Exploitation of LOFAR surveys to study galaxy clusters

Cycle-0: status

Francesco de Gasperin

LC0_037 (PI: Bruggen) has been awarded **156** observing hours and **224** processing hours.

Cluster	HBA	LBA	Lead
Coma	10 hr		Annalisa
Perseus	10 hr		Emanuela
A2256	10 hr	18 hr	Reinout
A2255	10 hr		Roberto
Sausage	10 hr		Reinout/Andra
Toothbrush	10 hr	16 hr	Reinout/Francesco
MACS0717+3745	10 hr	16 hr	Annalisa
A1682	10 hr		Giulia
A1914	10 hr	16 hr	Chiara

HBA

HBA dual inner - 8 bit - 1s integration time
Strong calibrator observed for 10 min at the beginning and end of the observation
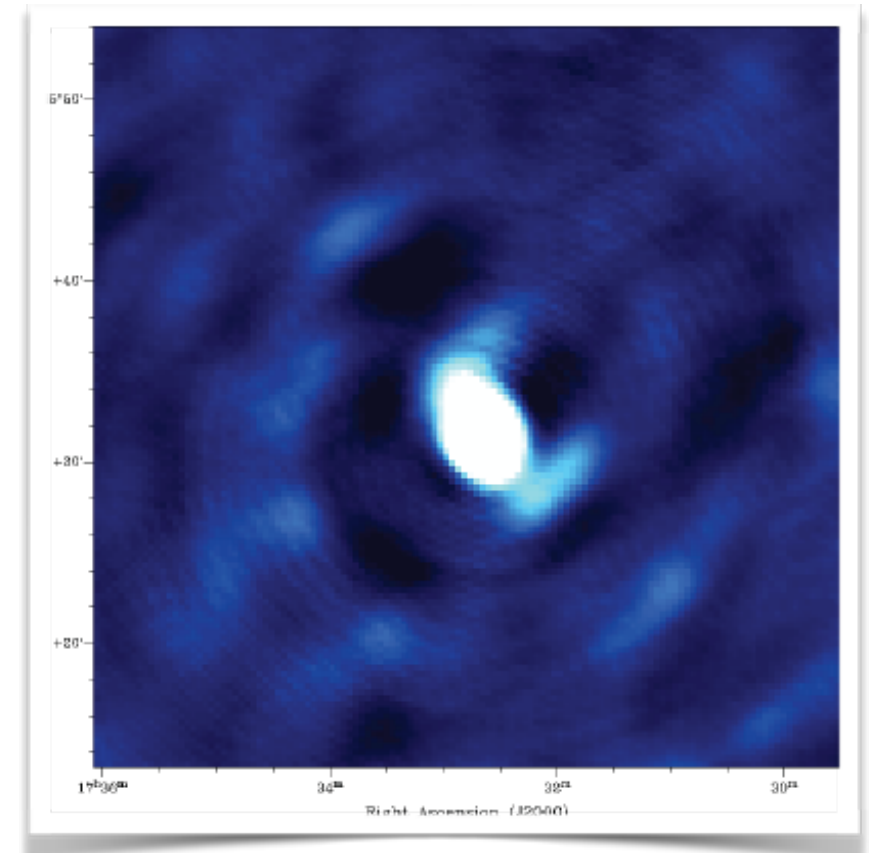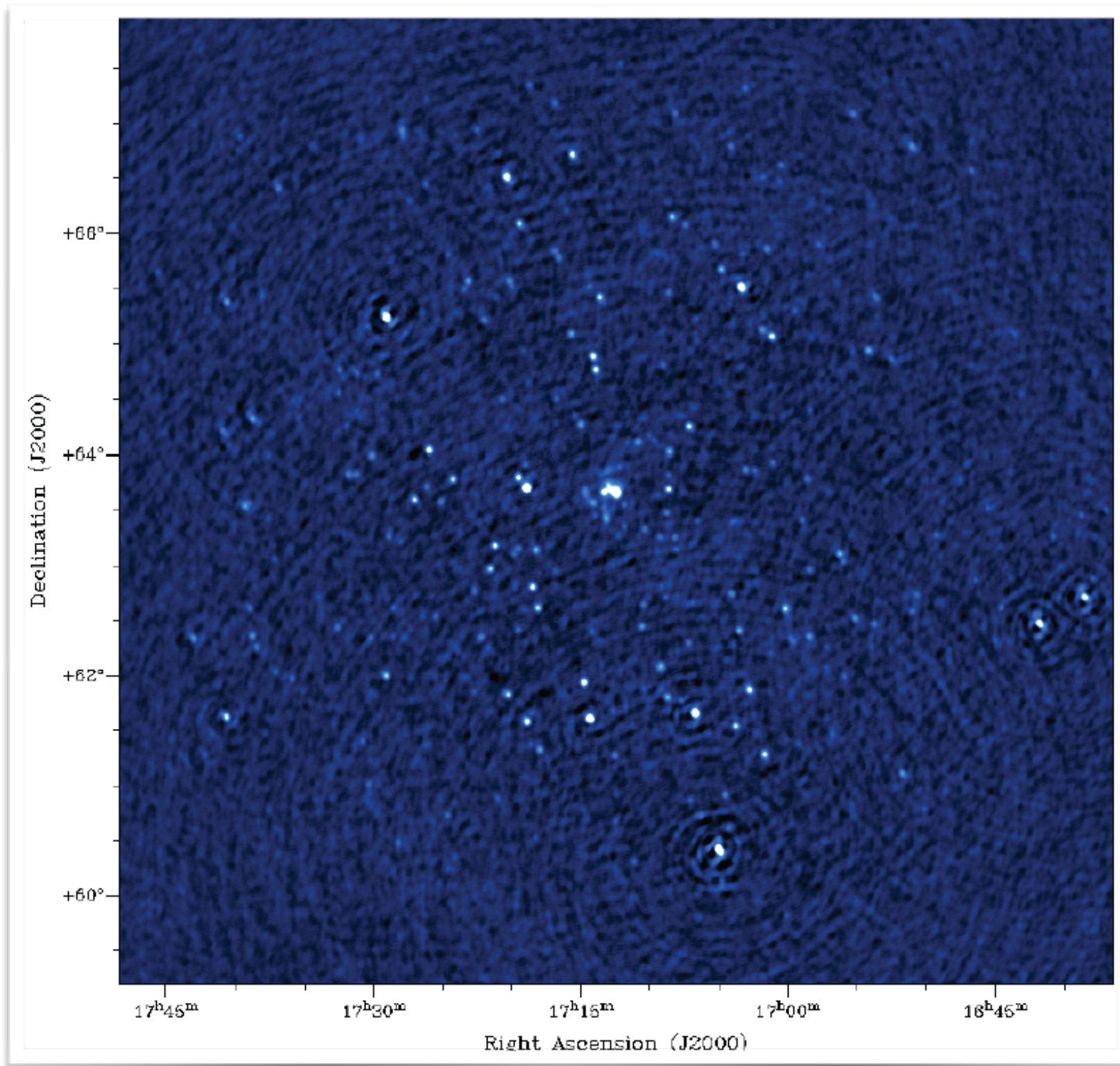Calibrator within the tile beam for Clock/TEC separation

