Correlation Status

Project Code	Block Code	Sources	DOYS	UT	Freq	Stations	Status	PI	Comment
	f231a		123			European			fringe test
	c231a		124		86	Global	correlation finished		.vex, .v2d ready
	c231b		125		43, 86	Global	correlation finished		.vex, .v2d ready
	c231c		126		86	Global	correlation finished		.vex, .v2d ready
	c231d		128		86	Global	correlation finished		.vex, .v2d ready

General comments

Metadata

- Draft schedules: https://cloud.mpifr-bonn.mpg.de/index.php/s/J6SYRbxWJ8zMRF
- VLBA clock infos: Jay Blanchard from NRAO has uploaded *.vex.preobs files with clock_early sections
- Observing block scans into PI projects association: SPLIT_c231.v1.txt

Stations

- Station feedback summary at https://www3.mpifr-bonn.mpg.de/div/vlbi/globalmm/sessions/may23/feedback_may23.asc
- ALMA scheduled, will have 3 MHz frequency offset
- LMT runs off Oscilloquartz xtal without H-maser/Rb
- LMT is linear polarized, has a feed rotator active during calibration scans that ought to return to 'origin' for VLBI scans avoiding any per-scan instrumental polarization angle offsets
- MOPRA is linear polarized as in 2022 - LBAOps wiki page showing circulars is incorrect
- NOEMA reference pad N07
- TAMNA is not observing due to broken maser
- Onsala DBBC3 16 Gbps in f231a and c231a as station "OD", DDC_U v126 firmware; f231a unfortunately with wrong receiver; Flexbuff (koll.oso.chalmers.se 130.242.10.6) for the DBBC3 backend. Not all of the 16 Gbps data need to be correlated. Perhaps only on LLAGN.

Observing Notes

- MRO c231a on time. Some scattered clouds
- ATCA late as setup cannot start until CenA and 3c279 rise
- LMT stopped observations after scan 598; LMT is ready to join c231b. Opacity at 225 GHz is 0.1. Tsys= 94 K
- LMT skipped a few scans for focus/astigmatism corrections? Message at 7:53 CEST May 6. Missed scan 885. LMT will stop observations after scan 670. Tonight we missed a few scans and were late on a few observations that had a small downtime. Otherwise everything went well at 01:50 CEST May 7.
- JCMT cannot run pointing/focus/Tsys/efficiency observation now, but can point source.
  With our pointing model we can point source within 10'' without running pointing observation, and focus is pretty stable.
  Problem is we cannot run Tsys.

- JCMT: We are on source on time from the start. Tau is getting lower and current tau225 ~ 0.2. Our first scan number in the log is 373 (start=2023y129d02h20m00s), but in the vex file scan No for the first scan is No627. Vex starts at 255?
- EB Tsys=210 K, 20mm water, but still can point on BLLac at 13:20 CEST, May 5; Started c231b a bit late, due to a thunderstorm warning, now we point on 3C273, Tsys=220 K @ elv=20deg, cloudy conditions, 15mm pwv; affected by rain, we point at 27 GHz and do VLBI at 86 GHz, though with marginal performance, Tsys ~300 K at 16:48 CEST, May 6
- Last night EB had bad weather, heavy rain and thick clouds, Since 3 UT is getting better and we are now pointed on 0954+65 and observing. Tsys=250K at elv=20 at 6:07 CEST, May 8
- NOEMA c231b, we lost polarization RCP between 02:00 and 04:00 and four scans between 03:02 and 03:25. Most of the scan 18:04 on M87 was lost due to a blocked antenna (the last 2 minutes of that scan are ok). The rest of the scans were done under good conditions. Message from 11:14 May 6, referring to the night before.
- Preliminary NOEMA flux estimates: NGC3998 = 76 mJy , NGC5077 = 51 mJy , NGC4594 = 151 mJy for 3C279 = 10.45 Jy
- NOEMA joined c231a on 12:00 UT. The first two scans were not calibrated optimally but now we're good, phasing efficiency around 90%; Reference antenna is on pad N07, maser/gps drift should be below 1 nsec/day; at 16:36 CEST, May 5: Conditions are degrading, we are getting to low elevation through turbulent cloud layers. Phasing efficiency frequently below 50% now

ALMA

Modules shipped from ALMA OSF to Bonn 08/2023.

