Future outlook


MIT Haystack Observatory

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Future plans

Immediate near term plans:

- Finish processing the VGOS (broad-band) portion of RD2005 and RD2006.
- Determine logistics of multiple databases per session, release RD2005/RD2006 broad-band.
- Finish processing RD2007 (both mixed-mode and broad-band) and release.
- Clean-up mixed-mode post-processing software and make user-friendly in preparation for release.
- Establish (tagged) DiFX version for use with mixed-mode data.
Software Versions

• DiFX version:
  • We have used 2.5* (patch of 2.5 branch).
  • The DiFX tag 2.5.4 was intended to resolve VGOS processing needs.
  • Need to validate 2.5.4 processing with mixed-mode data.
  • Also need to make sure all features of difx2mark4 2.6.2 are also supported in the 2.5.4 branch.

• Post-processing software:
  • Currently using experimental version of HOPS 3.22*, needs to be tagged/released.
  • Fourfit requires at least one new feature/keyword.
  • Mixed-mode counterparts of familiar VGOS post-processing helper scripts (ffres2pcp, fourphase, batch_fourfit, etc.)
Post-processing software and other improvements

- New fourfit feature needs documentation (extension to CP L-pol?)
- Mixed-mode helper scripts need documentation and should be augmented so that no manual S/X band control file stitching is needed.
- Other diagnostic/plotting tools need to be augmented to support mixed-mode data.
- If/when a stable cadence of mixed-mode sessions occurs, pc_phases and Y-X phase delay offsets should be monitored for stability (for VGOS stations in mixed-mode, and VGOS broad-band at SX frequencies).
Resolved issues - post-processing

At EVGA 2021 meeting we reported on the following open issue, which is now most resolved:

- Y-X offset 90 degree phase shift (different value needed on mixed and VGOS-only baselines):
  - At the time this is how we processed RD2005
  - This is resolved (at least experimentally) with the addition of fourfit keyword `mixed_pol_yshift90`.
  - RD2006 was processed with this new feature.
  - Question: Should we augment this to support values other than 90°?
Resolved issues - post-processing

At post-EVGA IVS analysis workshop discussed:

- Non-closure of phases on some triangles in mixed-mode experiments.
- Reference frequency issue causing jumps in cphase → resolved through choice of new reference frequencies.
- Mixed LP-LP-CP triangles - dPA rotation on LP-LP baselines is uncorrected by fourfit and is visible in closure phase.
- fourfit is baseline based but cphase corrections would need to be done on per-triangle basis. → Leave as is for now, correction can be done in database creation (pre-analysis).
Open issues - post-processing

As mentioned at EVGA-2021 meeting, but as of yet un-investigated:

- Due to differences in the S/X and VGOS back-end systems the per-channel phase-structure on mixed-baseline data is non-linear.

- Without correction, this leads to a slightly asymmetric SBD function on mixed baselines, correctable with 3rd-order poly.

- Not yet applied in sessions we have processed so far, needs further investigation.
Open issues - analysis

- For each mixed-mode session we can generate two databases: mixed-SX and broad-band VGOS.
- Experimentally, we have done a combined analysis of both databases (RD2005) with VieVs.
- The combined analysis shows reduced uncertainties on site positions.
- How should we go about releasing and/or combining the two DB types?
- A single database with both data-sets does not appear possible (due to dual observations on same baseline and difference in the way dTEC correction is done). Comments?
Future prospects

- A framework with basic functionality in processing mixed-mode sessions is ready.
- More solid documentation/memos needed and some clean up needed before release.
- Most of the open post-processing issues have been resolved with exception of VBP and aforementioned analysis questions.
- Are there alternative methods for processing mixed-mode data (pol-convert)?