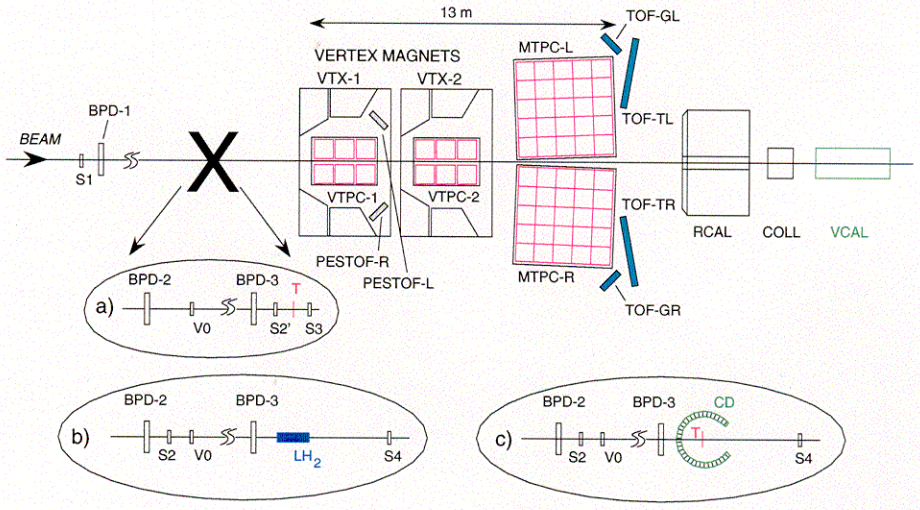
REPORT FROM NA49

- **Energy Dependence for Central Pb+Pb Collisions**
  (tracing onset of deconfinement)
- **System Size Dependence at 158 A GeV**
  (role of volume in strong interactions)
- **Future Programme at the CERN SPS**
  (volume and deconfinement, pentaquarks)



M. Gaździcki for NA49
IKF Frankfurt
AS Kielce

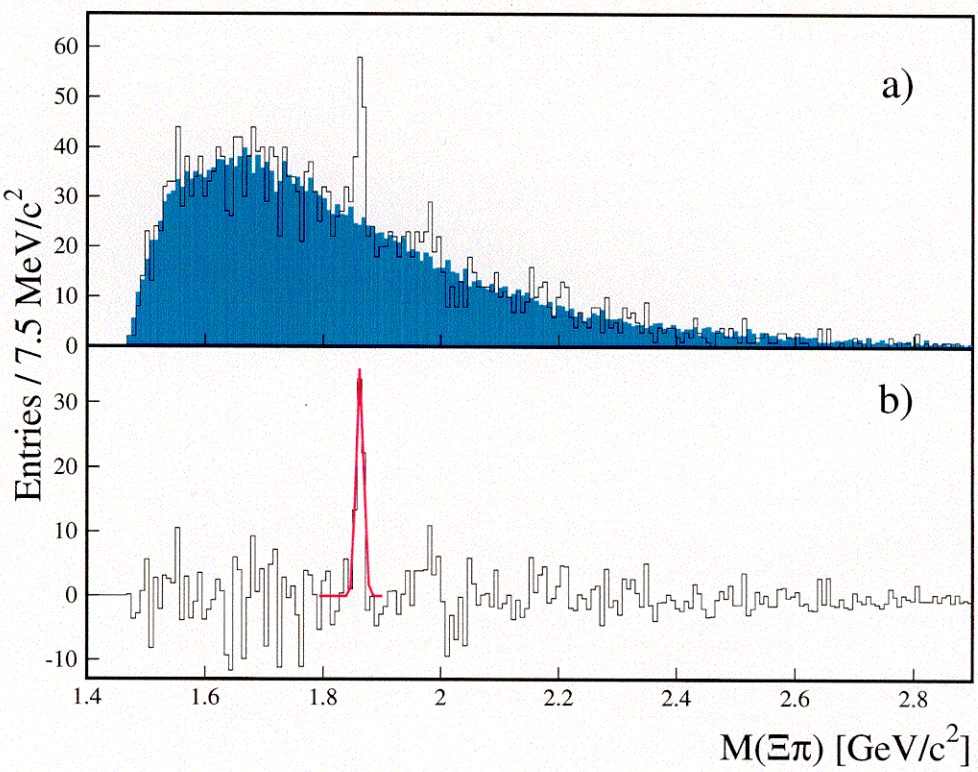
More on subjects presented in this talk in NA49 POSTERS on system size dependence of:

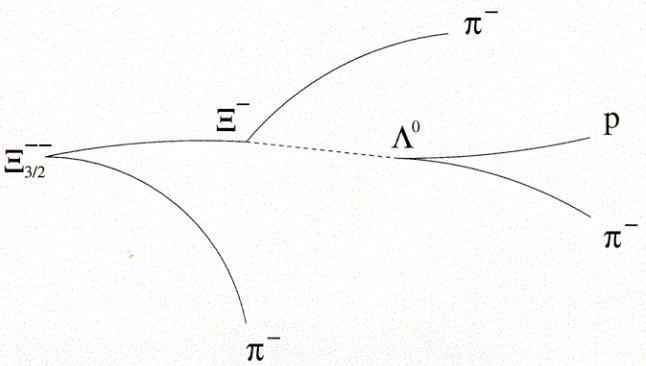
- Multiplicity and p_T Fluctuations
  by Kielce and Warsaw (Corr 27)
- Charge Correlations and Fluctuations
  by Athens and Frankfurt (Corr 17)
- Strange Hadron Production
  by Marburg and Darmstadt (Strange 11)

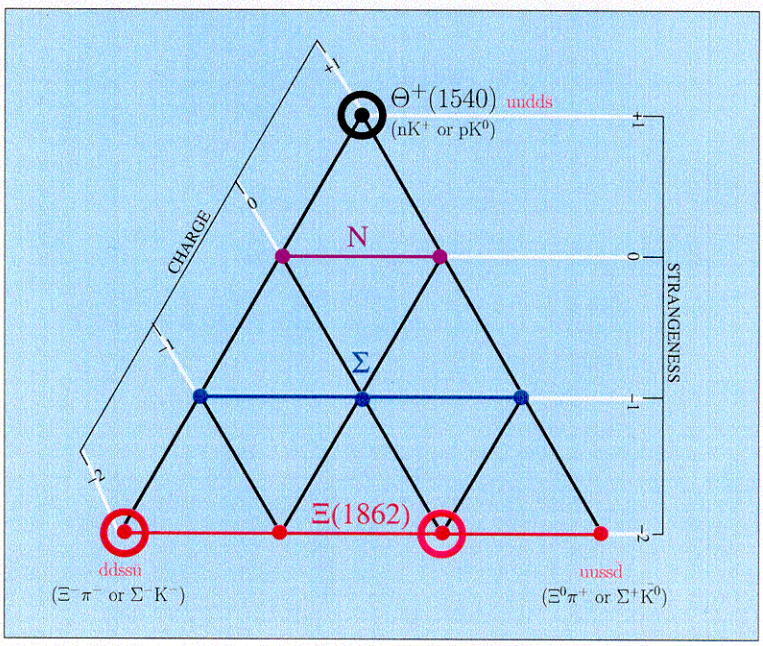
Further news in NA49 PARALLEL TALKS on:

