European VLBI Network Newsletter
Number 24
October 2009

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1. Message from the EVN Chairman

This is the first issue of the EVN Newsletter edited in Torun, Poland. Magdalena Kunert-Bajraszewska (TCfA) has agreed to become Secretary of the CBD and naturally the Newsletter Editor for next two years. During this period the newsletter will continue to be published prior to each VLBI proposal deadline with the aim on (i) informing astronomers interested in VLBI about the current capabilities of the EVN array, (ii) bringing EVN users up to date with recent and planned enhancements, and (iii) underlining the excellent scientific results being obtained with VLBI technology. All EVN users are encouraged to communicate their recent scientific results to Magda (magda@astro.uni.torun.pl) making her work easier and the publication more interesting.

The EVN Board of Directors will meet at Manchester in November 11-12. We all look forward to a friendly and constructive meeting, as it is usually for the group. At the meeting, in addition to discussion about the policy, operations, and technical developments of the array, we plan to sign the updated version of EVN Memorandum of Agreement and further review with our colleagues from Latvia and Ukraine possible ways to join EVN membership. The new members and new telescopes coming into operation will strengthen EVN power as the world leading high sensitivity, high resolution radio astronomy infrastructure on the Northern Hemisphere.

After two years (2007-2009) of serving the EVN community by Prof. Rafael Bachiller the Chairman of the Consortium Board of Directors I am very pleased to thank him for the excellent work, which he has done for the Network expansion and its successful operation.

Personally also I would like to thank him for the support and encouragement given to me before I succeed as new Chairman of the CBD.

The EVN Consortium Board of Directors approved me as new Chairman of the CBD in May 2009 at the Onsala Meeting till May 2011. Prof. Simon Garrington (JBO) has kindly agreed to continue as Vice-Chairman for the same period. I have been on the Board from 1991 representing Torun Radio Astronomy Observatory and from 2001 the Torun Centre for Astronomy. I have been involved into VLBI since 1979 and together with Torun Team joined EVN and Global Network observations from 1982. The new 32m antenna commissioned in 1994 entered the Network two years later. Torun with modern design telescope and reliable instrumentation has become an important element of e-EVN and a valuable addition to W-E baselines, the milestone on connections to Russia and China. During my directorship at Torun the Centre for Astronomy we established Torun position as a reliable, robust partner of the EVN. Current progress on instrumentation, which includes a plan to build a large diameter dish, should further enforce scientific and technical capabilities of Torun. The major strategic direction is the EVN expansion towards broad band - high sensitivity, real time, frequency agility, and extremely high angular resolution world leading instrument. The enhancement of existing and development of new generation correlator for JIVE and the ultra fast fibre-optical links to all network telescopes are the worth effort activities. The current capabilities of EVN in terms of sensitivity, frequency coverage and spectral resolution, wide-field mapping, and rapid-response have allowed European radio astronomers to produce significant advances in many areas of modern astronomy. Adding new European telescopes and those in Russia, China, Ukraine and Latvia would guide the EVN towards unique future high angular resolution Northern Array scientifically competitive to the SKA. The EVN is in fact the SKA path finder and the major drive in technology area, so important and vital for new generation instruments. FP7 RadioNet EC program coordinates and shares results of this development and leads the European Radio Astronomy along the European road map strategy. The EVN will remain for next decade the major radio astronomy facility in the world around which the new ideas will continue to emerge.

Very impressive and politically important contributions from EVN to enlighten the inauguration of IYoA and other international, relevant activities, have been of great success. It is the time to congratulate all being involved and to wish more spectacular events, which so well promote world class research conducted under exceptionally effective and profitable international co-operation scheme of the VLBI.

Andrzej Kus, Chairman of the EVN Board of Directors.

2. Call for EVN Proposals - Deadline October 1st 2009

ALL EVN, GLOBAL, and e-VLBI PROPOSALS must now be submitted

with the ONLINE PROPOSAL SUBMISSION tool Northstar.

Email submission is no longer accepted

Detailed Call for Proposals

(This text is also available on the web at http://www.ira.inaf.it/evn_doc/call.txt)

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 observations may be conducted with disk recording (standard EVN) or in real-time (e-VLBI).

The EVN is open to all astronomers. **Use of the Network by astronomers not specialized 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.

Standard EVN Observing Sessions in 2010 (disk recording)

2010 Session 1	Mar 4 - Mar 25	18/21cm, 6cm, 5cm, 30cm
2010 Session 2	May 27 - Jun 17	18/21cm, 6cm, 5cm, ...

Proposals received by 1 October 2009 will be considered for scheduling in Session 1, 2010 or later. Finalisation of the planned observing wavelengths will depend on proposal pressure. Note the possible availability of 30cm observing in Session 1, 2010.

e-VLBI Observing Sessions in 2009 - 2010(real-time)

2009 Dec 10 - Dec 11 (start at 13 UTC)	18/21cm, 6cm, 5cm, 1.3cm
2010 Jan 27 - Jan 28 (start at 13 UTC)	18/21cm, 6cm, 5cm, 1.3cm
2010 Feb 10 - Feb 11 (start at 13 UTC)	18/21cm, 6cm, 5cm, 1.3cm
2010 Mar 30 - Mar 31 (start at 13 UTC)	18/21cm, 6cm, 5cm, 1.3cm
2010 Apr 22 - Apr 23 (start at 13 UTC)	18/21cm, 6cm, 5cm, 1.3cm
2010 May 18 - May 19 (start at 13 UTC)	18/21cm, 6cm, 5cm, 1.3cm

Please consult the e-EVN web page at http://www.evlbi.org/evlbi/e-vlbi_status.html to check for any updates and for the available array.

Note that only one wavelength will be run in each session, depending on proposal priorities.

There are three e-VLBI observation classes: general e-VLBI proposals; triggered e-VLBI proposals; short observations. General and triggered e-VLBI proposals must be submitted by the October 1st deadline to be considered for scheduling in the above e-VLBI sessions starting from December 2009.

Requests for short observations (up to two hours) may be submitted up to three weeks prior to any e-VLBI session.

Continuum and spectral line observations can be carried out.

See http://www.ira.inaf.it/evn_doc/guidelines.html for details concerning the e-VLBI observation classes and the observing modes.

Features for the next regular EVN and e-VLBI sessions

Please consult http://www.evlbi.org/evlbi/e-vlbi_status.html for the current e-VLBI array and for the availability of different eVLBI stations per observing band and for the dates of the e-VLBI observing sessions.

MERLIN is normally available for joint EVN+MERLIN observations in all standard sessions, for any EVN wavelengths which MERLIN supports (18/21cm, 6/5cm, 1.3cm). However, due to the e-MERLIN construction only an incomplete MERLIN array will be available in early 2010 due to limited resources. For updated information please consult the web at http://www.merlin.ac.uk/evn+merlin.html

Large EVN 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

All EVN, Global and e-VLBI proposals (except ToO proposals) must be submitted using the on-line proposal submission tool Northstar. Global proposals will be forwarded to NRAO automatically and do not need to be submitted to NRAO separately.

To use Northstar, people should register (at http://proposal.jive.nl, only for the first proposal submission), enter the information about the investigators and the technical specifications of the proposed observations (equivalent to that previously in the coversheet) using the on-line forms, and upload a scientific justification in pdf or ps format. The scientific justification MUST BE LIMITED to 2 pages in length. Up to 2 additional pages with diagrams may be included. The deadline for submission is 23:59:59 UTC on 1 October 2009.

