ELT Programme Status

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ELT Programme Engineer

Scope of this presentation

1. ESO, European Southern Observatory
2. Why ESO builds the an Extremely Large Telescope (ELT)
3. The ELT in a nutshell
4. Current status and Procurements

- Intergovernmental Organisation
- International Convention (1962), between 5 countries
- Currently 16 Member States
- Annual Budget: ~ 200 million €

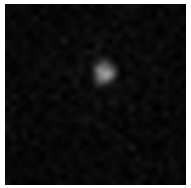
The ESO Mission

- Mission (Convention):
  - Build and operate world-class ground-based astronomical facilities
  - Foster collaboration in Astronomy
- ESO enables:
  - Scientific discoveries & understanding of the Universe
  - Other: Development of new technologies, impact in economy, international cooperation
- Complementing other ground & space facilities
- In collaboration with Scientists, Institutes and Industry

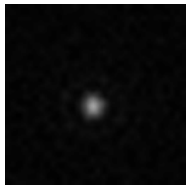
ESO programme landscape

Why the ESO Observatories are in Chile?

- Excellent conditions in the Atacama Desert
  - Extremely dry
  - 90% clean sky
  - Low turbulence
  - Very limited light pollution
- Excellent vision to the Southern Hemisphere

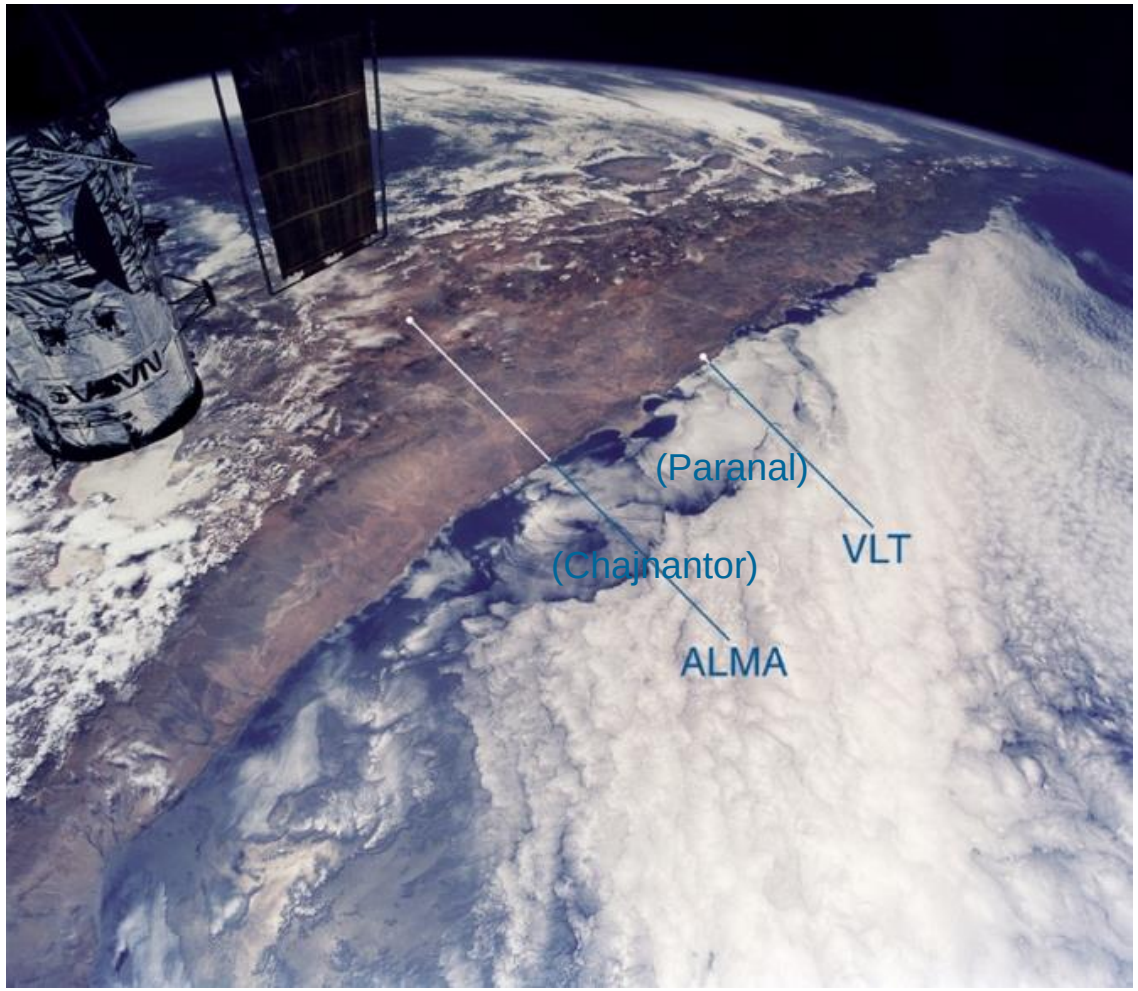


Poor site



Chile

- But: highly seismic and remote



Why the ELT?

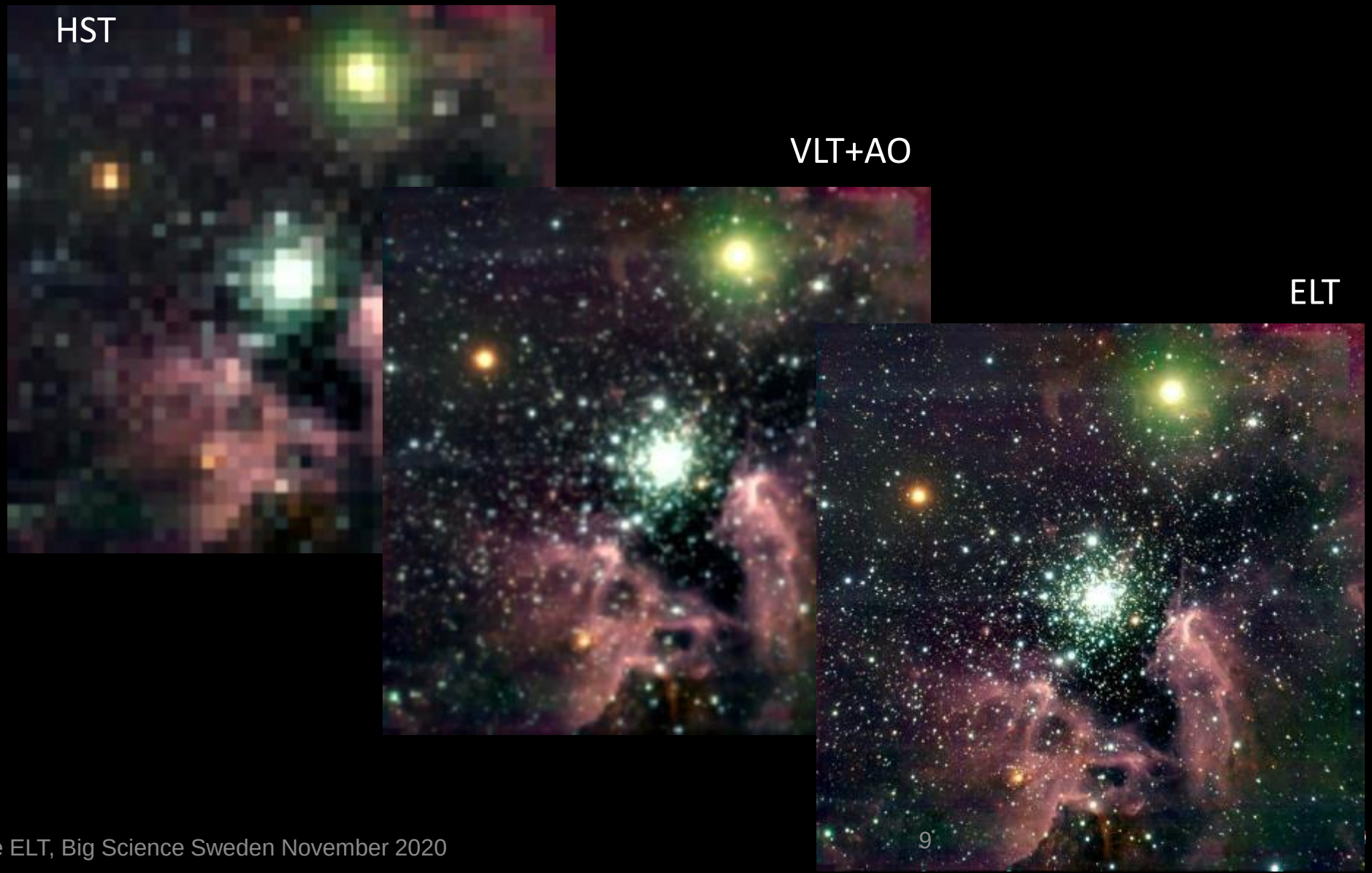
ELT Discovery Potential

ELT will have unprecedented collecting power *and* angular resolution

Compared to existing 8m telescopes, 39m telescope with Adaptive Optics:

