

The new e-MERLIN CASA Pipeline

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The e-MERLIN array



e-MERLIN is an array of seven radio telescopes, spanning 217 km, connected by a new optical fibre network to Jodrell Bank Observatory. e-MERLIN is an SKA pathfinder and it is a key part of the EVN. <http://www.e-merlin.ac.uk/>

- 7 antennas, including the 76-m Lovell
- Obs. bands: 1.3-1.8, 4-8, 22-24 GHz
- Resolution 10 to 150 mas
- Total bandwidth 512 MHz
- $\sim 10\mu\text{Jy}$ continuum sensitivity
- Astrometry, polarimetry, spectroscopy

The e-MERLIN pipeline

The e-MERLIN CASA Pipeline is a python package composed of different modules that can be run together sequentially to calibrate an e-MERLIN data set, producing calibration tables, calibrated data, assessment plots and a summary weblog. The key idea is that the pipeline provides an easy, ready-to-use toolkit that delivers calibrated data in a consistent, clear and repeatable way. Good quality images are usually obtained with minimum human intervention.

Where to find it? The pipeline is hosted in github, which contains the code, documentation, examples, and an open issue tracker.

https://github.com/e-merlin/eMERLIN_CASA_pipeline

How to run? The pipeline is initialized with a CASA (python) script. An inputs file is used to specify the project information and what steps to run. Then execute a single-line command:

```
casa -c /path/to/pipeline/eMERLIN_CASA_pipeline.py -i <input file>
```

Customization The pipeline is optimized for standard C and L band observations. A parameters file allows the user to modify any parameter used by the pipeline if needed.

Dependencies? CASA 5.3 and AOflagger (optional)

What does it do? The pipeline will pre-process the Measurement Set to make it ready for calibration. It includes automatic removal of RFI. Then the data will be calibrated: bandpass, delay (gaincal or fringeft), phase and amplitude calibration. Flux scale is bootstrapped from observatory model of 3C286. Finally it will find improved bandpass and amplitude calibration including the calibrators spectral index.

How long does it take? In a good processing machine the pipeline takes about 0.2-0.5 x the observing time to pre-process and calibrate the data and produce all the necessary plots.

Pipeline outputs

- Flagged and calibrated dataset
- Visibility plots: amp/phase of data/model against time/frequency
- Plots of all calibration tables produced
- Automatic images to assess quality of the calibration
- Weblog organizing all the information produced by the pipeline easily accessible with any browser

