RHESSI Detector Efficiency > 6 keV: 2002-2011

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Test for decrease in detector efficiency:

- **Motivated by calculation of B. Dennis for some flares which found that detector efficiency relative to D1 decreased with time.**

- **Here we do a similar calculation for approximately 4100 flares, from feb-2002 through oct-2011.**

- **Also tracks changes in D1 response in comparison with GOES Hi (short-wavelength) channel.**

The calculation:

- For each of a sample of flares, find excess counts > 6 keV for each detector.

- Fit data for each detector, while keeping T fixed at the D1 value.

- Excess counts normalized by D1 counts are used as a measure of the relative sensitivity for each detector.

- OSPEX setup code supplied by B. Dennis

Flare Sample:

- **The sample of flares includes each "clean" flare with no attenuators, no data gaps, no SAA, no particles, no decimation, no high latitudes.**

- **12 seconds before and after start and end must be "clean" for background subtraction. "Good" spectral fits are required, flares that are excessively small (less than 1 count/sec, and 10^{-45}cm^{-3}) are dropped.**

- **The time interval for each flare was the same one used to find position, 1 to 2 minutes at peak.**
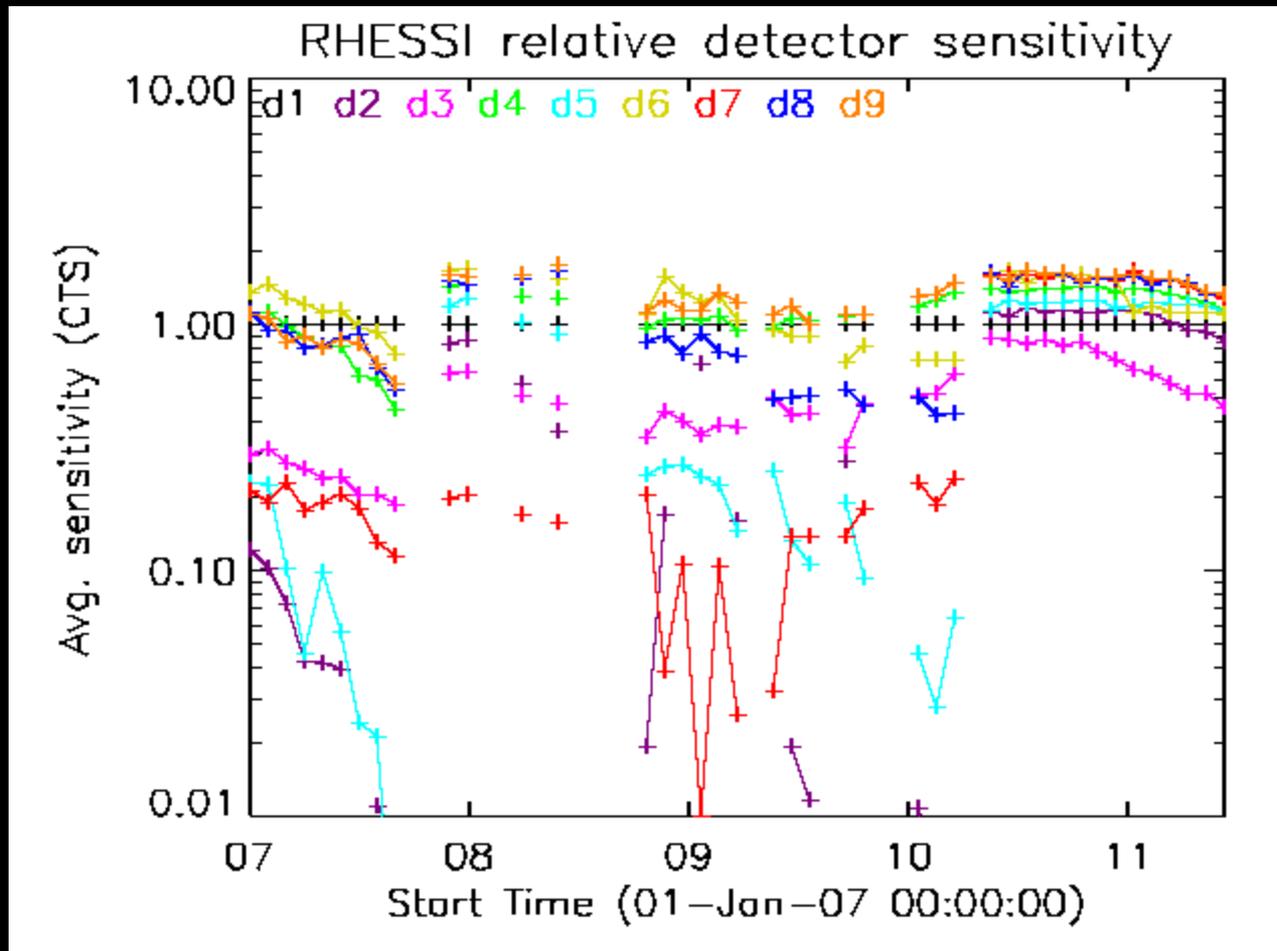
Results:

- **There are spectra for 4137 flares.**

- **30 day averages of counts/counts(D1); all detectors.**

RHESSI relative detector sensitivity
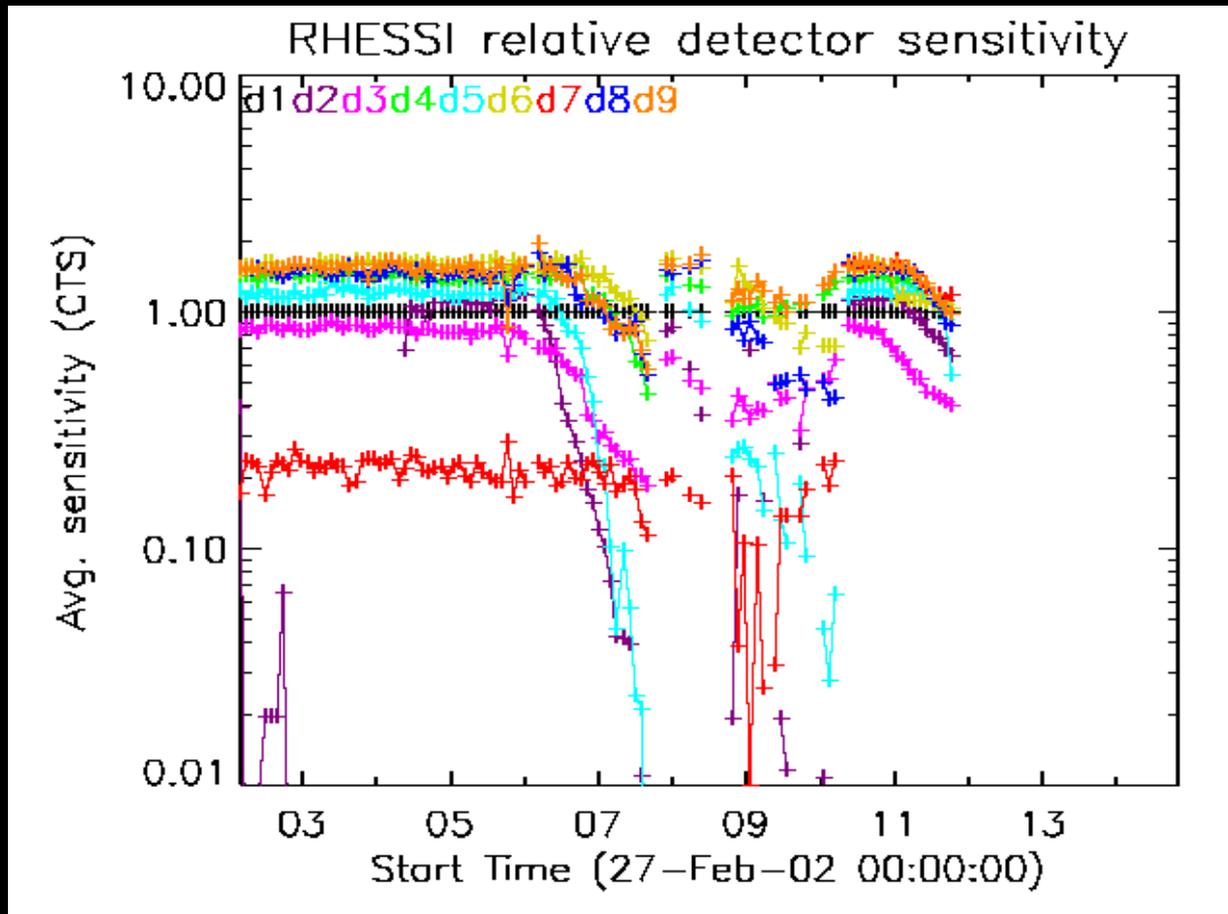
