Public Surveys@ESO
User Committee 36th meeting
Garching 23-24 April 2012

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Leader ESO Survey team (EST)
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Outline

• ESO public surveys
  • Motivations
  • VISTA Public Surveys: overview & completion rates
  • VST Public Surveys: overview & time allocation
  • Spectroscopic Public Surveys: status
  • ESO workshop on Surveys & VISTA PSP review – 2.5 years into operations

• ESO Phase 3
  • Policies and web pages
  • Phase 3 : DR1 for VISTA Public Surveys
  • Statistics on community access to data products from ESO Public Surveys
  • ESO milestones for further Phase 3 activities

• Conclusions
Observational astronomy is in an era of surveys SDSS, UKIDSS, Pan-STARRS, SkyMapper and LSST. These projects all entail large investment in survey “systems” which include dedicated telescopes and instruments to data distribution. **GOAL: target new science in a variety of fields and serve broad communities**

ESO has a strong background in survey projects (ESO/SERC southern sky survey 1974 - 1987, EIS)

ESO operates dedicated telescopes, VST and VISTA, and organizes public surveys projects. ESO holds peer review periodically to ensure legacy value and scientific excellence of the survey program.

In the current implementation for ESO public survey projects, the community carries out all those activities that go beyond those enlisted in the ESO mission statement

The ESO Science Archive Facility is the collection point for the survey products and the primary point of publication/availability of these products to the ESO community (as per ESO Council Meeting 104, 17–18 December 2004).
- Very large programmes (>2 years)
- Legacy value for astronomical community at large
- All raw observations are immediately public
- Survey teams commit to deliver reduced images/spectra and catalogues within ~yearly releases
- Further allocation of telescope time for ESO PS is conditional to the submission of data products via Phase 3. ASG is monitoring of Phase 3 process and reports to Public Survey Panels/OPC.
ESO imaging Public Surveys - VISTA & VST

Observations carried out in service mode

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ESO Public Surveys Science - VISTA

- Ultra-VISTA PIs: Dunlop, Edinburgh; Le Fevre, Marseille; Franx, Leiden; Fynbo, Dark Cosmology Centre
- The VISTA Hemisphere Survey (VHS) PI: McMahon, IoA, Cambridge
- VIDEO Survey PI: Jarvis, Hertfordshire
- VVV (VISTA Variables in the Via Lactea) PI: Minniti, Catolica
- VIKING (kilo-degree IR galaxy survey) PI: Sutherland, Queen Mary, Univ of London
- VMC (Vista Magellanic Survey) PI: Cioni, Hertfordshire
### ESO Public Surveys Science - VISTA

Deep high z Whole sky Galactic Extragalactic Star Form. History

<table>
<thead>
<tr>
<th>Surveys</th>
<th>Area deg^2</th>
<th>Cumulative Area covered &lt;P89</th>
<th>Filters</th>
<th>Magnitude limit 5σ (AB)</th>
<th>Magnitude limit 10σ (AB) x VMC</th>
<th>Cumulative OB ex. time &lt;P89 (hrs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ultra-VISTA</td>
<td>1.7 d</td>
<td>1.7</td>
<td>Y J H K_s</td>
<td>25.7 25.5 25.1 24.5</td>
<td>26.7 26.6 26.1 25.6 26.0</td>
<td>475</td>
</tr>
<tr>
<td></td>
<td>0.73 u-d</td>
<td></td>
<td>Y J H K_s NB</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VHS</td>
<td>17800</td>
<td>&gt; 4208</td>
<td>Y J H K_s</td>
<td>21.2 21.1 20.6 20.0</td>
<td></td>
<td>1165</td>
</tr>
<tr>
<td>VIDEO</td>
<td>12.0</td>
<td>10</td>
<td>Z Y J H K_s</td>
<td>25.7 24.6 24.5 24.0 23.5</td>
<td></td>
<td>379</td>
</tr>
<tr>
<td>VVV</td>
<td>560</td>
<td>562</td>
<td>Z Y J H K_s</td>
<td>21.9 21.1 20.2 18.2 18.1</td>
<td></td>
<td>430</td>
</tr>
<tr>
<td>VIKING</td>
<td>1500</td>
<td>&gt; 470</td>
<td>Z Y J H K_s</td>
<td>23.1 22.3 22.1 21.5 21.2</td>
<td></td>
<td>616</td>
</tr>
<tr>
<td>VMC</td>
<td>180</td>
<td>54.3</td>
<td>Y J K_s</td>
<td>21.9 21.4 20.3</td>
<td></td>
<td>325</td>
</tr>
</tbody>
</table>

