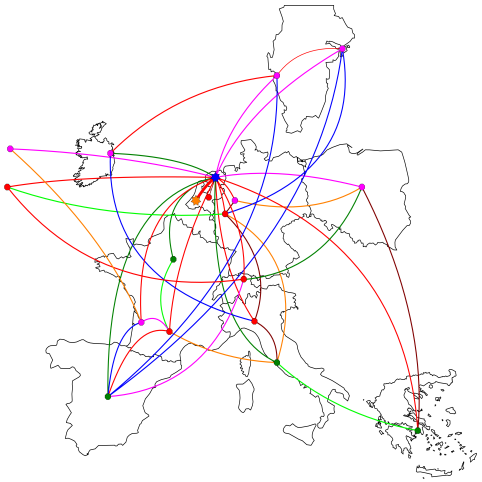
WP 15: High-energy events (HEE)

V. Ossenkopf, E. Chambers



HIFI ICC co-location, Florence
October 21-25, 2013

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Overview

- Tasks
- Deliverables
- Progress in last 6 months
- Next steps
- Open points

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WP 15: HEE

- Tasks:
  - Statistics of HIFI SEUs in different subunits
  - Identify data anomalies from "glitches", develop mitigation routines
  - Search for showers in WBS:
    - individual pixels
    - readout lines
    - identify other false signals
    - develop routines for identification close to noise level
  - Correlate with space weather, SREM readouts
  - Lab tests for energy-dependence → dropped
    - Identification of critical energy for different subsystems/events
- Deliverables
  - Glitch correction routine in pipeline
  - Report

WP 15: HEE

- Progress in the last 6 months
  - Post-He tests provided 168038 WBS zero scans
  - First analysis of warm tests and cold zero scans

