JLab Hall A/C non-SoLID TMD program

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Outline

- **Intro**
- **JLab@12 GeV and experimental Halls new Equipment**
- **TMDs related experiments, some expected results**
  - **Hall C SIDIS regime tests**
  - **Hall A SIDIS precision measurements**

Parton TMDs at large x: a window into parton dynamics in nucleon structure within QCD

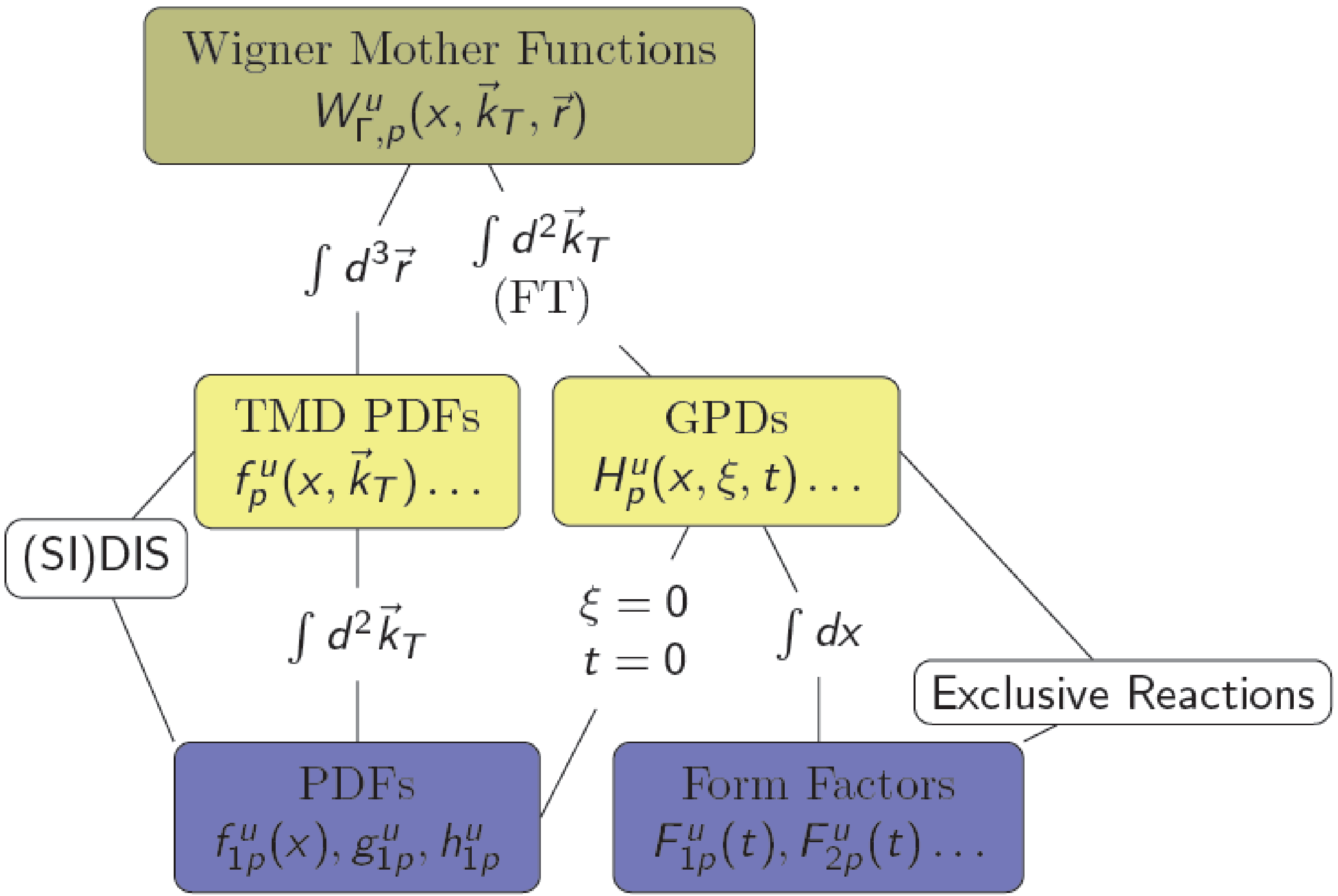
11-15/April/2016 – ECT, Trento*

Search for the “ultimate” nucleon description

Large “firepower” required:

- Elastic Scattering
- WACS
- DVCS
- SI-DIS
- DY
- Lepton-Lepton
- ….

(at “low” and “high” energies)



Next week workshop at ETC*

Polarization played and is playing a central role

(some) Experimental directions

Improve statistics

- Simultaneous extraction of different moments
- Disentangle dependencies on relevant variables
- Reduce statistical errors

Access unexplored phase space

- Toward high x / Valence region
- P_T dependence
- Q^2 dependence

Measure poorly known TMDs / extract different flavours

- Measure moments by:
  - Different beam/target spin states
  - Different final state hadron(s) (π,K)
- Access Higher twists

Experimental Challenges

<u>Beam</u>:
"high" energy, intensity, stable, polarized

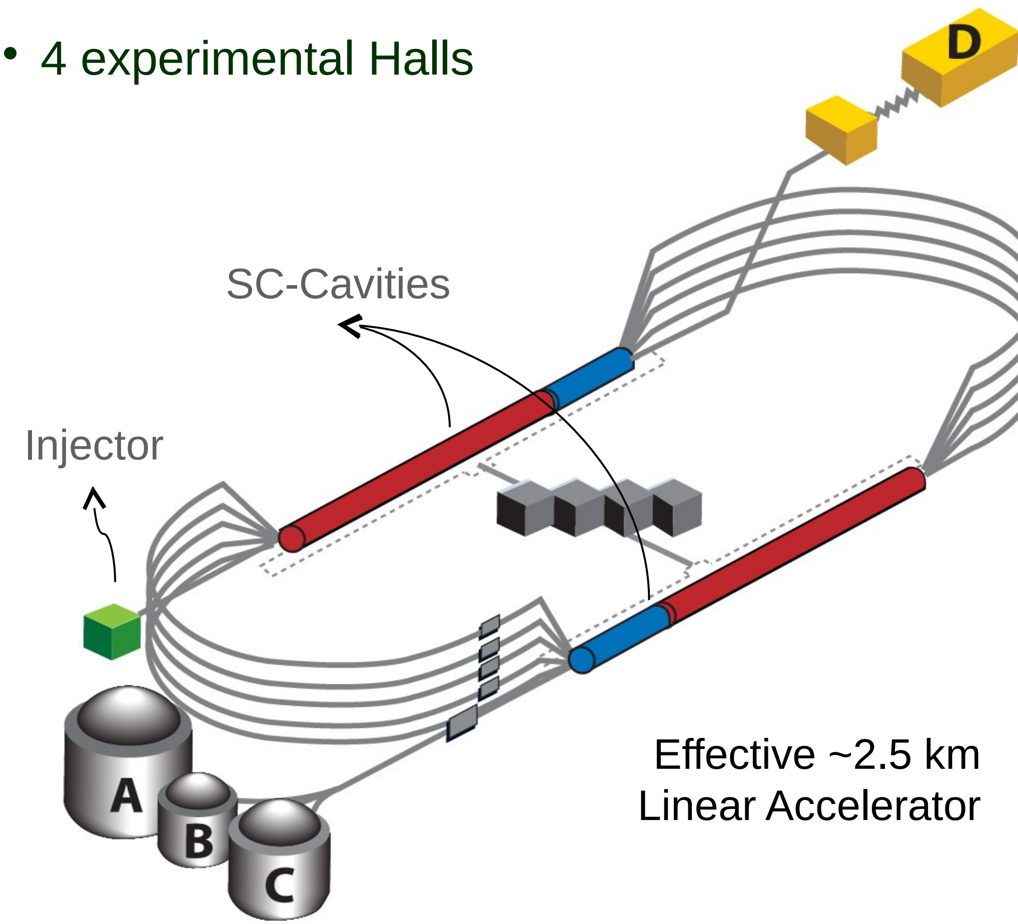
<u>Targets</u>:
high performance, different types, polarized

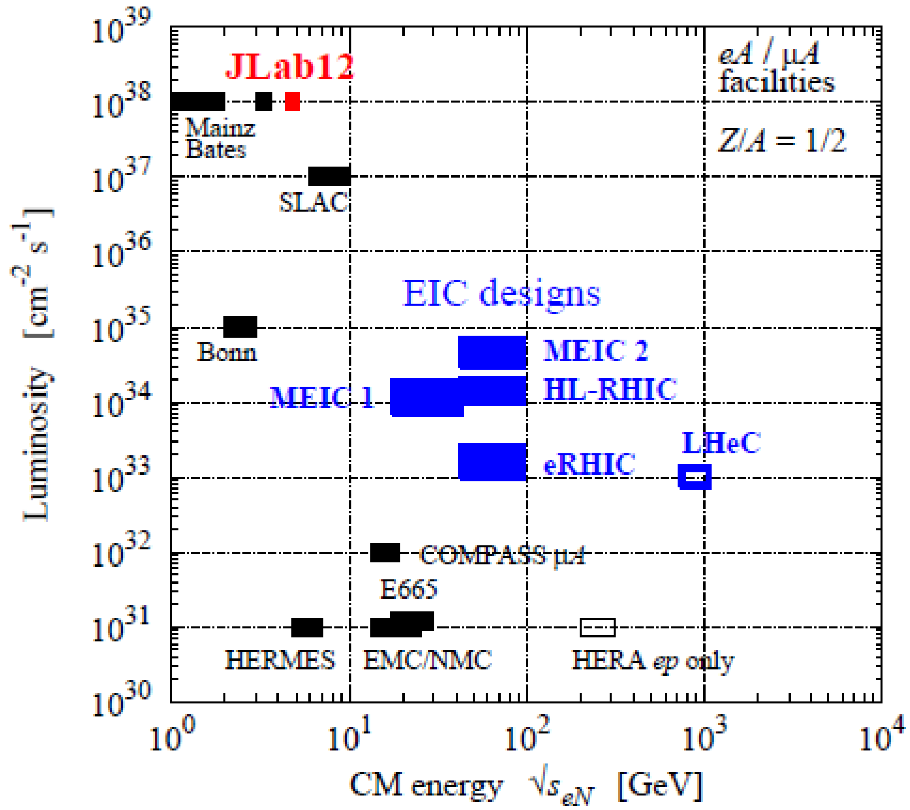
<u>Detectors</u>:
large acceptances, support high background, hadron identification

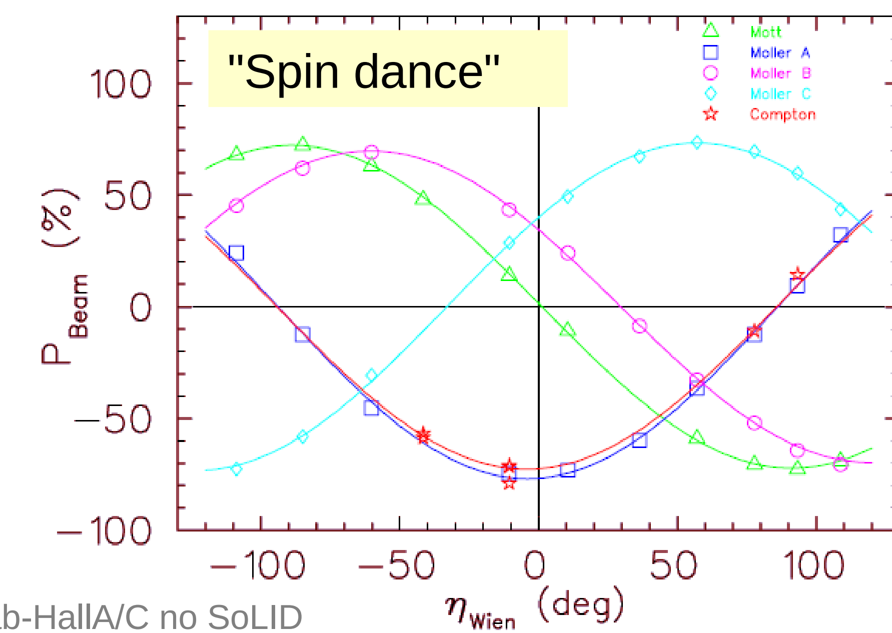
... and keep systematics under control !

JLab 12 GeV - CEBAF

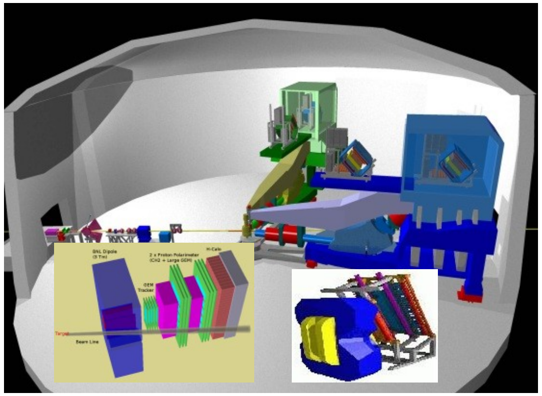
- Energy up to 12 GeV with $\delta E/E \sim 10^{-4}$
- *Excellent emittance:* ~ few nm-rad
- Long. Polarized Beam ~ 85%
  - (1kHz helicity flip)
- Current up to 100 μA
  - 100% duty factor (CW, 499 MHz)
- 4 experimental Halls

