Which strategy for AO at LBTO in the 10+ years to come?

C. Veillet – J. Christou

Which strategy for AO at LBTO in the 10+ years to come?

C. Veillet – J. Christou

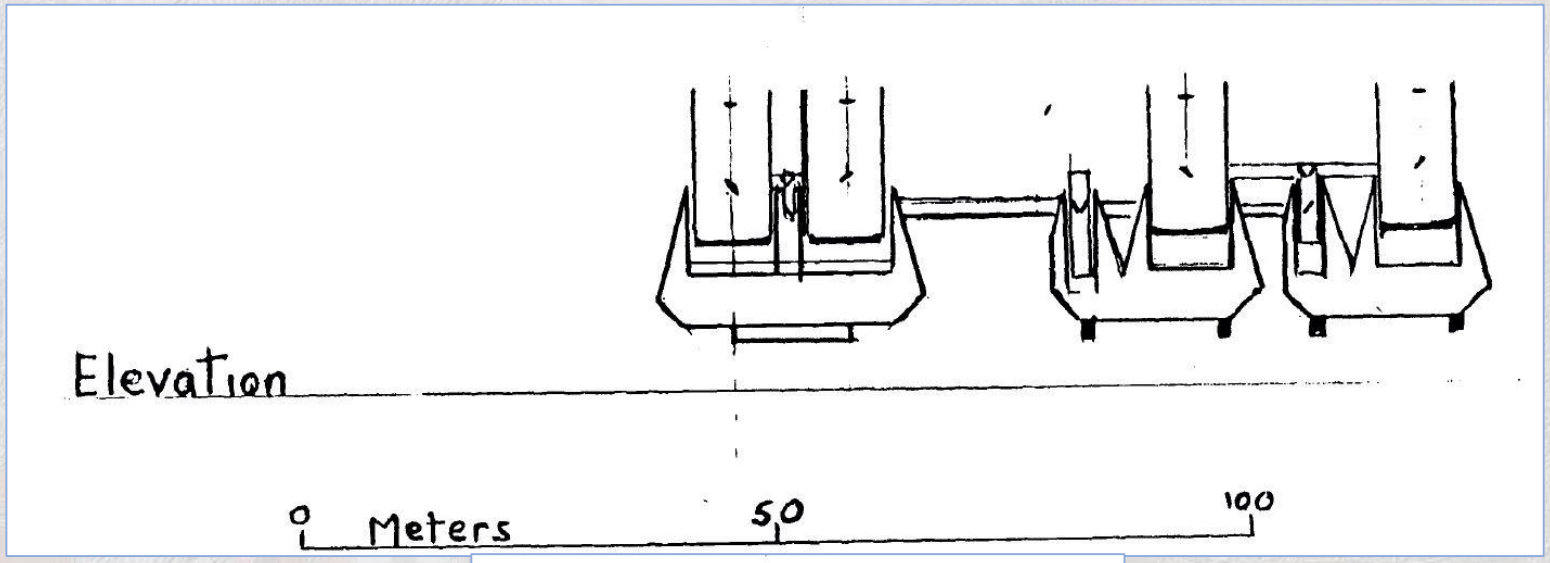
About LBTO

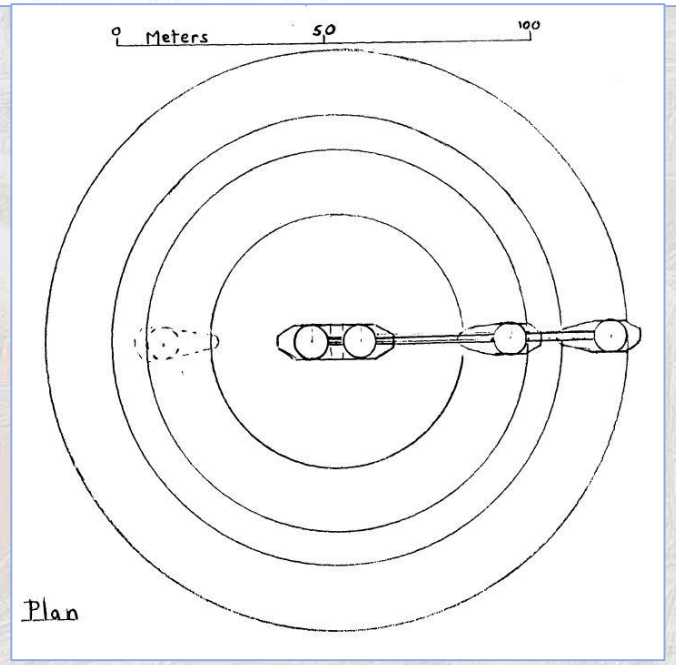
AO so far

AO soon

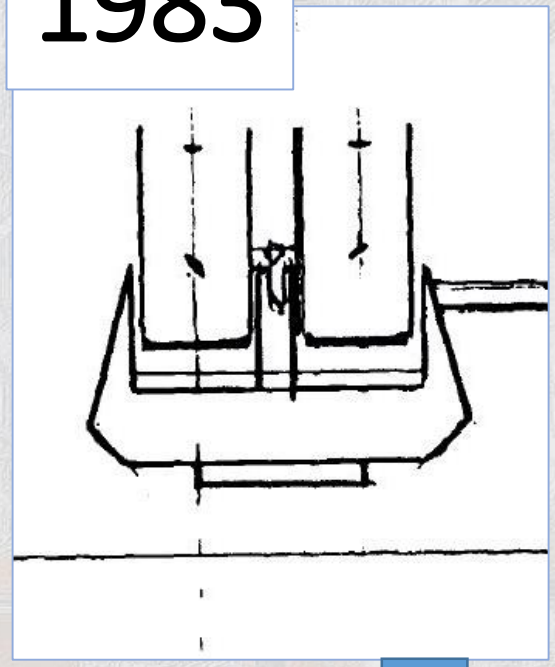
Fulfilling the mission

Versatile Array (from Woolf et al., May 1983)

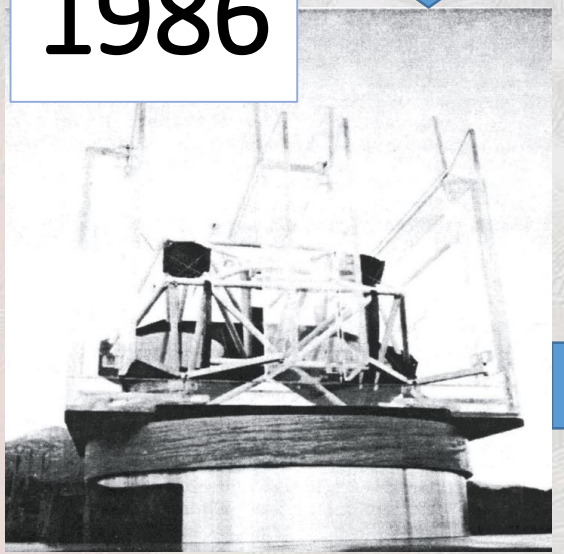




1983



1986



2016

Left Side (SX)

LBC Blue

Tertiary mirror

Primary mirror

LUCI auxiliary mask cabinet

ARGOS lasers

ARGOS calibration arm

Right side (DX)

ARGOS launch mirror

Adaptive Secondary mirror

LUCI calibration unit

LBTI access platform

LINC-NIRVANA access platform

PEPSI fiber feed unit

LINC-NIRVANA cover

LUCI

LBTI

LINC-NIRVANA

Primary mirror

Tertiary mirror

The mission of the observatory

LBT2020

A six-year development plan for LBTO [2014-2019]

"As the first of the ELTs and one of the leading 8-m class telescopes, LBTO must offer, as efficiently as possible, state-of-the art instruments delivering high-quality data to the users of the observatory, thus enabling excellent science at the forefront of astronomy"

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AO needed!

