

GEM Tracking: impacts of removing one layer

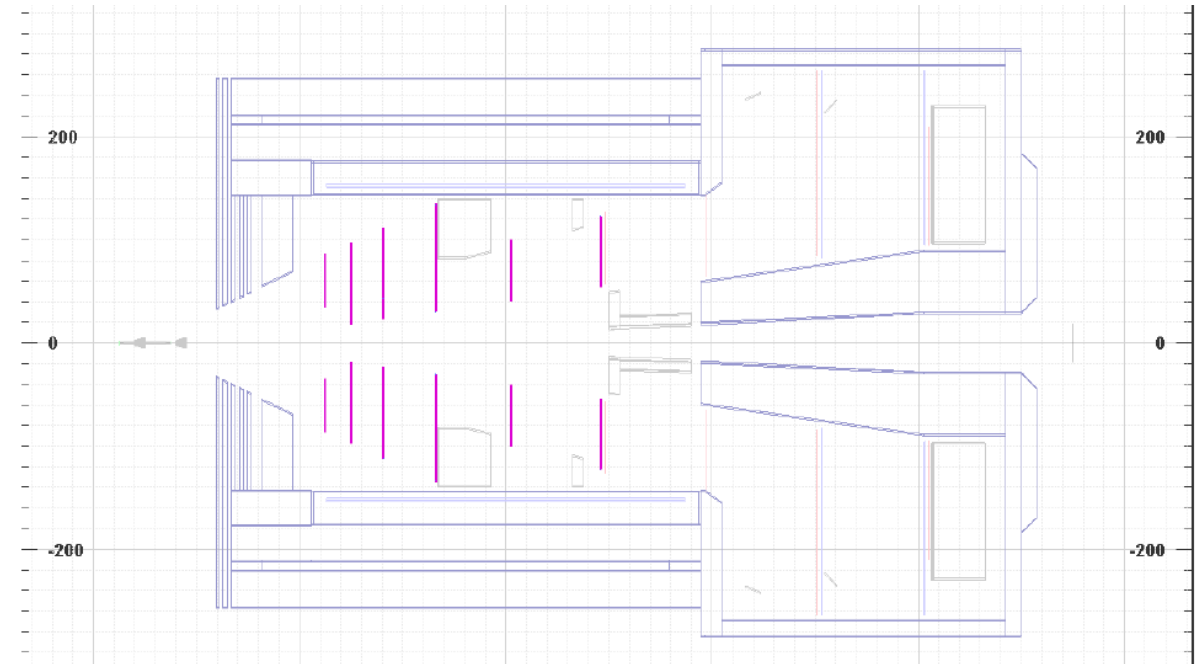
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Based on Weizhi's work

Introduction

Questions:

- What's the impacts on tracking efficiency, resolution with one layer GEM disabled?
- What's the differences for excluding different layers?
- Can we get the efficiency etc back by reducing background ratio (luminosity) ?



SIDIS He3 configuration

Changes from Weizhi's studies

- Disable processing hits for different layers.
- Update seeding parameters as needed.

Location	Z (cm)	R_{min} (cm)	R_{max} (cm)	Surface (m ²)	# chan
1	-175	36	87	2.0	24 k
2	-150	21	98	2.9	30 k
3	-119	25	112	3.7	33 k
4	-68	32	135	5.4	28 k
5	5	42	100	2.6	20 k
6	92	55	123	3.8	26 k
Total				≈ 20.4	≈ 161 k

Efficiency

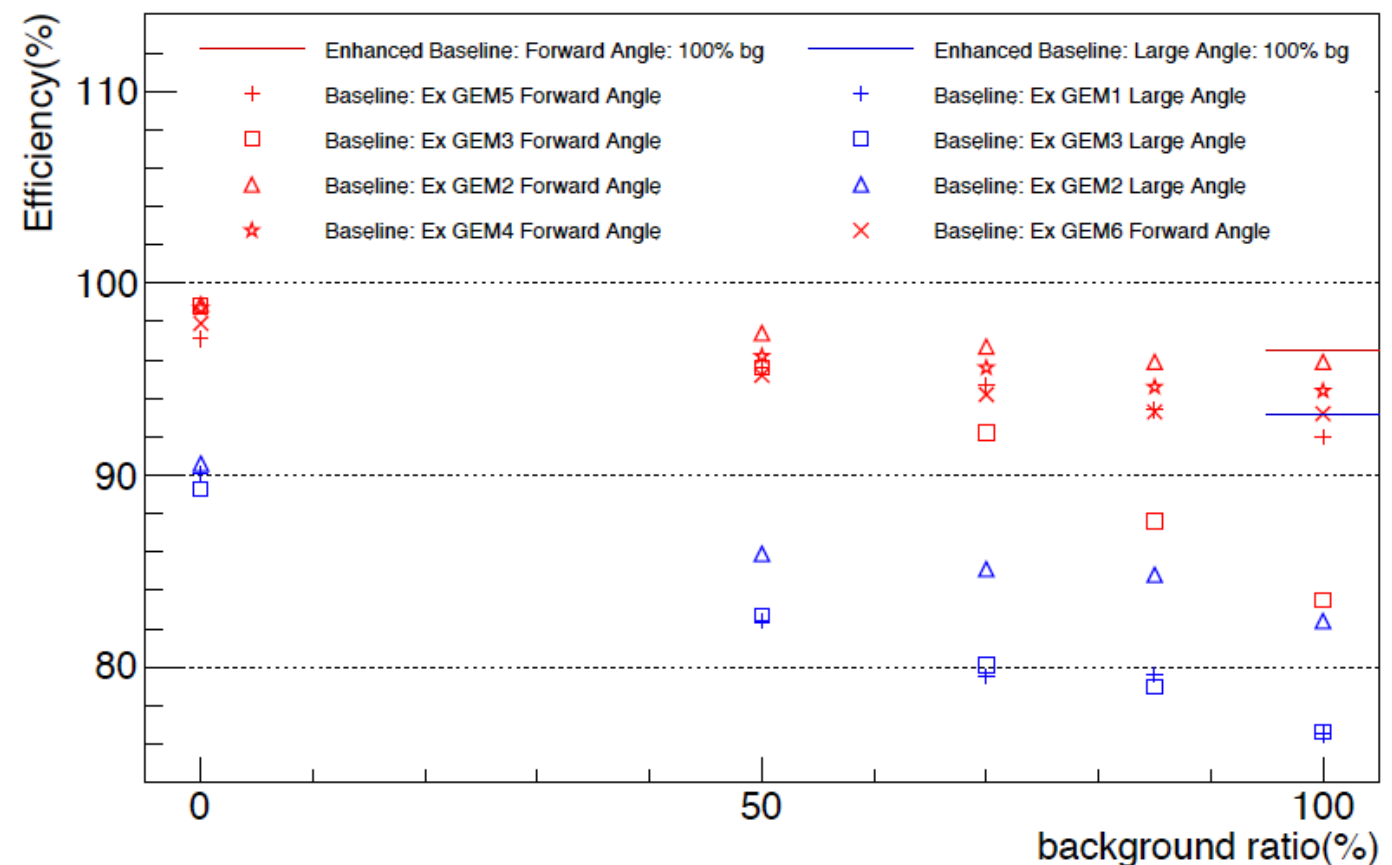
Forward Angle

- From 5 (+1) to 4 (+1) layers
- 50% decreased bkgd ratio can get the lost efficiency back
- Different sensitivity on bkgd ratio for different layers

Large Angle

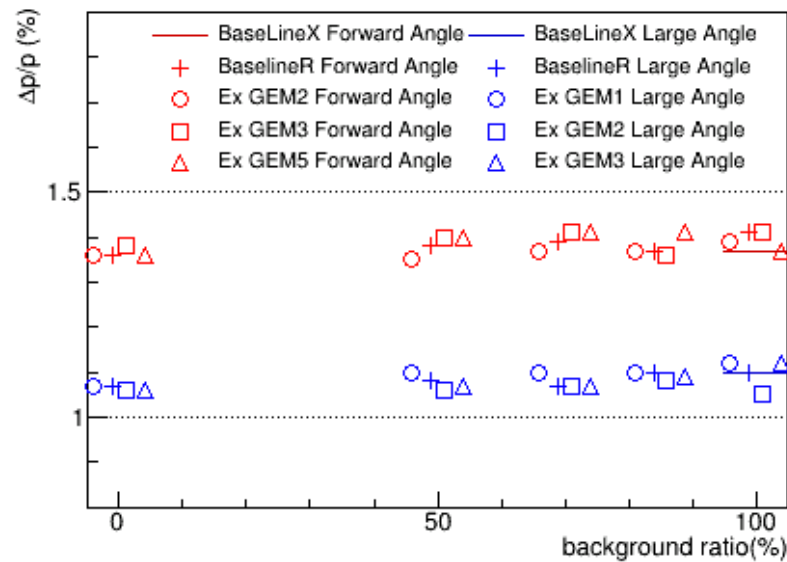
- From 4 to 3 layers
- Dramatically decreased efficiency; lower than 4 layers even with no background.
- Least impact by excluding GEM2 at high background ratio.

