GLINT

GREEN BANK LUNAR INTERFEROMETER FOR NEUTRINO TRANSIENTS

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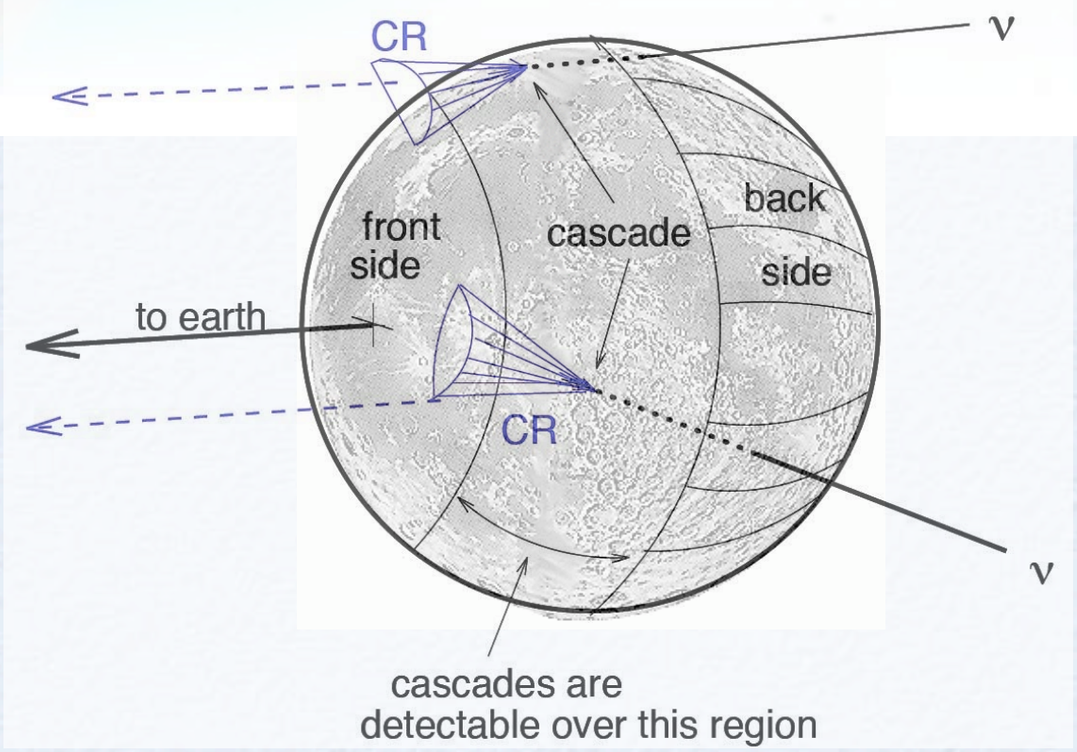
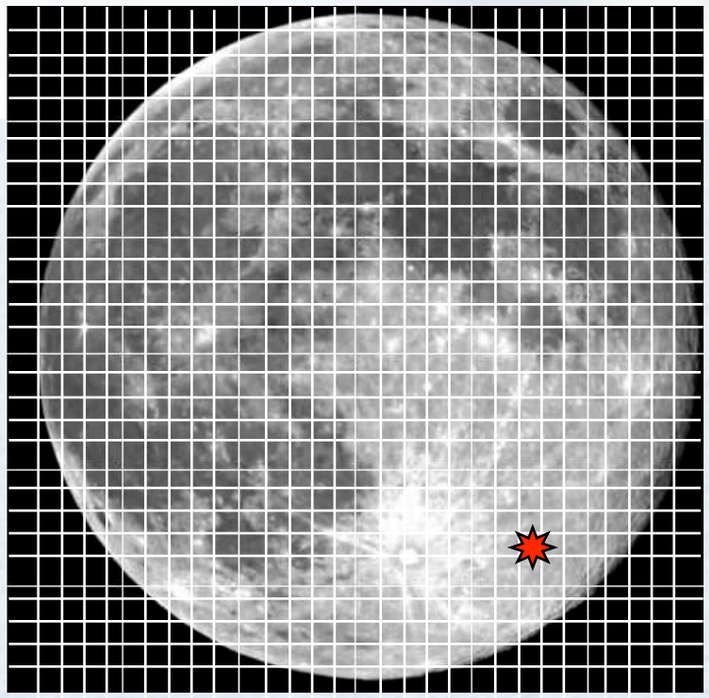
Green Bank Lunar Interferometer for Neutrino Transients





Three year project to build a wide band (0.5 to 3 GHz) array dedicated to observations of transient events. Target is detection of few bright (> 2000 Jy) short duration (few nano-second) pulses from the lunar regolith.

