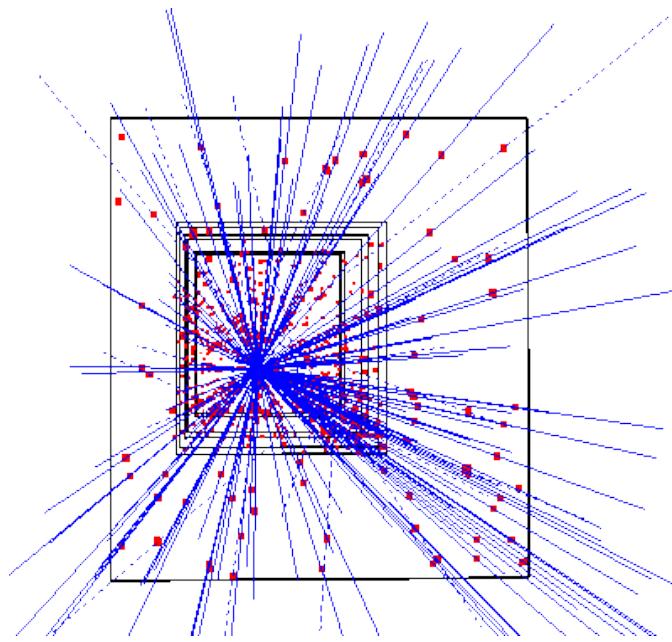


Results from NA57

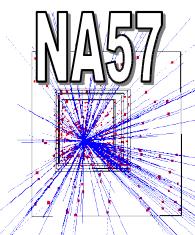


Andrea Dainese

*Padova – University and INFN
on behalf of the NA57 Collaboration*



Outline



- ◆ The NA57 experiment at the CERN SPS

Study the production of strange and multi-strange hadrons at mid-rapidity in heavy-ion interactions, as a function of centrality and c.m.s. energy

- ◆ Strangeness Enhancement (and energy dep.)
 - ◆ Expansion dynamics: m_T spectra
- NEW** ◆ R_{CP} for h^- , K_S^0 , Λ , $\bar{\Lambda}$ at $\sqrt{s_{NN}} = 17.3$ GeV

NA57 Posters at QM05:

- “Rapidity spectra in Pb-Pb collisions at 160 GeV/c” by G.E.Bruno
- “ R_{CP} in Pb-Pb collisions at 160 GeV/c” by G.E.Bruno and A.Dainese
- “ K^0 and Λ production in p-Be collisions at 40 GeV/c ” by I.Kralik

Strange Particles Reconstruction

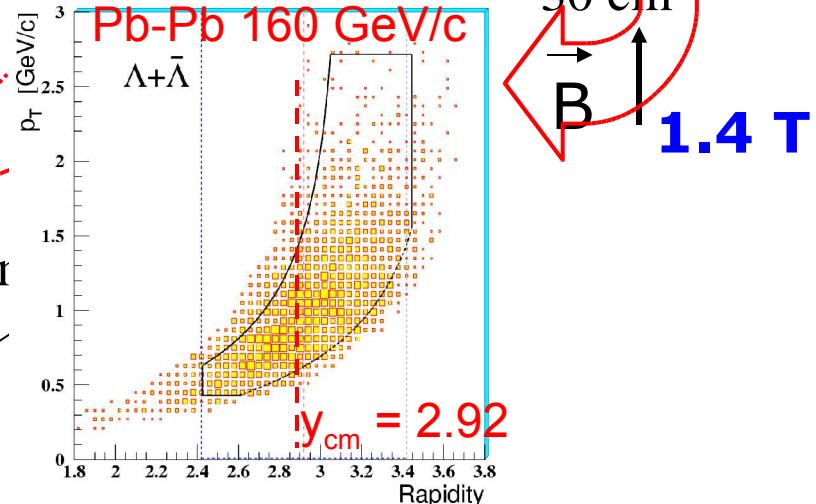
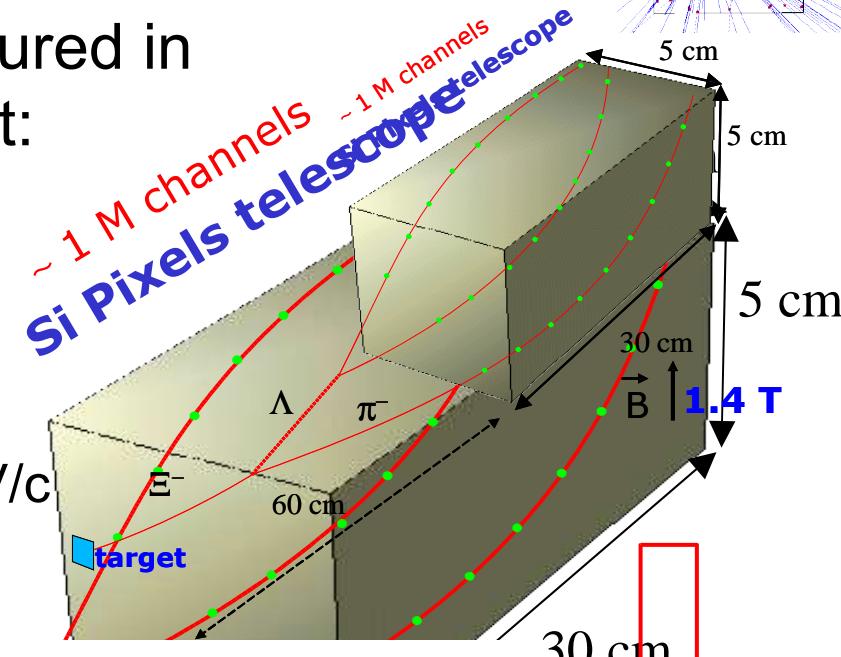
NA57

- Use charged decay-tracks measured in the pixel telescope to reconstruct:



in:

- Pb-Pb, p-Be, p-Pb @ $p = 160A$ GeV/c
- Pb-Pb, p-Be @ $p = 40A$ GeV/c

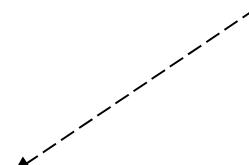


Acceptance:

$\Delta y \approx 1$ around mid-rapidity

$p_T \gtrsim 0.5$ GeV/c

target



Yields and Enhancements

- ◆ Double-differential cross section for each particle fitted to:

$$\frac{1}{m_T} \frac{d^2N}{dm_T dy} = f(y) \cdot \exp\left(-\frac{m_T}{T_{app}}\right)$$

- ◆ with flat/gaussian(K^0 and Λ) y distribution in the selected acceptance
- ◆ inverse slope of m_T distribution (T_{app}) free parameter of the fit

- ◆ **Yield** (average particle multiplicity / event) extrapolated to a common $y-p_T$ region:

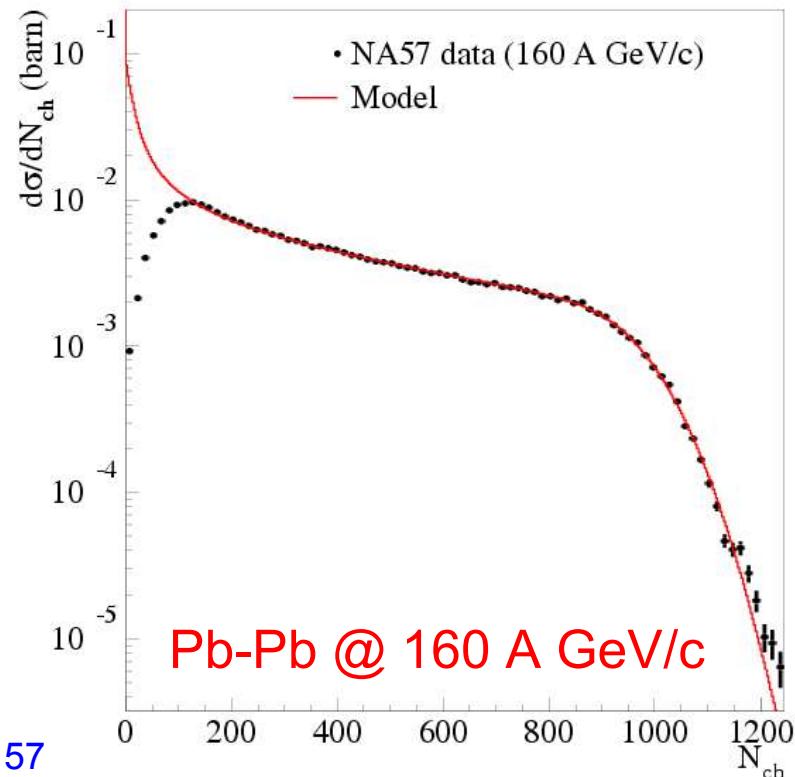
$$Y = \int_m^\infty dm_T \int_{y_{cm}-0.5}^{y_{cm}+0.5} \frac{d^2N}{dm_T dy} dy$$

- ◆ **Strangeness Enhancement** (in Pb-Pb relative to p-Be):

$$E = \left(\frac{Y}{\langle N_{part} \rangle} \right)_{Pb-Pb} \Bigg/ \left(\frac{Y}{\langle N_{part} \rangle} \right)_{p-Be}$$

Collision Centrality

- ◆ Determined from charged multiplicity, measured from the hits in a dedicated Si- μ strip detector
- ◆ N_{part} and N_{coll} from trigger cross section (Glauber model calc.)
 - ◆ $\sigma_{\text{trigger}} \approx 60\%$ of Pb-Pb σ_{inel} (7.26 b)



WA97 Coll., EPJC18 (2000) 57
 NA57 Coll., JPG31 (2005) 321

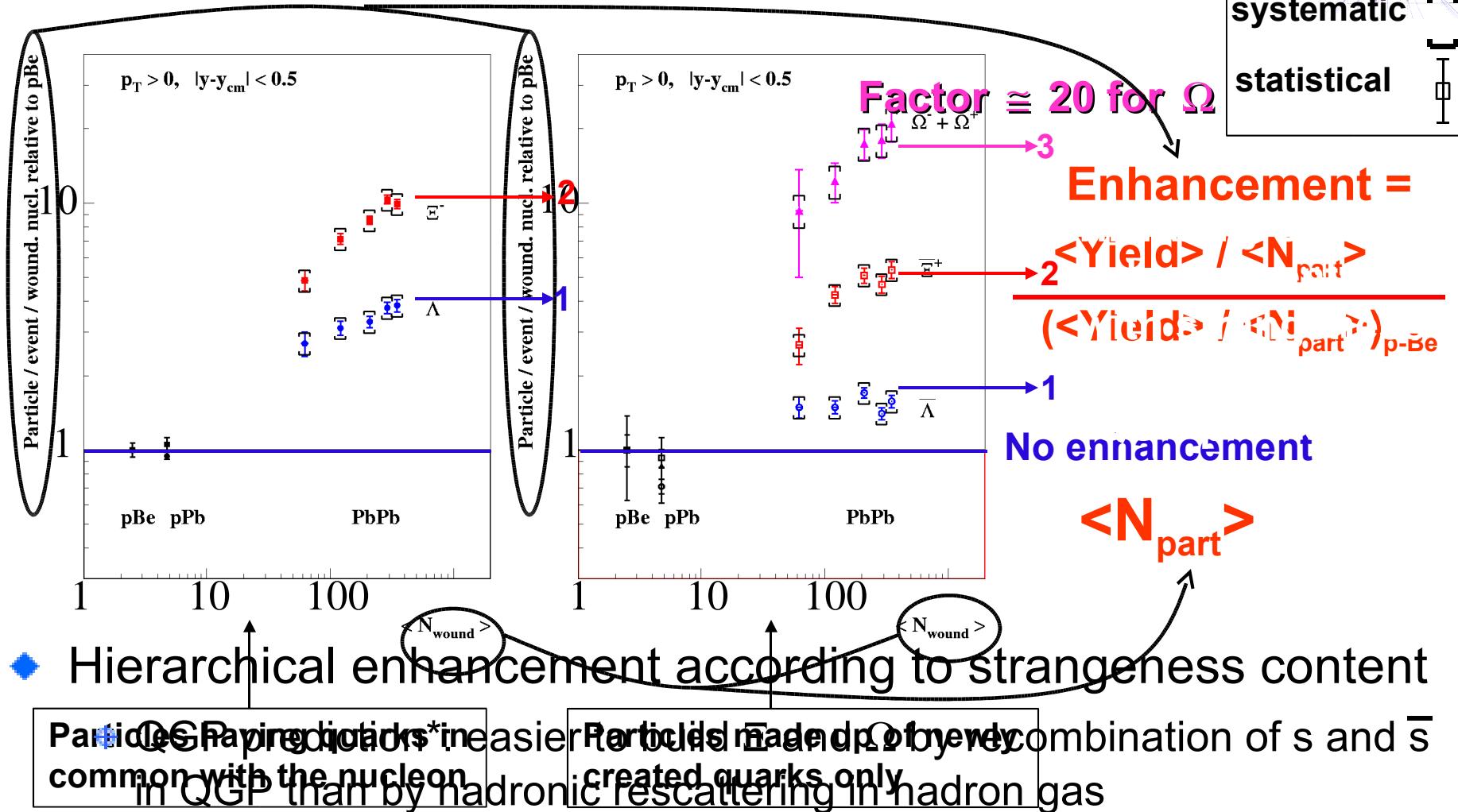
Strangeness Enhancements

160A GeV/c

Errors:

systematic

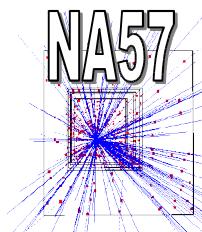
statistical



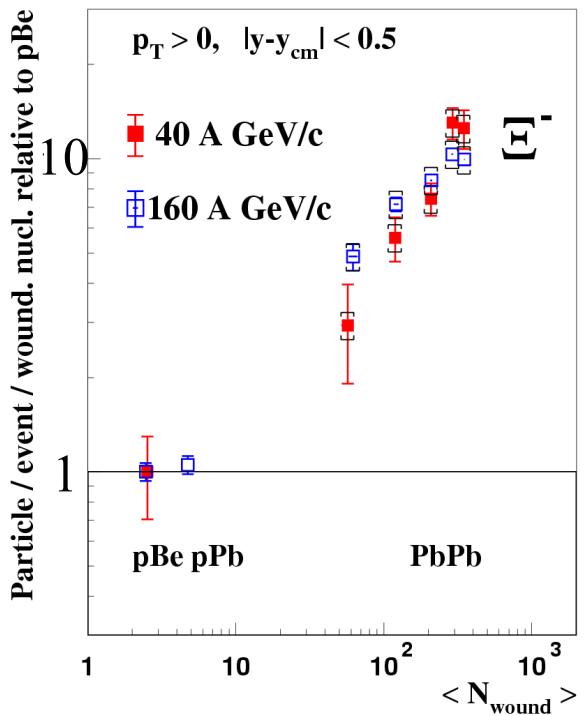
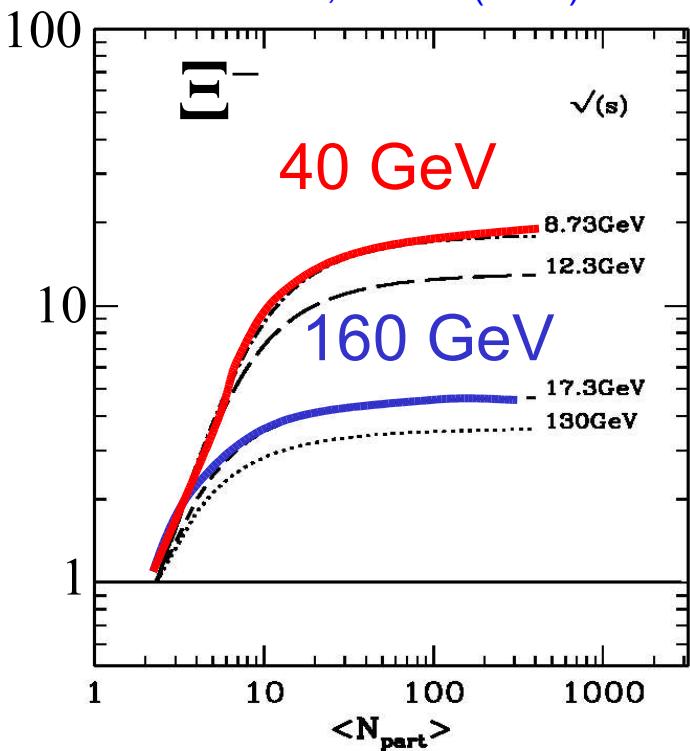
- Significant centrality dependence, except for $\bar{\Lambda}$

