K_S^0 production in p+p interactions measured by NA61/SHINE

for the NA61/SHINE

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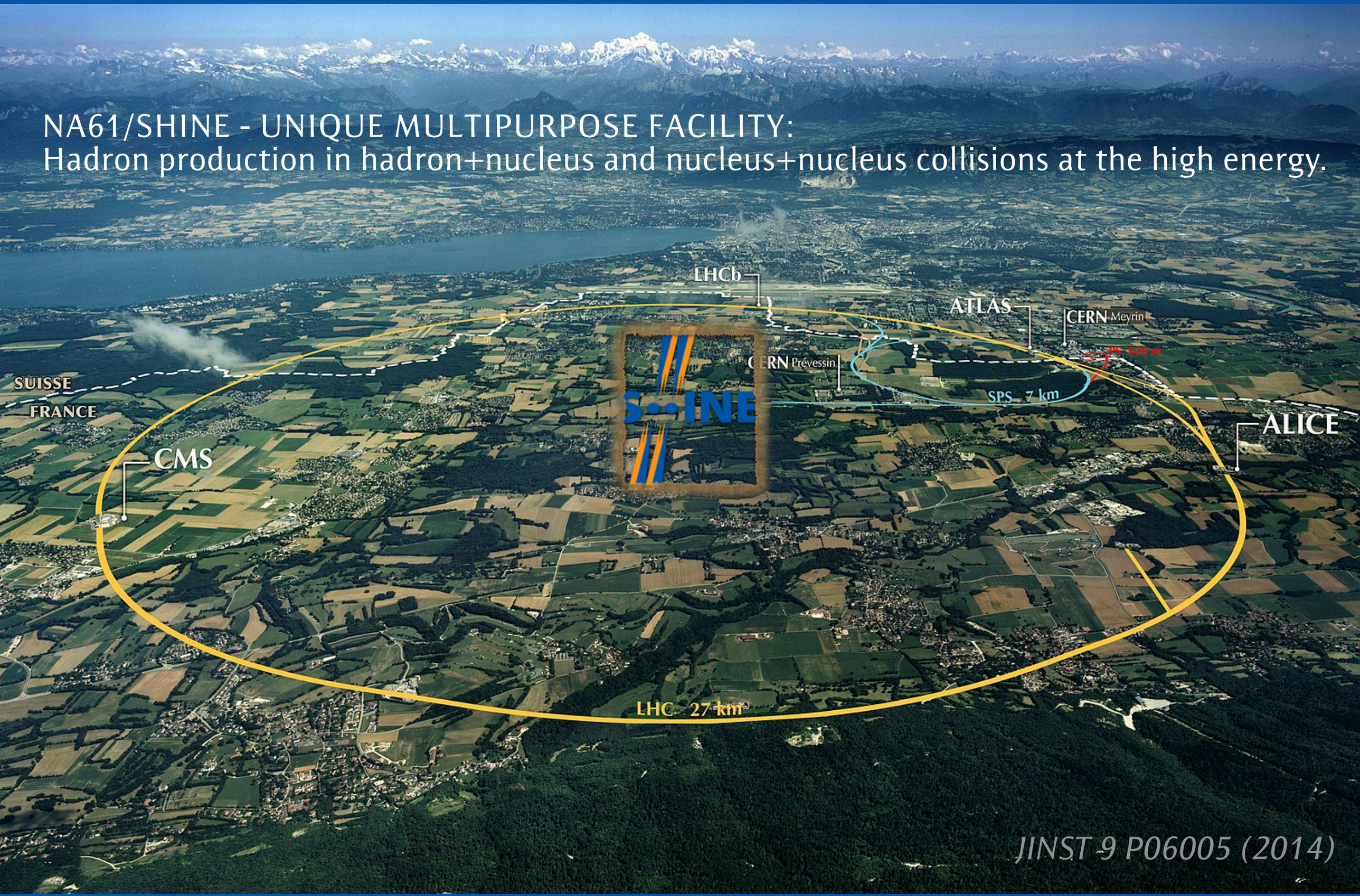
NA61/SHINE at CERN SPS

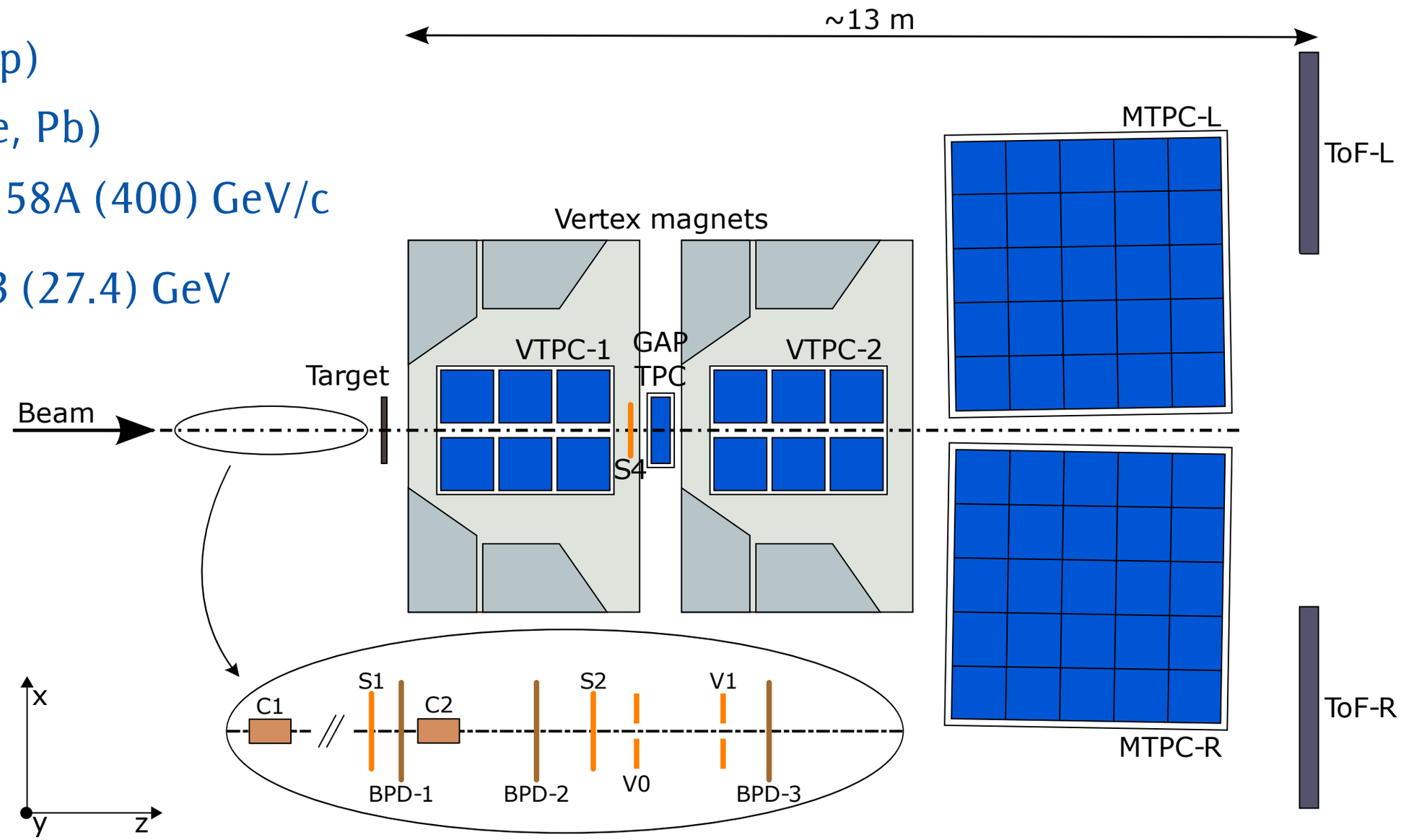
NA61/SHINE - UNIQUE MULTIPURPOSE FACILITY:
Hadron production in hadron+nucleus and nucleus+nucleus collisions at the high energy.



