SIDIS Responses

Tianbo Liu
Duke University and Duke Kunshan University

SoLID Collaboration Meeting
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Recommendations from Director's Review (1)

- Acceptances, efficiencies, and systematic uncertainties should be simulated for each of the core measurements.

- End-to-end simulations with realistic subsystem responses and material budgets, and complete track finding and reconstruction should be developed.

- The development of a simulation framework with realistic reconstruction and analysis should be pursued with high priority and increased resources.

Recommendations from Director's Review (2)

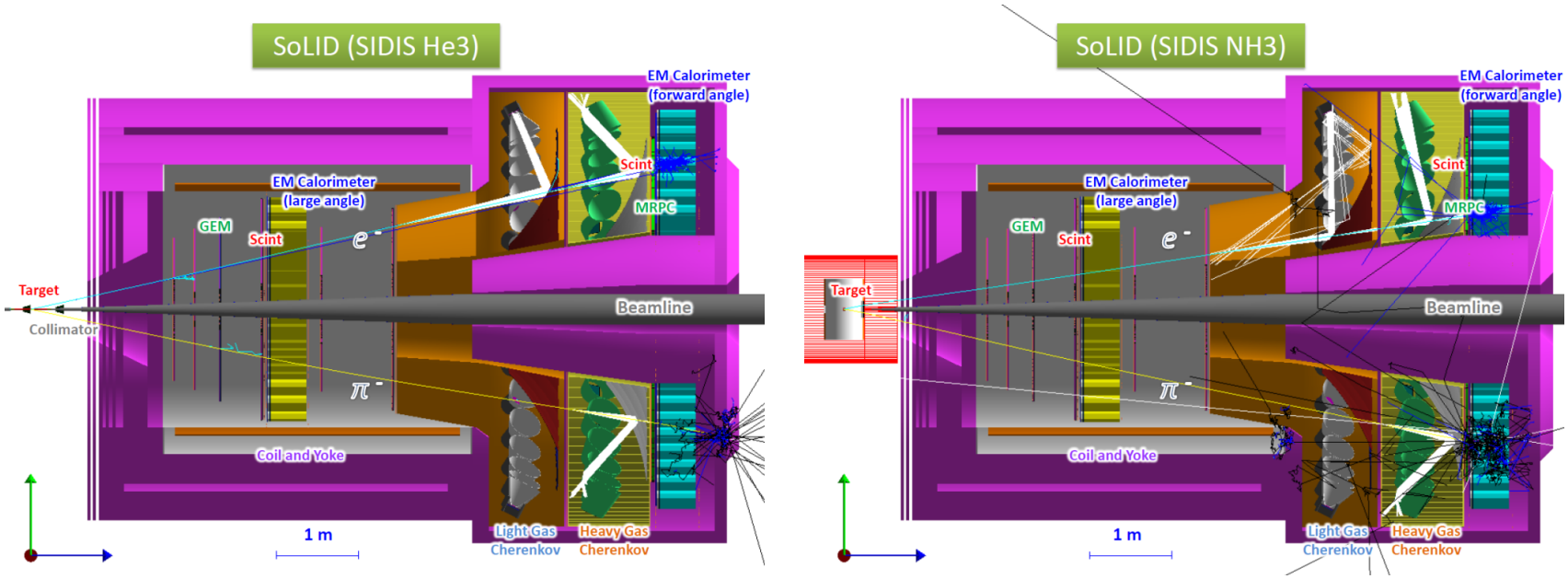
- Better comparisons with expected results on programs such as SBS and particularly CLAS12 are needed to clarify the need for the SoLID SIDIS program. Crisp demonstrations of the improvements possible with SoLID should be developed.

- The SoLID Collaboration should investigate the possibility of kaon identification, especially given their high luminosity.
- The collaboration is encouraged to explore the power of extended kaon identification (through Cherenkov or TOF).

Simulation

refer to Zhiwen's talk

- Simulation in "SoLID GEMC" with all subsystems (GEM, HGC, MRPC, SPD, EC, LGC)
- Various files generated at shared central location. They can be used for studies of acceptance, triger, GEM, etc., and ensure consistent results.



