GLAST and Low Frequency Radio Observations

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Low Frequency Radio?

Physical connections between Gamma & Radio:

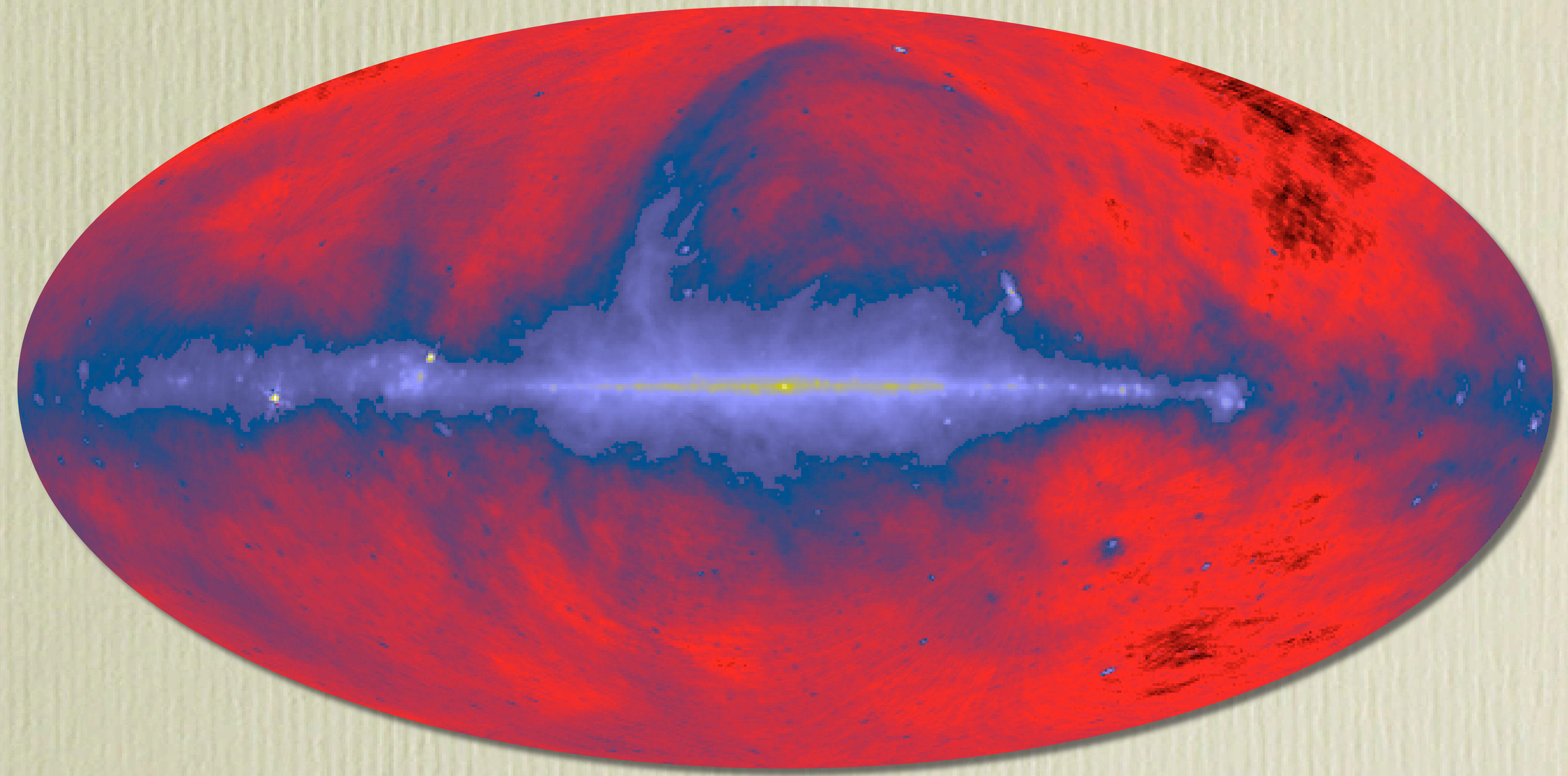
- Non-thermal (synchrotron,etc.)
- Shocks & plasma dynamics (via particle acceleration, and coherent or collective processes)
- Magnetic fields (Faraday rotation)

Technical advances:

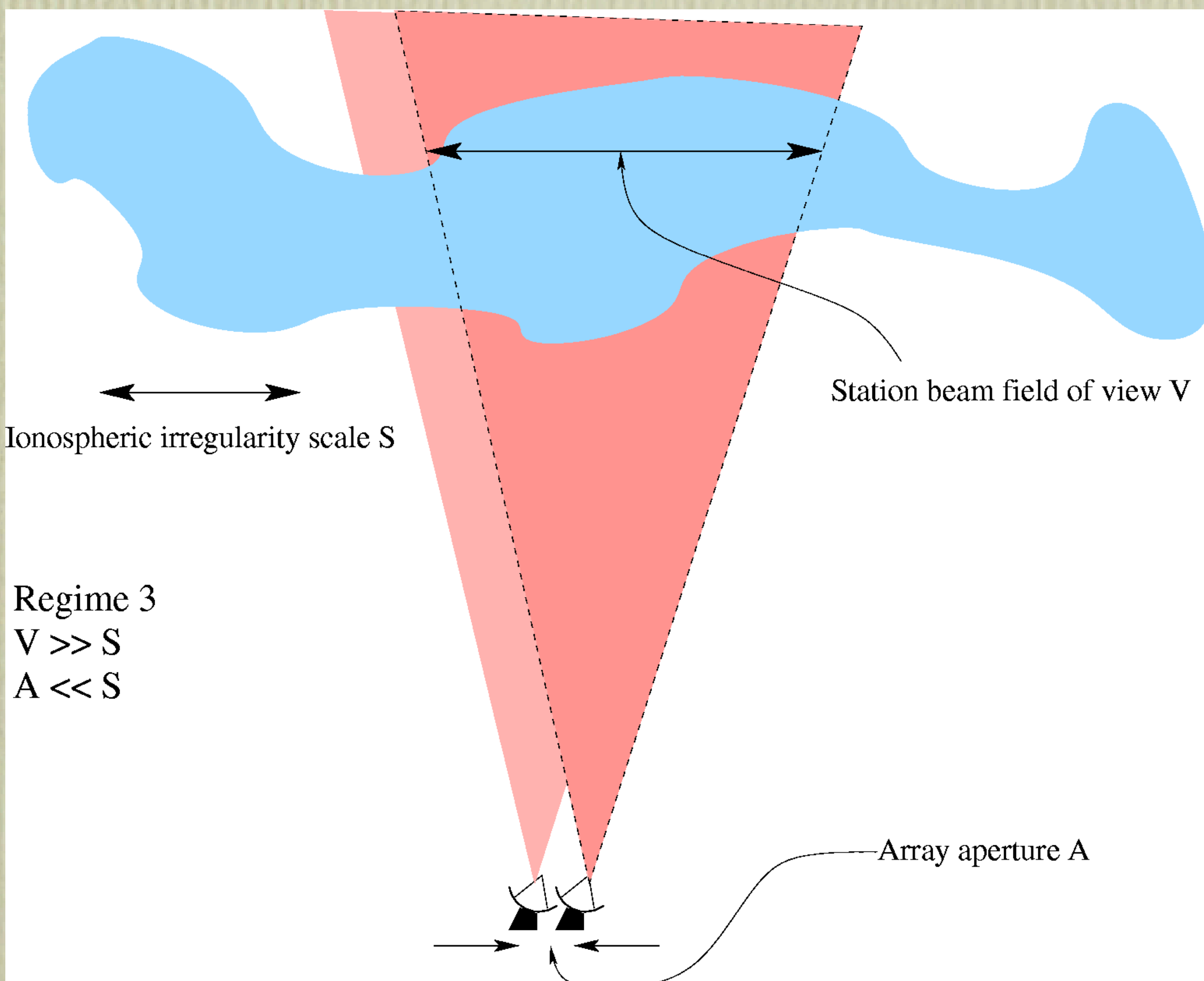
- Ionospheric calibration
- Wide fields of view

