Developing the most powerful ground-based astronomical facilities

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ESO – European Southern Observatory

Public

The ESO Mission

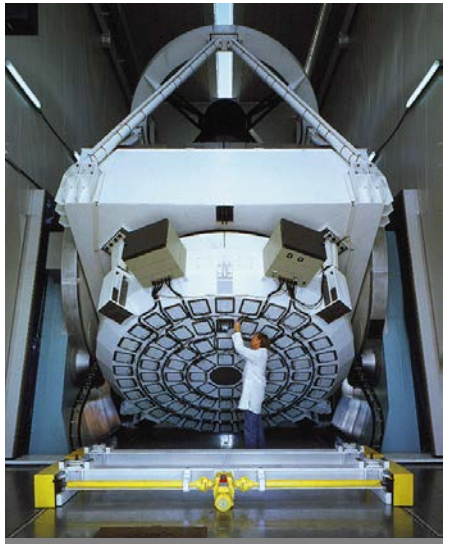
- ESO (European Organisation for Astronomical Research in the Southern Hemisphere), intergovernmental organisation
- Mission (Convention 1962):
  - Build and operate world-class ground-based astronomical facilities
  - Foster collaboration in Astronomy
- ESO enables:
  - Scientific discoveries & understanding of the Universe
  - Other: Development of new technologies, impact in economy, international cooperation, education, training etc
- Complementing other ground & space facilities
- In collaboration with scientists, R&D institutes and industry

ESO today

- Currently 16 Member States
  - Last: Ireland (2018)
  - 10-year partnership with Australia in La Silla Paranal programme 2018-2027
  - Brazil and ESO signed accession agreement in 2010, but accession process incomplete. BR not a member of ESO, but welcome to join/renegotiate at any stage
- Personnel ~700+.
- ESO Programmes:
  - La Silla Paranal – in operation
    - La Silla
    - VLT/I Programme in Paranal
    - APEX (Partnership MPIfR/OSO/ESO)
  - ALMA (Partnership ESO/NSF/NINS) – in operation
  - ELT – in construction
  - CTA-S – finalising design phase by CTAO
- ESO is a key actor in the European Research Area, with a central role in European astronomy (EIROForum, ASTRONET, cooperation with ESA, CERN, EC/ESFRI…)

