



EXPR e S Report

Mike Garrett (Coordinator)

19 July 2006

NA1 (Management)

Most of the activity has focussed on recruitment and finalising the Consortium agreement. In particular, a project manager has been appointed, Charles Yun (previously of Internet2). Charles will arrive in the Netherlands on 25 July but will not start working until his work permit arrives (expected mid-August).

His first tasks will be to:

- Arrange the project kick-off meeting and first board meeting
- Begin monitoring real progress vs project milestones
- Make preparations for the first board meeting
- Distribute reporting and accounting rules (likely to mimic RadioNet I3 and SKA Design Study)
- Kick start NA2 (and to a lesser extent NA3)
- Understand financial aspects of the project management (e.g. 70% rule; depreciation issues; networking costs; level of flexibility with respect to reassigning money etc.)
- Network testing to Chile – establish dialogue with SURFnet and South American network.

The coordinator (Mike Garrett) made many presentations related to EXPR e S during the period of this report, and also visited to Sardinia to discuss the network situation there and to discuss their activity within the Cyberstar distributed PC cluster computing project.

NA2 –EVN-NREN

Last EVN-NREN meeting was in October 2005. No major developments to report but there is constant interaction between correlator, telescope and networking staff in the run up to the recent open e-VLBI observations.

NA3 – e-VLBI Science

Considerable activity (led by the VSOG chair John Conway) in preparing for the first publicly open e-VLBI Call for Proposals (see Appendix 1 for the text of the Call). Five proposals were received for February and March deadlines – 3 were accepted. 1 adhoc e-VLBI proposal was received in May and accepted.

The next open Call will appear in September. August e-VLBI run will be dedicated to testing (in support of SA1).

Observations in March were largely unsuccessful. Preliminary science results were reported in the June 2006 EVN Newsletter.

In March and April the first open call for e-EVN proposals was announced. Unfortunately the first observation in March failed due to a software bug at the Correlator at JIVE - no useful astronomy data were obtained but first e-VLBI fringes to the Medicina antenna were obtained. The software bug was quickly diagnosed (see section on SA1) and on 20/21 April the first successful "open" e-VLBI observing run was made at 5 GHz involving the telescopes at Westerbork, Onsala, Torun, Jodrell Bank, Cambridge and Medicina. Good data were obtained from all telescopes over a 24 hours period, data being sent to the EVN correlator at JIVE at sustained data rates of 128 Mbps.

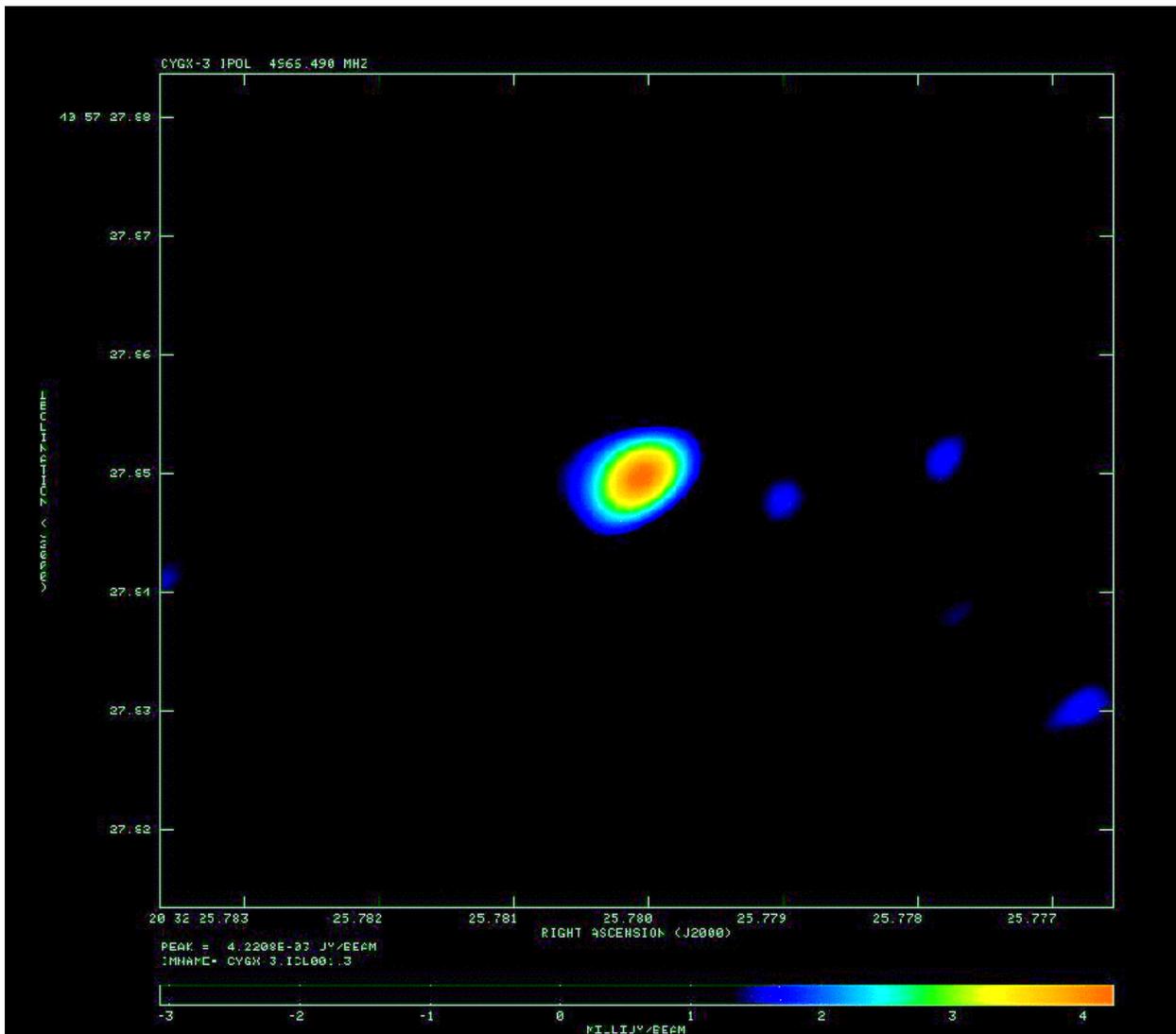


Figure 1: e-VLBI image of Cygnus X-3 from the April run. Unfortunately the source was quiescent during the observations and was only barely detectable.