Additional information

Further information on Global VLBI, EVN+MERLIN and e-VLBI observations, and guidelines for proposal submission are available at: http://www.ira.inaf.it/evn_doc/guidelines.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 current antenna capabilities can be found in the status tables. For the standard EVN see http://www.evlbi.org/user_guide/EVNstatus.txt. For the e-VLBI array see http://www.evlbi.org/evlbi/e-vlbi_status.html

The On-line VLBI catalogue (http://db.ira.inaf.it/evn/) lists sources observed by the EVN and Global VLBI.

Tiziana Venturi - Chairperson of the EVN Program Committee

3. EVN Scientific Highlights

6.7 GHz methanol masers probing the magnetic field during high-mass protostellar-phase

The magnetic field likely plays a crucial role during the formation of low-mass stars, in particular in halting the collapse of the parent molecular cloud, transferring angular momentum and powering the outflows. However, its role during the formation of high-mass stars is still heavily debated. In particular, it is unclear how the magnetic field influence the formation and dynamic of disks and outflows. The best probes of the magnetic field at the smallest scales in the high-mass star-forming environment are maser sources. Their bright and narrow spectral line emission is ideal for detecting the Zeeman-splitting and weak linear polarization. Although 6.7GHz methanol masers are the most abundant of the massive star-forming maser species, the first high resolution methanol maser observations in full polarization with the EVN were made by us only very recently.

In our successful pilot observations, towards the massive star-forming region W75N, we detected fractional linear polarization (1-5%) in 8 of the 10 methanol maser features (the residual polarization leakage after calibration was much less than 1%) revealing a tightly ordered magnetic field over more than 2000 AU around the radio source VLA 1 and almost perfectly aligned with the large-scale molecular bipolar outflow (Fig.1). The linear polarization further indicates that the field is close to the plane of the sky at an angle of about 70 degrees from the line of sight. We also detected the 6.7GHz methanol maser Zeeman-splitting in 3 maser features (B|| is about 15 mG) indicating a total magnetic field of the order of 50mG. These important first EVN results have shown that the linear polarization observation at high angular resolution can reveal the 3D magnetic field morphology and consequently, with the measured Zeeman-splitting, give the total magnetic field strength.

This work is available at http://arxiv.org/abs/0908.3585 http://arxiv.org/abs/0908.3585 and it will be published in a forthcoming A&A paper.

Authors: Gabriele Surcis (AIfA Bonn & MPIfR), Wouter H.T. Vlemmings (AIfA Bonn), Richard Dodson (ICRAR), and Huib van Langevelde (JIVE & Sterrewacht Leiden)

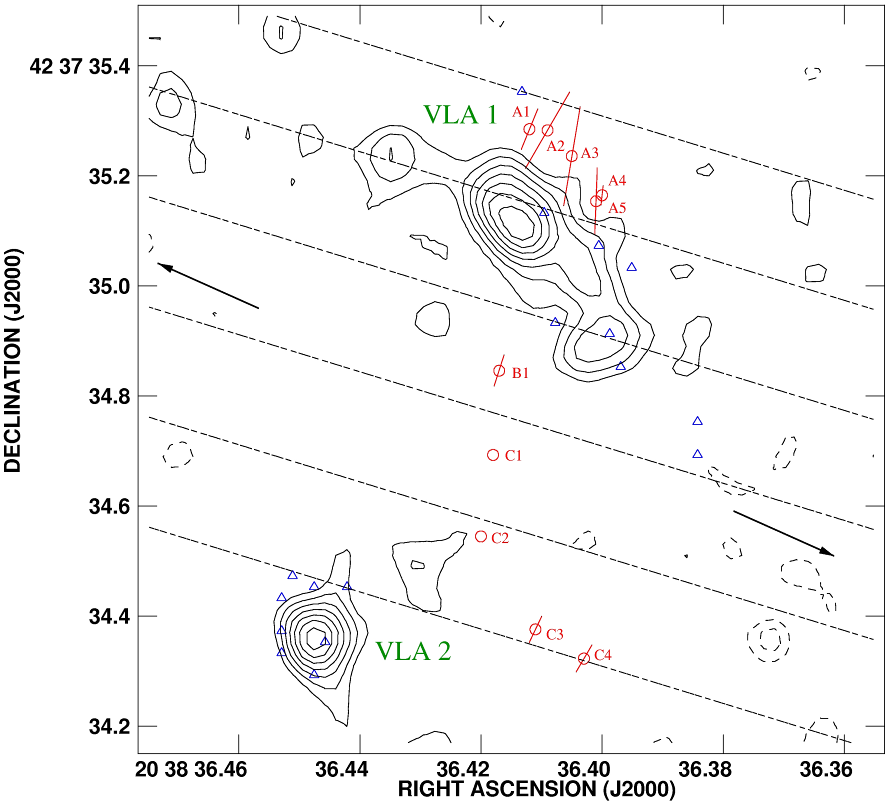


Fig.1: *Positions of methanol (red circles) and water (blue triangles) masers superimposed on 1.3cm continuum contour map of the VLA 1 thermal jet and VLA 2 (Torrelles et al., 1997, ApJ, 489, 744). The red segments indicate the methanol masers linear polarization vectors (40mas correspond to a linear polarization fraction of 1%). The two arrows indicate the direction of the bipolar outflow (66d) and the parallel dashed lines the magnetic field lines (73d +/- 10d) as derived from the linear polarization.*

An AGN in the heart of a suspected "dark lens" galaxy

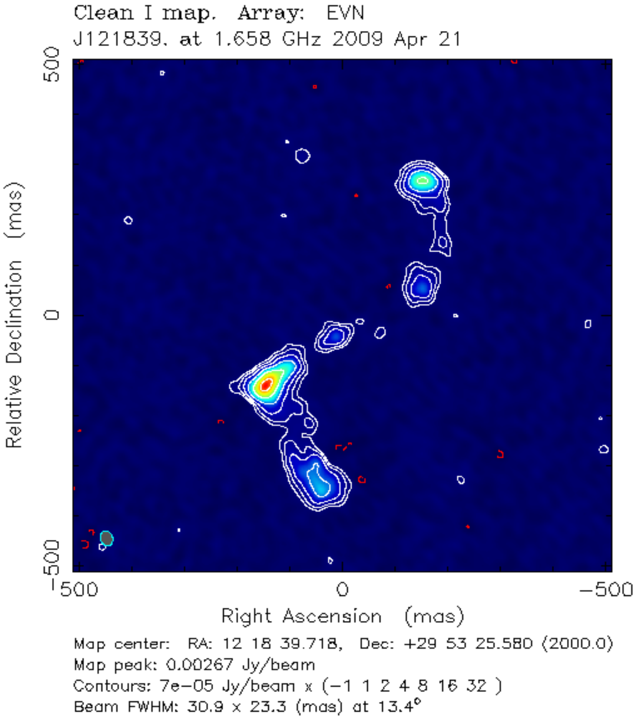
Recently Ryan et al. (2008, ApJ 688, 43) found and optical arc which looks like a gravitationally lensed image of a galaxy. However, the foreground lensing object apparently needed for producing such an arc is not seen in the deep optical and infrared images. The high mass-to-light ratio implied by the non-detection would further imply that the total mass of this galaxy (about $10^{12.5}$ solar mass derived from lens modelling) is primarily in the form of dark matter. As such, this could be the first known example of a "dark lens"; alternatively, and perhaps less exotically, the lens could be an unusually obscured galaxy. The only definite information we knew about the suspected lens is that there is a radio source (J1218+2953) consistent with its presumed position about 4" away from the optical arc. Its integrated flux density is 33.9 mJy at 1.4 GHz, according to the VLA FIRST survey. The radio spectrum of the source is steep, with a spectral index of -0.7.

