JOINT INSTITUTE FOR VLBI IN EUROPE

Report for the third quarter, 1998

Summary

Three weeks before the official inauguration of the EVN Data Processor at JIVE, all the hardware is in place, as well as sufficient software to run the demonstration. The quarter was spent in bringing the hardware and software into operation, testing the system, and checking its reliability. Fringes were achieved on all baselines in the 16 station observation of 3C380 carried out specifically for the inauguration ceremony. Preparations for receiving the 300 guests expected for the ceremony were in full swing at the end of the quarter.

Following the discovery of severe tape packing problems with a number of the playback drives, the tape paths of 13 of the 16 playback units were completely readjusted by JIVE staff. This removed the packing problem.

Many of the high level control software modules have been brought into operation, and considerable progress has been made with the data handler, an essential element in the data path to the user. A graphical user interface has been developed and will be used for the inauguration ceremony. Work has begun on database management.

The World Wide Processing Activity Display was brought into operation. This is a real time display involving a world map and LEDs showing which telescopes are taking part in the correlation.

The MkIV upgrade of most of the VLBA terminals in the EVN is continuing. The formatters were under test at Haystack Observatory at the end of the quarter.

Support by JIVE staff for EVN operations continued during the quarter - data correlation in Bonn and Socorro, network monitoring, calibration, telescope support at Cambridge, Westerbork and Onsala, analysis of instrumental polarisation. Support was also provided for individual astronomers in scheduling and data analysis and for EVN observations with VSOP/HALCA.

Preparations for the 4th EVN/JIVE Symposium to be held in conjunction with the inauguration of the data processor, were in full swing at the end of the quarter.

Five research papers were published in refereed journals and one in a conference proceedings; 7 papers were submitted for publication.

1. Institute

JIVE Board

Garrett prepared a draft of the minutes of the April meeting of the JIVE Board of Directors and distributed it for comment.

European Commission

The annual and final reports of the PECO1 contract involving JIVE, FOMI and TCfA (Torun) were submitted to the EC by Garrett. The reports, including the financial statements, were accepted by Brussels and the contract is now closed. Garrett prepared and submitted an updated list of new TMR Access Users to the EC.

EVN/JIVE Symposium and inauguration of the Data Processor

Serious preparation for the EVN/JIVE Symposium began with the first of several meetings of the LOC and SOC (both chaired by Garrett). The Symposium web pages were finalised and oral/poster presentations selected.

Gurvits prepared public-relation materials for the inauguration of the EVN Data Processing Centre.at JIVE.

Personnel changes

Ron Heald joined JIVE for a six month visit from NRAO (August to February). Scott Aaron resigned as Support Scientist in Bonn on 21 August.

Infrastructure

Garrett monitored e-mail from the generic JIVE account and maintained the EVN Home Page. Responsibility for the JIVE Institute web page transferred to van Langevelde (1/9/98). Garrett completed work on the EVN Poster with a visit to Brandsma Communication Group's offices. Garrett oversaw the allocation to visitors to JIVE of computing resources and support personnel.

Sjouwerman and Philips alterated in writing the minutes of the monthly JIVE institute meetings. Sjouwerman created an email facility for EVN/JIVE Symposium attendees which can be used without the need for a computer account with password.

Publications

Material for the Annual Reports from JIVE and the European Consortium for VLBI was sent to the printer in July.

Visitors:

A. Kus (Torun), R. Noble, P. Shepherd, P. Maguire (Jodrell Bank), B. van Dam (Leiden), I. Fejes (FOMI), J. Takayama (SONY, Japan), W. Tschager (Leiden), M. Clemow, J. Cowell (Metrum), A. Maccaferri (IRA, Bologna)

1. EVN/MkIV Data Processor (Anderson, Bos, Buiter, Casse, Van Langevelde, Maguire, Millenaar, Noble, Parsley, Phillips, Pogrebenko, Shepherd, Tuccari, Verkouter, Zwier)

Summary

Just three weeks before the official opening, the last hardware required to complete the 16 station data processor arrived at JIVE. Although some equipment still needed further fine-tuning, it was already an impressive sight to see the complete row of data playback units for the first time. It was also obvious from the absence of cables, once very abundant around the basement that the assembly phase of the EVN MkIV data processor was nearing completion. Almost all of the final cabling has been neatly tucked away under the floor. This includes a new LAN network dedicated to the Data Processor and shielded from the Ethernet traffic in the rest of the building. The complete four crate correlator resides in its separate room and the air conditioning for the complete processor has been switched on.

On the testing side we have been concentrating on issues involving the correlator model, after we had verified a number of MkIV and VLBA modes earlier. First, some time was spent on understanding the residual phase rates still in the data after correlation. This was part of the attempt to get fringes on a global, thin tape experiment observed at 6cm. When all was understood, we achieved intercontinental detections between the EVN and the VLBA. Then a long-planned major revision of the processor's internal format for transferring the correlator model was necessary to progress further. This has been completed and it is a major step in the path that leads to the first image, which is scheduled for the end of this year.

We have concentrated in the last month of the third quarter on reliability issues, in the software as well as in the hardware. While updating the software, firmware and hardware necessary for the model, several patches were implemented that make the entire data processor run more smoothly. With the addition of the user interface, the correlator can now be started very simply, as required for the opening ceremony on October 22.