APP QA2 calibration tables for PolConvert are still in progress (status of 12/2023, and 02/2024, and 05/2024).

Feedback for PIs - the visibility data in the two FITS-IDI IFs that start at 85308 MHz and the other at 87164 MHz are spectrally incomplete on the baselines to ALMA.

For example, the latter IF covers 87164.0 to 87228.0 MHz, while the standard ALMA setup recorded only up to sky frequency 87210.453125 MHz. Thus the last ~18 MHz of this FITS-IDI IF do not contain proper data from ALMA. Similarly for the IF starting at 85308 MHz. Due to a bug in the DiFX correlator these incomplete visibility records were written out rather than discarded.

In post-processing these two IFs should be flagged on baselines to ALMA.

background/debugging:

All c231d PolConvert.log log files:

c231d_1151.polconvert-*/PolConvert.log
WARNING! There is no spw that covers all the IF frequencies!
Problematic IFs are: 62,63,64,76,82
(sometimes 62,63,64,65 or other depending on the scan)

The corresponding DiFX IFs (0-based indices) in c231d_1151:

```
 fq  61 :    64.000000 MHz USB [4096-ch/32-avg] @ 87164.000000 MHz
 fq  62 :    64.000000 MHz USB [4096-ch/32-avg] @ 87228.000000 MHz
 fq  63 :    64.000000 MHz USB [4096-ch/32-avg] @ 85308.000000 MHz
 fq  75 :    64.000000 MHz LSB [4096-ch/32-avg] @ 85308.000000 MHz
 fq  81 :    64.000000 MHz USB [4096-ch/32-avg] @ 85244.000000 MHz
```

In the end after Polconversion there remain mixed polarization visibilities,

```
$ printDiFX.py c231d_1151.difx | grep "AA-"  | grep "\/Y\|\/X"
AA-AA/257/61:87164.0000000U/XX  mjd:60073.00001454 nchan:128 bw:64.0000
AA-AA/257/63:85308.0000000U/XX  mjd:60073.00001454 nchan:128 bw:64.0000
AA-AA/257/61:87164.0000000U/XY  mjd:60073.00001454 nchan:128 bw:64.0000
AA-AA/257/63:85308.0000000U/XY  mjd:60073.00001454 nchan:128 bw:64.0000
AA-AA/257/61:87164.0000000U/YX  mjd:60073.00001454 nchan:128 bw:64.0000
AA-AA/257/63:85308.0000000U/YX  mjd:60073.00001454 nchan:128 bw:64.0000
AA-AA/257/61:87164.0000000U/YY  mjd:60073.00001454 nchan:128 bw:64.0000
AA-AA/257/63:85308.0000000U/YY  mjd:60073.00001454 nchan:128 bw:64.0000
AA-GL/261/61:87164.0000000U/XL  mjd:60073.00001454 nchan:128 bw:64.0000
AA-GL/261/63:85308.0000000U/XL  mjd:60073.00001454 nchan:128 bw:64.0000
AA-GL/261/61:87164.0000000U/XR  mjd:60073.00001454 nchan:128 bw:64.0000
AA-GL/261/63:85308.0000000U/XR  mjd:60073.00001454 nchan:128 bw:64.0000
AA-GL/261/61:87164.0000000U/YL  mjd:60073.00001454 nchan:128 bw:64.0000
AA-GL/261/63:85308.0000000U/YL  mjd:60073.00001454 nchan:128 bw:64.0000
AA-GL/261/61:87164.0000000U/YR  mjd:60073.00001454 nchan:128 bw:64.0000
AA-GL/261/63:85308.0000000U/YR  mjd:60073.00001454 nchan:128 bw:64.0000
AA-OD/266/63:85308.0000000U/XL  mjd:60073.00001454 nchan:128 bw:64.0000
AA-OD/266/61:87164.0000000U/XL  mjd:60073.00001454 nchan:128 bw:64.0000
AA-OD/266/63:85308.0000000U/XR  mjd:60073.00001454 nchan:128 bw:64.0000
AA-OD/266/61:87164.0000000U/XR  mjd:60073.00001454 nchan:128 bw:64.0000
AA-OD/266/63:85308.0000000U/YL  mjd:60073.00001454 nchan:128 bw:64.0000XL
AA-OD/266/61:87164.0000000U/YL  mjd:60073.00001454 nchan:128 bw:64.0000
AA-OD/266/63:85308.0000000U/YR  mjd:60073.00001454 nchan:128 bw:64.0000
AA-OD/266/61:87164.0000000U/YR  mjd:60073.00001454 nchan:128 bw:64.0000
...
```

