Observing with Modern Observatories

Martino Romaniello
European Southern Observatory

NEON Archive Observing School 2008

What is modern? (Merriam-Webster dictionary)

Main Entry: [1]modern

Pronunciation: \ˈmä-dərn, ÷ˈmä-d(ə-)rən\

Function: adjective

Etymology: Late Latin modernus, from Latin modo just now, from modus measure

1 a : of, relating to, or characteristic of the present or the immediate past

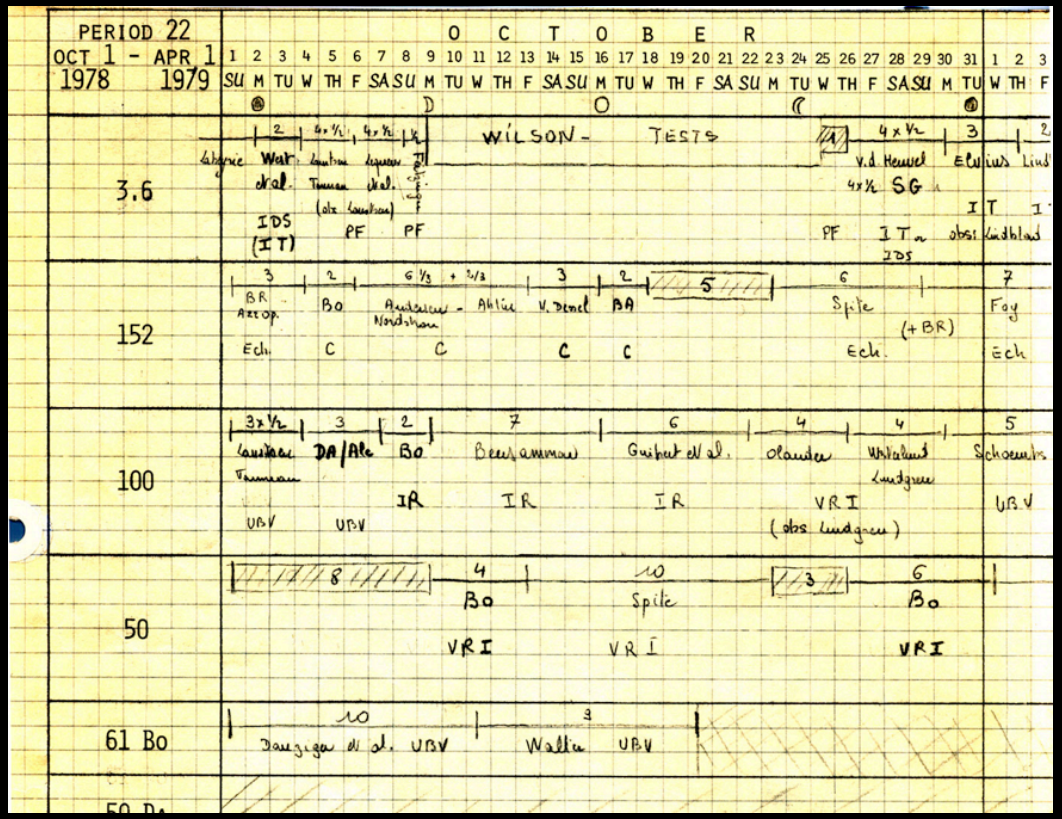
b : of, relating to, or characteristic of a period extending from a relevant remote past to the present

