Status Report of, and plans for Herschel Data Processing/HIPE

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with many thanks to all colleagues who contributed and provided inputs

Outline

- ➤ **Data Processing Overview**
- ➤ **Highlights of HCSS 9**
- ➤ **Priorities for HCSS 10**
- ➤ **Data Processing Status**
- ➤ **Post-ops plans for data processing @ HSC**

Herschel observation used as backdrop in the entrance of the new ESAC multipurpose facility showing Álvaro Giménez, ESA's Director of Science and Robotic Exploration and Head of ESAC and ESA's Director General Jean-Jacques Dordain at the opening event

Data Processing Overview

➢ **HCSS 8.0 was released 9th of December 2011**

   ➢ **HCSS 8.1 was released 15th of February 2012**

   ➢ **HCSS 8.2 was released 4th of April 2012**

   ➢ **HCSS 8.3 was released 2nd of July 2012**

➢ **The branch-off – point of HCSS 9.0 was 17th of April 2012. HCSS 9.0 was released 24th of July 2012 after a three month stabilisation and validation period**

➢ **1871 software tickets were implemented _and validated_ – a great step forward!**

➢ **97 tickets were raised during the validation process (comparable number to HCSS 8)**

➢ **Test reports can be found at http://herschel.esac.esa.int/twiki/bin/view/Hcss/AstronomerAcceptanceTesting9**

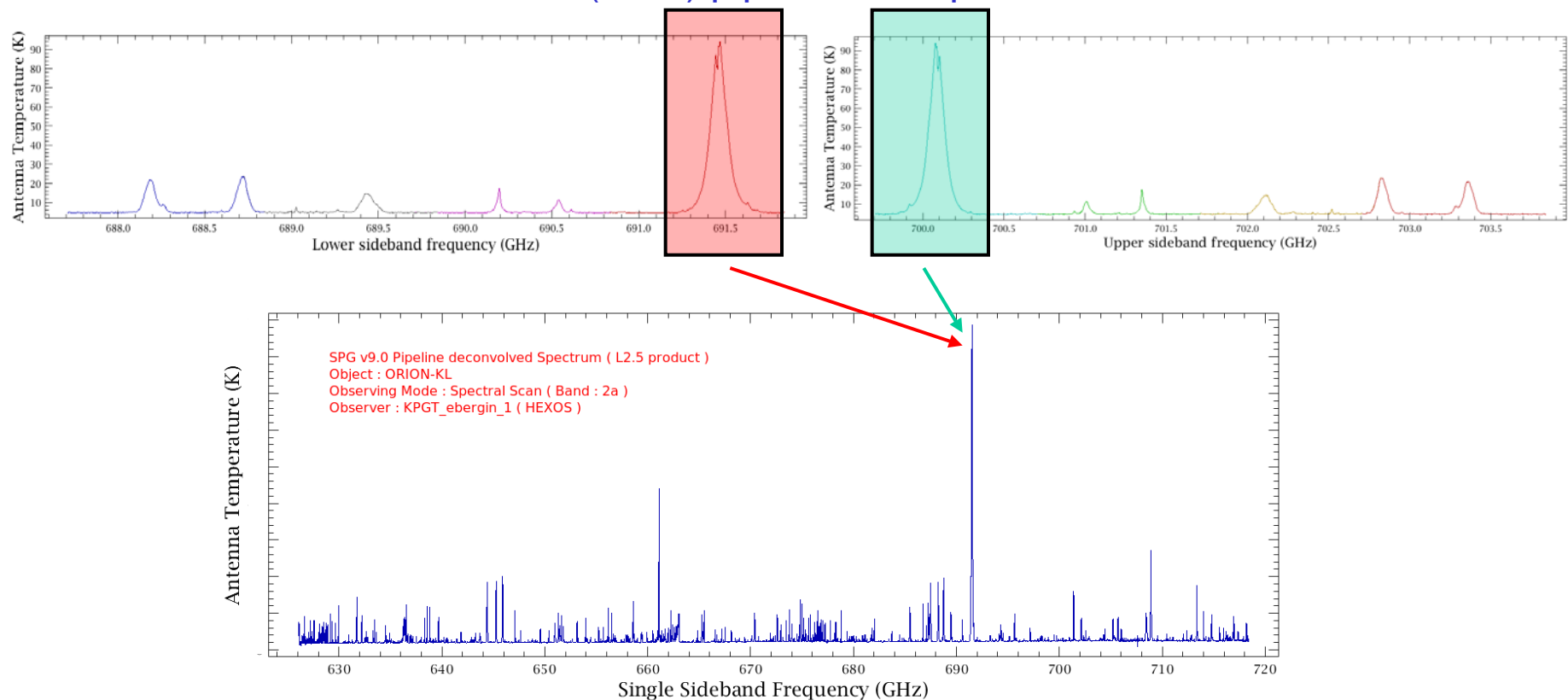# Selection of Highlights of HCSS 9 for Pipeline system, HIPE, Documentation and User Tools

➢ **New cube toolbox**. The new toolbox replaces the Cube Spectrum Analysis Toolbox (CSAT). Common look and feel with the Spectrum Explorer and improved algorithms.

➢ **Easier data access.** Handling Herschel data is now easier with the improved MyHSA getObservation task

➢ **Human-made index**. Added to three core manuals: *HIPE Owner's Guide*, *Data Analysis Guide* and *Scripting* and *Data Mining Guide*

➢ **Comments on documentation.** You can now leave comments at the bottom of any page in the HIPE Help System.

➢ **Support to OSX Lion.** HIPE is now officially supported on version 10.7 of Mac OS X.

