Relative Location of Barrels

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Motivation

- Paranoia about barrel-to-barrel motion since Dec 20th.

- Assumption 1: Internal alignment of barrels is much smaller than what we care about for this study ($\approx 100\ \mu$m).

- Assumption 2: Using OIZ Tracking. Assuming pull of COT on i.p. is small.

-Using run number 123496 (Live Luminosity 21.359 pb^{-1}, "Good Run")

Procedure

- Select events with 2 “good” silicon (or COT) tracks. Take the two highest p_T tracks, form a vertex from them.

- Form a profile of the beam. Slice up the profile into z bins of about 5 cm.

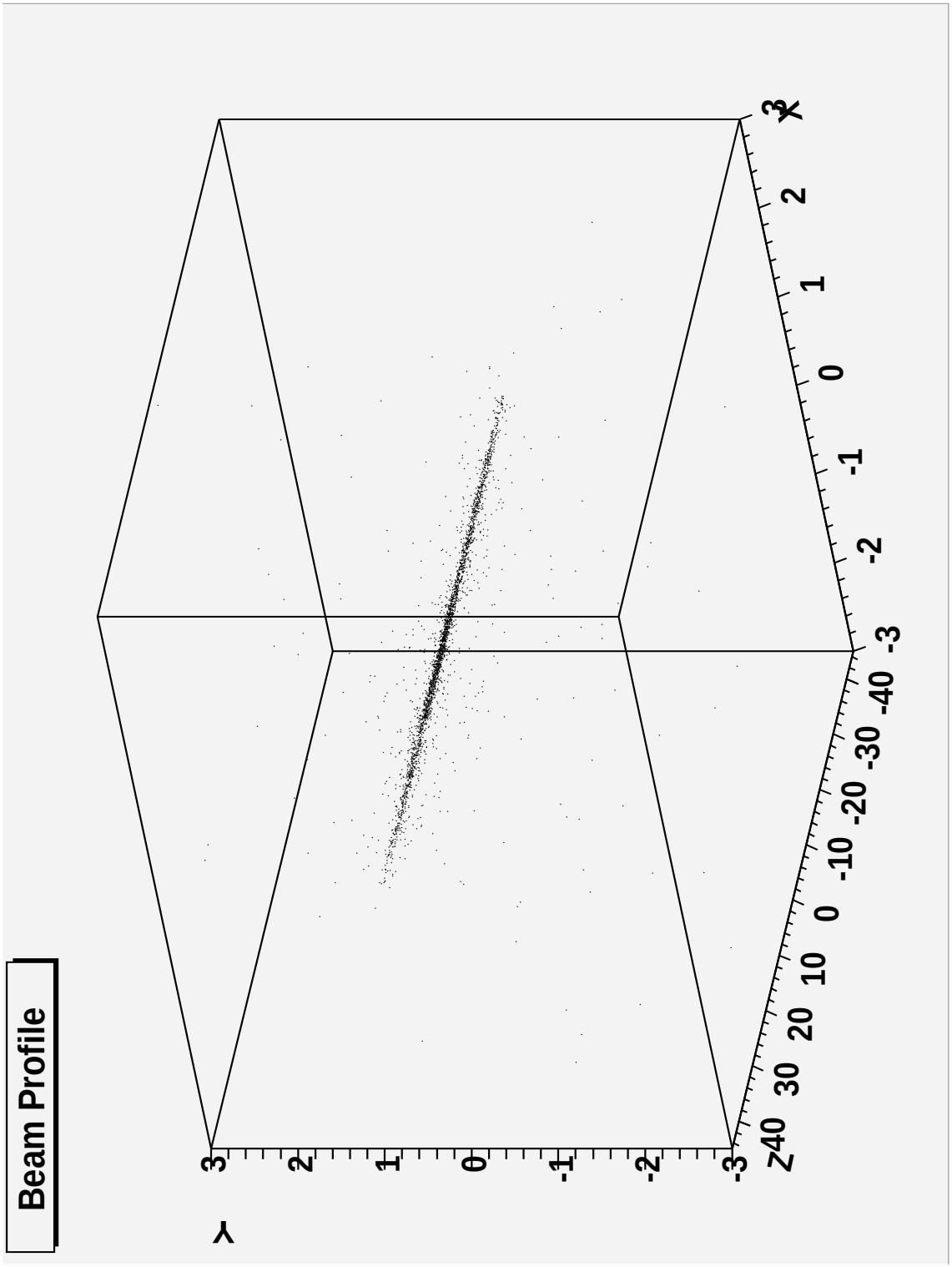
- Project the x and y slices of each bin into a histogram.

