

Minutes of first eVSAG face-to-face meeting. Westerbork, Netherlands, November 28th 2006

Present in person: J.Conway, A.Szomoru, F.Colomer, H. van Langevelde, R. Porcas, P. Charlot, R.M.Campbell, Z, Paragi, T.Venturi, R. Strom., I. Schmied, A, Kus (proxy), R.Strom, D.Jiang, S.Garrington.

Present by Telecon: R.Haas, C. Salter, H.Hase

Invited guest: C.Yun (EXPREs project manager).

1 Introduction

1.1 Role of eVSAG in NA3/EXPREs (John Conway)

A description of the EXPREs component parts NA's (Network activities) SA's (Service activities) and JRA (joint research activity) was given. NA3's main parts were outlined, included a eVLBI science forum and this eVSAG committee.

The membership of eVSAG is now finalised with 25 members (10 officers including EVN PC chair, EVN scheduler heads of SA1,SA1, JRA1, Geodetic rep, Spacecraft navigation, and JIVE correlator rep plus 15 representatives of EXPREs astronomy participants. Major milestones given in the EXPREs DOW (Description of Work) are eVSAG face-to-face meetings, organisation of eVLBI science workshop in Onsala in project month 30 (September 2008). Other products are the organisation of eVLBI observing runs, memos on science use and other subjects, science advice to the rest of project, outreach to the astronomy community (articles in EVN newsletter etc). Finally the eVSAG chair gives monthly reports on NA3 activities to the project manager which forms a part of the monthly project report to the EU science officer.

Funding to NA3 is mainly for the month 30 conference and partial travel funding for eVSAG members to attend face-to-face meetings. Each participating eVSAG institute has a travel budget as specified in the DOW. This is part the institute EXPREs funding and you do do not need the approval of the eVSAG chair to use it. However the eVSAG chair will every quarter contact members to keep track of how spending is proceeding.

1.2 Present and future eVLBI capabilities, SA1 activities (Arpad Szomoro)

The large amount of work done already this year on tools for control and data reduction of eVLBI was reviewed. These tools included integrating fringe plots to detect sources of medium flux density ($>50\text{mJy}$). A tool has been created to make writing of output FITS files for astronomers easier therefore making the automatic data pipeline easier and quicker to use. This speed up the production of final images or detections of very weak sources using phase-referencing. Also available are Web pages available showing

in real time data quality, link quality and a tool making it much simpler to change correlator jobs in real-time.

The correlator has been made more robust for real time operations, and can be run for eVLBI by a single non-expert. the major remaining problem is the stability of station units (increasingly less stable at high bitrates). This bottleneck will be removed when correlator moves to Mk5B (sometime in 2007).

A person has been hired at JIVE to work on protocols and will start early next month. This is one route to to achieving higher more reliable bit rates. When Mk5B comes this will allow VSI-E format output in which many different protocols can be implemented, including UDP based protocols (developed at Jodrell Bank) locally developed protocols at JIVE and perhaps protocols such as Tsunami (involving the Metsahovi group).

Also SA1 is actively discussing with stations the provision of dedicated lightpaths to the JIVE correlator, this will also improve reliability and bit rate.

1.3 Station Connectivity, SA2 activities (Paco Colomer)

A large fraction of the budget for EXPReS is in SA2 which deals with 'last mile connectivity' for stations and also connectivity to stations outside Europe (China, South Africa, Puerto Rico, Chile). Despite this the ratio of matching to EU contributed funds in the contract is very high (8:1).

At the moment 7 stations have both 1Gbit/s local connections and high capacity routes through to JIVE. These are Onsala (Sweden), Westerbork (Netherlands), Cambridge (UK), Jodrell Bank(UK), Torun (Poland), Medicina (Italy) and Metsahovi (Finland). The first six of these stations regularly take part in eVLBI runs (the last does not because it does not have a receiver at the present operating wavelengths of 6cm and 18cm).

