



VLT Science Priorities

A personal view of the future

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Overview

■ Planning the VLT future

➤ Maintaining leadership

- Instruments now and next
- Operations

(based on input from Alain Smette, Luca Pasquini and Michael Sterzik)

■ VLT opportunities

■ Adapting to the future

➤ Instrumentation

➤ Operations

Note: La Silla is considered part of this discussion

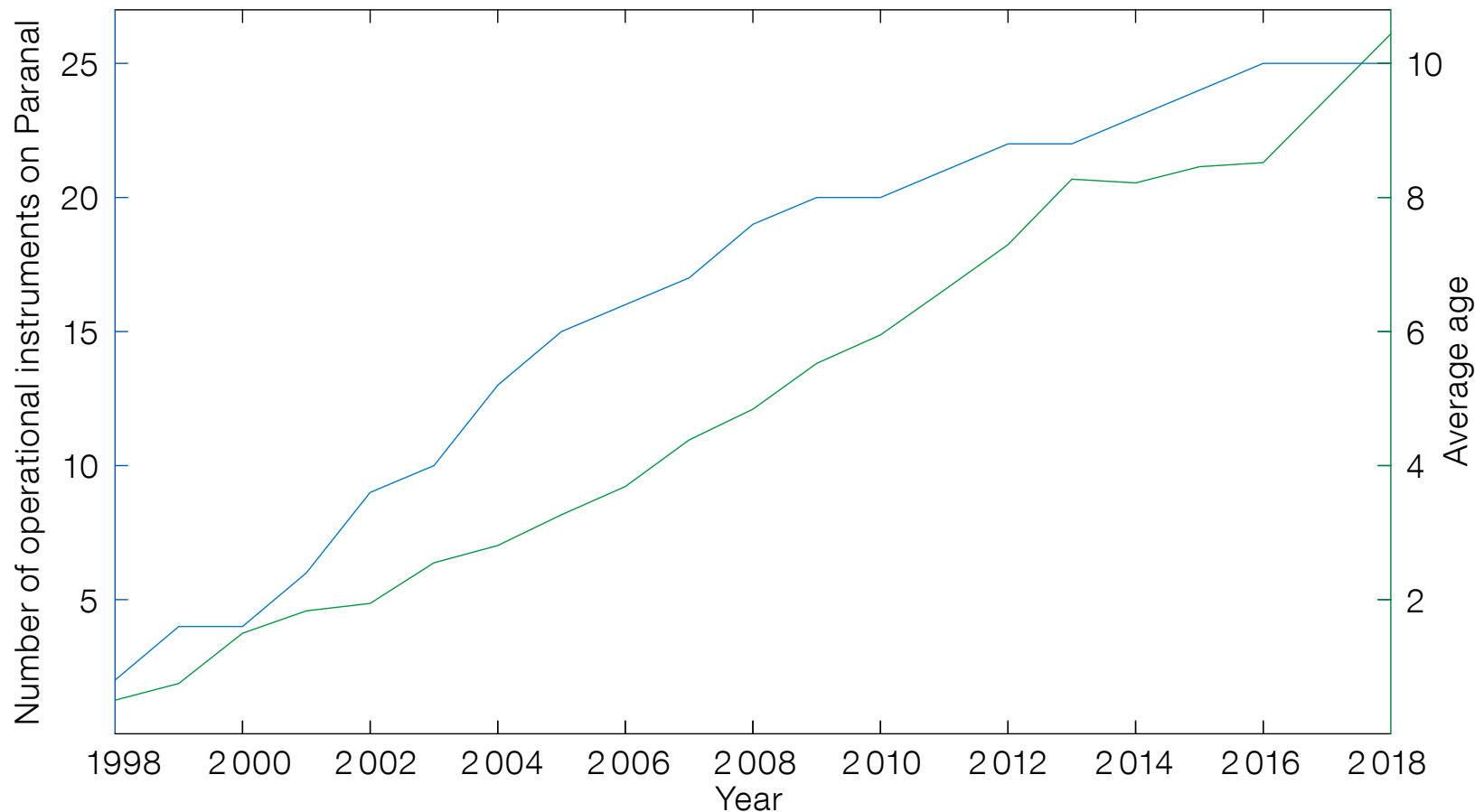


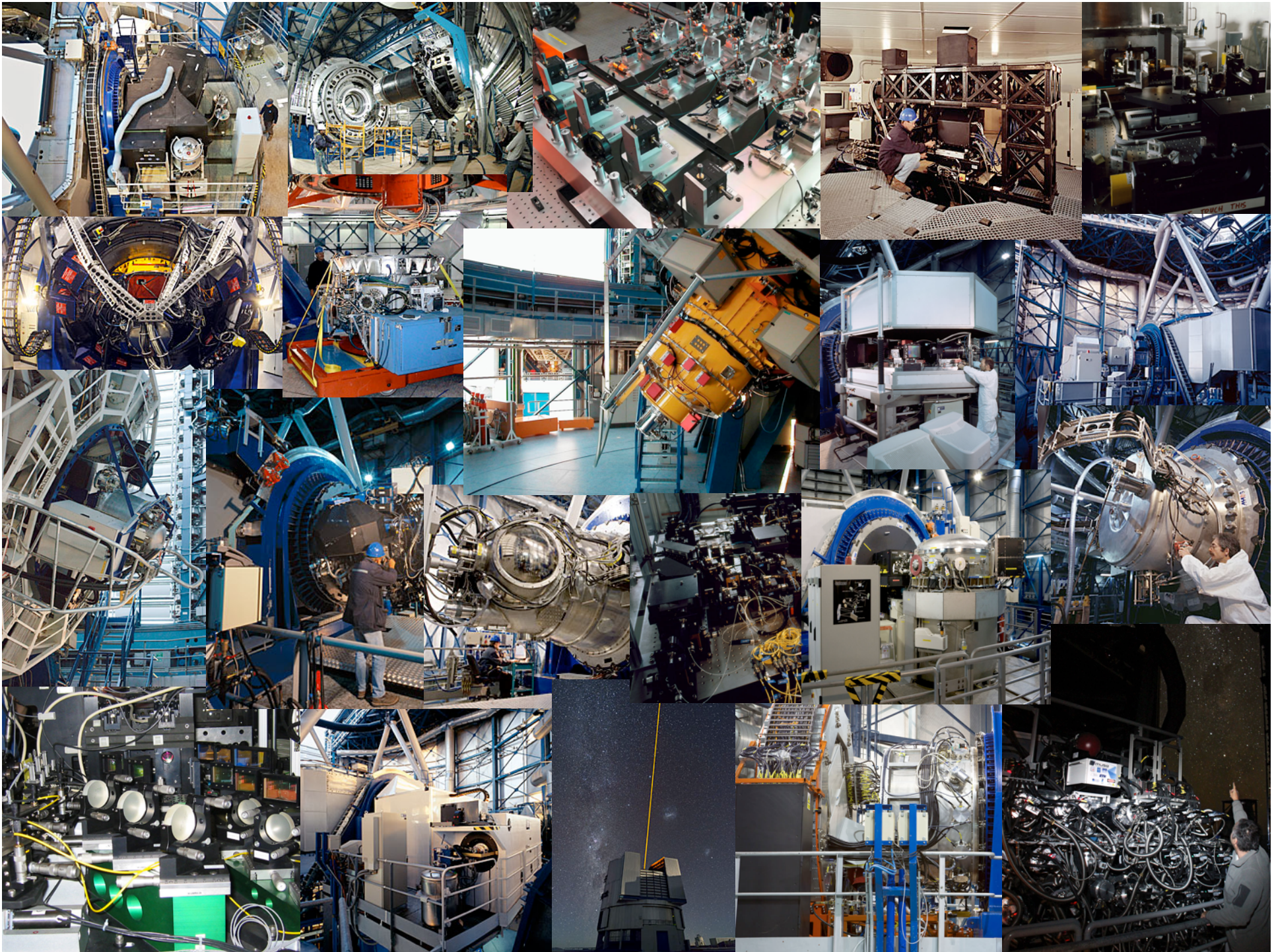
Maintaining leadership

- Keep current instrumentation state of the art

- Messenger article by Frederic Gonté et al.

