European VLBI Network Newsletter
Number 6
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1. Call for Proposals - Deadline 1 October 2003

Observing proposals are invited for the EVN, a VLBI network of radio telescopes spread throughout Europe and beyond, operated by an international Consortium of institutes (http://www.evlbi.org/). The EVN is open to all astronomers. Use of the Network by astronomers not specialised in the VLBI technique is encouraged.
The Joint Institute for VLBI in Europe (JIVE) can provide support and advice on project preparation, scheduling, correlation and analysis. See EVN User Support at http://www.jive.nl.

EVN Observing Sessions in 2003-2004

2003 Session 3 Oct 23 - Nov 13 18/21cm, S/X, 6cm
2004 Session 1 Feb 05 - Feb 26 6cm (+ MERLIN), 5cm (+MERLIN), +...
2004 Session 2 May 20 - Jun 10 30cm, +...

Proposals received by 1 October 2003 will be considered for scheduling in Session 1, 2004 or later. Finalisation of the planned observing wavelengths will depend on proposal pressure.

Special features for Sessions in 2004

* Lovell Telescope should be available in session 1, 2004, following completion of the surface adjustment later this year (http://www.jb.man.ac.uk/tech/lovellupgrade).
* Recording at 512 Mb/s (Mark IV) available. Use of such rate should be clearly justified and limited to projects which really need it.
* EVN Data Analysis pipeline in operation. See http://www.evlbi.org/pipeline/user_expts.html.

Large projects

Most proposals request 12-48hrs observing time. The EVN Program Committee (PC) also encourages larger projects (>48 hrs); these will be subject to more detailed scrutiny, and the EVN PC may, in some cases, attach conditions on the release of the data.

How to submit

Complete a coversheet (now available in LaTeX format) and attach a scientific justification (maximum 2 pages). Up to 2 additional pages with diagrams may be included; the total, including cover sheet,

should not exceed 6 pages.

Submit to: Dr. Richard Porcas, EVN Scheduler, MPIfR, Auf dem Huegel 69, D 53121 BONN, GERMANY or by email to: proposevn@HP.mpifr-bonn.mpg.de. For further details seehttp://www.evlbi.org/proposals/prop.html.

Additional information

The detailed "Call for Proposals" has further information on Global VLBI, EVN+MERLIN and guidelines for proposal submission: see http://www.obs.u-bordeaux1.fr/vlbi/EVN/call-long.html".

The EVN User Guide (http://www.evlbi.org/user_guide/user_guide.html) describes the network and provides general information on its capabilities.
The EVN Status Table (http://www.mpifr-bonn.mpg.de/EVN/EVNstatus.txt) gives current antenna capabilities.

The On-line VLBI catalogue (http://www.ira.cnr.it/~tventuri/cata.html) lists sources observed by the EVN and Global VLBI.

2. Report from the Chairman of the Consortium Board of Directors (CBD) of the EVN

At the recent Meeting in May in Noto, Phil Diamond stepped down as Chair of the Consortium Board after two years of active involvement in the welfare of the EVN and of creative leadership. *Thank you Phil*. At the beginning of his tenure, Phil Diamond presented an improvement course to make EVN more reliable, more competitive, and user-friendlier. Some of the areas of improvement will continue to be with us, and I, with the help of vice-chair Franco Mantovani, intend to work on reaching these EVN objectives and on continuing the upward trends that we have seen in the EVN in recent years. EVN represents a wonderful group of people that time and again make the European Observatories work together as a most sensitive and versatile long-baseline interferometry instrument.

At the recent Berlin meeting, the EVN CBD made the very difficult (and emotional) decision to opt for Mk V recorder technology over the elegant EVNPC system from Metsahövi. The new technology of the Mk V will allow EVN to go for to higher recording bandwidths and more continuum sensitivity. The recorder developments and the recent successes of fibre-based 1Gbps data transfer form the basis for making the EVN push towards bigger and better.

The EVN operations strongly rely on two important groups of scientists and technical people: the EVN Program Committee under the leadership of Patrick Charlot (Bordeaux) and the Technical Operations Group under the leadership of Walter Alef (Bonn). These groups work very hard on getting the best in science quality and in technology. These groups deserve our active support.

Willem Baan (baan@astron.nl)

Chairman, CDB of the EVN

3. RadioNet: Advanced Radio Astronomy in Europe

Over recent years European radio astronomy and the EVN in particular, has been the beneficiary of significant funding from the European Commission (EC). These grants have funded such things as Research and Technical Development (RTD) projects, Marie Curie research networks, an Infrastructure Cooperation Network and an Access programme for the EVN.

