

Yields update

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Last time Review

Yields Drift Table

Production Settings	Total Momentum Settings	Momentum Settings which have yields drifts	Total Runs	Drift Runs	Comment
2.2GeV, 2.5T Tran	37	7	259	21	<p>a. Drift Settings defined: yields spread>3.5%</p> <p>b. At least 7% (76 runs) have drift (total 1137 runs)</p> <p>c. 32% (360 runs) are in the momentum setting which have drift runs.</p>
1.7GeV, 2.5T Tran	20	4	213	18	
1.1GeV, 2.5T Tran	36	4	344	13	
2.2GeV, 5T Tran	20	1	90	7	
2.2GeV, 5T Long	15	4	179	6	
3.3GeV, 2.5T Tran	7	3	52	11	

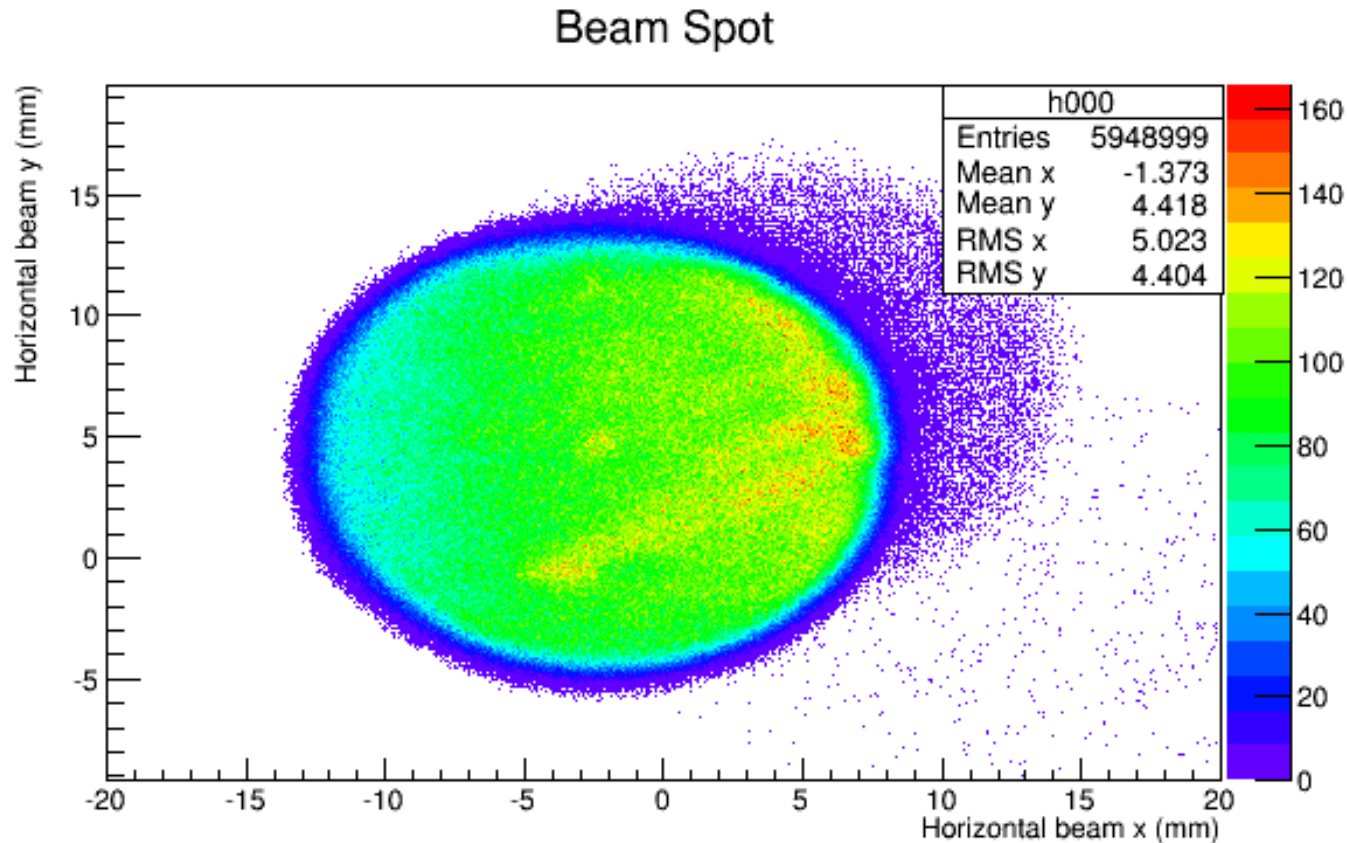
Note: here assume drift runs : smaller run group in that momentum setting if target different, different momentum setting

