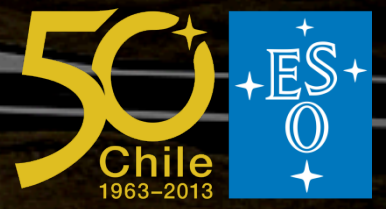
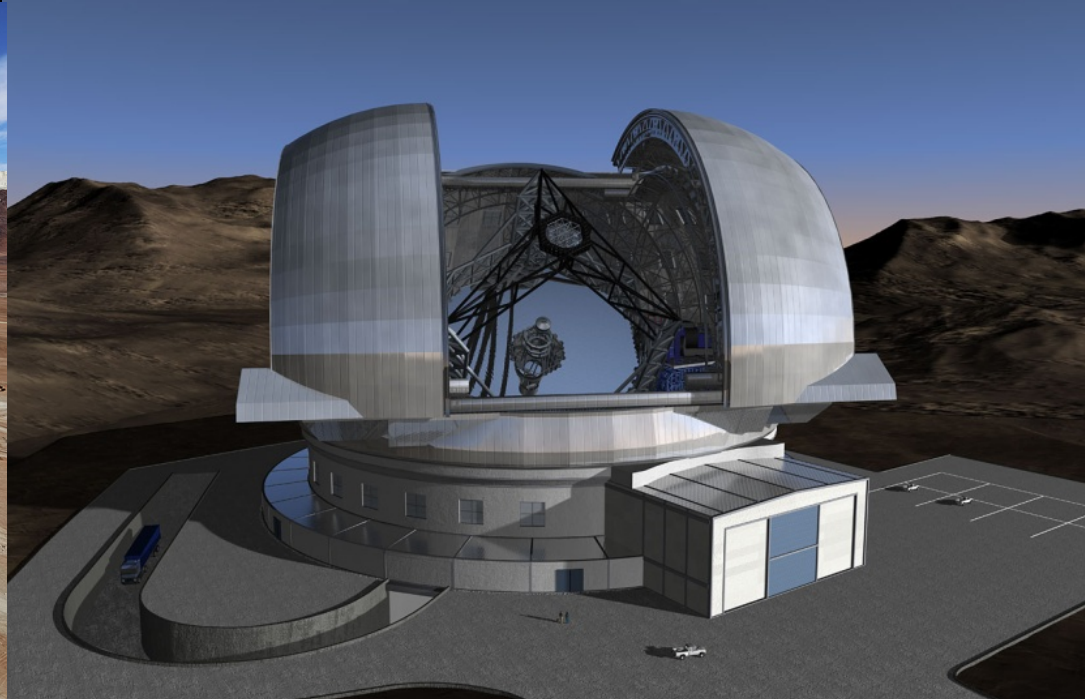


New facilities and instruments: the European Extremely Large Telescope



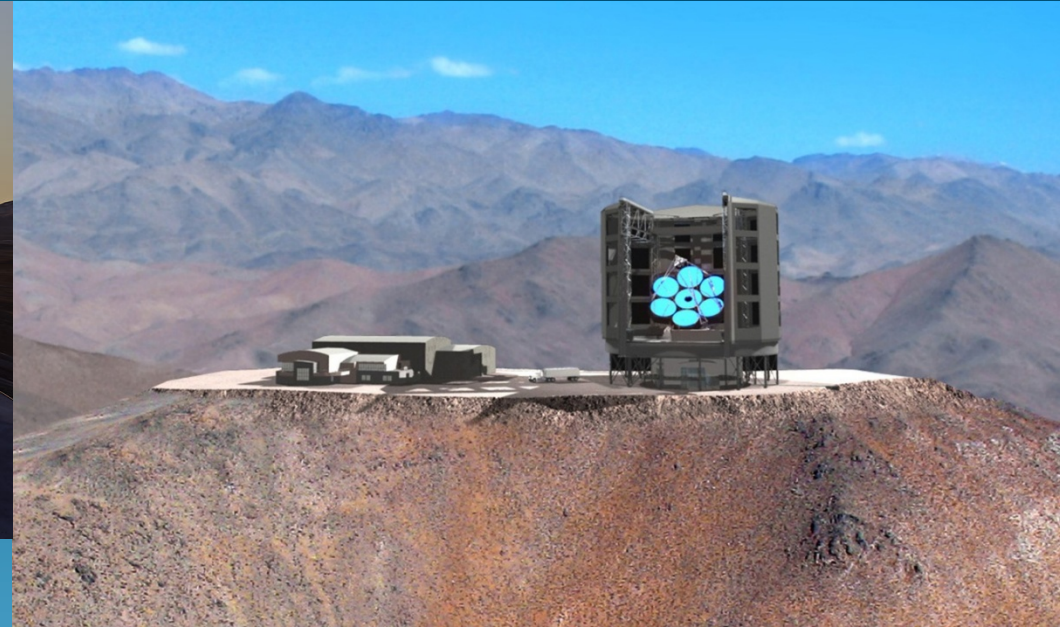
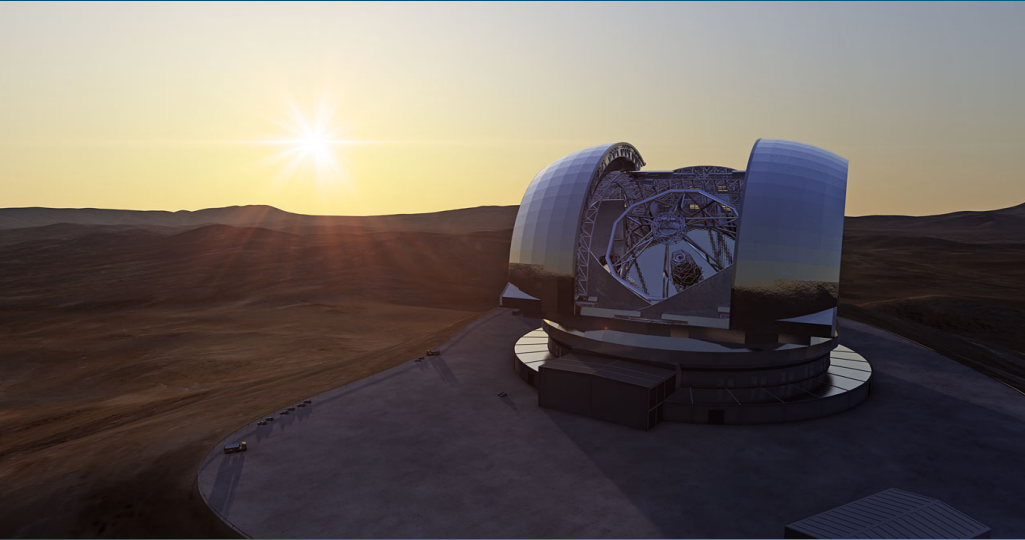
Fernando Comerón



