

## Precise magnetic fields for 40 meV neutrino mass sensitivity in Project 8

*Friday, 21 June 2024 17:30 (2 hours)*

The Project 8 experiment aims to probe the absolute neutrino mass through direct kinematic measurements of the tritium beta decay spectrum using cyclotron radiation emission spectroscopy (CRES). Non-uniformity of the magnetic field in the physics volume is expected to dominate the achievable energy resolution, and thus sensitivity.

CRES requires precise knowledge of the field through which an electron travels, but due to the electrons' high velocity, they would exit a region of flat field too rapidly to be observed. Therefore, we augment a carefully tuned uniform field with a magnetic bottle trap. Around the sides of the electron trap, a high-order multipole magnet adds a strong field only near the wall. This traps the cold tritium atoms whose decay provides the electrons for CRES.

This contribution details how, individually and in concert, the three elements of Project 8's magnetic field impact key performance parameters like electron trapping efficiency and energy resolution. By including all three fields and realistic manufacturing choices and tolerances in this integrated magnet program, we link field design choices directly to neutrino mass sensitivity.

### Poster prize

No

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Project 8

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