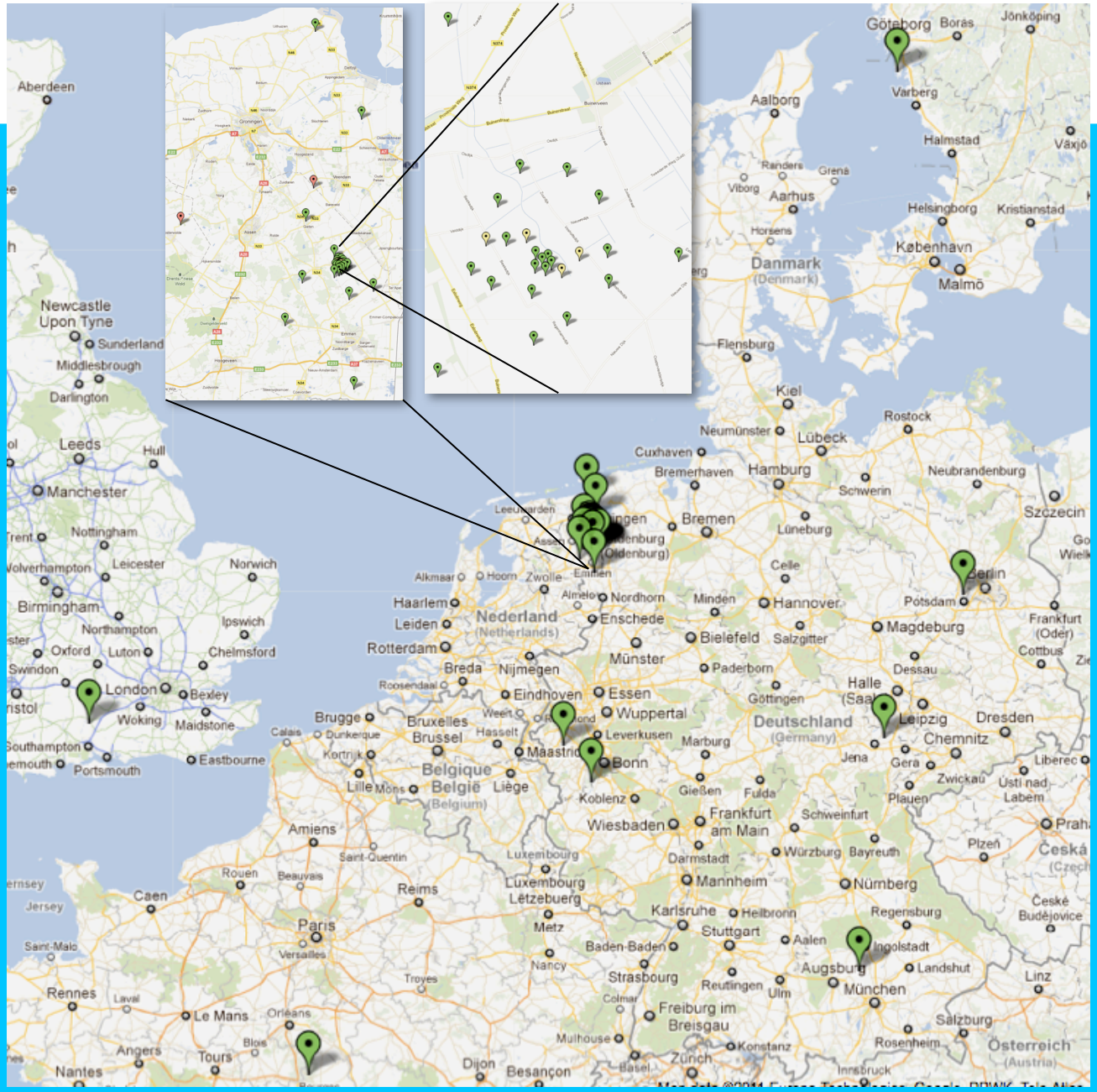
Heino Falcke
Radboud University (RU), Nijmegen
ASTRON & MPIfR Bonn

LOFAR WORKSHOP SUMMARY

LOFAR Stations Across Europe

Array Status & Rollout



- 37 operational
- 41 validated

Recent Progress:

- RS508 & RS509
- DE604 (Potsdam) & DE605 (Juelich)
- SE607 (Onsala) validated; in the array soon.
- CS011, CS028, CS031, CS013: expected end Sept.
- RS409 installed.
- RS407 earthworks end of year.

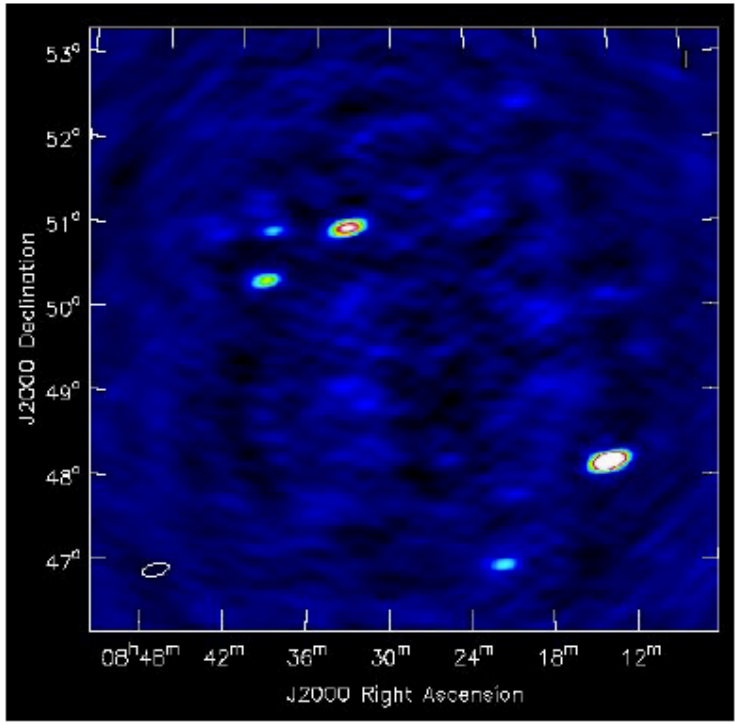
The new imager with A-projection

Talk by Tasse

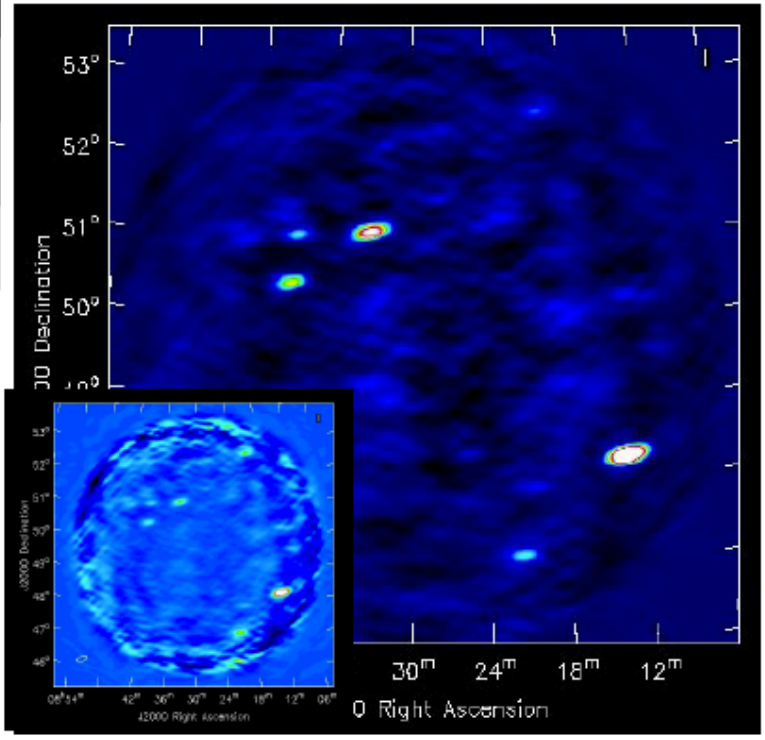
3C196 off axis ~150MHz

- Calibrated using 3C196+2 sources sources
- AW visibility estimates for those. Little difference?

NOT Taking the beam into account



Taking the beam into account



Tracking MSSS observations

8hr of MSSS-test observations: 1% of MSSS sky

MSSS fundamentally a commissioning survey

Key roles:

- Fill the initial GSM for calibration of arbitrary fields at arbitrary frequency in LOFAR bands

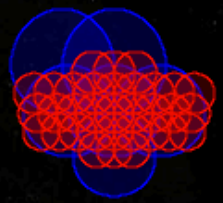
Multifrequency - need fluxes over wide LOFAR bands

Snapshot - spend little time to image the sky

Sky - cover the full LOFAR sky (dec ≳ 0 degrees)

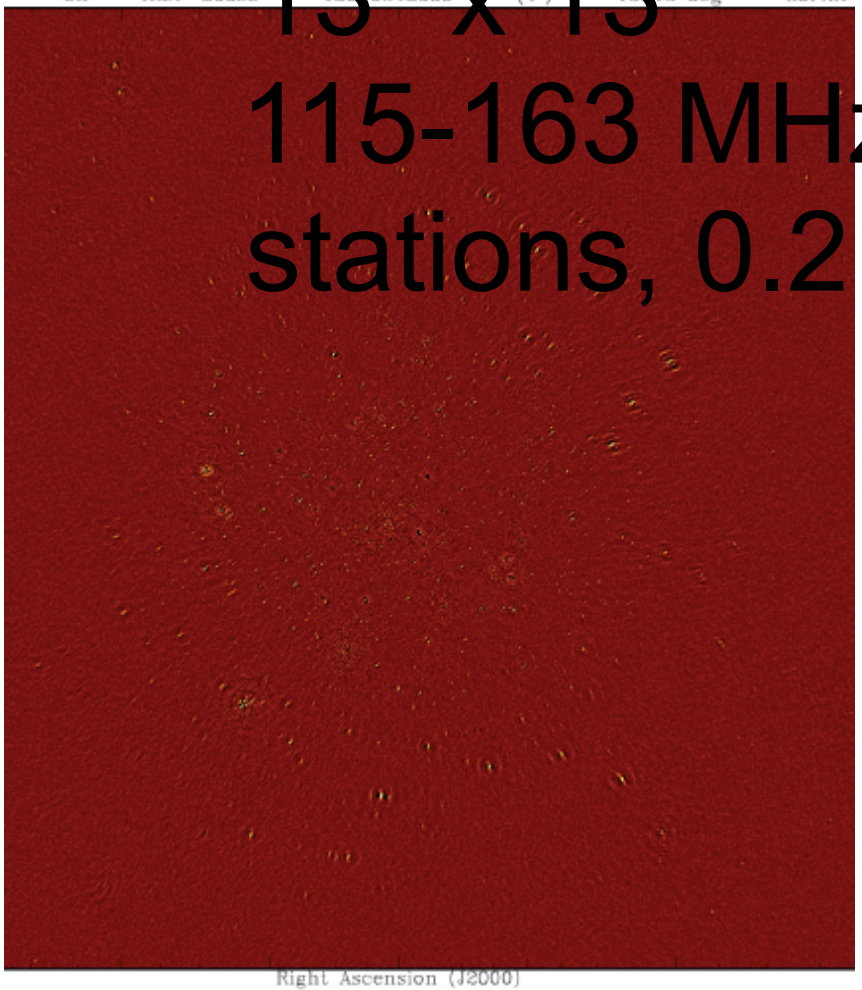
Survey - provides output catalog of sources in the sky

- Guide development of, and exercise observatory operations, processing software, imaging pipeline, (and commensal applications?)



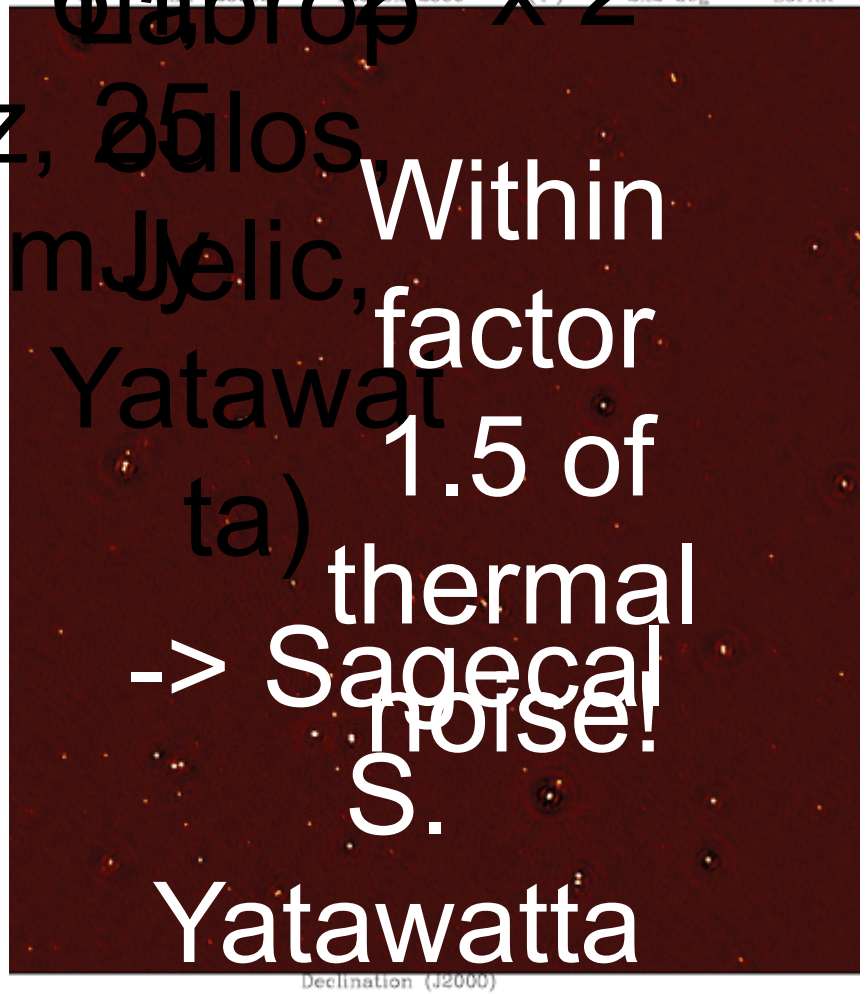
Deep Imaging EOR

13° x 13°
115-163 MHz, 25 stations, 0.2 mJy



de Bruyn, Labropoulos, Jelic, Yatawatta)

2° x 2°



Within factor 1.5 of thermal noise!