The EC's Sixth Framework Programme (FP6), which started this year and runs until 2008, broadened the scope of such support and created an instrument known as an Integrated Infrastructure Initiative (I3). I3s are designed to bring together a broad group of institutes to collaborate in a range of areas. European radio astronomers felt that this was an opportunity not to be missed and so put together a broad programme in a proposal called RadioNet.

In late July of this year we heard that RadioNet had been well-rated, in fact it was first among all astronomy proposals, and was to be considered for contract negotiations; hopefully to be concluded by mid-October. We were told that we could expect up to 12.4 MEuro for European radio astronomy over the next five years.

The RadioNet programme has three strands:

- **Trans-National Access (TNA)**. This programme is the largest in RadioNet and is designed to encourage and increase the European user base of the radio telescopes run by Europe. These include the EVN, MERLIN, IRAM, JCMT, WSRT and the two single-dishes at Effelsberg (100m) and Onsala Space Observatory (20m mm telescope). This programme provides the additional running costs needed to support these users and will pay for the travel expenses incurred by eligible users for making their observations or reducing their data.

- **Joint Research Activities (JRA)**. There are three technical R&D programmes within RadioNet:

  - ALBUS is focused on improving user software for cm-wave interferometers

  - AMSTAR will develop new technologies for RadioNet's mm/sub-mm facilities

  - PHAROS will build on the successful FP5 FARADAY project and develop low-noise, *phased* receiver arrays to be installed at the foci of large radio telescopes.

- **Networking Activities.** This area is designed to enhance the communication between scientists, engineers, programmers etc within the European radio community and to strengthen the links to our colleagues who work in other wavebands. It will be funding science and engineering workshops, working visits between institutes, training schools and more.

A RadioNet website exists (http://www.radionet-eu.org) but it does not, as yet have any content. However, once it becomes active you will be informed.

Philip Diamond (pdiamond@jb.man.ac.uk)

University of Manchester, RadioNet Coordinator.

4. Recent changes at JIVE

Over the last few months some changes have been made regarding the organisational structure of JIVE, and the responsibilities of some staff members. In particular, the support scientists at JIVE are now collected together in one group, reporting to Bob Campbell. In addition, Bob is also supervising the Correlator Operators. He is aided in both tasks by Cormac Reynolds (Support Scientist) and Nico Schonewille (Chief Operator).

Huib Jan van Langevelde leads the Software Development Group - maintaining the EVN correlator on-line software but also being responsible for software development associated with post-correlation data. We expect the latter to be the main area of development at JIVE over the next few years - the FP6 ALBUS project (see RadioNet report by Phil Diamond) will be coordinated by Huib, and other activities of this group will focus on High Performace Computing - using PC clusters to cope with the enormous output data rates permitted by the introduction of the Post-Correlator Integrator (PCInt) system.

Steve Parsley remains head of the Technical Operations and R&D group - spear-heading the EVN's efforts towards a real-time (eVLBI) capability (see Steve's report). Leonid Gurvits joins the Management Team at JIVE. As well as playing a more substantial role within the institute, Leonid will also play a major role in our FP6 activities.

With all these changes in place our "bread and butter" activities continue to make steady progress. So far we have processed about 1/2 of the experiments scheduled in the previous "bumper" EVN session

(May/June 2003). Projects crecently completed, include the EVN's first 512 Mbits per second user experiment. Other projects in the queue will include our first sub-netting experiment, and the first 21 telescope experiment. One of the projects also uses 16 MHz EVN MkIV filters for the first time. We also looking forward to the next session in which we

will see the first serious use of Mk5 for user projects. Cormac Reynolds has been updating Sched to write vex files appropriate for Mk5 observations/correlation. This will find its way into the next release of Sched. Arpad Szomoru has completed our programme to permit transparent correlation of disk-only and mixed disk-tape projects at JIVE. Note that disk-only experiments are much preferred - it is only then that the improved efficiency (and other benefits) of Mk5 operations is fully realised.

Finally, I'd like to draw your attention to the new JIVE web pages at "www.jive.nl". For more details on the new structure at JIVE consult the "organogramme" at www.jive.nl/institute/institute.html

Mike Garrett (garrett@jive.nl)

Director of JIVE

5. Support Scientist post-doc opening at JIVE

Jive invites applications for a Support Scientist position becoming available in September 2003. Further details of the position can be found on the JIVE website at http://www.jive.nl/institute/jobs.html.

Closing date for applications is 1 October 2003.