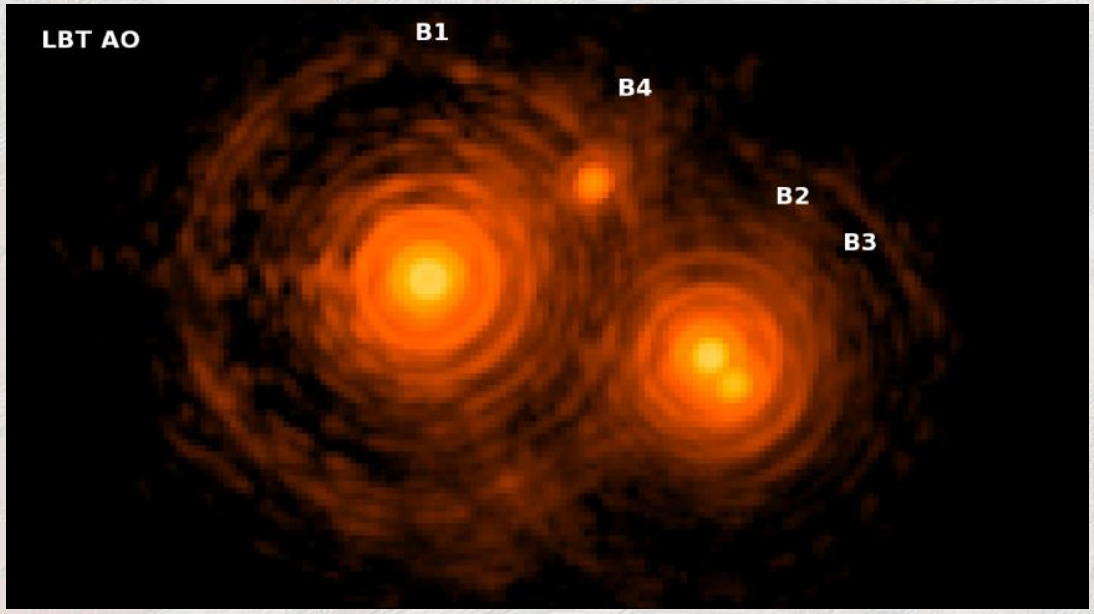
DSM/ASM/AdSec are part of the telescope design

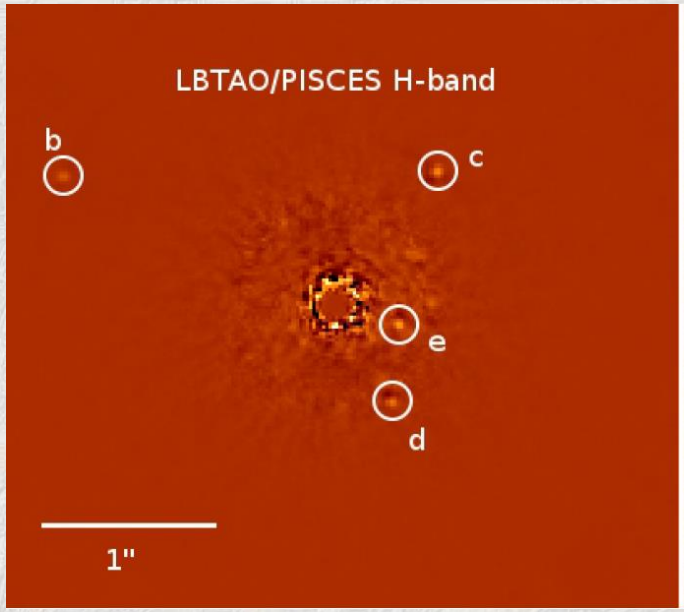
- May 2010… 1st AdSec on sky

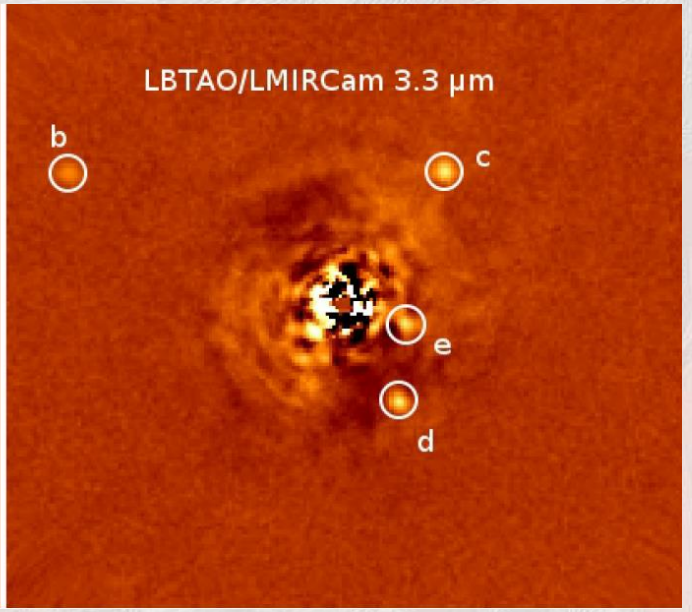
"Testing has continued since the system was first put on the sky on May 25. The LBT's adaptive optics have functioned flawlessly and have achieved peak Strehl Ratios of 82 to 84 percent."