Acceptance and Efficiency

refer to Zhiwen's talk

^{3}He

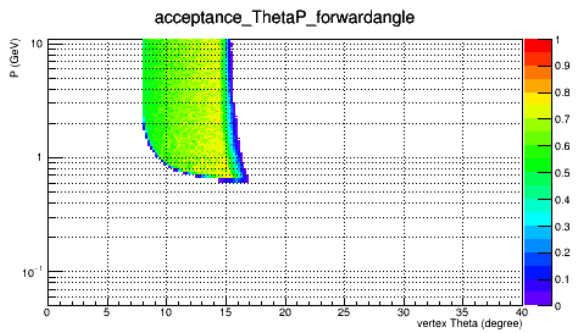
p

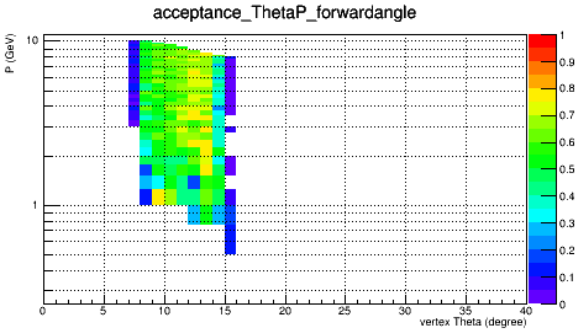
e^- e^- π^-

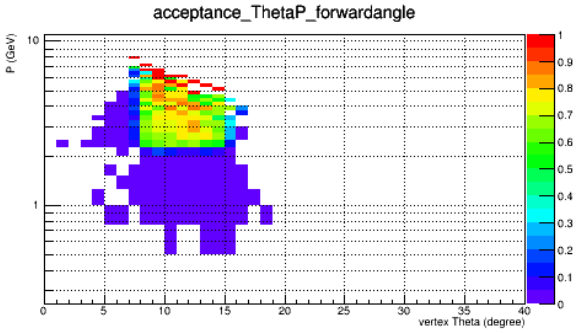
FA:

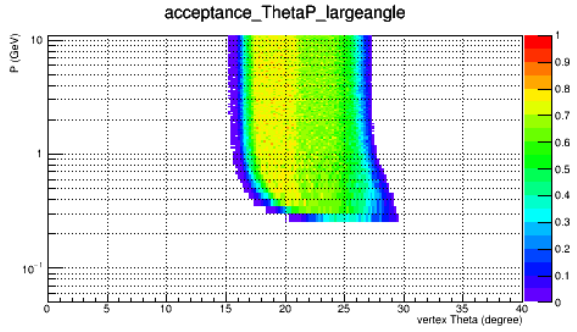
LA:

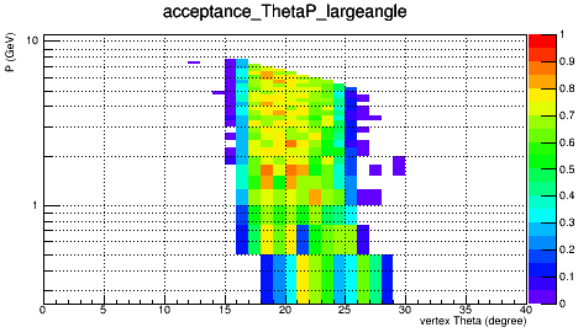
F&L:

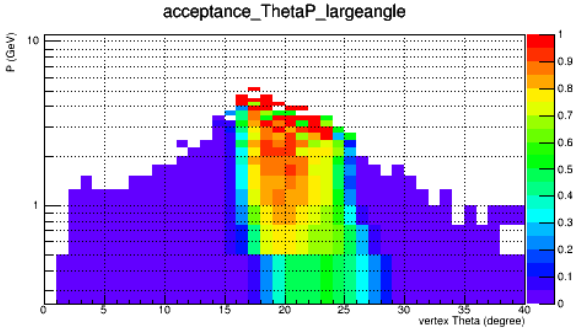


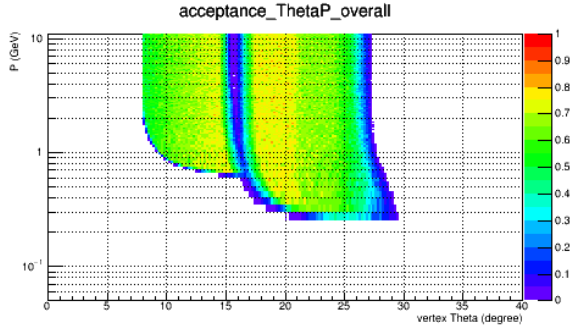


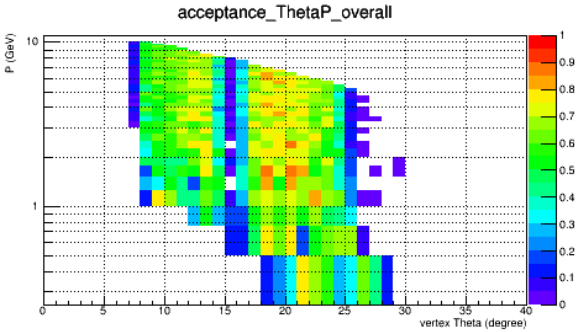


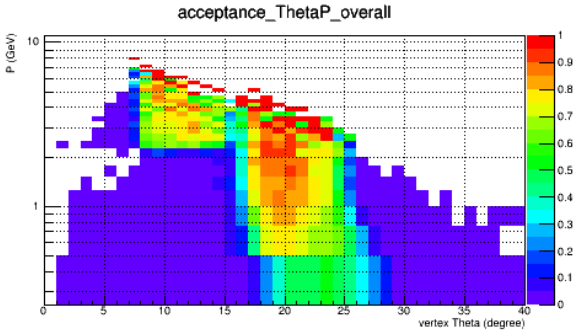












θ

simplified setup
(without secondary)

Simulation with secondary (EC+GEM+LGC/HGC)

Systematic Uncertainties

- Systematic uncertainties: raw asymmetry, target polarization, detector resolution, random coincidence background, nuclear effect, radiative correction, diffractive rho meson. (refer to Tianbo's talk May2016)

- Total systematic errors of SSA: abs.+ rel.

