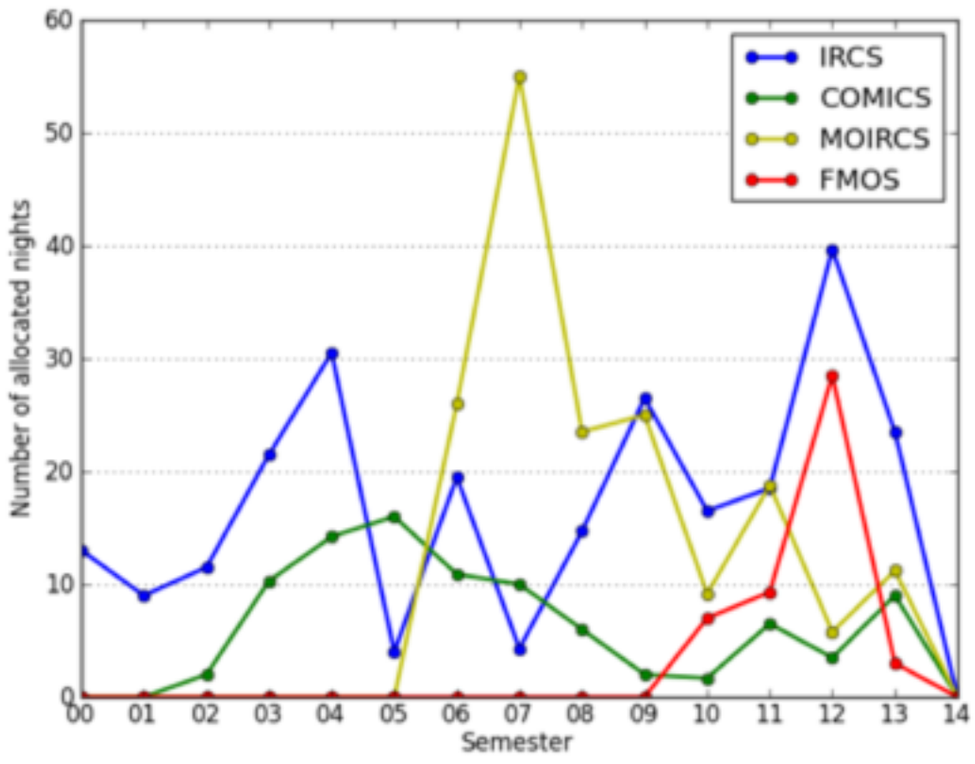
Publication Survey in 2014

- Normal open-use, service programs, time exchange programs, UH time
- From S00 to S13B (+some S14A)
- 1136 answers among 1760 programs - 65% reply rate
- PI-related publication only (publications based on data archive (SMOKA) are not included.)
- Hereafter statistics are for seven current facility instruments.