- 2011-12… 2nd AdSec on sky

Arcetri
Microgate - ADS

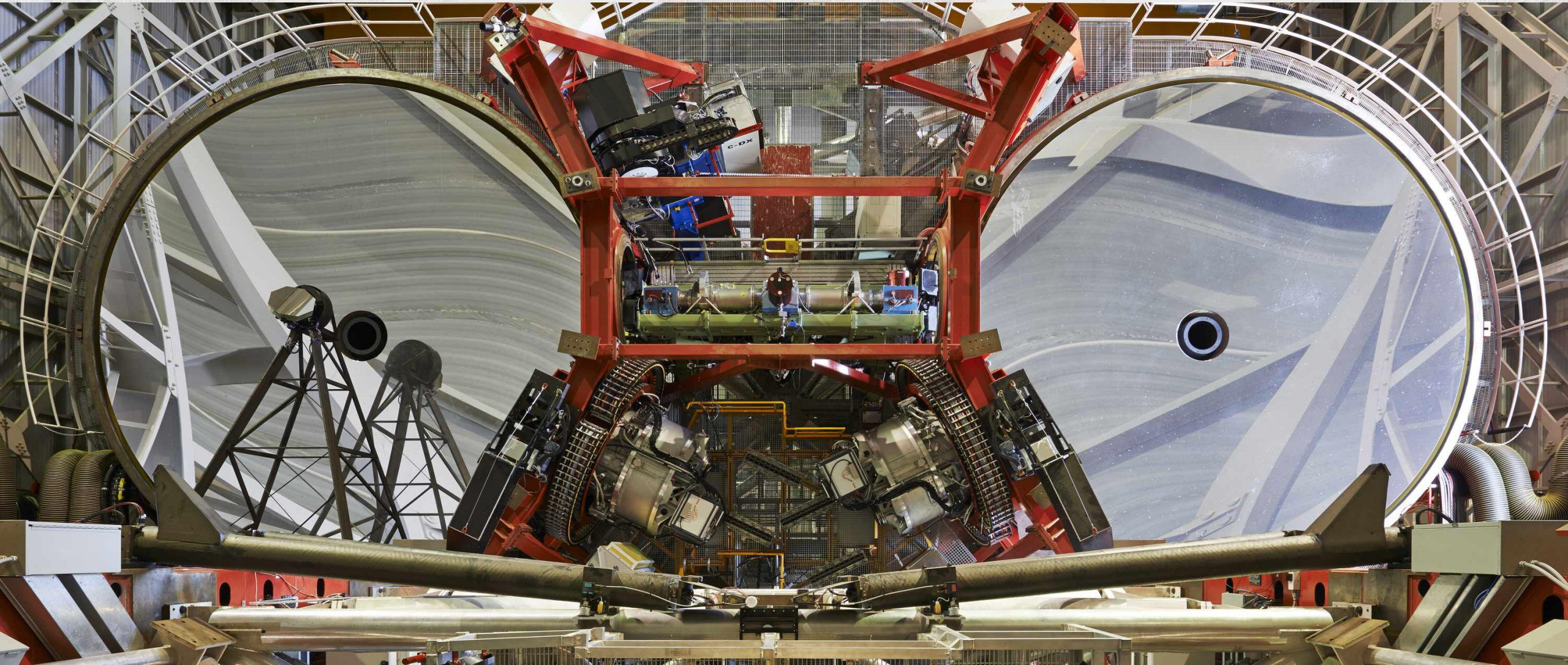






Four pyramid sensor AO systems…

- FLAO#1 and FLAO#2 – LBTIAO#1 and LBTIAO#2



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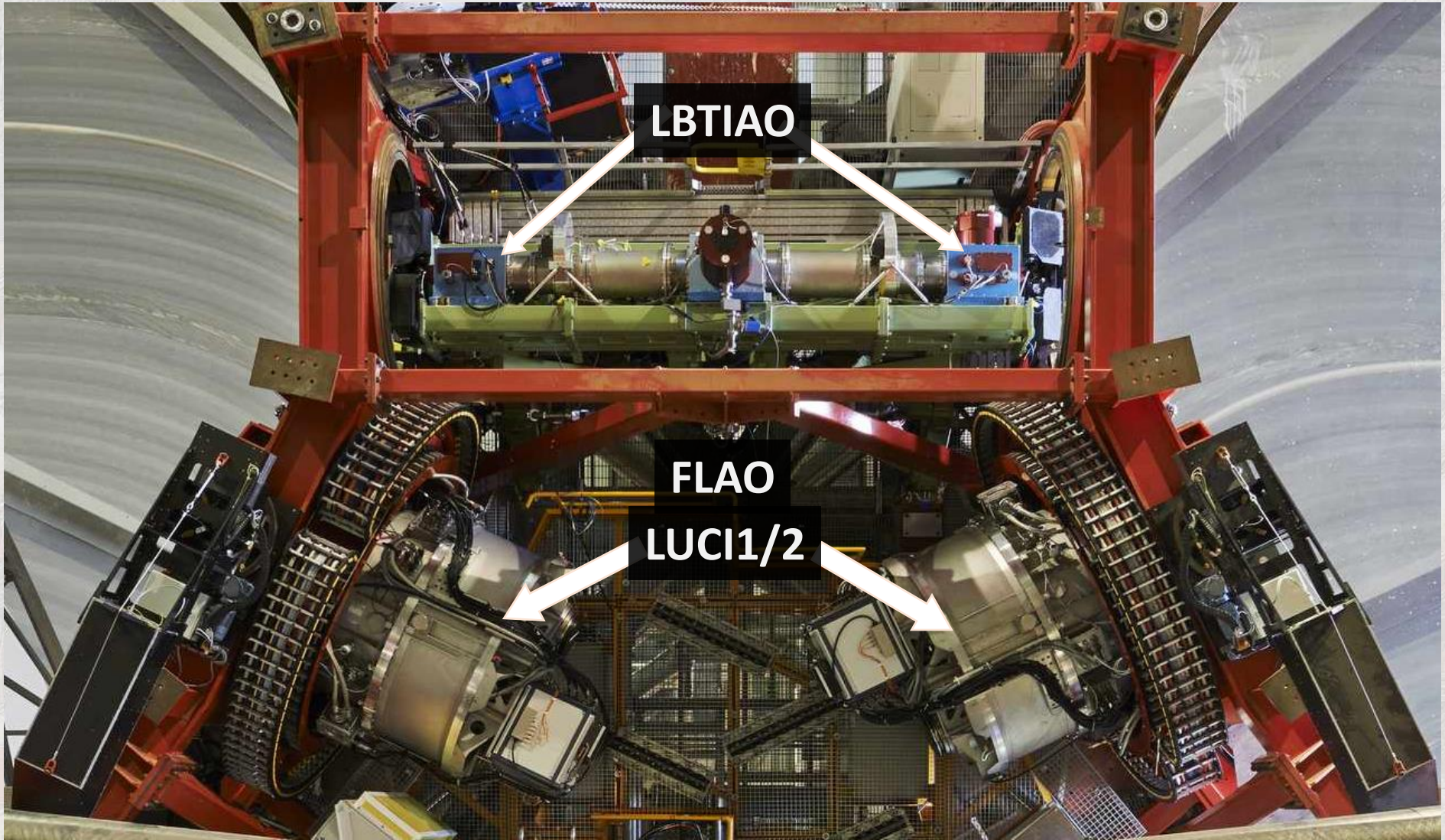
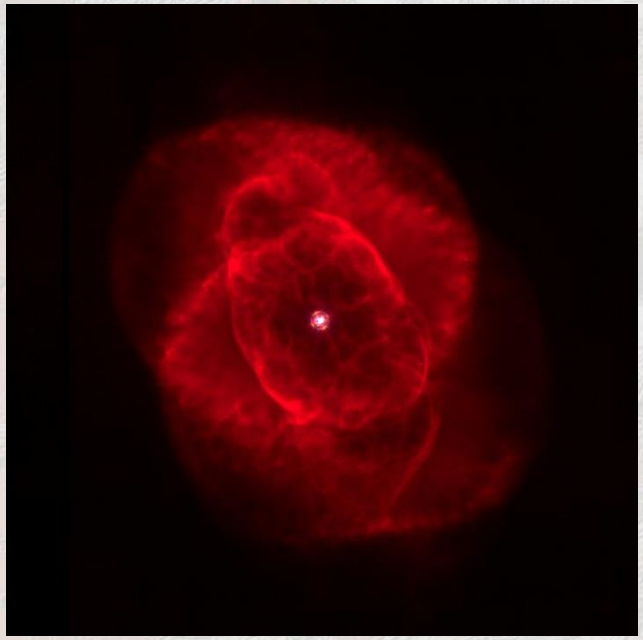
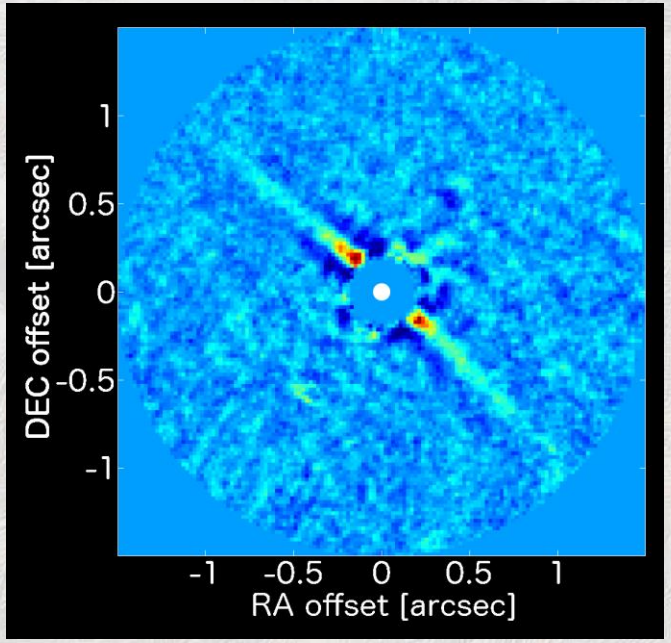
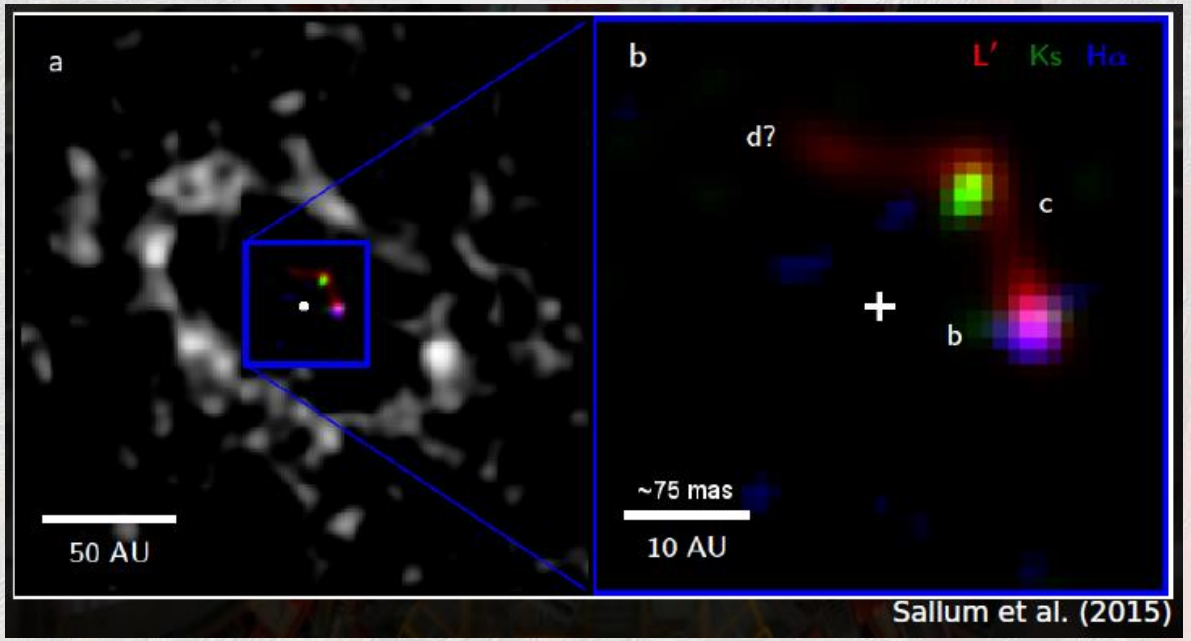


…currently feeding four instruments

- LUCI1 & LUCI2 – Near imager and multi-objects spectrographs
  - Commissioning ongoing in AO mode (imaging 30” field on LUCI1/2- long slit spectroscopy on LUCI2)
- LBTI/LMIRcam – 1-5µm (optimized for 3-5µm)
  - (1) Single and dual aperture non-coherent (direct) imaging - (2) Single and Dual aperture nonredundant mask imaging. - (3) Single aperture apodizing phase plate coronagraphy. (4) IFS (only thermal-infrared IFS - in commissioning)
- LBTI/NOMIC - mid-infrared (8-13 µm) camera







Upgrading FLAO and LBTI WFS: The SOUL project

"**S**ingle Conjugated Adaptive **O**ptics **U**pgrade for **L**BT"