2: involving recent techniques, methods, or ideas

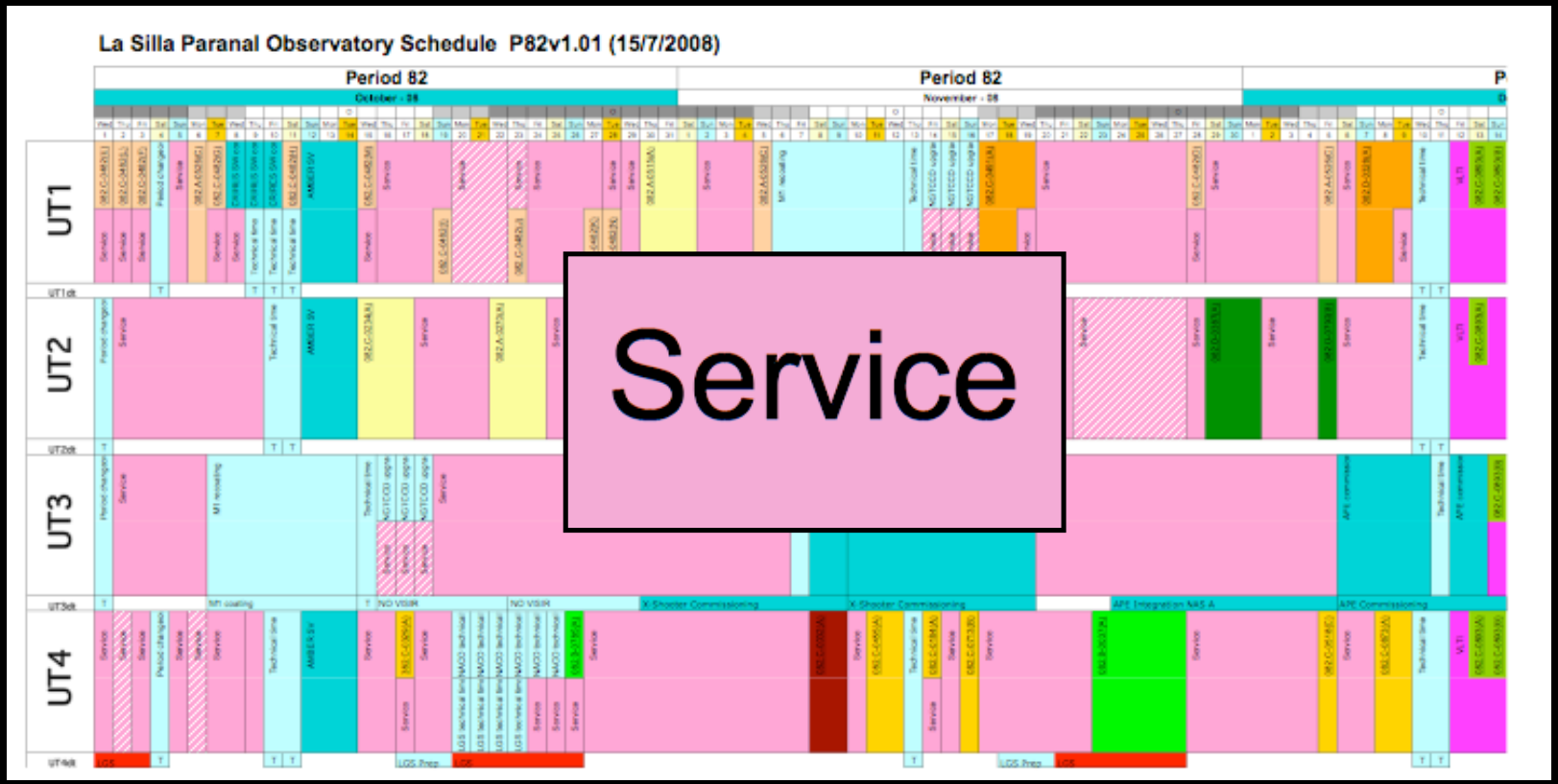
Outline

- The modes of modern observing
  - Visitor Mode
  - Service Mode
- The lifecycle of a proposal
  - Phase 1: proposal submission
  - Phase 2: definition of observations
  - Phase 3: archive ingestion of data products
- The afterlife of a proposal
  - Science Archives
  - Virtual Observatory

It was 30 years ago today: the Period 22 schedule



The modern schedule: what's with all this pink?



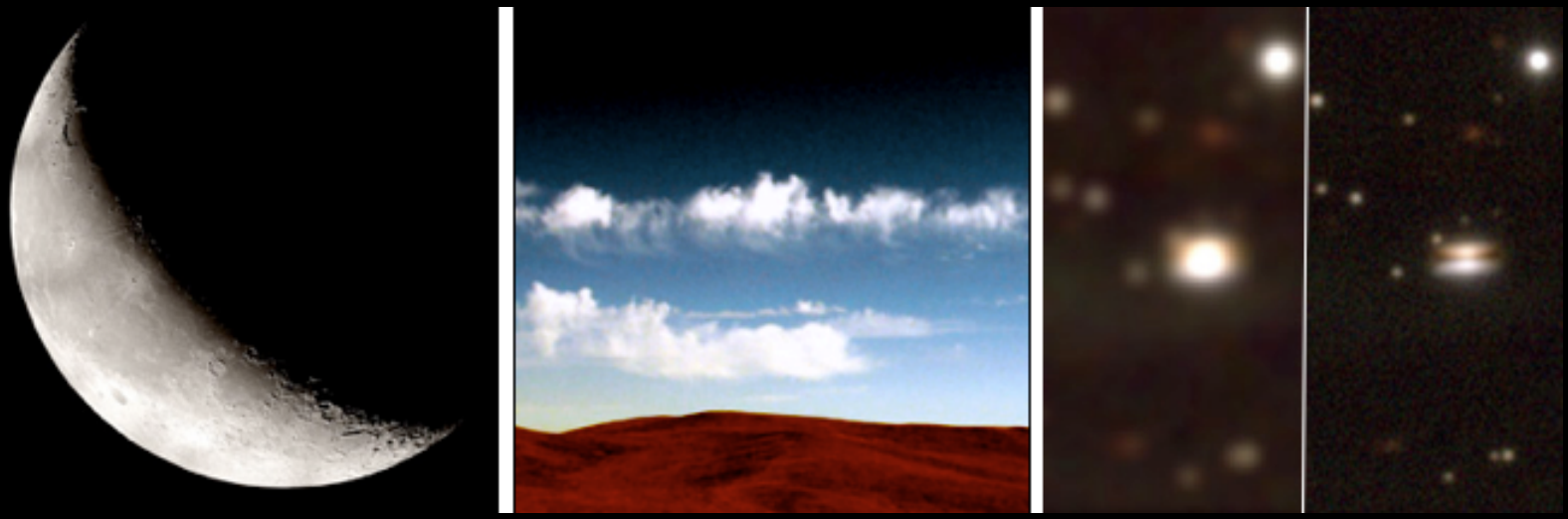
Service mode observing (aka queue observing)

- The observations are scheduled and executed without the the Principal Investigator (or collaborators) being present at the telescope
- The telescope is above the atmosphere: cumbersome to send observers there
- The telescope is below the atmosphere: desire to control its effects (and efficiently schedule transients/monitoring)

The principle of ground-based Service Observing

- **Flexible Scheduling**, i.e. the capability to continuously adapt the observing schedule to the external, often unpredictable conditions
- For this reason, and unlike in the case of space observatories, it is not generally possible to foresee the precise date when a given observation or programme will be carried out

The effects of the atmosphere



Moon

Transparency

Image quality
(seeing, strehl)

Service Observing to maximize:

- The **science efficiency** by executing the programmes with highest scientific priority first and under the required observing conditions
- The **scientific use of telescope time** by having appropriate programmes ready for execution under a broad range of observing conditions
- The **operational efficiency** by sharing calibration data between programmes

Tips for a Service Mode observer

- Set the loosest possible constraints compatible with your science
- Consider observing in bad weather (filler programme)
- Simplify as much as possible the strategy
- Keep the Observing Blocks as short as possible: varying conditions vs. saving on overheads
- Understand very well the Calibration Plan and ask for additional calibrations if needed
- Remember: no real-time decisions!