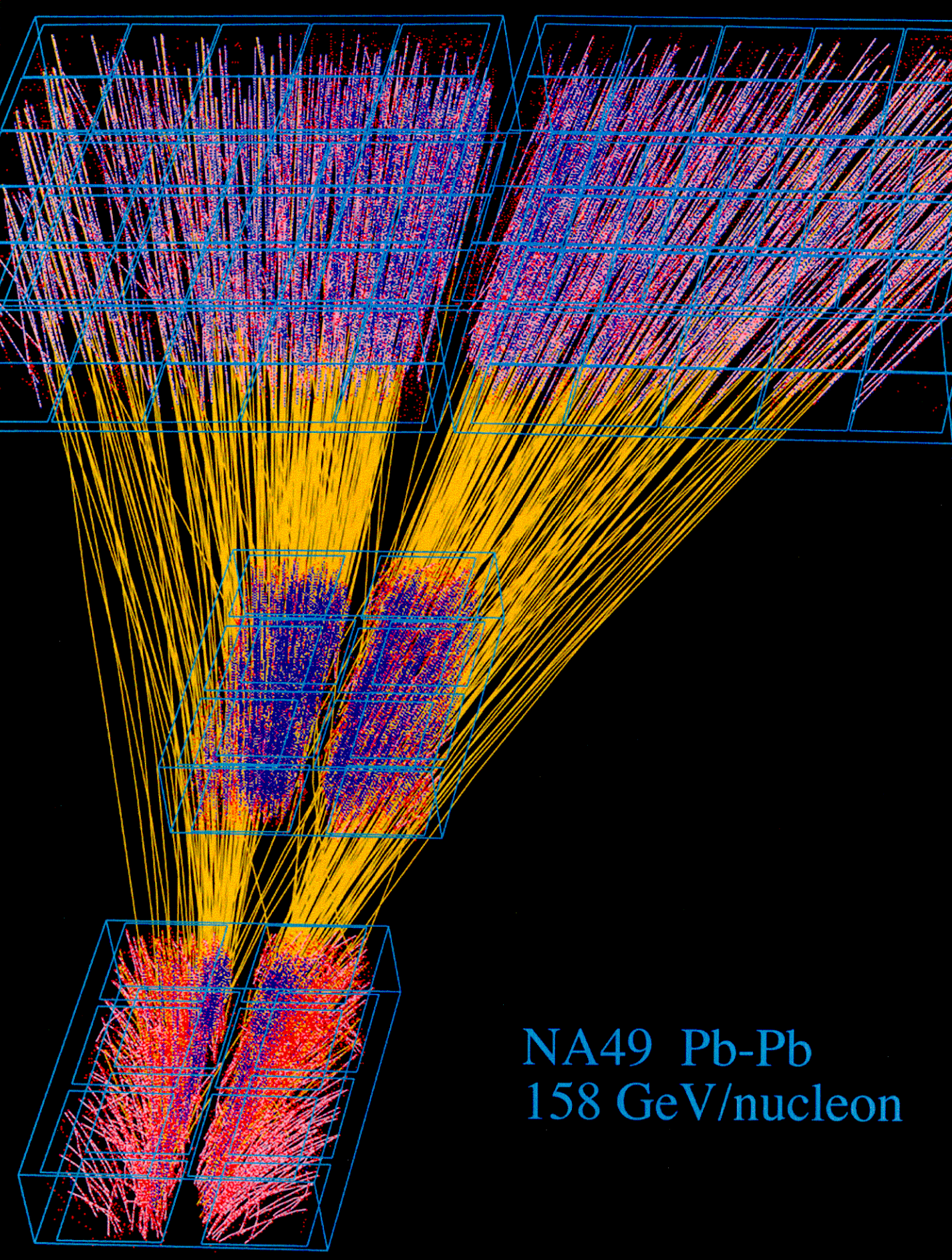
- Two Pion Correlations by Stefan Kniege (Frankfurt)
  (Tuesday, Session 3)
- Hyperon Production by Christine Meurer (Frankfurt)
  (Friday, Session 2)
- Fluctuations of Particle Ratios by Christof Roland (MIT)
  (Friday, Session 4)
- Pentaquarks by Kreso Kadija (Zagreb)
  (Friday, Session 3)

Pentaquarks:








NA49 Pb-Pb
158 GeV/nucleon

- **Energy Dependence:**

NEW

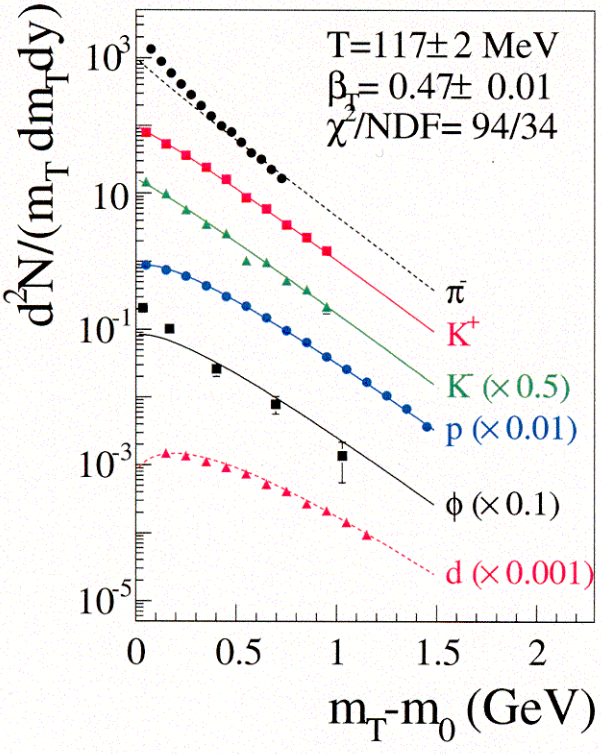
- central (7%) Pb+Pb collsions at 20 A·GeV III
- central (7%) Pb+Pb collsions at 30 A·GeV II
- central (7%) Pb+Pb collsions at 40 A·GeV I
- central (7%) Pb+Pb collsions at 80 A·GeV
- central (5%, 10%, 20%) Pb+Pb collsions at 158 A·GeV