* Rafelski and Müller, PRL48 (1982) 1066

Energy Dependence of Enhancements

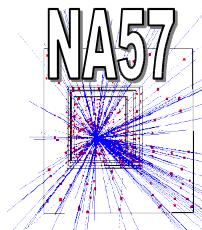


Redlich et al., JPG28 (2002) 2095



- ◆ Steeper increase with centrality at lower energy
- ◆ Ξ^- in most central class: larger enhancement at lower energy
 - ✿ qualitative agreement with theory (canonical suppression model)
but energy and centrality dependence not well predicted

Blast-wave Fit of m_T Spectra

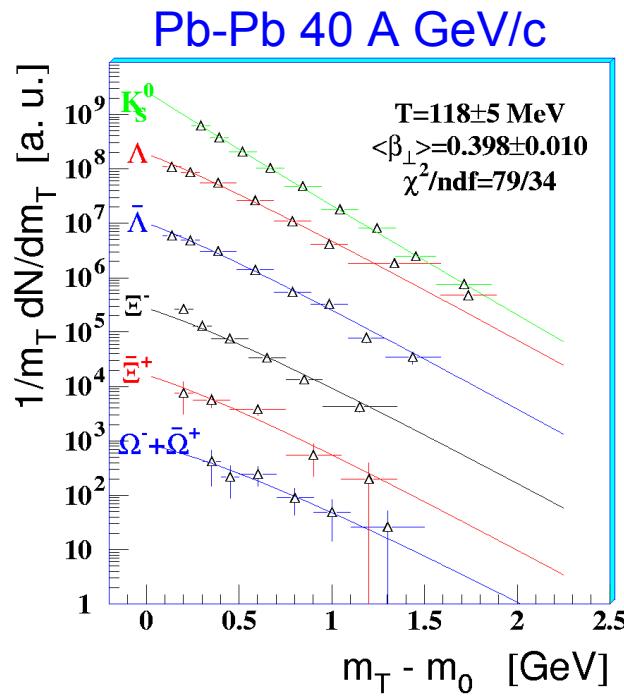
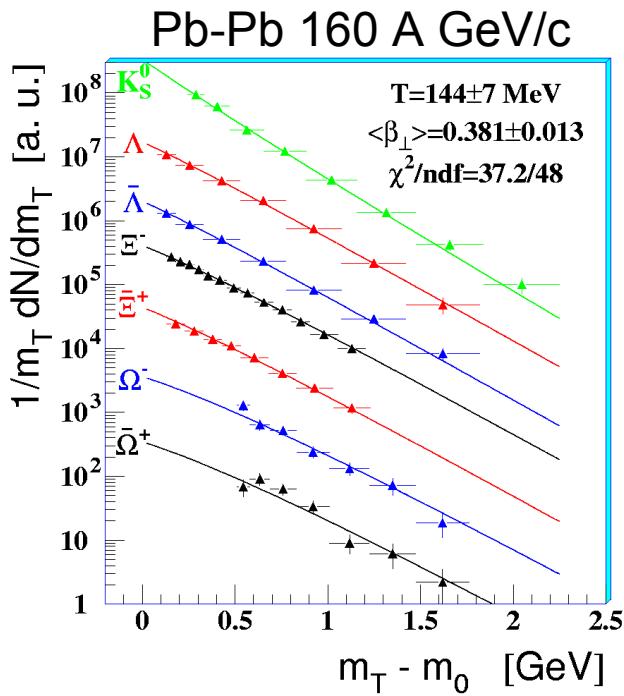


**Model : thermalization
plus hydro-dynamical
transverse flow
description**

$$\frac{d^2N_j}{m_T dy dm_T} = \int_0^{R_G} A_j m_T \cdot K_1\left(\frac{m_T \cosh \rho}{T}\right) \cdot I_0\left(\frac{p_T \sinh \rho}{T}\right) dr$$

$$\rho(r) = \tanh^{-1} \beta_\perp(r)$$

$$\beta_\perp(r) = \beta_s \left[\frac{r}{R_G} \right]^{n(=1)} \quad r \leq R_G$$

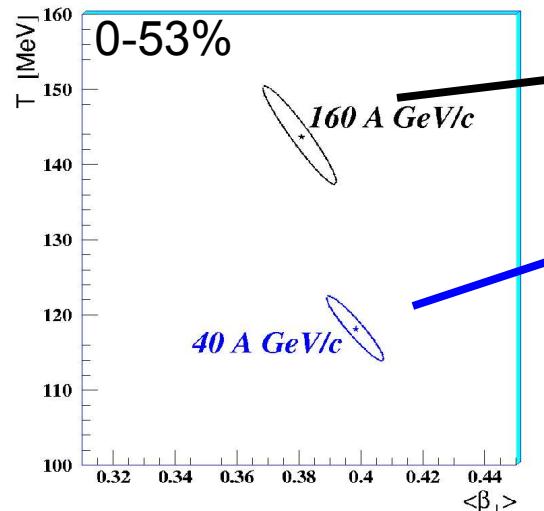
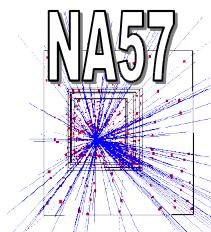


Schnedermann, Sollfrank, Heinz, PRC48 (1993) 2462

NA57, JPG30 (2004) 823

Bruno (NA57), JPG31 (2005) S127

Blast-wave Fit Results



$$T_{kin.f.o.} = 144 \pm 7(\text{stat}) \pm 14(\text{syst}) \text{ MeV}$$

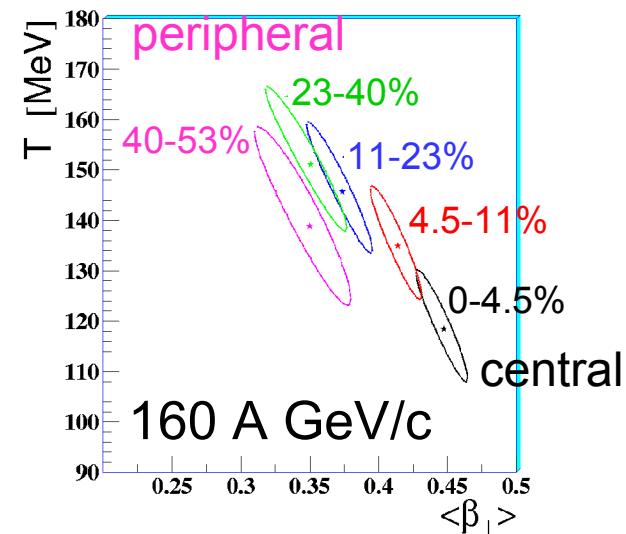
$$\langle\beta_{\perp}\rangle = 0.381 \pm 0.013(\text{stat}) \pm 0.012(\text{syst})$$

$$T_{kin.f.o.} = 118 \pm 5(\text{stat}) \pm 11(\text{syst}) \text{ MeV}$$

$$\langle\beta_{\perp}\rangle = 0.398 \pm 0.010(\text{stat}) \pm 0.011(\text{syst})$$

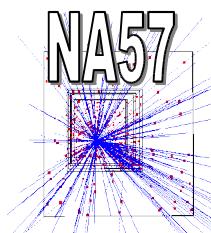
- ◆ $T_{kin.f.o.}$ lower at 40 A GeV/c
- ◆ Similar transverse flow

- ◆ From central to peripheral:
 - ◆ $T_{kin.f.o.}$ increases
 - ◆ $\langle\beta_{\perp}\rangle$ decreases
- earlier decoupling
in peripheral collisions ?*



- ◆ New analysis of dN/dy in $|y-y_{cm}| = 0.5$
 - ◆ $\langle\beta_L\rangle \sim \langle\beta_{\perp}\rangle \sim 0.4$
 - (large stopping?)
- see poster by G.E.Bruno

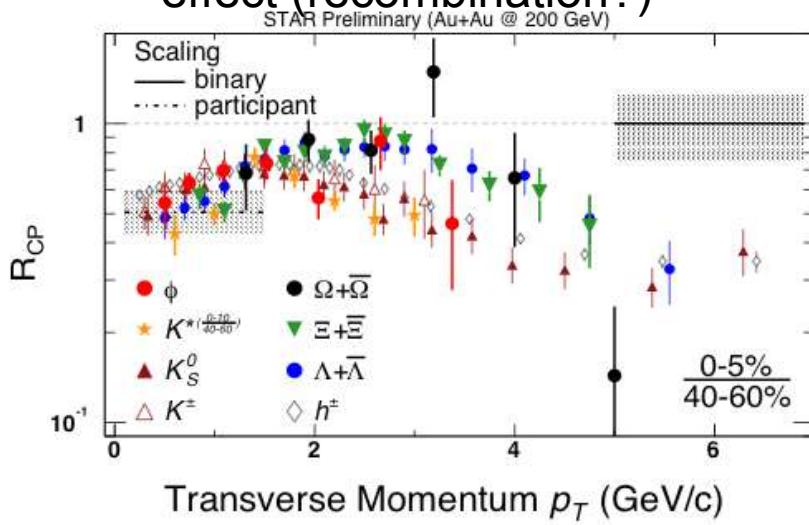
Central-to-peripheral nuclear modification factors



$$R_{CP}(p_t) = \frac{\langle N_{coll} \rangle_P}{\langle N_{coll} \rangle_C} \times \frac{d^2 N_C / dp_t dy}{d^2 N_P / dp_t dy}$$

- ◆ R_{CP} at RHIC:

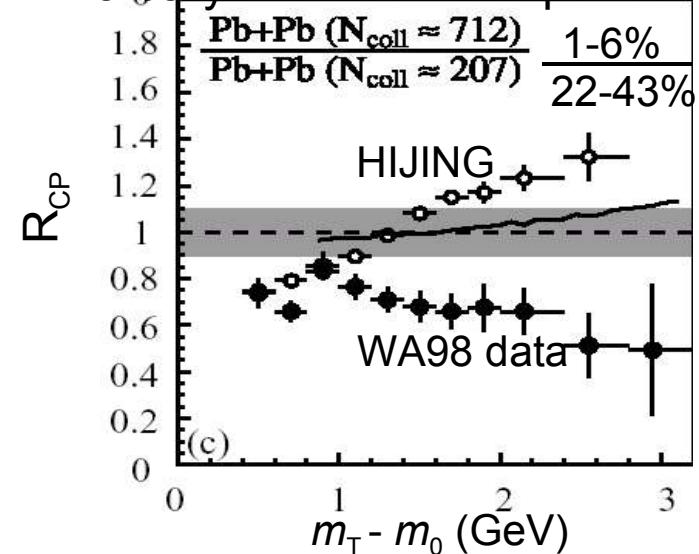
- ◆ high- p_T : parton energy loss
- ◆ intermediate p_T : baryon/meson effect (recombination?)



- ◆ R_{CP} at SPS?

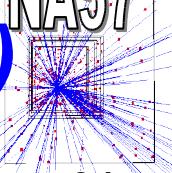
- ◆ π^0 suppressed: energy loss?
[WA98, EPJC23 \(2002\) 225](#)
(see also R_{AA} re-analysis)
[d'Enterria, PLB596 \(2004\) 32](#)

- ◆ no baryon/meson comparison



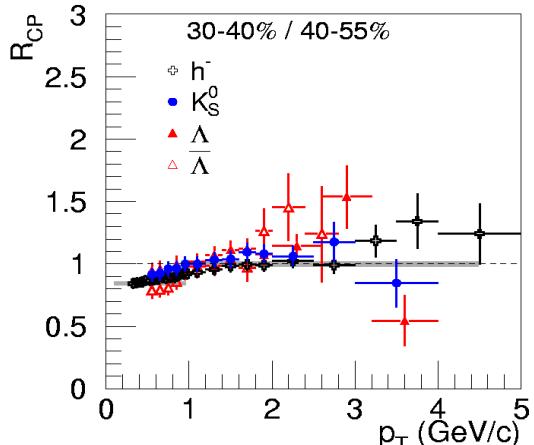
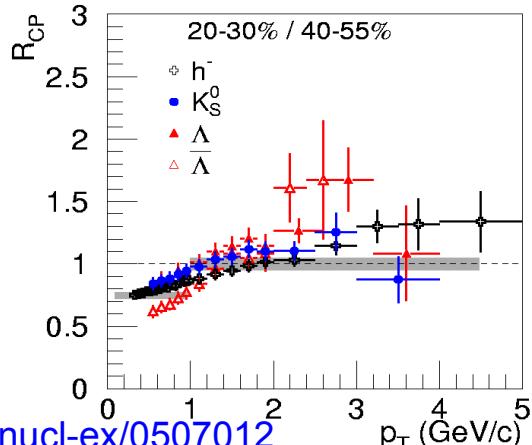
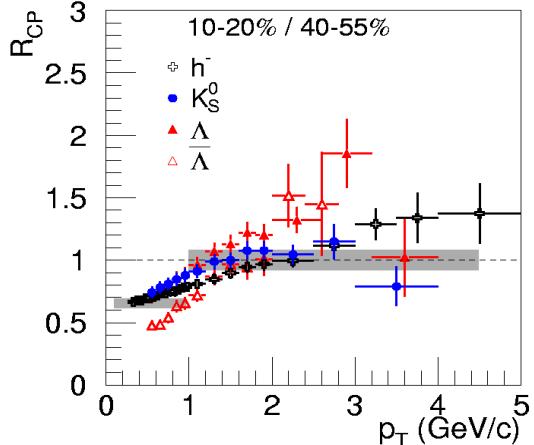
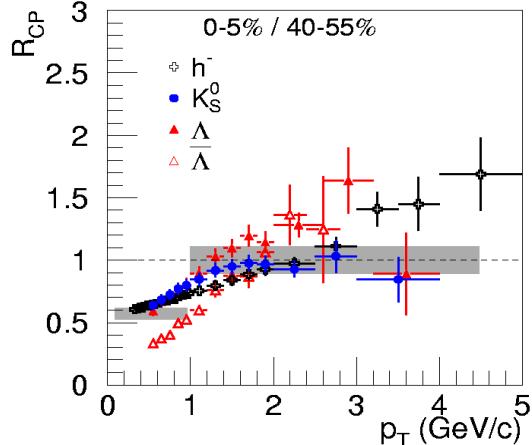
STAR, PRL92 (2004) 052302 + prelim.

