

## Minutes of 2nd eVSAG face-to-face meeting

Gothenburg, Sweden, June 28th 2007

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Present in person: J.Conway, M.Lindqvist, A.Szomoru, J.Alcolea (proxy for F, Colomer), R. Porcas, A. Lobanov, R. Vermuelen, P. Charlot, R. Campbell, Z. Paragi, T.Venturi, I.Schmeld, T.Muxlow.

Present by Telecon: C.Salter

### 1 Introduction Organisation, eVSAG role. John Conway

Members were welcomed to Gothenburg and the agenda presented by the Chairman. This meeting was deemed timely because eVLBI was now reaching a critical point with bandwidths comparable to disk recording, soon two new large western European antennas to be added by the start of 2008 (Bonn and Yebes) and progress is being made to connect at high bitrate to antennas outside Europe. At the recent EXPReS board meeting the results of the first EU evaluation were presented showing the steady progress of the EXPReS project. It is clear that a major criteria for success as measured by the EU is the impact on the user community as measured by publications. The eVSAG should think ambitiously about how to run eVLBI most successfully to allow high impact astronomical results 'Nature papers' to be produced.

### 2 Observatory reports

Written observatory reports were submitted and distributed by email prior to the meeting and a paper copy of the Arecibo report was distributed at the meeting (all of these reports are collated in attachment 1). Highlights include— The Yebes 40m telescope will have a 1Gbps link operating by January 2008 and will be able to participate at 1.3cm and S/X in early 2008. A 5GHz receiver will be available by mid-year. It is planned to operate geodetic VLBI one day per week with some impact on eVLBI scheduling. At Effelsburg digging work for the dark fibre to MPI Bonn has begun and the onward path to JIVE is being set up. In response to questions R.Porcas envisioned as a best guess the 100m might be available for eVLBI in early 2008. Arecibo has had only very low bandwidth available for some time (20Mbps) but will be connected to Florida within a few months with a 512Mbps line, allowing 256Mbps observations. Campbell pointed out that Arecibo will then be able to participate in EVN 512Mbps runs by transmitting 1 bit data. Future technical possibilities for obtaining high bandwidth to Arecibo via San Croix are being investigated. At Medicina work is continuing on making operational a shorter route (40km cf 140km) into Bologna. Discussions on connecting the Sardinia Radio Telescope are going well while connectivity to Noto remains difficult. At Medicina new switch equipment has been installed and a lighpath from Milan -JIVE initiated. Onsala is investigating options for a 10GdbBps lighpath from the observatory to Stockholm. At Hartebeesthoek a 'last mile' dark fibre to the telescope has been dug but provisioning of permanent termination equipment and onward connectivity is

not finalised. On a few month timescales temporary 128Mbps may however be possible and could be upgraded to 512Mbps by 2008/2009. In Latvia the last mile Irbene to Ventspils 1Gbps connection is now in place. During July permanent 100Mbps connectivity to the outside world will be established; larger data rates over a 1Gbps link may be possible on a temporary basis via special agreement with the Royal Institute of Technology in Stockholm. Irbene now has a Mk5A terminal and plans to upgrade to Mk5B by the end of 2007. dBBC's are being constructed at Noto. At present there is only a 12GHz receiver but a 5GHz receiver is planned by the end of year.

### **3 Geodesy eVLBI - John Conway for Rudiger Haas**

The Onsala 20m has recently been involved in a single baseline real time geodetic eVLBI observation to a station in Japan in order to make rapid determination of UT1-UTC and Earth orientation parameters. Data sent at 128Mbps(?) was correlated in real time on a software correlator in Japan. The data transfer was accomplished using the PC and PC-EVN card purchased for the JRA-FABRIC Month 7 demo connected in series to the Mk5. Future service observations of this type are planned at higher bitrate. In addition for many regular geodetic observations post experiment transfers of data from disks at Onsala to disks at Bonn ('electronic shipping') is being done on a regular basis using the Mk5-PC EVN combination.

### **4 Technical progress in SA1 - Arpad Szomoru**

Arpad summarised the progress in technical capability over the first 16 months of the project (see attachment 2). Results of the first 6 station fringes at 512Mbps were shown (astrophysically useful data from Cambridge is however limited to 128Mbps due to microwave link restrictions). Many tools have been developed for data inspection (integrating fringe plots) and rapid pipelining. Work is under way on tools for rapid changing of station schedules during observations. All but one of the six regularly participating stations now uses lightpaths.