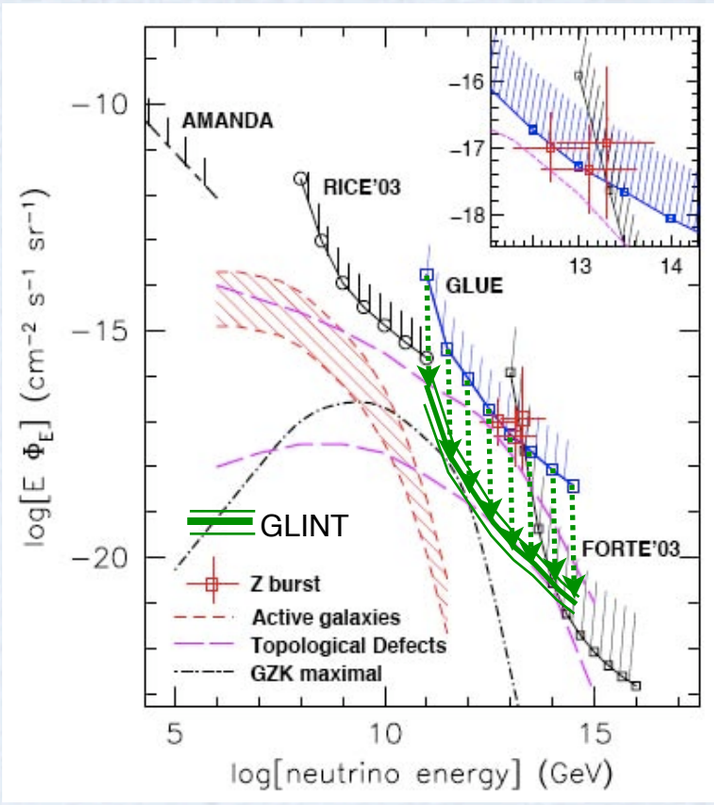
RESEARCH GOAL

- Maximize detection of statistically significant pulses originating from the lunar surface.
- Unambiguously differentiate neutrino pulses from other sources.
- Localize the direction of the incoming radio pulse resulting from neutrino interactions.

TECHNICAL GOAL

Factor of 300 improvement in sensitivity over original experiment

Group	Freq. (MHz)	Band-Width (MHz)	Diam-eter (m)	System Temp (K)	Neutrino Beam (degree)	Relative System Sensitivity	Obs. Duration (hours)	Rel. Counts
Parkes	1400	200	64.0	100	3.1	131	10	1
GLUE	2200	70	48.1	110	2.0	33	120	3
Westerbork	140	20	93.5	200	30.9	40	200	6
							500	15
GLINT	1300	2000	53.6	110	3.3	337	2000	513
							4000	1025



GLINT MOTIVATION

STATISTICALLY SIGNIFICANT DETECTION OF LUNAR NEUTRINOS REQUIRES DEDICATED EXPERIMENT

- 3 antenna interferometer in triangular configuration, ~1 km baselines.
- New, all digital, wide-band data capture and correlation system allows detection based on signals from individual antennas and correlated signals
- Two year continuous operations to achieve required statistical significance.

