emission from an expanding source, followed by breakup of residues excited to high temperatures (T $\gtrsim$12 MeV). The SMM model gives a reasonable description of the data for fragments with Z > 6, but under-predicts the lower Z correlations. These results suggest that multifragmentation induced by light ions is a time-dependent phenomenon in which light fragments are preferentially emitted from a hot, expanding source, followed by rapid multi-body disintegration for the hottest systems.

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MULTIFRAGMENTATION IN THE 5.0- TO 14.6-GeV/c π^-, p + ^{197}Au REACTIONS

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Excitation functions for charged-particle emission in the 6.0- to 14.6-GeV/c p + ^{197}Au and 5.0- to 9.2-GeV/c π^- + ^{197}Au reactions have been measured with the ISiS 4π detector array at the Brookhaven AGS (E900). For these secondary beams, we associate protons with the positive beam and π^- with the negative beam from the AGS production target.

In addition to ISiS, the apparatus included a dual inner- and outer-scintillator array for halo rejection and beam alignment. All events were tagged with a beam counter and the multiplicity trigger required signals in three or more of the 162 silicon detectors. In addition, all CsI signals with energy greater than 8 MeV but no companion silicon trigger were read out. This permitted inclusion in the multiplicities of energetic minimum-ionizing particles (energetic protons, π's, etc.) for which the silicon signal was too low to trigger the discriminators. Calibration of all gas-ion-chamber, silicon and CsI/photodiode detectors has recently been completed and preliminary results are presented below.

In Fig. 1, the raw charged particle multiplicity distributions are shown for events in which at least one intermdeiate mass fragment (IMF) is observed. The left-hand frame compares the probability distributions for charged particle multiplicities obtained with proton beams (6.2, 10.0, 12.8 and 14.6 GeV/c) and the right-hand frame provides the same information for the π^- beams (5.0, 8.2 and 9.2 GeV/c). The center frame compares p and π^- projectiles at an identical laboratory kinetic energy of 9.1 GeV. Two features stand out in these comparisons. First, there is little sensitivity to bombarding energy with either projectile, other than with the 5.0-GeV π^- beam, for which the multiplicity distribution does not extend as high as for the other systems. This is consistent with the observation of limiting fragmentation in these reactions and reflects a saturation in deposition energy, as has been previously reported for ^{3}He projectiles.[1] Second, for identical total energy, the distributions for p and π^- beams are nearly identical. This similarity suggests that both projectiles are equally effective in depositing energy in the target nucleus. Both the bombarding-energy and hadron-type independence are predicted by the quark-gluon string model of Toneev.[2]

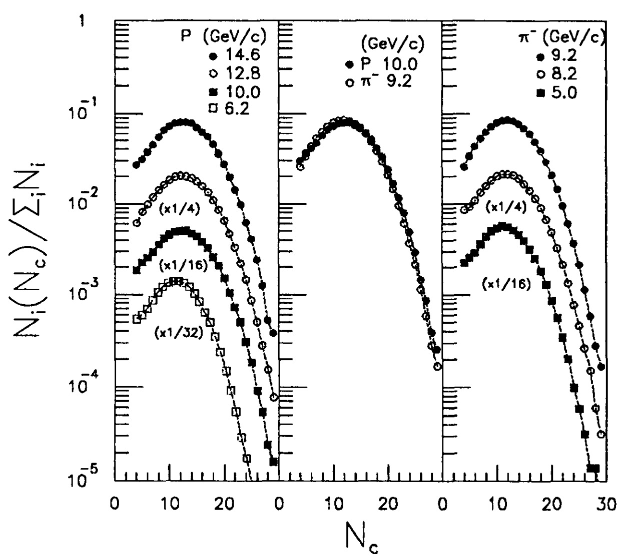
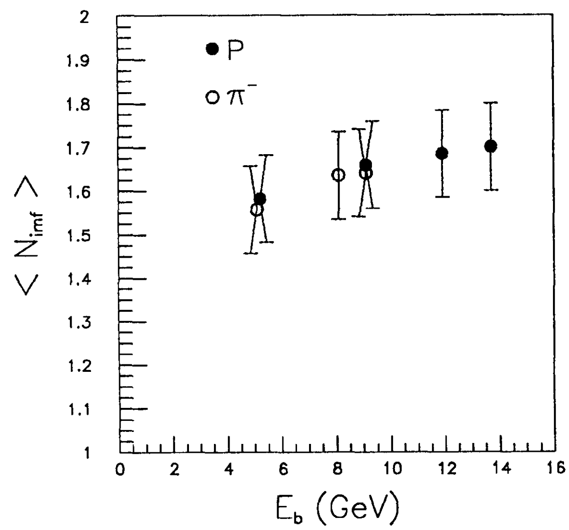


Figure 1. Probability distributions for charged particle multiplicities from ^{197}Au target in events with at least one IMF. Left frame gives data for proton beams; right frame for π^-, and center frame compares the p and π^- beams at the same total energy.

IMF (IMF: $3 \leq Z \lesssim 15$) multiplicities up to $N_{IMF} = 9 - 10$ are observed for all systems. As with the charged-particle multiplicities, the distributions are nearly identical for all systems – with the lowest momentum p and π^- cases being somewhat lower. Again, this similarity in the IMF multiplicity distributions, which should be a strong reflection of energy transferred to the ^{197}Au residue, argues for a saturation in deposition energy above a kinetic energy of $\sim$ 6 GeV for hadron beams, consistent with INC predictions.[2] Compared with earlier studies using 4.8-GeV ^{3}He beams,[1,3] the probability distributions for proton beams are nearly the same. This presumably reflects the expected dependence of both target and projectile nucleon number on the cascade steps leading to the deposition energy in the residue.



Figures 2. Average IMF multiplicity in events with one or more IMFs from p, π^- beams incident on ^{197}Au.

In Fig. 2, the average measured IMF multiplicity for events with one or more IMFs, $\langle N_{IMF} \rangle$, is plotted as a function of beam momentum. For incident momenta above 6 − 7 GeV/c, the average IMF multiplicity is nearly constant, $N_{IMF} \approx 1.60 - 1.65$. This value is compared with measurements of $\langle N_{IMF} \rangle = 1.6$ for the 4.8-GeV ^{3}He + ^{197}Au reaction and $\langle N_{IMF} \rangle = 1.3$ for the 4.8 GeV ^{3}He + ^{nat}Ag system. Although reconstruction of the IMF multiplicity distributions that correct for geometry and thresholds has not yet been performed, the measurements translate approximately to a value of $\langle N_{IMF} \rangle \approx 2.0$. This result is significantly lower than the value of $\langle N_{IMF} \rangle \approx 3$ reported in Ref. 4, in which Z identification could not be determined.

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