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Cosmic ray measurements with compact scintillator telescopes and SiPM readout

The Extreme Energy Events (EEE) Collaboration has built and operated so far a large set of cosmic ray telescopes, based on Multigap Resistive Plate Chambers, which are installed in high school buildings over the Italian territory for scientific and educational activities. To extend the potential of the EEE Project, a number of additional, scintillator-based, cosmic ray telescopes, were built and operated over the last years, as discussed in the present contribution.
A first detection facility includes four telescopes with two planes of segmented scintillator tiles, and an overall detection area of 40 x 60 cm2, with Silicon Photomultipliers (SiPM) readout on each tile. These
detectors, which are equipped with low power electronics and environmental sensors, have been used inseveral measurement campaigns over a wide range of geographical latitudes, on board of boats sailing in the Mediterranean and across the Arctic Sea, and have been also installed for long-term experiments at NyÅlesund (79° N), in the Svalbard archipelago. They were used for various analysis, also including the observation of Forbush decrease events in regions characterized by a low geomagnetic cutoff, and to investigate periodic components in the measured muon rate.
A second facility, mainly used for educational activities within the EEE Collaboration, is represented by the Cosmic Box (CB) detectors, small-size scintillator-based telescopes with SiPM readout, which were designed and built with the help of student teams. Their use allows efficiency measurement of MRPC telescopes and complementary measurements of the cosmic ray flux under conditions where the MRPC telescopes could not be easily installed or by schools not hosting one of the MRPC telescopes. Such detectors have been used since several years in a number of on-site measurements, to investigate the altitude dependence of the cosmic ray flux, in underground sites with a strongly reduced muon flux, and to perform measurements according to the school proposals, during the yearly Cosmic Box Contest, where the best proposals are evaluated and awarded.

Workshop topics

Applications

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