QUICK-START GUIDE TO HERSCHEL-SPIRE

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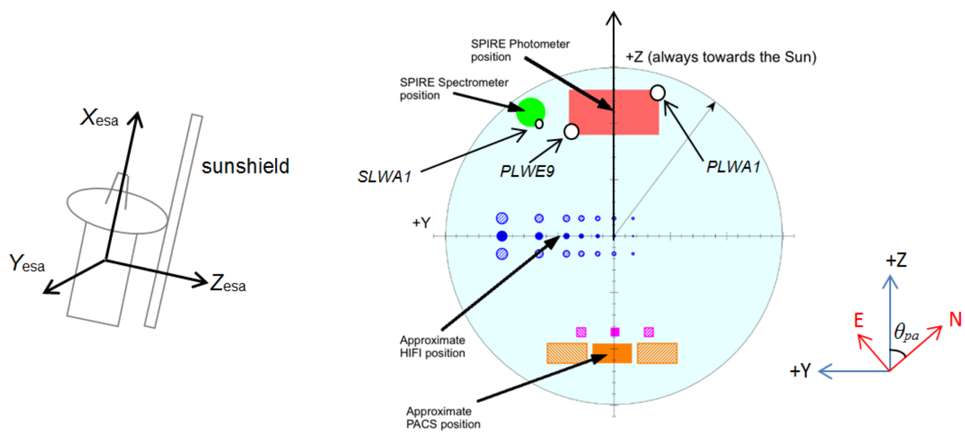
Contents

SPIRE instrument overview

The Spectral and Photometric Imaging Receiver (SPIRE; Griffin et al. 2010) consists of a three-band imaging photometer and a two-band imaging Fourier-Transform Spectrometer (FTS). This sub-mm instrument operated on board the *Herschel* Space Observatory (Pilbratt et al., 2010) between May 2009 and April 2013. Some general characteristics of the two SPIRE sub-instruments are presented in the following table:

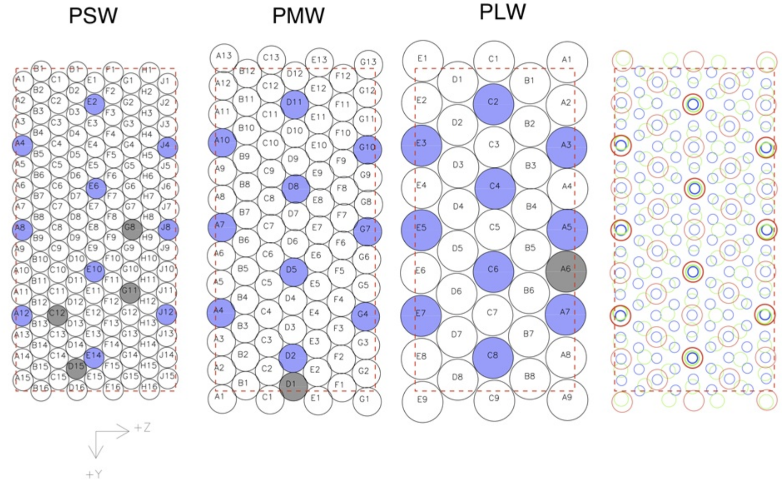
Sub-instrument	**Photometer**			**Spectrometer**	
Array Name	**PSW**	**PMW**	**PLW**	**SSW**	**SLW**
Band (μm)	250	350	500	191-318	294-671
Resolving power ($\lambda/\Delta\lambda$)	3.3	3.4	2.5	$\sim 40 - 1000$ at 250 μm (variable)	
Unvignetted field of view	$4' \times 8'$			$2.0'$ (diameter)	
Beam FWHM (arcsec)	17.6	23.9	35.2	16.5-20.5	31.0-42.8

SPIRE relative location on sky. The centre of the SPIRE photometer is offset by $\approx$11′ from the centre of the highly curved focal surface of the *Herschel* telescope, shown by the large shaded circle. The definition of the spacecraft X, Y, Z axes and position angle, θ_{pa} are also shown. The relative positions of some bolometer detectors from the Photometer and from the Spectrometer are indicated for reference, as well as the other two instruments: PACS (orange and magenta) and HIFI (in blue).

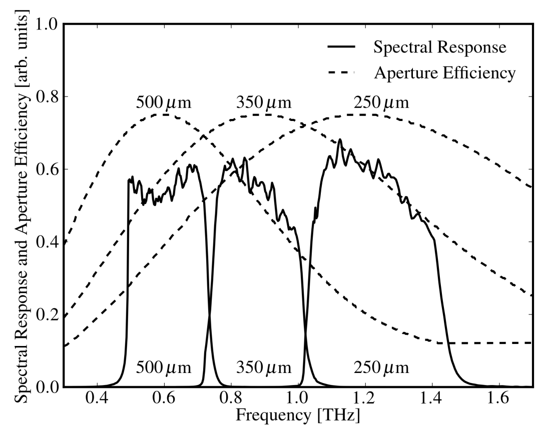


SPIRE Photometer

Photometer bolometer arrays. Each circle represents a detector feedhorn, the bolometer names are also shown. Those detectors centred on same sky positions are shaded in *blue*, the dead bolometers are shaded in *grey*. The $4' \times 8'$ unvignetted field of view of each array is delineated by a *red* dashed rectangle. The three arrays overlap on the sky as shown in the rightmost figure, where the PLW (500 μm), PMW (350 μm) and PSW (250 μm) are depicted by red, green and blue circles respectively. The circle sizes in the rightmost figure correspond to the FWHM of the beam. The spacecraft coordinate system (Y,Z) is also shown.



Photometer bands. The Relative Spectral Response Functions (RSRF) and the aperture efficiencies for the three photometer bands. The curves are available as calibration products.

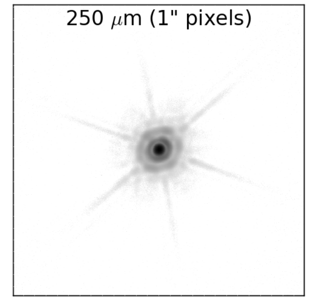


Photometer beams

The photometer beams are derived from fine scans of Neptune and using “shadow” observations of the same area in order to remove the background. The beam parameters are provided for the fine maps of $1''$/pixel and for the nominal pipeline maps pixel scale of (6,10,14) $''$/pixel at (250, 350 500) μm. The uncertainties on the beam FWHM are estimated at $< 1\%$, while the beam solid angle uncertainty is 1%. Note that the pipeline beam solid angle should be used with standard pipeline produced maps to convert them from Jy/beam to Jy/pixel or MJy/sr.

