ASTRON

Netherlands Institute for Radio Astronomy

LOFAR MSSS

Multifrequency Snapshot Sky Survey

M*S*S*S

STATUS REPORT AND UPDATE

MULTIFREQUENCY SNAPSHOT SKY SURVEY

George Heald (MSSS Project Leader)
(on behalf of the MSSS Team)

LOFAR status meeting, 1/4/2015

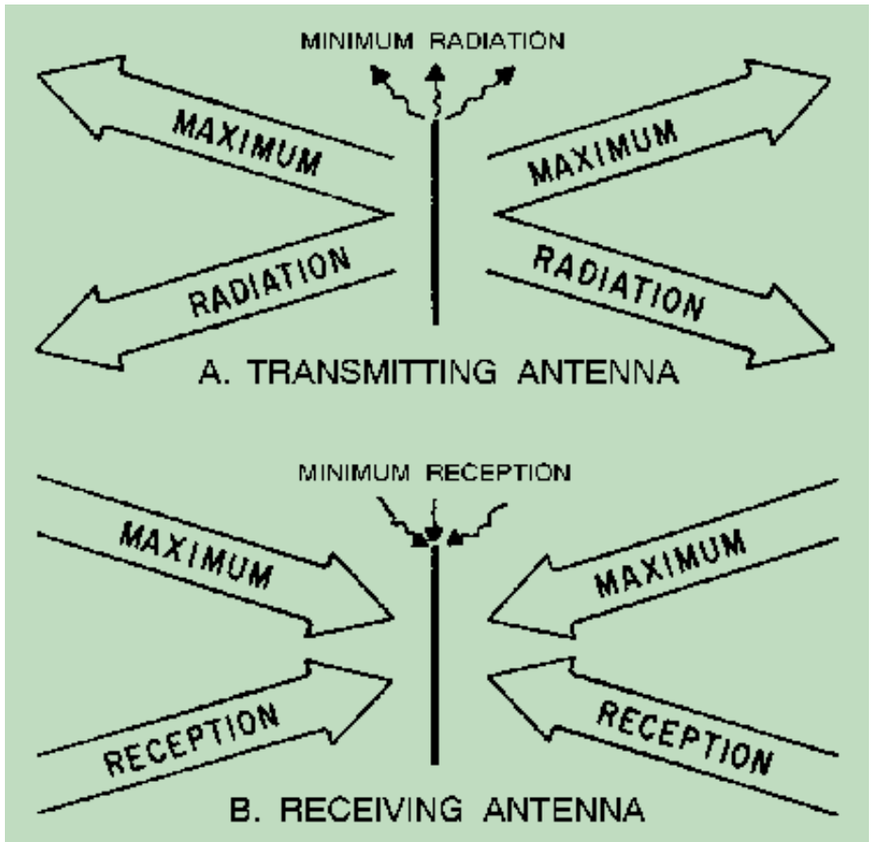
ASTRON is part of the Netherlands Organisation for Scientific Research (NWO)

