LGS Activity at Subaru Telescope

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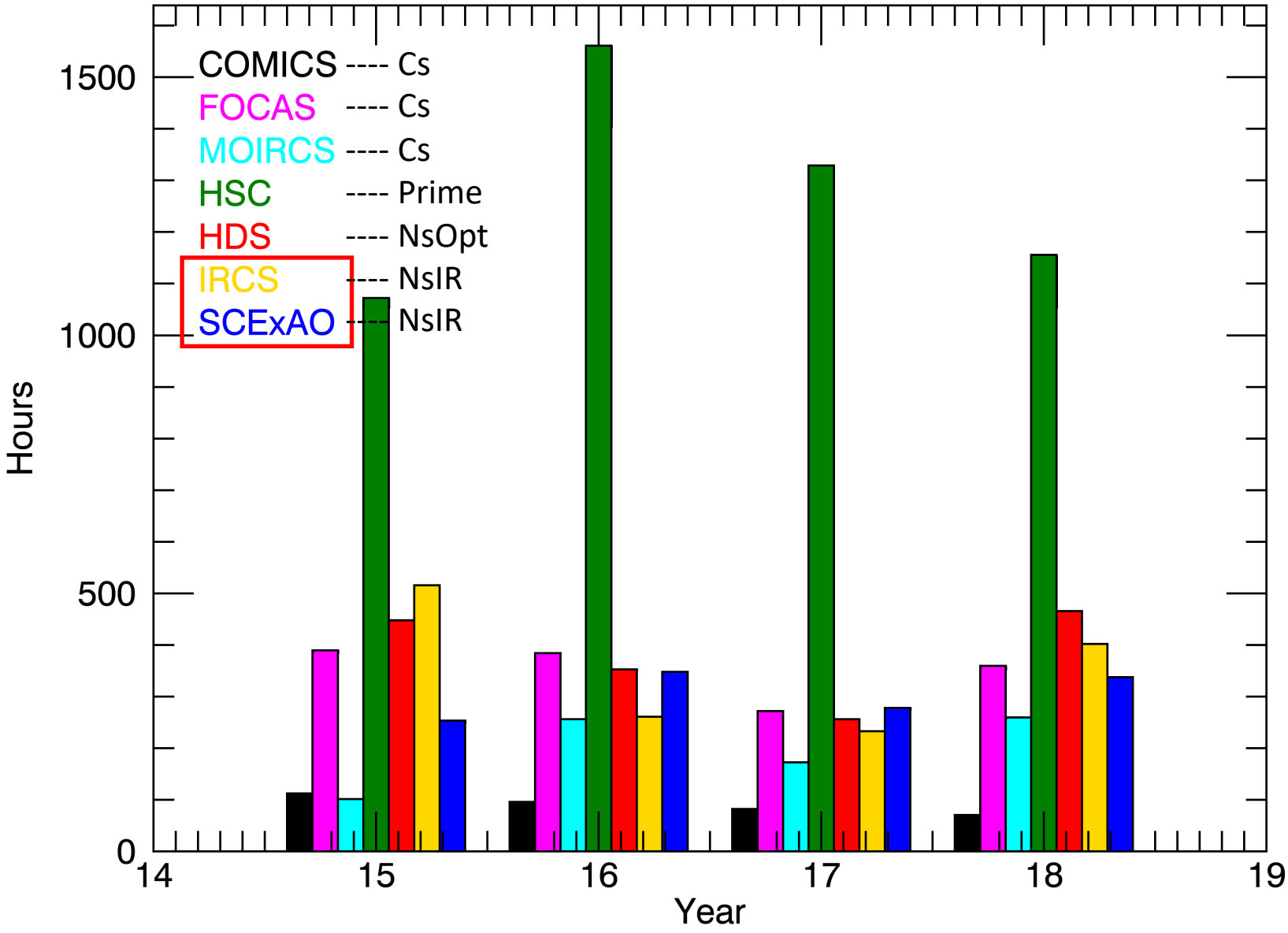
and all stuff members at Subaru Telescope

L4AO-13, 2019/06/08, Quebec City

Subaru Telescope

- At Mauna Kea
- D=8.2m monolithic primary mirror
- Prime/Cassegrain/NsIR/NsOpt foci
- 1 facility AO, 6 facility instruments, 2 PI instruments
- Famous for wide field capability: HSC at prime focus
- First light in 1999 → 20th anniversary this year!

Instrument Allocation



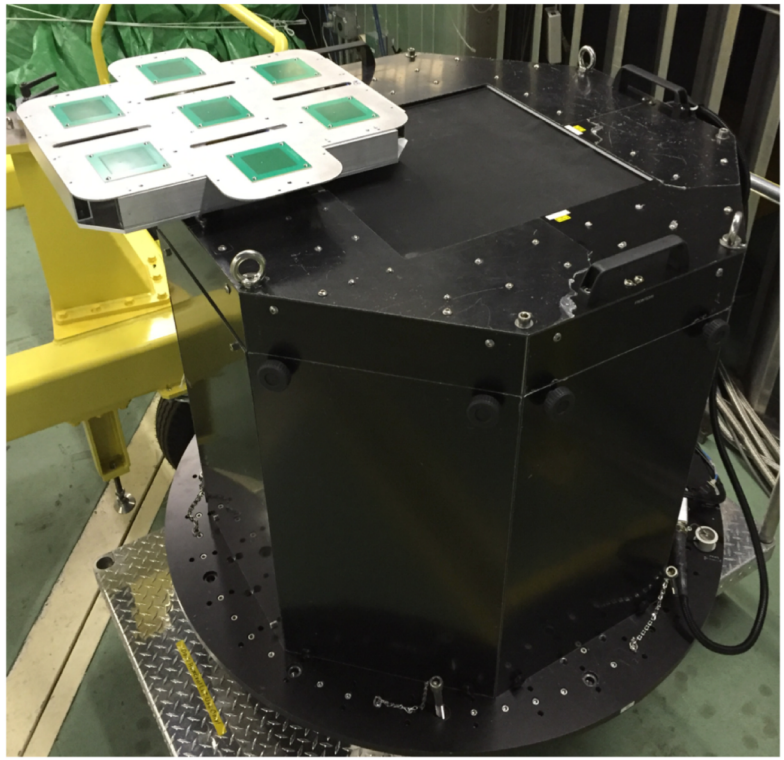
Subaru AO – AO188

- 188 element curvature-based wavefront sensor
- Open to public use in 2008
- added 1 LGS (sum-frequency mixing of Nd:YAG laser) in 2011
- Feeding AO corrected light to IRCS and IRD
- Used as a Woofer for SCExAO, an extreme AO for high contrast imaging

