MERLINnews
MERLIN/VLBI
National Facility

Newsletter

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1. Call for Proposals

The **deadline** for the receipt of proposals for Semester 05B (October 2005 - January 2006) on MERLIN is **March 15th, 2005**. All details are in the MERLIN web area, specifically;
http://www.merlin.ac.uk/propsub/call

L-Band: 1.35GHz to 1.43 GHz & 1.57 GHz to 1.73 GHz

C-Band 4.5 GHz to 5.2 GHz & 6.0 GHz to 6.8 GHz

K-Band 22.0 GHz to 24.0 GHz

- MERLIN will initially be configured for C and K-Band operations. L-Band will be installed towards the end of Semester 05B; after which frequency flexibility between L, C, and K-Band will be available. This flexibility will permit frequency band changes between complete observing runs. The Lovell Telescope will be available at both C and L-Bands for periods during Semester 05B.

The system parameters for observation of a continuum source in **good weather conditions** are;

	L-Band	C-Band	K-Band
Maximum angular resolution (mas)	~ 150	~ 40	~ 8
RMS for 12 hr. on source (μJy/beam)	~ 60/30	~ 60/30	~ 400
Maximum bandwidth/polarization (MHz)	~ 15	~ 15	~ 15

The use of the Lovell telescope at L-Band and C-Band reduces the 12 hour RMS noise level from ~60 to ~30 μJy/beam. The maximum rate at which the observing frequency can be switched within an observing band will be approximately once every five minutes for multi-frequency synthesis (MFS) observations. MFS is possible within each C-Band range (eg 4.5GHz-5.2 GHz), but not possible between 4.5/5.2 GHz and 6/7GHz. For spectral line work throughout the Semester, users are referred to Table 4.4 of the MERLIN User Guide Version 3 which is now available online. The maximum number of frequency channels per baseline to be divided between the 4 polarizations for bandwidths of 16 MHz, 8 MHz and 4 MHz are 64, 128 and 256, respectively. The number of frequency channels per baseline to be divided between the 4 polarizations will be 512 for bandwidths of 2 MHz or less. The minimum total bandwidth is 250 kHz.

Access to MERLIN for Scientists from EU Countries:

MERLIN is one of the participating institutes in the RadioNet (http://www.radionet-eu.org) project from which transnational access within the EU to existing observing facilities is financially supported.

There will be MERLIN+EVN observations at C-Band during October / November 2005. Applications to go to the EVN PC (http://www.evlbi.org/)

Proposal forms, information on MERLIN Key Programmes, and further information can be obtained via;
www: http://www.merlin.ac.uk
ftp: ftp.jb.man.ac.uk, directory: /pub/merlin/proposals
email: merlin@jb.man.ac.uk

2. Director's Report

At the end of January we welcomed the *e*-MERLIN Project Management Committee (EPMC) and PPARC's MERLIN Steering Committee (MStC) to their biannual meeting. This one was unusual in that it was held in the chapel of Tabley House; jokes about sermons and pulpits aside, the reason for this location was its proximity to the Pickmere telescope. As a break from the committees' deliberations they were taken to the telescope to see much of the hardware and a demonstration of the current state of the monitor and control software for *e*-MERLIN. The committees were shown and witnessed the operation of the L-band lens mechanism in the secondary focus; a photograph of which was shown in the previous Newsletter. They also saw the new *e*-MERLIN C-Band feed and receiver, which had just been used for real observations in Semester 04B. In addition, they witnessed a live demonstration of the monitor and control software – a brave thing to undertake with no backup in case of failure.

As the project moves forwards I sometimes feel frustrated at the apparent slow pace of progress from week to week; however, when we look back at the previous six months work as it is presented to the EPMC it is clear that an impressive amount of work has been achieved. It is also pleasing to note that the first benefits of *e*-MERLIN are being felt by our user community, with several groups receiving data from a 5-telecope array able to observe at 6.0 and 6.7 GHz for the first time. Simon Garrington's report below summarises the efforts to date.

On the VLBI front it is a pleasure to report that we were successful in obtaining a £200k grant from PPARC to improve our capabilities. These funds have been used to install a 2.5 Gbps link from Jodrell Bank to Manchester and from there into Super-Janet. This means that we are now linked, via Geant, to the EVN correlator at JIVE and are a full participant in e-VLBI. In addition, we also used the PPARC money to purchase additional Mk5 equipment and disks. All of these improvements will result in immediate benefits to the user community in terms of increased reliability, broader bandwidth observing capability and a gradually increasing use of e-VLBI.

On the e-VLBI front, you are probably aware of the first e-VLBI science observation performed last September (http://www.evlbi.org/evlbi/first_science/first_science.html) in which Jodrell Bank and the National Facility participated. This was a great success and is a portent of things to come.

