P-A Collisions with NIMROD

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Results from investigation of the dynamics of a large series of heavy ion reaction studies carried out in recent years indicate that much of the early particle emission may be attributed to nucleon-nucleon collisions occurring during the thermalization stage of the reaction. In order to better characterize the early stage emission we have carried out a series of experiments in which the reactions of ^{112}Sn and ^{124}Sn with a wide range of projectiles, ranging from p to ^{64}Zn, all at the same energy per nucleon were studied. This is the thesis project of L. J. Qin. The systems studied included:

^{1}H +^{112}Sn	^{1}H +^{124}Sn	^{2}H +^{112}Sn
^{2}H +^{124}Sn	^{3}He+^{112}Sn	^{3}He+^{124}Sn
^{4}He+^{112}Sn	^{4}He+^{124}Sn	^{10}B+^{112}Sn
^{10}B+^{124}Sn	^{20}Ne+^{112}Sn	^{20}Ne+^{124}Sn
^{40}Ar+^{112}Sn	^{40}Ar+^{124}Sn	^{64}Zn+^{112}Sn

By careful comparisons of the yields, spectra and angular distributions observed for these different systems we expect to be able to cleanly separate emission resulting from nucleon-nucleon collisions from that resulting from the thermalized system and obtain a much cleaner picture of the dynamic evolution of the hotter systems. Fig. 1 illustrates the isotopic identification spectrum for light particles in the reaction ^{10}B+^{112}Sn.

In order to extract more information on the excitation energy and refine coalescence model treatments which we expect to apply to these data [1], we also used five small neutron detectors belonging to the Laval University group to make simultaneous measurement of neutron spectra. Fig. 2 shows the Neutron Identification Spectrum obtained with one of these detectors.

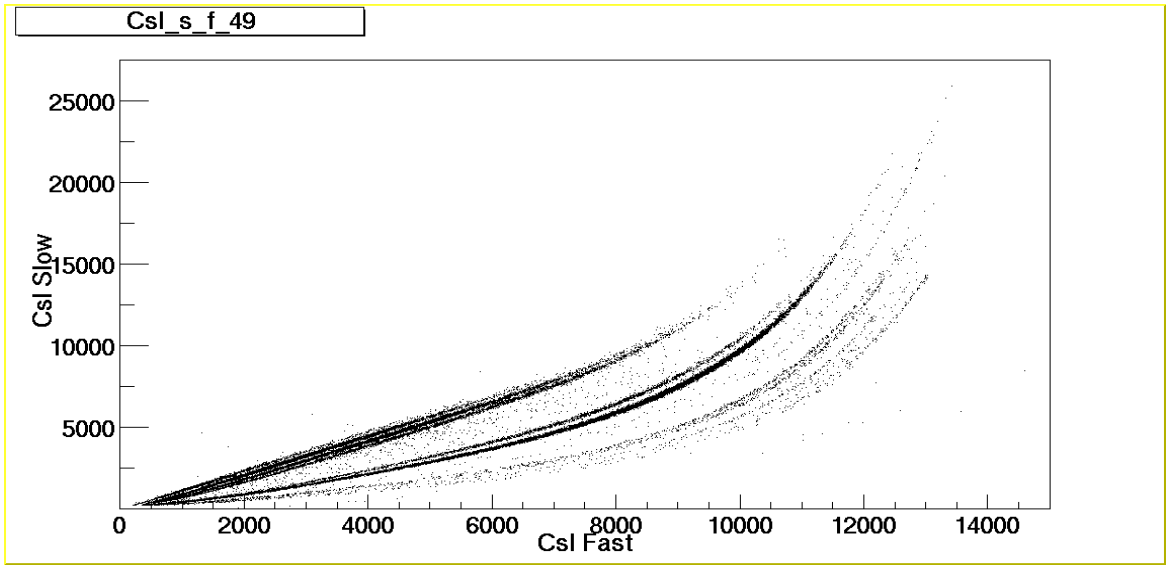

Figure 1: Particle Identification in a CsI Detector. A plot of the slow scintillation component versus the cast component allows discrimination of different light particles, p, d, t, ^{3}He, and α as well as some heavier species.

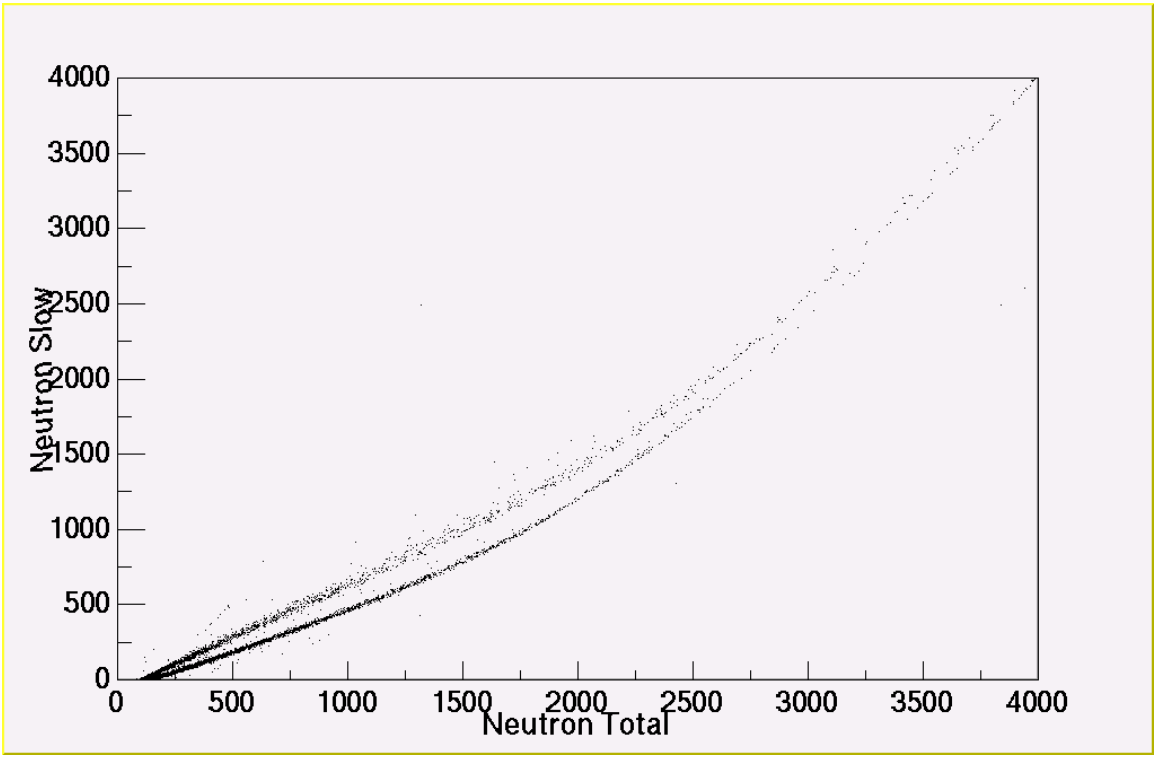

Figure 2: Neutron and γ ray discrimination in the neutron detector module.

The complete analysis of these experiment data is under way.

References

[1] K. Hagel *et al.*, Phys. Rev. C **62** (2000).