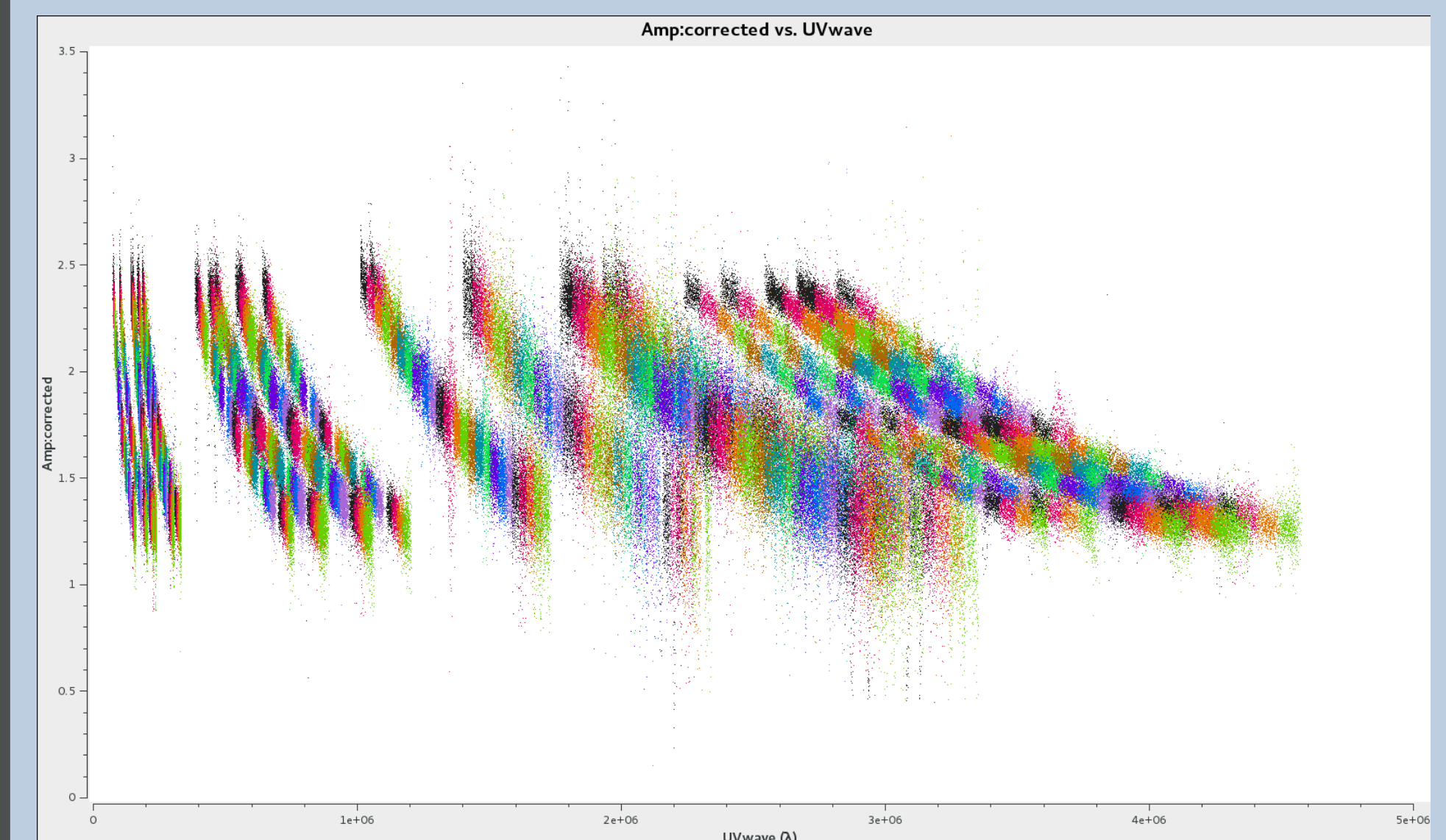
Future development:

- Spectral line calibration
- Polarization
- Tools for source self-calibration
- Execution from IPython Notebook (Rachael Ainsworth)
- Widefield imaging