LBA

LBA_OUTER - 8 bit - 2s integration time
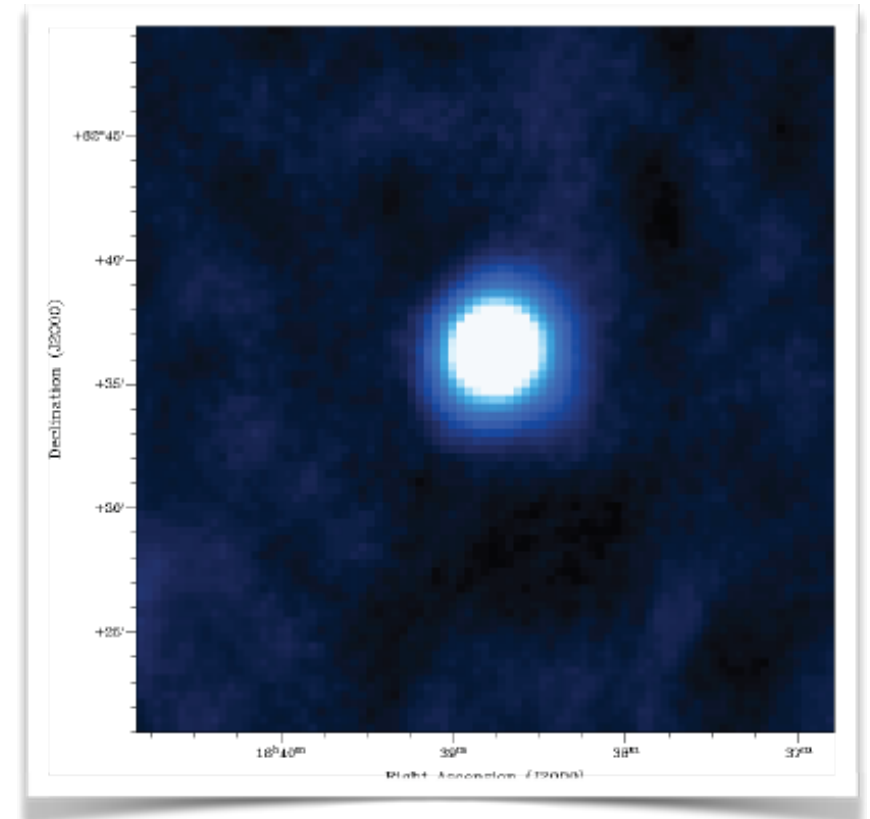48 MHz beam to the target field and a 48 MHz beam to a calibrator

Abell 2255 (HBA)