Last time Review

Raster Size Cut

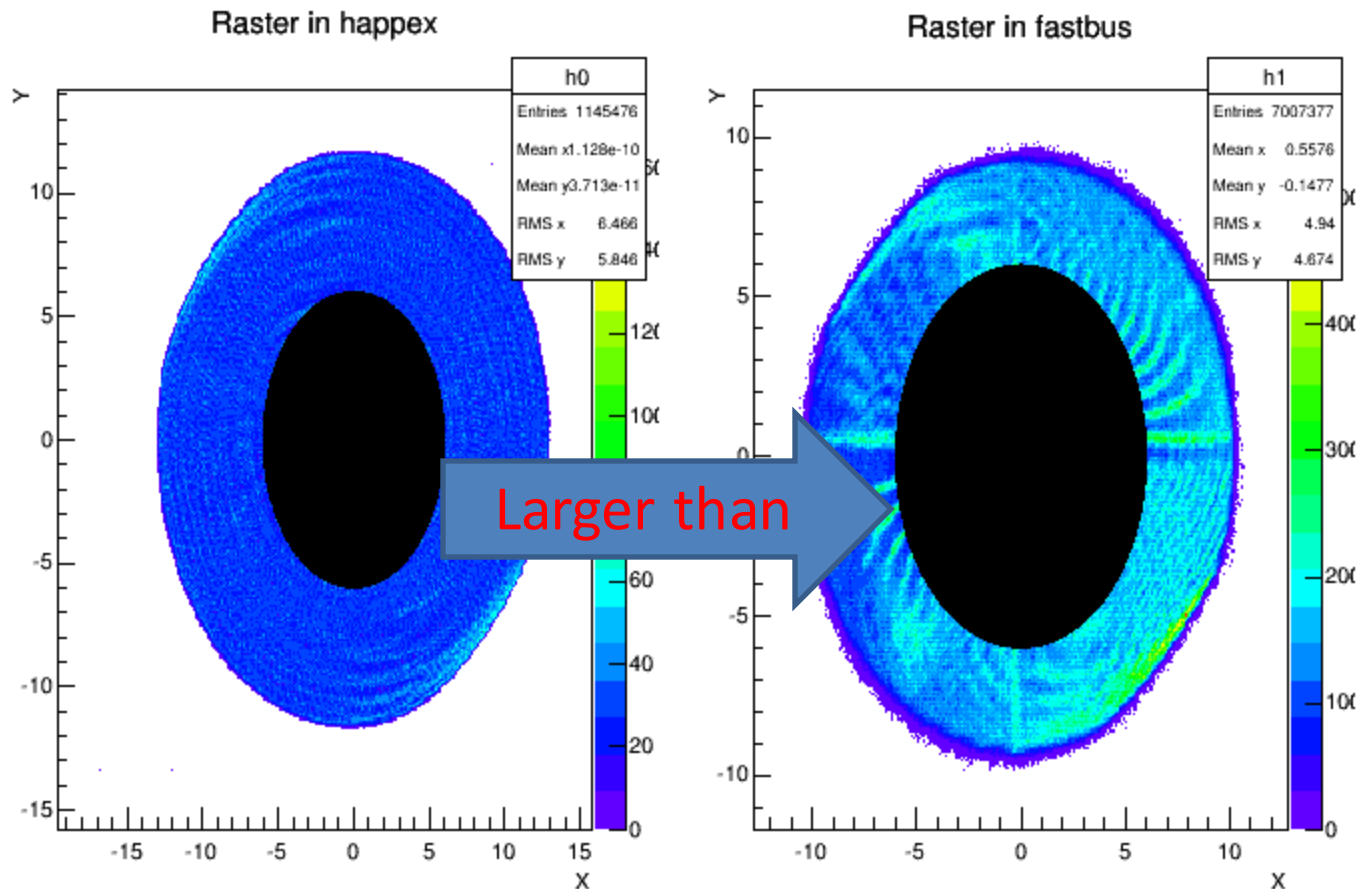
✓ Cut the raster size to remove the boundary effects

❑ Run 5868 (x horizontal, y vertical), E2.2GeV, P1.3GeV, 5T, longitudinal



Raster Size Cut

- ✓ Cut the raster size to remove the boundary effects
- ✓ Issue Before: 1.1GeV/1.7GeV raster size is not consistent

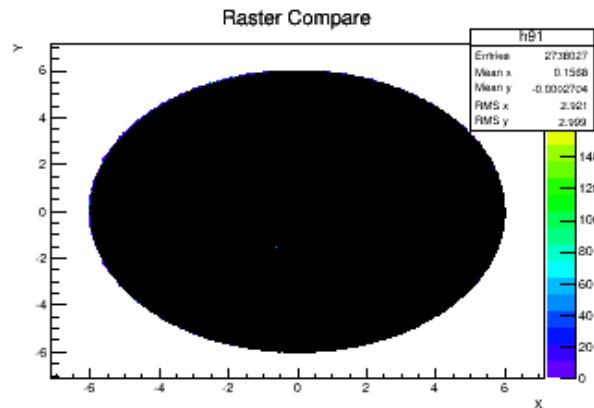
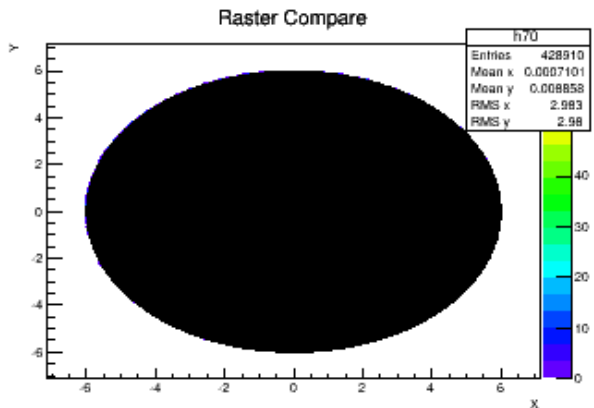
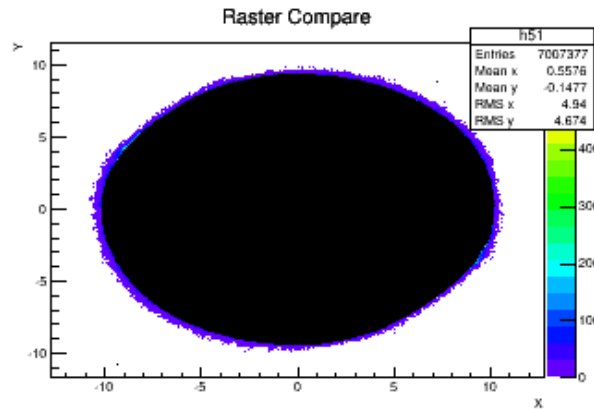
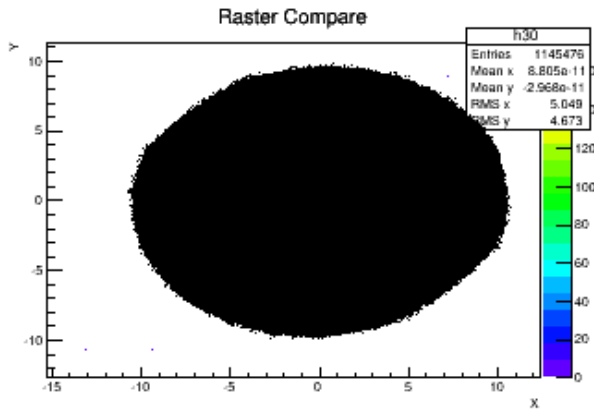