Future work planned in next 18 months:- All manpower is now hired at JIVE and Jodrell within SA1. At the JIVE correlator plan soon on going to Mk5B allowing retirement of the station units, eliminating a source of unreliability (it is a major software effort to implement this). Will continue working on remote editing of observing schedule during observing runs. Investigating a 1Gbps subarray for those stations with >1Gbps local links and onward connections. Investigate improving the granularity of transmission rates so say approx 900Mbps can be implemented over 1Gbps links. New streamstore card libraries will soon allow implementation of non standard data transmission protocols. Inclusion of 4 eMERLIN telescope in real time at 1Gbps into JIVE correlator is an important goal but is dependant on eMERLIN correlator timescale. Improving connectivity to stations outside of Europe is another important project goal with high priority. Because for global observations lightpaths all the way are not possible use of non-standard protocols are probably essential for high bitrate connections to Puerto Rico, China, SA etc. Initial tests have been done to China via Chicago. Good computer-computer performance was found on most parts of the route but in initial tests it was not possible to reach 32Mbps to the Shanghai telescope from JIVE. New trans-Siberia link soon available. Achieving high bitrate will need non-standard protocols.

Potential complications for Chinese connectivity are in reserving link times and disabling security machines on route etc etc.

## 5 Rapid reduction tools, calibration issues - Zsolt Paragi

Zsolt presented a summary of the rapid analysis tools that have been developed to support eVLBI (see PPT presentation attachment 3). These include control interfaces to the correlator, integrating fringe displays and data quality monitors (useful for stations to see their data quality in real time). Work has moved forward on optimising and adding web interfaces to the rapid pipelining which can give results within an hour or so (?) of a correlator job finishing.

A major headache is still the quality and speed at which station amplitude calibration is provided. There was (the usual) general discussion about this, with several arguing that for the intra-European baselines we should be able by scheduling nearby calibrators 'MERLIN style' to be able to determine all except the absolute flux densities via amplitude self-cal. It was countered that this did not always converge if the 'a priori' provided by stations was too bad. It was argued that really bad (factor of 2) errors could be easily trapped since SEFDs don't vary that much, and in those cases fudge correction factors or dummy cal files for affected stations could be inserted prior to starting the pipelining. John Conway gave his normal speech that amp cal should not be thought of as an either/or between a priori or self-cal calibration. JIVE can pursue making amp self-cal routes as robust as possible while pressure (and tools/training) to help the stations improve a priori cal continues.

It was noted by Paragi and Szomoru that getting absolute calibration right was important for being able to report a result in an astronomical telegram. They emphasised the importance of making use of WSRT internal baseline data in order to determine absolute fluxes of calibrators and hence fix the absolute flux scale of the VLBI observations. Such internal WSRT data is also important for polarisation calibration and for detecting/monitoring the total flux of the target source. There is active collaboration between JIVE and ASTRON in smoothly incorporating WSRT internal data into the eVLBI data reduction path.

## 6 Summary of recent eVLBI proposals for June 1st/June 12th deadlines - Patrick Charlot

Two? proposals were received for the June 1st deadline and two? proposals for the June 12th run. The disappointing number of proposals for the June 1st may be due to the relatively short period of advertisement and also because the Ryle telescope is temporarily not operating and so is not available as a source of triggers.

## 7 Upcoming scheduled eVLBI runs - Zsolt Paragi

At the meeting the following dates for upcoming eVLBI runs were presented.

21 August (Tue) 9:00 UT - 22 August (Wed) 13:00 UT

6 September (Thu) 9:00 UT - 7 September (Fri) 13:00 UT

9 October (Tue) 9:00 UT - 10 October (Wed) 13:00 UT

\*12 November (Mon) 9:00 UT - 13 November (Tue) 13:00 UT\*  
note below - subsequently cancelled.

15 November (Thu) 14:00 UT - 16 November (Fri) 16:00 UT

11 December (Tue) 9:00 UT - 12 December (Wed) 13:00 UT

The intention was that the runs starting on 12th and 15th November would be an adaptive double run. After the eVSAG meeting it was found that because of scheduling conflicts with the EVN TOG the 12/13Nov run had to be cancelled. A double run will be rescheduled for Jan/Feb. These runs in early 2008 and the remaining November and December runs can be proposed for the Oct 1st deadline.