The *status at the end of the quarter* of the integration and testing program can be read from the list of critical milestones shown below. This list with the dates of the major milestones, set up in June 1997, shows the highlights of the testing and debugging program of the Data Processor from then on.

Tasks Milestones

1. Correlation of the JB-CM tape with constant phase rotation 21 July 97
and using local control software (Achieved)

2. Correlation of the JB-CM tape with continuous phase rotation 26 January 98
and using local control software (Achieved)

3. Correlation of the JB-CM tape controlled from C3 29 January 98
with prototype CJD, data handler from Bos (Achieved)

4. Correlation of 2 MarkIII tapes using 2 SU/DPU 4 February 98
controlled from C3 with prototype CJD (Achieved 17 February)
Correlator control and data handler from Bos

5. Correlation of 2 MarkIII tapes controlled from C3 6 March 98
using final CJD fed manually, Data handler from Bos (Achieved 20 February)
simple correlator control from C3

6. Correlation of 2 MarkIV tapes as in 5. 12 March 98
CJD made at JIVE (Phillips) (Delayed 12 May)
(Achieved 13 May; no fringes detected; complexity to be tested end of June)
(Fringes on MarkIV-VLBA formatted tapes on June 15)

7. Correlation of two tapes controlled by C3 20 March 98
correlator controlled by C3 (Delayed 12 May)
prototype CJD, data handler from Bos
(Functionnality tested 22 May; testing full messaging delayed 12 June)
(Achieved 18 June)

8. AIPS++ to AIPS conversion via UVFITS and fringe 22 April 98
fit of JIVE data (Delayed 15 June)
Passed 14 July

9. Testing of functionality PCM using JB-CM tape Passed September 98 @ Haystack
data to be read into C3

10. Correlation of 2 tapes 1 May 98

with CJD fed from VEX (Achieved 22 May)

Partial data handler from C3

11. Correlation in MarkIV and VLBA mode with 4 stations 15 May 98

Test at all modes available (Delayed 10 June)

(Production SU not yet available; delayed to July 16)

5 Stations markIV correlation passed 24 July 98

12. Two station correlation with simple user interface 1 June 98

(Delayed July 16)

Passed 3 September 98

13. Two station correlation with first production SU 10 July 98

Achieved

14. Full operation simple array (8 stations) 1 August 98

Delayed 16 September 98

(Passed 8 October 98)

15. Two station correlation with prduction correlator 28 August 98

Passed 24 July 98

16. Correlate 16 stations (rehearse opening) 10 August 98

(Passed 14 October 98**)**

17. Official opening 22 October 98

2.1 Correlator section

Practically all the parts for the correlator section to be delivered by Haystack have reached Dwingeloo and integration and testing started. At the end of the quarter only 11 correlator boards and spare correlator and cross-bar chips still needed to be delivered.

Most of September was spent integrating and testing the four correlator racks at their final location. A number of faults, in particular with the correlator chips and the phase rotators have been found and cured.

The connection between the serial links in the Station units and the correlator racks was also extensively tested. In spite of the substantially longer cable between the two, the links appeared to be adequately stable.

At the end of September much work was spent debugging the "final" version of the correlator software.

Work on the preselector board for the Data Distributor is progressing; it is expected that the order for the production of the boards will be

placed in the next quarter. More control and test software for the Data Distributor has also been written.

2.2 Station Units

The prototype Phase Cal Module (PCM) has been formally tested and accepted at the Haystack Observatory at the beginning of September. This in principle ends all Station Unit development at Metrum. Unfortunately, it then appeared that a number of FPGA's (Xilinx) had become obsolete and had to be replaced by a new type of the so-called E-series. The fourth prototype PCM has hence been retained by Metrum to evaluate the migration of the design to E-series Xilinx.

By the end of September, Allied Signal Technical Services Corp. (ATSC) had produced and delivered to JIVE 15 (out of 18 ordered) production Station Units. The production of the remaining station units at ATSC was delayed partly as a result of guiding problems with the DPU borrowed from JIVE. Also the JIVE DPU was required at JIVE in order to complete the testing before the official opening. All produced and delivered Station Units performed well directly after start up which indicates that the testing at ATSC was well prepared and carried out.

2.3 Play Back Units

The last of the 16 DPUS passed the FAT at Metrum Information Storage in June but remained at Metrum a bit longer where it was needed to sort out problems with the first production SU's.

At the end of September all16 DPU's were present in the processor room. The 16th unit which had been sent to ATSC for the testing of the production station units had arrived back in the last week of September, just in time for a final adjustment and its installation.

Previous to that severe problems with the DPUs had been encountered. During extensive tests with thin tapes in August it appeared that some of the tapes developed bad packs. A team from Metrum visited JIVE at short notice and diagnosed a far too high tape tension (310 grf instead of 220 grf). The tape tension on practically all units had been adjusted using a faulty guage. This was quickly repaired on all units and a number of tape paths readjusted. This was necessary since a number of guiding caps had become loose. It then appeared that the tape paths needed a lot more attention and Buiter spent several weeks studying the situation and performing the adjustment. The tape path and the tape guiding in 13 DPU's has been completely readjusted.