A lot of activity is expected in 2007. The Bonn 100m may get a link by August and can become involved in eVLBI runs by the end of the year. The new Yebes 40m antenna will be inaugurated in June/July 2007 and will have immediately a dark fibre connection, it will however only be equipped with a receiver at 1.3cm until 2008. The Irbene antenna in Latvia will have a 1Gbit/s early in 2007, however work is required still with receivers and other VLBI equipment in order for it to become an operational VLBI antenna.

Going beyond Europe there is a lot of activity in China linking their 4 antennas to Beijing at high bitrates. These antennas include the two long term members of the EVN Urumqi and Shanghai and two new antennas primarily built for support of Chinese space activities that will also be used for VLBI. These two new telescopes are presently equipped only with 3.6cm and 13cm receivers. Shanghai is soon well connected at 1Gbit/s but Urumqi due to its more remote location is only connected at 128Mbit/s. The two new stations will have fast connections in place in 2007. Discussions on how to best get Chinese traffic into Europe are ongoing. Arecibo has negotiated a contract for a 256Mbit/s link which will be active 30 days after signing and hence will be in place early in 2007. TIGO in Chile has good local connections but is limited by the

link from Chile which is limited to 64Mbit/s. The Hartebeesthoek antenna in South Africa is in a similar situation.

1.4 e-VLBI in Geodesy (Rüdiger Haas)

Present activity for geodesy focuses on 'e-VLBI transfers' or 'electronic shipping' rather than real time operations. In this mode data are recorded locally on disk in the normal way. After the experiment ends data are transferred by internet to a disk at the correlator. Although not true real time this procedure significantly speeds up the time to results in particular for the IVS-Intensive sessions so that Earth rotation (UT1-UTC) parameters can be determined within a day.

The IVS-Intensive UT1 series INT-1 (baseline Wettzell-Kokee, observations every day Monday to Friday) and INT-2 (baseline Wettzell-Tsukuba, observations Saturday and Sunday) exclusively use e-VLBI transfer. Data from Wettzell are sent every weekday (INT-1) via internet to the Washington correlator, and on the weekends (INT-2) to the Tsukuba correlator. Presently Wettzell is sending the data of 1 hour of observations over a 34 Mbit/s link, taking several hours for the data transfer. Also Onsala participated in three such INT-2 sessions during 2005 and sent data to the Tsukuba correlator.

All data from Tsukuba observed during CONT05, the 15 days long continuous geodesic VLBI campaign in September 2005, were successfully sent via e-VLBI transfer to the Haystack correlator. Each of the 15 CONT05 sessions of 24 hours each took roughly 3 days to transfer electronically to Haystack.

Since late 2005 data from Ny-Ålesund (island of Spitsbergen, Norway) are transferred electronically to the Haystack correlator. The station is connected with a radio link of 85 Mbits/s capacity to Longyearbyen, the capital of Spitsbergen. From there the data go via internet to Haystack.

Within Europe Onsala has recently experimented with electronic shipping of data to the Bonn correlator. A regular R1-session for earth rotation observation was transferred using the software EGAE developed by Haystack. Since the transfer involved writing to and reading from the system disk in the MK5 unit, the achieved data transfer rate was not higher than about 80 Mbit/s.

2 Science use of eVLBI - discussion of draft document

The draft document was discussed. It was thought to cover most envisioned uses of eVLBI. There was some discussion of the usefulness of certain non-real-time eVLBI modes (like disk safer copy at stations, electronic shipping and remote recording.) Committee members felt to complete the document it should describe in which science areas these different modes would be useful and perhaps prioritise their implementation.

