

Measurement of Transverse Λ Polarisation at COMPASS

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on behalf of the *COMPASS* collaboration



bmb+f - Förderschwerpunkt
COMPASS
Großgeräte der physikalischen
Grundlagenforschung



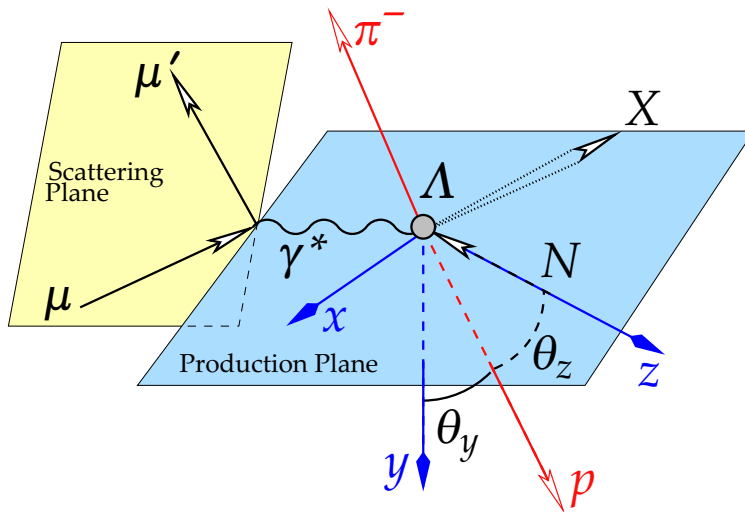
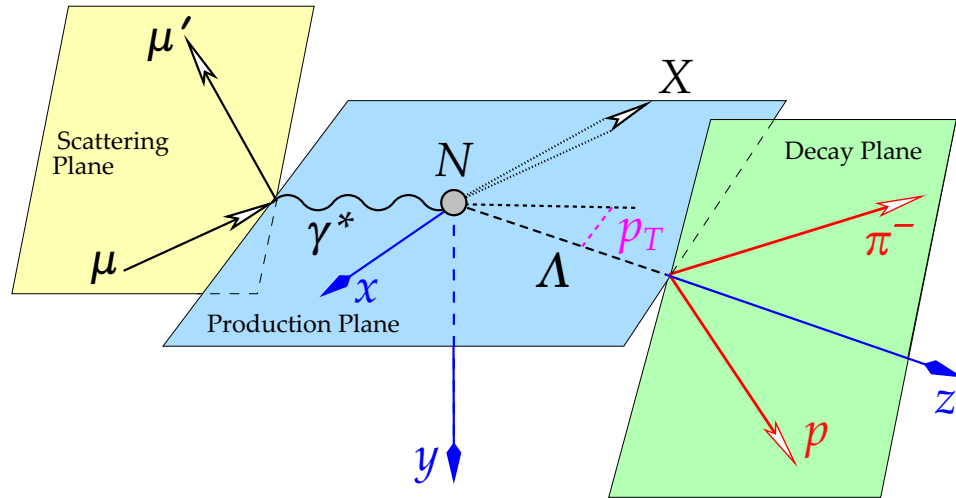
Overview

- The COMPASS Experiment
→ previous talks by Ch. Schill, Andrea, V. Alexakhin
- Λ Polarization in μN -Scattering
 - ▶ Kinematics
 - ▶ Aim of Measurement
 - ▶ Polarisation Extraction Method
- Results of Analysis of the 2002 Data
- Conclusion and Outlook



