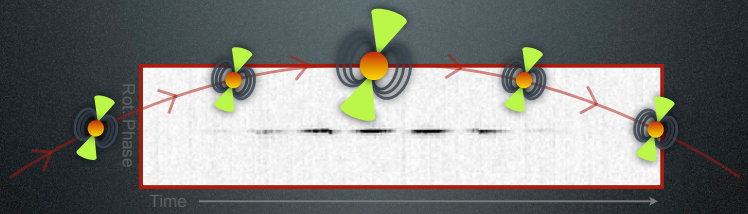
Summary of

Pulsar Busy Week 3

June 2nd-8th, 2009 ...and beyond.



Jason Hessels

on behalf of

LOFAR Pulsar Working Group

ASTRON HPC Group

LOFAR Transients Key Science Project

PBW3: Goals

- Make first pulsar observations with CS302 (12x more collecting area than CS010c).
- LOFAR commissioning: investigate system stability, data quality, beam shape, polarization, etc..
- Test pencil beams (tied-array beams).
- Write beam-formed data directly to HDF5 format.
- Bring new developers/commissioners into the fold.

LOFAR Status Meeting
June 24th, 2009

PBW3: People

- ASTRON HPC Group: Jan David Mol, Alwin de Jong.
- LOFAR Pulsar Working Group: Ben Stappers, Joeri van Leeuwen, Jason Hessels, Anastasia Alexov, Thijs Coenen, Tom Hassall.
- ASTRON Radio Observatory: Michiel Brentjens.

Advice: try using a meeting room and a beamer.

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PBW3: Bug Fixes

- HBA element offsets were incorrect in the default HBAdeltas.conf file. Needed to be corrected for station rotation w.r.t. N-S (*took two days to figure out*).
- CS010c was still very useful in debugging... even if it is sinking into the ground. We were able to reduce the problem down to the individual tiles not tracking properly.

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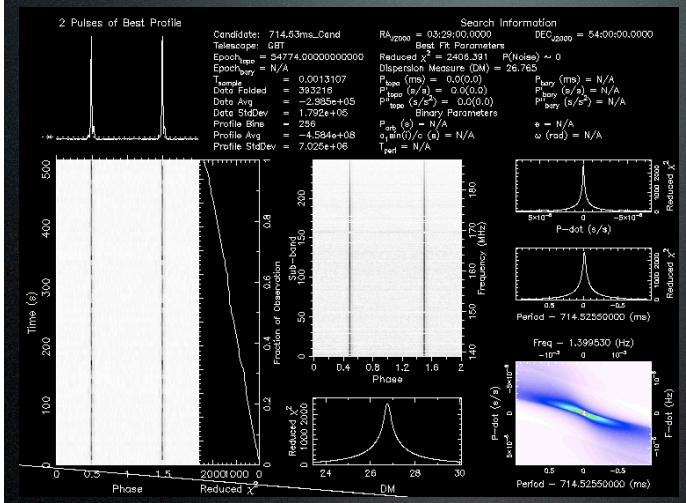
PSR B0329+54 with LOFAR Station CS302

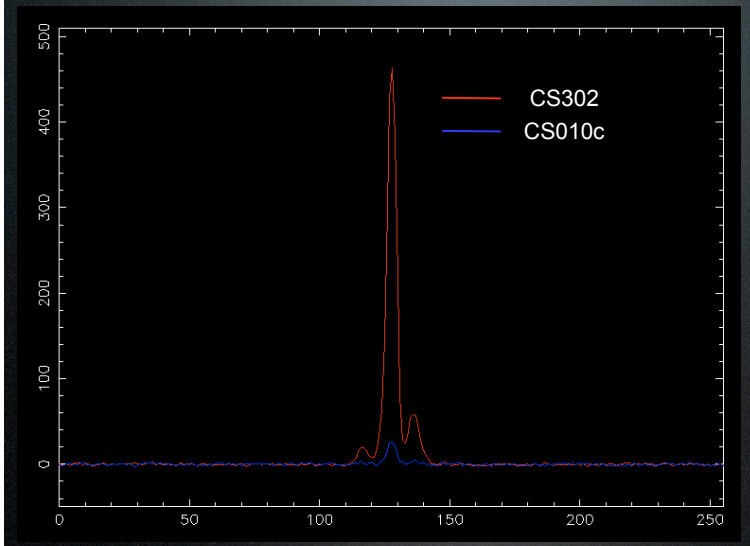


48 HBA Tiles
248 subbands
(48MHz bandw.)

~10% of subbands RFI contaminated.

