PVDIS BAFFLES AND PHOTON BACKGROUND

Rich Holmes

Aug 19 2013 SoLID Collaboration Meeting

PHOTON BACKGROUND AT LAST GEM AND ECAL

5E6 e^- into target

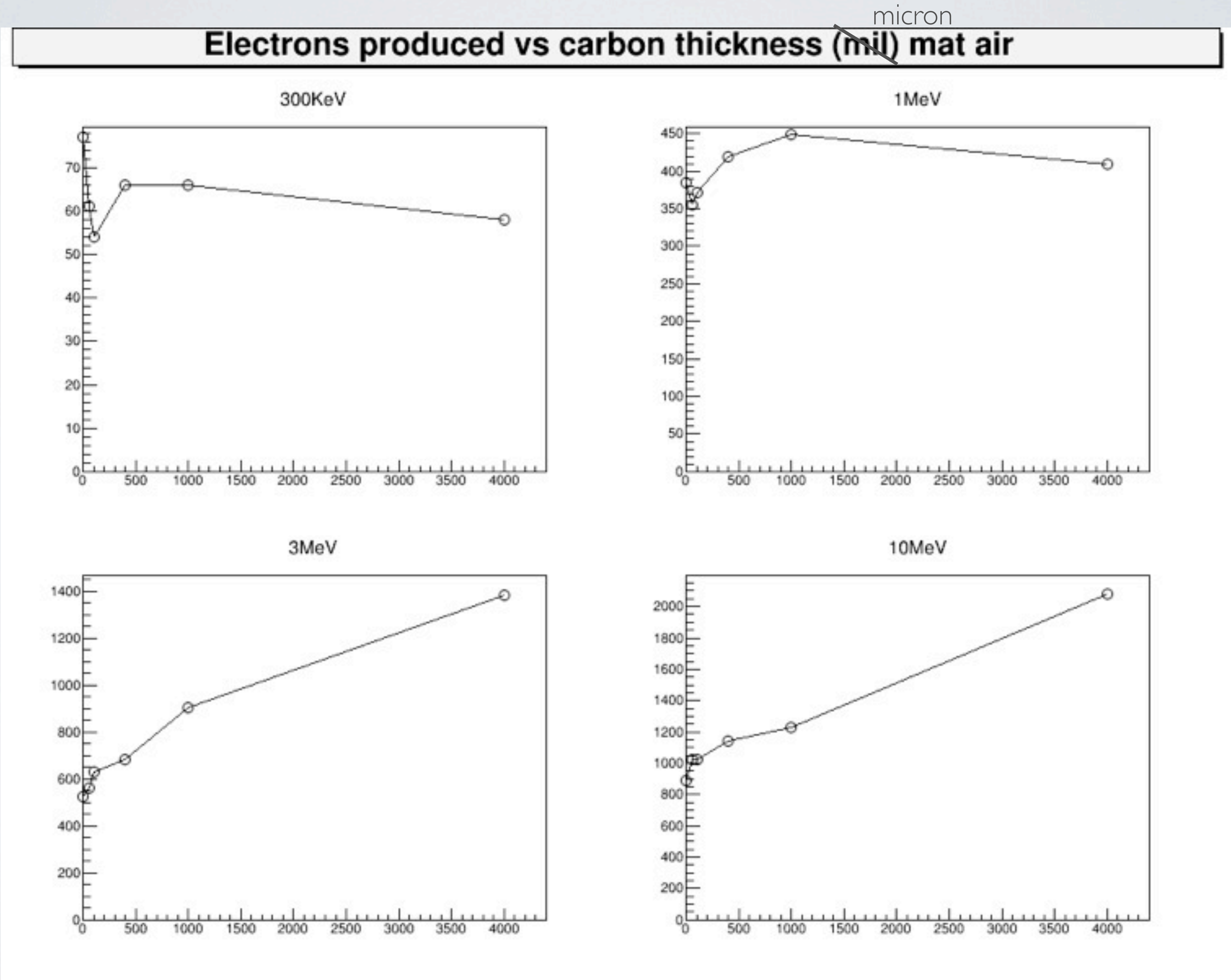
Real baffles & beamline

	gamma (all)	gamma (targ)	e-	eff (%)
Plane 1	34483	18488	307	0.89
Plane 2	15619	6846	193	1.2
Plane 3	9820	5046	120	1.2
Plane 4	9399	4822	103	1.1

Krypt baffles & beamline

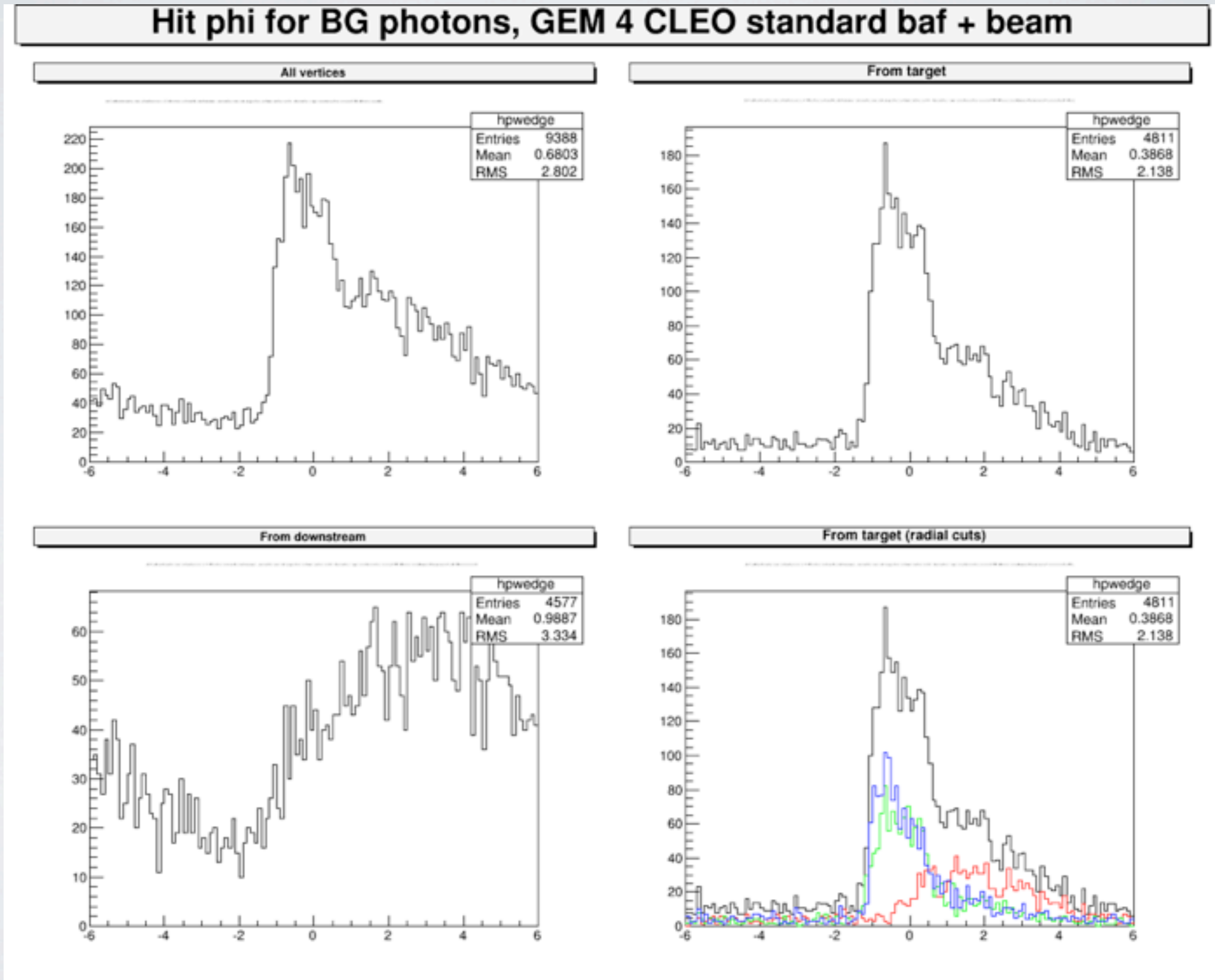
	gamma (all)	gamma (targ)	e-	eff (%)
Plane 1	15965	15495	91	0.57
Plane 2	4635	4566	25	0.54
Plane 3	3436	3401	15	0.44
Plane 4	3314	3281	15	0.45