## 8 User Feedback for eVLBI planning

The chairman noted that the EXPReS NA3 in addition to eVSAG has a mission to interact with the user community and to use this feedback in planning eVLBI activities. At the last CBD the directors also felt more could be done in this area. Such input might be very valuable given very few of the eVSAG membership are observers of variable sources. There was a general discussion of how to obtain such feedback. Questionnaires were discussed asking users about possible scheduling strategies/technical priorities. Also it was discussed how to distribute such questionnaires; for instance only to existing users or the whole radio community. An alternative suggestion was perhaps to approach outside experts in different areas, XRB's, GRB's SNe to get their suggestions of how to optimise observations and give priorities between different developments (new frequencies, longer baselines etc). Such an interaction with outside experts may also help generate proposals. To ensure openness as well as approaching people specifically a general call for contributions (perhaps via the EVN newsletter) would be made. The resulting document would be public and be useful to the eVSAG, PC and CBD for making decisions on scheduling policy.

**ACTION ITEM:** It was agreed that an outreach effort should be organised led by John Conway and Zsolt Paragi to reach both existing and potential eVLBI users interested in observing variable sources. The exact content of such an outreach to be discussed.

## 9 Discussion of new proposal rules

There was extensive discussion of the new proposal rules adopted for the June 1st deadline. The discussion centred around minor changes for the Oct 1st call that could be agreed by the EVN PC (meeting the next day) and more extensive changes for Feb 1st deadline and beyond that could be presented to the directors for their November meeting.

## 9.1 Allow limited generic proposals - John Conway

The June 1st call said that accurate coordinates of the target sources must be in the proposal, even in the case of 'triggered' proposals. This restricts observations to known objects that repeatedly flare. The rule precludes observations of some types of object such as radio supernovae which are 'one-off' but whose frequency of occurrence can be predicted even if their exact positions cannot be.

There was a general discussion of such 'generic class' proposals. Muxlow argued that because of difficulties of administration and possible conflicts very few observatories allowed such proposals and eMERLIN at least initially would not. The counter argument is that with very many more triggers becoming available in the future (satellites, LOFAR etc) major areas of astrophysics might be missed if generic proposals were not allowed. It was suggested that the wording of the June 1st call was partly a carry over from the previous rules and that for Oct 1st we simply state that for triggered observation accurate source coordinates must be available at the time of the trigger request (and not the time of the proposal). Bob Campbell will formulate words defining the technical requirements on source position. It was suggested that the next call should not explicitly solicit generic proposals but the rules would allow these. The PC would decide on the suitability of submitted generic proposals on a case-by-case basis.

## 9.2 Length of validity of Triggered proposals

For the June 1st call eVLBI proposals could only be made for runs in the coming trimester. There was email discussion before the June 1st call went out discussing asking the proposers of triggered observations to specify a length of validity up to maximum of (say) 1 year, though it was argued in that time that all proposers would probably then ask for the maximum. During discussions at the F2F meeting it was suggested that the wording of the next call would say proposals would be valid for a minimum of one trimester, with longer periods to be suggested and justified by the PI. The PC would discuss and decide the issue.

## 9.3 Relaxation on rules for short obs? - Zsolt Paragi

In an email prior to the F2F Zsolt Paragi proposed in the case that no user proposals were available for a given run that instead of observing only calibrators a mechanism should be created to allow JIVE staff to insert speculative but potentially interesting science targets taken from IAU telegrams or ATel alerts. The data to be made available publicly. After discussion it was suggested than instead of creating a new class of proposal JIVE/EXPRESS staff could lead and submit a proposal under the 'triggered' proposal class where the trigger would be the appearance of a source in an astronomical telegram. If approved such a proposal would then be available to fill in gaps in the astronomical observing schedule.

Another idea that was presented by Paragi was to catch sources varying on very short timescales (i.e. dME star flares) was to schedule WSRT either immediately (few hours) before an eVLBI run and then change the stations source schedules rapidly remotely from JIVE or even do such changes within a eVLBI run (using WSRT or eVLBI itself as the trigger).

## 10 Science requirements for eVLBI observations on unscheduled dates. - Zsolt Paragi

As actioned at a previous eVSAG telecon Zsolt Paragi after consultation with others in a small working group (including significant contributions from Cbris Salter) gave a presentation of various astronomical sources that could make use of Triggered eVLBI on unscheduled dates (TUD). These were defined in pre-meeting email discussions to be triggered proposals reviewed by the PC in advance but differing from present class 2 proposals in that they can be on any date, not just those pre-advertised in advance. They differ also from classical ToOs, as defined in the Porcas document which are totally unanticipated 'once per year' events in which the full science case must be submitted and reviewed rapidly in response to a new event. In contrast TUDs might be used to study a class of objects whose rate of appearance can be calculated and which are fairly frequent (more frequency than 1 per year) but whose exact dates cannot be predicted.