R_{CP} for h^- , K^0_S , Λ , $\bar{\Lambda}$ ($\sqrt{s_{NN}} = 17.3$ GeV)



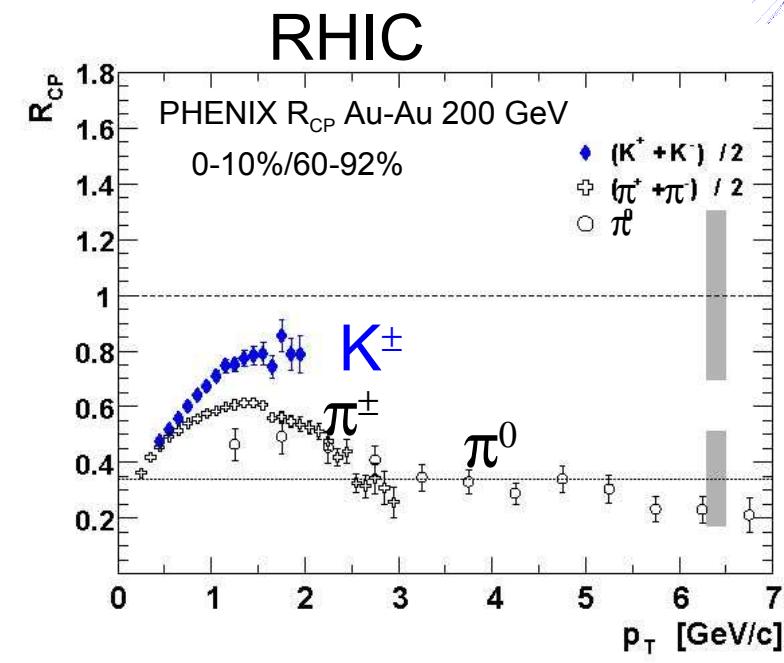
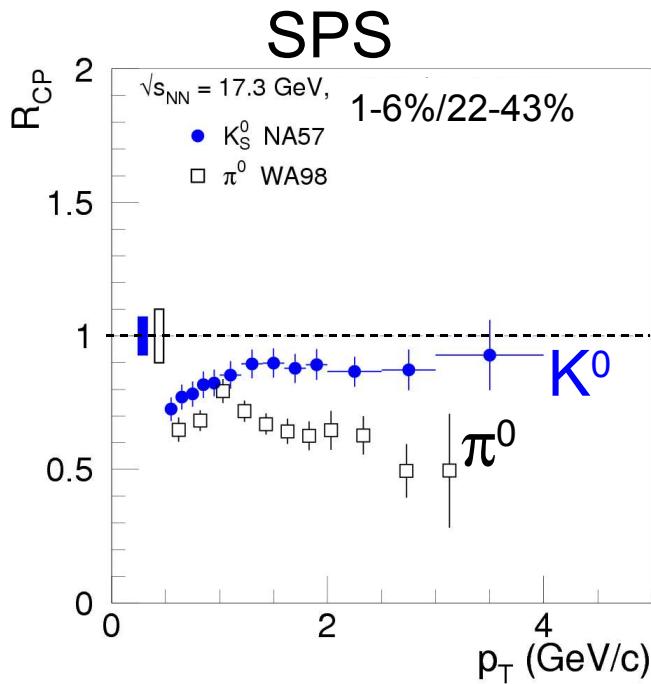
- Centrality classes: 0-5%, 10-20%, 20-30%, 30-40%, 40-55%
- R_{CP} from unweighted dN/dp_T (corrections are centrality independent within systematics)

NEW!



bars =
quadratic sum
of stat. and
 p_T -dep. syst.
errors

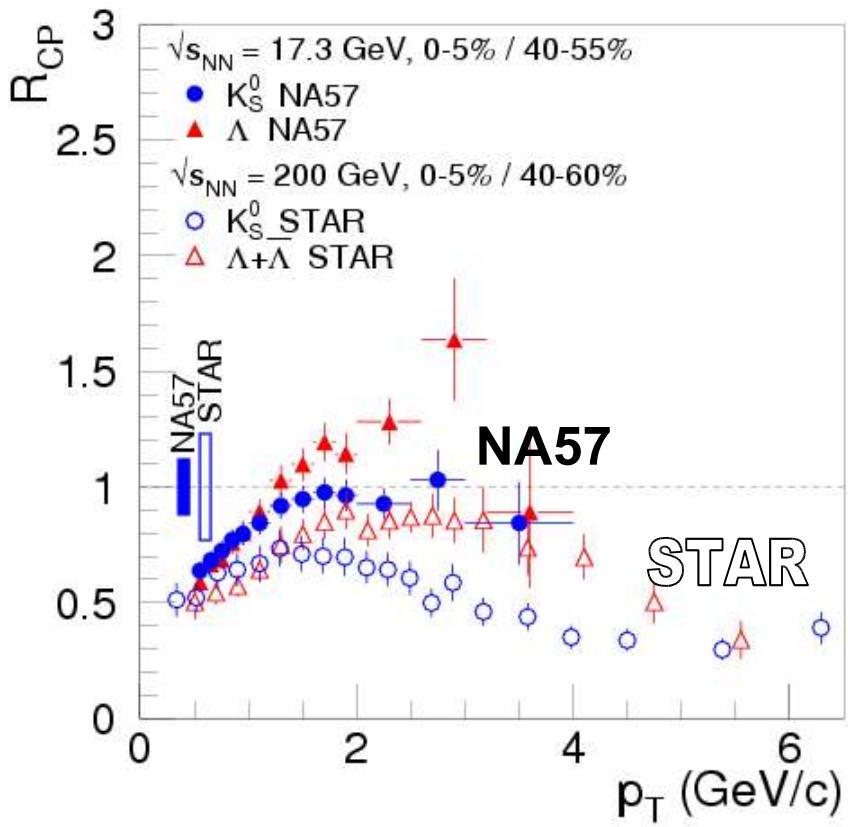
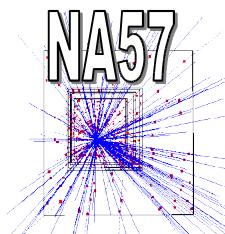
R_{CP} Comparisons: kaons & pions



◆ π^0 WA98 $R_{CP} < K^0 R_{CP}$

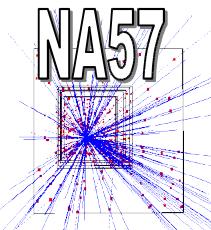
→ $\pi R_{CP} < K^\pm R_{CP}$ also at RHIC
for $p_T < 2 \text{ GeV}/c$

R_{CP} Comparisons: kaons & Λ

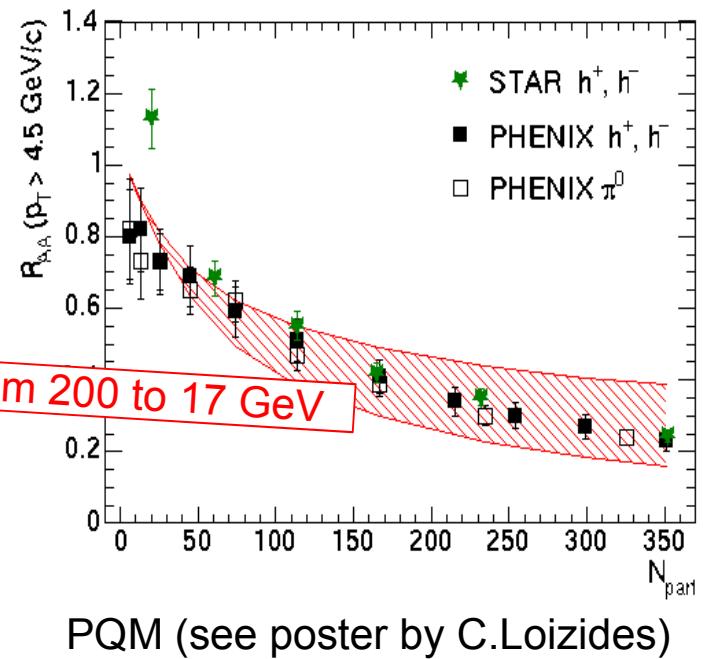
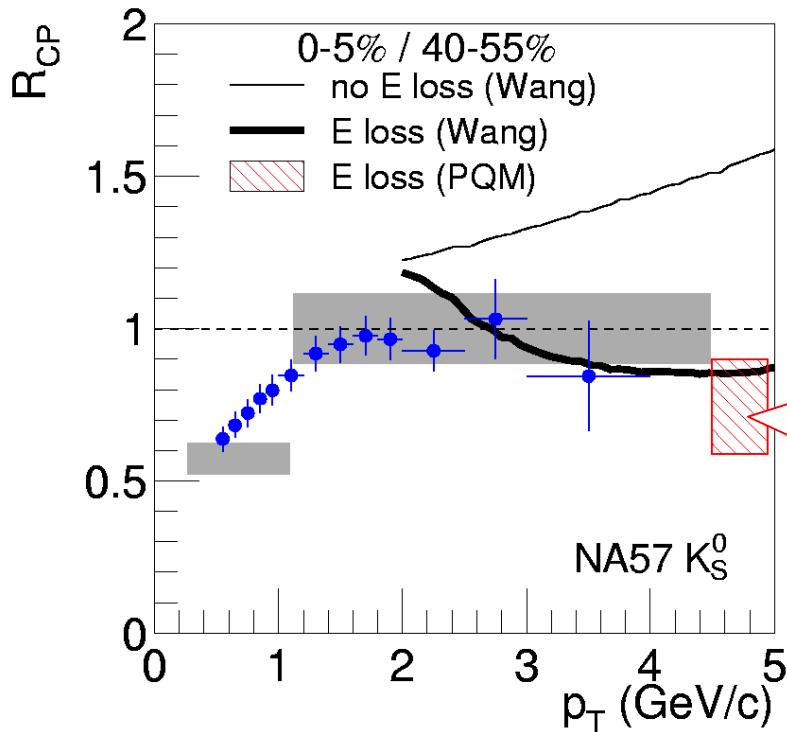


- ◆ Recombination at SPS energy?
 - ⊕ consistent with explanation of multi-strange enhancements as due to recombination of s and \bar{s}
- ◆ Note: effect may also be due to different “Cronin” for Λ and K

R_{CP} Comparisons: Models



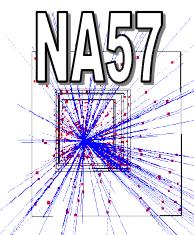
- ◆ Data compared to K^0 calculation by X.N.Wang
- ◆ Cross-checked using different model: PQM (BDMPS-based)
 - ◆ medium density determined from RHIC data and extrapolated down to SPS energy; Cronin enhancement included



X.N.Wang, PRC68 (2001) 064910; PRL81 (1998) 2655; PLB595 (2004) 165 + private comm.
 PQM: Dainese, Loizides, Paic, EPJC38 (2005) 495 + private comm.

Conclusions

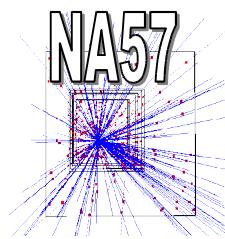
- ◆ Strangeness Enhancements at 160 and 40 GeV/c
 - ❖ same hierarchy, 160: $E(\Omega) > E(\Xi) > E(\Lambda)$, 40: $E(\Xi) > E(\Lambda)$
 - ❖ agreement with ‘historic’ QGP signature
- ◆ Transverse and longitudinal expansion described by hydro
 - ❖ $T_{kin,f.o.} \approx 120$ MeV in central collisions
 - ❖ earlier decoupling in peripheral collisions?
 - ❖ $\langle \beta_L \rangle \approx \langle \beta_\perp \rangle \approx 0.4$
- ◆ R_{CP} nuclear modification factor
 - ❖ similar patterns ($K^0 - \pi^0$ WA98, $K^0 - \Lambda$) as at RHIC
 - SPS: higher R_{CP} values, no significant suppression
 - ❖ described by calculations including parton energy loss
 - Cronin? need R_{pA} measurement



The NA57 Collaboration

F. Antinori^k, P.A. Bacon^e, A. Badalà^f, R. Barbera^f, A. Belogianni^a, I.J. Bloodworth^e, M. Bombara^h, G.E. Bruno^b, S.A. Bull^e, R. Caliandro^b, M. Campbell^g, W. Carena^g, N. Carrer^g, R.F. Clarke^e, A. Dainese^k, D. Di Bari^b, S. Di Libertoⁿ, R. Divià^g, D. Elia^b, D. Evans^e, G.A. Feofilov^p, R.A. Fini^b, P. Ganoti^a, B. Ghidini^b, G. Grella^o, H. Helstrup^d, K.F. Hetland^d, A.K. Holme^j, A. Jacholkowski^f, G.T. Jones^e, P. Jovanovic^e, A. Jusko^e, R. Kamermans^r, J.B. Kinson^e, K. Knudson^g, V. Kondratiev^p, I. Králik^h, A. Kravčákováⁱ, P. Kuijjer^r, V. Lenti^b, R. Lietava^e, G. Løvhøiden^j, V. Manzari^b, M.A. Mazzoniⁿ, F. Meddiⁿ, A. Michalon^q, M. Morando^k, P.I. Norman^e, A. Palmeri^f, G.S. Pappalardo^f, B. Pastirčák^h, R.J. Platte^e, E. Quercigh^k, F. Riggi^f, D. Röhrich^c, G. Romano^o, K. Šafařík^g, L. Šándor^h, E. Schillings^r, G. Segato^k, M. Sené^l, R. Sené^l, W. Snoeys^g, F. Soramel^k, M. Spyropoulou-Stassinaki^a, P. Staroba^m, R. Turisi^k, T.S. Tveterⁱ, J. Urbánⁱ, P. van de Ven^r, P. Vande Vyvre^g, A. Vascotto^g, T. Vikⁱ, O. Villalobos Baillie^e, L. Vinogradov^p, T. Virgili^o, M.F. Votruba^e, J. Vrlakovaⁱ, P. Závada^m.

a: Athens, b: Bari, c: Bergen, d: Bergen, e: Birmingham, f: Catania, g: CERN,
h: Kosice, i: Kosice, j: Oslo, k: Padova, l: Collège de France, m: Prague,
n: Rome, o: Salerno, p: St. Petersburg, q: Strasbourg, r: Utrecht



EXTRA SLIDES

Two historic QGP predictions

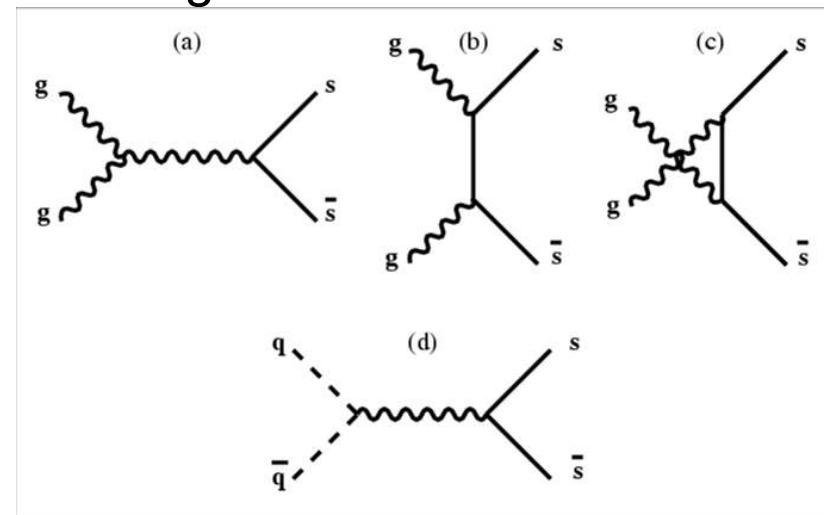
- ◆ restoration of χ symmetry -> increased production of s
 - ⊕ mass of strange quark in QGP expected to go back to current value

$$m_s \sim 150 \text{ MeV} \sim T_c$$

copious production of $s\bar{s}$ pairs,
mostly by gg fusion

[Rafelski: Phys. Rep. 88 (1982) 331]

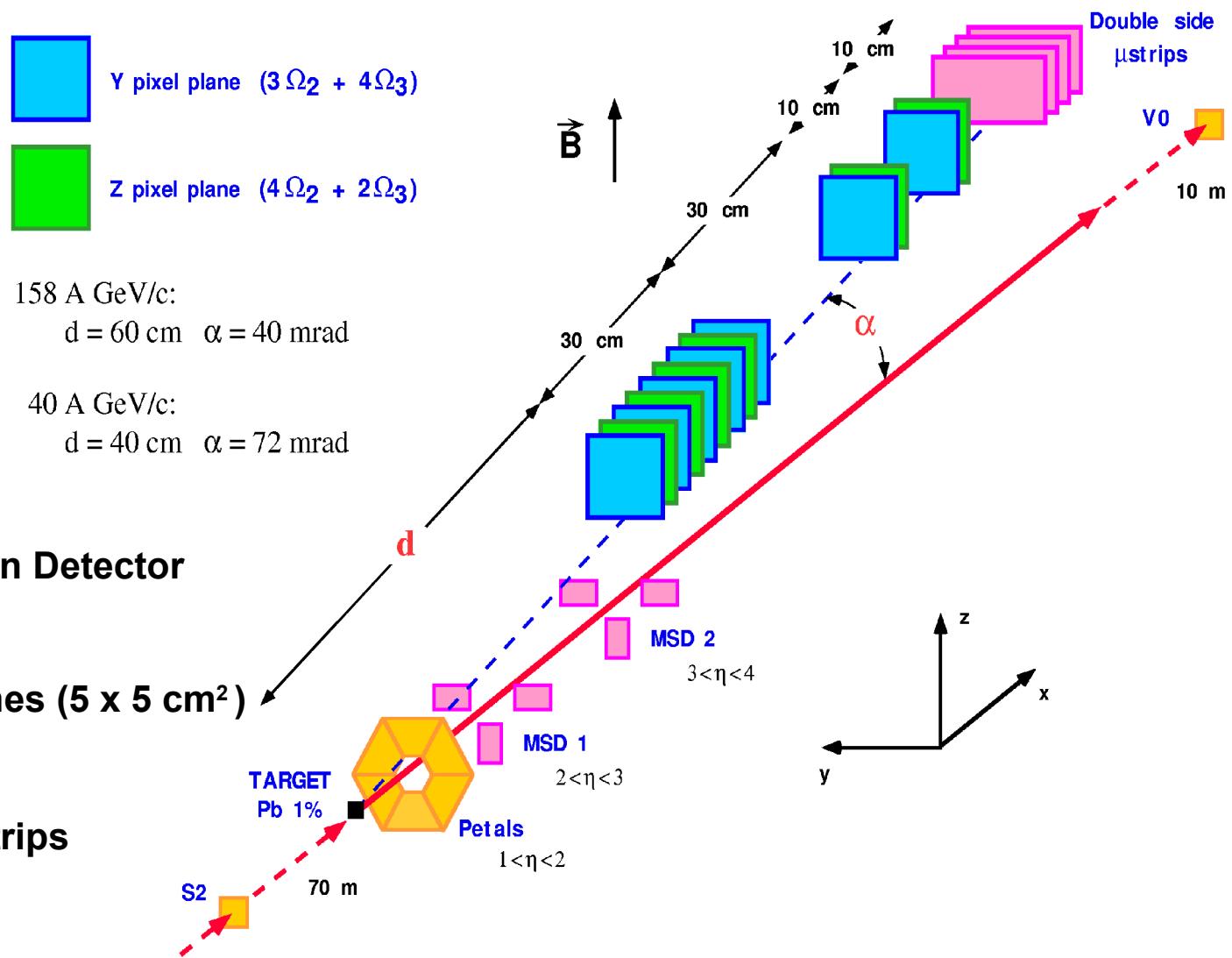
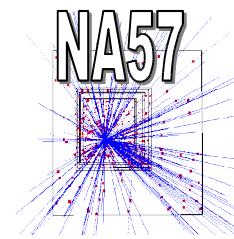
[Rafelski-Müller: P. R. Lett. 48 (1982) 1066]

