Observations of NGC 4631 and M81/M82 with LOFAR HBA

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Outline

- NGC 4631
- M81/M82

Data quality, problems, current stage, next tasks

NGC 4631

Observations:

- L27800, 28/29 May 2011 (19:05 - 01:05 UTC)
- 43 stations: 18CS x (HBA0 + HBA1) + 7RS HBA
- integration: 3s
- HBA-DUAL/ Double Pointing, NGC4631, 3C286
  SB 0-121 NGC4631, SB 122-243 3C286

Data quality:

- Reasonable, but strong RFI in CS26HBA1
- RS stations more noisy

NGC 4631

What has been done:

Pipeline:

- calibrator 3C286: NDPPP(flagging CS26HBA1)+demixing (CygA, CasA)+BBS (model 3C286 point source with flux from fitted reasonable data from NED >74MHz)
- target NGC4631: NDPPP (flagging CS26HBA1)+demixing(CygA,CasA)
- Script written to transfer solutions from 3C286 to NGC4631 („correct step” in bbs)
- In one sb data averaged to 1 channel (from 15) and to 30s (some decorellation of signal at long baselines but less time needed)

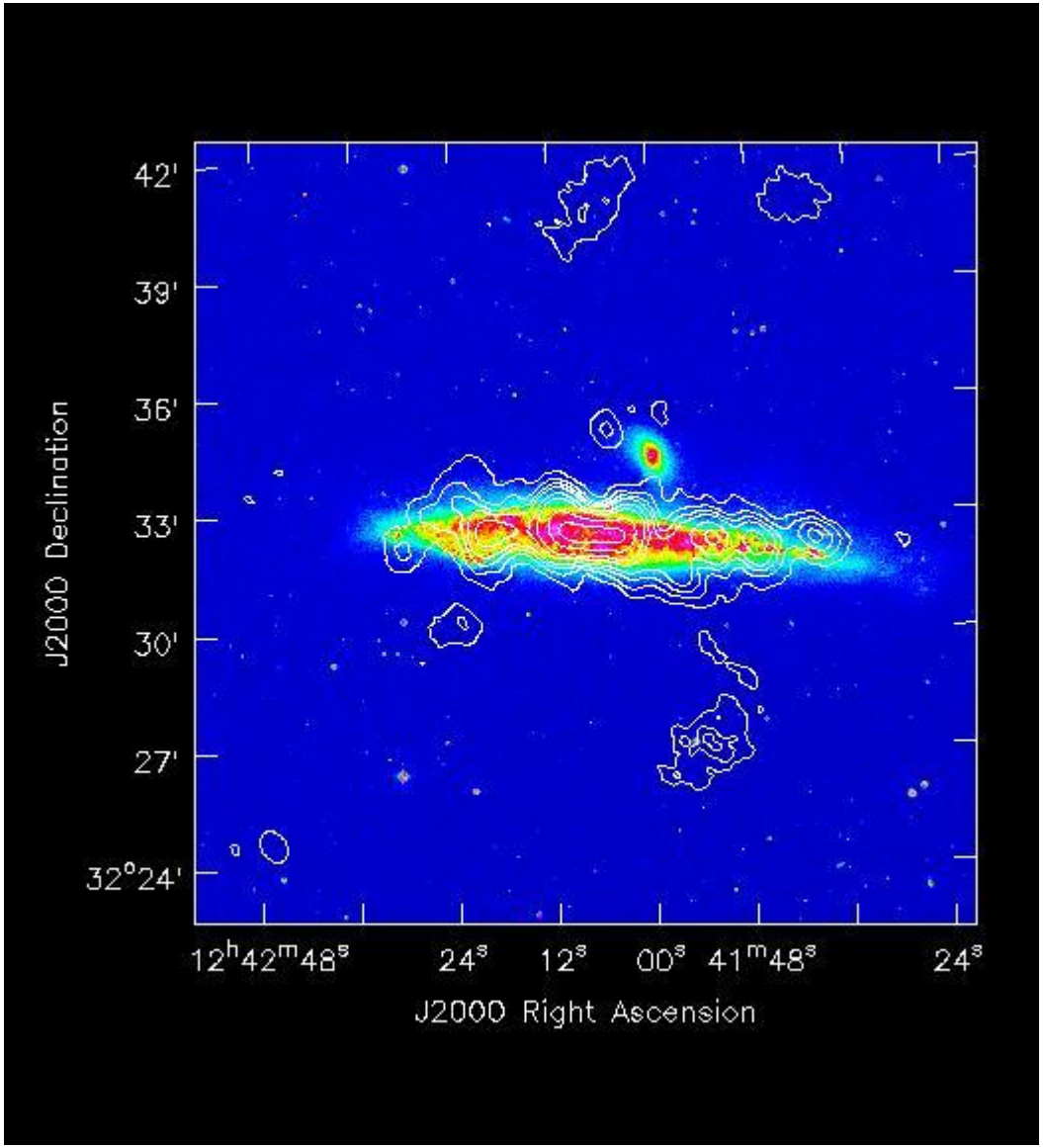
Further reduction:

- For 10 sbs: selfcalibration 6 steps, each subband with its own model, after each cicle rficonsole to flag corrected data, cleaning in CASA, gridemode='widefield’
- Combine 10 sbs after selfcalibration