Challenges 1: Foregrounds

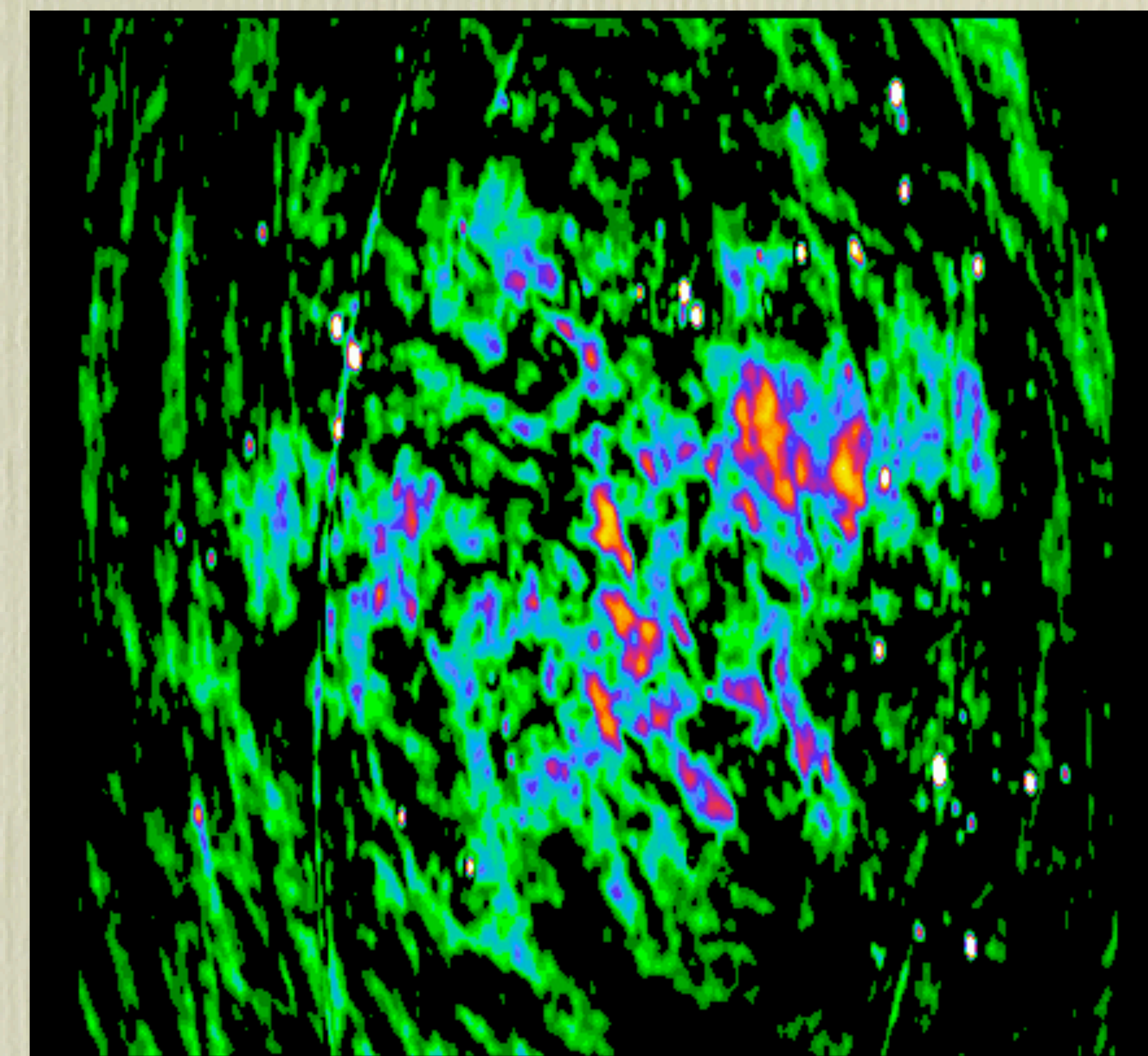
- Faint point sources
- Smooth galactic emission
- Galactic radio recombination lines
- RFI
- Others!



Challenges 2: Ionosphere & Polarization



Lonsdale (2004)



325 MHz polarized flux, 6° x 6°, 4’ beam, 5 K peaks (de Bruyn)

Mileura Widefield Array – Low Frequency Demonstrator

MWA-LFD Collaboration

MIT

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Harvard/CfA

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M. Lynch, D. Herne, B. Stansby

CSIRO/ATNF

J. Bunton, C. Jackson, M. Storey

ALSO

U. Tasmania, U. Sydney, W. Australian Gov't

Goals of MWA-LFD

- Key science drivers:
  - Epoch of Reionization
  - Heliospheric science — FR & IPS
  - Radio transients

