

LOFAR/CS1

Beams and Images

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Beam modeling for LOFAR

Beam models for dipoles (LBA)

- Numerical: Michel Arts (Antenna group)
- Semi-Analytical: Johan Hamaker
- Analytical

Beam models for stations:

- Analytical (without mutual coupling)
- Numerical (with mutual coupling)

Understanding the beam is essential for processing of LOFAR data!

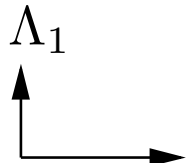
What is the beam?

1.



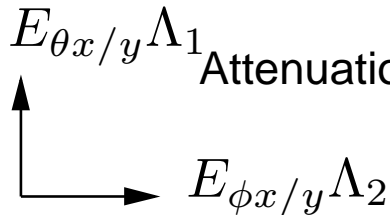
Arbitrarily Polarized Radiation
Approaching

2.



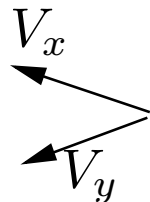
Decomposition into Horizontal
and Vertical Components

3.



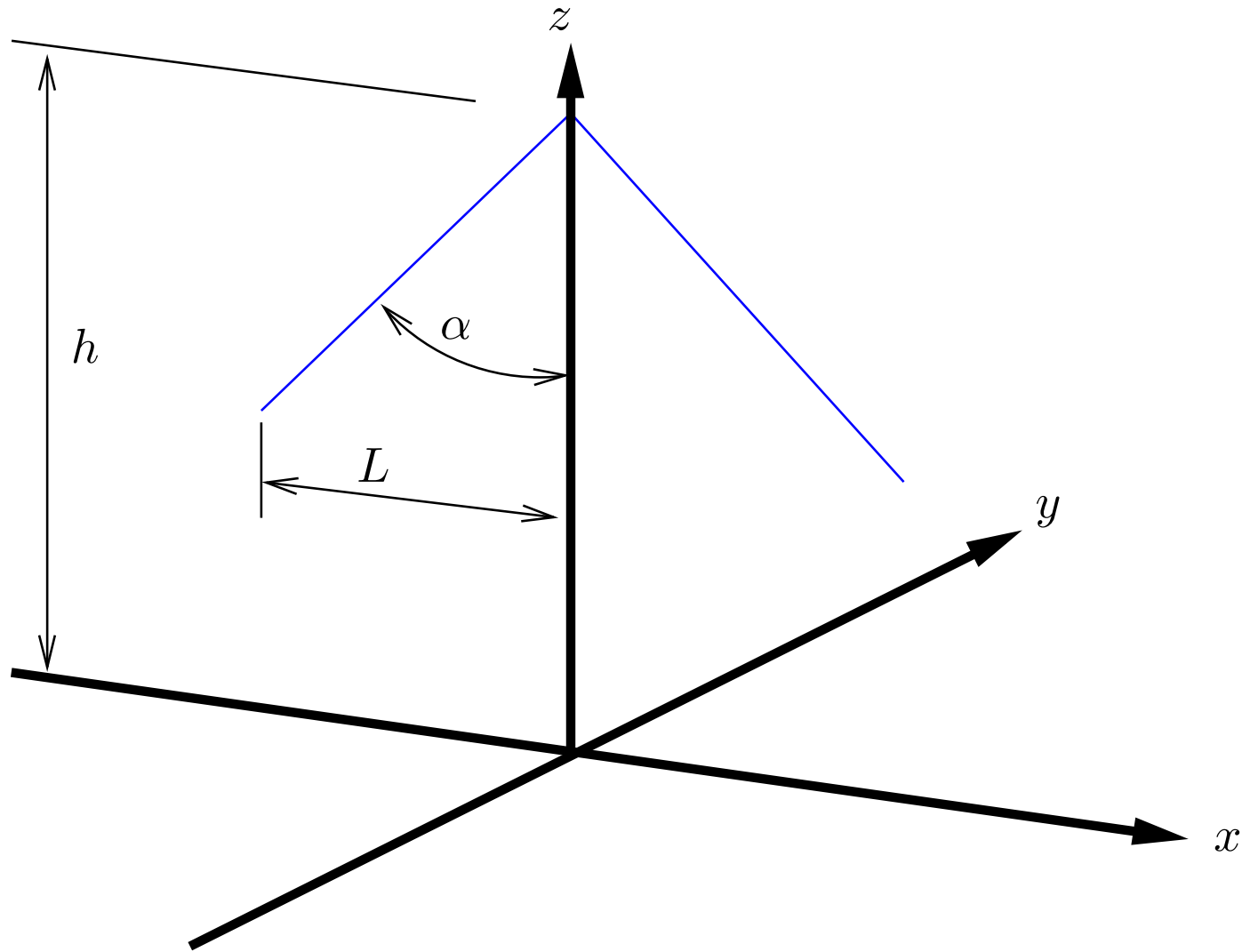
Attenuation by the X/Y beams

4.

