European VLBI Network Newsletter
Number 7
January 2004

Contents

1. Call for Proposals - Deadline 1 February 2004

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 2004

2004 Session 1 Feb 05 - Feb 26 18/21cm, 6cm (+ MERLIN), 3.6cm, 1.3cm
2004 Session 2 May 20 - Jun 10 30cm (UHF), 18/21cm, 6cm (+MERLIN), 5cm (+MERLIN)
2004 Session 3 Oct 21 - Nov 11 18/21cm, 6cm, 1.3cm, +...

Proposals received by 1 February 2004 will be considered for scheduling in Session 2, 2004 or later. Finalisation of the planned observing wavelengths will depend on proposal pressure.

Special features for Sessions in 2004

* Recording at 1 Gb/s (Mark 5A) is planned for session 2, 2004 at some telescopes with

implementation throughout the EVN by the end of 2004. Use of this data rate should be clearly justified and limited to projects which really need it. Check EVN Mark 5 status at: http://www.mpifr-bonn.mpg.de/div/vlbicor/evn_tog/EVN_Mark_5_Status.html
* Lovell Telescope now available for observing at 6 cm.
* 0.25s integrations available at EVN MkIV Data Processor at JIVE for wide-field applications (see article in forthcoming EVN newsletter).
* New 5 cm receivers are being installed at Westerbork (single antenna), Noto, and Jodrell Bank (Lovell Telescope) and should be available for observation in session 2, 2004. Simultaneous observing with the newly- equipped MERLIN array operating in this band is also possible.
* New UHF receivers are being installed at Noto and Urumqi and should be available for observation in session 2, 2004.
* 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 see http://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://db.ira.cnr.it/evn//) lists sources observed by the EVN and Global VLBI.

2. Words from the EVN Board

The EVN Consortium Board of Directors reviewed the overall EVN activity during its recent meeting in Dwingeloo. Many more of the action items in the Action Plan for e2e (end-to-end) EVN Operations have received a ''smile''. EVN and JIVE and all the stations are meeting the targets and the EVN CBD gave high marks to the operational and technical status of the EVN.
The EVN is moving to all-disk operation during 2004 and full MK5 operation is anticipated early 2005. At that time JIVE anticipates to have received all contributed MK5 units to accommodate all-disk operation. Three stations will already have an all-disk operation during Session 1/2004.
The EVN board has also decided to support the development of digital BBC's for use at the EVN stations. A project plan based on the developments at Noto is now being prepared and directed work will be initiated shortly.

The EVN-PC reported that the proposal pressure for the EVN remains high, although there

are fluctuations in the number of proposals. Some 60% of the proposals are extragalactic, 30% galactic, and the remaining cover astrometry and technical issues. The EVN are preparing for UHF observations for Session 2/2004 and several telescopes are getting ready for 6 GHz operations.

The TOG reported that the introduction MK5 represents a major activity. The network performance and reliability remains unchanged and high. Good progress has been made in the area of amplitude calibration and flagging, and also real-time fringe checking has become a reality now.
JIVE reported on the great progress made in the area of e-VLBI with tests between JIVE and WSRT, JBO, and Bologna. Plans are being made at more stations to establish fiber-connections on the timescale of one year. The initial e-EVN goal of having 4-5 stations on line will require a time scale of 3-6 months. Work on PC-Int is progressing well and currently ¼ sec correlation with the JIVE correlator is possible.

The Board also discussed a new policy EVN data access and agreed to seek alignment with the NRAO policy in this area. In short, this means that starting from February 1st 2004, the proprietary period for the data will be 12 months after correlation of the last data set of he project. JIVE will inform the PI one month before the data becomes public.

Our colleagues from Spain have proposed to host the next EVN symposium in Toledo and it is (tentatively) planned to start on October 4th, 2004.

The VLBI community in Europe is alive and well. Current EVN operations can accommodate further expansion of the user community and will be able support creative and non-standard observing proposals and more students.

Willem Baan (baan@astron.nl)

Chairman, CDB of the EVN

3. Advanced Radio Astronomy in Europe: RadioNet is launched

As reported in the previous issue of the EVN Newsletter by Phil Diamond (No. 6 of September 2003), the European radio astronomy community had been very successful in applying for the European Commission's Sixth Framework Programme Integrated Infrastructure Initiative (I3). The proposal named RadioNet has been granted 12.4 MEuro for a period of 5 years. The contract negotiation process concluded in the autumn of 2003, and RadioNet became operational on 1 January 2004.

RadioNet covers a broad range of activities. A significant fraction is directly related to EVN. This includes:
- Trans-National Access (TNA), which is the largest part of RadioNet, is designed to encourage and increase the user base of the radio telescopes run by Europe. The EVN is one of the facilities supported through RadioNet alongside MERLIN, IRAM, JCMT, WSRT, Effelsberg and Onsala (20m mm telescope). EVN users are encouraged to take the opportunity of obtaining support via RadioNet TNA. See item 4 of this News Letter for more details.

- Three Joint Research Acivities (JRA): ALBUS (user data processing software for cm-wavelength radio astronomy); AMSTAR (new technologies for RadioNet mm and sub-mm facilities;, and PHAROS (development of low-noise phased receiver arrays for large radio telescopes). All have components directly applicable to EVN activities. Of them, perhaps, ALBUS will be the most visible to EVN users as it will provide calibration and other software that will be used for data processing. See more on ALBUS activities in item 12 of this New

Letter.

- Networking Activities (NA) are designed to enhance the communication between scientists, engineers, programmers etc within the European radio community. It will be funding science and engineering workshops, working visits between institutes, training schools and more. Obviously, this area will cover a lot of EVN activities.