-> Sagecal

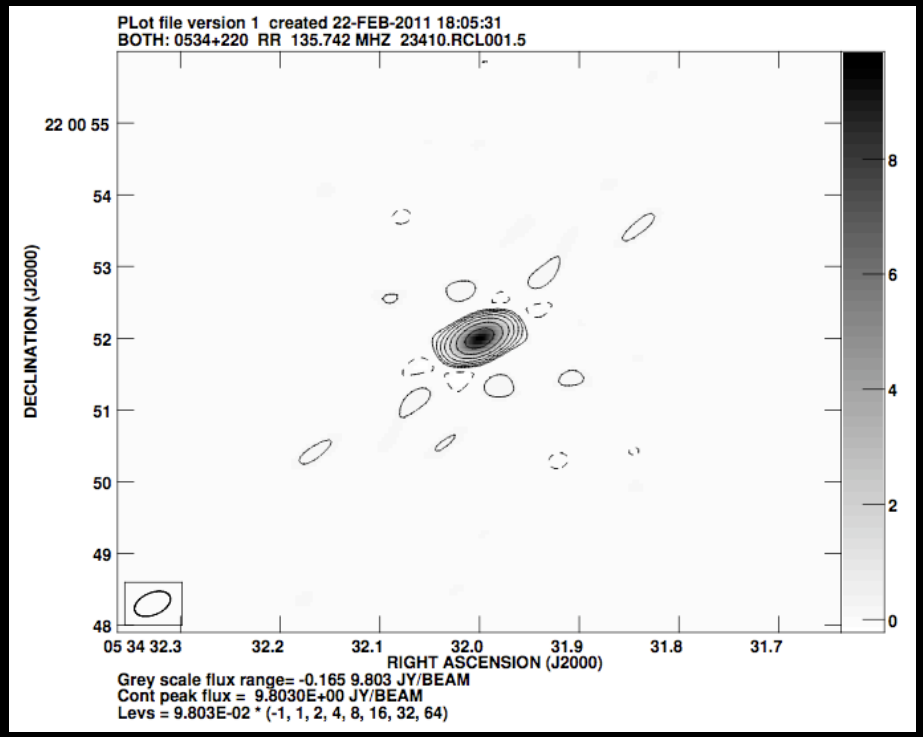
S. Yatawatta

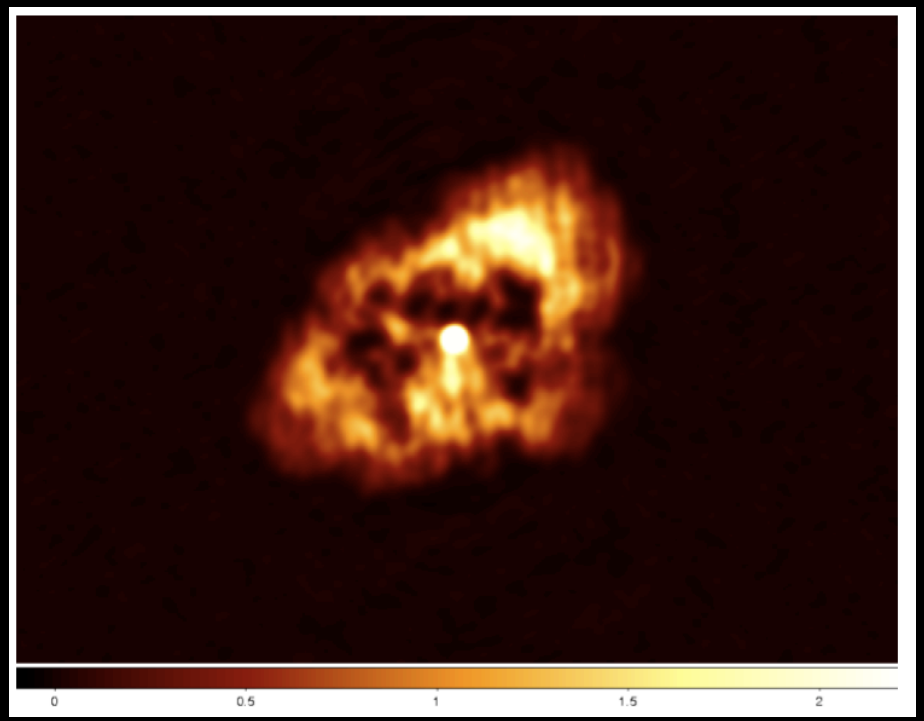
Taurus A with international baselines

1 Core station, 7 remote stations, 2 international stations

O. Wucknitz

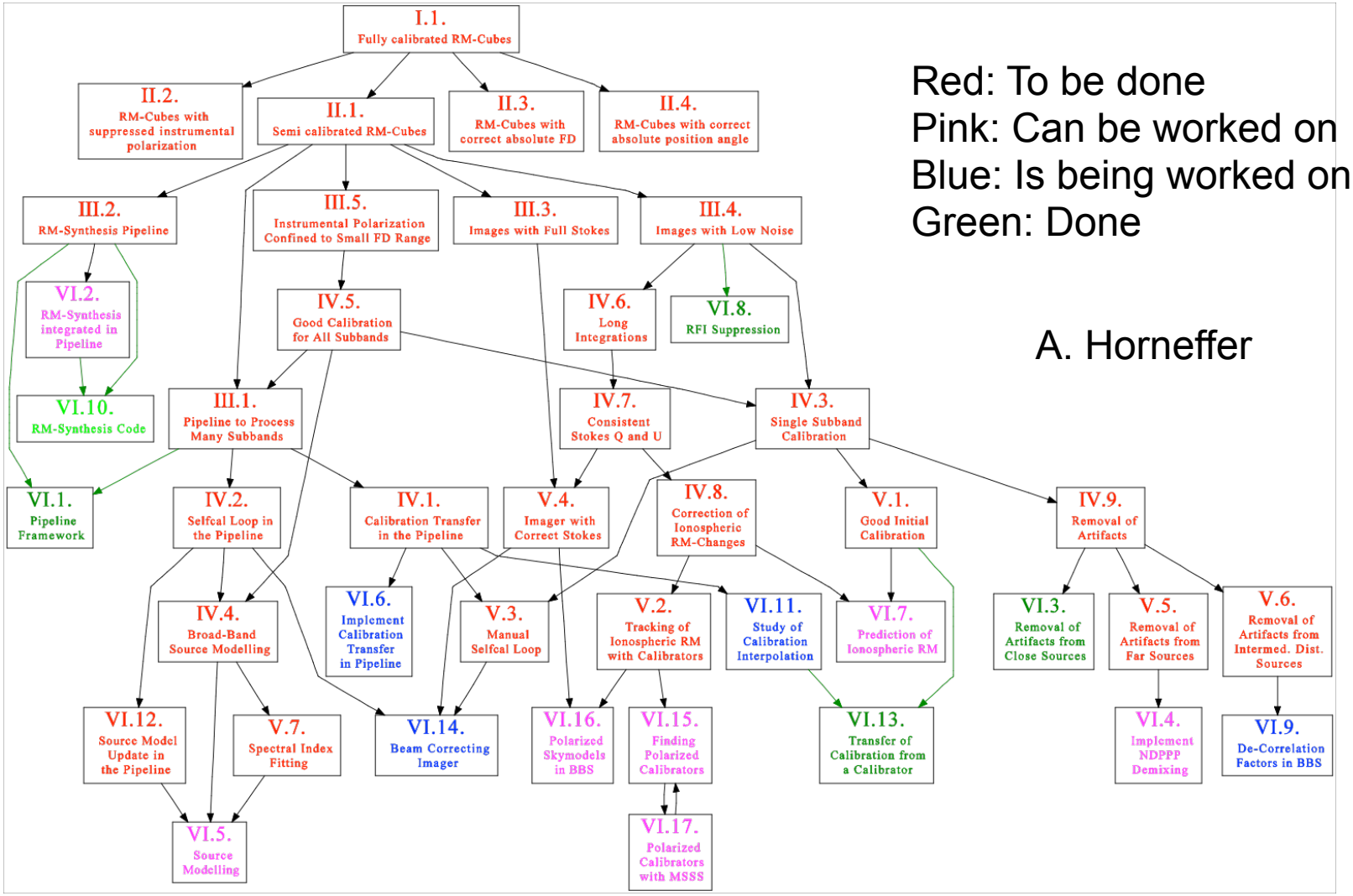
Detection of central source (Crab pulsar)