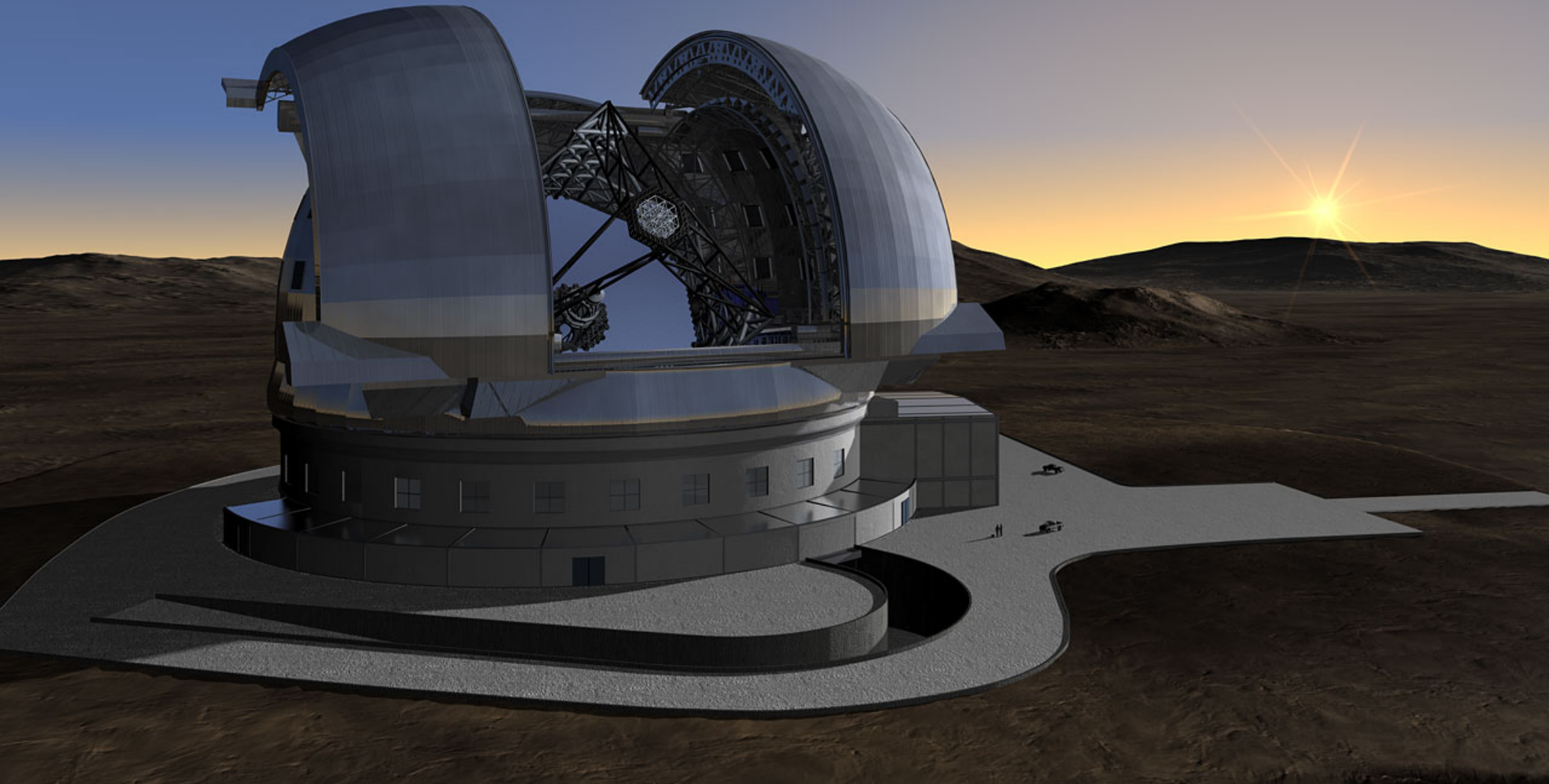


The new generation of giant telescopes

Two of the three projects under development of the next generation of giant telescopes are located in Chile: E-ELT (Cerro Armazones) and GMT (Las Campanas)