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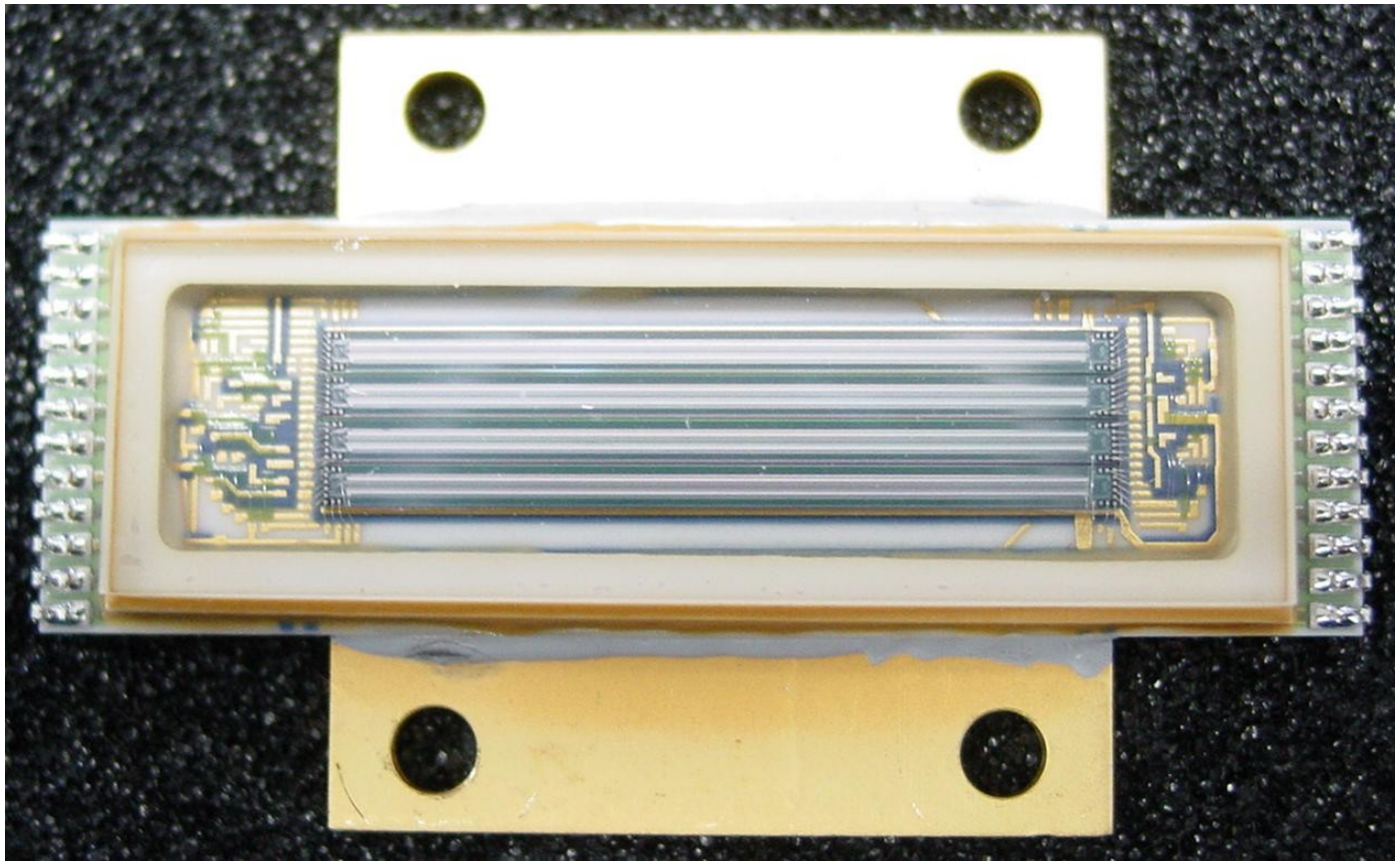
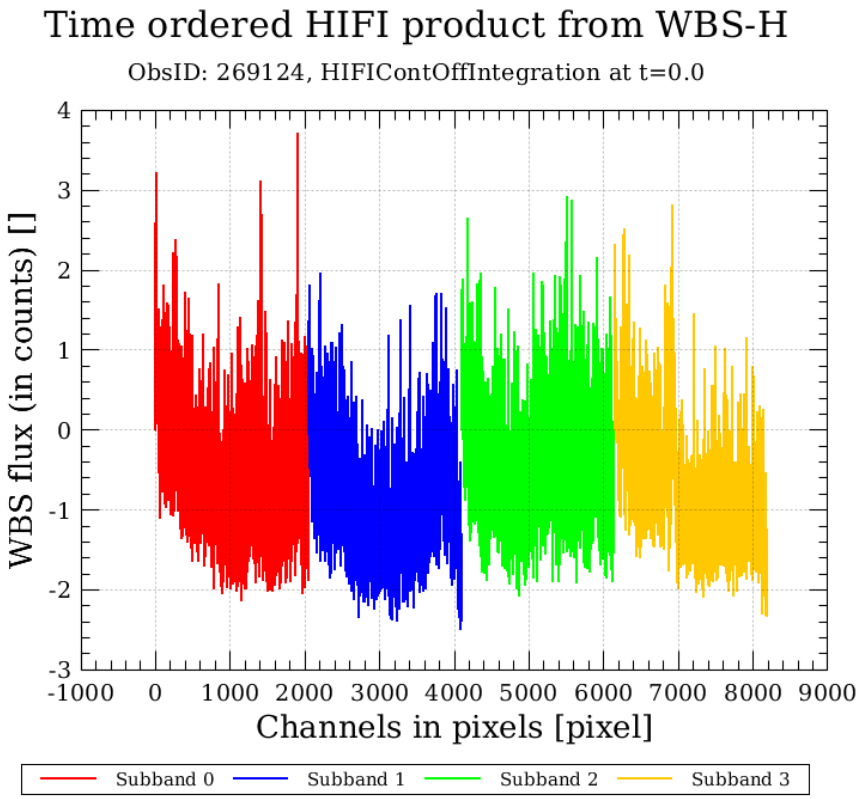
WBS CCD as HEE detector

» CCDs are high-energy event detectors by design



Zero scans



1342227409 WBS-V

- Detection of spikes
  - Structure of zero speckles prevents detection of signals ≤ 4
- Thresholds for GLITCH detection in pipeline:
  - 8.0 for WBS-H,
  - 7.6 for WBS-V