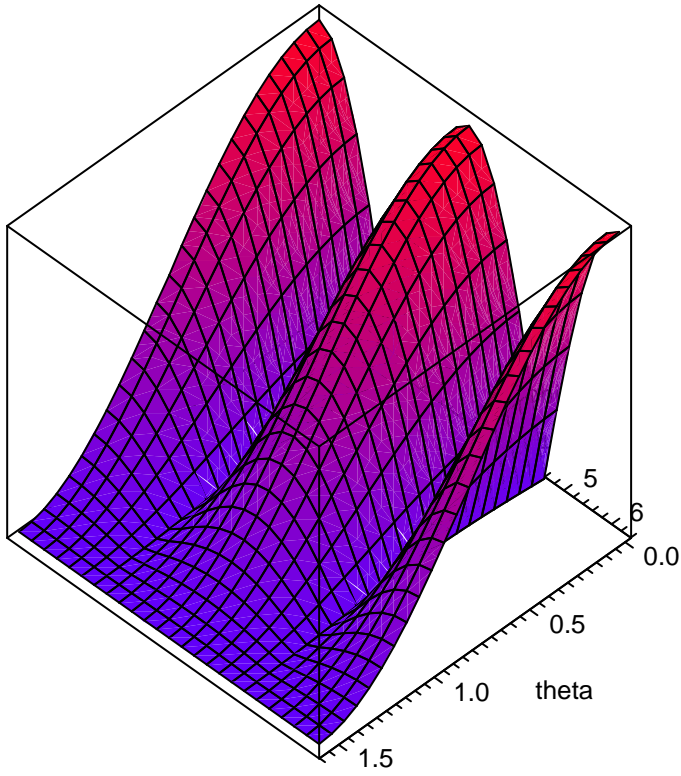


by Reciprocity, current induction
in X or Y dipole

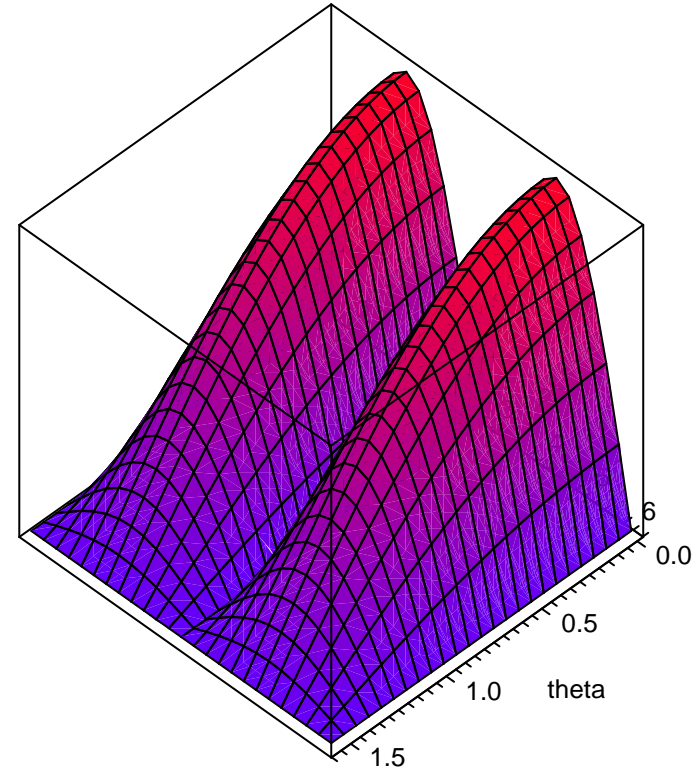
Droopy Dipole