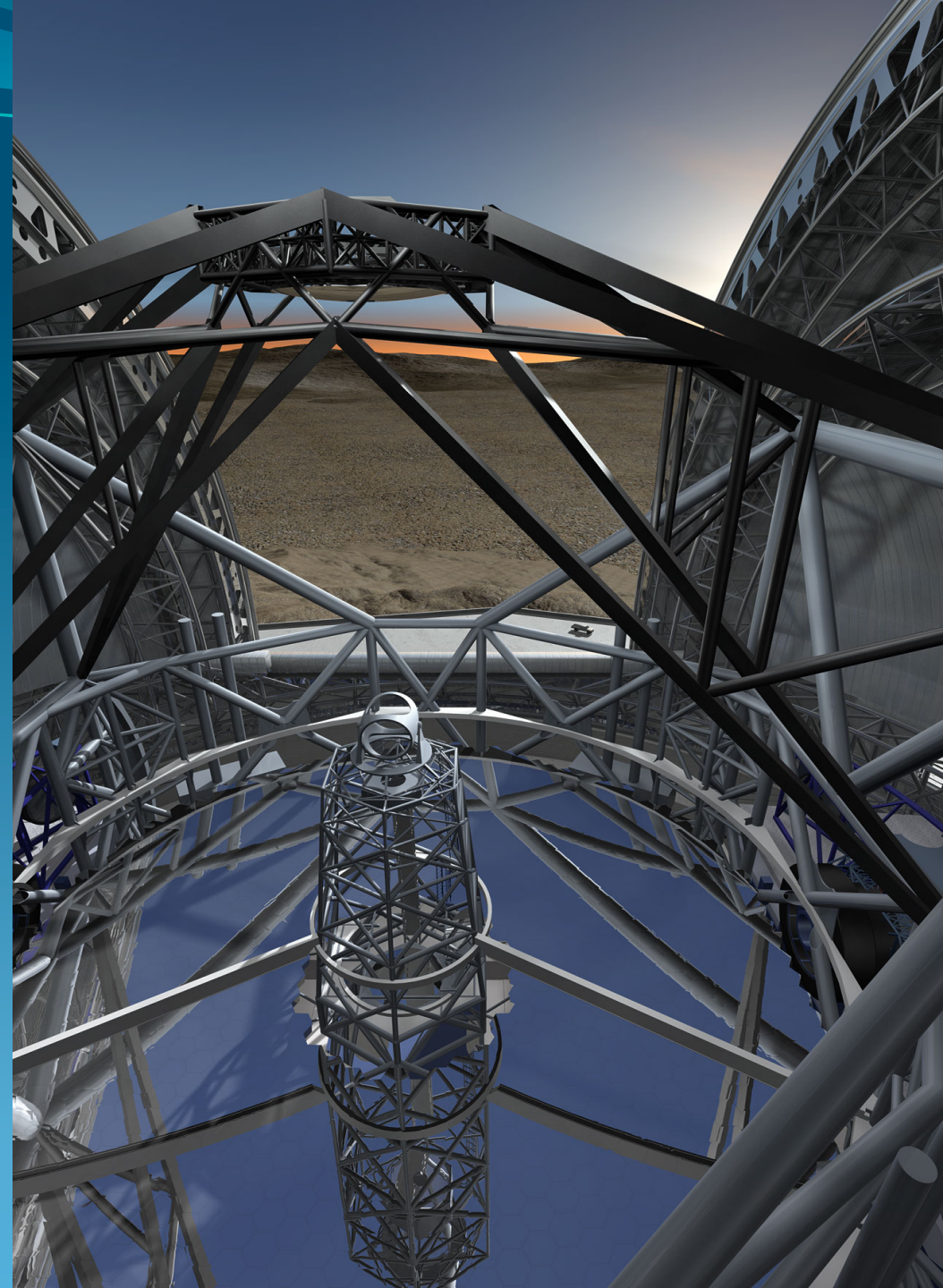


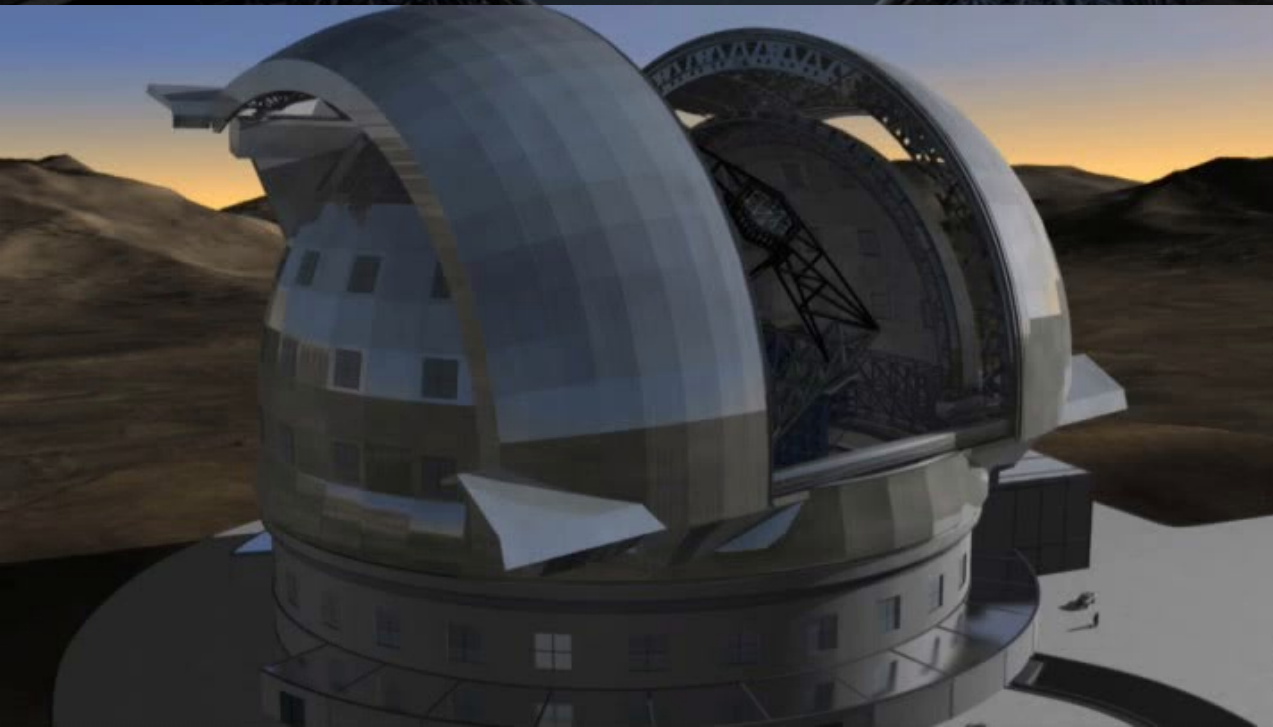
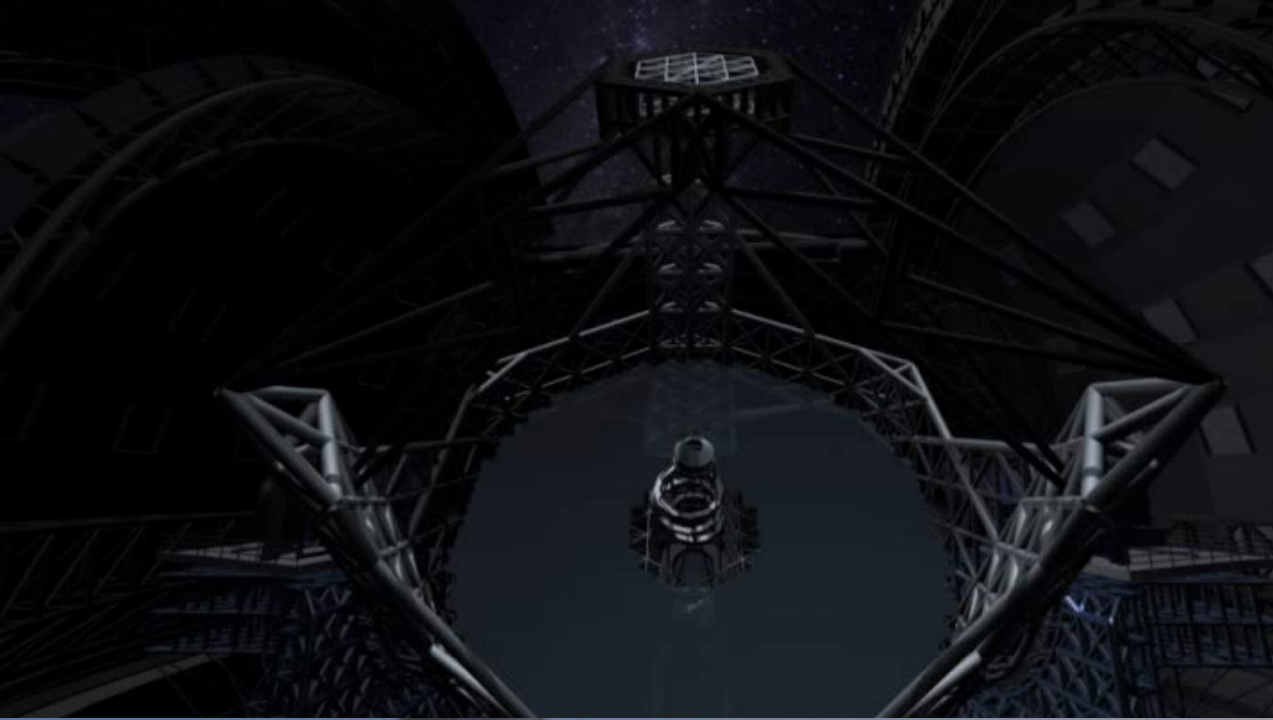
The European Extremely Large Telescope



