n21dk01 Correlation Report

General information

- Project: "Wideband spectral line VLBI study (Dongjin Kim) 22/43GHz 8Gbps"
- Epochs: G, H, I, J, E, K, L
- Station feedback: No further issues found outside the a priori known issues (weather, broken shutter).
- Data issues: No major issues, only that VDIF of KVN epoch J had to be processed at the correlator to split out the two VDIF threads into separate files - as all KVN Mark6 had recorded epoch J from two 10G interfaces, but onto the same Mark6 module "group", leading to "clumpy" VDIF and associated initial problems in DiFX
- Requested config: PI request was K-band 0.25 MHz/ch 1.0 sec AP, and separately Q-band 0.50 MHz/ch 0.5 sec AP
- Actual config: 0.25 MHz/ch 0.5 sec AP, because after a few unsuccessful split-correlation configuration "hacks" DiFX and recordings turned out to unavoidably require a joint K+Q correlation. The PI will need to use CASA/AIPS to split out K and Q bands, and apply spectral (Q) or temporal (K) averaging to the requested resolution.

Status

what	date
Effelsberg transfer Epochs G and H complete, remainder postponed due EVN Session 2 VLBI (27 May-17 Jun)	20.05.2021
Yebes transfer Epochs G, H, I, J, E complete	11.06.2021
Effelsberg transfer Epochs I, J, E, K, L completed	23.06.2021
Fringes Ef-Ys K-band and Ef-Ys Q-band, epoch G	10.06.2021
KVN started data transfer	16.06.2021
KVN ongoing transfers... 16.08.2021 still transferring... finished.	xx.08.2021
Epoch G full correlation K+Q v1 finished	15.08.2021
Epoch I full correlation K+Q v1 finished	16.08.2021
Released (difxexport) version 1 of epoch G and epoch I to the PI. Awaiting feedback.	17.08.2021
KVN finished data transfer, info from DK Jung	06.09.2021
Reported back that Ku missing in epoch H, 7 other files 0-byte, retransfer? No.	08.09.2021
Remaining five epochs correlated	xx.04.2022

Data Status

Ep	DOY	Ef 2021	Ys xfer	Kt xfer	Ku xfer	Ky xfer	Correlated	Releasable?
G	124	20.5. ok	8.6. ok	22.7. ok	10.7. ok	1.7. ok	rev 1	yes; Nov 2021
H	127	19.5. ok	29.5. ok	25.7. ok	-missing-	23.7. ok	rev1 4.4.22	yes; Apr 2022
I	141	20.6. ok	5.6. ok	5.8. ok	4.8. ok	3.8. ok	rev 1	yes; Nov 2021
J	141	21.6. ok	8.6. ok	20.8. ok	17.8. ok	14.8. ok	rev1 4.4.22	yes; Apr 2022
E	142	20.6. ok	11.6. ok	1.8. ok	29.7. ok	28.7. ok	rev1 3.4.22	yes; Apr 2022
K	143	23.6. ok	(not observed)	28.8. ok; 2 scans 0B	26.8. ok	23.8. ok	rev1 3.4.22	yes; Apr 2022
L	143	23.6. ok	(not observed)	2.9. ok	1.9. ok; 1 scan 0B	31.8. ok; 2 scans 0B	rev1 4.4.22	yes; Apr 2022

Production Correlation Status

Ep	DOY	Correlation	Config	Diagnostics	Notes
G	124	15.8.2021 rev1	v2d, vex	Residuals pdf, FITS pclist	Ef not on source until ~18:30 UT Ku residual rate +20 mHz
H	127	4.4.2022 rev1			Ku did not observe Effelsberg was scheduled for K-band only
I	1411	16.8.2021 rev1	v2d, vex	Residuals pdf, FITS pclist	Ku residual rate +20 mHz
J	141	4.4.2022 rev1			-
E	142	2.4.2022 rev1			Ku residual 0 Hz after Ku -0.8e-12 s/s in VEX Ef and KVN stopped after No0065 Ys did whole track but from No0066 no baselines
K	143	2.4.2022 rev1			Ys did not observe

Ep	DOY	Correlation	Config	Diagnostics	Notes
L	143	3.4.2022 rev1			Ys did not observe

