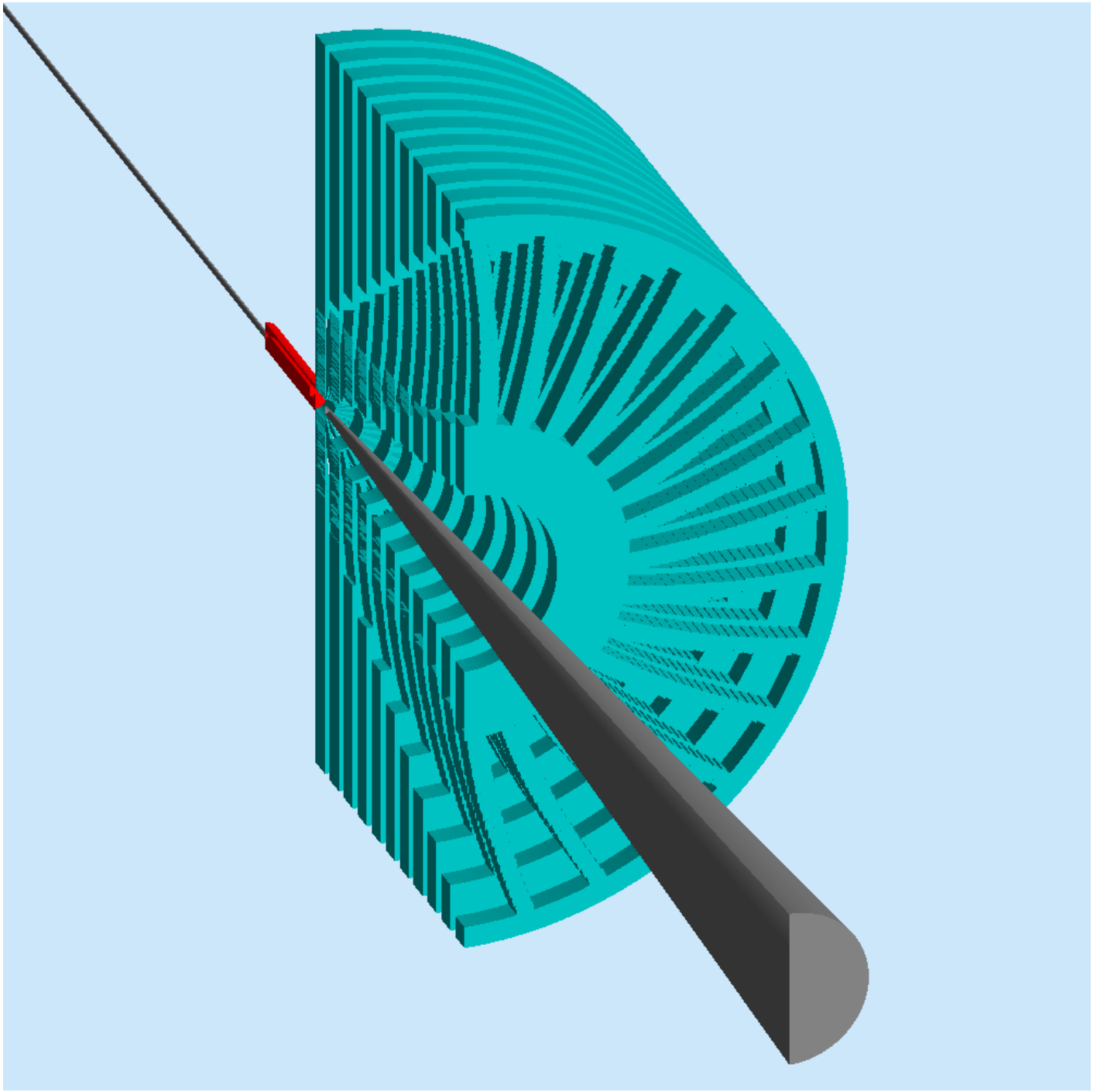
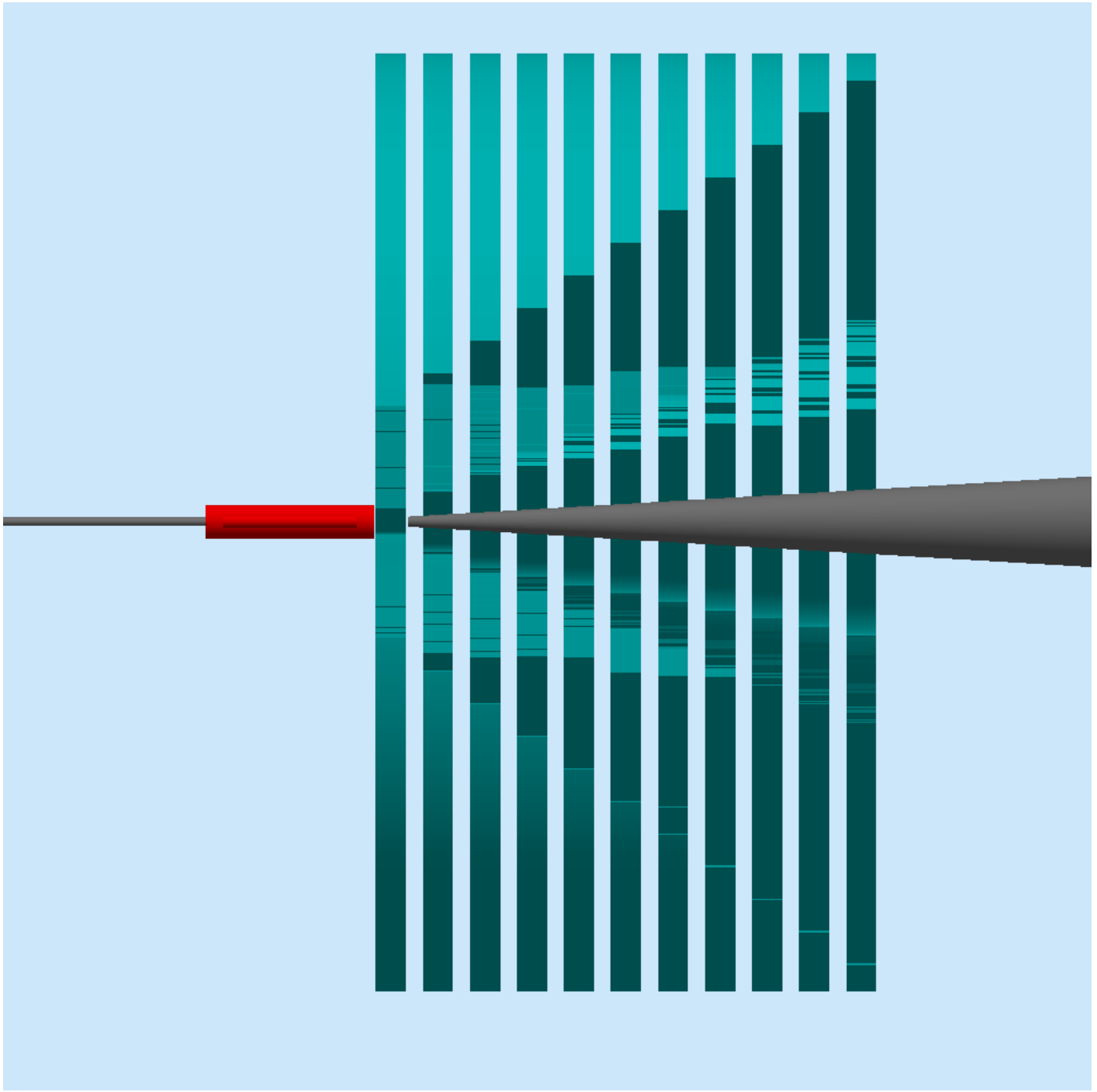
Pion Background Study

Update-6

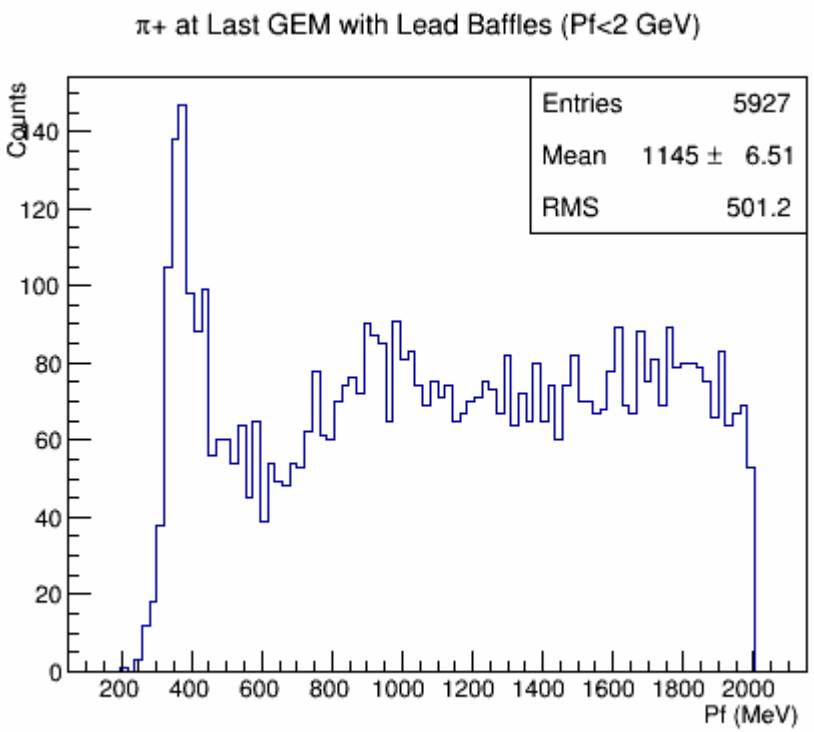
Baffle Materials and Geometry Comparison

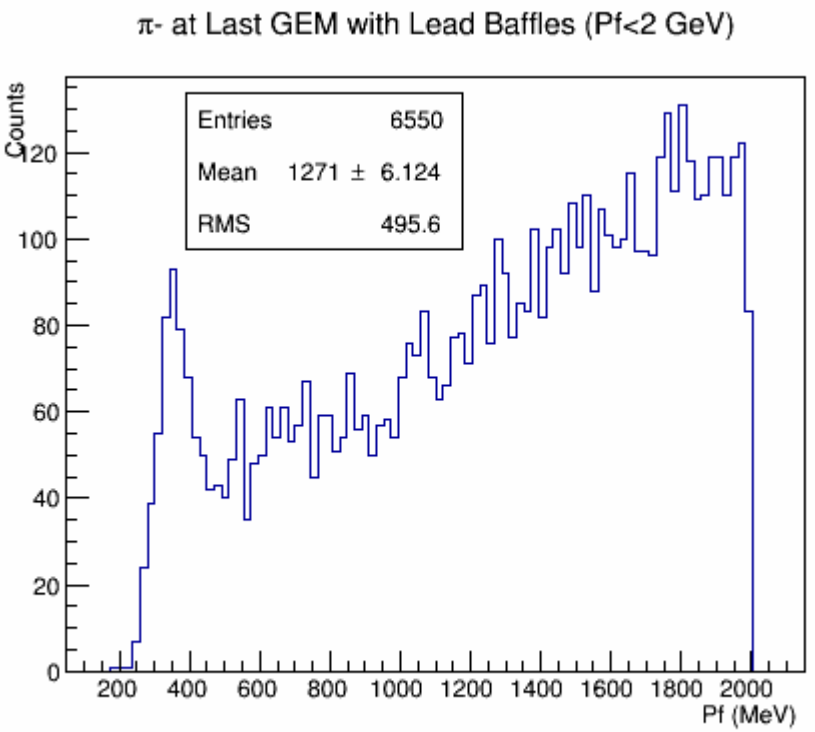
- Compared Wiser pions acceptance for CLEO baffles of Pb, W, and Kryptonite and Babar Pb baffles (regular and new)
- The regular Babar baffles have more materials in the acceptance area compared to CLEO baffles
  - From 35% more area in 1st baffle to 65% more area in 6th baffle are covered in Pb
  - Thickness is same for CLEO and Babar
- New one have 11 baffles, 5 added



