ESO Public Surveys Phase 2 Workshop

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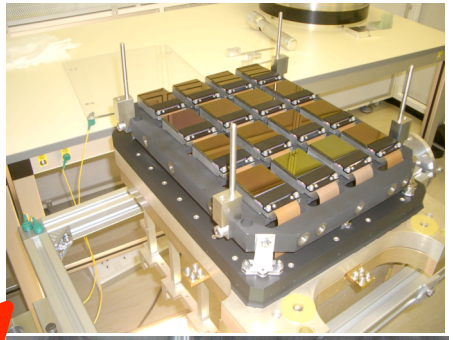
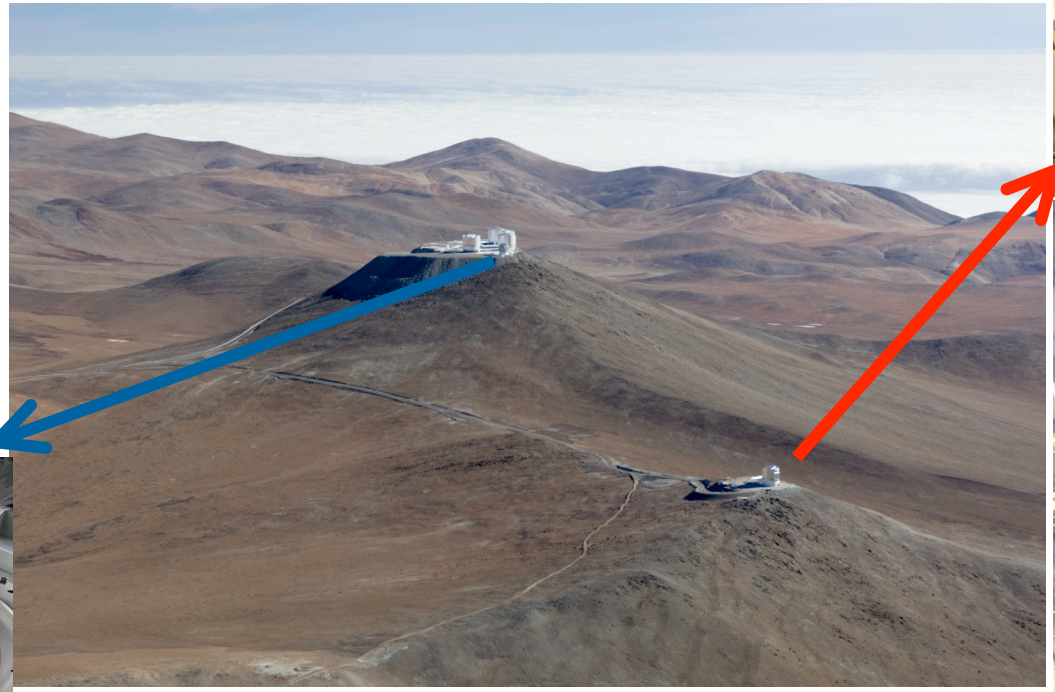
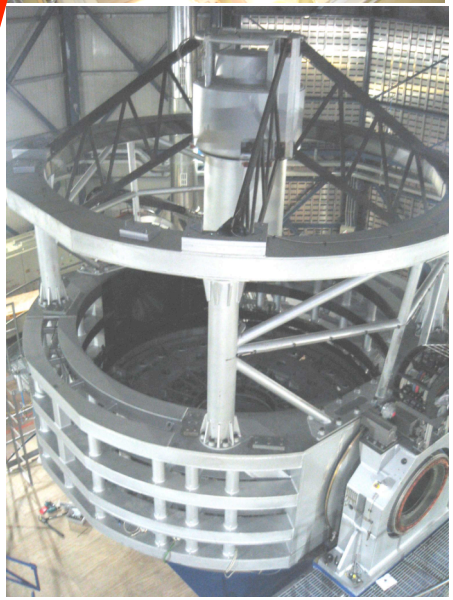
ESO, External Data Product Group
ESO Survey Team (EST) leader

Survey telescopes: VISTA & VST

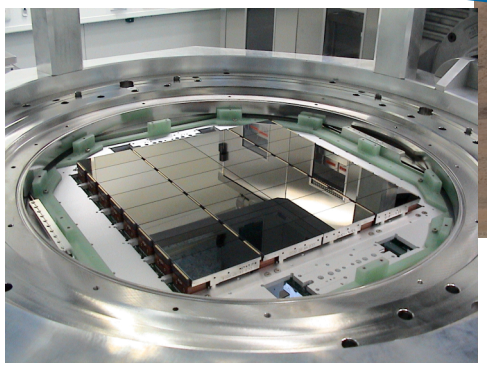
VIRCAM







OmegaCam



VISTA

More than 75% of the ESO time on VST (optical) and VISTA (NIR) will be devoted to Public Surveys. Data taking in SM.