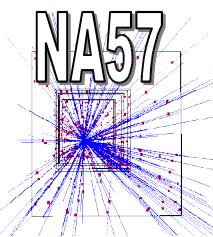


- ◆ deconfinement stronger effect for multi-strange
 - ⊕ can be built using uncorrelated s quarks produced in independent microscopic reactions
 - strangeness enhancement increasing with strangeness content

[Koch, Müller & Rafelski: Phys. Rep. 142 (1986) 167]

NA57 Experimental Layout





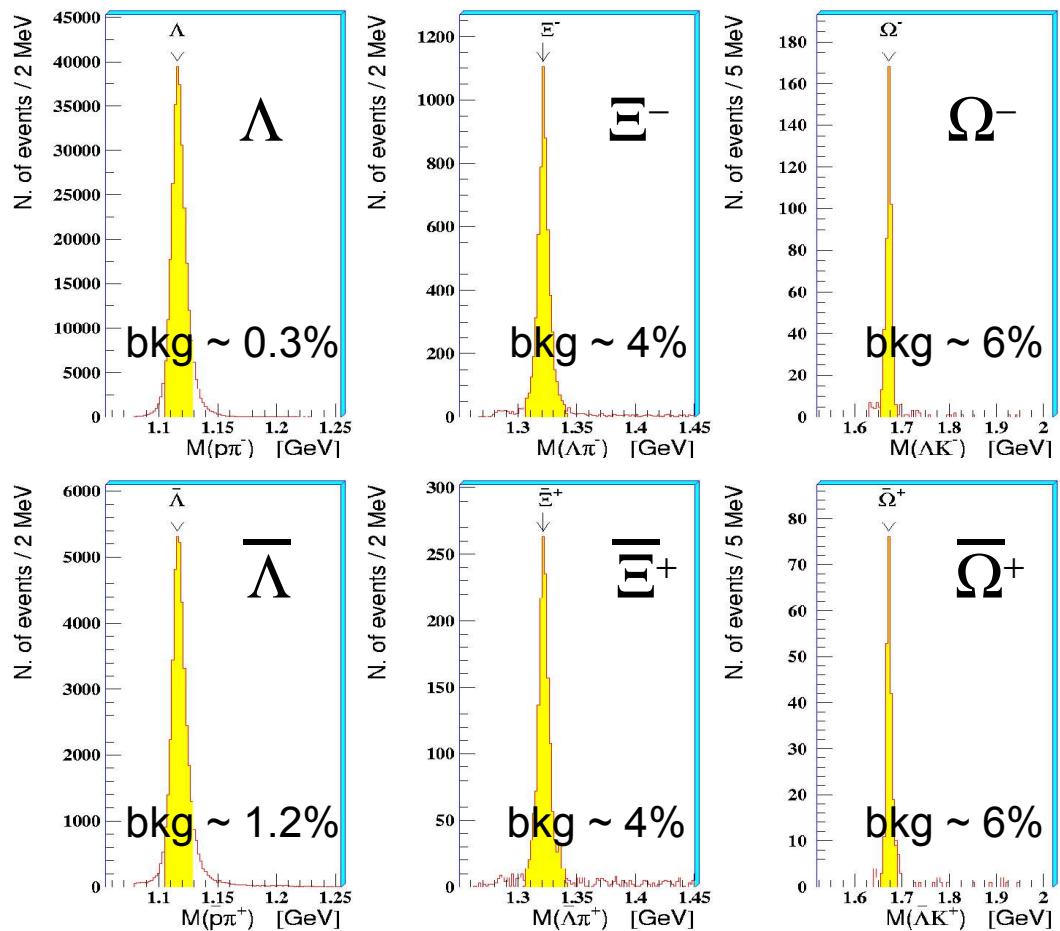
Data Samples

- ◆ p-Be 160 A GeV/c: 219 M events
- ◆ p-Pb 160 A GeV/c: 287 M events (WA97)
- ◆ Pb-Pb 160 A GeV/c: 460 M events (0-60% $\sigma^{\text{Pb-Pb}}$)

- ◆ Particle statistics for R_{CP} analysis:
 - ◆ K_S^0 : 1.8 M
 - ◆ Λ : 0.7 M
 - ◆ $\Lambda\bar{\nu}$: 0.1 M
 - ◆ h^- : 100 M

Invariant Mass Spectra

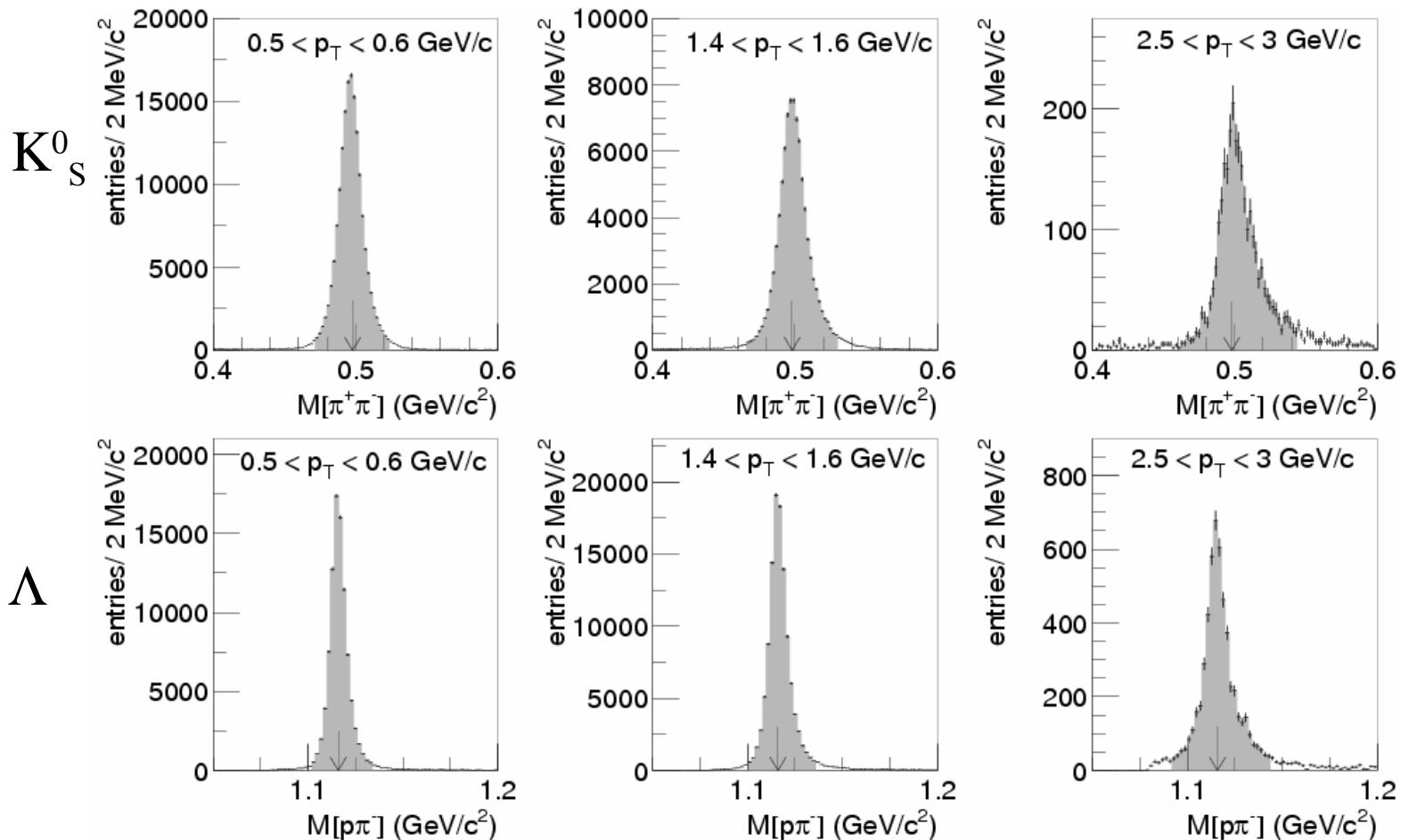
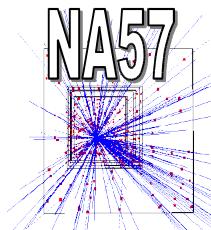
Pb-Pb 160



FWHM ~ 10 MeV

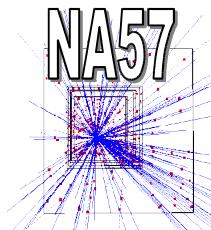
- Small residual combinatorial background (few % at most): subtracted or included in the systematics

Invariant Mass Spectra vs p_T



- Small residual combinatorial background subtracted
 - at most 10% for hight p_T ($> 2.5 \text{ GeV}/c$) K^0 in central Pb-Pb collisions

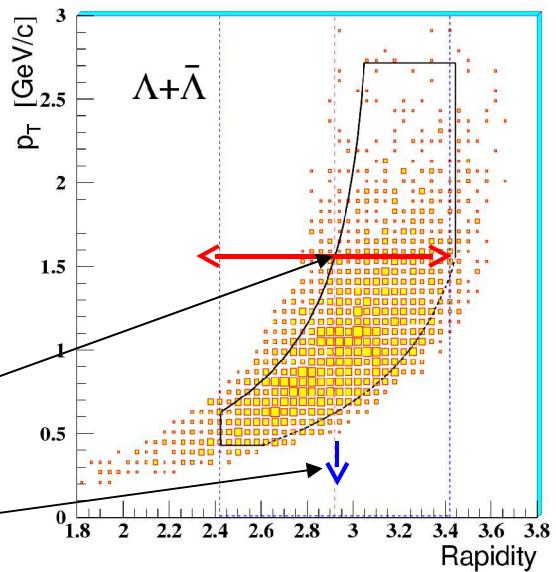
Hyperon yield measurement



- ◆ Data corrected for acceptance and also for detector and reconstruction efficiency by Monte Carlo simulation
- ◆ In the acceptance window:
 - ⊕ Yield (i.e. particle per event)
 - ⊕ Transverse mass spectra (T_{app}) →
- ◆ Extrapolation to a common window:
 - ⊕ one unit of rapidity about y_{cm}
 - ⊕ full range of p_T

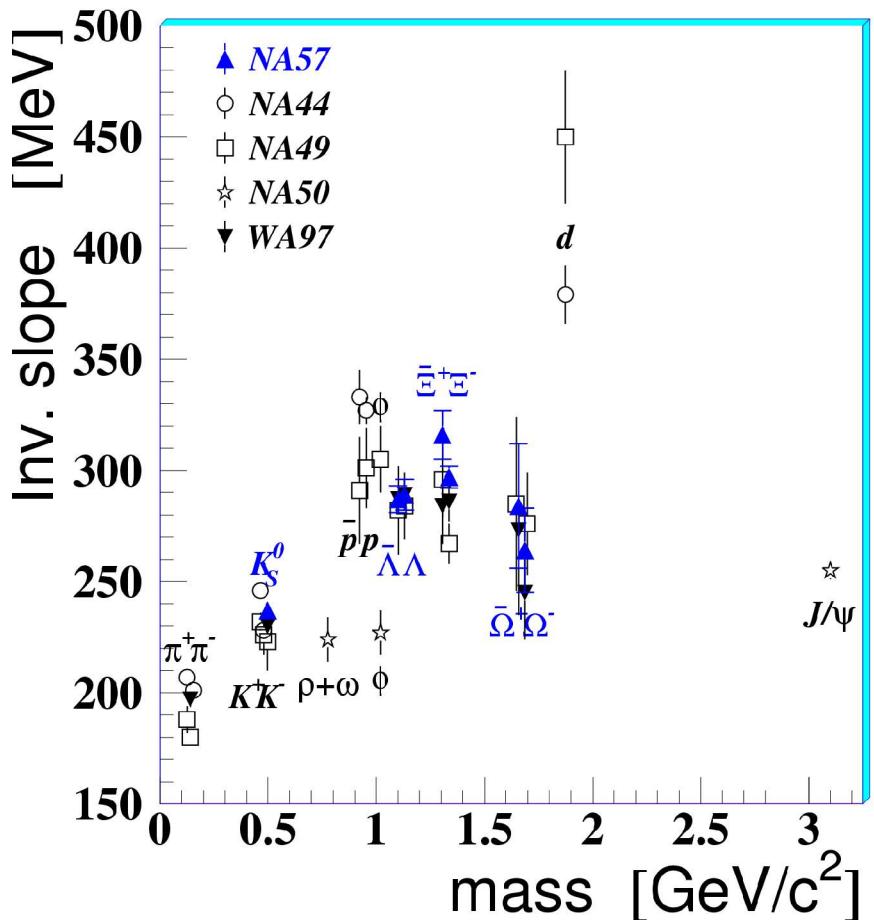
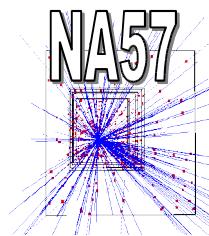
$$m_T = \sqrt{p_T^2 + m_0^2}$$

$$\frac{d^2N}{dy dm_T} = A m_T \exp\left(-\frac{m_T}{T_{app}}\right)$$



$$Y_{extr} = \int_{y_{CM}-0.5}^{y_{CM}+0.5} dy \int_{m_0}^{\infty} dm_T \frac{d^2N}{dm_T dy}$$

