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Survival of beta decaying nuclei relevant for a neutrino factory

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For many neutrino physics applications it is desirable to have an intense tunable neutrino source. In [1] the β-beam concept for constructing a neutrino-antineutrino facility was proposed. The idea is to obtain a collimated neutrino beam by accelerating radioactive ions to high energy, which subsequently β decay in the long arms of a heavy-ion storage ring. In Ref. [1], two radioactive nuclei were proposed: 6He and 18Ne. In a later development it was proposed that one could construct monocromatic neutrino beam facility using nuclei that decay by electron capture (EC) mainly to one energy level of the daughter nucleus [2].

In a recent article, we have studied the beta decay properties of several nuclei in the rare earth lantanide region in order to select the best candidates for a monocromatic neutrino beam facility [3]. In our study an effort was made to acurately determine the EC branches of the nuclei of interest to the daugther final states using the total absorption technique.

However, in oder to determine if these candidates are appropriate to build such facility several technical issues have to be clarified. The TSR at ISOLDE can provide an unique tool to study for instance the production and survival of the nuclear species of interest. In short, the possibility of producing many radioactive species at ISOLDE in combination with the storage ring offers a unique opportunity for feasibility studies for such neutrino-antineutrino facility.

[1] P. Zucchelli, Phys. Lett. B 532, 166 (2002).
[2] J. Bernabeu, et al. J. High Energy Phys. 12, 014 (2005).
[3] E. Estevez et al. PRC 84, 034304 (2011)

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