2011 Observation
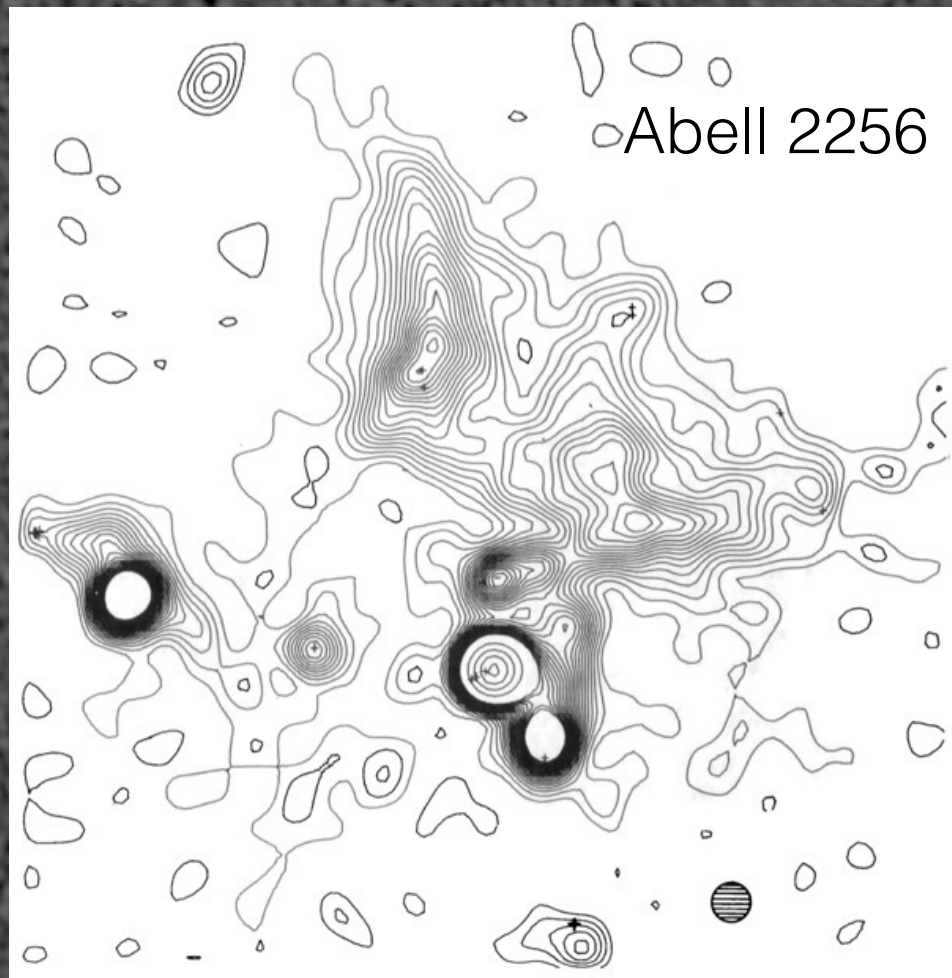

R. Pizzo

2013 Observation
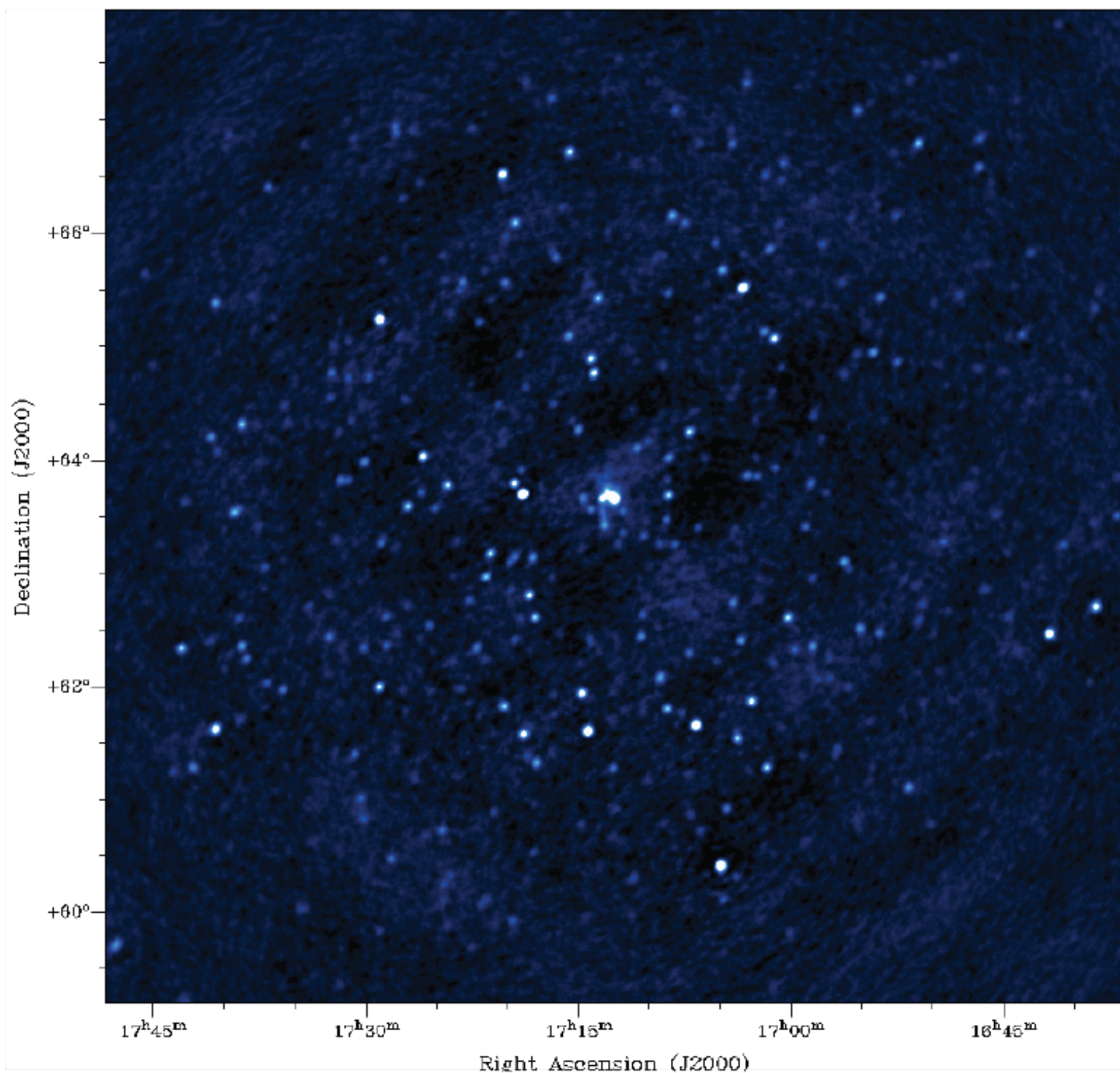
Noise improved
by a factor of 2

R. Pizzo

Abell 2256

- LOFAR HBA 150 MHz
- 2 MHz bandwidth (out of 72 MHz)
- max. baseline 4 km

Bridle, Formalont, Miley & Valentijn (1979):