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### Absolute Completion Rates

<table>
<thead>
<tr>
<th>Period</th>
<th>VVV</th>
<th>VMC</th>
<th>VIKING</th>
<th>Ultra-VISTA</th>
<th>VIDEO</th>
<th>VHS</th>
</tr>
</thead>
<tbody>
<tr>
<td>01.04.2010</td>
<td>24%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>01.04.2012</td>
<td></td>
<td>22%</td>
<td>32%</td>
<td>29%</td>
<td>25%</td>
<td>38%</td>
</tr>
</tbody>
</table>

- **Absolute completeness % = completed OB time / time requested in SMPs**
- Effective telescope time = 1.75 yr [24 months (operations) – 3 months (technical downtime)]
- VHS can be completed in ~5 yrs.
- VVV, UltraVISTA, VIDEO, VMC will take ≥ 7 yrs. This is a lower limit, as overheads in SMPs were underestimated.
- VIKING currently pending. It did not fulfill ESO policies for PS
• KIDS - PIs: Konrad Kujiken, Groningen
• VST ATLAS – PI Tom Shanks, Durham University
• VPHAS+ - PI Janet Drew, University of Hertfordshire
## ESO Public Survey Science - VST

<table>
<thead>
<tr>
<th>Surveys</th>
<th>Area deg^2</th>
<th>Filters</th>
<th>Magnitude limit</th>
<th>Depth measure</th>
<th>Cumulative OB exec. time &lt;P89 (hrs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>KIDS</td>
<td>1500</td>
<td>u',g,r,i</td>
<td>24.1, 24.6, 24.4, 23.4</td>
<td>10σ (AB)</td>
<td>153.2</td>
</tr>
<tr>
<td>VST ATLAS</td>
<td>4072</td>
<td>u',g,r,i,z</td>
<td>22.0, 22.8, 22.3, 21.8 , 20.7</td>
<td>10σ (AB)</td>
<td>306.1</td>
</tr>
<tr>
<td>VPHAS+</td>
<td>2000</td>
<td>u',g,r,Hα,i</td>
<td>21.8, 22.5, 22.5, 21.6, 21.8</td>
<td>10σ (AB)</td>
<td>59.4</td>
</tr>
</tbody>
</table>

**VST official date for start of operations is October 15, 2011!**
In this period there were the following interventions on the VST, when the telescope was not available for observations:

- **2011-12-05 to 2011-12-12** VST intervention by INAF to work on remaining Action Items after PAC
- **2012-01-06 to 2012-01-10** VST intervention by Paranal engineering for repair and maintenance of rotator brakes, encoders and cooling system
- **2012-01-27 to 2012-02-03** 2 nights OmegaCAM technical time to implement updates on OmegaCAM Software by the consortium
- **2012-02-03 to 2012-02-08** Six nights downtime due to OmegaCAM vacuum problem.
ESO Public Surveys – Spectroscopic PS

**PESSTO survey (PI: S.J. Smartt):**
- Total time requested: 576 nights
- Time allocation: 45n/semester for 4 yrs
- Additional year pending formal review
- NTT with SOFI and EFOSC
- Survey starts in P89, April 2012

**Science Goals**
- Spectroscopic follow up of 150 transient objects (mostly SN candidates) in an un-biased sample of nearby galaxies, from wide area surveys.
- Identify the progenitors of these faint SNe
- Reach a better understanding of the explosion mechanism.

