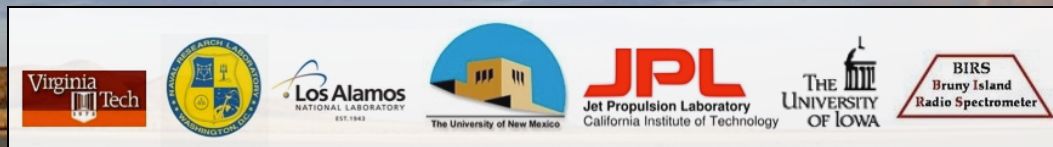


Low frequency time domain astronomy with the LWA

Steven Tremblay (UNM)

Greg Taylor (UNM) and Jake Hartman (Eureka Scientific)

on behalf of the LWA Collaboration



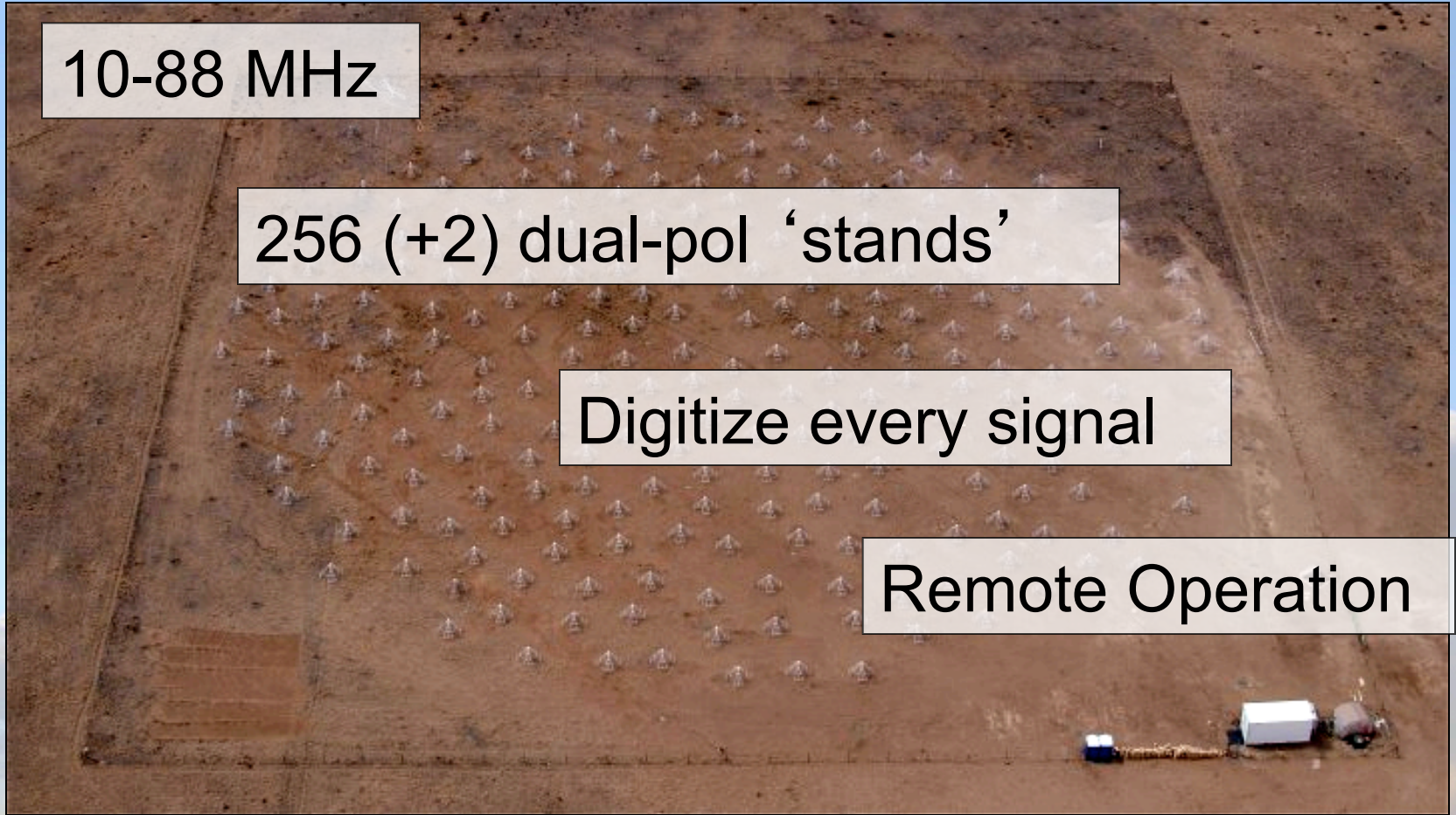
Station Overview

10-88 MHz

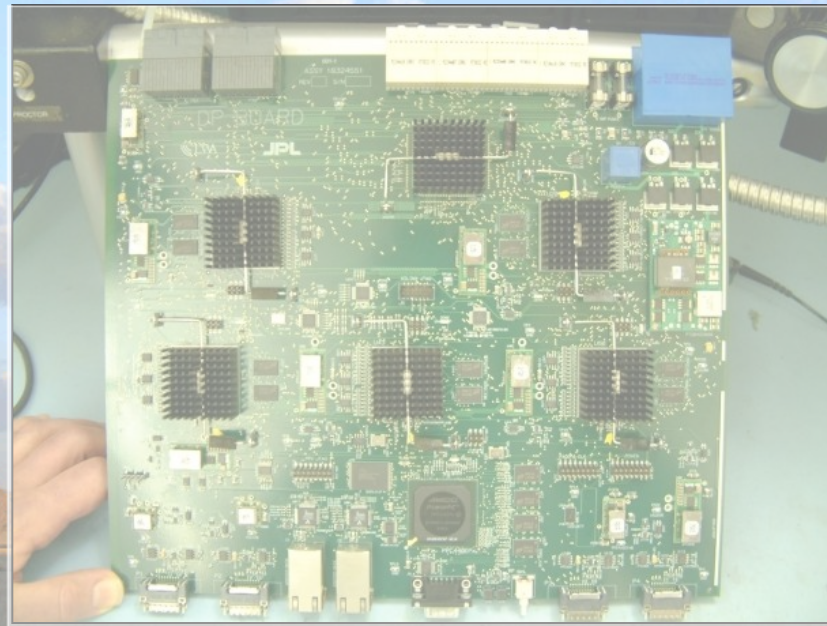
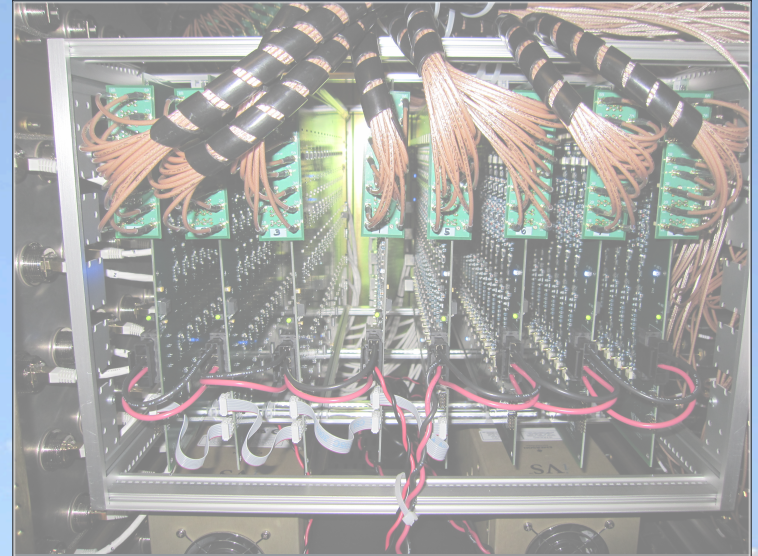
256 (+2) dual-pol 'stands'