JINST 9 P06005 (2014)

Layout of the NA61/SHINE experimental setup

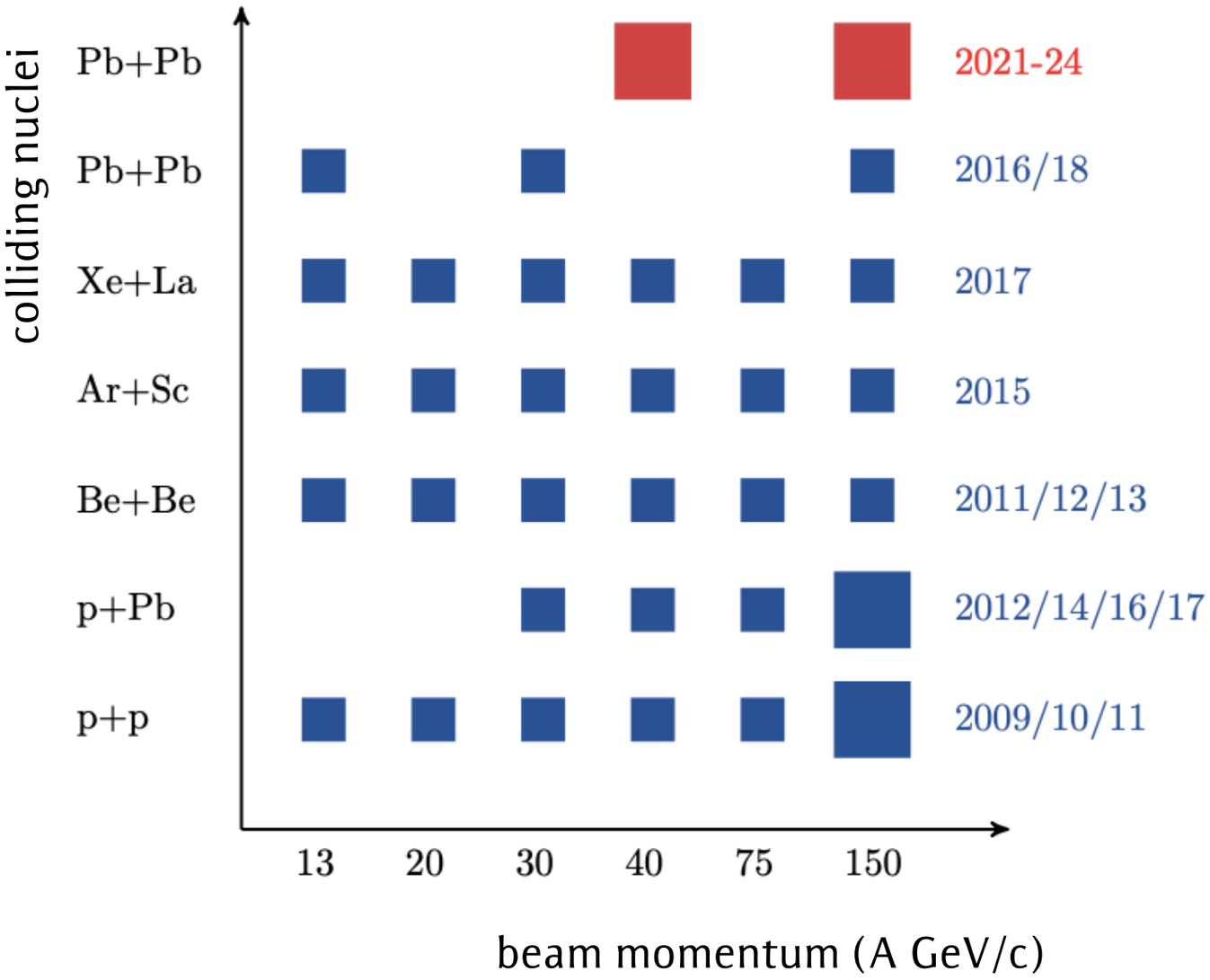
- **Beams**
  - hadrons (π, K, p)
  - ions (Be, Ar, Xe, Pb)
  - p_{beam} = 13A - 158A (400) GeV/c
  - $\sqrt{s}$ = 5.1 - 17.3 (27.4) GeV



- **Large acceptance hadron spectrometer:**
  - coverage of the full forward hemisphere, down to $p_T = 0$
- **Tracking by large volume TPCs** (VTPC-1 and VTPC-2 inside magnetic field)
- **PID** by dEdx, TOF, decay topology, invariant mass

NA61/SHINE Physics program

Unique 2D scan in **beam momentum** and **system size**.



Measurements of hadron production properties for:

- Neutrino beams (J-Parc, Fnal)
- Cosmic ray exp. (PAO, AMS..)
- **Strong interactions** (nucleus - nucleus collisions):
  - **Study of onset of deconfinement** (particle spectra)
  - **Search for the critical point** (search for non-monotonic behaviour of CP signatures: fluctuations of multiplicity, p_T ...)

