

Heavy-Ion Collisions & Equation of State: Homework Set 2

1. Average multiplicities of protons, deuterons, tritons, helions, alphas, and charged pions (i.e. positive and negative together), emitted into wide angles in Ar + KCl reactions at 800 MeV/nucleon are, respectively, measured at 6.8, 1.9, 0.3, 0.25, 0.08, and 1.17.
 - (a) Using ratio of the deuteron to proton multiplicities estimate the entropy per nucleon generated in these collisions.
 - (b) Determine the temperature from the c.m. 90° proton spectrum displayed in the figure below, and estimate the emission volume in fm^3 .
 - (c) Given that pions can be produced and absorbed in inelastic collisions of nucleons, what is the pion chemical potential? Consider the situation of $\mu_p \simeq \mu_n \equiv \mu_N$. Use $\epsilon \simeq m_\pi + p^2/2m_\pi$ for the pion energy and estimate the charged pion multiplicity expected in the thermodynamic model and compare to the measured multiplicity. Ignore here any potential contribution of the Δ resonances at freeze-out and their decay.

