Evaluation of nuclear reaction cross sections for the production of ^{90}Y via charged particle induced reactions.

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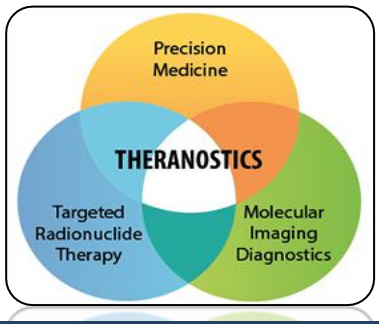
Introduction

Nuclear medicine is a specialty of medicine which uses radioactive material for diagnosis and treatment of diseases according to the decay properties of radionuclides.[1]



Theranostic = Therapeutic + Diagnostic

Yttrium-90

^{90}Y is a therapeutic radionuclide.
Use: Targeted therapy for Liver Cancer.

Half-Life	2.67 d
Decay Mode	Pure β^- emitter
E_{β^-} (MeV)	0.93 - 2.27 MeV
Range	2.5 - 11 mm

Methodology

Theoretical calculations of cross-section using nuclear model codes for production of ^{90}Y

- ALICE-IPPE
- TALYS 1.9
- EMPIRE 3.2.2

Comparison of experimental data with theoretical results to obtain most suitable production route.

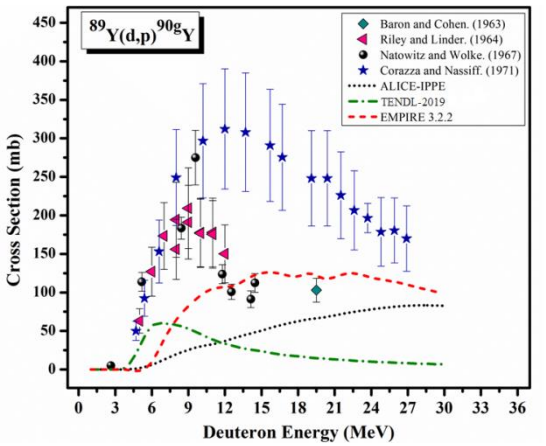
Cross-section is probability of a nuclear reaction to happen via interaction of incident particle and target.

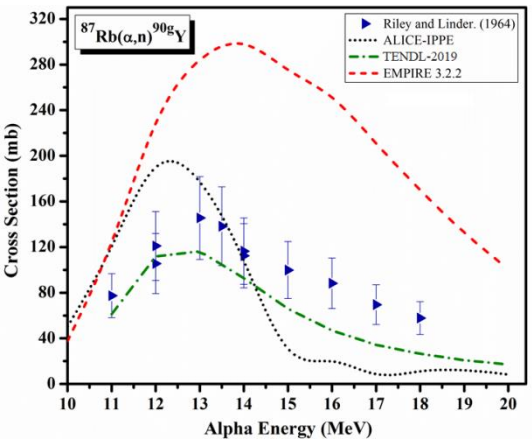
Results and Discussion

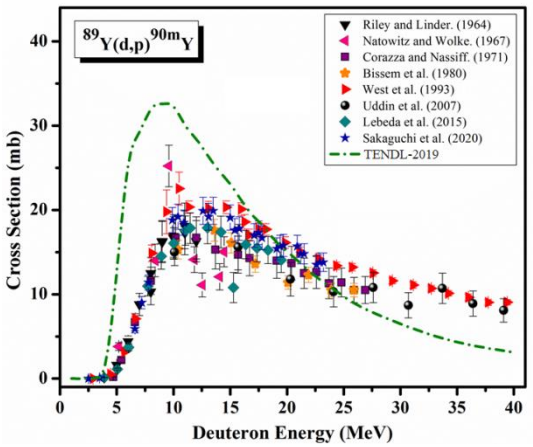
In this study nuclear reactions are selected on basis of two parameters

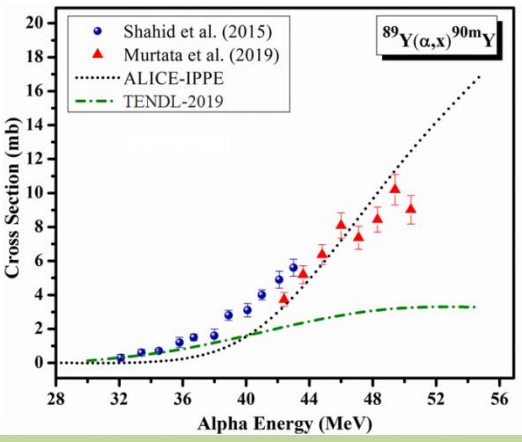
- Energy of projectile
- Nature of projectile

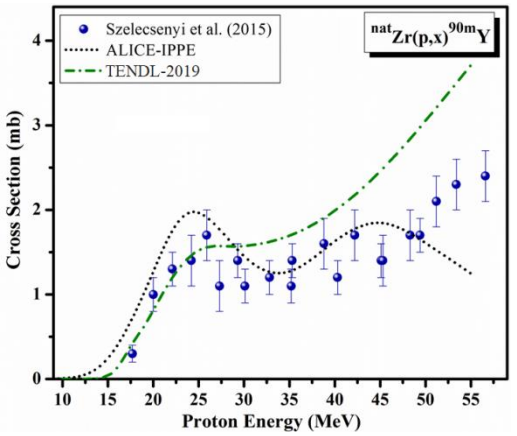
Projectile should be a charged particle, i.e., alpha, proton, deuteron, ^{3}He etc. and the energy of projectiles must be in range of 0-100 MeV.











Conclusion

- Maximum values of cross sections were observed for reactions ^{87}Rb(α,x)^{90}Y and ^{89}Y(d,x)^{90}Y.
- There is need to perform more experiments to study production routes with maximum yield and minimum impurities.

1. S. M. Qaim, "Nuclear data for production and medical application of radionuclides: Present status and future needs," *Nucl. Med. Biol.*, vol. 44, pp. 31–49, 2017.