Summary

1. Institute

2. Dataprocessor Operations

3. Post-commissioning development on the EVN/MkIV Data Processor

4. Recording terminal upgrade to MkIV

5. EVN Support Group Activities
6. Space VLBI

7. Research

8. Education and training

9. Meetings, work visits, symposia, conferences

10. Presentations

11. Publications

12. Summary of work effort

Summary

During the quarter, 14 projects were correlated, taking up 65% of the 80-hour weeks. The remaining time went into correlator testing and network tests for the EVN. The operational efficiency for the quarter was decreased by the holiday period in August and by a procedural error that required re-correlation of 4 experiments.

At the end of the quarter, the processor was declared capable of handling over-sampled spectral line data, and 16-station global experiments. In the calibration tables associated with the data, a sign reversal in the antenna coordinates compared with the AIPS convention was identified and remedied.

On the hardware side, the DSPs on one of the correlator boards were tested for the first time. Another milestone passed this quarter was the correlation of the first observation requiring pulsar gating. The byte-slip problem in the station units has not yet been eliminated. A start has been made to improve the flow of dry air to the headstacks on the PBUs, and reduce the wear of the heads. On the software side, a new version of the JIVE Correlator Control Software was released in July, and finally taken into operation in September. A number of bugs in the Station Unit software were identified and removed. Work is continuing on the post-correlation software.

The EVN Support Group analysed Network Monitoring Experiments from the May-June session, and investigated the accuracy of the a priori station amplitude calibration. Correlation of experiments designed to test the feasibility of frequency-switched experiments in the EVN was also carried out. Help was provided to PIs in proposal writing, scheduling, and data calibrations and analysis.

Six papers describing astronomical research were published during the quarter, and a further 10 submitted.
The report by the European Science Foundation on the EVN and JIVE was published on 18 September.

1. Institute

Management

The management team met on 12 July and 11 September.

Gurvits edited and distributed to the JIVE Board members the Minutes of the JIVE Board meeting No. 13 (Espoo, May 2000).

European Commission

Gurvits continued to coordinate TMR-LSF RTD project "Enhancing the European VLBI Network of Radio Telescopes". During the quarter, one coordination teleconference on this project was held (27.09.2000). The second Annual Report on the project was prepared and submitted to the EC. He also assisted in re-organizing sub-project 3 of the TMR-LSF RTD project "Development of new experimental techniques in radio astronomy and VLBI" vis-a-vis the scope of participation in the study by the OAN (Alcala de Henares, Spain).

Gurvits took the minutes of the first informal coordination meeting of the two EC-sponsored networks, the Infrastructure Cooperation Network (ICN) in Radio Astronomy (ICN RA) and the ICN in Optical and Infra-red Astronomy (OPTICON). The meeting took place in Manchester 11 Aug 2000. Gurvits coordinated financial support via ICN RA and other source travel grants for 21 participants of the 5th EVN Symposium (Gothenburg, 29.06-01.07.2000) and via ICN-RA funding - for the participants of the ALMA workshop (MPIfR, Bonn, Germany, 02.10.2000).

The annual report and associated cost statement for the Concerted Actions contract (FINA) was submitted to the FINA coordinator by Garrett. The task of creating a draft short-list of IHP Users using the new Excel database system was begun but not completed. Additional material was provided w.r.t. the TMR Final Report (TMR Access Contract ERBFMGECT950012) submitted in quarter 2.

International collaboration

Gurvits discussed with I.Fejes (Director, FOMI SGO, Penc, Hungary) the state of collaboration under the auspices of the NWO-OTKA grant during the visit of I.Fejes to Dwingeloo in August 2000. On the request of FOMI SGO, he obtained permission from NWO for particular spending items within the project budget for 2000.

Fejes and Gurvits prepared for submission to the NWO the first semi-annual report on joint activities under the NWO-OTKA grant.
Gurvits together with R.Strom (ASTRON) prepared and submitted to KNAW (the Dutch Academy of Sciences) a proposal for continuation of collaboration between Dutch and Chinese radio astronomy institutes in 2001. Gurvits prepared a visit to JIVE under the current KNAW grant a PhD student from the Beijing Normal University, Zhang Haiyan, for a half-year fellowship in Dwingeloo (to start in October 2000).

Review of the EVN and JIVE

- The ESF report was published on 18 September. Discussions began with the JIVE Board and NWO concerning the strategy to be followed in achieving a multi-lateral agreement at Research Council level on future funding for JIVE operations and development.

Publications

Gurvits continued the editing the "EVN and JIVE Annual Reports for 1999".

The reports were ready for submission to the printers at the end of the quarter.

Events

Reynolds produced posters for the JIVE stand at the IAU in Manchester in August. Reynolds also worked with Anita Richards (Jodrell Bank) on producing posters for the EVN/MERLIN section of the Jodrell Bank Observatory stand at the IAU.

- Personnel matters

Ian Max Avruch joined JIVE on August 21 as a Support Scientist in the Science Operations section of the Data Processor Group.

Erik Brogt, a student from Groningen, joined JIVE in August for 2 months to work on the JIVE and EVN Web pages. By the end of his period of employment, the web pages had been upgraded with a fresh look and the corresponding file structure had been rationalized.

Infrastructure

Schonewille updated several JIVE-web pages. Phillips shared writing the minutes for the JIVE meetings with Sjouwerman, Gabuzda, Campbell and Reynolds. Garrett assigned computing resources to visiting scientists and monitored e-mail from the generic JIVE account. Garrett and van Langevelde attended monthly meetings with the Computer System Management group.