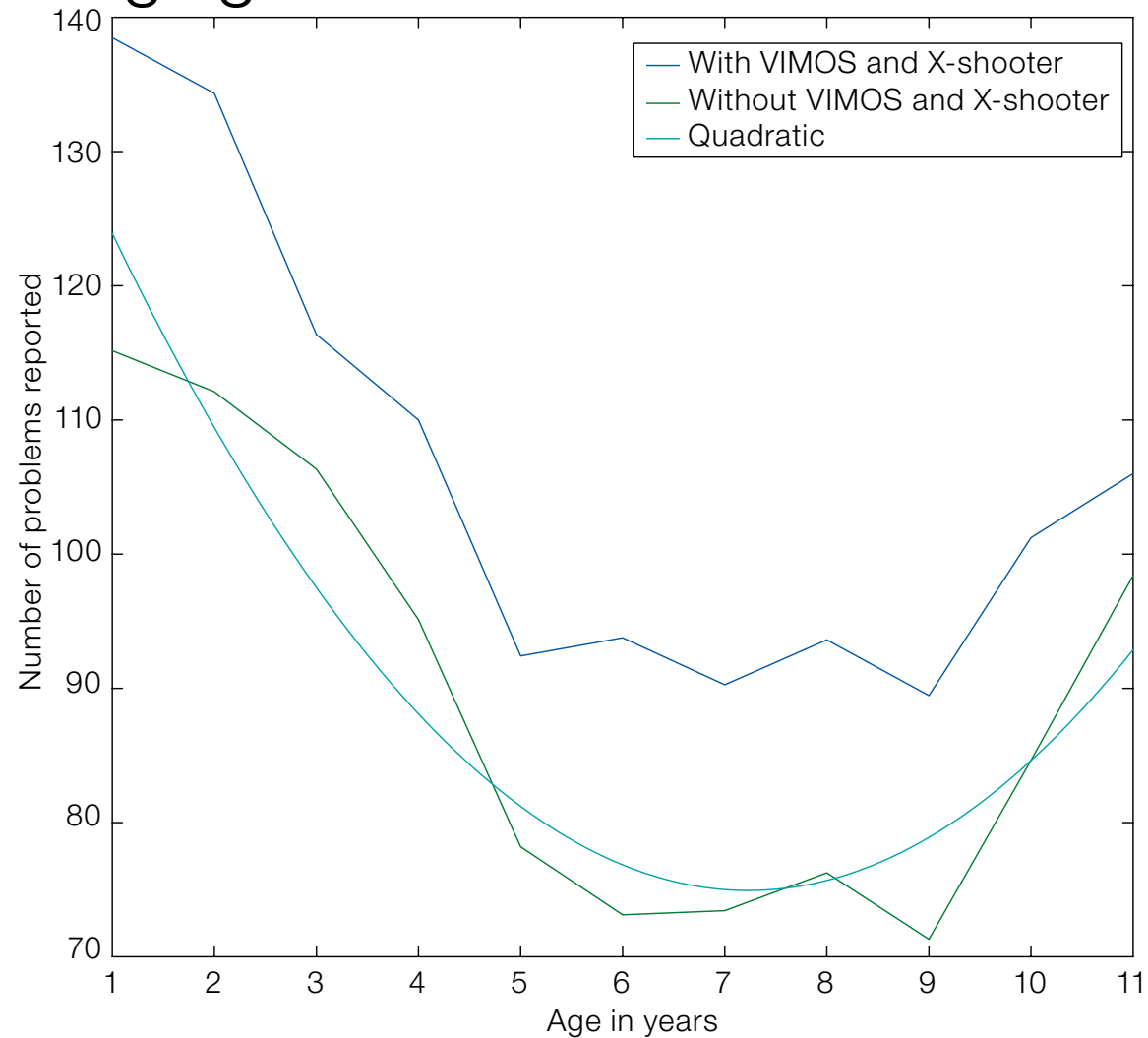
- <http://www.eso.org/sci/publications/messenger/archive/no.157-sep14/messenger-no157-17-25.pdf>





