rgsenergy

June 2, 2019

Abstract

This task performs energy calibrations on RGS telemetry. The input dataset is an event list created by rgsframes and is modified by the addition of the PI column to the PIXELS table.

1 Instruments/Modes

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>RGS</td>
<td>Spectroscopy</td>
</tr>
<tr>
<td>RGS</td>
<td>High Time Resolution</td>
</tr>
</tbody>
</table>

2 Use

<table>
<thead>
<tr>
<th></th>
<th>yes</th>
</tr>
</thead>
<tbody>
<tr>
<td>pipeline processing</td>
<td></td>
</tr>
<tr>
<td>interactive analysis</td>
<td></td>
</tr>
</tbody>
</table>

3 Description

This task calibrates the telemetered RGS pixel energies. It operates on a CCD-specific raw event list created by task rgsframes and adds the PI column to the PIXELS table. The calibration consists of three corrective procedures performed in sequence: offset correction, gain correction, and CTI correction. The CAL Handbook describes each procedure in detail. The offset correction can use static calibration data from the CCF (one value per CCD and node by each RGS), but also dynamic offset data derived from the diagnostic images can be used for subtraction. There are two methods available:

- Using averaged diagnostic images derived from three consecutive orbits, including the one corresponding to the data (parameter withdiagoffset). In this case the subtraction is performed pixel by pixel. This is the method considered as most accurate, due to the offset modulations observed with time within a CCD and node.
- Using any diagnostic data for derivation of one value per CCD and node (parameter withoffset).
The method used for offset correction is flagged in the keyword "OFFSCORR" in each EXPOSURE extension of the events file (either as "CCDNODE" or "PIX2PIX", corresponding to the one value or pixel by pixel subtraction, respectively).

For diagnostic purposes the gain and CTI corrections can be disabled independently (parameters withgain and withcti).

Throughout this document a † marks items that do not apply to HTR mode data and a ‡ marks items that apply only to HTR mode data.

4 Parameters

This section documents the parameters recognized by this task (if any).

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Mand</th>
<th>Type</th>
<th>Default</th>
<th>Constraints</th>
</tr>
</thead>
<tbody>
<tr>
<td>ccdset</td>
<td>yes</td>
<td>dataset</td>
<td>events.ds</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>A CCD-specific event list from rgsframes.</td>
</tr>
<tr>
<td>withoffset</td>
<td>no</td>
<td>boolean</td>
<td>no</td>
<td>Enables override of the static energy offset calibration data, using a data file (parameter offset) such as produced by task rgsoffsetcalc.</td>
</tr>
<tr>
<td>offset</td>
<td>no</td>
<td>dataset</td>
<td>offset.ds</td>
<td>Energy offset calibration override data, enabled by parameter withoffset.</td>
</tr>
<tr>
<td>withdiagoffset</td>
<td>no</td>
<td>boolean</td>
<td>yes</td>
<td>Performs the offset calibration by subtracting pixel by pixel offset values obtained from averaging diagnostic data over three consecutive orbits, including the one corresponding to the data. The average diagnostic offset files (rrrr_ooooooooo_R[1][2]X000000OFX.FIT) have to be included in the ODF.</td>
</tr>
<tr>
<td>withgain</td>
<td>no</td>
<td>boolean</td>
<td>yes</td>
<td>Enables gain correction.</td>
</tr>
<tr>
<td>withcti</td>
<td>no</td>
<td>boolean</td>
<td>yes</td>
<td>Enables CTI correction.</td>
</tr>
</tbody>
</table>
5 Errors

This section documents warnings and errors generated by this task (if any). Note that warnings and errors can also be generated in the SAS infrastructure libraries, in which case they would not be documented here. Refer to the index of all errors and warnings available in the HTML version of the SAS documentation.

6 Input Files

- **ccdset**
  The following tables are required from the input dataset, which is expected to have been created by *rgsframes*.

  - **EXPOSURE**
    Required columns:
    - FRAME int32 frame identifier
    - TIME real64 timestamp
  
  - **PIXELS**
    Required attributes:
    - WINDOWX0 WINDOWY0 telemetry window: origin (node coordinates)
    - WINDOWDX WINDOWDY telemetry window: dimensions
    - RAWY† nominal readout row in HTR mode
    Required columns:
    - FRAME int32 frame identifier
    - RAWX RAWY† int16 coordinates
    - ENERGY int16 uncalibrated energy
    - CCDNODE int8 node identifier
    - SHAPE† int8 shape code
    - GRADE† int8 number of pixels

- **offset**
  CCF component containing RGS energy offset correction override data. See *rgsoffsetcalc* for further details.

7 Output Files

- **ccdset**
  The input dataset is modified by the addition of one column to the **PIXELS** table:
  
  - PI real32 calibrated energy

8 Algorithm

temporary column: TIME = EXPOSURE:FRAME[0]
FOR EACH i,j such that (FRAME[i] == EXPOSURE:FRAME[j]):
  TIME[i] = EXPOSURE:TIME[j]

new column: PI
IF (datamode == Spectroscopy):
  PI = EnergyCorrector::offsetCorrect(TIME,RAWX,RAWY,SHAPE,CCDNODE,ENERGY)
ELSE:
  PI = EnergyCorrector::offsetCorrect(TIME,RAWX,CCDNODE,ENERGY)

IF (*withgain):
  PI = EnergyCorrector::gainCorrect(TIME,CCDNODE,PI)

IF (*withcti):
  temporary column: SEP = 1000
  IF (datamode == Spectroscopy):
    PI = CtiCorrector::ctiCorrect(TIME,RAWX,RAWY,SHAPE,SEP,CCDNODE,PI)
  ELSE:
    PI = CtiCorrector::ctiCorrect(TIME,RAWX,RAWY,CCDNODE,PI)

9 Comments

References