**GAIA ESO survey (PI: G. Gilmore):**
- Total time request: 3000 hrs
- Time allocation: 30n/semester for 4 yrs
- Additional year pending formal review
- UT2 with FLAMES/GIRAFFE
- Survey starts January 2012, 15n allocated in P88

**Science goals**
- Observations of $10^5$ stars distributed among the major components of the MW to get homogenous kinematics and element abundances.
- The spectroscopic data will be combined with GAIA astrometry and provide both the phase space structure and abundance information for the MW stellar populations.

UC 36th meeting, 24 April 2012
Observations carried out in visitor mode
<table>
<thead>
<tr>
<th>GAIA ESO P88</th>
<th>GAIA ESO P89</th>
<th>PESSTO P89</th>
</tr>
</thead>
<tbody>
<tr>
<td>01-05 Jan 2012</td>
<td>06-11 Apr 2012</td>
<td>20-21 Apr 2012</td>
</tr>
<tr>
<td>23 – 28 Sept 2012</td>
<td></td>
<td>22 -23 Sept 2012</td>
</tr>
</tbody>
</table>

**In visitor mode**
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. Ideally it closes the loop with the community by publishing the data obtained with the process initiated by the PI at Phase 1.

ESO’s policies governing Phase 3 are specific to the type of observing programme.

Phase 3 is mandatory for ESO Public Surveys and for ESO Large Programmes since period 75. For other ESO programmes, there is no obligation but PIs are invited to take advantage of the Phase 3.

Further allocation of telescope time for ESO PS is conditional to the submission of data products via Phase 3. ASG is monitoring of Phase 3 process and reports to Public Survey Panels/OPC.
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.
Registration open at
http://www.eso.org/sci/meetings/2012/surveys2012.html

Meeting to be followed by the VISTA PSP review

The goal is to review the whole VISTA program at an important milestone, i.e. 2.5 years after start of data acquisition, and will focus on a re-alignment of the survey program, to ensure its scientific excellence.

Participants will be the VISTA PS PIs, members of the ESO survey teams and management.

Format: Short presentations by PIs, presentation by ESO survey team on survey progress. Data products submission (Phase3) and data access by the community via the ESO archive.
Phase 3 start of operations: 10 March 2011

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

- Instructions and Documentation
- Components
  - Release Manager
  - Validation Tool
  - Upload
- Further information
- User support via usd-help@eso.org, Subj: Phase3
# ESO Phase 3 – VISTA DR1

<table>
<thead>
<tr>
<th>Survey</th>
<th>Submission Date</th>
<th>Date of Observations</th>
<th>Release Content</th>
<th>Pass-bands</th>
<th>Sky coverage (sq.deg)</th>
<th>Type of Data Products</th>
<th>Total volume</th>
<th>Total number of files</th>
<th>VISTA tile images</th>
<th>Pub. date</th>
</tr>
</thead>
<tbody>
<tr>
<td>VVV</td>
<td>03.05.2011</td>
<td>Feb 2010 – Sep 2010</td>
<td>Contiguous patch of bulge and disk region including multi-epoch data in Ks</td>
<td>ZYJHKs</td>
<td>~520 (348 tiles)</td>
<td>Tiles, single-band source lists</td>
<td>1.5 TB</td>
<td>7980</td>
<td>2660</td>
<td>25.07.2011</td>
</tr>
<tr>
<td>VIDEO</td>
<td>03.05.2011</td>
<td>Nov 2009 – Feb 2010</td>
<td>XMM-LSS field</td>
<td>YJHKs</td>
<td>1.5</td>
<td>Tiles, single-band source lists</td>
<td>24 GB</td>
<td>291</td>
<td>97</td>
<td>25.07.2011</td>
</tr>
<tr>
<td>VMC</td>
<td>08.09.2011</td>
<td>Nov 2009 – Nov 2010</td>
<td>2 tiles in the LMC: one overlapping the 30 Doradus and the other the South Ecliptic Pole region</td>
<td>YJKs</td>
<td>3</td>
<td>Stacked tiles and pawprints, single-band and band-merged source lists</td>
<td>8.1 GB</td>
<td>1256</td>
<td>6</td>
<td>25.09.2011</td>
</tr>
<tr>
<td>UltraVISTA</td>
<td>06.10.2011 – 30.01.2012</td>
<td>Dec 2009 – Apr 2010</td>
<td>Deep imaging of the COSMOS field</td>
<td>YJHKs, NB118</td>
<td>1.5</td>
<td>Stacked images, SExtractor catalogues including Ks-selected multi-band catalogue</td>
<td>87 GB</td>
<td>19</td>
<td>5</td>
<td>15.02.2012</td>
</tr>
<tr>
<td>VIKING</td>
<td>10.10.2011</td>
<td>Phase 3 data submission to be closed by P.I.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>19 GB</td>
<td>6276</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

