Correlation Recipe with the DiFX and HOPS software packages

- **Generate filelists per station**

mb5sum -s /global/lv71175/meq/DATA/aua036/ht/ > ht.filelist*
mb5sum -s /global/lv71175/meq/DATA/aua036/yg/ > yg.filelist*

- **Get gps-maser time offset from control file (look up how the value is stored fmout-gps or gps-fmout, no standard, if you don't find fringes try different sign)**

grep fmout-gps aua036ht.log
grep fmout-gps aua036yg.log

- **Set up v2d file (main control for DiFX)**

nano aua036.v2d

- **Define control settings in your .v2d file**

```
vex=aua036.vex        # tells difx where your vex file is located
antennas=HT,NY # set antennas you want to correlate

singleScan=True              # if True, split each scan into its own job
tweakIntTime=True     # ensure integer blocks per send

# specify your correlation settings in this block (usually provided by the session #designer)
SETUP geo
{
  tInt = 1                   # integration (accumulation period) default 1 sec
  doPolar = False            # do not correlate cross hands when possible
  nChan = 64                 # number number of channels per spectral window
 }

ANTENNA HT
{
  filelist = ht.filelist   # tells difx where the baseband data is stored
  clockOffset = -10.515    # difference gps maser time in usec
  clockRate = 4.1344e-07   # rate of difference gps maser time in usec/s
  clockEpoch = 2018y026d19h45m00s # epoch
}

ANTENNA NY
{
  filelist = ny.filelist
  clockOffset = -12.9715
  clockRate = 2.0672e-07
  clockEpoch = 2018y026d19h45m00s
}
```

- **Run vex2difx which generates required input files for DiFX**

vex2difx aua036.v2d

- **Start the Calc server to be able to compute theoretical delays**

startCalcServer &

- **Calculate theoretical values for your scan**

calcif2 aua032_001.calc

- **Define processing nodes in your machines file**

nano machines

- **Insert name of processing nodes**

```
n07-039
n07-039
n07-039
n07-039
n07-039
n07-039
n07-039
n07-039
n07-039
n07-039
n07-039
n07-039
n07-039
N07-039
```

- **Run DiFX with mpirun**

mpirun -np 14 -machinefile machines mpifxcorr aua036_001.input

- **DiFX output will be generated**
- **Convert difx database to mark4 database**

Difx2mark4 aua036_001

- **The mark4 database of your correlated scan is stored in the 1234 folder**
- **Create a control file for fourfit and define your control settings**

nano cf_1234

- **Define your control settings in the fourfit control file**

```
max_parity  0.01              # historical reasons (required for tapes)
pc_mode multitone             # define your phase calibration mode
pc_period 5                   # phase estimation period
start -2                      # start time for data to be included
sb_win -512.0 512.0           # single band delay window search range
mb_win -2.0 2.0       # multi band delay window search range
dr_win -300.e-4 300.e-4       # delay rate window search range
```

- **Execute fourfit to look for a fringe-detection**
    - *fourfit -t* (The -t option indicates “test” mode, where it doesn't create a fringe output (the Li.X.[Number].[6 letter code] file under the 323-0012 subdirectory)
    - *fourfit -x* (-x tells fourfit to use an Xwindow display for the fringe plot (using PGPLOT))
    - *fourfit -m0* (Message level is set to 0, so you get a lot of details on the fitting process and results.)
    - *fourfit -c cf_1234* (-c cf_1234 tells it to use the cf_1234 control file which sets the fitting option.)
    - *fourfit -b* (-b selects the baseline and frequency band. In this case, it's the Li (Hobart12→Katherine) baseline and X-band only. You can omit the baseline selection and only select on frequency with something like -b:S)
    - Look at HOPS station code to watch the letter code (cat $HOPS_STATION_CODE)

*fourfit -tx -c cf_1234 -bie:X -m1 1234/**