Magnetism Commissioning Plan: Task Graph

Max-Planck-Institut für Radioastronomie

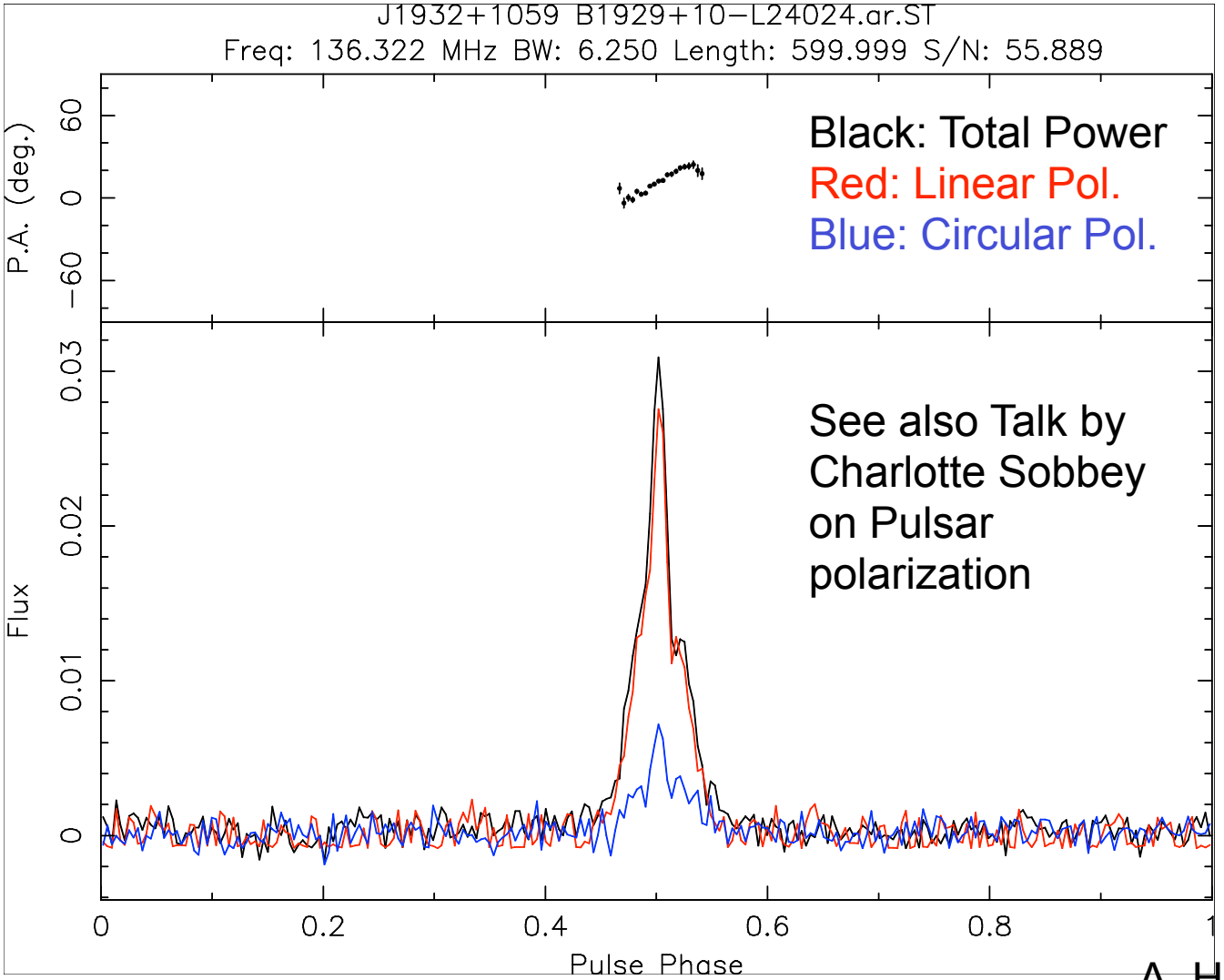


Red: To be done
Pink: Can be worked on
Blue: Is being worked on
Green: Done

A. Horneffer

Results: PSR B1929+10

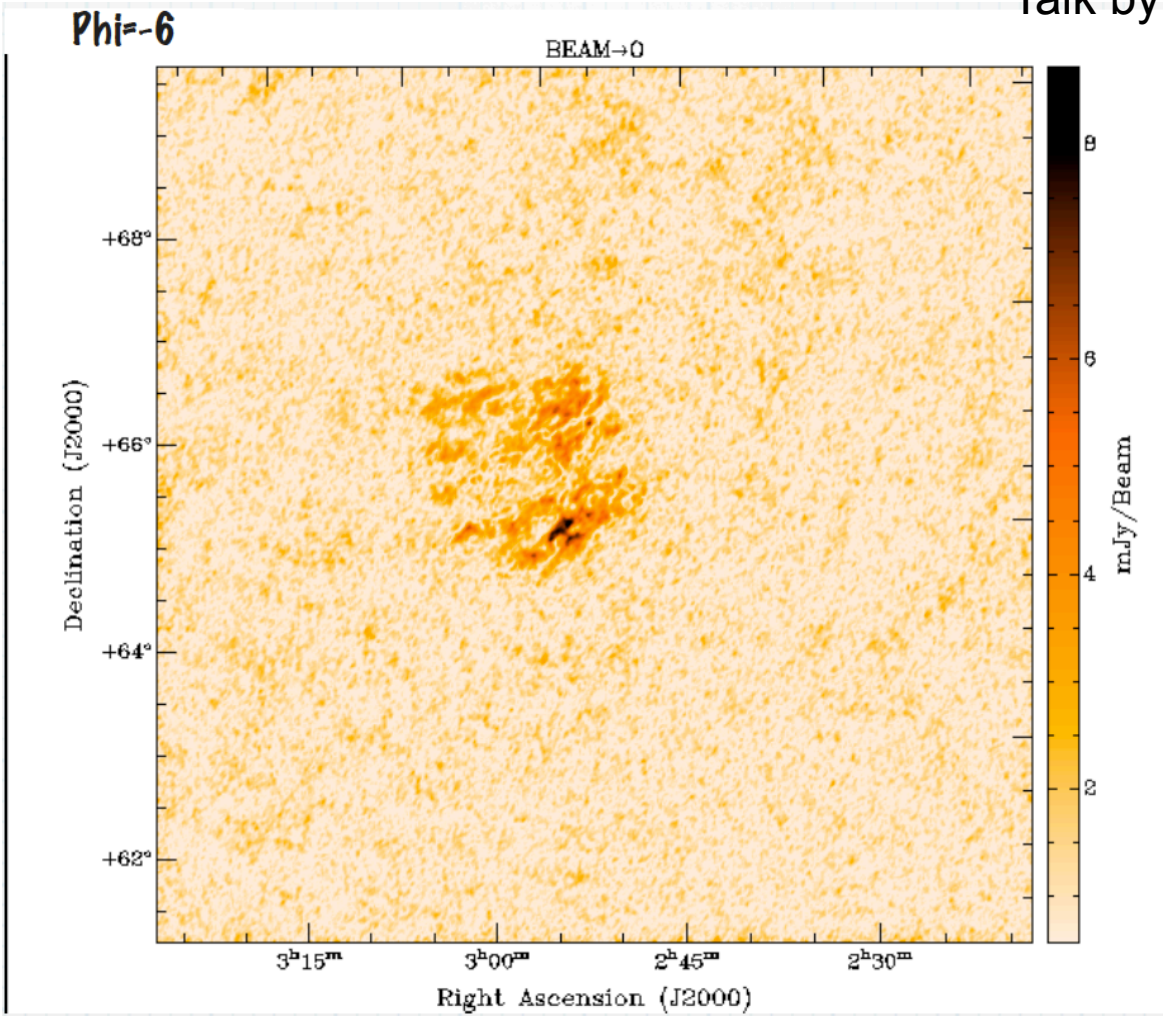
Max-Planck-Institut für Radioastronomie



A. Horneffer

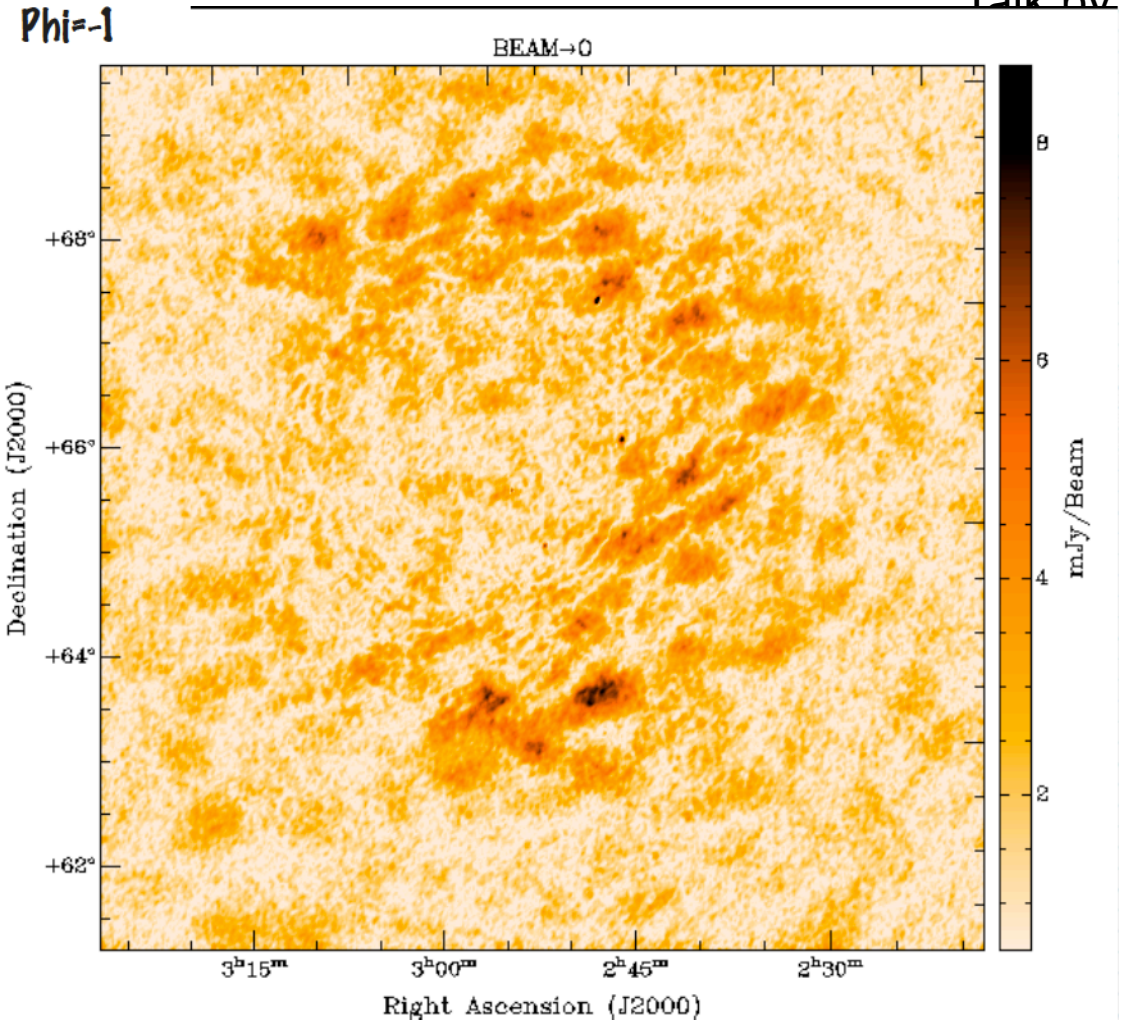
Polarized structure in Fan Region with RM synthesis

Talk by Orru

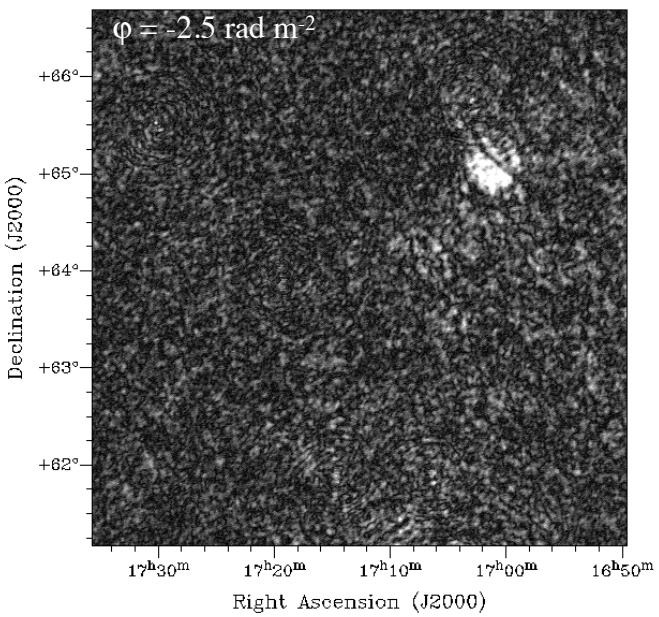


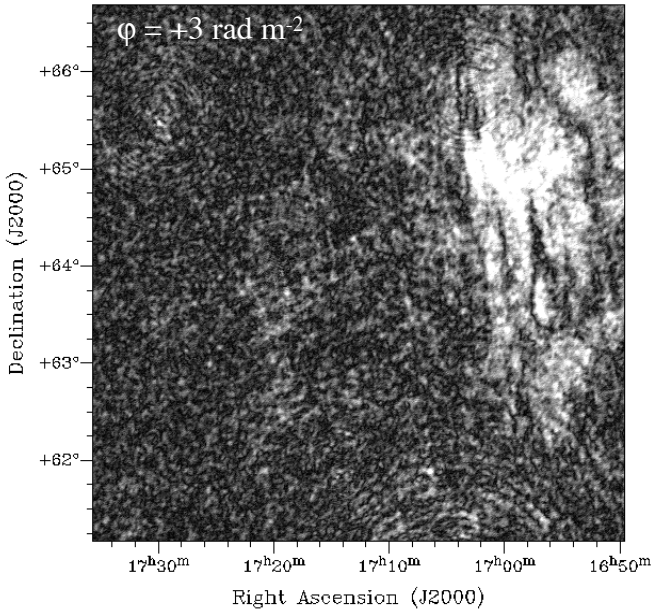
Polarized structure in Fan Region

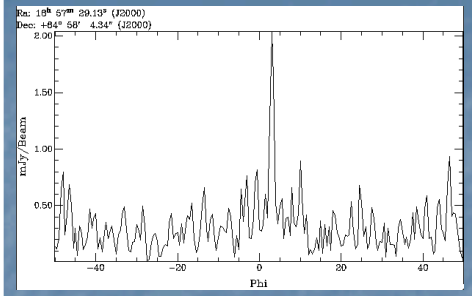
Talk by Orru

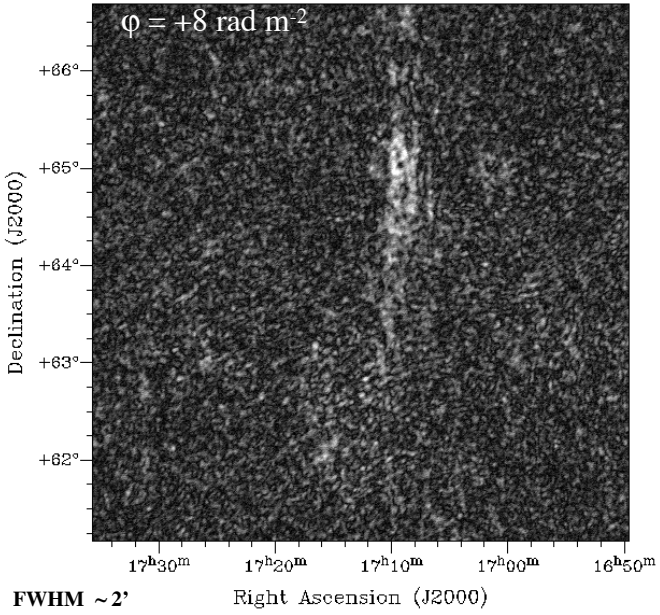


Faraday structures towards Abell 2255 (Roberto Pizzo)

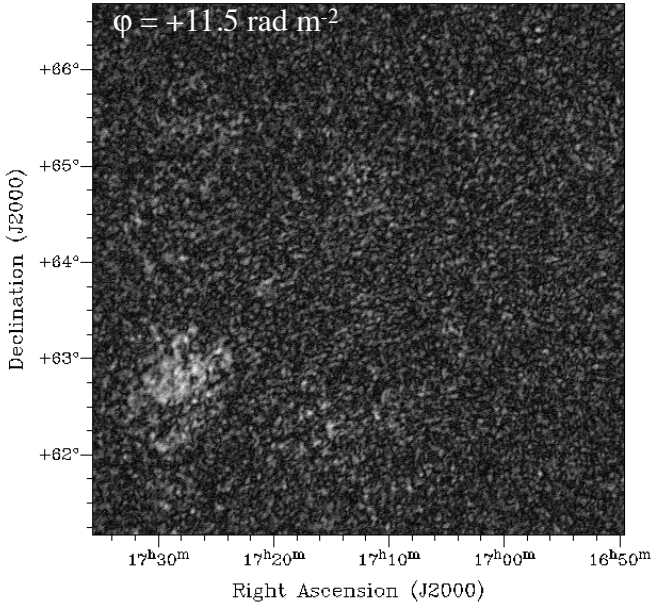








FWHM ~2'



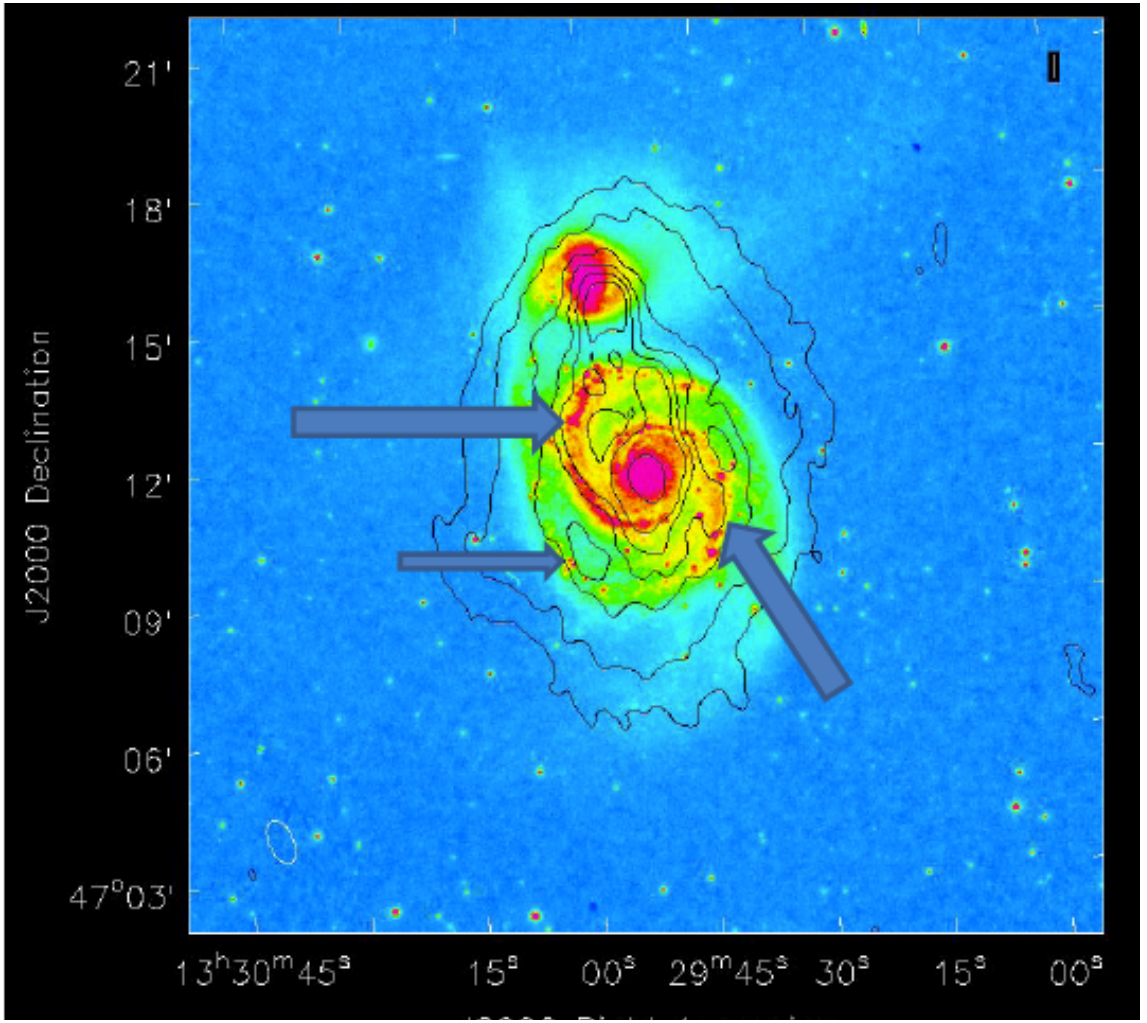
- ✓ Various polarized features with no counterpart in Stokes I
- ✓ Brightness temperature ~ 4 K
- ✓ Instrumental origin unlikely, as they do not happen at $\phi = 0$ rad m^{-2} are not symmetric w.r.t this Faraday depth