The X-ray binary Cyg X-3 (Tudose et al.) and micro-quasar GRS1915+105 (Spencer et al.) were both observed - although Cyg X-3 was flaring in the original March run, by April it was quiescent. A preliminary image of the source is shown in Figure 1. The peak flux density of Cyg X-3 was very faint, ~ 4 mJy. Contrary to expectations, GRS1915 turned out to be stronger than Cyg X-3 with a peak flux density in the eVLBI image of 8.5 mJy. There is some evidence of an extension to the North of around 12 mas (see Figure 2), corresponding to 130 AU at 11 kpc, however further calibration of the image is required. We caught the source at a short (< 3 day) flare after a period of around a month of gradually decaying radio flux. It appears that GRS 1915+105 still has occasional flaring activity even during the quiescent phase, possibly coinciding with the ejection of material in a jet, as in the stronger flares.

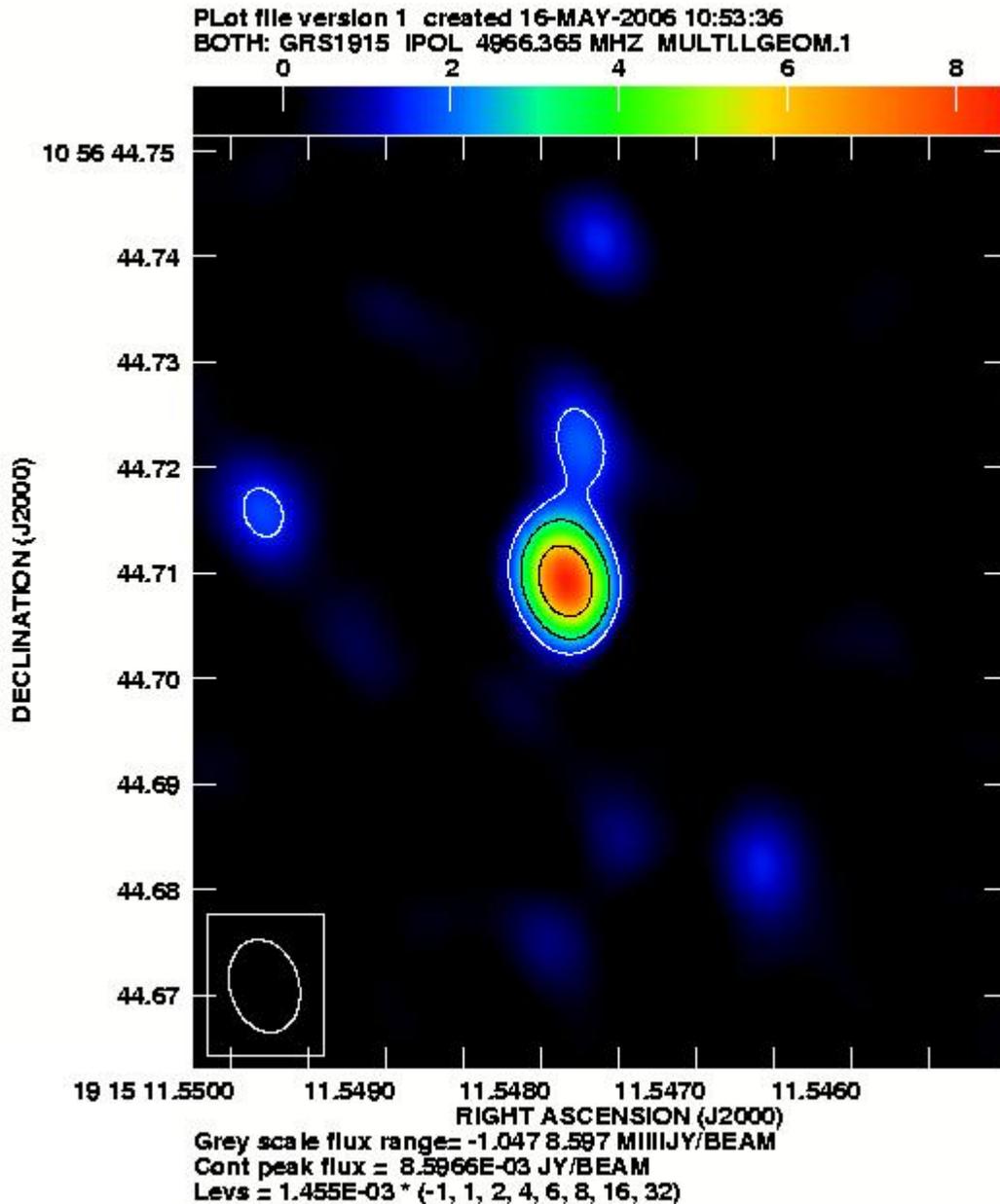


Figure 2: e-VLBI image of GRS1915 from the April observing run.

In May an “ad hoc” e-VLBI experiment was organised as Cygnus X-3 was again observed to be active again – about 1000 times brighter than in the previous observations in April! A map of the source (see Figure 3) shows that it is significantly resolved and the data are still being analysed (Tudose et al. Amsterdam). The observers visited JIVE during the observations and were supported by e-VLBI support scientist, Zsolt Paragi. A paper is in preparation – the hope is to submit this article to the journal “Science”.