At the end of the quarter some 12 triple cap headstacks from Spin Physics had been delivered to JIVE which brought the total to 24. All headstacks have been thoroughly measured on the microscope by Casse and Schonewille and accepted.

Extensive improvements to the DPU's have been made by Leeuwinga in the following areas:

- The TTL power supply distribution to the VME backplane of all DPU's was completely

renewed in order to remove problems such as a drop in speed of the drive and problems with the reading of the barcode. Those were all related to a too low VME- TTL voltage.

- The side panels of the VME crates were shortened to get better access to the backplane and other components inside the DPU.

- The trimplates were modified to allow easy adjustments of the low tape points.

The back doors of all DPU's have also been made longer. They now cover the whole backside of the DPU. This was required in order to seal the closed air-cooling system for the DPU's.

At the end of September all DPU's were moved to their final location under the chimney. Then the cooling system for the DPU's and the Correlator was powered up. The dry air system, designed to extend the lifetime of the heads in the DPU's, was switched on and worked properly. A humidity level of 30 % in the area of the heads has been achieved.

2.4 SUIM/TSPU (Station Unit Interface Module/ Test Synchronisation Pulsar gating Unit)

All 16 SUIMs for the Station Units have been assembled and tested in Medicina. The units arrived at JIVE in this quarter and after populating with xilinxs were installed in the SU's. All worked as expected.

The 24 SUIMs ordered by the Haystack Observatory have also been completed. The front panels and belongings were installed on the SUIM, CLKM and TSPM boards. The 24 SUIM boards were then shipped to Haystack in fulfilment of our commitment to Haystack.

2.5 High level control software

During this quarter the priority was to ensure that the control software was sufficiently developed prior to the inauguration of the Data Processor on the 22nd October. Towards the end of the quarter, the control software was nominally frozen ready for the opening; however new software continued to be developed but it was not used for the opening ceremony. A considerable amount of time was spent by all members of the group in testing software and providing support to those testing the system.

Maguire completed the initial implementation of the Processor Control module, and so it is now possible to start up the control software from a single command. Processor Control looks after the general running of the entire system and is linked in with the Status Monitor GUI (see below).

Maguire has also completed a modification to SU Control (the software that communicates with the Station Units) to move the head peaking code into its own thread. Whereas this has no direct consequences externally, it will make it simpler to adjust the algorithm in future.

Shepherd has spent the bulk of the quarter working on the Data Handler and a task to display fringes from the data as it passes through the system. The latter was in fact ready for the opening. The Data Handler is nominally working now, but will require modification when the final data output format is adopted.

Olnon has completed the installation of the Control Software onto the new HP workstation (the real CCC!), and has continued to ensure that the software on both this and the previous machine are kept up to date.

Olnon has expanded the VEX-to-CJD conversion to a proper Preparation_Job which provides the Processing_Job with the necessary control information about the experiment to be correlated. At the same time the capabilities of prep_job were extended to work with any number of stations up to 16, where only two had been used before. Similar extensions and changes in the associated code were implemented to keep abreast with the increasing capabilities of the hardware and the consequent requests from the testers.

Olnon also started the design and prototyping of the inverse operation to the above, that is the CJD-to-VEX conversion. This is needed to provide a "persistent" form of the CJD and also for shipping out details of the processing to the PIs. Development of this was temporarily halted in September when his first priority became assisting with the testing of the rapidly extending Correlator System prior to the opening.

Olnon has also spent time in familiarising himself with the existing code, and also a little time looking into the pSOS+ real-time software that is used in the Station Units.

Noble completed the Status Monitor GUI, in so far as anything of this nature can said to be completed, and also the modifications required to the SU_Monitor module to provide it with information about the DPUs and tapes mounted. The GUI was also linked with the new Processor Control module to provide it with information about the remainder of the system, and to enable the GUI to send commands to the rest of the system.

Noble also completed a first draft of the design for the output data formats for the correlator and this was sent around for comments.

Phillips worked closely with the Jodrell Team, testing new functionality in the CCC control software. This included the incremental expansion of the data processor from a 2 station prototype to the final 16 station setup. During these tests numerous reliability problems were identified with the high-level control software on CCC as well as with the SUs. Most of these problems have been fixed with by changes in the Jodrell software and by an upgrade of the SU embedded real-time software and reprogrammed PROMs on many of the SU modules.

Phillips and van Langevelde identified a problem with correlator model calculations, resulting in very high residual fringe rates. Once this was corrected, the first fringes on an intercontinental baseline were

achieved.

2.6. Post correlation software

Ron Heald from NRAO who joined JIVE for 6 months began work on a tape library system. The system will keep relevant information on tapes while they are at JIVE. It will communicate with the paternoster and the global "Track" database in Socorro. The system is to use the "Persistence Classes" written by the group at Jodrell, and much time was spent by Heald and Kramer investigating this software. During this work several problems/bugs were identified and reported to the Jodrell group. Also investigated was the Qt GUI toolkit to be used in building the system user interface. Two GUI windows for the system were designed. The first will list all tapes at JIVE with the ability to sort them in a variety of ways. A second GUI "detail" window will allow the user to manipulate the attributes of an individual tape entry.

Verkouter spent most of his time refining the transformation from MS to UVFITS, especially for use at Westerbork. The code was upgraded to be able to write SYSCAL information (Gaincurve, Tsys) as well as being able to write multi-source multi-baseband data to FITSfiles (which the already existing FITS-writer in aips++ cannot deal with).

