



Science Data Management

Operations for the VLT



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European Southern Observatory
Data Management and Operations, Head

European Southern Observatory



- builds and operates state-of-the-art ground-based astronomical facilities
- most productive Observatory world-wide
- inter-governmental organisation supported by 16 member states
- involvement of ~1/2 of the astronomical community world-wide

“Data” Mandate from the VLT/I Science Policy (Cou. 996)

■ Monitor the long term evolution of instruments

- instrument health
- accuracy of calibrations

■ Produce Data Products

- remove instrumental signatures
- calibrate in physical units

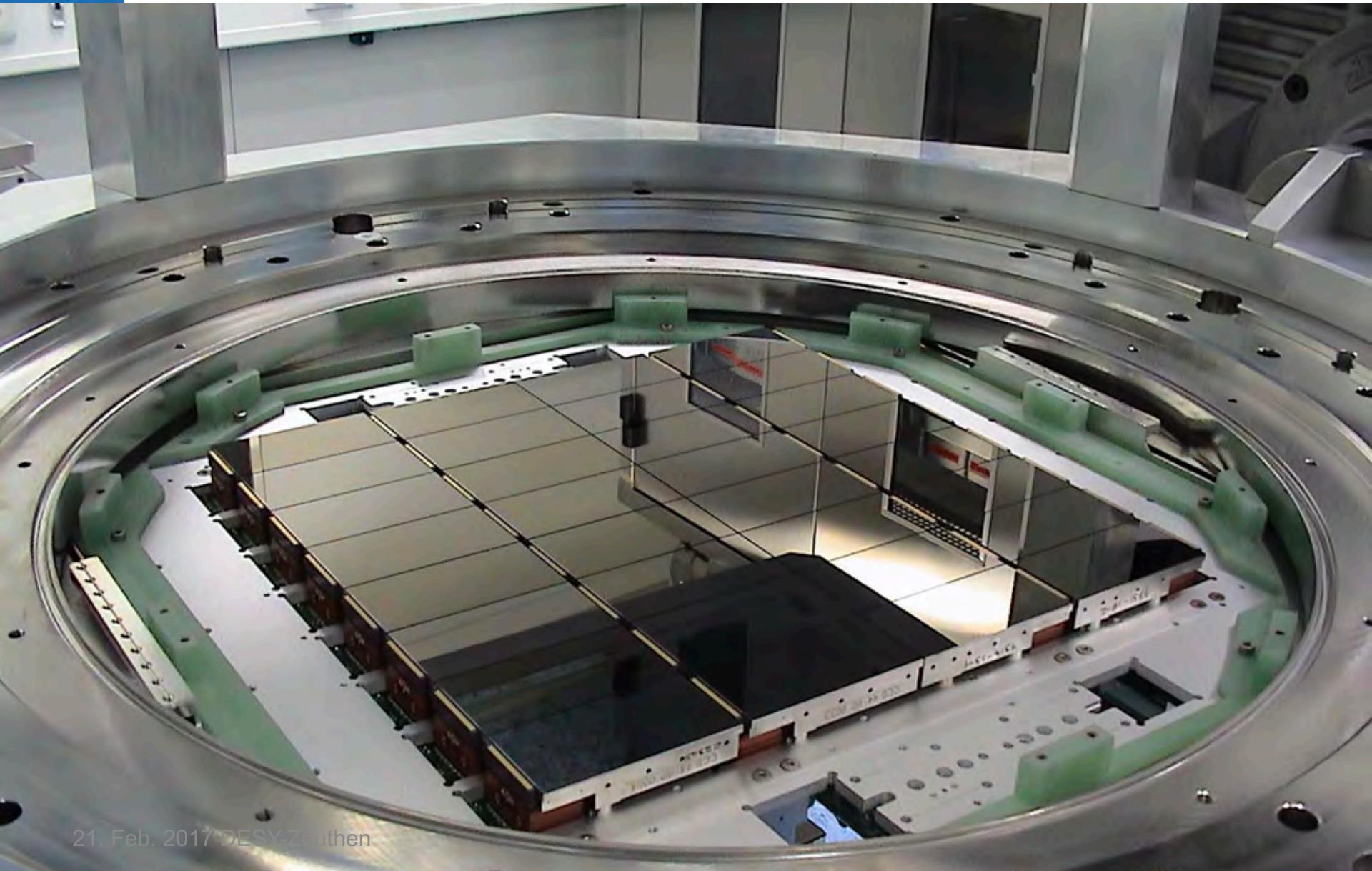
■ Deliver

- all raw, calibration and data products
- proprietary and public data through the Science Archive Facility
- pipelines and recipes (and increase their accuracy over time)