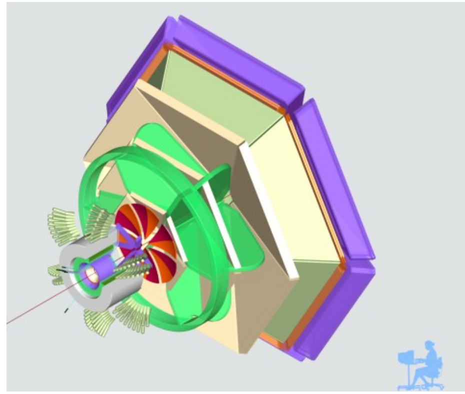


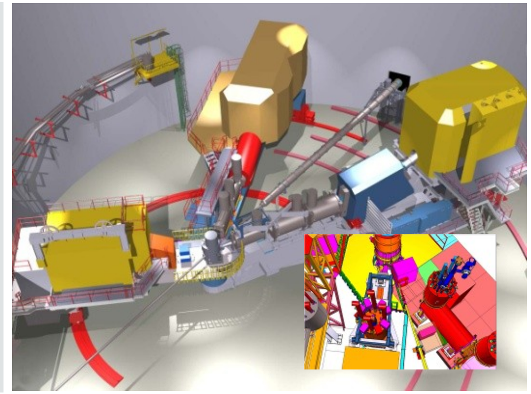


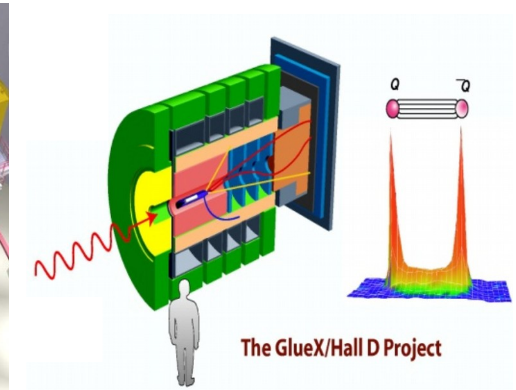


Jlab 12 GeV: Exp. Halls in the coming years



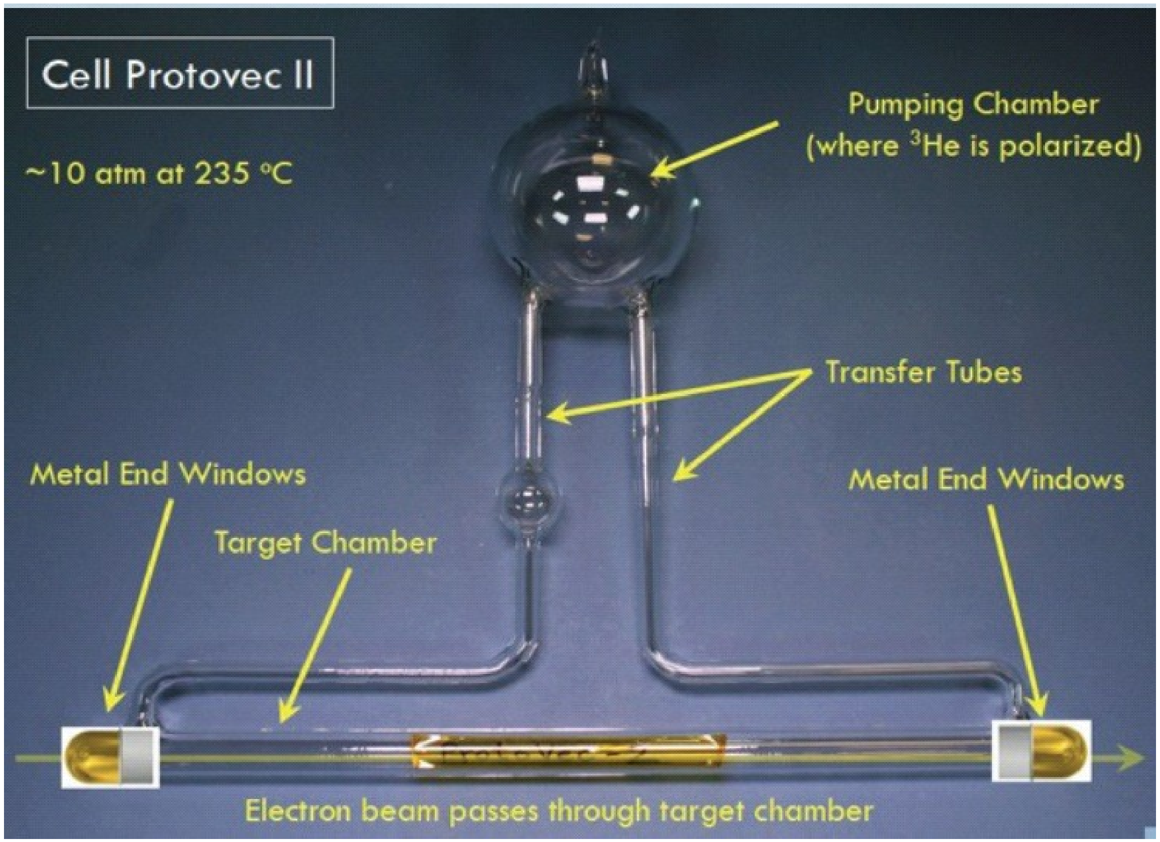


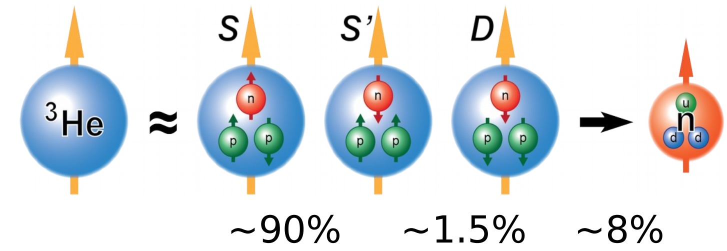




Hall A	Hall B/CLAS12	Hall C	Hall D/GLUEX
Very large equip. and flexible installations, high lumi	2π coverage, extended particle ID	Large and flexible installations, high lumi	Real photon beam, new Hall
2 High momentum resolution spectrometers 1 large acceptance, high lumi spectrometer with hadron ID dedicated equipment for neutron and gamma	New spectrometer, fixed installation	Two Asymmetric **High momentum range** and **high resolution spectrometers** **"super high" momentum spectrometer, neutral particle spectrometer**	Excellent hermetic coverage, Solenoid field High multiplicity reconstruction
High beam current lumi 10^{38} cm^{-2} s^{-1}	Forward tagger for real photons	High beam currents (>100 μA), **lumi 10^{37} cm^{-2} s^{-1}**	10^8 linearly pol., up to 12 GeV, real photons/s
3He T/L pol. target, many unpol. targets from H to Pb	NH3/ND3 pol. Target, trans. polarized H/D target	NH_3/ND_3 Polarized long. target, high flexibility unpol. from H to Pb	
hallaweb.jlab.org	www.jlab.org/Hall-B	www.jlab.org/Hall-C	www.jlab.org/Hall-D

^{3}He polarized target for Hall A and C





Effective polarized n target

May provide "any" polarization orientation

~ 60% polarization (with beam)

Used in many JLab 6 GeV experiment

Planned for several in JLab 12 GeV era.

Upgrade underway to sustain luminosity of 10^{37} Hz/cm^2 (x10 previous version)

Hall A - SuperBigbite Spectrometer

- Large luminosity
- Moderate acceptance
- Forward angles
- Reconfigurable detectors

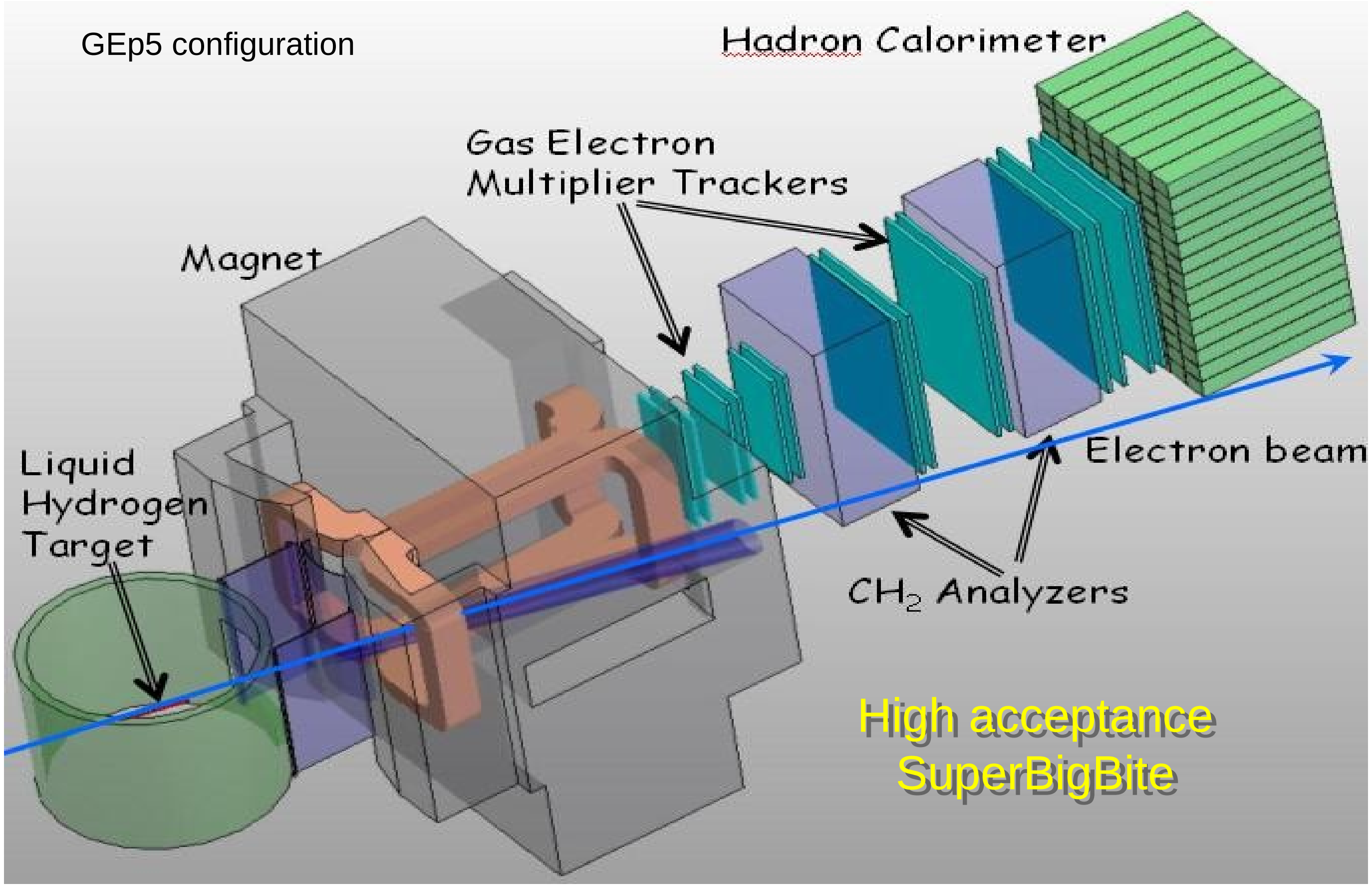
State of the art detector technologies in conventional configuration

Expected Background up to:

photon (~500 MHz/cm2)

charged (~200 kHz/cm2)

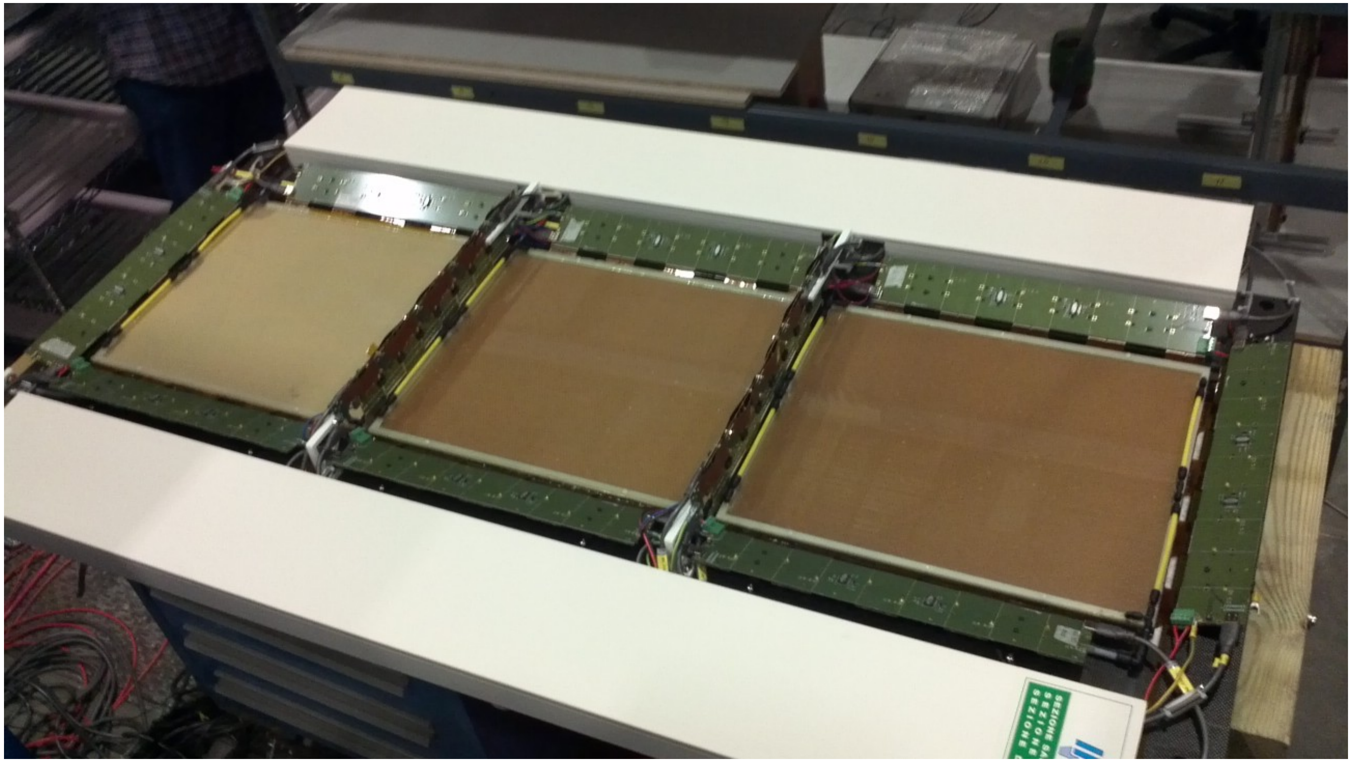
Physics:
Nucleon Form Factors
SIDIS – TMD's
Tagged-DIS
Compton Scattering
... Nucleon structure