Droopy Dipole Beam



$$|E_\theta(\theta, \phi)|$$

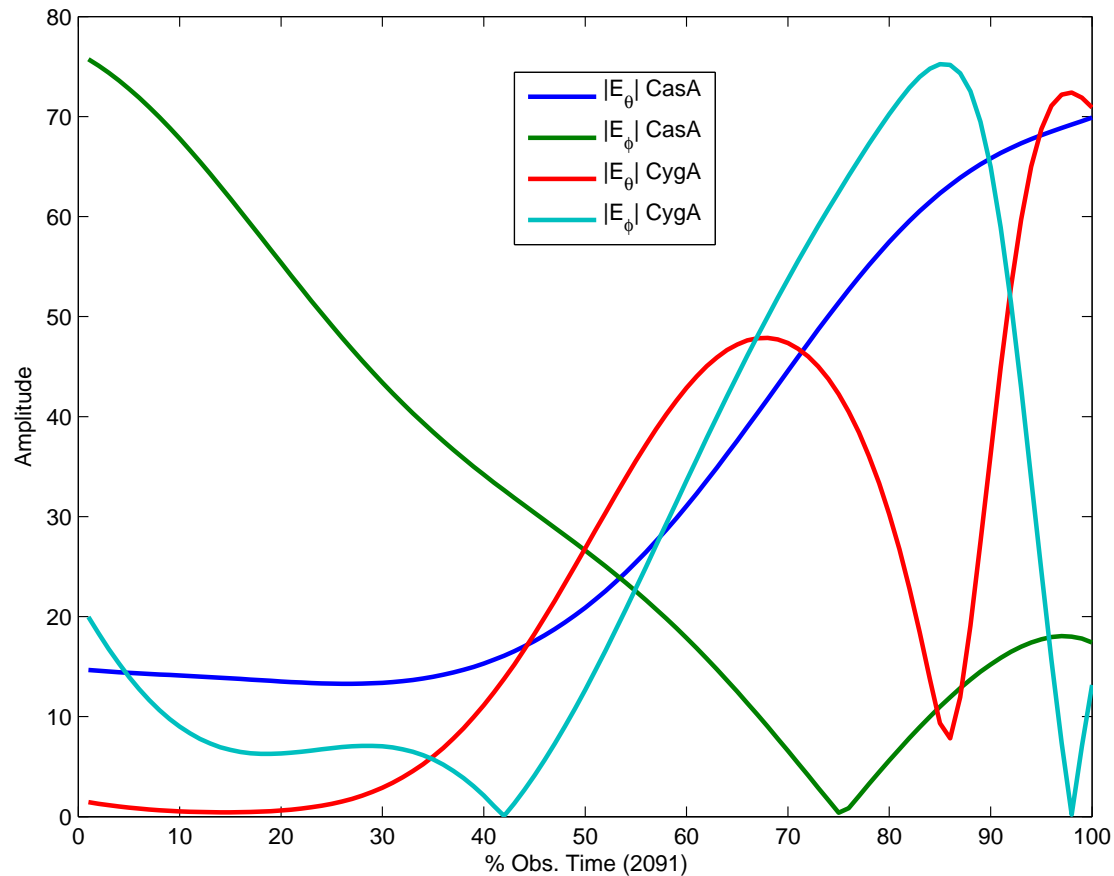


$$|E_\phi(\theta, \phi)|$$

Droopy Dipole Beam...

