Contribution ID: **99** Type: **Poster**

A Comparative Analysis of Neutron Flux from p(7Li,n)7Be and 7Li(p,n)7Be Reactions for the Neutron Radiography Facility of BIBA by Using MCNP6.2 Code

Thursday, November 14, 2024 1:00 PM (1h 30m)

BIBA (Busan Ion Beam Accelerator) is a compact linear accelerator that utilizes a 28 GHz superconducting electron cyclotron resonance ion source (SE-ECRIS) at the KBSI (Korea Basic Science Institute). The primary purpose of BIBA is to produce neutrons for high-resolution radiography and the implantation of multi-charged heavy ions. To operate the neutron radiography facility at BIBA, the ion beam must be accelerated to several MeV/u and interact with a target to generate high-intensity fast neutrons. In conventional quasi-monoenergetic neutron sources, neutrons are produced isotropically through direct reactions on nuclei, such as d(d,p)n or 7Li(p,n)7Be. However, this results in only a fraction of the emitted neutrons being available for irradiating samples, while the majority contributes to the background. To address this issue, natural collimation of neutron beams is employed using inverse kinematics reactions, such as p(7Li,n)7Be, where the projectile is significantly heavier than the target. In this study, we used the MCNP6.2 code to compare the neutron flux from 7Li(p,n)7Be and p(7Li,n)7Be reactions and to evaluate the effectiveness of the inverse kinematics method. The results indicated that the inverse kinematics method is more effective for establishing a compact linear accelerator of neutron radiography facility. In the near future, technical design work on the accelerator, high-power targetry, and target station will be required, and securing core technologies will be essential for the successful launch of BIBA's neutron radiography facility.

Paper submission Plan

Yes

Best Presentation

No

Contribution track

ICABU WG2. Beam Physics, Diagnostics & Novel Techniques

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Session Classification: ICABU Poster Session

Track Classification: ICABU: ICABU WG2. Beam Physics, Diagnostics & Novel Techniques