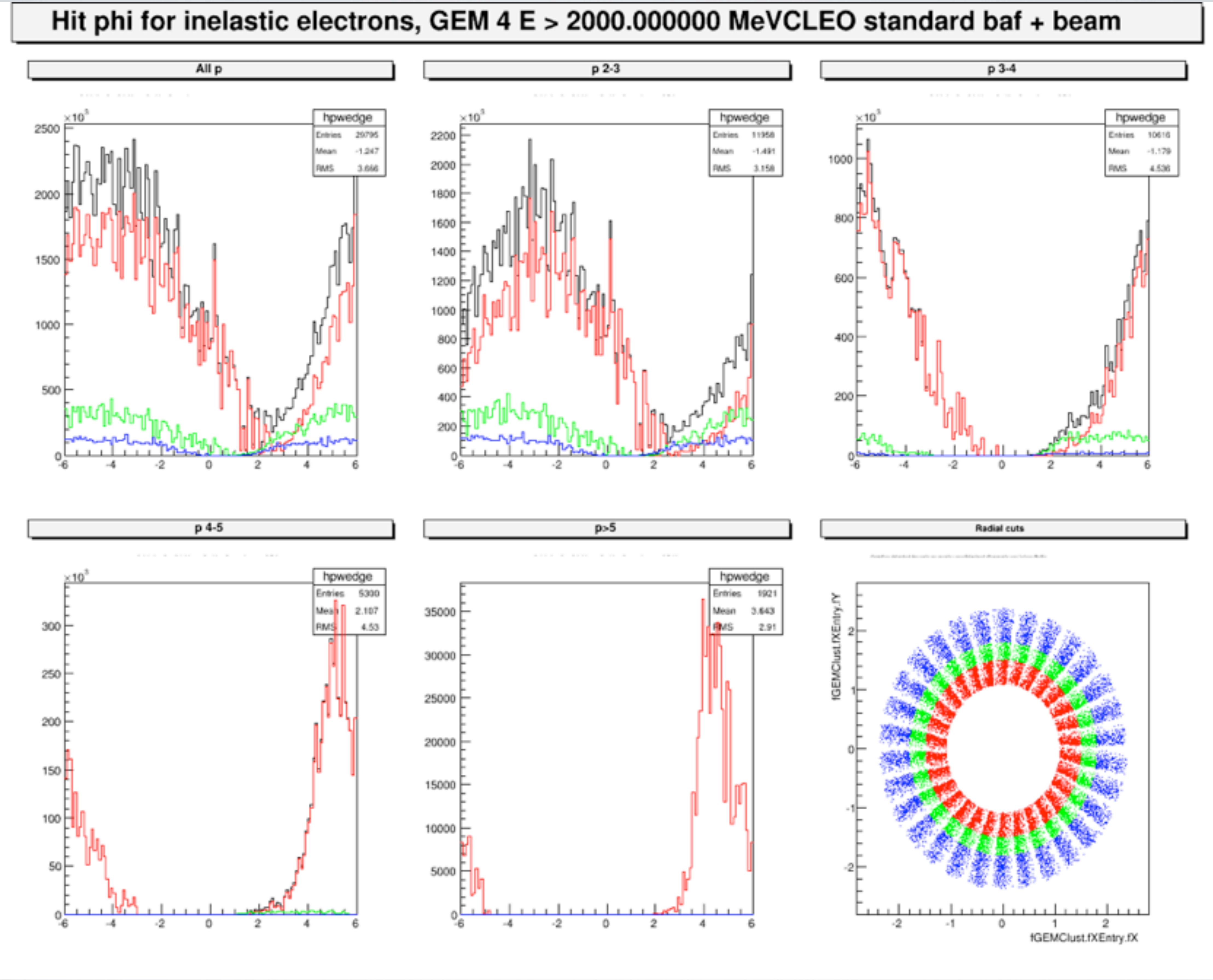
50K γ DIRECTLY INTO GEM WITH CARBON IN FRONT



- Look at numbers of photons crossing the 4th GEM plane
- Where are these photons produced? Look at vertex positions
- Since last collaboration meeting: Now using CLEO baffles and more complete apparatus

ϕ DISTRIBUTION RELATIVE TO SEGMENT CENTER



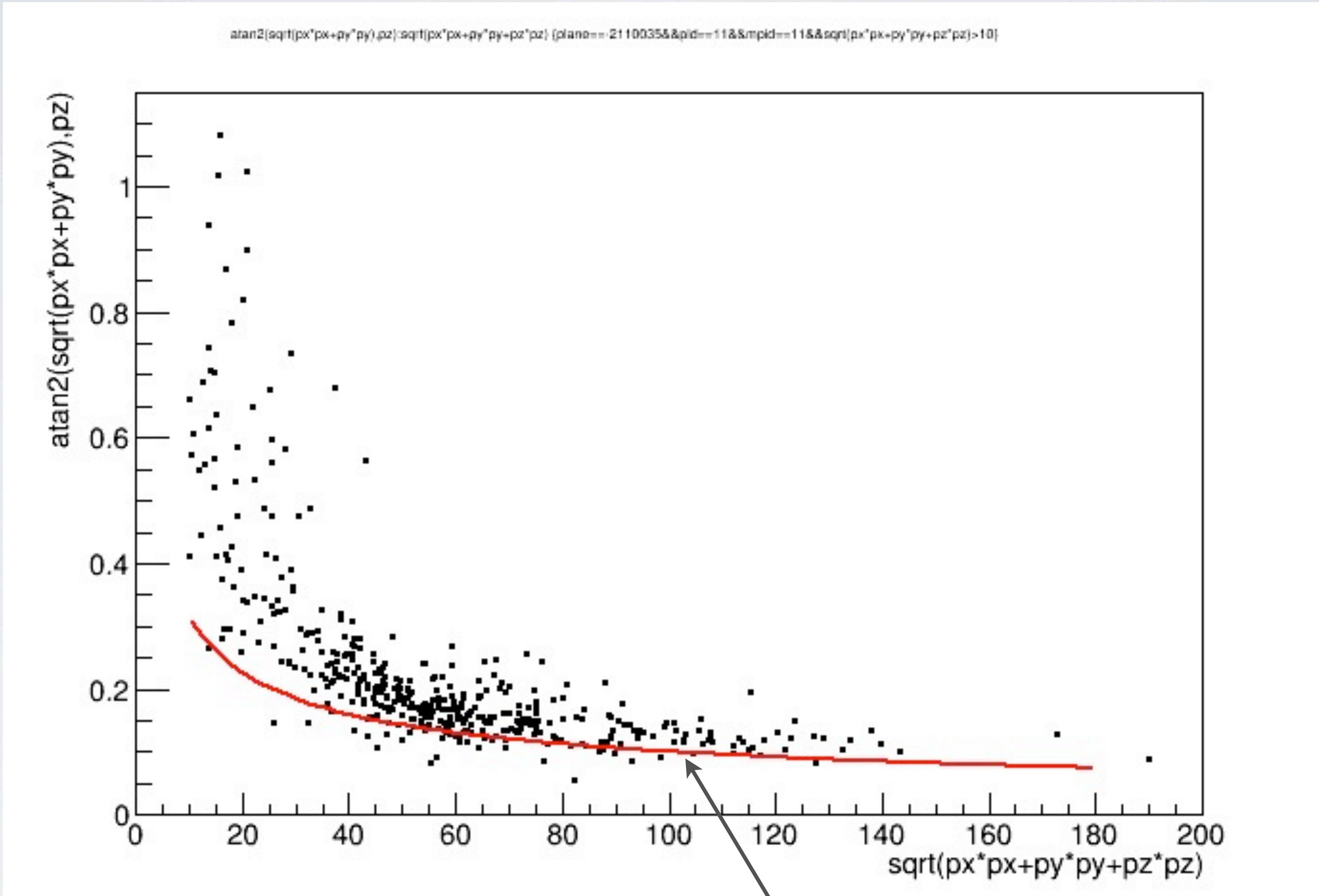


Hit phi for inelastic electrons, GEM 4 E > 2000.000000 MeVCLEO standard baf + beam
All p
p 2-3
p 3-4
p 4-5
p>5
Radial cuts
hpwedge
Entries 29795
Mean -1.247
RMS 3.666
Entries 11958
Mean -1.491
RMS 3.158
Entries 10616
Mean -1.179
RMS 4.536
Entries 5390
Mean 2.107
RMS 4.53
Entries 1921
Mean 3.643
RMS 2.91
fGEMClust.fXEntry.fY
fGEMClust.fXEntry.fX