Visitors
### Visitor List

<table>
<thead>
<tr>
<th>Visitor</th>
<th>From</th>
<th>Date</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Roy</td>
<td>MPIfR, Bonn</td>
<td>10 – 14 Jul</td>
<td>Reduction of ER0088</td>
</tr>
<tr>
<td>P. Augusto</td>
<td>Univ. of Madeira</td>
<td>3 – 13 Jul</td>
<td>Analysis of EVN Data</td>
</tr>
<tr>
<td>Jiyune Yi</td>
<td>Onsala Space Obs.</td>
<td>17 Jul – 14 Oct</td>
<td>EVN observations of 6.7 GHz Emission from a proto B star</td>
</tr>
<tr>
<td>A. Kus</td>
<td>Torun Centre for Astronomy</td>
<td>5 – 8 Aug</td>
<td>VLBI discussions</td>
</tr>
<tr>
<td>C. Walker</td>
<td>NRAO, Socorro</td>
<td>20–23 Aug</td>
<td>SCHED discussion</td>
</tr>
<tr>
<td>M. Aller</td>
<td>Univ. of Michigan</td>
<td>18–26 Aug</td>
<td>Collaboration on VLBA observations of a sample of BL Lac Objects</td>
</tr>
<tr>
<td>H. Aller</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I. Fejes</td>
<td>Satellite Geodetic Obs.</td>
<td>28 Aug - 8 Sept</td>
<td>NWO – OTKA Collaboration</td>
</tr>
<tr>
<td>S. Frey</td>
<td>FOMI SGO</td>
<td>18 Sept – 20 Oct</td>
<td>EVN data reduction and scientific collaboration</td>
</tr>
<tr>
<td>A. Pusharev</td>
<td>Astro Space Centre, Moscow</td>
<td>21 Sept – 17 Oct</td>
<td>Analysis of VLBI data for a complete sample of BL Lac objects</td>
</tr>
<tr>
<td>A. Gunn</td>
<td>Jodrell Bank</td>
<td>28 Sept – 1 Oct</td>
<td>EVN calibration software installation</td>
</tr>
</tbody>
</table>

### 2. Dataprocessor Operations

(Campbell, Kramer, Van Langevelde, Leeuwinga, Phillips, Schonewille, Tenkink)

#### 2.1 Introduction

Production correlation of user experiments was the main activity (65% of the 80 hr weeks) during this quarter. Around 25% of the correlator time is spent on testing, while the remainder goes into checking out experiments (clock searching and NMEs). During production we reach over 30% efficiency, which results in about 15 hours of effective experiment time per week. The operational efficiency was substantially decreased in the month of August, not only because of the holidays, but also because of a procedural error which required us to re-correlate 4 projects.
There are still a few concerns about the data quality. We have reviewed how AIPS interacts with JIVE data, and fixed a number of things in this area.

2.2 Production

In this quarter we completed 14 projects (7 user and 7 tests/NMEs). Note that various test experiments and check-outs take a substantial fraction of our time. Unfortunately 4 experiments had to be redone after initial completion. There were a number of mistakes made especially during the vacation time. The most serious of these was that one of the station units was running for 4 weeks with a test version of the internal software. This specific version would produce fringes, but the data would show biases in phase, and was deemed useless. Another operational problem is the difficulty to identify problems in the playback units. There is pressure to come to weekly check out procedure of correlator equipment.

The re-correlation of a number of projects and the expansion of the support group allowed us to keep up on the distribution of user data. The same number of projects were distributed as were completed. Apart from tests/NMEs, it remains difficult to make PIs agree to release their tapes. For 8 projects PIs were prompted, only one reacted positively.

Campbell overviewed the correlation, review, and data distribution of EH007A/B, EP031B, EO004B/C, EH006, EC014, ET008, ES031. Avruch and Campbell performed clock-searching and fringe-finding on experiments ET008 and EC014. Phillips supported clock searching in EK010A and processed part of ER011. Van Langevelde supported EK010A, which was distributed to the PI. This project served as an example to iterate on the standard plots.

There were various tours of the correlator, notably to students in computer science from the "Hogeschool Leeuwarden" and a representative of the ministry of O&W.

2.3 Correlator testing

During this quarter the two May NME’s were processed, and most of the September NME. Recorder tests for the September session were done as well as the session Fringe test. In addition there were tests to check out the VLBA4 stations and a test to verify the Chinese telescopes. A pulsar observation was processed to exercise the pulsar gating hardware.

FP001 was a pulsar-gate test observation of a regular (P=0.71s) pulsar bright enough to be seen without gating. Campbell and Pogrebenko supervised a test that exercised the ability to replicate some number of individual channels 2, 4, or 8 times, and then to apply different pulsar-gate waveforms onto each replicated channel. All combinations up to a total of 8 replicated channels (4x2, 2x4, 1x8) were tried, and the expected behavior was found, a reciprocal gate-width behavior in the correlation amplitude. A further planned test observation (incorporating absolute synchronization of gate phase with ROT, replicating 16 channels, and checking more rigorously the quadratic phase-representation algorithm with ms-PSR data) has been pushed back to November because of some key-antenna unavailability in the September session.

Campbell looked into the new phase-referencing test observation FR005. Results point out that some EVN station positions may not be adequate for phase-referencing at 6cm. A sub-array of stations that participate in geodetic campaigns yields reasonable phase-referenced maps for this test, but inclusion of other stations (Jb, Wb, Tr) markedly degrades the phase-referenced maps. Work has begun on seeing
what station position offsets can be estimated from residual delay rate or single band delay from already-correlated experiments.