Imaging of galaxies

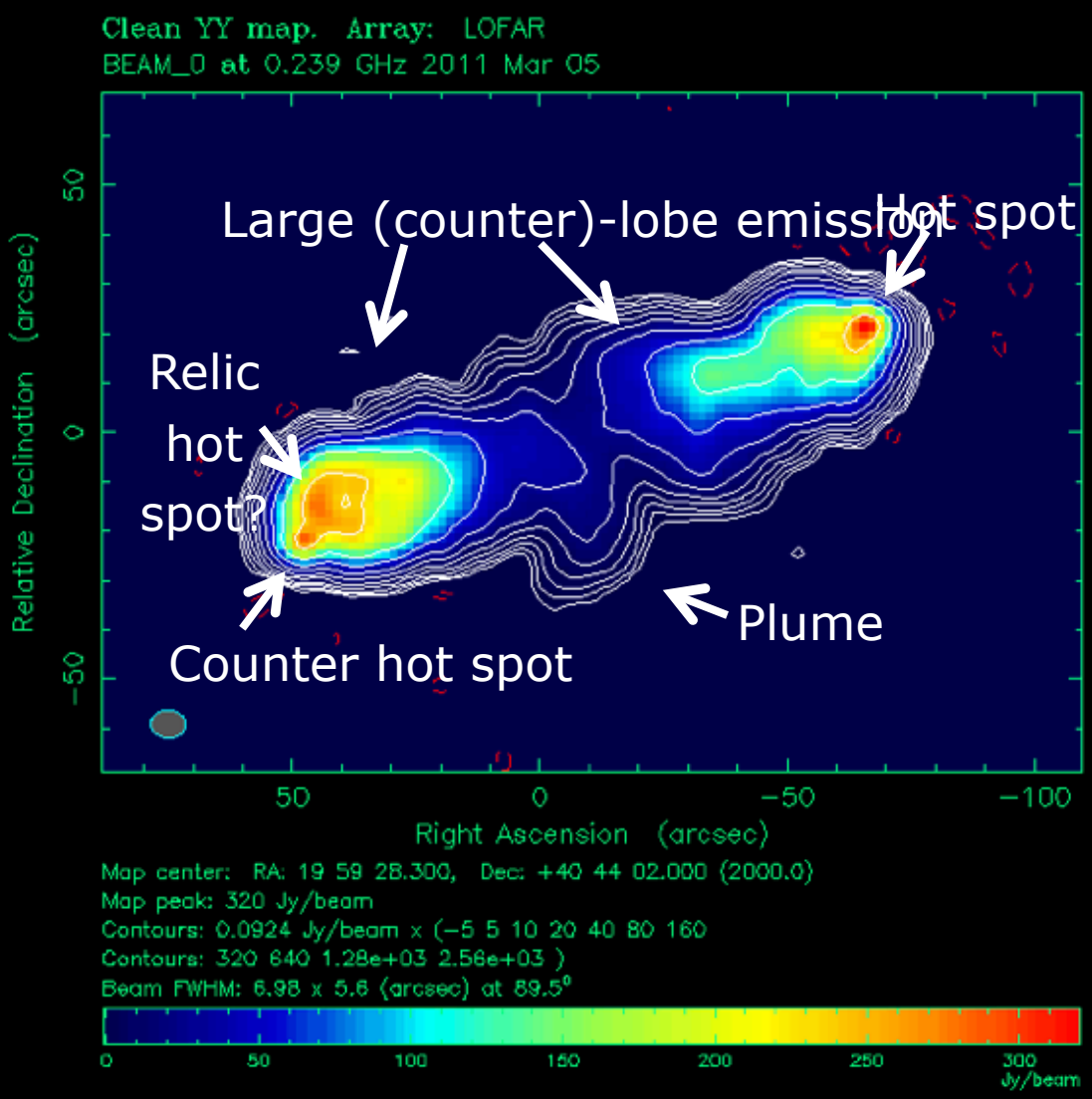
Talk by David Mulcahy

Higher Resolution map of M51

- Robust Weighting of 0.25 was used to produce image to the right.
- Single subband at 145.7 MHz
- Due to uv-coverage, beam is quite elliptical
- Left spiral arm can be seen.
- As well as sections of the right spiral arm.
- Base contour is at the 3 sigma level.
- Large Halo can also be seen!



HBA imaging at 239 MHz



SS433 (Jess Broderick)

31 SBs roughly evenly spread across freq. range (115-163 MHz)

El. 30-42 deg

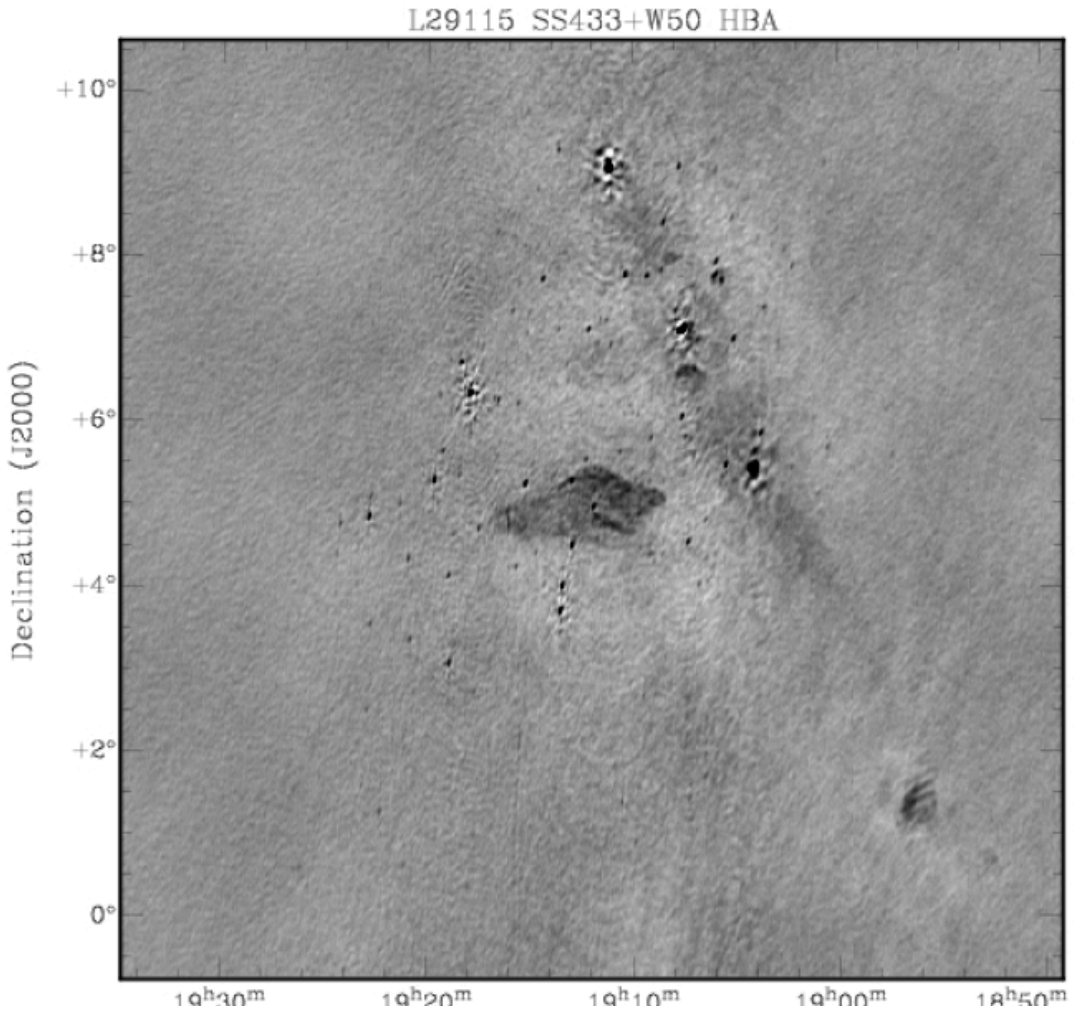
19 core stations (HBA_DUAL) and 7 Dutch remote stations

casapy imager (widefield gridmode)