On 12 November 2008, we applied for short 2-hour e-EVN observations at 1.6 GHz to check whether there is compact radio emission in the source, which would indicate an active nucleus in the lensing galaxy. We indeed detected the souce on 23 January 2009. It was resolved into two components separated by about 0.5". This result was not easy to interpret so we proposed full-track e-EVN observations at both 1.6 and 5 GHz at the 1 February 2009 deadline. The speed of this follow-up was possible only because of the rapid access to the correlated data afforded by the original short e-EVN observations. The full-track, phase-reference e-EVN observations of J1218+2953 took place on 24 March 2009 (5 GHz) and on 21 April 2009 (1.6 GHz), both lasting 8 hours. At the lower frequency, our tapered image reveals a rich and complex structure in a nearly symmetrical "inverted S" shape, spanning almost 0.7". Were the two "arms" visible in the tapered L-band map both gravitationally lensed images of the same background source as are the optical arc, then the lensing should produce flux-density ratios between the inner/outer components roughly similar in each arm. The map is not consistent with this interpretation. The source appears unresolved with the Westerbork synthesis array, whose data were recorded during its participation in the e-EVN observations. This allowed us to compare the total flux density with the correlated VLBI flux density. These values were close enough to exclude the possibility that the optical arc is sufficiently strong in the radio. Therefore both the arc and the radio source J1218+2953 cannot be gravitationaly lensed images of the same background object.

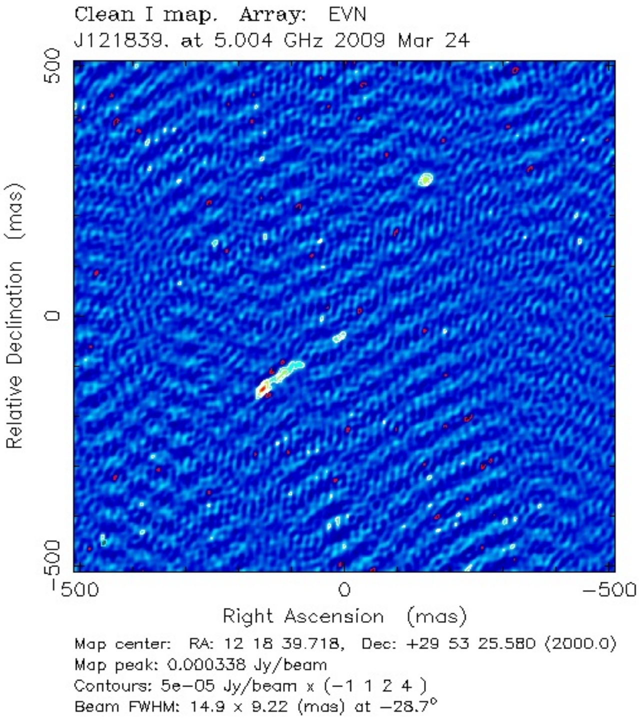
The observed radio structure may rather reside within a host galaxy providing the lensing potential to form the optical arc. Although the redshift of the optically unidentified source is not known, the corresponding projected linear size could be up to 5-6 kpc for a redshift range of ~0.8-1.5. The two brightest components are also seen in the 5-GHz image. A weak, relatively flat-spectrum feature seems to lie in between these two, which might mark the center of this galaxy. We believe that J1218+2953 is a young, recently triggered and heavily obscured AGN. It grows in a dense interstellar medium which might cause the observed two-sided bent radio jet structure. This makes the "dark lens" interpretation unlikely.

More details on the observations of this interesting object will be published soon, first in the proceedings of the 8th International e-VLBI Workshop, EXPReS09, held in Madrid this June.

Authors: S. Frey (FOMI SGO), Z. Paragi, B. Campbell (JIVE), A. Moor (Konkoly Obs.)



Caption: *The naturally weighted 1.6-GHz e-EVN mage of J1218+2953. A Gaussian taper was applied (with half amplitude at 10 Mlambda) to reduce the relative weight of the longest baselines (European antennas to Arecibo), to map the more extended emission.*



Caption: *The naturally weighted 5-GHz e-EVN image.*

Is cold gas fuelling the radio galaxy NGC315?

We have studied the properties of the HI in the radio galaxy NGC 315. Two HI absorption components are present, a broad one (FWZI ~150 km s^{-1}) redshifted (~80 km s^{-1}) with respect to the systemic velocity, and a very narrow component (FWZI ~8 km s^{-1}). Both are detected and spatially resolved by the global VLBI observations and, interestingly, the two absorption components have very different properties, suggesting that they have very distinct origins.

The broad absorption shows a strong gradient in column density (or spin temperature) along the jet, with the highest densities (or lowest spin temperatures) furthest away from the AGN. It also shows a strong velocity gradient (more than 100 km s^{-1} over 10 pc) with the more redshifted velocities away from the AGN. These properties suggest that the gas producing the absorption is physically close to the AGN. The redshifted velocities argue against the gas being entrained by the radio jet (and partly responsible of the deceleration of the jet). Gas located in a thick circum-nuclear toroidal structure, with orientation similar to the dusty, circumnuclear disk observed with HST, cannot be completely ruled out although it appears difficult to reconcile with the observed morphology of the absorption and it would require inward streaming motion in addition to rotation. The scenario we favour, is that the gas producing the broad absorption could be (directly or indirectly) connected with the fuelling of the AGN, i.e. gas that is falling into the nucleus. If this is the case, the accretion rate derived is similar to that found for other X-ray luminous elliptical galaxies, although lower than that derived from the radio core luminosity for NGC 315. On the other hand, the properties of the narrow absorption are very uniform. Moreover, it tightly connects, in space and in velocity, with the H i emission in NGC 315 we detected a few kpc SW of the nucleus. Most likely, the narrow absorption cloud is quite far from the AGN and is likely due to material falling into NGC 315. Five nearby, small gas-rich companions are also detected in H i. This implies that the environment of NGC 315 is quite gas rich and that accretion of gas from the environment is quite likely.[astroph/0908.3951]

Authors: R.Morganti(1,2), A.B.Peck (3,4), T.A.Oosterloo (1,2), G.vanMoorsel (4), A.Capetti (5), R.Fanti (6,7) ,P.Parma (6) and H.R.deRuiter (6,8)

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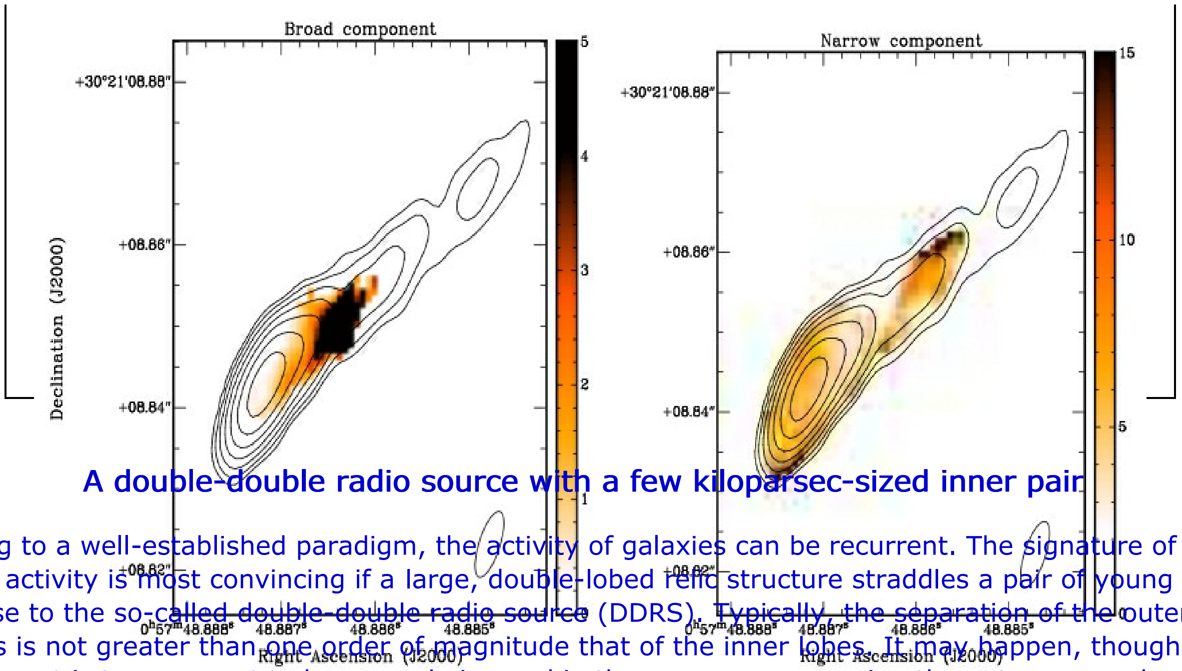