Tracking efficiency vs. background ratio

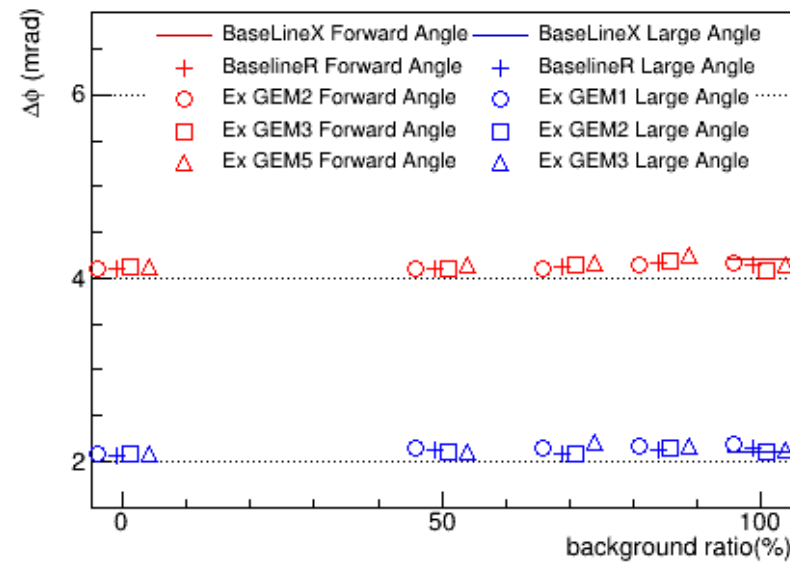


Resolution

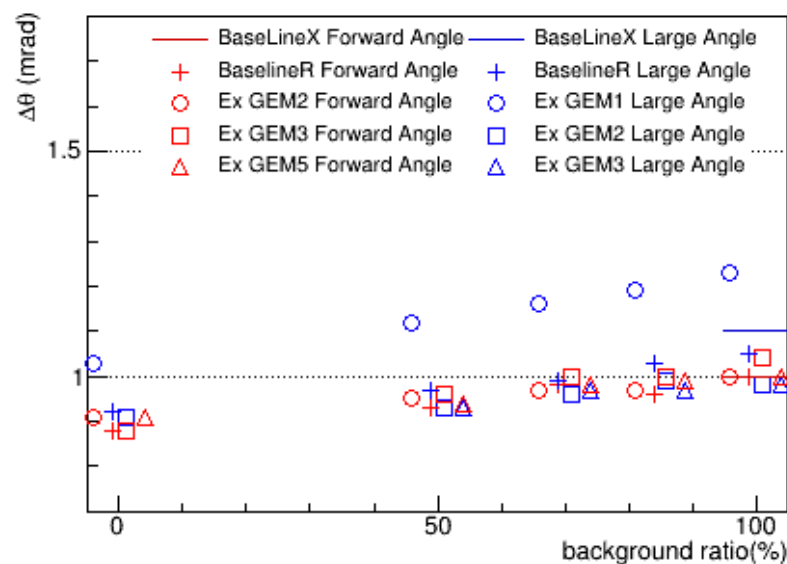
Momentum resolution vs. background ratio



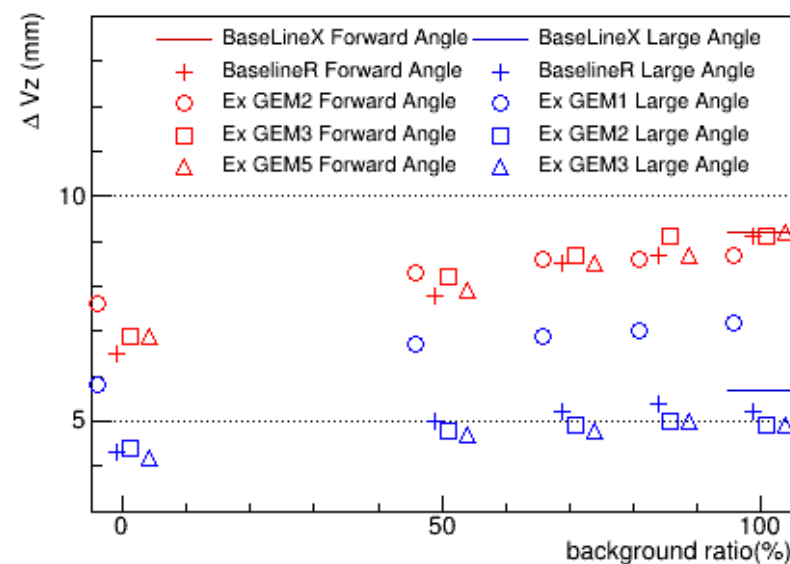
Azimuthal angle resolution vs. background ratio



Polar angle resolution vs. background ratio



Vertex z resolution vs. background ratio



- Simply used the sigmas from Gaussian fitting.

- Small impacts in general except for: large angle — visibly decreased polar angle and vertex resolution by excluding the 1st layer.

Numerical numbers

Efficiency: All(FA: 96.5%, LA: 93.2%) (%)

	0%	50%	70%	85%	100%
LA_ex1	90.1	82.4	79.5	79.6	76.5
LA_ex2	90.6	85.9	85.1	84.8	82.4
LA_ex3	89.3	82.7	80.1	79.0	76.4
LA_full	98.5	95.5	94.4	94.4	93.4
FA_ex2	98.9	97.4	96.7	95.9	95.9
FA_ex3	98.8	95.6	92.2	87.6	83.5
FA_ex5	97.1	95.6	94.7	93.4	92.0
FA_full	98.7	97.6	97.3	96.9	97.3

Vertex Z Resolution (mm)

	0%	50%	70%	85%	100%
LA_ex1	5.8	6.67	6.91	6.97	7.2
LA_ex2	4.4	4.8	4.9	5.0	4.9
LA_ex3	4.2	4.7	4.8	5.0	4.9
LA_full	4.3	5.0	5.2	5.4	5.2
FA_ex2	7.6	8.3	8.6	8.6	8.7
FA_ex3	6.9	8.2	8.7	9.1	9.1
FA_ex5	6.9	7.9	8.5	8.67	9.2
FA_full	6.5	7.8	8.5	8.7	9.1

Momentum Resolution (%)

	0%	50%	70%	85%	100%
LA_ex1	1.07	1.10	1.10	1.10	1.12
LA_ex2	1.06	1.06	1.07	1.08	1.05
LA_ex3	1.06	1.07	1.07	1.09	1.12
LA_full	1.07	1.08	1.07	1.10	1.10
FA_ex2	1.36	1.35	1.37	1.37	1.39
FA_ex3	1.38	1.40	1.41	1.36	1.41
FA_ex5	1.36	1.40	1.41	1.41	1.37
FA_full	1.36	1.38	1.39	1.37	1.41

Phi Resolution (mrad)

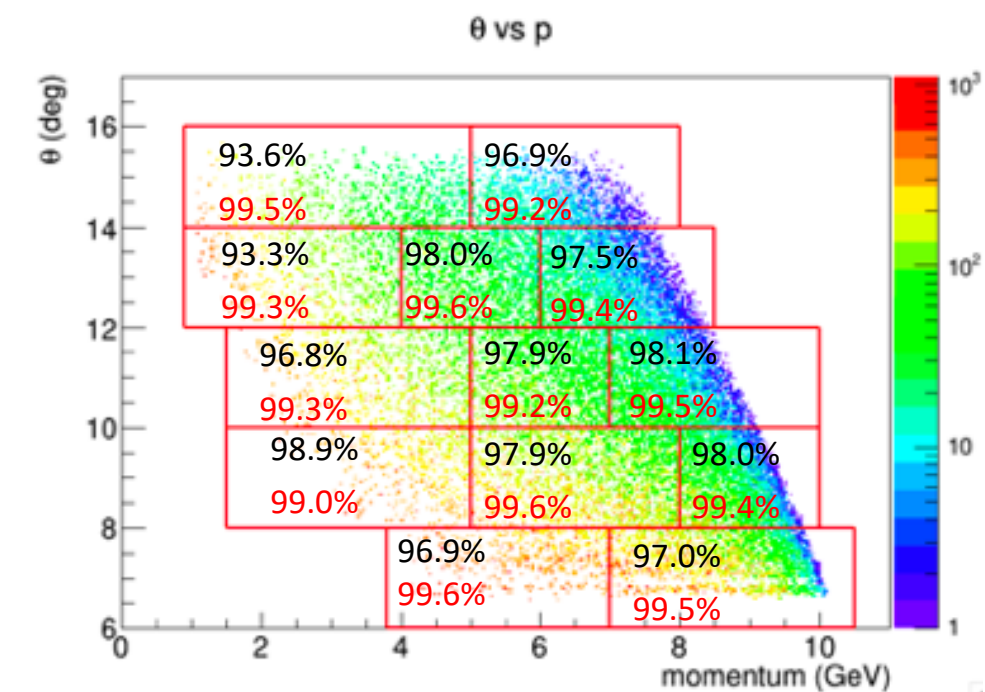
	0%	50%	70%	85%	100%
LA_ex1	2.09	2.15	2.15	2.16	2.18
LA_ex2	2.09	2.11	2.09	2.15	2.11
LA_ex3	2.09	2.1	2.2	2.16	2.13
LA_full	2.06	2.12	2.08	2.13	2.14
FA_ex2	4.10	4.11	4.11	4.15	4.16
FA_ex3	4.12	4.11	4.14	4.19	4.09
FA_ex5	4.12	4.14	4.16	4.25	4.15
FA_full	4.11	4.11	4.12	4.17	4.15

Theta Resolution (mrad)