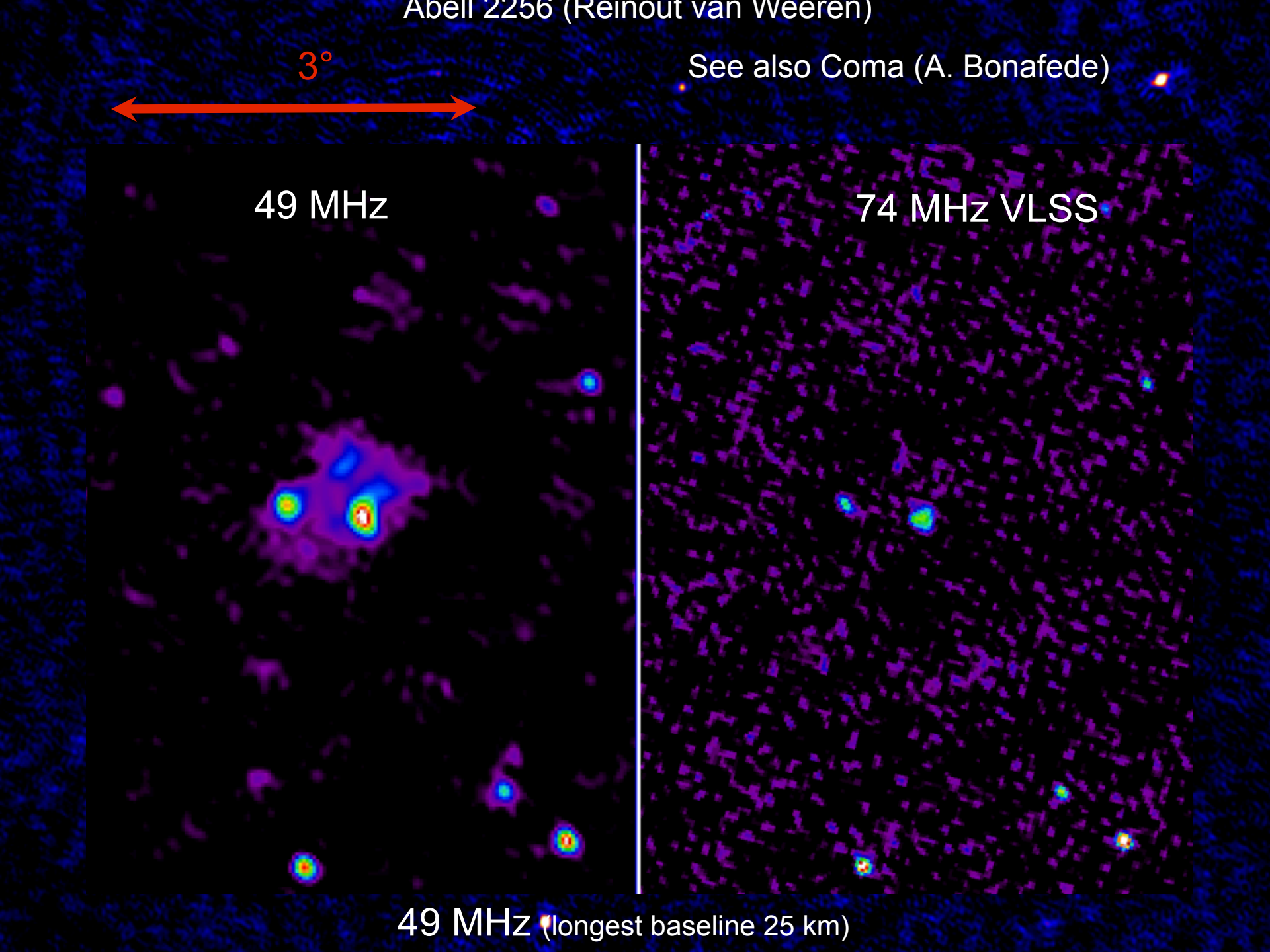
Robust=0 weighting; core Stations only

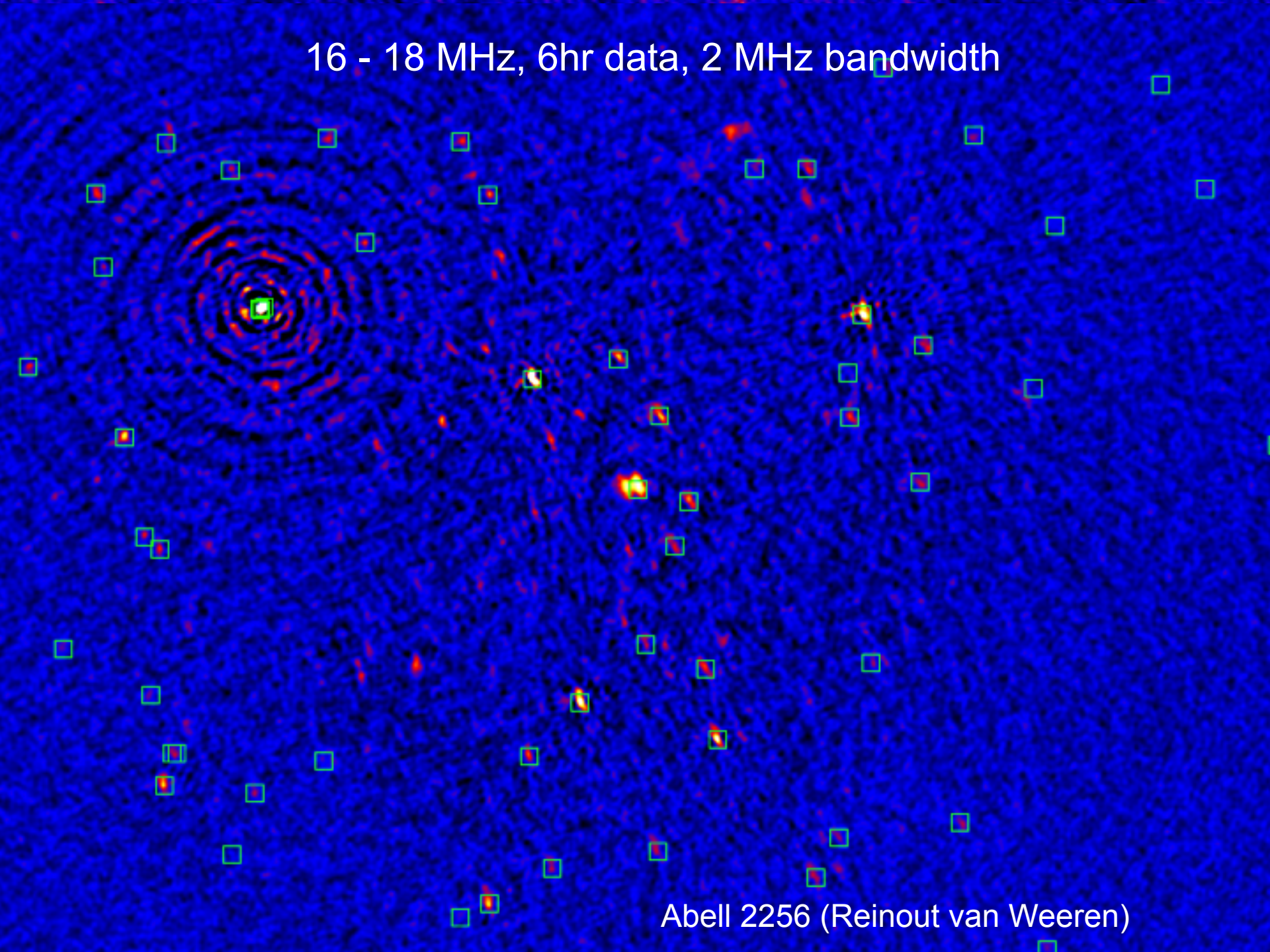
~20 mJy/beam rms

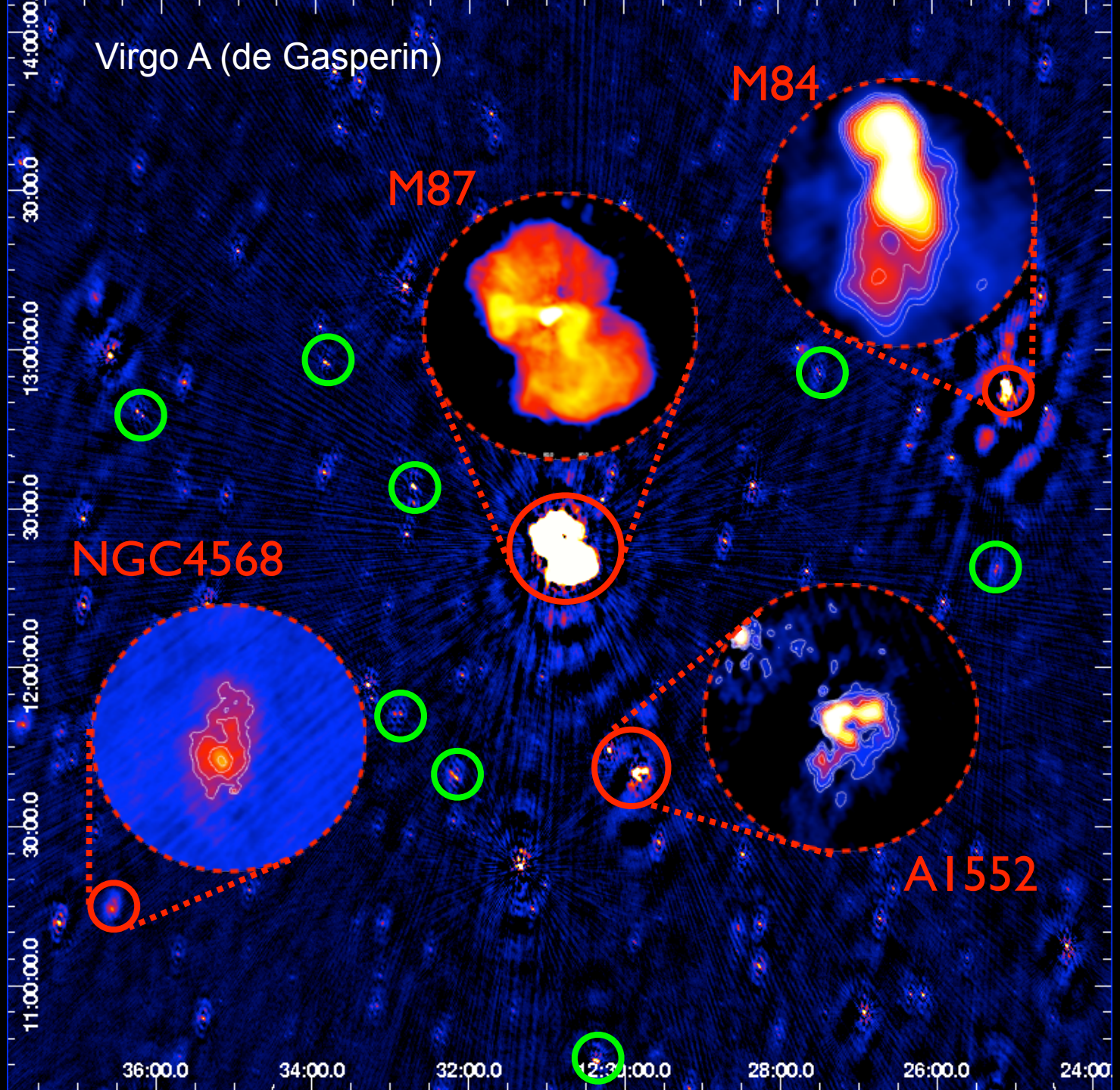
resolution ~180 arcsec x 120 arcsec



SS433 flux about 1.2 Jy

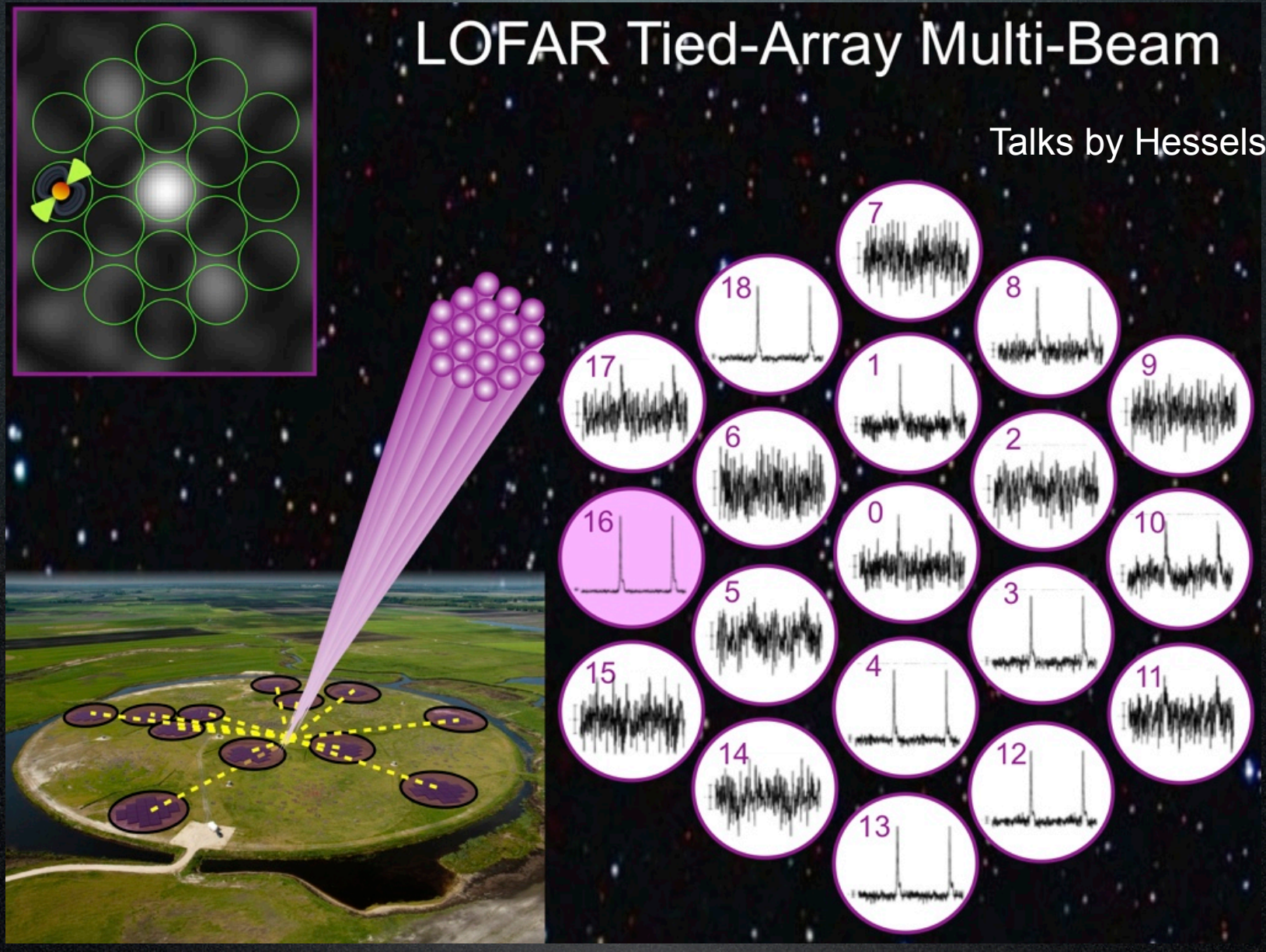

Abell 2256 (Reinout van Weeren)
3°
See also Coma (A. Bonafede)
49 MHz
74 MHz VLSS
49 MHz (longest baseline 25 km)


16 - 18 MHz, 6hr data, 2 MHz bandwidth
Abell 2256 (Reinout van Weeren)


Virgo A (de Gasperin)
M84
M87
NGC4568
A1552
14:00:00.0
30:00.0
13:00:00.0
30:00.0
12:00:00.0
30:00.0
11:00:00.0
36:00.0
34:00.0
32:00.0
28:00.0
26:00.0
24:00

LOFAR Tied-Array Multi-Beam

Talks by Hessels



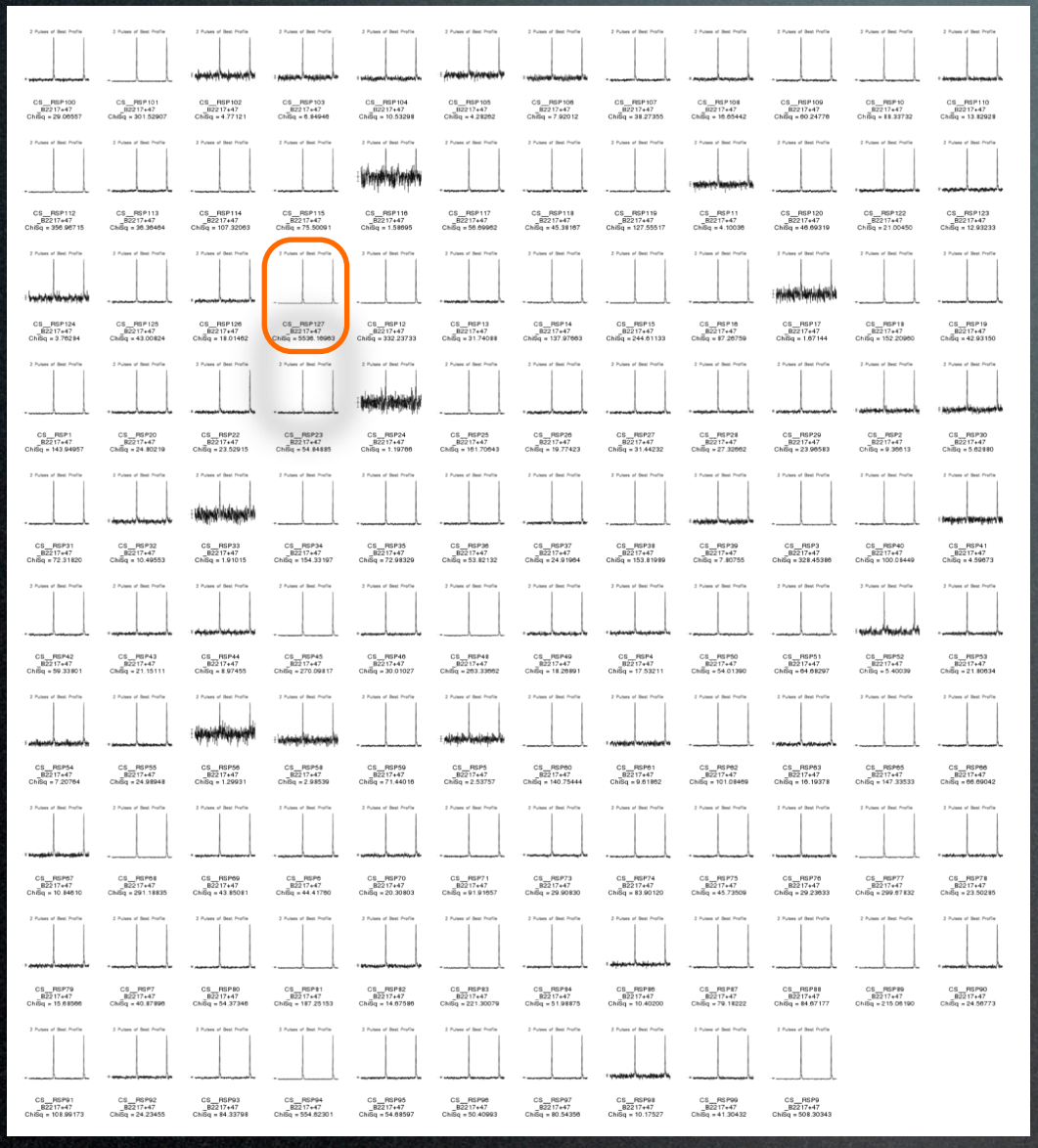
See Mol & Romein 2011 for multi-beam tied-array benchmarking results

Credit: Hessels, Stappers & Scaife

Data <12 hours old!!!

