

POCKET CORRELATOR BEAMFORMER IMAGER (PoCoBI)

Glenn Jones and Casey Law



Assembly of PoCoBI in digital lab

FAST IMAGING

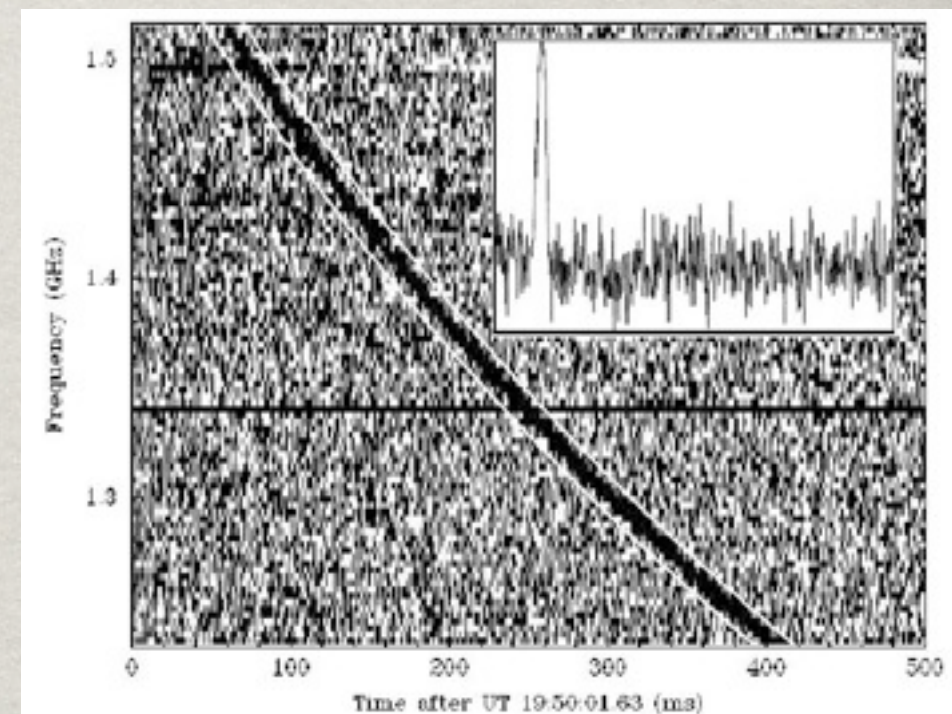
✶ Why?

✶ “Fast” => high energy density

✶ Dispersion

✶ ~10 ms for ATA at 1.4 GHz.

✶ Figure of merit: $A_{\text{eff}} * \Omega / \Delta\Omega * T / \Delta t$



FAST IMAGING

☼How?

☼Figure of merit: $A_{\text{eff}} * \Omega / \Delta\Omega * T / \Delta t$

☼Maximize the number of samples on the sky

1. Build massive telescope with multibeam receiver.
2. Build fast correlator for interferometer.

IMPLEMENTATIONS

✻ ATA corr. (16 antpol, 100ms, 3MHz)