PRODUCTION OF BACKGROUND PHOTONS IN FIRST BAFFLE AND BEAM PIPE

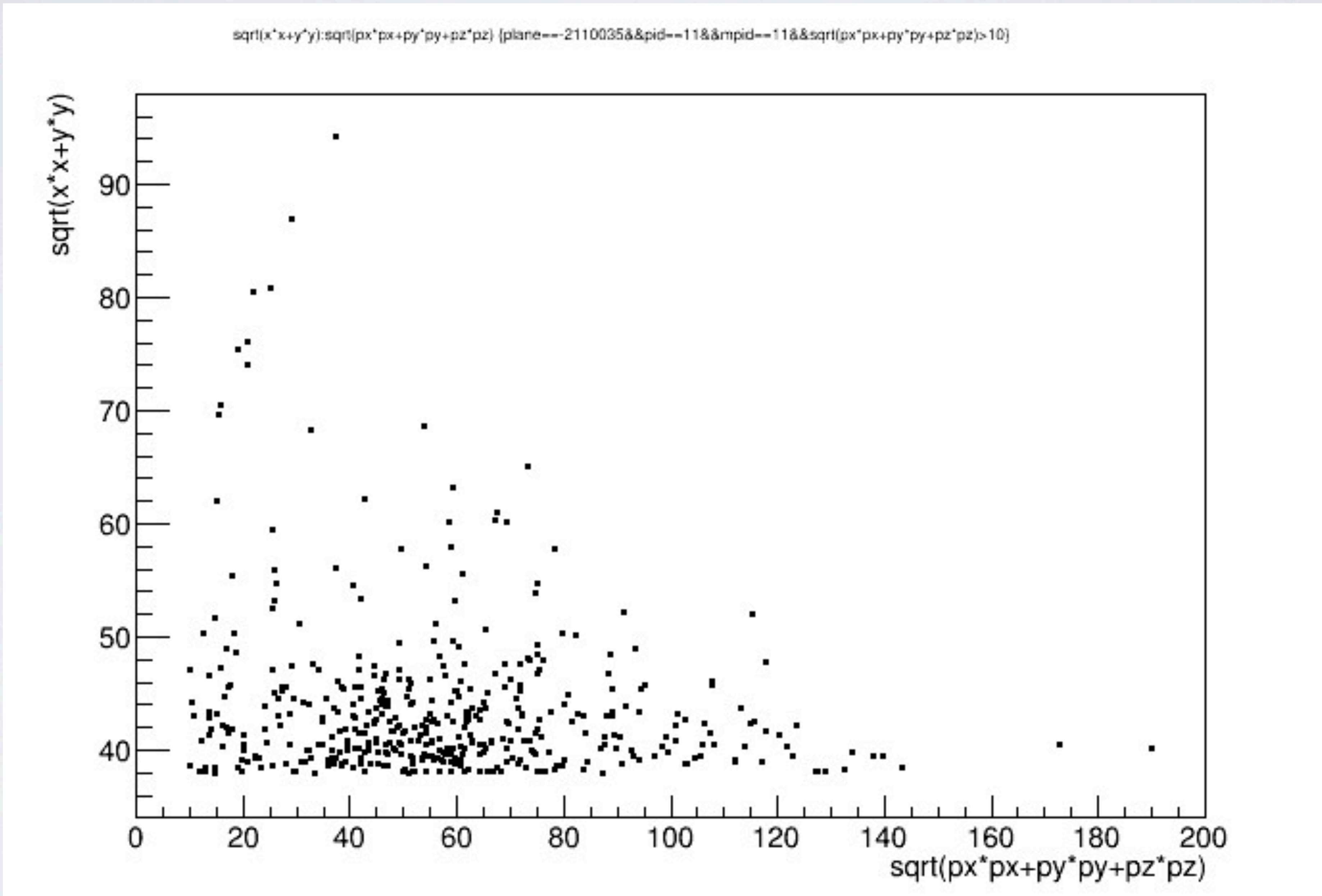
Virtual detector placed just upstream of first baffle

POLAR ANGLE VS MOMENTUM



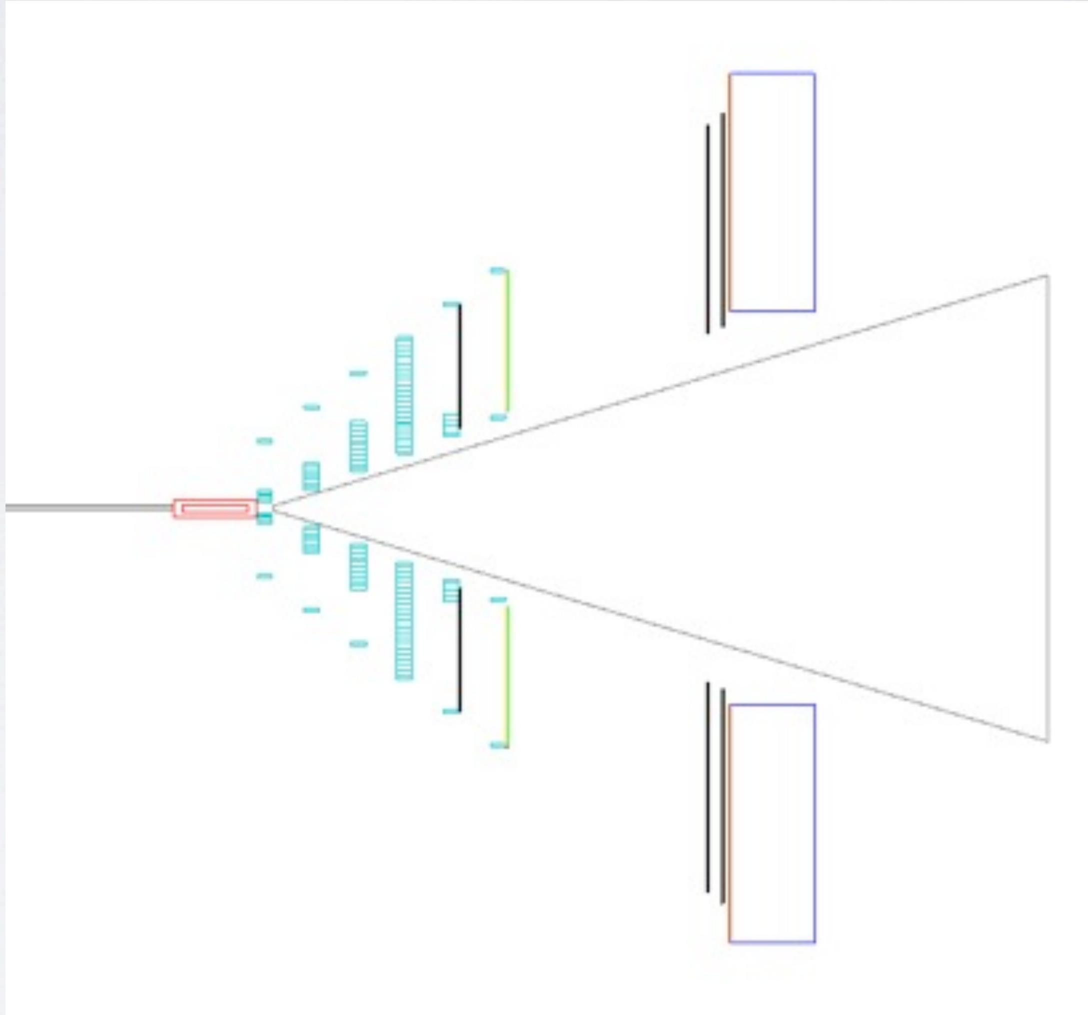
Moller $\theta = \sqrt{(2m_e(1/E' - 1/E_{beam}))}$

