Proton removal cross section for neutron rich nuclei N~20 using lead and carbon target and hence the scaling factor.

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Introduction: Depending upon the choice of target material and energy of Radioactive Ion Beam the excitation mechanism for exotic nuclei varies drastically. Such a target dependence on nuclear excitation has been observed for nuclei (A~8) by T.Aumann et. al [1] at a beam energy 600 MeV/nucleon. Two distinct mechanisms for the excitation of the nuclei are Electromagnetic and Nuclear Dissociation (ED and ND respectively). Giant and Pygmy Dipole Resonance (GDR and PDR) are the collective excitation of nuclei by absorbing the virtual photon [2] which is perfectly due to ED. So it is necessary to subtract the ND part from the observed total cross-section of those processes. Outline for such a treatment is described in details by T. Le Bleis et. al [3]. Due to low charge, carbon (^{12}C) is one of the possible candidates to consider its negligible contribution for ED in comparison to lead (^{208}Pb). A suitable scaling factor is necessary for carbon to lead target for the determination of contribution in ND of lead. Here we are interested in proton removal (S_p= 20.30 MeV for ^{32}Mg) cross-section which mainly due to the contribution of ND. After extracting the ND part from total cross-section the rest part ED may be used for GDR and PDR.

Experiment: Radioactive Ion Beams (RIB) with energy ~530 MeV/nucleon were produced by fragmentation of ^{40}Ar beam delivered by the synchrotron SIS at GSI, Darmstadt impinging on a Be target (8gm/ cm^2). The fragments were separated using Fragment Separator FRS [4]. Suitable degrader was used to take care of our interested nuclei $^{27-28}$Ne, $^{30-31}$ Na,$^{31-33}$Mg, $^{34-35}$Al. At cave C, complete kinematical measurements were performed after the secondary reactions with Pb and C targets using LAND [5], TFW and DTF. SST, GFI and DC were used for the tracking of neutron(s), fragment(s) and proton(s).

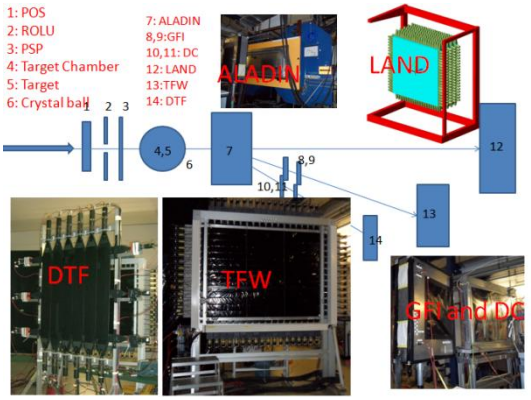

Fig. 1 Experimental set-up

Analysis: TFW detector used for outgoing fragments identification has already been calibrated and calibration of this detector was presented in DAE symposium, 2010 [6]. Proton removal cross section has been measured of these neutron rich nuclei from the Z distribution in TFW. Carbon and lead targets were used to study the excitation of these neutron rich nuclei. In Fig-2 and Fig-3 the Z distribution has been shown after the secondary targets. Using different trigger pattern useful events have been extracted e.g. Tpat=2, Tpat=16, Tpat=128 which corresponds to trigger from POS with TFW, DTF and LAND respectively.

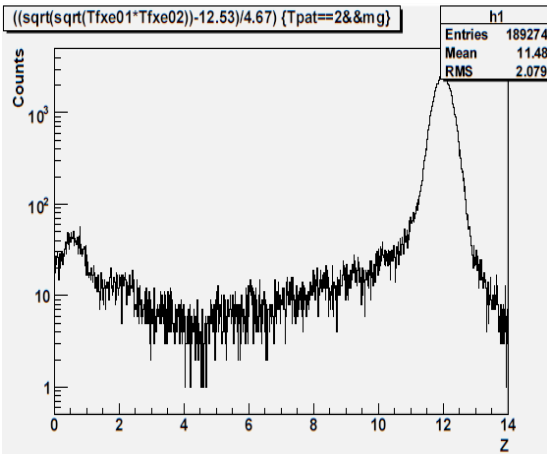

Fig:2 Outgoing fragment's Z distribution in TFW using carbon Target.

From this spectra proton removal cross-section has been measured. The same thing was also performed for lead target to measure the scale factor.

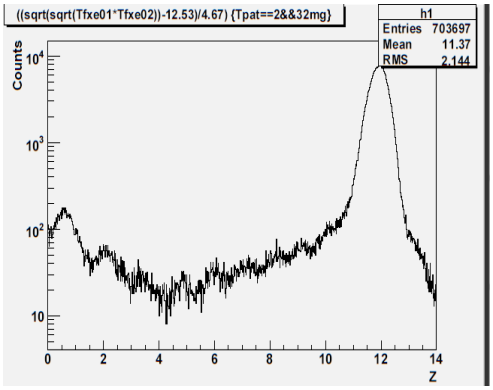

Fig.3: Outgoing fragment's Z distribution in TFW using lead Target

Result: Analyzing these data we have obtained proton removal cross-section for these neutron rich nuclei of the order of few mille barn for carbon target. For the determination of scaling factor in Nuclear Dissociation (ND) we are analyzing the fragments after lead target. Contribution of Electromagnetic Dissociation will only be obtained after subtracting the ND part.

Refference:
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