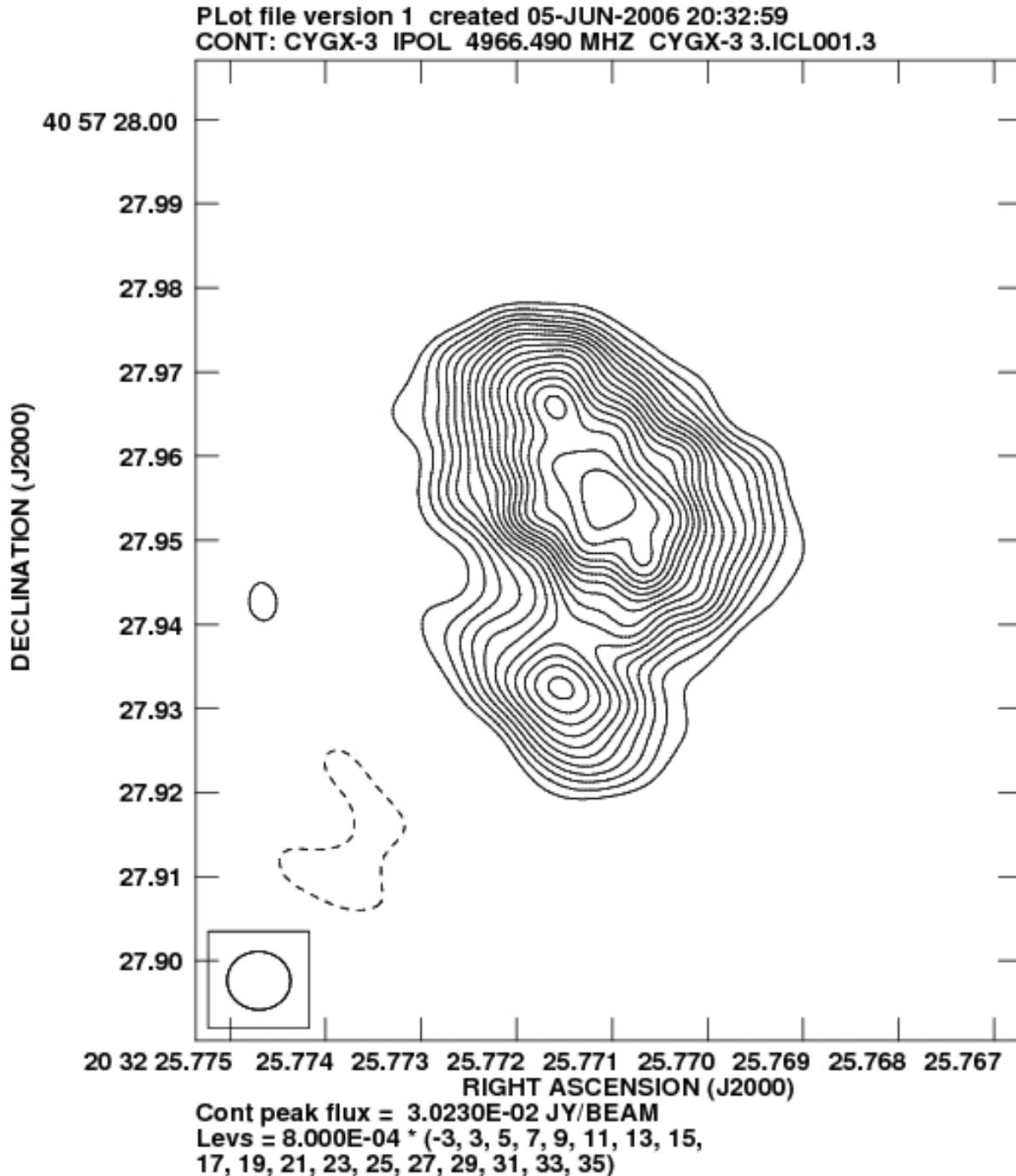


Figure 3: Cygnus X-3 in its flaring state - as observed by the 6-telescope e-VLBI network.

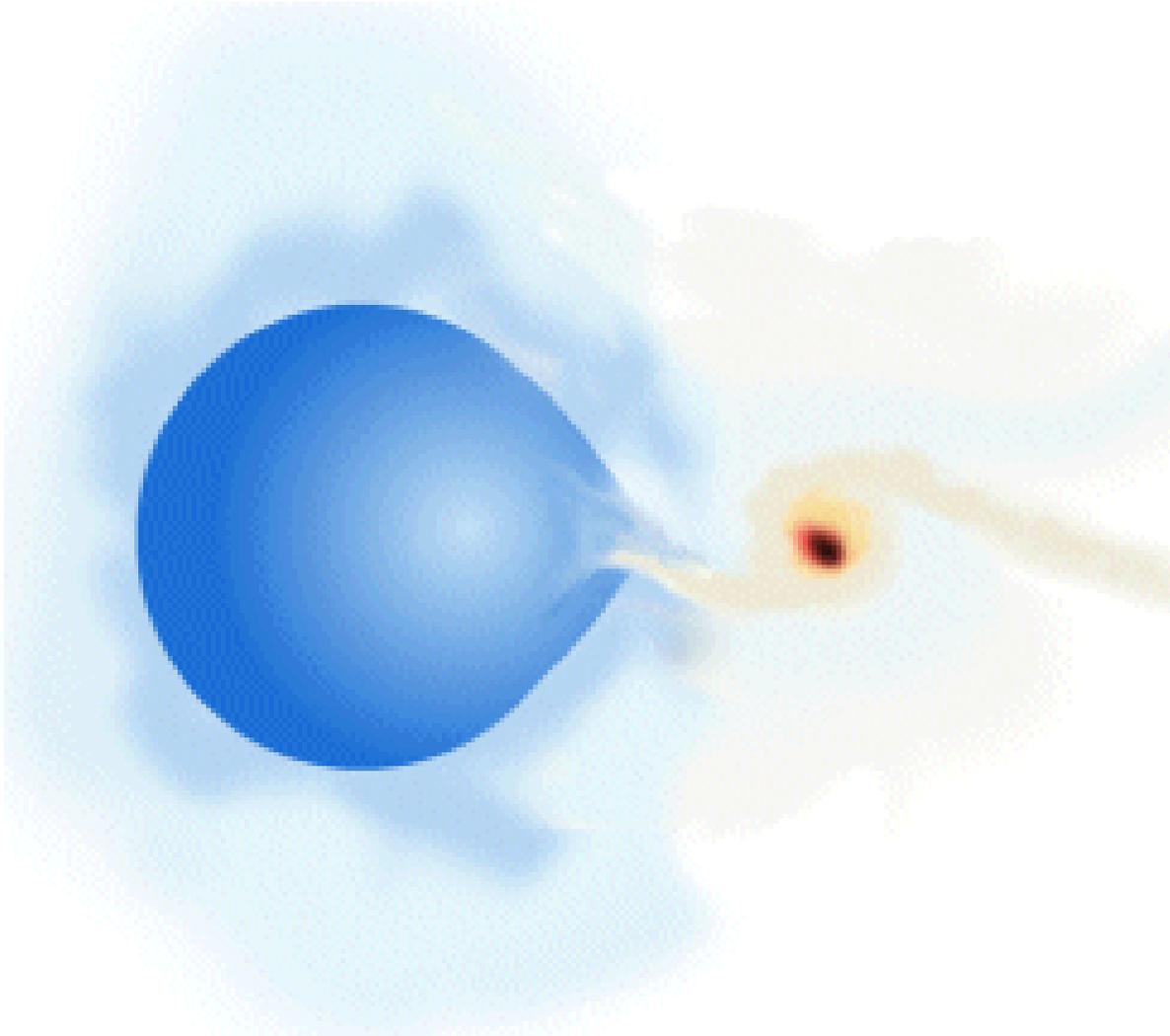


Figure 4: An artists impression of the Cygnus X-3 binary system. Matter from the giant evolved star feeds a compact black hole companion. The resulting energy release produces jets of radio emission that are accelerated about the spin-axis.

NA4: Public Outreach

A preliminary website has been set up:

www.express-eu.org

A logo has also been created (see EXPReS web pages).