Last but not least, RadioNet has close links with the two other astronomical programmes funded via EC's FP6: OPTICON, which embraces major initiatives and facilities of the European optical astronomy, and ILIAS, a European astroparticle physics network.

Over the last weeks of 2003 RadioNet has been organising itself by establishing the Board, Executive and Management Teams. Its structure, functions and various documents are and will be posted at the RadioNet website http://www.radionet-eu.org.

Leonid Gurvits (JIVE, lgurvits@jive.nl)

RadioNet Programme Scientist

4. European VLBI Network : Access and Financial Support to users

The EVN is an open scientific facility which offers its observing time and other resources on the basis of the scientific merit of observing proposals from the worldwide astronomical community. The use of the Network by astronomers who are unfamiliar with VLBI is particularly encouraged and supported by JIVE Support Scientists. As part of the EVN's major goal to make VLBI a friendly and transparent astrophysical tool, we are pleased to announce that from January 2004 further support to the EVN users will be provided via the European Commission's Sixth Framework Programme Integrated Infrastructure Initiative RadioNet, specifically its 'Trans-National Access (TNA) programme (see more on RadioNet in item 4 of this News Letter). In particular, the programme is designed to facilitate the use of the EVN by those who are not affiliated to the EVN Consortium institutes. The FP6 RadioNet contract begins on 1 January 2004 and runs for 5 years. The EVN Session 2004-1 (February 2004) will be the first to be supported by RadioNet.

EVN PIs affiliated to an institute located in the European Union or one of the Associated States are eligible to apply for support (please do not hesitate to ask the undersigned if you have a specific question on eligibility). Such support is available automatically for eligible groups who obtain observing time on the EVN. Co-investigators associated with projects led by eligible PIs can also obtain support - including co-Is from countries other than listed above.

The support provided by this programme includes:

- full financial support for eligible users who wish to visit JIVE or any other EVN institute in order to schedule or process EVN, EVN+MERLIN or EVN+VLBA data;
- assistance from EVN Support Scientists (located at JIVE) at all stages associated with a VLBI experiment - from proposal writing to scheduling, calibration, and data analysis;
- absentee processing (pipelining) of the data at JIVE.

To apply for time on the EVN please refer to the EVN Call for Proposals (see item 1 of this Newsletter).

Further information on the EVN Access programme can also be obtained from the EVN Programme Committee chairman, Patrick Charlot (charlot@u-bordeaux1.fr). For more information on the RadioNet EVN's TNA programme please contact the undersigned.

Leonid Gurvits (JIVE, lgurvits@jive.nl)

5. News from the TOG

Implementation of Mark 5 recording systems in the EVN

The Mark 5 disk recording system (http://web.haystack.mit.edu/mark5/Mark5.htm) has been developed at Haystack Observatory with financial support from BKG, EVN, KVN, MPI, NASA, NRAO and USNO. Early test observations in summer 2002 with the prototype Mark 5 system were very promising. The production system Mark 5A became available for purchase from Conduant corporation towards the end of 2002 at the cost of about 15000 EUR. Since then worldwide more than 50 Mark 5A systems have been deployed in the field.

In December of 2002 the EVN board of directors decided to adopt the Mark 5 system as the new recording standard. In 2003 several EVN stations purchased systems for themselves and the EVN correlator at JIVE. Test observations performed throughout the year to verify that the stations can record at the maximum data-rate of the Mark 5 system of 1024 Mbit/s. After initial problems at some stations this aim could be achieved at all 6 telescopes who had Mark 5 equipment installed at that time.
At the meeting of the Consortium Board of Directors (CBD) of the EVN at the end of 2003 it was agreed that the EVN should switch over from tape to disk recording in the course of 2004. A plan for disk procurement was agreed. Every station which purchases enough disks to sustain two observing sessions with disks alone, can switch to exclusive recording with disks. The tape drives will be kept operational if possible, for observations destined for the VLBA correlator.

It was also agreed that first user experiments at 1024 Mbit/s should be offered as soon as possible. In discussions between the EVN-PC chairman, EVN scheduler, head of the EVN correlator and the TOG chairman it was agreed that in the Call for Proposals for the February deadline a first limited offer for observations at 1024 Mbit/s for the May session should be made. As the status of the Mark 5 deployment in the EVN is in constant flux a web page with the up-to-date Mark 5 status information was created http://www.mpifr-bonn.mpg.de/div/vlbicor/evn_tog/EVN_Mark_5_Status.html which should help potential proposers to estimate for which observing session what fraction of EVN telescopes might be available for 1 Gbit/s observations.
In the February session the modes and available bandwidth for 1024 Mbit/s will be tested for 1.3, 3.6, 6, and 18 cm wavelenght. This will not be done with disk units so that every station will take part. The trick is to use the same modes as for 1024 Mbit/s but switch from 2 to 1-bit sampling so that the total bitrate is ony 512 Mbit/s which can be recorded with tapes.
It is hoped that the Mk5 systems at Hartebeesthoek, Yebes, Urumqi, and Shanghai can be tested before the May observing session. Jodrell Bank is also trying to get a second unit for the Jodrell telescopes before May, so that in an optimistic scenario nearly all EVN stations will have a Mk5 unit availble for May for the first user observations at 1024 Mbit/s.

Next TOG meeting in Wettzell

The next meeting of the EVN Technical and Operations Group (TOG) will be held on April, 1 in Wettzell in the Bavarian Forest, Germany (http://www.wettzell.ifag.de). Wettzell is a Fundamental Station for geodetic services and an associate member of the EVN; they host all major geodetic measuring methods and observe geodetic VLBI daily. The one day

meeting of technical VLBI people and VLBI operators serves mainly for information exchange and discussions on operational and technical issues. The major topics will be implementation of Mark 5, calibration and performance of the EVN. A second day will be devoted to training of operators in the new tecnical fields like Mark 5, antenna calibration, calibration tools etc.