Need to do a similar obs. from 110-160 MHz.

CS010c vs. CS302 Sensitivity

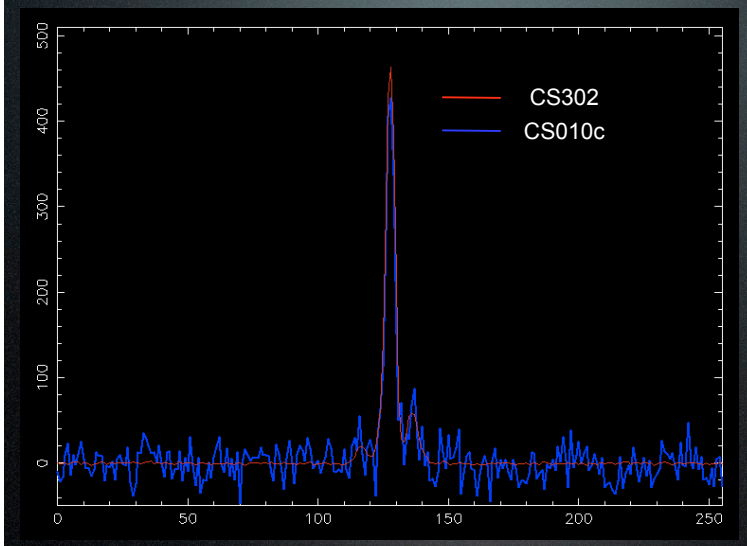


CS010c:
4 tiles
46 subbands
180s int.

CS302:
48 tiles
248 subbands
500s int.

Off pulse std. dev. scaled to 1 in both cases.

CS010c vs. CS302 Sensitivity



CS010c:
4 tiles
46 subbands
180s int.

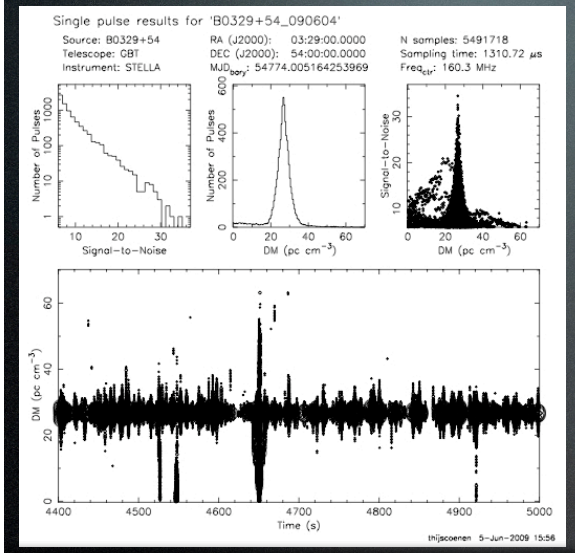
CS302:
48 tiles
248 subbands
500s int.

48/4 = 12 x
(248/46)**0.5 = 2.3x
(180/500)**0.5 = 0.6x

12 x 2.3 x 0.6 = 16.6

CS010c std. dev. increased by this factor.

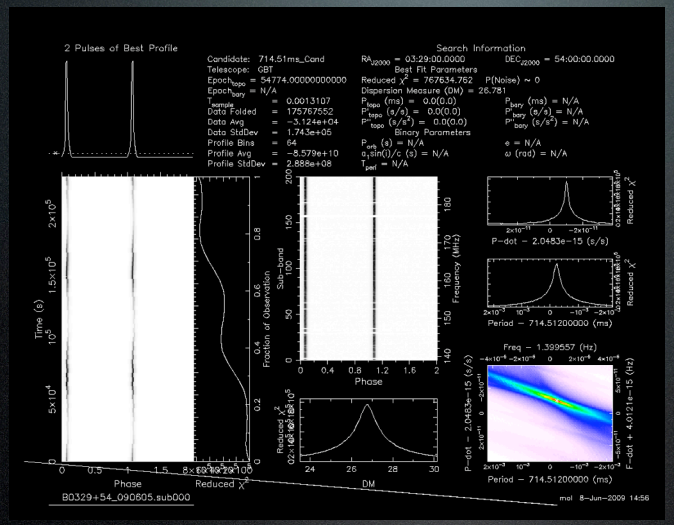
PSR B0329+54: Single Pulses



We now see the majority of PSR B0329+54's *individual* pulses by eye.