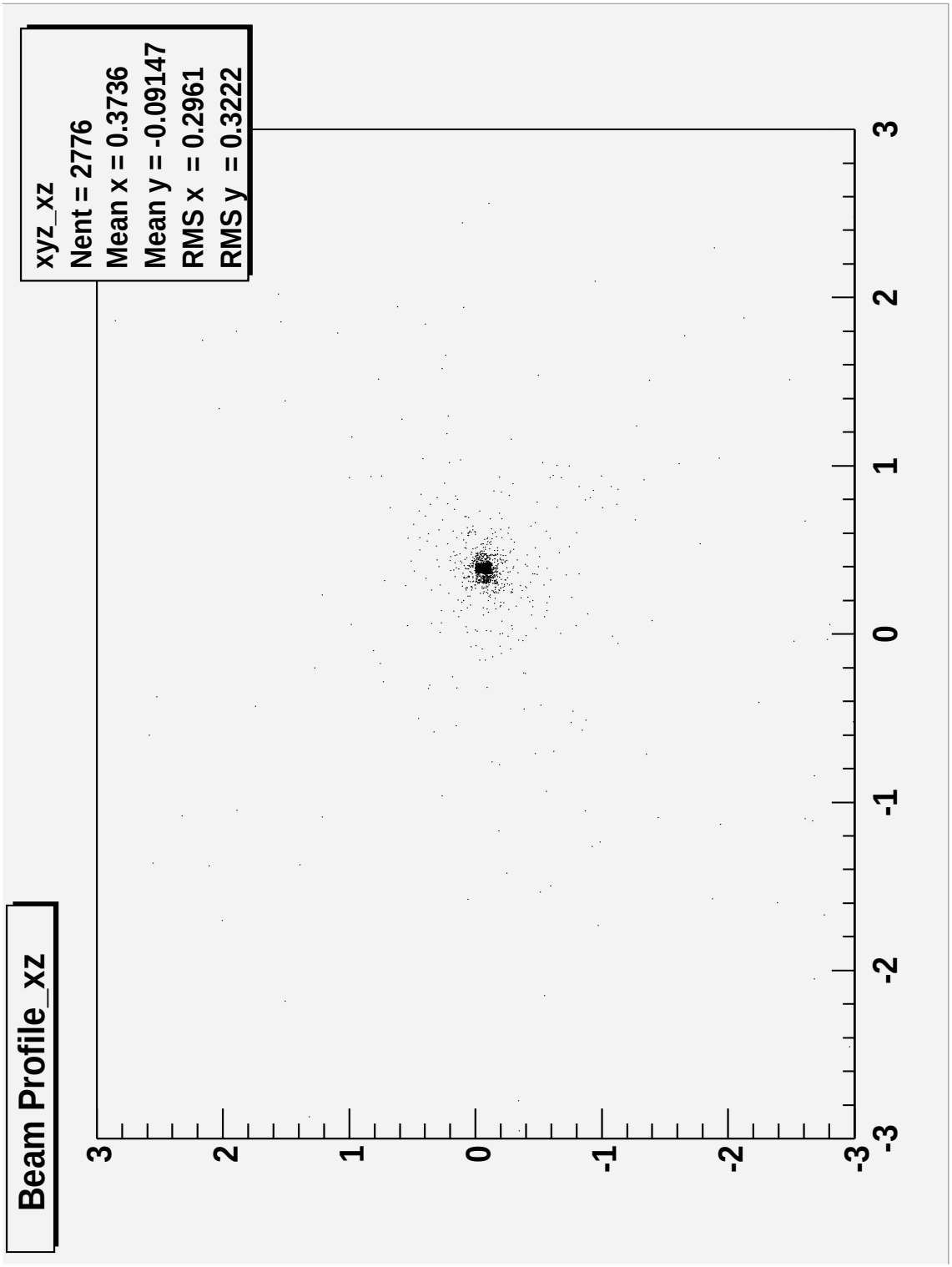
- Fit a gaussian to each x and y histogram. Record $\overline{x}$, $\overline{y}$ and $\sigma_{\overline{x}}$, $\sigma_{\overline{y}}$.

