

Observing with Modern Observatories

Martino Romaniello
European Southern Observatory

NEON Archive Observing School 2008

What is **modern**?

(Merriam-Webster dictionary)

Main Entry: ¹modern

Pronunciation: \ 'mä-dərn, ÷ 'mä-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**

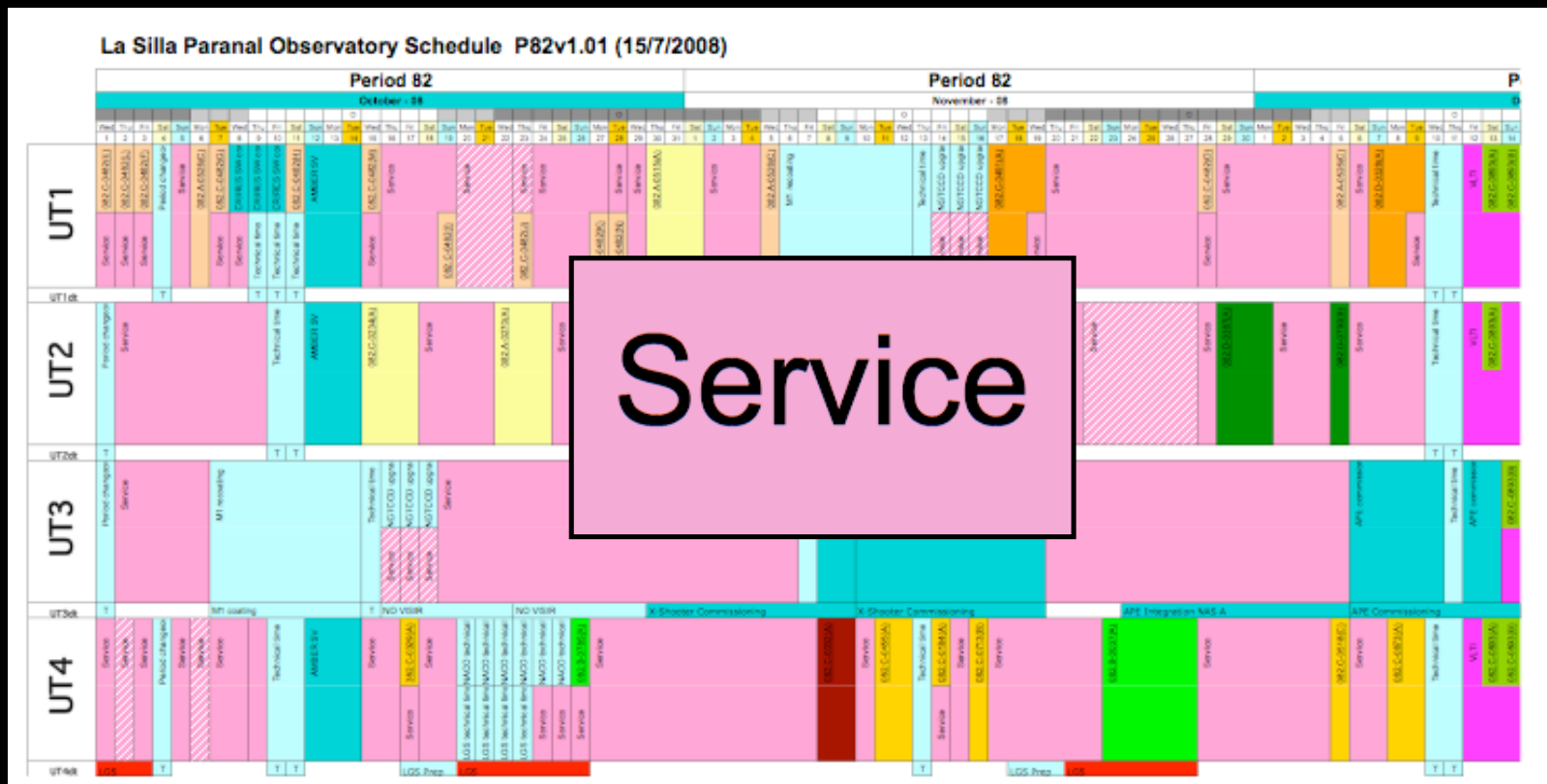
Outline

- 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

PERIOD 22		OCTOBER																																										
OCT 1	APR 1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	1	2	3									