Van Langevelde and Avruch supported CHIN01, a second test to verify the Chinese stations were working properly after the visit of the upgrade team. It showed that Shanghai was now OK, but could not confirm proper functioning of the Urumqi station.

Van Langevelde supported C00R3, the recording test for the September session. Only 5 stations participated and a number of problems were encountered. A report was issued just before the session, but unfortunately it was lost on the evntech exploder for a couple of days.

Avruch and Van Langevelde ran a series of tests on the correlator, investigating the maximum internal resources and output data rates achievable with the current firmware and software. Some problems in correlator configuration software were identified and are being fixed.

Avruch performed the clock-search on the network evaluation experiments FT003 and FT004 with Reynolds, and some irregularities reported to the participating stations. With Gabuzda, the network monitoring experiment C00C3 was correlated. This produced fringes to Urumqi observatory for the first time since it was upgraded to MkIV.

2.4 Logistics

Campbell revised the pre-correlation and clock-searching guides to incorporate new advances (the new on-line fringe display, script-based VEX-file clock updating, etc.). He also created a new data-review guide for the post-correlation to FITS-file process.

Kramer continued to work on programs that support the operations. He wrote an offline perl program, called mounted, that shows which tapes are mounted on the playback units. The program loops over all playback units. Then it uses test program pgtest to get the identity of the mounted tapes. Kramer also changed the logbook such that it now reports the positions of the stations on the playback units.

Van Langevelde made progress on designing and implementing a GUI for the experiment administration. A tool to compose e-mail to groups of users was also finished.

Schonewille made schedules for the operator shifts. He oversaw that the tape-library remained up to date and he arranged tape transports.

2.5 Astronomical Capabilities

On August 7 we reviewed the current capabilities of the correlator and specifically the progress on spectral line capabilities. Although we had built up confidence that oversampling was working properly in the latest correlator version, we could not accept the bulk of line experiments in the September session. Because the "DSP project" was delayed, the correlator capacity is not sufficient yet for these. Another issue was the short integration times requested for many Methanol projects that do not have very accurate source positions. The data processor is currently not capable of producing integration times shorter than 2 seconds.
The interaction of the JIVE FITS data and the standard AIPS calibration was reviewed in a few meetings. A number of problems were identified and mostly fixed. These had to do with station Y coordinates being inverted with respect to the AIPS convention (now fixed). This caused a small problem when applying a-priori system temperatures (for EVN antennas which are close to longitude zero; the problem is more serious for VLBA antennas or antennas such as Shanghai). It was also found that u,v,w and phase definition having opposite, but canceling in Stokes I, sign definitions (will be fixed in next major release). There were also other inconsistencies: the values of the Earth-orientation parameters, leap-seconds, source coordinates precessed to epoch, and the definition for the bandwidth/frequency parameters. The determination of the actual conventions that were needed often came only through investigation of the AIPS code itself.

Phillips made a careful audit of AIPS code and in a few places VLBA specific code was discovered. In a number of places AIPS takes the wrong strategy because it does not (yet) recognize EVN/JIVE data. This also prevents us from using the IDI FITS standard, because FITLD has VLBA specific corrections. Another problem are the slightly incorrect application of the Earth rotation part of Doppler corrections. Spectral line bandpass correction should also take into account how fringe rotation was performed, but it does not. This only will have a serious effect for high frequency observations (> 20 GHz).

Van Langevelde sent a letter to all JIVE users pointing out the potential problems one can encounter when processing JIVE data in AIPS.

3. Post-commissioning development on the EVN/MkIV Data Processor

(Bos, Buiter, Campbell, Casse, Hazell, Kamphuis, Kramer, Van Langevelde, Leeuwinga, Millenaar, Noble, Olnon, Parsley, Phillips, Pogrebenko, Schonewille, Tenkink, Verkouter, Zwier)

3.1 Correlator Section

Kamphuis worked on the correlator board DSP software and discovered several hardware problems on the correlator board, related to the DSP functionality. These hardware problems were solved by making modifications to the correlator board. Testing of modified correlator boards indicate that normal operations are not affected by the changes and that the boards are now capable of running the DSP software.

Kamphuis and Bos achieved a milestone by using the DSPs on the correlator board to perform measurements. This setup is now to be extended to include integration on the correlator boards.

3.2 Station Units

Investigation of byte slip problem continued involving the efforts of Pogrebenko, Campbell, Phillips and Leeuwinga. A controlled process of swapping various boards among station units isolated the byte slips to a specific set of DMMs. Operationally, the byte-slip problem, which would necessitate re-correlation of affected sub-jobs, has been localized sufficiently that we can avoid its effects with a fair degree of confidence for the typical experiment currently in the
queue. The real physical reason of their occurrence is however still not understood and work on deeper, board-level testing continues.

Szomoru and Hazell continued testing of JIVE-build SUCC-code (RAM.HEX). It was shown that at some basic modes JIVE-build software is fully compatible with that built at Haystack. Phillips tracked down a "too small queue" bug in the SUCC software and initiated a fix by Szomoru and Hazell.

### 3.3 Play Back Units

Only a few problems occurred with the DPU hardware. A couple of dead tracks on DPUs 11, 12 and 15 were repaired by Buiter. These were caused by loose emitter follower boards in the head connectors. The boards move out of the head connectors by the movements of the cables from the boards to the pre-amplifiers. The construction of these parts is critical and movements need to be avoided in this area.