With a 13-station LOFAR core, we'll be able to get SNR comparable to the current cumulative pulse in 500s for many of the individual pulses!

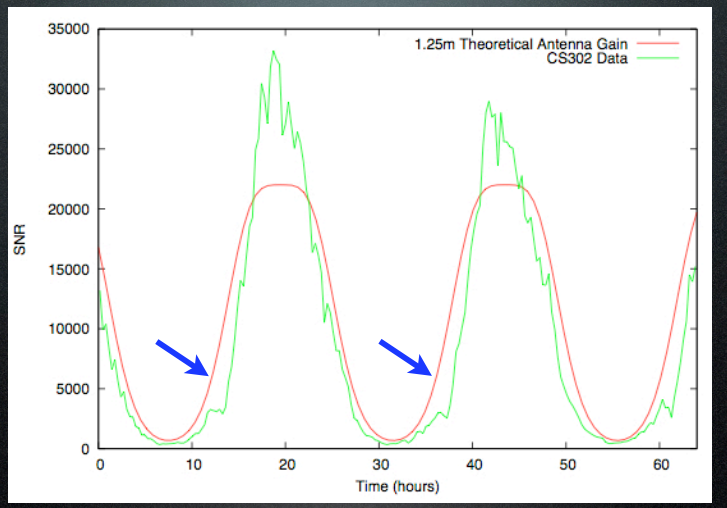
PSR B0329+54: 64-hr Continuous Obs.



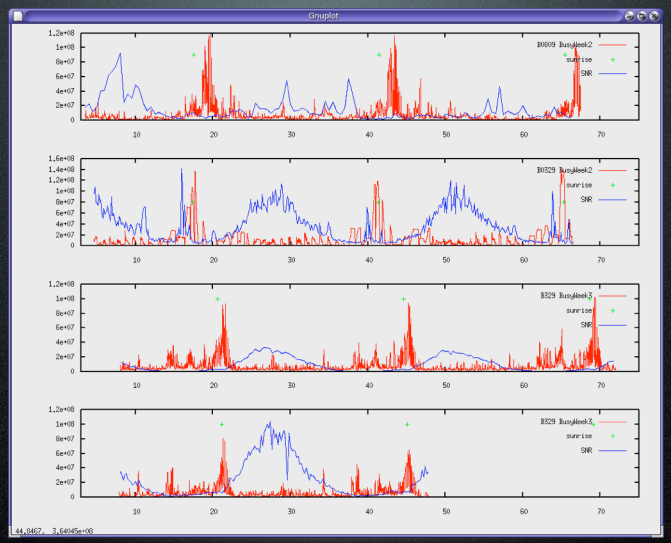
NB: HBA offsets were still a little off here.

2nd, 40-hr, observation also done.

