PAON4 first light

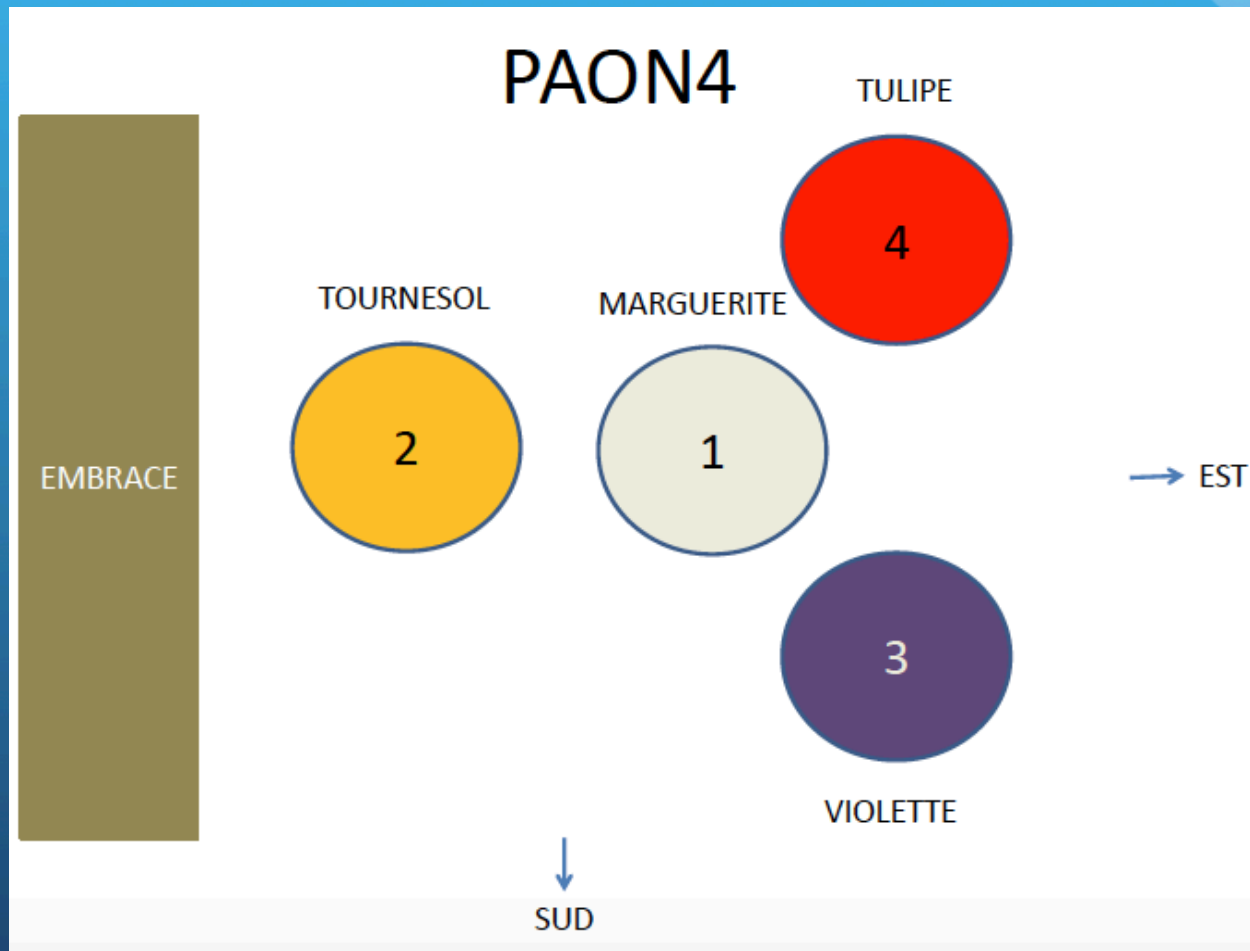## Cygnus A transit on 2 March 2015

Qizhi Huang

12 March 2015

PAON4 Antennas

Each feed has 2 polarizations,