Transverse mass spectra in Pb-Pb at 160 A GeV/c



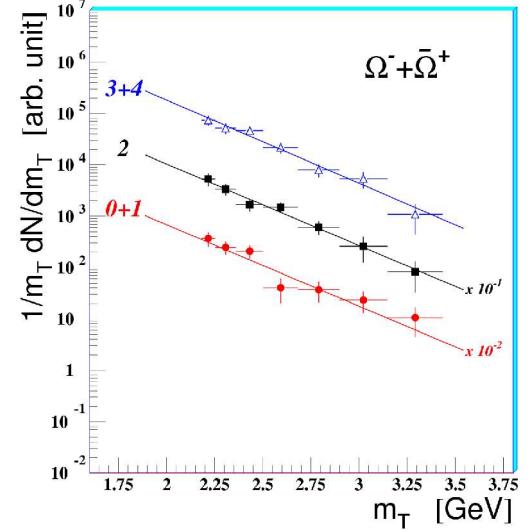
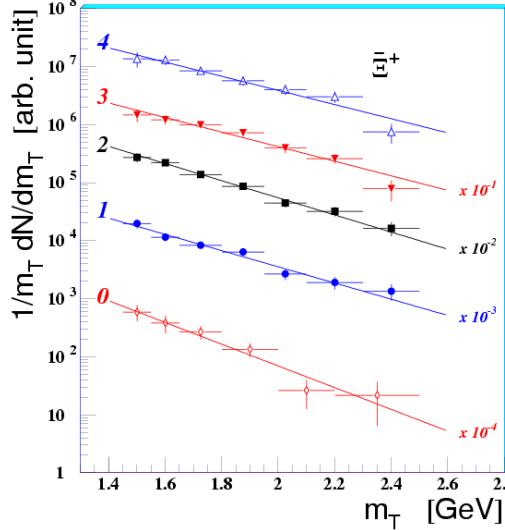
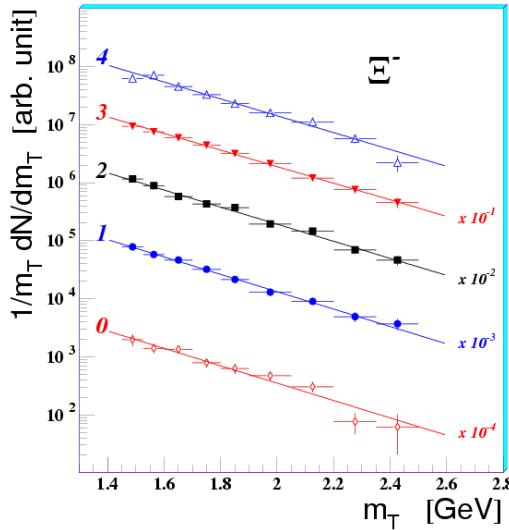
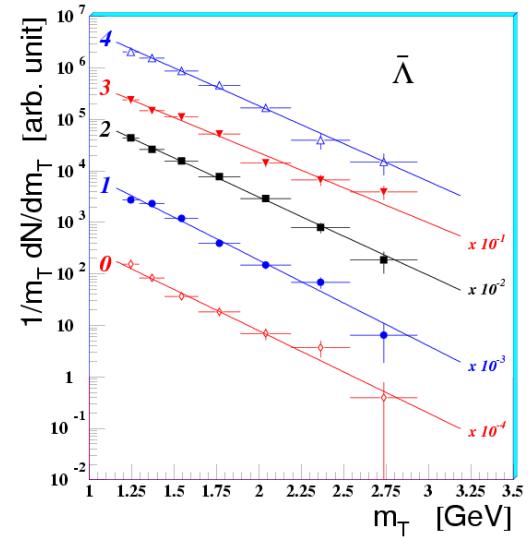
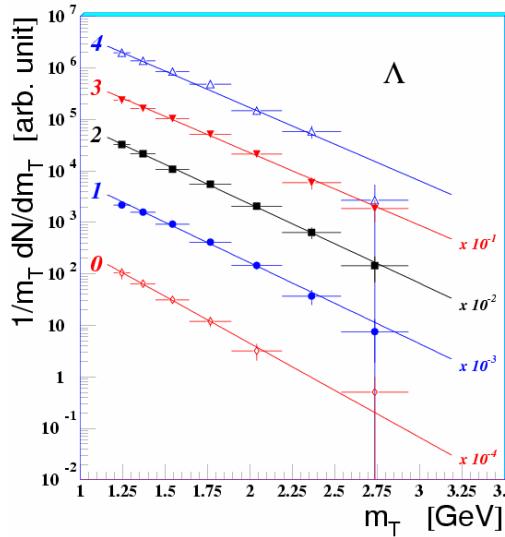
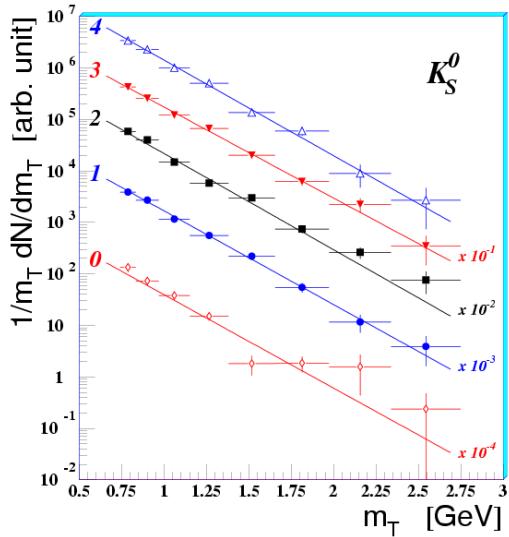
53% most central
events

Inverse slopes (MeV)

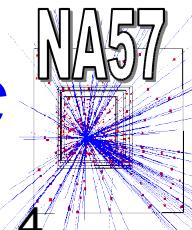
K_S^0	$237 \pm 4 \pm 24$
Λ	$289 \pm 7 \pm 29$
$\bar{\Lambda}$	$287 \pm 6 \pm 29$
Ξ^-	$297 \pm 5 \pm 30$
Ξ^+	$316 \pm 11 \pm 30$
$\Omega^- + \bar{\Omega}^+$	$271 \pm 16 \pm 27$
Ω^-	$264 \pm 19 \pm 27$
$\bar{\Omega}^+$	$284 \pm 28 \pm 27$



Transverse mass spectra in Pb-Pb at 160 A GeV/c



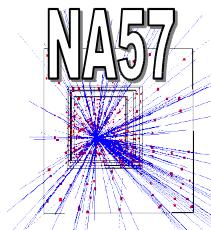
Inverse slopes at 160 A GeV/c



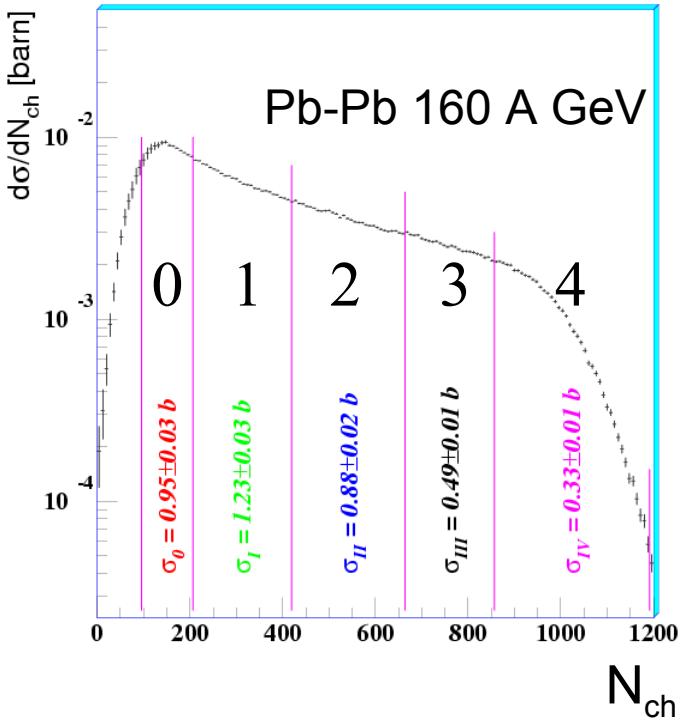
	p-Be	p-Pb	0	1	2	3	4		
K^0_S	197±4	217±6	239±15	239±8	233±7	244±8	234±9		
Λ	180±2	196±6	237±19	274±13	282±12	315±14	305±15		
$\bar{\Lambda}$	157±2	183±11	277±19	264±11	283±10	313±14	295±14		
Ξ^-	202±13	235±14	290±20	290±11	295±9	304±11	299±12		
Ξ^+	182±17	224±21	232±29	311±23	294±18	346±28	356±31		
$\Omega^- + \bar{\Omega}^+$	169 ±40	334±99	274±34		274±28	268±23			
Ω^-			264±19						
$\bar{\Omega}^+$			284±28						

In central and semi-central Pb-Pb collisions (bin 1,2,3,4) we measure compatible slopes for particle and its anti-particle
 This symmetry lost in p-Be

Collision Centrality



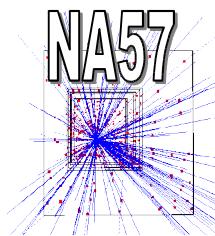
- ◆ Determined from charged multiplicity measurement
- ◆ N_{part} and N_{coll} from trigger cross section (Glauber model calc.)
 - ⊕ $\sigma_{\text{trigger}} \approx 60\%$ of Pb-Pb σ_{inel} (7.26 b)



bin	% of σ_{tot}	$\langle N_{\text{part}} \rangle$		$\langle N_{\text{coll}} \rangle$	
		160	40	160	40
0	40-53 %	62	57	77	81
1	23-40%	121	119	191	203
2	11-23 %	209	208	395	416
3	4.5-11 %	290	292	614	644
4	0-4.5 %	349	346	789	807

Collision Centrality

[for R_{CP} analysis]

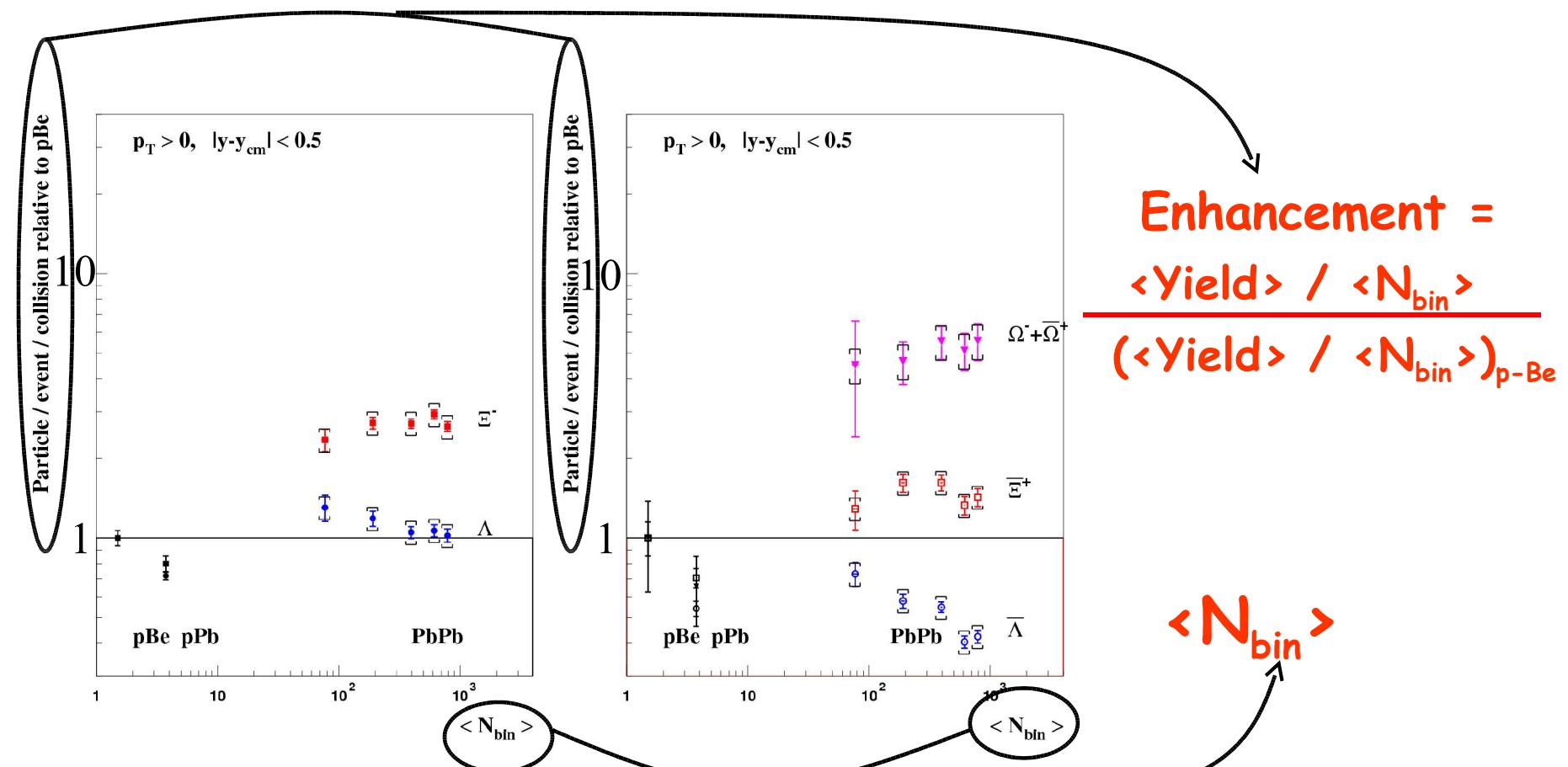
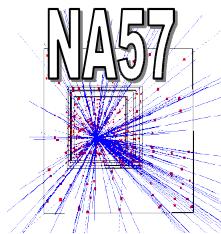


- ◆ Determined from charged multiplicity measurement
- ◆ N_{part} and N_{coll} from trigger cross section (Glauber model calc.)
 - ‡ $\sigma_{\text{trigger}} \approx 60\%$ of Pb-Pb σ_{inel} (7.26 b)

Class (% $\sigma_{\text{inel}}^{\text{Pb-Pb}}$)	$\langle N_{\text{part}} \rangle$	$\langle N_{\text{coll}} \rangle$
0–5.0%	345.3 ± 1.7	779.2 ± 26.6
10.0–20.0%	214.7 ± 5.8	421.7 ± 26.1
20.0–30.0%	143.0 ± 6.6	247.7 ± 21.5
30.0–40.0%	92.6 ± 6.4	140.5 ± 16.2
40.0–55.0%	49.5 ± 5.0	63.8 ± 9.8

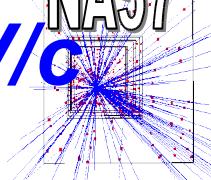
Systematic errors from: variation of multiplicity fit parameters, variation of Pb Woods-Saxon, uncertainty on $\sigma_{\text{inel}}^{\text{NN}}$ ($\sim 1.5\%$)

Enhancements w.r.t. number of binary collisions at 160 A GeV/c

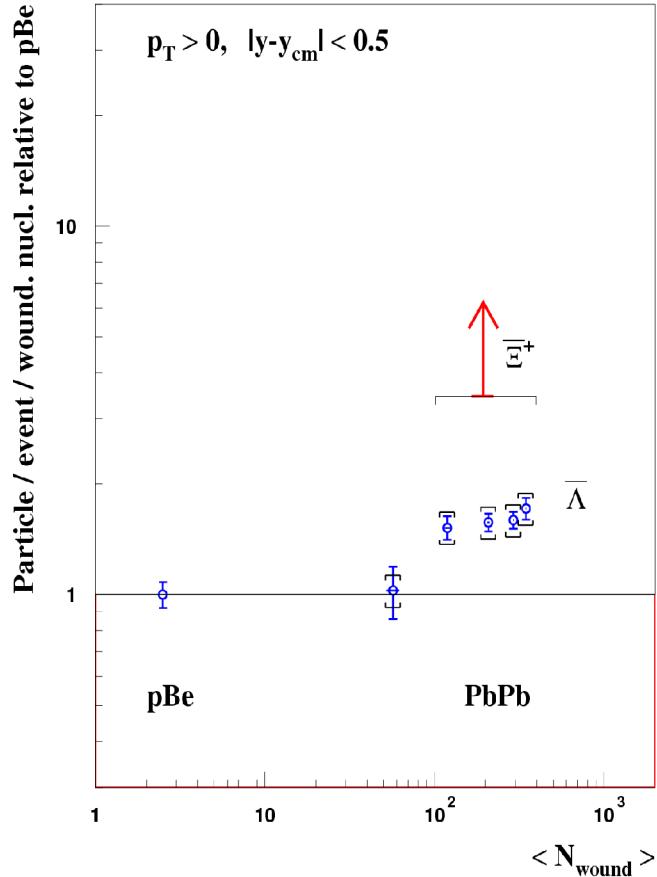
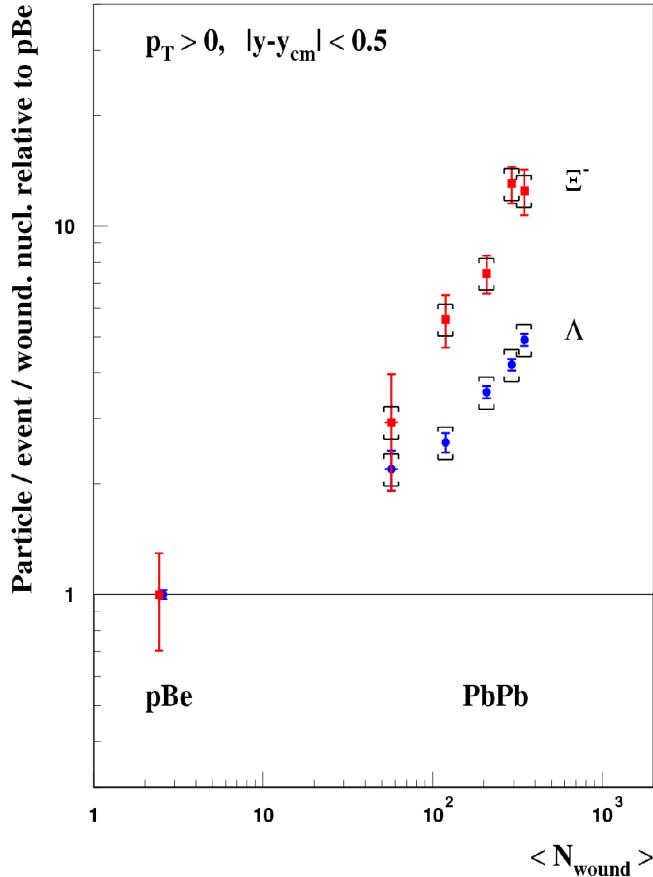


- Going from p-Be to Pb-Pb Ξ and Ω yields scale faster than $\langle N_{\text{bin}} \rangle$

