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OBSERVING THE LOW FREQUENCY RADIO SKY WITH PAPER

Collaborators

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38:25:59.24 N
-79:51:02.1 W
Green Bank, WV

30:43:17.5 S
21:25:41.9 W
Karoo, ZA

PAPER Array Status

- Currently, each array consists of 32 elements

- PAPER Green Bank **(PGB)** is internet linked and can be operated remotely
  - In the middle of antenna reconfiguration

- The internet is making its way out to PAPER South Africa **(PSA)**
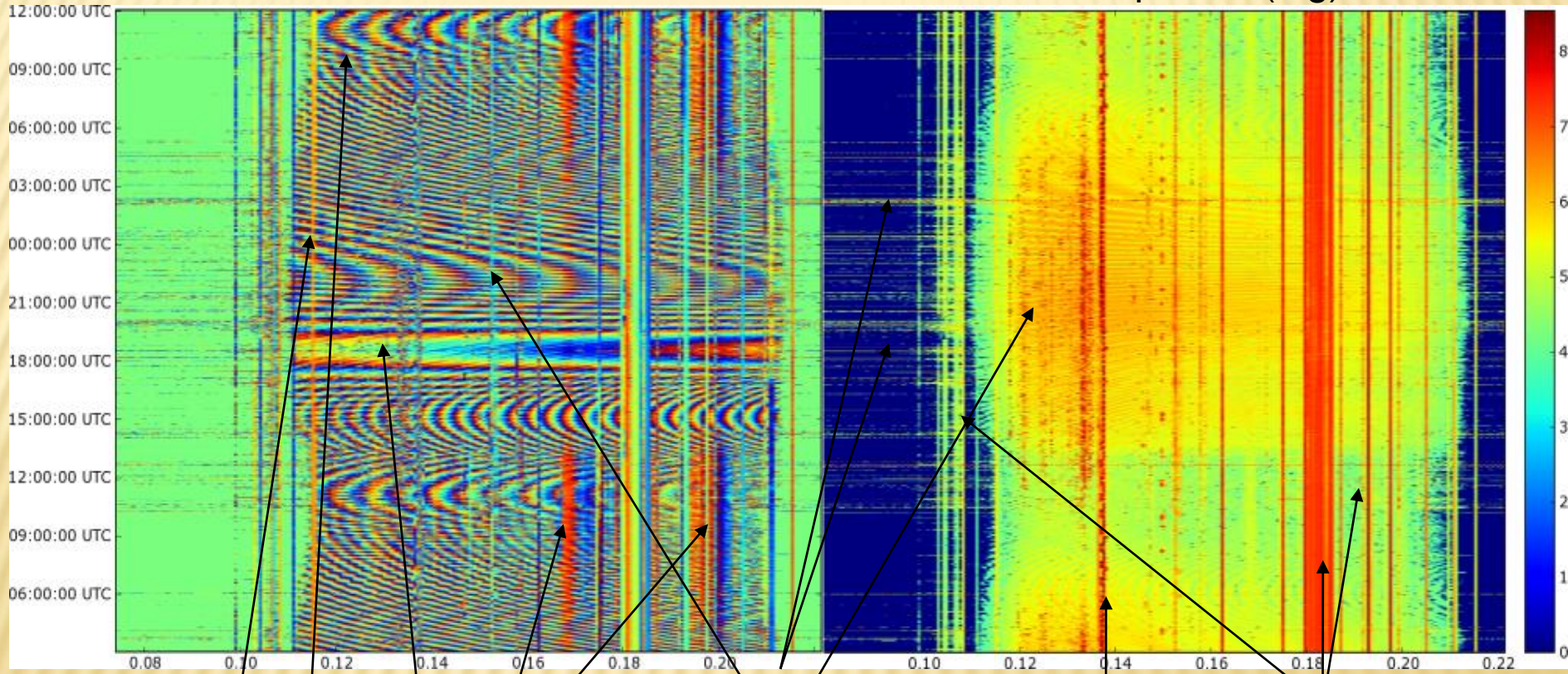 - Expansion to 64 dipoles in the next few months

Why Two Arrays?

