ENERGY DEPOSITION IN HEAVY ION COLLISIONS FROM NEUTRON MULTIPLICITY MEASUREMENTS

R.P.Schmitt,[a] J. Boger,[b] T. Botting,[a] L. Cooke,[a] B. Hurst,[a] D.O'Kelly[a] and W. Turmel[c]
[a]Cyclotron Institute, Texas A&M University, College Station, TX 77843-3366, USA
[b]Brookhaven National Laboratory, Upton, NY, USA
[c]Texas A&M-Corpus Christi, Corpus Christi, TX, USA

A knowledge of the excitation energy of the intermediate system is essential in elucidating the properties and the decay modes of hot nuclei. For medium mass and heavy nuclei, the neutron multiplicity (M_n) should be a reliable indicator of the energy deposition in a nuclear collision. Extensive neutron multiplicity studies have been conducted at Texas A&M using a 4π neutron ball. Targets throughout the periodic table have been bombarded with projectiles ranging from ^{4}He to ^{63}Cu. In the measurements the neutron ball was triggered by light particles, intermediate mass fragments and fission fragments. The detector was also operated in a self triggered mode to obtain a global view of the various reactions.

The figure below shows some of the results obtained with 30 AMeV ^{14}N, ^{20}Ne, ^{63}Cu and 55 AMeV ^{4}He using the self triggered mode. The solid points show the measured mean M_n corrected for background and pileup but not efficiency. The other symbols depict the results of various model calculations that have been corrected for detector efficiency using Monte Carlo simulations. The open circles and the triangles show the respective predictions of CASCADE and GEMINI assuming an initial excitation energy derived from momentum transfer systematics. While these calculations reproduce the gross trends in the data, both systematically over predict M_n. Model calculations using a code which includes entrance channel dynamics schematically (EUGENE) come close to explaining the experimental M_n values (see stars). An analysis of these results and others suggest that the linear momentum transfer gives only a rough indication of the actual excitation energy of the intermediate system.