Caption: *Continuum (contours) and column density (grayscale) of the broad (left) and narrow (right) H i absorption as derived from the VLBI observations. The intensity scales given on the right side of each panel are in units of 1020 cm^{-2}. The contours of the continuum are 2, 4, 8, 16, ... mJy beam^{-1}.*

A double-double radio source with a few kiloparsec-sized inner pair

According to a well-established paradigm, the activity of galaxies can be recurrent. The signature of a renewed activity is most convincing if a large, double-lobed relic structure straddles a pair of young lobes giving rise to the so-called double-double radio source (DDRS). Typically, the separation of the outer lobes in DDRSs is not greater than one order of magnitude that of the inner lobes. It may happen, though, that the inner part is too compact to be properly imaged in the maps encompassing the outer one and so, as a whole, the source does not appear as a DDRS but as a core-dominated triple (CDT), where the alleged core is actually a compact, luminous double source. Of course, not every CDT will turn out to be a DDRS when its core is magnified, but B0818+214 was a likely candidate for a DDRS. Fig. 1 shows its overall structure as seen in FIRST.

To reveal the nature of the "core" of B0818+214, we launched an 18-cm observation using the EVN combined with MERLIN. 14 antennae, including the largest two: Lovell and Effelsberg, took part in the project (EM063). Four hours of observing with 41 baselines produced a very good, uniform u-v coverage and good sensitivity: the noise in the resulting image was ~40 microJy/beam. The resulting image is shown in Fig. 2. The "core" of B0818+214 is actually a double, well aligned with the outer double seen in the FIRST image. Can B0818+214 be labelled a DDRS then?

To answer this question we measured the flux densities of all components in the most recent EVN+MERLIN L-band image and an earlier MERLIN-only C-band image, and calculated the spectral indices. They make it clear that the southeastern feature of the inner structure is an FRII lobe. The morphology and steep spectrum of the northwestern region leaves no doubt that it is a lobe as well. All in all, the inner double is a mini-FRII and B0818+214 as a whole, indeed, fulfills the criteria of a DDRS. However, given that the linear size of the inner pair is less than 5.7 kpc, the inner-to-outer size ratio amounts to only 1:100 - an order of magnitude less than in standard DDRSs.

There is yet another characteristic that makes B0818+214 a special object. The majority of well-known DDRSs, apart from two pairs of lobes, have a core. We have found no core in B0818+214. This could mean that the energy transport from the core has ceased. The assumption that the double radio source in the centre of B0818+214 is in the coasting phase leads to the conclusion that the behaviour of the active nucleus in B0818+214 fits two different evolutionary tracks. On the one hand, its outer lobes resulted from a long phase of activity interrupted due to e.g. ionisation instability operating on longer timescales. On the other hand, in the most recent activity cycle, the central source is intermittent due to radiation-pressure instability operating on much shorter timescales. Hence, it appears that two accretion disk instability mechanisms, ionisation and radiation-pressure driven, could be at work in the same radio galaxy.

Authors: A. Marecki & M. Szablewski (TCfA), A&A in press, arXiv:0909.3741

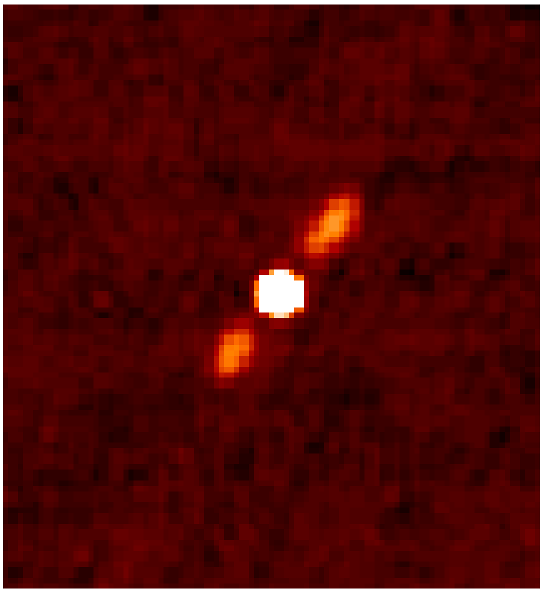


Fig.1: *In the FIRST image, B0818+214 appears as a core-dominated triple. But what is the true nature of that bright "core"?*

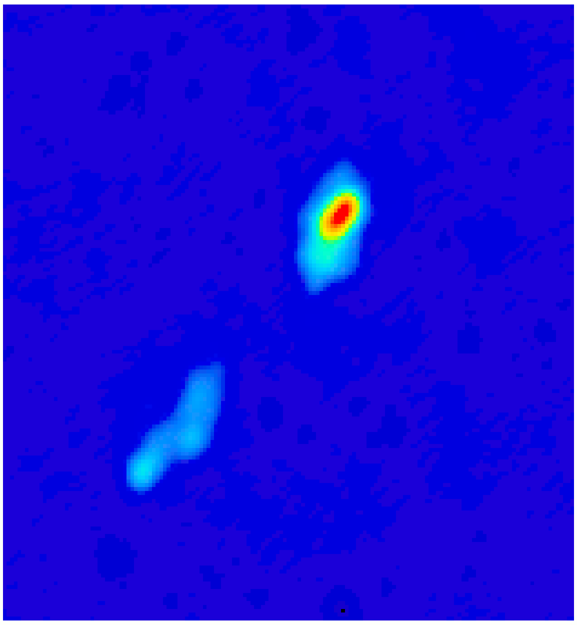


Fig.2: *EVN+MERLIN L-band image of the central component of B0818+214. It turns out to be an FRII-like double, a hundred times more compact than the whole radio source.*

Science and Technology of Long Baseline Real-Time Interferometry:

The 8th International e-VLBI Workshop.

Madrid (Spain), June 22nd - 26th 2009.

In recent years real-time, long-baseline, radio interferometry over optical networks has developed from a technical possibility to a mature technique. Scientifically, real-time operation is more important for long baselines, with their high spatial resolution, than for short baselines. However, until recently the required technology has not been readily available. Technical advances and the explosive increase of connection capacity have now radically changed the situation. Emerging radio interferometers (e-MERLIN, E-LOFAR, e-EVN and other e-VLBI arrays) do and will exploit mixed private/shared networks to achieve wide-bandwidth real-time operation. Mirroring developments in other wavebands of astronomy, these new real-time radio instruments are being optimized to study transient phenomena. Moving data transport to fiber also gives the prospect of rapidly expanding observing bandwidth and sensitivity as network capacity continues to increase. Technically and operationally today's e-VLBI instruments serve as precursors to the real-time Square Kilometer Array. People working on the science and technology of real-time, long-baseline radio interferometry met together in Madrid and Yebes (Spain) to discuss the state-of-the-art and future prospects.

