MANCHESTER 1824
The University of Manchester

# e-MERLIN proposal preparation

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# e-MERLIN cycles

- Two call for proposals per year (moving from previous one per year).
  - April/May
  - October/November
- Proposals submitted using Northstar webpage http://www.e-merlin.ac.uk/observe/northstar.html
- Proposals evaluated by TAC members and external referees to prioritize based on science quality and technical feasibility

# Frequency selection

Observing frequencies available:

L-Band: 1.23GHz to 1.74GHz
C-Band: 4.5GHz to 7.5GHz
K-Band: 21GHz to 24GHz

# System parameters

The system parameters for observation of a continuum source in optimum conditions are:-

| | 1.23-1.74 GHz (L-band) | 4.3-7.5 GHz (C-band) | 21-24 GHz (K-band) | |
|---|---|---|---|---|
| Maximum angular resolution | ~150 | ~40 | ~12 | (milliarcsec) |
| RMS level for 12 hr on source | ~14/7** | ~13/7** | ~55 | (uJy/bm) |
| Maximum bandwidth/polarization | 512 | 512* | 512* | (MHz) |

More extensive technical details are available at e-MERLIN cycle-7 capabilities.

e-MERLIN capabilities: http://www.e-merlin.ac.uk/observe/cycle7.html

# Technical capabilities

**Table 1:** cycle-7 continuum observing capabilities of e-MERLIN

| | 1.5 GHz (L-band) | 5 GHz (C-band) | 22 GHz (K-band) | Comments |
|---|---|---|---|---|
| Freq. Range (GHz) | 1.23-1.74 | 4.3-7.5 | 21-24 | C-band range eventually will be extended |
| Resolution (mas) | 150 | 40 | 12 | Uniform weighting at central frequency |
| Maximum angular scale (arcsec)[1] | 2.0 | 0.5 | 0.1 | Natural weighting, good coverage. |
| Field of View (arcmin) 25-m dishes[2] | 30 | 7 | 1.5 | To primary beam FWHM. |
| Field of View (arcmin) including Lovell[2] | 12 | 5 | - | To primary beam FWHM. |
| Continuum sensitivity rms (μJy/bm) in 12 hr on-target, with Lovell | 7 | 7 | - | Good conditions, target above about Dec. 20 deg. |
| Continuum sensitivity rms (μJy/bm) in 12 hr on-target, no Lovell | 14 | 13 | ~55 | |
| Astrometric performance (mas) | ~2 | ~1 | ~1 | WRT the ICRF (typical 3-deg target-calibrator separation using VLBA Calibrator Survey) |

# Spectral capabilities

## C band

**Table 2:** C-band cycle-7 spectral line configurations.

| spw width | | Channel separation | | $1\sigma_{rms}$ 12 hr sensitivity per channel | | | |
|---|---|---|---|---|---|---|---|
| (MHz) | (km/s) | (kHz) | (km/s) | with Lovell | | no Lovell | |
| | | | | (mJy/bm) | (1000 K) | (mJy/bm) | (1000 K) |
| 128 | 6400 | 250 | 12.5 | 0.25 | 3.8 | 0.47 | 7.0 |
| 64 | 3400 | 125 | 6.3 | 0.35 | 5.3 | 0.66 | 9.9 |
| 32 | 1600 | 62.5 | 3.1 | 0.50 | 7.5 | 0.93 | 14 |
| 16 | 800 | 31.25 | 1.6 | 0.71 | 11 | 1.3 | 20 |
| 8 | 400 | 15.625 | 0.8 | 1.0 | 15 | 1.9 | 28 |
| 4 | 200 | 7.7125 | 0.4 | 1.4 | 21 | 2.6 | 39 |
| 2 | 100 | 3.9063 | 0.2 | 2.0 | 30 | 3.7 | 56 |
| 1 | 50 | 1.9531 | 0.1 | 2.8 | 43 | 5.3 | 79 |
| 0.5 | 25 | 0.9766 | 0.05 | 4.0 | 60 | 7.4 | 112 |
| 0.25 | 12.5 | 0.4882 | 0.03 | 5.7 | 85 | 11 | 158 |