After selfcalibration

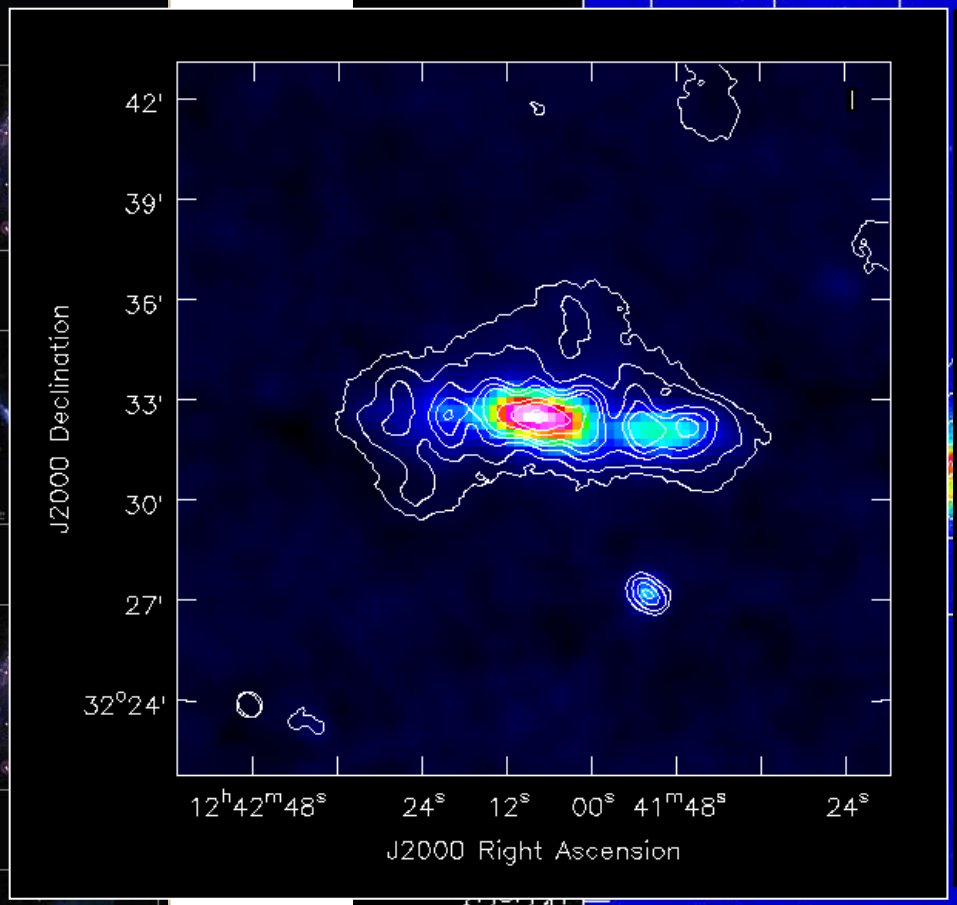
NGC 4631 single subbands 107-116

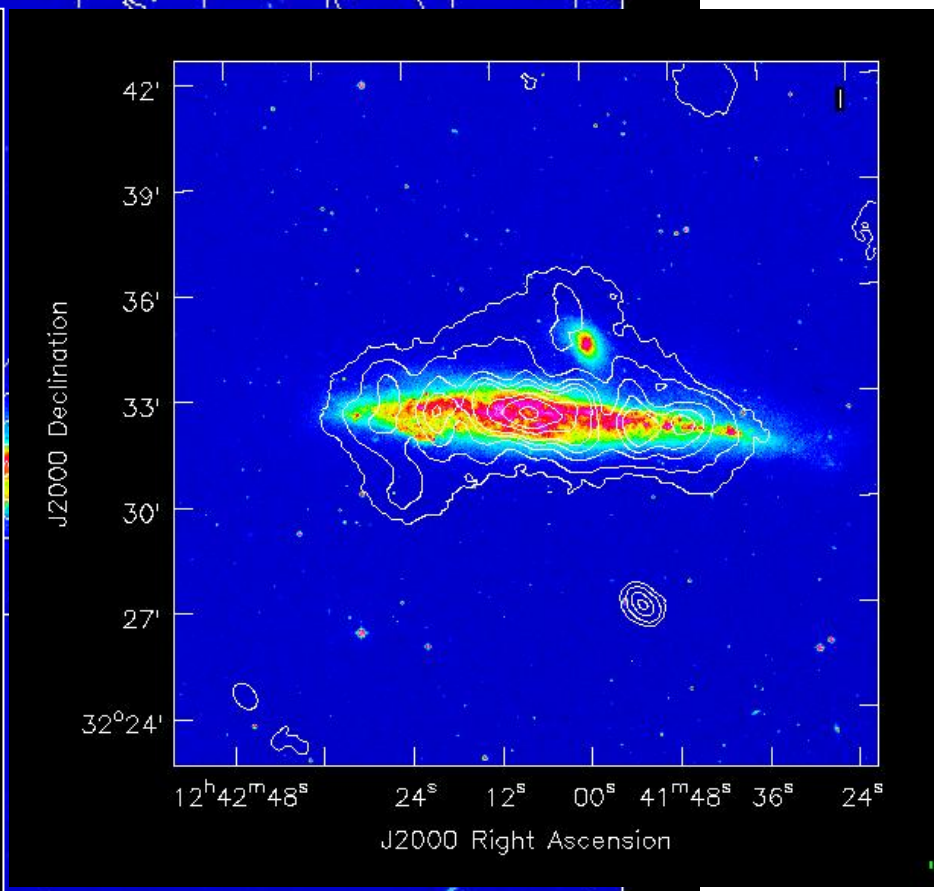
#SB	rms mJy
107	11
108	8
109	9
110	9
111	10
112	11
113	10
114	11
115	10
116	9