Kinematics for $\mu N \rightarrow \mu' \Lambda + X$

Laboratory
 $\vec{y} = \vec{\gamma}^* \times \vec{\Lambda}$



Λ rest system

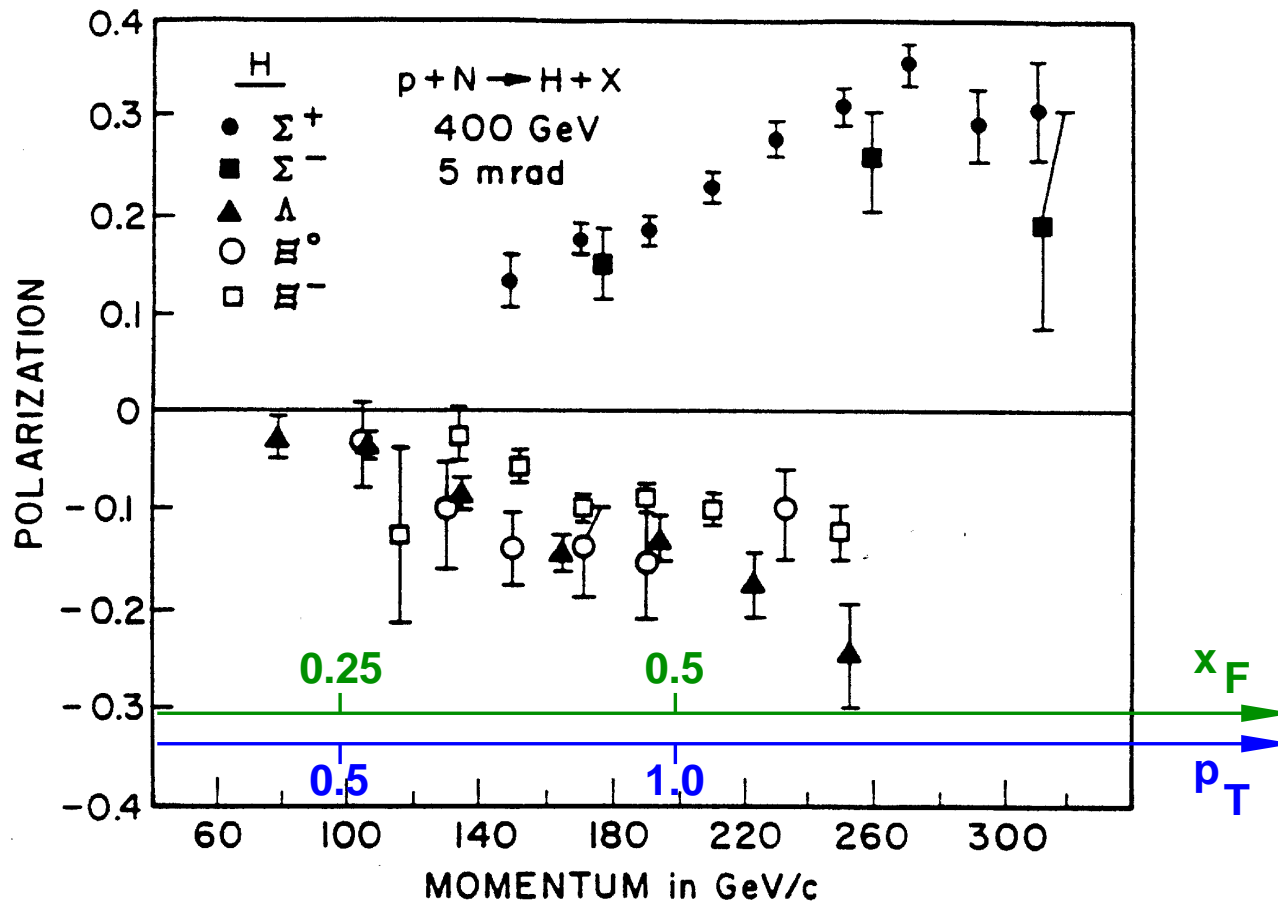


Experiments on Λ Polarisation

- longitudinal: spin transfer, double spin asymmetry
fragmentation/distribution functions q , Δq , D , ΔD
- transverse
 - ▶ polarised target: transversity h_1
 - ▶ **Spontaneous** polarisation in unpolarised collisions
(known in **Hadro**production, seen also in Neutrino-
and Electroproduction)
polarising fragmentation functions



