Research Report
ICRR Inter-University Research Program 2021

Research Subject:	Outer Detector for the Hyper-Kamiokande experiment
Principal Investigator:	Francesca Di Lodovico (King's College London)
Participating Researchers:	Francesca Di Lodovico (King's College London)

Summary of Research Result :

The year 2021 was critical in the evolution of the detector of the Hyper-Kamiokande experiment for construction. Construction already started with the cavern excavation in 2020, so the detector also needs to evolve at an adequate pace to be able to be constructed on time for data taking.

Due to the ongoing pandemic, in 2021 Francesca was unable to travel to Japan. Work proceeded on the Outer Detector (OD) for Hyper-Kamiokande, that is the topic of this project, through work in the UK and Japan, where the work in Japan was done through collaborators.

The outcome of the work is the optimization of the number of units, ie PMTs, for the OD, with corresponding multilayer Tyvek on the walls and about 30cm x 30cm - wide WLS plates. The PMT candidates were tested at King's College London for their properties, such as gain, dark noise etc. Waterproof samples were sent to both the Boulby mine (Dr Matthiew Thiesse, University of Sheffield) and Kamioka (Dr Guillaume Pronost, ILANCE) to check Rn emanation and Gd compatibility. The discussions with the PMT companies continued by email and virtual meetings. Only in August 2022 was it possible for Francesca to finally meet in person with the Hamamatsu engineers. Covid restrictions are still in place at their company so the were unable to meet at the company location and came to Mozumi instead for our meeting. Work at IPMU, Kashiwa, on the installation was performed by Dr Stephane Zsoldos (Marie Curie Fellow at King's College London, on long term attachment at IPMU). The work revealed the benefits and drawbacks of different options. Similarly initial work on the design of the QA for the PMT production phase has started.

In summary, although it wasn't possible to travel to Japan, work on the OD, which is the topic of this of this project, continued, and the main outcomes are: optimization of the number of units, selection of PMTs candidates and their characterization, discussion with the PMT production companies, installation planning and QA work.

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