Specific areas covered included:

- **Scientific**: Applications of real-time operation to astronomy, geodesy and other fields. Coordination of emerging e-VLBI arrays for best scientific return. Connections to transient monitoring in other wavebands.
- **Technical**: e-VLBI test experiments, use of new long distance links, development in techniques including selective packet dropping and novel protocols, the search for higher bandwidths, network status and monitoring, distributed processing, and future developments.
- **Scientific/Technical**: Technical possibilities of interest in planning future instruments. Desired technical requirements to fulfill scientific goals, science priorities for development.

The National Geographical Institute (IGN) of Spain, in cooperation with the EXPReS project, hosted the conference at the premises of the National Astronomical Observatory in Madrid (Spain). One full day was spent at the Center for Technological Development in Yebes.

Participants had a chance to visit the historic site in Madrid, plus the 40-m radiotelescope and all laboratories (in particular the LNA's one) in Yebes.

Because many experts were present, discussion panels on future organisation/multiwavelngth coordination to maximize science impact of e-VLBI, network issues, and VDIF specifications, were organized.

A meeting of the Internet (academic) national providers (NREN) took place on Thursday, as part of the workshop regular agenda. Chaired by the DANTE representative, John Chevers, issues on coordination of the European GEANT high capacity data transport infrastructures with the NRENs, who provide connectivity to the VLBI radiotelescopes, were discussed, as well as links to non-european partners such as Australia, of great impact to the scientific return of the e-VLBI network.

A meeting of the EVN Program Committee was held in parallel to the conference, on June 24th 2009.

The proceedings of the EXPReS09 conference will be published soon in "Proceedings of Science" (PoS; http://pos.sissa.it/).

Authors: Francisco Colomer (OAN-IGN, Spain), Laura Barbas (OAN-IGN, Spain), Jean-Fran�ois Desmurs (OAN-IGN, Spain), Yvonne Kool (JIVE), Rebeca Soria (OAN-IGN, Spain), Charles Yun (JIVE, EXPReS09 conference LOC)

4. EVN Technical Development and Operations

Next generation EVN correlator

The next generation EVN correlator will have to be at least a factor of 100 more powerful than the current MarkIV correlator. The new ALMA, EVLA, E-MERLIN and KVN correlators are all based on more modern versions of the MarkIV concept, using mainly custom-made chips (ASICs). Because of the very long development times and the high cost of such systems, alternatives are actively being investigated.

Of late, software correlators have seen a lot of attention, and several institutes have, or are planning to, purchase compute clusters for this purpose. In spite of the obvious advantages such as flexibility and ease of installation and maintenance, it is not clear that a software correlator will actually scale to the size of future instruments such as the e-EVN and other SKA pathfinders. In terms of power consumption, cooling and processing power versus physical volume Field Programmable Gate Arrays (FPGAs) perform far better.

In 2009 two projects aimed at developing an FPGA-based next-generation EVN correlator, both led by JIVE, kicked off. The first, UniBoard, is a Joint Research Activity within the RadioNet FP7 project. This JRA, with 7 partners in 5 countries (JIVE, ASTRON, Universities of Manchester, Orleans and Bordeaux, Arcetri and KASI) and a total budget of nearly 2 Meuro, will develop a generic high-performance FPGA-based computing platform, with a number of different personalities. These are an EVN correlator, an Apertif correlator plus beamformer, a digital receiver and a pulsar binning machine.

The project started on the first of January 2009. Hardware development, lead by ASTRON, is right on track, and the first prototype board is expected by the end of this year/beginning of next. The firmware development for the different applications is ramping up, and work has started on a generic software interface and a correlator control system.

In parallel to this effort, JIVE and ASTRON have obtained an NWO (Netherlands Science Foundation) grant for a project called ExBox. This project will create an EVN/Apertif correlator system by combining several FPGA-based correlator boards via a backplane, where the intention of course is to use the UniBoard as a building block for this system. Both projects are well underway and making good progress.

Arpad Szomoru (JIVE)

Metsähovi Summer Update

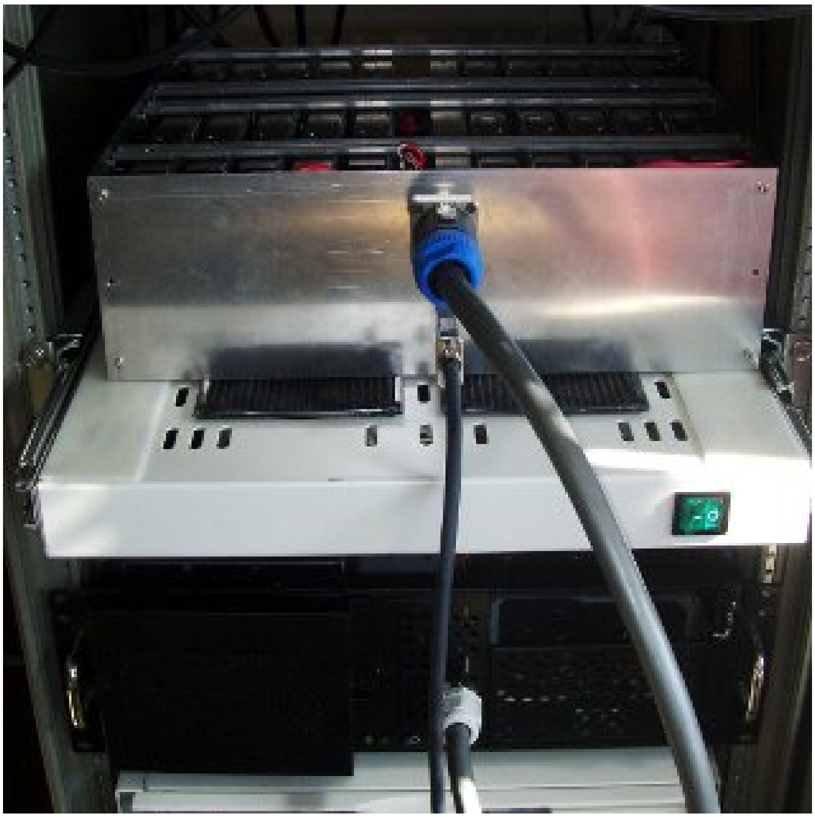
In July 2009 during the slow summer months Metsähovi disspelled the myth of VLBI data non-compressibility. Particulary data with more than 2 bits can benefit from lossless compression. Depending on the input distribution and bit resolution up to 25% compression is possible. Best compression on 8-bit VLBI data can be achieved using the FLAC lossless audio codec. For tools and results see bit-dd at http://bdd.sourceforge.net and Esa Turtiainens memo at www.metsahovi.fi/en/vlbi/misc-hardware/MiM31aug09_Compression_of_VLBI_data.pdf

In June 2009 we released the first 'mark5cEmu' software version. Written entirely in Python, the server allows FieldSystem control and user can present any networked computer as a running Mark5A, Mark5B or Mark5C unit. The software for example translates scan recording commands and invokes user recording applications such as Metsähovi's iBOB and VDIF network capture programs and legacy PCEVN recording programs.

Mark5cEmu v1.0.0 can be found at the end of www.metsahovi.fi/en/vlbi/ibob/4gexpres.

