

Accessing the Positions of the H and V beams within HIFI observation contexts

The observed differences in HIFI horizontal (H) and vertical (V) polarisation line profiles has made it desirable to have astrometry available for both H and V spectrometers. The possibility that small scale structural or velocity variations may be responsible can then be examined.

In the past, the pointing information associated with both H- and V- spectra has been that of a synthesised aperture, which is a position midway between the H and V spectrometer beams. It is now possible to use an option in the HIFI pipeline with the 4.2 User Release of HIPE, when re-processing data, to calculate the positions for the H and V beams separately. This is done in the attached jython script, HVPointing.py.

Data in the HSA that has been processed with SPG version 4.1 and higher (4.2, 4.3...) reports the synthesized aperture. However, a miscommunication meant that data in the HSA processed with HIPE 4.0 (between ODs 477 and 488 for HIFI data) contains astrometry for the H and V beams. Bulk reprocessing using HIPE 4.1 is being carried out now, and this will replace any data processed with HIPE 4.0 (or earlier versions). **Any programme that is interested in knowing the positions of the H and V beams should look carefully at the SPG version used for their data.** This can be found in the metadata of the Observation context.

Meta Data			
name	value	unit	description
type	OBS		Product Type Identification
creator	SPG v4.0.0		Generator of this product

When SPG 5.0 is used, then data will again contain pointing information for the H and V beams.

When looking at position information in your data, please use the **longitude** and **latitude** columns in the datasets; at the moment, the metadata can contain contributions from calibration observations. This will be rectified in the future.

1. I want to know the H and V positions and I use HIPE User Release 4.2

Unless your data was processed with SPG version 4.0, reprocess your observation with the attached script. Data processed with SPG version 4.0 already contains the astrometry for the H and V beams. Use the values in the longitude and latitude columns of the HifiSpectrumDataset. These are correct - values in the metadata include positions of reference observations too.

2. I want to know the H and V positions and I export the level 2 dataset to CLASS.

Unless your data was processed with SPG version 4.0, reprocess your observation with the attached script. Data processed with SPG version 4.0 already contains the astrometry for the H and V beams.

HiClass uses the raNominal and decNominal (the values you entered into HSpot), which correspond to the synthesised beam to set the zero position from which offsets are measured in CLASS. The values in the longitude and latitude columns are used to calculate these offsets. This means that even perfectly pointed data will appear to be offset from the zero position when H and V astrometry is calculated.

If you wish to average together the H and V polarization data in CLASS, you will need to set a tolerance appropriate for the offset between the beams.

Band	ΔHV in Y (")	ΔHV in Z (")
1	-6.2	+2.2
2	-4.4	-1.3
3	-5.2	-3.5
4	-1.2	-3.3
5	0.0	+2.8
6	+0.7	+0.3
7	0.0	-1.0

Also, don't forget to check your level 1 data in case of any problems.

3. I don't care about the positions of the H and V beams but my scripts do use pointing information.

Make sure you use the longitude and latitude values found in the columns of the HifiSpectrumDatasets, these are the values that we have verified as correct; RA and dec meta data may also include pointing information from calibration observations.

4. I don't care about the positions of the H and V beams and I don't use any pointing information in my scripts.

You can just take the data from the HSA.

5. I want to know the H and V positions and I use the developer builds.

For simplicity, we recommend that you only use HIPE 5.0.1749 or more recent versions. This is recommended due to a mix of behaviours before this version, including an incorrect calculation of longitude and latitude in the builds between 5.0.1490 and 5.0.1749.

There is a different behaviour in HIPE 5.0.1749 than in HIPE 4.2:

- The useSynt parameter is deprecated and re-applying the doPointing step will add new columns to the dataset
- The "longitude" and "latitude" columns contain the pointing information appropriate to the polarization.
- The pointing information for the synthesised aperture, which is used to point the instrument, is found in the columns "longitude_cmd" and "latitude_cmd".

To re-run doPointing when using versions of HIPE more recent than 5.0.1389 replace

```
htp=doPointing(htp=htp,useIntegration=1, aux=obs.auxiliary, useSynt=0)
```

in the script attached with:

```
htp=doPointing(htp=htp,useIntegration=1, aux=obs.auxiliary)
```