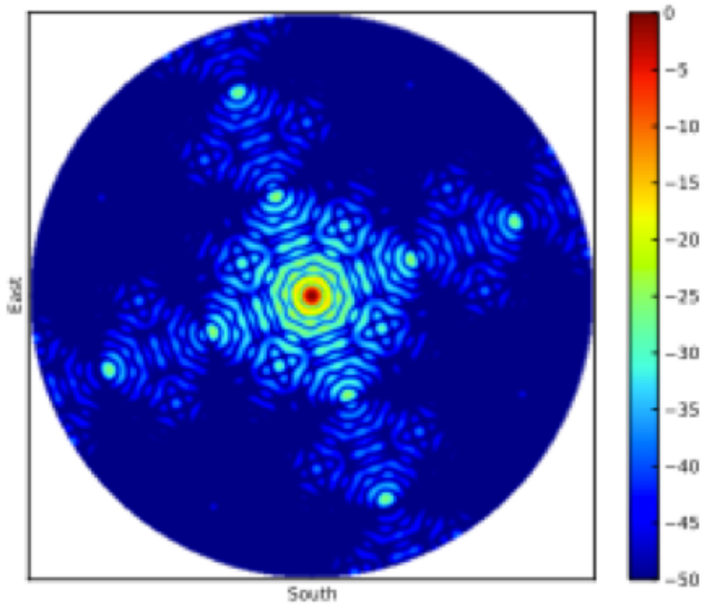
LOFAR

Flux scale

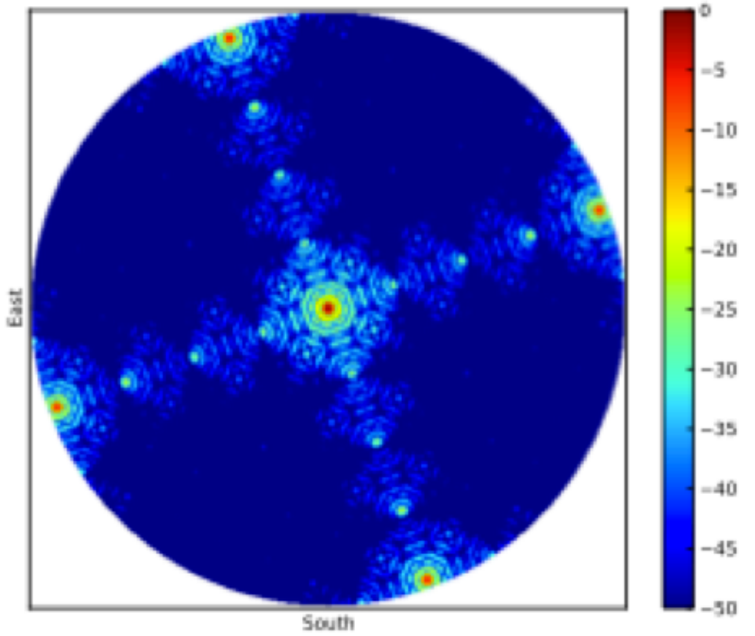
Unmodeled beam effects

- Aspects not included in LOFAR's standard beam model
  - power in grating lobes
  - mutual coupling
- These can lead to strong frequency dependent effects