✻ B0329+54 movies

✻ ATA memo

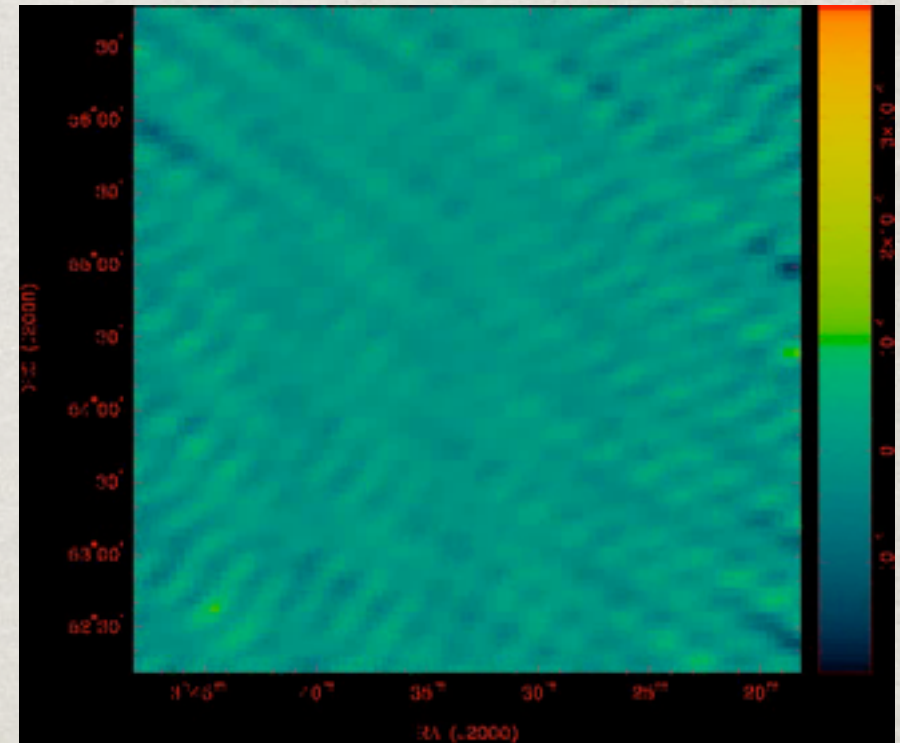
Movie of
average
pulse
profile

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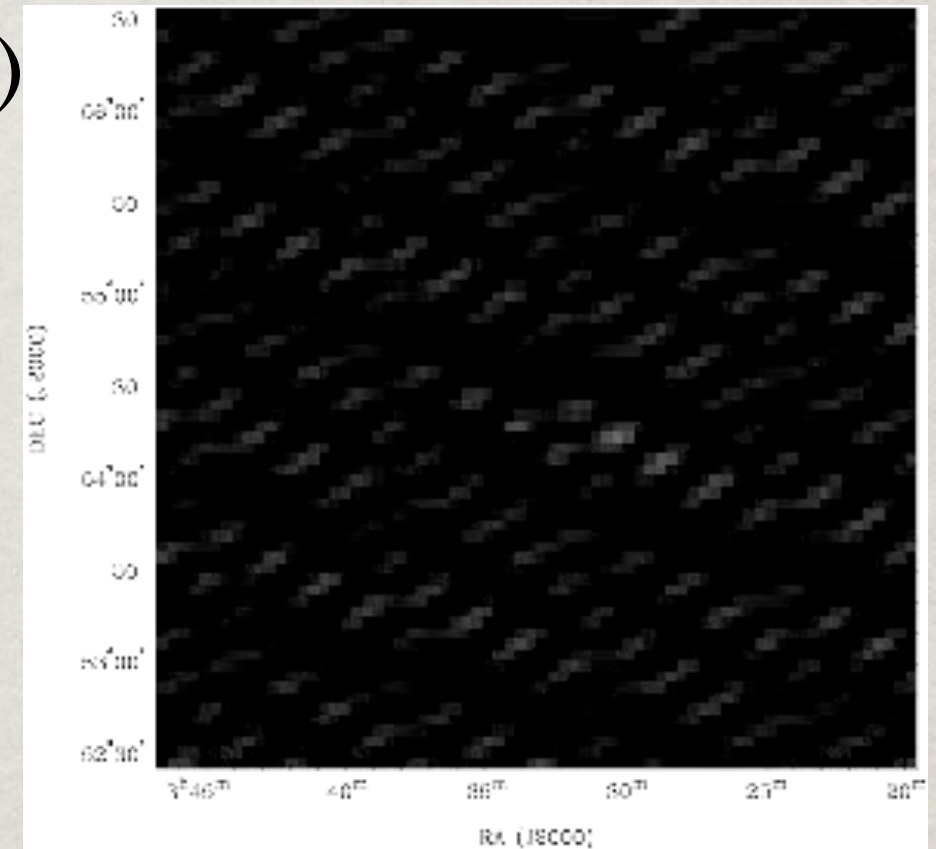
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Movie
of "on
phase"

