Beam Width Measurements using Vertex Distributions

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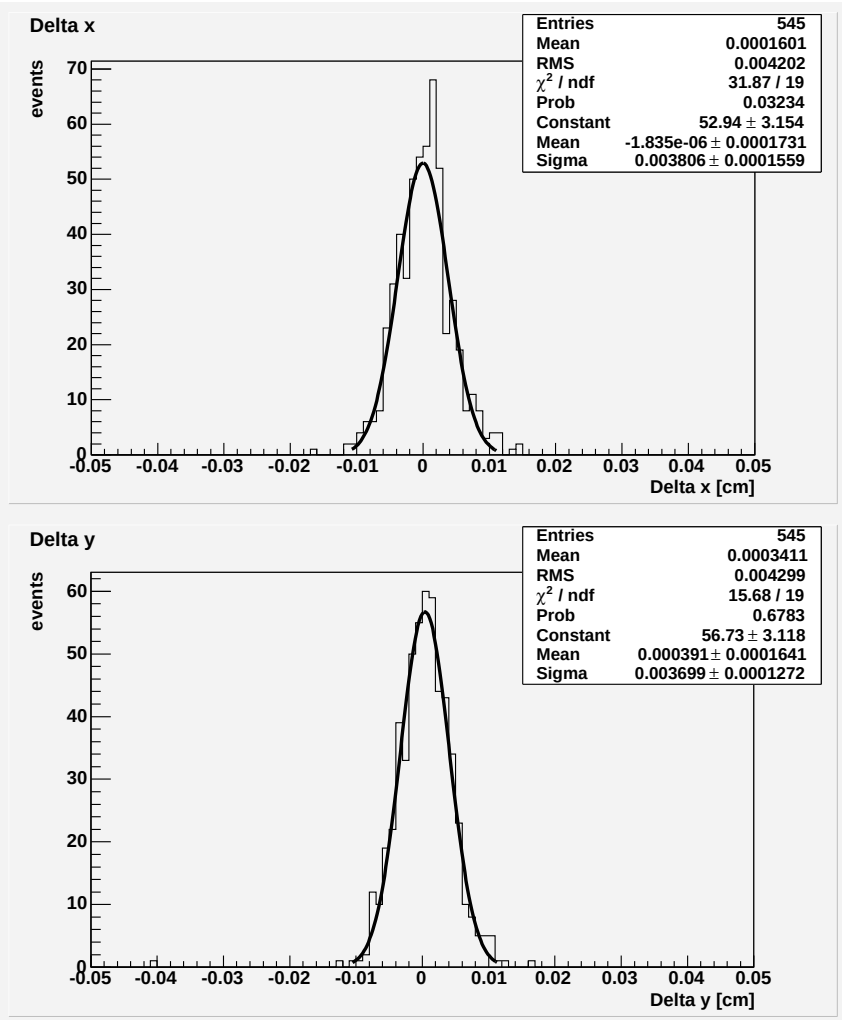
Method:

- Use PrimeVtx to find primary vertex distribution on 5.3.1 $Jet50$ data
- Fit Gaussian to the vertex distribution
- $\sigma_{beam} = \sqrt{\sigma_{obs}^2 - \kappa^2 < \sigma_{pvtx}^2 >}$
- Use PrimeVtx scale factors as a function of z
- Look at the variation of beam width with z
- Functional Form is $\sigma^2 = \epsilon(\beta^* + (z - z_0)^2/\beta^*)$