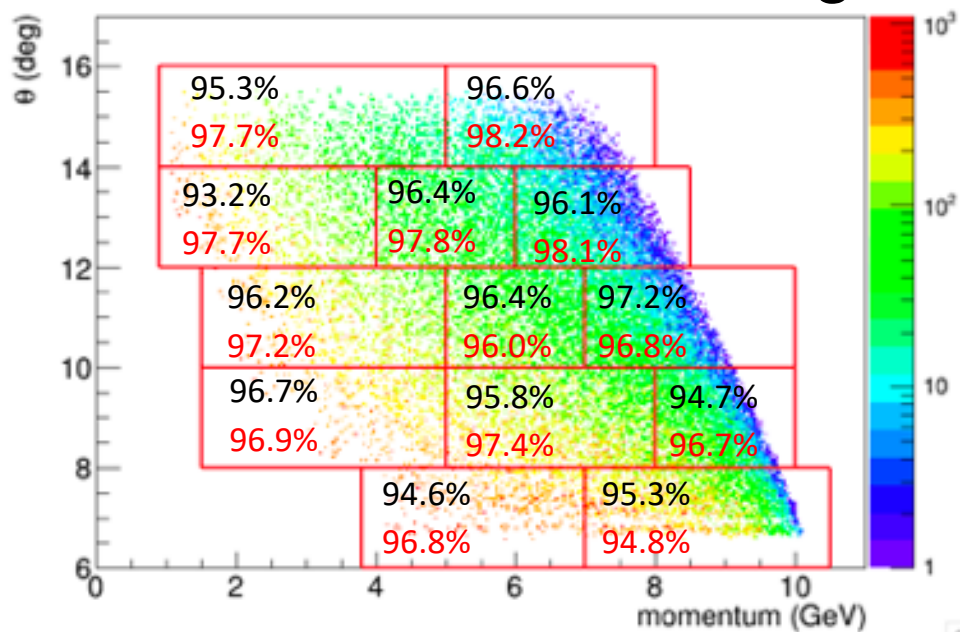
	0%	50%	70%	85%	100%
LA_ex1	1.03	1.12	1.16	1.19	1.23
LA_ex2	0.91	0.93	0.96	0.99	0.98
LA_ex3	0.91	0.93	0.97	0.97	0.98
LA_full	0.92	0.97	0.99	1.03	1.05
FA_ex2	0.91	0.95	0.97	0.97	1.00
FA_ex3	0.88	0.96	1.0	1.0	1.04
FA_ex5	0.91	0.94	0.98	0.99	1.00
FA_full	0.88	0.93	0.98	0.96	1.00