- Complete sky coverage

- PGB: convenience
  - technology testbed site

- PSA: data quality
  - science site

PGB: 1 DAY, 1 BASELINE

Phase · Amplitude (log)

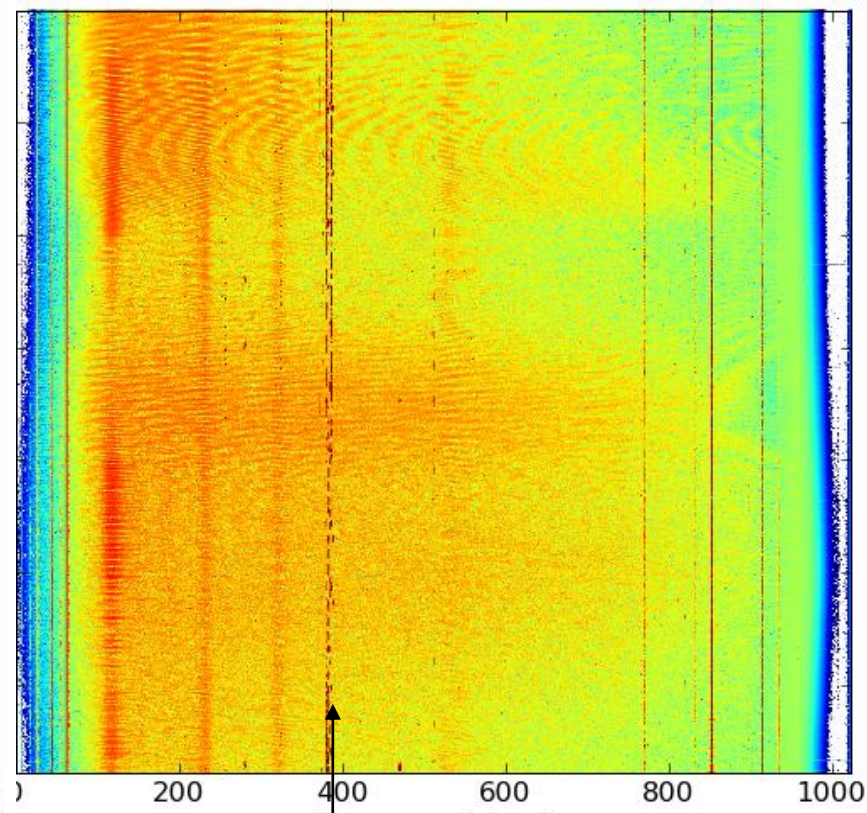