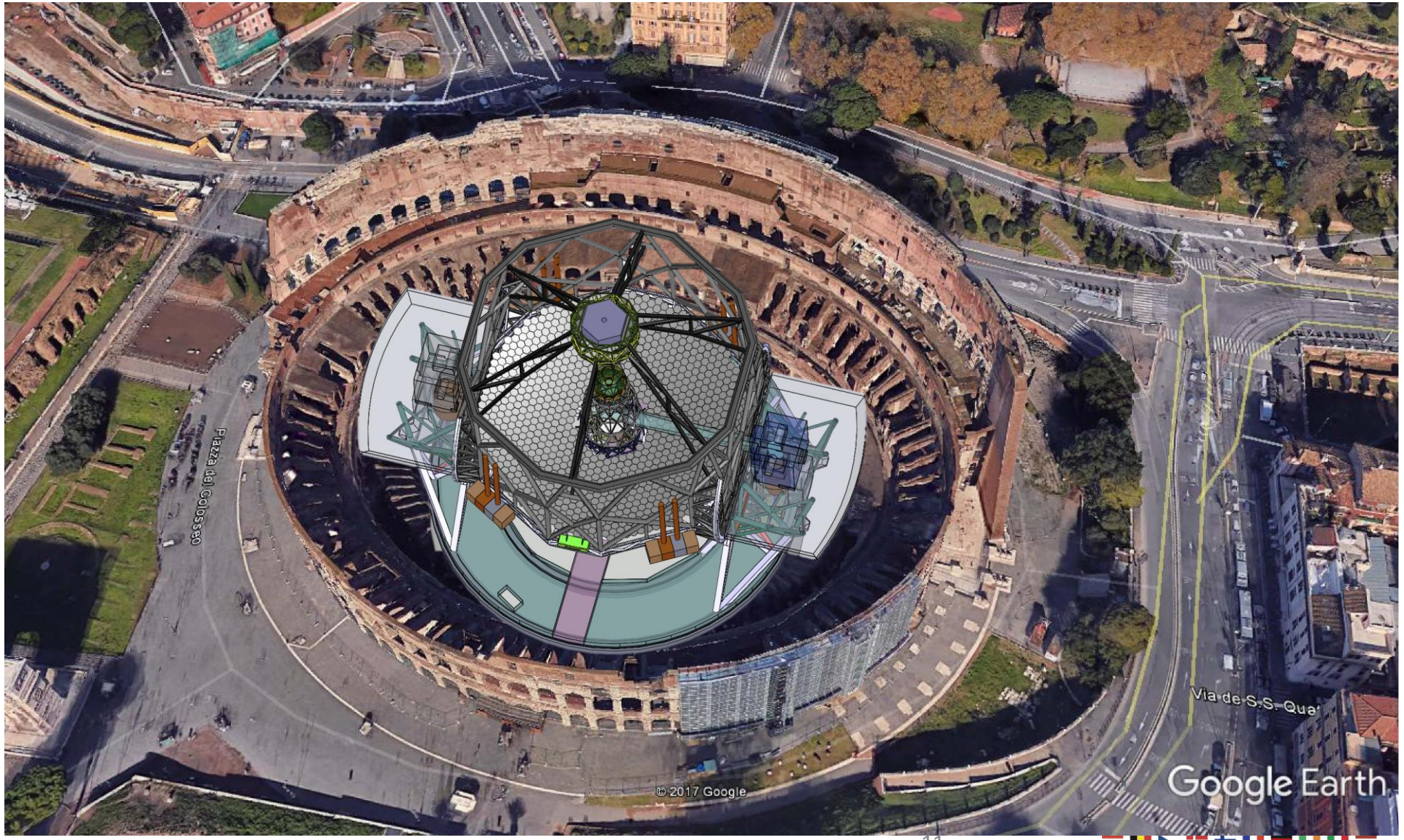
- 5x better angular resolution (D)
- 500x faster exposure time (D^4)