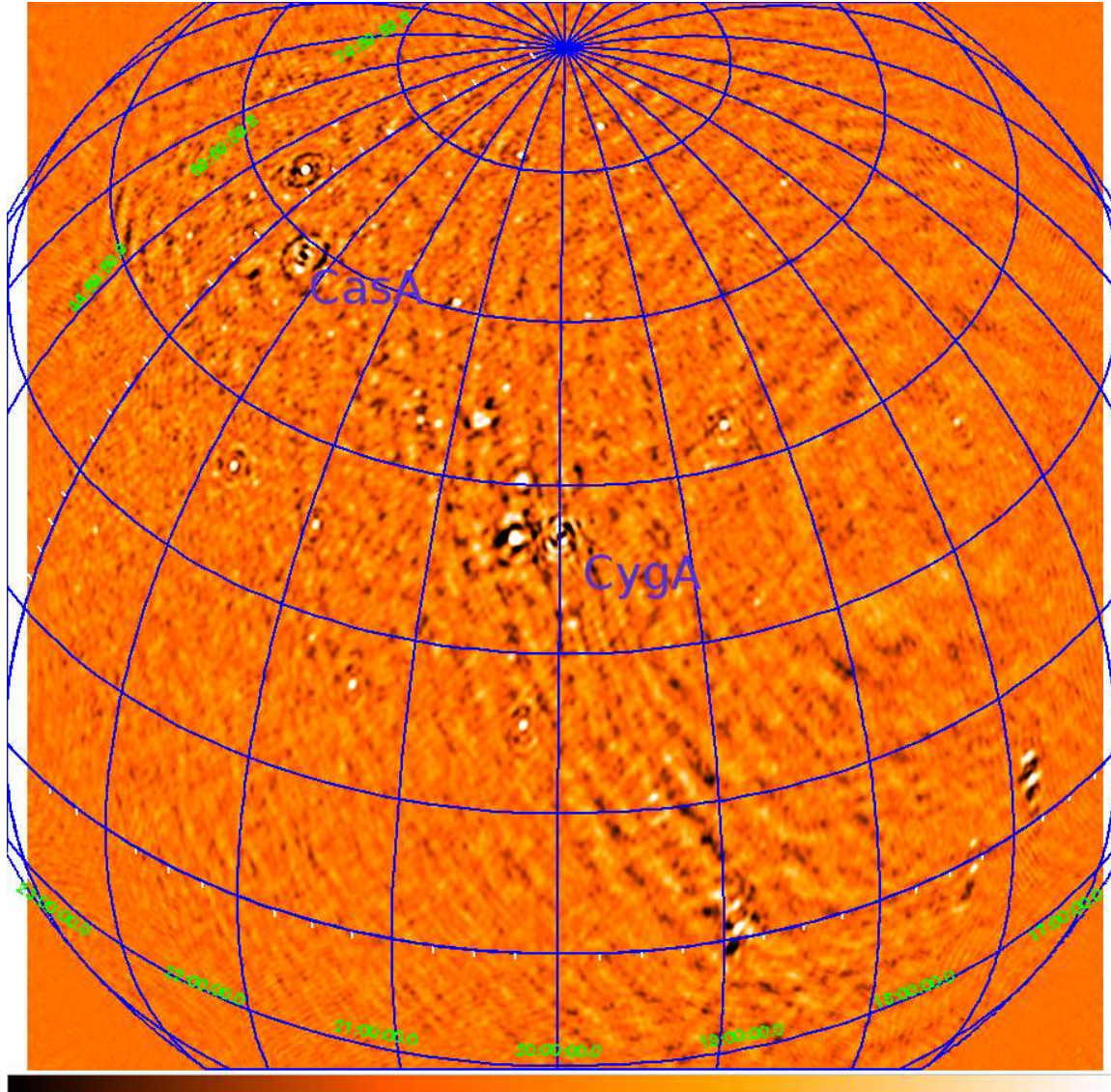
$$\begin{bmatrix} V_x \\ V_y \end{bmatrix} = \begin{bmatrix} \mathbf{E}_\theta(\gamma, \beta) & \mathbf{E}_\phi(\gamma, \beta) \\ \mathbf{E}_\theta(\gamma, \beta - \pi/2) & \mathbf{E}_\phi(\gamma, \beta - \pi/2) \end{bmatrix} \times \begin{bmatrix} \Lambda_1 \\ \Lambda_2 \end{bmatrix}$$

