

# ESO Policies and Practices of Access to Observing Time and Data

A large, bright orange circle representing the sun dominates the background. In front of it, the silhouette of the Very Large Telescope (VLT) at Paranal Observatory is visible, including the four large domes and the surrounding construction cranes.

Xavier Barcons

*Director General, European Southern Observatory*



# Our identity Our facilities

# ESO: facts and figures

- Intergovernmental Organisation, founded in 1962
- 16 (European) Member States and partnerships with Chile (since 1963) and Australia (2017-2028)
- 750 staff of 30 nationalities: 450 in Germany and 300 in Chile
- Yearly financial income (from Member States and Australia): 228 MEUR (in 2024)
  - In proportion to GDP
- Expenditure budget 2024: 400 MEUR, including ELT construction costs
  - About 60% is used to design and develop new telescopes and instruments
- Important role in international science policy
  - Cooperation agreements with ESA, CERN and SKA
  - Participation in international forums: EIROForum, ESFRI, UNOOSA/COPUOS

# ESO's Mission



*We design, build, and  
operate advanced  
ground-based  
observatories*



*We foster international  
collaboration  
for astronomy*



# ESO's Vision



**To advance humanity's understanding of the Universe** by working with and for the astronomy community, providing it with **world-leading facilities**

# ESO Headquarters in Garching (Germany)

Development of new telescopes and instruments

Back-end of observatory operations

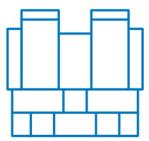
Administration

Science



# ESO telescopes

## Paranal



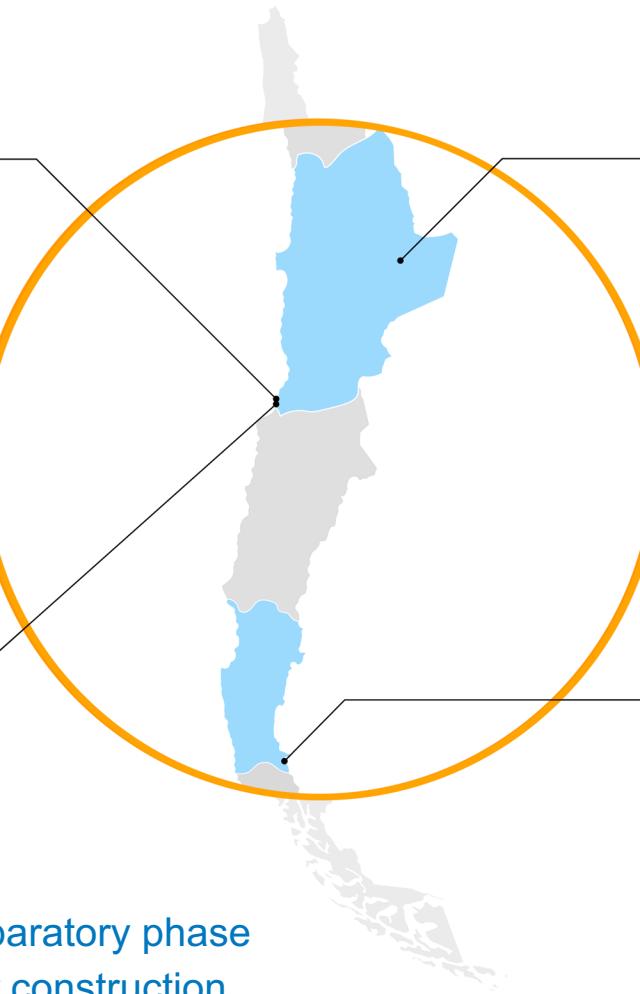
VLT  
VLTI



VISTA



CTA  
South\*

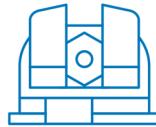


## Chajnantor



ALMA

## Armazones



ELT\*\*

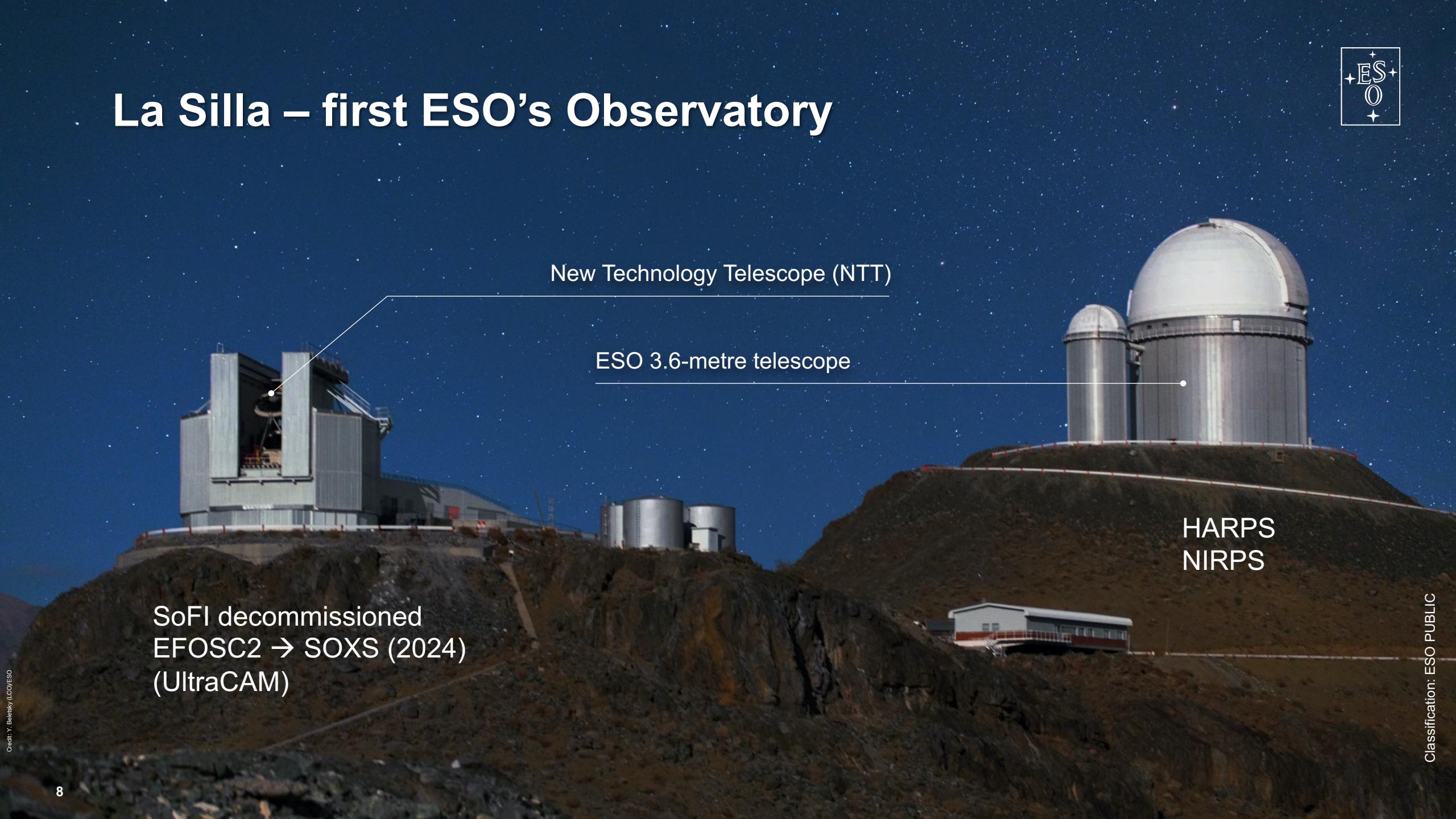
\* In preparatory phase  
\*\* under construction