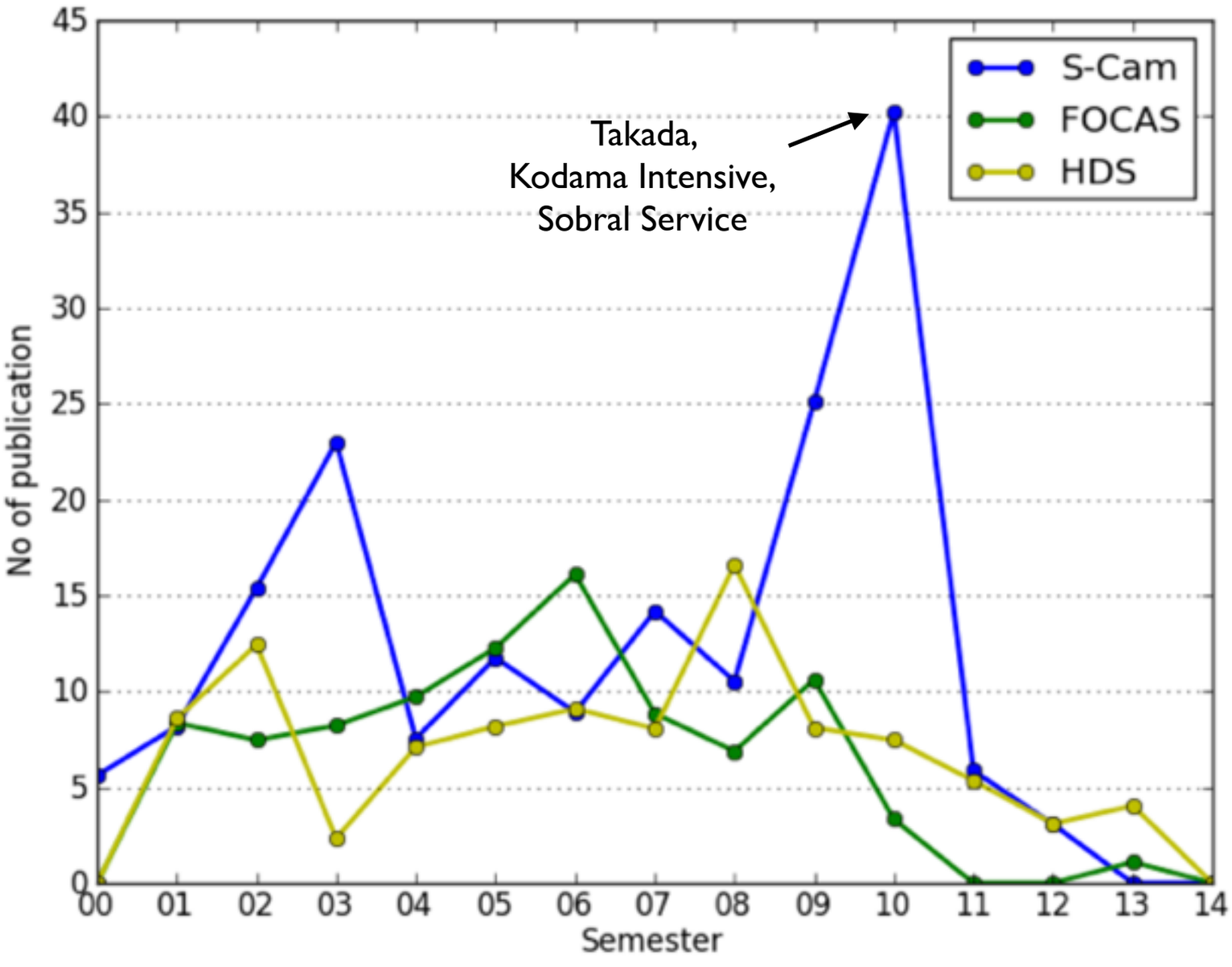
Number of Publications - IR Instruments

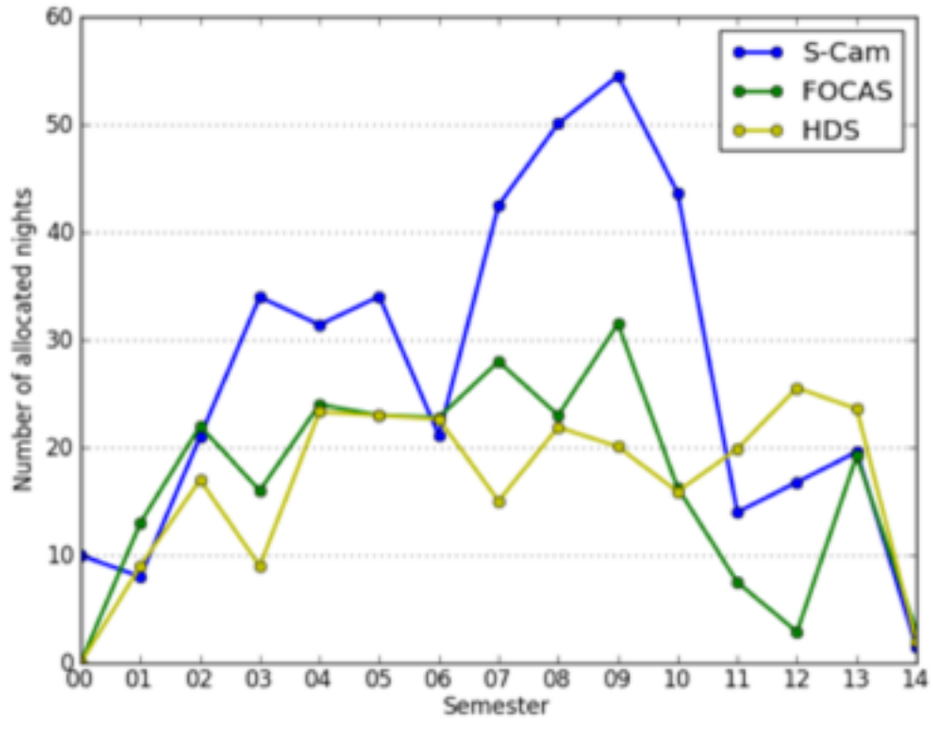




allocation

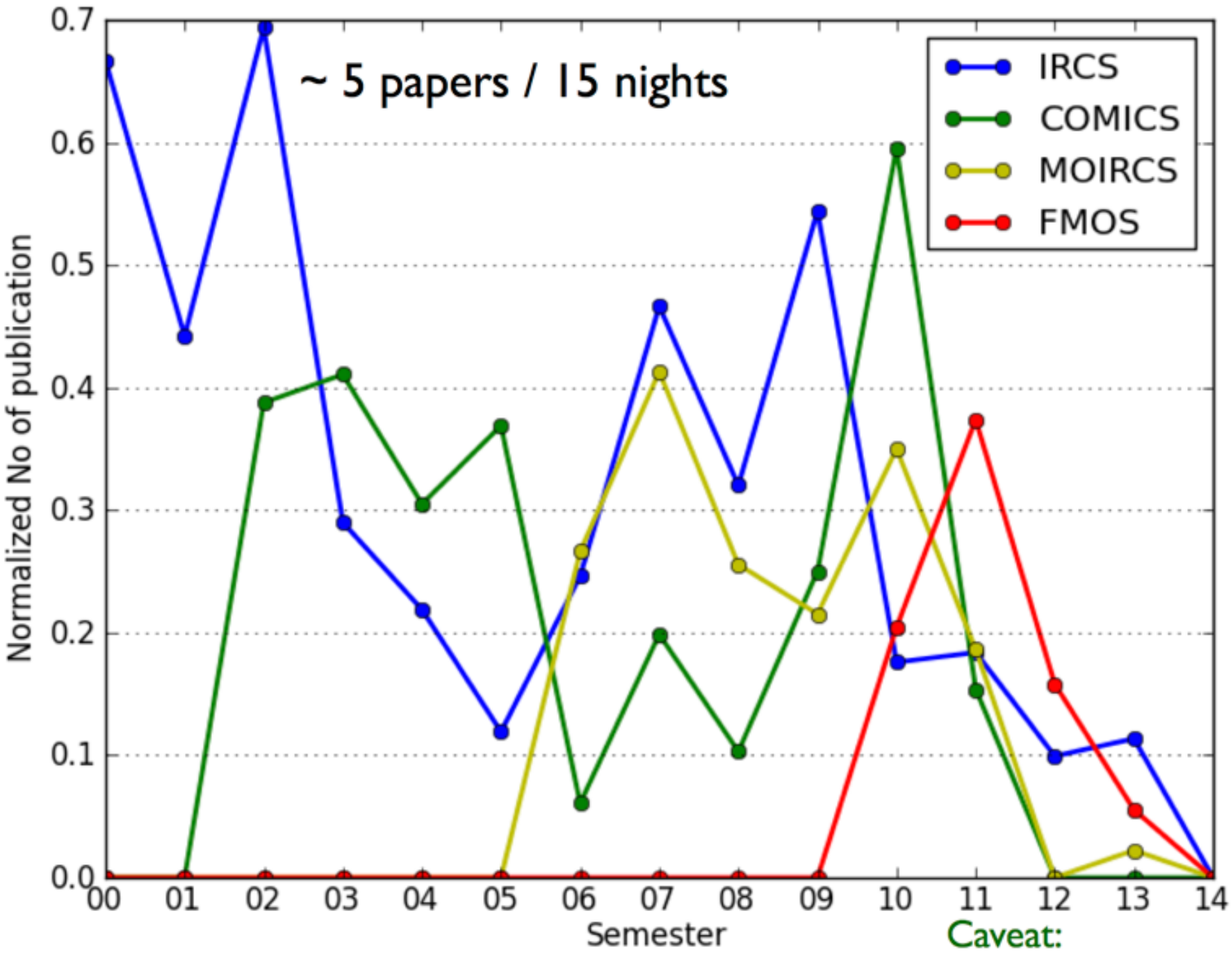
Number of Publications - Opt Instruments





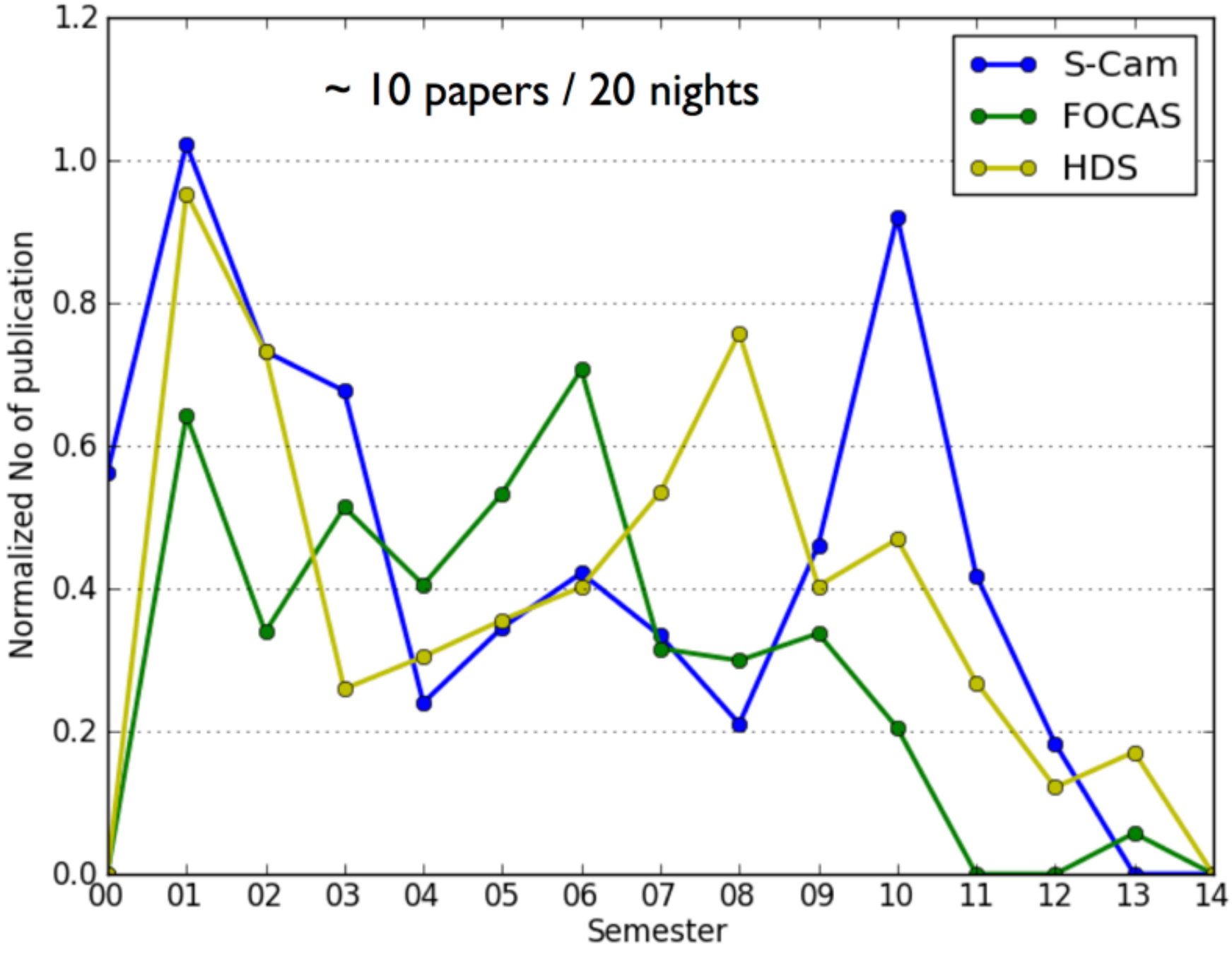
allocation

Publication / Night - IR Instruments



Caveat:
small statistics for COMICS
(Publication < 1 after 2008)