All detectors by 2007 lost sensitivity relative to D1. Annealing in late 2007 and 2010 restored sensitivity.
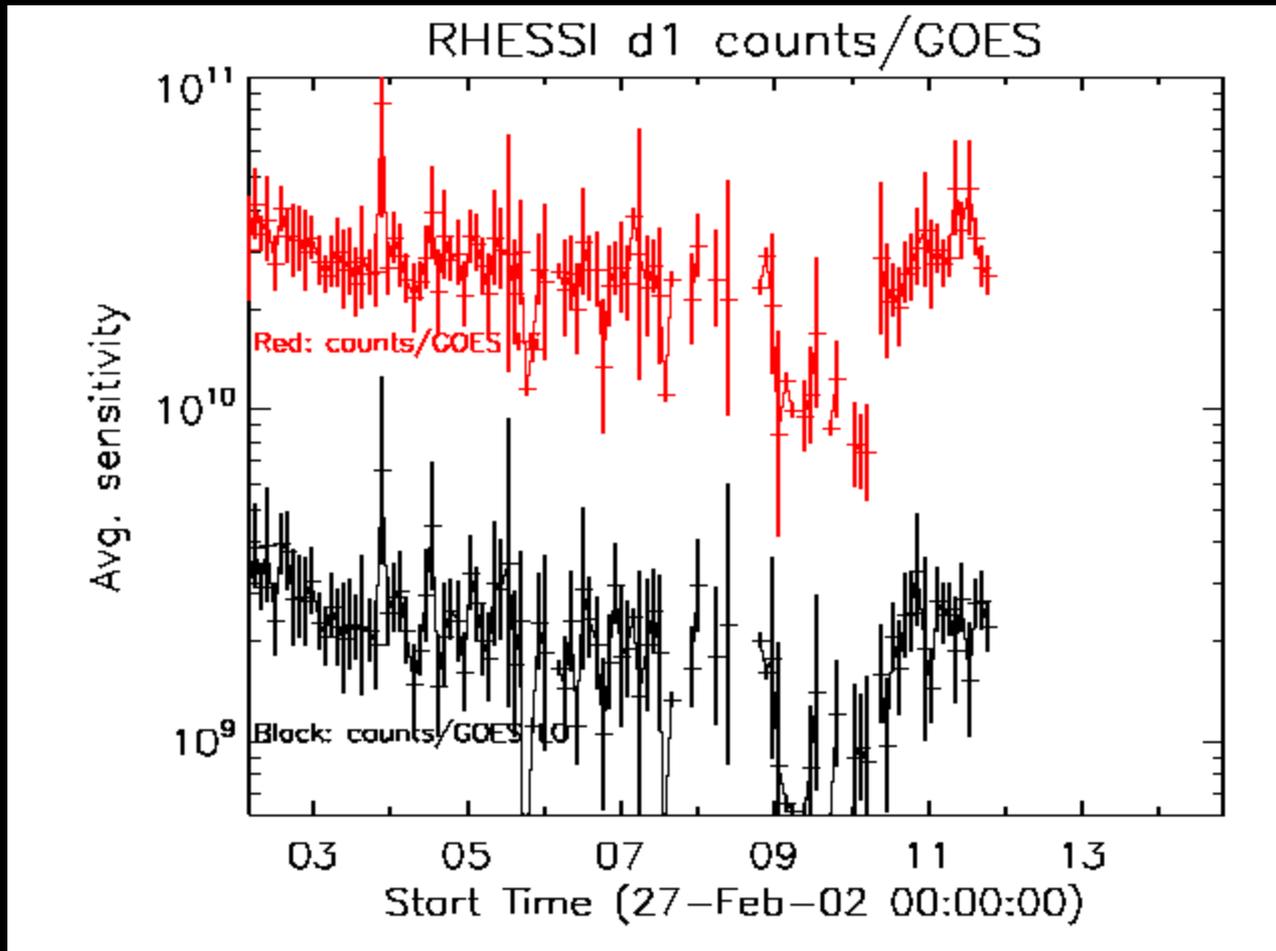
Sensitivity is being lost again.

