Поляризация Лямбда гиперонов в эксперименте ГЕРМЕС

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EMC (1988) experiment and spin crisis

Deep Inelastic Scattering (DIS) of polarized muons on polarized target

$$\Delta\Sigma = \mathbf{0.12 \pm 0.09 \pm 0.14 \neq 1\ !!!}$$

Jaffe sum rule based on SU(3) f.s. and assumption of unpolarized strange sea ($\Delta s=0$)

$$\Delta\Sigma = 3F - D = 0.586 \pm 0.08 \qquad (\Delta s + \Delta \bar{s} = 0)$$

$$\Delta u + \Delta \bar{u} = 2F = 0.928 \qquad \Delta d + \Delta \bar{d} = F - D = -0.342$$

EMC, SMC, SLAC, HERMES, COMPASS, RHIC

to date sum rule ⇒

$$S_z = \frac{1}{2} = \frac{1}{2}\Delta\Sigma + \Delta G + J_q + J_g$$

quarks *gluons* *orbital motion*

Hermes result

$$\Delta\Sigma = 0.330 \pm 0.025_{exp} \pm 0.011_{theo} \pm 0.028_{evol}$$

$$\Delta u + \Delta \bar{u} = 0.842 \pm 0.008_{exp} \pm 0.004_{theo}$$

$$\Delta d + \Delta \bar{d} = -0.427 \pm 0.008_{exp} \pm 0.004_{theo}$$

$$\Delta s + \Delta \bar{s} = -0.085 \pm 0.008_{exp} \pm 0.013_{theo}$$

Λ and other hyperon spin structure ? ?

Naïve CQM

ΔΣ=1 Δu=Δd= **0** Δs= **1**

Jaffe assumption (Δs_{proton}=0)

ΔΣ=**0.586** Δu=Δd= **-0.073** Δs= **0.732**

Burkard & Jaffe from EMC result

ΔΣ=**0.12** Δu=Δd= **-0.23** Δs= **0.58** **(±0.04)**

Lattice-QCD

Δu=Δd=**-0.02** Δs= **0.68** **(±0.04)**

ΔΣ=**0.32** F=0.47 D=0.81

	Δu	Δd	Δs
p(uud)	0.84	-0.43	-0.09
n(udd)	-0.43	0.84	-0.09
Λ^0(uds)	-0.16	-0.16	0.64
Σ^+(uus)	0.84	-0.09	-0.43
Σ^0(uds)	0.375	0.375	-0.43
Σ^-(dds)	-0.09	0.84	-0.43
Ξ^0(uss)	-0.43	-0.09	0.84
Ξ^-(dss)	-0.09	-0.43	0.84

Spin transfer to Λ in DIS and Λ spin structure

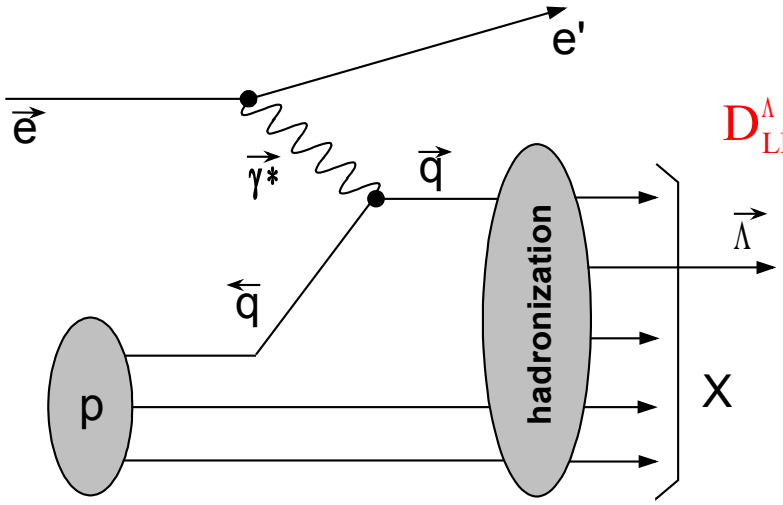
In one-photon exchange mechanism

$$P_{L'}^{\Lambda} = P_{\gamma^*} D_{LL'}^{\Lambda} = P_B D(y) D_{LL'}^{\Lambda}$$

In LO QCD

$$D_{LL}^{\Lambda}(x,z) = \sum_f D_{LL,f}^{\Lambda}(z)\, \omega_f^{\Lambda}(x,z) \text{ at } Q^2 \approx \langle Q^2 \rangle$$

$$(\langle D(y) \rangle = 0.7 \quad \langle Q^2 \rangle = 2.41(\text{GeV})^2 \text{ for HERMES})$$



Here partial spin transfer

$$D_{LL,f}^{\Lambda}(z) = \frac{\Delta F_f^{\Lambda}(z)}{F_f^{\Lambda}(z)} = \frac{F_{f\uparrow}^{\Lambda\uparrow}(z) - F_{f\uparrow}^{\Lambda\downarrow}(z)}{F_{f\uparrow}^{\Lambda\uparrow}(z) + F_{f\uparrow}^{\Lambda\downarrow}(z)}$$

DIS variables

$$Q^2 = -(k - k')^2$$

$$\nu = E - E' \quad y = \frac{\nu}{E}$$

$$x = \frac{Q^2}{2M\nu} \quad z = \frac{E_{\Lambda}}{\nu}$$

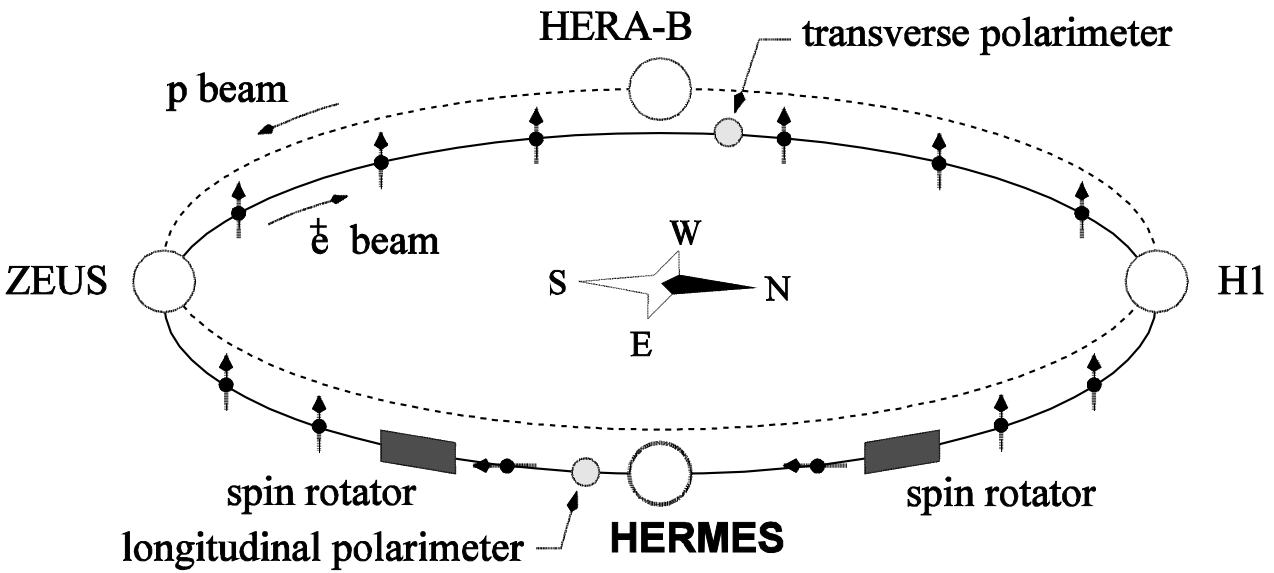
Linked to Λ spin structure in a model dependent way,

e.g. *R.L.Jaffe PRD 1996*

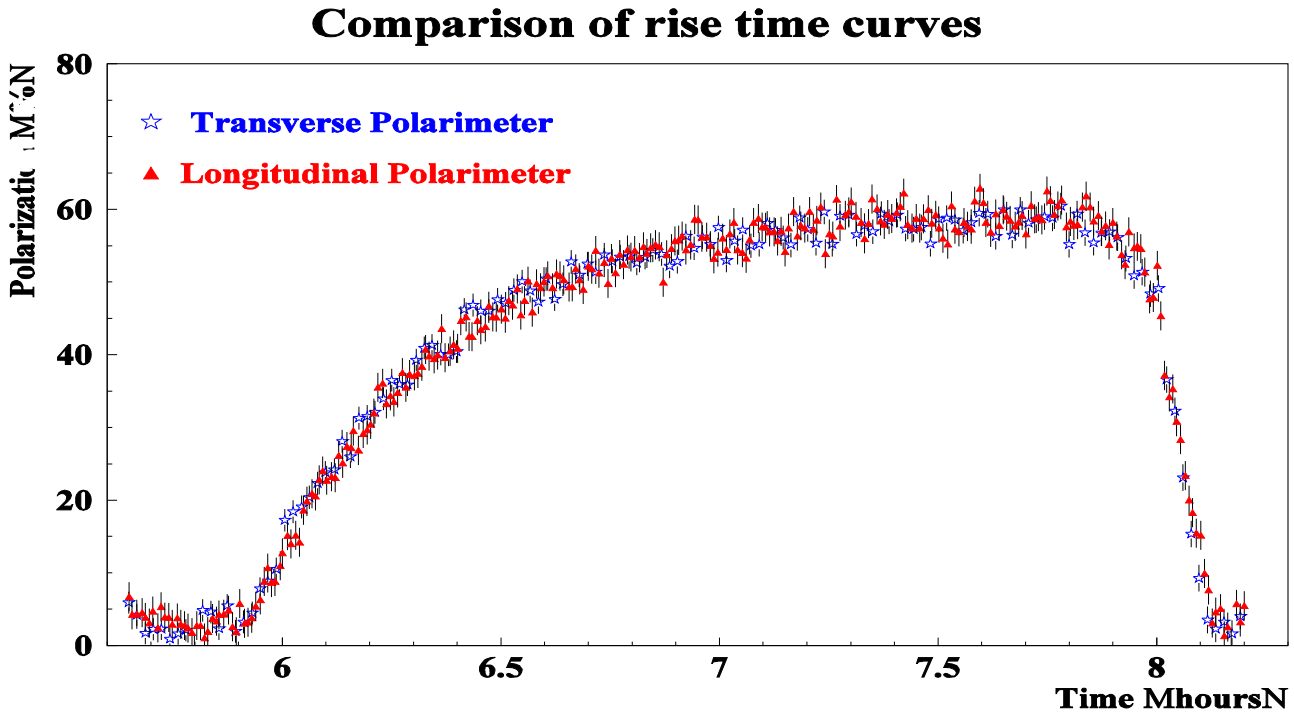
$$F_f^h(z) \Leftrightarrow q_f^h(x)$$

Reciprocity relation Gribov Lipatov PLB 37 1971

HERA self-polarized positron beam (HERA shutdown in 2007)



$E_e = 27.6\ GeV$



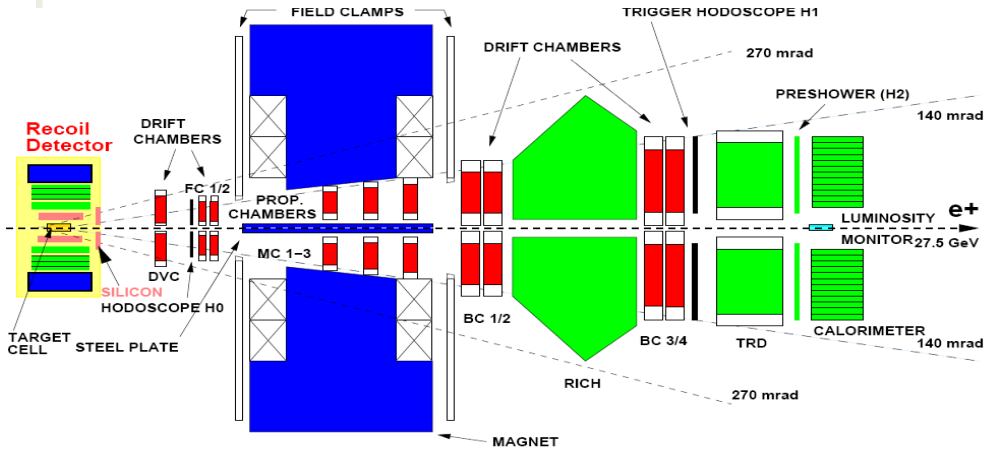
Sokolov-Ternov effect
transverse polarization