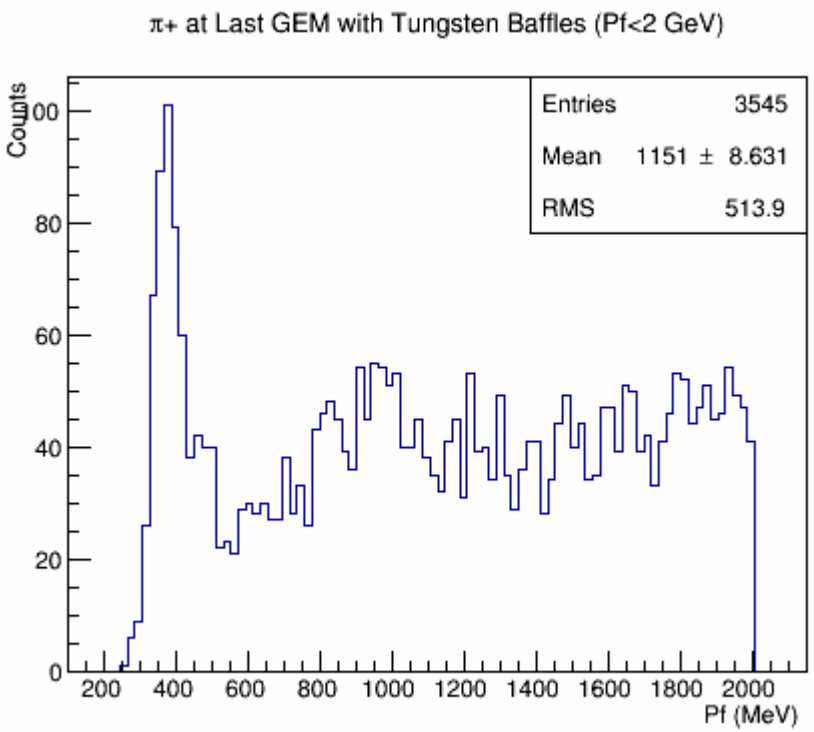


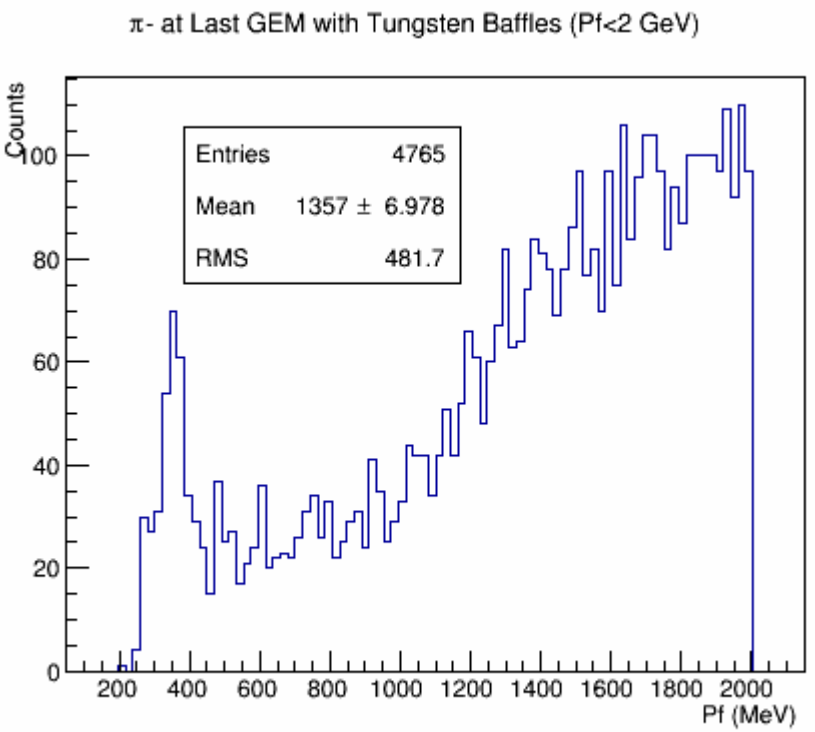
Pions Momentum at the Last GEM : Pb Baffles



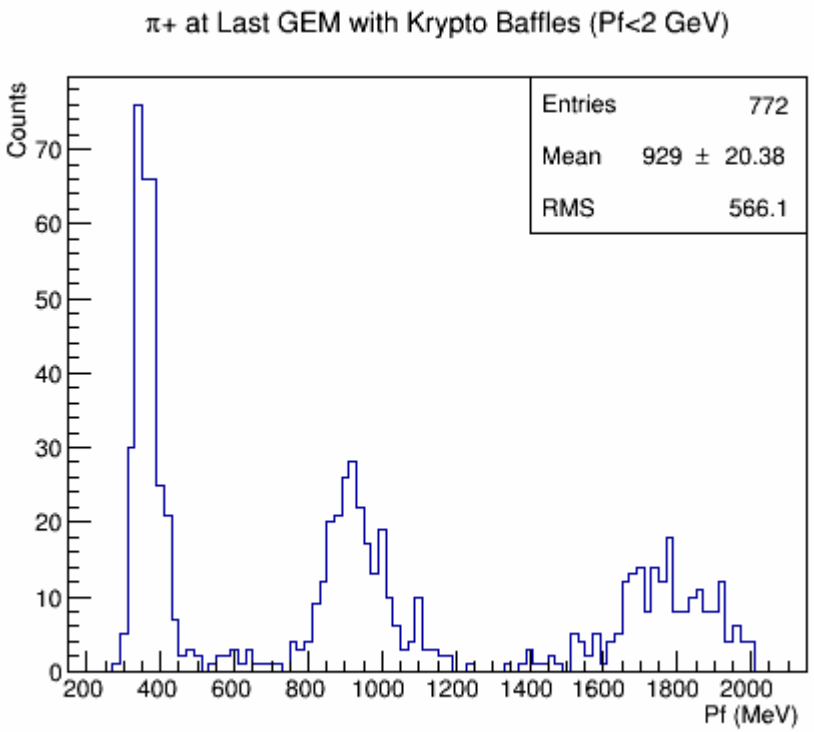


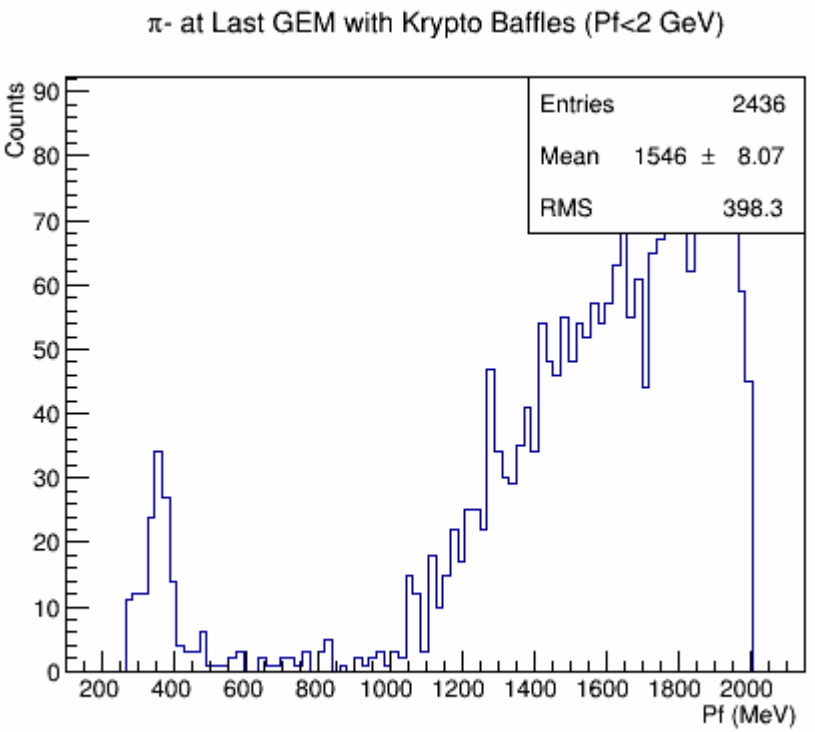
Pions Momentum at the Last GEM : W Baffles



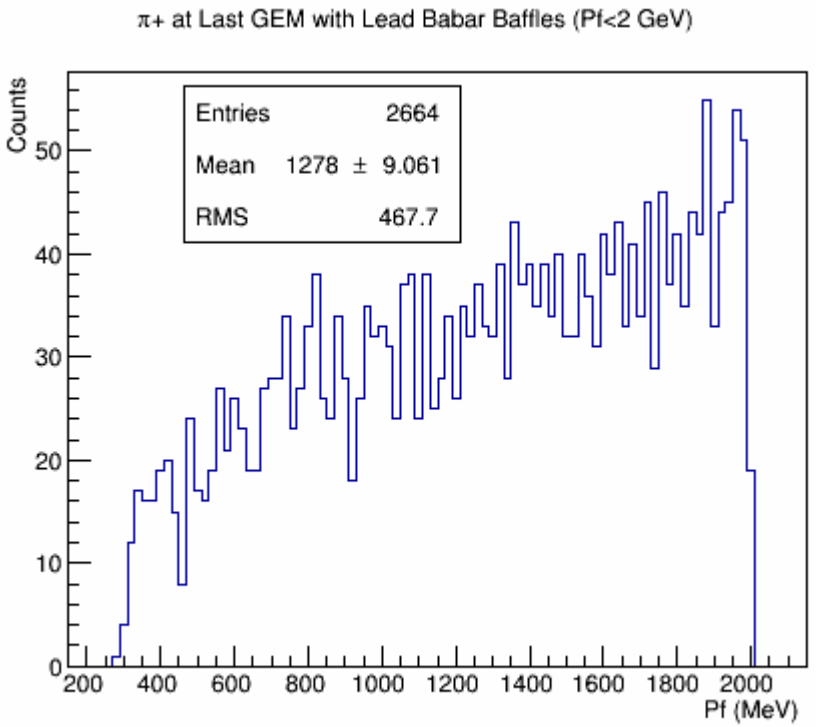


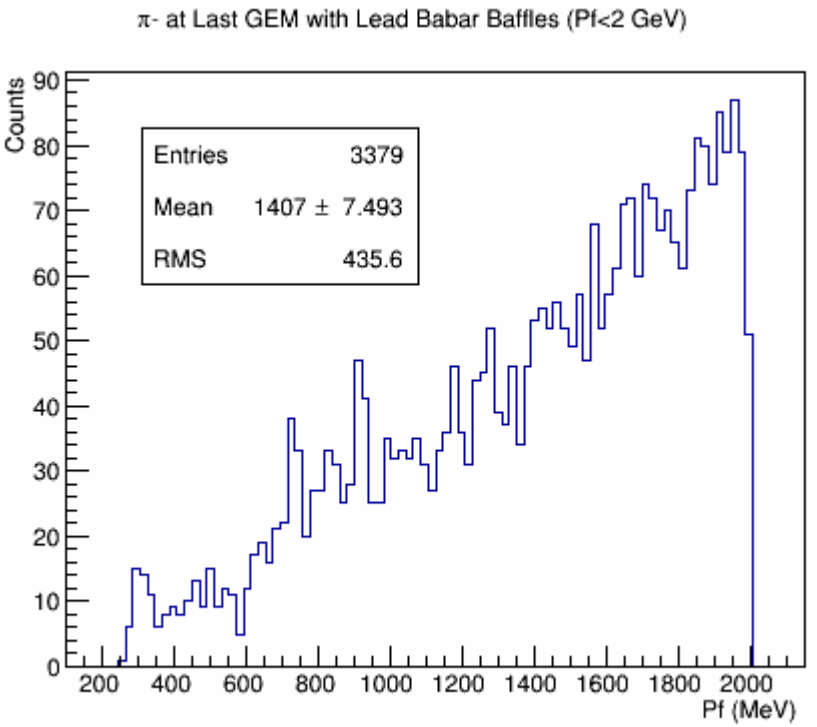
Pions Momentum at the Last GEM : Kryp. Baffles



