Cosmic Rays KSP

LSM Update 4/05/2011

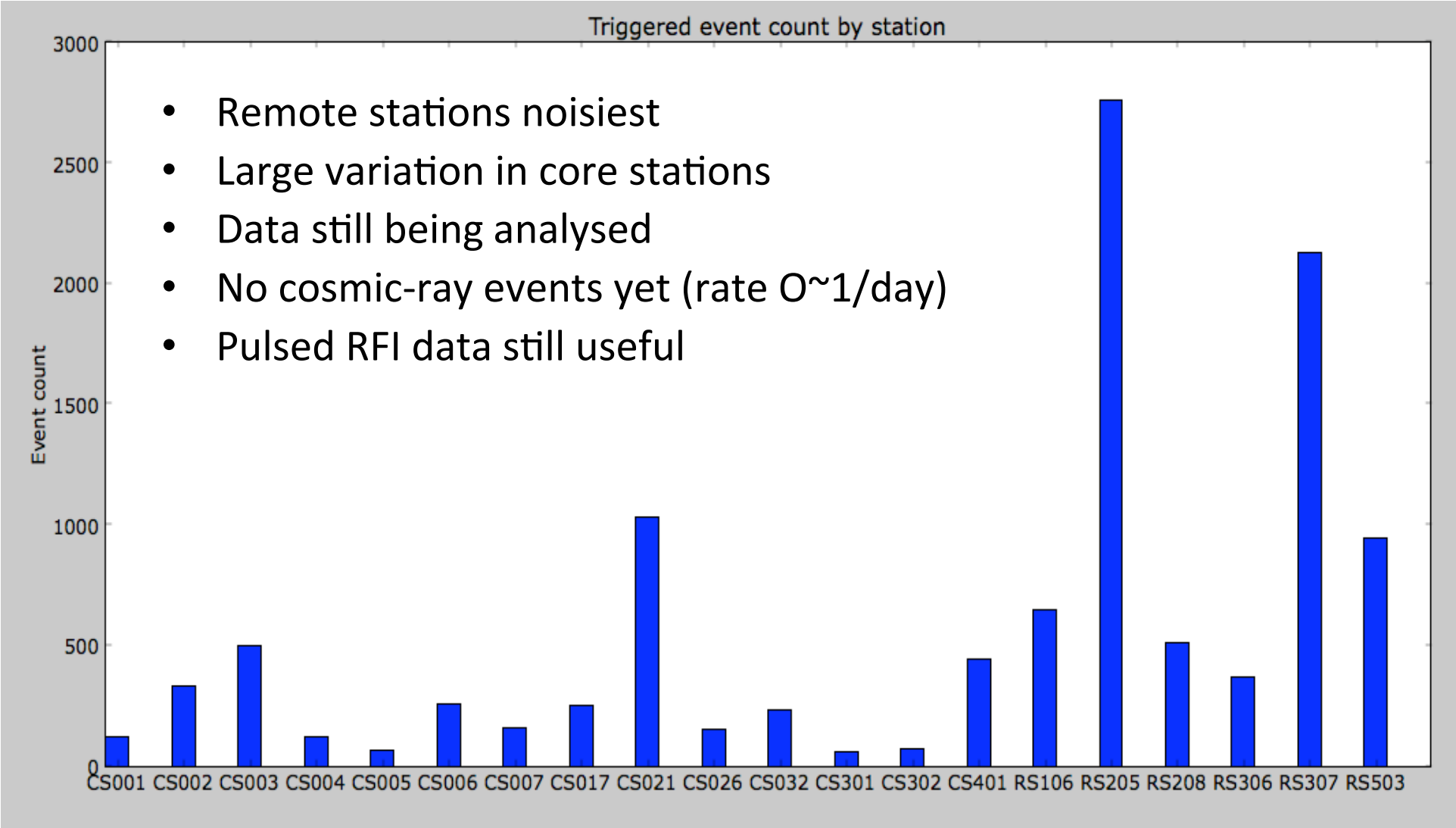
VHECR mode: 12 hr ‘all station’ run

- Observation:
  - Friday 18th March
  - 12 hr in VHECR mode (LBA outer)
  - 14 core + 6 remote stations.
  - Thanks to Wilfred Frieswijk for getting this going!
- Specification:
  - Used the OTB (not scheduler or MOM)
  - Data-writer started manually

- Stability:
  - TBBs require 48 V resets to start
  - CS024 board 0: could not be activated
  - After observation: few stations needed SWL 5&6 resets.

GOAL: test stability and take a ‘pipeline testing’ data-set.

