

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

LOFAR/SKA Focus Group meeting

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# 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

$$\tau = \tau_0$$

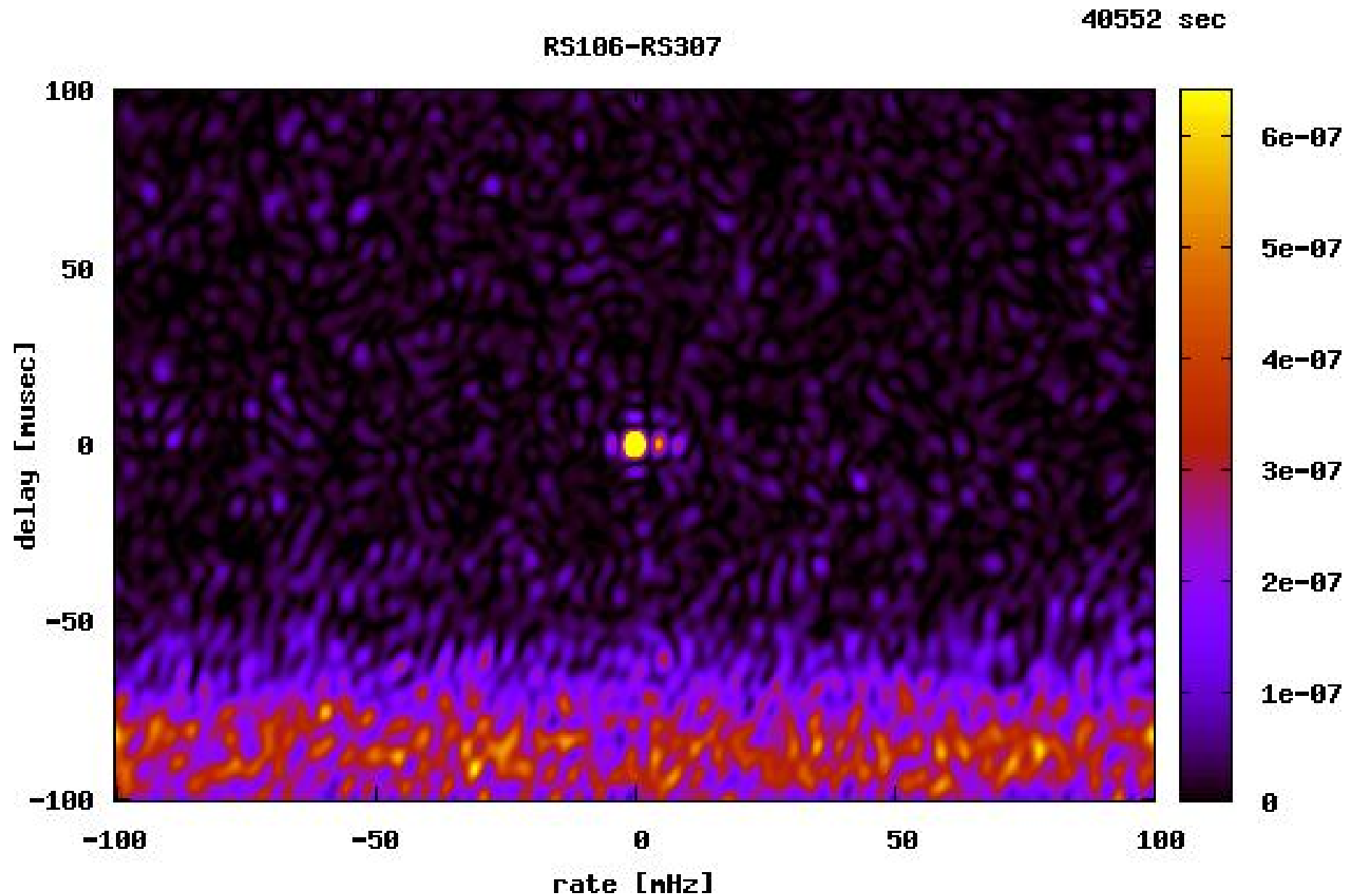
- dispersive

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

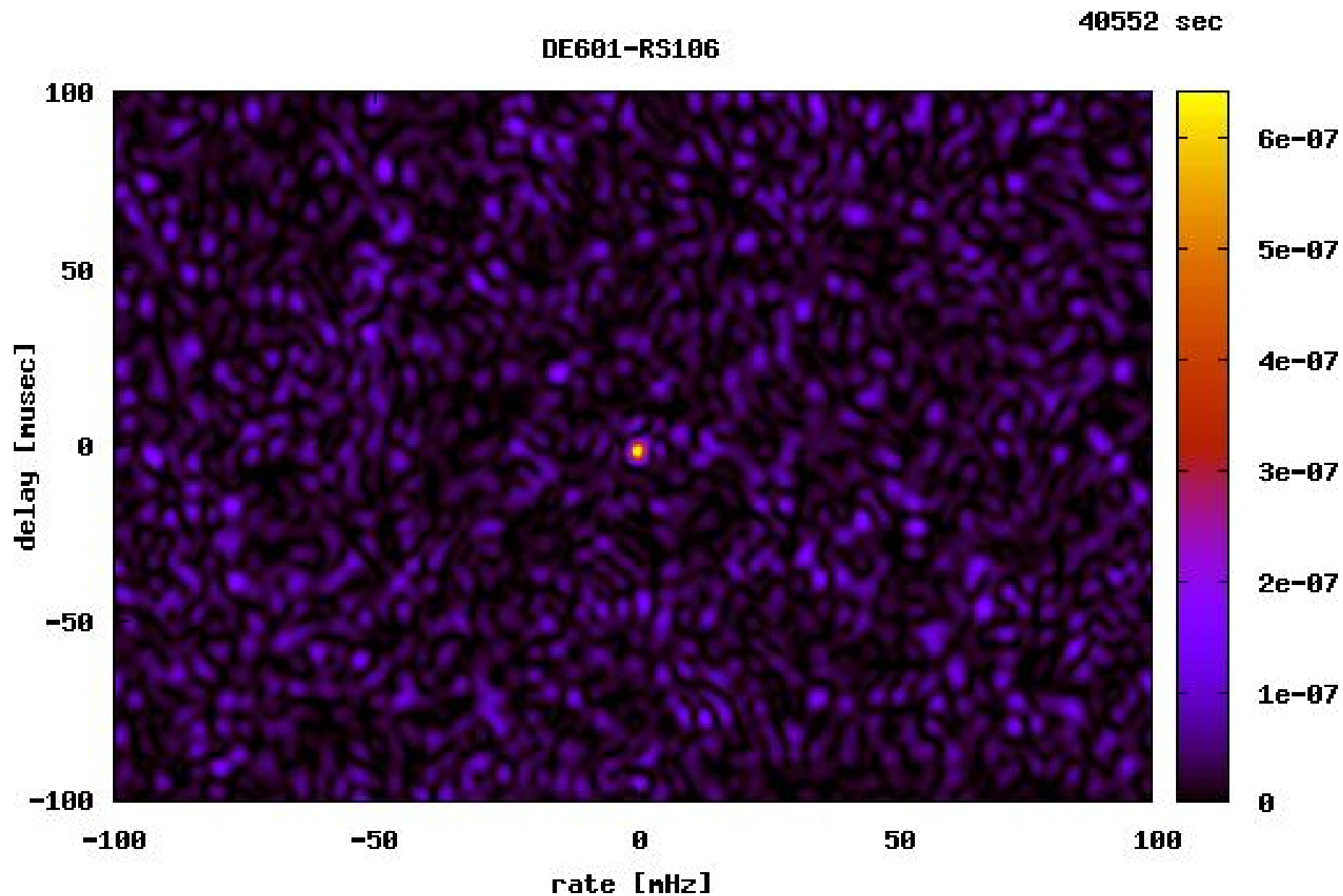
# Fringe-fitting

- 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)