– **Transverse Mass Spectra**
– **Rapidity Spectra**
– **Hadron Multiplicities**

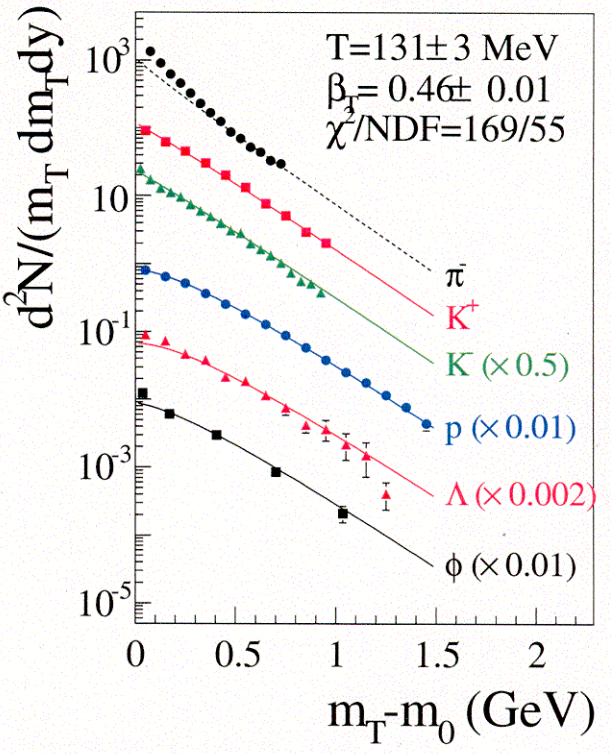
CENTRAL Pb+Pb COLLISIONS

Transverse Mass Spectra

20 A GeV

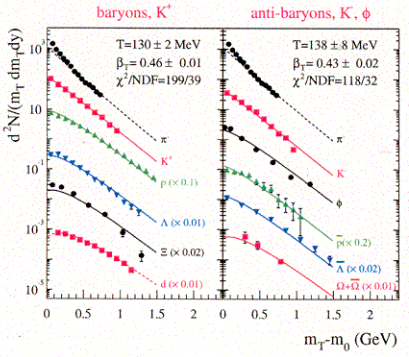


30 A GeV

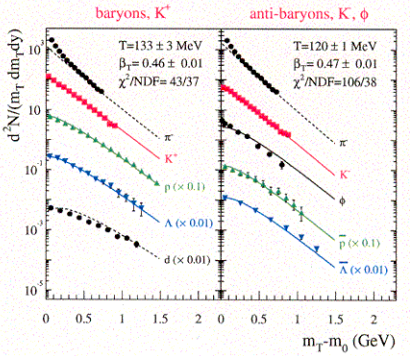


– BLAST WAVE FITS

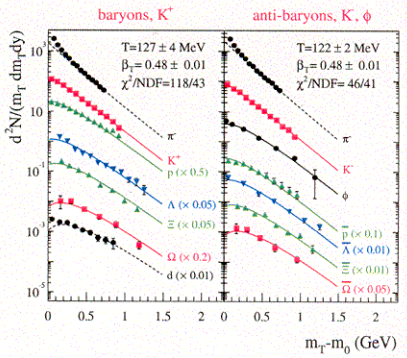
40 A GeV



80 A GeV



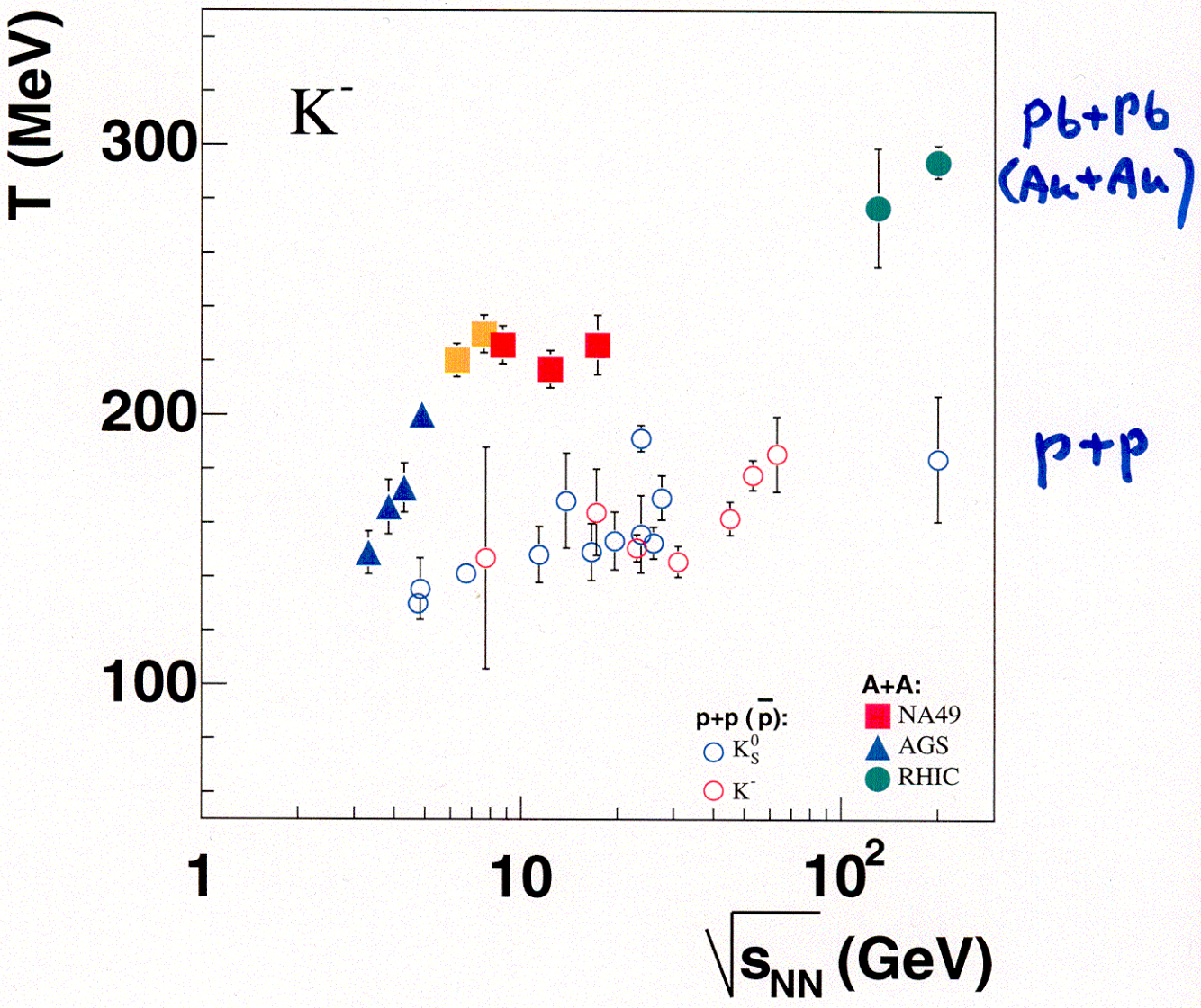
158 A GeV



