Update on Second-level Cosmic-ray Trigger

LOFAR Status meeting,
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Coincidence trigger

- Single-RCU triggers coming in from FPGAs
- On station's LCU: combine into coincident pulses

Coincidence trigger

- Find coincidences of single-RCU triggers within specified time window

- Find direction of incoming pulse

- Make decision to dump TBB data

- Make the software run & work in real-time
  - Functioning as part of TBBControl
  - Controllable by MAC/SAS layer

- Status: software runs in manual emulation of MAC/SAS
 - Finds coincidences in real-time and logs them

Coincidence trigger

- Estimate direction from given times of arrival
  - Assume plane wave from (θ, ϕ)
  - Calculate time differences for RCUs: $\quad c\,\Delta t_i = \vec{s} \bullet \vec{r}_i$
  - Compare with measured arrival times (variance)
  - Find best fit by exhaustive search (~ 10 ms)
- Tested offline on data from 6 stations:
  - Works on 3 out of 6 stations, for isolated pulses
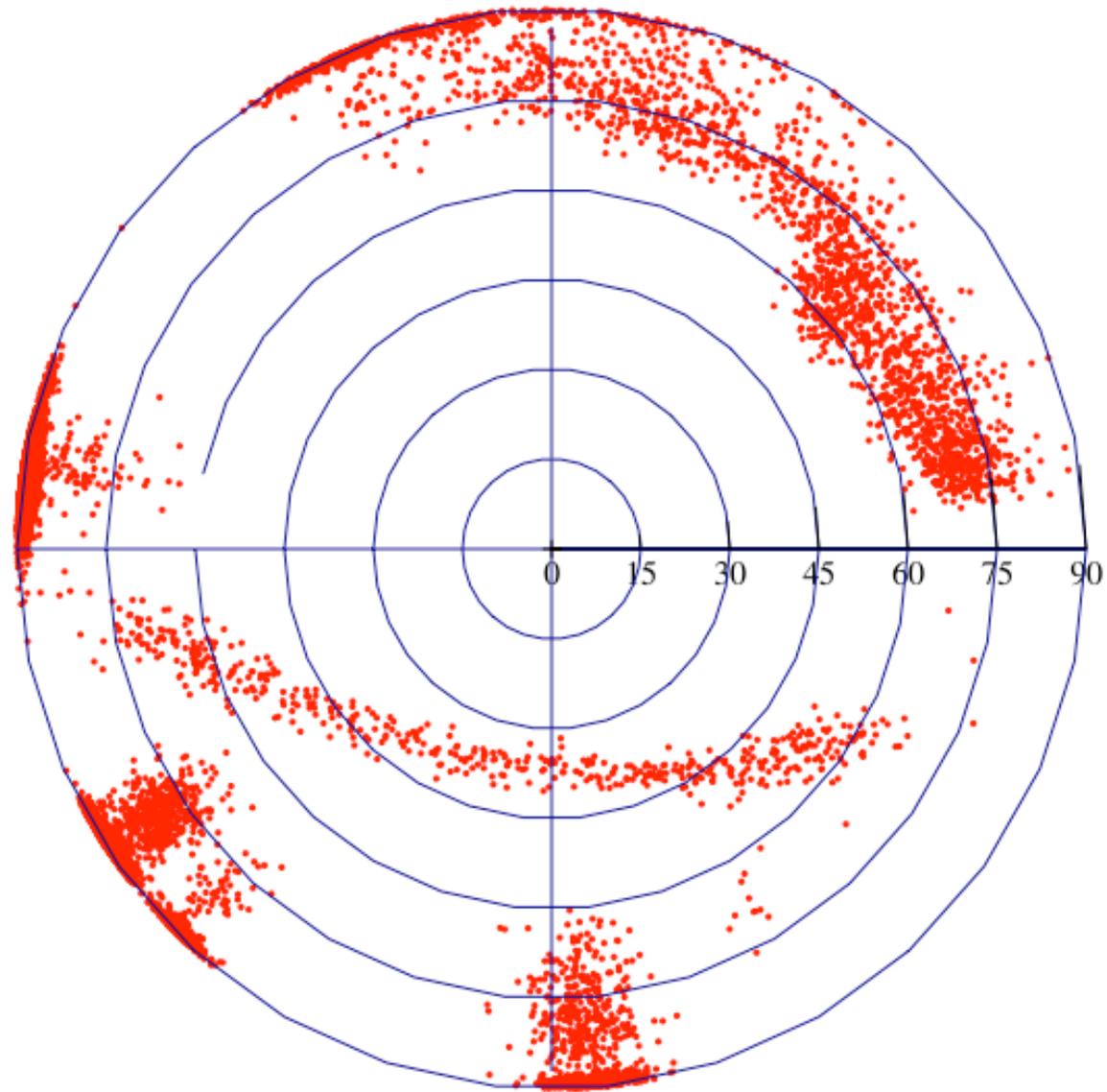 - reports 'bad fit' when two separate pulses in the same window (happens regularly)
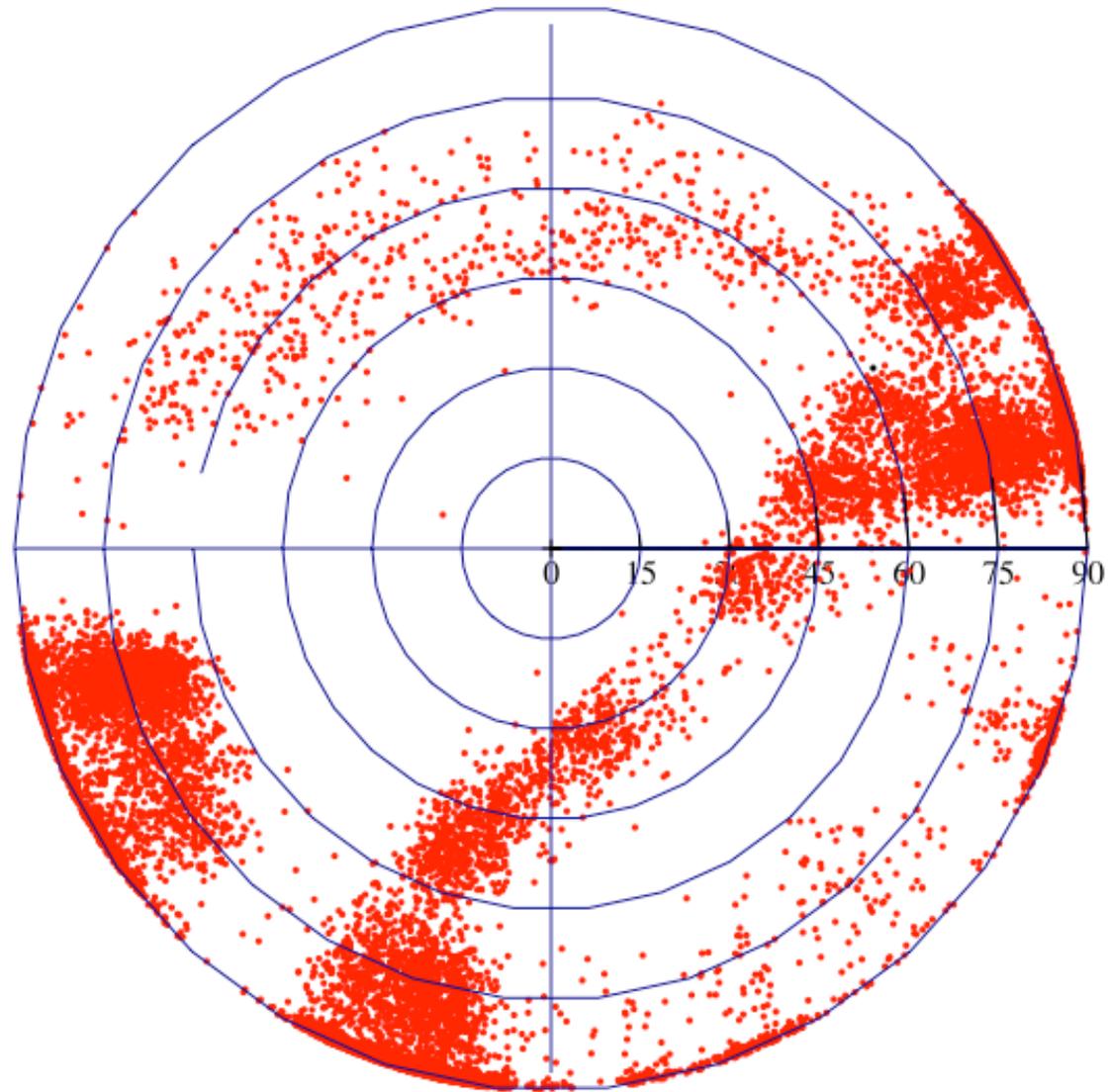
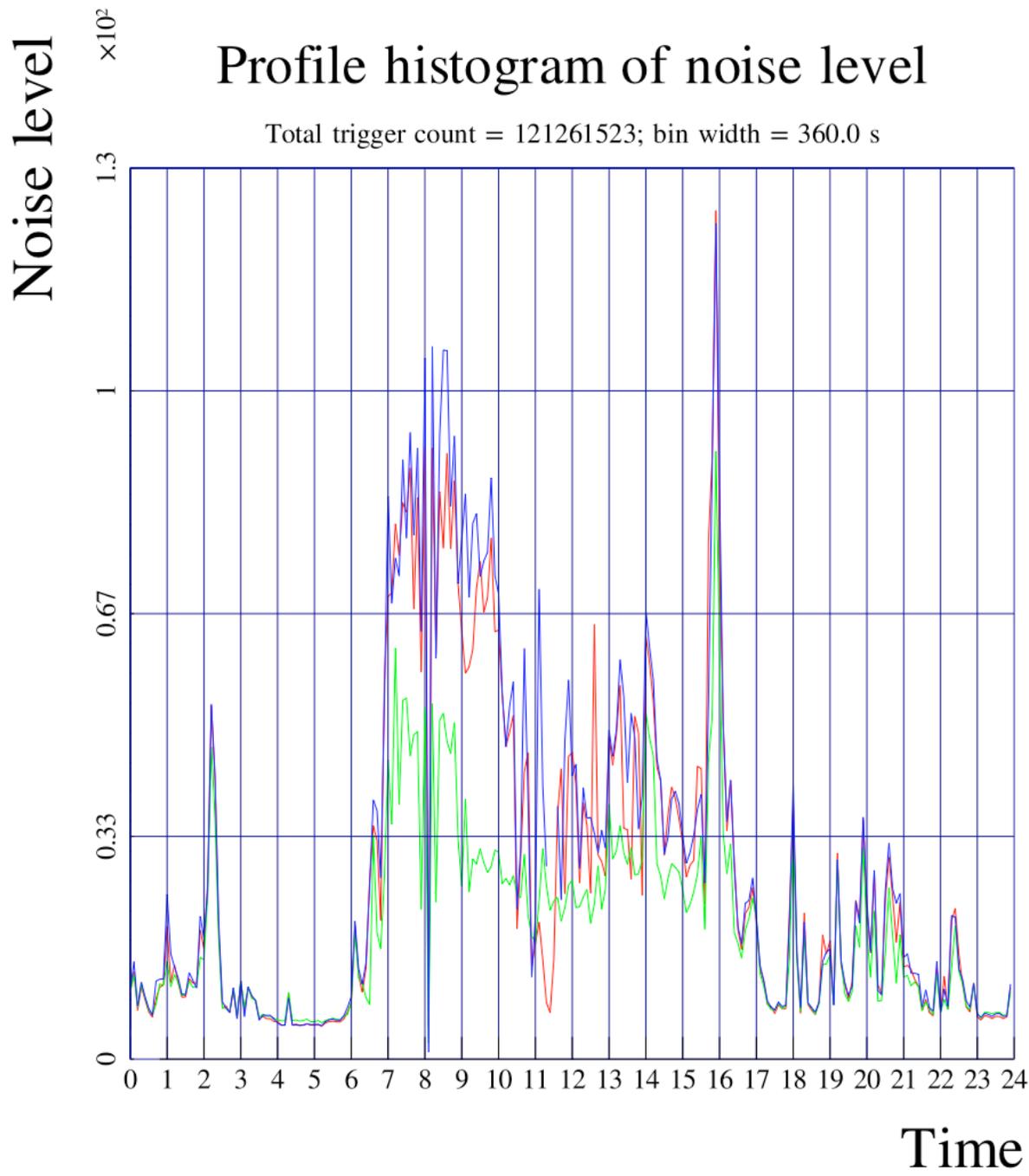CS021, 32 channels, Nov 30 2009
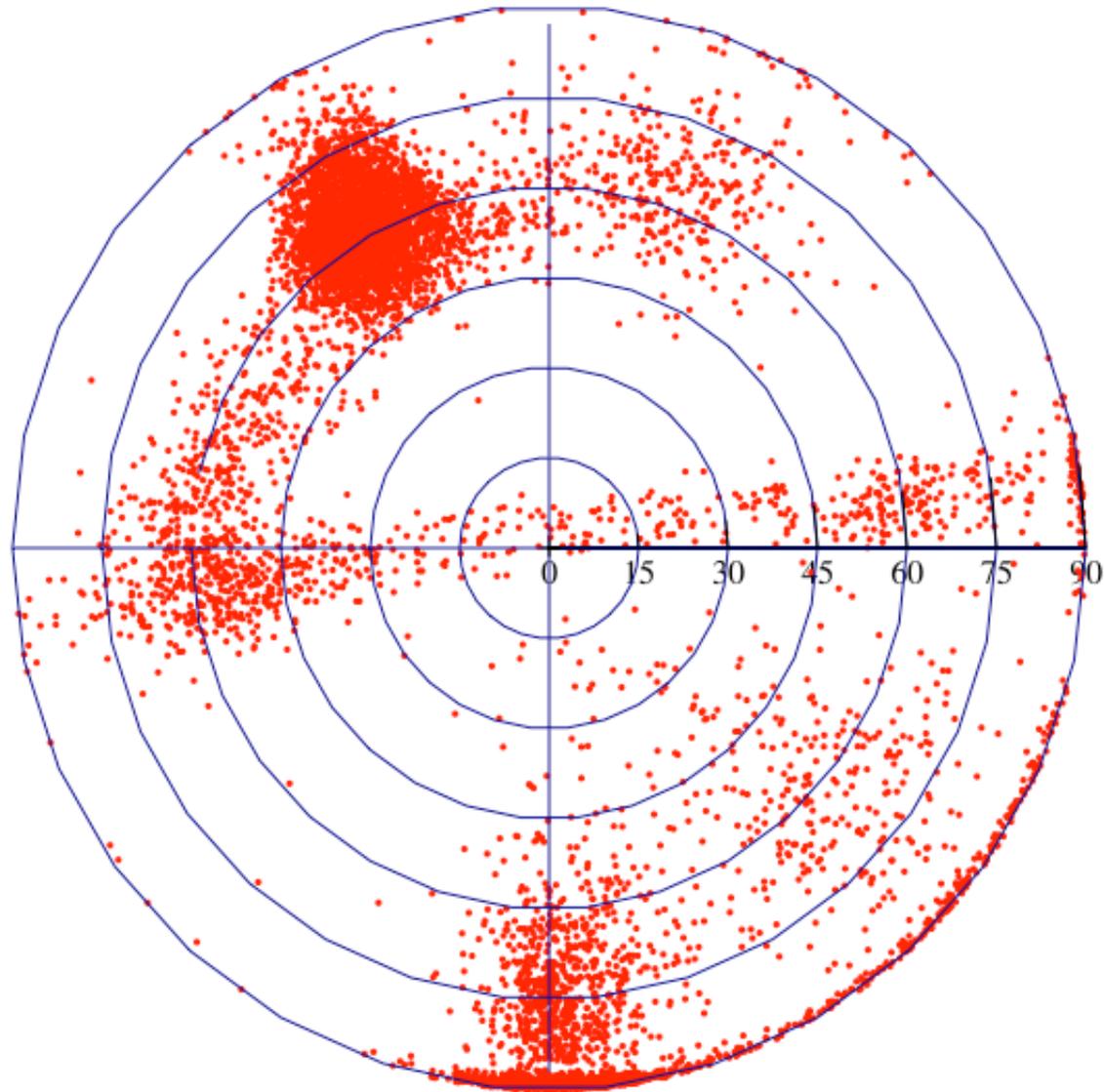