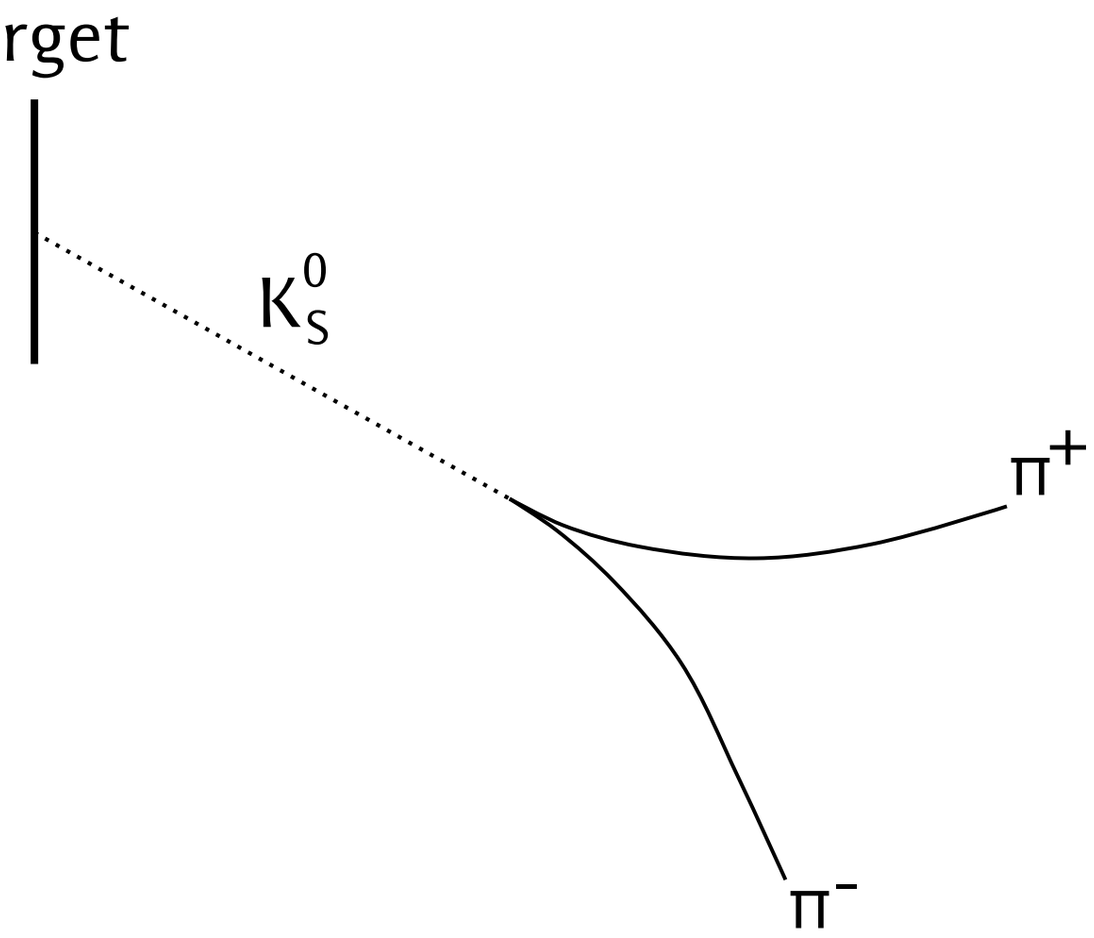
K_S^0 measurements

- **Final results** (p+p@158 GeV/c) and **preliminary results** (p+p@80 GeV/c) for K_S^0 meson production measured by NA61.

- A total of **58 million** (p+p@158 GeV/c) and **5 million** (p+p@80 GeV/c) events were analyzed.

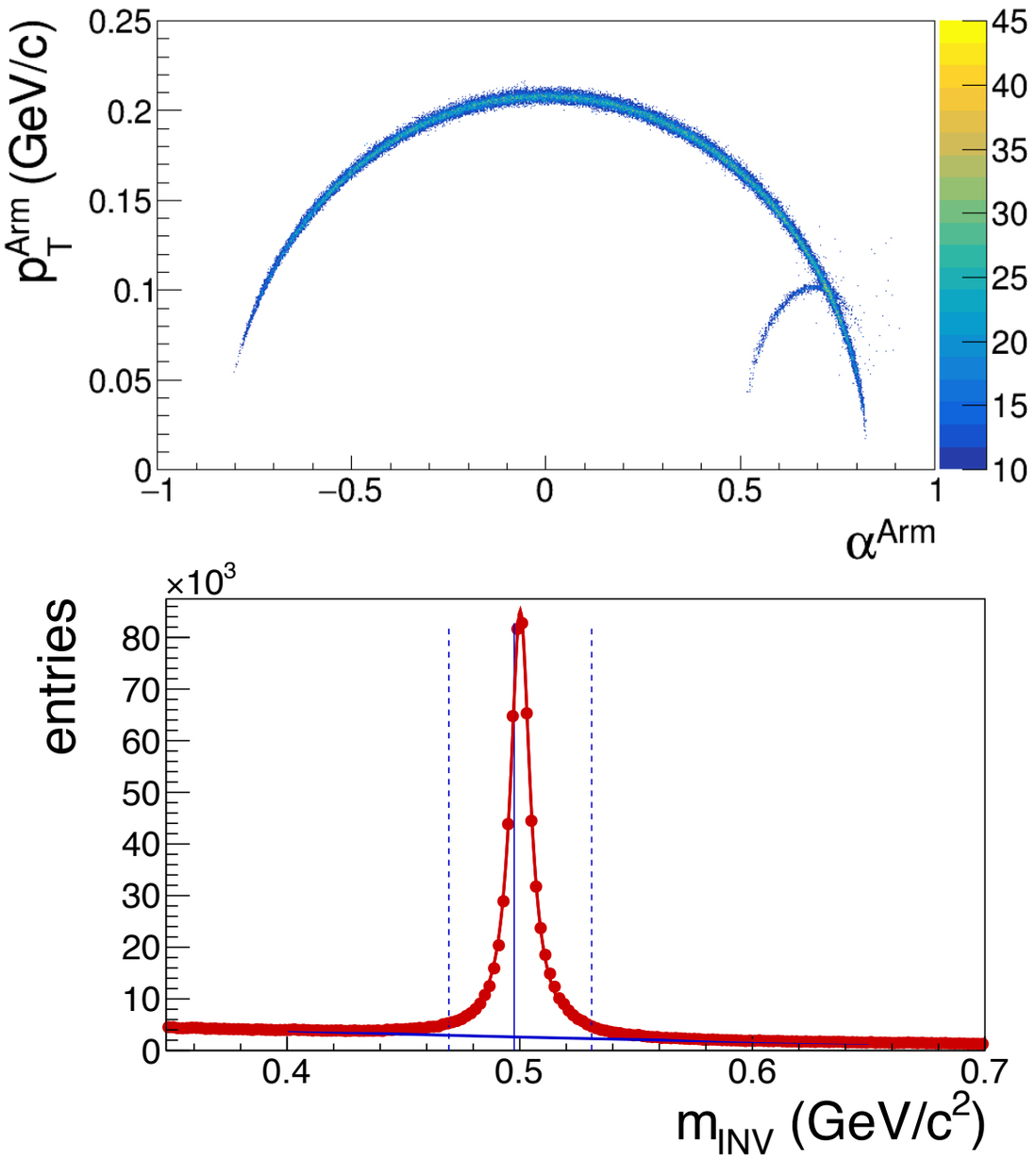
- K_S^0 mesons are identified by their decay topology ($\pi^+ + \pi^-$).

