Elastic scattering of ^{32}S on ^{13}C

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In the previous work, elastic scattering channel ^{13}C(^{26}Mg,^{26}Mg)^{13}C and the single neutron transfer channel ^{13}C(^{26}Mg,^{27}Mg)^{12}C measurements were performed with the purpose of extracting the parameters of the optical model potentials that were needed for DWBA calculations to determine the asymptotic normalization coefficient (ANC) for the ^{26}Mg + n → ^{27}Mg system, and consequently calculating the astrophysical reaction rate for ^{26}Si(p,gamma)^{27}P from ANC [1]. It is shown below on Fig. 1 shows the angular distribution of the cross-section in the center-of-mass system for the elastic scattering of ^{26}Mg on ^{13}C.

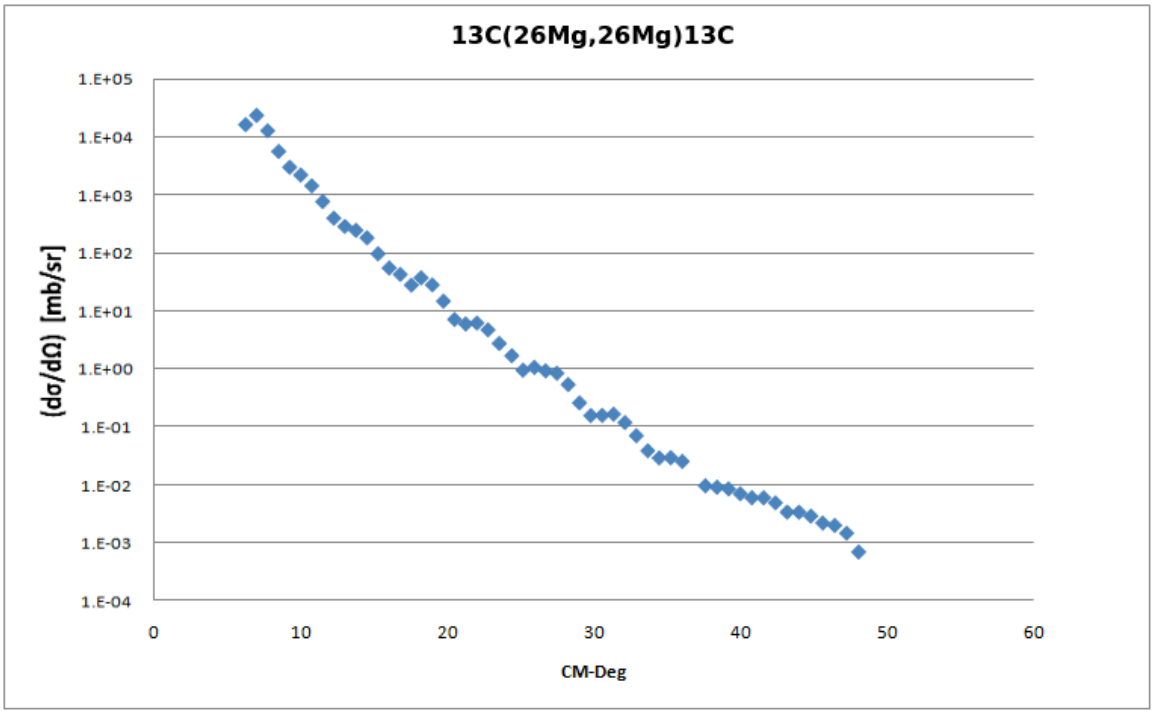

FIG. 1. The angular distribution of the cross-section in the center-of-mass system for the elastic scattering of ^{26}Mg on ^{13}C.

Subsequently, the elastic scattering of ^{28}Si on ^{13}C experiment was carried out to better understand the optical model parameters that are needed for ^{26}Mg and other systems in this mass region [2]. The angular distribution of the cross-section in the center-of-mass system for the elastic scattering of ^{28}Si on ^{13}C is shown below on Fig. 2.