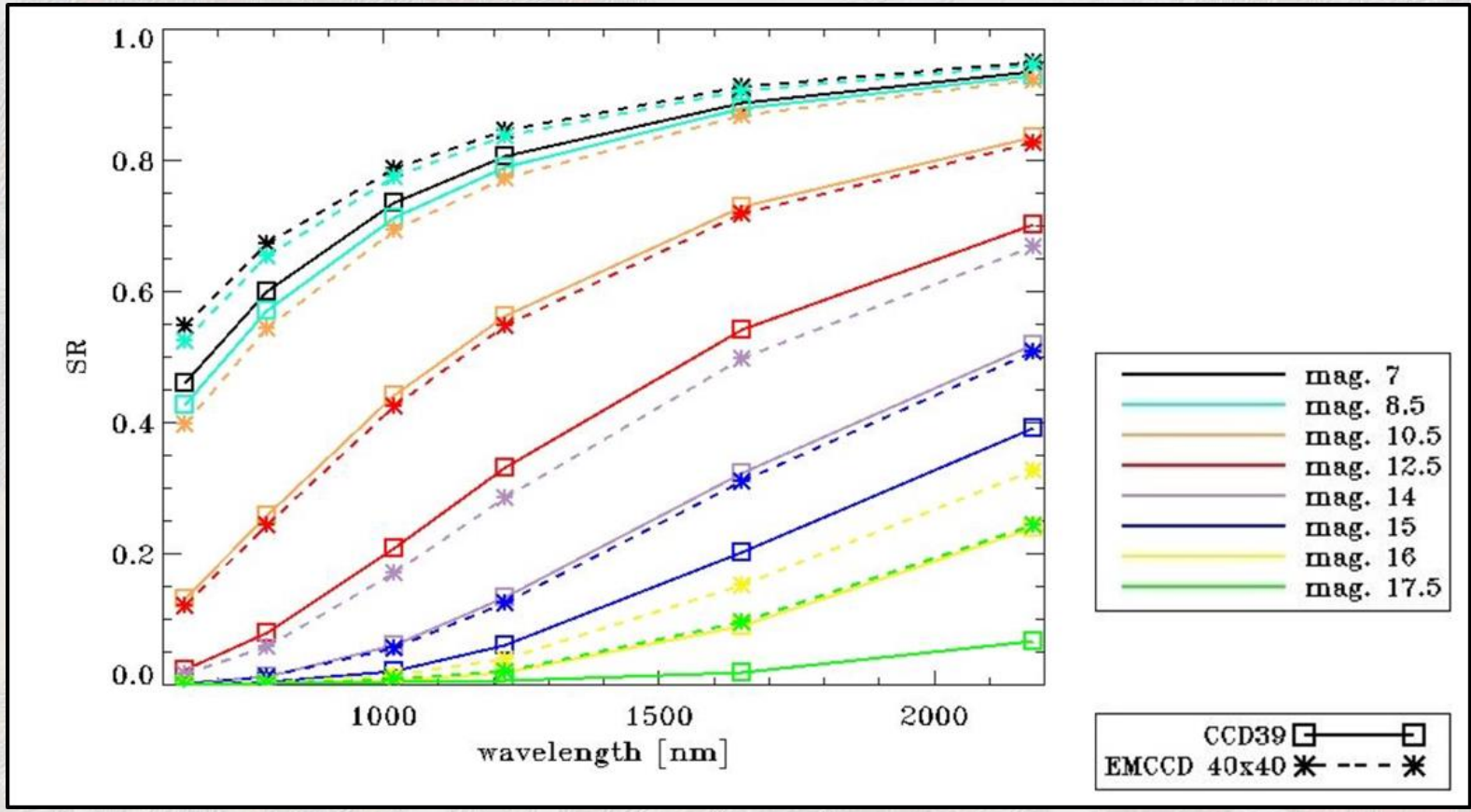
Low-noise EMCCDs (First Light OCAM2K)

