Deconfinement Transition vs Nuclear Liquid Gas Transition

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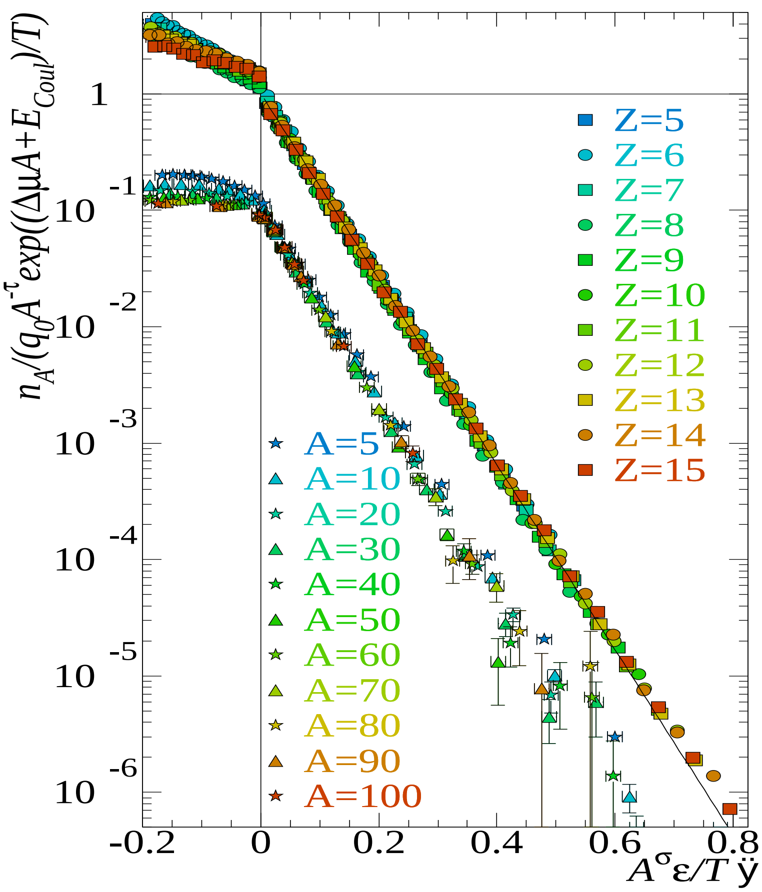
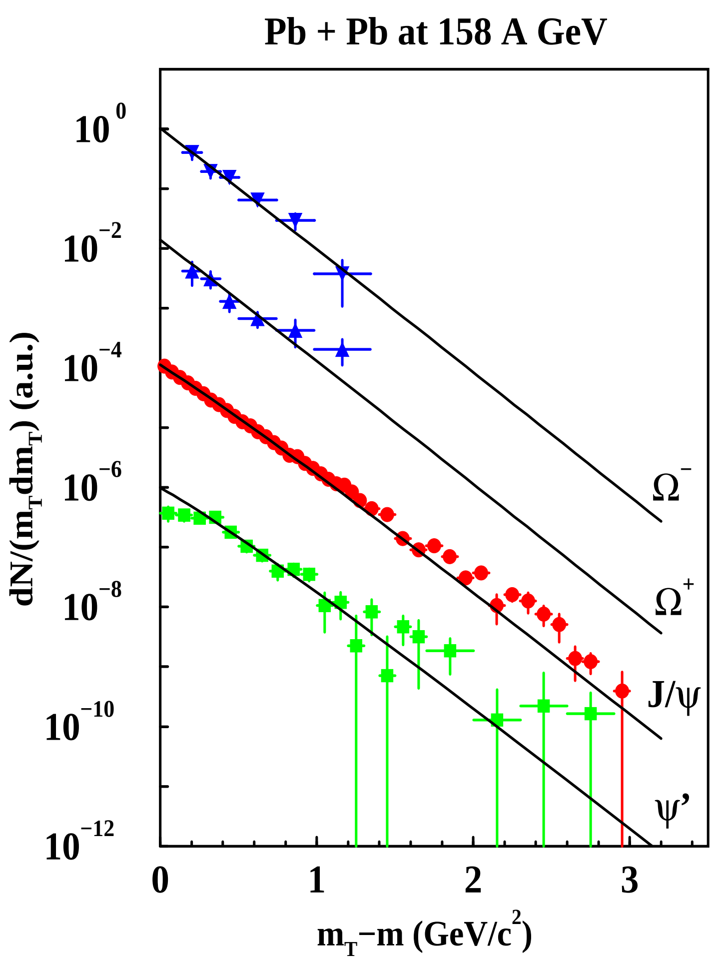




