Electro-Production Hall D Generator Rate Comparison with Wiser Generator

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Hall D vs. Geant4 : Proton Target

- Using hall D gen, 1 million hadron events were generated
- Using Geant4, 100 million electrons incident on 40 cm proton target

Pion Type	Total Proton xs for theta < 90 deg			Hall D vs. G4 agreement
	Wiser xs (μb)	Hall D xs (μb)	Geant4 xs (μb)	(%)
pi0*	88.5	21.5	26.5	-19
pi-	54.6	13.6	13.4	2
pi+	123.7	29.6	29.3	1

* It is not trivial to check pi0 cross section directly using outside detector. Therefore cross section is computed from hits inside the target

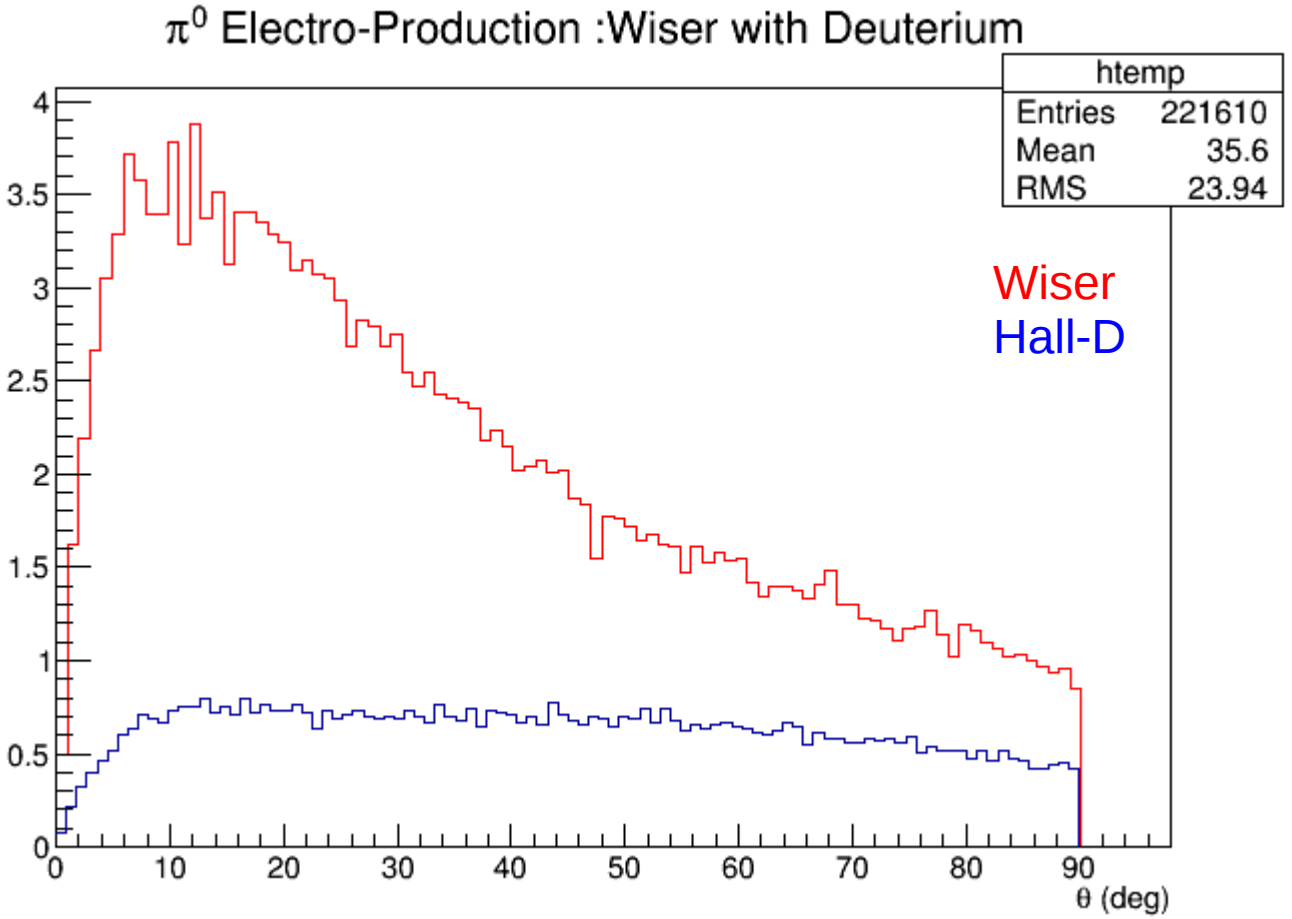
Hall D vs. Geant4 : Deuterium Target

- Using hall D gen, 1 million hadron events were generated
- Using Geant4, 100 million electrons incident on 40 cm deuterium target

