An Update on Commissioning the Pulsar Survey Mode(s)

Jason Hessels
on behalf of
Aris Noutsos, Aris Karastergiou, Ben Stappers, Anastasia Alexov, Vlad Kondratiev, Tom Hassall, Thijs Coenen, Joeri van Leeuwen, John Romein, Jan David Mol, and Anna Scaife

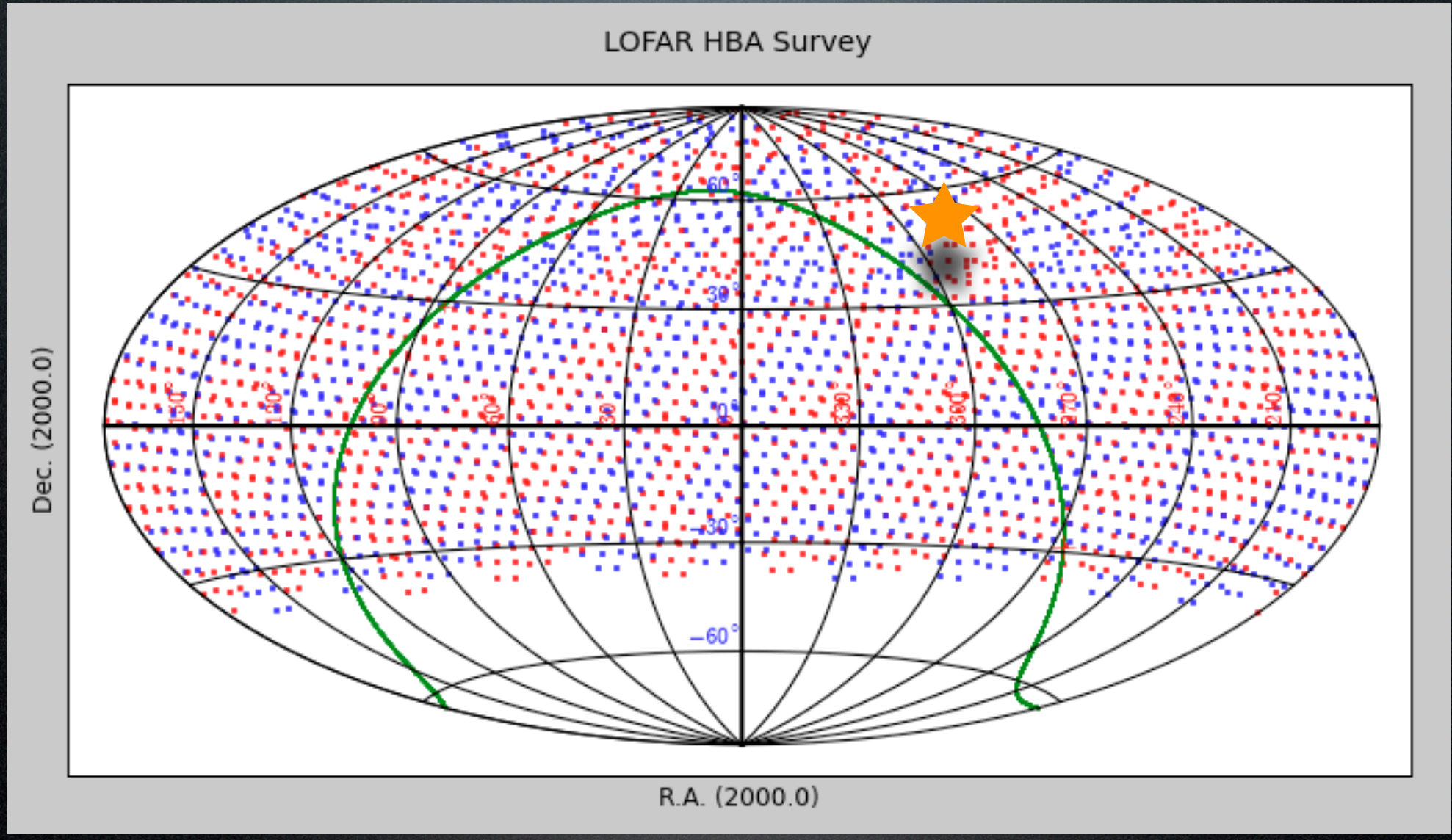
Pulsar Survey Modes

- Incoherent beam(s): large FoV
- Tied-array beam(s): high sensitivity
- Online coherent dedispersion: highest time resolution.