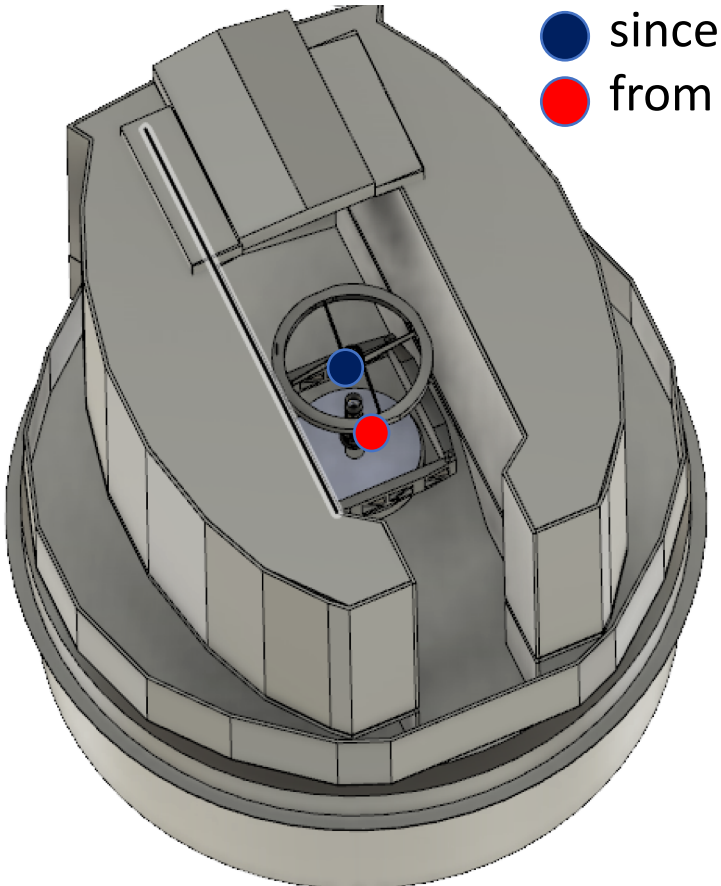
Laser activity summary

TBAD at Subaru

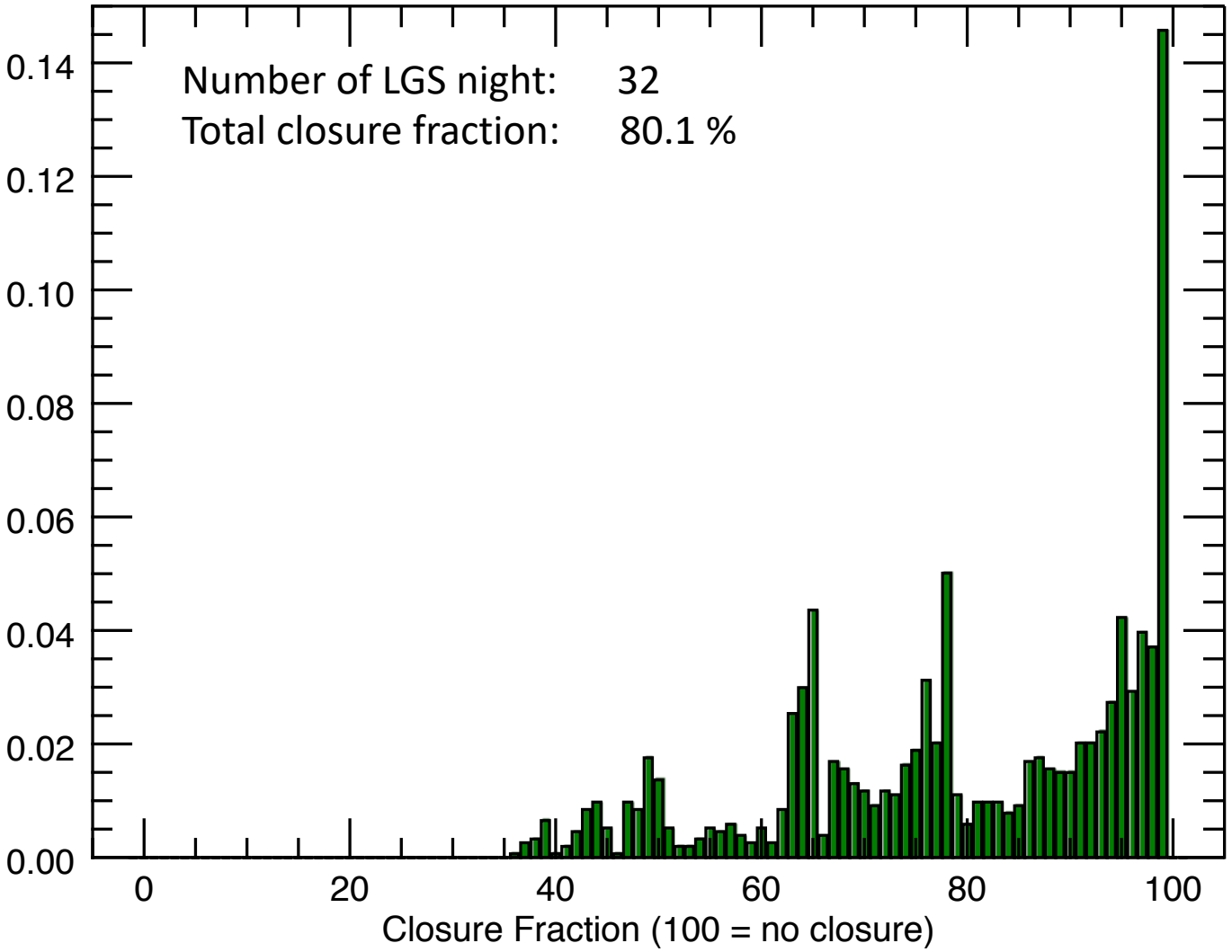
- Our TBAD system is ready for fly-over test
- Fly-over test was planned for March 2019 but canceled due to plane issue
- Because we will eventually want to move the location of TBAD from LLT to the edge of TR in multi-laser phase, we decided to postpone the test to 2020