## La Silla



ESO 3,6m and NTT

# La Silla – first ESO's Observatory



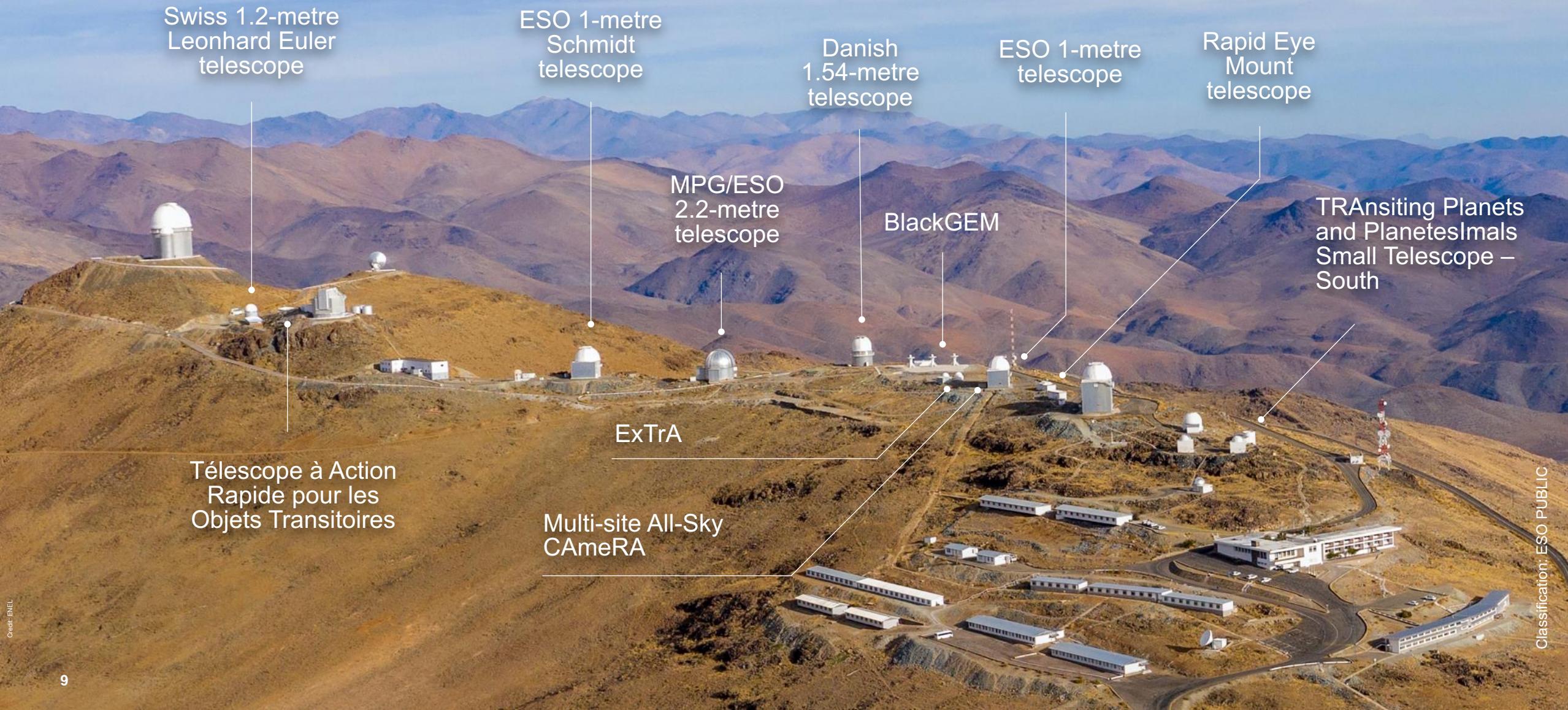
SoFI decommissioned  
EFOSC2 → SOXS (2024)  
(UltraCAM)

New Technology Telescope (NTT)

ESO 3.6-metre telescope

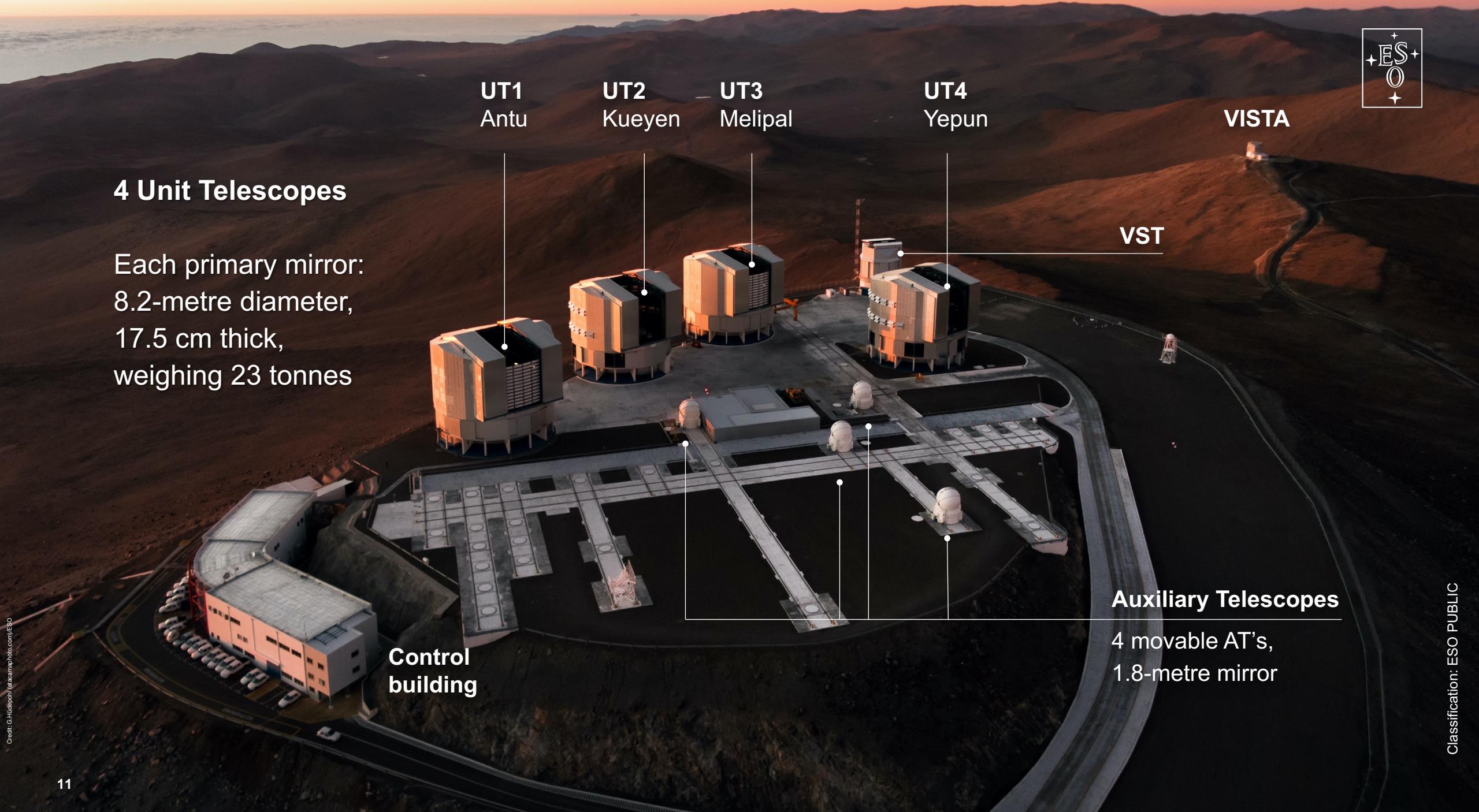
HARPS  
NIRPS

# La Silla as science platform – Hosted Telescopes



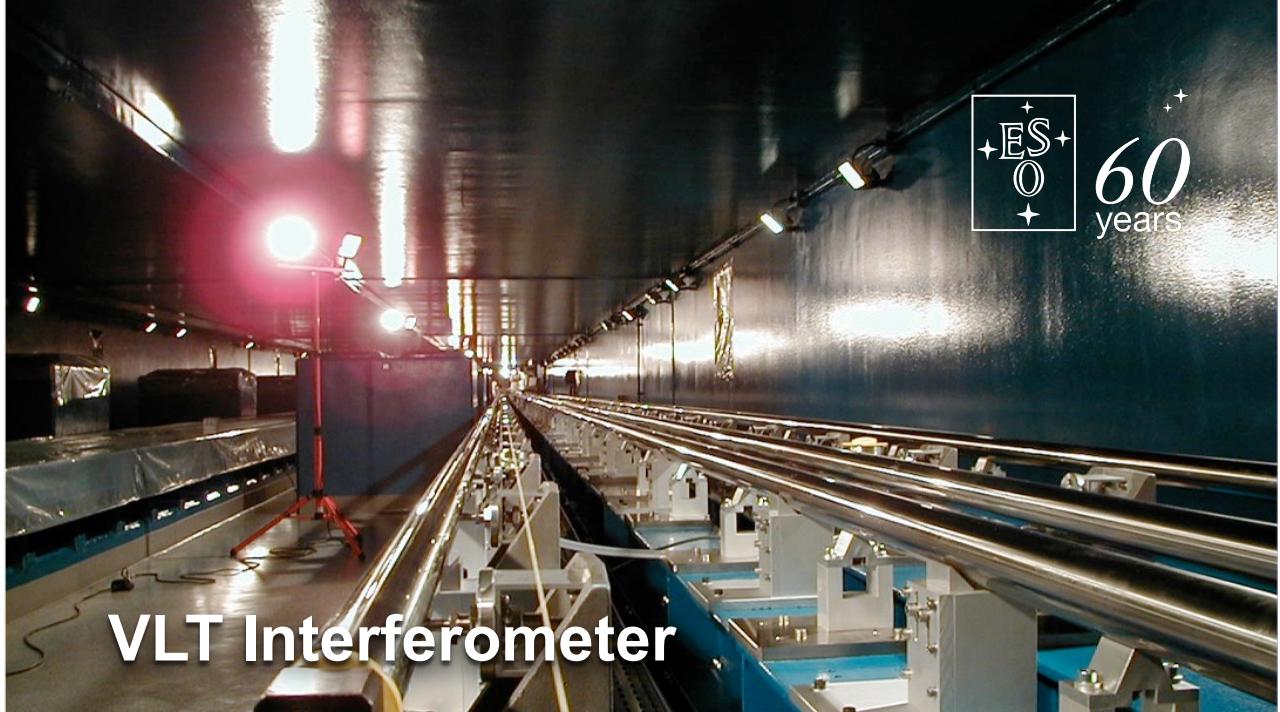
# Paranal – home of the Very Large Telescope