ELT and existing facilities

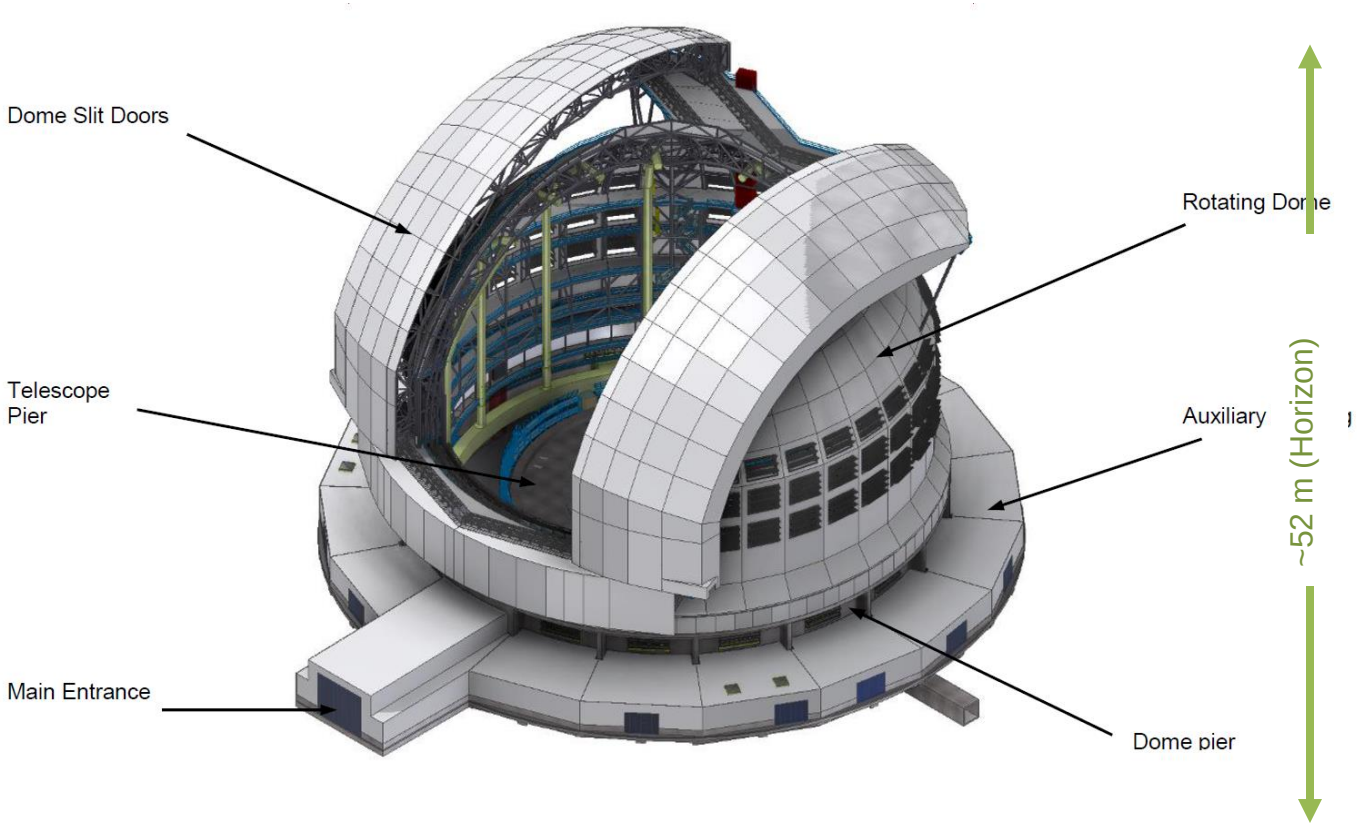


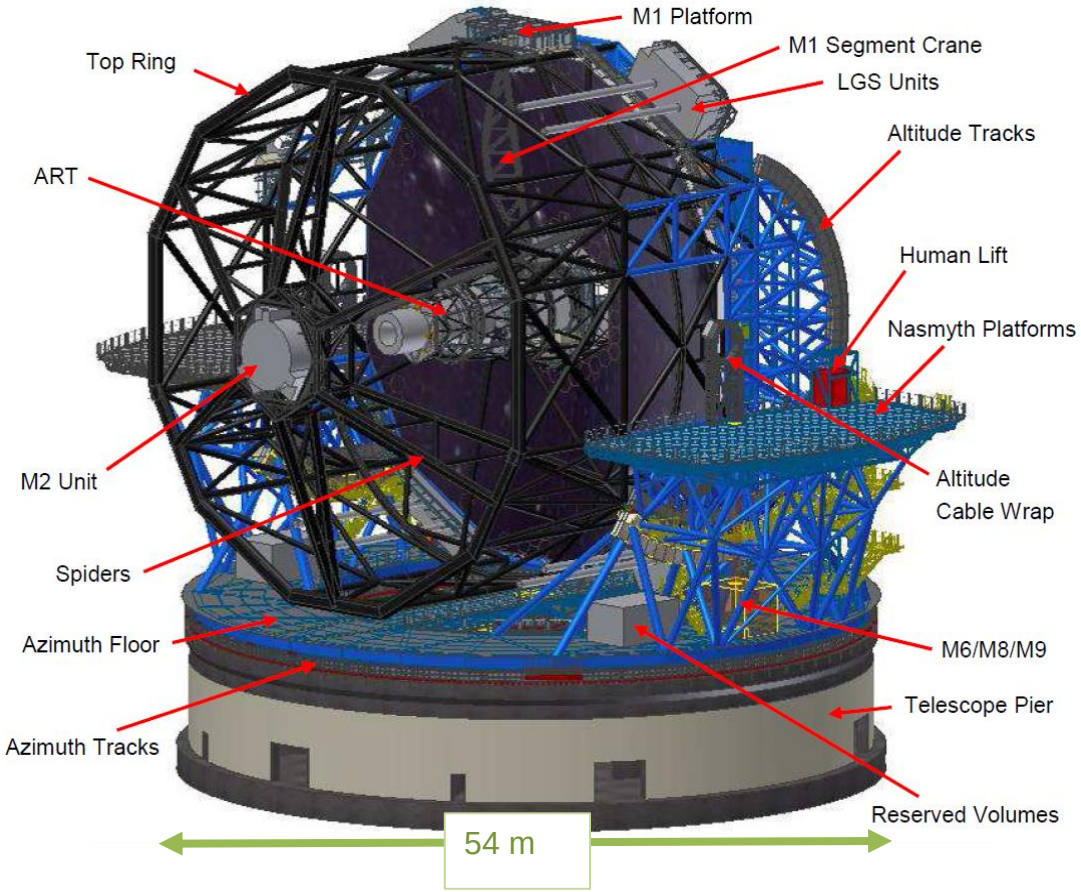
The ELT in a nutshell

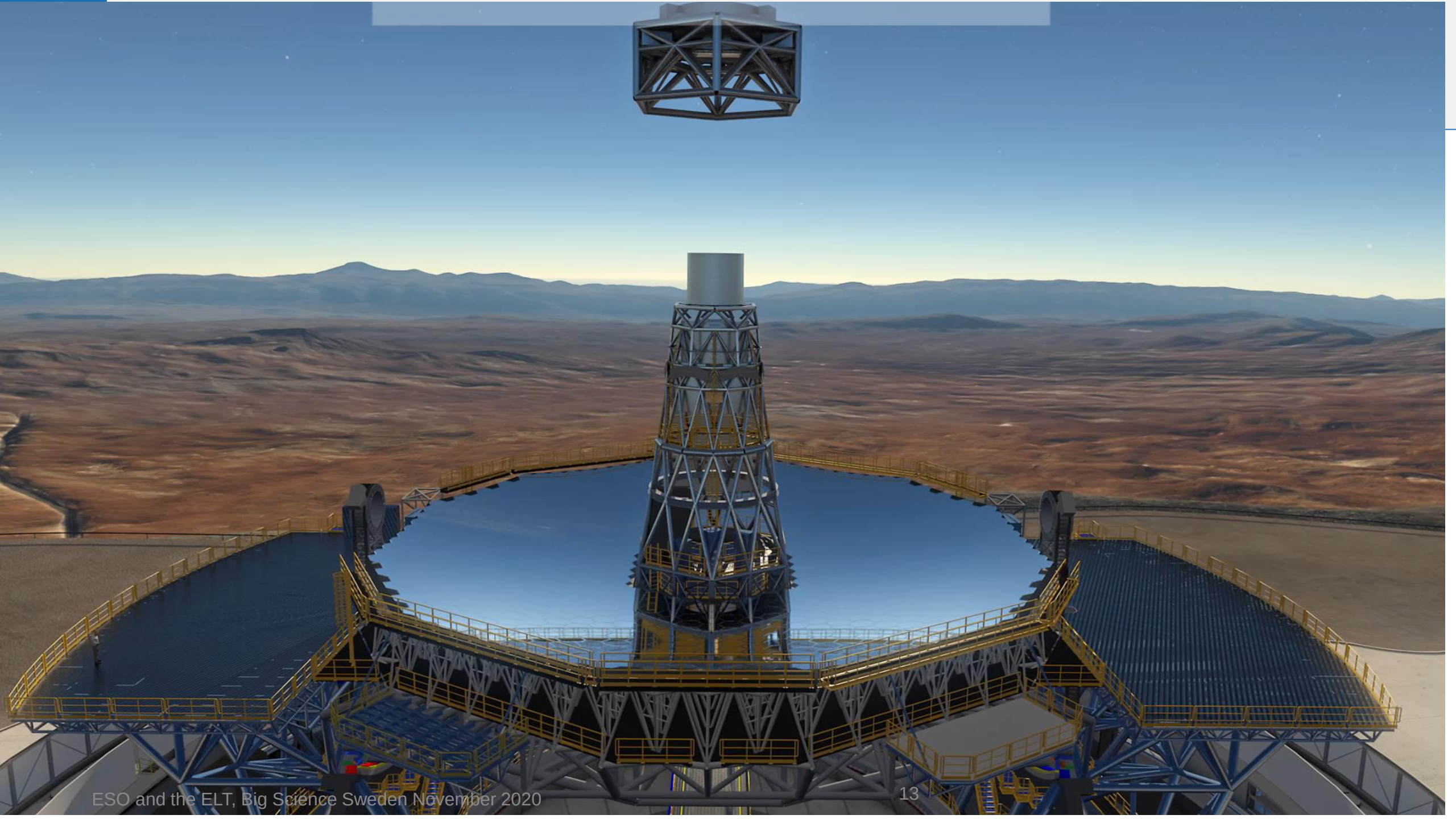
To put it in perspective…



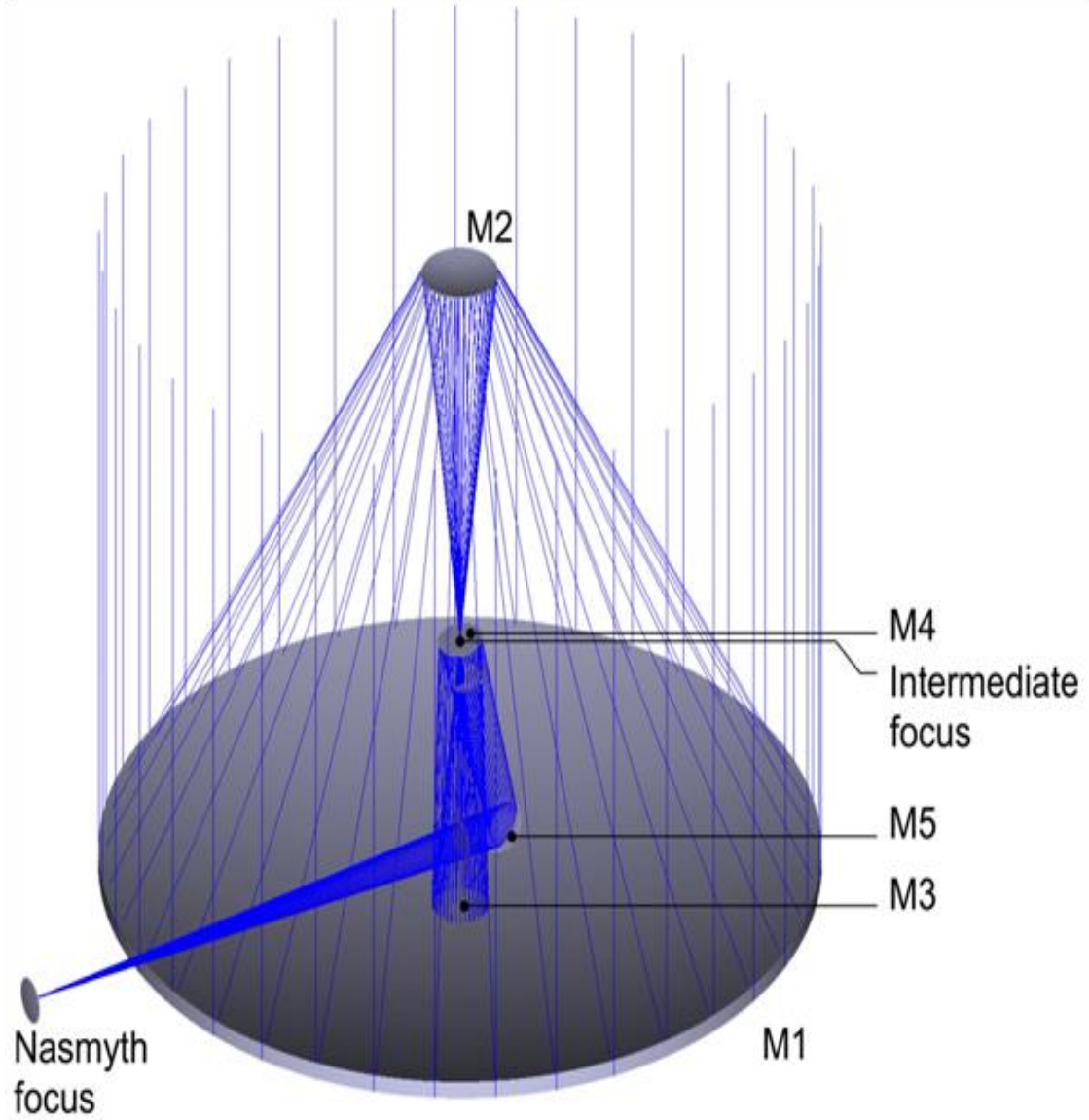
Dome & Main Structure (DMS)







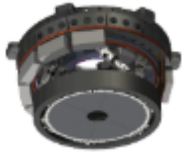
ELT Optomechanics



M1 Unit
39-m
Concave – Aspheric f/0.9
Segmented (798 Segments)
Active + Segment shape Control

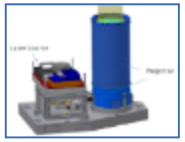
M2 Unit
4-m
Convex Aspheric f/1.1
Passive + Position Control