Data summary: station-level triggers

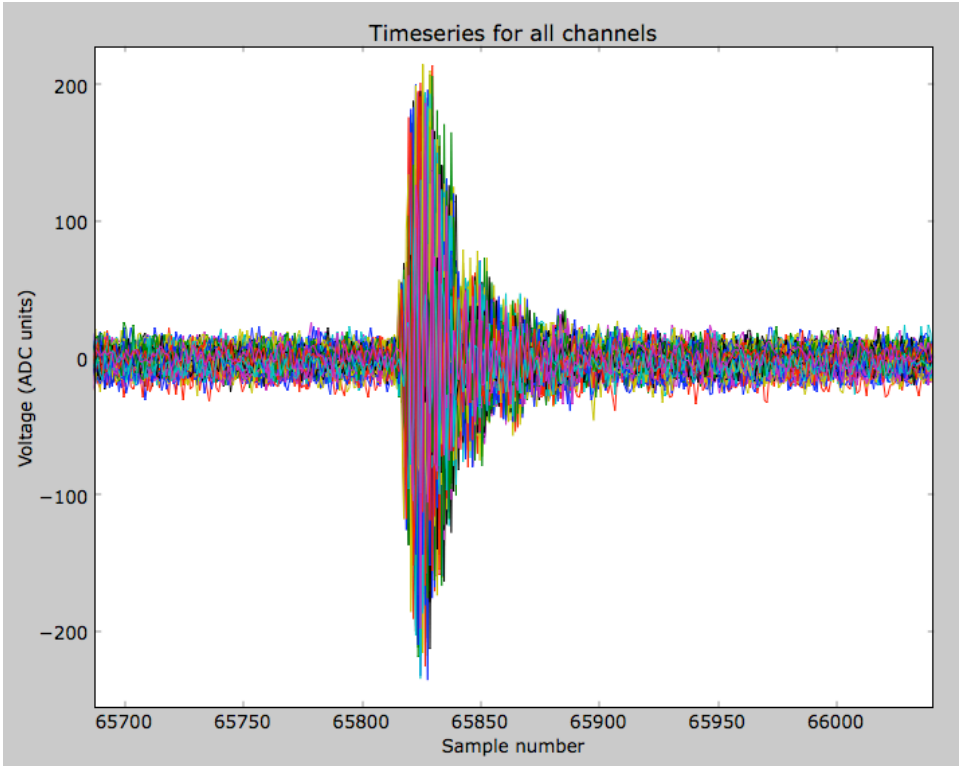


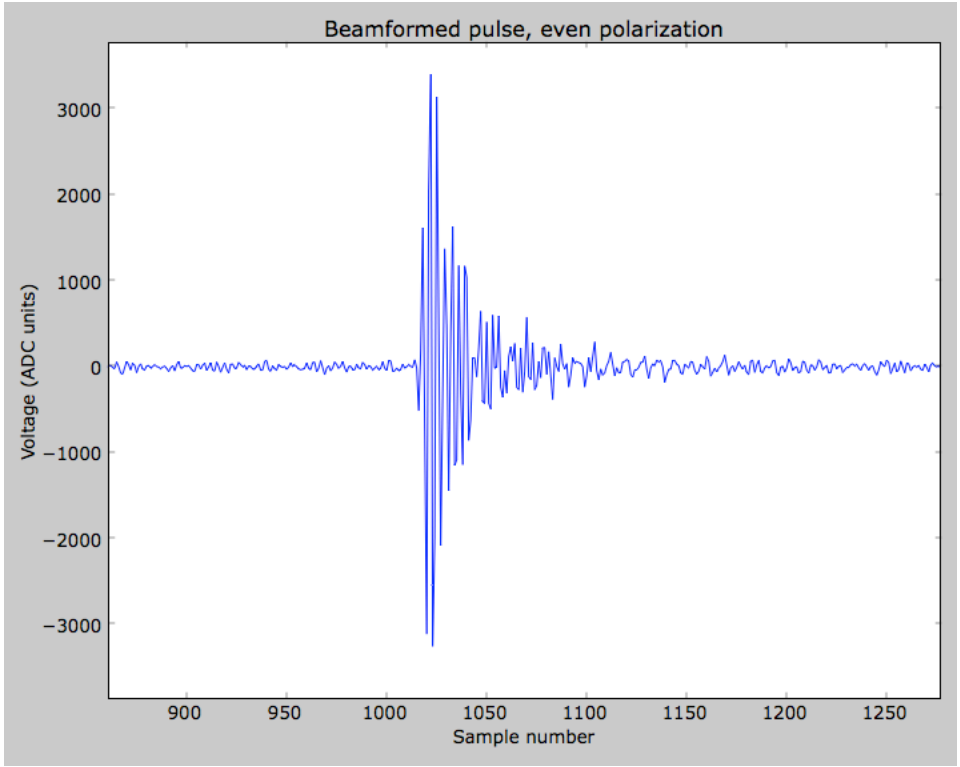
- Remote stations noisiest
- Large variation in core stations
- Data still being analysed
- No cosmic-ray events yet (rate O~1/day)
- Pulsed RFI data still useful