➢ The complete overview can be found at
http://herschel.esac.esa.int/twiki/bin/view/Public/HipeWhatsNew9x

Selection of Highlights of HCSS 9 for HIFI

➢ **HIFI level 2.5 product introduced.** For Spectral Scans it holds the deconvolved single sideband solutions; for Maps it holds the cubes; for all cases it holds a copy of the level 2 HTP.

➢ **New interactive pipeline between level 2 and 2.5.** This allows the insertion of tasks like fitHifiFringe and fitBaseline into the pipeline between level 2 and 2.5.

➢ **Browse products added** for spectral scans and maps.

Selection of Highlights of HCSS 9 for HIFI

Deconvolved spectrum is created and attached to the observations by the automatic (SPG) pipeline for Spectral Scans

SPG v9.0 Pipeline deconvolved Spectrum (L2.5 product)
Object : ORION-KL
Observing Mode : Spectral Scan (Band : 2a)
Observer : KPGT_ebergin_1 (HEXOS)

Selection of Highlights of HCSS 9 for HIFI

Browse product is created and attached to the observations by the automatic (SPG) pipeline for Mapping modes
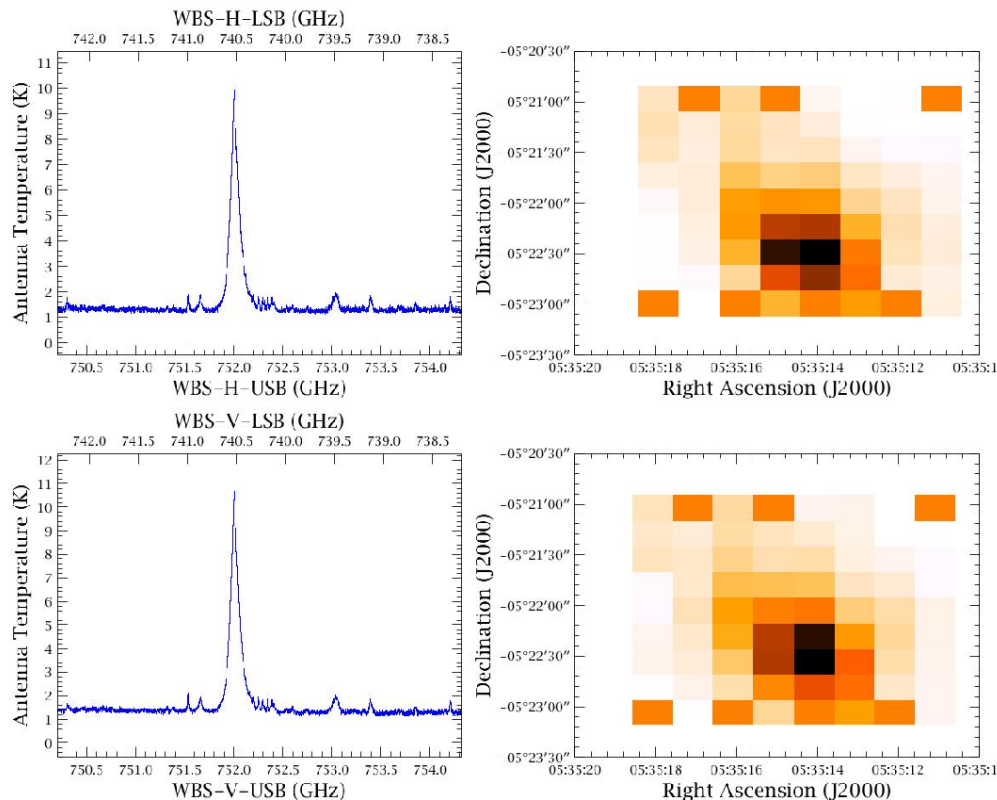

ORION Small Map

2' * 2'

Selection of Highlights of HCSS 9 for PACS

➢ **Photometer.** Addressing additional specific cases in new interactive pipeline scripts. Improved MADmap scripts with a new pre-processing and a post-processing task to remove bright point-source artifacts

➢ **Spectrometer pipeline processing.** Improved pipeline processing for better reliability of broadband features. Level 2.5 product generation for unchopped range mode

➢ **Spectral flatfielding.** Improved spectral flatfielding for wide spectral ranges

➢ **Flux losses.** Correction for flux losses due to pointing jitter and pointing offset

➢ **Flux extraction for point-sources.** Use of central 3x3 spaxel fluxes for a more reliable beam correction. Improved error propagation

➢ **Correction of SSO pointing coordinates**
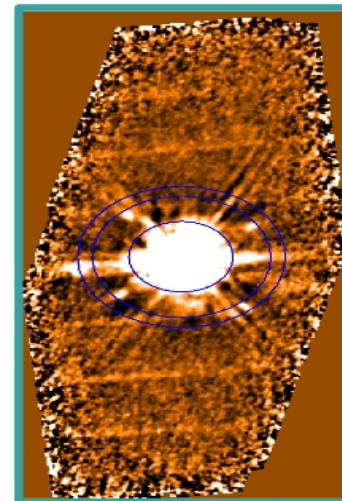
➢ **Improved drizzling routines**

Selection of Highlights of HCSS 9 for PACS

- The **non-linearity correction** has been added in hcss 9.1 correcting the fluxes of bright objects. Values of fluxes calculated in HIPE