Visitor Mode Observing
(aka classical observing)

- The observer is physically present at the telescope: for the VLT this happens 40% of the time (about 300 people a year!)
- Rationale:
  - Real-time decisions
  - Complex observing strategy
  - Non-standard settings
  - Non-standard calibrations
  - Keep the community familiar with the observatories

Picture courtesy of João Alves

Service + Visitor = Modern Observing

Entr'acte I
misconceptions on Service Observing

- Service Mode is cheaper than Visitor Mode
  - False: Service Mode requires a rather large supporting structure (User Support, Quality Control, infrastructure, etc.)
- Service Observing is more efficient in terms of scientific shutter open time
  - Not necessarily true: many more setups and instrument changes imply higher overheads and calibration load

Entr'acte II
IT infrastructure

- If people don't travel, then information has to!
  - E-mail
  - Teleconferences
  - Videoconferences
  - Databases, database replication
  - Data transfer (internet, hard media)
  - Observing Block transfer
  - ...

Entr'acte III
the VLT/VLTI instruments

More in Mark Casali's and Andrea Richichi's lectures

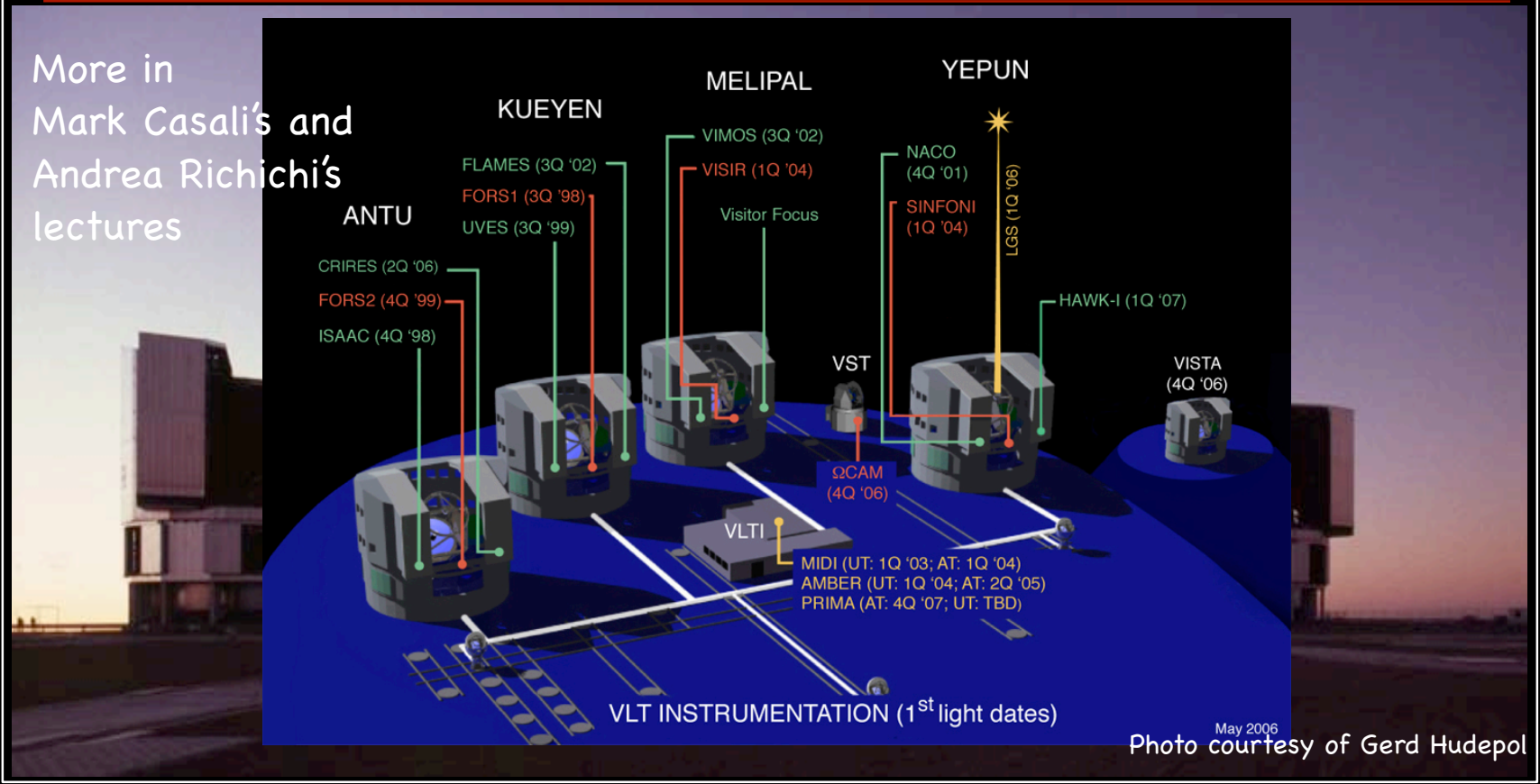


Photo courtesy of Gerd Hudepol

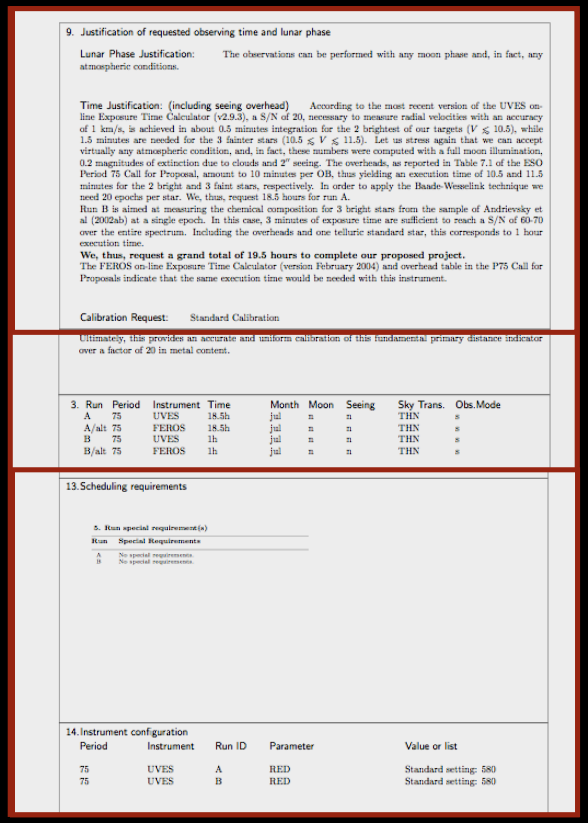
The World's most advanced  optical telescope

Entr'acte IV
the VLT model vs. the Keck model

VLT	Keck
Open to a wide community	Restricted access (UC, Caltech)
Public funding	Private funding
Service and Visitor mode	Only classical observing
Multiple instruments a night	Fixed instrument configuration
World-wide public archive	(almost) No archive
"Get there right!"	"Get there first!"

Will this be the scheme also for the next generation of telescopes, i.e. European ELT and the Californian TMT???

The lifecycle of a proposal
Phase 1



9. Justification of requested observing time and lunar phase

Lunar Phase Justification: The observations can be performed with any moon phase and, in fact, any atmospheric conditions.