150 MHz

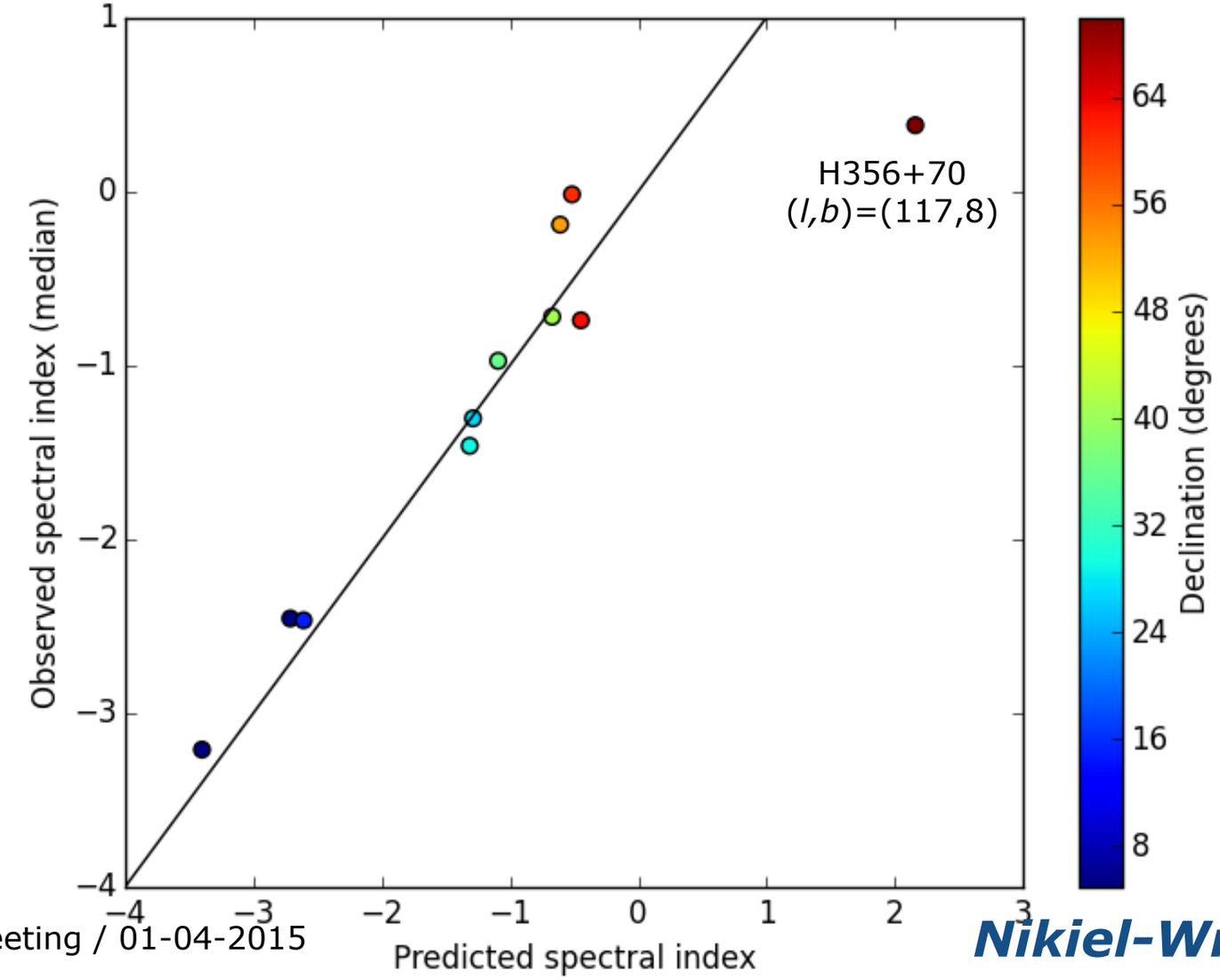


240 MHz

Beam images from Michiel Brentjens

Early correction tests

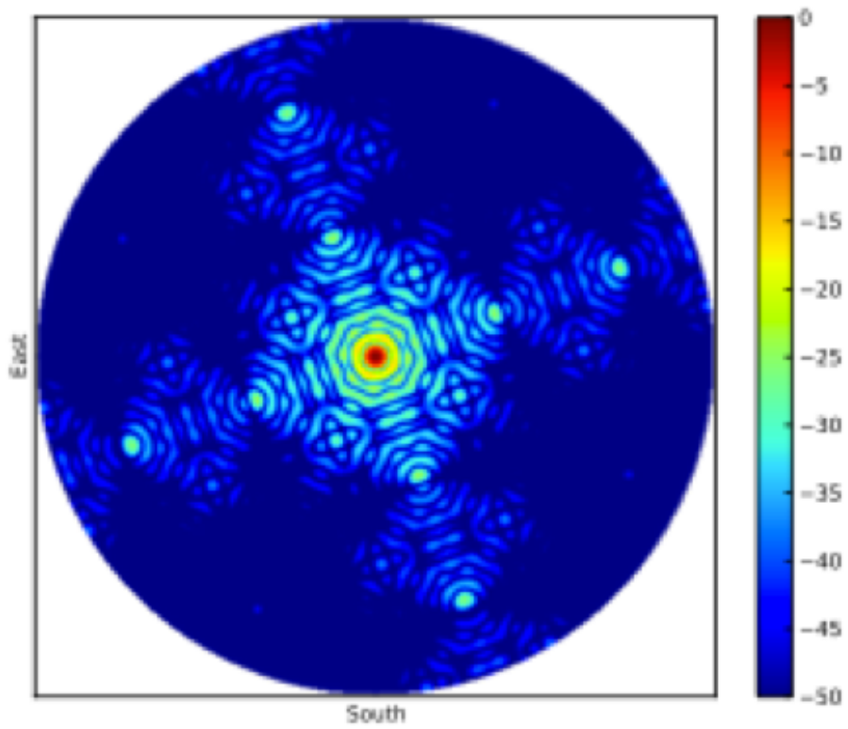
- See LSM presentations from 1 Oct and 26 Nov 2014
- Script provided to community to estimate effect in observations:
  CEP2: /home/heald/snu/senscorr.py (use with suspicion!)
- Based on EM models by Wijnholds, Arts, & Kant
- In principle can be used to adjust fluxes in flux corrected images (at least for snapshots)



More direct approach: beam integrals

- Approximate post-hoc correction possible for snapshot observations like MSSS (HBA)
- Adjust flux scale with ratio of normalization values:

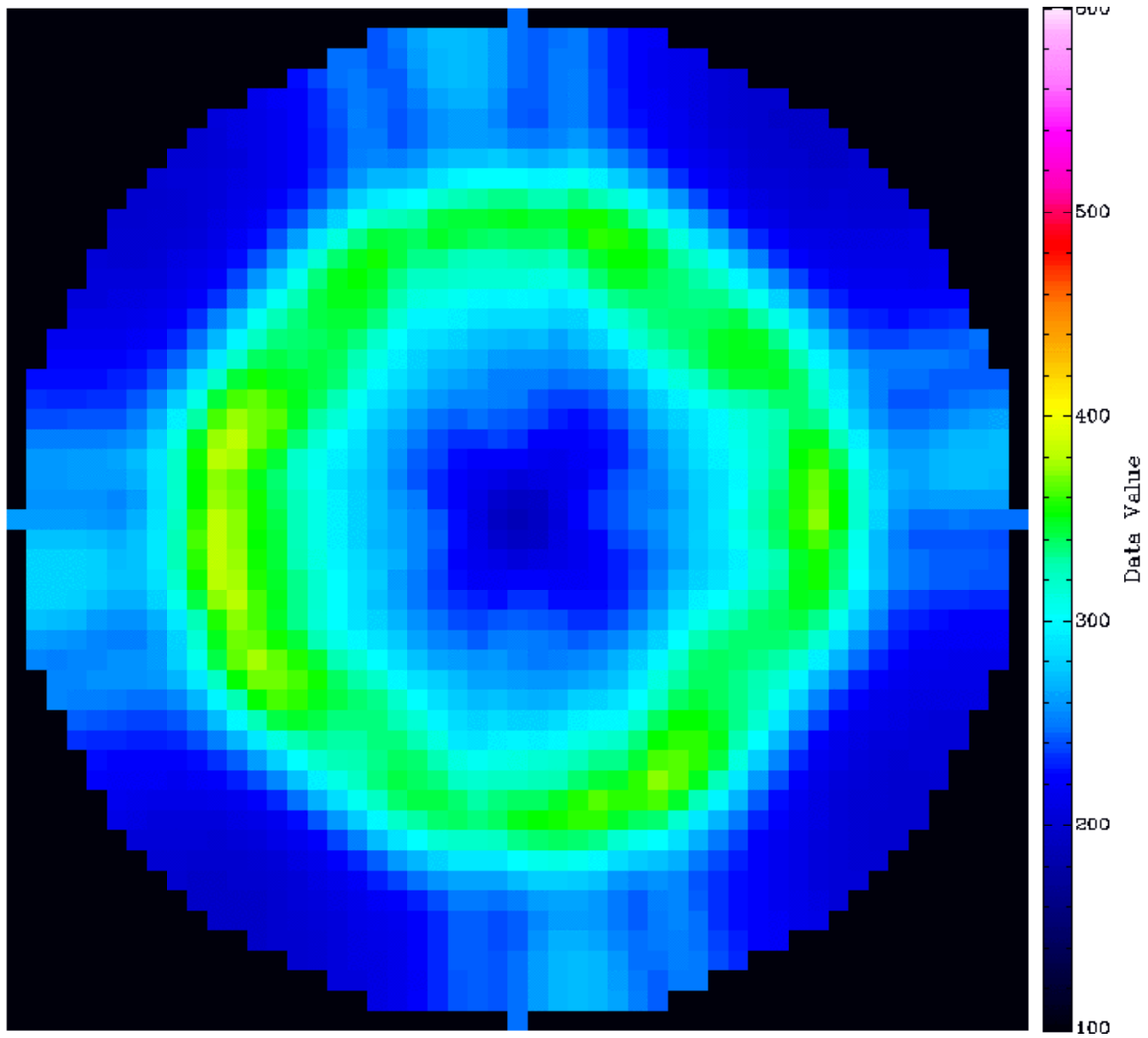
$$N(150\ \mathrm{MHz}) = \int \mathrm{dl\ dm}$$



