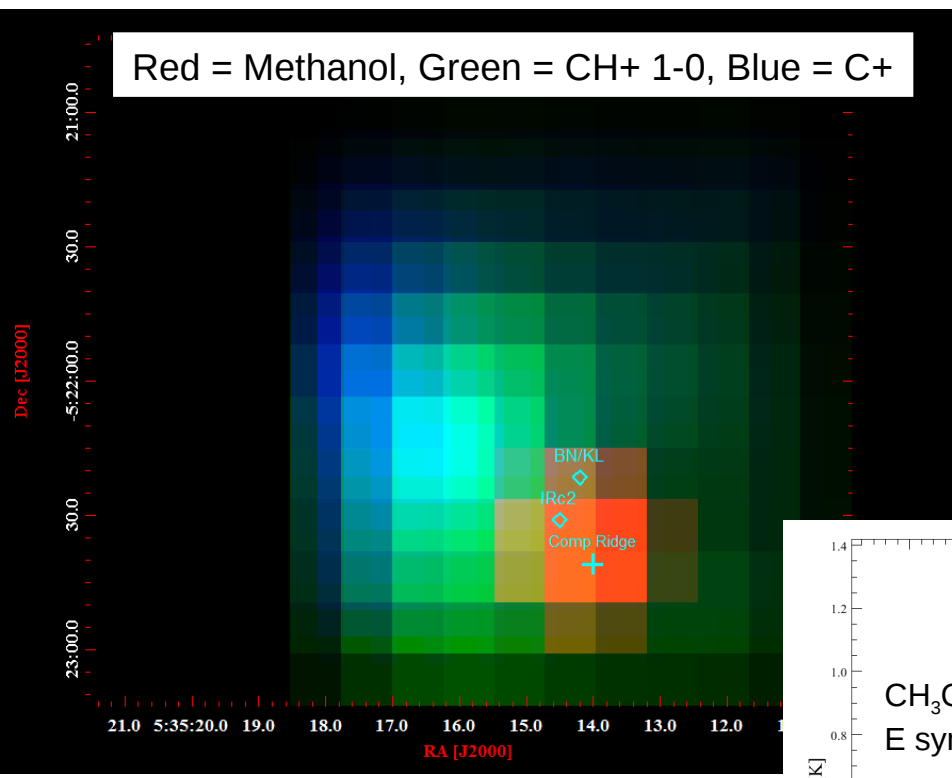
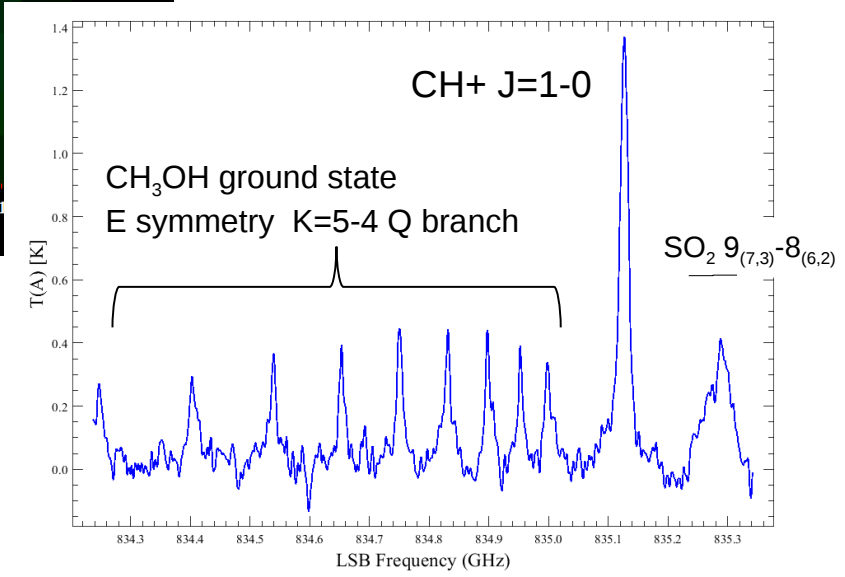


Mapping with HIFI

Adwin Boogert, NHSC



[HIFI OTF map of Orion IRc2 by Morris et al. 2011]

