# Delay/rate analysis of NL-NL and NL-DE baselines

## LOFAR status meeting

Olaf Wucknitz

wucknitz@astro.uni-bonn.de

Argelander-
Institut
für
Astronomie

Dwingeloo, 30 September 2009

# Delay/rate analysis of NL-NL and NL-DE baselines

- What's all this then?

- fringe-fitting

- single-band fringes on NL-NL and DE-NL

- multi-band fringes

- CygA at 65deg distance

- whole-sky maps

- polarisations

# What's all this then?

- **Long baselines require VLBI techniques**

- unstable phases, short coherence times

- fringe-fitting and beyond

- solve for delays
$$\tau = \frac{\partial \phi}{\partial \nu}$$

- solve for rates
$$r = \frac{\partial \phi}{\partial t} = \nu \frac{\partial \tau}{\partial t}$$
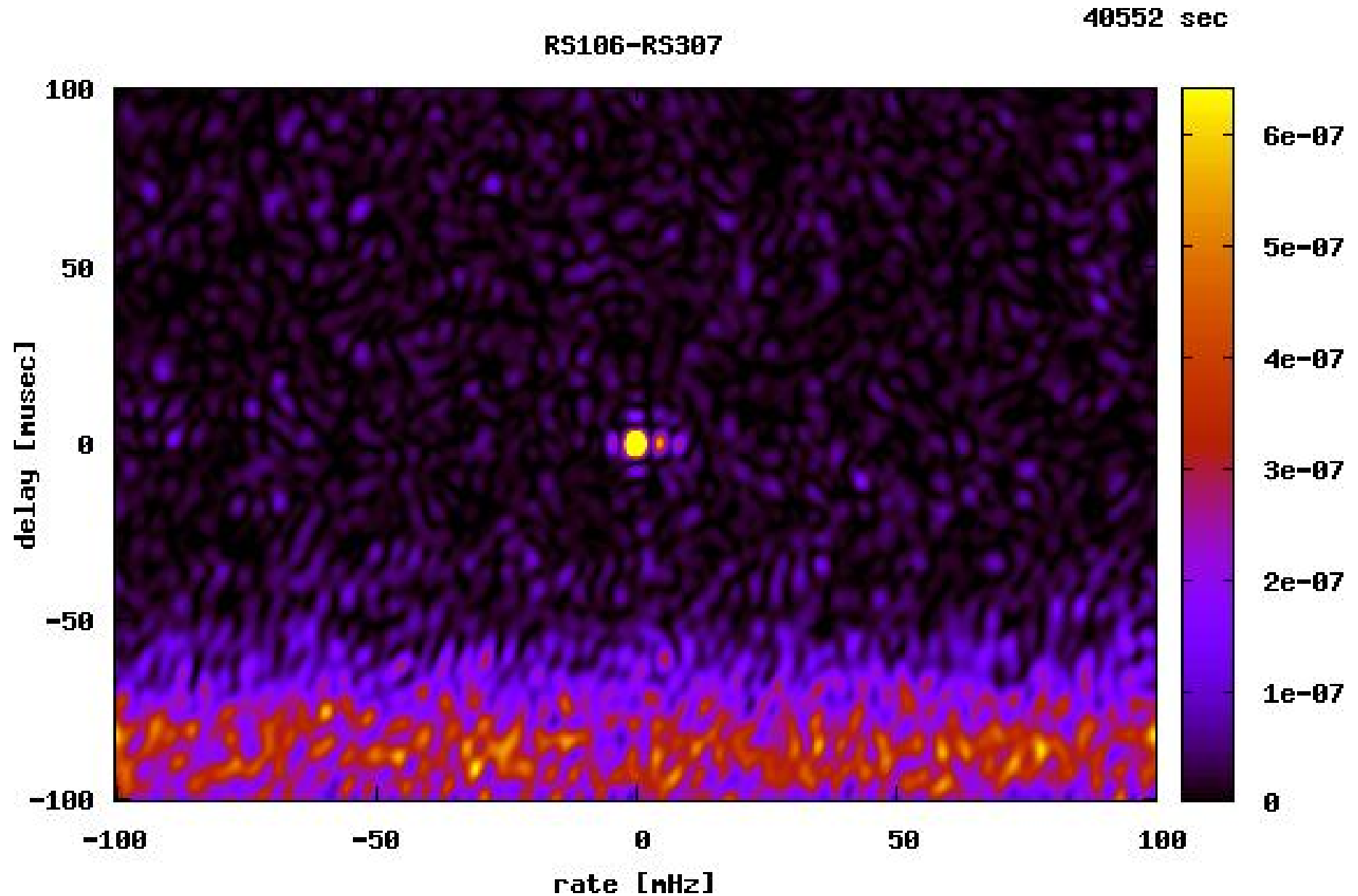
- non-dispersive
$$\tau = \tau_0$$

- dispersive
$$\tau = \tau_0 \left(\frac{\nu_0}{\nu}\right)^2$$

# Fringe-fitting

- either for single subbands ($\Delta \tau \propto 5\,\mu\text{sec}$)

- or coherent multi-band ($\Delta \tau \propto 0.02\,\mu\text{sec}$)

