

Ion production needs for beta beams

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“Neutrino properties are interesting probes to physics beyond the Standard Model. High quality neutrino beams of pure electron (anti-)neutrinos can be produced by accelerating beams of beta radioactive ions (beta beams) and let them decay in long straight sections in a race track shaped storage ring. Two ion species are needed, one producing neutrinos and the other anti-neutrinos. The reactions should have similar Q-values and the ions should have similar magnetic rigidities to be able to be accelerated in the same accelerator. A suitable scenario, using the CERN accelerator complex, has been studied within the EURISOL program, using ${}^6\text{He}$ and ${}^{18}\text{Ne}$. The production of these isotopes, specific to this application, is crucial for the efficiency of this setup. For the time being there is a significant shortfall of ${}^{18}\text{Ne}$. The production of ${}^{18}\text{Ne}$ would need specific research. Recent encouraging experiments at ISOLDE show that sufficient quantities of ${}^6\text{He}$ can be obtained.

Alternative ions, ${}^8\text{B}$ and ${}^8\text{Li}$, could also be good candidates for beta beams. ${}^8\text{Li}$ could probably be produced by similar techniques as ${}^6\text{He}$, but ${}^8\text{B}$ could probably not be produced by ISOL technology. Studies of the production of ${}^8\text{Li}$ and ${}^8\text{B}$ are ongoing in the EUROnu design studies within the European framework program (FP7) and could conceivably benefit from studies at ISOLDE.

In this presentaion we explain the needs for these radioactive ions to give beta beams useful for neutrino physics after acceleration and storage in the CERN accelerator complex proposed in the EURISOL design study.”

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