

Bpm study

-- check beam position

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BPM pedestal Study

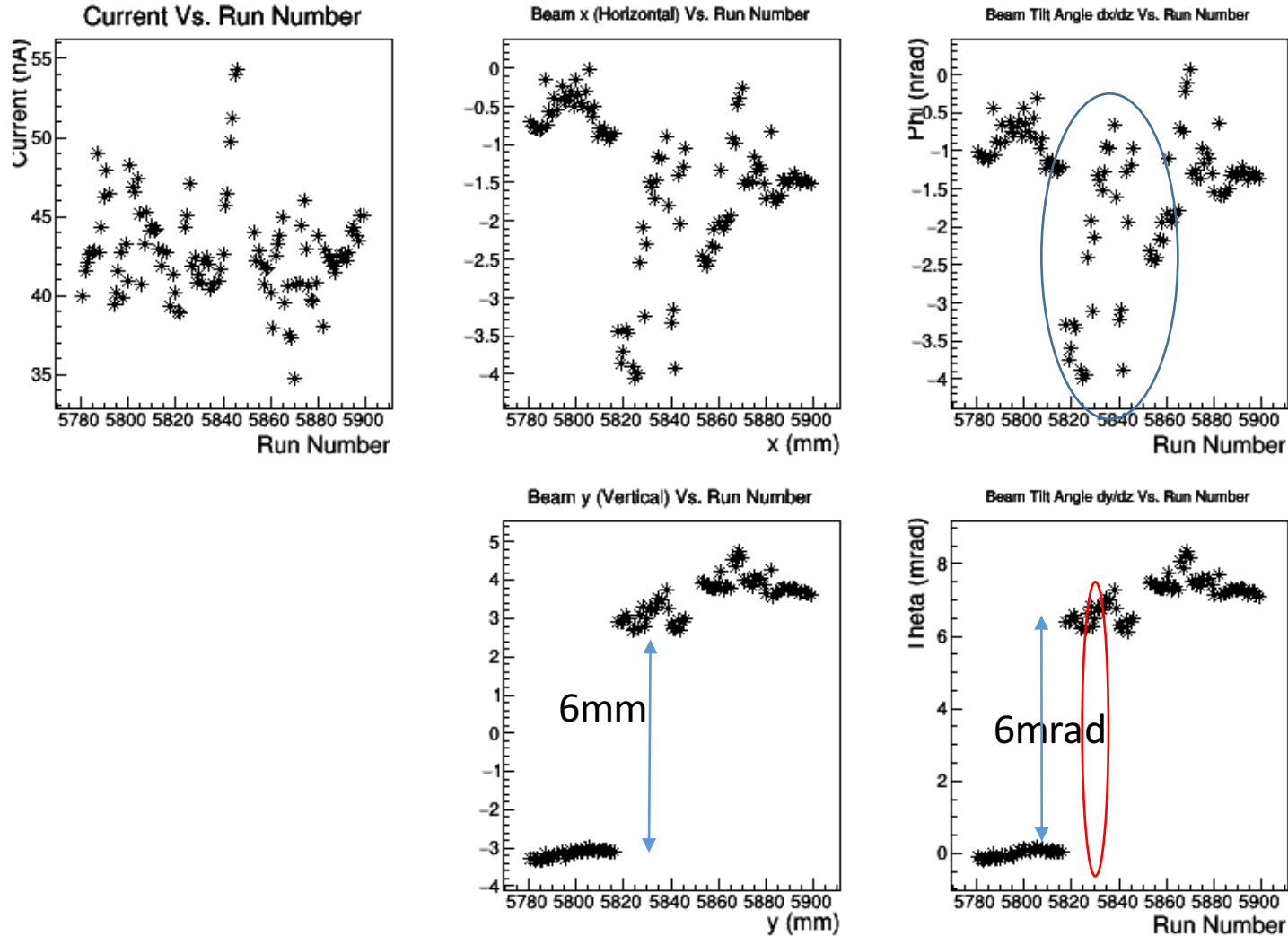
□ Goal: To help resolve the yields drift problems