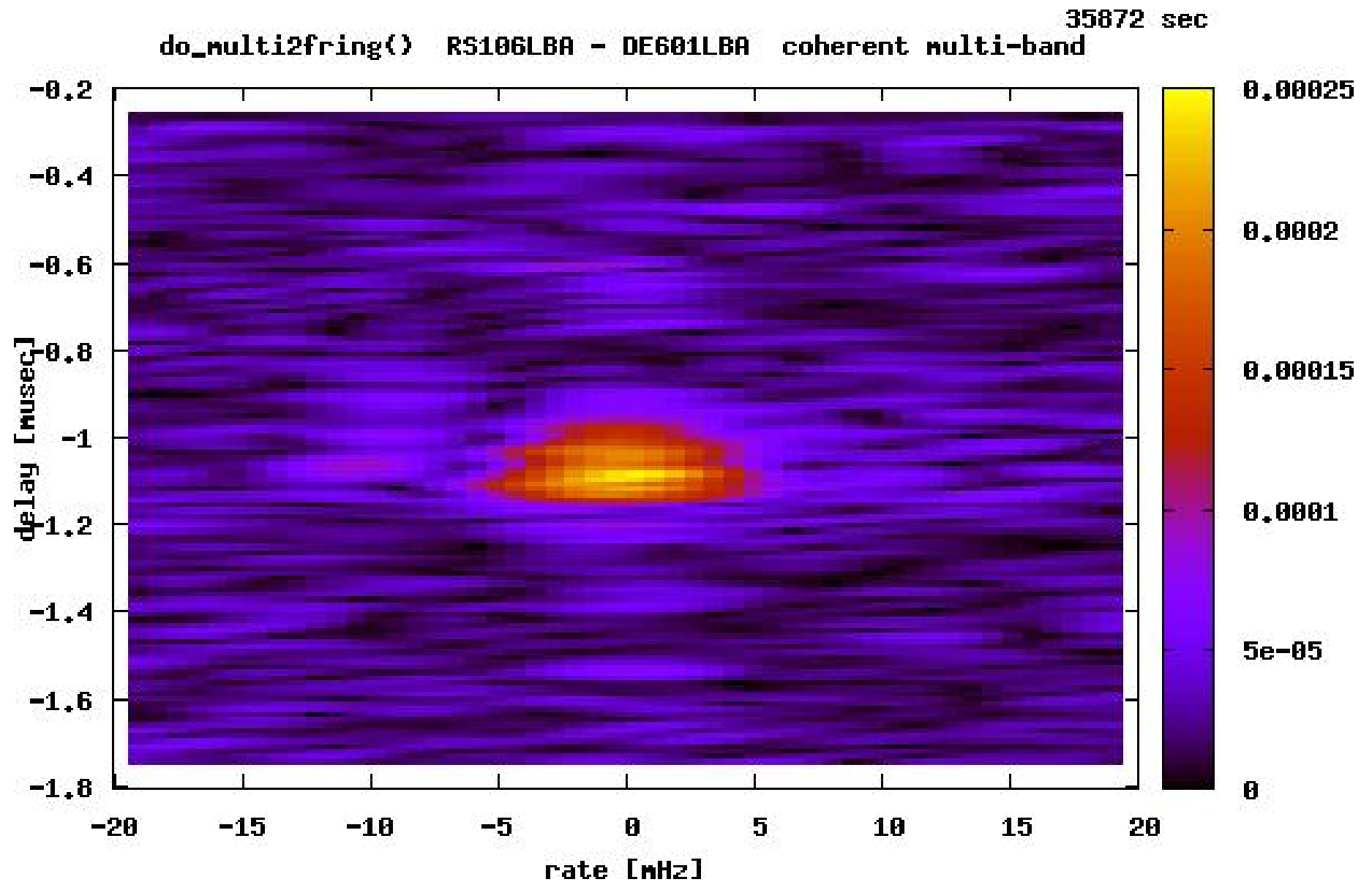
# Single-band, NL-NL, 3C196, 20 August



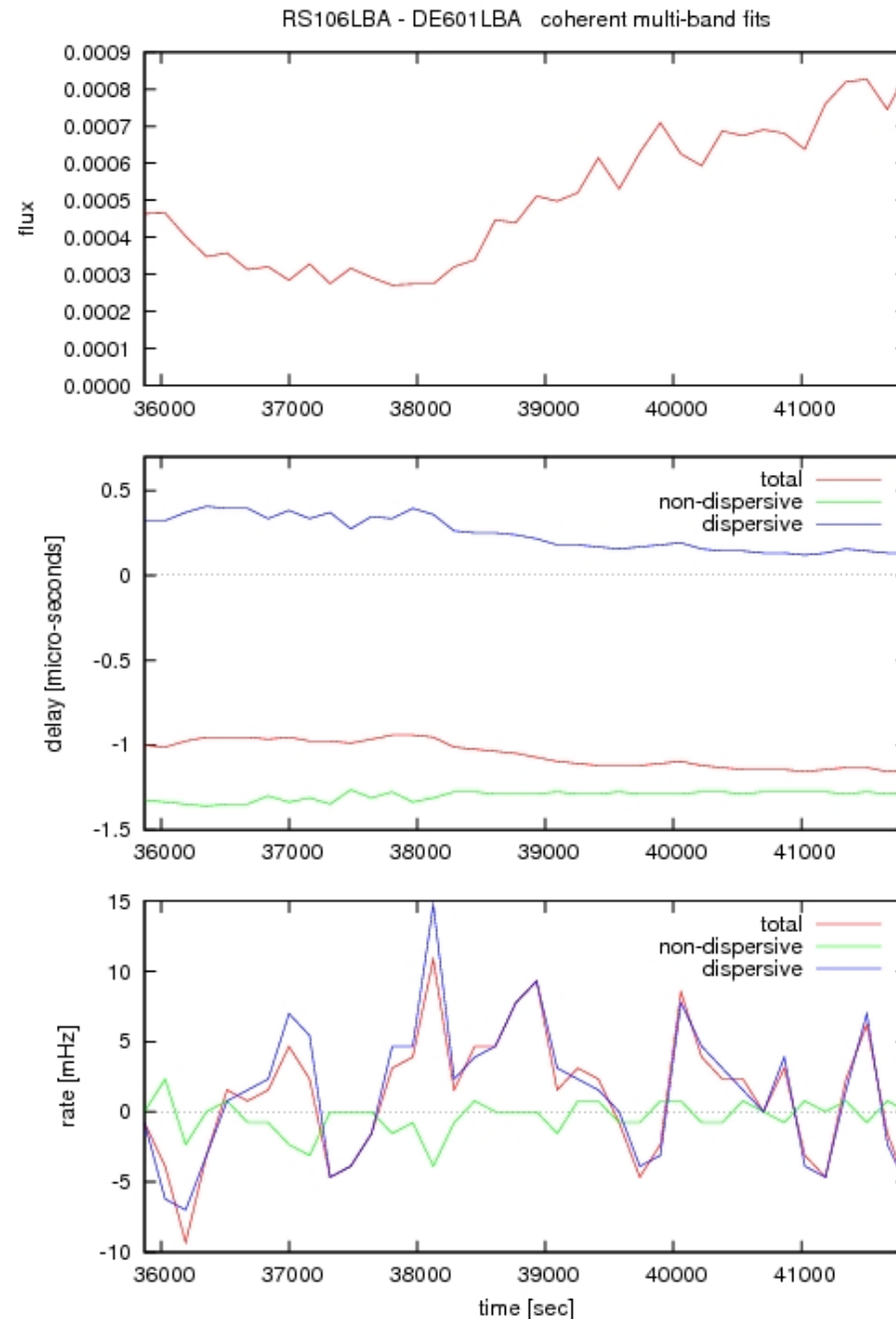
# Single-band, DE-NL, 3C196, 20 August, first DE-fringe!