Polarisation in Hadroproduction

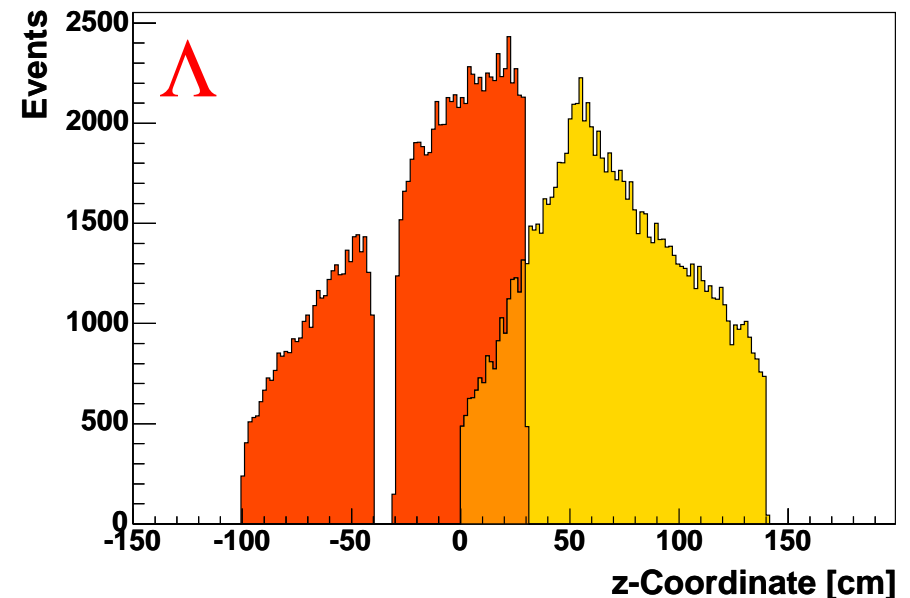


Data (mainly)
from FermiLab
since 1975

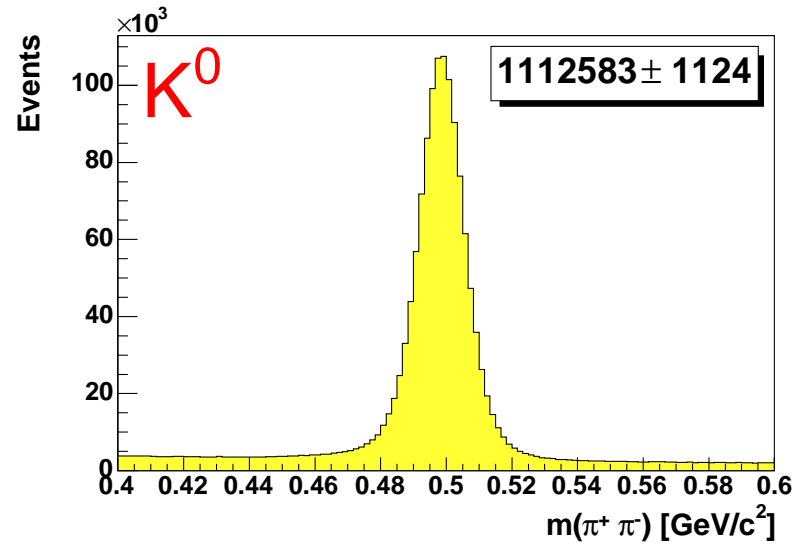
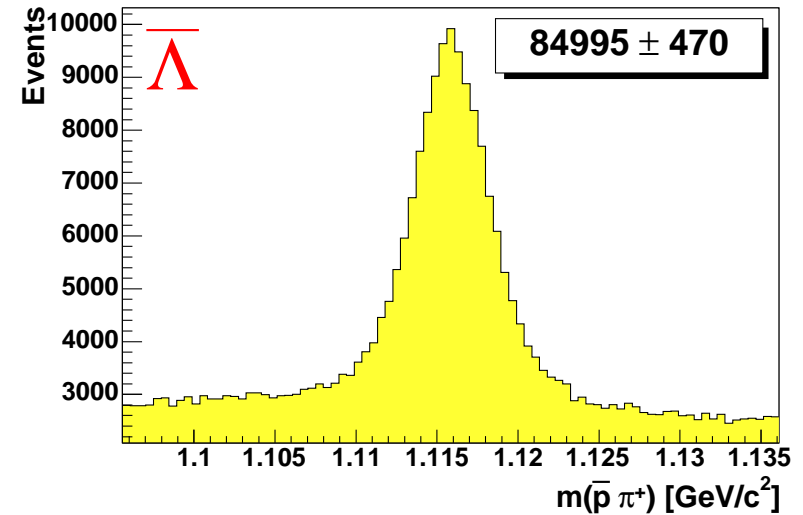
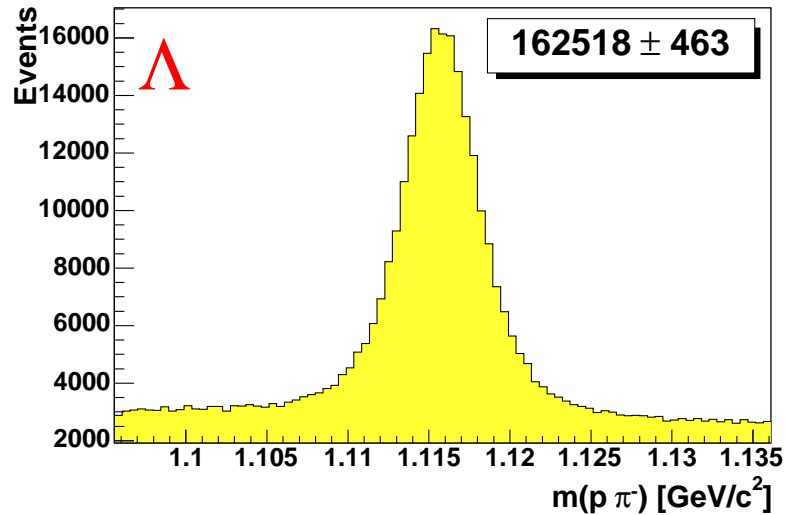


Event Selection

- All 2002 data, longitudinal target polarisation, **no Q^2 cut**
- **Primary interaction point μ, μ'**
- **Decay vertex $\Lambda^0 \rightarrow p\pi^-$**
- Λ flight path > 20 cm
- Collinearity (prompt production)
 $\angle(\vec{p}_{V^0}, \vec{\delta}_{PD}) < 15$ mrad
- $p_T > 100$ MeV/c (definition of \vec{y})
- Rejection of e^+e^- -pairs: $-0.70 < \cos \theta_z < 0.80$



Λ , $\bar{\Lambda}$, K_S Samples



Extraction Method for Polarisation

- detector effects may fake polarization
- 2 subsamples: Λ momentum U p- and D Down-going:

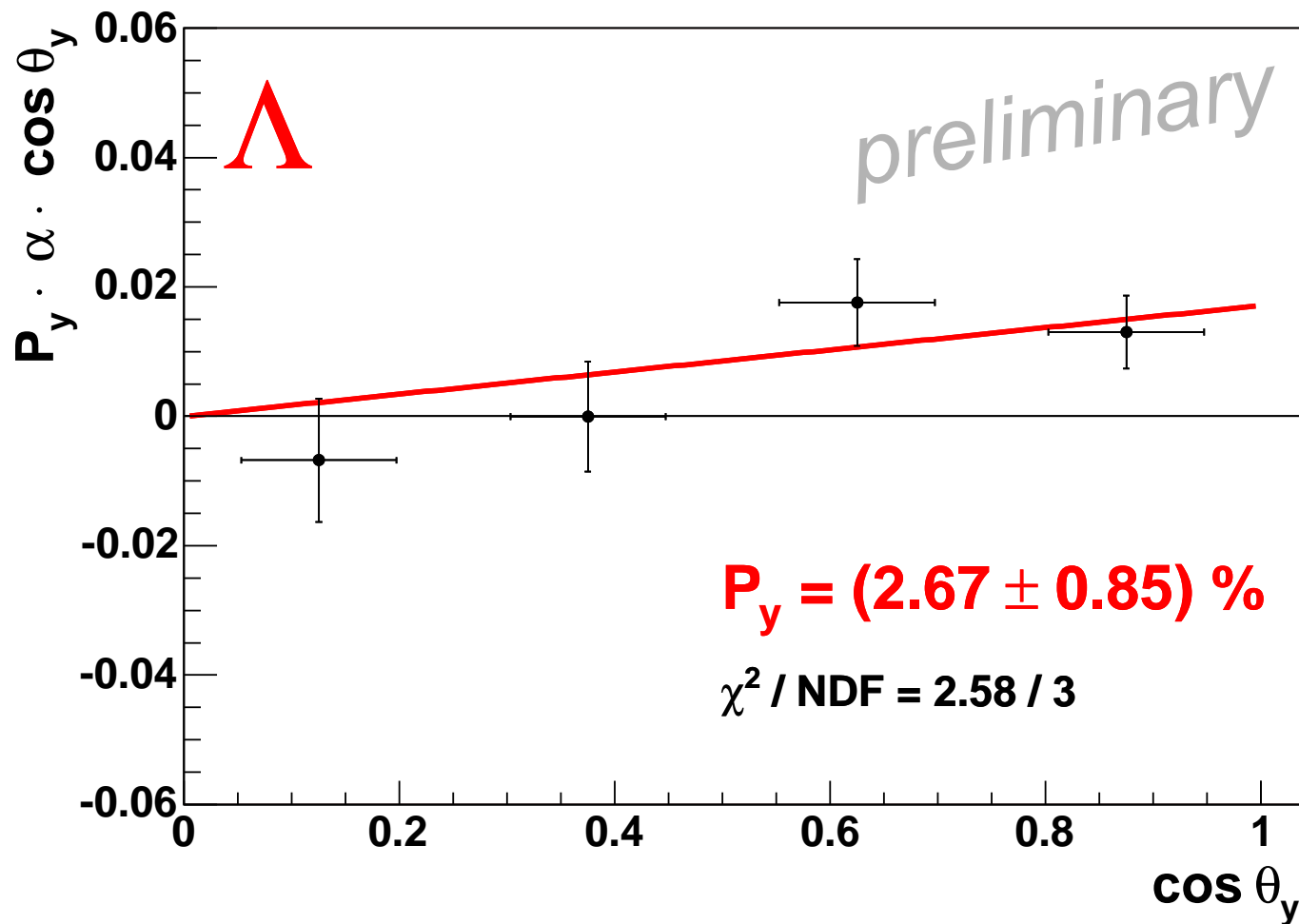
$$(U, D)_{\pm} = \frac{dN_{U,D}}{d\cos\theta} = A_{U,D}(\cos\theta)(1 \pm \alpha P_y \cos\theta)$$

- where $A_U(+\cos\theta) = A_D(-\cos\theta)$ (midplane symmetry)

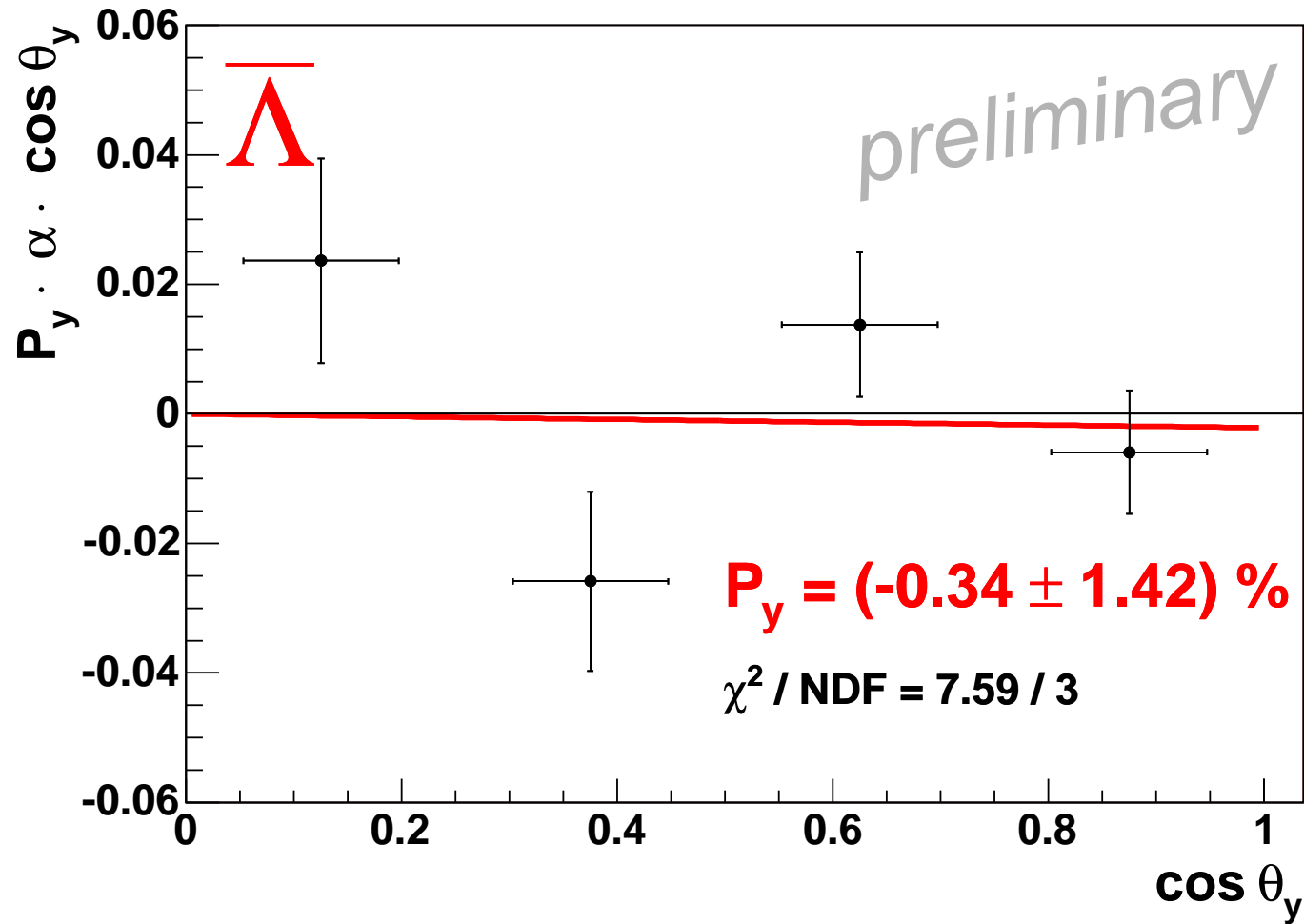
$$\begin{aligned}\rightarrow R &= \frac{\sqrt{U_+ D_+} - \sqrt{U_- D_-}}{\sqrt{U_+ D_+} + \sqrt{U_- D_-}} \\ &= \alpha P_y \cos\theta \quad (\text{acceptance-corrected})\end{aligned}$$