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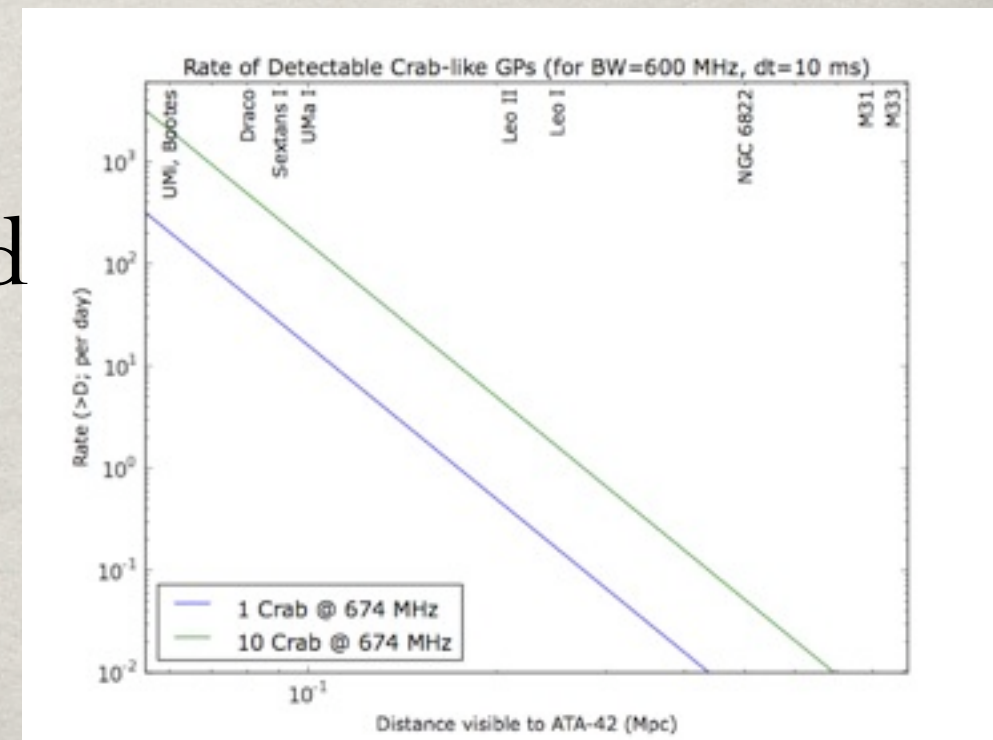
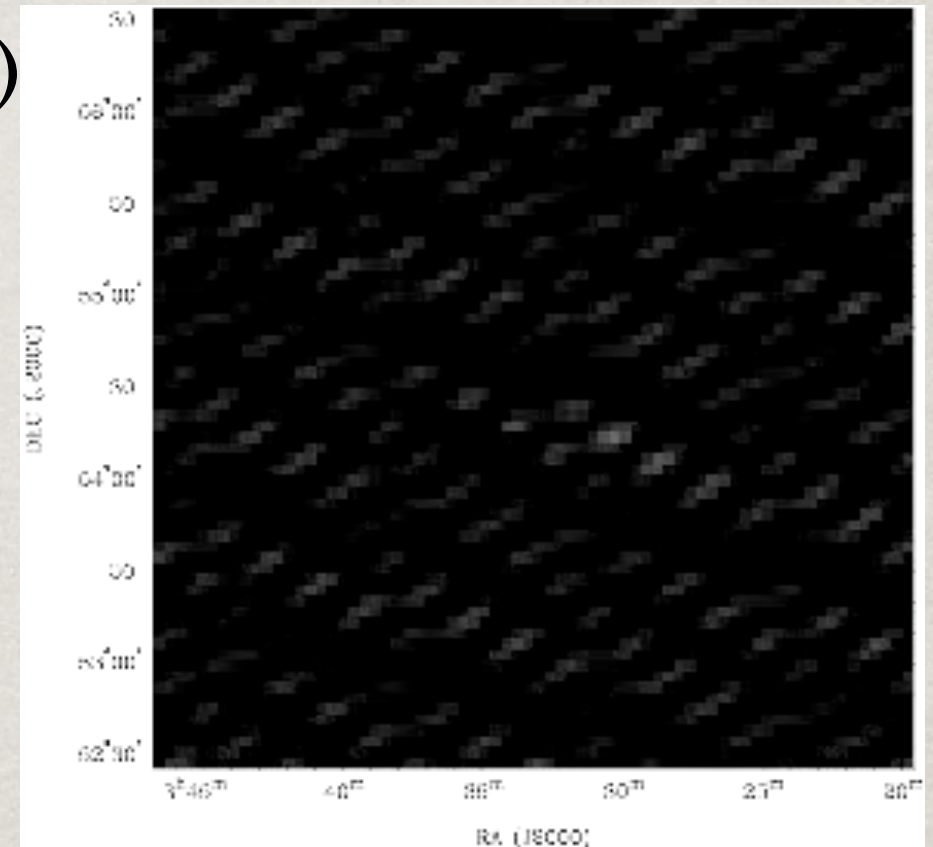
- ATA memo

- CoBI (84 antpol, 10ms, 500MHz)