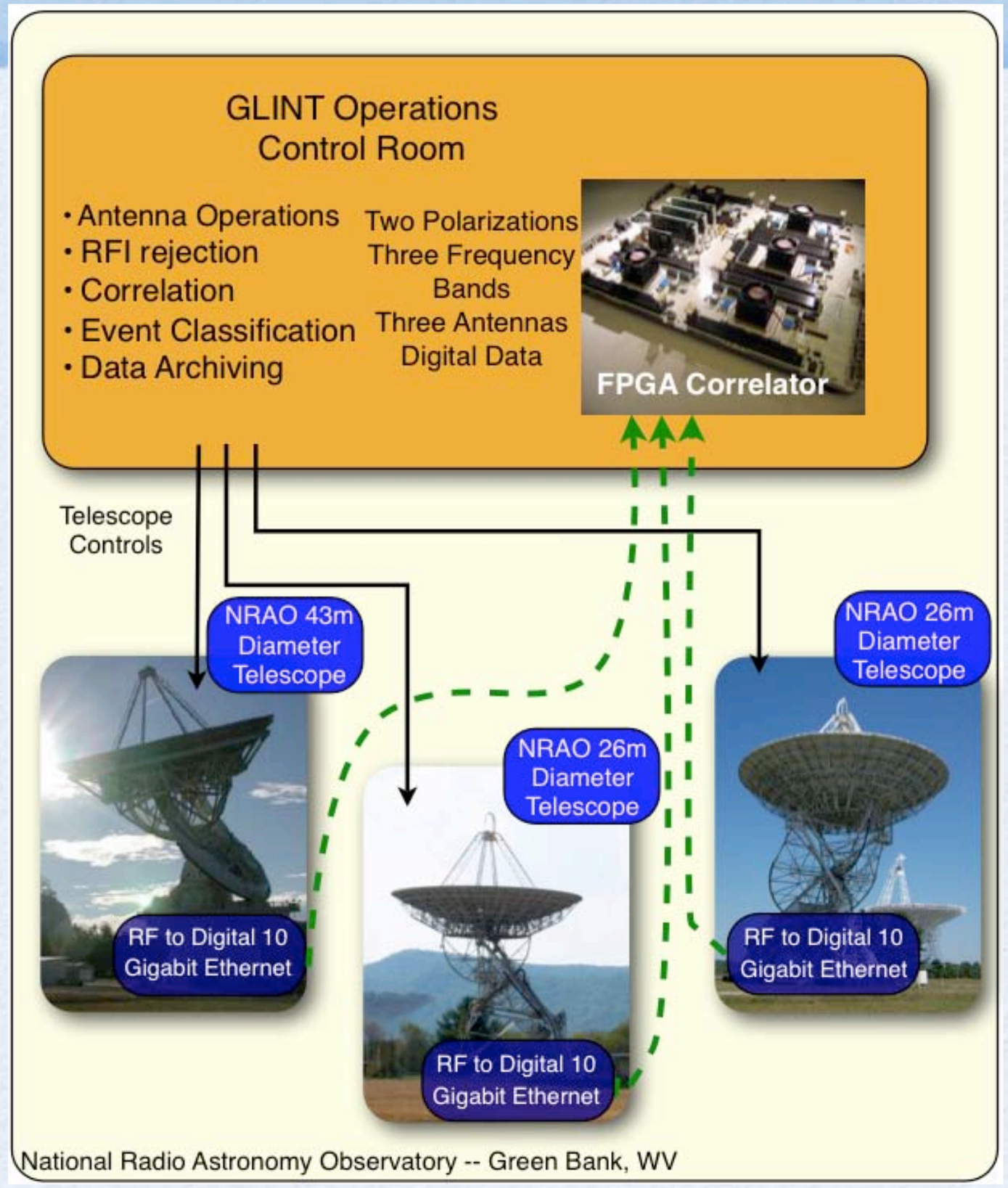
NEW INITIATIVES ENCOURAGED BY NSF/AUI

THREE ANTENNA ARRAY

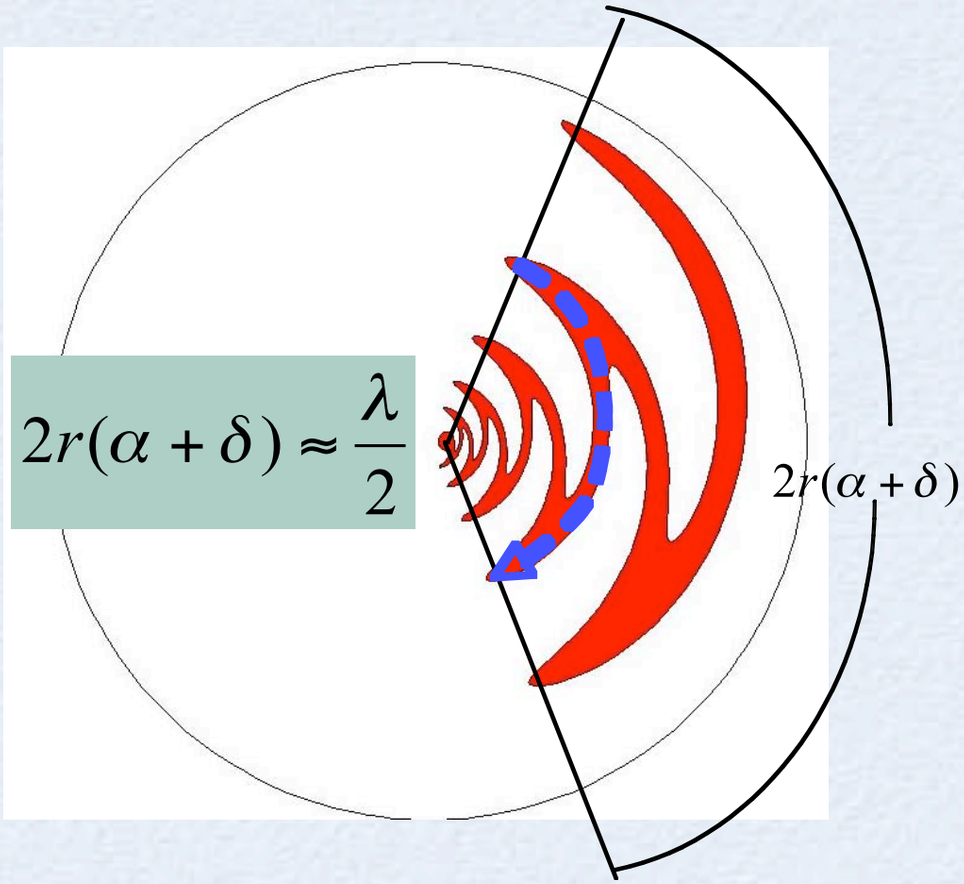
Array is 43m and two 26m antennas arranged roughly in a triangle with 0.8 to 1.5 km baselines.

