Form 8

Research Result Report
ICRR Inter-University Research Program 2022

Research Subject:

Development and testing of cost-effective, high-performance PhotoDetector anti-implosion covers for Hyper-Kamiokande

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Summary of Research Result :

This grant is to be used to help the works towards stablishing the shockwave arresting "anti-implosion" PMT cover for the Hyper-Kamiokande far detector's 20" ID PMTs.

This ICRR-IURP 2022 is a follow-up of three similar, granted to UAM, ICRR-IURP projects: 2019, 2020 and 2021 (the 2019 one had D. Bravo as IP). Most important expenses covered are:

- Research trips inside Japan
- Finite Element Modeling of the V3 approach (with flangeless acrylic window).
- Acquisition of HK PMTs with no vacuum for mechanical tests
- Shipping of prototypes, material parts etc. between Japan and Spain
- Acquisition of HK flanged acrylic windows for several cover test programs: hydrostatic in Spain and induced implosion at 80m depth in JAMIC (Kamisunagawa, Hokkaido, Japan)

This ICRR-IURP 2022 grant had as starting point the outcome of the above-mentioned implosion test program in Hokkaido and the proposal was based on its success. There, units of different cover designs, the so-called Jp-sus, Jp-resin and the V3.4 and V3.3 versions of TC-cover were tested. Unfortunately, the results were not satisfactory enough for the Jp-resin and TC-cover cases.

That fact obliged the re-evaluation of the plan of activities during the period of the grant. As general considerations a) we felt that we had to move to the Jp-sus cover as the baseline for HK but, that we should not give up the TC-cover designs yet since they are still, probably, significantly cheaper for a mass production of ~20K units, b)

we also felt the need of a thorough, extensive, detailed (and expensive) FEM program, that stresses the dynamical behavior and the connection between the parts; Its results might point to just minor changes to the TC-cover design that provide the additional robustness needed. It could not be carried out for the designs before the Implosion test because of the no possibility to access the already granted funds in Spain (they are not yet available to us).

In top of those uncertainties the restrictions etc. because of the COVID19 were significantly affecting our regular research activity. Normality with respect to COVID was established in Japan only in October 2022.

Because of the above circumstances we concluded that a larger and more appropriate scientific outcome of the IURP-2022 funds was to be obtained if carried over to FJ2023, where the situation is expected to be more stable and clearer. Our corresponding request to the ICRR-IURP Management was accepted.

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