In August Parsley met the representative of TDM Tape Services Ltd. in the UK. This company specialises in the supply, certification and maintenance of professional recording media. TDM agreed to accept samples of JIVE thin tapes (Quantegy 741) and to investigate supply of ready-to-use tapes and recovery of badly packed tapes.

Parsley successfully modified the DPU Position-Tape-to-Footage (MPTTF) algorithm to operate at 360ips (fast spooling speed). Timed slews have been abandoned in favour of direct monitoring of tape footage. The routing of requests for footage and low tape status has been changed so that these indications can be read whilst Position-Tape-to-Footage is in progress. The new version is installed on all DPUs as version 3.0.

### 3.4 SUIM/TSPU

No significant activity during this quarter.

### 3.5 High level control software

** Releases 

Early July Olnon released a new version of the JCCS (JIVE Correlator Control Software). Its main objective was to make it easier (or even possible) to process observations with not-so-simple schedules: stations dropping in and out from scan to scan, tapes starting a bit later than the others, long tape stops between scans, short scans, and multiple tapes per station.

The new release did do all that properly, but problems were detected when reviewing the final correlated data. Somewhere in every sub-job, there was two minutes of data lost for all baselines to one station. This could occur for any station anywhere in the sub-job, such that the loss starts at some multiple of 2-minutes from the beginning of the sub-job and lasts exactly 2 minutes. The operations team therefore kept using the old March release for production throughout the holiday season.

In September Olnon and Phillips identified and removed the bug: the retrieval of a single set of model data from persistent storage failed in a subtle way we still don’t understand completely. After the patch the new release
performed well; affected sub-jobs (from a couple experiments) were re-correlated.

Olnon and Phillips built several secondary JCCS systems based on the July release to allow testing of various development and performance issues, such as oversampling, pulsar gating, changes in the Station Unit software, and changes on the Correlator boards.

Development

Phillips worked with Olnon to make changes to SU_CONTROL and CORRELATOR_CONTROL to allow specific channels in the station unit to be duplicated arbitrarily (and correlated). This is needed for initial tests of pulsar gating and will be used eventually for multi-field correlation. Phillips added a gating option to SU_CONTROL for initial pulsar gating tests.

Olnon and Szomoru continued to work on problems in the somewhat more hidden areas of the control software. These usually manifest themselves as annoying limitations in the actual operational procedures: why can't we process (parts of) single scans (very useful for clock searches); why do we still have to trick the control program into accepting irregular but valid sequences of scans (hand editing the VEX file); why can't we reliably run several/many sub-jobs in a batch-like procedure (too many unsolicited shut-downs); why can't we use the Experiment Database to do just that (problems with the persistence database)?

Olnon, Verkouter and Szomoru also started to seriously work on the portability of the JCCS System. We must be able to build and run JCCS on different hosts with different operating systems and different compilers. Our short-term aim is to use the newest GNU C++ compiler on all our operational and development machines instead of the machine-specific, and in the case of HP even obsolete, compilers. An additional benefit of such a new ANSI compatible C++ compiler is the possibility to start using the Standard C++ Template Library for all kinds of low-level support routines. That compiler also demands a better quality of C++ code, which will lead to more robust and stable control software.

The MERLIN group is partly using the same control software as we are. They are already using the compiler we want to switch to, although they run it on a SUN workstation. Noble improved some of the software we share, and Olnon continued that effort by systematically adding the const property to all output functions and adapt the depending code where necessary.

Szomoru has started investigating the persistency scheme in detail in connection with the experiments and polynomial databases. He has tested and compared the performance of two types of relational databases (mSQL and MySQL) using different methods of storing arrays. He also has written an interface between correlator control software and MySQL, which has the advantage of supporting multithreading. The final problems in upgrading the embedded station unit control software to a JIVE-owned and up-to-date version of the operating system

Maintenance

End of July Olnon did another re-synchronization operation on our CVS code repository to integrate the changes by the MERLIN group in the code we share. After a year of independence from each other the divergence is beginning to show. We still benefit from bug fixes made in Jodrell Bank, but the overlap area becomes smaller and the actual work involved in synching those areas increases.

Olnon is trying to keep the JIVE code repository in such a shape that a new release or test system can be made any
time and "on specification", and that an old release can be recreated any time to posthumously analyse problems. Olnon's main task is then to keep track of the various development streams and merge them into the main stream at the most opportune time. With relatively few people contributing code and thanks to the discipline accepted by these people, this scheme still works with an acceptable amount of overhead.

3.6 Post correlation software

Verkouter spent the bulk of his time on changing the msfiller (j2ms2) and the FITS-writer (tConvert) code to accommodate the imminent changeover in the AIPS++ project from MeasurementSet version 1 to MeasurementSet version 2. Together with these modifications the code was cleaned up in places and modifications were made to write the Earth-OrientationParameters correctly in the produced FITS-files. This last item is especially important when trying to do spectral line VLBI or antenna calibration.

More features were added to the JIVE specific plotting software (jivegui). Feedback of users was incorporated. Adaptation of the jivegui to MeasurementSet version 2 was started but is work in progress.

Avruch began writing a program to semi-automate correlated data tape labeling and distribution.

3.7 Infrastructure

The compressor of the dry air system was replaced this quarter by a tubular fan with a higher capacity. This is in order to supply more dry air to the heads of the DPU's. A start was made to modify the DPU decks in such a way that the dry air is supplied more directly to the environment where the heads make contact with the tape.