**VLT with Laser Guide Star**



**VLT Interferometer**



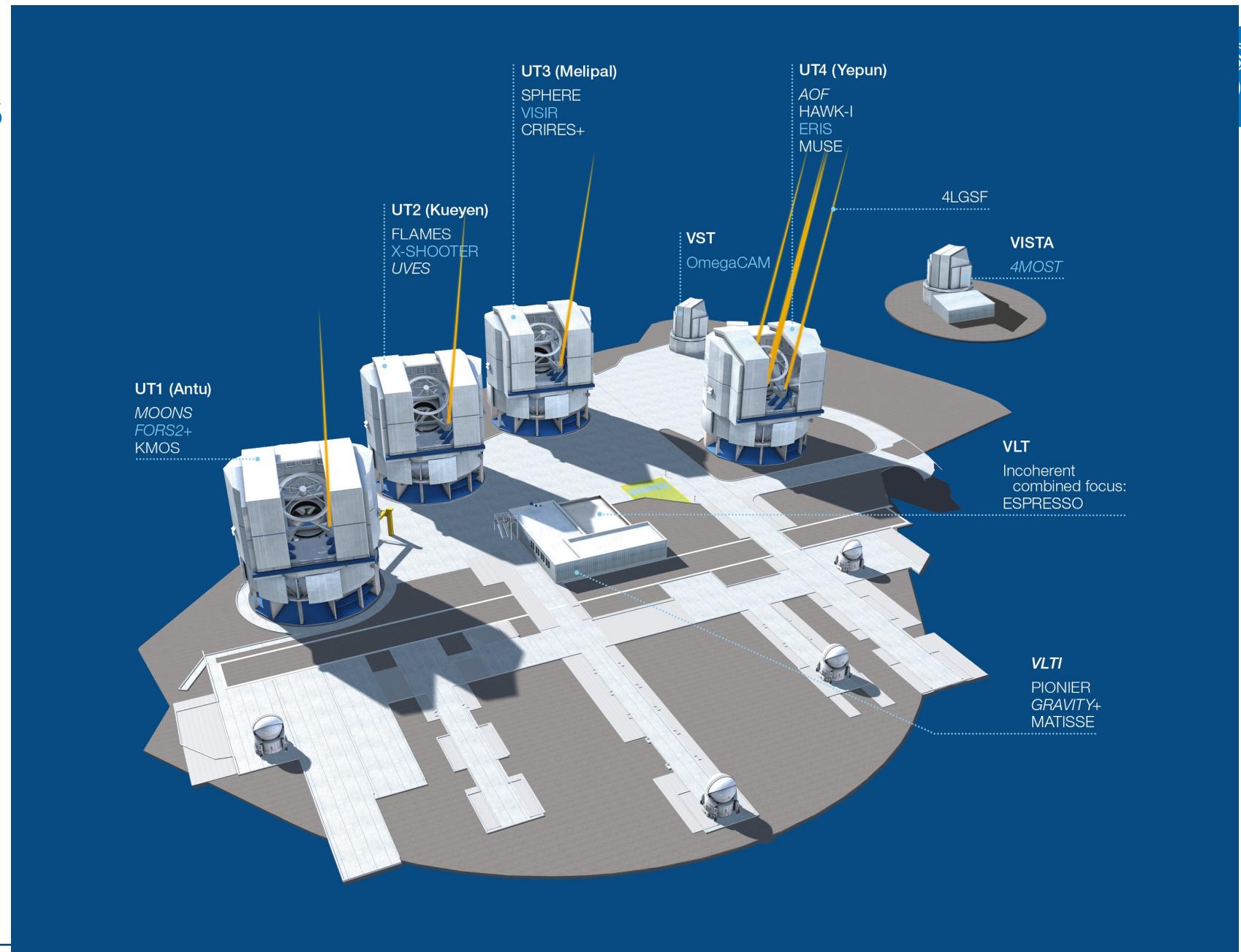
**MUSE VLT instrument**



**GRAVITY VLTI instrument**



# VLT/I instruments



The **ALMA observatory** is a **partnership** between **ESO** (37.5%), **NINS** (25%) and **NSF** (37.5%), in cooperation with the Republic of Chile.

**ALMA** is governed through a Trilateral Agreement (ESO, NINS, NSF) and a Trilateral Management Agreement (AUI/NRAO, ESO, NAOJ)



# ALMA today



11 years of successful operations since its inauguration in March 2013



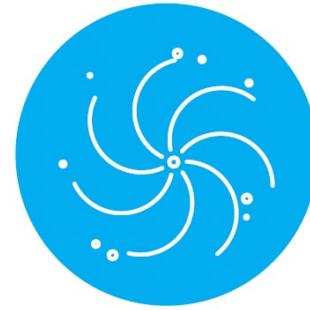
Operations model:

- Front-end in Chile, managed by the JAO
- Back-ends in the 3 Executive regions (ESO, NAOJ, NRAO), including the ALMA Regional Centres (ARCs)



# ALMA Development

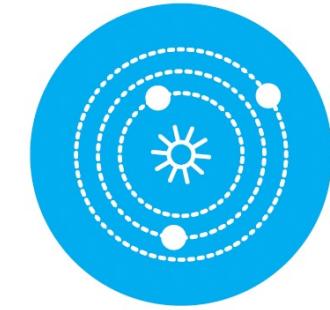
150 Million Euro upgrade is now underway



ORIGINS OF GALAXIES



ORIGINS OF CHEMICAL COMPLEXITY



ORIGINS OF PLANETS

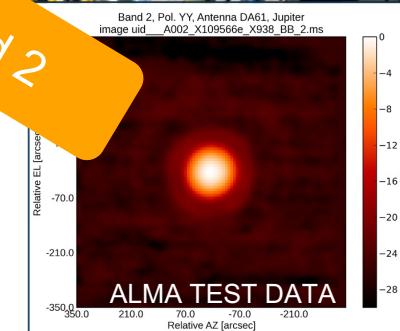
- The [ALMA Development Roadmap](#) (approved by the ALMA Board in 2017) gave the priorities for upgrading ALMA for ALMA2030
- The current upgrade – the **Wideband Sensitivity Upgrade (WSU)** - aims at implementing the highest-priority items
- **It is an upgrade of virtually the entire signal chain:**
  - receivers with increased bandwidth by factors x2 to x4
  - new digitizers and data transmission system
  - correlator with improved efficiency
  - improved data processing and archive
- ESO WSU deliverables include wideband Band 2, 7 & 9 receivers; digitizers; ...

