A-dependence of the transverse Λ polarization

Yu. Naryshkin

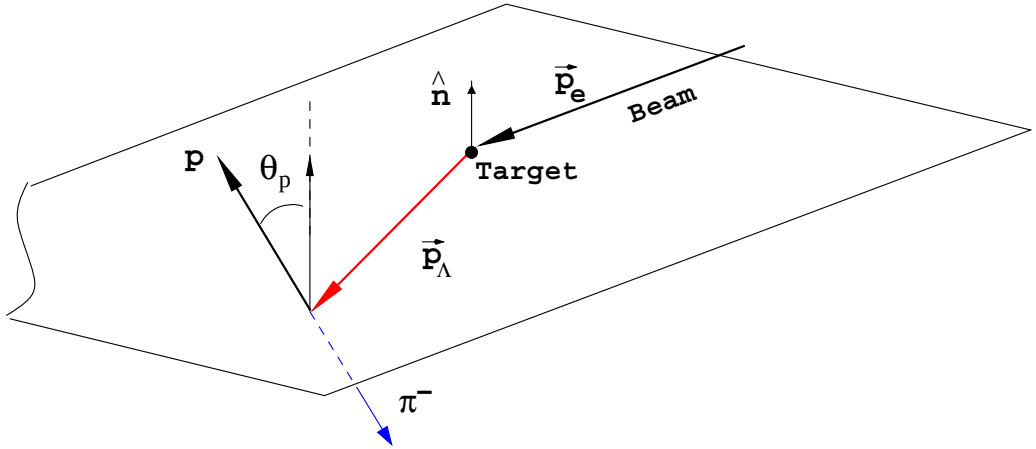
On behalf of the HERMES collaboration

Introduction

Spontaneous Λ polarization (neither beam nor target is polarized) is directed along $\hat{n}$

$$\vec{P}_\Lambda = P_\Lambda \cdot \hat{n}, \quad \hat{n} = \frac{\vec{p}_e \times \vec{p}_\Lambda}{|\vec{p}_e \times \vec{p}_\Lambda|}$$

Polarized Λ decay in Λ rest frame



$$\frac{dN}{d\Omega_p} = \frac{dN_0}{d\Omega_p}(1 + \alpha P_\Lambda \cos\theta_p)$$

$$\Lambda \to p\pi^-$$

Extraction of Λ polarization

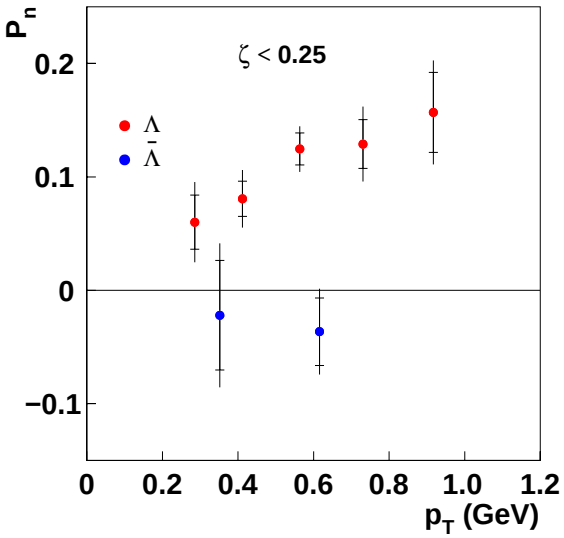
Formalism of Λ polarization extraction is based on up/down mirror (geometrical) symmetry of the detector