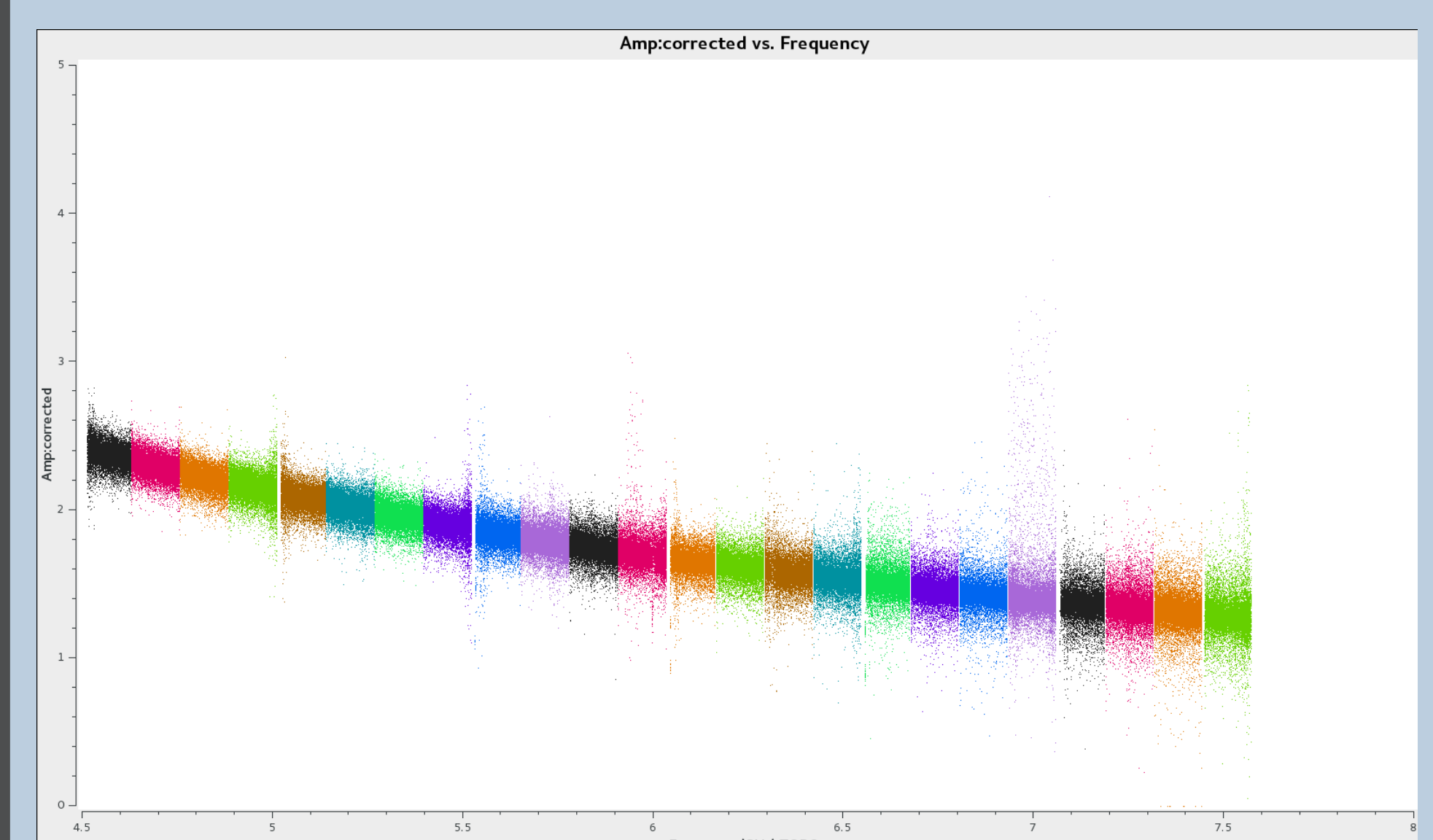
Other e-MERLIN announcements

- e-MERLIN call for proposals: Deadline in early-November
- First e-MERLIN + e-EVN fringes correlated at JIVE. Check ASTRON Daily Image 28-09-2018
- Future modes: Commensal phased-up e-MERLIN for high time resolution science.

