TMDGen for SIDIS

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WILLIAM & MARY
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TMDGen

- Monte Carlo event generator developed by Stephen Gliske (HERMES).
- SIDIS single and dihadron processes (dedicated generator).
- Full angular dependence (pythia does not have this), object oriented, root output. “Easily extendable.”

Models

- Many distribution and fragmentation function models are already included.
- Full packaged within TMDGen.

Distribution Functions	Model Identifier
f_1	CTEQ [74]
f_1	LHAPDF [75]
f_1	BCR08 [76]
f_1	GRV98 [77]
g_1	GRSV2000 [78]
f_{1T}, $h_{1T}^{\perp}$, h_1	Torino Group [79, 80, 81, 82, 83]
f_1, g_1, g_{1L}, g_{1T}, f_{1T}, h_1, $h_1^{\perp}$, $h_{1T}^{\perp}$	Pavia Spectator Model [31]

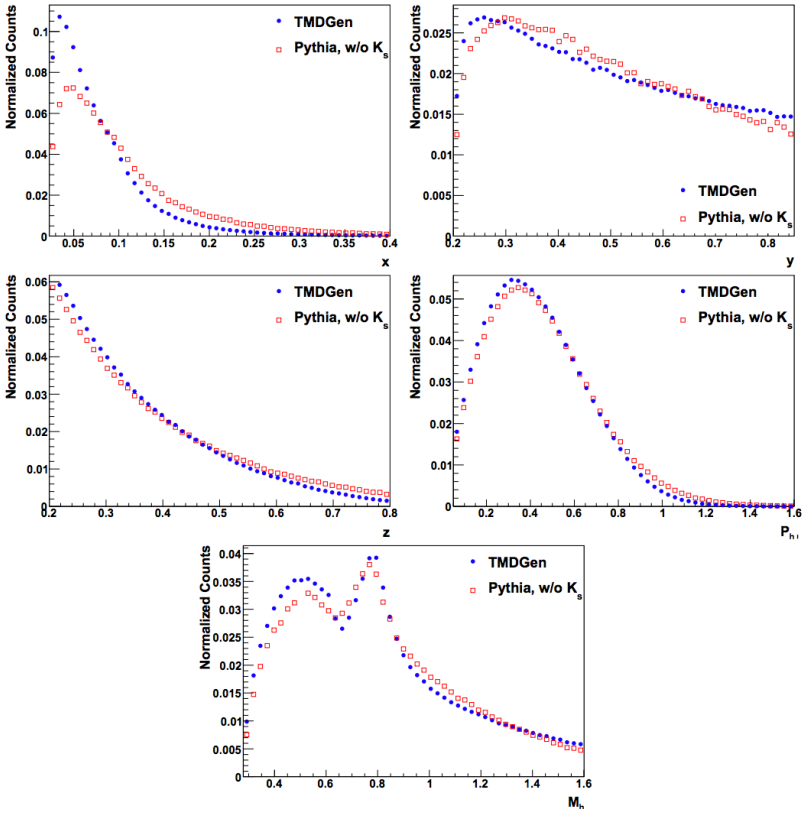
Table 3.1: Models of distribution function available in `TMDGen`.

Frag. Functions	Final State	Model Identifier
D_1	pseudo-scalar	fDSS [84, 85]
D_1	pseudo-scalar	Kretzer [86]
D_1, $H_1^{\perp}$	dihadron	Spectator Model (Section 2.4)
D_1, $H_1^{\perp}$	dihadron	Set given partial wave proportional to any other partial wave

Table 3.2: Models of fragmentation function available in `TMDGen`.

Pythia vs TMDGen

- Gliske comparisons between Pythia and TMDGen for e’$\pi^+\pi^-$X .



Instruction Files

- Simple text instruction file.
- Allows for specification of particles, polarizations and models.

```
# Comments can be inserted by either beginning the line with a '#'
# Or placed after a '!'
# Whitespace within a line is ignored, as are blank lines

# Basic process information

Process             SIDIS                ! Only SIDIS so far, later could have other options
Final_State         Dihadron        ! Current options are 'Single Hadron' or 'Dihadron'
Beam_Pol            U                    ! options are U, T, L (but not everything is programmed
Target_Pol          U                    ! options are U, T, L (but not everything is programmed yet)
Twist               3                    !
Hadron_1_PID         pi+                   ! options are pi+, pi-, pi0, K+, K
Hadron_2_PID         pi-                   ! options are pi+, pi-, pi0, K+, K-


# Models

f1                      GRV98
f1_pT                   Exp Torino 0.18
Re_D1_00                Spec_Ia
D1                      fDSS 0 /group/gpd/sidis/pasquale/grids
#D1_kT                   Exp Torino 0.25
```