Walter Alef (alef@mpifr-bonn.mpg.de)

chairman of the TOG

6. Scheduler's Diary

October 2: A grand total of 23 proposals received for the October deadline - a reasonable catch. (Of course, not up to the record 40 received in February 1997; that was said to be due to "the dynamism of the new EVNPC Chairman" but if so, it clearly faded since the number sank to only 13 in October 1997 !) There are, unusually, more globals (13) than EVN-only this time. Our secretary Ute Runkel, with her usual efficiency, assigns codes (after liason with Lori Appel at NRAO), makes copies and distributes them to the EVNPC referees (and to Arecibo, DSN and MERLIN staff if relevent).

October 17: Session 3 starts in a few days. There have been some problems for PIs making schedules at 6cm for the Jodrell Lovell Telescope (first time available at this wavelength for VLBI); hopefully these are now resolved. This triggers me to send a request for feedback to all investigators assigned time in Session 3, to see if, in general, the scheduling process is working well; the deadline for depositing schedules was 9 October so the experience should be fairly fresh in their memories. (7 out of 14 reply - there is nothing too troubling apparently.)

November 10: The EVNPC meeting is approaching. Ryanair has foiled my plans to fly to Bologna and back for 35.67 Euros by giving the outward flight a new (and for me impossible) departure time. I contrive a new, cheap way via London Stansted. Inspection of the proposals reveals quite a lot of ambiguous, or missing, information on scheduling and technical aspects. I decide to email the proposers directly, in an attempt to get most of this sorted out before the meeting. Getting a correct specification of the desired recording mode seems to be particularly difficult, along with remembering to specify GST interval(s) for multi-source projects.

November 21: Attend the PC meeting in Bologna. The main part of the meeting is used for discussing the proposals, but various administrative aspects are also aired. New receivers for 5cm will be available for tests in the New Year at Westerbork, Jodrell (Lovell Telescope), and at Onsala they will test their present receiver on the 20m telescope. We decide to postpone the advertised 5cm session until May 2004, to take advantage of these new capabilities. We also learn that the new UHF receiver at Urumqi is well on the way to completion. It is the last meeting for 3 members of the committee, giving rise to speculation about their replacements. Whilst the EVN Consortium Directors must take into account areas of expertise and geo-political considerations when they make their choice, we are more concerned about the quality of the local restaurants near the new members' institutes, since they will host a meeting sometime in the future !

November 26: I begin to worry about making a draft block schedule for the February session. This cannot actually be done until I know the results of the NRAO review of the global proposals (their scheduling committee meets on 4-5 December) but it's worth sounding out some of the telescopes which are more difficult to schedule. I'd like to have a rough draft (version-0) available for discussion with NRAO before everyone disappears for the Christmas break. We will run 18/21cm (L-band), 6cm, and possible 1 or 2 of 1.3cm, 3.6cm, 90cm, since there are eligible proposals at all these wavelengths. In which order I cannot yet say. I email Pam Wolken at JPL to see if a certain GST interval, critical for

scheduling one EVN 1.3cm experiment, will be available on the DSN anytime in the session. I go home wondering (not for the first time) why, if the Creator had really intended us to do VLBI, he/she did not shape the Earth as a disk rotating about a diameter, instead of the oblate spheroid which we have. On our side of the disk we'd all work the same hours (making communication about long baselines not subject to time-zone difficulties), each source would be visible for the same 12h at all antennas in the array on our side, and those "w-terms" might even be dispensed with.

November 27: Had I waited a few more minutes yesterday I would have received Pam's speedy reply. The PI of the 1.3cm experiment has foolishly chosen a source at the same RA as Mars: "Due to the high activity of multiple spacecraft at Mars, our options reserved in February are just wrong". I grab the slots she has reserved for EVN for safe-keeping.

November 28: I sound out Hector Hernandez, Arecibo scheduler, on reserving possible slots for 3 global projects. One of these, at 3.6cm, can also use one of the DSN slots, thus fixing the day, and thereby providing a constraint on the order of wavelengths in the session.

December 2: My distinguished counterpart at NRAO, Barry Clark, the long-serving VLBA/VLA scheduler, can hazard a guess at the outcome of their scheduling committee for only 2 of the globals. For these, the referees agree well with the EVNPC review. Hector replies that Arecibo is indeed available for the times I requested.

December 8: Wonders will never cease ! Barry, famed for his 1-line replies, sends me an email a full 65 lines long ! It contains global grades and comments, but also the news that GBT time is going to be seriously rationed, in February (maximum 30h) and probably May, too. Worse still, GBT time is not available in the most popular GST range until February 20th; the EVN session window is 5-26 February. This news, and the NRAO committee ratings, start to constrain the session considerably. In fact, all but one of the global proposals also request the GBT. The highest rated global project (at 21cm) must get all 30h of GBT time and, as it requires the popular GST range, must go after 20 February. Clearly, L-band comes at the end of the session. I probably cannot schedule any of the projects needing Arecibo since they all need GBT, also. There IS, however, one EVN-only project (18cm) which can use one of the two DSN allocations at Robledo; I think of giving it the later period (20 February) since L-band comes at the end.

December 11: I attend a "working breakfast" in Dwingeloo, prior to the FP6 meeting. My colleague Walter Alef, the TOG Chair, is keen to open up the opportunity for 1 Gbps observing to EVN users, now that the agreed acquisition of MK5A systems makes this a reality. Patrick Charlot (EVNPC Chair), Bob Campbell (Head, JIVE scientific operations), Walter and I discuss strategy. We'll announce the opportunity in time to receive 1Gbps proposals by the 1 February deadline, with possible observing in the May session (depending on how many stations are actually on the air with MK5 by then). Walter offers to set up a webpage showing the MK5 status throughout the EVN. I volunteer to draft a "pre-flash" announcement (to "sensitize" proposers before receiving the actual Call for Proposals !) about 1Gbps recording. And we agree there must be tests of the telescope RF and IF systems at many frequencies in the February session.