New ALMA receivers that will probe our cosmic origins successfully tested

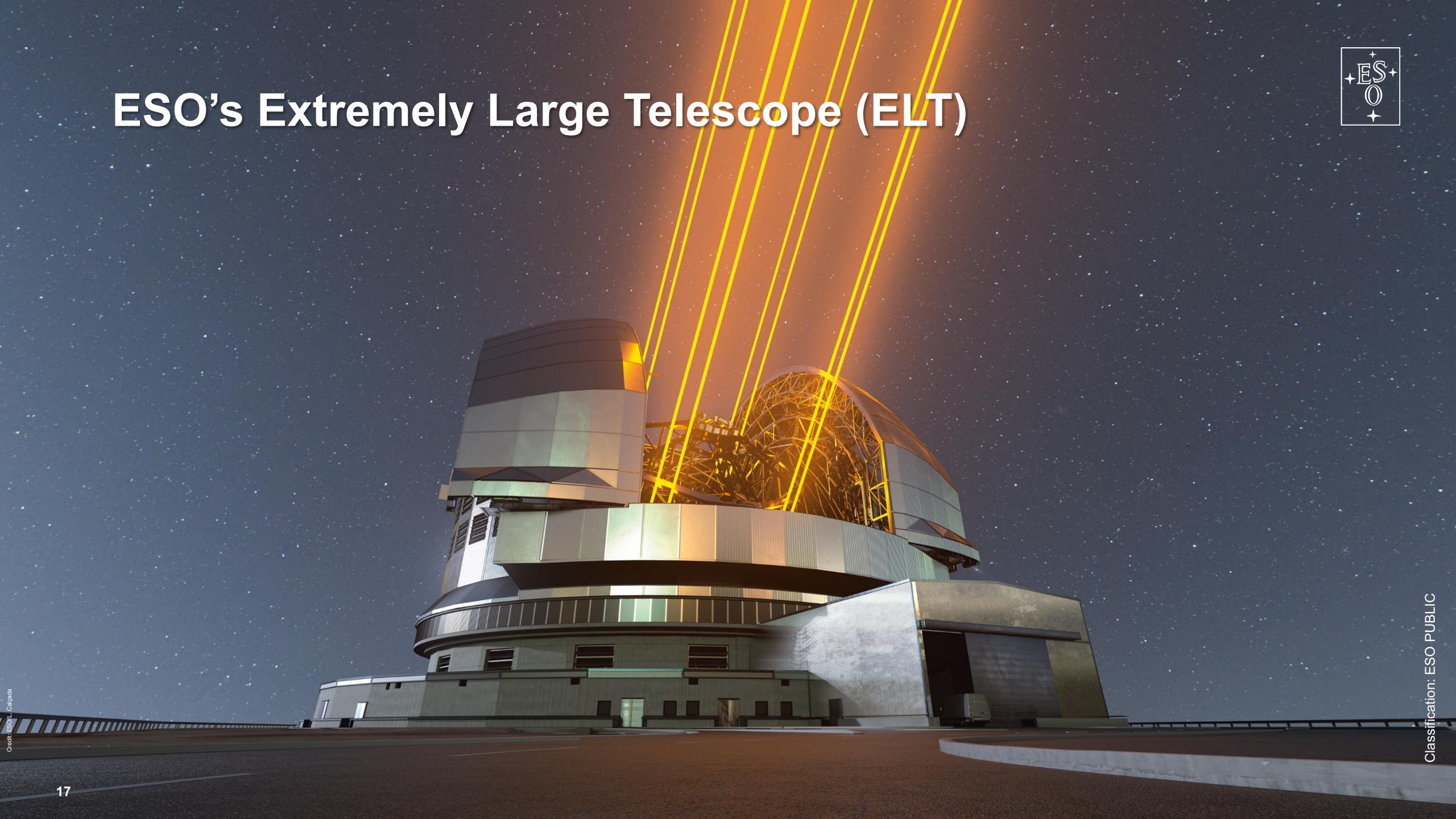
14 August 2023



Band 2



# ESO's Extremely Large Telescope (ELT)



# ESO's ELT

Will be the largest optical/infrared telescope ever built or planned

Segmented primary mirror of 39.3 m diameter (798 tiles); adaptive optics

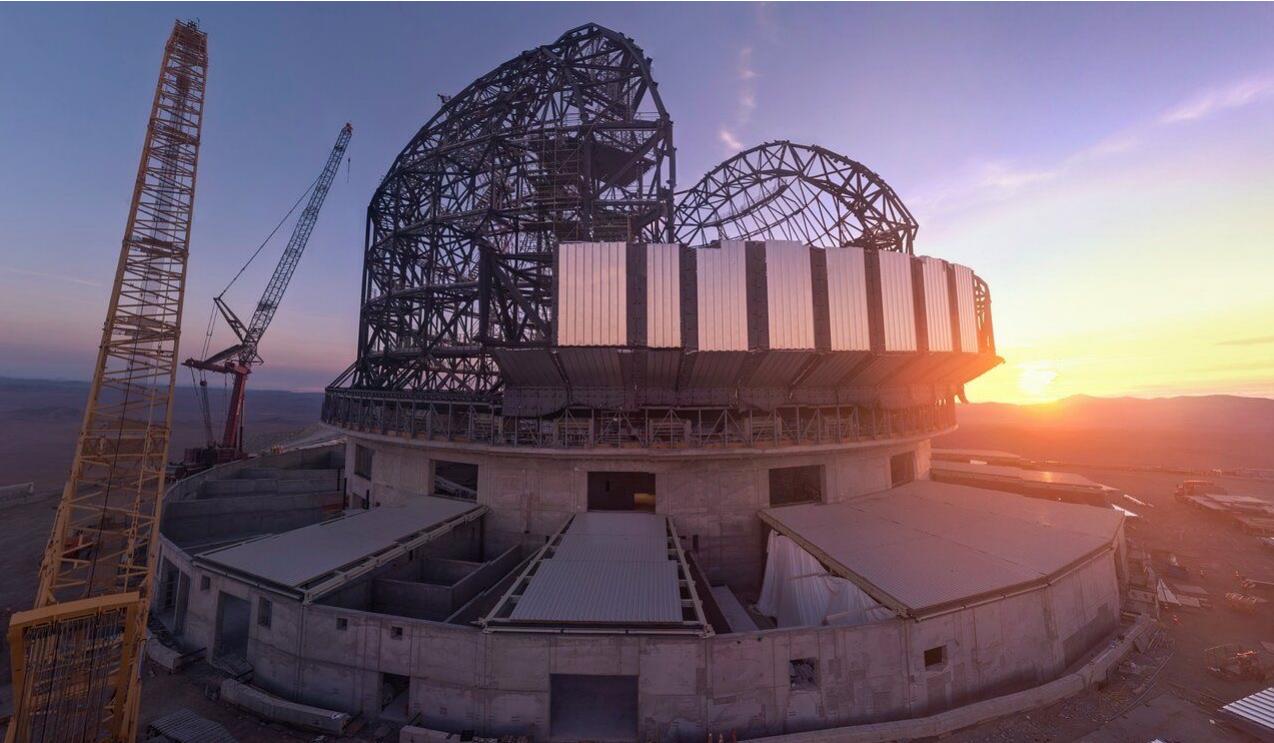
Construction 2015-2028

CtC: 1500 MEUR + Organisational support + in-kind contributions to the instrumentation

First scientific observations by end of 2028 (TBC)

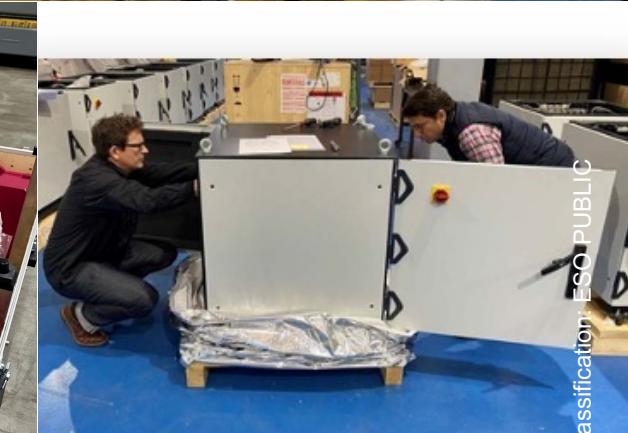
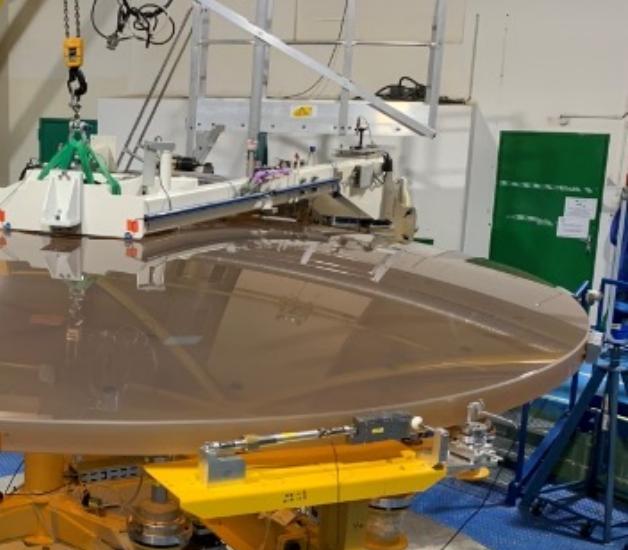
Erected on Cerro Armazones. To be operated jointly with the VLT and VLTI in Paranal (24 km)

The ELT is the most powerful telescope of the new generation, the only one with secured funding and the one which is more advanced in its construction.





# ESO's ELT beyond 50% construction completion



First batch of polished M1 segments received at ELT Technical Facility (ETF) in Paranal, 12.01.2024



First M1 segments coated at ETF, 15.03.2024



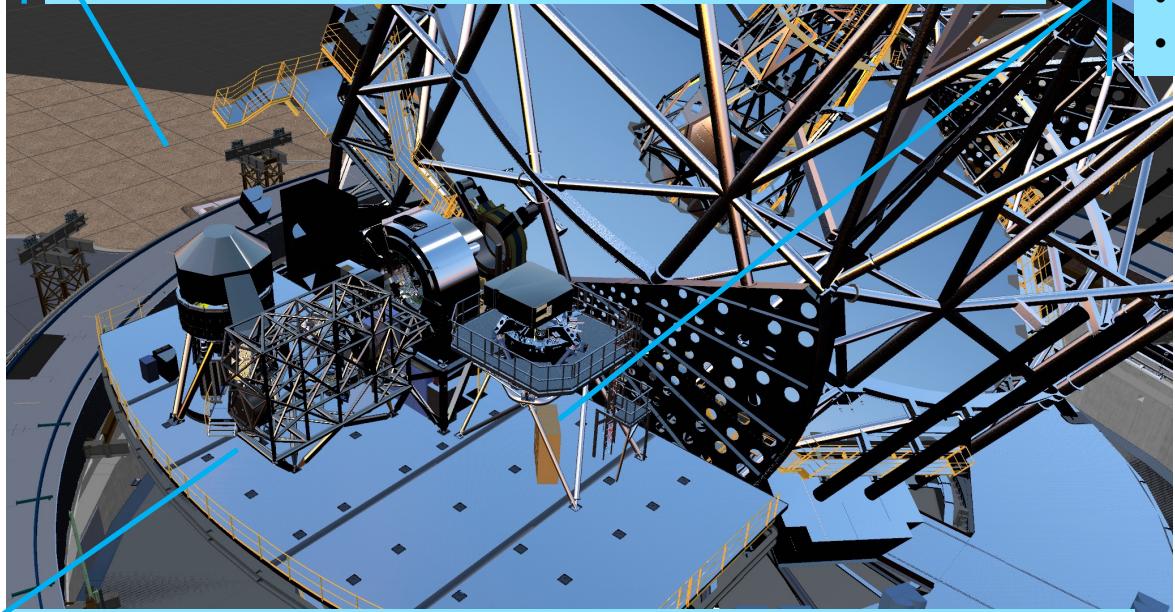
# ELT First set of Instruments



*All in various stages of FDR, long-lead items under procurement*

## MICADO

- Diffraction limited **Imager and spectrograph**
- **Near-Infrared** (0.8 - 2.45  $\mu\text{m}$ ),  $R \sim 8000$
- Last step of FDR in Q2/2024

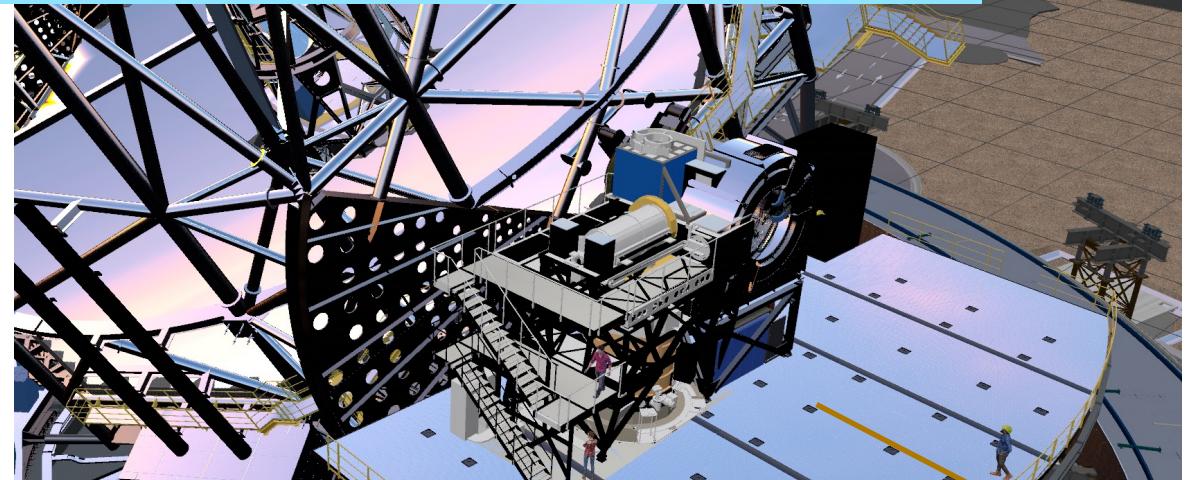


## MORFEO

- Multi-conjugate adaptive optics module for MICADO
- 2 deformable mirrors inside instruments
- FDR schedule in discussion