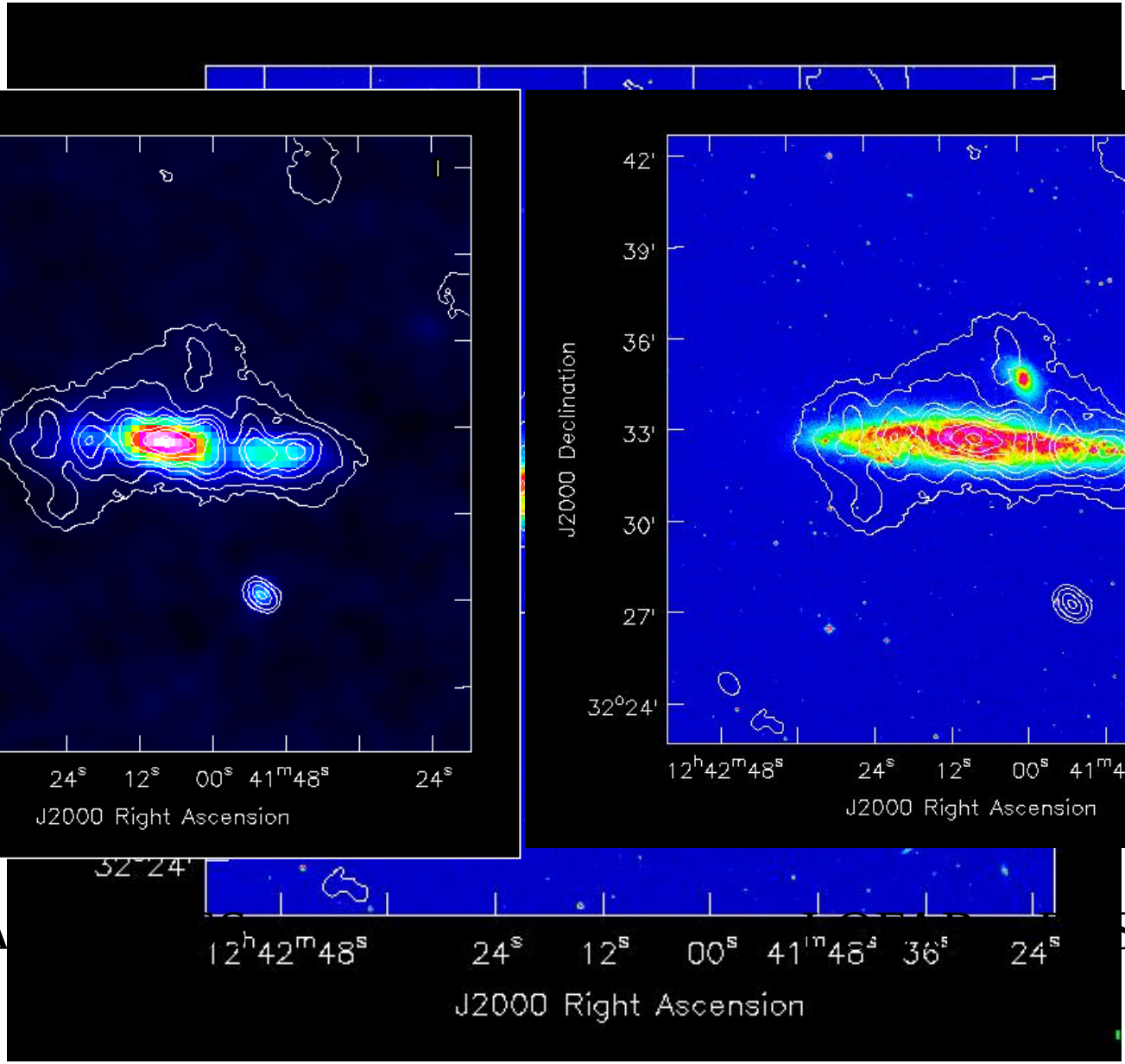


Final image 10 sb

NGC 4631 rob=1, briggs rob=1, beam 49”x35”, selfcal 6, rms=6.5 mJy



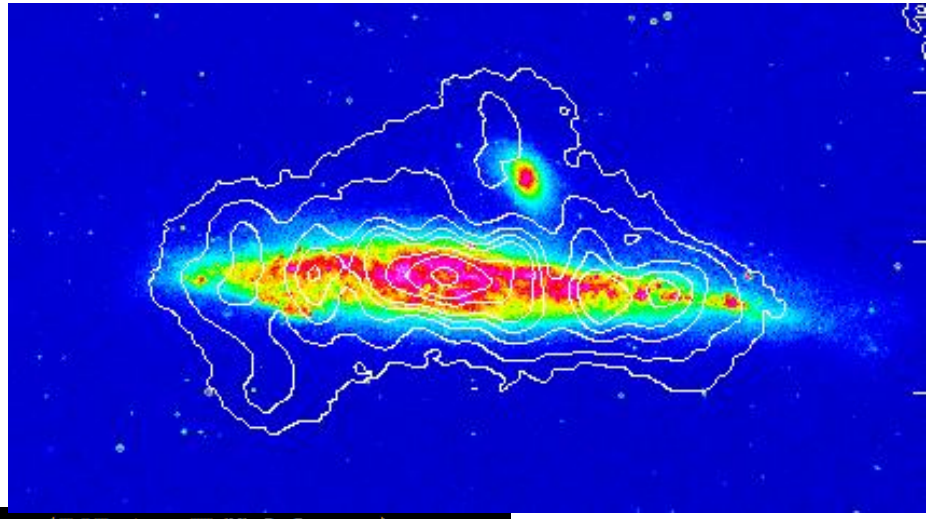


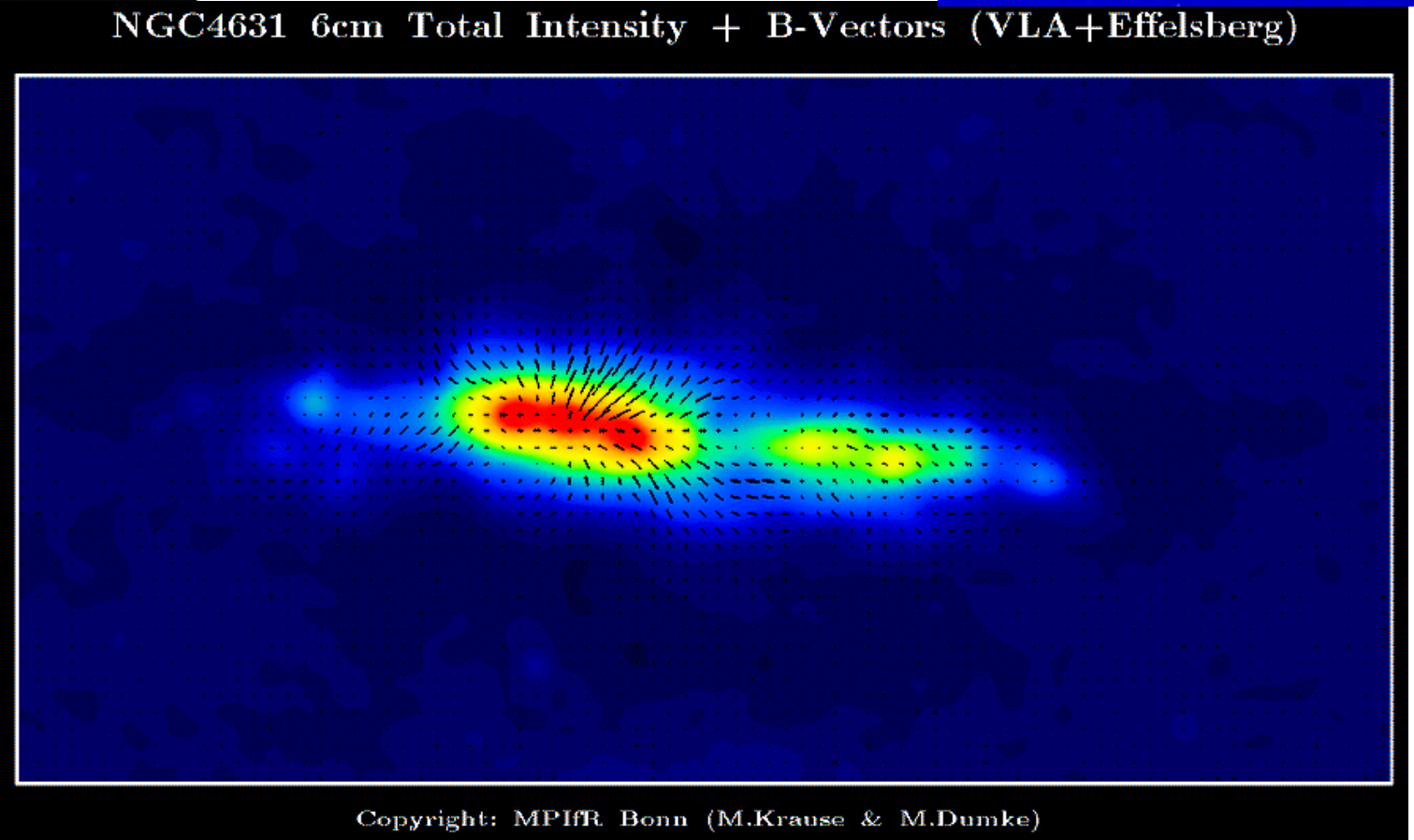


LOFA S Blue

NGC 4631

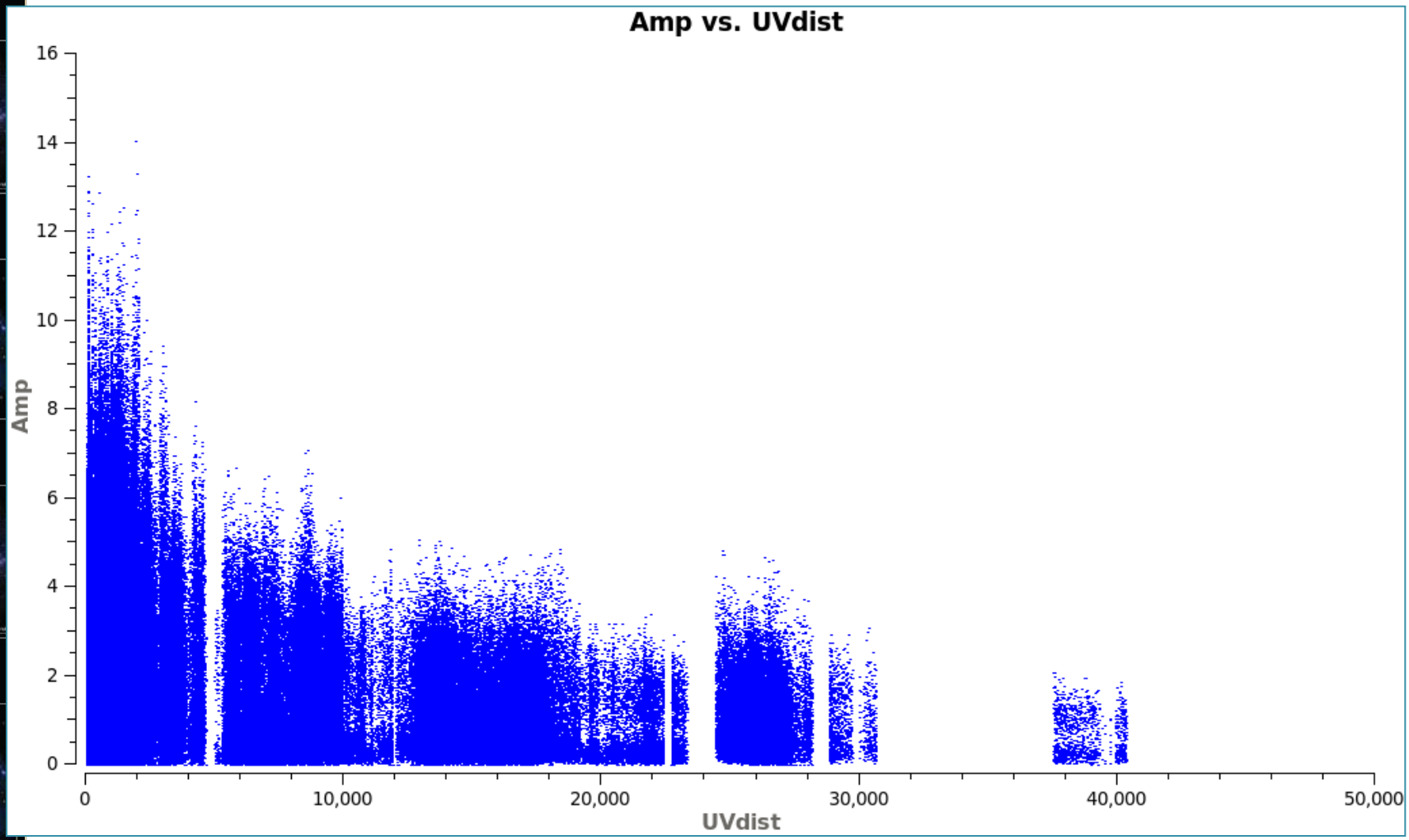
4.8 GHz VLA+EFF versus LOFAR HBA





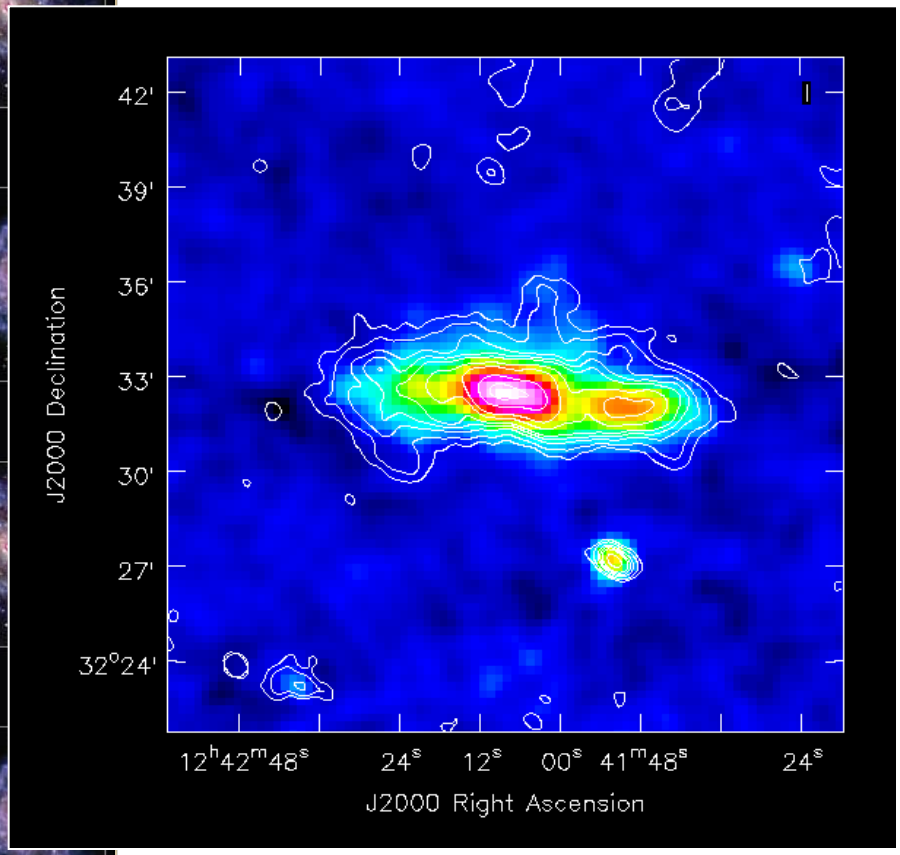
NGC 4631 – data quality

Looks reasonable, but RS looks more noisy, RFI in CS26HBA1

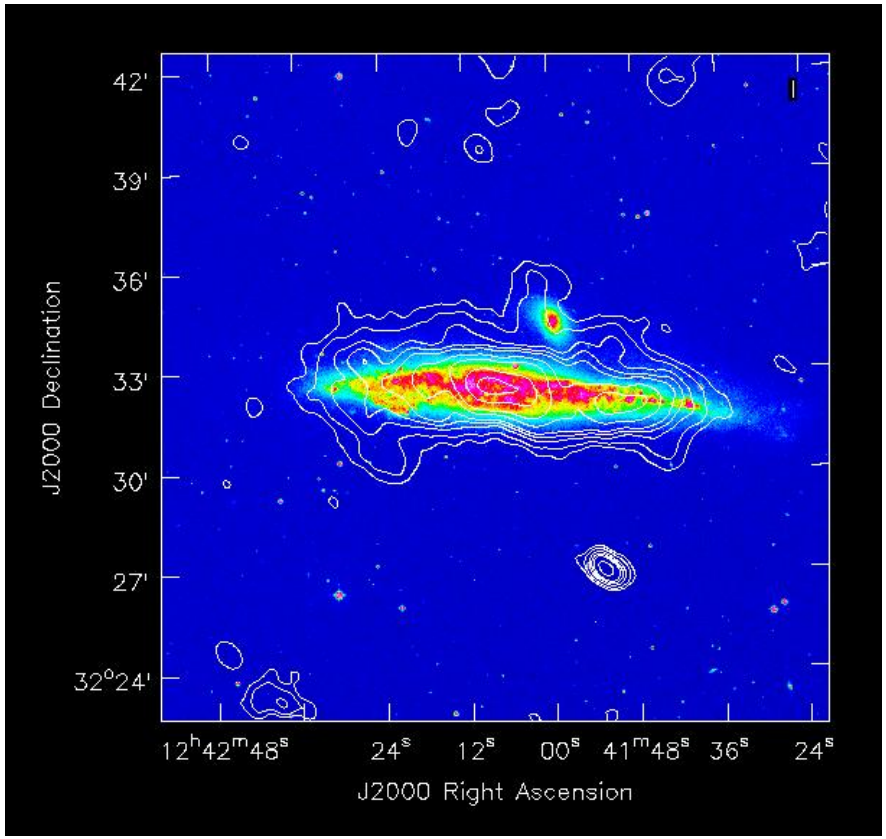


NGC 4631 – with taper of longer baselines

Combined 10 sb after 6 selfcal cycles, briggs, rob=0, uvtaper 30”