150 thin tapes arrived on 3 July. Buiter developed a procedure to re-reel the thin tapes from the manufacturers metal reel onto a self-packing glass reel. DPU 13 is modified and set apart for this purpose. A successful test was done with 7 tapes. The rest has to wait for the delivery of the ordered self-packing glass reels. Buiter wrote a report: "Procedure for the re-reeling of thin tapes" (EVNDOC #110)

An order was placed at NRAO to obtain 600 empty blue cassettes for the new thin tapes.

Contacts were made with companies that are able to produce the foam inserts for the tape cassette boxes. At the end of this quarter an order went out to produce 650 foam inserts. An order was placed for the production of 600 aluminium latches to replace the plastic latch of the tape cassettes.

3.8 Testing and preparing for operations

Phillips made modifications to SU_CONTROL and tested some modified station units (with an updated SUCC) to get the first fringes with over-sampled data. The initial results look very promising and a better-designed experiment has been scheduled and observed to make a more quantitative judgment on the results.

Phillips also experimented with automated plots using a template text file to produce Glish code to make the plots.

3.9 Post Correlator Integrator
Kamphuis changed the Post Correlator Integrator software to a similar setup as the correlator board DSP software. This means that the Post Correlator Integrator can now be operated in the same way as the correlator boards, making the use of the unit more transparent.

4. Recording terminal upgrade to MkIV

VLBA – MkIV upgrade

In preparation for the upcoming EVN CBD meeting in Madrid (December 2000), Gurvits discussed with various authorities in Ukraine and USA possible arrangements for upgrade of the MkIII terminal in Simeiz to the MkIV level.

e-VLBI/Real-Time Correlator

Some of Verkouter’s time was spent on the continuing development of the new rtc software, rtc++. The 'data area' handling is working, i.e. incoming files are detected, parsed and checked if they are valid RTC-datafiles. The 'experiment database area' is functional, i.e. properties of an experiment are parsed from the drudge file rather than from the commandline. The 'web area' is basically functional: the structure of the website is built up correctly, the archive is persistent (no links to already correlated stuff are lost, as is the situation now).

5. EVN Support Group Activities

(Campbell, Gabuzda, Garrett, Gurvits, van Langevelde, Reynolds, Sjouwerman)

5.1 Network Monitoring, Reliability and Performance

Sjouwerman, Reynolds and Gabuzda scheduled and correlated the September Network Monitoring Experiments. A report was circulated to the stations via EVNtech. D. Gabuzda continued to work on the analysis of the network monitoring experiment C00C1 (high dynamic range JIVE correlator test).

H.J. van Langevelde, N. Schonewille, B. Kramer, and I. Avruch evaluated EVN station tape performance in experiment C00R4. Recorded tapes from EVN stations Medicina, Noto, Onsala, Shanghai, Westerbork, and Yebes were read and data quality statistics compiled and reported to the network.
The test observation CHIN01 on behalf of Shanghai and Urumqi observatories (PI Tuccari) was correlated by H.J. van Langevelde. Fringes were found to Shanghai. The network evaluation experiments FT003 and FT004 were clock-searched with C. Reynolds, and some irregularities reported to the participating stations. With D. Gabuzda, the network monitoring experiment C00C3 was correlated and produced fringes to Urumqi observatory, the first fringes since the data acquisition system was upgraded to MkIV.

5.2 Calibration

Reynolds worked with Alastair Gunn (Jodrell Bank) to produce the ANTAB files for experiments from session 2/2000. It was agreed that Reynolds would be responsible for producing ANTAB files for the September session.

5.3 Data Correlation

Avruch, van Langevelde and Reynolds correlated fringe test experiments FT003 and FT004. Reynolds and Sjouwerman correlated Network Monitoring Experiment C00C3. Reynolds and Sjouwerman correlated high resolution spectral line experiments EM039, ES033 and ES036 at the VLBA correlator in Socorro.

5.4 General Network Support

Campbell analysed the data from FR005 - a phase-reference test for the correlator. Analyzing the data highlighted the possibility of poor station coordinates for those telescopes that do not participate in geodetic network observations. In hindsight, the attempts to see improvements in the residual-phase behavior by adding station-position adjustments via CLCOR were foiled by the FITS-table problems discussed in Sect. 2.6 of this report. The analytic portion of estimating station position offsets via residual delay rates has been completed (but not yet coded into glish); the opportunity to apply this to the 12-hr NME C00C1 will hopefully present itself shortly.

Gurvits arranged a contract with the Oriental Scientific Instruments Shanghai Impex Ltd. on the purchase by the Shanghai Astronomical Observatory thin tapes for EVN operations.

Gurvits assisted in organising a visit to Westerbork of an engineer from the Ventspils International Radio Astronomy Center (VIRAC, Latvia). The visit could result in the donation to VIRAC of some redundant WSRT equipment.

Sjouwerman generated the Experiment Feedback Facility web pages for the September EVN session and updated some EVN web pages. Sjouwerman and Verkouter discussed Verkouter's aips++ software for scrutinizing JIVE correlator data.

Garrett was involved in coordinating a TOG/Team China repsonse to the problems associated with the performance of the Chinese antennas after the upgrade to MkIV. Tucarri (IRA) took the lead, and organised various fringe tests (see section 5.1) remotely diagnosing cabling problems at both stations. Once rectified fringes were found to both stations. Discussion with Ed Himwich were initiated with respect to possible developments in the FS directly associated with EVN requirements. Garrett followed the progress made with
respect to firmware upgrades in the formatter (Graham, MPIfR and Smythe, Haystack) and Two-head recording (Smythe et al.). Preparations were made w.r.t. the TOG meeting in Torun. Together with Garrington (JBO), Garrett chaired the Evn Users meeting held during the EVN Symposium in Onsala. Garrett produced and circulated an advert for the ICN coordinator.

