EVN Technical and Operations Group Meeting

Hybrid meeting, hosted online and at Elite Park Hotel Onsala / Sweden
25 Jun 2024, 09:04 CEST

Minutes

Participants:
According to the event registration page (via the meeting site[1]) thirty-five participants registered, of which six remote attendees and fourteen local staff. Out of the fifteen remaining participants seven were JIVE staff, implying that eight EVN station technical staff attended in person.
Twenty-six people attended in person and eleven online. In total thirteen institutes in eleven countries were represented.

Agenda:
The agenda is published online[2] on the JIVE TOG wiki.

1. Introduction

a) Welcome (Poppi (chair))
Poppi welcomes both online and local participants. **Hammargren** explains last-minute local arrangements for the in-person participants for the meeting today and the trip to Onsala Space Observatory tomorrow.

b) Last-minute additions to Agenda (all)
Marcote: There is a discussion on block schedules needed (*added as AOB*)

c) Acceptance of minutes from last meeting (all)
The minutes of the previous TOG (Toruń, Dec 13th, 2023) were approved without comments.

[1] https://www.chalmers.se/en/conference/evntog2024/
[2] hhttps://www.jive.eu/jivewiki/doku.php?id=tog:june-2024-goteborg

d) Review of Action Items from last meeting (all)

Comparing the Current Action Items list on the MPIfR (Max Planck Institut Für Radioastronomie) Deki[3] with Poppi's own list (TOG Chair notes) AI#7 is missing. Added to the minutes here.

1. **All:** 80 Hz continuous calibration. Update the table on the wiki[4]
   Discussion about whether or not this AI should be here or permanent.
   Verkouter stresses that the rationale behind this AI is that stations keep everyone else informed *if something changes at your station*. After some discussion decided to:
   Reword: "**All:** Check the permanent action items and inform on change"
   Action remains

2. **Bach:** Look at EHT station set-up document and see if it could be modified for use in the EVN. Create a master check list.
   Bach: have all the documents, there is a TOW checklist, and (a significant) part of those are already in the Permanent Action Items; what is needed is to sit down and write it up for the EVN.
   Action remains, **Poppi** added as co-owner of the AI

3. **Bach, Himwich:** Investigate how to improve opacity and T_{sys} measurements at high frequencies in the Field System by incorporating the `atm` software
   No change in situation: FORTRAN code available to **Himwich**.
   Discussion ensues: no path to get geographic location differences between sites into the code; unclear how important this is, but current FORTRAN version can be made to write a value in the log. **Bach** reported finding Python versions (used at ALMA) but Python difficult to integrate in FS. Decided to put current FORTRAN version in FS to get started.
   Action remains, add **Himwich** as co-owner of the AI

4. **Bach:** compare `gnplt` opacity estimation versus WVR measurement.
   Basically done; `gnplt` results seem comparable, there is some scatter but nothing systematically different. Discussion can continue in a dedicated channel on the TOG Mattermost.
   Action can be **removed**
   +New Action create Mattermost channel for opacity estimates

[3] https://deki.mpifr-bonn.mpg.de/Working_Groups/EVN_TOG/Current_Action_Items
[4] https://deki.mpifr-bonn.mpg.de/Working_Groups/EVN_TOG/Continuous_calibration

5. **Poppi, Stagni:** sftp server set up on vlbeer **(Stagni)**, set up discussion where to host server **(Poppi)**
   `sftp` server set up in Bologna: done.
   Ad-hoc discussion ensues why vlbeer is where it is: apparently no other reason than Bologna being the (first) volunteer when the need arose. JIVE needs a copy of all the information too to make sure that e.g. the EVN Archive access to log files is uninterrupted - `ssh` access from JIVE to vlbeer does not always work. **Himwich** `ssh` access to vlbeer is extremely useful for running commands without having to download all data over a slow-ish connection.
   Action remains, but **reassigned+reworded:**
   Action Poppi, Verkouter, Stagni: write document with pros/cons of hosting vlbeer in Bologna or JIVE.

