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Hybrid cosmic rays detector (15' + 5')

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Here is the design, the construction and characterization of a hybrid cosmic rays detector based on drift tube and Cherenkov radiation detector with two ionization detection channels and two Cherenkov radiation detection channels operating simultaneously. The basic detection cell is a structural Aluminum tube of 2.54 cm x 2.54 cm cross section, 1.01 m long and 0.1 cm thick tube interiorly polished to mirror and slightly covered with TiO₂, filled with (90%)Argon + (10%)Methane gas mixture. There is an Au-coated Tungsten wire coaxially and instrumented at both ends, to supply a high voltage, around +1800 V to +2000 V to the metal wire and read the output signals from ionization detection channel. The Cherenkov channel is based on S10362-11-100U Hamamatsu avalanche photodiodes placed in both ends over the acrylic caps designed to hold them. The avalanche photodiodes are electronically instrumented to supply them + 70 V and read the output signals due to Cherenkov radiation produced inside the cell. All the output signals are amplified in a 2 factor; the data acquisition system, CompactRio, from National Instruments records digital pulses from the discriminated output signals every 1 ms for each detection channel. This detector is the basic unit to build a larger cosmic rays detector. Details on design, construction, characterization, calibration, operation and potential applications of this hybrid cosmic rays detector is all about this report.

Keywords: Cosmic rays, hybrid detector, drift tubes, ionizing radiation, Cherenkov radiation.

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