□ Today

- Study the jump - calibrated position changed while yields not change

Recall Beam Position Issue

Energy 2254 GeV -- beam information versus Run Number



Use Pengjia's database

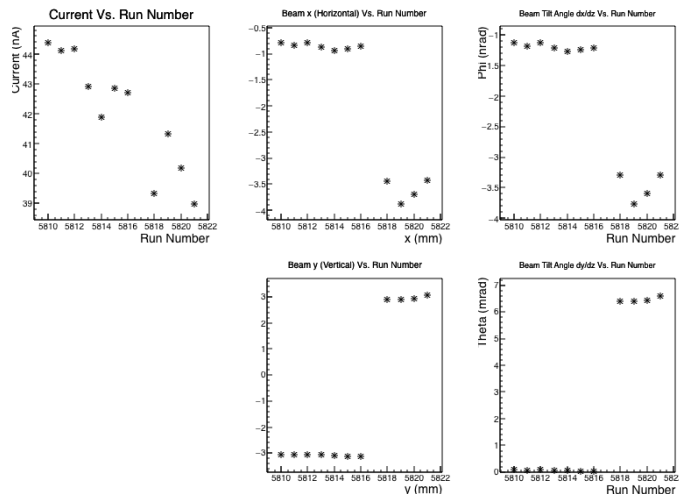
How to deal with beam jumps here:

Two types of beam position jumps

- Red circle part** (after adding the carbon cover, run 5816), jump about 6mm or 6mrad? But yields no change
- Blue circle part** (run 5838-5851, continuous taking data, position jump back and forth, spread 3mm or 3mrad) yields change within 3%

Ebeam=2.2GeV, momentum 1.886GeV, Longitudinal 5T - 1st type jump

run	materialID	Momentum	current/nA	yield(use 6mm Raster cut)	BPMA x (mm)	BPMA y (mm)	BPMB x (mm)	BPMB y (mm)	Horizontal tg_x (mm)	tg_phi=dx/dz (mrad)	Vertical tg_y (mm)	tg_theta =dy/dz (mrad)
5809	17	1.8857	44.07	1	-1.39	-2.35	-1.23	-2.57	-0.9	-1.23	-3.11	0.04
5810	17	1.8857	44.39	1.005	-1.37	-2.34	-1.19	-2.57	-0.78	-1.12	-3.05	0.08
5811	17	1.8857	44.12	1.003	-1.37	-2.34	-1.2	-2.56	-0.84	-1.18	-3.06	0.06
5812	17	1.8857	44.17	1.001	-1.37	-2.35	-1.18	-2.57	-0.78	-1.12	-3.05	0.08
5813	17	1.8857	42.92	0.997	-1.36	-2.34	-1.2	-2.56	-0.87	-1.21	-3.07	0.05
5814	17	1.8857	41.89	1.01	-1.39	-2.34	-1.24	-2.56	-0.94	-1.27	-3.09	0.05
5815	17	1.8857	42.84	1.005	-1.39	-2.35	-1.23	-2.58	-0.9	-1.24	-3.11	0.03
5816	17	1.8857	42.72	1.004	-1.36	-2.37	-1.2	-2.59	-0.85	-1.21	-3.11	0.03
5818	17	1.8857	39.35	1.002	-1.86	-2.02	-1.31	-0.64	-3.45	-3.3	2.89	6.4
5819	17	1.8857	41.33	1.006	-1.84	-2.02	-1.39	-0.57	-3.87	-3.76	2.89	6.39
5820	17	1.8857	40.19	1.005	-1.84	-2.02	-1.35	-0.59	-3.7	-3.59	2.93	6.43
5821	17	1.8857	39	1.021	-1.84	-2.02	-1.27	-0.59	-3.42	-3.29	3.08	6.59
5822	17	1.8857	38.88	1.006	-1.86	-2.02	-1.3	-0.61	-3.47	-3.33	2.99	6.51



1.5 hours beam down (target anneal) between run 5816 and run 5818
 Carbon cover added after run 5816
 Calibrated Beam position Jump happened when beam back
 X jump -2.6mm; y jump 6.0mm
 Theta jump 6.37mrad; phi jump -1.8mrad
 Data Yields within 1% for the momentum setting
 Usually 1mm (1mrad) shift change yields ~3%