6. **All: s**et up basic monitoring information sent to the EVN Monitor at JIVE. Several EVN stations still not submitting regularly.
   Action remains until more stations are added

7. **Poppi, Verkouter:** questionnaire to stations and correlator to base document to CBD on to indicate needs of EVN to remain competetive. Partially done. Triggered by three-day-mixed-eVLBI-minisessions discussion in the CBD since last TOG. Large ad-hoc discussion ensues:
   Gunn against my recommendation - none of the real issues are solved by this, need more dynamic scheduling but instead get more and more different modes and rules shoehorned into the same old "static" model.
   Campbell each system has consequences for some science capability; the mini-sessions won't allow multi-band observations, the long sessions will impact rapid response and/or time domain science.
   The EVN Program Committee does not really help here - by design - as their job is to evaluate the science cases, not the practical impact.
   Marcote why not a week every month-and-a-half or so? Not too dynamic for the stations but more possibilities for the users.
   Gunn actually, if you add up the three twenty-one-day sessions plus ten e-VLBI days, the triggered e-VLBI days and the 144 hours of Out of Session you get to roughly two days per week. It would be very efficient to be able to decide in one week what would be the best to observe next week.
   Action remains, focus on feasibility of three-day sessions first

10:01 CEST coffee break, reconvene at 10:15 CEST

2. Update by the TOG Chair (Poppi)

Review of Permanent Action Items (all): could do with some modernisation, e.g. remove the Mark5 spare parts section. Also the Mattermost is not mentioned yet.

Updates following the CBD meeting:

CBD suggestion for three-day e-VLBI sessions already discussed.

Beam maps not everyone has sent beam maps to JIVE yet but for e.g. the SWEEPS project (McKean commensal wide-field processing) it's essential. Discussion ensues identical as in previous TOG - see minutes thereof. There could be scope to allocate a few hours in a future session to do a coordinated measurement at each station locally, not a central experiment. Undecided.
Currently missing for C/L band: Hh,Ir,Jb,Da,De,Kn,Pi,Cm,Sh,T6,Tr,Ur,Wb

4 Gbps operations CBD focus on 4 Gbps, not all stations have supplied 500 GB of storage to JIVE, causing the biggest problem. **Campbell** was asked to provide a better (numerical) model for predicting disk space usage - current model based on old assumptions (e.g. does not account for increased scheduling efficiency). Model of 8+ Gbps scales linearly.

RFI situation concerns about satellite mega-constellations based on CRAF chair **Winkel** - Lindquist to present on this later today.

3. Performance of the EVN

Performance of the EVN[5] presentation by **Oh**.
Oh requests discussion on two important topics:

Block schedule posting format/process?
Oh now happens in PDF on `evlbi.org`, but updates are (very) hard to notice. Can we start discussing machine-readable format?

Extra test scan before each experiment?
Oh Many stations fail in the first scan of each experiment. This is a critical scan because it is on the fringe finder. Add time for testing before experiment?

[5] https://www.jive.eu/jivewiki/lib/exe/fetch.php?media=tog:evn_perfomance_tog_2024.pdf

A long discussion ensues about the impact of (automatically) adding extra non-science/test time to each experiment if the gap between experiments (aim: at least half an hour) is - apparently - not enough for stations to get ready for when the experiment is scheduled to start, how much time to add, if it would be the PI's responsibility or added by support scientists, to record and/or correlate that data or not, and whether the extra time goes out of the allocated time or not, and how this would impact short observations, of which there are quite a few. In the end, from the discussion, the picture emerges that it is not entirely clear what the *actual* problem is, which means discussing possible solutions may not be very useful at this point. It was explictly noted that the TOG is not per se against the addition of extra time at the start, but wants to explore deeper before deciding to impact *all* experiments.
+New Action JIVE support scientists provide a more detailed report about which stations miss the criticical fringe finder scan and why.

4. Report from stations

a+b. wide-band C/X and/or tri-band status (all)

Ef (Bach): available, still linear, discussing how to change to circular before recording; same true for tri-band receiver - also should be made circular: idea is to use GPU backend for this (promised by digital lab, but not done yet).
Campbell: what about T_{sys}? If measured in linear base but correlating rotated data - what impact does that have?
Bach: for polarised source or in presence of non-zero D-terms and/or feeds not 100% perpendicular will have impact, although expect no more than ~%.

Tr (Wolak): receivers are there but front-end needs to be redesigned for 4-8 GHz bandwidth, work is planned.

On (Yang): can do 4-7 GHz now, plan to build C/X/Q receiver, but will take ~five years. Current priority is tri-band.

Ys (García-Miró): sensitivity problem w/ the 4.5 - 9 GHz receiver; affected e-VLBI and Session II C/X observations. Problem found that affects both polarisations. Also building 4 - 18 GHz receiver, expected second half of this year. Cryohead of K-band receiver was broken, but new K-band 18 - 32 GHz receiver being built, also expected second part of the year.

Sr (Poppi): going back to operations with all receivers; have put in the M-band receiver after solving focus positioner, also going forward with K-band receiver operations (good system temperature - 20 K). No L/P this year.

Installed Q-band (based on W-band multibeam) and also installing K/Q/W tri-band, having some problems with signal downconversion into the backend: did not get all the fiber links and equipment.