# Same with multi-band

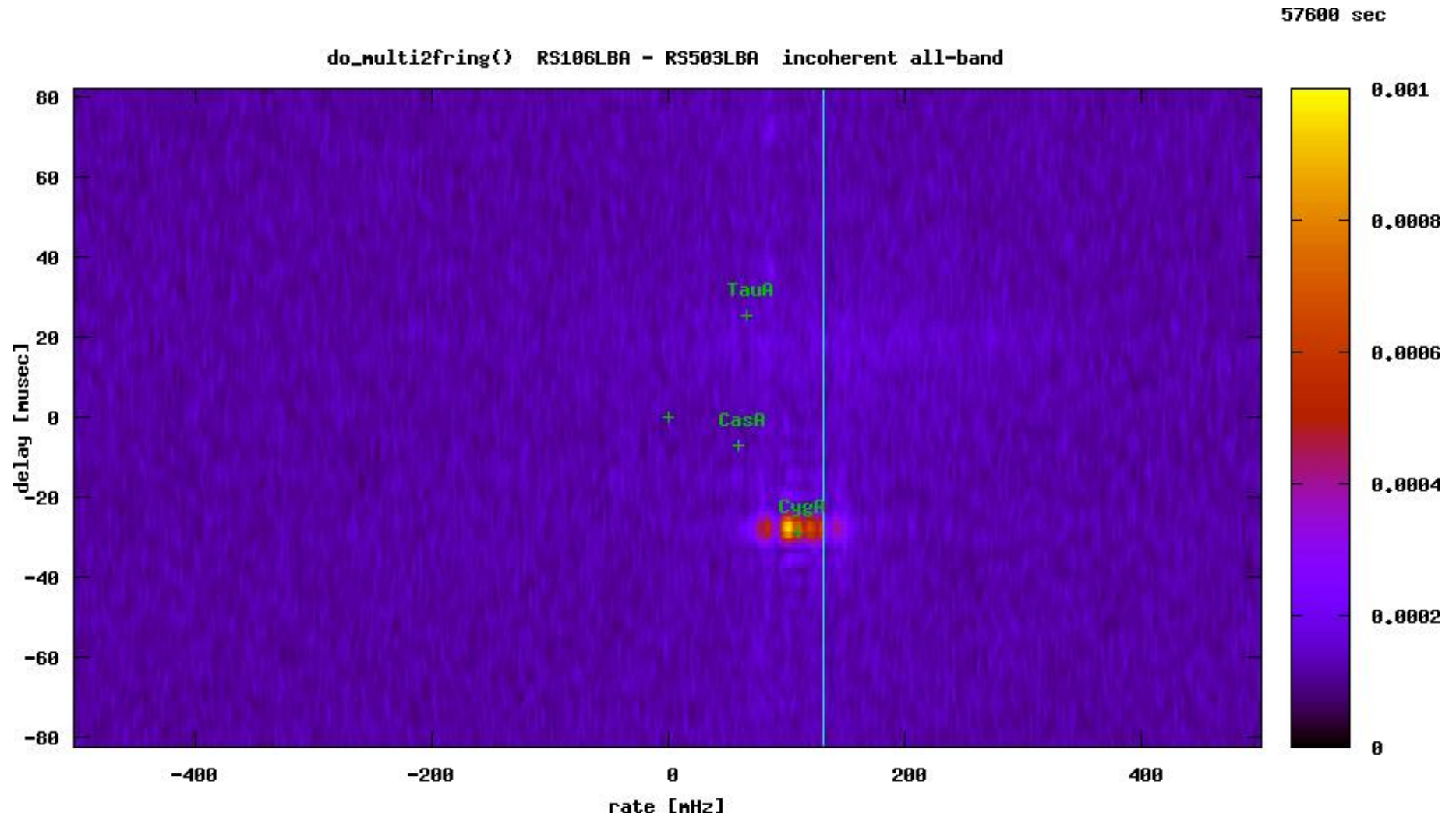


# Flux, delay, rate

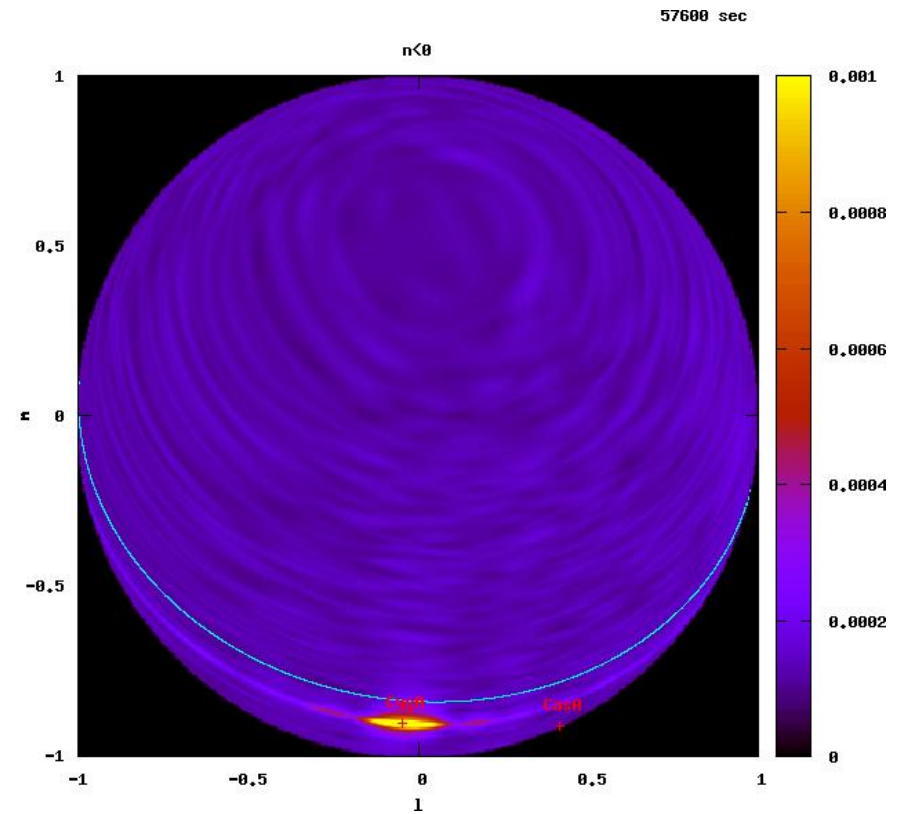
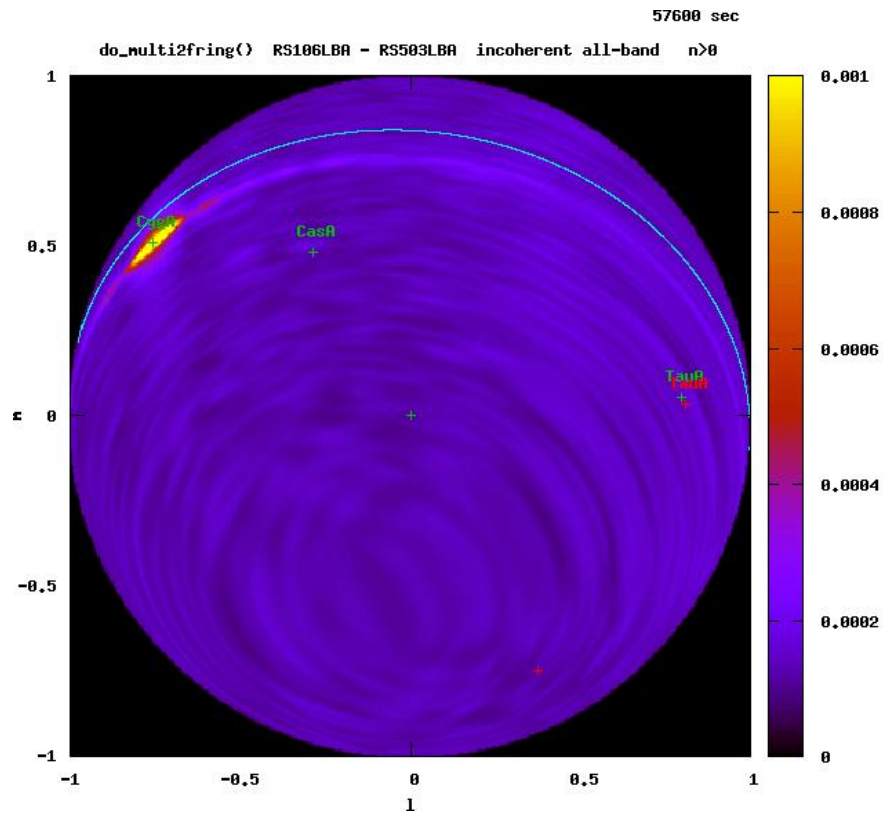