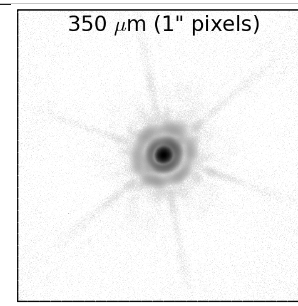
PSW beams

Measured beam solid angle (arcsec^2)	454.00	
Pipeline beam solid angle (arcsec^2)	**469.35**	
Pixel size (arcsec)	1	6
Major x Minor FWHM (arcsec)	18.4×17.4	18.9×18.0
Position angle (deg)	37.98	
Geometric mean FWHM (arcsec)	17.9	18.4
Flattening(%)	5.1	4.8



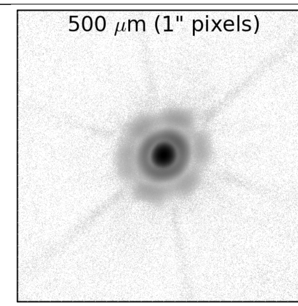
PMW beams

Measured beam solid angle (arcsec^2)	803.00	
Pipeline beam solid angle (arcsec^2)	**831.27**	
Pixel size (arcsec)	1	10
Major x Minor FWHM (arcsec)	24.9×23.6	25.8×24.6
Position angle (deg)	28.44	
Geometric mean FWHM (arcsec)	24.2	25.2
Flattening(%)	5.4	5.0



PLW beams

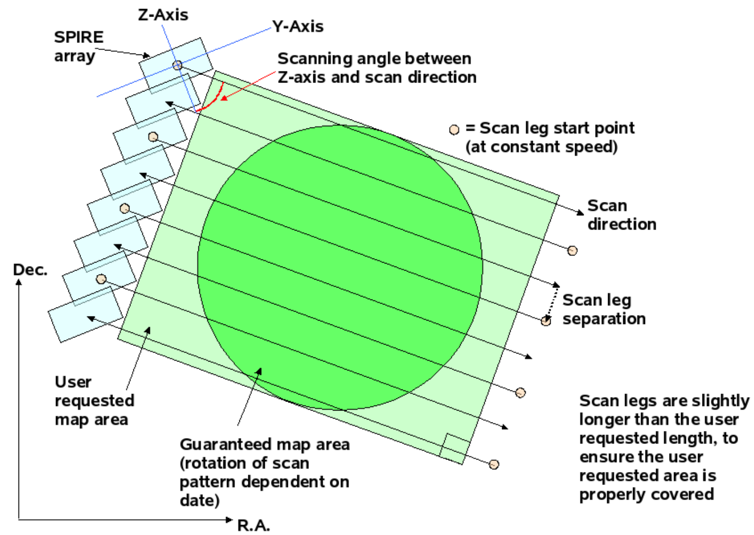
Measured beam solid angle (arcsec^2)	1700.00	
Pipeline beam solid angle (arcsec^2)	**1804.31**	
Pixel size (arcsec)	1	14
Major x Minor FWHM (arcsec)	37.0×33.8	38.3×35.2
Position angle (deg)	51.17	
Geometric mean FWHM (arcsec)	35.4	36.7
Flattening(%)	8.7	8.1

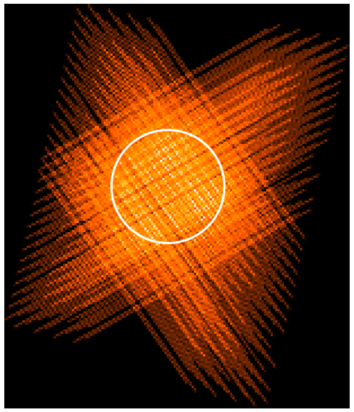
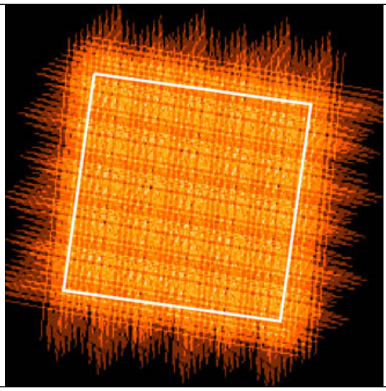
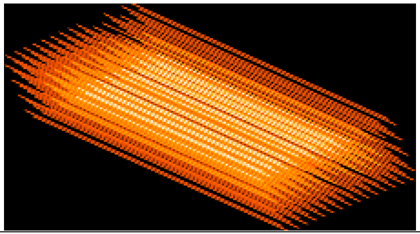


Photometer observing modes

Three Astronomer Observing Templates (AOT) were available for SPIRE Photometer observations, all performed by scanning the telescope in one of the two "magic" angles: scan A or scan B, at $\pm 42.4\,\mathrm{deg}$ with respect to the Spacecraft Z-axis.

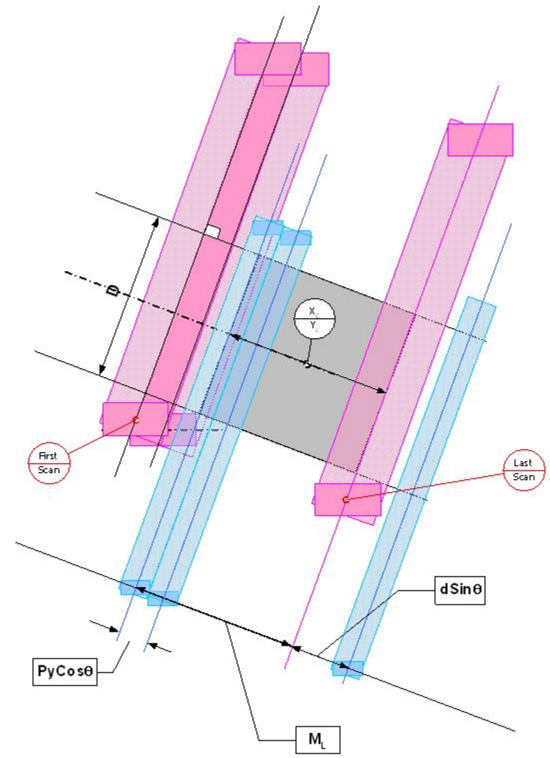
A drawing of how a Large Map is built by telescope scanning, showing the scan angle, the scan leg and the guaranteed area. For Solar System Objects, the telescope is also tracking the moving target. The scan leg separation is fixed to $348''$ for both scan directions for SPIRE-only observations. For the simultaneous PACS and SPIRE observations, the so called Parallel Mode, the scan leg separations are different (see later)



AOT	Details	Coverage map
Small Map Mode	To cover areas smaller than 5′ diameter (white circle). Only at nominal scan speed of 30″/s. Two short scan legs at 84.8 deg. Depth achieved by increasing the number of repetitions of the map.	
Large Map Mode	To cover areas larger than 5′ diameter. Can be performed in any of the two scan angles or both – the cross-scan A+B mode. The scan speed can be *nominal* (30″/s) or *fast* (60″/s). Depth achieved by increasing the number of repetitions of the map. The example coverage map is for user requested area of $30' \times 30'$ (white square). There is some 10% increased coverage due to turnaround.	
Parallel Mode	To cover very large areas, simultaneously with the PACS photometer. Can be performed in one of the two scan angles, *nominal* or *orthogonal*, at ± 42.4 deg with respect to the telescope Z-axis. A *separate observation* is needed to cover the adjacent scan direction. Only one repetition maps are possible, to increase the depth a separate *grouped observation* is needed. The scan speed can be *slow* (20″/s) or *fast* (60″/s).	