Time Justification: (including seeing overhead) According to the most recent version of the UVES on-line Exposure Time Calculator (v2.9.3), a S/N of 20, necessary to measure radial velocities with an accuracy of 1 km/s, is achieved in about 0.5 minutes integration for the 2 brightest of our targets ($V \lesssim 10.5$), while 1.5 minutes are needed for the 3 fainter stars ($10.5 \lesssim V \lesssim 11.5$). Let us stress again that we can accept virtually any atmospheric condition, and, in fact, these numbers were computed with a full moon illumination, 0.2 magnitudes of extinction due to clouds and 2" seeing. The overheads, as reported in Table 7.1 of the ESO Period 75 Call for Proposal, amount to 10 minutes per OB, thus yielding an execution time of 10.5 and 11.5 minutes for the 2 bright and 3 faint stars, respectively. In order to apply the Baade-Wesselink technique we need 20 epochs per star. We, thus, request 18.5 hours for run A.
Run B is aimed at measuring the chemical composition for 3 bright stars from the sample of Andrievsky et al (2002ab) at a single epoch. In this case, 3 minutes of exposure time are sufficient to reach a S/N of 60-70 over the entire spectrum. Including the overheads and one telluric standard star, this corresponds to 1 hour execution time.
We, thus, request a grand total of 19.5 hours to complete our proposed project.
The FEROS on-line Exposure Time Calculator (version February 2004) and overhead table in the P75 Call for Proposals indicate that the same execution time would be needed with this instrument.

Calibration Request: Standard Calibration

Ultimately, this provides an accurate and uniform calibration of this fundamental primary distance indicator over a factor of 20 in metal content.

3.

Run	Period	Instrument	Time	Month	Moon	Seeing	Sky Trans.	Obs.Mode
A	75	UVES	18.5h	jul	n	n	THN	s
A/alt	75	FEROS	18.5h	jul	n	n	THN	s
B	75	UVES	1h	jul	n	n	THN	s
B/alt	75	FEROS	1h	jul	n	n	THN	s

13. Scheduling requirements

5. Run special requirement(s)

Run	Special Requirements
A	No special requirements.
B	No special requirements.

14. Instrument configuration

Period	Instrument	Run ID	Parameter	Value or list
75	UVES	A	RED	Standard setting: 580
75	UVES	B	RED	Standard setting: 580

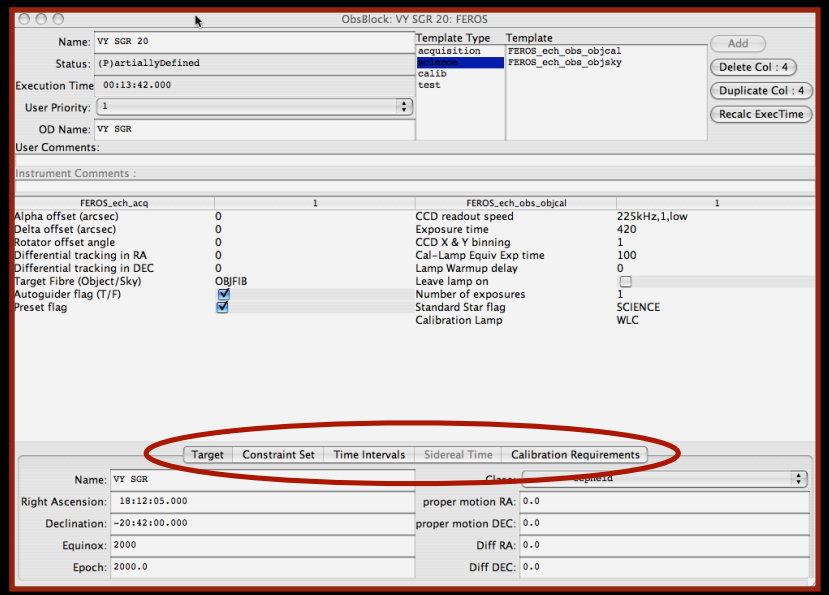
- You have to explain to a peer-review panel…
  - What you want to observe
  - Why you want to observe it
  - How you want to observe it
- …and convince them to grant you time!