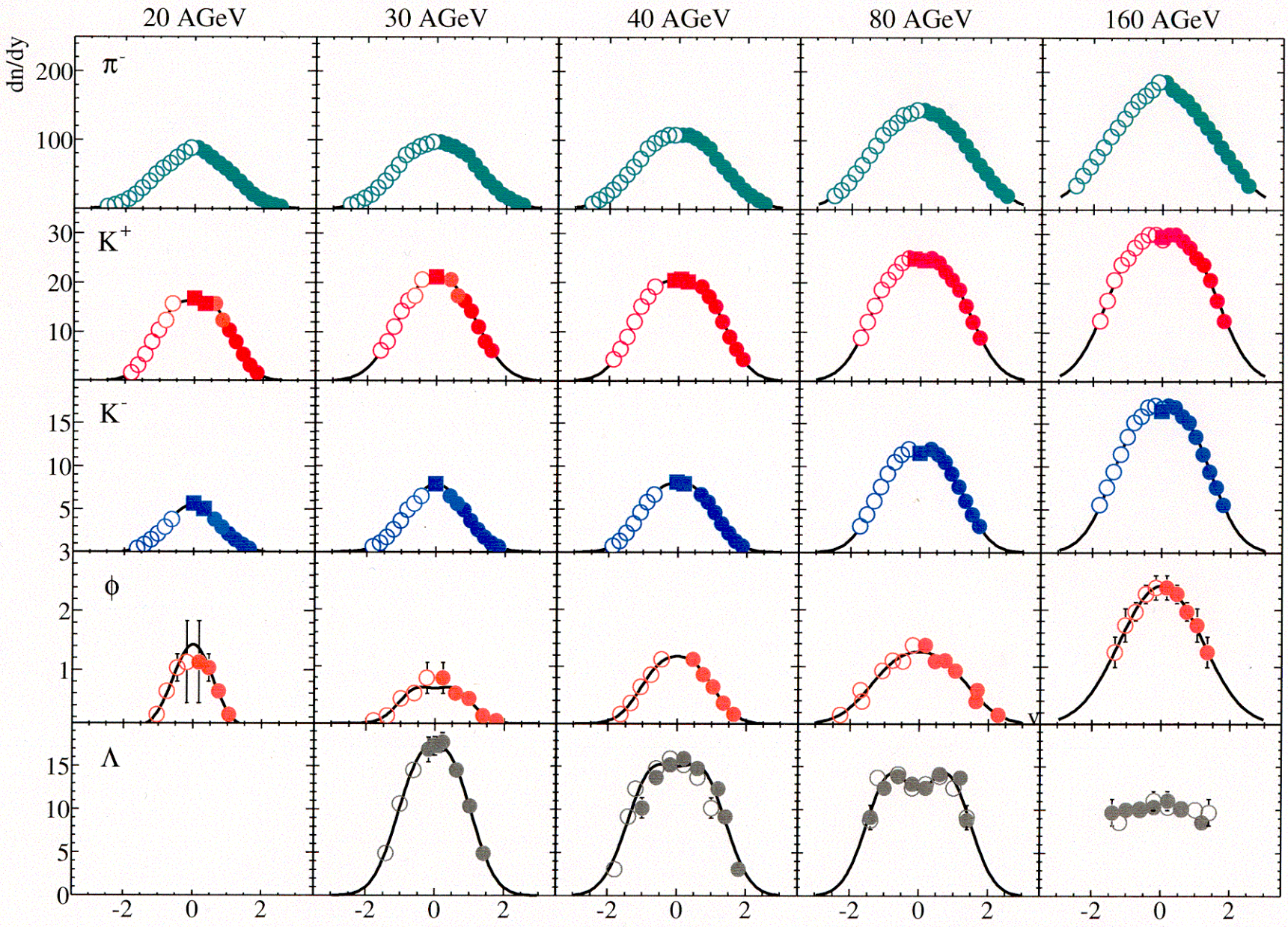
Transverse Mass Spectra

$$\frac{dN}{m_T dm_T dy} \sim e^{-m_T/T}$$

THE STEP



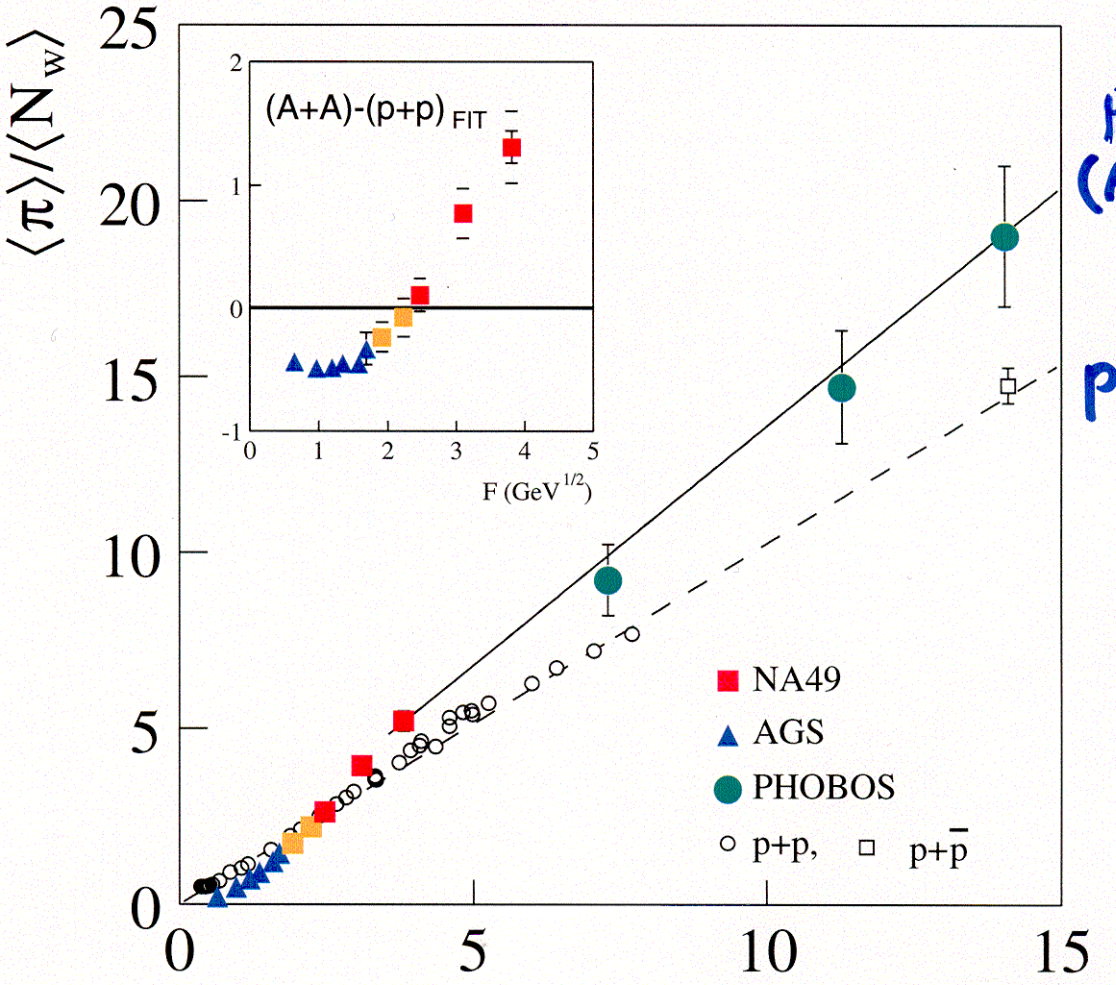
CENTRAL Pb+Pb COLLISIONS



Rapidity Spectra

LARGE ACCEPTANCE → 4π YIELDS

Hadron Multiplicities



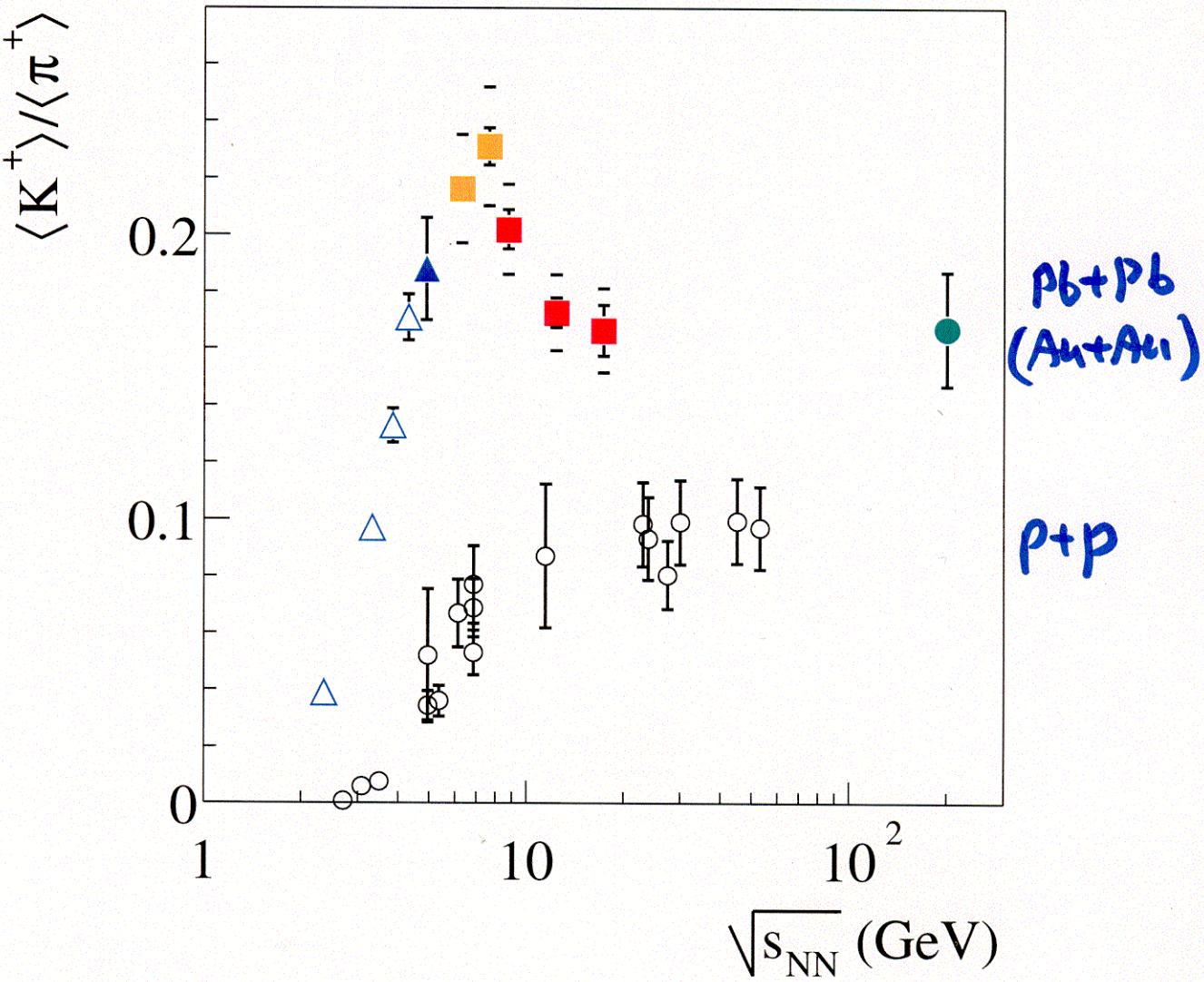
Pb+Pb (Au+Au)

p+p

THE KINK

$(F \approx \sqrt{s})$

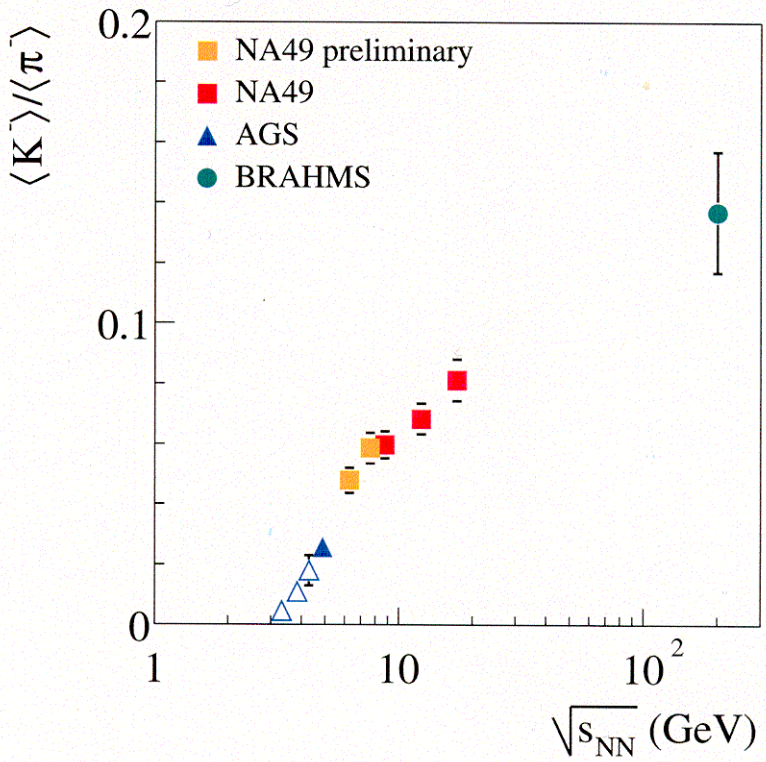
Hadron Multiplicities ($\bar{s}$-QUARK CARRIER)