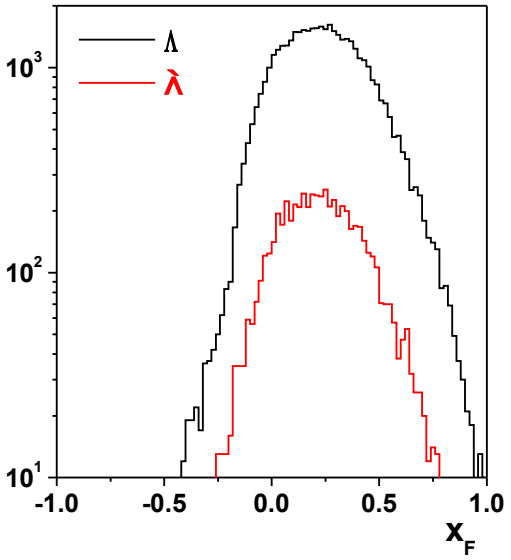
spin rotators
longitudinal polarization

$P_{beam} \simeq 40 - 50\%$

Λ and λ̄ detection in HERMES experiment

$$\Lambda \to p + \pi^-$$
$$\bar{\Lambda} \to \bar{p} + \pi^+$$





✓limited acceptance for Λ (λ̄) hyperon detection

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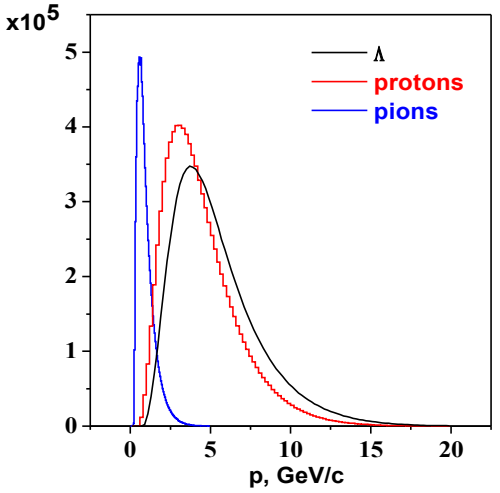
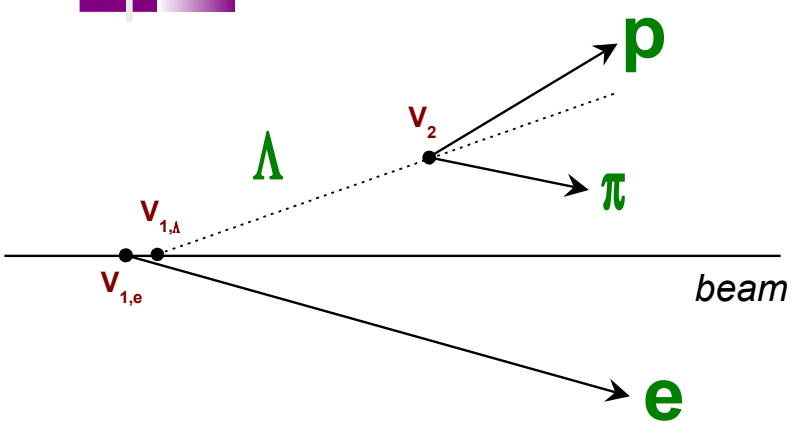
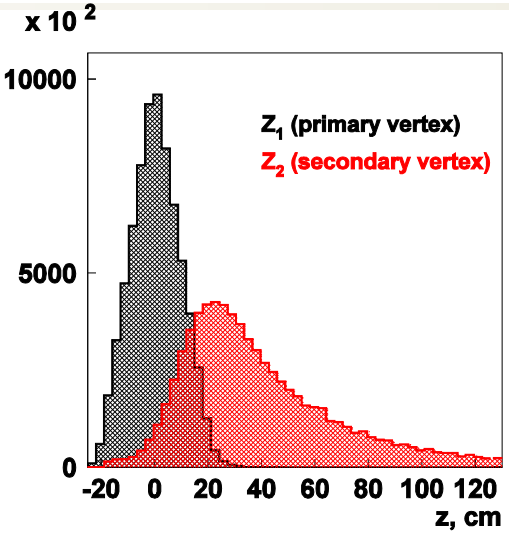
$$x_F = \frac{p_{\parallel}^{\Lambda}}{p_{max}^{\Lambda}} \quad \text{in } \gamma^* \text{proton c.m. frame}$$



Λ and λ̄ events selection





main bgr is π+ π- and K π pairs production;

bgr supression cuts:

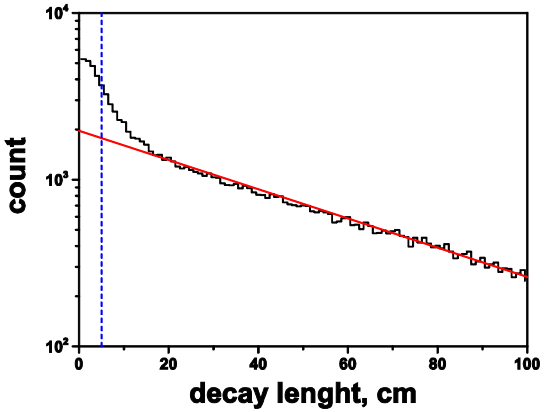
- Leading π rejection

using threshold Cherenkov det. (1996-1997)

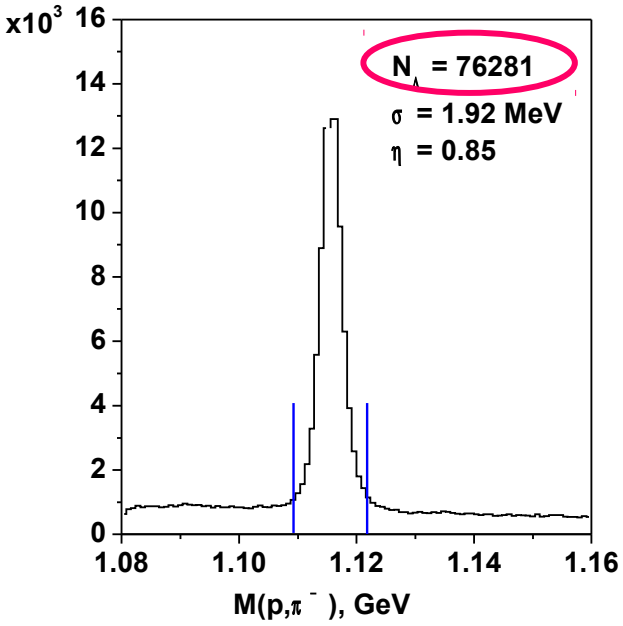
or RICH (1998-2007)

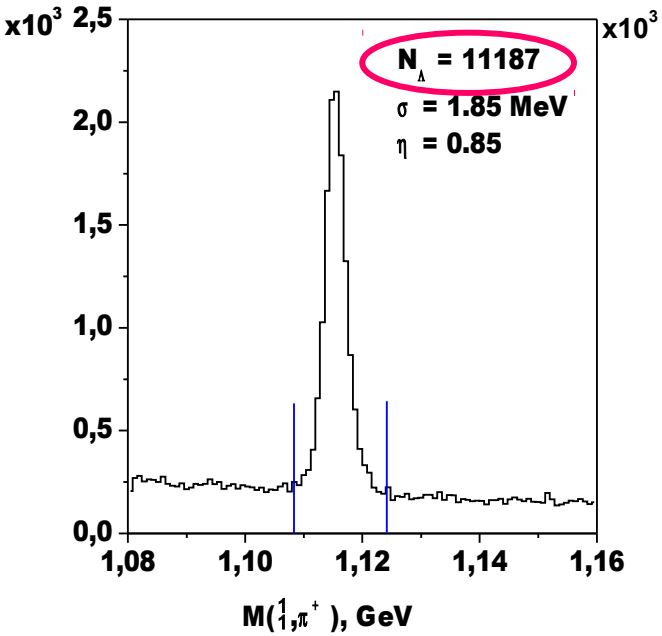
- Vertex separation.

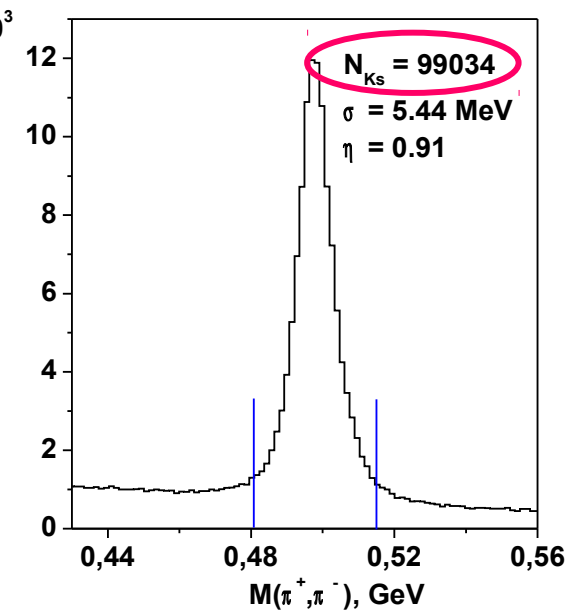
Distance between V1 and V2 vertices > 5 cm



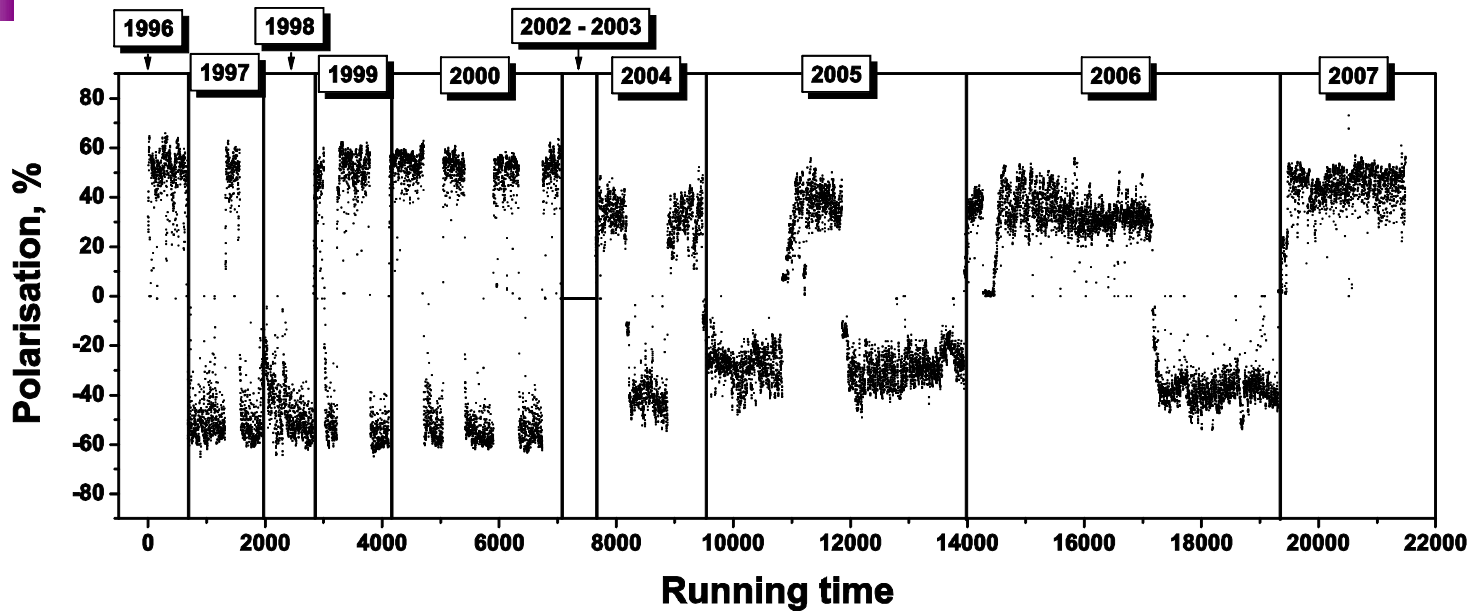
Λ,λ and Ks invariant mass distributions







Beam polarization periodic reversal helps to exclude acceptance effect



$$[\![P_B]\!] = \frac{\int P(t)L(t)dt}{\int L(t)dt} \approx 0$$

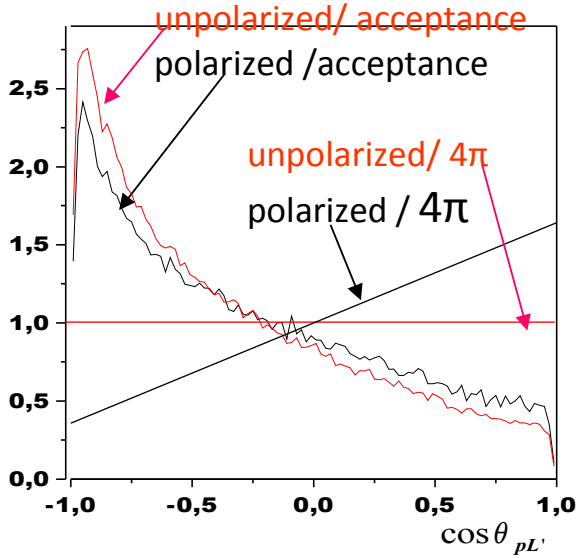
This essentially simplifies DLL extraction from the data

