MUSE data reduction & analysis

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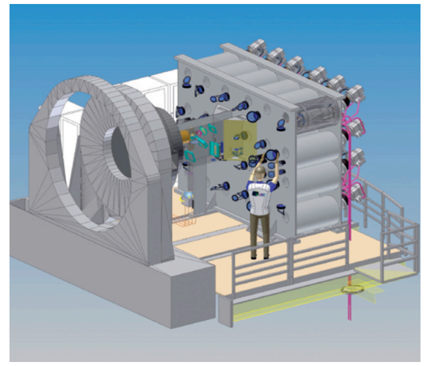
AIP

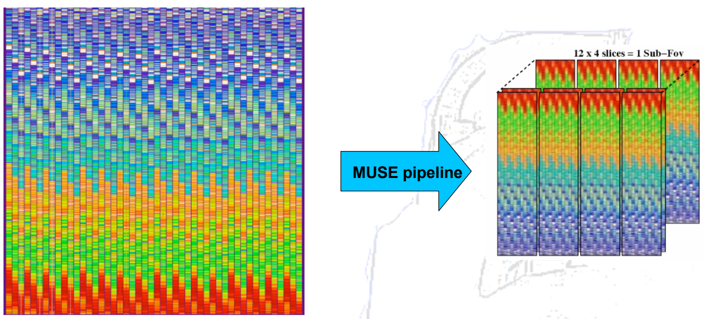
The Multi Unit Spectroscopic Explorer (MUSE, Bacon et al. 2006) is an ambitious 2nd generation VLT instrument that will be available by 2012. This wide field (1 arcmin, 0.2 arcsec sampling) optical (465-930nm) integral field spectrograph with adaptive optics support generates 24 times 4kx4k of data per exposure. A quick-look reduction at the telescope is essential to assess the data quality and to interactively change the observing strategy.



Representation of the 24 spectrographs that make up MUSE on the Nasmyth platform of the VLT.

MUSE pipeline in the ESO framework

ESO stipulates that all pipeline procedures are written as C plugins to the ESO recipe execution tool: esorex. The *Common Pipeline Library* provides the basic functions with which to write the plugins. However, *CPL* is somewhat limited at the moment; interpolation and Gaussian fitting routines are (still) missing. The pipeline reduced data sets are stored in E3D format (a set of FITS tables, see Kissler-Patig et al. 2004).



Each of the 24 MUSE spectrographs observes a sub-field that is broken up into 48 mini slits (15 x 0.2 arcsec each) as shown here on a mock CCD frame. The MUSE pipeline calibrates and extracts all 24 x 48 mini slits and stores them at their correct spatial location in the final data cube.

Data Reduction

The MUSE pipeline performs all the basic reduction steps and assembles the 24 frames into a datacube with minimal user interaction. This is illustrated schematically for a single CCD in the figure on the left. At the telescope an 'online' version of the pipeline is required to perform this process in under a minute.

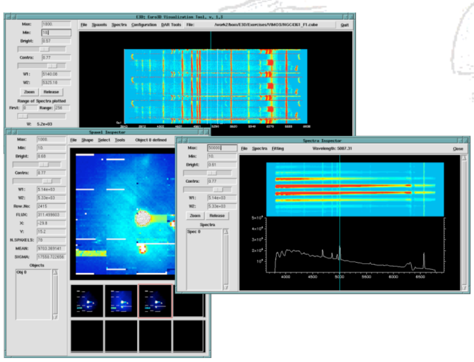
Tests run in IDL show that a basic CCD reduction and extraction of all spectra (without any wavelength calibration) takes about 10 seconds. However, this ignores disk transfer which at the moment stands at around two minutes for all 24 frames.

Data Analysis Software Tools

Within the MUSE consortium the DAST programme has been initiated to develop a comprehensive MUSE analysis package. This is a critical item for the scientific success of MUSE. Although each task is meant to be standalone they are obviously closely linked to each other. A uniform interface is therefore a key issue in the design of these tools.

Visualization Tool

The main purpose of this tool is to visualize, inspect and quantify MUSE data as well as data from other IFUs. Another important goal is to provide a quick look tool with which the telescope pointing can be checked during observations.



The visualization tool will probably be written in python and builds upon the lessons learned from the Euro3D tool (Sanchez et al. 2004). It will handle E3D format natively as this is the standard format for all future ESO IFUs. But it will also work with standard FITS format data. The scope and exact design requirements for the new tool are currently being defined.

Milestones

- Early development stage (now)
  - basic data reduction plugins are written
- Initiated DAST (not an ESO deliverable)
- PDR (mid 2007) Delivery to ESO of:
  - first documentation
  - prototype plugins and mock data
- FDR (2008):
  - full documentation to be delivered
  - prototype of the MUSE pipeline
- Early 2012: First Light
  - complete code
  - testing procedures
  - documentation

References

Bacon et al. 2006, SPIE
Kissler-Patig et al. 2004, AN 325 2, 159
Sanchez et al. 2004, AN, 325 2, 167

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