- A **better error map** has been developed in hcss 9.1

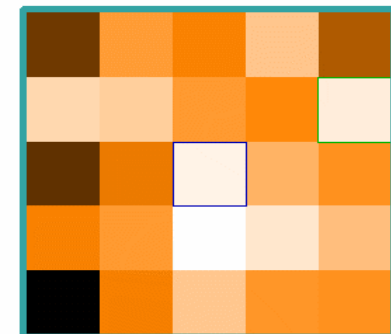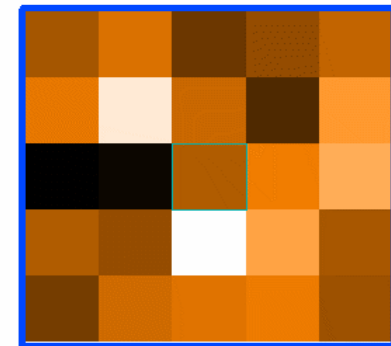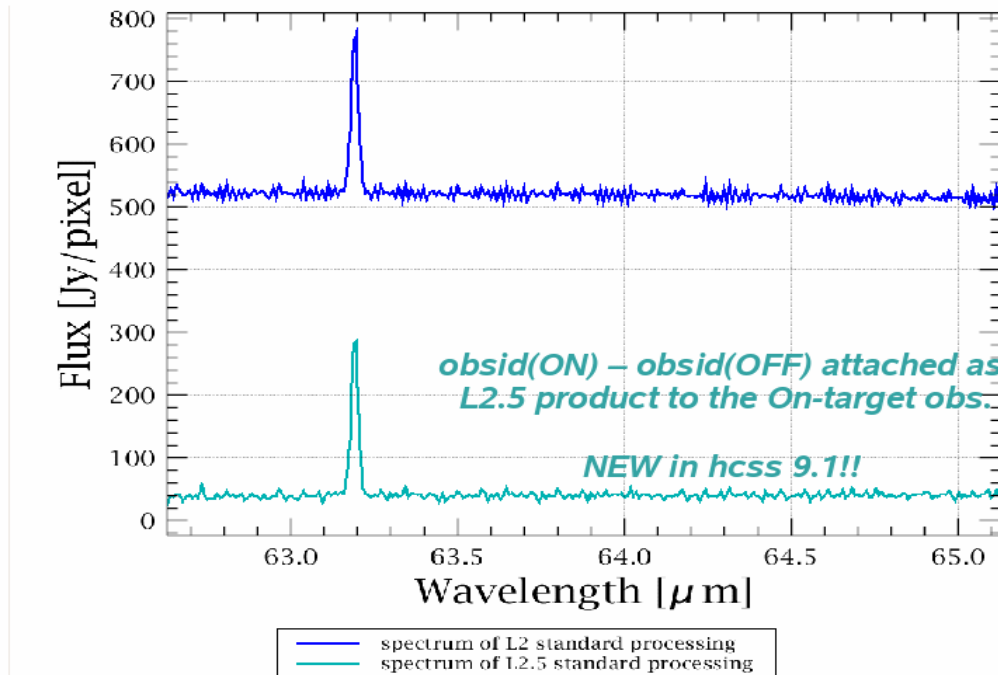| SPG version	Total flux	Intensity per pixel
HCSS 8.2	238.586	0.015
HCSS 9.1	247.810	0.016
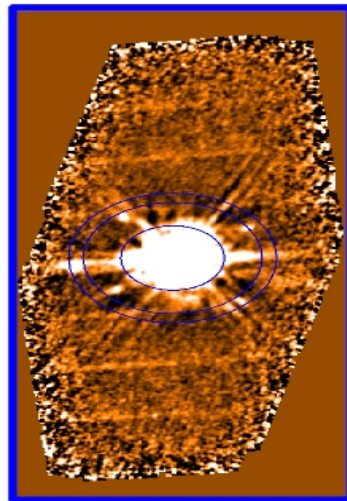
✓ *Calibration version = 32*

✓ *Calibration version = 41*
✓ *Non-linearity correction applied*

Selection of Highlights of HCSS 9 for PACS

Background subtracted for Unchopped Range Spectrometer observations only as Extended Processing (L2.5 products) in hcss 9.1
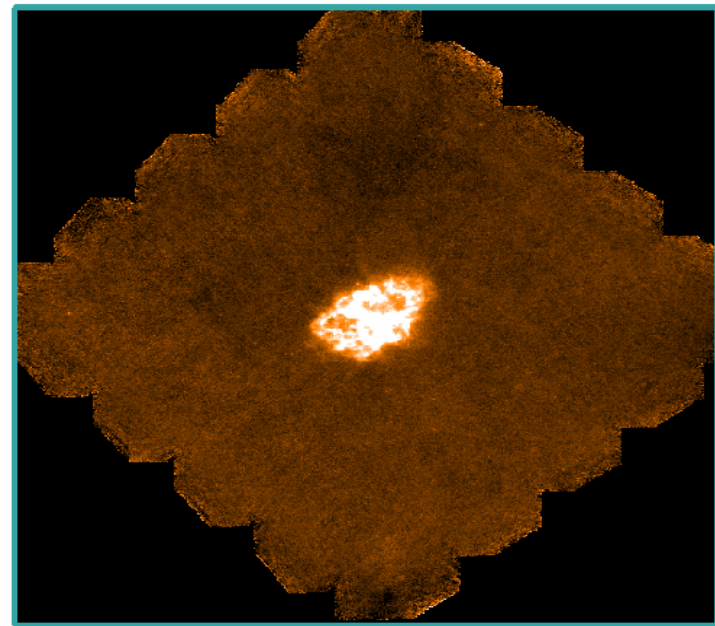

obsid(ON) – obsid(OFF) attached as L2.5 product to the On-target obs.