- Results are corrected for geometrical detector acceptance and reconstruction efficiency.

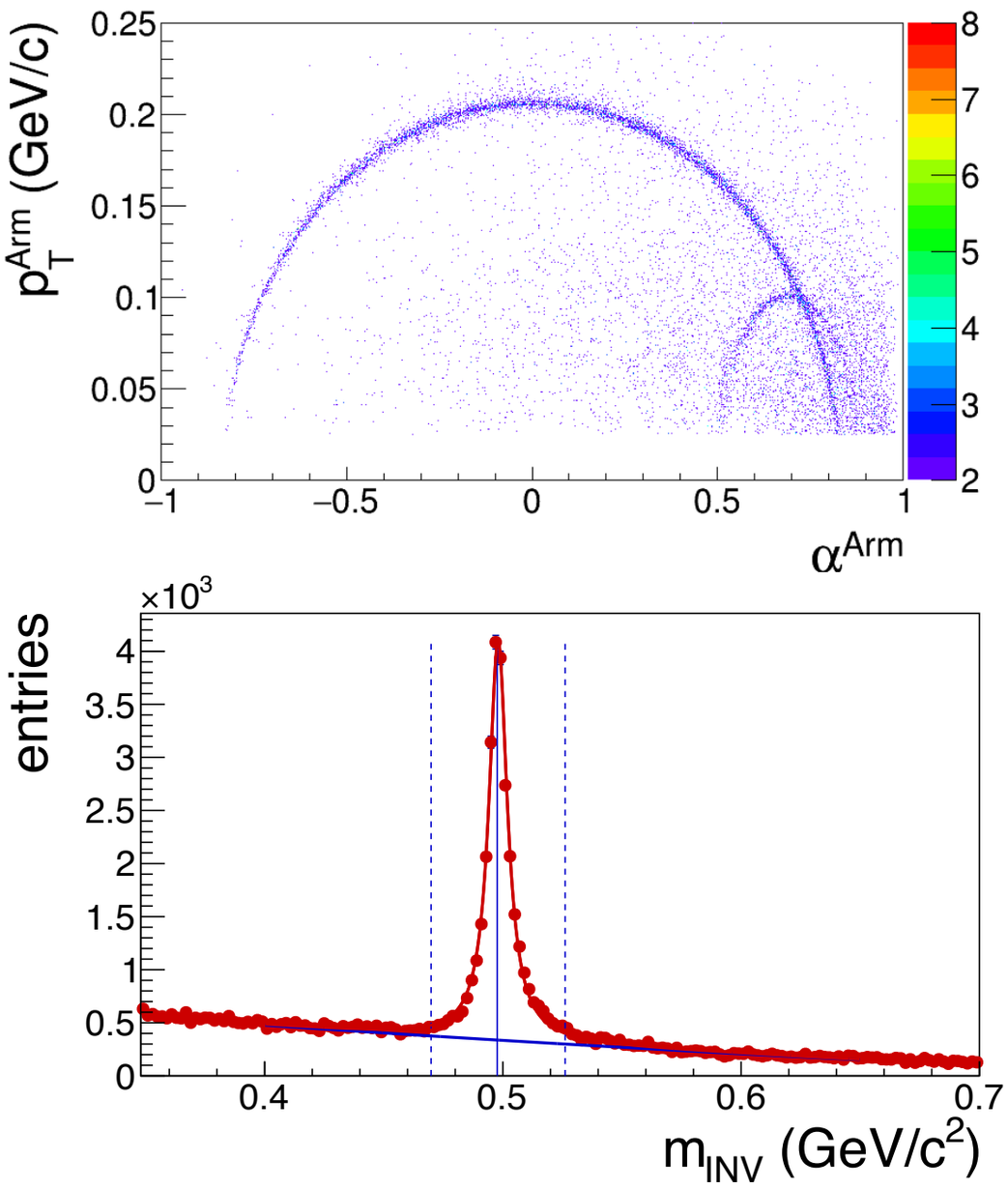


Signal purity

158 GeV/c



80 GeV/c



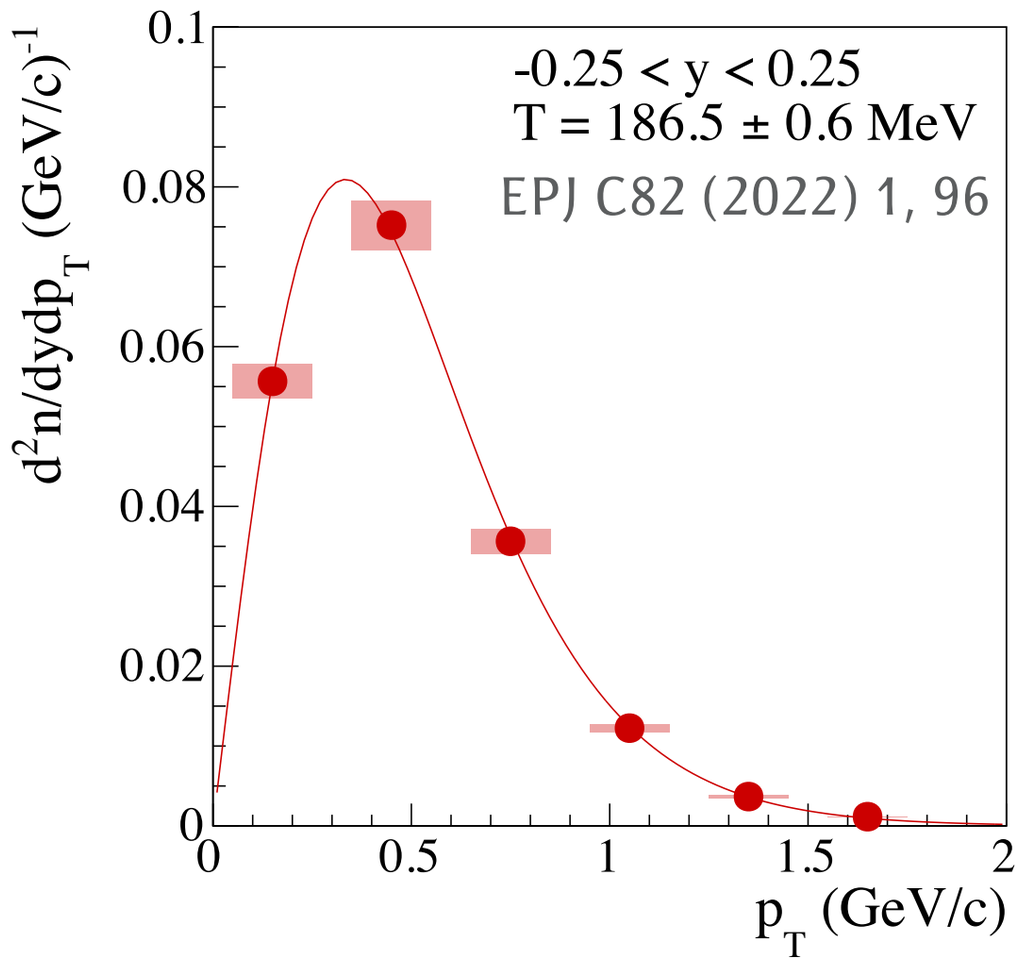
$S/\sqrt{B} = 2088$

$S/\sqrt{B} = 252$

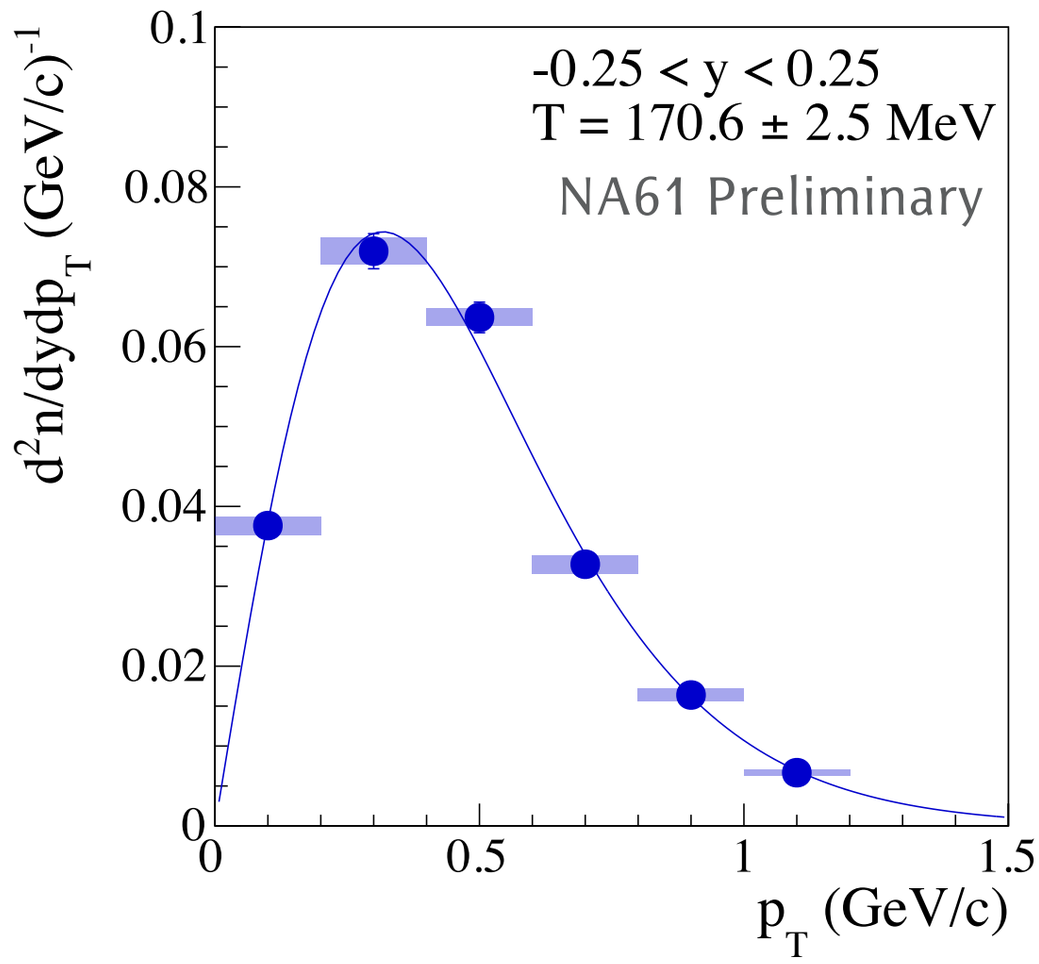
- **High purity of signal after applying all cuts.**

p_T at mid rapidity (y≈0)