December 12: I report to the EVN Consortium Directors on recent scheduling activities. During the meeting I learn of yet another UHF receiver, recently completed for Noto. I urge the Directors to support tests of the new 5cm and UHF receivers in time for the observing session in May. I inadvertently raise the temperature during a discussion on the pipe-lining of data, establishing an EVN archive, and the policy on the proprietary period for EVN data. Sorry !

December 16: Phil Diamond, Director of MERLIN and Jodrell VLBI, emails a suggestion for a "minor limitation" to session1, that is, to start at L-band ! Help ! I discuss with him how

the present plan for the session is shaping up. We agree to leave L-band at the end of the session, although this involves an additional Lovell Telescope receiver change.

December 22: I return to the schedule. One global project requires time at both 6 and 3.6cm in the same session. We don't plan to run 3.6cm in May so it will really be delayed if I can't schedule it in February. After consultation with the PC Chair and the PI, we agree to go ahead without GBT. I see that this project could use the available DSN time (at 3.6cm) at both Robledo and Goldstone. Perhaps this will be sufficient compensation for not having GBT at either wavelength ? This will also require EVN to have 3.6cm on 13 February. I email Barry to see if this will work at the VLBA but, alas, he has disappeared for Christmas. I finalise a version-0 of the block schedule and distribute it to the observatories. They have various logistical constraints, some of which I know (2 days for receiver changes on the Lovell Telescope) but I need to check before making a public version of the schedule.

January 6: Things seem to have converged. Pam and Barry agree with version-0 and there has been no great outcry from the stations. I distribute the version-1 block schedule to the PIs and the stations. It includes a suggestion for testing 5cm and UHF receivers after the last project but before the nominal end of the session.

January 13: Patrick has distributed the Call for Proposals, following the pre-flash on January 8th. All three special opportunities - 1Gbps, 5cm and UHF VLBI are unique to the EVN. Let's hope we harvest a good crop of proposals !

January 16: I have accumulated enough schedule adjustments to make distribution of version-2 worthwhile. After a week-long debate the nature of the 1Gbps tests to be scheduled takes shape. (We are to test the set-ups for 1Gbps but, by using 1-bit sampling we reduce the bit-rate to 512 Mbps so it can be recorded on tape). One PI has requested a minor telescope change; another realises he needs a single telescope only at Westerbork to get a wider primary beam. There is a pilot "short observation" added to the 6cm session. The Yebes antenna will not be able to take part, due to damage sustained during a geodetic VLBI observation. And - Raffaella is giving a final call for Newsletter contributions.

Richard Porcas, EVN Scheduler

7. FTP fringe test

At the beginning of each EVN session there is a fringe test experiment to make sure that everything is working fine at the stations, before user projects start. The correlator reports back on fringes within a couple of days to a week, depending on how quickly we receive the tapes.

With disk recording, there is a faster way of checking telescope performance. It is possible to send a short segment of data over the internet to the correlator - we tested this option in session 2/2003. Transfering two minutes of data (2-4 GBytes) to Dwingeloo was found to be feasible, using the new 1 Gbit/s connection to JIVE. The file transfer time was several hours, it was limited by the slow connection lines of some of the EVN telescopes. The data were processed at the EVN Correlator, and fringes were reported back within 1-2 days.

By the November session ftp fringe tests became more regular. The following stations were equipped with the Mk5 recording system: Effelsberg, Jodrell Bank, Medicina, Noto, Onsala, and Westerbork. The Communications Research Laboratory (CRL), Japan, provided JIVE a Software Correlator with which fringe tests could be carried out without interrupting normal data processing at the EVN Correlator. With this software we can process very short segments of data. In practice we use 15-30s datasets, which are easier to transfer over the internet.

There were several mid-session ftp tests organized in session 3/2003. The goal was to

monitor the EVN performance more regularly than before. There were "ftp scans" scheduled in fringe test and network monitoring experiments. After receiving these data (extracted from the Mk5 disk packs by the telescope staff), the CRL Software Correlator was run by an automated script for several baselines. The results were put on the following web page: http://www.evlbi.org/tog/ftp_fringes/ftp.html (see also the figure below for an example).

At present the correlation vexfile is made by JIVE staff, shortly before an experiment. Efforts are being made to further automate the ftp-fringe tests both at the telescope and at the correlator. It is intended that "ftp-scans" will be included in the schedules which will be automatically detected by the telescope control software and ftp'd to the correlator, where local software will carry out the data correlation with minimal manual intervention. In the longer term astronomers will be encouraged to schedule an ftp test for their own projects (similar in fashion to the readback tests used with tape). In principle, the results can be automatically posted on the EVN website, immediately after an experiment. It is hoped that in this way, EVN reliability will increase by more regular monitoring of the network.