The lifecycle of a (successful) proposal
Phase 2

- Specify all of the details of the observations:
  - Instrumental setups
  - Exposure and execution times (ETC, overheads, etc.)
  - Observing techniques (offsets, chopping, etc.)
  - Constraint set(s)
  - README file
  - Finding charts
  - Ephemeris
  - …

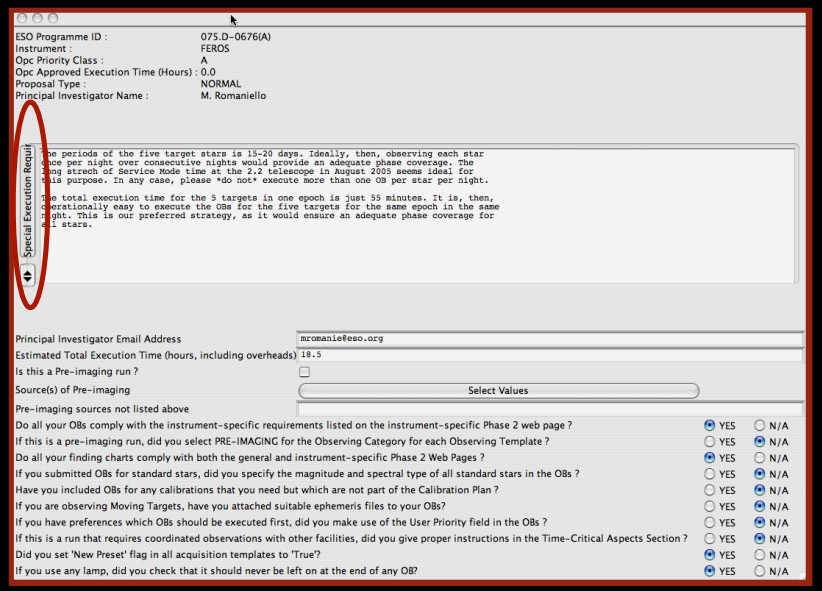
Phase 2

Observing Blocks and templates



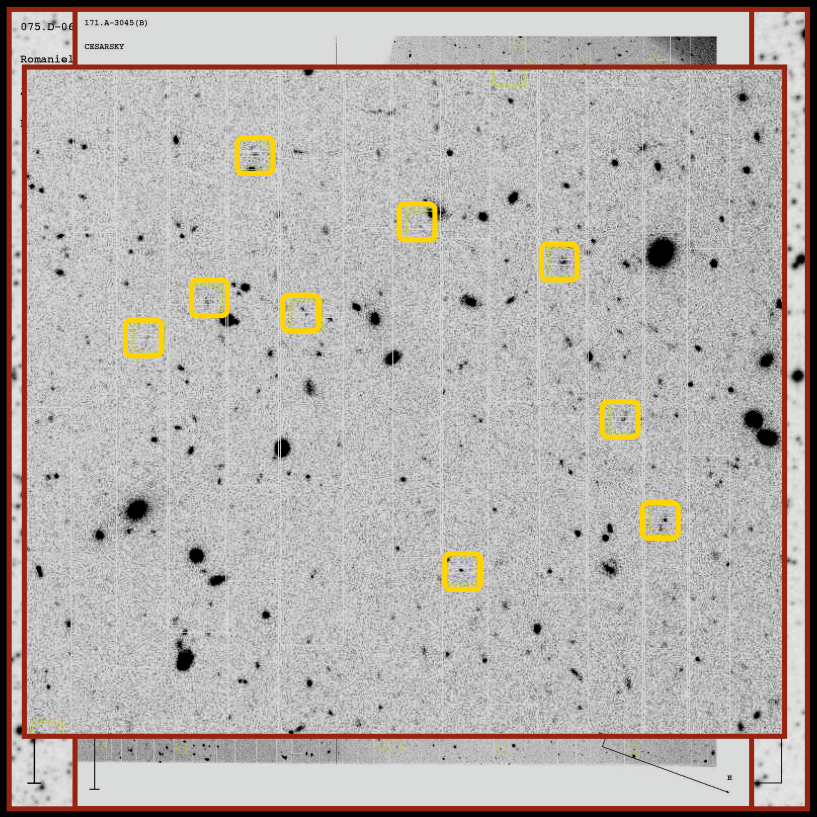
- OBs are observing sequences based on templates
- Templates describe the basic operations that the instrument can perform
- Templates are customized with parameters
- OBs also contain additional information: constraints, timing, etc.

Phase 2
README file



- The README file is used to communicate relevant information to the staff astronomer on the mountain, such as the description of the programme…
- …and any other special requirements (time constraints, execution sequence, etc.)