- beware of multiple peaks in delay/rate

- produce 2-d delay/rate spectra

- simultaneously 'fit' for four parameters

- dispersive/nondispersive delays/rates

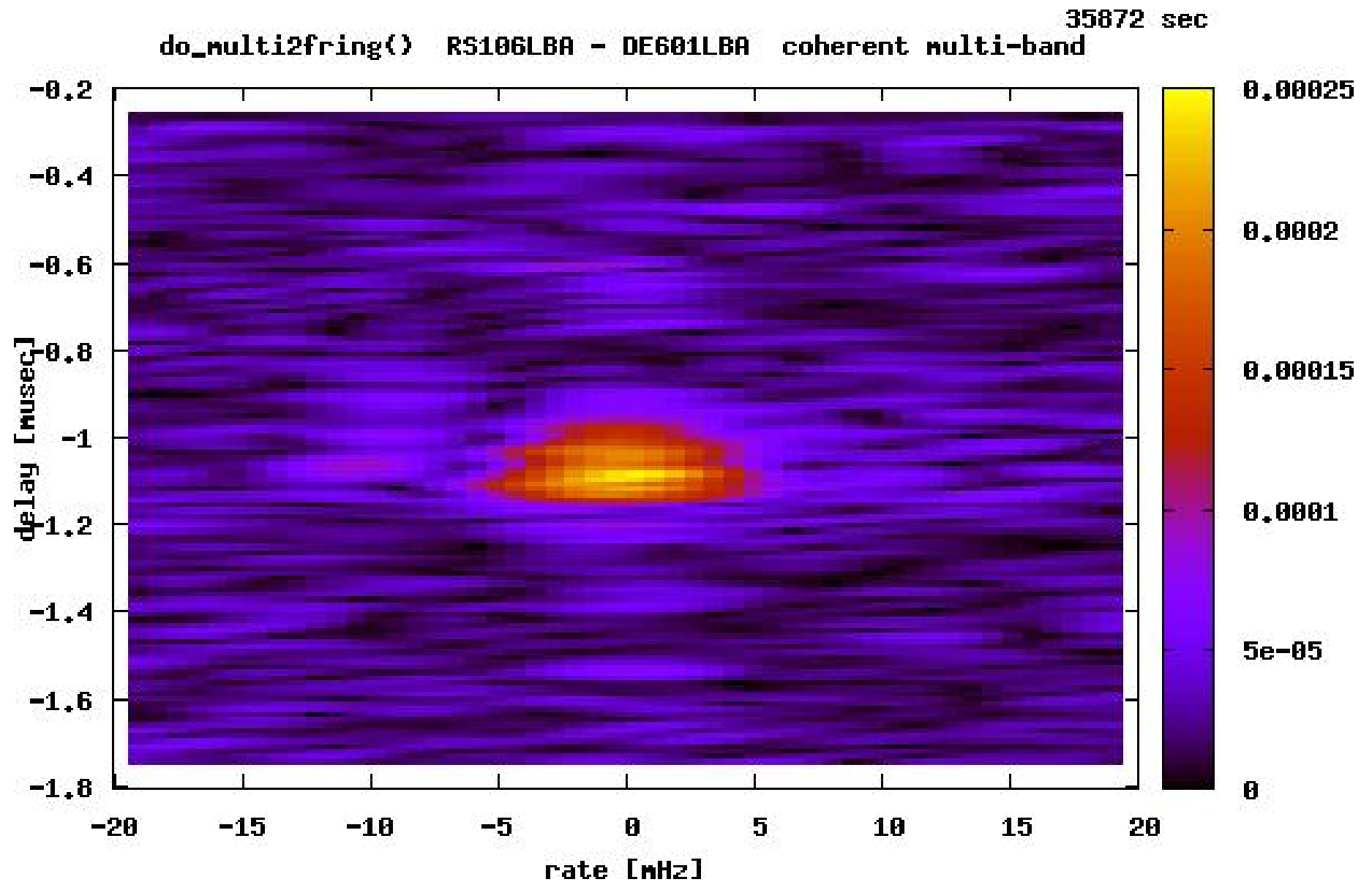- own simple flagger (based on Gaussian noise statistics)