LOFAR Pilot Pulsar Survey (LPPS)

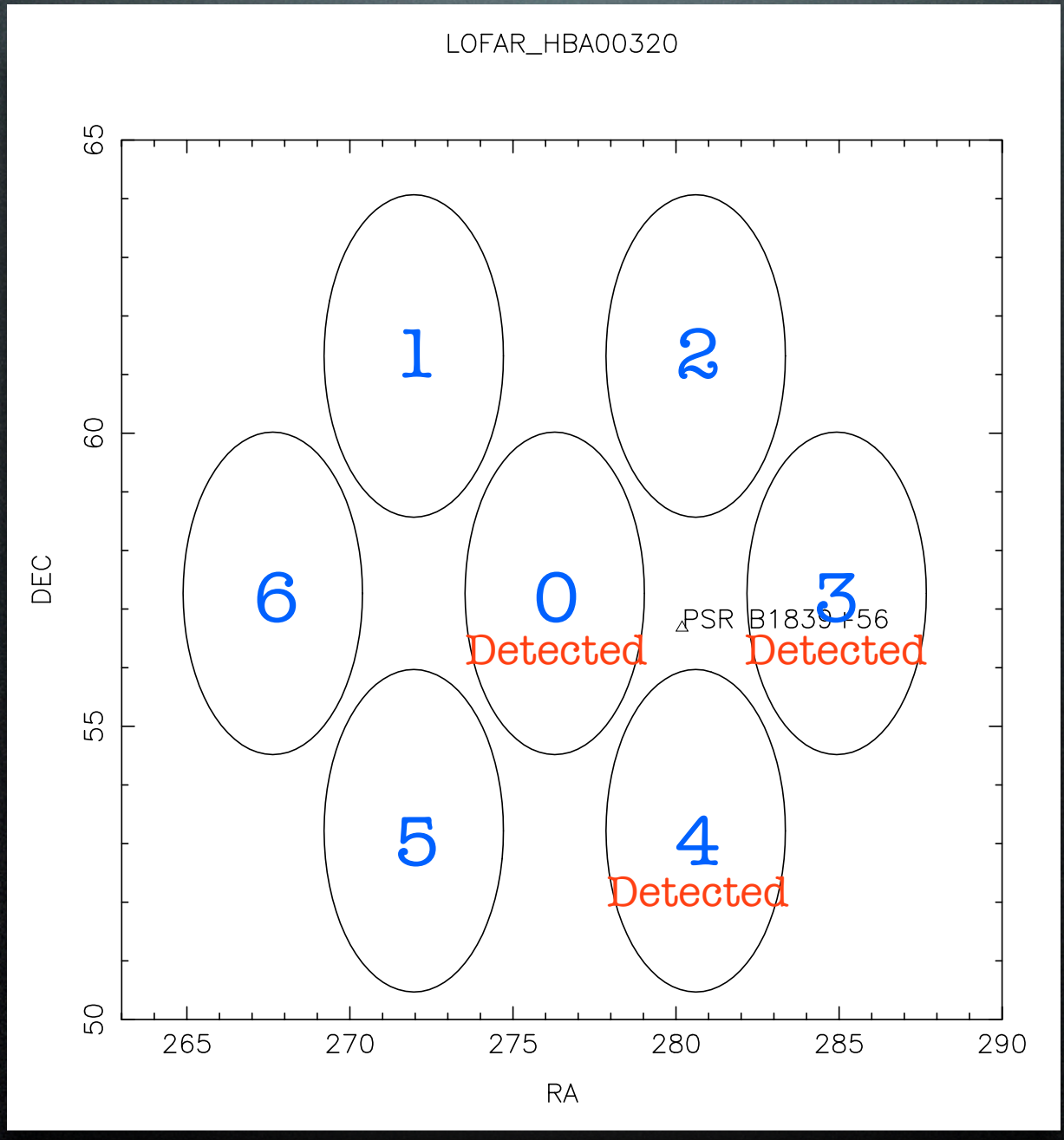
- Incoherent beams (all avail. stations)
- 7 beams of 7 MHz each and 0.65ms samp.
- 57 minutes per pointing (82GB)
- ~167 sq. deg. FoV per pointing
- ~200 pointings taken during Christmas 2010
- Data being processed on “Hydra” at the University of Manchester
- Pipeline code written by Thijs Coenen (UvA) now ready for production.
- Will (re)process all beams in the coming weeks.

LOFAR Pilot Pulsar Survey (LPPS)