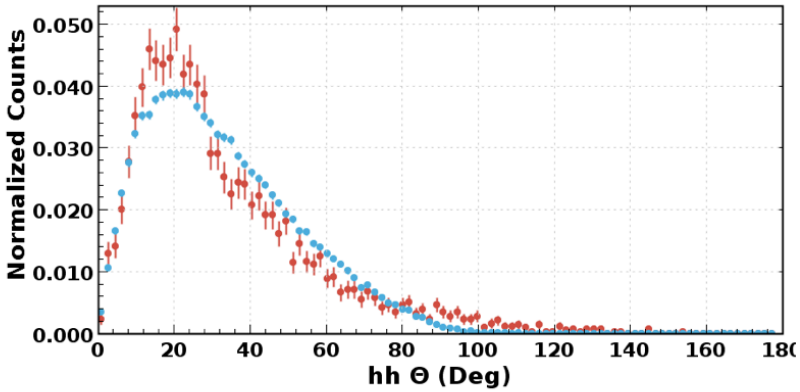
Polarization

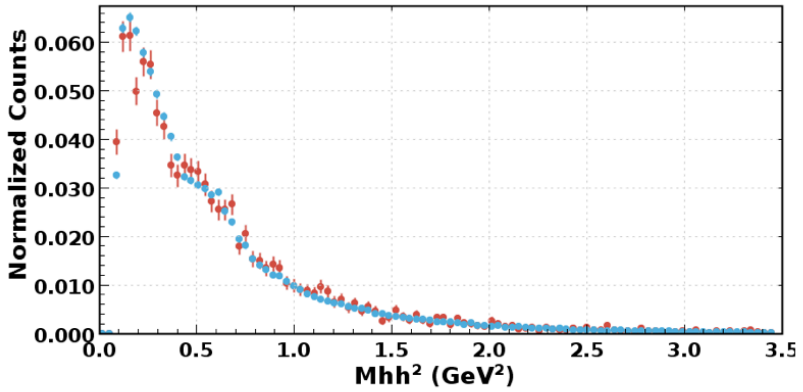
- Polarized beam and target cross sections coded for single hadron case.
- Only longitudinally polarized target cross section coded for dihadron.
- Long term goal is to (probably) incorporate the polarized beam cross sections in an extension of the generator.

Incipient Data Analysis

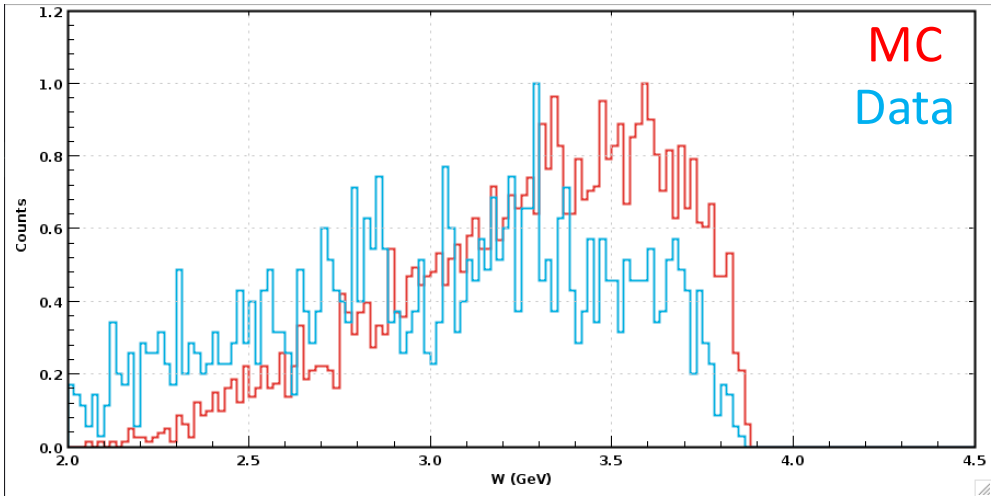
- Chose run 3222 (25 nA, 10.6 GeV, torus +1.00, solenoid -1.00) cooked with coatjava 5b.3.3
- Used EventBuilder REC::Particle to find e' pi+ pi- X events
- **Only** cut applied is $Q^2 > 1.0\ GeV^2$.