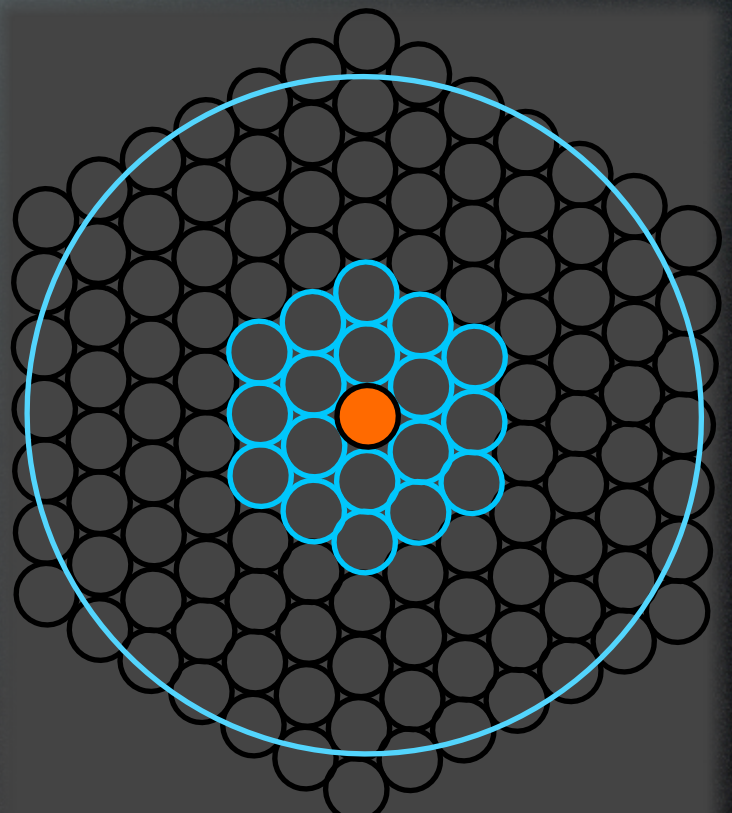
>100 beam Tied-Array!!

Talks by Hessels



Credit: Alexov & Hessels

Pulsar in the center of FoV



Pulsar is 10x brighter in the correct (center) beam!

LOFAR-Lovell-Effelsberg Observations

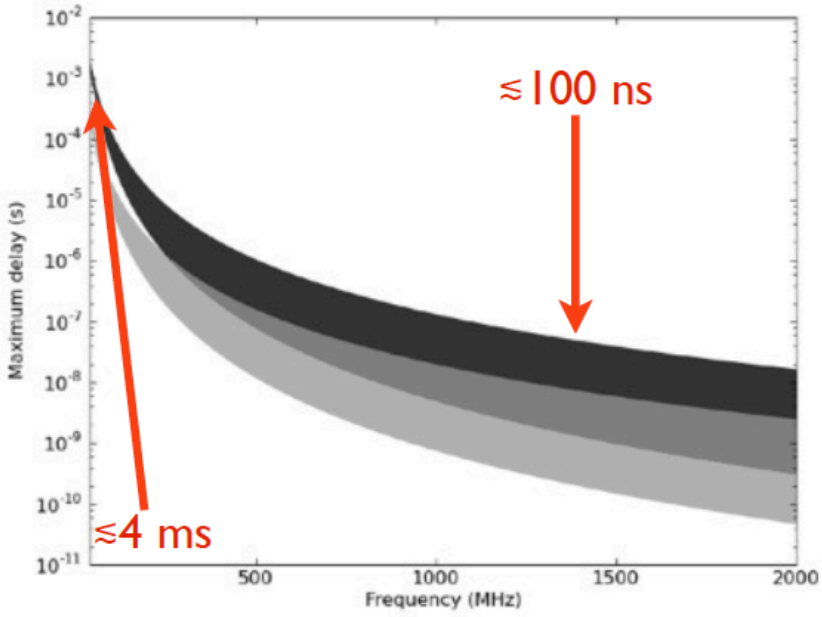
Aberration and Retardation

$$t_{AR} = \frac{\Delta r}{c}(1 + \sin\alpha)$$

	Delay (ms)	α (^{o})	ΔR (km)
B0329+54	0.65	30.8	< 128
B0809+74	1.28	0.0^b	< 384
B1133+16	0.35	51.3	< 59
B1919+21	0.28	45.4	< 49

Emission all comes from a surprisingly narrow range in the magnetosphere

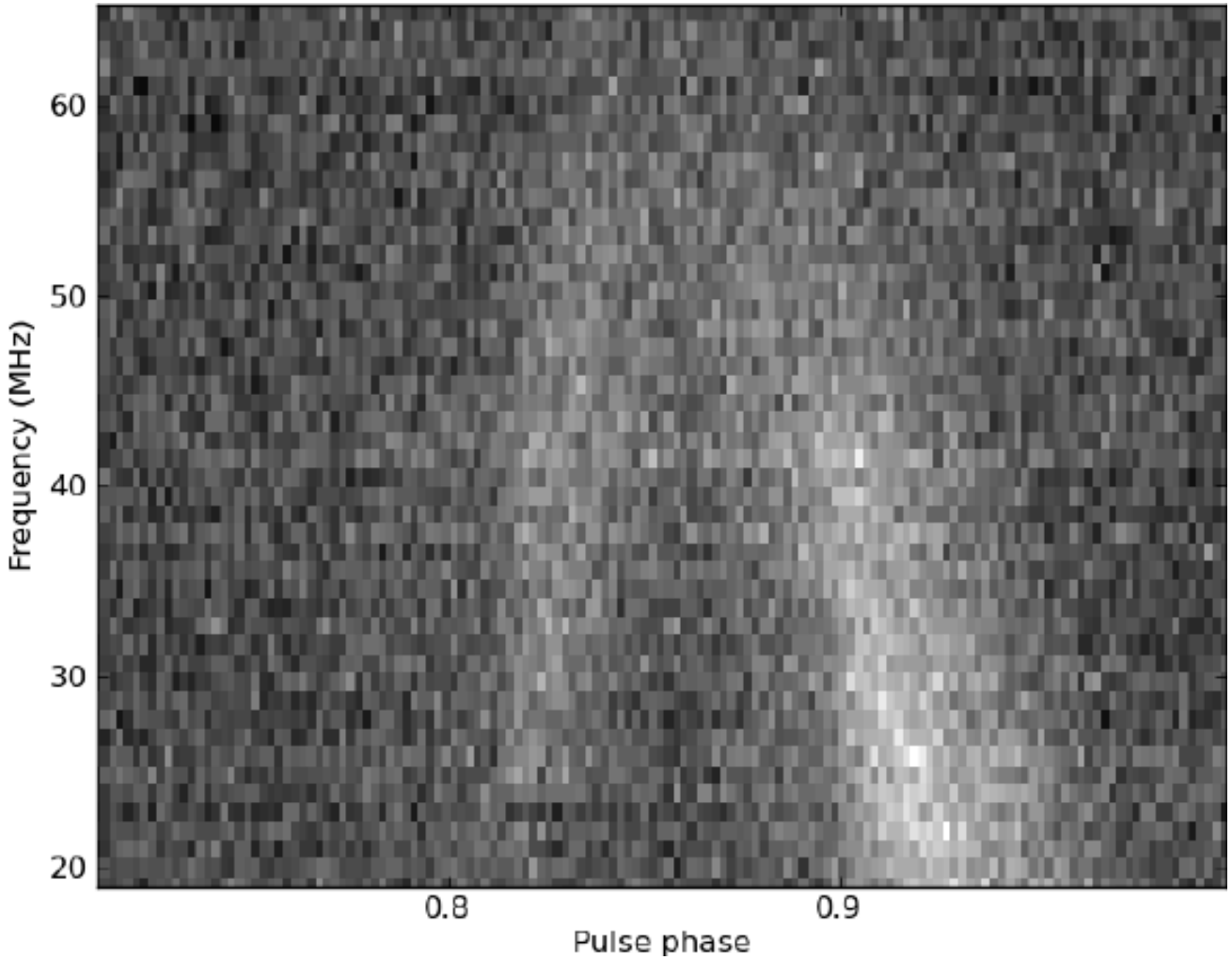
Within a few stellar radii of the neutron star surface



Tom Hassall

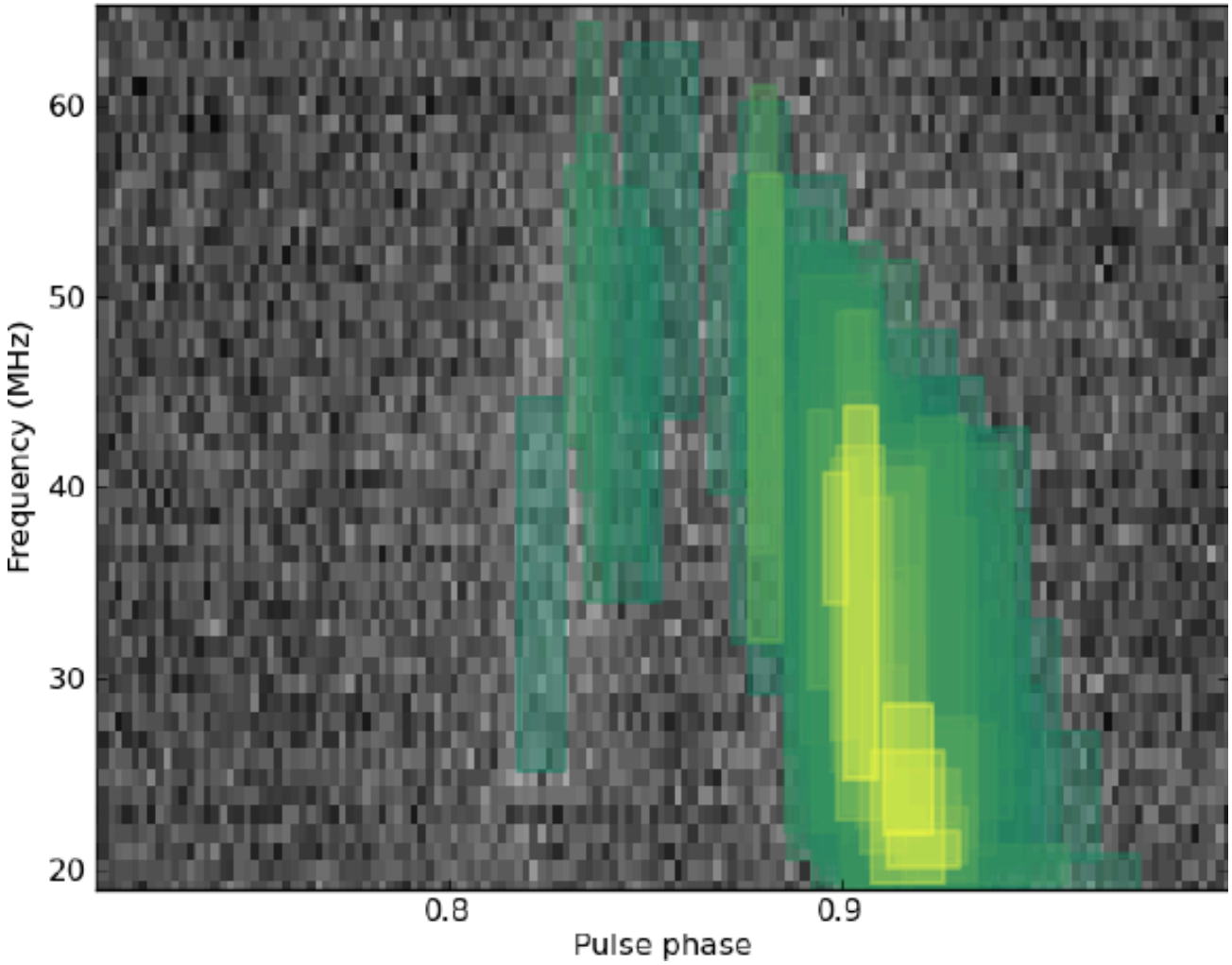
Anomalous Intensity Pulses

Vlad Kondratiev

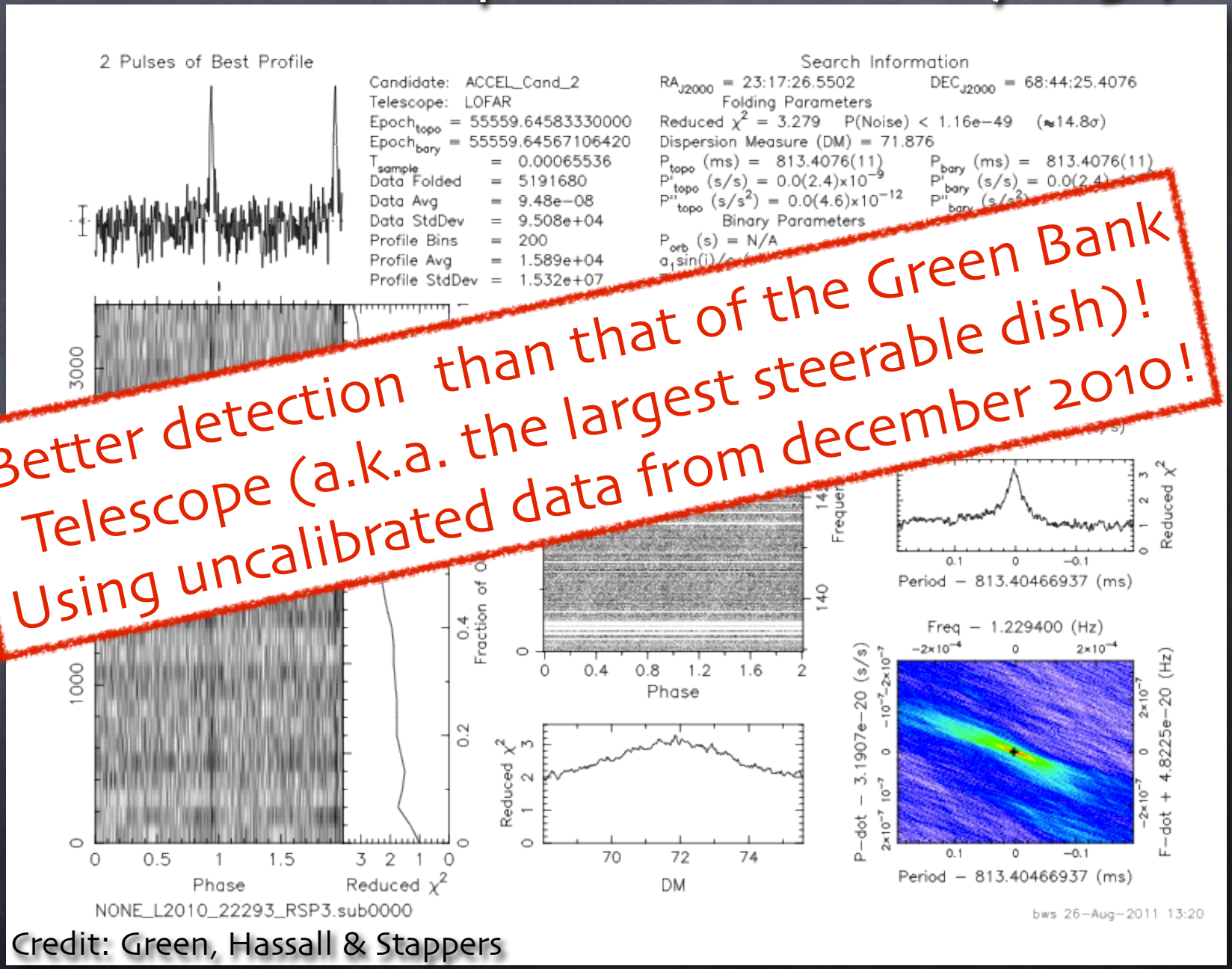


Anomalous Intensity Pulses

Vlad Kondratiev



Independent discovery J2317+68



Better detection than that of the Green Bank Telescope (a.k.a. the largest steerable dish)! Using uncalibrated data from december 2010!