158 GeV/c



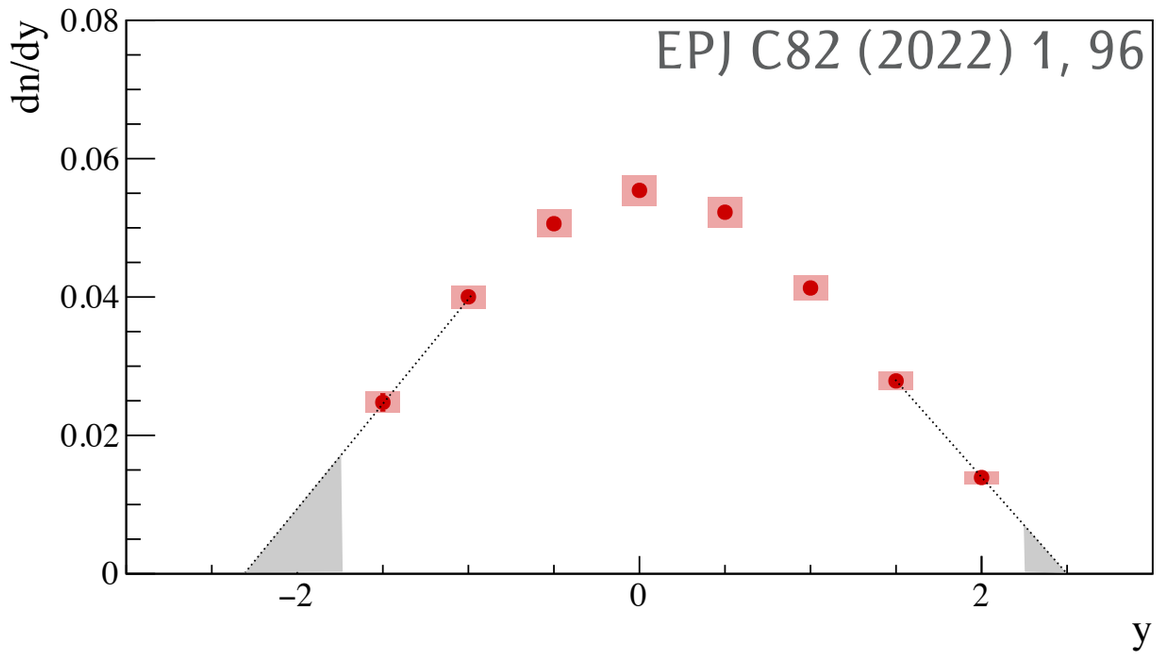
80 GeV/c



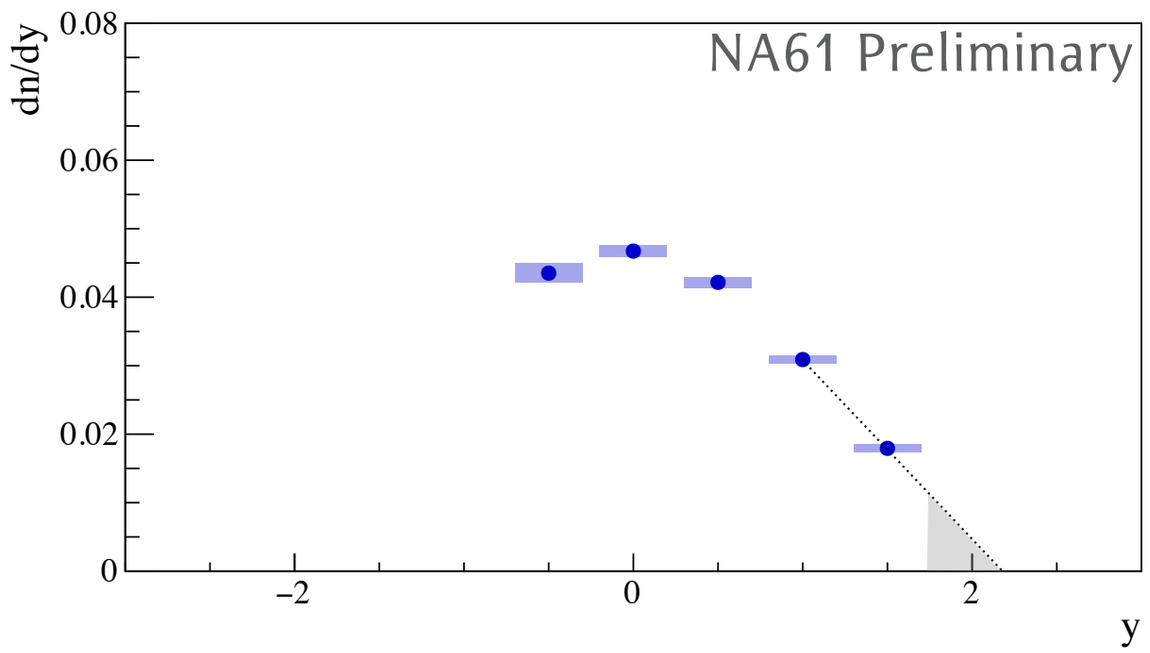
- **First measurement** of K_S^0 meson production in p+p interactions at 158 and 80 GeV/c.
- $d^2n/dydp_T$ spectra fitted with exponential function: $f = A \cdot p_T \cdot e^{-\frac{\sqrt{p_T^2 + m_{PDG}^2}}{T}}$.
- The systematic uncertainty is shown by a red/blue shaded box.