M3 Unit
4-m – Concave – Aspheric f/2.6
Active + Position Control



M4 Unit
2.4-m
Flat
Segmented (6 petals)
Adaptive + Position Control

M5 Unit
2.7x2.1-m
Flat
Passive + Fast Tip/Tilt



LGSU
(Laser Guide Star Units)
Laser Sources + Laser Beacons
shaping and emitting

ELT Construction Status

ELT – On-Going Large Contracts

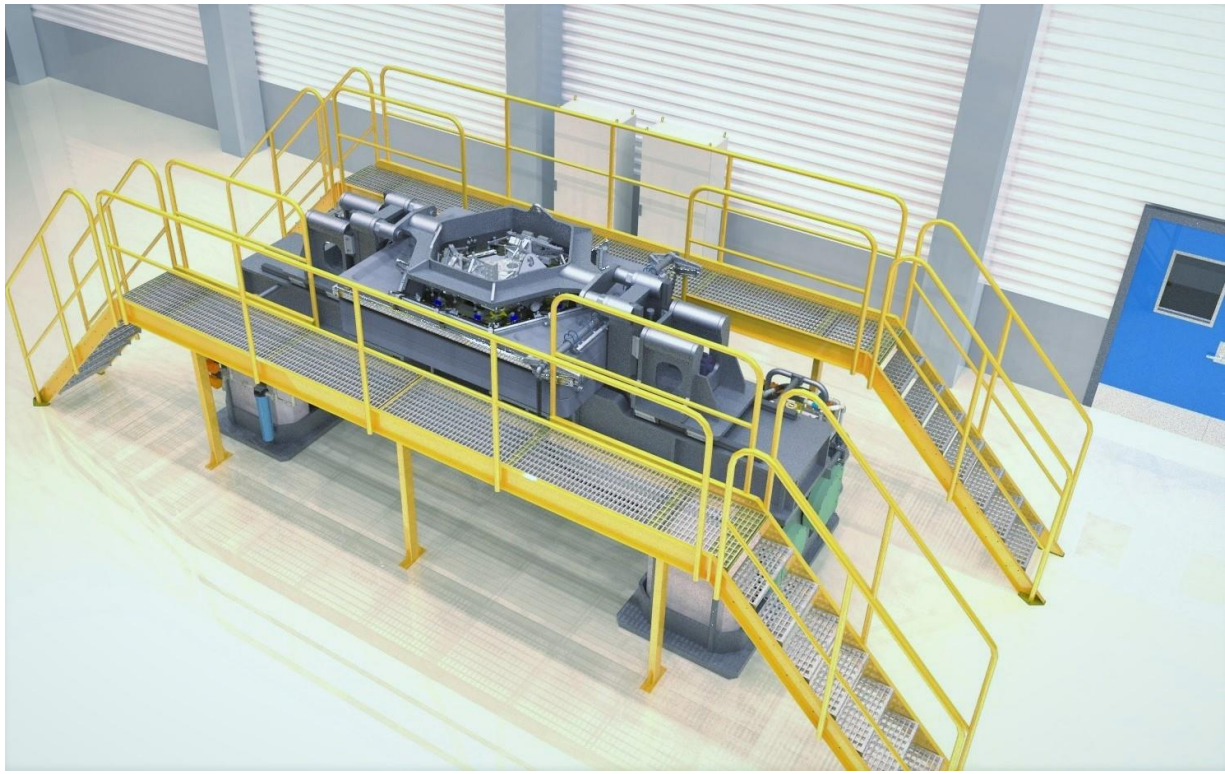
	Description of Work	Contract Signature	Contractor	Forecast Completion	Status
PJ42.01 Project Office	PA Consultancy Services	Jan-16	ISQ	Dec-21	On-going
	ISVV Consultancy Services	Jan-16	Critical Software	Dec-21	On-going
	Construction All Risks Insurance	Mar-18	SCOR	Mar-26	On-going
PJ42.02 DMS	Consultancy Support	Jun-13	Ramboll	May-21	On-going
	DM&S Design and Construction Contract	May-16	ACe Consortium	May-23	On-going
PJ42.03 Optomechanics	M4 Phase 1 Preliminary Design	May-12	AdOptica	Jan-15	Closed
	M4 Unit Final Design and Manufacturing	Jun-15	AdOptica	Jan-23	On-going
	M1 Segment Supports - Qual. Units	Jan-15	VDL	Jul-17	Warranty
	M1 Segment supports - Qual. Units	Feb-15	CESA	Oct-17	Closed
	M4 Mirror Shells Supply	Jul-15	Safran Reosc	Nov-23	On-going
	M2 Mirror and Auxiliary Equipment Supply	Jul-16	Safran Reosc	Feb-24	On-going
	M2 Blank Supply	Jan-17	Schott	Jan-19	Warranty
	M3 Blank Supply	Jan-17	Schott	Jul-19	Warranty
	M3 Mirror and Auxiliary Equipment Supply	Feb-17	Safran Reosc	Sep-23	On-going
	M2 and M3 Cell Design and Manufacturing	Jan-17	Sener	Jul-22	On-going
	M1 Edge Sensors Design and Manufacturing	Jan-17	CAMES	May-22	On-going
	M1 Mirrors Polishing	May-17	Safran Reosc	Jun-23	On-going
	M1 Blanks Supply	May-17	Schott	Sep-22	On-going
	M1 Position Actuators	Jun-17	PI	Sep-22	On-going
	M1 Segment supports – Production	Apr-18	VDL	May-22	On-going
	M5 Blank Supply + Polishing	Mar-19	Safran Reosc	Sep-24	On-going
	M5 Cell Design and Manufacturing	Nov-19	Sener	Feb-24	On-going
PJ42.04 Control	Core Integration Infrastructure	Jul-17	Cosylab AB	Jun-20	On-going
PJ42.05 Civil Infrastructure	Road and Platform	Dec-13	ICAFAL	Feb-17	Closed
	Paranal ELT Technical Facility Design and Construction	Mar-18	Abengoa	Jul-19	Warranty
PJ42.06 Support Infrastructure	Supply, and installation of ABC Power Substations (23kV + 0.4 kV)	Oct-16	SIEMENS	Jul-18	Warranty
	M1 Coating Plants Supply	Jun-18	AGC	Nov-21	On-going
	M1 Mirror Washing & Stripping plant Supply	Jan-20	Fagerström Industrikonsult	Jan-24	On-going
	Power Conditioning System	Nov-19	SAESA	Nov-49	On-going
PJ42.09 Science Data Ops	Dataflow Software Components for ELT	Nov-18	Etamax	Nov-22	On-going
PJ18.10 Instrumentation	MICADO Construction	Oct-15	MPE	Mar-25	On-going
	HARMONI Construction	Oct-15	STFC	Apr-26	On-going
	METIS Construction	Oct-15	NOVA	Mar-26	On-going
	MAORY Construction	Feb-16	INAF	Aug-25	On-going
	IR Detectors for HARMONI, MICADO, METIS	Jul-18	Teledyne UK	Jan-23	On-going
	C-RED Cameras for MAORY	Jul-18	FLI	Sep-20	On-going
	CCD-220 Detectors for MAORY, MICADO, HARMONI, PFS-A, PDS	May-19	Teledyne UK	May-21	On-going
	MUSE type detectors	Sep-19	Teledyne UK	Jun-21	On-going
PJ42.11 Optical Control	PFS-A Main system Design and Manufacture	Apr-18	IDOM	Feb-24	On-going
	Laser Sources	Dec-17	Toptica	Dec-22	On-going

32 running contracts including the 4 Instr. agreements
6 contracts closed or in warranty period

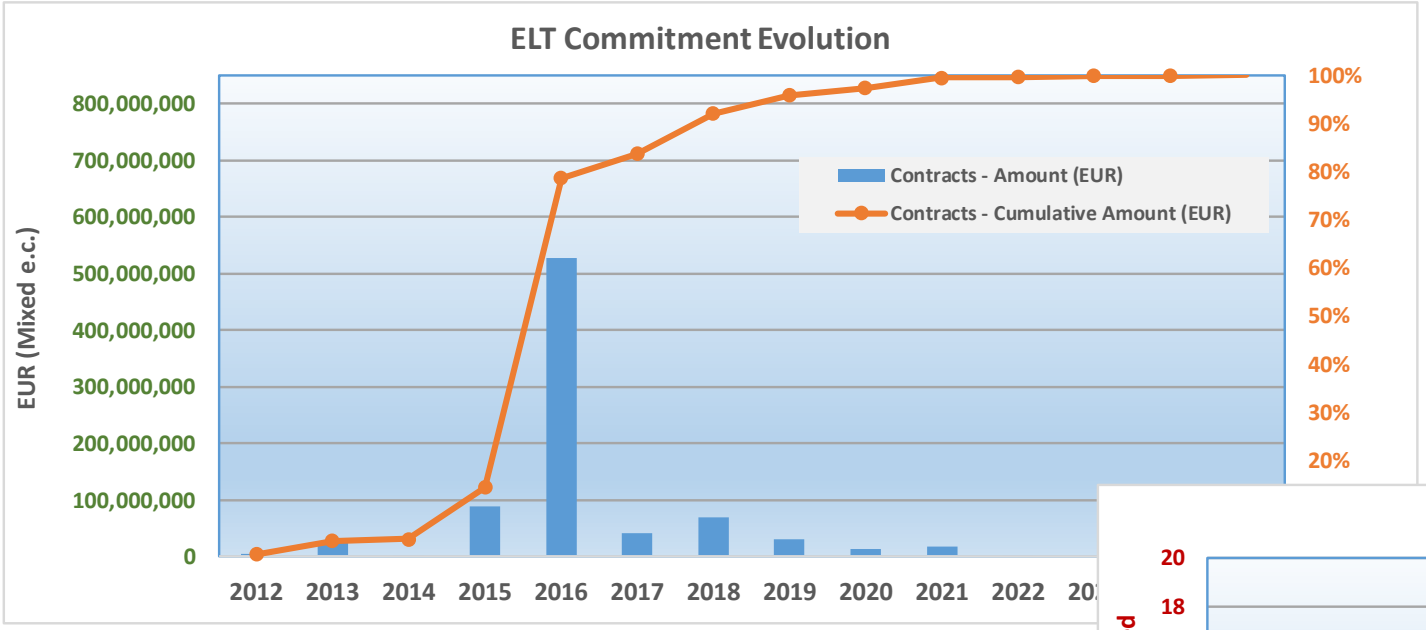
M1 Washing and Stripping Plant

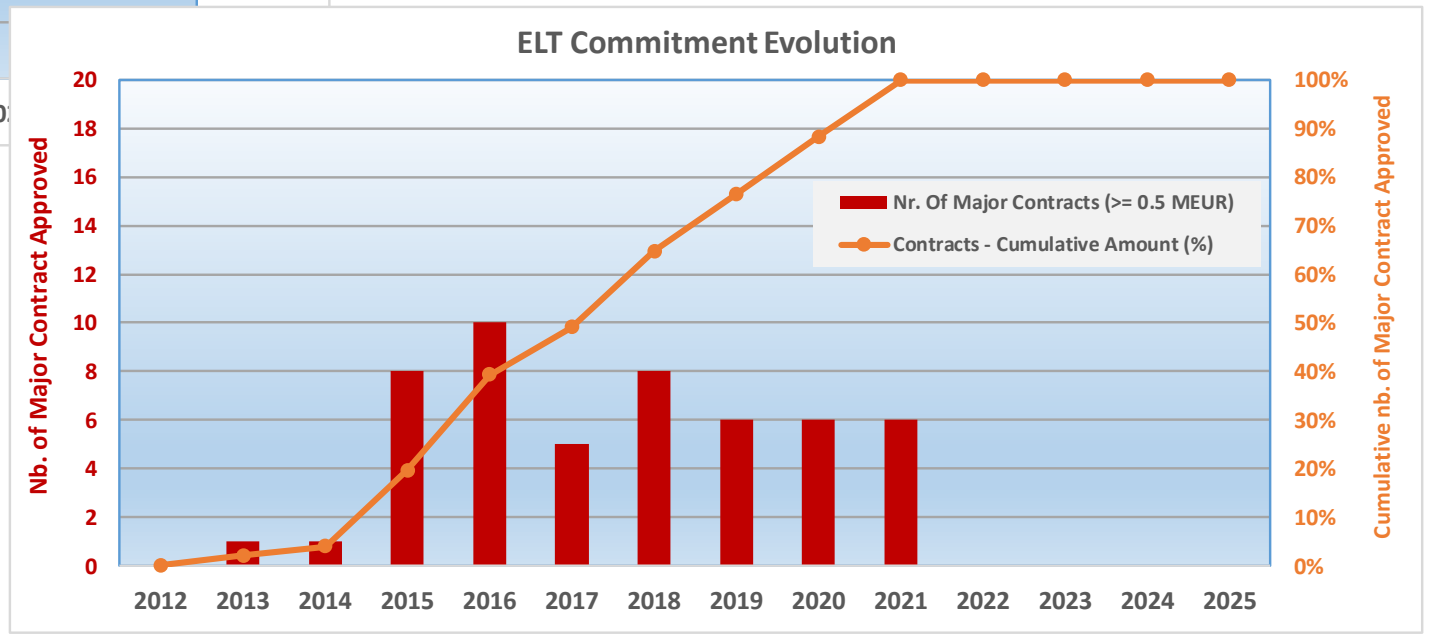
The contract was awarded after a competitive process, because of the innovative concept