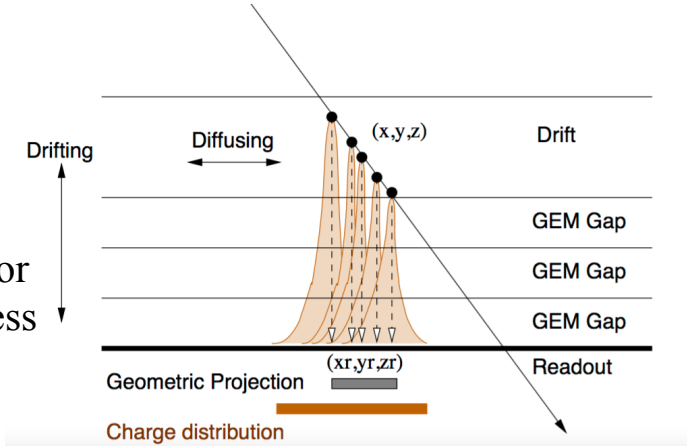
Asymmetry	Sivers		Collins/Pretzelosity	
Hadron	π^+	π^-	π^+	π^-
neutron (11GeV)	1.4E-3+6.3%	1.0E-3+6.0%	1.4E-3+6.4%	1.0E-3+6.6%
neutron (8.8GeV)	2.1E-3+6.3%	1.5E-3+6.0%	2.1E-3+6.4%	1.5E-3+6.3%
proton (11GeV)	7.5E-3+8.0%	8.9E-3+8.0%	7.5E-3+8.0%	8.9E-3+8.0%
proton (8.8GeV)	1.0E-2+8.0%	1.3E-2+8.0%	1.0E-2+8.0%	1.3E-2+8.0%

- Need to update
  - re-estimate nuclear effect with new theoretical calculations (Scopetta et al.)
  - contribution from diffractive rho meson production

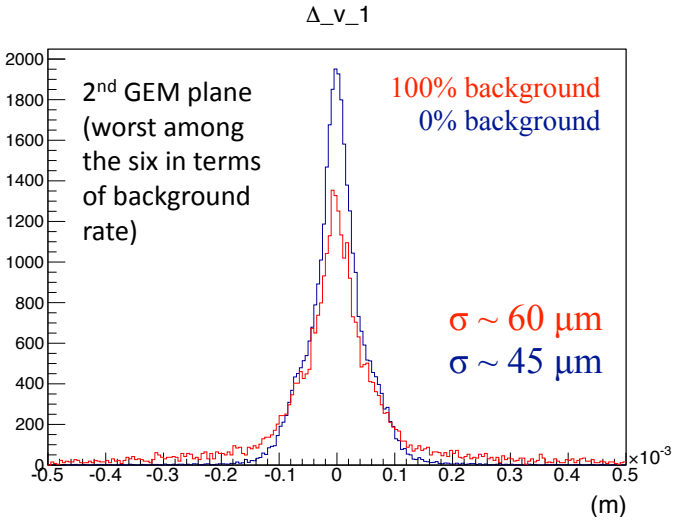
GEM Digitization

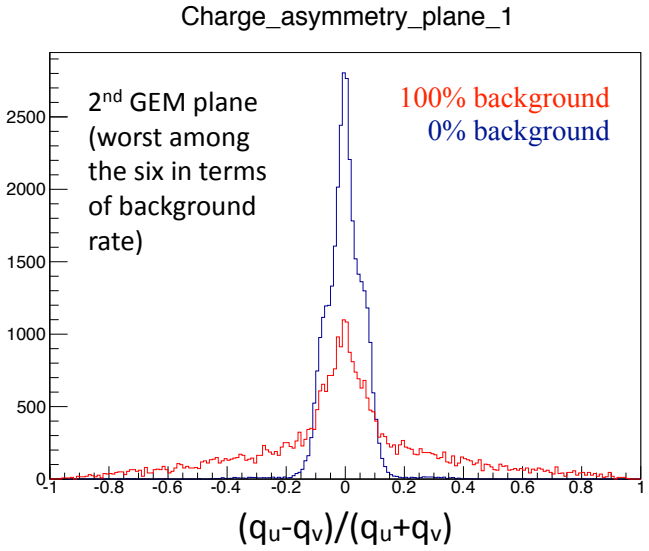
refer to Weizhi's talk

- GEM digitization for SIDIS configuration have been developed, currently with simplified detector geometry (30 GEM sectors and no overlapping area)
- Digitization process:
  - Use GEMC simulated energy deposition and hit position in the GEM detector
  - Use simple model to effectively simulate the ionization and avalanche process
  - Produce time-dependent signal amplitudes as output
- Background events are mixed with randomized event time and azimuthal angle



- Randomize background event time within a 275ns time window (200ns before trigger, 75ns after) for studying pile-up effect
- GEM resolution and charge asymmetry at with 0% and 100% background