Gaussian Fits to PrimeVtx Vertices

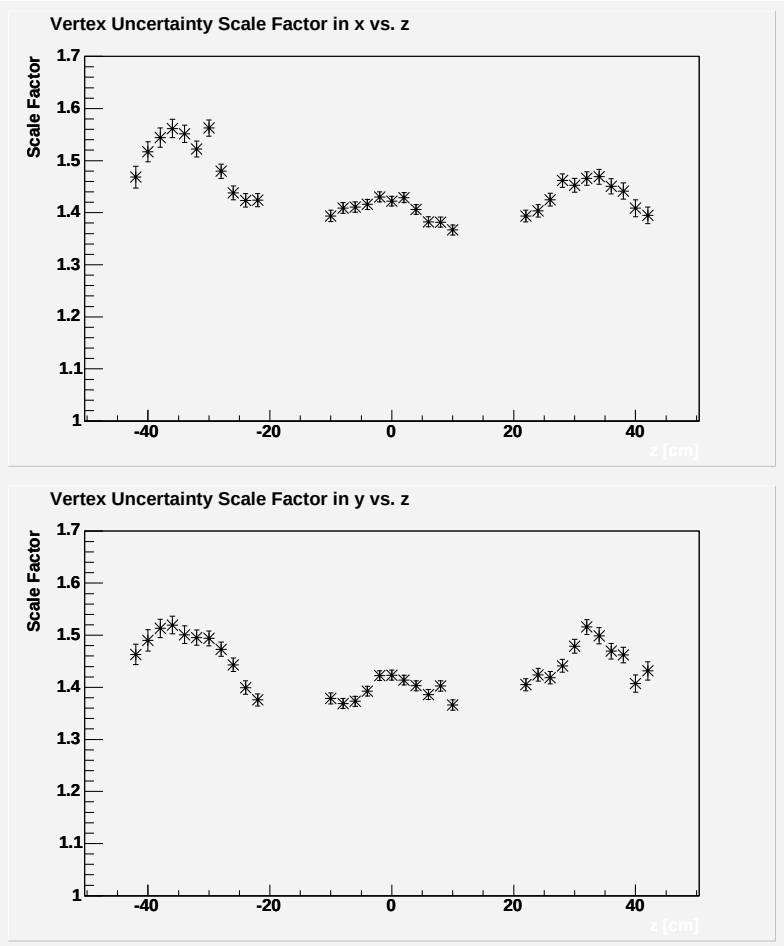


Gaussian fit for vertices (between $-1 < z < 1$ cm)