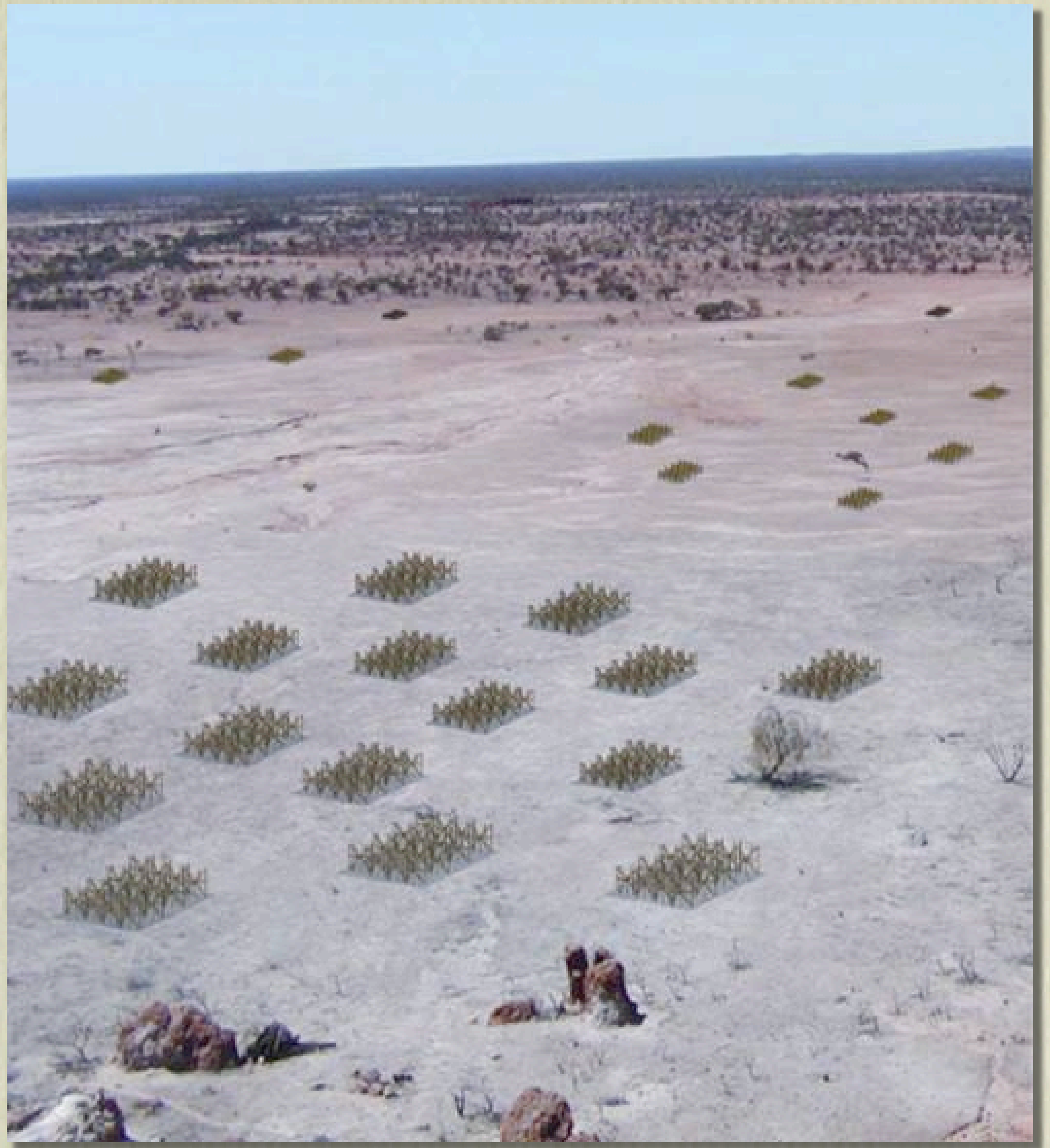
Mileura Station

Very radio quiet

Antenna

Mileura Widefield Array – Low Frequency Demonstrator

- 500 16 dipole antennas
- Radio quiet Mileura site
- Full cross-correlation of all 500 antennas
- Very wide 20°– 40° field of view
- Strict attention to systematics



LOFAR

- Two antenna types (30-80, 120–240 MHz)
- 45 stations (virtual antennas)
- 100 km baselines
- Very large collecting area

Long Wavelength Array

- Very low frequency (10-80 MHz)
- Very long baselines (400 km)
- Co-located with the VLA

MWA vs. LOFAR vs. LWA Cheat Sheet

	MWA	LOFAR	LWA
Frequency Coverage	80–300 MHz	30–80 MHz 120–240 MHz	10–88 MHz
Field of View (typical)	30° across	2° across	3° across
Collecting Area (typical)	8 x 10^3 m^2	1.9 x 10^5 m^2	6 x 10^4 m^2
Angular resolution	4 arc min.	6 arc sec.	3 arc sec.
Bandwidth	32 MHz	32 MHz	32 MHz