1978	1979	SU	M	TU	W	TH	F	S	A	SU	M	TU	W	TH	F	S	A	SU	M	TU	W	TH	F	S	A	SU	M	TU	W	TH	F	S	A	SU	M	TU	W	TH	F					
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50 Da																																												

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)

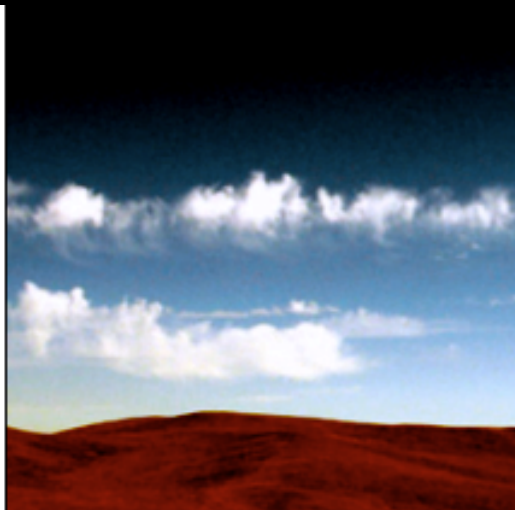
The principle of ground-based Service Observing

- **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

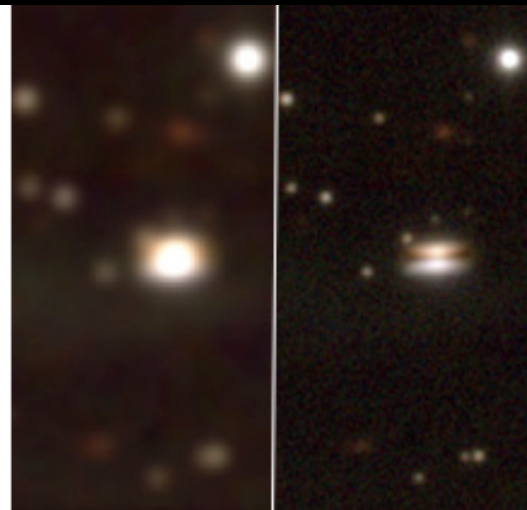


Image quality
(seeing, strehl)