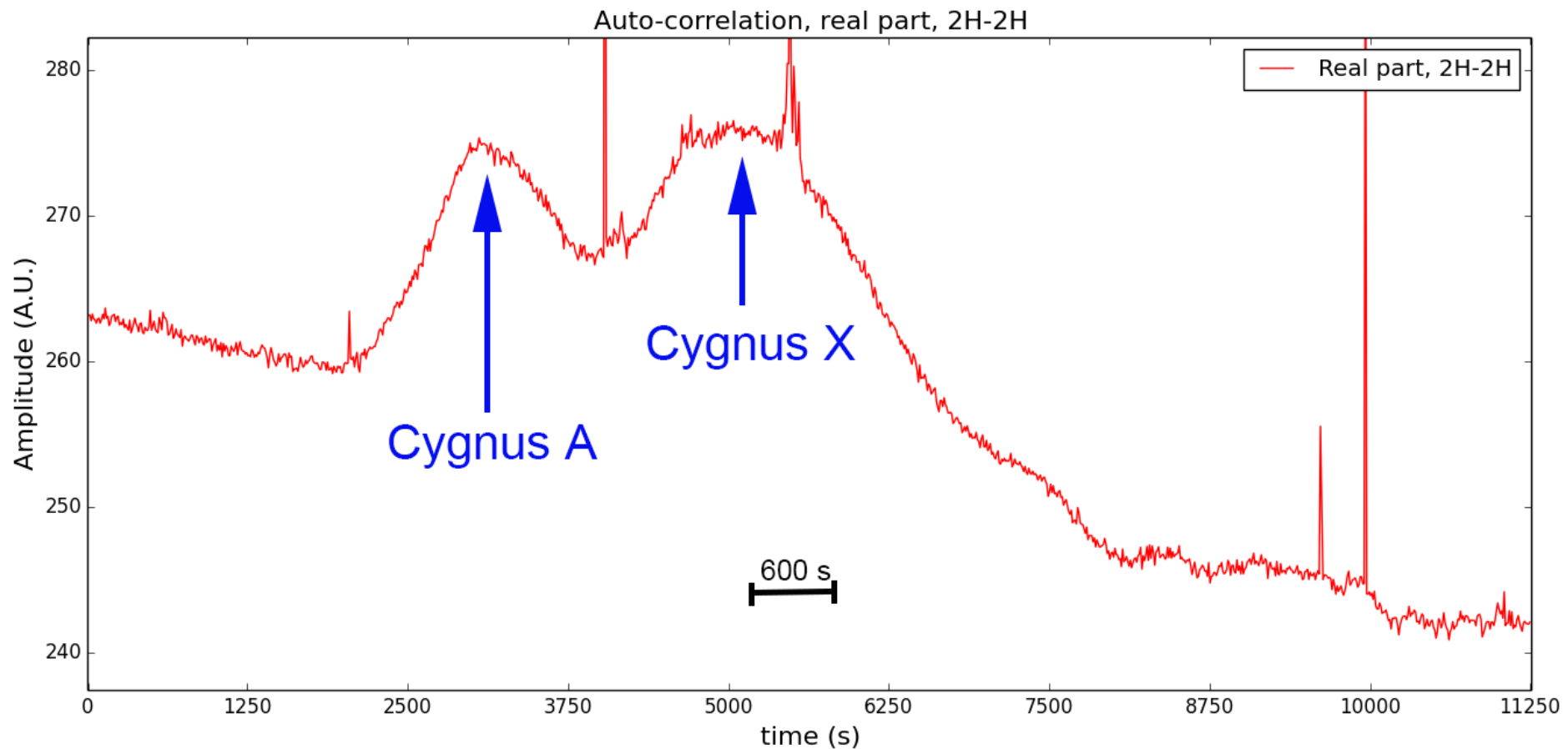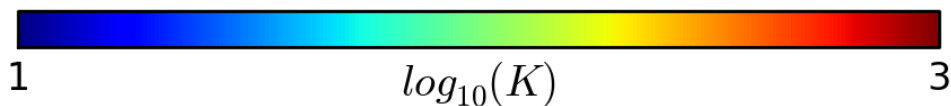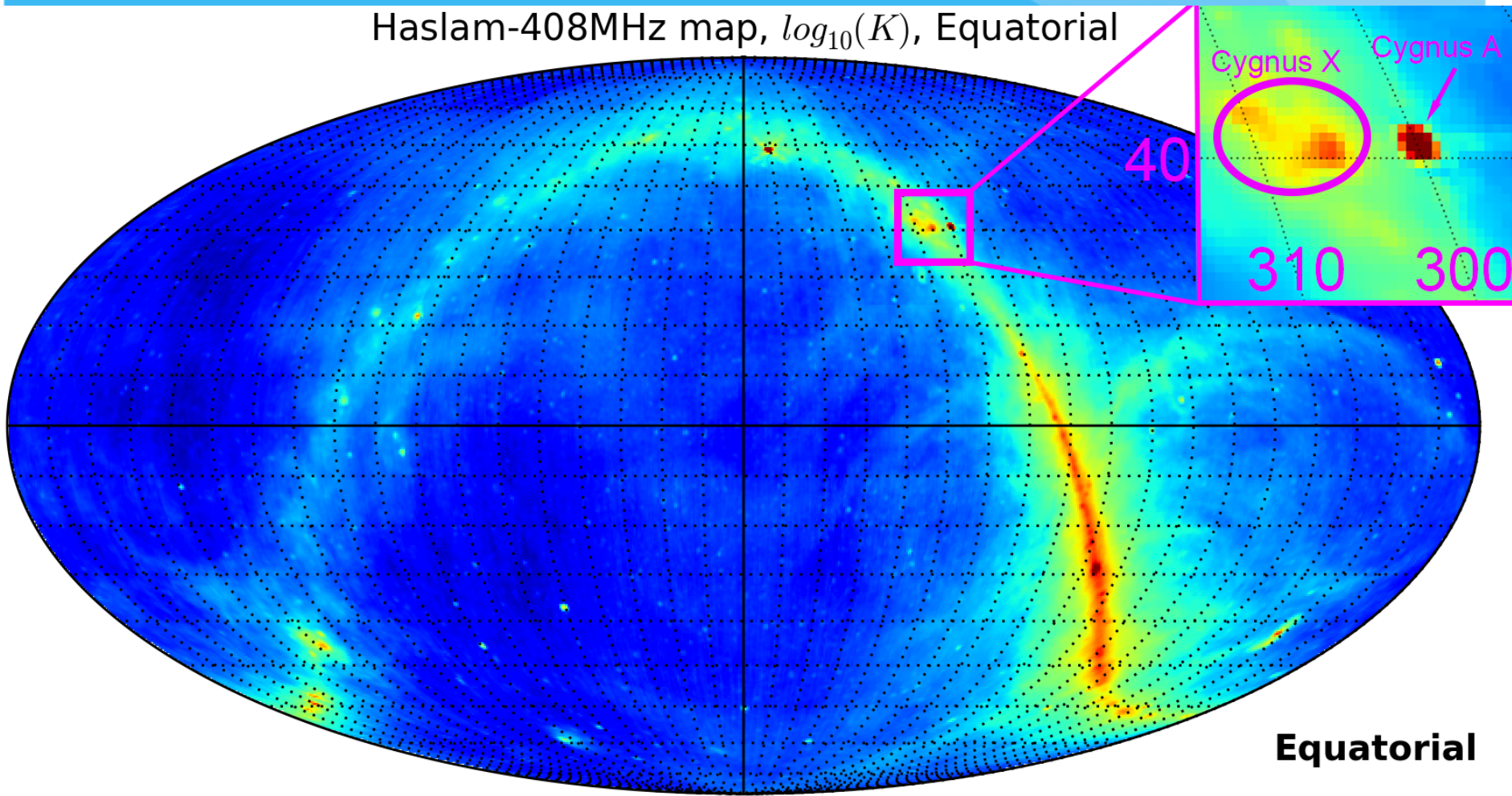Horizontal (H) and vertical (V):
(1H, 1V), (2H, 2V), (3H, 3V), (4H, 4V)