## METIS

- **Imager and (IFU) spectrograph**
- **Mid-Infrared** (3 - 14  $\mu\text{m}$ ),  $R$  up to **100 000**
- FDR full closure within next weeks



## HARMONI

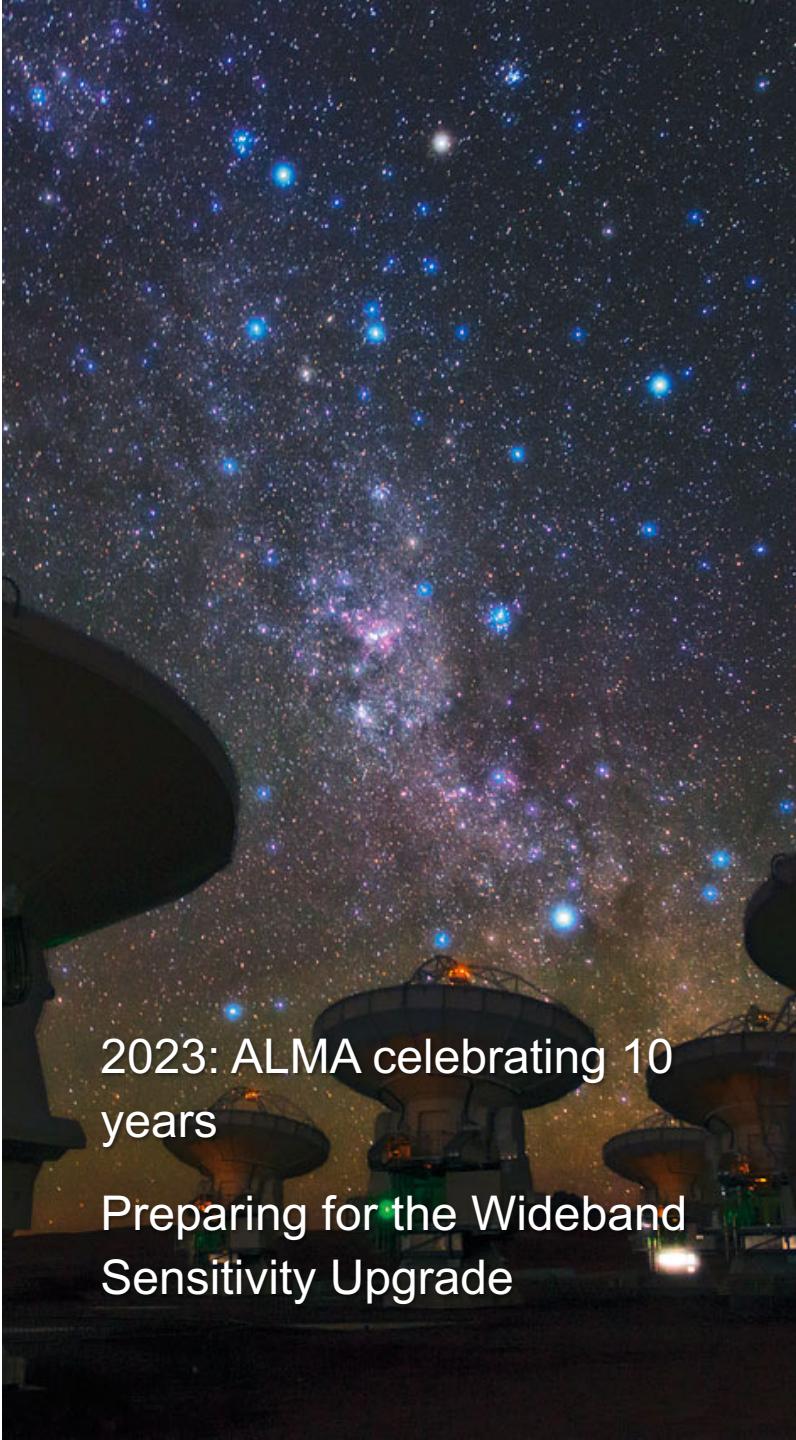
- **3D spectrograph (IFU)**
- **Optical** (0.47  $\mu\text{m}$ ) to **NIR** (2.45  $\mu\text{m}$ ),  $R=3500 - 20000$
- **Optics FDR in Q4/2024**



2023: VLT celebrated 25 years  
since first light

Preparing for the next  
instruments

23



2023: ALMA celebrating 10  
years

Preparing for the Wideband  
Sensitivity Upgrade



2023: ELT half-way through  
construction

# Cherenkov Telescope Array – South (CTA-S)



CTAO will be the first high-energy gamma-ray observatory on the ground, with a part (CTA-N) in La Palma and a part in the South in Paranal-Armazones.

It is expected that construction may start shortly.

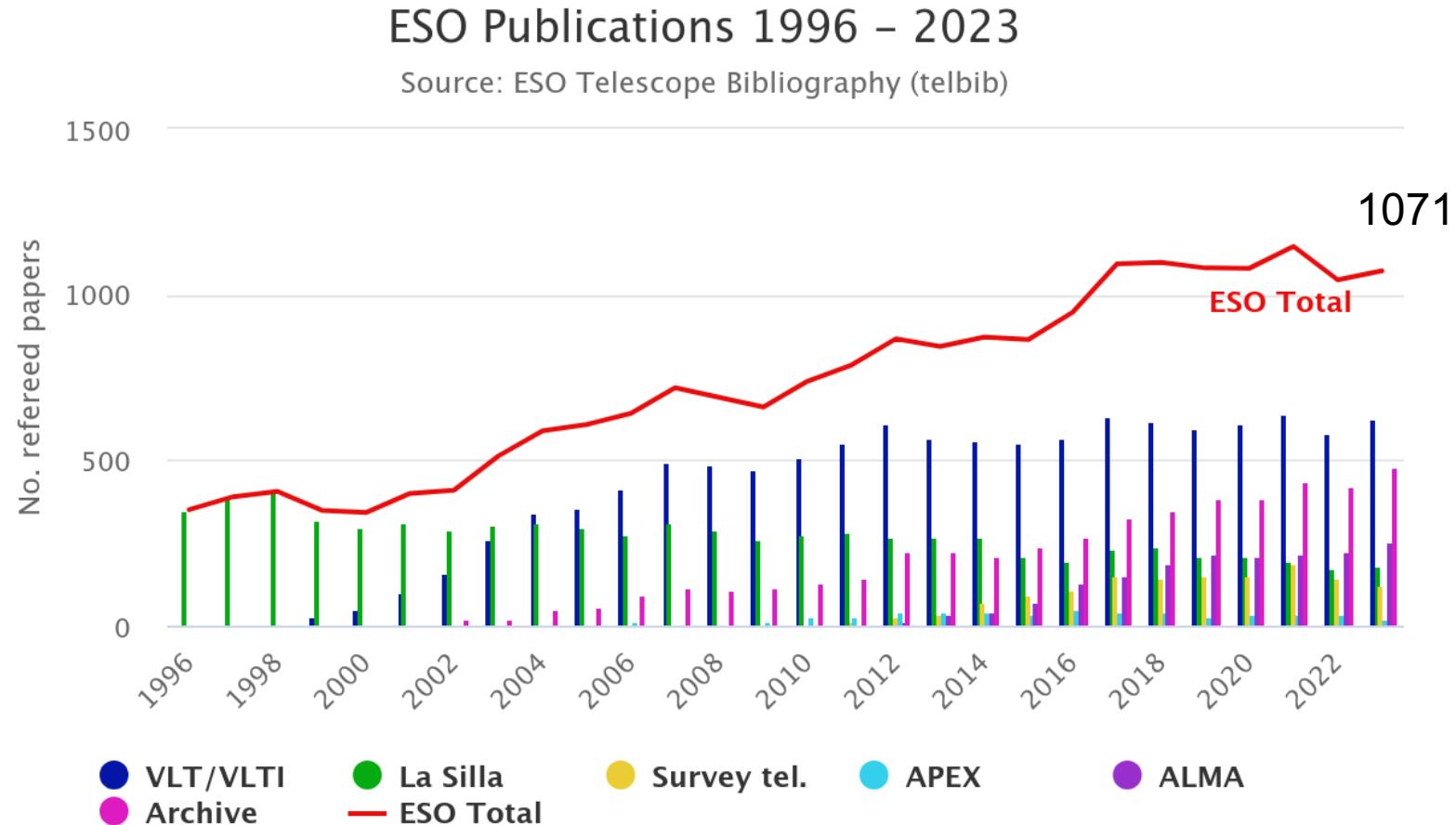
ESO will host and operate CTA-S inside the Paranal-Armazones observatory.