WSRT 610 MHz
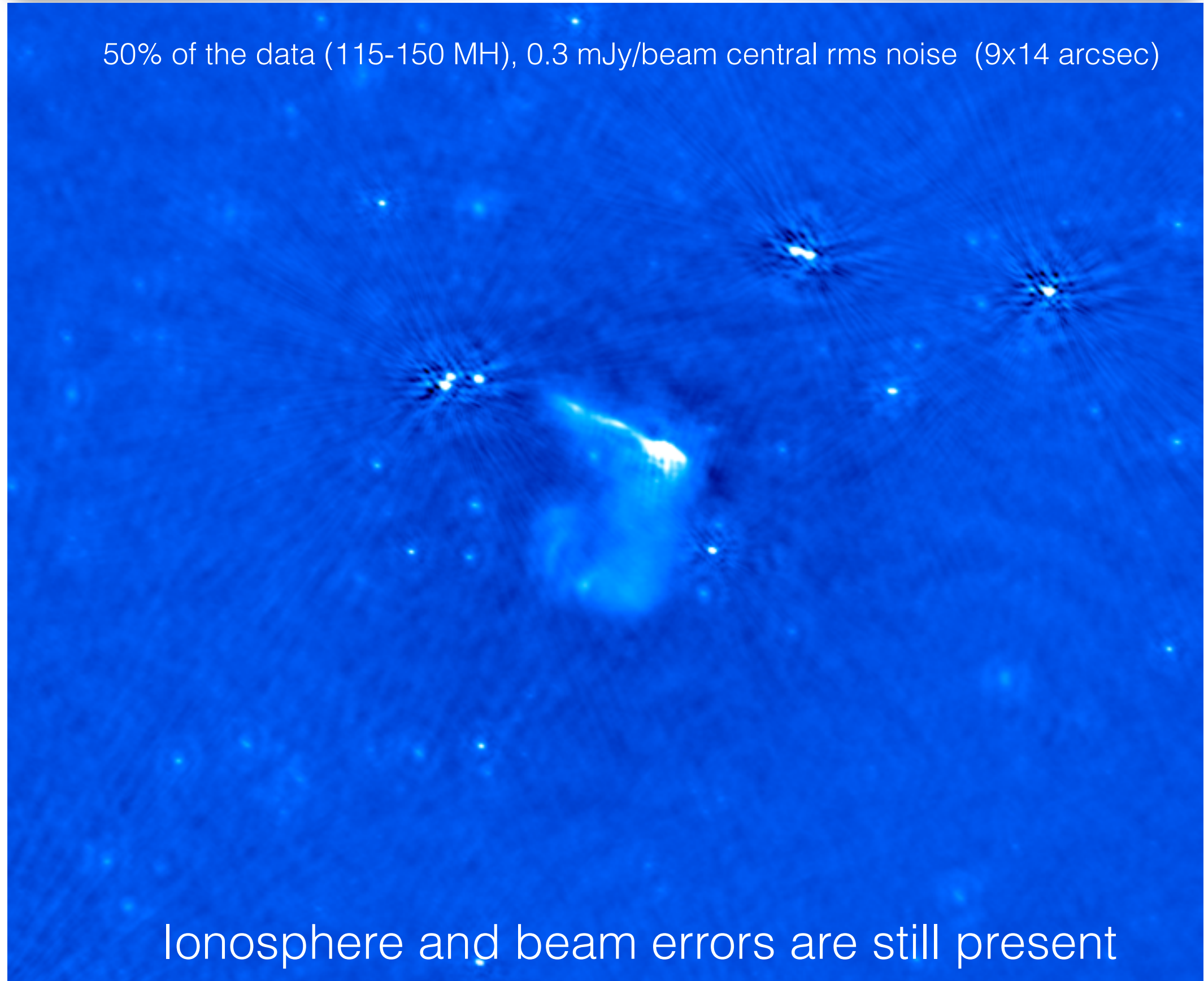
R. van Weeren
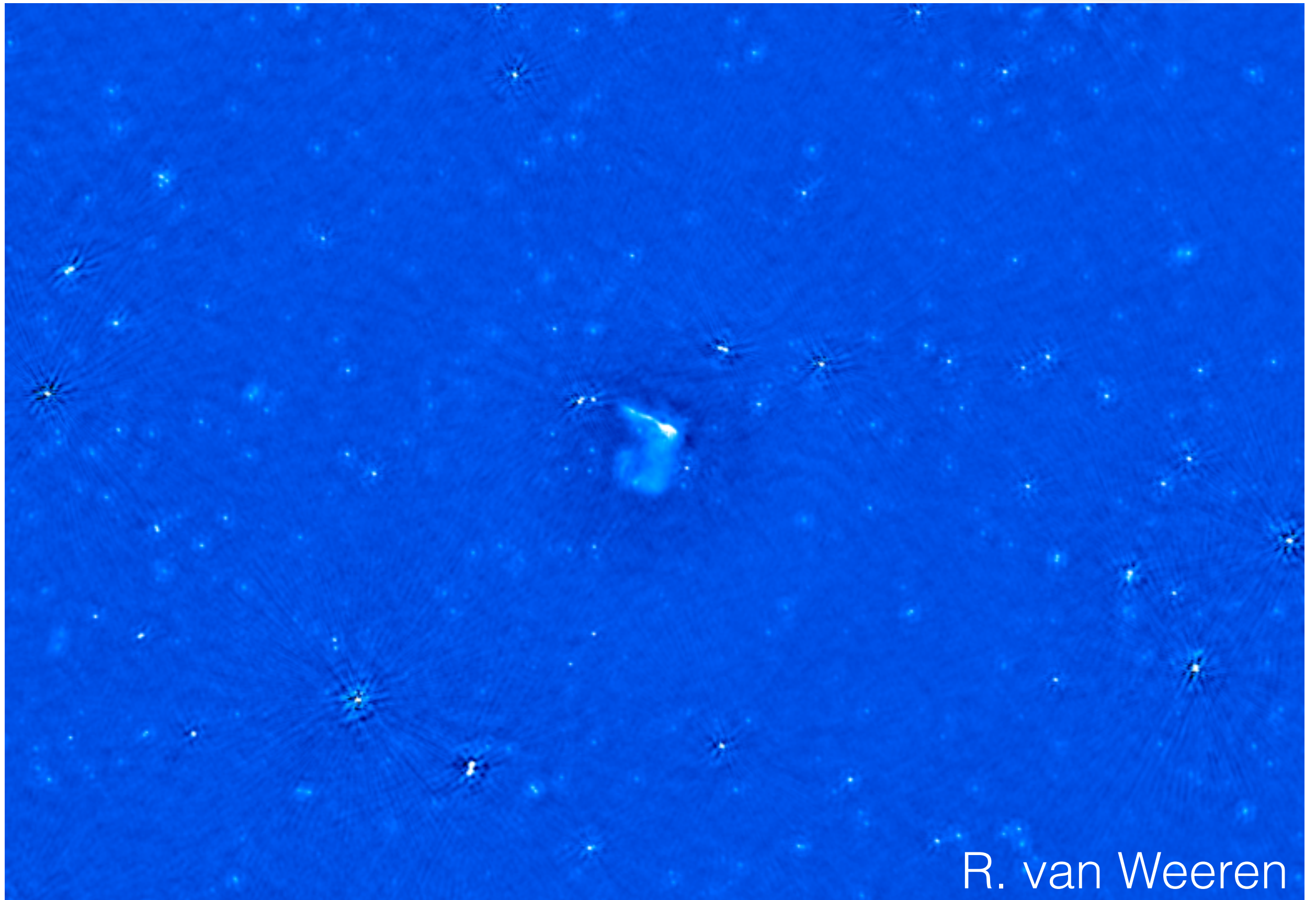
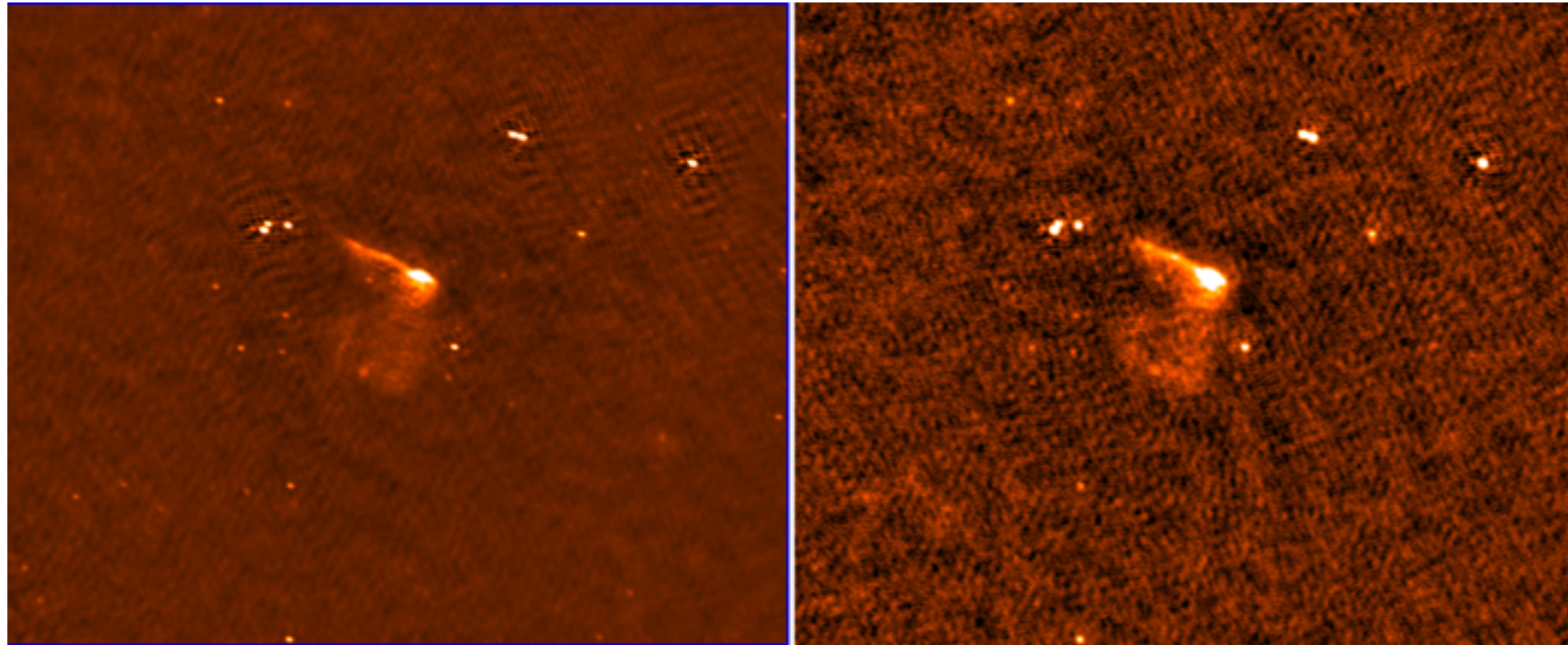# Toothbrush (HBA)

R. van Weeren

Toothbrush (HBA)

50% of the data (115-150 MH), 0.3 mJy/beam central rms noise (9x14 arcsec)

