

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

# **Stephan Ott**

**Herschel Science Centre** 

on behalf of the Herschel Science Ground Segment Consortium

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











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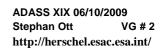
# **Overview**

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- 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













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# **Current Spacecraft Status**

- Herschel was launched together with Planck on an Ariane 5 ECA 14<sup>th</sup> 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 onemonth long Science Demonstration Phase with the Routine Science Phase starting about 6 months after launch











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# 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











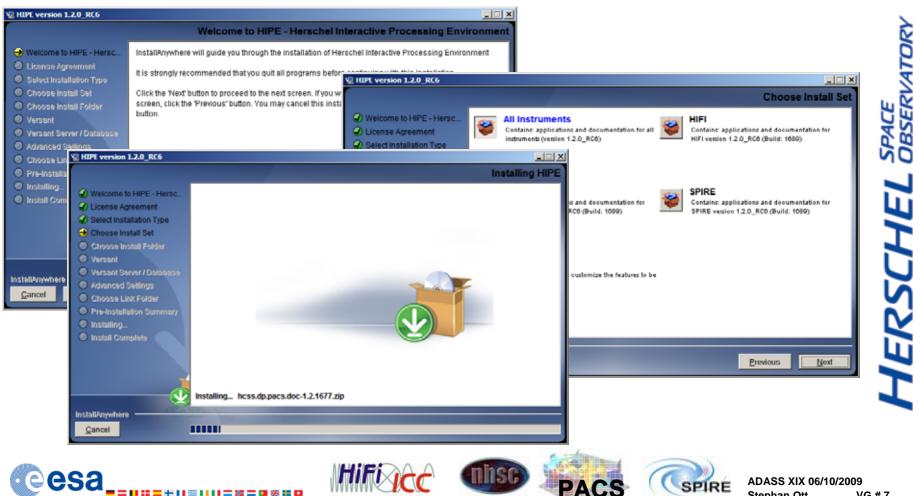
ADASS XIX 06/10/2009 Stephan Ott VG # 5 http://herschel.esac.esa.int/ Key S/W Elements, Status and further **Milestones of the** Herschel Data **Processing System** 