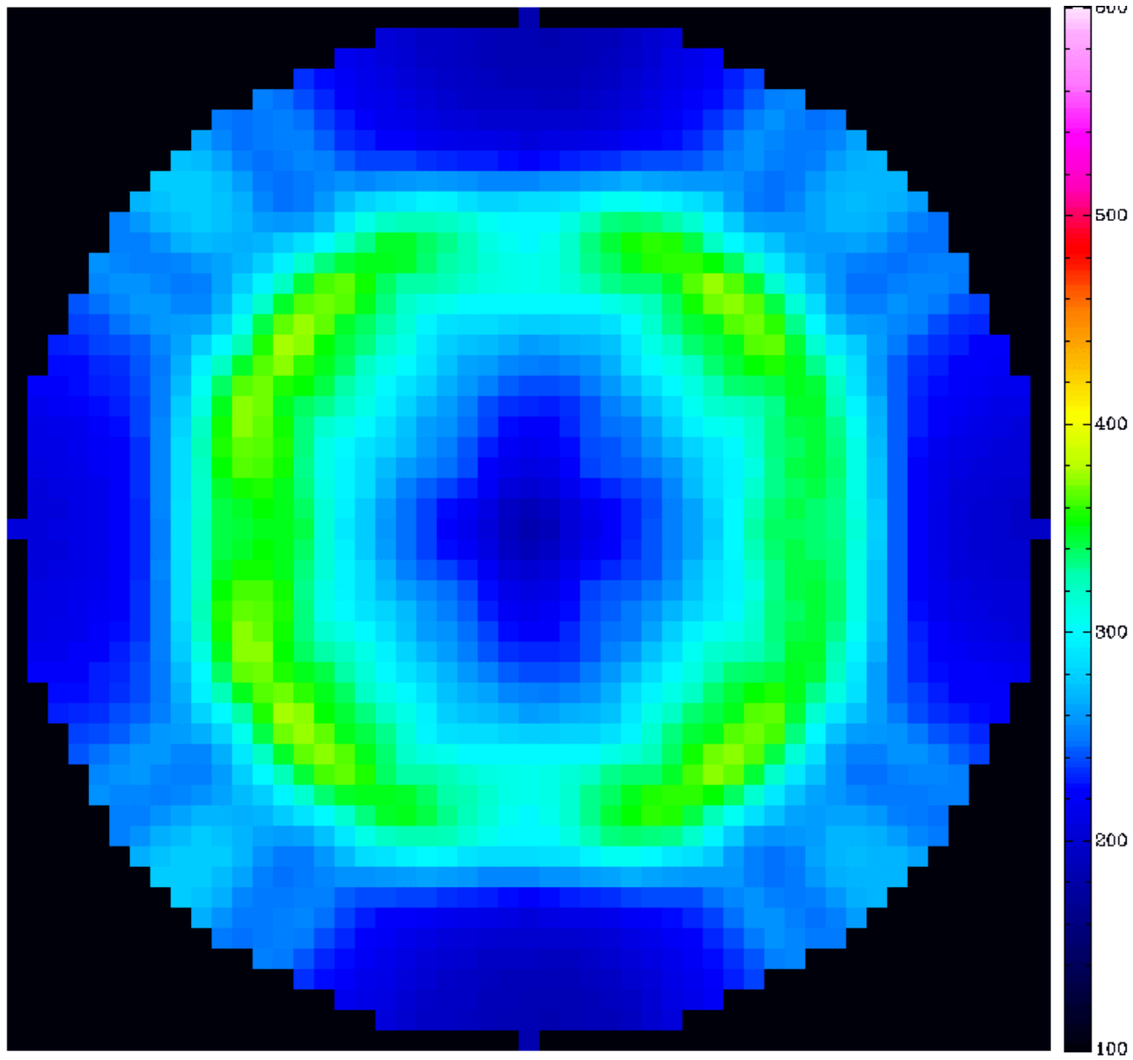
150 MHz

Beam integrals

- Beam integral computed per station, per frequency (step 10 MHz), on az,el pointing grid sampled with density ~ station beam size