Updated Raster Size

✓ Solved: 1.1GeV/1.7GeV raster size is now consistent

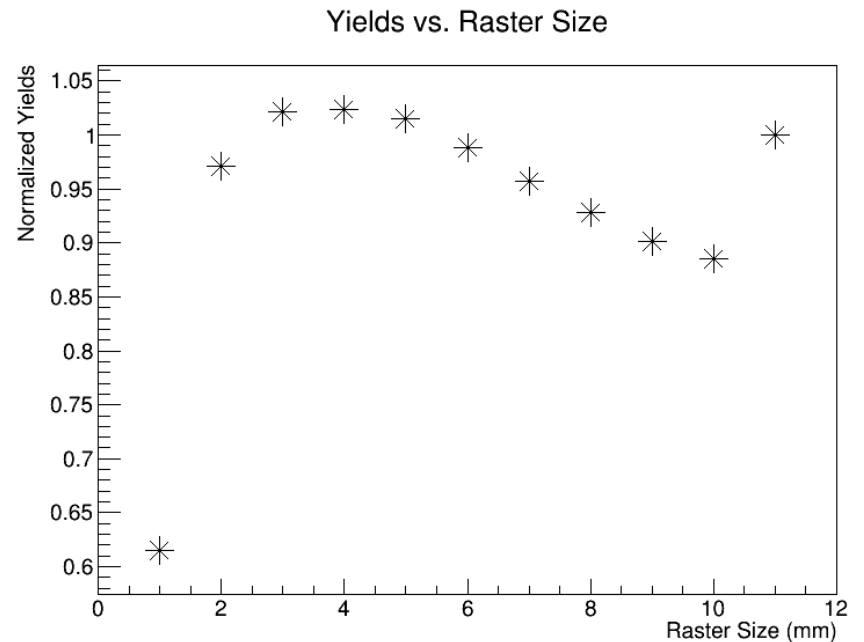
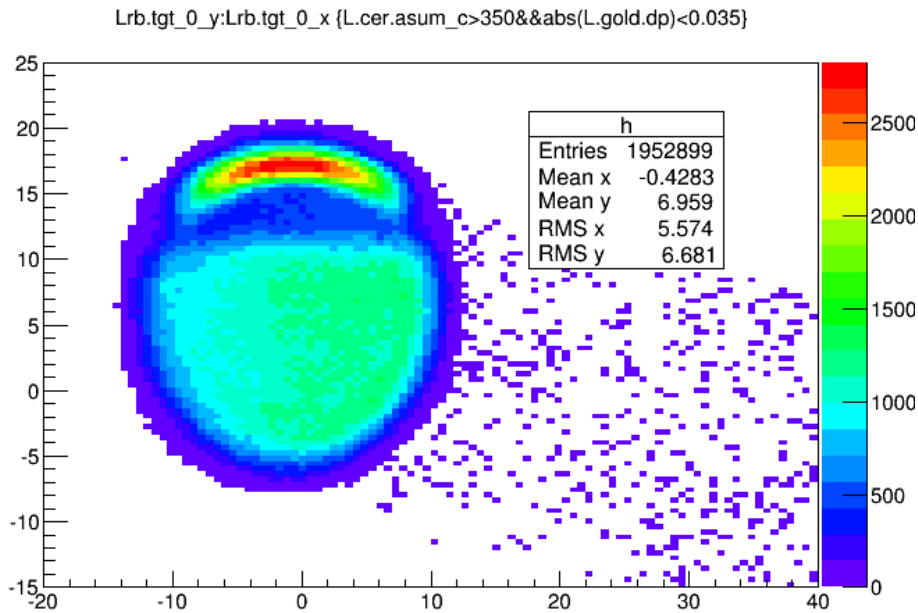
Top (no raster cut): Left(happex on fastbus), right (fastbus on happex)

Bottom (6mm raster cut): Left(happex on fastbus), right (fastbus on happex)



