

Hyperon yields in Pb-Pb collisions

Latest results from the WA97 and NA57 collaborations

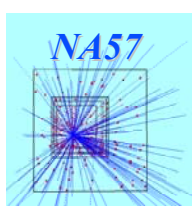
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on behalf of the WA97 and NA57 collaborations



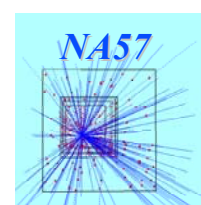
Talk content



- Physics motivation
- Hyperon yields
 - centrality dependence
 - New:** Ω yields at 160 A GeV/c from NA57
 - energy dependence
 - New:** Ξ and Ω yields at 40 A GeV/c from NA57
 - Comparison with STAR
- Conclusions
- Outlook



Physics motivation

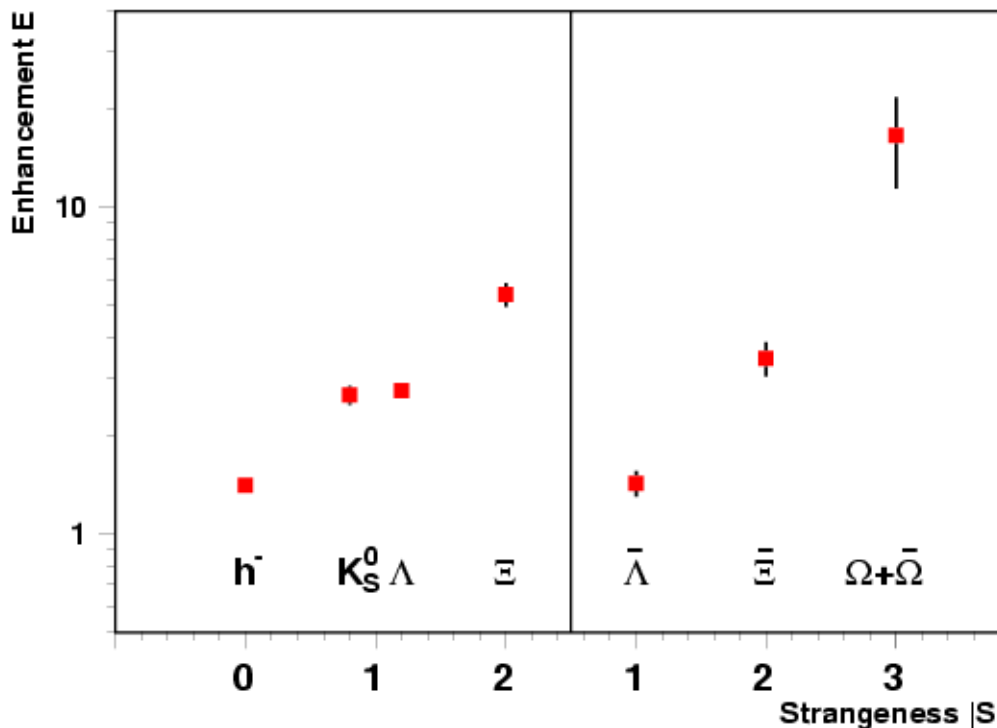


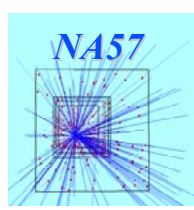
➤ Enhancement of strange baryons : QGP signature (PRL42,1982)

$$E = \frac{\left[\frac{Y}{N_{\text{wound}}} \right]_{\text{Pb-Pb}}}{\left[\frac{Y}{N_{\text{wound}}} \right]_{\text{p-Pb}}}$$

Y – strange particle yield
 N_{wound} – number of wounded nucleons in collision

WA97 Pb-Pb 160A GeV 40% of σ_{in} (SQM98)





Study of hyperon enhancement

- Dependence on the centrality of collision
- Dependence on energy of colliding system

WA97 experiment:

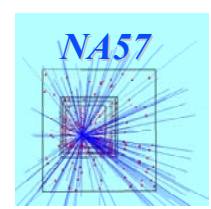
Energy: 160 A GeV/c.