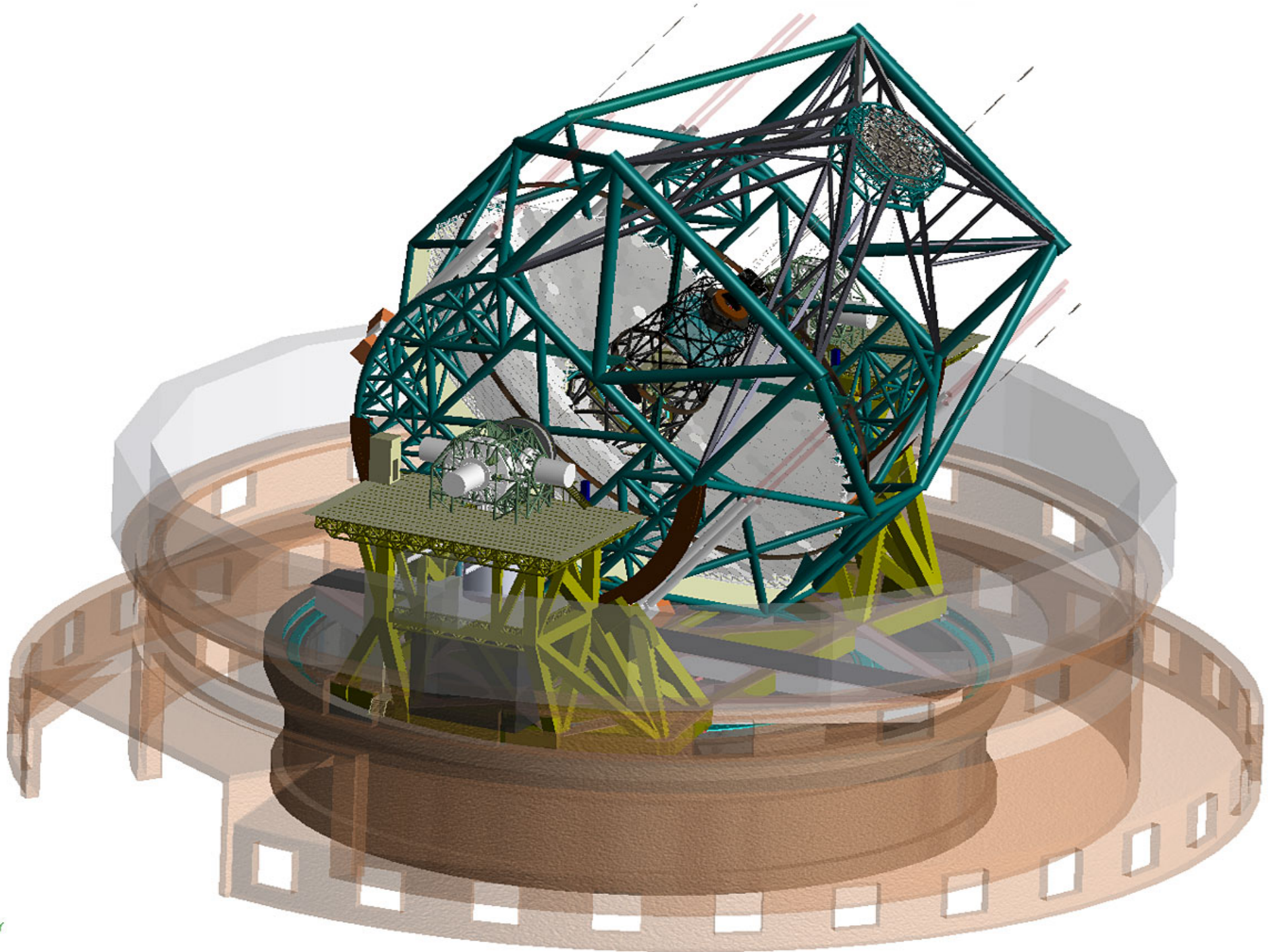
- A primary mirror of 39.3m equivalent diameter
- Segmented mirror
- Designed for observations from 0.35 to 20 microns (violet to thermal infrared)
- 10x increase in light gathering power and 4x in diffraction-limited resolution with respect to the largest current telescopes