Z. Paragi & C. Reynolds (JIVE; paragi@jive.nl, reynolds@jive.nl)

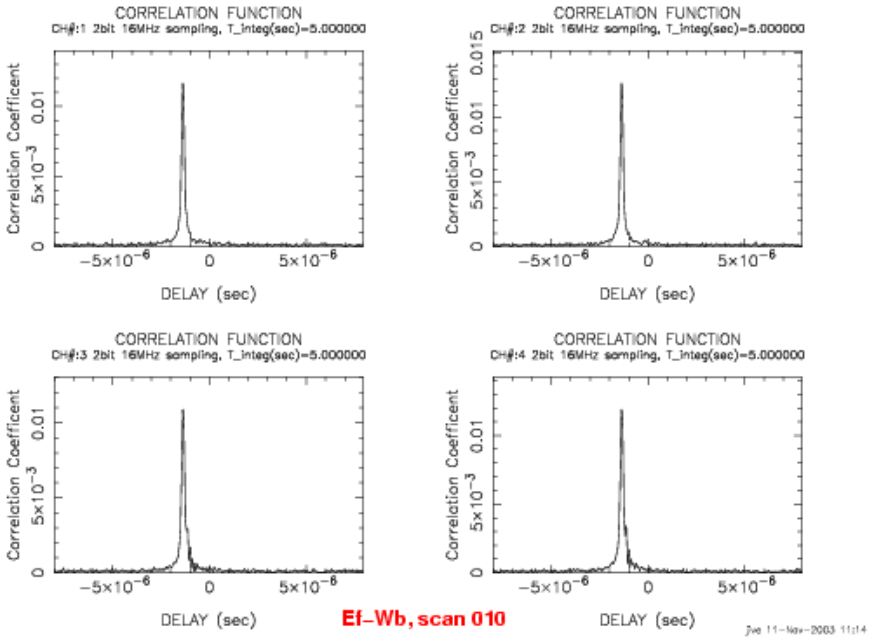


Figure 1. Effelsberg-Westerbork fringes from the L-band Network Monitoring Experiment in session 2/2003

8. Wide-field mapping using the EVN MkIV correlator

Recent enhancements at the EVN MkIV data processor at JIVE have boosted our capabilities to offer you the opportunity to map a wider field of view around a single phase center. We have reduced the minimum integration time for the whole correlator to 0.25s (or 0.125s for half the correlator). The combination of sub-second integrations and good spectral resolution will permit many sources to be detected simultaneously in a single observation, with full sensitivity and milliarcsecond resolution. This is an important new capability for VLBI and will enable deep, wide-field surveys to be conducted.

To give you a flavor of our current capabilities, let's take an 8-station European-only L-band experiment, with one 16MHz subband and one polarization (64Mb/s total recording rate with 2-bit sampling). We can get a field of view limited by bandwidth smearing (to a 10% reduction for the response to a point source) on the order of a 25m single-dish beam by

using 1024 frequency points. This works out to be one-half the total correlator capacity, which means that we could use an integration time of 0.125s. Such a t_int for this array would provide a field of view limited by time smearing (to the same 10%-reduction level) of ~90% of a 25m single-dish beam -- this case works out fairly well. (Of course, the data volume for this sort of wide-field application mounts quickly: this case would produce ~7GB per hour of [on-source] observation.) A general conclusion about our current situation would be that time smearing will more often be the limiting factor in trying to map full single-dish beams.

The figures show the result of a test in which we intentionally correlated a scan of DA193 with incorrect coordinates, to simulate the observation of a source far from the phase center. Figure 1 shows the map resulting from the normal correlation, and figure 2 that from a phase center offset by 120", both using ~5 minutes of data. The array was EfWbJbMcNtHhUrSh, observing at L-band with 4 subbands (8MHz each) and 2 polarizations. The off-center correlation used 256 frequency points (filling the whole correlator in this case) and 0.25s integrations. The "normal" correlation used 16 frequency points and 4s integrations. The off-center map loses ~3% of peak flux density, and the source becomes somewhat more elongated in the NE-SW direction (axial ratio decreases ~8%). The anticipated field-of-view limitations from bandwidth and time smearing (again to the 10%-reduction level) for this case would be ~200" and 167", respectively -- reassuringly consistent with the observed differences in the "normal" and off-center maps.

We've put a tutorial-like document onto the EVN web page that describes field-of-view issues in more detail. It lives in the EVN User Guide, under the "Imaging Limitations" bullet. It provides the formulae you need to tie the EVN MkIV data processor's spectral-resolution and integration-time capacities together with observational parameters (array/band/sensitivity) when computing bandwidth- and time-smearing limits, along with tabulated results for representative configurations of observation/correlation parameters.

R.M. Campbell, C. Reynolds, Z. Paragi (JIVE)