Scaled yields of nuclear fragments of charge Z $\Longleftrightarrow$ m_T spectra of early hadronized particles

ISiS data with Coulomb correction

Line: Fisher Model

$\varepsilon = \frac{T_c - T}{T_c}$

J. B. Elliott et al., PRL 88 (2002)

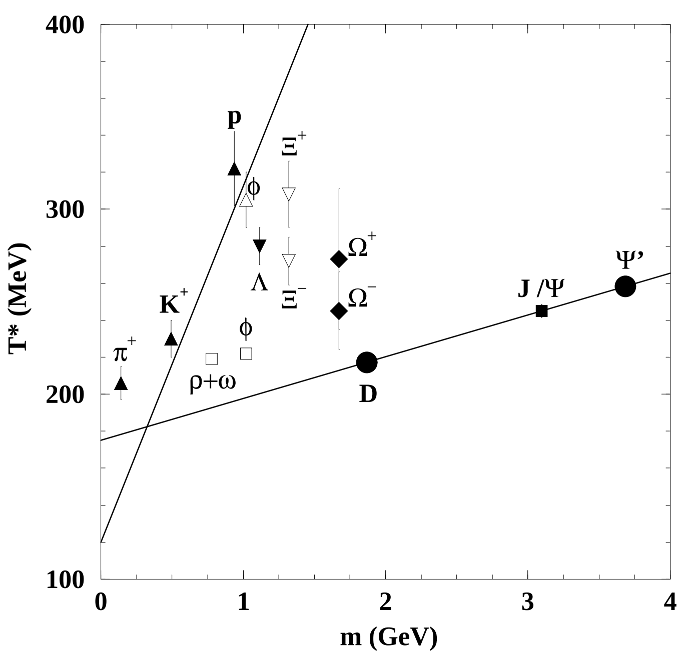
WA97, NA50 data

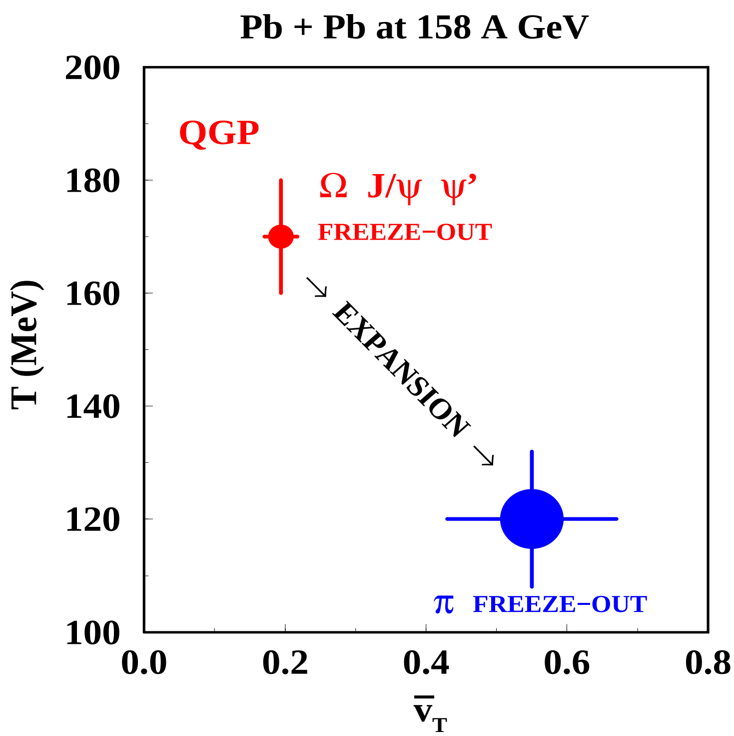
Blast wave with

$T_{fr} = 170 \pm 10$ MeV, $\bar{v} = 0.2$

K.A.B. et al., PRL 88 (2002)