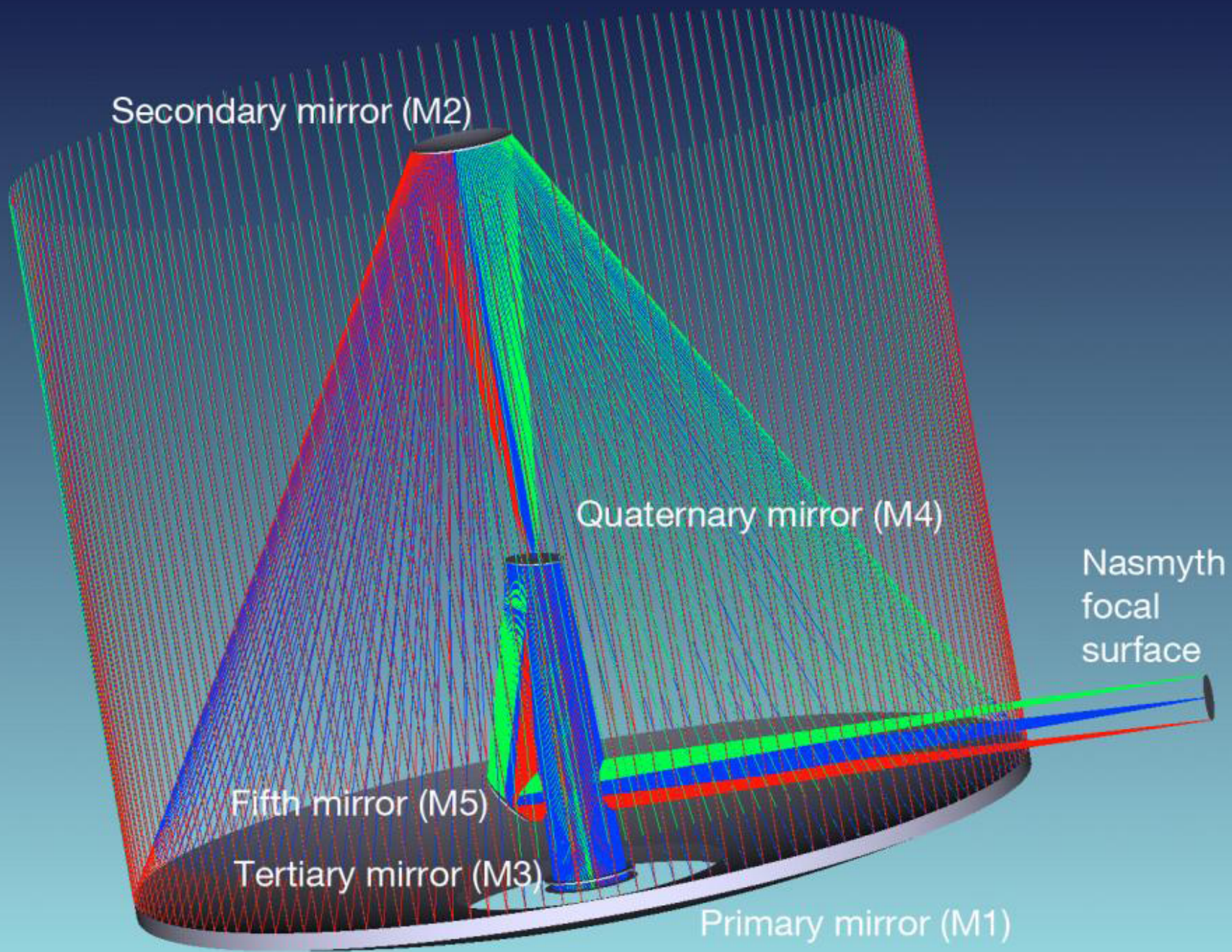
*A huge increase in parameter space
for new discoveries*





- Nearly 800 segments to be aligned with extreme accuracy
- 5-mirrors optical configuration (astigmatism, coma and spherical aberration corrected on a wide field $\sim 10'$ across)
- Adaptive optics fully built in the telescope optical design: ability to work near the diffraction limit
- Pointing and tracking with very high accuracy for a structure of over 4,000 kg weight
- Enclosure includes a rotating dome over 80m in diameter
- Cost: \$1,500,000,000





Secondary mirror (M2)

Quaternary mirror (M4)

Nasmyth focal surface

Fifth mirror (M5)

Tertiary mirror (M3)

Primary mirror (M1)

New technologies

ESO is implementing at the VLT new technologies needed for the E-ELT

- Laser guide stars
- Extreme adaptive optics
- Multiconjugated adaptive optics
- Large deformable mirrors
- Instrument concepts

ESO is also experimenting with segmented mirror control via access to the GTC (Gran Telescopio Canarias)