The conversion program that converts raw correlator data into a MeasurementSet was updated. The user now can supply time, frequency and antenna information as well as source position, which will be

transferred to the MeasurementSet. With the help of this information uvw-values are calculated. This was needed to be able to let elementary Classic AIPS tasks run on the data (after conversion from

MeasurementSet to UVFITS). Classic AIPS is still needed because of the fact that calibration cannot be done in AIPS++ yet.

2.7 Infrastructure

All coaxial, signal and network cables for the connections and communication between the DPU's , Station Units and Correlator have been installed under the computer floor. The total length of all the cables under the floor is about 3 km.

For the network equipment, such as hubs, bridges and switches a network cabinet has been ordered and installed in the correlator room.

A terminal server for monitoring the Station Units has been purchased and installed. The monitoring information is currently available from any work station.

The World Wide Processing Activity Display (WWPAD) which displays on a world map the stations being correlated became ready this quarter. Leds have been installed and wired. Also the cables to connect the display to a PC were made. At the end of September the WWPAD was succesfully tested with the software written by Verkouter to to control the WorldWide Processing Activity Display (WWPAD). The software driving the PC-boards is controlled either via a RS232 serial line or from the keyboard.

Kramer produced a CGI interface for a program to print bar-code labels (http:// juw01.nfra.nl:9123/ label/label.pl). Furthermore, the program "iersdb" was created with use of the persistence classes. This program stores IERS data in a database. Preliminary shell-scripts were

created to fetch log-files and GPS files from the appropriate websites using ftp. Kramer carried out a local test with the storage program for the Paternoster. The result was that some changes in the program are required to make the procedure for loading and unloading tapes in and out the Paternoster easier.

Van Langevelde supervised the purchasing and implementation of new computer hardware for the JIVE correlator. The central computer, an HP C200 was purchased, configured and installed. A new Switch and Hubs that upgrade the JIVE corrrelator network to 100 Mb/s were installed.

2.8 Preparing for the opening and operations

Van Langevelde and Phillips started commissioning the data processor for the opening ceremony. This involved first upgrading the SUCH to the latest version, during which many problems were encountered. After that a areful step by step procedure was taken to ensure that no new feature were introduced in the process of making the processor opening proof.

Phillips also started initial astronomical analysis of the correlated data in AIPS++ and found that for simple recording modes the amplitude and phases behave as expected. However, for wider bandwidths

observations the signal to noise does not improve. It is unclear whether this is a problem with the increased bandwidth or an incorrect implementation of fanout modes. It was also found that 2-bit recording shows no improvement on the signal to noise. Pogrebenko and Phillips confirmed that is a problem in the SU or SUIM, as the magnitude bit of data sent to the correlator has a fixed value.

2.9. Thin Film Head array project

The first prototype thin film head array has been delivered to the Haystack observatory and Hinteregger is currently integrating the 6 single-bar subassemblies into a headstack. The specification for these TFH arrays still do not meet the needs for VLBI. Hence phase 2, which was planned for the Spring of 1998 and just achieved delivery, is not yet ended. Instead the Haystack Observatory is negociating with Seagate Technology Inc. the delivery in a phase 2B of a second prototype.

- Recording terminal upgrade, MkIII to MkIV (Spencer et al)

Formatters

MkIV upgrade

Agreement for a test of the remaining modes was made at the last TOG meeting. R. E. Spencer was to ensure that the experiment happened during the November session and JIVE staff were to coo-ordinate the test. Due to pressure of work this was overlooked, but luckily we have been able to fix up a test during time previously allocated for a real time fringe test on 27 November. D. Mackay is to go to JIVE to help produce the schedule.

VLBA upgrade

a) The new formatters (7) are being tested at Haystack. Delivery is expected soon.

b) Customs requirements demand that the formatter for Torun is installed into the Torun terminal in Bonn, before being shipped as a complete unit to Torun. This will require arrangements to be made between Bonn and Torun, dates will become clearer after delivery of the formatters.

c) Export arrangements for China are actively being arranged (by L. Gurvits). It is now clearer what the procedures should be and appropriate information has been sent to Allied Signal.

Manual

We are still waiting for the final version for this from GMR Associates.

Formatter installation requirements.

Quotations for extended NIM bins (VLBA Crates) to hold the MkIV formatters have have been sought from a number of suppliers by A. Freihold. We are waiting for replies before ordering. Unfortunately NRAO cannot supply them, and they are not available from European NIM suppliers.

Read/Write Electronics.

A reminder that stations with VLBA terminals will need to purchase a second headstack, inch worm drivers etc. to achieve full 1Gbit/sec capability.

Jouko Ritakari is in charge of the read/write electronics project at Metsähovi. An order will be placed as soon as the prices are known.

MPI Bonn has kindly agreed to produce the head assemblies (amplifiers, connectors and cables that connect directly to the recording heads) using kits of parts from Metsähovi. Student labour will be used for the cables.