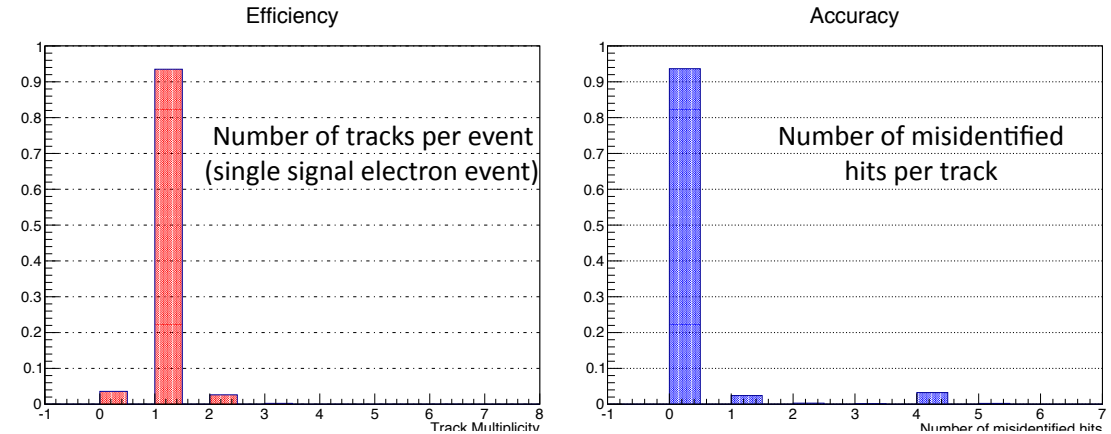


Tracking Reconstruction

refer to Weizhi's talk

- Using one time-sample from APV25
- Kalman Filter as concurrent track finding and fitting algorithm
- Reasonable performance and execution speed for finding high energy electrons in both forward and large angle region

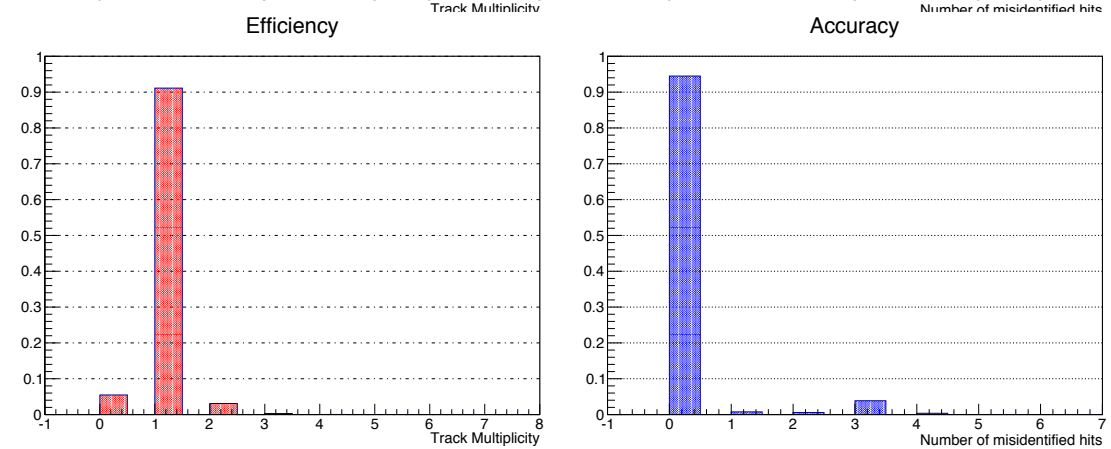
FA-^{3}He



Resolution with 100% background

$\Delta p/p \sim 1.28\%$	$\Delta\theta \sim 1.22$ mrad
$\Delta\varphi \sim 5.36$ mrad	$\Delta z \sim 0.86$ cm

