

β^* Measurement at D0

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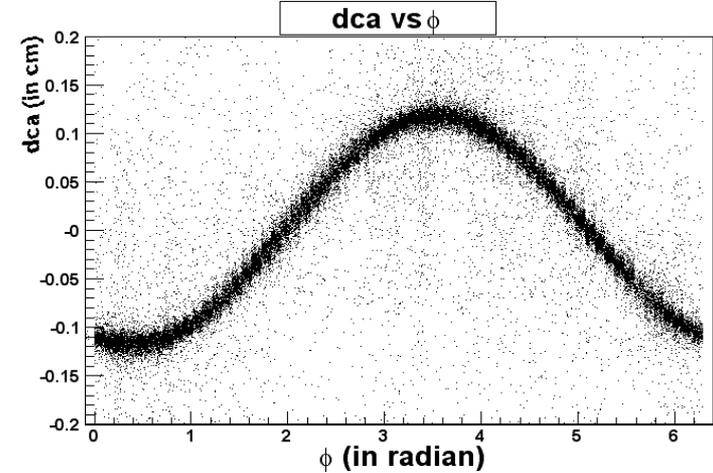
Luminosity Meeting

Dec 5th 2007

The Method

- Interaction region is from -40cm to +40cm on z-axis, dividing data in slices of 5 cm each on z-axis, total 16 division (say z-region)
- For each z-region, dca vs ϕ plot is of sinusoidal shape because of

$$dca = y_v \cos\phi - x_v \sin\phi$$



$$\langle d_1 d_2 \rangle = \frac{1}{2} (\sigma_2^2 - \sigma_1^2) \cos 2\Phi + \frac{1}{2} (\sigma_2^2 + \sigma_1^2) \cos \Delta\Phi - T \sin 2\Phi$$

where, σ_1 , σ_2 and T are parameters

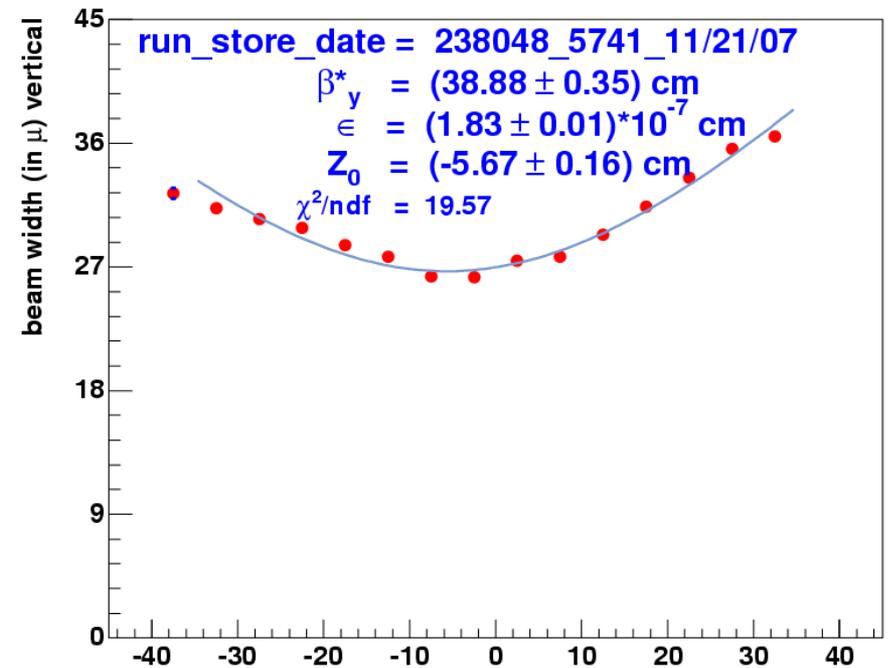
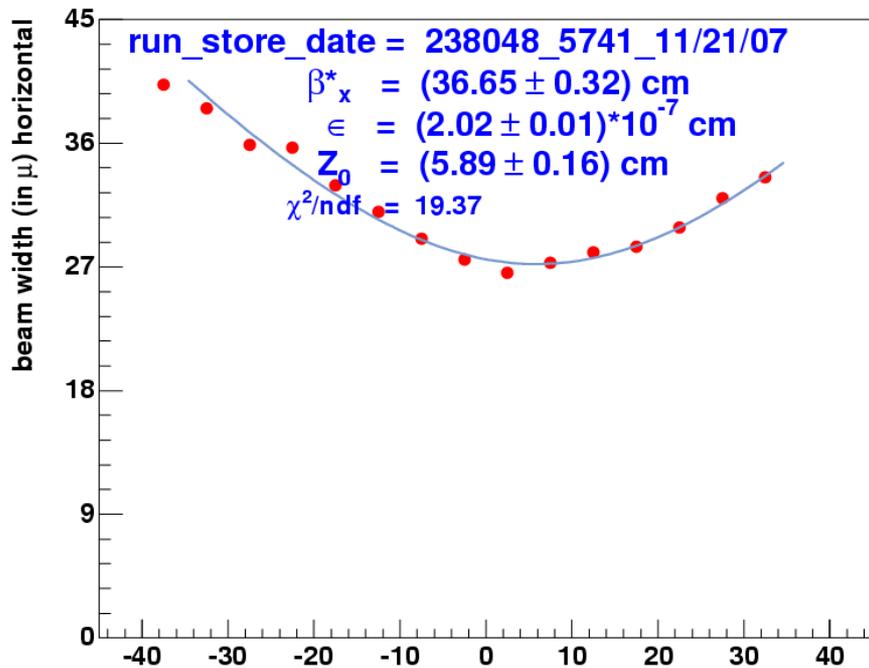
- x_v & $y_v \rightarrow (x, y)$ coordinate of the vertex
- d_1 & $d_2 \rightarrow$ impact parameter of two tracks from the same vertex
 - σ_1 & $\sigma_2 \rightarrow$ beam width in horizontal and vertical plane
 - $T \rightarrow$ correlation between σ_1 & σ_2