Hyperon Enhancements at 40A GeV/c



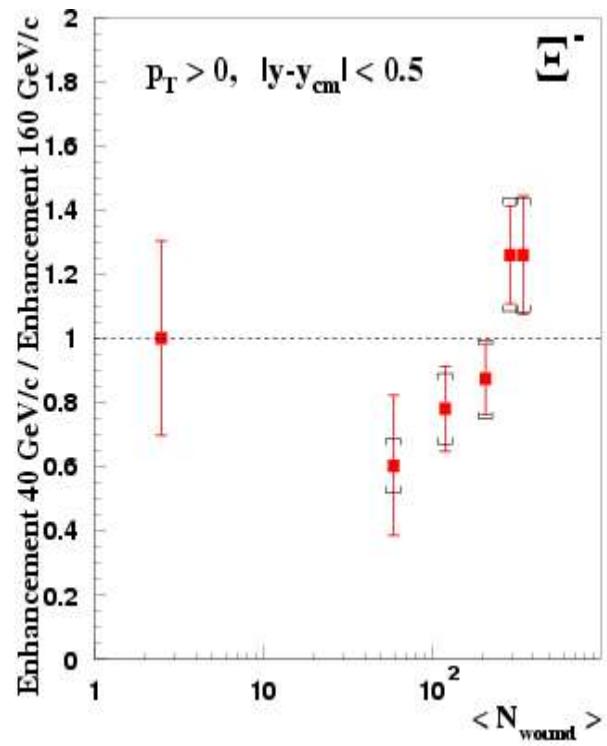
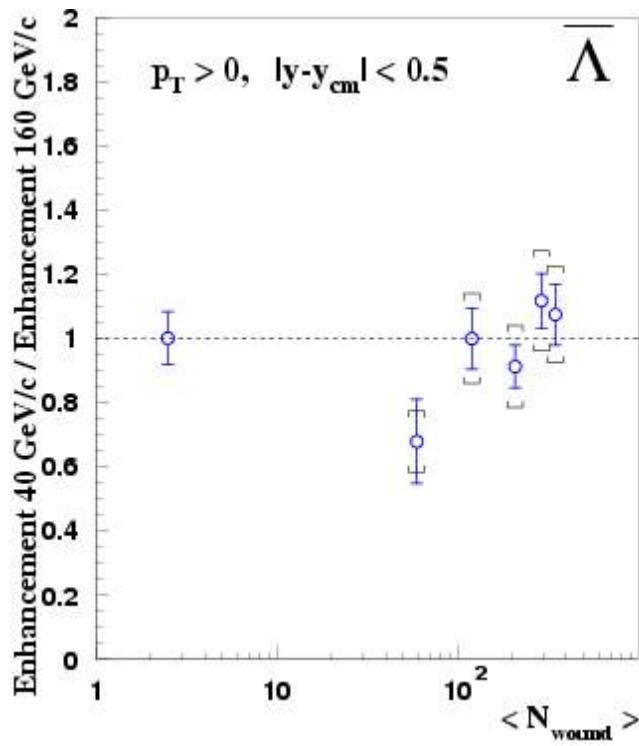
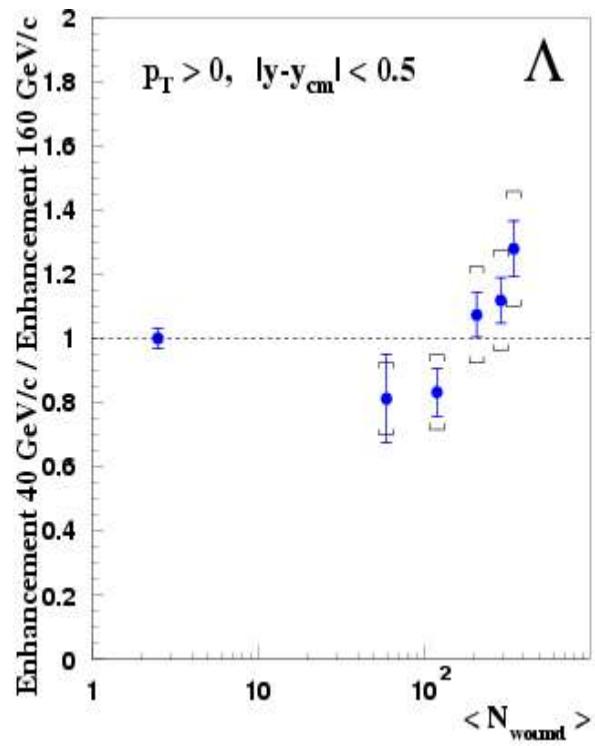
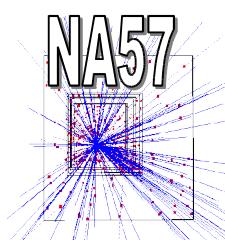
- Only lower limit for Ξ^+ , due to limited statistics



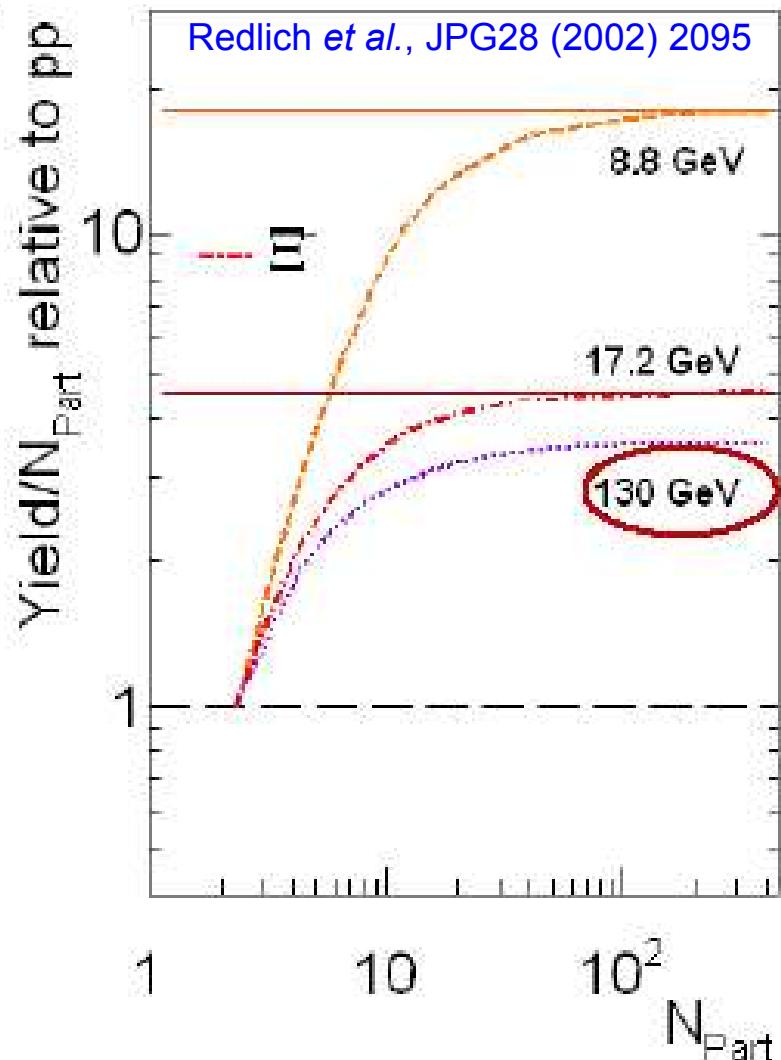
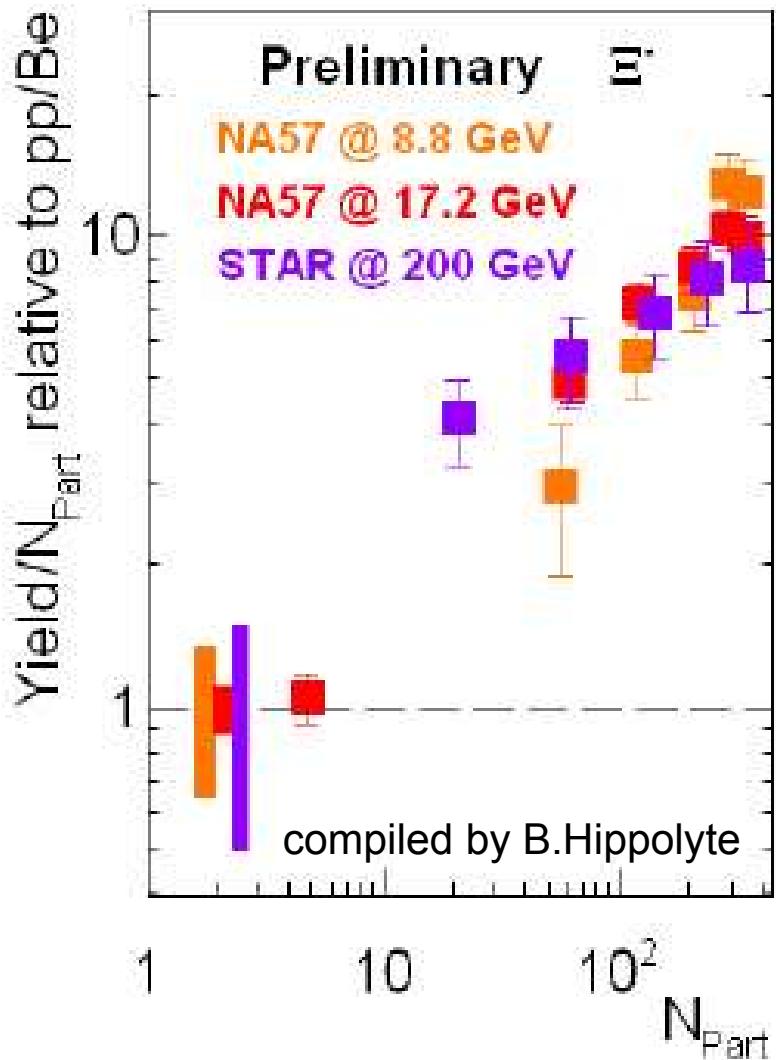
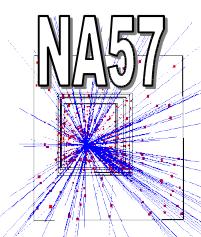
- Same hierarchy as for higher-energy data: $E(\Lambda) < E(\Xi)$

Ratios of Enhancements

40 GeV/c / 160 GeV/c

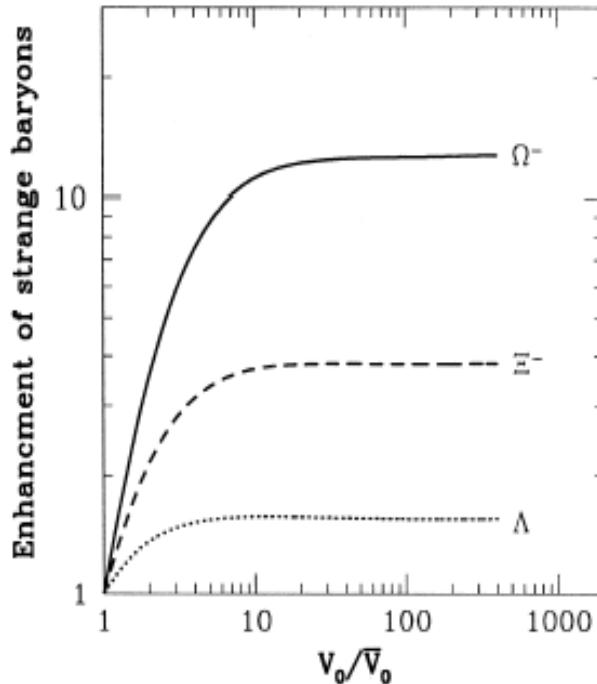


Energy Dependence of Ξ Enhancement

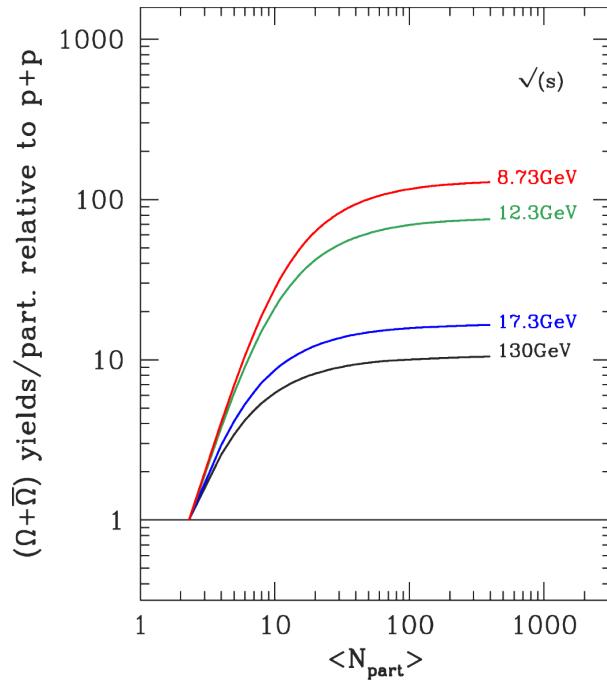


Canonical vs Grand Canonical

- Energy penalty to create a strange particle:
 - Canonical: computed taking into account also energy to create companion to ensure conservation of strangeness
 - Grand Canonical limit: just due to creation of particle itself. The rest of the system acts as a reservoir and “picks up the slack”



Canonical suppression increases with increasing strangeness



Canonical suppression increases with decreasing energy

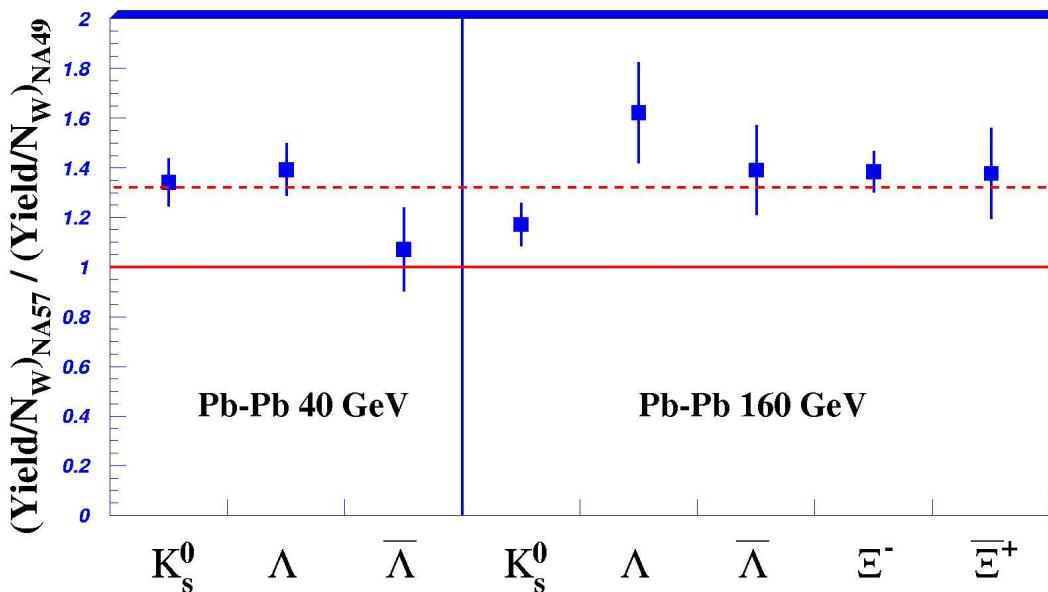
Comparison NA57-NA49

Particle yields per participant

Similar centrality regions:

	NA57	NA49*
40 GeV	5%	7%
160 GeV (K)	5%	7%
160 GeV (Λ , Ξ)	12%	10%

For NA49: $K^0_s = 0.5 * (K^+ + K^-)$

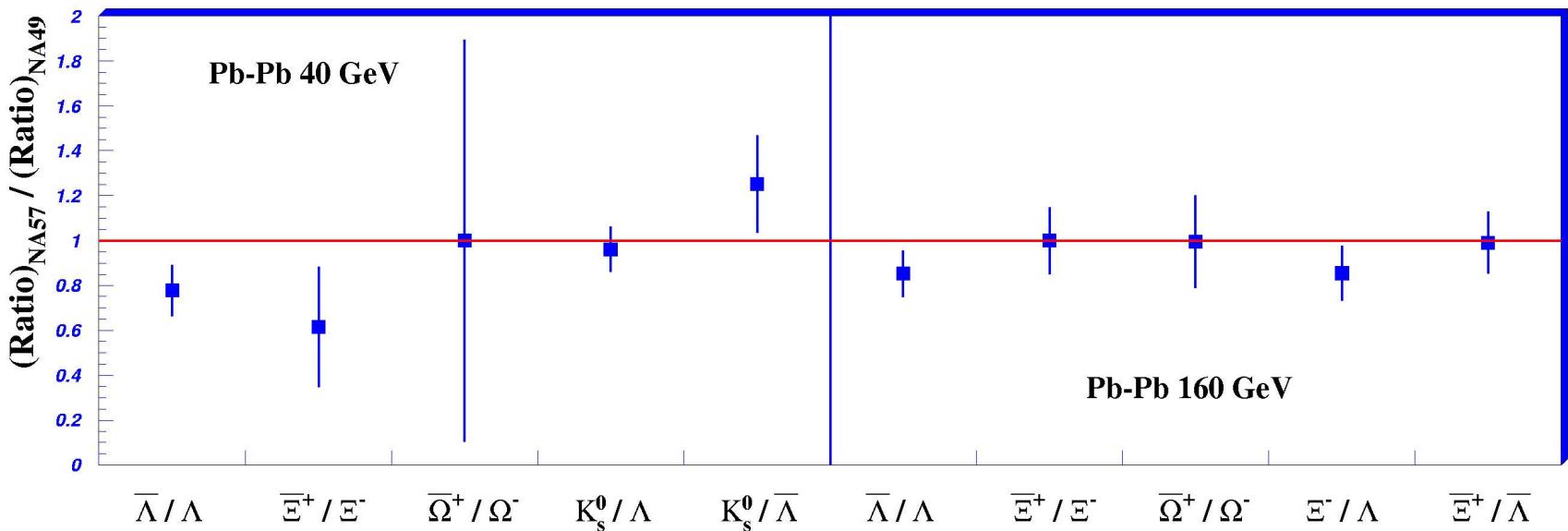


about 30% systematics on the absolute value of the yields (under investigation) but ...