# Re-observations: 12h of 3C48

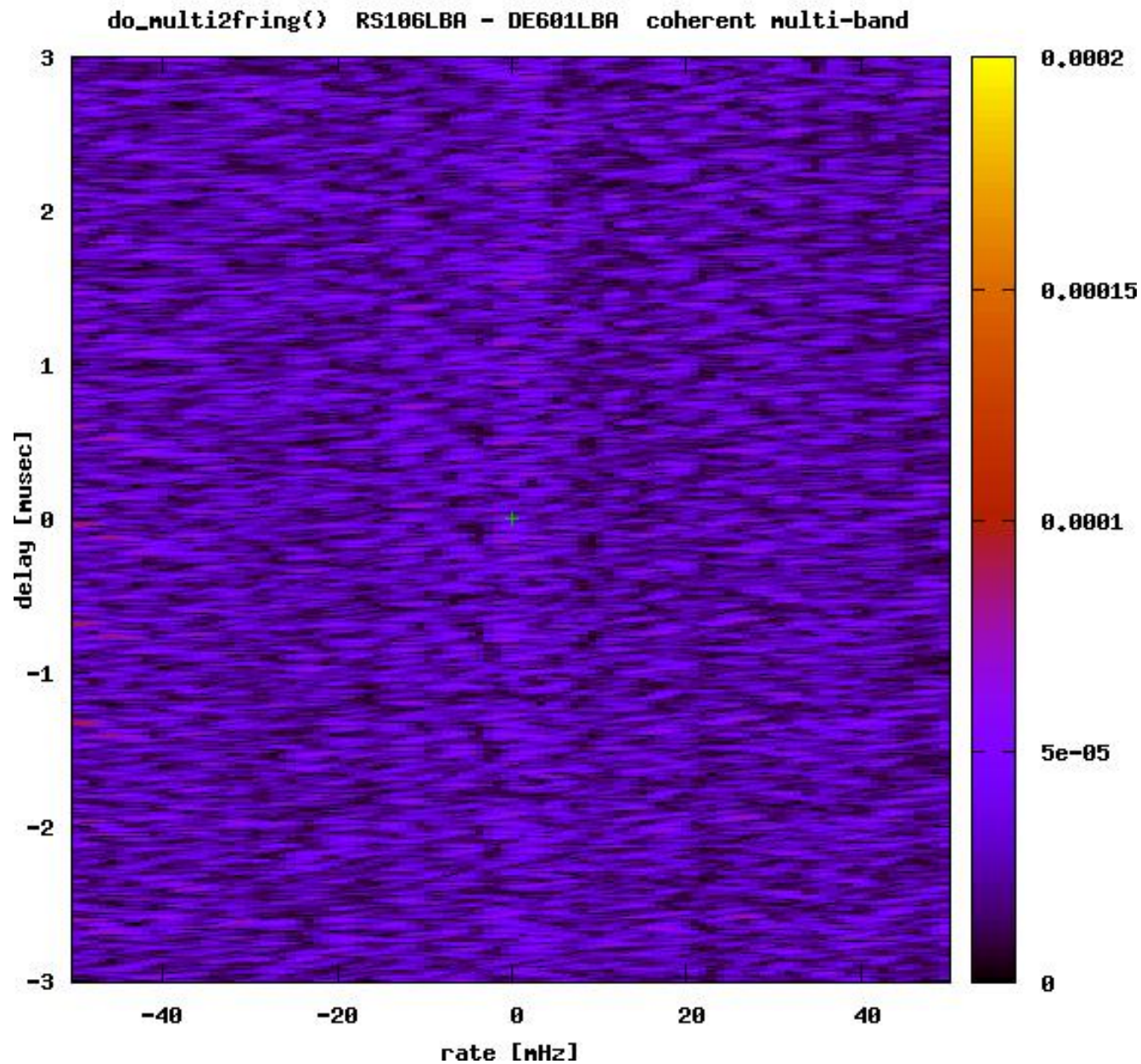


# Mapping sources to the sky

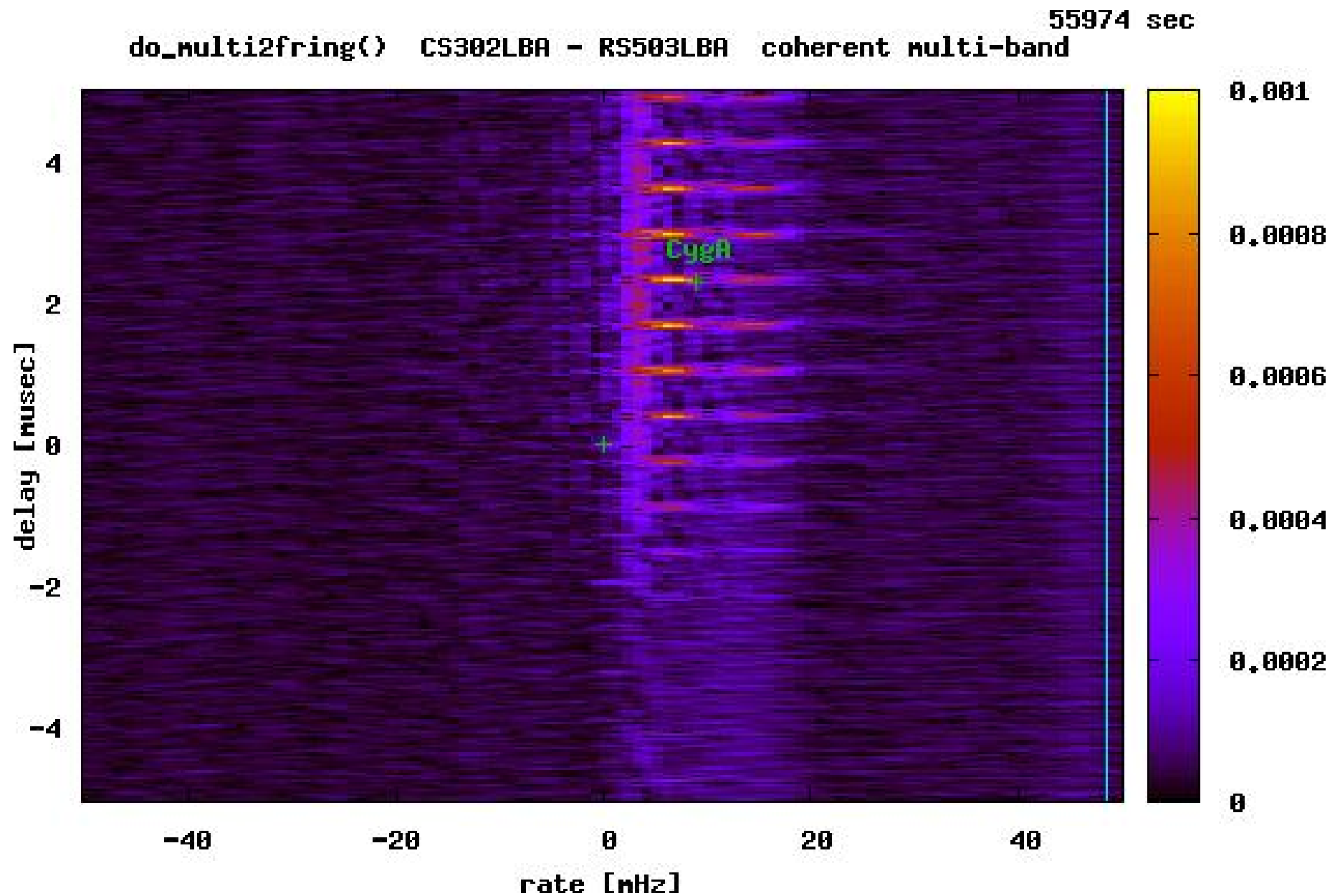


# 3C48 on NL-DE, coherent multi-band