#### Installer



**OBSERVAT** 

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

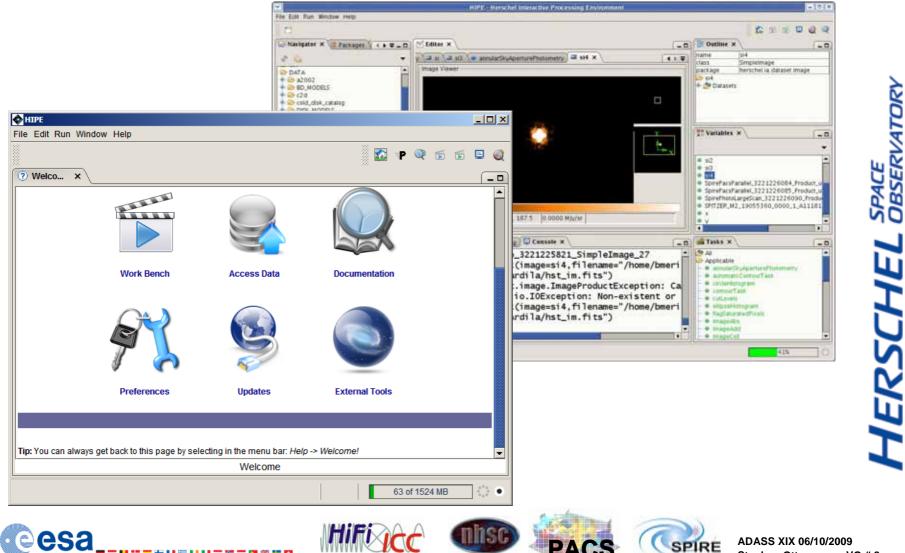


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**OBSERVATOR** 

# **Herschel Interactive Processing Environment (HIPE)**

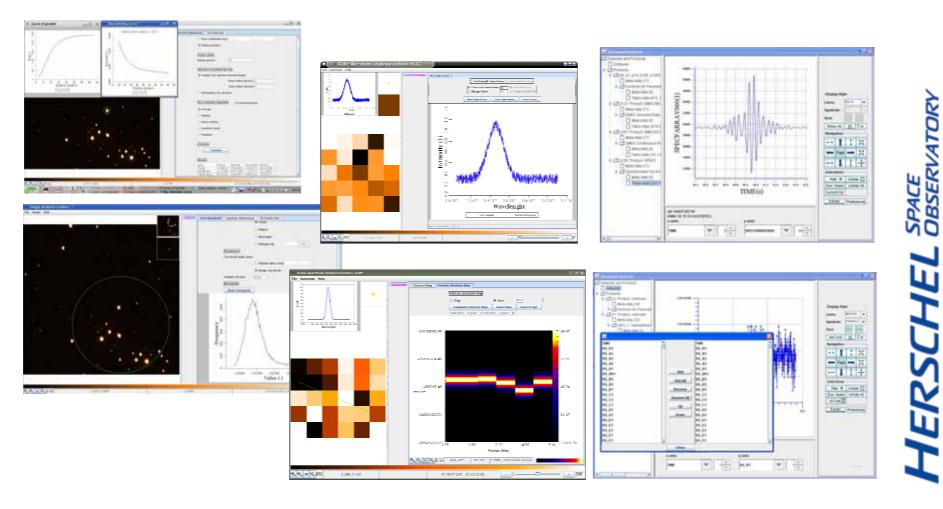


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### **User friendly tools**



#### Tools to inspect images, data cubes and manipulate tables









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#### **Documentation**



# HIPE provides documentation for the framework and all instruments, including search functionality

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### **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

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# **Herschel Quality Control**

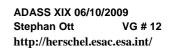


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- Quality control reports are electronically distributed to experts

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#### **Data Access**

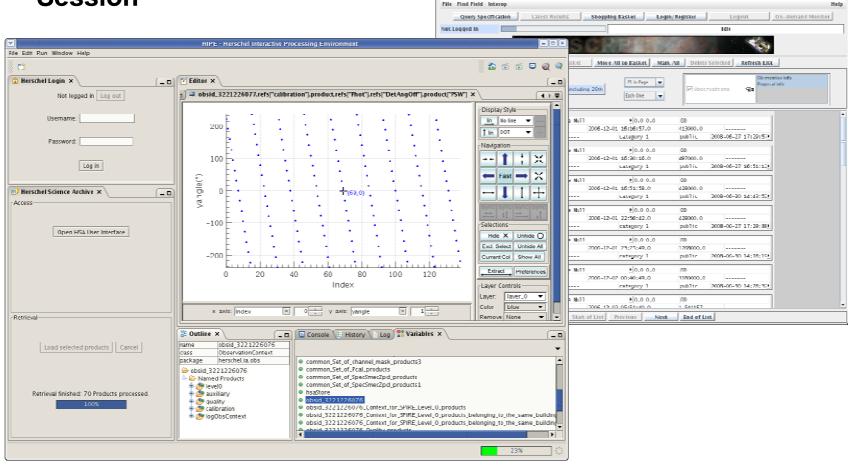


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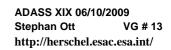
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HERSCHEI