A 0.5 FTE Public Outreach officer has been appointed - Kristine Yun.

Kirstine arrives in the Netherlands on 25 July but is not expected to obtain a work permit until mid-August. Her first job will be to expand the web pages to fully reflect project activities and to work on the generation of publicity material. The next major event is the local ASTRON-JIVE open day. Publicity produced for this will also be used at Networking and Astronomy meetings.

An article appeared in the dutch astronomy magazine ZENIT about VLBI (July 2006), also describing recent progress in e-VLBI using GEANT.

Arpad Szomoru (together with Alan Whitney USA and 2 other colleagues from Japan - Koyama san and Uose san, Japan) received the Internet-2 Idea award for the development of the e-VLBI technique.



Figure 5: Arpad Szomoru (JIVE) and leader of SA1 receiving the IDEA2 award, together with colleagues from Japan and the USA.

SA1 – Production e-VLBI Correlation

Progress has been made in recruiting new staff. The following software engineers were recruited: Bob Eldering (May 2006), & Des Small (June 2006). Zsolt Paragi (March 2006) was appointed as the EXPReS e-VLBI support scientist. It has not yet been possible to fill the Network Engineer position with an appropriately qualified individual.

The main progress has been in improving the reliability of the correlator during regular e-VLBI observing runs (currently scheduled 1 per 6 weeks). Two science runs were conducted on March 16 and April 20, followed by a Target-of-Opportunity observation on May 18.

The first run on March 16 involved the Cambridge, Jodrell Bank (UK), Torun (PL), Onsala (SE), Westerbork (NL) and, for the very first time, Medicina (IT) telescopes. Because of a combination of problems, such as the re-appearance of a software bug introduced in the online system, plus very poor connectivity to Torun and Medicina, most of the run was lost. On a positive note, we saw first real-time fringes to Mc at 128 Mbps, and the actual data transfer went flawlessly, with GEANT reporting zero packet loss across their network.

The second run, April 20, was a completely different story, with the same 6 EVN telescopes participating nearly continuously for the full duration of the observations (~ 24 hours), transferring more than 5 TB of data in real-time to the correlator at JIVE at 128 Mbps. During the setup/test phase, some new software interfaces intended to facilitate access from JIVE to the Mark5A recorder (data transfer) units at the telescopes were tested (remotely monitoring, stopping and re-starting the Mark5A control software, and even remotely re-booting the units). These were partly successful. During this phase Arecibo (Puerto Rico) joined the network but we were unable to get fringes, even at 32 Mbps. The science observations started at 2100UT. As the two accepted proposals covered more or less the same hour angle range, the observations were scheduled in alternating blocks of about 1 hour.

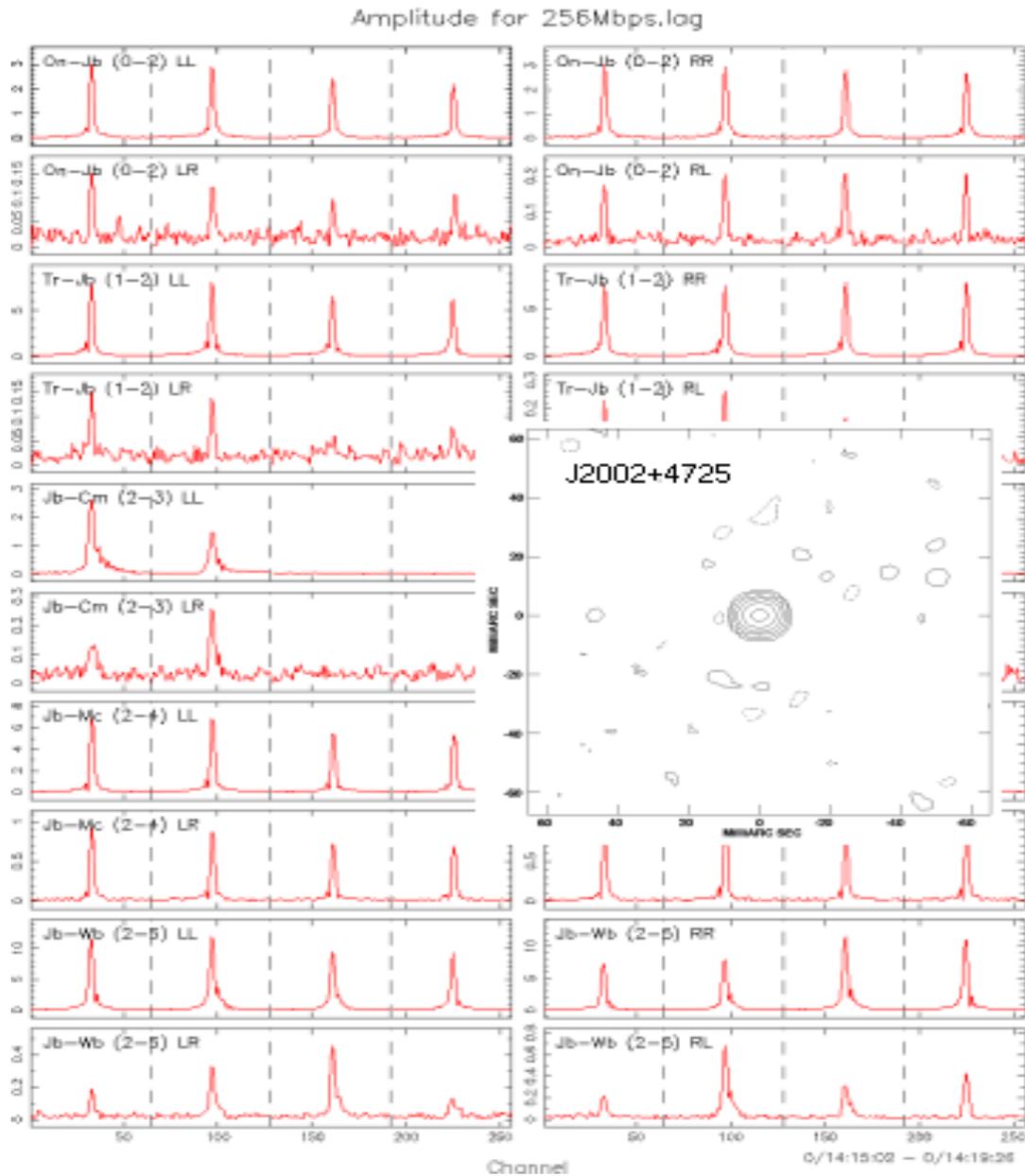


Figure 6: 256 Mbps fringes to 6 European telescopes simultaaneously!