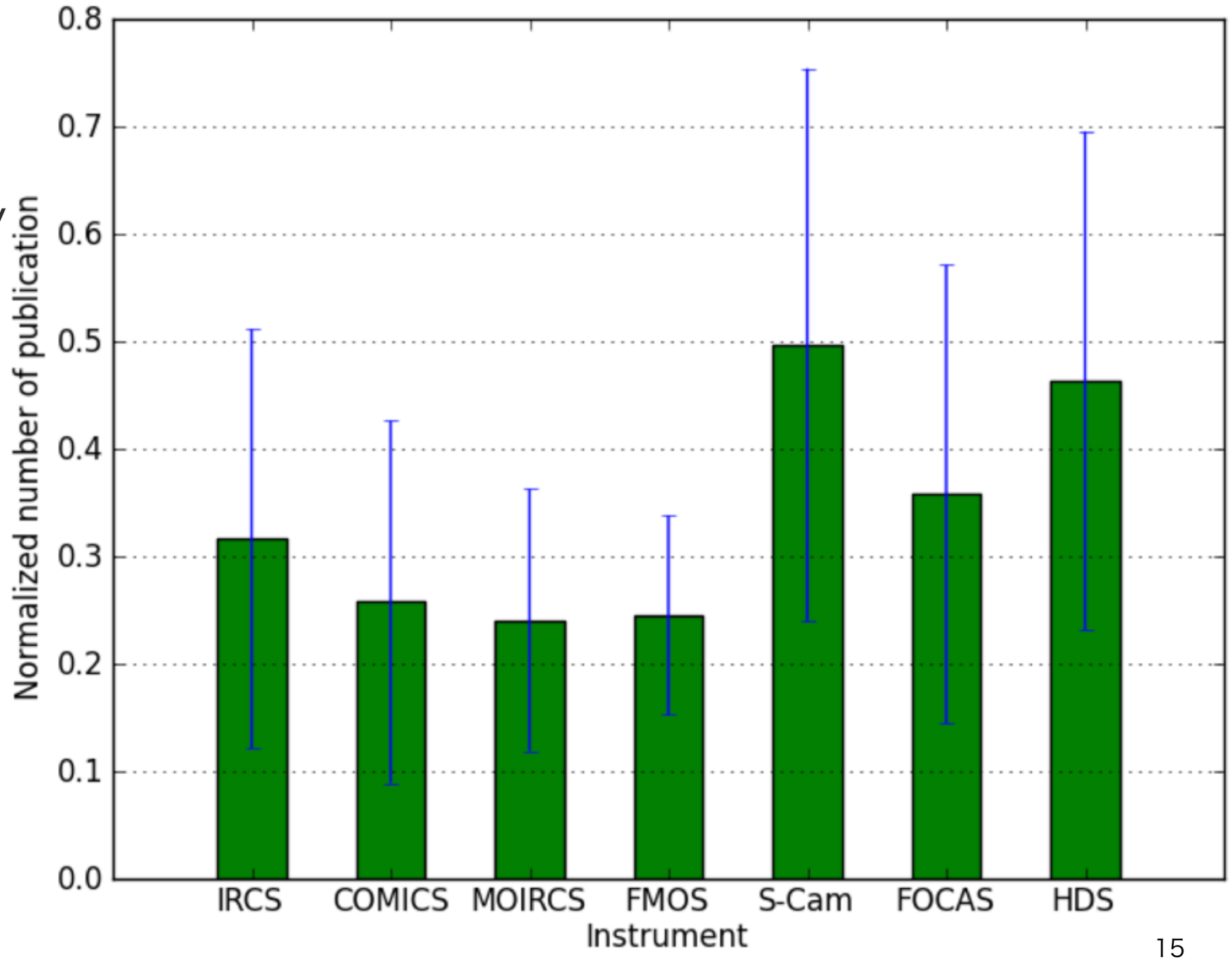
Publication / Night - Opt Instruments



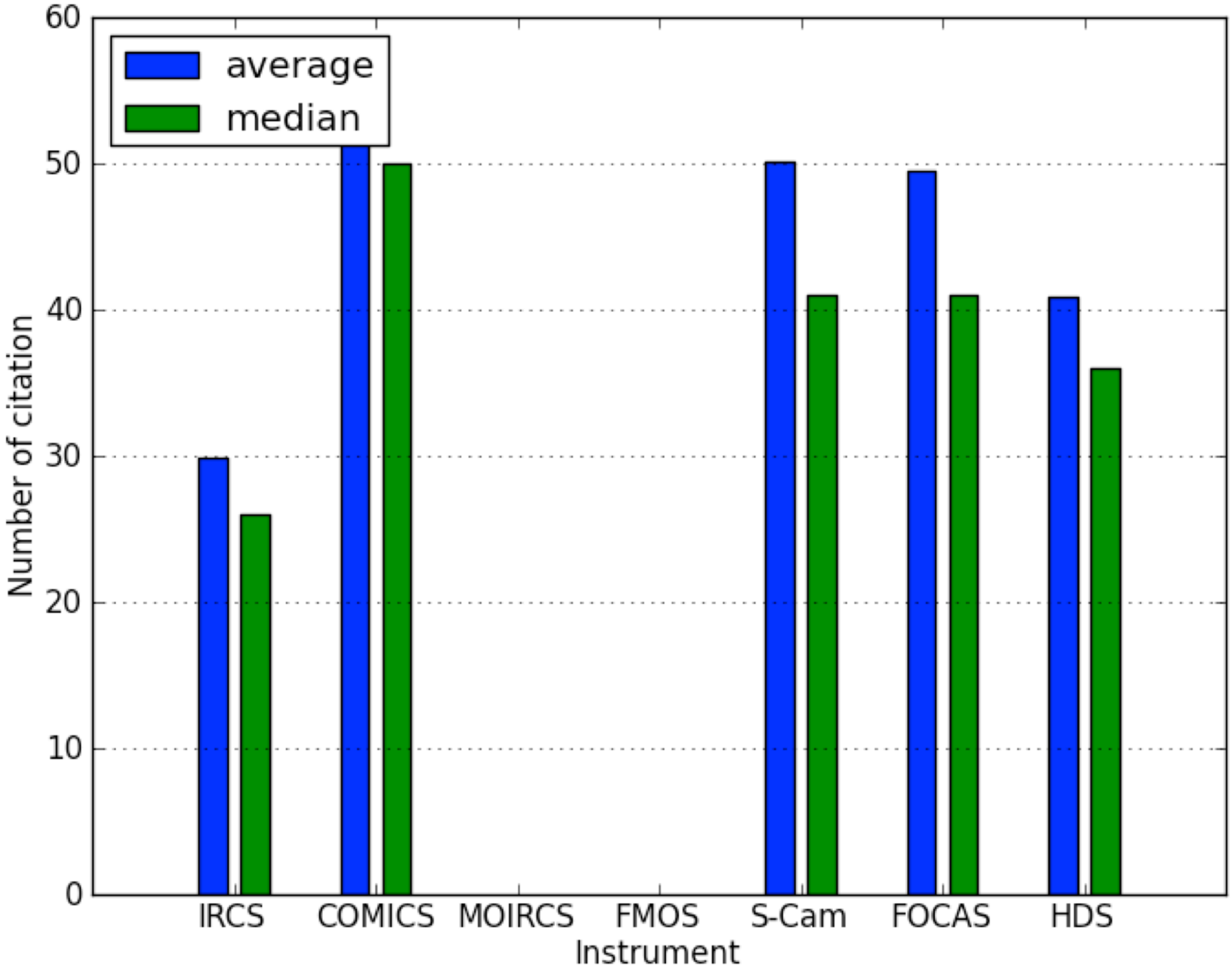
Publication / Night for Seven Instruments

- Average of S00-S12B
- Error bar: dispersion for semesters
- Optical instruments show better efficiency in publication than IR

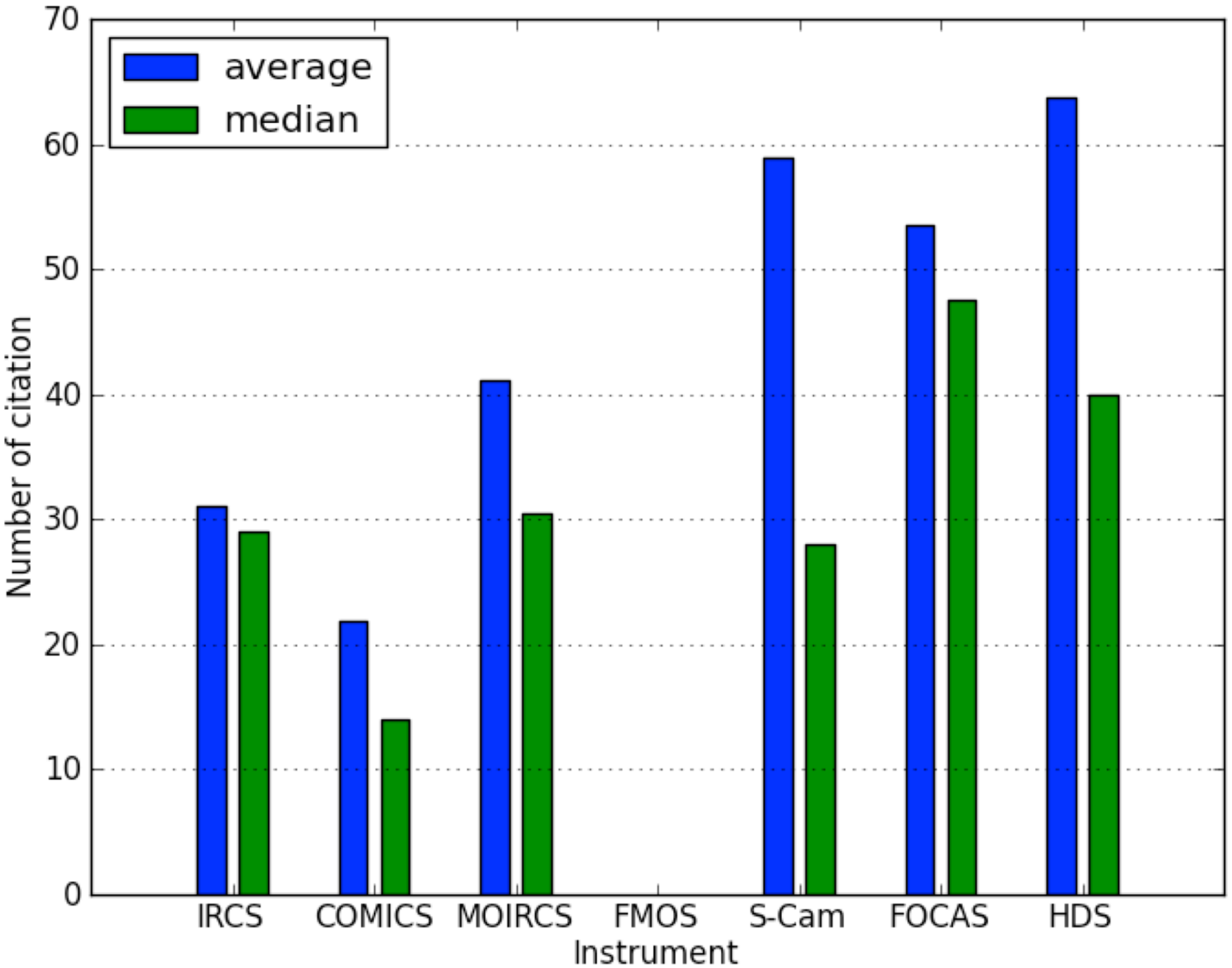
(Opt: ~10 papers / 20 nights, IR: ~5 papers / 15 nights)