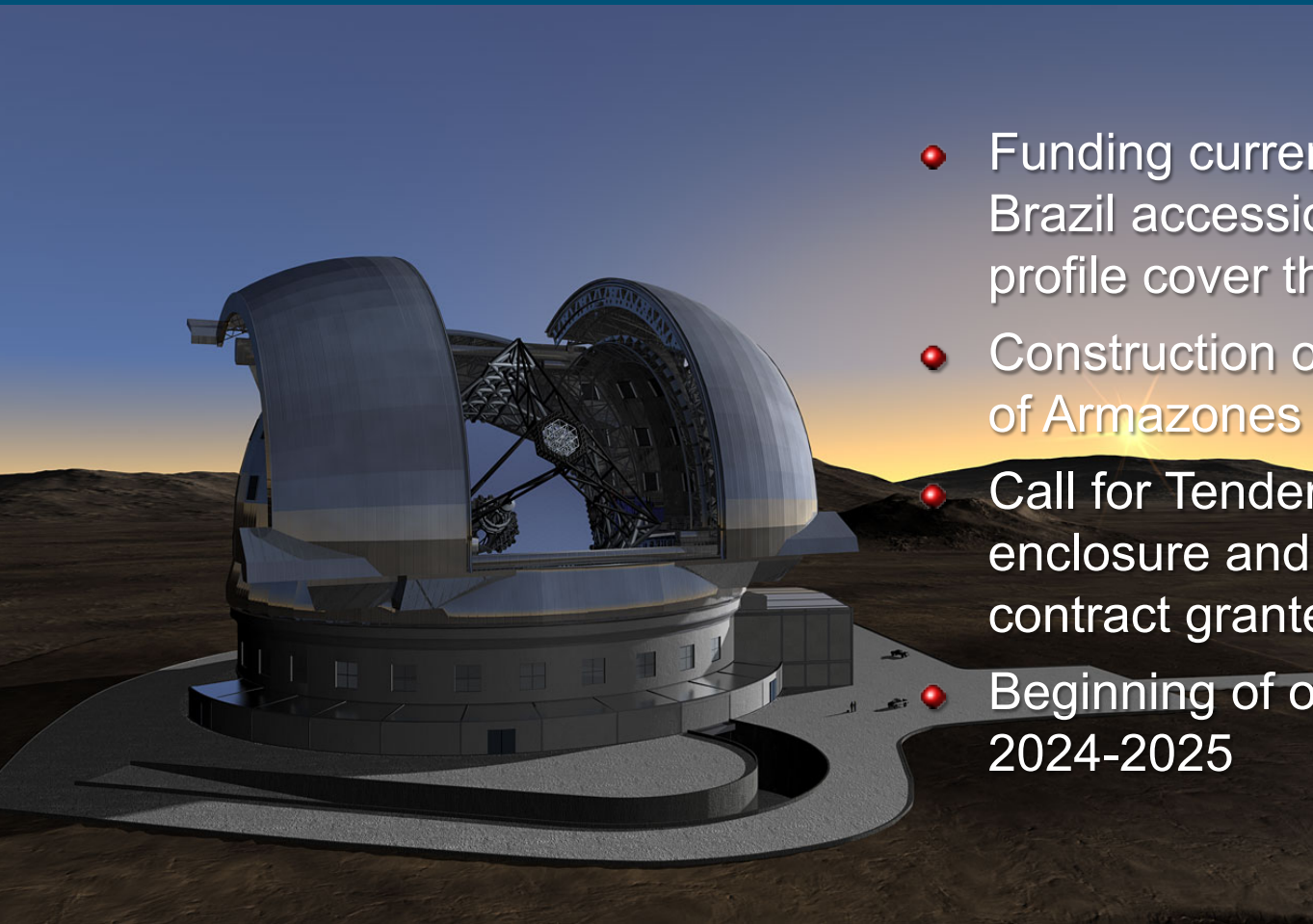


Location: Cerro Armazones

22 km away from Paranal in straight line, allowing its integration in a single observatory