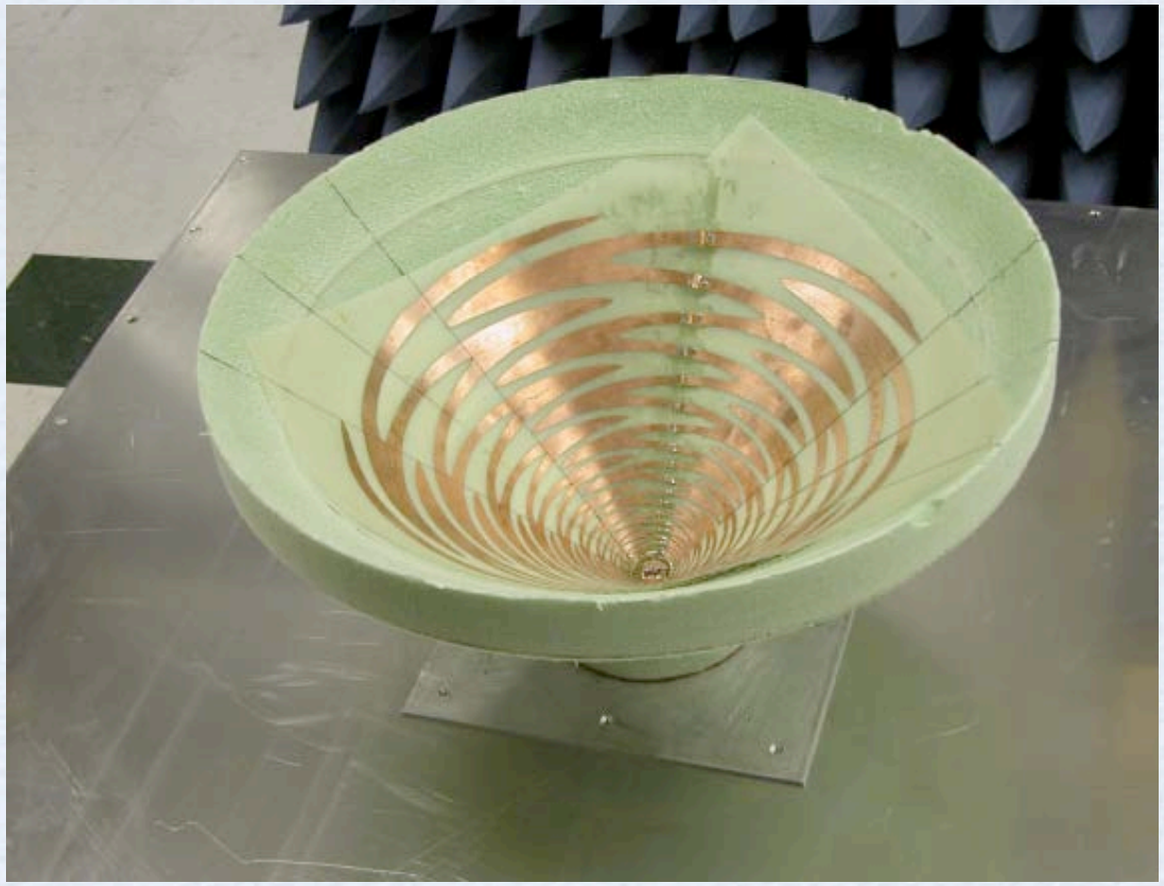
43m currently used for Ionospheric studies (0.15 to 1.7 GHz).

