

## A PLD IMPLEMENTATION OF THE PIERRE AUGER OBSERVATORY FIRST LEVEL TRIGGER

Z. Szadkowski (1), D. Nitz (2) for the The Pierre Auger Observatory Collaboration (3)

(1) Physics Department, Michigan Technological University, Houghton, MI 49931, USA and University of Łódź, Pomorska 151, 90-236 Łódź, Poland,

(2) Physics Department, Michigan Technological University, Houghton, MI 49931, USA, (3) Observatorio Pierre Auger, Av. San Martin Norte 304, (5613) Malargüe, Argentina.

zszadkow@mtu.edu

A surface detector trigger for the southern hemisphere Pierre Auger Cosmic Ray Observatory implemented using Altera<sup>TM</sup> programmable logic devices (PLDs) is presented. The ultra large scale integrated circuit (ULSI) technology of the APEX<sup>TM</sup> family allows the trigger logic to be implemented using only one PLD chip. Digitized waveforms produced by the passage of an extensive air shower front through a surface detector are stored in the internal PLD memory. While awaiting a trigger the first 256 64-bit words of the waveform (from 6 10-bit analog to digital converters) are stored in a circulating memory. Upon determination of a trigger, an additional 512 words are recorded. The size of the internal memory in the PLD allows two buffers to be implemented. When one buffer is full it is transferred to the detector station micro-controller via direct memory access. The other buffer remains active to record another shower waveform. Such a solution minimizes dead time. Additional logic implemented in the PLD records single muons. A reduced threshold interval following the detection of a muon-like signal enhances the capture of the signal from a stopped muon decay. The memory size required for the muon buffers exceeds the capacity of the internal PLD memory. An external memory chip is added for this memory. More than 40 trigger boards have been fabricated and installed in the surface detectors of the Auger Engineering Array.