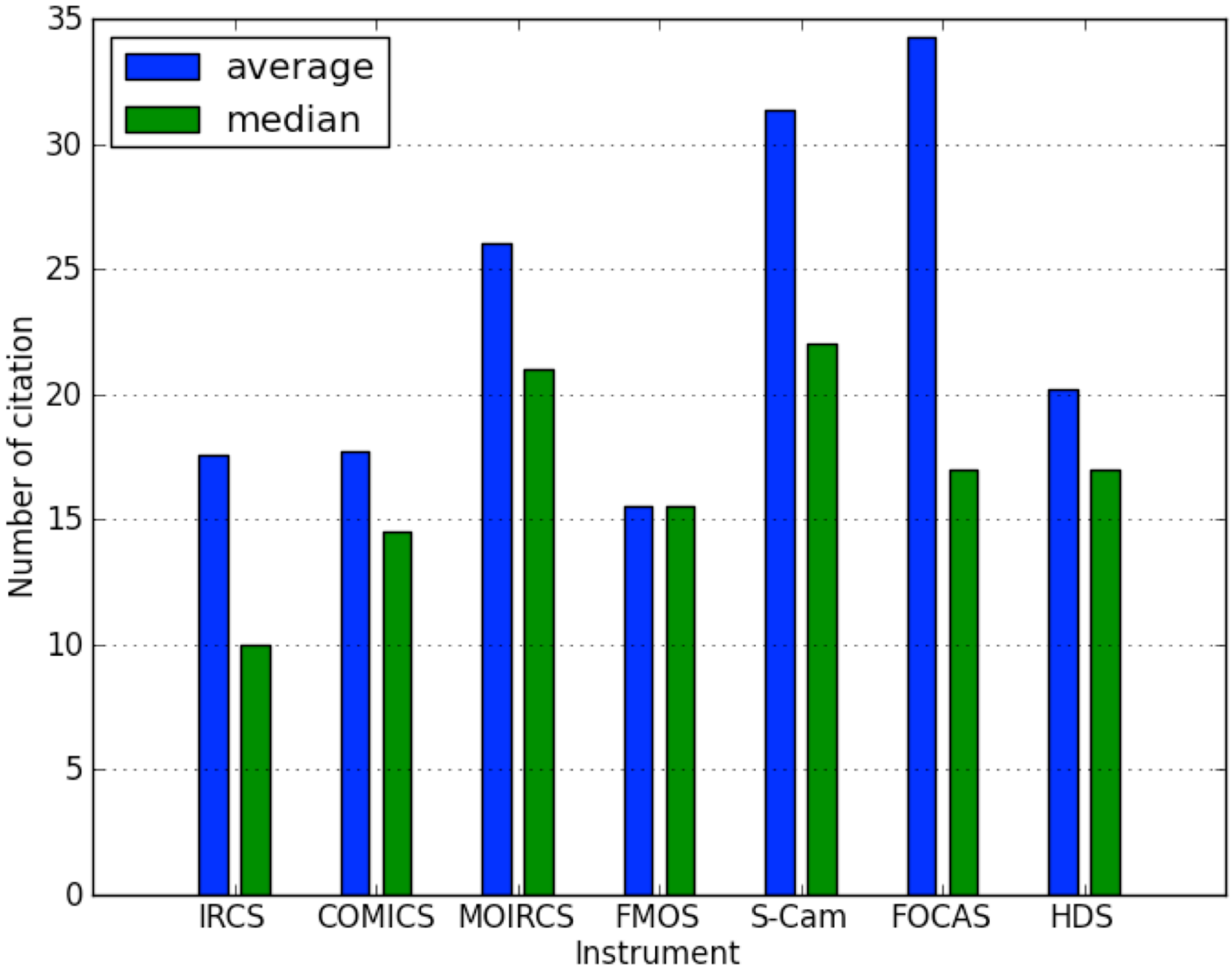
Citations, 2001-2004 (year of publication)



Citations, 2005-2008 (year of publication)



Citations, 2009-2012 (year of publication)



