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Segmented scintillator neutrino detector SuperFGD for T2K experiment

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The long baseline T2K neutrino experiment in Japan obtained a first indication of CP violation in neutrino oscillations. To obtain better sensitivity, T2K will accumulate more statistics with a higher intensity beam and the upgraded near detector ND280 which allows us to reduce systematic uncertainties in oscillation measurements. The upgraded detector will have the full polar angle coverage for muons produced in neutrino charged current interactions, a low threshold for proton detection and will be able to measure neutrons using time-of-flight due to a good timing performance. Thanks to these new capabilities, the energy spectra of muon neutrinos and antineutrinos will be measured with an unprecedented level of accuracy. A 3D highly granular scintillator detector called SuperFGD with a mass of about 2 tons is being constructed at J-PARC now. It consists of about two millions of small optically-isolated plastic scintillator cubes with a 1 cm side. Each cube is read out in the three orthogonal directions with wave-length shifting (WLS) fibers coupled to micro pixel photon counters (MPPC). All cubes are assembled in a light protected box with about 60000 holes for WLS fibers. An LED calibration system with Light Guide Plates is used for calibration and control for WLS/MPPC readout. SuperFGD Front End Board electronics based on CITIROC chips is developed and tested. On-surface SuperFGD will be provided with cosmic muons and the installation into the ND280 magnet is expected in September 2023 to take the neutrino beam in the Fall of 2023. In this talk, the results of the tests, obtained parameters and current status of SuperFGD will be reported. The unique features of SuperFGD physics program will be also described.

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