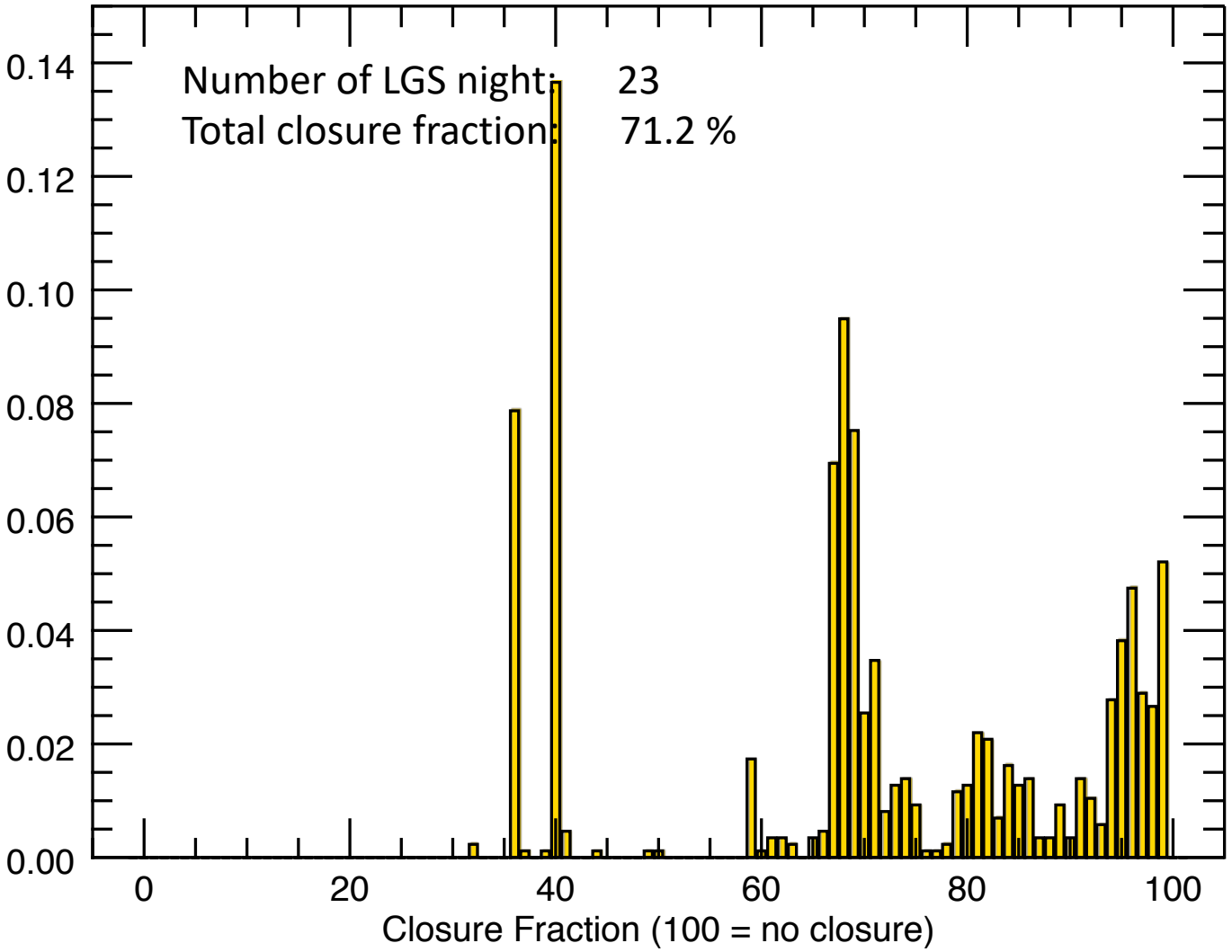
TBAD location:
since 2006
from 2020



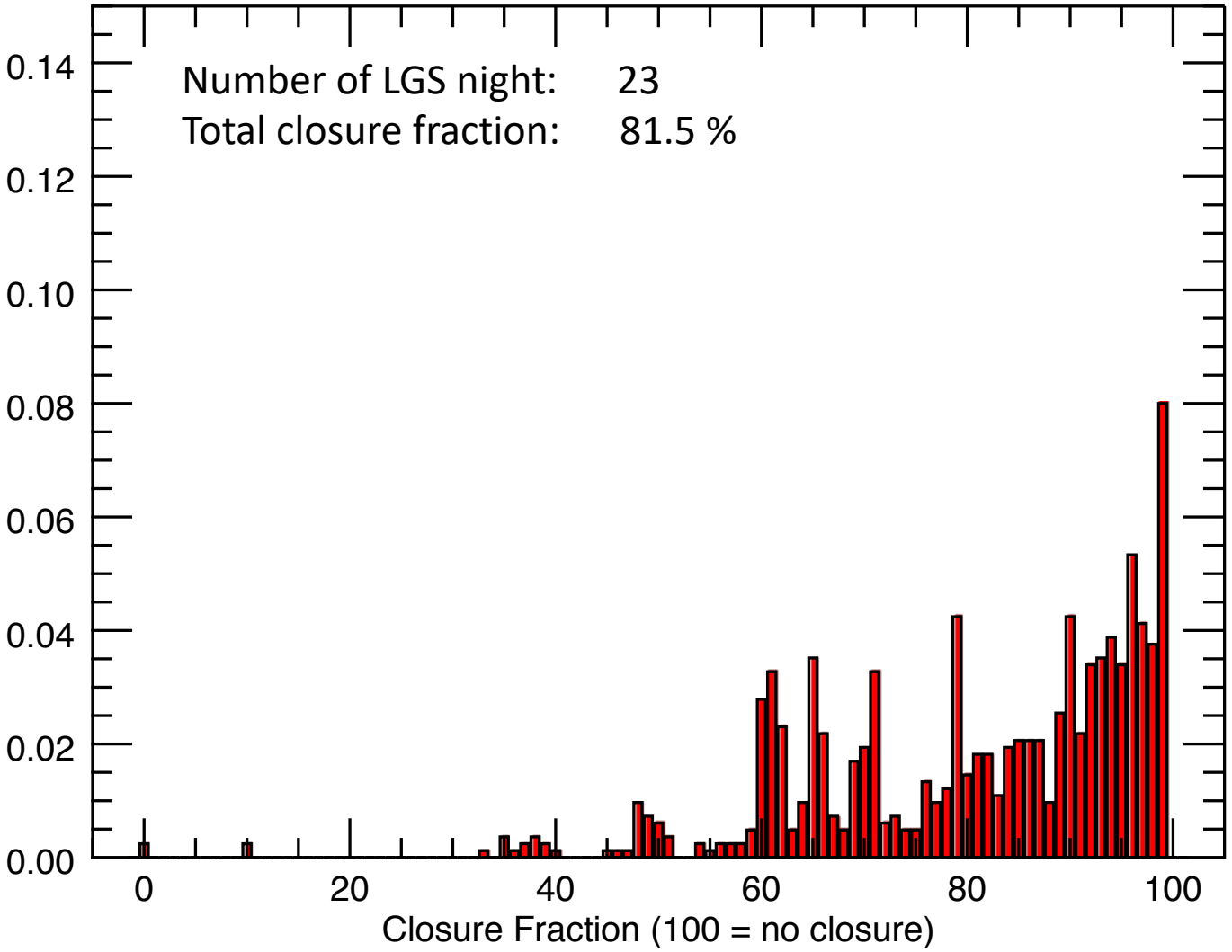
Satellite closure: 2015



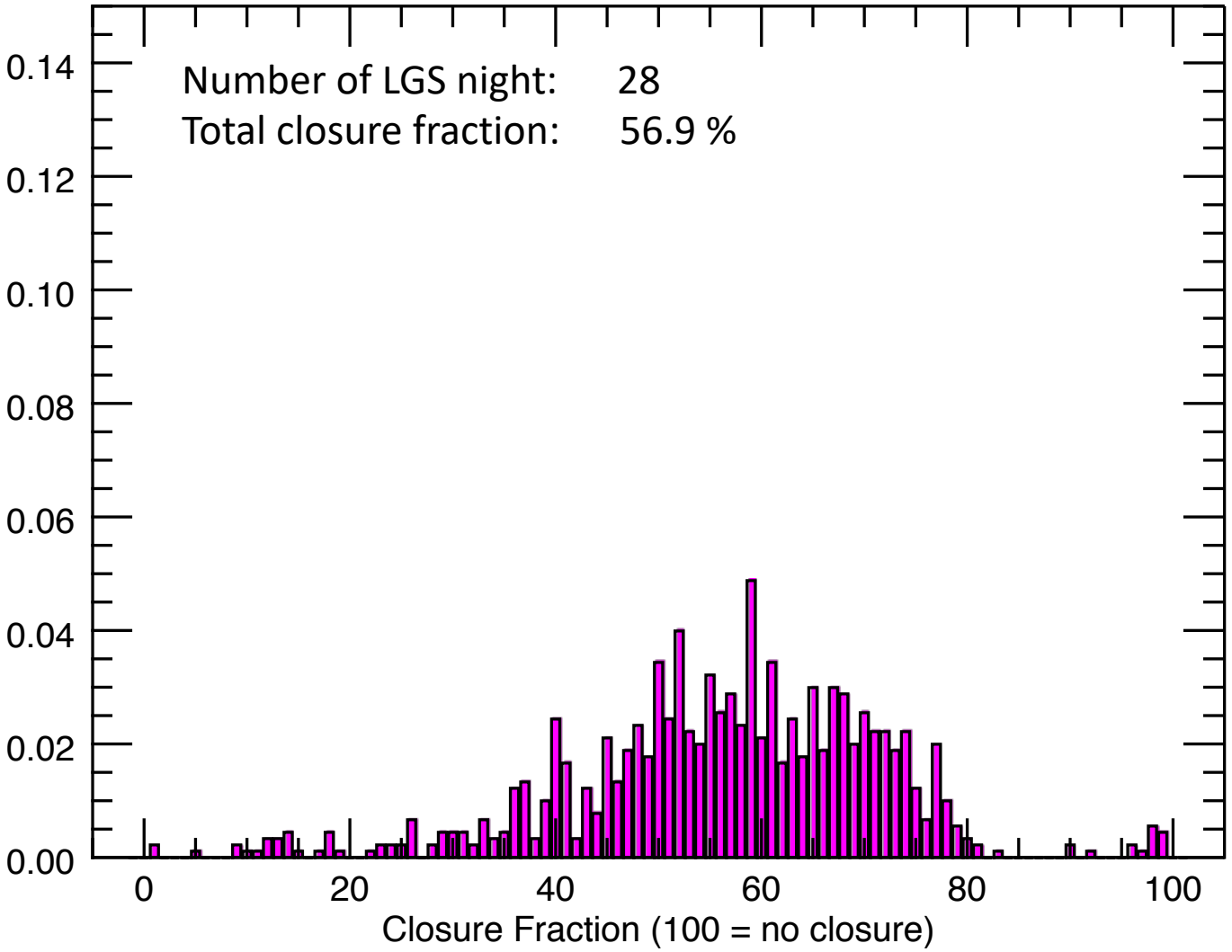
Satellite closure: 2016



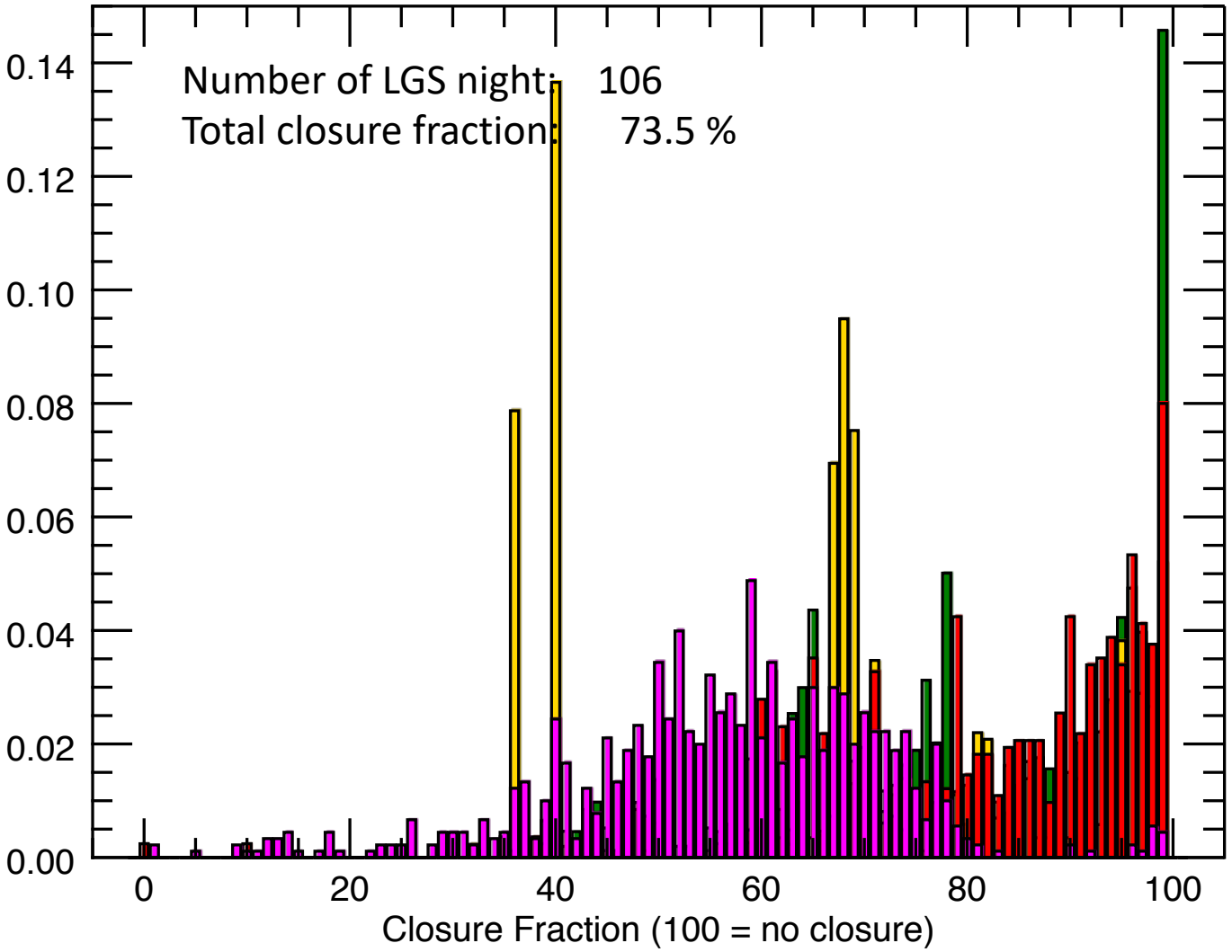