VEX file:

```
ALMA
chan_def = &W : 87210.453125 MHz : L : 62.5 MHz : &CH01 : &BBC07 : &cp;
...
chan_def = &W : 85394.046875 MHz : L : 62.5 MHz : &CH32 : &BBC07 : &cp;
```

with ch01 covering approx 87147.95 to 87210.45 MHz

hence freq #61 covering 87164.0 to 87228.0

ATCA, Mopra

$ atcapos.py 2023y125d11h45m01s # first At scan in c231a.vex.obs ==> track A: AT_W110
$ atcapos.py 2023y126d07h15m00s # first At scan in c231b.vex.obs ==> track B: AT_W110
$ atcapos.py 2023y129d07h00m00s # first At scan in c231d.vex.obs ==> track D: AT_W104 !
$ export STADB=~/jwagner/sched/sched_11.6/catalogs/locations.dat
$ updatepos.py ATCA AT_W110 <vexfile>
$ updatepos.py ATCA AT_W104 <vexfile>

...

Clock data and Tsys are available via:

- https://www.atnf.csiro.au/vlbi/dokuwiki/doku.php/lbaops/lbamay2023/c231a
- https://www.atnf.csiro.au/vlbi/dokuwiki/doku.php/lbaops/lbamay2023/c231b
- https://www.atnf.csiro.au/vlbi/dokuwiki/doku.php/lbaops/lbamay2023/c231d

Mopra polarization is linear X,Y, not circular as indicated by https://www.atnf.csiro.au/vlbi/dokuwiki/doku.php/lbaops/lbamay2023/c231b

ATCA polarization too is linear X, Y, judging from fringes to KVN and VLBA

NOEMA

Phase center is pad N07 at (4523959.3899 m : 468037.3577 m : 4460353.5681 m), reconfirmed by M. Bremer 22.08.2023 from NOEMA data headers and setup

GLT

Note, if there are no fringes, watch out for alternate YIG LO lock like in C221A vs C221B.
After fringe search: found fringes using the nominal observing frequency, 87292.00 LSB.

C231A C231C are found on EHT 2023 modules already at Bonn
C231B C231D were at SHAO due to other 3mm experiments on the same module set, received 11/2023 in Bonn

LMT

Modules stuck at LMT for a while then shipped to Bonn 09/2023.

VEX needs "axis_offset = 3.30 m;", the default of 0 meters is incorrect.

No fringes found.

JCMT

P. Friberg: modules were shipped to SHAO. Jiang Wu at SHAO preparing shipping 08/2023.

Modules arrived in Bonn end of 10/2023, contain C231B C231D. No data to e-transfer.

Recording media

See the media distribution plan

Correlation and HOPS notes

The 7 mm observation was correlated with as-recorded 128 MHz wide channels.