A useful table was distributed prior to the meeting (see attachment 4) showing for each source type the triggers, the expected lead times, length of monitoring and epoch separation, the observing frequency and baselines required. Further presentations of these source classes were given in a PPT presentation (attachment 5). It was clear that many of the target classes required global baselines which underlines the importance of demonstrating high eVLBI bitrates to China, Arecibo and South Africa.

## 11 Organisation of possible 'Triggered eVLBI on unscheduled dates (TUDs)' in 2008

A specific proposal by Paragi for implementing TUDs suggested that from (say) the February 2008 call onward PIs would be able to submit a triggered proposal which can be activated on any date when the trigger was valid. It is assumed that probably only the smaller EVN dishes might be available for such TUD observations. It was accepted that for these unscheduled date observations the turnaround between trigger and observations would likely be longer than 24hrs and that the observations would be done on a 'best effort basis' with success not ensured.

In discussion of this proposal there was a variable amount of enthusiasm from different stations. Some (e.g. WSRT) may be able to participate as long as certain times were 'blacked out', others saw it as difficult organisationally (i.e. MERLIN telescopes). It seemed likely that the extent of participation in such observations would have to be decided by each station. Perhaps a detailed proposal could be put before the CBD for its November meeting; such a proposal might contain a science case justifying the new scheduling mode.

From the subsequent discussion it was clear that a number of practical issues need to be discussed by the eVSAG prior to such a proposal. For instance would a central data base of which telescopes were available and when be maintained, and if so how? Is the final selection of telescopes and observing data/time done by PI alone or does it involve EVN officers? It is likely that the PI will want several closely spaced observations, estimates of this could be in the original proposal but the PI might want to vary these (and perhaps even the observing frequency) in response to initial eVLBI results (since rapidity of results is the main advantage of eVLBI there needs to be a mechanism to make use of the knowledge obtained), how would this be handled? How would the PC or its chair be involved in approving any changes to

the initial plan for follow-up observations? It also is quite possible that an on-going sequence of TUD observations collides with a pre-scheduled eVLBI date, how are the conflicts with standard or triggered observations on those dates resolved? What about conflicts between TUD's and classical ToOs?

ACTION ITEM - There should be further email or telecon discussion of whether a policy for TUD's should be put in place during early 2008. If so a specific proposal could be generated to be put before the CBD in November. It might be good if such a proposal also contained a science case justifying to the directors the effort involved in implementing TUDs. The production of this science case could be merged with the proposed user science survey (see action item above).

## 12 AOB - Joint eVLBI/recording modes

The chairman raised the issue of whether it was technically possible for ToO or other high priority obs to configure two Mk5s in series at JIVE to do remote recording of data at JIVE plus streaming into the correlator. This would allow a mixture of eVLBI and non-eVLBI stations to participate with most of the advantages of both modes. Results on the baselines between the eVLBI stations would be available immediately -allowing planning of follow up obs. When disks from non-eVLBI antennas arrived they would be combined by the remote recordings from the eVLBI stations in a second non-realtime correlation involving all antennas. Variations on this theme would be to do just remote recording at JIVE using only one Mk5 per station, this would delay the 'prompt' correlation to only start after the expt ended but such a small delay might be acceptable given the relative simplicity of the mode. Even simpler but with longer delay might be 'electronic' shipping from a station recorded disk after the expt to a disk at JIVE. For all of the above options (except perhaps the last) the record bitrate would be 512Mbps not 1024Mbps for pure disk, but Campbell pointed out the sensitivity improvement is less than  $\sqrt{2}$  since many EVN stations do not have full effective bandwidth to support 1024Mbps. Potential disadvantages are that some of the above mixed modes would involve changing disks at JIVE and those involving remote recording would be susceptible to loss of data due to link problems. However within W. Europe over mostly lightpaths links are fairly stable. A final alternative would be to do simultaneous local recording and transmission at eVLBI stations but this involves stations buying extra Mk5 units. If and when they did this the production of the hard copy could be moved from remote recording at JIVE to local recording at the station.

ACTION ITEM : Arpad to investigate the technical possibilities of the above modes

## 13 List of attachments

- 1 - Collated station reports
- 2 - Technical progress in SA1 (PPT) - Arpad Szomoru
- 3 - Rapid reduction tools (PPT)- Zsolt Paragi
- 4 - Table of possible variable targets for eVLBI (pdf) - Zsolt Paragi
- 5 - Science and requirements for eVLBI of variable sources (PPT)- Zsolt Paragi