3 Present operations and operations in 2007

3.1 Summary of proposals received and observed in 2006 (P. Charlot)

A total of 8 eVLBI runs using the full complement of antennas were organised in 2006, for combined technical testing/astronomical use. There were five open calls made for the runs on March 16th, April 20th, June 26th, October 26th and December 14th. The call deadlines in each case was set two weeks before the run, allowing one week for review and one week for scheduling. The call notes that proposals should be made primarily for projects with some 'urgency' with the need for rapid feedback. All open runs except the first were for 24hrs of time (+4hrs pre technical testing and setup); the first run being for only 5hrs. All runs used the 6 telescopes at respectively Onsala (Sweden), Westerbork (Netherlands), Cambridge (UK), Jodrell Bank(UK), Torun (Poland) and Medicina (Italy), except again for the first run where Medicina was not yet connected. All calls were for observations at either 6cm or 18cm wavelength. The proposals received and scheduled were as follows, March 16th - 3 proposals -1 scheduled, April 20th - 3 proposals - 2 scheduled, Oct 26th - 4 proposals - 2 scheduled, Dec 14th - deadline 30th Nov. In addition one proposal that was successful for the March 16th/April 20th runs was given time in the May 20th technical run because the source showed flaring behavior.

The first two refereed papers (accepted by MNRAS) using eVLBI data appeared on the astro-ph exploder on Nov 2nd (Tudose et al and Rushton et al).

3.2 Any problems with administration of proposals/schedules

None were reported except the lack of consultation on technical issues prior to submission as mandated by the call. Bob Campbell noted that the re-written call for the Dec 16th rub which gave more prominence to this requirement may have had some effect since he had been contacted this time by users.

3.3 Schedule for first half of 2007

The following dates have been arranged for 2007.

29 Jan. 9:00 UT - 30 Jan. 13:00 UT (Mon/Tue)

1 Feb. 14:00 UT - 2 Feb. 16:00 UT (Thu/Fri)

20 Feb. 9:00 UT - 21 Feb. 13:00 UT (Tue/Wed)

27 Mar 9:00 UT - 28 Mar 13:00 UT (Tue/Wed)

22 May 9:00 UT - 23 May 13:00 UT (Tue/Wed)

25 Jun. 9:00 UT - 26 Jun. 13:00 UT (Mon/Tue)

The first two runs are intended to be part of a 'double header' observation with one common deadline to exercise 'adaptive observing', with the second run being scheduled on the basis of the results of the first run.

3.4 Should more bands be offered

At the moment only 6cm and 18cm are offered. Other possibilities include 1.3cm, 5cm and 3.6cm.

The 1.3cm band is probably the next feasible one to add. Amongst the present eVLBI telescopes Westerbork and Torun (right now) does not have this band. Also use at Onsala may be harder to arrange because it uses the 20m telescope. However on the plus side the new 40m Yebes antenna will be available in July (and will initially only have 1.3cm) and Bonn will be available at the end of the 2007. Torun is also scheduled to get a system in 2007 and Metsahovi already has 1.3cm. Shanghai has 1.3cm and when connectivity is demonstrated it could join. It was felt that a large telescope is needed for successful 1.3cm observation so use should wait till the second half of 2007 when Yebes comes online. By the end of 2007 there may be 8 or 9 eVLBI stations at 1.3cm.

At 3.6cm by the end of there will only be three or four European antennas with 3.6cm plus Shanghai and Arecibo (with its usual HA limitation). Other Chinese antennas may be available at 3.6cm. At 5cm all 6 present participating eVLBI telescopes can observe, though Westerbork only has one antenna equipped, so there won't be any large antenna available till the end of 2007 when Bonn joins. The main issue here is that the 5cm band is primarily for spectral line and whether this is offered for eVLBI must be decided.

3.5 Can we offer spectral line?

Bob Campbell reported that he saw no special problems at the correlator for spectral line. The larger potential difficulties are at the stations. WSRT has a problem scheduling tied-array spectral line setups which will persist until new hardware is installed (in about 6 months).

At present the call asks for urgency in proposals but a difficulty is that there are few urgent spectral line observations. Monitoring for structural changes and parallax/proper motion is a possible use but requires a long term commitment inconsistent with 'urgent' use (see below). It was concluded that we do not yet offer spectral line yet but consider the issue at the next telecon meeting.

3.6 Allow long term monitoring use of eVLBI

Discussion led by EVN PC members present suggested it was hard to mix monitoring programs and 'urgent' use because the requirements (long term commitment) versus rapid response were contradictory. It was also agreed that if monitoring proposals were allowed for eVLBI time they should be submitted for the normal EVN deadlines. For

now it was felt that long term monitoring use should not be promoted in the call for eVLBI proposals. The situation will be reviewed at the next telecon meeting.

