

# Phase 3 for VST Public Surveys

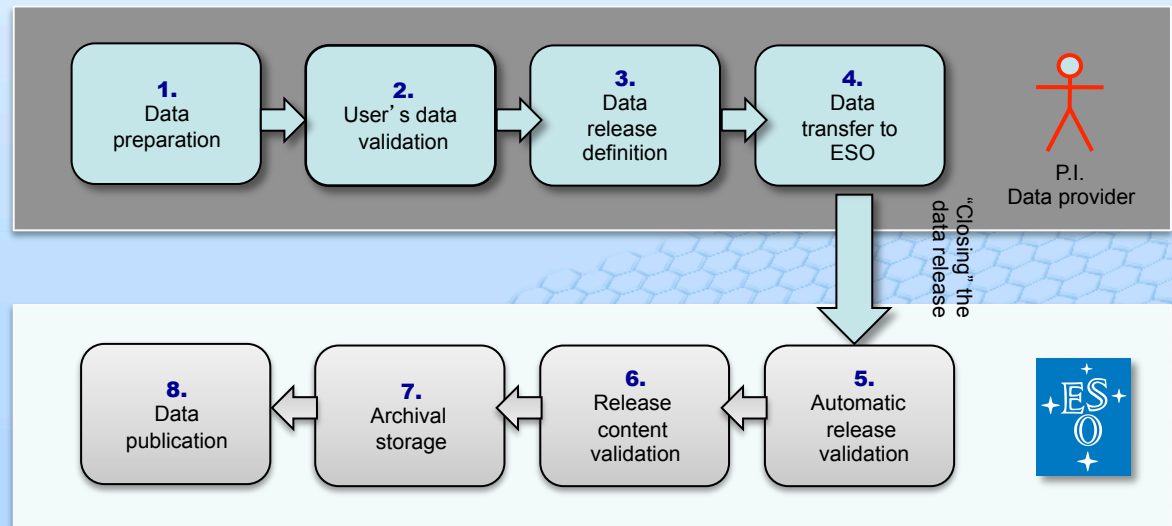
*Jörg Retzlaff*  
*ESO Archive Science Group*

Data Products from the VST/OmegaCAM pipelines, ESO Garching,  
21.03.2012

# Handling Data Products from ESO Public Surveys and Large Programmes

Phase 3 denotes the process in which principal investigators of ESO observing programmes return their reduced data products to ESO for storage in the ESO archive and subsequent data publication to the scientific community.

## Phase 3 Process and Responsibilities



<http://www.eso.org/sci/observing/phase3.html>

The new Phase 3 infrastructure – in operations since March 2011 – supports the reception, validation and publication of data products from the public survey projects and large programmes to the ESO Science Archive Facility.

# Outline

- Phase 3 policies
- Product types
- The Phase 3 process
- Web pages & user manuals
- Data collection and release
- Phase 3 user support
- Data release validation
- Monitoring the delivery of data products
- Timeline

# Policies for the delivery of data products from ESO public surveys

- The delivery to the ESO archive is the responsibility of the PI, which certifies the scientific quality and accuracy of the data products.
- Core deliveries to the ESO archive:
  - Astrometrically and photometrically calibrated, co-added, re-gridded tiles, along with their respective confidence maps, in all of the project-relevant filters;
  - source catalogues for a tile based on individual, co-added bands, as well as associated source catalogues linking the parameters of individual objects across all of the observed filter bands;
- Survey products will be delivered to the ESO archive in a format specified in the [ESO External Data Products Standard](#), which is accessible from the top-level Phase 3 web page.
- Data products must be supported and characterized by additional information, i.e. meta-data, which provides a full description for their scientific exploitation. See the ESO/EDP Standard for a description and definition of the meta-data.

# Product types

## Survey tile image:

- Simple FITS image (data array in the PHDU)
- Associated confidence/weight map
- Based on nightly calibrations
- WCS astrometry
- Photometric zero point (AB or Vega)
- Limiting magnitude, avg. PSF size, etc.
- Time of observation
- Provenance

## Source list:

- File format for the source catalogues directly extracted from the (tile) images
- pipeline-produced, based on nightly calibrations, tile-by-tile delivery
- Example: single-band source catalogue extracted from one tile
- Associated to its originating image (provenance keyword PROVi)
- FITS binary table format



## Source Lists

- ❖ Based on single-night calibrations
- ❖ Pipeline-processed
- ❖ Usually per tile
- ❖ Possibly band-merged
- ❖ Degeneracy due to multiple detections
- ❖ Mostly single-epoch (except for deep stacks)

## Survey Catalogues

- ✧ One homogeneous merged multi-band catalogue for each survey (region)
- ✧ Global Astrometry/Photometry; Cross-calibrated using overlapping tiles and across bands
- ✧ Multiple detections merged—unique entries
- ✧ Uniform tabular structure including content descriptors
- ✧ Multi-epoch photometric catalogues (light curves)