FAGERSTRÖM INDUSTRIKONSULT



ELT Programme – Commitment Evolution





Timeline 2014-2026

ESO cost:

- Capital cost: ~1200 MEUR incl. manpower, instruments and contingency
- Operation cost: ~50 MEUR / year

Cameras for LVSM and CCD220

- Scope:
  - Manufacture, Verification and Delivery of different types of Wavefront Sensing Cameras for Adaptive Optics applications at the ELT
  - The cameras consist of the detector (ESO furnished) and its mount, read-out Front-End board, Main Control board, Power Regulator board, Peltier Controller/Cryostat, main structure and cooling system
- Expected Contract Duration: ~ 2 years
- Timeline (TBC):

PHASE	TIME
Request For Information	Q4 2018
Release Preliminary Inquiry	Q2 2021
Release Call for Tender	Q1 2022
FC Approval	May 2022

Coarse Metrology and Alignment System

- Scope:
  - Procurement of standard tools and design, fabrication of high-accuracy long-range metrology network to monitor relative positions of telescope mirrors [long-range (tens of m) non-contact, micron-accuracy optical sensing in industrial environment]
- Expected Contract Duration:
  - ~ 3 years
- Timeline (TBC):

PHASE	TIME
Start procurement process	Q1 2021
Closing date	Q2 2021
FC Approval	Q3 2021

Nevetheless the ELT is only one of the many ESO projects. Have a look at:

https://www.eso.org/public/industry/

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THANKS!

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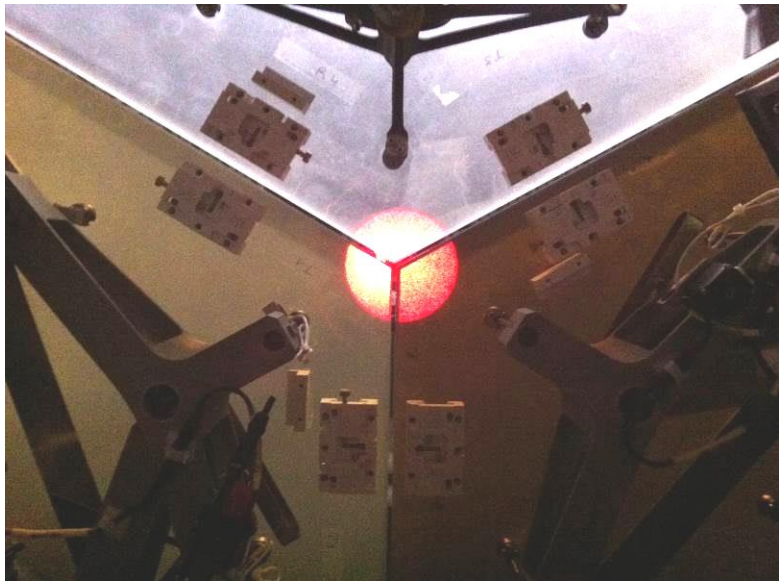
Supporting Slides

M1 Segment Assembly - Local Coherencer (LOCO)

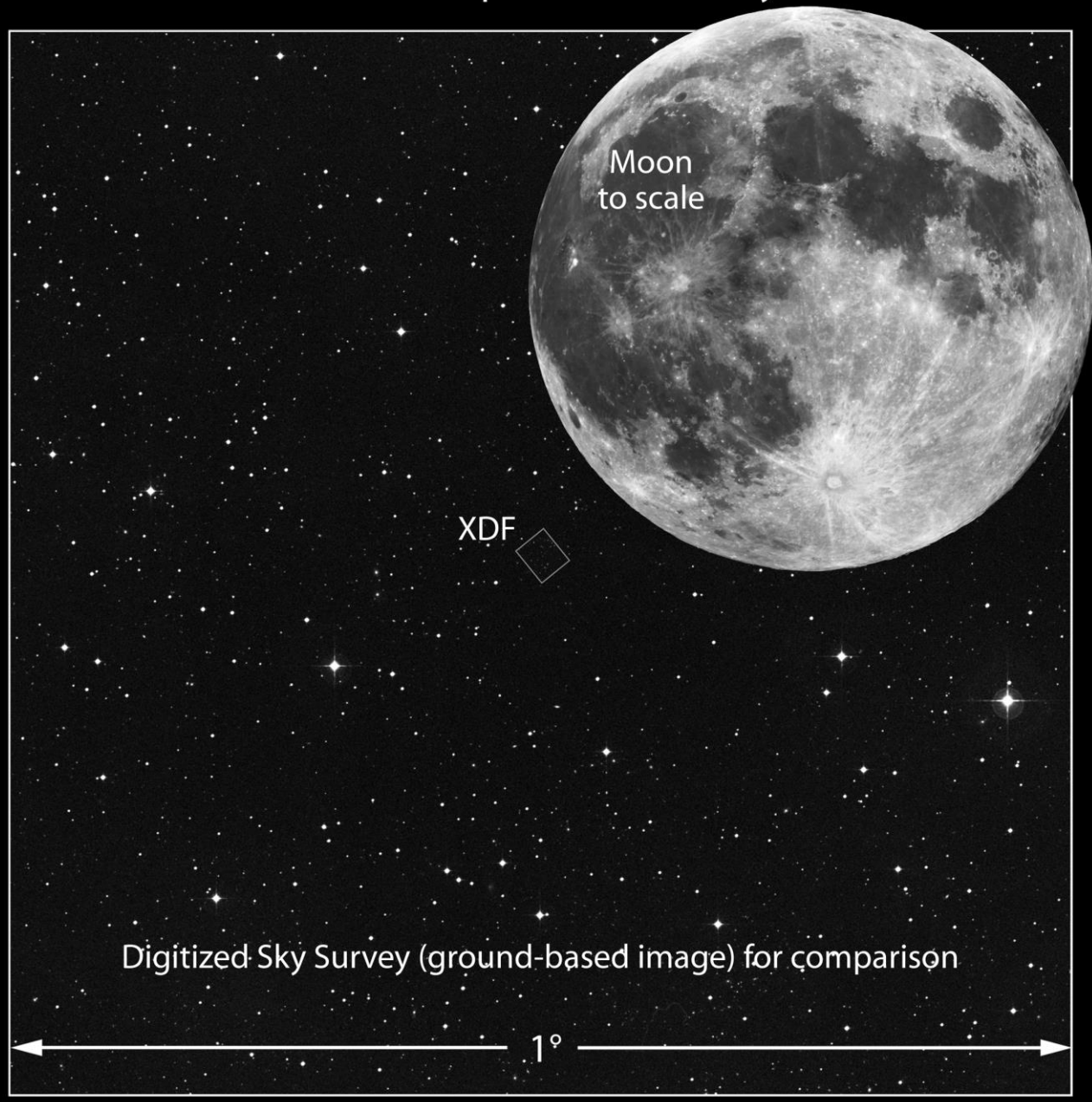
- Specialties for potential (sub)contractors:
  - mechatronics,
  - automation engineering,
  - non-contact nanometer-accuracy
  - optical sensing in industrial environment



