MERLINnews
MERLIN/VLBI
National Facility

Newsletter

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1. Call for Proposals

The **deadline** for the receipt of proposals for Semester 06A (February 2006 - June 2006) on MERLIN is **September 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

- The Lovell Telescope will be available at both C and L-Bands for periods during Semester 06A*
- It is envisaged that frequency flexibility between L, C, and K-Band will be available. This flexibility will permit frequency band changes between complete observing runs

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

The most important event that occurred over the last 6 months was, without doubt, the International Review of the future operations of *e*-MERLIN and the National Facility. PPARC appointed a distinguished panel chaired by Brian Boyle, Director of the Australia Telescope National Facility; other members were Mark Birkinshaw (Univ. Bristol), Steve Rawlings (Univ. Oxford), Mark Reid (Harvard-Smithsonian Center for Astrophysics) and Rene Vermeuelen (ASTRON). The panel met at Jodrell Bank Observatory on July 15th. They were provided with an update of the *e*-MERLIN construction project and then conducted a wide-ranging investigation of the National Facility's plans for commissioning of *e*-MERLIN and future science operations. The report of the panel is not quite ready for publication but I believe that the NF team made a strong and very positive impression on the panel and am optimistic that an excellent report will be presented to PPARC and the MERLIN Steering Committee.

PPARC organised the review in the context of a programmatic review that it is conducting of all of its facilities and experiments, both in astronomy and particle physics. PPARC's Science Committee is gathering information on the science impact, future potential, operational costs and possible lifetimes of the various telescopes and related activities. This information will provide input to an examination of PPARC's whole programme with a view to considering the likely future scientific impact of current facilities and experiments and to develop long-term plans for their extension or withdrawal. The exercise will be repeated every two years.

At the end of June we entered the summer engineering period; much of the work happening over the summer is aimed at preparing the various MERLIN telescopes for the installation of the IF electronics, which is expected to occur in 2006. As explained below in Simon Garrington's report, all other areas of the *e*-MERLIN project are also progressing well with no major problems of which we are aware. We expect the array to be back in operation in October/November, some telescopes will be participating in the autumn session of the EVN.

A major development for the EVN in recent weeks was the news that EXPReS, a proposal to the EC's Sixth Framework Programme, was funded; indeed, it was ranked first of all the proposals under consideration! The primary purpose of EXPReS is to turn the current experimental e-VLBI links within the EVN into an operational network. EXPReS is led by JIVE, with Mike Garrett as Coordinator. Mike is currently in contract negotiations with the EC and we hope to officially start the project in March of 2006.

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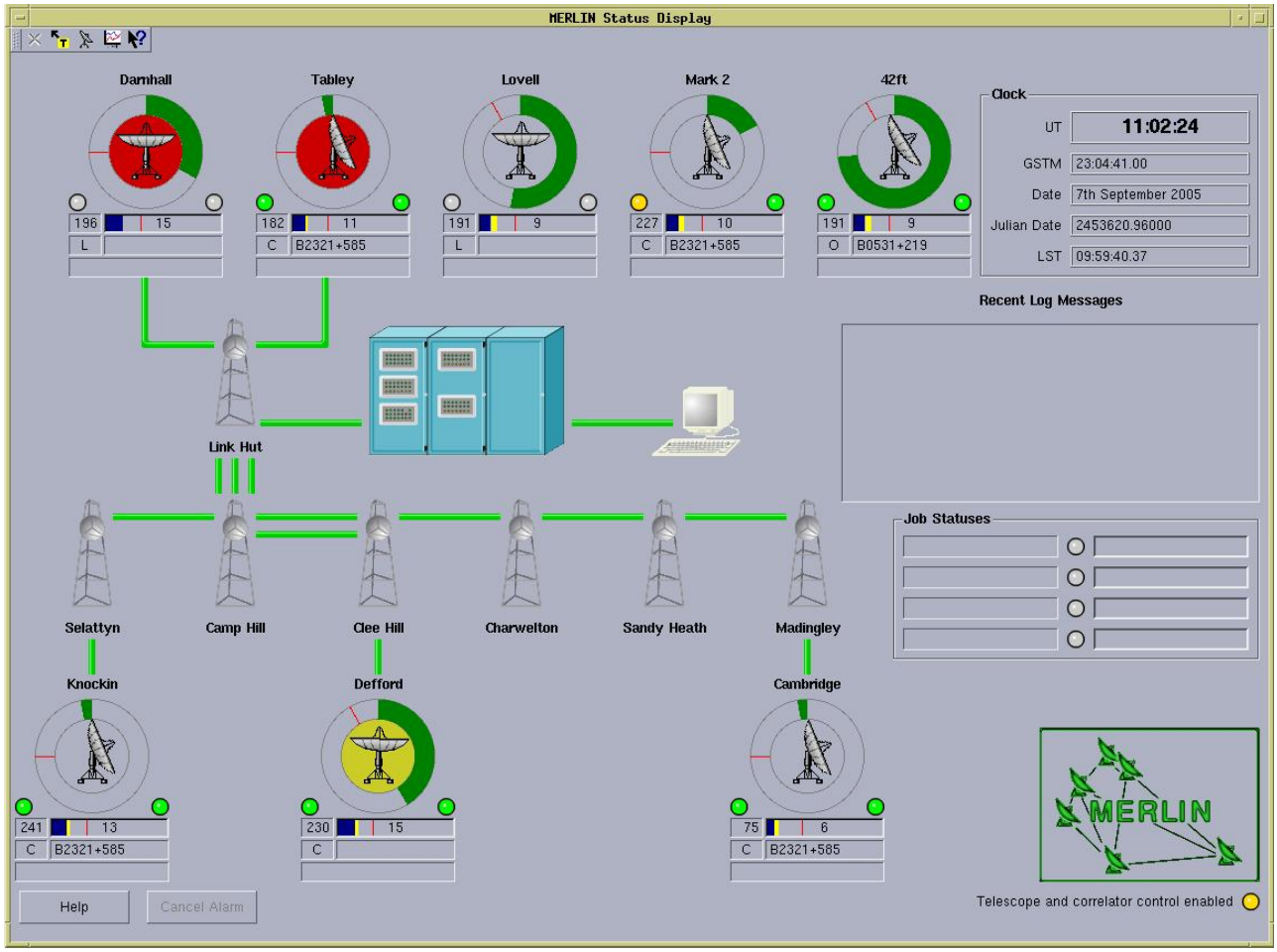
3. *e*-MERLIN Update