~400 7-beam pointings > -35 deg DEC

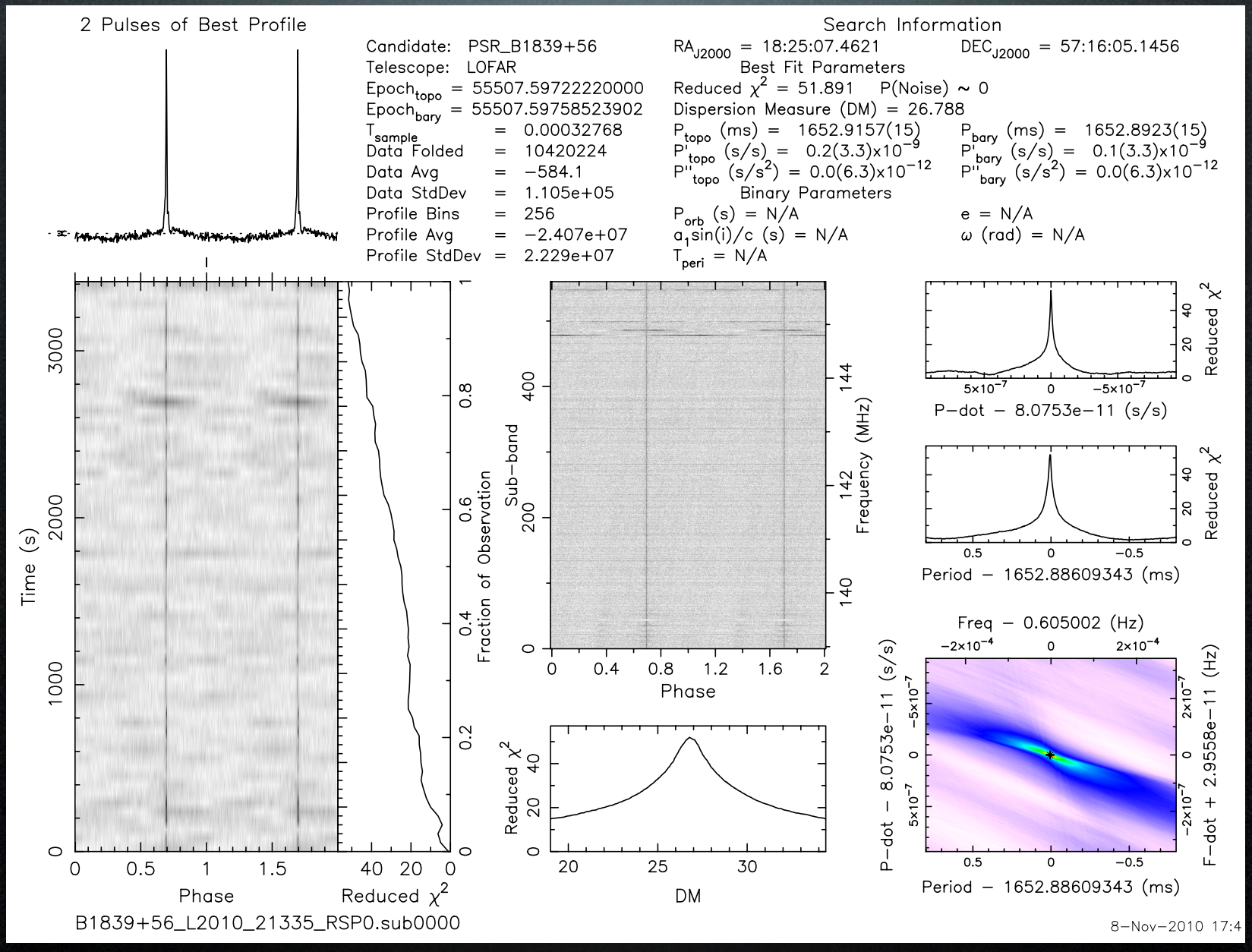
LOFAR Pilot Pulsar Survey (LPPS)



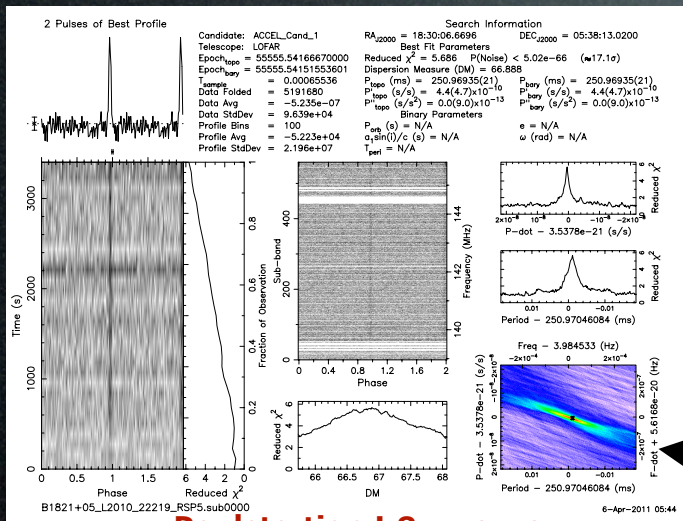
7-beam HBA grid covers 166 sq deg!!!

NB: beams are 2x wider than shown here.