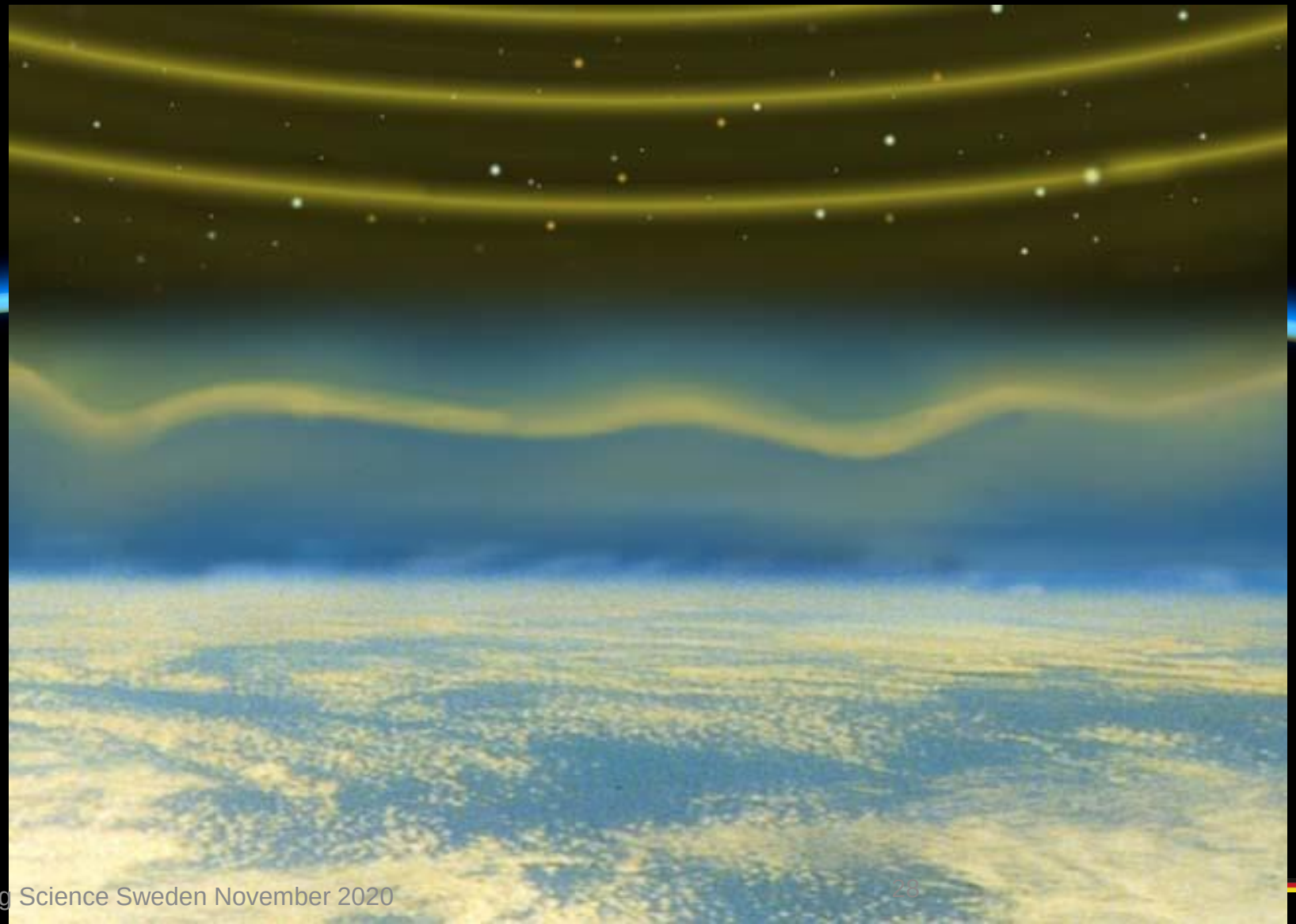
The Author

Fabio Biancat Marchet *was born in Venice, Italy. With a background in Automation and Control, he started his career in the off-shore industry designing submarine robots, and in 1994 joined ESO to work on the Very Large Telescope project. At the conclusion of the VLT construction he moved to the ALMA project , where he eventually covered the role of deputy European Project Manager. After having been the head of the Project Management Department, Fabio has been appointed as Programme Engineer for the European Extremely Large Telescope in 2017.*