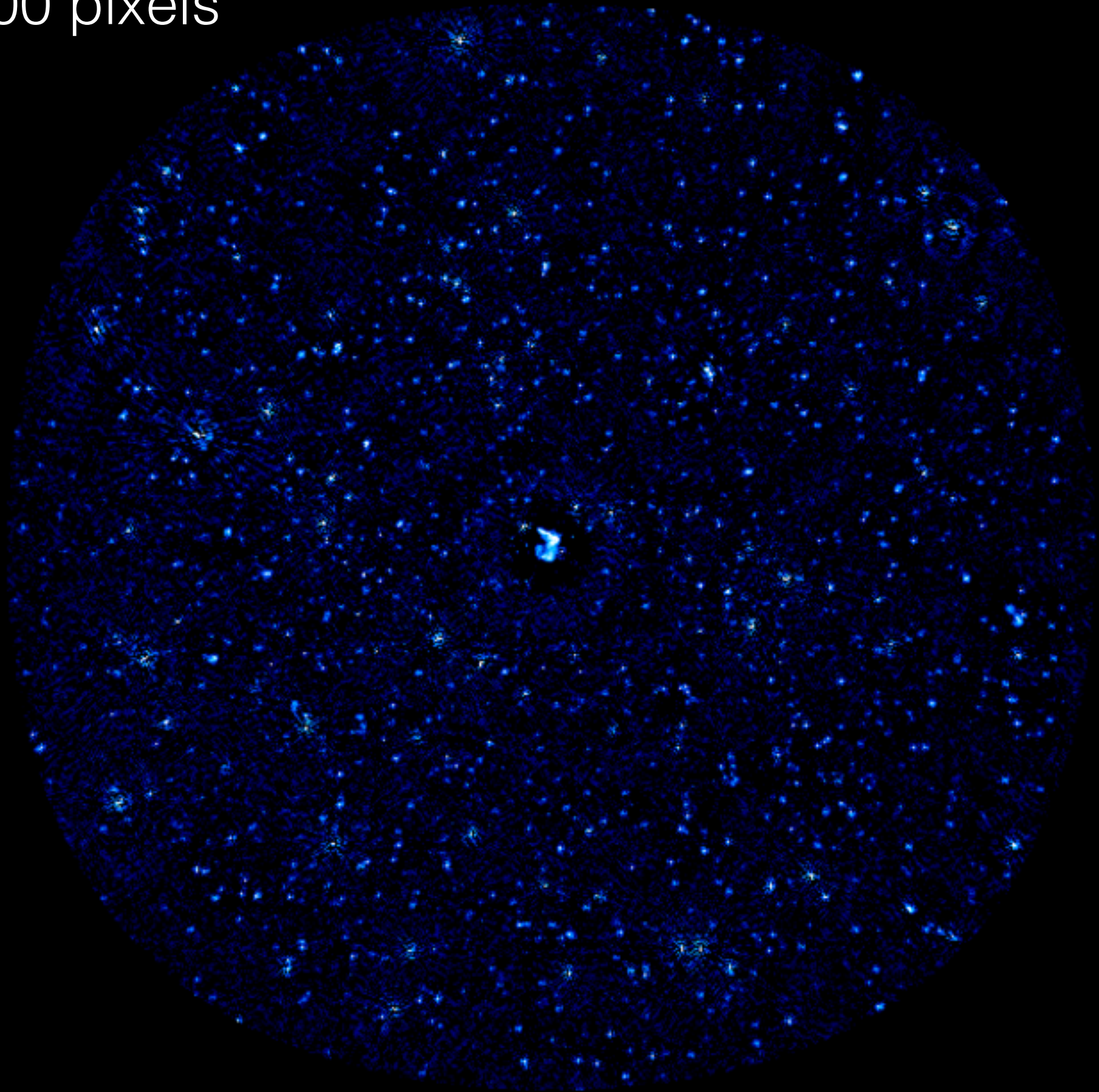Ionosphere and beam errors are still present

Toothbrush (HBA)

10 hrs LOFAR @150 MHz
- 3 % of the data,
- 1/4 of the resolution available

10 hrs LOFAR @150 MHz
- 0.5 % of the data,
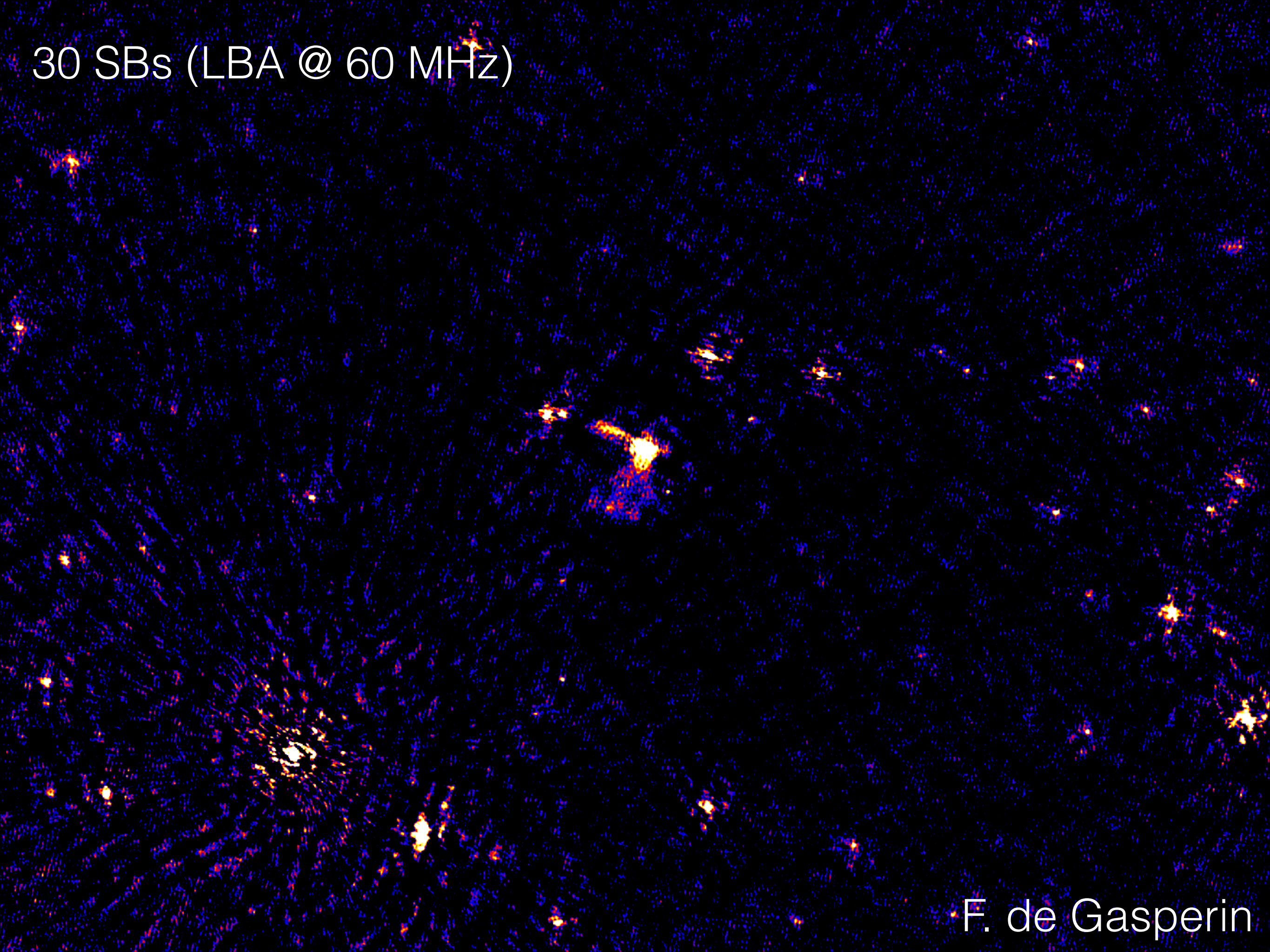- 1/4 of the resolution available