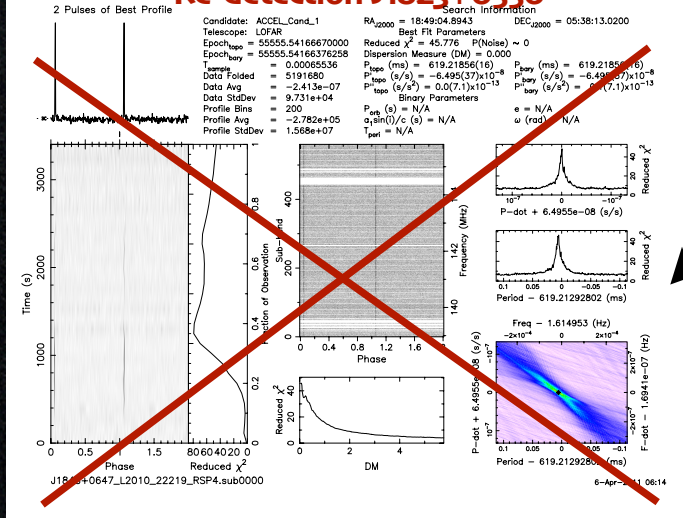
Pulsar Survey Pipeline



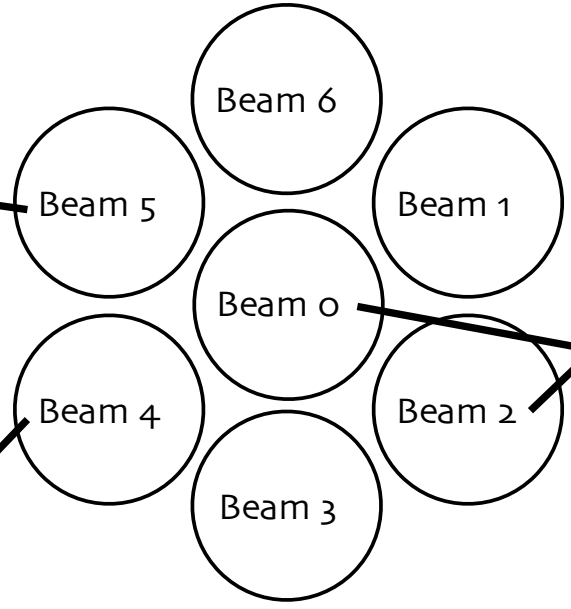
LOFAR Pilot Pulsar Survey (LPPS)



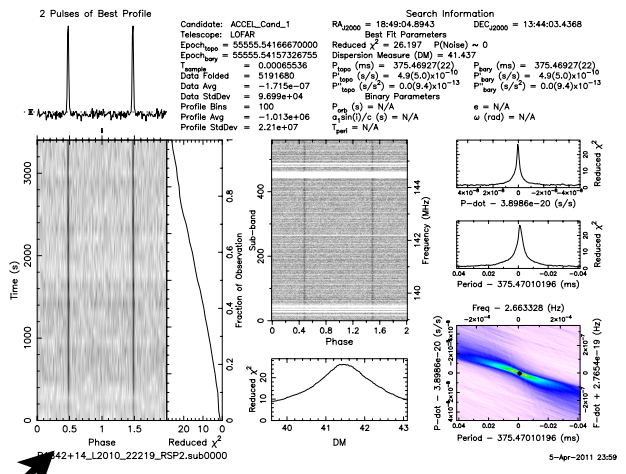
Re-detection J1823+0550



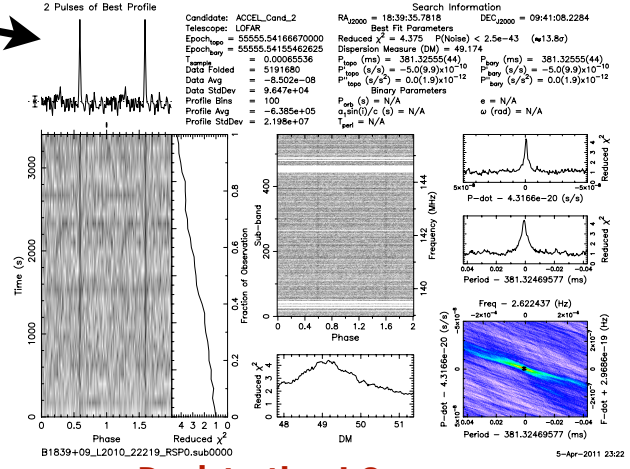
RFI (DM = 0 cm-3 pc)