Slide #4

Here is a shorter time span for more recent variations:
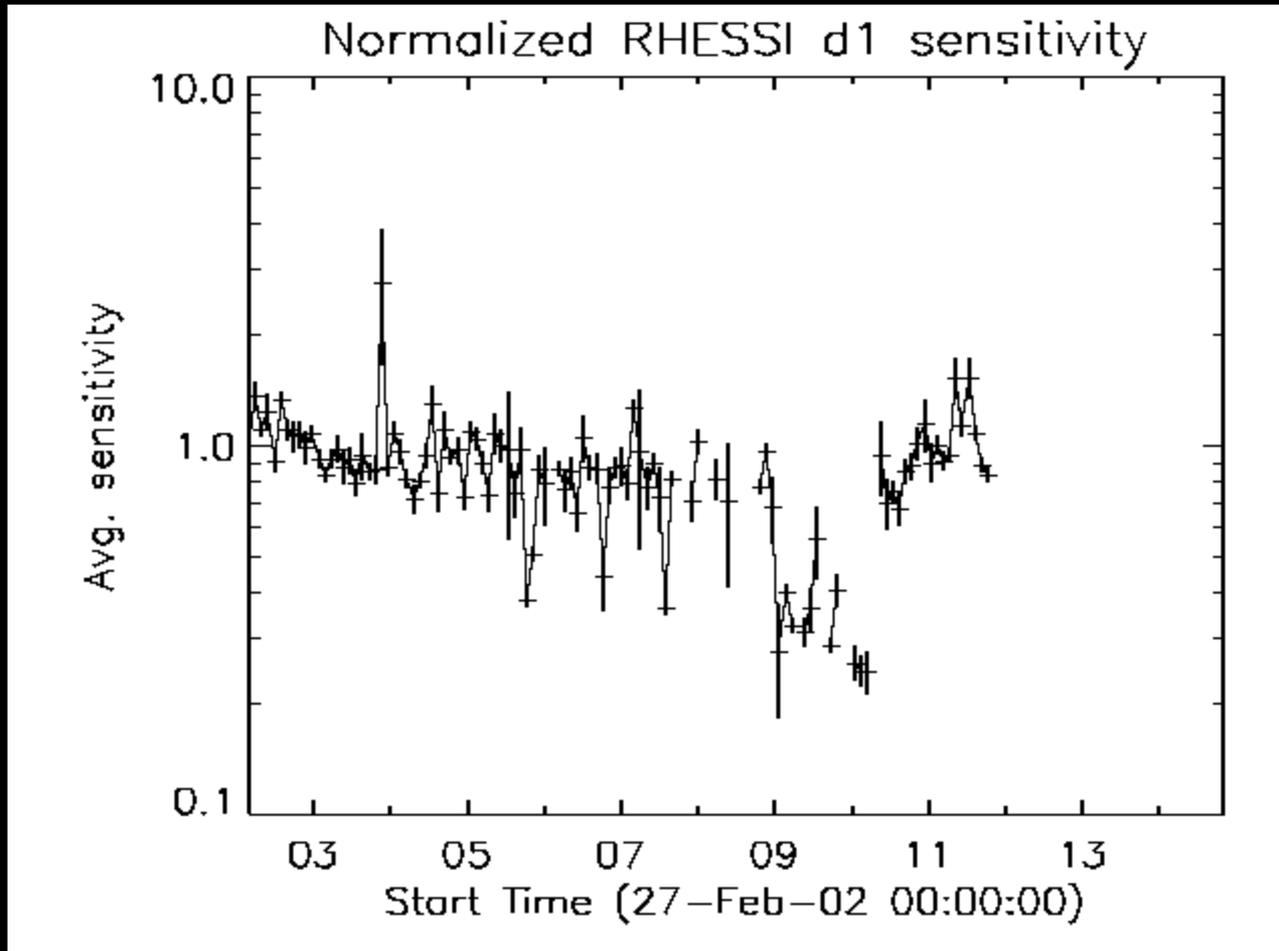

This doesn't look as bad, compared to 2007 or 2010.

For absolute efficiency changes compare with GOES.