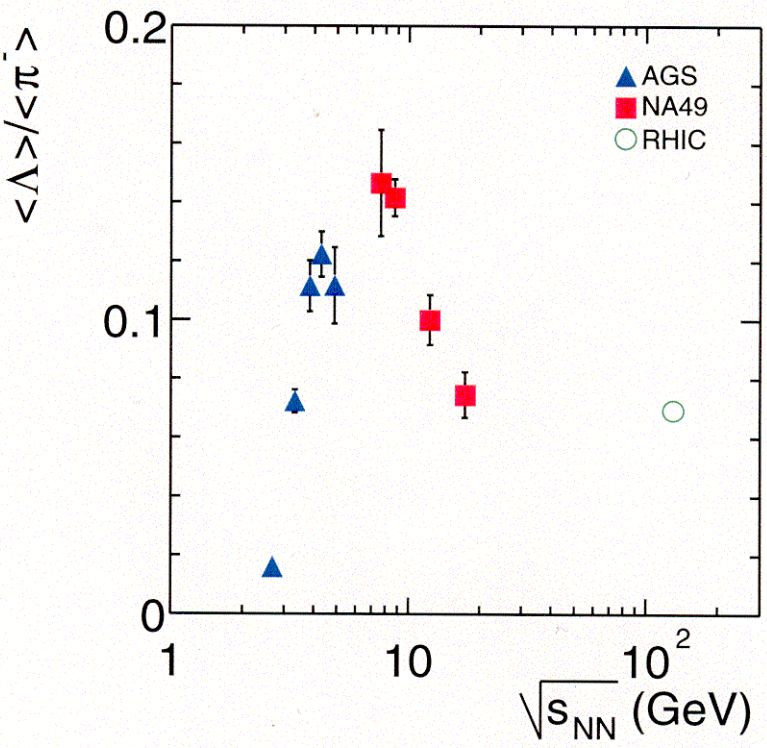


THE HORN

CENTRAL Pb+Pb COLLISIONS

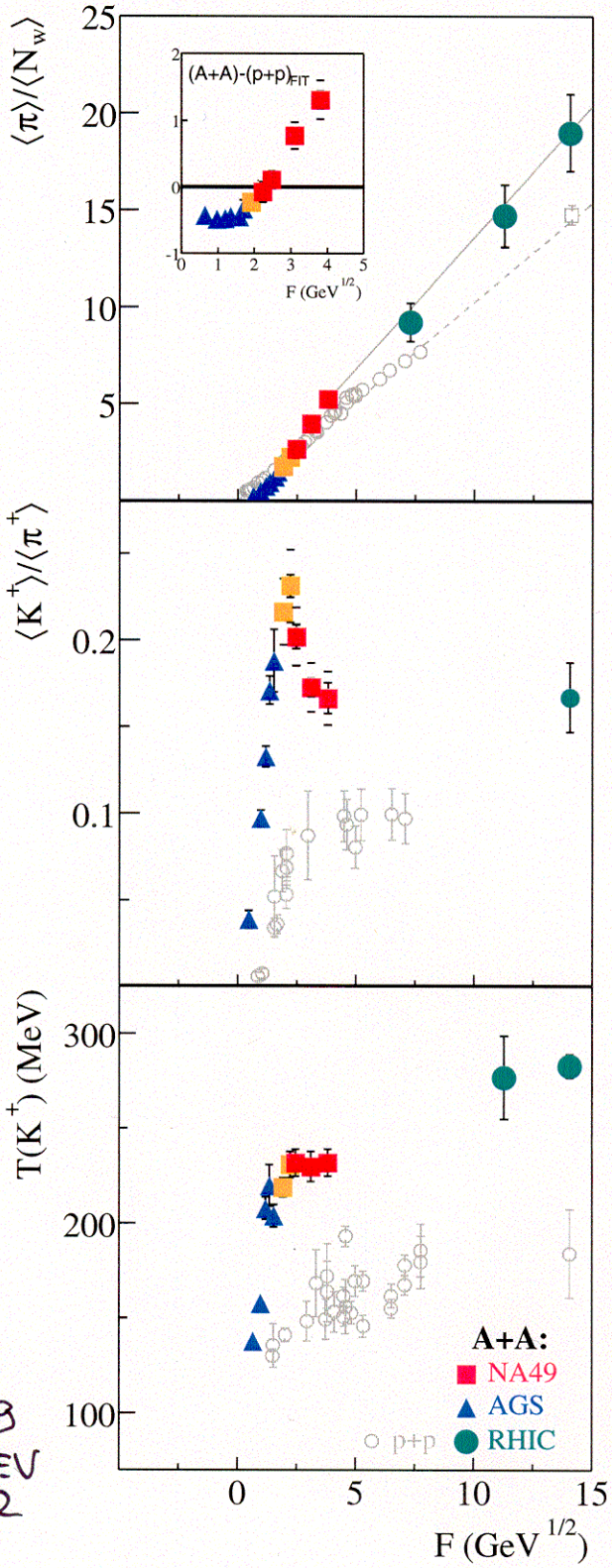
Hadron Multiplicities (S-QUARK CARRIERS)





THE HORN

Summary on Energy Dependence ●:
(tracing onset of deconfinement)



KINK

HORN

STEP

+

ONSET OF DECONFINEMENT AT LOW SPS ENERGIES !

M.G. RÖHRICH, 94-96
M.G., GORENSTEIN, 99
GORENSTEIN, M.G. BUGAEV 02

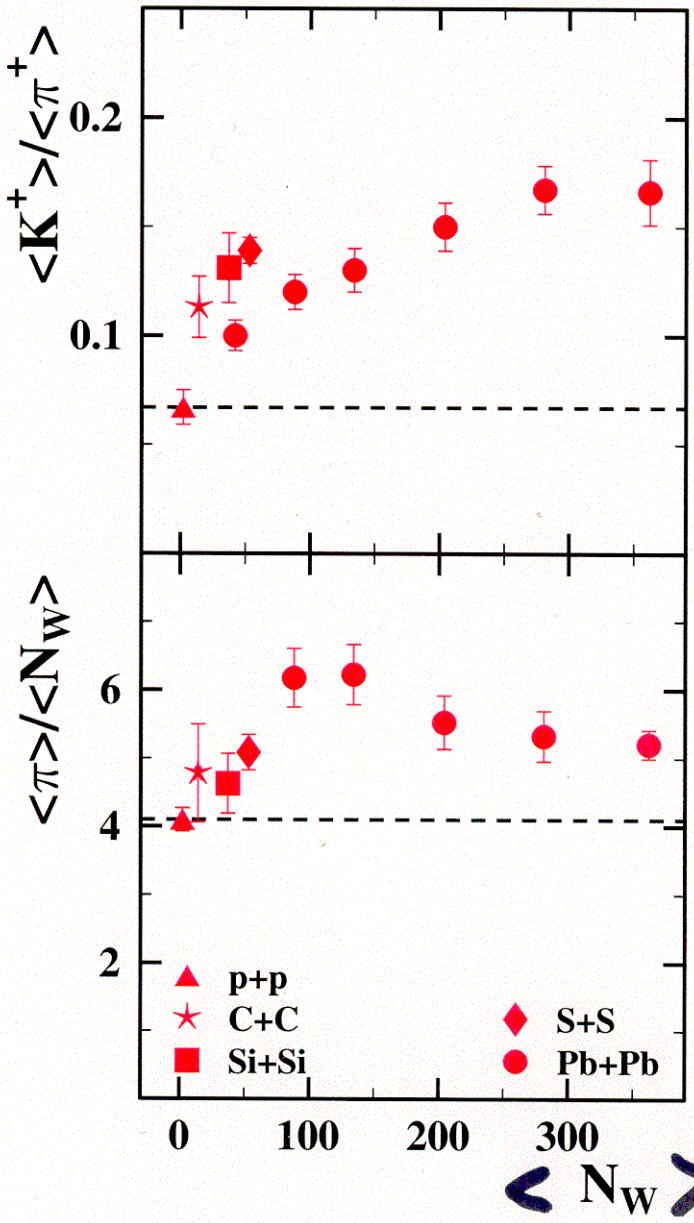
•• System Size Dependence at 158 A GeV:

- minimum bias p+p interactions
- central C+C collisions
- central Si+Si collisions
- minimum bias Pb+Pb interactions

(event selection using energy of projectile spectators

	NEW
– Hadron Multiplicities	I
– Charge Correlations	III
– p_T Fluctuations	I
– Multiplicity Fluctuations	III

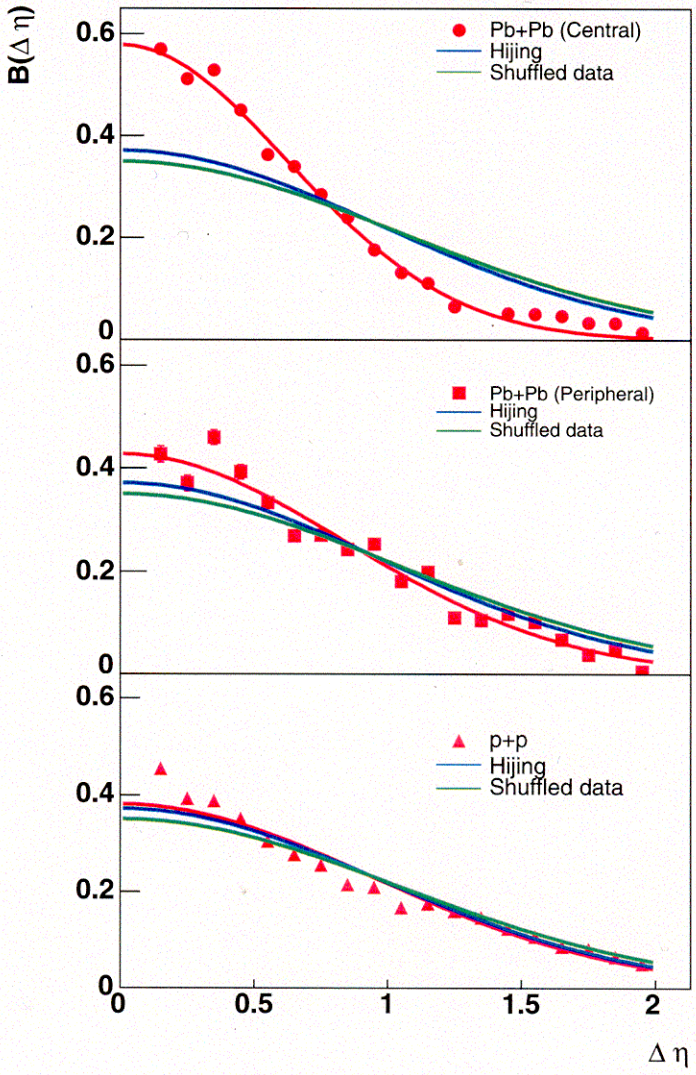
Hadron Multiplicities at 158 A·GeV



(NUMBER OF WOUNDED NUCLEONS)