LA-^{3}He

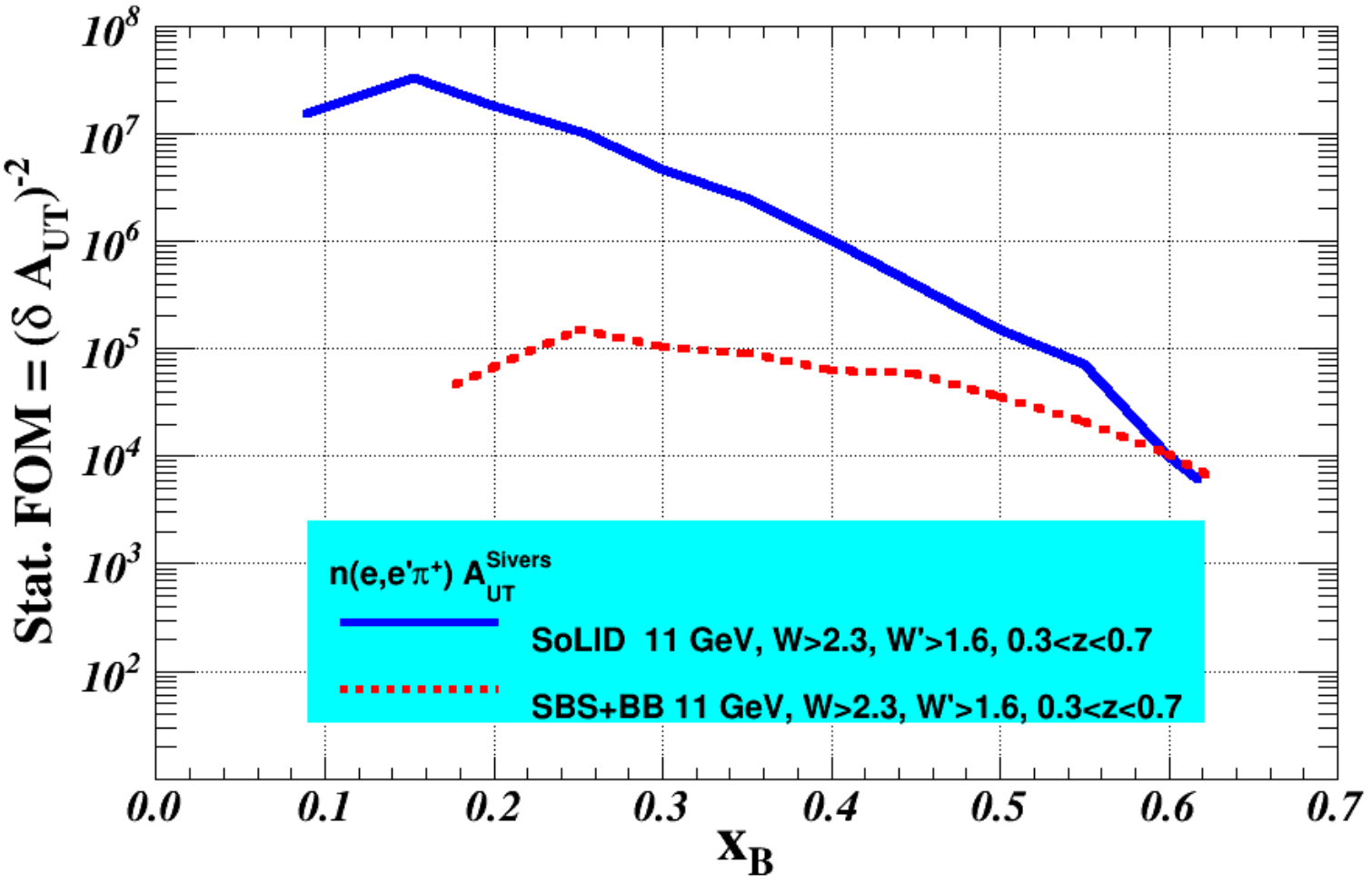


Resolution with 100% background

$\Delta p/p \sim 1.05\%$	$\Delta\theta \sim 1.08$ mrad
$\Delta\varphi \sim 2.19$ mrad	$\Delta z \sim 0.45$ cm

