Production of High Quality ^{7}Be Radioactive Beam for Nuclear Astrophysics Experiments.

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Low energy ^{7}Be radioactive beam has been produced at Nuclear Science Centre, New Delhi, using the existing 15UD Pelletron and the recoil mass spectrometer HIRA. For this purpose HIRA is operated in a new ion optical mode[1]. In this mode there is an intermediate focal plane where new slit system is installed to reject the primary beam without loosing the RIB. Optics has been experimentally tested for p(^{7}Li,^{7}Be)n reaction in inverse kinematics to produce ^{7}Be[2]. We obtained beam rejection of ~ 10^{10} at 0° with respect to the primary beam. A polypropylene $(CH_2)_n$ foil, mounted on a rotary/linear motion device, is used as production target. In the new optical mode we have unit magnification at intermediate focal plane as well as secondary target position. So beam spot size on secondary target is a replica of the primary beam spot i.e. ~ 3 mm(dia.). Purity of the RIB has been consistently found to be better than 99.9% in the energy range 11–21 MeV with yields of the order of 1kHz/pnA/mSr. Recently an LN_2 cooled gas cell has been tested as a production target. With this we expect to produce more RIBs like ^{6}He,^{8}Li, ^{8}B, ^{11}C, ^{13}N, ^{14,15}O, ^{17,18}F, ^{18,19}Ne etc. with similar quality. As many of these beams at low energies may not be available from major ISOL/Fragmentation facilities, we have the opportunity to study the nuclear–astrophysical CNO cycle reactions and also to measure precise angular distributions in near barrier transfer, fusion etc. reactions.

Recently, ^{7}Be beam was provided for a couple of experiments to measure astrophysical $S_{17}(0)$ factor using ANC method. In these experiments, we have measured angular distribution for d(^{7}Be,^{7}Be)d and d(^{7}Be,^{8}B)n reactions at E_{cm}=4.5 MeV. To our knowledge this is the lowest energy measurement of this kind.

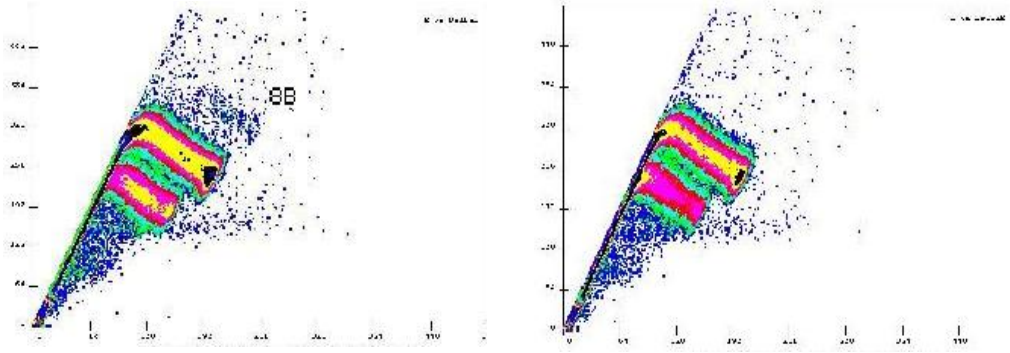

Figure 1: ΔE–E Spectra from d(^{7}Be,^{8}B)n reactions at E_{cm}=4.5 MeV. The first spectrum is measured with $(CD_2)_n$ target which shows the ^{8}B band and is not present in the other one is with $(CH_2)_n$ target

References:

1. J.J. Das et al, Journal of PhysicsG 24(1998)1371–1375.
2. NSC–RIB web–site: http://www.nsc.ernet.in/rib/index.html

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