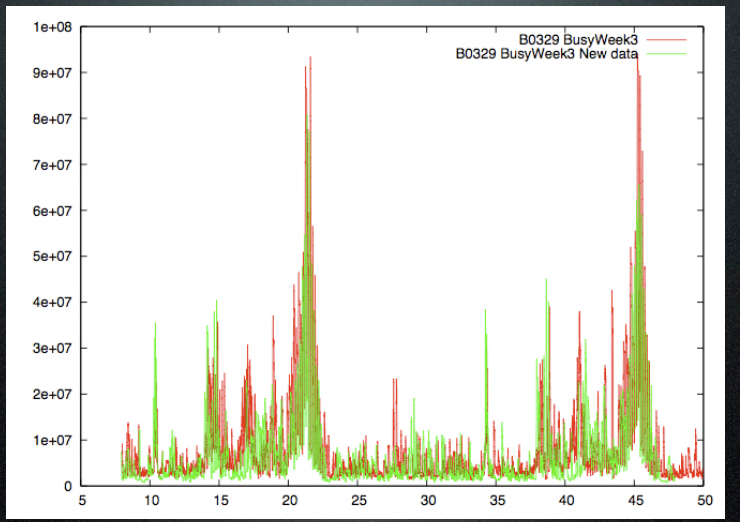
CS302 Single Element Beam Pattern



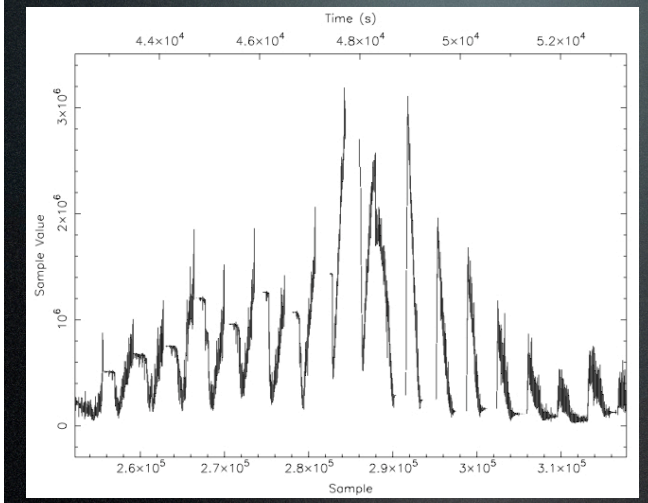
CS302: Power Peaks from Grating Lobes?



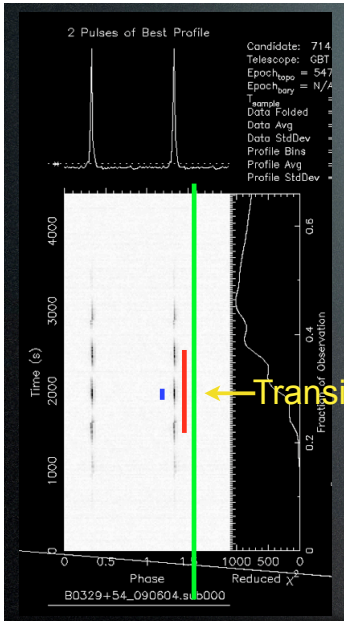
CS302: Power Peaks from Grating Lobes?



Float to Short Int. Scaling Issues



May need to scale baseline with a line instead of a constant mean every 10 minutes.



CS302 Beam Shapes

PSR B0329+54 Transit Experiment

Beam FWHM @ 160MHz:
Single HBA dipole: ~92 deg
One HBA tile: ~23 deg
One HBA ear: ~4.5 deg
Two ears combined: ~0.6 deg

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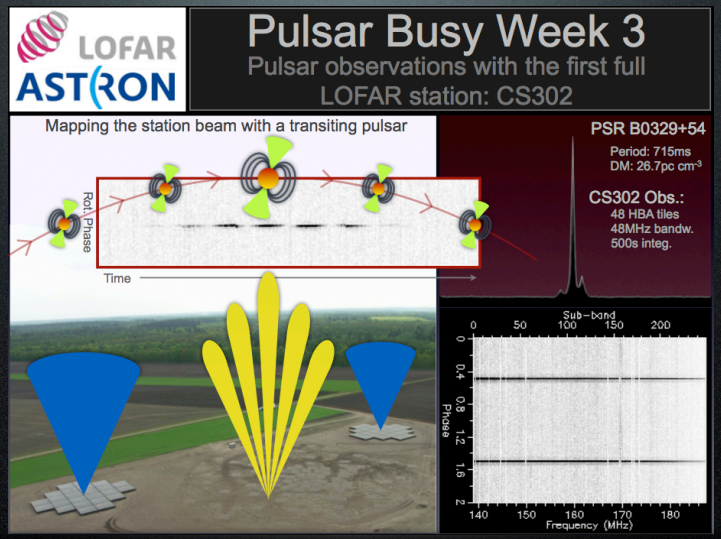
PBW3: AJDI