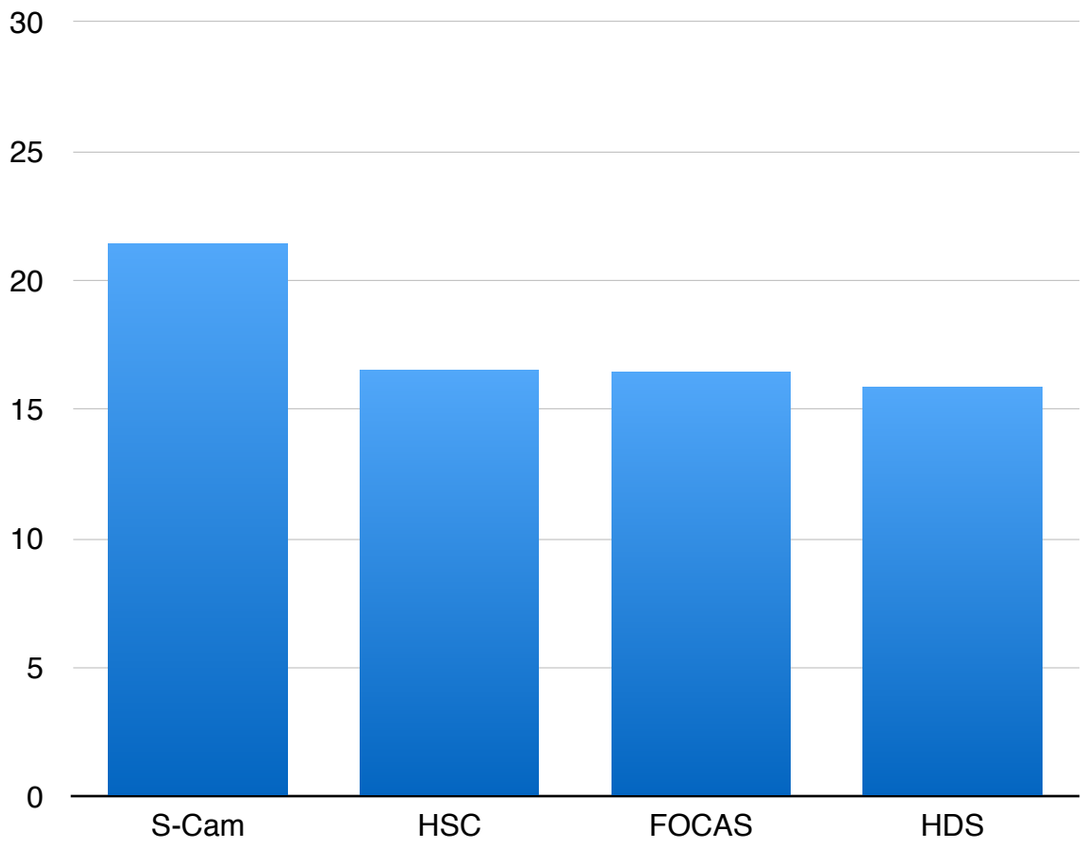
Instrument Radar Charts

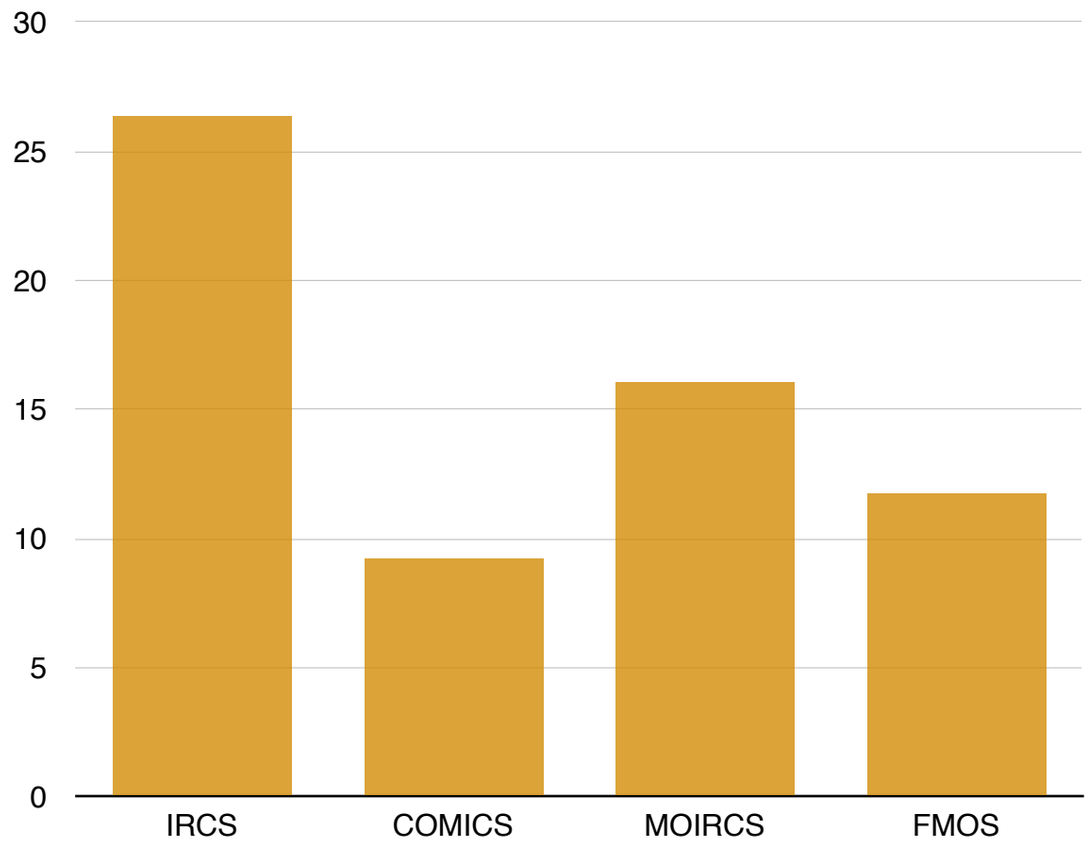
Instrument Radar Charts

- Demand - From number of submitted proposals from S10A to S14B
- Performance - From results of publication survey
- Competitiveness - From proposal referee scores (fraction of proposals with score >=6)
- Troubles - From nightlog reports from S10A - S14B
- Work loads - Day crews and instrument division / SA works
- Uniqueness - Existence of alternative instruments in Keck / Gemini / TAO

- Scores: 5 (good) - 1 (bad)

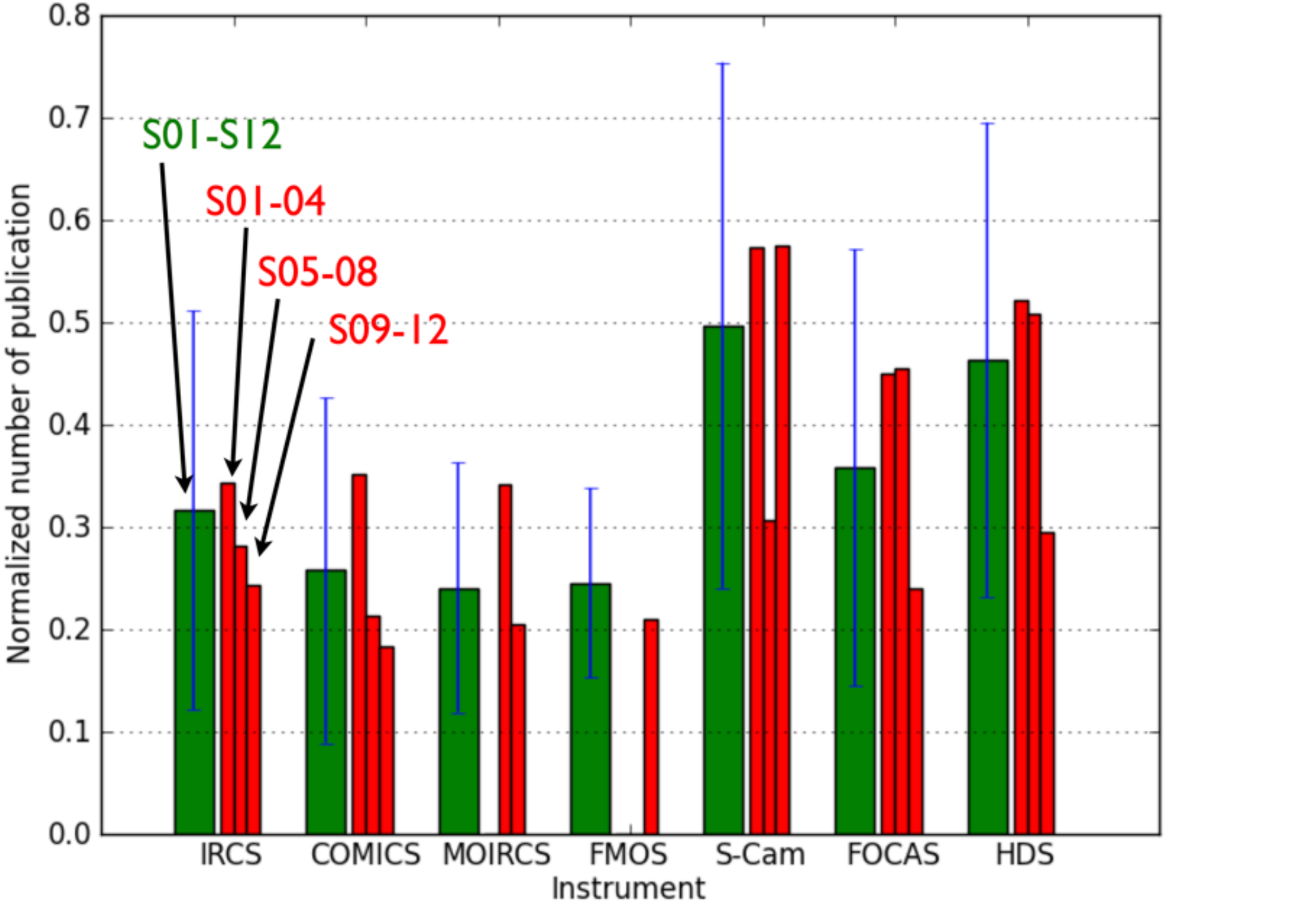
Number of Proposals, S10A - S14B (average)





Masaomi Tanaka-san

Publication/night (time evolution)



Imanishi-san

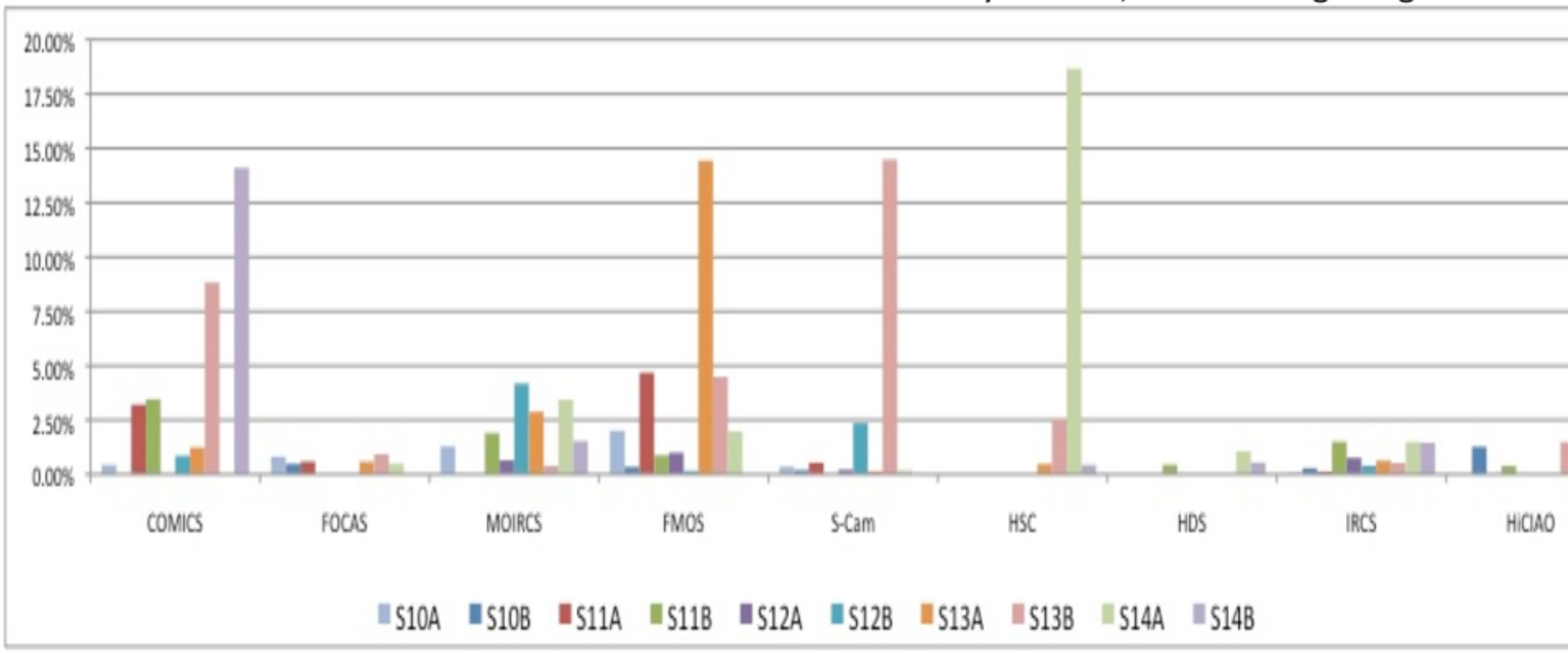
Competitiveness: Fraction of proposals with high referee scores (>=6)