Phase 2
Finding Charts



Courtesy of Paola Popesso

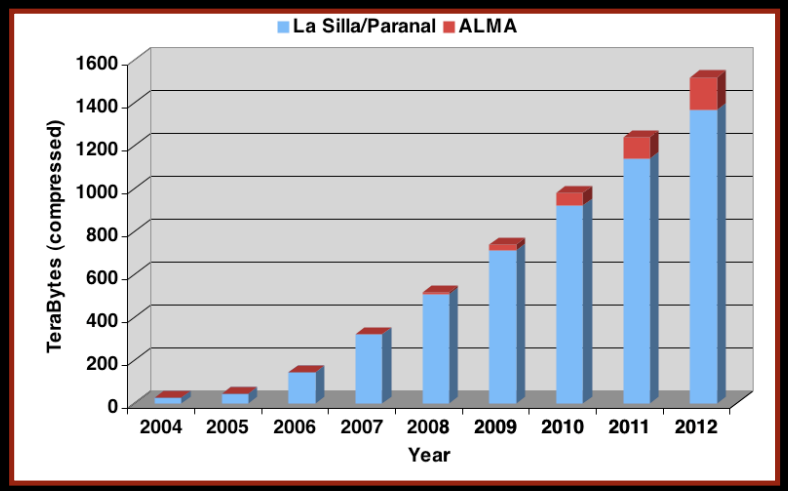
- And, finally, finding charts visually help the observer to identify the intended target...
- ...sometime it's easy...
- ...sometimes not quite!

Phase 2
Definition of the Observing Run

- Service Mode PIs interact with the Observatory staff, e.g. the ESO User Support Department here in Garching, until the Phase 2 package is ready for execution
- Visitor Mode PIs are required to go to the mountain ahead of time to finalize the observations with the local staff
- Ideally all problems are caught and solved before the night starts so that no telescope time is lost


...the data are finally acquired...
(and you go happily about doing your science with it)

The afterlife of a proposal
Archives and Virtual Observatory



- Data are archived to be used by present and future generations for research and education
- The archive becomes an instrument in its own right, capable of producing genuinely novel science

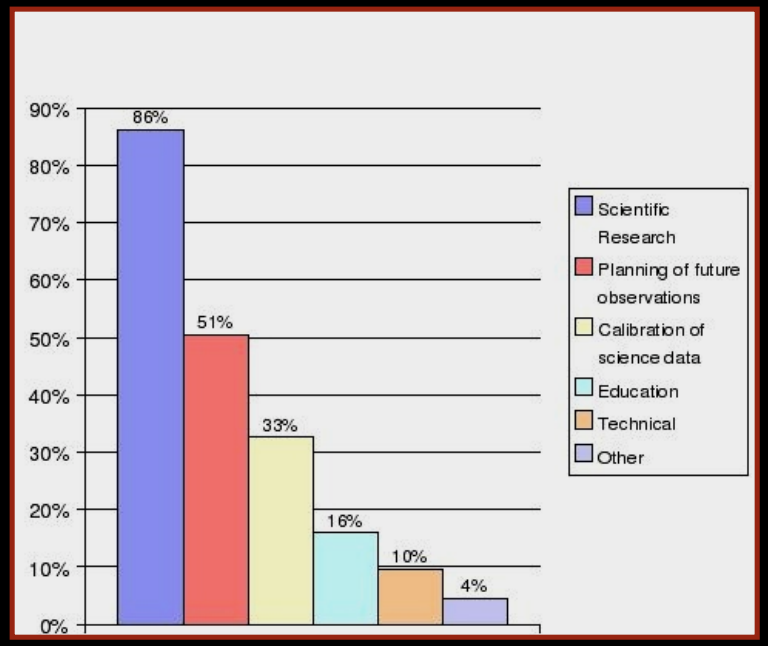
Phase 3
Returning the Data Products to the Observatory

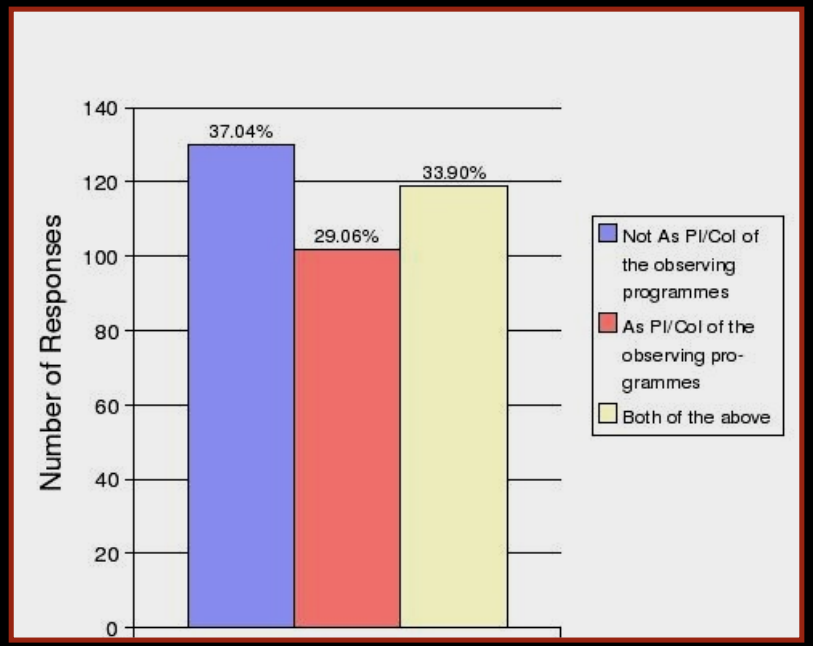
- PIs of Public Surveys and Large Programmes (as of P75) have to return data products to ESO
- All other users are encouraged to do so
- In-house production of data products
- These data products include:
  - calibrated images and/or spectra (flux calibrated, astrometrized, etc.)
  - catalogues with the physical properties of the sources (redshift, chemical abundances, emitted fluxes at different wavelengths, etc.)