A Priori

Yebes

- J. Gonzales: rate 1.17e-13 s/s, offsets in logs named n1k01?ys.log on vlbeer.
- Did not observe K and L due to heavy rain and broken shutter.
- VEX freq block sidebands UUUU UUUU LLLL LLLL rather than the default UL UL ... from SCHED
- Epoch E: scan No0003 (142-0814) file empty or not recorded

Effelsberg

- U. Bach, etransferred epochs G & H. Pending transfer of the remaining epochs.
- Offset +19.3 usec in G
- Logs named ndk01g, ndk01h, and later n1k01i, n1k01j, n1k01k, n1k01l, n1k01e on vlbeer.
- H-maser rate same as in GMVA f211a, i.e., 2.05e-13 s/s.
- VEX freq block sidebands UUUU LLLL rather than the default UL UL ... from SCHED.
- Epoch G: wind and bad weather, first part ot track unusable, not on source until ~18:30 UT

KVN Yonsei, Ulsan, Tamna

- Table of clock offsets, sign for VEX same as in table
- Table of most recently determined site positions
- H-maser rates not available, assuming 0 us/s for Yonsei and Tamna, same 0 us/s for Ulsan but high residual rate 20 mHz and used VEX Ku -0.8e-12 s/s
- Tie of KVN to Ef+Ys : shift KVN VEX clocks by -2.83 us from kvn a priori values

DiFX

Special setup for correlation, because Effelsberg does not have simultaneous K and Q capability.

- Modes 'kband' and 'qband' in Observed VEX are are dual band at KVN, single band at Ef: would end up with FITS with KVN+Ef KQ+K for mode 'kband', and FITS with KVN+Ef KQ+Q and mode 'qband', i.e., KVN KQ in both FITS files (data duplication).
- Initial attempt using v2d "freqIds=..." and a K-band and a separate Q-band v2d file was only partially successful. Issue: any change in array composition (e.g., telescope recorded data in one scan, in another one not) jumbles the DiFX .input FREQ table frequency IDs an e.g nominally K-band -only list of freqIds refers to some Q-band recorded channels as well and misses some K-band recorded channels.

- Production approach uses VEX file where Ef has been made dual K&Q, a v2d file with two Datastreams for Ef (one K, one Q), and a bit of scripting to separate the Ef filelist into two lists one with K-band and the other with Q-band VDIF files
- Zoom bands of 64 MHz added into to KVN 2ch x 512 MHz to match Ef Ys 64 MHz wide channels in USB/LSB
- Zoom bands added also to Ef Ys 64 MHz LSB channels in order to flip these into USB and produce all-USB visibility data; avoids HOPS fourfit issues with mixed USB-LSB visibilities

Effelsberg file list splitting by band, example for Epoch G:

```
vsum -s /data/n21dk01g/Ef/*.m5a > filelist.ef
rm -f filelist.ef.k filelist.ef.q
for scanNr in `vexpeek -s n21dk01g.vex.obs | grep kband | grep EF | cut
```

```
-c 3-6`; do
    echo "grep kband 01g_ef_no$scanNr"
    grep "01g_ef_no$scanNr" filelist.ef >> filelist.ef.k
done
for scanNr in `vexpeek -s n21dk01g.vex.obs | grep qband | grep EF | cut
-c 3-6`; do
    echo "grep qband 01g_ef_no$scanNr"
    grep "01g_ef_no$scanNr" filelist.ef >> filelist.ef.q
done
```

Notes

The FITS-IDI file of each epoch contains both K and Q band, at a resolution of 0.5 seconds and 0.25 MHz/channel

This is due to the way that the correlation had to be configured because not all scans had all recordings from all stations, hence the DiFX-internal frequency indices were not consistent across all scans, hence selective correlation in two runs using only specific frequency indices and per-band averaging settings never produced consistent K(/Q)-only products per run.

The K and Q bands must be manually split out by the PI from the FITS-IDI file under AIPS/CASA.

For K-band, temporal averaging needs to be applied during the manual splitting to get from 0.5s AP to PI-requested 1.0s APs.

For Q-band, spectral averaging needs to be applied during the manual splitting to get from 0.25 MHz/channel to the PI-requested 0.50 MHz/channel.