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

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

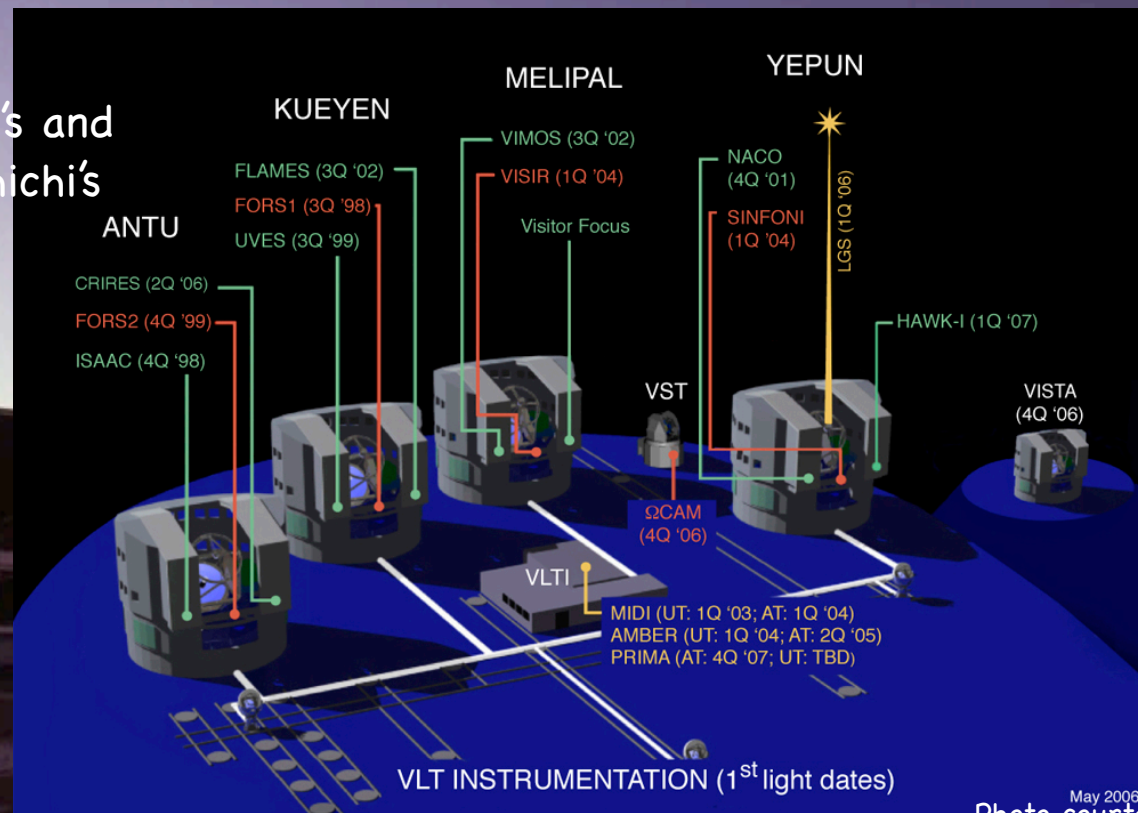
IT infrastructure

- 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



May 2006
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 ($V \leq 10.5$), while 1.5 minutes are needed for the 3 fainter stars ($10.5 \leq V \leq 11.5$). 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-Wesselnik 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 requirements(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

ObsBlock: VY SGR 20: FEROS

Name: VY SGR 20
Status: (Partially)Defined
Execution Time: 00:13:42.000
User Priority: 1
OD Name: VY SGR
User Comments:

Template Type	Template
acquisition	FEROS_ech_obs_objcal
osLib	FEROS_ech_obs_objsky
test	

Instrument Comments:

Parameter	Value	Unit	Parameter	Value	Unit
FEROS_ech_acq	1		FEROS_ech_obs_objcal	1	
Alpha offset (arcsec)	0		CCD readout speed	225KHz,1,low	
Delta offset (arcsec)	0		Exposure time	420	
Rotator offset angle	0		CCD X & Y binning	1	
Differential tracking in RA	0		Cal-Lamp Equiv Exp time	100	
Differential tracking in DEC	0		Lamp Warmup delay	0	
Target Fibre (Object/Sky)	OBJ/FIB		Leave lamp on	<input type="checkbox"/>	
Autoguider flag (T/F)	<input checked="" type="checkbox"/>		Number of exposures	1	
Preset flag	<input checked="" type="checkbox"/>		Standard Star flag	SCIENCE	
			Calibration Lamp	WLC	

Target

Name: VY SGR
Right Ascension: 18:12:05.000
Declination: -20:42:00.000
Equinox: 2000
Epoch: 2000.0

proper motion RA: 0.0
proper motion DEC: 0.0
Diff RA: 0.0
Diff DEC: 0.0

- 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

ESO Programme ID : 075.D-0676(A)
Instrument : FEROS
Opc Priority Class : A
Opc Approved Execution Time (Hours) : 0.0
Proposal Type : NORMAL
Principal Investigator Name : M. Romaniello

Special Execution Requirements

The periods of the five target stars is 15-20 days. Ideally, then, observing each star once per night over consecutive nights would provide an adequate phase coverage. The long stretch of service mode time at the 2.2 telescope in August 029 seems ideal for this purpose. In any case, please *do not* execute more than one OB per star per night. The total execution time for the 5 targets in one epoch is just 55 minutes. It is, then, occasionally easy to execute the OBs for the five targets for the same epoch in the same night. This is our preferred strategy, as it would ensure an adequate phase coverage for all stars.

