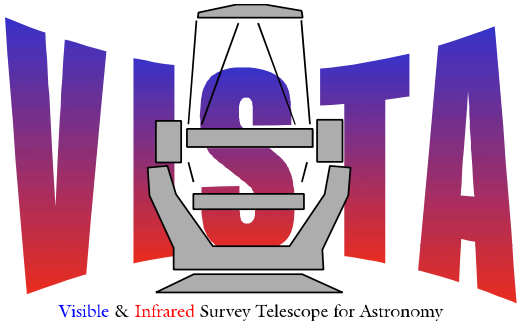

Visible & Infrared Survey Telescope for Astronomy

Data Flow System

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Notification List

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Contents

1 Introduction

Section 2 of this document outlines those aspects of the VDFS specific to the UK version of the pipeline and the general approach to dealing with the differences with respect to the ESO pipelines.

A large amount of documentation describing the functionality of the VISTA pipeline designed for ESO (Garching and Paranal) is available and the relevant documents are listed in Section 3 below. These documents describe in some detail the processing and calibration of VISTA data and will be common to both the ESO and UK versions of the pipeline. In addition the allowed observing and calibration modes are also described.

A number of relevant VDFS reports have been produced and are listed in Section 4. Some are specific to WFCAM and will be updated to incorporate VISTA where appropriate; others are already applicable to both. An example is the detailed Photometric Calibration document for WFCAM, which has been modified and incorporated as part of the VISTA Calibration Plan. Other documents, e.g. aspects of PSF fitting will be re-released as versions including VISTA-specific examples. In addition to the reports a list of useful publications is also given in this section.

Section 5 lists other documents that are relevant to designing and carrying out surveys on VISTA. These include the specification of the VISTA Exposure Time Calculator (ETC) and a link to a working version of the ETC to illustrate the sensitivity of VISTA and the efficiency of doing surveys with it; and the Survey Area Definition Tool document which forms the link between the survey PI and the standard ESO observing preparation tool (P2PP).

Section 6 specifies the pipeline version deliverables and gives an updated estimate of the timeframe for delivery.

Section 7 goes through each of the UK URD requirements and indicates which will need more development effort, which are already covered, and also provides some additional comments where appropriate.

2 UK Pipeline Specific Docs

2.1 VDFS UK Pipeline Software Architecture Design

System pipeline processing architecture will either be based on the extant WFCAM pipelines in Cambridge or on an enhanced version of the ESO Garching pipeline (the data reduction library is a CASU VDFS deliverable). The former uses high level perl scripts for pipeline control and header interrogation and updates; CFITSIO for all data I/O operations; and calls specific C-modules for detailed numerical analysis. The

latter runs within the ESO CPL environment using a proprietary data I/O engine, QFITS, but is also based on the same underlying software C-modules.

There are pros and cons to both approaches. The final decision will be deferred until we have more experience of the CPL environment after delivery of early stages of the Garching pipeline and of running test datasets through it.

2.2 VDFS UK Pipeline Enhancements Specification

A first pass at this has been made by examining all the UK VDFS requirements and assessing which ones are already covered by existing pipeline software or planned ESO VDFS deliverables and which ones are not. The results of this exercise are annotated in Section 6. At some point in the near future an assessment of the development effort required for each enhancement will be made. Together with the requirements this can be used to define a priority order for enhancements and possibly also a cut-off point if insufficient development effort is available.

2.3 ICDS: ESO (DICB) + WFAU

The interface control documents between ESO and CASU (DICD - see the DRLD below for the current state of play of the FITS headers and the quality control parameters) and CASU and WFAU (VISTA ICD - see http://www.roe.ac.uk/~nch/wfcam/VDF-WFA-VSA-001-I0/ for an example) specify the format and content of the data, data headers and data products and are crucial to the automation and successful operation of the pipeline and science archive. The main manifestation of this is the FITS file header content, which has to be well defined and agreed upon since it forms the basis of information transfer all the way through from the survey PI, through data taking, data processing, long term data-quality control, archiving and delivery to the end user.

3 Relevant VDFS ESO Docs[1]

VDFS DFS Impact	VIS-SPE-IOA-20000-0001
VDFS Calibration Plan	VIS-SPE-IOA-20000-0002
VDFS Data Reduction Library Design (DRLD)	VIS-SPE-IOA-20000-0010

4 Relevant Reports

WFCAM photometric calibration	VDF-PLA-IOA-00008-0001
Astrometric & photometric distortion for WFCAM & VISTA	VDF-TRE-IOA-00009-0002
Note on non-linearity correction	VDF-TRE-IOA-00008-0003
Atmospheric Differential Refraction in the Infrared	VDF-TRE-IOA-00009-0003

[1] see http://www.ast.cam.ac.uk/vdfs/documentation.html

PSF fitting tests	VDF-TRE-IOA-00016-0003
PSF fitting of WFCAM Data: Astrometry	VDF-TRE-IOA-00016-0004

See also http://www.ast.cam.ac.uk/vdfs/publications.html for related published papers.