Yields - E2.2GeV, 5T Tran

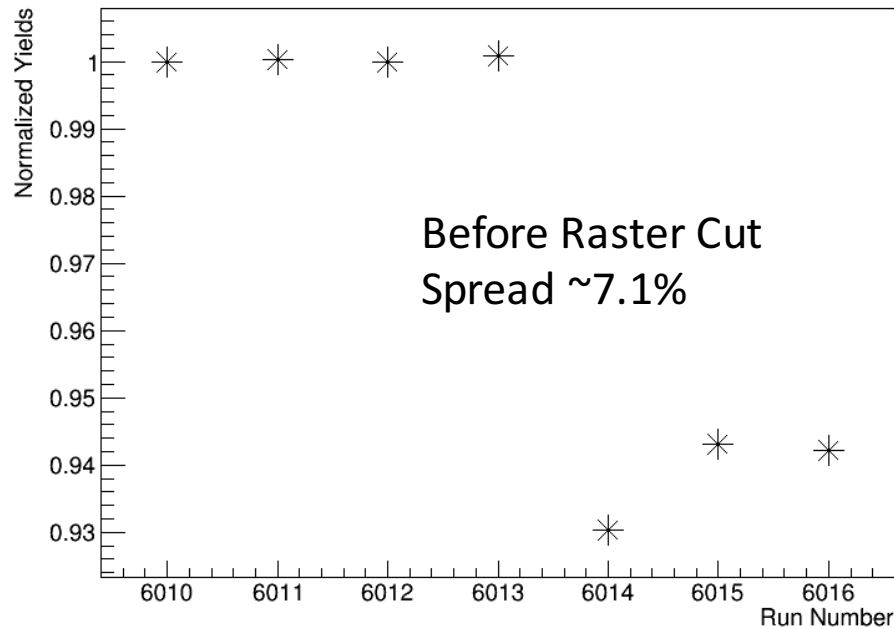
- ✓ Left Plot: Shows the beam spot of run 6010, momentum 1.6GeV
- ✓ Right Plot: Show the Ratio of Yields (raster cut)/Yields (no cut)



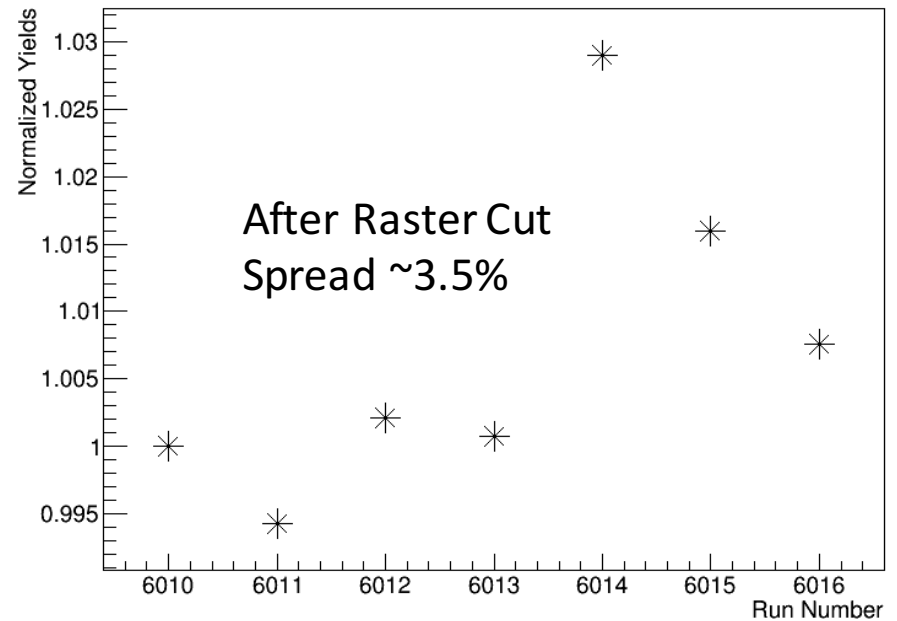
Yields - E2.2GeV, 5T Tran

- ✓ Left Plot: Yields for momentum 1.6GeV, production data, before cut
- ✓ Right Plot: Show the Yields after applying 6mm circle cut on raster