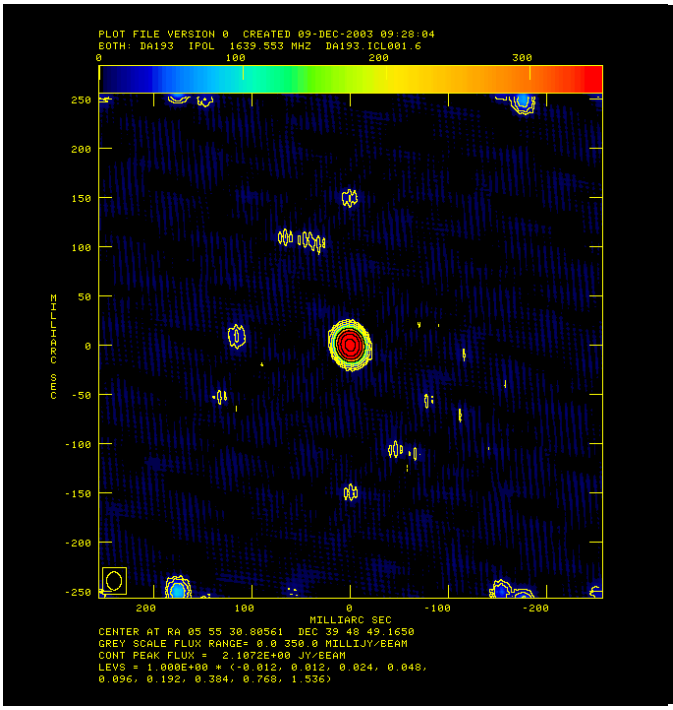


Figure 1

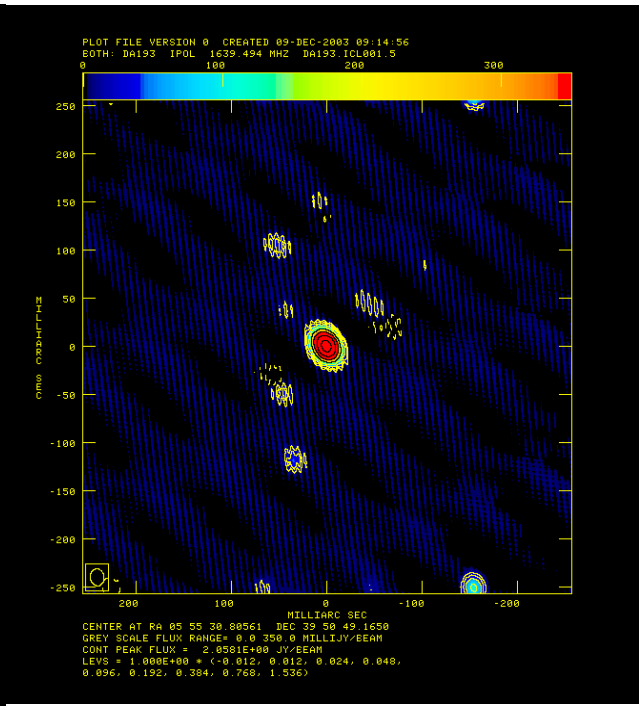


Figure 2

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

Progress with the PoC project accelerated in the later part of 2003. JIVE infrastructure for eVLBI has matured. Mk5 is a stable interface to the correlator and fibre-optic lines are installed in the basement connecting multiple Mk5 units to the GEthernet connections from Amsterdam. Six such connections are now available. The first regular user of these facilities are FTP fringe checks. These are now routine and have moved beyond the scope of the PoC project (see item 6).

In September a Mk5 system from Medicina was installed at the Bologna PoP of GARR, the Italian National Research and Education Network (NREN). Data were transported to JIVE via GEANT and SURFnet. Maximum data rates achieved were 125Mb/s in disk2net2dsik tests and 700Mb/s in UDP memory-memory tests.
In October JIVE participated in a demonstration of eVLBI, staged by Haystack Observatory, at the Internet2 Members meeting in Indianapolis. A total of 85 Gbyte of data were uploaded to JIVE using BBFTP (broadband FTP) at a maximum data rate of 71.4 Mbps. UDP tests showed a maximum of 612 Mbps. Transferred data represented a VLBI test between Westford and Kashima in June. Attempts to correlate these data at JIVE were frustrated by format incompatibility problems.

'First light' on the 1Gbit/s optical fibre between Westerbork and Dwingeloo/JIVE was achieved on 16th Oct. With very little adjustment, data were transferred from Westerbork to JIVE at more than 300Mb/s using disk2net and net2disk. UPD memory to memory tests once again achieved rates between 700 and 800Mbit/s. Direct transfer of data using in2net was also performed for the first time (in Europe). A rate of 256Mb/s was easily achieved but 512Mbit/s crashed almost immediately.
During L-band Network Monitoring Experiment (N03L3, 1.6 GHz, 7th November) one scan of Westerbork data were sent directly, via the Wb-JIVE optical-fibre, to a JIVE Mark5 and recorded on disk. A week later the Westerbork disk was correlated with Effelsberg data, producing normal fringes in all sub-bands.

Mid-November the first engineering test of real-time eVLBI was performed. During disk-disk correlation of Wb and Jb data, one of the JIVE Mk5s was re-configured to pass data received from the network directly to the correlator. Jodrell Bank sent data to this unit, producing solid orange leds on the SU and incrementing TOT on the SU console. From this test we can conclude that, at 64Mb/s, in2net2out works and data streaming across the network are re-constructed correctly, to be fed directly into the data processor. Further engineering work is needed to synchronise the correlator to UT before genuine, real-time eVLBI will be possible.
Later in November fringes between Westerbork and Jodrell Bank were detected, just 15min after the observation was completed. The 15min scan was streamed directly to Mk5 disk units at JIVE, bypassing the local disks completely. Further details and a fringe plot can be found at: http://www.evlbi.org/eVLBI/tevlb7/tevlb7.html. The data rate was 64Mb/s per station, limited by the link to Jodrell.

Laboratory research and development continued at JIVE in December. Further parameter tuning increased the disk2net2disk data rate to >550Mb/s, in agreement with the highest rates achieved by Haystack. Mark5 *2net and net2* processes were adjusted to use UDP but, surprisingly, this was slower than TCP. Two new Intel Xeon Serverboards were purchased to explore the apparent MK5 hardware limitations. These are currently being installed in two of the Mk5 units at JIVE.

Conclusions

Two hard limits of the Mark5 for eVLBI have been evaluated. Transfers of data from and/or to disk over a network are limited to a maximum of ~550Mb/s. When no disk access is involved rates of ~700Mb/s can be sustained. These results are obtained on an isolated

link, away from the effect of competing traffic. In a shared network, TCP data rates are further reduced but the UDP maximum remains about the same. Understanding of parameter tuning has improved since the last cross-network test, so further tests are now needed to establish a new benchmark. In the last weeks of December, Onsala announced that their connection was ready, providing the ideal test-bed for such investigations. The project runs for a further 12 months only. A meeting of PoC participants is scheduled for 28th January at Schiphol. More direct telescope links are expected in the next three-six months to maintain progress.