Forward angle ex.GEM5

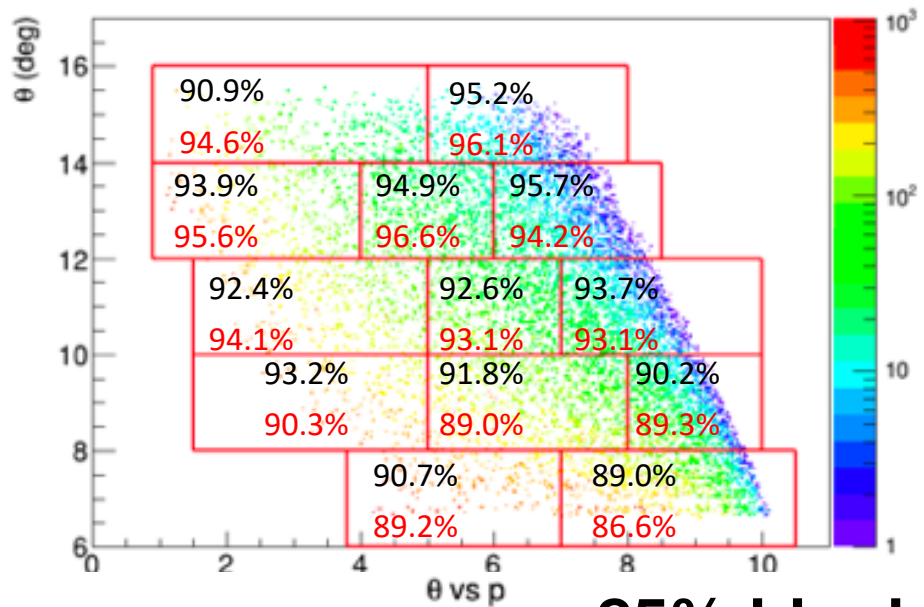
0% bkgd



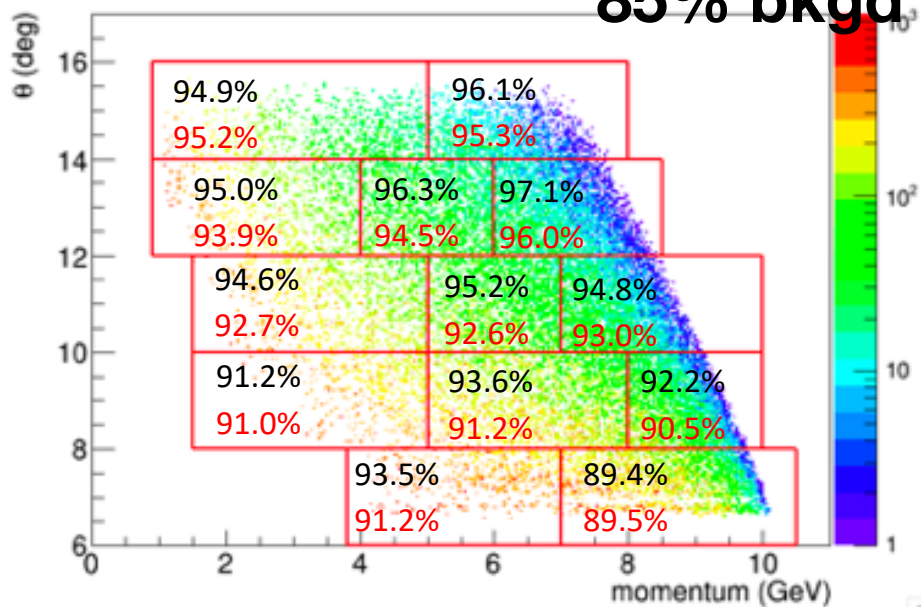
50% bkgd



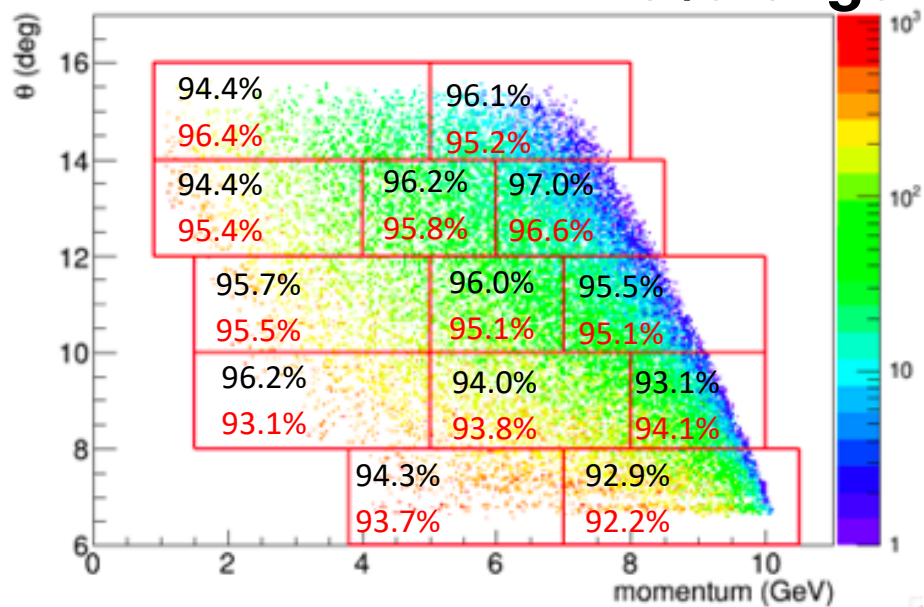
100% bkgd



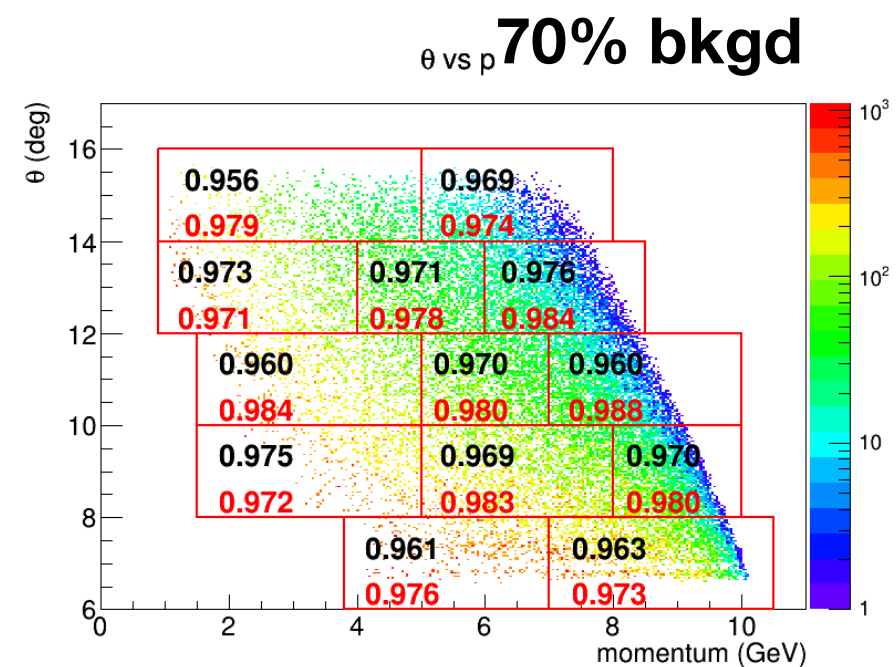
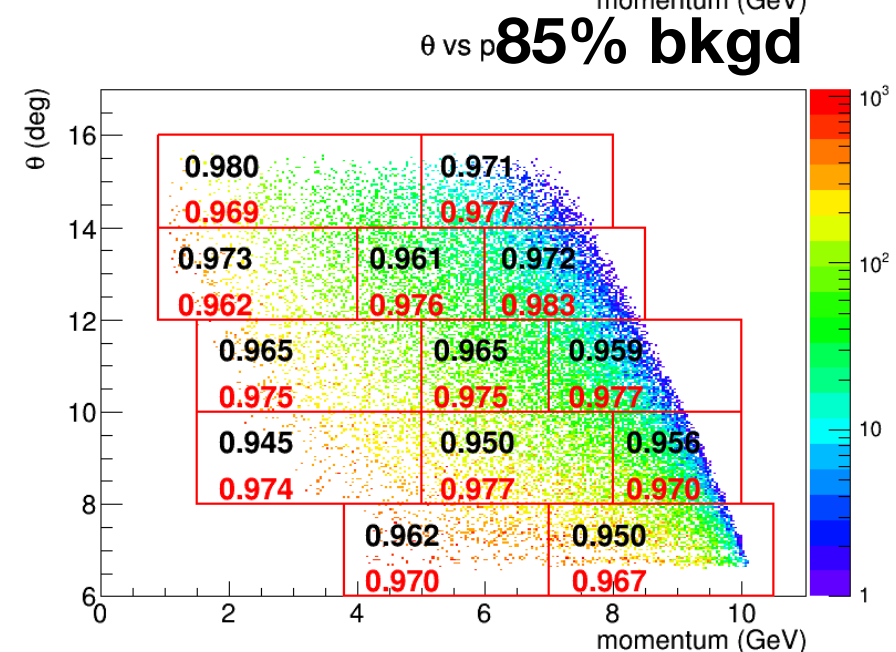
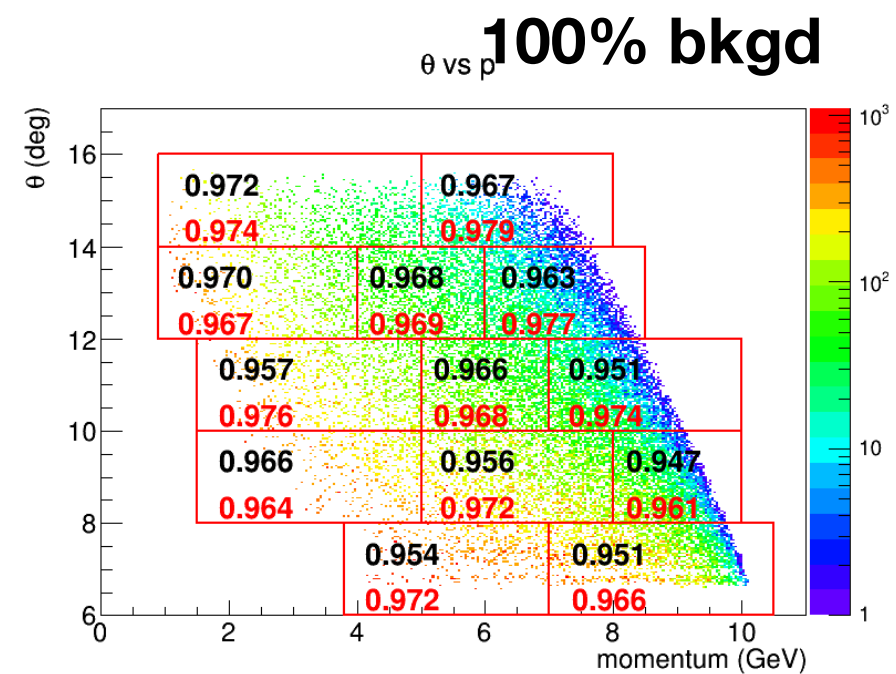
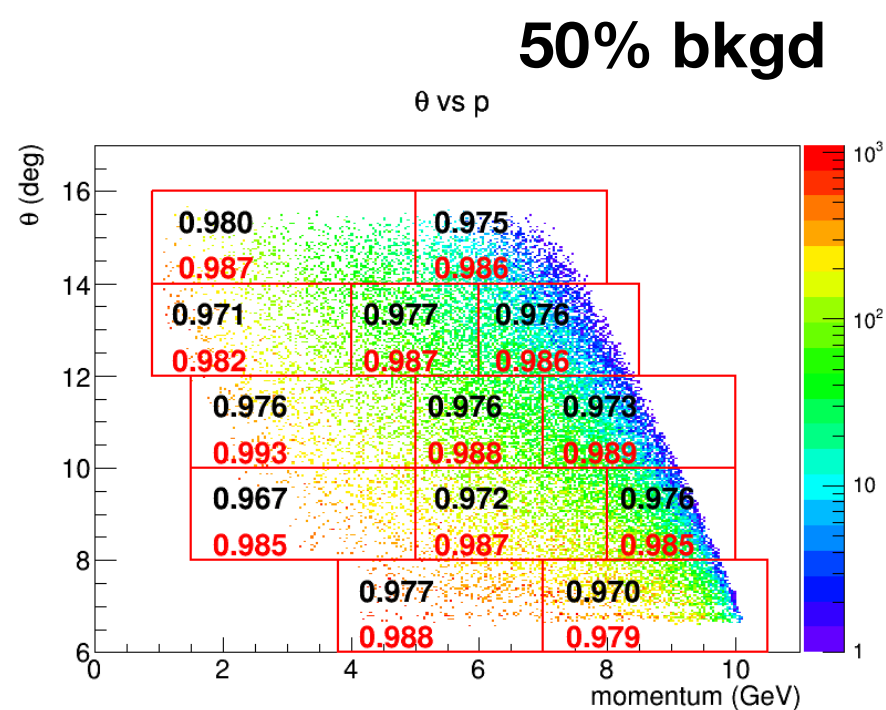
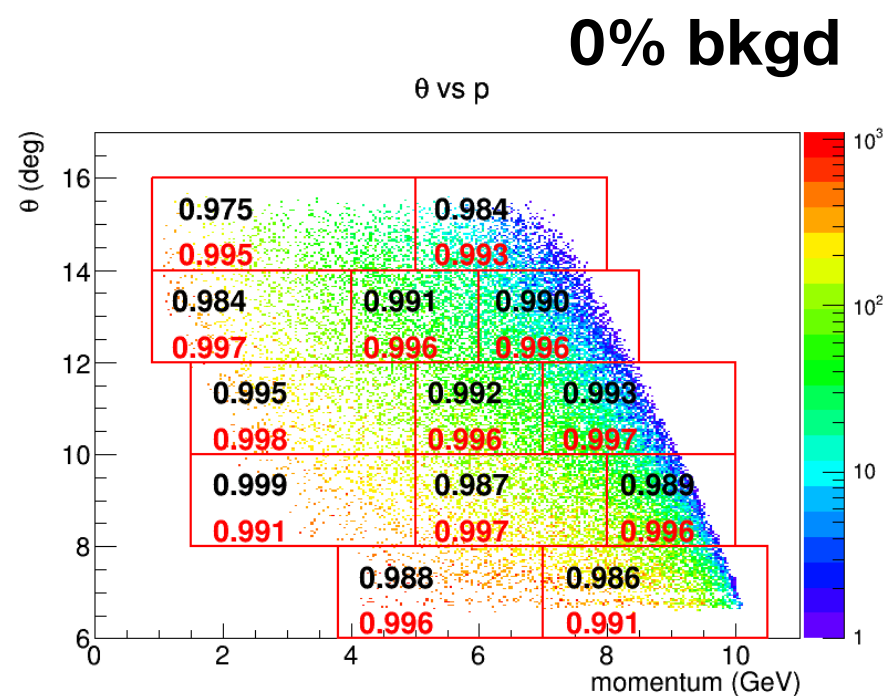
85% bkgd