Systems: p-Be; p-Pb; Pb-Pb – 40% of σ_{in} , $N_{wound} > 100$.

NA57 experiment:

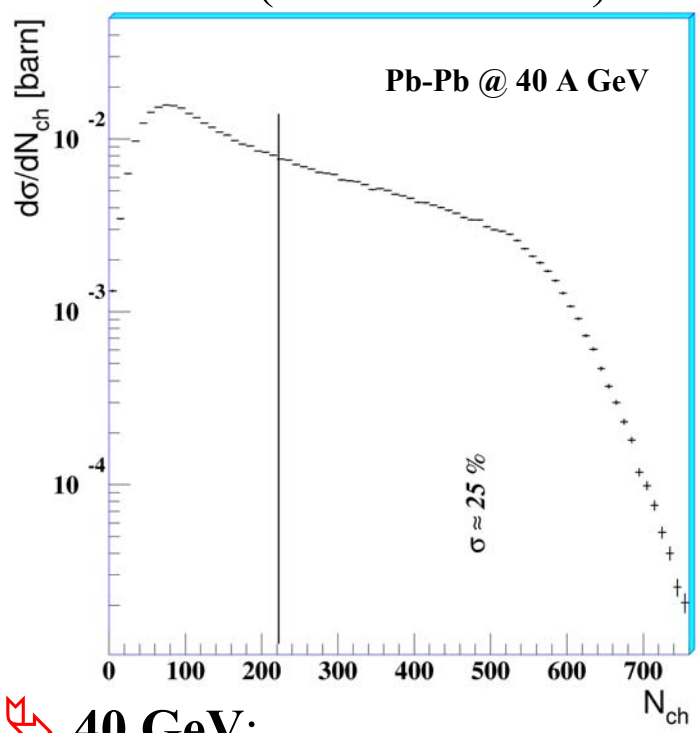
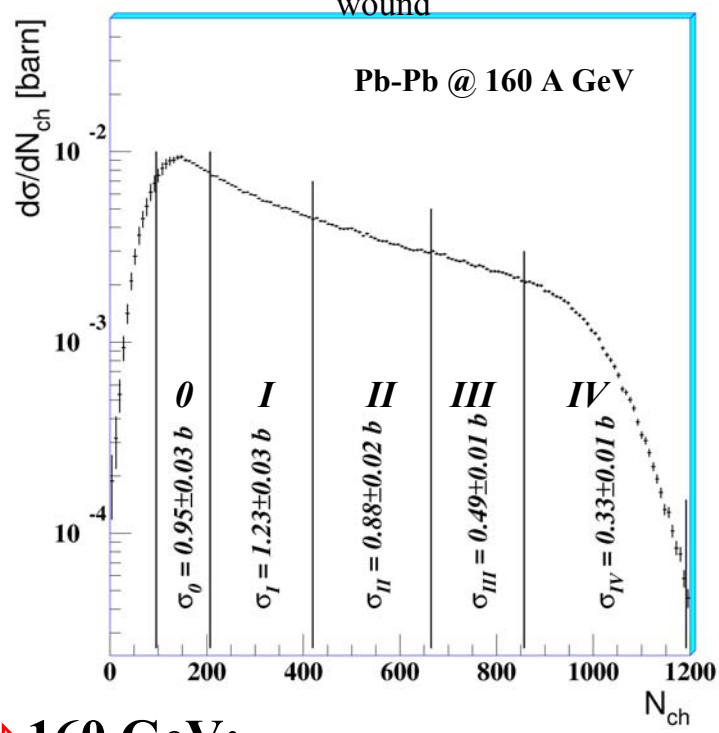
Energy: 160 A GeV/c. Systems: Pb-Pb – 60% of σ_{in} , $N_{wound} > 50$

Energy: 40 A GeV/c. Systems: p-Be; Pb-Pb



Collisions centrality

- Centrality selection \rightarrow charged part. multiplicity (MSD)
- N_{wound} from cross sections for each class (Glauber model)



↪ 160 GeV:

56 % most central collisions in 5 bins
(from 0 to IV)