SPIRE and PACS parallel mode

Illustration on how Parallel Mode map is build with SPIRE and PACS photometers working simultaneously and providing common maps of the greyed area in 5 bands: 70 or 100, 160, 250, 350 and 500 μm. SPIRE scanning path is in red, PACS scanning is in blue. Scan leg separation is different from the SPIRE-only maps and it is also different for maps in *nominal* (168″) and *orthogonal* (155″) direction.



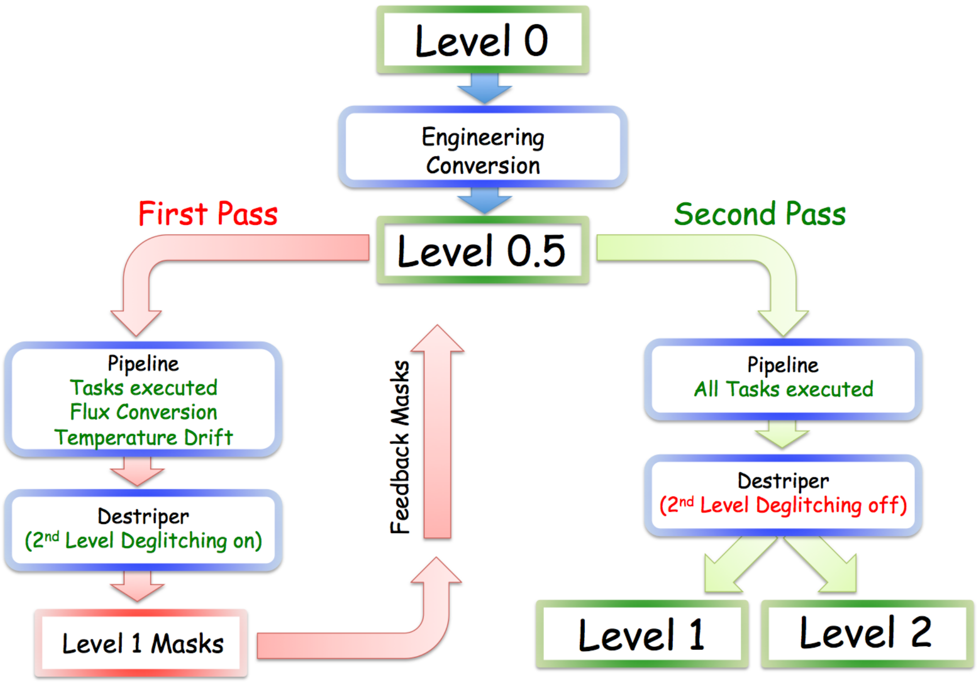
Photometer calibration and calibration uncertainties

The detailed calibration framework is explained in SPIRE Handbook (2017); Bendo et al. (2013); Griffin et al. (2013). The SPIRE maps (including those in Parallel mode) are provided for two calibration schemes: point source and extended source. The extended source calibrated maps are based on the point source one, incorporating the knowledge of the SPIRE beam and the aperture efficiencies.

Uncertainty	**Comment**
Absolute calibration (4%)	Associated with our knowledge of the brightness of the primary calibrator, Neptune, and is estimated at $\pm 4\%$ (ESA-4 model, R. Moreno, private communication). It is correlated across the three bands.
Relative calibration (1.5%)	Reproducibility of a measurement of the same flux at the same time. This is a random contribution and it is of the order of 1.5% (Bendo et al., 2013).
Overall (5.5%)	At present, we recommend that the overall calibration uncertainty for the SPIRE photometer, taking these two contributions into account, should be taken conservatively as $\pm 5.5\%$ (the direct rather than quadrature sum of the absolute and relative calibration uncertainties). It should be noted that this is dominated by the absolute component and is thus largely correlated across the three bands.
	Additional sources of uncertainty
Photometric	This component is due to the source measurement errors. Astrometry errors, aperture photometry or source fitting errors, confusion noise or source crowding. It is important to note that these photometric uncertainties will be significant or dominant except for sources which stand out very clearly above any confusion noise or local sky background fluctuations.
Extended source calibration	In addition to the components described above, the calibration accuracy of extended sources is limited by the uncertainty on the SPIRE beam solid angle, estimated at $< 1\%$ (Schulz et al. in preparation). For absolute surface brightness measurements, the uncertainty is estimated at $\sim 10\%$, coming from the *Planck*-derived absolute zero-level offsets. It should be noted that (i) these offsets are normally small in comparison to the SPIRE signals, and (ii) for science analysis involving *differential* measurements on SPIRE maps, such as point source photometry or aperture photometry, the uncertainty associated with the zero-level has no effect on the results.

Photometer pipeline

Step-by-step description of the pipeline is presented in the SPIRE Data Reduction Guide. The same pipeline steps are applied to all SPIRE Photometer observing modes, including Parallel mode. A high-level schematic overview of the currently adopted two-pass pipeline is given below:



Observational context for SPIRE Photometer

High level description of the different levels in the SPIRE Observational Context

Level 0	Raw data, formatted from the raw telemetry by an external pre-processing stage.
Level 0.5	Produced by processing the raw Level 0 data through the Common Engineering Conversion (Level 0 - Level 0.5) Pipeline. The Level 0.5 data are the uncalibrated, uncorrected timelines measured in Volts.
Level 1	Flux calibrated and *destriped* timelines for each scan line and each bolometer. For observations that are part of Level 2.5 maps, the destriped timelines are derived from the combined maps.
Level 2	The calibrated and destriped timelines from Level 1 are directly projected on sky maps with default pixel size of (6, 10, 14) $''$/pixel for (250, 350, 500) μm bands. Point-source and extended-source calibrated maps for the three Photometer bands are available at this level. For Solar System Objects, point-source calibrated maps in the moving frame of the target are also provided. For extended-source calibrated maps with high signal-to-noise, hi-resolutions (HiRes) maps produced with Richardson-Lucy deconvolution are also available. The HiRes method typically increases the resolution of the image by a factor of 2. All extended-source calibrated maps at level-2 and above have their zero-level offset derived from *Planck*-HFI.
Level 2.5	Maps are produced using the combined destriped Level 1 timelines of Parallel mode observations in separate nominal and orthogonal scan directions. In some cases, when there is a suitable overlap, SPIRE-only observations at single scan directions and/or cross-scans are also combined in Level 2.5 maps.
Level 3	A mosaic with direct re-projection of Level 2 and/or Level 2.5 maps over a large contiguous area.

SPIRE Photometer products in the Herschel Science Archive (HSA)

For any observation the full observational context (including the calibration tree, the auxiliary products etc) can be downloaded from the HSA in a single compressed archive file (tar.gz). Products at individual levels, e.g. Level 0 to Level 3, can also be retrieved with the HSA interface. The following table provides information about the folder structure and the files in the tar.gz file.