Visit of Chinese engineers

Drs Hongbo Zhang and Wenren Wei visited Jodrell Bank from 4th August - 4 November funded by the Royal Society of the UK. During that time they have successfully installed and tested 8 and 16 Mhz filters on 30 'spare' filter boards (supplied by NRAL) for use at Urumqi. MHz filters are on order. They modified one of the Chinese video convertors for wide band operation, and have a supply of chip capacitors for modifying the rest. They took part in observing sessions and helped with general logistics etc., becoming familiar with VLBI operations. They constructed 3 phase-cal test units (one for China) and familiarised themselves in detail with MkIV read/write electronics and formatters. Altogether a successful visit.

For customs purposes it is best if the equipment is sent as one shipment to Shanghai. (MkIV for both Shanghai and Urumqi. This will require collection at one central point (JIVE), packing and shipping.

A further visit to Urumqi is required for thin tape path installation.

It is clear that Urumqi has a severe cabling problem. We are investigating sending 300 + m of Heliax to Urumqi.

Haystack Decoder

An outline design is available but it is unclear whether or not this is the best approach. Software on a separate PC plus appropriate data capture may give a more flexible and less obsolescence prone system. More investigation is required.

- Network Support Group Activities (Garrett, Aaron, Desmurs, Fridman,

Gurvits, van Langevelde, Massi, McKay, Mioduszewski, Polatidis,

Sjouwerman)

4.1 Network Monitoring, Reliability and Performance

No NMEs or FTT experiments were scheduled for EVN session 3, due to its small size.

As requested at the TOG meeting in June 1998, Mioduszewski arranged for the EVN stations to receive more detailed information w.r.t recording problems. These additional details include, for example, parity error rate about individual recorder tracks so that problems can be diagnosed with greater speed and ease. The standard VLBA PI letter template recommends that data with weights less than 75% be flagged. Mioduszewski revised this to state that non-VLBA antennas should be treated more carefully, so that good but low weight EVN data would not be inadvertently flagged by PIs.

McKay is in consultation with JPL concerning an existing software correlator for the proposed EVN real- ime fringe checking project. Work on a Field-System integrated version of the DBGET software is nearing completion. The first release of this new version will support only MkIII data buffers, but VLBA buffer support is also planned. So far, 14 new "SNAP" type commands have been implemented, but only one is really needed for real-time fringe checking. This command captures data at a specified time and FTPs the formatted results to the software correlator. Tests carried out during EVN session 2 proved successful, with data successfully captured and transmitted from four stations (Cambridge, Jodrell Bank, Westerbork and Medicina). Further tests are planned for EVN session 4 (1998).

In order to investigate the stability of the D-terms of the European Telescopes, Massi has compared the results of two independent VLBI runs. Small variations between the two sets of D-terms have been found. In order to judge the significance of such a variation an analysis of the final images has been performed. The parallel hand data of the second VLBI run, once corrected with the two different sets of D terms, have produced two identical images at the 3.5-sigma level.

This means that the observed variations in the D terms are negligible for the correction of the second order error in the parallel hand data. The implications of such a high degree of stability, if proved on longer time scales, are that the same set of D-terms can be used for many runs, thus improving the performance of the European network. A paper is in preparation.

Garrett wrote up a short report on the performance of the EVN (with particular relevance to expt GG034) to be included in the minutes of the TOG.

4.2 Calibration

Desmurs produced the ANTAB files for EVN session 3. Garrett reported a problem with the values used for Cambridge and these were corrected.

4.3 Data Correlation

Aaron (Bonn) resigned from his post in August as support scientist in Bonn. A search for a possible replacement was immediately initiated.

Mioduszewski was the contact for experiments V085S, V057G, V030C and V064A2. This involved checking schedules, facilitating correlation and checking correlator output. Mioduszewski also tested new AIPS SVLBI capabilities.

4.4 Space VLBI

4.5 Observing and Telescope Support

McKay and Polatidis supported telescope observations at their respective stations for the EVN session 3, 1998. Observing support activity was at a relatively low-level during this period due to the small size of session 3 - only two experiments were scheduled -due to last minute problems with HALCA.

Fridman has assembled and tested the new APEX injection phase-cal system at Westerbork.

Support provided by Desmurs at the Yebes telescope was further limited by continuing problems with the VLBA formatter - Yebes did not participate in any geodetic or EVN sessions during this period. The telescope will not be operational until early next year, once the MkIV formatter is installed.

McKay has coded a software message-repeater system for the NRAL "High Speed Link". This system has been extended and will be used for new telescope control/monitoring for Cambridge (and other MERLIN telescopes too). This system will be used for phase correction and Tsys acquisition, as well as being part of a general move to replace the old control/monitor system that is currently in place. Work continues on this project, in collaboration with the MERLIN software team.

Polatidis participated in the installation and testing of the UHF system on the 25 meter antenna and the measurement of radio frequency interference through the UHF band, in preparation for the October 1998 UHF VLBI observations. The UHF receiver is a ~1000 Jy system and the band is relatively free of RFI below the mobile telephone region at 900 MHz. Moderate RFI is seen at some frequencies higher than 1000 MHz.

4.6 General Network Support

Sjouwerman generated the Experiment Feedback Facility web pages for the September EVN session. Garrett continuously updated the "feedback from Socorro pages". Gurvits assisted in finding a temporary replacement for the faulty headstack of the VLBI recorder at Sheshan (China).