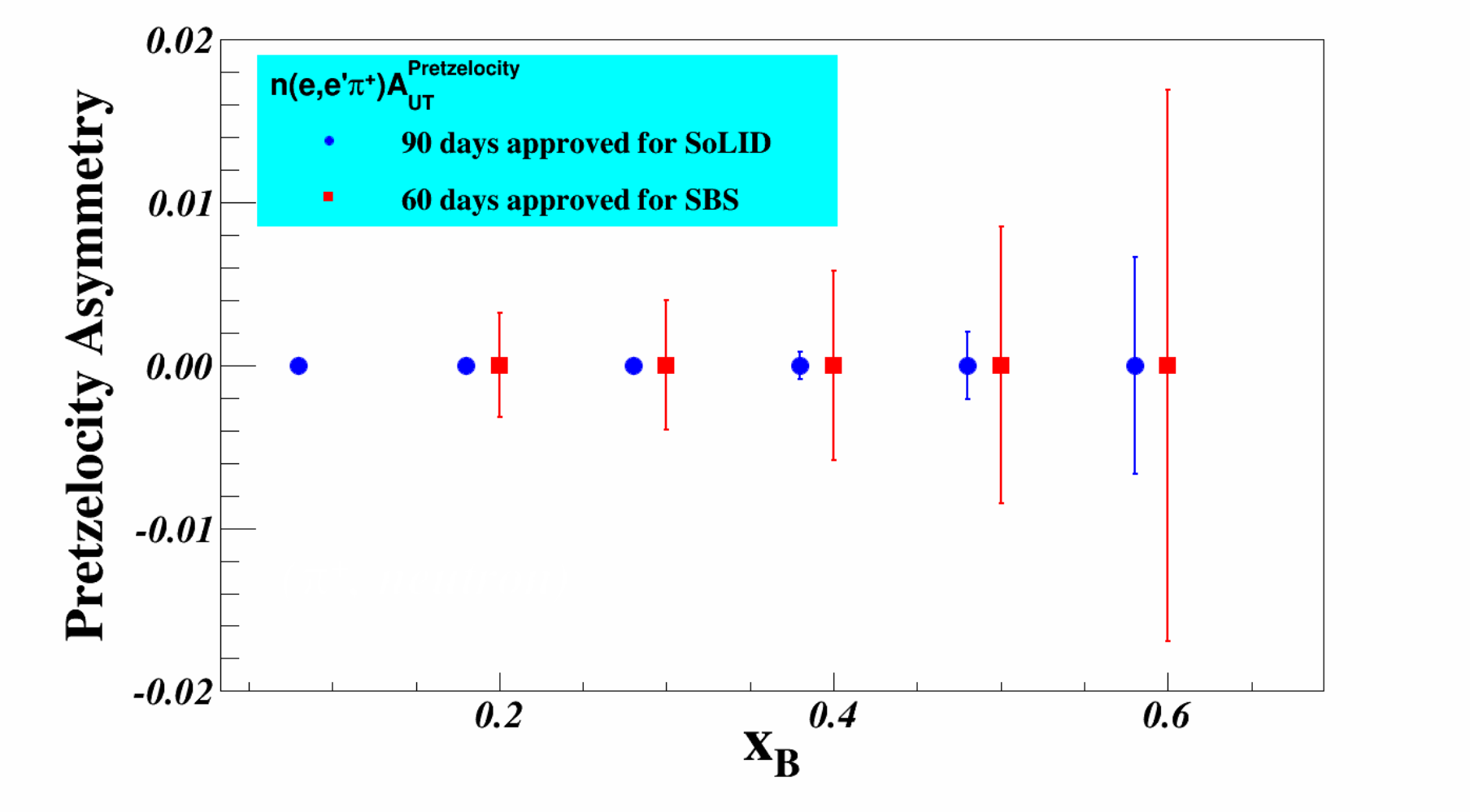
SoLID vs. SBS

refer to Haiyan's talk Sep.2015



SoLID vs. SBS

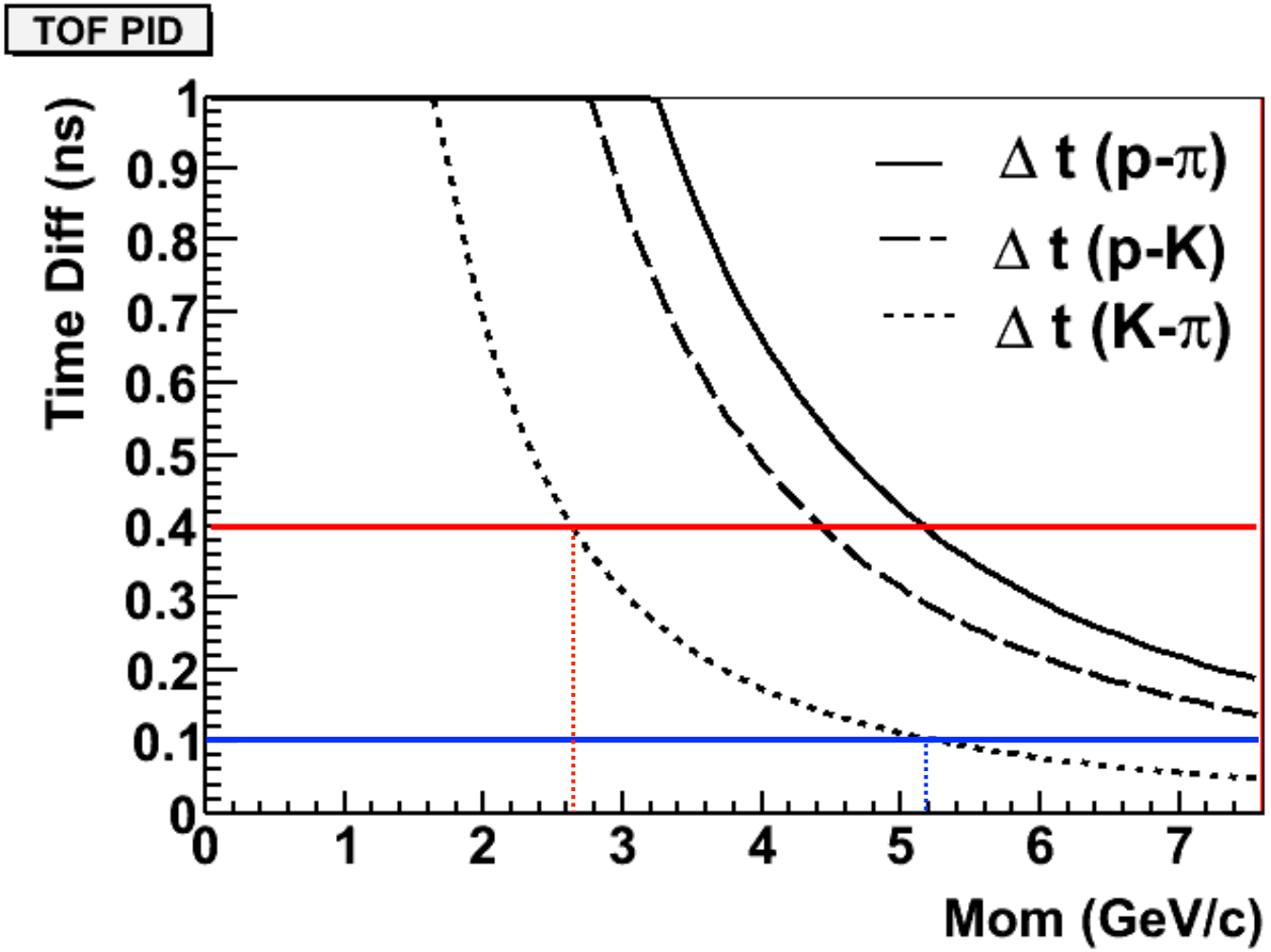
refer to Haiyan's talk Sep.2015



SoLID bins are to match the SBS ones and thus are not optimized for SoLID kinematics