Group vertices in z-bins of 2 cm

Reject vertices at the tails and with $\sigma_{pvtx} > 55\mu$m

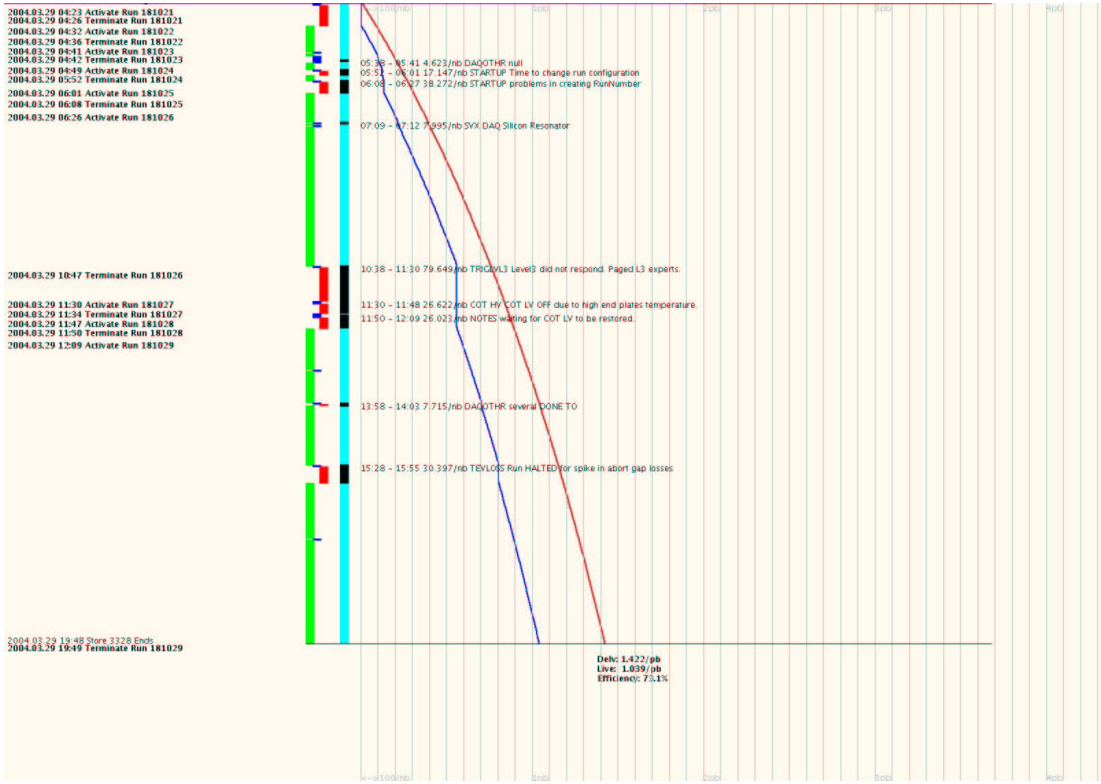
Scale Factor for PrimeVtx



Can see quite a variation in z

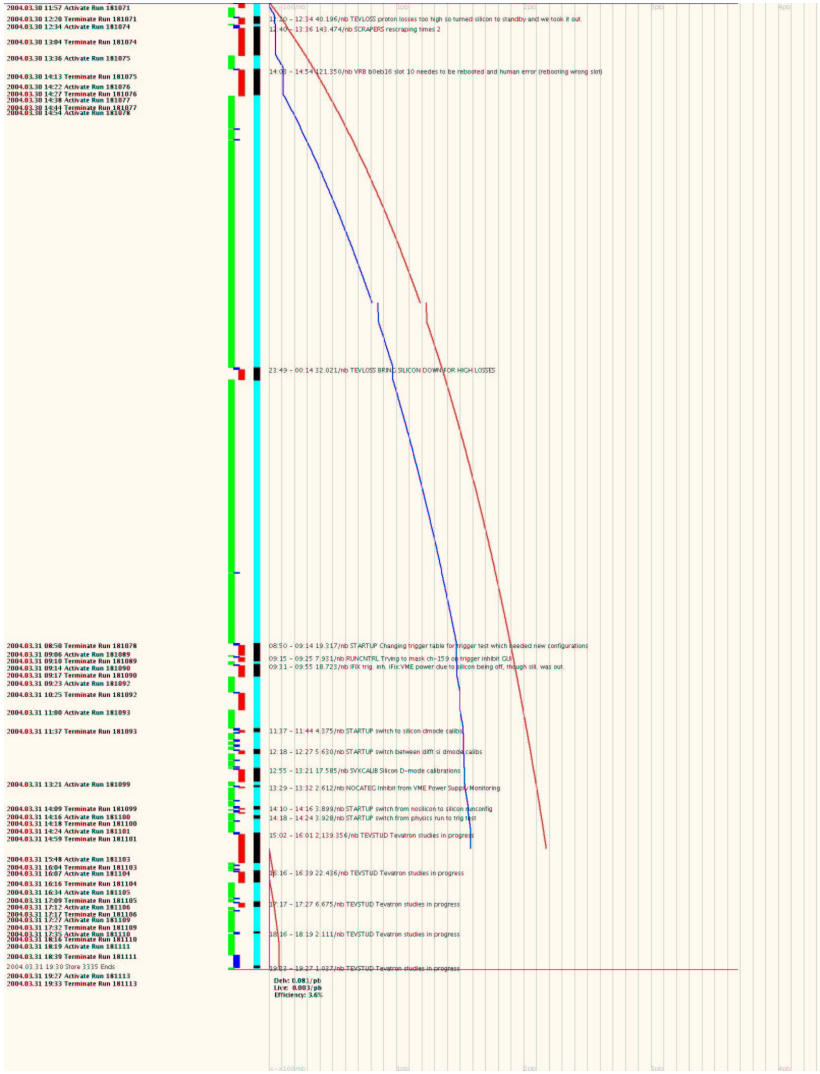
Scale factors for vertex uncertainties measured using pull distributions

