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Data Acquisition System of the Water Cherenkov Detector Prototype for the TAIGA-100 Pilot Project

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TAIGA-100 is a project of a large-scale astrophysical complex designed to solve a wide range of fundamental problems in gamma astronomy in the energy range from 300 GeV to above 1 PeV, cosmic ray (CR) physics from 100 TeV to 10 EeV, particle astrophysics, neutrino physics, and interdisciplinary research. The complex will include several types of detectors for registering different components of extensive air showers (EAS) over an area of 100 km². The basic elements of the project will be wide-angle atmospheric Cherenkov stations with a field of view of ~2 sr and water Cherenkov detectors (WCD) with an area of ~40 m², supplemented by scintillation counters and radio antennas. Atmospheric Cherenkov telescopes are also planned to be placed in the central part of the new installation, and fluorescence detectors on its periphery.

The construction of the TAIGA-100 complex is planned to be carried out in stages. At present, work is proceeding in three key directions. First, computer simulations are being performed to determine the optimal configuration of the installation and its potential, as well as to develop methods for reconstructing EAS parameters and primary radiation. Second, a site is being sought for the TAIGA-100 complex. Third, detector systems are being developed. Within the latter direction, the construction of a pilot installation with an area of 0.5 km² is also planned, using the infrastructure and operational experience of the existing TAIGA-1 gamma observatory. As a first step, in autumn 2025 an experimental station based on a WCD prototype with an area of ~7 m² was created and put into data taking. At the next stage, two full-scale water detectors are expected to be deployed during autumn 2026. In addition, the development and implementation of an innovative system for the extraction and transmission of trigger signals is planned.

The report presents a description and results of test measurements of the analog signal readout channel for the WCD over a wide dynamic range, the data acquisition system, and the system for generating and transmitting trigger signals.

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