RADIAL POSITION VERSUS MOMENTUM

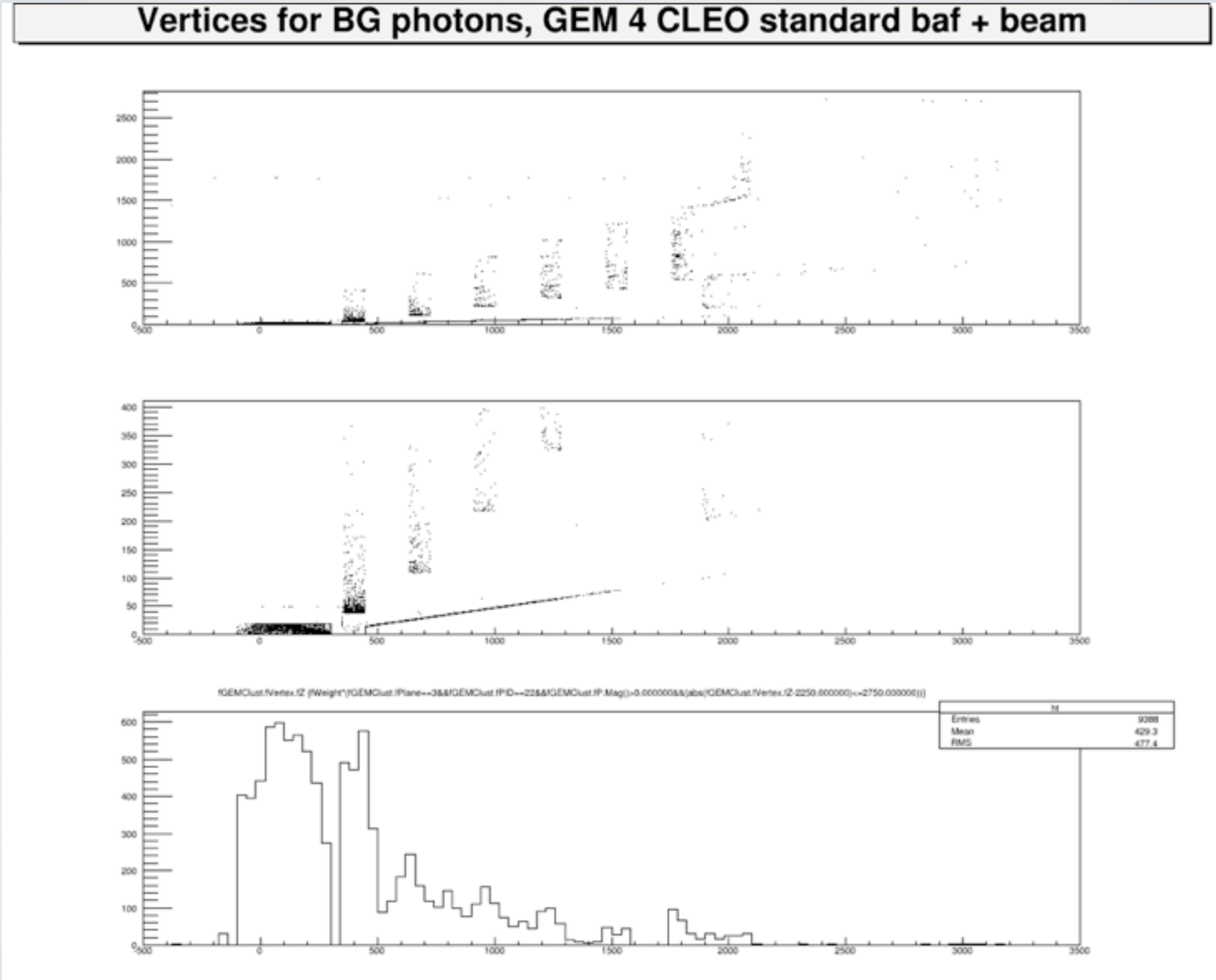


REDUCING MOLLERS IN BEAMLINE, BAFFLE

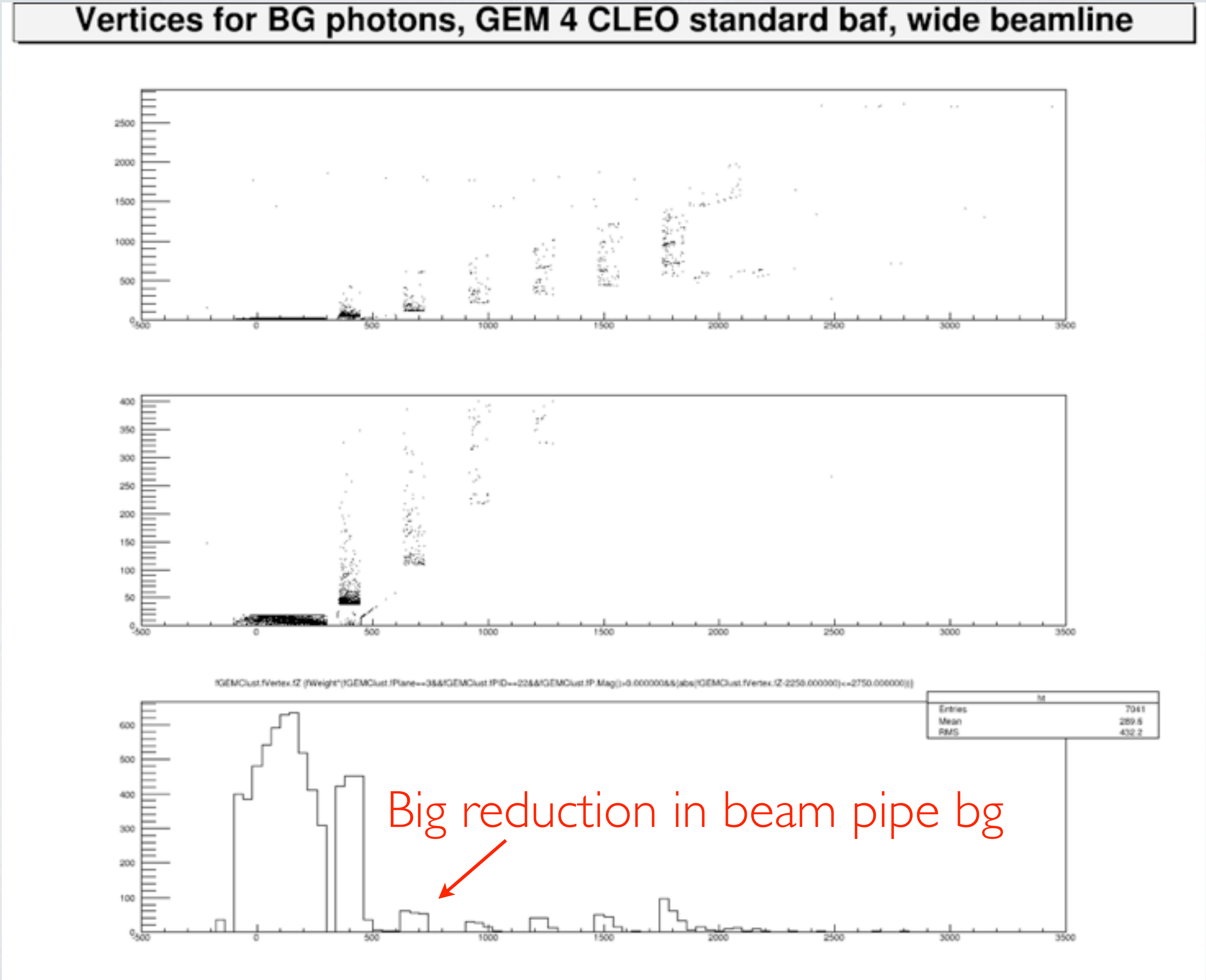
- Wider beamline
- Larger aperture in first baffle



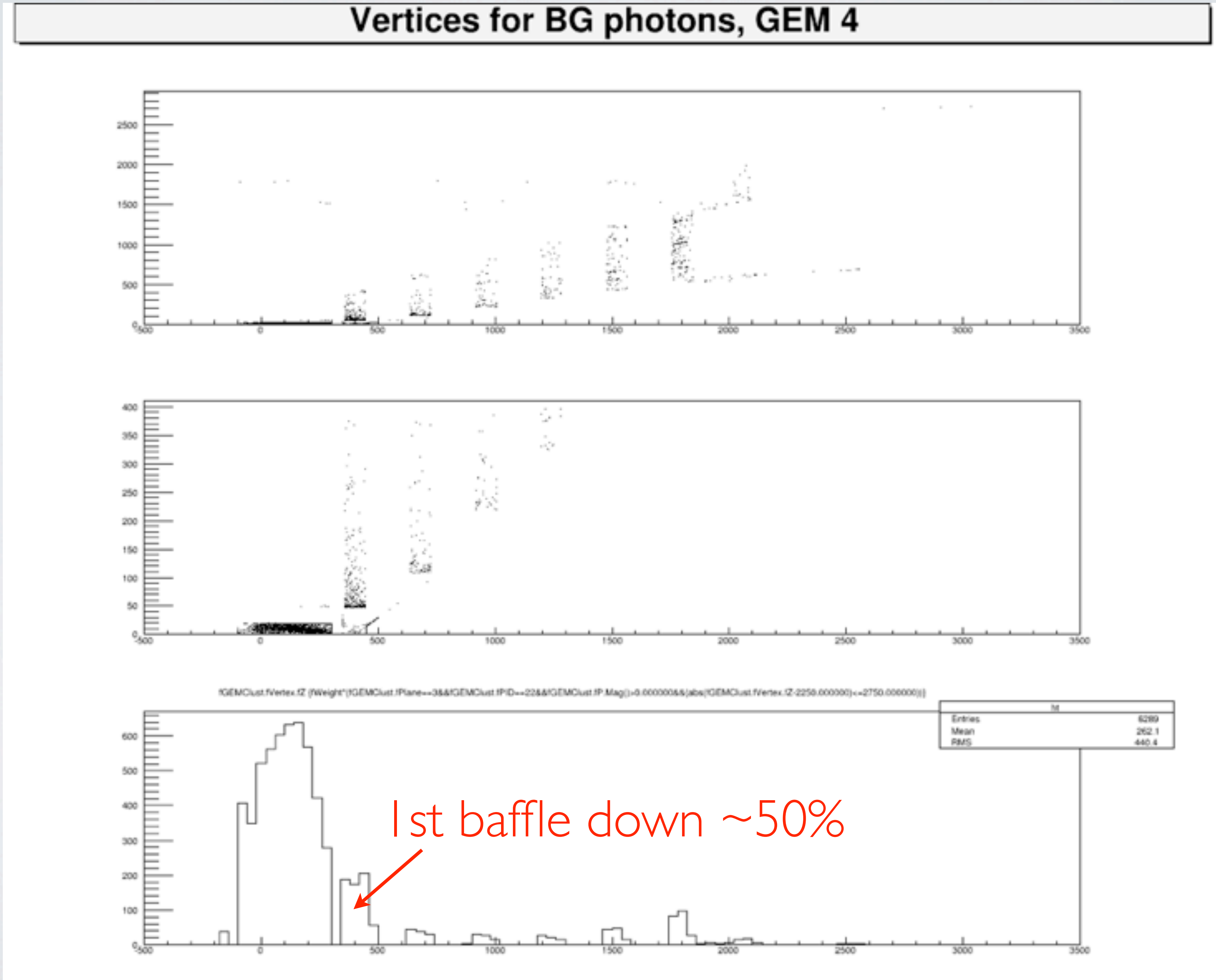
STANDARD CLEO BEAMLINE AND BAFFLES — 4 cm APERTURE