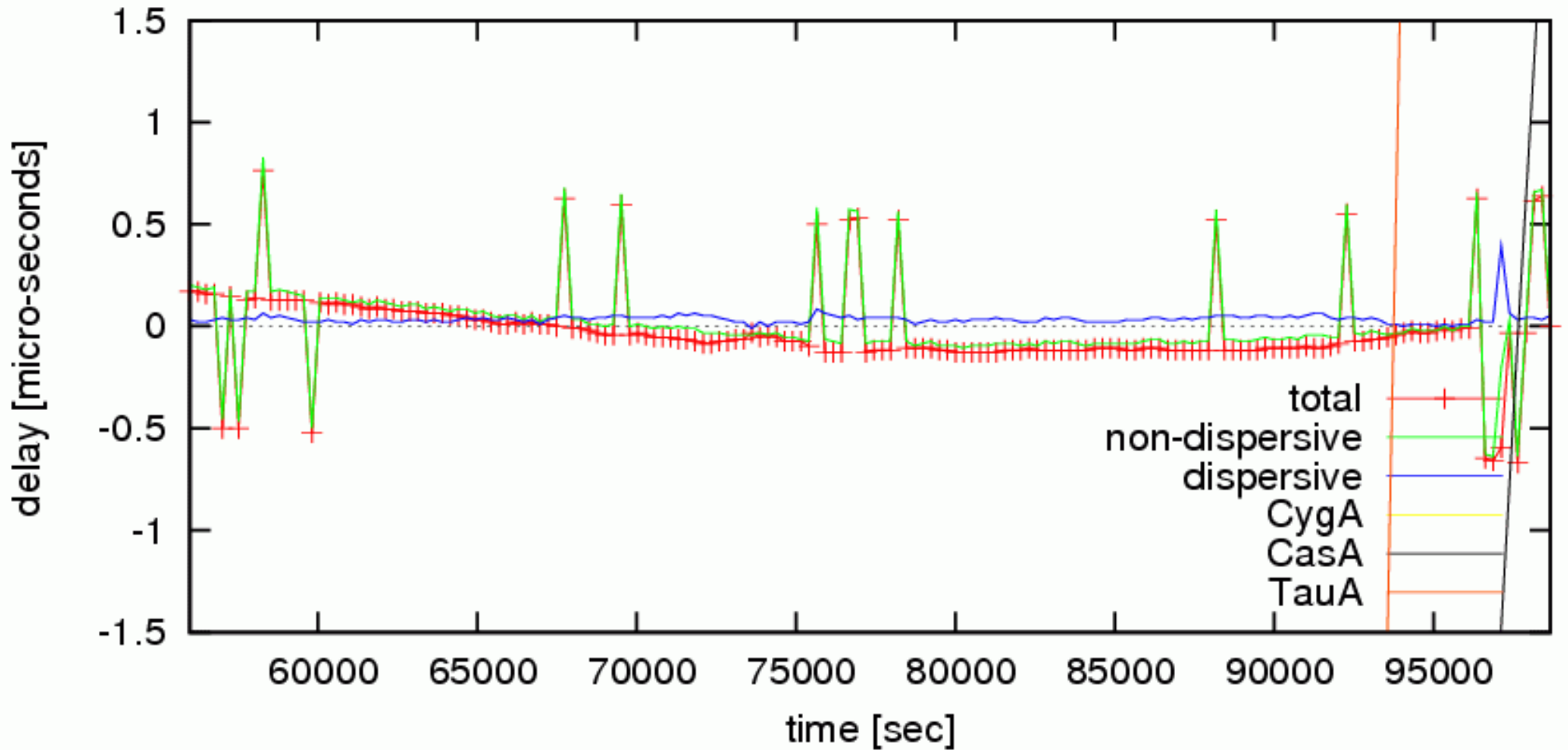
57600 sec



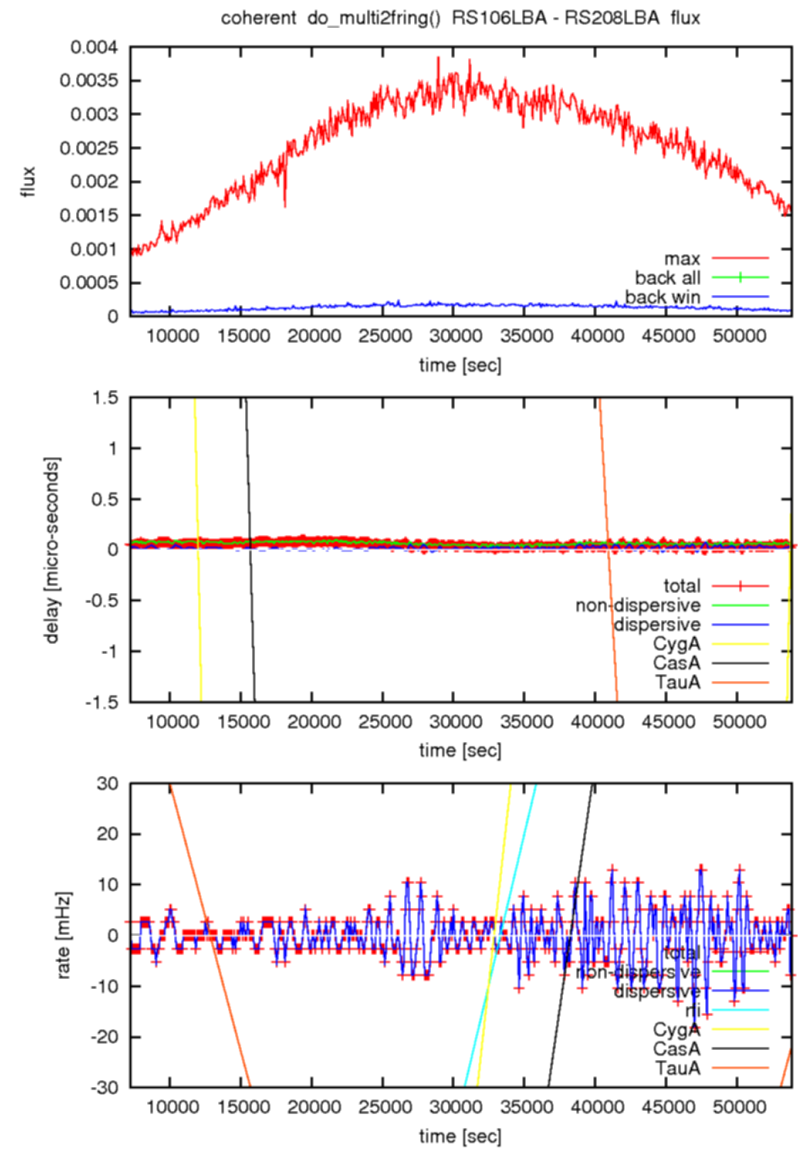
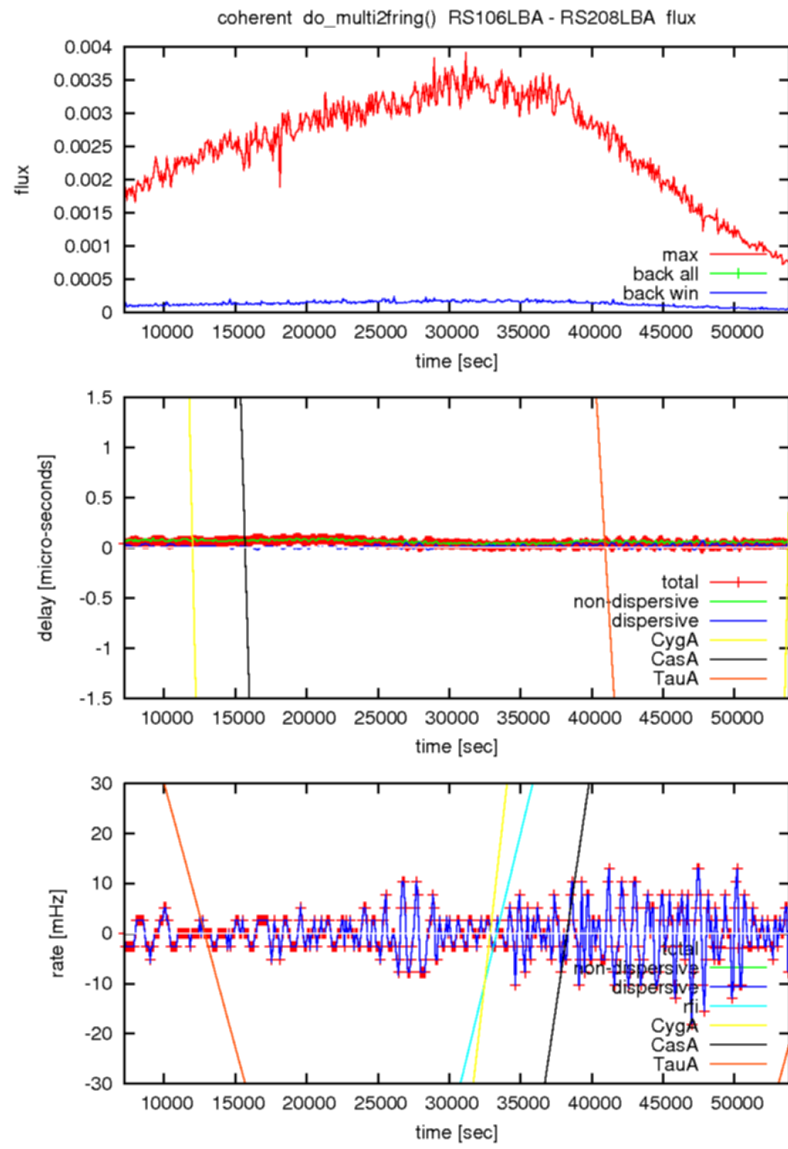
# 3C409 on NL-NL, multi-band, contaminated by CygA