The archive as a new instrument

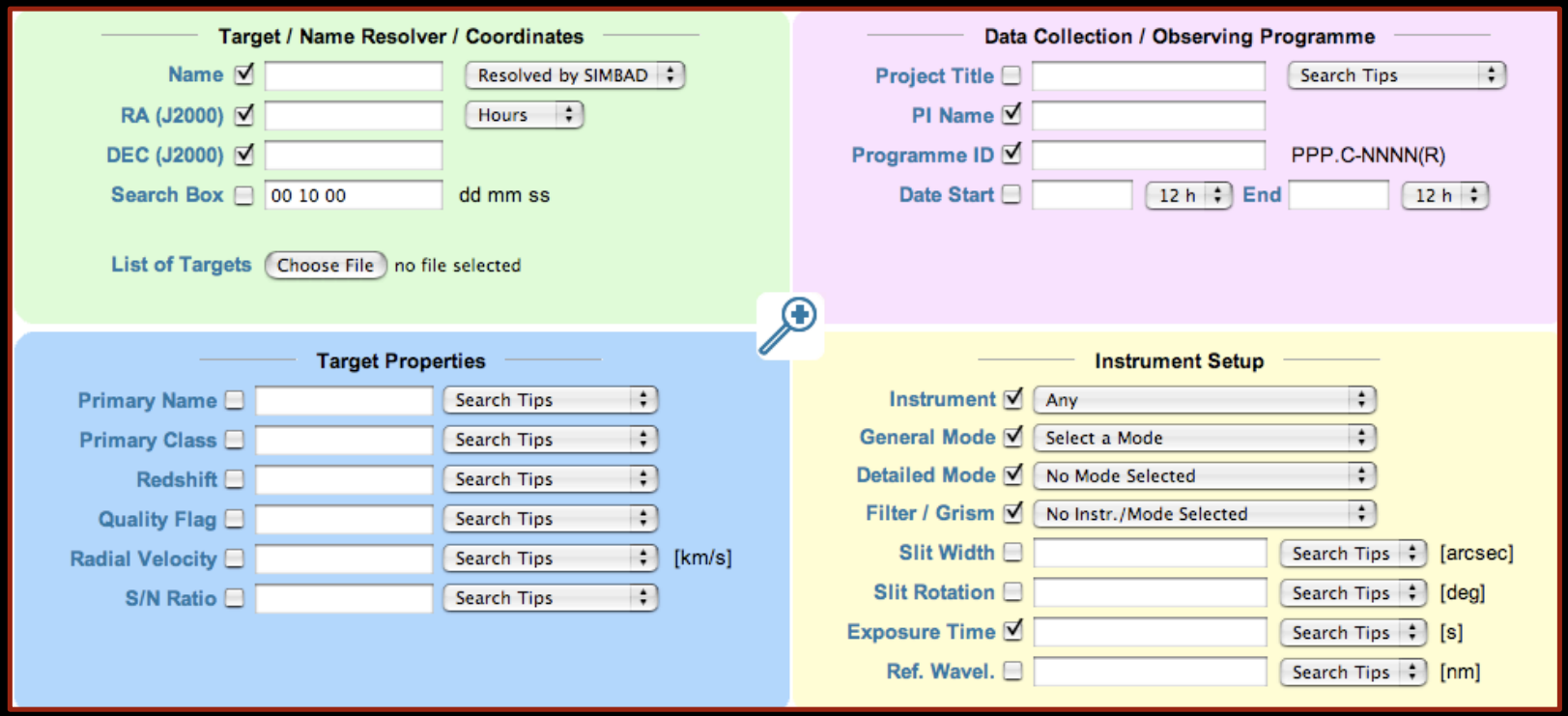
- A modern archive contains the raw data and processed data of different levels, possibly all the way up to highly processed data ready for scientific use
- The full exploitation of archive data requires specific tools to, e.g., easily combine data from different instruments and observatories: the Virtual Observatory (cf. Paolo Padovani's and Evanthia Hatziminaoglou lectures)

The archive as a new instrument (ESO Science Archive Survey)