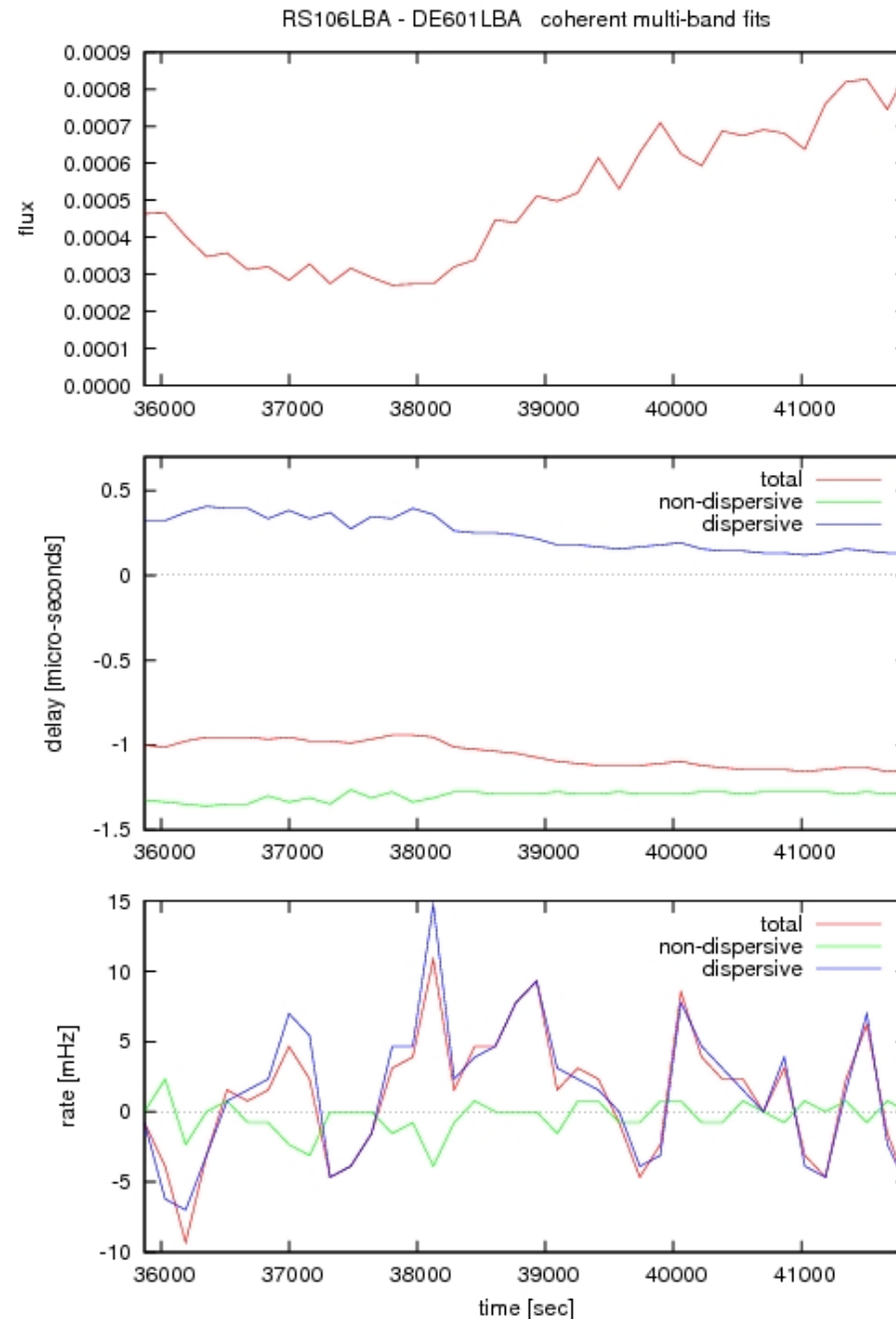
# Single-band, NL-NL, 3C196, 20 August
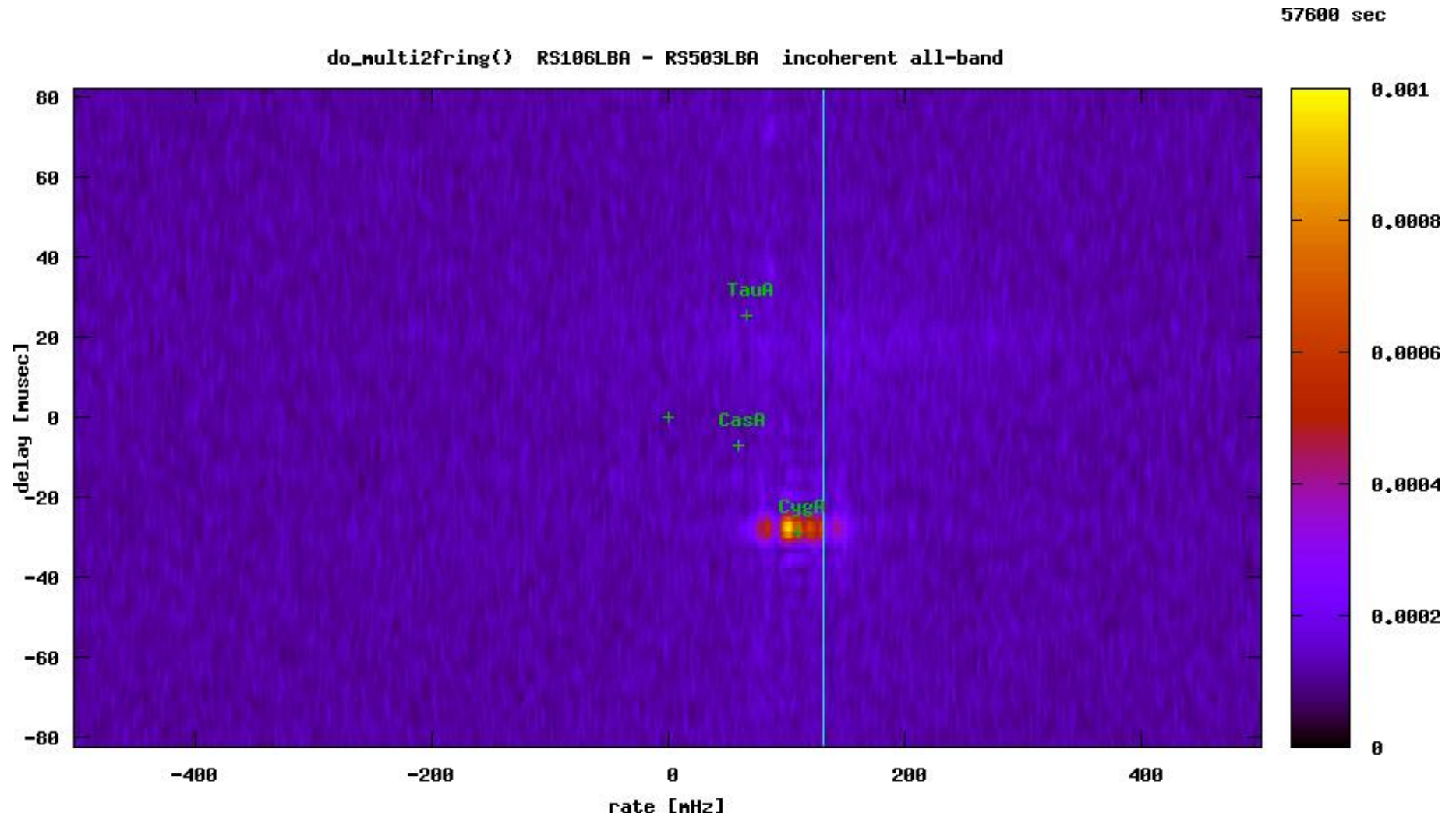
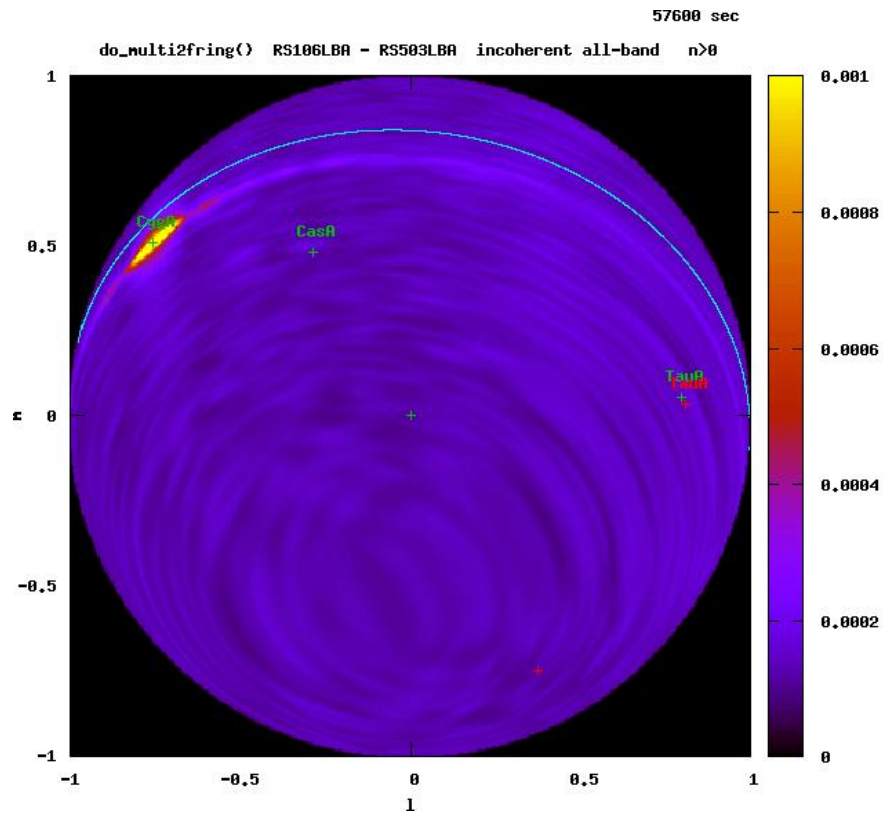# Single-band, DE-NL, 3C196, 20 August, first DE-fringe!
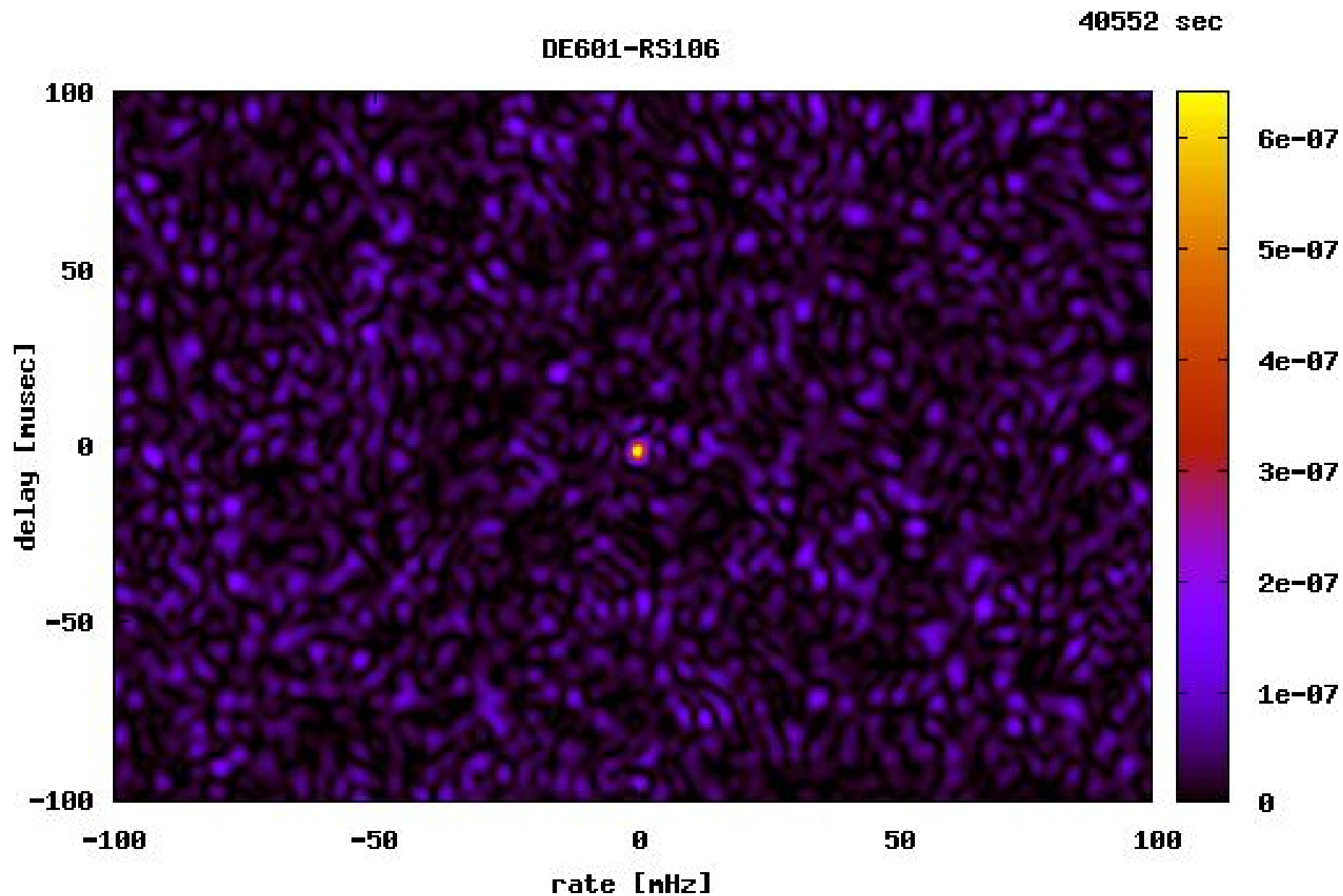
# Same with multi-band