Maintaining leadership

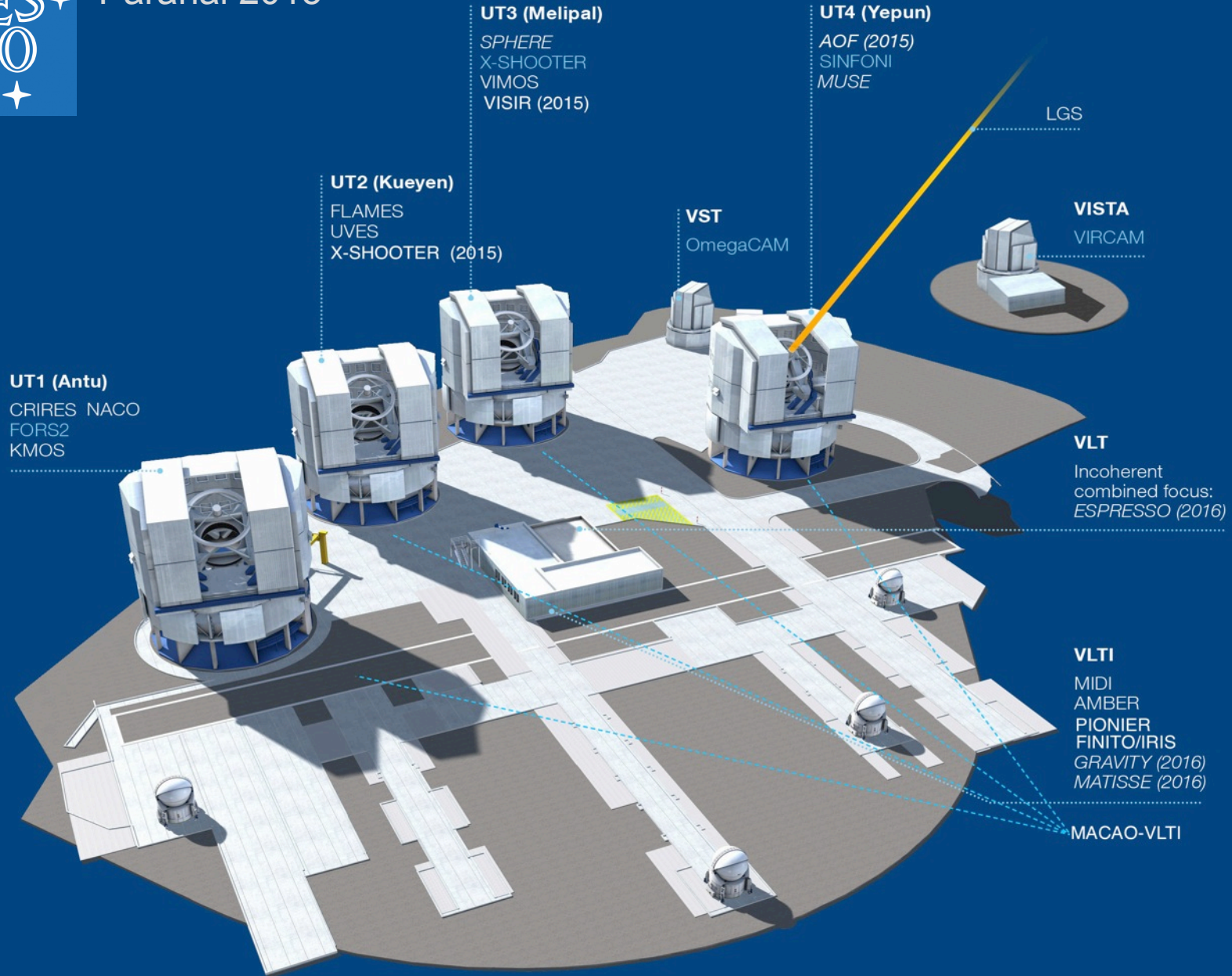
■ Instruments aging



Gonté et al.



Paranal 2015





Maintaining leadership

- Implement strategy to keep instruments competitive
 - repair defective instruments
 - establish replacement plan for core capabilities
 - plan for instrument upgrades
 - decommission instruments, which are no longer competitive
 - selective decommissioning of instrument modes, if required
- Instrument Development Plan
 - Messenger article by Luca Pasquini et al.
<http://www.eso.org/sci/publications/messenger/archive/no.154-dec13/messenger-no154-2-6.pdf>



