HBA observations at low elevation: effect of the A-Team sources

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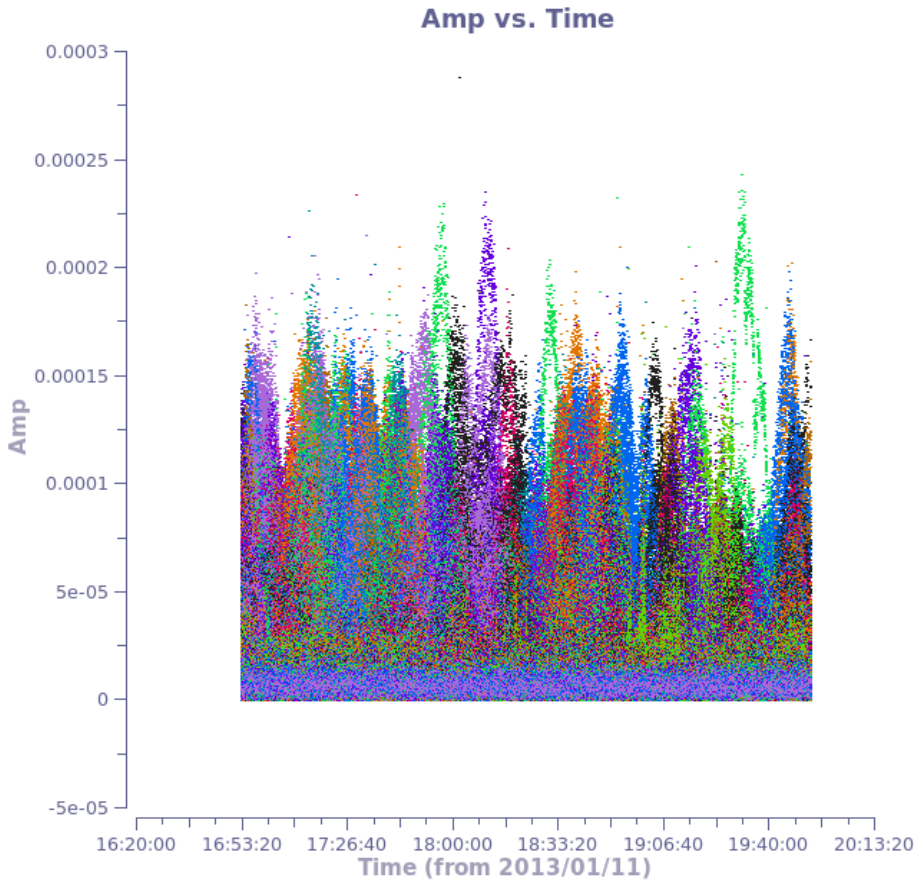
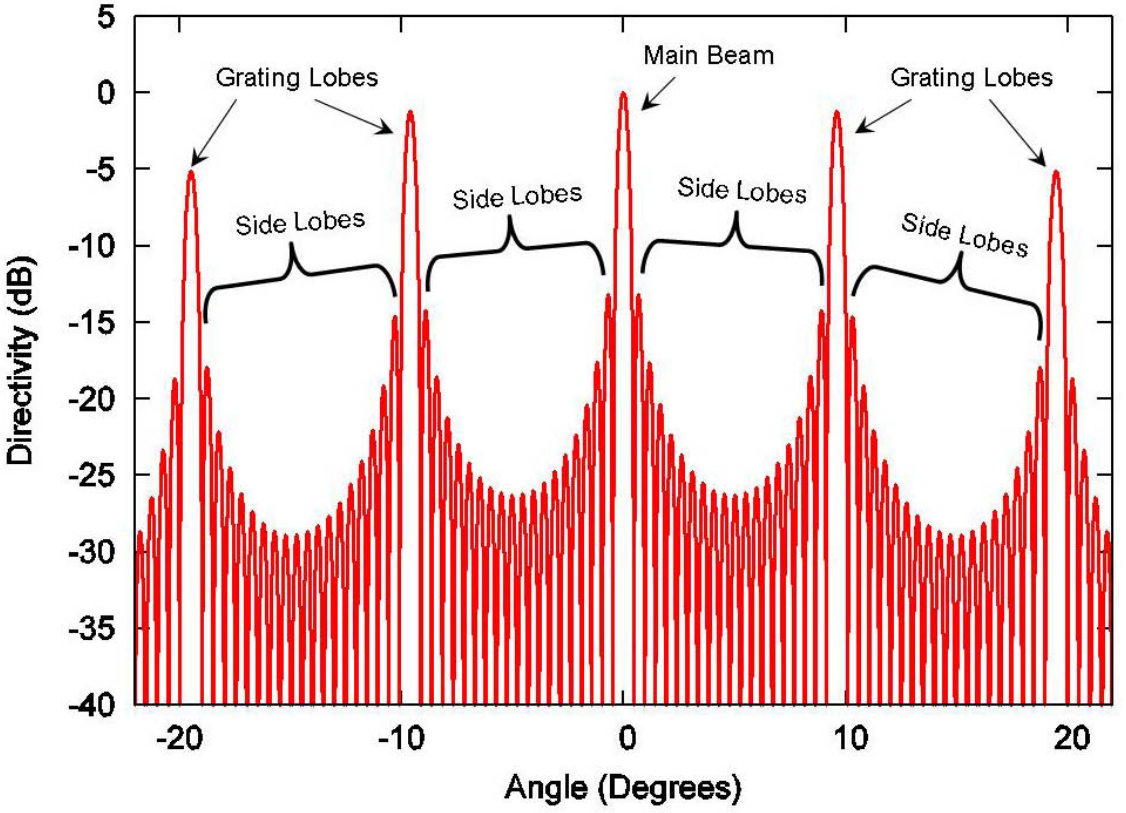
XMM-LSS in HBA

- Observation of a calibrator field close to XMM-LSS (3C53; dec ~ -4 deg)
- Problems with the calibration solutions, especially at higher frequencies.
- Data apparently affected by A-team sources.



