Longitudinal Polarization of $\Lambda/\bar{\Lambda}$ Hyperons in Lepton-Nucleon SIDIS

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JINR

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Preface

Paper: Longitudinal Polarization of Lambda and anti-Lambda Hyperons in Lepton-Nucleon Deep-Inelastic Scattering., John Ellis, Aram Kotzinian, Dmitry Naumov, Mikhail Sapozhnikov, hep-ph/0702222. European Physics Journal C 2007.

Basic conclusions of our work:

- We demonstrate that new COMPASS data can sharpen two free parameters of our model
- An accurate measurement of $\Lambda, \bar{\Lambda}$ longitudinal polarization in COMPASS and HERA gives a new method to measure $s(x), \bar{s}(x)$ in the nucleon.
- The spin structure of $\Lambda, \bar{\Lambda}$ hyperons could be extracted from the same data (SU(6) Й BJ models)
- Finally, we emphasize that the nucleon polarized strangeness is reflected in a longitudinal polarization of Λ hyperons which can be measured in COMPASS, HERA, JLAB

Outline

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What is a proton?

- A particle of matter with mass 938 MeV
- Electric charge $+1$
- Consists of three (valence) quarks: uud
- Spin $1/2$

$SU(3)$ model is able to host 8 baryons with $J^P = 1/2^+$:

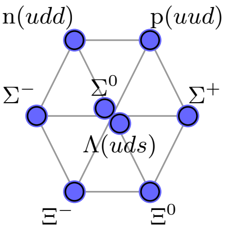
$$p(uud), n(udd), \Sigma^+(uus), \Sigma^0(uds), \Sigma^-(dds), \Lambda^0(uds), \Xi^0(uss), \Xi^-(dss),$$

and 10 excited baryonds with $J^P = 3/2^+$:

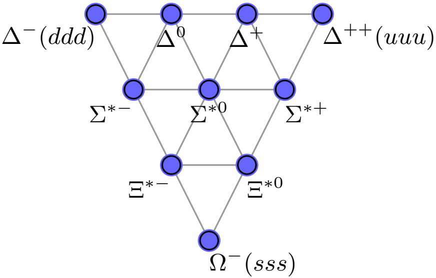
$$\Delta, \Sigma^\star, \Xi^\star, \Omega^-.$$

$SU(3)$ group

Octet and decuplet of baryons



$SU(3)$-octet



$SU(3)$-decuplet

$SU(3) \times SU(2)$ wave functions of baryons

$$p^{\uparrow} = \frac{1}{\sqrt{18}} \left(2u^{\uparrow}u^{\uparrow}d^{\downarrow} - u^{\uparrow}u^{\downarrow}d^{\uparrow} - u^{\downarrow}u^{\uparrow}d^{\uparrow} + \text{ cycl. permutations } \right)$$

$$n^{\uparrow} = \frac{1}{\sqrt{18}} \left(2d^{\uparrow}d^{\uparrow}u^{\downarrow} - d^{\uparrow}d^{\downarrow}u^{\uparrow} - d^{\downarrow}d^{\uparrow}u^{\uparrow} + \dots \right)$$

$$\Sigma^{+\uparrow} = \frac{1}{\sqrt{18}} \left(2u^{\uparrow}u^{\uparrow}s^{\downarrow} - u^{\uparrow}u^{\downarrow}s^{\uparrow} - u^{\downarrow}u^{\uparrow}s^{\uparrow} + \dots \right)$$

$$\Sigma^{0\uparrow} = \frac{1}{6} \left(2(u^{\uparrow}d^{\uparrow} + d^{\uparrow}u^{\uparrow})s^{\downarrow} - s^{\uparrow}(u^{\downarrow}d^{\uparrow} + d^{\downarrow}u^{\uparrow}) - d^{\downarrow}s^{\uparrow}u^{\uparrow} - u^{\downarrow}s^{\uparrow}d^{\uparrow} + \dots \right)$$

$$\Sigma^{-\uparrow} = \frac{1}{\sqrt{18}} \left(2d^{\uparrow}d^{\uparrow}s^{\downarrow} - d^{\uparrow}d^{\downarrow}s^{\uparrow} - d^{\downarrow}d^{\uparrow}s^{\uparrow} + \dots \right)$$

$$\Lambda^{0\uparrow} = \frac{1}{\sqrt{12}} \left(u^{\uparrow}d^{\downarrow}s^{\uparrow} - u^{\downarrow}d^{\uparrow}s^{\uparrow} - d^{\uparrow}u^{\downarrow}s^{\uparrow} + d^{\downarrow}u^{\uparrow}s^{\uparrow} + \dots \right)$$

$$\Xi^{0\uparrow} = \frac{1}{\sqrt{18}} \left(2s^{\uparrow}s^{\uparrow}u^{\downarrow} - s^{\uparrow}s^{\downarrow}u^{\uparrow} - s^{\downarrow}s^{\uparrow}u^{\uparrow} + \dots \right)$$

$$\Xi^{-\uparrow} = \frac{1}{\sqrt{18}} \left(2s^{\uparrow}s^{\uparrow}d^{\downarrow} - s^{\uparrow}s^{\downarrow}d^{\uparrow} - s^{\downarrow}s^{\uparrow}d^{\uparrow} + \dots \right)$$

Magnetic moments of baryons

Static magnetic-dipole moments of baryons are defined by:

$$\boldsymbol{\mu}_B = \sum_q \mu_q \boldsymbol{\sigma}_q,$$

where $\mu_q = e_q/2m_q$—magnetic dipole moment of quark q. Magnetic moment of a baryon B, described by a ket-vector $|B\rangle$, can be computed as:

$$\mu(B) = \langle B|\boldsymbol{\mu}_B|B\rangle.$$

Magnetic moments of baryons

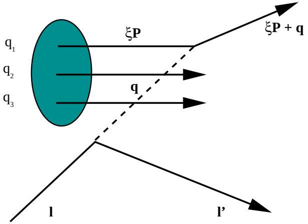
Prediction of SU(6)			Experiment
Magnetic moment	formula	value (in μ_N)	(in μ_N)
$\mu(p)$	$\frac{4}{3}\mu_u - \frac{1}{3}\mu_d$	(input)	2.793
$\mu(n)$	$\frac{4}{3}\mu_d - \frac{1}{3}\mu_u$	-1.86	-1.913
$\mu(\Lambda^0)$	μ_s	(input)	-0.613 ± 0.004
$\mu(\Sigma^+)$	$\frac{4}{3}\mu_u - \frac{1}{3}\mu_s$	2.69	2.458 ± 0.010
$\mu(\Sigma^-)$	$\frac{4}{3}\mu_d - \frac{1}{3}\mu_s$	-1.04	-1.16 ± 0.025
$\mu(\Xi^0)$	$\frac{4}{3}\mu_s - \frac{1}{3}\mu_u$	-1.44	-1.25 ± 0.014
$\mu(\Xi^-)$	$\frac{4}{3}\mu_s - \frac{1}{3}\mu_d$	-0.51	-0.679 ± 0.031
$\mu(\Omega^-)$	$3\mu_s$	-1.84	-1.94 ± 0.22

Scatter hign energy leptons off protons

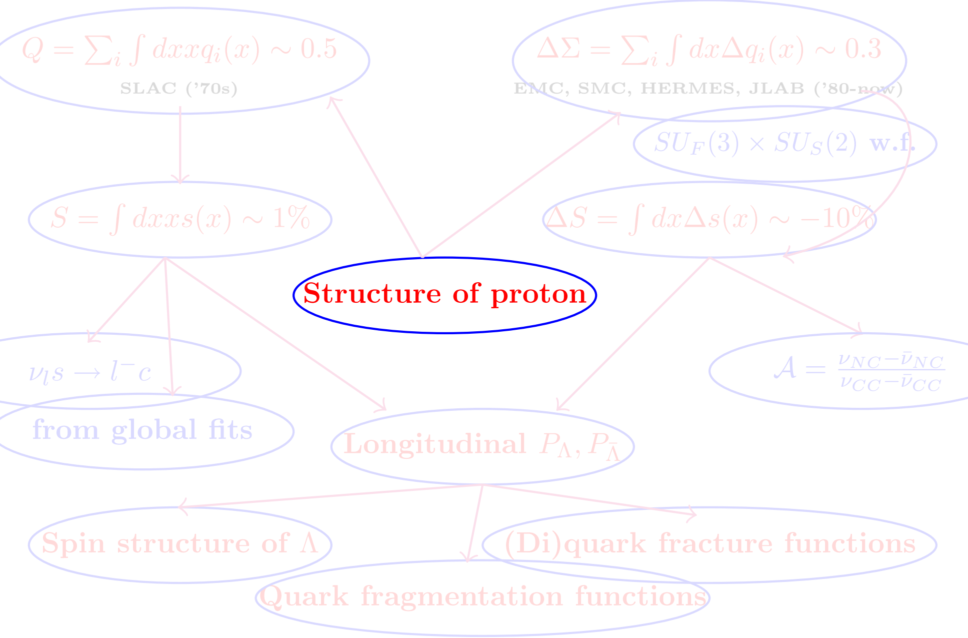
Measuring polarized cross-sections we can access the proton structure:

$$\frac{d^2\sigma^{\uparrow\Uparrow}}{d\Omega dE'}+\frac{d^2\sigma^{\uparrow\Downarrow}}{d\Omega dE'} = \frac{8\alpha^2 E'^2}{MQ^4}\left[2\sin^2\theta/2\, F_1^{em}(x,Q^2)+\frac{M}{\nu}\cos^2\theta/2\, F_2^{em}(x,Q^2)\right]$$

$$\frac{d^2\sigma^{\uparrow\Downarrow}}{d\Omega dE'}-\frac{d^2\sigma^{\uparrow\Uparrow}}{d\Omega dE'} = \frac{4\alpha^2 E'}{Q^2 EM\nu}\left[(E+E'\cos\theta)\; g_1(x,Q^2) - 2xM\; g_2(x,Q^2)\right].$$



