1. SPIRE Spectrometer Launch Pad

1.1 Does the observation data need re-processing?

*Data processing recipes for the Spectrometer are covered in SDRG\(^1\) §6.4.*

Re-processing spectrometer data using the User pipeline scripts in HIPE may benefit your observation:

- By using newer improved calibration files – to check the Calibration Tree version see the *SDRG §4.2.*
- Updating to a new Calibration Tree is described in the *SDRG §4.4.*
- By tailoring individual pipeline steps, to optimize the processing for different astronomical sources, e.g. faint, bright, or extended (see *SDRG §6.4*)

1.2 Re-processing with the User Pipeline Scripts

*This topic is covered in SDRG §6.3.1.*

*The Spectrometer pipeline flowchart is shown in SDRG Figure 6.31.*

Simplified User Pipeline Scripts for re-processing SPIRE data are provided in HIPE:

- Accessed directly from the **Pipeline>SPIRE** menu at the top of the HIPE window
- Include processing steps taking the data from Level 0.5, through to Level 1 and 2
- Final results are saved as FITS files (not a pool) to any specified directory
- The Observation Context can also be updated and saved to a new pool

Line by line descriptions of the Spectrometer scripts with example plots are shown in *SDRG §6.3.1*

The scripts assume the following:

- The data are already stored in a Pool on your disk
- The latest **Calibration Tree** is stored as a pool on your disk (to do this, see *SDRG Chapter 4*)

To run the User Scripts, several options must be set **inside** the script:

- Observation ID, data pool name, output directory path (see *SDRG §6.3.3* for other options).

Considerations for reprocessing with the Spectrometer User scripts are:

- **Memory usage** can be reduced by limiting the number of detectors processed in the script
- **Apodization** removes the ringing from the instrumental line function at the cost of reduced spectral resolution. Apodized line profiles can be fitted well by Gaussian functions
- **Second level deglitching** parameters can be modified in the script if there are outlying scans seen in the level-1 spectra (*SDRG §6.3.1*)

Inspecting the data at various stages can provide diagnostic information (see *SDRG §6.3.1*)

General considerations for **faint** and **medium strength** sources are (see *SDRG §6.4.1*):

- Optimise telescope and instrument correction
- Check spectral noise with respect to expected HSpot values
- Compare with SPIRE Photometer
- Compare point source and extended calibration

And for **extended** sources (see *SDRG §6.4.3*):

- Check for clipping in individual interferograms
- Restrict the data made into the cube

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\(^1\) **SDRG SPIRE Data Reduction Guide**
• Examine the actual positions on sky observed
• Change the algorithm used for gridding
• Examine coverage and redundancy in the cube
• Maps with faint continuum
• Account for beam effects

1.3 Further Analysis

SPIRE spectral analysis is described in SDRG §6.5 and cube analysis in SDRG §6.6.

Spectral analysis and visualisation tools are provided in HIPE (right click on product in Variables tab > Open With):

• SPIRE specific SDI/SDS Explorer (SDRG §6.2.6) for viewing spectral/interferograms via a clickable footprint of the detector arrays
• Spectrum Explorer (Herschel Data Analysis Guide Chapters 5 and 6) for viewing one-, two-, and three-dimensional spectral products
• Spectrum Toolbox (Herschel Data Analysis Guide Chapters 5 and 6) for a set of mathematical functions that operate on Herschel spectral data (launched from Spectrum Explorer dialogs menu)
• Spectrum Fitter GUI (Herschel Data Analysis Guide Chapter 7) for interactive line and continuum fitting (launched from Spectrum Explorer dialogs menu)
• Cube Spectrum Analysis Toolbox (Herschel Data Analysis Guide Chapter 6) for spectral cube related tasks (launched from Spectrum Explorer dialogs menu)

Spectrometer useful scripts (Scripts > SPIRE Useful scripts menu at the top of the HIPE window):

• Spectrometer Array Footprint Plot SDRG §6.4.1
• Spectrometer Background Subtraction SDRG §6.4.1
• Spectrometer Line Fitting SDRG §6.5
• Spectrometer Thumbnail Mosaic Plot SDRG §6.2.7
• Spectrometer Convolve Spectrum
• Spectrometer Noise Estimate SDRG §6.4.1

Additional notes for SPIRE Spectrometer data:

• The data obtained from the HSA have not been corrected to the Local Standard of Rest (see SDRG Section 6.5)
• Lines in high resolution FTS spectra should be fitted with a Sinc profile for unapodized data, and a Gaussian for apodized data. Various tools exist within and outside of HIPE to fit lines to spectra (see SDRG Section 6.5)
• The beam size of the FTS changes across the band of each array in a non-trivial way (see SDRG Section 6.4.1.4)