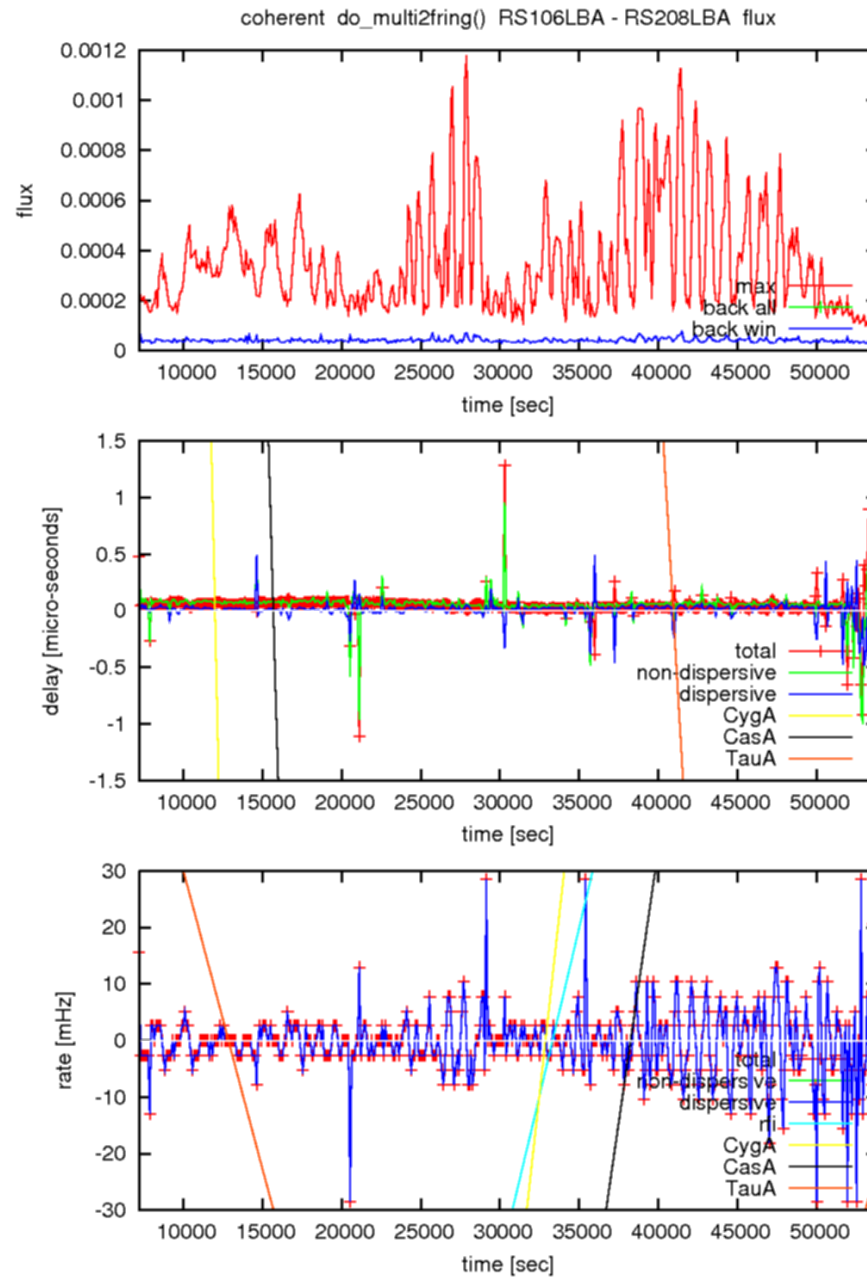
# 3C409: RS208 position error?



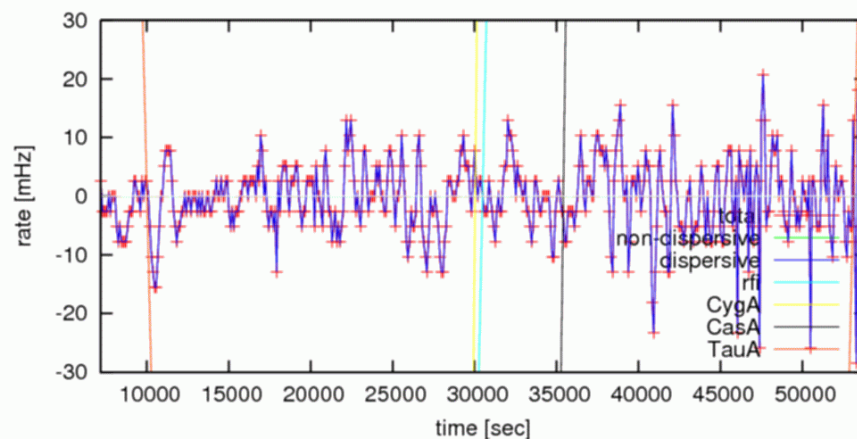
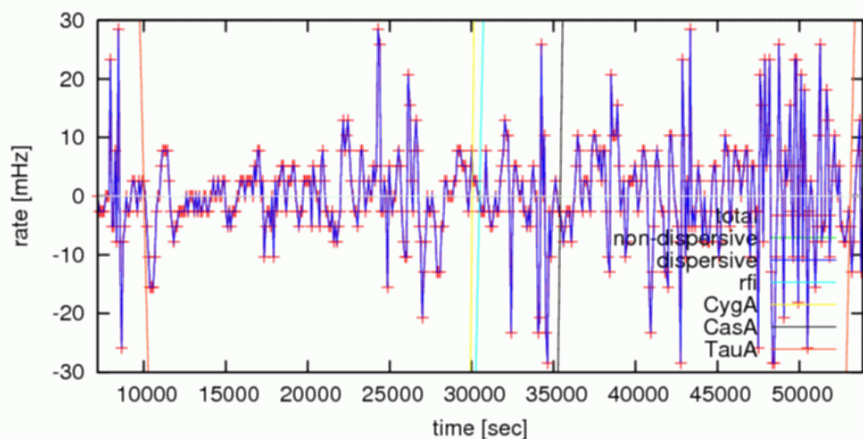
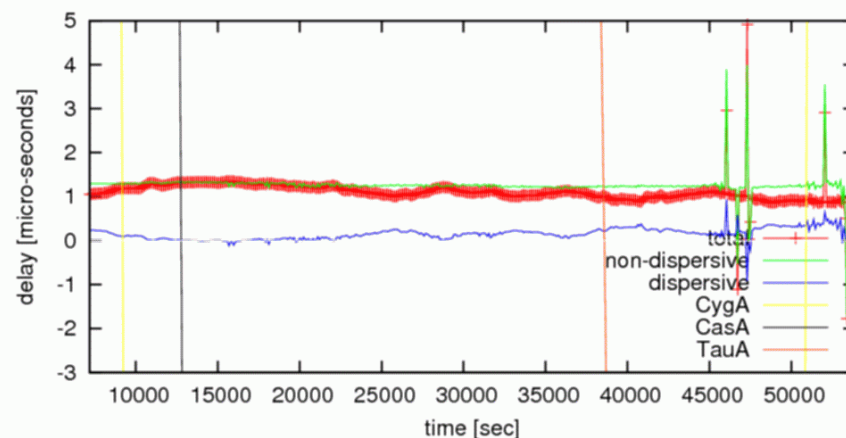