$\gamma = \pi/2 - \theta$ for elevation, $\beta = \phi - \pi/4$ for azimuth



Typical Beam Gains

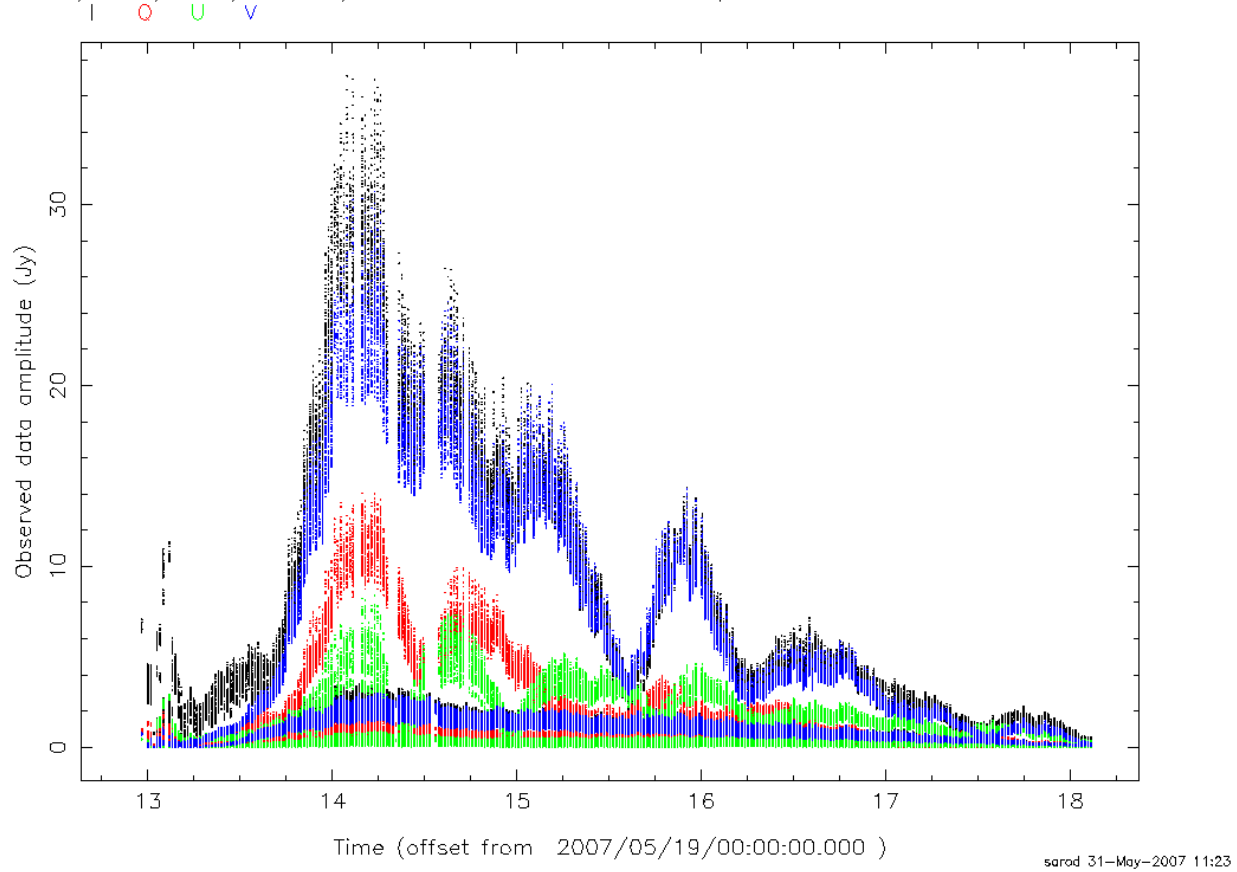
Movies...