Recall BPM Calibration

□ The calculation of beam position (pengjia technote):

$$x_b = \frac{(A_+ - A_{+ped} + b_+) - g_x(A_- - A_{-ped} + b_-)}{(A_+ - A_{+ped} + b_+) + g_x(A_- - A_{-ped} + b_-)}$$

$$x = Rx_b \left(\frac{1}{x_b^2 + y_b^2} - \frac{1}{\sqrt{x_b^2 + y_b^2}} \sqrt{\frac{1}{x_b^2 + y_b^2} - 1} \right)$$

$$y = Ry_b \left(\frac{1}{x_b^2 + y_b^2} - \frac{1}{\sqrt{x_b^2 + y_b^2}} \sqrt{\frac{1}{x_b^2 + y_b^2} - 1} \right)$$



Beam pos



$$x_{BPMrealBPM} = c_0 + c_1x + c_2y$$

$$y_{BPMrealBPM} = c'_0 + c'_1x + c'_2y$$

- A_+, A_- : bpm raw signal for + and - channel
- A_{+ped}, A_{-ped} : bpm pedestal for + and - channel
- b_+, b_- : offset, calibration constant
- $g_x, c_0, c_1, c_2, c'_0, c'_1, c'_2$: calibration constant

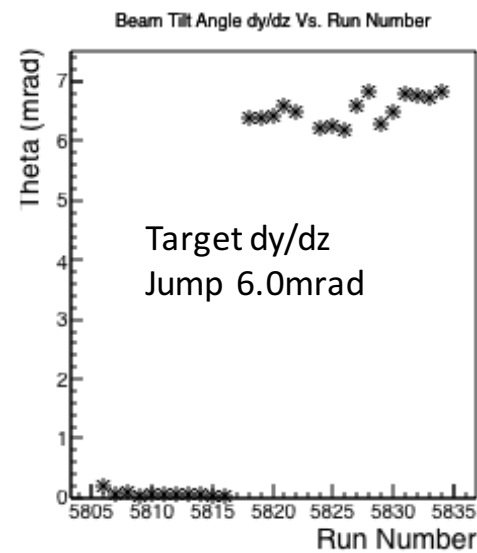
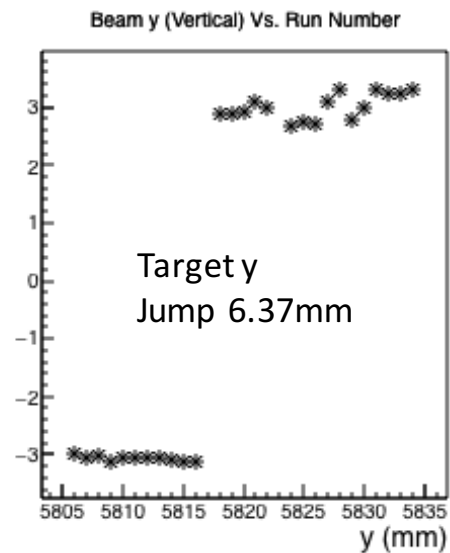
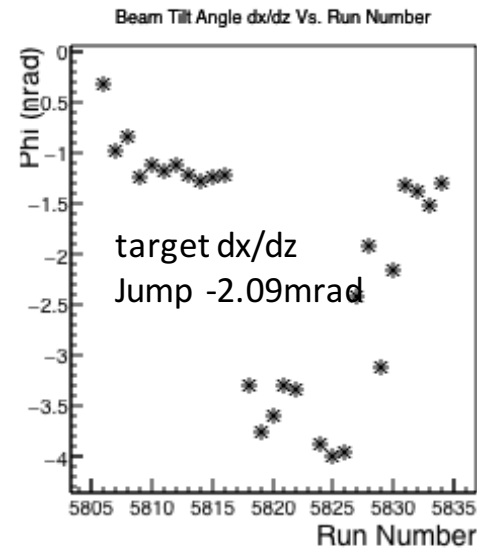
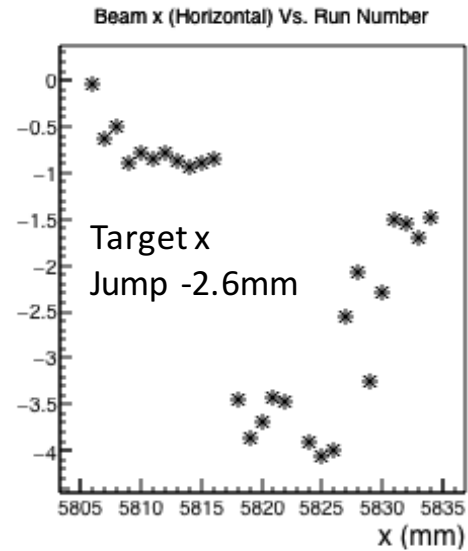
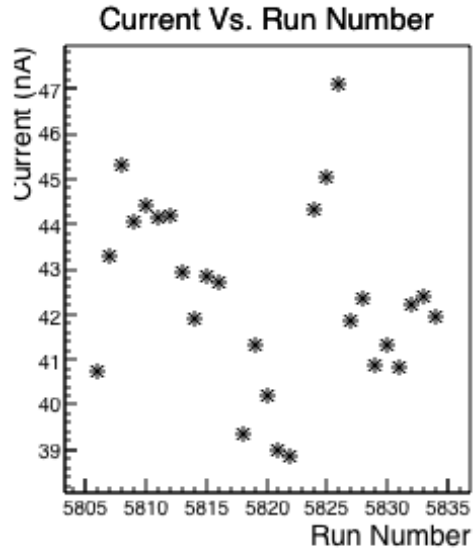
□ Near run 5816/5818, choose two run with almost equal current and stable position, get new offset b_+

