The fragmentation of quasiprojectiles

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Fragments emitted from quasi projectile formed from the reactions of ^{40}Ca, ^{40}Ar, ^{48}Ca with $^{112,124}Sn$, were studied using the FAUST array. Isobaric, isotopic, fractional and mean N/Z yield comparisons were made between systems [1]. These comparisons showed that the neutron richness of the system affected the fragment yields, with the neutron-rich nuclides populated preferentially by the neutron-rich systems; the neutron-poor nuclides populated preferentially by the neutron-poor systems. This trend is observed at all angles and all nuclides. For an example figure 1 shows the carbon fractional yields at both energies at 7°.

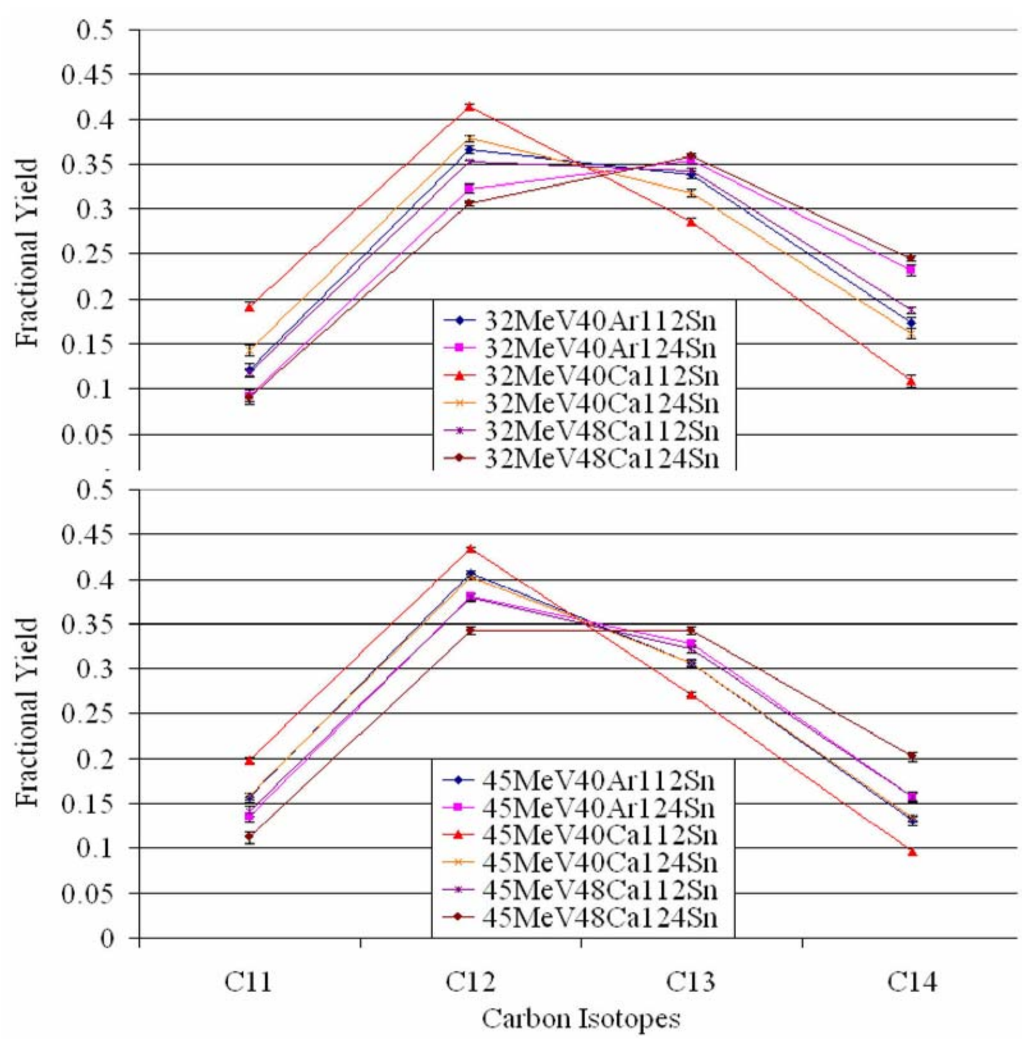

Figure 1. Carbon fractional yields for the 32 MeV/nucleon systems top and 45 MeV/nucleon systems bottom at the lab angle of 7°.