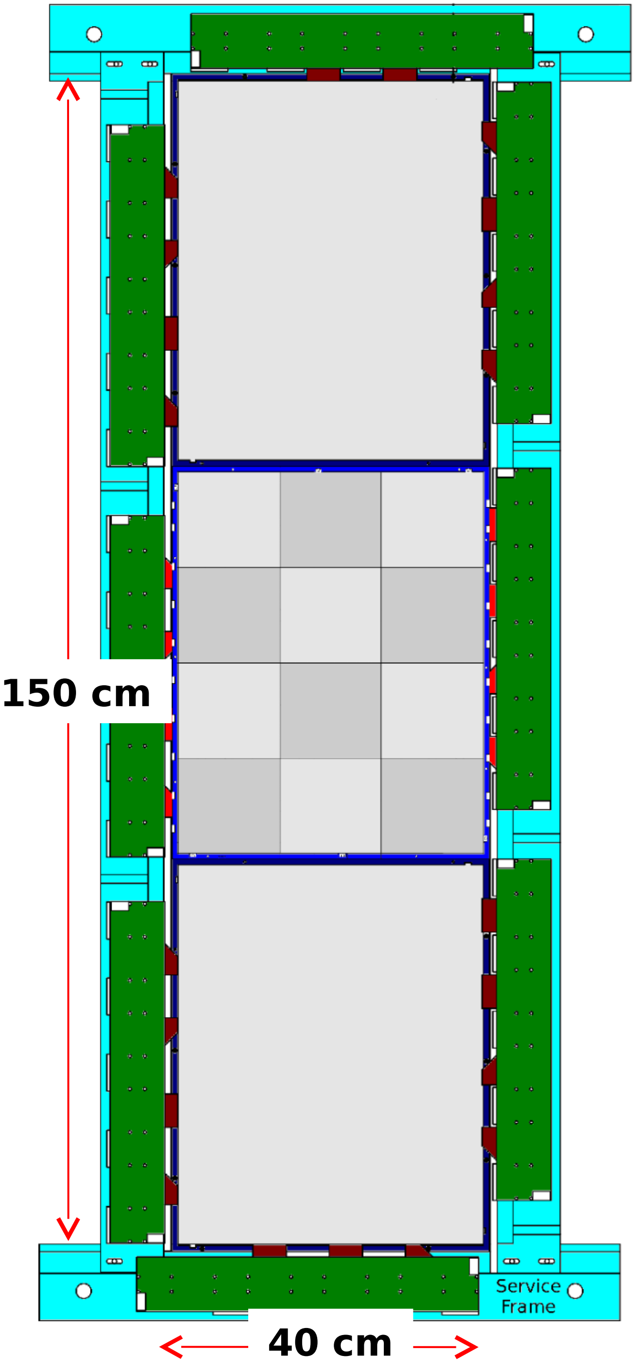


Installation second half 2017

SBS GEM Front Tracker – Single Chamber

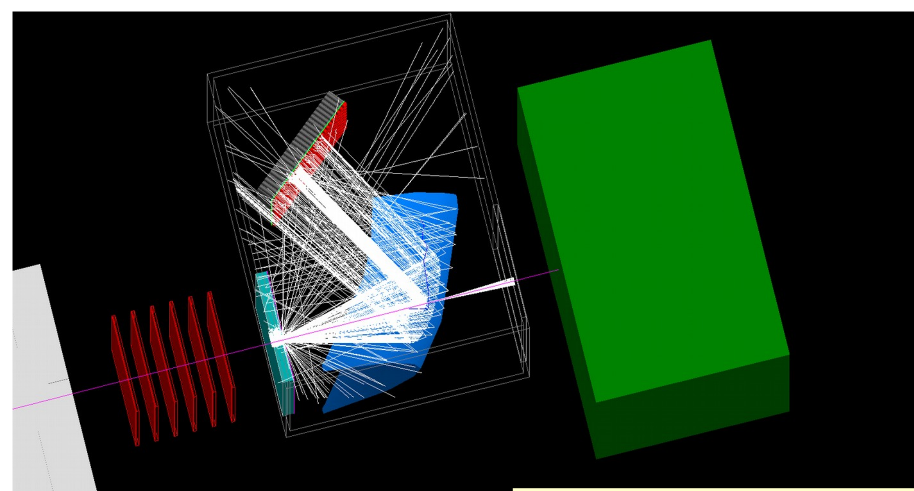
- Spatial resolution < 0.1 mm; high radiation tolerance
- Six 150x40 cm^2 chambers with small dead area (~10%)
- Each chamber consists of 3x 50x40 cm^2 lightweight 3xGEM modules with x/y strip readout (0.4 mm pitch)
- Tracking Resolution (in SBS):
  - momentum resolution: 1%
  - angular resolution: 1 mrad
  - vertex reconstruction: 5 mm





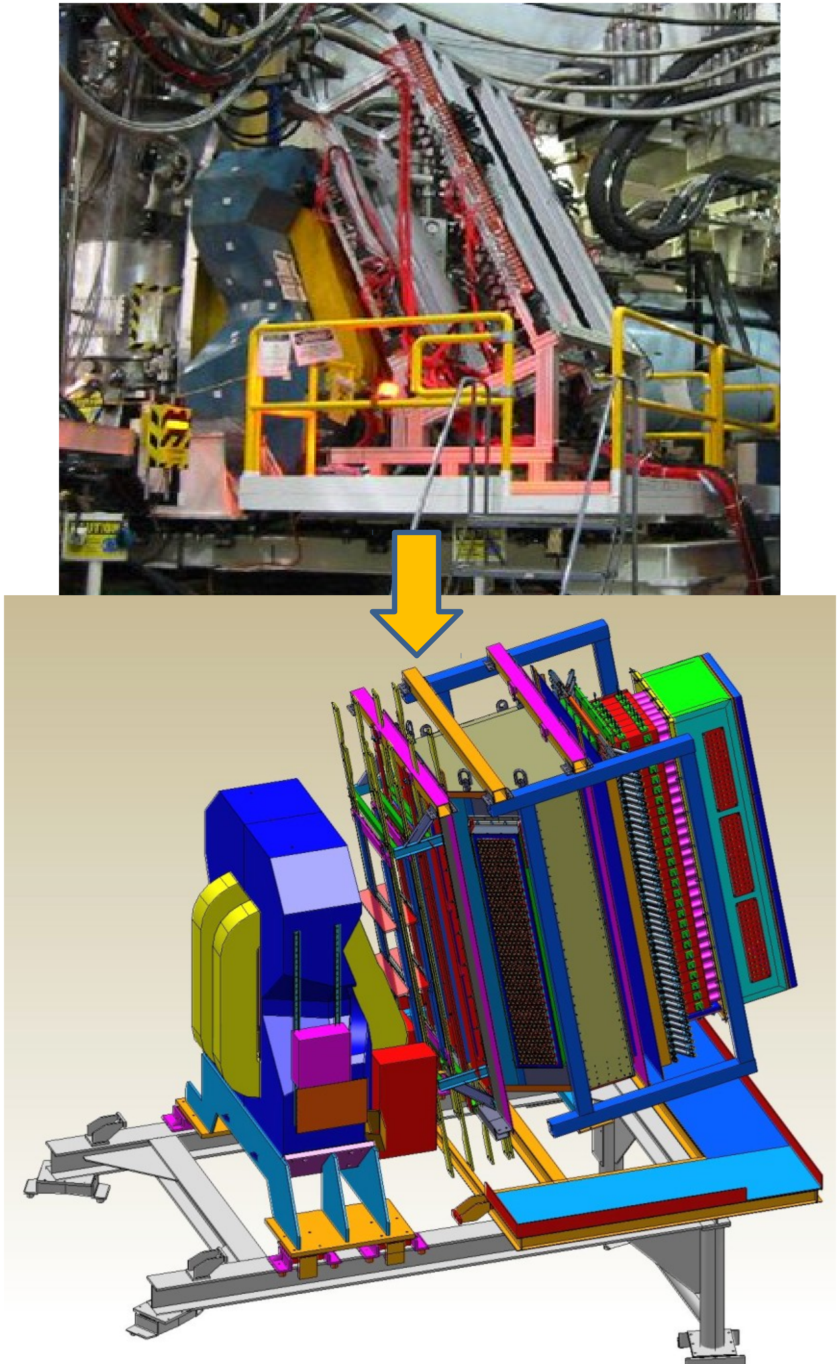
The HERMES RICH becomes the SBS RICH

- The dual radiator HERMES RICH operated very well and stable from 2 GeV/c to more that 10 GeV/c
- We had chance to preserve one of the two HERMES RICH (and spare PMTs and aerogel tiles)
- HERMES RICH (rotated) fits pretty well in SBS acceptance
- High segmentation (~2000 PMTs) & TDC readout (10 ns window) lead to very low ~0.1% average PMT occupancy (up to L~10^{37} /cm^2/s at least)
- Expected to provide excellent p-K-π separation (by a well characterized detector)



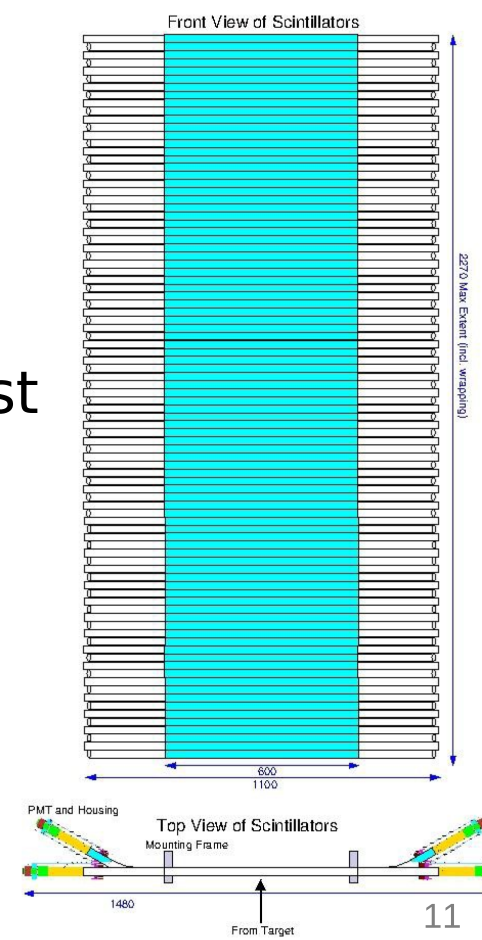
A. Puckett / UConn

Hall A: companion spectrometer BigBite (BB)



- 80 msr solid angle (≥30 deg)
- Mom. resolution 0.5% at 1.5 GeV/c
- Angular resolution ~1 mrad
- New Threshold Cherenkov Detector (GRINCH)

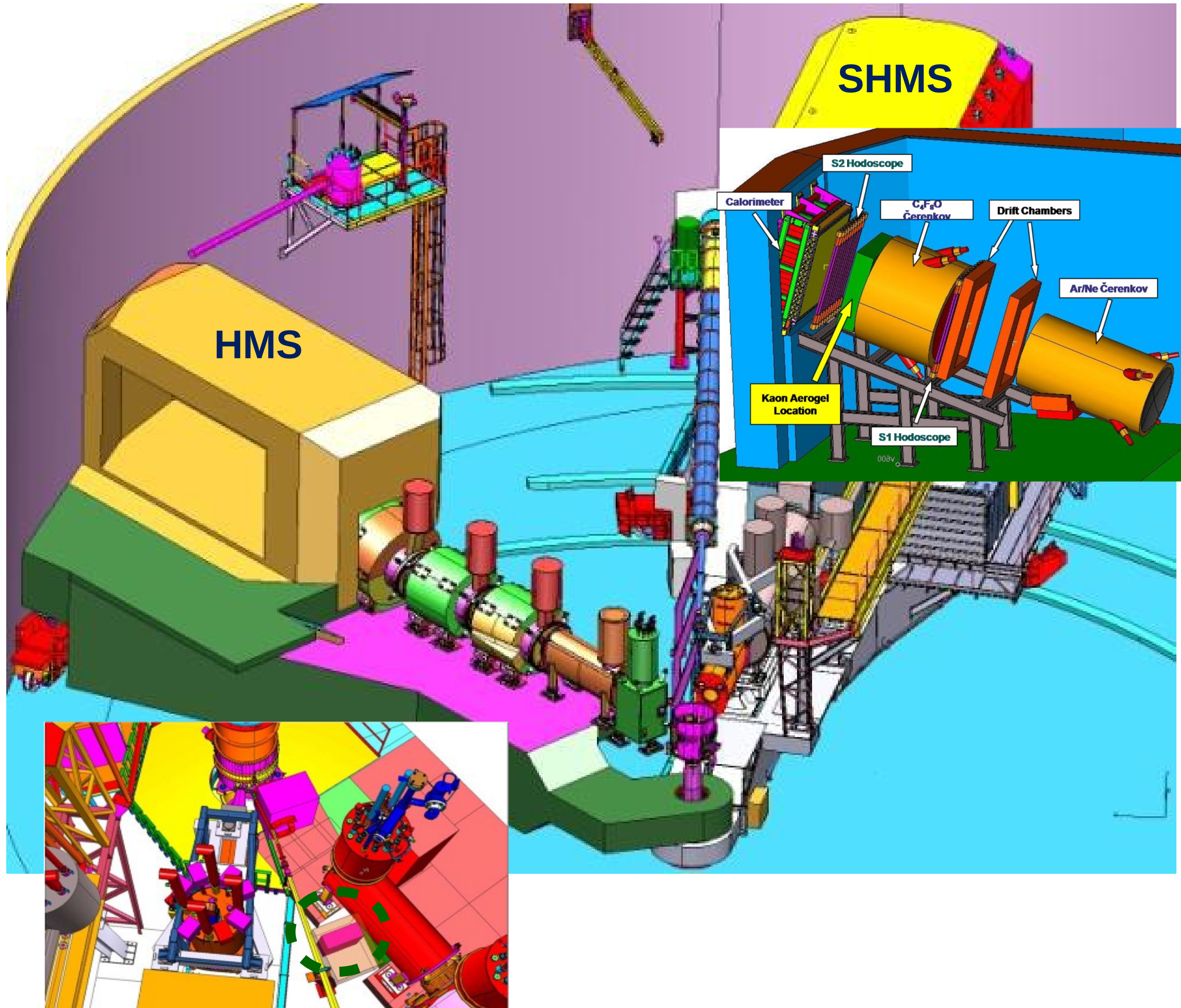
- New Timing Hodoscope (right) made of plastic scintillator bars coupled to 180 fast PMTs; time resolution of 300 ps



JLab Hall C

Existing HMS spectrometer + new improved version (Super)HMS

- Luminosity up to 10^{38}/s/cm^2
- Small acceptance (~5 msr) but precise event reconstruction ($dp/p < 10^{-3}$)
- Good PID
- Systematics well under control
- Precise measurements of production cross sections
- Standalone Neutral Particle Spectrometer, 25 msr, sweeping magnet + PbWO4-based calirimeter



+ Compton and Møller polarimeters

The Multi-Hall SIDIS Program at 12 GeV

M. Aghasyan, K. Allada, H. Avakian, F. Benmokhtar, E. Cisbani, J-P. Chen, M. Contalbrigo, D. Dutta, R. Ent, D. Gaskell, H. Gao, K. Griffioen, K. Hafidi, J. Huang, X. Jiang, K. Joo, N. Kalantarians, Z-E. Meziani, M. Mirazita, H. Mkrtchyan, L.L. Pappalardo, A. Prokudin, A. Puckett, P. Rossi, X. Qian, Y. Qiang, B. Wojtsekhowski

JLab SIDIS working group

The complete mapping of the multi-dimensional SIDIS phase space will allow a comprehensive study of the TMDs and the transition to the perturbative regime.

Flavor separation will be possible by the use of different target nucleons and the detection of final state hadrons.

Measurements with pions and kaons in the final state will also provide important information on the hadronization mechanism in general and on the role of spin-orbit correlations in the fragmentation in particular.

Higher-twist effects will be present in both TMDs and fragmentation processes due to the still relatively low Q^2 range accessible at JLab, and can apart from contributing to leading-twist observables also lead to observable asymmetries vanishing at leading twist. These are worth studying in themselves and provide important information on quark-gluon correlations.