Ebeam=2.2GeV, momentum 1.886GeV, Longitudinal 5T - 1st type jump

run	Current/ nA	Raw bpma1	Raw bpma2	Raw bpma3	raw bpma4	Raw bpmb1	Raw bpmb2	Raw bpmb3	Raw bpmb4	Ped bpma1	Ped bpma2	Ped bpma3	Ped bpma4	Ped bpmb1	ped bpmb2	Ped bpmb3	Ped bpmb4
5805	45.14	47827.1	62124.9	72482.5	60302.4	40241.8	52025.9	50591.9	57581.4	12965.5	10264.8	28467.7	20975.2	9687.7	24603.5	38833	13282
5816	42.72	45343.3	58977.4	68716.6	57357.2	38144.8	49708.6	48634.1	54589.8	12960.8	10273.7	28466.8	20890.4	9634.3	24319.8	38692.9	13401.6
5818	39.35	42699.1	55462.4	63425.2	52859	35602.6	43520.5	44564.1	49739.3	12330.5	10944.4	22877.8	19800.2	12966.4	23190.1	23574.1	11721.8
5825	45.06	48430.9	62861.9	71928.8	59984.7	40245.4	48028.7	48781.4	56286.2	12316.2	10958.9	23199.2	19747.2	12778.1	22965.7	23183.5	11688.7

Near run 5816/5818, choose two run with almost equal current and stable position, get new offset b_+