3.7 Use of eVLBI for targets of Opportunity (ToO)

ToO are observations not scheduled in advance that are triggered by an external event (Supernova exploding etc). eVLBI has a contribution by giving fast results to allow planing of next observation (and it may also may be more reliable because of real time feedback). There are four possible uses of eVLBI for ToOs 1) do whole ToO expt with eVLBI (but presently this has reduced bitrate and number of antennas compared to disk recording) 2) Same plus local 'safe' copy recorded (technically difficult with present Mk5A). 3) Electronic shipping of disk recorded data after expt 4) eVLBI observations at the start of disk expt to test fringes in real time (faster than using the software correlator). Some members of the eVSAG thought that in the long term option 1 was the only useful option others that he other options may be useful.

A working group of the EVN has been set up to consider procedures for ToOs in general (independent of the data transfer mode disk or eVLBI). This includes both procedures for administering proposals and technical aspects. The eVSAG chair is a member of this subgroup inputing advice on eVLBI support for eVLBI and may consult with the full eVSAG on these issues.

3.8 How can we best use Arecibo in production eVLBI?

With Arecibo getting a 256Mbit/s link in 2007 it should be able to participate at least 128Mbit/s. However because of its limited HA and Dec range it is impractical to keep 24hrs of observations 'blocked out' till a week before just so that that perhaps 2-4hrs will be used somewhere within that period.

The idea was suggested that we consider for the runs in 2007 offering Arecibo for a fixed short UT periods (2-4hrs) for astronomy on the eVLBI dates in 2007. We may get then specific proposals tailored to use Arecibo during these limited GST periods. If there are no such proposals or the PIs don't want Arecibo its participation will of course be cancelled for that run (but in this scheme some hours are lost on short notice which is better than at short notice cancelling all or most of a 24 hr slot). Z.Paragi suggested that if only short periods for Arcecibo van be scheduled we could consider scheduling those GST times when popular classes of galactic object may be visible.

3.9 What is best model for eVLBI runs in second half of 2007 and beyond?

Probably keep the same pattern as first half of 2007 but schedule more double header adaptive expts if initial obs are successful. Simon Garrington and Richard Porcas suggested that for monitoring perhaps 6 regular EVN sessions per year could be adopted in 2008, with eVLBI at the start or end (or mixed in) with these sessions. (Note at the EVN directors meeting the following day the idea was put to the directors who then formed a small subgroup, including the eVSAG chair, to study this idea and report back).

3.10 Timescales for software correlator capable of real time 2 or 3 station spectral line obs

As noted in the document on eVLBI science use the availability of a realtime software correlator combined with eVLBI could enable long almost autonomous observing - so allowing new types of survey or long term monitoring observations to be done. The head of JRA1 estimated that a (probably non-distributed) version of such a real time correlator possible of handling 2 or 3 stations with MHz bandwidths may be available by the end of 2007.

4 Other business

4.1 How to get feedback from users on what they want?

Ideas discussed included sending a questionnaire to present users. Z.Paragi noted he would be attending the meeting on 'Bursts, Pulses and Flickering: Wide-Field Monitoring of the Dynamic Radio Sky' in June in Greece. It was felt that other members of the eVSAG should consider going to this conference to talk about eVLBI. Likewise it was important to have a presence at meetings involving X-ray binaries and active stars. Z.Paragi's attendance at such a meeting in Como this year resulted in at least one eVLBI proposal.

4.2 Time of next meeting

A logical time would be to have a telecon meeting after Jan/Feb adaptive expt and before the detailed schedule for the second half of 2007 is made (suggesting early February 2007).

The next face to face meeting should be in project month 16 (June 2007). Possible venues are in Gothenburg, Sweden or at the opening of the Yebes antenna in Spain which will be coordinated with a ToG meeting in early summer but is not decided yet. We will consult by email and make a final choice at the next telecon meeting.