Gurvits was also involved in negotiations with the appropriate authorities in China and Poland with respect to the procedures to be followed for the import of MkIV formatters to these countries. Preparation of contractual documents for export of MkIV-upgrade hardware packages to China (Shanghai and Urumqi) MkIV-upgrade hardware packages were also initiated.

4.7 EVN PI Support

4.7.1 Scheduling

Gurvits assisted W.Tschager (Leiden U) in the preparation of schedule files for global VLBA observation of GPS sources at 15 GHz.

4.7.2 Support of Visitors to JIVE

During this period there were 4 visitors to JIVE for EVN data analysis: I. Fejes, M. Masheder, A. Kus and B. van Dam.

Sjouwerman maintained the JIVE visitor friendly workstation environment with its standard settings and set-ups. He maintained the test version of AIPS (15OCT98) and its 'midnight job'. Sjouwerman also maintained the EVNtech VLBI exploder and PC-SCHED software, and developed several scripts to aid him in managing the data disks that are used by the visitors on JIVE machines.

- Space VLBI

VSOP/HALCA

As an EVN representative in the VSOP In-orbit Checkout (IOC) group, Gurvits continued to participate in the scheduling and preparation of the VSOP in-orbit operations and evaluating their quality.

He took part in the evaluation of observing proposals received in response to the 2nd VSOP Announcement of Opportunity as a member of the VSOP Science Review Committee representing JIVE (replacing H.J. van Langevelde) and attended the meeting of this committee at ISAS (Japan) 20-22 July 1998.

Gurvits assisted in the preparation of a meeting of the VSOP International Science Council (Nagoya, Japan), and he subsequently attended this meeting.

RADIOASTRON

Gurvits organized a technical working meeting on the RadioAstron Moon-perturbed orbit (held in Moscow 6-8 July).

He also took on the chairmanship of the organizing committee of the scientific workshop "Radio Astrophysics of Extremely High Angular Resolution" (to be held in Woods Hole, MA, USA, 5-7 Oct 1998). He prepared the RISC meeting in Woods Hole (MA, USA; to be held on 7 Oct).

Gurvits assisted in the preparation of thermal-vacuum tests at ESTEC of RadioAstron antenna petals (conducted 11-16.09.1998).

- Research

Desmurs

Demurs' scientific output during the quarter was severely affected by a problem on the mother card of his work-station and the crash of one of the disks, which caused him to lose the results of more than 2 months of data reduction.

A new proposal for the EVN was submitted concerning observations of ground state OH maser.

He spent three weeks in Bordeaux observatory in July to reduce data from his project with the VLBA (BC075) in collaboration with F.Combes (P.I.). But the data at 43 GHz were not usable as the sub reflectors of a number of antennas were not correctly positioned. During his stay in Bordeaux, he wrote an article in collaboration with A. Baudry on the last part of project EB007. The article has been accepted by A&A.

Garrett

Garrett attended the ARISE Space VLBI workshop in Greenbank, and presented a talk on the impact the ARISE mission could have on the field of Gravitational Lensing. A brief summary of this presentation was also submitted to the workshop convenor, Jim Ulvestad, for inclusion in the first draft of the ARISE Science white paper. Garrett continued, at a very low level, to collaborate with Jin Chengjin (MPIfR) on the gravitational lens 1830-211.

Gurvits

Gurvits together with K.Kellermann and S.Frey finalized a study of cosmological applications of VLBI surveys data at 6 cm. A revised paper has been submitted to A&A (currently accepted).

Data reduction of VSOP observations of high-redshift quasars continued. Preliminary results on a high-z quasar 0014+813 are published in the "first" scientific VSOP paper (Science Magazine, see below) and in broader version presented at the COSPAR Scientific Assembly (Nagoya, July 1998; also submitted to Advances in Space Research). Gurvits together with S.Frey, Zs.Paragi, R.T.Schilizzi et al. continued to analyse data of global and EVN VLBI observations of ten high-z quasars, including the most distant known radio-loud quasar 1428+4217. The paper is in a final stage of preparation. Schedule files were prepared for global VLBA observations of three z>4 quasars (BG081, observed 3 Oct.).

Gurvits prepared schedule files for VLBA survey observation of 26 near-equatorial extragalactic sources at 15 GHz in support to the VSOP Survey Programme (BG077b, observed 27-28 Sep).Gurvits continued data reduction on and interpretation of pre-launch VLBA observation of 380 VSOP survey sources at 5 GHz (BH019).

Gurvits participated in preparations for the COSPAR Symposium E1.3 "VSOP mission and its results" (Nagoya, 16-18 July) as a member of its SOC. He is a guest editor of Advances in Space Research, the COSPAR scientific journal.

Gurvits continued to elaborate the scientific and technical case for the next generation Space VLBI mission. A concept of such the mission in the framework of the International Space Station has been

considered by ESA based on the document "Assembly, test and ..." (see below). Gurvits participated in preparations for the ARISE (Advanced Radio Interferometer between Space and Earth) Science Workshop (held in Green Bank, 19-21 Aug) as a member of the SOC. He participated in drafting a "white paper" document on the scientific case on the ARISE mission (as a member of the ARISE Science Advisory Group).

