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The EEE Project, science in school: recent results on cosmic rays detection and performances

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The EEE (Extreme Energy Event) project will study extensive air showers through the detection of the muon component by means of a network of tracking detectors, installed inside high schools distributed all over Italy. Project's aim is to involve teachers and students in a frontier cosmic ray experiment, as well.

The EEE telescope is based on a large but simplified and cheap version of the detector designed for the time of flight measurements (TOF) of the ALICE experiment at LHC: 3 large (~2 m²) Multi-gap Resistive Plate Chambers (MRPC), built at CERN by high school students and teachers, which contribute directly to the full operation of the telescope.

Using multiple small gas gaps combined with the use of high gain and fast gas mixture (C₂H₂F₄ and SF₆ based), these MRPCs show a time resolution better than 100 ps. Particle tracking is performed equipping MRPCs with 24 strips read at both ends, by front-end electronics based on NINO ASIC and using commercial multi-hit TDCs.

The two-dimensional information on the cosmic muon impact point is obtained by the hit strip, in one direction, and by the time difference of the signals arriving at the two strip ends in the other direction, thus providing space resolution of the order of 1 cm. By using the three impact points it is possible to reconstruct the direction of the crossing muon. The angular resolution obtained for the muon zenith angle is better than 1°. The GPS synchronization of the telescopes will open the way to search for coincidences between far away sites exploiting muon timing and direction.

The first phase of the project is started with the installation of the detector telescopes in 21 high schools in 7 cities. Nowadays a total of 52 telescopes has been built and more than 40 telescopes are installed in schools covering an area of about 3x10⁵ km² of the Italian surface.

About 35 telescopes during the last 2 years are successfully running in a network.

Data are collected at CNAF where they are stored and elaborated to be analysed in an easy way also by students.

Recent results of the last data taking are presented showing the performances of the telescopes network and MRPC detectors with over than 20 billion of muon tracks.

The main field of investigation are search for coincidences between far telescopes, forrush decrease studies, upward going particles, east-west asymmetry, observation of moon shadow, CR anisotropy.

The educational aspect will also be showed.

Presenter: MIOZZI, Silvia (LNF)

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