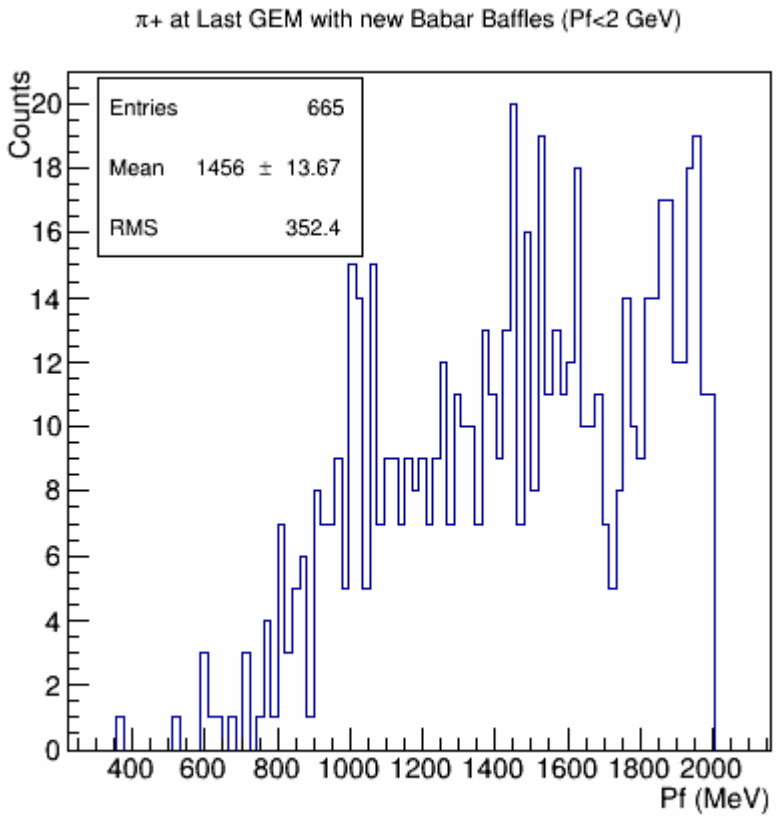


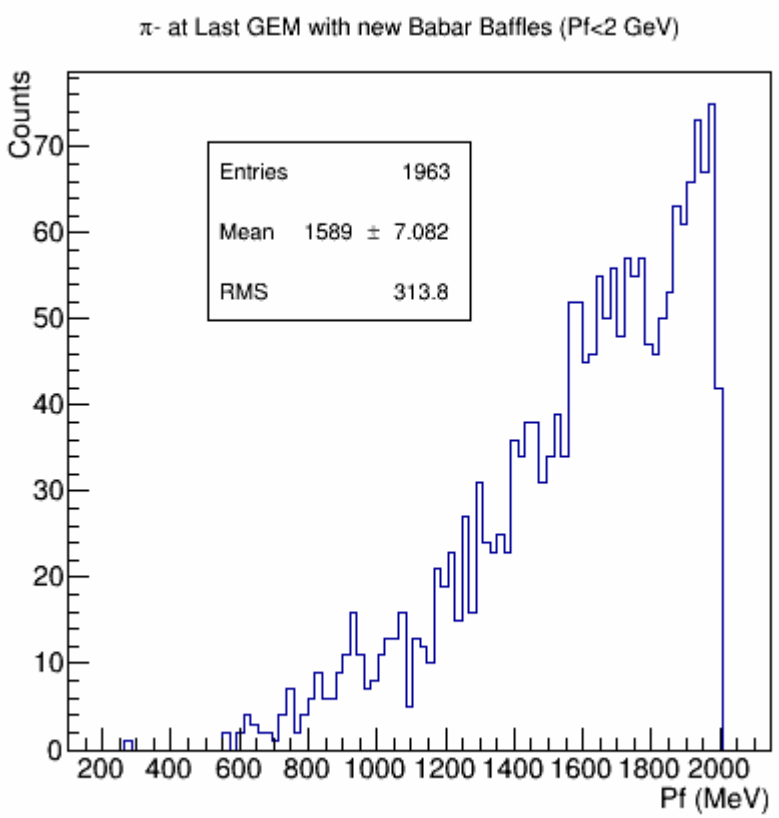
Pions Momentum at the Last GEM : Babar Pb Baffles





Pions Momentum at the Last GEM : New Babar Pb Baffles





Pions Rate Summary

Pi- Rate							
	Input*	No Baffles	Lead	Tungsten	Kryptonite	Babar Lead	New Babar Lead
(GeV)	(GHz)	(GHz)	(GHz)	(GHz)	(GHz)	(GHz)	(GHz)
p0>0	80.60	26.94	6.35	3.56	0.82	2.76	0.71
p0>0.3	48.60	22.45	6.02	3.28	0.70	2.61	0.71
p0>1.0	8.60	2.54	1.42	1.01	0.38	0.84	0.47
p0>2.0	1.20	0.17	0.15	0.11	0.05	0.12	0.07

Pi+ Rate							
	Input*	No Baffles	Lead	Tungsten	Kryptonite	Babar Lead	New Babar Lead
(GeV)	(GHz)	(GHz)	(GHz)	(GHz)	(GHz)	(GHz)	(GHz)
p0>0	81.80	26.36	7.51	4.46	1.33	3.28	0.33
p0>0.3	49.10	22.23	7.40	4.40	1.33	3.26	0.33
p0>1.0	8.60	2.48	1.18	0.64	0.02	0.70	0.20
p0>2.0	1.30	0.15	0.12	0.06	0.00	0.07	0.02

*Input pion rates for scattered angles from 10 to 60 deg from the Wiser input file

P0 is the momentum at the vertex

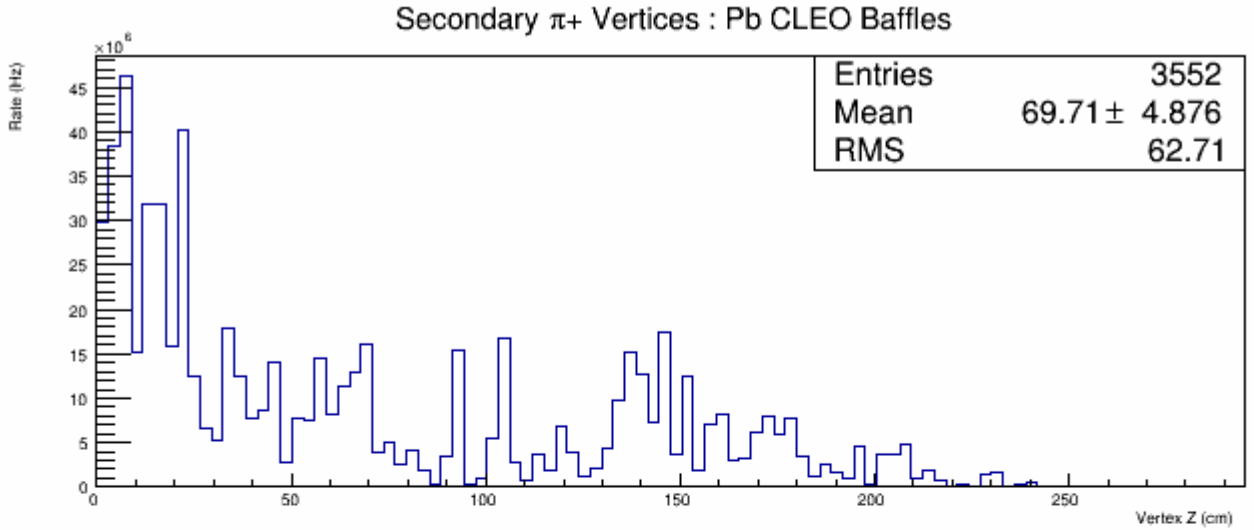
Pion Vertex Momentum vs Momentum at the Last GEM

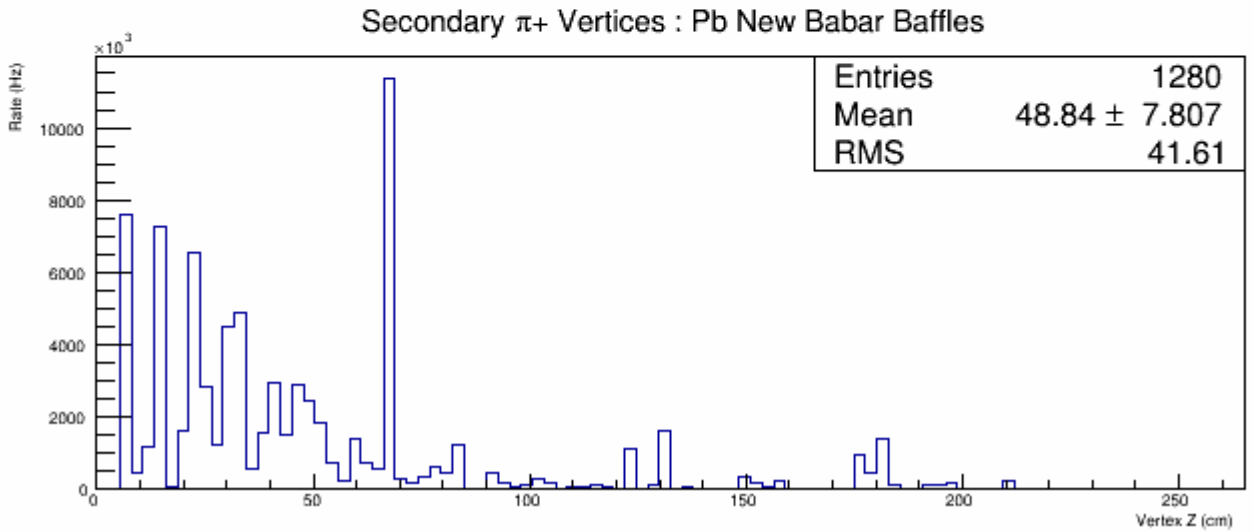
- The rate is dependent on the parameter we used for the momentum cut
  - I used Momentum at the vertex
  - We can also use momentum at the GEM

	P at Vertex	P at Last GEM	Difference
(GeV)	(GHz)	(GHz)	(%)
P >0	0.71	0.71	0.00
P >0.3	0.71	0.59	17.46
P >1.0	0.47	0.23	50.78
P >2.0	0.07	0.05	38.27