40 x 40 sub-apertures

~2 mag. gain in sensitivity

Increased sky coverage

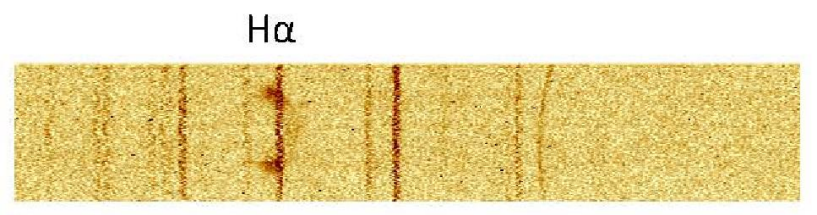
Completion by 2018

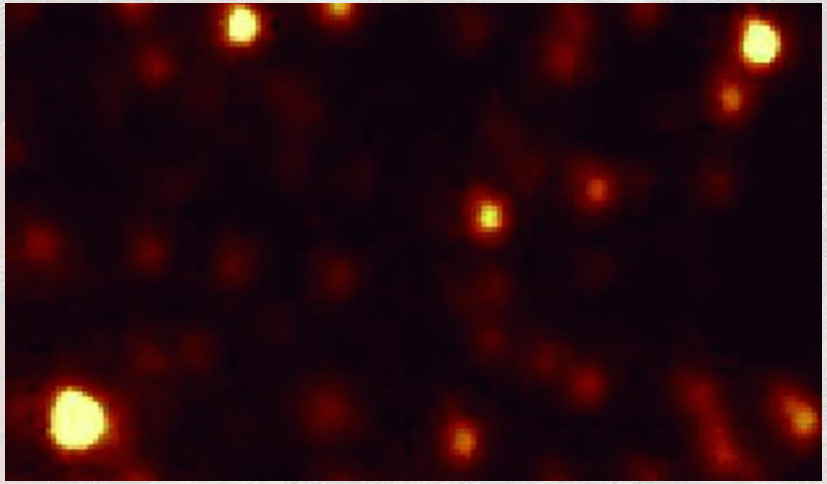


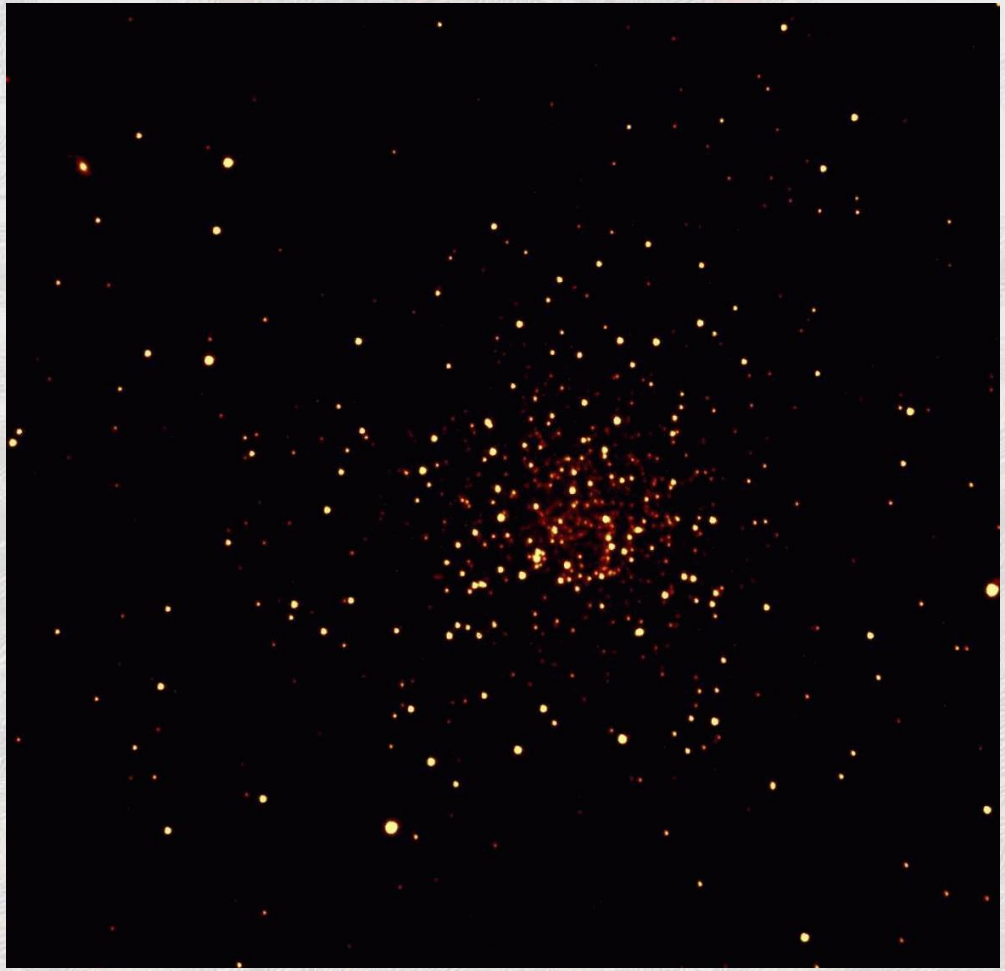
Meanwhile… ARGOS is moving forward

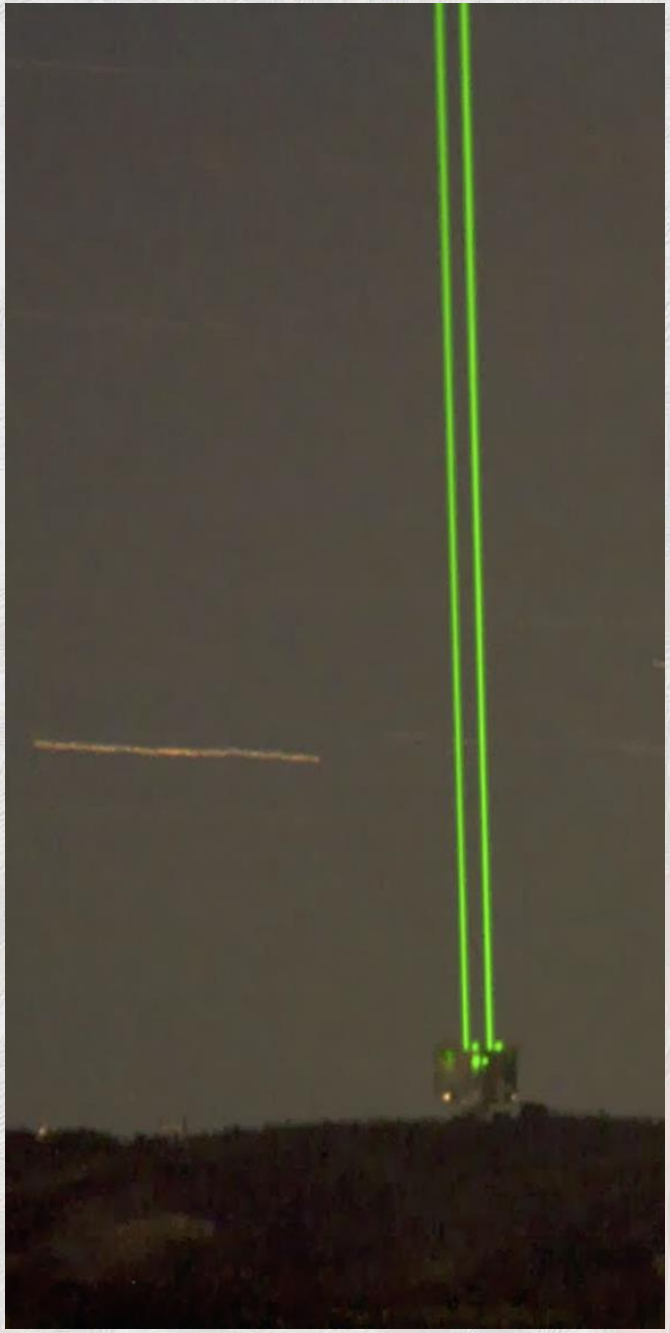
Ground-layer AO for the LUCIs

See S. Rabien's talk later in this session!





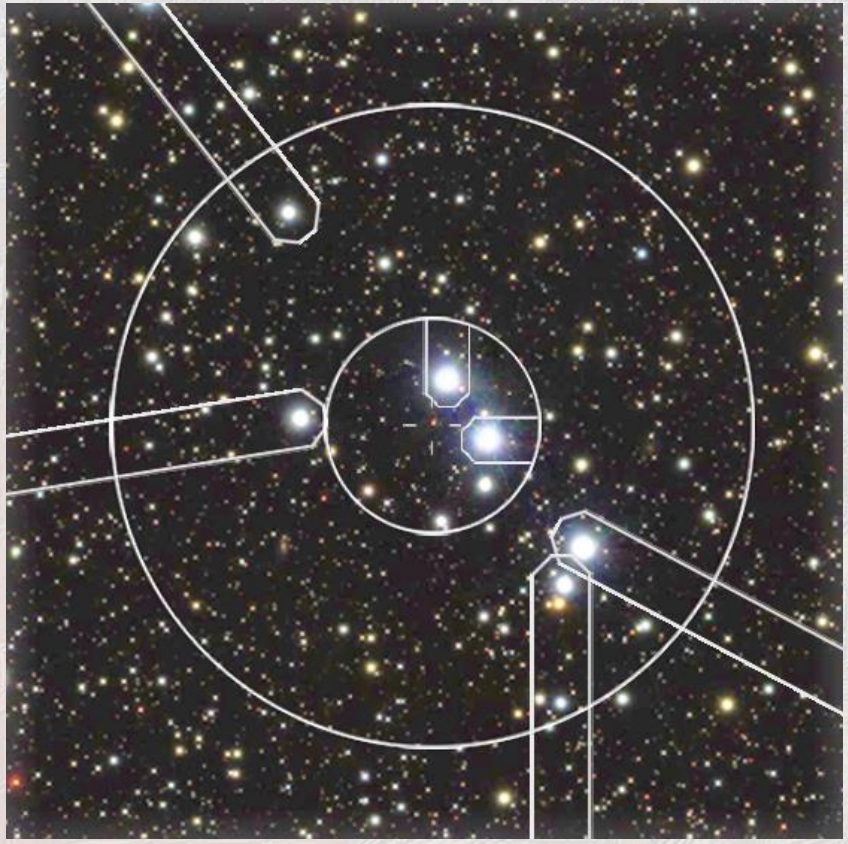




Meanwhile… Lean-MCAO is moving forward

The current inception of LINC-NIRVANA

T. Herbst's presentation yesterday!



High Resolution NIR Imager

MCAO Interferometry

λ: JHK

Pixel: 5.11 mas

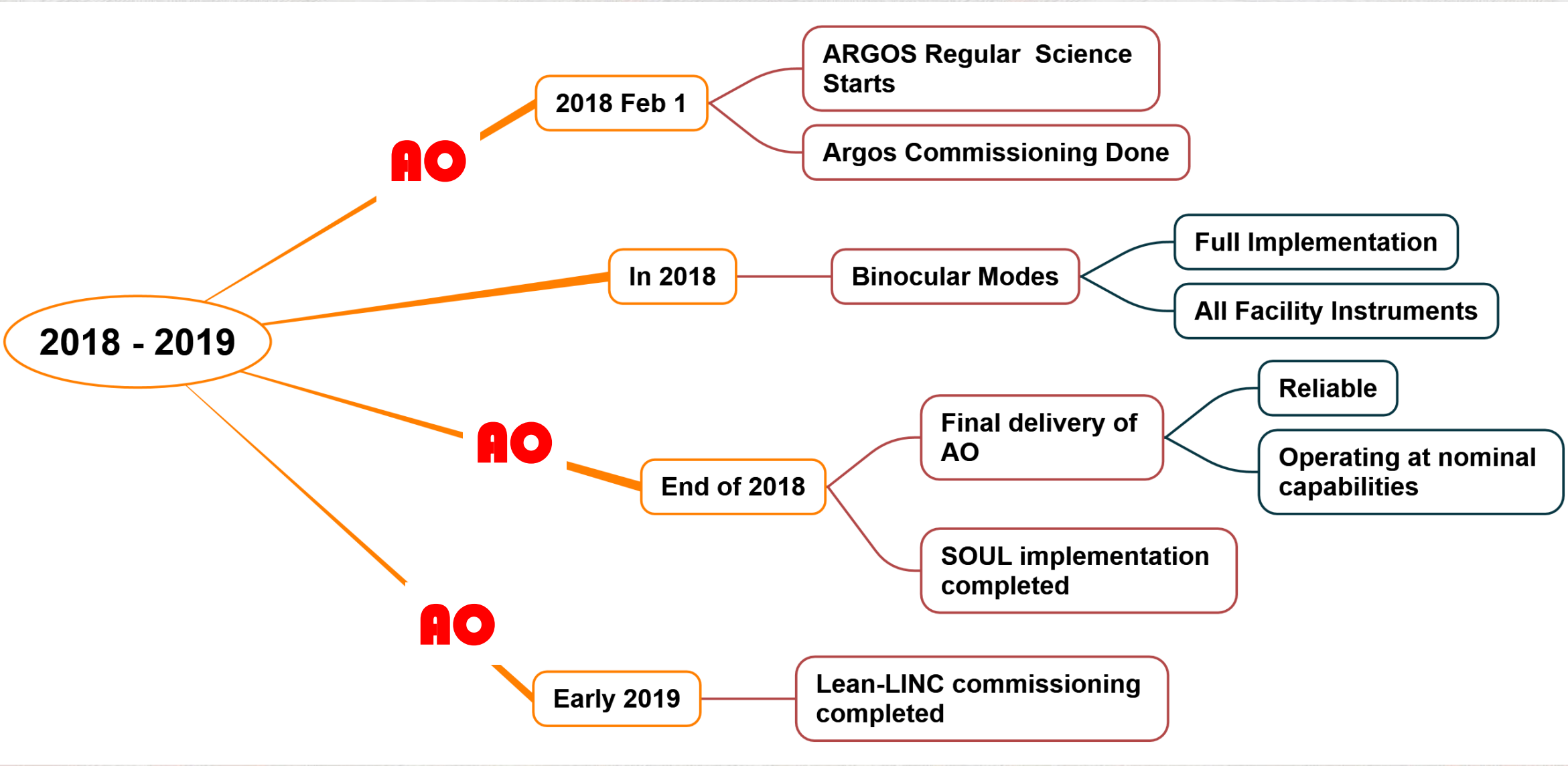
Resolution: 10 - 30 mas (J)