LPPS pointings contains 7 beams



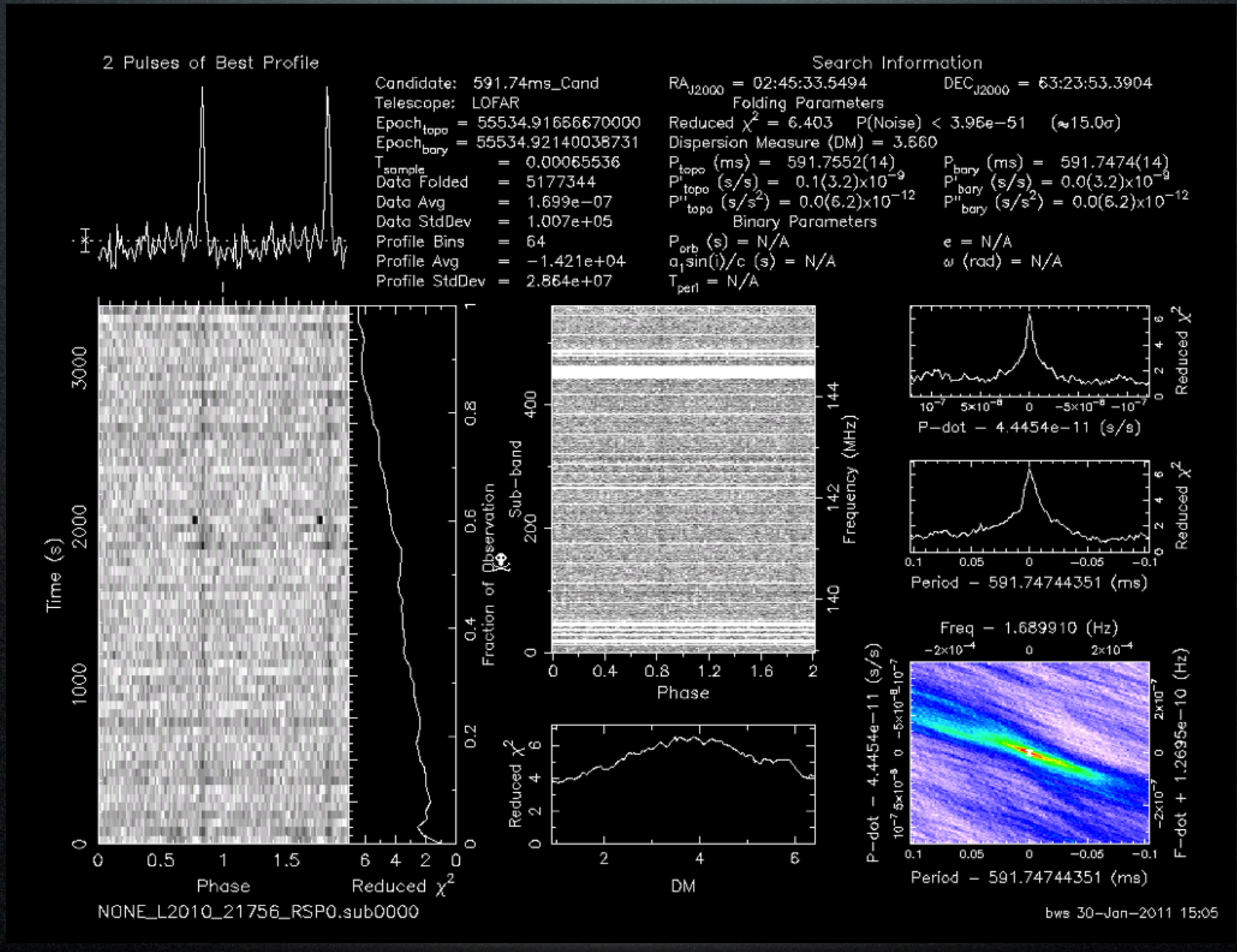
Re-detection J1844+1454



Re-detection J1841+0912

Courtesy Thijs Coenen

Redection of recent, faint GBT discovery



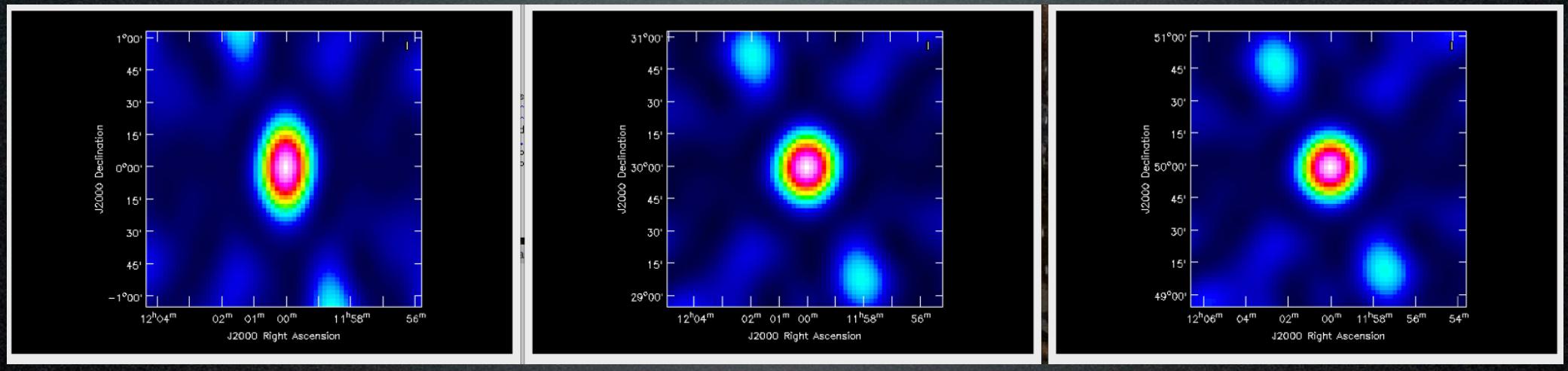
LOFAR Tied-Array Survey (LOTAS)

