Preparations for measuring the excitation function of 149g-Tb with alpha beams at the TAMU Cyclotron Institute using Europium Targets

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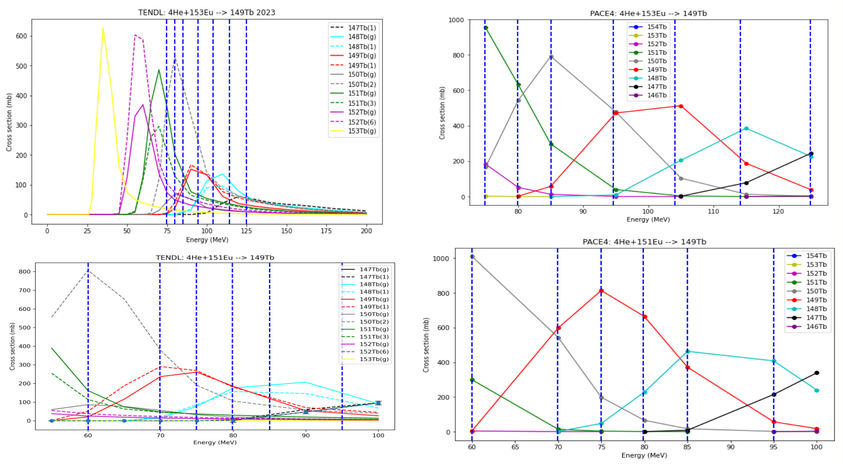
HIPPO Horizon-Broadening Isotope Production Pipeline Opportunities

Introduction:

- **149Tb is desirable for medical applications in cancer treatment. It is unusual in that it is short-lived and emits both alpha particles (good for killing cancer cells) and positrons (good for imaging). Since it is far from stability, it is challenging to make.**
- **We are investigating the production pathway using 4-He + Nat-Eu. We will measure the excitation function using a stack of thin foils to simultaneously measure the cross sections for multiple beam energies.**
- **At the same time, these measurements will afford the determination of cross-sections to produce several nearby isotopes.**
- **These cross-sections can be used to improve predictive models, in addition to exploring a production pathway for 149Tb.**

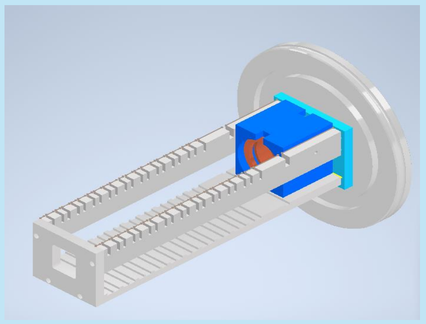
Expected Production Beam energy



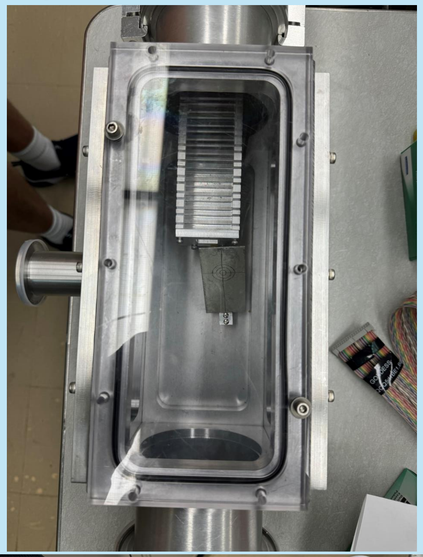
Method

- **LISE Physical Calculator was used to find and determine the energy loss and energy remaining after each respective stack foil. This allowed us to determine the energy range for producing 149Tb.**
- **PACE4 and TENDL were used to find the excitation function of the production of 149Tb and other related isotopes. The production peak varied with each model.**