6. The TOG meeting in Madrid

For those who do not attend it, the TOG is the EVN Technical and Operations Group. EVN stations send their *Friend of VLBI* and the *Technical Friend* to discuss operational matters and coordinate changes at an EVN site. Often there are members of the technical VLBI community present, for example from Haystack or the VLBA. The last TOG meeting was held at the MDSCC (Madrid Deep Space Communication Complex) site at Robledo, close to Madrid, Spain on 30th June 2003. The local organizer was Cristina Garcia Miro, and the JPL representative was Peter Poon.

The main items were the introduction of Mark5 (disk-based) recorder systems at many sites to replace the tape based systems of the past, and the ongoing tests and plans for electronic VLBI.

Haystack submitted a report the Mark5 system. Of particular interest to the TOG was the low price, the ready availability of recording medium (disk drives) and the natural path to optical fibre linked observing (*eVLBI*).

There were reports on progress in eVLBI, some of which had already been noted at the JIVE workshop held in May 2003. Several observations had been done with limited numbers of baselines, and there was considerable support from research networks. Haystack and Metsahovi also presented reports on their progress with demonstrations of eVLBI at 1Gbits/ and 2Gbit/s in the last months.

Updates at stations

- The crack in the rail track at Effelsberg has been repaired, and they also have improved the 1.3cm and 2cm receivers. There is now a Mark5 recorder in Effelsberg, and they plan to move to Mark5 recording only as soon as possible.
- The Medicina antenna was being refurbished, and had installed a Mark5 recorder. A new low-noise 22GHz receiver was being built. There was also a tender for a high-bandwidth optical fibre links to the main interconnection at Bologna
- Noto had also upgraded the dish surface and control system. A Mark5 recorder was working. New receivers were under construction for Lband (1-2GHz) and 3.6/13cm, and a low frequency (250-1000MHz) receiver would be working by October.
- Onsala has new wide-band (4-8GHz) receivers for the 25m telescope.
- The tape unit for recording Cambridge has been giving many problems, so Jodrell Bank plan to replace it with a Mark5 recorder as soon as possible.

Gino Tuccari sent a report about the Bear Lakes telescope, 60km outside Moscow. He was optimistic that it could join in regular VLBI observations soon.

Correlators

JIVE had 4 Mark5 playback systems, and had demonstrated Mark4/Mark5 correlation. There was also support for multiple projects per disk pack.

Four MK5A units were integrated into the Bonn correlator, and bitrates up to 1Gbit/s had been tested sucessfully. 30 Mark5 "8-packs" will be purchased before session 3 2003.

Spare Parts

There was much concern about the unavailability of many spare parts crucial to VLBI observing. Even the (relatively) new Mk4 formatter has several components which are already unavailable. The end of the tape drive era is now in sight, so many obscure spare parts for tape drives will no longer be needed. Some work is being done on a digital replacement for the BaseBand Converters by Gino Tuccari.

Tony Foley (ASTRON, foley@astron.nl)

7. EVN-NREN eVLBI Proof-of-Concept (PoC) Project

Though it has not been discussed in this newsletter before, most people probably know about this project. The aim is to connect Westerbork and up to five other EVN telescopes, in real-time, to the EVN MkIV data processor via the European research networks using normal IP services.

Progress with the PoC project was modest in the first half of 2003. Several trials have confirmed that a fragment of data from each telescope can be sent to JIVE by FTP for quick turn-around fringe checks. This mode of operation will be the first real benefit of eVLBI and it is hoped that this will become routine shortly. The scheduled Mk5 disk system tests have secured a few disk packs with real VLBI data that can be used for ongoing eVLBI experiments. Initially these will be taken to a local POP since, so far, no telescope in the EVN has a direct high bandwidth connection. Notable progress has been made regarding the "local loop" problem by Onsala and Torun who both expect to have a connection at 1Gb/s before the end of the year. JBO also report good progress with the last-mile connenctions; Lovell/Mk2 telescopes and Cambridge will be hooked up very soon, probably as part of the eMERLIN project. In May a fibre optic link between Westerbork and Dwingeloo was completed. Dedicated fibres in this line will be used to provide a VLBI connection to the data processor. It is expected that this will be a direct link between two Mk5 units, completely outside the general network domains.

At JIVE, following some preliminary laboratory testing, work has begun to refine the connection to SURFnet in Amsterdam. The first step was to perform a loop test between two Mk5s. Each unit was connected to one GEthernet wavelength and data were transferred from one to the other via Amsterdam, a round trip of 360 km. The data rate achieved was 120 Mb/s, disappointingly low and inexplicably 2.5 timesless than between units on the bench. SURFnet are currently considering why this should be. Further progress has been hampered by a decision by SURFnet to switch to LX optics. This required JIVE to acquire new NICs, only available on a lengthy lead time.

