The Hitch Hiker's Guide to OYSTER:

A quick reference to NPOI Calibration

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1. The first step in calibrating NPOI data is to run *Constrictor* on the raw data files. How this is done will be explain in a separate document.

2. Once you have identified your .con file, start OYSTER by typing

   - oyster # Start OYSTER.
   - get_data,'filename.con' # Load constrictor file.
   - list_scans # Check that the configurations are correct.
   - flagstation # flag the array configurations used.
   - get_stationtable # Where does this data come from.
   - calcgeo
   - oyster # Bring up the main widget.

3. We first edit the data based on the FDL residuals.

   - Reduce → PointData → Astrometry → PLOT
     - Y-axis: FDLDelay (res.)
     - X-Axis: Index
     - Errors

These widget operations set up plotting attributes so that we can flag data due to bad FDL tracking. We hand flag obvious bad data, and then use

- Pl/E → Auto

This flags any other outliers. Continue editing for each of the other inputs beams, which are selected with

- InputBeam: 1,2,3,5,6 # Do each in succession.

Input beam 4 is the reference beam, and does not need to be edited.

4. Save the flag table:

   - Reduce → PointData → Flagtable → Save

5. We next edit the data based on delay line jitter:

    - ♦ Reduce → PointData → Imaging → PLOT

        - Y-axis: DelayJitter
        - Baselines: All
        - OutputBeam: 1
        - Pl/E → Auto
        - OutputBeam: 2
        - Pl/E → Auto

Note that we do this for both OutputBeams (There are currently 2 spectrometers and, therefore, 2 output beams.

6. Edit the data based on the NAT counts:

        - Y-axis: NATCounts

Check all 6 input beams.

7. Edit based on photon rates:

        - Y-Axis: PhotonRate
        - OutputBeam: 1
        - Channels: Selected 1,2,3,4

This will plot the photon rates for all sources for the first 4 spectrometer channels of spectrometer (OutputBeam:) 1. Flag any really bad outliers (see tutorial), and then do

        - Channels: All
        - OutputBeam: 1
        - Pl/E → Auto
        - OutputBeam: 2
        - Pl/E → Auto

This will edit out any other outliers.

8. Edit bad squared visibility amplitude data:

        - Y-Axis: VisSq
        - Channels: All
        - Baselines: All
        - Stars: All
        - OutputBeam: 1
        - Pl/E → Auto

    - OutputBeam: 2
    - Pl/E → Auto

9. Save your work:

  - Reduce → PointData → Flagtable → Save

NB: At this point you could stop the editing session and restart it later. To restart editing do the following:

- get_data,'filename.con'
- flagstation
- oyster
  - Reduce → PointData → Flagtable → Load
  - Reduce → PointData → Flagtable → Apply

10. The Bias Correction should be done next. The V^2 bias corrections are done in *Constrictor*, so we only do the triple product amplitudes here. Start by doing the following:

- average
  - Calibrate → SYSTEM   # This is a special purpose widget.
    - Star: Selected   # Select program star and calibrator
    - Channels : All
    - Baseline: Selected   # Pick one, *e.g.*, 1
    - Point: 111101   # Bits identify array configuration
    - Output Beam: 1

This will allow you to examine some of the fits. If they look reasonable try using all the stars.

    - Baselines: All
    - Pl/E → Screen
    - Output Beam: 2
    - Pl/E → Screen
    - Points: 111111
    - Pl/E → Screen
    - Output Beam: 1
    - Pl/E → Screen

By plotting to the screen the bias correction is applied to the data.

11. Editing the background data.

- get_bgdata
  - Reduce → BGData → PLOT
    - Y-Axis: BGRate
    - Channels : All

- Pl/E → Screen

We are looking for bad background scans which we would edit by hand. Check channel 11 for signs of leakage through the metrology notch filter.
Do the other output beam as well:

- Output Beam: 2
- Pl/E → Screen

Now expand the background data to include all scans;

- Reduce → BGData → ExpandBG

12. We are now ready to Calibrate. Start by averaging the data.

- average
  - Calibrate → Visibility → FlagIncoh # Flag the incoherent scans.
  - Access → Write → HDS # Write a .cha file.
  - Calibrate → Visibility → PLOT
    - Y-Axis: VisSq c
    - Stars: Selected # Select program star and calibrator
    - ❑ Lines
    - Channels: Selected # Try 1,5,9,13 say. Press Enter!
    - Baselines: Selected # Start with 1, say. Press Enter!

Examine some plots of V^2 *v.* Time for different channels and baselines to determine how well the variations of V^2 in the program star are tracked by the calibrator. Then do the calibration.

- Calibrate → Visibility → CALIBRATE

The stars to be calibrated are selected in the Visibility Plot widget, select both the program star and the calibrator. In the Index selection widget we choose:

- Channels: All
- Baselines: All
- Points: 111101

In the Visibility Calibrate widget select the Calibrator, select Time as the independent variable, and press the Loop button. In the Time widget select the Smoothing Interval: S_20, for 20 minute smoothing.

Now we are ready to do the calibration:

- Output Beam: 1 # Spectrometer 1
- Points: 111101
- ❑ Calibrate

- Output Beam: 2 # Spectrometer 2
- Calibrate
- Points 111111
- Calibrate
- Output Beam: 1 # Back to spectrometer 1
- Calibrate

This completes the calibration of the V^2's. We are ready to move on to the calibration of the Triple Product.

13. Closure Phase Calibration:

Visibility Calibrate widget

- Variable: Triple Phase

Visibility Plot widget

- Lines
- All in 1
- Triple: 1

Plot the triple phase for each triple to see if the phases need to be unwrapped. If the phases do need to be unwrapped use manuel unwrapping.

- Calibrate → Visibility → Triple → Manuel Unwrap

After unwrapping we can press

- Calibrate

Now continue to cycle through all the triple phases, unwrapping if necessary, and then pressing Calibrate. Some Triple Products may have no data.

14. Closure Amplitude Calibration:

Visibility Calibrate widget

- Variable: Triple Amp

Cycle through the Triple Amplitudes, pressing Calibrate for each one.

15. Write a UVFITS file:

- set_complexvis
- put_fits, ’Star Name’ # For example, ‘FKV0705’

16. Finally, save your work:

- ♦ Reduce → PointData → Flagtable → Save
- ♦ Access → Write → HDS