Satellite closure: 2017



Satellite closure: 2018

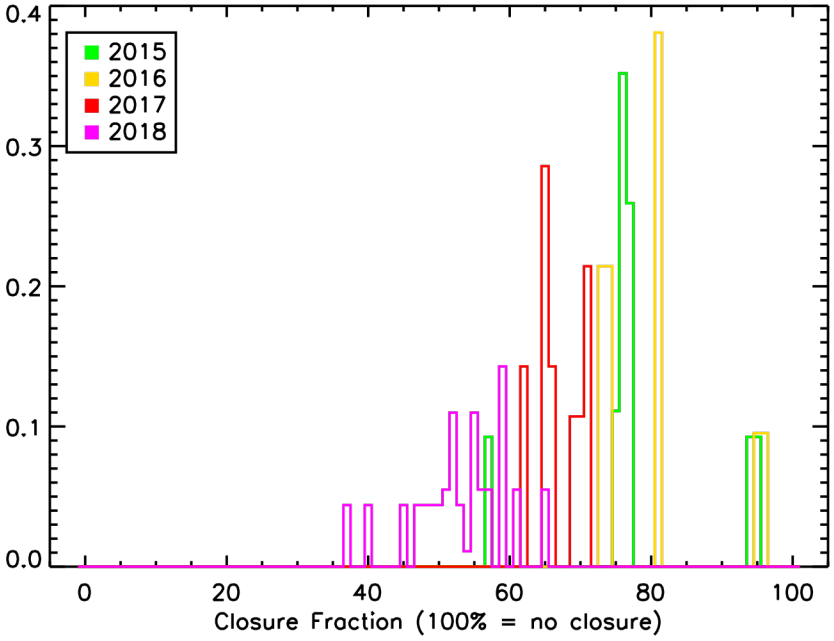


Satellite closure: 2015 - 2018

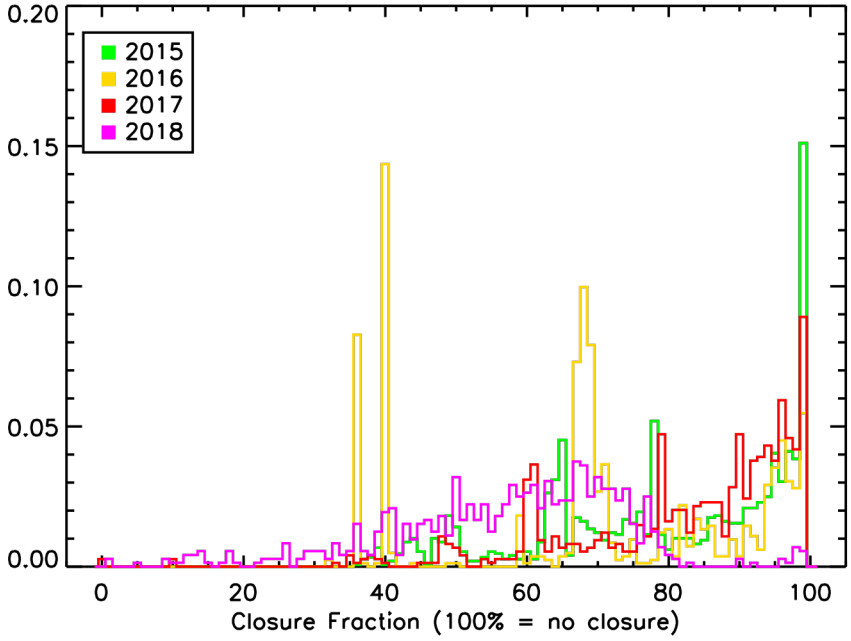


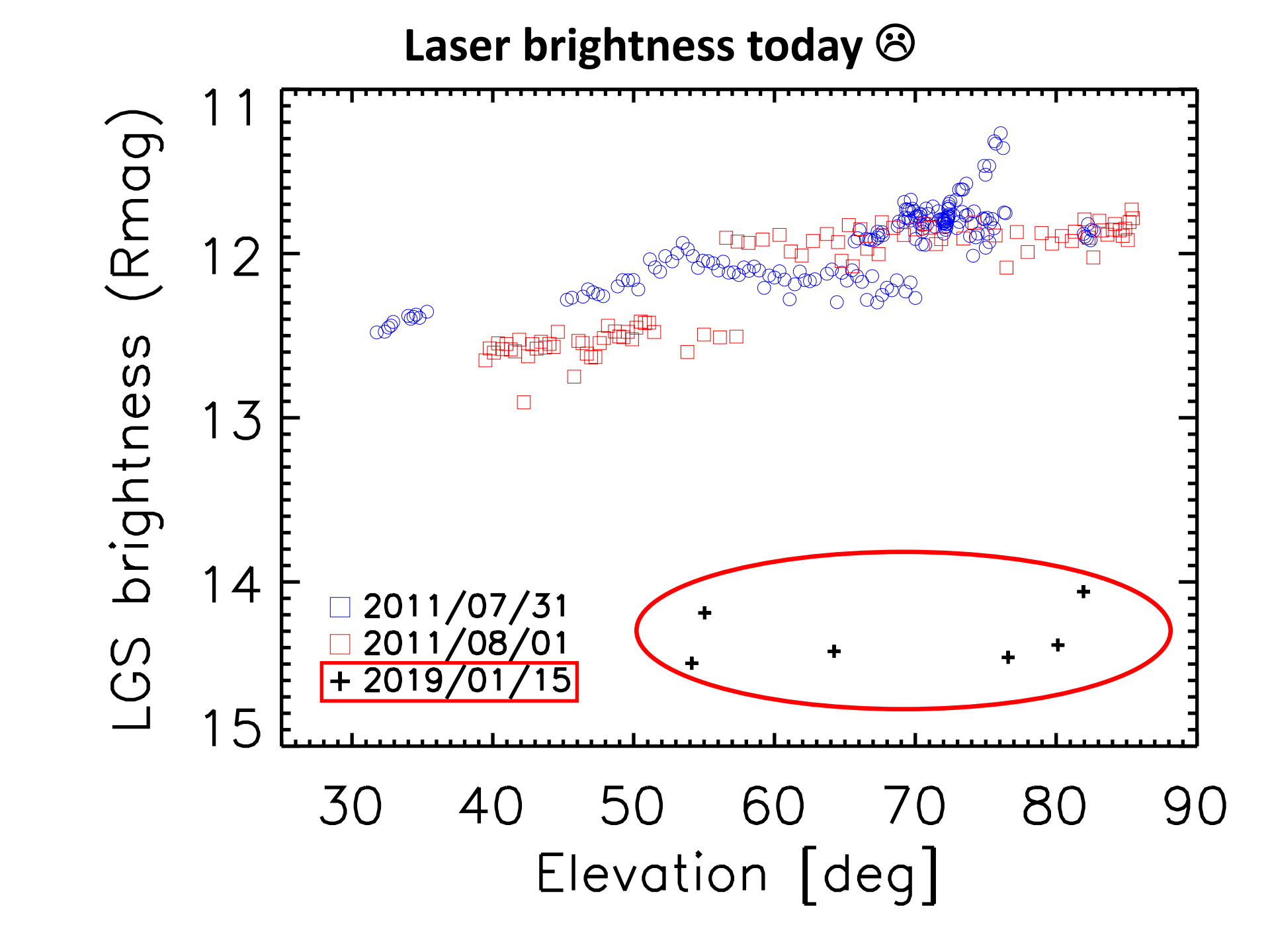
Satellite closure at GC: 2015 - 2018

< 60’



> 60’

