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 $10^{-45}\text{cm}^{-3}$) 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.

All detectors by 2007 lost sensitivity relative to D1. Annealing in late 2007 and 2010 restored sensitivity. Sensitivity is being lost again.
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.
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 data has pre-flare background subtracted.

The slope of the dashed red line is 0.8
### Table of sensitivity: (D1* is relative to GOES H1, all others relative to D1)

<table>
<thead>
<tr>
<th></th>
<th>Feb2002</th>
<th>--</th>
<th>Pre 1&lt;sup&gt;st&lt;/sup&gt; – Post 1&lt;sup&gt;st&lt;/sup&gt;</th>
<th>Pre 2&lt;sup&gt;nd&lt;/sup&gt; – Post 2&lt;sup&gt;nd&lt;/sup&gt;</th>
<th>Now</th>
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<tbody>
<tr>
<td>D1</td>
<td>1.00</td>
<td></td>
<td>1.00</td>
<td>1.00</td>
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<td>D2</td>
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<td></td>
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<td>1.01</td>
<td>0.24</td>
</tr>
</tbody>
</table>

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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.