- Multi-function, commensal, automated

- Pulsar timing, SETI, transients

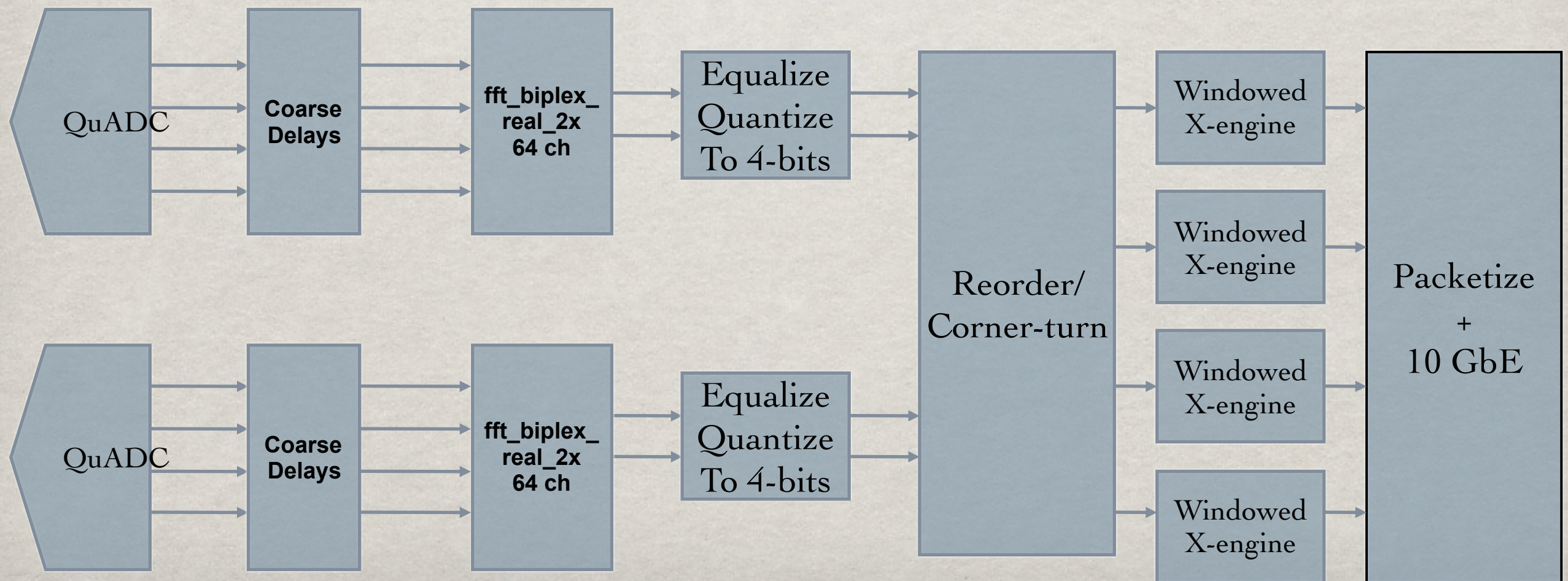
- NSF MRI proposal under review



Event rate for extragalactic Crabs

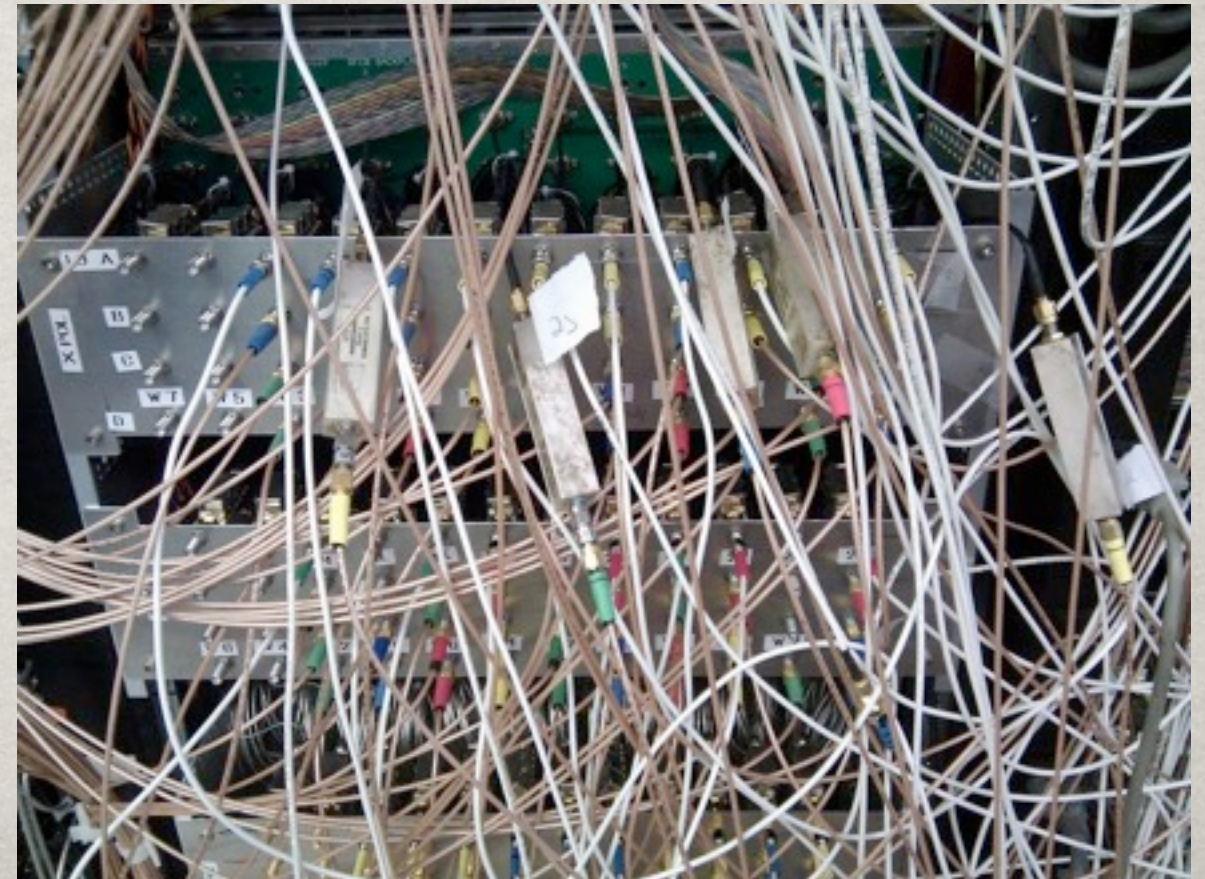
LATEST IMPLEMENTATION: PoCoBI-8

- ✱ (Pocket) Correlator, (Beamformer), Imager
- ✱ 8 single-pol inputs
- ✱ 100 MHz BW, 64 channels (LX110)
- ✱ 128 spectra basic integration, $\sim 80\mu\text{s} \rightarrow \sim 117 \text{ MB/s}$
- ✱ Further integration done on CPU