Outline

- Phase 1 – Public survey proposals submission, evaluation, and Survey management plans
- Phase 2 – Preparing for the service mode operations
- Phase 3 – Submission, Validation and Publication of data products to the ESO archive
- SADT demo
- Vista Science Verification

Phase 1 – Public Survey Proposals Submission, Evaluation, and Survey Management Plans

Phase 1 - ESO Policies for Public Surveys

Following recommendations by STC and OPC, **>75% of the ESO time on VST (optical) and VISTA (NIR) will be devoted to Public Surveys.**

ESO does not have the resources (mostly man-power) to conduct Public Surveys on behalf of the community, but it also seems more appropriate **if teams interested in the exploitation of surveys are also responsible for delivering the data products to the community.**

Therefore, ESO decided to open the public survey time on these telescopes to proposals from the community.

The ESO public surveys were selected by the VST and the VISTA Public Survey panels (Chair: D. Macchetto) – This process takes one full year: from the letter of interests to the OPC recommendation.

GOAL: best scientific use of all the available telescope time!

Phase 1 - Implementation of ESO Policies

1. After the OPC recommends the Public Surveys (PSs), the PI's submit a management plan to ESO, which will be an important part for ESO's appraisal of the proposal.
2. Guidelines for the Survey Management Plan – VST
3. Guidelines for the Survey Management Plan - VISTA
4. The SMP will be reviewed by the EST, iterated with the PIs and the VLT program scientist. A senior review is held at the completion of the process. The ESO DG will grant final approval, or decide for further actions required
   Process successfully completed by 3 VST + 6 VISTA Public Survey Projects!
5. Time allocation after the 1st year is subject to the successful outcome of the PSP and OPC review of the PS progress.
6. Time allocation for any additional survey related observations (e.g. spectroscopic follow-up) at other ESO telescopes must be applied for.
7. All available at http://www.eso.org/sci/observing/p2pp/policies/PublicSurveys/

Phase 1 - The ESO Survey Team

The EST is composed of the following ESO staff:

Magda Arnaboldi (*Team Leader* – External Data Product Group) responsible for the Phase 1 process, Phase 2 preparation and tools, PS monitoring and team coordination. Currently in charge of the ingestion of the data products into ESO Science Archive Facility, and advising the PI's on all issues related with Phase 3.

Joeg Dietrich (ESO fellows - Office for Science) supporting SMP review, Phase 2 preparation and quality control, PS monitoring.

Gaitee Hussain (VISAS) responsible for the scheduling of observations at VISTA and VST