56”x 38”, rms=3 mJy (better)



LOFAR + NVSS



LOFAR + DSS Blue

NGC 4631 - next steps

Present work and tests

- Peeling (of combined sbs, after selfcal), compare results
- Which model gives better results: casapy2bbs (used now) or PyBDSM?
- Deeper cleaning - better sensitivity(?) but longer execution time
- Repeat the whole procedure for next 10 sb, compare results
- Use computer cluster 2 for reduction of the rest sbs
- Construct distribution of spectral index.
  Are the data suitable for publication?

M81/M82

Motivation

- M82 strong source, B-team
- How M82 influences nearby sources, M81 (relatively weak, difficult)
- We have WSRT data at 330 MHz (partly reduced), use as a model?
- Analysis how averaging and peeling influence the image quality
- Develop best strategy for data reduction to run the pipeline

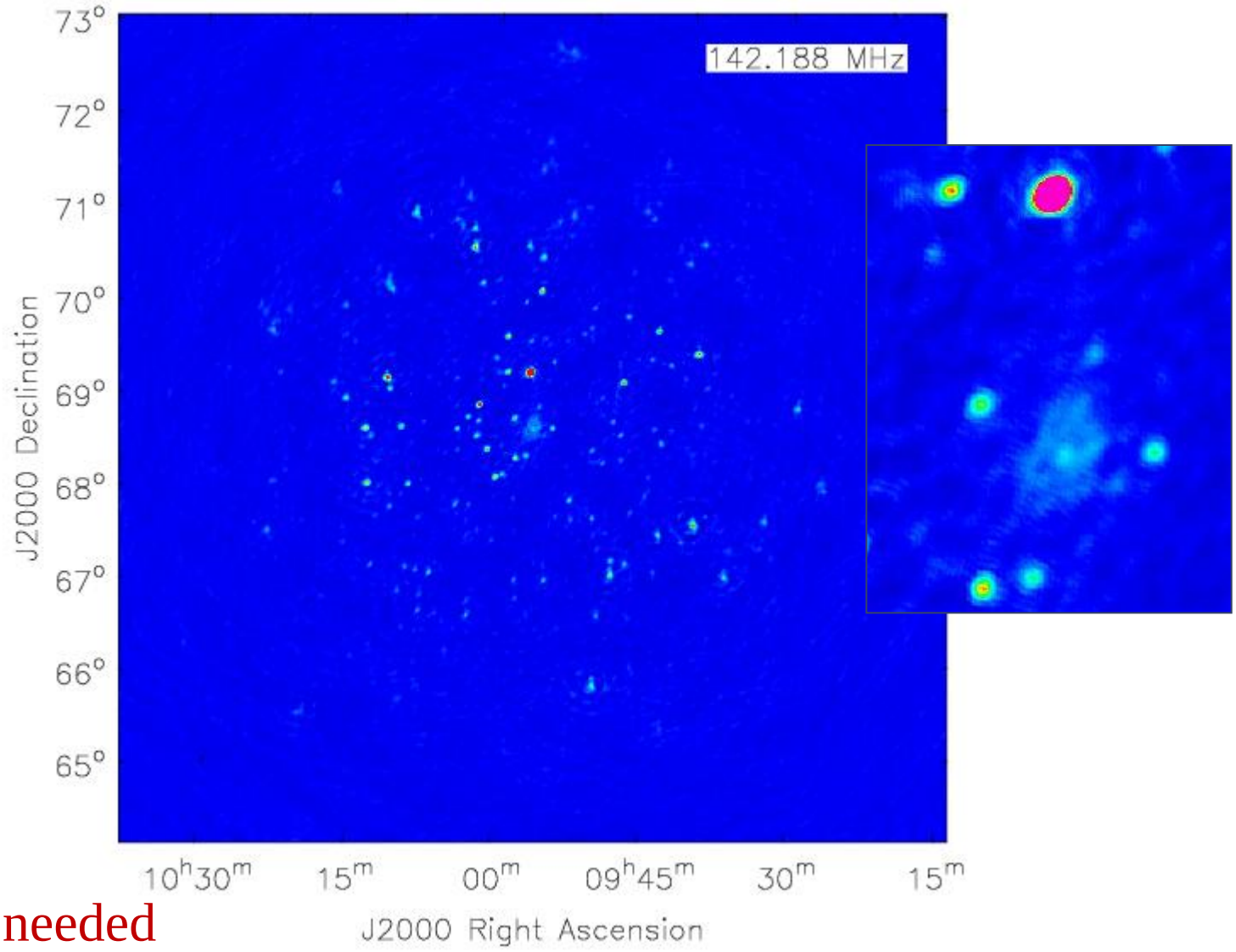
Observations

- Time: 16.04.2011, 17:00- 23:00
- Integration time: 1 s
- HBA-DUAL/ Single Pointing (on M81)
- 19x2 CS + 7 RS

- ❖ No transfer of solutions (M82 is in the field)
- ❖ 1 hr removed due to solar interferences
- ❖ No demixing – no needed (ampl. – time)
- ❖ Data quality similar in examined 4 sbs

