



# HIFI Science driven cases

## Herschel Observation Planning Workshop

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**David Teyssier, Tony Marston**

HIFI Instrument and Calibration Scientists  
ESAC

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# Outline

1. Accurate Line Intensity Measurement
  1. Point-like sources
  2. Extended sources
2. Multiple Line measurements: best use of Freq. Editor
3. Continuum/line absorption measurements
4. Mapping ( + some elements on Overlays)
  1. Small sources
  2. Extended sources
5. Strategies for spectral scans
6. This afternoon:
  1. Your proposal
  2. Addressing the bug list

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# Accurate line intensity measurement



- *Objectives*
  - Measure line intensity on a specific position
  - Obtain the best baseline possible
- *Point-like source*
  - If APE ( $\sim 2$  arcsec) not accurate enough, use *cross-map with DBS*, and a step size of the order of the pointing error to reconstruct flux
  - If APE acceptable, use *DBS mode*
- *Extended source (size > chopper throw of 3 arcmin)*
  - Best option likely to be *load-chop with an OFF position*

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# Multiple line observations



- *Objectives*
  - Measure multiple lines in a single spectrometer bandwidth
  - Obtain better spectral resolution in dedicated lines
- *Optimal selection of HRS resolution mode*
  - WBS 4 GHz bandwidth simultaneously obtained in both polarizations
  - Up to 4 HRS sub-bands can be strategically placed with at least twice a better spectral resolution
- *Optimal use of frequency editor*
  - Insert all lines of interest via the internal or personal line catalogues
  - Adjust LO frequency manually if necessary
  - Move HRS sub-band manually if necessary

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# The Frequency Editor: summary



- *Backend coverage adapted to HRS resolution mode*
- *Line selection*
  - Scroll-down menus (HSpot internal database)
  - On-line catalogues
  - Personal catalogues
  - USB vs LSB
- *Line location within the IF*
  - Automatic offset applied
- *“Red-shifts”*
  - Automatic velocity changes applied

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# Continuum/line absorption observations

- *Disclaimer*
  - HIFI is not a continuum instrument ! Use PACS/SPIRE for this
- *Objectives*
  - Measure line against (diffuse ISM, Galactic Center) or onto a continuum (planets) with good baseline
- *Optimal observing modes*
  - Avoid *Frequency Switching* and *Position Switching* !
  - *DBS* is the most accurate mode for point sources – *continuum option* allows fast chopping to beat the fast gain drifts. If pointing uncertainty is an issue, use *cross-map* variant of it
  - For extended sources, potentially *load-chop with an OFF position* could help, although strong continuum contrasts will enhance standing waves – TBC in science demonstration phase

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# Mapping observations

- *Objectives*
  - Measure line emission spatial distribution with good baselines
- *Selection of mapping mode*
  - On sources smaller than the chopper throw (3 arcmin + beam size), *DBS raster map* can be used
  - If sources too extended for chopper throw, *OTF* is the only approach so far:
    - Combined with an *OFF position* – standard option
    - Combined with *FSW* when lines are narrow enough, but baseline quality may be affected (esp. in HEB bands) – use of additional *OFF* will help
- *Use of overlays*
  - Background image from catalogue of personal database
  - Overlay mapping coverage – accounts for time visibilities
  - Orientation of map and chopper throw depending on date

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# Spectral surveys: some advice



- *Objectives*

- Obtain complete census of spectral line in given frequency windows

- *Spectral survey strategies*

- Use redundancy factor carefully. Time estimates do not scale proportionally to redundancy, and increased redundancy allows improvement in achieved noise: main driver should be line density, but try several cases to find the best compromise !
- Bands 7a and 7b strongly overlap. You can save quite some time by selecting frequency windows with smaller overlap

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**See you this afternoon to  
check your cases**

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# Going through the bug list: illustration and work-arounds



- *HIFI DBS raster map mode: wrong use of PA angle*
- *“Too” long time estimates*
- *HIFI load-chop w/OFF: wrong overlay orientation*
- *Frequency editor problem with HRS-only*
- *Wrong best-goal spectral resolution with WBS-only*
- *Any other missing bug you know of ?*

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