Store 3328



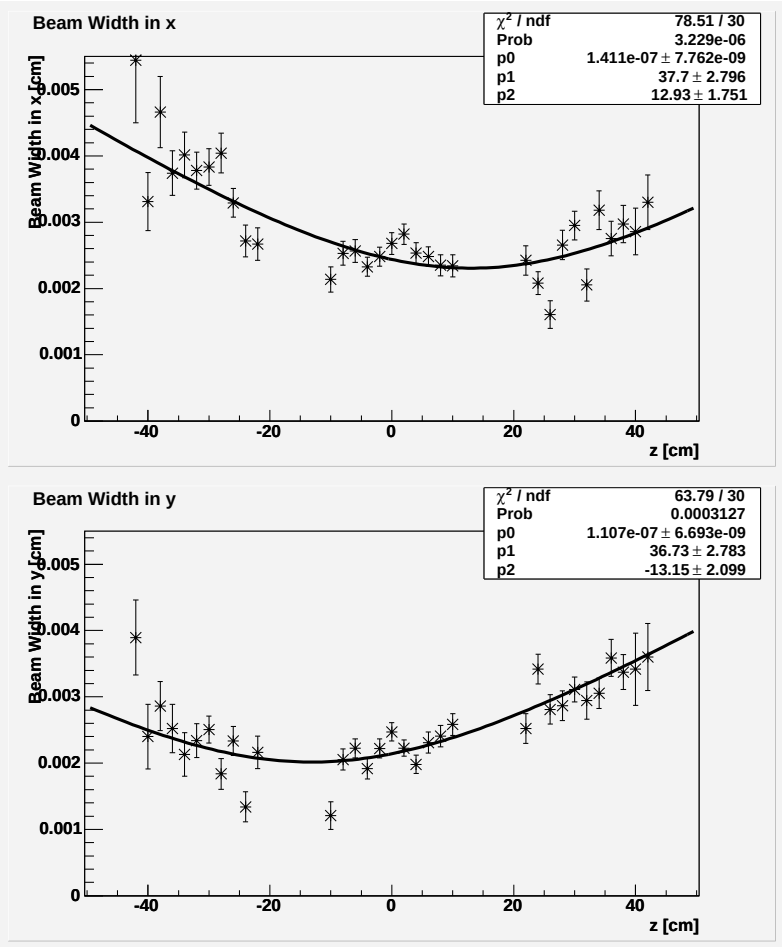
Runs 181026, 181029

Store 3335



Run 181078

Run 181026



Values for Run 181026 are

$$\epsilon_x = (1.41 \pm 0.08) \times 10^{-7} \text{ cm}$$

$$\epsilon_y = (1.11 \pm 0.07) \times 10^{-7} \text{ cm}$$

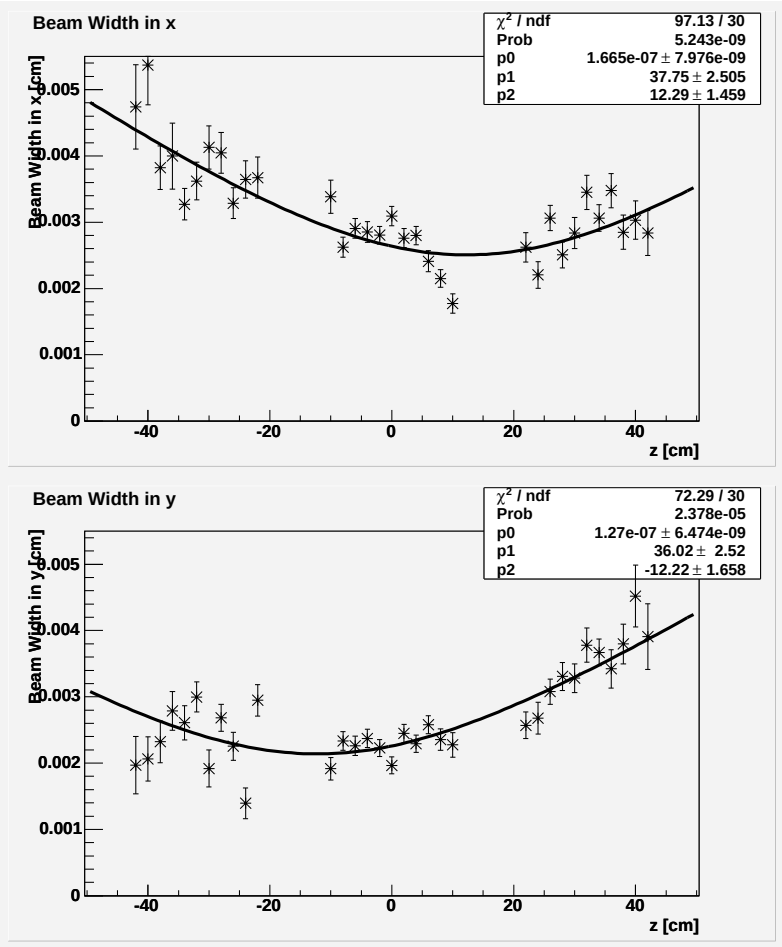
$$\beta_x^* = 37.7 \pm 2.8 \text{ cm}$$

$$\beta_y^* = 36.7 \pm 2.8 \text{ cm}$$

$$z_0^x = 12.9 \pm 1.8 \text{ cm}$$

$$z_0^y = -13.2 \pm 2.1 \text{ cm}$$

Run 181029



Values for Run 181029 are

$$\epsilon_x = (1.67 \pm 0.08) \times 10^{-7} \text{ cm}$$

$$\epsilon_y = (1.27 \pm 0.06) \times 10^{-7} \text{ cm}$$

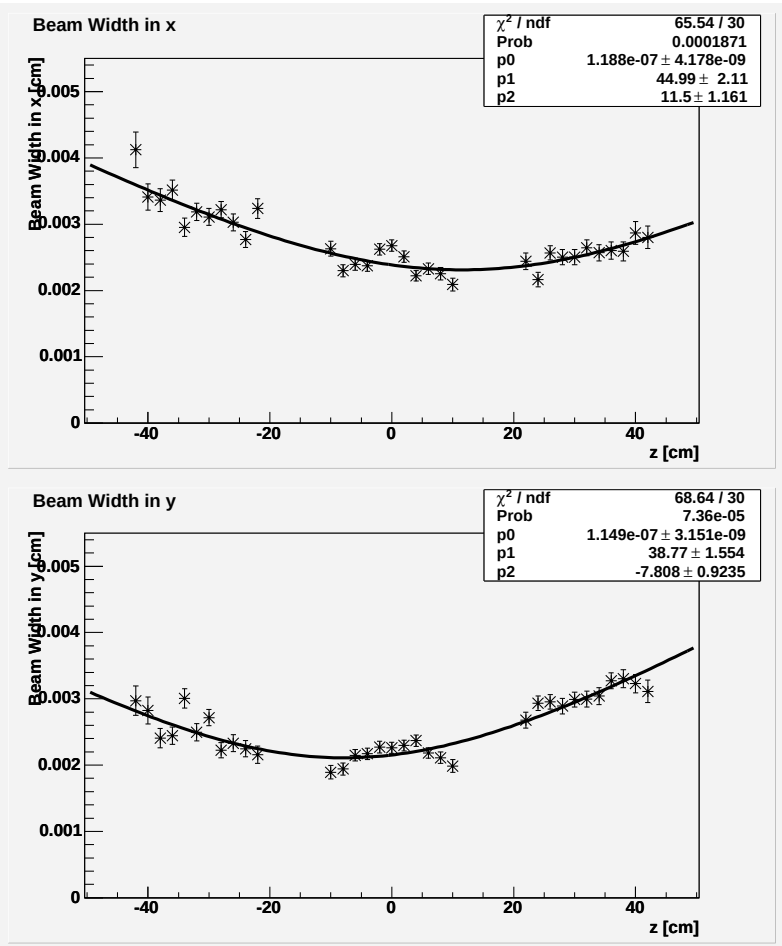
$$\beta_x^* = 37.8 \pm 2.5 \text{ cm}$$