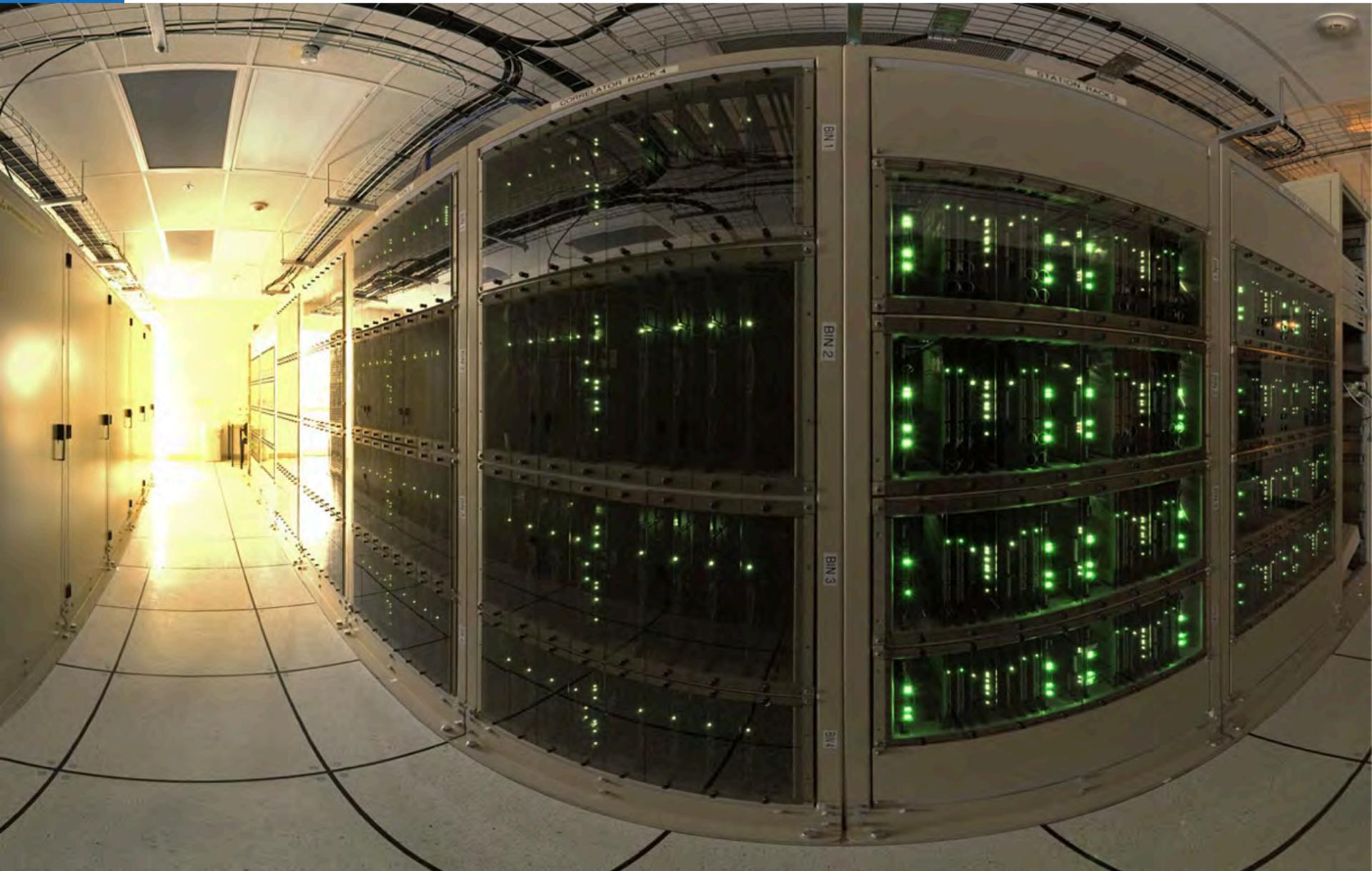
■ Support the community

- helpdesk
- in the generation of Advanced Data Products

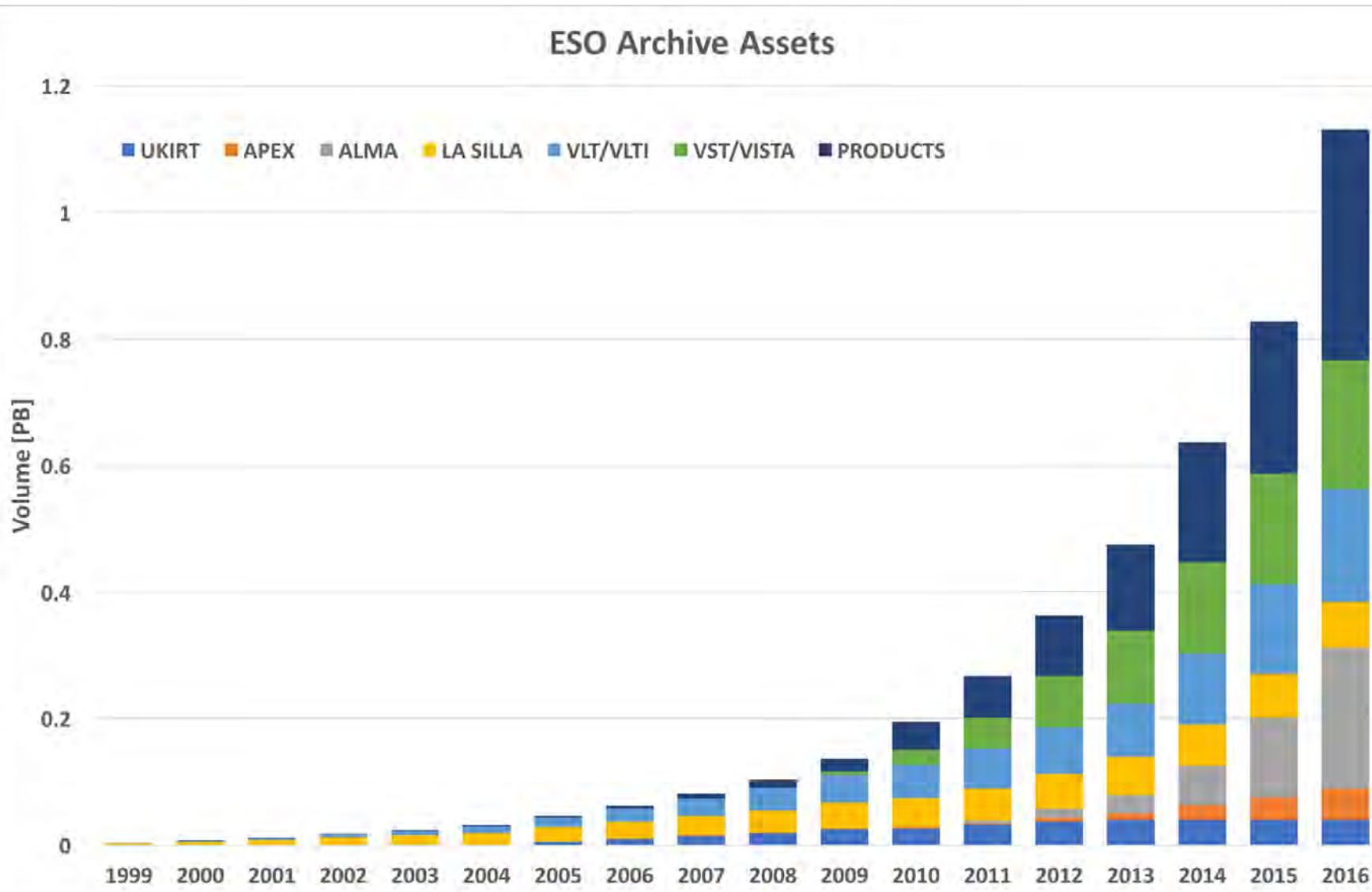
(Not a real) challenge for DM



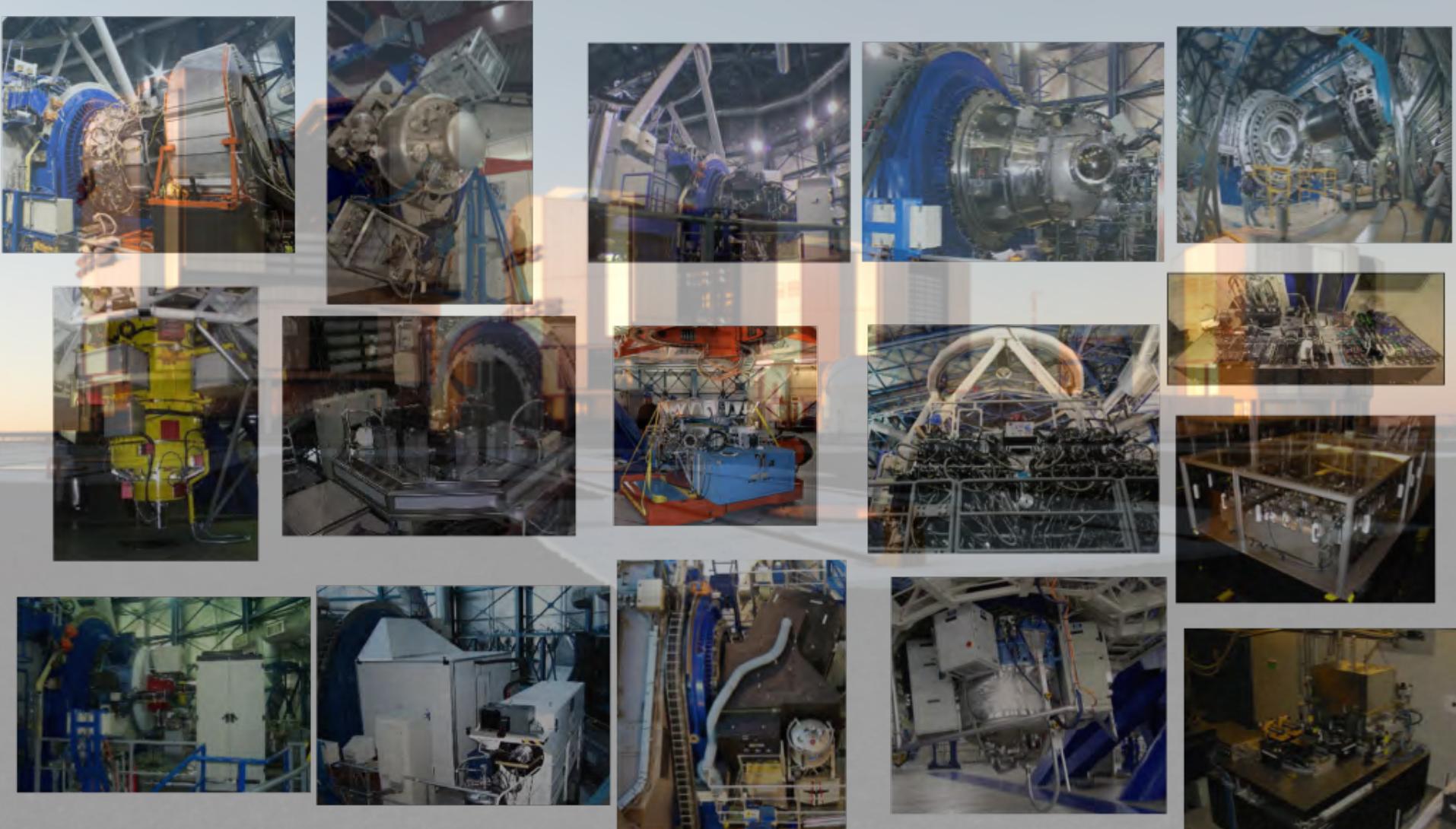
(Not a real) challenge for DM



Data Volume in the ESO Archive



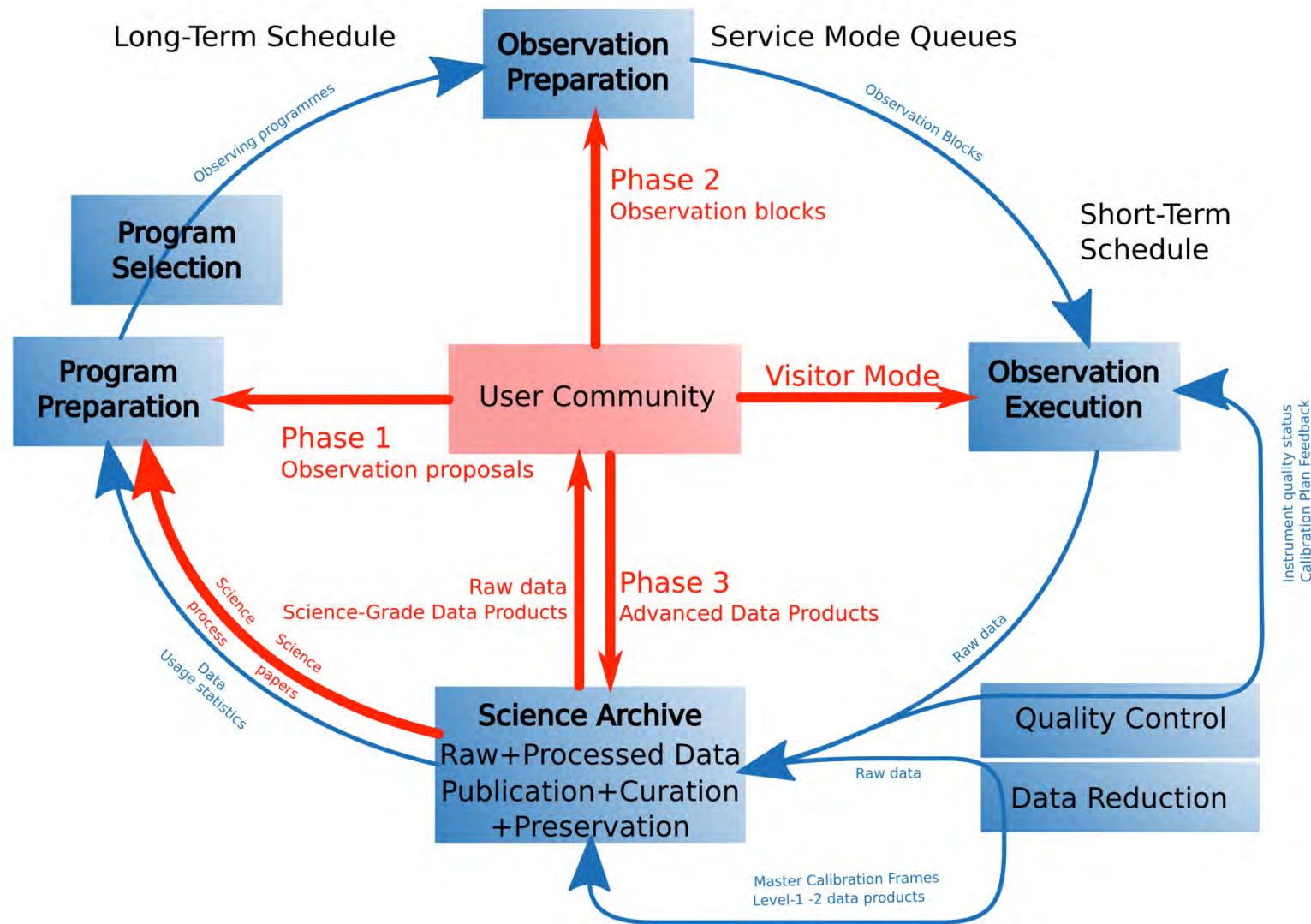
Challenges



Research cycle Astronomy

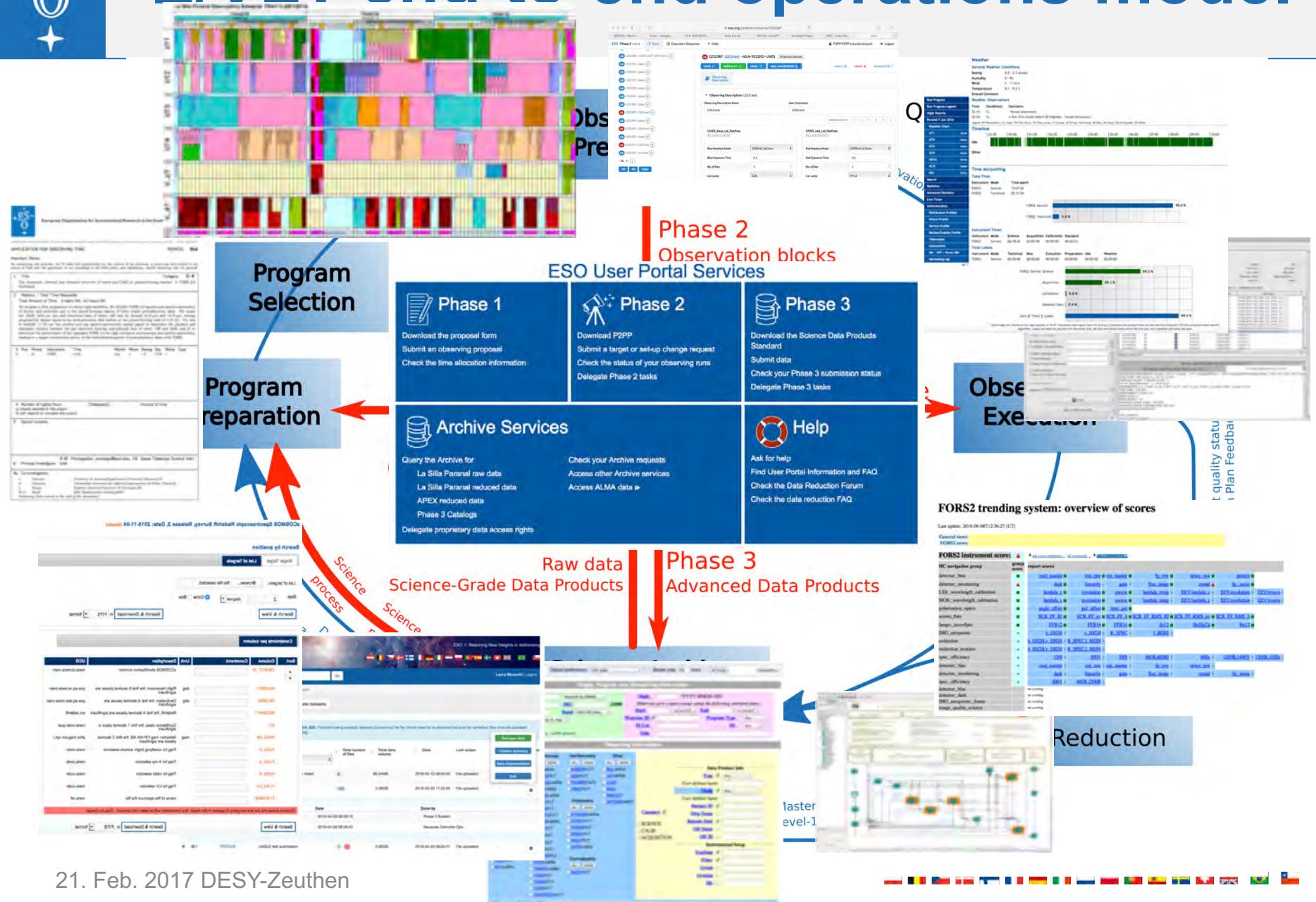


E/VLT end-to-end operations model

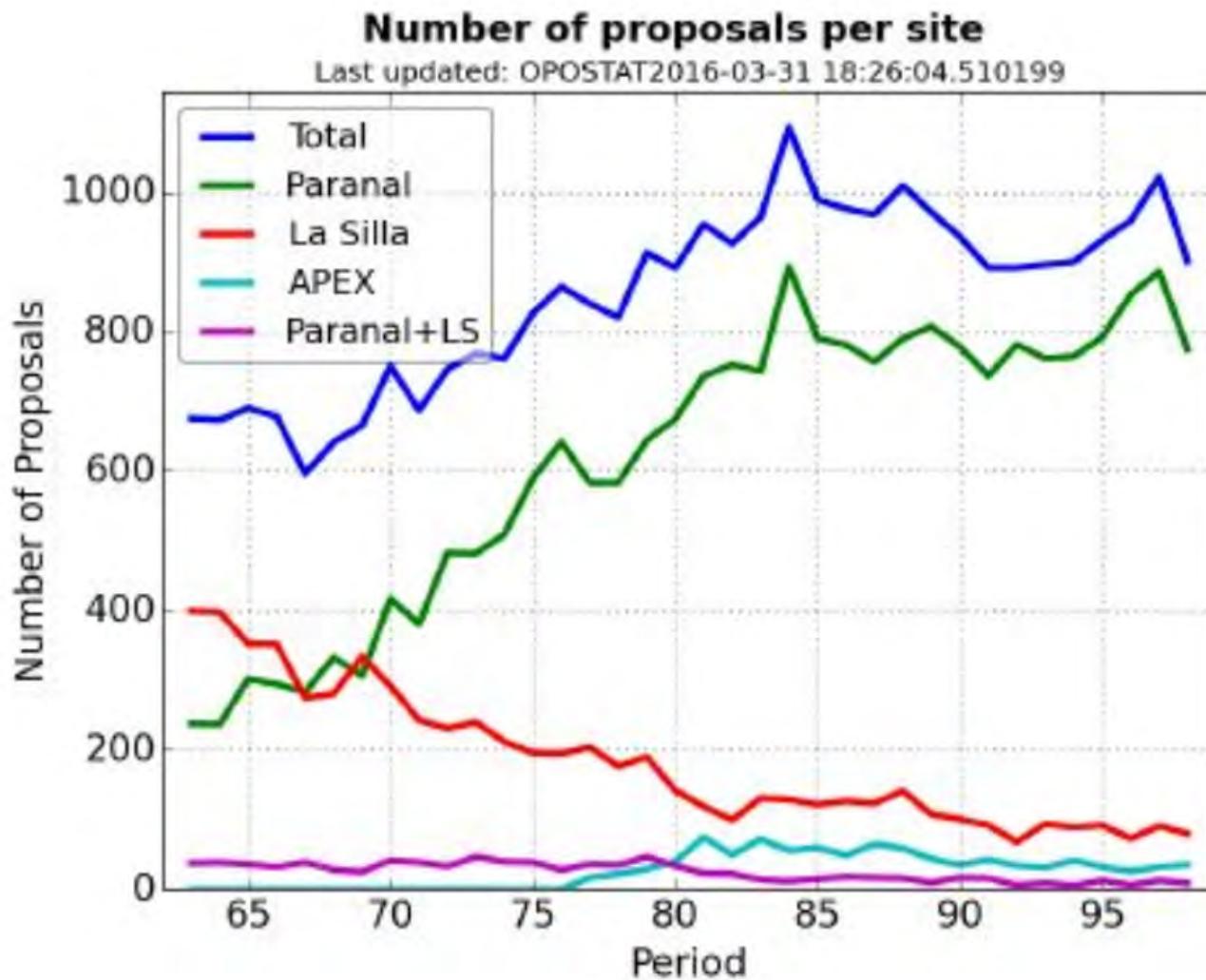




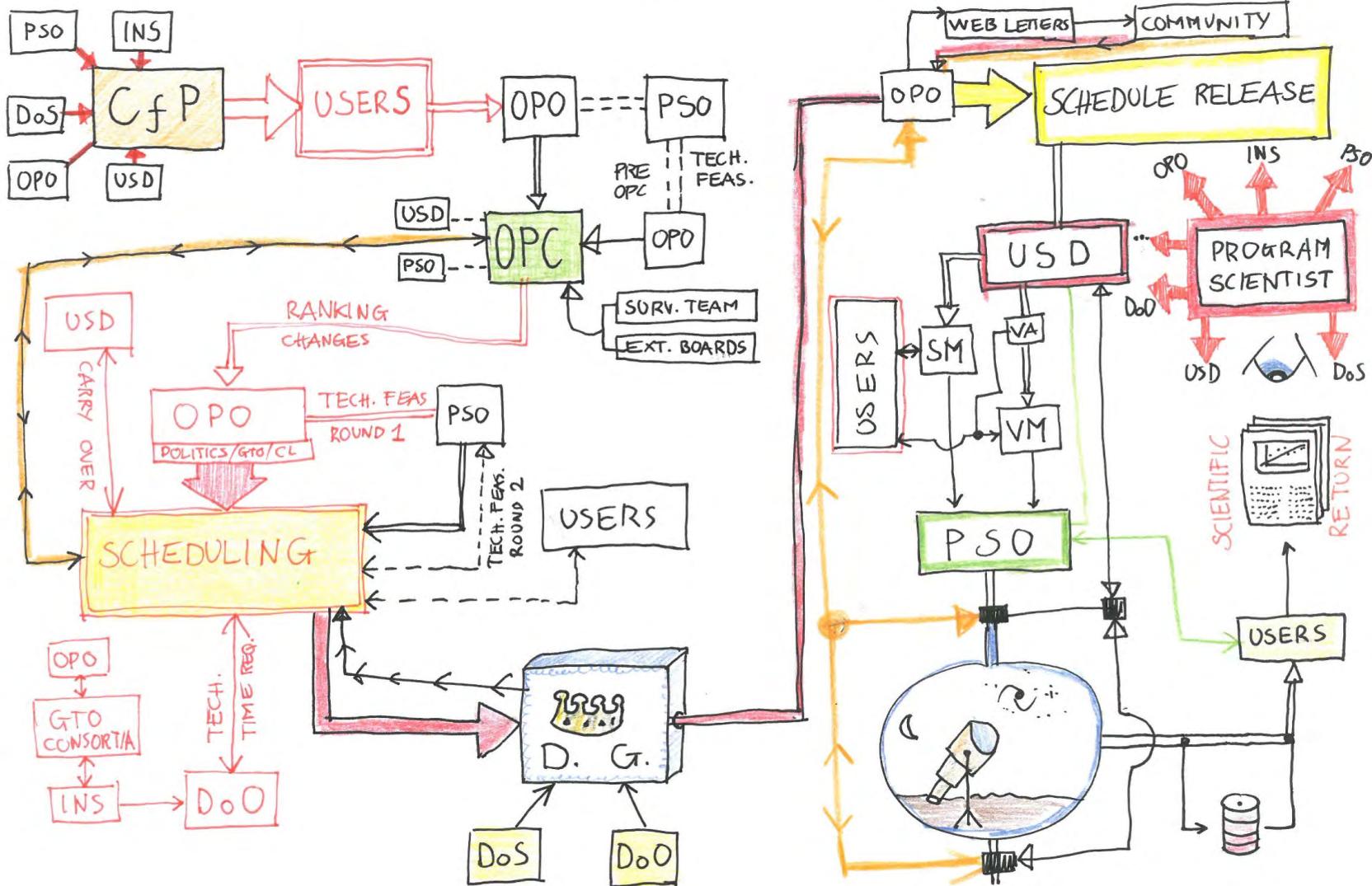
E/VLT end-to-end operations model



Challenges

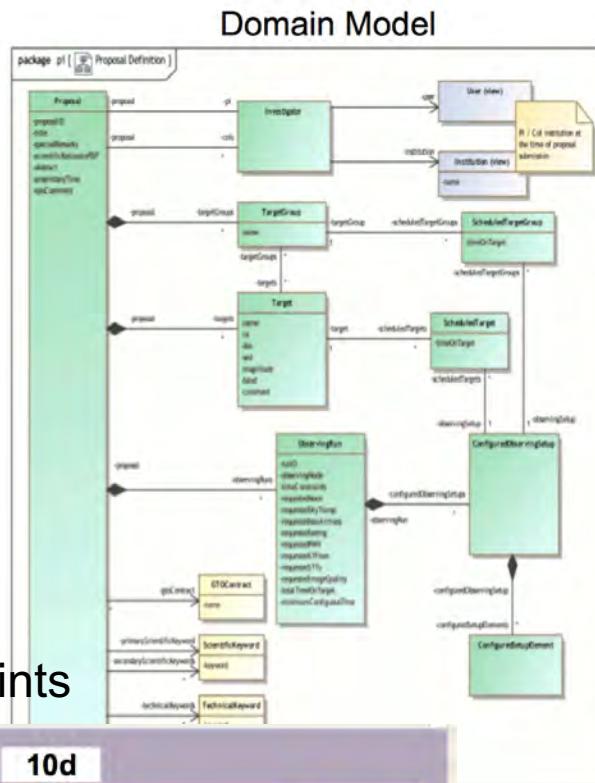