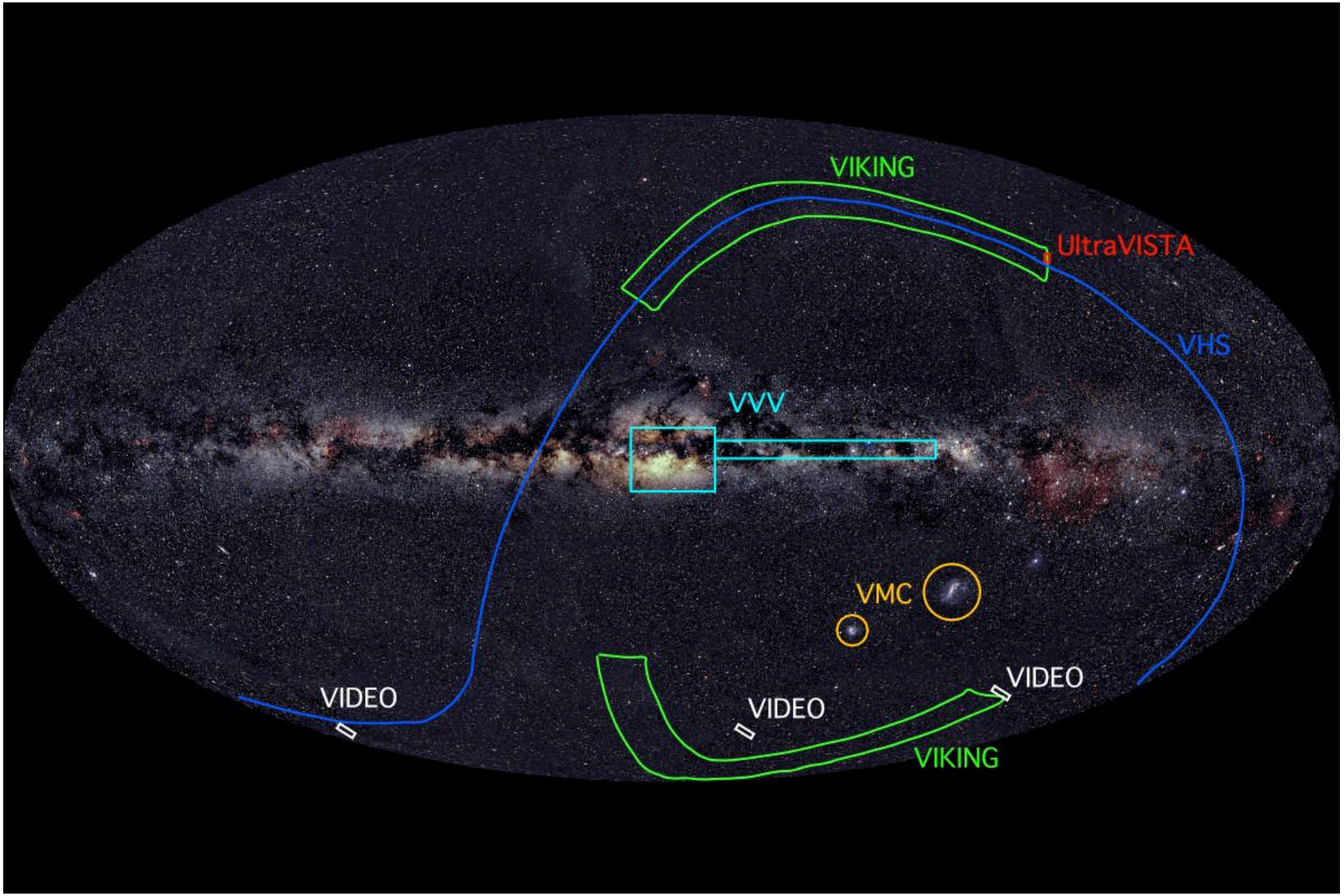
Mark Neeser, Wolfgang Hummel (Quality Control Group within the Data Flow Operations Department; QC scientists) responsible for QC & validation of the data-products.

Marina Rejkuba (User Support Department) Phase 2 preparation and tools, Service mode operations.

E. Hatziminaoglou (VO) – Publication of the data in the VO network.

Phase 2 – Preparing for the Observations in Service Mode

VISTA Public Surveys



Phase 2 -Public Survey Service Mode Operations - Number of OBs per year (M. Rejkuba)

VLT - average number of OBs per year over the last 2 years (including carry-over, LPs):

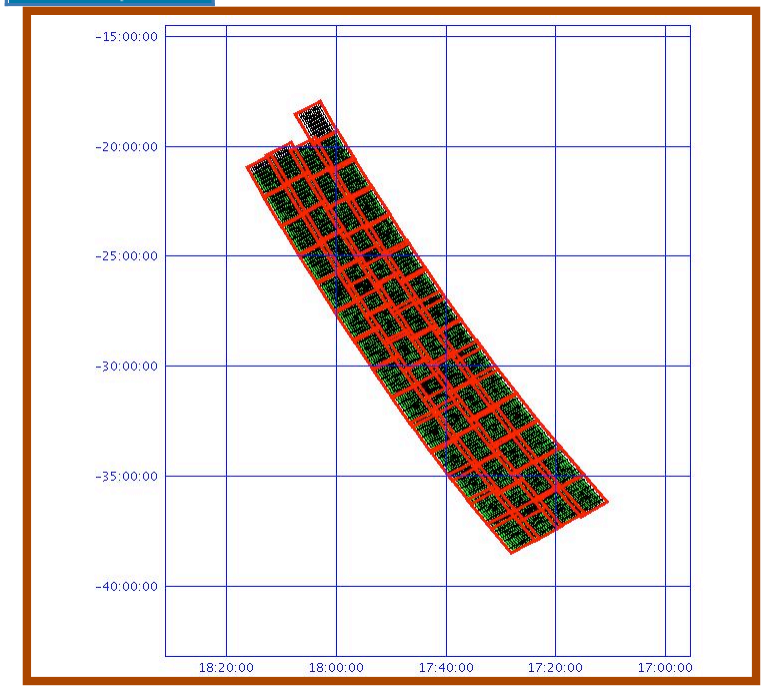
- UT1: 5637,
- UT2: 3734,
- UT3: 2555,
- UT4: 2717