Forward Planning

Goals for the next three months include:

- Tests involving Onsala Gb/s link shake-down
- Understanding and removal of Mk5 data rate limitations
- Development of UDP for higher data rates
- Achieve higher data rate between Bologna and JIVE using UDP
- Production of first 3-telescope astronomical image

Next six months

- Further tests between Wb, On & Jb when links speed improves
- More NREN PoP
- JIVE tests to push larger data volumes across the European networks
- Development and trial of Real-Time correlation at JIVE

2nd Half 2004

- Real-time eVLBI using all available stations
- Attempt to use real-time system for scientific studies
- Project review and report: Recommendations for future of eVLBI

Breaking News:

The first European eVLBI image has been produced from data transferred to JIVE only 24 hours earlier. At 1400 UT on Thursday, 15th January, Onsala, Cambridge (via Jodrell Bank) and Westerbork observed together and transferred data directly to JIVE at up to 256Mb/s. Further details, fringe plot, map and other pictures can be seen at: http://www.evlbi.org/evlbi/tevlb8/tevlb8.html

Figure 1. First eVLBI fringes from Onsala

Steve Parsley (parsley@jive.nl)

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

10. Bonn-Dwingeloo Neighbourhood Meeting on *High-Resolution Radio Astronomy*, November 2003

Over the last 6 years it has become a tradition to bring together for a one-day meeting radio astronomers based in Bonn and Dwingeloo who are working primarily, but not exclusively, in the VLBI technique. These meetings are known as “neighbourhood” meetings since the baseline between Bonn in Dwingeloo is indeed one of the shortest in EVN. The meetings take place once a year and are hosted in turn by Bonn and Dwingeloo groups. The Bonn contingent consists of staff members and students from MPIfR and University of Bonn, while the Dwingeloo team includes astronomers from JIVE, ASTRON as well as students and researchers from several Dutch universities.

The latest of these meetings was held in Dwingeloo on 5 November 2003. The scientific part of the event included 19 presentations (an original intention of having 10 presentations from each group unfortunately did not materialize due to last minute force-majeure cancellation of one talk). The programme covered a broad range of topics. They included “traditional” VLBI themes such as studies of parsec-scale continuum radio emission from AGN of different kinds (I.Agudo, C.Reynolds, U.Bach, Bong Won Sohn), including two cases of gravitationally lensed objects (A.Biggs, R.Mittal), atomic, molecular and maser absorption in AGN (R.Morganti, Y.Hagiwara, H.J. van Langevelde), as well as applications of these measurements for cosmological tests within the Local Group and throughout the most distant radio quasars (A.Brunthaler, L.Gurvits). IDV sources, the champions of brightness temperature among extragalactic objects, featured as targets of studies with ultimate angular resolution using VSOP (S.Friedrichs) and “scintillation interferometry” (H.Bignall). It is fair to say that all these presentations, in one or another way, were based on observations which were pushing the envelope defined by technical characteristics of present-day VLBI instrumentation. Not surprisingly, state-of-the-art technical developments and less traditional applications of VLBI and aperture synthesis technique were quite prominent in the programme too. They covered both ends of the radio domain - low frequencies (LOFAR, J.Noordam, and LOPES, T.Huege) and short wavelengths (A.Roy and

E.Middelberg). S.Pogrebenko demonstrated how modern VLBI can help to locate a spacecraft 8 AU away with sub-km accuracy. The programme was concluded by a preview of the coming age of real-time VLBI or "eVLBI" (A.Szomoru).

At the end of the scientific part of the meeting, the Bonn tribe presented to the host tribe a generous gift: a Mark-5 system which was to be installed at the EVN Data Processor at JIVE (and is already operational by the time of this writing).

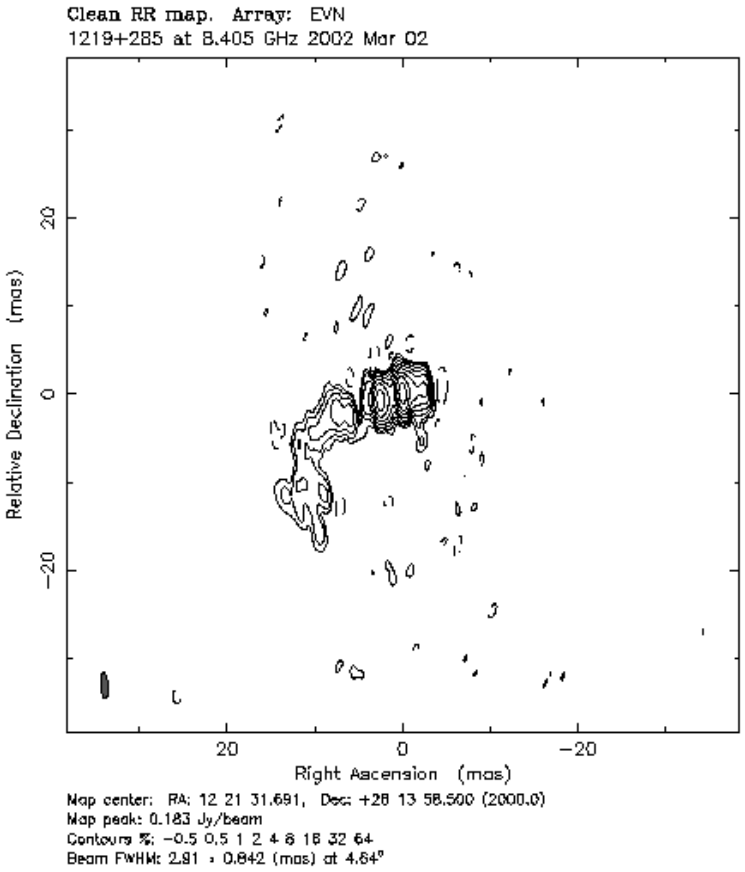
The day was crowned by the traditional friendly football match Bonn-Dwingeloo (NB for our readers on the other side of Atlantic: it's soccer). The host team won 2:0. Some people said that the result should be attributed to the weather, which, as typical for November in Drenthe, was calm and absolutely cloudless, while the Bonn team was training for heavy rain conditions. The latter was obvious from the presentation by A.Roy on tropospheric phase correction with water vapour radiometry: he demonstrated a very impressive movie of so convincing water absorption over Effelsberg that even the screen of the colloquium room in Dwingeloo was covered with rain droplets…

The programme of the meeting and several dozen pictures of all phases of the event are available at www.jive.nl/institute/bonn-dw2003.