$$F_1^{em}(x) = \frac{1}{2}\sum_q e_q^2 q(x)$$
$$F_2^{em}(x) = 2xF_1^{em}(x)$$
$$g_1(x) = \frac{1}{2}\sum_q e_q^2 \Delta q(x)$$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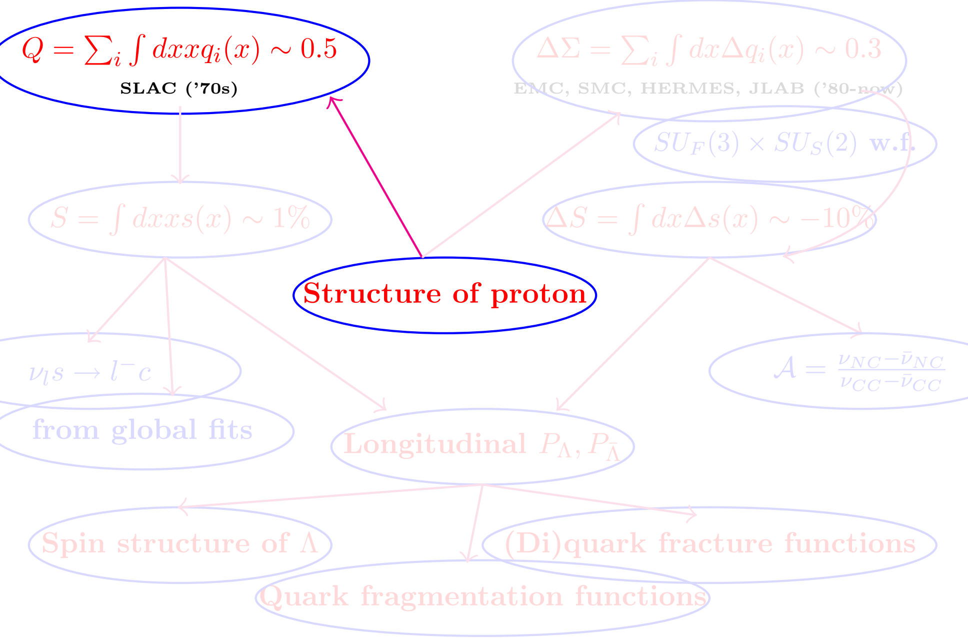
SLAC ('70s)
$\Delta\Sigma = \sum_i \int dx \Delta q_i(x) \sim 0.3$
EMC, SMC, HERMES, JLAB ('80-now)
$SU_F(3) \times SU_S(2)$ w.f.
$S = \int dx x s(x) \sim 1\%$
$\Delta S = \int dx \Delta s(x) \sim -10\%$
Structure of proton
$\nu_l s \to l^- c$
$\mathcal{A} = \frac{\nu_{NC} - \bar{\nu}_{NC}}{\nu_{CC} - \bar{\nu}_{CC}}$
from global fits
Longitudinal $P_\Lambda, P_{\bar{\Lambda}}$
Spin structure of Λ
(Di)quark fracture functions
Quark fragmentation functions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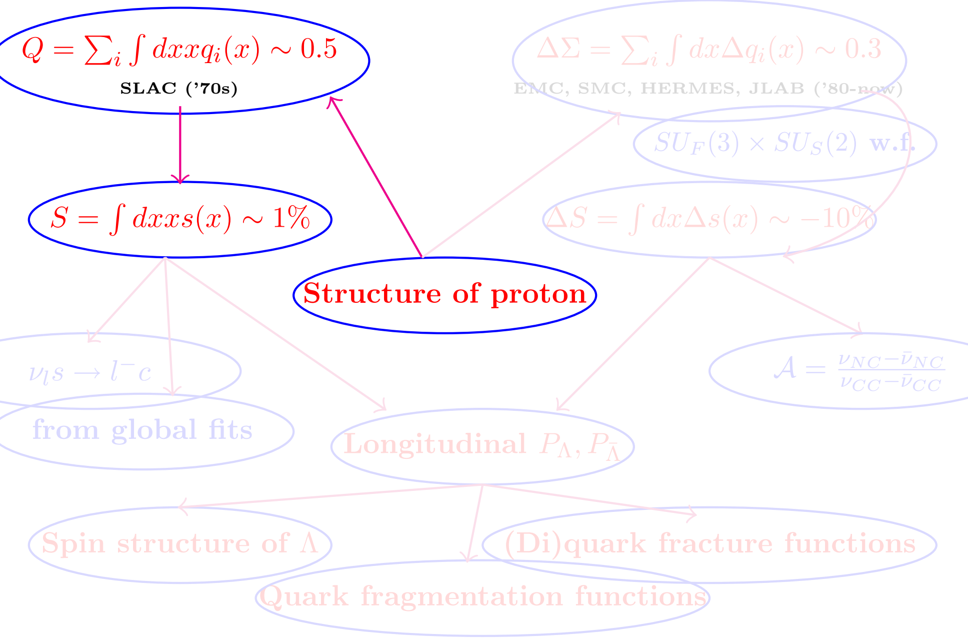
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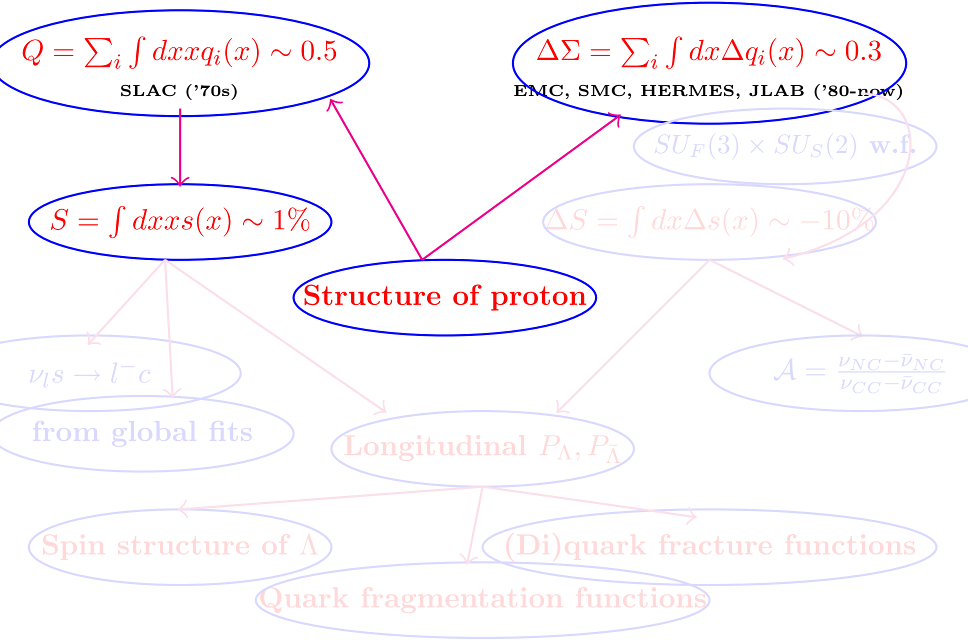
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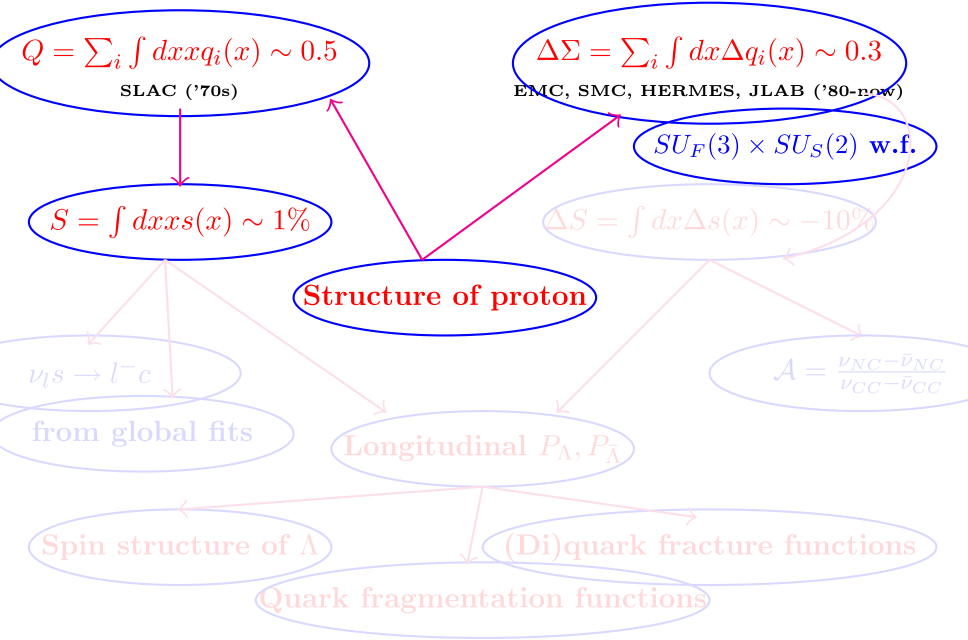
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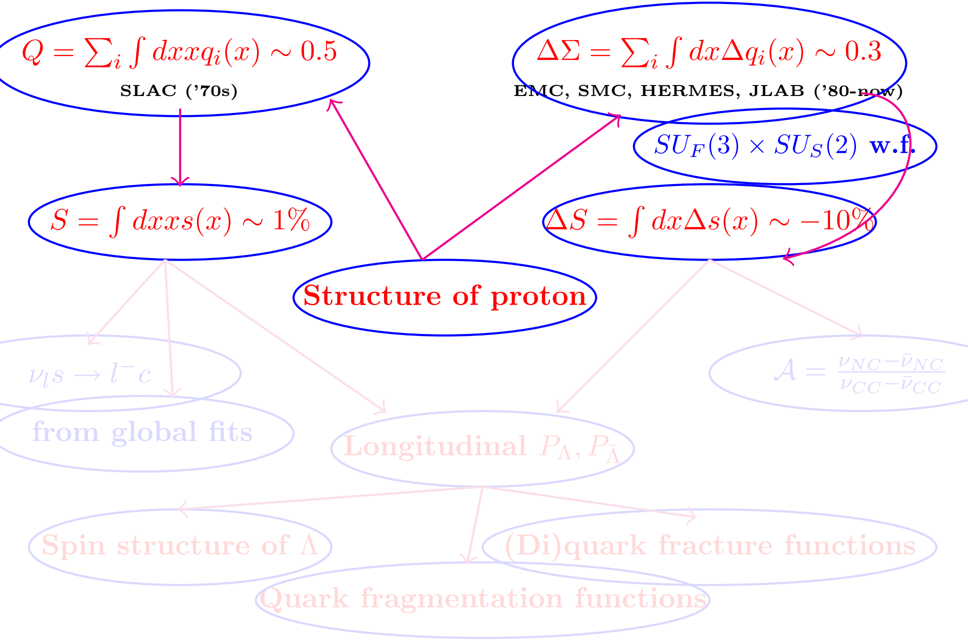
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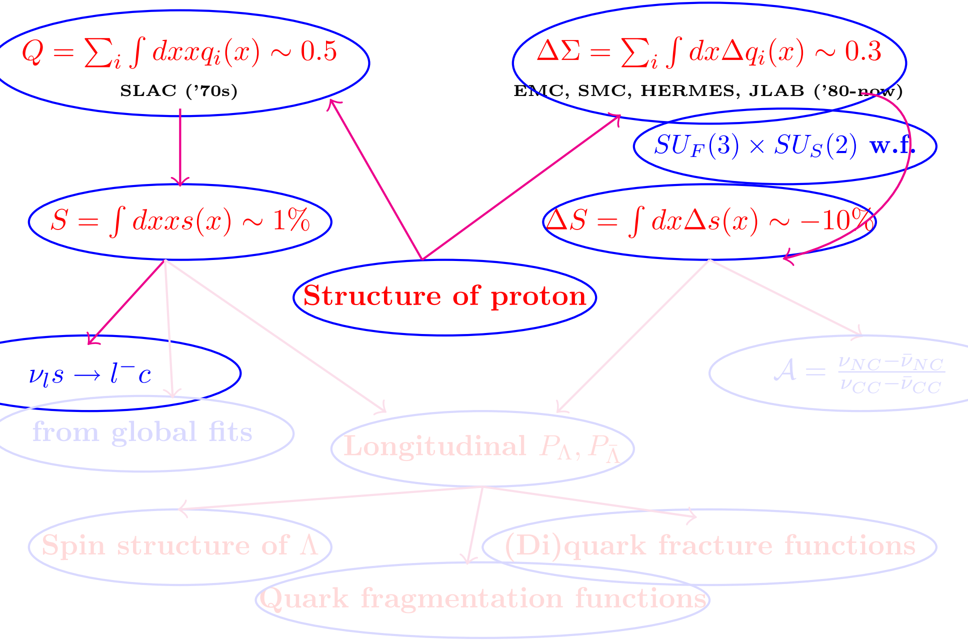
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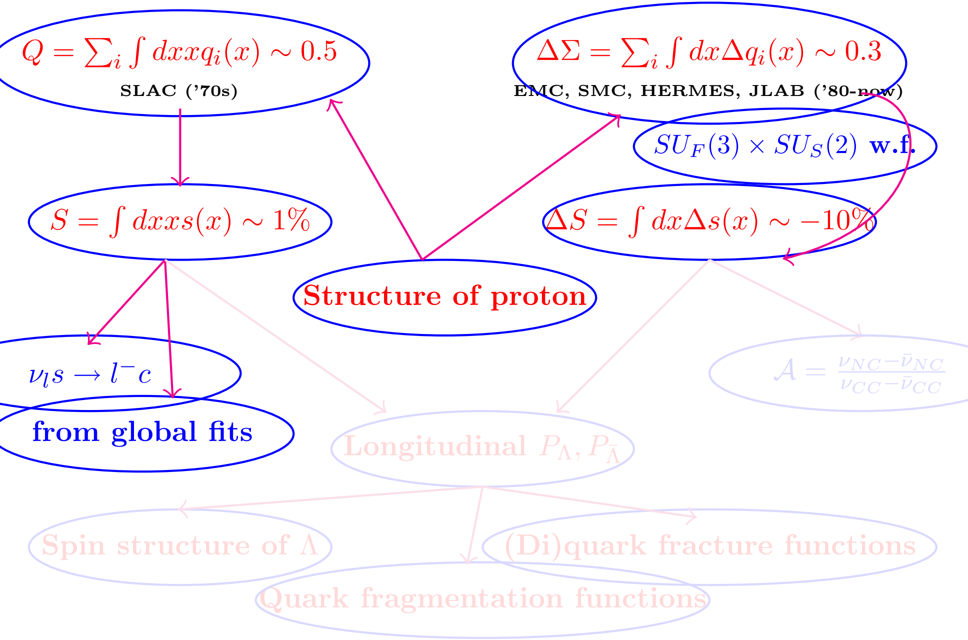
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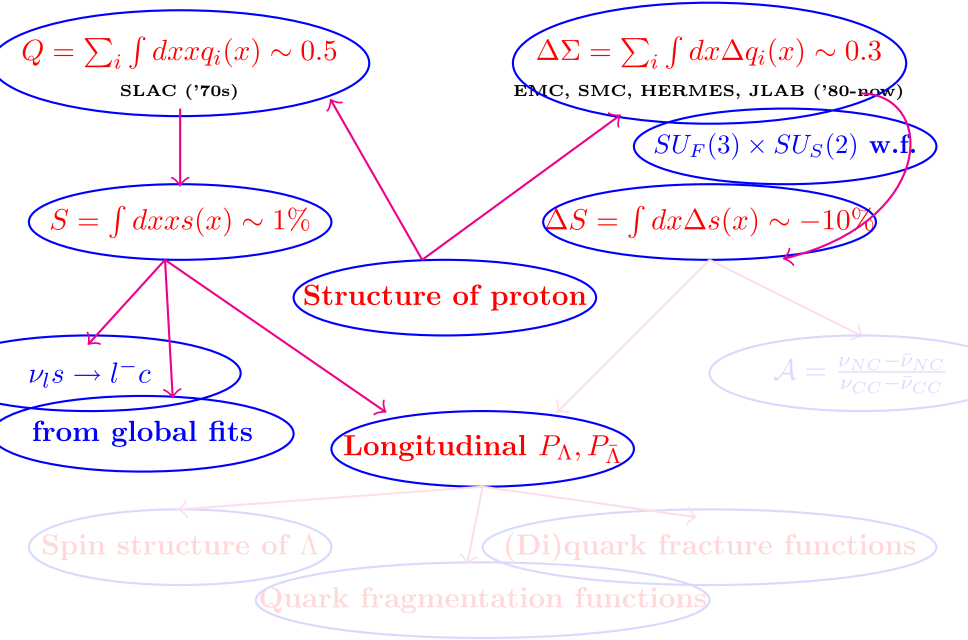
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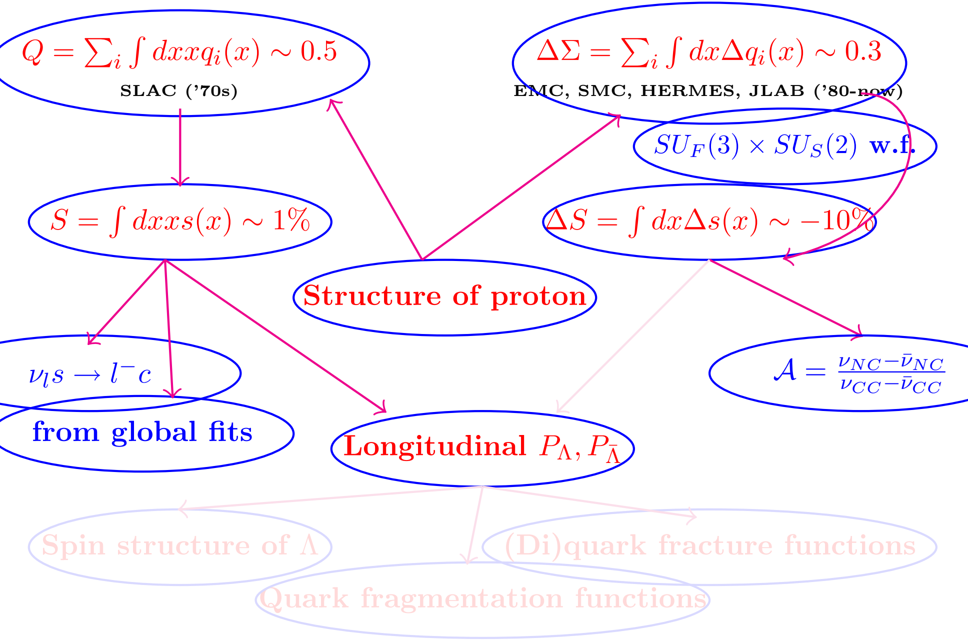
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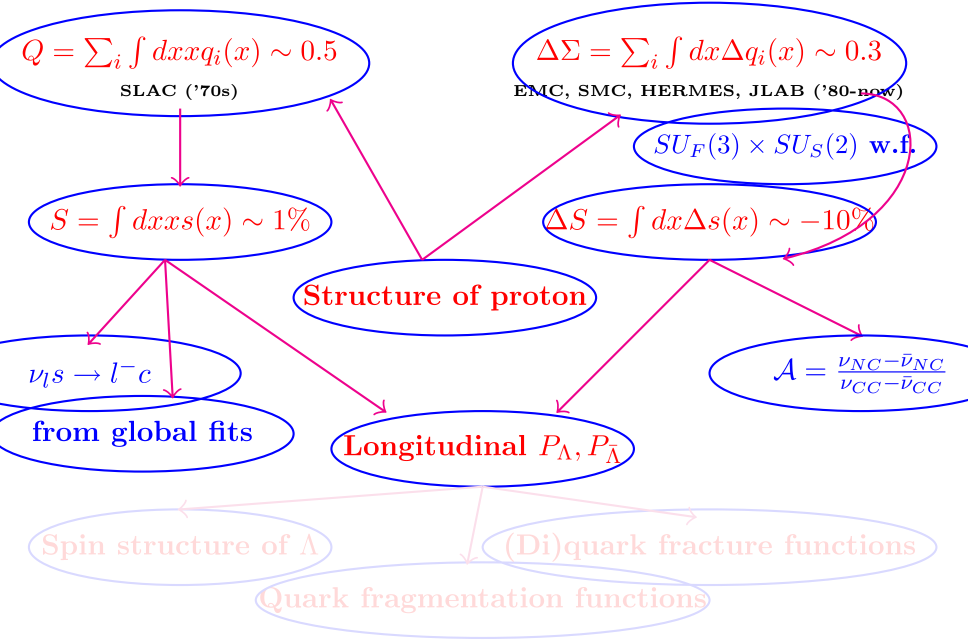
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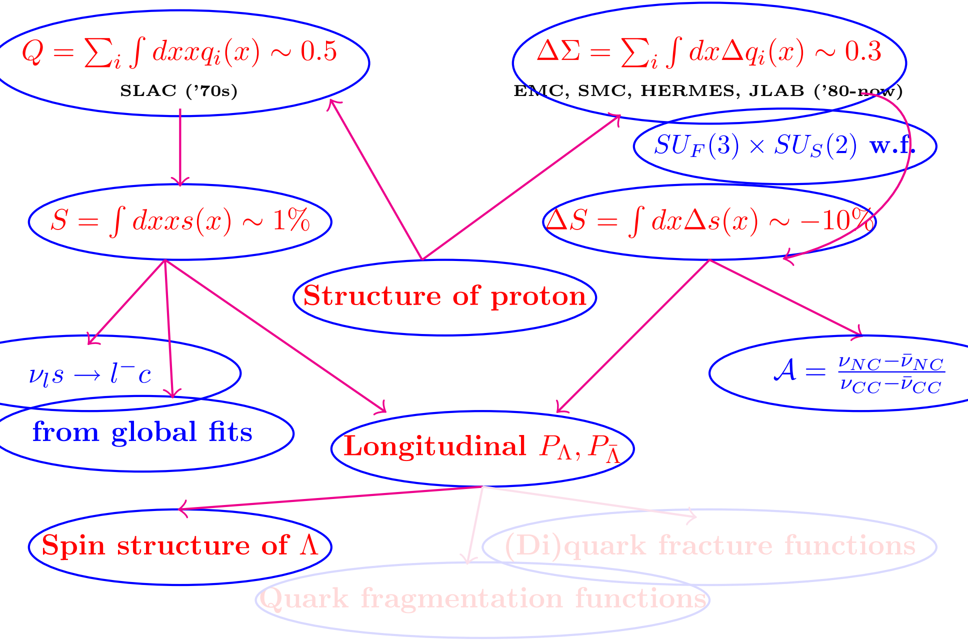
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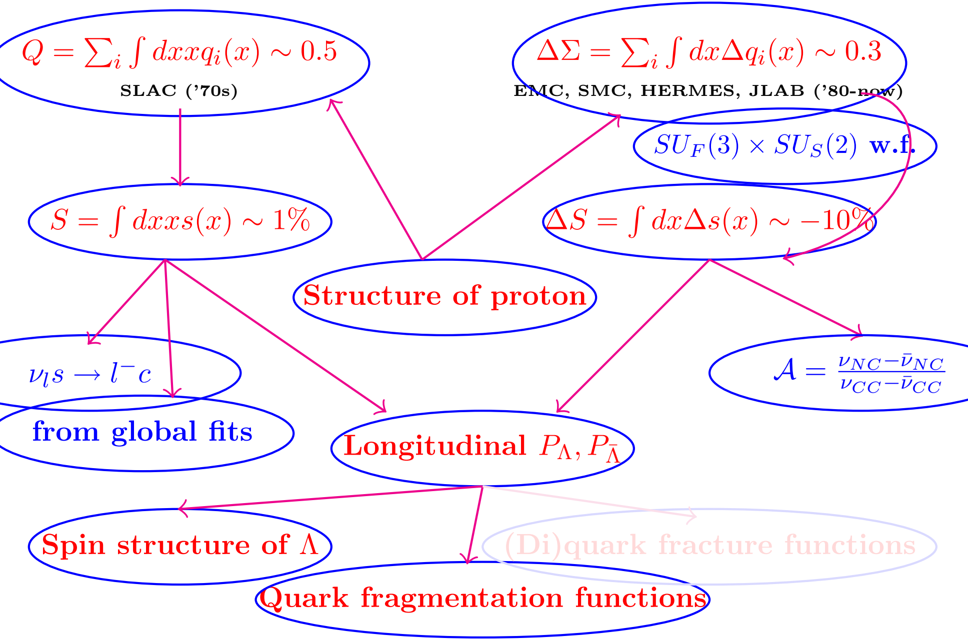
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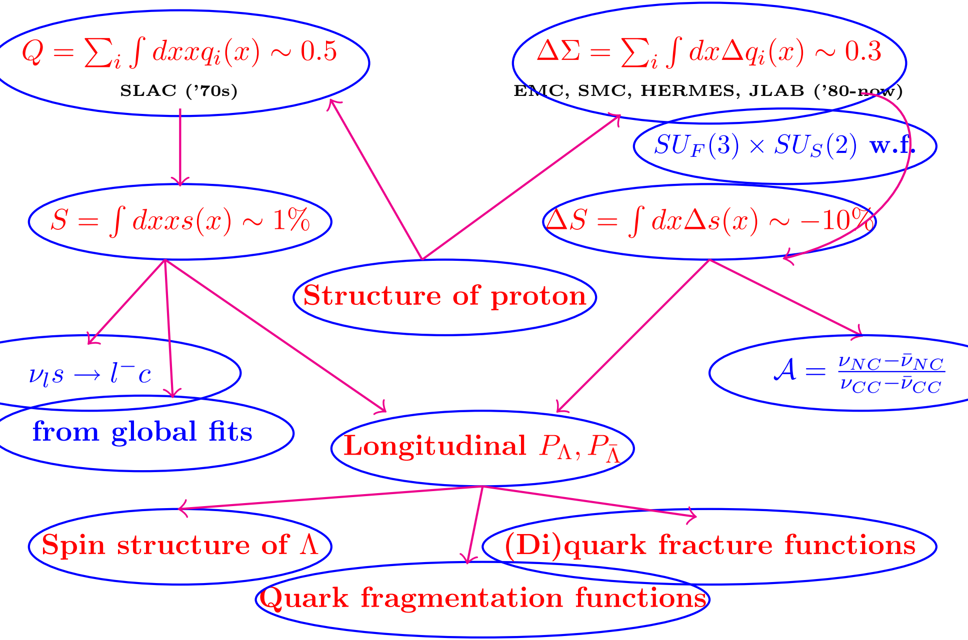