Phase 1/OPC breakdown

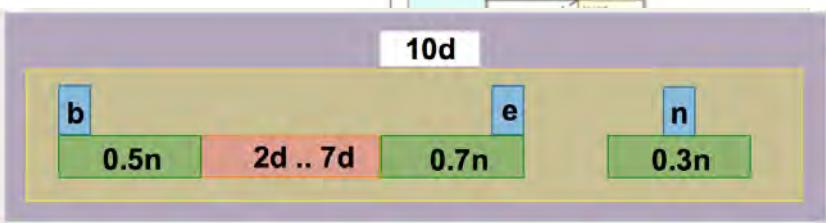


... and formalization

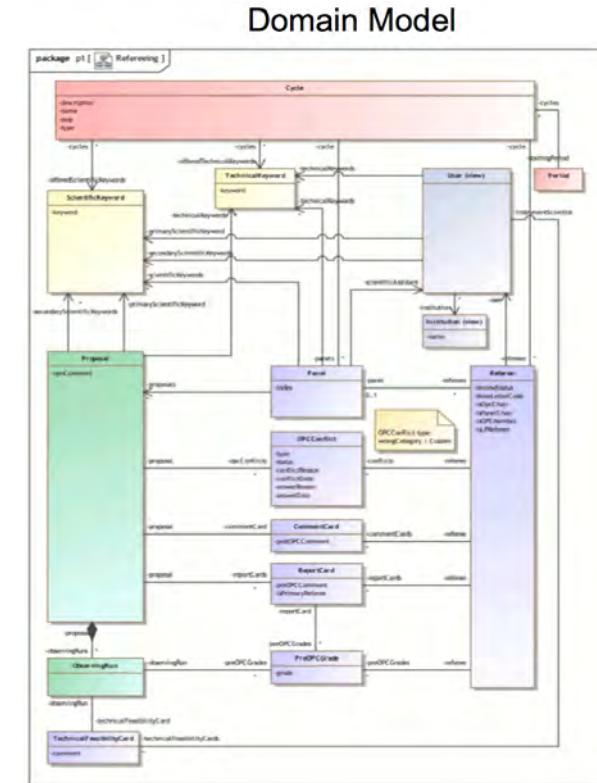
Proposal definition



Eg (time) constraints



OPC (TAC) process



Towards WEB apps (I)

Offered Programmes of cycle 85A

Offered Programmes	Maximum Proprietary Time
DDT	0 months
GTO	0 months
GTOLARGE	
LARGE	0 months
NORMAL	6 months

GTO Contracts for programme type NORMAL

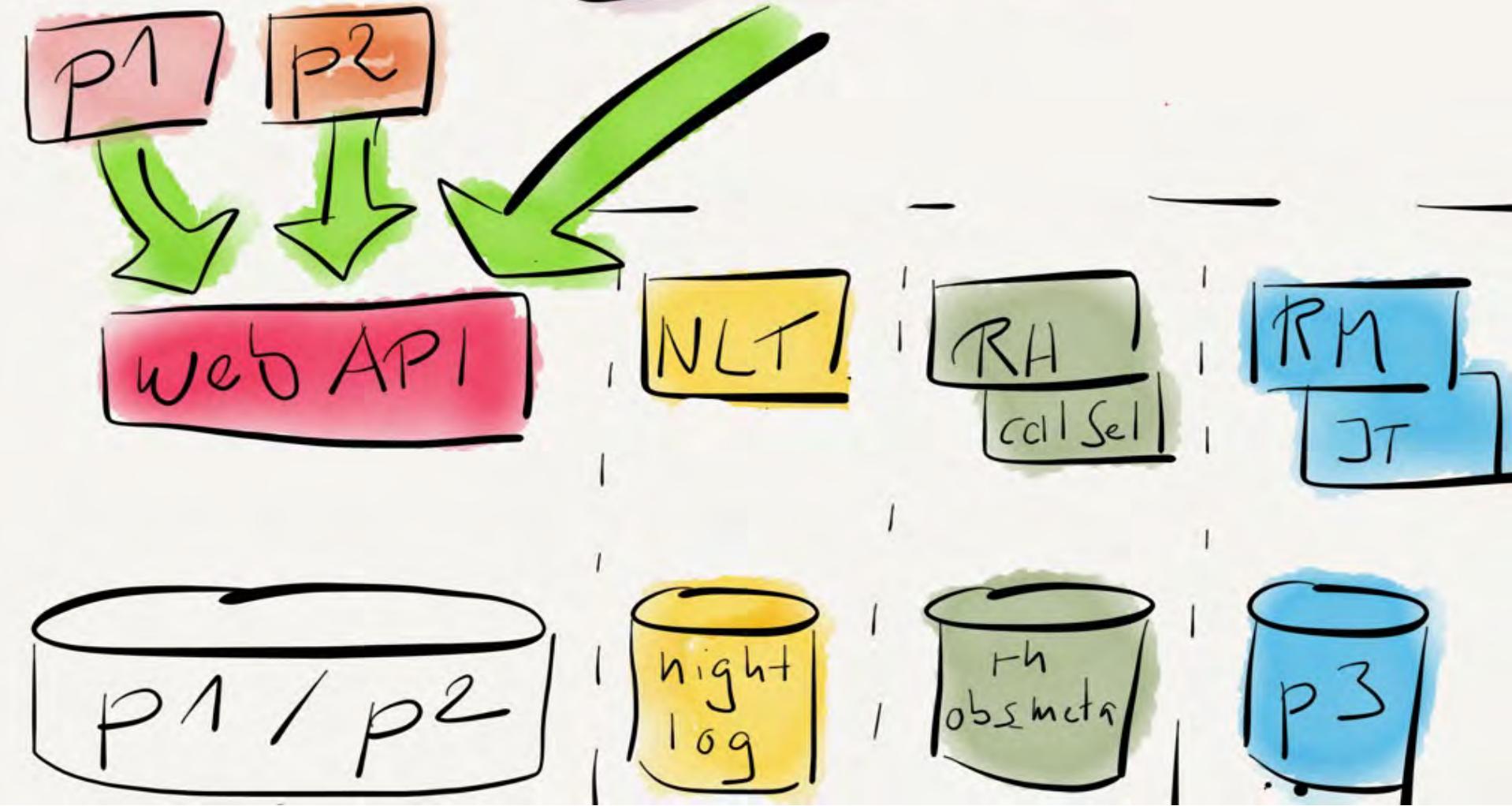
Available	Assigned
AMBER-consortium	
ARTEMIS-consortium	
CAMCAO-Lisbon	
FINITO-Torino	
HARPS-consortium	
HARPS-upg-Geneva	
HARPS-upg-Geneva2	
HARPS-upg-Uppsala	

Observing Setups of NORMAL Programme in Cycle 85A

Instrument	Instrument Mode	Tel. Setup	Obs. Mode	Run Types	Setup Elements
FORS2	IMAGING	UT1	VM	NORMAL	<input checked="" type="checkbox"/> Filter
EFOSC	IMAGING	UT	VM	TOO, NORMAL	Filter: K, J GRISM: GRISM4, GRISM1, GRISM3
FLAMES-GIRAFFE	MEDUSA	UT2	SM	NORMAL	Setup: HR14 6515 B Readout: 255kHz,1x1,low
FLAMES-UVES	UVES	UT2	SM	LARGE	Readout: 255kHz,1x1,low Setup: Red580+SimCal

Astro
Community

Programmatic Access





Towards WEB apps (II)

www.eso.org/UserPortal/authenticatedArea/welcome2.eso

projects.knmi.nl/atcom/o... Puyehue-Cordón Caulle -... ESO – Employee Leave Ti... https://www.staff.science.... www.solar.lfa.hawaii.edu/... ESO User Portal