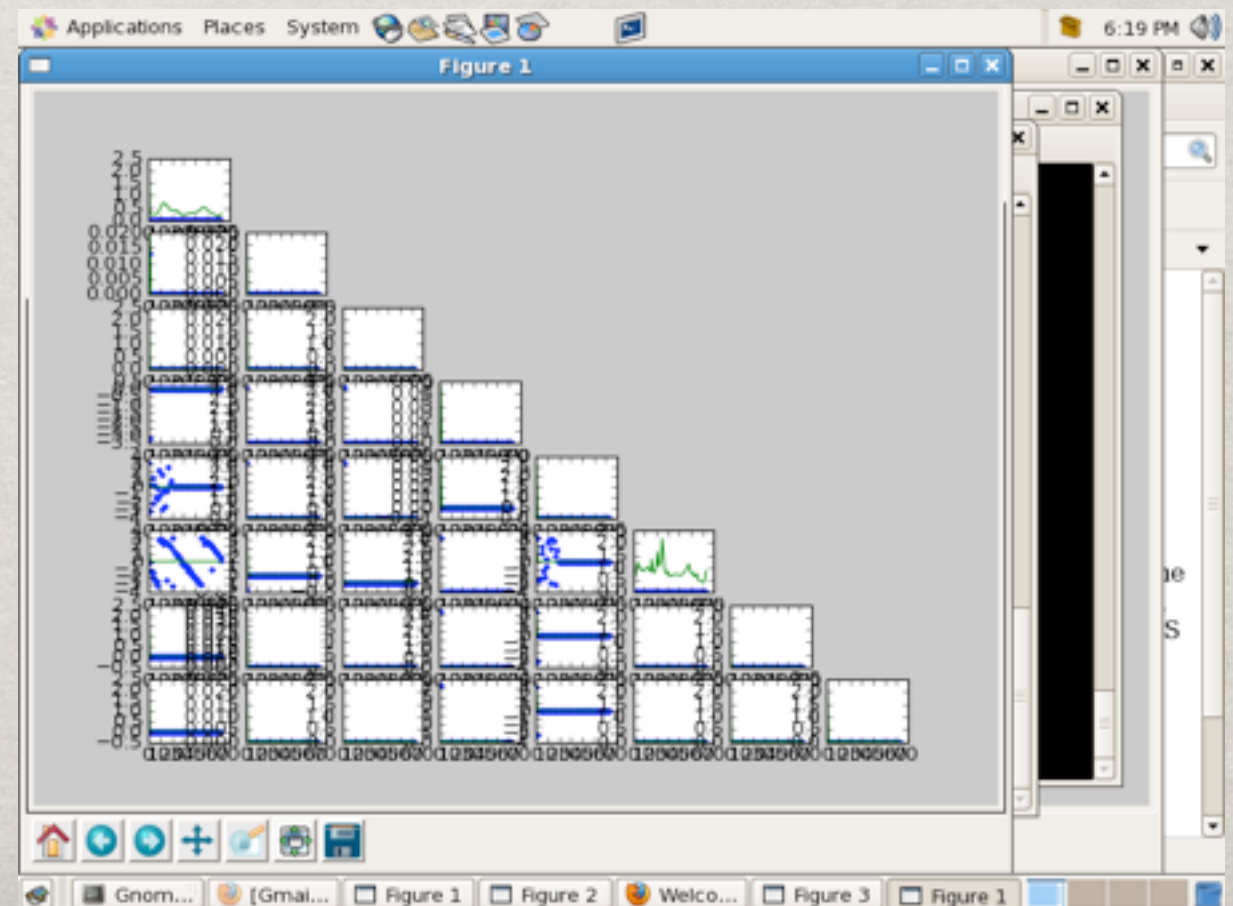
OBSERVING WITH PoCoBI

- ✱ ROACH borrowed from Dan
- ✱ Assembly in Digital Lab
- ✱ 1-wk July visit to HCRO
- ✱ Goal: image a pulsar pulse