Extraction of D_{Li} components from experimental data sample

$$\frac{dN}{d\Omega_p} = \frac{dN_0}{d\Omega_p}(1+\alpha\,\vec{P}^{\Lambda}\times\hat{k}_p) = \frac{dN_0}{d\Omega_p}(1+\alpha_{\Lambda}P_B\sum_{i=x,y,z} D_{Li}^{\Lambda}\cos\theta_i) \text{ in } \Lambda \text{ rest frame}$$

$$\alpha_{\Lambda\to p+\pi^-} = 0.642\pm 0.013 \qquad \alpha_{\bar{\Lambda}\to \bar{p}+\pi^+} = -0.642\pm 0.013$$

Spectrometer acceptance results in strong distortion of decay angular distribution,
intensive MC acceptance simulation (COMPSS)



For beam helicity balance case $[\![P_B]\!] = 0$

MC simulation of spectrometer acceptance is not needed, acceptance correction does not affect measured asymmetries. D_{Li} components are extracted using experimental data sample only !!

$$\sum_{k=x,y,z} D_{Lk}A_{ik} = \frac{1}{\alpha}\frac{B_i}{[\![P_B^2]\!]} \quad i = x,y,z$$

$$A_{ik} = \frac{1}{N^{\Lambda}}\sum_{\nu=1}^{N^{\Lambda}}\left(D^2(y)\cos\theta_i\cos\theta_k\right)_{\nu}$$

$$B_i = \frac{1}{N^{\Lambda}}\sum_{\nu=1}^{N^{\Lambda}}\left(P_B D(y)\cos\theta_i\right)_{\nu}$$

$$[\![P_B^2]\!] = \frac{\int P^2(t)L(t)dt}{\int L(t)dt}$$

average over experimental data sample

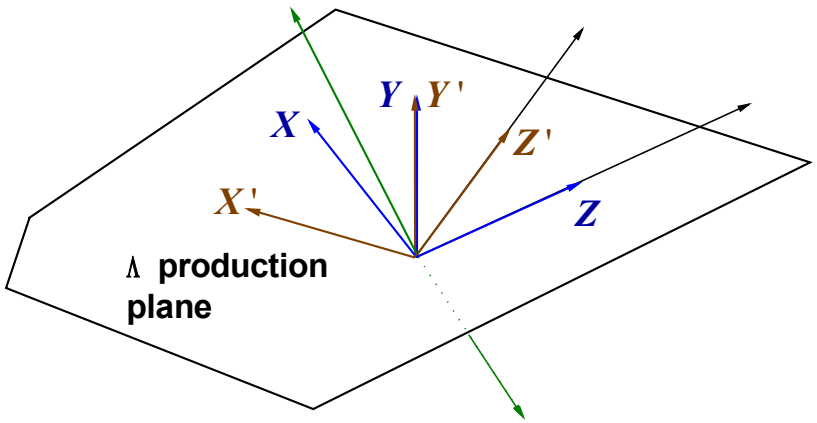
Coordinate systems in Λ rest frame

$$\gamma^{*} + P_{target} \rightarrow \Lambda + X,$$

in Λ rest frame $p_{\gamma^{*}}$ and $-p_{target} = p_{\Lambda}^{lab}$

$\vec{p}_{\gamma^{*}}$

All 3 components of spin transfer D_{Li}^{Λ} are extracted from the data in **Λ hyperon rest frame** using two coordinate system:



I. X,Y,Z with Z along virtual photon momentum

X',Y',Z' with Z' along Λ momentum (in lab frame)

II. Z and Z' are used to be ***Longitudinal*** spin transfer axes

X and X' ***transverse*** spin transfer axes

Important

Y and Y' components of spin transfer are compatible with zero due to parity conservation requirement

Results: Integrated spin transfer for Λ

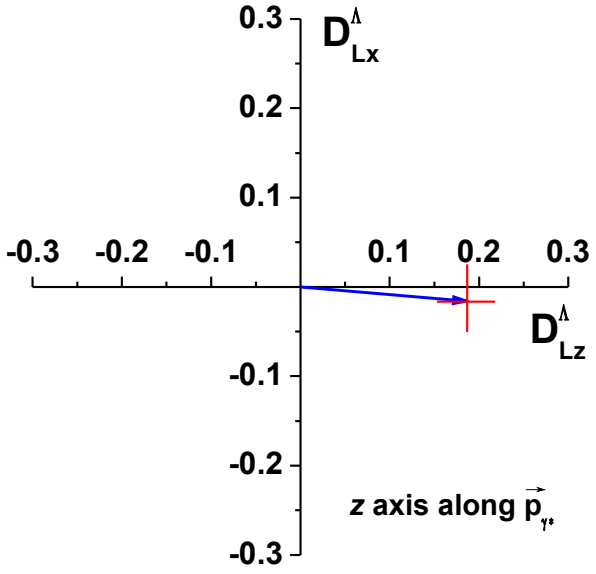
$\langle Q^2 \rangle = 2.14\,(\mathrm{GeV})^2,\ \langle y \rangle = 0.64,\ \langle x \rangle = 0.073,\ \langle z \rangle = 0.43,\ \langle x_F \rangle = 0.30$

$D^{\Lambda}_{Lx} = -0.016 \pm 0.0042_{stat} \pm 0.02_{syst}$

$D^{\Lambda}_{Ly} = 0.0037 \pm 0.0037_{stat} \pm 0.02_{syst}$

$D^{\Lambda}_{Lz} = 0.186 \pm 0.040_{stat} \pm 0.02_{syst}$

$\left|D^{\Lambda}_{LL'}\right| = 0.187 \pm 0.040_{stat} \pm 0.02_{syst}$

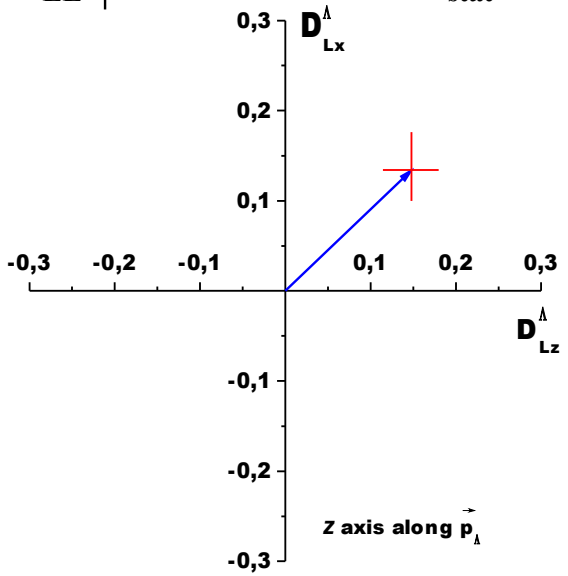


$D^{\Lambda}_{Lx} = 0.133 \pm 0.0039_{stat} \pm 0.02_{syst}$

$D^{\Lambda}_{Ly} = 0.0037 \pm 0.0037_{stat} \pm 0.02_{syst}$

$D^{\Lambda}_{Lz} = 0.147 \pm 0.038_{stat} \pm 0.02_{syst}$

$\left|D^{\Lambda}_{LL'}\right| = 0.197 \pm 0.039_{stat} \pm 0.02_{syst}$



Spin is transferred along virtual photon momentum

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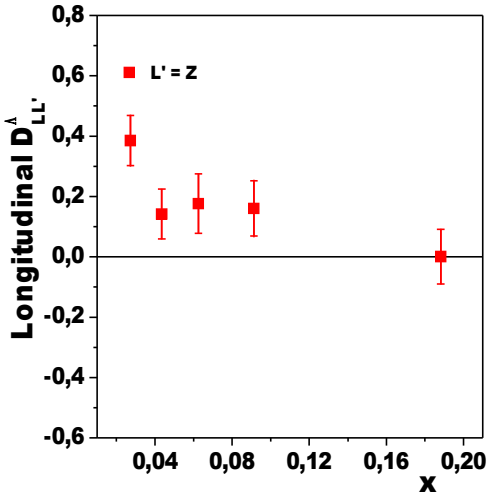
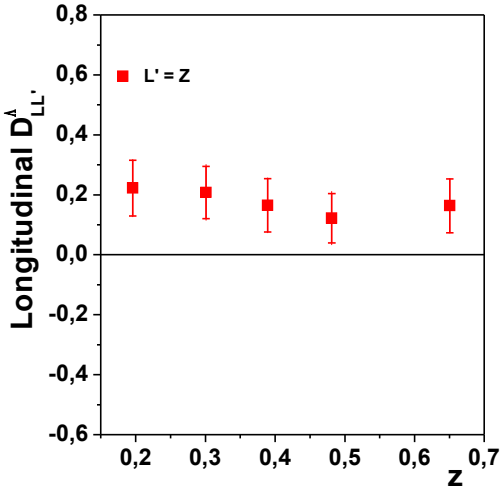
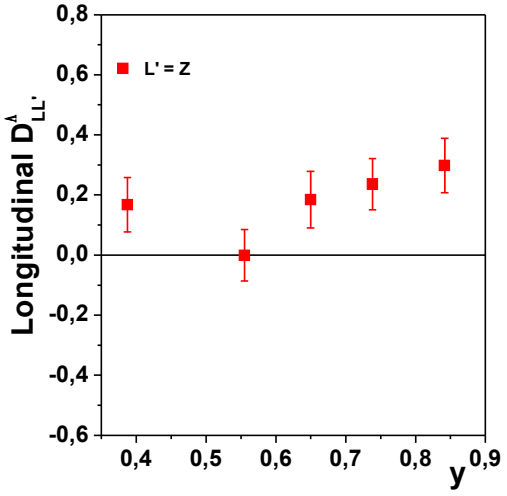
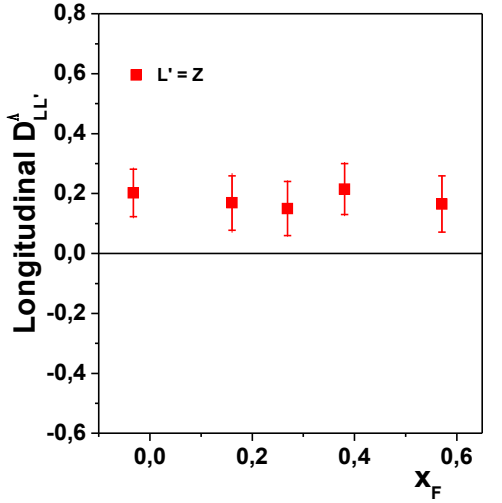
Results: Dependences on kinematic variables for Λ hyperon