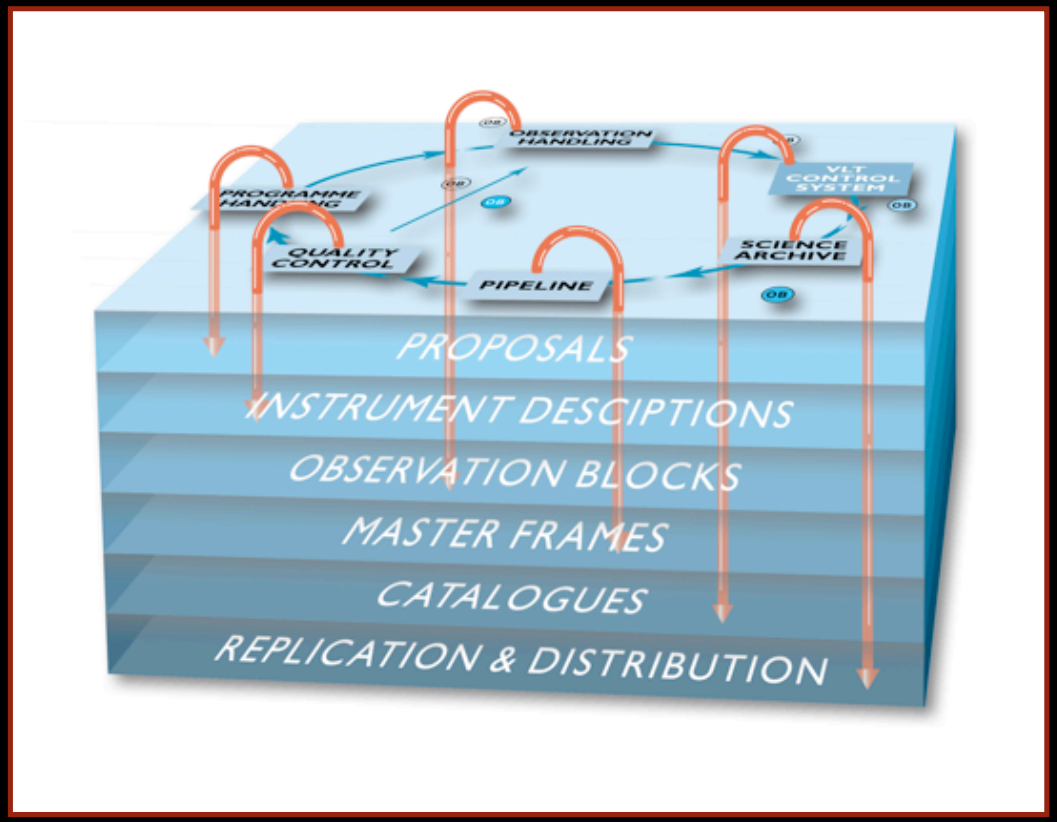


A modern archive in action



archive.eso.org

Putting everything together:
The Data Flow System



Courtesy of Benoît Pirenne

Service + Visitor + Virtual Observatory

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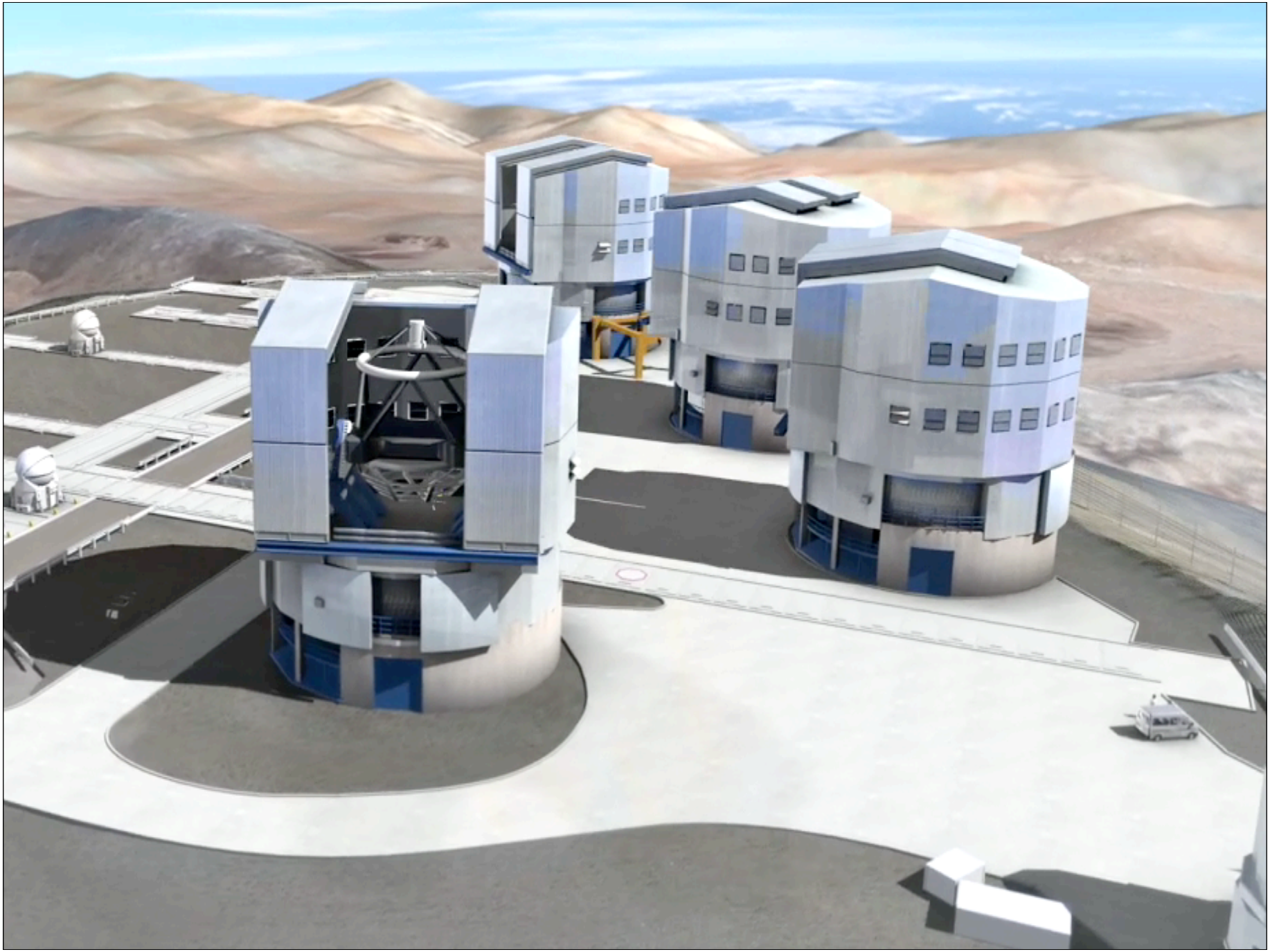
The Observatory of the future




Enjoy the 2008 Neon School!!
Photo courtesy of Yuri Beletsky