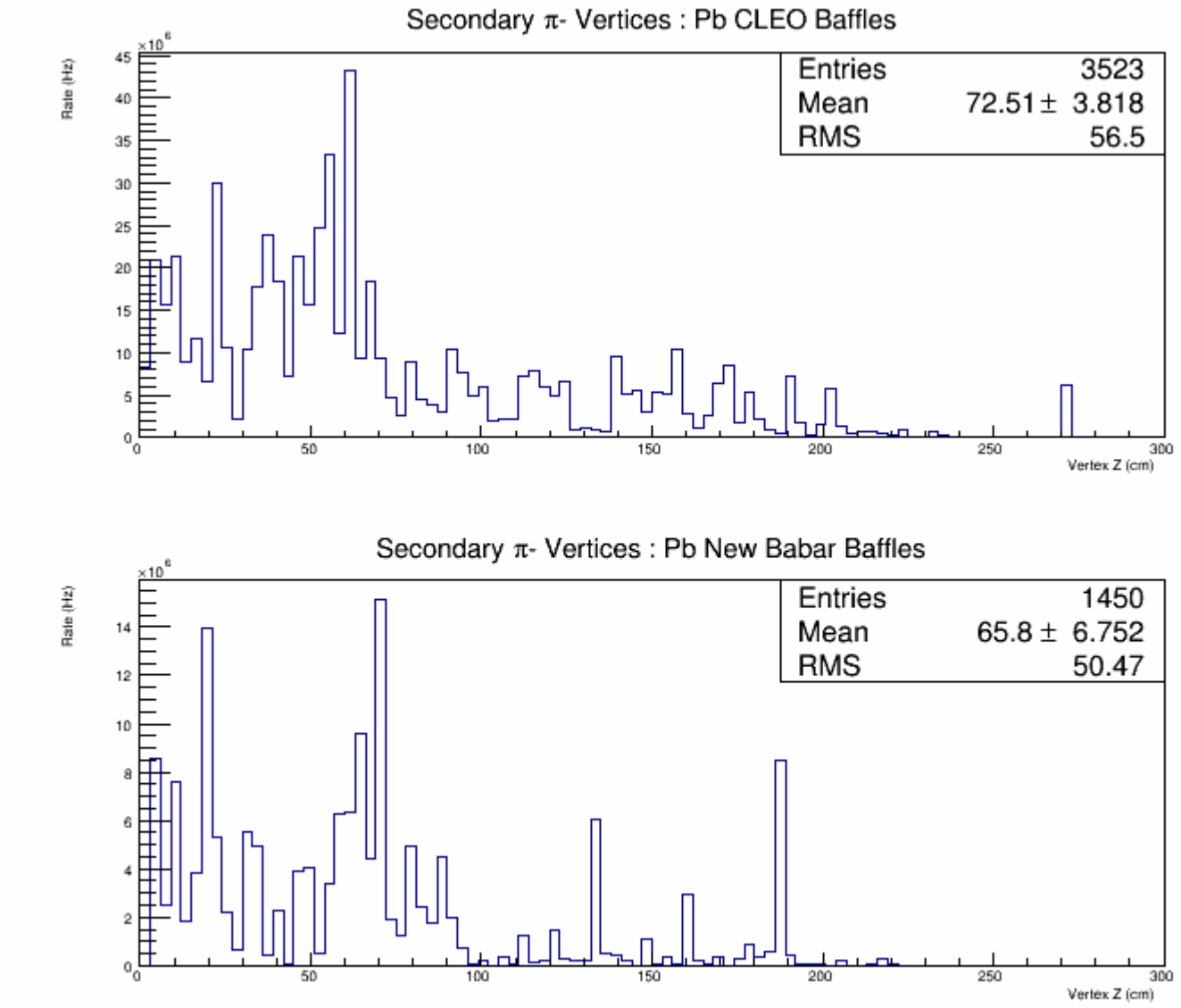
	Pi+ Rate		
	P at Vertex	P at Last GEM	Difference
(GeV)	(GHz)	(GHz)	(%)
P >0	0.33	0.33	0.00
P >0.3	0.33	0.25	22.42
P >1.0	0.20	0.04	81.64
P >2.0	0.019	0.002	88.36

Secondary Pions : π+





Secondary Pions : π-



Primary vs. Secondary Pion Rates

Primary Pi- Rate at 50 uA

Pi-			Cut on Final Momentum (Pf) at GEM			
	Input	No Baffles	Lead		New Babar Lead	
(GeV)	(GHz)	(GHz)	(GHz)	Counts	(GHz)	Counts
pf>0	80.60	26.94	5.65	15261	0.55	10646
pf>0.3	48.60	22.45	3.94	14833	0.48	10622
pf>1.0	8.60	2.54	0.72	13004	0.21	10334
pf>2.0	1.20	0.17	0.06	9333	0.04	8779

Secondary Pi- Rate at 50 uA

Pi-			Cut on Final Momentum (Pf) at GEM			
	Input	No Baffles	Lead		New Babar Lead	
(GeV)	(GHz)	(GHz)	(GHz)	Counts	(GHz)	Counts
pf>0	80.60	26.94	0.70	3523	0.16	1450
pf>0.3	48.60	22.45	0.43	2633	0.10	1031
pf>1.0	8.60	2.54	0.05	968	0.02	468
pf>2.0	1.20	0.17	0.003	380	0.001	197

Primary vs. Secondary Pion Rates

Primary Pi+ Rate at 50 uA

Pi+			Cut on Final Momentum (Pf) at GEM			
	Input	No Baffles	Lead		New Babar Lead	
(GeV)	(GHz)	(GHz)	(GHz)	Counts	(GHz)	Counts
pf>0	81.80	26.36	6.74	11751	0.25	1843
pf>0.3	49.10	22.23	5.53	11419	0.19	1804
pf>1.0	8.60	2.48	0.42	8927	0.03	1525
pf>2.0	1.30	0.15	0.02	6114	0.001	1048

Secondary Pi+ Rate at 50 uA

Pi+			Cut on Final Momentum (Pf) at GEM			
	Input	No Baffles	Lead		New Babar Lead	
(GeV)	(GHz)	(GHz)	(GHz)	Counts	(GHz)	Counts
pf>0	81.80	26.36	0.77	3552	0.08	1280
pf>0.3	49.10	22.23	0.50	2789	0.06	1114
pf>1.0	8.60	2.48	0.05	1029	0.01	499
pf>2.0	1.30	0.15	0.002	399	0.001	217

Pions Rate Summary

Total Pi- Rate at 50 uA

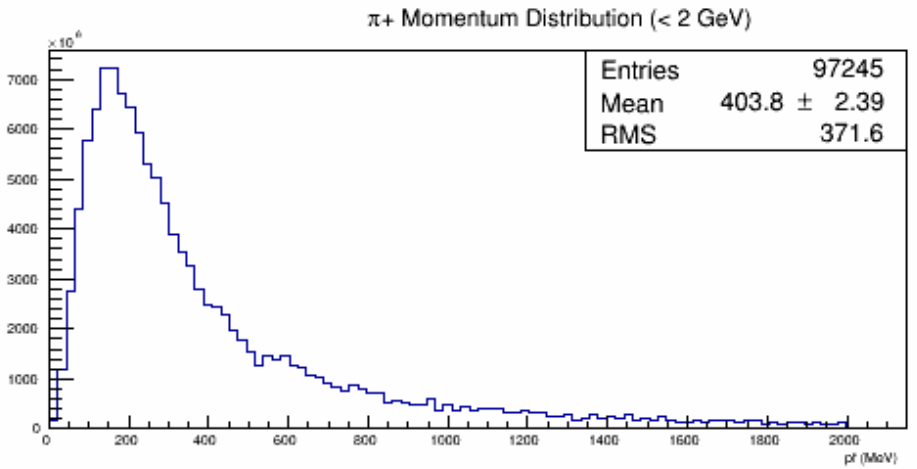
Pi-			Cut on Final Momentum (Pf) at GEM			
	Input	No Baffles	Lead		New Babar Lead	
(GeV)	(GHz)	(GHz)	(GHz)	Counts	(GHz)	Counts
pf>0	80.60	26.94	6.35	18784	0.71	12096
pf>0.3	48.60	22.45	4.37	17466	0.59	11653
pf>1.0	8.60	2.54	0.77	13972	0.23	10802
pf>2.0	1.20	0.17	0.06	9713	0.05	8976

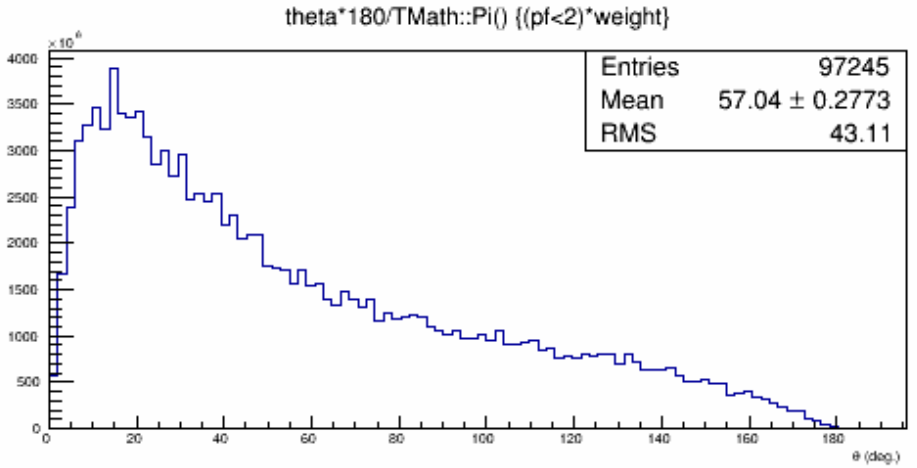
Total Pi+ Rate at 50 uA

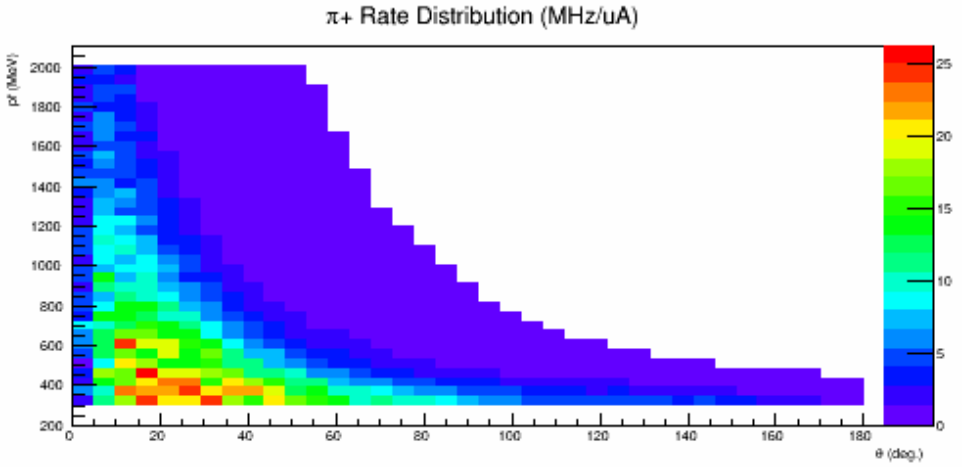
Pi+			Cut on Final Momentum (Pf) at GEM			
	Input	No Baffles	Lead		New Babar Lead	
(GeV)	(GHz)	(GHz)	(GHz)	Counts	(GHz)	Counts
pf>0	81.80	26.36	7.51	15303	0.33	3123
pf>0.3	49.10	22.23	6.03	14208	0.25	2918
pf>1.0	8.60	2.48	0.47	9956	0.04	2024
pf>2.0	1.30	0.15	0.02	6513	0.002	1265

