

HBA Tied-Array Observations of Radio Recombination Lines

Leah Morabito, Raymond Oonk, Reinout van Weeren
+ RRL Working Group

LOFAR Status Meeting

29 May 2013

Commissioning Project Intent

Goals

- ▶ Test the tied-array beam mode with the full NL-core for spectral line observations with the HBA
- ▶ Test the spectral sensitivity of the HBA as a function of time and frequency
- ▶ Test the bandpass stability of the HBA as a function of time and frequency

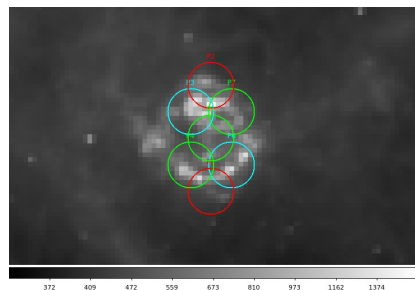
Status

- ▶ 50% complete (time)
- ▶ 15% complete (fields)
- ▶ Field observed: Cas-A
 - ▶ Known RRL emitter
 - ▶ Brightest of 4 targets, can study noise properties

Cas-A Observation & Data Processing

Intent of Observing Cas-A: Strong source with known RRL observations to check the system for anomalies

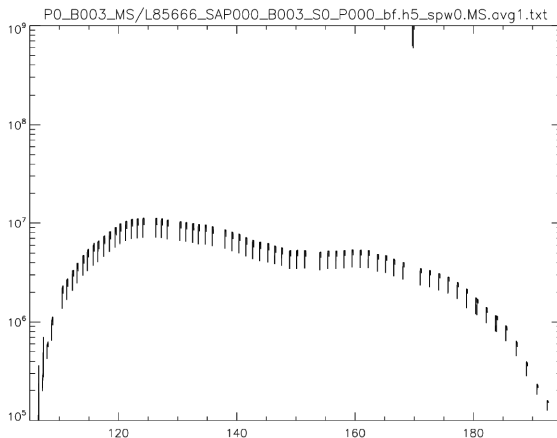
- ▶ 27 January 2013
- ▶ 8 hours day time
- ▶ 256 ch/SB
- ▶ 7 TA beams centered on source
- ▶ No data last 3 hours (BG crash)
- ▶ Data processed through specialized scripts adapted from LBA observations

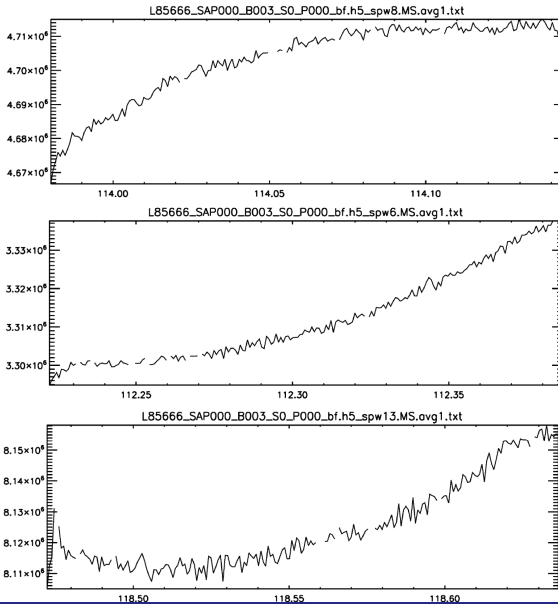


TA Beam pointings overlaid on 12 μm WISE Observation of dust in Cas-A

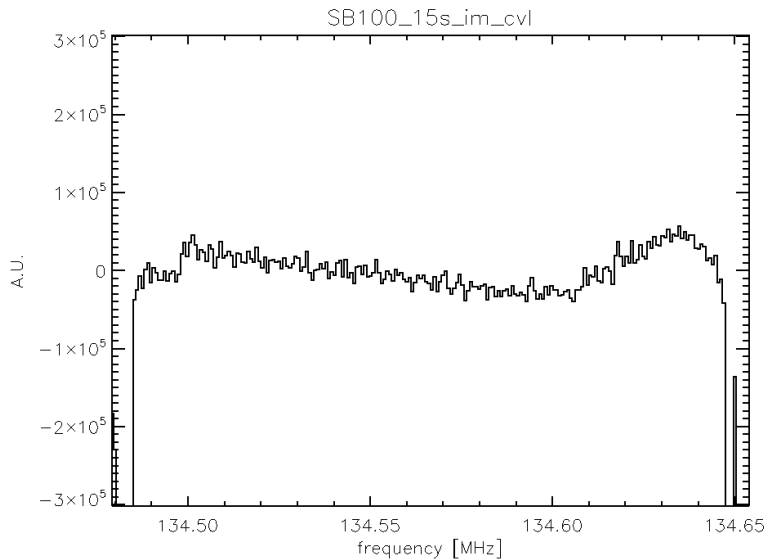
Commissioning Goals

- ▶ Test the bandpass stability of the HBA as a function of time and frequency





Also seen in interferometric observation of Cas-A (2 hr, Aug 2012)

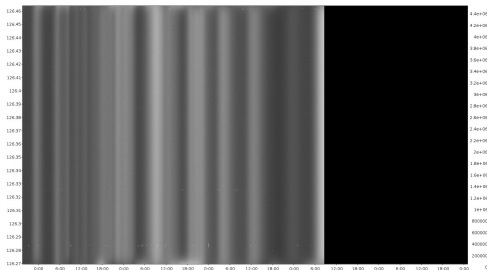


Commissioning Goals

- ▶ Test spectral sensitivity as a function of time and frequency

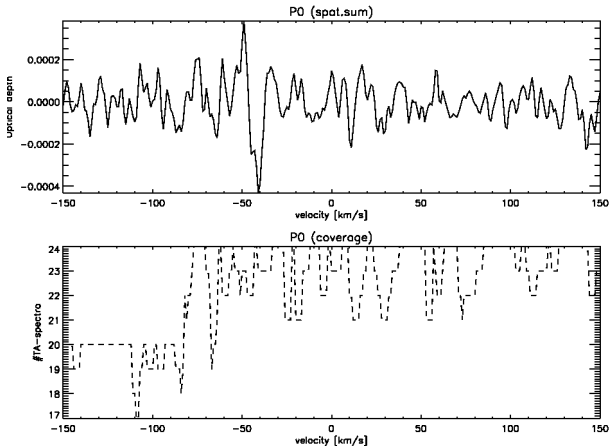
NOTE: Limited by dynamic range of observing bright object that dominates the sky for the observation

- ▶ RMS noise $\sim 4 \times 10^{-4}$ (LBA: $\sim 5 \times 10^{-4}$)
- ▶ Amplitude variations in time
- ▶ Still need to check RMS noise as a function of time



Commissioning Goals

- ▶ Test the tied-array beam mode with the full NL-core for spectral line observations with the HBA



Are we meeting our goals?

Goals

- ▶ Test the tied-array beam mode with the full NL-core for spectral line observations with the HBA
 - ▶ Initial observation & reduction accomplished
 - ▶ Promising observational mode for spectral line work
- ▶ Test the spectral sensitivity of the HBA as a function of time and frequency
 - ▶ This observation is entirely dominated by Cas-A
 - ▶ The other 4 fields will not be source dominated
- ▶ Test the bandpass stability of the HBA as a function of time and frequency
 - ▶ Subbands (0.2 MHz wide) show spectral curvature
 - ▶ Overall bandpass is stable

Top Action Items

- ▶ Test the tied-array beam mode with the full NL-core for spectral line observations with the HBA
 - ▶ Observe next 3 fields which have different noise properties
- ▶ Test the spectral sensitivity of the HBA as a function of time and frequency
 - ▶ Characterize noise dependence on time
 - ▶ Investigate dependence of amplitude on time – A-team?
- ▶ Test the bandpass stability of the HBA as a function of time and frequency
 - ▶ Curvature of SB: is this seen in other observations?