Early Hadronization at SPS



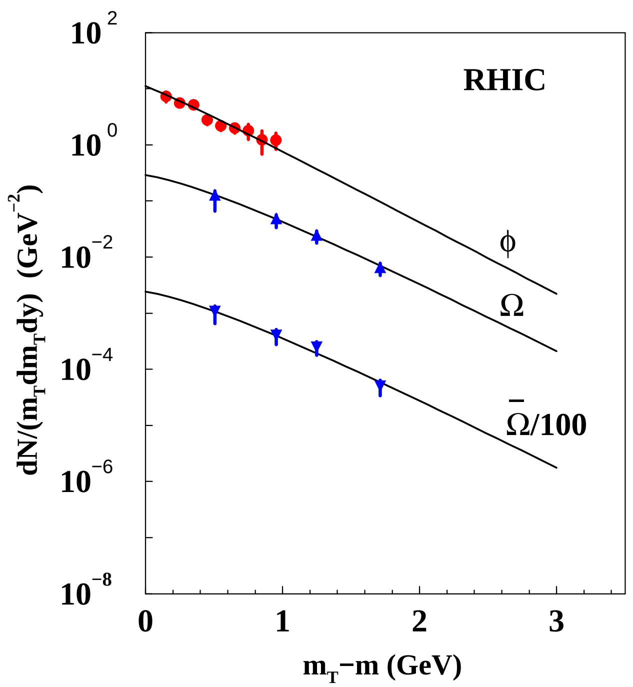


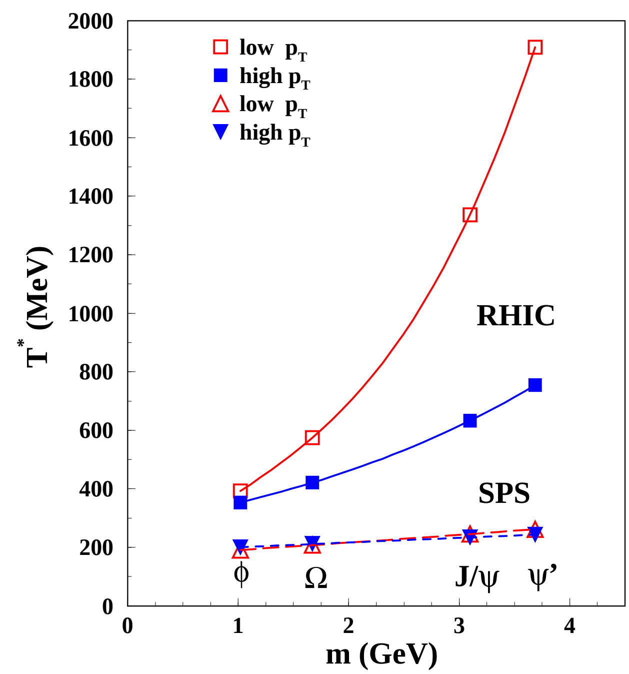
No fit, just data	$\Longleftrightarrow$	Fit of m_T spectra
Lines: $T^* = T + \frac{m\langle v^2 \rangle}{2}$		$T_{fr} = 170 \pm 10$ MeV, $\bar{v} = 0.2$
Predictions for ψ' and D	$\Longleftrightarrow$	Consistent with fit
K.A.B. et al., PL B 523 (2001)		K.A.B. et al., PRL 88 (2002)

Early Hadronization at RHIC $\sqrt{s_{NN}} = 130$GeV

Early Hadronization (weak flow) is similar to Compound Nucleus

At RHIC flow is stronger $\rightarrow$ shape is not exponential





Fixed:	$T_{fr} = 170 \pm 5$ MeV	$\Longleftrightarrow$	High and low p_T
	$\lambda_{\Omega^-} = 1.09 \pm 0.06$		Temperatures
Fitted:	$\langle v \rangle = 0.42 \pm 0.06$	$\Longrightarrow$	**Predictions for** J/ψ**,** ψ'
	$\tau_H R_H^2 = 275 \pm 70$ fm^3/c		K.A.B. et al., PRC 68 (2003)

