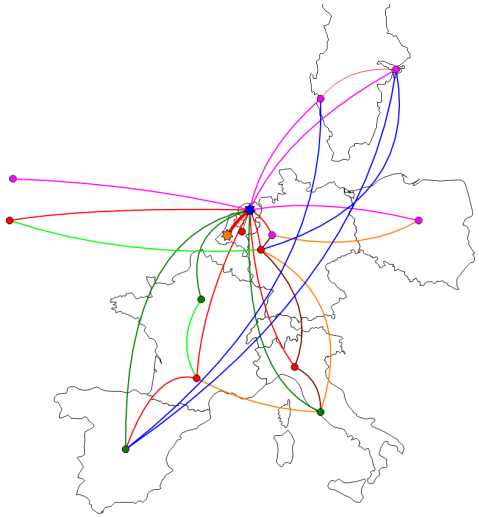
Inspection of Off Positions

R. Shipman
SRON



Netherlands Institute for Space Research

Outline

1. Introduction: reminder of different kinds of Refs for HIFI
2. How to inspect possible emission in OFFs
3. Recipe per observing mode – *Demo*
4. Conclusions/look-ahead

OFF and Referencing Schemes

- The purpose of this session is to show how to inspect the OFF data in HIFI spectra. Each HIFI AOR makes use of a differencing scheme. The quick differencing schemes of Load Chop/Frequency Switch/ DBS correct for drifts in the instrument on a relatively short time scale.
  - → Load Chop look repeatedly at the cold load to reference ,
  - → Frequency switch modulates the LO frequency
  - → Standing waves and baseline instabilities in both Load Chop and Frequency Switch can be further corrected via a dedicated OFF observation on blank sky using the same mode.
    - Load Chop with OFF
    - FSW with OFF
  - → DBS uses the internal chopper to look 3' off source, then a telescope slew. DBS will actually observe two OFF positions which are differenced and placed with the observation making off inspection easy.

OFF and Referencing Schemes (2)

- A few points:
  - Fixed Targets: absolute coordinate or offset wrt ON-target
  - SSO: offset wrt ON-target coordinate only, as a consequence OFF is co-moving
- In this session, the OFFs we will see will have poorer baseline quality than the ON, since it is exactly these data which are used to correct the ON.
- Further details can be found in the documentation
  - ***HIFI Observer's manual***

http://herschel.esac.esa.int/Docs/HIFI/html/hifi_om.html

  - ***HIFI Cookbooks***

http://herschel.esac.esa.int/hcss-doc-12.0/load/hifi_um/html/hdrg_cookbooks.html

OFFs in Frequency Switch

- Details of the Frequency Switch AOT are found in the Frequency Switch Cookbook
  - http://herschel.esac.esa.int/hcss-doc-12.0/load/hifi_um/html/hcb_pfsw.html
  - In the current pipeline (12.0) the OFF data are used to correct the ON and then discarded. The OFF spectra can be preserved after a re-running of the level 2 pipeline.
  - In HIPE 13.0 the OFF data will be saved in the observation like the DBS OFFs.

OFFs in Load Chop

- Details of the LoadChop AOT are found in the Load Chop Cookbook
  - http://herschel.esac.esa.int/hcss-doc-12.0/load/hifi_um/html/hcb_plc.html
  - Currently Off spectra will have to be re-generated (pipeline has to be re-run):
    - Data identifier (BBID) for OFFs in LC point spectra and LC OTF maps is the same. The OFFs can be extracted and inspected in the same way.
  - For HEB bands. The HEB correction may correct most of the baseline issues. If so, it may not be necessary to also apply the OFF correction. The OFF correction may introduce more noise than it corrects for any baseline distortions.

OFFs in Double Beam Switch

- Details of the DBS AOT are found in the DBS Cookbook
- In DBS mode there are two OFF positions observed.
- These two OFF can be subtracted from each other to provide a calibrated and relatively clean reference spectrum which is found in the ObservationContext obs
  - obs → ["calibration"] → ["pipeline-out"] → ["ReferenceSpectra"]

- For more information about the DBS mode please see the documentation:
- http://herschel.esac.esa.int/hcss-doc-12.0/load/hifi_um/html/pdbscook.html

Demo

FSW/LC/DBS OFF Demos

- **Walk through of scripts to inspect OFFs**

OFFs in Position Switch

- Details of the PSW AOT are found in the PSW Cookbook
- In PSW mode there is no quick referencing (unlike load chop/ frequency switch or DBS).
  - This means the OFFs are not independently calibrated.
  - We can produce a “calibration” by reusing the cold loads.
    - This is a poor-mans calibration and not proper, since the same cold loads are already used in the bandpass calibration.
    - At the end of level 1, the OFF data are bandpass corrected
    - We form OFF-cold/bandpass
    - Further fitHifiFringe and fitBaseline will be needed to clean up these final off spectra.
- For more information about the PSW mode please see the documentation:
- http://herschel.esac.esa.int/hcss-doc-12.0/load/hifi_um/html/hcb_ppsw.htm

PSW demo

PSW OFF demo

- **PSW observation inspection**
- **Walk through of script**

Conclusion/Look Ahead

- Above generated OFFs can in principle be added back to the ON in cases there is emission in the OFF which needs to be corrected. → baseline artifacts need to be clean up though in order not to re-introduce these to the ON spectra. Also care should be taken not to introduce noise from the poorly calibrated OFF.
- In HIPE 13, The OFFs will be saved with the observation for simple inspection as part of the standard pipeline output (like DBS).

Questions ?