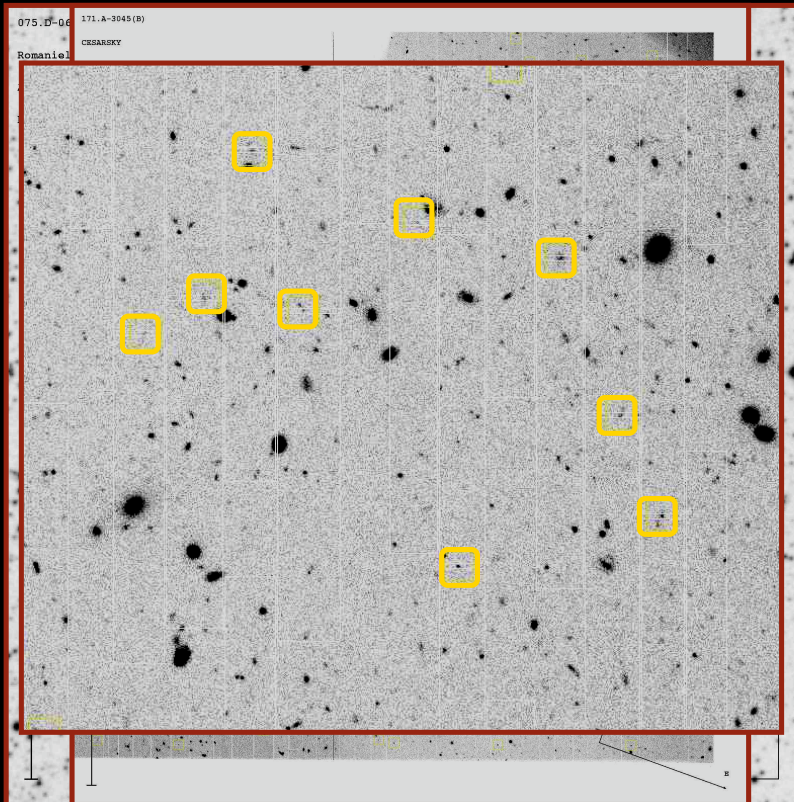
Principal Investigator Email Address : mromanie@eso.org
Estimated Total Execution Time (hours, including overheads) : 18.5
Is this a Pre-imaging run ?
Source(s) of Pre-imaging :
Pre-imaging sources not listed above

Do all your OBs comply with the instrument-specific requirements listed on the instrument-specific Phase 2 web page ? YES N/A
If this is a pre-imaging run, did you select PRE-IMAGING for the Observing Category for each Observing Template ? YES N/A
Do all your finding charts comply with both the general and instrument-specific Phase 2 Web Pages ? YES N/A
If you submitted OBs for standard stars, did you specify the magnitude and spectral type of all standard stars in the OBs ? YES N/A
Have you included OBs for any calibrations that you need but which are not part of the Calibration Plan ? YES N/A
If you are observing Moving Targets, have you attached suitable ephemeris files to your OBs? YES N/A
If you have preferences which OBs should be executed first, did you make use of the User Priority field in the OBs ? YES N/A
If this is a run that requires coordinated observations with other facilities, did you give proper instructions in the Time-Critical Aspects Section ? YES N/A
Did you set 'New Preset' flag in all acquisition templates to 'True'? YES N/A
If you use any lamp, did you check that it should never be left on at the end of any OB? YES N/A