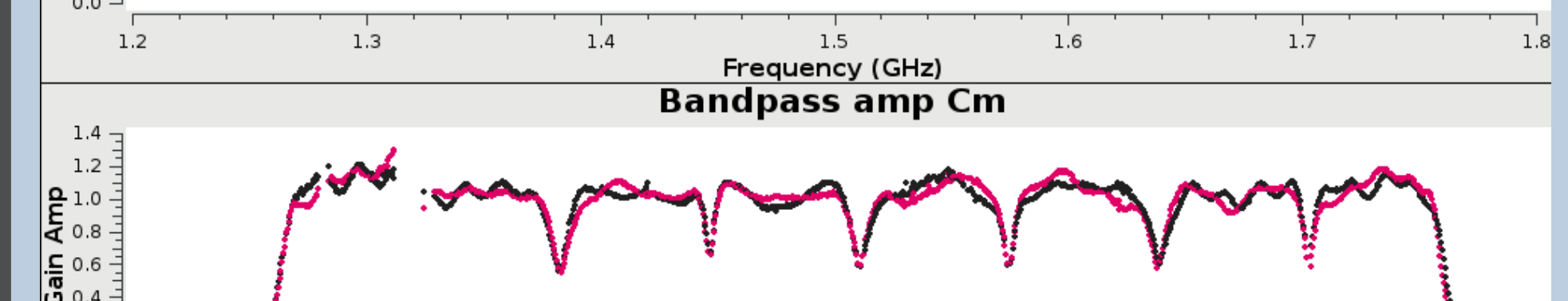
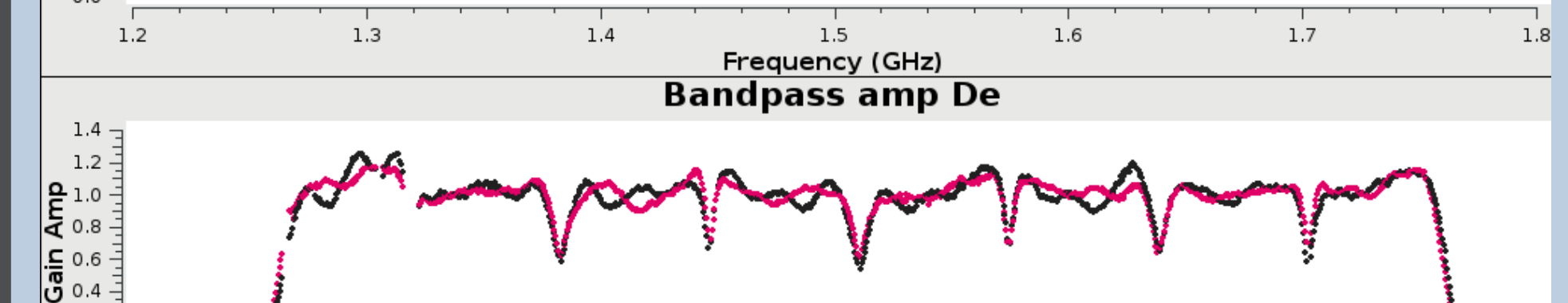
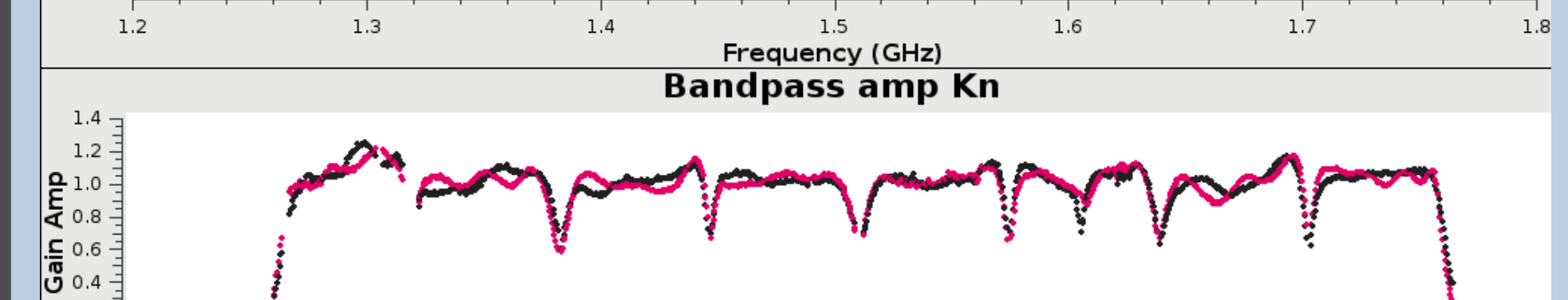