- Tied-array (coherent) beams (Superterp)
- 19 beams with full 48MHz and 1.3ms samp.
- 17 minutes per pointing (246GB)
- ~3.7 sq. deg. FoV per pointing
- ~200 pointings taken from May 11-15th
- Used CEP2 and the new Scheduler
- Increase in sensitivity ~9xLPPS
- Less affected by RFI?
- Data being processed on CEP2 (takes ~5hrs per beam using 12 cores)

LOFAR Tied-Array Survey (LOTAS)

Beam model

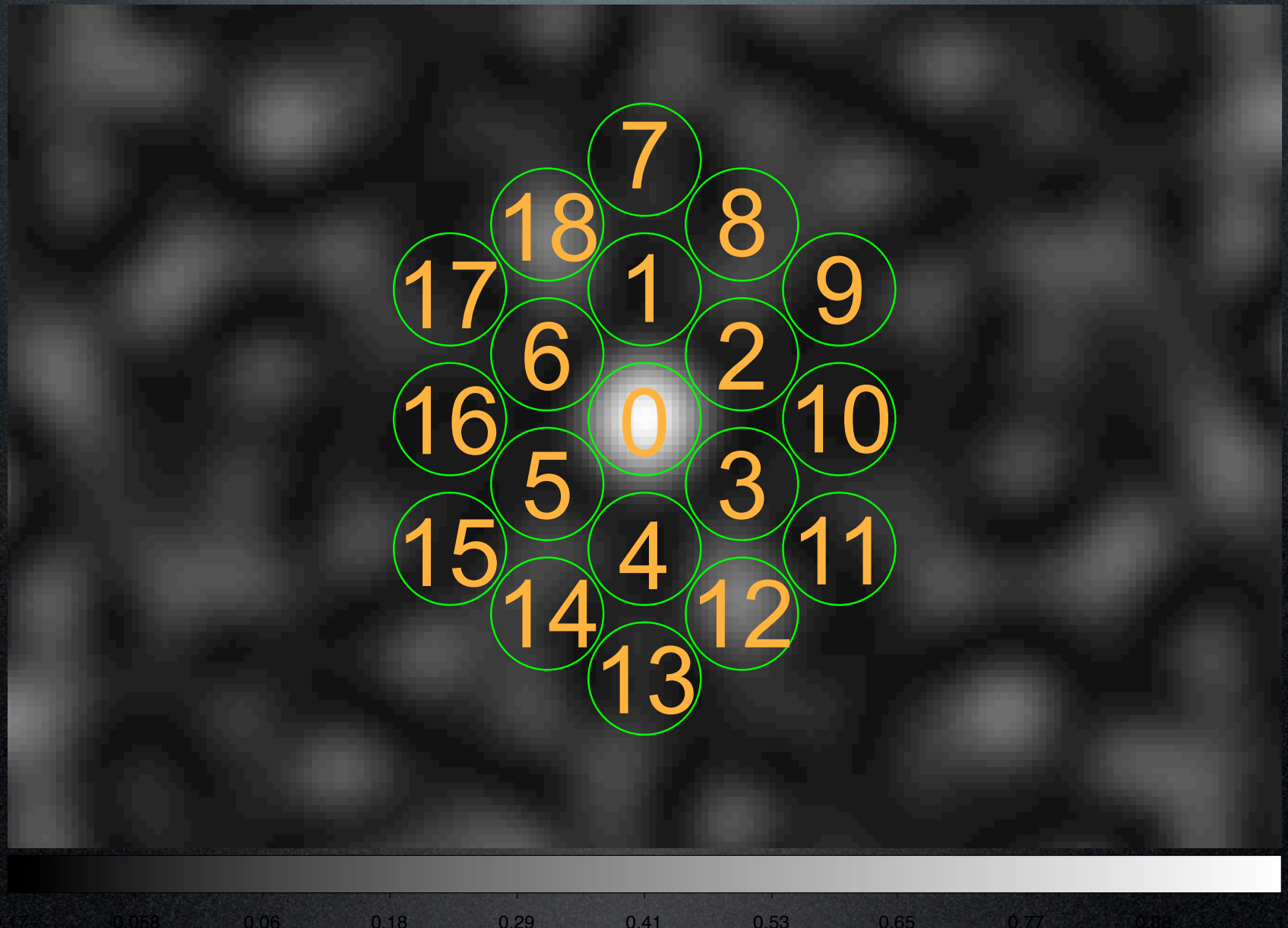
Dec = 0 | Dec = 30 | Dec = 50



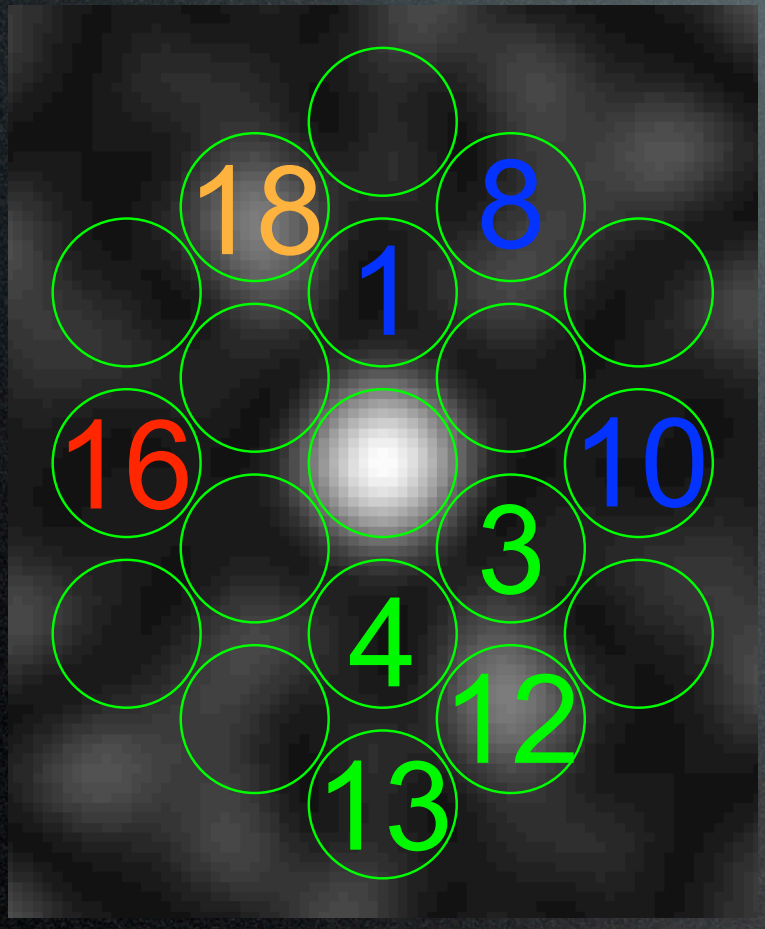
For 12 Superterp HBA sub-stations

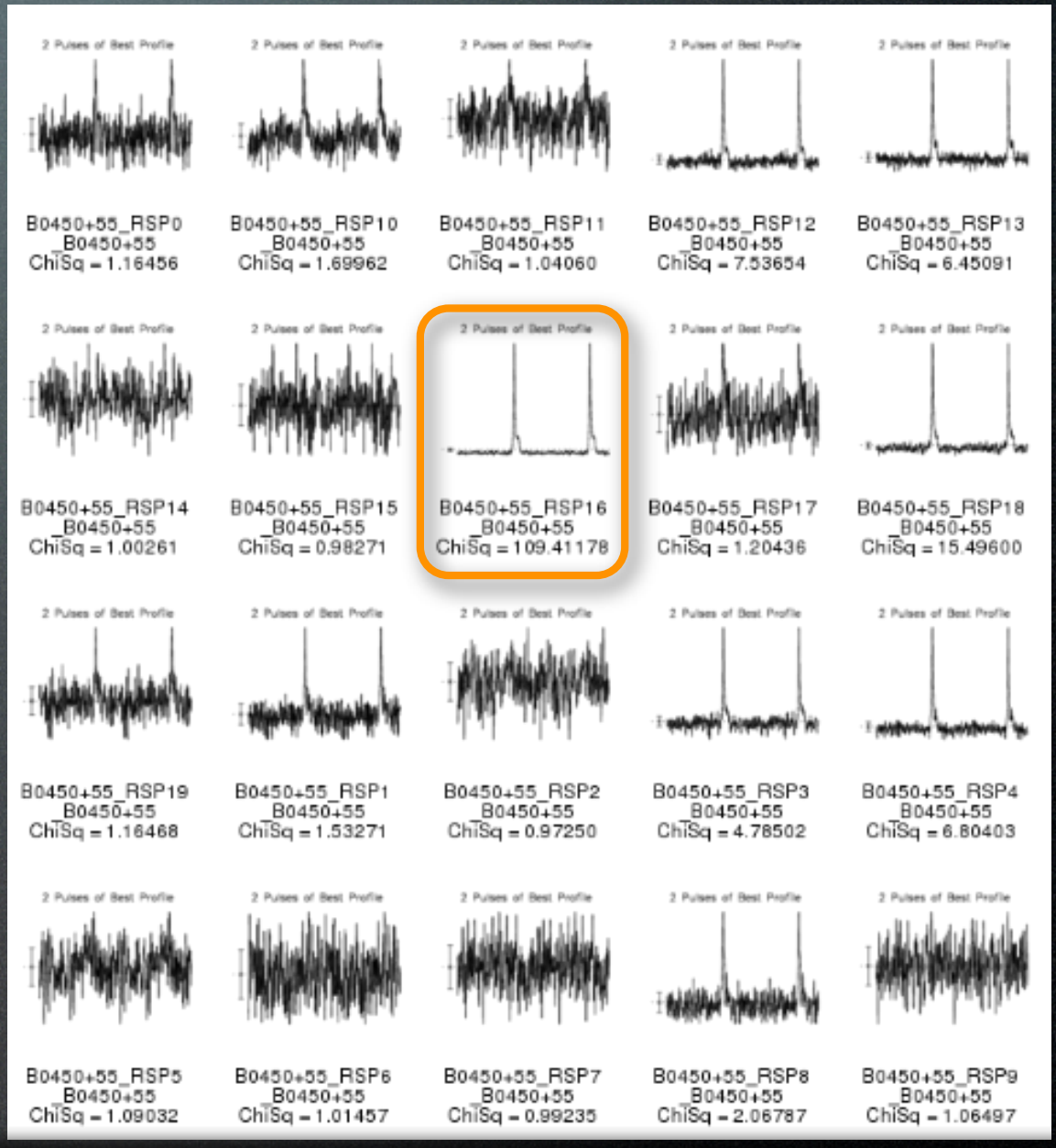
Big thanks to Anna Scaife... Honorary Pulsar Person