The next phase will begin to transfer data across the NREN/GEANT network. First to participate in this way will be Bologna in mid September. The Bologna team have already made all preparations for such a test. GEthernet boards compatible with nearest GARR pop have been purchased and some internal transfer test have been performed.

Bench tests, both at JIVE and Bologna, have revealed some practical problems associated with the use of Mk5 as the eVLBI interface platform. To achieve a full 1Gb/s data rate, two GEthernet channels are required. The existing MK5 motherboards however have only two 64bit slots and one these is occupied by
the Streamstorm card so it is not possible to mount two GE NICs (Haystack's announced transfer rate of ~900 Mb/s was, in fact, achieved using two Mk5 units at each end). Bench tests at JIVE using the Mk5 in-built disk2net and net2disk commands achieve a maximum of 300 Mb/s. Why this is lower

than
Haystack's maximum of 440 Mb/s is unknown. In any case, for real-time operation a rate of 600 Mb/s per GE is needed. Memory-to-memory tests at both JIVE and Bologna confirm that much higher data rates are possible when there is no disk access activity. Rates of 800-900 Mb/s have been achieved in Bologna
using UDP software from R.Huges-Jones. Clearly further refinement and optimisation is required.

Steve Parsley (parsley@jive.nl)

Head of the Technical Operations and R&D group at JIVE

8. EVN Observations of OH Megamasering in Mrk 273

EVN and Westerbork observations have been carried out to study the hydroxyl Megamaser emission in Mrk 273 at different spatial resolution. The line and continuum observations display a number of distinct structural components in the 1 square arcsec central region. The observed continuum emission shows three prominent regions with both flat and steep spectral indexes. The spatial distribution of the maser emission observed in Mrk 273 and also in Mrk 231 (Klöckner, Baan & Garrett (2003) provide unexpected views of the structure of the molecular environment in the nuclear region.
The hydroxyl (OH) emission detected by the EVN measurements accounts for only 12% of the total OH emission in Mrk 273 as seen with Westerbork, but it does show all dominant line emission structures. OH emission has only been detected toward a distinct northeastern radio component in the nucleus with a spatial extent of 107 pc. The OH emission itself is partially superposed on the radio continuum and associated with the NIR emission. The emission characteristics suggest that this maser originates in an optically thin and unsaturated maser environment with a complex pumping scheme. The spatial structure and the velocity characteristics of the OH emission reveal organized motion of an edge-on disk/TORUS with Keplerian rotation surrounding a central object with a binding mass of 1.4 x 109 Msolar. These results are presented in a paper by Klöckner & Baan (2003, submitted).

Willem Baan (ASTRON, baan@astron.nl), Hans-Rainer Klöckner (RUG)

9. Widefield imaging of methanol masers in W51

Methanol masers are of interest because they are strong, wide-spread and (the class II variant) are only ever detected towards regions of massive star formation. Recent studies of the 6.7-GHz transition using the EVN and the ATCA, along with observations of cm and mid-IR wavelength continuum emission, indicate that the masers are associated with very young, extremely embedded massive stars. As this phase of the life-cycle of massive stars is short lived and difficult to detect, methanol masers have the potential to be a powerful probe for inding and studying massive proto-stars.

W51a is one field in W51, one of the most luminous regions of massive star formation in our Galaxy. It is known to show methanol maser emission and two isolated sources has been previously observed at 6.7-GHz with the EVN and 12.2 GHz with the VLBA (Phillip, 2000, Proceedings of the 5th EVN Symposium; Minier etal 2000, A&A, 362,1093), following initial work with limited uv-coverage at the ATCA. To get high precision position information we used the EVN in phased referenced mode, and made wide field of view spectral line observations of the region. The maser emission is spread over a region larger than the primary beam of Effelsberg, so the observations had to be made using two separate pointings.

Figure 1 shows the position of the detected methanol emission, overlayed on VLA continuum observations at 4.8~GHz. Most of the points of methanol maser emission are not associated with previously known sources. However, the presence of methanol masers indicates some sort of activity at these locations. Interestingly, 800um observations made by Ladd etal (1993, AIP Conference Proceedings 278: Back to the
Galaxy), show a compact continuum source at the same position of the masers in the South-East. Follow-up observations using instruments such as BIMA and the VLA at 20 GHz will be needed to understand the
origin of these sources.