M81/M82 sb 139

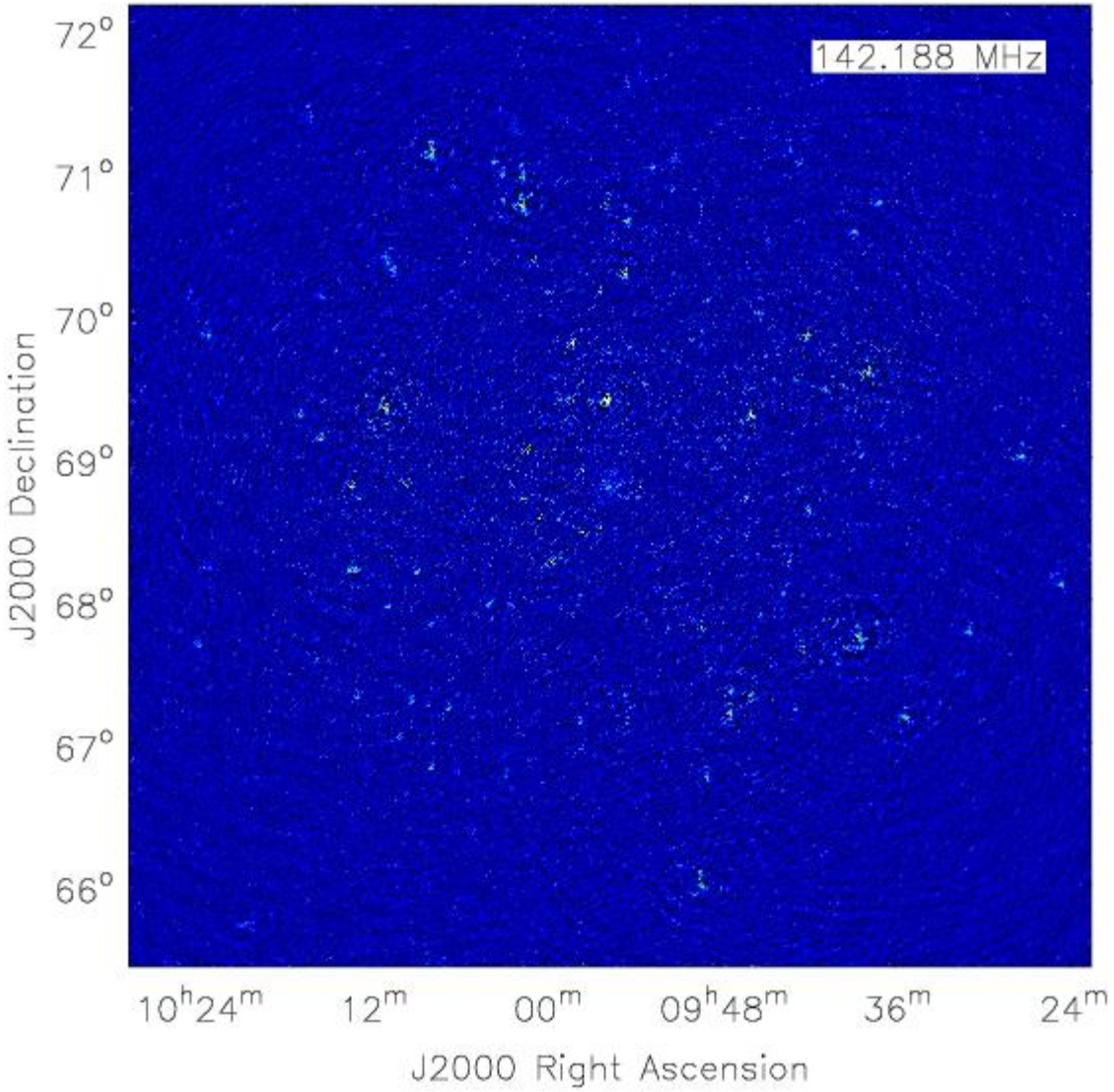
1 subband, 15 ch, not averaged before selfcal, 4 selfcal, model M82 (point s. 17Jy), 160”x 128”, weighting briggs, robust = 1, rms = 24 mJy/b



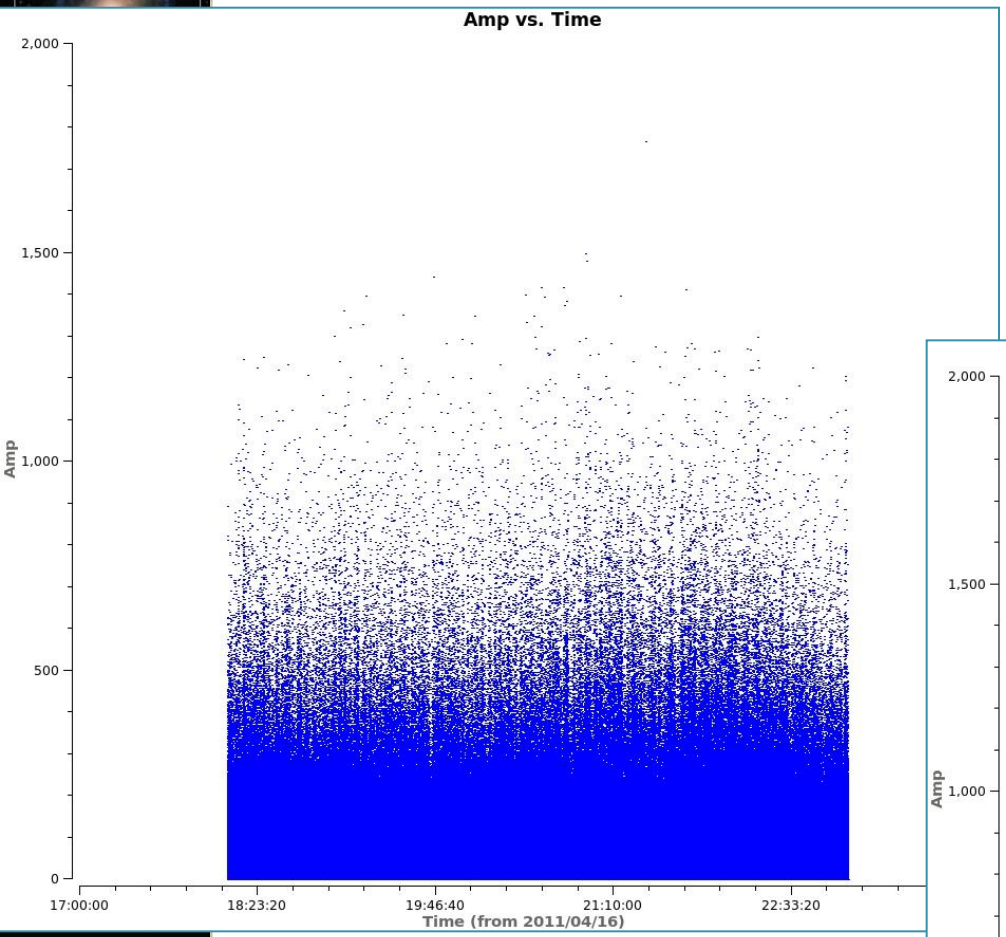
Peeling needed

M81/M82 sb 139

51.8” x 33.2”, weighting briggs, robust = 0, rms = 25 mJy/b
M81_AllStations_iter4_r0.eps