Auto-correlation

- Auto-correlation of channel 2H at 1400MHz

Auto-correlation, real part, 2H-2H

The second peak in auto-correlation

Haslam-408MHz map, $log_{10}(K)$, Equatorial

Cygnus X   Cygnus A
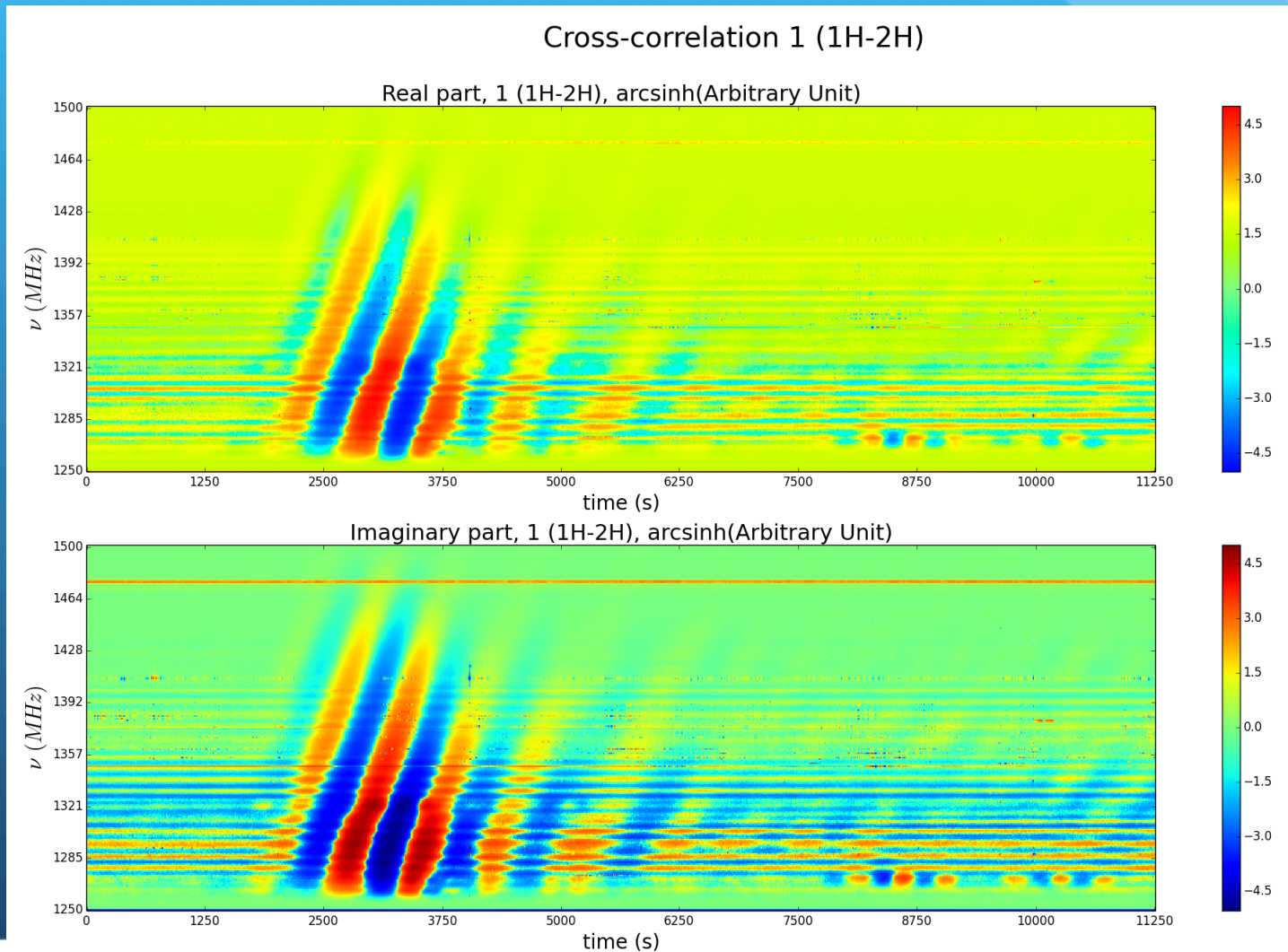
40

310   300

Equatorial

1    $log_{10}(K)$ 3

The second peak in auto-correlation

- The first peak is Cygnus A (raio galaxy):
  - Right Ascension: 19h 59m 28.36s
  - Declination: +40d 44arcmin 2.096arcsec

- The second peak is actually the so-call **"Cygnus X"**. Cygnus-X is a massive star formation region located in the constellation of Cygnus at a distance from the Sun of 1.4 kpc. Cygnus-X has a size of 200 parsecs and contains the largest number of massive protostars as well as the largest stellar association (Cygnus OB2, with up to 2600 star of spectral type OB and a mass of up to 105 solar masses). It's also associated with one of the largest molecular clouds known, with a mass of 3 million solar masses. Its stellar population includes a large number of early-type stars as well as evolved massive stars such as Luminous blue variable candidates, Wolf-Rayet stars, and supergiant stars of spectral types O and B.
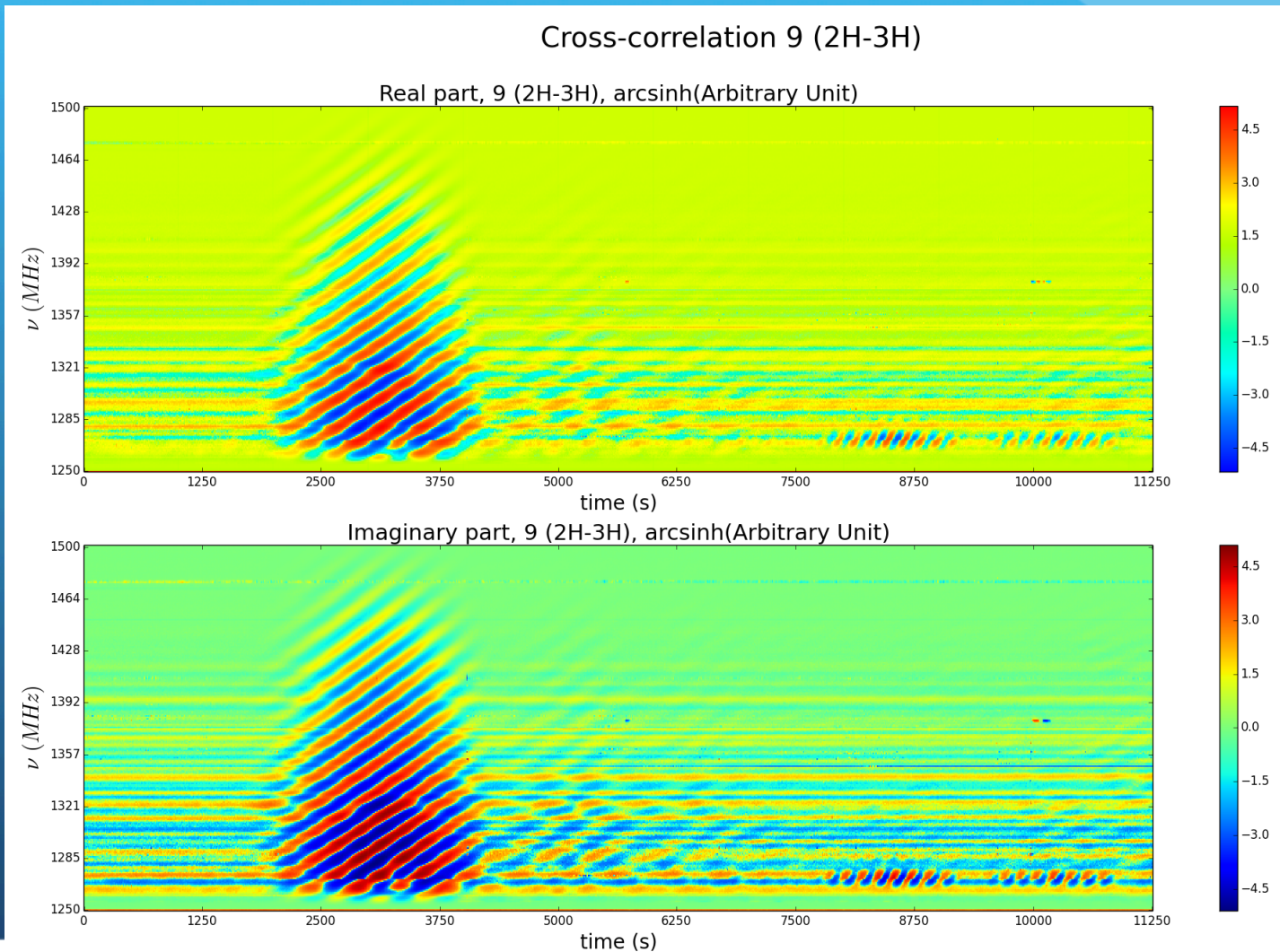
2D Cross-correlation