European Southern Observatory

ESO — Reaching New Heights in Astronomy

ESO Home Science Contact

Science Users Information > ESO User Portal > Home Page Michael Slezak | Logout

ESO User Portal Services

 **Phase 1**

Download the proposal form
Submit an observing proposal
Check the time allocation information

 **Phase 2**

Download P2PP
Submit a target or set-up change request
Check the status of your observing runs
Delegate Phase 2 tasks

 **Phase 3**

Download the Science Data Products Standard
Submit data
Check your Phase 3 submission status
Delegate Phase 3 tasks

 **Archive Services**

Query the Archive for
La Silla Paranal raw data
La Silla Paranal reduced data
APEX reduced data
Phase 3 Catalogs
Delegate proprietary data access rights

Check your Archive requests
Access other Archive services
Access ALMA data ↗

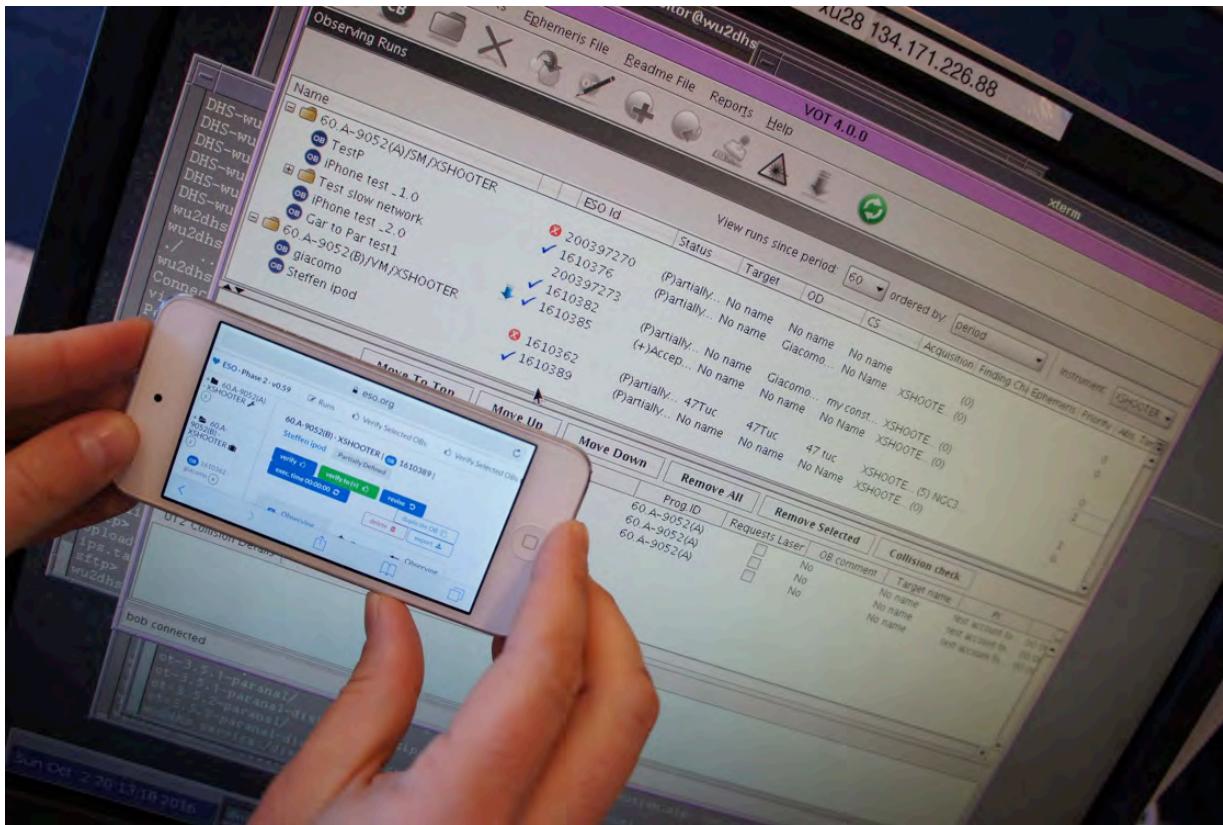
 **Help**

Ask for help
Find User Portal Information and FAQ
Check the Data Reduction Forum
Check the data reduction FAQ

Towards WEB apps (III)

■ NEW Phase 2 Preparation Solution:

- dynamic WEB application, based on Angular 2
- API, zero-install, realtime, bi-directional DB handling





Formal interface to consortia...

 European Southern Observatory

Phase 2 Programmatic Web Interface
ESO — Reaching New Heights in Astronomy

User: 52052 Password: D52052 Login 



Proposal Show/Hide | List Operations | Expand Operations

GET /proposals find proposals by username

ObservingRun Show/Hide | List Operations | Expand Operations

GET /proposals/{proposalId}/obsRuns find observing runs by proposal

OB Show/Hide | List Operations | Expand Operations

GET /proposals/{proposalId}/obsRuns/{runId}/obsBlocks Get all OBs of an observing run

POST /proposals/{proposalId}/obsRuns/{runId}/obsBlocks create new OB

GET /proposals/{proposalId}/obsRuns/{runId}/obsBlocks/{obId} get existing OB

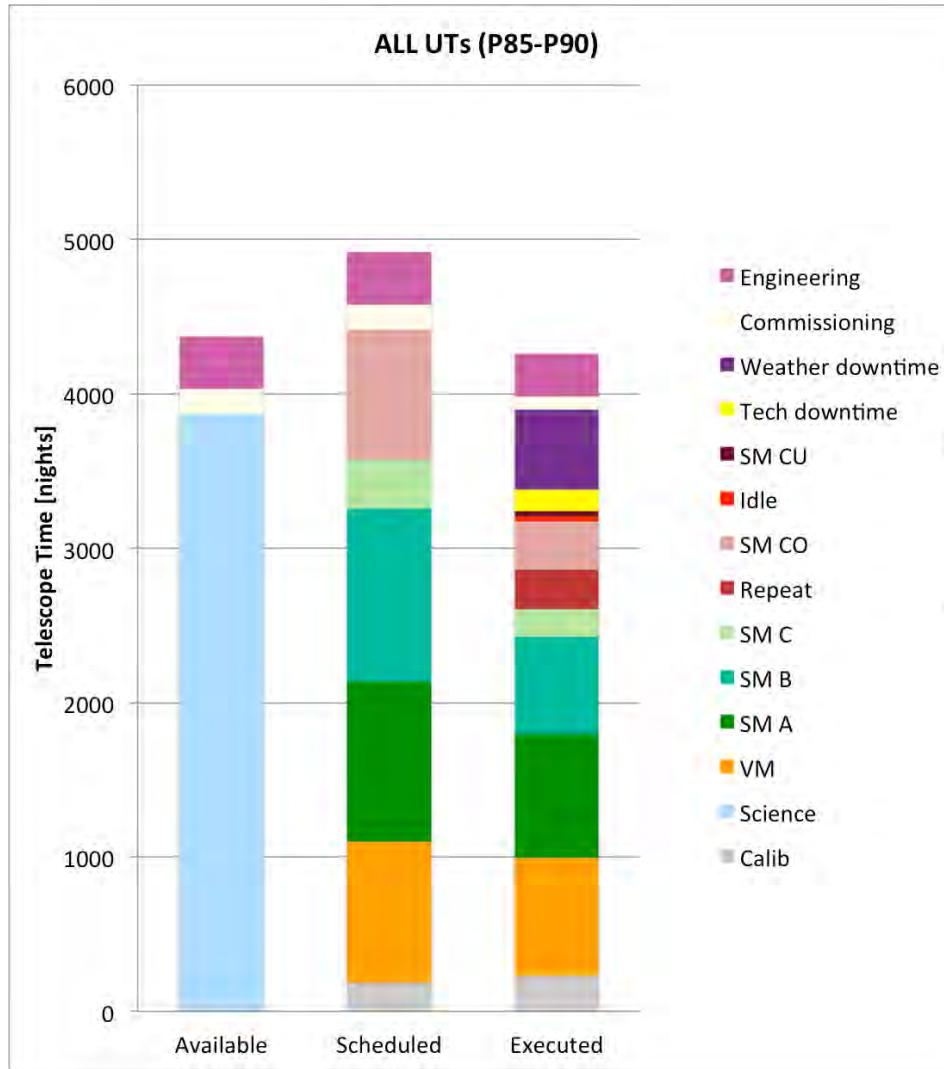
PUT /proposals/{proposalId}/obsRuns/{runId}/obsBlocks/{obId} update existing OB

Towards understanding operation metrics (I)

P97

Towards understanding operation metrics (II)

Available ... Scheduled ... Executed: Telescope Time



Projectable Losses
Weather (10%)
Technical (3%)

Problems
Carry-under (<1%)
Idle (1%)
Carry-Over (20%)
Repeat (5-10%)

Production of Science Data

■ In-house generation of Data Products (IDPs)

- enabled through standardized acquisition and quality control
 - near-real time quality control process ensures certified master calibrations
- un-attended processing w/ certified pipelines, process is QC'Id
- goal: science grade data for all popular instrument modes (“Level 1”)
 - UVES, XSHOOTER, HARPS, FLAMES/GIRAFFE, MUSE, HAWK-I, FEROS
 - imminent: VIMOS (IMG), PIONIER, KMOS, FORS2

■ External Data Products (EDPs)

- provided by public surveys and large programs (deliverables)
- programs selected by their high legacy value
- most use dedicated (non-ESO) user-pipes (eg CASU)
- goal: advanced products (wide, deep, merged catalogs, “Level 2/3”)
- perspective: users *at large* contribute EDPs
 - quality assurance: published datasets only?
 - acknowledgement: DOIs?

