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P3.007 TITUS as a new intermediate detector for T2K and Hyper-Kamiokande

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TITUS (Tokai Intermediate Tank for Unoscillated Physics) is a 2kTonne gadolinium-doped water Cherenkov detector with a magnetized muon range detector downstream. It is a near detector located 1.5-2 km from the JPARC off-axis neutrino beam that is proposed for T2K phase 2 (~2020-2025) and Hyper-Kamiokande. The detector is optimized for the measurement of delta-CP and oscillation physics at T2KII and Hyper-Kamiokande. The additional potential of the detector includes cross section measurements, precision standard model physics, supernova, sterile neutrinos, dark matter, etc. The water target and 4pi acceptance allow cancellation of many uncertainties in the far detector - such as those from nuclear effects. The distance is chosen such that TITUS will see a similar beam flux to Super-Kamiokande or Hyper-Kamiokande, reducing the need for reweighting by external measurements.The excellent resolution and particle identification of a water Cherenkov detector are highly enhanced by the ability of neutron tagging in gadolinium that allows the separation between different neutrino interactions, in particular, neutrinos and antineutrinos.

This poster discusses the main design features and physics impact of the TITUS detector. It focusses in particular on oscillation physics. Gadolinium doping will enable final state neutrons to be tagged with high efficiency, allowing neutrino and antineutrino charged current quasielastic (CCQE) events to be distinguished, and non-CCQE events to be identified by neutron multiplicity for better background discrimination. The detector's horizontal orientation will lead to high energy events being better contained. This, with the downstream magnetised muon range detector, not included yet in the current analysis, will improve measurement of the neutrino beam's high energy tail.

In conclusion, we demonstrate that the TITUS detector is needed to improve the potential of T2K phase 2 and Hyper-Kamiokande for oscillation neutrino physics and determination of CP violation.