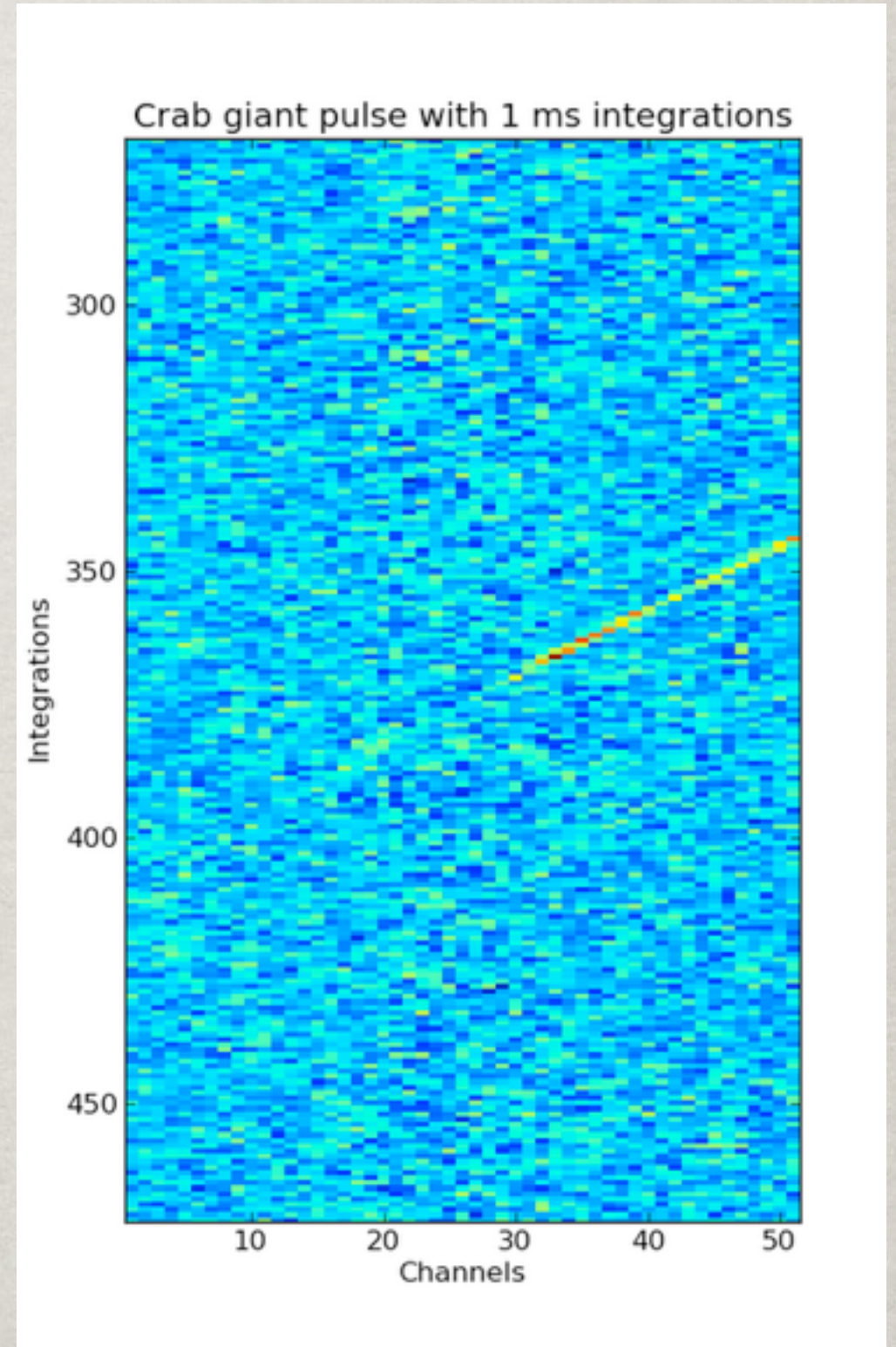
OBSERVING WITH PoCoBI

- ✱ Major rewiring at observatory to get analog passband at correct frequency and bandwidth
- ✱ Visibilities written in binary, converted to Miriad
- ✱ Fortran code from PAPER folks
- ✱ Fringe rotation!
- ✱ Delay calibration!
- ✱ First Fringe!