Science Data Process (Phase 3)

■ ESO Phase 3 process enables

- preparation, submission, validation and archiving of science products for storage in the ESO archive and subsequent publication to the community

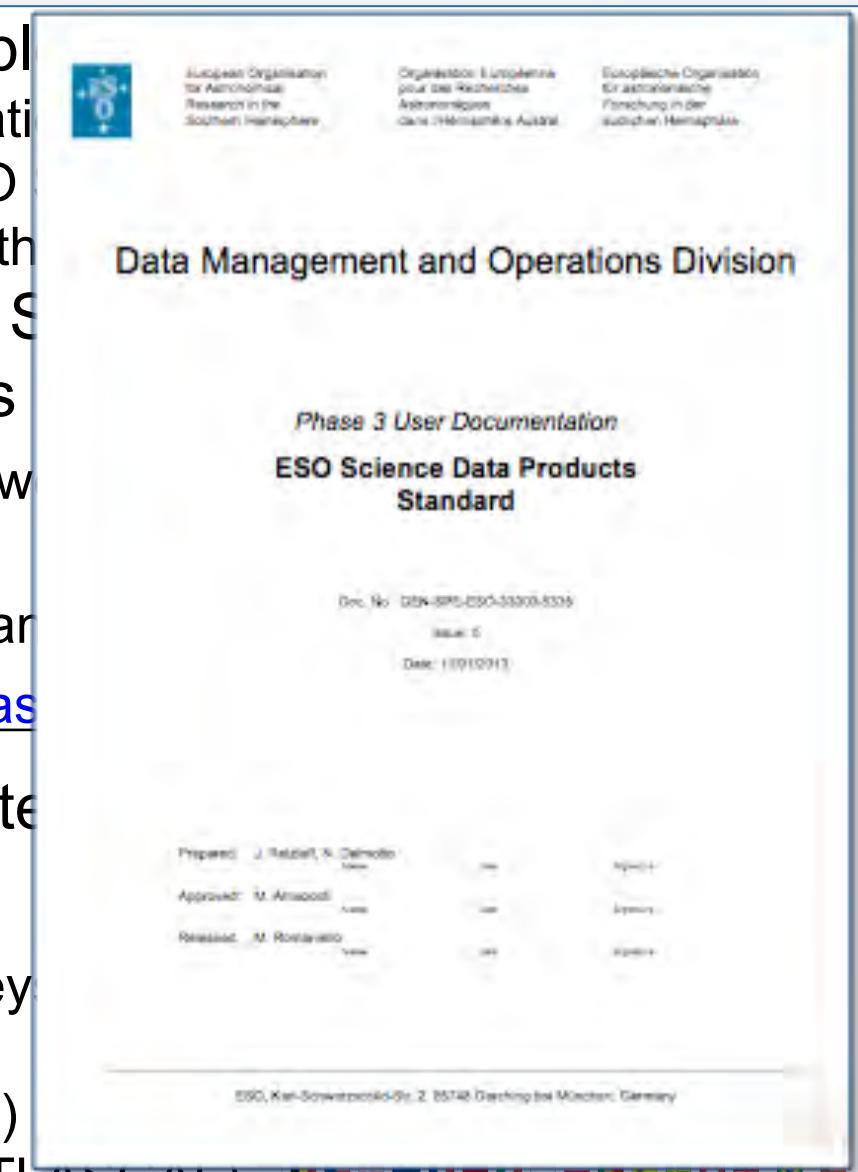
■ ESO Science Data Product Standard defines the coherence of EDPs and IDPs

- defines format, meta-data, keywords and processing provenance
- generally derived from “VO” standards
- www.eso.org/sci/observing/phase3

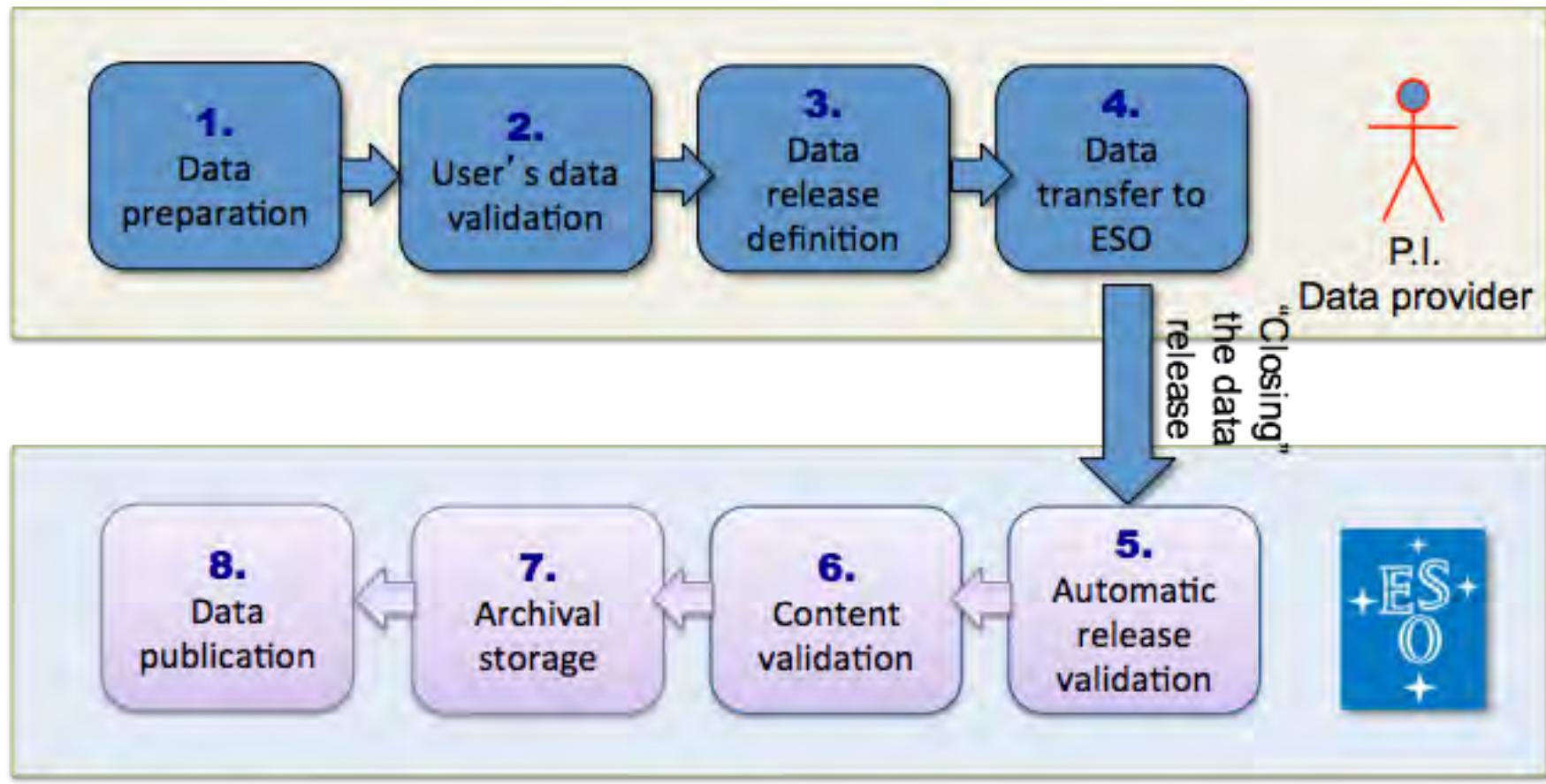
■ added-value through validation

■ ESO SDPS innovations

- multi-epoch photometry (survey mode)
- processing provenance
- 3D/IFU cubes (KMOS, MUSE!)
- sub-mm/radio maps (APEX/ATLASGAL)



EDP Process (II)



ESO defines the required data format, provides dedicated tools, user documentation and direct support for Phase 3 data providers.

The data provider i.e. survey P.I. is responsible for the quality of the reduced data products and the associated data release documentation.

ESO Data Portal

archive.eso.org

Category	Query Forms	Data collection	Data Type	Instruments
LPO Raw Data	Raw data query form (all instruments) Instrument specific query forms Direct retrieval of raw data by file name	All ESO raw data	Various	Many La Silla Paranal instruments
LPO Data Products	Phase 3 main query form Phase 3 Imaging query form Phase 3 spectral query form Phase 3 VIRCAM-specific query form	Phase 3 Data Products (ESO public surveys, large programs, pipeline products, etc.)	Currently, Imaging and Spectroscopy	Currently, VISTA/VIRCAM, VST/OmegaCAM, UVES pipeline products, zCOSMOS (VIMOS, S.Lilly), GOODS (FORS2, C.Cesarsky), HARPS, etc.
	Catalogue Facility query Interface	Phase 3 Catalogues [ESO User Portal authentication required also when browsing]	Catalogues	Currently, VISTA/VIRCAM, FEROS
	Advanced Data Products query form	GOODS (C.Cesarsky)	Imaging, Spectroscopy	ISAAC/VIMOS
		Observation of Corot astroseismologically-selected HD stars (E.Poretti)	Spectroscopy (time series)	FEROS
		Time-domain survey of NGC 2547 (S.Aigrain)	Imaging	WFI
	FEROS and HARPS-Polarimetry pipeline processed data query form	FEROS and HARPS-Polarimetry pipeline processed data	Spectroscopy	FEROS, HARPS-Polarimetry (other HARPS see Phase3 above)
APEX Quick Look Products	Science Verification, Commissioning, EIS, etc.	Full list of available data packages	Various	Many
	APEX query form	APEX	Heterodyne, Bolometer	APEX-2A, LABOCA, SABOCA, SHeFI
LPO Schedule	Scheduling query form	ESO Observing Programme Information and Scheduling		All La Silla Paranal instruments, including APEX
ALMA Data	ALMA Science Archive	All ALMA data	Cube	ALMA



To request a single dataset press the **Request marked datasets** button next to the chosen dataset.

(*You will be prompted for your ESO User Portal username and password. If you do not yet have an ESO User Portal account, please*

Datasets for which the proprietary period is over are highlighted in **green** and are publicly available.

Datasets that are still under the proprietary period are highlighted in **red** and can only be downloaded by the corresponding PI.

Datasets that are not yet available in the Archive are marked with a "N/A".