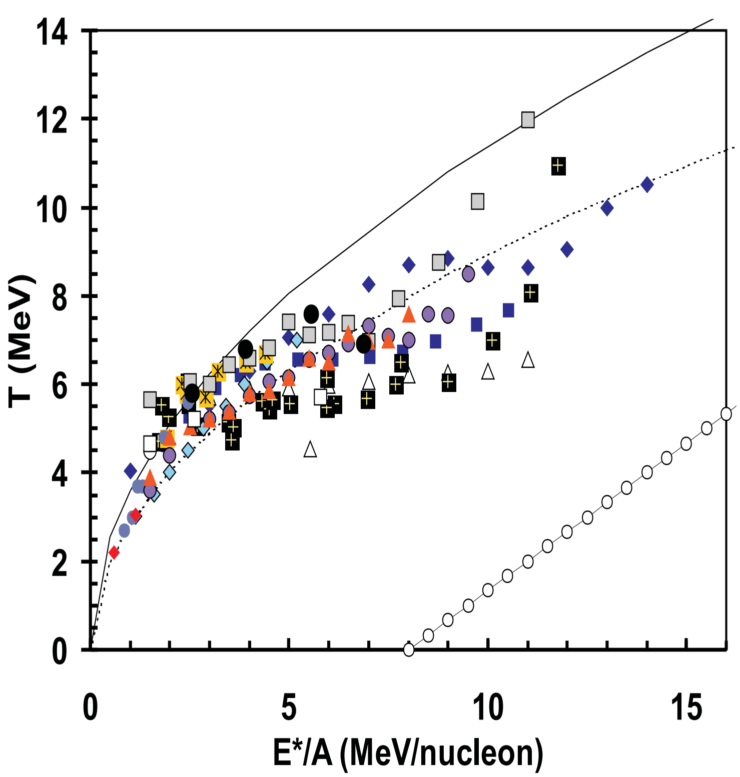
$$\frac{dN_i}{m_T dm_T dy}\Big|_{y=0} = \frac{d_i\ \lambda_i\ \gamma_i^{n_i}}{\pi}\ \tau_H\ R_H^2 \int_0^1 \xi\ d\xi\ K_1\left(\frac{m_T \cosh y_T}{T_H}\right)\ I_0\left(\frac{p_T \sinh y_T}{T_H}\right) ,$$

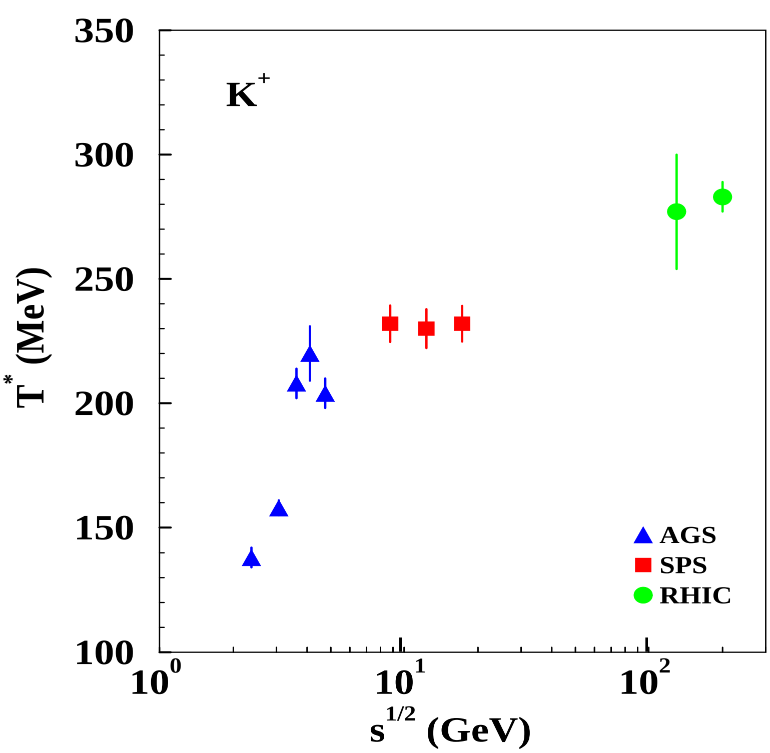
d_i is degeneracy, λ_i is fugacity, $\xi = r/R_H$ and rapidity $y_T(\xi) = y_T^{max}\xi$

γ_i is suppression factor

Caloric Curves

Plateau-like caloric curves signal I-order transition?