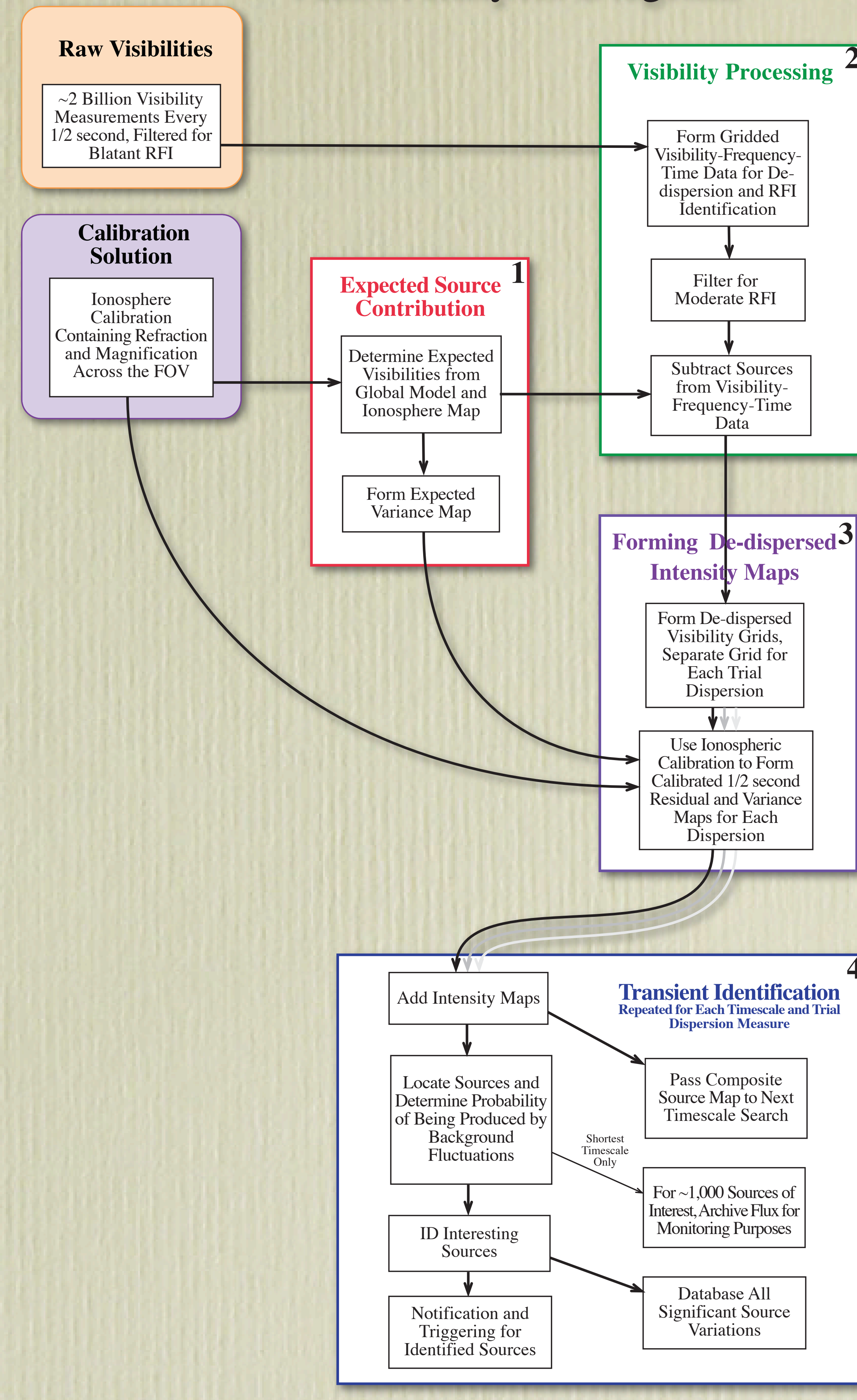
Capabilities that compliment GLAST

- Transients
- Source monitoring
- Magnetic fields

ASM Transient Search

- 5 dimensional search over position, start time, duration, & dispersion measure
- Typical coverage of ~0.3 str., ~2π str. at reduced sensitivity
- Minimum timescale of 8 sec. (initial, 1/2 sec. ultimate)
- Alerts will be formed for the community once system is fully developed (collaborators welcome)
- Roger Cappallo, lead

ASM Analysis Diagram



Monitoring with Tracking Lightcurve Analyzer

- We cannot save all of the ASM snapshots
- We can save light curves for thousands of interesting sources
  - 8 second resolution
  - ~4 arc min. pixel
  - 32 MHz bandwidth
  - ~32 kHz spectral resolution
  - Full Stokes polarization
- Justin Kasper, lead

Magnetic fields

- Through use of Faraday rotation, can map magnetic fields
- MWA & LOFAR should produce a full sky survey of rotation measure
- LOFAR & LWA can produce high resolution maps of particular sources
- MWA can produce magnetic tomography of solar events
- Bryan Gaensler, lead; Justin Kasper, solar lead;

Conclusion

Powerful opportunities for synergy between low frequency radio and GLAST observations