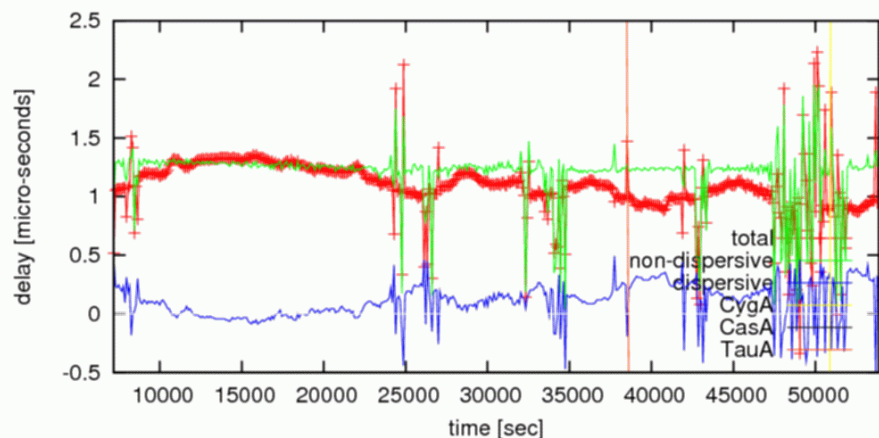
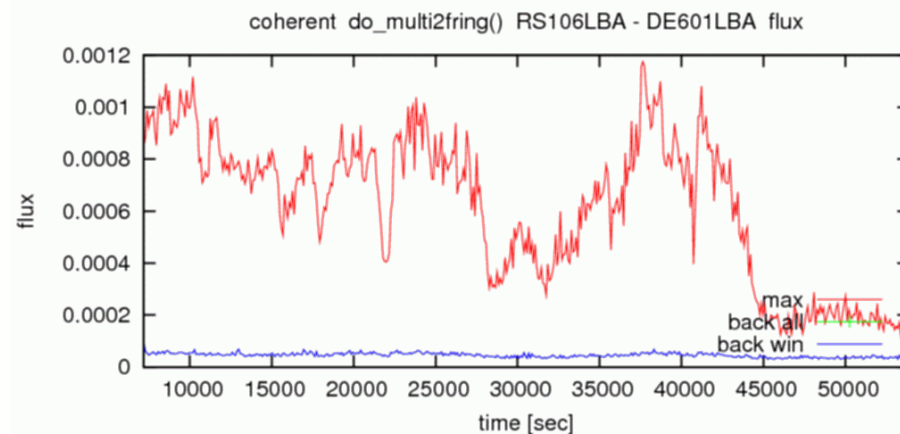
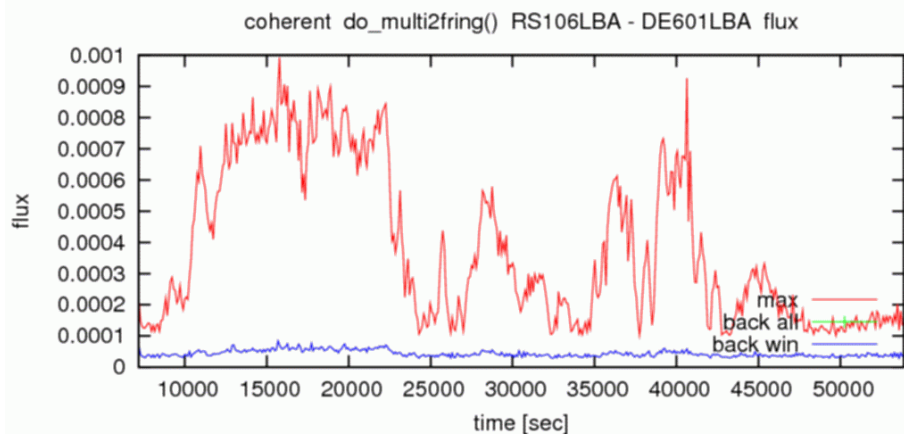
# 3C196: XX and YY polarisation on NL-NL