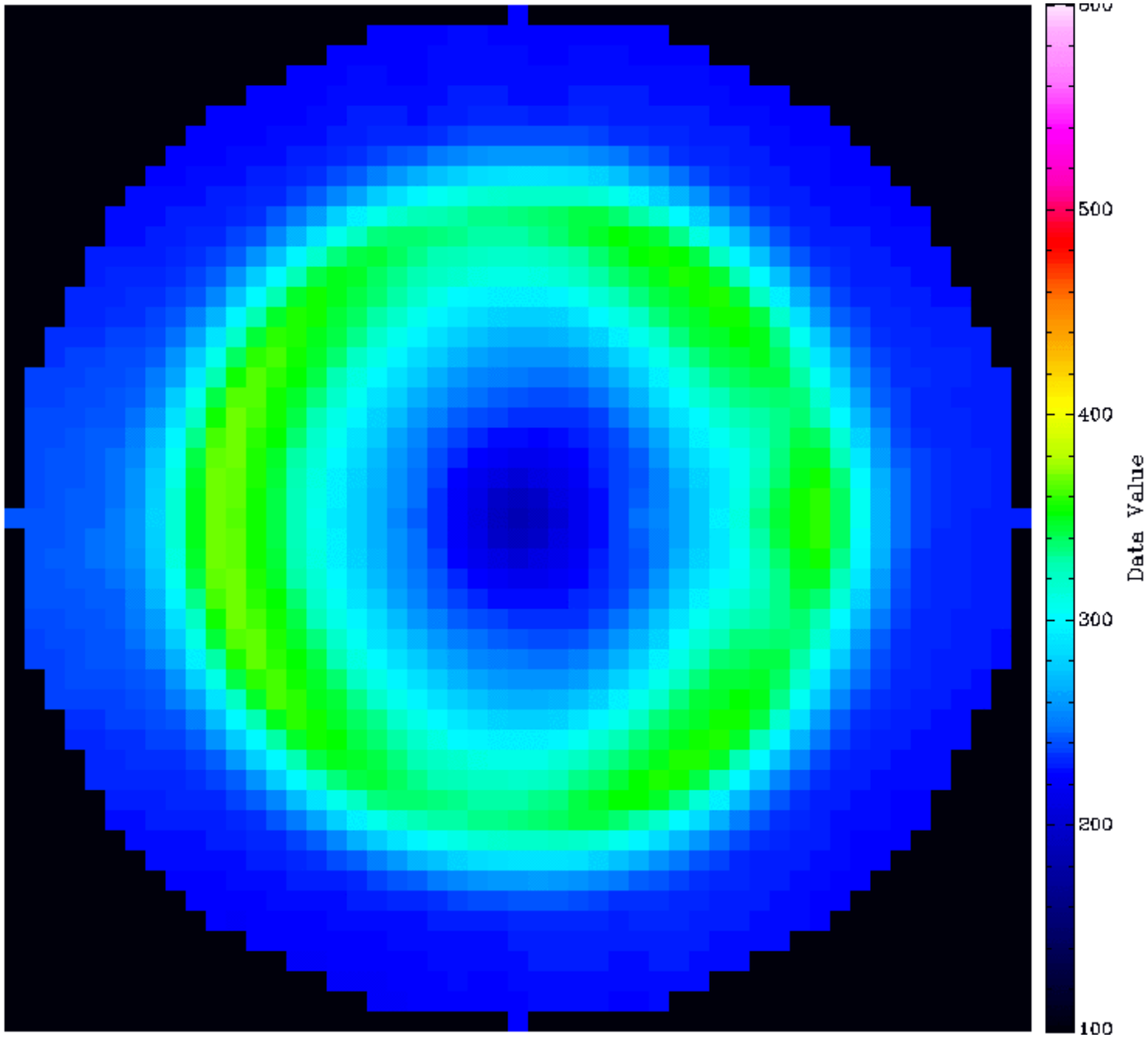
CS002HBA0



CS002HBA1

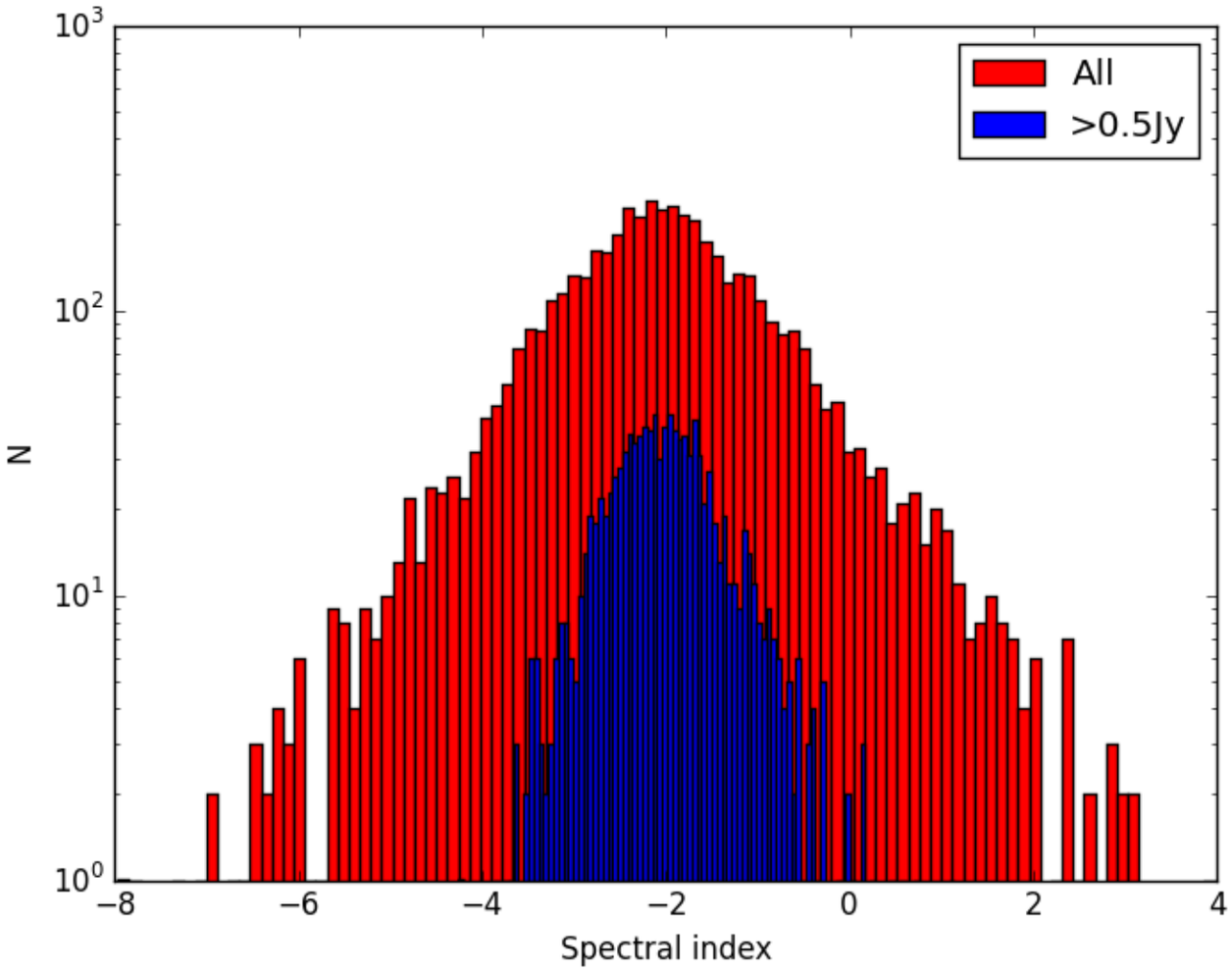
MSSS test of beam integrals

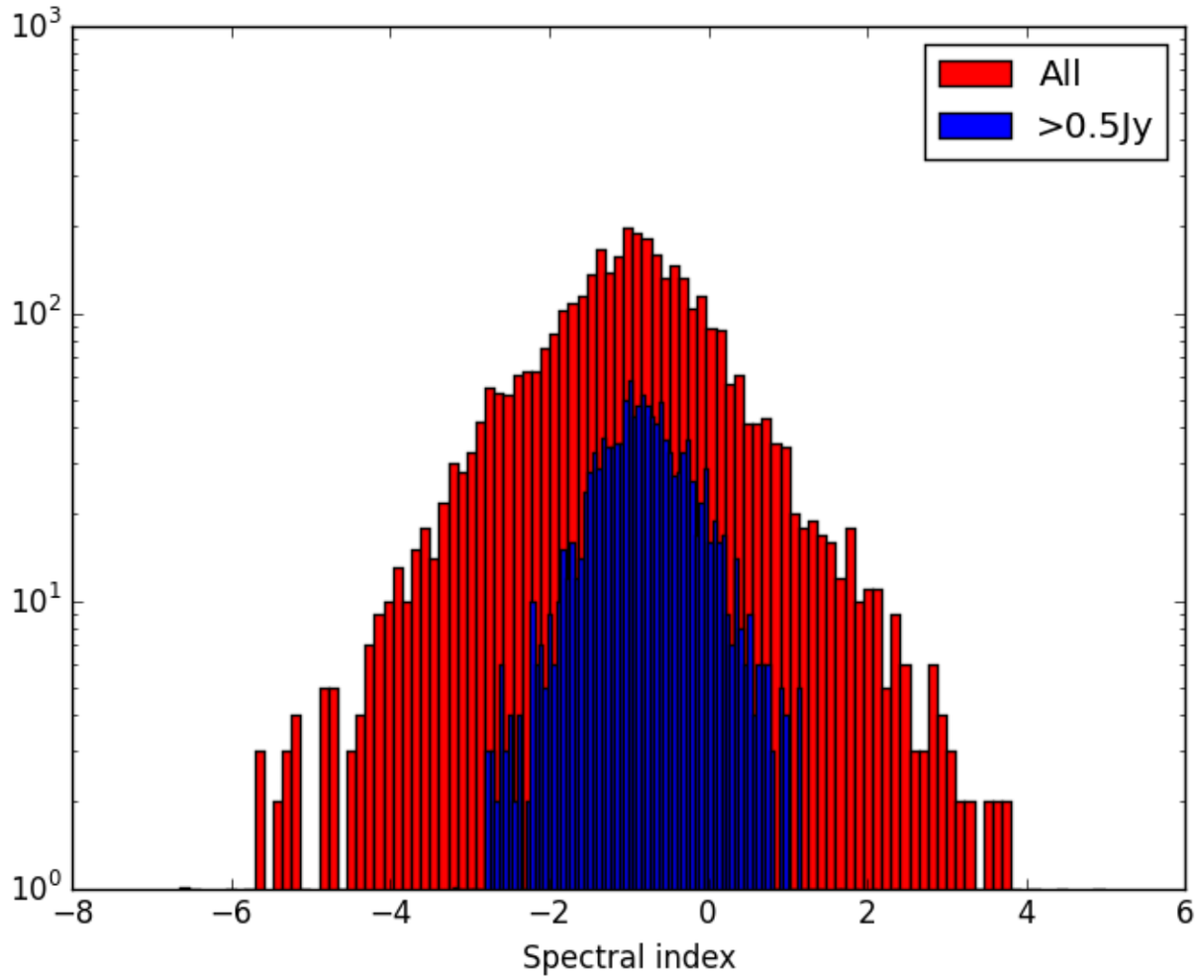
- Simple test with MSSS: correction based on average integral over all core stations (still with same az,el,freq sampling)
- Compute ratio of integrated response in cal,target directions