Very early into the science run, we found that connectivity to Torun was not as good as it had been during the day. What is more, we also had problems reaching the control interface of the Mark5A at Torun, a problem very similar to the one experienced in the past to Medicina. Not wanting to lose five telescopes to debugging the problems with one, we ran the schedule anyway. From about 2400UT onwards connectivity to Torun improved enough to join the network again, and from that moment on all telescopes transferred data continuously. Aside from some minor glitches (temporary loss of connectivity, mainly from Torun and surprisingly, Jodrell Bank, and some occasional correlator problems forcing system re-starts) the whole system worked remarkably well.

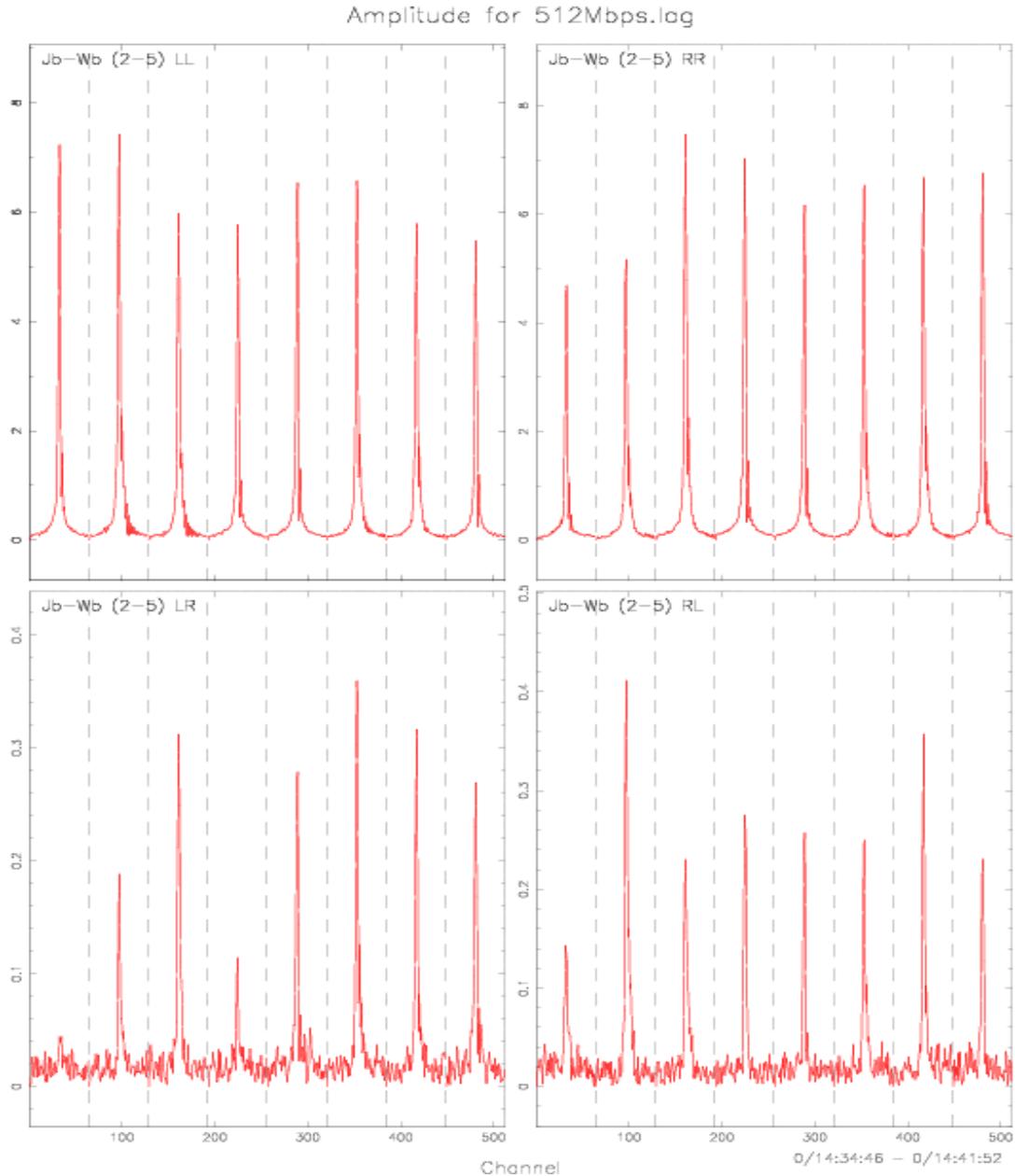


Figure 7: First European fringes at 512 Mbps. between the Westerbork and Jodrell Bank telescopes.

Although no formal call for proposals had been issued, an e-VLBI Target-of-Opportunity proposal was granted time on the May 18 time slot. The science observations lasted from May 18 2100UT until 0945UT

the next day and again involved the same 6 European EVN telescopes. The data rate was 128 Mbps, and apart from some short-lived connectivity problem to Medicina and some problems with the Mark5 unit at Jodrell Bank (fixed after a reboot) the run went very well.

During technical testing before the science run, the software interfaces with the Mark5 units at the stations were tried once again and were found to function well. A newly developed fringe display (incorporating integration in both time and frequency) makes it possible to see fringes on weak sources, rather than just bright calibrators. This is intended to be the default fringe display during the next e-VLBI run.

In the morning before the science observations began, bwctl measurements from Torun showed an unprecedented 700 Mbps. This, we heard later, was thanks to a change of the network topology in Poland. As a result, we managed the first ever 6-station correlation at 256 Mbps (see Figure 6). In addition we saw the first ever European 512 Mbps fringes on the Westerbork-Jodrell Bank baseline (see Figure 7). Although Onsala mostly performs well at 512 Mbps, in this particular case, a communication failure prevented it from sending data.

As in the previous run, Arecibo participated for a short time. Unfortunately, although the connection (as checked through iperf tests) seemed adequate to sustain 32 Mbps, this failed again. The search for the bottleneck continues.

With the software engineers in position, it has been possible to start the process of investigating new transport protocols for e-VLBI. Code for a more aggressive form of ftp has been obtained and in the summer this will be installed on one of the Mk5 units at JIVE - tests can then begin. In addition, automatic post-processing of correlated e-VLBI data is currently being worked on - the first goal is to generate FITS files of the data with minimal human intervention.

Talks with SURFnet have begun regarding how best to configure the 16 x 1 Gbps (lambda switched) network into JIVE.

SA2 – telescope network connections

The main activity has been monitoring progress of telescopes w.r.t. local-loop connections.