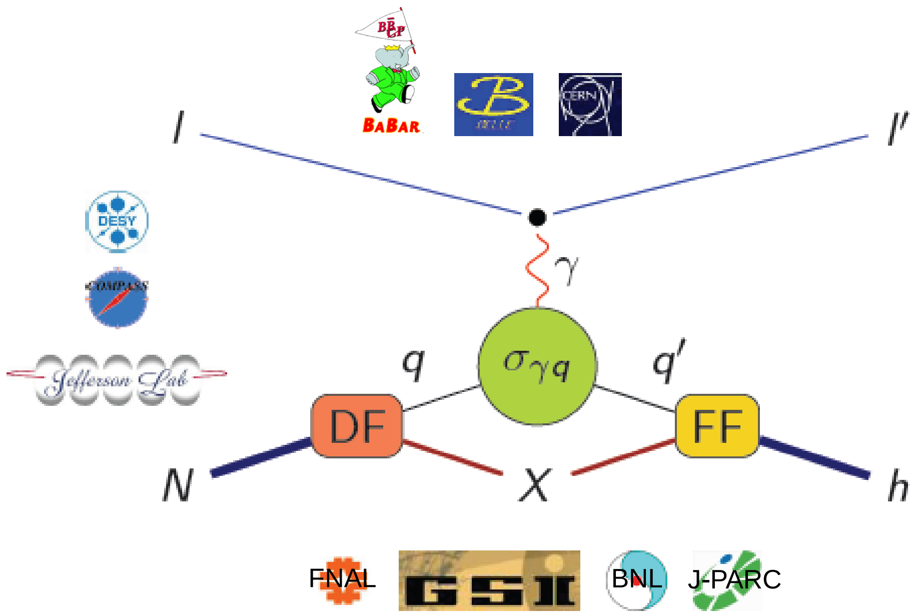
TMDs MultiHall exp. at JLab/12GeV

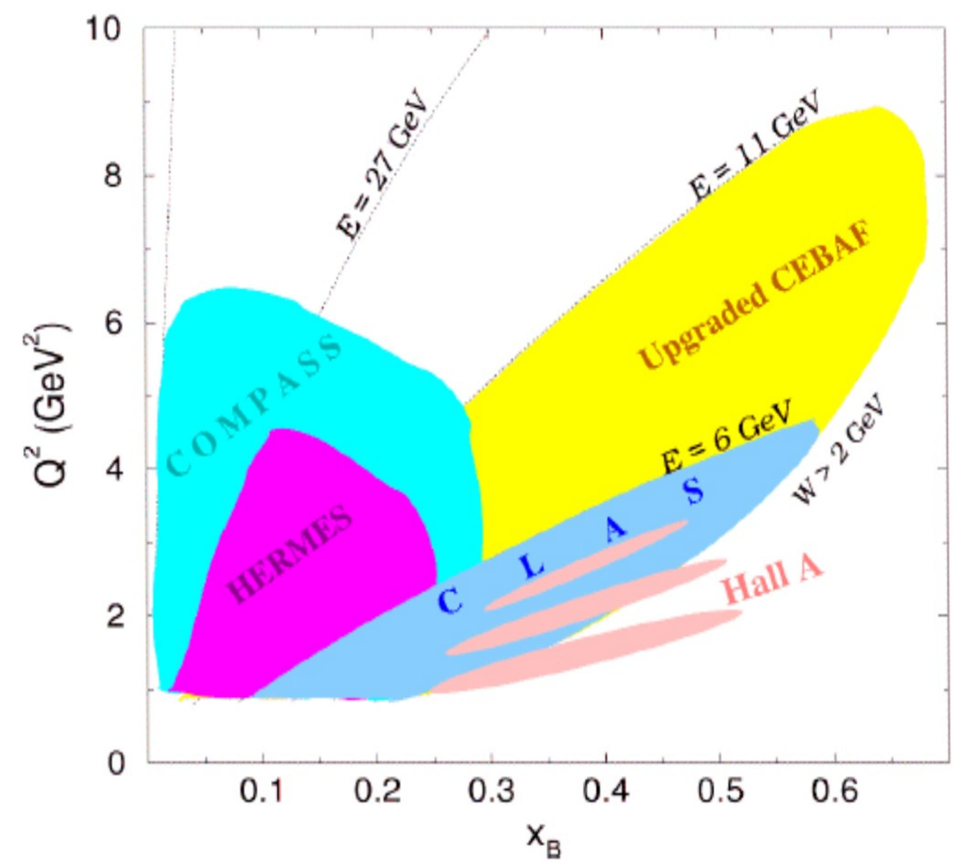
		Quark			Experiment							
		U	L	T	Test SIDIS		Complete TMDs investigation			Precise Measurements		
Nucleon	U	f_1		$h^\perp_1$ Boer-Mulders	$\pi^\pm$ $K^\pm$	π^0	$\pi^{\pm,0}$ $K^{\pm,0}$					
	L		G_1 Helicity	$h^\perp_{1L}$ Worm-gear				$\pi^{\pm,0}$ $K^{\pm,0}$			$\pi^\pm$	
	T	$f^\perp_{1T}$ Sivers	$g^\perp_{1T}$ Worm-gear	h_1, $h^\perp_{1T}$					$\pi^{\pm,0}$ $K^\pm$	$\pi^{\pm,(0)}$ $K^\pm$	$\pi^\pm$	$\pi^\pm$
Target					LH2, LD2	LH2, LD2	LH_2 + LD_2	NH_3, ND_3 or ^{6}LiD or HD	HD	**^{3}He**	**^{3}He**	**NH_3**
Detector					HMS SHMS	HMS SHMS + π^0 detector	CLAS12	CLAS12 + RICH	CLAS12 + RICH	SBS + HERMES RICH	SoLID	SoLID
Lumi ($cm^{-2}s^{-1}$)					10^{36}	10^{36}	10^{35}	10^{35}	10^{34}	**4 10^{36}**	**2 10^{36}**	**10^{35}**
Experiment ID					E12-06-104 E12-09-017	E12-13-007 C12-11-102	E12-06-112, E12-09-008	E12-07-107, E12-09-009	C12-11-111	E12-09-018 (SIDIS)	E12-10-006 E12-11-007 (SoLID n)	C12-11-108 (SoLID p)

Precision test of SIDIS

Experiment	Title	Main Purpose	Tecnique
E12-06-104 P. Bosted, R.Ent, H. Mkrtchyan et al.	Measurement of the Ratio R = σ_L/σ_T in Semi-Inclusive DIS	Check R~$1/Q^2$ at fixed x (as expected for exclusive processes)	Measure R dependence on Q^2, P_T and z on H and D
C12-11-102 R.Ent, T. Horn, H. Mkrtchyan et al.	Measurement of the Ratio R = σ_L/σ_T in Exclusive and Semi-Inclusive π^0 Production	SIDIS behavior at JLab energies σ_L/σ_T on π^0 info on twist-4 (σ_L=0 at 1/Q) Combined to E12-06-104 verify $\pi^0=(\pi^++\pi^-)/2$ Test z->1 exclusive regime	R dependence on Q^2, t and x on H and D
E12-09-017 P. Bosted, R.Ent, H. Mkrtchyan et al. * first to run ? 2017	Transverse Momentum Dependence of Semi-Inclusive Pion and Kaon Production	Constraint up and down quarks transverse momentum (combined to CLAS12 E12-06-112)	Map π and K charged cross section in SIDIS over x, Q^2, z and P_T<0.5 GeV Full ϕ coverage
E12-13-007 R.Ent, H. Horn, H. Mkrtchyan et al.	Measurement of Semi-Inclusive π^0 Production as validation of Factorization	Validate flavor decomposition and k_T dependence of unp. u and d quarks; verify σ_π^0(x,z)	Measure p(e,e'π^0) cross section in x,z on NPS and SHMS

(SI)DIS: TMD and Frag.Func.





Access nucleon structure by SIDIS

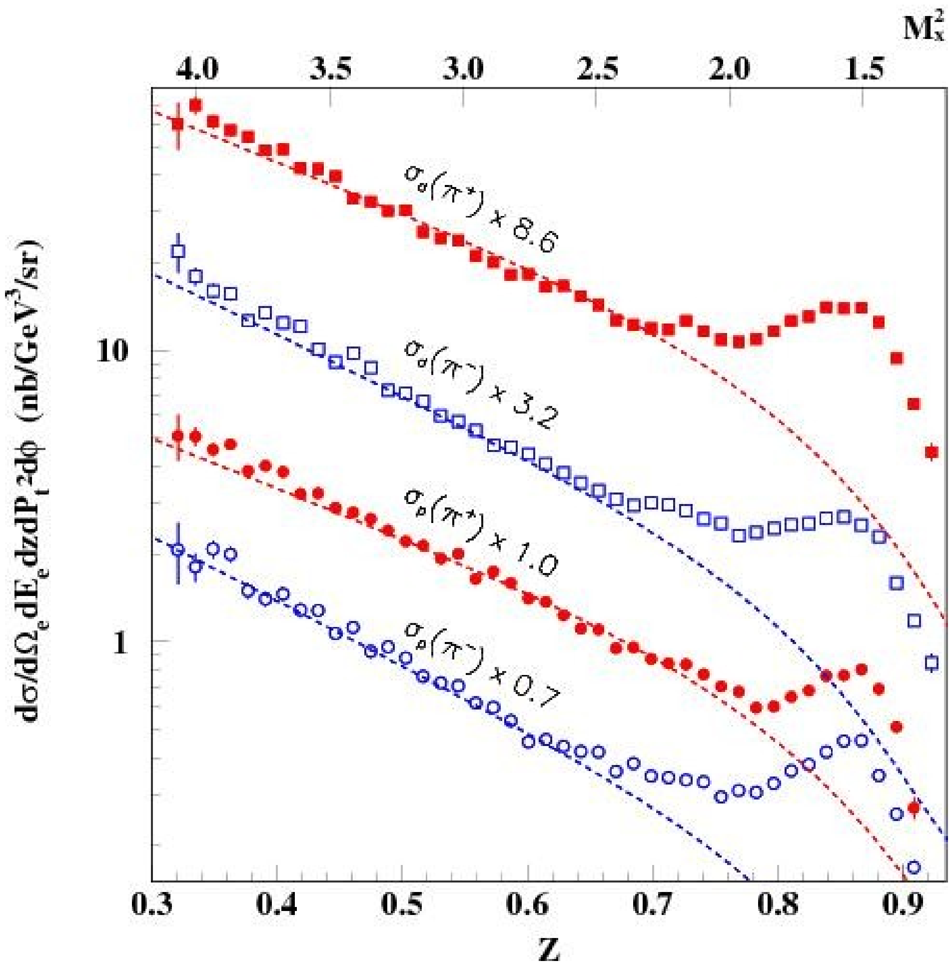
$$\sigma^{lN\to lhX} \sim \sum_q e_q^2 \int d^2\vec{k}_T\, d^2\vec{p}_T\, d^2\vec{l}_T\ f^{N\to q}(x,k_T;Q) \cdot \sigma_{\gamma q}(y,k_T;Q) \cdot D^{q\to h}(z,p_T;Q)\ \delta(z\vec{k}_T+\vec{p}_T+\vec{l}_T-\vec{P}_T)$$

factorization and universality ... but it is still a complicated business

Hall C E00-108 Exp.