5 Supporting Documents[2]

VISTA Infra Red Camera DFS ETC Specification[3]	VIS-SPE-IOA-20000-0009
Survey Area Definition and Progress Tool	VIS-SPE-ATC-20500-0001

6 Updated VDFS pipeline deliverables timetable

6.1 VDFS-v1 delivered during Q2 2005, tuned with WFCAM semester 05A data

- summit pipeline run at JAC under ORAC-DR
- standard pipeline (some catalogue parameters still to be added)
- pre-WFCAM version advanced processing software (stacking, mosaicing, difference imaging, list-driven photometry)
- raw WFCAM archive setup and transfers to ESO archive initiated
- trial versions of automatic PSF generation and PSF fitting (1,2) running on test nights of data

6.2 VDFS-v2 by end of Q4 2005

- as for v1 but with final versions of summit and standard pipeline including full standard catalogue parameter set tuned using 05A data
- further processing PSF fitting stage 1,2 (tested by completing for 05A data)
- trial version of Sersic profile fitting for galaxy images
- database driven software updated for full WFCAM compliance and delivered to WSA including stacking, mosaicing, difference imaging, list-driven photometry and catalogue generation software assessment of feasibility of LSB object detection and nebulosity characterisation (possible descope item)
- photometry characterised and secondary photometric standards setup
- ESO deliverables: DRL prototype test recipes and DRL V0.1 recipes and code, ETC software modules code, updated FDR docs

[2] see http://www.ast.cam.ac.uk/vdfs/documentation.html
[3] see live ETC at http://www.ast.cam.ac.uk/vdfs/etc

- VST data products design requirements assessment and schema for implementation
- assessment of extra processing requirements from UK URD for VISTA

6.3 VDFS-v3 by end of Q2 2006

- as for v1,v2 but with final version of further processing pipeline fully tuned on 1st year of WFCAM data (expect to descope by not attempting full iterative PSF model fitting)
- optimised stacking and mosaicing software coping automatically with variable seeing and extinction/throughput
- detection of transient phenomena using optional adaptive kernel difference imaging software or aperture-based list driven lightcurve analysis
- LSB object detection and nebulosity characterisation (if not descoped by reality)
- trial versions of some of the enhanced software modules to meet surviving extra UK URD requirements (mainly stacking and mosaicing at this stage) tested on WFCAM data

6.4 VDFS-v4 by end of Q4 2006

As for v1,v2,v3 but with addition of

- ESO deliverables: DRL V1.0 recipes and code including
- DRL for VISTA summit pipeline to be run at Paranal to generate QC information
- DRL for VISTA processing pipeline to be run in garching by DMD, main purpose astrometric and photometric calibration, QC information, and standard OB processing for ESO users
- ETC v1.0++ tuned using commissioning data
- VST survey data processing pipeline to be run in Cambridge

6.5 VDFS-v5 by Q4 2007

- DRL v1.0++ for Garching and Paranal updated and tuned using VISTA science data
- final shakedown and tuning of UK pipelines for VISTA based on real science data
- photometry characterised and secondary photometric standards setup

7 UK URD point-by-point

7.1 General Requirements

5.1	covered by the existing design
5.2-3	WFAU, though there is a worry about agreeing to standards that don't exist yet
5.4	covered if buy enough hardware
5.5a	covered by the existing design
5.5b	the comment is covered by 5.5a, *i.e.* there will be a traceable series of processing steps recorded in the headers that provide enough information to do a comparison given the relevant technical description (TBC)
5.6	covered by the existing design
5.7	we need to discuss who is going to do this
5.8	covered by existing design
5.9-17	WFAU

7.2 Astrometric Requirements

6.1	covered by existing design (WFCAM)
6.2	covered by existing design (WFCAM)
6.3-4	covered by existing design (iff sources have high enough signal:noise and iff intra-pixel effects and colour-dependent and other atmospheric effects are not an issue)

7.3 Photometric Requirements

7.1-2	covered by existing design (WFCAM) but 1% may be impossible
7.3	covered by existing design (WFCAM)
7.4	the goal is hard since if you defocus too much it is difficult to measure the aperture corrections accurately and automatically.

7.4 Tiling, Stacking, Microstepping

8.1	covered by existing design
8.2	would require modifications of existing software, but we have severe doubts about the usefulness of this, surely better to do variable objects from either catalogues or difference imaging, since at the pixel level all objects vary due to seeing differences
8.3	from a pipeline POV the same stacking for all is preferred, otherwise as we have noted previously, the information about which stacking algorithm to use has to be propagated all the way through the observing system (the choice of stacking method would have negligible impact on derived QC parameters). Drizzle, SWARP, MONTAGE *etc* are available as external packages so cost-wise it would be better to run different stacking/tiling choices on the archived products

8.4	would require modifications of existing software, however these are already planned and needed elsewhere
8.5	only a modest change required to handle 2x1 interlacing, though the 45 deg implicit rotation requires more thought
8.6a,b	if a choice is really needed this generally moves tiling to the archive end. But why would you want to "trim", since you are throwing information away. Which contributing pixels would you choose ? Since the associated confidence maps convey all this information anyway what's the point ? [its effectively no different to taking the normal stacked pawprints and adding noise to higher confidence pixels]. Another possibility is to modify the catalogue generation software to deal with this (in fact it already does) Option b. is covered by existing design.

7.5 Variable Objects

9.1	could use catalogues or difference imaging for this - see comment to 8.2
9.2	WFAU
9.3-4	WFAU time series analysis is best done as a list-driven photometry application from a master catalogue at the archive end

7.6 Object Catalogues

10.1	covered by existing design
10.2	covered by existing design
10.2	covered by existing design
10.4	WFAU
10.5	WFAU: not all asteroids are catalogued and the surveys will turn up many more than are currently known about which implies this type of detection/flagging is best left until later catalogue matching stages
10.6	probably covered by existing design though would need assessing with real VISTA data
10.7	probably requires a more sophisticated detection filter, this is specialist LSB galaxy detection, feasibility would need assessing with real VISTA data. [10-sigma at 4.5x is probably currently met]
10.8-9	radioactive detectors and large patches of bad pixels notwithstanding
10.10	in planned design enhancements for WFCAM
10.11	WFAU this may be tricky if the system does not have reasonably uniform sensitivity (cf. WFCAM)
10.12	same as 9.3?
10.13	same as 9.4?