 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





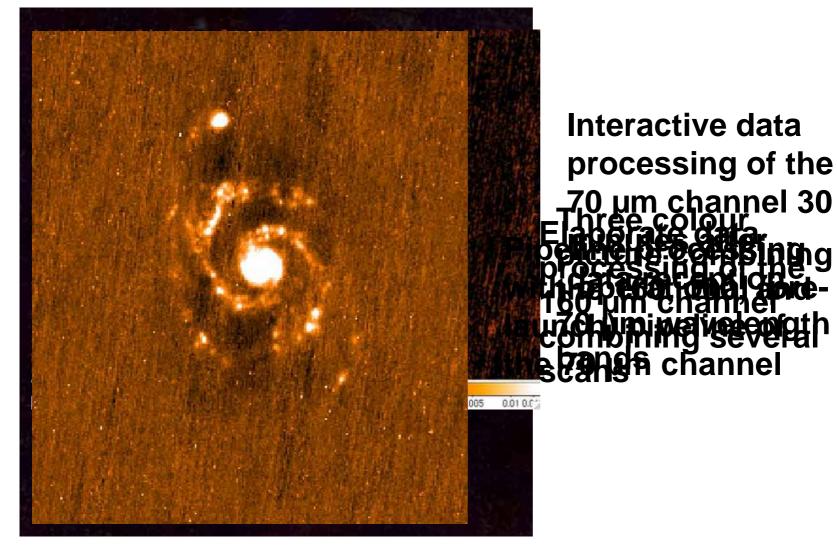






# What can HIPE do with Herschel data?













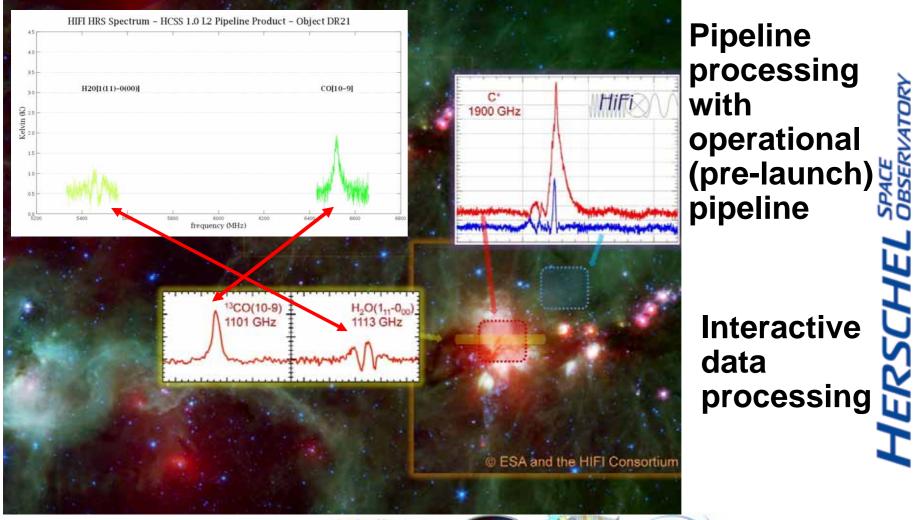


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HERSCHEL OBSERVAN



# **HIFI 'first light' of DR21 star forming** region during OD 39



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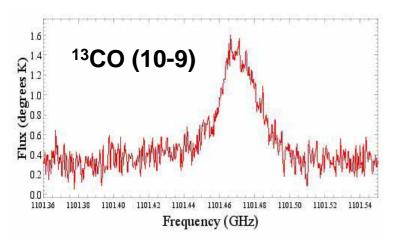


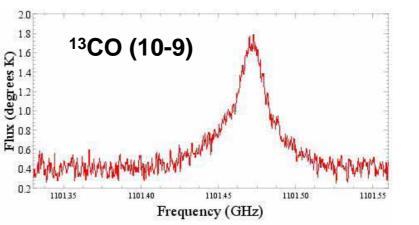




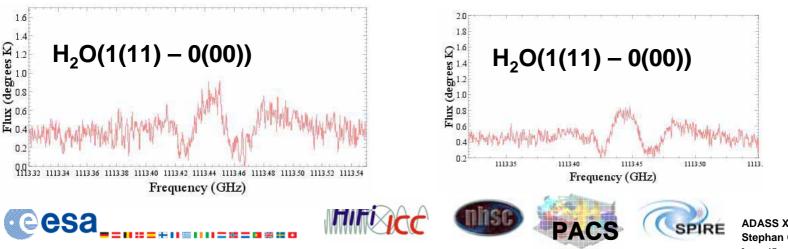
HERSCHEL OBSERVATI

# HIFI 'first light' of DR21 star forming region during OD 39 – Final sky spectra





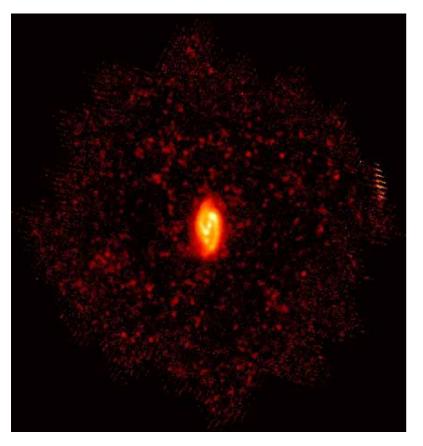
 Interactive (left – one mapping element) and standard pipeline (right – average of 5 mapping elements) results for HIFI first light using the HRS spectrometer, used simultaneously with the WBS spectrometer.

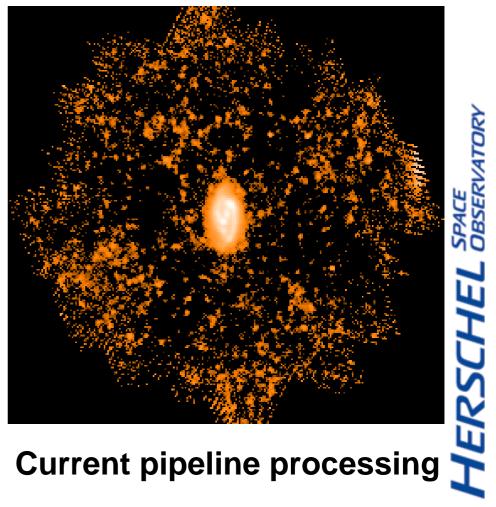


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# SPIRE 'first light' of M66 during OD 42







#### Interactive data reduction





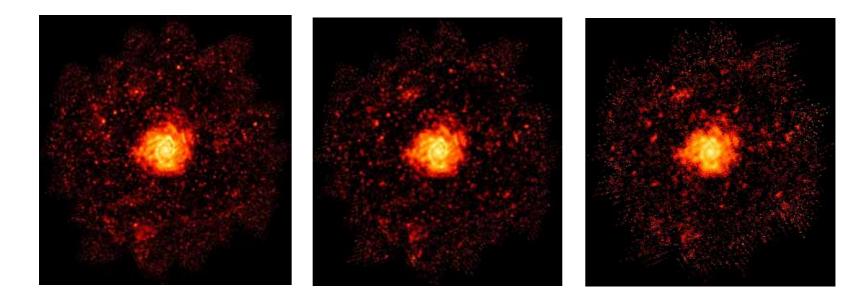




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# **SPIRE 'first light' of M74 during OD 42**





#### 250 µm



500 µm

#### Interactive data reduction









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# PACS/SPIRE parallel mode observations of the Milky Way

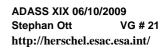












# Summary





- 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









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# We are looking forward to demonstrate this exciting state-of-the-art software with the ledered the during

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