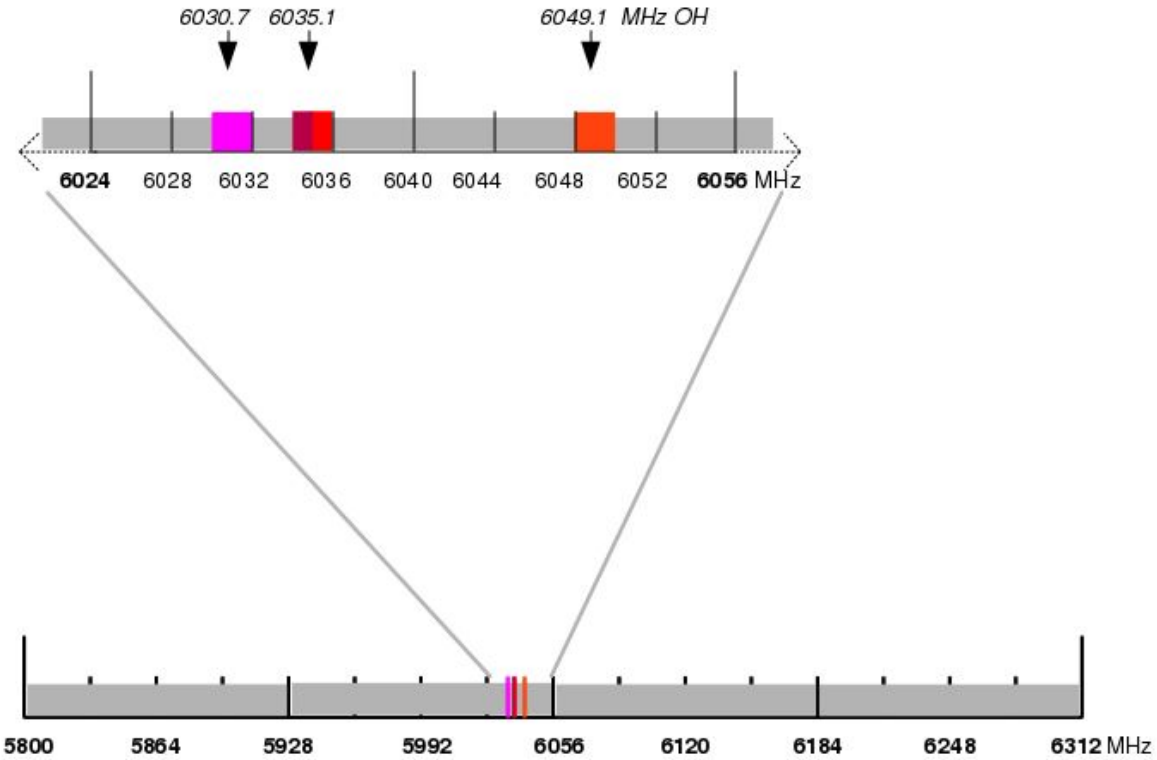
## L band

**Table 3:** L-band cycle-7 spectral line configurations.

| spw width | | Channel separation | | $1\sigma_{rms}$ 12 hr sensit |
|---|---|---|---|---|
| (MHz) | (km/s) | (kHz) | (km/s) | with Lovell |
| | | | | (mJy/bm) | (1000 K) |
| 32 | 6760 | 62.5 | 13.2 | 0.43 | 6.4 |
| 16 | 3380 | 31.25 | 6.6 | 0.61 | 9.1 |
| 8 | 1690 | 15.625 | 3.3 | 0.86 | 13 |
| 4 | 845 | 7.7125 | 1.7 | 1.2 | 18 |
| 2 | 423 | 3.9063 | 0.8 | 1.7 | 26 |
| 1 | 211 | 1.9531 | 0.4 | 2.4 | 36 |
| 0.5 | 106 | 0.9766 | 0.2 | 3.4 | 52 |
| 0.25 | 52.8 | 0.4882 | 0.1 | 4.9 | 73 |

# Example spectral configuration

- Four spectral windows (apart from continuum)
- Two spws of 2 MHz width are centred on 6030.7MHz and 6049.1MHz
- two remaining spw (1MHz wide) aligned on 6035.1MHz.



# e-Merlin Observation Support Tool (OST)

- It is a tool to simulate the result of an observation
- Different types of sources
- Different observation configuration (frequency, schedule, etc)
- Different types of imaging (deconvolution)
- Flux density of your source

Output:

- Simulated image with the result

# e-Merlin Observation Support Tool

**Version 0.1**

| | | | |
|---|---|---|---|
| **Array** | Instrument | e-Merlin | |
| **Sky Setup** | Source model | OST Library: Central point source | Choose a library source model |
| | Upload a FITS file | Browse... No file selected. | Not Currently supported. |
| | Declination | +60d00m00.0s | Ensure correct formatting of this string (+/-00d00m00.0s). Must be **exactly** this format. |
| | Image peak / point flux in mJy | 0.0 | Set to 0.0 for no rescaling of source model |
| **Observation Setup** | Central frequency in GHz | 1.42 | The value entered must be within an e-Merlin band |
| | Bandwidth in MHz | 400 | Use broad for continuum, narrow for single channel |
| | Pointing strategy | Single | Currently only single pointings are available |
| | Start hour angle | 0.0 | Deviation of start of observation from transit |
| | Phase Cycle | 0.0 | The length of time in seconds between cutting to a phase calibrator (arbitrarily limited to 0s to 600s) |
| | On Phase Calibrator | 0.0 | The length of time in seconds spent observing phase calibrator (arbitrarily limited to 0s to 600s) |
| | On-source time in hours | 3 | Per pointing for Mosaics. |
| | Number of visits | 1 | How many times the observation is repeated |
| | Number of polarizations | 2 | This affects the noise in the final map |

| | | | |
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| **Corruption** | Atmospheric conditions | British Weather | Determines level of noise due to water vapour |
| **Imaging** | Imaging weights | Natural | This allows a resolution / sensitivity trade-off |
| | Perform deconvolution? | No (Return dirty image) | Apply the CLEAN algorithm to deconvolve the image |
| | Output image format | FITS | CASA format images are returned as a tar file |
| | Your email address is | essential! | Submit |

# Observation preparation

- Observations are prepared by observatory staff.
- No need to select sources to be used, scan length, frequency configuration.
- The staff will adapt to the proposal requirements, and will interact with PI if some points need clarification.
- The minimum standard is to select source to observe (coordinates), and desired image noise to achieve science goals.

# Call for proposals

- Next call for proposals:
  - Cycle 8: mid-October (to be announced soon)
  - Regular, ToO

- DDT (Director's Discretionary Time), always open

- Any questions. Email: emerlin@jb.man.ac.uk

# Northstar example

http://www.e-merlin.ac.uk/observe/northstar.html