Van Langevelde

Van Langevelde started up a project with Vlemmings on phase referencing of nearby Mira variables. Some previous OH data from the VLBA was used to introduce Vlemmings to the subject. A observing proposal for a small sample was written

Massi

In order to investigate the stability of the D terms of the European Telescopes the results of two VLBI runs have been compared. Variations between the two sets of D terms have been found. In order to judge about the significance of such a variation, an analysis of the final images has been performed. The parallel hand data of the second VLBI run, once corrected with the two different sets of D terms, have produced two images equal at the 3.5 level. This means that the observed variations in the D terms are negligible for the correction of the second order error in the parallel hand data.

The implications of such a high degree of stability, if proved on longer time scales, are that the same set of D terms can be used for many runs, to improve the performance of the European network.

Three VLBI observations at 5 GHz of UX~Ari have been made during five consecutive days with the aim to study the variations of the source structure during the decay phase of a flare. We find that during the observations UX~Ari was undergoing a low-energy flare (peak flux ~60 mJy) with a decay time of a few days. The maps show a clear variation of the source structure with time. The visibility function and the maps can be reproduced using two gaussian components of angular dimensions ~2x1 mas, whose relative position changes. Since the observations have been made at different orbital phases, we interpret the observed variations of the source structure as due to two distinct flaring loops that are seen in different positions as the star rotates. (Franciosini, Massi, Paredes, Estalella. A&A in press)

McKay

McKay continues work on the MERLIN observations of GRS1915+105. A collaboration with Diana Haanikan (Helsinki) is now looking at the polarisation of early, post-outbust data from the Aug'94 event of GRO1655-40. Similarities between the GRS1915 and GRO1655 data suggest a comparable environment in the immediate vicinity of these two objects.

Mioduszewski

Mioduszewski received 2 more VLBA target of opportunity observations of CI Cam, a star which experienced a very unusual X-ray/radio /optical flare in April 1998. These show a slowly expanding remnant. Mioduszewski also participated (with Hjellming and Rupen (NRAO)) in observations of the new galactic relativistic jet source XTE 1748-288. Mioduszewski also spent the first week of July at Oxford University working with her collaborator, Katherine Blundell on their SS433 project.

Phillips

Phillips continued processing methanol VLBI data. He also prepared a poster for the Zermatt symposium on work from his thesis.

Polatidis

Polatidis scheduled and subsequently analysed data from 6cm VLBA experiment BM100 (PI M. Marcha, co PIs M. Bondi, D. Dallacasa). This project concerns the continuing investigation of a complete flux limited sample of flat spectrum radio sources. The analysis of the data so far revealed three new Compact Symmetric Objects whle the rest of the objects show core-jet structures. The analysis of the observations is still under way.

Polatidis has worked with D. Murphy in the analysis of the 4th epoch 6cm VSOP observations of the quasar 1928+738 during the later's visit to Onsala Space Observatory. Comparison of the 6cm VSOP observations with the 43 GHz VLBA observatoons analysed earlier have located the position of the higly inverted radio spectrum core to be at the extreme northmost end of the source. The multi-epoch VSOP observations also reveal structural changes occuring in the jet at ~10 mas from the core.

Sjouwerman

Sjouwerman pursued his research on the starburst episode, about 1-4 Gyr ago, in the Galactic nucleus.

- Education and training

Sjouwerman attended the IRAM "mm-interferometry school" in Grenoble, September 14-18

Gurvits continued to supervise a masters degree project by B. van Dam (Leiden University) on VLBI studies of high-redshift radio galaxies. He also continued to supervise S.Frey and Z.Paragi (former JIVE fellows) on their PhD theses.

- Meetings, work visits, symposia, conferences

Meetings, work visits, symposia, conferences		
Third Quarter 1998		
meetings, work visits, symposia, conferences	date	name
RadioAstron orbit working meeting, ASC, Moscow, Russia	6-8 Jul	Gurvits
COSPAR Sci. Assembly, Nagoya, Japan	13-18 Jul	Gurvits, Schilizzi
IACG SVLBI panel, Nagoya, Japan	18 Jul	Gurvits, Schilizzi
VISC meeting, Nagoya, Japan	19 Jul	Gurvits, Schilizzi
SKA Science Meeting, Calgary, Canada	20-23 Jul	Schilizzi
VSOP SRC meeting, Sagamihara, Japan	21-23 Jul	Gurvits

TSPU/SUIM testing, Bologna, Italy	27Jul-10 Aug	Pogrebenko
Haystack, USA and ATSC, UK	6 -13 Aug	Parsley
Metrum, Wookey Hole, UK	7 Aug-14	Casse
Workvisit Satellite Geodetic Observatory, Penc, Hungary	3-12 Aug	Gurvits
ARISE meeting, Green Bank, Charlottesville, USA	16-22 Aug	Gurvits
ARISE meeting, Green Bank, Charlottesville, USA	17-23 Aug	Garrett
Workvisit NRAO, Charlottesville, USA	22-25 Aug	Gurvits
NASA HQ, Washington DC, USA	25-27 Aug	Gurvits
IAU 191, AGB stars, Montpellier, France	26 Aug-5 Sept	Masheder
IAU 191, AGB stars, Montpellier France	27 Aug - 2 Sep	van Langevelde
Workvisit ESTEC, Noordwijk, NL	11 Sep	Gurvits
IRAM, Grenoble, France	12-20 Sept	Sjouwerman
Conference on "The Central Parsecs", Tucson, USA	7-11 Sep	Sjouwerman
3rd Cologne-Zermatt Symposium, Zermatt, Switzerland	22-25 Sep	Phillips
Metrum, Wells, UK	26-30 Sept	Parsley

- Presentations

Garrett

"Arise and Gravitational Lenses", ARISE S-VLBI Workshop at Greenbank. USA., 20 August.