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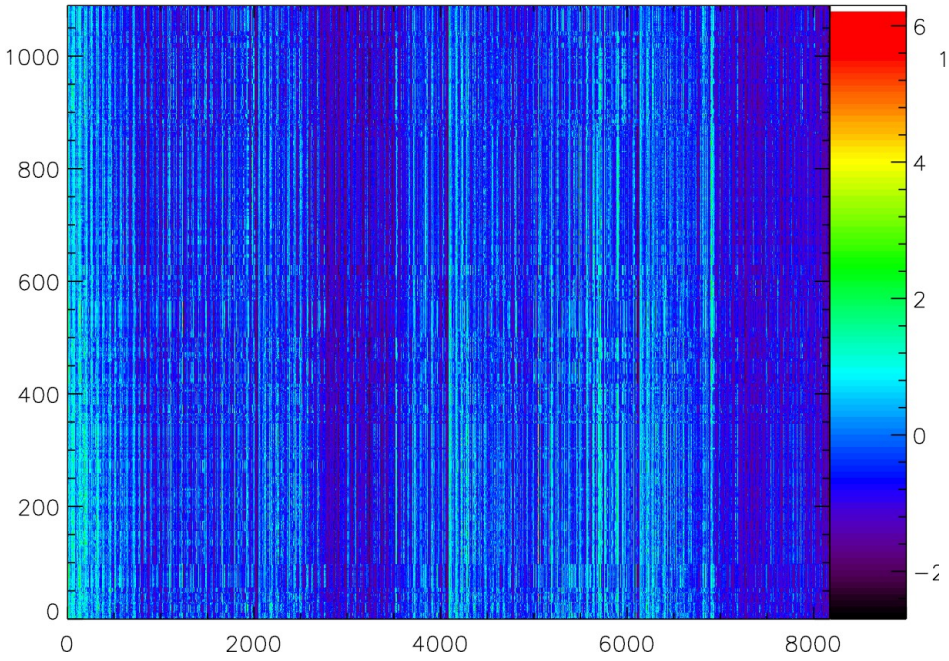
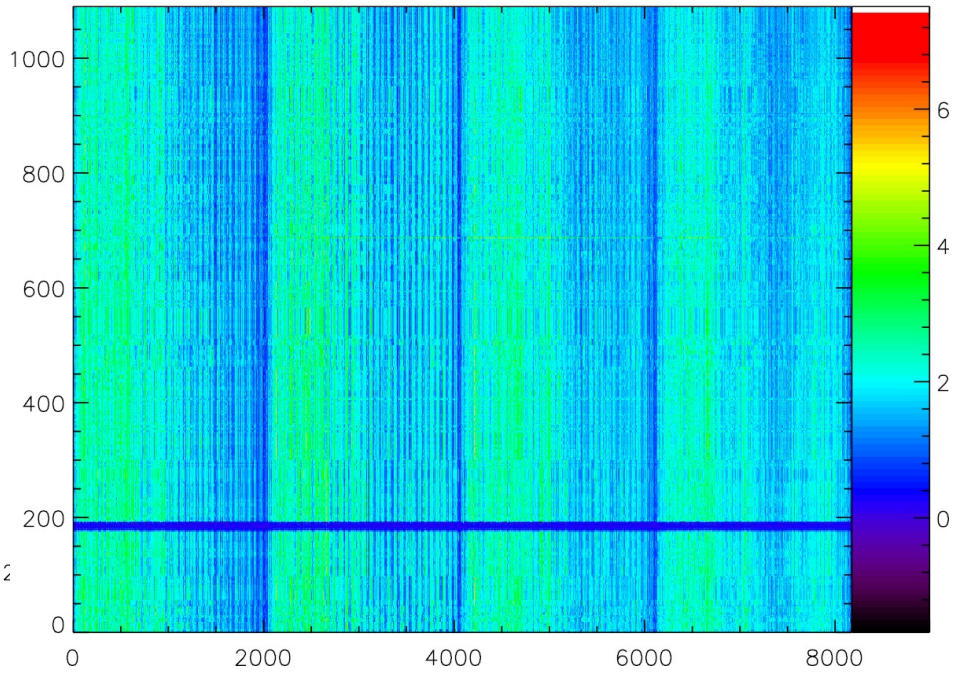
Zero scans