# Flux, delay, rate



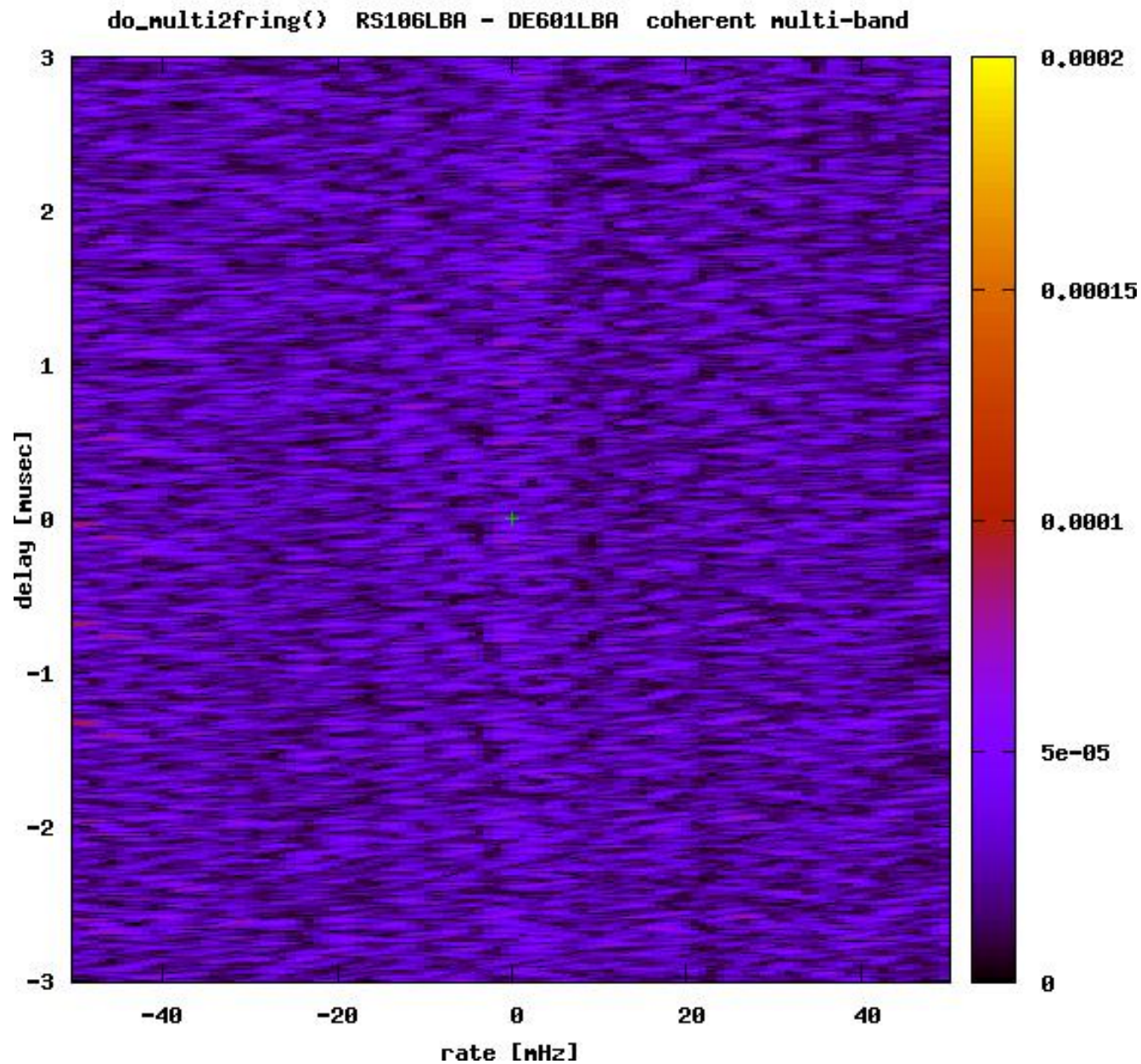RS106LBA - DE601LBA   coherent multi-band fits
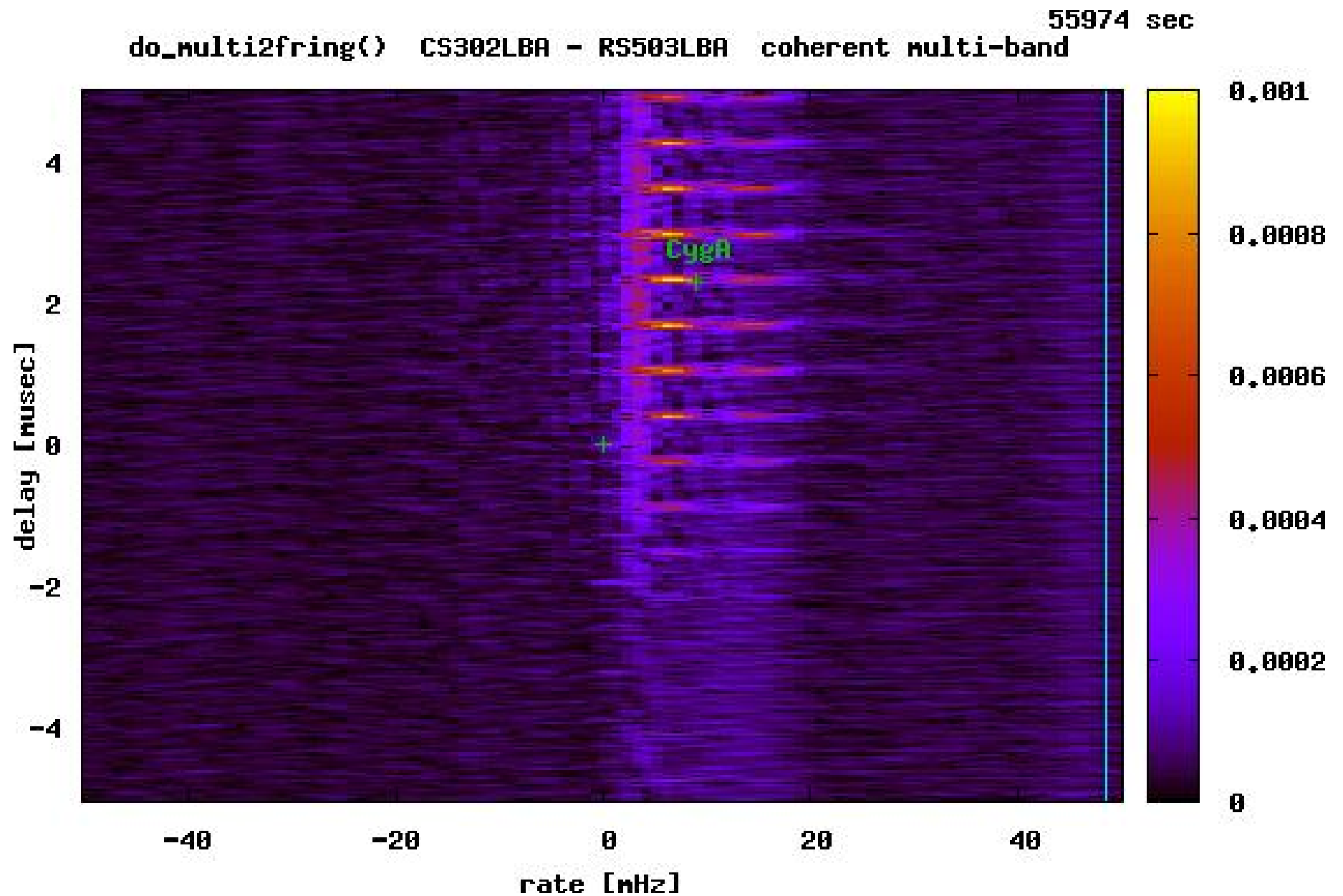
# Re-observations: 12h of 3C48