- #1 group (~40%): HDS, SCam, Keck, HSC
- #2 group (~35%): FMOS, IRCS
- #3 group (~30%): MOIRCS, COMICS, FOCAS
- #4 group (~25%): Gemini

Imanishi-san

Instrument Troubles

By Nakano, based on night log



In addition to this,

One spectrograph was not used many times (2011-2013) for FMOS

One array was not used many times (2007-2013) for MOIRCS

Hattori-san

Regular Workload

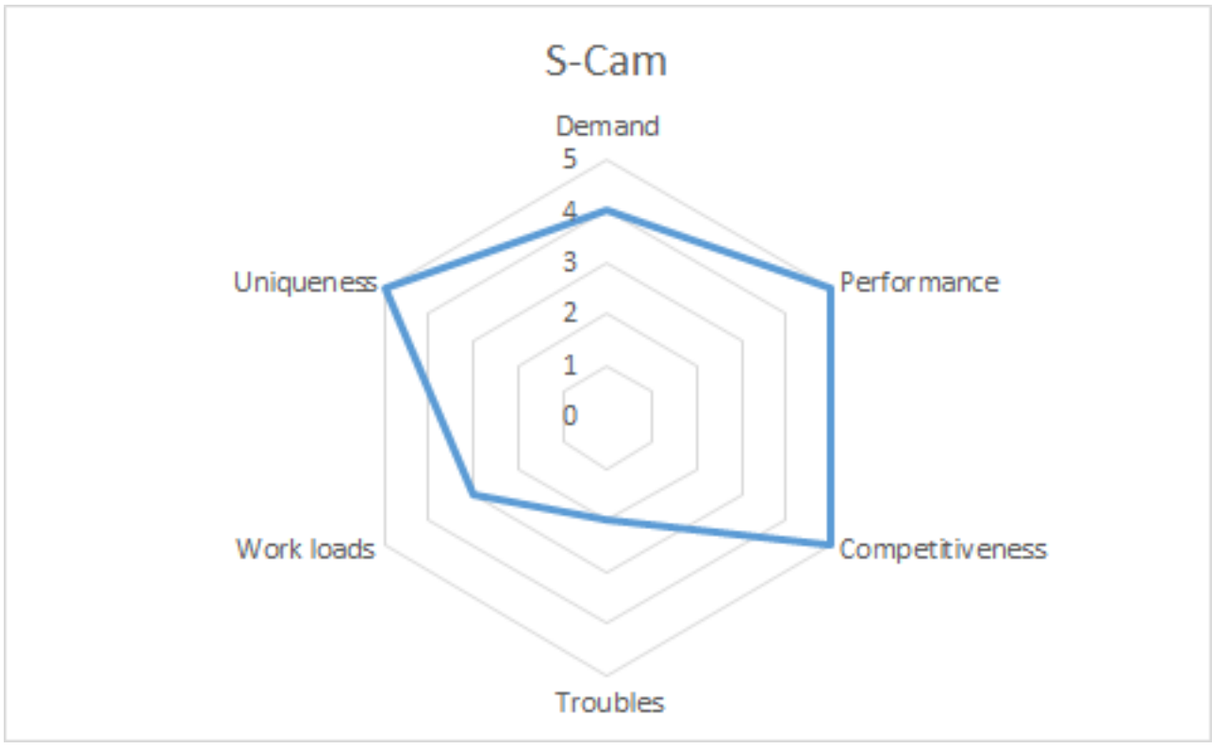
(FTE-Days/Year)

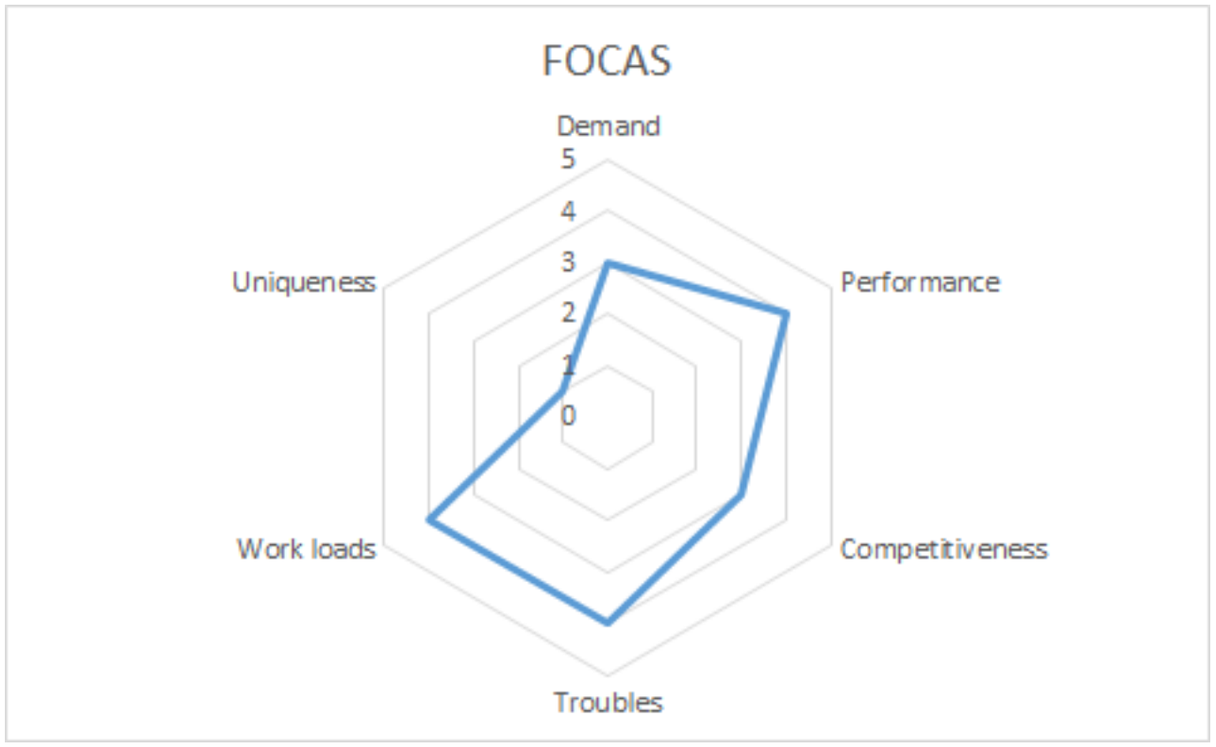
	IA/SA	ID tech	DC	Total
COMICS	3.3	10.5	30.6	44.4
FMOS	12.4	2.7	19.5	34.6
IRCS+AO	11.7	21.2	19.3	52.3
MOIRCS	15.8	44.8	33.3	94.0
FOCAS	12.4	2.7	19.5	34.6
HDS	10.6	0.5	22.1	33.2
SCam	20.8	7.0	36.0	63.9

* this does not include Prep work in Hilo and sudden troubles, which often occupies most man power (but very difficult to quantify).

Alternatives / Uniqueness

Subaru	Keck	Gemini	TAO
IRCS	OSIRIS NIRC2 NIRSPEC	GNIRS NIFS	
COMICS		TEXES	MIMIZUKU
MOIRCS	MOSFIRE	NIRI GSAOI FLAMINGOS-2	SWIMS
FMOS			
HSC			
FOCAS	LRIS DEIMOS ESI	GMOS	
HDS	HIRES		
HiCIAO		GPI	


S-Cam
Demand
5
4
3
2
1
0
Performance
Competitiveness
Troubles
Work loads
Uniqueness