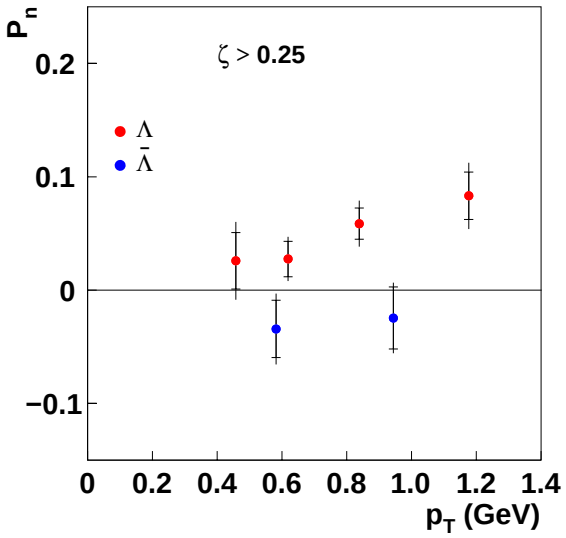
$$< \cos\theta >_0^{up} = - < \cos\theta >_0^{down}$$

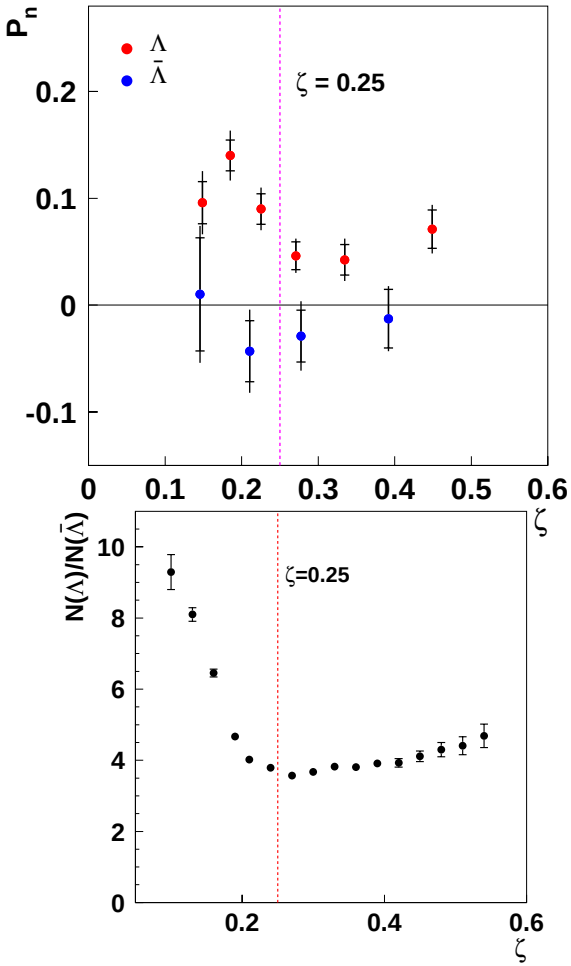
$$P_\Lambda = \frac{<\cos\theta_p>}{\alpha<\cos^2\theta_p>} = \frac{\frac{1}{N_\Lambda}\sum_{i=1}^{N_\Lambda}\cos\theta_p}{\alpha\frac{1}{N_\Lambda}\sum_{i=1}^{N_\Lambda}\cos^2\theta_p}$$

Results for HERA Run I

Quasi-real photoproduction: $e + N \Rightarrow \Lambda\uparrow + X$ *at 27.6 GeV*







$\zeta < 0.25$
$P_\Lambda = 0.099 \pm 0.008$

$\zeta > 0.25$
$P_\Lambda = 0.049 \pm 0.008$

$$\zeta = \frac{E_\Lambda + p_{\Lambda z}}{E_e + p_e}, \quad p_{\Lambda T} = \sqrt{p_{\Lambda x}^2 + p_{\Lambda y}^2}$$