ESO Phase 3 – VISTA DR1

- VISTA DR1 announced on ESO web pages, ESO newsletter & the Messenger
- VISTA DPs available from generic query interfaces for DPs and newly deployed query interfaces

http://archive.eso.org/wdb/wdb/adp/phase3_vircam/form
ESO Phase 3 – Community access

- The total number of Phase 3 data product files downloaded is 2007 for a volume of ~\textbf{940 GB} since Dec 01, 2011

- Data volume and number of files downloaded listed by release name:
  - VHS: 22 GB, 1046 files
  - VVV: 128 GB, 656 files
  - UltraVISTA: 776 GB, 176 files
  - VMC: 8 GB, 80 files
  - VIDEO: 6 GB, 49 files

- Data volume and number of files downloaded listed by data products type:
  - Source lists (tables): 80 GB, 1042 files
  - Calibrated images: 466 GB, 371 files
  - Weight-maps: 387 GB, 411 files
  - Preview images: 3 MB, 59 files
  - Calibrated pawprints: 8 GB, 124 files

- \textbf{Public raw data} downloaded from ESO SAF by the community in same period is 6 TB!
ESO Phase 3 – Next milestones

- April 2012: deployment of the Phase 3 infrastructure with Catalogue validation and ingestion
- May – June 2012: submission of catalogs by VISTA PS
- July 2012 –
  - VISTA DR2 – images, weight-maps, source lists
  - Publication of catalogs via SAF
- November 2012: VST DR1 - images, weight-maps, source lists
- Q1 2013 – Spectroscopic PS DR1
Table 1: Overview of Phase 3 catalogue data deliveries from the ESO/VISTA public survey programmes