Figure courtesy of A. Corstanje

Typical Noise Event

- Time-domain traces from each LBA cross dipole
- Add in phase to get beamformed pulse
- Many signals strongly polarised





Figs courtesy of A. Corstanje

Signal ‘footprints’

- VHECR science goal: measure pulse height vs distance from shower core
- Plot strength vs position on ground

- Test with RFI pulse
  - CS004 LBA data
  - Dot size ~ voltage height
  - Dots are even/odd RSPs

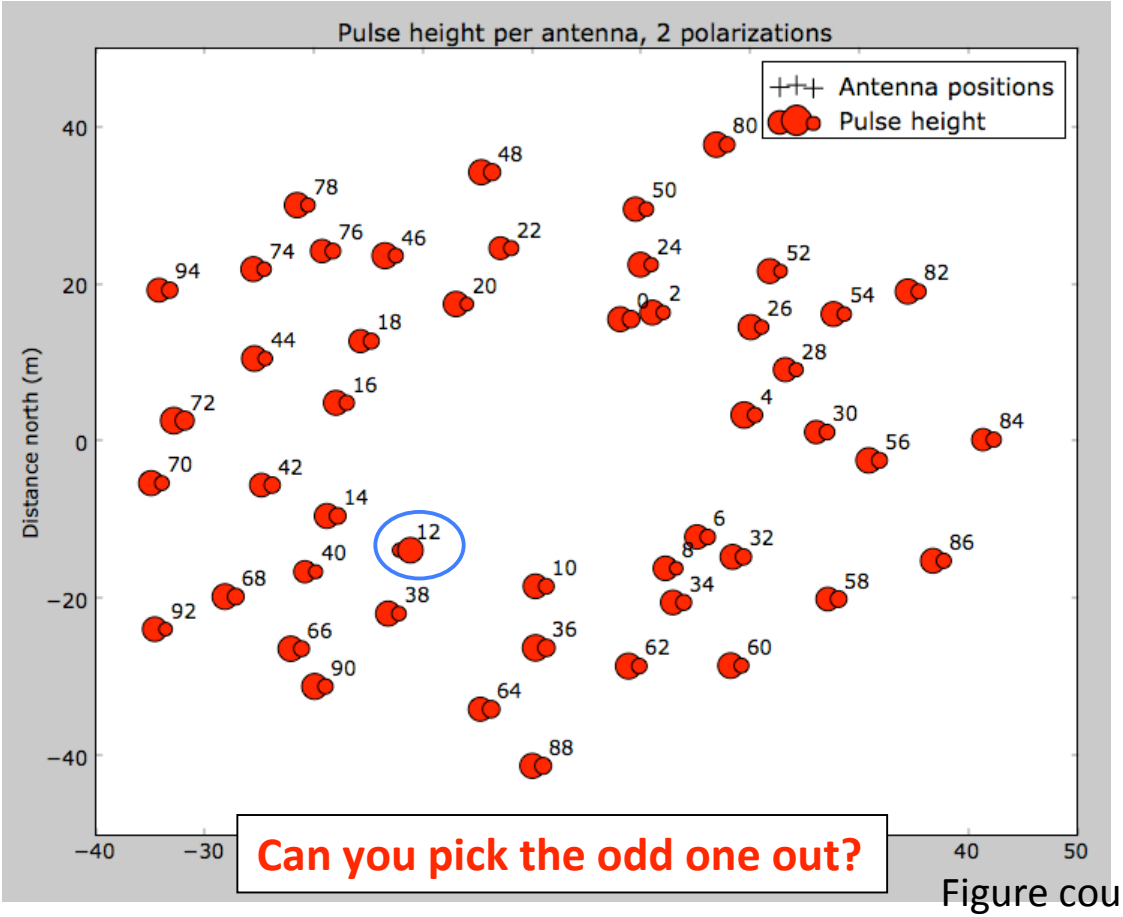
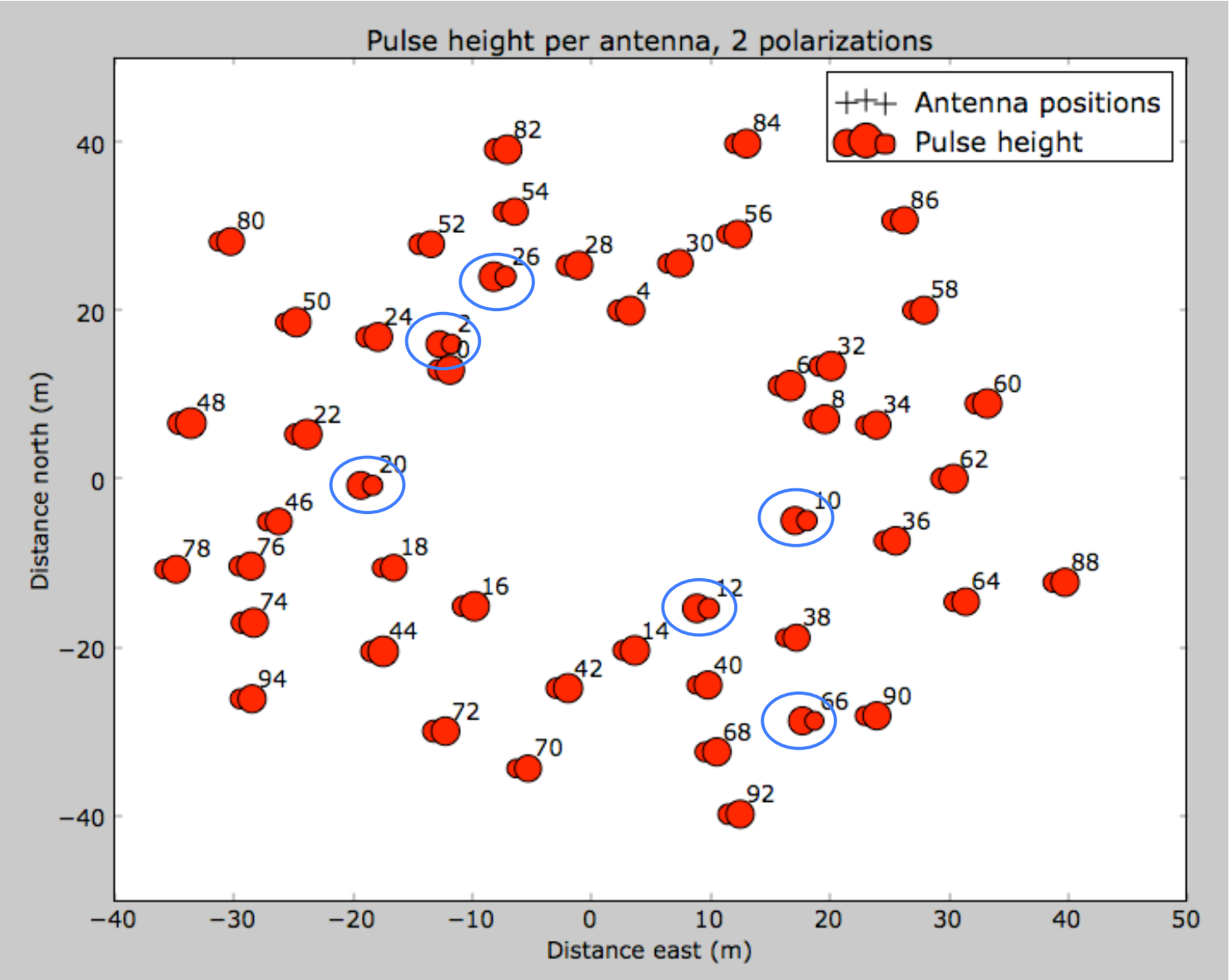


