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Method and portable bench for tests of the laser optical calibration system components for the Baikal-GVD underwater neutrino Cherenkov telescope

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The large-scale deep underwater Cherenkov neutrino telescopes like Baikal-GVD, ANTARES or KM3NeT, require calibration and testing methods of their optical modules. These methods usually include laser-based systems which allow to check the telescope responses to the light and for real-time monitoring of the optical parameters of water such as absorption and scattering lengths, which show seasonal changes in natural reservoirs of water. We will present a testing method of a laser calibration system and a set of dedicated tools developed for Baikal-GVD, which includes a specially designed and built, compact, portable, and reconfigurable scanning station. This station is adapted to perform fast quality tests of the underwater laser sets just before their deployment in the telescope structure, even on ice, without darkroom. The testing procedure includes the energy stability test of the laser device, 3D scan of the light emission from the diffuser and attenuation test of the optical elements of the laser calibration system. The test bench consists primarily of an automatic mechanical scanner with a movable Si detector, beam splitter with a reference Si detector and, optionally, Q-switched diode-pumped solid-state laser used for laboratory scans of the diffusers. The presented test bench enables a three-dimensional scan of the light emission from diffusers, which are designed to obtain the isotropic distribution of photons around the point of emission. The results of the measurement can be easily shown on a 3D plot immediately after the test and may be also implemented to a dedicated program simulating photons propagation in water, which allows to check the quality of the diffuser in the scale of the Baikal-GVD telescope geometry.

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