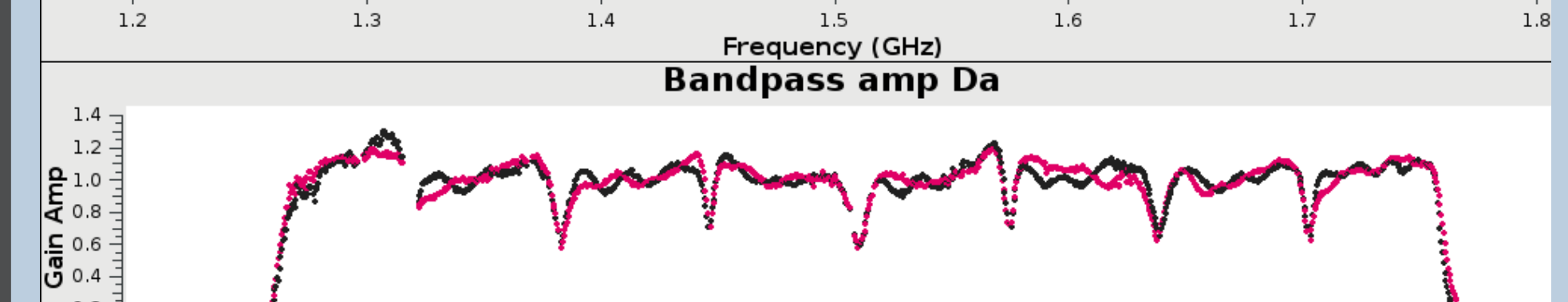
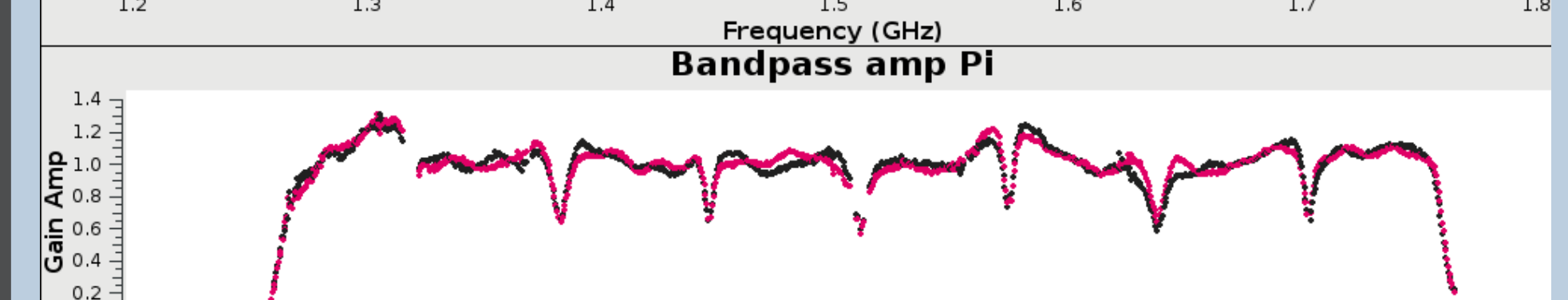
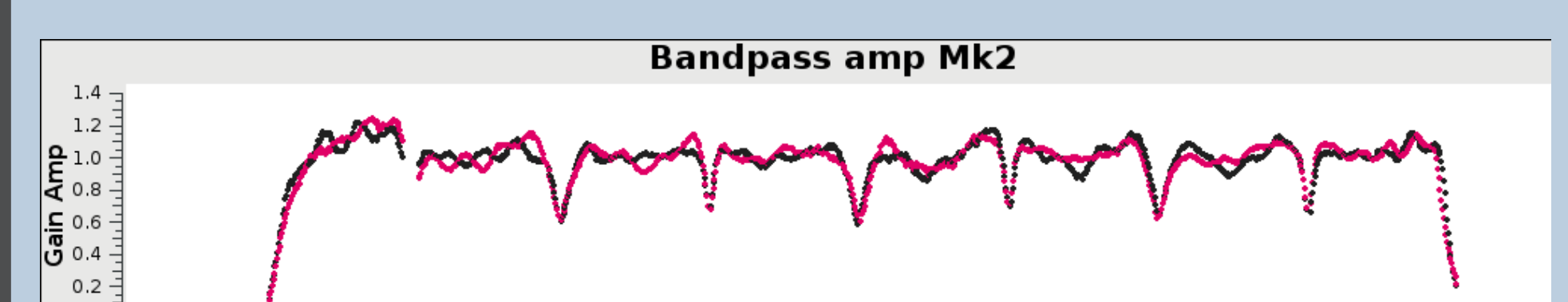
Output examples