L2007_02413

Solar Flare

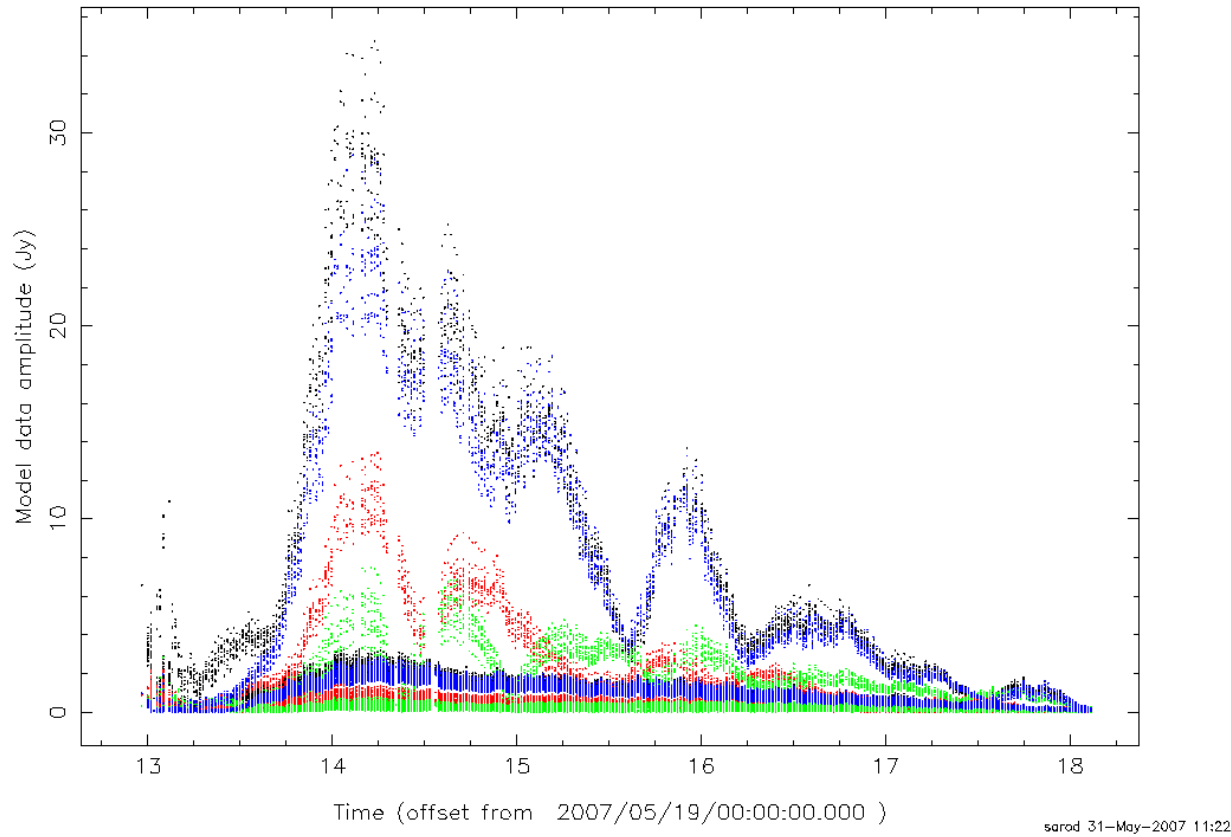
name: /home/sarod/CS1calib/L2007_02339_SB18-23_T.M5 Spectral Window: 1 Polarization: 1 Fields: BEAN



Observed Visibilities

Predicted Using Beam Model

name: /home/sarod/CS1calib/L2007_02339_SB18-23_T.M5 Spectral Window: 1 Polarization: 1 Fields: BEAM
| O U V