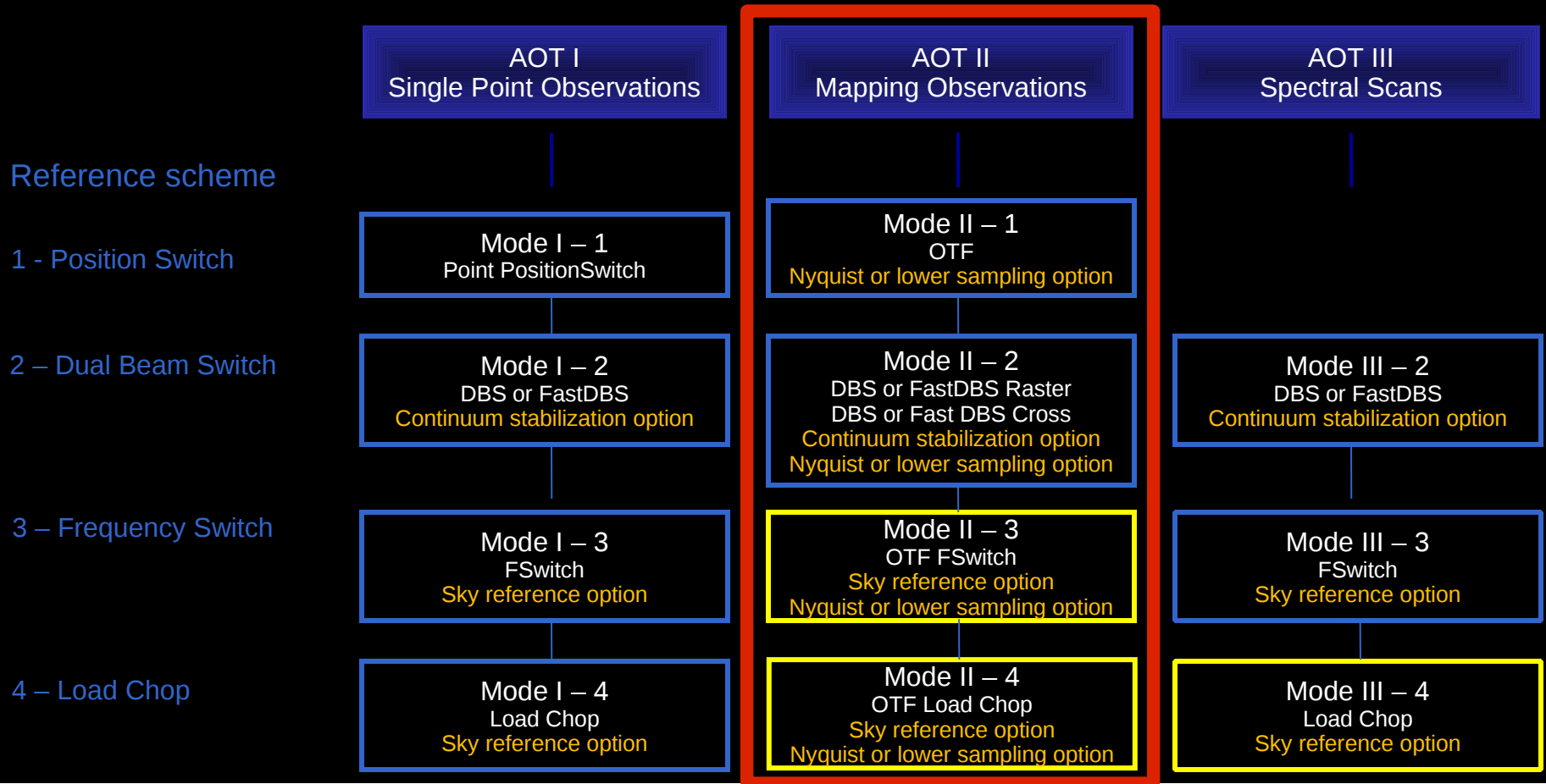




Mapping with HIFI



AOT Schemes with HSPOT 6.0





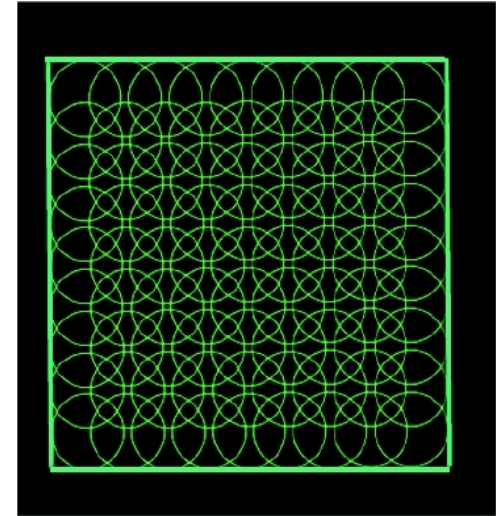
Mapping with HIFI General Remarks



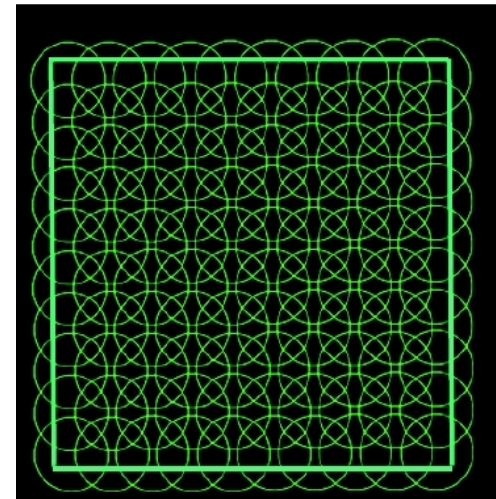
Map coverage:

- HIFI fills requested map area (**plot A**) different than one may be used to from ground-based telescopes (**plot B**).
- In OTF mode, HIFI coverage may be in **between cases A and B**, because mapping is very sensitive to timing correlations between instrument and telescope, and to avoid undersampling, sometimes extra readouts are added.
- **HSPOT advice: always plot AOR on image to check actually mapped area**

[A]



[B]





Mapping with HIFI

General Remarks



More on map coverage:

- HSPOT fills a requested area according to a requested sampling. Always **check** exact pointings after Observing Time calculation **in messages and by overplotting AOR on image**. By adjusting requested map size a bit one might be able to save much observing time.
- If mapping an area with a central point source one might want to make sure there are uneven number of columns and rows, so central pointing is on source. **Check output messages and overplot AOR on image**.
- Position Angles defined in degrees East of North, again, check orientation by overplotting on image.

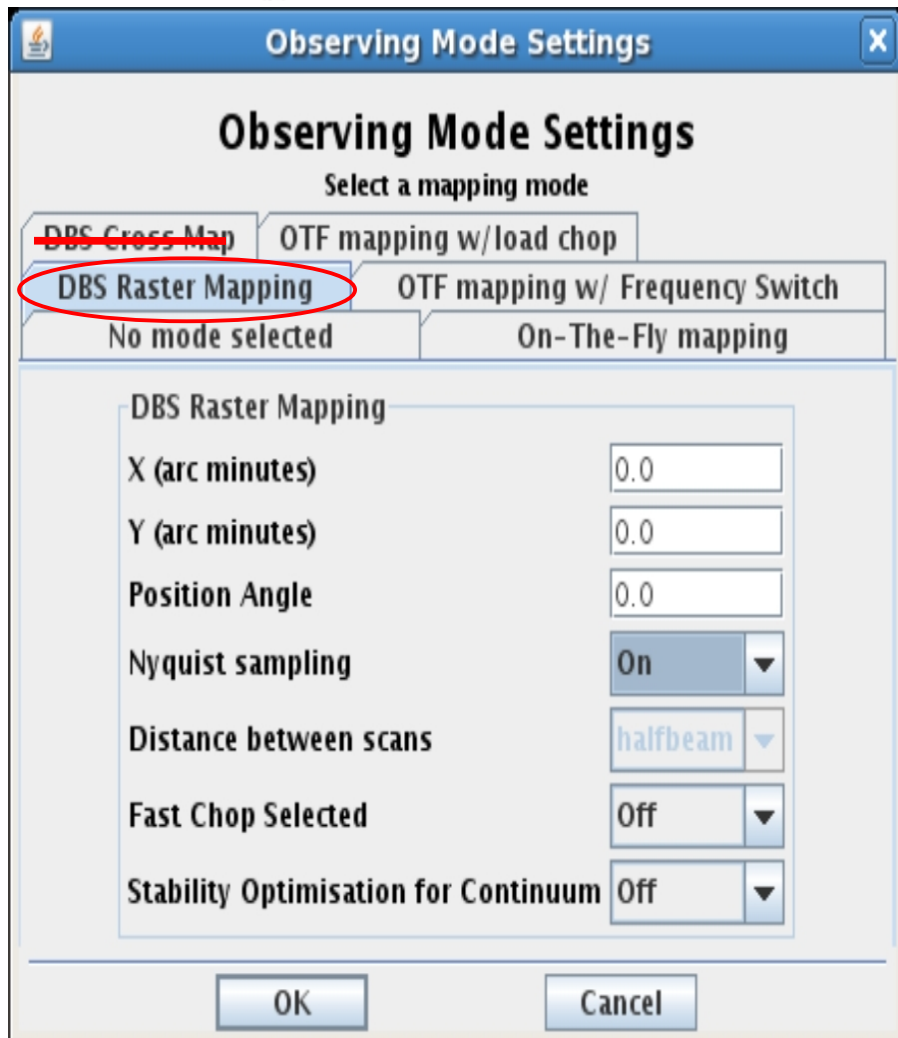
Sky sampling definitions:

- Nyquist sampling is not the same as “half-beam” (HPBW/2) sampling.
- Nyquist has ~20% finer grid, requiring ~40% more time for fixed noise goal.