		Request marked datasets	Reset		MarkAll	MarkPublic	MarkProprietary	
M	More	HDR	OBJECT	Target Ra, Dec	Program ID	Instrument	Category	Type
<input checked="" type="checkbox"/>		Header	OBJECT	18:01:39.00 -26:50:16.5	093.D-0179(A)	CRIRES	ACQUISITION	OBJECT
<input checked="" type="checkbox"/>		Header	TER9S9247S9354	18:01:38.70 -26:50:19.5	093.D-0179(A)	CRIRES	SCIENCE	OBJECT
<input checked="" type="checkbox"/>		Header	TER9S9247S9354	18:01:39.28 -26:50:13.7	093.D-0179(A)	CRIRES	SCIENCE	OBJECT
<input checked="" type="checkbox"/>		Header	TER9S9247S9354	18:01:38.67 -26:50:19.8	093.D-0179(A)	CRIRES	SCIENCE	OBJECT
<input checked="" type="checkbox"/>		Header	TER9S9247S9354	18:01:39.25 -26:50:13.9	093.D-0179(A)	CRIRES	SCIENCE	OBJECT
<input checked="" type="checkbox"/>		Header	OBJECT	18:16:49.89 -16:31:09.4	093.D-0179(A)	CRIRES	ACQUISITION	OBJECT

NEW ESO Archive Services: project outline

■ Interactive access

- Query, display, interact, preview, retrieve

■ Programmatic interface

- incl. ADQL, TAP, ObsTAP/ObsCore, DataLink, AccessData...

■ Operational access

- Custom queries, full access

■ Underlying Infrastructure:

- Data storage, optimized for fast retrieval
- Databases, SQL and/or nonSQL (Solr/ElasticSearch etc)
- Full integration into Data Flow System

Linking Data and Publications

telbib.eso.org



ESO Telescope Bibliography

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Year: 2015

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REFINE SEARCH

Journal

MNRAS (43)

A&A (40)

ApJ (20)

Icar (4)

AJ (1)

[more...](#)

Instrument

UVES (20)

ALMA_Bands (14)

XSHOOTER (10)

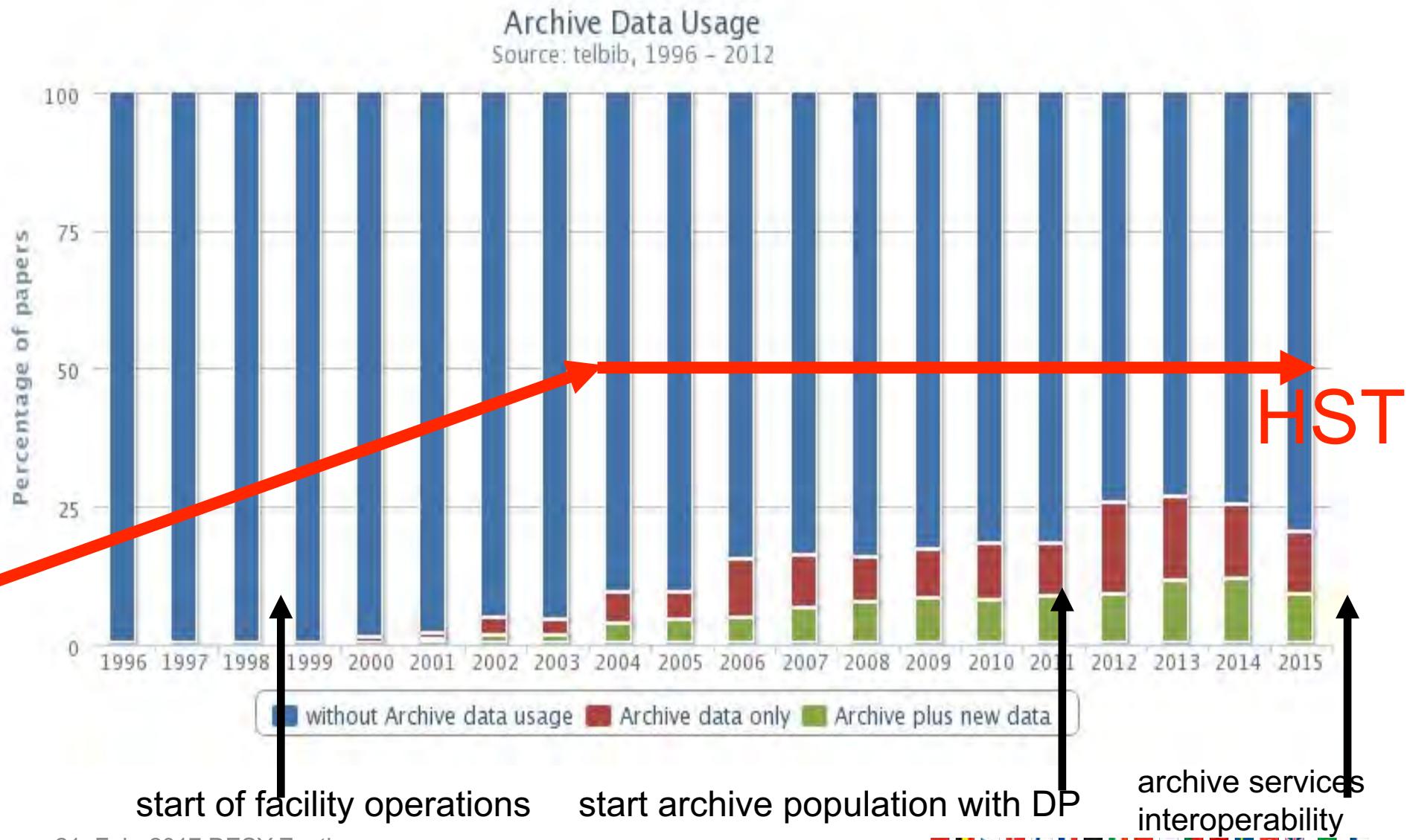
FLAMES (8)

SOFI (8)

[more...](#)

YEAR	AUTHOR	TITLE	INSTRUMENTS	ACCESS TO DATA	FULLTEXT ADS
2015	Taddia, F. et al.	Early-time light curves of Type Ib/c supernovae from the SDSS-II Supernova Survey	EMMI	077.A-0437, 078.A-0325, 079.A-0715	E2015A&A...574A..60T
2015	van der Plas, G. et al.	The structure of disks around Herbig Ae/Be stars as traced by CO ro-vibrational emission	CRIRES	079.C-0349, 081.C-0833	E2015A&A...574A..75V
2015	Kochukhov, O. et al.	Magnetic field topology and chemical spot distributions in the extreme Ap star HD 75049	FORS1, HARPS, UVES	078.D-0192, 080.D-0170, 084.D-0338, 085.D-0296, 086.D-0240, 088.D-0066, 090.D-0256	E2015A&A...574A..79K
2015	Valenti, E. et al.	High-resolution CRIRES spectra of Terzan 1: a metal-poor globular cluster toward the inner bulge	CRIRES	093.D-0179	E2015A&A...574A..80V
2015	Perna, M. et al.	Galaxy-wide outflows in $z \sim 1.5$ luminous obscured quasars revealed through near-IR slit-spectral spectroscopy	XSHOOTER	090.A-0830	E2015A&A...574A..82P

Science Return (I): Science Archive as a Resource



... and costs?

(fraction of total operation costs)

■ data archive operations

- archive infrastructure TCO (1PB, 3 safe copies) 0.3-1%
- content management (production, curation) ~10%