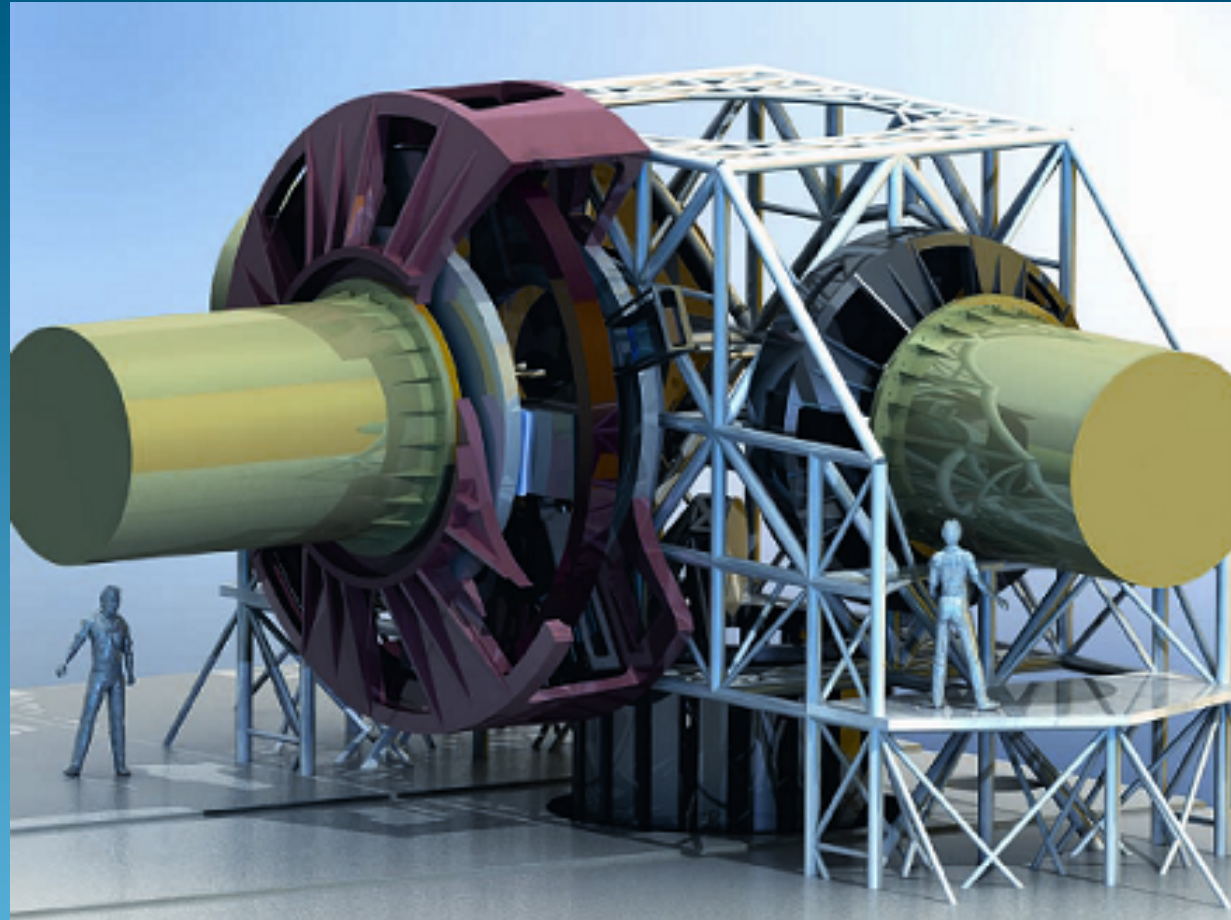
Current status



- Funding currently guaranteed over 80%: Brazil accession or a modified payment profile cover the rest
- Construction of access road and flattening of Armazones summit is ongoing
- Call for Tenders for construction of enclosure and main structure is out: contract granted in mid2015
- Beginning of operations estimated in 2024-2025

E-ELT instrumentation

- Probably up to 8 foci simultaneously available (6 Nasmyth, 1 vertical, 1 coudé)
- Adaptive optics possible, in different flavors (GLAO, SCAO, LTAO, MCAO, MOAO, XAO)
- 8 instruments and 2 post-focal adaptive optics modules gone through conceptual design
- 6 instrument concepts selected, 7th to be decided later

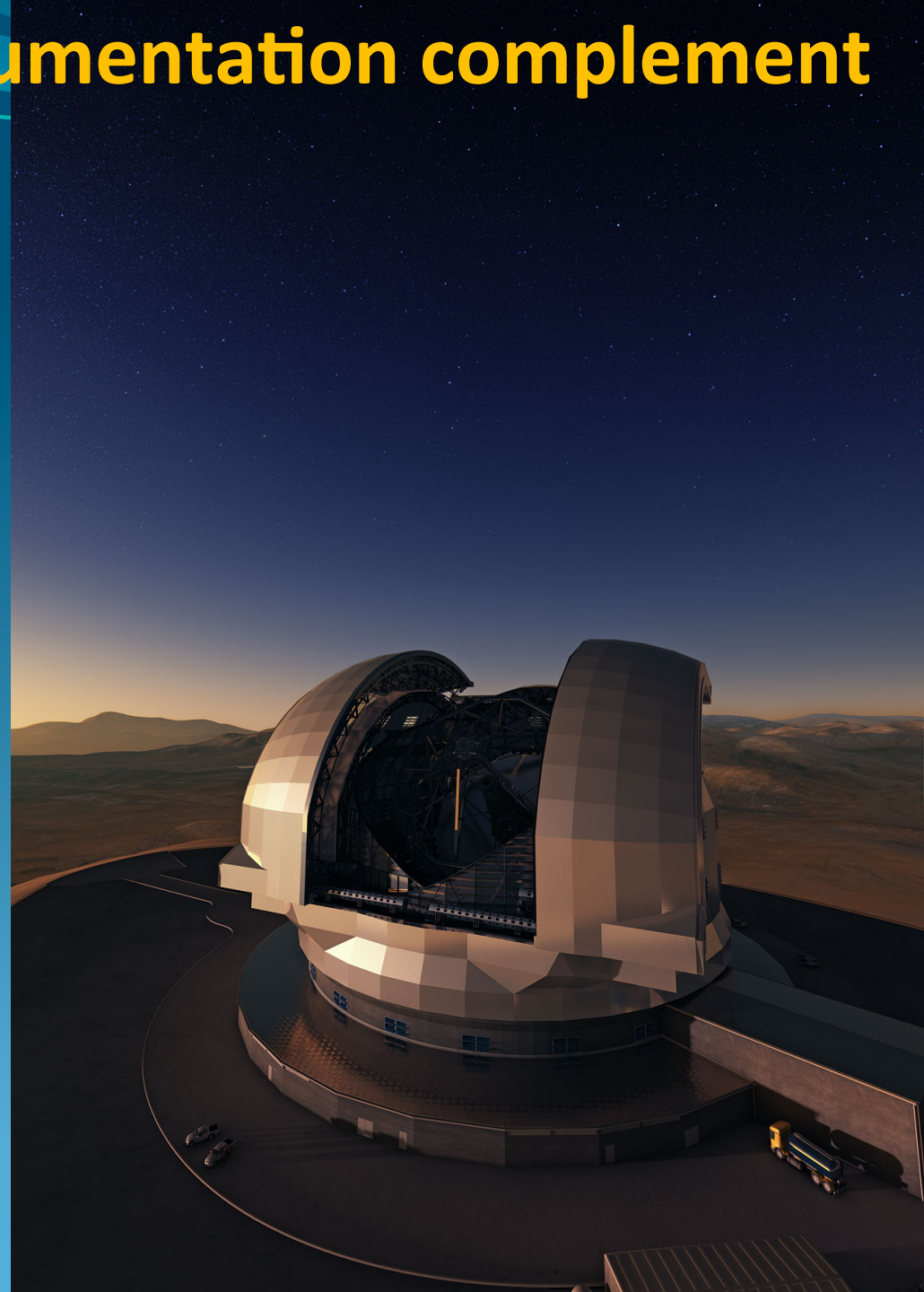


E-ELT instrumentation plan

Year	ELT-IFU + LTAO	ELT-CAM + MCAO	ELT-MIR	ELT-MOS	ELT-HIRES	ELT-6	ELT-PCS
2012	Develop science reqmts, AO architecture.						
2013			Develop science requirements for MIR/MOS/HIRES				
2014			VISIR start on-sky. Detector check.	Call for proposals Start Ph A	Call for proposals Start Ph A		Start ETD
2015				Consortium selection for construction	Consortium selection for construction		
2016						Call for Proposals	
2017						Start Ph A	TRL check – start when ready
2018							
2019						Consortium selection for construction	
2020							
2021							
2022							
2023							
	Pre-studies taking the form of Phase-A or delta-Phase-A work and/or ESO-funded enabling technology development (ETD)						
	Decision point						
	Development of Technical Specifications , Statement of Work, Agreement, Instrument Start.						