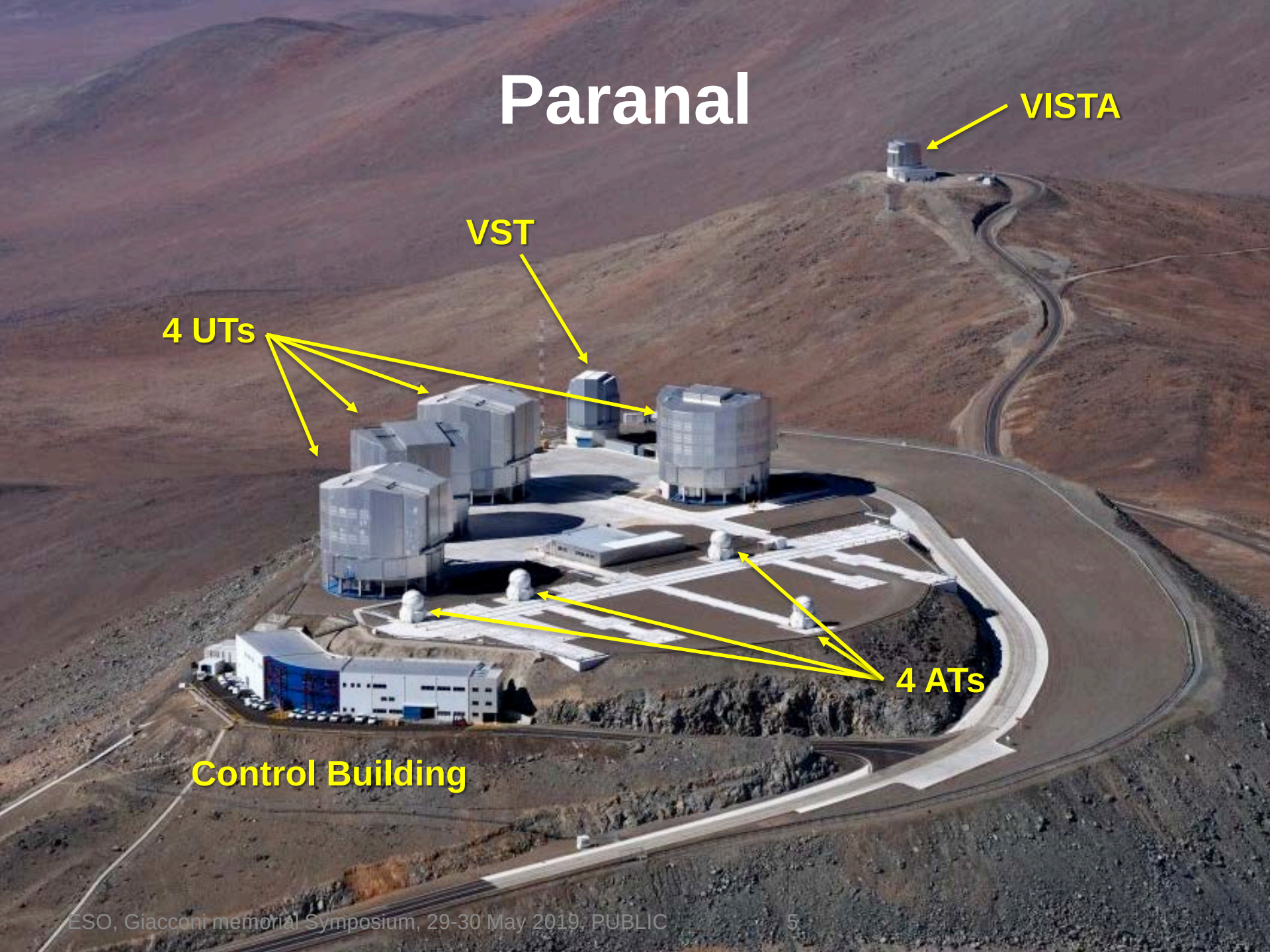
La Silla

ESO 3.6 Metre

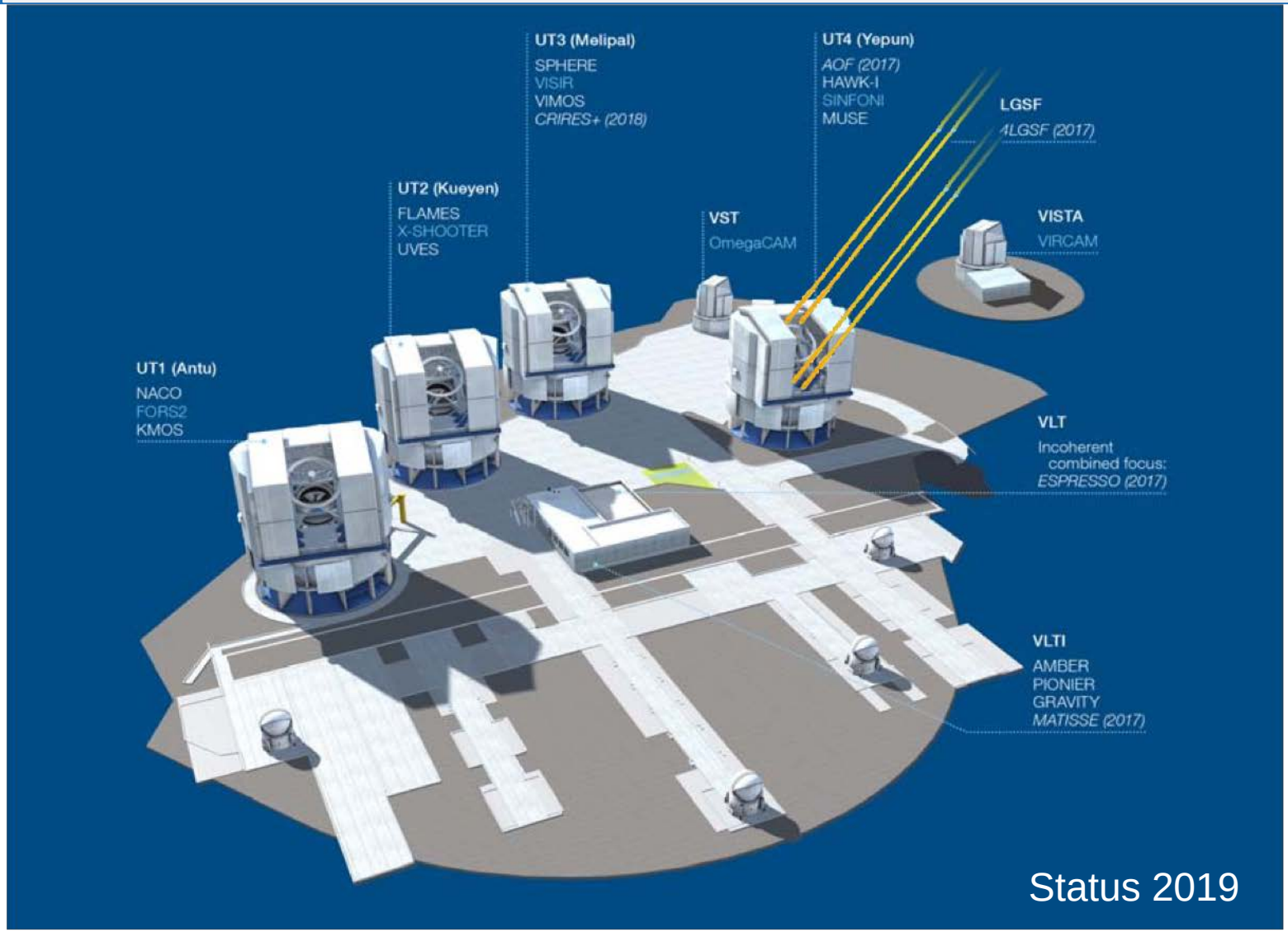


New Technology Telescope – 3.5 Metre

Paranal



VLT system

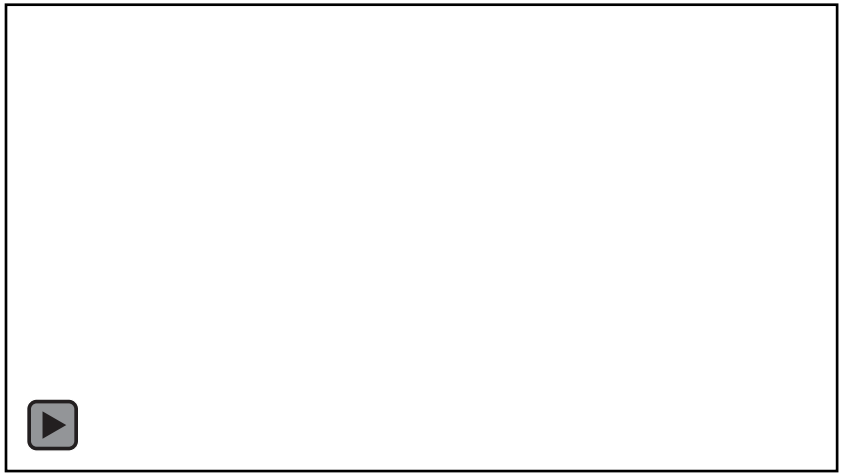

UT3 (Melipal)
SPHERE
VISIR
VIMOS
CRIRES+ (2018)
UT4 (Yepun)
AOF (2017)
HAWK-I
SINFONI
MUSE
LGSF
4LGSF (2017)
UT2 (Kueyen)
FLAMES
X-SHOOTER
UVES
VST
OmegaCAM
VISTA
VIRCAM
UT1 (Antu)
NACO
FORS2
KMOS
VLT
Incoherent
combined focus:
ESPRESSO (2017)
VLTI
AMBER
PIONIER
GRAVITY
MATISSE (2017)
Status 2019