Digitize every signal

Remote Operation



Signal Path



Observing Modes

TBW

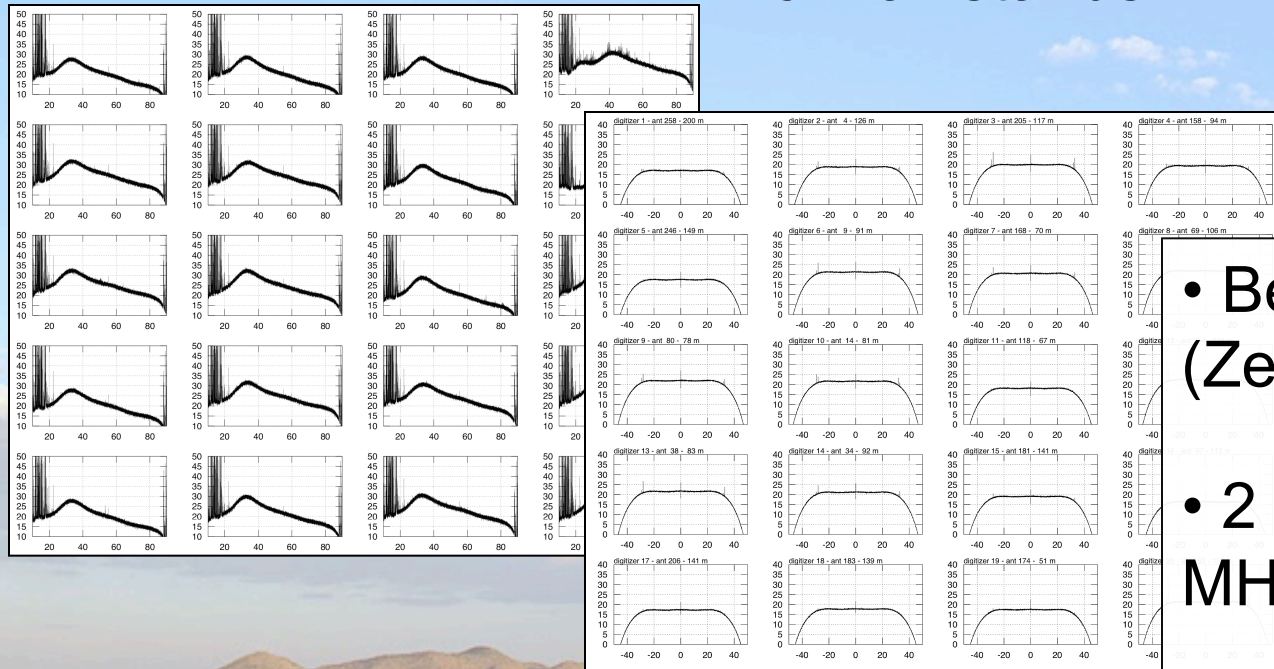
Full spectrum from
all stands in 61 ms
or 183 ms blocks

