

Research Report

ICRR Inter-University Research Program 2020

Research Subject: Tests on mPMT photodetection system for Hyper-Kamiokande Experiment
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Summary of Research Result : <p>The goals of the proposed research were to perform measurements on radioactive contamination in the mPMT system and to identify more clean materials to be used to keep low level backgrounds.</p> <p>Specifically, the goals to be met by the proposed research program were:</p> <ul style="list-style-type: none">- radioactive contamination measurements of Hamamatsu 3" PMTs (R14374) at the facility available at ICRR- radioactive contamination measurements of the mPMT protective vessel, of the high-voltage supplies and readout electronic boards and all the components to be used in the mPMT system. These measurements were planned in Italy at INFN laboratories.- realization of a mPMT photodetector prototype and its radioactive contamination measurements at the facility available at ICRR. <p>Due to the Covid-19 pandemic, the team could not conduct the research as initially planned because it was not possible for international collaborators travel to Japan. Thus, most of the activities have been conducted at INFN laboratories in Italy and several delays were recorded. In any case, the main results of the project have been achieved.</p> <p>The main deliverable of the project was the radioactivity measurements and material selection for the mPMT photodetection system for the HK and IWCD detectors. These measurements have been realized at INFN LNGS facilities.</p> <p>In the following the report for each Working Packages (WP):</p> <ul style="list-style-type: none">• WP1: Photosensors: A sample of 3" PMT produced by Hamamatsu (R14374) have been characterized and tested at INFN laboratory in Naples. More PMTs were tested at Tokyo Univ of Science. The results will be the basis for the decision on 3" PMT for the mPMT to be used in Hyper-Kamiokande far detector.• WP2: mPMT Electronics: Both the HV and read-out electronics boards have ben optimized at INFN laboratories in Naples, the optimized boards have been produced and tested. Radioactivity measurements are currently ongoing at INFN laboratories in Italy.• WP3: mPMT case and components: For all the materials used in the mPMT case and all the components, radioactivity measurements at have been completed at LNGS INFN laboratories in Italy. The material used for the mPMT cylinder resulted not clean. Contacts with the manufacturer lead to

the use of a different material. This will be test soon at LNGS INFN laboratories in Italy.

- WP4: the mPMT prototype assembly has been completed at INFN laboratory in Naples. It will be tested first in Italy and then it will be shipped at ICRR facilities for more tests and radioactivity measurements.

No.