FOCAS
Demand
5
4
3
2
1
0
Performance
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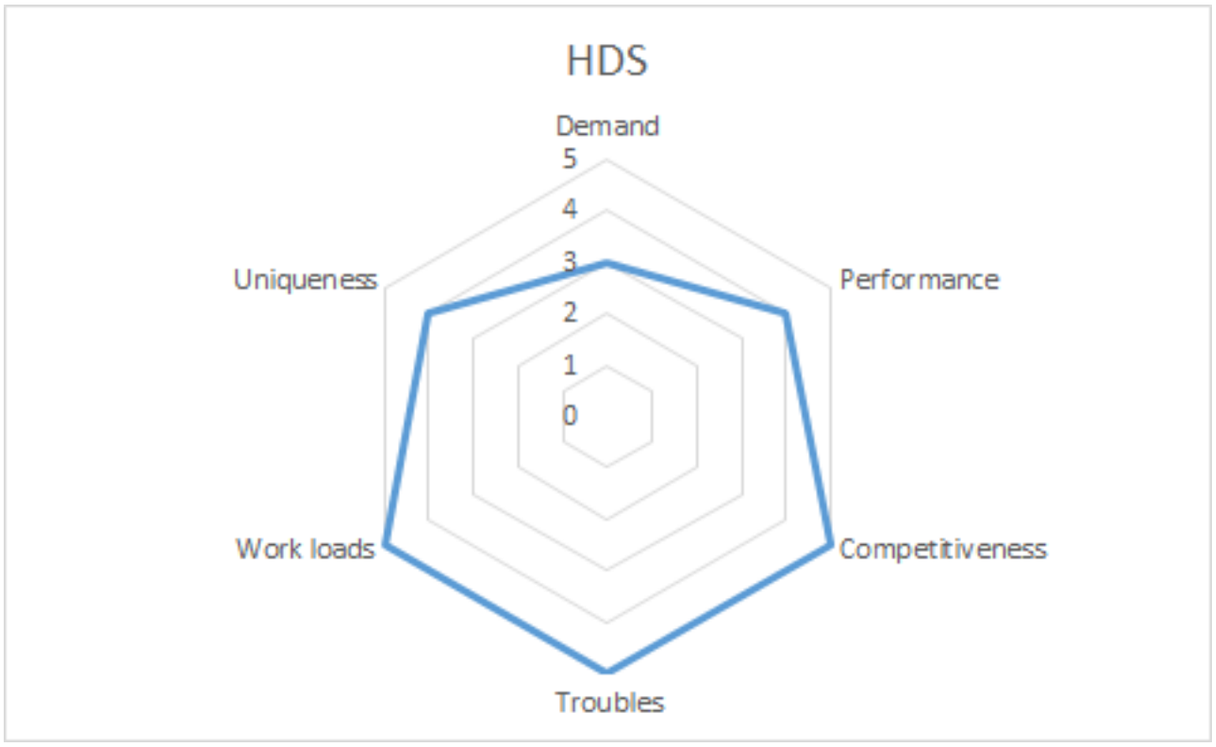
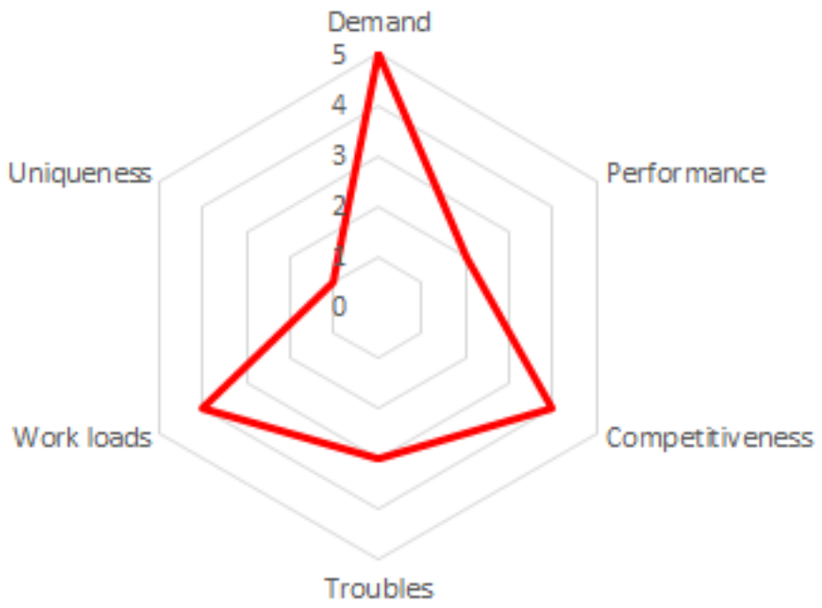
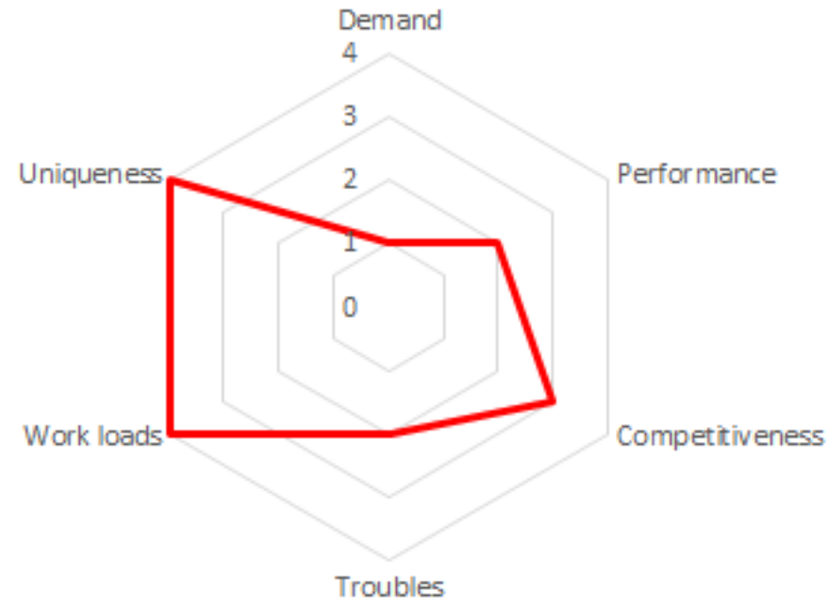
Work loads
Uniqueness


HDS
Demand
5
4
3
2
1
0
Performance
Competitiveness
Troubles
Work loads
Uniqueness

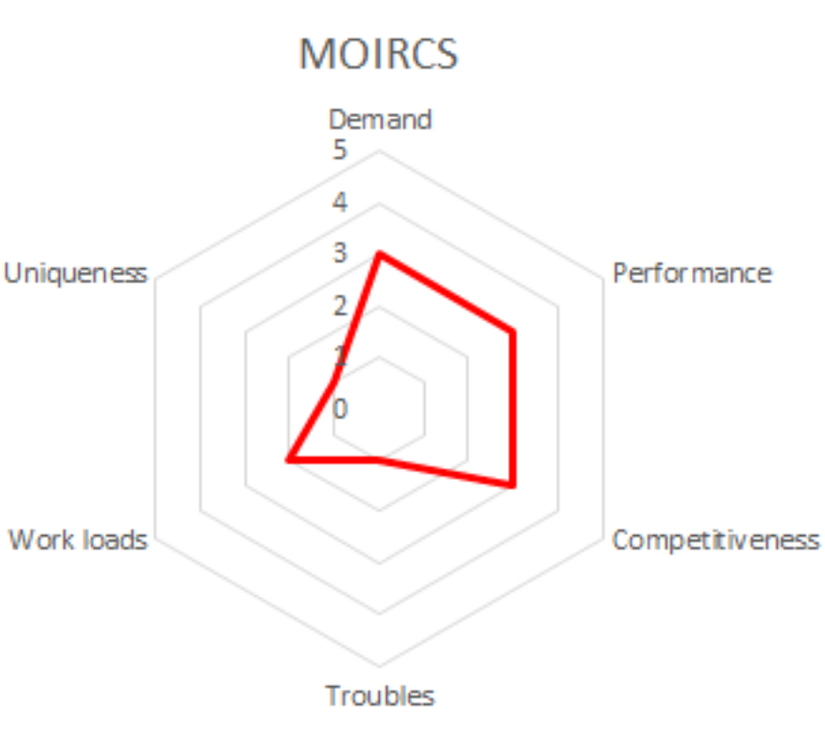
IRCS



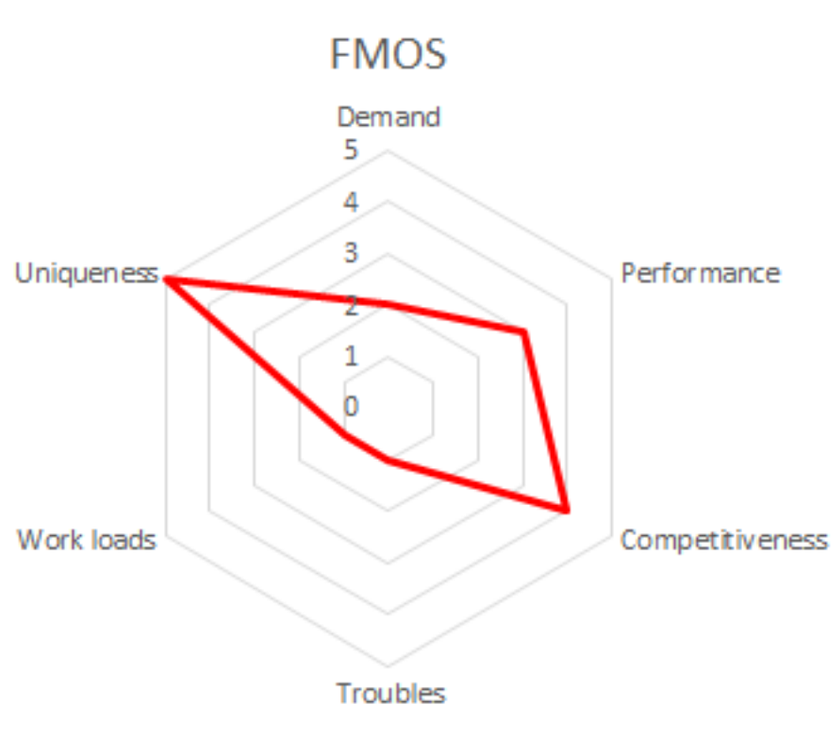
COMICS



MOIRCS



FMOS



Radar Chart Scores

	S-Cam	HSC	FOCAS	HDS	IRCS	COMICS	MOIRCS	FMOS
Demand	4	3	3	3	5	1	3	2
Performance	5		4	4	2	2	3	3
Competitiveness	5	5	3	5	4	3	3	4
Troubles	2	2	4	5	3	2	1	1
Work loads	3	1	4	5	4	4	2	1
Uniqueness	5	5	1	4	1	4	1	5
Score	24		19	26	19	16	13	16
Score (normalized)	0.96		0.80	1.07	0.78	0.64	0.52	0.62