CS021, 32 channels, Dec 4, 2009
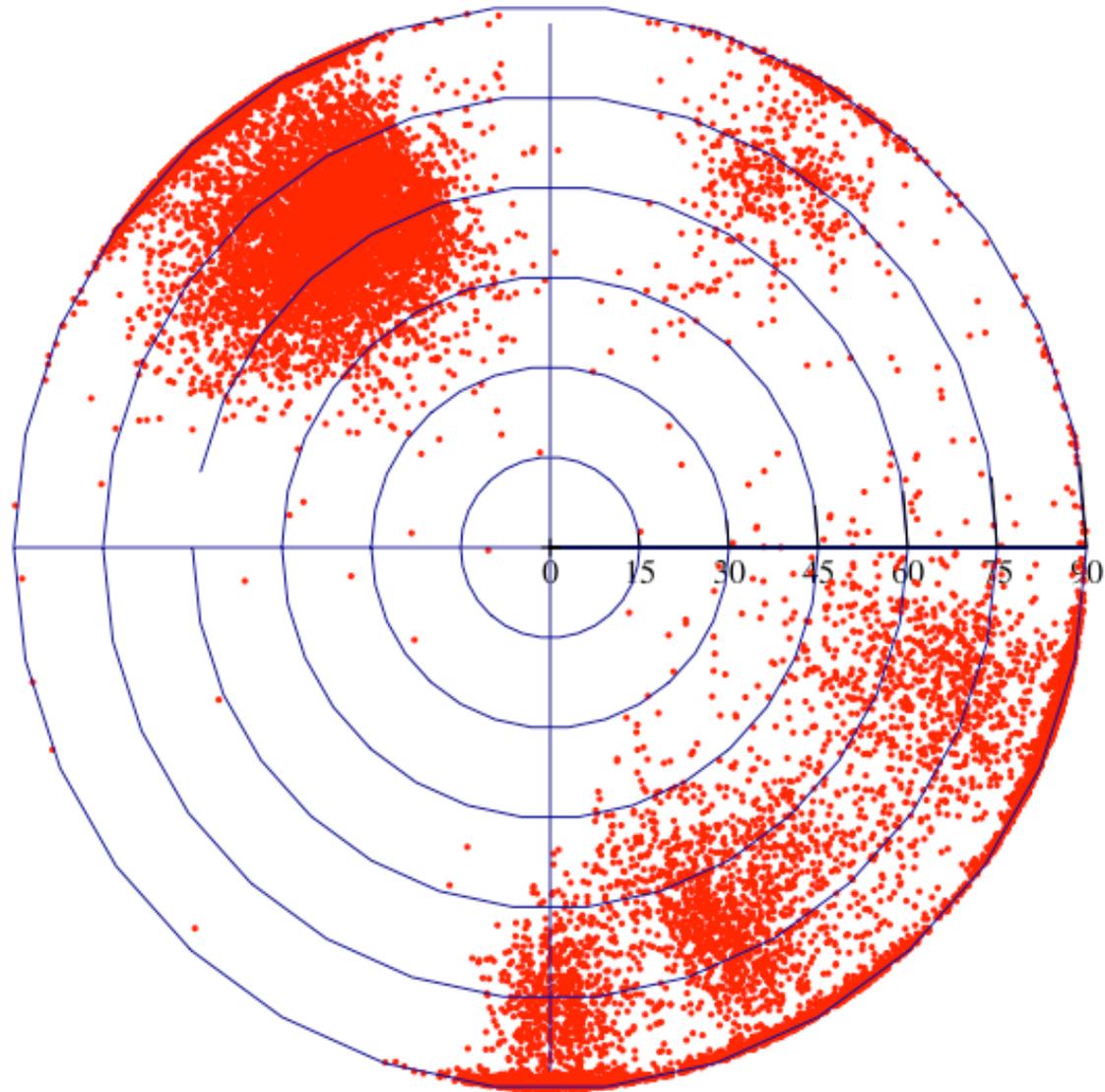
RS208, 48 channels, Nov 30 - Dec 7, 2009
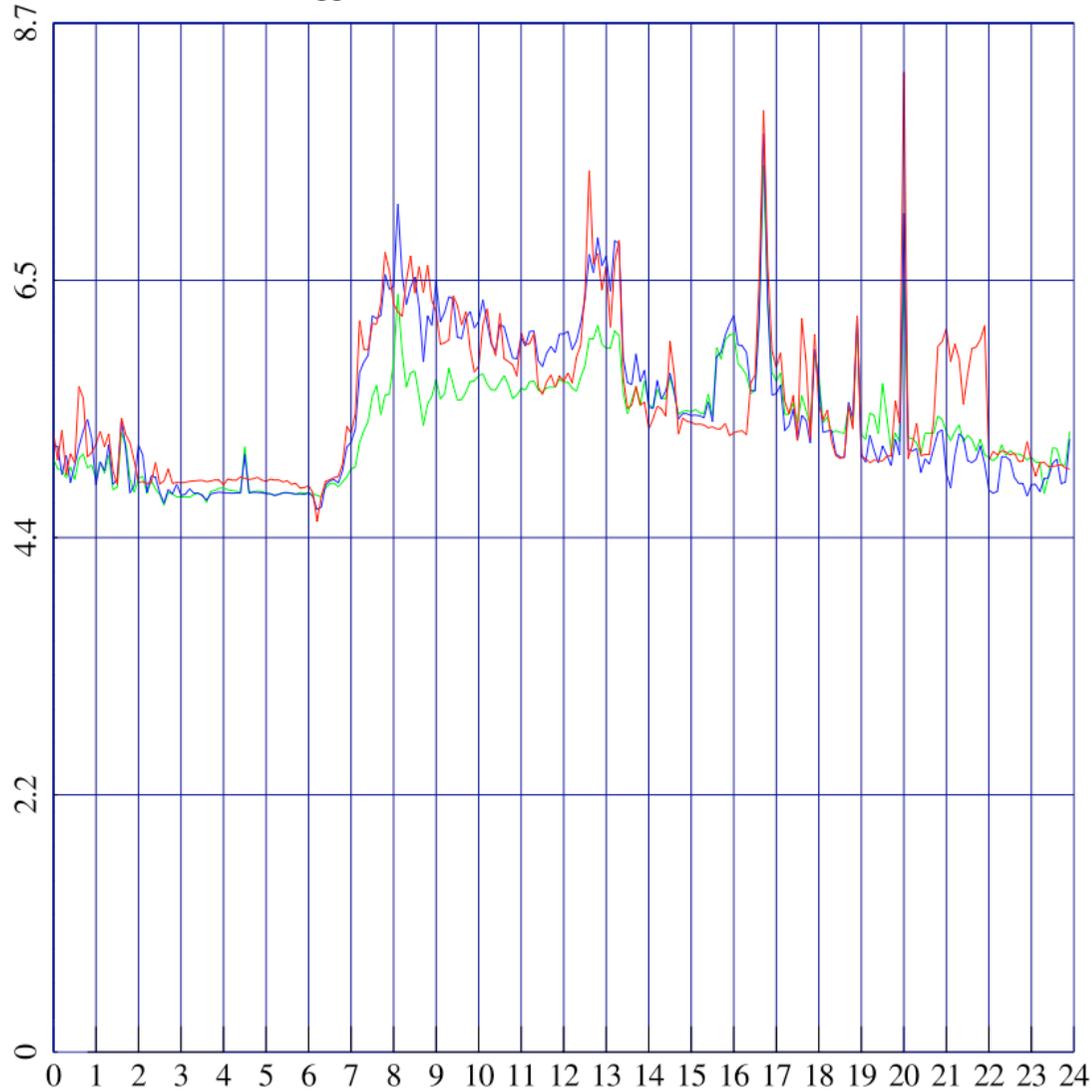
RS106, 48 channels, Nov 30 - Dec 7, 2009

Profile histogram of noise level

Total trigger count = 121261523; bin width = 360.0 s

CS021

- Noise level in ADC counts

- Blue: no filter
- Red: 88 MHz notch
- Green: 15 MHz notch

Profile histogram of noise level

Total trigger count = 202289361; bin width = 360.0 s

RS503

- Noise level in ADC counts

- Blue: no filter
- Red: 88 MHz notch
- Green: 15 MHz notch

Next step

- Make 2nd level trigger work and dump data in real-time!

- Work in progress…