PERFORMANCE OF THE MASS TESTING SETUP FOR ARRAYS OF SILICON PHOTOMULTIPLIERS IN THE TAO EXPERIMENT

A. Rybnikov
Joint Institute for Nuclear Research
E-mail: arv@jinr.ru

Modern neutrino physics detectors often employ thousands, and sometimes even hundreds of thousands, of Silicon Photomultipliers (SiPMs). The TAO experiment is a notable example that utilizes a spherical scintillator barrel with a diameter of 1.8 meters, housing approximately 130,000 SiPMs organized into 4,100 tiles. Each tile with size of 5×5 cm^2 consists of a 32-SiPM array functioning as a single detector unit. To achieve an unparalleled energy resolution of 2% at 1 MeV within this volume, the SiPMs must possess cutting-edge parameters, including a photon detection efficiency (PDE) exceeding 50%, cross-talk of approximately 10%, and an extremely low dark count rate (DCR) below 50 Hz/mm^2. Maintaining the setup at a negative temperature of -50°C is necessary to achieve the desired DCR. This talk presents the setup and methods employed to individually characterize the mass of SiPMs across all 4,100 tiles at the specified negative temperature.