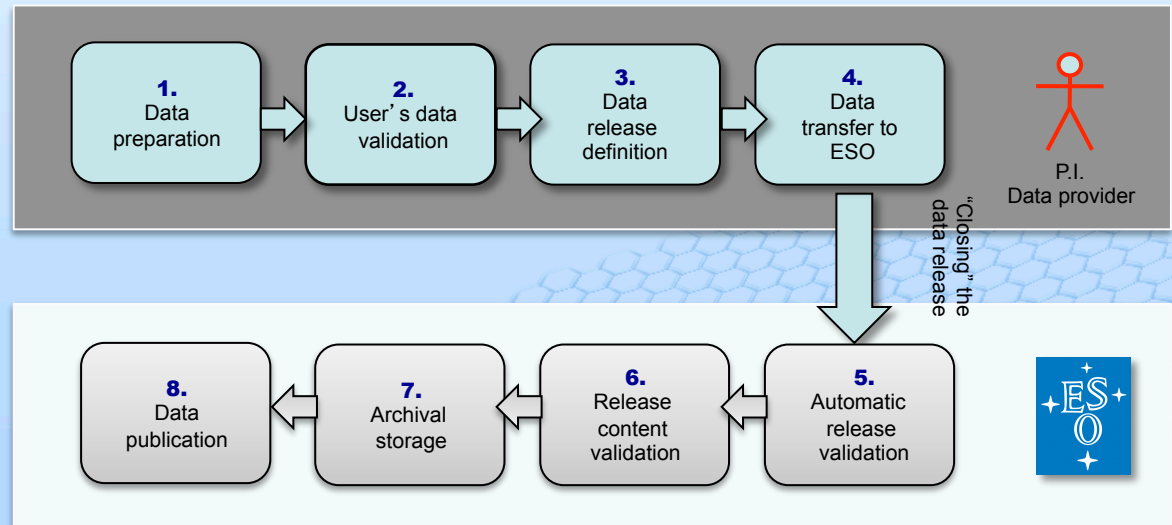
*The content and format specifically required for catalogues will be provided in the instructions for catalogue data submission.*

# The Phase 3 process

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# Phase 3 Web Pages

<http://www.eso.org/sci/observing/phase3.html>



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## Phase 3

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To ensure the successful integration of External Data Products (EDPs) into the archive, ESO supports the users in carrying out the Phase 3 process by defining ESO/EDP data standards, by devising procedures and providing the infrastructure for the delivery of EDPs, and by supplying tools for the data preparation.

The description of the policies, the data standard and the procedure for the submission of reduced data products applicable to the ESO Phase 3 process given here is intended to provide the information for the preparation and successful completion of the ESO Phase 3 process. The target audience consists of the principal investigators and their collaborators who return reduced data products resulting from ESO observations for public release to the astronomical community through the ESO archive.

### Instructions and Documentation

- [Overview of the Phase 3 process](#)
- [Phase 3 Policies for ESO Public Surveys](#)
- [ESO External Data Products standard \[PDF\]](#)
- [Phase 3 User Guide to the Data Submission \[PDF\]](#)

### Phase 3 Infrastructure and Software Tools

- [Phase 3 Release Manager](#)
- [Release Validator](#)
- [FTP upload \(phase3ftp.eso.org\)](#)

### Further Information

- [Questions & Answers](#)
- [Public Surveys Phase 3 Workshop, Garching, 30.11.2010](#)

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[usd-help@eso.org](mailto:usd-help@eso.org), subject: Phase 3

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Data Management and Operations Division

## ESO External Data Products Standard

Doc. No.: GEN-SPE-ESO-33000-5335

Issue: 2

Date: 09.03.2011

Prepared: J. Retzlaff  
Name

16.6.2011  
Date

Retzlaff  
Signature

Approved: M. Arnaboldi  
Name

16.6.2011  
Date

M. Arnaboldi  
Signature

Released: F. Comeron  
Name

16.06.2011  
Date

F. Comeron  
Signature

ESO, Karl-Schwarzschild-Str. 2, 85748 Garching bei München, Germany

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## ESO External Data Products Standard

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### 3.6.4 World coordinate system

Table 5: World coordinate system keywords

Type	Keyword	Description
(R)	CRVAL <i>i</i>	Coordinate value at reference pixel.
(R)	CRPIX <i>i</i>	Reference pixel in axis <i>i</i> .
(S)	CTYPE <i>i</i>	Pixel coordinate system.
(S)	CUNIT <i>i</i>	Specifies the unit of the coordinate transformation. For celestial coordinate systems the default unit is "degree", i.e., CUNIT1="deg" and CUNIT2="deg".
(R)	CD <i>i j</i>	Transformation matrix element.
(R)	CDEL <i>i</i>	Alternative for the CD <i>i j</i> matrix representation. Deprecated for images, but may be used for extracted, i.e. one-dimensional, spectra.
(R)	CSYER <i>i</i>	Systematic error in axis <i>i</i> (unit given by CUNIT <i>i</i> , usually degree)
(R)	CRDER <i>i</i>	Random error in axis <i>i</i> (unit given by CUNIT <i>i</i> , usually degree).

