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Simulation of GRD ARF and RMF response

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Contents

- Latest GRD mass model
- Simulation methods and configuration
- Show the response of RMF and ARF

Latest mass model with bracket



Offered by Zhang Juan, we set origin of coordinates at center of bottom bracket of one GRD mass. Key updating points compared with previous version:

- remove PS (component, weight, consumption);
- new GCD (calibration detector) model design
- new bracket design
- different size of some materials

complete all simulation work based on the new

mass model.

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X

Latest mass model of SVOM satellite



Offered by Zhang Juan

Request details in the GRM-IT wiki page

- **Task**: Simulate the GRD ARF and RMF response files for a source placed at different angles in the FoV.
- Justification: The simulated responses that have been provided by the GRM team(Xie Fei) so far have been performed in two configurations only (0 ° and 30 °). More configurations are needed to generate the angular response of the GRM.
- **Method**: Simulate one GRD with a gamma-ray source placed at different angles in the FoV, equally spaced in cos(theta) by steps of 0.05.

• Output:

- If possible, ARF and RMF FITS files (OGIP compliant); otherwise, GEANT4 output files in ROOT format.

- A report presenting a posterior analysis and verification of the generated response files

Simulation of Input files

Use generator program to produce input file with configuration as follows:

- **Particle**: gamma;
- Energy: from 10keV to 5005keV, and the energy is binned as follows:10-550keV,ΔE=1keV;555keV-5005keV, ΔE=10keV. There are 986 energy points contained.
- **Photos**: inject 10^5 photos at each energy point, so there are 986×10^5 photos enter simulation program at each incidence angle totally.
- Direction: phi=-90° (opposite to GCD), theta changed equally spaced in cos(theta) by step of 0.05 from 0.00 to 1.00, so 21 incidence angles included.
- **Position**: all photos are placed in a circular surface source, which located 80mm above the GRD and parallel to its surface. The source with R=80mm injected perpendicular and R=160mm differently injected off-axis.





One input file covers one energy point of one incidence angle with 10⁵ photos .

Simulation process



Off-axis On-axis Use script program to simulate all energy files one by one at one angle, and then other angles.

Simulation of output files



RMF response analysis

- RMF is a file contains a matrix where each element is the total number of photos injected with a certain energy detected in a certain channel.
- The matrix is composed of 986 rows (corresponding to injected energy points) and 8192 columns (the total number of channels with 4096 in low range and the other half in high range)
- A 2-D histogram to show RMF result, which is filled as follows: RMF->Fill(E_dep,Ch_gaus)

E_dep: injected energy value;

RMF response analysis-continue

RMF->Fill(E_input,Ch_gaus)



Part RMF results show



Part RMF results show-continue



ARF response analysis

At one incidence angle:

Injection statistics: Incident->SetBinContent(en_init , incN[en_init]);

Detection statistics: Detect->SetBinContent(en_init , detN_thr[en_init]);

en_init: energy bin setting corresponds with input file.

incN[]: number of events injected to GRD at the energy bin.

detN[]: number of events detected by GRD at the energy bin.

Efficiency->SetBinContent(en_init , detN_thr[i]/incN[i]);

Same way at other incidence angles.

ARF result show

Efficiency_curve(costheta = 0.40~1.00)



Efficiency_curve(costheta = 0.40~1.00)



ARF results show with costheta from 0.35 to 0.00

Efficiency curve(costheta=0.35)



Energy(keV)

Efficiency curve(costheta=0.30)





Efficiency curve(costheta=0.00)



Efficiency curve(costheta=0.25)



Strange points with 100% efficiency ? Issue locating is in progress

RMF and **ARF** root files



Thank you for your attention!



Mass model used by Xie Fei to simulate the entire spacecraft and each GRD