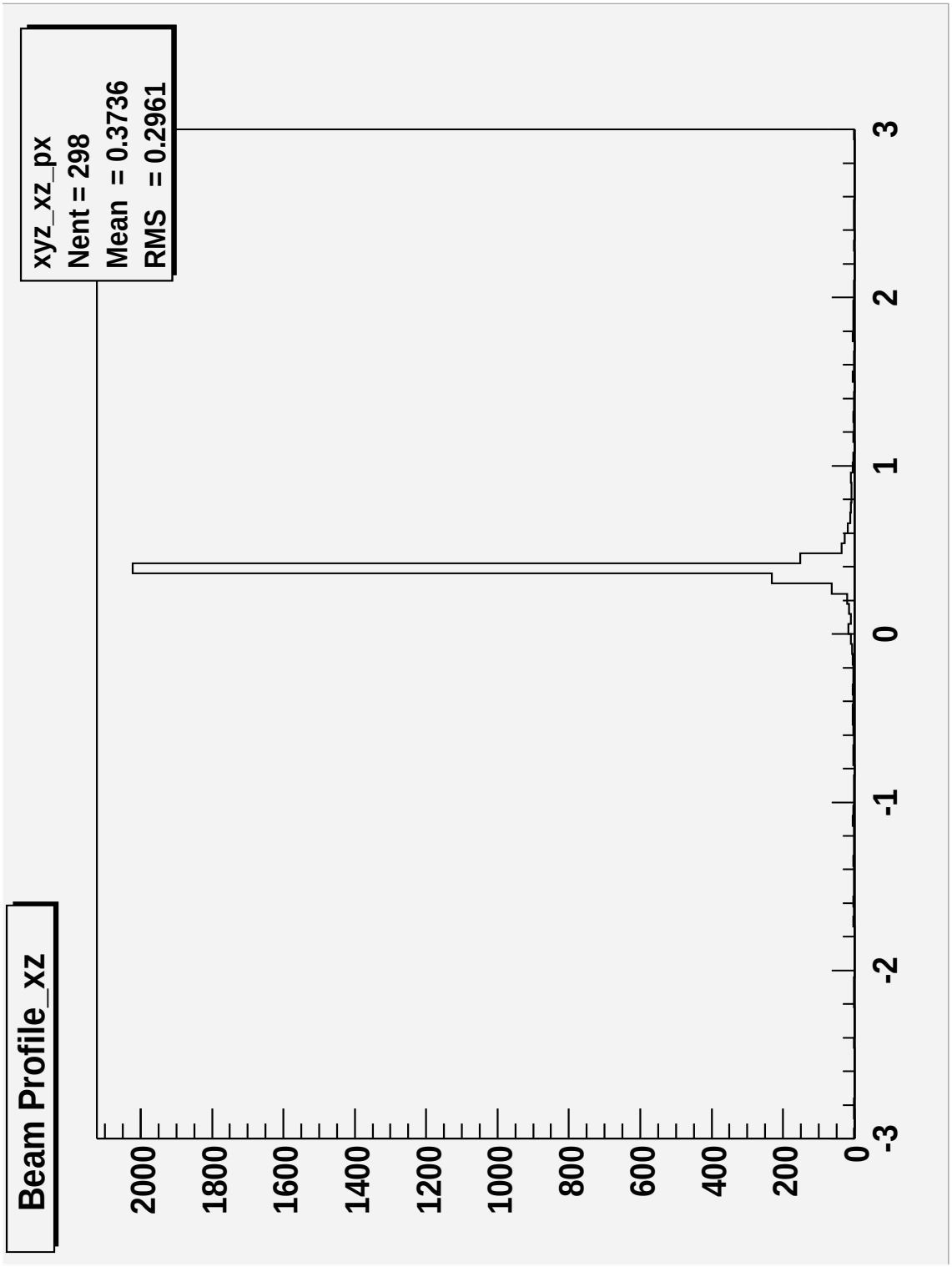
- Plot $\overline{x}$ and $\overline{y}$ versus z, and fit to a line.