- Cross-correlation between two same polarizations
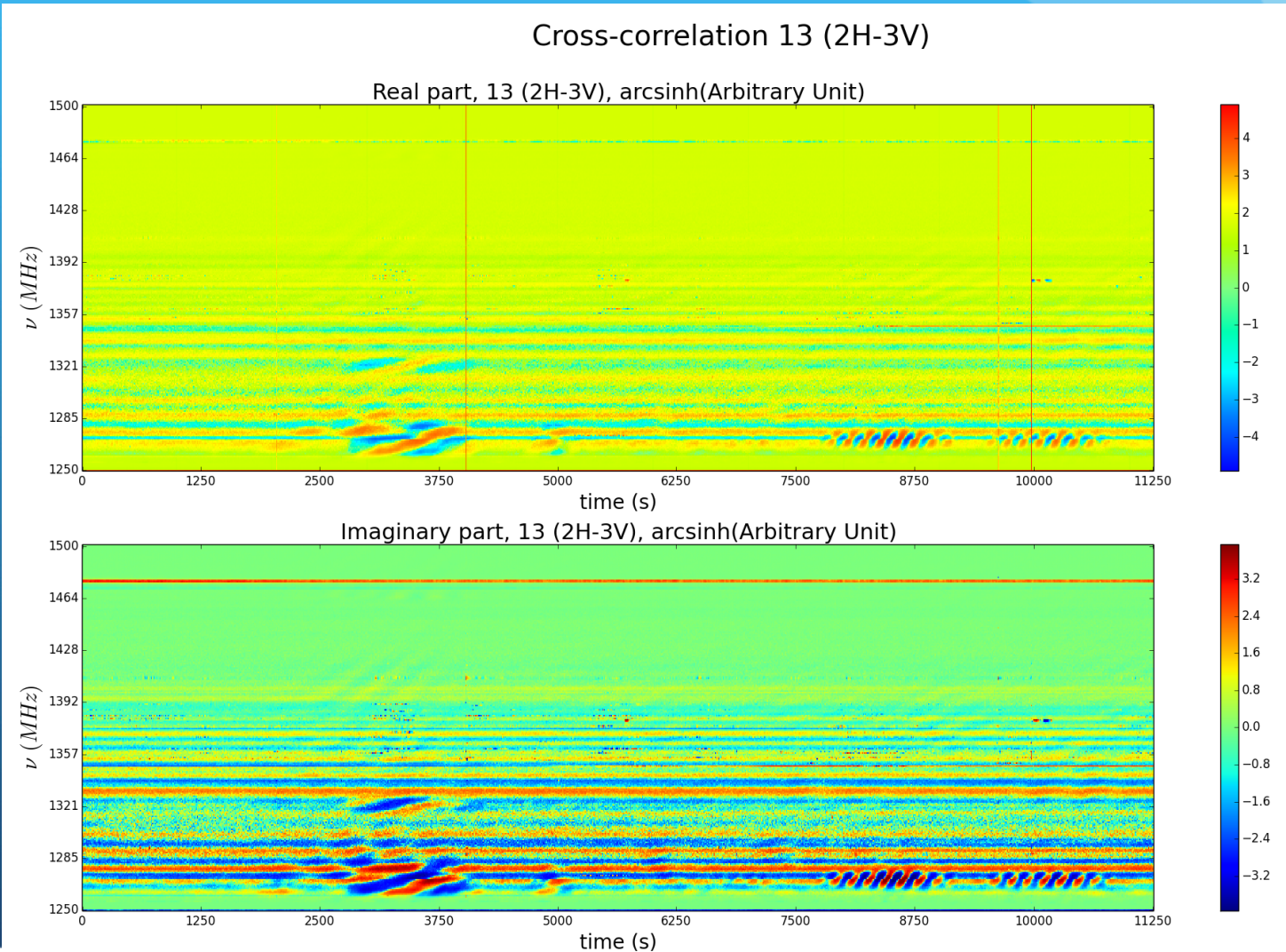
2D Cross-correlation

- Cross-correlation between two same polarizations

Cross-correlation 9 (2H-3H)