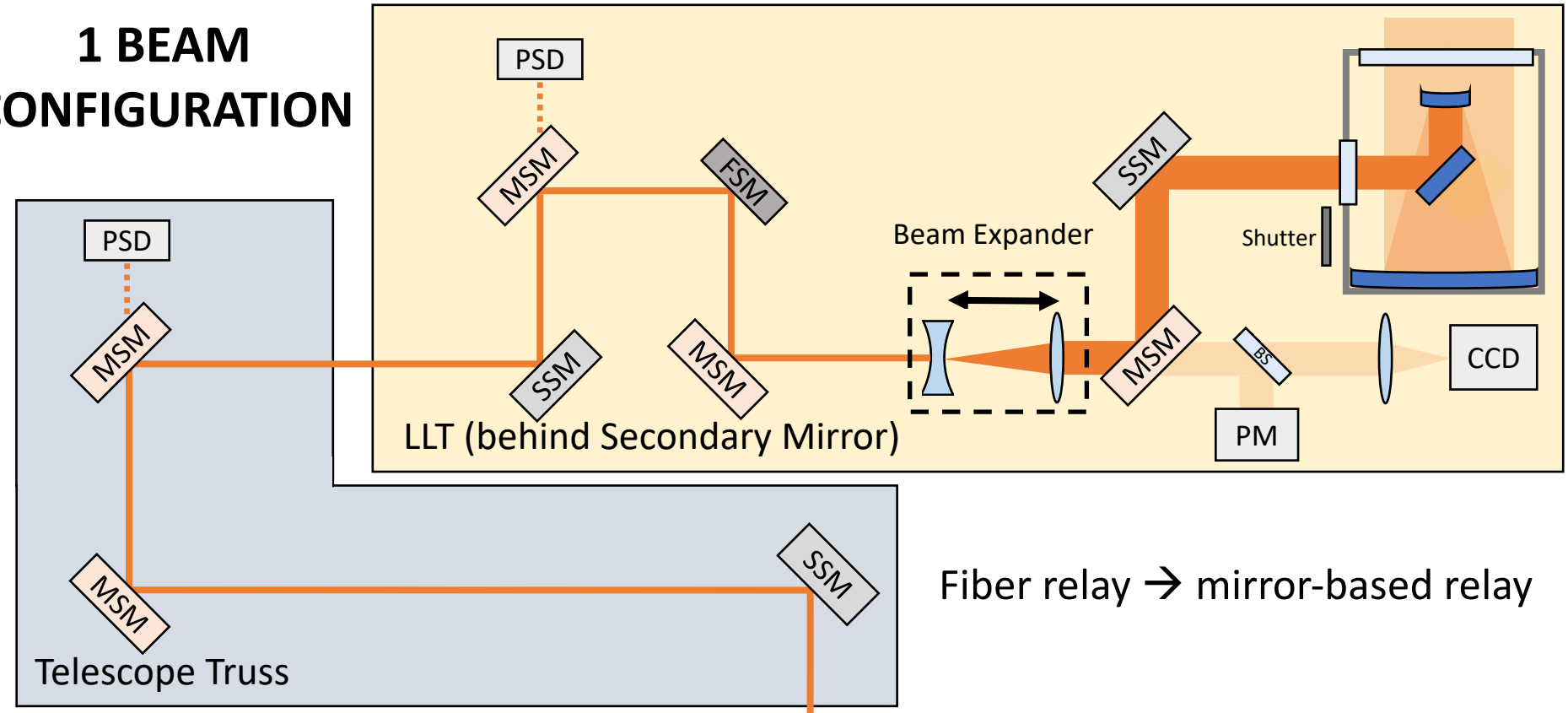



Laser brightness today ☹
LGS brightness (Rmag)
11
12
13
14
15
30
40
50
60
70
80
90
Elevation [deg]
2011/07/31
2011/08/01
2019/01/15

Laser upgrade plans at Subaru

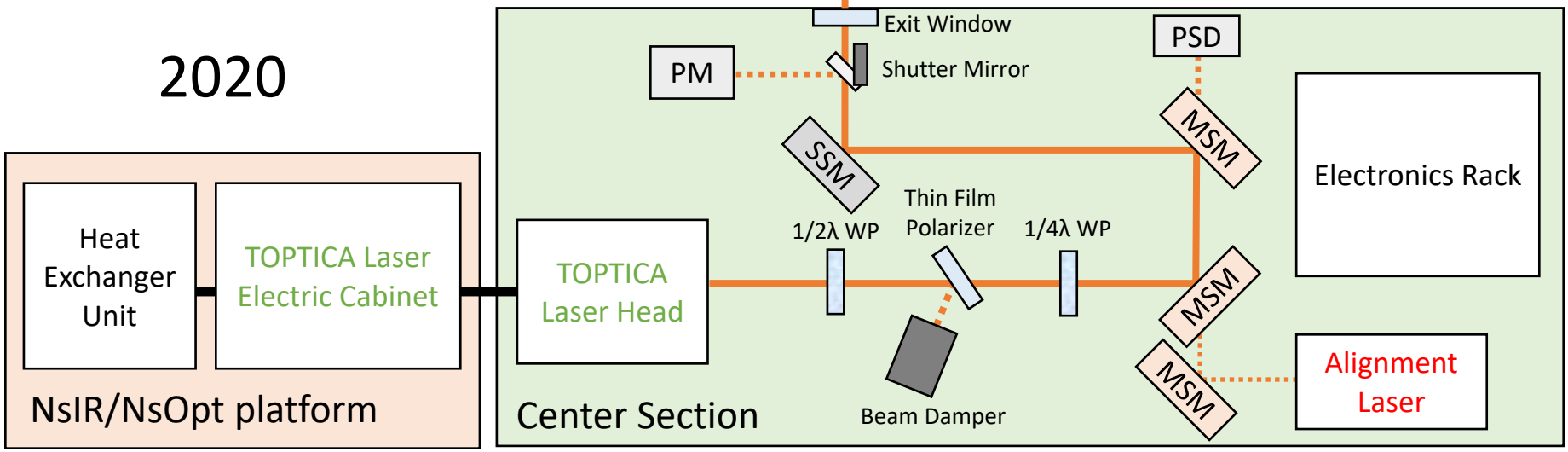
- Replace with TOPTICA laser and make LGS brighter
- Split to 4 beam for LTAO
- Two lasers, 4 beam for GLAO