<table>
<thead>
<tr>
<th>Name</th>
<th>Title</th>
<th>Content</th>
<th>2012 Data Release</th>
</tr>
</thead>
<tbody>
<tr>
<td>UVISTA_DEEP_CAT</td>
<td>Deep Near-Infrared Catalogue of the COSMOS Field</td>
<td>Aperture-matched source catalogue in YJHKs and NB118 based on the deep stacked images.</td>
<td>✓</td>
</tr>
<tr>
<td>UVISTA_UDEEP_CAT</td>
<td>Ultra-deep Near-Infrared Catalogue of the COSMOS Field</td>
<td>Aperture-matched source catalogue in the YJHKs and NB118 based on the stacked images of the ultra-deep part of the survey.</td>
<td>✓</td>
</tr>
<tr>
<td>VIKING_CAT</td>
<td>VIKING J-Band Selected ZYJHKs Source Catalogue</td>
<td>Merged multi-band source catalogue with aperture-matched photometry in ZYJHKs for all objects selected and defined in J-band.</td>
<td>✓</td>
</tr>
<tr>
<td>VMC_CAT</td>
<td>VISTA Magellanic Survey YJKs Source Catalogue</td>
<td>Homogeneous epoch-merged and band-merged master source catalogue in YJKs</td>
<td>✓</td>
</tr>
<tr>
<td>VMC_VAR</td>
<td>VISTA Magellanic Survey Catalogue of Variables</td>
<td>Mean magnitude, amplitude/likelihood of variation (when possible), variable type (i.e. RR Lyrae stars, Cepheids, late-type giants, eclipsing binaries).</td>
<td>✓</td>
</tr>
<tr>
<td>VMC_MPHOT</td>
<td>VISTA Magellanic Survey Multi-Epoch Photometry</td>
<td>Homogeneous catalogue of multi-epoch photometric data points listing the measured magnitude as a function of source ID and time of observation (also known as light curve).</td>
<td>✓</td>
</tr>
<tr>
<td>VVV_CAT</td>
<td>ZYJHKs Catalogue in the Via Lactea</td>
<td>Homogeneous source catalogue with aperture-matched photometry on the whole survey area (bulge and plane region) based on the first epoch data.</td>
<td>✓</td>
</tr>
<tr>
<td>VVV_VAR</td>
<td>Catalogue of Variables in the Via Lactea</td>
<td>Mean magnitude, amplitude/likelihood of variation (when possible), variable type (i.e. RR Lyrae stars, Cepheids, late-type giants, eclipsing binaries).</td>
<td>✓</td>
</tr>
<tr>
<td>VVV_MPHOT</td>
<td>Multi-Epoch Ks-Band Photometry in the Via Lactea</td>
<td>One homogeneous catalogue of multi-epoch Ks photometry in the VVV bulge and plane region.</td>
<td>✓</td>
</tr>
<tr>
<td>VHS_DES_CAT</td>
<td>VHS-DES Source Catalogue</td>
<td>Merged multi-band source catalogue with aperture-matched photometry in JHKs.</td>
<td>✓</td>
</tr>
<tr>
<td>VHS_ATLAS_CAT</td>
<td>VHS-ATLAS Source Catalogue</td>
<td>Merged multi-band source catalogue with aperture-matched photometry in YJHKs.</td>
<td>✓</td>
</tr>
<tr>
<td>VIDEO_ELIAS_CAT</td>
<td>Deep ZYJHK's Catalogue of the ELIAS-S1 field</td>
<td>Combined multi-band source catalogue with aperture-matched photometry in ZYJHKs based on the deep (i.e. stacked) images.</td>
<td>✓</td>
</tr>
<tr>
<td>VIDEO_XMM_CAT</td>
<td>Deep ZYJHK's Catalogue of the XMM-LSS field</td>
<td>Combined multi-band source catalogue with aperture-matched photometry in ZYJHKs based on the deep (i.e. stacked) images.</td>
<td>✓</td>
</tr>
<tr>
<td>VIDEO_CDFS_CAT</td>
<td>Deep ZYJHKs Catalogue of the Chandra Deep Field South</td>
<td>Combined multi-band source catalogue with aperture-matched photometry in ZYJHKs based on the deep (i.e. stacked) images.</td>
<td>✓</td>
</tr>
</tbody>
</table>
April 2012: deployment of the Phase 3 infrastructure with Catalogue validation and ingestion

May – June 2012: submission of catalogs by VISTA PS

July 2012 –
- VISTA DR2 – images, weight-maps, source lists
- Publication of catalogs via SAF

November 2012: VST DR1- images, weight-maps, source lists

Q1 2013 – Spectroscopic PS DR1
Eleven public survey projects ongoing – several hundreds astronomers involved as PIs, co-Is – lots more DP to be ingested/validated/published

~7 TB of DPs from VISTA DR1 were transferred, validated for standard and contents, and then ingested into the ESO archive.

The community accesses these DPs and has downloaded ~1TB since official announcement of VISTA DR1 on 12/2011

Phase 3 is fulfilling its goals in terms of

- Supporting PS and advertise their scientific results (NAM2012, 21 referred papers, 11 ESO PRs, etc.)
- Delivery & publication of data products - Community is eager to download/access them.