The installation of the optical fibre network connecting the five remote telescopes to Jodrell Bank has now been completed. The various spans making up the network have been tested at 10 Gb/s and all perform well. The longest section of the network, from Cambridge to Birmingham (via Nottingham!) requires amplification at two co-location sites and was tested satisfactorily over the summer. This was a key test of the optical network design as well as the performance of the installed trunk fibre.

The digital formatter/transmitter and receiver/de-formatter boards, which have been developed mainly by NRAO have been produced and are now being commissioned. These will be used for further tests of the optical network later this year.

Development of the samplers and IF system continues. A new platform to house the new IF equipment is being constructed on the Mk2 telescope at Jodrell Bank.

The correlator has been designed by DRAO, Penticton and is a scaled-down version of the WIDAR correlator for the EVLA. Prototype modules are due in Penticton towards the end of this year, ready for assembly and testing.



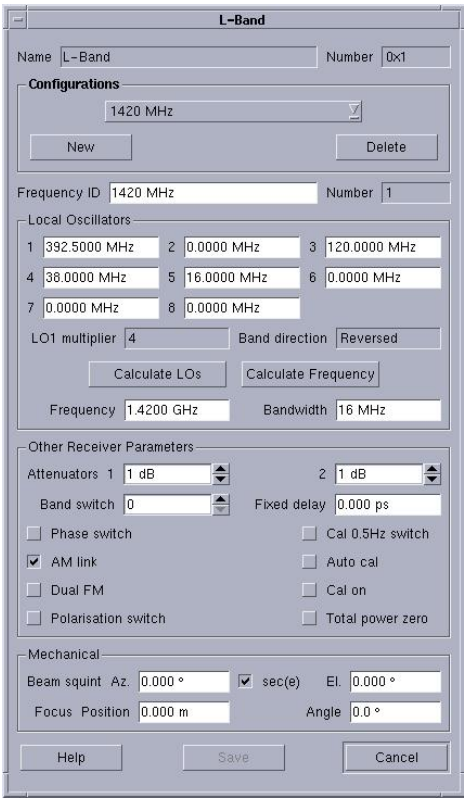


Figure 1 (above): New graphical MERLIN status display showing the current state of all the MERLIN telescopes and radio links. Figure 2 (right): MERLIN receiver definition dialogue from the new telescope configuration editor

A new software system has been developed for both MERLIN and *e*-MERLIN operations. This has been designed to work with an interim upgrade to the MERLIN correlator control computer but has been developed with *e*-MERLIN in mind, and only a few components will need modification for *e*-MERLIN. The new software allows control and monitoring of all aspects of the MERLIN/*e*-MERLIN systems. Sophisticated graphical interfaces allow access for controllers, schedulers, engineers, local and remote users. The functionality includes detailed control and monitoring of individual telescopes and their receiver and IF hardware; a sophisticated scheduling system; configuration editors for both correlator and receiver setups; and displays for real-time and archived correlator output.

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4.Topical News and Recent Science

Sub-arcecond imaging of the Radio Continuum and Neutral gas in the Medusa Merger.