$$\beta_y^* = 36.0 \pm 2.5 \text{ cm}$$

$$z_0^x = 12.3 \pm 1.6 \text{ cm}$$

$$z_0^y = -12.2 \pm 1.7 \text{ cm}$$

Run 181078



Values for Run 181078 are

$$\epsilon_x = (1.19 \pm 0.04) \times 10^{-7} \text{ cm}$$

$$\epsilon_y = (1.15 \pm 0.03) \times 10^{-7} \text{ cm}$$

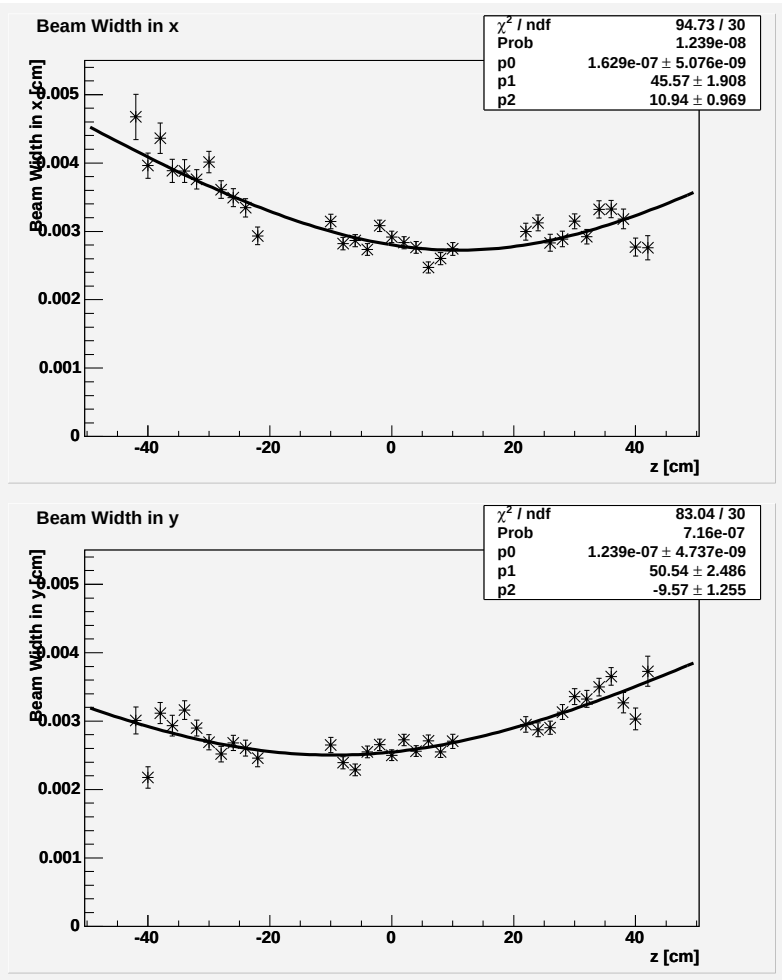
$$\beta_x^* = 45.0 \pm 2.1 \text{ cm}$$

$$\beta_y^* = 38.8 \pm 1.6 \text{ cm}$$

$$z_0^x = 11.5 \pm 1.2 \text{ cm}$$

$$z_0^y = -7.8 \pm 0.9 \text{ cm}$$

Store 3123



Values for Store 3123 are

$$\epsilon_x = (1.63 \pm 0.05) \times 10^{-7} \text{ cm}$$

$$\epsilon_y = (1.24 \pm 0.05) \times 10^{-7} \text{ cm}$$

$$\beta_x^* = 45.6 \pm 1.9 \text{ cm}$$

$$\beta_y^* = 50.5 \pm 2.5 \text{ cm}$$