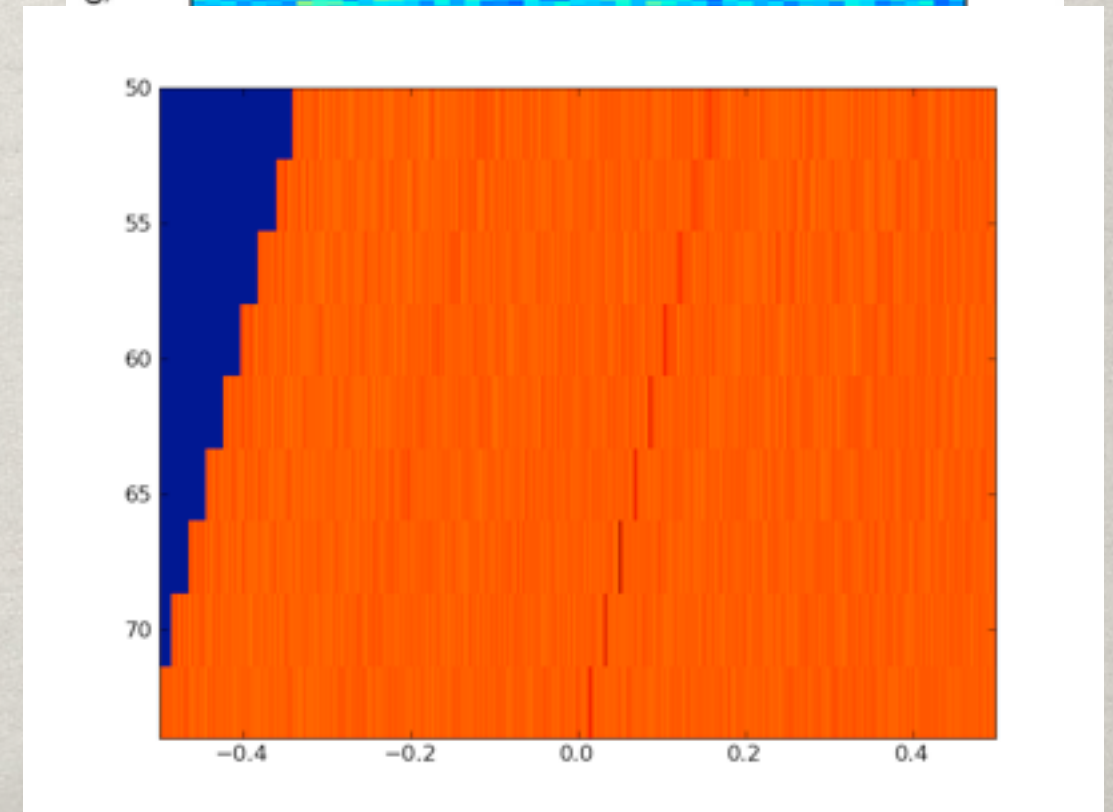
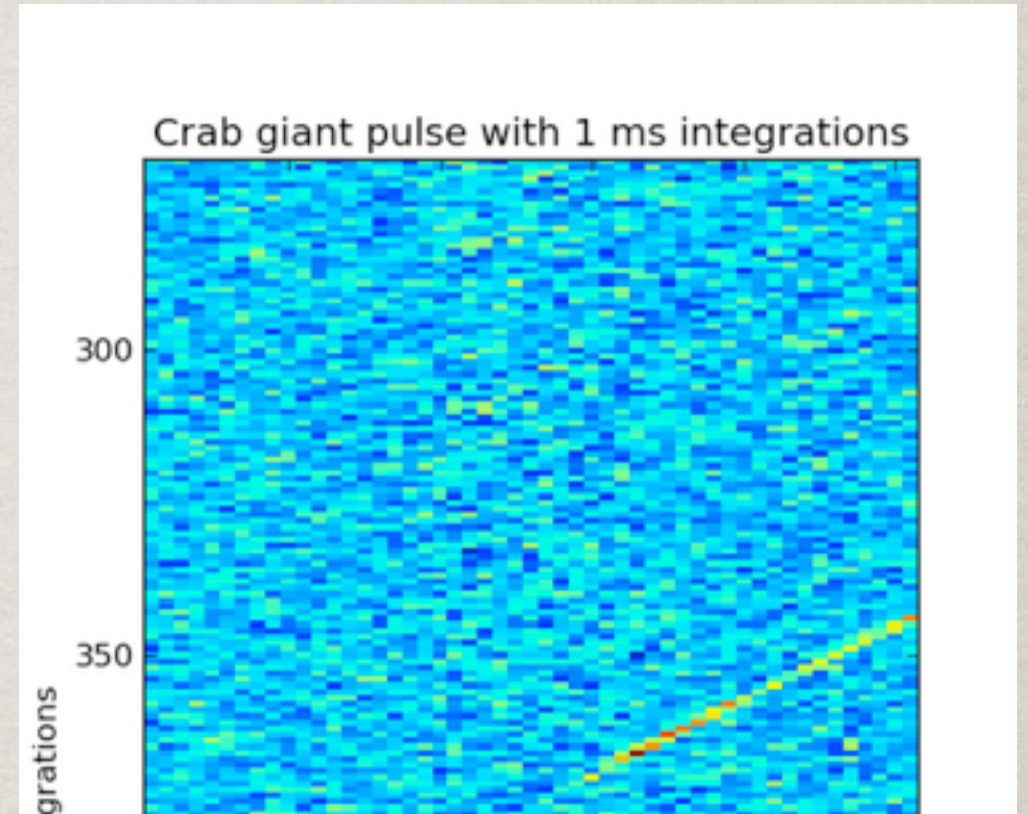
POCOBI RESULTS

- ✱ About 500 GB of data
 - ✱ Crab, B0329+54, Sun, M31
- ✱ First Pulse!
 - ✱ 7 sigma => ~10 kJy
 - ✱ Crude dedispersion algorithm
 - ✱ DM~70 pc/cm²