- CRDER1 and CRDER2 may be set both to 1/2 times the RMS accuracy of the astrometric registration if errors are isotropic (and similarly for CSYER*i*).

#### Example of WCS keywords for an image:

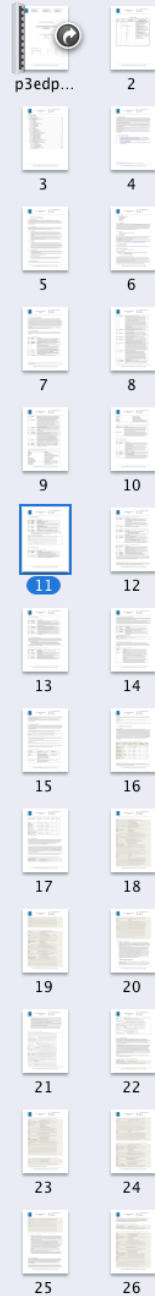
```
CRVAL1 - 53.11604 / 03:32:27.8, RA at ref pixel
CRVAL2 - -27.791 / -27:47:27.6, DEC at ref pixel
CRPIX1 - 433.780 / Ref pixel in X
CRPIX2 - 410.550 / Ref pixel in Y
CTYPE1 - 'RA---TAN' / pixel coordinate system
CTYPE2 - 'DEC--TAN' / pixel coordinate system
CD1_1 - 4.122000000000E-05 / Transformation matrix element
CD1_2 - 0. / Transformation matrix element
CD2_1 - 0. / Transformation matrix element
CD2_2 - -4.122000000000E-05 / Transformation matrix element
EQUINOX - 2000. / Standard FK5 (years)
RADECSYS- 'ICRS' / Coordinate reference frame
```

### 3.6.5 Imaging data products

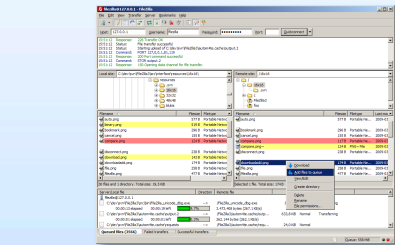
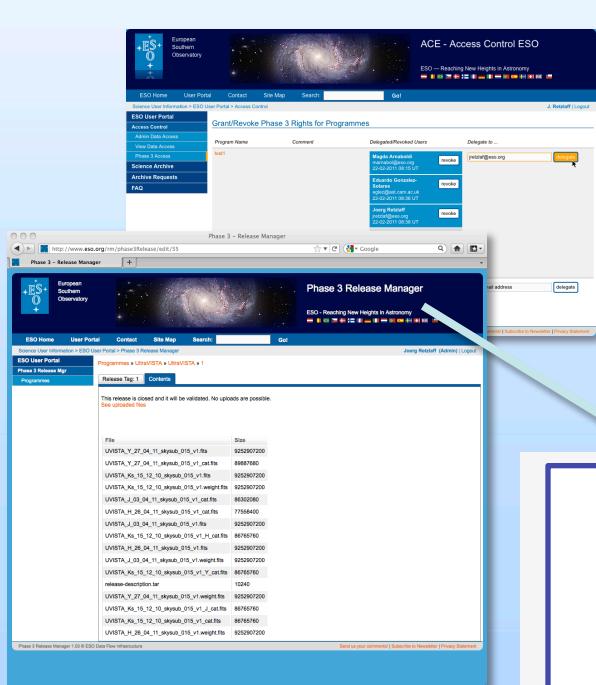
Table 6: Keywords specific to imaging data products

Type	Keyword	Description
(S)	IMATYPE	Specific image type, according to Table 16.
(L)	ISAMP	Flag to indicate if the imaging data represents multiple disconnected regions, i.e. a <i>sampling</i> of the sky (ISAMP='T'), or one <i>contiguous</i> fraction of the sky (ISAMP='F' or unset).
(L)	APMATCHD	TRUE if the tabulated fluxes, magnitudes, and parameters derived thereof like colors etc. were <i>aperture-matched</i> in order to correct for possible PSF variations across different bands.