Mh (McKay): struggling with lack of staff; tri-band receiver on order from MPIfR but not due until next year; DBBC3 on site, but no staff to commission it. In the process of building an active secondary mirror assembly, to be ready before delivery of the tri-band receiver. Trying to build a C-band interferometer locally, but currently just trundling along.

Mc (Maccaferri): requested quote for C/X receiver for Mc and Nt - very expensive so budget not sufficient; working to increase budget and request second quote. Did some tri-band lab tests: cooled receiver connected up to DBBC3 but could not get good bandpass, not even when using DBBC3 downconversion.
In Sept will stop Mc operations to replace panels and secondary (much more accurate surfaces) and mount tri-band; hope to be done by spring 2025.

T6: someone was online but not responsive.

Nt (Poppi): organisational changing happening - new procedure for operators and other staff. Servo repair complete, see **Orlati** report; some issues remain, expect maintenance, optical fiber about to be completed. Only LCXM primary focus available; expect C-band repair to be complete ~Sept this year, M-band unsure, K-band decommissioned, will be replaced by tri-band.

c. BRAND receiver integration tests at Effelsberg (Rahimi)
Integration of the BRAND receiver in Effelsberg presentation **Rahimi** (master student) on thesis work. First sky tests done with BRAND receiver and fringes to On, Ys, Mc.

12:26 CEST lunch break, reconvene at 13:30 CEST

d. operations (commissioning tests?) (Yang)
Possible VLBI operation modes presentation **Yang**.

Aim at minimum 8 Gbps; requires phase stability: better have PCAL available. **Poppi** that is the goal for Sr in second half of the year. **Yang** might take ~three years to run the tri-band receiver with circular polarisation.
Clear that tri-band receiver developers need to make sure the different versions support compatible tunings (at least three versions on order/being

designed/installed) or else the amount of overlapping bandwidth could be disappointingly / vanishingly small.

e. DBBC3 status (all)
No-one indicates they do not have a DBBC3 with enough CORE4 boards to support the tri-band receivers.

Recorder performance?
Yang (On) succesfully do 32 Gbps.
Bach (Ef) struggling w/ 16 Gbps but not upgraded to latest `jive5ab` yet, expect better performance after that's done.
García-Miró (Ys) possible problem sustaining > 6 Gbps recording.
Maccaferri (Mc) good until 24 Gbps, errors / packet loss at 32 Gbps.
Feiler (Tr) 2 x 8 Gbps worked fine, minimal losses.
Quick (Hh) only have DBBC3 for the VGOS antenna; but struggling w/ 4 Gbps.
Yang (on behalf of T6) 32 Gbps demonstrated.

DBBC3 eVLBI tests[6] presentation **Eldering**.
Campbell is it necessary / problematic passing VEX2 level information to stations' FieldSystem, which only support VEX1.5 still? **Eldering** for now only JIVE needs to run from the VEX2 file, stations can run from VEX1.5 - although I'm never quite sure how they actually do that. **Bach** for DBBC3 observations we have local control files that fill in the missing information - less flexible but works. **Campbell** most important is to share that information with JIVE to know what happened at the station.

VLBI test observations with 8-bit quantization data presentation **Yang**
Need manual editing of the `.prc` file b/c FieldSystem cannot handle 8-bits-per-sample. Also explains why only two bits per channel shown in bitmask. Correctly handling this requires work; SCHED 12 should be out by the end of the year and VEX2 can handle this more naturally, but don't know what NRAO's role in this is: SCHED limits the value to 1 or 2, pySCHED more flexible.
How to proceed with this feature? It seems a useful enhancement (10% more sensitivity "for free"). Big question: how to resource this - requires 4x more disk space, so maybe use in e-VLBI? Currently still in commissioning mode but should pursue this.

[6] https://www.jive.eu/jivewiki/lib/exe/fetch.php?media=tog:dbbc3-evlbi-test.pdf

Campbell four or five successful multi-datastream (from Australian DBBC3s and/or new Robledo backend) user experiment correlated. Hope to get to be able to analyse DBBC3 NME test observations (**On**, **Ef**, **Ys**, **Mc**).

5. System and network management at JIVE (Buijs)

System and network management at JIVE[7] presentation by Buijs.

Discussion on plans re switching to a tape robot system for the raw data - JIVE staff is working on such a plan, because there are a lot of good reasons to do so. The plan will describe and evaluate all the pros and cons of such a system.

On the topic of sustainability of the FlexBuff approach when going to higher data rates, it is pointed out that with the current storage at JIVE it's already not. Data has to reside on the station's FlexBuffs for longer: it is necessary to be able to delete an experiment's data to make room for downloading another experiment for correlation.
Another topic that come up was that some stations are having issues sustaining usable e-shipping bandwidths; if stations can only sustain 300-400 Mbps then they would be scheduled for at most 2 Gbps, otherwise they hold up correlation too much. Affected stations will be contacted to see if something needs fixing at the station or correlator end. Some of this could be related to undersea-cable breaks, but not all observations of "deterioration".