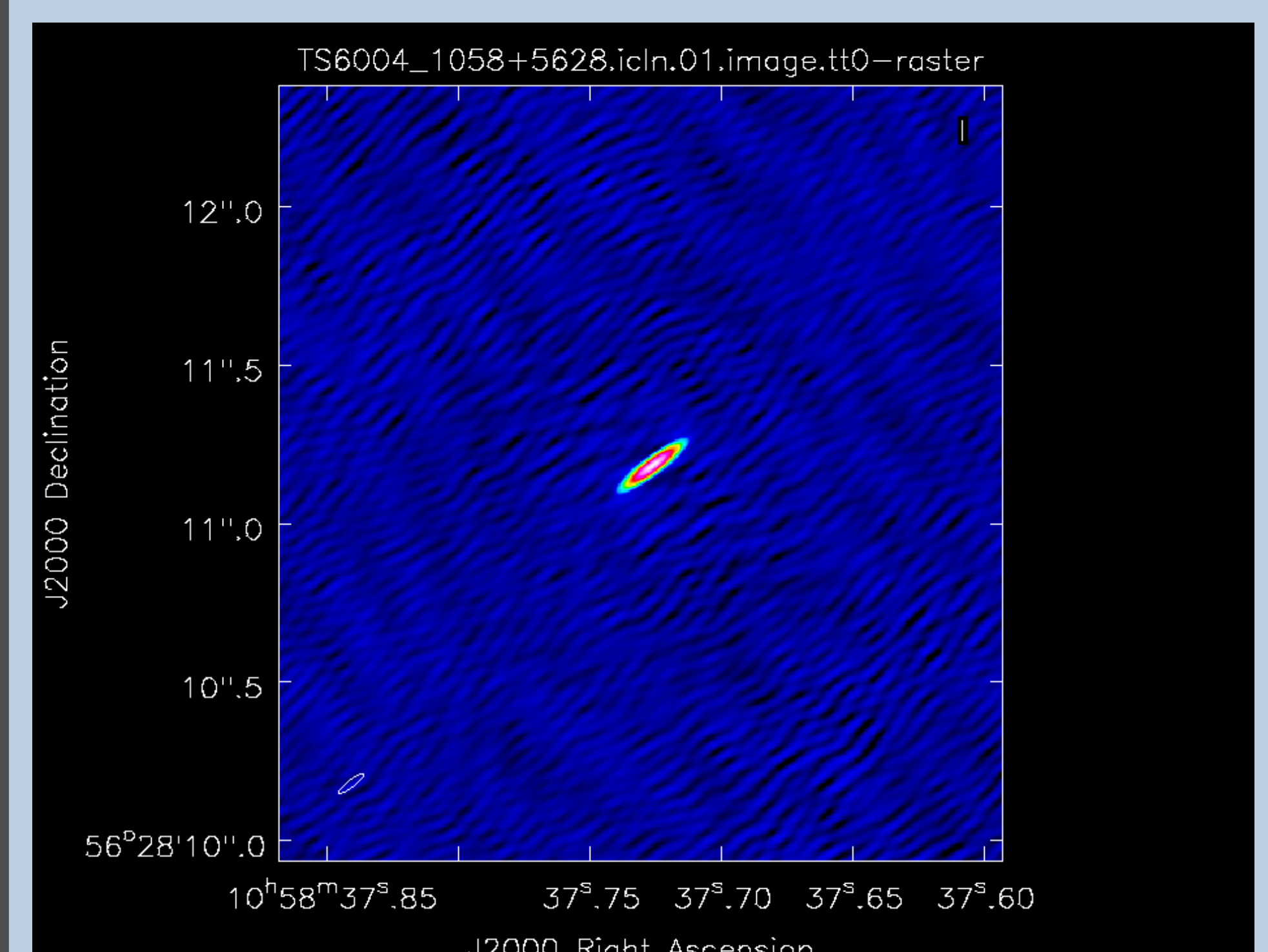
OQ208 at C band. Noisier baselines correspond to the less sensitive antenna Defford



C-band spectrum of the BP calibrator OQ208



L-band bandpass calibration after RFI removal



Pipelined phase calibrator image