» Speckle pattern strongly affected by optics temperature



Time series of all cold WBS-H zero spectra



WBS-V

•In total 54585 usable spectra per WBS
  – Less than 100 spectra unusable

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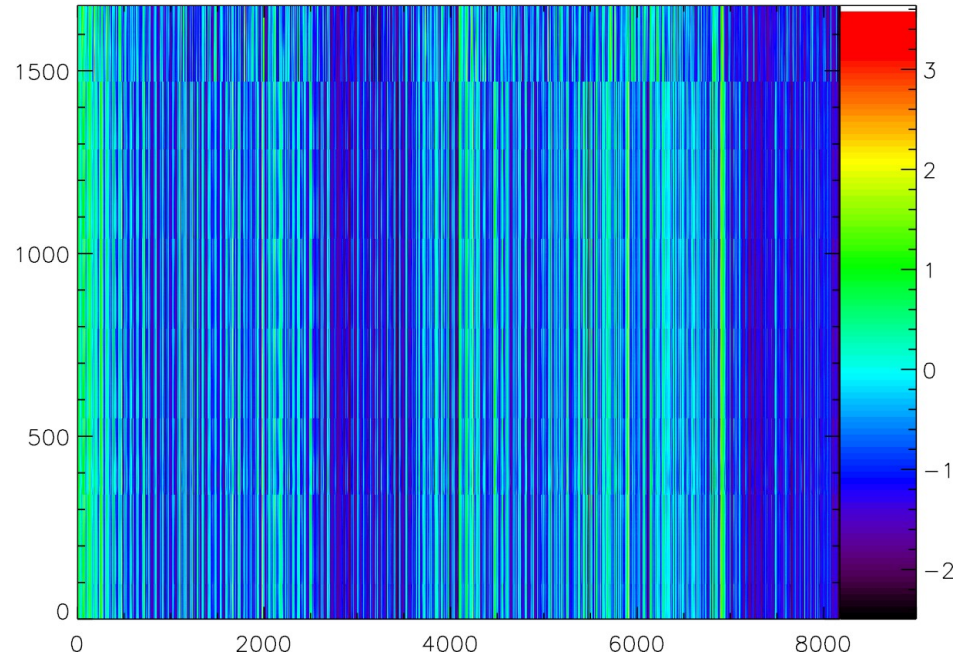
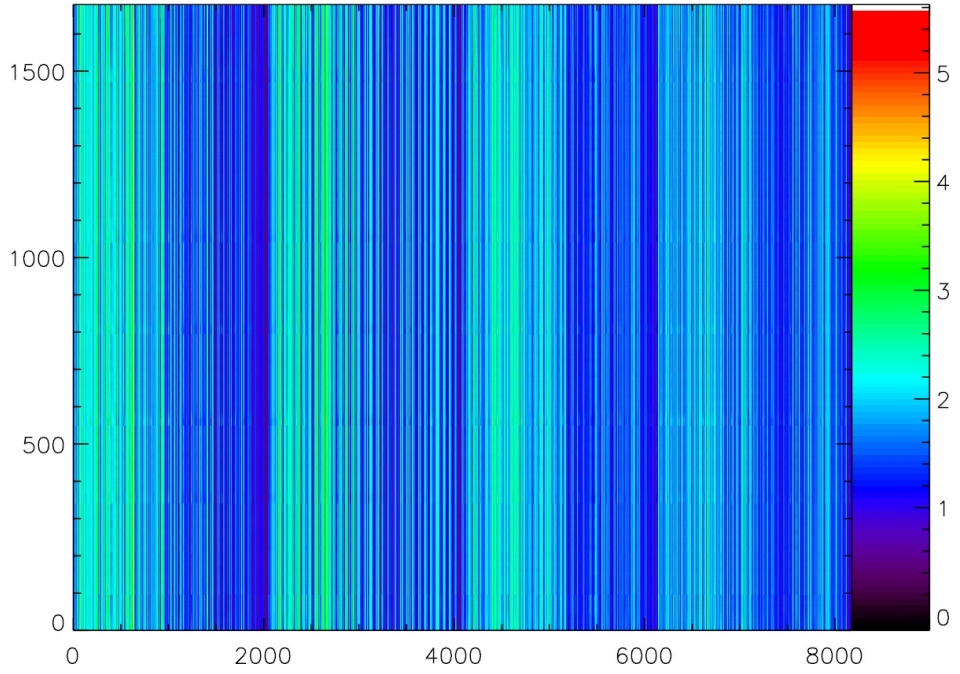
Post-He tests