HARDWARE OVERVIEW



FREQUENCY RANGE

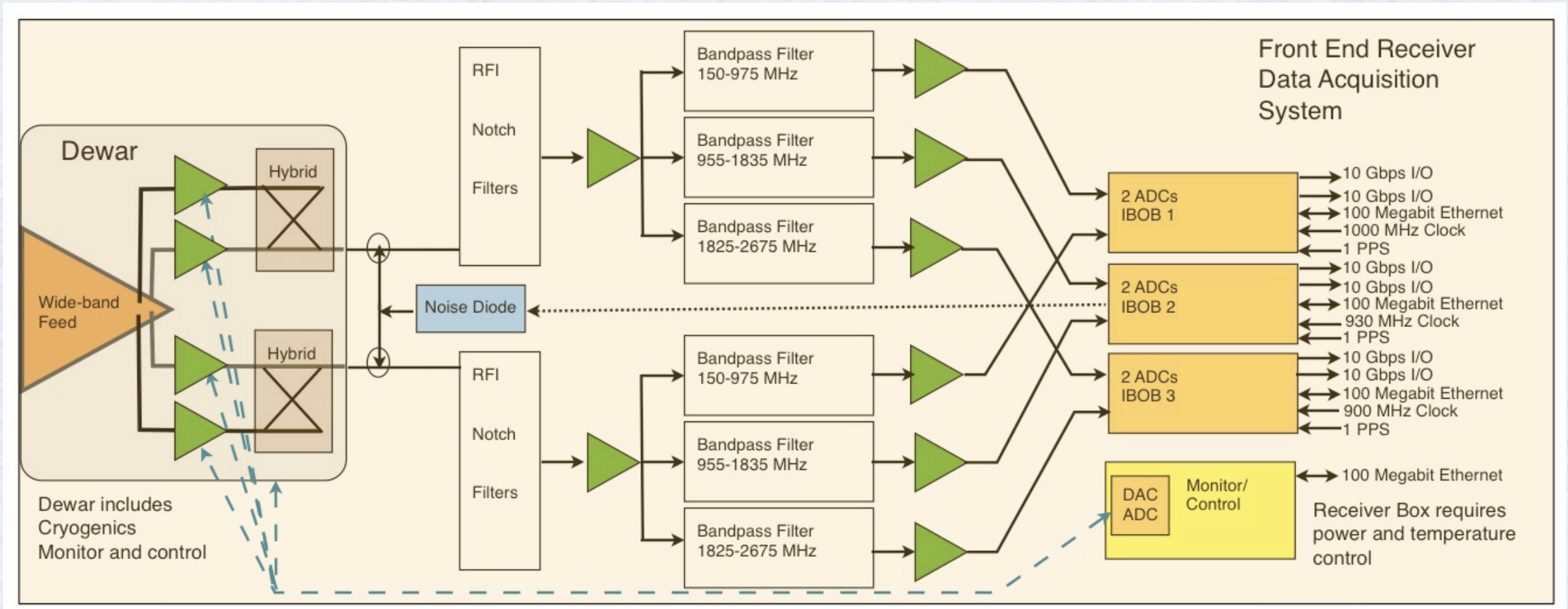




R. Bradley and Rohit Gawande tested FASR Feed (0.5 to 3.0 GHz) on 43m in May 2008

Cryogenically cooled feed by end of year.

DIGITAL FPGA DETECTOR



- U.C. Berkeley IBOB/ROACH/BEE2 hardware is basis for sampler and correlator systems

FPGA DEVELOPMENTS

Initial tests of digital data sampler successful for detection of few nano-second events, using U.C. Berkeley hardware and development software. (See Langston et al memos on http://wikio.nrao.edu/CICADA)

Collaboration with Peter McMahon on Full Stokes Pulsar processing system using the IBOB board and 10 Giga-bit XAUI interface to PC.s

Existing 8 station IBOB/BEE2 correlator at Green Bank for Epoch of Re-ionization experiment. (Backer, Bradley and collaborators)

Next Steps

GLINT proposal completed, and technical review completed by NRAO science and technical councils