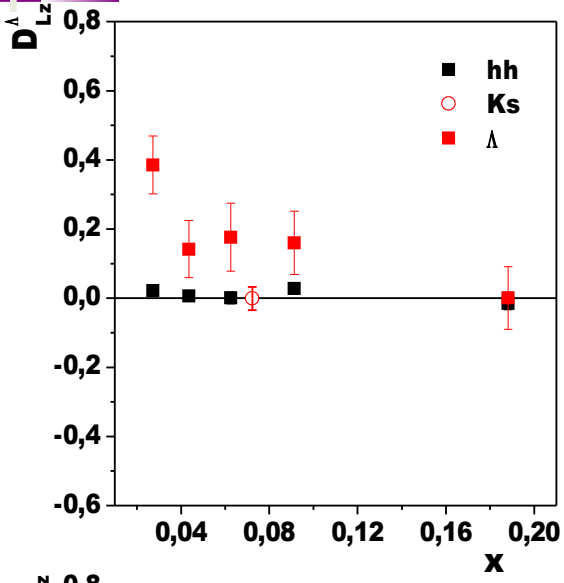


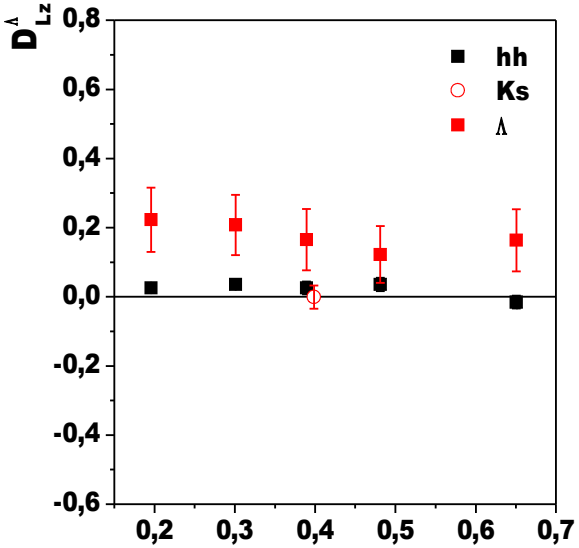


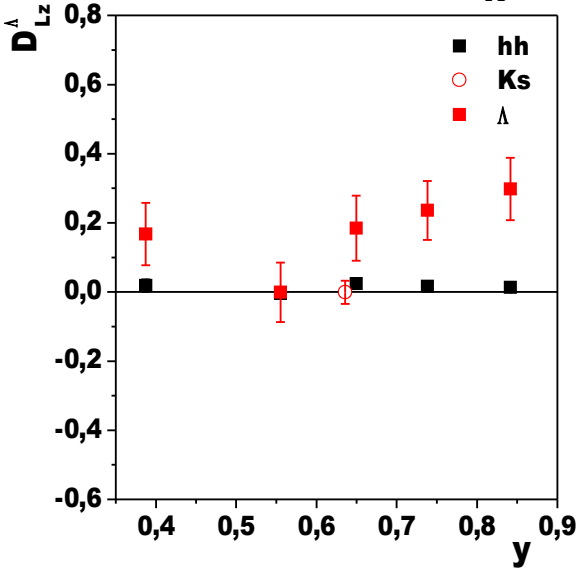


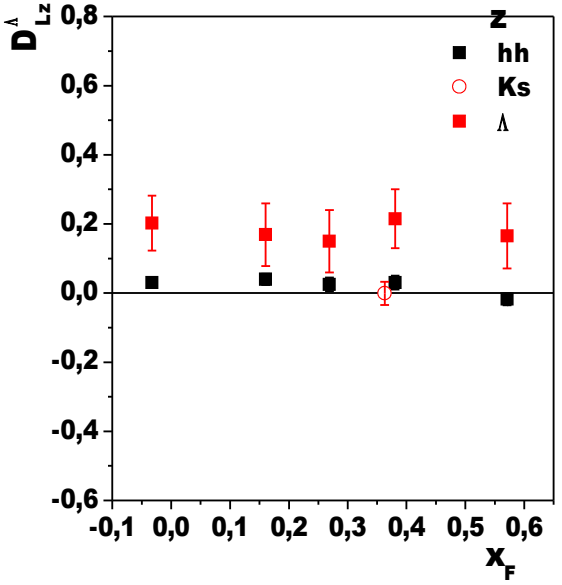


False asymmetry control using h+h- and KS









$$D_{Lx}^{hh} = 0.017 \pm 0.006$$
$$D_{Ly}^{hh} = 0.015 \pm 0.006$$
$$D_{Lz}^{hh} = 0.012 \pm 0.006$$

$$D_{Lx}^{Ks} = 0.019 \pm 0.030$$
$$D_{Ly}^{Ks} = 0.015 \pm 0.031$$
$$D_{Lz}^{Ks} = -0.001 \pm 0.033$$

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Simple estimation of spin transfer to Λ

$$D^{\Lambda}_{LL,f} = \Delta q^{\Lambda}_{f}$$

R.L. Jaffe PRD 54, (1996), C. Boros et al PRD 61, (2000), Ashery&Lipkin PLB 469 (1993), B.Q.Ma et al PLB 477

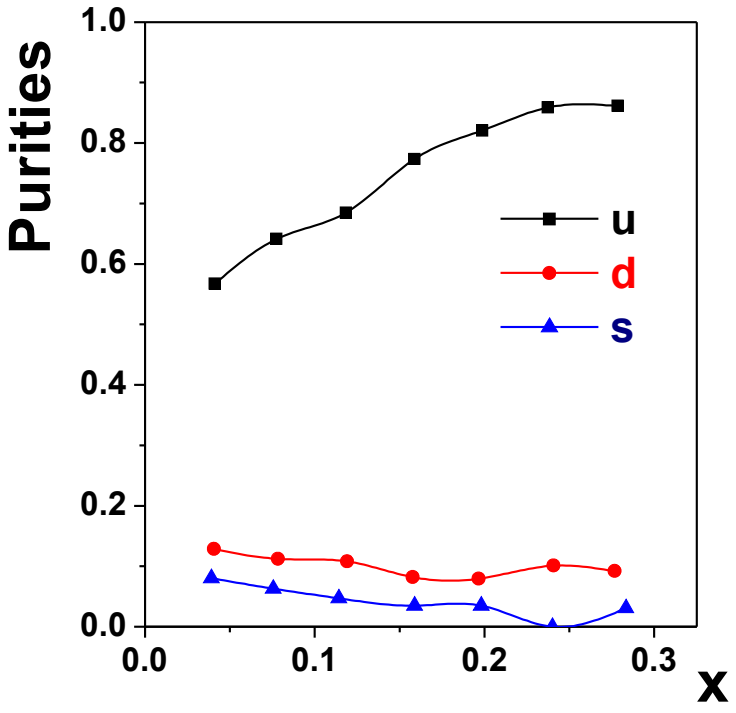
Constituent quark model (CQM) Δu=Δd=0, Δs=1

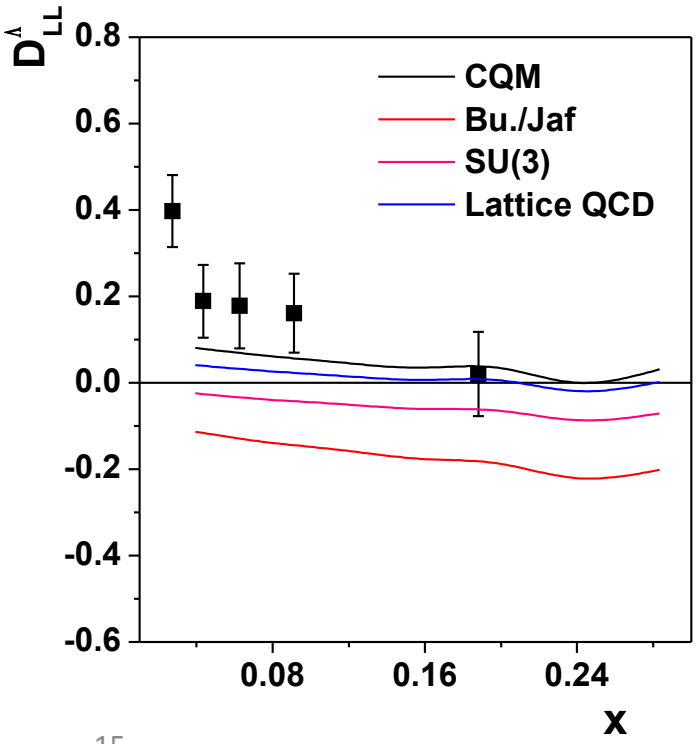
Burkard/Jaffe Δu=Δd=-0.23, Δs=0.58

SU(3) flavor symmetry Δu=Δd=-0.09, Δs=0.47

Lattice QCD Δu=Δd=-0.02, Δs=0.68

$$D^{\Lambda}_{LL'} = \sum_{f} D^{\Lambda}_{LL',f}\, \omega^{\Lambda}_{f}$$





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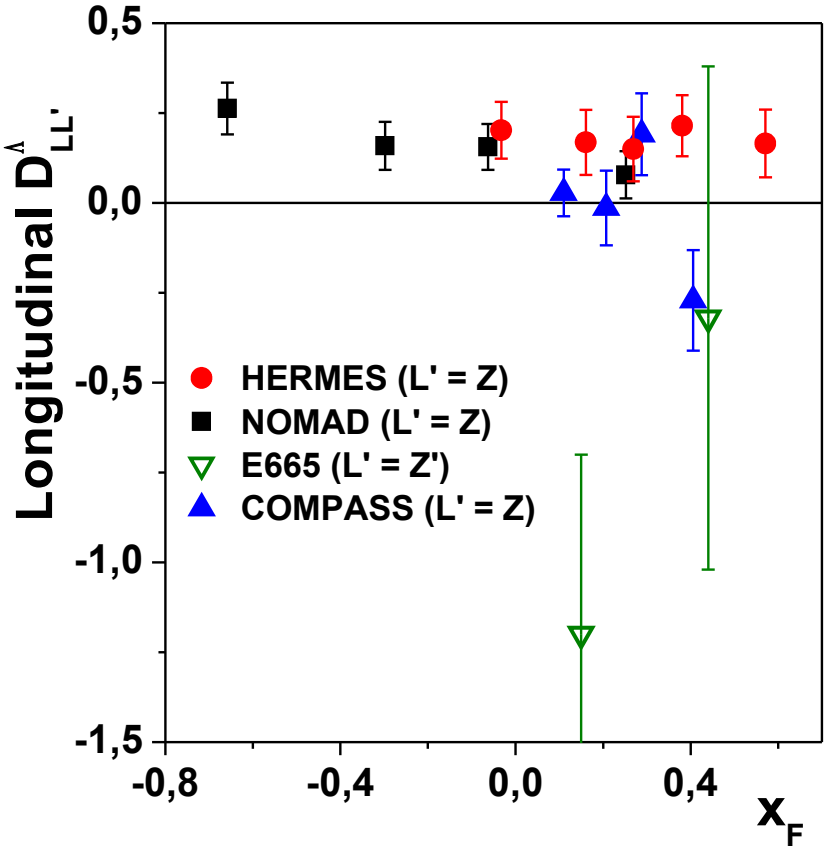
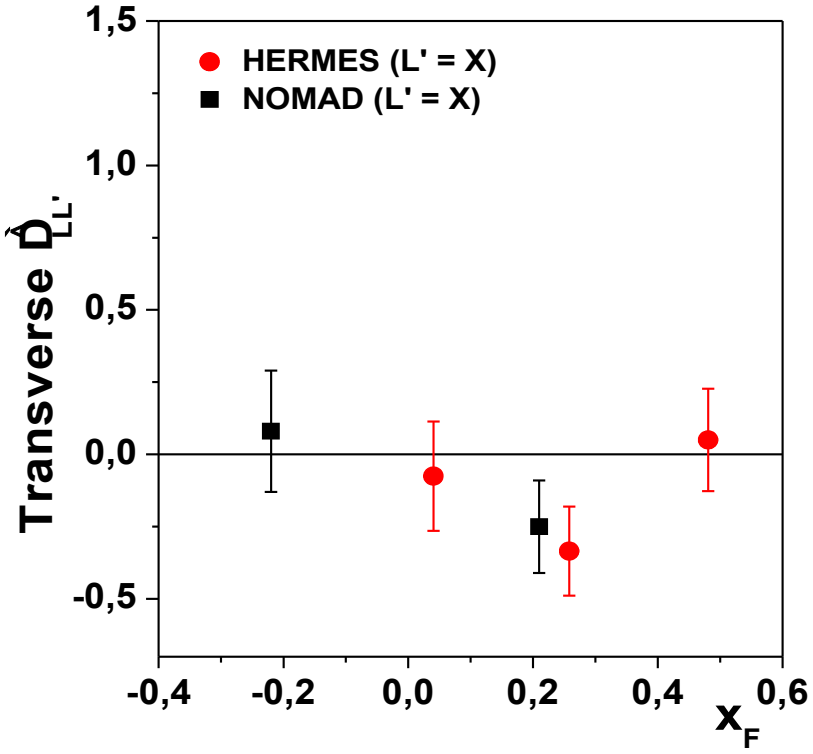
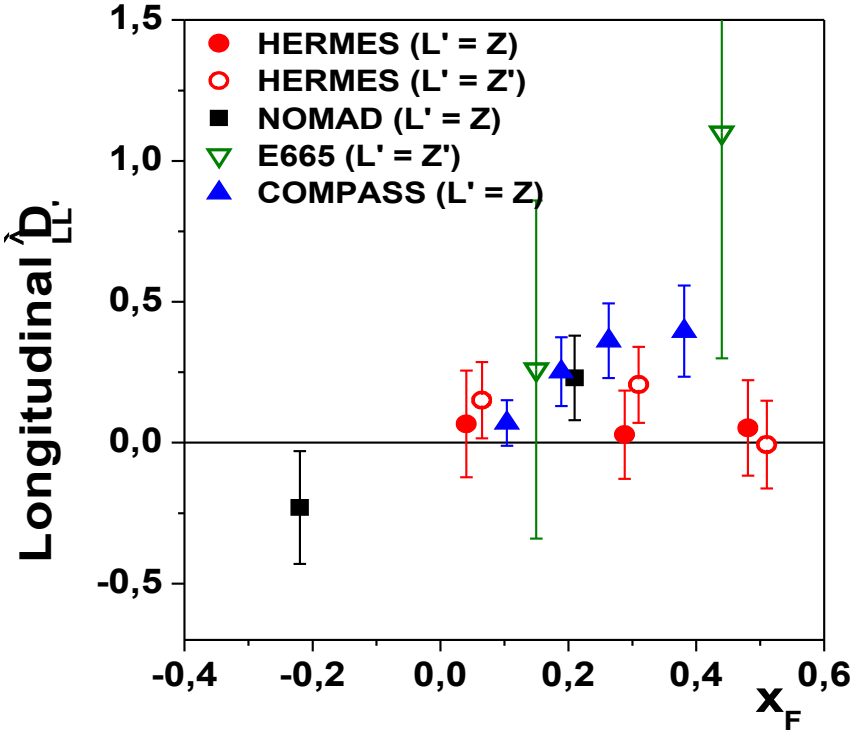
Longitudinal spin transfer to Λ world data



Longitudinal and transverse spin transfer to Λ world data





DIS regime $Q^2 > 0.8\,(\mathrm{GeV})^2$

- Spin transfer coefficient DLL from polarized beam in semi inclusive Λ and λ̄ production
- Multiplicity and fragmentation function u-quark to Λ

e and Λ (λ̄) detected in coincidence

$N_\Lambda \approx 80 \times 10^3$

Quasi real (inclusive) photoproduction $Q^2 \approx 0$

- Spin transfer coefficient KLL from polarized target to Λ or λ̄
- Spin transfer coefficient DLL from polarized beam to Λ or λ̄
- Transverse Λ and λ̄ polarization, A-dependence of Λ polarization

e not detected, Λ (λ̄) detected inclusively

$N_\Lambda \approx 0.5 \times 10^6$

Published:

Measurement of longitudinal spin transfer to Lambda hyperons in deep inelastic lepton scattering.
Phys.Rev.D64:112005,2001.

