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TO TESTING OF THRESHOLD SILICA AEROGEL CHERENKOV DETECTORS ON COSMIC RAYS

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At present, threshold aerogel Cherenkov detectors based on SiO2 with chosen refractive indices (hereinafter referred to as "threshold detectors") are widely used for studies in physics of elementary particles (in particular, for separating charged pions and kaons, see about it, e.g., in [1] and in references therein). Since the number of Cherenkov photons is small compared to that from scintillators, it is required to test such threshold detectors and measure their significant characteristics on accelerator beams and / or on cosmic rays. In our case, the detector, when the entire aerogel block is viewed by a set of photomultiplier tubes (PMTs), such characteristics are the distribution of the number of "activated" PMTs, the total detection efficiency, etc.
Usually (see, e.g., [1]), at cosmic ray testing of some threshold detector, several horizontal plastics (viewed by their PMTs) form telescope around vertical axis. Signals from these detectors are used as a trigger for testing of the threshold detector placed on the same axis. In [1], layers of Pb with additional plastic detectors behind each Pb layer are installed ahead and behind the tested threshold detector to separate particles with energies higher than thresholds for production of Cherenkov radiation. However, because of complicated content of incident cosmic rays, initial distributions of their energies, and spreads of ionization losses, there are restrictions on definiteness of energies (and velocities) of the registered particles (mostly muons). Moreover, such testing installations are rather bulky and heavy.
In the present work instead of layers of Pb, we added to trigger detectors the small threshold detector which made from the same aerogel as the tested detector, installed just behind the tested detector, viewed by single PMT of the same type as for the tested threshold detector, and plays the role of Cherenkov monitor with its total detection efficiency close to 100%. This efficiency level is ensured by the small sizes of the aerogel (5 x 5 x 9 cm3) and of the PMT photocathode diameter (˜5 cm). In our case, the number of Cherenkov photons in the photocathode sensitivity region (260 nm – 610 nm) generated by a muon in the Cherenkov monitor is about 200. Due to the small sizes of the monitor, a sufficient number of photons always hit the PMT photocathode for a signal to appear even when using PMTs with moderate quantum efficiency.

1. A.R. Buzykaev. Development of Cherenkov ASHPH counters for the KEDR detector. The candidate of sciences (phy
mathematics) dissertation. Budker Institute of Nuclear Physics. Novosibirsk. 2017.

The speaker is a student or young scientist

No

Section

1. Applications of nuclear methods in science and technology

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