Gurvits

"Recent results of the VSOP mission", Lebedev Physical Inst. Moscow, Russia, 7 July

"Dual-frequency VSOP observations of extremely high redshift quasars", COSPAR Scientific Assembly, Nagoya, Japan, 16 July

"Milliarcsecond scale compactness of extragalactic radio sources at cosmological distances", COSPAR Scientific Assembly, Nagoya, Japan, 17 July

"A concept of the second generation Space VLBI mission", COSPAR Scientific Assembly, Nagoya, Japan, 18 July

"Cosmological tests with the second generation SVLBI mission, ARISE Science Workshop, Green Bank, USA, 20 August

"SVLBI-2 and ISS", ARISE Science Workshop, Green Bank, USA, 21 August

"Overview and early scientific results of the VSOP mission", ESTEC, Noordwijk, NL, 11 September

Van Langevelde

"VLBI measurements of the parallax and proper motion of U Herculis", IAU 191, Montpellier France,

28 August

Schilizzi

"A morphological and spectral study of GPS galaxies and quasars" COSPAR General Assembly, Nagoya, Japan, 16 July

"Active Galactic Nuclei and the Square Kilometer Array", SKA Science Workshop, Calgary, Canada, 21 July

- Publications

Published:

M. Bondi, M.A. Garrett, L.I. Gurvits, "PKS 1117+146: a new Compact Symmetric Object", MNRAS 297, 559

J.F. Desmurs, A. Baudry, "VLBI Observations of 6 GHz OH masers in three ultra-compact HII regions", A&A 340.

H. Hirabayashi, H. Hirosawa, H. Kobayashi, Y. Murata, P.G. Edwards, E.B. Fomalont, K. Fujisawa, T. Ichikawa, T. Kii, J.E.J. Lovell, G.A. Moellenbrock, R. Okayasu, M. Inoue, N. Kawaguchi, S. Kameno, K.M. Shibata, Y. Asaki, T. Bushimata, S. Enome, S. Horiuchi, T. Miyaji, T. Umemoto, V. Migenes, K. Wajima, J. Nakajima, M. Morimoto, J. Ellis, D.L. Meier, D.W. Murphy, R.A. Preston, J.G. Smith, S.J. Tingay, D.L. Traub, R.D. Wietfeldt, J.M. Benson, M.J. Claussen, C. Flatters, J.D. Romney, J.S. Ulvestad, L.R. D'Addario, G.I. Langston, A.H. Minter, B.R. Carlson, P.E. Dewdney, D.L. Jauncey, J.E. Reynolds, A.R. Taylor, P.M. McCulloch, W.H. Cannon, L.I. Gurvits, A.J. Mioduszewski, R.T. Schilizzi, R.S. Booth, "Overview and Initial Results of the Very Long Baseline Interferometry Space Observatory Programme (VSOP)", Science 281, 1825

McKay, D.J., "A software correlator for the EVN", Proceedings of the Real-Time VLBI Forum, MIT Haystack, 1998.

Submitted:

R.P.Fender, S.T.Garrington, D.J.McKay et al. "MERLIN observations of superluminal motions in

GRS1915+105", MNRAS

S. Frey, L.I. Gurvits, Z. Paragi, W.K. Scott, "Milliarcsecond scale compactness of extragalactic radio sources at cosmological distances", Advances in Space Research (Proc COSPAR Symposium on VSOP)

E. Franciosini, M. Massi, J.M. Paredes, R. Estalella "Flaring loop structures at VLBI scale in UX~Arietis" A&A in press

L.I. Gurvits, S. Frey, R.T. Schilizzi, K.I. Kellermann, A.P. Lobanov, N. Kawaguchi, H. Kobayashi, Y. Murata, H. Hirabayashi, I.I.K. Pauliny-Toth, "Dual-frequency VSOP observations of extremely high redshift quasars", Advances in Space Research, (Proc COSPAR Symposium on VSOP)

L.I. Gurvits, "A concept of the second generation Space VLBI mission" Advances in Space Research, (Proc COSPAR Symposium on VSOP)

D.W. Murphy, S.J. Tingay, R.M. Preston, D.L. Meier, J.C. Guirado, J.E. Conway, A.G. Polatidis, H. Hirabayashi, H. Kobayashi, Y. Murata, 1998, "VSOP Monitoring of the Quasar 1928+738" Advances in Space Research (Proc COSPAR Symposium on VSOP)

R. T. Schilizzi, W. Tschager, I. A. G. Snellen, A. G. De Bruyn, G. K. Miley, H. J. A. Rottgering, H. J. Van Langevelde, Advances in Space Research (Proc COSPAR Symposium on VSOP)

Other papers:

ESA Document: Assembly, Test and Commissioning of a Space-based VLBI Radio Telescope at the International Space Station, Statement of Work for CCN#1 under ESA contract No. 12860/98/F/TB,

L.I. Gurvits