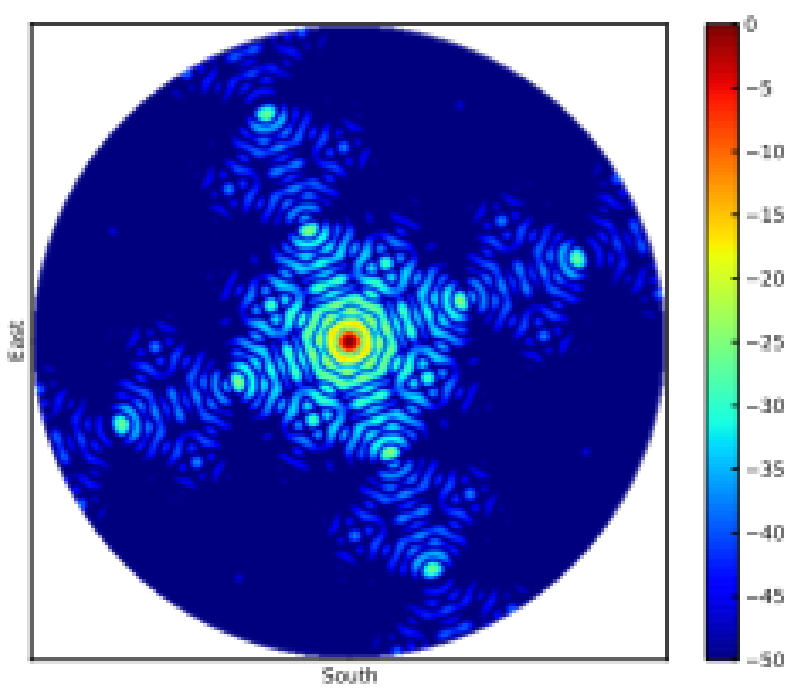
Possible explanation

- One of the A-team sources located close to a grating lobe.