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What do we know about the strangenss in nucleon?

- s quarks carry about 4% of the nucleon momentum at $Q^2 = 20$ GeV ©CCFR
- combination of electric and magnetic form-factors is small:
  $G_E + 0.39G_M = 0.025 \pm 0.020 \pm 0.014$ ©HAPPEX,
  $G_E + 0.225G_M = 0.039 \pm 0.034$ ©A4
- s quark contributes little to the magnetic moment of nucleon:
  $-0.1 \pm 5.1\%$ ©SAMPLE

On the other hand:

"Spin crysis" suggests that the quarks carry only $\sim 1/3$ of the nucleon spin with $\Delta s \approx -10\%$!

How else the strangeness can be measured?

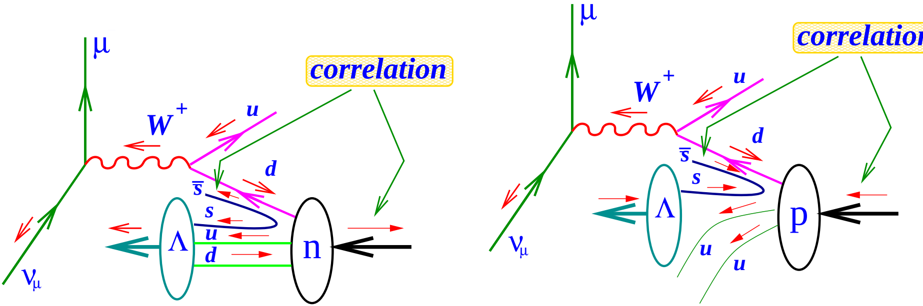
- di-muon events in (anti) neutrino
  - needs large neutrino statistics... seems doable at short time scale only with NOMAD
  - involves large uncertainties in m_c and hadronization. Not sensitive to $\Delta s \ldots$
- neutrino and anti-neutrino cross-sections asymmetry:

$$A = \frac{\nu_{NC} - \bar{\nu}_{NC}}{\nu_{CC} - \bar{\nu}_{CC}}$$

  gives a road to strange form-factors and thus to Δs.
  ©W.A.Alberico, S.M.Bilenky, C.Maieron, hep-ph/0102269
  - unfortunatelly this is VERY difficult experimentally...

Λ and Δs

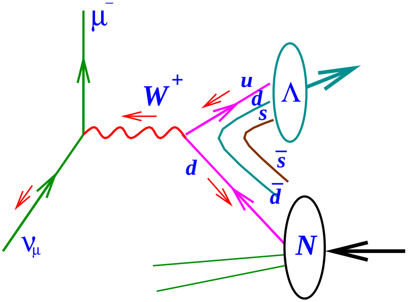
In SU(6) model the $\Lambda/\bar{\Lambda}$ spin is carried by $s/\bar{s}$, thus a possible Δs can be transfered to Λ hyperon and measured in $\Lambda \to p + K_s^0$



Idea

Measure P_Λ in lepton-nucleon DIS to feel Δs in the nucleon

Spin structure of Λ



Bukrhard, Jaffe noted that using SU(6) and the "spin crysis" for the proton one gets the same "spin crysis" for Λ:

$$\Delta u_\Lambda = \Delta d_\Lambda \approx -20\%$$

$\Lambda/\bar{\Lambda}$ vs $s(x)/\bar{s}(x)$

- Today $s(x)/\bar{s}(x)$ are badly known
- Various parametrizations differ by 100% (as GRV98 and CTEQ5L)
- If $\Lambda/\bar{\Lambda}$ are produced from fragmentation of $s(x)/\bar{s}(x)$ than one can expect the final hyperon polarization to be proportional to $s(x)$ for Λ and $\bar{s}(x)$ for $\bar{\Lambda}$. The Λ polarization is a complicated issue as it involves both quark and target remnant fragmentation including the resonances $(\Sigma^*, \Sigma^0, \Xi)$

$$P_\Lambda = P_B D(y) \frac{\sum_q e_q^2 q(x)(\Delta D_q^\Lambda(z) + \Delta F_{p\ominus q}^\Lambda(z))}{\sum_q e_q^2 q(x)(D_q^\Lambda(z) + F_{p\ominus q}^\Lambda(z))}$$

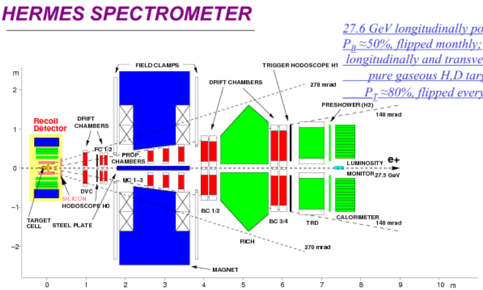
Considering an anti-baryon $\bar{\Lambda}$ essentially simplifies the life:

$$P_{\bar{\Lambda}} = P_B D(y) \frac{e_s^2 \bar{s}(x) \Delta D_{\bar{s}}^{\bar{\Lambda}}(z)}{\sum_q e_q^2 q(x)(D_q^{\bar{\Lambda}}(z) + F_{p\ominus q}^{\bar{\Lambda}}(z))}$$

Outline

Experiments in the game. HERMES

27.6 GeV longitudinally polarized e-beam
$P_B \approx 50\%$, flipped monthly;
longitudinally and transversely polarized
pure gaseous H,D targets
$P_T \approx 80\%$, flipped every 60 sek



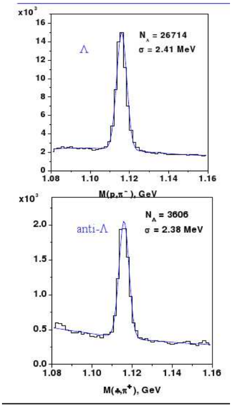
$$\text{HERMES dipole} \quad BL = 1.3\ TM \qquad \frac{\Delta p}{p} \simeq 1\% \qquad \Delta\theta_x, \Delta\theta_y \simeq 1\,mrad$$

$$-170 < \theta_x < +170\,mrad \qquad -140 < \theta_y < -40\,mrad \qquad 140 > \theta_y > 40\,mrad$$

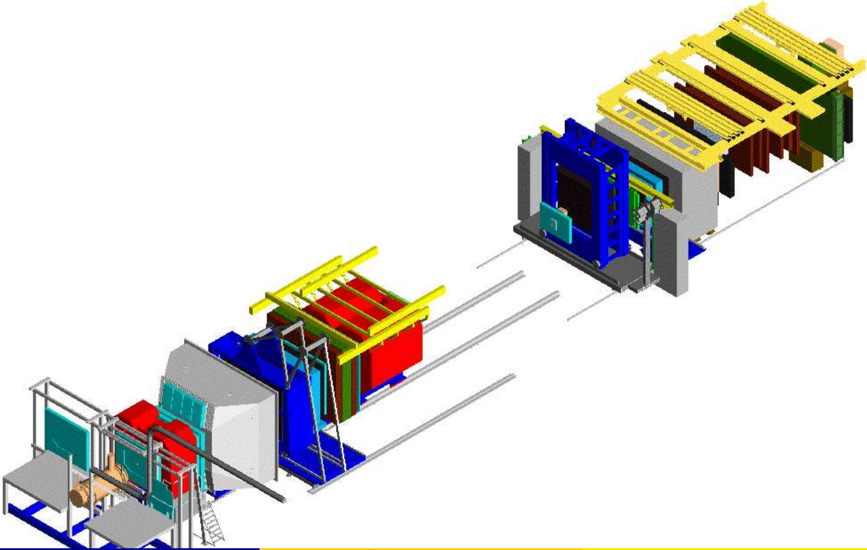
$$40 < \theta < 220\,mrad$$

Very good PID !!