Garrett updated the content of the EVN Web Pages. Frames were introduced by Erik Brogt (summer student) to improve navigation.

An EVN poster was created by Reynolds & Garrett and displayed in Manchester at the IAU general assembly. EVNtech was successfully transferred from the Novell system operated at Dwingeloo, to a majordomo system at Jodrell Bank.

5.5 EVN PI Support

D. Gabuzda provided scheduling support for EVN experiments EC015B (Y. J. Chen) and ET007 (W. Tschager) for the June 2000 session. Phillips supported EM039 (McDonald).

Gurvits provided support to and collaborated with S. Frey visiting JIVE from 18.09 - 19.10.2000.

5.5.1 Scheduling

During a visit of Craig Walker, Van Langevelde begun working on 2 head recording modes in Sched. Most of it was implemented by the end of the quarter. Several users required a patch to Sched from Van Langevelde in order to be able to schedule oversampling experiments for the JIVE correlator.

During the S/X session in May it was realized that Sched does not support the patching scheme used by geodetic stations. This requires some work, and for the time being considerable manual intervention is required to accommodate the geodetic stations for EVN observing.

5.5.2 Support of Visitors to JIVE

D. Gabuzda provided data calibration and analysis support for EVN experiments ER008B (A. Roy) and ET003 (V. Tornatore) and for global VLBI experiment GA018 (P. Augusto).

5.5.3 Local and Visitor Computing Environment

Sjouwerman maintained the JIVE visitor friendly workstation environment with its standard settings and setups.
6. Space VLBI

Gurvits continued to participate in supporting VSOP operations, particularly, joint EVN-HALCA observations.

Gurvits prepared a meeting with ESA representatives aimed at defining the format of ESA participation in the VSOP-2 project. The meeting is tentatively scheduled for the send half of November 2000.

7. Research

Campbell

Continued to provide ionospheric simulations to D. Lebach (CfA) in support of VLBI astrometry related to the GP-B guide-star program and to collaborate with S. Britzen (NFRA) observations and theoretical interpretation of the OVV PKS 0420-14. Reviewed e-MERLIN science-case draft per request. Drafted manual/guide for exporting totals for MkIII experiments processed at Bonn for J.-F. Lestrade. Worked with N. van der Valk (T.U. Delft/Fokker Space) going over ionospheric considerations related to a future P-band synthetic-aperture biomass mapping satellite.

Gabuzda

Comparison of 6 cm VSOP space VLBI total intensity and polarization images of the BL Lacertae object 0735+178 with 2 cm VLBA images (with nearly the same resolution) obtained by J.-L. Gomez about a month later revealed very good correspondence in the structures at the two wavelengths in some places and intriguing discrepancies in others. Analysis of the two images together with VLBA images at 1 cm and 7 mm indicates the presence of appreciable absorption near the first of two nearly 90-degree bends in the VLBI jet, suggesting that this bend may be associated with a collision or interaction with a dense cloud. These results are in preparation for submission to the Monthly Notices of the Royal Astronomical Society.

Garrett

Garrett continued to write-up the EVN observations of faint microJy radio sources in the Hubble Deep Field. Garrett produced some text w.r.t faint radio sources at high redshift for the LOFAR scientific case. A global VLBI proposal targeting the HDF was submitted. A paper discussing "WSRT 1.4 GHz observations of the HDF" was submitted and accepted by A&A letters. The associated interactive HDF catalogue was placed on-line (www.jive.nl/~mag/hdf)
Gurvits

Gurvits began statistical studies of the VLBI images of more than 300 extragalactic radio sources from the VSOP/VLBA Pre-launch survey at 5 GHz (Fomalont et al. 2000, ApJS, in press). The preliminary results have been presented at the IAU Symposium No. 205 (Manchester, UK, August 2000).

Gurvits continued to post-process data from the VLBA survey at 15 GHz of VSOP Survey sources (the project BG077).

Gurvits and S.Frey obtained preliminary results of the MkIV project ES034 (correlated at JIVE) on the set of quasars at z>4.

Gurvits and S.Frey finalized data reduction of the VLBA observations at 5 GHz of a sample of extremely high redshift quasars. In one of the quasars, 1713+218, an unusually prominent for z>4 object "core-jet" structure has been revealed. The study also involves data from VLA, MERLIN and ROSAT.

Gurvits continued to participate in the reduction and analysis of the VSOP Survey data. The status report on the Survey was presented at the IAU Symposium No. 205 (Manchester, UK, August 2000).

Gurvits participated in preparation and submission of three VSOP observing proposals as a co-I and one proposal as a PI.

Van Langevelde

Van Langevelde is collaborating with Vlemmings (Leiden) on several projects. New VLBA data was obtained on astrometric monitoring of circumstellar OH masers. MERLIN observations of water masers in one of the sources turned out to be affected by a technical problem.

In collaboration with Sevenster (Mt Stromlo), van Langevelde worked on a paper about the VLA part of a survey for OH/IR stars.

Phillips

Phillips spent 3 days in Onsala, Sweden, discussing various aspects of methanol masers.

Phillips continued processing some ATCA and EVN observations of Northern methanol masers.

Phillips submitted a proposal to use BIMA to image high density tracers associated with methanol maser sources.