Beam Position Jump Issue



Use Pengjia database

Beam position at target
for run 5805-5830

1.5 hours beam down (target anneal)
between run 5816 and run 5818

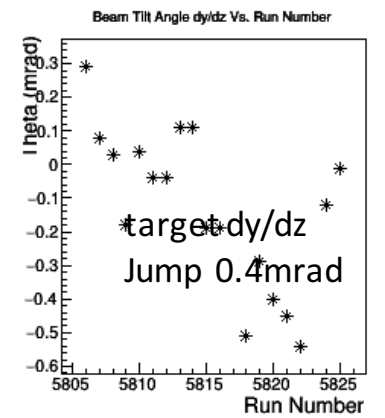
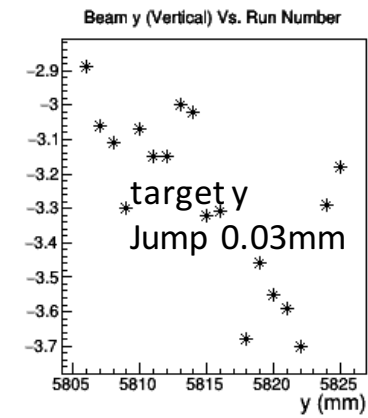
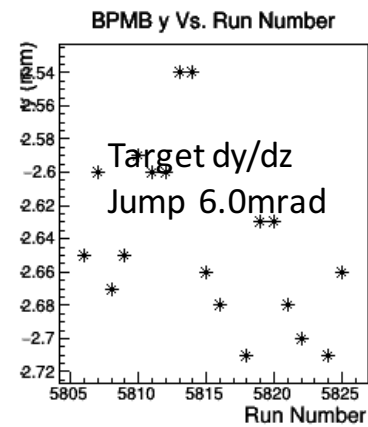
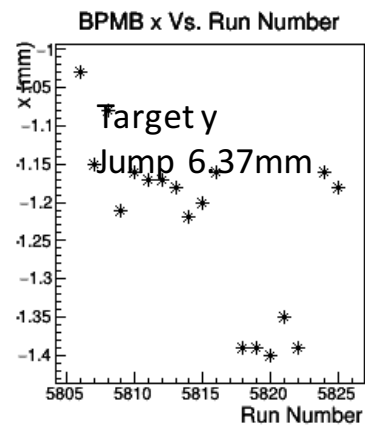
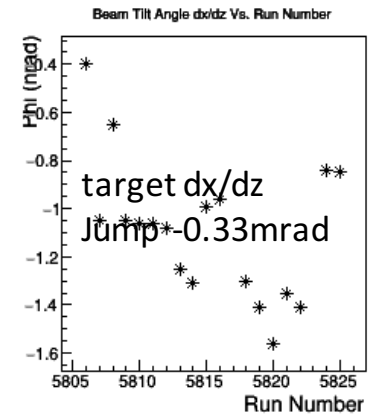
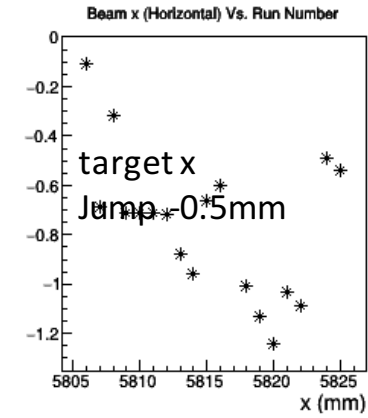
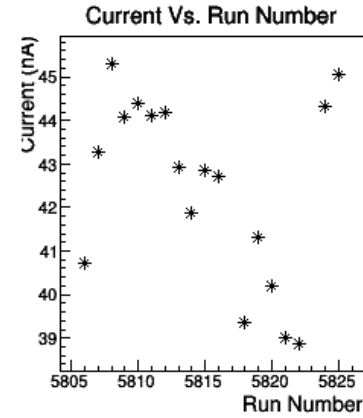
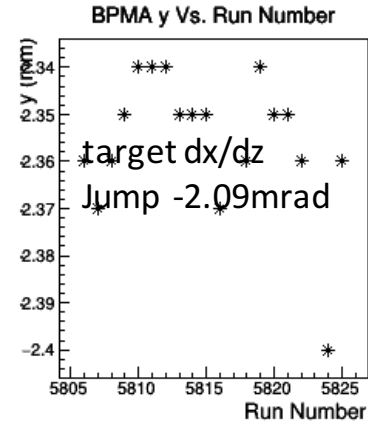
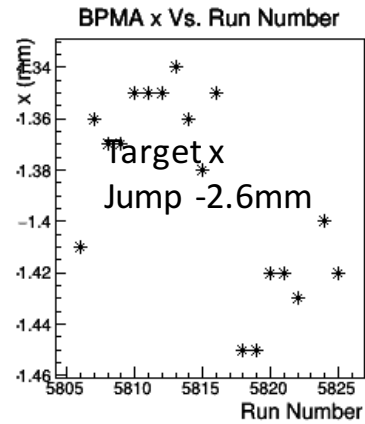
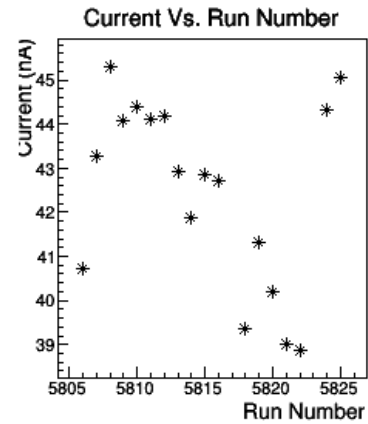
Carbon cover added after run 5816