Longitudinal Spin Transfer to the Lambda Hyperon in Semi-Inclusive Deep-Inelastic Scattering.
Phys.Rev.D74:072004,2006.

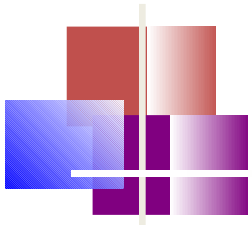
Transverse Polarization of Lambda and anti-Lambda Hyperons in Quasireal Photoproduction.
Phys.Rev.D76:092008,2007.

PhD thesis 7

Conference proceedings about **25**

To be published :

Draft 88. Final paper on DLL
Draft 83. A-dependens of transverse Lambda polarization



BACKUP SLIDES

Purity distributions within HERMES acceptance

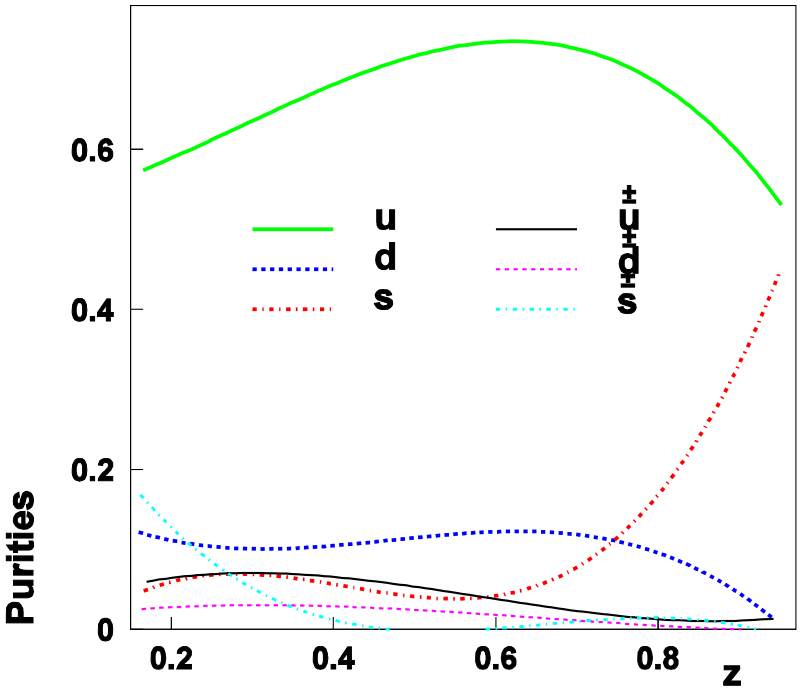
Purity and partial spin transfer

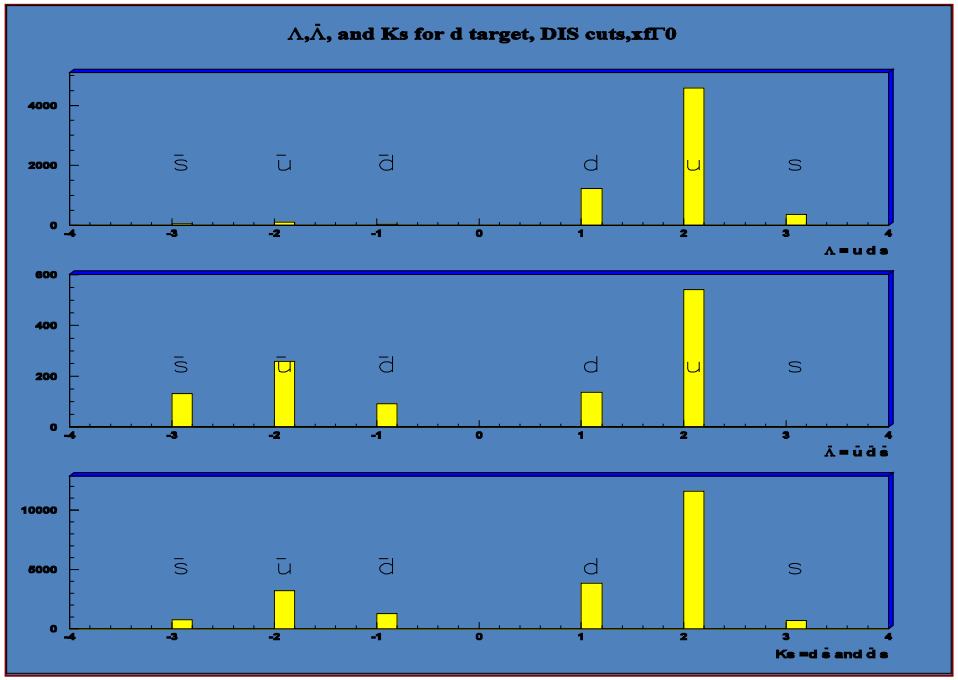
Calculated using LUND MC

$$D_{LL}^{\Lambda}(x,z) = \sum_f D_{LL,f}^{\Lambda}(z)\,\omega_f^{\Lambda}(x,z)$$

$$\rightarrow \quad D_{LL}^{\Lambda}(z) = \sum_f D_{LL,f}^{\Lambda}(z) \int_0^1 \omega_f^{\Lambda}(x,z)dx$$

$$\omega_f(x,z) = \frac{e_f^2 q_f(x) F_f^{\Lambda}(z)}{\sum_{f'} e_{f'}^2 q_{f'}(x) F_f^{\Lambda}(z)} \qquad \sum_f \omega_f = 1$$





Results: Integrated spin transfer for $\bar{\Lambda}$

$\langle Q^2 \rangle = 1.98(\mathrm{GeV})^2$, $\langle y \rangle = 0.71$, $\langle x \rangle = 0.059$, $\langle z \rangle = 0.37$, $\langle x_F \rangle = 0.25$

$$D_{Lx}^{\bar{\Lambda}} = -0.14 \pm 0.11_{stat} \pm 0.02_{syst}$$

$$D_{Ly}^{\bar{\Lambda}} = 0.05 \pm 0.10_{stat} \pm 0.02_{syst}$$

$$D_{Lz}^{\bar{\Lambda}} = 0.05 \pm 0.10_{stat} \pm 0.02_{syst}$$

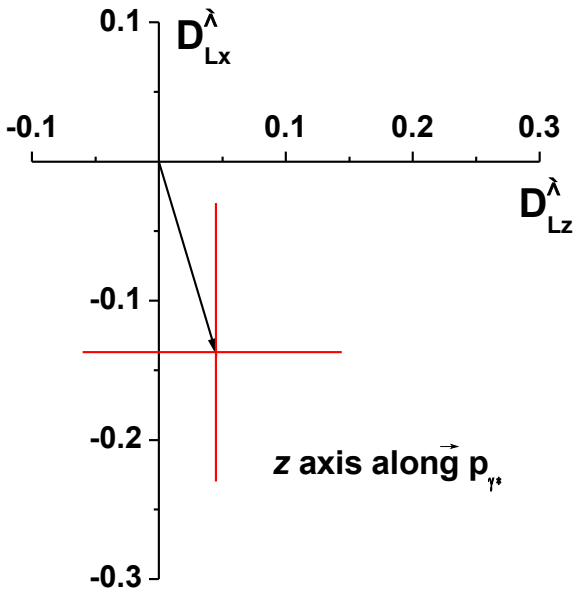
$$\left|D_{LL'}^{\bar{\Lambda}}\right| = 0.15 \pm 0.11_{stat} \pm 0.02_{syst}$$

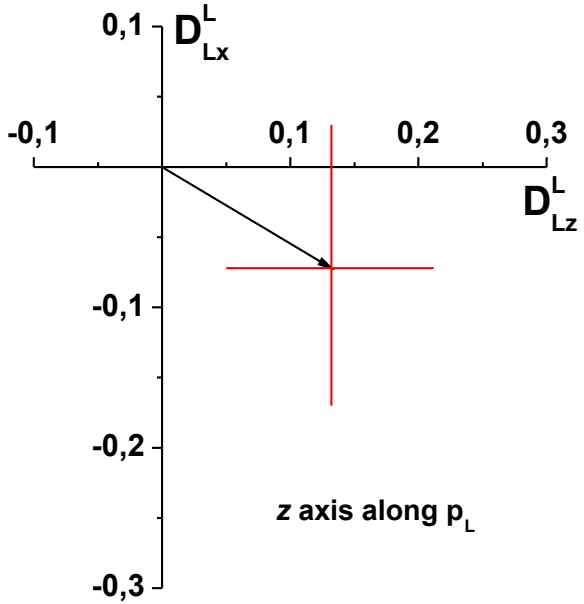
$$D_{Lx}^{\bar{\Lambda}} = -0.07 \pm 0.10_{stat} \pm 0.02_{syst}$$

$$D_{Ly}^{\bar{\Lambda}} = 0.05 \pm 0.10_{stat} \pm 0.02_{syst}$$

$$D_{Lz}^{\bar{\Lambda}} = 0.13 \pm 0.09_{stat} \pm 0.02_{syst}$$

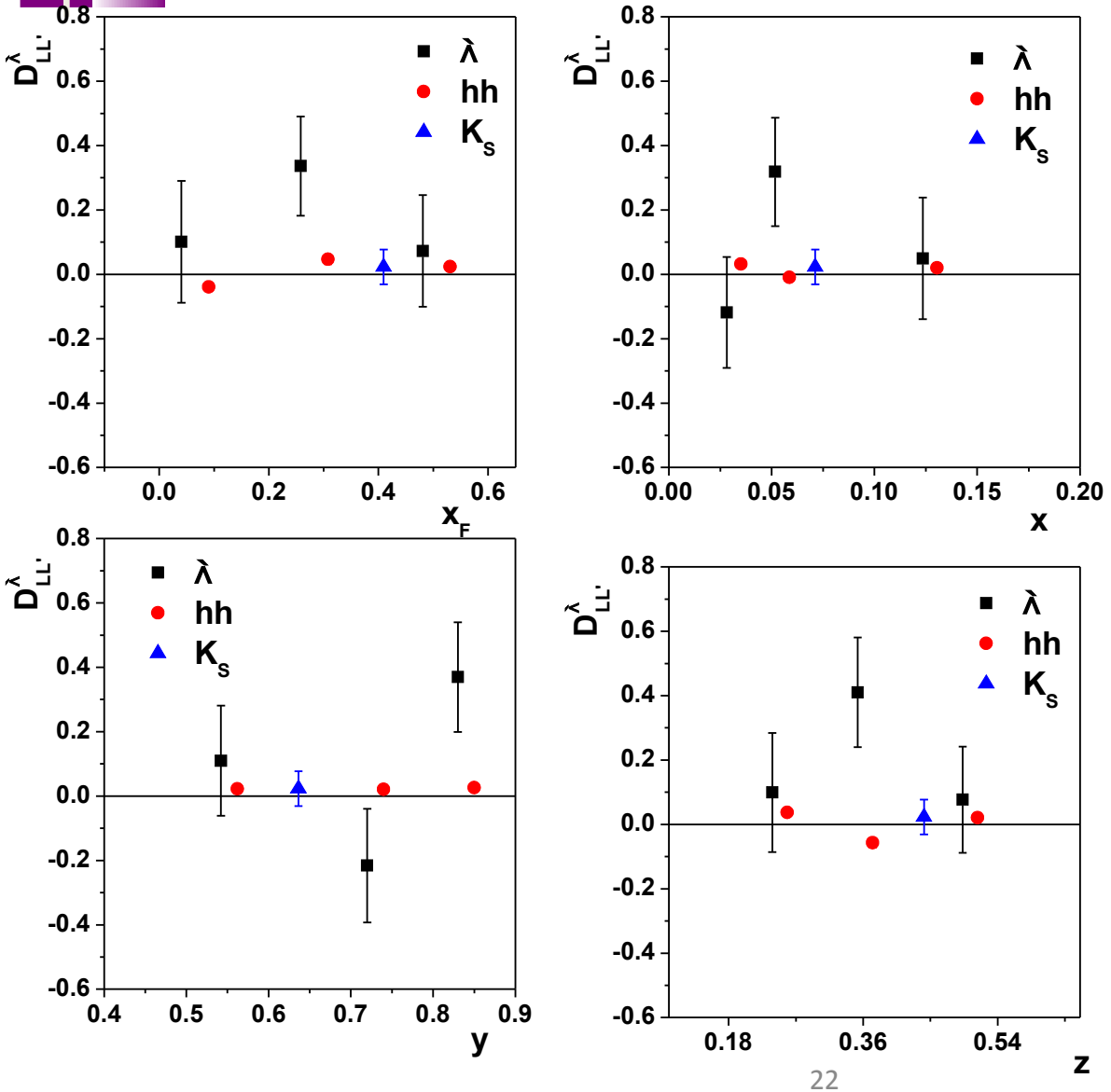
$$\left|D_{LL'}^{\bar{\Lambda}}\right| = 0.15 \pm 0.10_{stat} \pm 0.02_{syst}$$





