MISSISSIPPI STATE UNIVERSITY

SIDIS π^+ rates with Pythia

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With MANY thanks to Eric Fuchey

TDIS biweekly meeting
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Reminder

Energy beam: 11 GeV

Scattered electron range: [0.05, 10] GeV
Scattered electron theta: [0.01, 90] deg
Scattered electron phi: [-180, 180] deg

Produced hadron energy: [0.140, 1.5] (pions);
Produced hadron theta: [10, 90] deg;
Produced hadron phi: [-180, 180] deg

SIDIS cross section makes use DSS2007 fragmentation functions and CTEQ6 PDFs

π^+ rate: 64.4 kHz

In order to compare with SIMC:

- $P_{e'}$ = 5 GeV ± 10%
- $\theta_{e'}$ = 25 deg ± 100mrad
- $P_{\pi+}$ =1 GeV ± 10%
- $\theta_{\pi+}$ = 20 deg ± 100mrad

From the generator:
6.7 pions/sec

SIMC: 1.5 pions/sec

C. Ayerbe Gayoso and D. Dutta
TDIS biweekly meeting
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Using Pythia data

- Pythia is a particle generator designed for High Energy physics and mainly colliders, but some tweak allows to extract some information to inclusive reactions.

- I make use of the ep at 11GeV statistics produced by Andrew:
  `/w/halla-scifs17exp/sbs/puckett/Pythia6_11GeV_proton_target`

Selecting events

- In order to compare with the generator, I applied the same cuts:

Scattered electron range: [0.05, 10] GeV
Scattered electron theta: [0.01, 90] deg

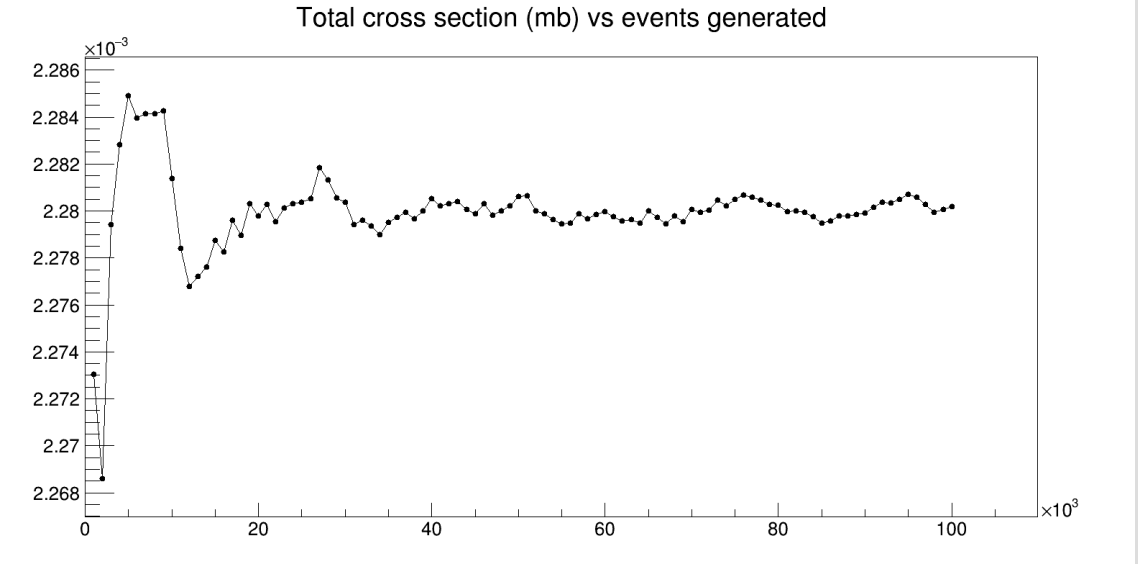
Produced pion energy: [0.140, 1.5]
Produced pion theta: [10, 90] deg

$Q^2 > 1\ GeV^2$

An extra cut, to remove pions produced out of the mTPC

```
abs(vx) <=150 &&
abs(vy) <=150 &&
abs(vz - 200) <=200
```

The catch is that Pythia doesn't calculate cross-section by event, but the total cross-section



Typical output

```
File to analyze: /w/halla-scifs17exp/sbs/puckett/Pythia6_11GeV_proton_target/Pythia6_minbias_protontarget_
E11GeV_job3.root
Entries: 100000
event Limit (<0> all events) : Event Limit: 100000
XSP: 0.00227733
Total Events with Pions multiplicity 0 :        13704
Events with Pions (passing cuts) multiplicity 0 :       89014
Total Events with Pions multiplicity 1 :        46568
Events with Pions (passing cuts) multiplicity 1 :       8658
Total Events with Pions multiplicity 2 :        33625
Events with Pions (passing cuts) multiplicity 2 :       2150
Total Events with Pions multiplicity 3 :        5870
Events with Pions (passing cuts) multiplicity 3 :       176
Total Events with Pions multiplicity 4 :        232
Events with Pions (passing cuts) multiplicity 4 :       2
Total Events with Pions multiplicity 5 :        1
Events with Pions (passing cuts) multiplicity 5 :       0
Total Events with Pions multiplicity 6 :        0
Events with Pions (passing cuts) multiplicity 6 :       0
Total Events with Pions multiplicity 7 :        0
Events with Pions (passing cuts) multiplicity 7 :       0
Total Events with Pions multiplicity 8 :        0
Events with Pions (passing cuts) multiplicity 8 :       0
Total Events with Pions multiplicity 9 :        0
Events with Pions (passing cuts) multiplicity 9 :       0
  No Events with Pions: 86296
  No Events with Pions passing cuts: 10986
 Total No Pions passing cuts (in the event): 13494
Rate: 571796 Hz
```

x1
x2
x3
x4
x5

= # of pions

Rate = XS x Lumi x (#pions multi 1/ #events)

Choosing only multi 1 has been under great debate, so not sure how correct is it.

Rate ~570 kHz

DIS π^+ rates account

0.57 MHz → **0.064 MHz**

PYTHIA6

Could be lower

g4sbs SIDIS generator
CTEQ6 PDF and DSS2007 FF

Could be higher

These two could be ~x2 higher
accounting π^+ from neutron target