*Refs: Physical Review C 66, 054902 (2002), arXiv:nucl-ex/0311024,
Phys. Lett. B 538 (2002), 275.

Comparison NA57-NA49

Particle ratios



... particle ratios compatible within errors
 (no impact on relative yields)

*Refs: Physical Review C 66, 054902 (2002), arXiv:nucl-ex/0311024,
 arXiv:nucl-ex/0305021, arXiv:nucl-ex/0311029.

Blast Wave

Blast-wave description of the spectra:

$$\frac{d^2N_j}{m_T dy dm_T} = \int_0^{R_G} A_j m_T \cdot K_1\left(\frac{m_t \cosh \rho}{T}\right) \cdot I_0\left(\frac{p_t \sinh \rho}{T}\right) r dr$$

Uniform particle density

$$\rho(r) = \tanh^{-1} \beta_{\perp}(r) \quad \beta_{\perp}(r) = \beta_s \left[\frac{r}{R_G} \right]^n \quad r \leq R_G$$

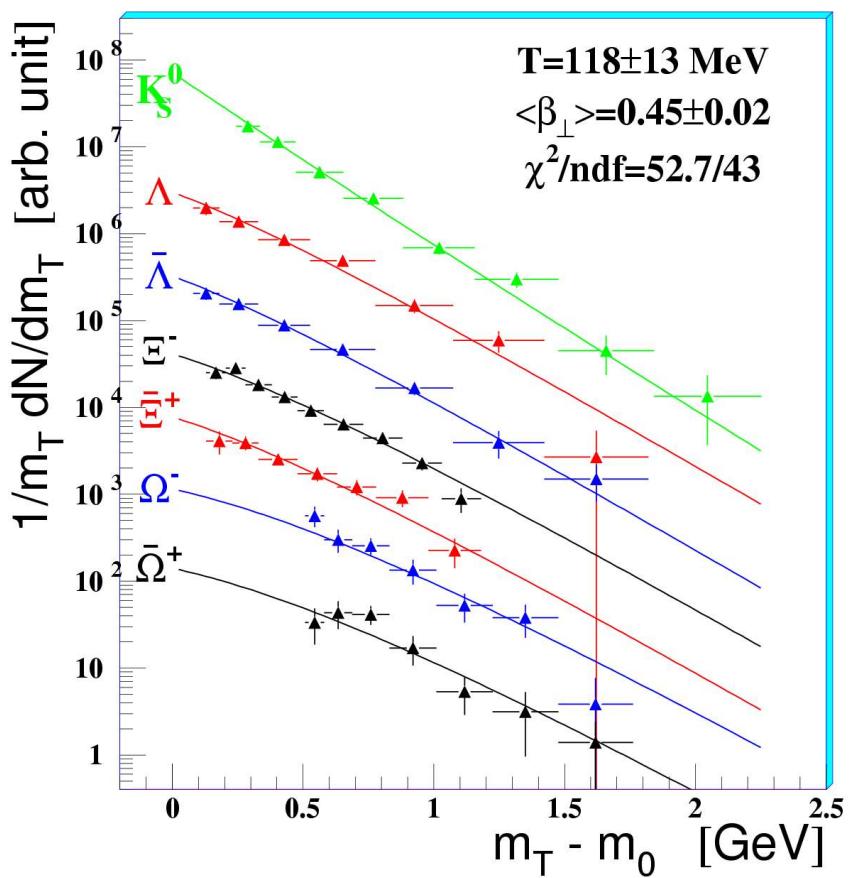
$$\langle \beta_{\perp} \rangle = \frac{2}{2+n} \beta_s$$

	n=0	n=1/2	n=1	n=2
T (MeV)	158±6	152±6	144±7	151±11
β_s	0.396 ±0.015	0.493 ±0.016	0.571 ±0.019	0.633 ±0.028
$\langle \beta_{\perp} \rangle$	0.396 ±0.015	0.394 ±0.013	0.381 ±0.013	0.316 ±0.014
χ^2/ndf	39.6/48	36.9/48	37.2/48	68.0/48

Schnedermann, Sollfrank, Heinz, PRC48 (1993) 2462

Blast fit for most central collisions

5% most central events



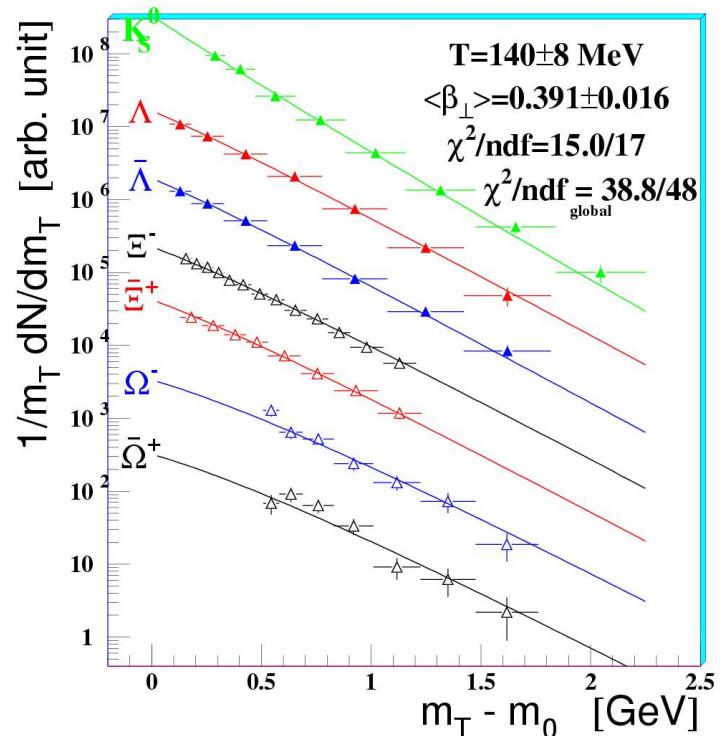
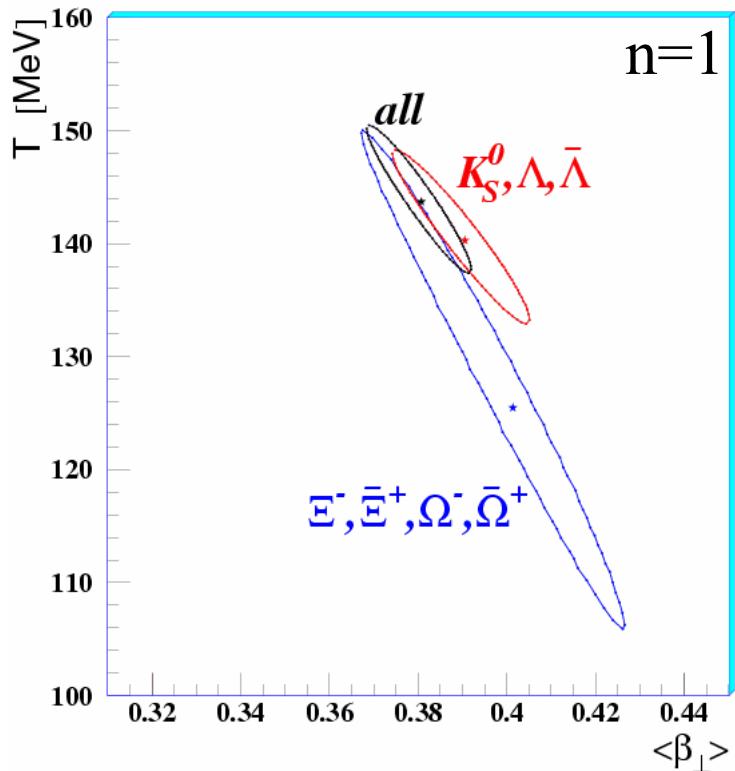
n	T (MeV)	$\langle \beta_{\perp} \rangle$	χ^2/ndf
NA57	1	118 ± 13 0.02	53/43
NA49 (a)	0	127 ± 1 0.01	120/43
NA49 (b)	0	114 ± 2 0.01	91/41

- (a) $K^+, p, \Lambda, \Xi^-, \Omega^-$
- (b) $K^-, \bar{p}, \phi, \bar{\Lambda}, \Xi^+, \bar{\Omega}^+$

NA49 centrality: 5% for K^\pm, ϕ
 10% for p, Λ, Ξ ; 20% for Ω

Ref: M van Leeuwen, Nucl. Phys. A715 (2003) 161c

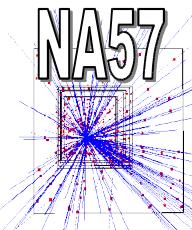
Freeze-out parameters: multi- vs. singly strange particles



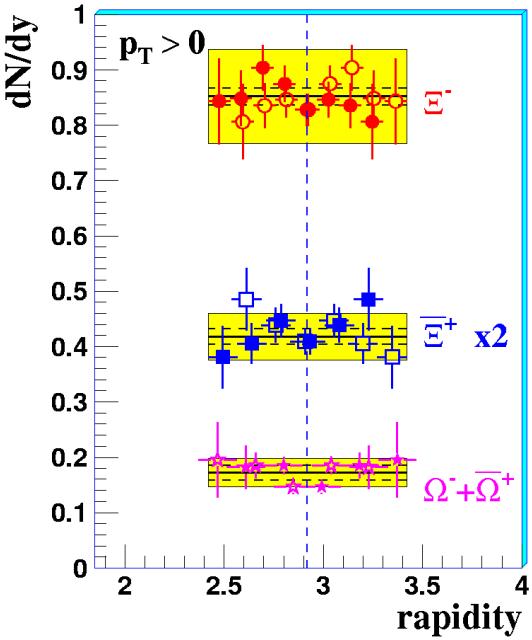
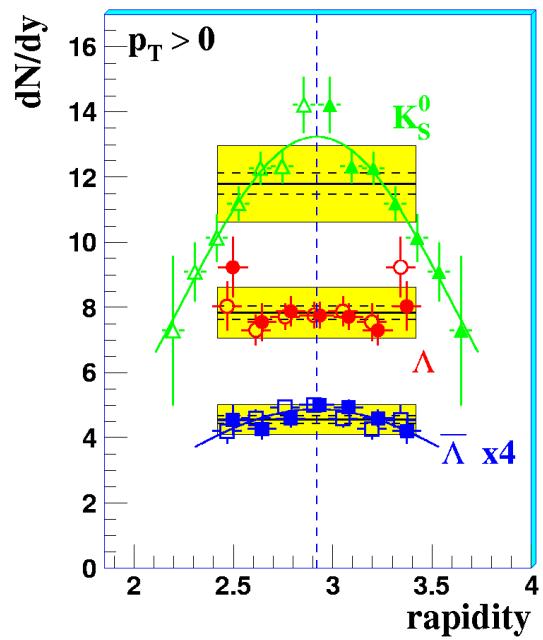
Fit to singly strange particles

- Fit driven by singly strange particles
- Σ and Ω fit well with same parameters

Longitudinal Dynamics: Rapidity Distributions



Pb-Pb, 0-53%

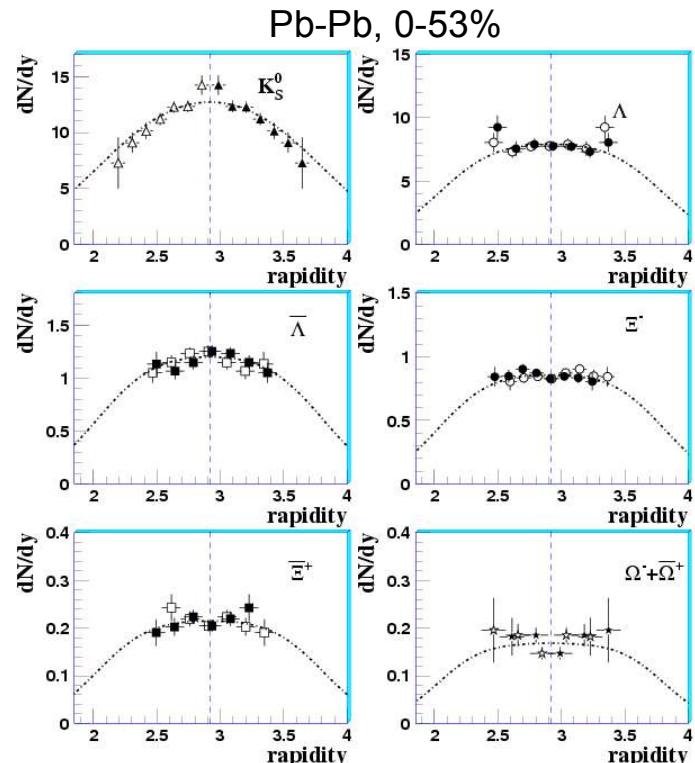


Fitted with thermal model + longitudinal flow
(Bjorken) using $T_{kin.f.o.}$ from blast-wave fit



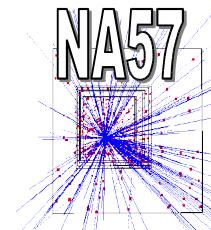
$$\langle \beta_L \rangle \sim \langle \beta_\perp \rangle \sim 0.4$$

Only K^0 and $\bar{\Lambda}$ deviate significantly from flatness within our acceptance



Schnedermann, Solfrank, Heinz, PRC48 (1993) 2462
Mohanty and Alam, PRC68 (2003) 064903

Comparison NA57-NA49

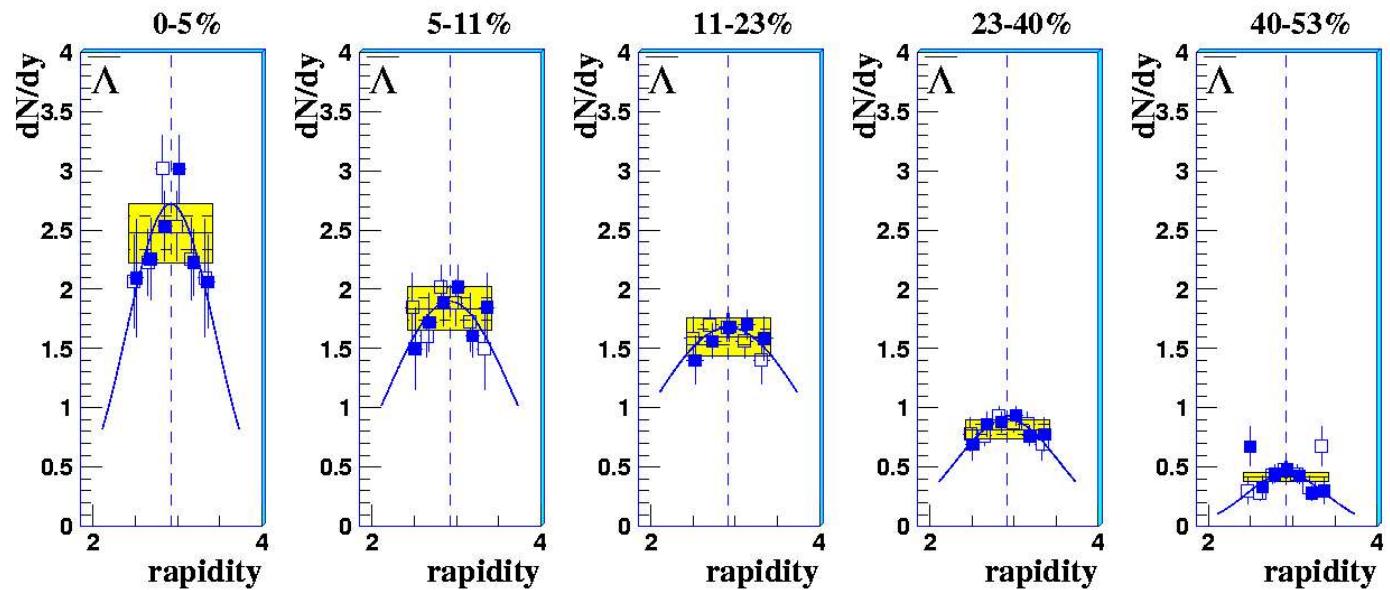
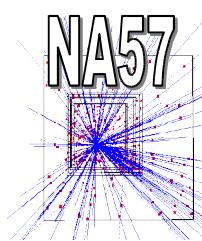


dN/dy

- Different acceptances:
 - NA57: $\sim |y - y_{cm}| < 0.5$
 - NA49: $\sim |y - y_{cm}| < 1.5$

