Operational Status and Power Upgrade Prospects of the Neutrino Experimental Facility at J-PARC

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The J-PARC neutrino experimental facility was built to carry out leading neutrino research using the world's highest intensity neutrino beam. The facility was commissioned in April 2009, and data collection for the T2K (*Tokai-to-Kamioka*) long-baseline neutrino experiment commenced in January 2010, with a beam power of 20 kW. Since then, the facility beam power has improved steadily, and operation with a beam power of 230 kW has been realized. This high power operation was key for a recent achievement by T2K: the first-ever *observation* of electron neutrino appearance [1].

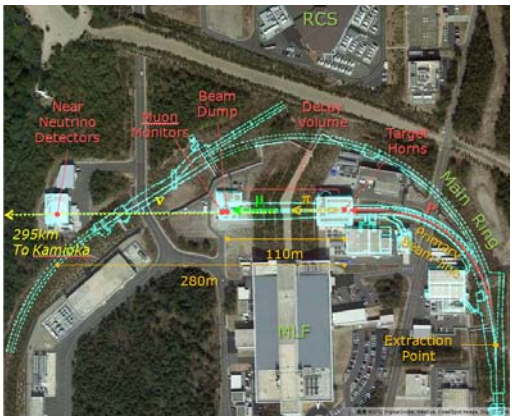

Fig. 1 The neutrino experimental facility at J-PARC

The number of events observed by T2K so far is significantly higher than that which is expected based on disappearance measurements of anti-electron neutrinos from reactor experiments. This phenomenon can be explained by a fairly large contribution from CP violation (CPV), which only contributes to measurements of accelerator-based appearance mode oscillations. With data corresponding to about 10 times more protons on target (7.8×10^{21} *p.o.t.*), T2K has the opportunity to establish "*evidence*" (~3σ) of CPV in the lepton sector [2]. For this purpose, a prompt realization of the design beam power of 750 kW is highly desirable. If the CPV effect is found to be large by T2K, the prospect of making a definitive observation by a future project, such as a long-baseline experiment using the neutrino facility at J-PARC and the Hyper-Kamiokande detector [3], will become even more promising. A power upgrade of the neutrino facility to handle a Mega-Watt class beam will directly enhance the physics reach of these

future projects.

In this talk, various experiences with and upgrades to the facility during the past years will be reviewed, and necessary steps towards achieving the design 750 kW beam power, and to further realize MW-class beam operation, will be presented.

References

[1] K.Abe et al {T2K collaboration}, Phys. Rev. Lett. 112, 061802 (2014).
[2] T2K collaboration, report in 17th J-PARC PAC meeting (2013).
[3] Hyper-Kamiokande working group, report in 18th J-PARC PAC meeting (2014).