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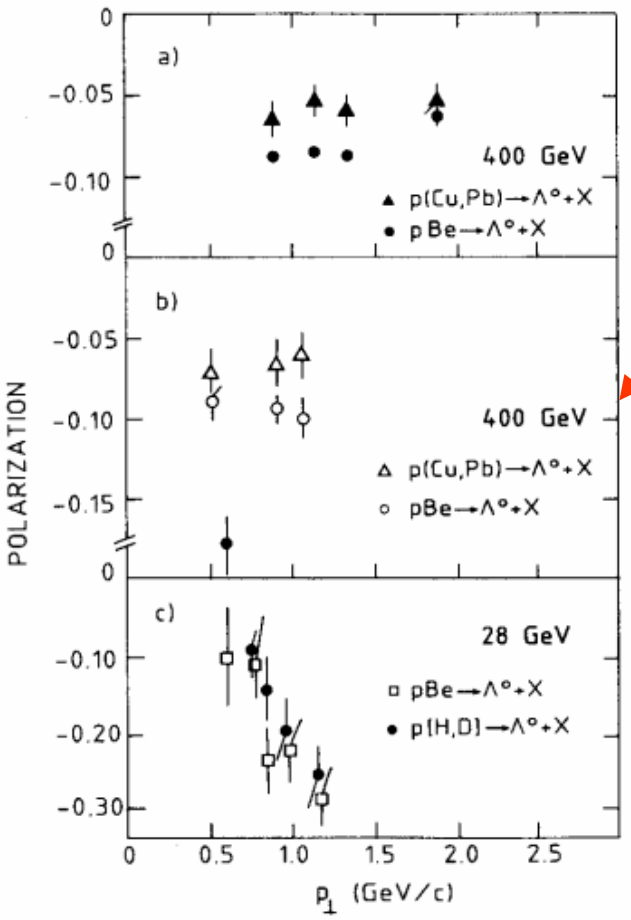
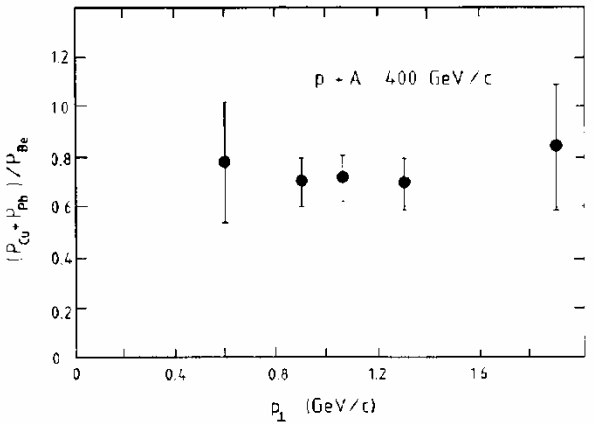
A-dependence in pA collisions



Experiment @ FNAL
p A → Λ X
(targets Cu, Pb, Be)
$p_{beam} = 400$ *GeV*

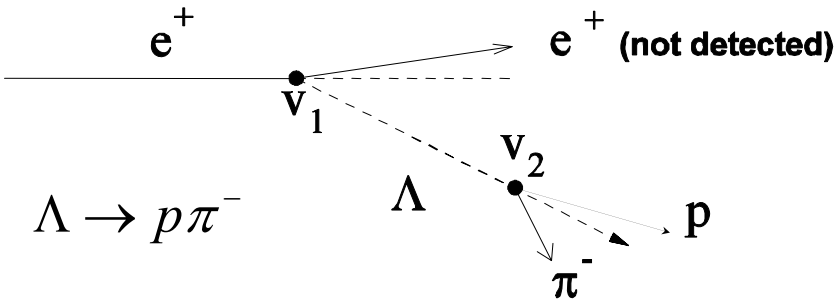


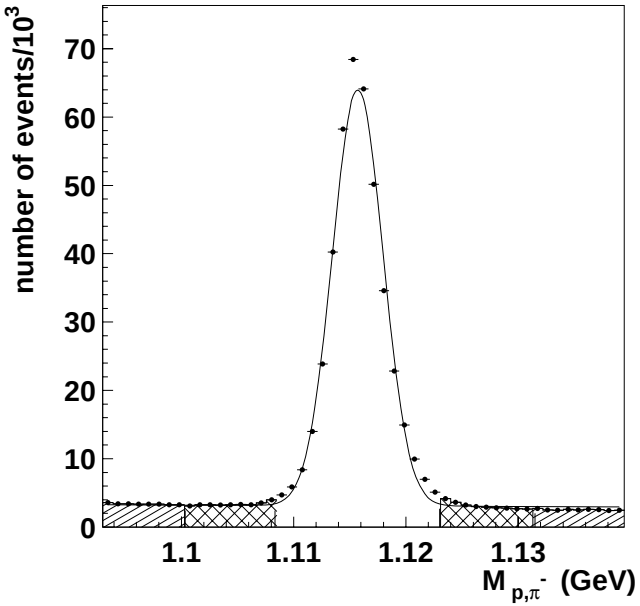
Experiment @ BNL
p A → Λ X
(targets H, D, Be)
$p_{beam} = 28$ *GeV*

Reconstruction of Λ events

Quasi-real photoproduction, $Q^2 < 0.05\ GeV^2$ ***for 80% of the events***

$< \nu >= 15.6\ GeV$



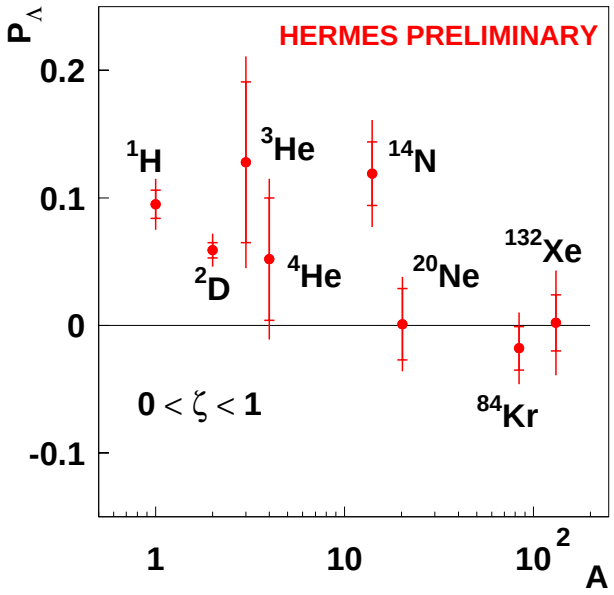


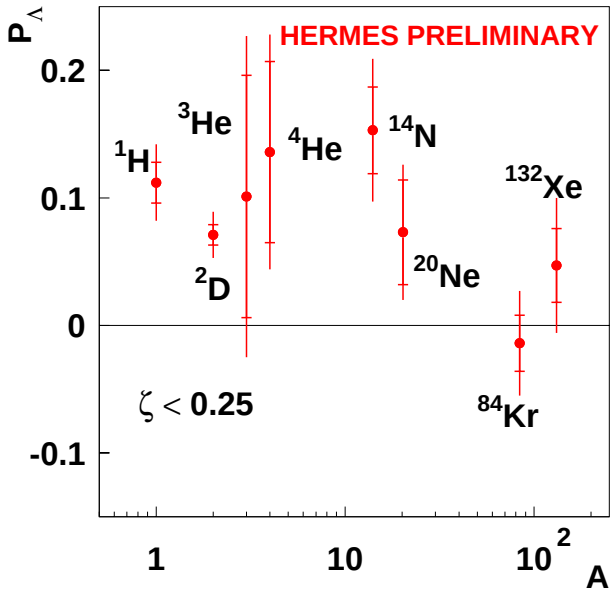
Background suppression cuts:
Threshold Cherenkov det. 1996-1997
Ring imaging Cherenkov det. 1999-2005
Vertex separation cut is 15 cm