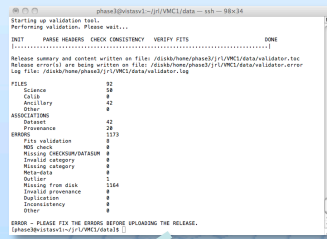
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# Phase 3 data flow & infrastructure



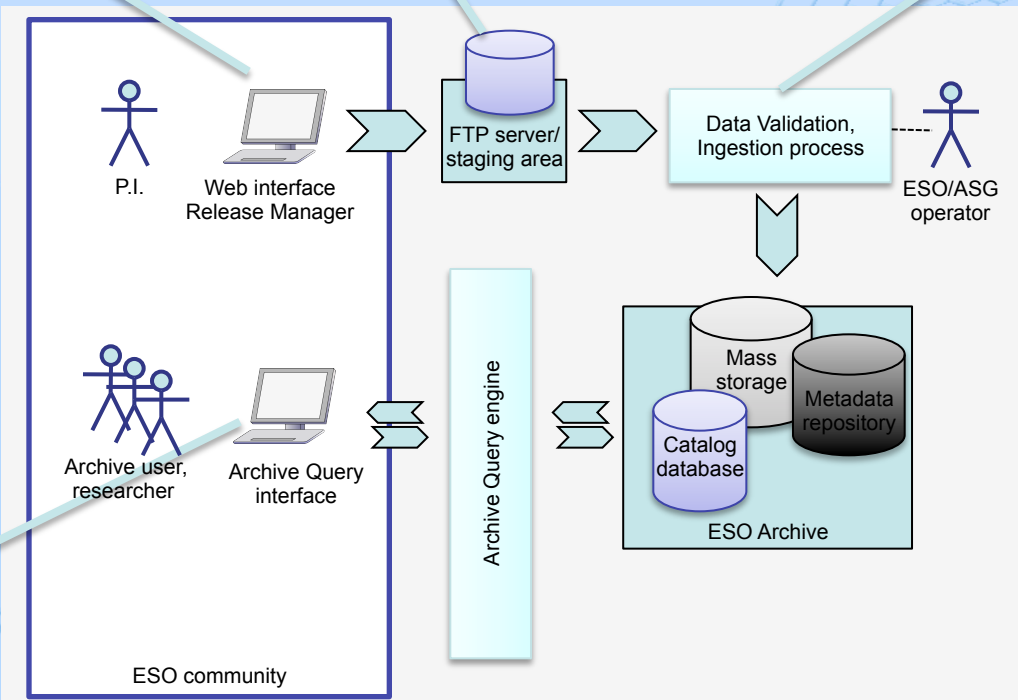
The release validator is a command-line application that helps to verify the data standard and validity of the header keywords against predefined rules.



The data is transferred by the PI/Co-I via FTP to the dedicated staging area.

The release manager is a web application that allows the P.I. to define data collections and releases and to manage the Phase 3 delegation to co-investigators.

[http://archive.eso.org/wdb/wdb/adp/phase3\\_main/form](http://archive.eso.org/wdb/wdb/adp/phase3_main/form)



Interfaces between the Phase 3 data flow, its users and the ESO Science Archive Facility.

Start of operations: March 2011





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Data Management and Operations Division

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Doc. No.: GEN-SPE-ESO-33000-xxxx

Issue: 2

Date: 09.03.2011

Prepared: J. Retzlaff  
Name Date Signature

Approved: M. Arnaboldi  
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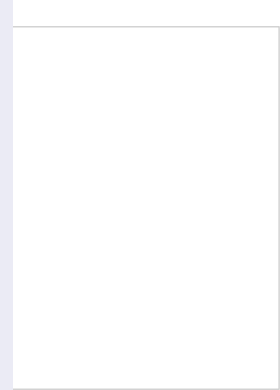
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## Working with ESO Telescopes

New Heights in Astronomy

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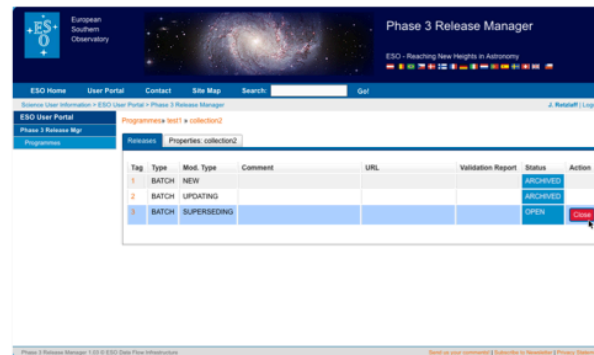


Figure 9: Closing a data release

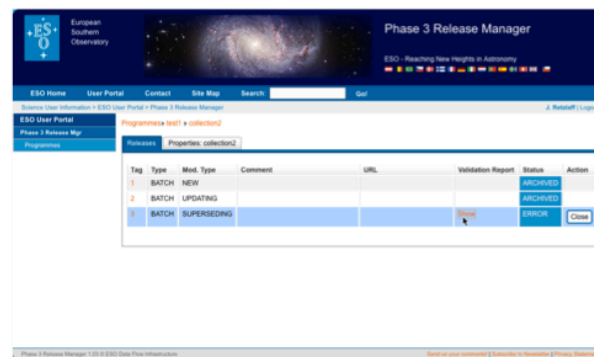


Figure 10: Failed data release validation results in ERROR status

### 4.8 Closing the data release

The PI concludes the data submission by closing the data release, an action that cannot be delegated but has to be taken by the principal investigator in person. Normally, thereafter, the release and its content cannot be changed anymore.