Sum of all OBs from VISTA SMPs and divide by 5

→ **Total: ~15800 OBs/year**

- VISTA 1st year: ~11250 OBs (due to VVV major variability campaign coming up later)

Phase 2 -Public Survey Service Mode Operations – New tools



Vista Focal Plane: Geometry

- SADT – Survey Area Definition Tool – Developed by VISTA consortium http://www.vista.ac.uk/observing/sadt/index.html

- P2PP - http://www.eso.org/observing/p2pp/P2PP_future.html

  Implementation of scheduling containers:
  - Groups, Timelinks, Concatenations
  - "scores" set by the user - It allows more personalized observing strategies.

Phase 2 -Public Survey Service Mode Operations – USD support & Documentation

USD contact: Marina Rejkuba and Michael Hilker

Phase 2 web pages

- ESO Public Survey web pages
- VISTA telescope and VIRCAM instrument web pages
- Phase 2 specific information for VISTA
- Helpdesk

VISTA user manual, templates manual, VISTA calibration plan

- First version to be delivered by the VISTA consortium
- Final release based on commissioning and Paranalization results
  - Released to the public through the VISTA instrument web page
  - Written by the VISTA telescope and instrument scientists
  - Support from USD

Phase 2 -Public Survey Service Mode Operations – New tools and their documentation

P2PP manual

- Written by the USD
- Revision of the current P2PP manual with updates specific for surveys
- Delivery date:
  - Preliminary version for the ESO public surveys PIs workshop in September
  - Final release for the Phase 2 for VISTA public surveys

SADT manual

- SADT user manual provided by the VISTA consortium

VIRCAM ETC (internal ESO web page, but coming soon!)

- http://w4.hq.eso.org/observing/etc/bin/gen/form?INS.MODE=swimaging+INS.NAME=VIRCAM

Phase 2 – Web pages and Documentation

1. ESO Public Surveys main web page:
   http://www.eso.org/sci/observing/policies/PublicSurveys/
   - Public Survey - phase 2:
     http://www.eso.org/sci/observing/policies/PublicSurveys/phase2publicsurveys.html#phase2t
   - Public Surveys web page - useful links:
     http://www.eso.org/sci/observing/policies/PublicSurveys/PSuseful_links.html
2. ESO P2PP web page and P2PP Surveys User Manual are available from:
   http://www.eso.org/observing/p2pp/P2PP_future.html
3. VISTA Paranal web page and VISTA User Manuals
   http://www.eso.org/sci/facilities/paranal/instruments/vista/

Phase 2 – Web pages and Documentation (cont.)

4. SADT User Manual

The VISTA consortium provides the SADT user manual. It can be downloaded from the SADT web page:
http://www.vista.ac.uk/observing/sadt/index.html

The following ESO web pages make reference to the external SADT page:

- Public Surveys web page - phase 2:
  http://www.eso.org/sci/observing/policies/PublicSurveys/phase2publicsurveys.html#phase2t
- Public Surveys web page - useful links:
  http://www.eso.org/sci/observing/policies/PublicSurveys/PSuseful_links.html