Radar Chart Scores

	Score	Normalized Score
HDS	26	1.07
SCam	24	0.96
FOCAS	19	0.80
IRCS	19	0.78
COMICS	16	0.64
FMOS	16	0.62
MOIRCS	13	0.52

Instrument Plan Proposals from Subaru Telescope

Instrument Plan: Prime Focus

- HSC and PFS
- FMOS: will be decommissioned once PFS feasibility is confirmed and agreed
  - Continue operation at least till the end of S15B
  - We need to remove FMOS spectrographs from IR-TUE floor soon after decommission
  - OK to extend at least until March or April 2016?
- Suprime-Cam: will be decommissioned once HSC operation becomes stable
  - Continue operation at least till the end of S15B
  - Need to determine when to stop operation of SCam
  - Will be kept as a back-up of HSC

Instrument Plan: Nasmyth IR

- AO188+IRCS
  - High demand
  - Similar instruments available at Gemini and Keck but they are as old as IRCS
  - [Proposal] Keep IRCS+AO188+LGS operational at least in 2010s to maintain general AO capability - until GLAO commissioned?
- AO188+SCExAO+CHARIS, AO188 + IRD
  - SCExAO review in 2016

Instrument Plan: Nasmyth Opt

- HDS: Moderately high demand, Good publication performance, Stable operations
  - MOS capability commissioned in 2015
  - Uniqueness: higher throughput at shorter wavelength compared to Keck/HIRES and Gemini/CFHT/GRACES
- Discussions on transfer to other telescopes stalled
  - Gemini is planning GHOST (N or S undetermined)
  - Fibre: Lower throughput in shorter wavelength - would spoil HDS's strength
- [Proposal]
  - Keep HDS at least in 2010s
  - Decommission of Red Image Rotator to reduce loads for PA/MA
  - Recoating of Blue Image Rotator to boost HDS's strength
  - Operation with NsOpt for >1 week operations

Cs - PI-type instruments

- SWIMS (proposal):
  - Test in Hilo - Dec. 2015 - May 2016
  - Test at Summit - Sept. 2016 - Dec. 2016
  - Performance Verification - Dec. 2016 - March 2017 (?)
  - Science Observation - March 2017 (?) - June 2018
  - Transfer to TAO - June 2018-
- MIMIZUKU (proposal):
  - Test in Hilo - Feb. 2016 - July 2017
  - Test at Summit - Dec. 2016 - March 2017
  - Performance Verification - March 2017 - June 2017 (?)
  - Science Observation - June 2017 (?) - Sept. 2018
  - Transfer to TAO - Sept. 2018-

Instrument Plan: COMICS

- can be unique even in 2020s
- Publication performance is comparable to other IR instruments
- Small user groups, fewer allocated nights
  - Relatively frequent instrument troubles
- Commissioning of MIMIZUKU (Subaru PI-type instrument => TAO)
  - Southern hemisphere
- [Proposal]
  - Hibernate operation during commissioning / operations of MIMIZUKU
    - Possibly continue COMICS operation until MIMIZUKU performance verified?
  - Decommission or Resume after MIMIZUKU
    - PI-type instrument?

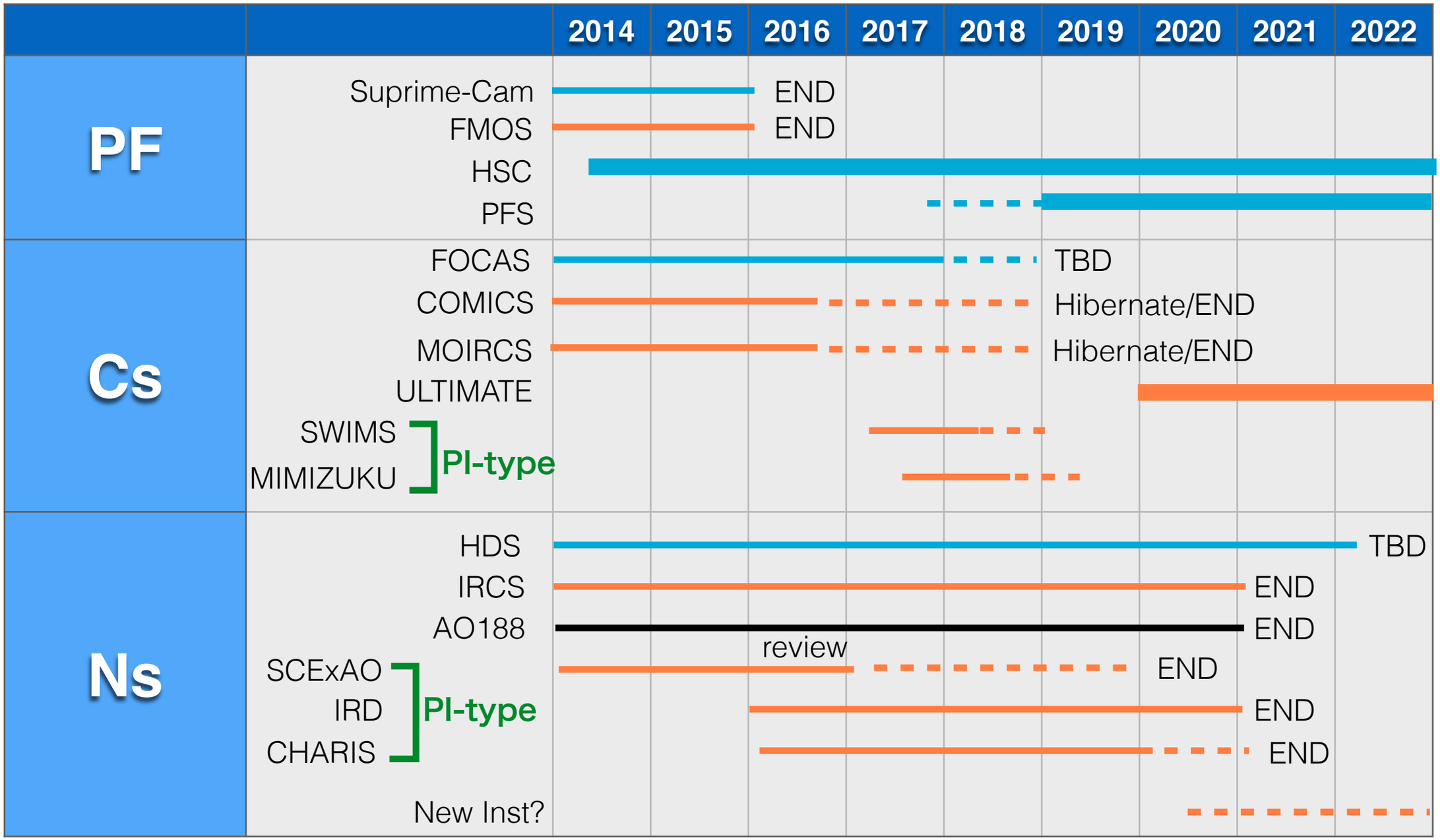
Instrument Plan: MOIRCS

- Frequent troubles - loss of nights, large workloads
- MOSFIRE has better sensitivity
- Upgrade (‘nuMOIRCS’) on-going
  - Detector replacement (H2 to H2RG), IFU, Stability improvement
- Possibility of ‘recycle’ as spectrograph for ‘Phase-0.5’ of ULTIMATE-SUBARU
- [Proposal]
  - Hibernate operation during commissioning / operations of SWIMS
    - Possibly continue MOIRCS operation until SWIMS performance verified?
  - Halt of continuation of upgrade (= decommission of MOIRCS) will be discussed.

Instrument Plan: FOCAS

- Similar instruments available at Gemini and Keck
  - need to check performance of LRIS polarimetry mode
  - provides very basic observation modes in optical wavelength
- Demand and publication performance are moderately high
- Use of CsOpt requires an extra Top Unit Exchange
- [Proposal]
  - Need further investigation on human resource requirements for PFS
  - Hibernate operations but keep FOCAS as a back-up instrument?

Timeline (proposal)



Discussion items

- Is this proposal acceptable for you?
- Acceptance of SWIMS and MIMIZUKU:
  - Hibernate / End of MOIRCS and COMICS
- The case without accepting SWIMS and MIMIZUKU?
  - Plan for FOCAS?
  - The case without ULTIMATE? How Subaru can be competitive in IR instruments?