Design Study on the 9 GeV Proton Linac at KEKB Tunnel for the Next Generation Neutrino Experiment

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Toward to the next generation experimental investigation of neutrino physics, the J-PARC accelerator group is now considering several candidates to extend the proton beam power to multi-MW region. One of the major candidates is the adoption of a superconducting proton linac.

A neutrino is generated by bombarding a proton beam to a target. In Monte-Carlo simulations with GCALOR or FLUKA2011 package, the generated neutrino flux per proton beam energy monotonously increases with the energy reaching to around 9 GeV, and then saturation is seen in higher energy [1]. Therefore, if we only focus on the efficiency of neutrino generation, it is efficient to improve the average beam current with staying the beam energy to 9 GeV. It motivated us to consider the 9 GeV proton linac for neutrino beam generation.

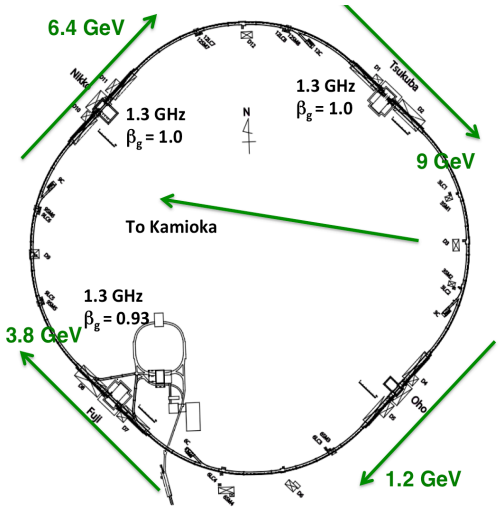

Fig. 1 Top view of the KEKB tunnel. Proton beam is accelerated in the straight sections to 1.2, 3.8, 6.4 and 9 GeV, respectively.

For the study on the design, we assume that the linac is constructed in the KEKB tunnel. As shown in Fig.1, the tunnel is fourfold symmetric structure and its circumference is 3 km. The accelerator cavities are placed only in the straight sections. In the each straight section, beam energy reaches 1.2, 3.8, 6.4 and 9 GeV, respectively. From 1.2 GeV to 9 GeV, ILC type superconducting cavities with two kinds of geometrical beta (β_g) are placed. The 2nd straight is β_g = 0.93, and the 3rd to 4th straights are β_g = 1.0.

In this presentation, we introduce the present accelerator design under the term of construction in the KEKB tunnel.

References

[1] K. Sakashita, private communication.