Wiser Input

Input 1x10^6 Pions for simulations



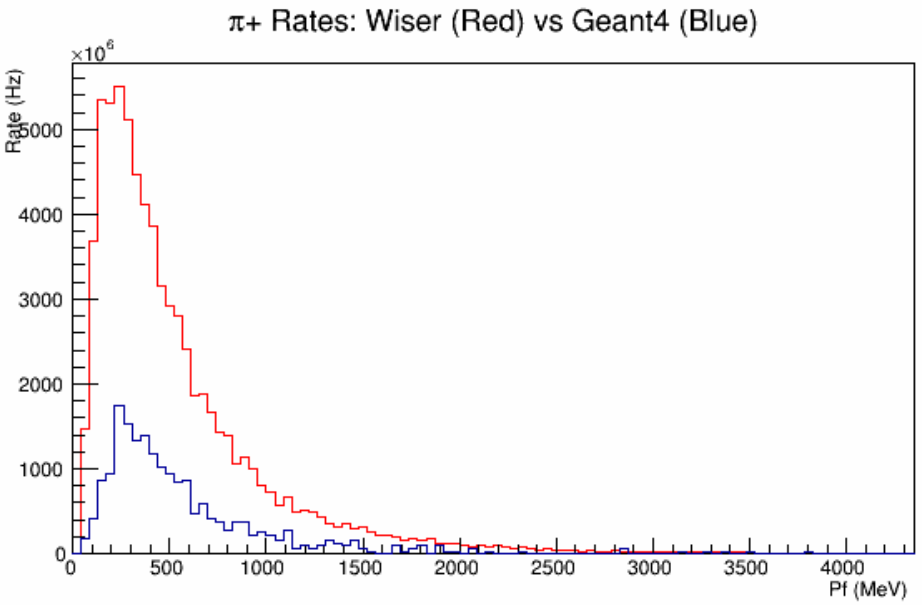


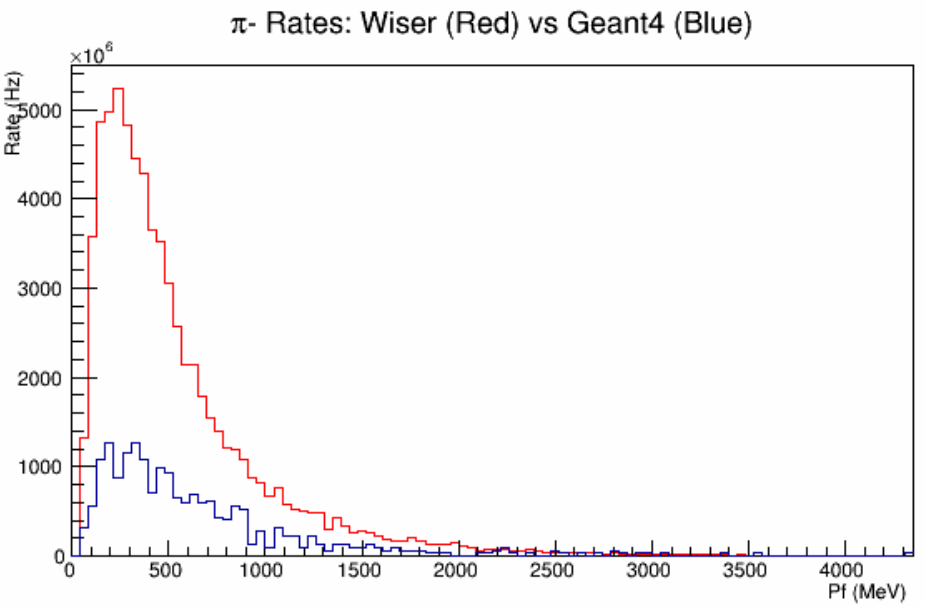


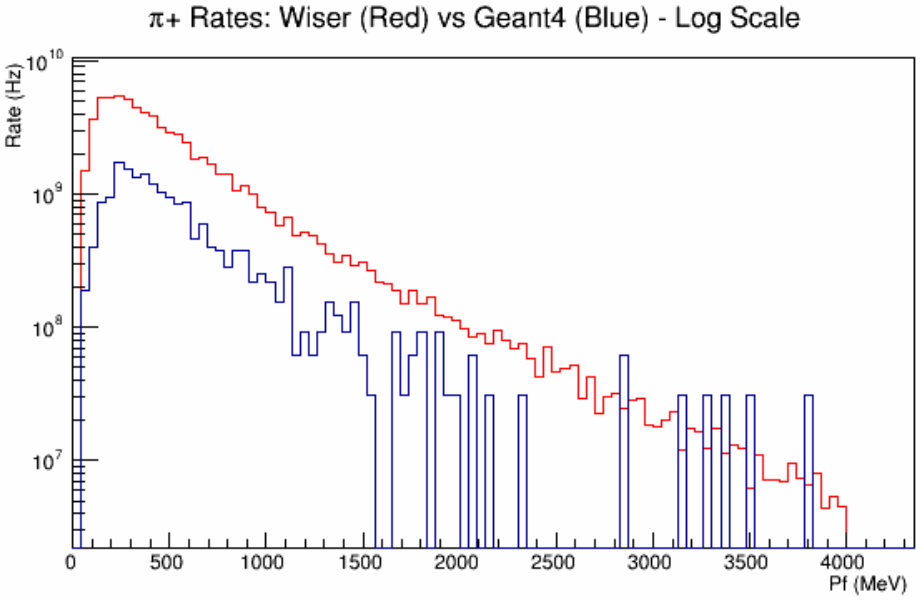
Wiser vs Geant4 Input Comparison

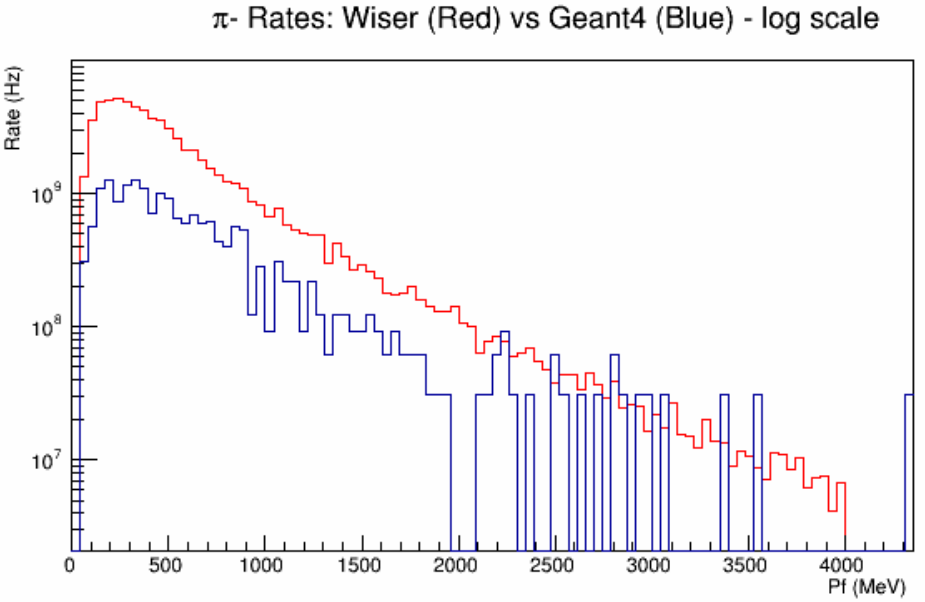
- 11 GeV electrons incident on the LD2 target
- Incident 10 x 10^6 electrons
- Simulation with no baffles and magnetic field
  - GEMs are included
- A disk detector at the upstream face of the frist baffle detects hits
  - Detector inner/out radii are same as 1^{st} baffle