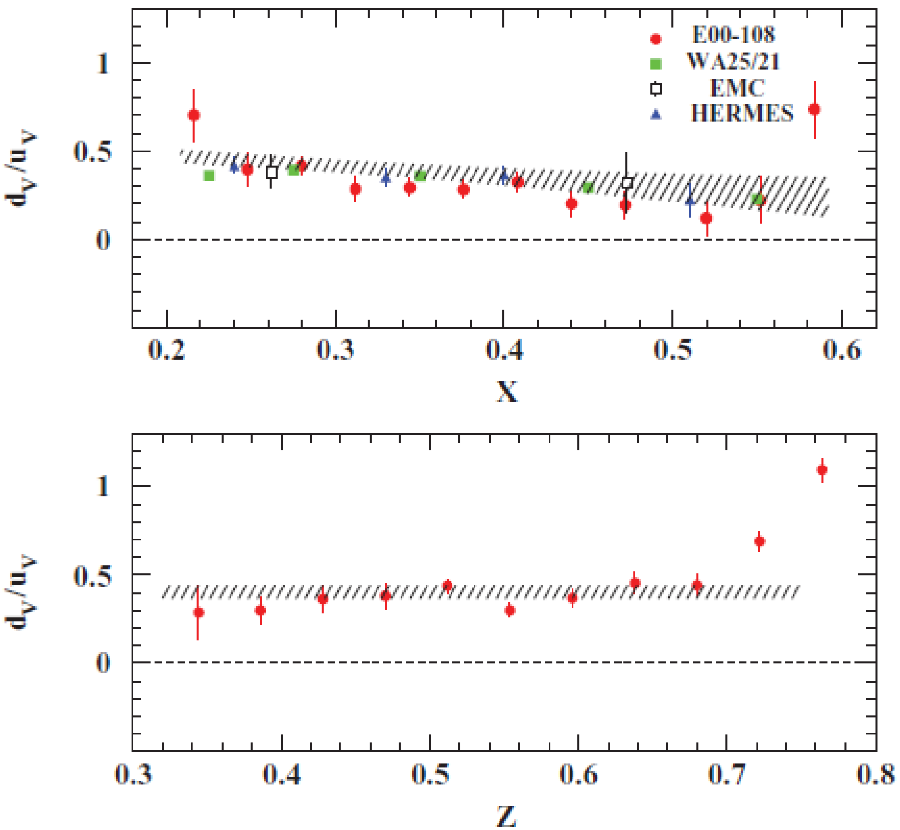
e + LH_2/LD_2 → e' + π+/π- + X

Ebeam=5.5 GeV



T. Navasardyan et al. PRL 98, 022001 (2007)

bands evaluated using CTEQ PDFs

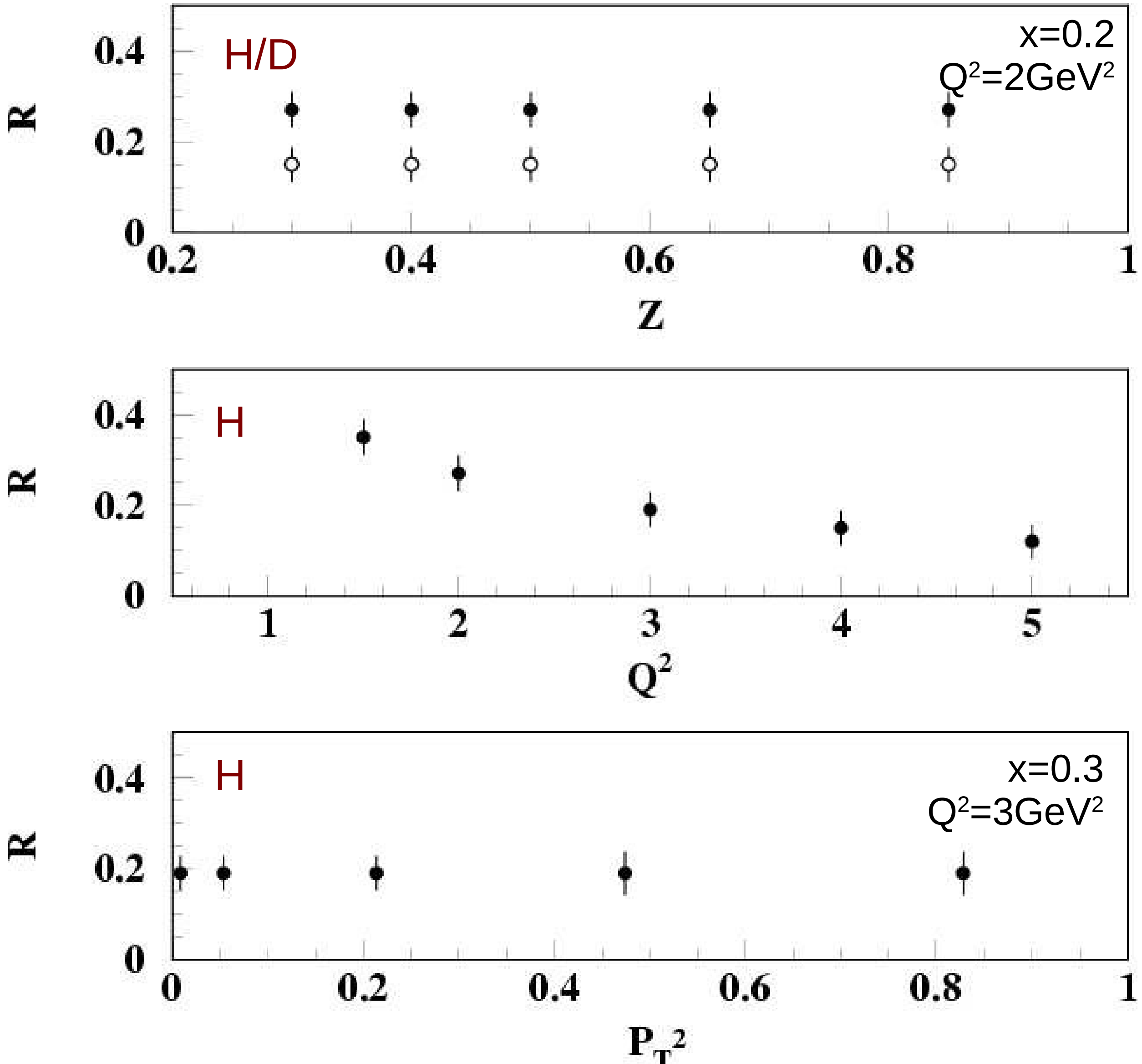


R. Asaturyan et al. PRL 85, 015202 (2012)

Low Energy SIDIS xsec reproduced by calculation using high energy parameters and PDF

Doors are opened for SIDIS program at JLab

E12-06-104: R=σ_L/σ_T - H/D(e,e'$\pi^{+/-}$)X

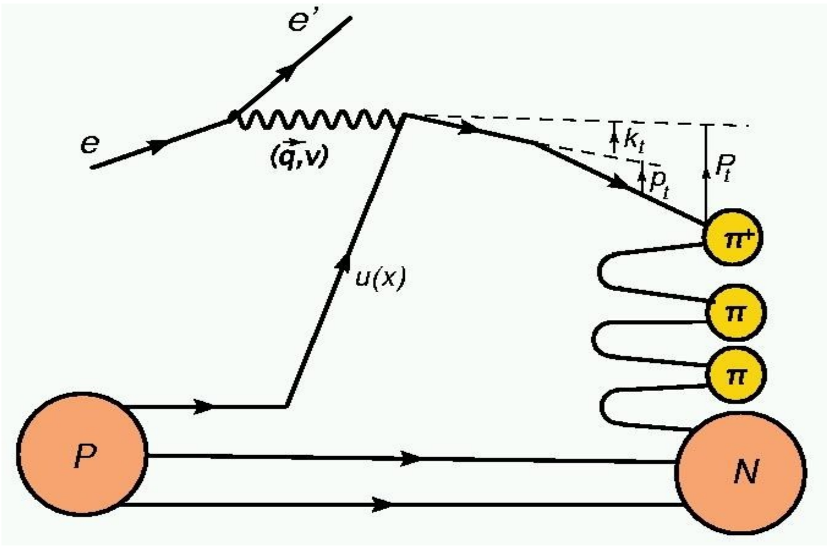


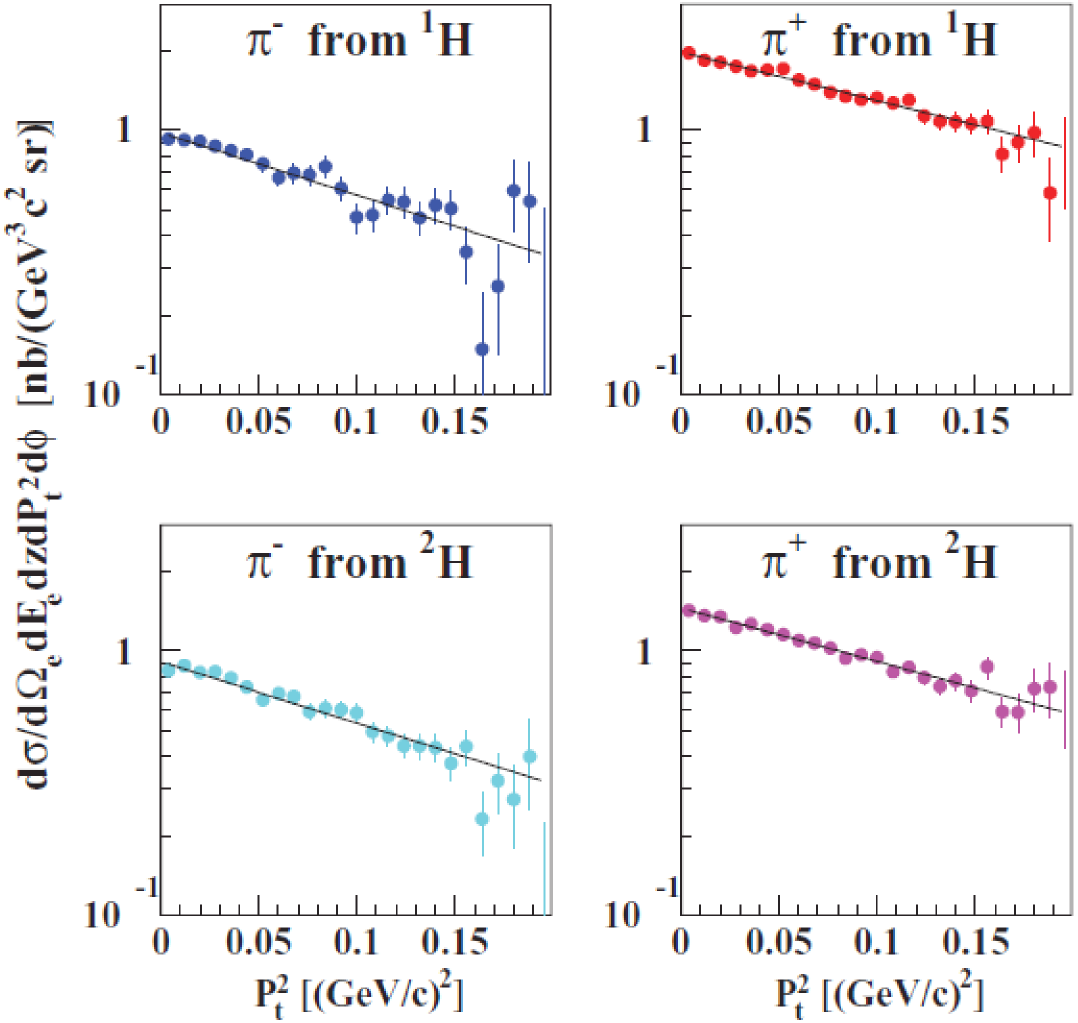
Projected precision

- How the struck quark convert into pion (single hard-gluon or soft-gluons exchange)
- Provide information on SIDIS
- flavor decomposition
- z dependence should show transition from semi inclusive to exclusive region
- Hard scattering limit expected at large p_T ($R_{SIDIS} \sim R_{DIS}$)

Hall C E00-108 – Transverse quark motion

$$F_{AB} \sim \sum_q e_q^2 \int d^2p_t d^2k_t \delta(zp_t + k_t - P_t) w(p_t, -\frac{k_t}{z}) f^a(x, p_t^2) D^a(z, k_t^2)$$





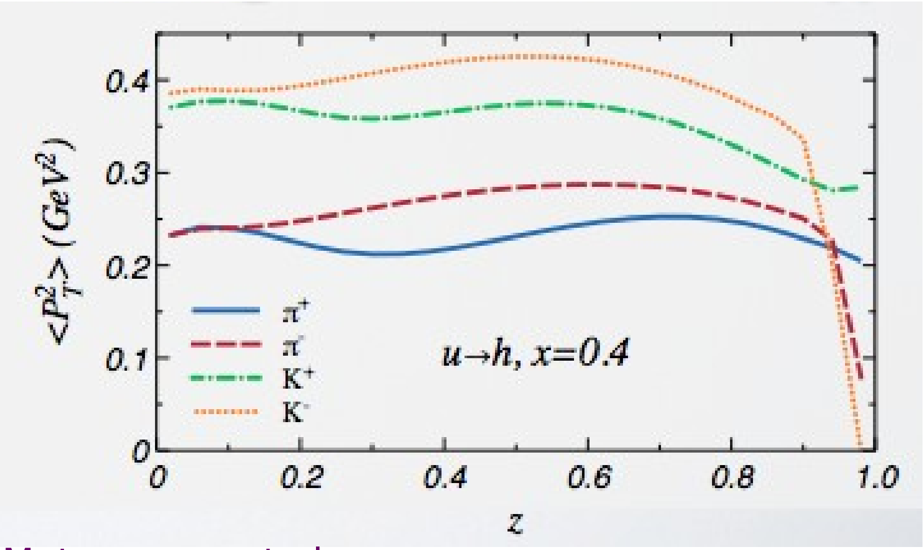
Potential separation of p_t/k_t widths (needs assumptions)

R. Asaturyan et al. PRL 85, 015202 (2012)

Data (+ contrib. from valence quarks only and two FF only)

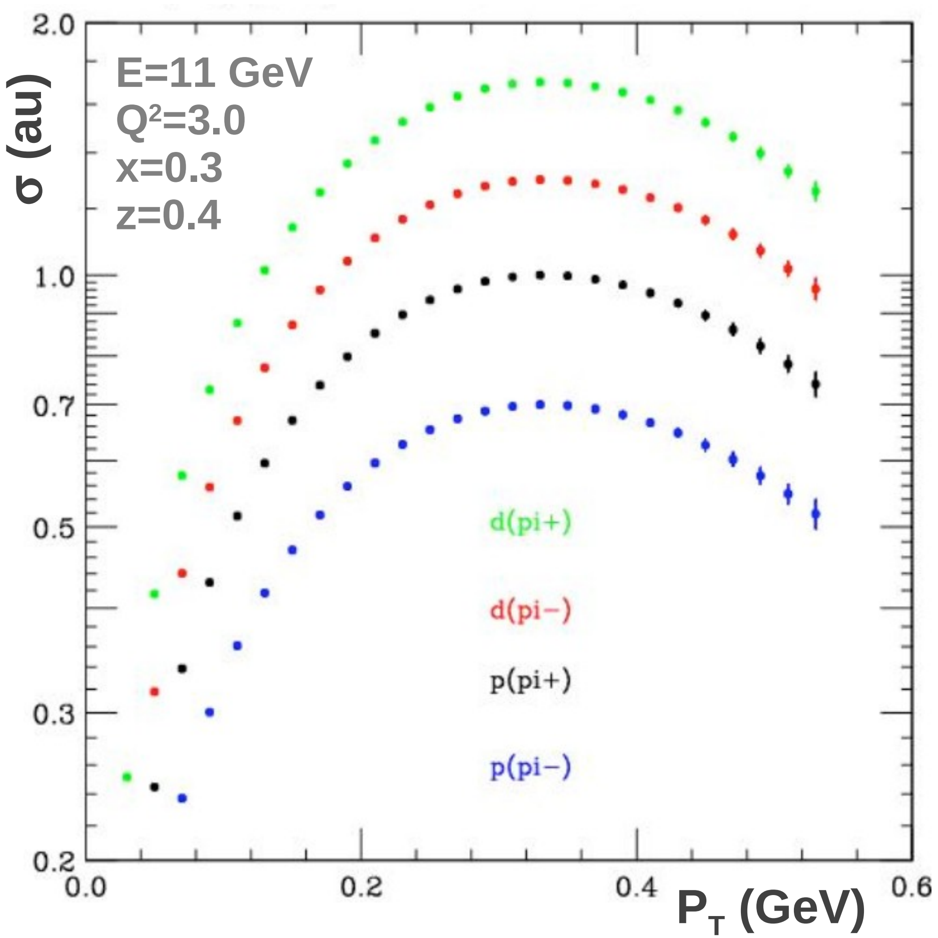
→ k_t width of u-quark > k_t width of d-quark

E12-09-017: Transverse Motion of quarks



H. Matevosyan et al.
Phys.Rev.D85:014021,2012

Expected precision from
Hall C/E12-09-017



Cover wide range in Q^2

Full coverage of ϕ

Larger p_T and z range

Charged pions and kaons production

Toward flavor and helicity dependence of

the transverse motion of quark (and gluon)

Precise TMDs measurements

Experiment	Title	Main Purpose	Tecnique
E12-09-018 *G. Cates, E. Cisbani, G. B. Franklin, A. Puckett, B. Wojtsekhowski et al.*	Target Single-Spin Asymmetries in Semi-Inclusive Pion and Kaon Electroproduction on a Transversely Polarized ^{3}He Target using Super BigBite and BigBite in Hall A	Extract Sivers, Collins and Pretzelosity neutron asymmetries on π and K with high statistics Explore for the first time the high x valence region (with overlap to HERMES, COMPASS, Jlab 6GeV data at lower x)	3D binning on the relevant variables: x, $P_\perp$ and z, for both hadrons; 2 Q^2 values
E12-10-006 *H. Gao, X. Qian, J.-P. Chen, J.-C. Peng et al.*	Target Single Spin Asymmetry in Semi-Inclusive Deep-Inelastic (e, e′$\pi^\pm$) Reaction on a Transversely Polarized ^{3}He Target at 8.8 and 11 GeV	Extract Sivers, Collins and Pretzelosity neutron asymmetries on π with very high statistics and minimize systematics; multi term fitting	4D binning on the relevant variables: x, $P_\perp$ and z and Q^2
C12-11-008 *H. Gao, K. Allada, J.-P. Chen, Z.-E. Meziani et al.*	Target Single Spin Asymmetry in Semi-Inclusive Deep-Inelastic (e, e′$\pi^\pm$) Reaction on a Transversely Polarized Proton Target	Extend previuos experiment to proton target	
E12-11-007 *J.P. Chen, J, Huang, Y. Qiang, W.B. Yan et al.*	Asymmetries in Semi-Inclusive Deep-Inelastic (e, e'$\pi^\pm$) Reactions on a Longitudinally Polarized ^{3}He Target at 8.8 and 11 GeV	Precise study of Worm-gear TMDs (combined to E12-10-006)	Multidimensional mapping as in E12-10-006