12000x12000 pixels

4°

30 SBs (LBA @ 60 MHz)

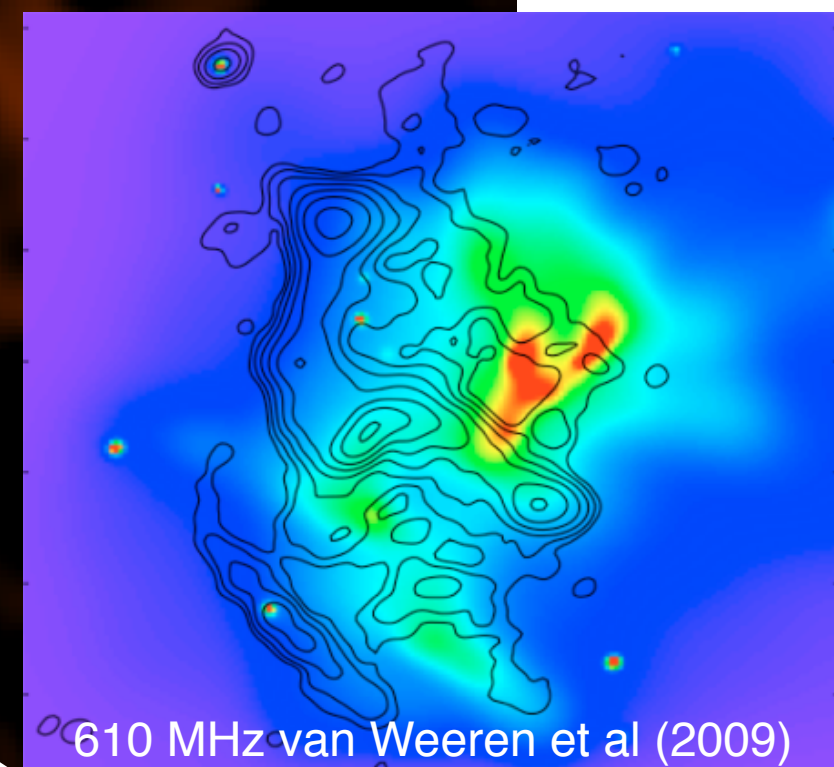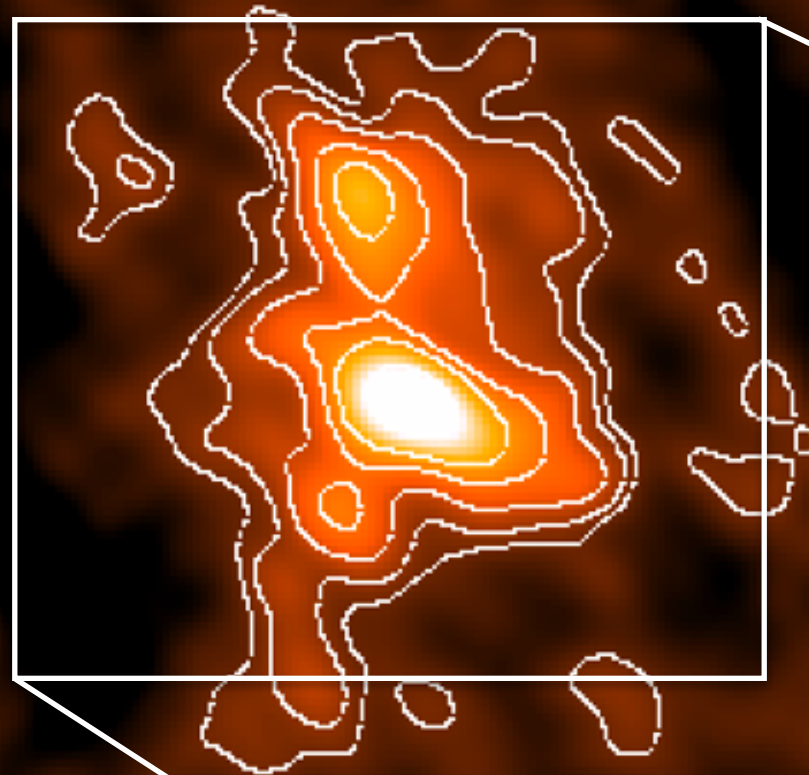F. de Gasperin

MACS (HBA)

A. Bonafede

10 degrees

Image at 150 MHz,
5 MHz Bandwidth [10% of data]

25" resolution
rms noise ~0.2 mJy/beam

MACS (HBA)