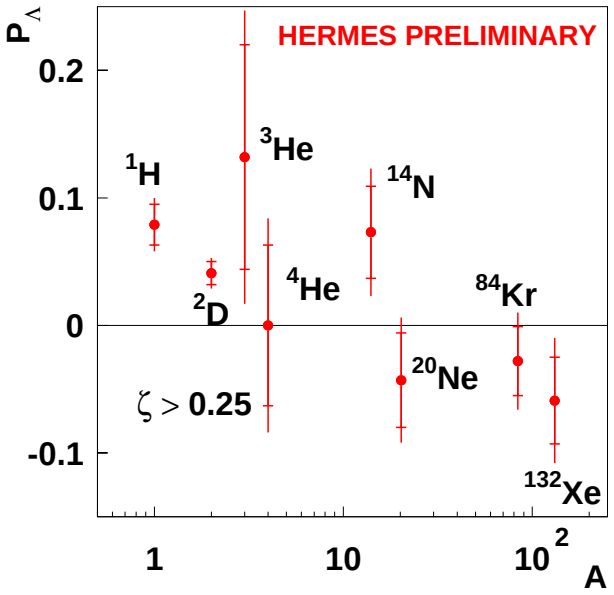
$$N(\Lambda) = 385 \cdot 10^3$$

(¹H, ²D, ³He, ⁴He, ¹⁴N, ²⁰Ne, ⁸⁴Kr and ¹³¹Xe)