Most peripheral bin: $\langle N_{\text{wound}} \rangle = 62 \pm 4$

↪ 40 GeV:

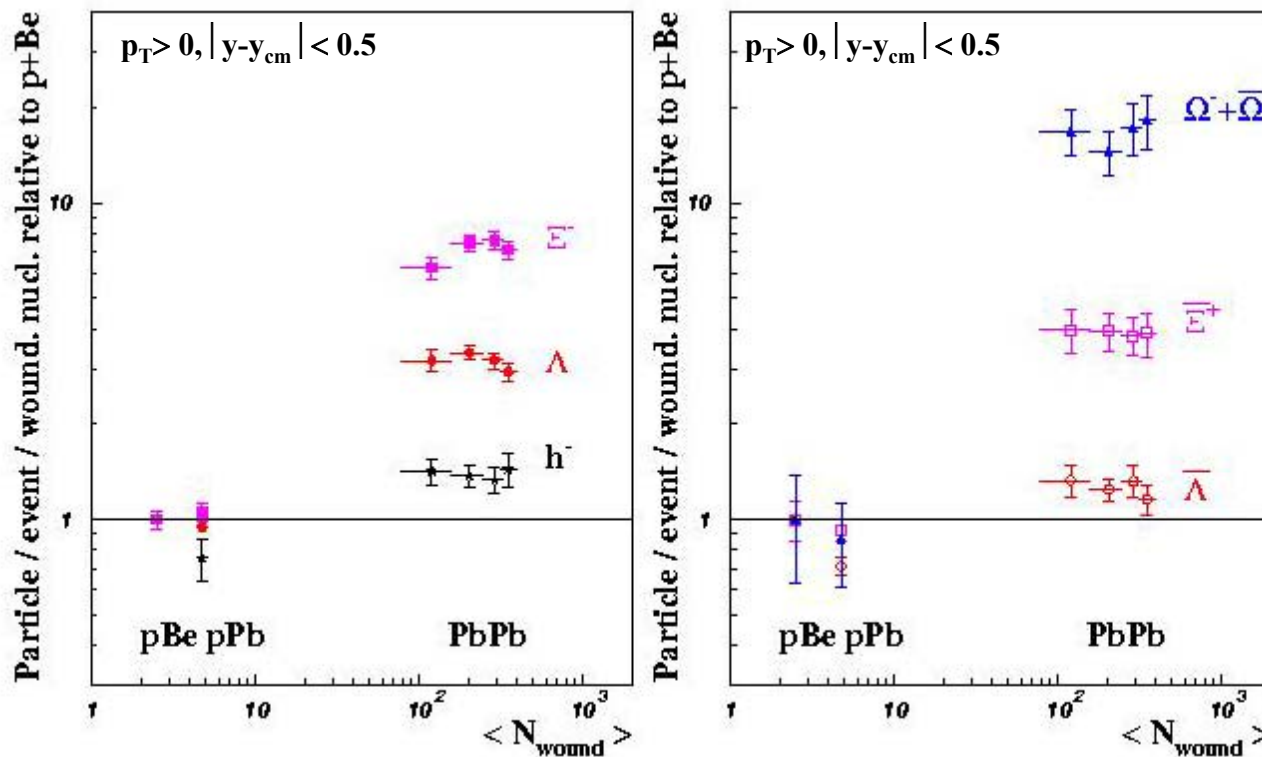
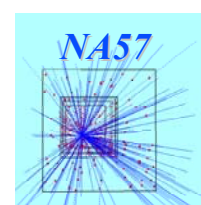
≈ 25% most central events

(corresponding to bins II+III+IV @160 GeV)