21

False asymmetry control using h+h- and KS



$$D_{LL'}^{hh} = 0.021 \pm 0.006$$

$$D_{LL'}^{Ks} = 0.023 \pm 0.054$$

22

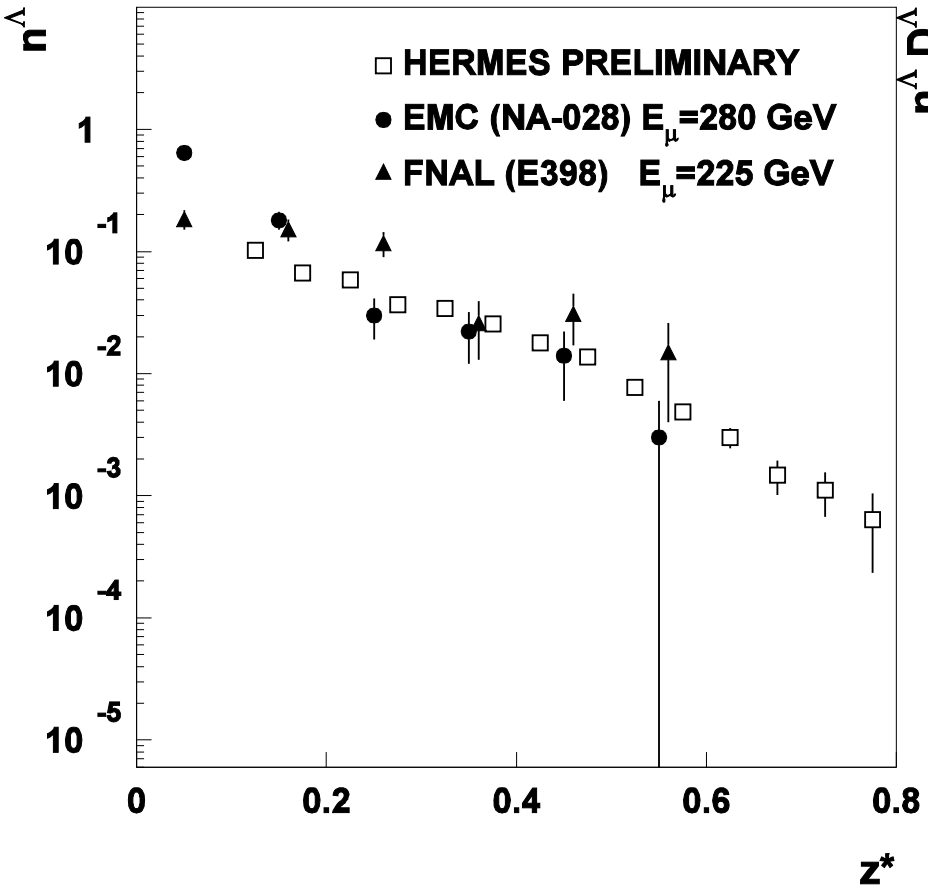
Multiplicity distribution and fragmentation function

$$n^{\Lambda}(z) = \frac{N_{\Lambda}(z)}{N_e} = \sum_q n_q^{\Lambda}(z) = \sum_q \omega_q D^{q\Lambda}(z,\overline{Q^2}) \qquad \{Pu\}_q^{\Lambda}(z) = \frac{n_q^{\Lambda}(z)}{n^{\Lambda}(z)}$$

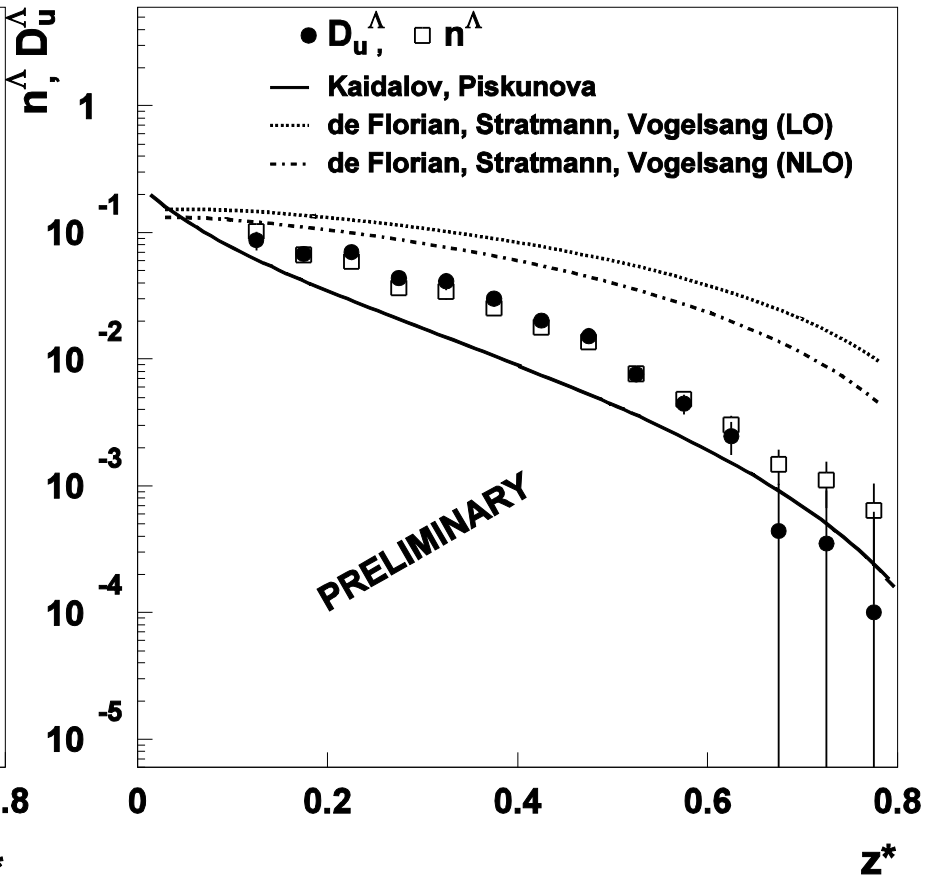
$$\sum_q \omega_q = 1 \qquad \sum_q \{Pu\}_q^{\Lambda}(z) = 1$$

$$D^{u\Lambda}(z^*) = D^{d\Lambda}(z^*) \qquad z^* = \frac{E^{\Lambda} - m^{\Lambda}}{\nu}$$

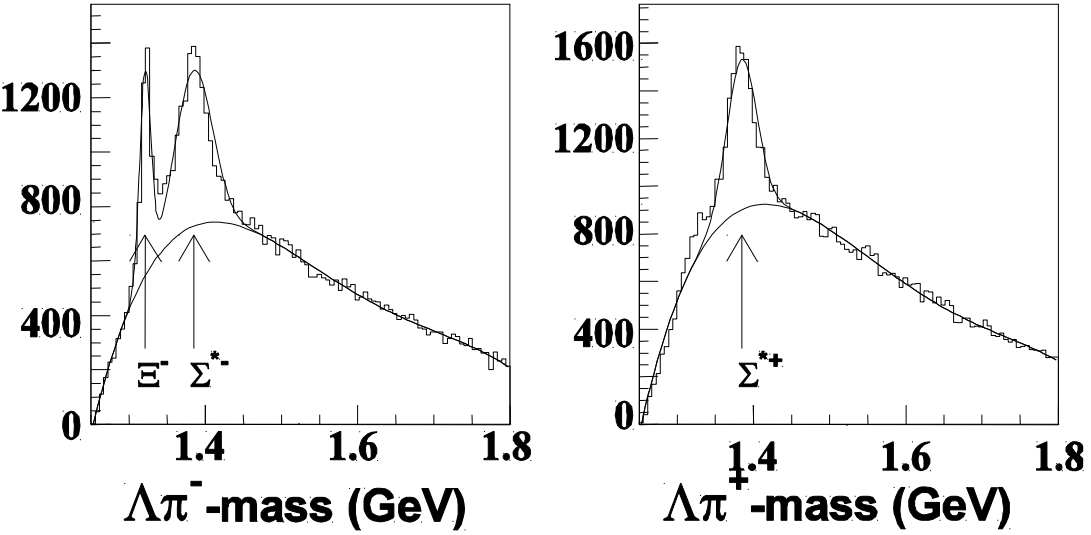
Multiplicity z-distribution



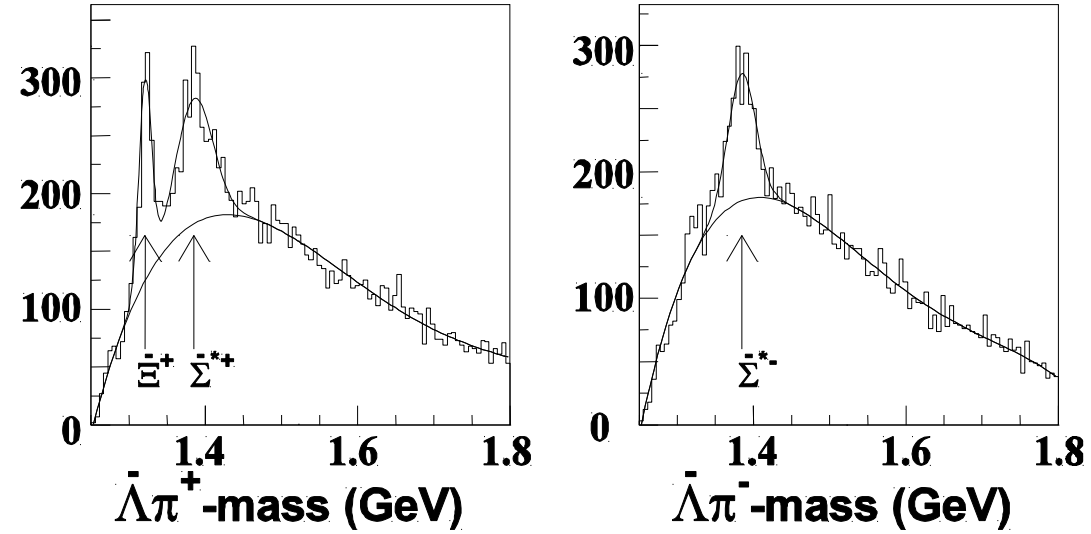
Fragmentation function u→Λ



$\Lambda(\bar{\Lambda})$ from hyperon (anti-hyperon) decays (quasi-real photoproduction regime)



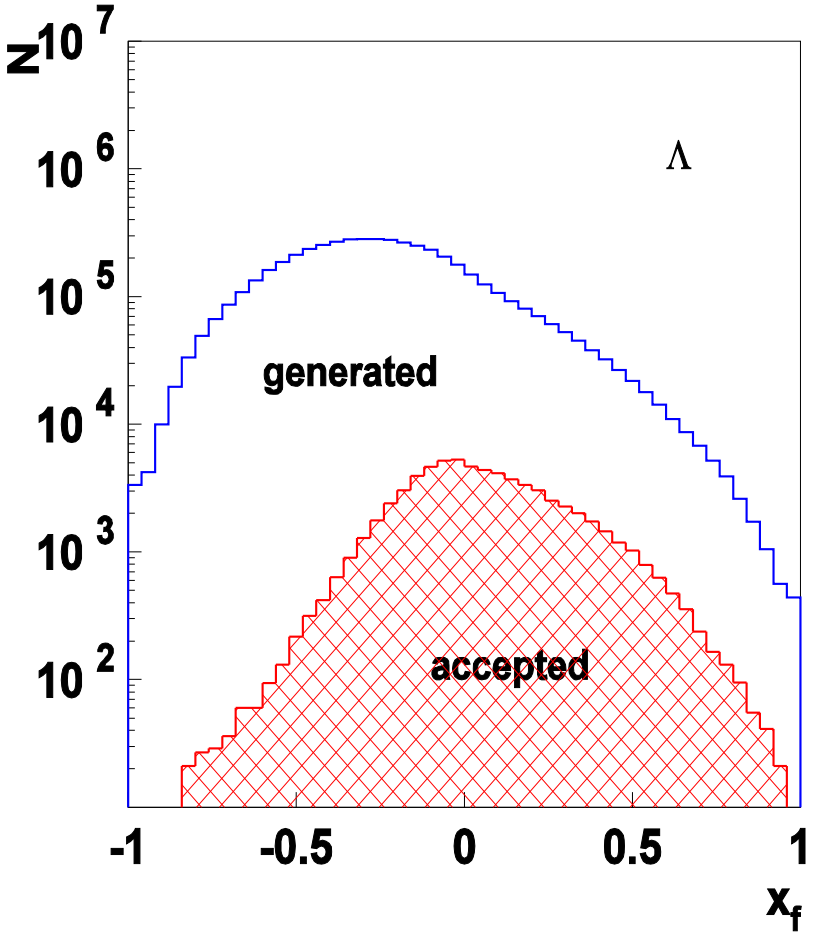
Parent particles	Contribution to Λ production (%)
String(direct)	40
Σ^0	18
Ξ^- and Ξ^0	4
$\Sigma^{*+}\,\Sigma^{*0}\,\Sigma^{*-}$	38