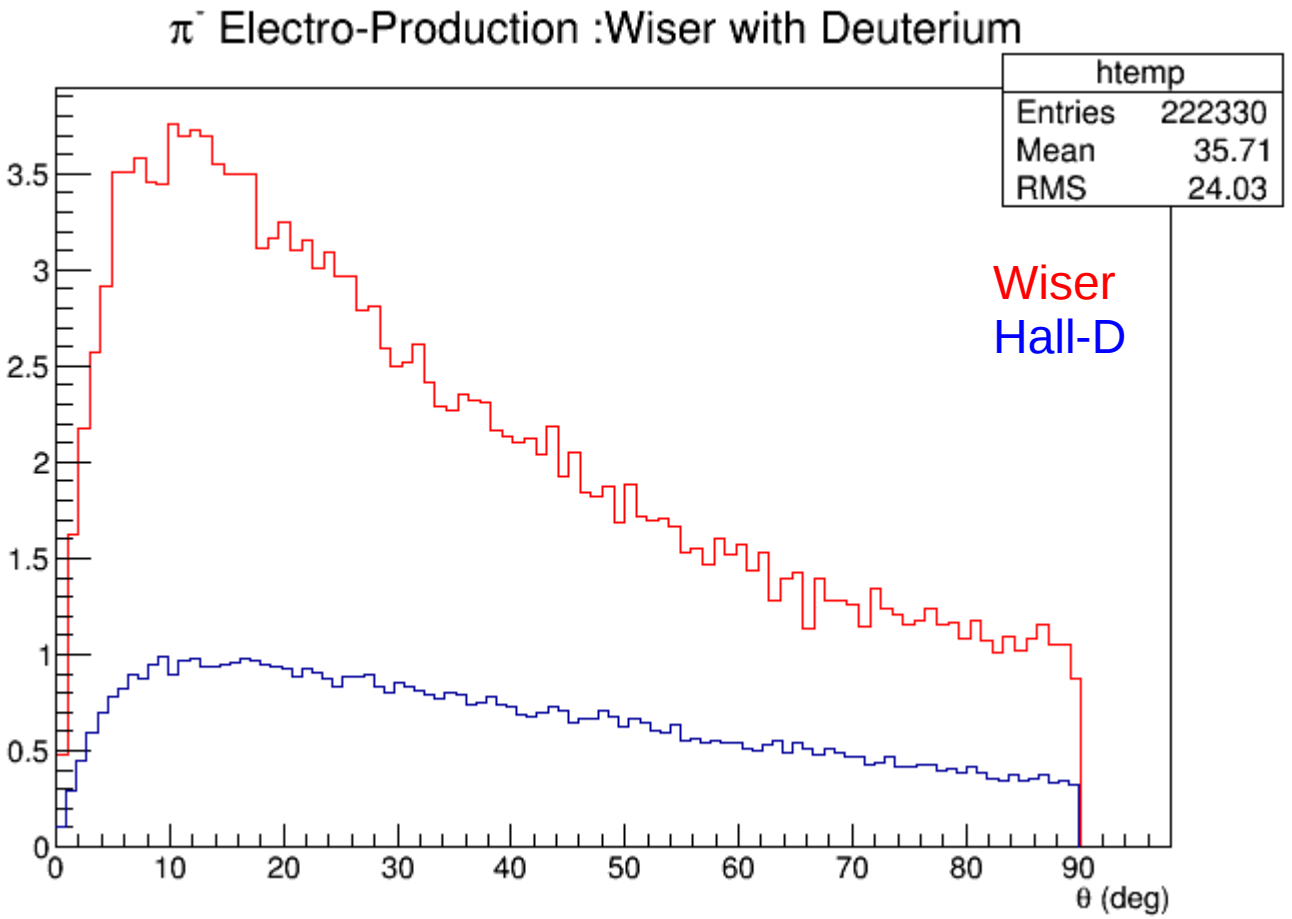
Pion Type	Total Deuterium xs for theta < 90 deg			Hall D vs. G4 agreement
	Wiser xs (μb)	Hall D xs (μb)	Geant4 xs (μb)	(%)
pi0*	189.7	43.0	84.8	-49
pi-	191.6	43.2	38.1	13
pi+	192.7	43.2	37.6	15

* It is not trivial to check pi0 cross section directly using outside detector. Therefore cross section is computed from hits inside the target