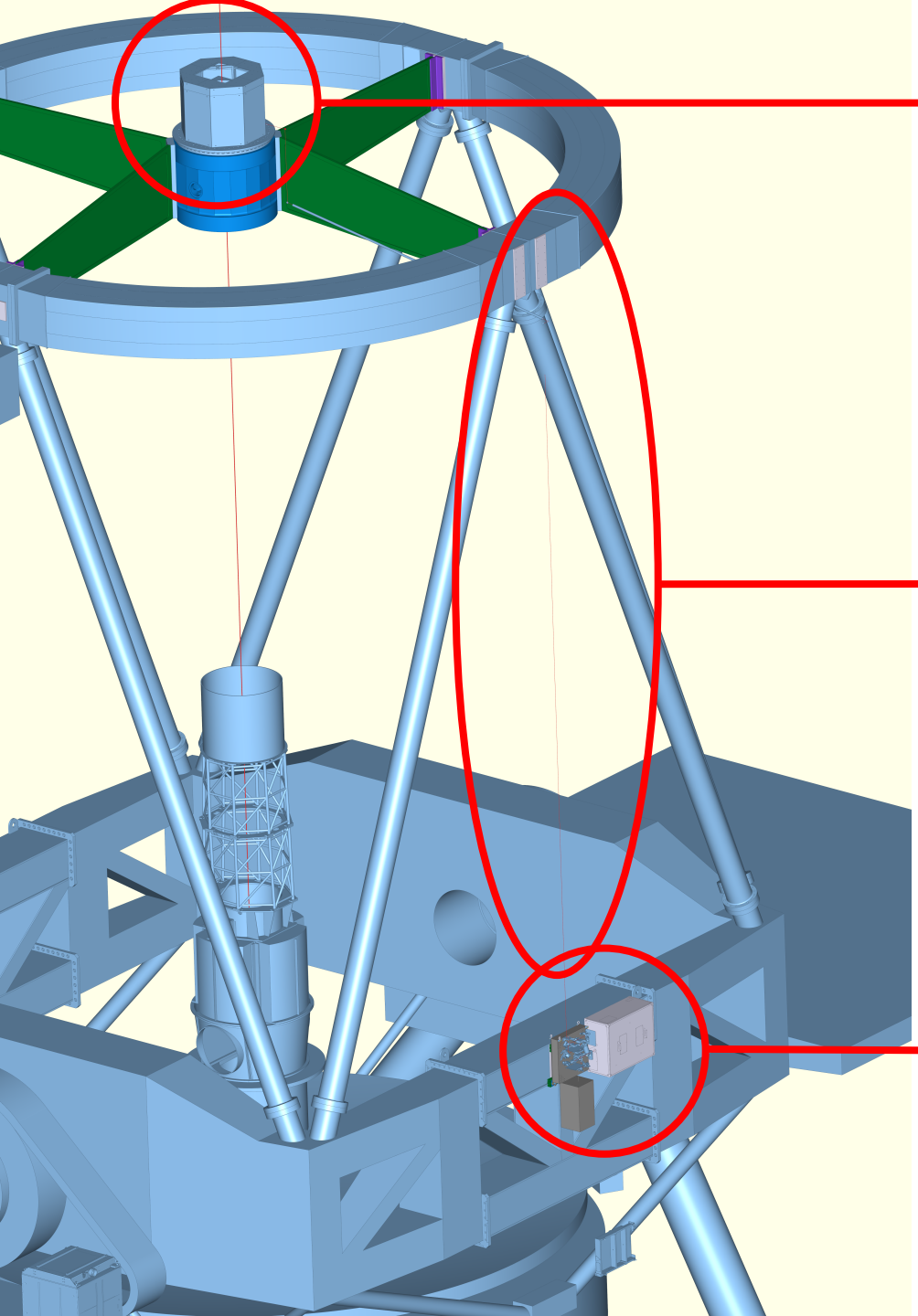
1 BEAM CONFIGURATION



Fiber relay → mirror-based relay

2020



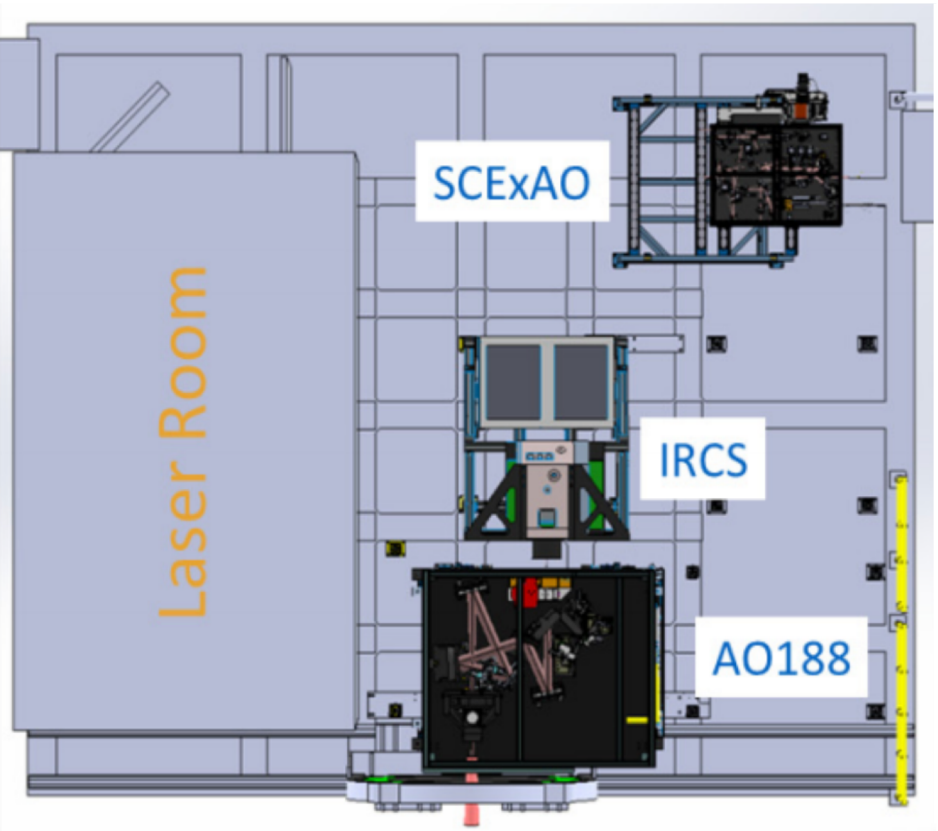

LLT
Truss
Center section

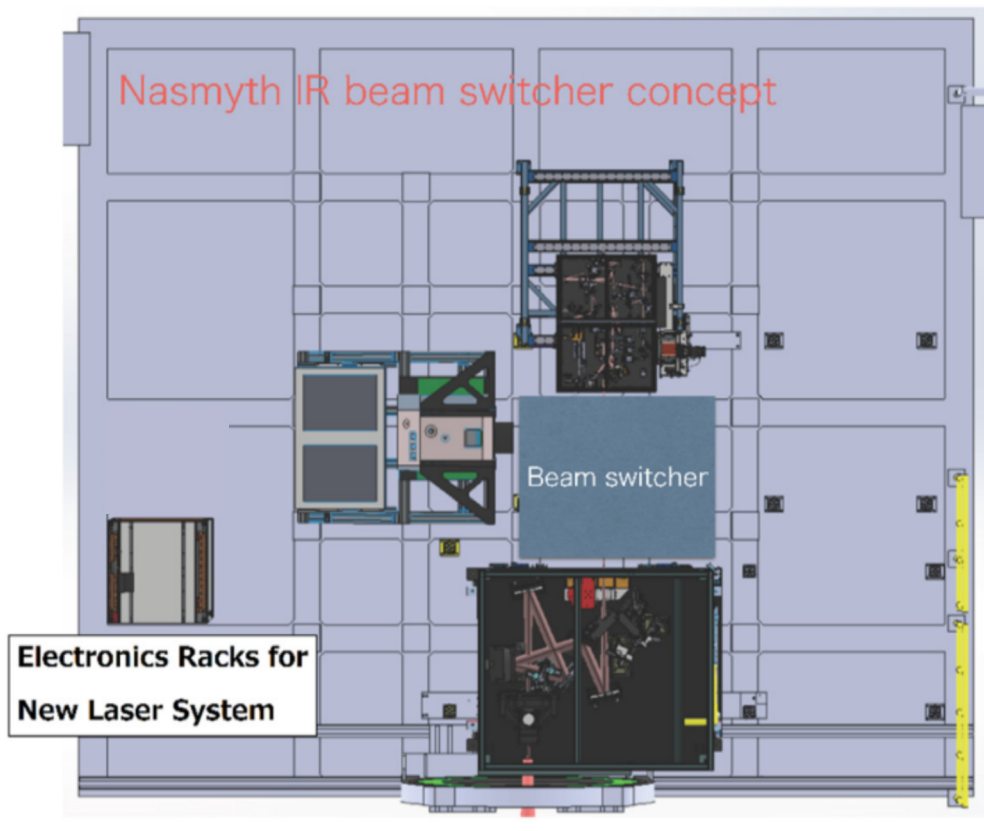
Remove big laser room from NsIR

→ about a refrigerator size TOPTICA electric cabinet

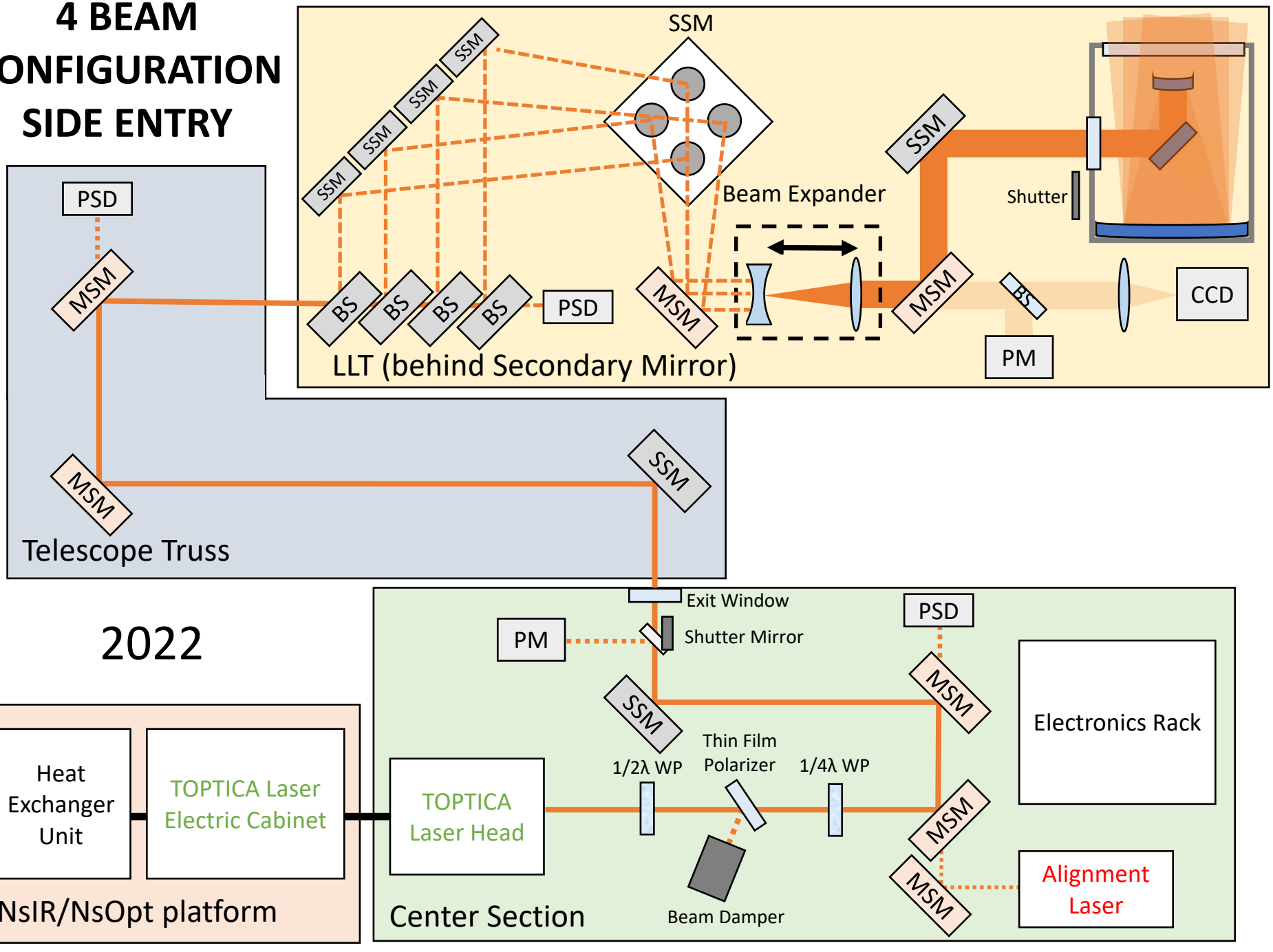
→ beam switcher behind AO188

→ easy instrument switch between IRCS + SCExAO

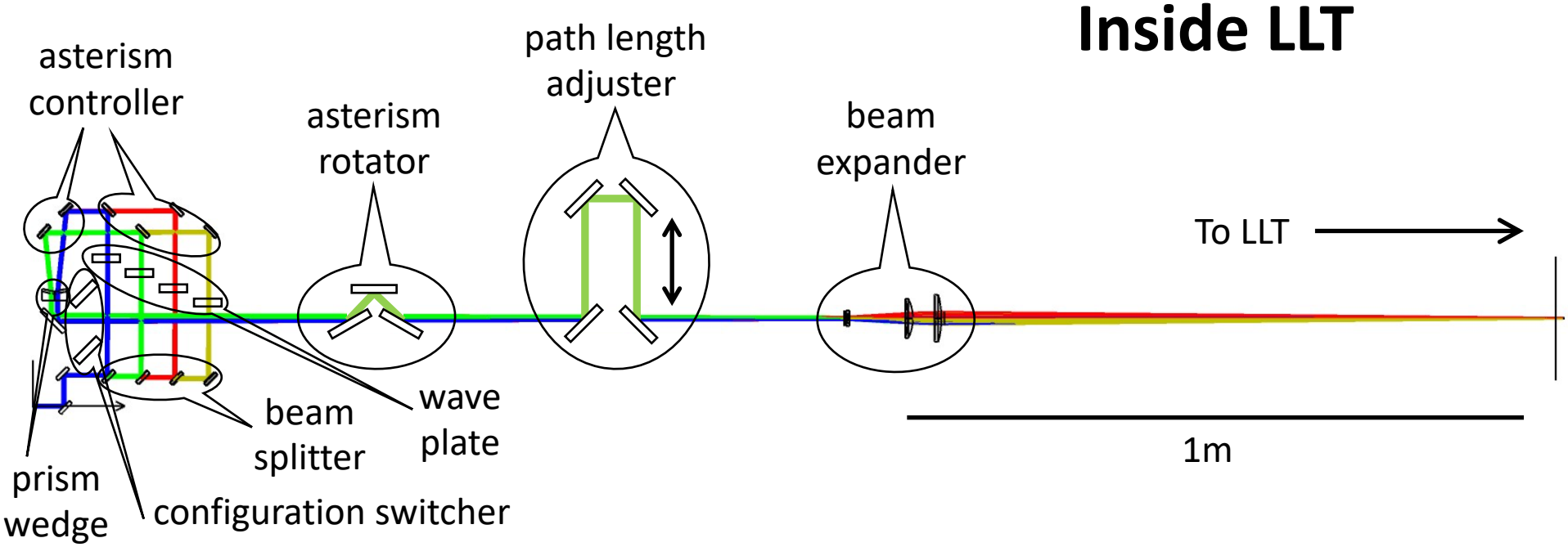




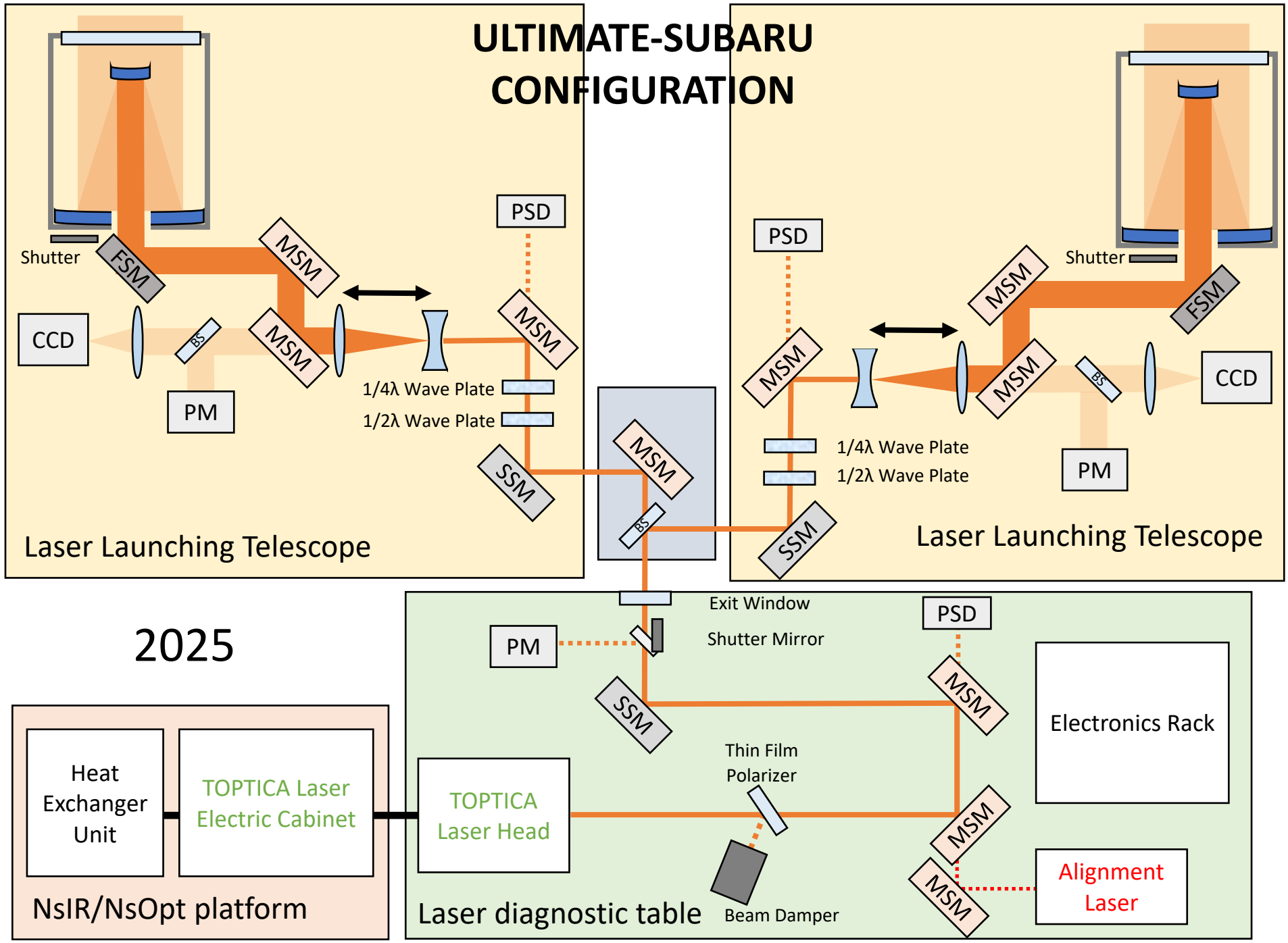
4 BEAM CONFIGURATION SIDE ENTRY

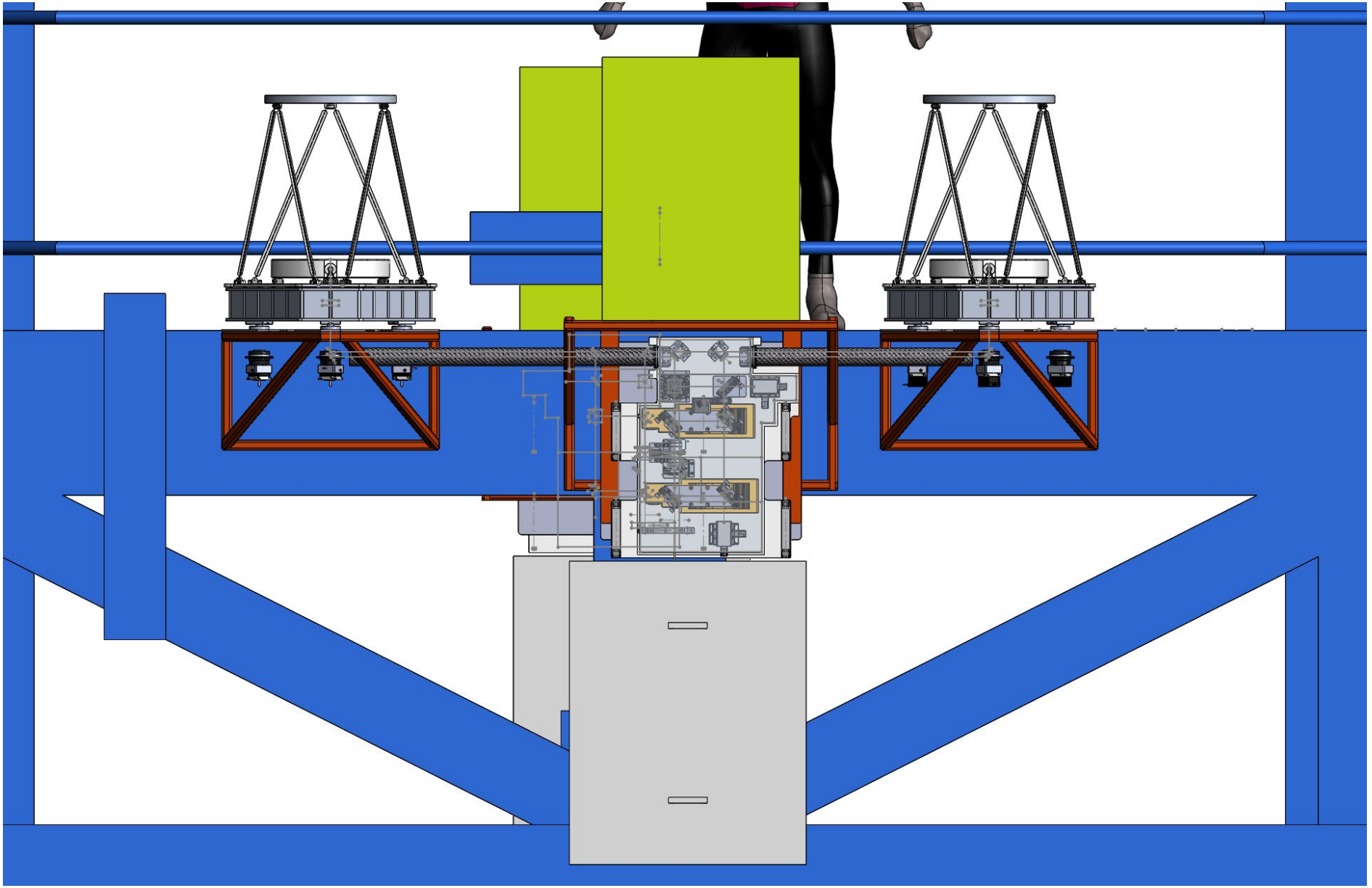


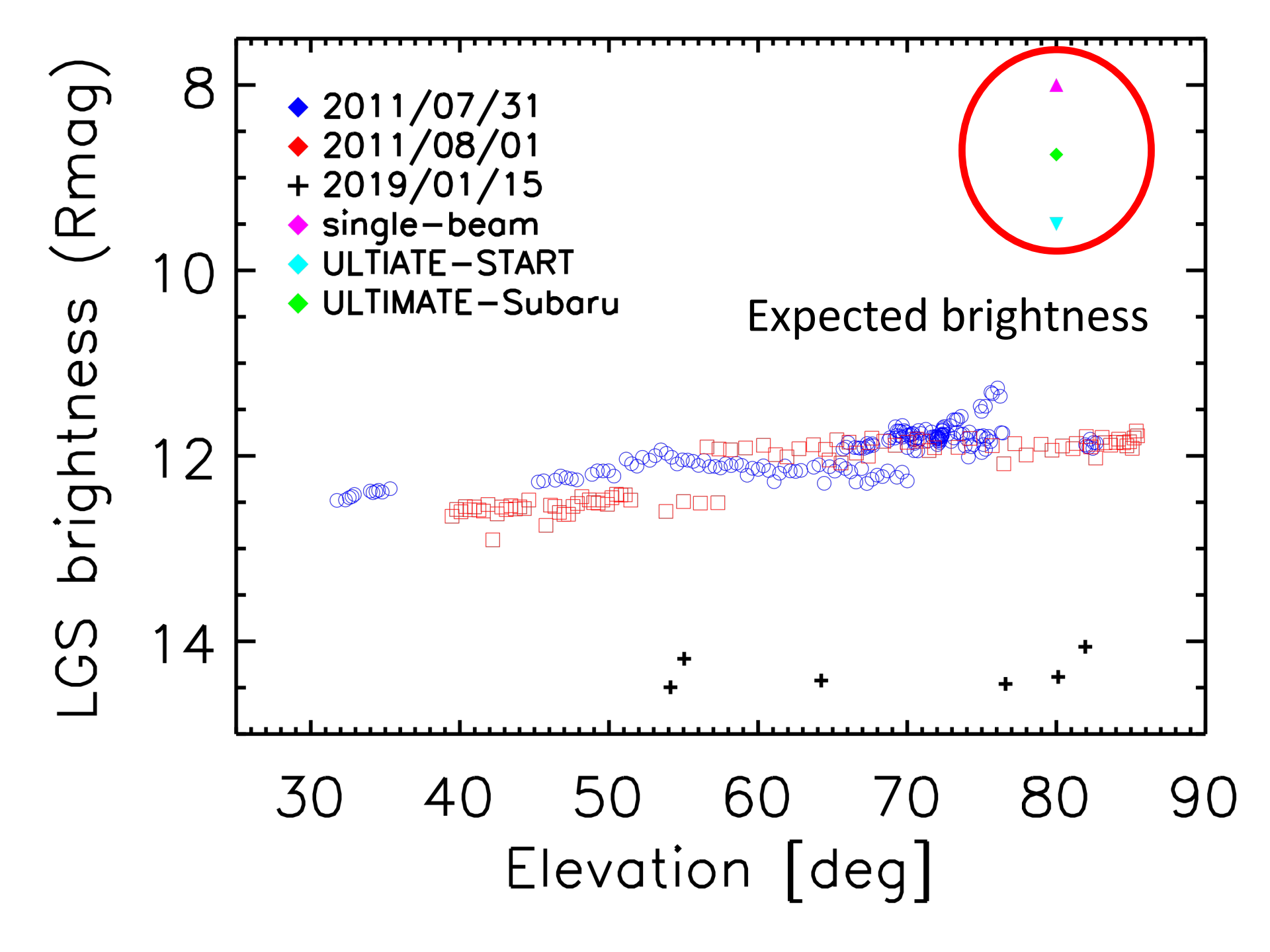
Inside LLT



COMPONENTS	DESCRIPTION
Configuration switcher	Switches 4- or 1-beam config. by inserting/removing mirrors
