Instrument Calibration report
SGD Bad/Threshold
ASTH-SGD-CALDB-BADPIX

Version 0.1
15 November 2015

JAXA / GSFC

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**DOCUMENT TITLE:** SGD Bad/Threshold

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<td>Version 0.1</td>
<td>November 2015</td>
<td>All</td>
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Introduction

1.1 Purpose

This document describes how the Bad/Threshold CALDB of the Soft Gamma-ray Detector (SGD) is prepared. The CALDB file structure is defined in the ASTH-SCT-04 and available from the CALDB web page at http://hitomi.gsfc.nasa.gov.

1.2 Scientific Impact

The Si and CdTe pixel-array type detectors onboard the SGD have channels with relatively lower sensitivity, or higher noise level compared to the majority of the remaining channels. In the current release of CALDB, all channels are treated as “Good” (channels defined as “Bad” are not included). In CdTe sensors, however, there are some specified channels called as “Strange”, which are ~10% of total channels in each Compton camera. Such channels have lower detection efficiency probably due to charge leakage in the electronics. Some methods to avoid the decreasing of detection efficiency due to the charge leakage are under development.

In the event reconstruction process (sgdevtid), threshold values configured for each channel are applied in order to detect valid signals emitted from each readout pixel. Signals that have energy deposits, or ADC channels more precisely, larger than the threshold defined in the CALDB will be only considered. Signals with energy deposits smaller than the threshold value will be discarded.

These Bad/Threshold conditions of the current release of CALDB are defined by using data taken in the ground experiments. If the performance of noise level in orbit makes a requirement to change the conditions, defining the Bad or Strange channels and updates of threshold values should be performed.

Release CALDB 20160310

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2.1 Data Description

Bad/Strange channels

There are no channels defined as “Bad” and “Strange” in the current release of CALDB. These channels will be defined based on the conditions of noise performance in orbit. In the CALDB file, difference flags are given to each good/bad/strange channel as shown in Table 1.

Threshold

The threshold energies contained in the current release were determined based on the noise level observed in the low temperature calibration test and the thermal-vacuum test conducted from
October 2014 to July 2015. Signals from significant noise are excluded by the threshold determined in the CALDB. While the threshold of 1 keV is given to most of channels, larger thresholds are set for the other relatively noisy channels (a few hundred channels in one Compton camera) as shown in Figure 1.

In Table 1, the column list of the CALDB is summarized.

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<thead>
<tr>
<th>Column Name</th>
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<tr>
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<td>ASIC_ID</td>
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<td>READOUT_ID</td>
<td>Channel ID of each ASIC</td>
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<td>READOUT_ID_RMAP</td>
<td>Remapped channel ID</td>
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<tr>
<td>ACTIVE_FLAG</td>
<td>Flag values of each channel; Good:0/Bad:1/Strange:2</td>
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<td>EPI_THRE</td>
<td>Threshold energy (keV) of each channel</td>
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<td>ALIVEASIC</td>
<td>Number of ASIC working well</td>
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<td>DATAMODE</td>
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</table>

### 2.2 Data Analysis

The threshold was determined based on the noise performance observed in the on-ground tests. Figure 1 shows the threshold energy of all channels in the current release of CALDB. In each Compton camera, there are ~200 channels with the threshold above 1 keV.
2.3 Results

In Figure 2, the threshold distribution of each Compton camera in the current release of CALDB is summarized.

2.4 Comparison with previous releases

Not applicable because this is the first release of the Bad/Threshold CALDB file of the SGD.
2.5 Final remarks

The following summarize the current release of the Bad/Threshold CALDB files.

- In the current release CALDB, there are no channels defined as “Bad”. In CdTe sensors, a few hundred channels with lower efficiency are seen, called as “Strange”. These channels will be defined based on the noise performance in orbit.
- Energy threshold values were determined by using data taken during the on-ground tests. While the thresholds of most of channels are set to 1 keV, larger thresholds are set for some noisy channels. These values will be optimized based on the noise performance in orbit.