

External BlackHoleCam Face-2-face meeting

Date: 23 February 2016, MPIfR, Bonn

Subject: dataprocessing, fringe finding

Present: Eduardo Ros, Thomas Krichbaum, Rusen Lu (MPIfR), Cornelia Müller, Raquel Fragas-Encinas, Chrstiaan Brinkerink, Michael Janßen, Ciriaco Goddi (Radboud), Des Small, Mark Kettenis, Ilse van Bommel (JIVE), Karl Schuster (IRAM).

Calibration order of events

TK remarks that the order in which calibration is done is important, because it is an iterative process. He recommends to do fringe finding before amplitude calibration. That way, if you find problems with the amplitude calibration at the end of the calibration process, you do not need to rerun the fringe finding. He also recommends to do bandpass correction before fringe finding, and use a two step approach: first calibrate the bandpass amplitude using the auto-correlations, then correct bandpass phase separately. For spectroscopy it may be required to include a time correction as well, since bandpass can slowly vary with time.

The recommended order of calibration is now:

- Conversion from correlator to FITS-IDI and MS format
- Importing data and metadata into CASA
- PA correction (make sure all mount types are accounted for)
- Flagging strong RFI and known bad data
- Bandpass amplitude calibration from auto correlations
- Fringe finding (Gain phase calibration)
- Gain amplitude calibration
- Bandpass phase calibration

Fringe fitting details

If we can solve for delay and rate within the tropospheric coherence time, these solutions can be used as starting values for the next solution interval. This might speed up the fringe finding routine, and also make solutions more reliable. It is important to have a good initial guess for the first time stamp. The method from Alef & Porcas may provide this.

One major problem at the moment is the lack of a proper definition of a fringe detection. In HOPS this is handled better, but only on a per baseline basis. The signal-to-noise definition in AIPS is unclear. This needs to be improved in the CASA implementation. AIPS has a task (BLING or BLAP) to convert baseline based solutions to station based solutions. This might be of help in defining a SNR for the fringe detection. There are also two alternative fringe finders in AIPS (KRING and BLING), which could be used for verification.

Metadata

The discussion includes requirements for the metadata. For the moment we can stick to the ANTAB format, but for future processing the format needs more transparency and accessibility for the end-user.

For the gain amplitude calibration we require better gain elevation curves and opacity correction. The gain elevation curve is only valid for the weather conditions under which it was observed. For future operations over large bandwidth, the opacity correction should be frequency dependent. The WVR at ALMA and PdB are in beam, but this may not be the case for other stations. We need to know where the WVR points to ensure a proper correction for opacity. The total power measurement on single dish telescopes also gives information on the atmospheric conditions.

For both Tsys and weather info the preferred cadence is ~10 seconds or less. Ideally this information is provided per IF, per recorder.

Other metadata that is needed: everything that is currently in the field system, including source elevation and on source information. For full calculation of the SEFD the phasing efficiency of interferometers (ALMA and NOEMA) is also needed.

Other concerns:

The EHT is not known in CASA. At some point it needs to be implemented, but this is not a bottle neck if the data are in MS format.

For imaging larger fields in CASA the beam correction is needed. This is also not a bottle neck for VLBI observations, but can become an issue for fields larger than the smallest telescope beam.

Polarization calibration has not been included in the pipeline at the moment. CASA can handle this intrinsically, but we need to think about how to cope with the Hawai'i situation where two distinct telescope are observing orthogonal polarizations and later combined into one.

It will be beneficial to maintain the AIPS functionality even after full implementation in CASA, since we will need to perform in depth verification.