The mark5cEmu server is of particular interest for easy FS-controlled data capture. For capture you can use systems such as the BackBlaze 45-disk 90TB storage computer (2000 EUR enclosure and system w/o disks) or the Metsähovi 10/20-disk 40TB storage diskpack 4G-EXPReS (340 EUR diskpack, 60 EUR PCIe card, 20 * 90EUR disks).

Jan Wagner (Metsähovi Radio Observatory)



First EVN Fringes to the Kunming 40-m and Miyun 50-m Radio Telescopes

The Kunming 40-m and Miyun 50-m radio telescopes are two new Chinese VLBI facilities (Fig.1). They were commissioned in 2007 as key elements of the VLBI support to the first Chinese lunnar mission Chang'E-1. The Kunming telescope is situated on Phoenix Mountain (102.80 E, 25.17 N, 1985 m above sea level), just east of the city of Kunming, Yunnan Province. The Miyun telescope is located at Bulaotun (116.9 E, 40.5 N, 155 m above sea level), a little town in Miyun County, about 140~km NE of Beijing.

Fig.1: *Left: the Kuming 40-m radio telescope; right: the Miyun 50-m radio telescope.*

This last summer, JIVE organised two experiments to test EVN compatibilities with the two Chinese new telescopes. On 17 Jun 2009, the Kunming telescope participated for the first time in an EVN observation during the network monitoring experiment N09SX1. Fringes were successfully obtained by the EVN correlator at JIVE to a number of EVN telescopes (Ef, Mc, On, Ur, Nt, Sh) at S band. In addition, the Kunming and Miyun telescopes participated in the X-band experiment EY008A observed on 5-6 Aug 2009, leading to the first EVN fringes to Miyun, and the first X-band fringes to Kunming. Results from these two new Chinese telescopes can be seen in the standard plots for these two experiments on the EVN archive archive.jive.nl/scripts/arch.php?exp=EY008A and archive.jive.nl/scripts/arch.php?exp=N09SX1 and via their ftp fringe-test plots (www.evlbi.org/tog/ftp_fringes/ftp.html).

Fig.2 shows the *u-v* coverage of the source J1756+5748 with an array comprising the available EVN telescopes at X band and the two new Chinese telescopes. Their addition improves the EVN *u-v* coverage considerably, especially on the long baselines.

As part of the experiment CLEP (China's Lunar Exploration Program, www.clep.org.cn) with the Chang'E-1 spacecraft, the two telescopes saw their first light three years ago. Currently, each telescope is equipped with an S/X band VLBI observing system consisting of a cooled RCP receiver, an IF distributor with two outputs, eight baseband converters, a VLBA formatter, a Mark5A recorder, a H-Maser, and a GPS receiver. A computer running the field system is also used to control all the VLBI devices except for the antenna and to monitor the system performance at each station. A Mark5B+ and a Chinese data acquisition system (similar to the digital BBC) have been installed recently. The new backend is expected to be used in routine VLBI observations beginning from the next year. Moreover, a L-band receiver will be equipped with the Miyun telescope in the next year.

The two telescopes successfully tracked the Chinese Chang'E-1 lunar satellite with the other two older Chinese telescopes, Seshan and Nanshan, and received the spacecraft downlink data in 2007--2008. In addition, the Kunming station staff is now working on pulsar observations; the Miyun station has joined the "Meridian Project" to study the interplanetary scintillation with an UHF receiver. Although both telescopes have not yet officially joined the EVN, potential users are encouraged to consider including them in their observing proposals. We anticipate continuing advances in their capabilities and participation in a growing number of EVN experiments. The tools available to the users (*e.g.,* SCHED, EVN status table, EVN calculator) would keep abreast of these developments. More information can be provided by Longfei HAO (haolongfei@ynao.ac.cn) at Kunming station and Xinying ZHU (zhuxy@bao.ac.cn) at the Miyun station.

The EVN community congratulates the staff at the Kuming and Miyun stations and looks forward to a lengthy and fruitful collaboration.

J. Yang, L.I. Gurvits, and R.M. Campbell (JIVE)

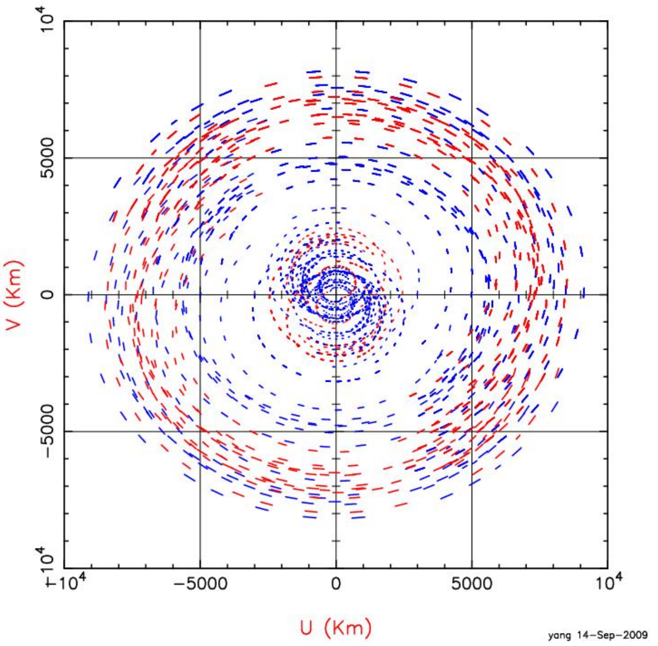


Fig.2: *The u-v coverage of the source J1756+5748 with EVN+Kunming+Miyun at X band. The used EVN*

telescopes: Mc, On, Ur, Sh, Nt, Mh, Ys, Ef, and Wb; the red points: baselines to Km and My. With the two telescopes, the u-v coverage is significantly improved.

Recirculation on the EVN MkIV Correlator at JIVE: a boon to spectral line experiments with more than 8 stations

Recirculation is a means of time-sharing correlator resources for experiments that don't use the maximum sampling rate. The correlator "runs" at 32 MHz, fast enough to handle Nyquist-sampled 16 MHz subbands. In observations using narrower subbands, the correlator chips processing a specific baseline/subband/polarization will be idle for some fraction of the time. Recirculation is a means to take advantage of those idling times to process a different baseline/subband/polarization. Following some final testing, we have correlated the first user experiments (from session 2/2009) involving recirculation.

From the astronomer's viewpoint, the advantage of recirculation is that it can increase the apparent correlator spectral capacity in experiments that otherwise would have had spectral resolution limited by the number of stations or polarizations. You may recall (from the web site, from correlator talks at EVN symposia) that the correlator capacity formula was:

$N_{sta}^2 * N_{sb} * N_{pol} * N_{frq} \leq 131072$

where N_{frq} is the number of frequency points per baseline/subband/polarization. The value of N_{sta} to use is granular by 4 (if N_{sta} = 5-8, use 8; if 9-12, use 12; etc.), and a separate maximum limit to N_{frq} is 2048. This formula led to the following maximal spectral resolutions:

5-8 stations	1 SB	1 pol	2048 frq.pt
5-8 stations	1 SB	4 pol	512 frq.pt
9-16 stations	1 SB	1 pol	512 frq.pt
9-16 stations	1 SB	4 pol	128 frq.pt

Recirculation changes the picture by increasing the right-hand side of the formula by a factor R, where R=16MHz/bbfilter, up to a maximum of 8. Thus for the various subband bandwidths in use:

bbfilter =	16MHz	R = 1
	8MHz	R = 2
	4MHz	R = 4
	≤2MHz	R = 8

Thus for the "standard" methanol or OH observation using 2MHz subbands, the maximal spectral-resolution table becomes:

5-8 stations	2 SB	4 pol	2048 frq.pt
9-16 stations	1 SB	2 pol	2048 frq.pt
9-16 stations	1 SB	4 pol	1024 frq.pt

where the separate maximum N_{frq} = 2048 remains a constraint (this arises from the requirement that a single baseline/subband/polarization must "fit" onto a single correlator board).