WIDE (ALUMINUM) BEAMLINE, STANDARD BAFFLES — 4 cm APERTURE



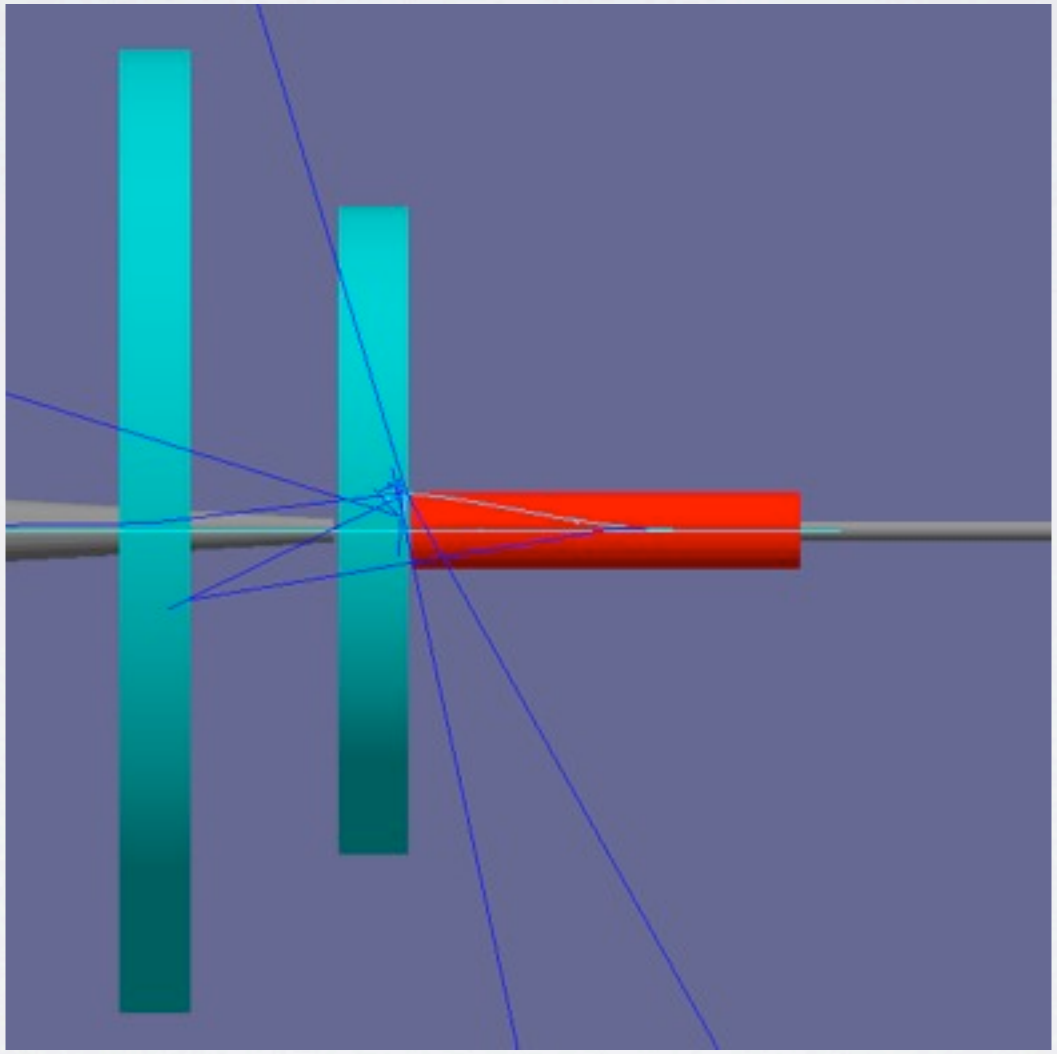
WIDE (ALUMINUM) BEAMLINE, STANDARD BAFFLES — 5 cm APERTURE



- Increasing 1st baffle aperture reduced bg from Mollers
- Reduction NOT as much as expected
- Is there something else going on? Look at individual events.

CATEGORIES OF EVENTS WITH VERTEX IN FIRST BAFFLE

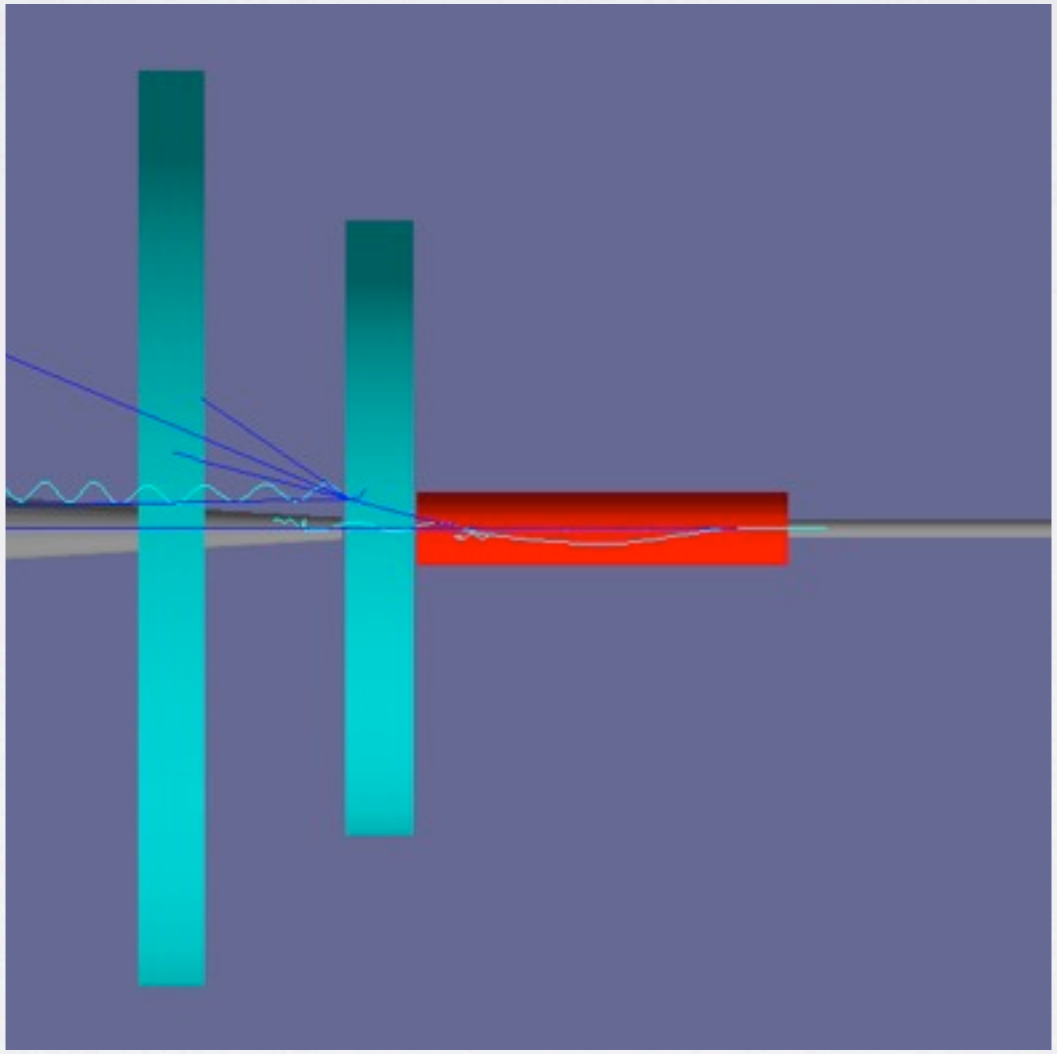
- "External" Moller — creates photon in baffle (13 events for 500k e^- on target)



Optimized baffle design should get rid of most of these.

CATEGORIES OF EVENTS WITH VERTEX IN FIRST BAFFLE

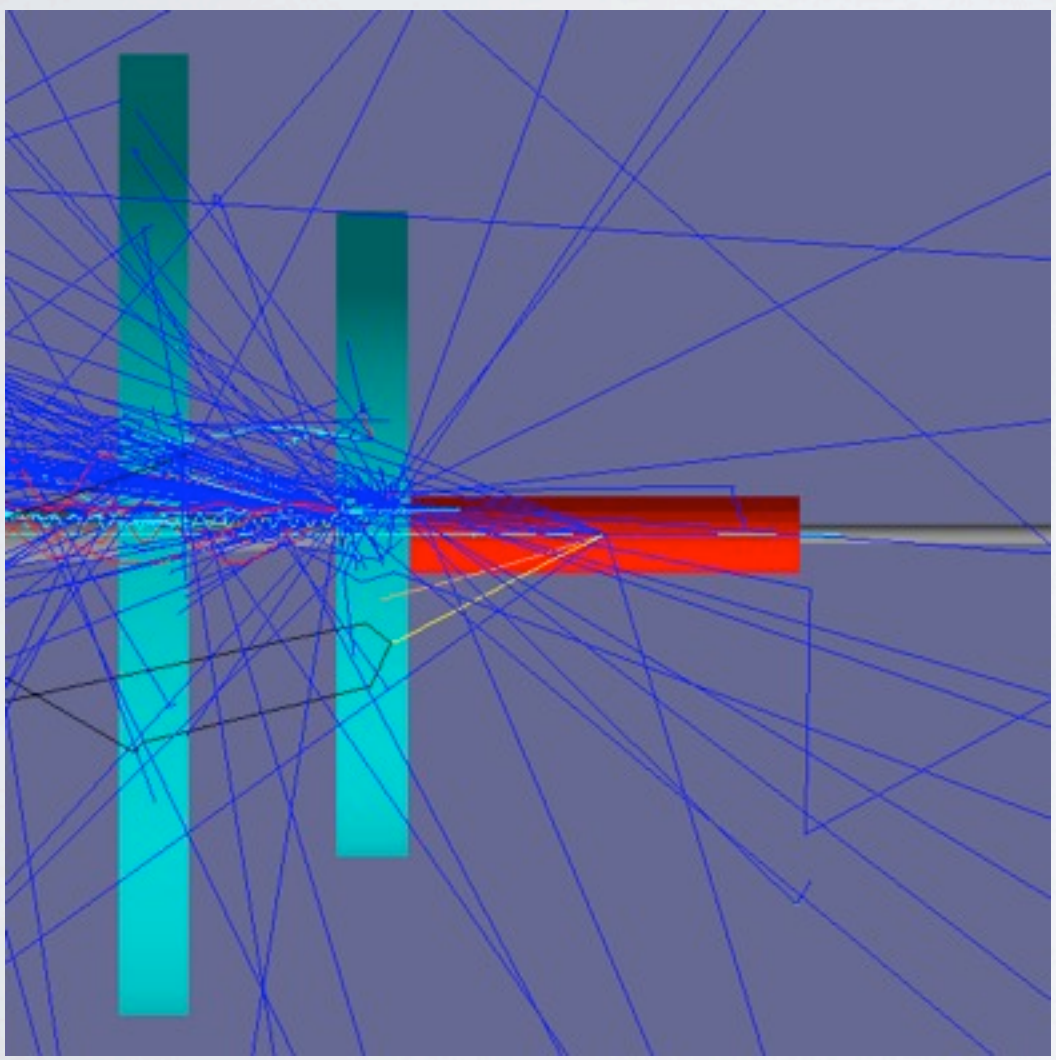
- "Internal" Moller — creates photon in target which interacts in baffle (6 events for 500k e^- on target)