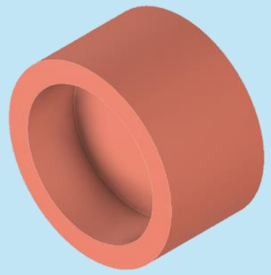
Target Chamber



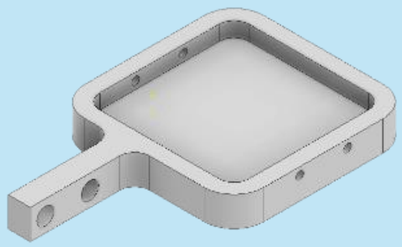
Target Chamber



Foil slits



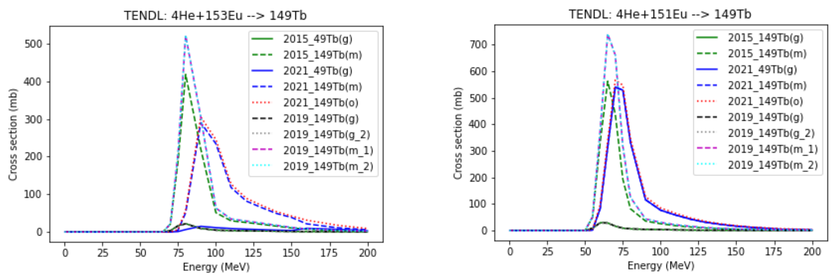
Faraday Cup



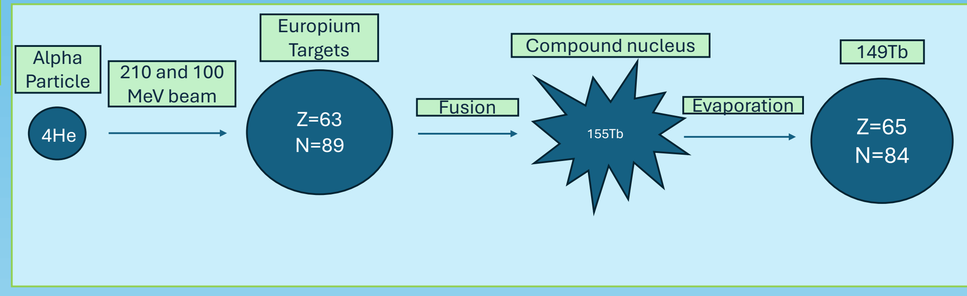
Phosphor Target Holder

Actuator

TENDL excitation function comparison graphs



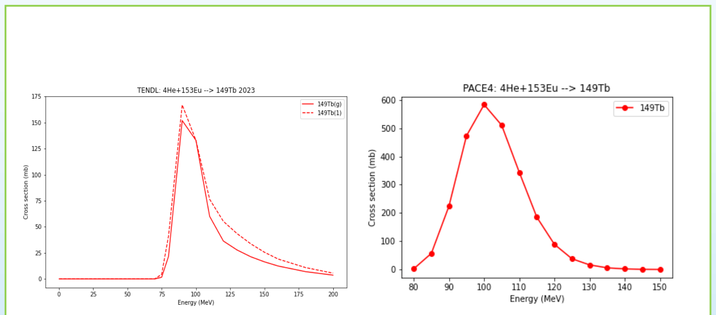
TENDL changes the magnitude, location, and shape of the excitation function between different versions.



149Tb Excitation Function

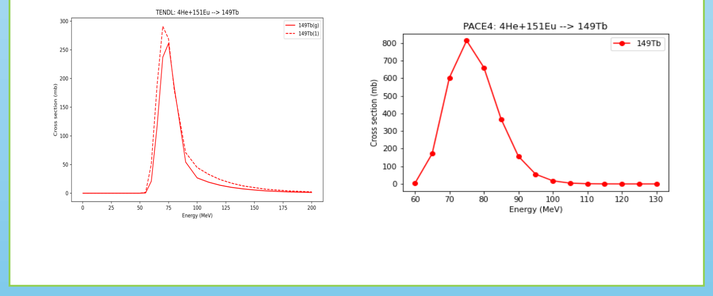
TENDL Vs PACE4
4He+153Eu→149Tb

- TENDL and PACE4 Peak energy predictions range from 95 and 100 MeV
- The max cross-section by both models is between 300 and 600 Mb
- Notably both excitation function peaks are shaped differently



TENDL Vs PACE4
4He+151Eu→149Tb

- TENDL and PACE4 Peak energy predictions peak at 75MeV
- The max cross-section by both models is between 550 and 800 mb
- Notably both excitation function peaks are shaped differently



Future Plans

- **Make natural Europium Targets using electro-deposition.**
- **Assembling machined parts.**
- **Creating a reliable target holder to measure the activity at different positions with respect to the detector.**
- **Making measurements of cross sections with beam energies between 60-125 MeV**
- **Activity measured by High-Purity Germanium detector.**

Acknowledgments

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