Of course, you can't have everything for free. A possible downside to recirculation is that it will tend to increase the shortest possible integration time by a corresponding factor of R. This comes about because the correlator is producing more than "one correlator's worth" of output per integration time, which all still needs to be read out. This increase in the minimum integration time with recirculation could affect spectral-line experiments with >8 stations and/or cross-pols desiring a larger field-of-view (i.e., reduced time smearing). Without recirculation, the minimum integration time for the whole correlator is 0.25s.

We've revised the correlator capacity page on the web to reflect the availability of recirculation: www.jive.nl/correlator/status.html Viewgraphs about both the spectral and output capacities have been added as further links.

R.M. Campbell (JIVE)

Pipeline-calibrated FITS files for individual sources now available on the EVN Archive

The EVN pipeline is an automated script written in Python, using ParselTongue to access AIPS tasks. Among other things, it applies an a priori amplitude calibration using the system temperatures and gain curves from the stations, fringe-fits (a subset of) sources, applies bandpass calibration, and makes preliminary CLEAN images using either iterations of phase and amplitude self-cal or phase-referencing. It saves a set of AIPS tables from various stages of the calibration/fringe-fitting process, which the PI can later apply to the raw data if desired. The pipeline results are available on the EVN Archive, following the standard one-year proprietary period data-release policyfor plots/images of sources identified by the PI as "private".

UV FITS files that include the cumulative calibration resulting from the pipelining are also now available for individual sources on the EVN Archive. The link to these calibrated FITS files can be found at the bottom of the table shown in the main pipeline page for each experiment (per pass, if applicable). The calibrated FITS files associated with "private" sources are protected by the same one-year proprietary period as are the plots/images of these sources and the full set of raw IDI FITS files.

R.M. Campbell (JIVE)

EXPReS Project Concludes

The EC funded EXPReS Project concluded on schedule at the end of August 2009. Over the past 42 months, operational e-VLBI has moved from a heroic-effort demonstration to a regular, supported and reliable service. In this period, network connectivity to telescopes was established and improved, the EVN correlator, originally designed to handle tapes in batch-type operations, was transformed into a real-time instrument, numerous new software tools were developed for monitoring and feedback purposes, research into tools were developed to monitor e-VLBI (disk based observation as well) and next-generation correlation techniques were investigated. e-VLBI has become an operational service with multiple papers published and hundreds of hours of stable observations.

The 19 member consortium brought together the network engineers, computer scientists and astronomers necessary to make the move into e-VLBI. Our international partners provided long baselines, using the fast, long-distance networks. The new EXPReS Network Map displays our partner telescopes and the network connections that bring the data to the correlator at JIVE.

The project has cleared all of the major technical hurdles and is now preparing for the final project review. We are proud of our accomplishments and look forward to upcoming activities which will expand and improve upon the work pioneered by EXPReS.

EXPReS is an Integrated Infrastructure Initiative (I3), funded under the European Commission's Sixth Framework Programme (FP6), contract number 026642. For additional information, you can visit the EXPReS website at http://www.expres-eu.org/.

The EXPReS team

Report from the EVN TOG

The present analog VLBI data acquisition hardware at the EVN (and other) telescopes is in general more than 20 years old. The Onsala system was installed in 1979. It was the first MK III terminal in Europe. It has been used for observations since November 21-26, 1979. The Effelsberg terminal was installed in 1982. Other "European" systems were installed soon after. Although some upgrades were applied like wider filters, a new decoder and a new formatter, the core of the acquisition system is still the same old hardware.

For a few years a small team from Noto and Bonn under the leadership of Gino Tuccari has been working on the hardware and the firmware of a digital replacement for the analog acquisition systems, which is called DBBC (digital Base Band Converter). Recently more people have joined the project e.g. Mets�hovi, Shanghai and Arcetri for the development of firmware and people from Wettzell and NASA/GSFC (Ed Himwich) for writing DBBC control software for the Field System (FS). The FS is used to execute all VLBI observations and thus has to be able to handle the DBBC.

First prototype units have been installed at Wettzell and Effelsberg. Soon Noto will follow. Together with the installation of a DBBC the VLBI disk recorders have to be upgraded from Mark 5A to Mark 5B.

The development of the DBBC is now nearing its end and thus a small company - HAT-Lab (http://www.hat-lab.com/ under construction) - has been founded for the production of DBBCs. Interested institutes can get quotes for DBBCs in different configurations as required at telescopes which observe astronomy projects or also geodetic experiments.

New capabilities of the DBBC will be better shapes of bandpasses, wider sub-bands, continuous calibration and higher bitrates. In addition the phases of sub-bands will line up without any calibration phases.

The so-called poly-phase filterbank firmware has successfully been tested and compared to the Haystack Digital BackEnd (DBE). The downconverter firmware will see its final tests this year. In a few months a 10 Gb Ethernet interface for the DBBC will become available. Together with an upgrade of the reocorders to Mark 5C, maximum datarates of 4 Gbit/s will become possible.

Walter Alef

EVN Scheduler's Report from the last observing session

2009 Session 2: 28 May - 18 June

Wavelengths: 5, 18, 6, 13/3.6 cm

This was another full length session, and the first for some time without any global projects (at least since June 2002 when the present scheduler came to office !). 4 observations involved Arecibo. 5 observations used an incomplete MERLIN array. There was only a single user project at 13/3.6 cm. One project was correlated at the Bonn correlator and the rest at the EVN correlator at JIVE. A total of 25 observations from 11 proposals was scheduled. Yebes was scheduled for the first time at 6cm. The Yamaguchi (Japan) antenna was added to one of the 5cm projects.

Disk space usage in recent sessions

Session	Space
2007 Session I	373.7 TB

2007 Session II	305.2 TB
2007 Session III	260.4 TB (no Chinese antennas)
2008 Session I	411.6 TB
2008 Session I	411.6 TB
2008 Session II	451.3 TB
2008 Session III	508.0 TB
2009 Session I	474.7 TB
2009 Session II	556.0 TB
2009 Session III	595.0 TB

Recent eVLBI runs:

Date	l	Duration	
19MAY09	18cm	24h	2 normal proposals + 1 ToO + 1 trigger proposal (not triggered)
27AUG09	6cm	---	test run only
10SEP09	18cm	15h	2 normal proposals
29SEP09	18cm	10h	1 normal + 2 short + 1 trigger proposal

Dates for EVN sessions in 2010 agreed by the EVN CBD are as follows:

Session	Date
2010 Session I	Mar 4 - Mar 25
2010 Session II	May 27 - Jun 17
2010 Session III	Oct 21 - Nov 11

Due to the planned introduction of the new WIDAR correlator at the VLA in January 2010, it is "prudent to assume that neither Y1 nor Y27 will be available" for an indefinite period thereafter.

Richard Porcas (EVN Scheduler)

5. EVN Staff matters

Staff changes at EVN institutes

Mehreen Mahmud joined the Science Operations and Support Group at JIVE as a Support Scientist at the beginning of August, after completing her thesis work at the University of Cork. **Yurii Pidopryhora** also joined the group as a full-time Support Scientist at the beginning of September. For a few months prior to this, he had been splitting his time between the group and the EXPReS project, for which he had previously worked exclusively. The arrival of these two new support scientists brings the group up to full strength for the first time since the end of last year. The chances are good that you may be interacting with them in the course of your experiments in the near future.

