NIMROD Detector Calibrations

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The TAMU NIMROD detector array has been used to carry out a large number of experiments to explore the mechanisms of multifragmentation and the nature of hot nuclear matter produced by intermediate energy heavy ion reactions. Measurements have been performed for several different combinations of projectiles and targets in the energy range of 15A MeV to 55A MeV [1].

The energy calibration of Si detectors has been performed using alpha particles from ^{228}Th and ^{252}Cf sources and punch through energies of different particles through the Si detector. These calibrations show a linear relation between the deposited energy in the Si and the output signal.

For the Csl detectors, the relation between the deposited energy and the light output was evaluated using a Range-Energy table and the energy lost in the Si in Si-CsI telescopes. The extracted results are shown by symbols in Figure 1. The different symbols correspond to different particles as indicated in the figure. The extracted data have been fitted using a Tabacaru function [2] as shown by solid lines in the figure.

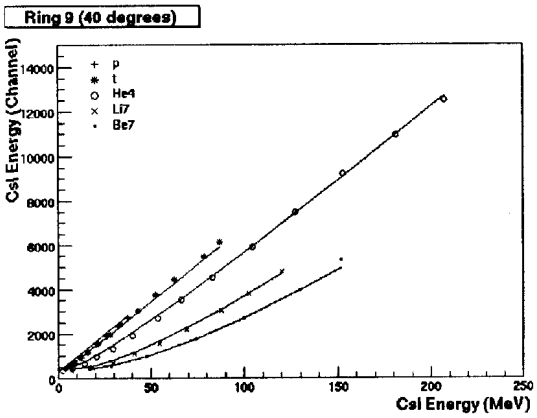

Figure 1: Proton energy spectra measured different thicknesses of CsI.

For high energy particles of Hydrogen, however, this method causes a large ambiguity in energy in the CsI because of the very small energy loss in Si. In order to establish the relation up to the highest energy observed in the experiments, a separate experiment has been performed using cylindrical CsI's (2.5cm diameter) of three different lengths (1cm, 3cm and 5cm). One or two Si detectors are placed in front of each CsI for particle identification and energy calibration. The ^{64}Zn + ^{92}Mo reaction at 47A MeV was chosen as a reference reaction and the energy spectra of light particles have been measured at angles corresponding to the

central angle of the 13 rings in NIMROD. Typical energy spectra measured by different length of the CsI detectors are shown in Figure 2 for protons at $2_{Lab} = 9.4^{o}$.

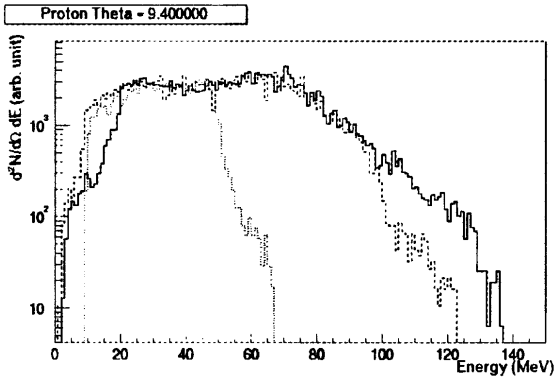

Figure 2: Proton energy spectra measured with different thicknesses of CsI.

The energy spectra for the Csl with length of lcm, 3cm and 5cm are shown by dashed-dotted, dashed and solid lines, respectively. The differences on the low energy side for three different Csl detectors are caused by different thicknesses of Si detectors used as Si-Csl telescopes. One can clearly see the punch through energies of protons through each telescope. The final energy calibrations of the CsI detector in NIMROD is now underway, using the measured energy spectra in this separate run as a reference.

References

[1] *Progress in Research*, Cyclotron Institute, Texas A&M University (2000-2001) p. II-1.

[2] M. Parlog *et al.*, submitted for publication to Elsevier (2000).