6. Recorder status

NcFTP ➞ fringetest transfer problems presentation by **Feiler**[8].

It is clear some stations experience upload speed issues using `ncftp` in the FS `autoftp` script, but absolutely not clear why. Other solutions were tried and do not show sluggish upload.

+New Action (Jb, Ir, Mc, Nt, O6, Sr, Ys) Those with ftp upload issues try non-`ncftp` solutions in FS's `autoftp` script and share/discuss on Mattermost.

15:08 CEST coffee break, reconvene at 15:30 CEST

[7] https://www.jive.eu/jivewiki/lib/exe/fetch.php?media=tog:tog2024june-buijs-systemandnetworkmanagementatjive.pdf
[8] https://www.jive.eu/jivewiki/lib/exe/fetch.php?media=tog:tog-ncftp-2024.pdf

7. RFI monitoring, CRAF, SpaceX/Starlink (Lindquist)

Committee on Radio Astronomy Frequencies (CRAF) presentation Lindquist[9].
The L-band NME plots (autocorrelations) show extremely valuable information about the RFI situation at the stations - CRAF would benefit hugely from more systematic information.
Poppi at CBD, **Winkel** suggested coordinated observation w/ Starlink.
Lindquist requires setting up coordination w/ Starlink first.

+New Action (Lindquist, Campbell?, Madkour?) extract useful information from L-band NME plots.

8. Field System status/update (Himwich)

Presentation by **Himwich**[10]
VEX2 status: could make current 1- and 2-bit modes work with VEX2 syntax, anything else would require quite a lot of work.
`plotlog` now using giza[11] in stead of `PGPLOT`, had to work around "frozen" giza version in Debian version.
Maccaferri support for > 1 FlexBuff e.g. for increased throughput?
Himwich controlling serial FlexBuffs (switch to another one if full) is feasible, parallel recorders most likely not: never used in tape era.

Use cases are there (EHT, going beyond single recorder throughput limit).
Himwich the RDBEs and Mark6s are operated in parallel, but merging FlexBuff support slightly more difficult because that came in via the Mark5 route.

9. VLBA/NRAO update (Hunt}

VNDA:VLBA New Digital Architecture presentation by **Hunt**.

Vijayaraghavan why is the channelisation not done on the FPGA?
Hunt to keep sampling and channelisation separate to prevent phase jumps.

Verkouter VNDA still based on shipping disks - does that scale to 16+ Gbps?
Hunt those data rates certainly not at start of project, not given lot of thought.

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[9] https://www.jive.eu/jivewiki/lib/exe/fetch.php?media=tog:lindqvist-craf-tog-june-2024.pdf
[10] https://www.jive.eu/jivewiki/lib/exe/fetch.php?media=tog:weh_tog_june_2024.pdf
[11] https://github.com/danieljprice/giza

Brisken movement to network based transport moving forward but not very fast, unlikely to get > 10 Gbps to sites, so 8 Gbps may be standard operating mode and ship disks for wide band/sensitivity requiring observations.

10. AOB

Discussion on last-minute addition to the agenda "block schedules" - revolving around two different topics. After reordering the discussions as they happened:

A. Version control of block schedules
The versioning scheme of the block schedule is not necessarily watertight; there can be different versions for the same day with same name.
Gunn there can be unpublished changes, a running copy if you will.
If a version is shared with **Campbell**, assume all support scientists will also see it and can start checking or generating other overviews.
Verkouter is using git for version of control of the text file(s) an option? For example it can be configured that if a new version is uploaded that some action(s) get triggered.

+New Action (Gunn, Marcote, Verkouter) take discussion offline.

B. Machine readable block schedules
Supporting the network from JIVE could be better streamlined if the block schedule(s) version(s) are machine readable. "They're already ASCII format, so machine readable by design" - however, opinions differ on whether it's machine *parseable* to drive automation or not. The format is not 100% consistent over time or type of session (globals break the format); attempts to create a parser require heuristics.

+New Action (Campbell, Marcote, Gunn) Discuss recommendations offline with affected individuals

10. Next TOG
Proposal to aim for holding the next TOG at **Sr** or **Nt** or in ~9 months.
Decision made after having had discussion of maybe alternating physical/virtual (six-?)month schedule, but that was rejected. So we stick to the ~nine month schedule.

+Possible New Action (Poppi, Verkouter) poll stations about schedule

17:15 CEST meeting ends