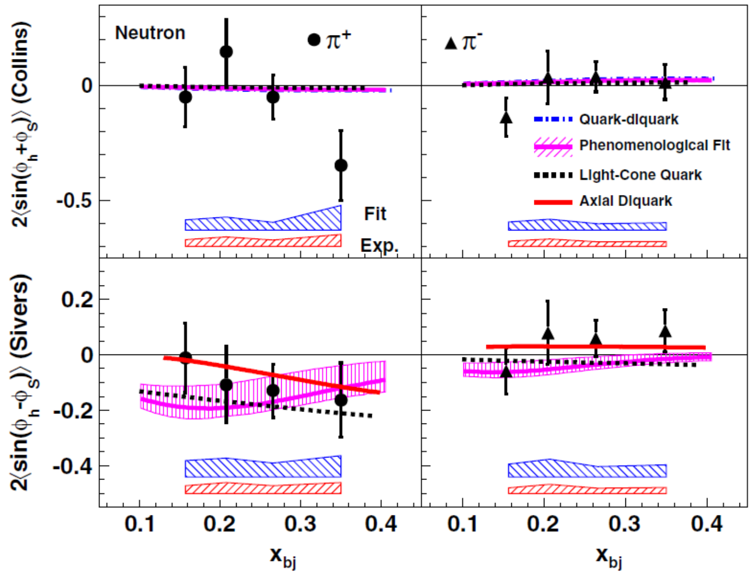
SoLID

E06-010: Hall A ^{3}He Transversity Experiment at 6 GeV

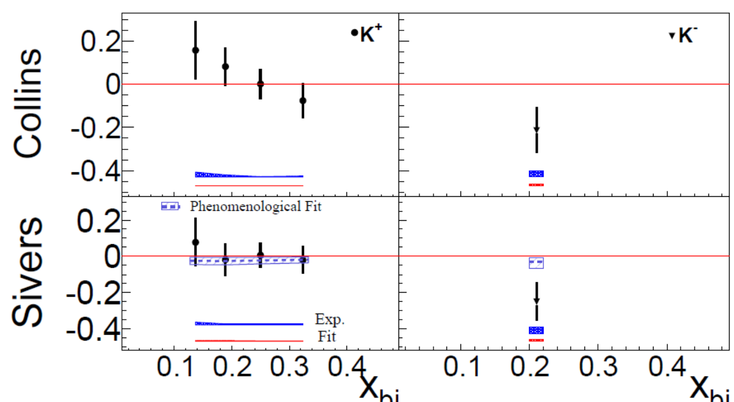
<4 months of data taking: E=5.9 GeV, 15 mA; target 65% trans. polarization, 10^{36} Hz/cm^2

$$e + {}^3He^{\uparrow} \rightarrow e' + \pi(K)^{\pm} + X$$

PRL 107, 072003 (2011) – first results

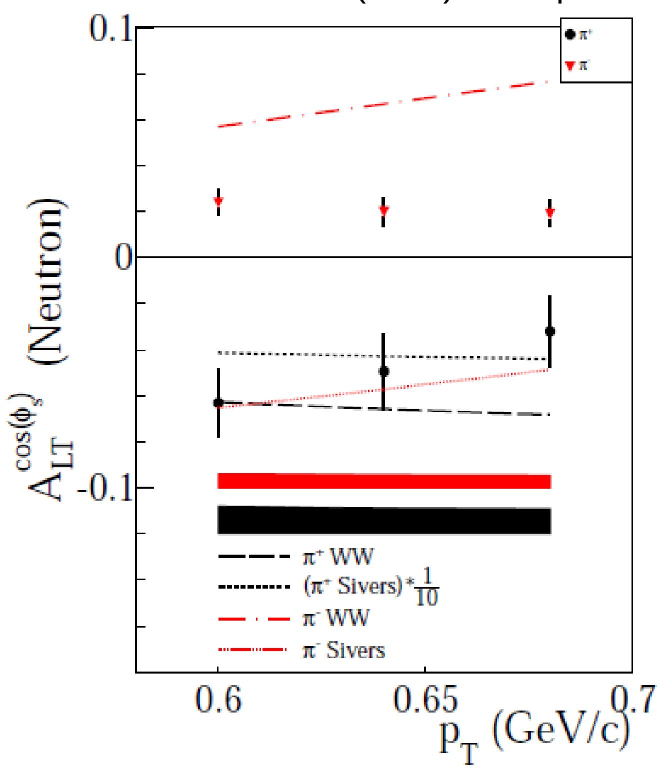


PRC 90, 055201 (2014)



$$e + {}^3He^{\uparrow} \rightarrow h + X$$

PRC 92 015207 (2015) – last pub. results



Related to twist-3 Worm-Gear type function

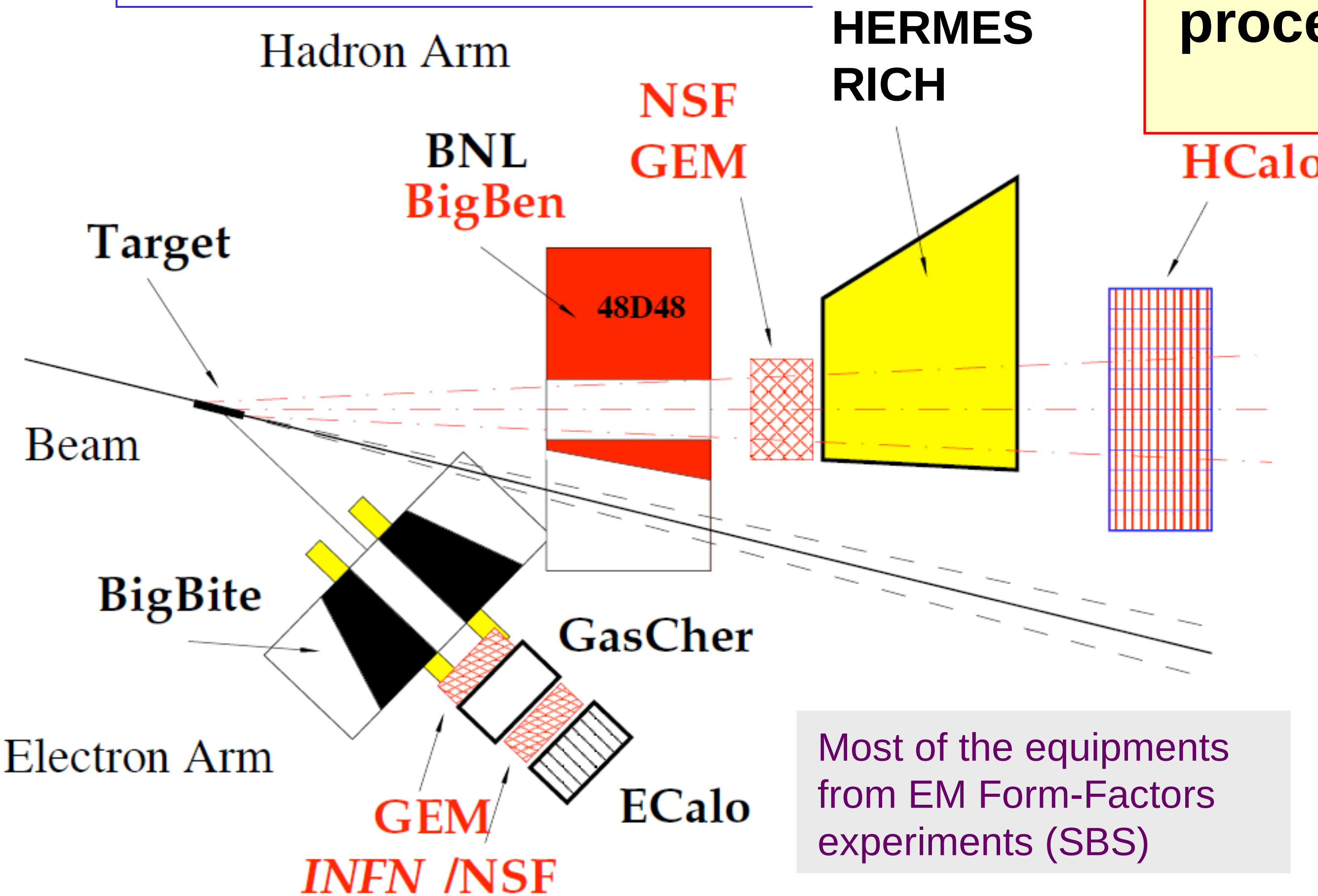
- q-g-q correlation in nucleon
- Frag. Func. twist-3

Potentiality of the ^{3}He transverse setup originated the high stat. proposal at 11 GeV with SBS

11 GeV SIDIS: Experimental Setup

$e + {}^3He^{\uparrow} \rightarrow e' + \pi(K)^{\pm} + X$

Measure the SSA of SIDIS processes $n^{\uparrow}(e,e'p^{\pm})X$ and $n^{\uparrow}(e,e'K^{\pm})X$



Most of the equipments from EM Form-Factors experiments (SBS)

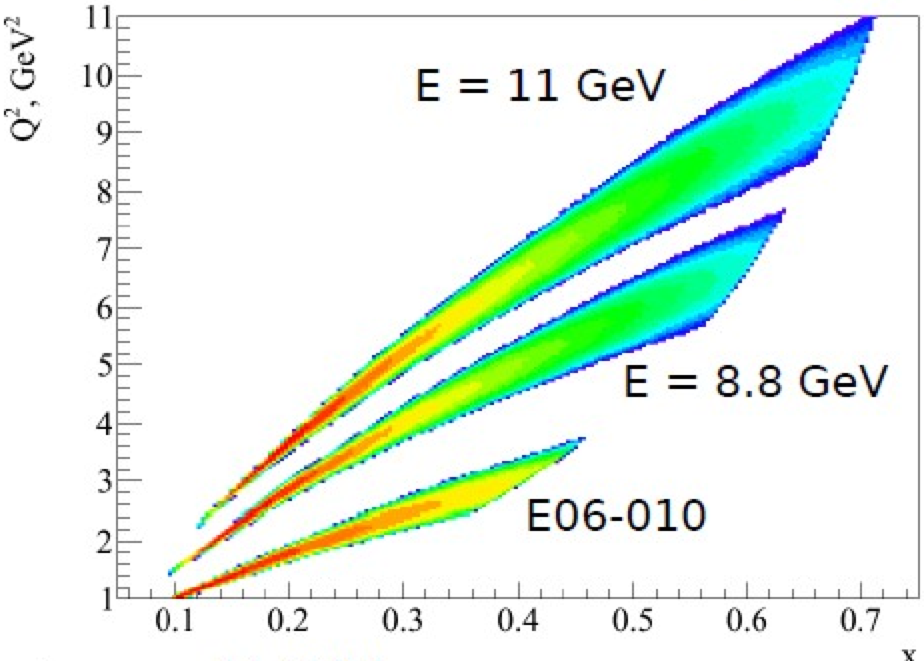
BB: e-arm at 30°
- Ω = 45 msr
- GEM Tracker
- Gas Cherenkov
- Shower
- ⇐ A1n

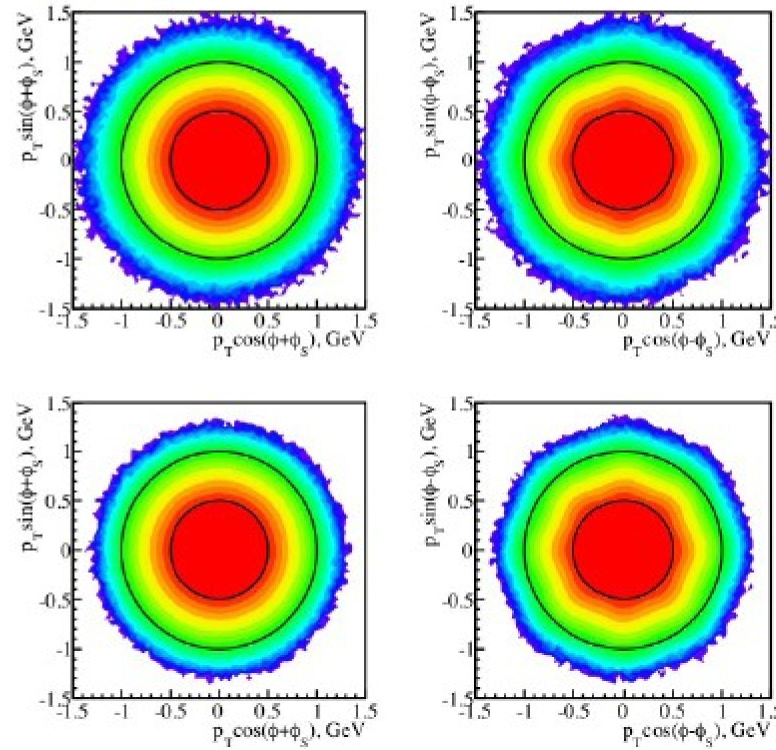
SBS: h-arm at 14°
- Ω = 50 msr
- GEM tracker
- excellent PID / RICH
- Hadron CALO

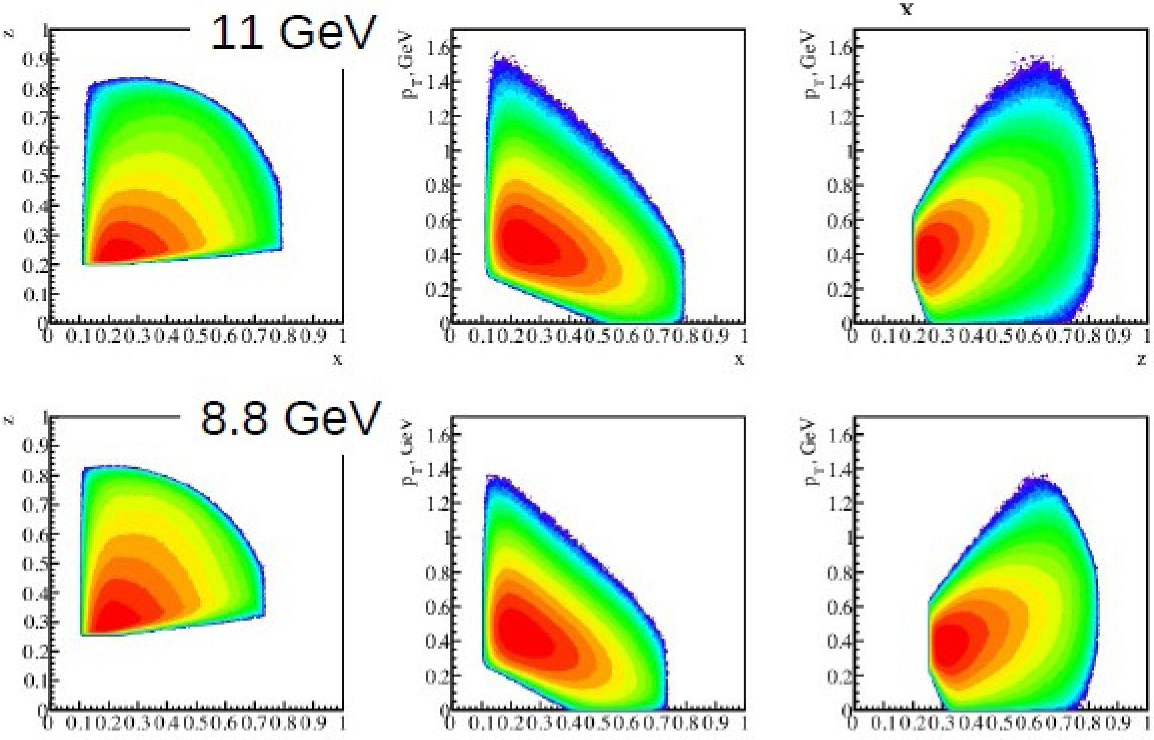
Beam: 40 µA, E=8.8 and 11 GeV (80% long. Pol.)
Target: 65% transv. polarized ${}^3He$, 8 spin directions
Luminosity: 4×10^{36} cm^{-2}s^{-1}

E12-09-018 / SIDIS exp.

