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TITUS: An Intermediate Distance Detector for the Tokai-to-Hyper-Kamiokande Neutrino Beam

The Tokai Intermediate Tank for Unoscillated Spectrum (TITUS) detector is a proposed near detector for the Hyper-Kamiokande (Hyper-K) experiment, located approximately 2 km from the J-PARC neutrino beam. The design consists of a 2 kton Gd-doped water Cherenkov tank, surrounded by a muon range detector on the sides and downstream. The downstream part could potentially be magnetized, resulting in a MIND-type detector. The target material (water) and location (~2 km) were chosen so that the neutrino interactions and beam spectrum at TITUS would match those of Hyper-K. Including a 0.1% Gd concentration enhances tagging of neutrino interactions, based on their neutron multiplicity. The primary goal of TITUS is to reduce the systematic uncertainty of the long-baseline oscillation physics program at Hyper-K and enhance its sensitivity to CP violation. TITUS can also be used for physics unrelated to the J-PARC beam, such as measuring the neutron rate to improve Hyper-K proton decay searches and functioning as an independent detector for supernova neutrino bursts.

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