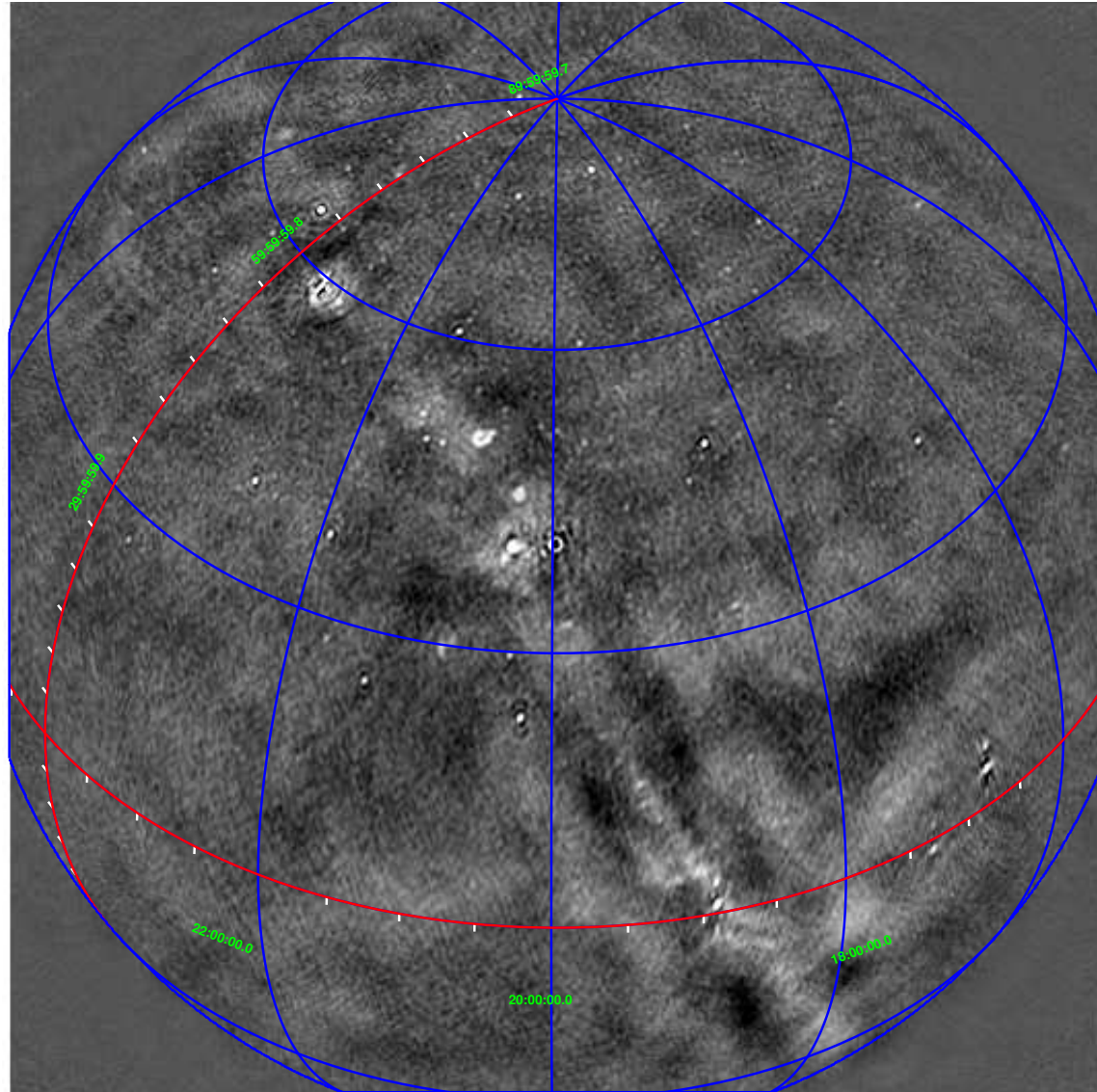


Predicted Visibilities

Pipeline Updates

- Processed so far: CasA (60 subbands), CygA (36 subbands): images available
- New tools
 - Average a whole subband to one channel
 - Combine a whole observation (multiple subbands) to one MS (single subband)
- Using new tools a 4 hr imaging job can be done in 1/4 hr.

Latest Image



L2007_02413