Spectral index behavior

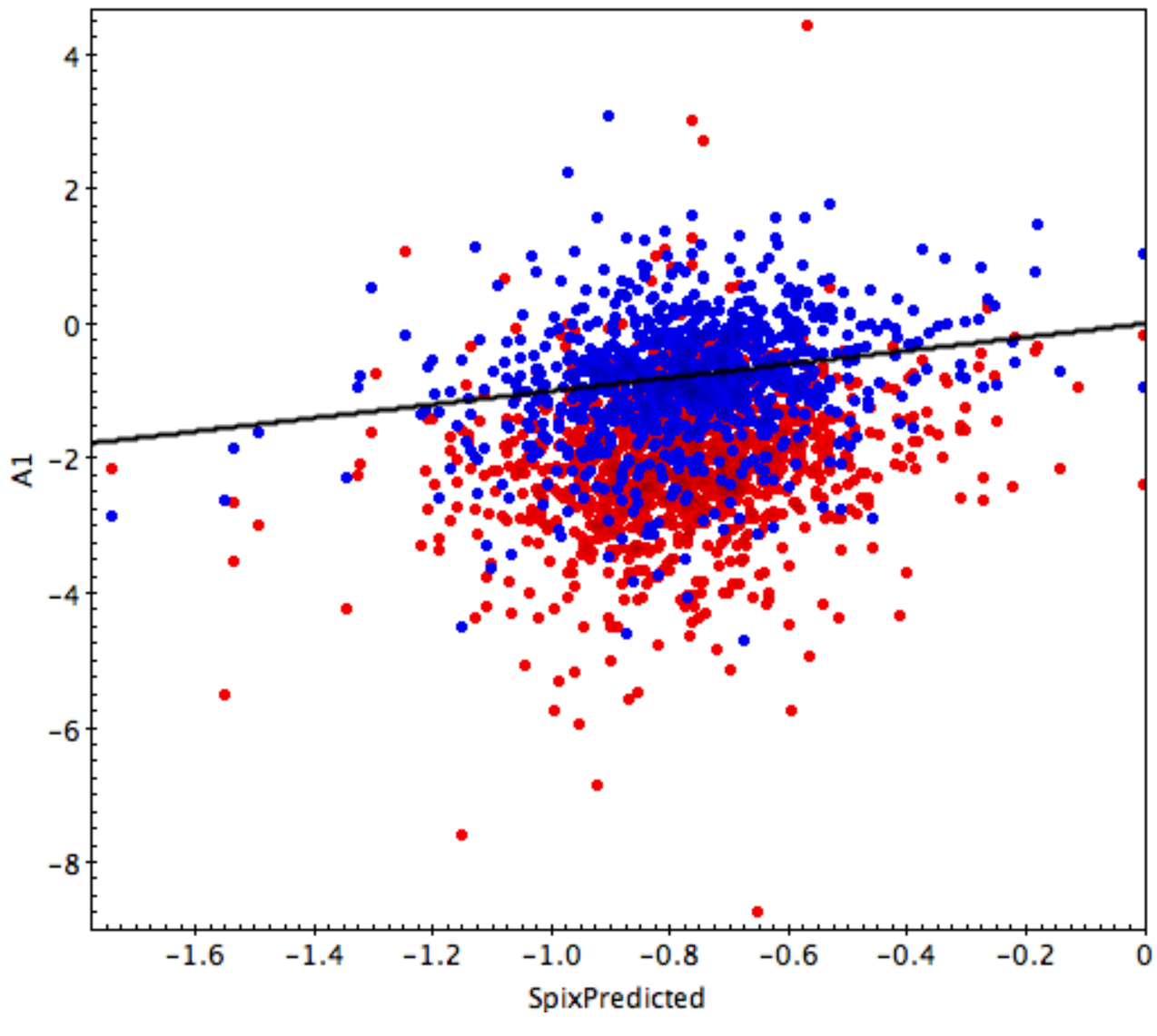
- Initial flux calibration (left):
  median spectral index ~ -2.05 (-2.03 for S>0.5 Jy)
- Adjusted flux calibration (right):
  median spectral index ~ -0.97 (-0.83 for S>0.5 Jy)