On 1 March 2006, five telescopes were online at 1 Gbps (Westerbork - NL, Onsala - SE, Jodrell Bank - UK, Cambridge - UK, Torun - PL).

In mid-March the Medicina (located near Bologna) telescope came online at 1 Gbps. First interferometric fringes were obtained (during the first open e-VLBI science run) at 128 Mbps.

Metsahovi (FI) is expected to become the next telescope to connect at 10 Gbps. The fibre has been installed at the telescope and 10 Gbps equipment ordered. First fringes are expected in the autumn of 2006.

CSIRO ATNF (AU) - good progress has been made in connecting up various Australian telescopes. Fringes have been obtained in Australia and it is hoped to correlate 3 or 4 Australian telescopes at JIVE in the autumn 2006. Chris Phillips visited JIVE in July in order to discuss how to make progress in this area. The experiment partly requires JIVE to be able to handle Mk5B data but the timescales for this are still unclear.

Effelsberg (DE) - funding to connect the telescope to JIVE has been approved by the MPG and the connection is expected to be ready by the end of 2007 or before.

Yebes (ES) - operation of the new 40-m telescope is delayed due to re-engineering of the backing

structure. A 2.5 Gbps fibre connection is expected to appear once the telescope is operational, probably around the middle of 2007.

Sardinia (IT) - the foundations of the telescope are complete. The telescope is expected to be completed over the next 2-3 years. The telescope will be connected by fibre to the CYBERSTAR computing network in Sardinia - either at 2.5 or 10 Gbps.

China (CN) - the telescopes in Shanghai, Urumqi, and the new telescopes in Kunming and Mijun have fibre installed. The first fringes were obtained in May 2006 within China. First fringes at JIVE for the Chinese telescopes is expected in 2007. SURFnet has been involved in considering the network paths that may be involved in connecting Chinese telescopes to JIVE.

Noto (IT) - as yet no real progress in solving the last-mile (90 km) problem.

Latvia (LT) - expect to have a fibre connection by the end of the year. Also involved in obtaining VLBI capability. First VLBI fringes expected in Summer 2006. First e-VLBI fringes in early 2007 ?

South Africa (SA) – colleagues in South Africa continue to be closely coupled to national ambitions to improve network connections to Europe. The context of this ambition relates not only to e-VLBI activities but to South Africa's bid to be the main site for the Square Km Array (a next generation radio telescope with a square kilometre of collecting area). However, exactly how the connection to the radio observatory in Haartebeesthoek will be made is as yet unclear, as are timescales.

TIGO (Chile) -

On June 16th, 2006, JIVE staff coordinated VLBI observations of the ESA Smart-1 spacecraft, currently orbiting around the moon. The spacecraft will crash into the moons surface in early September (see figures 8 and 9) and the European Space Agency are interested in accurately tracking the motion of the probe with VLBI, during its final moments (the timing of which is somewhat unpredictable due to local lunar topography). Unfortunately the event is unlikely to be visible from Europe but can be seen in the southern hemisphere. The TIGO VLBI station (Concepcion, Chile) was one of several telescopes involved in the June 16 test observations.

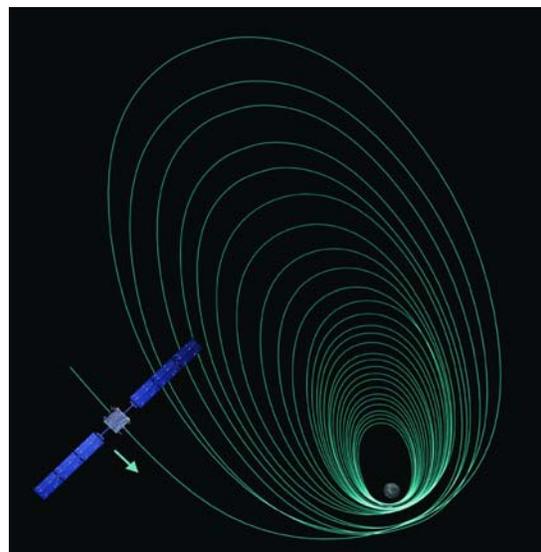


Figure 8: Artists impression of SMART-1s final moments (left), the spacecrafts elliptical orbit (right).

The observations described here were carried out in the framework of the European part of EVN EH019 project. One observing scan of 10 minutes duration was copied from the TIGO Mark5A disk pack

to the system disk and then onto DVD. The Mark5A diskpack and DVD were shipped from Chile to Europe, the DVD data arriving first in Hayo Haas' (BKG/TIGO) pocket; its analysis showed a good detection of the spacecraft signal (see Figure 9).