2D Cross-correlation

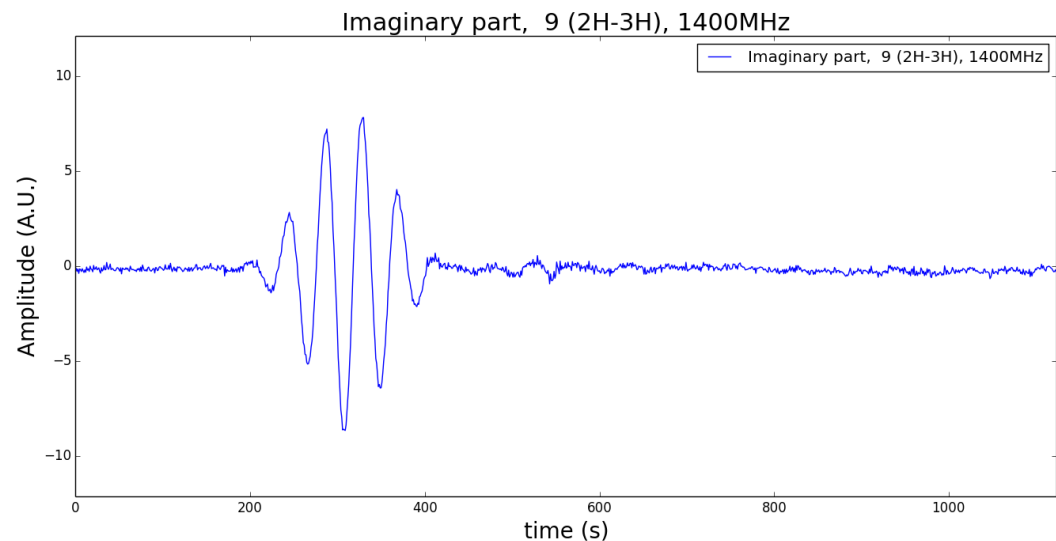- Cross-correlation between different polarizations
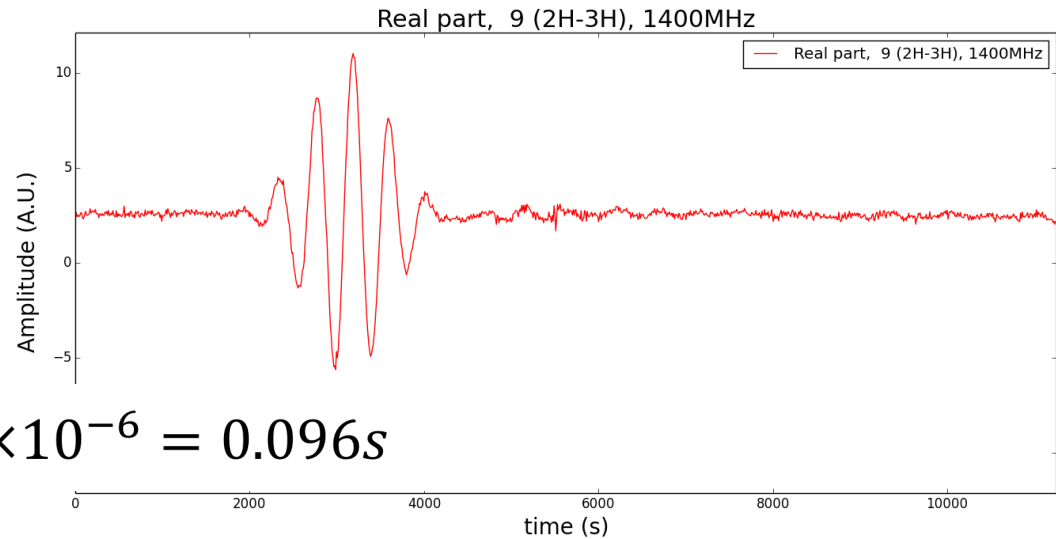
1D Cross-correlation

- the fringe at
  1400MHz

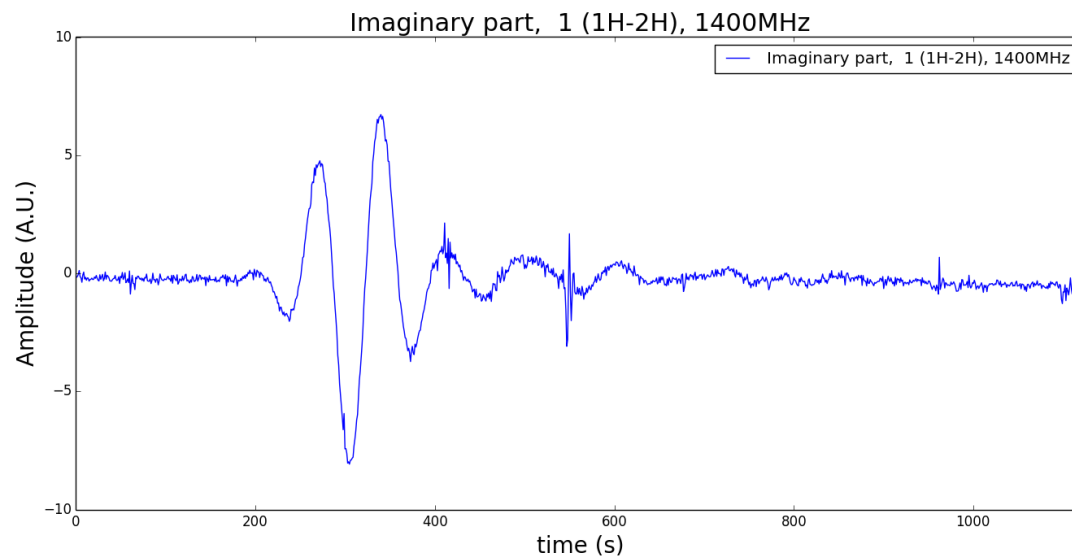$$\Delta t_{int} = 1 \times 6000 \times 16 \times 10^{-6} = 0.096s$$