11 GeV SIDIS Phase Space



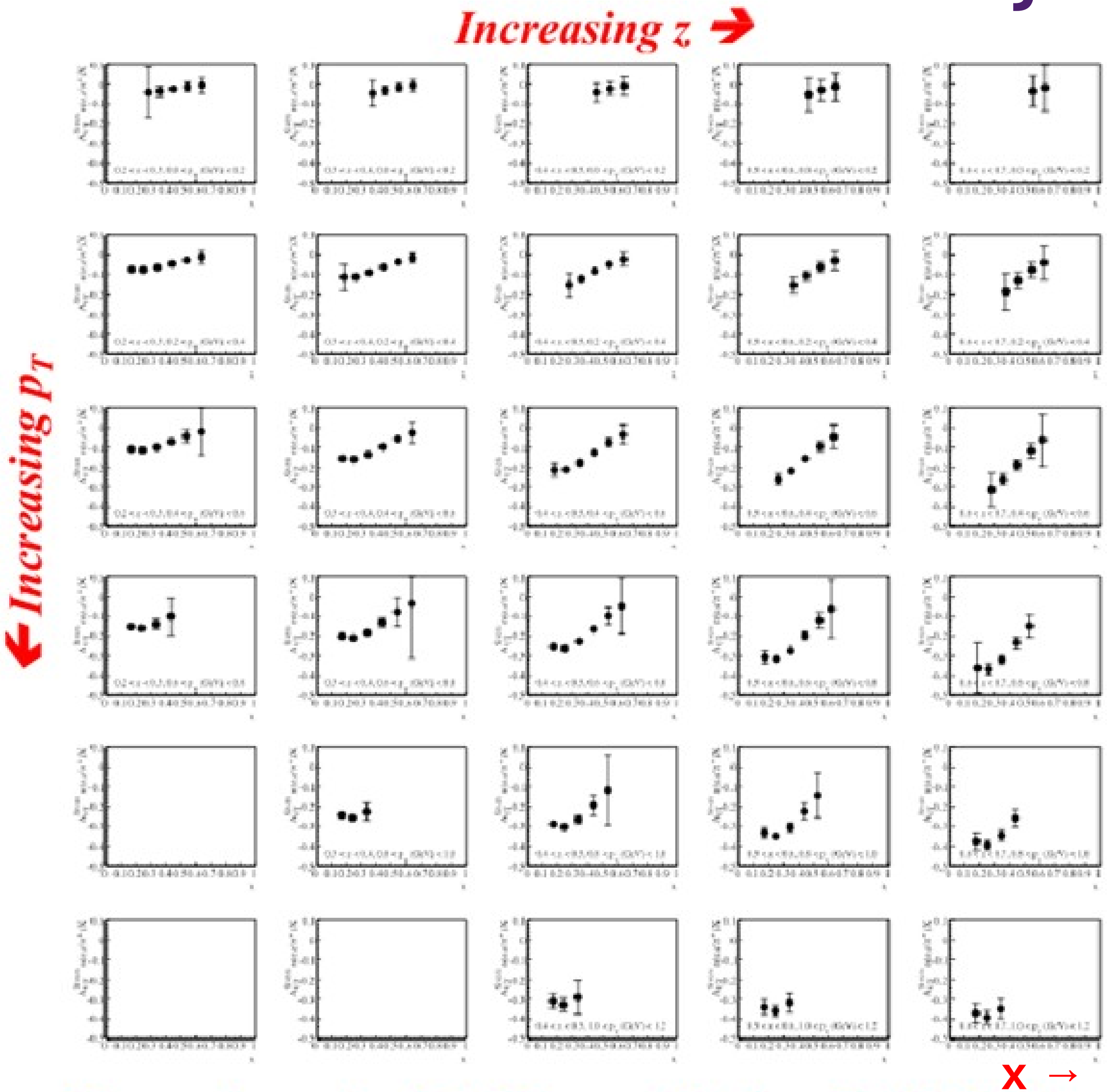




Full coverage of the azimuthal modulation functions

Large coverage in all variables; evolution and factorization effects can be investigated

11 GeV SIDIS: Projected results



Sivers A_{UP} $n(e,e'\pi^+)X$ vs. x, 40 days @ 11 GeV

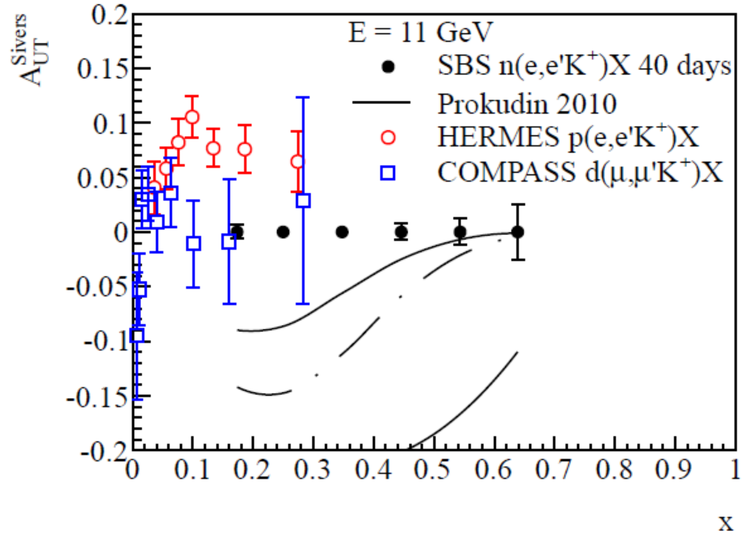
- 6 (0.1 < x < 0.7) × 5 (0.2 < z < 0.7) × 6 (0 < p_T (GeV) < 1.2) 3D binning
- Q^2 dependence with E = 11 and 8.8 GeV data gives fully-differential analysis
- Typically 120 bins with good stats per beam energy
- ***Statistical precision:***
- ***83% of 3D bins have separated Collins/Sivers neutron asymmetry error of less than 5% (absolute)***
- ***Average stat. err ~4%***
- ***Most probable stat. err ~1.5%***

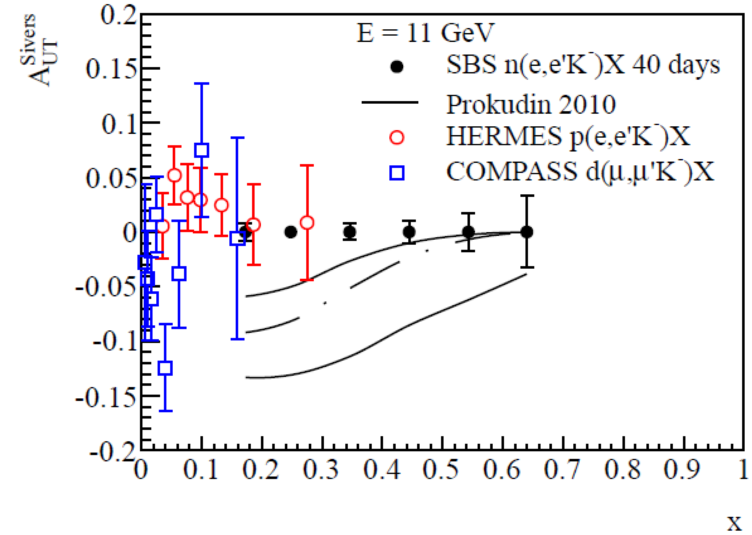
A. Puckett (PAC38 presentation)

- Precision multi-dimensional analysis
- Statistical FOM ~ 100xHERMES-p ~ 1000xE06-010-n

11 GeV SIDIS: Expected Effects

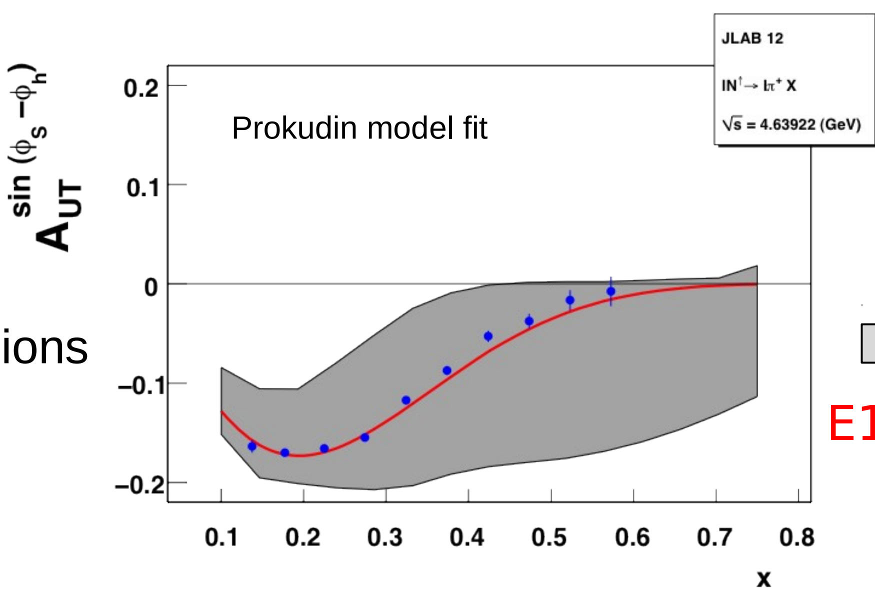
kaons

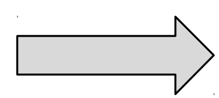




Squeeze model uncertainty corridor

pions





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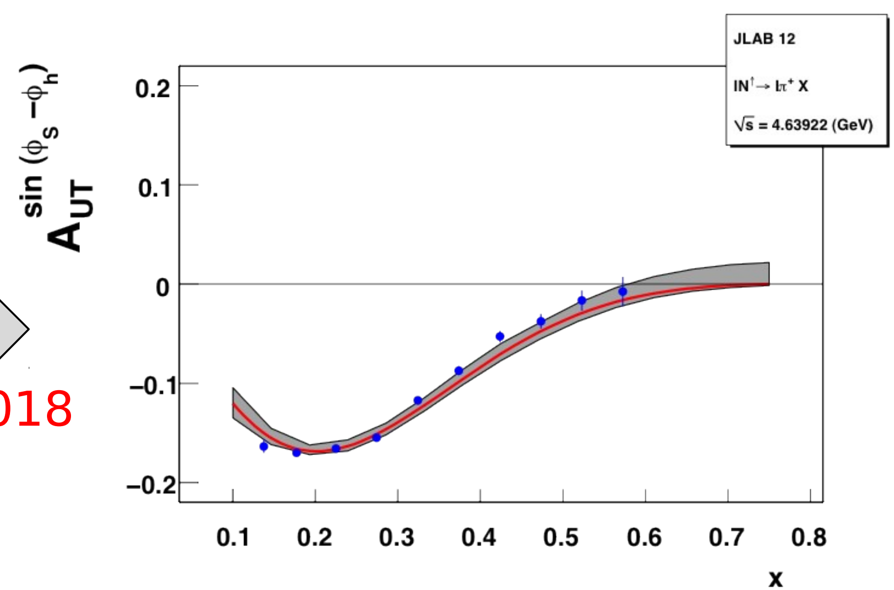
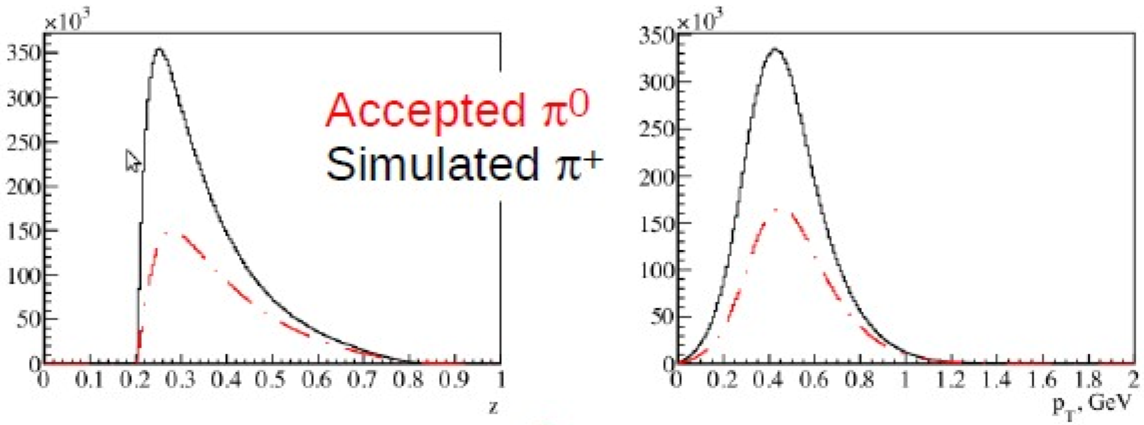
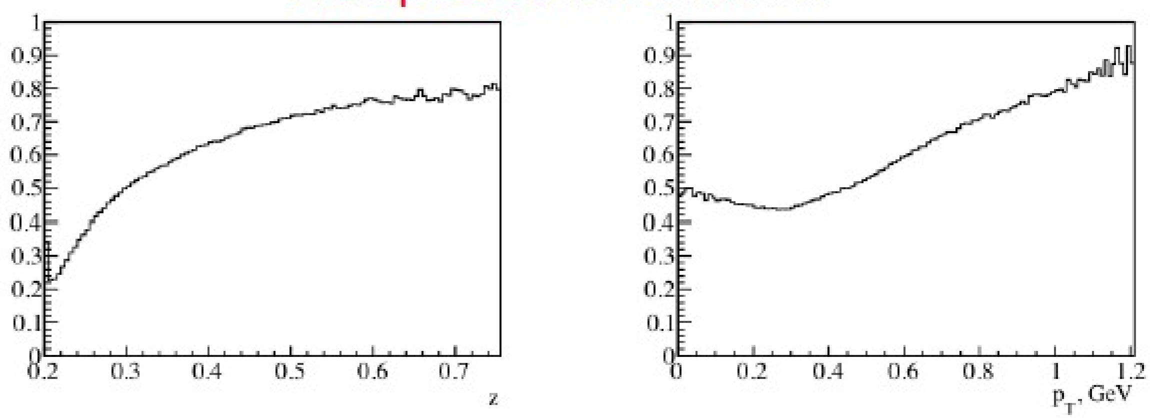
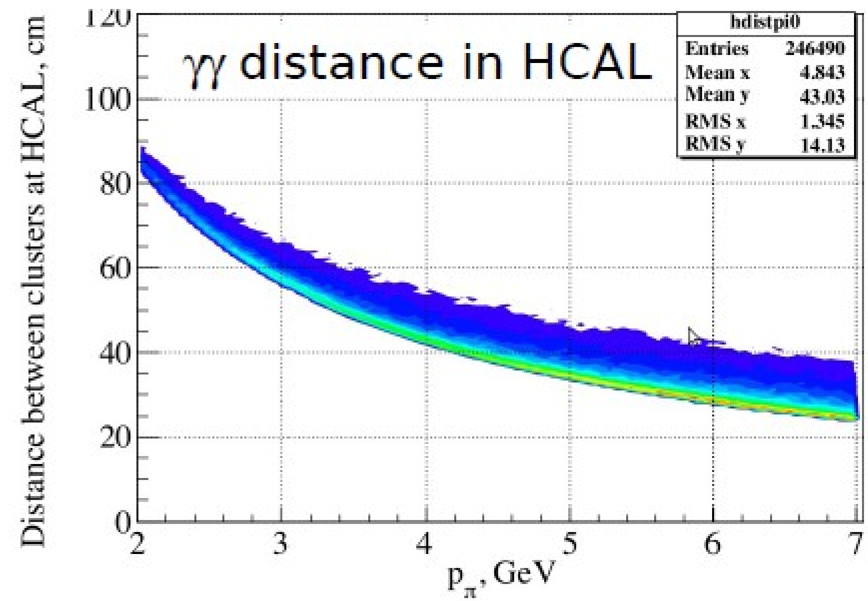


