Spectrometer Mapping Observations for 11th March 2010 (updated justification 4th March 2010)

1. Dark Sky

We need to measure the dark sky at all of the BSM positions – we have already shown that the background changes with BSM position. We have previously measured this in Low resolution but we need a new measurement at calibration resolution. The 16 point pattern covers the positions for the 4-point pattern, so only the fully sampled jiggle is needed. We need to use these measurements to determine the first flux calibration based on the telescope model, so need as many repetitions as possible to maximise the signal to noise. This measurement forms the basis of the calibration for all future observations using SOF2. In addition, this measurement will form the basis of the background subtraction for the first science observations – it takes too long to reobserve it every time a science observation is made. Therefore the number of repetitions set here will limit the noise level achievable in the first results. More repetitions will need to be built up slowly through the mission using routine calibration time (probably a few repetitions at a time).

Dark Sky, 10, CR, full, nominal, ***25096 sec***

2. Point source

We need to prove that we have good relative calibration across the array. To do this we will place a point source at different offsets in the map and should reproduce the correct flux at each. Low resolution is sufficient for this measurement.

We have decided that this measurement would be far more useful if Neptune was used as the target (this would in addition give information about the beam). Therefore the main observations (also see point 6) with different offsets will be postponed until Neptune is visible. However, we have still included one point source observation of CRL 618 because this will allow us to check a possible astrometry offset between spectrometer and photometer maps seen in the OD261 data.

CRL618, 4, LR, full, nominal, ***1711 sec***

3. Extended source

We need to be able to calculate the wavelength correction (obliquity effect) for every detector at every BSM position. Therefore we need a smoothly extended source with strong spectral lines. Orion Bar has already been observed in sparse mode and is good for this purpose. We also need to prove we can reproduce extended emission correctly – to prove this we will reobserve 3 maps with different offsets. We need 3 different offsets to really prove that the map is reproducible in all parts of the array. High resolution and full sampling are required.

Orion Bar, 2, HR, full, nominal, ***5149 sec*** *(the same position used before in Sparse mode)*
Orion Bar, 2, HR, full, nominal, ***5149 sec*** *(offset by approx. 1 arcmin)*
Orion Bar, 2, HR, full, nominal, ***5149 sec*** *(offset by approx. 1 arcmin)*

4. Raster positions

We have corrected the raster positions in the uplink after the first initial measurements. We need to prove that the updated positions are better. We will repeat the map of NGC7023 using the new positions (90 degree rotation). Also with a map offset to reproduce the structure when observed with different parts of the array. Medium resolution will be used so that we can investigate spectral line maps at this resolution (this may be attractive for science observations because it takes less time than high resolution). Intermediate sampling is sufficient to investigate the map. Comparison with the OD261 data will give 3 maps of NGC7023 at different orientations/offsets.

NGC7023, 4, MR, raster 2x2, intermediate, nominal, ***4089 sec*** *(same position as OD261 but with corrected rotation)*
NGC7023, 4, MR, raster 2x2, intermediate, nominal, ***4089 sec*** *(offset by approx 1 arcmin)*

5. Test in bright source mode

The mapping mode will mostly be used with bright sources. We need to prove this works in bright source mode. The central position of Orion will be observed with intermediate sampling and HR using bright source settings – the equivalent dark sky measurement will also be required.

Dark Sky, 4, CR, intermediate, bright, ***2776 sec***
Orion OMC-1, 2, HR, intermediate, bright, ***1607 sec***

6. Point/extended source correction & prove BSM positions understood

To calculate point/extended source correction at different BSM positions, we need to recentre a point source onto the centre detectors when we have moved the BSM. This will also prove once and for all that we understand where the BSM is moving. LR will be sufficient, and only the 4 points of intermediate sampling will be used.

We have now derived some convincing maps showing we understand the BSM positions from the OD261 data. In addition, these measurements would work much better with a bright source such as Neptune. Therefore, we will postpone these measurements (if still necessary) until Neptune is visible.