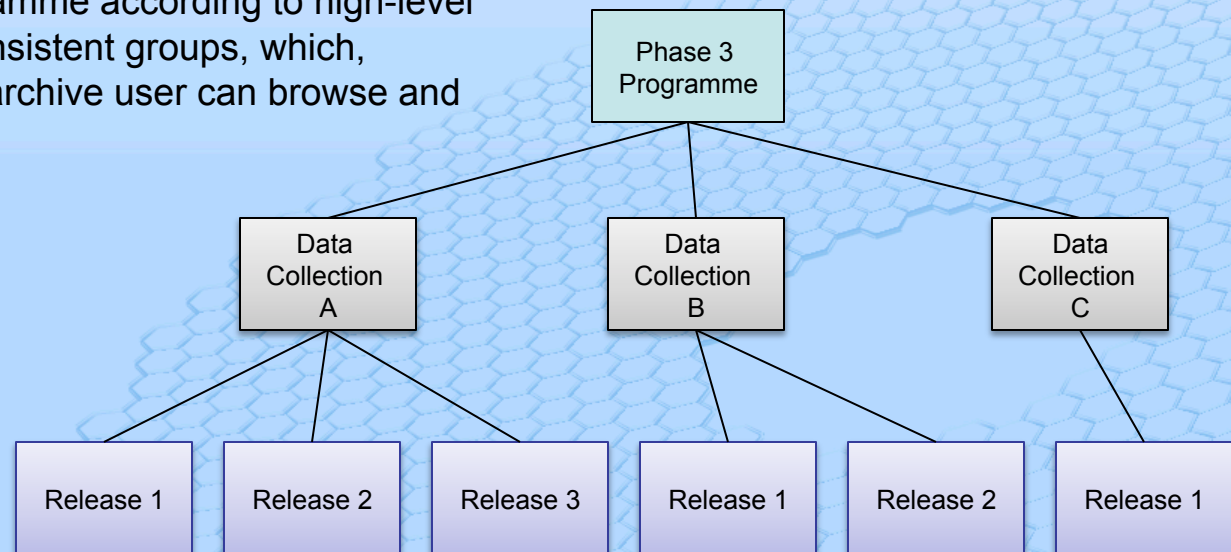
By closing the release the principal investigator approves the completeness and correctness of the submitted data and its description. Furthermore, the principal investigator agrees to the publication of the data being currently stored in the release directory of the staging area and to the publication of the associated data release description.



# The concepts of Phase 3 data collection and release

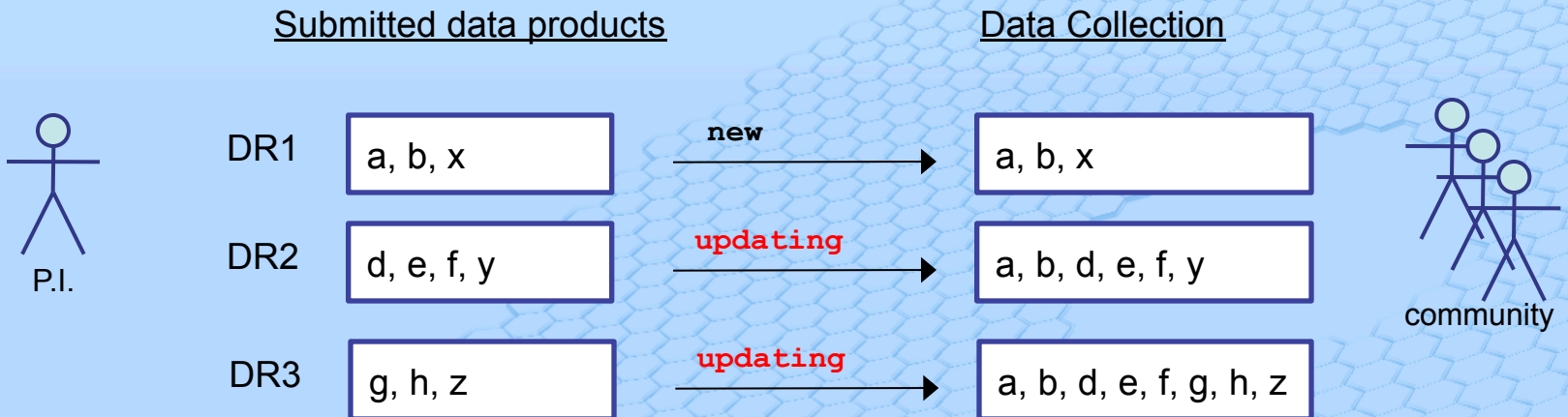
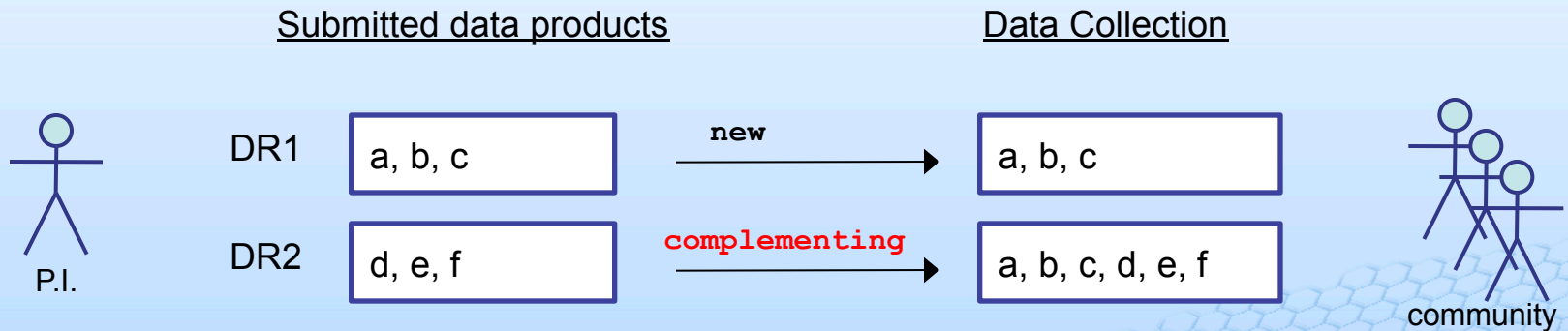
# ESO Data Release and Data Collection