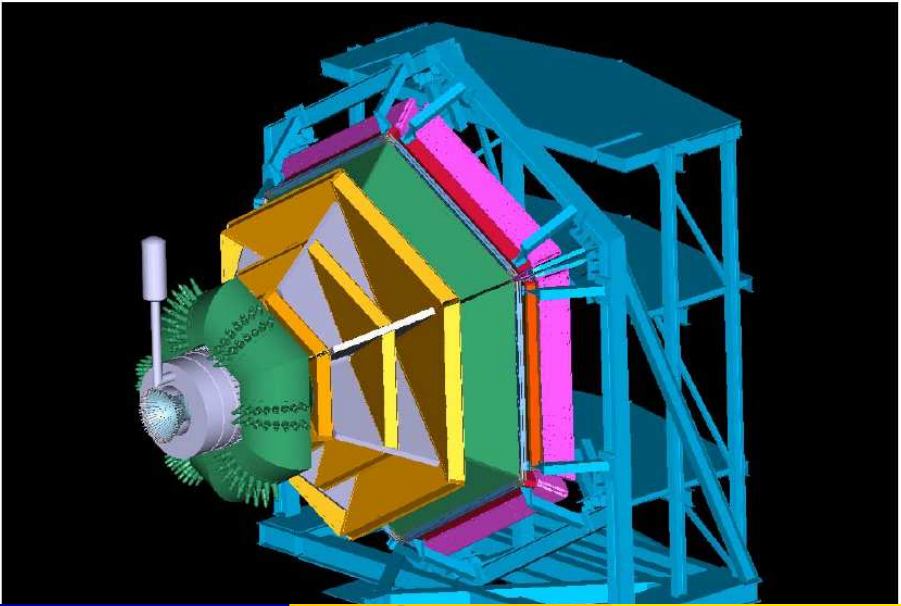
Belostotski "Strangeness polarization…" Trento, Oct.2008



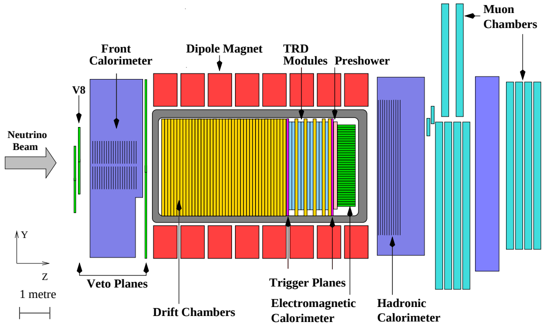
Experiments in the game. COMPASS



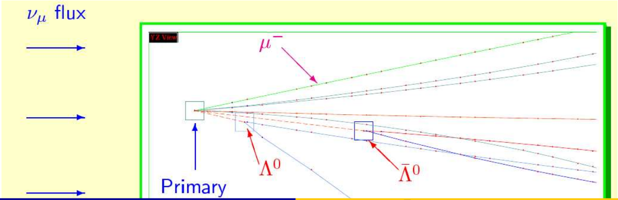
Experiments in the game. JLAB



The NOMAD detector and V^0 reconstruction

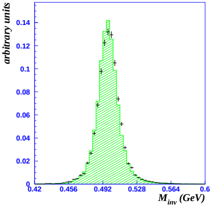


- Drift chambers used as a target (2.7 tons) and for momentum measurement (3.5% resolution)
- Magnetic field: 0.4 T
- TRD and Preshower for electron identification
- ECAL and HCAL for energy measurement
- Muon chambers: detect and identify muon

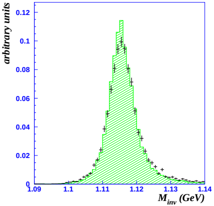


Identification of K_S^0, Λ^0, $\bar{\Lambda}^0$

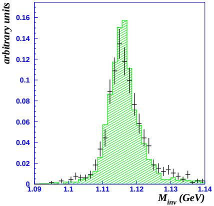
- Kinematic fit of V^0 like vertices for four hypotheses: $K_S^0 \to \pi^+\pi^0$, $\Lambda^0 \to p\pi^-$, $\bar{\Lambda}^0 - \bar{p}\pi^+$, $\gamma \to e^+e^-$
- Good mass resolution



$M_{K_S^0}$: mean = 497.9 sigma = 9.7 (MeV)

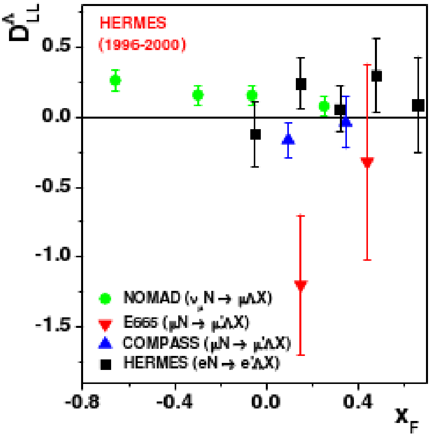


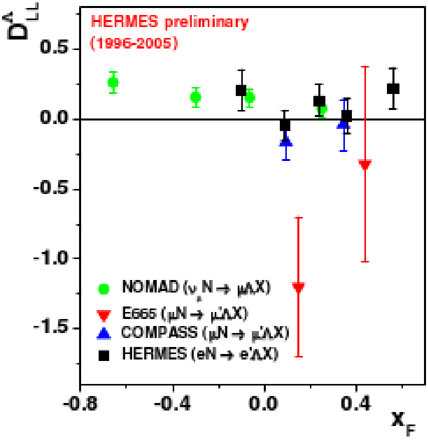
M_Λ: mean = 1115.8, sigma = 3.8 (MeV)



$M_{\bar{\Lambda}}$: mean = 1116.0 sigma = 3.1 (MeV)

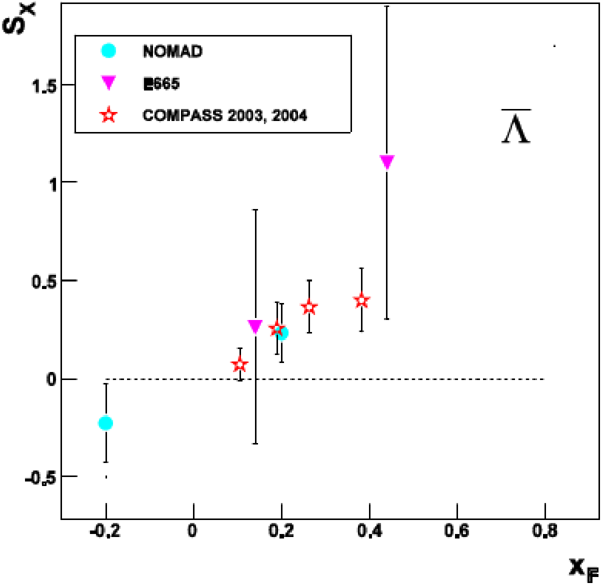
World data on longitudinal polarization of Λs





taken from S.Belostotski talk, Trento 2008

World data on longitudinal polarization of $\bar{\Lambda}$s



Models

Almost all models ignore nucleon target end and deal with a quark fragmentation...

- $SU(6)$: $\Delta u_\Lambda = \Delta d_\Lambda = 0, \Delta s_\Lambda = 1$
- DIS-spin crysis picture (Burkardt-Jaffe): $\Delta u_\Lambda = \Delta d_\Lambda = -0.2, \Delta s_\Lambda = 0.6$
- B.Ma: $\Delta u_\Lambda = \Delta d_\Lambda = \Delta s_\Lambda$
- Lattice calculations: $\Delta u_\Lambda = \Delta d_\Lambda \approx 0, \Delta s_\Lambda = 0.68$

However it is not enough just to assume a quark polarization in Λ. The quark should fragment somehow into it and it will loose partialy its original polarization.

- How much?
- Is it a dominant production mechanism?

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However it is not enough just to assume a quark polarization in Λ. The quark should fragment somehow into it and it will loose partialy its original polarization.

- How much?
- Is it a dominant production mechanism?

Unfortunatelly not. The situation is much more complicated and requires a lot of work:

- Target nucleon remnant is in most cases the dominant process (Factorization “theorem“ is not working)
  - a model pretending to describe polarized data must describe $\Lambda, \bar{\Lambda}$ unpolarized properties because they are defined by production mechanisms (di-quark, string, quark)
  - difficult to make a realistic model for the di-quark fragmentation. [Needs to develop a theory for it which should be confronted to data and tuned if needed]
- Heavy resonances contribute significantly
  - to understand the data many unpolarized measurements are needed (yields of Σ^*, Ξ, Σ^0

Outline

Ingredients

- Interaction of lepton with nucleon
- Hadron fragmentation
- What is the mother of a hadron?
- Polarization of hadrons
- Uncertainties

Interaction of lepton with nucleon

We use LEPTO 6.1 package to model interactions of lepton (charged or neutrino) with nucleon. The following bugs were corrected by us:

- In LEPTO 6.1 it was missing the lepton scattering off sea u, d quarks
  - the bug was corrected and the author of LEPTO 6.1 was informed
- To model a nucleus LEPTO 6.1 “reweights“ quark distributions of protons and neutrons accordning to their fractions. This is OK for unpolarized case but wrong for polarized physics.
  - We first generate samples with protons and neutrons targets, perform polarization analyses and then mix events proportionally to the cross-sections.

Hadron fragmentation

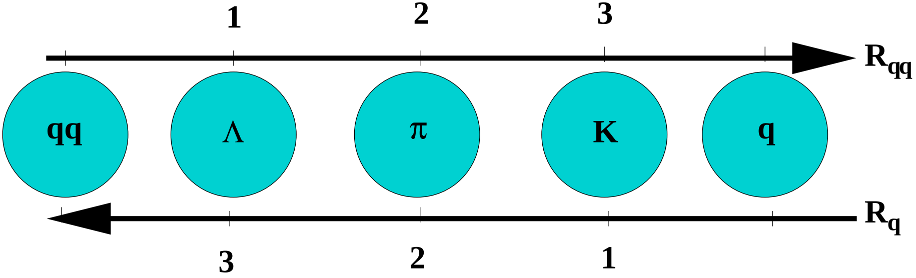
We use JETSET7.4 package to model hadron fragmentation of quarks, di-quarks. JETSET has many free parameters tunable from experiments:

- we used the parameters tuned by the NOMAD Collaboration, which describe yields of Λ and $\bar{\Lambda}$ hyperons, produced promtly or from decays of $(\Sigma^*, \Sigma^0, \Xi)$. ©Artem Chukanov

Hadron rank or what is the hadron mother

In order to assign a polarization to the hadron one has to order hadrons in the hadrons string: decide is the considered hadron close to fragmenting quark or close to the target nucleon remnant. To account this we introduce two ranks:

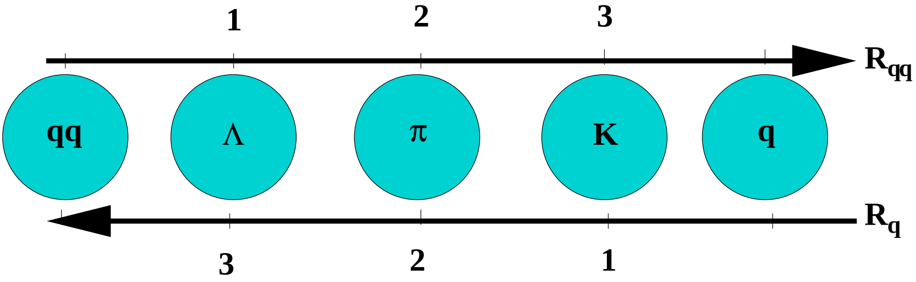
- R_q - hadron number from the quark end of the string
- R_{qq} - hadron number from the target nucleon remnant



Hadron rank or what is the hadron mother

We consider two extreme cases to get an estimate of theory uncertainty.

- **Model A**: Restrict spin transfer in (di)quark fragmentation to hyperons with $(R_{qq} = 1, R_q \neq 1)$ $R_{qq} \neq 1, R_q = 1$;
- **Model B**: Allow spin transfer in (di)quark fragmentation to hyperons with $(R_{qq} > R_q)$ $R_{qq} < R_q$.