Phase 2 -Public Survey Service Mode Operations: Next steps

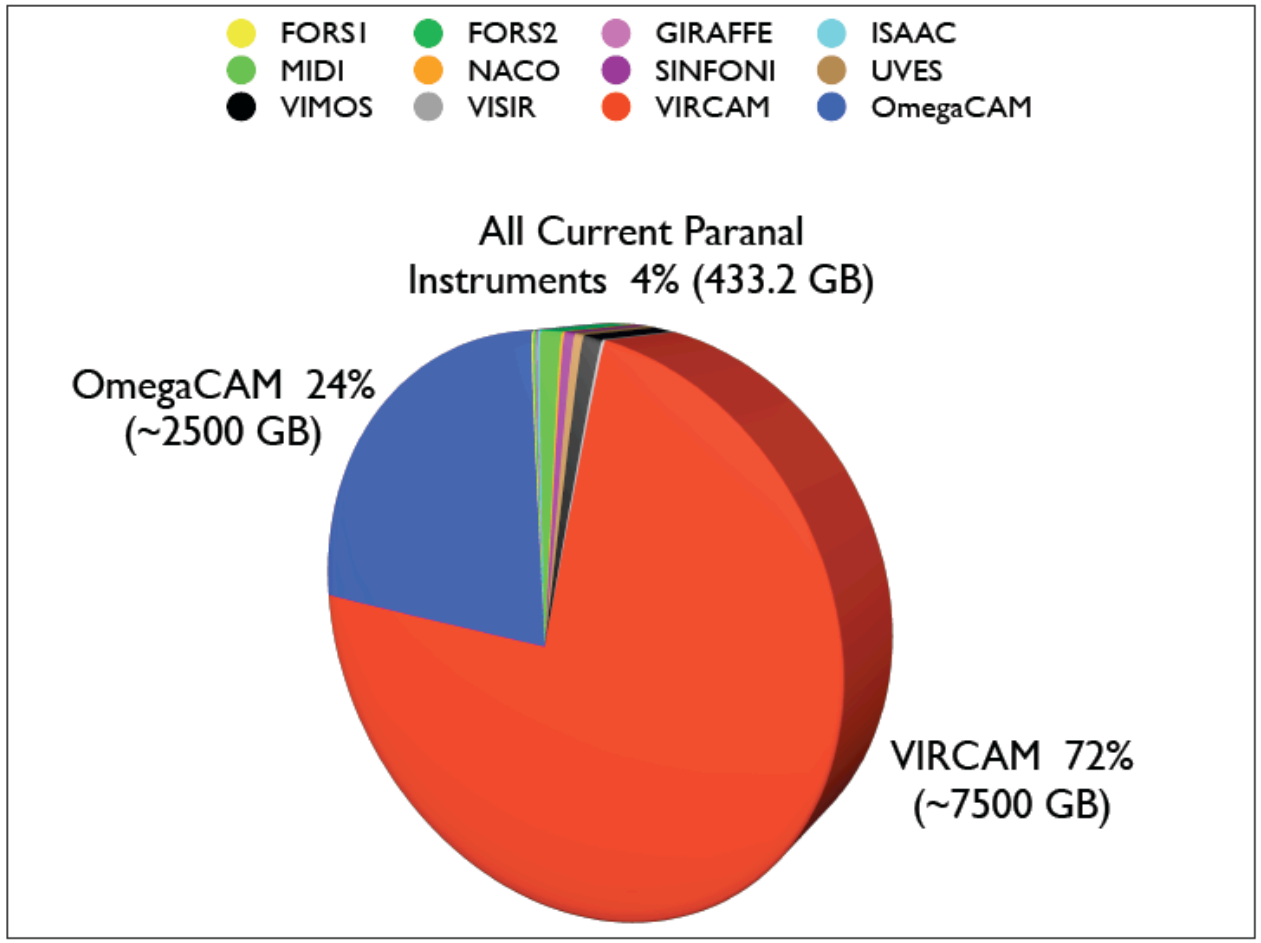
1. Workshop for PIs
2. Science Verification
   - Feedback from science verification for the Phase 2 tools, templates, observation tools, qc
3. Final release of manuals and web pages for VISTA
4. Phase 2 for survey PIs
5. Review of the Phase 2 material
6. Start of survey operations when the telescope is ready

Phase 3 – Submission, Validation and Publication of Survey Data Products to the ESO archive

Public Survey Data Products

Expected monthly dataflow (raw calibration and science frames) from Survey Telescopes

The plan is for ESO PS raw data to be available from ESO archive as soon as they are ingested



Phase 3 - Policies for Archiving Data Products

The raw data from the public surveys with OmegaCAM and VIRCAM will be immediately made public worldwide from the ESO archive, with public users being able to download limited volumes.