$$z_0^x = 10.9 \pm 1.0 \text{ cm}$$

$$z_0^y = -9.6 \pm 1.3 \text{ cm}$$

Summary

All values in cm

For X:

Store	Run Number	Date	$\epsilon_x \times 10^{-7}$	β_x^*	z_0^x
3123	All	Jan 2/04	1.63 ± 0.05	45.6 ± 1.9	10.9 ± 1.0
3328	181026	Mar 29/04	1.41 ± 0.08	37.7 ± 2.8	12.9 ± 1.8
3328	181029	Mar 29/02	1.67 ± 0.08	37.8 ± 2.5	12.3 ± 1.6
3335	181078	Mar 30/02	1.19 ± 0.04	45.0 ± 2.1	11.5 ± 1.2

For Y:

Store	Run Number	Date	$\epsilon_x \times 10^{-7}$	β_x^*	z_0^x
3123	All	Jan 2/04	1.24 ± 0.05	50.5 ± 2.5	-9.6 ± 1.3
3328	181026	Mar 29/04	1.11 ± 0.07	36.7 ± 2.8	-13.2 ± 2.1
3328	181029	Mar 29/02	1.27 ± 0.06	36.0 ± 2.5	-12.2 ± 1.7
3335	181078	Mar 30/02	1.15 ± 0.03	38.8 ± 1.6	-7.8 ± 0.9