# A true astronomy science park



# ESO-enabled refereed publications 2023



Telescope	#	%
VLT/I	624	58
La Silla	185	15
VST/VISTA	123	11
APEX	24	2
ALMA	257	24
Archive	477	45

Fig. 1: Refereed papers using ESO data

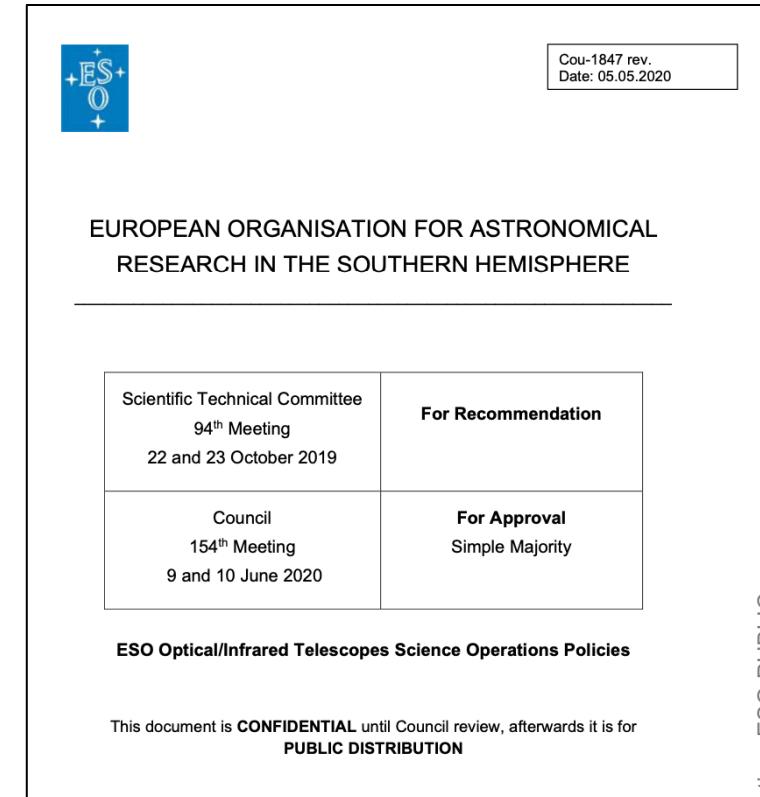
provided by the ESO Library & Information Centre, realized with Highcharts.com

# Access to observing time

# ESO proposals and data access policy

## *ESO Science Operations Policy (Cou-1847 rev.)*

- Access to ESO telescopes and the data rights for the optical/NIR facilities are defined by a Council-approved public document
  - Covers La Silla facility telescopes, VLT/I, ELT
  - ALMA covered separately, as agreed by the partnership
- General statement:
  - ***The proposal selection process shall ensure that the most exciting and fundamental research is selected for observations. The scheduling process and the telescope operations shall maintain the potential for scientific excellence implied in the research proposals. ESO supports the community with tools for data reduction for instruments it offers. ESO supports an open data policy.***



The image shows the cover of the ESO Science Operations Policy document. It features the ESO logo at the top left, the title 'ESO Science Operations Policy (Cou-1847 rev.)' in the center, and a small box in the top right corner containing the text 'Cou-1847 rev. Date: 05.05.2020'. Below the title, the text 'EUROPEAN ORGANISATION FOR ASTRONOMICAL RESEARCH IN THE SOUTHERN HEMISPHERE' is printed. The document is structured into two main sections: 'Scientific Technical Committee' and 'Council'. Each section contains a table with two columns: 'For Recommendation' and 'For Approval'. The 'Scientific Technical Committee' section includes the 94<sup>th</sup> Meeting (22 and 23 October 2019). The 'Council' section includes the 154<sup>th</sup> Meeting (9 and 10 June 2020). At the bottom, there is a note: 'This document is CONFIDENTIAL until Council review, afterwards it is for PUBLIC DISTRIBUTION'.

For Recommendation	For Approval
Scientific Technical Committee 94 <sup>th</sup> Meeting 22 and 23 October 2019	
	Council 154 <sup>th</sup> Meeting 9 and 10 June 2020

ESO Optical/Infrared Telescopes Science Operations Policies

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# ESO proposals

## *Various proposal types. Access to non-ESO member states*

- All observations are based on approved proposals.
- Proposals can be solicited in different categories:
  - Normal or Large Programmes, Surveys, Guaranteed Time, Director Discretionary Time, Technical Time, Science Verification, Host State (Chile) proposals, Non-Member States proposals
- Non-Member State proposal definition:
  - *A proposal is designated as Non-Member State proposal if more than 2/3 of the applicants are from institutes not affiliated with an ESO Member State, the Host State, or with a Party with which ESO has established a partnership which enables access to specific ESO facilities on an equal footing with ESO Member States, independently of the affiliation of the Principal Investigator. In cases where an ESO Member State proposal is rated equally during the proposal evaluation process with a Non-Member State proposal seeking to do similar science, preference is given to the ESO Member State proposal.*
  - *For the specific case of ELT, Council may restrict the percentage of time allocated to Non-Member State proposals such that outstanding proposals from these communities are executed while protecting the interests of ESO Member States and potential ELT partners.*

# ESO proposals

## *Solicitation and evaluation*

- Proposal solicitation through regular Calls for Proposals
  - Soon to be moved from 6-monthly to yearly calls, plus a fast-track channel
- Proposal evaluation through the Observing Programmes Committee (OPC)
- OPC and topical panels. Panels for
  - Cosmology and the Intergalactic Medium
  - Galaxies
  - Interstellar medium, star formation and planetary systems
  - Stellar evolution



The banner for the ESO Call for Proposals P114 features a large image of the Very Large Telescope (VLT) at the Paranal Observatory in the background. In the foreground, three circular inset images show the VLT's Unit Telescopes, the control building, and the construction of the European Extremely Large Telescope (E-ELT) dome. The text on the banner includes 'ESO Call for Proposals P114', 'Proposal Deadline: 21 March 2024, 12:00 noon CET', and the ESO logo.

# ESO proposal evaluation

*Observing Programmes Committee (OPC) and Distributed Peer Review (DPR)*

- Double anonymous proposal evaluation in place
  - Anonymity violations lead to disqualification
- Evaluation is hybrid between OPC, including panel discussions and DPR.
  - Director's Discretionary Time (DDT) follow a separate channel (internal review)
- **OPC**
  - Regular proposals requesting more than a certain amount of time
  - Large Programmes
  - Target-of-Opportunity proposals
  - Proposals requesting time on several facilities, eg with ESA's XMM-Newton and ALMA
- **DPR**
  - Short regular proposals (below the time limit above)

# ESO proposal selection and scheduling

## *Fully blinded process*

- Proposals are requested to be submitted in anonymized form
  - Evaluation without any information on provenance of the proposal
  - This implies the evaluation is blind to member or non-member state proposals
  - Reviewers in the whole evaluation do not know from where the proposals have been submitted
- Scheduling is also done blind to the origin of the proposals
- Exception: Host State proposals, which are regulated through the agreement with Chile
  - Checked after schedule creation and adjusted to fulfil the agreement
  - Currently no check for Non-Member State proposals. Not done as far as remembered, and not intended to be done with La Silla or Paranal time allocation/scheduling