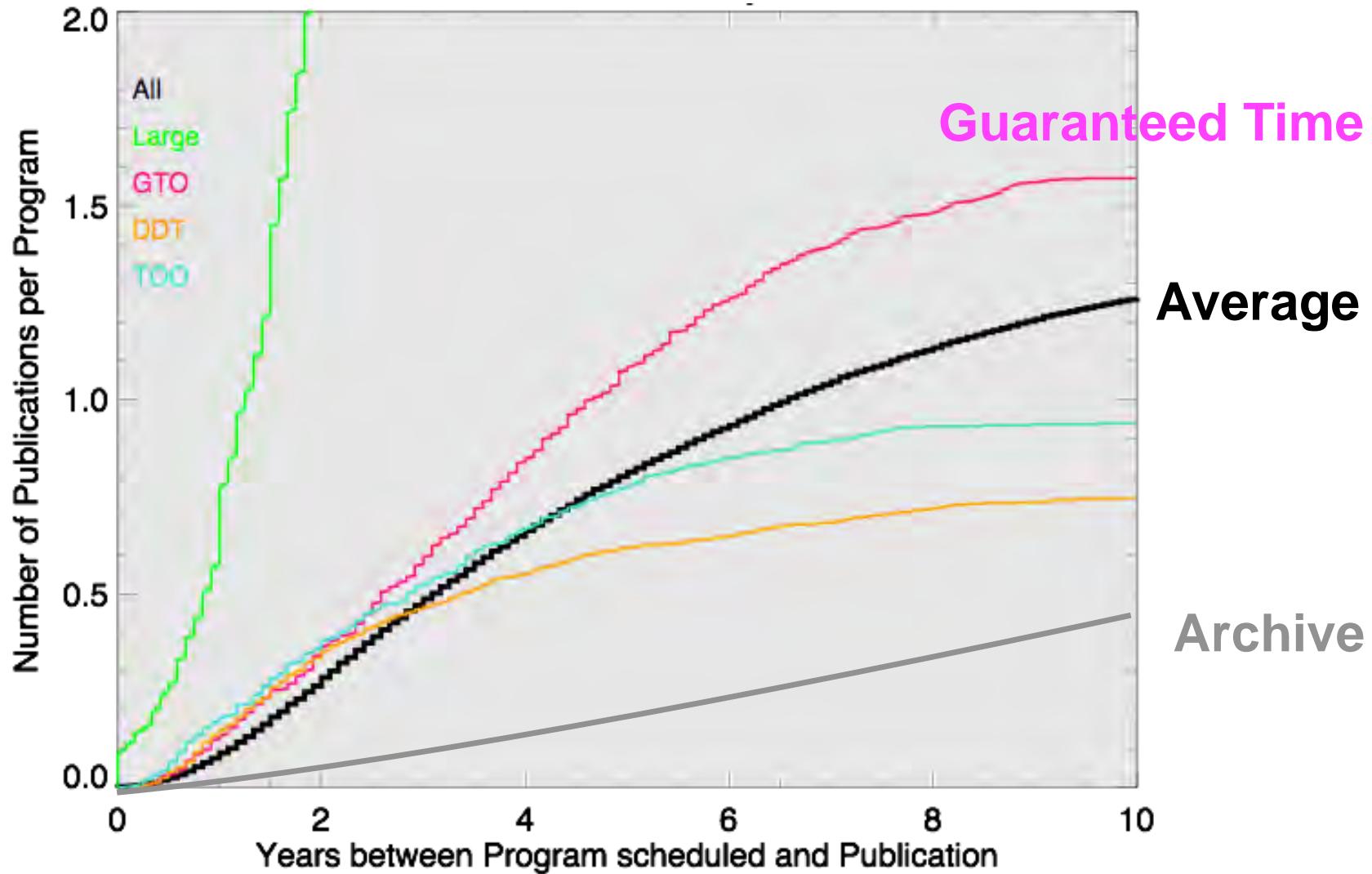
■ “systemic” data generation

- facility (VLT) time for calibrations ~ 4%

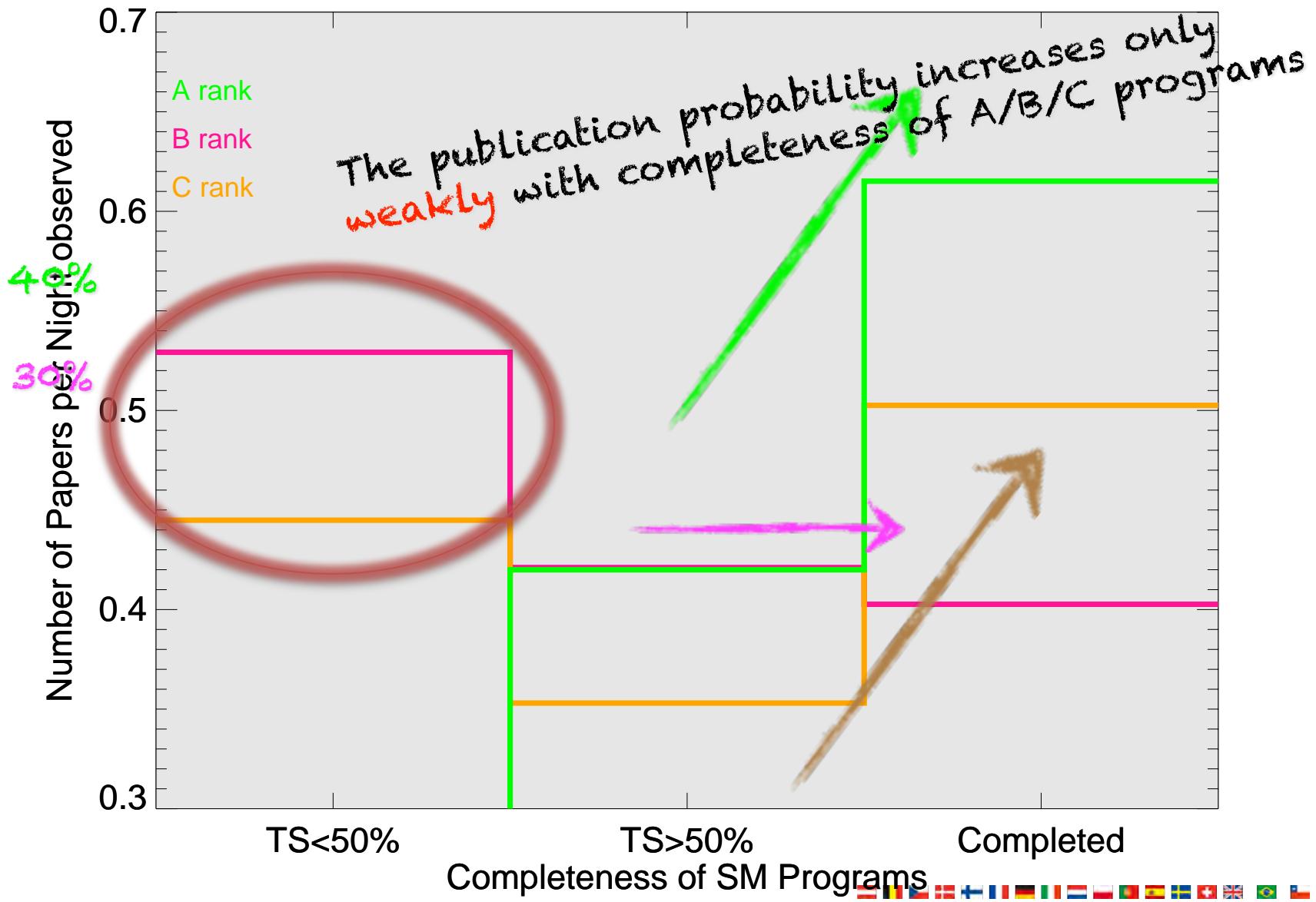
■ cost-benefit relation

- close monitoring
 - operational metrics
 - bibliometrics
- effective use of resources (observing time, FTE and \$)

Science Return (II): Intra-facility bibliometrics

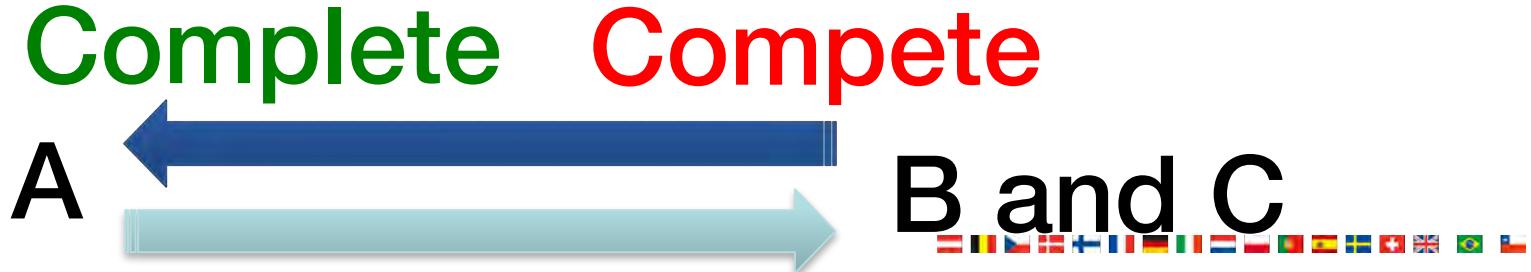


Science Return (III): programme implementation



Science Return (IV): programme implementation

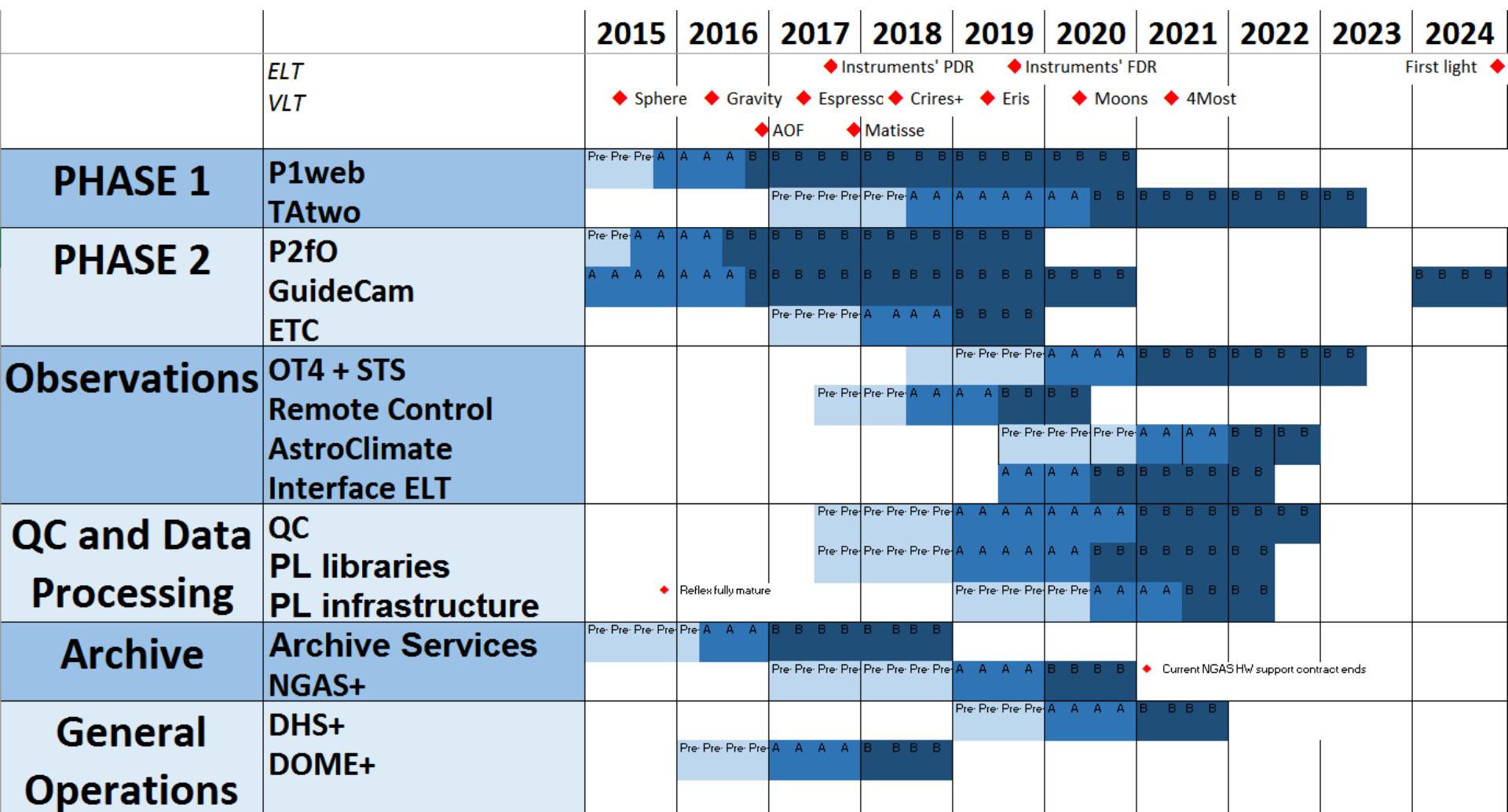
- visitor programs have highest impact (# of citations)
- cost – benefit proxy: “merit” (= average citation rate per telescope time invested allocated/observed)
 - highest merit from (long) SM/A programs
 - high merit from (short) SM programs
 - high merit from (normal) VM programs
- “completeness” has DIFFERENT impact for DIFFERENT program ranks
 - completed A rank yield highest science return (productivity/night)
 - B rank program completion does not necessarily increase return
 - even (some) “uncompleted” B and C programs yield useful return!



ELT construction at full speed



E/VLT Development Roadmap



ELT First Light: 2024



Welcome!