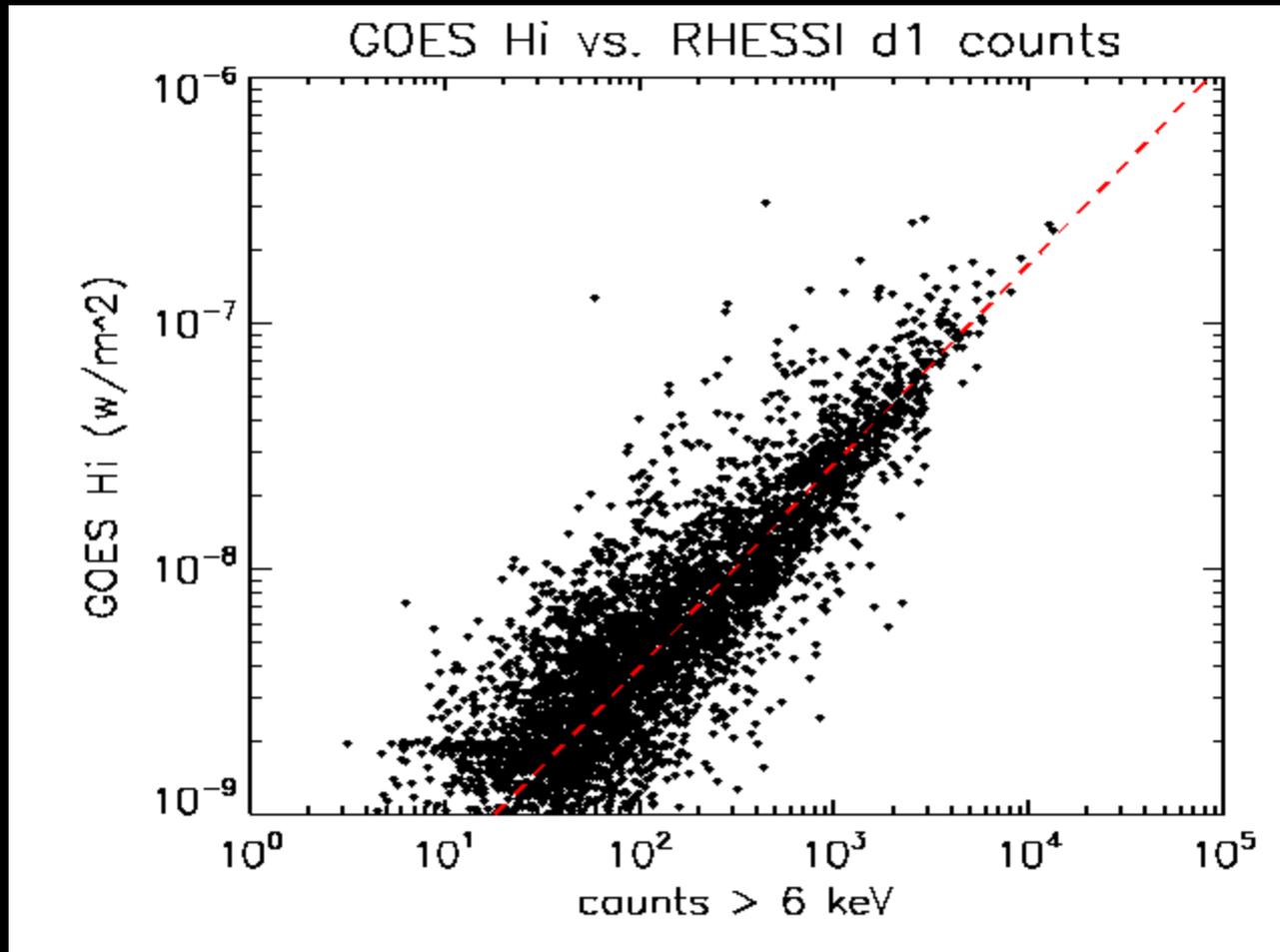**Sensitivity decreasing over the last few months, but error bars are not small.**

Slide #6

D1 Efficiency relative to Feb 2002:

D1 to GOES Sensitivity is now about 0.8 of the sensitivity at launch.

Comparison of D1 and GOES, All flares:

- **D1 counts correlate well with GOES.**

GOES Hi vs. RHESSI d1 counts

GOES data has pre-flare background subtracted.

The slope of the dashed red line is 0.8

Table of sensitivity: (D1* is relative to GOES HI, all others relative to D1)

Feb2002 --	Pre 1st –	Post 1st –	Pre 2nd –	Post 2nd –	Now
D1: 1.00	1.00	1.00	1.00	1.00	1.00
D2: 0.006	0.00	0.00	0.00	1.10	0.65
D3: 0.83	0.19	0.63	0.62	0.88	0.40
D4: 1.41	0.45	1.43	1.35	1.41	0.98
D5: 1.22	0.003	1.19	0.06	1.13	0.54
D6: 1.48	0.76	1.66	0.72	1.59	1.03
D7: 0.17	0.11	0.19	0.23	1.58	1.18
D8: 1.53	0.54	1.49	0.43	1.60	0.87
D9: 1.54	0.57	1.59	1.47	1.56	0.98
D1*:1.00	0.80	1.01	0.24	0.94	0.83

Conclusions:

- **Detectors lost sensitivity relative to detector 1, especially in 2007. Annealing restored sensitivity; the 2010 anneal one restored relative sensitivity to 2002 levels, but sensitivity is decreasing again.**

- **D1 lost sensitivity relative to GOES, especially in 2007. Annealing restored sensitivity, but it looks as if it is decreasing again.**