- ❑ provide the framework that supports the data submission process and facilitates data access through the ESO Archive;
- ❑ form a simple hierarchical structure where data collection is at the top and any data release must be associated to one and only one data collection;
- ❑ The data collection allows organizing the data from a given programme according to high-level criteria into self-consistent groups, which, subsequently, the archive user can browse and access;





# Building Data Collections



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http://www.eso.org/sci/observing/phase3.html

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# Observing with ESO Telescopes

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## Phase 3 Questions & Answers

This page records specific questions of Phase 3 users and the corresponding answers given by the ESO/EDP support team assuming that the provided information appears to be helpful to a broader audience.

### About multi-band aperture-matched source lists and band merged catalogues.

**Q: What are the differences between multi-band aperture-matched source lists and band-merged catalogue-like products.**

A: Here are some useful information on multi-band aperture-matched source lists and band-merged catalogs.

**Multi-band aperture-matched source lists** (FITS tables) are produced from the single band source lists and are associated with the tiles observed in different bands for one pointing sky position. The astrometric and photometric calibrations for the ra/dec and magnitudes of the sources in these lists are based on night-calibrations. E.g. these are not global calibrations. The multi-band aperture matched source lists cannot be queried for content from the ESO archive; they can be downloaded as fits tables and will refer to the ra/dec sky position of tiles they were produced from.

**Multi-band (or band merged) catalog** are released at the milestones for the survey releases. The first of such milestones is October 1st, 2011. The calibration of the astrometry and photometry is global, on the whole region covered by the release. The catalogs will be querable for content, differently from the multi-band aperture-matched source lists, i.e. the individual sources in the catalogs will be accessed via the ESO query interface.

Sources in the catalogs may be detected based on the  $\chi^2$  image or other criteria, driven by the scientific goal of the project. They will not come necessarily from matching single band source lists from the CASU data reduction pipeline.

Furthermore catalogues delivered at the survey releases may contain additional data, that do not come from the VISTA observations: for example photo-z or matched information with X-ray or other multi wavelength observations, weak lensing information etc.

### Band-merged catalogues for the deep survey fields

**Q: What are multi-band aperture-matched source lists and band merged catalogues for the deep survey fields?**

A: It deals with the specific properties of deep surveys with respect to the wide area surveys. As illustrated before multi-band aperture matched source lists are different data products from band-merged catalogues.

Multi-band aperture matched source lists may refer to shallower data products than the deep stacked tiles that are obtained from the data collected over the whole period.

In case of the deep fields, the survey teams may decide to release 1 hr or xx hrs deep tiles with associated multi-band aperture-matched source lists, which will be very valuable data-products for multi-epoch observations, for example monitoring AGN variability or SN searches. In this case the information contained in the multi-band aperture matched source lists is not equivalent to the catalogue extracted from the deep stacks, as the variability information is lost in this final catalogue.