- 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

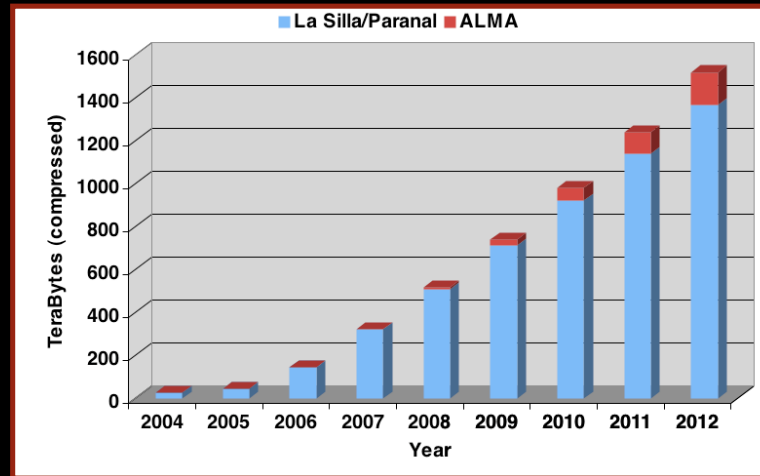


...the data are finally acquired...

(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

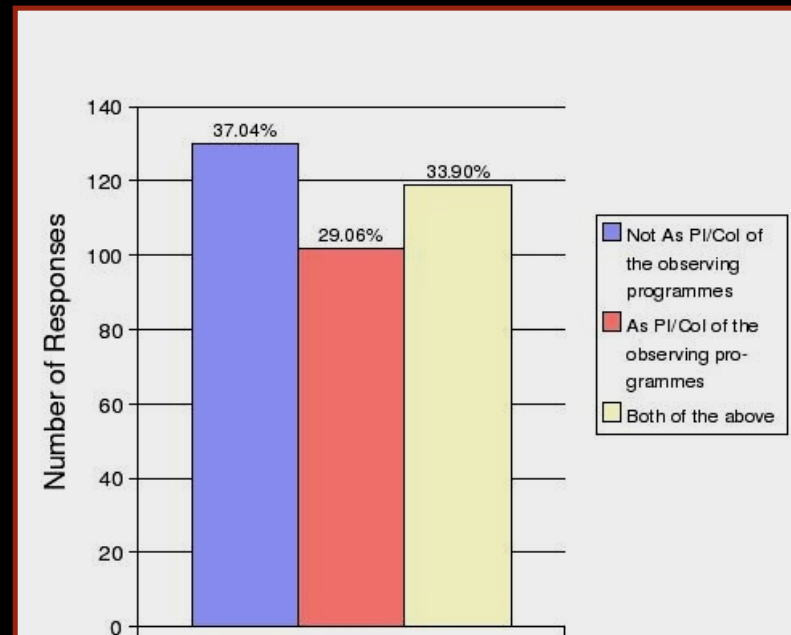
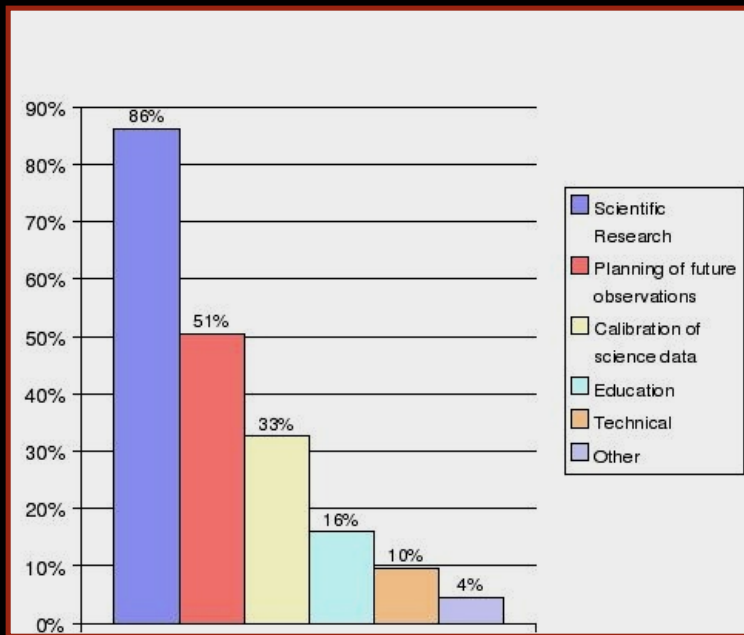
Returning the Data Products to the Observatory