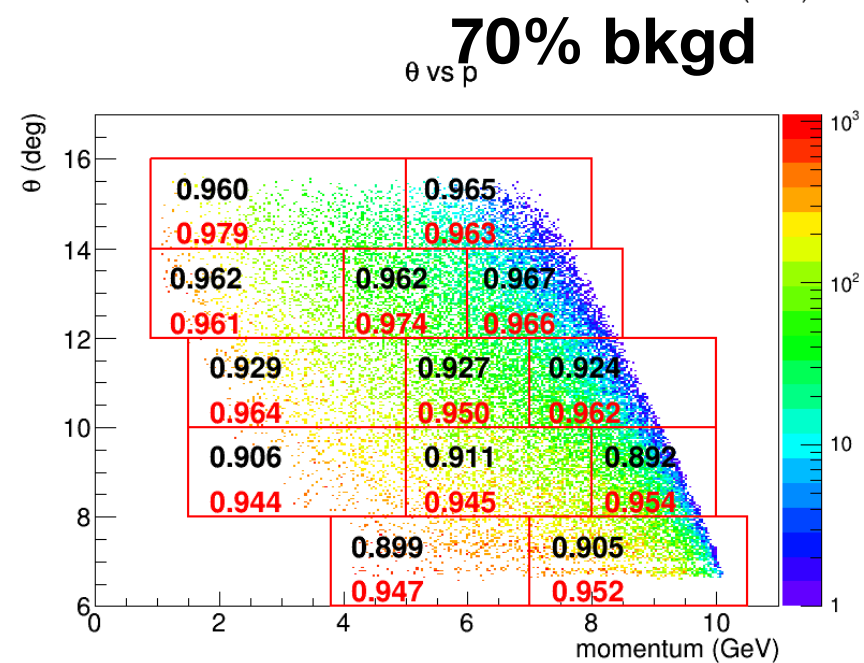
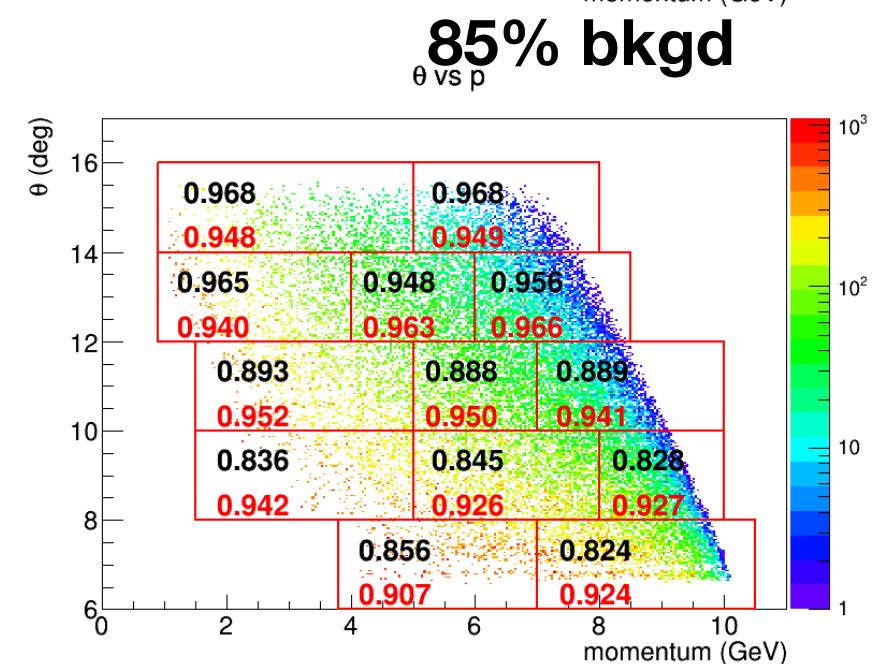
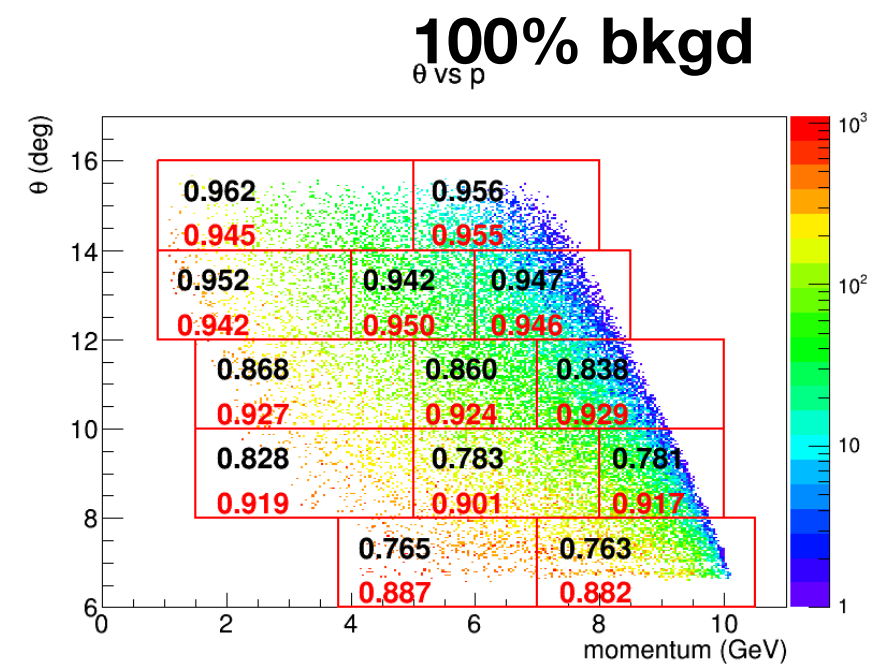
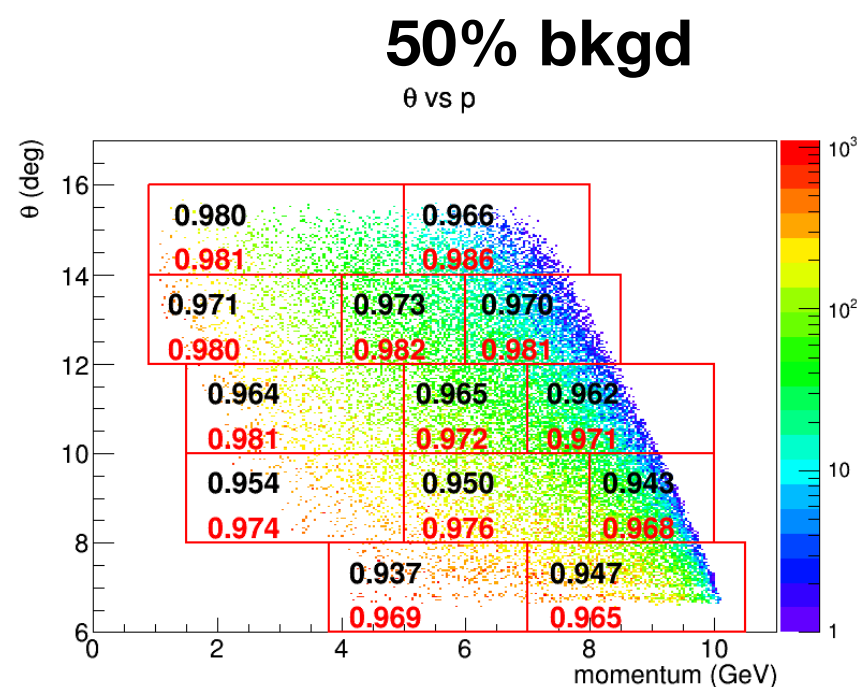
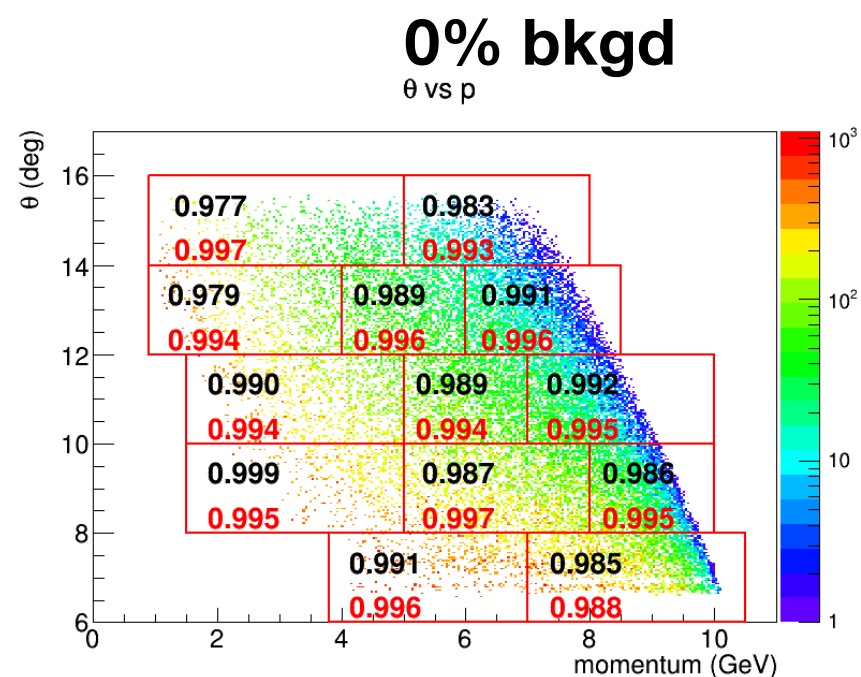
70% bkgd