AUI/NSF Reviews

Submission to DOE

Negotiations with MIT/LL

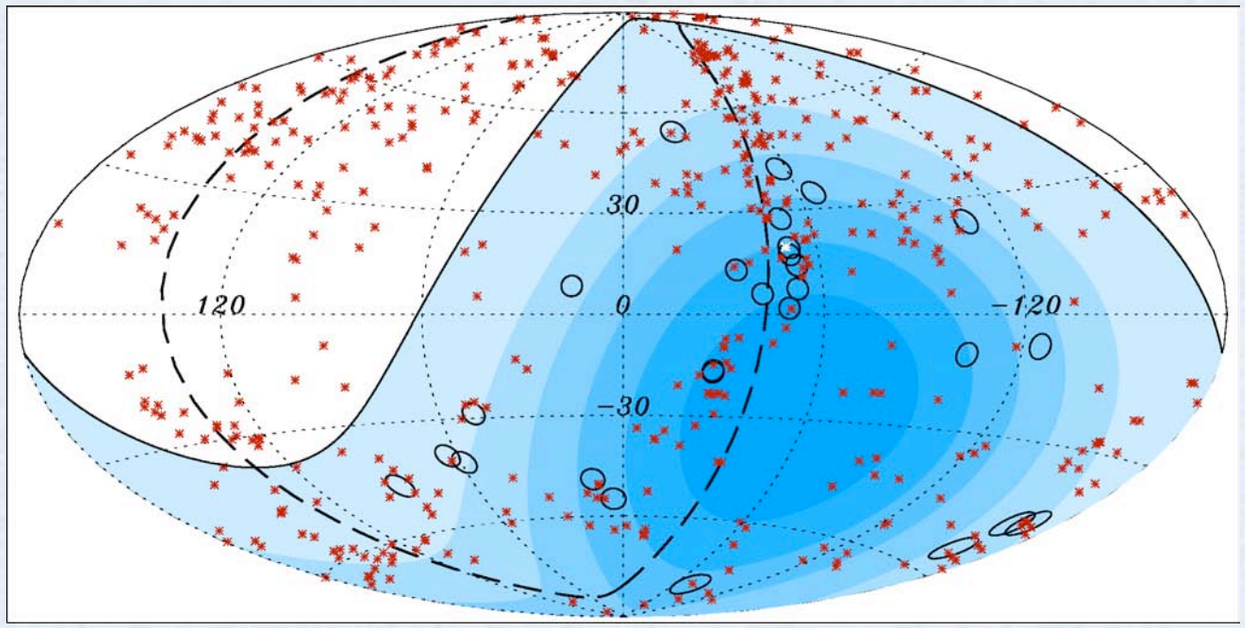
Construction!

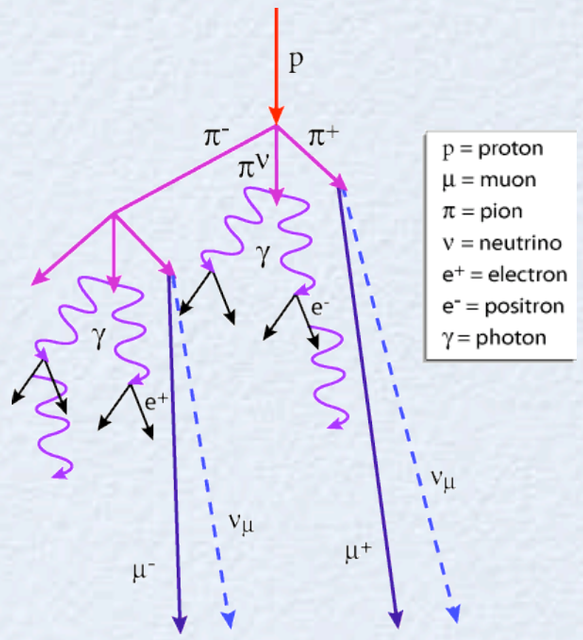
SUMMARY

The GLINT interferometer will have very wide frequency coverage and the ability to determine the point of origin of radio transients generated by neutrinos.

Our proposed system will operate for two or more years, in order to detect a statistically significant number of neutrino transients.

UHE COSMIC RAYS





Recently the Pierre Auger experiment team has concluded that the highest energy cosmic rays originate in a direction associated with the nearest Active Galactic Nuclei (AGN).
Image from Abbasi et al. 2008

UHE > 10^{18} eV

Large Neutrino detectors observe neutrinos as flashes of light in a large volume (i.e. $km^{3)}$