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The development of a converter target for the production of radioactive beams at iThemba LABS

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Abstract :

iThemba LABS proposes a new proton accelerator for the production of radioactive beams and for simultaneous production of medical isotopes. Neutron-rich radioactive beams can be produced using the Isotope Separation Online (ISOL) method by the fission of uranium. One of the figures of merits for a radioactive beam facility is the intensity of beams as well as purity: being free of unwanted elements.High intense beams require the fission rate to be optimised in the uranium target. Neutron induced fission results in enhanced (much pure) production of neutron-rich fission fragments. It is therefore necessary for neutrons to be created from a high current thus high proton beam power.This project then will characterise the (p, xn) reactions on selected targets between the energies of 20MeV to 70MeV, so as to understand the actual energy and angular distributions of the emitted neutrons. The system being considered will consist of a primary neutron converter and a secondary uranium target. The advantage of a primary neutron converter over a system in which protons hit directly the uranium is that more beam power can be deposited in the converter target without uranium target reaching unbearable temperatures. At GANIL, Ridikas and Mittig found that when bombarding target nuclei with protons, the neutron yields are similar for most nuclei but more favourable for very light (lithium or beryllium) and very heavy (thorium or uranium) nuclei. The experiment taking place at iThemba LABS in September 2013 will measure neutron cross sections of beryllium; oxygen-18 and Tantalum. At the moment predictions are being conducted using MCNPX code. Once the parameters of the converter are optimised then criticality calculations on the uranium target must reveal the extent to which these produced neutrons from the primary target contribute to the fission fragment yields.

Award :

Yes

Level :

PhD

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Paper :

No

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