Rapidity distribution

158 GeV/c



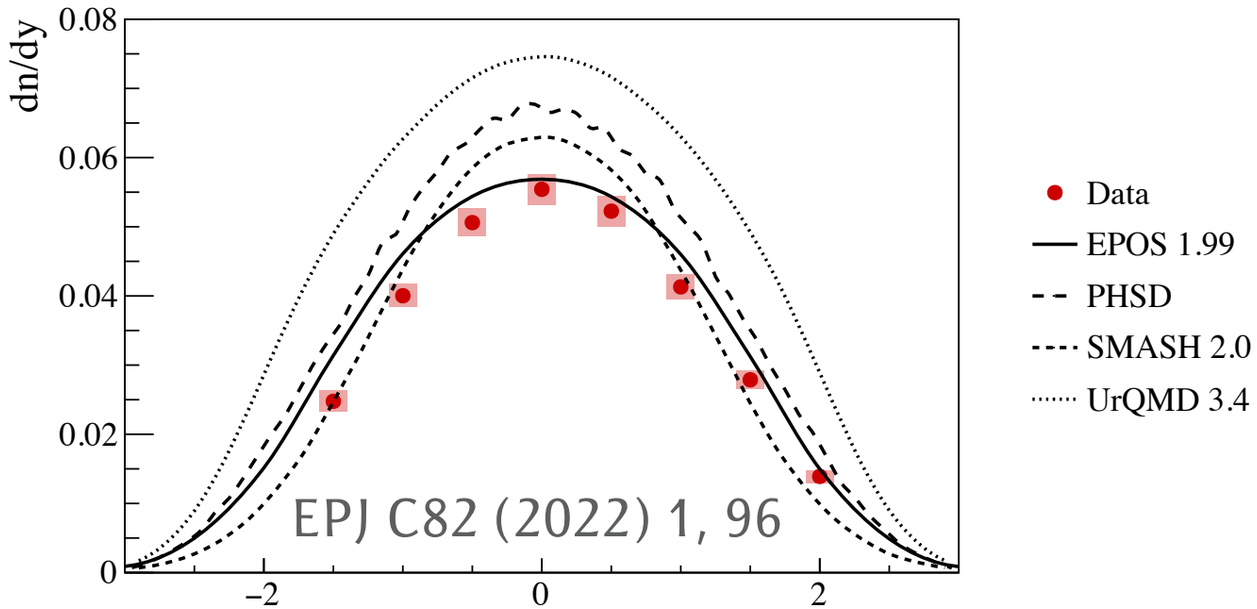
80 GeV/c



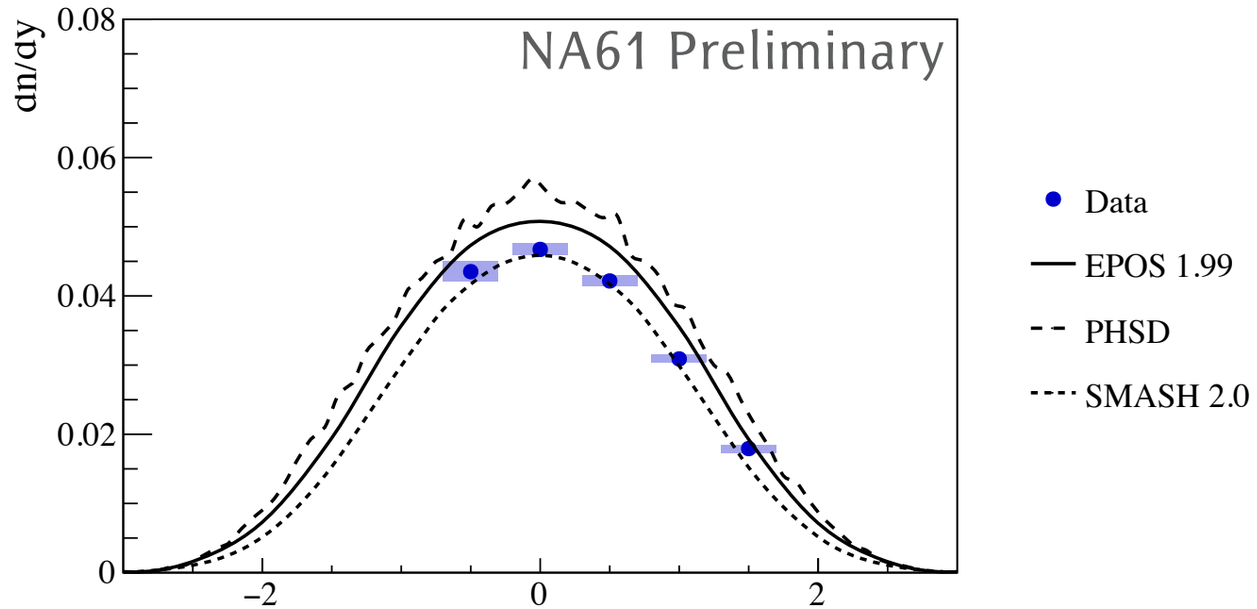
- Rapidity distribution obtained by p_T - integration.
- Large coverage in rapidity.
- The mean multiplicity of K_S^0 meson was calculated as the sum of measured points + extrapolated part (shaded triangles).
- Extrapolated part calculated from linear fit through the first and the last two measured points.