Credit: Green, Hassall & Stappers

Future

- LPPS re-processing:
  - Mostly automated!
  - Will likely find new pulsars.
- LOTAS processing:
  - Re-use search software.
  - 10x more sensitive than LPPS
- Bet: 256 new pulsars by

- Coherent addition of LOFAR Superterp.
- 19 beams, 48 MHz bandwidth per beam, 1.3 ms sampling time.
- 17 minutes integrations.
- 3.7 square degrees of sky per pointing.

Transients (RoI, Broderick)

L2010_21641 (December)

240 SBs

cimager

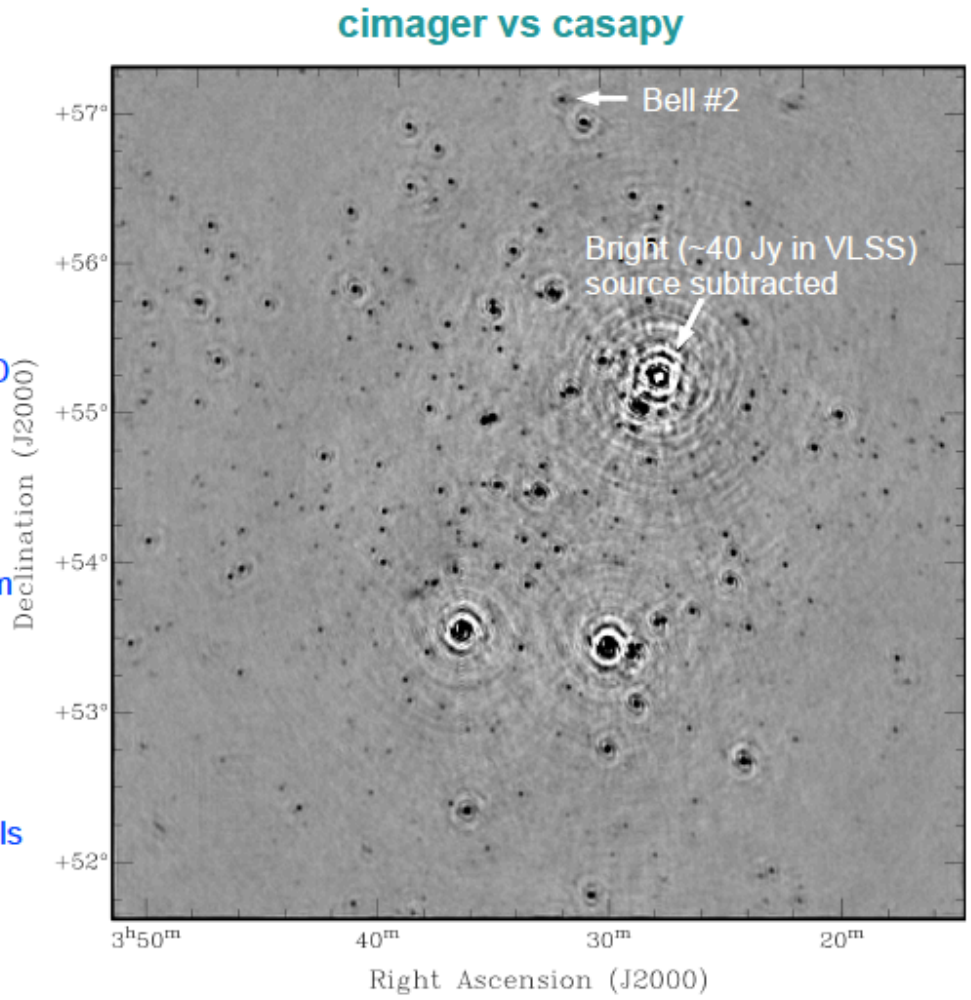
SUBTRACTED DATA column

robust=0 weighting

~2.9 mJy/beam rms

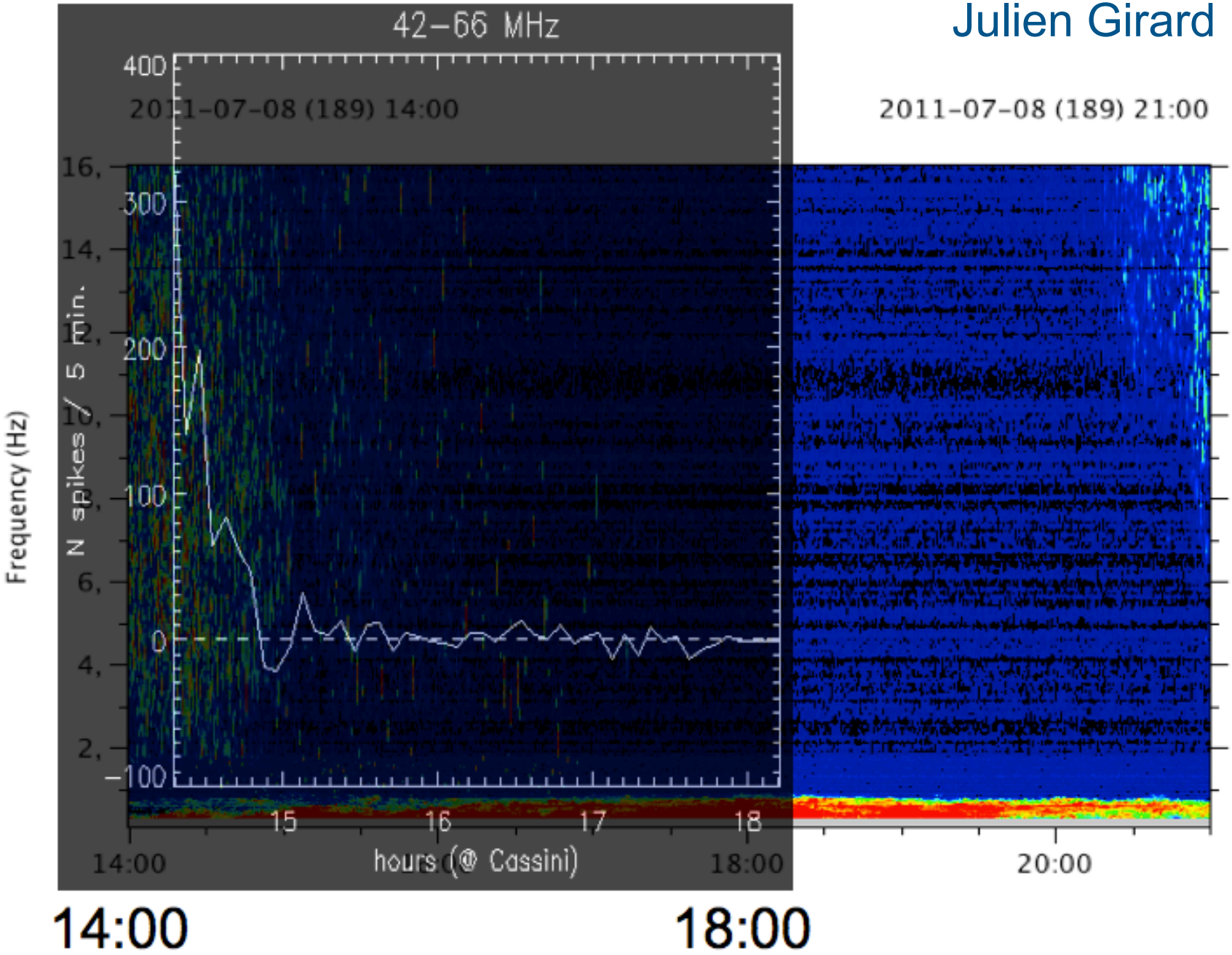
resolution 100 arcsec x 90 arcsec

40 arcsec pixels



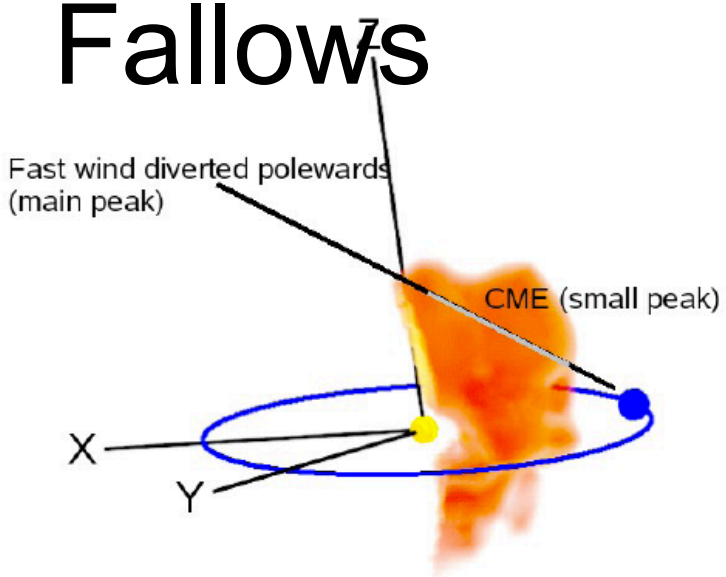
Comparing with Cassini data

Julien Girard

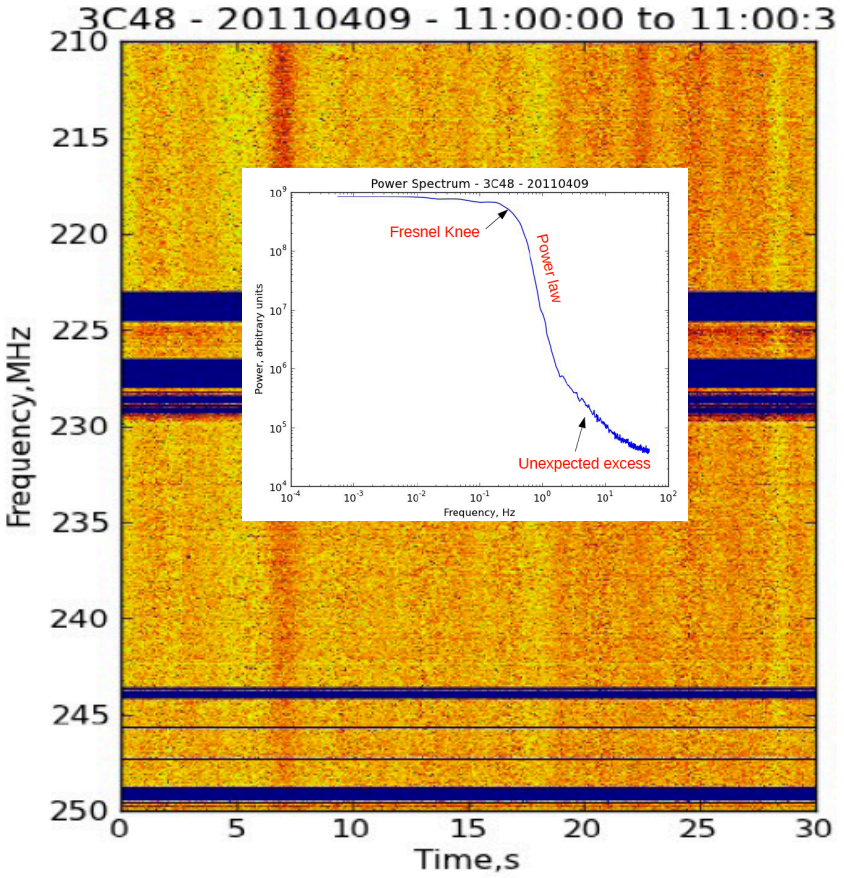


Interplanetary Scintilation

Richard Fallows

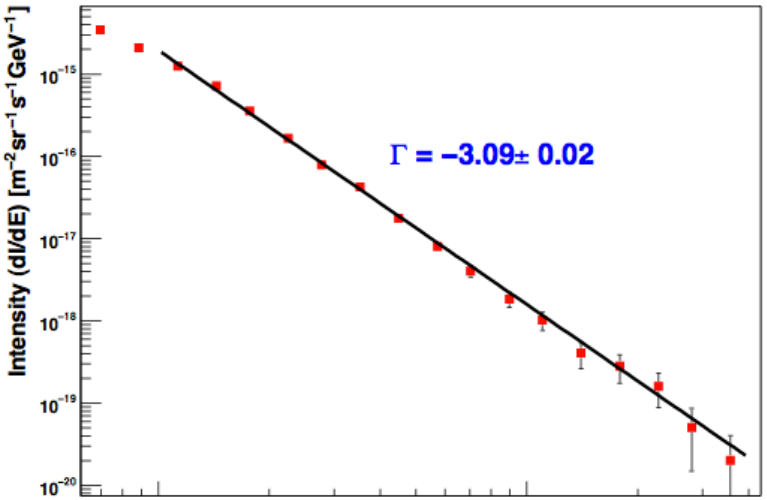


2005/05/14 15:00 UT

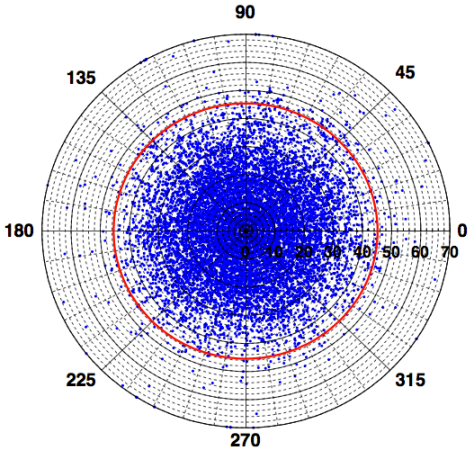


LOFAR Radboud Air Shower Array

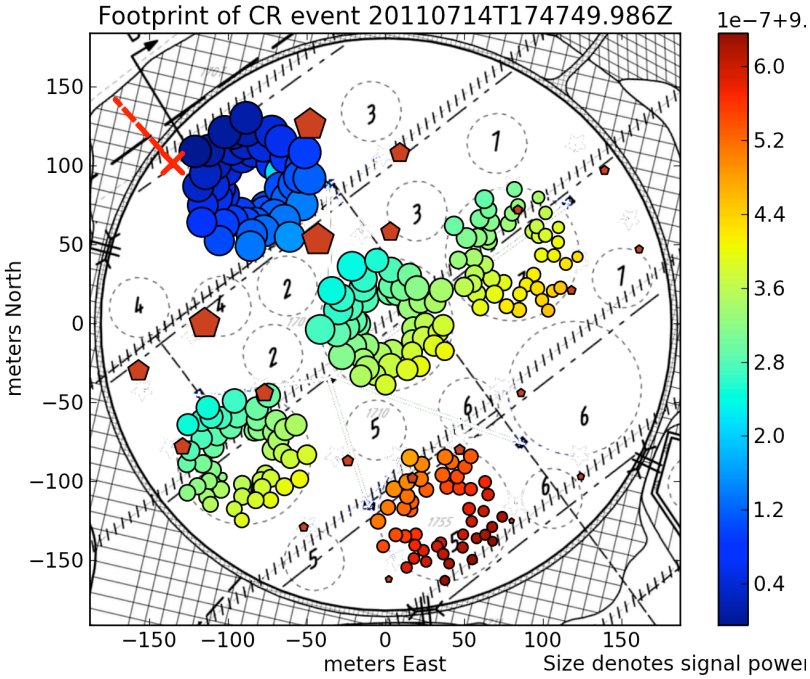
Talk by

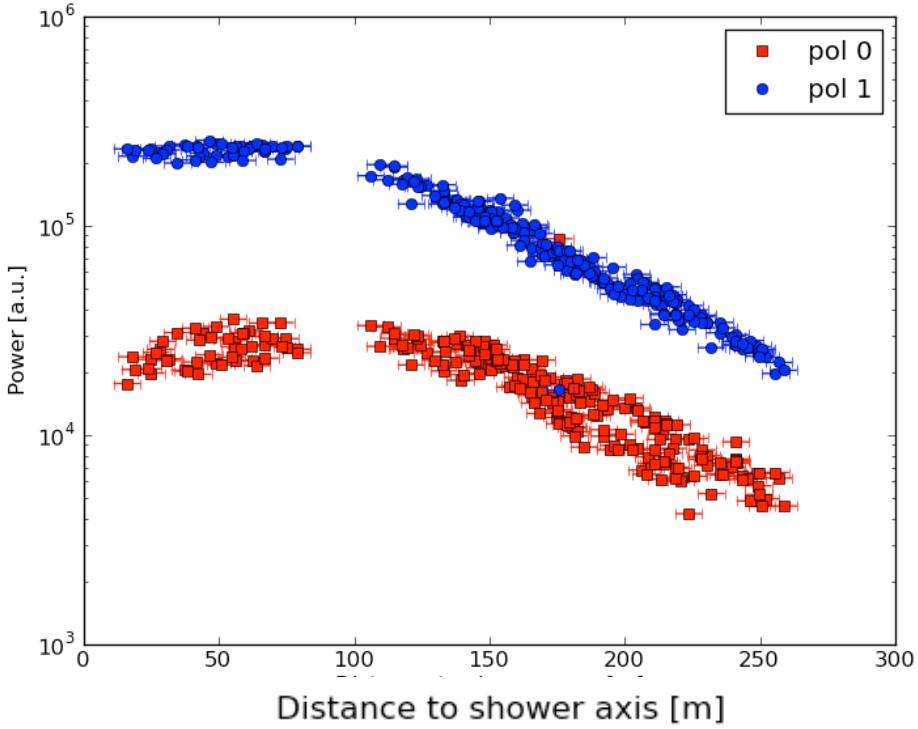


Arrival direction distributions



Cosmic Rays seen with Talk by S. ter Veen

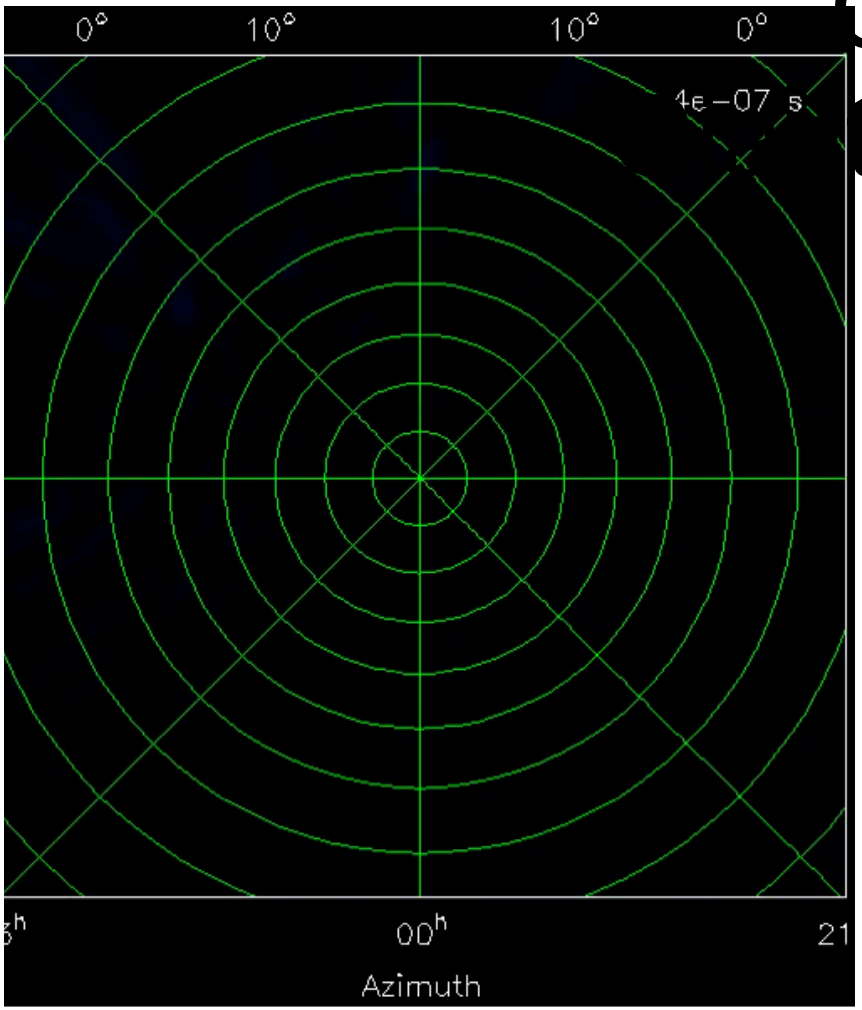


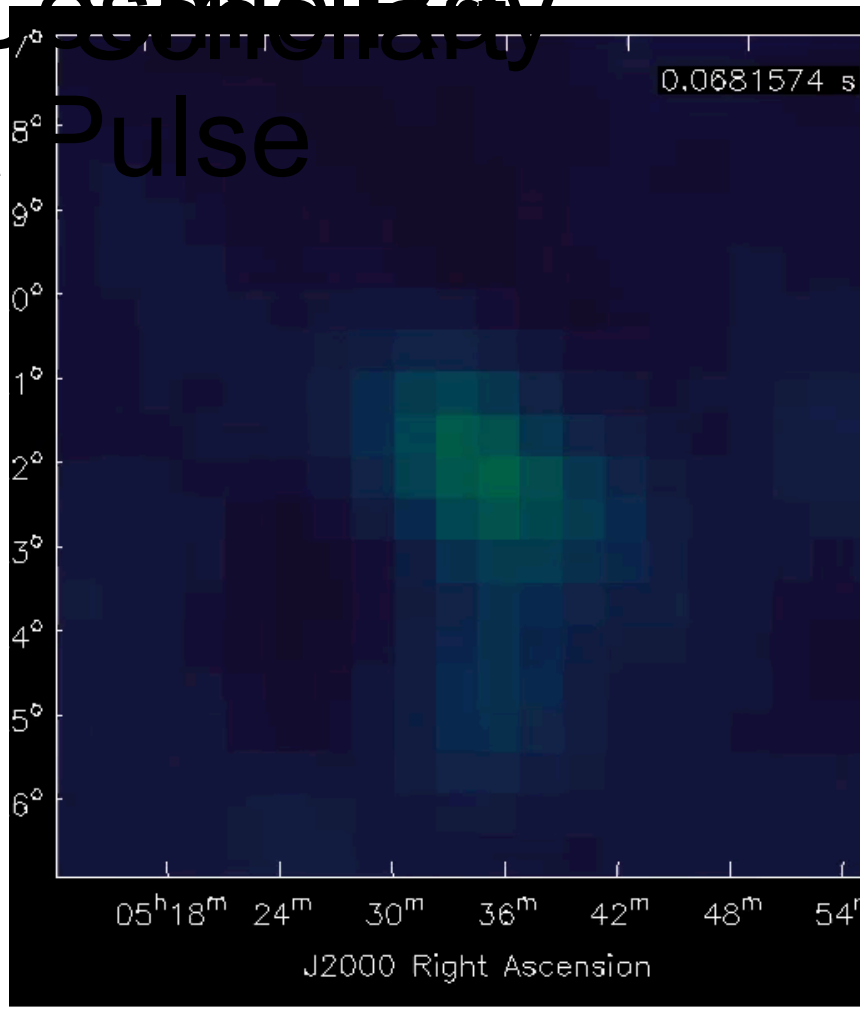


Most densely instrumented measurements of air shower radio emission!

TBB Imager

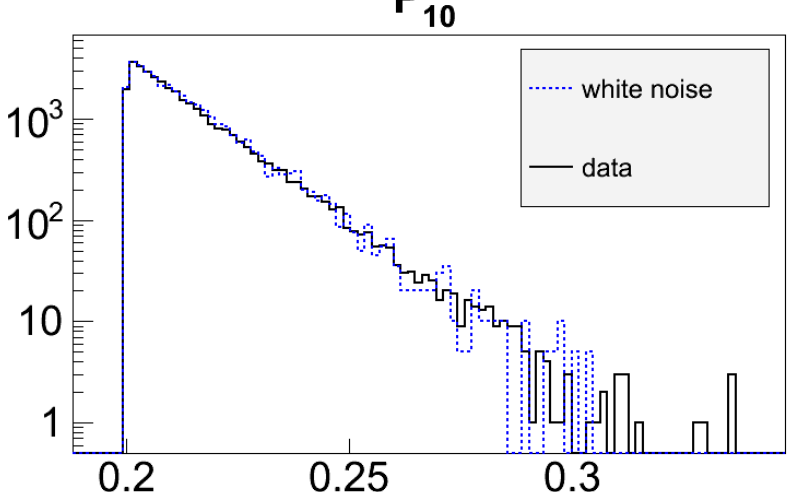
Talk by Pim



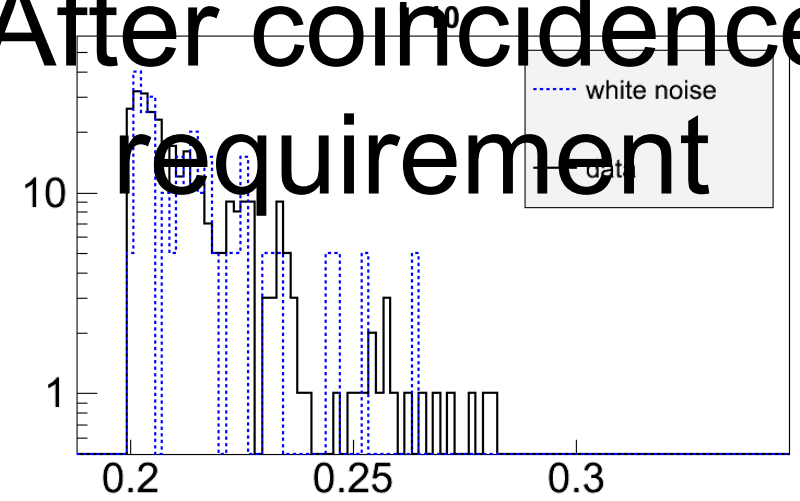


NuMoon – Cosmic Rays hitting the Moon (Mevius)

P10 distributions

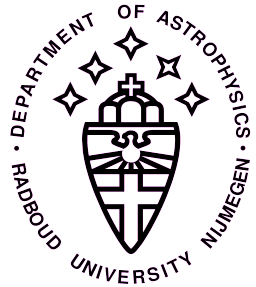