Wiser vs Geant4 Input Comparison

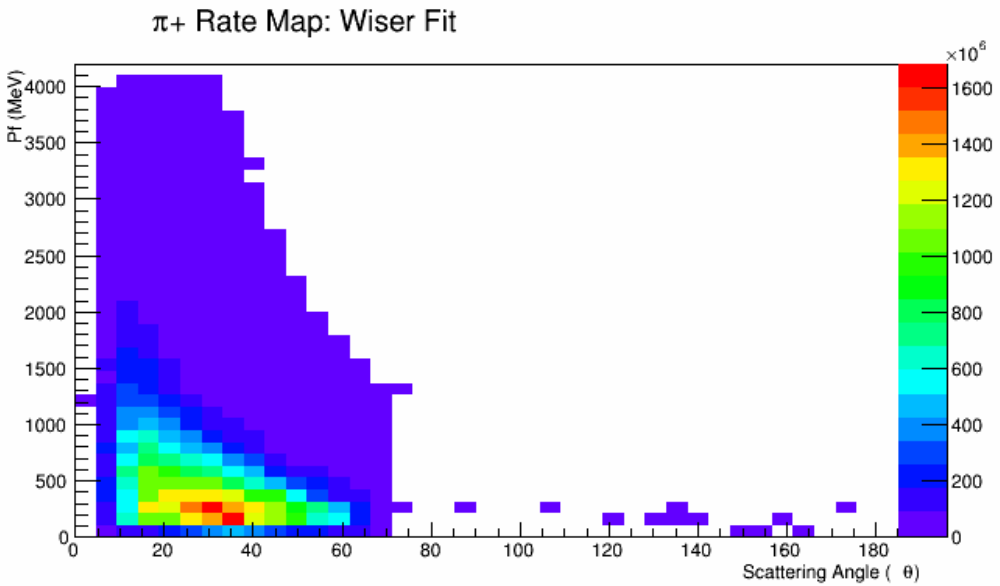


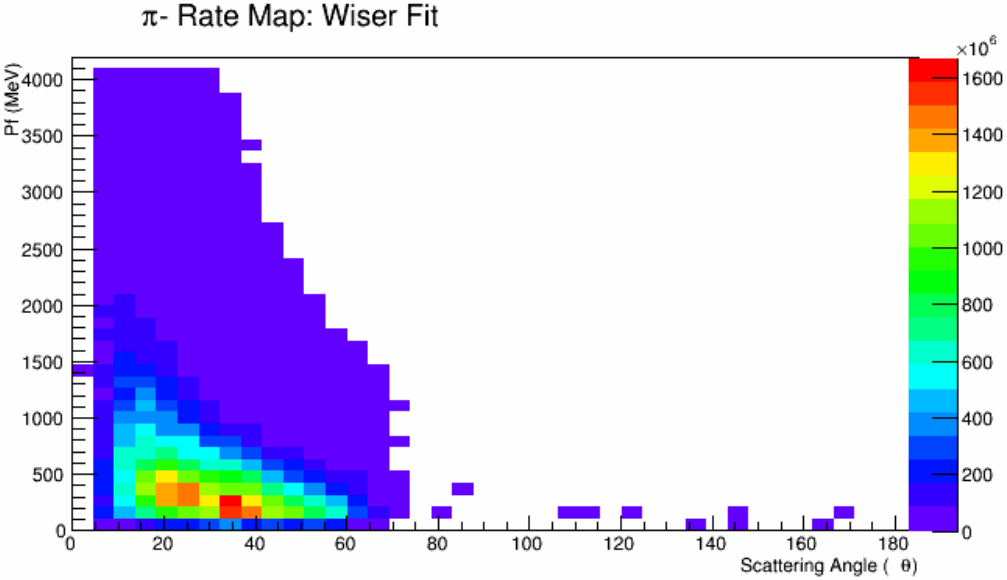


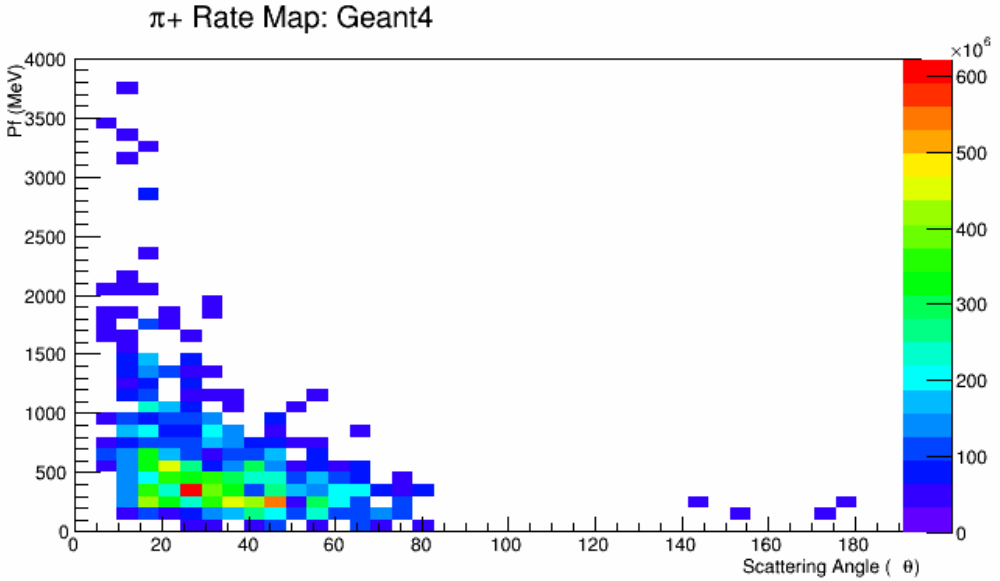


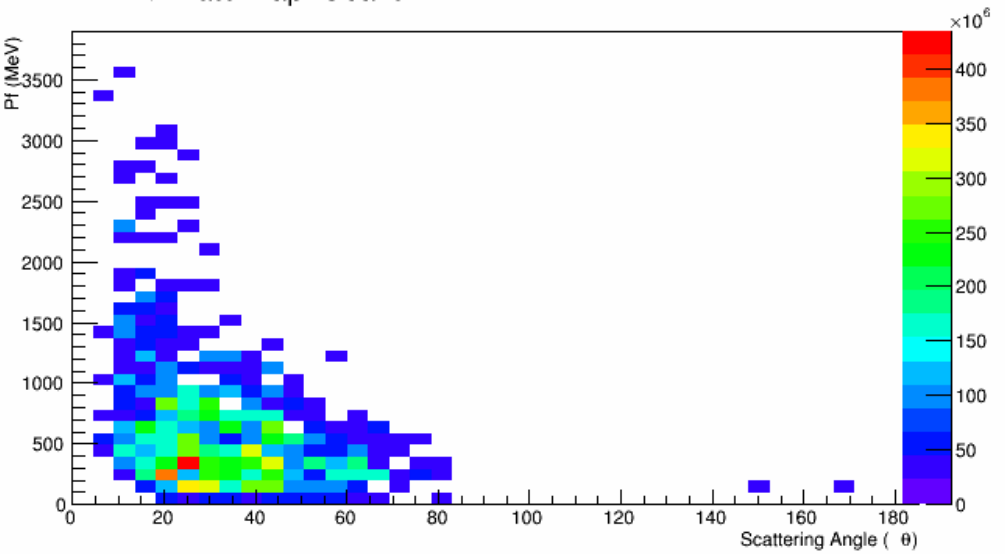


Wiser vs Geant4 Input Comparison









Wiser vs Geant4 Input Comparison

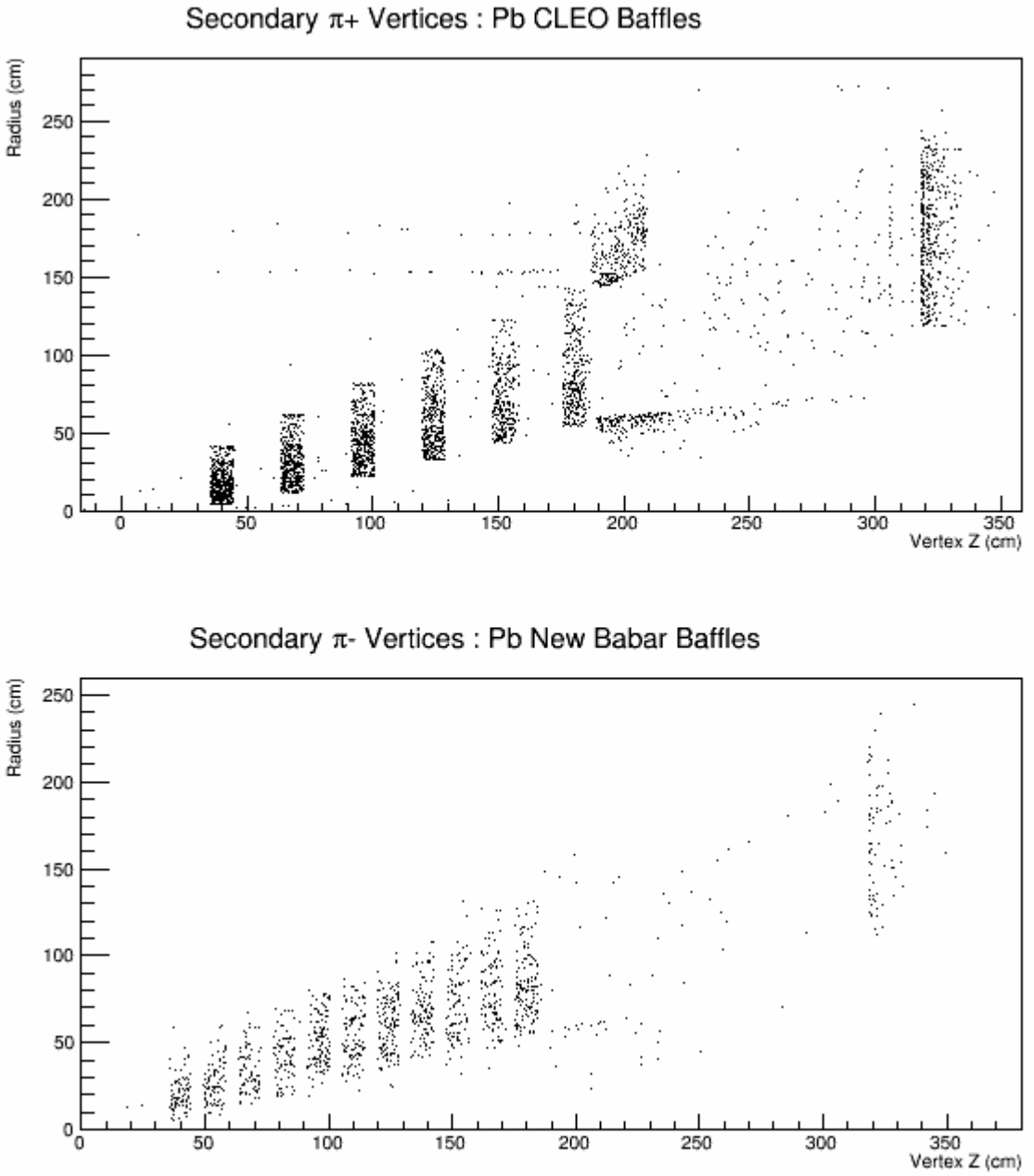
Rates from Geant 4 and Wiser generators

	Pi-		
	Geant 4	Wiser	Ratio
(GeV)	(GHz)	(GHz)	
pf>0	18.75	69.62	3.71
pf>0.3	13.75	45.28	3.29
pf>1.0	3.14	9.15	2.91
pf>2.0	0.72	1.58	2.20

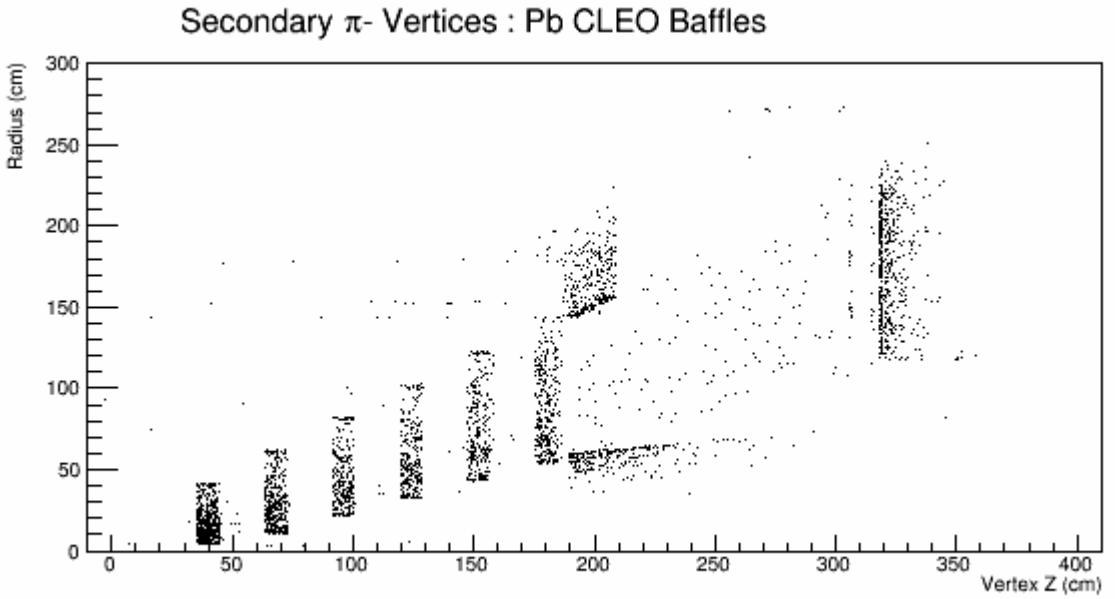
	Pi+		
	Geant 4	Wiser	Ratio
(GeV)	(GHz)	(GHz)	
pf>0	18.75	71.35	3.80
pf>0.3	13.31	45.44	3.41
pf>1.0	2.36	9.04	3.82
pf>2.0	0.37	1.60	4.29

