Contribution ID: **22** Type: **oral**

Secondary neutrons as the main source of the neutron rich fission residues production after the bombardment of a thick U target by 1 GeV protons: experimental evidences for Cs isotopes

Tuesday, 8 June 2010 10:40 (20 minutes)

To predict isotope yields in the future ISOL installations it is of crucial importance to understand properly the mechanism of isotope production in thick target. The present work seems to be a step toward this understanding.
Experimental yields of the mass separated Cs isotopes produced by 1 GeV proton beam in thick U targets (with the thicknesses 6.5, 91 and 146 g/cm2) have been analyzed in the framework of diffusion-effusion model. The applicability of the model has been shown by the analysis of the Fr isotopes yields. Comparison of the neutron rich and neutron deficient Cs isotopes production efficiencies allows to divide contributions from the direct reaction (p+238U) and secondary reaction ((secondary n)+238U) in the neutron rich Cs isotopes production. For 146Cs, for example, the secondary neutron contribution is greater than the direct reaction contribution from 10 to 40 times depending on the thickness and geometry of a target material. Simple calculation of the "neutron contribution"with the known secondary neutron multiplicity and the isotope production cross-sections in the reaction (n14MeV+238U) describes these data fairly well.

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no

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Session Classification: Production and Manipulation of RIB

Track Classification: Production and manipulation of RIB