$\langle N_{\text{wound}} \rangle = 262 \pm 17$



Centrality dependence: WA97 @160 A GeV/c

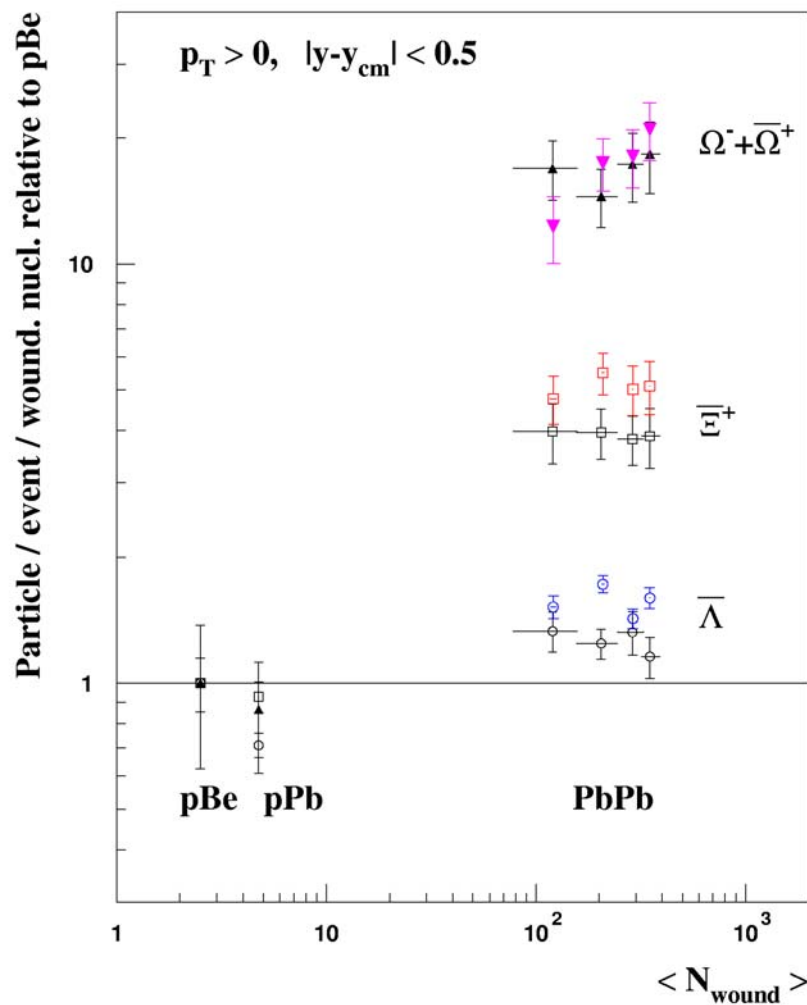
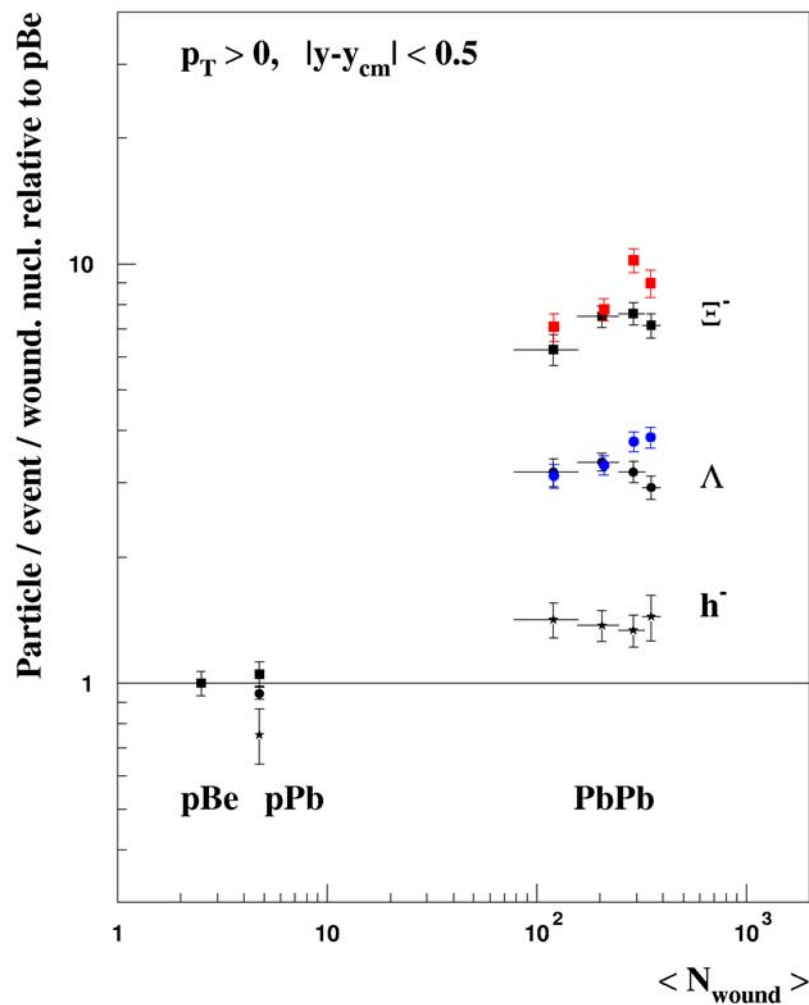
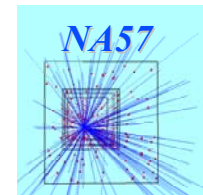


