The Herschel Data Processing System – HIPE and pipelines – doing well during Herschel’s early mission phase

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http://herschel.esac.esa.int/DpHipeContributors.shtml
Overview

• Herschel and Herschel Data Processing
• Key S/W Elements, Status and further Milestones of Herschel Data Processing
• What can HIPE do with Herschel data?
• Summary
Overview of Herschel

• ESA cornerstone observatory
  – Instruments nationally funded

• Far Infrared (55 - 672 µm) space facility
  – 3.5 m Cassegrain telescope – the largest space telescope ever launched
  – 3 science instruments (HIFI, PACS, SPIRE)
  – 3 years routine operational lifetime
Current Spacecraft Status

- Herschel was launched together with Planck on an Ariane 5 ECA 14\textsuperscript{th} of May 2009 on V188
- Herschel reached its operational orbit around L2
- Herschel’s Commissioning Phase successfully completed mid July
- Herschel is close to complete its Performance Verification Phase
- PV Phase is followed by a one-month long Science Demonstration Phase with the Routine Science Phase starting about 6 months after launch
Scope and Methodology of Herschel Data Processing Development

- Development of the Herschel Data Processing System started seven years ago to support the data analysis for Instrument Level Tests
- The system is coded in Java/Jython to be license free and portable for different operating systems
- The system combines for the first time data retrieval, pipeline execution and scientific analysis in one single environment
- All tools for data reduction and analysis, e.g. also the expert applications for ‘Instrument Calibration’, ‘Trend Analysis’ and ‘Quality Control’ systems are part of the Data Processing System
- Herschel Science Centre (ESA), the Instrument Control Centres (HIFI, PACS and SPIRE) and NHSC jointly manage and contribute to the Herschel Data Processing System
Key S/W Elements, Status and further Milestones of the Herschel Data Processing System
Installer

- Installers are available for Windows XP, Vista, Linux, Mac OS X and with or without the Java Runtime Environment for both user and developer versions
Herschel Interactive Processing Environment (HIPE)
User friendly tools

Tools to inspect images, data cubes and manipulate tables
Documentation

- HIPE provides documentation for the framework and all instruments, including search functionality.
Herschel Pipeline Processing

• Pipeline is executed on the ESAC Grid using the Herschel Science Archive to produce Herschel Products to different reduction levels
  – Level 0  raw data
  – Level 1  instrumental and satellite effects removed
  – Level 2  scientific analysis can be performed
Herschel Quality Control

- Data quality control is a combination of automatic screening and manual inspection
- Quality control reports are electronically distributed to experts
Data Access

- HIPE is connected to the Herschel Science Archive, and data can be retrieved directly into an Interactive Analysis Session.
Current Status

- HIPE 1.1 (Performance Verification Phase version) made available to Herschel Key Program teams
- First bulk reprocessing exercise of Herschel data started
- First Science Demonstration Phase observations conducted and data provided to observers using an early version of HIPE 1.2
- HIPE 1.2 (Science Demonstration Phase version) under testing
- HIPE 2.0 (Science Routine Phase version) to be made available to Herschel community early next year
- Future HIPE versions will be released regularly

HIPE source code is freely available under the GNU lesser general public license
What can HIPE do with Herschel data?
PACS ‘sneak preview’ of M51 during OD 32

Interactive data processing of the 70 µm channel 30 minutes after data reception.

Elaborate data processing of the 160 µm channel combining several scans.

Three colour picture combining the 160, 100, and 70 µm wavelength bands.

Pipeline processing with operational (pre-launch) pipeline of the 70 µm channel.
HIFI ‘first light’ of DR21 star forming region during OD 39

Pipeline processing with operational (pre-launch) pipeline

Interactive data processing

HIFI HRS Spectrum - HCSS 1.0 L2 Pipeline Product - Object DR21

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HIFI ‘first light’ of DR21 star forming region during OD 39 – Final sky spectra

- Interactive (left – one mapping element) and standard pipeline (right – average of 5 mapping elements) results for HIFI first light using the HRS spectrometer, used simultaneously with the WBS spectrometer.
SPIRE ‘first light’ of M66 during OD 42

Interactive data reduction  Current pipeline processing

http://herschel.esac.esa.int/
SPIRE ‘first light’ of M74 during OD 42

Interactive data reduction
PACS/SPIRE parallel mode observations of the Milky Way

PACS/SPIRE 5 colour image

SPIRE 3 colour
Summary
Summary

• Herschel Data Processing supported Herschel’s Commissioning and Performance Verification Phase

• Herschel Data Processing was able to support the early delivery of science data to the users community and is ready for Herschel’s Science Demonstration and Routine Phase

• During the next months hands-on workshops for Herschel Key Program Teams on Science Demonstration Phase data reduction will follow

• February 2010 the availability of HIPE 2.0 to the whole Herschel community will be announced together with the opening of the Herschel Science Archive

• The Herschel Data Processing System is in a well advanced state, containing an impressive suite of functionality and documentation

You can follow the Herschel news at

  http://herschel.esac.esa.int/Data_Processing.shtml
  http://herschel.esac.esa.int/latest_news.shtml
We are looking forward to demonstrate this exciting state-of-the-art software with in-flight Herschel data during ADASS XX