RAPID CHANGES FROM p+p TO $N_W \approx 200$

Charge Correlations at 158 A GeV

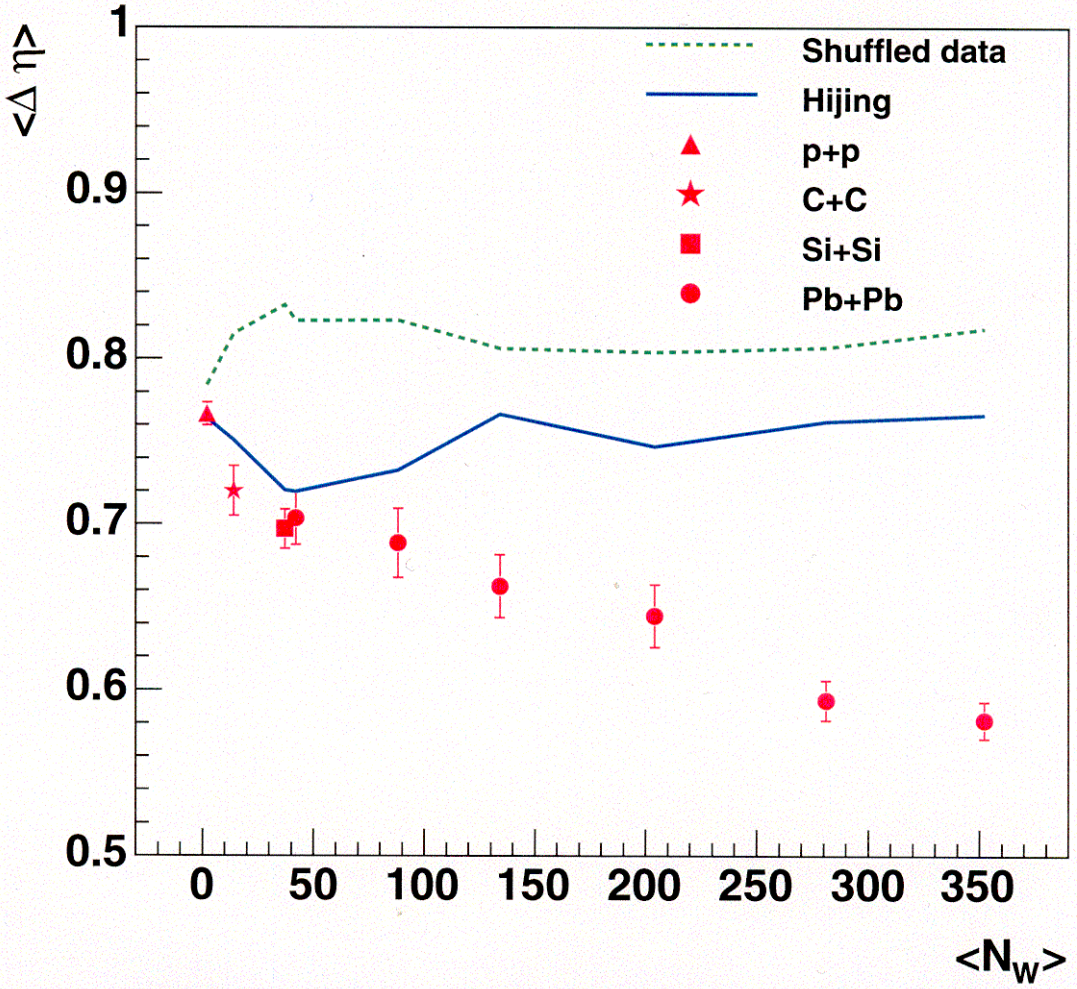


NARROW BF FOR CENTRAL Pb+Pb COLL.

(B($\Delta\eta$) – Balance Function in Pseudorapidity)

(**Acceptance:** h^+, h^-
$-0.3 < \eta < 2.1$ **and the NA49 filter (see Corr 27)**
(about 30% of 4π multiplicity is accepted))

Charge Correlations at 158 A·GeV



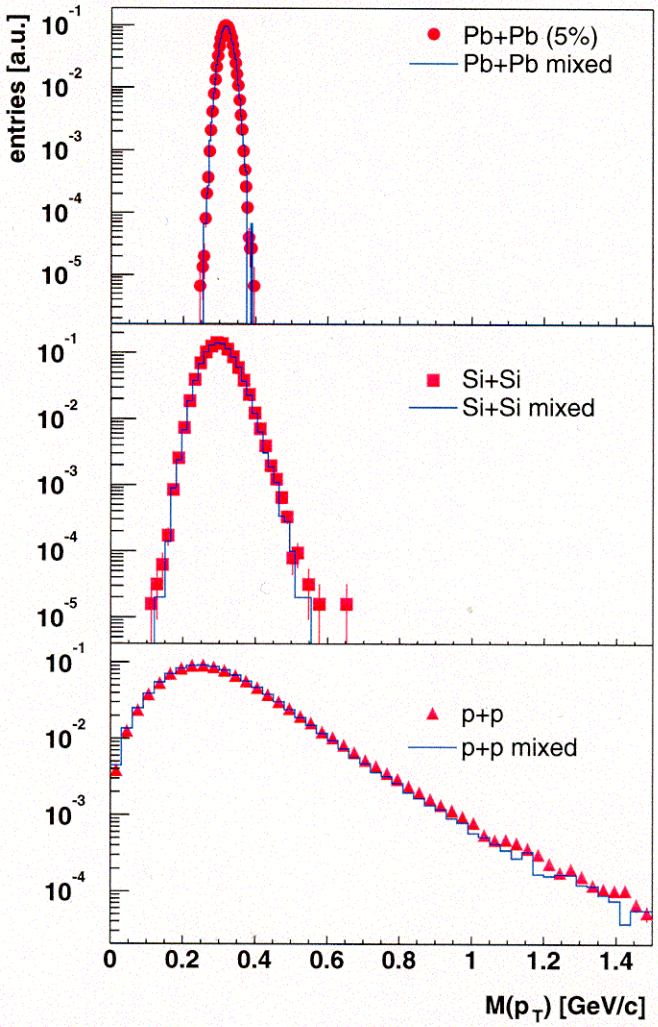
MONOTONIC DECREASE OF $\langle\Delta\eta\rangle$ WITH $\langle N_W\rangle$

$$\left(\langle\Delta\eta\rangle = \left(\int_{0.1}^{2.4} \Delta\eta B(\Delta\eta) d\Delta\eta\right) / \left(\int_{0.1}^{2.4} B(\Delta\eta) d\Delta\eta\right) \right)$$

	(40 GeV)	(158 GeV)	RHIC
central Pb+Pb (Au+Au) at:	8.7	17.2	130 GeV
(data-shuffled)/shuffled:	-28%	-29%	-31%

ENERGY INDEPENDENT NARROWING OF B.F.!

p_T Fluctuations AT 158 A·GEV

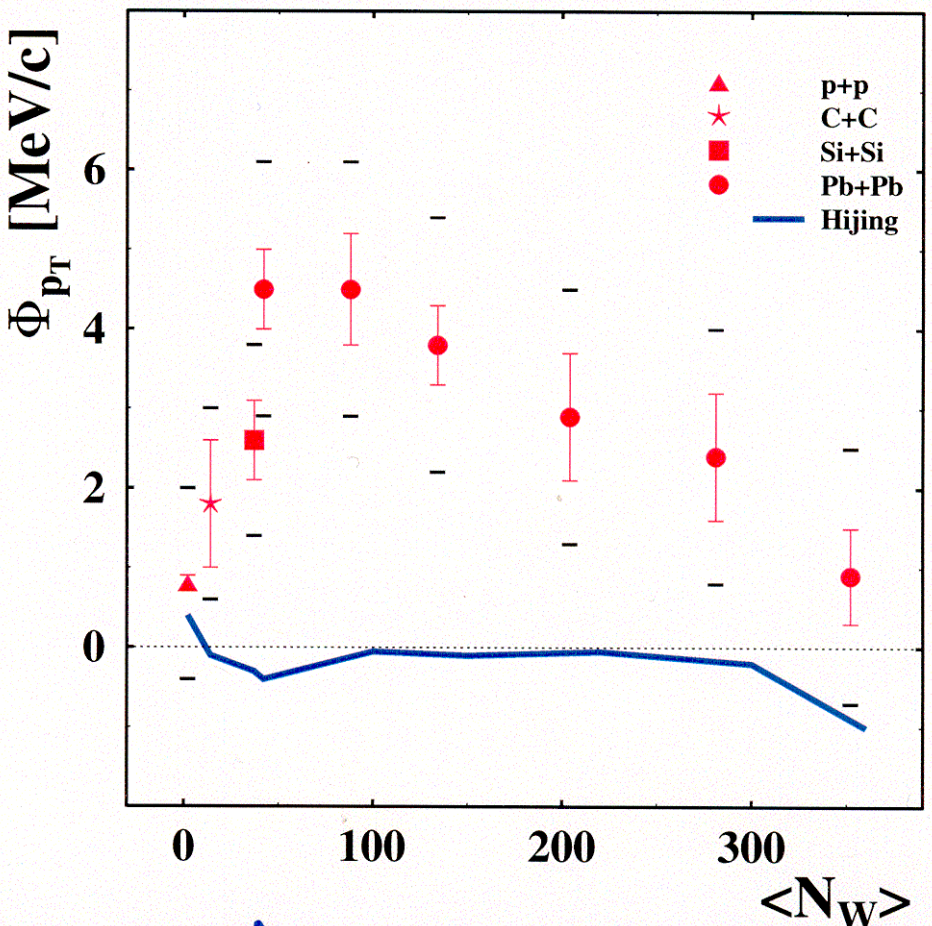


WEAK INTERPARTICLE CORRELATIONS IN p_T

($M(p_T)$ – Mean p_T in the event)