Forward angle ex.GEM2

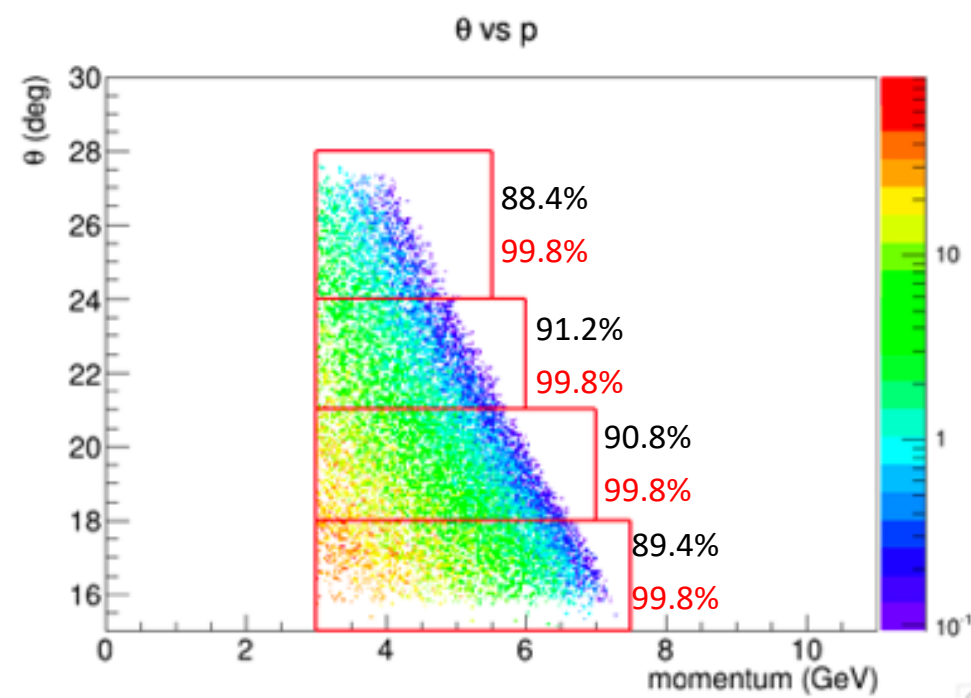


Forward angle ex.GEM3

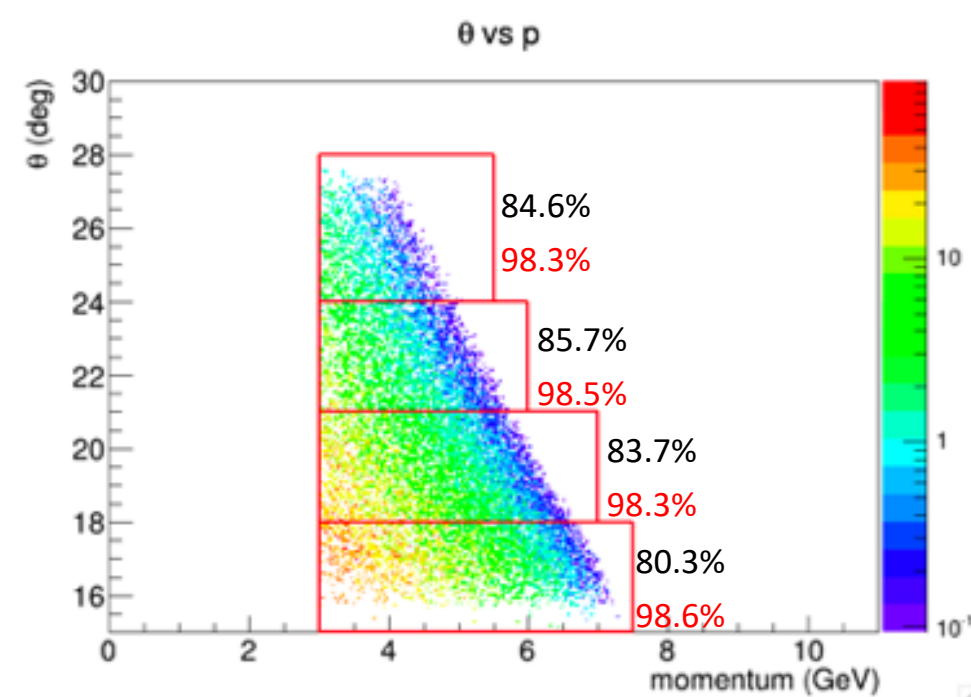


Large angle ex.GEM1

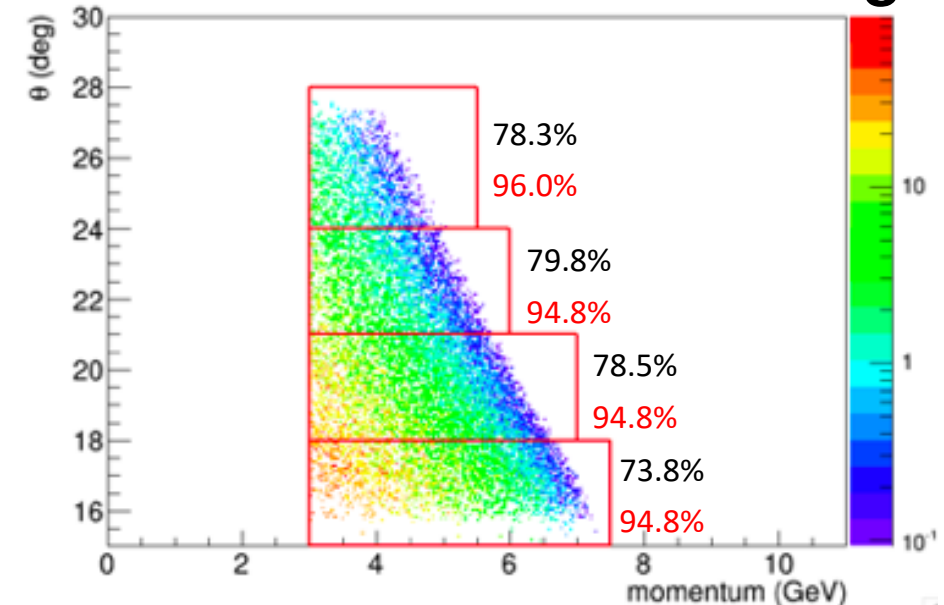
0% bkgd



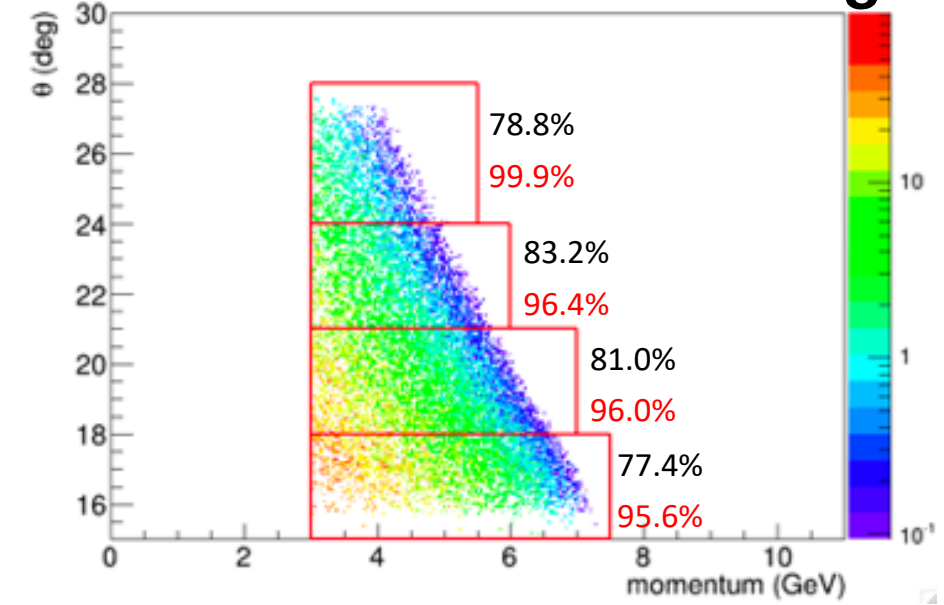
50% bkgd