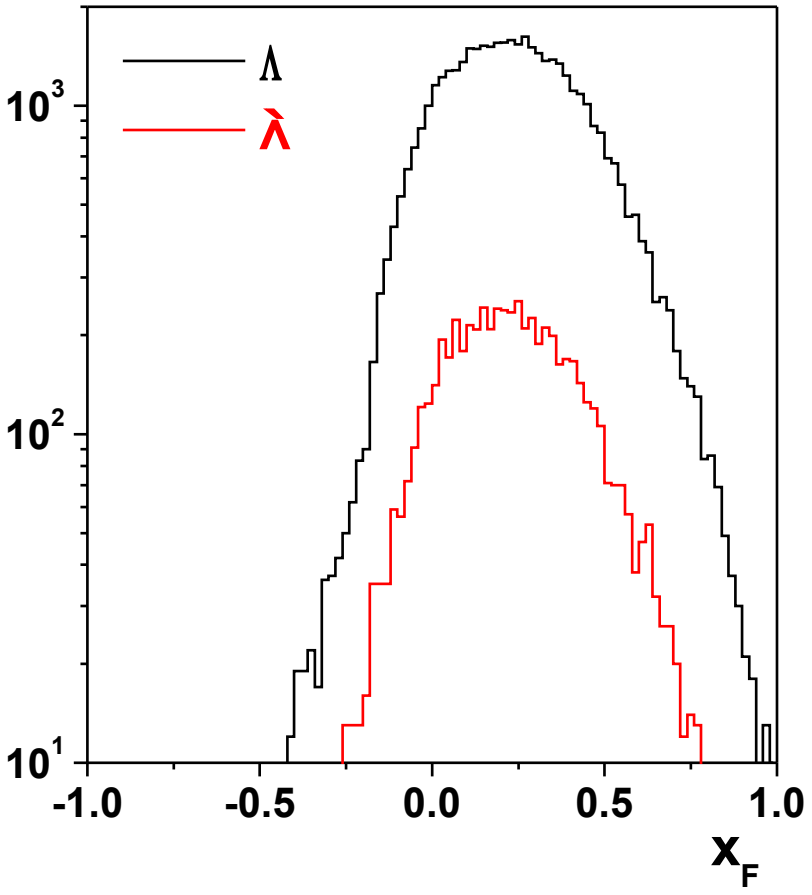
Hyperon	Decay mode, %	Hyperon yield	Antihyperon Yield
$\Lambda^0(1116)$	$p\,\pi^-$ (63.9)	386000	72000
Σ^0 (1193)	$\Lambda^0\gamma$ (100)	19000	5200
Ξ^- (1321)	$\Lambda^0\pi^-$ (99)	2500	650
Σ^{*+} (1393)	$\Lambda^0\pi^+$ (88)	5700	820
Σ^{*-} (1388)	$\Lambda^0\pi^-$ (88)	6300	1200

X_F distributions (semi-inclusive DIS)

Pythia MC for Λ



Experiment for Λ and λ̄



HERMES is a forward spectrometer ⇒ p_Λ(min)~1 GeV

Summary of HERMES data-taking with polarized targets

1994 HERMES test RUN

1995-2000 HERMES RUN I

Beam pol. =51%

Lumi H,D pol=259 pb-1

Lumi unpol = 593 pb-1

(H,D, ^{3}He, ^{4}He, ^{14}N, ^{20}Ne and ^{84}Kr)

Longitudinal polarization

year	type	target polar. %
1995	^{3}He	46
1996	H	76
1997	H	85
1998	D	86
1999	D	83
2000	D	84.5

2001-2002 HERA lumi upgrade

2002-2007 HERMES RUN II

Beam pol. =36%

Lumi H pol=161 pb-1

Lumi unpol ~ 530 pb-1

Transverse polarization

years	type	polar.%
2002-2005	H	78

2006-2007 unpol (RD)

Extraction of $D_{LL'}$

- Angular distribution of decay protons in Λ rest frame

$$\frac{dN}{d\Omega_p} = \frac{dN_0}{d\Omega_p}\left(1 + \alpha P_{Beam} \vec{D}^{\Lambda}_{LL'} \cdot \hat{\vec{k}}_p\right)$$

$$\alpha = 0.642 \pm 0.013$$

$$\frac{dN_0}{d\Omega_p} = \text{const} \quad \text{for } 4\pi \text{ acceptance}$$

for restricted acceptance

$$\frac{dN_0}{d\Omega_p} \text{ depends on } \cos\theta_{pL'}$$

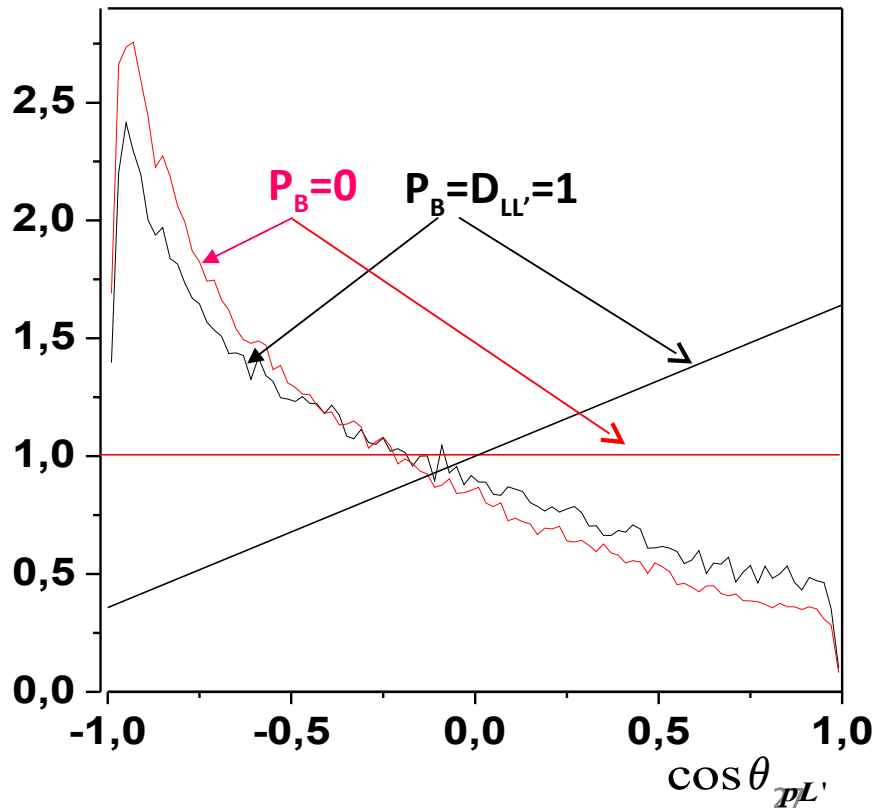
↓

Distorted by spectrometer acceptance

↓

May in principle be calculated using MC

→ **difficulty to avoid false asymmetry induced by MC acceptance simulation**

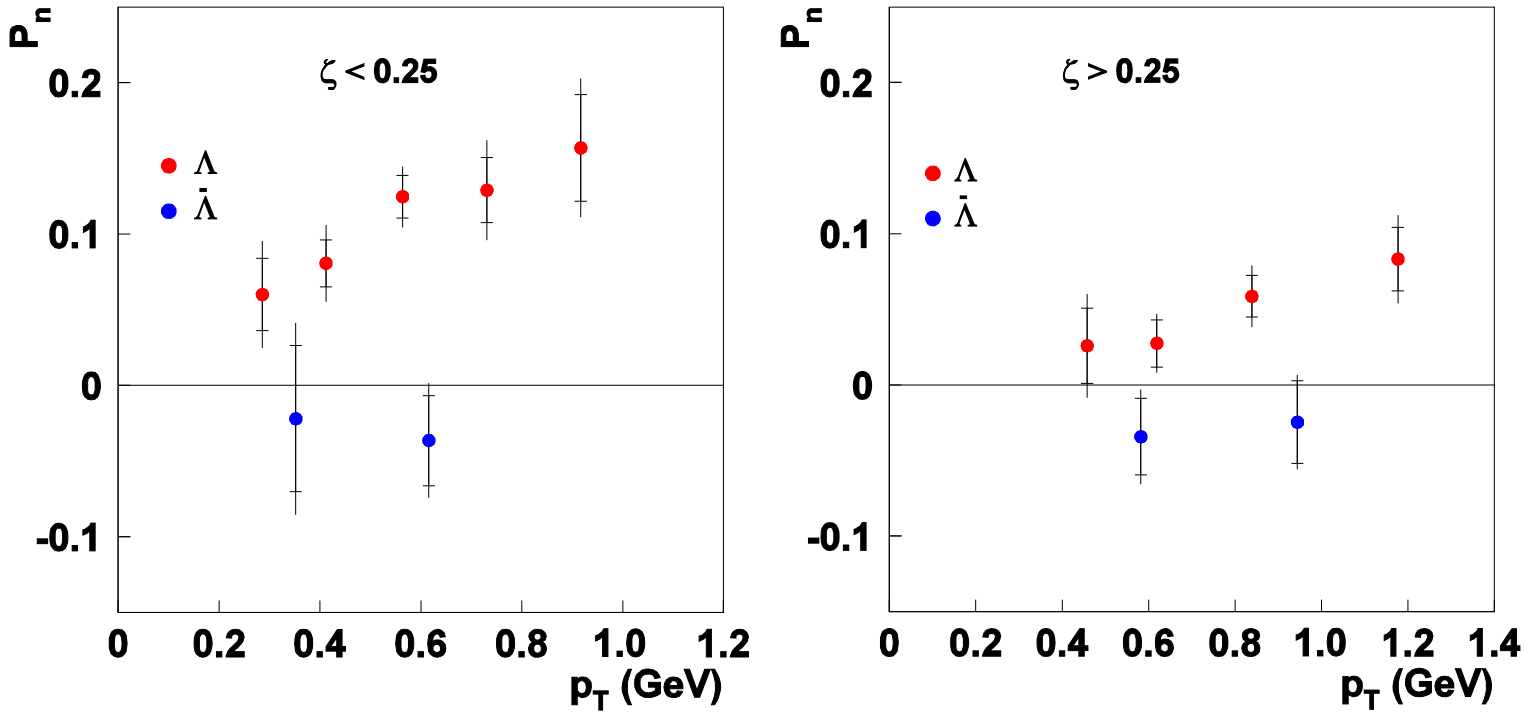


$\bar{P}_{n\Lambda}$ results

Phys Rev. D 2007
(RUN I)