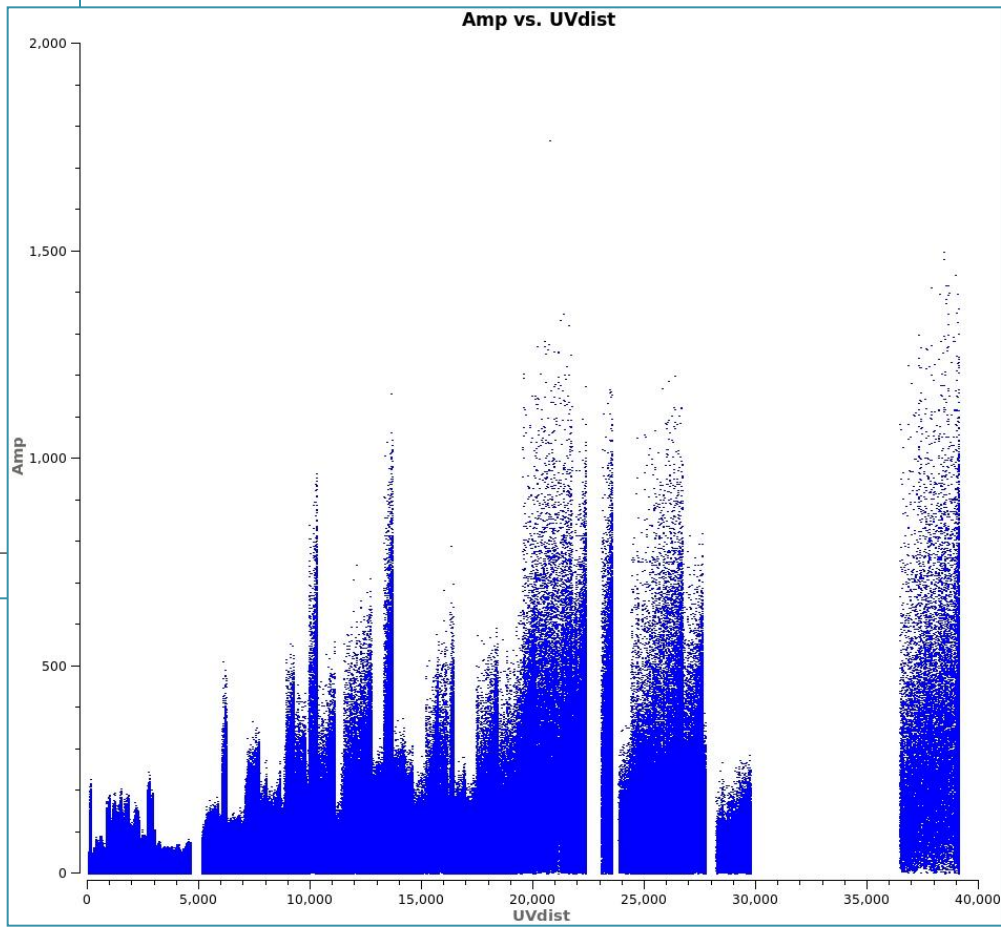


M81/M82 data quality?



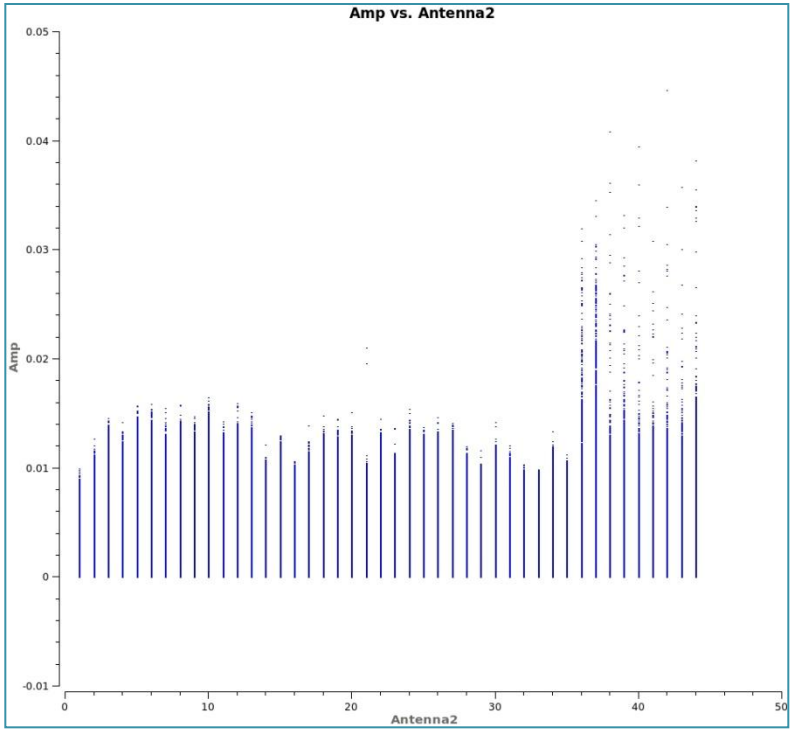
Why so strong peaks at long baselines?

- At each selfcal cycle they are smaller but at the cost of the flagging of 5 of 7 remote stations
- Beam is increasing – we will reach confusion limit – no way to get better results?