Yields vs. Run Number



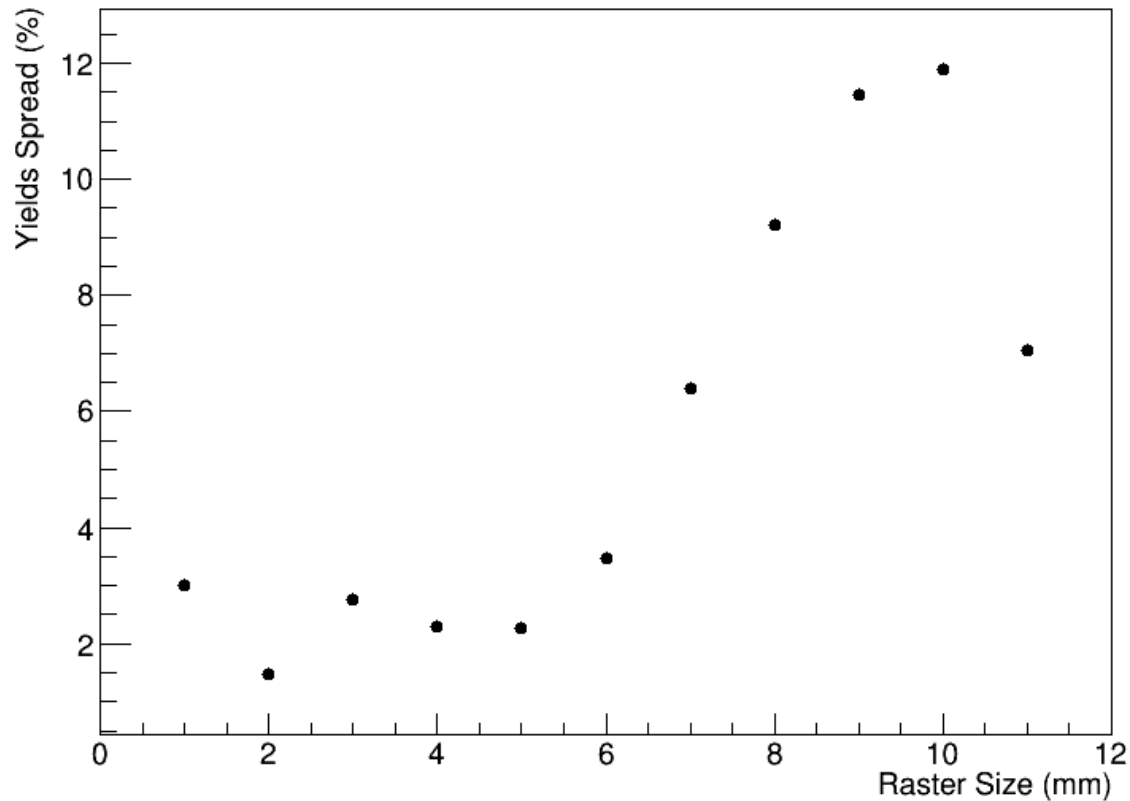
Yields vs. Run Number



Yields - E2.2GeV, 5T Tran

- ✓ Yields Spread versus raster cut Size for momentum 1.6GeV, production data

Yields Spread Vs. Raster Size for Momentum 1.600GeV




Yields - E2.2GeV, 5T Tran

Material	Momentum (GeV)	Exp. Yields Spread without cut	Exp. Yields Spread With 6mm cut (Type A)	Exp. Yields Spread With 6mm cut (Type B)	Exp. Yields Spread With 6mm cut (Type C)	Comment
7	1.6	7.1%	3.5%	3.3%	4.1%	

Type A: circle cut radius 6mm on raster, cut circle center respect to raster pattern center (beam center for each run)

Type B: circle cut radius 6mm on raster, circle center respect to relative beam position offset(which is average position center of momentum settings minus run position center)

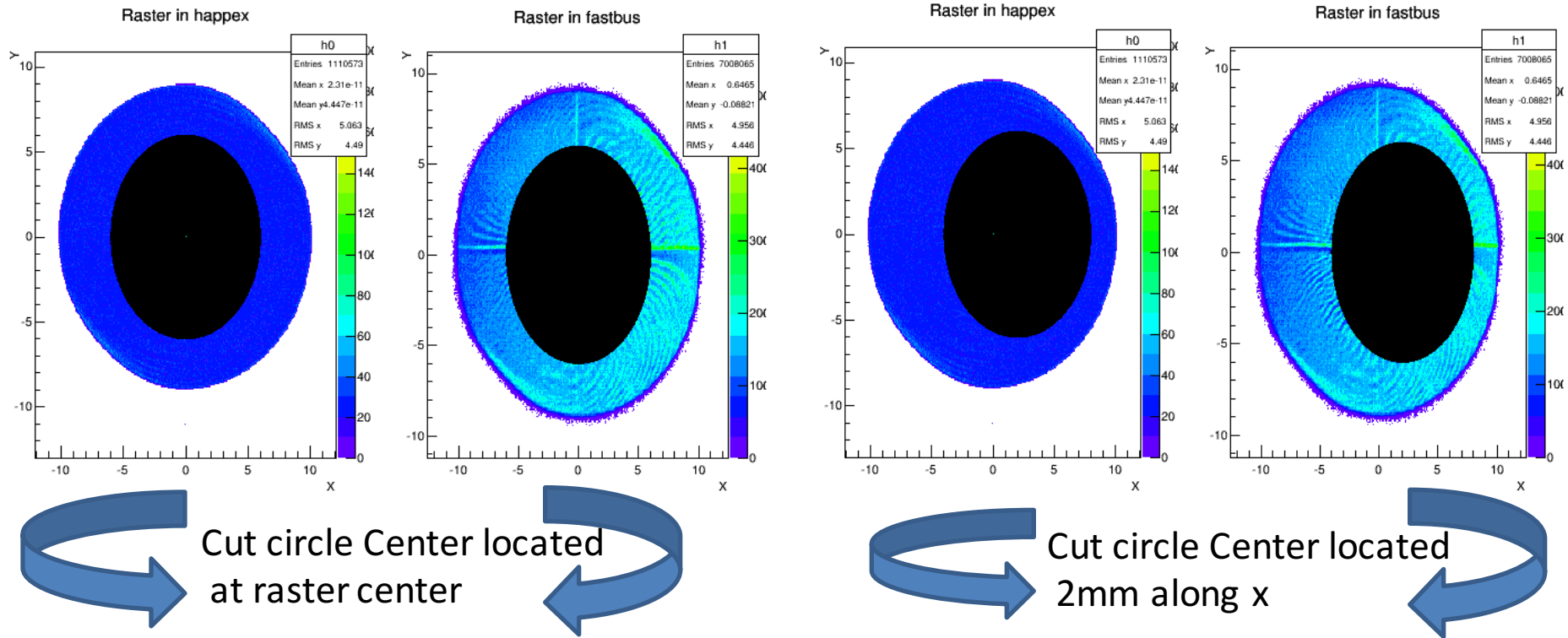
 after apply cut, each cut pattern respect to the spectrometer the same in x,y
Same acceptance!