Size of Hubble eXtreme Deep Field on the Sky



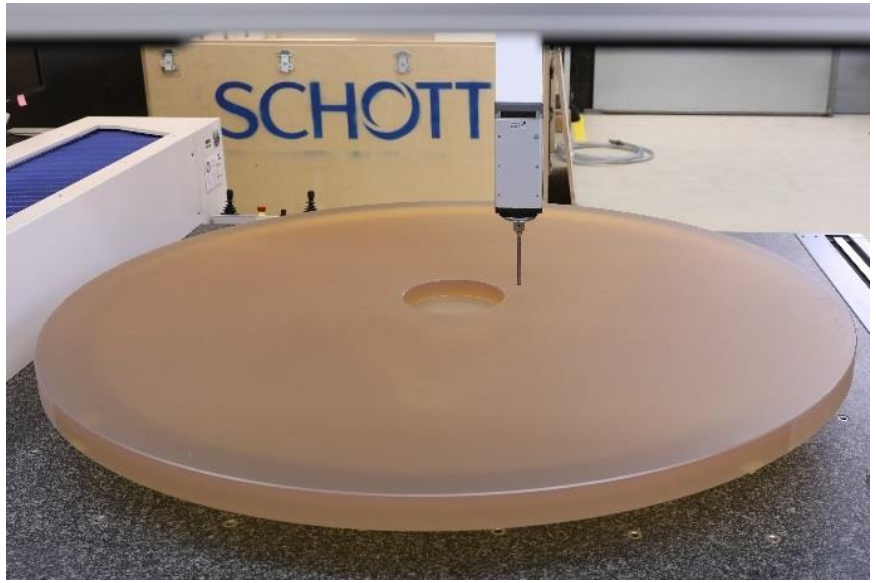
The challenge: atmosphere



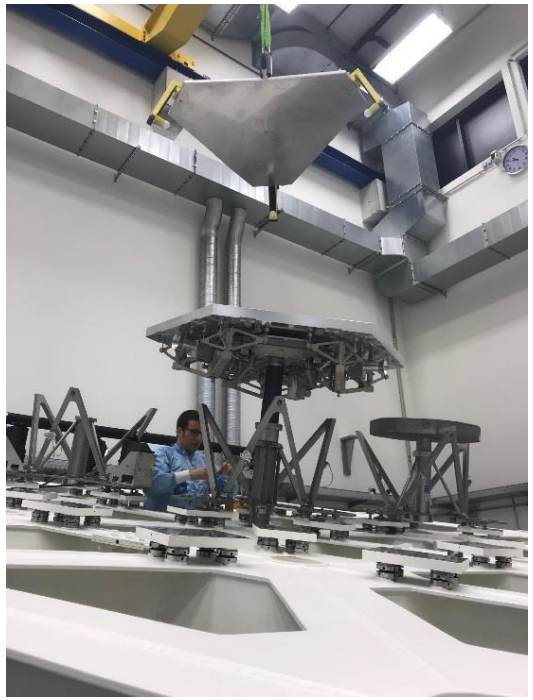
Without Adaptive Optic

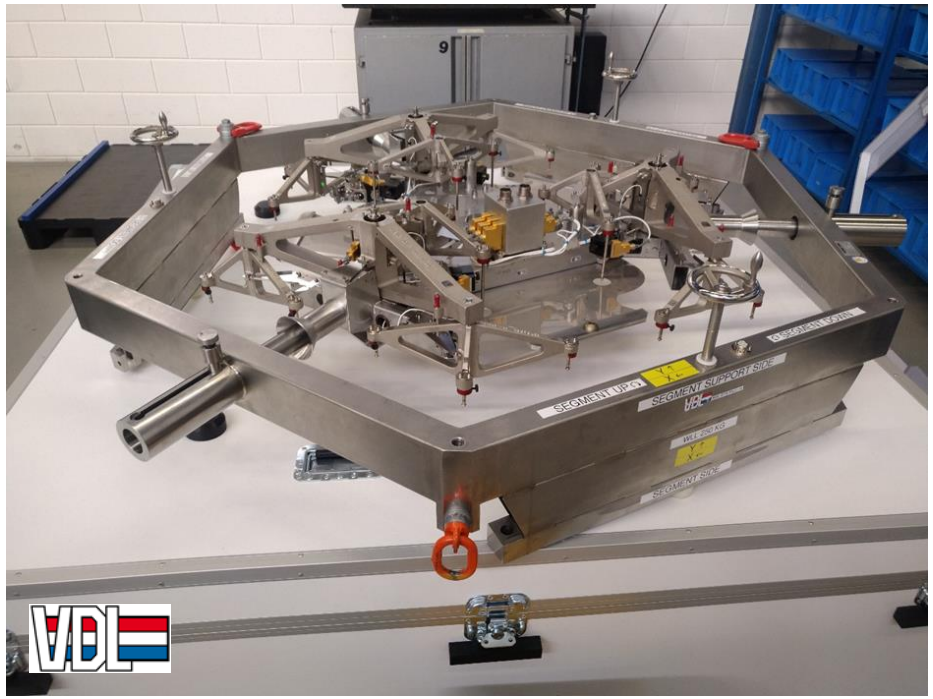
With Adaptive Optic

M1 Segment Blanks



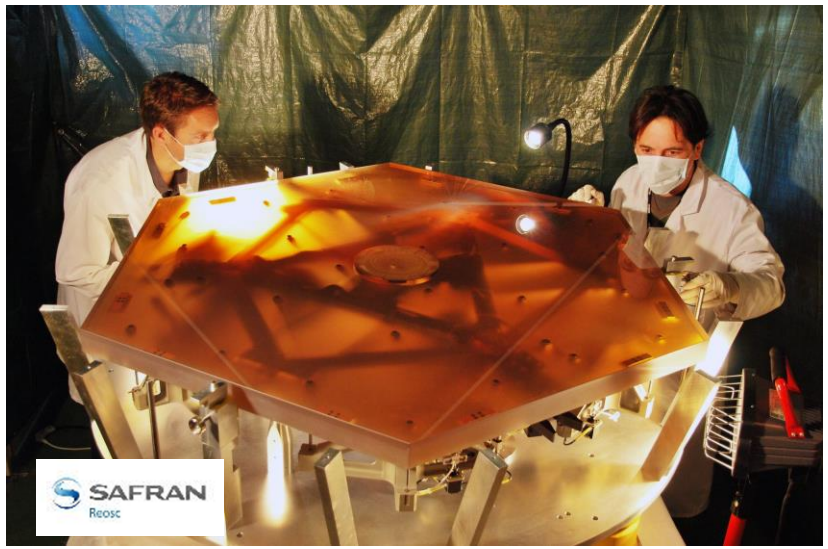
M1 Segment Support



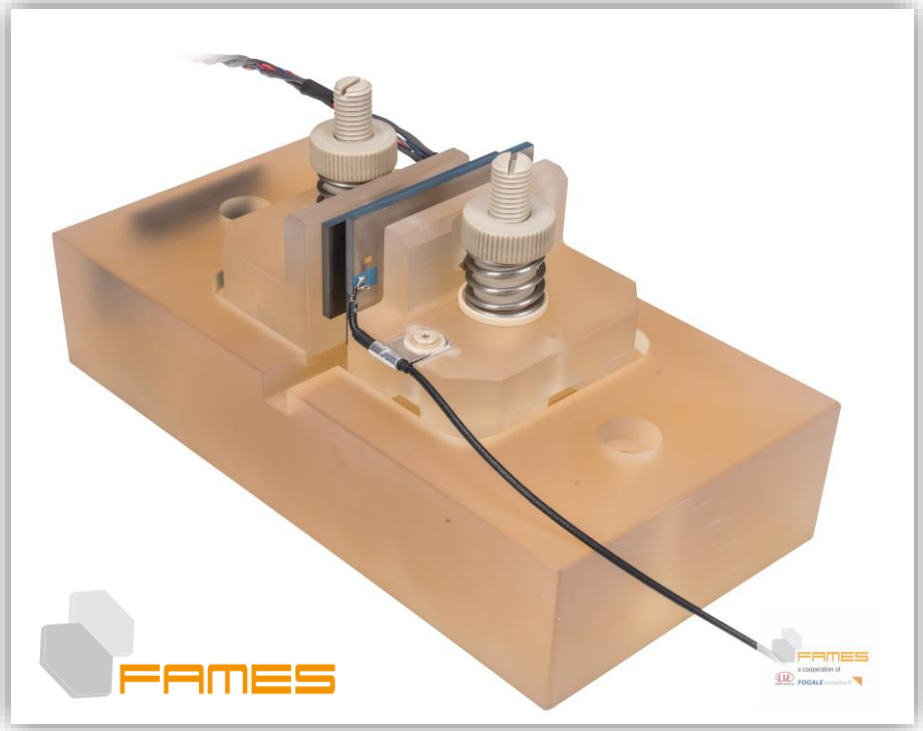


M1 Segment Polishing

Status – Facilities and Production Equipment

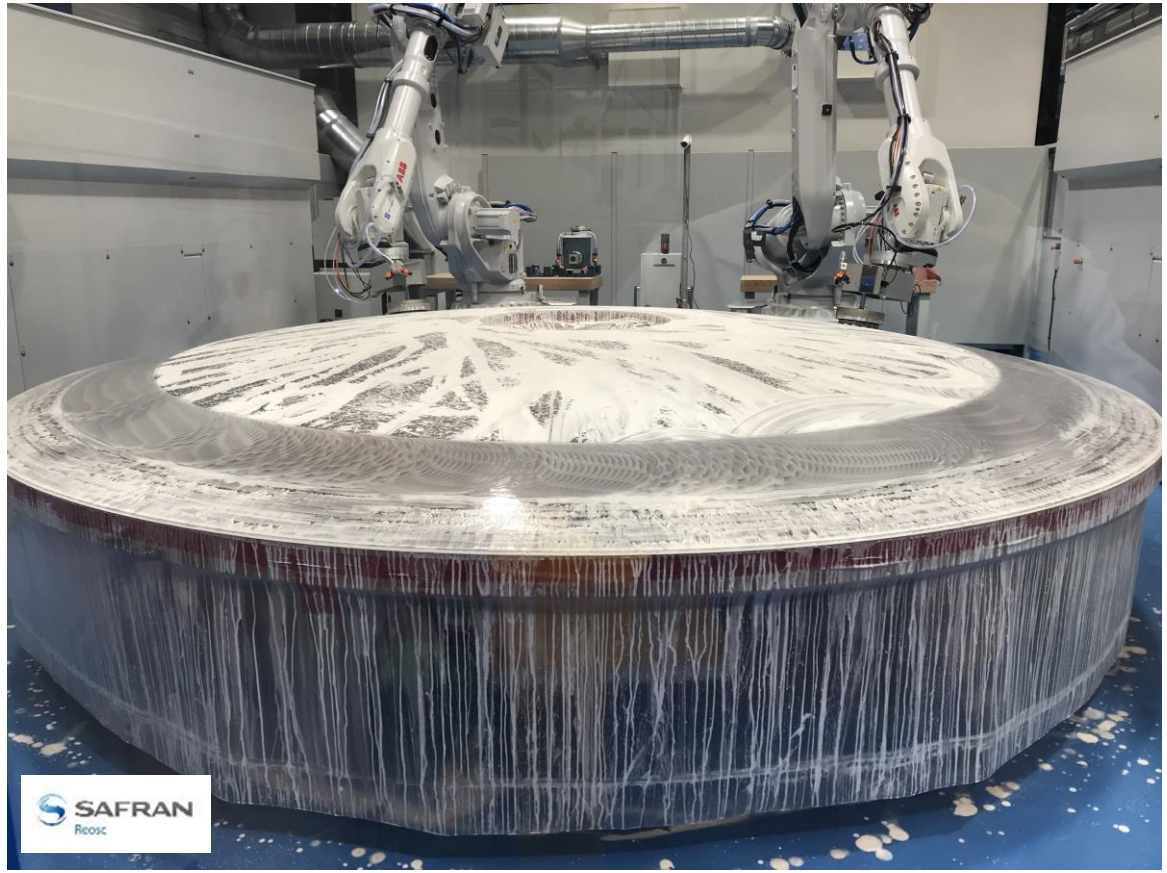


M1 PACT and Edge Sensors

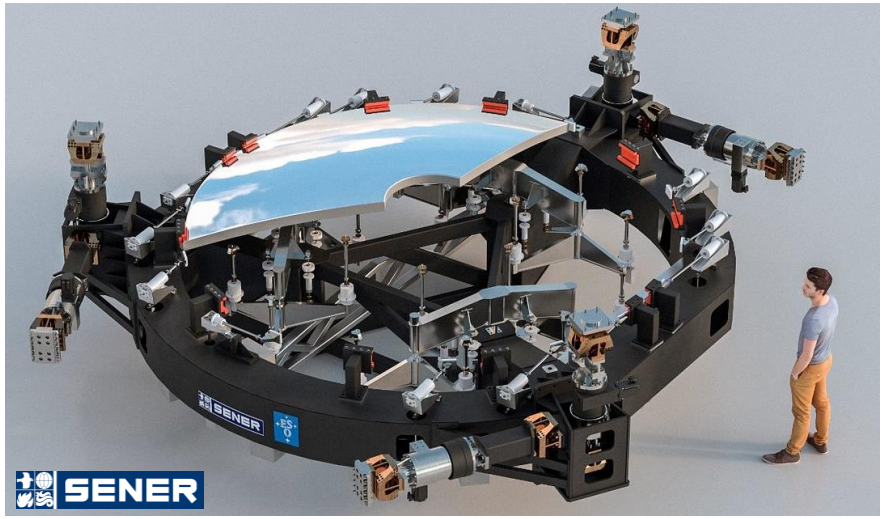


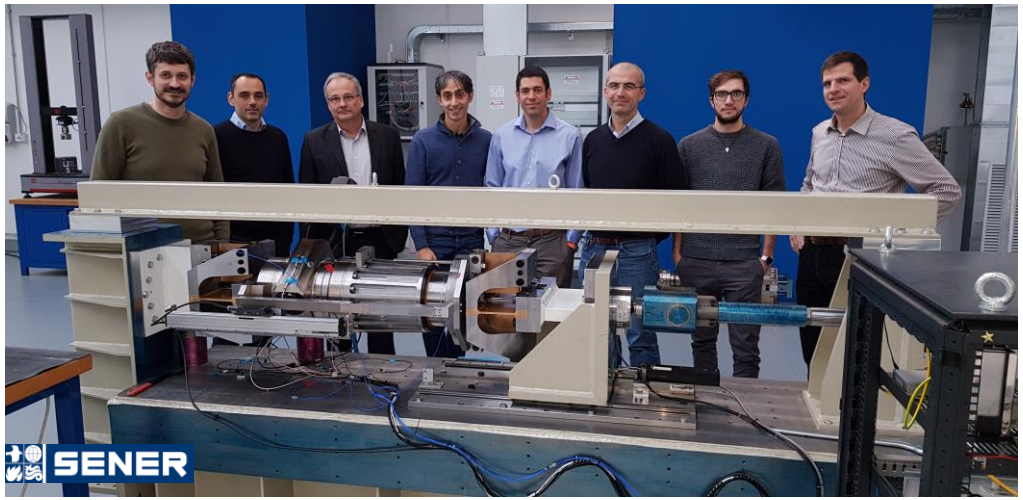
M2 blank from SCHOTT to ESO to SAFRAN-Reosc