(**Acceptance:** h^+, h^-
$1.1 < y < 2.6$ **and the NA49 filter (see Corr 27)**
(about 15% of 4π multiplicity is accepted))

p_T Fluctuations at 158 A·GEV



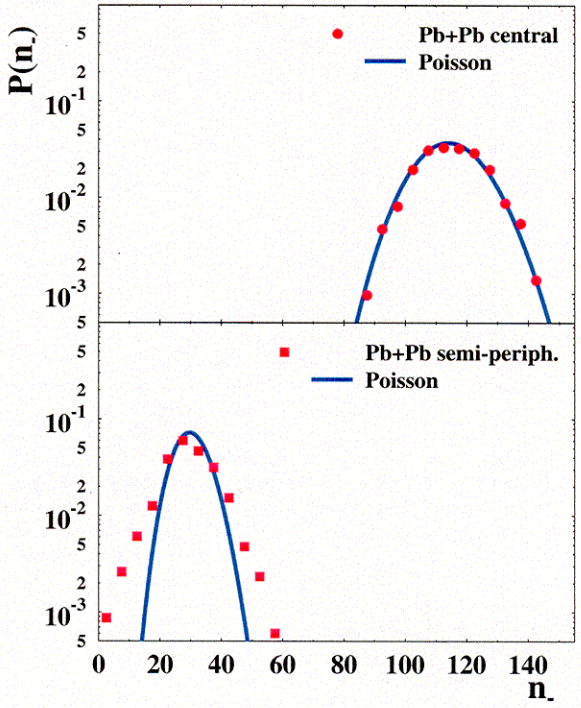
MAXIMUM OF Φ_{p_T} AT $\langle N_W \rangle \approx 70$?

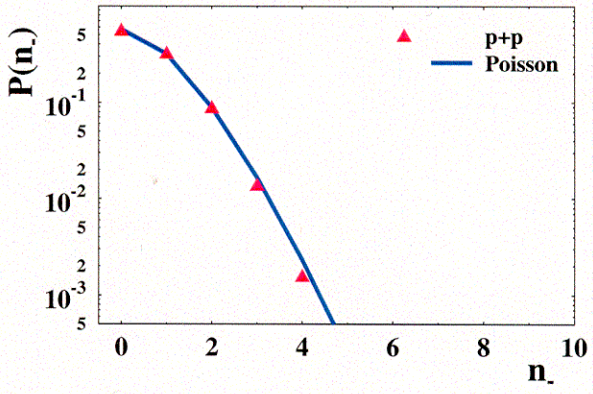
(Φ_{p_T} – Intensive Measure of p_T Fluctuations)

(**Acceptance:** h^-
$1.1 < y < 2.6$ **and the NA49 filter (see Corr 27)**
(about 15% of 4π multiplicity is accepted))

Multiplicity Fluctuations at 158 A·GEV

LARGE FLUCTUATIONS

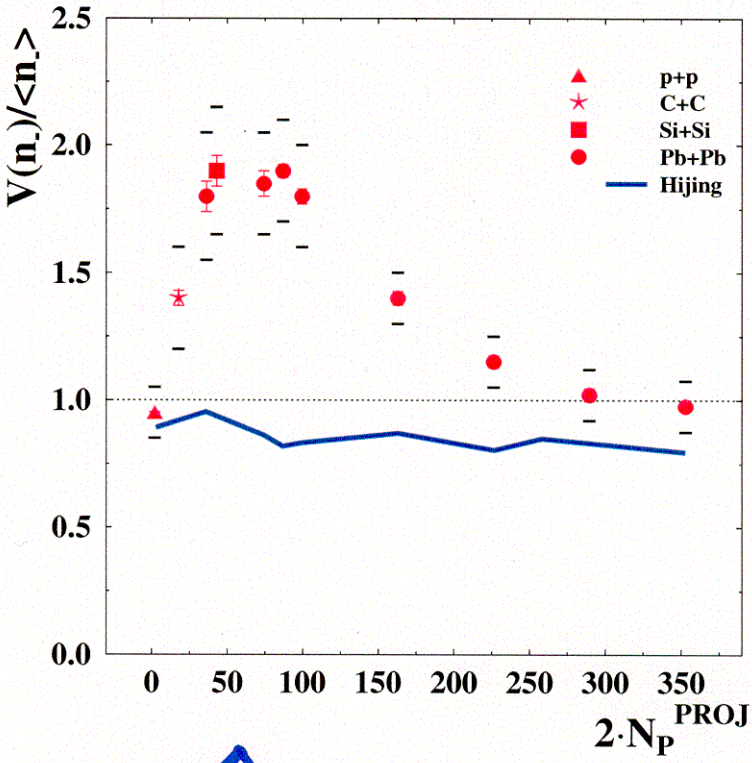




(P(n_) – Multiplicity Distribution of Negatively Charged Hadrons)

(Acceptance: h^-
$1.1 < y < 2.6$ and the NA49 filter (see Corr 27)
(about 15% of 4π multiplicity accepted))