Leonid Gurvits (JIVE, lgurvits@jive.nl)

11. EVN potential at X-band: results from observations of ON231

ON231 (B1219+65) is a BL Lac object characterized by long term optical trend. Previous 1.6 GHz and 5.0 GHz EVN observations showed new interesting features in the source structure when compared with images from literature: a component in the opposite side of the jet, and a long extension in the jet with a bow shape (Massaro et al. 2001). These finding, correlated with the time evolution of the optical luminosity, can be interpreted as produced either by a jet slowly precessing approaching the line of sight or by strong interaction with the surrounding medium. In particular, the detected extension of the jet in the western direction (a counter-jet?) may have been confirmed obtaining a spectral index distribution along the source structure. To this aim ON231 has been observed in a follow-up project with the EVN at X-band. The geodetic stations of Wettzell and Matera have joined the EVN in the observations scheduled by March 02, 2002. Nine in total were the stations able to observe at 8.4 GHz. The data were correlated at JIVE and analysed at the Istituto di Radioastronomia, Bologna. The image, obtained using DIFMAP, is shown in the Figure. The structure of the source is very similar to that previously obtained at 5 GHz. A preliminary analysis suggests that the brightest component, which shows a flat spectum, probably is the core of the source. The extension to the West of the core on the other hand, shows a steep spectral index, supporting the interpretation that it may be a counter-jet. These observations show the potential of the EVN plus geodetic stations at 8.4 GHz. The schedule was made using SCHED after the implementation of an ad-hoc setup written following the suggestion by D. Graham in order to avoid changes in the patch panel at geodetic stations. A standard setup was later implemented by C. Reynolds in the SCHED cataloque to allow astronomical observations at X-band with the EVN plus geodetic stations.



Enrico Massaro, Dept. of Physics, Universita' la Sapienza, Rome (massaro@astro1.phys.uniroma1.it)

Franco Mantovani, Istituto di Radioastronomia, Bologna (fmantovani@ira.cnr.ir)

12. New positions at JIVE

THE JOINT INSTITUTE FOR VLBI IN EUROPE (JIVE) is seeking candidates for

1) a fixed-term appointment as a POST-DOCTORAL RESEARCH ASSISTANT in data processing techniques to be located at JIVE, Dwingeloo (The Netherlands) and becoming available in March 2004. The appointee is expected to develop and test algorithms that enhance the data product from the correlator. These could include:

- A-priori phase and amplitude calibration, including phase cal detection
- Ionospheric calibration based on GPS measurements and models.
- Wide field imaging, including cross and self-calibration

The post-doc will work on the RadioNet project which has received research funding from the
European Community's Sixth Framework Programme. He or she can spend up to 25% of his/her time on scientific research

2) a fixed-term appointment as a **SOFTWARE ENGINEER** to be located at JIVE, Dwingeloo, The Netherlands.
Responsibilities of the position include enhancement of the data product by making

calibration data available, and re-processing the data based on user requests. The successful applicant is expected to work in an environment of high performance computing and understand the requirements for accessing large data volumes.

The full description of these positions can be found at http://www.jive.nl/institute/jobs.

Deadline for applications: March 15 2004. Further information can be obtained from Dr. Huib van Langevelde (langevelde@jive.nl, +31-521-596515).

13. ANGLES: PhD positions

PhD studentships in Gravitational lensing, Galaxy formation, Galaxy dynamics, optical instrumentation. Several PhD studentships will be available starting from Aug. 1, 2004. They are funded by an European Union Research Training Network called **ANGLES** (**A**strophysics **N**etwork for **G**alaxy **LE**nsing **S**tudies, co-ordinated by Dr. I. Browne of Jodrell Bank Observatory) and are open to competition from all nationalities.

The ANGLES partners are:

Jodrell Bank Observatory,	PI; Ian Browne
MPIfR Bonn/University of Bonn,	PI; Richard Porcas
University of Cambridge,	PI; Wyn Evans
University of Copenhagen,	PI; Jens Hjorth
University of California Davis,	PI; Chris Fassnacht
JIVE/ASTRON/University of Groningen,	PI; Mike Garrett
University of Potsdam/AIP,	PI; Joachim Wambsganss
University of Shanghai,	PI; Yi-Peng Jing
University of Valencia/IAC,	PI; Jose Munoz

Two studentships will be at Jodrell Bank Observatory and one each at Groningen/Dwingeloo, Bonn, Potsdam, Copenhagen and Valencia/IAC. Research topics include; gravitational lensing, galaxy formation and dynamics, optical instrumentation. More details can be found on the ANGLES web site (http://www.jive.nl/angles/).

Ian Browne (iwb@jb.man.ac.uk)

14. Summer Students Programme in Dwingeloo

As every year, a limited number of grants is available to enable astronomy students (graduate or advance undergraduate) to spend the summer (10 to 12 weeks) in Dwingeloo conducting astronomical research under the supervision of ASTRON or JIVE staff members.

More information can be found at www.astron.nl/wsrt/summer.html. The deadline for application for the Summer Student Programme is the 15th of february.

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