Kaon Identification (TOF)

refer to Mickey's talk



4σ with 100ps res. of MRPC

if fast TOF~25ps

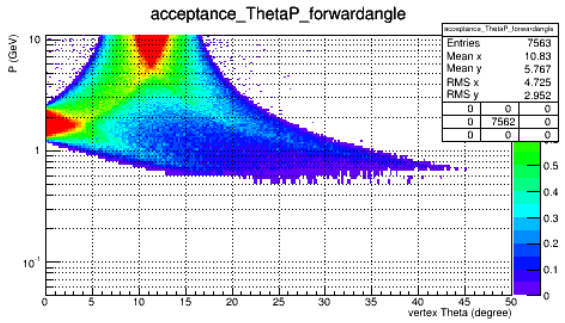
Backup

Acceptance and Efficiency

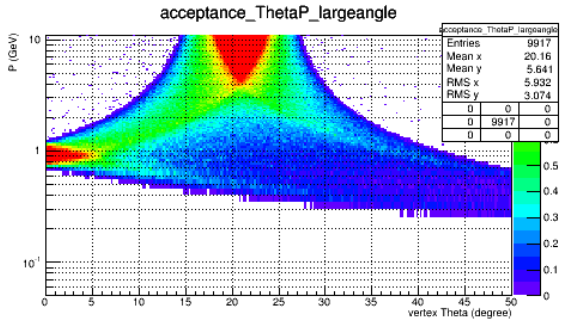
- Acceptance with NH_3 target

2D

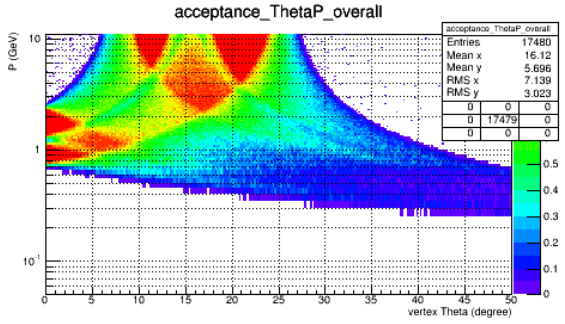
FA:



LA:

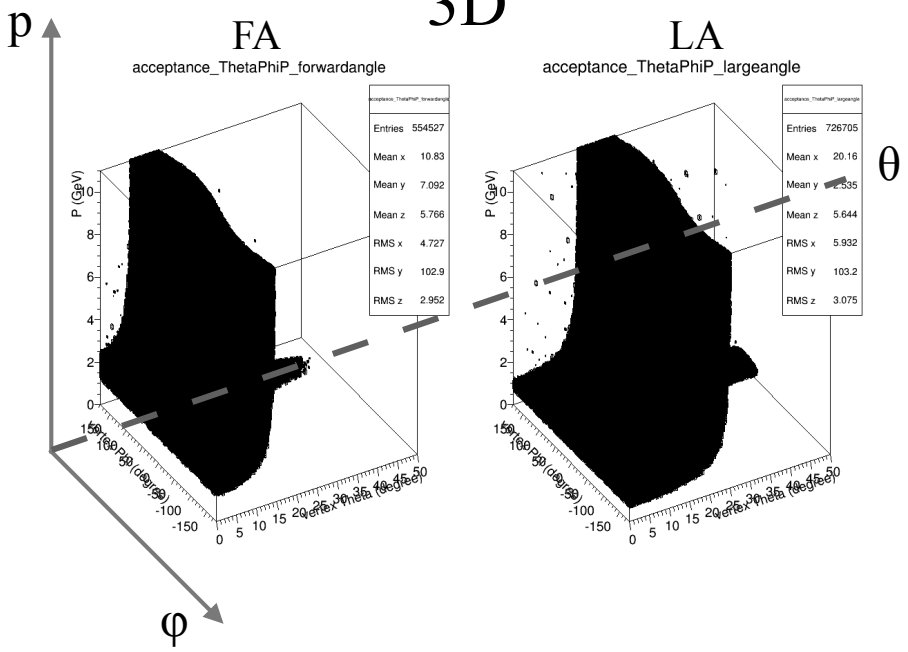


F&L:

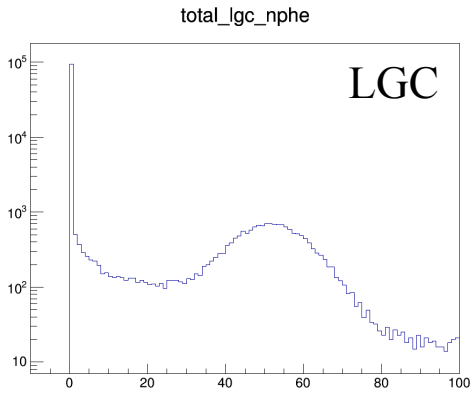


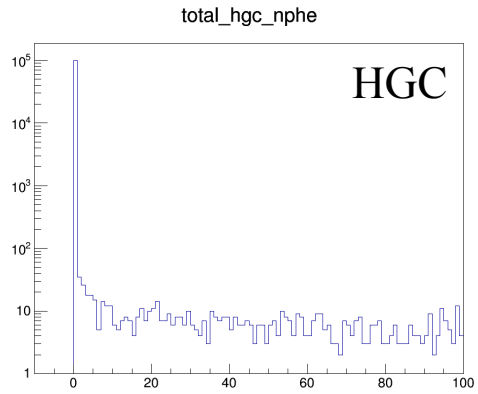
simplified setup
(without secondary)

3D



- Total n_photon (^{3}He target)