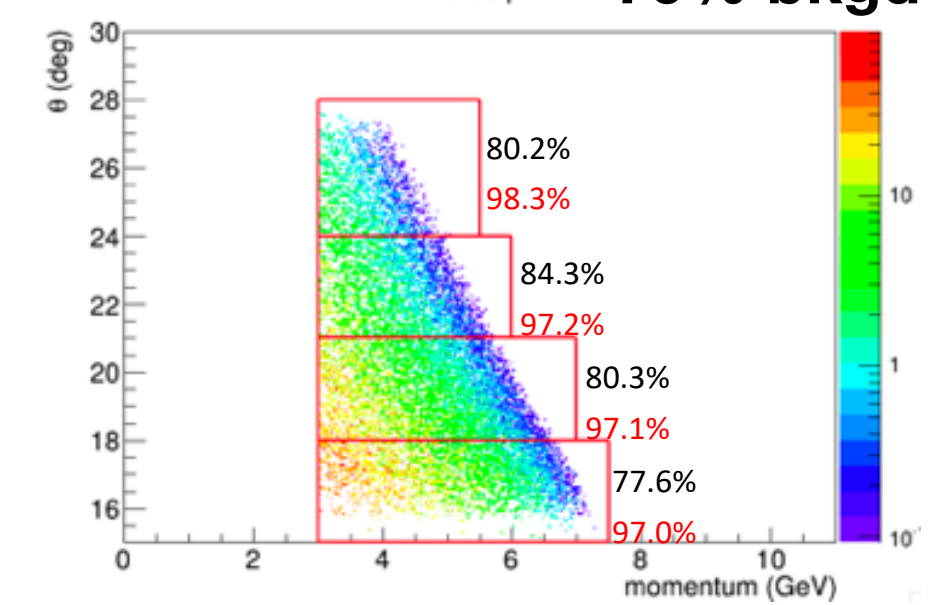
100% bkgd



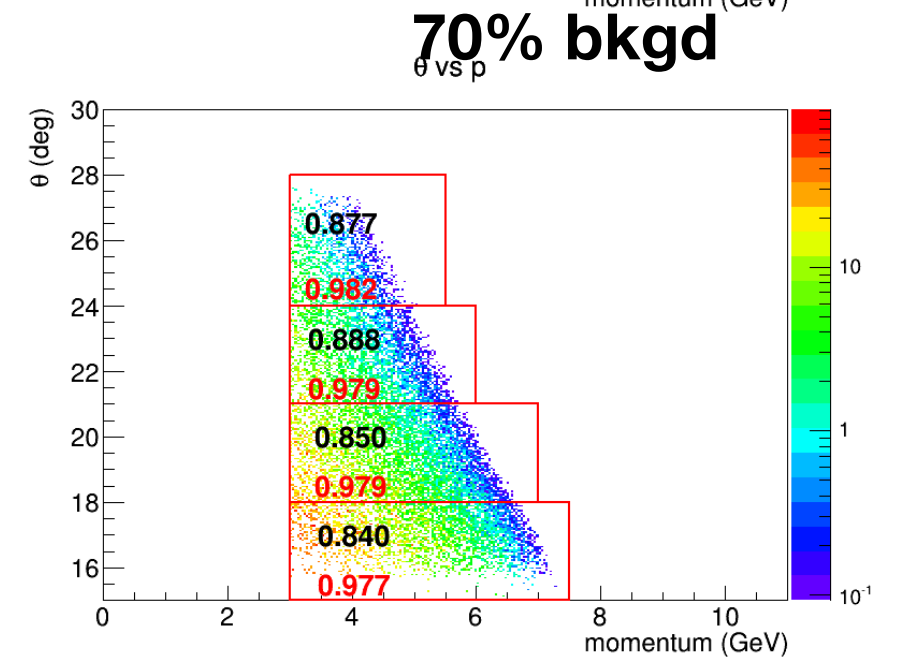
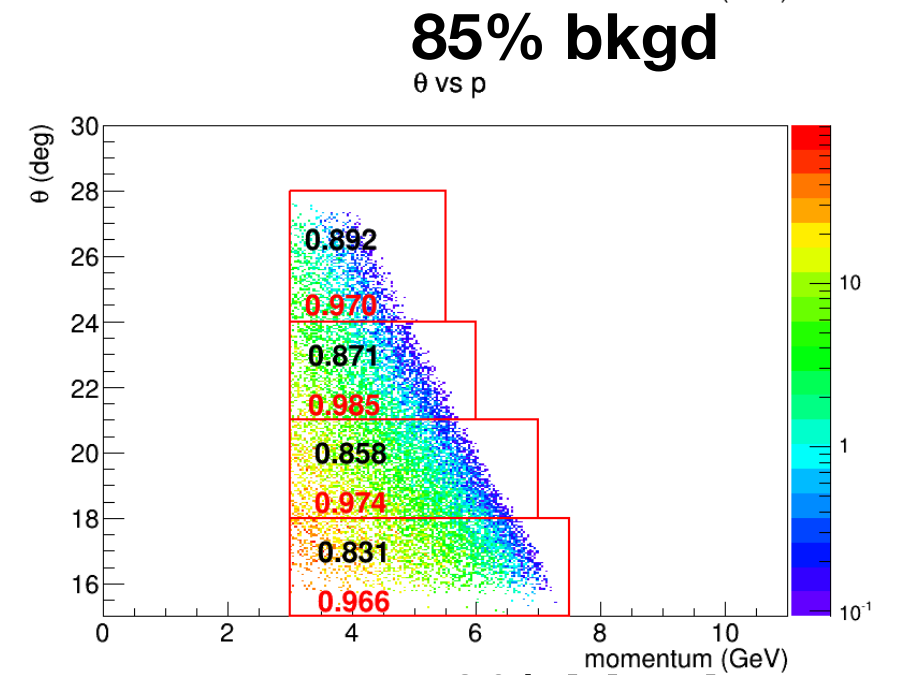
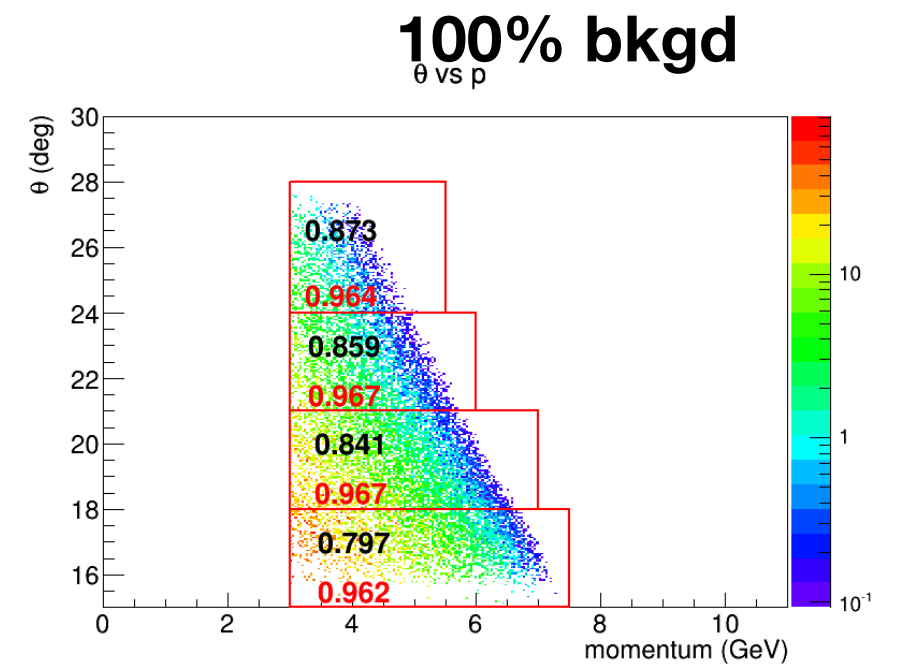
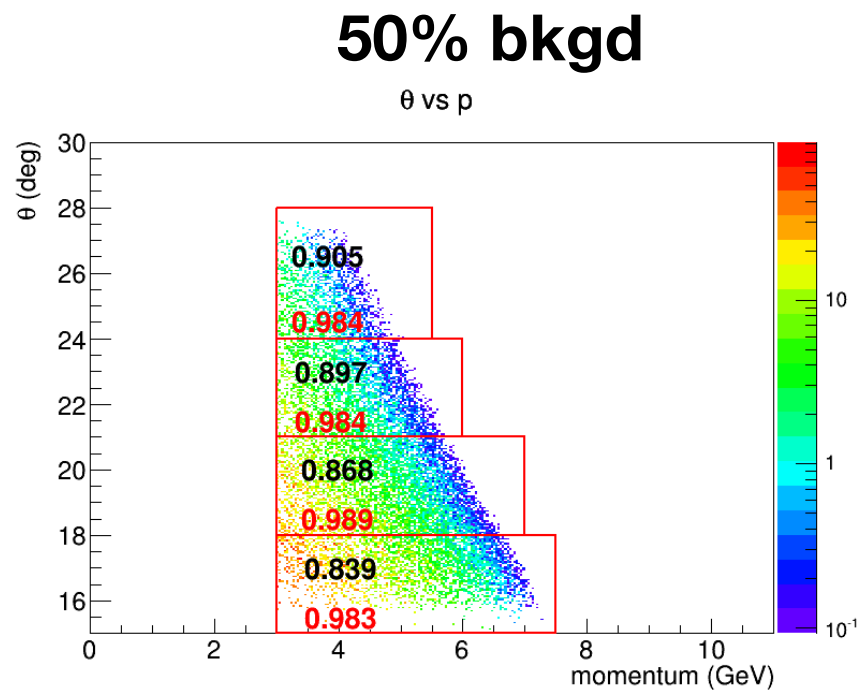
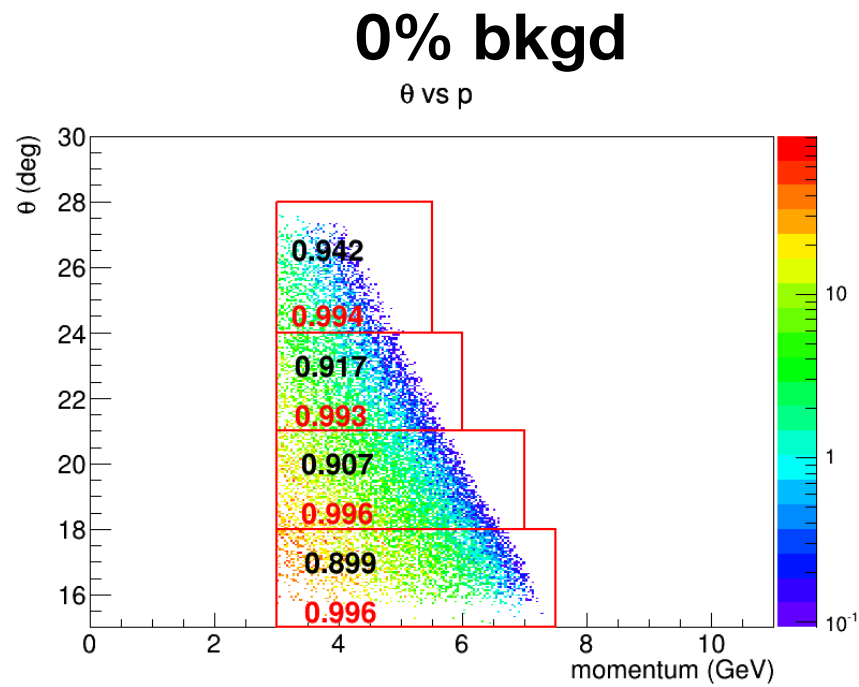
85% bkgd