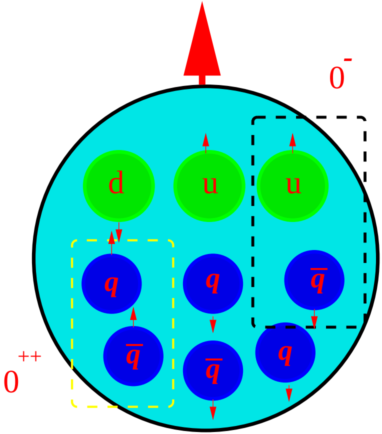


Polarization of hadrons. Quarks fragmentation

If a hadron is produced from the quark fragmentation (promtly or via heavier resonance), it could be polarized. The spin transfer is computed for SU(6) and "spin crysis" BJ models:

Λ's parent	C_u^Λ		C_d^Λ		C_s^Λ	
	SU(6)	BJ	SU(6)	BJ	SU(6)	BJ
quark	0	-0.18	0	-0.18	1	0.63
Σ^0	-2/9	-0.12	-2/9	-0.12	1/9	0.15
Ξ^0	-0.15	0.07	0	0.05	0.6	-0.37
Ξ^-	0	0.05	-0.15	0.07	0.6	-0.37
$\Sigma^\star$	5/9	–	5/9	–	5/9	–

Polarization of hadrons. Di-quarks fragmentation



Model of polarized strangeness

1. small mass of pseudo scaler mesons π, K, η means strong attraction with quantum numbers $J^P = 0^-$.
2. Vacuum density of strange pairs is quite large

$$\langle 0|\bar{u}u|0\rangle \approx \langle 0|\bar{d}d|0\rangle \approx (250\text{MeV})^3,$$
$$\langle 0|\bar{s}s|0\rangle \approx (0.8 \pm 0.1)\langle 0|\bar{u}u|0\rangle.$$

This model was suggested in works of Ellis, Sapozhnikov, Kotzinian and Kharzeev

Polarization of hadrons. Di-quarks fragmentation

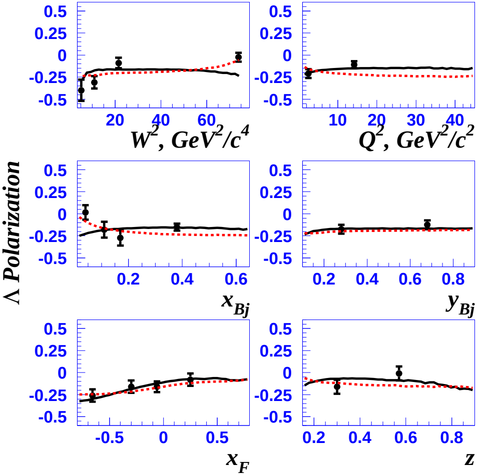
We do not know how strong is the correlation between spins of struch quark and sea strange (anti)quark. We introduce two free parameters $C_{sq_{sea}}, C_{sq_{val}}$. We fit these parameters from the NOMAD data:

$$\textbf{Model A:} C_{sq_{val}} = -0.35 \pm 0.05, C_{sq_{sea}} = -0.95 \pm 0.05.$$
$$\textbf{Model B:} C_{sq_{val}} = -0.25 \pm 0.05, \quad C_{sq_{sea}} = 0.15 \pm 0.05.$$

Spin transfer to Λ is computed as:

$$C_{\Lambda}^{l\,u}(prompt; N) = C_{\Lambda}^{l\,d}(prompt; N) = C_{sq},$$
$$C_{\Lambda}^{l\,u}(\Sigma^0; p) = C_{\Lambda}^{l\,d}(\Sigma^0; n) = \frac{1}{3} \cdot \frac{2 + C_{sq}}{3 + 2C_{sq}},$$
$$C_{\Lambda}^{l\,u}(\Sigma^{\star 0}; p) = C_{\Lambda}^{l\,d}(\Sigma^{\star 0}; n) = C_{\Lambda}^{l\,d}(\Sigma^{\star +}; p) =$$
$$C_{\Lambda}^{l\,u}(\Sigma^{\star -}; n) = -\frac{5}{3} \cdot \frac{1 - C_{sq}}{3 - C_{sq}}.$$

Description of the NOMAD data



John Ellis, Aram Kotzinian, Dmitry V. Naumov published a paper in 2002 with predictions for Λ hyperons polarization for various experiments **Eur.Phys.J.C25:603-613,2002.**

Theoretical uncertainties

- Assigning ranks (close to a quark or di-quark end) by construction displays two extreme cases - however nobody knows which way is correct - this is a source of uncertainty
- Related to this the spin correlation coefficients C_{sq} fitted from the NOMAD data at moderate $x_{Bj} \sim 0.1$ could not be accurate enough for electromagnetic interaction for which $x_{Bj} \sim 10^{-3}$ is typical.
- This implies that a new data in previously not explored domains can better fix only two parameters of our model

What is our aim in this work 5 years later?

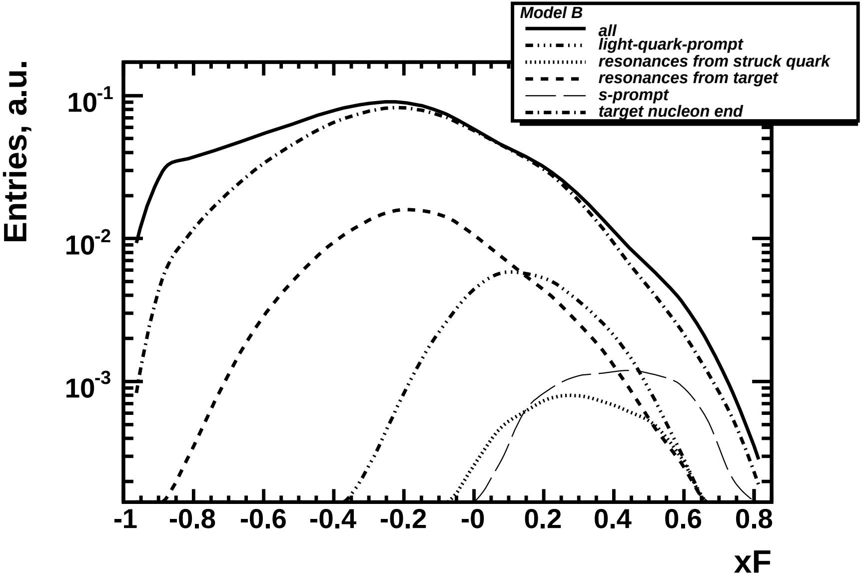
1. Predictions for $\bar{\Lambda}$ for COMPASS, HERA
2. Predictions for Λ for JLAB, COMPASS, HERA
    1. The NOMAD data are restricted to $x > 0.05$. We need smaller x to better fix $C_{sq_{sea}}, C_{sq_{val}}$. For this purpose the COMPASS data is essential.
3. Study a dependence of spin transfer to $s(x)/\bar{s}(x)$ ДМС COMPASS, HERA

Outline

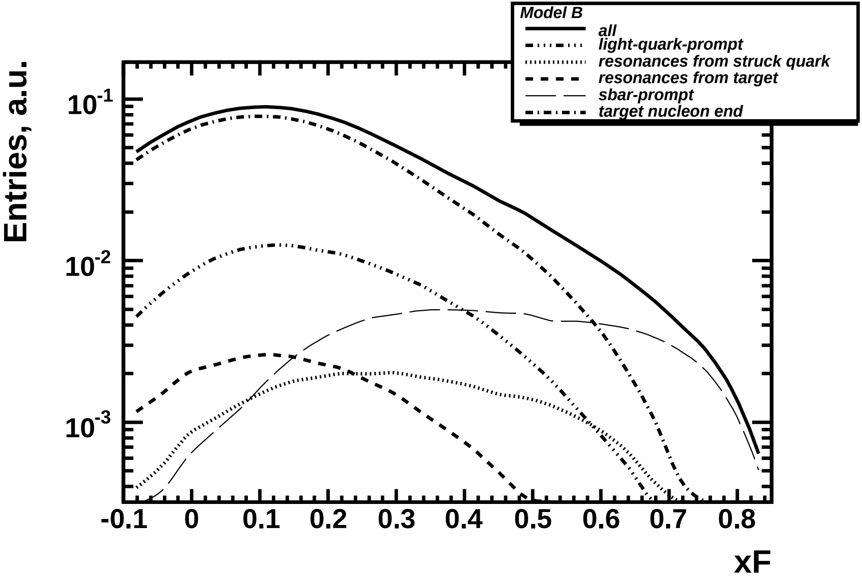
Distributions of x_F for $\Lambda/\bar{\Lambda}$

- Let us examine distributions of x_F for $\Lambda/\bar{\Lambda}$ in different kinematic domains.
- What is the fraction of $\Lambda/\bar{\Lambda}$ produced from fragmentation of quark, di-quark, or resonance?

Distributions of x_F for Λ in COMPASS



Distributions of x_F for $\bar{\Lambda}$ in COMPASS



Resume

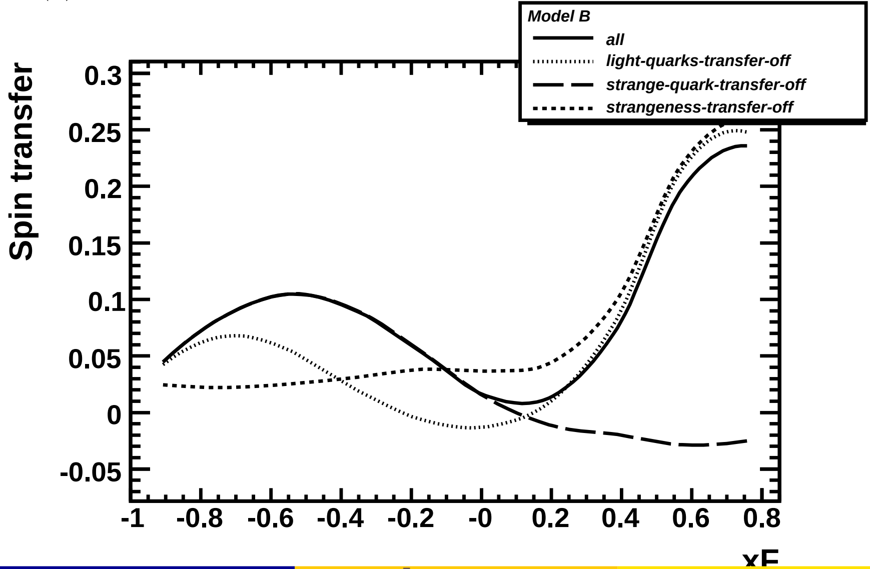
- For the COMPASS energy the dominant mechanism of Λ production is the di-quark fragmentation. $\bar{\Lambda}$ are produced mainly from $\bar{s}$ fragmentation.
- For the HERA energy quark and diquark mechanisms are well separated, however a new mechanism becomes effective - quark-antiquatk string fragmentation, like in $e^+ - e^-$ collisions. Thus it is not instructive to require really very large energies for such studies (pictures moved to backup slides)

Spin transfer to $\Lambda/\bar{\Lambda}$

- How it depends on kinematics?
- How large it is?
- What are the main sources?