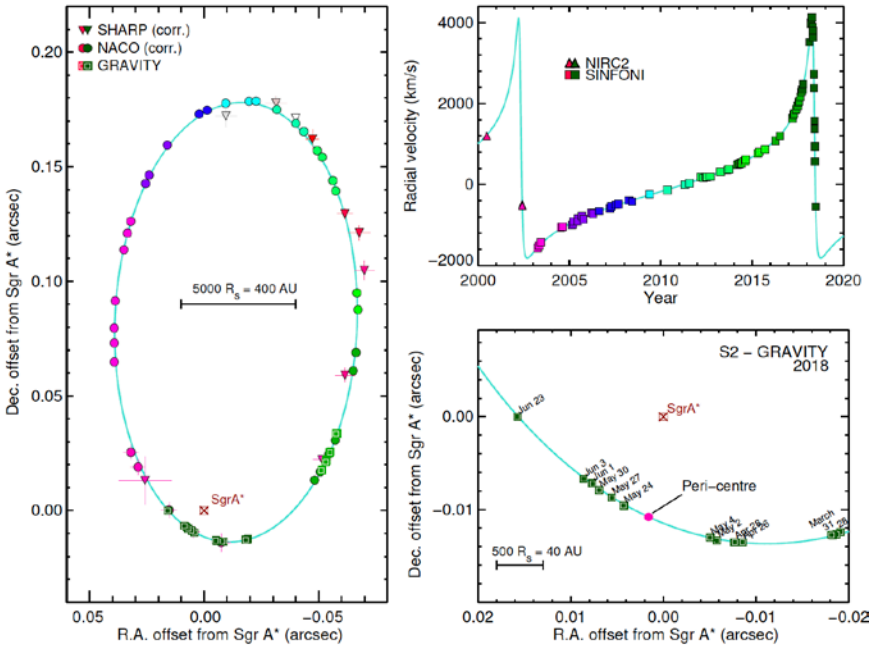
Twenty years of VLT operation

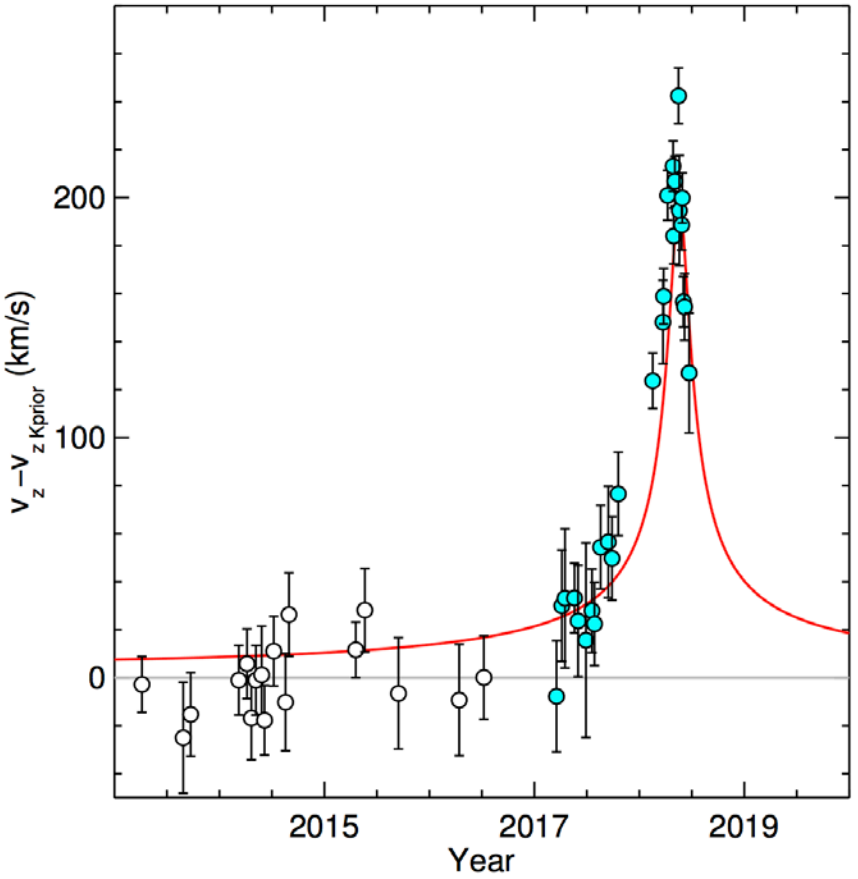
- VLT first light on the night of 25 to 26.05.1998 on UT1