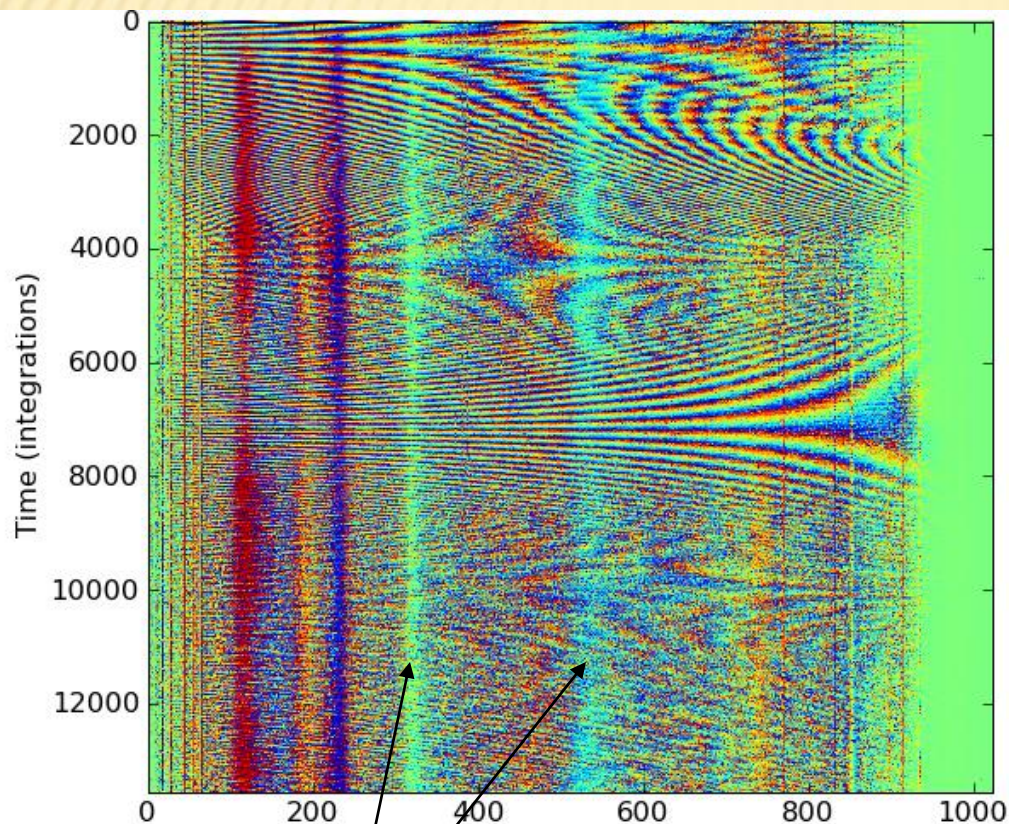Fringes (Cas,Cyg,Sun) · Crosstalk · Intermittent TX · Beating sources · Satellite TX · TV/Aircraft TX
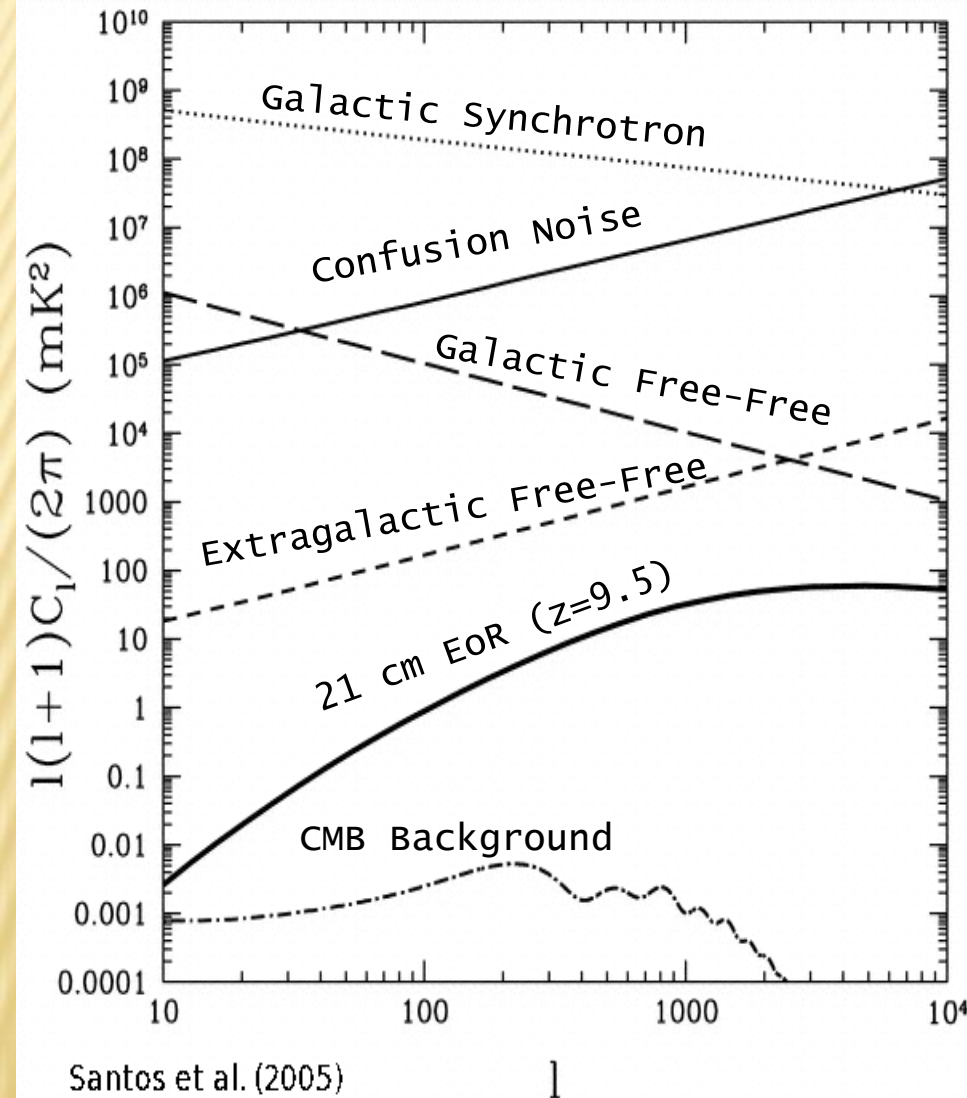
PSA: 1 DAY, 1 BASELINE