Methanol is also detected towards two sources which are well known sites of high mass star formation; W51 main and W51 IRS2. A detailed image of W51 main is shown in Figure 2, which shows the relative position of the methanol masers as well as OH and water masers overlayed on the 8.4 GHz emission from the UCHII region and NH3 (1,1)emission. The astrometry shows an elongated shape, offset to the edge of a bright UCHII region (e2) which shows deep NH3 absorption. Linear structures such as this are commonly seen in methanol maser sources, and a disc hypothesis is often used to explain the structure and velocity gradient along the sources (Phillips etal 1998, MNRAS, 300, 1131). The current observations suggest that the methanol emission in this source is not associated with a disc, but is at the interface of the expanding HII region and the molecular envelope.

Figure 3 show the methanol emission towards W51 IRS2. The methanol masers are at the edge of an NH3 core and associated with a very compact UCHII region. From 8 to 20 GHz the UCHII region has an spectral index of 2.1 and has a size < 300 AU, which indicates the methanol is associated with a very young, highly embedded massive star.

Chris Phillips (ATNF, phillips@atnf.csiro.au), Huib Jan van Langevelde, (JIVE, langevelde@jive.nl)

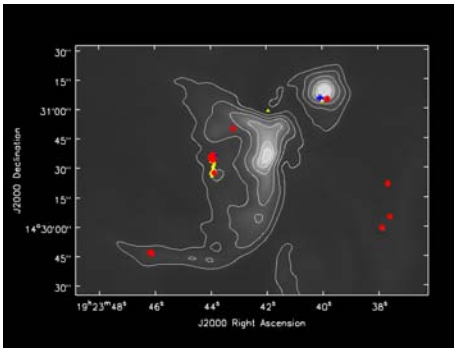

Figure 1: Red circles show the positions of methanol masers towards W51A, overlayed on 4.8 GHz continuum observed with the VLA (Mehringer etal, 1994, ApJSS, 91, 713) (greyscale and contours). Positions of OH and H20 masers are indicated by yellow triangle and blue crosses (Argon etal, 2000, ApJSS, 129, 159; Imai et al, 2002, PASJ, 54, 741).

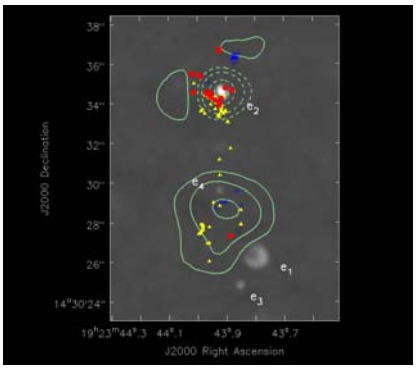

Figure 2: Detail of the W51main region. Methanol, OH and water masers are indicated by red circles, yellow triangles and blue crosses. The greyscale shows the 8.4 GHz continuum observed with the VLA-A array (Gaume etal, 1993, ApJ, 417, 645). The green contours show NH3 (1,1) emission (Zhang etal, 1997, ApJ, 241). The dashed contours deep absorption towards the UCHII region e2.

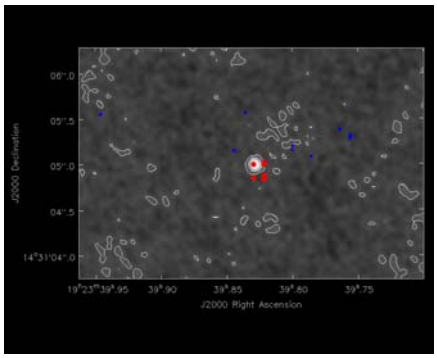

Figure3: Methanol masers towards the W51 IRS2 region (IRS2 is slightly to the east of viewable region). Position of methanol masers are shown by red circles, blue crosses indicated the position of H20 masers (Eisner et al, 2002, ApJ, 569, 334). The greyscale and contours show the 22 GHz continuum observed with the VLA-A array (Gaume etal, 1993, ApJ, 417, 645).

10. The Rest-of-the-World beats US in Socorro (3-0)

Following tradition, a football (i.e. soccer) match was held during the conference ``Future Directions in High Resolution Astronomy: A Celebration of the 10th Anniversary of the VLBA''. On June 10th the teams from the Americas (white shirts in the picture) clashed with the Rest-of-the-World on Tech field, Socorro, New Mexico. Despite, heat, altitude and jet-lag, our EVN representatives found themselves on the
winning side! The score was 0-3.

Huib Jan van Langevelde, (JIVE, langevelde@jive.nl)

The European VLBI Network (EVN) website (http://www.evlbi.org/) is hosted by the Joint Institute for VLBI in Europe (http://www.jive.nl/).