Multiplicity Fluctuations at 158 A·GEV



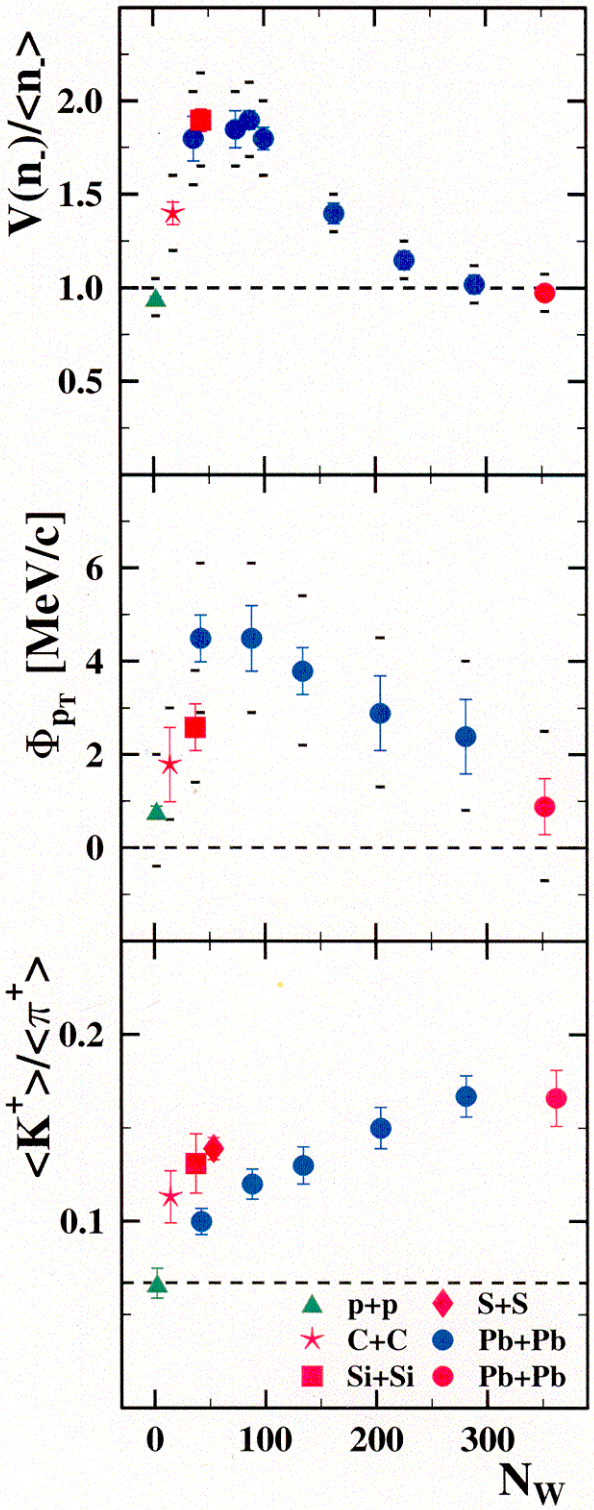
$(\approx N_W)$

$\left(V(n_-) = \langle n_-^2 \rangle - \langle n_- \rangle^2\right)$

MAXIMUM AT $N_W \approx 70$

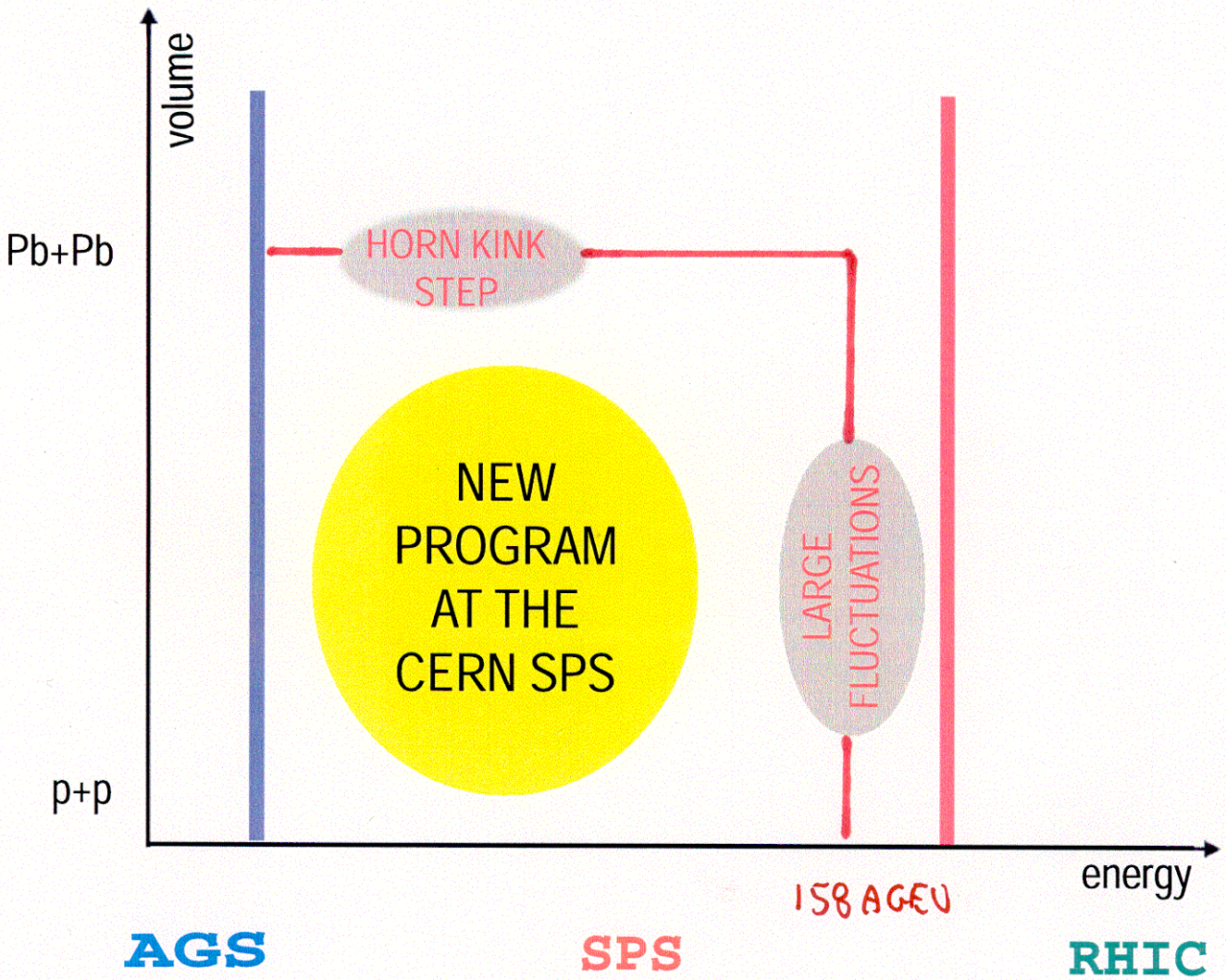
Summary on System Size Dependence at 158 A GeV ● ●:
(role of volume in strong interactions)

STRANGE ANOMALIES AT $N_W \approx 70$

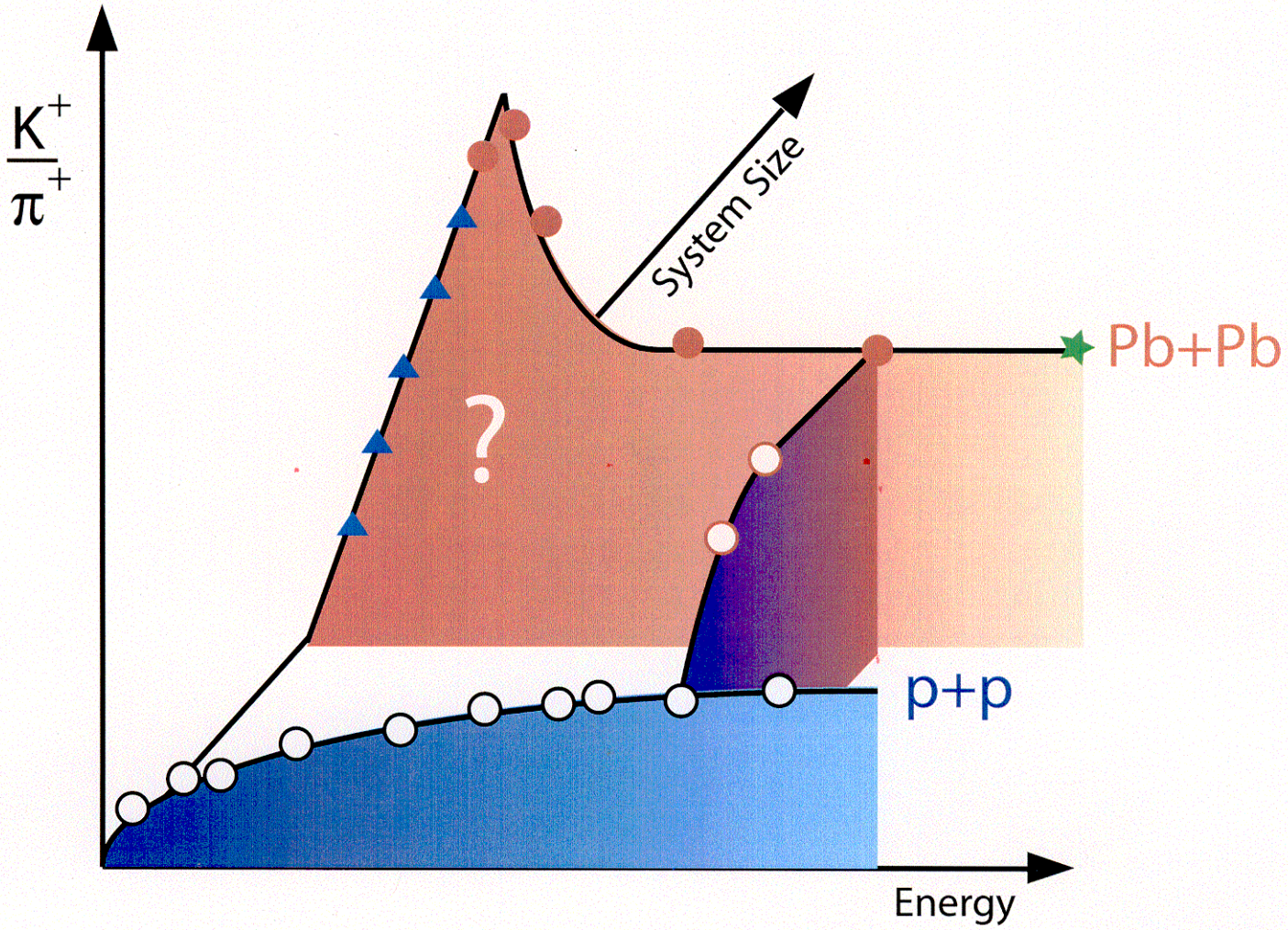


● ● ● Future Programme at the CERN SPS:

Volume and Deconfinement:



Volume and Deconfinement:



A New Experimental Programme with Nuclei and Proton Beams at the CERN SPS

Expression of Interest (CERN-SPSC-2003-038, SPSC-EOI-01
submitted to the CERN SPSC on November 21, 2003.

Physics:

- Energy Scan with Light Nuclei
  (volume and deconfinement)
- Energy Scan for p+p and p+A
  (constrain models for A+A and astroparticle physics)
- Identified Hadrons at High p_T
  (onset of jet quenching)
- High Statistics p+p Data
  (pentaquarks)

Experiment:

- Upgraded NA49 Installation
- Low Cost ($\approx$1 M EUR)
- First Data Taking Possible in 2007

New Collaborators are Welcome !!!

The NA49 Collaboration

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