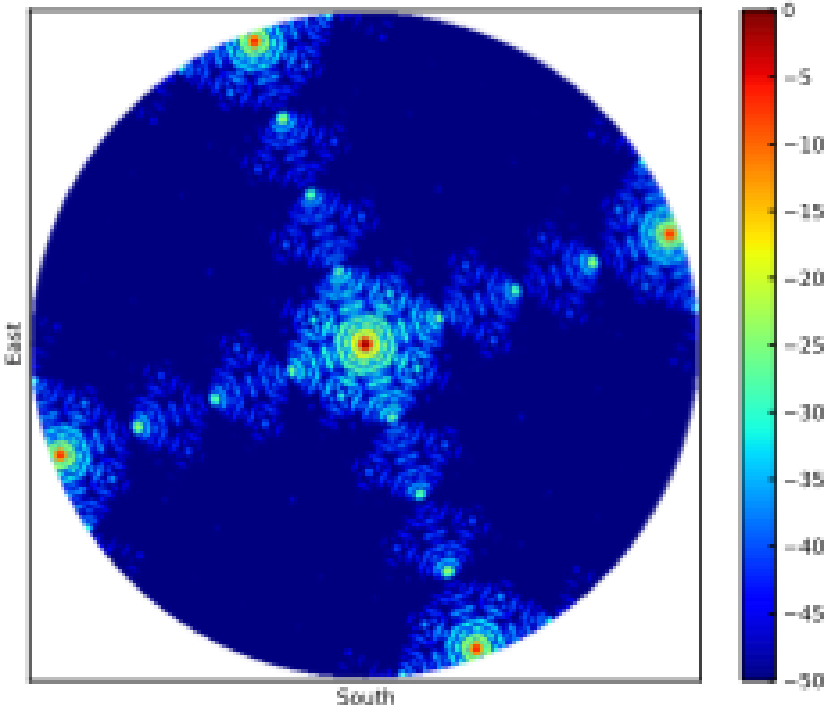


Source: http://en.wikipedia.org/wiki/Side_lobe

Grating lobes: dependence with frequency



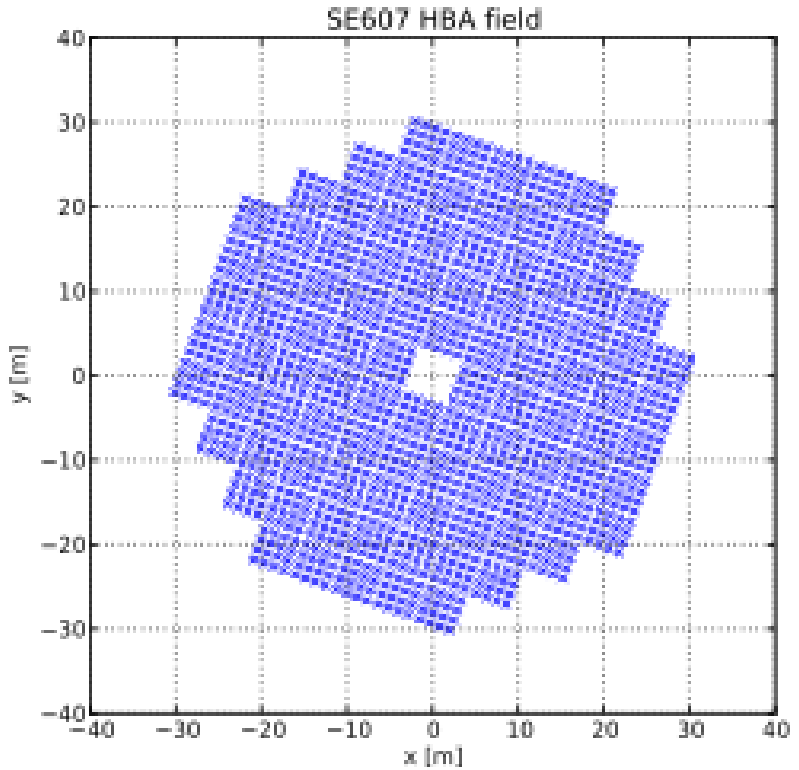
150 MHz

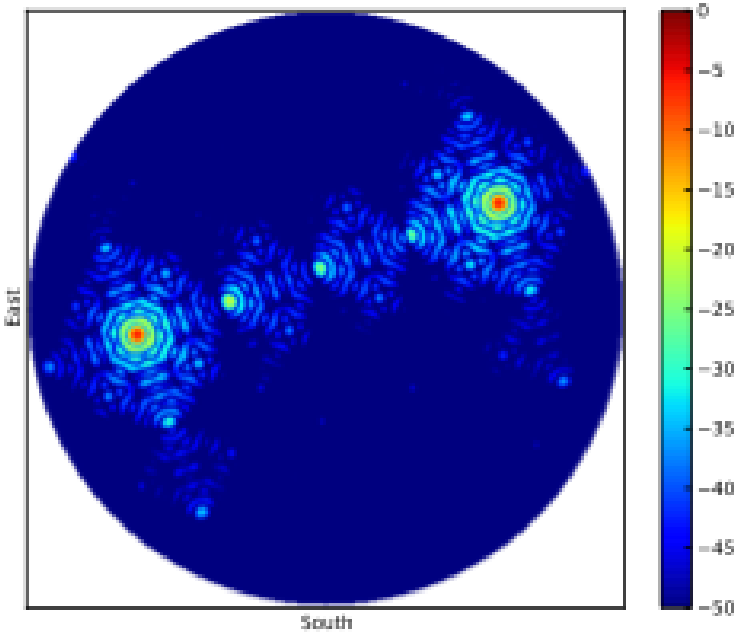


240 MHz

Source: M. Brentjens talk in Manchester (December 2012)

Grating lobes: dependence with position





180 MHz

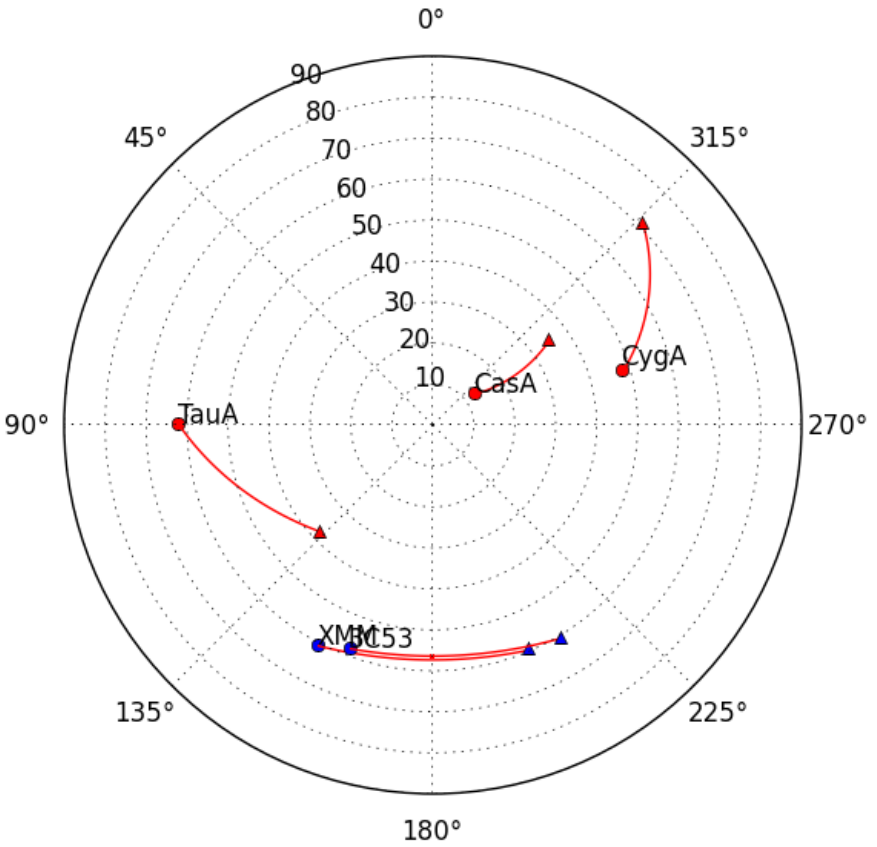
At low elevations the grating lobes may appear above the horizon.

Source: M. Brentjens talk in Manchester (December 2012)

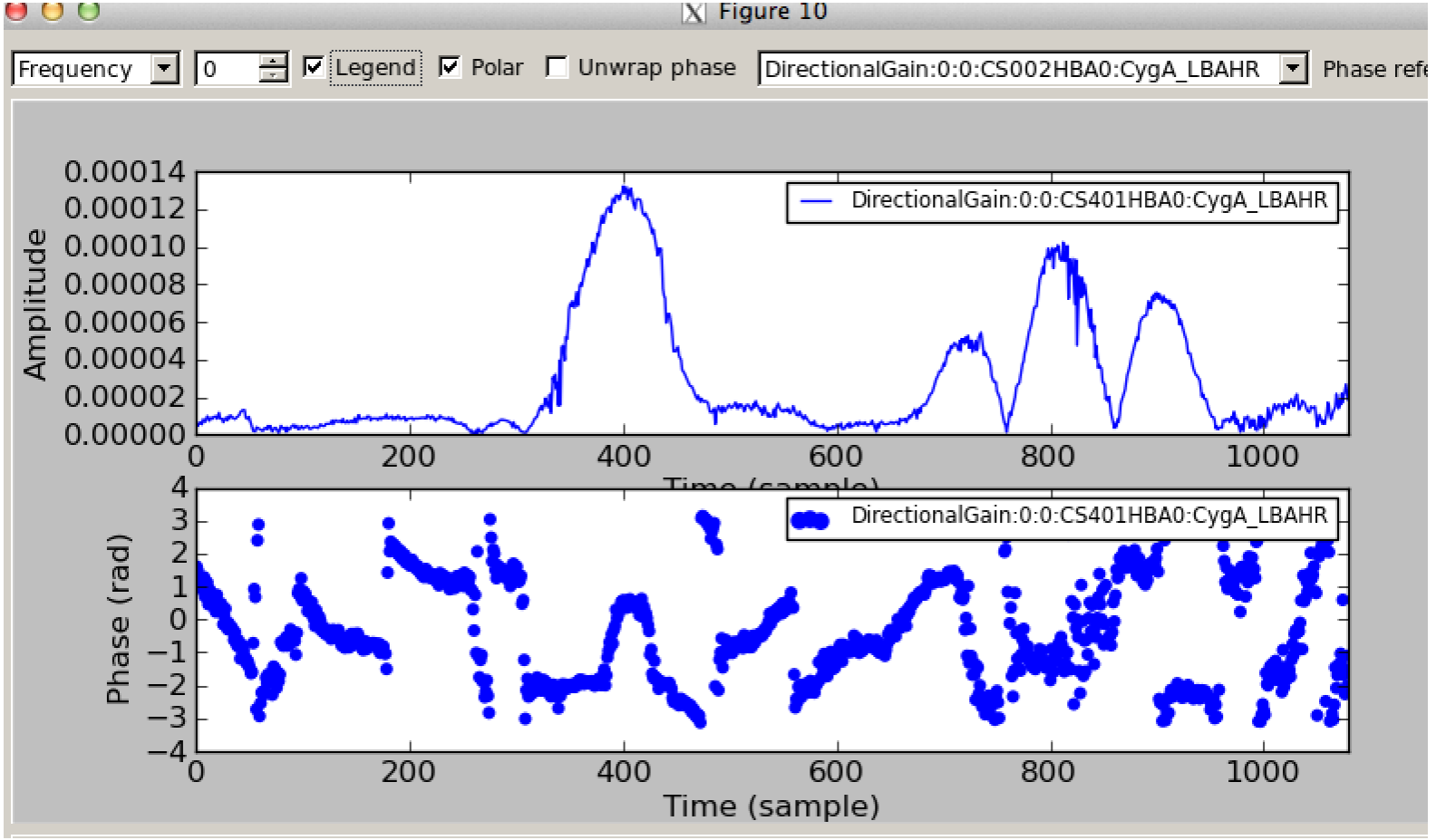
Effect of the grating lobes

- Strong sources close to the grating lobes may affect the data.
- This effect depends on:
  - The position of the main target: The grating lobes are more likely to be observed above the horizon when the main lobe is at low elevations.
  - The frequency: The position of the grating lobes depends on frequency. Higher frequency -> closer to the main lobe -> higher elevation.
  - The time: Grating lobes do not track the sky as the main lobe does. Sources may come in and out of them during the observation.

Position of the fields and sources

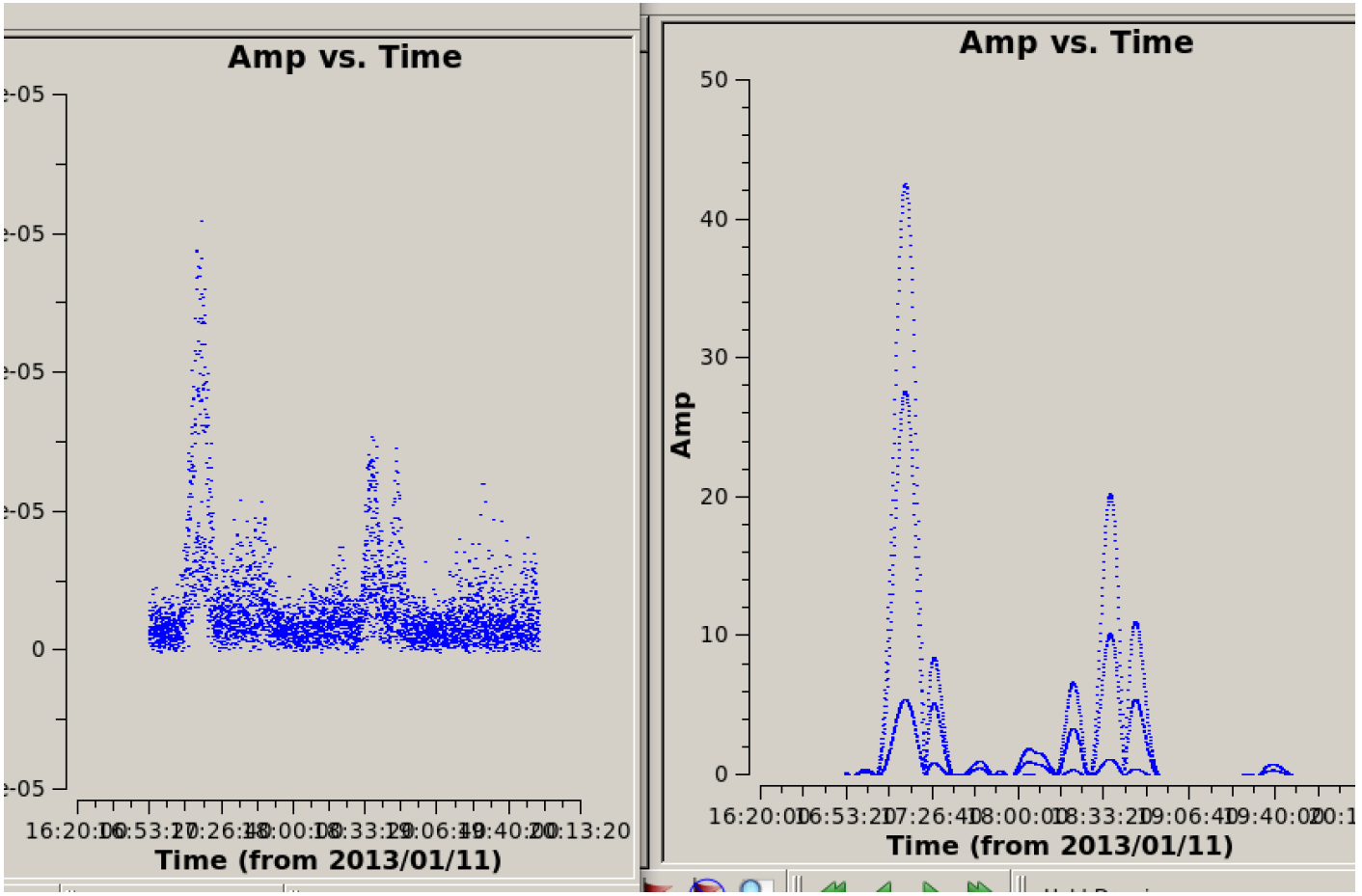


Test with the demixing solutions



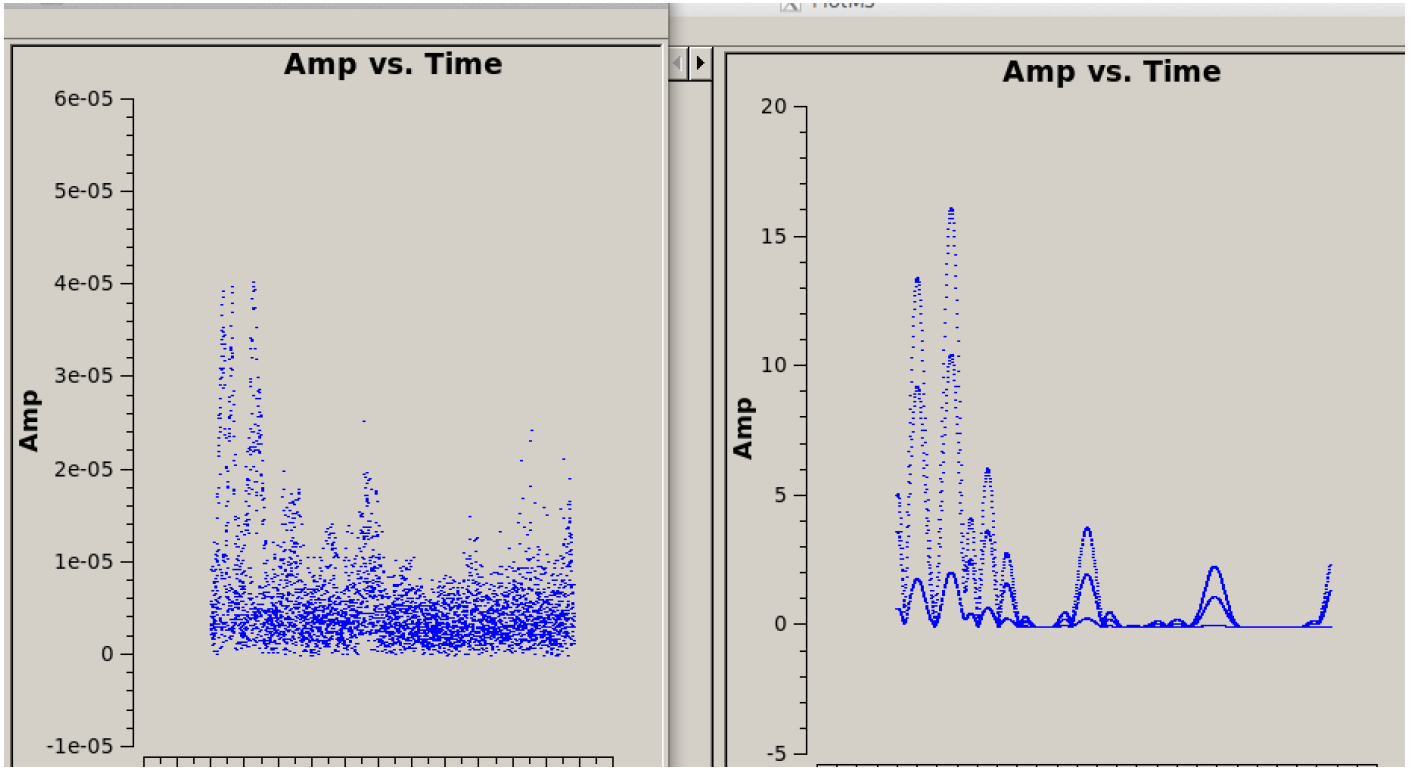
Solutions of the demixing of Cyg A

Test with a BBS simulation



Simulated effect of Cyg A (right) versus real data (left)

Test with a BBS simulation



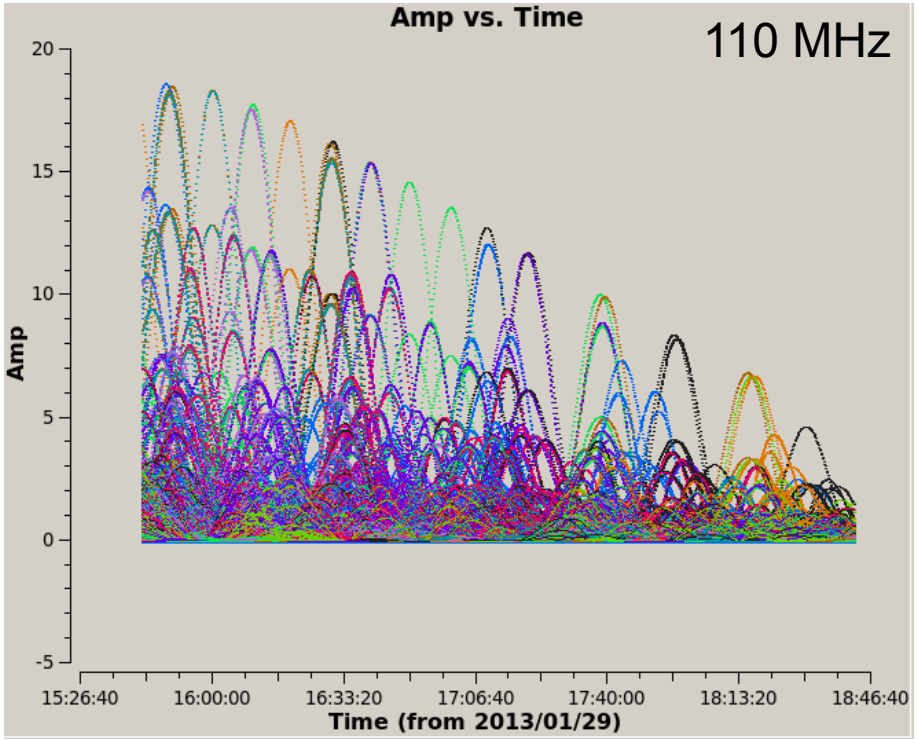
Simulated effect of Cyg A (right) versus real data (left)

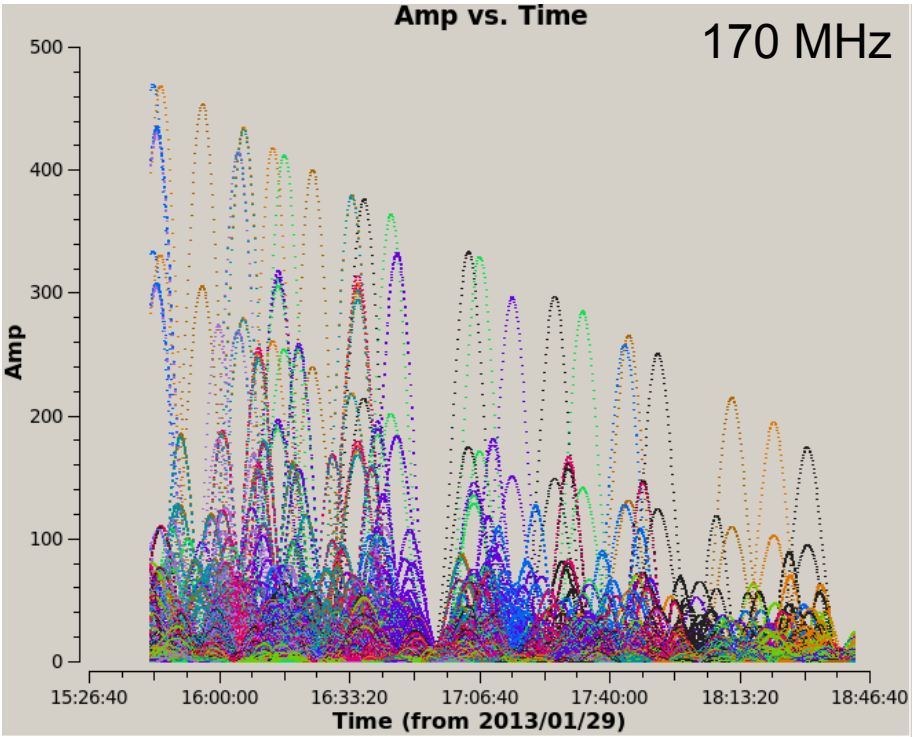
Simulations with BBS

- **makems** to create a simulated MS.
- **makebeamtables** to update the calibration tables.
- **predict** with **BBS** to simulate the effect of the A-team sources.

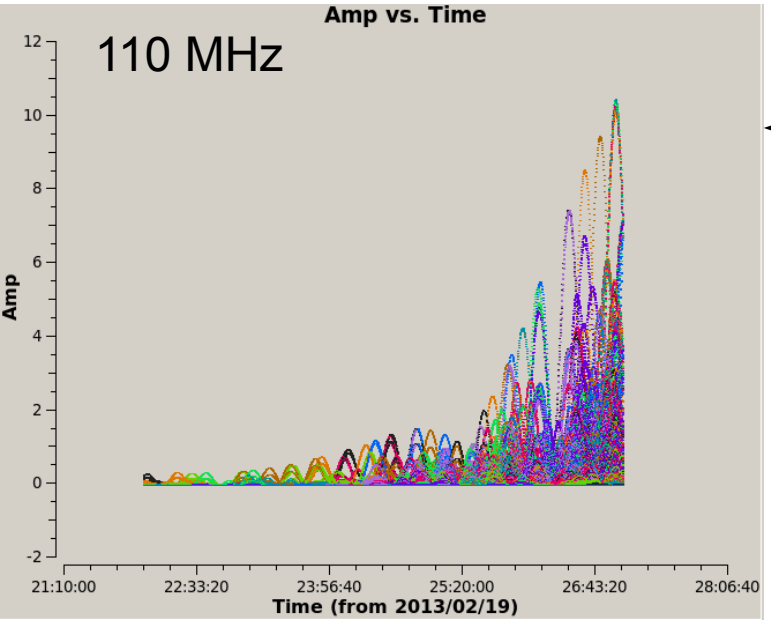
Simulations with BBS

Simulation of CygA in 3C53 field (XMM-LSS); dec ~-3deg

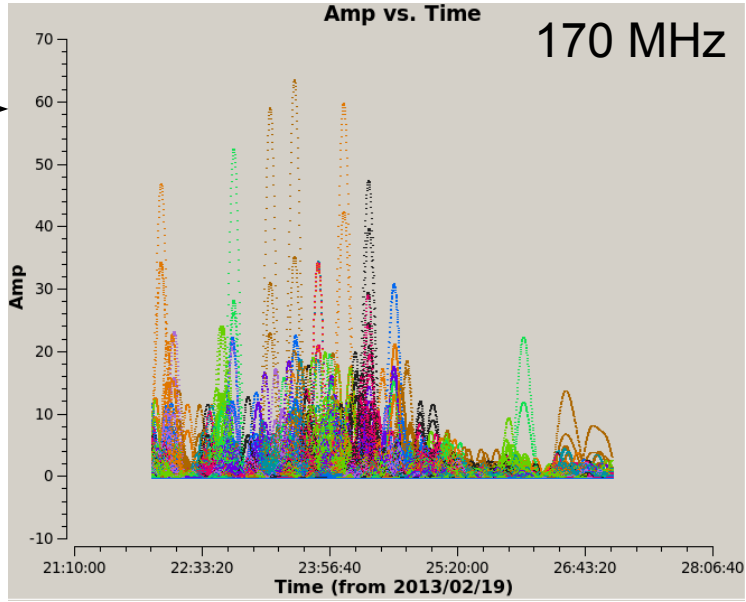




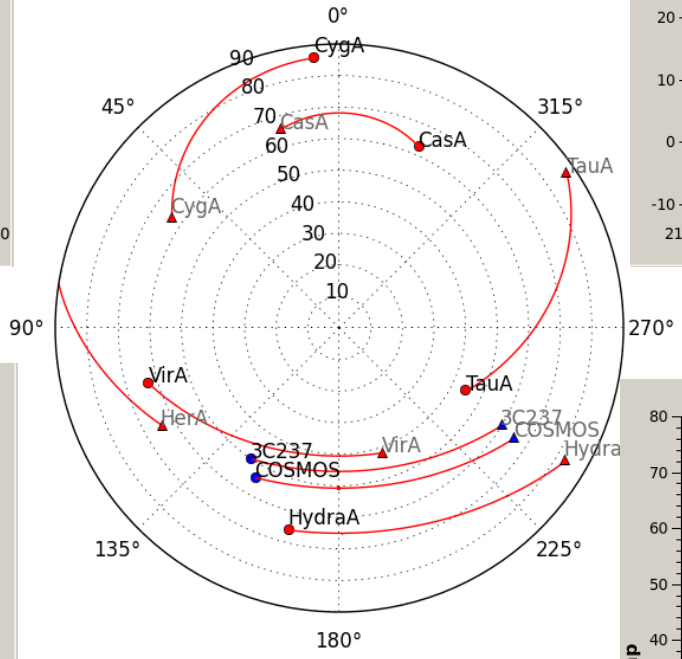
Simulations with BBS

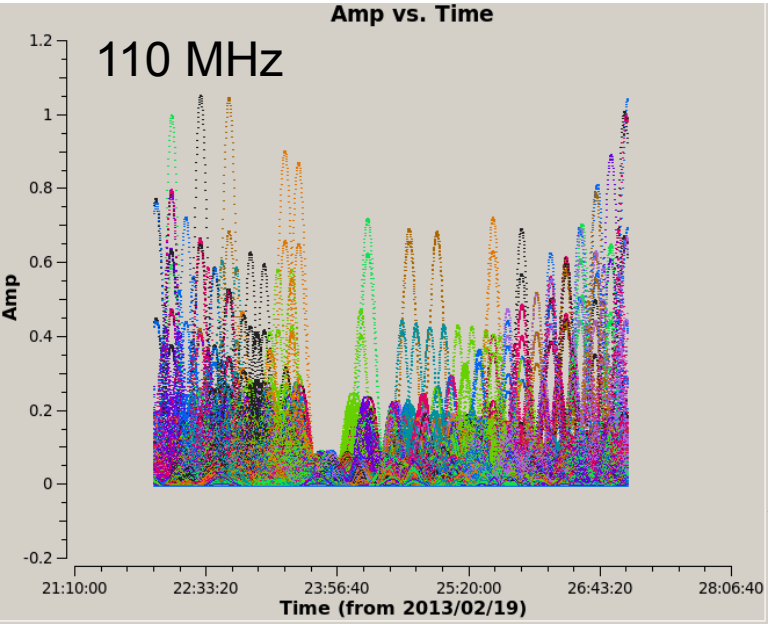


CygA

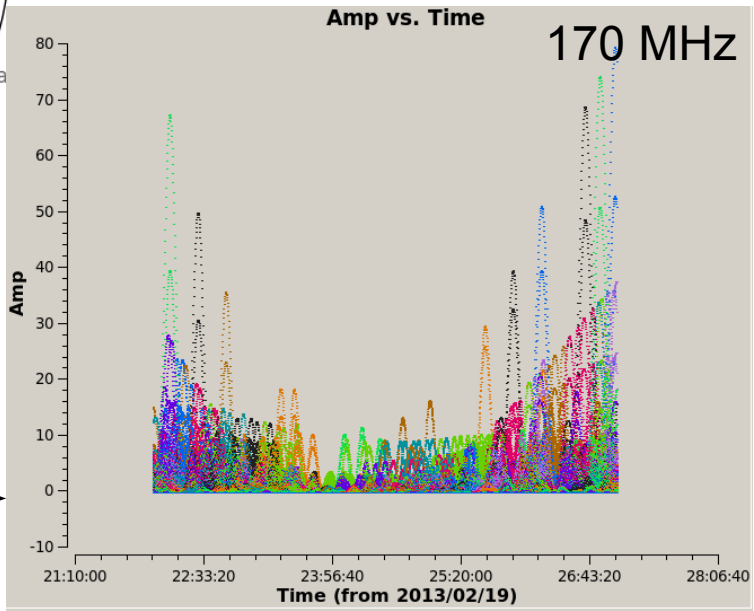


3C297 field (COSMOS)
dec ~5deg

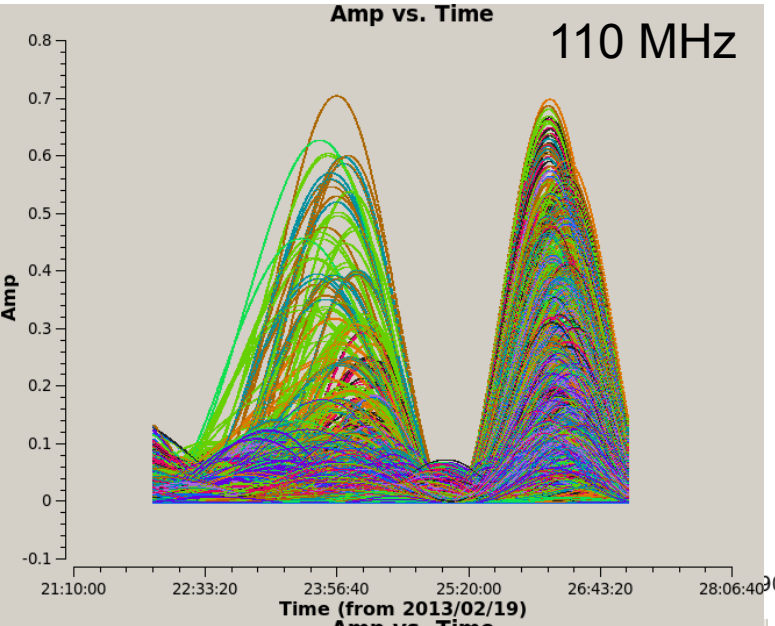




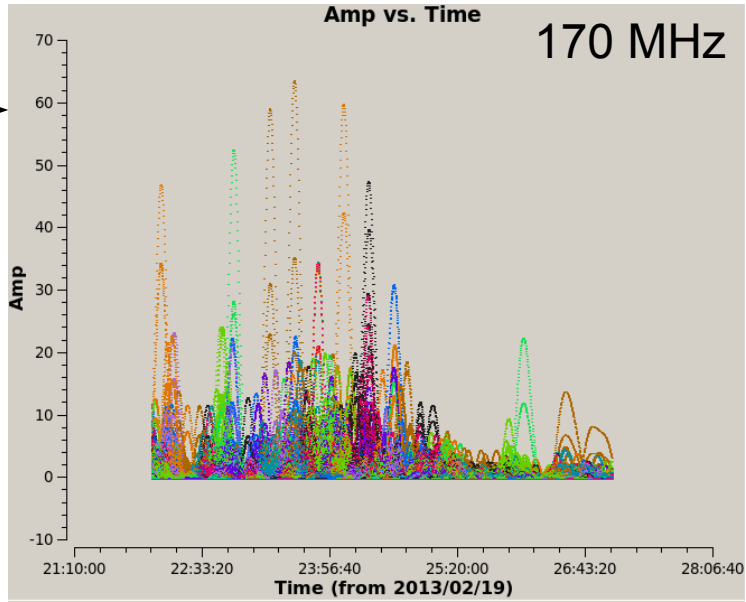
CasA



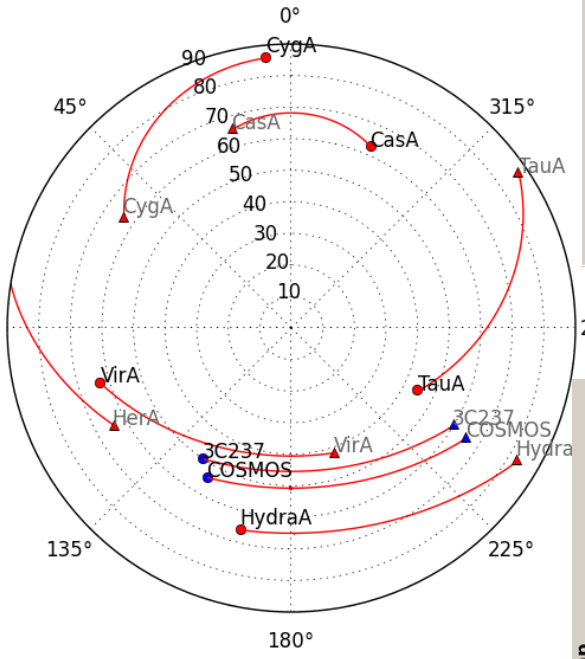
Simulations with BBS

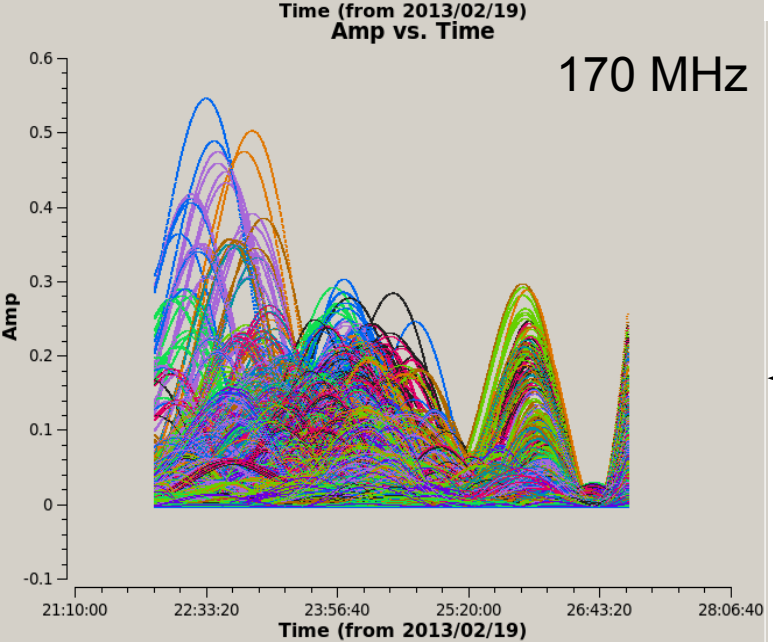


CygA



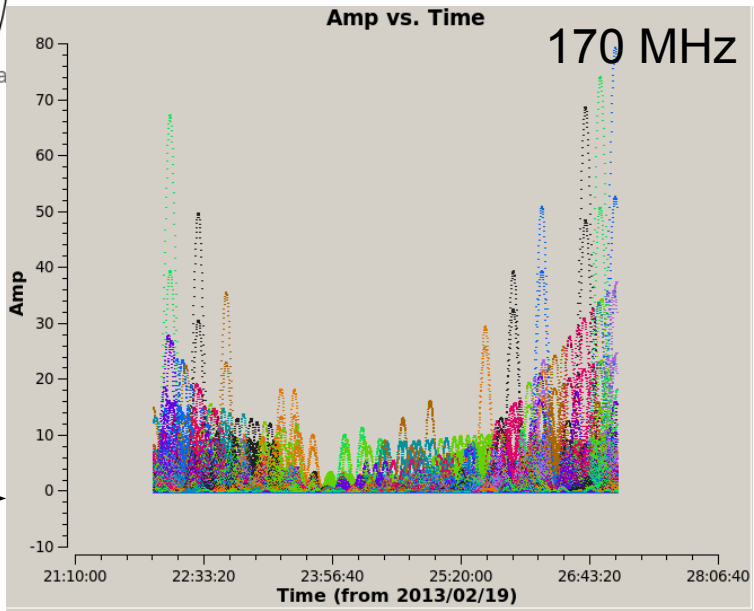
3C297 field (COSMOS)
dec ~5deg





HydraA

CasA



Results

- At low elevations, A-team sources may affect the observation even if they are very far away.
- The effect depends on postion of the main target, frequency and time.
- The beam model seems to be very good as shown in the BBS simulations.
- It may be possible to predict the effect of A-team sources before an observation with a BBS simulation. Test with COSMOS (observed yesterday night).

Appendix: The drawer (3C53 field)

- Cyg A located at about 91 degrees.
- Probably plotted by the drawer as an overdensity of lines in the border.