# ESO proposal statistics

10-year statistics (2013-2023) – Cou-2060

All proposal requests (top) and allocations (bottom) in percent

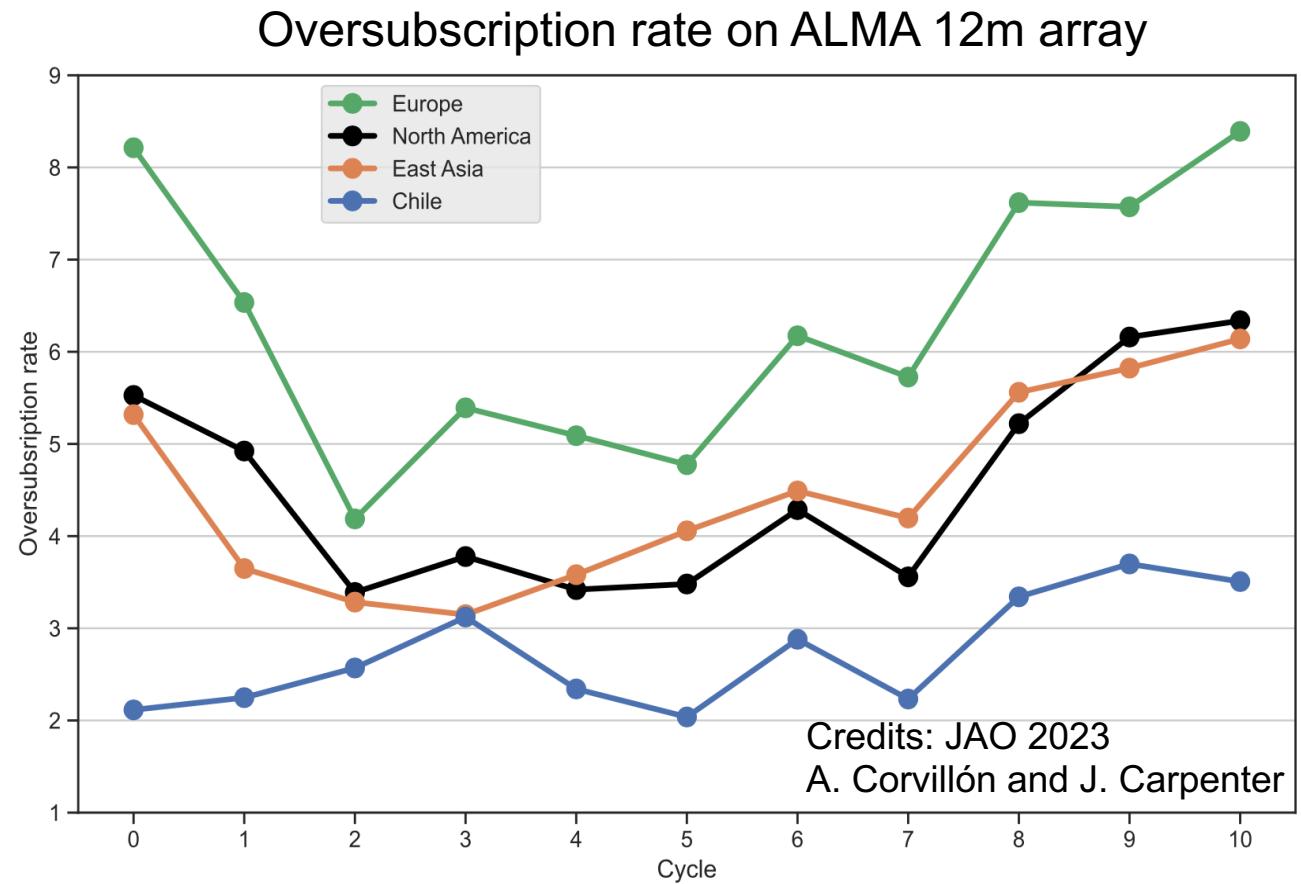
		Requested Nights	AT	AUS	B	CZ	DK	FIN	F	D	I	IE	NL	P	PL	E	S	CH	UK	ESO	ESA	RCH	USA	Other
VLT/I	PI	35348	1.49	3.04	2.53	0.40	2.15	1.44	9.50	12.25	7.80	0.25	3.01	1.10	0.90	3.67	1.68	4.08	17.46	9.63	0.68	8.89	3.72	4.35
	All		1.10	2.54	1.89	0.40	1.83	0.82	9.26	11.90	8.84	0.18	3.46	1.17	0.87	4.68	1.54	3.56	14.99	7.42	0.38	5.60	10.15	7.41
3.6m + NTT + 2.2m + APEX	PI	18035	0.51	1.13	0.79	0.32	0.57	1.06	10.99	8.74	9.00	0.01	1.15	2.32	1.50	3.11	0.63	9.69	21.76	5.84	0.12	11.08	2.71	6.96
	All		0.78	1.24	1.46	0.51	0.72	0.93	9.63	10.55	7.81	0.16	1.14	2.41	1.44	4.63	1.53	7.88	16.35	6.02	0.11	7.45	7.38	9.86

		Allocated Nights	AT	AUS	B	CZ	DK	FIN	F	D	I	IE	NL	P	PL	E	S	CH	UK	ESO	ESA	RCH	USA	Other
VLT/I	PI	10786	0.71	2.52	2.60	0.23	2.02	0.54	11.14	15.86	8.03	0.24	3.23	0.41	0.65	2.67	1.85	5.41	16.86	8.52	0.25	10.55	2.89	2.82
	All		0.59	2.39	1.79	0.31	1.66	0.38	11.01	14.28	8.60	0.19	4.11	1.32	0.72	3.59	1.74	4.48	13.66	6.97	0.40	5.90	9.79	6.11
3.6m + NTT + 2.2m + APEX	PI	7533	0.45	0.93	0.86	0.15	0.29	1.13	12.92	9.13	7.68	0.00	1.04	3.50	1.56	2.34	0.60	7.92	29.24	5.37	0.04	8.98	1.64	4.21
	All		0.57	1.39	1.22	0.29	0.75	1.11	10.48	11.70	7.33	0.35	1.27	3.26	1.26	4.70	2.14	8.48	17.66	5.50	0.14	6.83	7.00	6.58

# ALMA observing time access

*Partnership between ESO (EU), North America (NA) and East Asia (EA)*

- Distribution of telescope time across partnership and Chile:
  - Chile: 10%
  - NSF: 33.75%
  - ESO: 33.75%
  - NINS: 22.5%
- High oversubscription, consistently higher by EU/ESO region proposers



# ALMA proposal review policies

- Principles of the ALMA proposal review process:
  - Dual anonymous
- Various proposal types: Regular proposals, Target of Opportunity proposals, Multi-Cycle proposals and Directors' Discretionary Time (DDT) proposals
- Proposal selection through a single, international ALMA Proposal Review Committee (APRC) and DPR
  - Proposals requesting more than 50h on the 12m array or more than 150 h on the 7m array are reviewed by the APRC
  - Otherwise through DPR

# ALMA and open skies

*From the Principles of the ALMA proposal review process*

- Proposals from outside the ALMA Partnership and Chile are welcome (open sky proposals)
  - Open Skies proposals are reviewed identically to all other proposals.
  - The unaffiliated time attributable to PIs or co-PIs of Open Skies proposals scheduled are charged to the three Parties and Chile according to the observing time shares defined in Section 6, up to an amount of 5% of the total available ALMA time.
  - Any Open Skies time that exceeds the above limit of 5% is charged to North America, which follows current United States government policy.
  - PIs of accepted Open Skies projects can select which ARC they wish to use for support.
- As an example, open skies proposals in ALMA Cycle 10 requested 2.3% of the 12 m array observing time and were scheduled 0.76% of the available time.



# Data Management at ESO

# ESO data rights

*Defined in the Science Operations Policy*

*All data obtained with ESO instruments are ESO property. ESO usually grants exclusive access rights for a limited amount of time (sometimes referred to as the proprietary period) to the PI for the science data acquired for an observing programme. [...] The length of the proprietary period is set by the Director General and communicated in the [Call for Proposals].*

Proprietary time is currently set to 1 year after the observations.

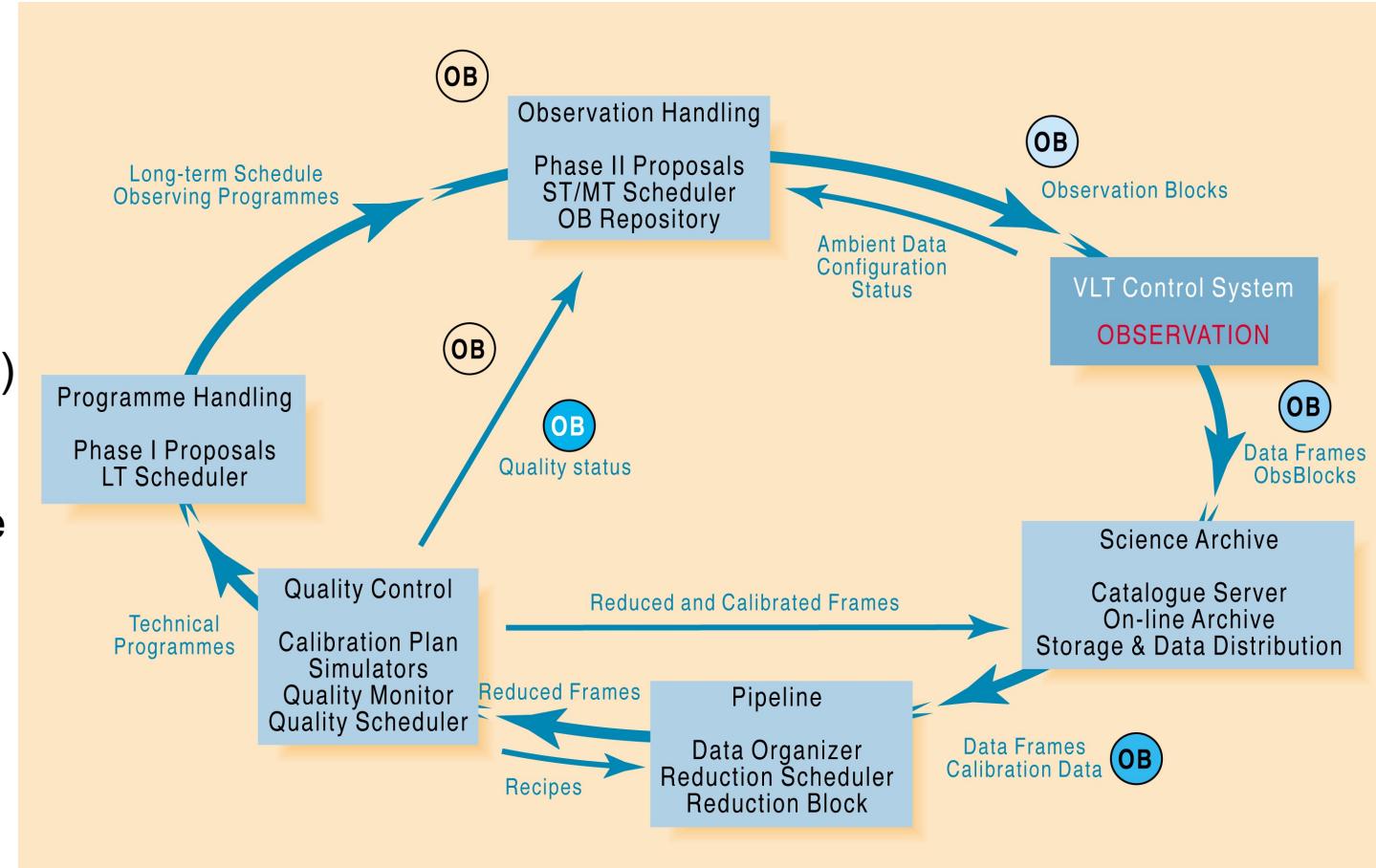
# Data Flow System and its development

Data Flow System (DFS) project aims at providing an end-to-end facility (from proposal submission to the archive) for all optical/IR telescopes at ESO (including ELT)

DFS Project is more than 50% complete, on time for ELT science operations

The ESO Science Archive Facility gives access to all data from all ESO telescopes, including ALMA

## Data Flow System



# ESO science data archive

*Defined in the Science Operations Policy*

- All data are archived and accessible with no regional restrictions. The ESO archive follows the FAIR (findable, accessible, interoperable, reusable) principle and following the [European Open Science Cloud policy](#).
- All archived data have passed quality control.
- Collects data for many of the hosted telescopes on the ESO sites.
- Data products are delivered for all ESO public surveys and Large Programmes. ESO provides data products for many of its instruments as a service through the archive.
- The ESO Telescope bibliography connects publications to the archive data.