TBN

Tunable 100 kHz
from all stands

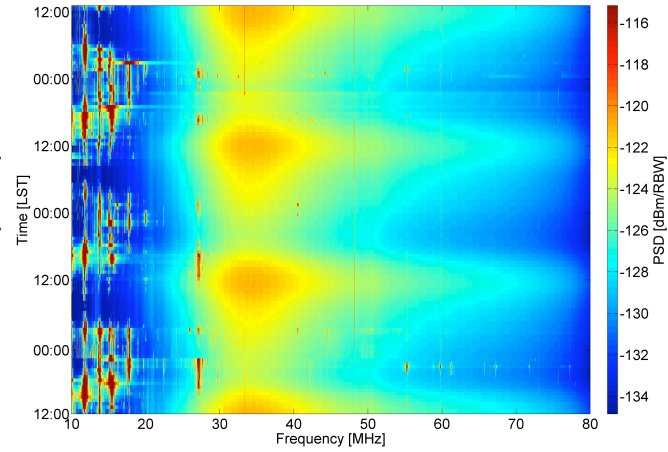
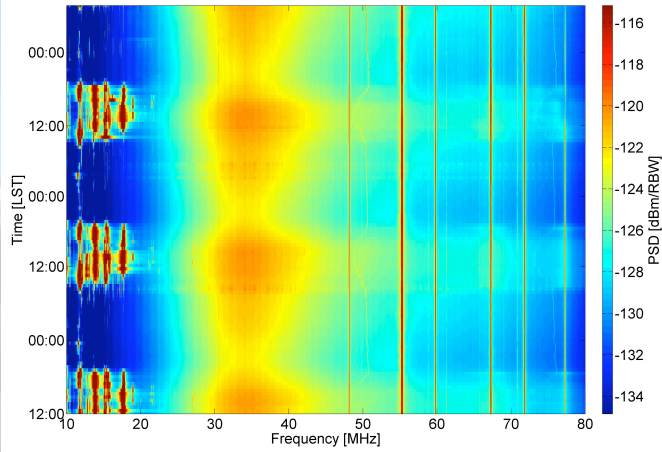
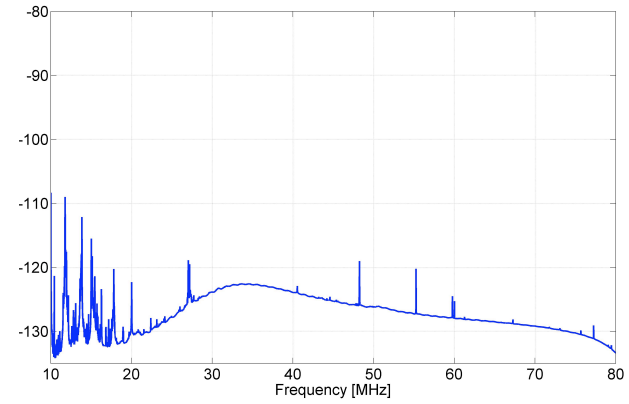
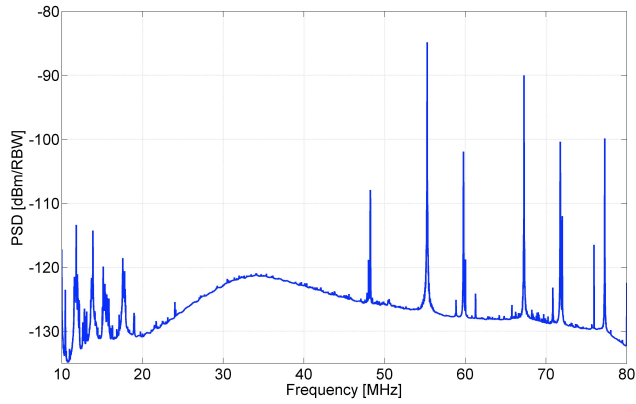
DRX

4 simultaneous
beams

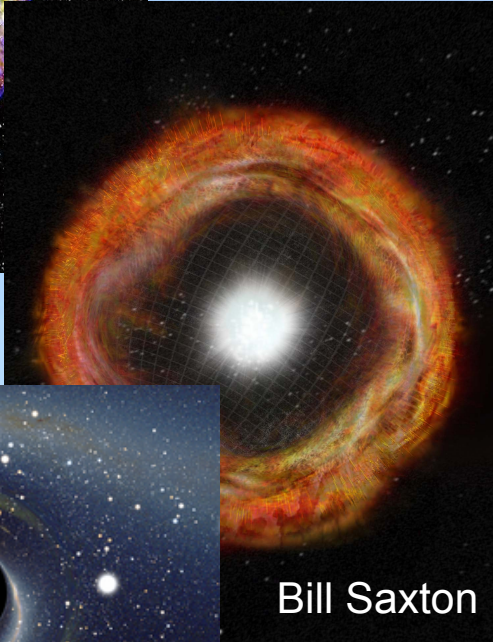
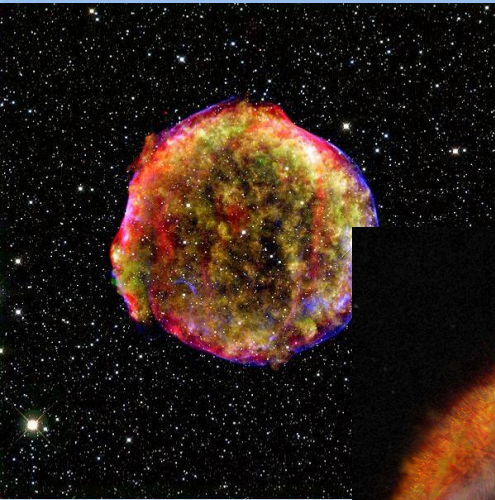