11 GeV SIDIS: π^0 detection
(preliminary study)



Efficiency Accepted π^0/Simulated π^+





HCAL Energy resolution = 14%/sqrt(E)

Invariant mass reconstruction resolution ~ 19 MeV (~ 12 MeV in HERMES)

Kinematic variables reconstruction ~ 4 better than planned bin width

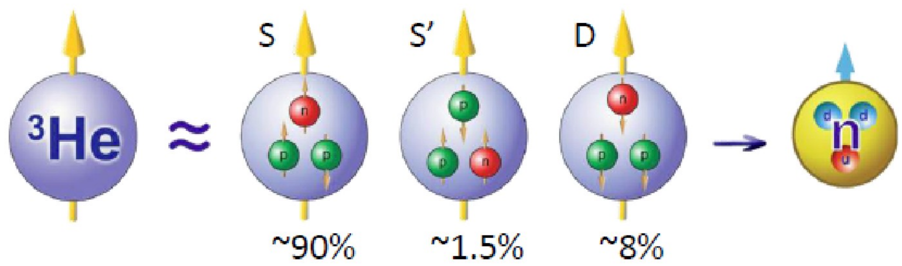
Some issues

- High statistics measurements needs small systematics
  - from detectors (new equipments require time for adequate undestanding!)
  - from models (competing processes, radiative corrections, two photons, nuclear effects ...)
- Nucleon structure investigation is high priority of JLab, however
  - Other hot scientific topics (parity violating experiments, search of hidden matter and energy ...), are gaining more and more importance
  - beam time is limited

^{3}He polarized target

From the work of: Alessio Del Dotto, Leonid Kaptari, Emanuele Pace, Matteo Rinaldi, Giovanni Salmè, Sergio Scopetta

$$^3\vec{He} \simeq \vec{n}$$



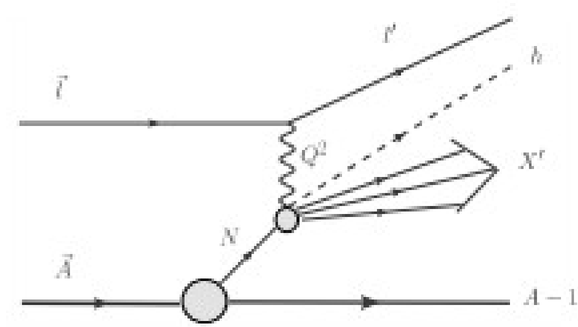
(Ciofi degli Atti et al. PRC48(1993)R968)

---> applied to DIS, first naive extension to SIDIS

The two protons are mostly in a s=0 wave.

The first guess:

- The virtual photon interact with a single nucleon. The FSI among the hadron, the nucleons and the spectator nuclear system is disregarded
- The internal structure of the bond nucleon is the same as the free one



$$A_n \simeq \frac{1}{p_n f_n}(A_3^{exp} - 2p_p f_p A_p^{exp})$$

Effective polarizations:

$$p_p = -0.023 \qquad p_n = 0.878$$

Dilution factor:

$$f_{p(n)} \simeq 0.2$$

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Courtesy of Alessio Del Dotto

FSI through distorted spectral function

In the asymmetry extraction enters the ^{3}He spectral function P :

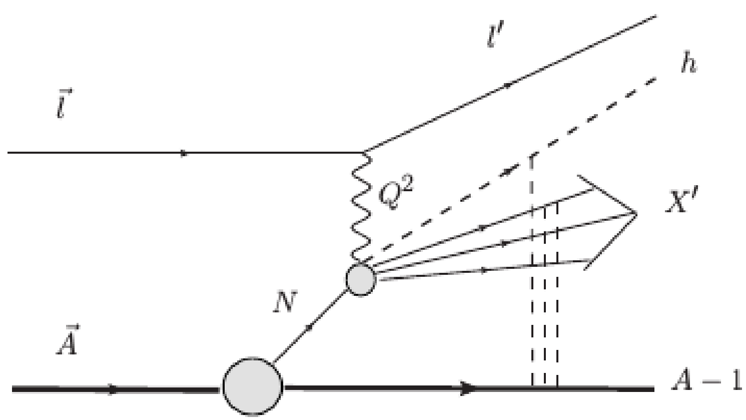
$$p_p = \int dE \int d\vec{p}\, P^p_{\parallel}(\vec{p}, E) = -0.023$$

$$p_n = \int dE \int d\vec{p}\, P^n_{\parallel}(\vec{p}, E) = 0.878$$

$$f_{p(n)}(x,z) = \frac{\sum_q e_q^2 f_1^{q,p(n)}(x)\, D_1^{q,h}(z)}{\sum_{N=p,n} \sum_q e_q^2 f_1^{q,N}(x) D_1^{q,h}(z)} \simeq 0.2$$

To add FSI the spectral function has to be modified --> ***distorted spectral function***

Ref: Phys. Rev. C 89, 035206 (2014) ; Few Body Syst. 55 (2014) 877-880 .



$$\mathcal{P}_{||}^{\hat{\mathbf{S}}_A IA(FSI)} = \mathcal{O}^{\hat{\mathbf{S}}_A}_{\frac{1}{2}\frac{1}{2}} - \mathcal{O}^{\hat{\mathbf{S}}_A}_{-\frac{1}{2}-\frac{1}{2}}$$

$$\mathcal{O}^{\hat{\mathbf{S}}_A IA(FSI)}{}_{\lambda\lambda'}(\mathbf{p}_N, E) = \sum\!\!\!\!\!\!\int_{\epsilon^*_{A-1}} \rho\left(\epsilon^*_{A-1}\right) \langle \hat{S}_{Gl}\{\Phi_{\epsilon^*_{A-1}}, \lambda, \mathbf{p}_N\}|S_A, \Phi_A\rangle\langle S_A, \Phi_A|\hat{S}_{Gl}\{\Phi_{\epsilon^*_{A-1}}, \lambda', \mathbf{p}_N\}\rangle \times \delta\left(E + M_A - m_N - M^*_{A-1} - T_{A-1}\right)$$

$$\hat{S}_{Gl}(\mathbf{r}_1, \mathbf{r}_2, \mathbf{r}_3) = \prod_{i=2,3} [1 - \theta(z_i - z_1)\Gamma(\mathbf{b}_1 - \mathbf{b}_i, z_1 - z_i)]$$

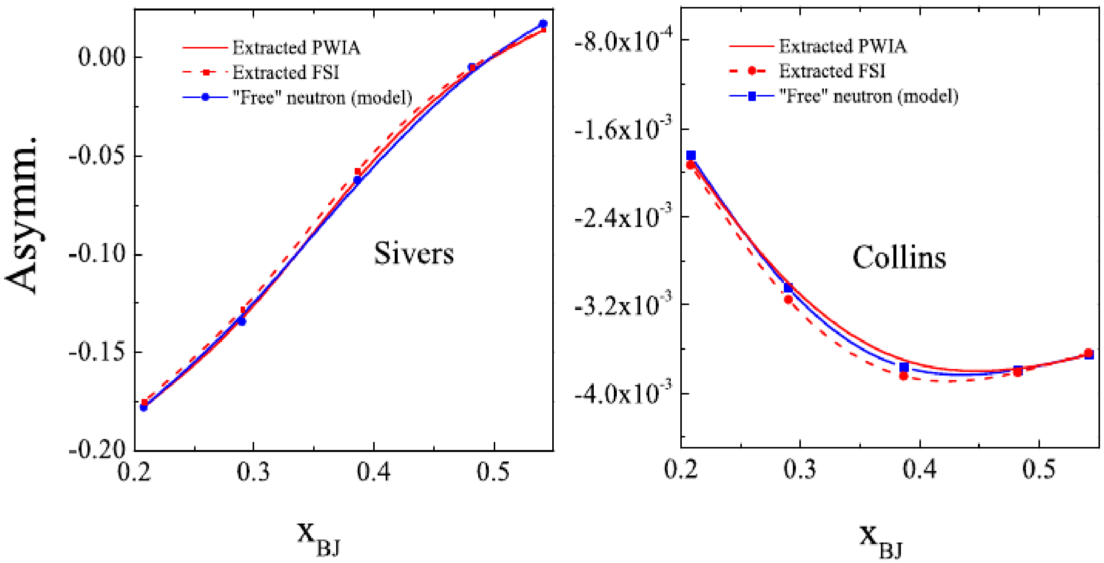
$$\Gamma(\mathbf{b}_{1i}, z_{1i}) = \frac{(1 - i\,\alpha)\,\sigma_{eff}(z_{1i})}{4\,\pi\, b_0^2} \exp\left[-\frac{\mathbf{b}_{1i}^2}{2\, b_0^2}\right]$$

The relative energy between the A-1 and the remnant is order GeV -> Eikonal approximation (Glauber operator)

The profile funcion Γ contains the effective cross section -> hadronization

Courtesy of Alessio Del Dotto

Preliminary results for Collins and Sivers Asymmetries



1) **PWIA:** $\langle p_n \rangle$= 0.876, $\langle p_p \rangle$= -0.0237, $\theta_e = 30^\circ$, $\theta_\pi = 14^\circ$

E_{beam}, GeV	x_{Bj}	ν GeV	p_π GeV/c	$f_n(x,z)$	$\langle p_n \rangle f_n$	$f_p(x,z)$	$\langle p_p \rangle f_p$
8.8	0.21	7.55	3.40	0.304	0.266	0.348	-8.410^{-3}
8.8	0.29	7.15	3.19	0.286	0.251	0.357	-8.510^{-3}
8.8	0.48	6.36	2.77	0.257	0.225	0.372	-8.910^{-3}
11	0.21	9.68	4.29	0.302	0.265	0.349	-8.310^{-3}
11	0.29	9.28	4.11	0.285	0.25	0.357	-8.510^{-3}

2) **FSI:** $\langle p_n \rangle$= 0.756, $\langle p_p \rangle$= -0.0265, $\langle N_n \rangle = 0.85$, $\langle N_p \rangle = 0.87$, $\langle \sigma_{eff.} \rangle = 71\ mb$

E_{beam}, GeV	x_{Bj}	ν GeV	p_π GeV/c	$f_n(x,z)$	$\langle p_n \rangle f_n$	$f_p(x,z)$	$\langle p_p \rangle f_p$
8.8	0.21	7.55	3.40	0.353	0.267	0.405	-1.110^{-2}
8.8	0.29	7.15	3.19	0.332	0.251	0.415	-1.110^{-2}
8.8	0.48	6.36	2.77	0.298	0.225	0.432	-1.210^{-2}
11	0.21	9.68	4.29	0.351	0.266	0.405	-1.10^{-2}
11	0.29	9.28	4.11	0.331	0.250	0.415	-1.110^{-2}

$$\mathbf{A_n} \simeq \frac{1}{\mathbf{p_n^{FSI}\ f_n^{FSI}}} \left(\mathbf{A_3^{exp}} - 2\mathbf{p_p^{FSI} f_p^{FSI} A_p^{exp}} \right) \simeq \frac{1}{\mathbf{p_n\ f_n}} \left(\mathbf{A_3^{exp}} - 2\mathbf{p_p f_p A_p^{exp}} \right)$$

Ref: Few Body Syst. 56 (2015) 425-430 ; arXiv:1602.06521 ; EPJ Web Conf. 113 (2016) 05010.

- The effective polarizations $p_{p(n)}$ differs by 15-20%, but they have to be considered in combination with the dilution factor and the products in the asymmetries extraction change very little
- Therefore, the extraction procedure seems to be safe
- The extraction procedure can be carefully tested in MC simulating the phase space of the JLab ^{3}He target dedicated experiments

Courtesy of Alessio Del Dotto

Conclusions

JLab energy upgrade is going to offer new exciting opportunities to study the spin/momentum structure of the nucleons:

- high precision
- unexplored phase space, large kinematical coverage
- flavor decomposition (p,n)x(π,K)
- better undestanding of the SIDIS regime

Large technological efforts is in progress to optimally exploit these opportunities

Expected results will likely provide rich set of new informations both to validate SIDIS regime and extract TMDs

Analysis of the data will require precise knowledge of the new detectors and physics assumptions

First experiment in HallC expected in 2017, SBS in operation in 2018 (?)