Folder	**Sub-folder**	**Filename pattern**
level0	*BuildingBlockProduct	hspire<OBSID>_<BBID><NNNN>_00rst_ID
level0_5	*EdpBlockContext	hspirephotometer<OBSID>_a103<NNNN>_10psp_ID
level1	*PointedPhotTimeline	hspirephotometer<OBSID>_a103<NNNN>_10psp_ID
level2	extdPxW extdPxWdiag psrcPxW psrcPxWdiag ssoPxW ssoPxWdiag hiresPxW	hspire<ARR><OBSID>_20pxmp_ID hspire<ARR><OBSID>_20pdd_ID hspire<ARR><OBSID>_20pmp_ID hspire<ARR><OBSID>_20pdd_ID hspire<ARR><OBSID>_20ssopmp_ID hspire<ARR><OBSID>_20pmp_ID hspire<ARR><OBSID>_20hirespxmp_ID
level2_5	Same folders as level2	Same pattern as Level 2 except *<OBSID>_25* instead of *<OBSID>_20*
level3	extdPxW	hspire<ARR>_30pxmp_*

Notes: PxW denotes any of the three arrays, PSW=250μm, PMW=350μm or PLW=500μm. <OBSID> is the decimal OBSID, <ARR> is the array name and can be one of *psw, pmw* or *plw*. The ID is a unique product identification number. <NNNN> stands for the scan number.

Standalone Browse Products (SBP): HSA provides quick access to a subset of the science ready products: these are the extended-source calibrated maps at Level 2.5 if available, else at Level 2. For Solar System Object (SSO) the SBP are the Level 2 point-source calibrated maps in the SSO rest-frame.

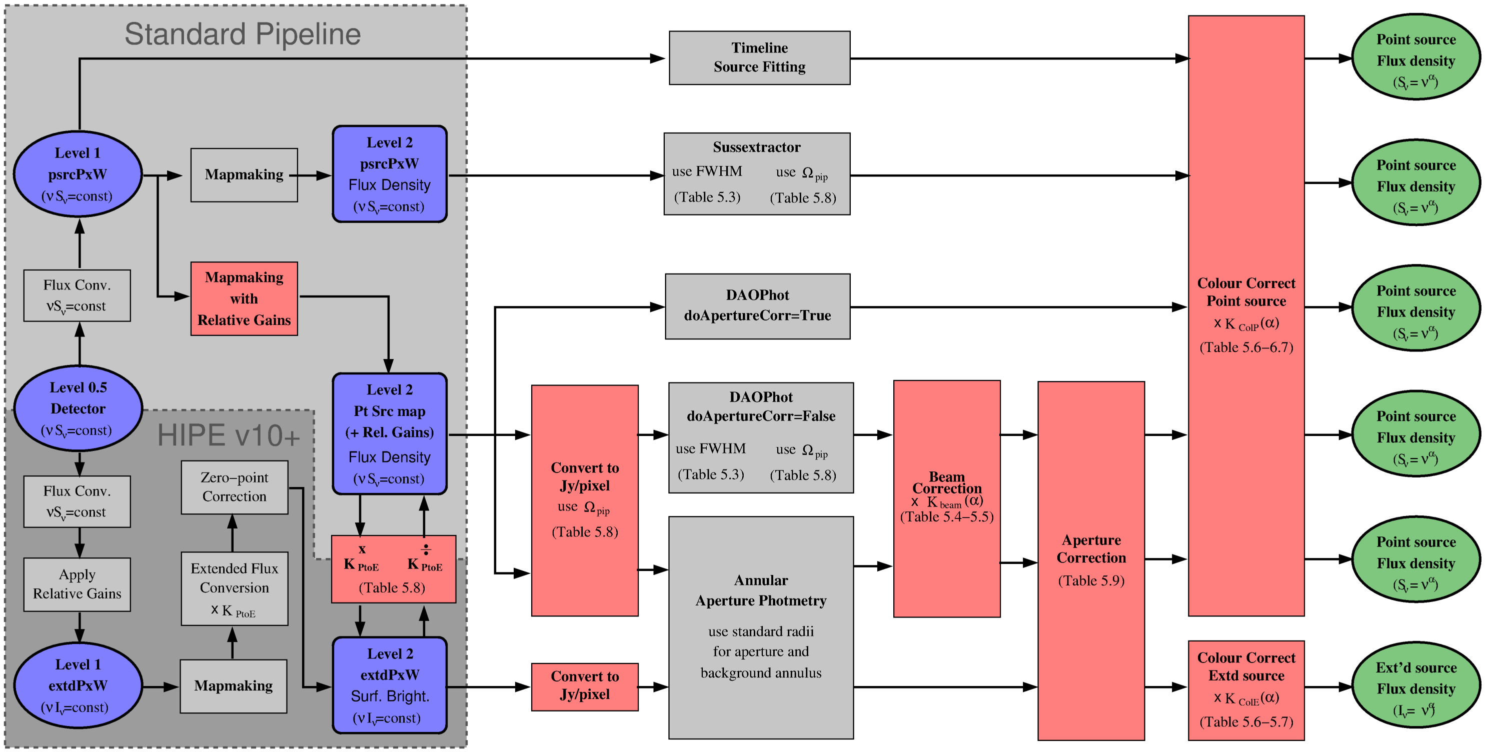
Science readiness of the products

All SPIRE Photometer products at Level 1 and above are science ready with the following caveats:

- Point-source calibrated timelines and maps provide monochromatic flux densities at 250, 350 and 500 μm, and are in units of Jy/beam for a source with $S_\nu \propto \nu^{-1}$ spectral shape. Colour corrections need to be applied for sources with different SEDs, as explained in the SPIRE Handbook (2017).
- Extended-source calibrated maps provide monochromatic intensities at 250, 350 and 500 μm, and are in units of MJy/sr for a source with $I_\nu \propto \nu^{-1}$ spectral shape. The zero offsets of the maps are derived via cross-calibration with *Planck*-HFI. Colour corrections need to be applied for sources with different SEDs, as explained in the SPIRE Handbook (2017).
- The combined maps at Level 2.5 and Level 3 are not astrometrically corrected before the merging of the timelines or the mosaicking of the maps.
- Some huge Level 3 maps are split into smaller non-overlapping tiles, in order to provide FITS files with manageable size. The Galactic plane is provided as a Highly Processed Data Product, outside the individual observational contexts.

