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Development of bases and qualification tests of Photomultiplier Tubes for the AugerPrime scintillation detectors

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We describe two test benches that were designed and constructed to perform a set of acceptance tests for about 1200 Photomultiplier Tube (PMT) units to be operated in the surface scintillation detectors of AugerPrime. Besides robustness, long-term reliability, and low power consumption, the dynamic range of the PMT-unit is required to cover signals ranging from a single to more than 20,000 minimum ionizing particles with not more than 5% deviation from linear response. This poses a particular challenge that was met by combining a specially selected 1.5"PMT type with a custom-made Cockcroft Walton type base. The characteristics of the PMT units and qualification results obtained for a large quantity will be presented and discussed.
Besides measuring the gain and linearity for each PMT-unit for different supply voltages, we also measured for a sub-sample of about 10% the quantum-efficiency of the photocathode as a function of wavelength and its homogeneity across the full photocathode area with 1 mm spatial resolution. The latter is of importance because of the fiber-optical readout of the scintillation detectors.

Keywords

PMT qualification test setup, high linearity photon detection, quantum-efficiency homogeneity

Collaboration

other Collaboration

Subcategory

Experimental Methods & Instrumentation

Primary authors: Mr BECKER, Karl-Heinz (University of Wuppertal); Mr GROSSE-RHODE, Urs (University of Wuppertal); KAMPERT, Karl-Heinz (U Wuppertal); Mr KELLER, Stephan (University of Wuppertal); Dr PAULY, Christian (University of Wuppertal); Mr PAWLOWSKY, Jannis (University of Wuppertal); Mr PFEIFER, Dennis (University of Wuppertal); RAUTENBERG, Julian (Bergische Universitaet Wuppertal); Mr STROTMANN, Simon (University of Wuppertal); Mrs UZEIROSKA, Rukije (University of Wuppertal); Mrs WEIMER, Natalia (University of Wuppertal)

Presenter: RAUTENBERG, Julian (Bergische Universitaet Wuppertal)

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