About the multi-band aperture-matched source lists: for deep surveys, the distinction between these source lists and the catalogs expected for the survey releases is more difficult to draw. While for wide surveys the scientific quality difference is clear, it is less so for deep surveys.

#### Example specific for a deep field

A deep field is observed in Z, J, and Ks in a period with 28 tile-OBS in Z, 21 tile-OBS in J and 21 tile-OBS in Ks successfully executed. The relative data products would be 28 tiles in Z, 21 tiles in J and 21 tiles in Ks + weight maps + single band source lists as data products for these observations.

One would then have 21 multi-band aperture matched source lists in Z, J, and Ks computed from the single-band source lists closest in time.

### Light curves

**Q: Are the data standards specified for light curves data products? When is the submission date for these products?**

A: The current ESO/EDP data standard (Issue 2, dated 09.03.2011) does not apply to light curves. EDP has decided to publish the data standard for light curves along with the general specification for catalogue products on time for the VISTA survey data release in October 2011. Therefore ESO does not expect the delivery of light curves in April 2011.



01 Jun 2011

Phase 3 Quick Links

Phase 3 Main Level

EDP standard [PDF]

Phase 3 User Guide [PDF]

Phase 3 Release Manager

Phase Validator

Phase 3 FTP upload

Phase 3 template for the data release description

Contact the Phase 3 Helpdesk

Please feel free to contact the EDP

Helpdesk | Subscribe to Newsletter | Privacy Statement

# Support to Phase 3 Users— ESO PIs and their Delegates

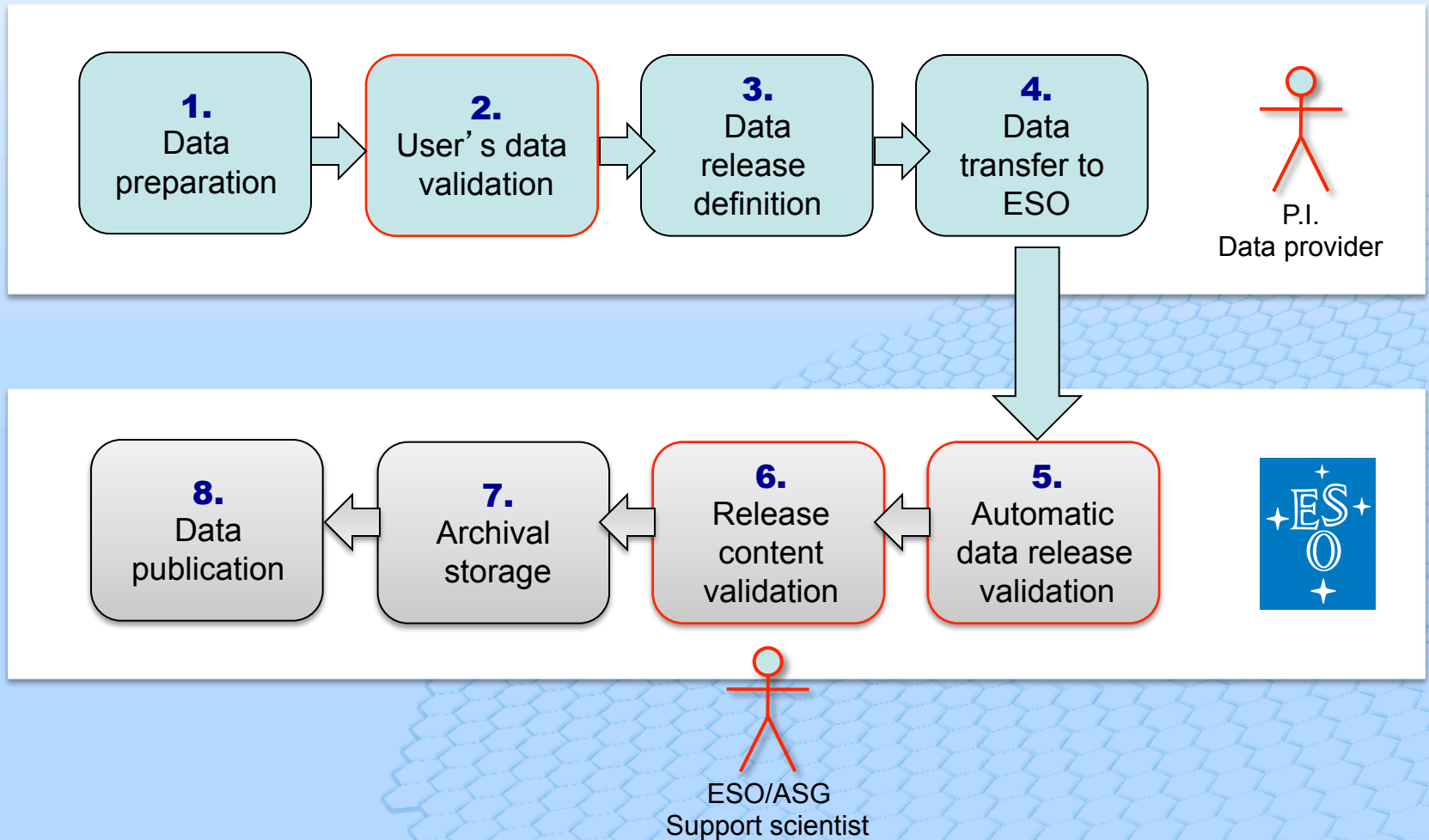
## Support Operations:

- Unique point of contact for all user inquiries related to Phase 3  
**[usd-help@eso.org](mailto:usd-help@eso.org),  
subject: Phase 3**
- Phase 3 support is provided by ESO's Archive Science Group (ASG):
  - ❖ *M. Arnaboldi (lead),*
  - ❖ *N. Delmotte,*
  - ❖ *J. Retzlaff*

## Kind of Questions:

- Clarification of Phase 3 policies, procedures & deadlines; when to deliver what?
- Description of the ESO/EDP data standard, data formats, FITS keyword definitions
- Applications of the Phase 3 tools: "How do I close my data release?"
- Software support: "Can I run the Phase 3 validator on Mac/OSX?"
- Technical support: e.g. bandwidth, data corruption

# Phase 3 Data Release Validation





# Phase 3 Data Release Description and Content Validation

The *data release description*, which provides an account of the release content, observations, calibration strategy and data reduction procedures, data quality, format, and, possibly, the scientific context of the programme, forms an integral part of any ESO Phase 3 data release.

The data provider is responsible for the preparation (following a pre-defined structure) and its submission to ESO (along with the data).

Combined with links to access the data products, the release description will be hosted on the ESO web for public access.

## Validation of the data release content includes:

■ Checking the completeness and consistency of the data release description with respect to the submitted data products.

- Phase 3 Data Submission Compliance Report
- Checklist for the ESO/EDP data standard
- The checklist is to be used with the ESO/EDP data standard, and is to be used in conjunction with the automated validation steps and manual inspection.
- Verify FITS keyword types against the ESO/EDP dictionary **DONE**
  - Check for the presence of mandatory keywords depending on detailed format **DONE**
  - Check the value of mandatory keywords against blanks **DONE**
  - Spot check metadata for consistency/plausibility

■ Spot checks of the metadata content and the reported quality parameters for consistency/plausibility.

- Checklist for the data release description
- The verification of the data release description should be done using the following questions:
- Does the general structure comply with the recommended structure in the ESO/EDP standard, Sect. 3.9? **DONE**
  - List each deviation and assess whether information is missing in this case or if an omission seems to be justified. **DONE**
  - It is a general requirement that the release description shall be self-contained. Release notes, possibly naming calibration issues etc., should be part of the description itself. Pointers or references to other resources may be used additionally. Preference should be given to bibliographic references of scientific publications over resources that purely exist on the WWW. **DONE**
  - Check the overall consistency of the description and the submitted data products (product types, target fields, passbands, time of observation). Any products being described but not submitted? Any data being submitted but included in the description? **DONE**

# Monitoring the Phase 3 Process

□ The delivery of Public Survey data products via Phase 3 is monitored and reported to the ESO PSP to support the evaluation of the survey progress.

□ The Public Survey Panel will periodically review the progress of the surveys and will assess the compliance to the specification of the surveys' products.

**Layer Color:** ■ **Opacity:**

1595 items covering 562.213 deg<sup>2</sup>

**Cumulated Exposure Time (hours):**  
H: 12.760 J: 18.013 Ks: 26.333 Y: 12.200 Z: 12.200

**Constraints**

Type	OB Status	Project	Instrument
OB <input checked="" type="checkbox"/>	C <input checked="" type="checkbox"/>	VVV <input checked="" type="checkbox"/>	VIRCAM

Programme ID: 179.B-2002  
Transparency Constraint: 2CLR  
Moon Constraint (FLI): 1

**Project**

GTO-NB118 (2) SV (78) Ultra-VISTA (270) VHS (2049)  
VIDEO (282) VIKING (449) VMC (258) VV (1595)

**Filter**

H (349) J (349) Ks (1367) Y (229) Z (229)

**Area (Union)**

Filter	Area
H	303
J	316
Ks	529
Y	56
Z	36
Other	28
Other	65
Other	89
Other	109
Other	57

[1.77140 .. 1.77207]

**OB Execution Time**

1009 q1 196 137 153

FOV 205° 34.3 FPS

# Anticipated timeline for the first annual VST survey data release

June/July 2012	Release of the data format specification for VST data products and the Phase 3 Release validator tool.
October 2012	Period for data submission by the survey teams (one month). For the observations which have been completed (per tile) within the first 6 months of survey operations.
November 2012	Content validation and data publication through the ESO archive

*The End*