Mapping with HIFI

Raster Maps



- Uses **Dual Beam Switch** mode
- Less efficient than OTF mapping, but better baselines. Use for weak, broad lines.
- Check HSPOT observing estimate messages for **chopper speed**. Slight modifications in goal resolution can change it. Higher gives better baselines.
- **Chop throw is 3 arcmin**. For maps larger than 3 arcmin, chopping is done within map!
- Normal or fast chop
- Calibration timing available for optimum baseline stability (e.g., continuum measurement)
- *DBS Cross Map not available in OT2 (as of HSPOT 6.0.1)*



Mapping with HIFI

On the Fly Maps



Observing Mode Settings

Select a mapping mode

DBS Cross Map | **OTF mapping w/load chop** | OTF mapping w/ Frequency Switch

DBS Raster Mapping | OTF mapping w/ Frequency Switch

No mode selected | **On-The-Fly mapping**

On-The-Fly mapping

X (arc minutes)

Y (arc minutes)

Position Angle

Nyquist sampling

Distance between scans

Reference Position

Specifications

Type By offset By position

Ref Yes No

RA offset (arcmins)

Dec offset (arcmins)

RA (degrees)

Dec (degrees)

- Continuous telescope motion and readouts
- Select 'empty' sky reference position
- Optionally use **frequency switch** or **load chop** calibration modes. Sky reference position not obligatory, but recommended.
- Generally has poorer baselines than raster mapping, so be careful with broad lines.





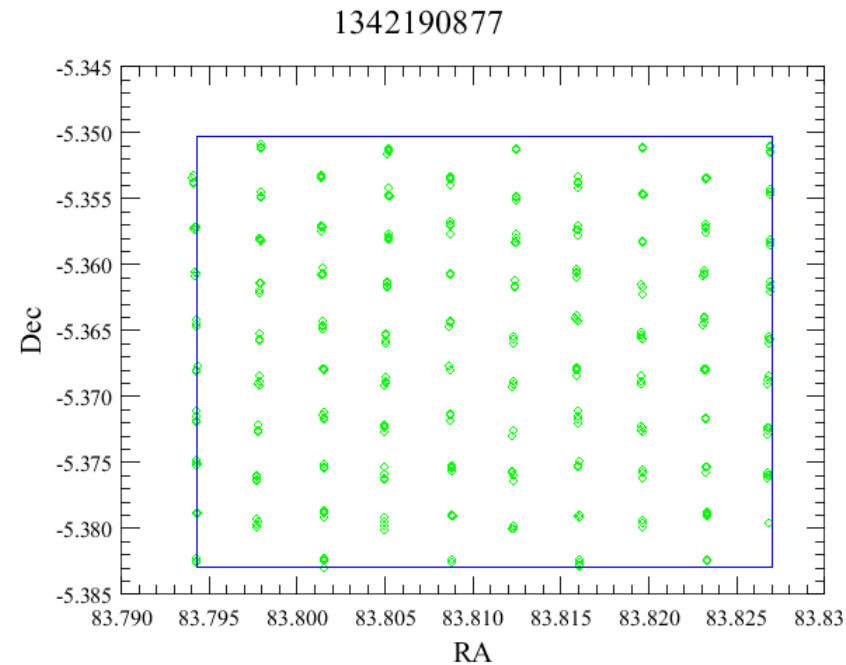
Mapping with HIFI

Issues



OTF mapping is extremely sensitive to timing correlations between the instrument and telescope, including the pointing system and command dispatching. HIFI OTF pointings may show the so called “zig-zag” effect:

- Slight timing mis-correlations due to command timing in the uplink system and scan speed granularity. *Could affect what the user expects from HSPOT vs sees in the data, but otherwise not problematic.*





Mapping with HIFI

Summary of Caveats



Restrictions:

- Frequency Switching not offered with OTF Mapping in Bands 6 and 7, except in the LO range 1890 – 1898 GHz (C+ frequencies).
- Recommendations:
 - Use fast-chop DBS in Bands 6 and 7, for best baseline corrections.
 - If FastDBS can't be used, LChop is the alternative.
 - Avoid placing key lines of interest at the upper or lower edges of the IF of either sideband, in the bands with employ signal-coupling diplexers:
 - Bands 3, 4: avoid upper/lower 250 MHz.
 - Bands 6, 7: avoid upper/lower 150 MHz.
 - All FSwitch and LChop with all modes should be taken with sky reference, esp in the diplexer Bands 3,4,6,7.
 - OTF Maps may over-compensate for timing correlation and granularities in telescope scanning vs readout rate over requested area. **Read time estimate messages, and visualize map for what you want.**