Phase

Amplitude (log)


Crosstalk

Satellite TX

Foregrounds

Santos et al. (2005)

- EoR is a long ways down there!

- Techniques proposed for foreground removal

- At some level, no substitute for foreground characterization

THE LOW-FREQUENCY RADIO SKY

- ~1-2 days data from PSA & PGB
- 5 brightest sources removed using Delay/Delay-Rate filters (Parsons and Backer 2009)
- Sources down to 1 Jy detected with high significance
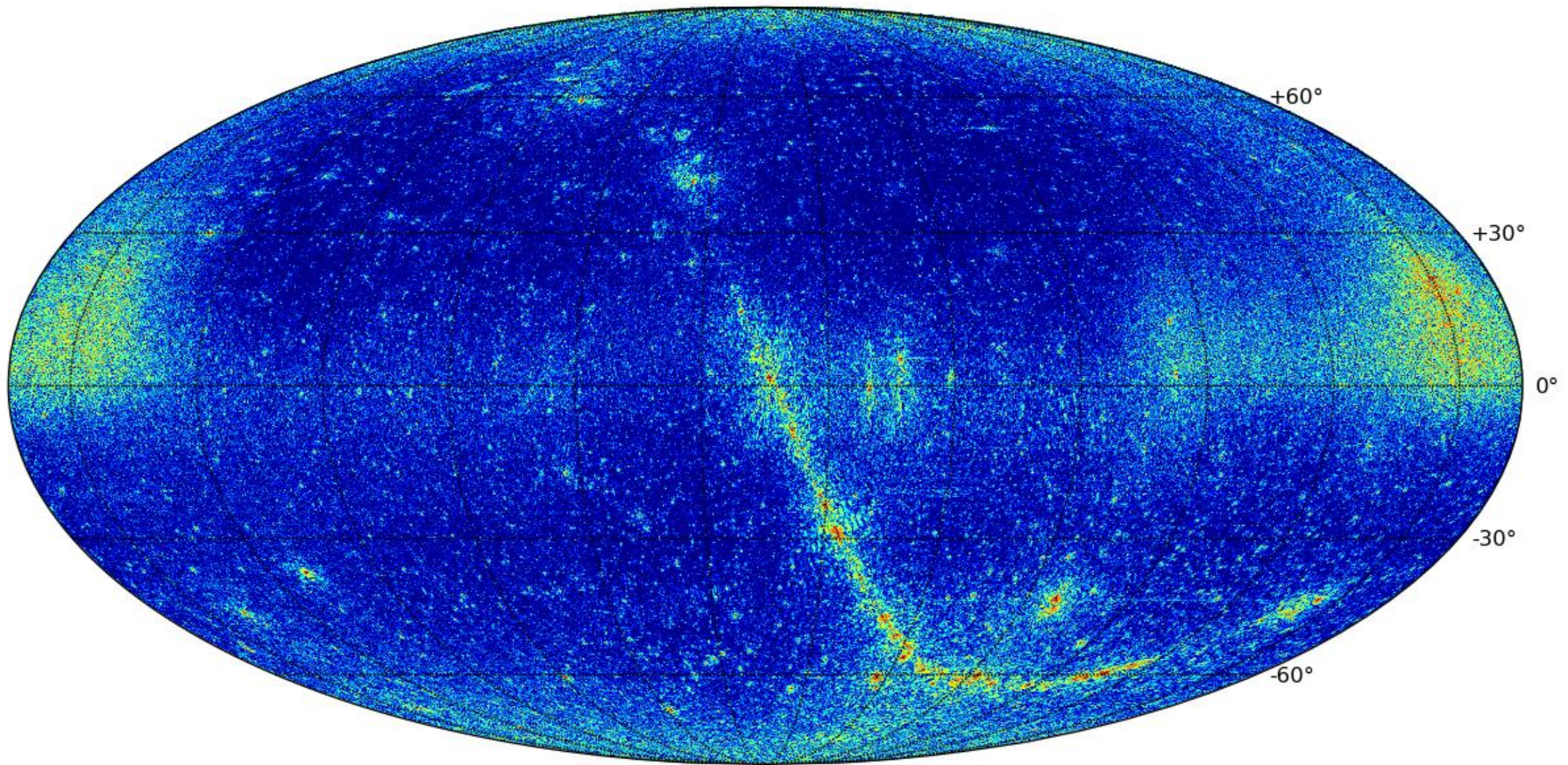
THANKS!