- Beam size $\sim 2^\circ/8^\circ$ (Zenith)
- 2 tunings 0.2-16 MHz Bandwidth/beam
- 4096 channels/tuning

LWA1 RFI Environment



LWA1 & Transients



"We'll be looking for the occasional celestial flash," said Joseph Lazio, a radio astronomer at JPL. "These flashes can be anything from explosions on surfaces of nearby stars, deaths of distant stars, exploding black holes, or even perhaps transmissions by other civilizations."

LWA1 & Transients

- Rotating radio transients (RRATs)
- Radio Pulsars
- Giant Pulses
- Solar Radio Bursts
- Jovian/Exoplanet Bursts
- GRBs
- Exotica (Primordial BHs, Cosmic Strings, SETI, etc.)

Prototype All-Sky Imager

- 4 node ‘mini-cluster’
- Real time correlation $> 33,000$ baselines
- Automated RFI excision/mitigation and Imaging
- Transient detection and beam triggering
- Alert interested members of community
- Hardware ‘in hand’

PASI

4 x 8 2.93 GHz Nehalem Cores

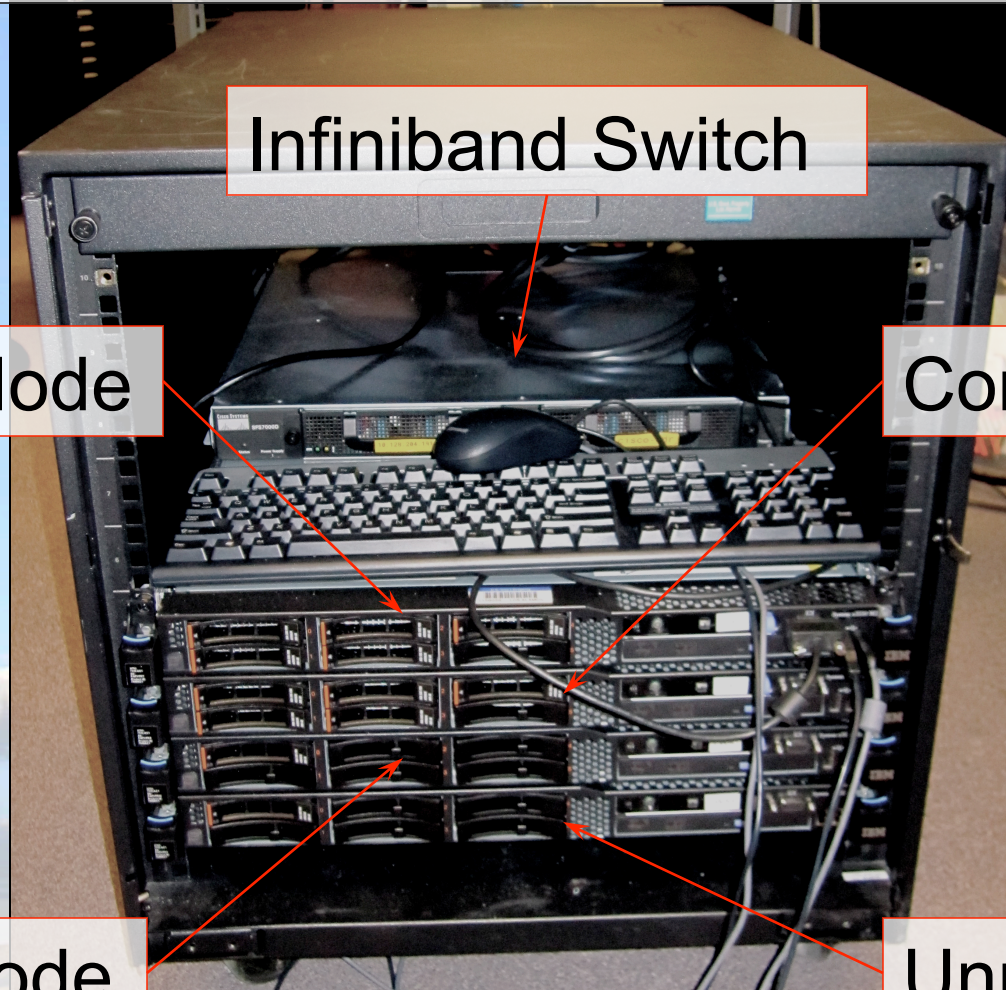
Infiniband Switch

ReaderFftNode

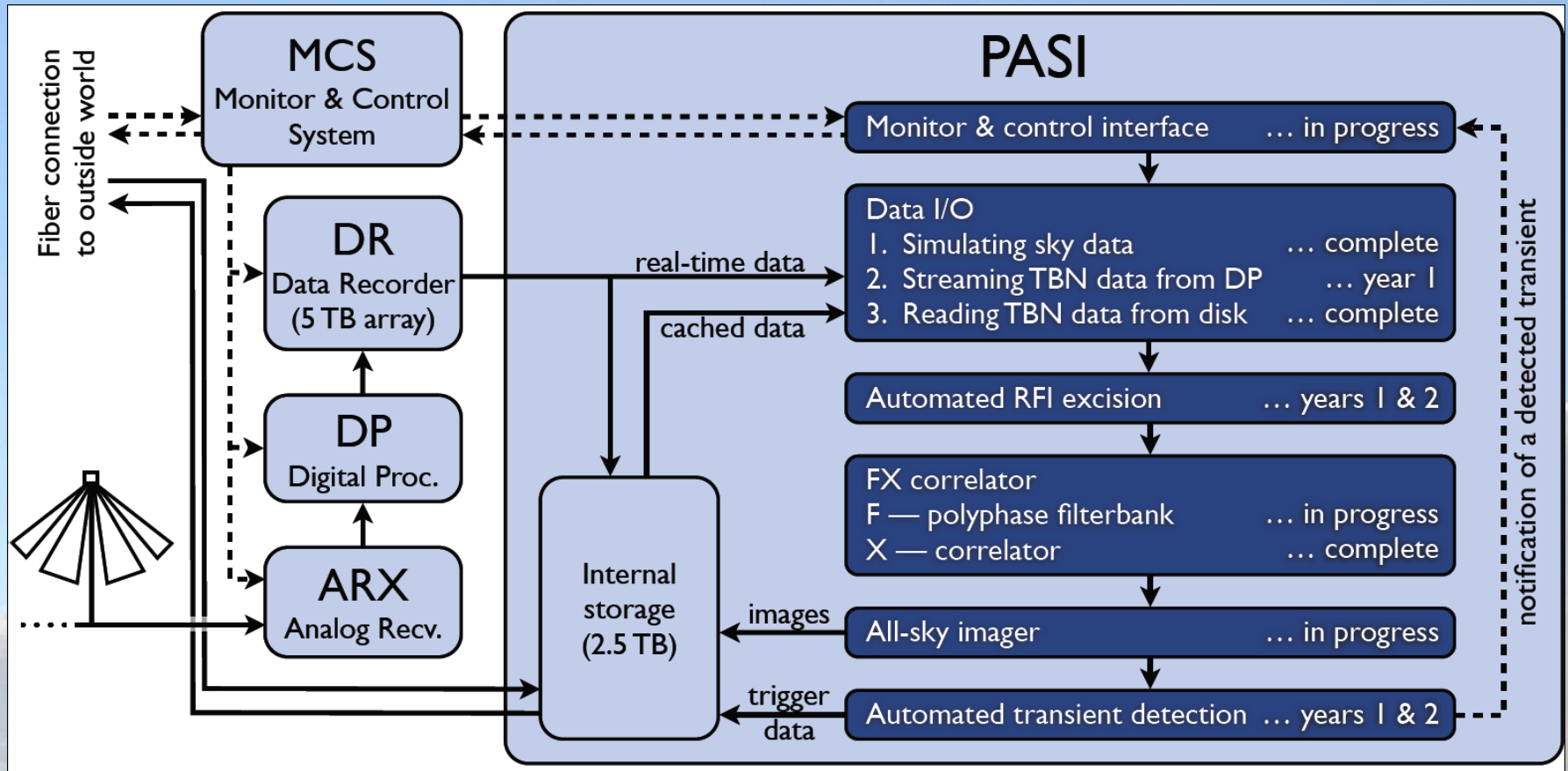
CorrelatorNode

ImagerNode

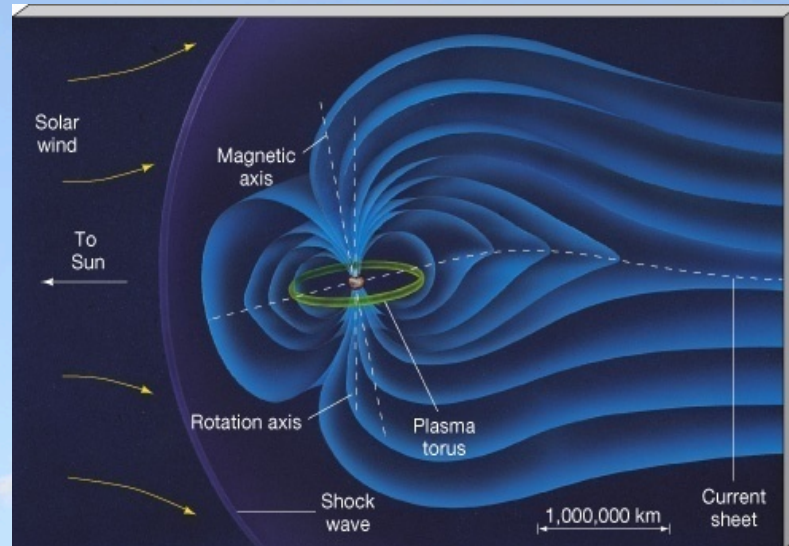
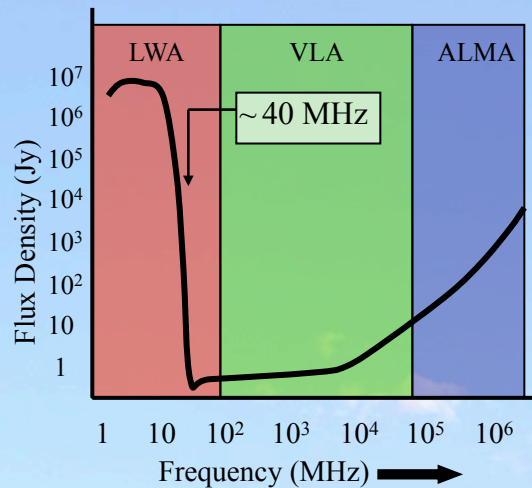
UnnamedNode



PASI



Jovian Bursts



Emission mechanism: electron cyclotron maser emission along the stellar wind/magnetosphere shock front.

Frequency cutoff dependent on polar B_{max}

Extra-solar ‘Hot Jupiters’