Systematic Uncertainties

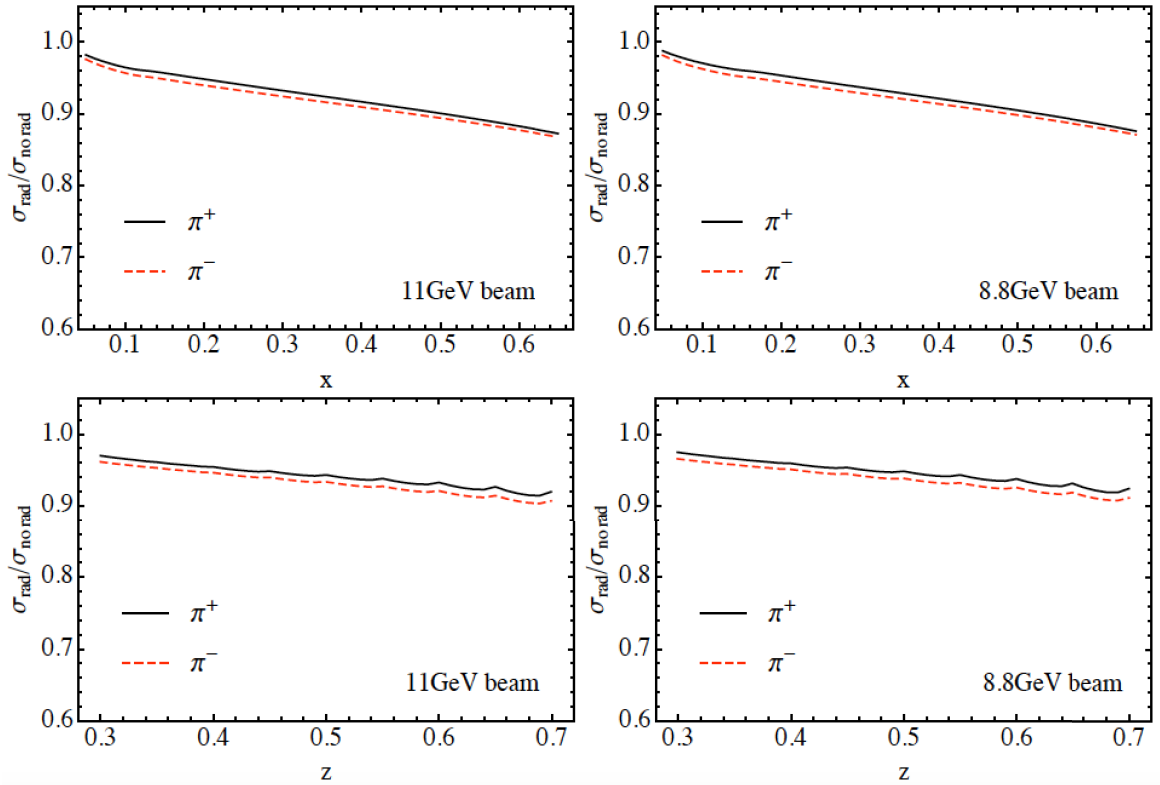
- Systematic errors:

Asymmetry	Sivers		Collins/Pretzelosity	
Hadron	π^+	π^-	π^+	π^-
Raw asym. (abs)	1.4E-3	1.0E-3	1.4E-3	1.0E-3
Resolution (abs)	3.3E-5	3.3E-5	2.3E-5	2.3E-5
Target pol. (rel)	3%	3%	3%	3%
Nuclear eff. (rel)	4.2%	4.2%	4.2%	4.2%
Background (rel.)	0.2%	0.2%	0.2%	0.2%
Radiative (rel.)	2%	2%	2%	2%
Diffractive (rel.)	3%	2%	3%	2%
Total (abs.+rel.)	1.4E-3+6.3%	1.0E-3+6.0%	1.4E-3+6.4%	1.0E-3+6.6%

11GeV ^{3}He target

Radiative Correction

- Ratio of $\sigma_{rad}/\sigma_{no\ rad}$ (^{3}He)



P_T=0.3GeV,z=0.45

P_T=0.3GeV,x=0.2

- Relative uncertainty: estimated by varying the gaussian width in TMDs by 2.

Target	"neutron"		"proton"	
Hadron	π^+	π^-	π^+	π^-
11GeV	2.2%	2.0%	2.1%	2.0%
8.8GeV	1.8%	1.7%	1.9%	1.7%

Random Coincidence Background

- Signal to background ratio

P_T (GeV)		0.0~0.2	0.2~0.4	0.4~0.6	0.6~0.8	0.8~1.0	1.0~1.2
11 GeV	"n" π^+	110	160	150	105	75	40
11 GeV	"n" π^-	125	160	140	90	70	50
11 GeV	"p" π^+	160	130	130	115	75	70
11 GeV	"p" π^-	175	160	135	120	90	60
8.8 GeV	"n" π^+	75	100	80	50	45	
8.8 GeV	"n" π^-	65	95	75	50	45	
8.8 GeV	"p" π^+	120	80	85	90	80	
8.8 GeV	"p" π^-	140	105	75	85	80	

- inclusive pion estimated with Wiser's fit.

Resolution

- Resolution of "Trento" variables

		x	z	Q^2 (GeV^2)	P_T (GeV)	φ_h (rad)	φ_S (rad)
11 GeV	"n" π^+	0.002	0.003	0.02	0.006	0.015	0.006
11 GeV	"n" π^-	0.002	0.003	0.02	0.006	0.015	0.006
8.8 GeV	"n" π^+	0.002	0.004	0.02	0.006	0.018	0.006
8.8 GeV	"n" π^-	0.002	0.004	0.02	0.006	0.018	0.006