Delay/Delay-Rate Transform

- 1 hour of data with Cas A, Cyg A, Tau A
- Phase to a source (here, Cas A)
- FFT of frequency axis = "Delay Image"
- FFT of time axis = "Delay/Delay-Rate"
- Cas A is confined to a region near origin
- PSF determined by bandpass + time variabliit
- Can recover bandpass + beam functions
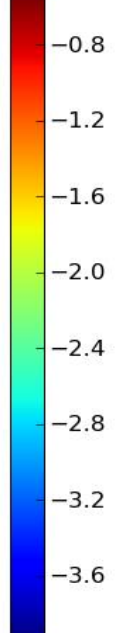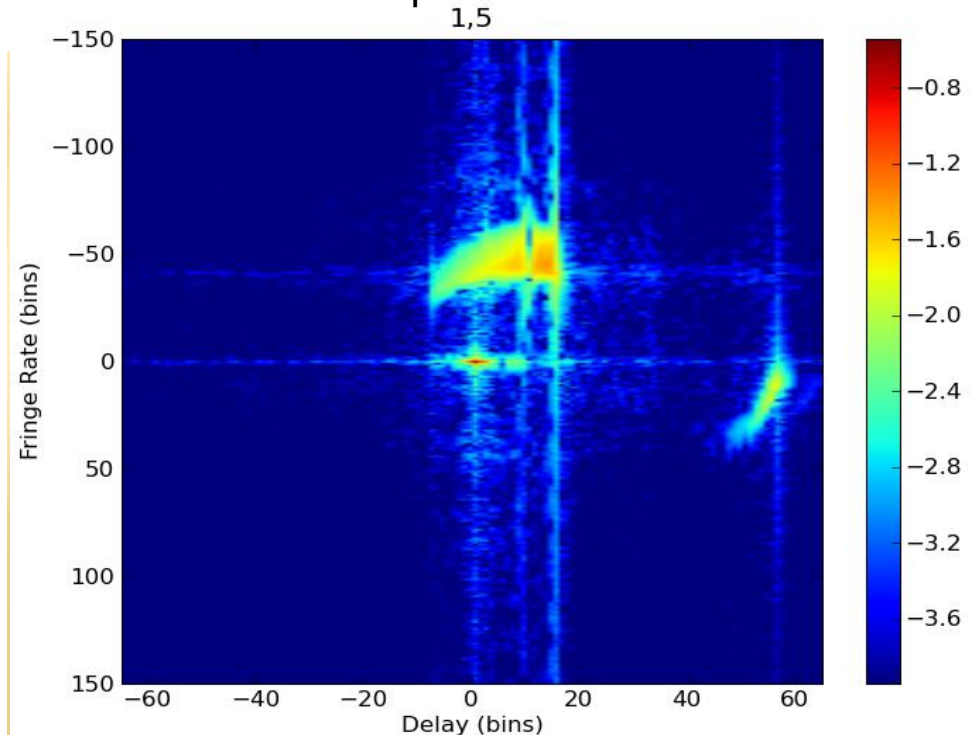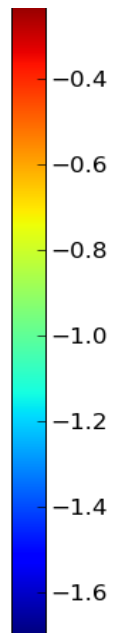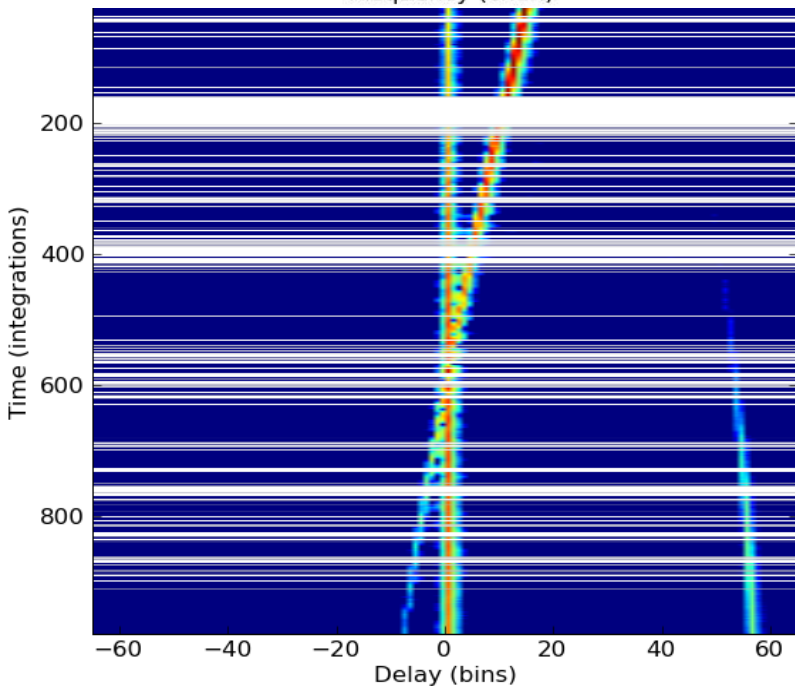