

Design study of a Split-Coaxial RFQ for IsoDAR

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The Isotope Decay-At-Rest experiment (IsoDAR) is a proposed experiment to search for sterile neutrinos by measuring neutrino oscillations. The electron-antineutrino generation requires a high intensity primary proton beam impinging on a beryllium target surrounded by lithium. In IsoDAR, H₂⁺ ions are generated and accelerated to avoid space charge effects in the low energy region, which will be stripped into protons after extraction from a cyclotron. As part of the IsoDAR injection system, an RFQ buncher with 32.8 MHz of operation frequency provides 70 keV acceleration and strong bunching of the H₂⁺ beam. The RFQ will be installed halfway inside the iron yoke of the cyclotron to be very close to the median plane. Because the beam starts diverging after the RFQ in both transverse and longitudinal direction, a re-buncher is employed in the end transition cell to re-focus the beam longitudinally. In this paper, we describe in detail the beam dynamics study and RF analysis of the IsoDAR RFQ for direct injection into a compact cyclotron.

Presenter: BAHNG, Jungbae

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