$$\Delta \nu = 0.977\text{MHz}$$
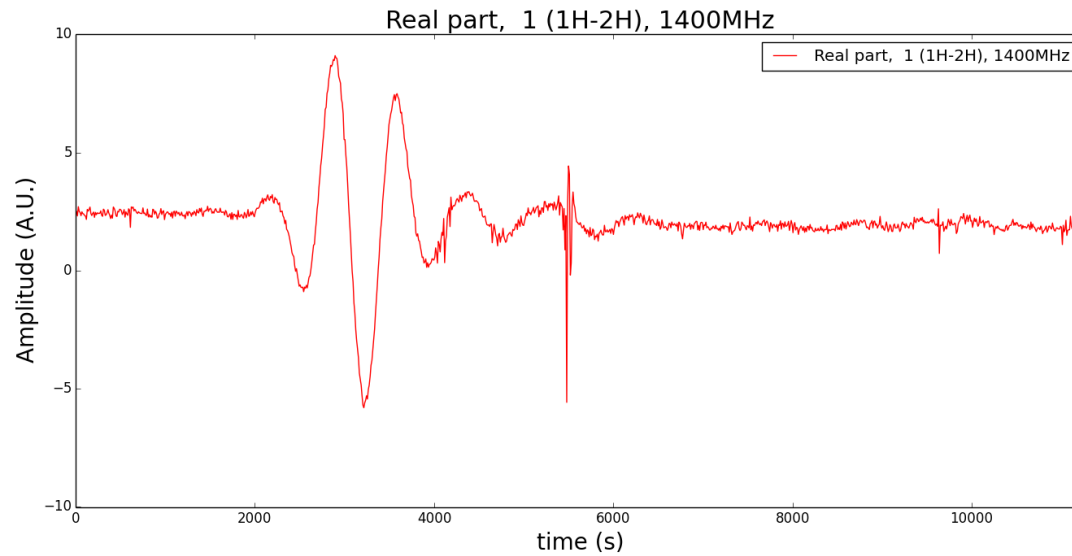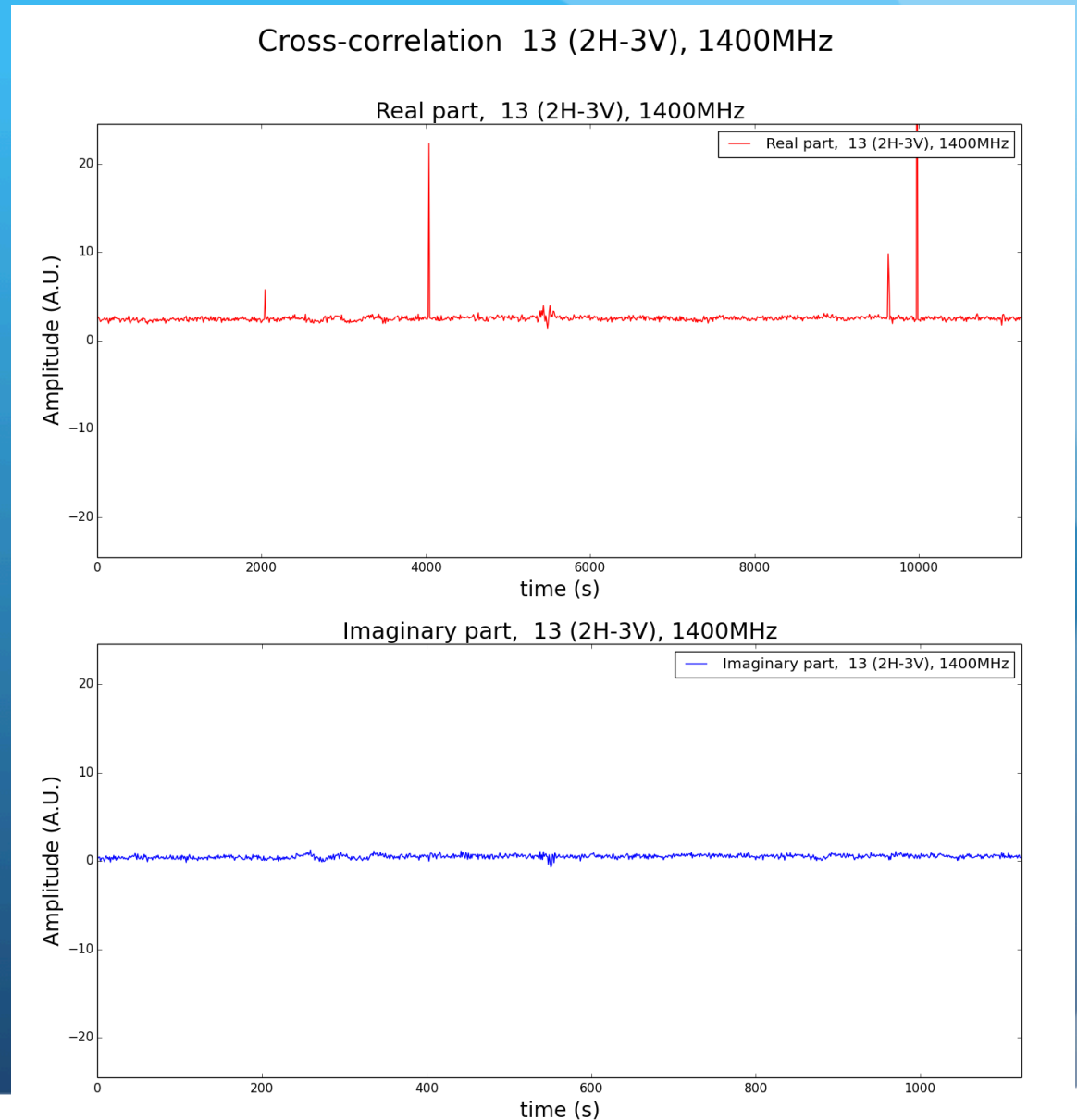
Cross-correlation 9 (2H-3H), 1400MHz

Real part, 9 (2H-3H), 1400MHz

Imaginary part, 9 (2H-3H), 1400MHz

1D Cross-correlation

Cross-correlation 1 (1H-2H), 1400MHz

1D Cross-correlation

- Between different polarizations
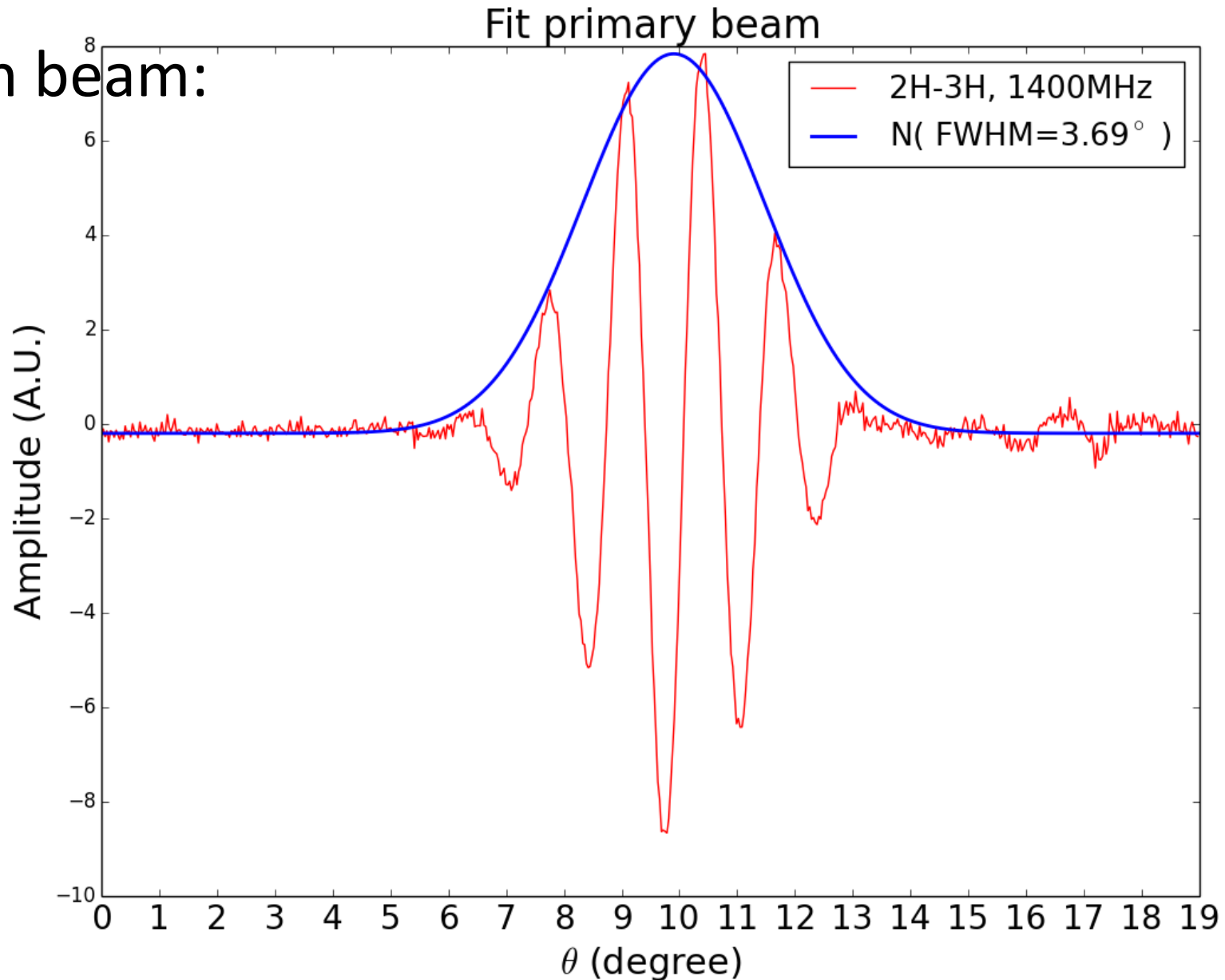

Cross-correlation 13 (2H-3V), 1400MHz

Fringe rate

- Baseline (1,2)