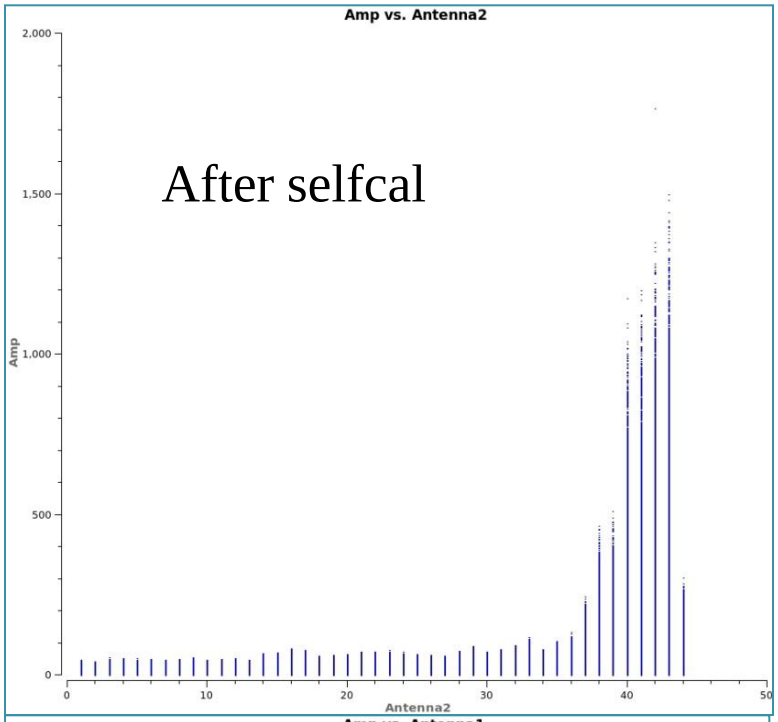
M81/M82

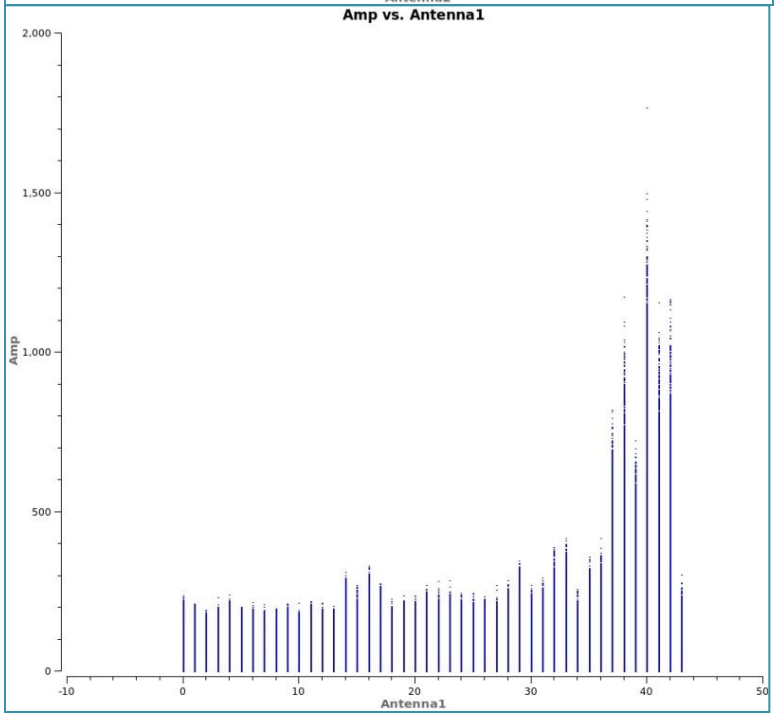
Bad antennas? Different beams?



Before selfcal

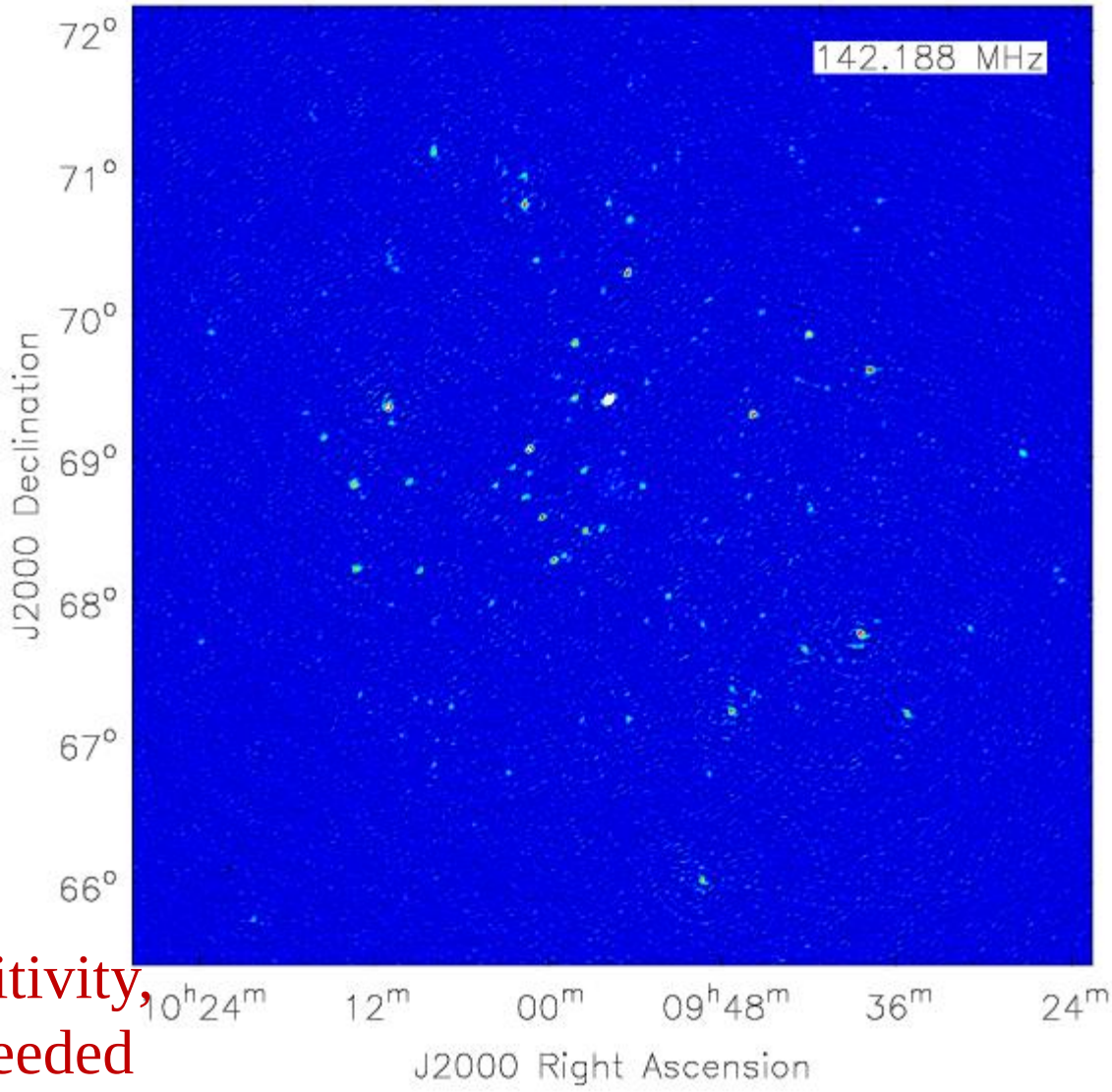
After selfcal





M81/M82 sb 139

Data averaged to 3s, 3 ch, 2 selfcal, **removed remote stations**
151” x 97”, weighting uniform + widefield technique, rms= 38 mJy/b
M81_RSremoved_iter2_uniform_wf.eps



Less sensitivity,
Peeling needed

M81/M82 – next steps

Present work and tests

- Data from all stations: peeling of 5 sources started 3 weeks ago (Nov 2), will be finished in 2 weeks
- Data without remote stations: peeling of 3 sources, two days to finish
- Check if other sbs have similar problems with long baselines
- 1 cycle o selfcal for 1 sb, 500-700 clean comp., without averaging – 24h , averaged data - 3h
- Plotting via Internet is very slow

Future work

- Beam corrections
- Run pipeline for all sbs (during Wojtek visit at ASTRON)

Thanks!

Great help from ASTRON people, George, Roberto, …