Hierarchy of enhancements

$$En(\Omega) > En(\Xi) > En(\Lambda)$$

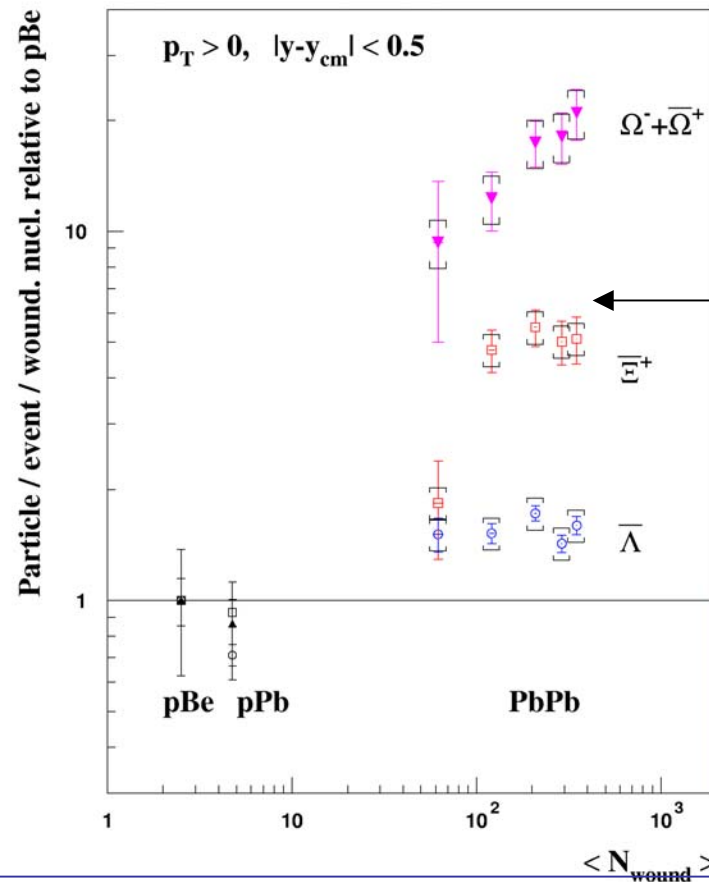
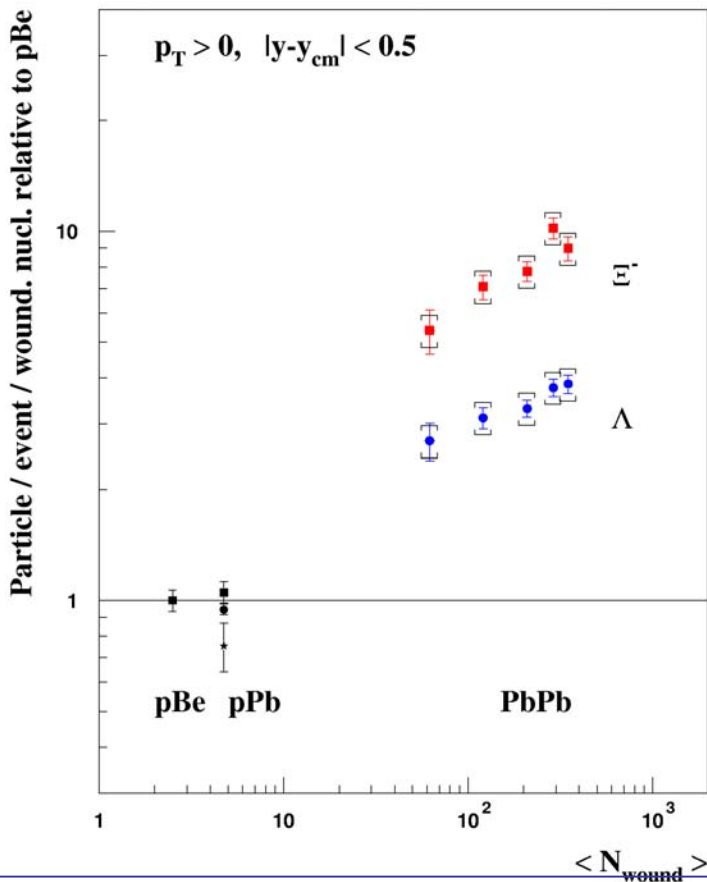
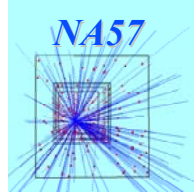
up to ≈ 15 times for Ω from p-Be to Pb-Pb