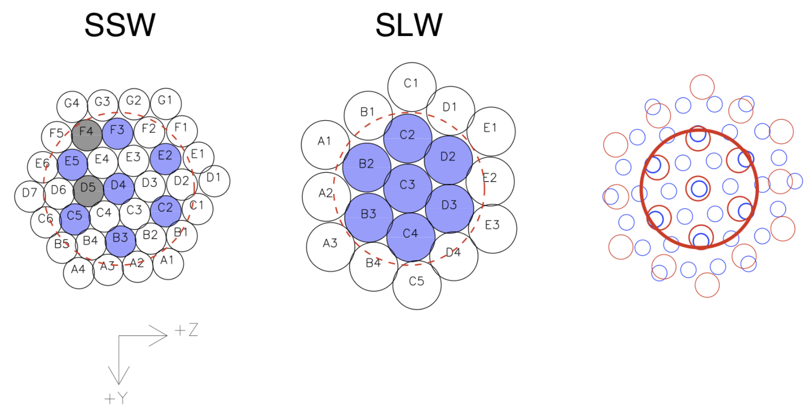
Detailed list of caveats is available in the Data Products Known Issues public page.

Photometer maps conversions and photometry flowchart



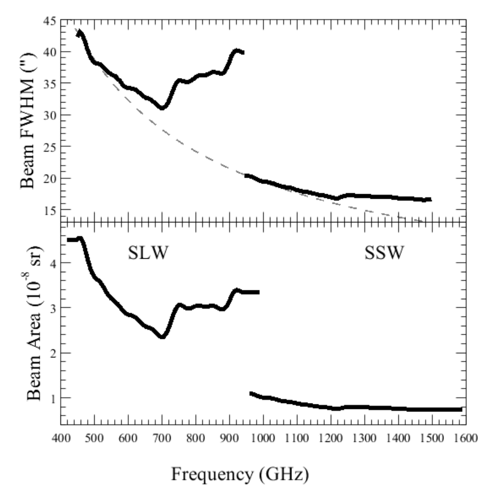
The standard pipelines are in the grey box on the left, the pipeline products are in blue, steps the user should perform are in red. The photometry-derived products, based on user inputs for the red boxes, are in green. More details are provided in the SPIRE Data Reduction Guide, section 6.9 and in the SPIRE Handbook (2017), where the referenced tables and conversion parameters can be found.

SPIRE Spectrometer



Spectrometer bolometer arrays. Each circle represents a detector feedhorn, the bolometer names are also shown. Those detectors centred on same sky positions are shaded in *blue*, the dead bolometers are shaded in *grey*. The two arrays overlap on the sky as shown in the right-most panel. The $2'$ diameter unvignetted field of view of each array is delineated by a *red* circle. The spacecraft coordinate system (Y,Z) is also shown.

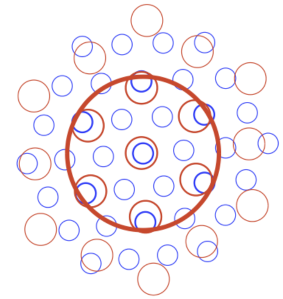
Spectrometer bands	SSW: 191–318 μm , SLW: 294–671 μm SSW: 1568–944 GHz , SLW: 1018–447 GHz



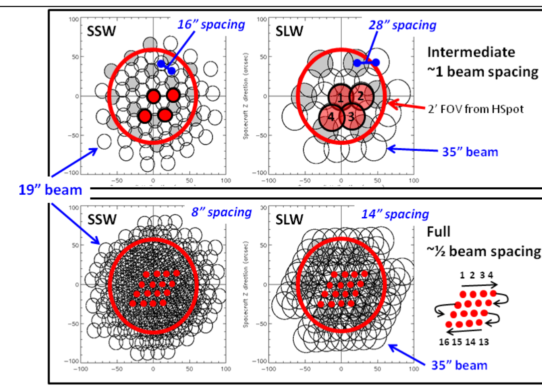
Spectrometer beams. The Spectrometer beam is multi-moded and the FWHM, as a function of frequency, deviates significantly from the diffraction theory beam FWHM (dashed curve). Check Makiwa et al. (2013) for details.

Spectrometer observing modes

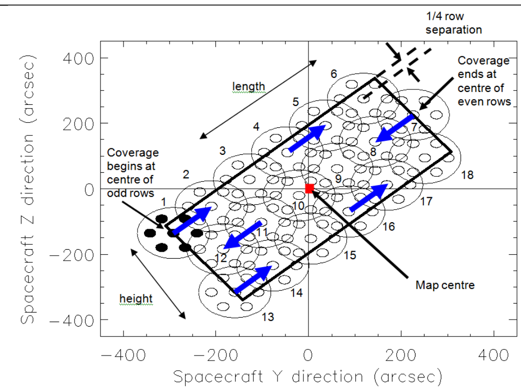
Sparse mode. Each individual detector from the two arrays register a spectrum. The unvignetted field of view is indicated by the red circle of 2′ diameter. The spectra outside the red circle will be partially or fully vignetted and suffer from significant noise.



Intermediate & Full. The sparse mode footprint is moved over 4-points for intermediate (one beam sampling) and over 16-points (half beam, i.e. Nyquist sampled) for full spatial coverage.

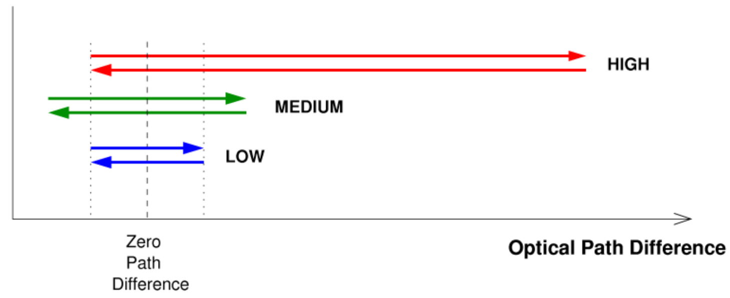


Raster. The raster is built by repeating the sparse, intermediate or full pattern on a set of pre-defined telescope sky positions, in order to cover the user requested area.



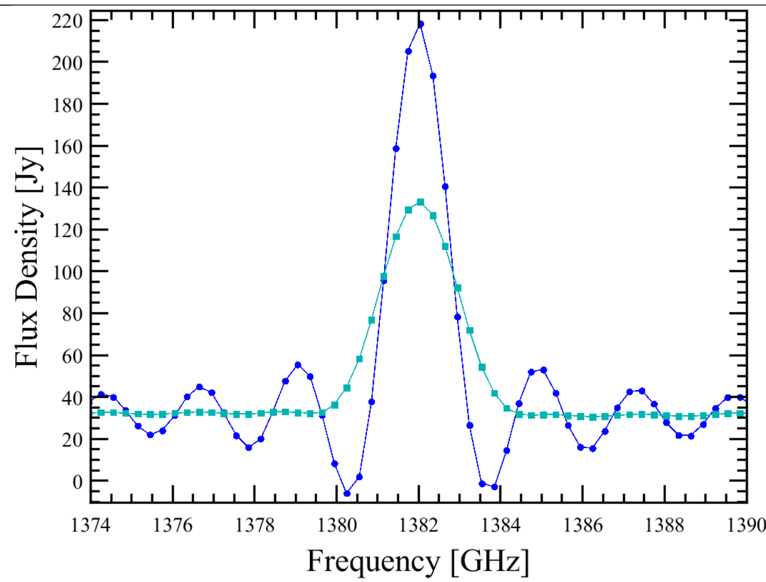
Spectral resolution

Spectral resolution. The spectral resolution depends on the maximum excursion of the Spectrometer Mirror Mechanism (SMEC), i.e. on the maximum optical path difference attained. Only HR (resolution of 1.2 GHz) and LR (resolution 25 GHz) were used for science.