  length of east-west projection: 6.8m

  Fringe duration: 0.097hour=5.8minutes

  Fringe rate: 10.3/hour

- Baseline (2,3)

  length of east-west projection: 10.4m

  Fringe duration: 0.058hour=3.5minutes

  Fringe rate: 17/hour

Fit the primary beam

Gaussian beam:

Fit primary beam

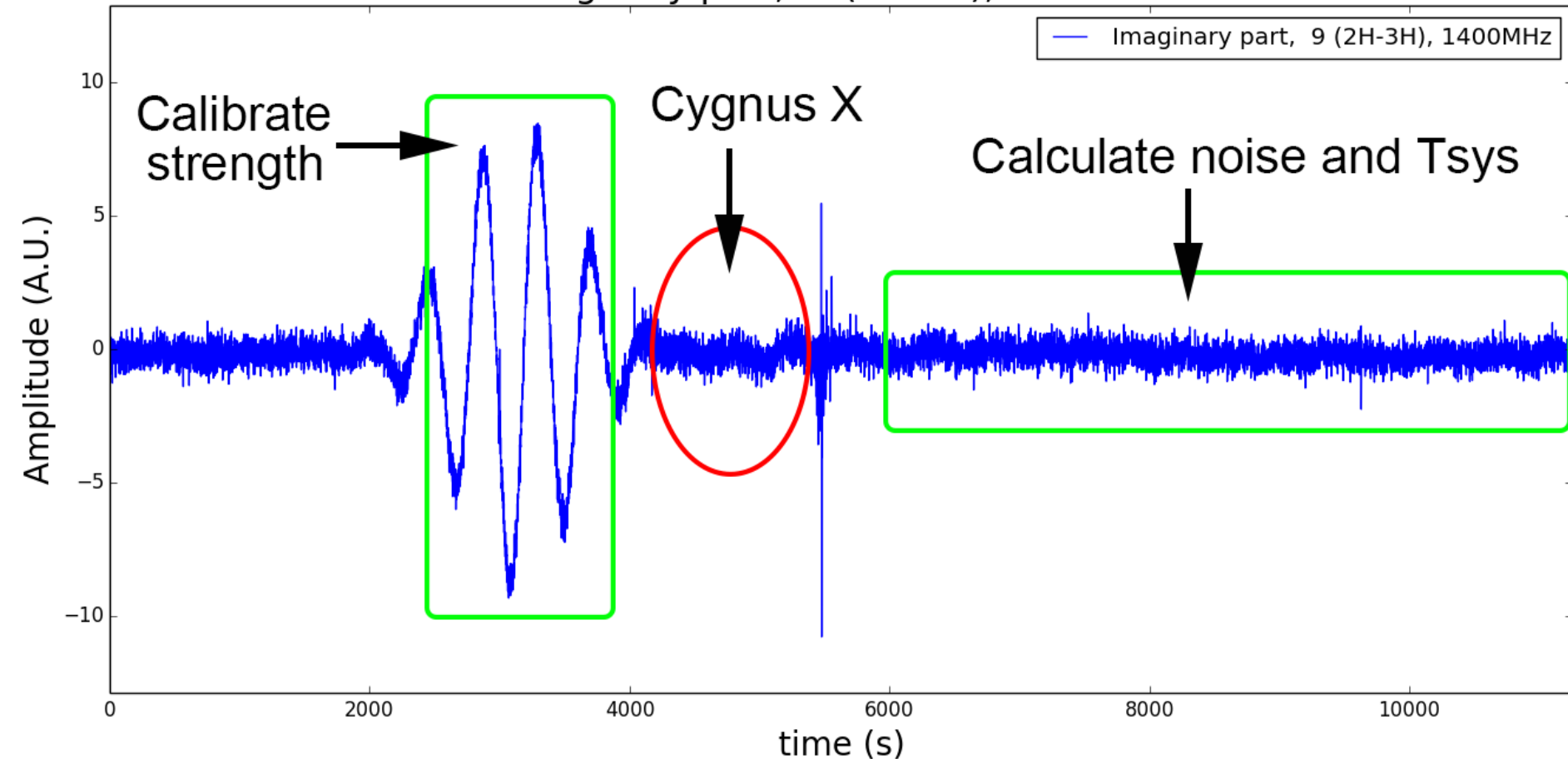Legend: 2H-3H, 1400MHz ; N(FWHM=3.69°)