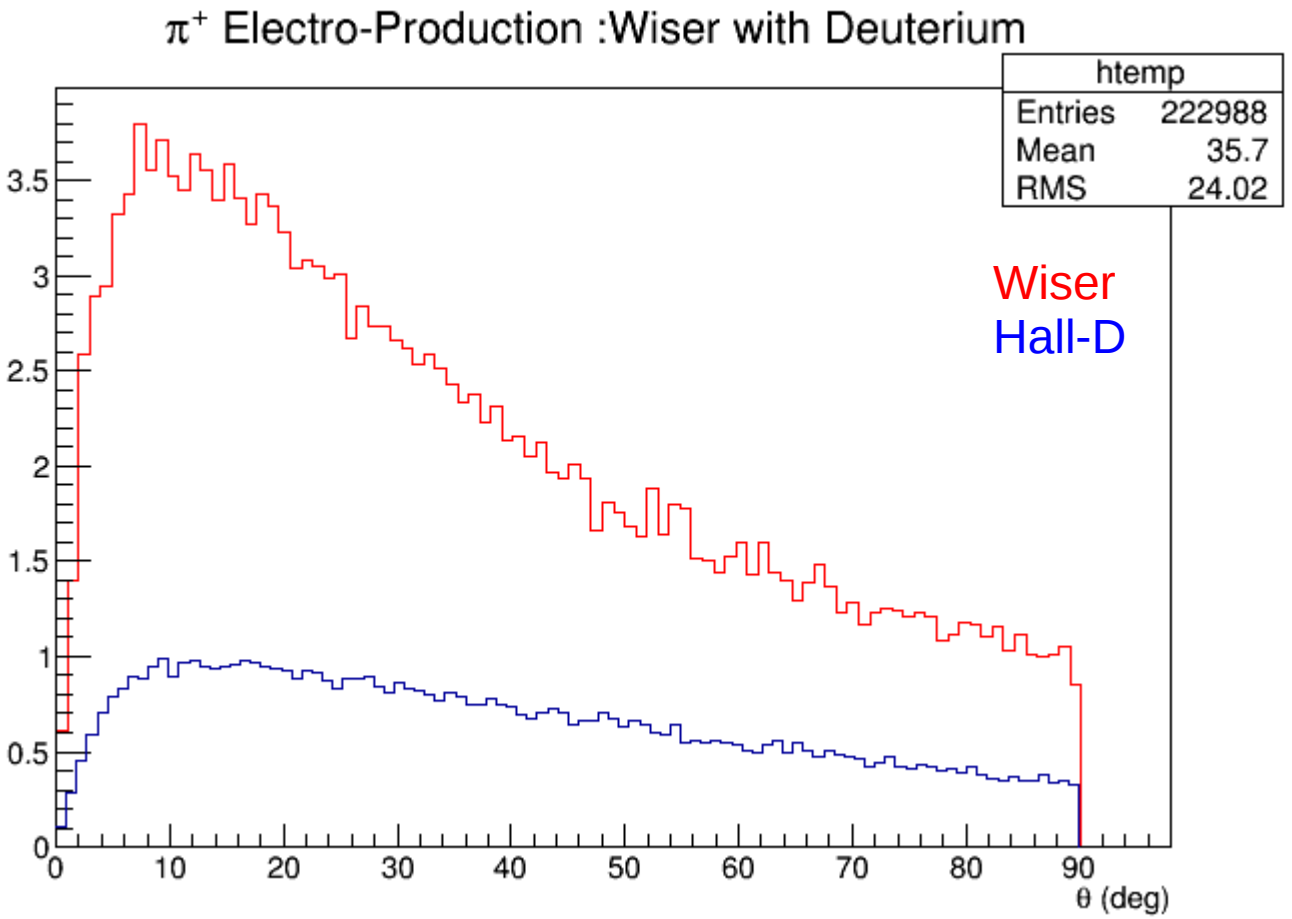
Hall D vs. Wiser : Deuterium Target



Hall D vs. Wiser : Deuterium Target



Hall D vs. Wiser : Deuterium Target



Generator Output Summary

- Geant4 and Hall generators agrees within 10% - 50%
  - I do not distinguish primary and secondary vertex produced pions in G4 while hall D only produce primary vetices → Could explain higher pion xs in G4
- Wiser overestimates pions

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Total Deuterium Rates for theta < 90 deg				Hall D vs. G4 agreement
Pion Type	Wiser Total (MHz)	Hall D Total (MHz)	Geant4 Tota (MHz)	(%)
pi0	123166.2	40627.8	53831.7	-25
pi-	126437.2	42695.7	46536.0	-8
pi+	125068.8	42695.7	45337.7	-6

ECAL Total Rates

Before Trigger : ECAL Incident Rates						
	All Mom		P < 1 GeV		P > 1 GeV	
	Wiser	Hall D	Wiser	Hall D	Wiser	Hall D
PID	Rate	Rate	Rate	Rate	Rate	Rate
	(kHz)	(kHz)	(kHz)	(kHz)	(kHz)	(kHz)
pi-	6.67E+05	2.80E+05	5.12E+05	1.94E+05	1.55E+05	8.60E+04
pi+	3.82E+05	1.50E+05	3.59E+05	1.39E+05	2.35E+04	1.14E+04
Gamma(Pi0)	9.23E+07	2.59E+07	9.20E+07	2.59E+07	2.06E+05	2.19E+02
Proton	5.50E+04	n/a	n/a	n/a	n/a	n/a
	GEMC	Remoll	GEMC	Remoll	GEMC	Remoll
DIS	4.13E+02	4.37E+02	0.00E+00	0.00E+00	4.13E+02	4.37E+02
Total	9.34E+07	2.63E+07	9.29E+07	2.62E+07	3.85E+05	9.80E+04

ECAL Trigger Rates

trigger rate for p>1 GeV (kHZ)		
	Wiser	Hall D
PID	Rate	Rate
	(kHz)	(kHz)
pi-	4800	4539
pi+	280	328
Gamma(Pi0)	4	0
Proton	180	n/a
	GEMC	Remoll
DIS	321	260
Total	5585	5127
trigger rate for p<1 GeV (kHZ)		
From pileups	3100	60
Total Trigger Rate (kHz)		
Total	8685	5187