Planetary Nebula NGC 6302

Unique successful test of General Relativity around the SgrA* BH







GRAVITY collaboration: Abuter et al. 2018, A&A, 615, L15

The Paranal model

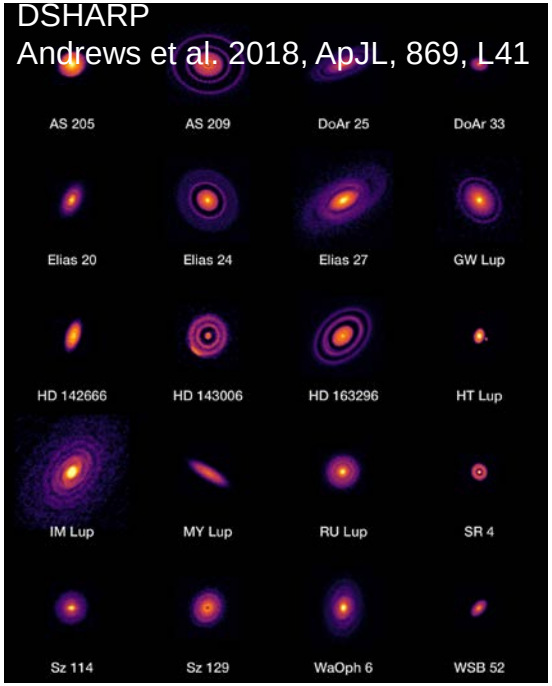
- ESO builds the telescopes and all the infrastructure
- Instruments developed in partnership with consortia
  - ESO provides capital costs and oversight
  - Effort from consortia compensated by GTO
- ESO operates the entire facility
  - Technical downtime < 3%

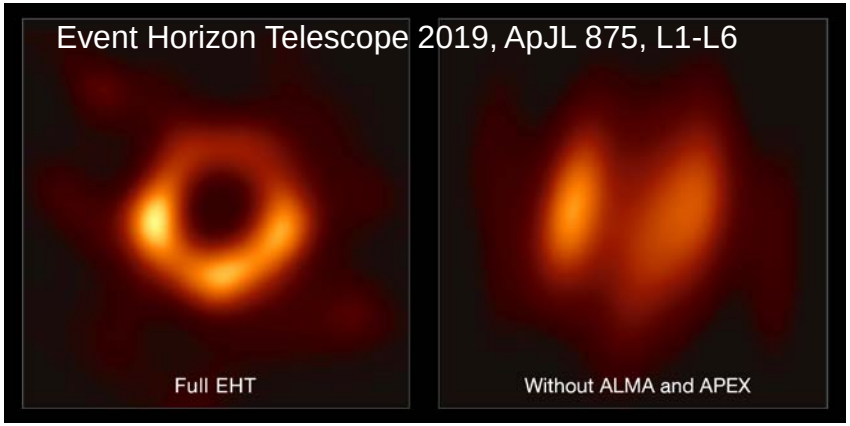
ALMA

- Largest sub/mm radio interferometer
  - In operations since 2011
- Global partnership: ESO, NSF (NA) and NINS (EA)
  - Executives are AUI/NRAO (NA), ESO and NAOJ (EA)
  - On-site operation by JAO (Joint ALMA Observatory)
- Array Operations Site in Chajnantor (5050m)
  - 66 (movable) antennas, over a 16 km plateau
  - Back end and correlator
- Operations Support Facility at 3000m, near San Pedro de Atacama

ALMA science ops & development

- Science operations
  - Cycle 5: 3800 hr obs
  - Cycle 6: on-going
    - 66 antennas available
    - Target > 4000 hr
  - Cycle 7: >1800 proposals submitted
- Science production: more than 1200 refereed papers so far
  - Typically, the ESO region
    - Submits 41% proposals
    - Leads 41% of the papers
    - Allocated time: 34%
- ALMA development:
  - Development roadmap for next decade focused in doubling sensitivity



