Yield ratio of neutrons to protons in $^{12}C(d, n)^{13}N$ and $^{12}C(d,p)^{13}C$ from 0.6 MeV to 3 MeV

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The neutron yield in the $^{12}C(d,n)^{13}N$ reaction and the proton yield in the $^{12}C(d,p)^{13}C$ reaction have been measured using deuteron beams of energies 0.63 MeV, some of the results are shown in Fig. 1. The deuteron beam is delivered from a 4 MeV electrostatic accelerator and bombarded on a thick carbon target. The neutrons are detected at 0°, 24°, and 48° and the protons at 135° in the lab frame. Further, the ratio of the neutron yield to the proton yield was calculated. This can be used to effectively recognize the resonances. The resonances are found at 1.4 MeV, 1.7 MeV, and 2.5 MeV in the $^{12}C(d,p)^{13}C$ reaction, and at 1.6 MeV and 2.7 MeV in the $^{12}C(d,n)^{13}N$ reaction. The proposed method provides a way to reduce systematic uncertainty and helps confirm more resonances in compound nuclei.

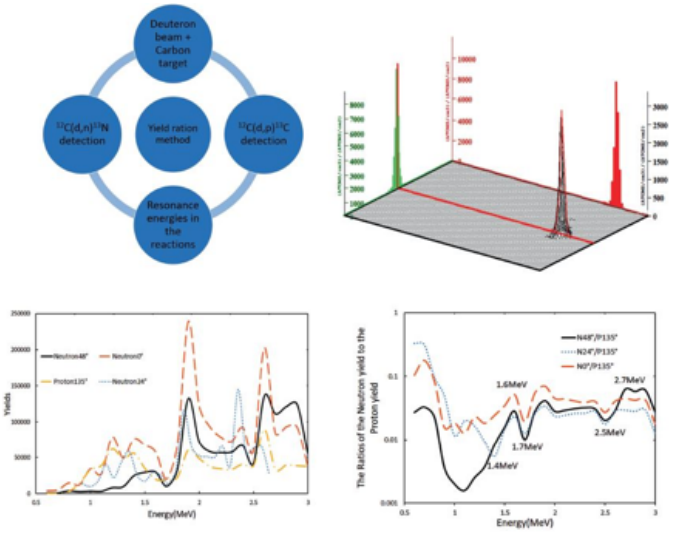

Fig. 1. Yield of neutron and ratio of neutron yield to proton yield from this experiment [1].

[1] W.-J. Li, Y.-G. Ma, G.-Q. Zhang, X.-G. Deng, M.-R. Huang, A. Bonasera, D.-Q. Fang, J.-Q. Cao, Q. Deng, Y.-Q. Wang, and Q.-T. Lei, Nuclear Science and Techniques **30**, 180 (2019).