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Small Dosimeter based on Timepix device for International Space Station

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The radiation environment in space is different than on Earth. The standard detection methods that are used nowadays fails. The reason is that most of the dose comes from interactions of heavy ions, mainly protons, that are not present on Earth.

Measuring a track of particles and their deposited energy allows us to distinguish different particles. This information can be used for sorting of particles into different categories. It is possible to distinguish light particles and ions. Moreover Linear Energy Transfer (LET) for ions can be determined. Each category is assigned a quality factor corresponding to the energy a particle would deposit in human tissue. By summing the dose of all particles an estimate of total dose rate can be calculated.

Timepix detector possesses suitable properties for measurements of this type. It is a position sensitive pixelated detector (300 μm thick silicon sensor, 256x256 square pixels with 55 μm pitch) developed at CERN in a frame of Medipix collaboration. This ability to visualize tracks of ionizing particles was already demonstrated. For the dosimetry purposes a miniature device with Timepix detector and integrated USB interface has been designed. The entire device has dimensions of USB flash drive.

The device is connected the whole measurement time to a control PC. The PC runs a software that controls data acquisition, adjust acquisition time adaptively according to particle rate, analyzes particle tracks, evaluates energy and LET and visualizes in a simple display an estimated dose rate. The properties of the device will be tested during a mission on International Space Station planned towards the end of year 2011.

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