Particle	NA57	NA49
Kaon	K^0 Gaussian $rms = 0.221$ in NA57 acc.	$K^{+/-}$ 2 Gaussians $rms = 0.219$ in NA57 acc.
Λ	flat	flat
$\bar{\Lambda}$	Gaussian $\sigma = 0.83 \pm 0.22$	Gaussian $\sigma = 0.95 \pm 0.05$
Ξ $\bar{\Xi}$	flat / not-sensitive	2 Gaussians Gaussian
Ω $\bar{\Omega}$	flat / not-sensitive	Gaussian $\sigma = 1.2 \pm 0.4$ $\sigma = 1.0 \pm 0.4$

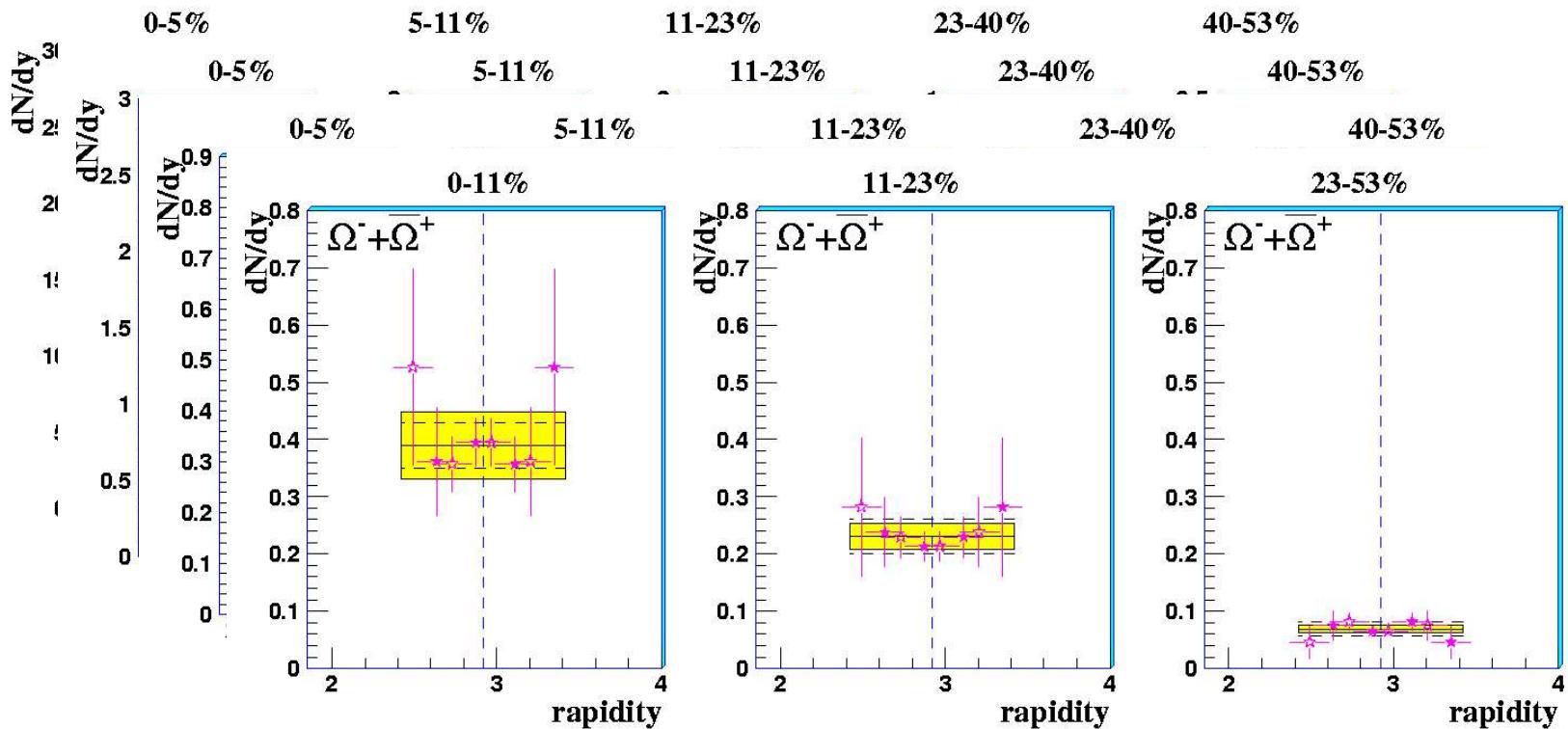
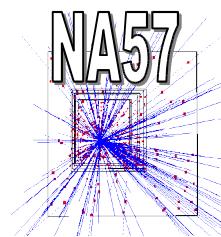
Centrality dependence (i)



	4	3	2	1	0	
K_S^0	$\frac{dN}{dy} \Big _{y=y_{cm}}$	30.3 ± 2.2	24.4 ± 1.6	17.2 ± 0.9	9.4 ± 0.6	3.3 ± 0.4
σ		0.61 ± 0.12	0.67 ± 0.13	0.72 ± 0.13	0.61 ± 0.11	0.71 ± 0.34
χ^2/ndf		$1.2/4$	$2.4/3$	$5.2/4$	$1.9/5$	$2.4/4$
$\bar{\Lambda}$	$\frac{dN}{dy} \Big _{y=y_{cm}}$	2.72 ± 0.20	1.90 ± 0.13	1.68 ± 0.09	0.90 ± 0.06	0.44 ± 0.05
σ		0.52 ± 0.14	0.73 ± 0.34	0.9 ± 0.5	0.61 ± 0.20	0.48 ± 0.19
χ^2/ndf		$2.6/4$	$2.4/4$	$1.14/3$	$1.18/4$	$7.0/5$

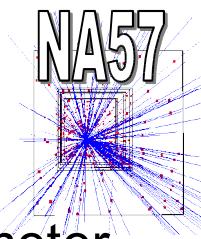
No centrality dependence in our limited acceptance

Centrality dependence (ii)

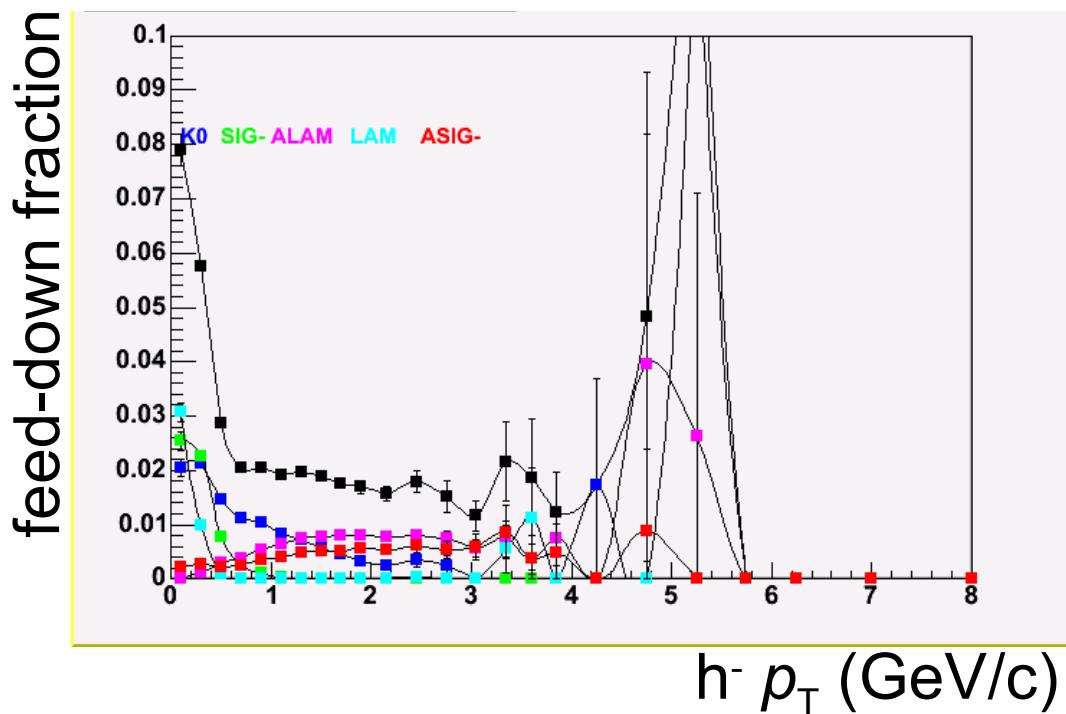


No centrality dependence in our limited acceptance

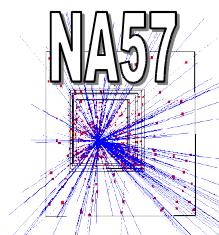
Analysis of Negatives (h^-)



- ◆ Negatives selected on the basis of track quality and impact parameter cut (reject secondaries)
- ◆ Residual contamination from weak-decays feed-down estimated from Monte Carlo: smaller than 3% for most central collisions (even smaller for less central)
 - ◆ negligible effect on R_{CP}



Centrality (in)dependence of correction weights



- ◆ Corrections for acceptance and efficiency calculated by embedding MC particles of given p_T and y in real events, at the level of hits

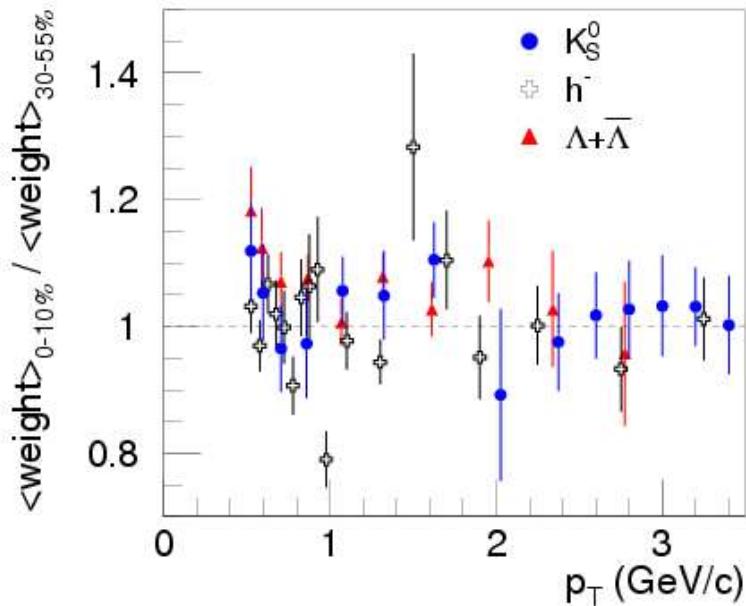
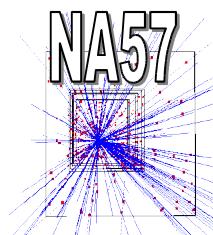
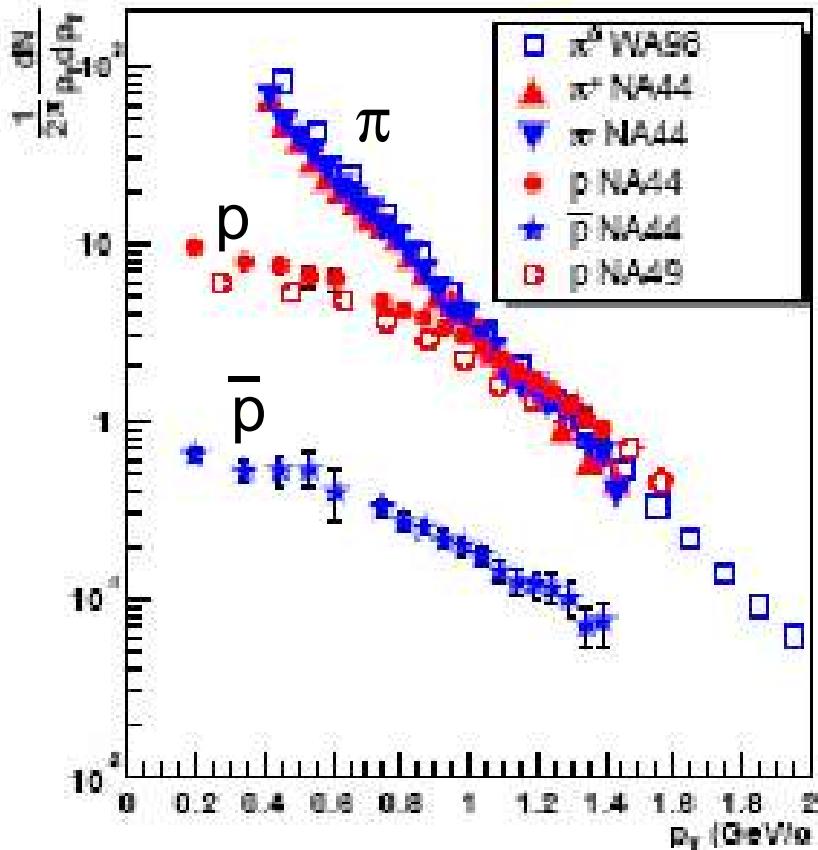


Fig. 2. (colour online) Ratio of the average correction weights for a sample of central events (0–10%) and a sample of peripheral events (30–55%), as a function of p_T and of the particle species.

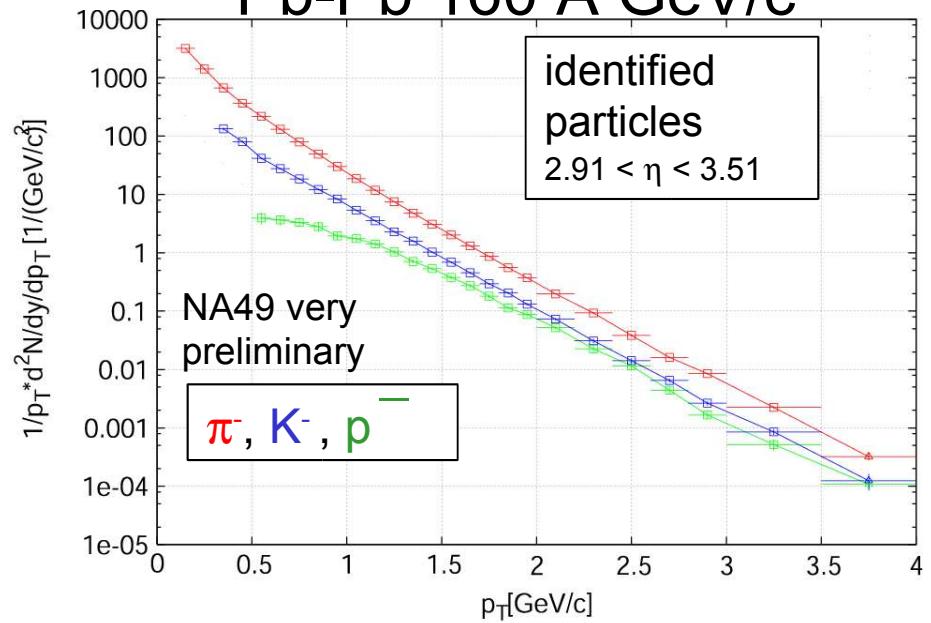
The Negative Cocktail at SPS



Pb-Pb 160 A GeV/c



Pb-Pb 160 A GeV/c



presented by C.Blume at Moriond, March 2005

R_{CP} Comparisons: WA98