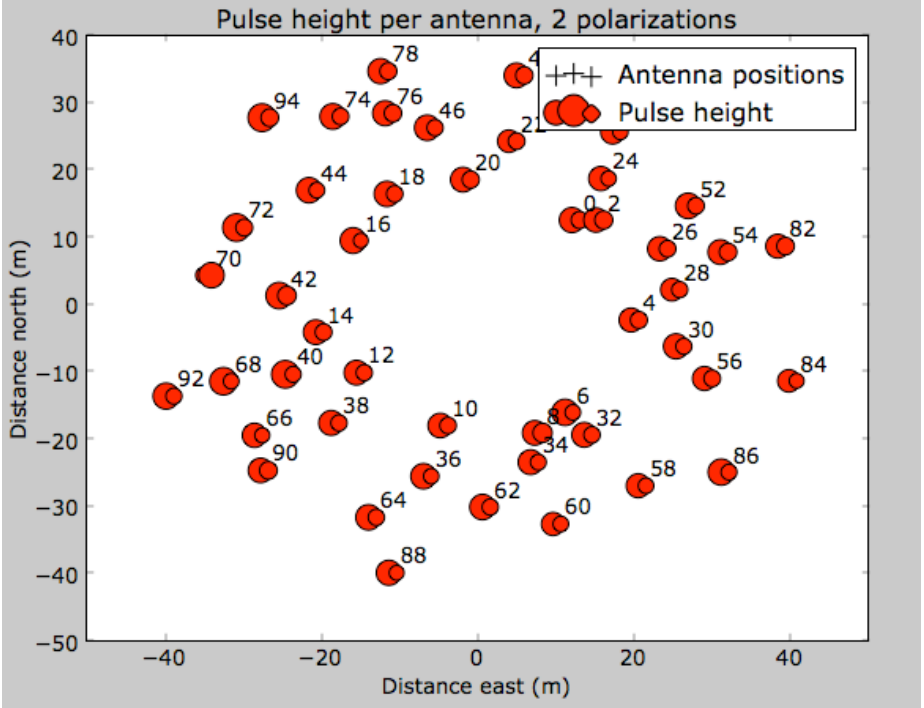
Figure courtesy of A. Corstanje

CS017: now fixed



Current status…

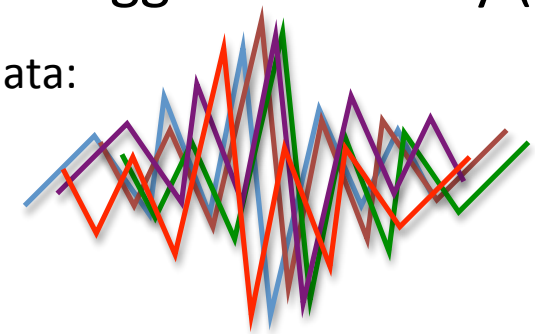
- Analysis finished for the super-terp
  - CS001 RCU 70/71 switched
  - CS004 12/13 switched
- Pending:
  - Analysis on core
  - remote stations pending (CS017 fixed)
  - Test observations for LBA inner



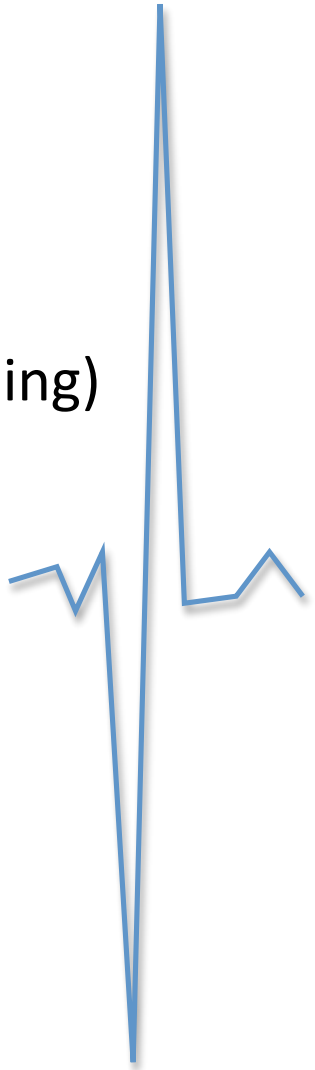
LORA progress

- LOFAR VHECR sensitivity
  - Low trigger sensitivity (uses single antennas)
  - Very high post-trigger sensitivity (station beamforming)

LBA dipole data:



Beamformed:



- Use LORA particle detectors to trigger the core
  - There is no relativistic muon background!
  - More sensitive.
  - Guarantees cosmic-ray origin
- Station 5 complete: other stations to be completed next week (install network switches)

LORA triggering

- Test April 20th
  - Signal from LORA: triggered TBB dumps
  - Time delay to trigger: 1.45 +- 0.15 seconds.
  - 0.25s due to LORA
  - 0.13s due to LOFAR processing

- Q: Where comes the 1 remaining second?
- A: LORA clock is 1 s fast.

- To be done:
  - Implement LORA triggering ‘nicely’ (not hacked).
  - Calibrate LORA threshold and determine sensible threshold.

- Plan for MSSS: have this run in parallel for LBA observations

Stations in VHECR run

- [CS001,CS002,CS003,CS004,CS005,CS006,CS007,CS017,CS021,CS026,CS030,CS032,CS101,CS103,CS201,CS301,CS302,CS401,RS205,RS208,RS307,RS106,RS306,RS406,RS503]