# Mapping sources to the sky
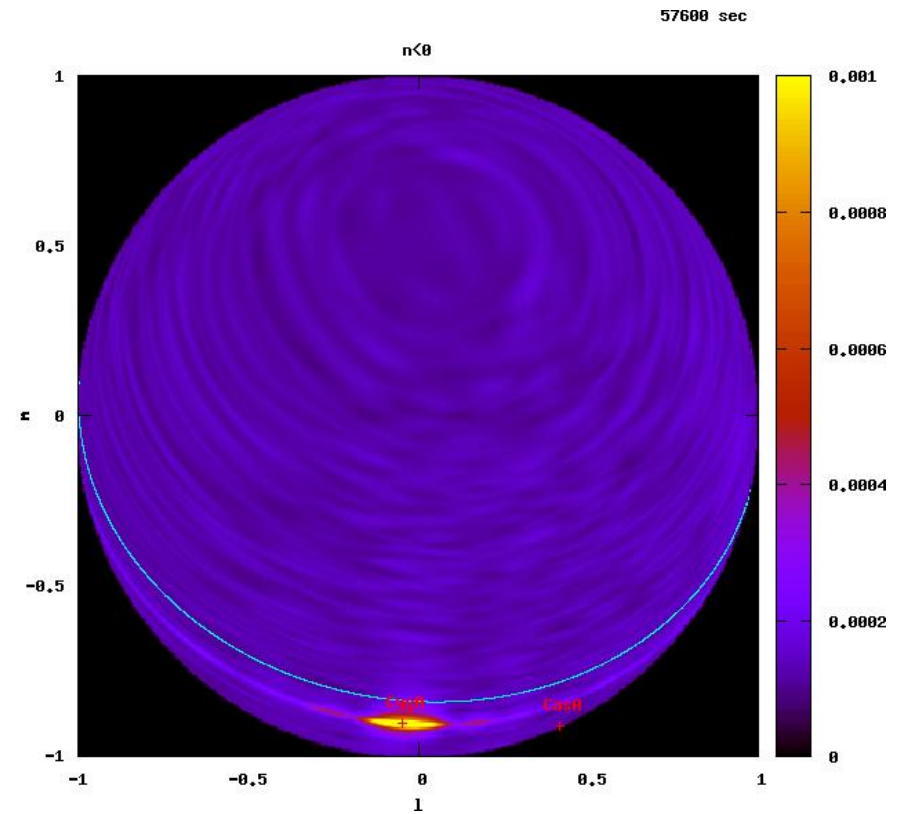
# 3C48 on NL-DE, coherent multi-band
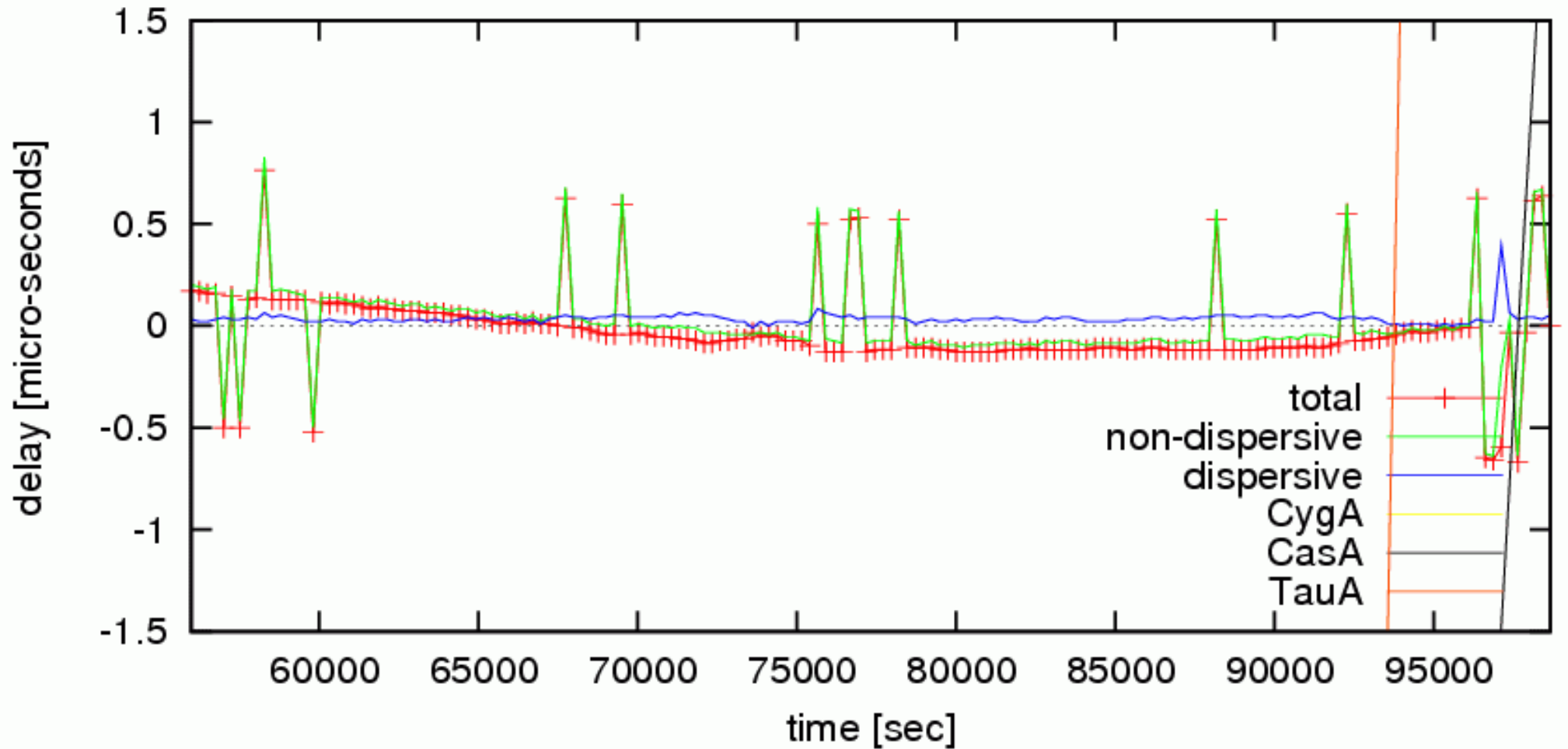