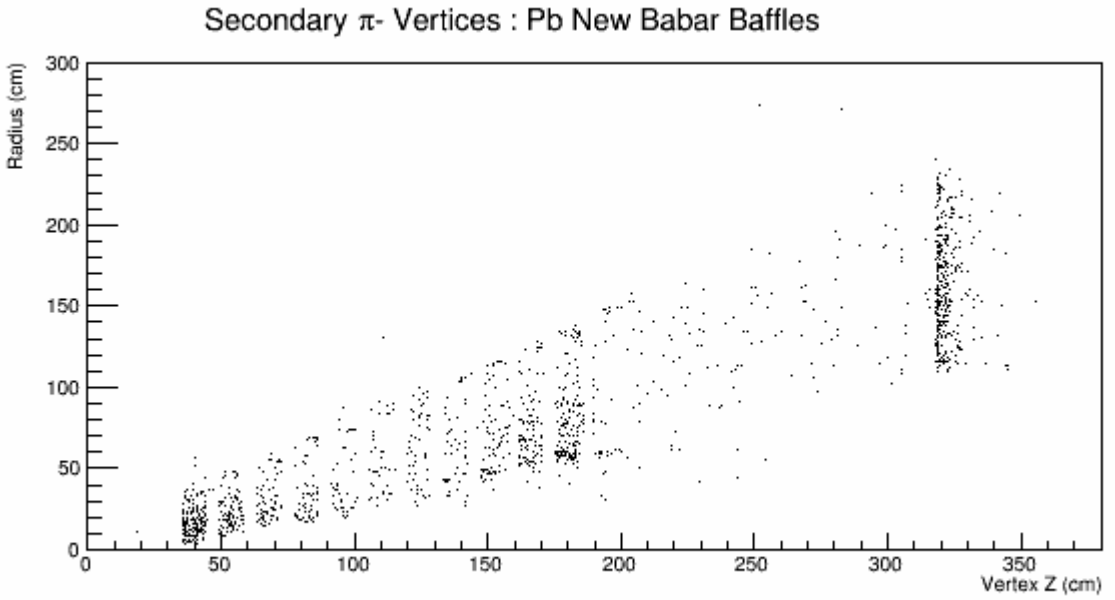
Supplementary

Secondary Pions : π+

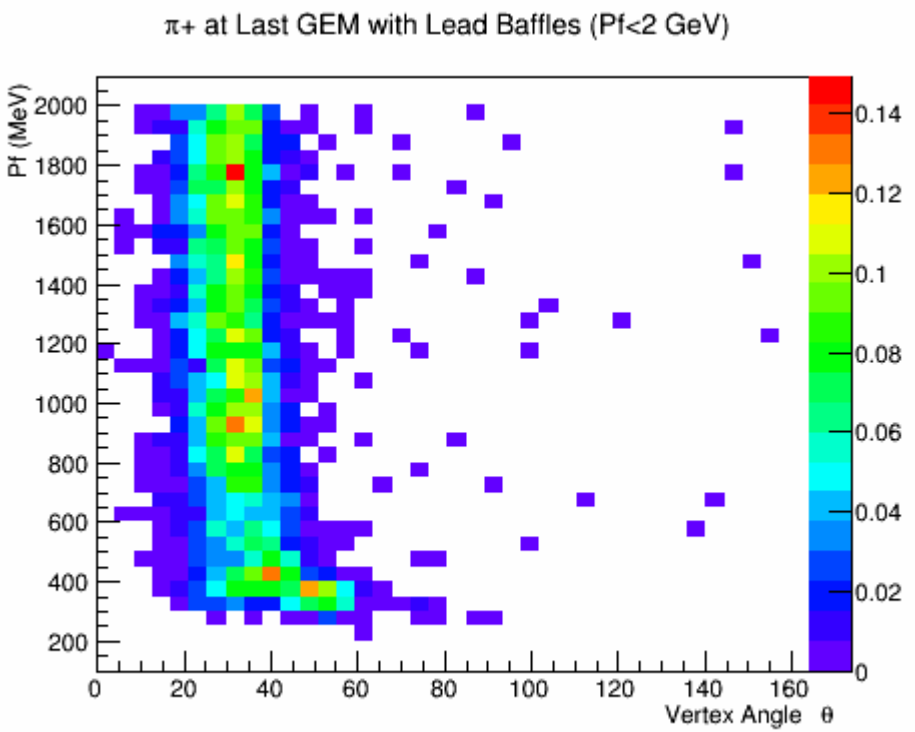


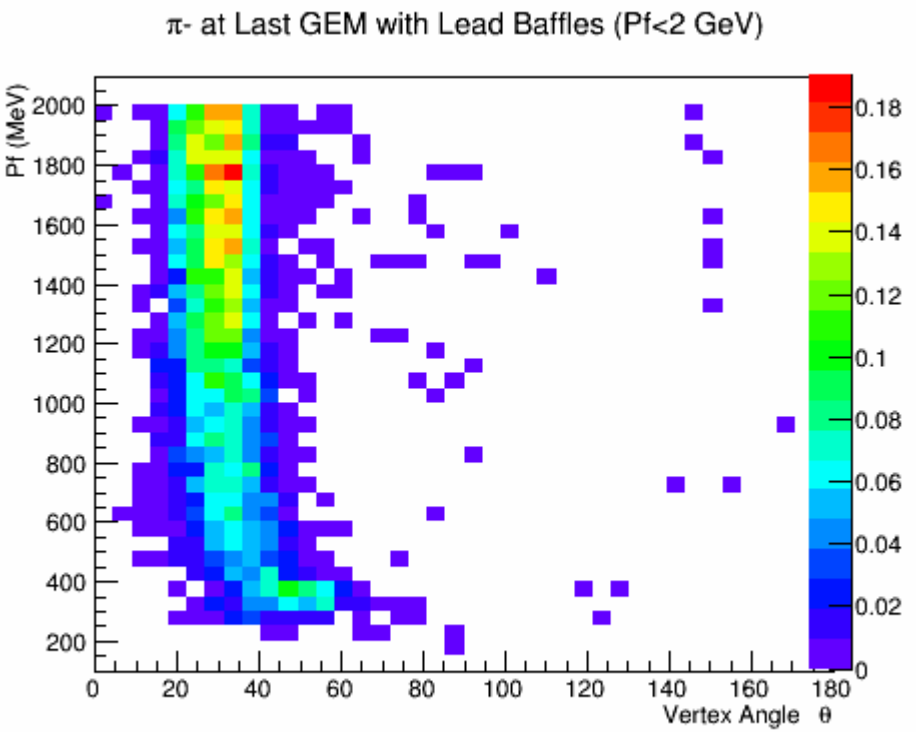
Secondary Pions : π-





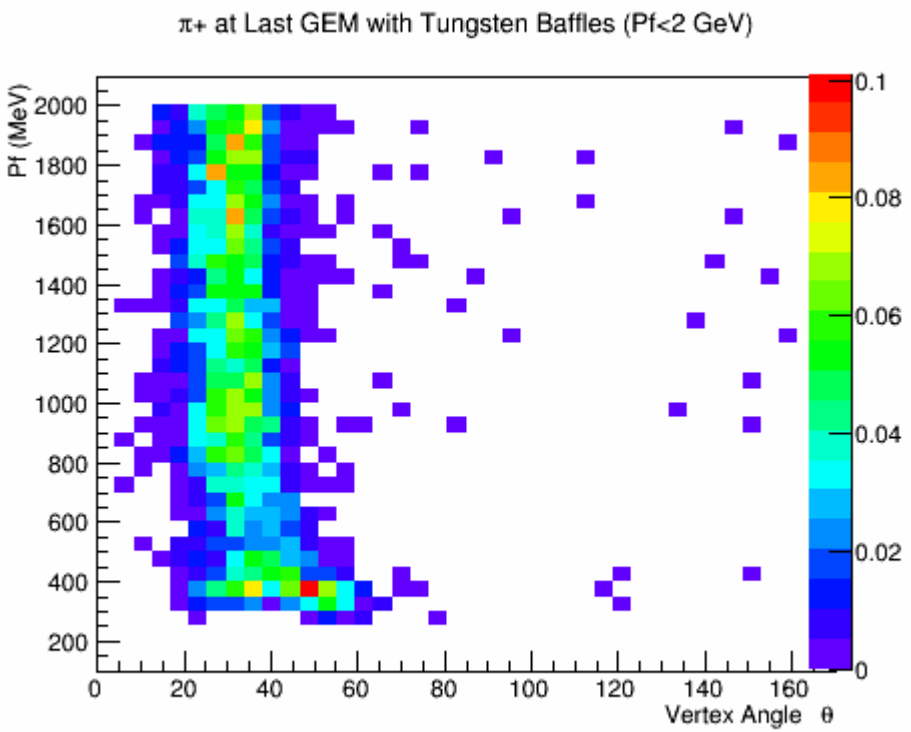
Pions Acceptance at the Last GEM : Pb Baffles

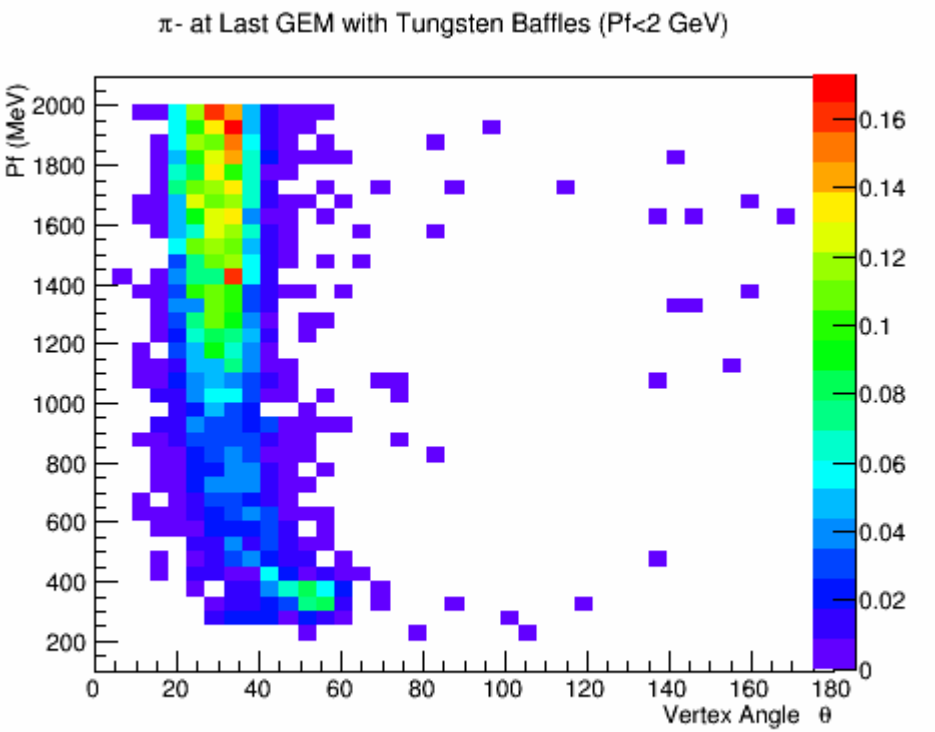




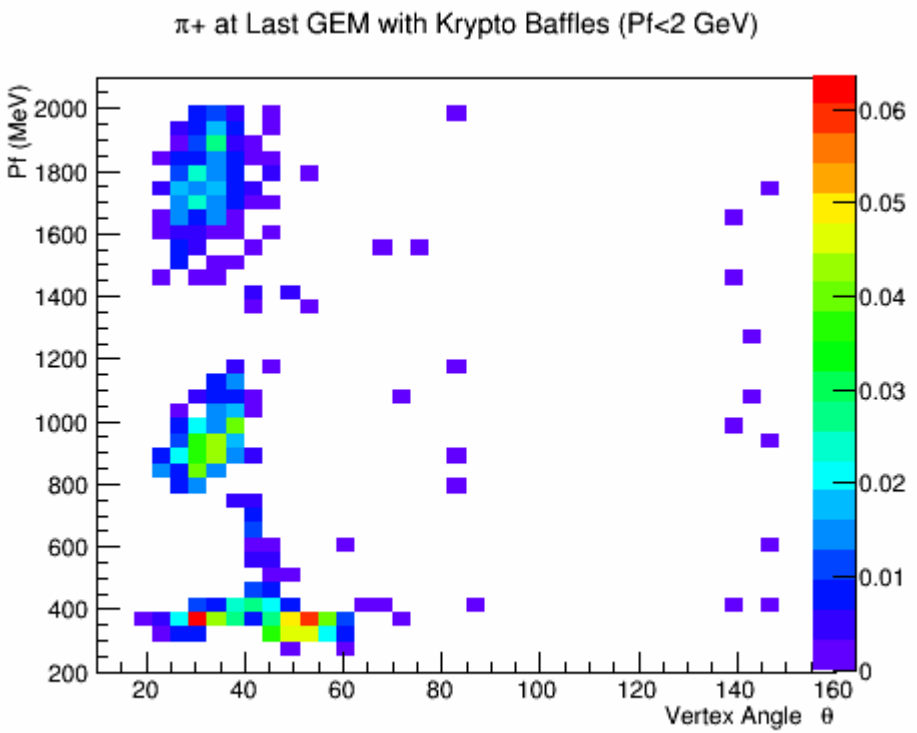
Acceptance = Hits at Last GEM * 100 / Total Pions input for (0 < θ < 60)