Calibrated Beam position Jump
happened when beam back

Beam Position Jump Issue

Previous

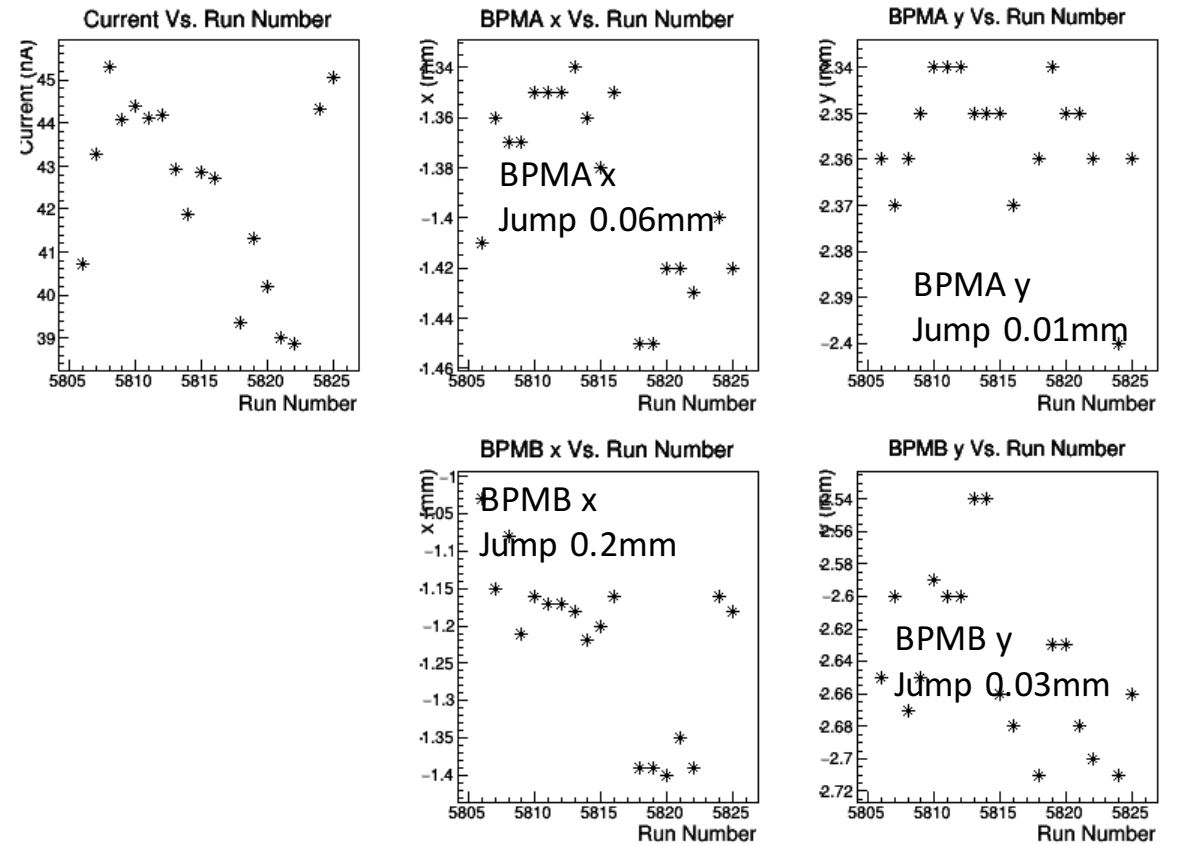
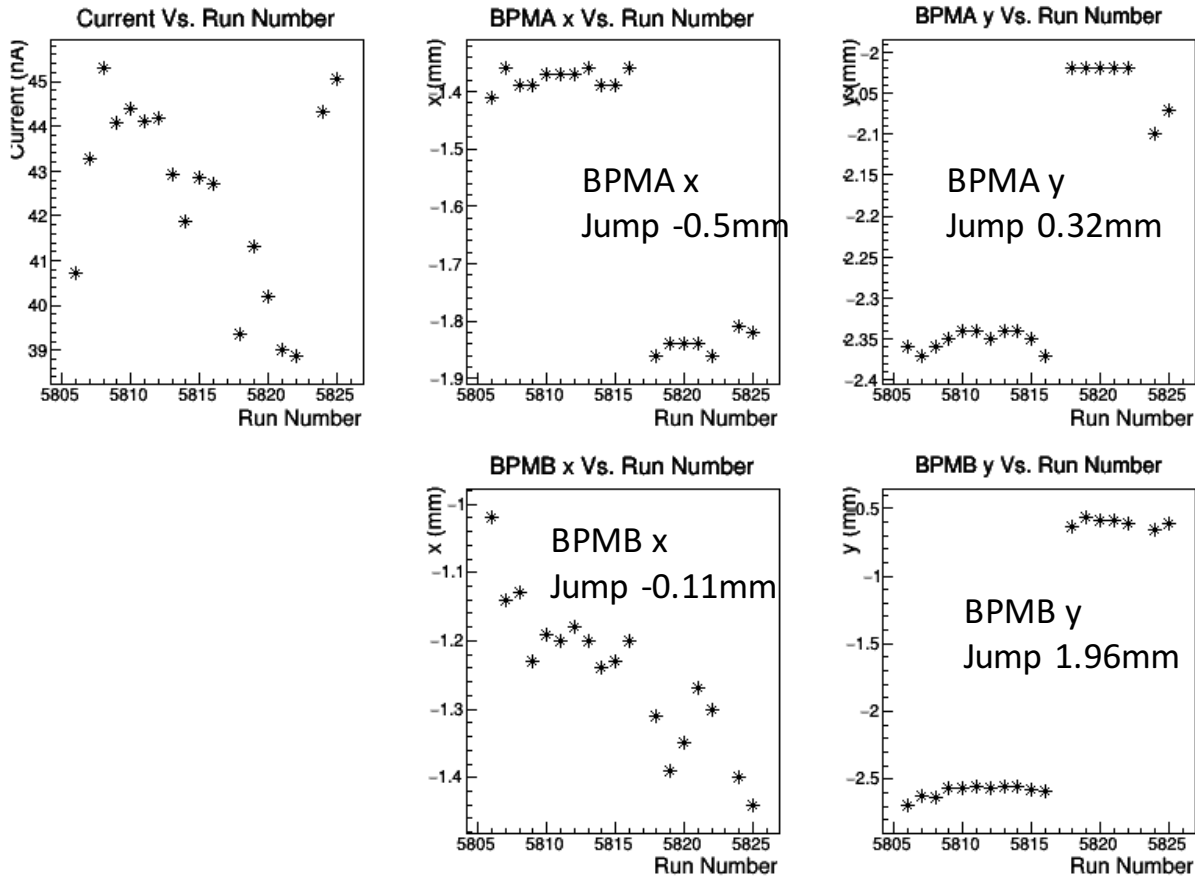
New