- 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

Target / Name Resolver / Coordinates

Name Resolved by SIMBAD

RA (J2000) Hours

DEC (J2000)

Search Box 00 10 00 dd mm ss

List of Targets no file selected

Data Collection / Observing Programme

Project Title Search Tips

PI Name

Programme ID PPP.C-NNNN(R)

Date Start 12 h End 12 h

Target Properties

Primary Name Search Tips

Primary Class Search Tips

Redshift Search Tips

Quality Flag Search Tips

Radial Velocity Search Tips [km/s]

S/N Ratio Search Tips

Instrument Setup

Instrument Any

General Mode Select a Mode

Detailed Mode No Mode Selected

Filter / Grism No Instr./Mode Selected

Slit Width Search Tips [arcsec]

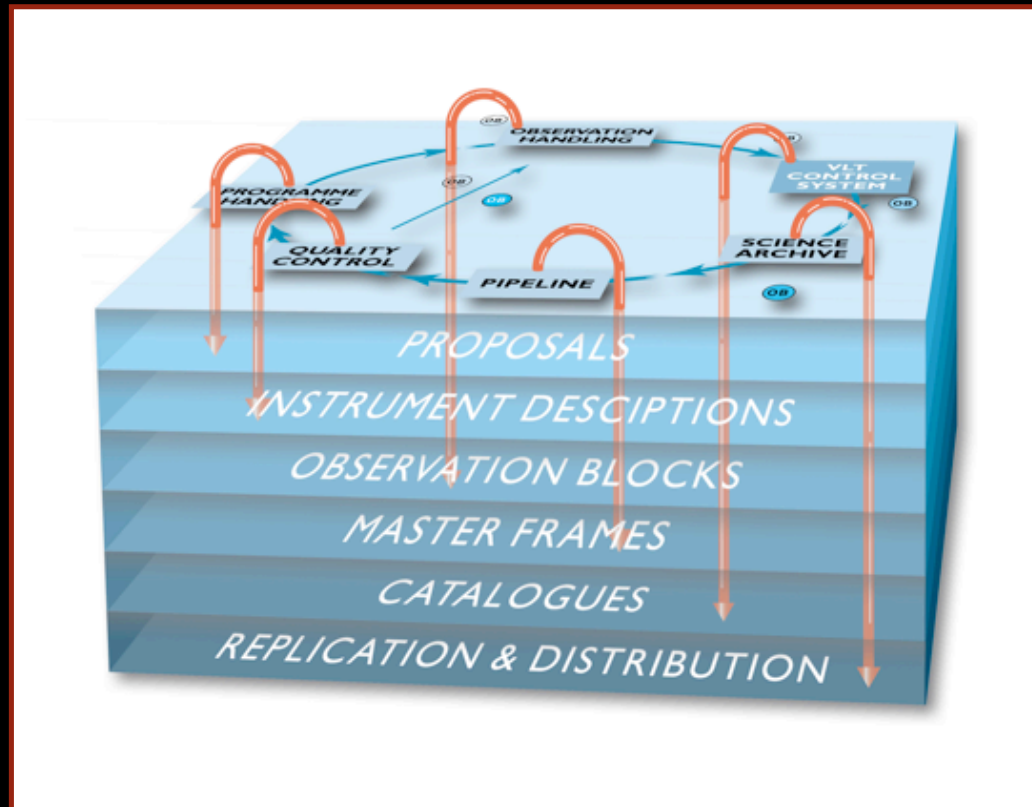
Slit Rotation Search Tips [deg]

Exposure Time Search Tips [s]

Ref. Wavel. Search Tips [nm]