Data products from the ESO public surveys will be available worldwide from the ESO archive. See also:
Virtual Observatory: http://www.eso.org/org/dmd/vos/
Advanced Data Products : http://www.euro-vo.org/pub/

The data formats and metadata to be delivered to ESO will be compliant with the Virtual Observatory standards . Specific guidelines will be issued as soon as the ADP ingestion infrastructure is built.

A copy will be available from the Wide field Astronomy Unit at the Royal Observatory Edinburgh archive for the VISTA public surveys.

Phase 3 – ESO Public Survey Data products

The data products from a PS consist (mostly) of :

1. Astrometrically and photometrically calibrated, co-added, re-gridded images, along with their respective weight maps, in all of the project-relevant filters;
2. Aperture-matched source catalogues based on individual or co-added bands. Associated source catalogues linking the parameters of individual objects across all of the observed filter bands.
3. Light curves for multi-epoch observations of variable sources

Data Reduction Pipelines and Data Centers- VST surveys

PIs of VST PS receive a copy of the raw data!

1. Astro-WISE - http://www.astro-wise.org Astronomical Wide-field Imaging System for Europe.
2. TERAPIX - http://terapix.iap.fr/ (Traitement Élémentaire, Réduction et Analyse des PIXels de Megacam) is an astronomical data reduction centre dedicated to the processing of extremely large data flows from digital sky surveys.

1 + 2 will support data reduction of ULTRAVISTA & VIKING

3. VDFS- http://www.ast.cam.ac.uk/vdfs/ (VISTA data flow system) adapted to optical data to support the data reduction of VPHAS+ and VST ATLAS.

Data Reduction Pipelines and Data Centers
VISTA Surveys

PIs of VISTA PS do not receive a copy of the raw data (unless explicitly requested!)

VISTA data flow system (VDFS). http://www.ast.cam.ac.uk/vdfs/

Data will be pipeline processed at ESO HQ to generate real-time data quality control parameters and then shipped to Cambridge for full science data processing.

The Cambridge Astronomical Survey Unit (CASU: http://www.ast.cam.ac.uk/~mike/casu/index.html) is responsible for the design and implementation of the data processing aspects of VISTA observations. PI may access the processed data after the CASU step.

After processing, the plan is that the VISTA data will be transferred to Edinburgh where the Wide Field Astronomy Unit (WFAU: http://www.roe.ac.uk/~nch/wfcam/) will be responsible for the design and implementation of the survey-oriented data reduction.

An Estimate of ESO-VISTA Public Survey Data Delivery (M. Neeser)

Tile size : effective area of one tile: 1.017 deg x 1.475 deg = 1.5 sqr. deg.

effective area of one pawprint: 0.595 sqr. deg.

therefore, the ratio of tile to pawprint coverage = 2.521

size of one pawprint image = 67.6 MB (int)

= 269 MB (float)

therefore, effective size of one tile = 678 MB (float)

Catalogue size : from the number density counts of King et al. 2003 (H-band) and comparing these to the H-band limits of the extra-galactic surveys, we deduce the number of sources per square degree. For the VVV Galactic survey the expected source numbers are explicitly given in the SMP, while for the VMC we have assumed source counts 1/10 of those from the VVV.

An Estimate of ESO-VISTA Public Survey Data Delivery (cont. I)

Survey	Filters	Area	# counts x filter x area	Catalogue size (GB)
Ultra-VISTA	5	1.5	4.7×10^6	6.9
VHS	4	20000	1.6×10^9	2370
VIDEO	5	12	1.2×10^7	18
VVV	5	520	5.0×10^9	7395
VIKING	5	1500	3.0×10^8	445
VMC	3	184	3.0×10^8	444

An Estimate of ESO-VISTA Public Survey Data Delivery (cont. II)

Survey	Image Size (TB)	Catalogue size (TB)	Total (TB) over 5 years	Total (TB) per period
Ultra-VISTA	0.0034	0.0069	0.01	0.001
VHS	36.2	2.37	38.6	3.9
VIDEO	0.027	0.018	0.05	0.005
VVV	2.4	7.4	9.8	1.0
VIKING	3.4	0.45	3.9	0.4
VMC	1.3	0.44	1.7	0.2
	Totals:		54	5.4

An Estimate of ESO-VST Public Survey Data Delivery (M. Neeser)