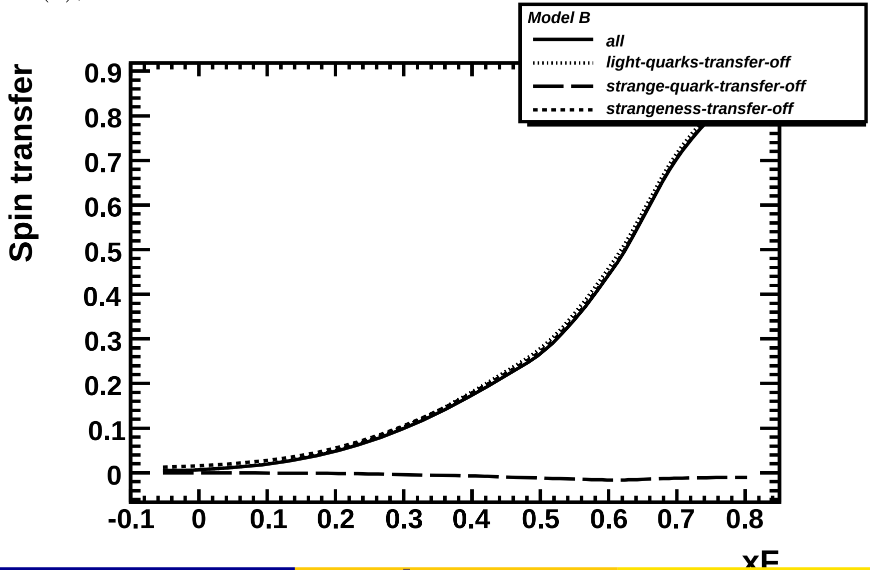
Spin transfer to Λ in COMPASS

SU(6), Model B



Spin transfer to $\bar{\Lambda}$ in COMPASS

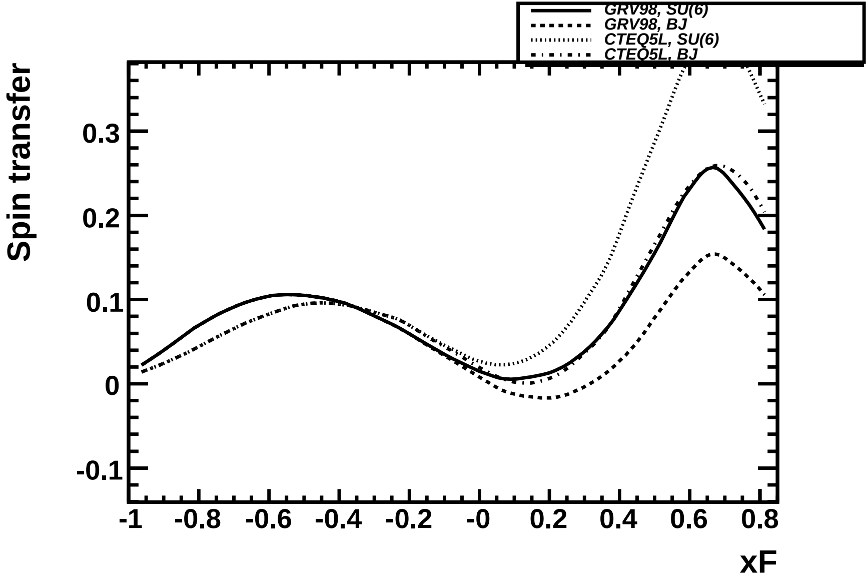
SU(6), Model B



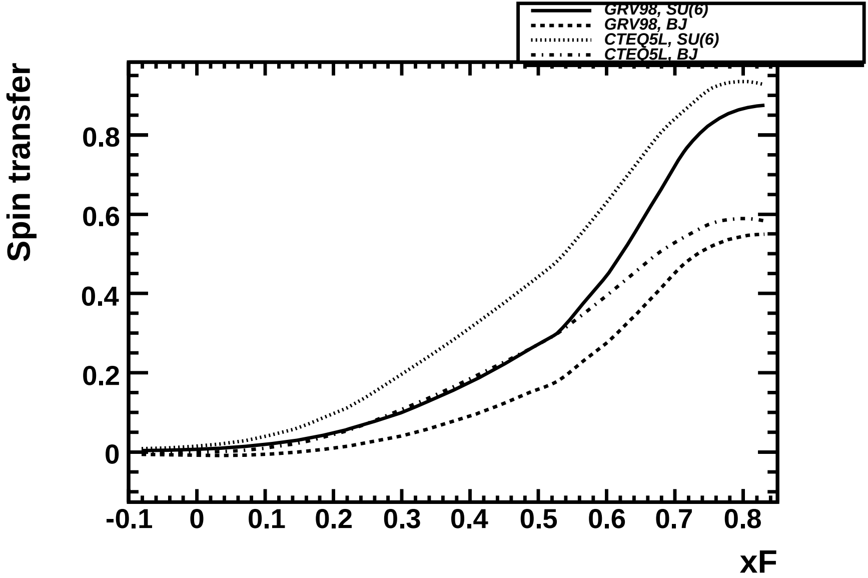
Resume

- Apparent domains in x_F, x - sources of $\Lambda/\bar{\Lambda}$ polarization - due to di-quark (only for Λ) and quark fragmentations.
- Polarization of $\bar{\Lambda}$ is essentially defined by $\bar{s}$ fragmentation. Thus it could be an instrument to study $\bar{s}(x)$

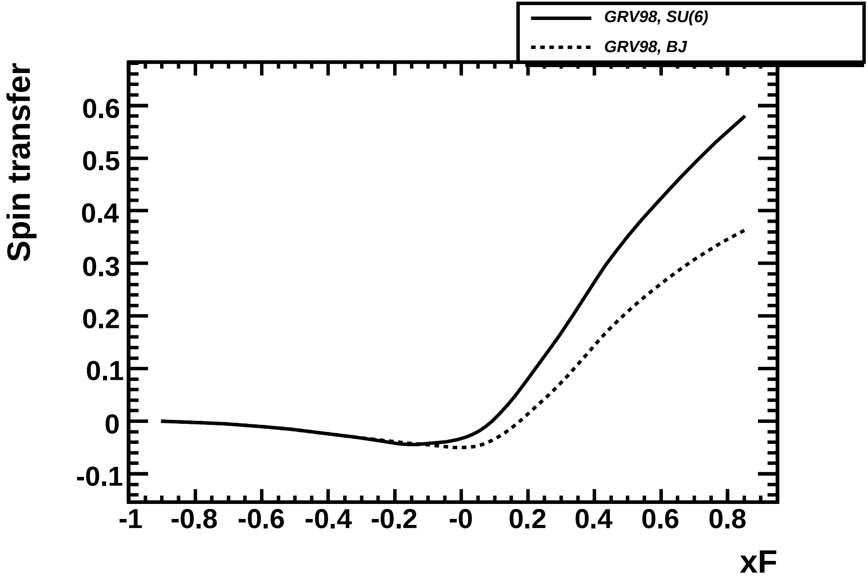
Spin transfer to Λ in COMPASS for various $s(x)$, BJ, SU6



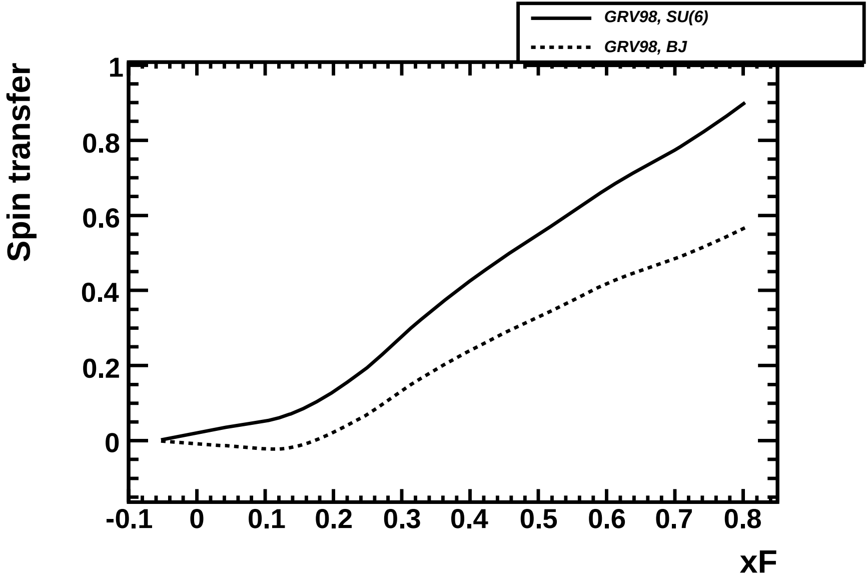
Spin transfer to $\bar{\Lambda}$ in COMPASS for various $\bar{s}(x)$, BJ, SU6



Comparison of SU(6) and BJ for Λ in HERA



Comparison of SU(6) and BJ for $\bar{\Lambda}$ in HERA



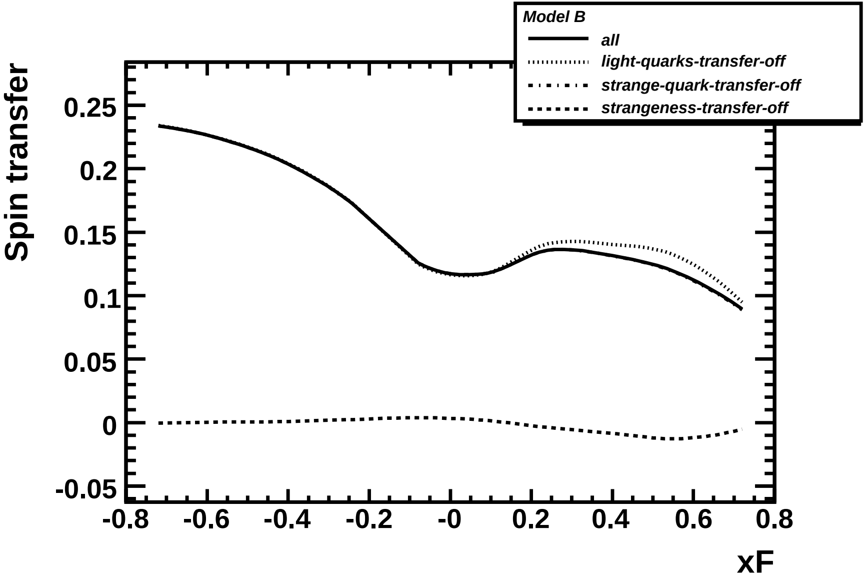
Resume

- An accurate measurement of spin transfer to $\Lambda/\bar{\Lambda}$ gives a possibility to study the spin structure of $\Lambda/\bar{\Lambda}$

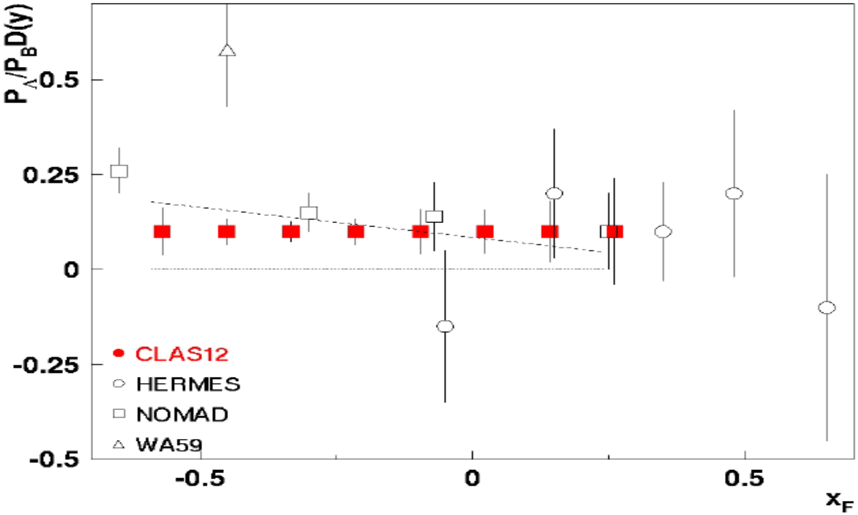
Sensitivity to polarized strangeness of Λ

- What will change if we switch off the spin stanfer from nucleon strangeness, i.e. $C_{sq} = 0$?

Sensitivity to polarized strangeness of Λ in JLAB



Sensitivity to polarized strangeness of Λ in JLAB (Projection for 1000 hours)



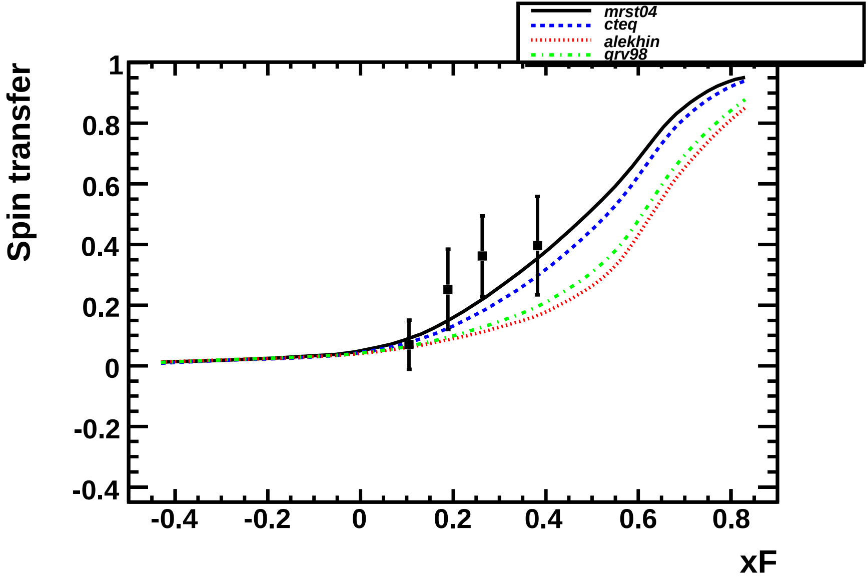
Resume

- Spin transfer to Λ in JLAB is defined by polarized strangeness. Thus JLAB could be essential to define C_{sq}.

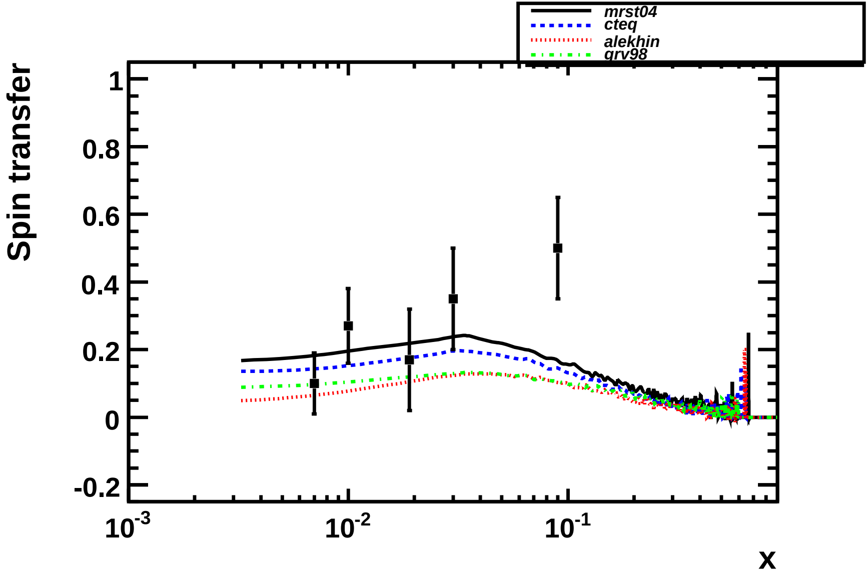
"Fit" of $\bar{s}(x)$

- Examine: MRST04, CTEQ06M, ALEKHIN02, GRV98
- We can "reweight" $s(x), \bar{s}(x)$ by hand trying to fit predictions to PRELIMINARY COMPASS DATA (could be done in a more consistent way fitting COMPASS results with all the world data by authors of distributions)

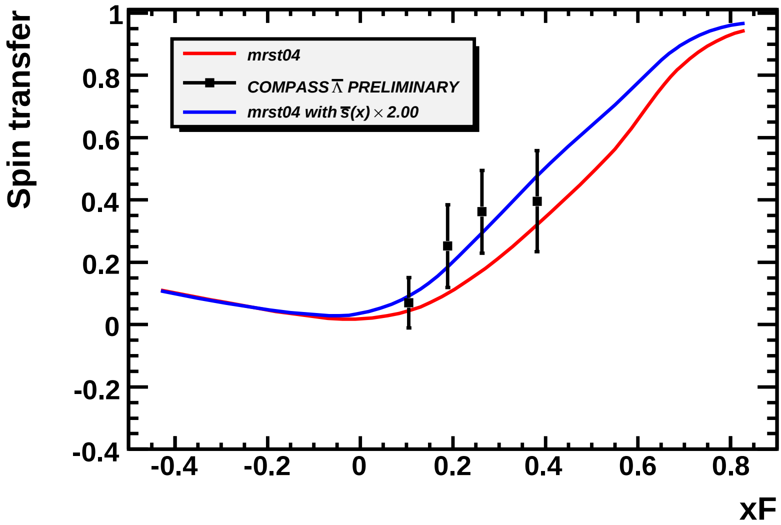
Spin transfer to $\bar{\Lambda}$ in COMPASS for various $\bar{s}(x)$