The N/Z distribution of the fragment yields was studied to observe an inhomogeneous N/Z distribution between the LCP's (Light Charged Particles: Z<3) and IMF's (Intermediate Mass Fragments: Z>2) [1]. Figure 2 shows the multiplicity of LCP's, IMF's and Total. The results showed a new trend. Previous studies had shown that increased proton richness increases the LCP multiplicity dramatically, while the IMF multiplicity remained nearly constant [2]. For increasing neutron richness the previous studies suggested that the neutron-rich LCP multiplicity would increase; however, this work showed that the IMF multiplicity increases, while the LCP multiplicity stays nearly constant with increasing neutron richness.

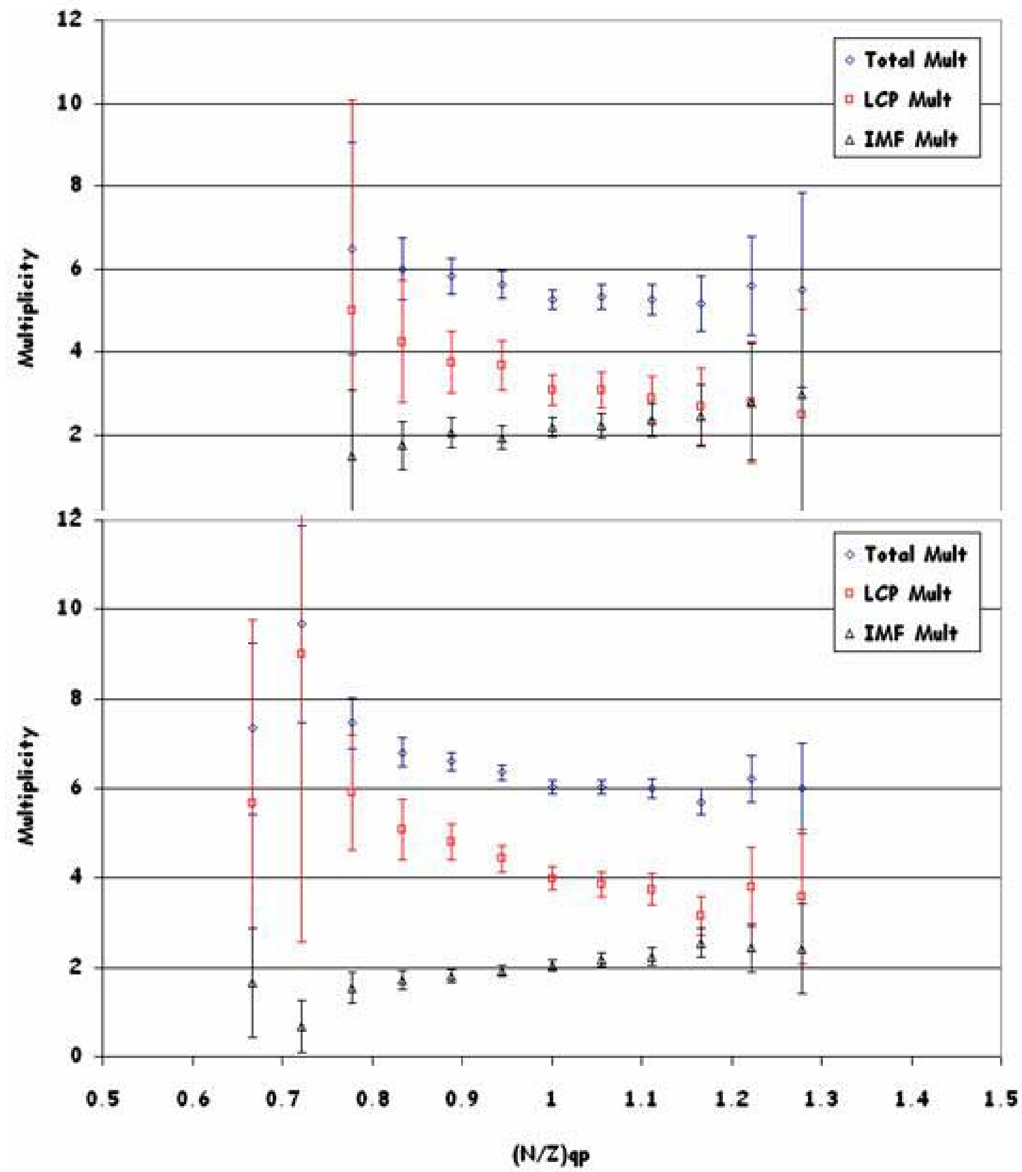

Figure 2. Multiplicity of LCP's, IMF's and Total as a function of N/Z of the quasiprojectile source for the 40Ar on 112Sn systems. 32 MeV/nucleon on top and 45 MeV/nucleon on bottom. Error bars are statistical.

The inhomogeneous distribution of N/Z was also studied using the mean N/Z of the IMF divided by the mean N/Z of the LCP shown in figure 3 [1]. The results were in accord with previous studies, however this work went further and showed that there was a dependence of the mean N/Z of the IMF on the quasiprojectile N/Z [1, 2].

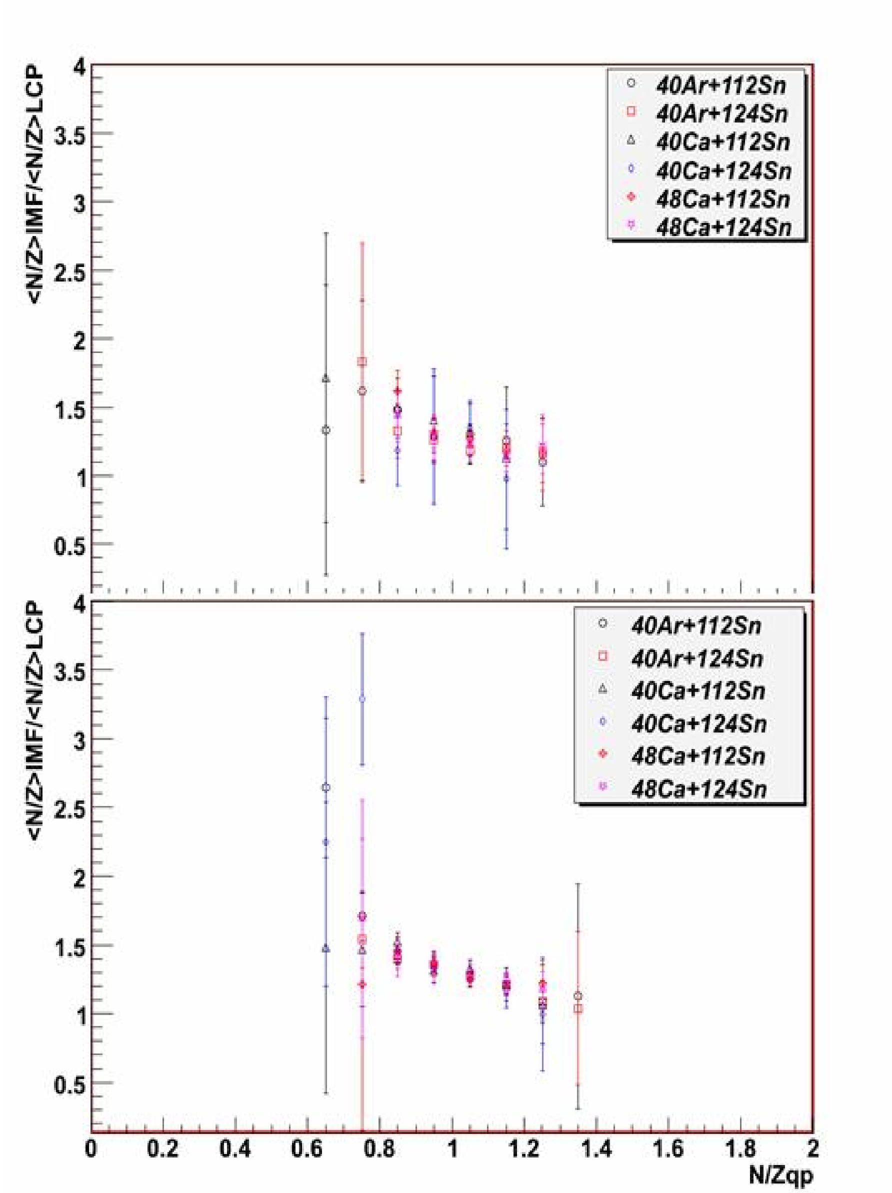

Figure 3. The ratio of the mean N/Z of the IMF and the mean N/Z of the LCP versus the N/Z of the quasiprojectile. 32 MeV/nucleon systems on top and 45 MeV/nucleon systems on bottom.