Sjouwerman

With Messineo and Habing (both Leiden) Sjouwerman observed 86 GHz masers of ISOGAL AGB sources in the Galactic center with the 30-m IRAM telescope. This detection experiment was very successful (with a detection rate of about 70%), most likely because of proper selection criteria. A follow-up proposal was submitted.

With J. Dickel (U. Illinois, temporarily at ASTRON), Sjouwerman combined 8.4 GHz high-resolution archival VLA data of
the center of M31 (M31*) and discovered a number of SNR's and point sources of yet unknown origin. Sjouwerman prepared a poster presentation of this result for a conference in October. A VLBA proposal was submitted to investigate possible phase-reference sources to target some of these sources with VLBI in the near future. The possible phase-reference sources were selected from observations made with MERLIN in April after analyzing the maps made in the summer. Meanwhile preparations were made for L-band observations of the central parts of M31 with MERLIN in October and November, and arrangements were made to obtain near-simultaneous Chandra X-ray observations of the nuclear source with M. Garcia (CfA).

Reynolds

With Gabuzda, Tim Cawthorne (University of Central Lancashire) and Alexander Pushkarev (Astro Space Center), Reynolds submitted a proposal to the VLBA to perform Faraday rotation measurements on a number of BL Lac objects.

Avruch

Avruch is contributing to the VSOP Survey program by reducing experiments from the database of observations. These experiments were performed with the HALCA satellite and telescopes in the southern hemisphere.

With Dr. Pearson (ISAS, Japan), I. Avruch is investigating the sensitivity of new and planned astronomical instruments to the population of galaxies at high redshift, and what details of galaxy formation and cosmology may be constrained by observation.

Pogrebenko

With Campbell, Phillips and Olnon Pogrebenko developed ow-level software for manual control for pulsar gating processing in TSPU and SU. Test observations of PSR 0359 were processed with no-gating and gating 1:2, 1:4 and 1:8. Correlation results show corresponding increase of signal to noise ratio in accordance with theoretical estimations. Results of this test processing were reported by Campbell at IAU meeting at Manchester in August this year. New set of test observations of PSR 0359 and Crab have been scheduled for the November EVN session. Work on definition of a pilot project for optical fiber connected EVN continued this quarter.
## 8. Education and training

<table>
<thead>
<tr>
<th>SUPERVISION</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Staff member</strong></td>
<td><strong>Student</strong></td>
<td><strong>Institute</strong></td>
<td><strong>Degree</strong></td>
<td><strong>Subject</strong></td>
</tr>
<tr>
<td>Gurvits</td>
<td>S. Frey</td>
<td>FOMI</td>
<td>PhD</td>
<td>VLBI studies of extremely distant quasars</td>
</tr>
<tr>
<td>Vermeulen and Gurvits</td>
<td>Z. Paragi</td>
<td>FOMI</td>
<td>PhD</td>
<td>Milliarcsecond structures in galactic and extra galactic radio sources</td>
</tr>
<tr>
<td>Gabuzda</td>
<td>V. Chernetskii</td>
<td>Sternberg Astronomical Institute, Moscow</td>
<td>undergraduate research student</td>
<td>Multi-epoch, multi-frequency study of the BL Lacertae object 1803+784</td>
</tr>
<tr>
<td>Gabuzda</td>
<td>A. Pushkarev</td>
<td>ASC, Moscow</td>
<td>PhD</td>
<td>Polarization Properties of BL Lac Objects</td>
</tr>
<tr>
<td>Gabuzda</td>
<td>N. Garnich</td>
<td>Sternberg Astronomical Institute, Moscow</td>
<td>Undergraduate research student</td>
<td>Study of Self-Calibration Algorithms and Second-Epoch Global VLBI Observations of a Complete Sample of BL Lac Objects</td>
</tr>
<tr>
<td>Van Langevelde</td>
<td>W. Vlemmings</td>
<td>Leiden Univ.</td>
<td>PhD</td>
<td>Astronomy of OH masers</td>
</tr>
<tr>
<td>Schilizzi</td>
<td>W. Tschager</td>
<td>Leiden Univ.</td>
<td>PhD</td>
<td>Peaked spectrum sources</td>
</tr>
</tbody>
</table>

Szomoru: advanced C++ programming course

Schonewille and Leeuwinga attended the BHV-course "Levensreddende handelingen" (Lifesaving actions).

Gurvits continued to supervise S.Frey and Z.Paragi (former JIVE fellows and PhD students of the Eotvos University, Budapest, Hungary) on their PhD Thesis studies. The thesis by S.Frey has been submitted to the Eotvos University Committee in September 2000.

Gurvits also prepared several topics for PhD study by Zhang Haiyan, who is expected to begin a half-year fellowship at Jive in October 2000.
Phillips worked with summer student Jiyune Yi from Onsala space observatory, Sweden, processing EVN observations of methanol masers.

D. Gabuzda supervised research by the following students:

1) N. Garnich (Sternberg Astronomical Institute, Moscow), undergraduate research student, topics: (1) Study of Self-Calibration Algorithms and (2) Second-Epoch Global VLBI Observations of a Complete Sample of BL Lac Objects. N. Garnich worked as a JIVE summer student from mid-June until the end of August.