Type C: circle raster cut 6mm on raster, circle center opposite to Type B. To help test the polarity of BPM coordinates.

Disadvantage: Type B and C will include the BPM uncertainty.

Yields - E2.2GeV, 5T Long

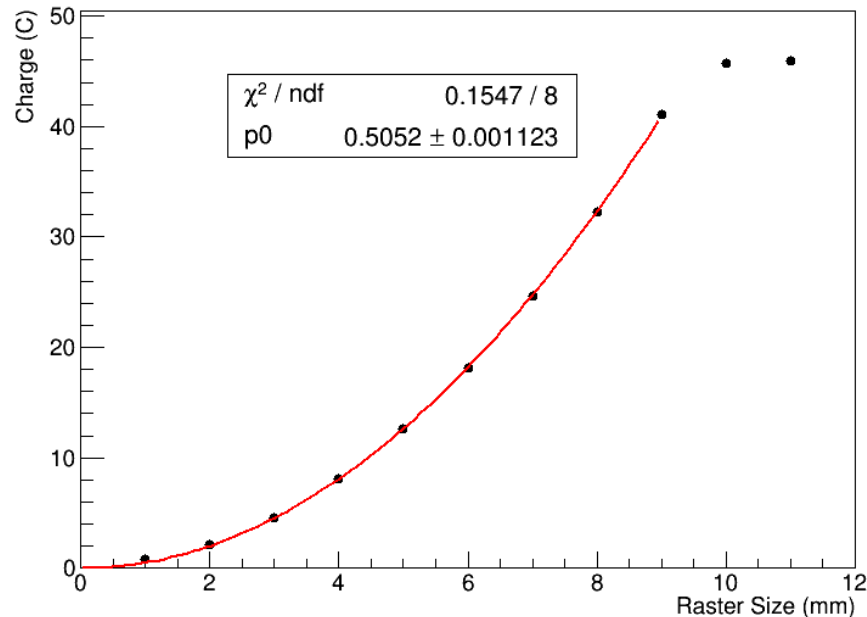
- ✓ Study the yields dependence on cut center position
- ✓ Run 5729, momentum 2.049GeV



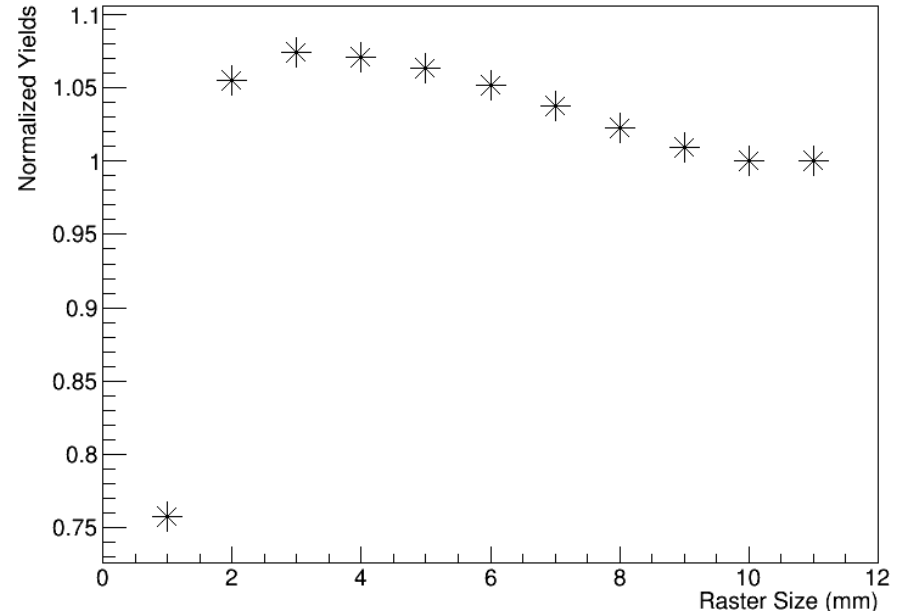
Yields - E2.2GeV, 5T Long

- ✓ Firstly, Look at...
- ✓ Left plot: Charge vs Raster size
- ✓ Right plot: Show the Ratio of Yields (Raster cut)/Yields (no cut)

Charge Vs Raster Size for Run 5729



Yields vs. Raster Size



Note: Cut Center respect to raster center (Type A) in both plots

Raster is ellipse, 10.3mm in x, 8.9 mm in y for half axis

Yields - E2.2GeV, 5T Long

- ✓ Secondly...
- ✓ Yields Table for raster cut circle at different center (x,y) in mm

Raster size	Center (0, 0)	Center (2, 0)	Center (0,2)	Center (-2,0)	Center (0,-2)	Yields Spread among These five circles
No cut	1	1	1	1	1	0
10mm	0.999	1.037	1.008	0.977	1.006	6%
9mm	1.003	1.06	1.011	0.964	1.016	9.6%
8mm	1.024	1.077	1.015	0.954	1.024	12%
7mm	1.039	1.093	1.022	0.971	1.034	11.7%
6mm	1.05	1.103	1.043	0.984	1.044	11.4%
5mm	1.061	1.11	1.057	0.994	1.052	11%
4mm	1.07	1.111	1.064	1.04	1.006	10.1%
3mm	1.074	1.093	1.052	0.999	1.053	9.8%
2mm	1.061	1.106	1.078	1.005	1.066	9.5%

