

Study and Beam Experiments of a Compact Accelerator-Based Neutron Source

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This study developed a compact accelerator-based neutron source integrating double Einzel-lens focusing and RFQ acceleration. In the LEBT section, dual electrostatic lenses were employed to focus the beam, achieving a 30 keV, 15 mA pulsed beam output within a length of 0.22 meters, meeting the input requirements of the accelerator. A four-vane RFQ operating at 325 MHz was utilized to accelerate protons from 30 keV to 2.5 MeV over a length of 2.6 meters, achieving a peak beam current of 12 mA and a duty factor of 3%. In the HEBT section, two quadrupole magnets were employed for beam focusing, along with the installation of essential beam diagnostic elements. Beam experiment results demonstrated that the system achieved a 10.6 mA peak proton beam current on the target, with an RFQ transmission efficiency of 93.8% and an effective acceleration efficiency of 87%. The design strategy and experimental results are presented and discussed in this paper.

Email Address

Email Address

Presenter if not the submitter of this abstract

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Primary author: HAOQUAN, Su (Xi'an Jiaotong University)

Co-authors: Mr LI, Haipeng (Xi'an Jiaotong University); Mr PAN, Wenlong (Xi'an Jiaotong University); Mr KONG, Guoqing (Xi'an Jiaotong University)

Presenter: HAOQUAN, Su (Xi'an Jiaotong University)

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