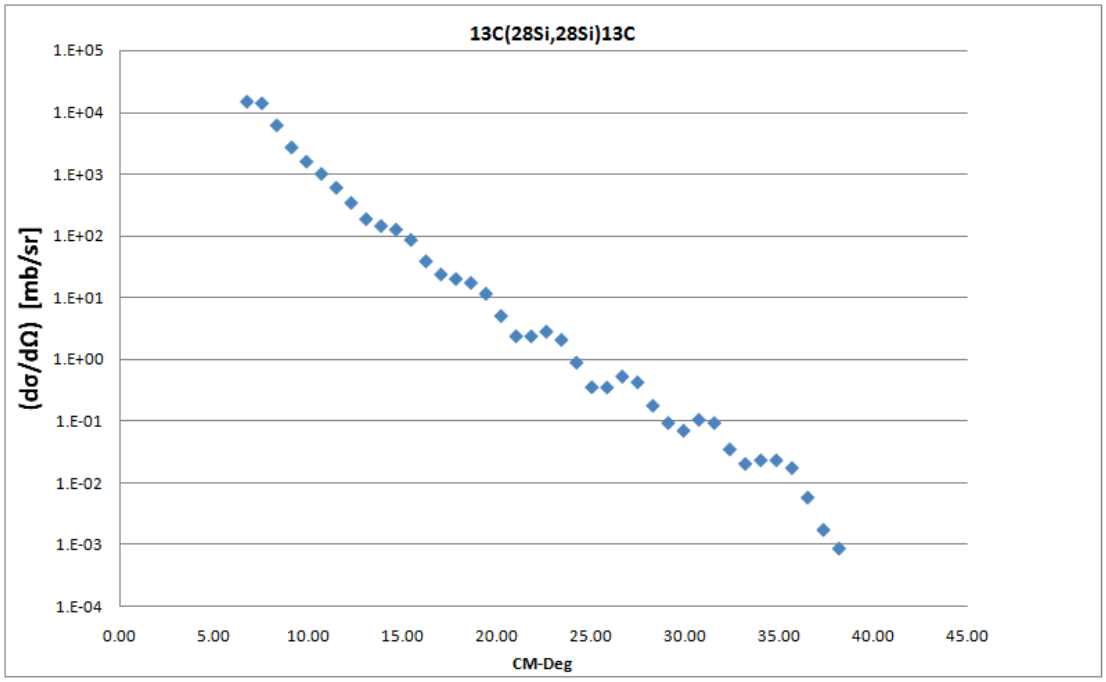

FIG. 2. : The angular distribution of the cross-section in the center-of-mass system for the elastic scattering of ^{28}Si on ^{13}C.

In this follow-up experiment conducted at Texas A&M Cyclotron Institute, a beam of 334 MeV ^{32}S ions from the K150 cyclotron impinged on a ^{13}C target in the chamber of the MDM spectrometer. Reaction products were separated using the multipole-dipole-multipole (MDM) spectrometer, and observed with the help with the recently updated Oxford detector. Elastic scattering of ^{32}S on ^{13}C was measured from 2^{o} to 14^{o} in the lab frame (corresponding to 6^{o} – 50^{o} in the center-of-mass frame). The angular distribution of the cross-section in the lab system for the elastic scattering can be seen in Fig. 3.