Paranal 2020

UT1 (Antu)
CRIRES
KMOS
FORS2

UT2 (Kueyen)
UVES
MOONS
X-shooter

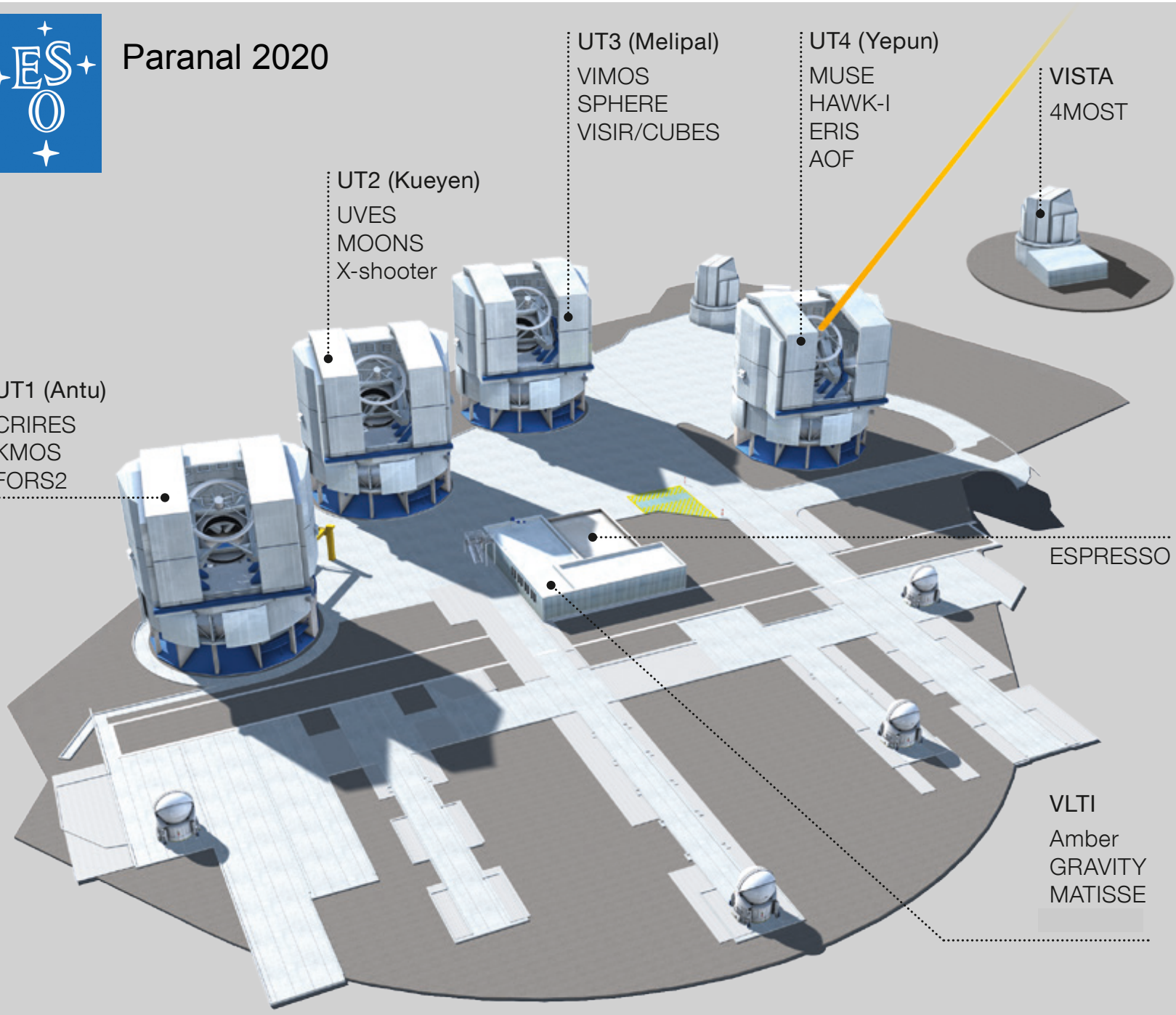
UT3 (Melipal)
VIMOS
SPHERE
VISIR/CUBES

UT4 (Yepun)
MUSE
HAWK-I
ERIS
AOF

VISTA
4MOST

ESPRESSO

VLTi
Amber
GRAVITY
MATISSE





Maintaining leadership

■ Operations

- Messenger article by Francesca Primas et al.
<http://www.eso.org/sci/publications/messenger/archive/no.158-dec14/messenger-no158-8-15.pdf>
- Internal investigation on the efficiency of operations and the scientific return by Michael Sterzik (2014)
- Current discussions on improving operations
 - scheduling
 - observations
 - data quality
 - archive



Vision for the next decade

The vision for the VLT builds on the strength of a long-term instrumentation programme and a modern operational model that enable the exploitation of four 8-m telescopes into the foreseeable future. The VLT remains the leading optical/infrared ground-based telescope system until the start of operations of the ELTs.

The VLTI will remain, even in the ELT and ALMA era, the European facility with the highest angular resolution.