Smart One at TIGO, Chili, 2006 167 04 06 00, Video span 8 MHz, resolution 125 Hz

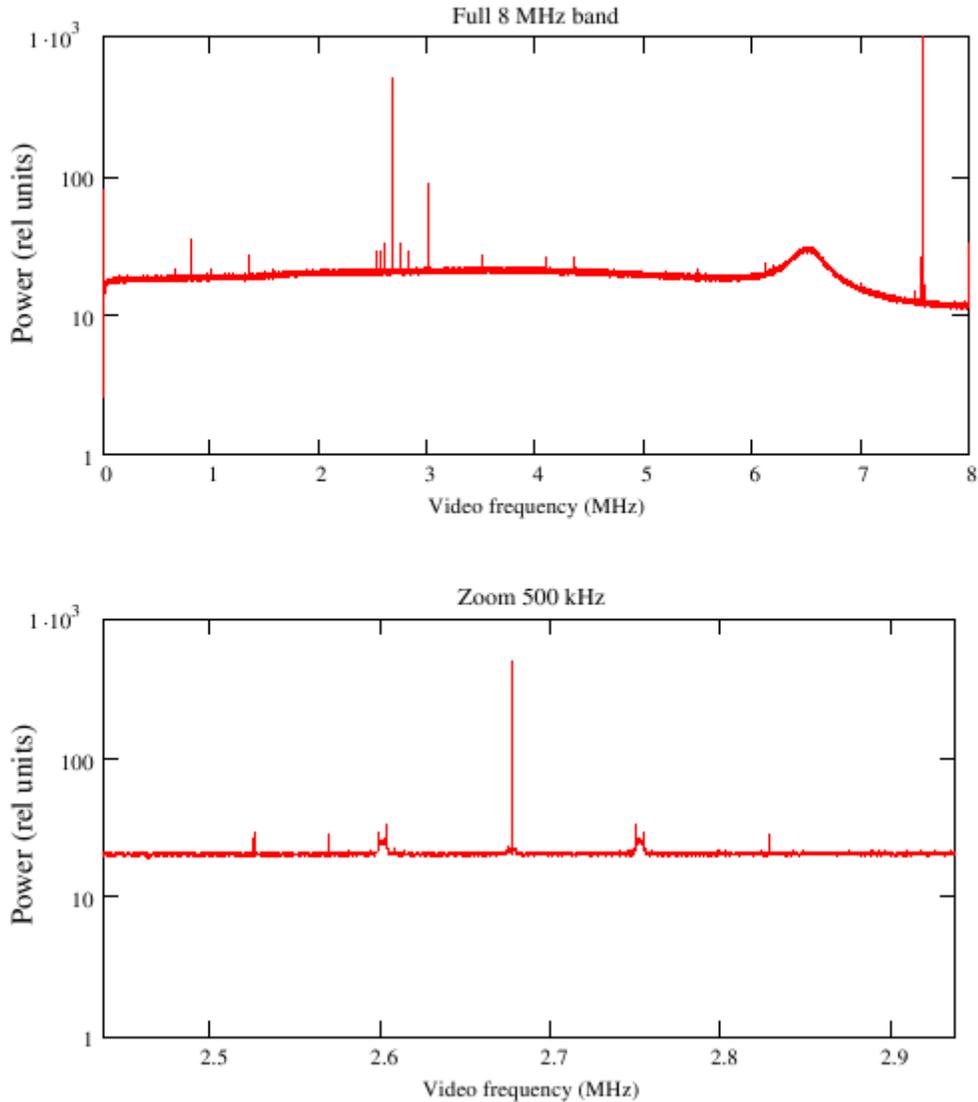


Figure 9: detection of the SMART-1 telescope by the TIGO telescope in Chile.

Two tests of electronic data transfer from the TIGO station to the processing centre at JIVE were performed. The first was a normal FTP session from the Mark5A system disk to another PC located at JIVE. For this test a standard, non-privileged network connection to the TIGO site was used, and achieved a data rate of about 1.6 Mbps.

The second data transfer test was performed on Sunday, July 9th 2006 using the File2net-Net2file Mark5A software functions; a privileged network setup at TIGO and a high performance computer at

the receiving end at JIVE. This test demonstrated 7 Mbps data rate, a considerable improvement with respect to the standard FTP test over a non-privileged connection.

Considering that it will be extremely interesting to transfer TIGO data to JIVE for express analysis of the final stage of the Smart-1 mission, significantly improved data transfer rate performance are being considered. It will be necessary to talk to networking people in SURFnet and Chile to get the ball rolling. With a network engineer not yet in place, it may fall to the EXPReS programme manager to arrange this dialogue.

JRA1 - FABRIC

A Kickoff meeting (see figure 9) involving all the main participants was held in March 2006 (see www.jive.nl/dokuwiki for minutes and presentations).

A software engineer (1 March) and scientific engineer have been appointed – the latter (currently working at NRAO, USA), cannot take up this position until the end of the year.

JIVE, University of Amsterdam (de Laat) and SARA submitted a proposal (known as SCARIE) to the NWO Astronomy-ICT programme, STARE. The project focuses on distributed software correlation and provides 0.5 MEuro funding over 3 years. This provides *extra* matching for the FABRIC project. Appointments are in the process of being made.

On 5-6 July a meeting was held between PNSC (Polish National Supercomputing Centre) and JIVE staff. The Aim was to see how PNSC's experience in distributed computing could be harnessed with respect to FABRICs goal of distributed correlation. In particular, features of PNSC's Virtual Laboratory environment were discussed, including the workflow manager. In principle, the latter may be able to control all aspects of a e-VLBI experiment, from scheduling through to distributed correlation. The latter must also include a workflow manager that is sensitive to both compute and network loading – a combination that appeals greatly to PNSC. Another issue is how to take the current software correlator (written by JIVE for the ESA Huygens programme) and make it e-VLBI and PC cluster friendly. In addition, it must also then become capable of running on a distributed network. How to make the software correlator portable and in particular scalable is a crucial aspect to this discussion. A draft version of the minutes of the JIVE-PNSC meeting is in the final stages of being released.

In July, Adam Deller (Swinburne University, Supercomputing and Astrophysics dept., Australia) visited JIVE in order to compare the performance of different computer architectures and software correlator approaches. The Swinburne group is currently collaborating with Cray Inc. - using a software correlator that uses the FPGA capabilities of Cray's newest (hybrid) supercomputer systems.

The next full FABRIC meeting will be held in September in Poznan, just before the EVN symposium in Torun.

Some FABRIC deliverables have already appeared and are (or are about to become) available via the FABRIC wiki. These include:

JIVE (WP 2.2.1, WP 2.2.2 WP 2.2.3) - Broad band software correlator code is available
JBO WP 1.2.2 Anderson produced : Export/Import of VLBI data from/to eMerlin; WP 1.2.1 Strong et.al produced: EXPReS/FABRIC strategic document: Protocol Investigation for e-VLBI data transfer.

MRO - WP 1.1.1 Mujunen et. al produced: Expres JRA1 FABRIC: Data acquisition requirements.

OSO WP 1.2.3 Telecom on zeroth order PC-EVN fringe demonstration on Monday May 22 2006. MoM on www.jive.nl/dokuwiki. Other actions and work towards this goal are progressing.



Figure 10: FABRIC kick-off meeting in Dwingeloo.

Financial Matters

Financial expenditures associated with EXPReS are shown below. These are expenditures that have occurred at JIVE. Matching expenditures for JRA1 are not shown. Expenditures by other partners are not shown. These will be reported once the project manager is in place.

629009 EXPRES - Networking

629009 010 EXPRES - NA 1

	Document number	Description	Expenditures Period
56220	Work of third parties		
	4/25/2006 CORSAL06	Correction salary of v. Dijk, March-April.	4,670.58
	5/31/2006 SAL0506	Salary May v. Dijk	2,335.29
	6/30/2006 SAL0606	Salary June v. Dijk	2,335.29
Total projectnr. 629009, subprojectnr. 010			9,341.16

629009 020 EXPRES - NA 2

Total projectnr. 629009, subprojectnr. 020 0.00

629009 030 EXPRES - NA 3

Total projectnr. 629009, subprojectnr. 030 0.00

629009 040 EXPRES - NA 4

56220	Work of third parties		
	7/13/2006 GJIF06-0329	Beabudai, design logo/animation website	500.00
Total projectnr. 629009, subprojectnr. 040			500.00