» Much more homogeneous and stable conditions



Time series of all post-He WBS-H zero spectra



WBS-V

• Reference data set of 168038 high quality spectra

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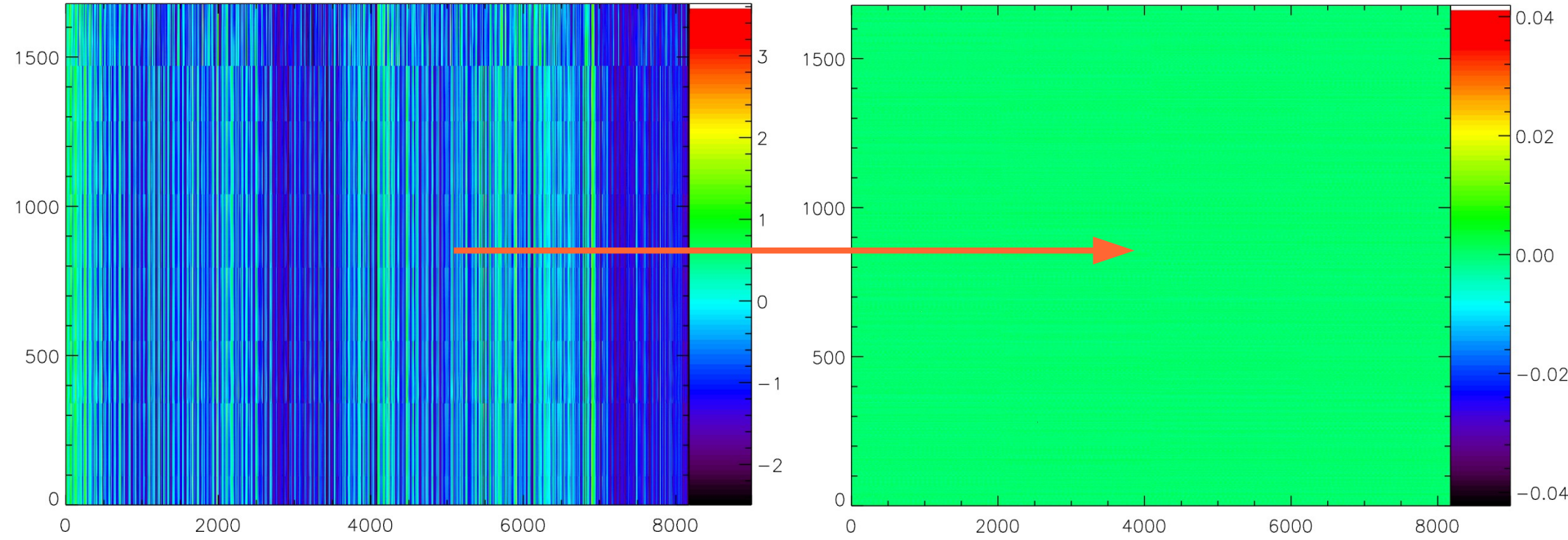
Remove speckle pattern

» Subtract gliding average



- Non-trivial
  - Based on nearest neighbours in time
  - Excellent results for post-He data

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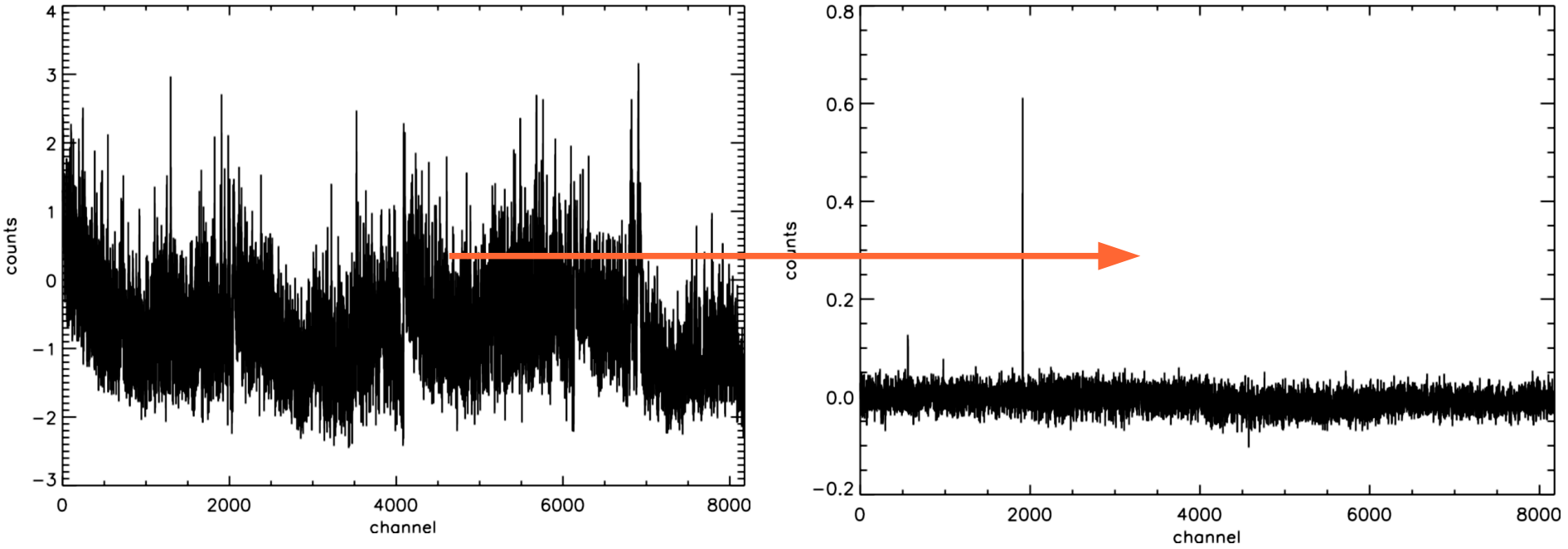
Remove speckle pattern