The path to the full instrumentation complement

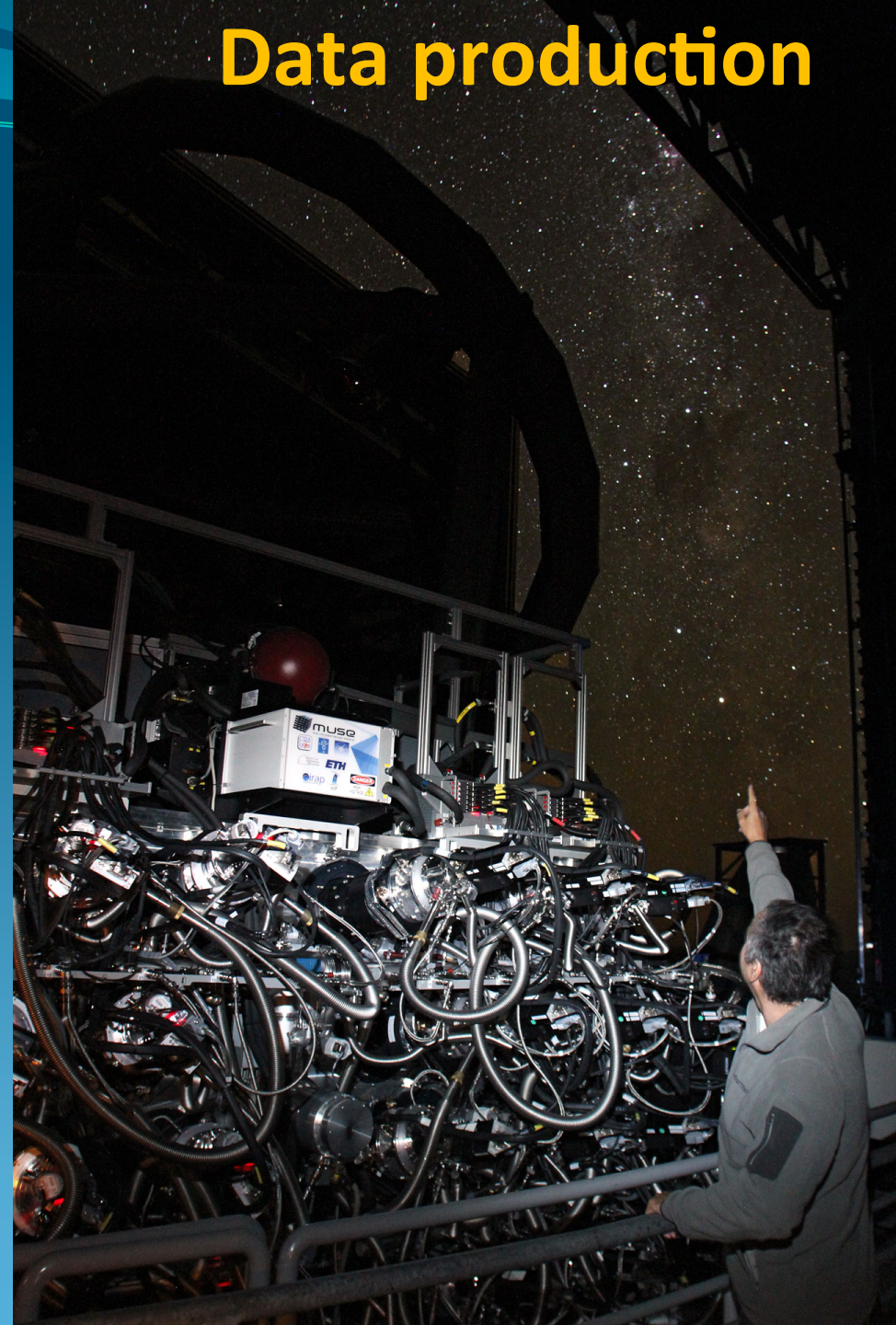
- Planned start with 2 instruments, built by institutes in the member states
- Steady increase up to 7 instruments over first ~10 years of operations, somewhat depending on
 - Budget availability
 - Capabilities of groups
 - Technology validation of new concepts
- Long lead time: concepts in place today are those that will be implemented in 1st generation for the E-ELT



Data production

- Planned instruments are based on concepts and technologies being implemented at the VLT
- Data rates, new modes, detector sizes, ... all expected to increase at the VLT before the E-ELT comes online
- Paranal throughput now: ~200 GB/night (VLT+VLTI+VISTA+VST)

Data volume of Paranal + Armazones expected to be dominated by telescopes on Paranal, also in the E-ELT era (estimate ~1 TB night, to be reached gradually: E-ELT brings “just one more instrument per night”)



Data challenges

Complex modes (multiplexing, IFUs, high-Strehl AO...) becoming more popular

- High data volume including science and calibration: high performance computing becomes critical
- Light-collecting power opens doors to high-frequency-sampling monitoring (burst mode): further increase in data volume
- Data reduction requires specialized knowledge
- Few end users expected to work on raw data products
- Archives of raw data will have limited use
- Good pipelines will play a primary role!
- Which data to be pushed across the Atlantic? Where to do data processing?

Data mining:

- Increasing variety of data types requires robust data description standards (VO)
- E-ELT time very limited: expected increase in the role of archives