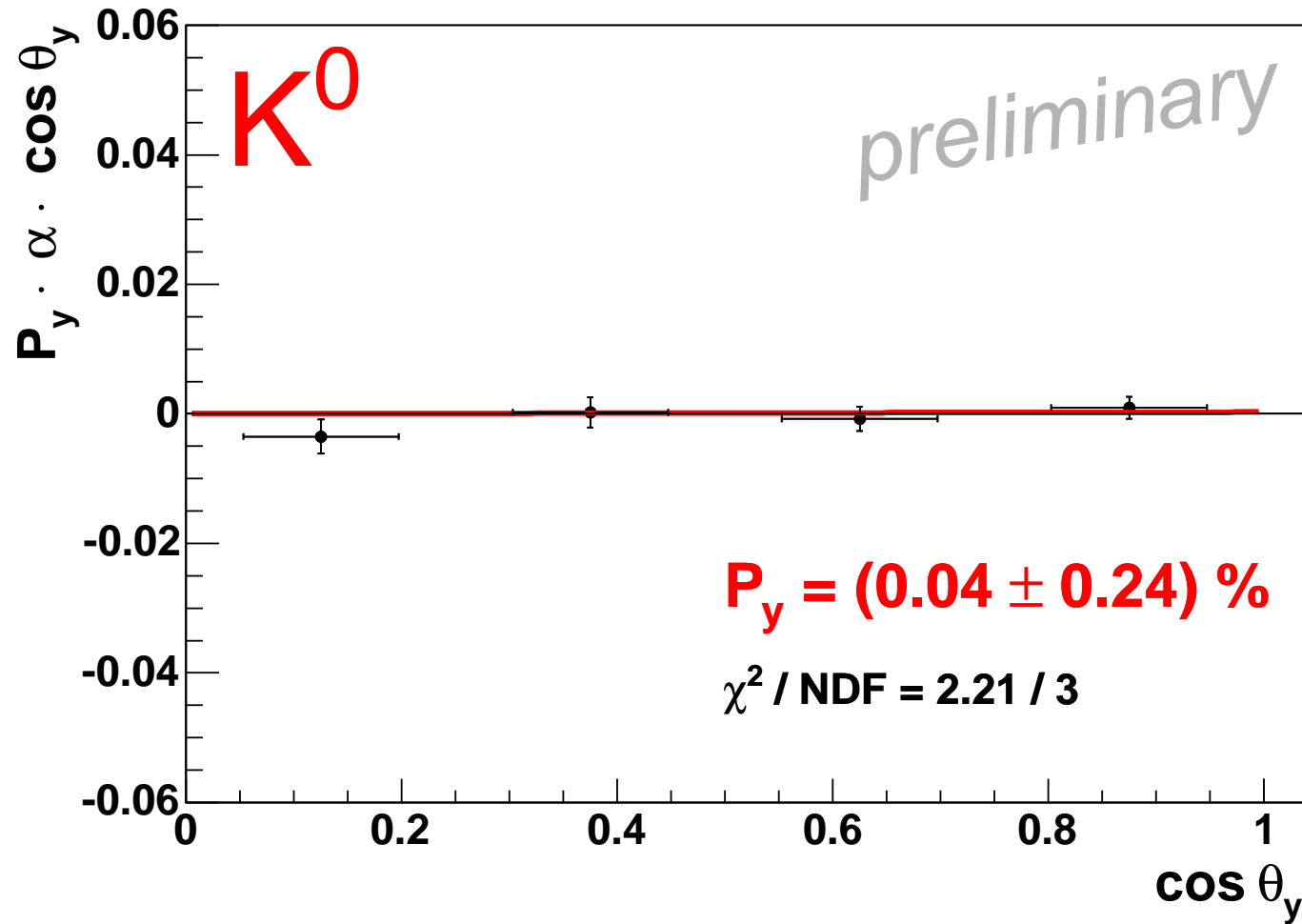
Result on Λ Polarisation



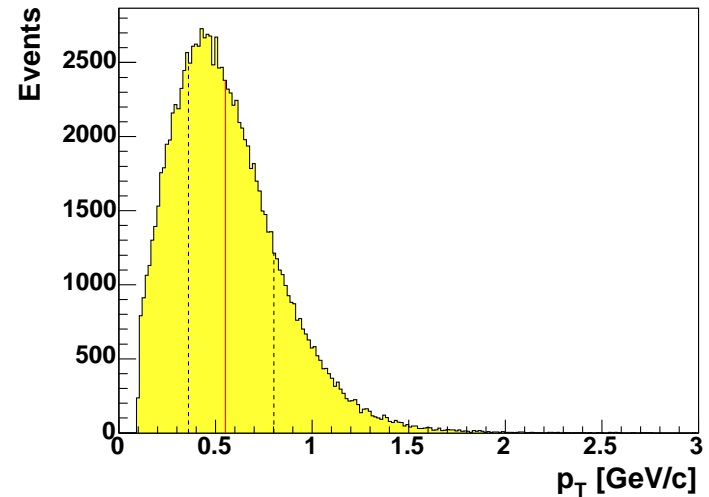
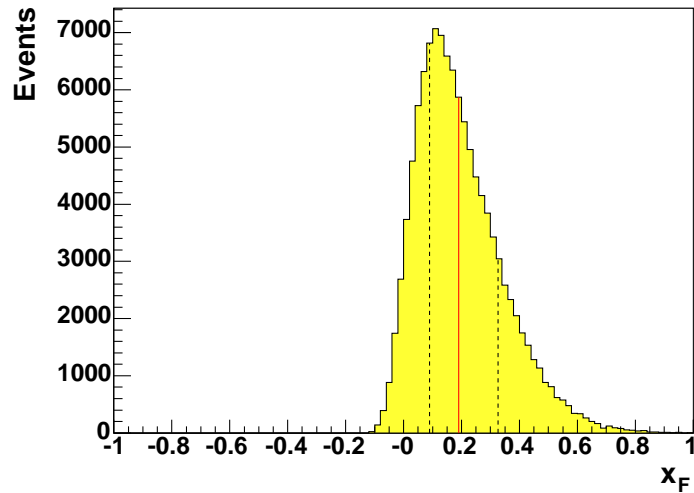
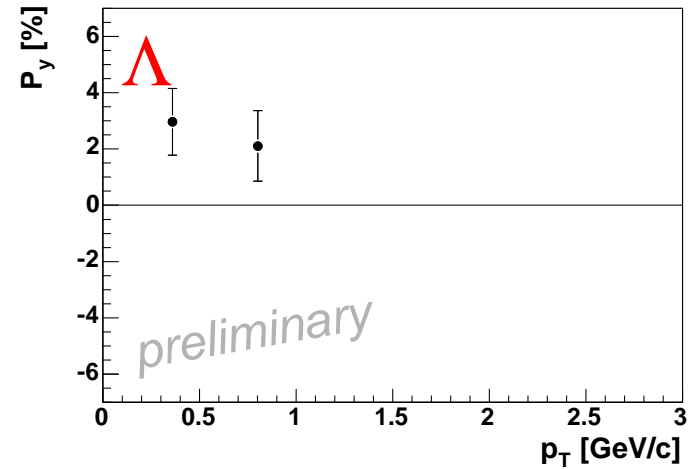
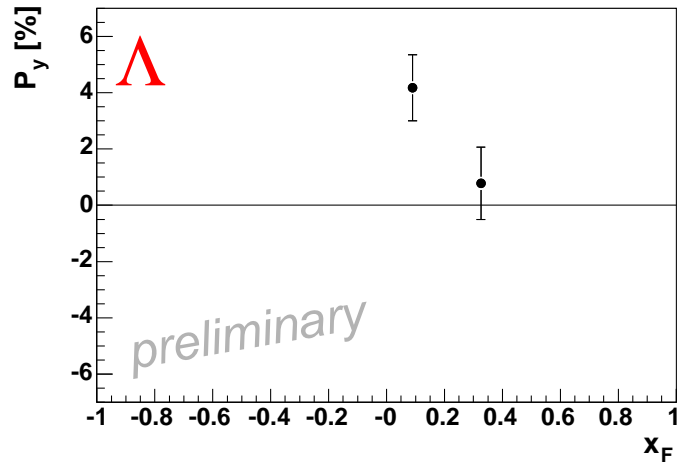
Result on $\bar{\Lambda}$ Polarisation



