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Commissioning of 3D-segmented neutrino detector SuperFGD in the T2K neutrino beam

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The long baseline neutrino oscillation experiment T2K [1] is aiming at searching for CP violation in the neutrino sector and precision measurements of neutrino oscillation parameters. T2K has obtained results indicating CP violation with more than 90% confidence level [2]. In the T2K experiment, the neutrino beam generated at J-PARC is measured at the near detector ND280 located 280m downstream from the proton target. The ND280 was recently upgraded to reduce systematic errors and improve measurement of the neutrino beam before oscillations. A new scintillation tracker Super Fine-Grained Detector (SuperFGD) consists of about 2 million scintillator cubes, each of 1 cm3 [3]. The signal from each cube is read out by three orthogonal WLS fibers and detected by micropixel photosensors MPPC. The detector has a high light yield for charged particles, a good time resolution and a low detection threshold. SuperFGD is a more efficient neutrino detector which selects high angle and low momentum particles, accumulate larger sample of neutrino interactions, and detect neutrons. SuperFGD was installed in the ND280 pit at J-PARC in October 2023, and started full data taking in June 2024. The calibration of SuperFGD readout channels using LED system and cosmic muons will be presented. Detection of muon neutrinos in SuperFGD through charged current in the T2K neutrino beam will be presented and discussed. The emphasis will be put of reconstruction of muons and stopped protons in SuperFGD.

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[3] A.Blondel et al. A fully active fine-grained detector with three readout views, JINST 13 (2018) 02, P02006.

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