» Subtract gliding average



- Non-trivial
  - Based on nearest neighbours in time
  - Excellent results for post-He data

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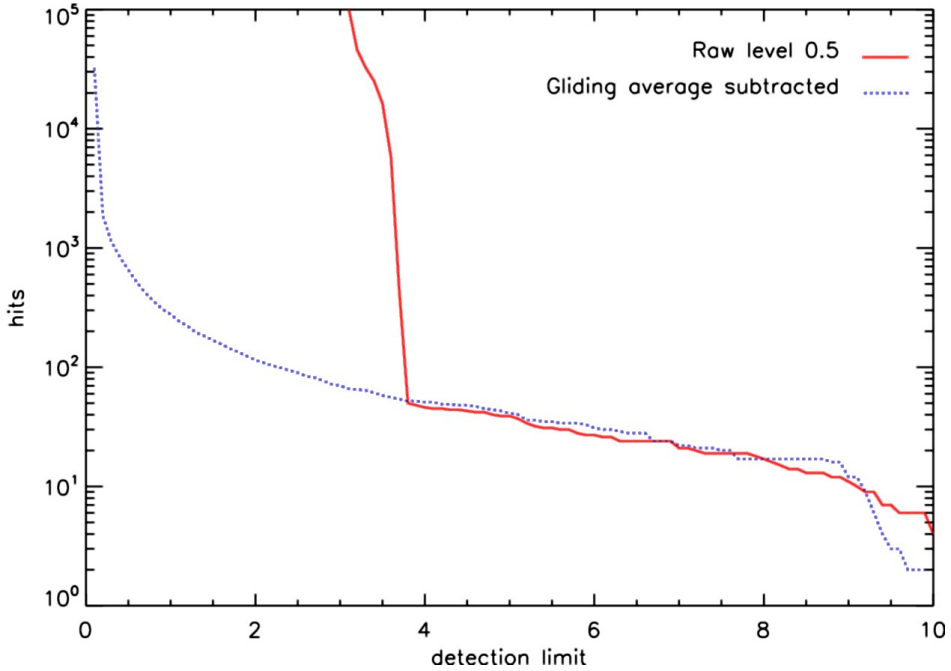
Event detection

» Statistics of spikes (outliers) above a given threshold:



- Speckle subtraction extends the dynamic range of HEE detection to < 0.5 counts
  - Significant exponential tail of low-energy events
  - Significance limit not fully clear yet: 0.2...0.8