NA57 hyperon yields vs WA97 (160 A GeV/c)



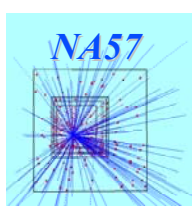
NA57 confirms the enhancements observed by WA97 (black symbols)

Centrality dependence: NA57@160 A GeV/c



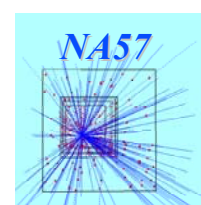
black bars –
systematic errors

- ↪ All particle yields per participant, but Ξ^+ , decrease with centrality (power law?)
- ↪ Significant change of Ξ^+ behaviour in the most peripheral bin: yield rises from $\langle N_{\text{wound}} \rangle = 62$ to $\langle N_{\text{wound}} \rangle = 121$ by a factor 2.6 (3.5σ effect)

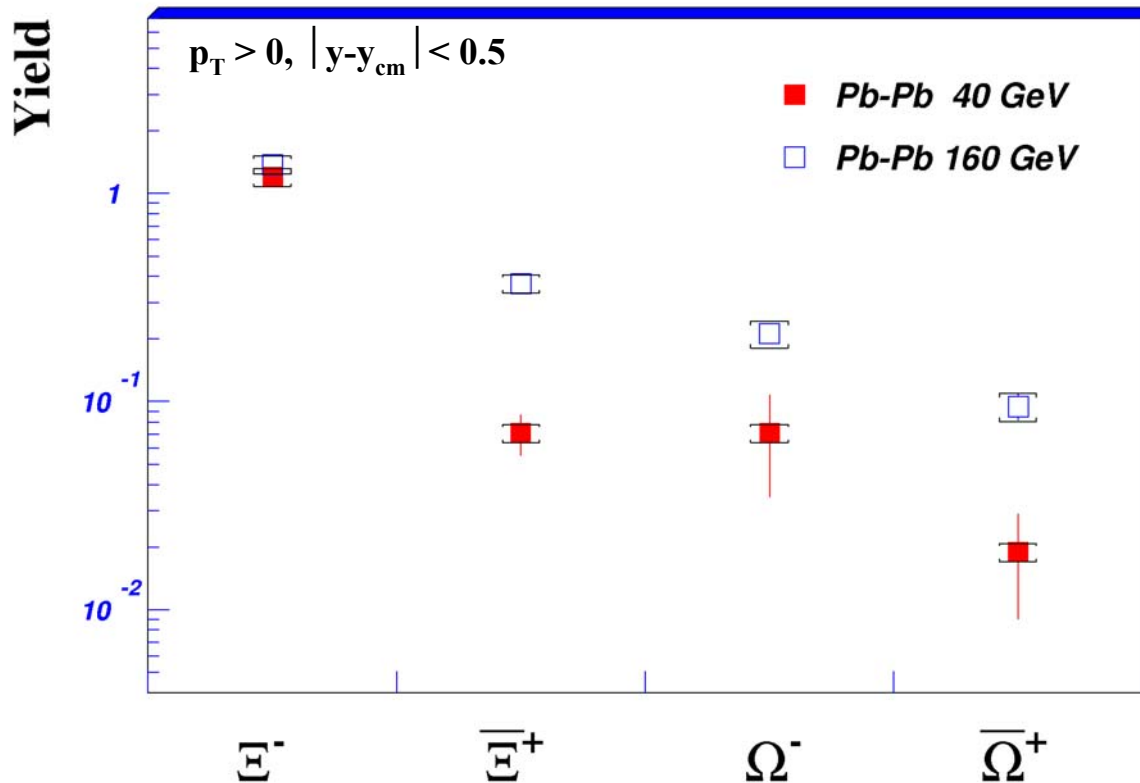


Energy dependence of the yields

- Ξ and Ω yields at 40 and 160 GeV/c (NA57)
- Ξ and Ω yields from SPS to RHIC



Ξ and Ω yields @ 40 and 160 GeV/c



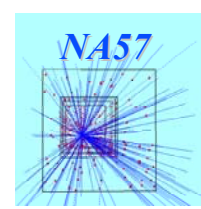
Energy dependence
in the $\approx 25\%$ most
central σ_{in}
for both energies

Black bars systematic errors

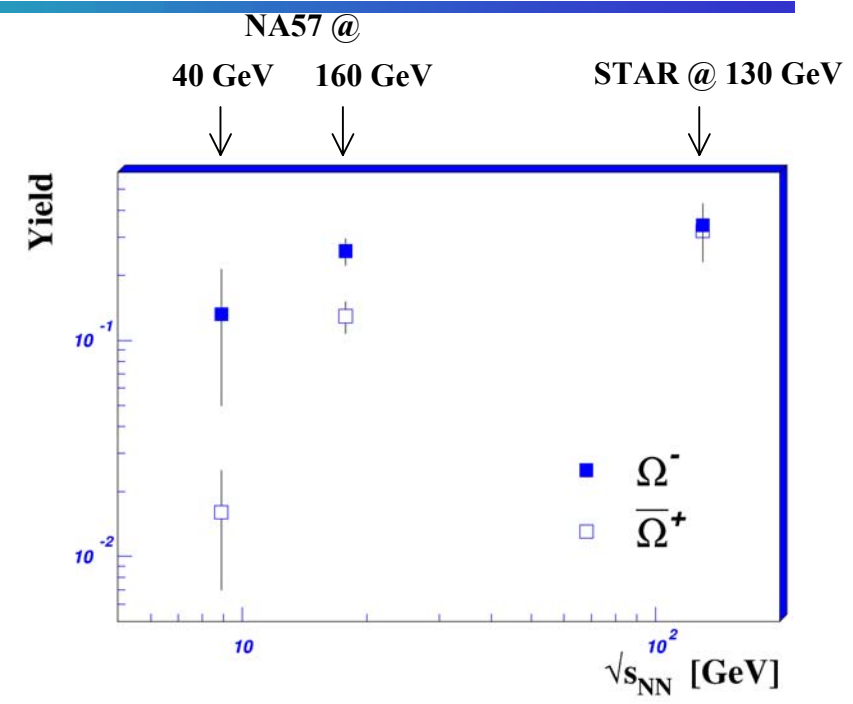
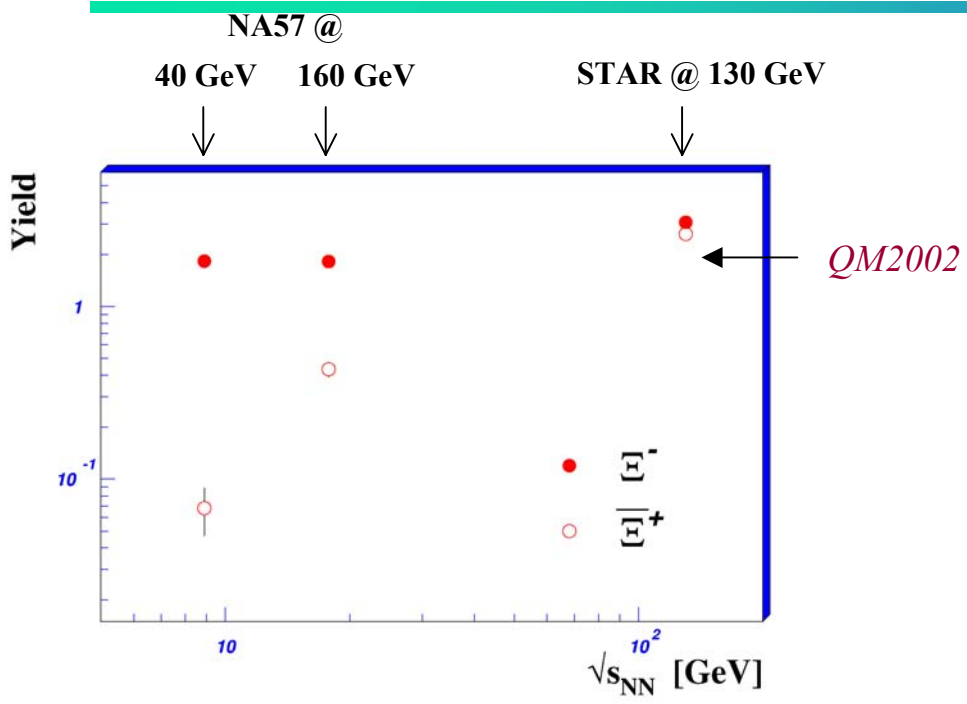
■ from 160 GeV to 40 GeV:

Ξ^- about the same, Ω^- down by a factor 3, Ξ^+ and Ω^+ down by a factor 5

↪ Larger baryon density



Ξ and Ω yields from SPS to RHIC



STAR results from:

- J. Castillo in SQM2001 for Λ and Ξ
- B. Hippolyte, PhD thesis, Universite de Strasbourg, for Ω

Most central events:
 $\approx 12\%$ for NA57 (bins III+IV)
 $\approx 14\%$ for STAR

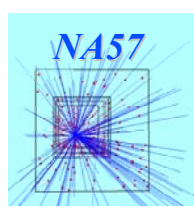
■ from NA57 to STAR energy:

both Ξ^- and Ω^- yields increase slower than their anti-particles

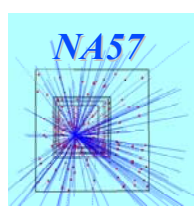
↪ at RHIC energy about same production rate for hyperon and anti-hyperon



Conclusions



- Enhancements:
 - NA57 confirms the enhancement observed by WA97 for Λ , Ξ and Ω and their antiparticles at 160 A GeV/c.
 - Hierarchy of enhancements $En(\Omega) > En(\Xi) > En(\Lambda)$ up to ≈ 15 times for Ω from p-Be to Pb-Pb.
- Yields per participant decrease with centrality (power law?) in Pb-Pb @ 160 A GeV/c.
- Ξ and Ω yields indicates a larger baryon density @ 40 w.r.t. 160 GeV/c.



Outlook

■ Pb-Pb @ 160 A GeV/c:

- Increase statistics for Ξ^- and Ξ^+ by a factor ≈ 2 (2000 data set).
- Negatives.

■ Pb-Pb @ 40 A GeV/c:

- Λ and $\bar{\Lambda}$ yields.
- Negatives.

■ p-Be @ 40 A GeV/c:

- Λ , $\bar{\Lambda}$ and Ξ^- (Ξ^+ ?) yields.
- Negatives.



Enhancements in Pb-Pb relative to p-Be @ 40 GeV/c.