

Known Data Processing issues in HIFI products generated with old pipeline versions HERSCHEL-HSC-TN-2173

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Apart from about a dozen observations processed with the pipeline from **HIPE 14.2**, the most recent HIFI products provided by the Herschel Science Archive have been reprocessed with **HIPE 14.1**. It is possible, however, that products generated with earlier versions of the pipeline have been shared among users, and in fact some of those are distributed in the form of User-Provided-Data-Products¹. We summarise in this note the main caveats that would affect products generated by pipeline versions older than 14.1.

If your data have been processed with HIPE 14.0.1

- **Spectra mean and median statistical numbers**
 - The HIFI 14.0.1 products suffered from a minor bug leading to a wrong computation of the mean and median spectra values (i.e. a measure of the DSB continuum to first order). This has been repaired in 14.1.

If your data have been processed with HIPE 13.0, HIPE 12.0 or HIPE 11.1

- **Intensity calibration uncertainty**
 - HIPE 14 introduced a new product providing an estimated breakdown of the intensity calibration uncertainty. The uncertainties are given separately for each component, as well as in a quadratic sum fashion for all statistically independent elements. This sum applies to the calibration of data in the T_A^* scale. Further systematic and random errors apply for data converted into different intensity scales (e.g. T_{mb} or Jy). See further details in section 9 of the [HIFI Data Reduction Guide](#).
- **Pointing reconstruction**
 - In HIPE 14, those observations where the interlacing mode was activated (i.e. using more than just 9 guide stars in the star tracker) have benefited from a more accurate reconstructed astrometry and so positions may change in those cases. On top of that, the quality figure associated to the new gyro-propagated method introduced back in HIPE 13 (see also the following [Pointing Information page](#)) is now computed in a slightly different fashion. Since the application or not of the gyro-propagated pointing is, for HIFI, conditional upon a certain threshold on this quality (avoiding to apply the new pointing reconstruction to under-performing case), the number of cases making use of one or the other approach will differ in HIPE 14 - we recall that in case the gyro-propagated method is discarded, the pointing is the same as that used back in HIPE 12. For the HIFI data, such a correction is applied in a conditional

¹ <https://www.cosmos.esa.int/web/herschel/user-provided-data-products>

fashion depending on a quality figure computed for each individual observation. The new pointing reconstruction will not apply to under-performing cases, and those latter will still use the pointing files used back in HIPE 12. Details about the new attitude reconstruction, and the way it is approached and may impact the HIFI data, can be found in [this memo](#).

- **Band 6 and 7 observations**
 - From HIPE 13 onward observations in bands 6 and 7 have been automatically corrected from the Electrical Standing Wave affecting those data. The correction is based on an optimised fit to the baseline artefact stored in the HIFI calibration files and applied by the pipeline. In HIPE 14, some of those stored solutions have been refined and so the resulting products will be improved. For instructions on how to benefit from this reprocessing and see the typical improvement expected in the data please refer to section 12 of the [HIFI Data Reduction Guide](#).
- **Spectral Scan observations**
 - The reprocessing of spectral scans in HIPE 13 made use of optimised mask tables for spurs and unruly baseline ranges, resulting in improved deconvolved solutions at the Level 2.5. In HIPE 14, a dozen of additional spectral scans (mostly from the calibration programme) have been added to this list. In order to benefit from this update you should reprocess your data from Level 0 with the new calibration tree.
- **Spur warning flags**
 - In HIPE 14, a new channel flag has been introduced ("warning") that will be assigned to the data based on a knowledge base of spurious features built from the spectral scan flagging (see bullet above). These flags will be applied to all point and mapping observations. They should be taken as indicative as they do not necessarily accurately match spurious features in the data where they got applied. For this reason, this new flag is not honoured by any of the standard interactive post-processing tasks.
- **Flags in OFF positions**
 - In HIPE 13 the data used in the OFF positions were already processed up to an equivalent Level 2 calibration (both in intensity and frequency) in order to be directly comparable to the ON-target data. In HIPE 14, those OFF spectra will also hold spur and warning flags that will be propagated from the ON-target ones. This feature is, for example, very interesting in order to perform a deconvolution of the OFF spectra in a spectral scan and be able to compare the OFF spectra to the Level 2.5 deconvolved products of those observations.

If your data have been processed with a version earlier than 11.1

- **Solar System Object ephemerides**

- A bug ([see here](#)) was fixed in the calculation of SSO ephemeris positions (*ra_centre/dec_centre*) that led to offsets of up to ~10". This bug affected users that use cubes in a co-moving frame (including the standard Level 2.5 cubes), use the `doOffset` task, or make explicit use of *ra_centre/dec_centre* in their HIPE scripts. The offset is practically constant over a map and could, e.g., make the emission of a comet appear to be off-center when it really isn't. The fixed bug is in the Level 0 pipeline, which users cannot run easily. The issue was fixed in HIPE 11.1.

If your data have been processed with a version earlier than 10.3

- **DBS Observations** If you have data processed with < HIPE 10
 - A new pipeline step, `mkDbsReference`, calculates the differences in the chop positions in all DBS observations, and after applying the band-pass correction, stores them in a product in `calibration->pipeline-out` called *ReferenceSpectra*. This allows you to check for contamination in chop positions for all types of DBS observations.
- **Improved pointing reconstruction for observations taken between OD 320 and OD 761 if you have data processed with < HIPE 9**
 - The pointing information attached to the data for observations taken between OD 320 and OD 761 did not use the most accurate representation of the star tracker focal length. This was done for the bulk reprocessing with HIPE 9. As a consequence, some observations will experience a shift in astrometry, which can be as high as 8 arcsec. Details about the consequences for a particular `obsid`, and recipes to reconstruct the improved pointing yourself can be found at <http://herschel.esac.esa.int/twiki/bin/view/Public/HowToUseImprovedPointingProducts> as well as in section 4.2 (Level 0) of the [HIFI Data Reduction Guide](#).
- **Backfilling of observational parameters – If you have data processed with < HIPE 9**
 - From 9.1 onwards, most of the observational parameters that got optimised in `HSpot` will be propagated into the observation context, under a new product called *HifiUplinkProduct* (in the auxiliary product branch). Some of these parameters will be used in the pipeline to e.g. estimate the dimension of the cubes in the mapping and have them more representative of how the map was really obtained.
- **Solar System Object maps – If you have data processed with < HIPE 9**
 - Cubes for moving targets are now created in the comoving frames in HIPE 9. In order to benefit from that, you should re-pipeline from Level 0 up to Level 2.5. Note that the `hifiPipeline` task should be called with the option `"Aux=True"`. Please check section 15 of the [HIFI Data Reduction Guide](#) for more details about how to do that.