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How to Measure Specific Heat Using Event-by-Event Average p_T Fluctuations. MICHAEL TANNENBAUM, Brookhaven National Laboratory, PHENIX COLLABORATION — A simple way to visualize event-by-event average p_T fluctuations is by assuming that each collision has a different temperature parameter (inverse p_T slope) and that the ensemble of events has a temperature distribution about the mean, $\langle T \rangle$, with standard deviation σ_T [R. Korus, *et al.* PRC **64**, 054908 (2001)]. PHENIX characterizes the non-random fluctuation of M_{p_T}, the event-by-event average p_T, by F_{p_T}, the fractional difference of the standard deviation of the data from that of a random sample obtained with mixed events. This can be related to the temperature fluctuation:

$$F_{p_T} = \sigma^{\rm data}_{M_{p_T}} / \sigma^{\rm random}_{M_{p_T}} - 1 \simeq (\langle n \rangle - 1)\sigma_T^2 / \langle T \rangle^2 \qquad .$$

Combining this with the Gavai, *et al.*, [hep-lat/0412036] definition of the specific heat per particle, a simple relationship is obtained:

$$c_v/T^3 = \frac{\langle n \rangle}{\langle N_{tot} \rangle} \frac{1}{F_{p_T}} \qquad .$$

F_{p_T} is measured with a fraction $\langle n \rangle / \langle N_{tot} \rangle$ of the total particles produced, a purely geometrical factor representing the fractional acceptance, $\sim 1/20$ in PHENIX. The Gavai, *et al.* prediction that $c_v/T^3 = 15$ corresponds to $F_{p_T} \sim 0.33\%$, which may be accessible in PHENIX by measurements of M_{p_T} in the range $0.2 \leq p_T \leq 0.6$ GeV/c.

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