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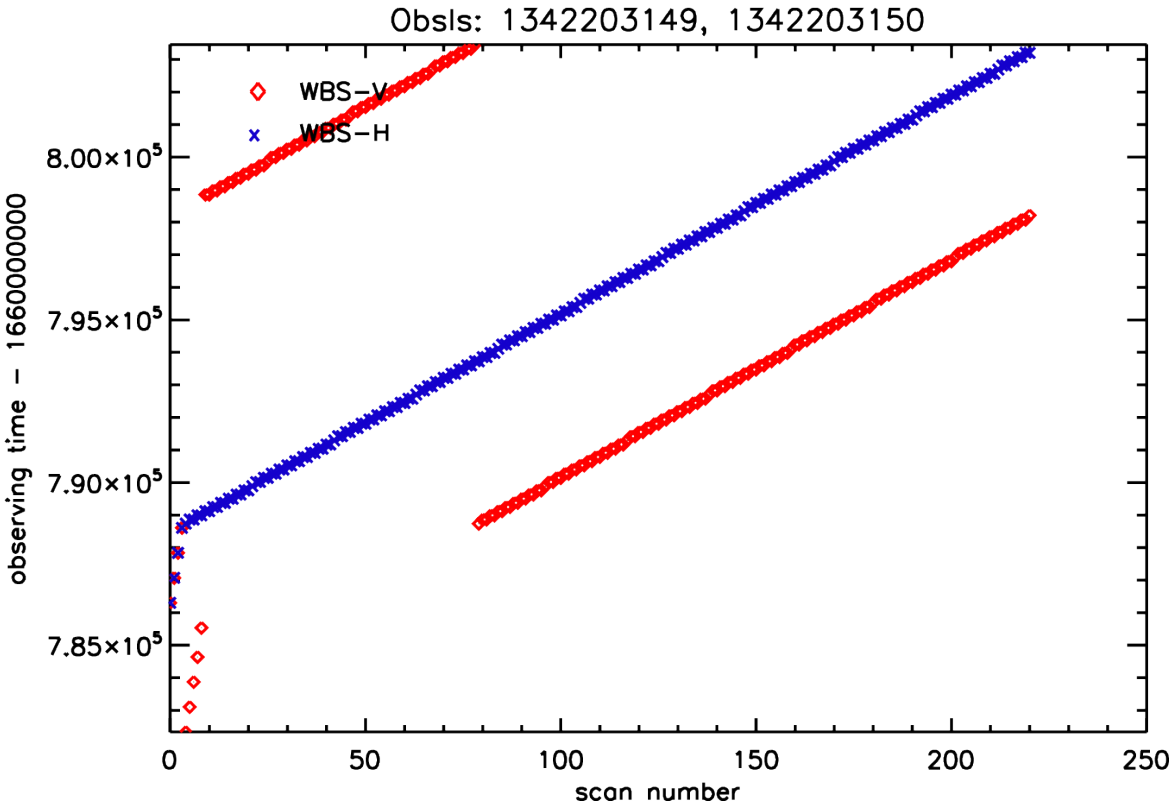
“Normal” zero scans

» Tricky because of many data issues
  - Ongoing work

- Example:
  - Screwed up ordering of scans in two ObsIds



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“Normal” zero scans

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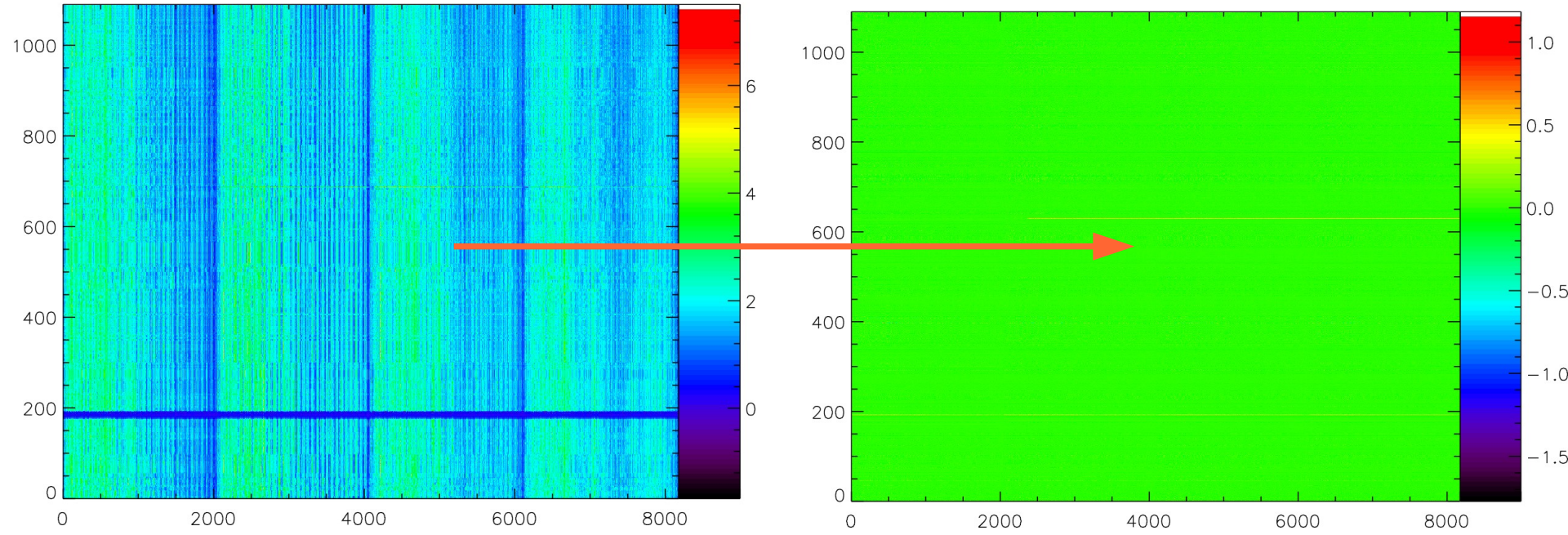