Line shape

Spectral line shape. The instrumental line shape is close to a *sinc* function (shown in blue). A small residual phase shift in the interferograms leads to a slight asymmetry, most evident in the first minimum towards higher frequencies. As a consequence, the integrated line flux derived from a canonical sinc is systematically underestimated by 2.6%. Applying apodization can smooth out the secondary peaks with the drawback of lowering the peak and widening the line, as shown by the green curve. Line fluxes, derived from apodized spectral lines fitted with a Gaussian, are overestimated by 2.4% and suffer from higher uncertainty compared to the standard spectra (see Hopwood et al. 2015 for more details). A set of apodized spectra are included in the final products.



Spectrometer calibration scheme

The detailed calibration framework is explained in the SPIRE Handbook (2017); Swinyard et al. (2014).

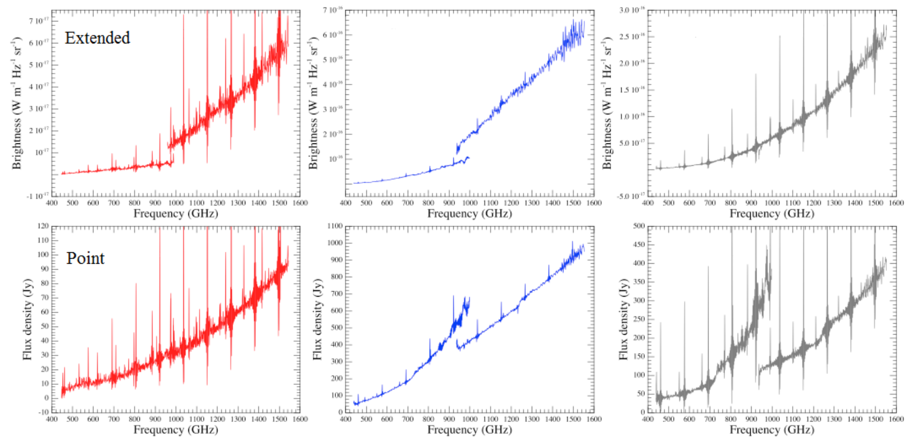
Calibration scheme	Notes
Extended source	Based on the instrument thermal model and the telescope thermal model and emissivity, with a small time-dependent correction for the latter. In HIPE v14, a correction for the far-field feedhorn efficiency was introduced (Valtchanov et al., 2017), which led to a significant increase in the flux levels for extended source calibrated data. The corrected data is more consistent with the SPIRE photometer.
Point source	Extended to point-source conversion factor derived from the ratio of the ESA-4 model* of Uranus (Orton et al., 2014) and its observed extended-source calibrated spectrum. The calibration is invariant with respect to the extended source calibration.
Low resolution (LR)	LR observations exhibit a characteristic double bump in SLW, which was empirically corrected as of HIPE v14 (Marchili et al., 2017). The analysis pointed out that the effect seen in LR spectra is due to the fast variations of the instrument temperature.

(*) Neptune and Uranus planetary brightness temperature tabulations are available from the ESA's *Herschel* Science Centre Legacy Products Area.

Note: Treatment in case of sources that are neither point-like nor fully extended is detailed in Wu et al. (2013).

Source classification based on the overlap region

Source size compared to the beam. Using the overlap region of the two bands SSW and SLW (944-1018 GHz; 294-318 μm) and checking the spectra for the two calibration schemes can give a clue about the source size with respect to the beam. Upper row shows the extended-source calibrated spectra for 3 targets, the bottom row shows their point-source calibrated equivalent. The source on the left (in red) is point-like, the source on the right (in blue) is extended, while the one in the middle (in grey) is semi-extended. Note that a mis-pointed perfect point source will manifest itself like a semi-extended one, i.e. there will be a jump in the overlap region.



Spectrometer calibration uncertainties

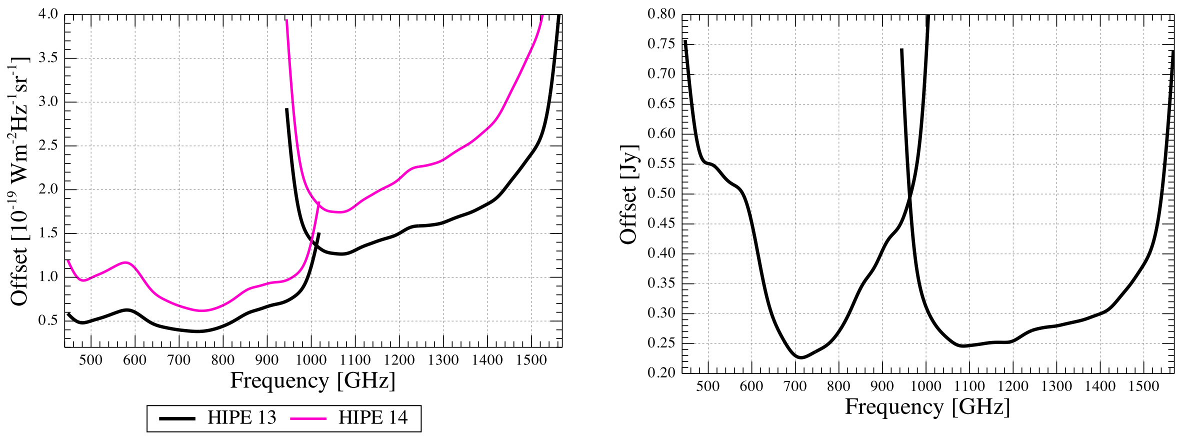
The details on the calibration uncertainties are provided in Swinyard et al. (2014) and in Hopwood et al. (2015).

Point-source calibration	
Absolute calibration (3%)	Associated with our knowledge of the primary calibrator, Uranus, and the secondary calibrator Neptune. It is estimated at $\pm 3\%$ for the ESA-4 model.
Relative calibration (1%)	Reproducibility of measurements of Uranus and Neptune. This is a random contribution of the order of 1% for pointing corrected spectra.
Additive continuum offset	Frequency dependent continuum offset. See the figure on next page.
Pointing offset	The effect of the *Herschel* absolute pointing error. Much more important for the SSW because of the smaller beam.
Overall (6%)	For point sources observed on the centre detectors (SSWD4 and SLWC3), the measured repeatability is 6%.
Extended-source calibration	
Systematic	The systematic uncertainty in telescope model of 0.06%
Statistical	The statistical repeatability estimated at $\pm 1\%$
Additive continuum offset	Frequency dependent continuum offset. See the figure on next page.
Correction uncertainty	Uncertainty of the far-field feedhorn efficiency $\eta_{\rm ff}$ estimated at $\pm 3\%$ for SLW. For SSW, $\eta_{\rm ff}$ was not measured and the uncertainty is unknown. But because of the simpler beam properties for SSW we assume the uncertainty to be the same.
Overall (4%)	For sparse observations of truly extended sources, the absolute uncertainty in flux for a reasonably bright and fully extended object, observed in the central detectors, is $\sim \pm 4\%$.