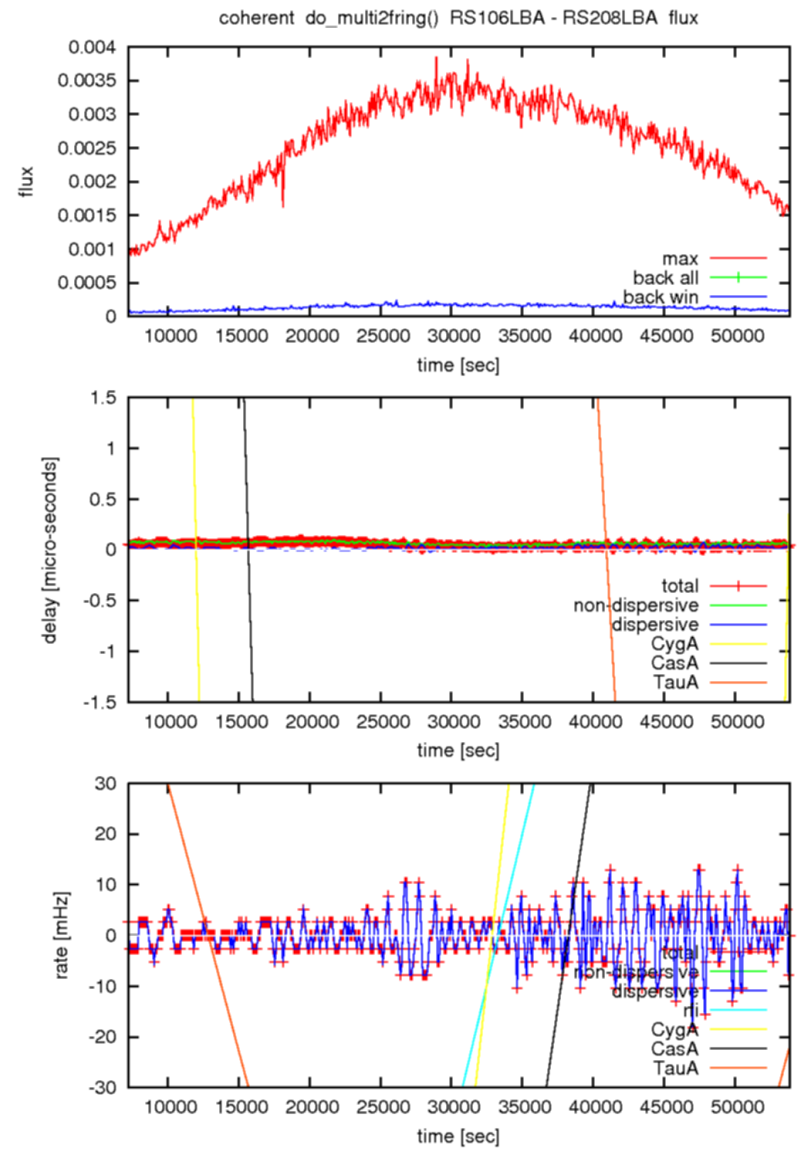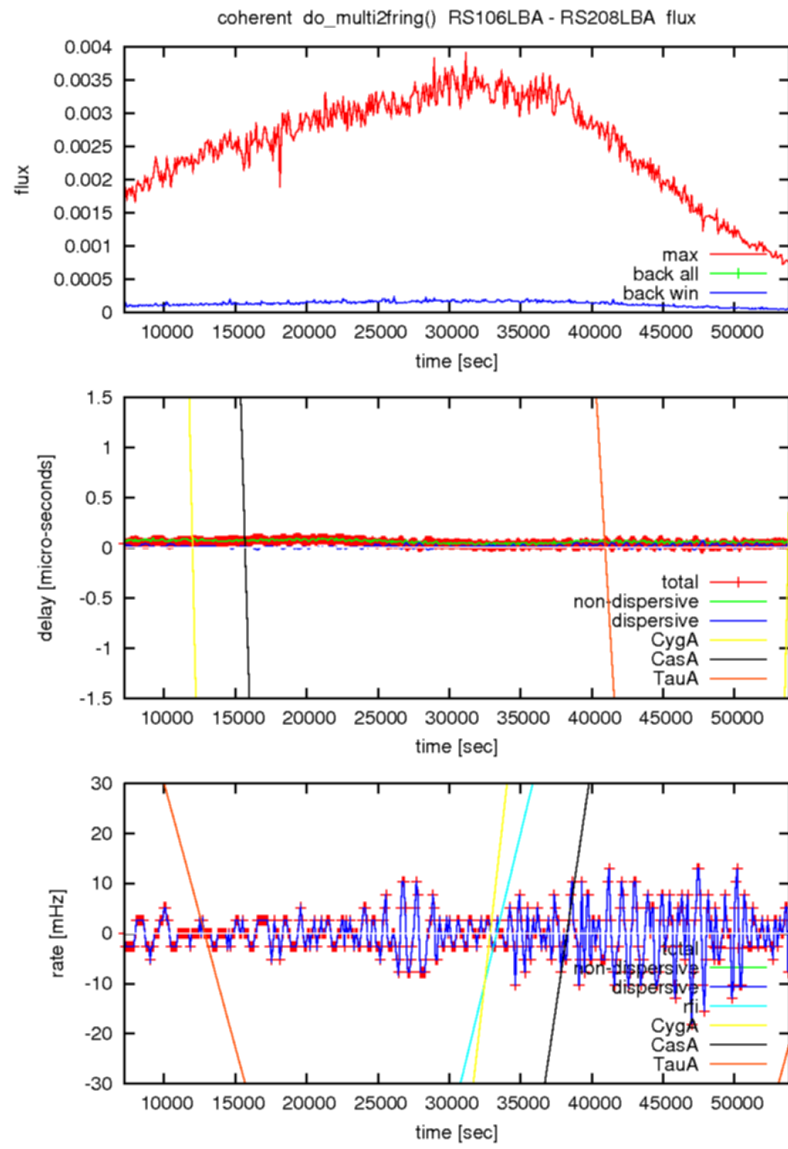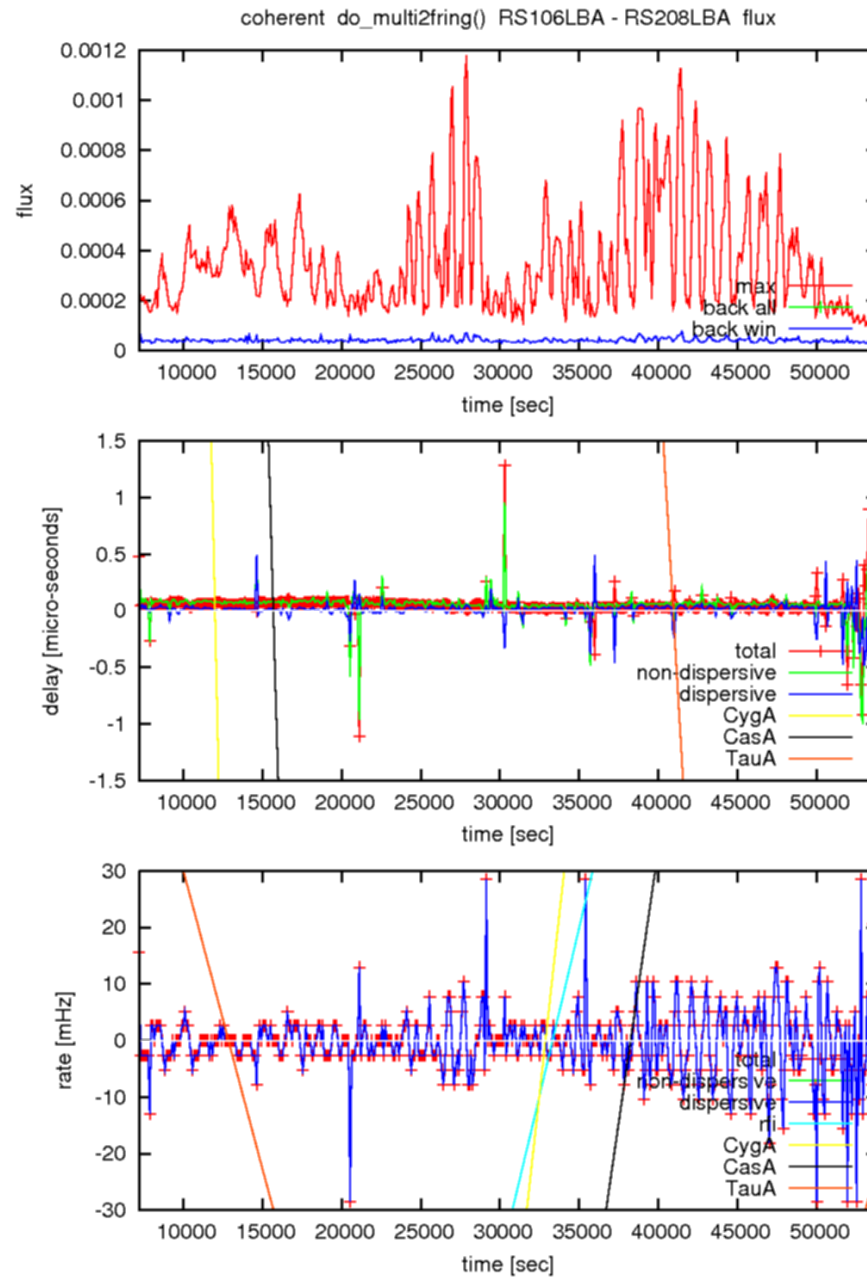
# 3C409 on NL-NL, multi-band, contaminated by