15 - 41 mas (H)

20 - 53 mas (K)

- two telescope operation (overlap not necessary)
- largest possible field of view (41 or 85 arcsec)

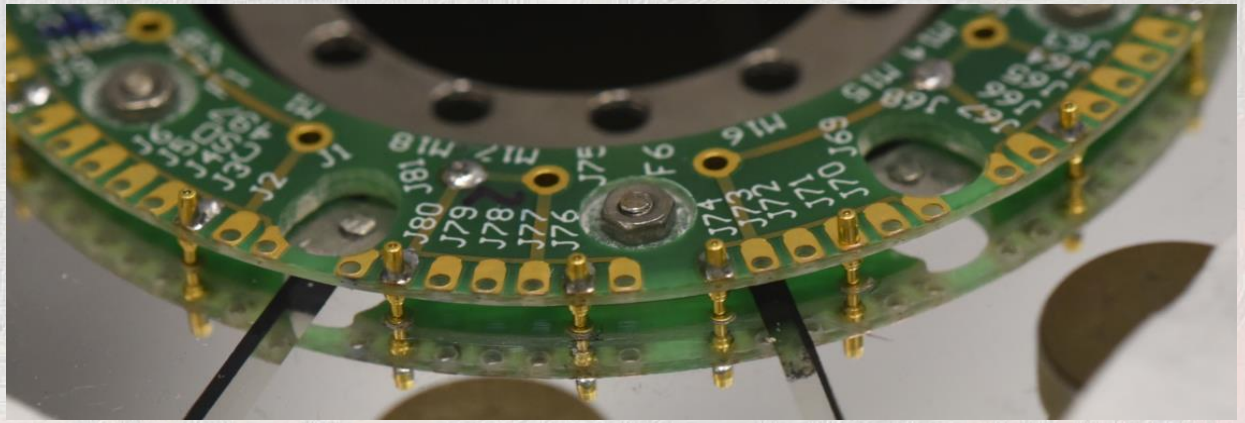
Wide Field Upgrade


2018 - 2019
AO
2018 Feb 1
ARGOS Regular Science Starts
Argos Commissioning Done
In 2018
Binocular Modes
Full Implementation
All Facility Instruments
AO
End of 2018
Final delivery of AO
Reliable
Operating at nominal capabilities
SOUL implementation completed
AO
Early 2019
Lean-LINC commissioning completed

Upgrading the AdSec?

- Implement some of the developments done for the ESO DSM by MICROGATE
  - new distribution board (DX done – SX in summer17)
  - new power backplanes (2018)

- Move away from glycol (2-3yrs)?
  - Glycol leak in 2016…
  - Direct expansion gas cooling technology? (see poster by R. Biasi this evening)



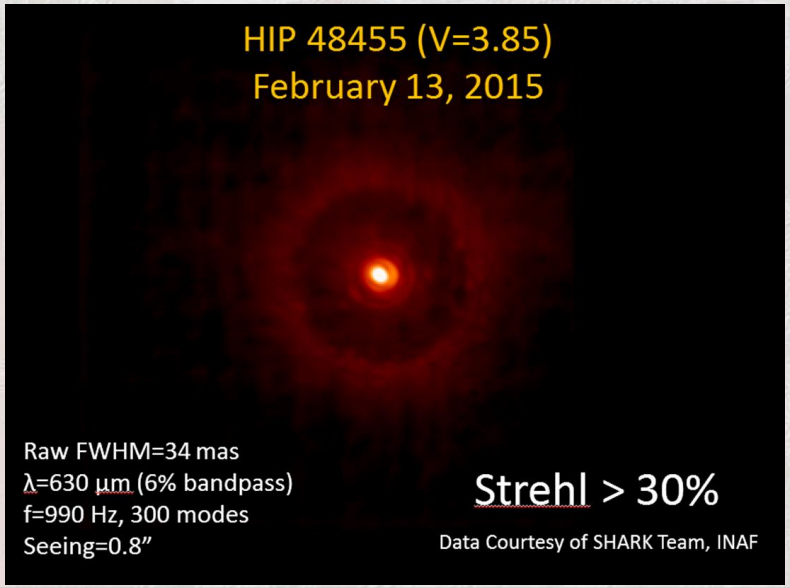
- Implement new electronics architecture studied for GMT?

Three new AO-based instruments in the making…

All of them on the LBTI bench and relying on SOUL

SHARK-VIS

10” fov
Diffraction limited 0.4 to 1µm
Active PSF and Pupil Stabilization
Fast frame rate (1kHz) for lucky imaging
Selectable pupil optics (stop, Wollaston, hologram, grism….)
Coronagraphy and IFU ready



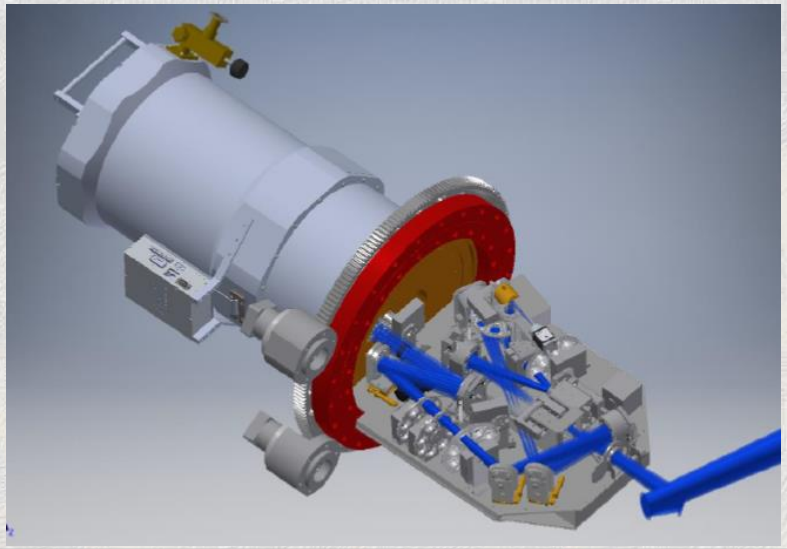
SHARK-NIR

18” fov - J & H

Imaging/Coronagraphy

Spectroscopy/DBI

Nominal Strehl at <18’’ FoV diameter (in all Bands) >98%

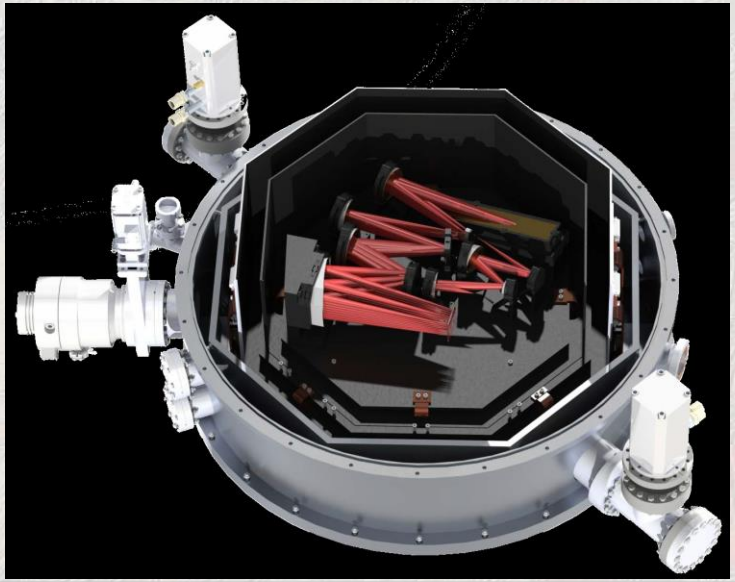


iLocater: AO-fed precision spectroscopy for exoplanet science

R > 150,000 – Y+J-bands(0.97-1.31µm)

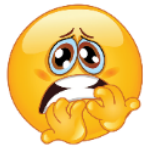
AO fed - 6µm single-mode fiber

Stable output and small instrument footprint for a better RV stability



New "instruments"

- SHARK-NIR — 2019 ??
- SHARK-VIS — 2019 ??
- iLocater — 2019 ??



In sequence...

All AO-dependent

Lean-MCAO wide field? — Decision in 2019?

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Interferometry needed!