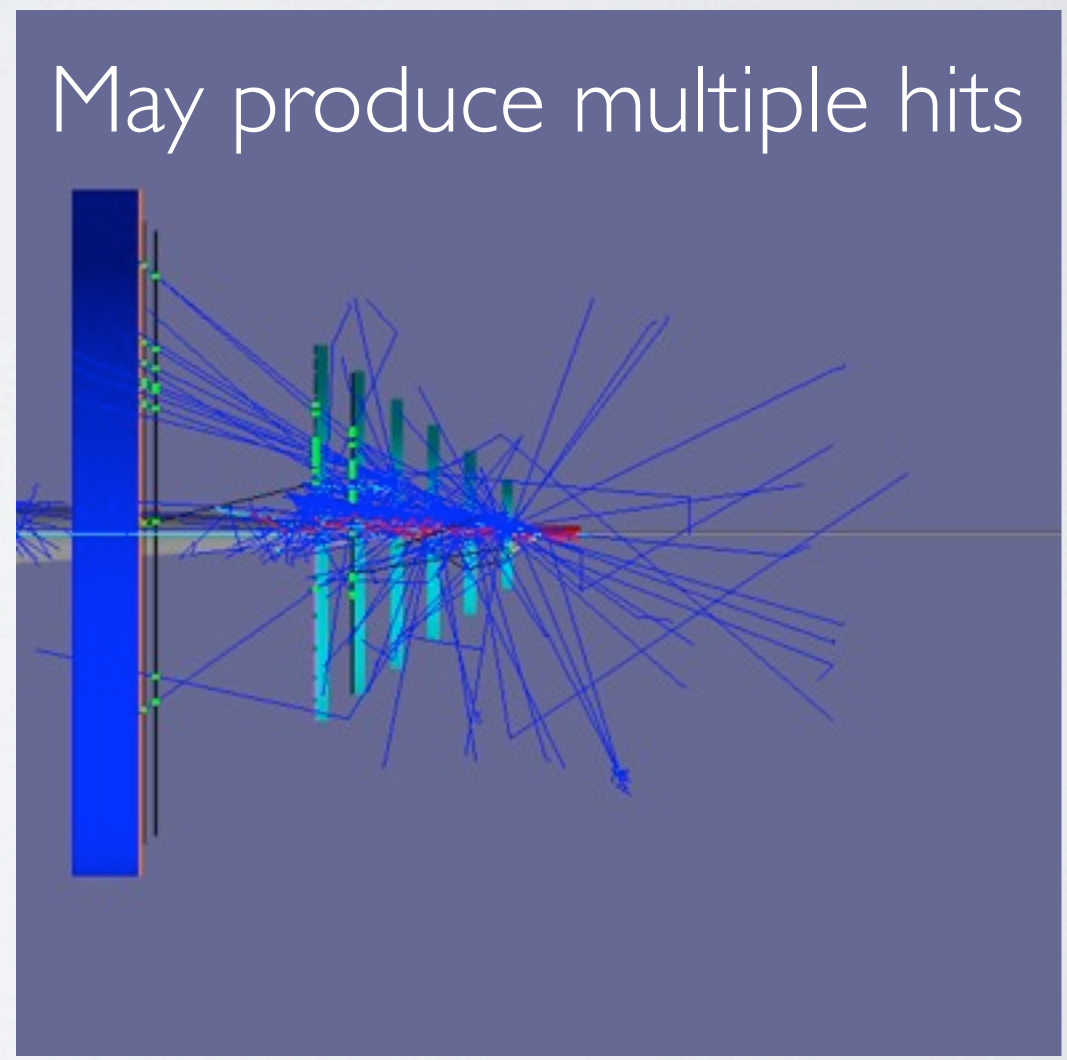


Can't eliminate these, but target length, diameter, and wall construction will affect.

CATEGORIES OF EVENTS WITH VERTEX IN FIRST BAFFLE

- Hadronic interaction in target (6 events for 500k e^- on target)





Entirely separate optimization issues

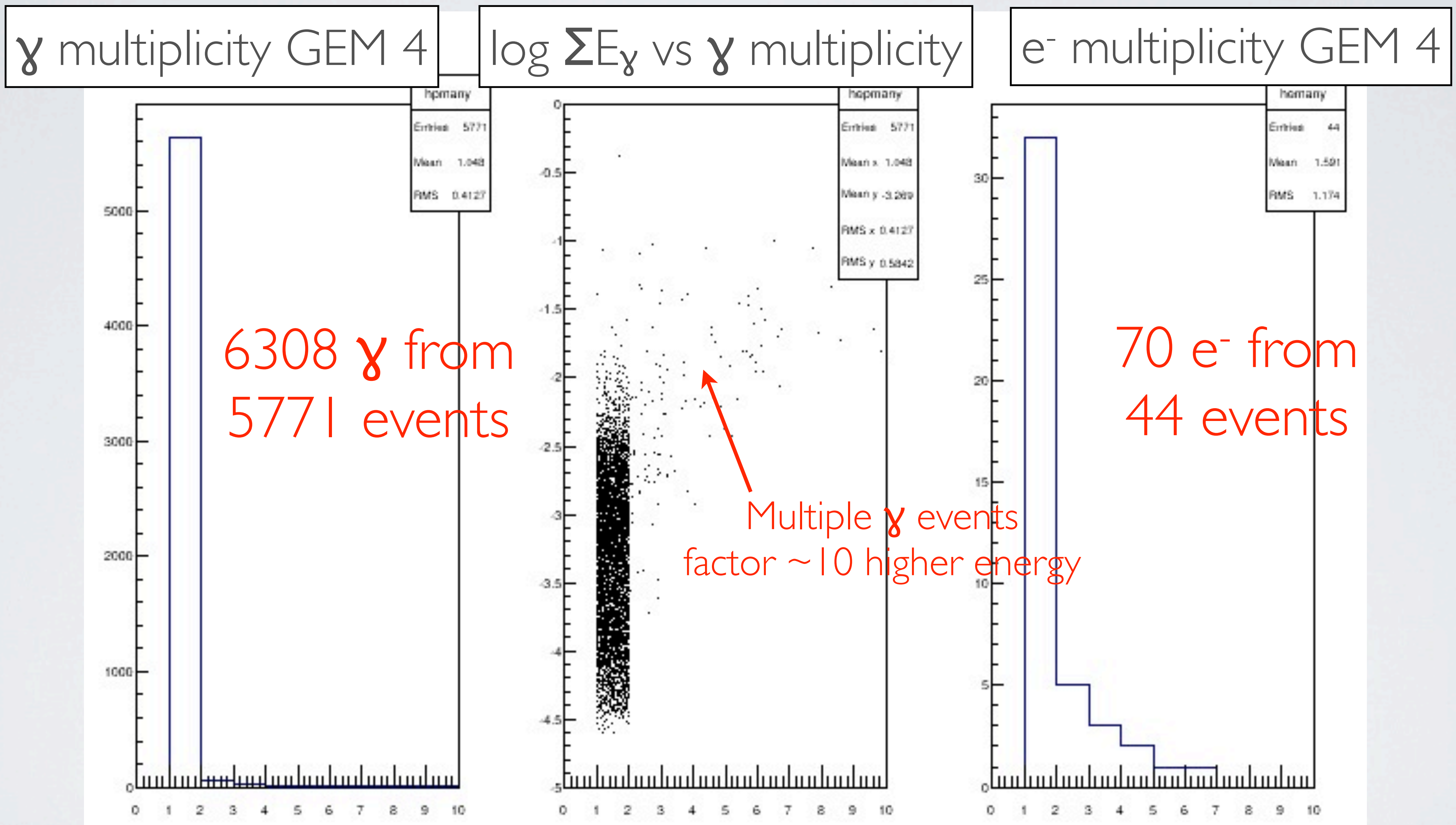
EFFECT ON STATISTICS

- We've looked at numbers of gammas and electrons per run, e.g.:

	gamma (all)	gamma (targ)	e-	eff (%)
Plane 1	20611	17687	177	0.86
Plane 2	9031	6738	91	1
Plane 3	6580	5238	64	0.97
Plane 4	6308	5024	70	1.1