629010 EXPRES - Specific Service Activities**629010 010 EXPRES - SA 1**

		Document number	Description	Expenditures Period
56220	Work of third parties			
		4/25/2006 CORSAL06	Salary Paragi March-April.	6,456.06
		5/31/2006 SAL0506	Salary May Paragi	6,545.82
		6/30/2006 SAL0606	Salary June Eldering	6,545.82
56310	Instruments			
		3/23/2006 GJIF06-0099	Avnet-13.02.06-75 x tranceivers	1,141.21
		3/23/2006 GJIF06-0100	Avnet-13.02.06-75 x tranceivers	1,222.73
		4/18/2006 GJIF06-0161	Digi-Key, IORD0600024 20 st. CTX285LVCT-ND	89.08
		5/8/2006 GJIF06-0185	Digi-Key-29.04.06-oscilators	143.06
		5/8/2006 GJIF06-0186	UPS, IORD 0600024 Digi-Key	20.33
		5/12/2006 GJIF06-0200	Avnet-15.02.06-200 x conn P50L-050P-C-TGF	1,606.50
		5/16/2006 EUR0600047	Koersversch. Digi-Key (060161)	44.82
		6/26/2006 GJIF06-0296	Cyner; PCB 2316-2 RX SErial Link	744.04
		7/6/2006 GJIF06-0309	Massachusetts Inst., MIT Area 1/7 - 30/10-06	36,525.00
56320	Tools			
		3/31/2006 IMGA310306	Corr. invoice. Avnet (060075)	692.88
56411	Travel costs by own car			
		7/6/2006 GJIF06-0318	Paragi-27/29.06.06-Groningen-NGC	68.40
56415	Travel expenses abroad			
		7/6/2006 GJIF06-0324	BPT, Szomoru Poznan 24-09-06	827.18
		7/13/2006 GJIF06-0325	BPT, Oerlemans Poznan 24-09-06	413.59
		7/17/2006 GJIF06-0341	BPT, Szomoru Boston 13-09-06	822.34

Total projectnr. 629010, subprojectnr. 010 63,908.86

629010 020 EXPRES - SA 2

Total projectnr. 629010, subprojectnr. 020 0.00

629011 EXPRES - JRA - FABRIC

629011 010 Project management

	Document number	Description	Expenditures Period
56110	Computers		
	4/30/2006 RC100506	TTEC:memory stick	71.40
56220	Work of third parties		
	4/25/2006 CORSAL06	Salary Oerlemans March-April.	10,005.20
	5/31/2006 SAL0506	Salary May Oerlemans	5,002.60
	6/30/2006 SAL0606	Salary June Oerlemans	5,002.60
56330	Software		
	5/18/2006 GJIF06-0223	Primavera-13.04.06-3 x TimeSheets	499.80
	6/22/2006 GJIF06-0292	Primavera-13.04.06-3 x TimeSheets	83.29
56410	Travel expenses inside NL		
	7/17/2006 GJIF06-0348	Taxi company Ellerie, transportation June 2006	48.60
56415	Travel expenses abroad		
	4/12/2006 GJIF06-0159	Taxi company Ellerie, transportation March 2006	28.06
	Costs for		
56420	guests		
	7/13/2006 GJIF06-0328	De Borken, kitchen 05-07-06	79.05
56490	Other exploit./general costs		
	4/11/2006 GJIF06-0157	FedEx, Bologna data disk 28-03-06	142.91
	4/30/2006 RC100506	Albert Heijn:Kickoff meeting	378.10
Total projectnr. 629011, subprojectnr. 010			<u><u>21,341.61</u></u>

Appendix 1

e-VLBI call for proposals

Call for experimental EVN e-VLBI science proposals, January 2006

Proposals for experimental science use of the EVN's developing e-VLBI real-time VLBI capability are invited. Available EVN e-VLBI capable telescopes in the first half of 2006 are Wb14 (tied array), Jb2, Cm, On, Tr and Mc. Proposals can be made for the following two runs:

Observation start	Observation end	Approx GST Range	Proposal Deadline
16th March 14 UTC	16th March, 19 UTC	01:30-06:30	1st March 2006
20th April, 15 UTC	21st April, 11 UTC	05:00-01:00	5th April 2006

Proposals may request observations in either the 6cm or 18/21cm bands (but not both in one experiment). In this initial call, only continuum observations will be supported (no spectral line). These observations will be run at the highest possible (variable) bit rate consistent with internet traffic. It is expected that during these sessions an average bit rate of 128Mbit/s will be possible; however due to the still experimental nature of the system this cannot be guaranteed. To accommodate observations requiring rapid reaction and results, e-VLBI proposals can be made up to two weeks prior to the observations by the special deadlines given above.

Envisioned ideal uses for e-VLBI runs are 1) Targets of Opportunity, 2) Preliminary fringe test or other observations where rapid turnaround is required to plan future proposals or observations and 3) Monitoring of sources on timescales shorter than the EVN inter-session interval. **NOTE: proposals in the last category which seek to combine an e-VLBI run with a regular disk based session observation must be made before the normal Feb 1st deadline as part of a standard EVN proposal.**

Any submitted e-VLBI proposals which can be better executed in regular session observations are unlikely to be scheduled for these e-VLBI runs. In all cases proposed projects should take account of the limited numbers of telescopes and bandwidth available, carefully justifying that the science goals can be reached. Proposals are eligible for scheduling in the run for which they are proposed, or for the next observing run if appropriate. Proprietary rights on the data are the standard ones of one year after data distribution. PIs are strongly encouraged to visit JIVE during or immediately after the observations to help rapidly reduce their data.

Proposals submitted for the e-VLBI deadlines will be reviewed by the EVN PC within one week. Scheduling of these proposals will be carried out by JIVE staff using information supplied in the proposal. Proposals must therefore contain all the necessary information needed for scheduling, including the exact target and calibrator positions etc.

All proposers MUST contact **Bob Campbell** (campbell@jive.nl) in good time PRIOR to submitting their proposal to ensure that all technical aspects required for observation and correlation are fully described in the proposal. Before submitting a proposal, proposers should also consult the [e-VLBI per-session status tables](#) where updated information about the status of each run can be found. Proposals should use the standard VLBI proposal cover sheet and include the normal scientific justification. Proposals must be mailed to proposevn@mpifr-bonn.mpg.de. The email subject line should clearly state 'e-VLBI proposal'.

Resources and support are available to users of the EVN and e-VLBI. See the [EVN user guide](#) for more information. The current status of all EVN telescopes is shown in the [EVN status table](#).

The continuing development of e-VLBI within the EVN is made possible via the EXPRoS project funded by the EC FP6 IST e-infrastructure initiative - with a goal to achieve 1Gbit/s e-VLBI real time data transfer.