  - Line describes passage of beam with respect to nominal axis of barrel

- Repeat fit for positions of each barrel.


Beam Profile
Y
3
2
1
0
-1
-2
-3
Z
40
30
20
10
0
-10
-20
-30
-40
X
-3
-2
-1
0
1
2
3

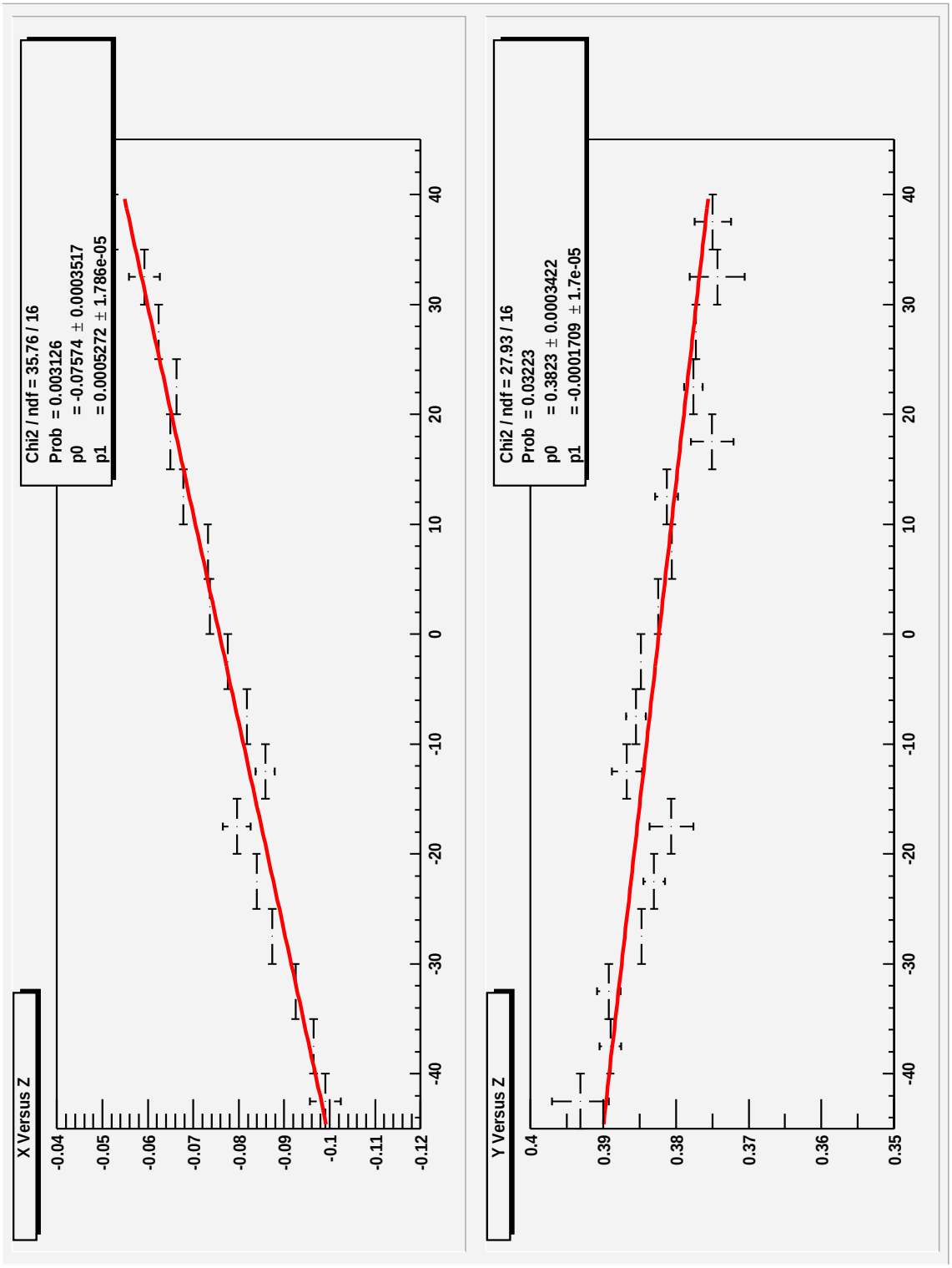

Beam Profile_xz
xyz_xz
Nent = 2776
Mean x = 0.3736
Mean y = -0.09147
RMS x = 0.2961
RMS y = 0.3222
3
2
1
0
-1
-2
-3
-3
-2
-1
0
1
2
3