Beam Position Jump Issue

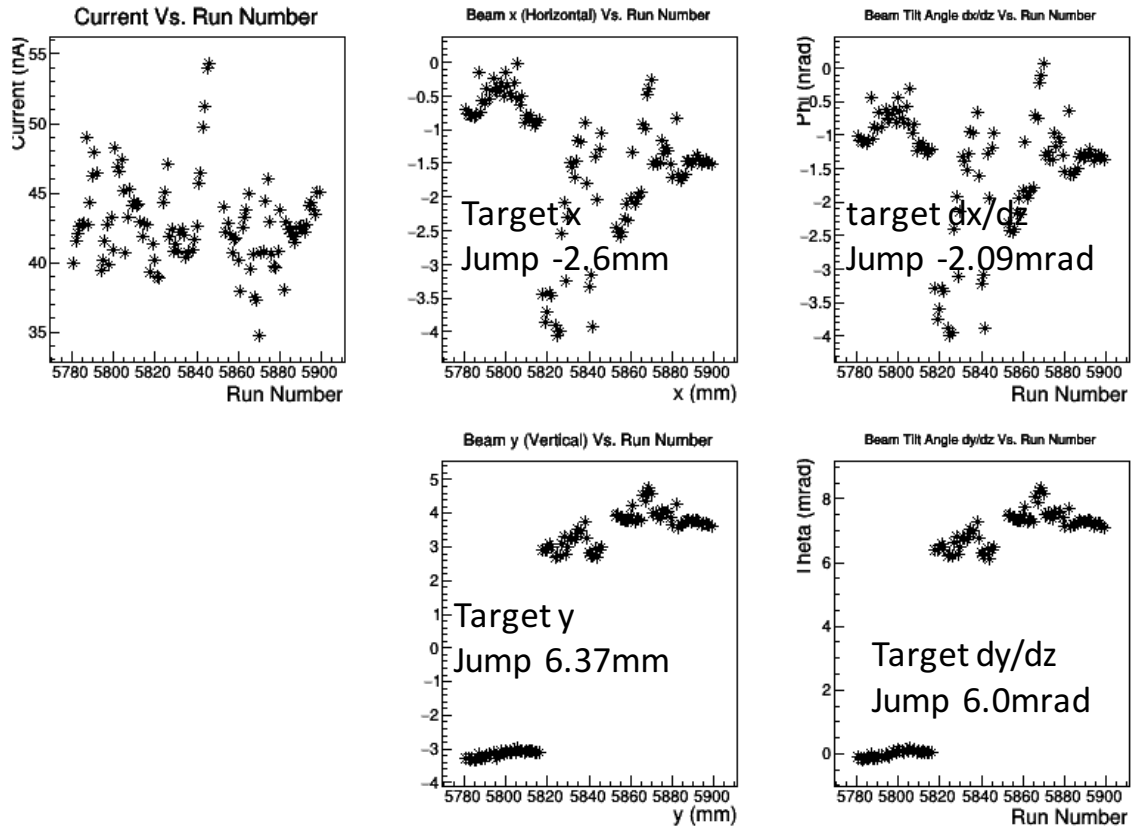
Previous

New

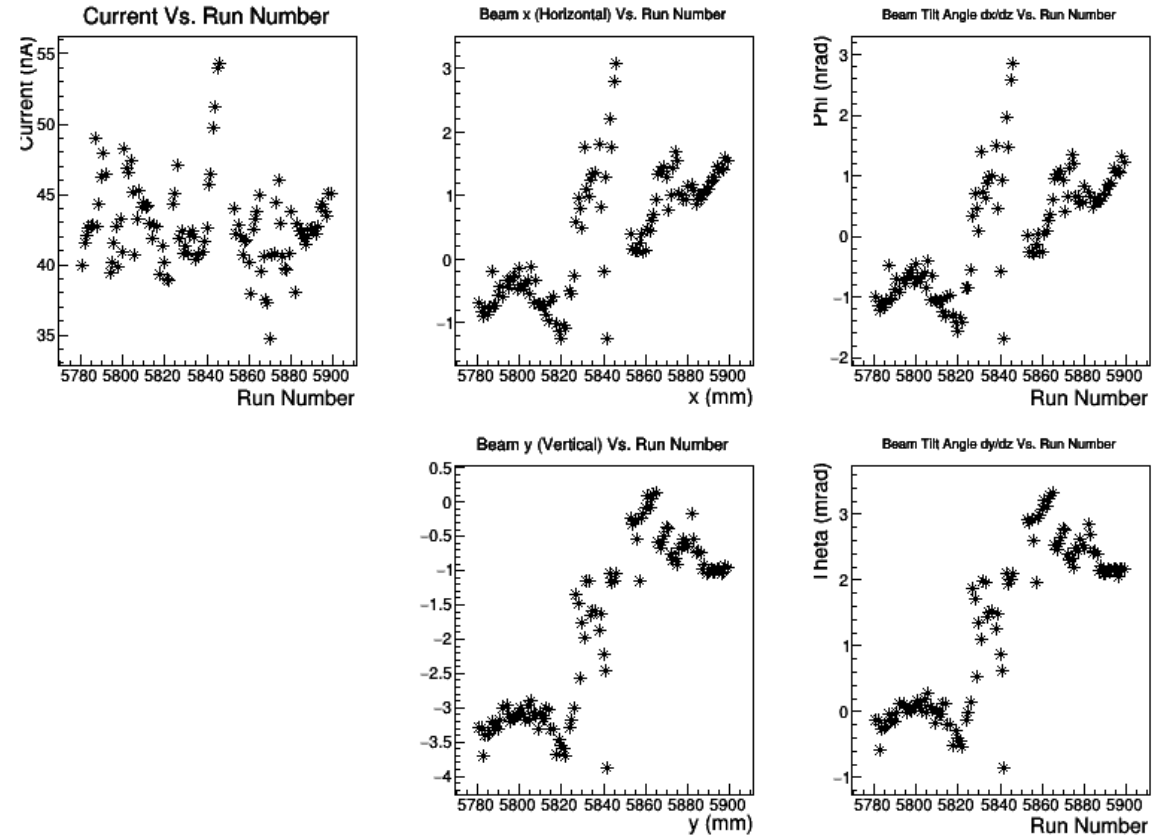


Beam Position Jump Issue

Previous



New



- Continue Looking at other jumps
- Any suggestions?