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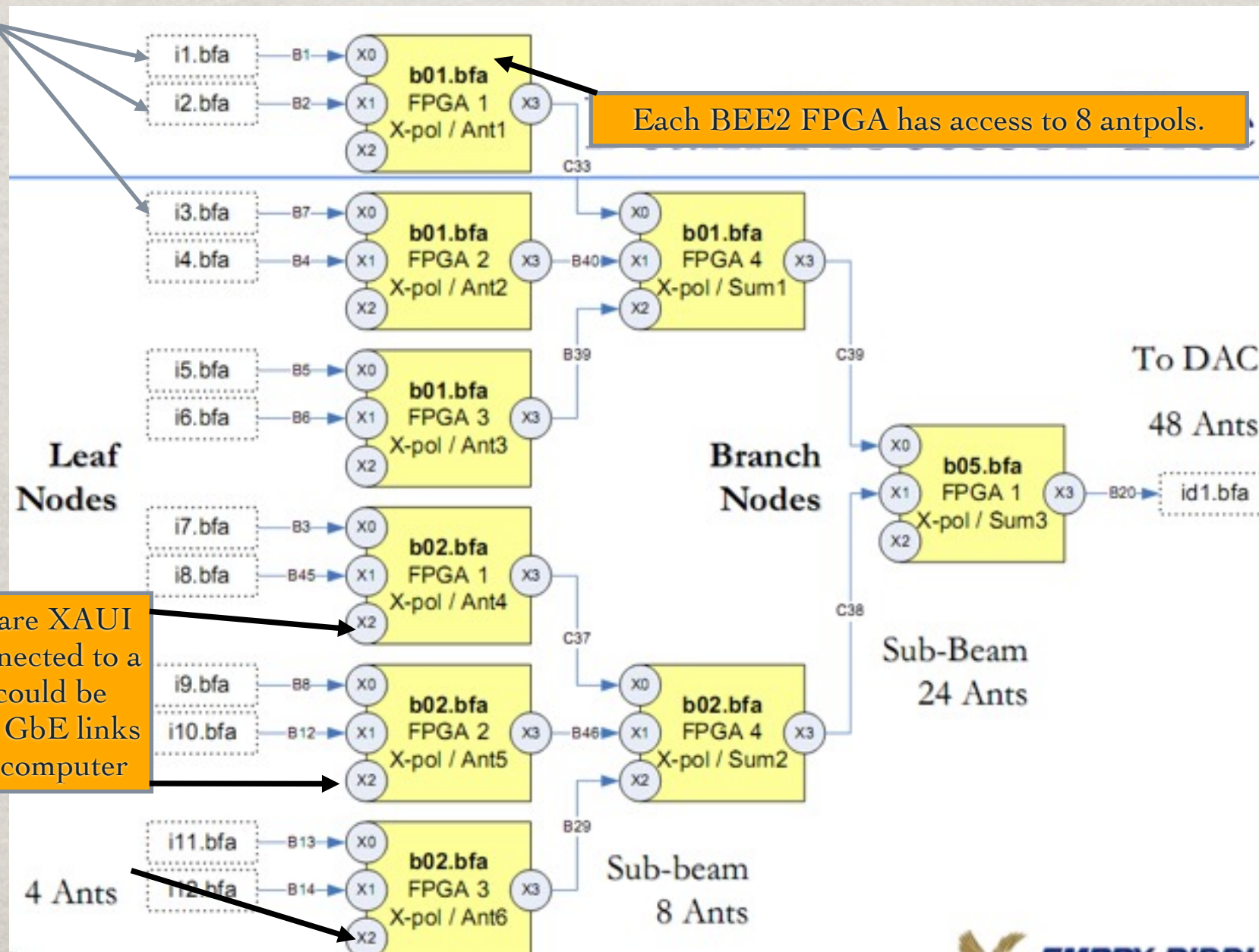


RECONFIGURING THE ATA BEAMFORMER FOR TRANSIENT SEARCHING

From W. Barrott, *Status, Capabilities and Use of the ATA Beamformer* July 8, 2008 presentation

Each iBOB provides 104 MHz from each of 4 antpols (48 total)

Each BEE2 FPGA has access to 8 antpols.



Each BEE2 FPGA has spare XAUI output which could be connected to a 10 GbE switch, or data could be aggregated down to 2 x 10 GbE links and directly connected to computer

6 X 8 INPUT CORRELATOR USING ATA BEAMFORMER HARDWARE

- ✱ Configuring the hardware for this mode would simply require reprogramming the FPGAs instead of invasive cabling changes needed for PoCoBI.
- ✱ Could be routinely used for surveys if post processing can keep up and scientifically interesting
- ✱ May be sensitive enough for an RRAT survey
- ✱ After experience with PoCoBI, would definitely like to add automatic coarse delay tracking.
- ✱ If memory limits integration time on BEE2 to same 80us, data rate will be ~700 MB/s, which likely could be swallowed by one machine for post integration and processing if necessary.