



Contribution ID: 50

Type: **Contributed Oral Presentation**

## Cross Section Measurements of Various Target Materials for High Energy Neutron Induced Reactions

*Thursday 18 September 2025 13:50 (12 minutes)*

iThemba Laboratories for Accelerator Based Sciences (LABS) is a national research facility in South Africa with its various activities centred around a number of sub-atomic particle accelerators. The largest accelerator at the facility, a K=200 separated sector cyclotron (SSC), accelerates protons of energies up to 200 MeV, and heavier particles to much higher energies. With the protons beams available from the SSC, quasi-monoenergetic neutron beams of energies ranging between 25 MeV and 200 MeV can be covered almost continuously, using  $^7\text{Li}$  and  $^9\text{Be}$  targets of varying thickness. The spectral distribution of these beams exhibits a high-energy peak resulting from transition to the ground state and the 1st excited states of the product nucleus and an adjacent continuum resulting from break-up reactions [1]. Researchers at iThemba LABS are currently involved in a joint research project focused on measuring high-energy neutron induced cross-sections for the  $(n, xn)$  reactions using various target materials important for reactor dosimetry, fusion and fission studies. For these target materials, experimental data for high-energy neutron cross-section libraries of  $(n, xn)$  reactions is currently missing. Moreover, there are disagreements between the existing limited experimental data and theoretical models. At neutron energies below 20 MeV, cross sections for these nuclear reactions are considered to be well-known [2, 3]. Test experiments commenced at the iThemba LABS fast neutron beam facility with irradiations of various target materials using quasi-monoenergetic neutron beams at high energies.

For this contribution, we report on the neutron activation analysis of Au, Bi, Co and Tm using quasi-monoenergetic neutron beams of about 90 MeV and 140 MeV. The discussions will focus on whether the resulting gamma-ray spectra can be clearly distinguished from the background levels of the counting system. This will include calibration of the system using certified reference sources and analyses of the gamma-ray spectra to identify the  $(n, 2-6n)$  reactions for each activated material. Further analysis of the gamma-ray spectra will include the estimation of the activity uncertainties. For cross-section determinations, the following parameters; neutron peak fluence, peak to continuum ratio in the neutron spectrum, neutron fluence monitor and the activities from the gamma-ray spectrum will contribute to the uncertainty budget.

Keywords: quasi-monoenergetic neutrons, induced reactions, gamma-ray spectra, background spectrum

### Abstract Category

Nuclear Physics

**Authors:** Ms NDEVU, Luyanda (University of Fort Hare); Dr LETHOLE, Ndanduleni (University of Fort Hare); Dr MALEKA, Peane (NRF-iThemba LABS); Dr NDABENI, Zina (NRF-iThemba LABS)

**Presenter:** Dr NDABENI, Zina (NRF-iThemba LABS)

**Session Classification:** Contributed talks

**Track Classification:** Physics Research