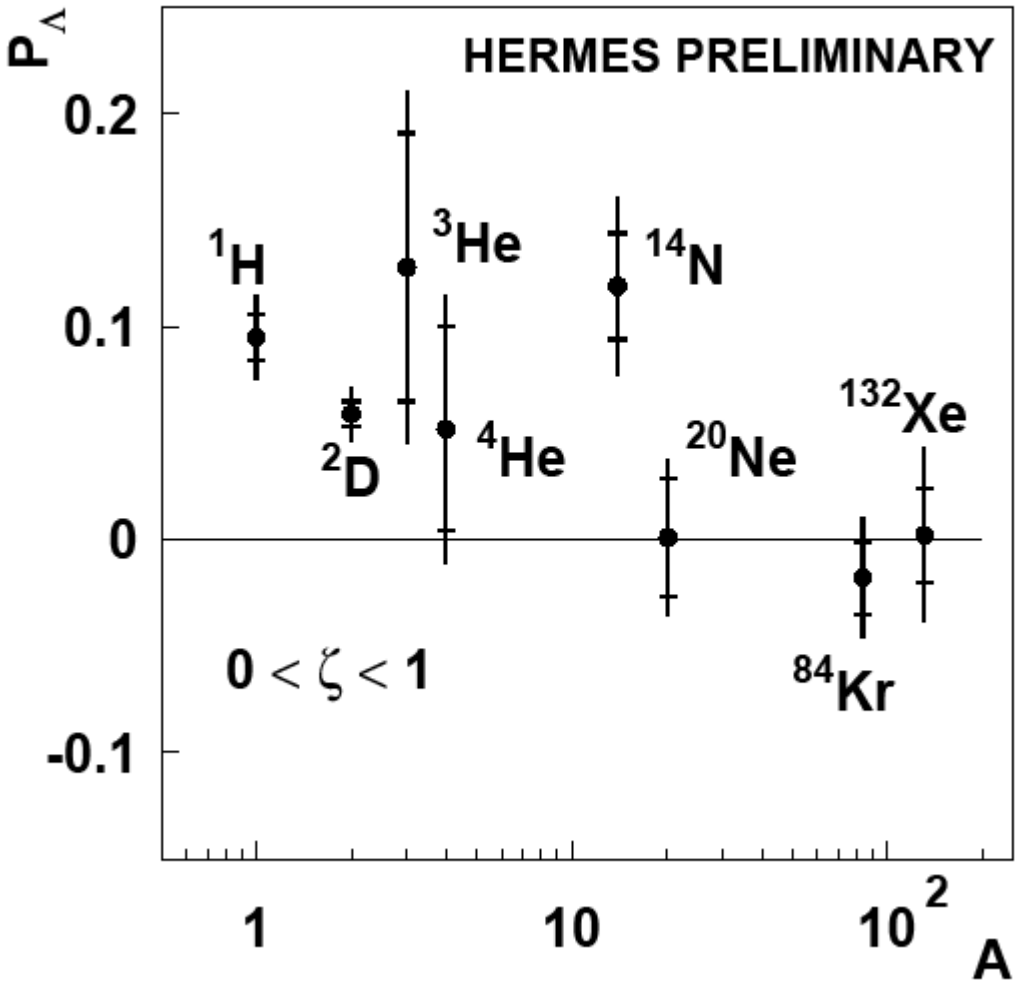
$$e + p \rightarrow \Lambda \uparrow + X \quad at \quad \langle E_\gamma \rangle = 15.6\ GeV$$

inclusively detected

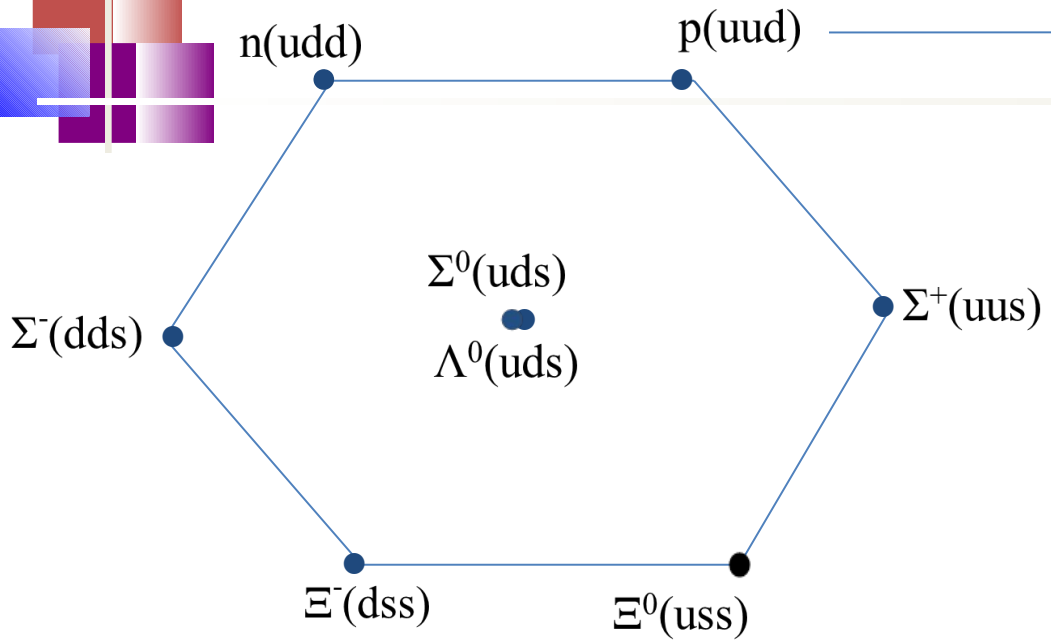


Lower ς (lower t) ⇒ *higher Λ polarization*

Transverse Lambda polarization A/Z dependence



Naïve Constituent Quark Model nCQM



low mass spin 1/2(3/2) baryon 8-et (10-et) can be built using various combination of u, d, s quarks within SU(3)_flavor symmetry model

Magnetic moments of baryons well described, e.g. $\frac{\mu_n}{\mu_p} = -\frac{2}{3}$ $(vs - 0.685exp)$

It implies that in nCQM $S_z = \frac{1}{2}\Delta\Sigma$, *where* $\Delta\Sigma = (\Delta u + \Delta d + \Delta s)$=1

Using SU(3) rotation one obtains: for $p\uparrow$ Δu =4/3 Δd=−1/3 $\Delta s = 0$

for $\Lambda\uparrow$ $\Delta u = 0$ $\Delta d = 0$ $\Delta s = 1$

etc. …….

PhD theses on lambda physics at HERMES

Longitudinal Polarization of the Lambda in Deep Inelastic Scattering of Polarized Positrons f
G. Schnell Ph.D. Thesis, New Mexico State University, May 1999

Messungen zum Spintransfer bei Lambda^0 -Produktion im polarisierter Lepton-Nukleon Streuung im HERMES-Experiment *S. Bernreuther* Dissertation, Friedrich-Alexander-Universitaet Erlangen-Nuernberg

Investigation of Lambda-hyperon production in deep inelastic positron nucleon scattering i
Y. Naryshkin Dissertation, Gatchina 2001

Lambda Hyperon Production Mechanisms and Longitudinal Spin Transfer at HERMES
H.C. Chiang Senior Thesis, University of Illinois at Urbana-Champaign, Sep 2002

Measurement of the Transverse Spin Polarization of the Lambda in Quasi-Real Photoproduc
PDF format *A.E. Andrus* Ph.D. thesis, University of Illinois at Urbana-Champaign, May 2006

Quasi-real photo-production of hyperons and their impact on the Lambda polarization measurements PDF format *A.J. Reischl* PhD thesis University of Amsterdam, April 2007

The polarization of Lambda hyperons in quasi-real photoproduction PDF format *M. Demey* PhD thesis University of Amsterdam, March 2007

Hyperon production at the HERMES experiment PDF format *C. Bonomo* Ph.D. thesis, Universita' degli Studi di Catania, Feb 2007

14th International Conference on Particles and Nuclei (PANIC 96)
May 22 - 28, 1996 ..... Williamsburg, USA
S. Belostotski - hadron spectroscopy
Results on Lambda0 Production at HERMES *P. Chumney* 2nd Topical Work on Deep Inelastic Scattering off Polarized Targets: Theory Meets Experiment (**SPIN 97**), Zeuthen, Germany, Sep 1 - 5, 1997
Lambda Production at HERMES *P. Chumney* 7th International Conference on Mesons and Light Nuclei, Pruhonice, Prague, Czech Republic, Aug 31 - Sep 4, 1998
Study of Strange Particle Production in HERMES Experiment *S.L. Belostotski* 13th International Symposium on High Energy Spin Physics (**SPIN 98**), Protvino, Russia, Sep 8 - 12, 1998
Strange Particle Production and Polarization of Lambda Hyperons in the HERMES Experiment *S. Belostotski* 7th International Work on Deep Inelastic Scattering and QCD (**DIS 99**), Zeuthen, Germany, Apr 19 - 23, 1999
Lambda Polarization Measured at HERMES and Lambda Spin Structure *S. Belostotski* International Work on Symmetry and Spin (**PRAHA**-SPIN 99), Prague, Czech Republic, Sep 5 - 12, 1999
Fragmentation Function of Up Quark to Lambda Measured in the HERMES Experiment *S. Belostotski, O. Grebenyuk, Y. Naryshkin* Workshop on the physics problems of Nucleon Structure and Meson Spectroscopy, Dubna, Russia, Oct 9 - 15, 2000
Longitudinal Lambda Polarization Measured at HERMES *O. Grebenyuk* 9th International Work on Deep Inelastic Scattering and QCD (**DIS 2001**), Bologna, Italy, Apr 27 - May 1, 2001
Longitudinal spin transfer to the Lambda hyperon in lepto-production *S. Belostotski* IX Workshop on High Energy **Spin** Physics, Dubna, Russia, Aug 2 - 7, 2001
Transverse polarization of Lambda hyperons produced inclusively in eN-scattering at HERMES *S. Belostotski and O. Grebenyuk* IX Workshop on High Energy **Spin** Physics, Dubna, Russia, Aug 2 - 7, 2001
Transverse Polarization of Lambda and Lambda-bar Produced Inclusively in eN Scattering at HERMES *O. Grebenyuk* 10th International Workshop on Deep Inelastic Scattering and QCD (**DIS 2002**), Cracow, Poland, Apr 30 - May 4, 2002
Transverse Polarisation of Lambda and Lambda Hyperons in Quasi-Real Photon Nucleon *A. Brüll* 15th International Spin Physics Symposium (**SPIN02**), Brookhaven National Lab, NY, USA, Sep 9 - 14, 2002
10th International Workshop on Deep Inelastic Scattering and QCD (DIS 2002)
Apr 30 - May 4, 2002 ..... Cracow, Poland
Y. Naryshkin – Study of Lambda hyperon production and longitudinal spin transfer in the HERMES Experiment
MESON2004 Workshop
Jun 4 - 8, 2004 ..... Krakow, Poland
Y. Naryshkin - Hyperon production at HERMES
Hyperon Production at HERMES *S. Belostotski* 16th International Spin Physics Symposium (**SPIN04**), Trieste, Italy, Oct 10 - 16, 2004 **INFO:** Proc. of the 16th Int. Spin Physics Symposium (SPIN), Trieste/I (2005) World Scientific p.400
Topical Aspects of Hyperon physics *S. Belostotski* **ASI** Summer School in Hadron Physics, St. Andrews, Scotland, UK, Aug 22 - Sep 29, 2004 **INFO:** Proc. of 58th Scottish Universities Summer School in Physics (SUSSP58): A NATO Advanced Study Institute and EU Hadron Physics 13 Summer Institute, St. Andrews, Scotland IOP Publishing
Measurement of longitudinal spin transfer to the Lambda0-hyperon at HERMES *Yu. Naryshkin* 7th International Conference on Hyperons, Charm and Beauty Hadrons (**BEACH 2006**), Lancaster University, Lancaster, United Kingdom, Jul 2 - 8, 2006 **INFO:** Nuclear Physics B **167** 110-113
Measurement of Transverse Lambda Polarization in Quasi-Real Photoproduction at HERMES *Yu. Naryshkin* 15th International Workshop on Deep Inelastic Scattering and QCD (**DIS 2007**), Munich, Germany, Apr 16 - 20, 2007 **INFO:** Proc. of 15th Int. Workshop on Deep-Inelastic Scattering and Related Subjects (DIS07), Sep. 2007. doi:10.3360/dis.2007.95
Lambda and antiLambda polarization and spin transfer in photoproduction at HERMES format *D. Veretennikov* 12th Workshop on High Energy Spin Physics (**DSPIN**-07), Dubna, Russia, Sep 3 - 7, 2007 **INFO:** Proceedings of XII Advanced Research Workshop on High Energy Spin Physics (DSPIN-07), JINR(2008), p381
SPIN TRANSFER COEFFICIENT $K_{L'}$ IN Lambda PHOTOPRODUCTION AT HERMES *D. Veretennikov* 16th International Workshop on Deep Inelastic Scattering and QCD (**DIS 2008**), London, UK, Apr 7 - 11, 2008 **INFO:** Proc. of XVI International Workshop on Deep-Inelastic Scattering and Related Subjects (DIS'08), Sept 2008. doi:10.3360/dis.2008.212
Polarization Effects in Lambda and Anti-Lambda Production at Hermes *PDF format *S.Belostotski* 18th International Spin Physics Symposium (**SPIN 2008**), Charlottesville, VA, USA, Oct 6 - 11, 2008 **INFO:** To be published by AIP
European Nuclear Physics Conference (ENPC09)
Mar 16 - 20, 2009 ..... Bochum, Germany
Y. Naryshkin - A-dependence of lambda polarisation
Physics at HERMES *PDF format *Yu. Naryshkin* XIII Workshop on High Energy Spin Physics (**DSPIN09**), Dubna, Russia, Sep 1 - 5, 2009
Lambda polarization at HERMES *PDF format *Yu. Naryshkin* **BEACH**'10: 9th International Conference On Hyperons, Charm And Beauty Hadrons, Perugia, Italy, Jun 21 - 26, 2010
19th International Spin Physics Symposium (SPIN 2010)
Sep 27 - Oct 2, 2010 ..... Juelich, Germany
Yuri N. - Transverse Lambda polarisation
19th International Spin Physics Symposium (SPIN 2010)
Sep 27 - Oct 2, 2010 ..... Juelich, Germany
Denis V. - long. Lambda polarisation
20th International Spin Physics Symposium (SPIN 2010)
April 2011, Newport news Virginia, USA
S.Belostotski Spin transfer in DIS