Contribution ID: **39** Type: **Oral**

Using Hybrid Pixel Radiation Imaging Detectors for Space Radiation Environmental and Dosimetric Applications

Tuesday, 1 July 2014 09:00 (30 minutes)

While it may seem like a retro-application to use hybrid pixel detectors for applications that consist primarily of observing incident charged particles, given the provenance of these detectors in high energy physics, in actuality the challenges faced are surprisingly novel, at least for these devices. While the space radiation environment consists of mainly charged particles, the routinely seen charges of dosimetric interest range from protons through that of fully ionized iron nuclei, and with energies from stopping to very relativistic. In addition, while their fluxes are not necessarily isotropic, as a practical matter, locally they can appear to be incident from any direction with respect to the detectors. Furthermore, the fluences can vary by many orders of magnitude both in location and time. In the end, the ultimate goal is to characterize the charged particle radiation field as completely as possible in order to be prepared to calculate any potential dosimetric endpoint, and to do so with minimum power and external bandwidth requirements. While devices that enjoy access to spacecraft (or even spacesuit) power, detector stacks with multiple layers can be considered, however for portable battery-powered "film-badge"replacements one is pretty much relegated to a single detector device. Using pattern recognition and an thorough analysis of the pixel cluster created in pixel-based device like the Medipix2 Timepix technology, it is possible to measure the track length of an energetic penetrating charged particle as well as the energy deposited, which leads to knowledge of the Lineal Energy Transferred (LET) to the sensor. Further one can determine the polar and azimuthal angles of the track, and by analyzing the δ-rays for more energetic particle's tracks the propagation direction can inferred. Likewise the δ-rays can give information about the energy (or more correctly the velocity), which when coupled with the LET can give a reasonable estimate of both the charge and kinetic energy of the particle. Some difficulties that need to be overcome include distinguishing crossing tracks, interactions, and stopping particles as well as having to deal with the huge range of potential input charge per pixel including accurate calibration. Results from 5 Timepix units with over a year and a half in orbit on the International Space Station will be presented.

Primary author: Prof. PINSKY, Lawrence (University of Houston (US))

Co-authors: Dr BAHADORI, Amir (NASA); TURECEK, Daniel (Czech Technical University (CZ)); Mr SEMONES, Edward (NASA); Mr KITAMURA, Hisashi (National Institute for Radiological Sciences); JAKUBEK, Jan (Czech Technical University (CZ)); IDARRAGA MUNOZ, John Paulo (University of Houston (US)); Dr KROUPA, Martin (NASA/Wyle Laboratories, Inc.); Mr STOFFLE, Nicholas (NASA/WYLE INTEG. SCI. & ENG.]); Dr RIOS, Ryan (NASA/WYLE INTEG. SCI. & ENG); Mr KODAIRA, Satoshi (National Institute for Radiological Sciences); Dr HOANG, Son-Minh (University of Houston); Dr POSPISIL, Stanislav (Institute of Experimental and Applied Physics, Czech Technical University in Prague); VYKYDAL, Zdenek (Czech Technical University (CZ))

Presenter: Prof. PINSKY, Lawrence (University of Houston (US))

Session Classification: Keynote

Track Classification: AMICSA 2014