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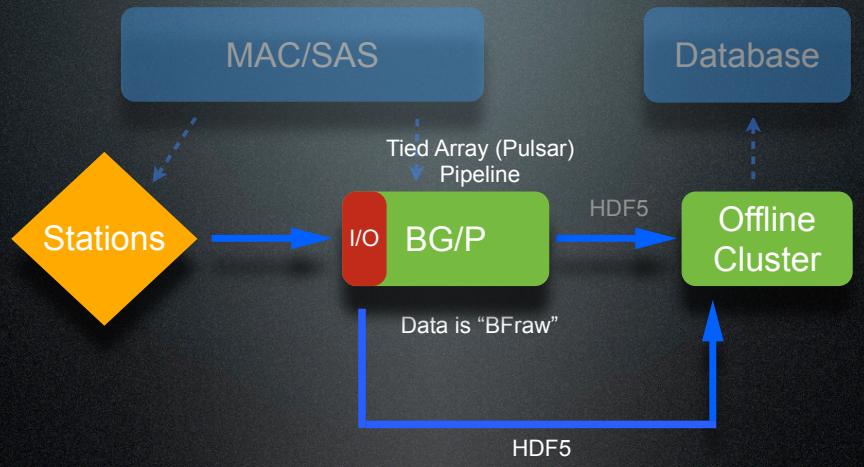
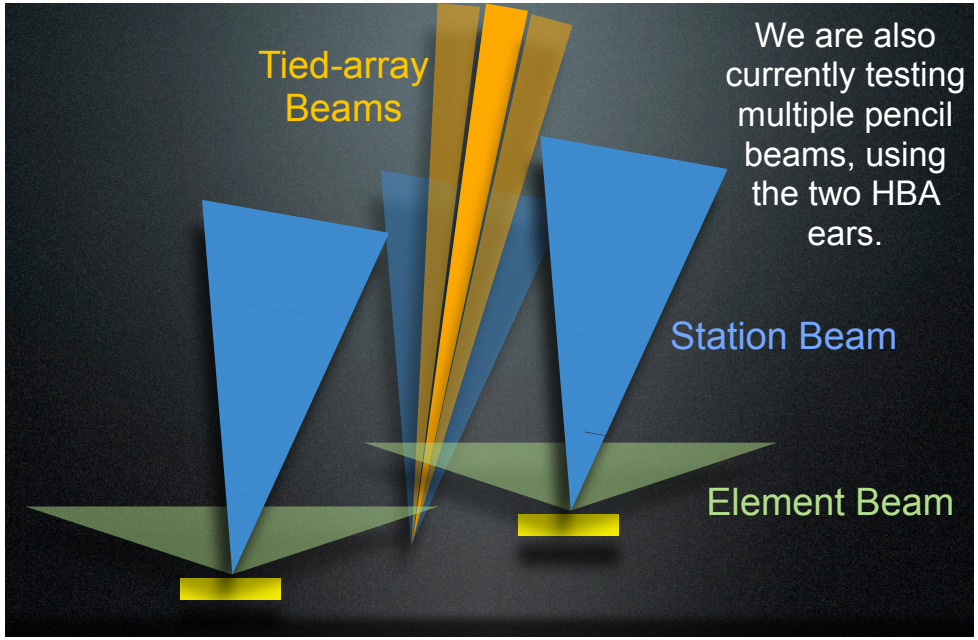
Pulsar/Beam-formed Pipeline



What were previously called .cor files (corrected for packet loss etc.) can now be written directly to HDF5 on the storage nodes. Next step: implement this *after* the Pulsar Pipeline.



PBW3: Summary

- First pulsar observations with CS302.
- Increase in sensitivity over CS010c at least roughly makes sense.
- Beam shape(s) at least roughly make sense.
- Large, repeating (each 24 hr) peaks in the total power, which may be due to the grating lobes.
- Need to improve float to short int. conversion.
- HDF5 file writing has taken an important step.
- Working on multiple pencil beam results.
- Still lots of digging into the data going on.
- Much higher sensitivity makes many new tests possible!

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Plans & PBW4

- Observe a true millisecond pulsar.
- Observe with the LBAs.
- Do quick snapshots of a couple dozen bright pulsars.
- Further pencil beam (tied-array) tests.
- Have HDF5 writer work on tail end of the pipeline.
- PBW4: aiming for mid September, when the core superstation should (sorry, *will*) be in place.

LOFAR Status Meeting
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