NEW in hcss 9.1!!

spectrum of L2 standard processing
spectrum of L2.5 standard processing

Selection of Highlights of HCSS 9 for PACS

Improvements in
"photGlobalDriftCorrectionTask"
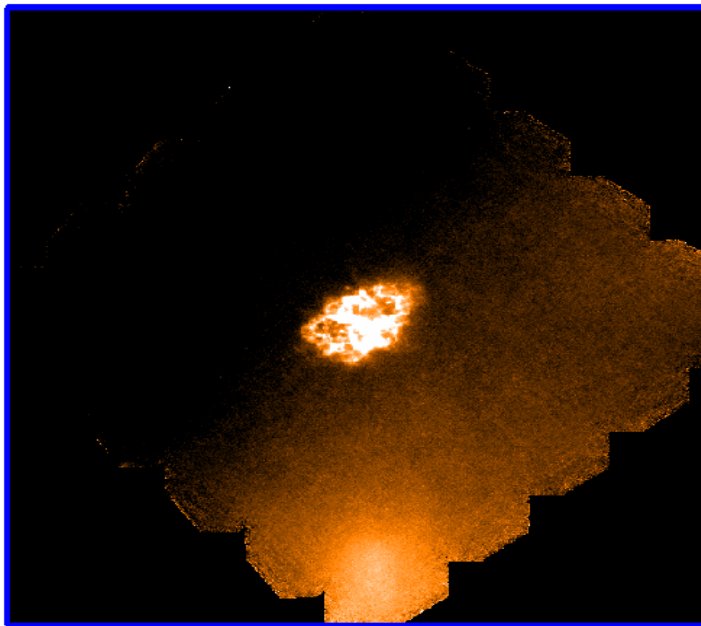
Hcss 8.3 Bulk reprocessing
L2.5 MadMap data
@70 microns

Hcss 9.1 Next Bulk
reprocessing
L2.5 MadMap data
@70 microns

Selection of Highlights of HCSS 9 for SPIRE

➢ **Faster processing.** Improved processing speed using multi-threading

➢ **Cooler burps.** Improved task for correction of *cooler burps*

➢ **Photometer pipeline processing.** Improved error maps and baseline correction by using the destriper

➢ **Spectrometer calibration.** Improved point source and bright mode calibration. Better calibration for low resolution observations