LOFAR Tied-Array Survey (LOTAS)



LOFAR Tied-Array Survey (LOTAS)

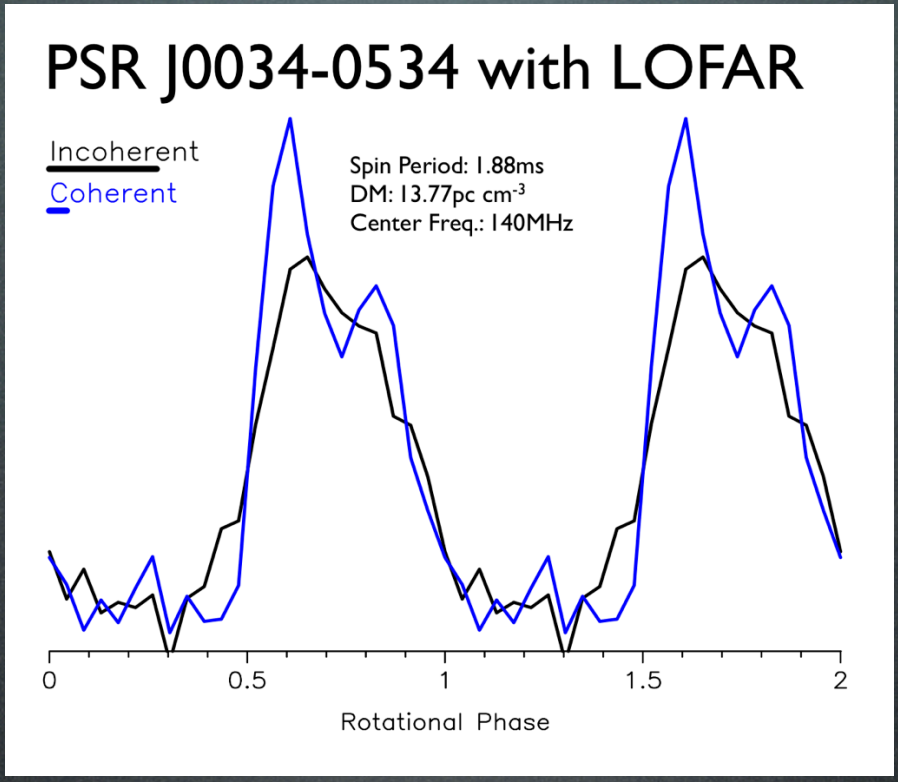




Searches with Online Coherent Dedispersion

- Online coherent dedispersion implemented on BG/P and being integrated in MoM etc..
- Could use this same code to produce multiple dispersion measures (beams) in a single direction.
- This would provide a powerful tool for targeted searching for millisecond pulsars (e.g. search Fermi gamma-ray sources).
- e.g. generate DM 0,2,4,6,.... online (coherently) and then fill in the gaps with offline incoherent dedispersion.

Searches with Online Coherent Dedispersion



- e.g. generate DM 0,2,4,6,... online (coherently) and then fill in the gaps with offline incoherent dedispersion.
- Hybrid coherent/incoherent search, greatly reduces intra-channel smearing and opens the high DM space for MSP searches.

Summary

- A LOFAR pulsar search pipeline has been developed and is being optimized by running on real LOFAR data.
- Two large datasets exist (LPPS and LOTAS) and provide the prospect for not only debugging any remaining issues, but also for finding new sources soon.
- Blind searches for millisecond pulsars would be greatly aided by an online coherent dedispersion mode for multiple DMs.