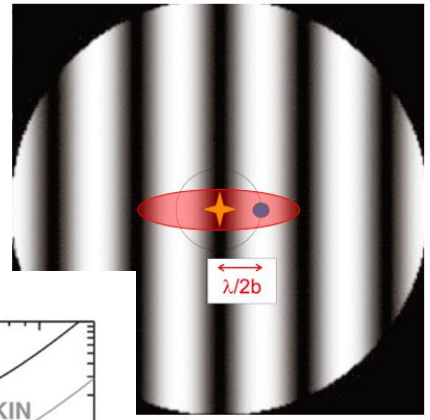
LBTI: Nulling and Fizeau! (Phil Hinz, PI)

The Hunt for Observable Signatures of Terrestrial planetary Systems (HOSTS)

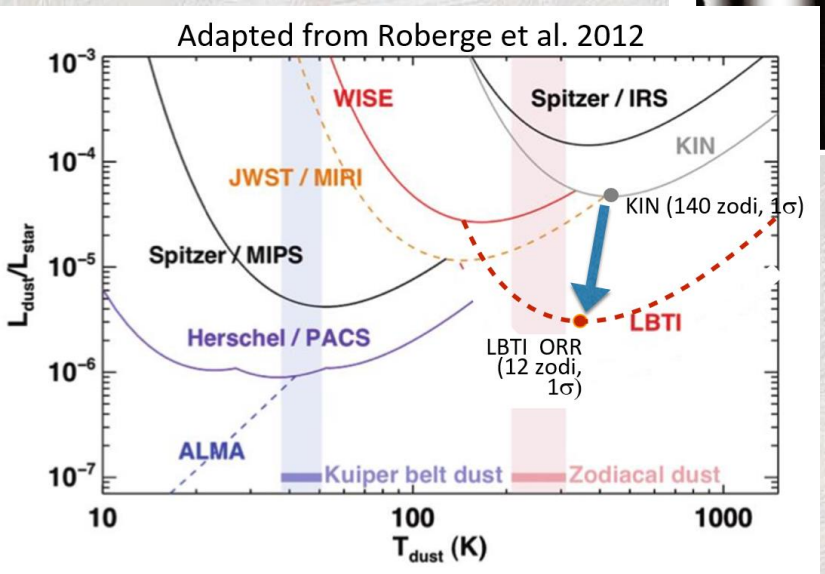
NASA Mission 75% complete!

Performance currently improved by x12 over KIN

Subtracts starlight by destructive interference

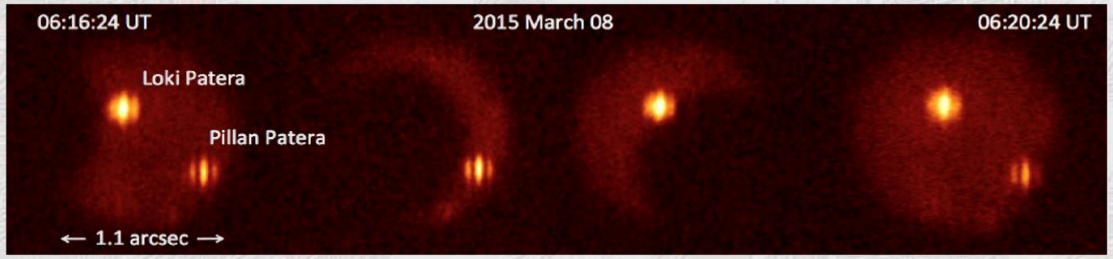


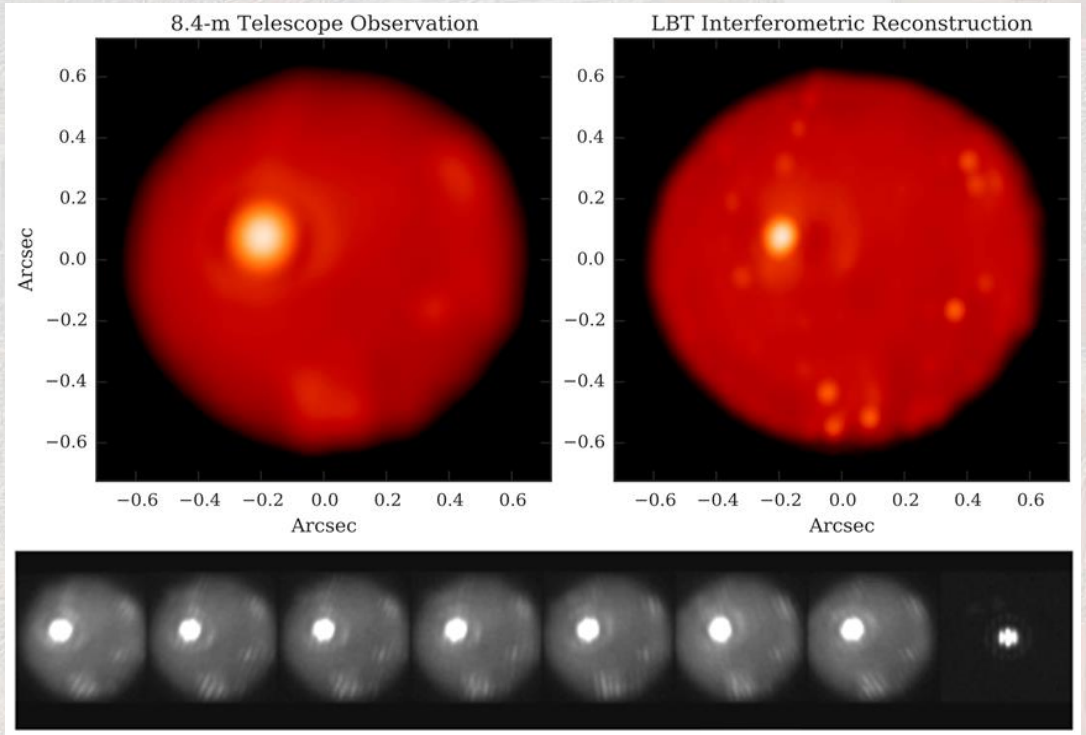
Adapted from Roberge et al. 2012



Al Conrad's presentation (yesterday)

Io's observations





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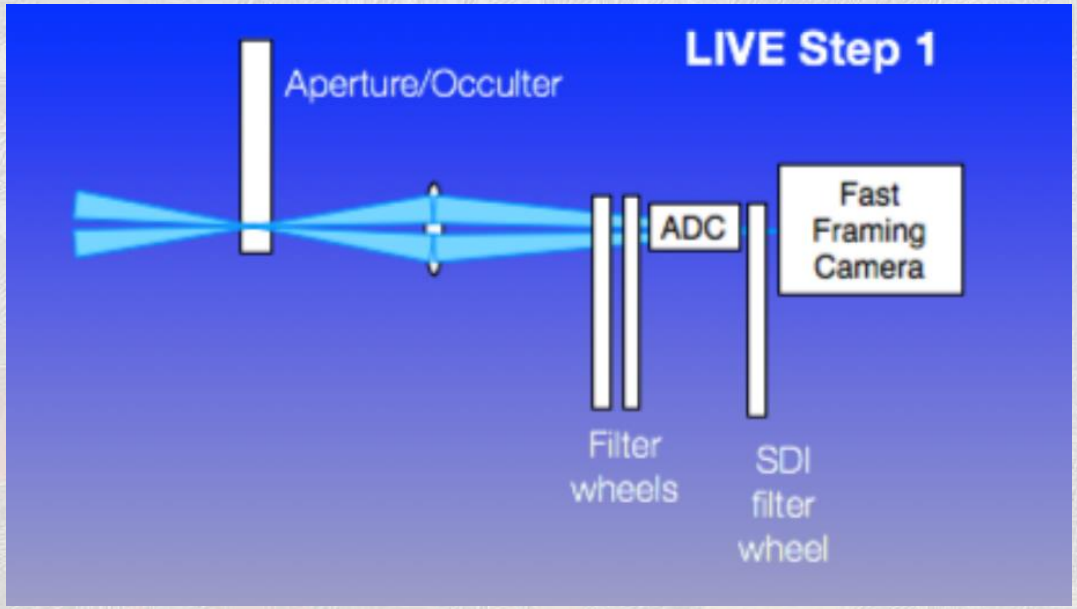
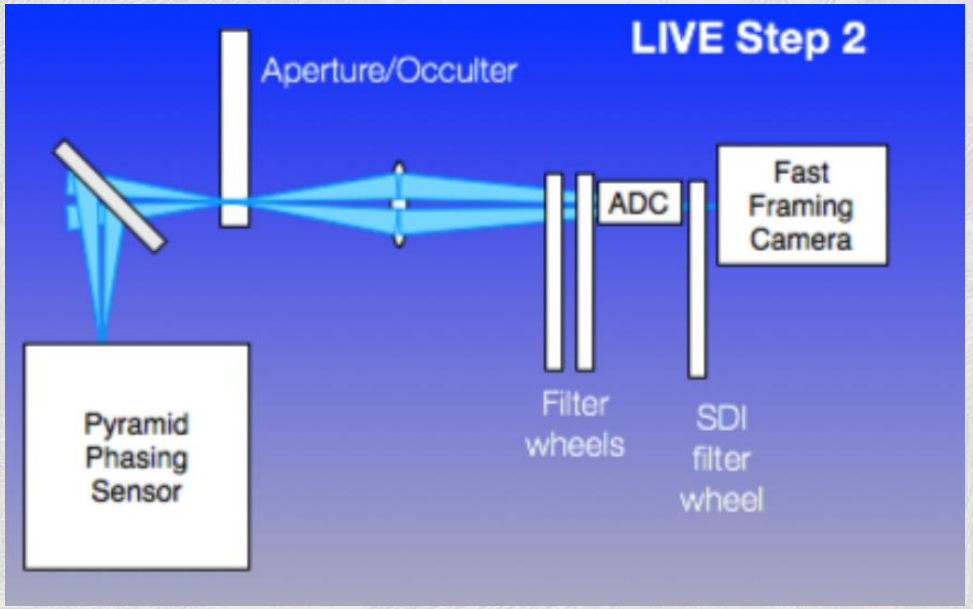
We need more!

