Report from Operations: La Silla Paranal Observatory back-end

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On behalf of the very many people who are developing and operating the system
The back-end in a nutshell

- The back-end of the VLT data flow system begins when the data acquisition at the telescope ends
  - Data Transfer System
  - Data Processing
  - Quality Control
  - Science Archive Facility (SAF)

- Combination of operations and development

- The menu for today -- some highlights on
  - Operations
  - Science data reduction
  - Data products in the Science Archive Facility
Operations
Highlights from operations - I

- New instruments integrated in the back-end data flow
  - KMOS, MUSE, SPHERE
- MUSE has a tremendous scientific potential, and poses some challenges
  - Raw-to-master CalSelector service to alleviate data reduction for users
  - Work in progress to define a Phase 3 standard for IFU to make science data products available through the Science Archive Facility
  - Reflex workflows being developed with the Consortium

- Quality Control loop with Paranal closed in minutes: instrument health and trending, calibration completeness
  - Information on demand to highlight only critical cases: scoring system significance revised to minimize false positives while still catching actual problems

Highlights from operations - II

Operations of the Science Archive Facility operations ran smoothly

- Inflow: ~4.1 TB/month; outflow ~10.5 TB/month
- Total archive holdings: ~370 TB of data and ~17 billion database rows worth of header keywords
- Infrastructure
  - Back-up copy with the IPP’s RZG here on campus
  - Migration of all operational systems from obsolete Solaris to state-of-the art Linux machines
Science data reduction
HAWK-I

- Part of the UK extended in-kind contribution
- Develop science grade CPL pipeline modules
  - Distribution to the community wrapped in Reflex workflow
- Reprocess data for archival ingestion
- The science quality looks excellent!

Current

New
KMOS Reflex workflow
KMOS Reflex workflow
Sky correction tools

- Tools to correct for atmospheric telluric absorption and emission publicly released
  - Part of the Austrian in-kind contribution towards joining ESO
  - *Molecfit*: corrects for atmospheric absorption features, based on fitting a synthetic sky transmission model
  - *Skycorr*: removes sky emission in science spectra, adapts a reference sky spectrum to a science spectrum taken at a different time
  - *SkyCalc*: advanced model of the sky emission and transmission spectrum at Cerro Paranal, applied, e.g., to the Exposure Time Calculator

http://www.eso.org/sci/software/pipelines/skytools
Sky correction tools

http://www.eso.org/sci/software/pipelines/skytools
A prototype Reflex workflow exists

- To evaluate the quality of the data reduction modules
- To finalize the workflow design itself by identifying the location and nature of the interactive reduction steps
- The expected timeline is to have a public release by October 2014
# Pipeline development in 2014

## Active development

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Data products in the Science Archive Facility
Data products in the SAF: introduction

- Science ready data products through the Science Archive Facility to foster their quicker, wider use

- Two channels to feed the archive with data products
  - **Internal** automated processing with scientifically validated pipelines
    - UVES echelle (100,000+ spectra from 14 yrs of ops), X-Shooter echelle about to start, then HAWK-I and VIMOS IMG (UK in-kind), FLAMES-MEDUSA, KMOS, MUSE, …
    - Migration into Phase 3 of legacy historical Advanced Data Products
  - **External** Principal Investigators of Public Surveys, Large Programmes, … provide high-level products (mosaics, source catalogues, …) that we validate and integrate
    - All 11 Public Surveys have returned data products
      - However, some are only partially compliant
    - Celebratory section in December 2013 Messenger: papers from ESO, the Survey Teams and archive users

- Building high-quality, extensive content…
Access to Survey products - I

Data volume (GB)

Number of files

~1800 unique requests by ~450 unique users
Access to Survey products - II

~1800 unique requests by ~450 unique users
Access to UVES reprocessing products

On average 500 files/week, 20 requests/week

- Files downloaded (/1000)
- Distinct requests (/10)
- Distinct users

117 users
92,998 files
472 requests
The Archive as Science Resource

Archive paper: none of the authors was part of the original proposal

- 30% of 2013 VLT/I archive papers used data products (40+ papers)
- 135 papers from Public Survey Teams, 15 archive papers

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The Science Archive Facility is being filled with high quality data products
- Goal: establish the SAF as a major source of high quality data products, in addition to its traditional role as source of raw data
  - Equips ESO with strategic scientific capability
- “Joint venture” with the community. It does require quite some work on both sides

The response from the community in terms of access to the data is encouraging
- Archive downloads doubled in the last six months
- We need to keep advertising our services

Next is to build archive services to facilitate and enhance data exploitation