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3. *e*-MERLIN Update

The installation of the optical fibre network for *e*-MERLIN is nearing completion and sections of the network are now being tested. The 'new dig' sections from Jodrell Bank to Pickmere, and from Knockin, Cambridge and Darnhall to the access points on the trunk fibre are complete and the last remaining section at Defford (a total of almost 80km) will be completed in the next few weeks. The fibre installation has progressed on schedule with few incidents. The horizontal drilling technique continues to be a success, producing minimal disruption within villages and allowing major roads, rivers and canals to be traversed fairly easily by placing the cable duct at depths of up to 6m. All the work on the trunk fibre sections has already been completed.

The Jodrell Bank to Pickmere and Jodrell Bank to Crewe sections have been tested at 10 Gb/s. The remainder of the network will be commissioned in the coming months.

An additional link from Jodrell Bank to Manchester has also been installed and lit with a commercial 2.5 Gb/s CWDM link. This link has already been used for e-VLBI tests, with data from EVN telescopes in the Netherlands, Sweden, Poland as well as Jodrell Bank, being piped to the EVN correlated at JIVE in the Netherlands for real-time correlation at data rates of up to 256 Mb/s.

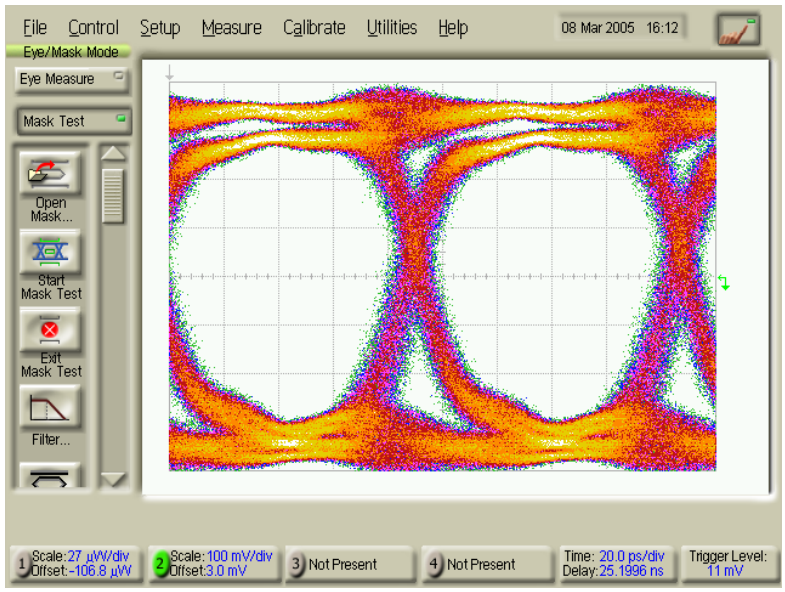

Figure 1: An 'Eye' plot showing folded rising and falling pulse edges on a looped test transmission of installed optical fibre between Jodrell Bank and Crewe – a total transmission distance of 87km. The distinct open 'eyes' demonstrates reliable pulse integrity with well formed rising and falling edges

Figure 2: One of the new *e*-MERLIN C-band receivers under assembly in the cyrogenic laboratories at Jodrell Bank

Four of the new C-Band receivers are now complete and the first science observations with MERLIN and MERLIN+EVN in the 6.0-6.7 GHz band covering the excited OH and methanol lines were made in November and December. The receiver system temperatures are close to the expected performance but there is further work to be done to optimize the illumination of the feed horns using internal polyethelene lenses. The full suite of new receivers, switchable between 4.5-5.2 and 6.0-6.8 GHz should be available by the autumn. Once the pressure of observations has relaxed in the summer, more detailed testing and characterization of the new receivers will be carried out.

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4.Topical News and Recent Science

New e-MERLIN Science – Full Multi-baseline imaging of Methanol Masers at 6.7 GHz

The 6.7 GHz transition of methanol is the brightest and most widespread methanol maser in the galaxy and is found solely in regions of massive star formation. Its brightness is second only to the 22 GHz water maser. High-resolution observations of maser regions can provide evidence on the gas temperature, velocity gradient, magnetic fields and chemical abundances within the region. Models of maser pumping have shown that simultaneous observations of masers in different rotational states is a powerful diagnostic of the physical conditions within the masing gas.