➢ **Spectrometer scripts.** New and updated useful scripts for background subtraction and spectral noise calculation
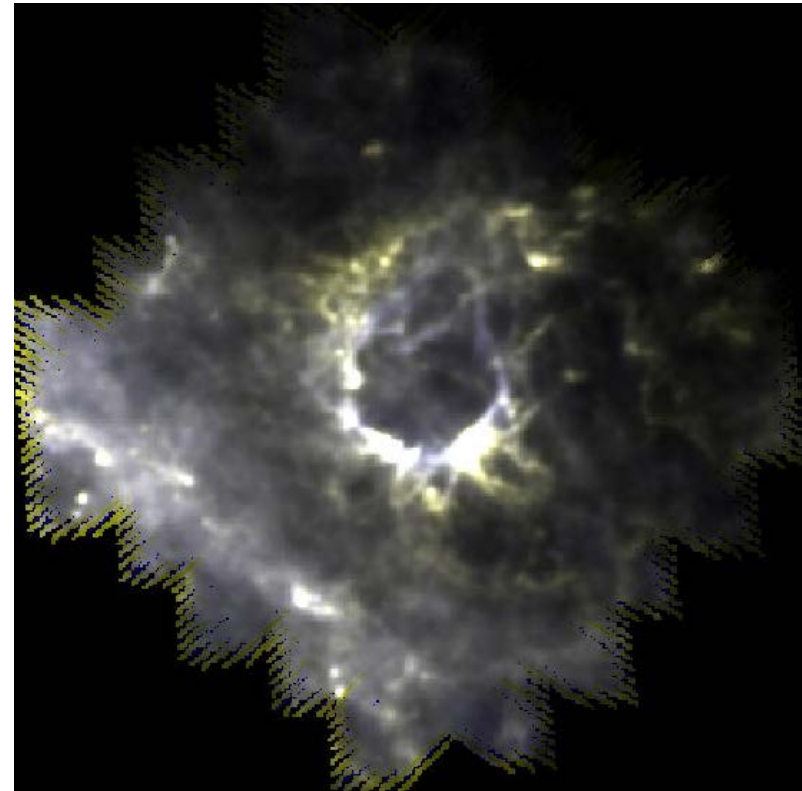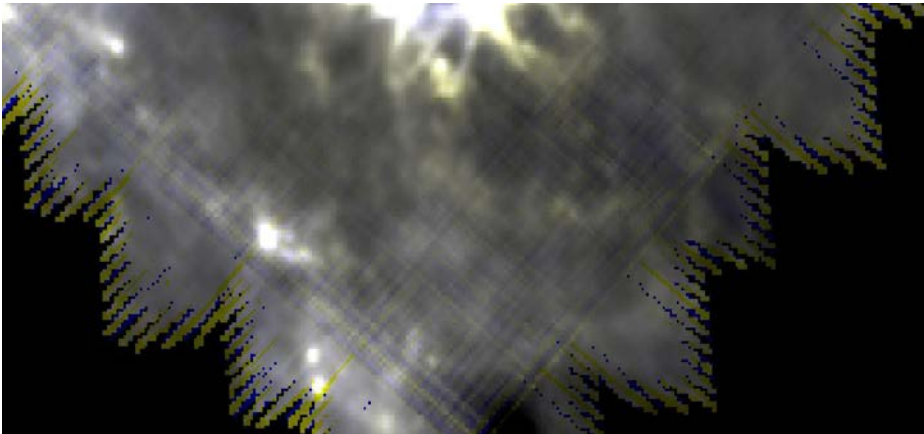
Selection of Highlights of HCSS 9 for SPIRE
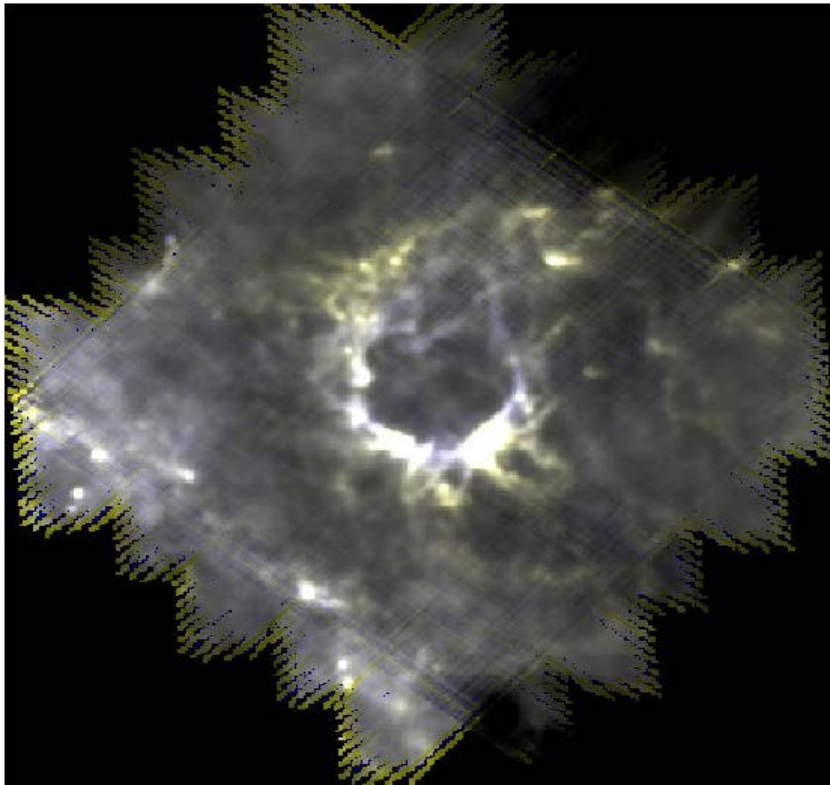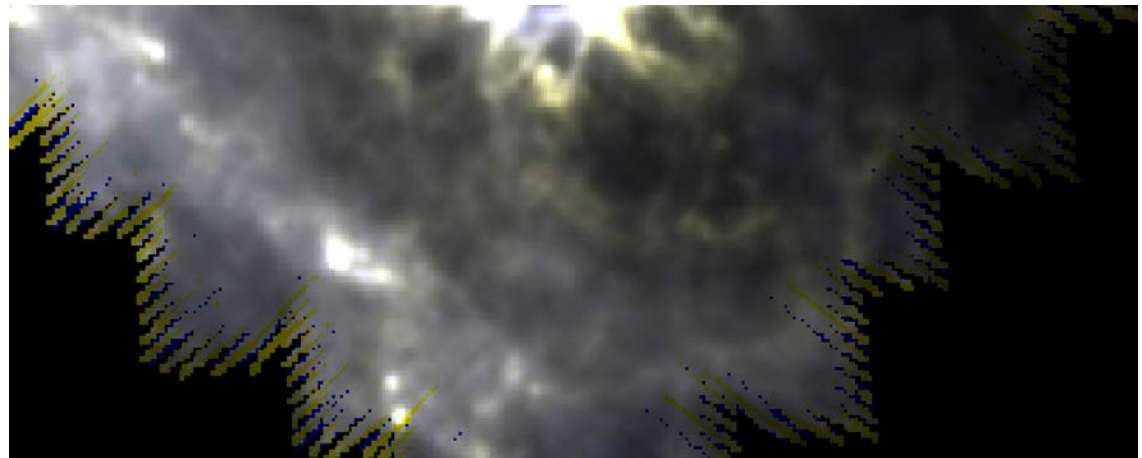

HCSS 9

HCSS 8

RCW120, PI Abergel

Selection of Highlights of HCSS 9 for SPIRE

HCSS 9

HCSS 8

Other main activities in reporting period

➢ **Bulk reprocessing with HCSS 8.** Reprocessing up to level 2 was usually reaching 40 ODs/day, with peaks of 60 ODs/day. Extended processing to level 2.5 was performed for SPIRE in 3 days and PACS in 16 days

➢ **Data processing workshop (ESAC, February 2012).** 53 persons participated. See http://herschel.esac.esa.int/DataProcessingWorkshop2012.shtml and http://herschel.esac.esa.int/twiki/bin/view/Public/DataProcessingWorkshop2012 for more information. News about this workshop were also distributed ESA wide http://intranet.sso.esa.int/esiIntranet/SEMXM62YRYG_ESAC_0.html

Priorities for HCSS 10

1. **Access to, and use of reconstructed pointing products**
2. **Improvements of calibration and data reduction pipelines**
3. **Reduction/optimisation of memory requirements by user pipelines**
4. **Migration to Java 7 (to be confirmed)**
5. **Harmonisation of Python syntax in HIPE**
6. **Improvements to display and plot**
7. **Convolution kernels cross-Herschel, cross-missions**
8. **Code improvements, including test harness coverage**

Additional future activities

- **NHSC NHSC OT2 Data Processing Workshop (Sep 2012)**
  https://nhscsci.ipac.caltech.edu/sc/index.php/Workshops/OT2DPSep2012

- **Bulk reprocessing of Herschel observations**

- **Map-making workshop (January 2013)**
  http://herschel.esac.esa.int/2013Mapmaking.shtml

- **HIPE Forum 2012 9-11 October 2012 in ESAC**
  http://herschel.esac.esa.int/twiki/bin/view/Hcss/HipeForum2012

  1. **To get feedback from astronomer users on how they use HIPE and how the system can be improved.**

  2. **To take stock of the quality of products generated with the SPG pipelines, quality control flag and logs and interactive reduction tools in HIPE, and the improvement outlooks for the near and far future.**

Scope of HIPE forum ctd

3. Exchange of knowledge between software developers on technical skills, tools and practices

4. Exchange of knowledge between users and software developers about how HIPE tools are being used / how HIPE tools were intended to be used / how HIPE tools should be used.

5. To get feedback on the use of documentation. Where to go for WWW/TWiki/Videos. Organisation of WWW pages

6. Define roadmaps for new or remaining development challenges, especially in view of reduced manpower for post-operations

7. To learn of Herschel data reduction tools outside of HIPE in order to understand to either include the functionality or improve connection between these tools
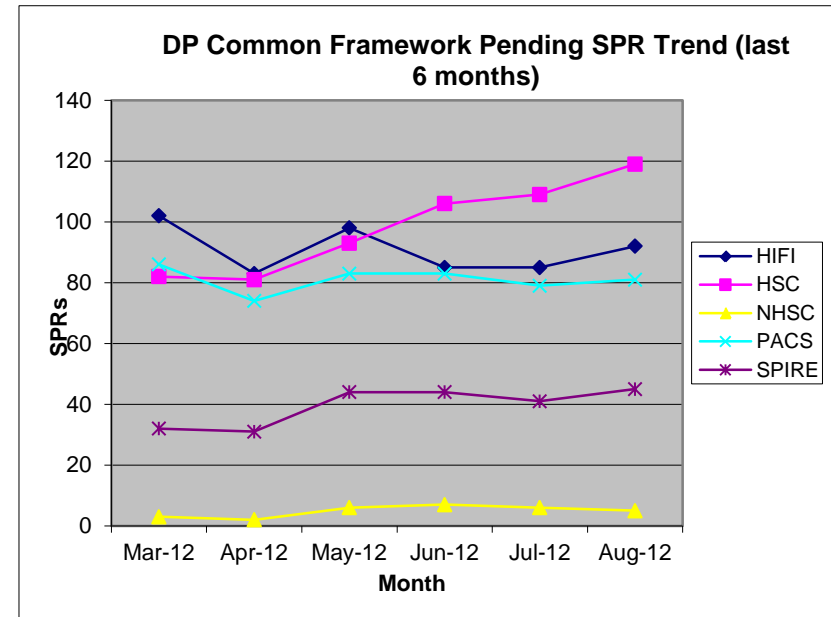
I hope to welcome a lot of HUG members in the HIPE Forum!

Project development statistics
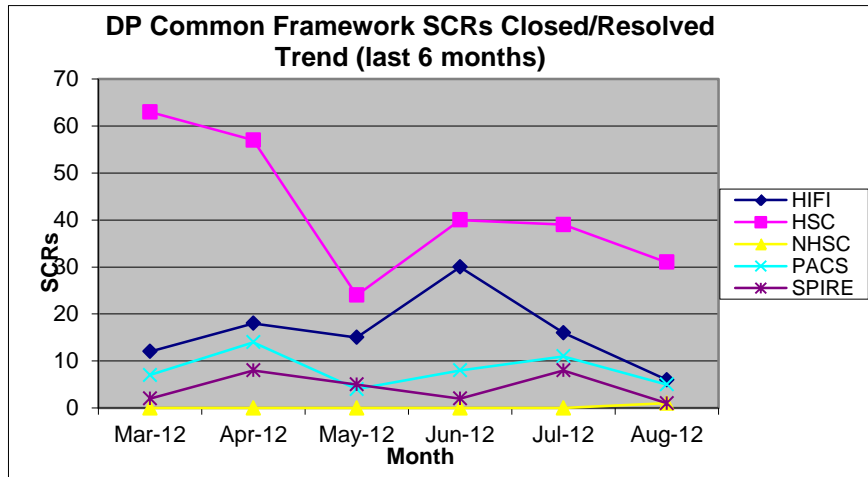## Trend of s/w tickets for pipeline system, HIPE, documentation and user tools
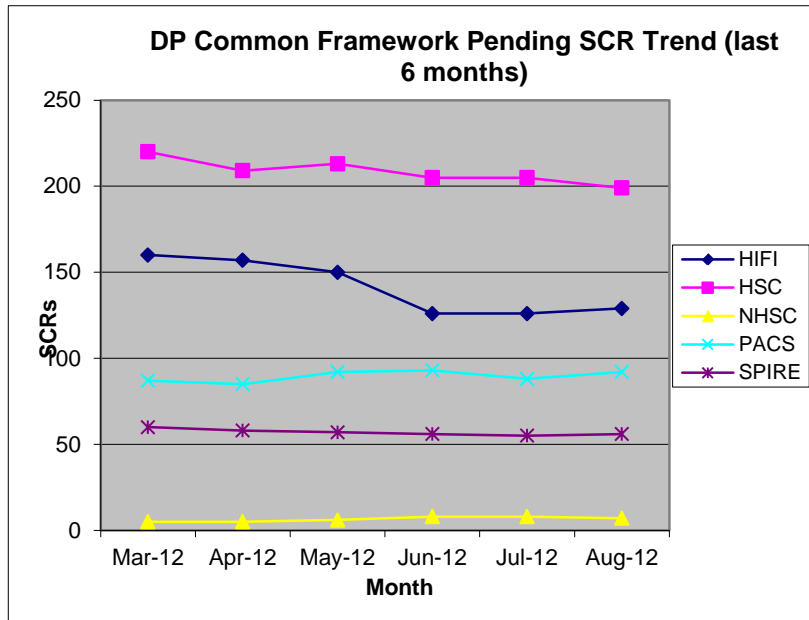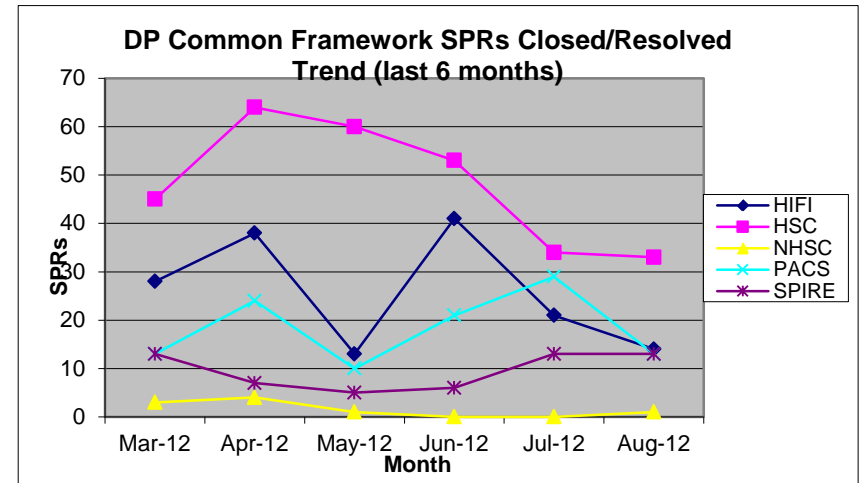

stable number of change requests

Overall stable number of problem reports; increase due to clean-up exercise

Project development statistics:
Closure rate of s/w tickets for pipeline system, HIPE, documentation and user tools

Change Requests

Problem Reports

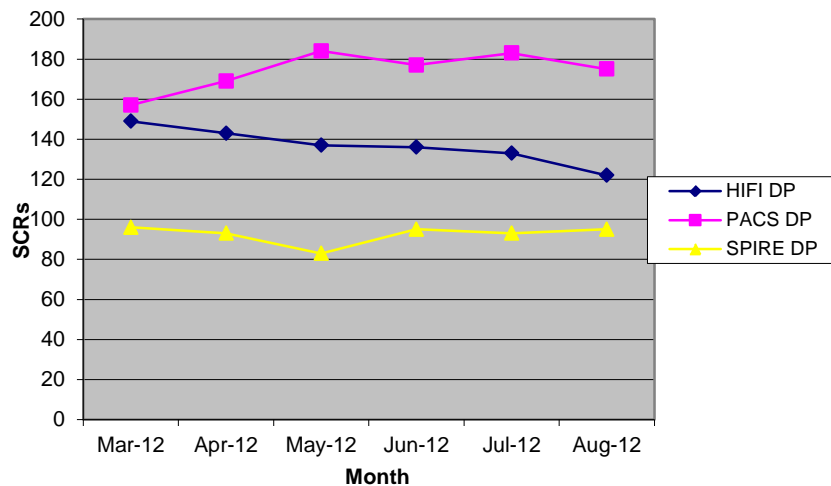Around 200 s/w tickets are implemented each month

Project development statistics:
Trend of instrument DP s/w tickets

Pending SCR Trend Chart (last 6 months)

HIFI DP, PACS DP, SPIRE DP

Pending SPR Trend Chart (last 6 months)

HIFI DP, PACS DP, SPIRE DP

number of software change requests overall stable
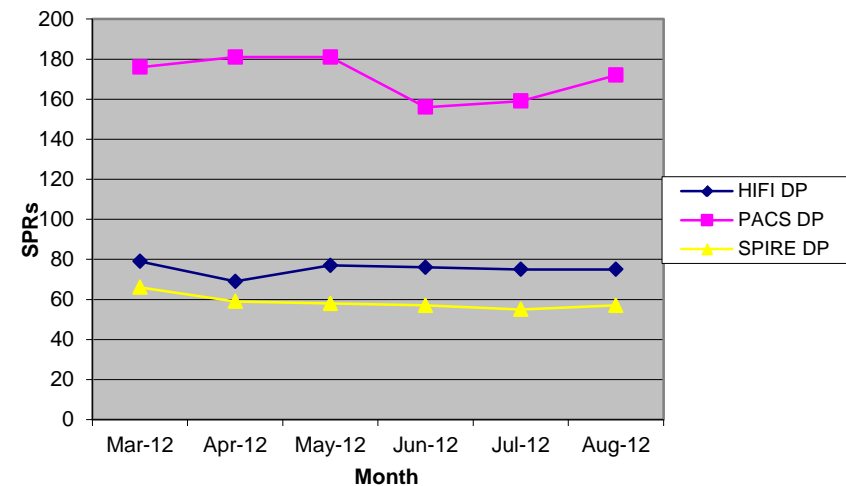
number of software problem reports overall stable; number of PACS SPRs remains high

Project development statistics:
Closure rate of instrument DP s/w tickets

SCRs Closed/Resolved (last 6 months)

Legend: HIFI DP, PACS DP, SPIRE DP

SPRs Closed/Resolved (last 6 months)

Legend: HIFI DP, PACS DP, SPIRE DP
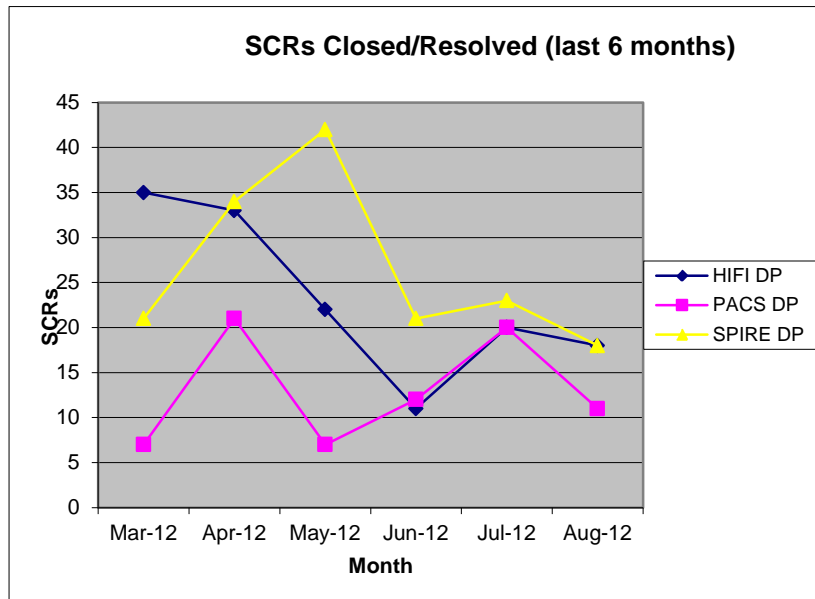
Change Requests   Problem Reports

Around150 s/w tickets are implemented each month

Post-ops plans for data processing @ HSC (1) History

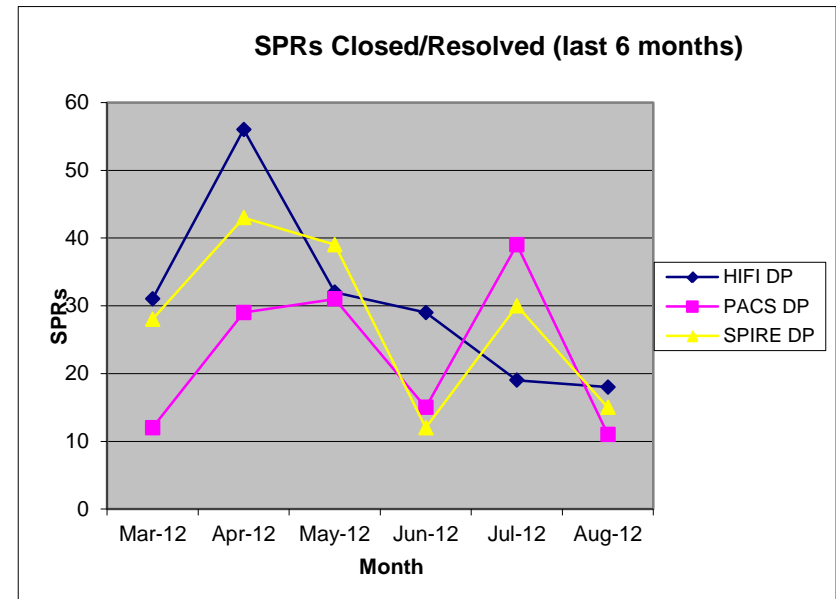➢ **When the Science Management Plan was approved in 1997 it was considered sufficient to provide astronomers with raw data only, and no 'data products' were to be generated and made accessible**

➢ **In 2002 it was realised that expectations of the astronomical community on what to expect from observatories and their data processing systems, data products, and archives have evolved; what was once considered acceptable is no longer considered palatable**

Post-ops plans for data processing @ HSC (2) History

➢ **In 2005 ESA's Science Programme Committee approved additional funding for an "extended Data Processing" development, recognising that Herschel observatory must offer its users, the astronomical community, comprehensive means, beyond observing opportunities, to do science. This permitted to award contracts to the Instrument Control Centres / provide funding for the Herschel Science Centre to hire developers to work on software for data products, algorithms, pipeline and observers' framework and support during operations**

➢ **The matter of "extended" Data Processing activities in the post-operational phase was not addressed**

Post-ops plans for data processing @ HSC (3) History

HUG internal only

Post-ops plans for data processing @ HSC (4) Comparison

HUG internal only

Post-ops plans for data processing @ HSC (5)
Comparison

HUG internal only

Post-ops plans for data processing @ HSC (6) Development priorities

➢ **Most important are the archive products that come from standard pipeline processing of the science and calibration observations that were made throughout the mission lifetime. Therefore the support to the pipeline processing environment and the generation and quality control of products has the highest priority**

➢ **The second highest priority is the maintenance of the interactive data processing system so that the astronomical community has the best means to exploit Herschel data in detail, and the experts from the ICCs and the HSC can continue to improve algorithms and calibration**

Post-ops plans for data processing @ HSC (7)
Development priorities

➢ **Documentation is the third highest priority as the analysis software and data products need to be well described so that the best science results can be extracted**

➢ **Maintenance of data visualisation and reduction tools, and any changes of basic infrastructure not needed for the SPG or HIPE framework are done on a best efforts basis**

➢ **All very desirable and important work packages like the inclusion of community provided software and ideas into HIPE and maintenance and upgrade of mobile applications can not be addressed**

Post-ops plans for data processing @ HSC (8) Further steps taken

➢ **Frontloading of manpower profile to minimise task swapping and excessive reprioritisation discussions as well as possible**

➢ **Herschel data processing activities end in 2016 (in line with ICCs, one year earlier than other HSC activities)**

➢ **Negotiations with NAOC (China) to ensure additional software development support are ongoing**

Post-ops plans for data processing @ HSC (9) Outlook

➢ **During the last year over 2200 non-instrument specific data processing tickets were implemented. With the currently allocated manpower one can forecast that around 700 data processing tickets will be implemented during the first year of post-operations, and even less in the following years, leaving all normal and low priority, and a sizable fraction of high priority tickets unresolved**

➢ **There is no reserve to support resolution of system wide problems or major software upgrades (major changes in Java/Jython version or development infrastructure)**

Looking forward to your reactions and questions