Tile Size:

effective area of one tile (consisting of 5 field dithers):
3645" (60.76') x 3672" (61.2') = 1.0329 sqr. deg.
with a pixel scale = 0.2134"/pixel

==> tile = 17080 x 17207 pixels
single CCD = 2144 x 4200 pixels
ratio tile/single OCAM image = 17080 x 17207
32 x 2144 x 4200
= 1.02

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size of a single OCAM image = 576.6 MB (int)
= 1.153 GB (float)
therefore, effective size of one OCAM tile = 1.176 GB (float)

Catalogs:

Assuming the number density counts of Metcalfe et al. 2001 (R-band) and comparing these to the r'-band limits of the extra-galactic surveys, we can deduce the number of sources per square degree. For the VPHAS+ Galactic survey the expected source numbers are explicitly given in the proposal.

An Estimate of ESO-VST Public Survey Data Delivery (cont. I)

Survey	Filters	Epochs	Area sqr. deg.	Filter x Epoch x Area	Number of Tiles*	x 1.176 TB per tile
KIDS	4	2 (g′ only)	1500	7500	7261	8.6 TB
ATLAS	5	1	4500	22500	21783	25.6 TB
VPHAS+	5	1	1800	9000	8713	10.3 TB

* Number of tiles = (filters x epoch x area)/1.033 sqr. deg. per tile

An Estimate of ESO-VST Public Survey Data Delivery (cont. II)

Survey	Filters	Area	# counts x filters x area	Catalogue size (GB)
KIDS	4	1500	4.8×10^8	710
ATLAS	5	4500	2.3×10^8	333
VPHAS+	5	1800	1.0×10^9	1479

Mark Neeser

An Estimate of ESO-VST Public Survey Data Delivery (cont. III)

Survey	Image Size (TB)	Catalogue size (TB)	Total (TB) over 3 years	Total (TB) per period
KIDS	8.6	0.71	9.3	1.55
ATLAS	25.6	0.33	25.9	4.32
VPHAS+	10.3	1.48	11.8	1.97
	Totals:		47	7.84

Phase 3 - ESO PS data products – Data delivery

External Data Product (EDP) group within the new Data Product Department

- members of EDP are: M. Arnaboldi (Head), Joerg Retzlaff, Remco Slijkhuis.

Phase 3 - The whole process to be carried out by the PI dealing with the publication of his/her data products in the ESO science archive facility (SAF). It consists of:

- Delivery of the data package(s)
- Their validation
  - EDP – metadata, consistency of data products with Phase 1/ SMP
  - EST – guideline for the validation of the data products. These are the reports and tests which will be requested by the EST from the Survey Teams in order to verify the declared accuracy/uniformity of the PS data products before their acceptance and ingestion into the ESO archive. See: http://www.eso.org/sci/observing/policies/PublicSurveys/policiesPS.html
- The ingestion of the data products in the SAF.

This requires a set of policies/guidelines and tools dealing with the above.

Phase 3 - ESO PS data products

As for the Phase 1 & 2, the PI is fully responsible for:

1) The delivery (technical),
2) ensuring the scientific standard; and
3) the versioning of the data products from the public survey project.

The EDP group will support and guide the PIs to the successful completion of their program's Phase 3.

The EDP group is in charge of the collection of survey data products from the PIs, their validation, in cooperation with EST, and their ingestion into the ESO archive.

To this end a set of inter-operating software tools is being developed, of which one is the web-based submission interface for data products (see J.Reztlaff presentation). Investigators are offered a standardized procedure with a unique entry point for returning their reduced data products to ESO.

Basic functionalities are in place, including a transfer mechanism using secure copy to a dedicated staging area

SADT Demo

SADT Demo

SADT – Survey Area Definition Tool for Public Surveys

Purposes (see also Presentation of J. Emerson 15.09.08):

1. To generate the pointing position for each tile making up a survey
2. To find the six sets of guide and active optics (AO) stars necessary to observe each survey tile
3. To output the results in a form that can be used in P2PP to generate the OBS for the service mode observations

SADT Demo

SADT is a tool developed by the VISTA consortium and it is part of the UK in-kind contribution to ESO.

The tool is going through a process that will take to the preliminary acceptance by ESO.

The version of the SADT being used during the workshop is a preliminary release – Final release currently planned for October 20, 2008

Please notify all bugs you may find during the tutorials!