# ESO archive and data curation

The Community expects uniform data products for surveys

- Legacy

Archives most useful, when data can be applied to science questions (“science-ready data”)

Data access

- Importance of data discovery

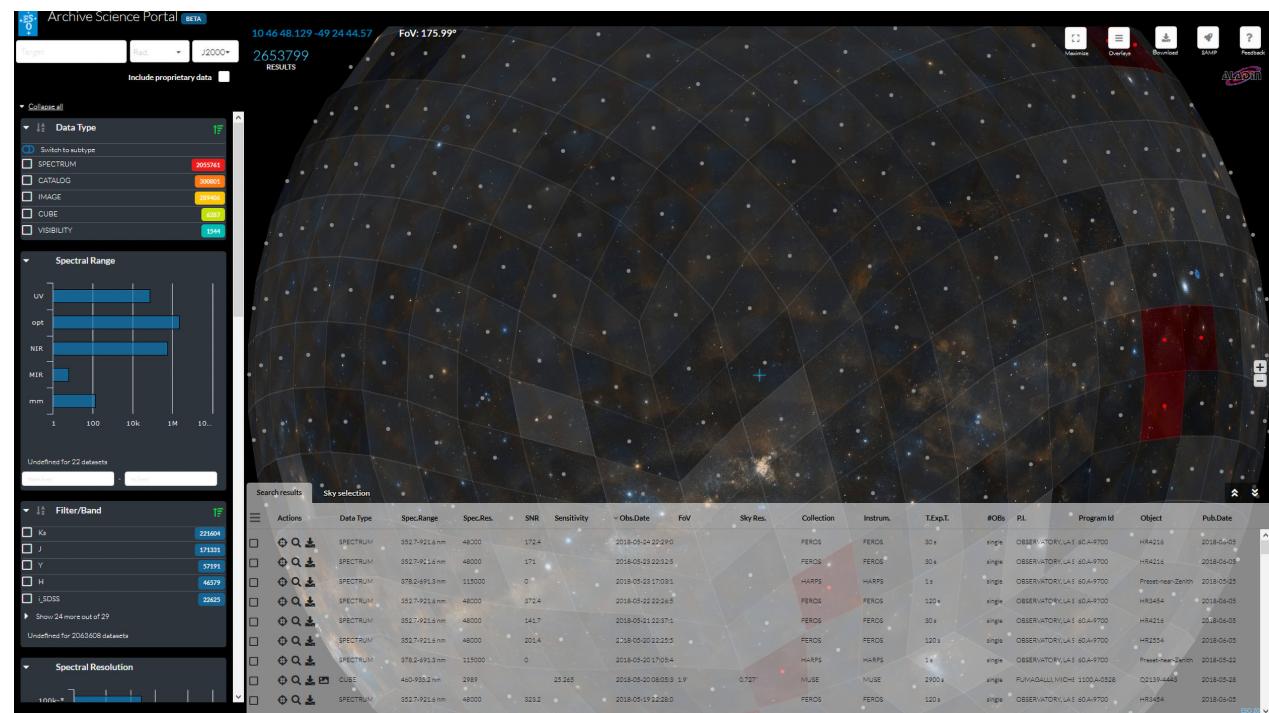
Synergies between ESA and ESO archives

- ESASky

ESO portal to LPO and ALMA data

- Coordination of developments

<https://archive.eso.org>





## TELBBIB SEARCH

## REFINE SEARCH

## Year

2024 (199)

2023 (1298)

2022 (1268)

2021 (1397)

2020 (1307)

more...

## Journal

A&amp;A (9704)

MNRAS (5108)

ApJ (4092)

ApJL (1235)

AJ (912)

more...

## Instrument

UVES (2702)

ALMA\_Band\_6 (2106)

FORS2 (1838)

ALMA\_Band\_7 (1481)

HARPS (1327)

more...

All fields

All fields

 or and

Author

Author

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Title / Abstract /  
Keywords

Title / Abstract / Keywords

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Journal

Any

Publication year

From

To

2024

BibCode/Article DOI

BibCode/Article DOI

ProgramID

Data Collection DOI

DataDOI

Instrument

Any



Telescope

Any



Site

Any



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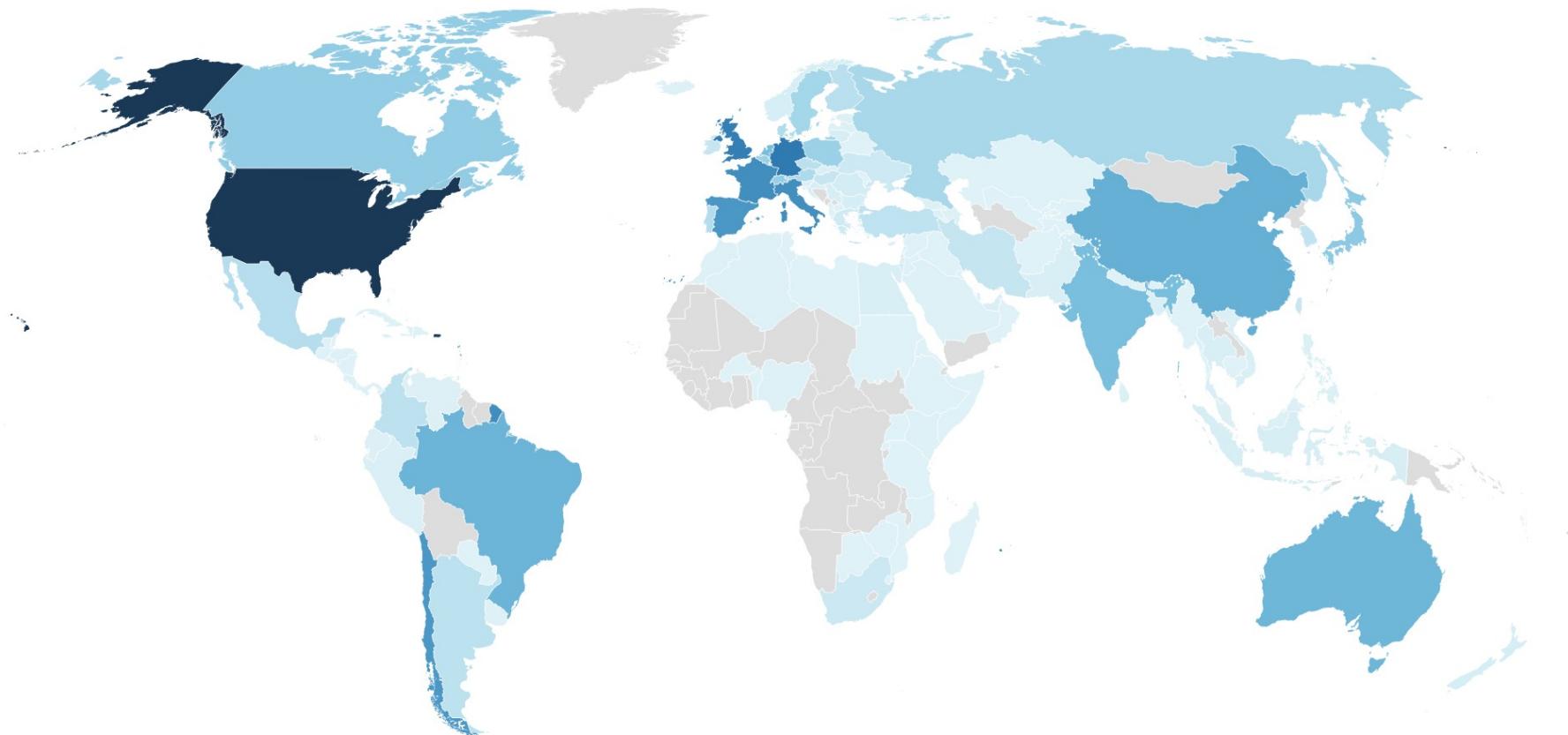
**\*Source: ESO Telescope Bibliography (telbib), maintained by the ESO Library.\***

<https://telbib.eso.org>

# ESO User portal users

ESO Users per country

1      1,100      5,000



# Summary

- Observing time proposals on ESO's optical telescopes (La Silla, VLT and VLTI) are evaluated and scheduled independent of their precedence
  - Exception, 10% allocated as per international agreements between ESO and Republic of Chile
  - For the ELT it is yet to be decided whether observing time allocated to proposals from non ESO Member States and its partners (including Chile) will be limited and to how much.
- Proposals for ALMA are allocated according to shares of the 3 Party regions
  - Plus 10% for Chile as per the international agreements
  - Open skies formally unlimited, but not reaching (by far) 5%
- ESO started 30 years ago a vigorous and sustained activity in data management, making all curated and quality-controlled data from all ESO telescopes available through its Science Archive Facility world-wide.
  - Default is 1 year proprietary period, not applicable to public surveys among others
  - Significant investment, returning scientific results: 45% of the refereed papers use the SAF