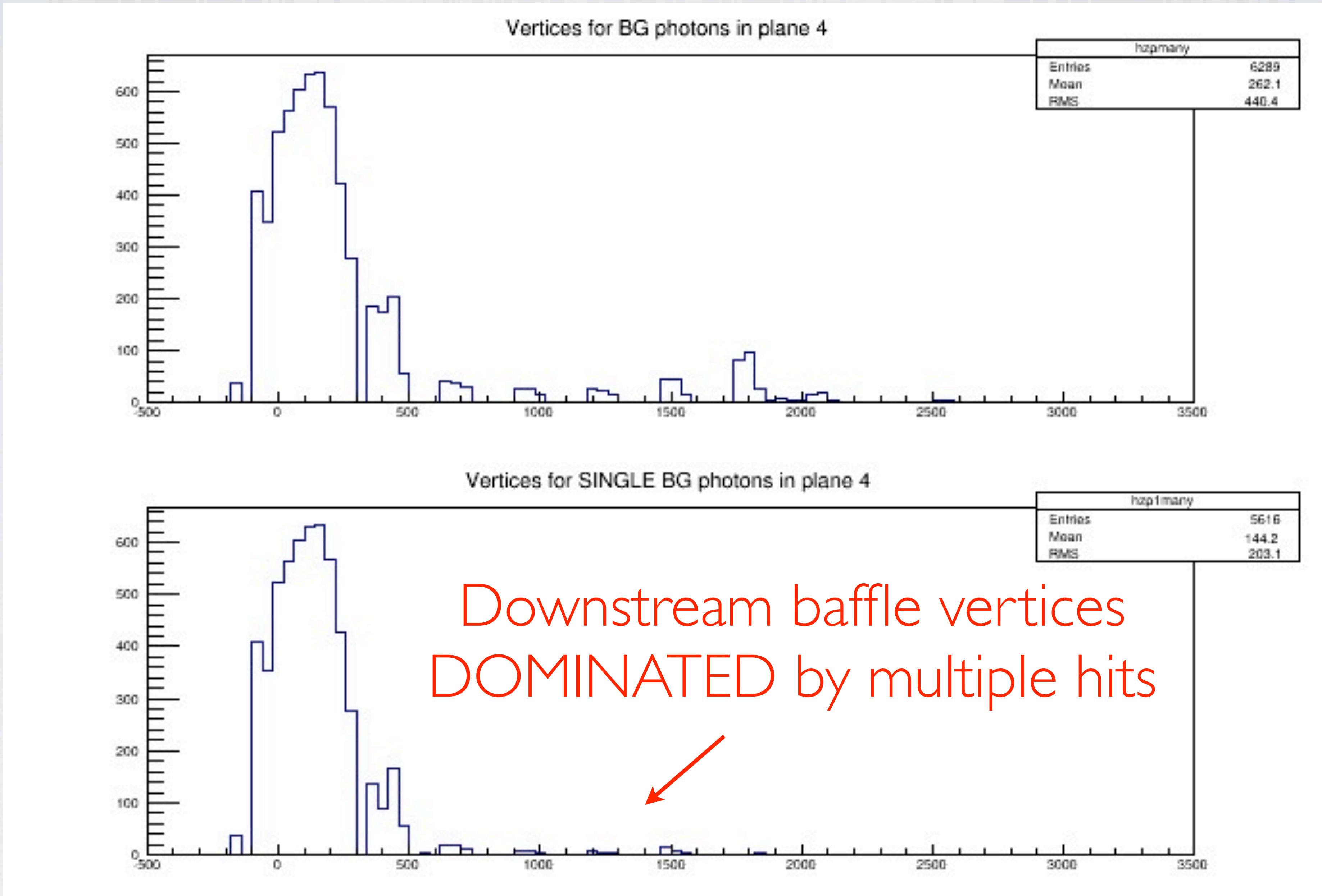
- But this counts multiple hits in one event

γ AND e^- MULTIPLICITIES



Presumably depends on what's in the physics list...

γ MULTIPLICITIES



60 events of 500000 e^- on target w/ vertices downstream: 35 hadronics, 18 external mollers (beam pipe), 6 internal mollers, 1 other (bremsstrahlung)

CONCLUSIONS

- Baffles, beam line, shielding need to be optimized to stay out of Moller region
- Consider shortening target to reduce internal Mollers
- Significant background from hadronic events — How well can we model this?

γ BG AND e- EFFICIENCY

Real baffles & beamline

	gamma (all)	gamma (targ)	e-	eff (%)
Plane 1	34483	18488	307	0.89
Plane 2	15619	6846	193	1.2
Plane 3	9820	5046	120	1.2
Plane 4	9399	4822	103	1.1

Krypt baffles, real beamline

	gamma (all)	gamma (targ)	e-	eff (%)
Plane 1	24514	15849	99	0.4
Plane 2	8798	4919	59	0.67
Plane 3	5024	3550	36	0.72
Plane 4	4793	3418	32	0.67

Real baffles, krypt beamline

	gamma (all)	gamma (targ)	e-	eff (%)
Plane 1	19947	15831	129	0.65
Plane 2	8725	5866	119	1.4
Plane 4	5396	3912	58	1.1

Real baffles, real wide beamline

	gamma (all)	gamma (targ)	e-	eff (%)
Plane 1	22775	17814	228	1
Plane 2	10075	6479	114	1.1
Plane 3	7363	5152	69	0.94
Plane 4	7068	4944	76	1.1

Real baffles, krypt wide beamline

	gamma (all)	gamma (targ)	e-	eff (%)
Plane 1	21276	17349	166	0.78
Plane 2	9038	6102	132	1.5
Plane 3	6597	4841	40	0.61
Plane 4	6394	4671	64	1

Krypt baffles & beamline

	gamma (all)	gamma (targ)	e-	eff (%)
Plane 1	15965	15495	91	0.57
Plane 2	4635	4566	25	0.54
Plane 3	3436	3401	15	0.44
Plane 4	3314	3281	15	0.45

Real baffles, no inner ring, real wide beamline

	gamma (all)	gamma (targ)	e-	eff (%)
Plane 1	22702	18505	192	0.85
Plane 2	9733	6711	106	1.1
Plane 3	7156	5359	67	0.94
Plane 4	6869	5117	75	1.1

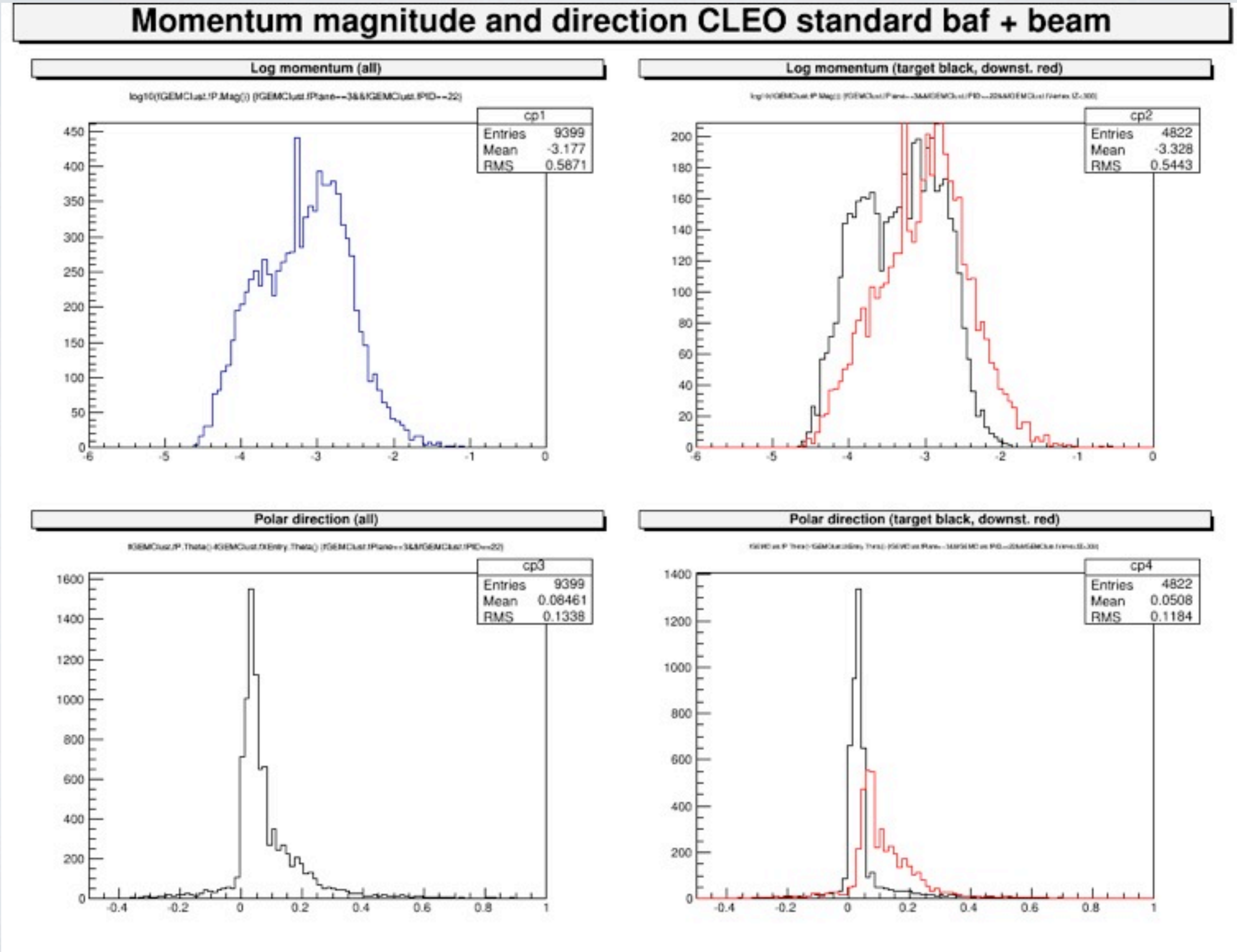
Krypt 1st baffle, no inner ring, real wide beamline

	gamma (all)	gamma (targ)	e-	eff (%)
Plane 1	19377	17557	191	0.99
Plane 2	7474	6116	101	1.4
Plane 3	5543	4755	38	0.69
Plane 4	5286	4539	48	0.91