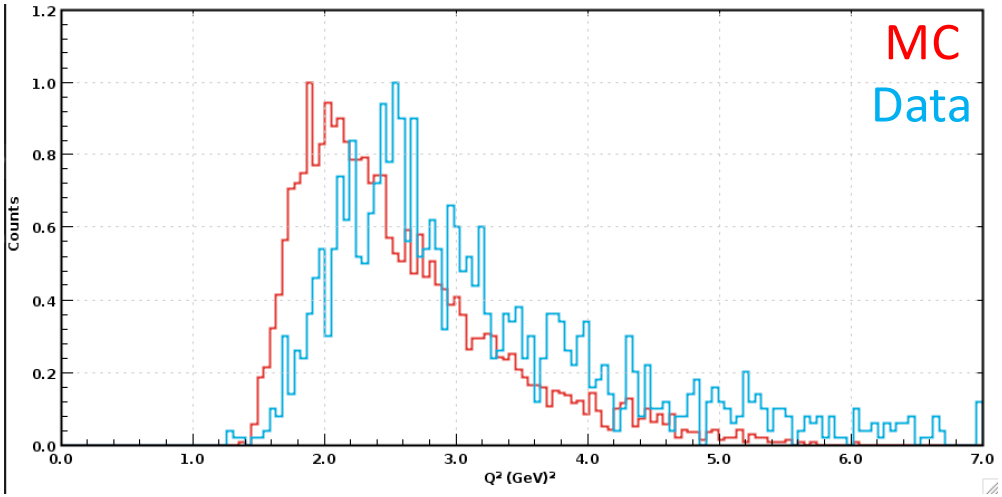
MC
Experimental





- Pre-DNP results with updated PID
  - e’ momentum > 2.25 GeV,
  - Q2 > 1 GeV2
  - W > 2 GeV
  - EC and DC fiducial cuts





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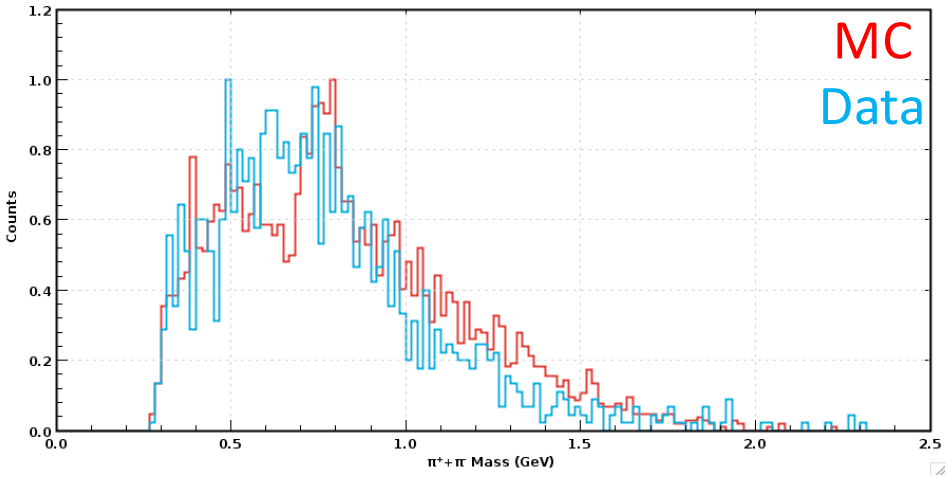

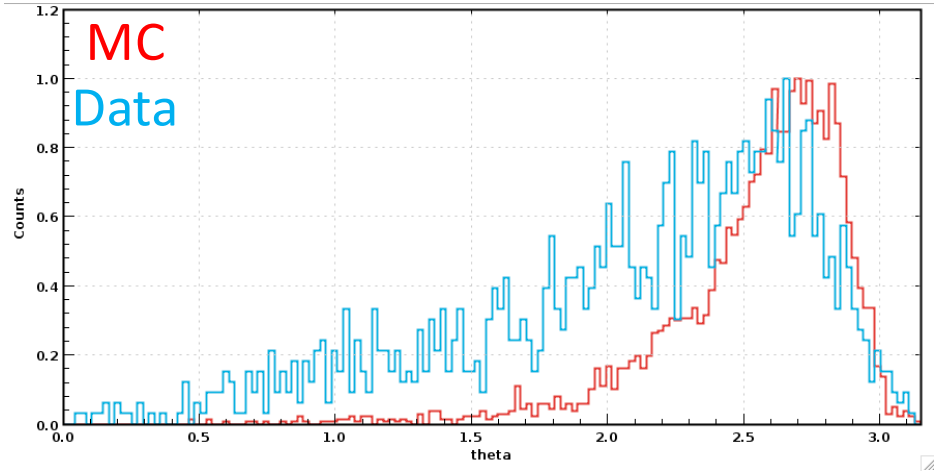

Conclusions

- Use of TMDGen is in very early stages.
- Just one of many possible and available generators.
- Needs significant study.