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Instrumentation for a prototype fusion propulsion system

Monday 11 August 2025 16:00 (2 hours)

A prototype colliding beam accelerator has been fabricated for the study of a fusion-based propulsion concept for interplanetary exploration. The purpose of this prototype is to demonstrate collider luminosities commensurate with the requirements of this application. While fusion fuels such as $p/\text{Li7}$ and $\text{He3}/\text{He3}$ would generate the required thrust characteristics, this prototype currently employs deuterium. Because neutrons are produced via DD fusion with a peak cross section of 0.1 barns, even modest initial luminosities yield event rates suitable for real-time measurements and lifetime monitoring. The proposed luminosity monitor is based on neutron moderation and absorption and subsequent gamma-ray detection. Sodium chloride serves as the moderator, with most neutrons absorbed by chlorine-35 nuclei having a thermal neutron absorption cross section of 43.6 barns. The collider is a linear device employing electrostatic axial confinement and radial focusing. A combination of destructive and nondestructive sensors are employed to monitor various beam parameters such as intensity, energy spectrum, transverse tunes and halo density distribution.

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Yes

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No

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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