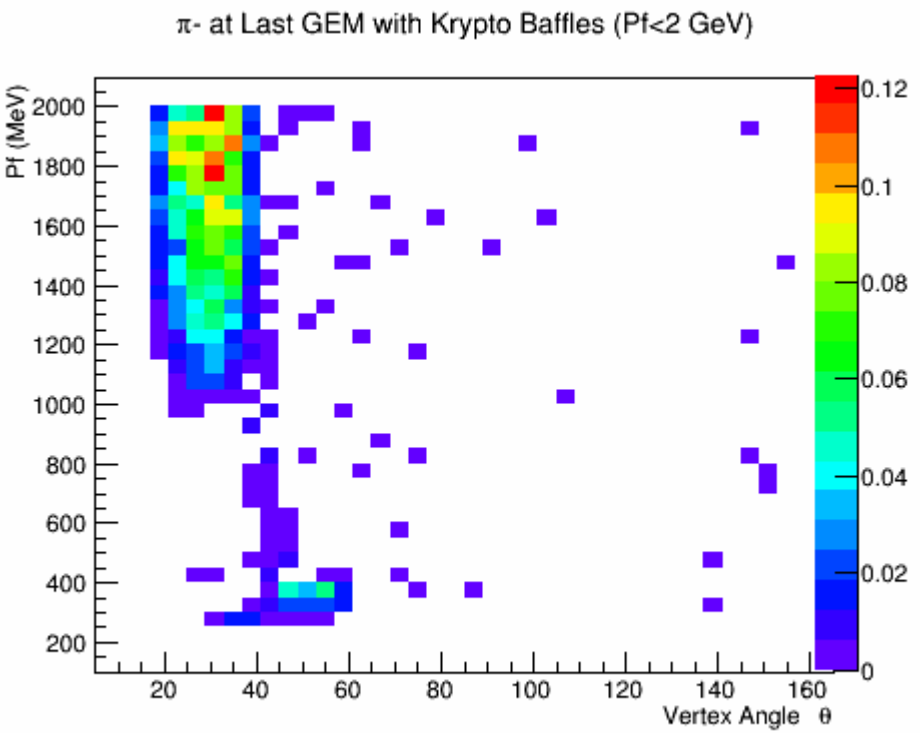
Pions Acceptance at the Last GEM : W Baffles



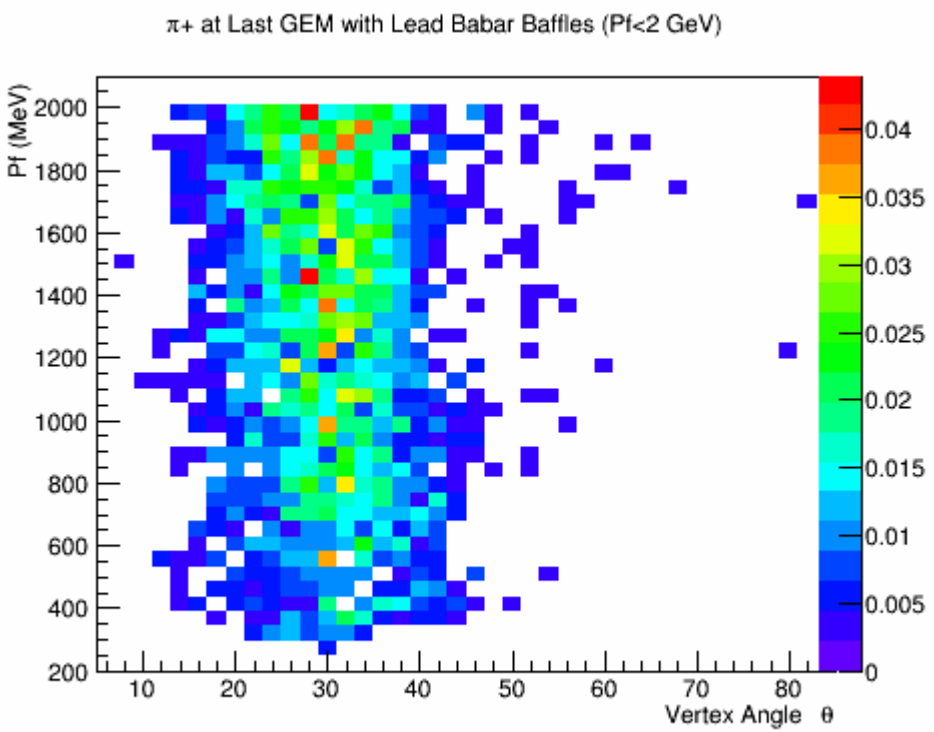


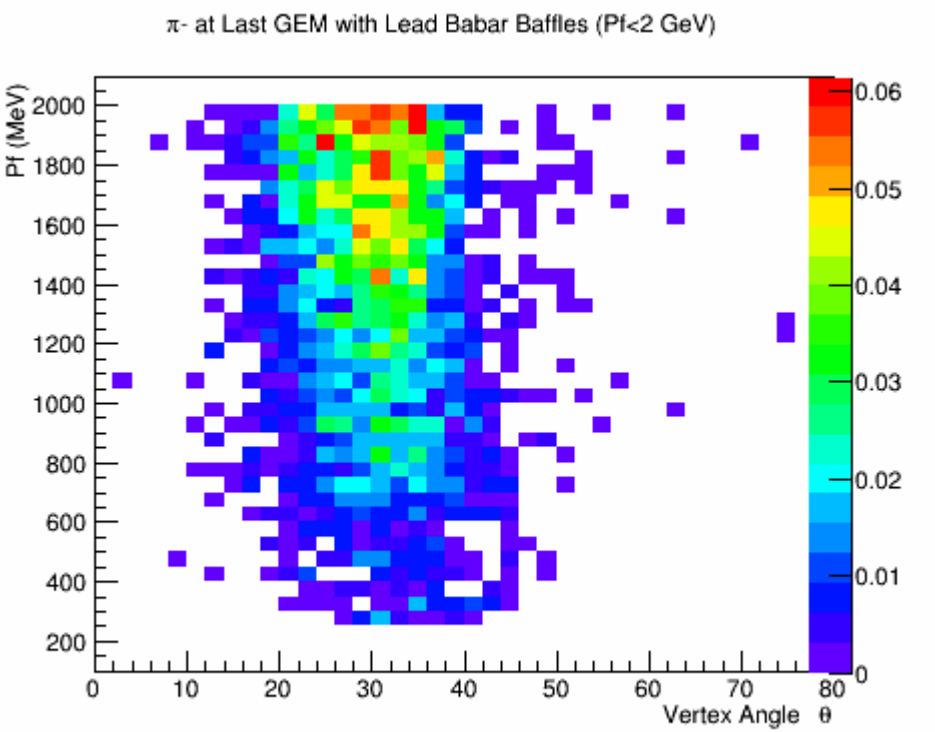
Pions Acceptance at the Last GEM : Kryp. Baffles



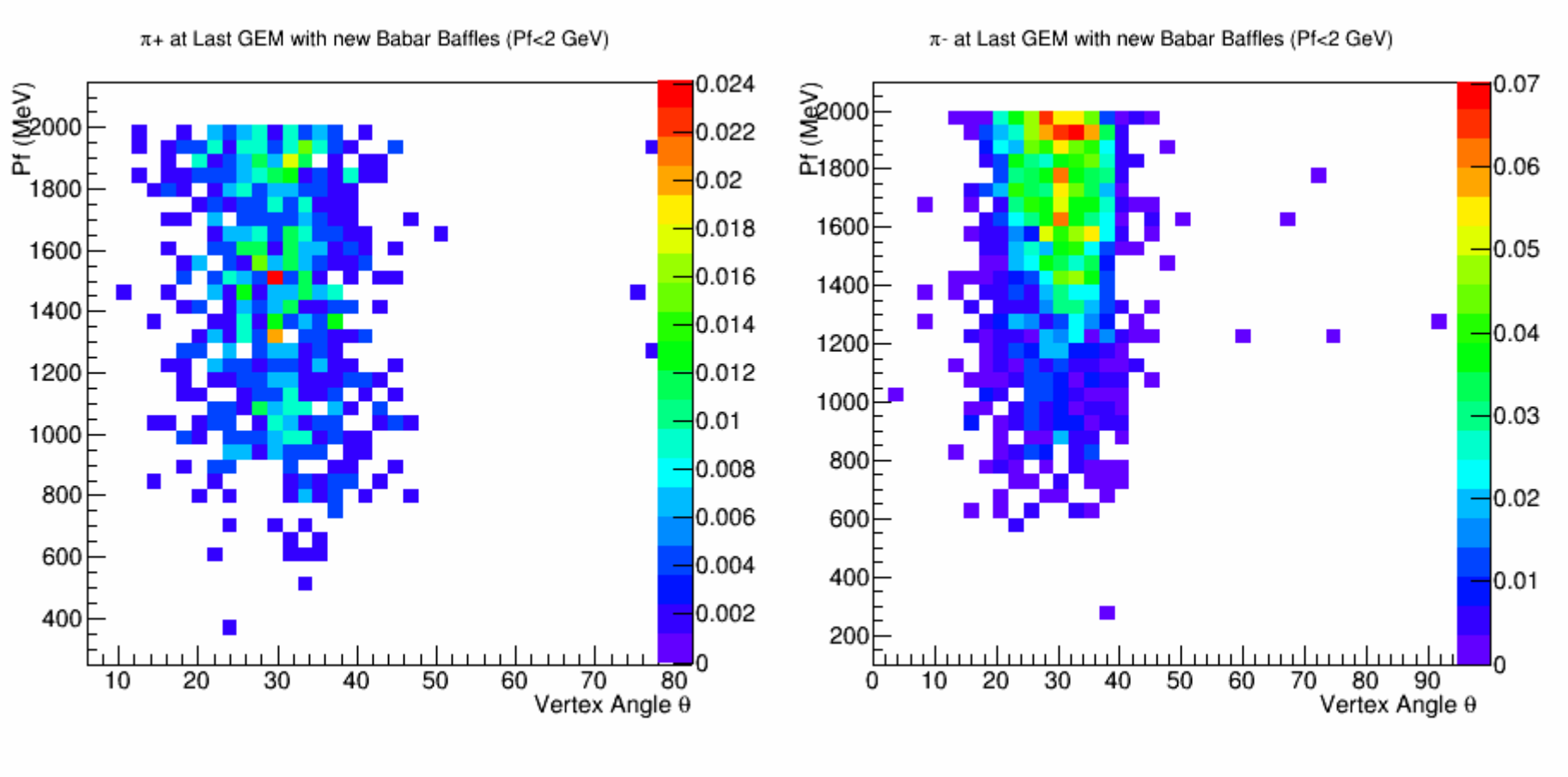


Pions Acceptance at the Last GEM : Pb Babar Baffles





Pions Acceptance at the Last GEM : Pb Babar New Baffles



Input Summary

- Pions(+/-) generated with following input conditions using Wiser fits,
  - LD2 target
  - Luminosity for 50 uA
  - Incident electron beam energy: 11 GeV
  - Target length: 40 cm
  - Raster: 2x2 mm^2
  - 1 million events