A-dependence of the polarization

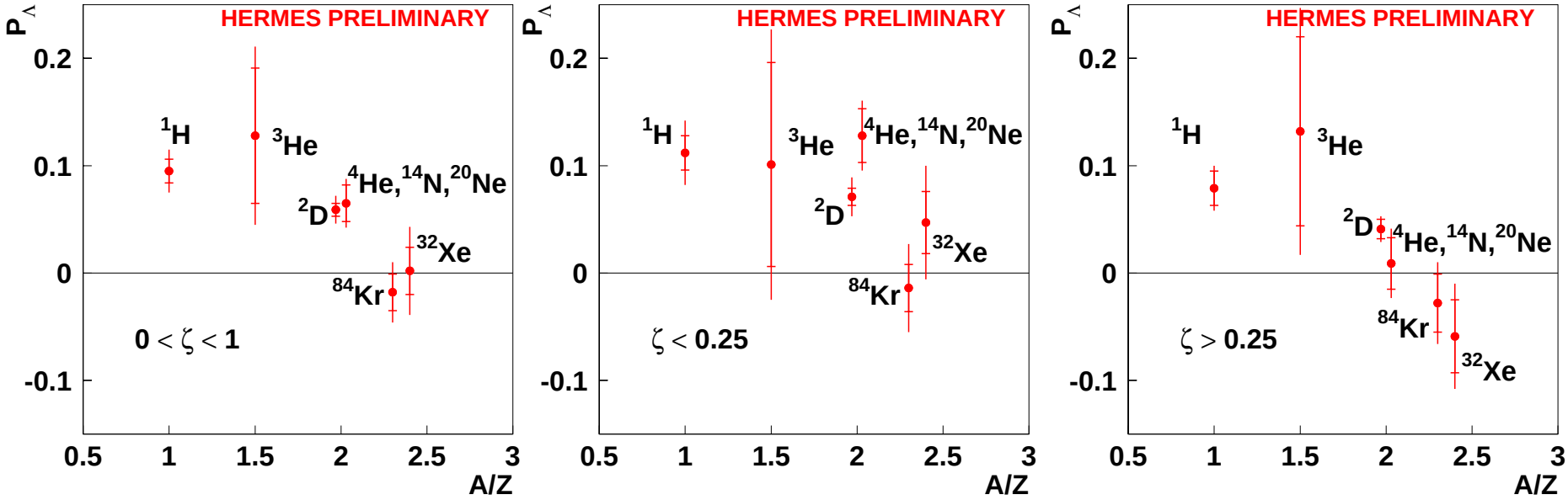






0<ζ<1 *ζ<0.25* *ζ>0.25*

A/Z-dependence of the polarization



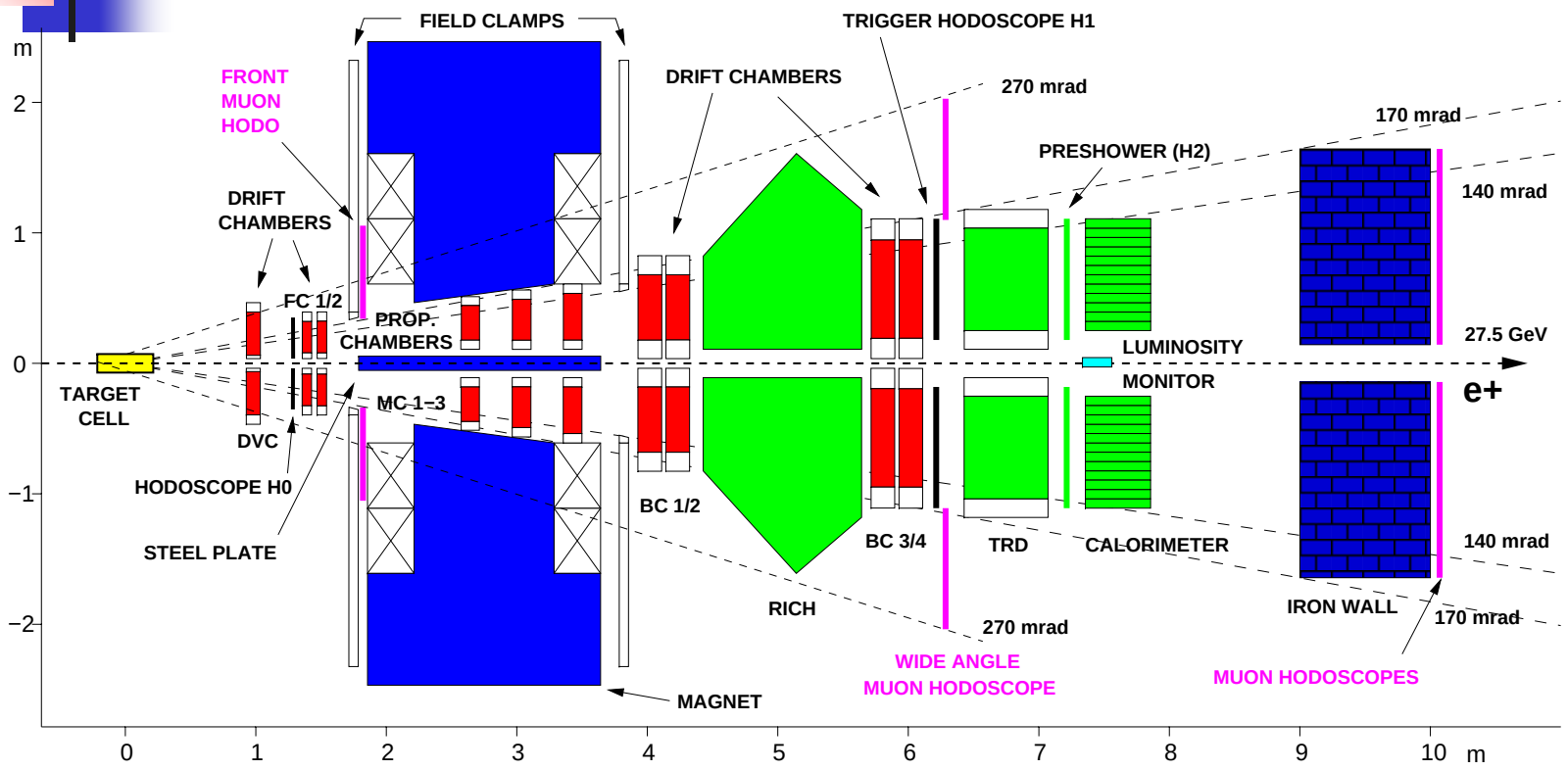
$0<\zeta<1$ $\zeta<0.25$ $\zeta>0.25$

Conclusion

- *Transverse Λ polarization has been measured in photoproduction regime. Low momentum Λ's ($\zeta<0.25$, target fragmentation) shows larger polarization then high momentum Λ's ($\zeta>0.25$, current fragmentation)*

- *There is an indication of A (A/Z) - dependence of P_Λ, in particular pronounced in the case of high momentum Λ's*

Experiment HERMES



polarized positron beam $E_e = 27.5$ *GeV,*

polarized and unpolarized internal gas targets H, D, He, Ne, N, Kr, Xe

GOOD RICH PID for hadron separation: π / K / p

detector is up/down symmetric