Beam splitter	Splits the laser into four beams
Wave plate	Controls polarization of each beam
Asterism controller	Adjusts separation of beams from 10” to 30” on sky
Prism wedge	Shortens optical path required
Asterism rotator	Rotates the position of beams on sky for WFSs
Path length adjuster	Adjusts optical path lengths for different beam separations
Beam expander	Expands all four beams by a factor of 6 at once


ULTIMATE-SUBARU
CONFIGURATION
Shutter
FSM
MSM
MSM
MSM
CCD
BS
PM
PSD
1/4λ Wave Plate
1/2λ Wave Plate
SSM
Laser Launching Telescope
MSM
BS
PSD
MSM
MSM
Shutter
FSM
MSM
MSM
BS
CCD
1/4λ Wave Plate
1/2λ Wave Plate
PM
SSM
Laser Launching Telescope
2025
Exit Window
Shutter Mirror
PM
PSD
SSM
MSM
Electronics Rack
Thin Film
Polarizer
Heat
Exchanger
Unit
TOPTICA Laser
Electric Cabinet
TOPTICA
Laser Head
MSM
MSM
Alignment
Laser
NsIR/NsOpt platform
Laser diagnostic table
Beam Damper




LGS brightness (Rmag)
8
10
12
14
30
40
50
60
70
80
90
Elevation [deg]
2011/07/31
2011/08/01
2019/01/15
single−beam
ULTIATE−START
ULTIMATE−Subaru
Expected brightness

Laser upgrade schedule

- July 13, 2019: Last LGS observation with the current laser
- End of July 2019: Remove laser from NsIR
- Early 2020: First light in single-beam configuration
- 2020B: Open to public use
- 2022: 4-beam configuration for LTAO (ULTIMATE-START)
- 2025: ULTIMATE configuration for GLAO (ULTIMATE-Subaru)