Contribution ID: **360** Type: **Oral Presentation**

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

Tuesday, 8 July 2014 10:00 (20 minutes)

Abstract content
   (Max 300 words)
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iThemba LABS (iTL) proposes to install a proton accelerator with energies of up to 70 MeV to produce neutron-rich radioactive ion beams (RIBs) by the fission of uranium. The literature shows that neutron induced fission gives enhanced production of neutron-rich fission fragments compared to proton induced fission. Thus the problem becomes one of finding the most efficient way of producing the neutrons from protons (converter target).

Higher fission rates may be achieved by increasing the beam current of protons hitting the converter. Cooling might be achieved in a natural way, by for example using water target. Oxygen-16 is unfortunately a poor converter, but it could be possible to use enriched oxygen-18 water (H218O).

This necessitates the measurement of oxygen-18 neutron yields. While oxygen-18 (p,n) cross sections have been measured up to 25 MeV, there is no data above this on the literature.

Neutron yields of lithium-7 and oxygen-18 water (97% enrichment) have been measured at iThemba LABS using the time of flight (ToF) technique. Proton beams of different energies (66, 54, 42 and 30 MeV) were used to bombard 3mm and 1mm thick targets of 7Li and 18O respectively. The neutron ToF measurements were done using the fast neutron detector (NE213) at angles 0° and 16° relative to the incoming proton beam. For both targets, energy spectrums and absolute cross sections were derived and compared.

As oxygen-18 water is considered to be used as a converter, the neutron yields from a thick 66 MeV proton stopping length target of 40 mm depth has also been measured. These measurements are compared to MCNPX calculations in which the MCNPX input file uses the cross sections that have been measured.

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Main supervisor (name and email)
and his / her institution

Dr Rob Bark
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**Would you like to
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Session Classification: NPRP

Track Classification: Track B - Nuclear, Particle and Radiation Physics