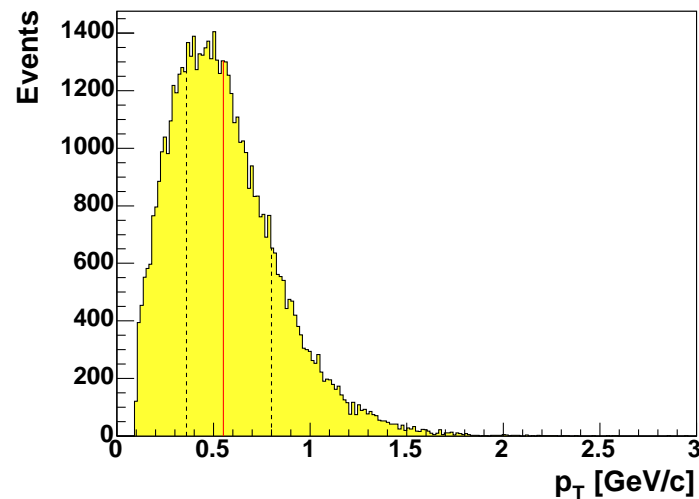
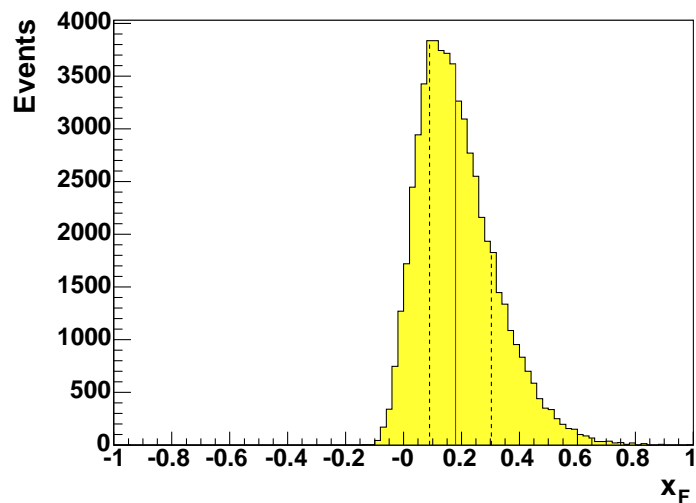
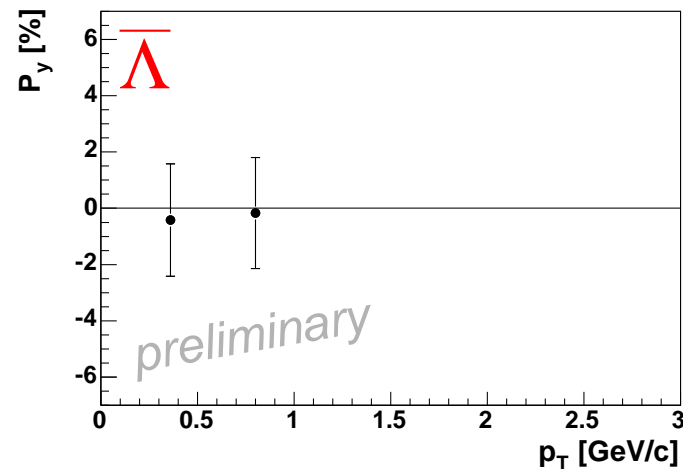
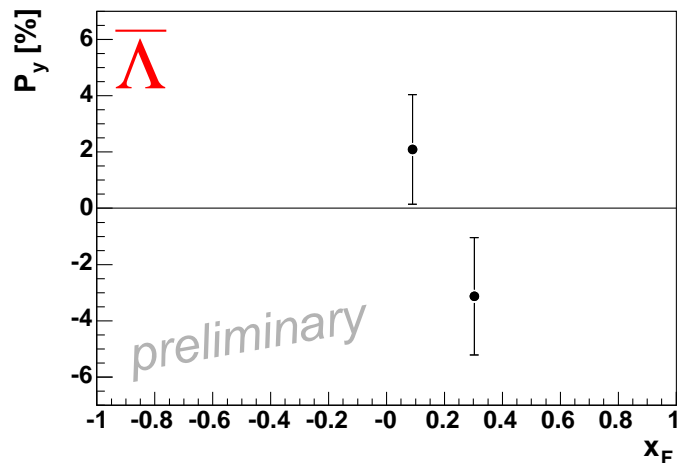
Cross check with K_s^0