Notes:

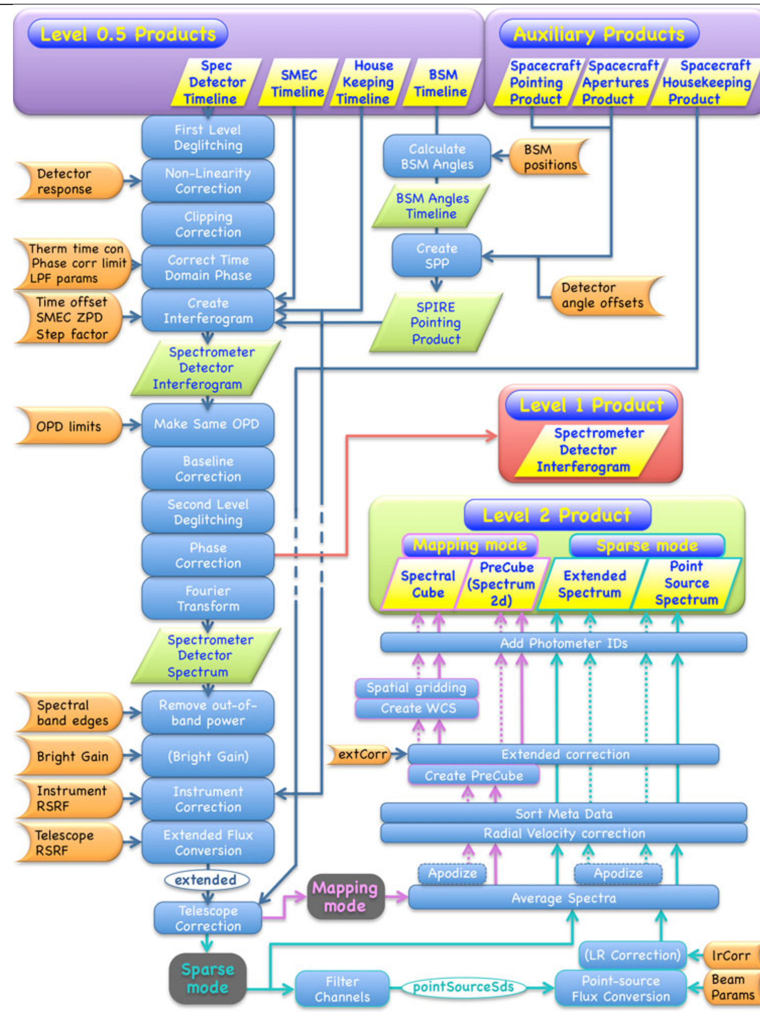
- For point-like or semi-extended sources, the pointing uncertainty only results in a reduction in flux and is therefore not a true statistical uncertainty on the recovered flux level. A large pointing offset also results in a significant distortion of the SSW spectrum of a point source and a mismatch between the SLW and SSW spectra. Providing one is convinced that the source in question has no spatial extension, the SLW portion of the point-source calibrated spectrum can be used to correct any apparent gain difference between the SLW and SSW spectra.
- Truly extended sources tend to be faint and the uncertainty is therefore dominated by the additive offsets. When the source extent is larger than the beam size, but not fully extended, or if there is structure inside the beam, then the uncertainties are dominated by the source-beam coupling (Wu et al., 2013) and are significantly greater than 4%.

- Comparison of the synthetic photometry for 24 selected extended and spatially flat sources with extended calibrated maps shows an agreement at 3-5% level, bearing in mind the 10% uncertainty of the maps zero-offsets derived from *Planck*-HFI.
- For spectral maps, the overall repeatability has been measured to be $\pm7\%$ (see Benielli et al., 2014, for a full discussion of mapping mode observations). The off axis detectors are less well calibrated, especially outside the unvignetted part of the field.
- The level of absolute flux accuracy and repeatability for point-source calibrated spectra obtained with the SPIRE FTS compares favourably with the SPIRE photometer: 1.5% repeatability and 4% absolute, initially presented in Bendo et al. (2013) and extended to all FTS calibrators in Hopwood et al. (2015).
- For LR observations the uncertainties for SSW should be similar to those quoted above. For SLW, because of the empirical correction, the calibration uncertainty unavoidably is larger because the correction function comes with its own, currently "uncharacterised", uncertainty.



Additive continuum offsets for extended source (left) and point source calibration (right). The extended source calibration continuum offsets for HIPE v14 (in magenta) are corrected for the far-field feedhorn efficiency (see Valtchanov et al. 2017).

Spectrometer pipeline



Flowchart depicting the steps in the Spectrometer pipeline. The pipeline tasks are in blue, the calibration tables are in brown, the output products in green. Sparse mode and mapping mode use the same processing with some modifications and additional steps, shown with magenta arrows for mapping and green arrows for sparse mode. More details are provided in Fulton et al. (2016).

Observational context for SPIRE Spectrometer

The final level for SPIRE Spectrometer is Level 2. No products exist at higher levels.

High level description of the different levels of the SPIRE Spectrometer pipeline

Level 0	Raw data, formatted from the raw telemetry by an external pre-processing stage.
Level 0.5	Produced by processing the raw Level 0 data through the Common Engineering Conversion (Level 0 - Level 0.5) Pipeline. The Level 0.5 data are the uncalibrated, uncorrected timelines measured in Volts.
Level 1	The voltage density interferograms per detector and per scan, forward or reversed. **Sparse mode:** There is only one sub-product with interferograms for all detectors. **Mapping:** There will be sub-products for each of the 4 or 16 jiggle positions and at each of the raster points.
Level 2	**Sparse mode:** point-source and extended source calibrated spectra, averaged for all scans and for all detectors, including their apodized versions. For H+LR mode the spectra for both the HR and LR are provided. **Mapping:** extended source calibrated hyper-spectral cubes, including their apodized versions as well as the individual scan-averaged detectors spectra at each jiggle and/or raster position, before their binning into a spectral cube. Two variants of cubes are provided: naive projection (may contain empty pixels) and convolution projection using the Gaussian beam approximation to redistribute the intensities. For H+LR mode the cubes for each HR and LR are provided. The cubes for SSW and SLW bands are provided separately as they have different sky pixel size and WCS.