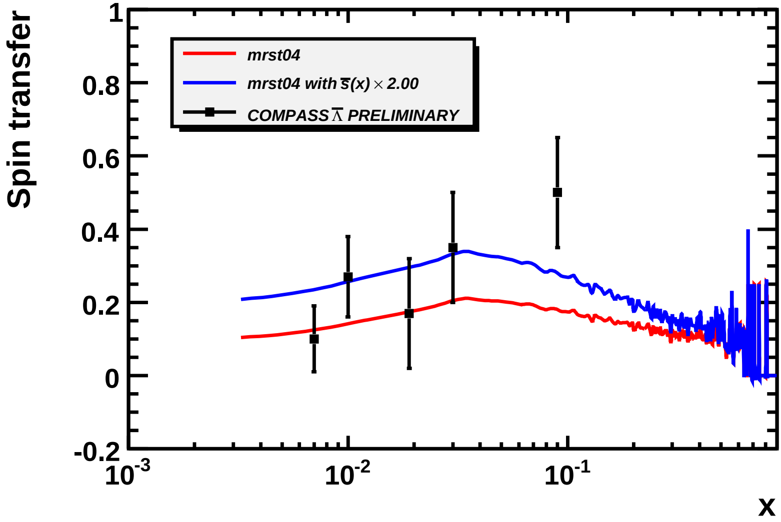
Spin transfer to $\bar{\Lambda}$ in COMPASS for various $\bar{s}(x)$



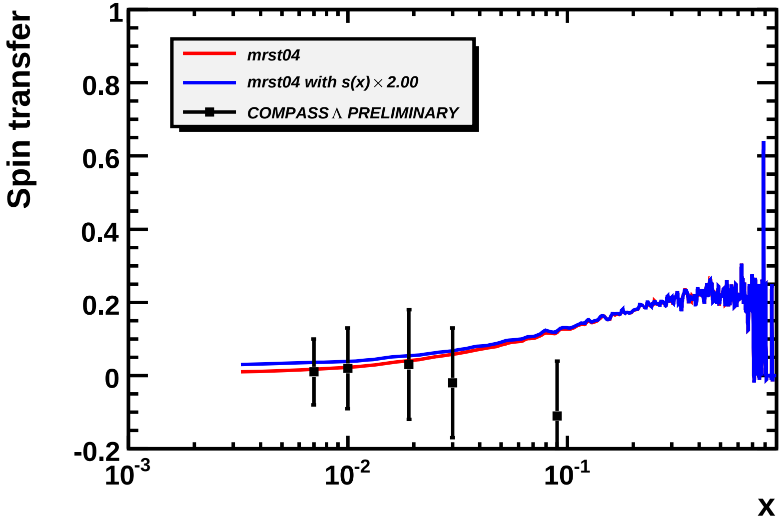
Spin transfer to $\bar{\Lambda}$ in COMPASS. MRST 04



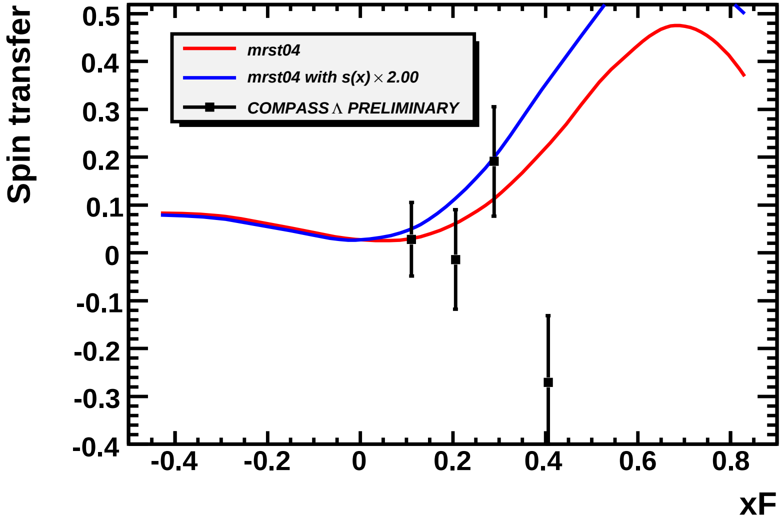
Spin transfer to $\bar{\Lambda}$ in COMPASS. MRST 04



Spin transfer to Λ in COMPASS. MRST 04



Spin transfer to Λ in COMPASS. MRST 04



Resume

- Spin transfer to $\bar{\Lambda}$ is sensitive to $\bar{s}(x)$ which could be fitted
- Spin transfer to Λ is less sensitive to $s(x)$ - more statistics is needed
- COMPASS with a factor X increase of statistics of $\bar{\Lambda}$ will improve our knowledge of $\bar{s}(x)$

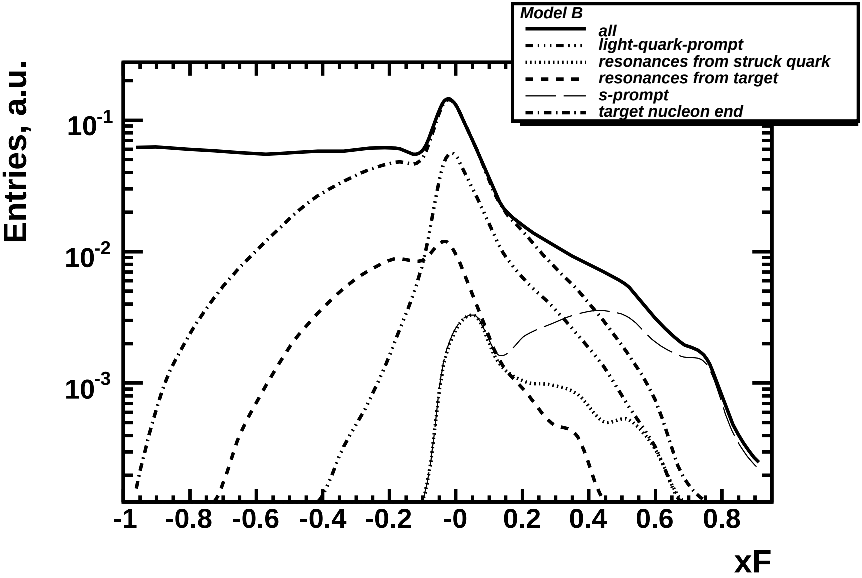
Outline

Conclusions

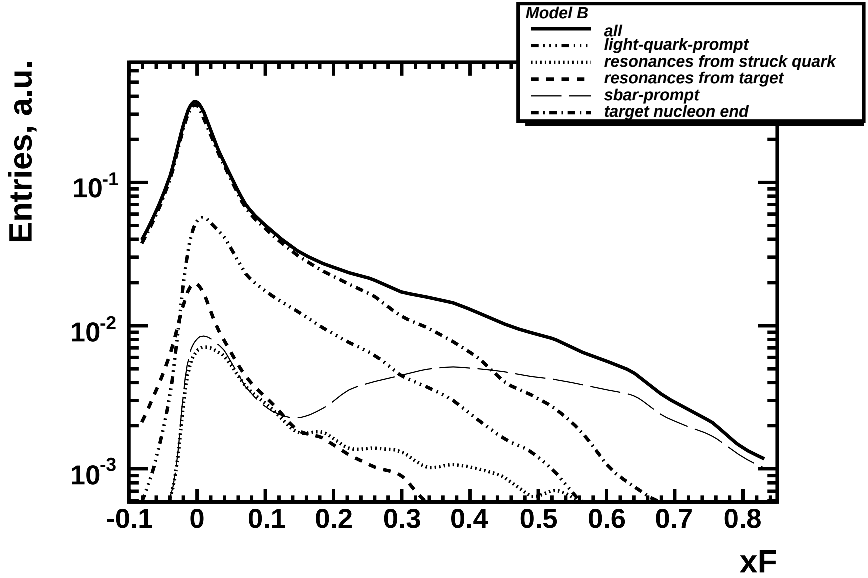
- New data of COMPASS can sharpen domain of two free parameters of our model
- An accurate measurement of polarization of $\Lambda, \bar{\Lambda}$ in COMPASS and HERA gives a new method to measure $s(x), \bar{s}(x)$ in nucleon
- Spin structure of $\Lambda, \bar{\Lambda}$ can be extracted from the same data
- Polarized nucleon strangeness can be extracted from measured Λ polarization in COMPASS, HERA, JLAB

Outline

Distributions of x_F ДМС Λ in HERA

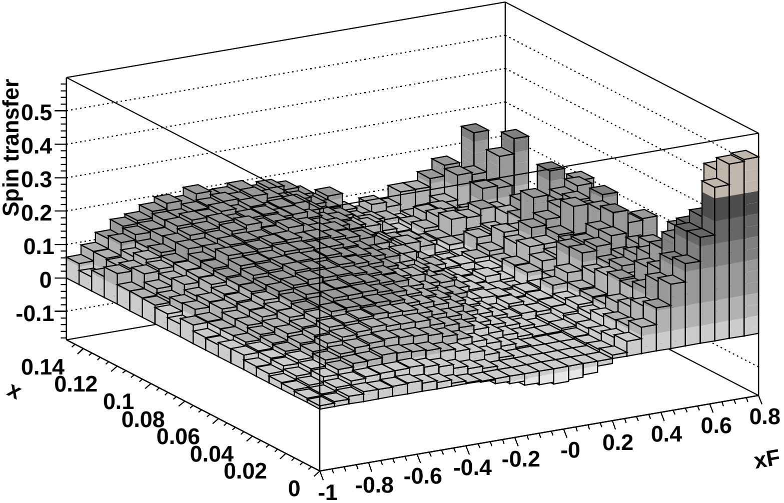


Distributions of x_F ДМС $\bar{\Lambda}$ in HERA



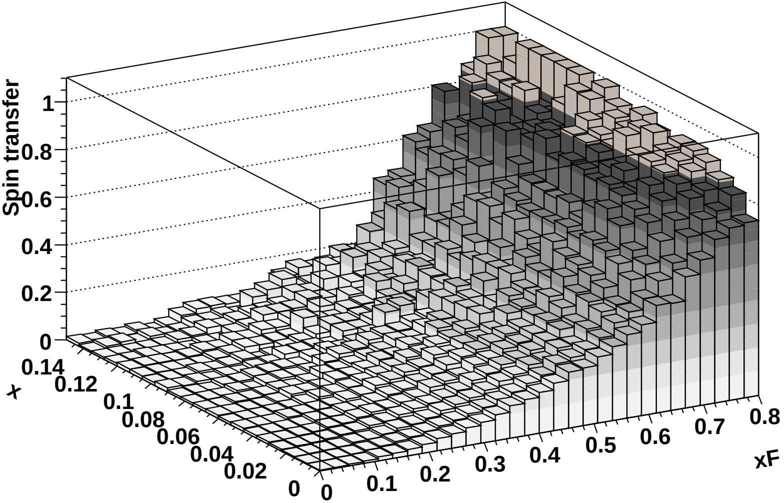
Spin transfer to Λ in COMPASS

SU(6), Model B



Spin transfer to $\bar{\Lambda}$ in COMPASS

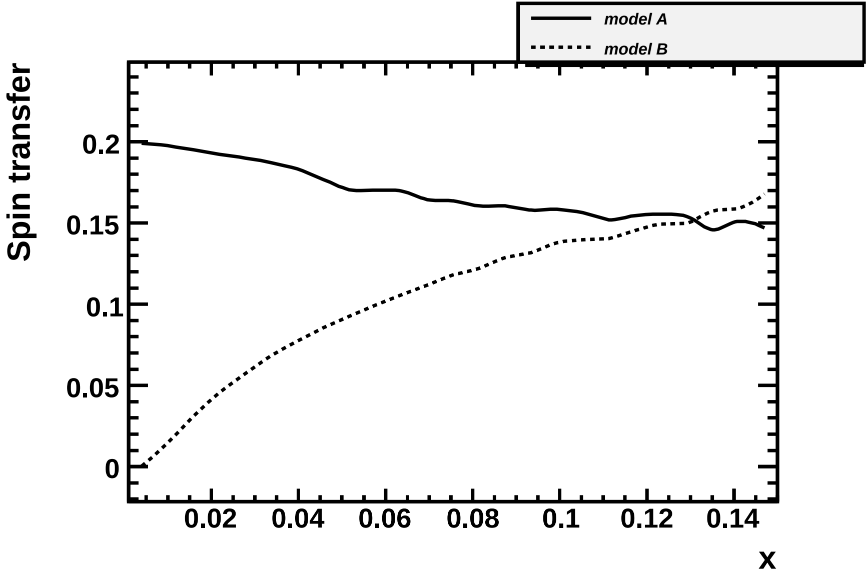
SU(6), Model B



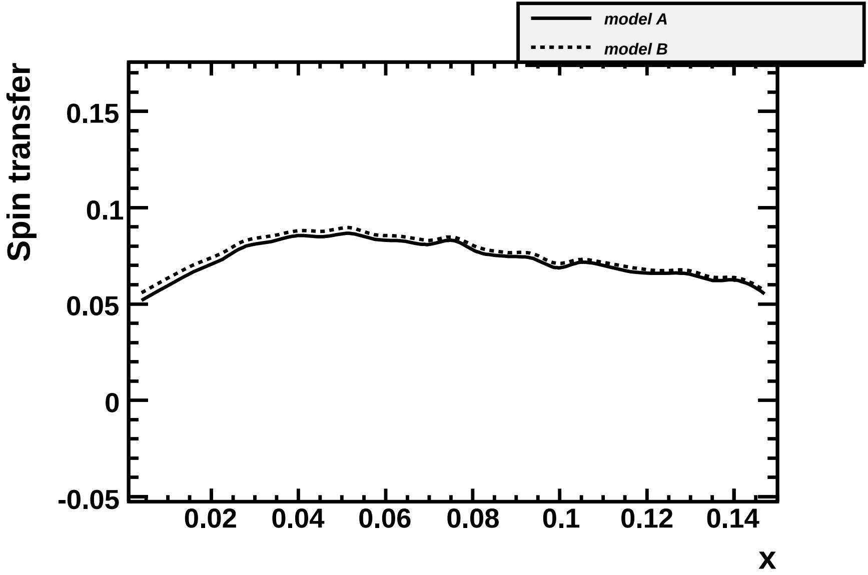
Models A and B for $\Lambda/\bar{\Lambda}$

- How sensitive are our predictions on model of tagging of particles?
- Is it possible to reduce theor. uncertainy?