Finally the inhomogeneous distribution of N/Z was studied using the mirror nuclei ratios $^{3}H/^{3}He$, $^{7}Li/^{7}Be$, $^{11}B/^{11}C$ and $^{15}N/^{15}O$ [1]. Figure 4 shows the $^{11}B/^{11}C$ ratio. Previous studies had only used the $^{3}H/^{3}He$ ratio and observed an increase of the ratio with increasing quasiprojectile N/Z [2]. This work demonstrated that all of the mirror ratios increased with increasing quasiprojectile N/Z [1].

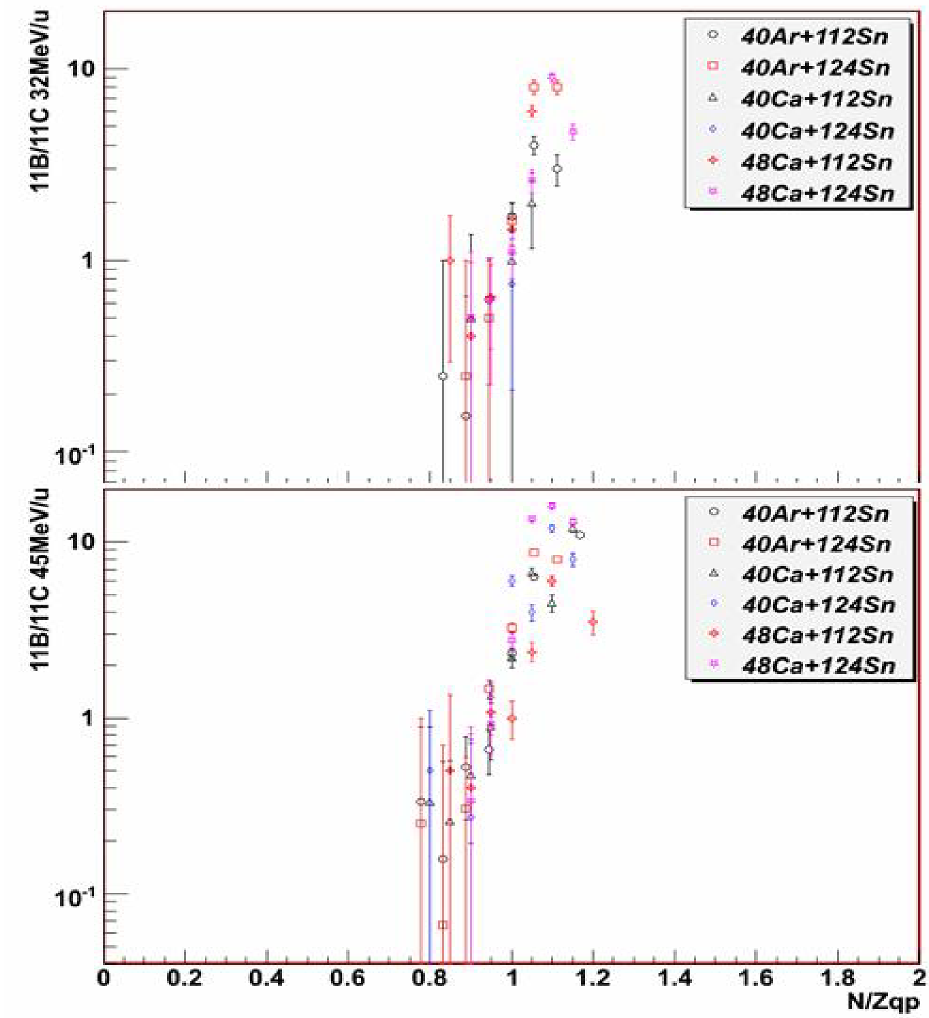

Figure 4. The $^{11}B/^{11}C$ ratio as a function of quasiprojectile N/Z. 32 MeV/nucleon systems on top and 45 MeV'/nucleon systems on bottom.

[1] A. L. Keksis, Ph. D. Thesis, Texas A&M University, 2007.

[2] M. Veselsky, R. W. Ibbotson, R. Laforest, E. Ramakrishnan, D. J. Rowland, A. Ruangma, E. M. Winchester, E. Martin, and S. J. Yennello. Phys. Rev. C **62**, 041605R (2000).