Summary: 1mm shift in x changes yields 3%, 4mm in y almost no change in yields

Yields - E2.2GeV, 5T Long

Material	Momentum (GeV)	Exp. Yields Spread without cut	Exp. Yields Spread With 6mm cut (Type A)	Exp. Yields Spread With 6mm cut (Type B)	Exp. Yields Spread With 6mm cut (Type C)	comment
18	1.885	4%	2.3%	5.6%	7%	x vary -0.7 to 1.1
18	2.228	6.0%	4.9%	6.1%	5.3%	x vary 0.2 to 0.7
17	2.049	11%	5.3%	17.3%	16.6%	X vary -0.6 to 4.4 Run 5718 yields deviated from -9.2% to -2.3%
17	2.228	6.1%	5%	5.9%	13.7%	X vary -0.6 to 1.8

Type A: raster cut 6mm, center respect to raster pattern center (beam center for each run)

Type B: raster cut 6mm, cut pattern center respect same to spectrometer

Type C: raster cut 6mm, center offset opposite to Type B, test the polarity of BPM coordinates.

Yields - E1.1GeV, 2.5T Tran

Material	Momentum (GeV)	Exp. Yields Spread without cut	Exp. Yields Spread With 6mm cut (Type A)	Exp. Yields Spread With 6mm cut (Type B)	Exp. Yields Spread With 6mm cut (Type C)	Comment To Exp Yields Without cut
11	1.017	6.9%	6%	3.4%	8.9%	X vary 2.6 to 3.9; Agree simulation 3.4%
12	0.582	3.4%	4.9%	2.7%	8.8%	X vary 1.9 to 2.9 Agree simulation 2%
14	0.809	3.6%	3.9%	5.4%	2.9%	X vary -0.9 to 0.5; Data -4.5%, Opposite simulation +5.3%
14	0.752	7.3%	4.7%	7.2%	4.9%	X vary -1.5 to 0.2; Data -4.5%, Opposite simulation +5%

Type A: raster cut 6mm, center respect to raster pattern center (beam center for each run)

Type B: raster cut 6mm, cut pattern center respect same to spectrometer

Type C: raster cut 6mm, center offset opposite to Type B, test the polarity of BPM coordinates.

Yields - E1.7GeV, 2.5T Tran

Material	Momentum (GeV)	Exp. Yields Spread without cut	Exp. Yields Spread With 6mm cut (Type A)	Exp. Yields Spread With 6mm cut (Type B)	Exp. Yields Spread With 6mm cut (Type C)	Comment To Exp Yields Without cut
7	1.589	4.1%	3%	6.4%	2.4%	X vary 2.6 to 4.1; Opposite simulation;
8	1.494	13.4%	12%	10.2%	18.1%	X vary 1 to 2.8; Raster size changed, beam pos moved run by run;
8	1.405	5.3%	4.5%	6.3%	8.1%	X vary 2.3 to 3.8
8	1.32	8.4%	11.2%	8.1%	16.1%	X vary 0.8 to 2.3 3days later, Ps3 changed from 3 to 5, deadtime dropped from 23% to 6%, yields increase 8%