CygA
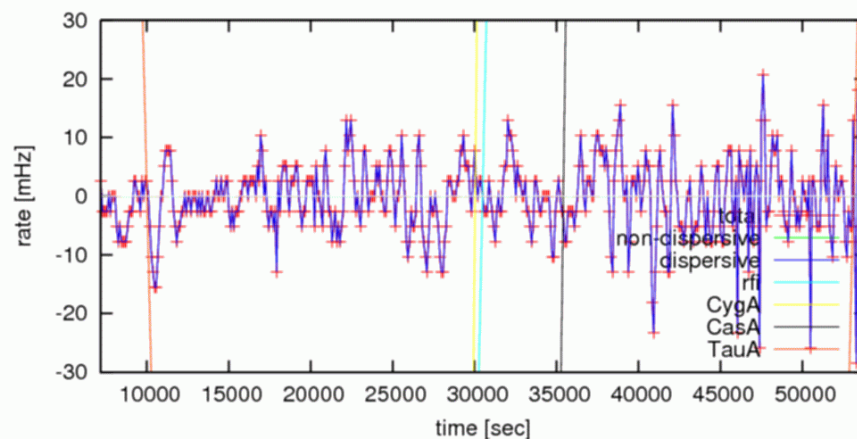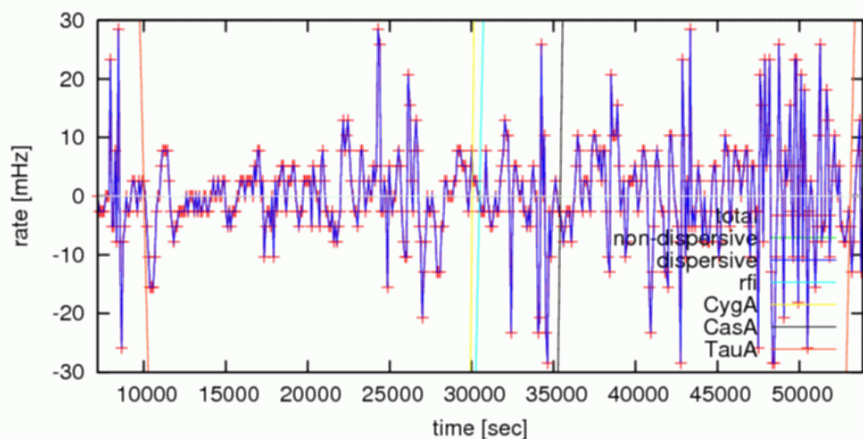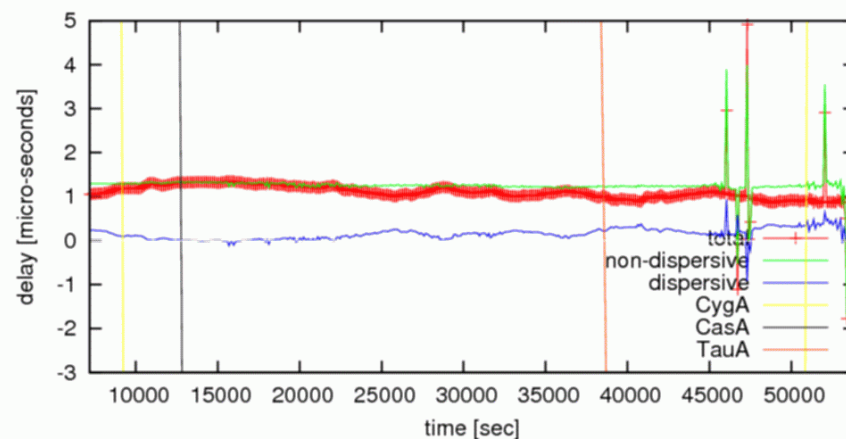
# 3C409: RS208 position error?