6. VLBI related news

First international LOFAR fringes

The first fringes have most likely been detected in baselines between Exloo and the first international LOFAR station of the MPIfR (Bonn) in Effelsberg (ca. 250km). The observations were prepared for the first "LOFAR Imaging Busy Week" (17-21 August 2009) by George Heald, Ger de Bryun and John McKean at ASTRON. The low band antennas (LBA) observed 3C196 for 2.5 hours on 20 August using 72 subbands of 195 kHz each, subdivided into 256 channels. The bands were uniformly spread over the frequency range 31-73 MHz. James Anderson (MPIfR) and Neal Jackson (Manchester) were the first to examine frequency-averaged data on baselines to Effelsberg, claiming a possible weak detection of periods with coherent phases, but without any certainty.

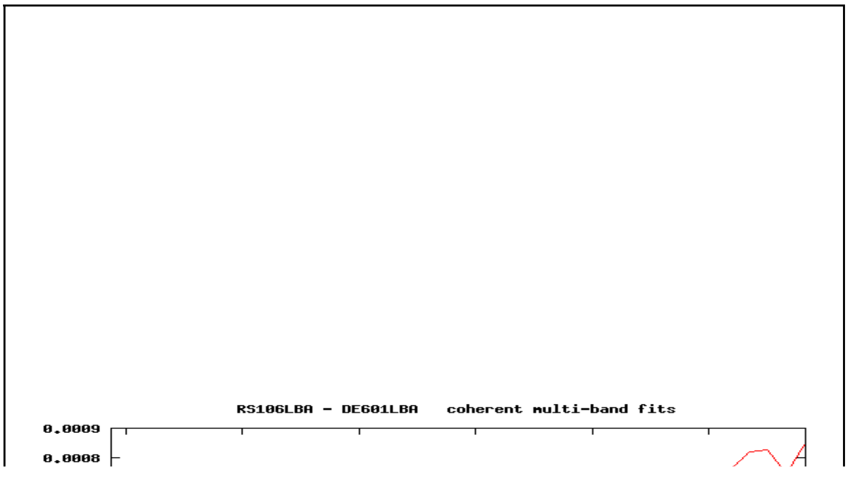
After detecting peaks in averaged one-dimensional delay-spectra, Olaf Wucknitz (AIfA, University of Bonn) produced time-dependent two-dimensional delay/rate spectra of single bands that already show clear signals on short and international baselines (see Fig. lofar_1a and lofar_1b). The ad hoc software was then extended to derive coherent multi-band delays, which also allowed to disentangle dispersive and non-dispersive delays and rates. Fig. lofar_2 shows the results as function of time for the usable 100min of data. The flux variations are probably due to the beating of the two source components (separation 6arcsec). The delay is dominated by a non-dispersive contribution (probably a clock offset of ca. 1.3 microsec) and furthermore shows a time-variable dispersive part due to the ionosphere (0.1-0.4 microsec). The phase-rates, on the other hand, are consistent with being purely dispersive. Shorter baselines (not shown) have constant non-dispersive delays of the order 0.1 microsec and dispersive time-variable rates.

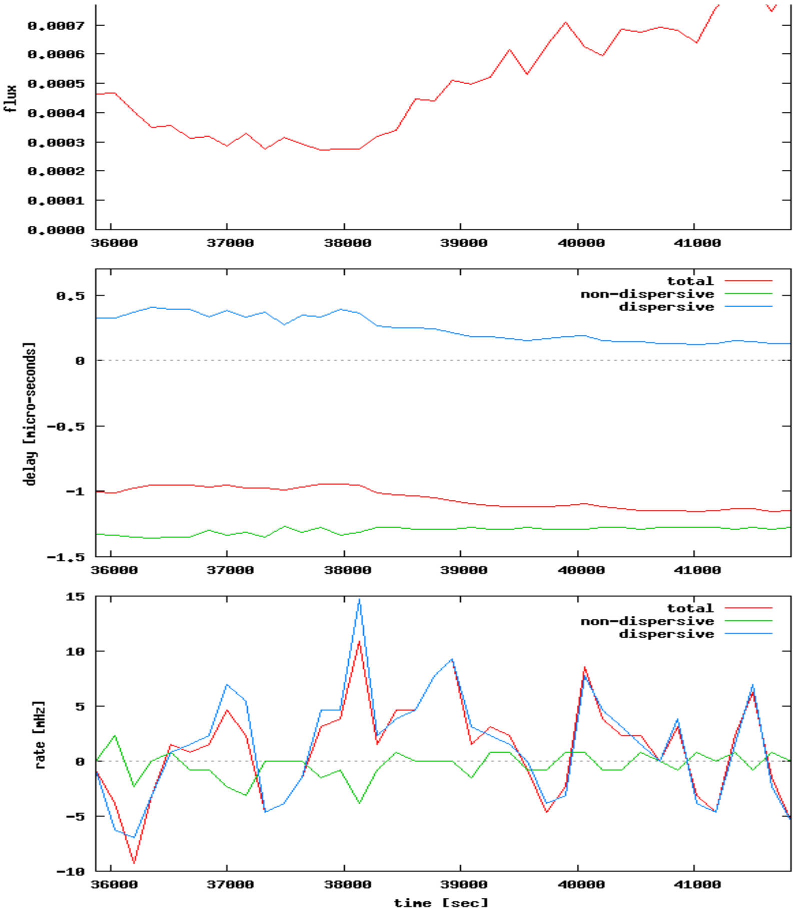
We consider this as a clear detection that is entirely consistent with the expectations. Later observations with 12-hour tracks are currently being analysed in order to confirm (or disprove) the findings.

More information is available at www.astro.uni-bonn.de/~wucknitz/lofar/firstfringes.php and in an upcoming press release of MPIfR and ASTRON.

Olaf Wucknitz (AIfA Bonn)
on behalf of the LOFAR Long Baseline Working Group (Anderson, Conway, Jackson and others) and the Effelsberg station team (Anderson, Kramer, Reich, Zensus and others).

Caption: *Delay/rate spectra movie covering ca. 1h for one subband around 69 MHz on a short (RS106-RS307) and international (DE601-RS106) baseline of LOFAR.*





Caption: *Flux (in arbitrary units), delay and rate as function of time for an international LOFAR baseline. These werde determined from peaks in coherently combined delay/rate spectra of most subbands. The convention for the dispersive delay was chosen so that the sign of the group delay is consistent with the non-dispersive delay. The rate thus corresponds to the negative time-derivative of the delay.*

7. LET'S KNOW EACH OTHER!

With this issue of the EVN Newsletter we start this new section, which can be called a 'meeting point'. The EVN community is a dynamic body: new people coming in, new stations are going to join the EVN and many of us are in this business from the beginnig but are faceless for many others! We thought we should know each other better. We start with the Torun EVN station and community. Here you can find a few photos of people there and of the observatory.

Please, send me your opinions about this meeting point and if you like it, send me photos of you and your observatories. Future issues of the EVN Newsletter need not be limited to photos nor to one station only!

Magdalena Kunert-Bajraszewska, EVN Newsletter Editor

 **Andrzej Kus**, Director of TCfA and a new Chairman of the EVN Consortium Board of Directores	 **Marian Szymczak**, Head of the Radioastronomy Dept., scientific interests: masers; **Kaz Borkowski**, VLBI Friend; **Andrzej Marecki**, scientific interests: AGNs, double-double objects
 **Magdalena Kunert-Bajraszewska**, CBD Secretary and Newsletter Editor, scientific interests: AGNs, CSS sources, BAL quasars	 First day of autumn: **Anna Bartkiewicz**, scientific interests: masers, and **Marcin Gawronski**, scientific interests: AGNs, Hybrid objects

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