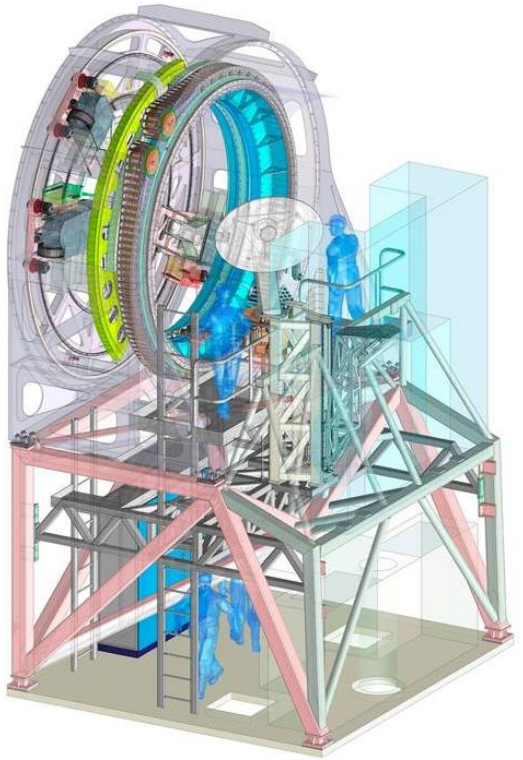
M2 Mirror Polishing

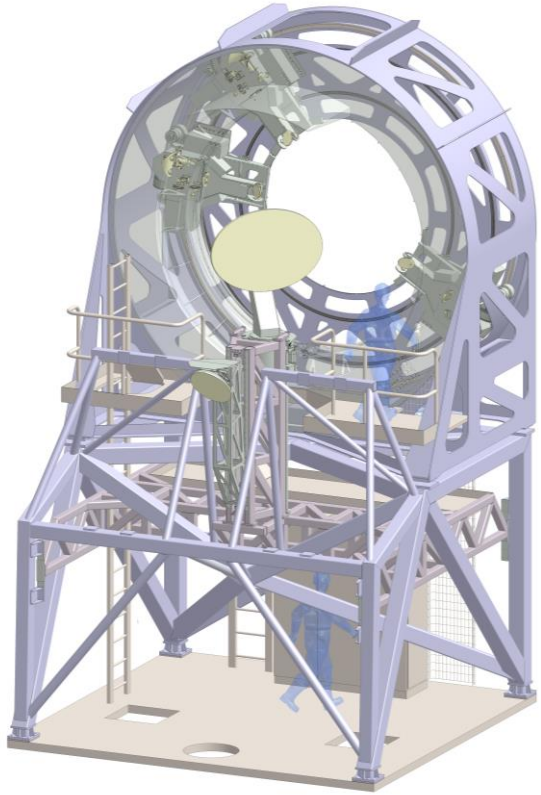


M2 Cell and PFS







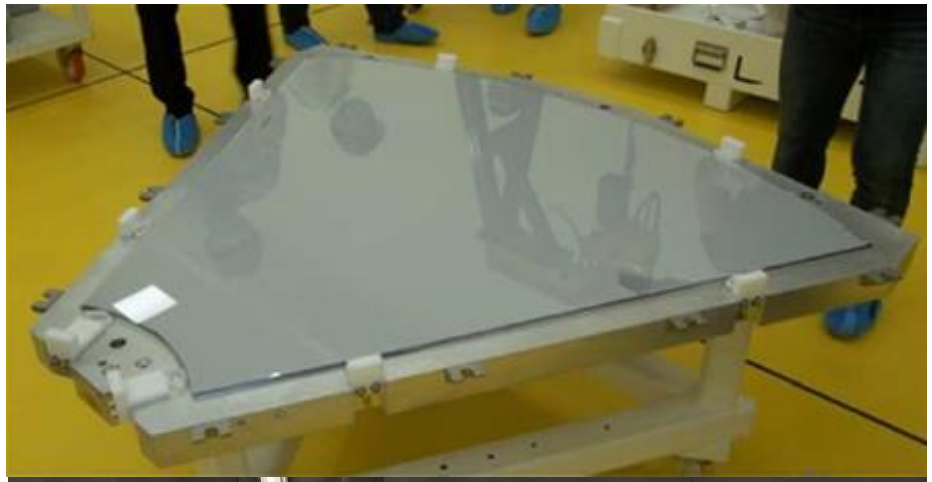


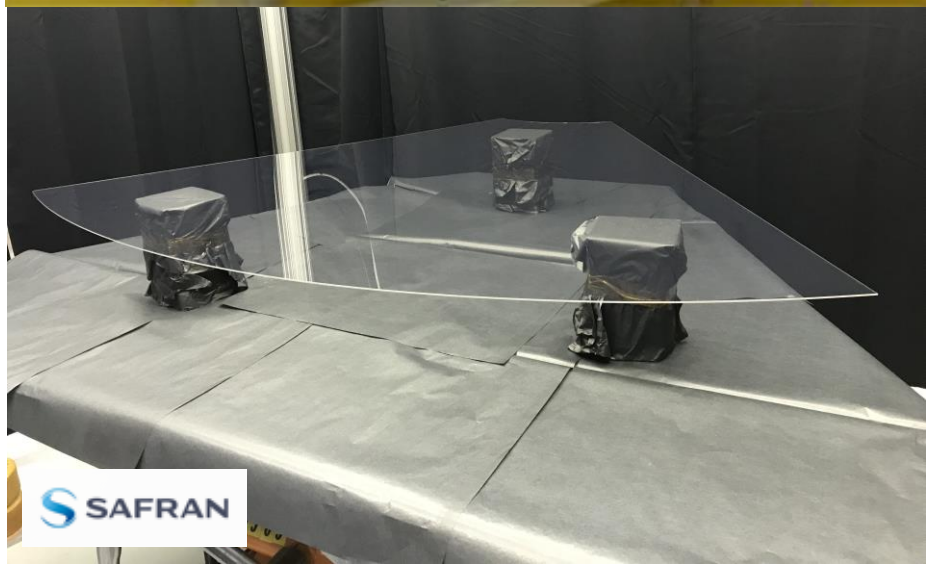
IDOM

adoptica

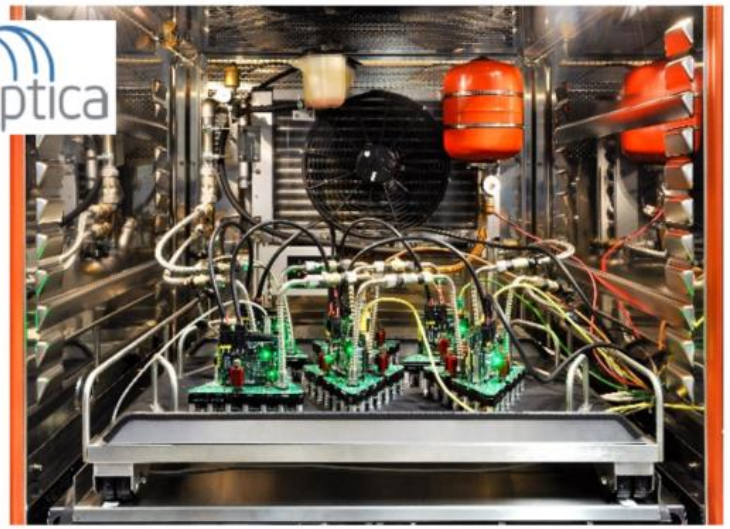
M4 Shells

Status



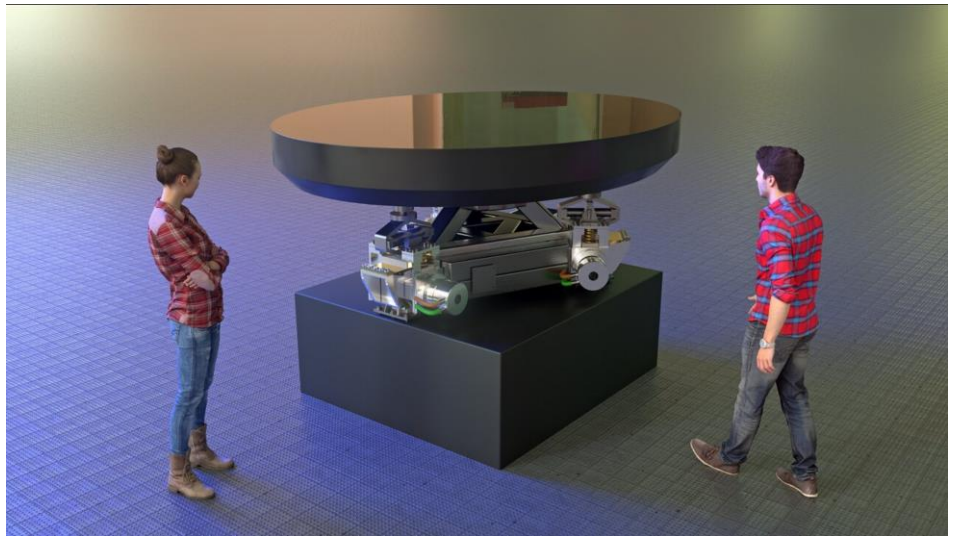


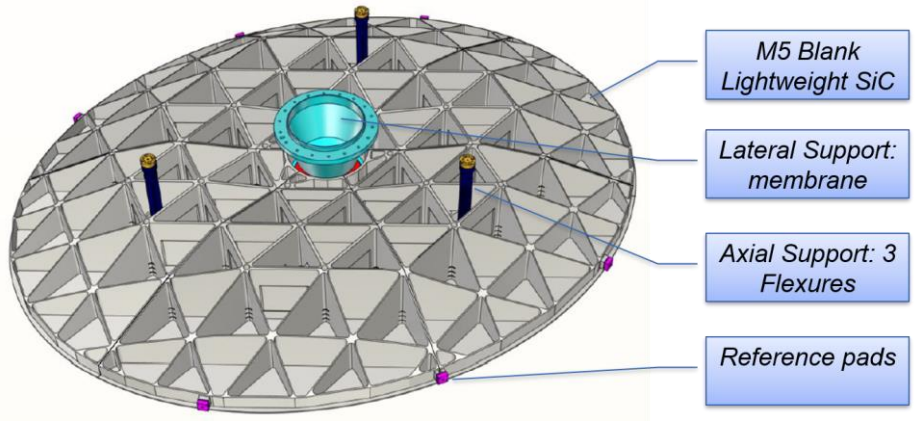
M4 Unit



The ELT M4 Actuator Bricks production and testing

M5 Unit

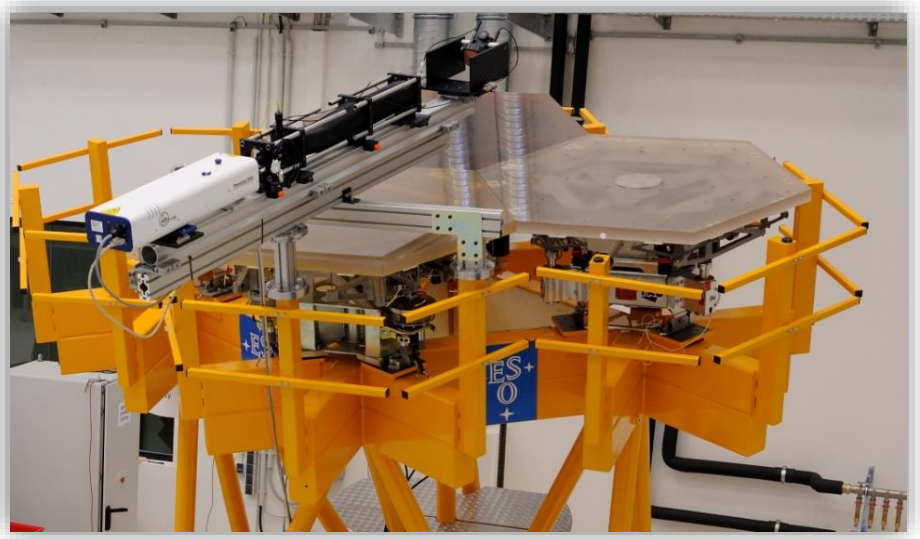




Scale 1 Prototype Unit

M1 Segment Assembly - Local Coherencer (LOCO)

- Scope:
  - Design, manufacturing and testing of a prototype optical sensing tool to perform local segment coherencing/alignment and offer for a fixed price offer for production of 6 units
- Expected Contract Duration:
  - ~ 1 + 1 years
    - 1 year for prototyping, (6 months ESO testing), 1 year for production of 6 units
- Timeline:



Release Call for Tender	Q4 2020 (tbc)
Closing date	TBD
FC Approval	Q2 2021