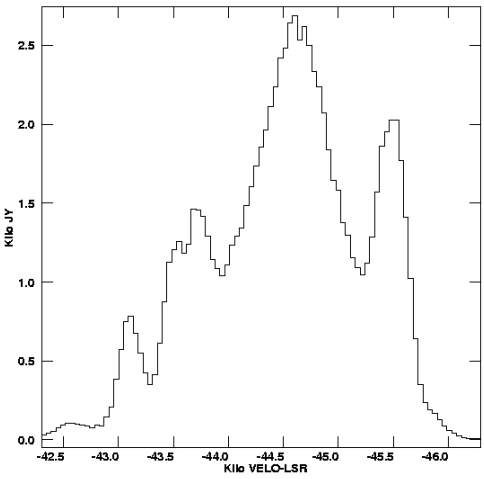

Figure 3: Integrated 6.7 GHz maser spectrum from the Galactic source W3(OH)

The recent deployment of new C-Band receivers has allowed full multi-baseline imaging of maser sources in the 6.0 to 6.7 GHz frequency band with MERLIN for the first time. W3(OH) is one of the first regions to be imaged by MERLIN in this band. Complimentary phase referenced astrometric studies of the masers in W3(OH) at different frequencies (methanol at 6.7 GHz and the OH transitions at 1.7 GHz, 4.7 GHz and 6.0 GHz) have been made. The correlation or otherwise of these masers on milliarcsecond scales will form the basis for improved models of maser pumping.

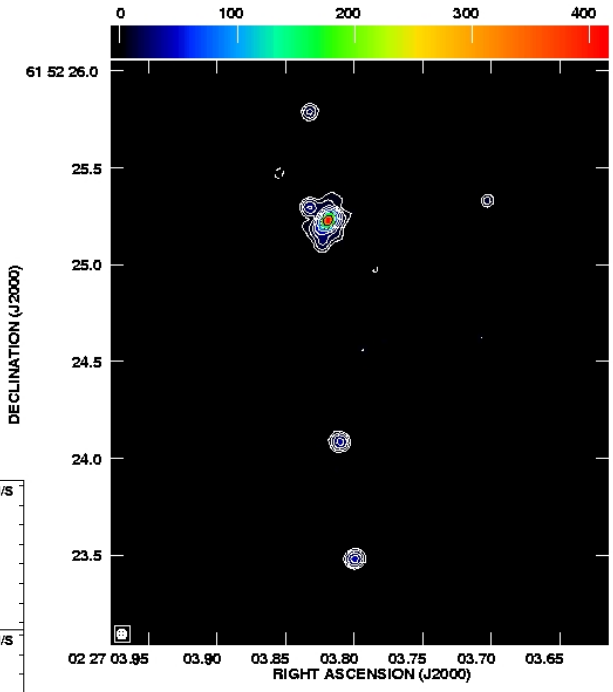

Figure 4: 6.7 GHz masers along a zone of interaction near a pre-main sequence massive star. in W3(OH)

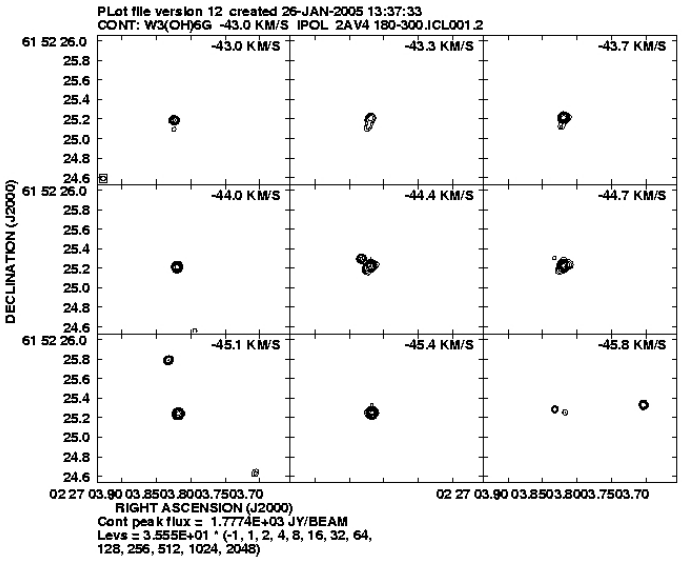

Figure 5: Individual velocity maps of the 6.7 GHz masers in W3(OH) averaged over 4 adjacent channels

The 6.7 GHz dataset is now partially reduced and 16 individual methanol maser spots have been identified, several of which were not seen using VLBI.

The observations were simultaneous with those of excited OH at 6.0 GHz. In addition, the same phase-reference source was used for all OH and methanol observations. This will ensure accurate registration between the images in the different wavebands and allow detailed astrometric studies between the various maser lines.

The Jodrell Bank research group working on these data plan to identify coincident (<10mas) pairs of methanol and OH masers and hence understand the extent to which the two species originate from the same column of gas. Of the sixteen 6.7 GHz methanol masers in W3(OH), ten have already been found to be associated with 4.7 GHz OH masers previously imaged by MERLIN. Analysis of the 6.0 GHz data will follow shortly.

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