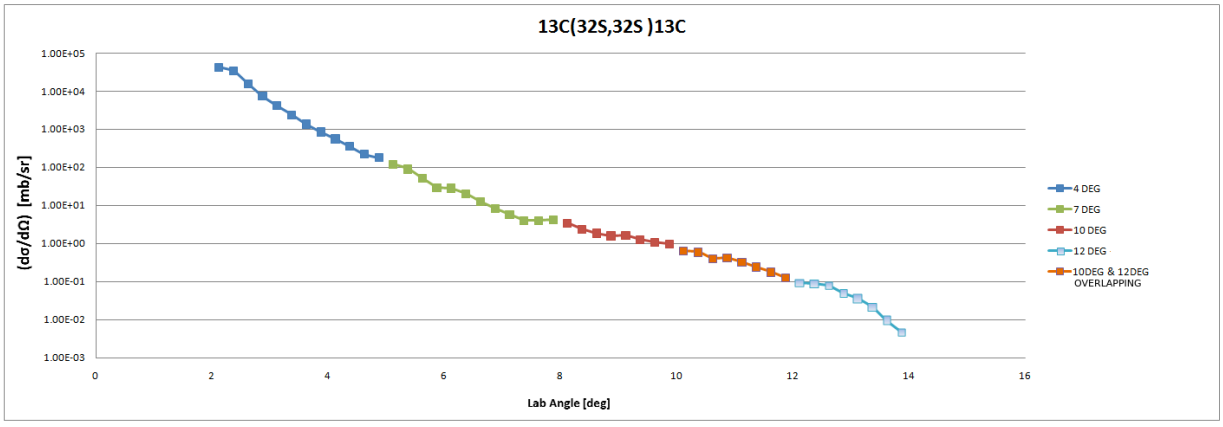

FIG. 3. : The angular distribution of the cross-section in the center-of-mass system for the elastic scattering of ^{32}S on ^{13}C.

Due to the insufficient residual energy of the particles left in the scintillator, which is placed behind the back window of Oxford detector where the reaction products stop, and a gradual loss in observed particles in the scintillator with a larger angle related to decreasing cross section, it was difficult to obtain data at lab angles larger than 12°. Hence, in order to overcome this issue, a second Micromegas pad was placed between wire 2 and 3 in the Oxford detector, as shown in Fig. 4, to increase the quality of identification as well as to obtain more data at larger angles by stopping the reaction products in the area right below Micromegas placed between wire3 and 4 [3].

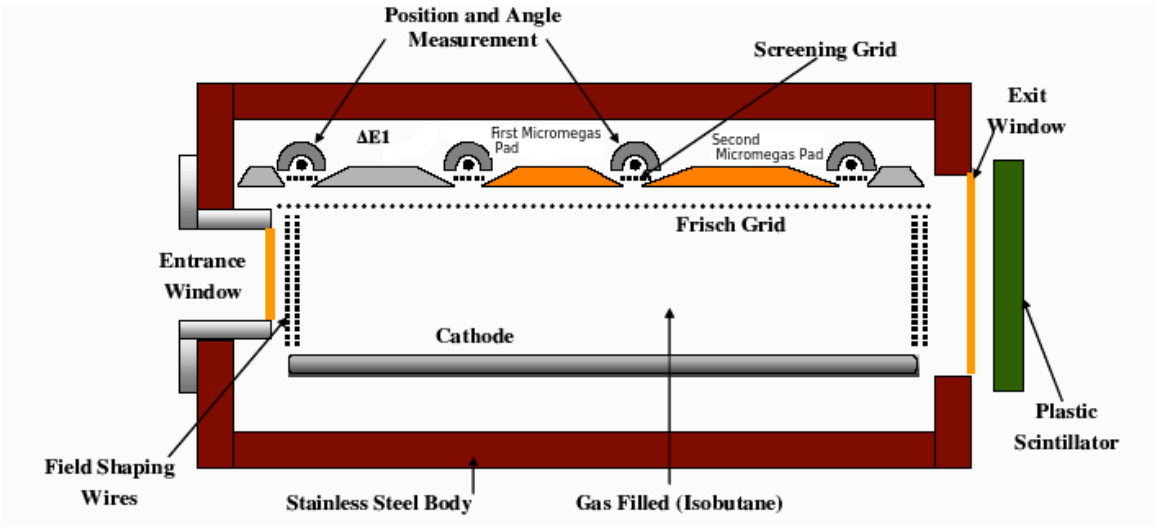

FIG. 4. Side View of newly upgraded Oxford detector.

New measurements of the elastic scattering of both ^{28}Si and ^{32}S on ^{13}C at larger lab angles will be performed with newly upgraded Oxford detector. New experiments are already scheduled and will be conducted in May 2016.

[1] M.Dag *et al.*, *Progress in Research*, Cyclotron Institute, Texas A&M University (2013-2014), p. I-40.
[2] M.Dag *et al.*, *Progress in Research*, Cyclotron Institute, Texas A&M University (2014-2015), p. I-28.
[3] A. Spiridon *et al.*, *Progress in Research*, Cyclotron Institute, Texas A&M University (2014-2015), p. IV-45.