Measuring the temperature of hot nuclear fragments

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A new thermometer based on fragment momentum fluctuations is presented. This thermometer exhibited residual contamination from the collective motion of the fragments along the beam axis. For this reason, the transverse direction has been explored. Additionally, a mass dependence was observed for this thermometer.

This mass dependence may be the result of the Fermi momentum of nucleons or the different properties of the fragments (binding energy, spin etc..) which might be more sensitive to different densities and temperatures of the exploding fragments. We expect some of these aspects to be smaller for protons (and/or neutrons); consequently, the proton transverse momentum fluctuations were used to investigate the temperature dependence of the source.
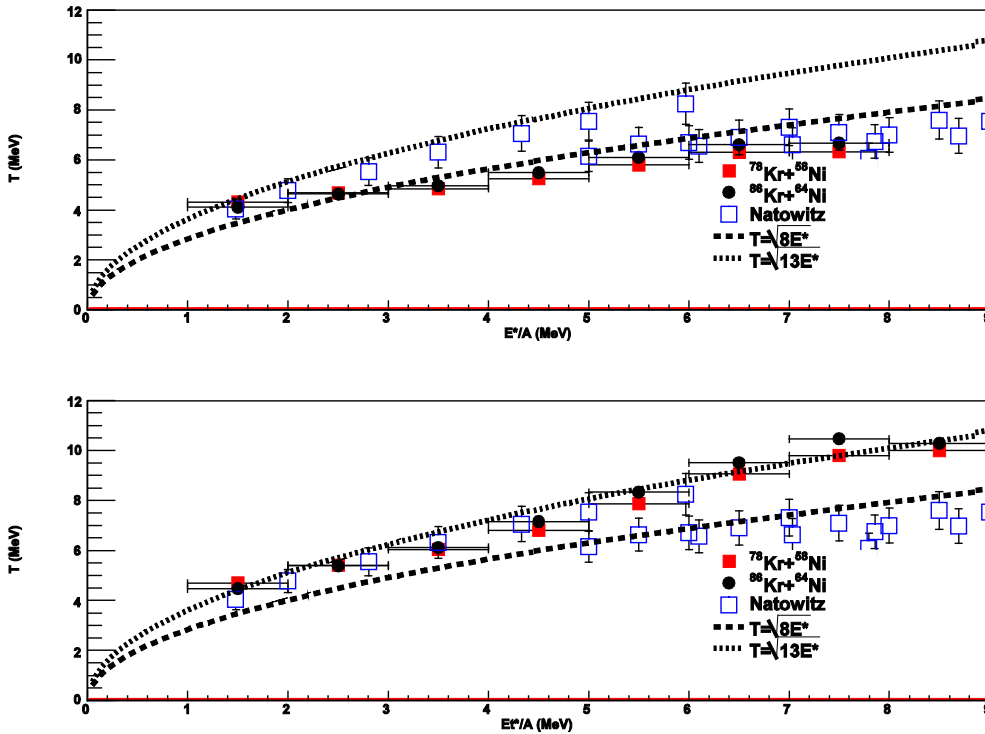

FIG. 1. Temperatures derived from proton momentum fluctuations as a function of E*/A of the source event. For reference the caloric curve for A=60-100 from the Natowitz compilation as well as two Fermi Gas ($T = (aE/A)^{1/2}$ with a = 8, 13) curves are plotted(Top panel). (Bottom panel) same as above but for the corresponding 'transverse' quantities.

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