Known Knowns

Previously detected planets with known periodicity

$$P_{\text{orb}} < 5 \text{ days}$$

Likely tidally locked

Daily observations scheduled to fully sample rot. phase

Known Unknowns

Previously detected planets with unknown periods

Logarithmically stepped observing schedule

Rotational phase sensitivity between 1 and 30 hours

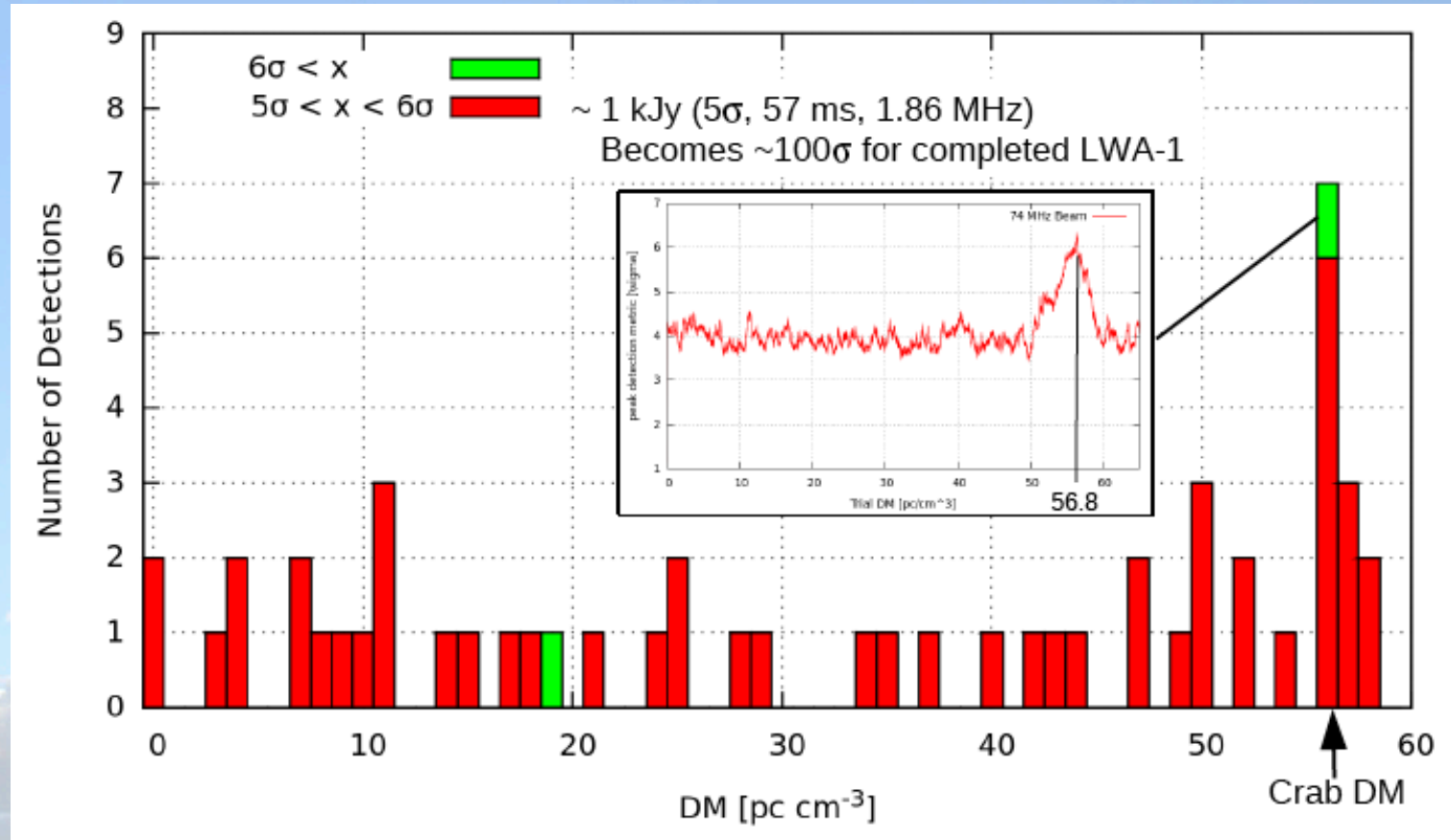
Unknown Unknowns

Non-targeted search

‘Should’ be ~5,000 within 100 pc

Blind search pipeline inserted into the data stream for ‘bursty’ circularly pol.

First Glimpse of Crab Giant Pulses



74.65 MHz $\sim 16\text{h}$ of analogue beam on Crab pulsar

Thank You!



<http://lwa.unm.edu>

<http://www.facebook.com/LWArray>