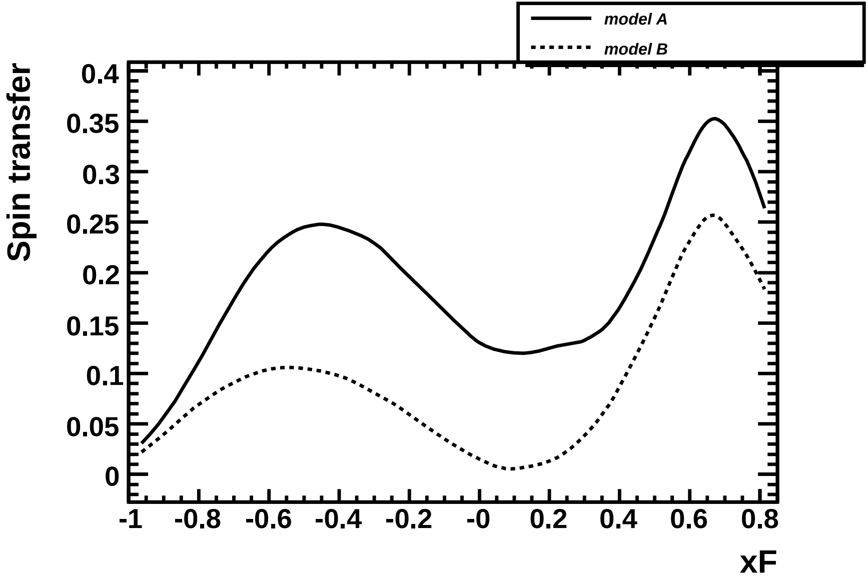
Models A and B for Λ in COMPASS



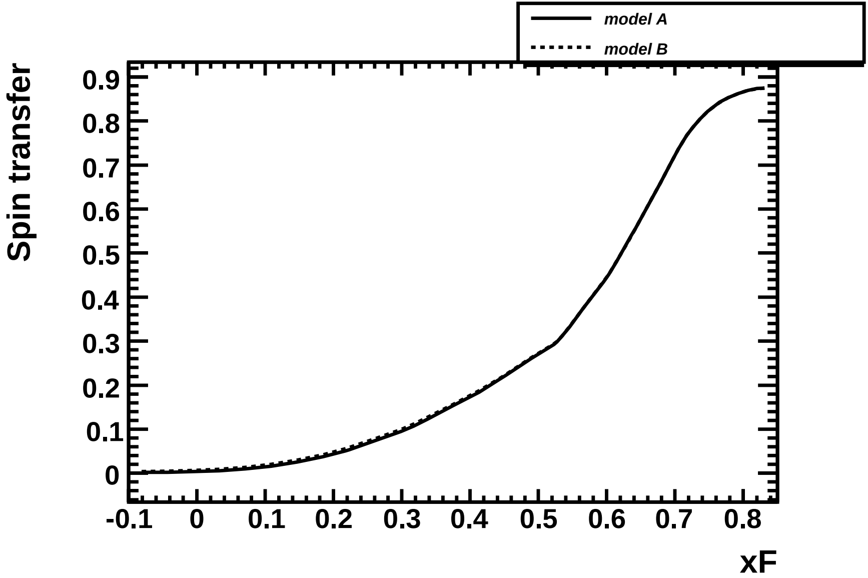
Models A and B for $\bar{\Lambda}$ in COMPASS



Models A and B for Λ in COMPASS



Models A and B for $\bar{\Lambda}$ in COMPASS



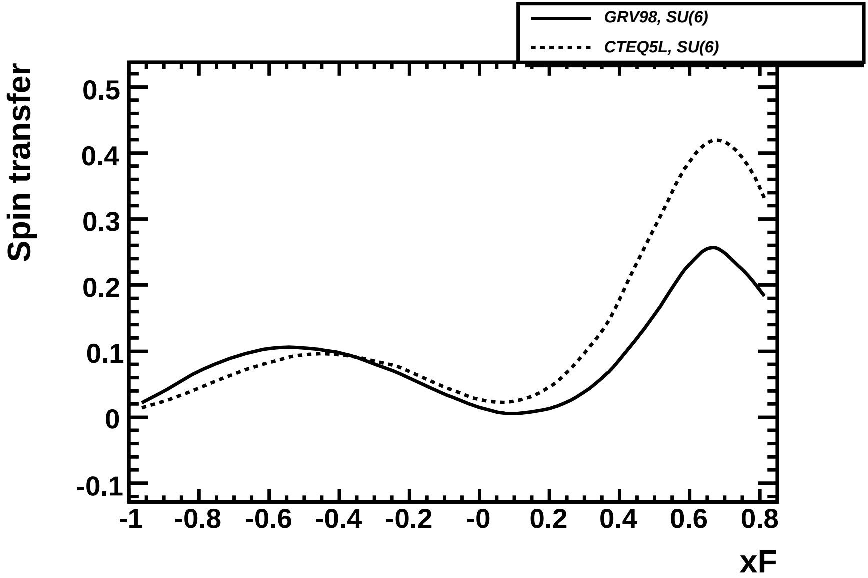
Resume

- Predictions for Λ strongly depend on models A and B. This dependence is due to much smaller x accessile in COMPASS an not accessible in NOMAD used to tune the parameres. We need the COMPASS data to fix the parameters and reduce systematics.
- Predictions for $\bar{\Lambda}$ are practically insensitive to A and B tagging. This is very valuable to have a model independet probe of $\bar{s}(x)$!

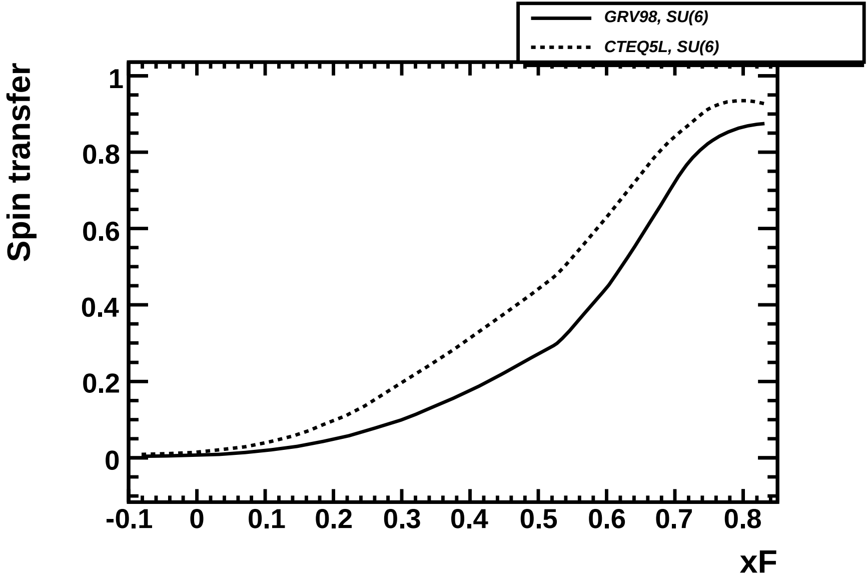
Comparison of GRV98 and CTEQ5L for $\Lambda/\bar{\Lambda}$

- How sensitive our predictions on parametrizations of strange sea in the nuclen?

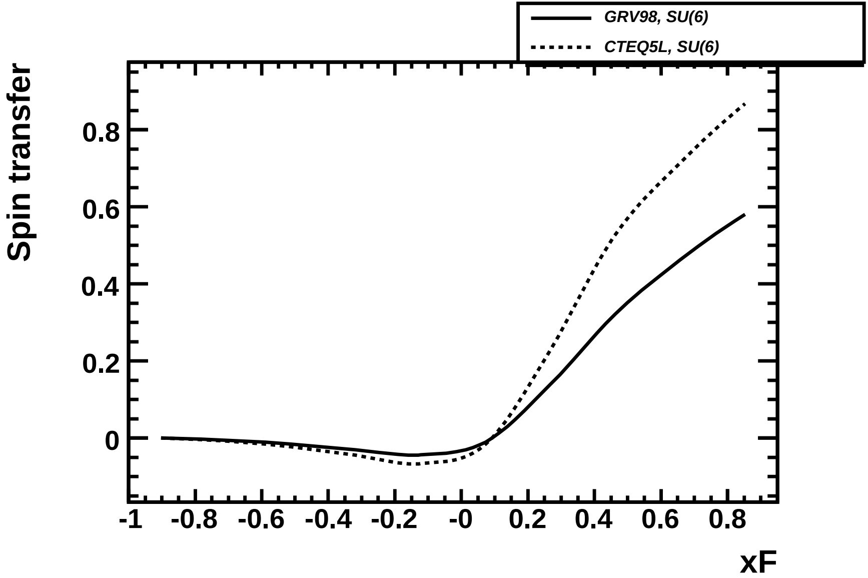
Comparison of GRV98 and CTEQ5L for Λ in COMPASS



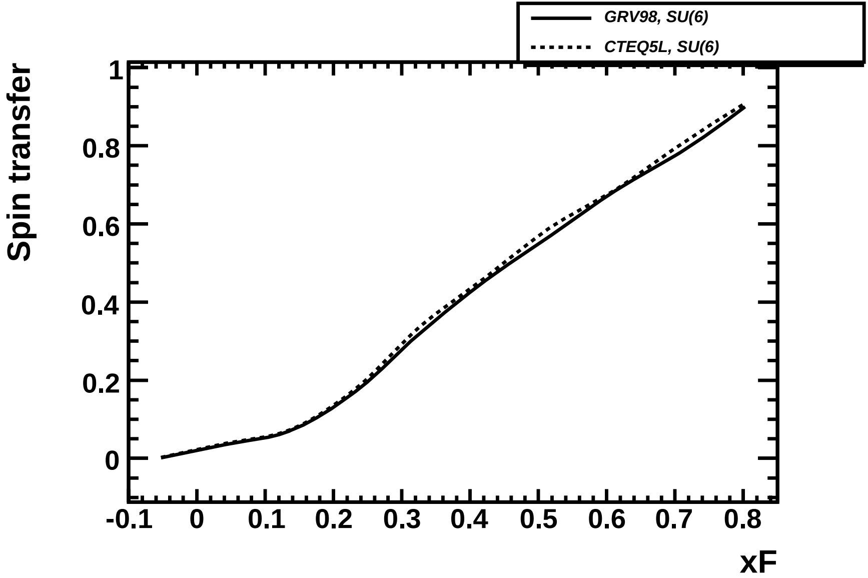
Comparison of GRV98 and CTEQ5L for $\bar{\Lambda}$ in COMPASS



Comparison of GRV98 and CTEQ5L for Λ in HERA



Comparison of GRV98 and CTEQ5L for $\bar{\Lambda}$ in HERA



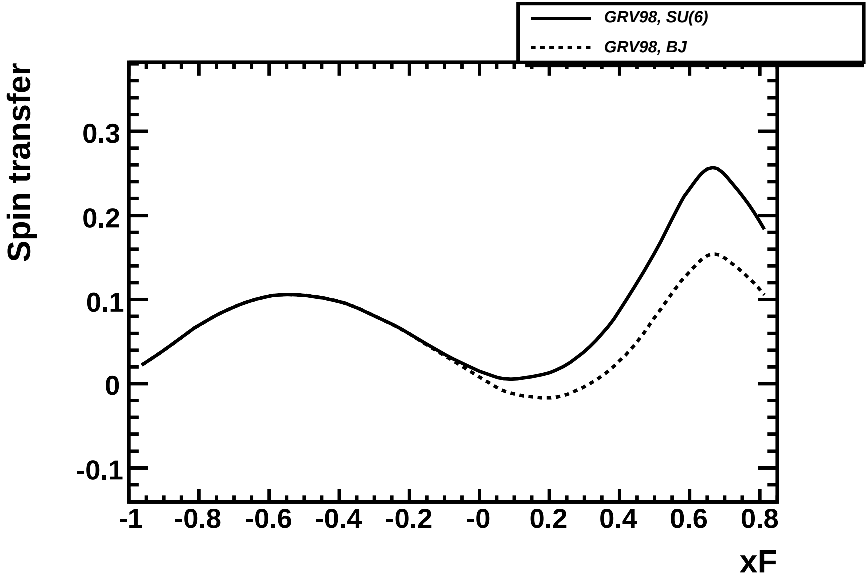
Resume

- An accurate measurement of spin transfer to $\Lambda/\bar{\Lambda}$ can be probes$s(x)$ Й $\bar{s}(x)$.
- For COMPASS this effect is present for both $\Lambda/\bar{\Lambda}$, while HERA would be sensitive only with Λ
- There is no sense to require large energy because new mechanisms (like in e^+e^-) becomes more and more effective thus loosing sensitivity to $s(x)$ and $\bar{s}(x)$.

Comparison of SU(6) and BJ for $\Lambda/\bar{\Lambda}$

- Can we learn from an experiment about the “spin crysis“ for$\Lambda/\bar{\Lambda}$?

Comparison of SU(6) and BJ for Λ in COMPASS



Comparison of SU(6) and BJ for $\bar{\Lambda}$ in COMPASS