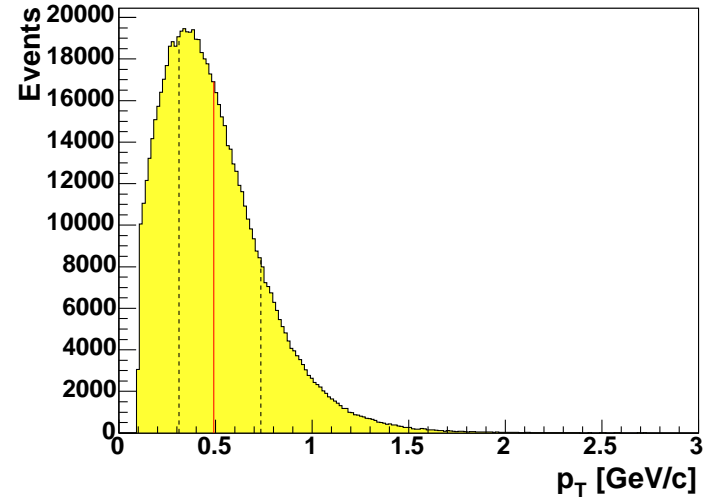
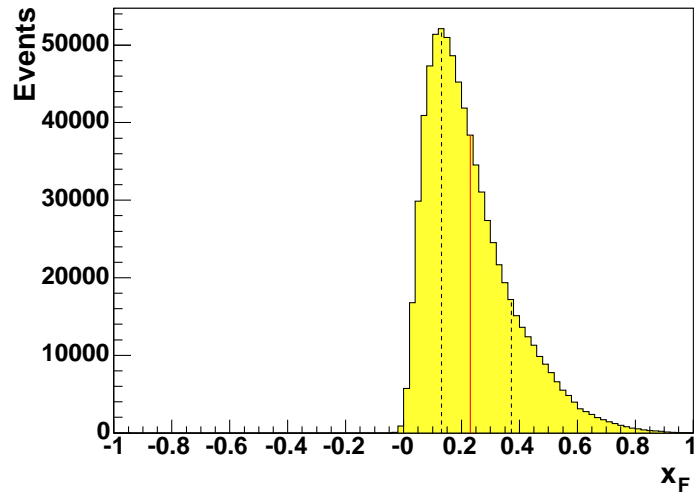
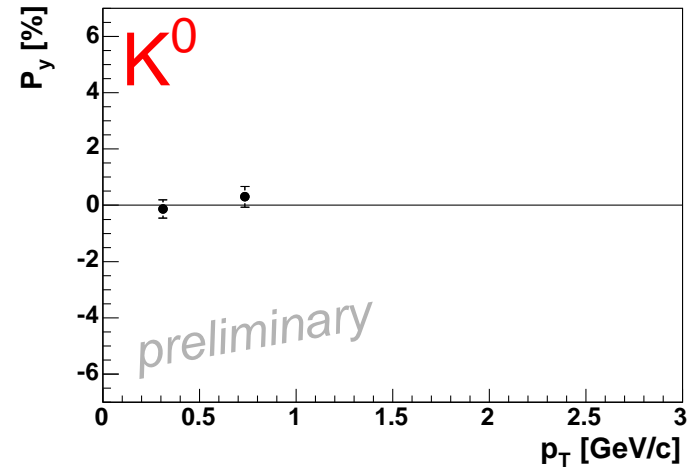
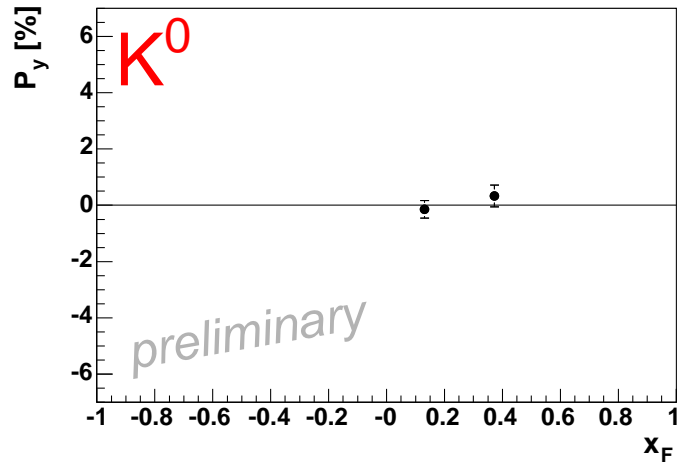
Dependence on x_F and p_T for Λ