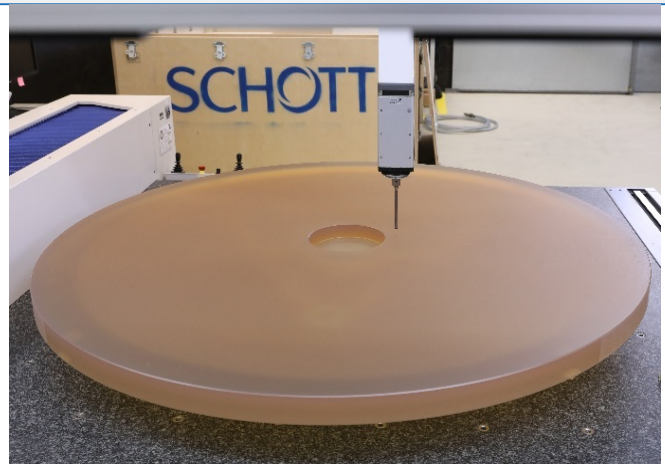


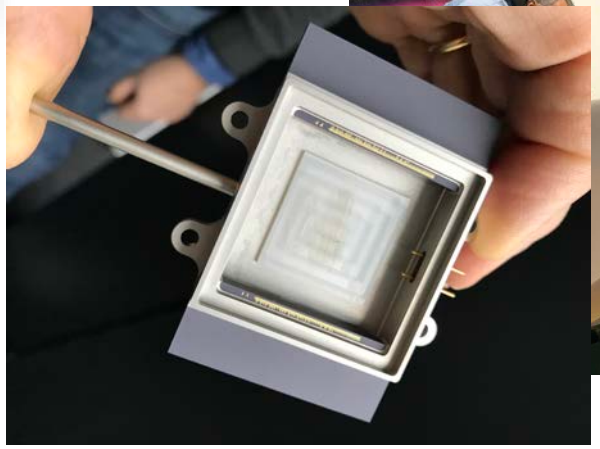
Extremely Large Telescope (ELT)

- Largest optical/infrared telescope in the world
  - 39.3 m segmented primary mirror & adaptive optics
  - Transformational science objectives
    - Including exo-earths, galaxies and first light
  - Construction 2015-2025 (~1200 MEUR)
  - On Cerro Armazones, to be operated as part of the Paranal system
    - Operations costs foreseen in ESO's budget

Cerro Armazones

ELT progress





M1 LCS Development Status

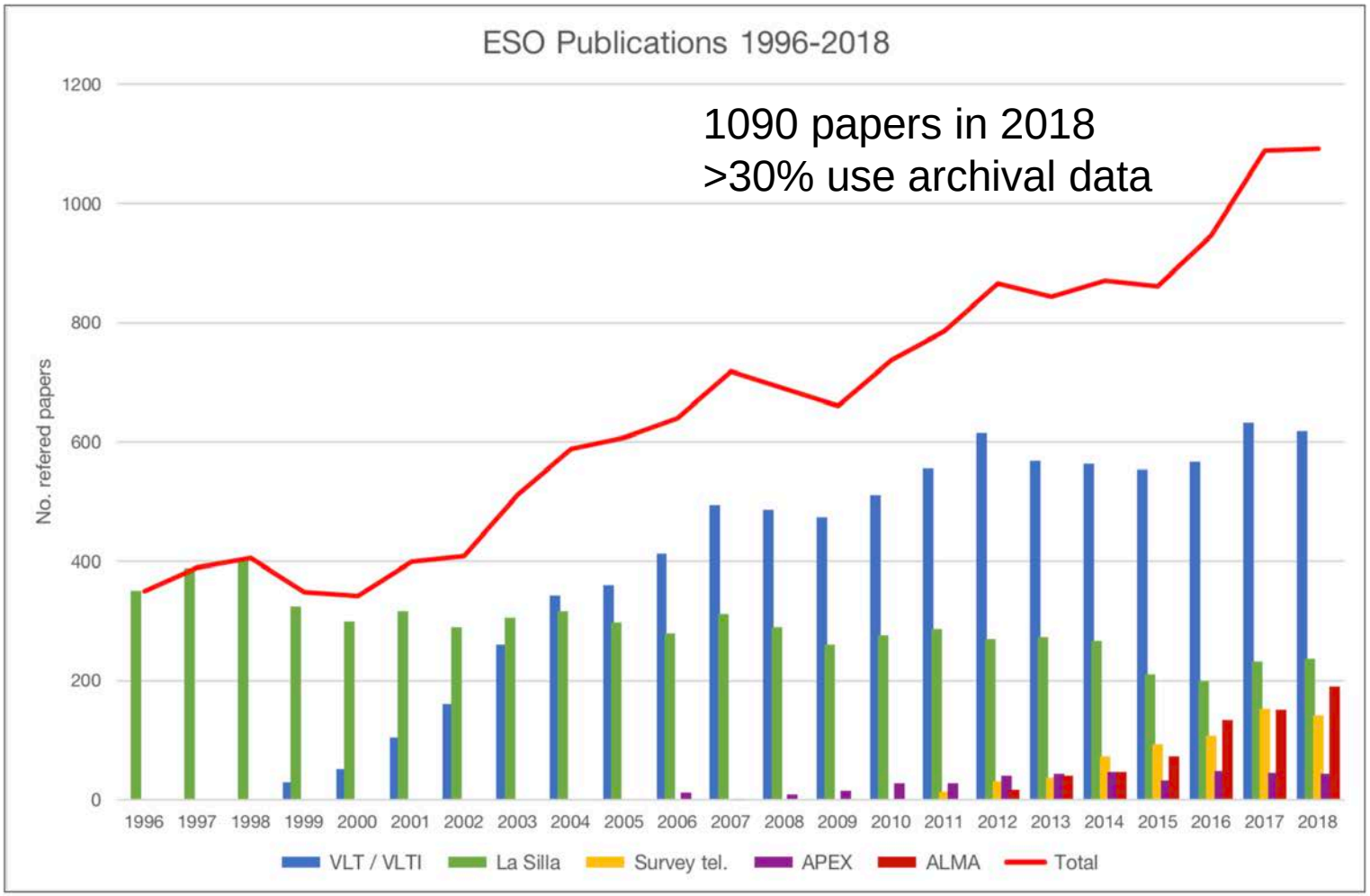
green = 1st version available, yellow = in progress, red = not started