Effective diameter

$$FWHM = 1.22 \frac{\lambda}{D}$$

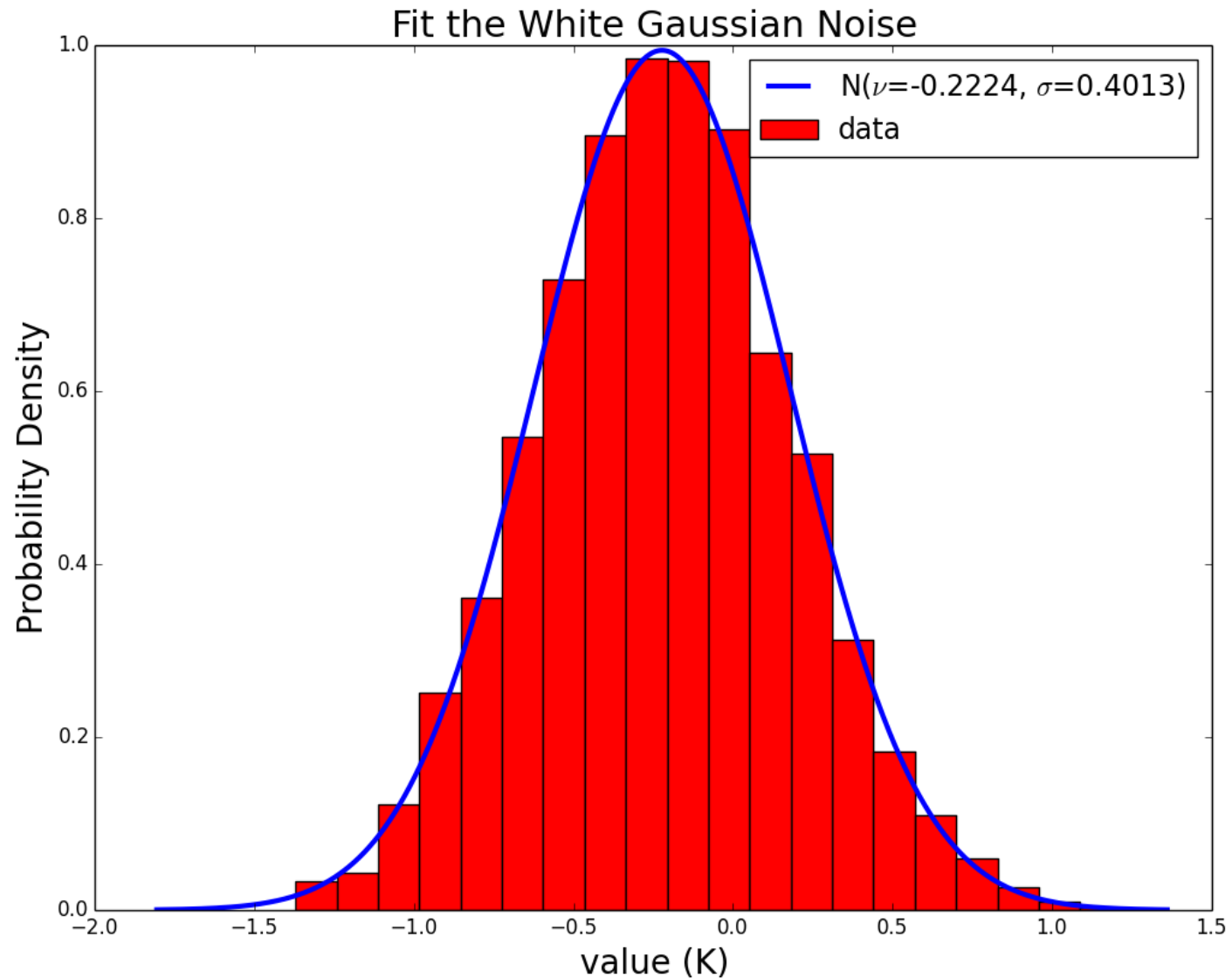we choose $\nu = 1400\text{MHz}$ $(\lambda = 21.43\text{cm})$,

Then $D_{eff} = 4.1\text{m}$

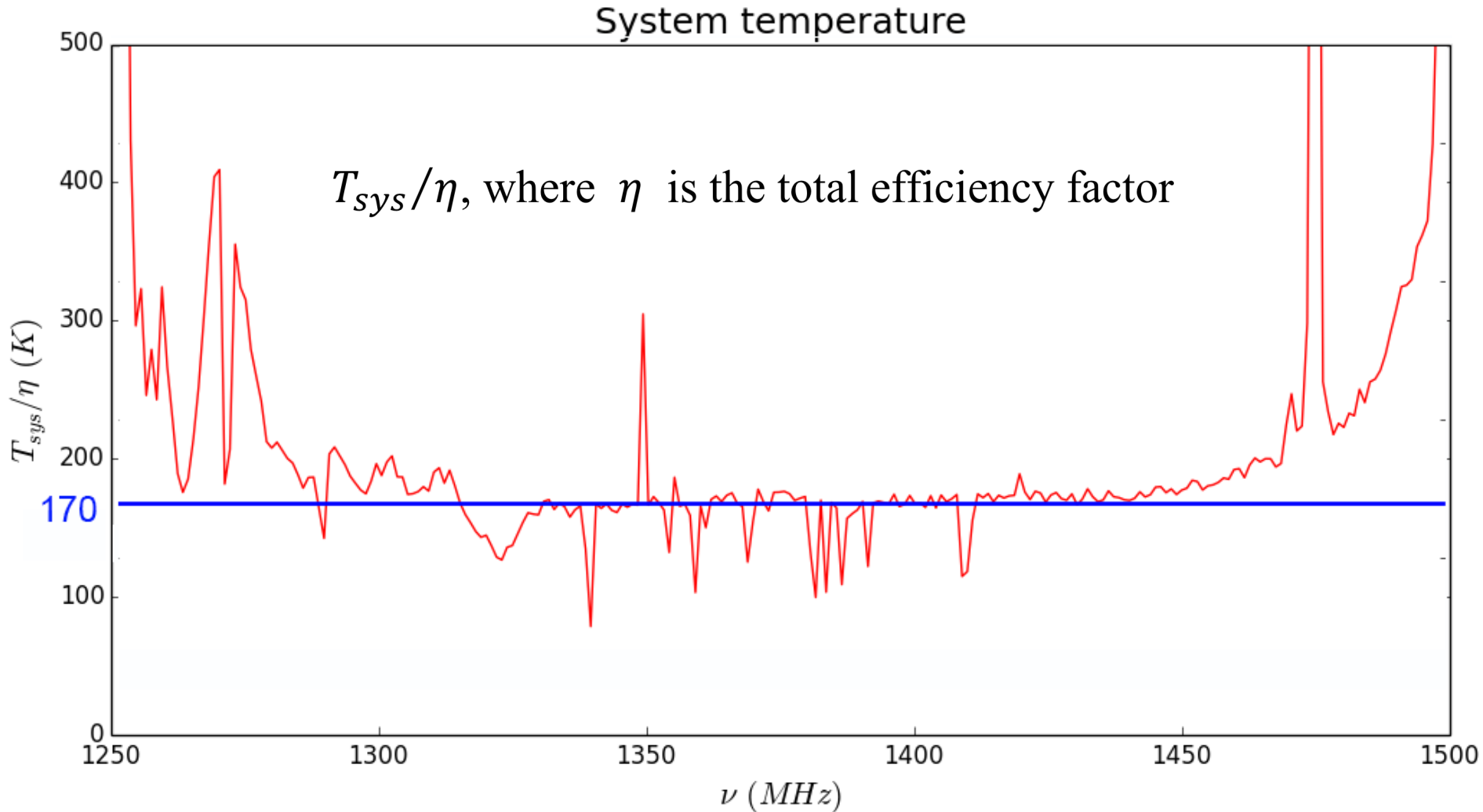# Fit the White Gaussian Noise

Imaginary part, 9 (2H-3H), 1400MHz

Fit the White Gaussian Noise

System temperature

System temperature

T_{sys}/η, where η is the total efficiency factor

Future work

- We have done the observation of

  Cygnus A

  Cassiopeia A

  Crab

  and will do the analysic later.