150 MHz,
5 MHz Bandwidth [10% of data]
25" resolution
rms ~0.2 mJy/beam

500 kpc

A. Bonafede

610 MHz van Weeren et al (2009)

Next steps

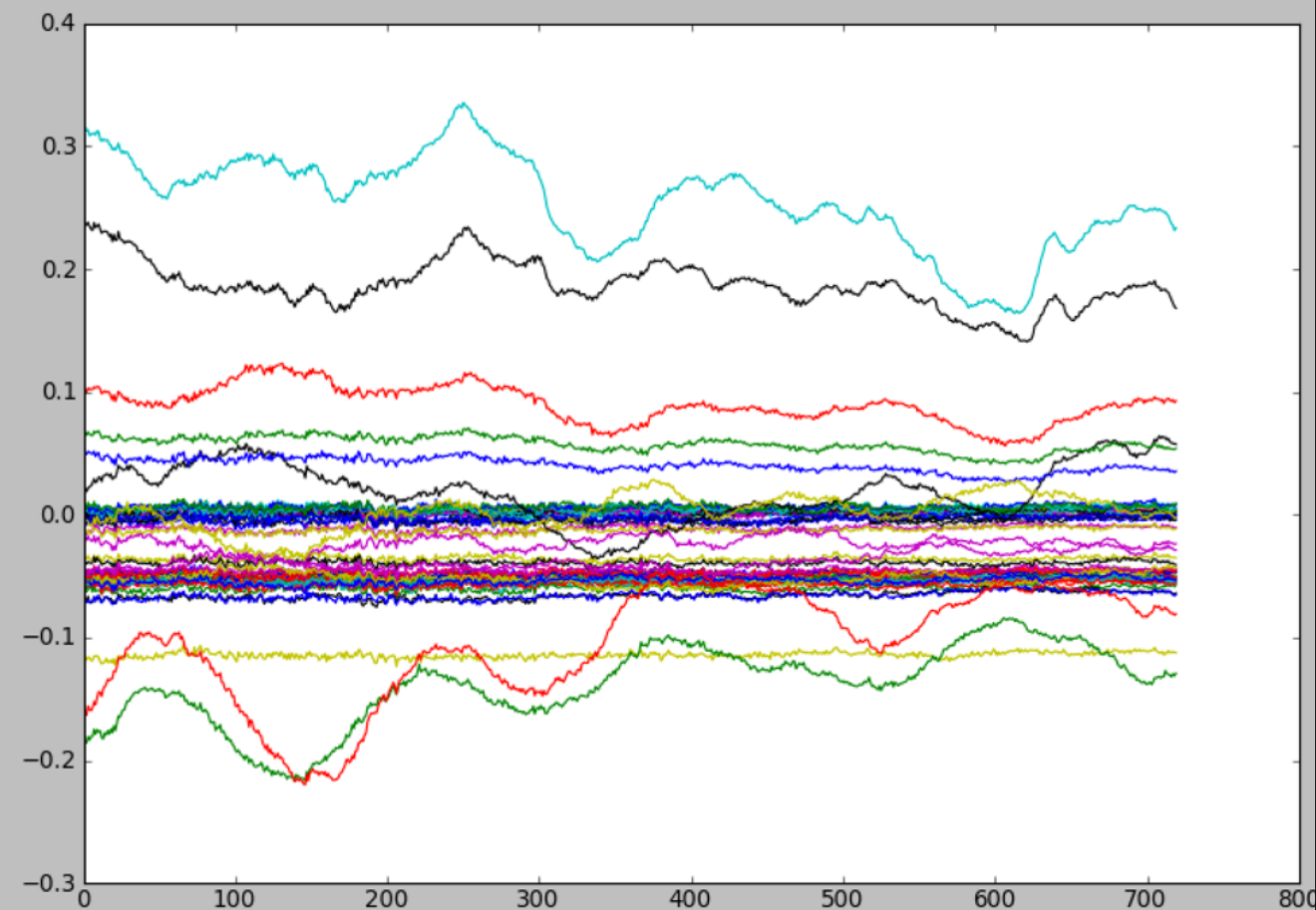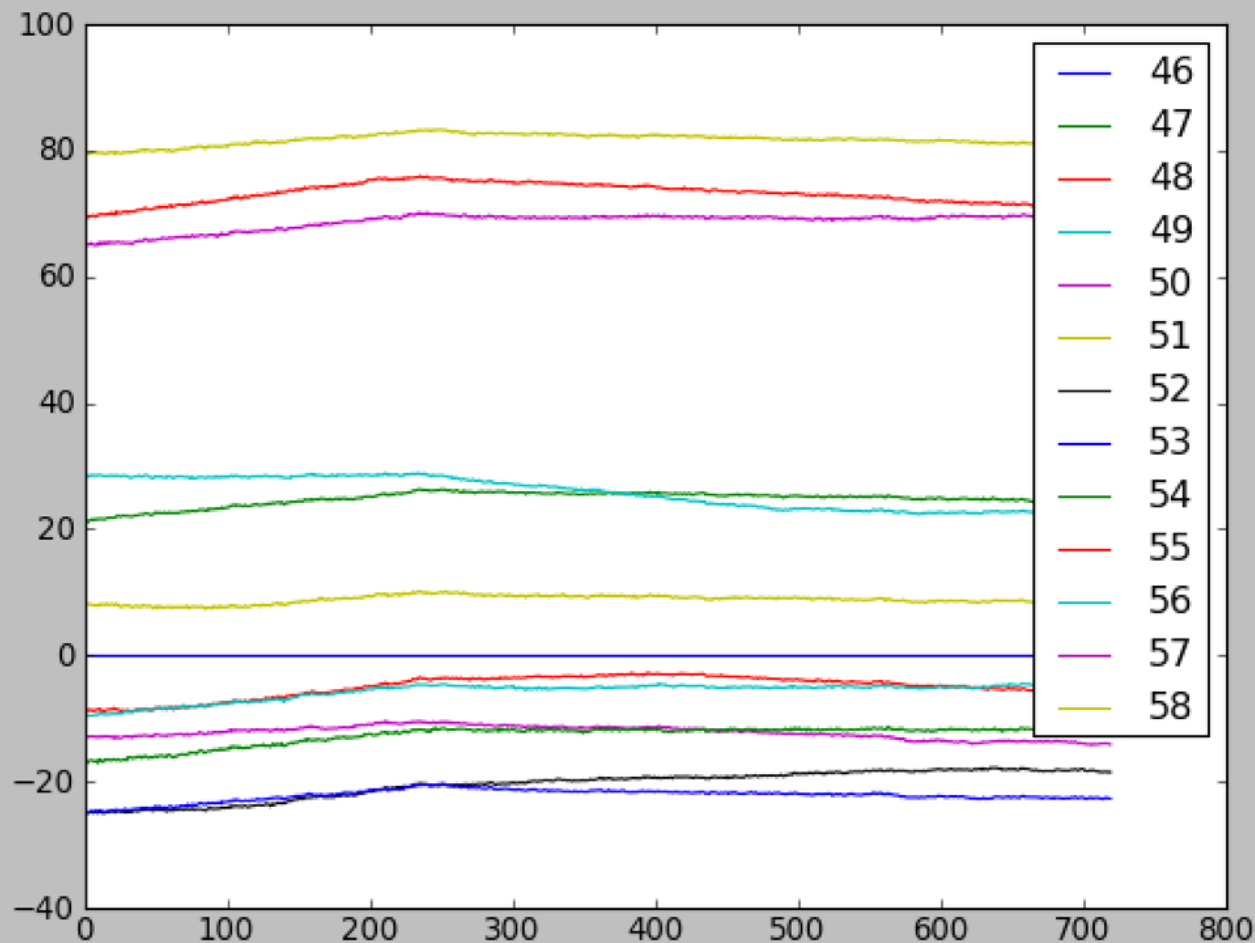**DDE correction procedure I:**
- Clock/TEC separation on calibrator
- TEC-screen fit and correction
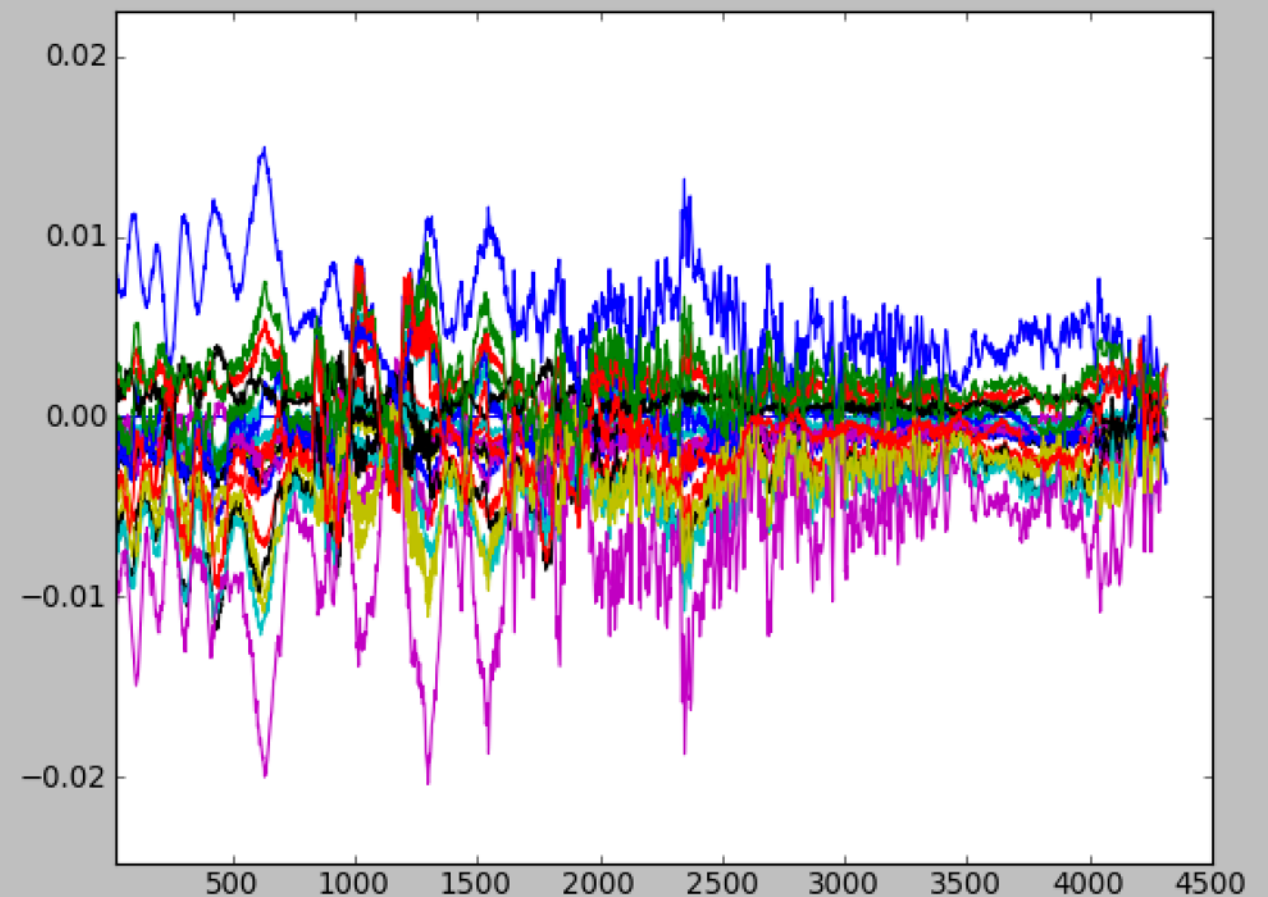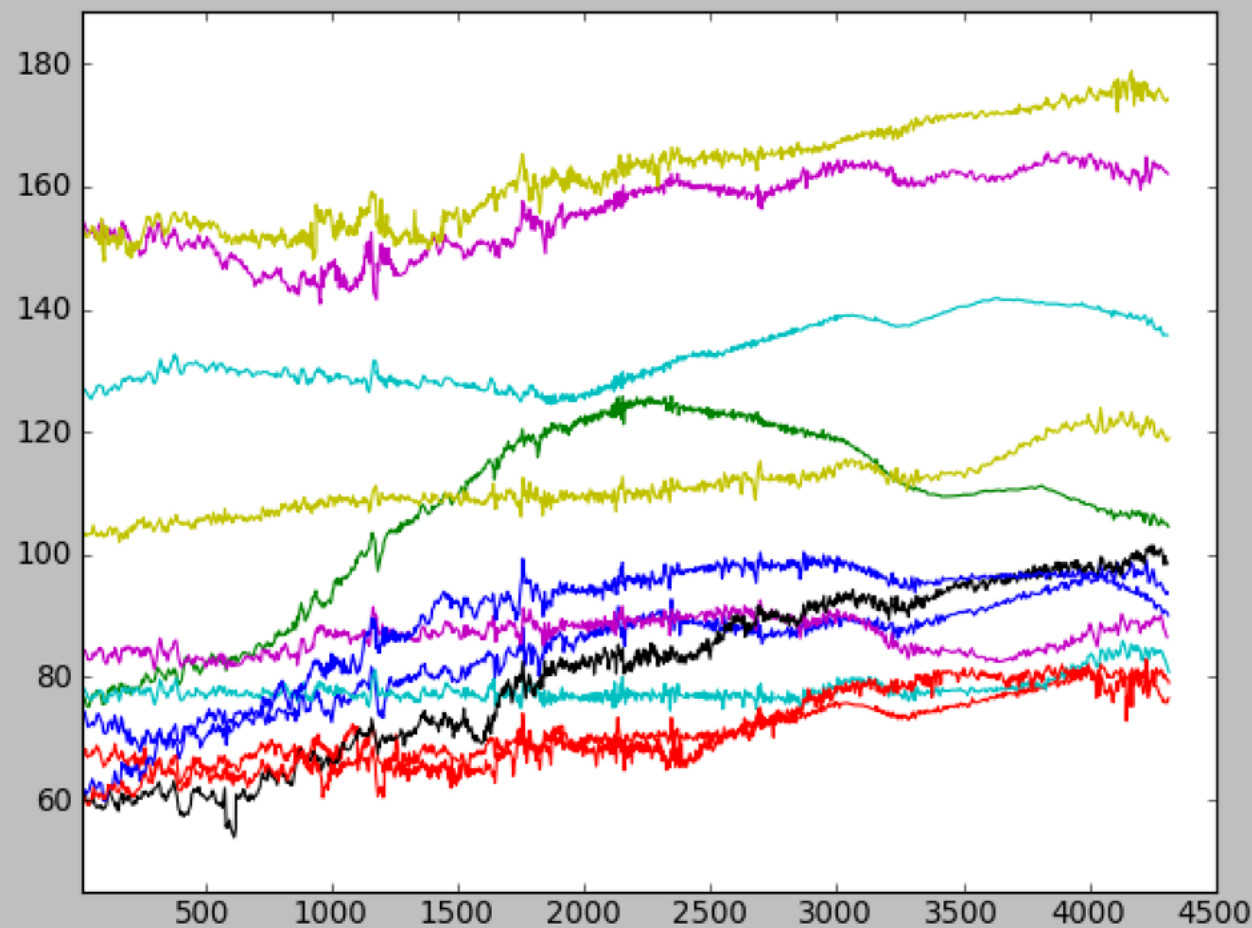
Clock fit   Coma (HBA)   dTEC fit

DDE correction procedure I:
- Clock/TEC separation on calibrator
- TEC-screen fit and correction

Clock fit   MACS (LBA)   dTEC fit

DDE correction procedure II:
- Directional-dependent calibration (amp&phase)
- Iterative peeling of clusters (to increase the S/N) of sources

- Promising results in HBA
- Tests undergoing in LBA (more difficult: less S/N, wider FoV, worst ionosphere)

Notes:
- Selfcal on phases improves the image, but only to a certain extent
- Selfcal on amp needed in order to take beam errors into account