Subsystem	Libraries and Applications
RuntimeDB	LPC (dbif) HPC (hpcif)
Data Framework	FEAdapter FECmdMgr FEMeasMon (FEEsMon, FEPactMon) FERefMgr FEInfoMon FESim (ref.impl.)
Sync	PtpAdapter SyncAdapter SyncMgr SyncMon
Net	NetAdapter NetMon NetConfig
PDC	PdcAdapter PdcMgr PdcMon PLCCode PLCSim PDCConfig
FDIR	FDIRMgr FDIREsMeasMgr
Data Recorder	DataRecorder
Scripts	Tests Configuration LSV-LCS
GUIs	FE (pymudpigui) RuntimeDB (DBBrowser) Status (m1StatusGui) PLC M1 FDIR
Common	mudplif msgif cfgif
Tools/Config	sink figlocp genconf repoloader msgsend msgpub msgsub mudpireceive mudpisend templates

CTA and ESO


CTA-Southern array to be hosted and operated
by ESO in the Paranal-Armazones area

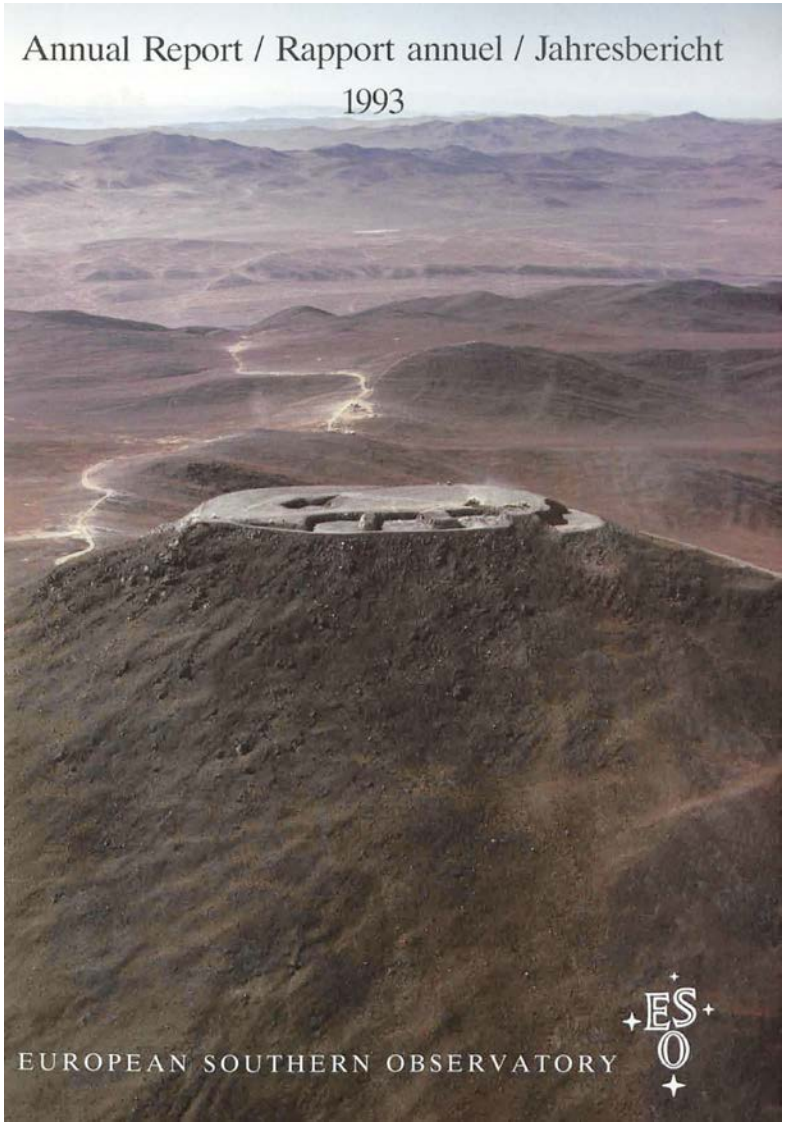
Science enabled by ESO

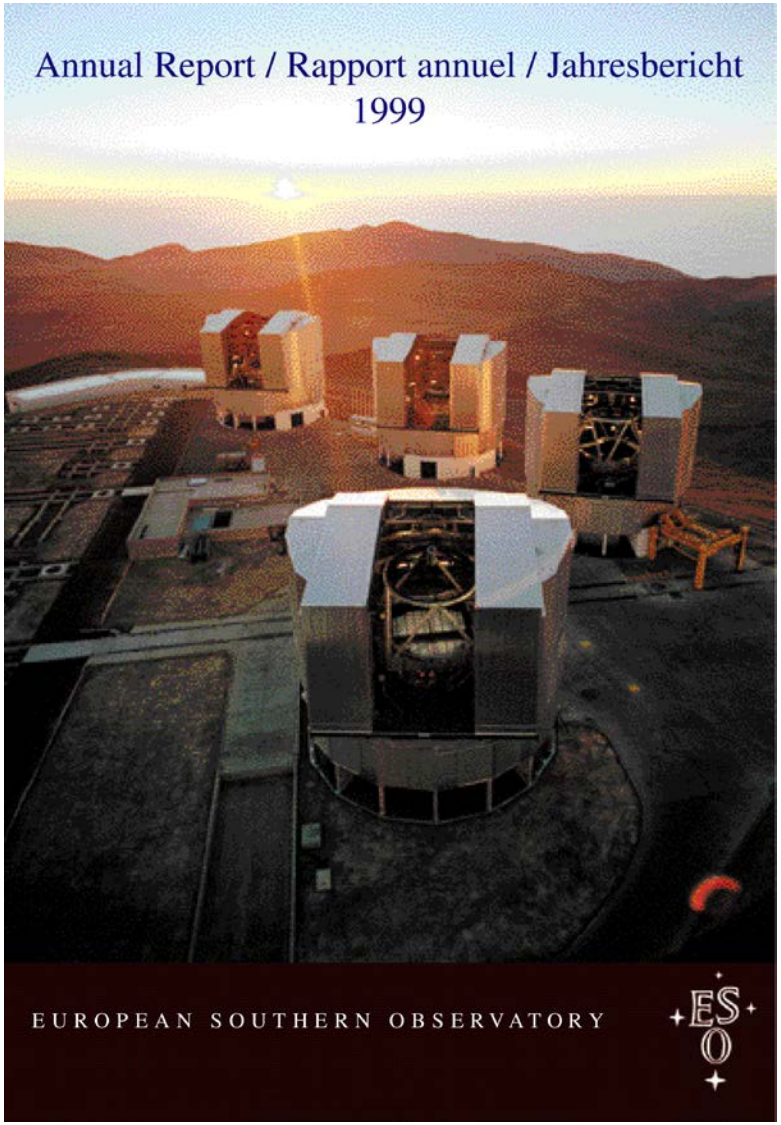


http://www.eso.org/sci/libraries/edocs/ESO/ESOstats.pdf

The legacy of Riccardo

Riccardo Giacconi
ESO DG 1993-1999





”…and more, much more than this, I did it my way”

- Made the strong point that ESO should focus on what individual member states cannot do alone
- Aligned the entire ESO strategy to deliver the **VLT**, supporting rigorous approach to project development
  - Installed yearly “VLT reviews”
- Postponed the **VLTI**, securing all civil work and basic infrastructure to let it develop in the future
- Overall **science** drive and service to the community
- Agreed with **Chile** the current legal framework ”Acuerdo interpretativo…” (1995)
- Channeled European efforts to participate in **ALMA** through ESO, as an equal partner with the USA

Thank you!