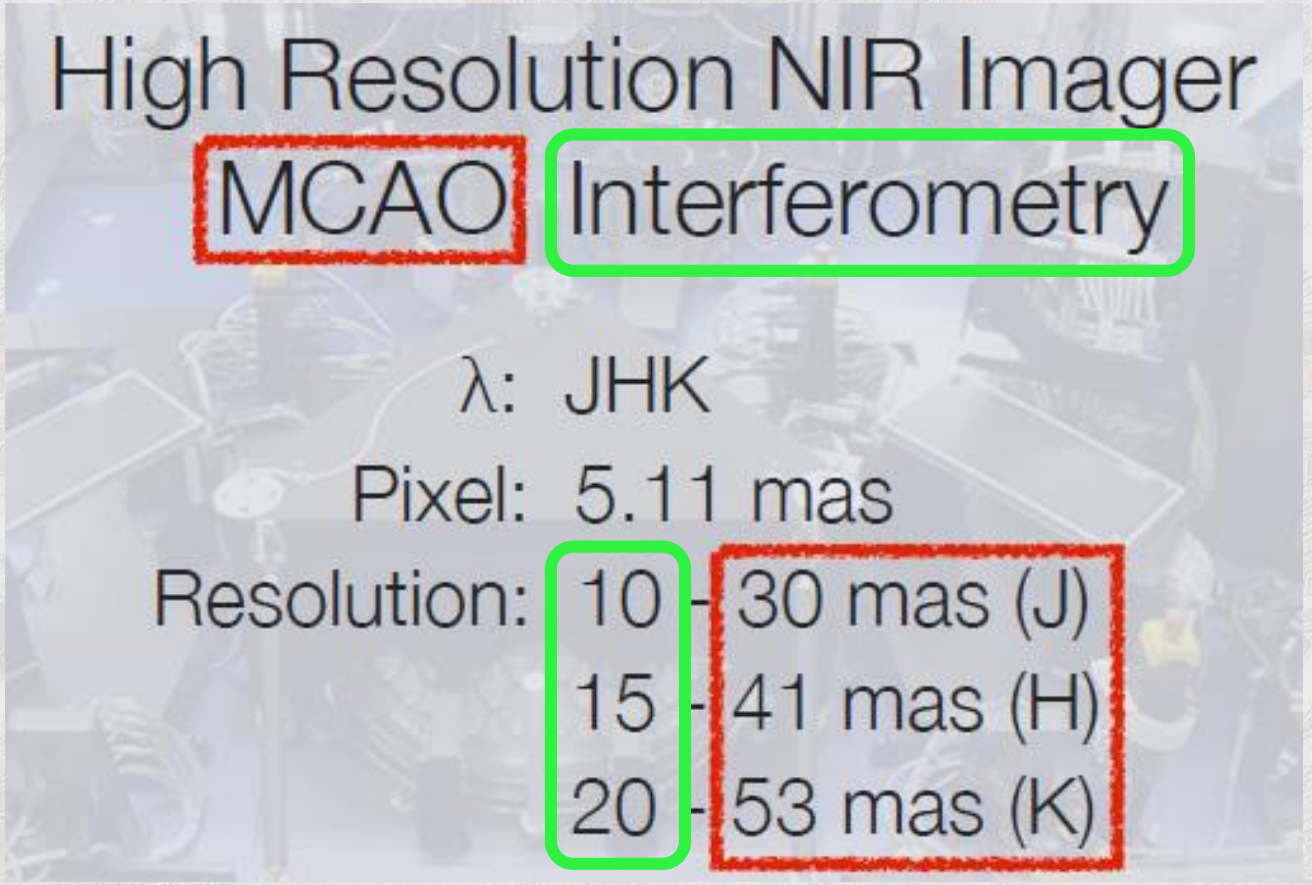
LIVE: the LBT Interferometer Visible Extension (P. Hinz, PI)

- Proposed in 2014 as an answer to the call for 2nd Generation instruments



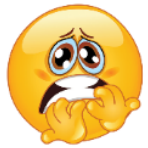


LINC-NIRVANA (T. Herbst, PI)



New "instruments"

- SHARK-NIR — 2019 ??
- SHARK-VIS — 2019 ??
- iLocater — 2019 ??



In sequence...

All AO-dependent

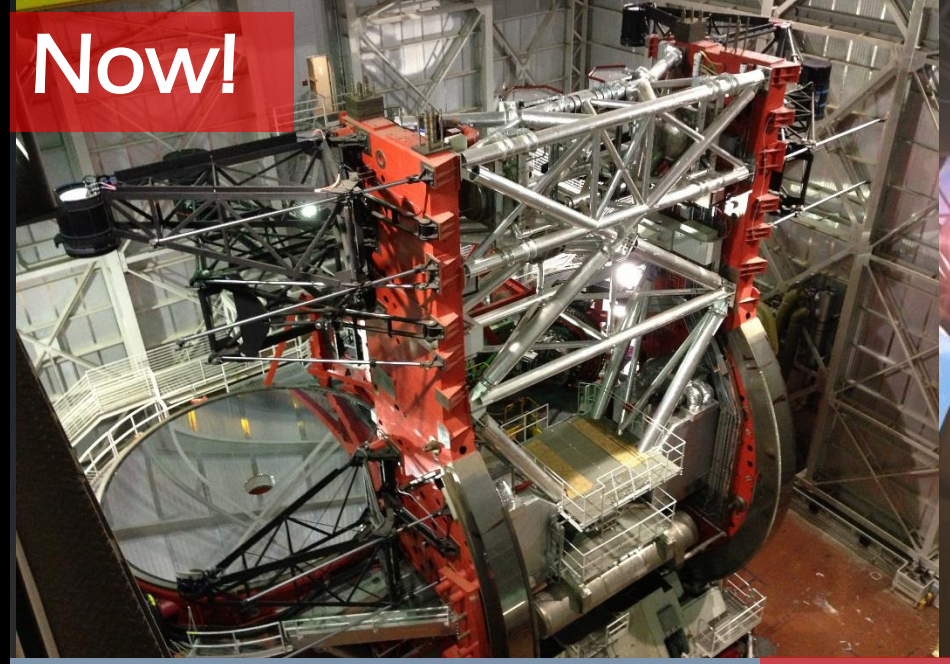
Lean-MCAO wide field? — Decision in 2019?

- **LINC-NIRVANA?**
- **LIVE - LBTI in the visible??**

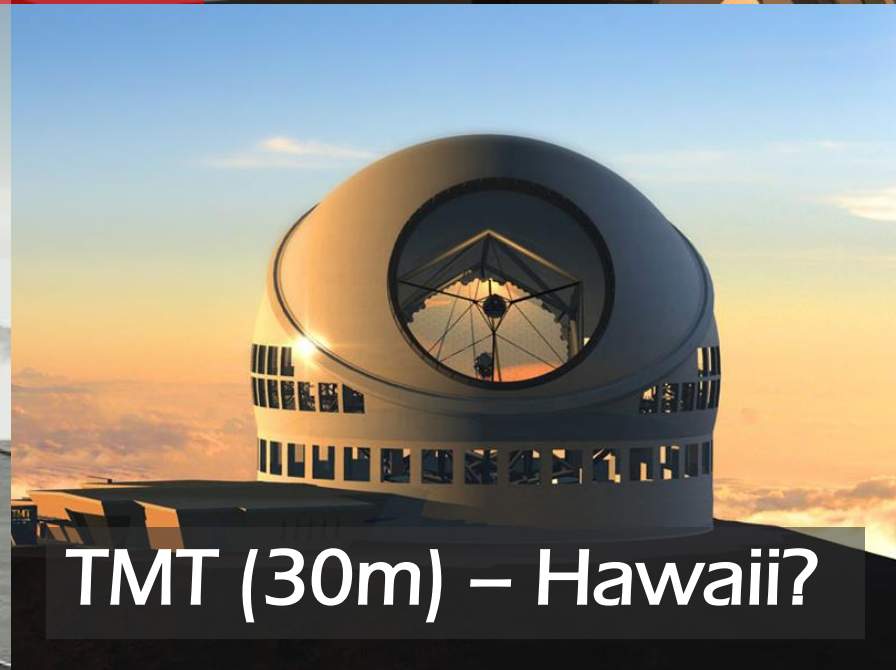
→ **pre-ELT...**

We have a time window to shine as a pre-ELT

Let’s ensure that we don’t miss it!



2025-2030



Another slide?

- Blah