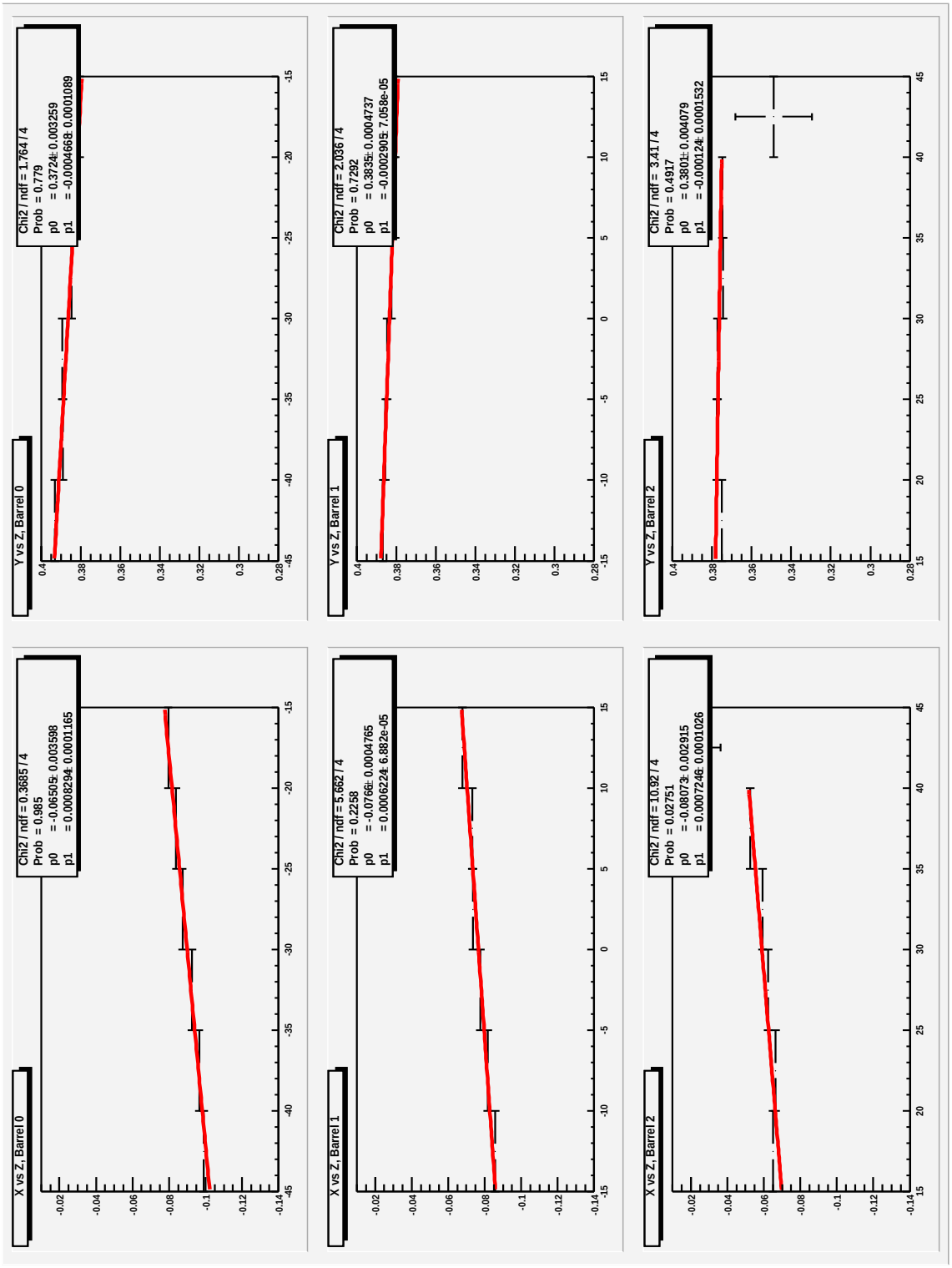

Beam Profile_xz
xyz_xz_px
Nent = 298
Mean = 0.3736
RMS = 0.2961
2000
1800
1600
1400
1200
1000
800
600
400
200
0
-3
-2
-1
0
1
2
3