R. J. Beswick, S. Aalto, A. Pedlar, S. Hűttemeistger

To appear in A&A (astro-ph/0508637)

The Medusa merger (NGC 4194) is a nearby (D=39Mpc) star-forming galaxy of intermediate infrared luminosity (L_{FIR}=8.5x10^{10} $L_{\odot}$). As such the Medusa merger falls in a luminosity class, considerably lower than the well-studied ultra luminous infrared galaxies (ULIRGs) but it still appears to show intense areas of starburst activity. The Medusa is in an advanced stage of merger and within it's centre contains regions of highly efficient star-formation.

The optical morphology of the Medusa merger, as its name suggests, traces clumpy and extended features stretching out to ~1 arcmin to the north of the main optical nucleus. A detailed study of the molecular gas (CO) composition and kinematics in NGC 4194 has been previously made using the Owens Valley Radio Observatory (OVRO) by Aalto & Hűttermeister (2000), albeit at arcsecond angular resolutions. This investigation revealed that the ^{12}CO emission was extended over an area of 25 arcsec (4.7 kpc) covering the central and north-eastern part of the optical galaxy. This CO emission was also shown to trace the two prominent dust lanes that cross the central region and extend into the northern tidal tail (See pale blue contours of figure 3).

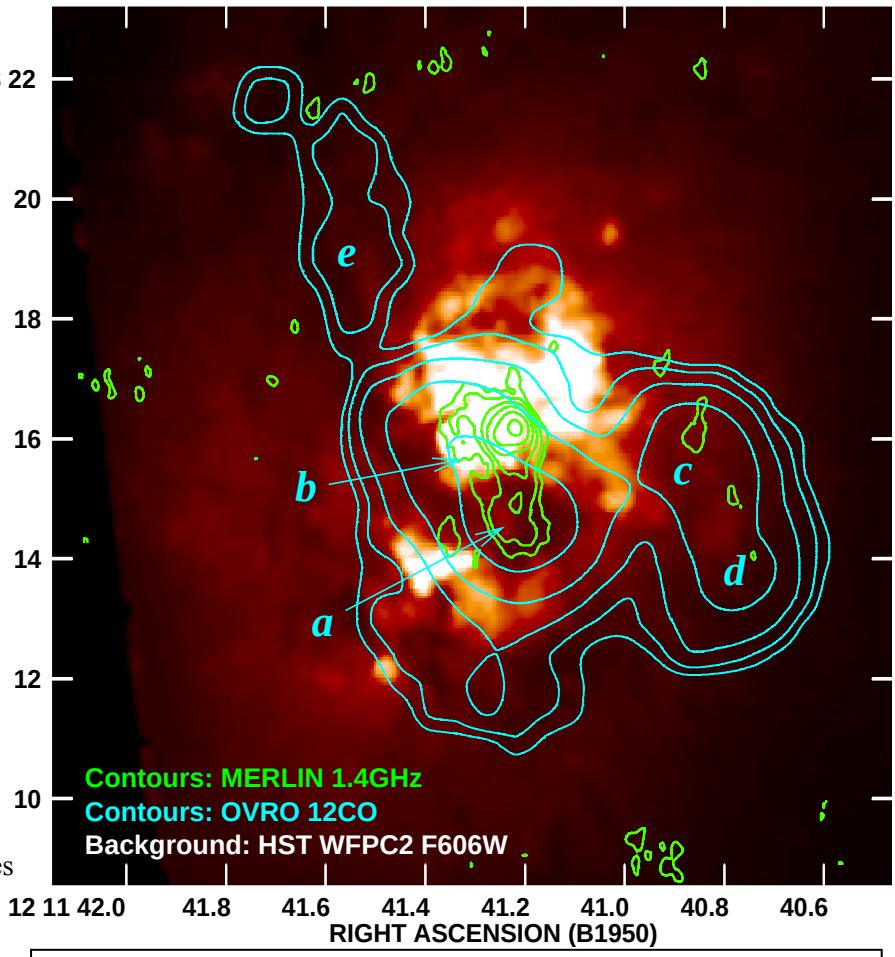

Figure 3: MERLIN 1.4 GHz continuum (green contours), OVRO ^{12}CO (pale blue contours) over a F606W WFPC2 HST image

Aalto & Hűttermeister suggest that the star-formation regions together with the kpc sized central starburst is being fueled by gas flows along the central dust lane. With the merger history of NGC 4194 possible resulting from a early-type/spiral merger with a shell emerging to the south of the centre.

MERLIN RESULTS:

Using the high resolution and high sensitivity capabilities of MERLIN it has been possible for the first time to map the neutral hydrogen, via absorption, against the central few hundred kiloparsecs of the Medusa at sub-arcsecond angular resolutions. These are the first sub-arcsecond observations of the neutral or molecular gas in this galaxy. Additionally these observations have also provided the highest angular L-band radio

continuum observations of this made to date (see figures 3 & 4).