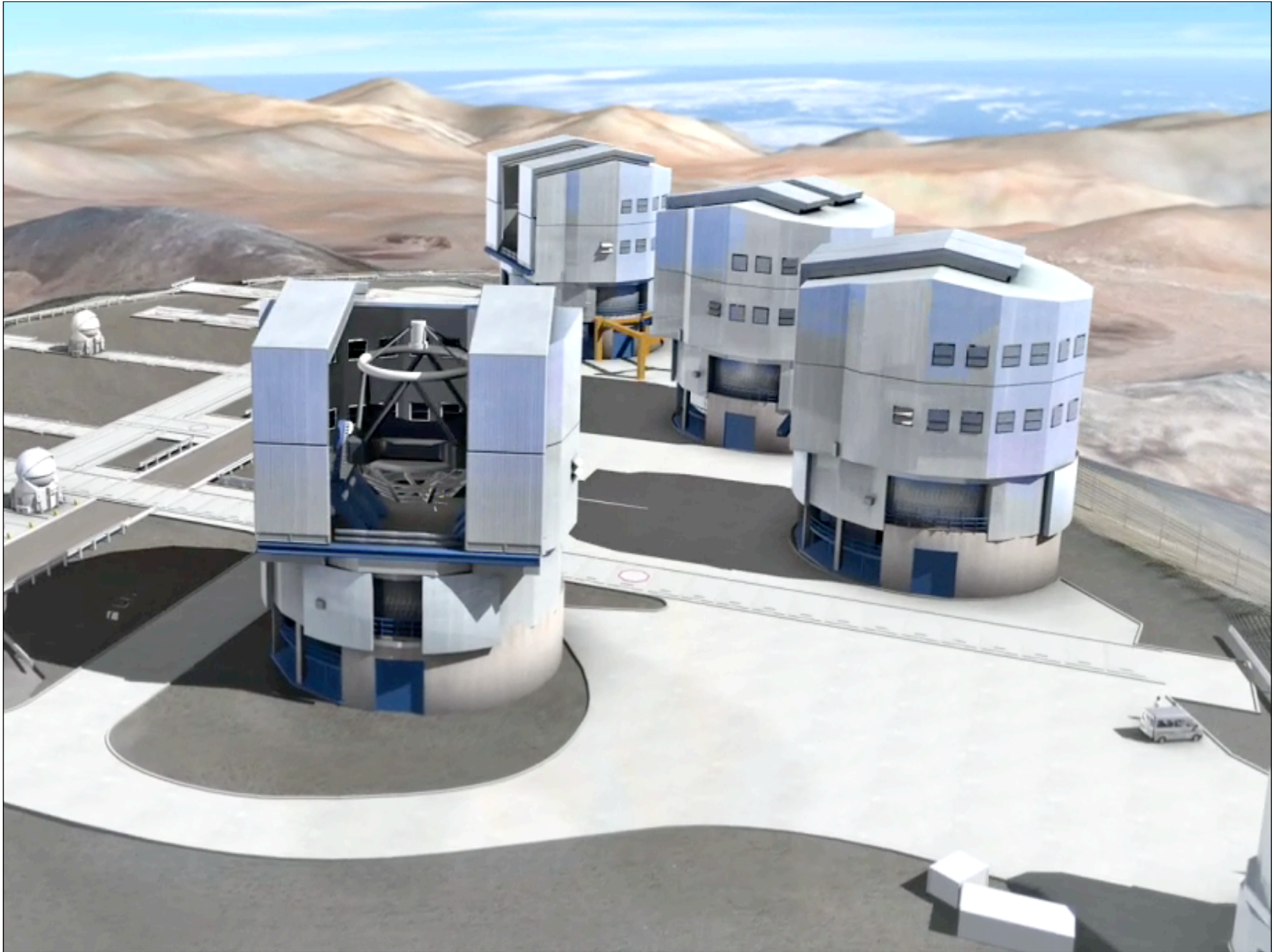
archive.eso.org

Putting everything together: The Data Flow System



Courtesy of Benoît Pirene

Service + Visitor + Virtual Observatory
=
The Observatory of the future





Enjoy the 2008 Neon School!!

Photo courtesy of Yuri Beletsky