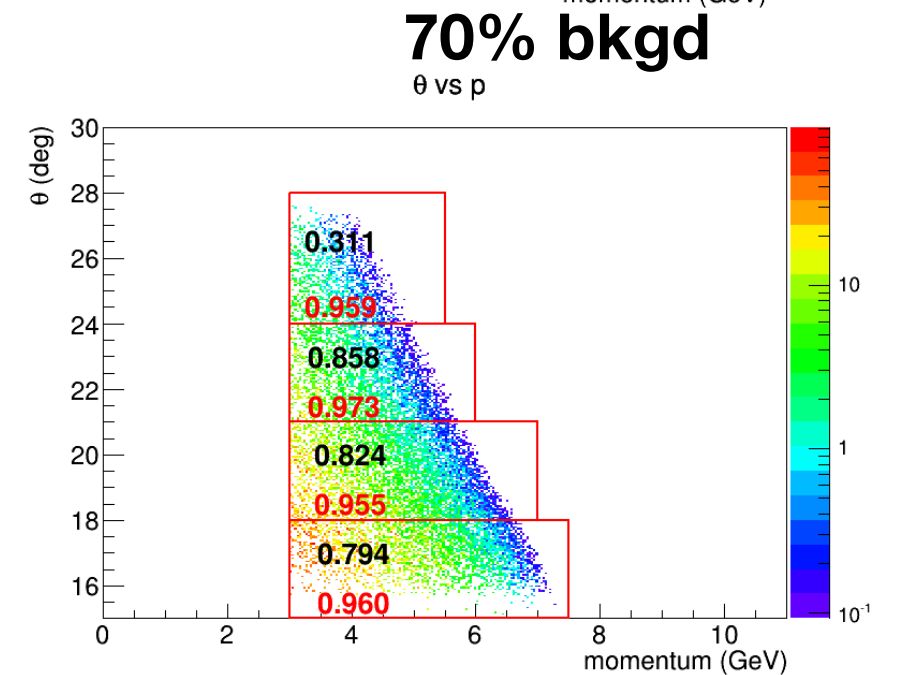
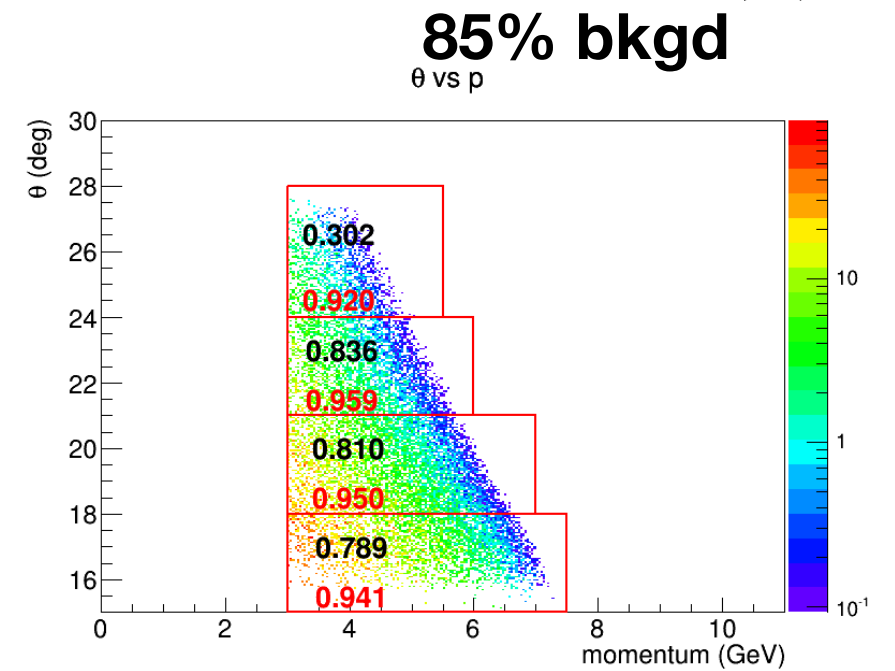
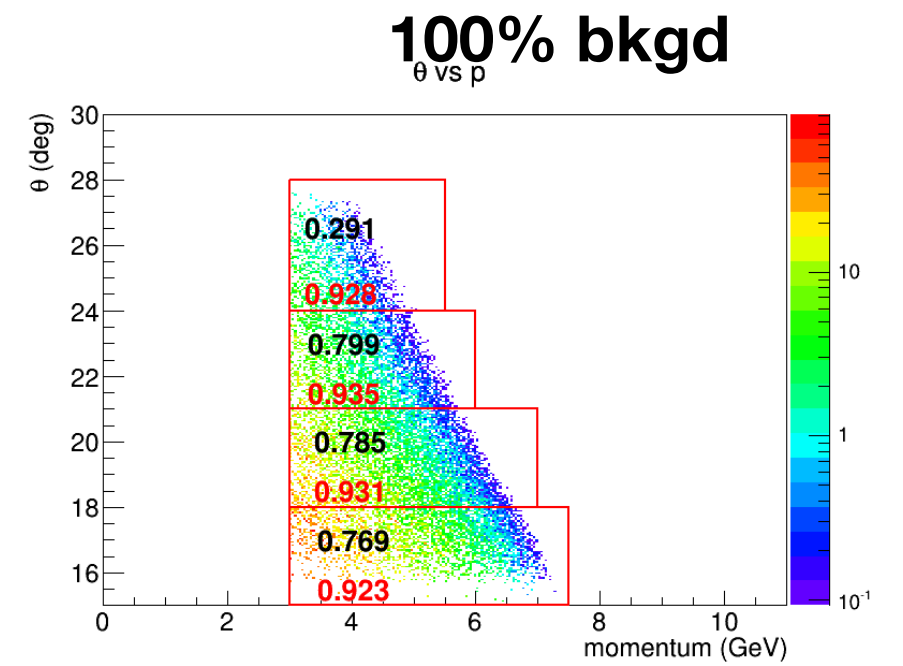
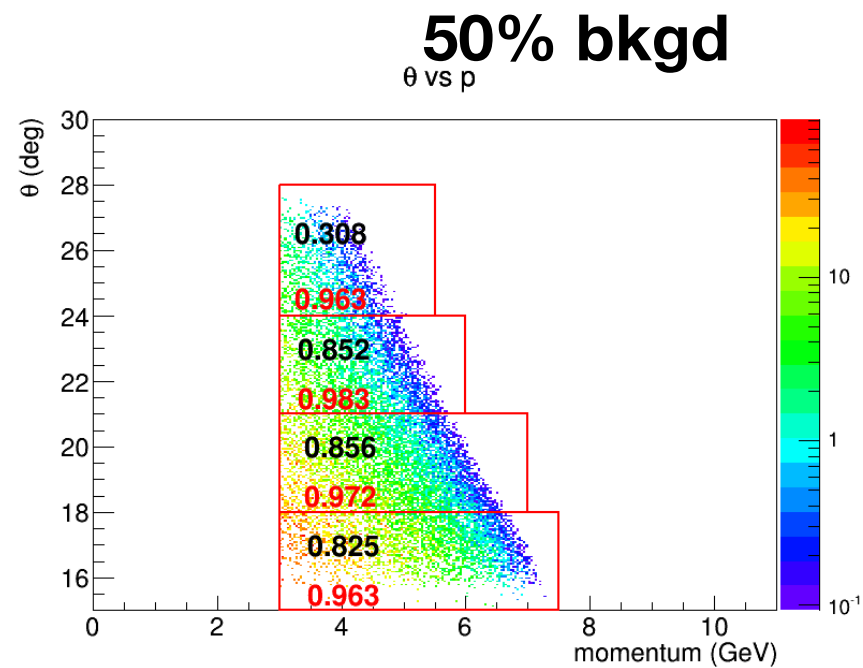
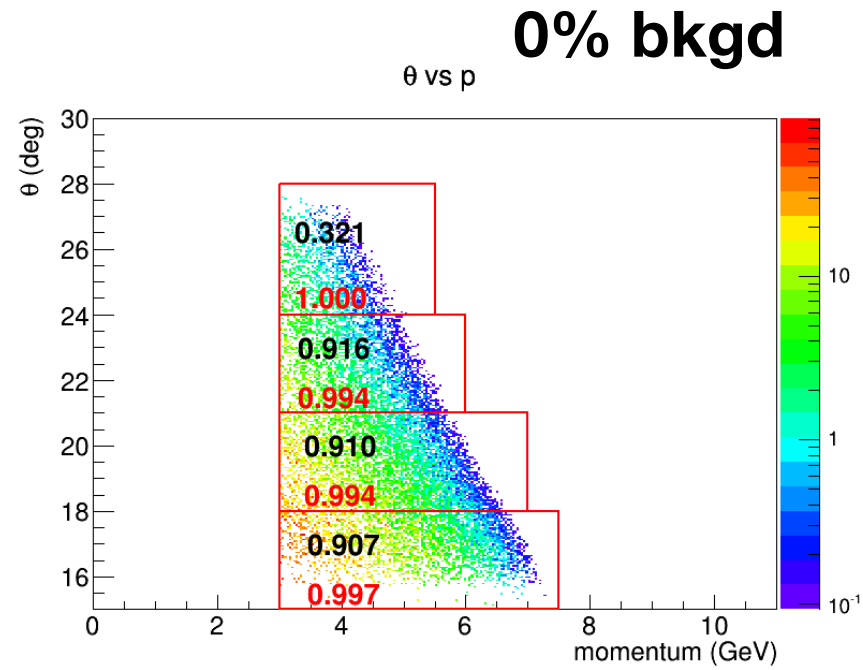
70% bkgd



Large angle ex.GEM2



Large angle ex.GEM3



Summary

- Efficiency decreases with 1 layer GEM disabled; especially for large angle (4 layers@baseline)
- No significant impact on resolution from simple Gaussian fit.