SPIRE Spectrometer products in the Herschel Science Archive (HSA)

For any observation the full observational context (including the calibration tree, the auxiliary products etc) can be downloaded from the HSA in a single compressed archive file (tar.gz). Products at individual levels, e.g. Level 0 to Level 2, can also be retrieved with the HSA interface. All files are gzipped FITS files (extension fits.gz, not shown in the table).

Folder	Sub-folders	Filename pattern
level0	*BuildingBlockProduct	hspire<OBSID>_<BBID><NNNN>_00rst_<ID>
level0_5	*EdpBlockContext	hspire<OBSID>_a107<NNNN>_05level05blockcontext_<ID>
level1	Point_<NR>_Jiggle_<NJ>_<RES>/interferogram/	<prefix><OBSID>_a106<NNNN>_10sdi_<ID>
level2 (mapping)	<RES>_<ARR>_cube <RES>_<ARR>_cube_convol <RES>_<ARR>_spectrum2d	<prefix><OBSID>_spg_<ARR>_<RES>_20ssc_<ID> <prefix><OBSID>_spg_<ARR>_convol_<RES>_20ssc_<ID> <prefix><OBSID>_spg_<ARR>_<RES>_20spc_<ID>
	<RES>_<ARR>_cube_apod <RES>_<ARR>_cube_convol_apod <RES>_<ARR>_spectrum2d_apod	<prefix><OBSID>_spgApod_<ARR>_<RES>_20ssc_<ID> <prefix><OBSID>_spgApod_<ARR>_convol_<RES>_20ssc_<ID> <prefix><OBSID>_spgApod_<ARR>_<RES>_20spc_<ID>
level2 (sparse)	<RES>_spectrum_ext <RES>_spectrum_point	<prefix><OBSID>_a1060001_spg_<RES>_20sds_<ID> <prefix><OBSID>_a1060001_spg_<RES>_20spss_<ID>
	<RES>_spectrum_ext_apod <RES>_spectrum_point_apod	<prefix><OBSID>_a1060001_spgApod_<RES>_20sds_<ID> <prefix><OBSID>_a1060001_spgApod_<RES>_20spss_<ID>

Notes: <prefix> stands for *hspirespectrometer*, <ARR> denotes any of the two arrays, SSW or SLW, both are always present. <OBSID> is the decimal observation ID. <RES> can be either HR or LR, for observations in H+LR mode, both are present. The <ID> is a unique product identification number. <NNNN> stands for the scan number. <BBID> is the building block ID in level0. Files with “apod” in the name are for apodized (smoothed) versions of the products.

Standalone Browse Products (SBP): HSA provides quick access to a subset of the science ready products: these are the level 2 point-source calibrated spectra for sparse mode or the convolution projection cubes for mapping.

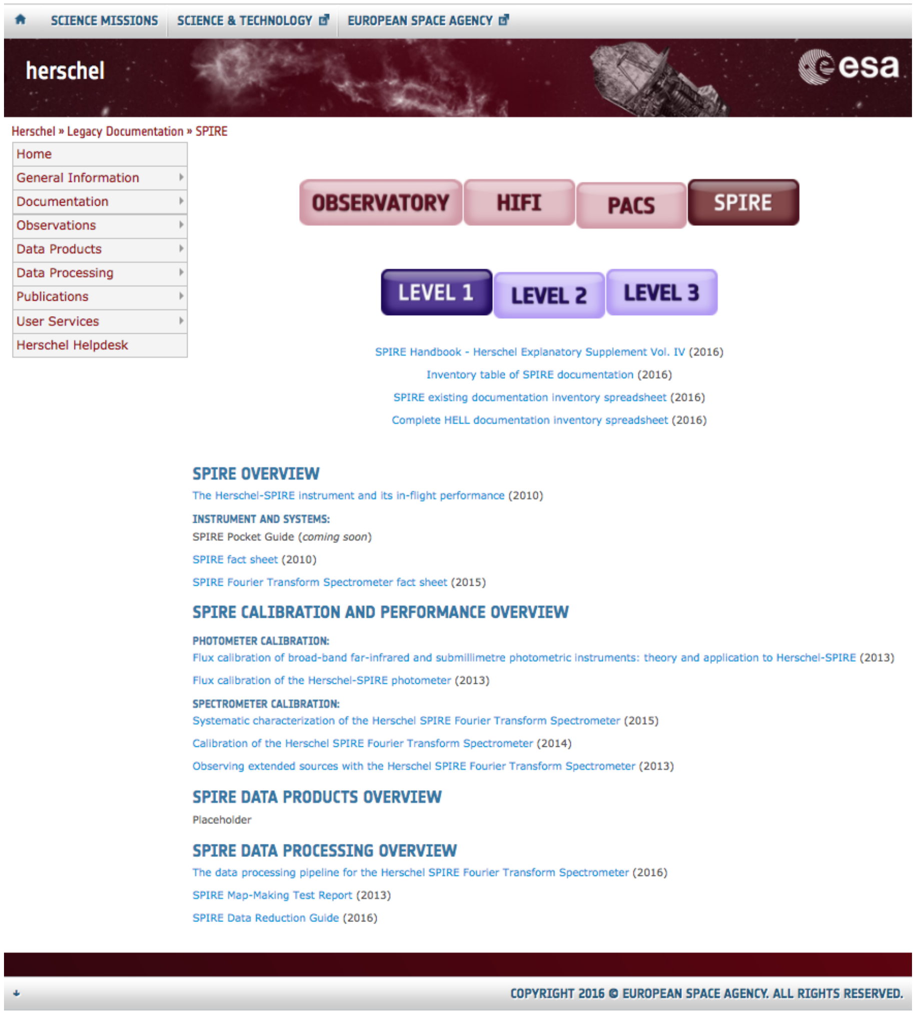
Science readiness of the products

All SPIRE Spectrometer products at Level 2 are science ready with the following caveats:

- The point-source calibration is only correct for spectra of sources with an intrinsic size much smaller than the SSW beam, i.e. $\lesssim 3''$ (this limit comes from the size of the primary calibrator, Uranus).
- The extended-source calibration is only correct for spectra of sources with an intrinsic size much larger than the beam, i.e. $\gg 42''$. Keep in mind the significant variation of the beam size with frequency (see figure on page 16), e.g. a source with size $35''$ can be considered fully extended in the SSW band, while it is not in the SLW band.
- Sources with a size between point-like and extended, need special treatment to correct the calibration, as described in Wu et al. (2013).
- If the correct calibration is used, the SLW and SSW spectra should agree in the overlap region between the frequency bands [944.0, 1017.8] GHz. For a true point-source, if there is a jump between the spectra this may be due to pointing offset or the presence of extended background or foreground emission. For the latter problem, the background may be subtracted using spectra from the surrounding detectors (as explained in Hopwood et al. 2015). For many sparse mode observations, background subtracted spectra are provided as highly processed data products in the HSA.

A detailed list of caveats is available in the Data Products Known Issues public page.

More in-depth information: the Herschel Explanatory Legacy Library



The *Herschel* SPIRE Explanatory Library contains all the relevant documents with details regarding the SPIRE instrument.

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