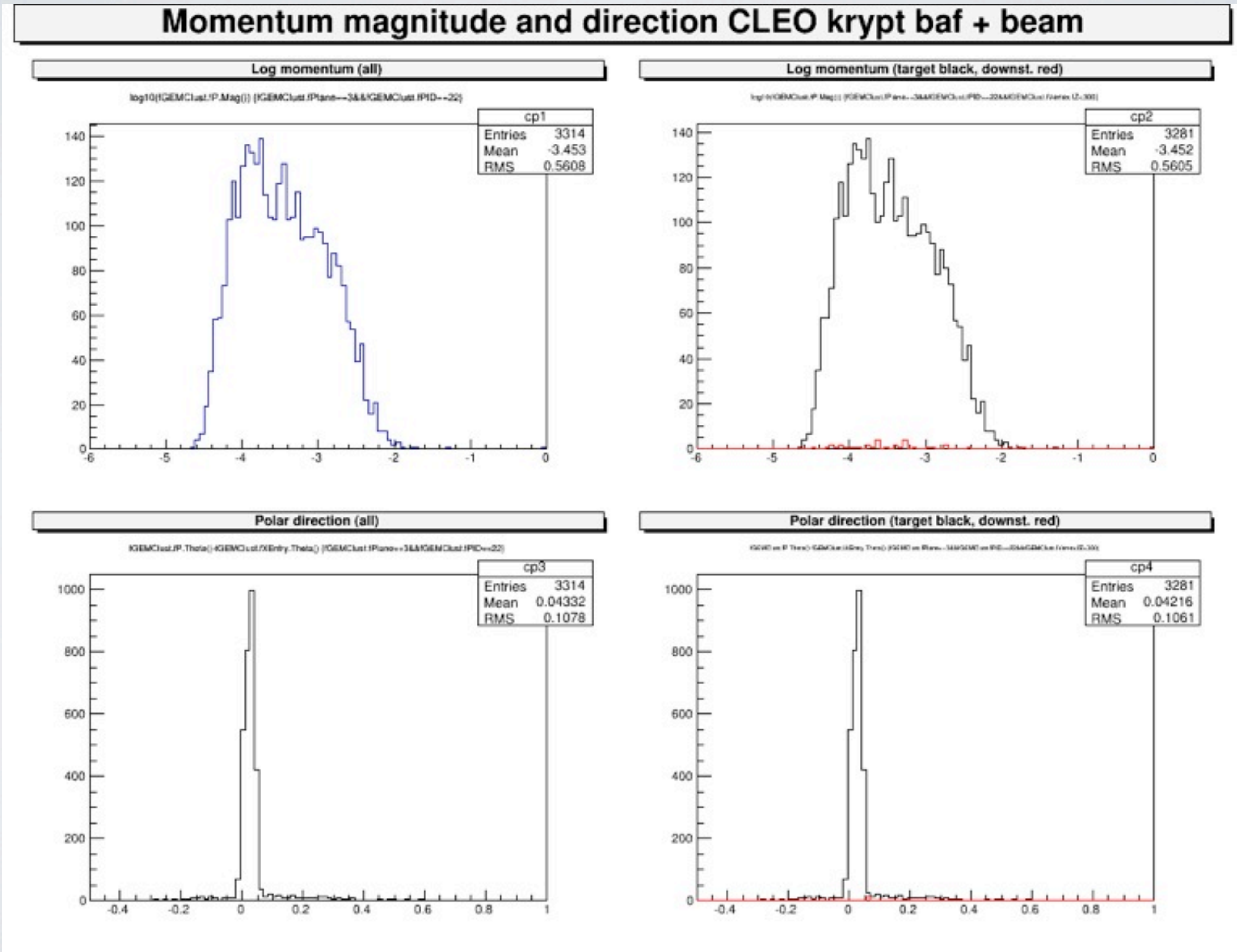
Krypt 1st baffle, no inner ring, tungsten baffles, real wide beamline

	gamma (all)	gamma (targ)	e-	eff (%)
Plane 1	18677	17169	120	0.64
Plane 2	6856	5852	96	1.4
Plane 3	5262	4690	34	0.65
Plane 4	5021	4474	38	0.76

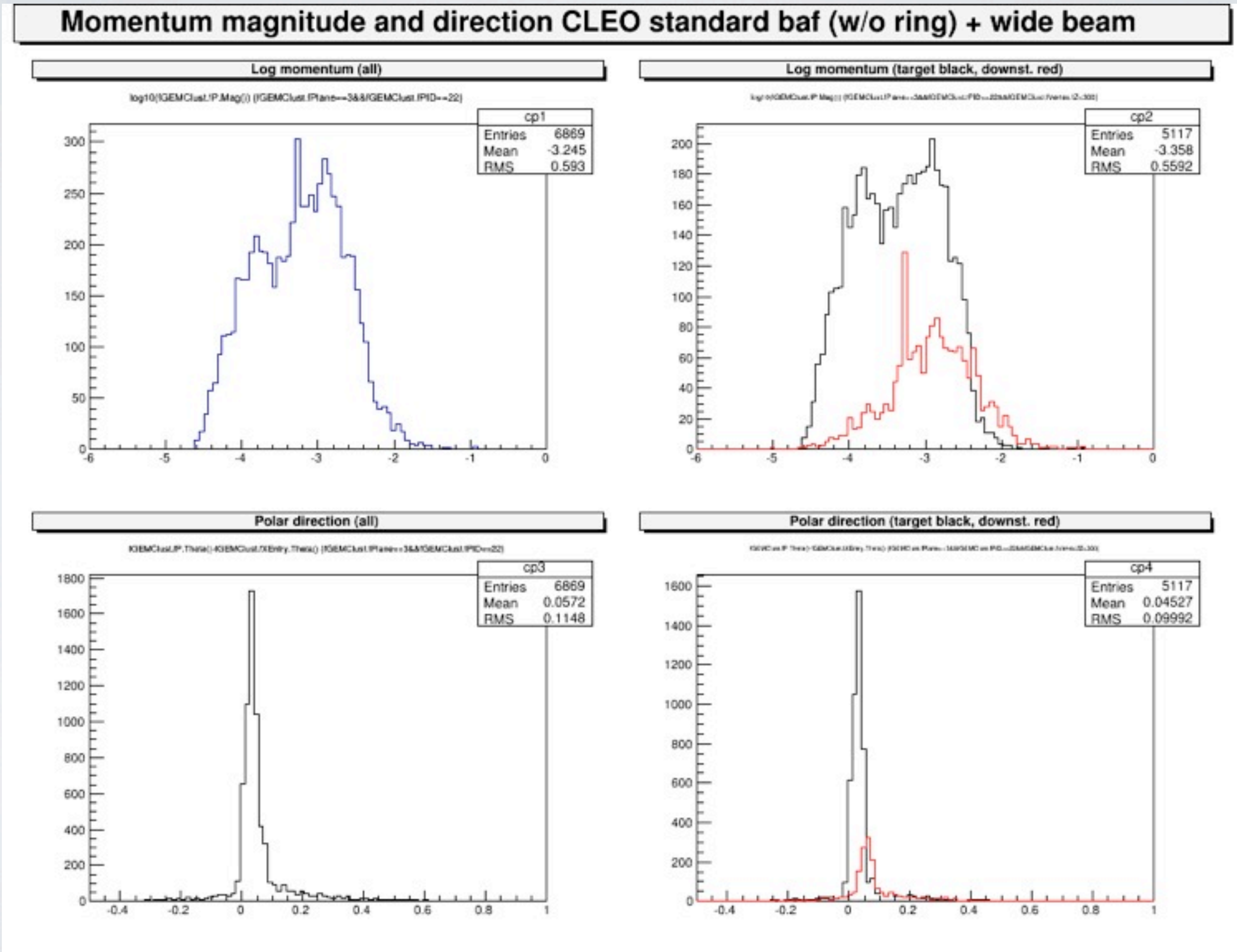
STANDARD CLEO BEAMLINE AND BAFFLES



KRYPTONITE CLEO BEAMLINE AND BAFFLES



WIDE (ALUMINUM) BEAMLINE, STANDARD BAFFLES, NO INNER RING ON FIRST



WIDE (ALUMINUM) BEAMLINE, STANDARD BAFFLES, KRYPT+NO INNER RING ON FIRST