Pre-release note for Unchopped line scan and Unchopped Range Scan/SED Mode (Referred to generically as Unchopped Mode)

As a result of tests performed in PV Phase, we have determined that the PACS Spectrometer wavelength-switching mode will be replaced with a new mode called Unchopped Mode which works for both standard Line Scan and Range Scan AOTs. This mode is not yet fully released, but we anticipate that it will be released at the end of July. However, in order to allow astronomers to propose observations in this mode for the OT1 deadline, HSpot 5.0.5 contains the mechanism to allow users to make AORs with this mode. However, we caution that although it is possible to design observations in this mode, only a preliminary S/N calculator is available in HSpot 5.0.5. (See further information below). At the time of writing of this note, observations are being obtained that will allow us to refine the actual in-orbit performance of PACS using Unchopped Mode. The S/N estimator in HSpot should be used only as a guide to the actual performance (which is likely to be slightly better than that calculated).

When to use this mode?

The unchopped grating scan is an alternative to the chopping/nodding mode if the maximum chopper-throw of 6 arcminutes does not take you off the target. For instance this could happen in crowded-fields or for spectral line mapping of extended objects with diameters larger than 5' respectively. Because the data acquired in this mode does not chop against a sky-background, it is not yet clear how reliable the mode will be for very faint signals. Based on our experience with wavelength switching in the so-called "direct mode" (which is quite analogous to the proposed Unchopped Mode), we found that we were able to detect faint signals in this mode in a manner similar to chop/nod. However, since very little data has yet been obtained in this mode we suggest caution for very faint sources. Unchopped mode observations are always made with the chopper set at the zero chopper-angle position which means that raster maps always see the same telescope background temperature, unlike the case of Chop/Nod observations. Much more details about the observing mode can be found in Section 6.1.8 of the PACS Observer's Manual (http://herschel.esac.esa.int/Docs/PACS/html/ch06.html#sec-unchopped-grating-scan). These details will not be repeated here.

Use of Reference "Off" position.

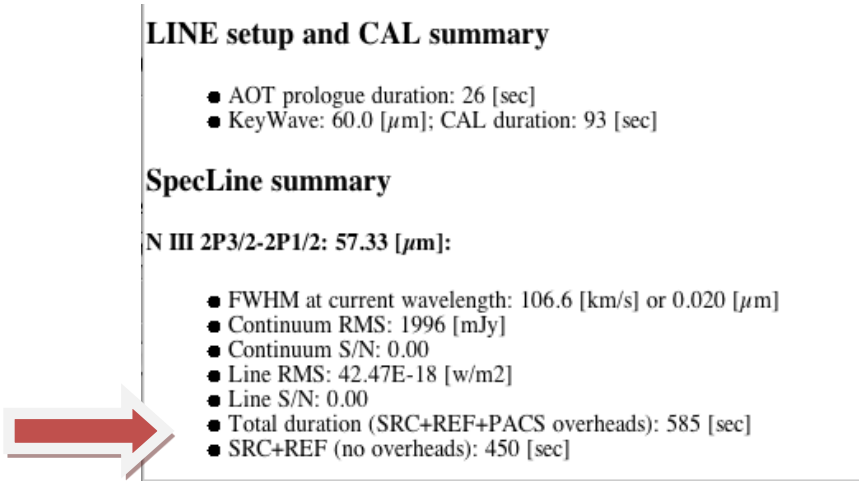
As in the previous Wavelength Switching mode, the user, in Line Spectroscopy, can specify an "off" position, either by offset or by RA and Dec specification. Note that by default these offsets are set to zero. The specification of an "off position" is provided in a special part of the HSpot window for both the "Pointed" and "Mapping" component of the Observing Mode option. Note that, because of the longer nature of a typical PACS Range Spectroscopy observation, no "off position" window is provided. In this case the user must request a separate observation of an "off position" which should then be linked to the main observation with a group-follow-on constraint to ensure that the observation is made either before or after the primary target observation. Unlike the previously available wavelength-switching mode, for Line Spectroscopy, there is much more flexibility for the observer in the choice and frequency of the "off" observation for raster mapping mode. In particular, it is now possible for the observer to specify that after a number of raster moves an "off" will be taken. If the observer wants to have an "off" taken at the beginning and end of a n x m raster, then the observer must specify that the "off" should be taken after n times m raster positions (Note that the default is 2 which in almost all cases should be changed since for a large raster this would be far too frequent and would inflate the AOR elapse time considerably).

S/N Estimation in HSpot 5.0.5

Currently, although HSpot correctly estimates the time required to make observations in this mode, the HSpot back-end is still being revised and the results currently should be treated as approximate values based on previous wavelength-switching data obtained in PV phase. We believe that the S/N estimation currently calculated underestimates the expected S/N by a factor of roughly SQRT(2). Thus the S/N obtained for a given observation is likely to be better than that shown in HSpot 5.0.5. However, since we have not yet obtained and fully analyzed data from this mode, we cannot provide more accurate results until after the OT1 deadline. As in previous announcements of opportunity, observers applying for time in this mode should write their science case to be robust to flux uncertainties of a factor of 2. If, as a result of in-orbit tests of this mode, we find it to be significantly more sensitive than expected, we may allow for changes in the AORs for accepted proposals at the Phase 2 level to take this into account.

SNR corrections: Hspot mis-calculation

Currently the SNR and RMS computed in HSpot is incorrect. The time used to estimate these two values includes the PACS overheads. The correction is simple as all the information can be found on the same information page.Figure 1 shows you the necessary information you should use to obtain the correct SNR and RMS values for your observation (off course taking into account the limitations mentioned above).



LINE setup and CAL summary

- AOT prologue duration: 26 [sec]
- KeyWave: 60.0 [μm]; CAL duration: 93 [sec]

SpecLine summary

N III 2P3/2-2P1/2: 57.33 [μm]:

- FWHM at current wavelength: 106.6 [km/s] or 0.020 [μm]
- Continuum RMS: 1996 [mJy]
- Continuum S/N: 0.00
- Line RMS: 42.47E-18 [w/m2]
- Line S/N: 0.00
- Total duration (SRC+REF+PACS overheads): 585 [sec]
- SRC+REF (no overheads): 450 [sec]

The RMS and SNR were computed using: the “Total duration” time, while what is needed is the “SRC+REF" time (in the case of un-chopped mode REF is 0).
As a result the RMS and SNR computed by HSpot have to be corrected as follow:

$$RMS(corrected) = RMS(HSpot)\frac{\sqrt{T(Total\ duration)}}{\sqrt{T(SRC+REF)}}$$

$$SNR(corrected) = \mathrm{SNR(Hspot)}\frac{\sqrt{T(SRC+REF)}}{\sqrt{T(Total\ duration)}}$$

Once the correction has been applied, the SQT(2) factor then shall be applied.

Note for previously approved Key Program Observers:

Currently, in this version of HSpot, the minimum time required to perform a single repetition of a single line is estimated to be ~ 600s. This is longer than the minimum time for the shortest wavelength-switching observation, and so for those observers in Key Programs who already have wavelength-switching observations approved (but not executed) from the previous Open Time cycle, it is not yet possible to replace these planned AORs with Unchopped equivalents without paying an extra time-penalty. We are currently investigating various options for those observers, and the HSC will contact those observers towards the end of July.