2) A. Pushkarev (ASC, Moscow), PhD, topic: VLBI Polarization Properties of a Complete Sample of BL Lac Objects.
## 9. Meetings, work visits, symposia, conferences

<table>
<thead>
<tr>
<th>Meetings, work visits, symposia, conferences</th>
<th>date</th>
<th>name</th>
</tr>
</thead>
<tbody>
<tr>
<td>EVN Symposium Gothenburg, Sweden</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>29 Jun – 1 Jul</td>
<td>Phillips</td>
</tr>
<tr>
<td></td>
<td>28 Jun – 2 Jul</td>
<td>Reynolds</td>
</tr>
<tr>
<td></td>
<td>28 Jun – 2 Jul</td>
<td>Schilizzi</td>
</tr>
<tr>
<td></td>
<td>28 Jun – 2 Jul</td>
<td>Gurvits</td>
</tr>
<tr>
<td></td>
<td>28 Jun – 2 Jul</td>
<td>Campbell</td>
</tr>
<tr>
<td></td>
<td>28 Jun – 2 Jul</td>
<td>Gabuzda</td>
</tr>
<tr>
<td></td>
<td>1 Jul</td>
<td>Garrett</td>
</tr>
<tr>
<td>AOC, Socorro, USA</td>
<td>3-14 Jul</td>
<td>Sjouwerman</td>
</tr>
<tr>
<td>Particles and Fields in Radio Galaxies, Oxford</td>
<td>3-5 Aug</td>
<td>Gabuzda</td>
</tr>
<tr>
<td>The SKA workshop at JBO</td>
<td>3-5 Aug</td>
<td>Garrett</td>
</tr>
<tr>
<td>Visit to T. Cawthorne at the University of Central Lancashire for collaborative work on VLBI polarization observation of BL Lac Objects</td>
<td>6-12 Aug</td>
<td>Gabuzda</td>
</tr>
<tr>
<td>IAU General Assembly 24 (IAU Symposium205,Joint Discussion2,Etc.)</td>
<td>5 –19 Aug</td>
<td>Schilizzi</td>
</tr>
<tr>
<td></td>
<td>9 –19 Aug</td>
<td>Campbell</td>
</tr>
<tr>
<td></td>
<td>9 –19 Aug</td>
<td>Sjouwerman</td>
</tr>
<tr>
<td></td>
<td>15-18 Aug</td>
<td>VanLangevelde</td>
</tr>
<tr>
<td></td>
<td>14-18 Aug</td>
<td>Gabuzda</td>
</tr>
<tr>
<td></td>
<td>7 – 9 Aug</td>
<td>Garrett</td>
</tr>
<tr>
<td></td>
<td>7 –18 Aug</td>
<td>Gurvits</td>
</tr>
<tr>
<td>Dutch ALMA-FC meeting, Dwingeloo</td>
<td>25 Aug</td>
<td>VanLangevelde</td>
</tr>
<tr>
<td>IRAM, Granada, Spain</td>
<td>20-28 Aug</td>
<td>Sjouwerman</td>
</tr>
<tr>
<td>Event</td>
<td>Date</td>
<td>Presenter</td>
</tr>
<tr>
<td>----------------------------------------------------------------------</td>
<td>------------</td>
<td>-----------</td>
</tr>
<tr>
<td>14th Working Meeting on European VLBI for Geodesy and Astronomy, Castel San Pietro Terme, IT</td>
<td>7-10 Sept</td>
<td>Campbell</td>
</tr>
<tr>
<td>The Geo-Astronomy workshop in Castel St. Pietro</td>
<td>7-10 Sept</td>
<td>Garrett</td>
</tr>
<tr>
<td>Strasbourg Conference on Research Infrastructure</td>
<td>18-21 Sept</td>
<td>Schilizzi</td>
</tr>
<tr>
<td>Dwingeloo PUMA Discussion Meeting, Dwingeloo, NL</td>
<td>21-22 Sept</td>
<td>Campbell</td>
</tr>
<tr>
<td>EVN support at VLBA correlator, Socorro</td>
<td>2 – 14 Oct</td>
<td>Reynolds</td>
</tr>
</tbody>
</table>

**10. Presentations**

**Campbell**


"The EVN MkIV Data Processor at JIVE", 14th Working Meeting on European VLBI for Geodesy and Astrometry, Castel San Pietro Terme, IT, 9 Sep.

"Pulsar Position, Proper Motion, and Parallax", Dwingeloo PUMA Discussion Meeting, 21 Sep.

**Garrett**

"SKA: the need for transcontinental baselines" (poster presentation at the SKA Workshop, JBO)

"VLBI Observations of Blank Fields!" (oral contribution at the The Geo-Astmetry workshop in Castel St. Pietro (Sep 7-9, 2000))

"Faint Radio Sources and Future trends radio astronomy" (Ministry OC&W visit on 6 Sept, 2000)

**Gurvits**

European participation in VSOP-2, Manchester, UK, 14 Aug.

Results from the VSOP continuum Survey IAU S205 (poster), Manchester, UK, 15 Aug.

Milliarcsecond radio structures in extragalactic radio sources across the redshift space (poster) IAU S205, Manchester, UK, 15 Aug
VSOP/VLBA pre-launch survey at 5 GHz (poster) IAU S205, Manchester, UK, 16 Aug

11. Publications

Published:


D. Gabuzda and T. Cawthorne, "VLBI Polarization Images of Eight Compact AGN at 1.3 cm" (Monthly Notices of the Royal Astronomical Society).


Submitted:

Campbell, R.M., "EVN MkIV Data Processor at JIVE", EVN Symposium 5.

"MERLIN, VLBI and HST observations of the giant radio galaxy 3C236" Schilizzi R.T., Tian W.W., Conway J.E., Nan R., Miley G.K., Barthel P.D., Normandeau M., Dallacasa D., Gurvits L.I, A&A


``Space VLBI observations of the extremely distant quasars 0201+113 and 0537-285``


Submitted and Accepted: