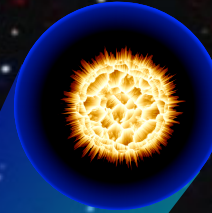


Update LOFAR Cycle0 Project LC0_034

Jason Hessels (ASTRON / UvA)

+LOFAR Pulsar Working Group



Lots of involvement by...

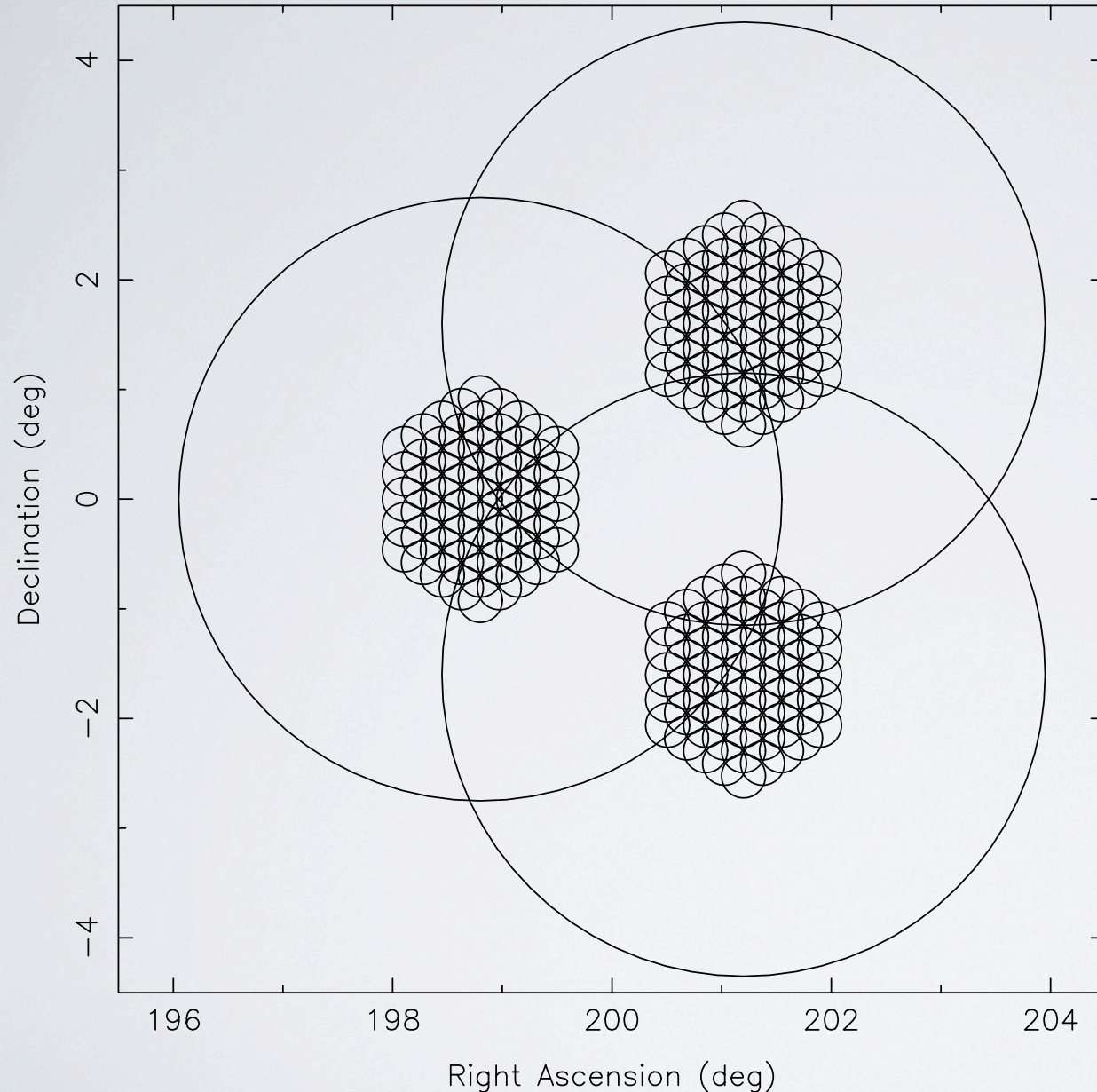
- Vlad Kondratiev
- Richard Fallows
- Ben Stappers
- Joeri van Leeuwen
- Thijs Coenen
- Patrick Weltevrede
- Sally Cooper

LC0_34

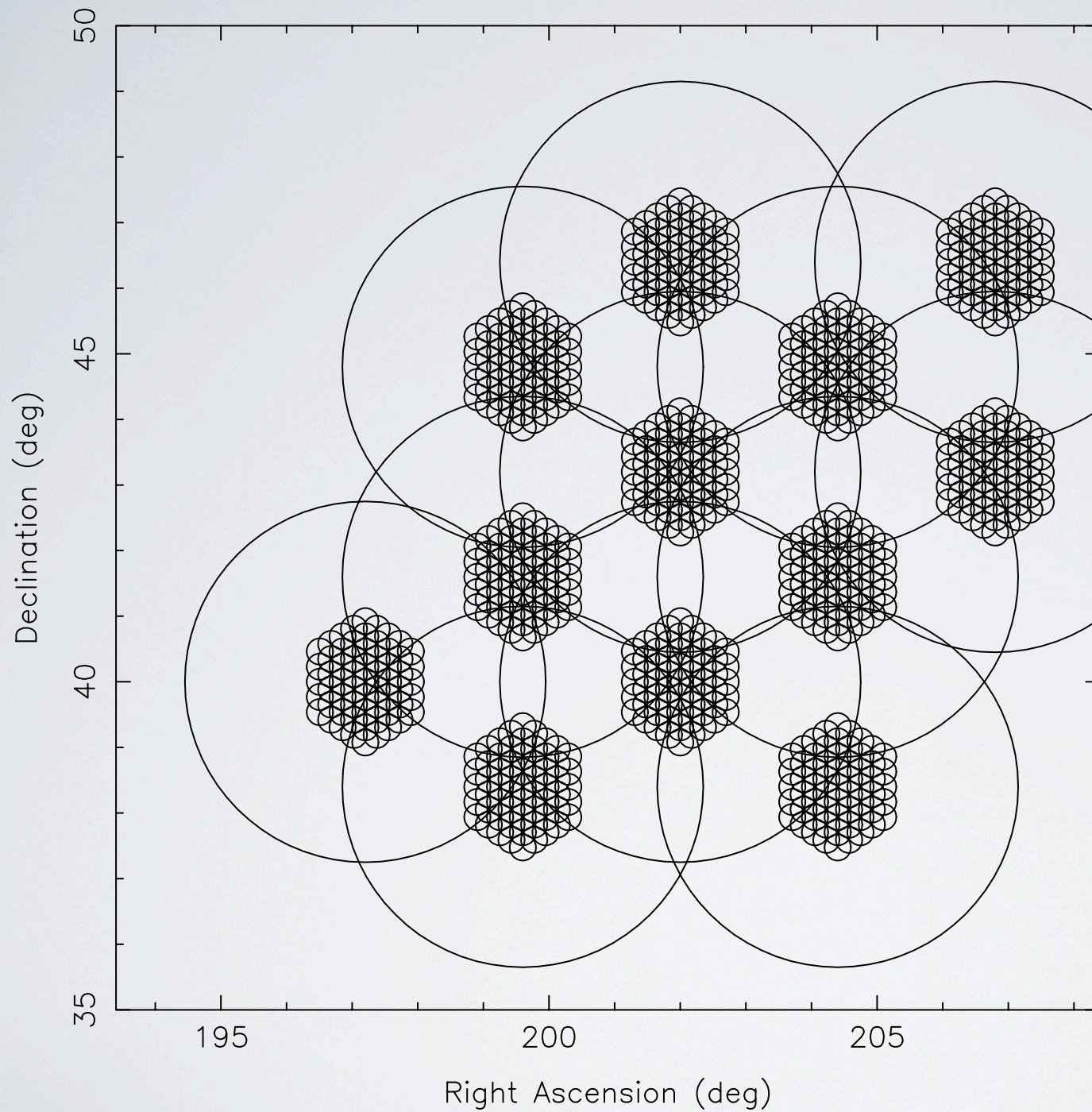
LOFAR Tied-Array All-Sky Survey (LOTAAS)

- Use 8-bit mode
- 3 SAPs of 32MHz each (119-151MHz)
- 1hr per pointing (1.5hr all-sky by end... new param. space)
- 0.49ms time resolution, 12kHz frequency channels
- Find millisecond pulsars out to DM $\sim 50 \text{ pc cm}^{-3}$
- 219 tied-array beams, 3 incoherent beams
- 12 sq deg. total per ptg. from tied-array beams
- 60 sq deg. total per ptg. from incoherent beams
- Sparse coverage of North. Hem. takes ~ 333 pointings
- Dense coverage of North. Hem. takes ~ 1000 pointings

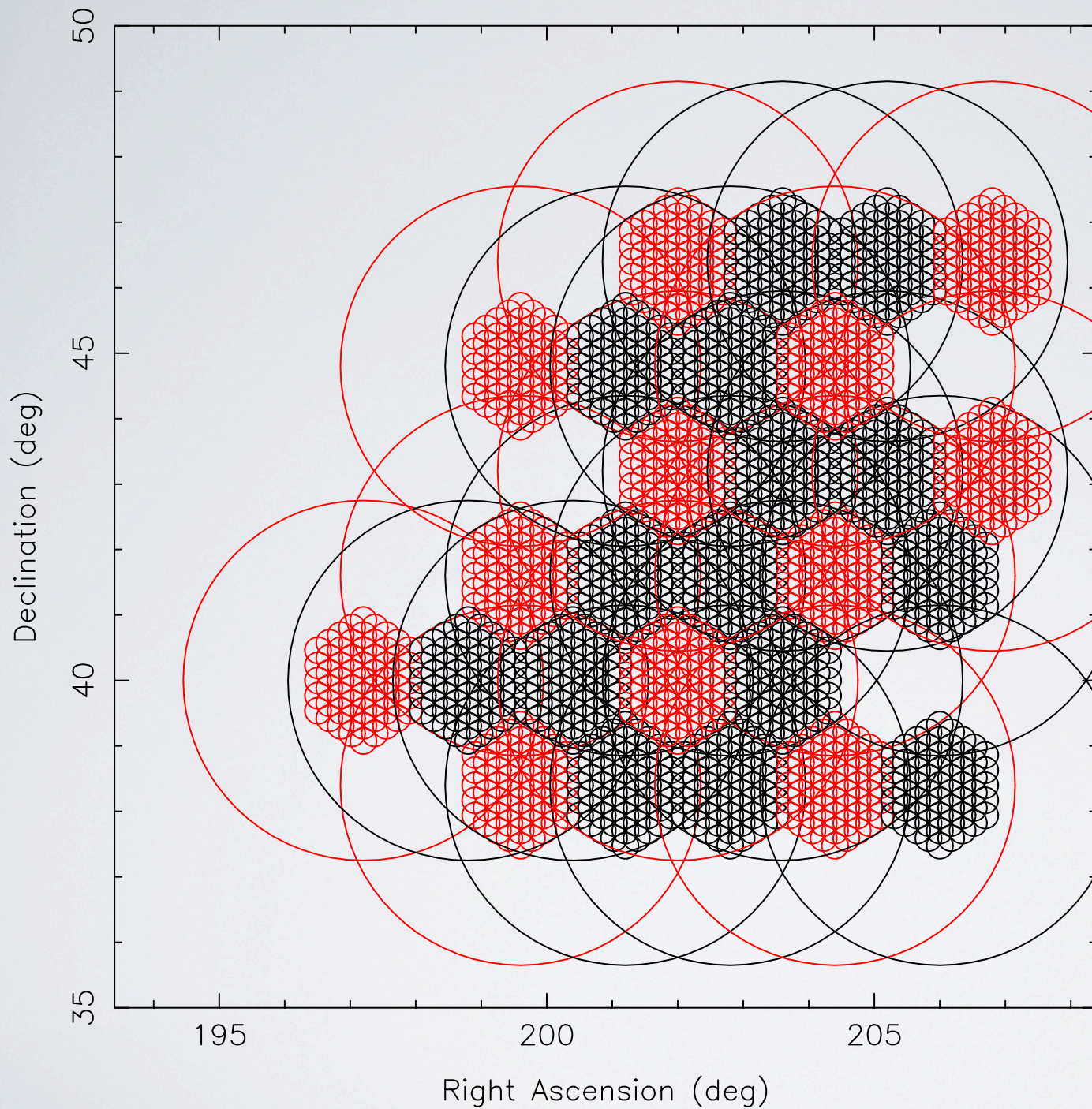
LOFAR Tied-Array All-Sky Survey (LOTAAS)



- $\sim 2x$ more sensitive than LOTAS (coh. pilot survey)
- $\sim 2x$ more sensitive than LPPS (incoh. pilot survey)

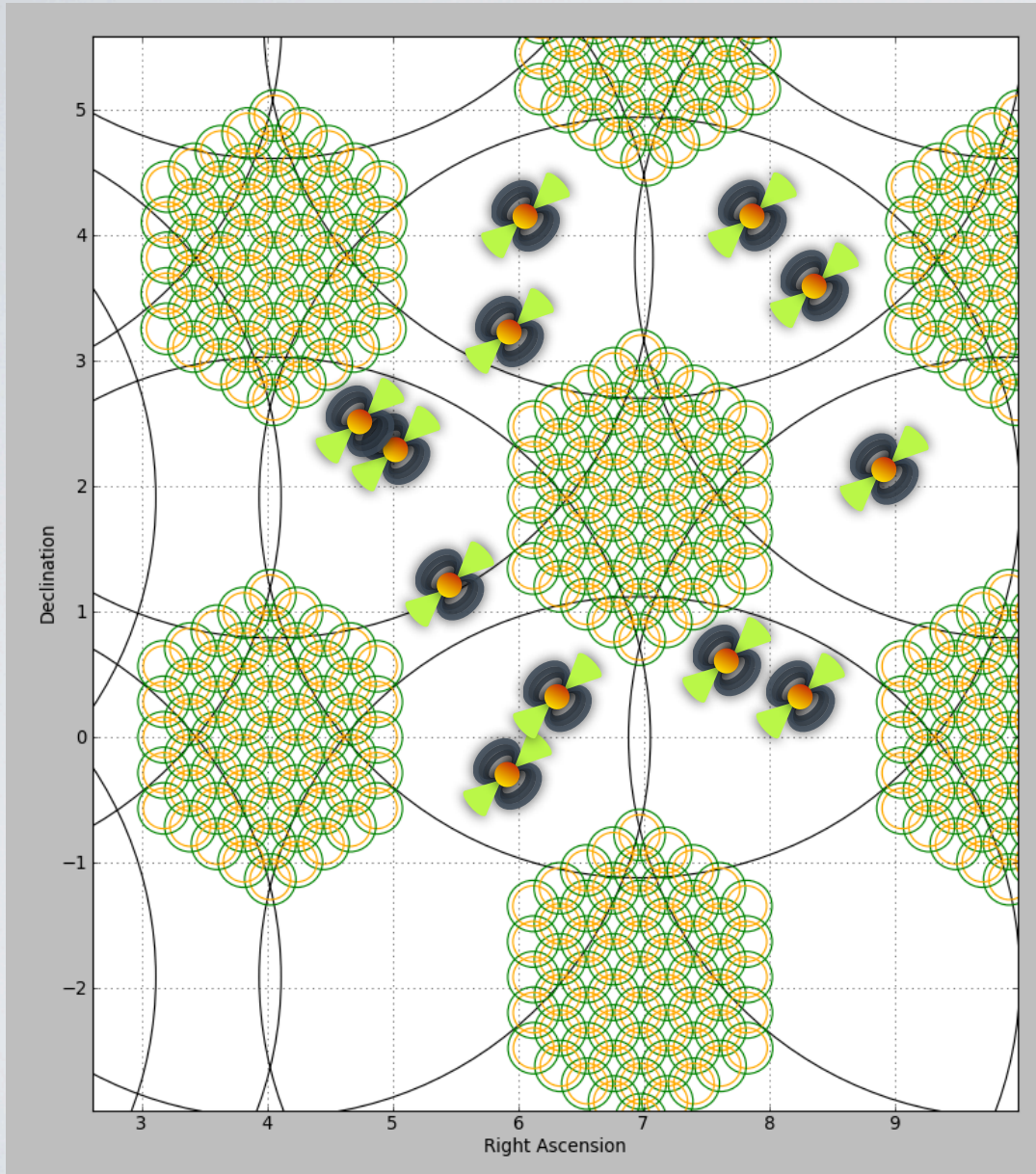


LOTAAS Sparse Sampling

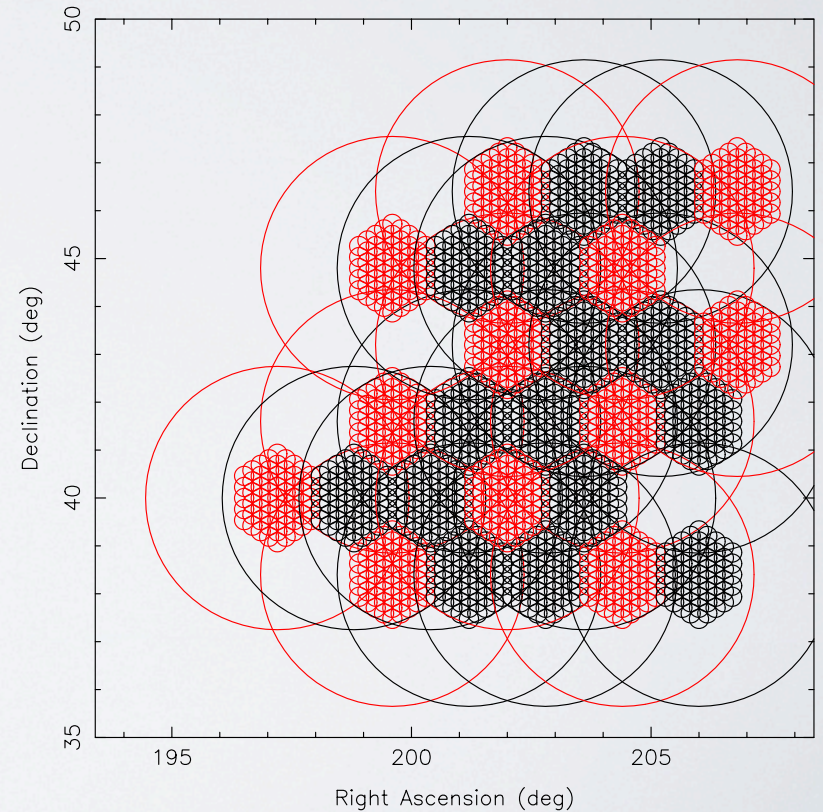


LOTAAS Sparse Sampling

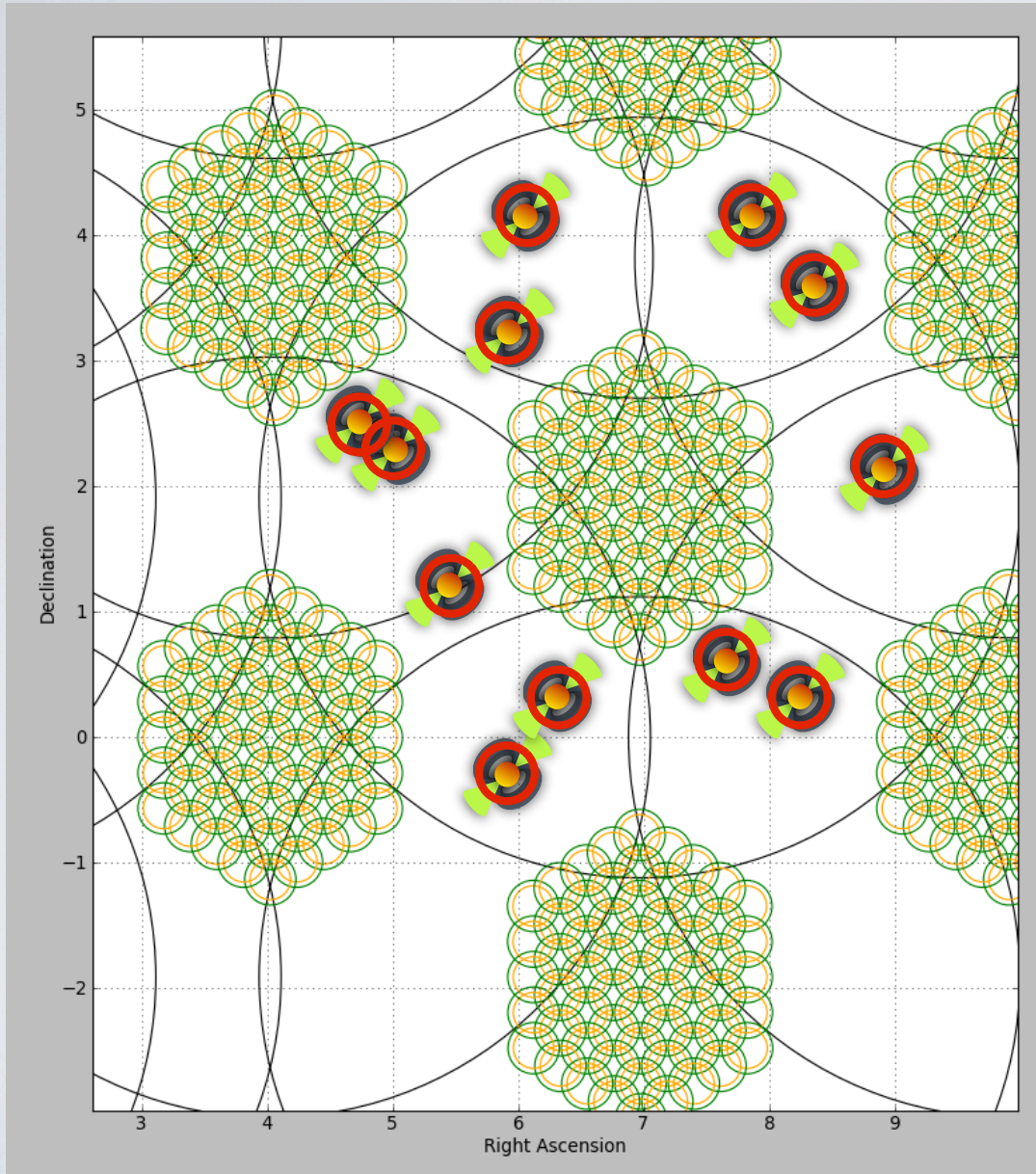
LOFAR Tied-Array All-Sky Survey (LOTAAS)



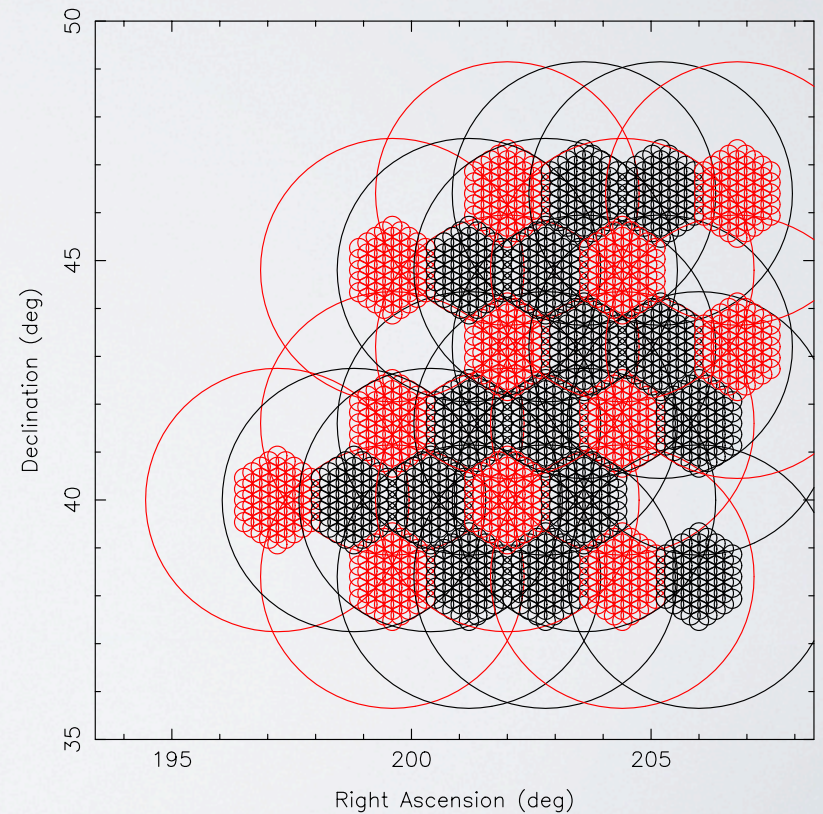
- ~2x more sensitive than LOTAS (coh. pilot survey)
- ~2x more sensitive than LPPS (incoh. pilot survey)



LOFAR Tied-Array All-Sky Survey (LOTAAS)



- $\sim 2x$ more sensitive than LOTAS (coh. pilot survey)
- $\sim 2x$ more sensitive than LPPS (incoh. pilot survey)



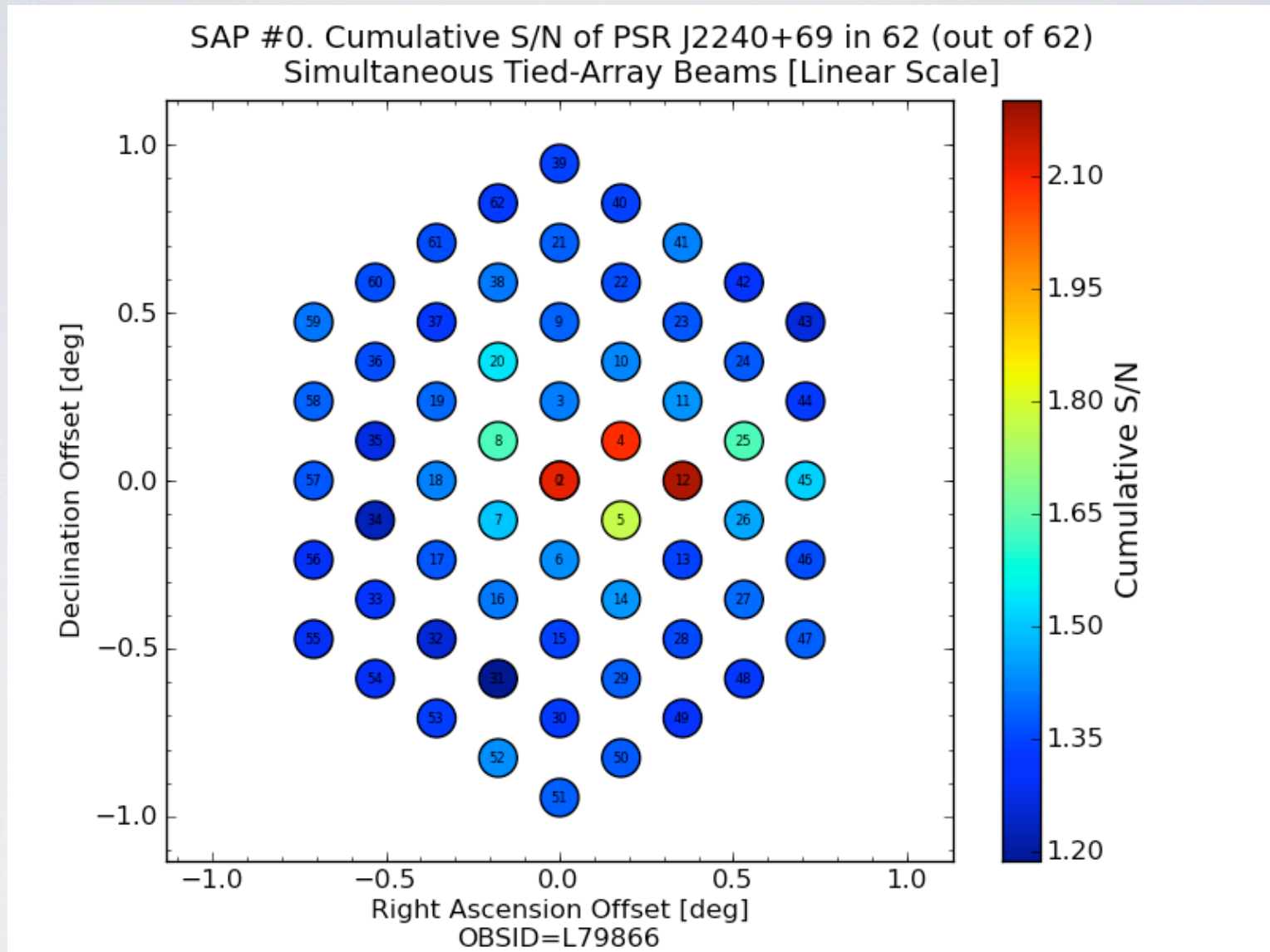
LOTAAS Observing So Far...

- Received 200hrs for LCU_034 in Cycle0.
- Started observing early December.
- 1hr = 15.7TB of 32-bit data converted to 4TB of 8-bit data.
- Data rate 36Gb/s (half the system's max capacity).
- Data drop percentage on average ~0.2%.
- 55 pointings taken so far, all pipelined using "Pulp".
- 220TB of 8-bit data taken so far.
- 48 pointings archived and raw data removed.
- Observing mostly in the Dec 10-15deg range to start.
- Taking 10-15 pointings per week in two sessions.
- At this rate, should take another ~3 months to finish LCU_034 observations for Cycle0.

LOTAAS Search Processing

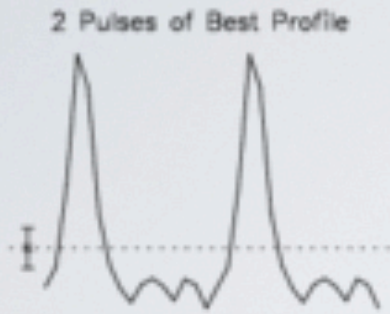
- At SARA and the University of Manchester.
- 200 8-core nodes available in total.
- Expand to more nodes in the coming months.
- One 100-node cluster can do a quick processing of a single pointing in ~14 hrs.
- 7000 trial dispersion measures must be searched.
- 3 full pointings processed so far, now quickly ramping up the processing.

LOFAR Tied-Array All-Sky Survey (LOTAAS)



Localize new source from pilot survey

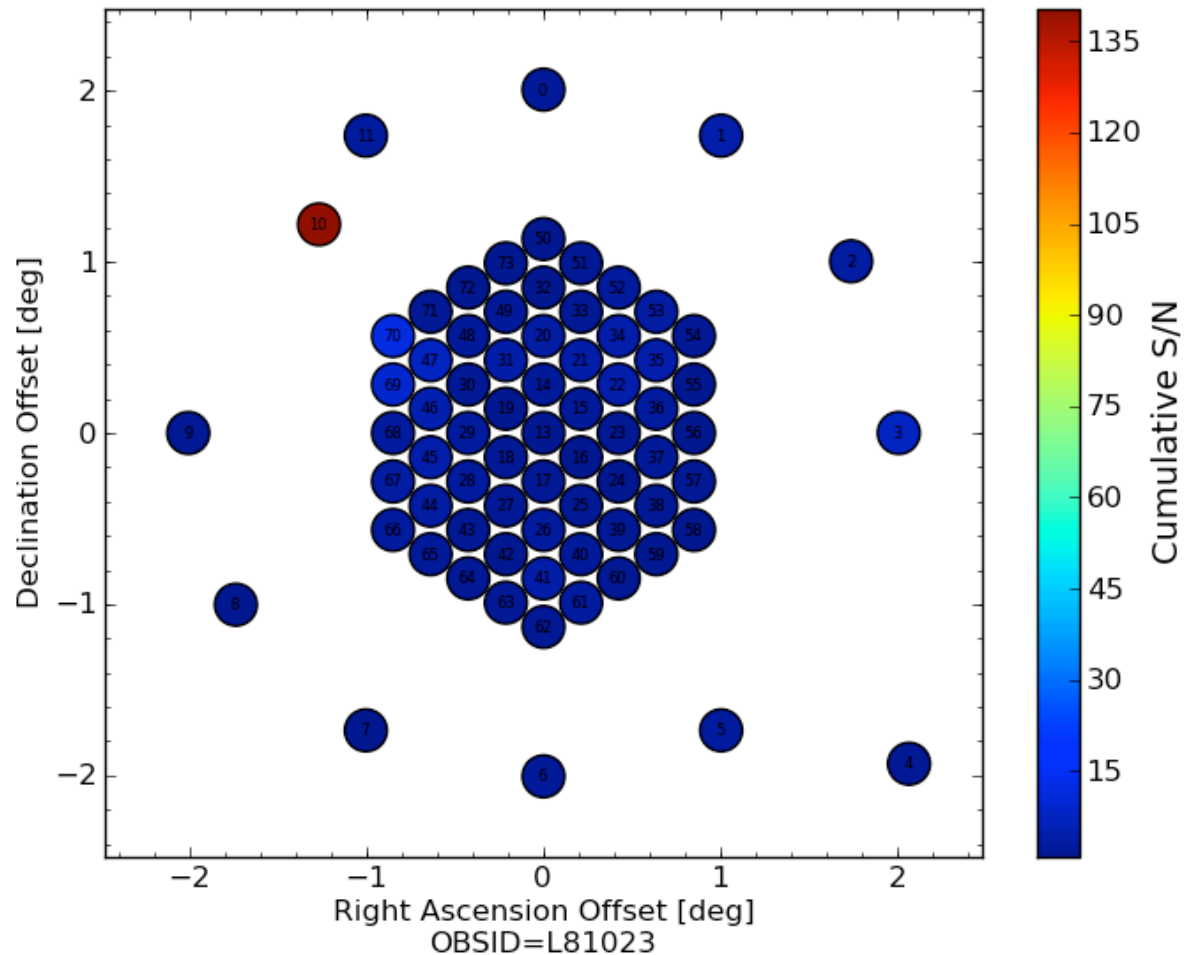
Real Data



IS SAPO BEAM12
B1257+12
ChiSq = 14.908

6.2-ms “Planet
Pulsar”

SAP #0. Cumulative S/N of PSR B1257+12 in 73 (out of 73)
Simultaneous Tied-Array Beams [Linear Scale]



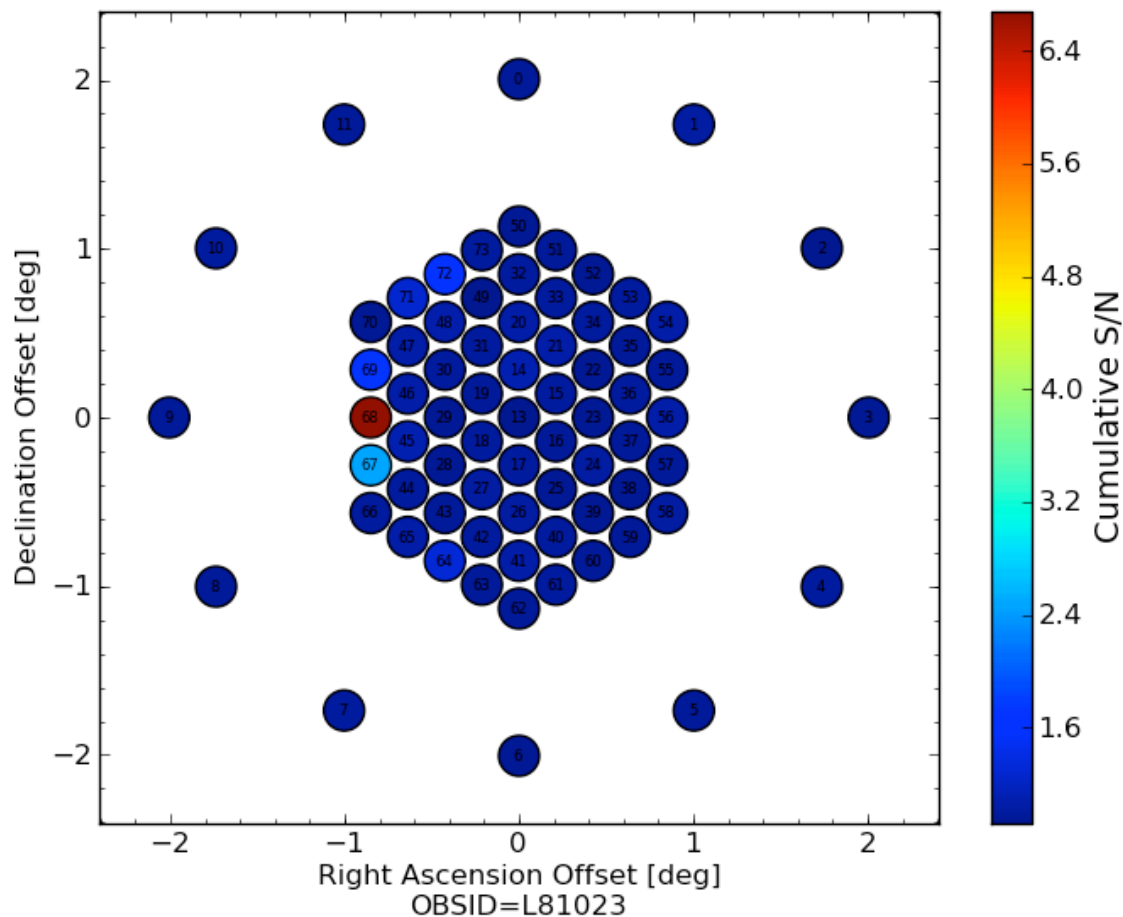
~15 first-time LOFAR detections made in this way!

Real Data

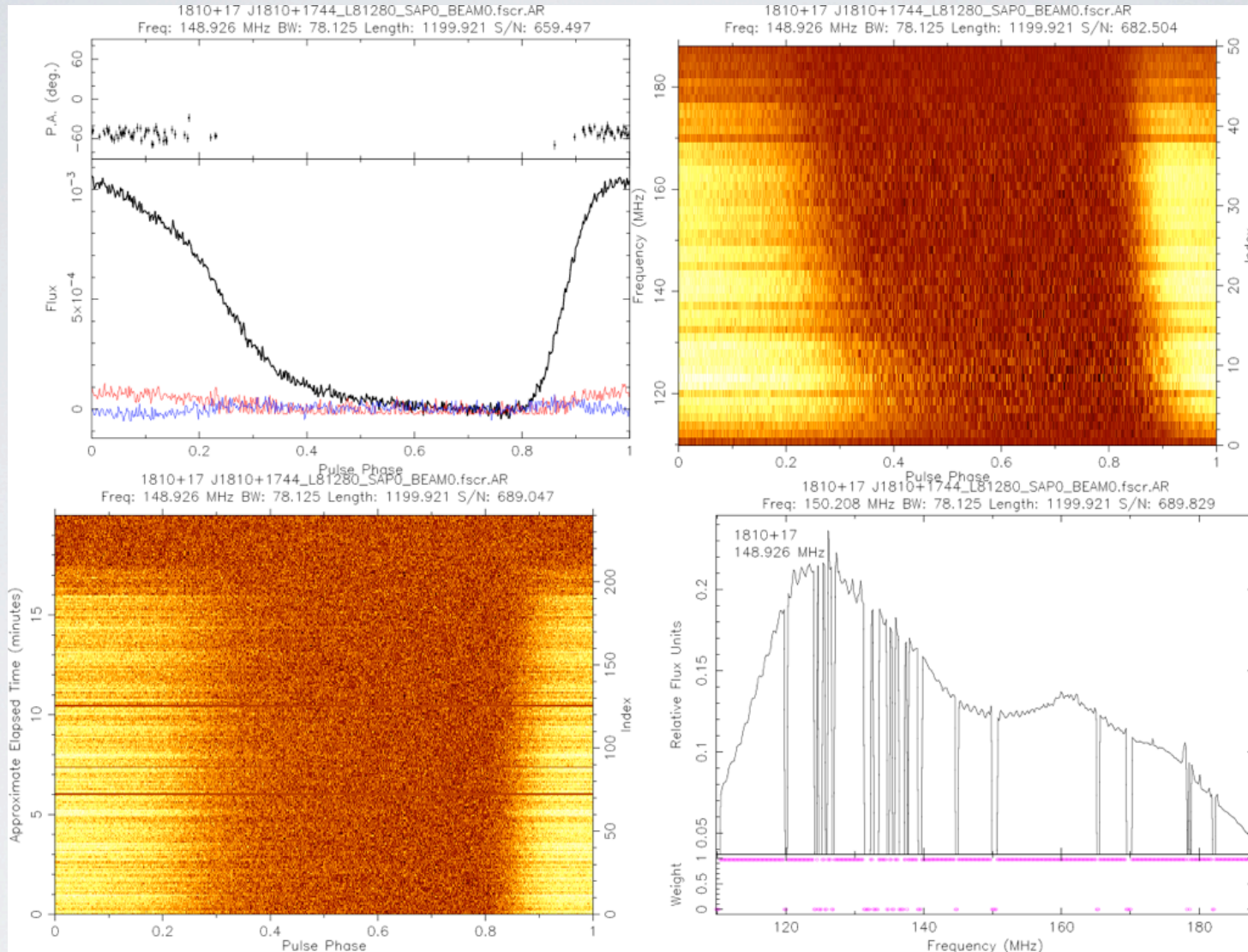


IS SAP2 BEAM12
J1313+0931
ChiSq = 1.353

SAP #2. Cumulative S/N of PSR J1313+0931 in 73 (out of 73) Simultaneous Tied-Array Beams [Linear Scale]



LCU_011 Also started



J1810+1715 - 1.6ms eclipsing pulsar

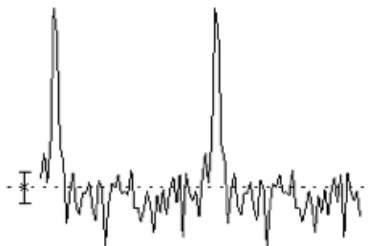
Extra Slides

Pilot LOFAR Pulsar Surveys

- LPPS (incoherent survey): $\sim 1/2$ of North. Hem., 7 SAPs, 1 hour pointings.
- LOTAS (coherent survey): ~ 1000 sq deg., 19 TABs, 17-minute pointing.
- Processing near completion, still lots of candidates to inspect.
- So far 5 independent discoveries of very recent GBT discoveries at 350MHz.

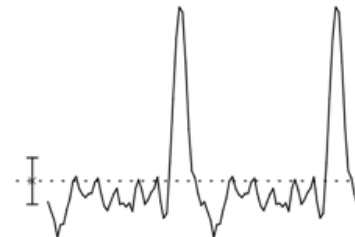
Pilot LOFAR Pulsar Surveys

2 Pulses of Best Profile

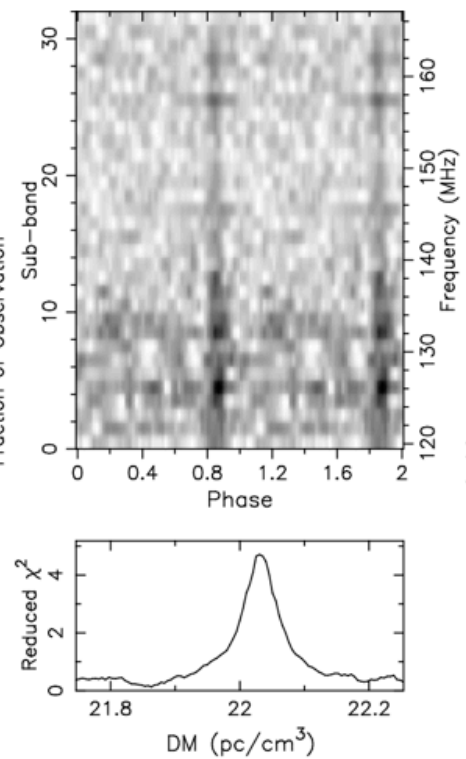
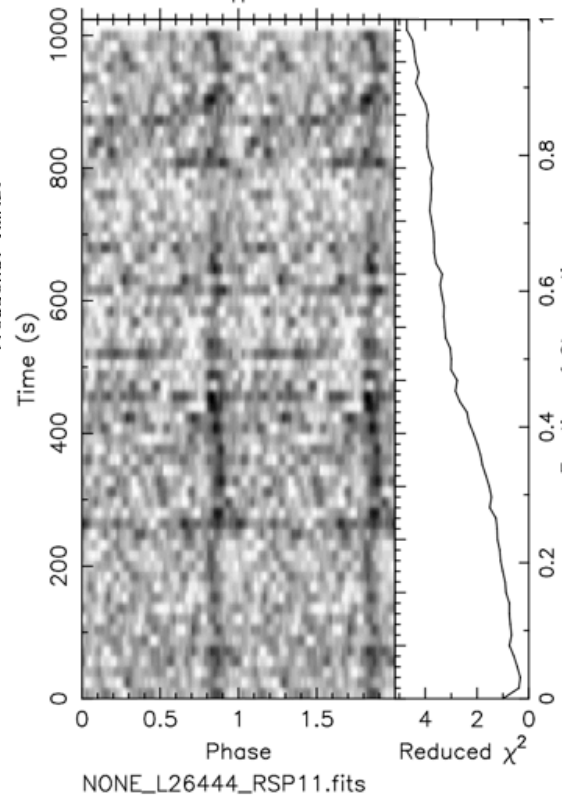
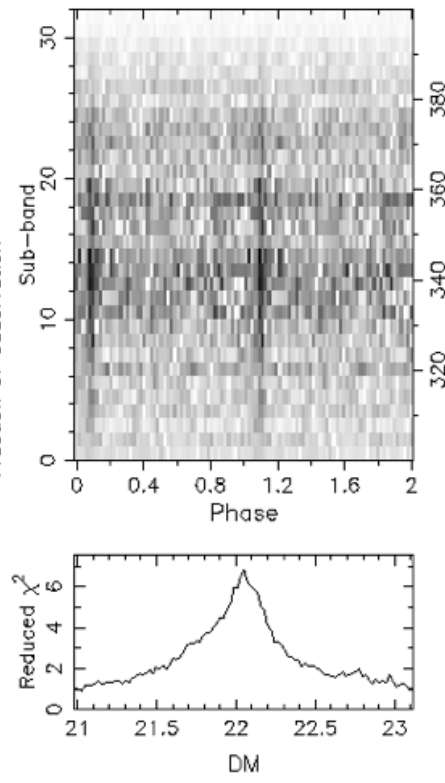
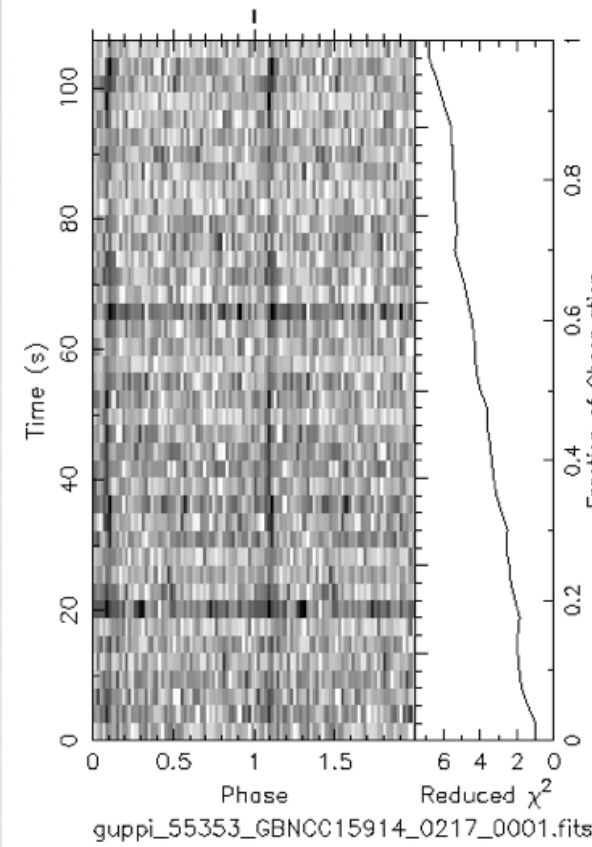


GBT

2 Pulses of Best Profile



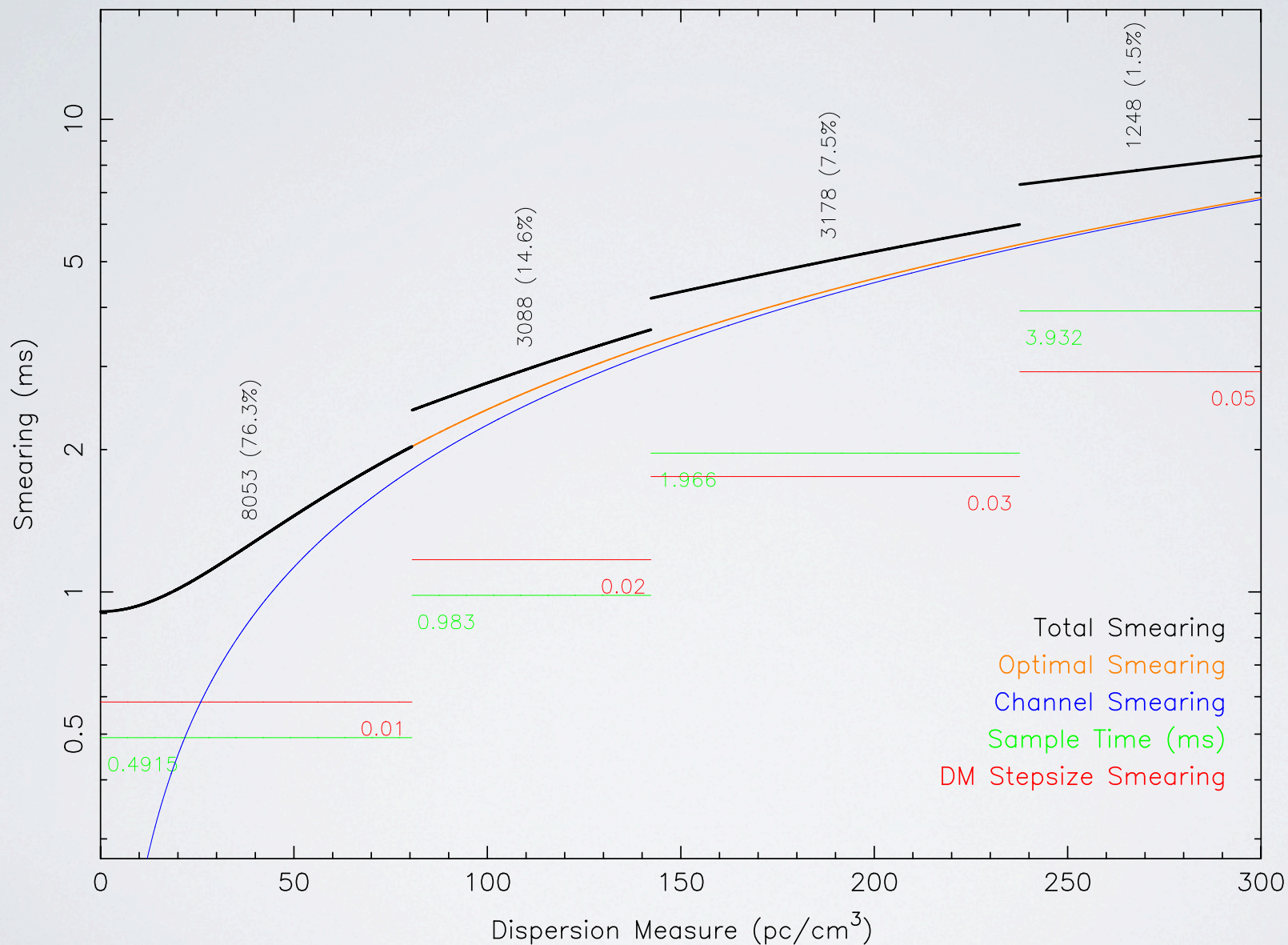
LOFAR



24-ms Pulsar!

LOFAR Tied-Array All-Sky Survey (LOTAAS)

$f_{\text{ctr}} = 130.75 \text{ MHz}$ $dt = 0.4915 \text{ ms}$ $BW = 31.5 \text{ MHz}$ $N_{\text{chan}} = 5184$



LOFAR Tied-Array All-Sky Survey (LOTAAS)