They need to be reported to Jim Emerson, with copy to usd-help@eso.org so that ESO USD & SDD can keep tracks of them, and make sure they are fixed by the time the tool is formally accepted.

Vista Science Verification

http://www.eso.org/sci/activities/vltsv/vista/index.html

VISTA SV

SV will take place after handover of telescope – beginning of 2009.

A total of 11 nights – to be divided up into two mini-surveys Galactic and Extragalactic – about 50 hrs obs. each.

The two mini surveys should not overlap with the VISTA public survey projects

Test the whole end-to-end system – crucial to optimize QC parameters & spot checks for telescope and instrument monitoring

Raw data will be publicly available.

Data will be reduced with the VISTA Data Flow System (VDFS – CASU & WFAU) and AstroWISE. Reduced data products will be publicly available from SAF

VISTA SV

1. Extragalactic mini survey: deep survey of the stellar halo in a nearby spiral galaxy
2. Galactic mini survey: the star formation region in Orion

1. Goals:

Detect faint stellar halo

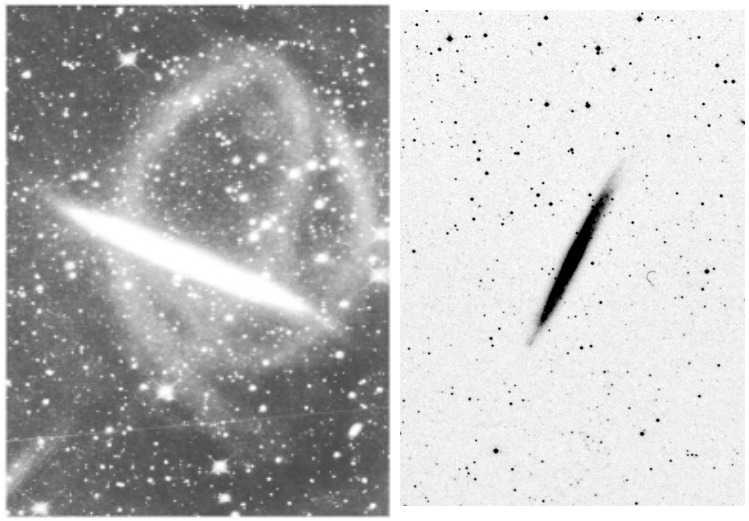
Detect and characterize the metallicities of satellites in the field

Detection of streams

Detection of GCs/UCDs

Narrow band imaging to map opacity

And star formation at z=0.84



NGC 5907 18'.2 x 27'.7
11.35 hrs BBRO image and DSS

VISTA SV -Target galaxy NGC 4945

1. NGC 4945 13 05 27 -49 28 05 (J2000); m-M = 27.63, D=3.9 Mpc
2. Detecting red giant branch stars in the diffuse stellar halo and streams using deep broad band Z and J
3. Satellites of M31 and MW are manly dSphs, within 300 kpc of the MW disk μ_V=23-26 mag arcsec^{-2}, V=-8.5 – 13, 11 Gyrs old, metal poor ([Fe/H]=-1.7).
4. For such a stellar population the absolute magnitude at the tip of the RGB is ➔ Z=-4.51;J=-4.94
5. mz=23.3, mj =22.9

VISTA FOV ~ 102 x 68 kpc^2

VISTA SV – Observing strategy

- In addition to brad band imaging we carry out a search for Halpha emitters in the background of NGC 4945 at 0.84 using the narrow band filter NB 118
- Goals: probe the opacity of the stellar halo and the star formation rate at this redshift,
- Observing strategy: 1 tile only, in Z,J, NB118.
- Exposure times: Narrow band 6 hrs, Broad band, see below:

Band	Abs. magnitude at RGB tip	App. magnitude at RGB tip	N_{obs}	Tot Exp. time	S/N (seeing = 0.8″)	S/N (seeing = 1.0″)
Z (MR)	−4.76	23.0	2	3.2h	10	8
Z (MP)	−4.51	23.3	4	6.3h	10	9
J (MR)	−5.65	22.1	4	5.9h	10	8.5
J (MP)	−4.94	22.9	15	22.1h	10	8

Band	DIT	N_{dit}	N_{jit}	N_{paw}
Z	60	3	5	6
J	35	6	4	6

VISTA Science Verification

End!