# 3C196: XY polarisation on NL-NL



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





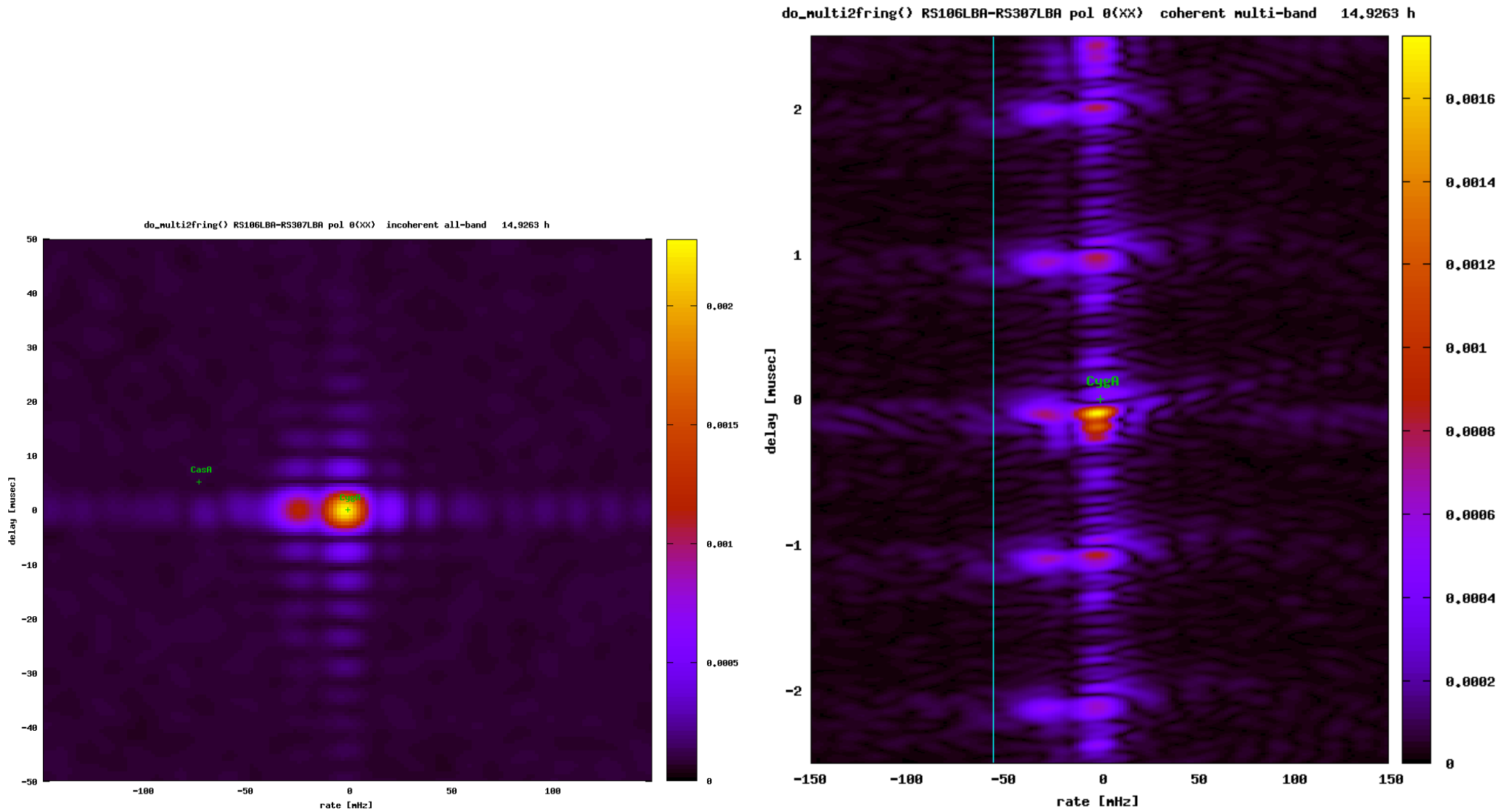
# Conclusions so far

- fringes on long baselines are real
- delays
  - ★ non-dispersive: small on NL-NL, typ.  $1 \mu\text{sec}$  on DE-NL  
can clock offsets be reduced?
  - ★ station position of RS208?
  - ★ dispersive: small on NL-NL, variable  $\lesssim 0.5 \mu\text{sec}$  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
- software situation is not optimal (aips++/casa/casacore)

# Epilogue: Cygnus A at 10–30 MHz



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