Rapidity distribution - models

158 GeV/c



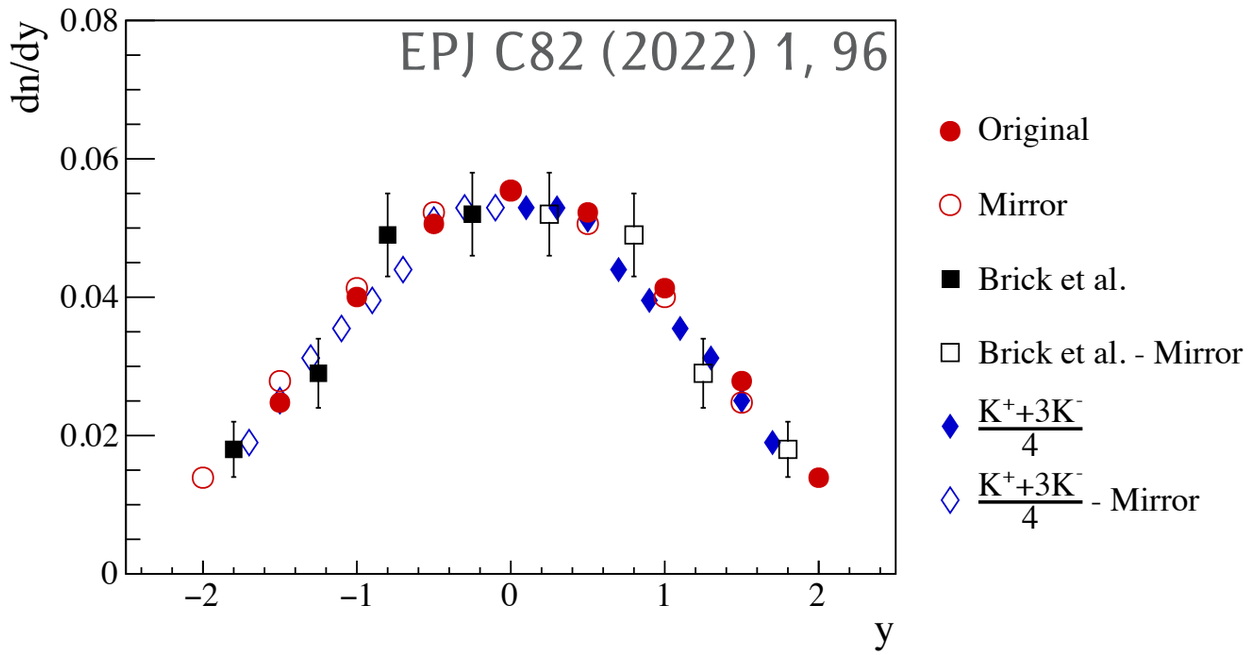
80 GeV/c



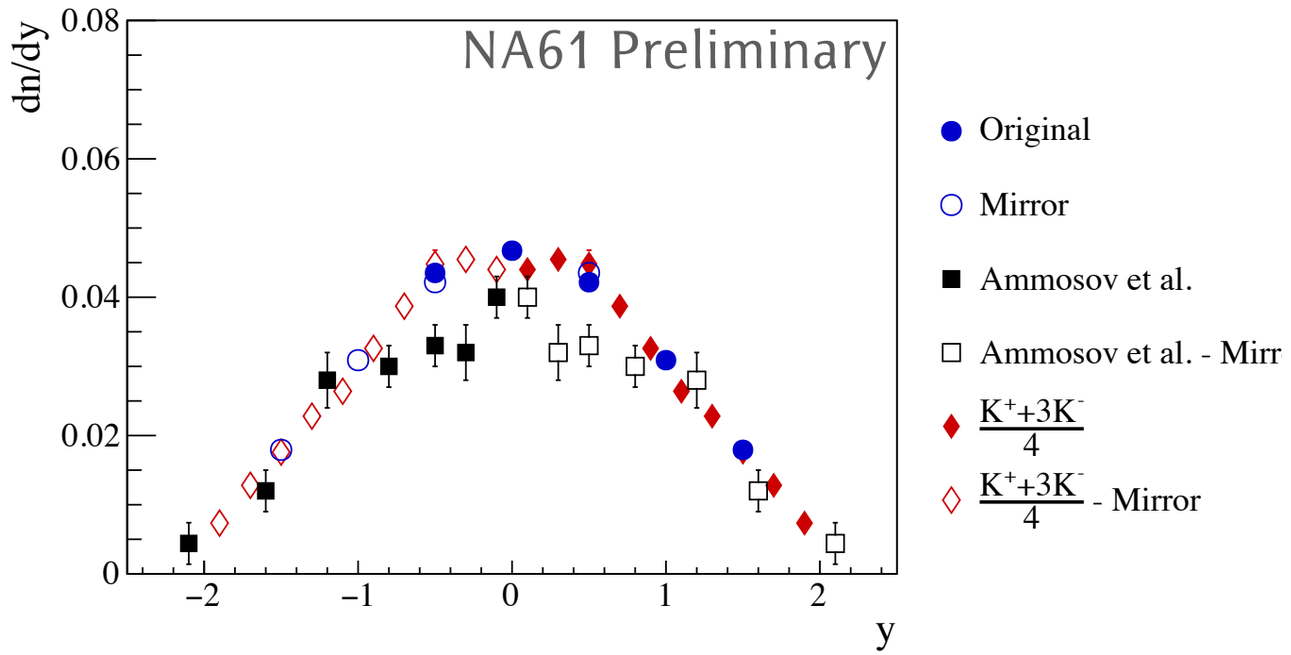
- Comparison of the results on the K_S^0 rapidity distribution with predictions of theoretical models.
- EPOS 1.99 (158 GeV/c) and SMASH 2.0 (80 GeV/c) describes the experimental data fairly well.
- The shape of the rapidity distribution is also reproduced by the PHSD (158 GeV/c) and EPOS and PHSD (80 GeV/c) models.

Rapidity distribution - comparisons

158 GeV/c

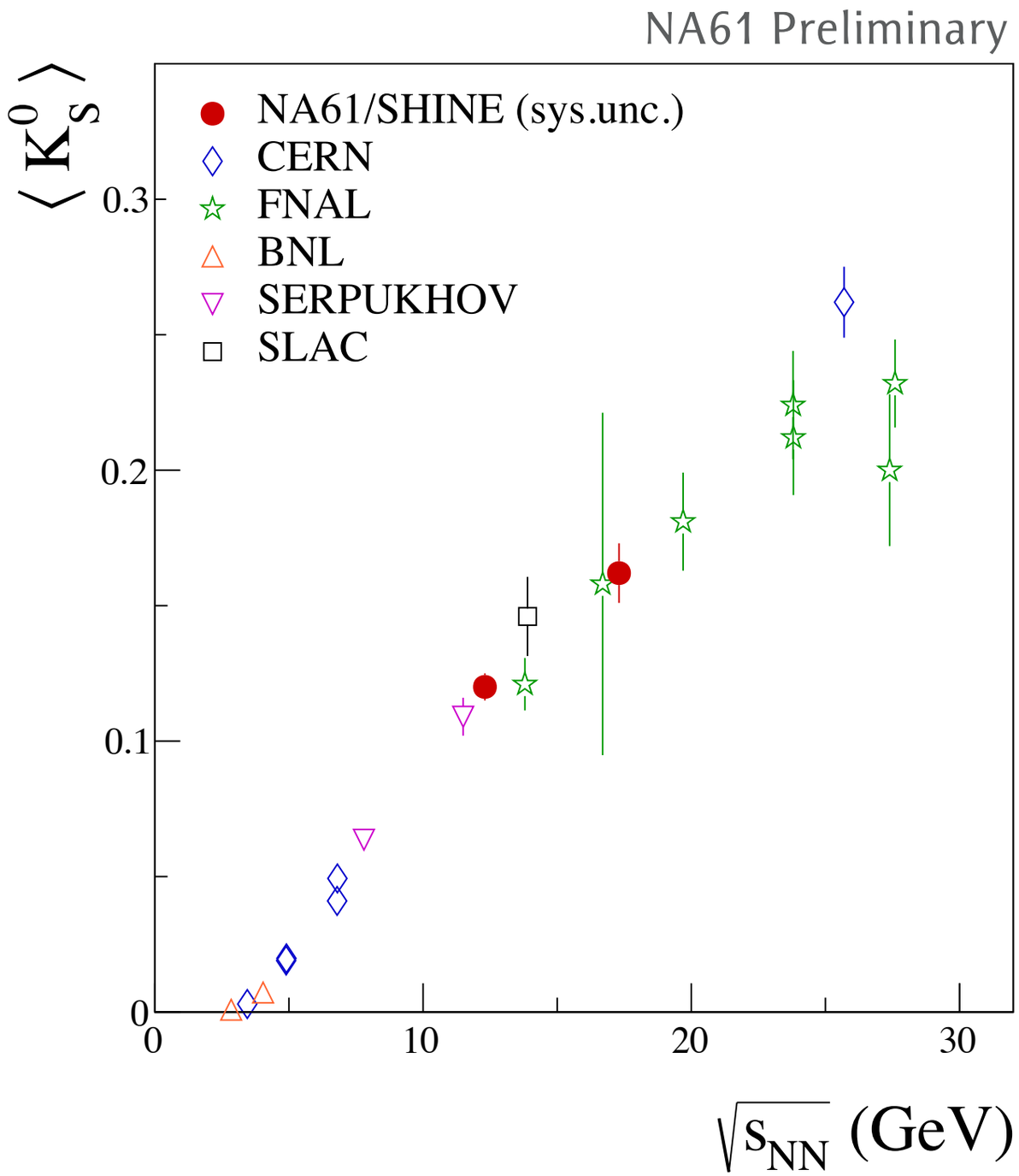


80 GeV/c



- The K_S^0 rapidity spectrum from NA61 is compared to the results from Brick et al. at 147 GeV/c (left), Ammosov et al. at 69 GeV/c (right), as well as with predictions obtained from K^+ and K^- yields published by NA61.
- The rapidity distributions are in agreement with results from other experiments at nearby beam momentum.

Total multiplicity



- Collision energy dependence of mean multiplicity of K^0_S mesons produced in p+p interactions.
- The measured values are seen to rise linearly with collision energy $\sqrt{s_{NN}}$.
- The results of K^0_S meson production in p+p interactions obtained by NA61 follow the trend.

Summary

- **Final results** (158 GeV/c) and **preliminary results** (80 GeV/c) for K_S^0 meson production in inelastic p+p collisions presented.
- Good agreement with theoretical models (especially the shape of rapidity distribution).
- Good agreement with available world results.
- Analysis of K_S^0 meson production for lower beam momentum (31 and 40 GeV/c) in progress.

Thank you for your attention.