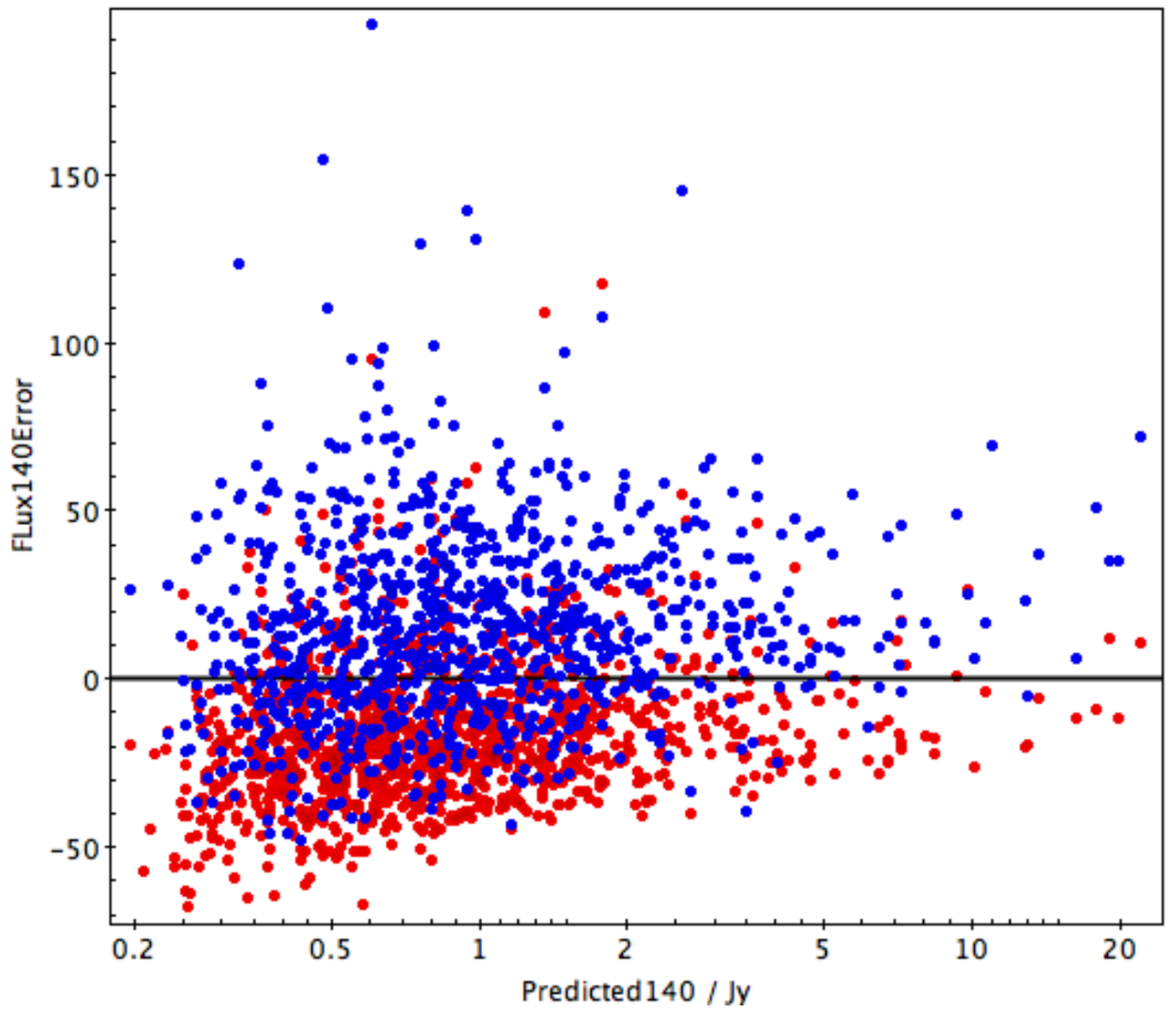




MSSS vs NVSS/VLSSr

- Comparison of cataloged A0,A1 values with interpolation between NVSS (1400 MHz; 47k sources) & VLSSr (74 MHz; 2388 sources): 1417 sources crossmatched with 10” tolerance
- MSSS crossmatch to that reference: ~1000 sources





Next steps

- Verify newest set of calculations (not including el beam weighting)

- Can be applied directly in beam model code, through the use of a simple lookup table
  (experimentation in progress together with Tammo Jan Dijkema)
  - Should allow use of proper normalization and variation with time, frequency, and station ID
    (applicable in NDPPP, BBS, awimager, etc)

- Later: implementation of full EM modeling (longer timescale)

Science projects

Science projects

- Initially organized following Amsterdam meeting in 2014
- Most active groups:
  - Clusters (Pizzo & Ferrari)
  - Polarization (Mulcahy & Jones)
  - High resolution (McKean, etc)
  - Nearby galaxies (Nikiel-Wroczyński, Jurusik, Sendlinger)
  - Supernova remnants (Riseley, Cantwell)
  - Pulsars (Breton, etc)

- Key aspect is addressing suitability of MSSS data products for science exploitation - and delivering recognition to MSSS workers!

Science workshop

- Announcing 2nd MSSS science workshop:

  4-5 June 2015

  Following LOFAR user and science meetings in Assen

June 2015

Today

Mon	Tue	Wed	Thu	Fri	Sat	Sun
1 Jun	2	3	4	5	6	7
Week 23						
lofar user&science meeting			MSSS workshop			

- **BUT NOTE:** MSSS workshop **to be held at ASTRON**

- Webpage and registration to be opened tomorrow (2 April)
  Informational email will be widely distributed
- Extra info: contact me and/or **secretaryastronomy@astron.nl**