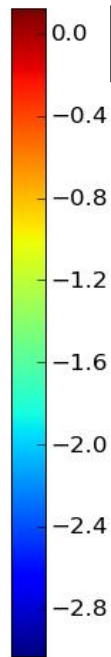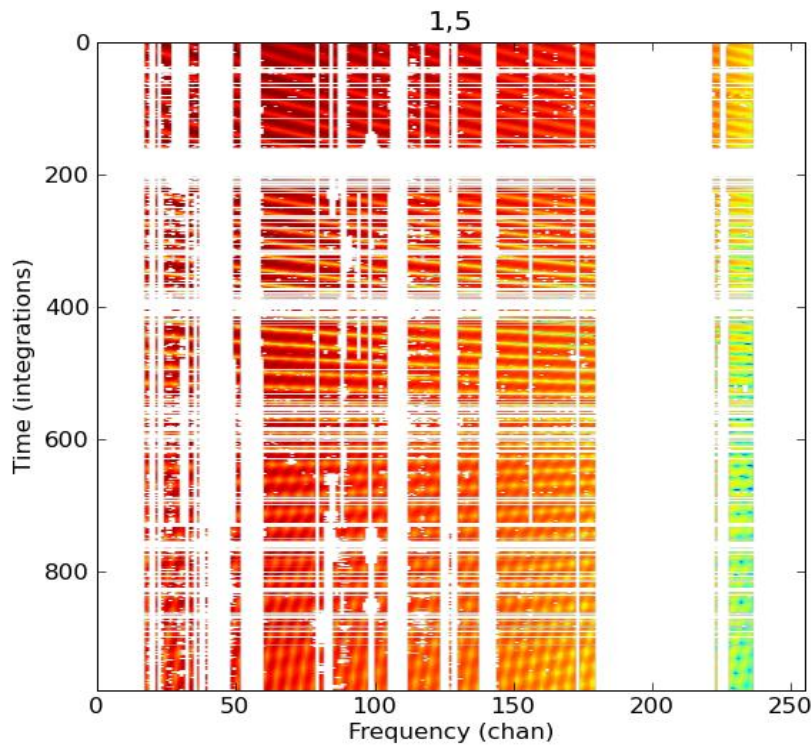
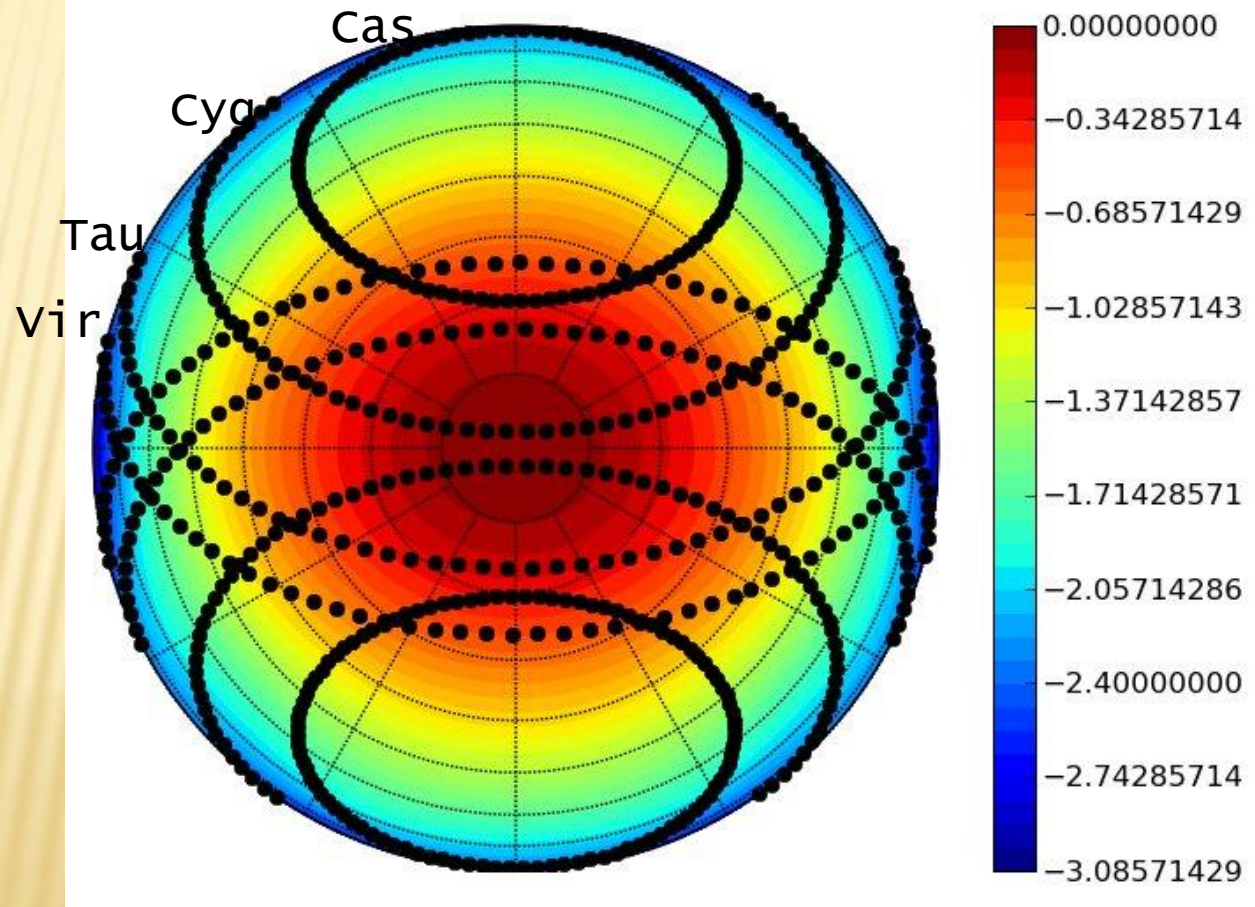# DDR Filters Used as Source Estimators
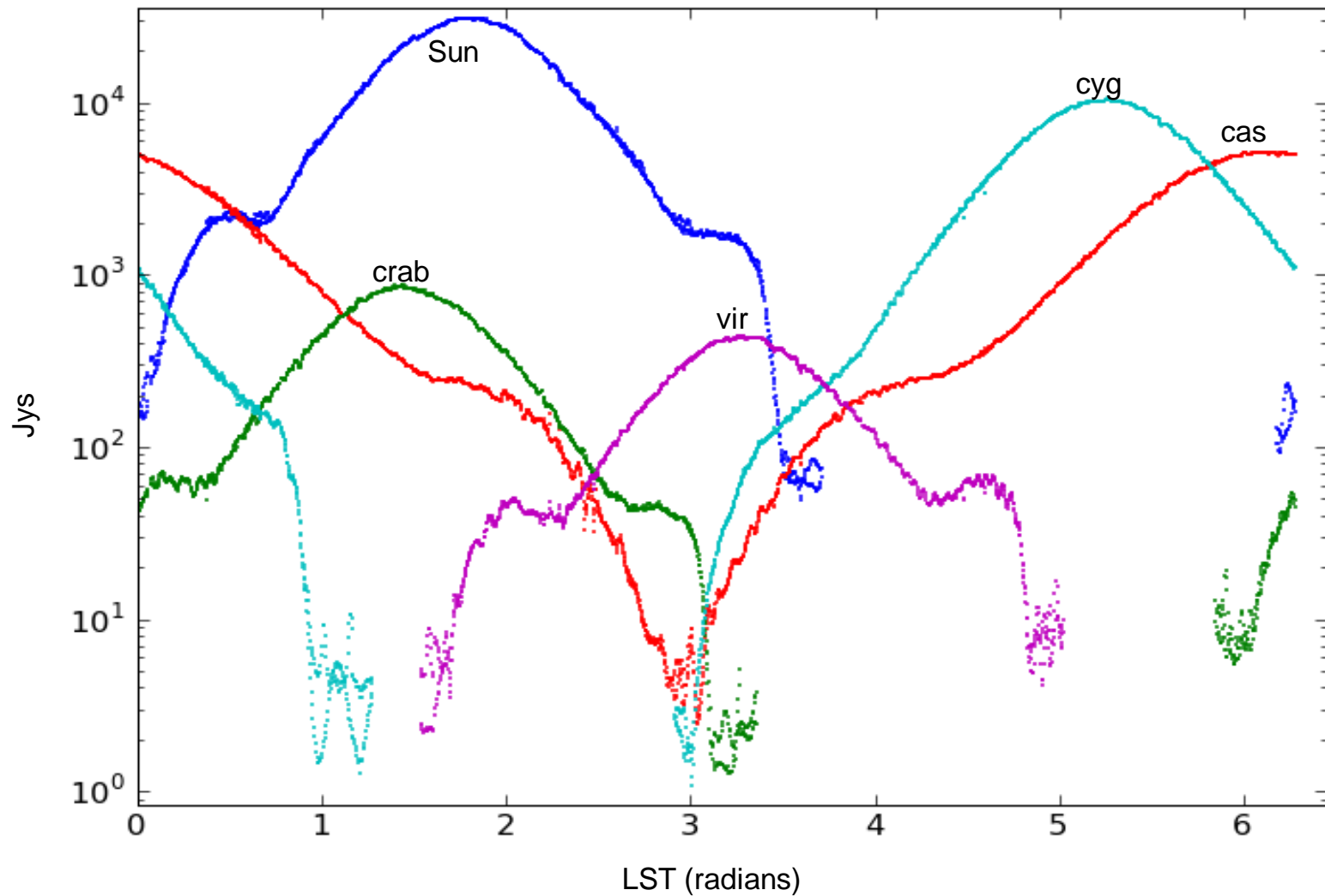
Improving Beam Model
with Calibrator Sources

- Isolate big sources with DDR filters
- Control time-dependent gains (GoM)
- Sources relate beam strength along a track
- Relating tracks takes some assumptions/creativity...

Beam Variation Mapped Using Orbcomm Satellites