Contribution ID: **81** Type: **Oral**

Evaluation of a Compton Camera Concept Using the 3D CdZnTe Drift Strip Detectors

Tuesday 26 June 2018 09:00 (20 minutes)

At DTU Space an early version of a 3D CZT drift strip detector prototype has successfully been developed and fabricated [1]. The design of the prototype detector (20 mm x 20 mm x 5 mm) is based on the CZT Drift Strip detector principle [2]. It contains 12 drift cells, each comprising one collecting anode strip with 4 drift strips, biased such that the electrons are focused and collected by the anode strips. The electrode geometry of these prototype detectors was optimized for having anode pitch of 1.6 mm and cathode pitch of 2 mm. A theoretical 3D CZT detector model has been developed using COMSOL for electrostatic calculation and IDL for charge collection and signal formation to display the expected pulse shapes for given interactions position. Furthermore, the model also calculates the electron and hole trapping during the charge movements. A readout technology and algorithm were developed, resulting in excellent position determination in 3D, and energy determination for high energies (>50 keV - few MeV, the developed algorithm is tested with a narrow beam at 662 keV). However, until this point the algorithm only comprised position and energy determination of single hit events.

The signal formation for all electrodes provides 3D position information of the interaction together with enabling a 3D correction of residual charge trapping. It also allows for detection and characterization of multiple interaction events occurring in the same or multiple detector cells, e.g. a Compton interaction with subsequent photoelectric absorption. In this project, the position determination of events with multiple hits were analysed and an algorithm developed for multiple interaction events. Compton imaging capability and achievable angular resolution of the single 3D CZT detector is evaluated with a point source illumination using Cs-137 source. The simulation platform MEGAlib [3] is used for image reconstruction from position and energy information provided by the developed algorithm. Furthermore, a 3D CZT Compton camera instrument model is evaluated with MEGAlib simulations of realistic source illumination scenarios to provide spatial and spectral performance figure of merit.

Authors: Mrs HOWALT OWE, Selina (DTU Space, Technical University of Denmark); Mr BUDTZ-JØRGENSEN, Carl (DTU Space, Technical University of Denmark); Mr KUVVETLI, Irfan (DTU Space, Technical University of Denmark)

Presenter: Mrs HOWALT OWE, Selina (DTU Space, Technical University of Denmark)

Session Classification: Oral

Track Classification: general