After coincidence requirement



- No pulses other than Gaussian noise were found in 5 minutes of data
- Next steps:
  - Repeat analysis on full bandwidth data
  - More stations (tied array mode)
  - Point one or more beams to the Moon, to check for differences
  - Investigate short time structure of others sources?
  - Implement simple trigger (@TBBS or CEP)

Some questions



- Many results, many at the edge of being interesting: Why don't we do a few things, but really well?
- Maybe we should do the things we can do well, rather than the ones we would like to do?
- Why can one person reach almost thermal noise and go down to 0.2 mJy with dynamic range 200.000:1 and the rest has just 3000:1?
- We seem to know what the problems are? Are we working focused enough to solve them? Do the different groups talk enough with each other?
- Why don't we do more long baselines? That's where LOFAR really stands out (and a few things become easier!). Why is only one person able to do this?
- Why do many of our "pretty pictures" have to look ugly?
  - Emphasis of noise, b/w color scale, small part of data,few subbands, no de-convolution
- Why haven't we published more papers?
  - Remember that they need to go through publication committee for commissioning data – but that is still better than not publishing at all.
- Why has there to be a gray control bar overlaid over half the presentations, obscuring the bottom part of the slide?


I WANT YOU
FOR MSSS ARMY
NEAREST RECRUITING STATION