Cuts

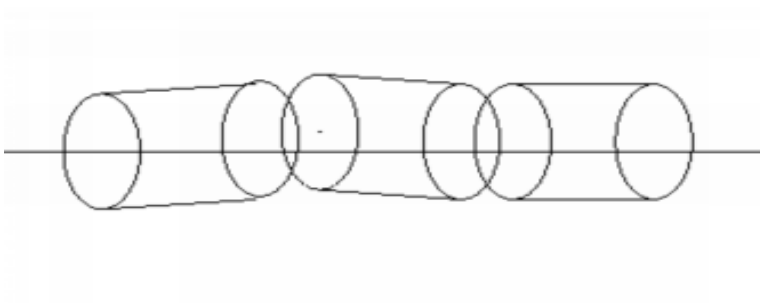
Parameter	SVX	COT
Track Set	GlobalSI_Tracking	COT_Global_Tracking
Algorithm	OutsideInAlg (PerformOutsideInTracking) (PerformOIZTracking)	CotStandAloneAlg
min p_T	1.0 GeV/c	1.0 GeV/c
$\lvert\Delta z_0\rvert_{max}$	4.0 cm	4.0 cm
min number of SI ϕ hits	4	0

Additionally, we require both SVX tracks to be in the same barrel as their vertex.


X Versus Z
Chi2 / ndf = 35.76 / 16
Prob = 0.003126
p0 = -0.07574 ± 0.0003517
p1 = 0.0005272 ± 1.786e-05
-0.04
-0.05
-0.06
-0.07
-0.08
-0.09
-0.1
-0.11
-0.12
-40
-30
-20
-10
0
10
20
30
40
Y Versus Z
Chi2 / ndf = 27.93 / 16
Prob = 0.03223
p0 = 0.3823 ± 0.0003422
p1 = -0.0001709 ± 1.7e-05
0.4
0.39
0.38
0.37
0.36
0.35
-40
-30
-20
-10
0
10
20
30
40


X vs Z, Barrel 0
Chi2 / ndf = 0.3685 / 4
Prob = 0.985
p0 = -0.06505± 0.003598
p1 = 0.0008294± 0.0001165
X vs Z, Barrel 1
Chi2 / ndf = 5.662 / 4
Prob = 0.2258
p0 = -0.0766± 0.0004765
p1 = 0.0006224± 6.882e-05
X vs Z, Barrel 2
Chi2 / ndf = 10.92 / 4
Prob = 0.02751
p0 = -0.08073± 0.002915
p1 = 0.0007246± 0.0001026
Y vs Z, Barrel 0
Chi2 / ndf = 1.764 / 4
Prob = 0.779
p0 = 0.3724± 0.003259
p1 = -0.0004668± 0.0001089
Y vs Z, Barrel 1
Chi2 / ndf = 2.036 / 4
Prob = 0.7292
p0 = 0.3835± 0.0004737
p1 = -0.0002905± 7.058e-05
Y vs Z, Barrel 2
Chi2 / ndf = 3.41 / 4
Prob = 0.4917
p0 = 0.3801± 0.004079
p1 = -0.000124± 0.0001532

By Barrel

	Barrel 0	Barrel 1	Barrel 2	All SVX	COT
$\overline{x}$	-650 $\pm$ 35	-766 $\pm$ 48	-807 $\pm$ 29	-757 $\pm$ 4	-896 $\pm$ 13
m_x	829 $\pm$ 117	622 $\pm$ 69	725 $\pm$ 103	527 $\pm$ 19	407 $\pm$ 55
$\overline{y}$	3724 $\pm$ 33	3835 $\pm$ 5	3801 $\pm$ 41	3823 $\pm$ 3	3414 $\pm$ 13
m_y	-467 $\pm$ 109	-291 $\pm$ 71	-124 $\pm$ 153	-170 $\pm$ 17	17 $\pm$ 62

- Note: all lengths are in microns, all slopes are in microradians.
- Recall: SVT spec: All barrels fall within 100 μrad of some line.
- Recall: Inchworm & Accelerator spec: That line is the beamline.