Some thoughts

- Over 40000 nights with 8 to 10m telescopes observed until today
 - covers 20 years
 - (goes back to a comment by Alvio Renzini)
- How to keep relevant?
 - do something different
 - new capabilities
 - instrumentation
 - observing modes, e.g. rapid reaction
 - unique instrumentation
 - operational model → coherent observing programmes



VLT Opportunities

- Four 8m telescopes
 - flexibility
 - scientific throughput
 - 1200 observing nights/year
- Successful operational model
 - expand existing model to allow new modes
 - high time resolution photometry and spectroscopy
 - faster turnaround (currently DDT)
 - closer interaction with user, e.g. remote observing
- Telescope system
 - spatial resolution from 1 degree to 2 mas
 - wavelength coverage from 320nm to 20 μ m
 - spectral resolutions from a few to 100000



VLT Opportunities

- Time series
 - monitoring of sources over many time scales
 - HARPS, ESPRESSO and CRIFRES+ for exo-planets
 - strong lenses over years
- Statistical astronomy
 - complete samples
 - surveys
- Powerful partner
 - Optical counterpart to ALMA
 - Spectra for LSST sources
 - complementarity to space missions
 - Rosetta, Gaia, Euclid, Plato, JWST

Adapting to the future

■ Define *Core Capabilities*

- poll provides guidelines
- always available at VLT
- does not cover capabilities that can be done better with other facilities
 - E-ELT, 4m telescopes, space
- competitive instrumentation

■ Allow *Experiments*

- instrumentation for specific purpose
- remove requirement to be useful to larger community
- explore risky instrument development for high-return science
- define 'expiration date' upfront



Adapting to the future

■ Flexibility

- use the fact that there are four 8m (and three 4m) telescopes

■ Uniqueness

- VLT
- simultaneous coverage of large wavelength ranges
 - e.g. observations of Comet Shoemaker-Levy 9

■ Complementarity

- spectral follow-up of imaging surveys
- monitoring of special objects
- complementarity to space missions

■ Supplementation

- supporting observations for other facilities



Adapting to the future

■ Changes for the community

➤ move towards ‘coherent programmes’

- obtain required observing time not in tranches, but sufficient to solve a scientific problem in one go
- allow observing time over many years to monitor specific objects/events
- obtain required wavelength coverage quickly and not over years

➤ importance of archives

- future astronomers will first work from archives (data discovery)
- combination of archival data and new observations
- statistical astronomy strongly depends on archives

➤ flexibility

- make use of the best opportunities offered
- (corollary for observatories: users will go where they find the best service)

Adapting to the future

■ Operations

- what are the community needs?
 - analyse poll results
- quick turnaround on unexpected events (“DDT”)
- allow massive surveys and individual observations
- importance of the data products
 - some data products are interesting for many
 - others for only a few
 - for some observational programmes the data product is the important unit and not the observing time
 - SDSS, surveys in general
 - provide coherent/consistent/uniform data products
- importance of a data broker



The future of the VLT

- Complement and supplement
- Be open to more experiments
 - instruments
 - science programmes
 - make use of the flexibility
- Form an integral (central?) part in the ESO optical observing system
 - E-ELT ↔ VLT ↔ 3.6m/NTT/VISTA
 - complementarity with ALMA
 - complementarity with other facilities
 - EUCLID, PLATO, JWST
 - SKA, CTA

The future of the VLT

- Make use of existing baseline
 - long-term programmes
 - open the decade time frame
 - e.g. HARPS/CRIRES+/ESPRESSO exo-planet observations
 - solar system projects
 - lens monitoring
 - VLTI
 - highest spatial resolution for decades
 - complementary to spatial resolution of other facilities
 - ALMA, VLBI, SKA



The future of the VLT

- Follow up of the large samples
 - optical identification/characterisation of objects found/observed at other wavelengths
 - large tradition for X-ray and γ -ray sources
 - ROSITA, XMM, Chandra, Integral, Fermi, eROSITA, ATHENA+
 - mm and sub-mm sources
 - Herschel, Gaia, ISO, Spitzer
 - radio sources
 - gravitational waves
 - differently selected sources
 - PLATO
 - Archival searches



The future of the VLT

- How is the commitment for the observing time made?
 - time scales
 - funding
 - selection process
- Ground-space collaboration
 - distinguish between experiments/surveys and general user facilities
 - Surveys
 - EUCLID
 - PLATO
 - General users
 - JUICE
 - ATHENA+