The radio continuum structure of the core region of the Medusa, as seen at 1.4GHz by MERLIN, offers some surprises. Prior to these observations no high resolution radio interferometric observations had been made of the Medusa at any frequency. However these observations have revealed not only the weak and diffuse radio emission, to the south of the nucleus which is probably related to the star-formation processes ongoing in this galaxy, but also compact double radio source at the core. These observations have been confirmed by multi-frequency VLA images (Susan Neff, private comm.). The constraints provided by these observations and those within the literature have allowed the conclusion that the majority of this radio emission is related to the ongoing star-formation in this merger system, although the presence of a weak active nucleus in the centre of the source cannot be categorically eliminated. High resolution 5GHz MERLIN observations are being planned to further constrain the nature of the nuclear radio continuum on parsec scales.

These observations also trace deep HI absorption across the detected radio continuum structure. The absorbing HI gas structure exhibits large variations in column densities. The largest column densities are found toward the south of the nuclear radio continuum, co-spatial with both a nuclear dust lane and peaks in $^{12}CO,(1\rightarrow0)$ emission. The dynamics of the HI absorption, which are consistent with lower resolution ^{12}CO emission observations, trace a shallow north-south velocity gradient. This gradient is interpreted as part of a rotating gas structure within the nuclear region. The HI and CO velocity structure, in conjunction with the observed gas column densities and distribution, offers glimpses of the fuelling mechanisms and gas physics of this ongoing starburst.

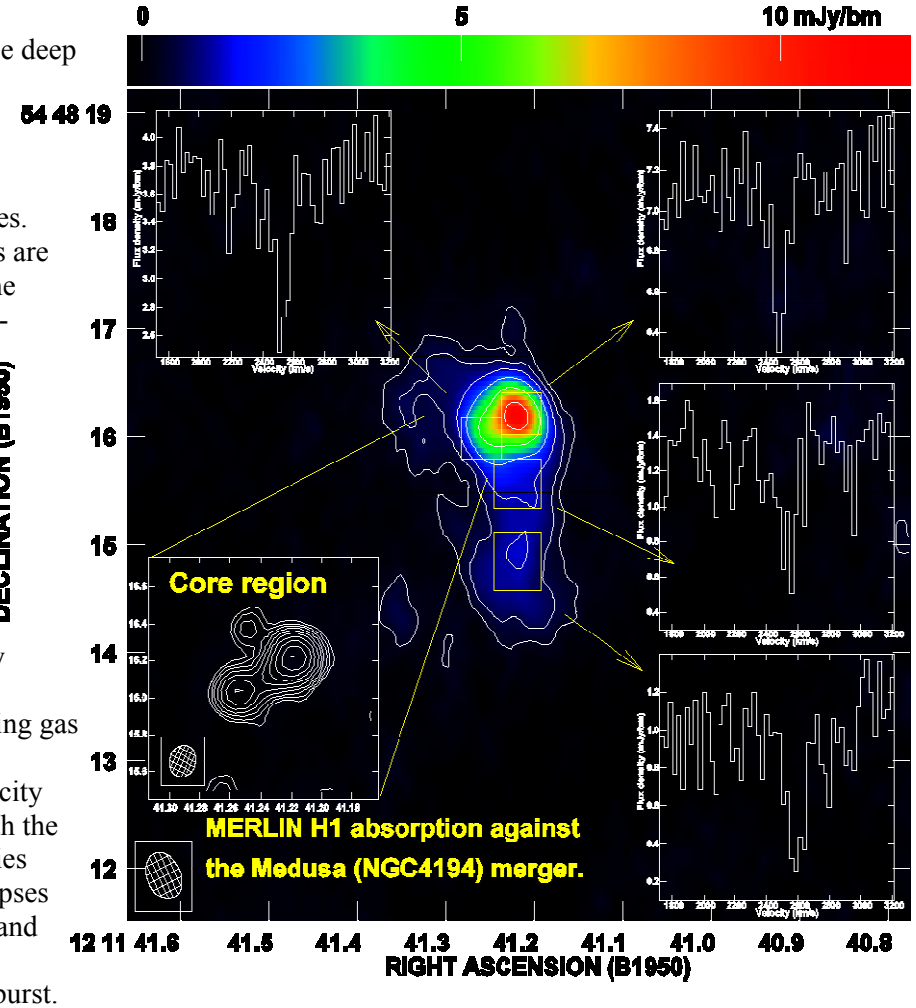

Figure 4: Montage of MERLIN radio continuum structure and HI absorption spectra in the nuclear region of NGC 4194

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