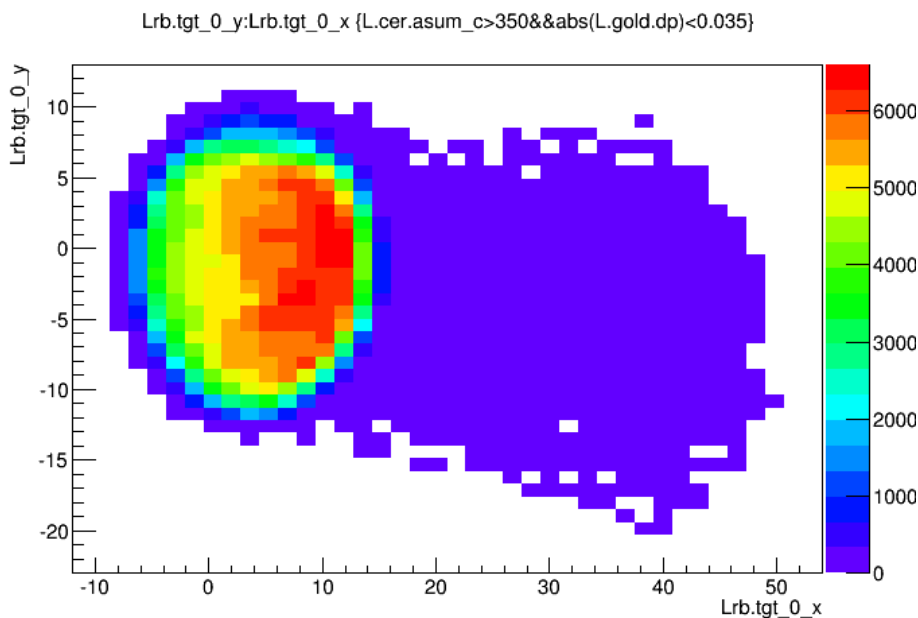
Yields - E2.2GeV, 2.5T Tran

Material	Momentum (GeV)	Exp. Yields Spread without cut	Exp. Yields Spread With 6mm cut (Type A)	Exp. Yields Spread With 6mm cut (Type B)	Exp. Yields Spread With 6mm cut (Type C)	Comment To Exp Yields Without cut
8	1.003	5.8%	8.8%	5%	12.6%	X vary 1.3 to 2.7;
8	2.071	38.6% (6.6% after remove run 3460)	37.6% (7.7% after remove run 3460)	33.6% (10% after remove run 3460)	50.6% (21.9% after remove run 3460)	x vary 1.8 to 6; Run 3460 deadtime 33%, other run deadtime ~10%, same ps3;
7	1.247	6.6%	6.3%	8.9%	18%	X vary -0.3 to 4.3;
7	1.441	6%	4.7%	4.5%	12.1%	X vary 0.2 to 2.7; Raster reduced from 10.3mm to 8.8mm, yields increase ~5%
7	1.792	19.1%	11.7%	11.8%	11.8%	X vary 1.7 to 4.7;
7	1.927	4.1%	4.6%	12.4%	5%	X vary 2 to 5
7	2.071	13.5%	9.6%	10.1%	30.7%	X vary -1.4 to 4.9; Run 3686-3691 no trigger eff

Yields - E3.3GeV, 5T tran

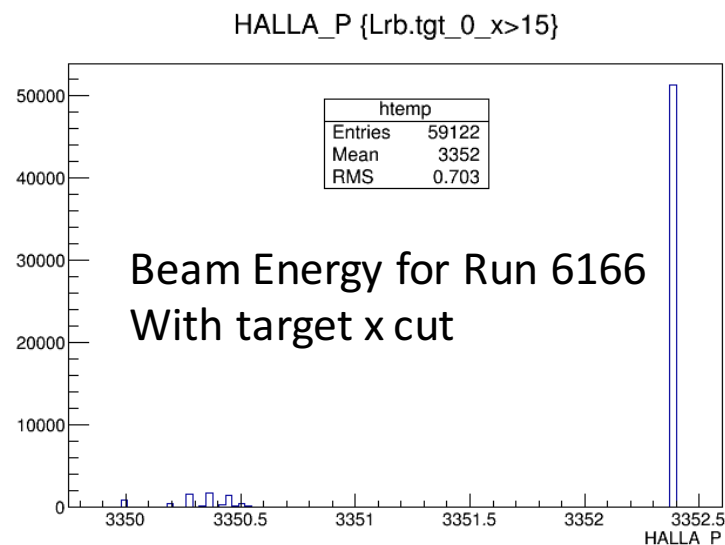
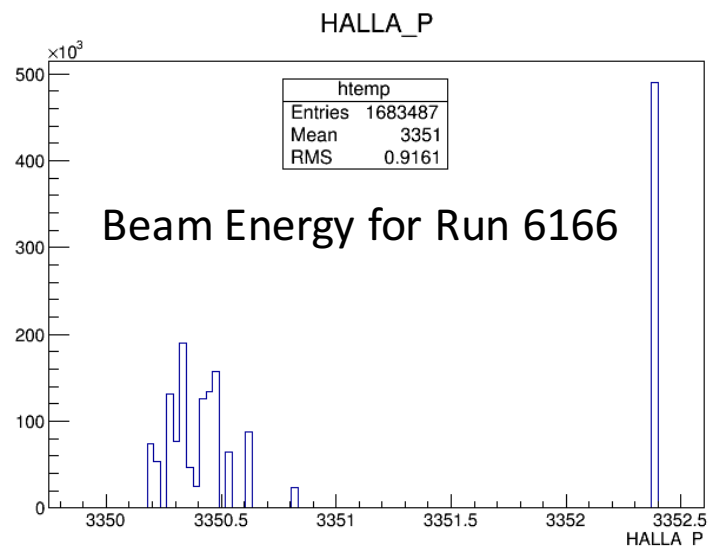
✓ 2.492GeV, Material ID=19

Beam Spot for Run 6166



Note:

1. Due to the unstable of energy, whole 2.492GeV have this issue
2. The 1st and last of 2.342 have this issue



Yields - E3.3GeV, 5T Tran

Material	Momentum (GeV)	Exp. Yields Spread without cut	Exp. Yields Spread With 6mm cut (Type A)	Exp. Yields Spread With 6mm cut (Type B)	Exp. Yields Spread With 6mm cut (Type C)	Comment To Exp Yields Without cut
19	2.342	6.6%	5.1% (3.2% remove 1 st run)	5.4% (3.7% remove 1 st run)	5.5% (2.5% remove 1 st run)	X vary 3.3 to 3.7; Yields steadily increase with run; Remove 1 st run, yields spread within 3.2%
19	2.492	15.2%	10.1%	9.8%	10.6%	X vary 3.4 to 4.1; Beam energy drifting, not stable
20	2.492	6.4%	2.1%	1.9%	2.3%	X vary 3.9 to 4.1;

Summary Table

Production Settings	Total Momentum Settings	Momentum Settings which have yields drifts	Settings Resolved Spread Within 5%	Settings Still Question?	Comment
2.2GeV, 2.5T Tran	37	7	2	5	<p>a. Drift Settings defined: yields spread>3.5%</p> <p>b. About 60% drift setting resolved with yields spread within 5%</p>
1.7GeV, 2.5T Tran	20	4	2	2	
1.1GeV, 2.5T Tran	36	4	4	0	
2.2GeV, 5T Tran	20	1	1	0	
2.2GeV, 5T Long	15	4	3	1	
3.3GeV, 2.5T Tran	7	3	2	1	