Dependence on x_F and p_T for $\bar{\Lambda}$



Cross check with K_S^0



Discussion

	COMPASS 2002	HERMES 1996-2000
P^Λ	0.027 $\pm 0.008_{\text{stat}} \pm 0.011_{\text{sys}}$	0.055 $\pm 0.006_{\text{stat}} \pm 0.016_{\text{sys}}$
$P^{\bar{\Lambda}}$	-0.003 $\pm 0.014_{\text{stat}} \pm 0.018_{\text{sys}}$	-0.043 $\pm 0.013_{\text{stat}} \pm 0.012_{\text{sys}}$

Dynamical model (from hadron phenomenology):

- $\vec{L} \cdot \vec{S}$ -coupling during acceleration process $s \rightarrow \Lambda$
(Thomas-Precession) [DeGrand, Miettinen (PRD24(1981)2419)]
- cascading completely ignored



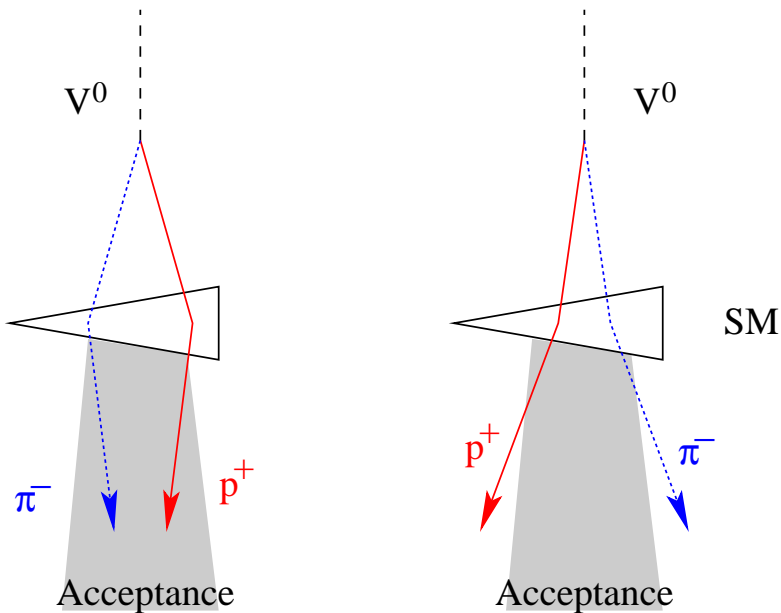
Conclusion and Outlook

- From COMPASS 2002 data: First analysis of spontaneous transverse Λ^0 polarisation in μN -scattering (quasi-real photoproduction)
- Positive Polarisation $2.67 \pm 0.8 \pm 1.1\%$ for Λ (same sign seen by HERMES), $\bar{\Lambda}$ polarisation consistent with 0
- Promising perspective for 2003/2004 data (statistics increase factor ~ 8 , trigger enhanced for high Q^2), more refinement in kinematical range will be possible
- Ξ polarisation analysis planned



Acceptance Correction

Effect of magnetic dipole field (top view):



- bending in magnet
→ left-right asymmetry
- midplane (Up-Down) symmetry
- Division into 2 subsamples
→ $A_U(+\cos\theta) = A_D(-\cos\theta)$