The 3 mm observation was correlated with 64 MHz wide channels assembled in DiFX from the mixture of station backend channelizations such as 62.5 MHz (ALMA), 64 MHz (ATCA, NOEMA, and EU), 128 MHz (VLBA), and 2048 MHz (KVN, GLT, Mopra, LMT). The corresponding setup for 64 MHz wide correlation output frequencies was:

```
OUTPUTBAND outputbands
{
   # NB: Should not have duplicate entries! DiFX 2.8.1 has an
   # incorrect check for duplicates-avoidance, fixed in a future 2.8.2.
   # NB2: Try to keep these sorted in increasing freq order,
   #     as difx2fits does not sort during export to FITS
   #
   # $ grep addOutputBand *.v2d | sort | uniq
   #
   addOutputBand = freq@85244.00/bw@64.0
   addOutputBand = freq@85308.00/bw@64.0
   addOutputBand = freq@85372.00/bw@64.0
   addOutputBand = freq@85436.00/bw@64.0
   addOutputBand = freq@85500.00/bw@64.0
   addOutputBand = freq@85564.00/bw@64.0
   addOutputBand = freq@85628.00/bw@64.0
   addOutputBand = freq@85692.00/bw@64.0
   addOutputBand = freq@85756.00/bw@64.0
   addOutputBand = freq@85820.00/bw@64.0
   addOutputBand = freq@85884.00/bw@64.0
   addOutputBand = freq@85948.00/bw@64.0
   addOutputBand = freq@86012.00/bw@64.0
   addOutputBand = freq@86076.00/bw@64.0
   addOutputBand = freq@86140.00/bw@64.0
   addOutputBand = freq@86204.00/bw@64.0
   addOutputBand = freq@86268.00/bw@64.0
   addOutputBand = freq@86332.00/bw@64.0
   addOutputBand = freq@86396.00/bw@64.0
   addOutputBand = freq@86460.00/bw@64.0
   addOutputBand = freq@86524.00/bw@64.0
   addOutputBand = freq@86588.00/bw@64.0
   addOutputBand = freq@86652.00/bw@64.0
   addOutputBand = freq@86716.00/bw@64.0
   addOutputBand = freq@86780.00/bw@64.0
   addOutputBand = freq@86844.00/bw@64.0
   addOutputBand = freq@86908.00/bw@64.0
   addOutputBand = freq@86972.00/bw@64.0
   addOutputBand = freq@87036.00/bw@64.0
   addOutputBand = freq@87100.00/bw@64.0
   addOutputBand = freq@87164.00/bw@64.0
   addOutputBand = freq@87228.00/bw@64.0
```

```
}

SETUP SetDefault
{
   tInt = 0.512
   outputSpecRes = 0.5

   # Tweaks required due to ALMA 62.5 MHz bandwidth
   # and ALMA 15.625 kHz tuning granularity:
   FFTSpecRes = 0.015625
   subintNS = 32000000
   xmacLength = 0
   strideLength = 0
}
```

For the 3 mm VLBI tracks the correlator output has a baseline-dependent number of channels, i.e., 8 channels x 64 MHz for any baseline to a 4 Gbps station, and 32 channels x 64 MHz for 16 Gbps station pairs.

For a consistent naming of the HOPS channels on either "kind" of baseline (i.e., on both 8-channel and the 32-channel baselines), the following HOPS control file setting can be used:

```
chan_ids abcdefghijklmnopqrstuvwxyzABCDEF
  85244.0 85308.0 85372.0 85436.0 85500.0 85564.0 85628.0 85692.0
  85756.0 85820.0 85884.0 85948.0 86012.0 86076.0 86140.0 86204.0
  86268.0 86332.0 86396.0 86460.0 86524.0 86588.0 86652.0 86716.0
  86780.0 86844.0 86908.0 86972.0 87036.0 87100.0 87164.0 87228.0
```