• Needs more manual treatment of outlier scans

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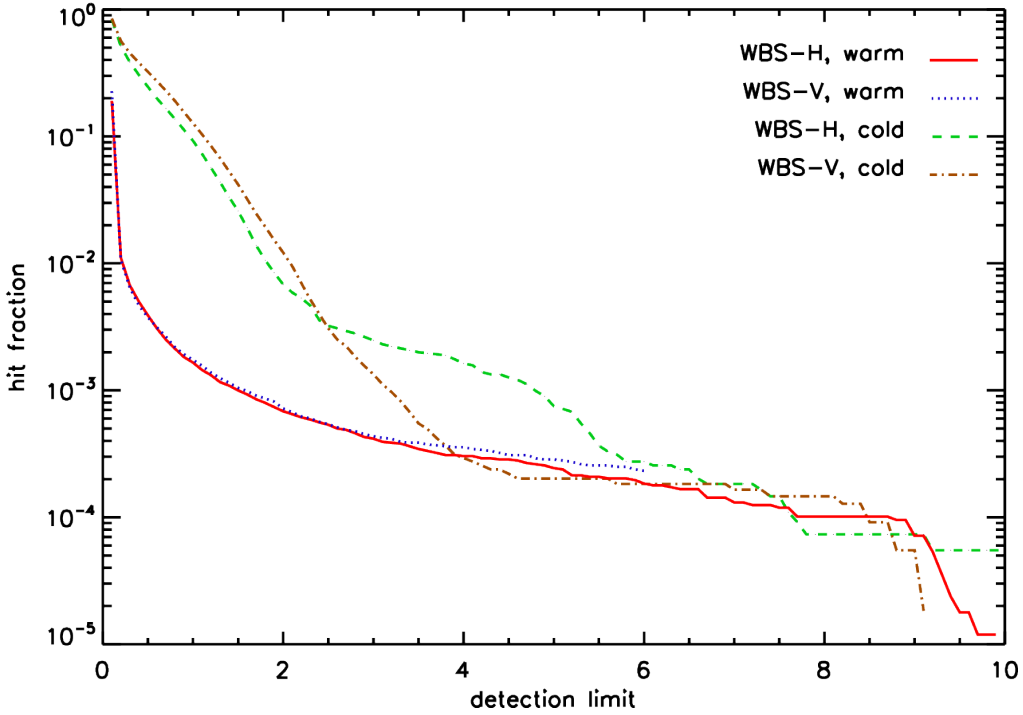
Event detection

» Statistics of spikes (outliers) above a given threshold:



- Should allow to flag about 1000 cold zero scans per WBS with HEEs
  - Limit still to be determined

Outcome of zero-scan analysis

» About 3000 clear events for further analysis

» GLITCH limit in current pipeline

- Definition is safe
- No false detections
- But overlooking many small events
- Rather calibration table of affected scans/channels (?)

» Energy statistics of events needs further analysis

- Much input for detailed statistics
- Full interpretation would require better CCD characterization
  → probably impossible due to lack of resources

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WP 15: HEE

» Progress in the last 6 months

- Post-He tests provided 168038 WBS zero scans
- First analysis of warm tests and cold zero scans

» Next steps

- Identify criteria for WBS hits to be used in pipeline (glitch limit/cal. table)
- Describe full statistics of hits
- Create statistics and correlation of ICU, SEU events, and SREM data
- Digest space weather statistics

» Open points:

- Analysis of comb scans and overlapping subband parts?
- Collaboration with ESA SEU analysis
- Information on bitflips in other EDACs on board

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