Temperatures: $\Longleftrightarrow$ **Inverse slopes:**

Fragments of 30 - 240 nucleons

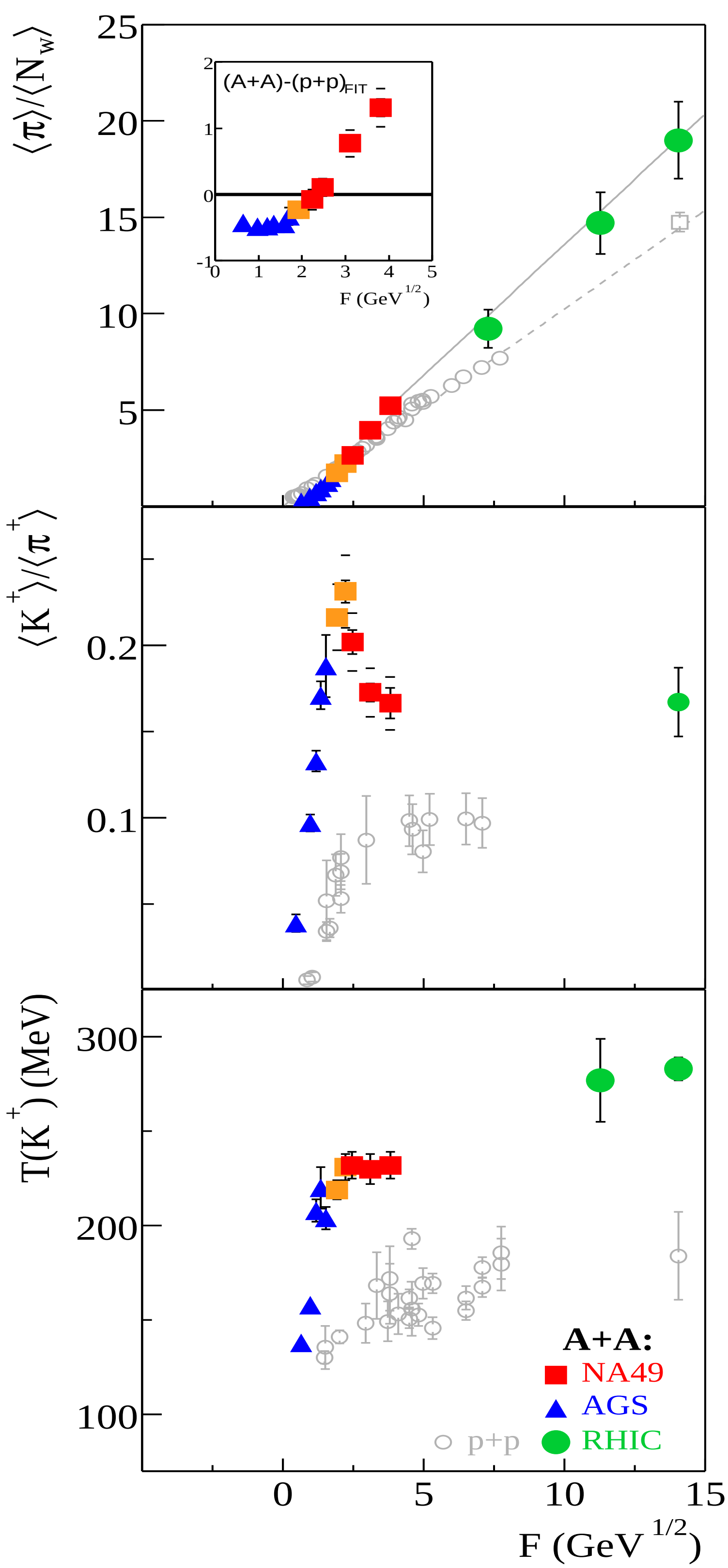
J. Natowitz et. al., PRC 65 (2002)

$K^{\pm}$ mesons

Gorenstein,Gazdzicki,Bugaev,

PL B 567 (2003)

Updated Signals Found by NA49



Kink in $\frac{\langle\pi\rangle}{\langle N_w\rangle} \approx g^{\frac{1}{4}}F$ shows that the number of d.o.f. g changes at about $E_{lab} = 30$ GeV

Horn in $\frac{\langle K^+\rangle}{\langle\pi^+\rangle}$ ratio shows that elementary d.o.f. of strangeness are changing from K$^{\pm}$ to s_q at about $E_{lab} = 30$ GeV

Step in K$^{\pm}$ inverse slopes shows that $\approx F$ independent initial pressure develops at about $E_{lab} = 30$ GeV

What Can We Learn from Signals?

Can SPS signals distinguish I-order phase transition from strong Crossover?
No

But:
RHIC community knows the deconfinement phase diagram from non-perturbative approaches: Lattice QCD at $\mu_b \to 0$ and Hard (Thermal) Loops at $T \to 0$.

$\Rightarrow$ We must essentially strengthen theoretical studies!

At most we can see an evidence for other (new) d.o.f.

$\Rightarrow$ The most promising approach is to build up a microscopic kinetics of phase transitions in small systems

Both communities face similar problems

$\Rightarrow$ Multifragmentation is indispensable for this task because experiments are cheaper and easier, and signals are not affected by strong flow