# 3C196: XX and YY polarisation on NL-NL

# 3C196: XY polarisation on NL-NL



coherent do_multi2fring() RS106LBA - RS208LBA flux

# 3C196: XX and XY polarisation on DE-NL
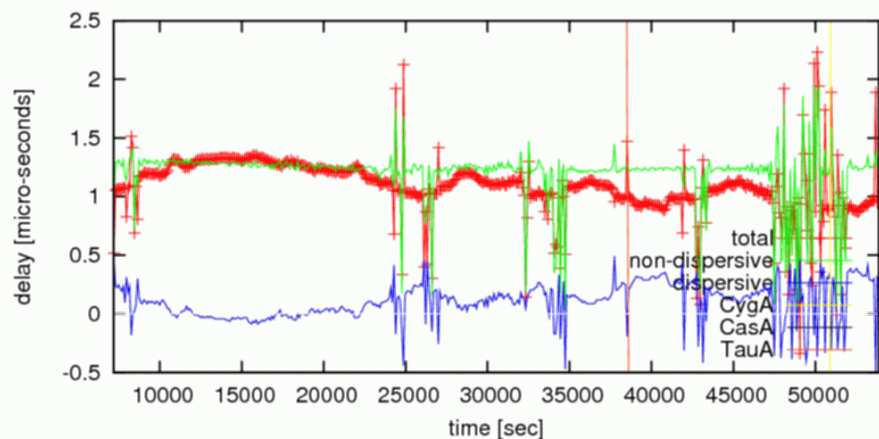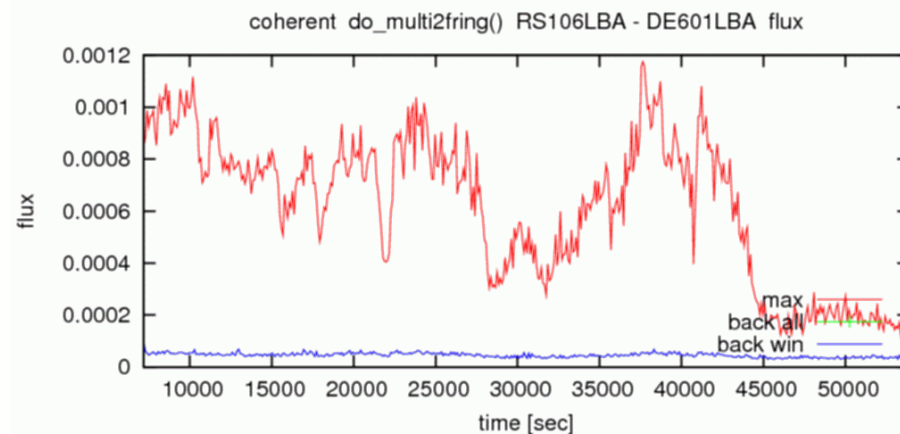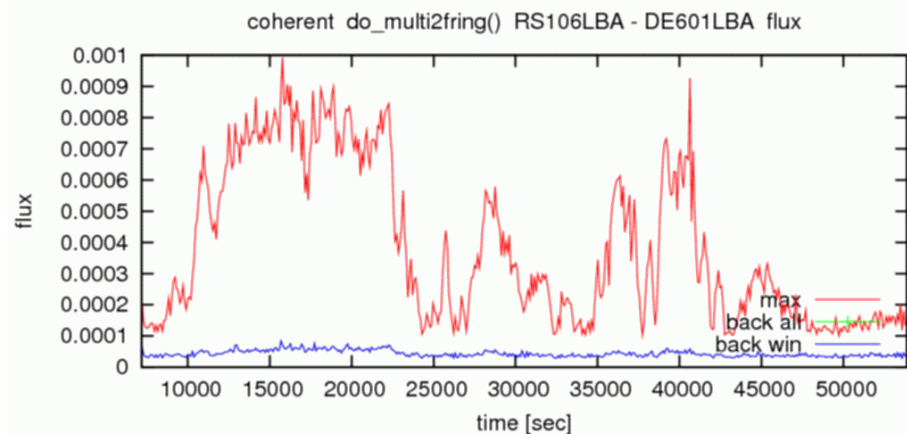
# Conclusions so far

- fringes on long baselines are real

- delays

  - ★ non-dispersive: small on NL-NL, typ. $1\,\mu$sec on DE-NL
    can clock offsets be reduced?
  - ★ station position of RS208?
  - ★ dispersive: small on NL-NL, variable $\lesssim 0.5\,\mu$sec on
    DE-NL

- rates

  - ★ non-dispersive: consistent with 0 (no clock rates)
  - ★ dispersive: highly time-variable, worse on DE-NL but
    not by factor of 10

# To do

- differential Faraday rotation
  - ⋆ convert to RR/LL? (missing $Z$) ?
  - ⋆ simultaneous delay and Faraday fit ?

- how much fringe-fitting needed ?

- solve Effelsberg clock offsets

- how to avoid CygA leaking in ?

- avoid grating lobes in delay

- 'optimise' frequency coverage (random?)

- proposal by Valeriu Tudose, Mike Garrett, me, etc

# Contents