The interaction region is a drift in the Tevatron, z dependence of beam width given by following formula

$$\sigma^2 = \varepsilon_{eff} \left[\beta^* + \frac{(z - z_0)^2}{\beta^*} \right]$$

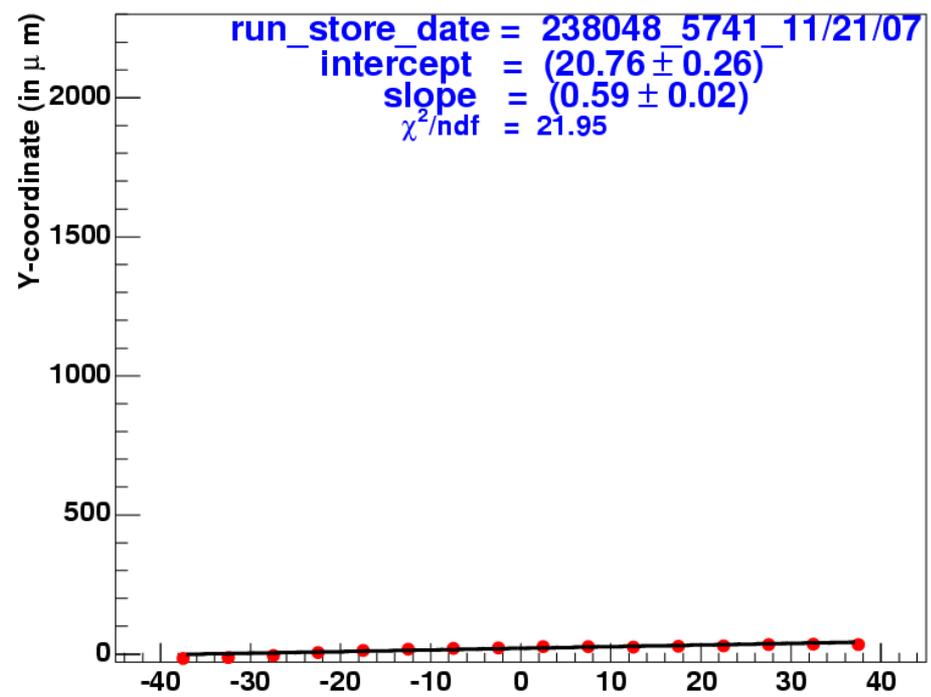
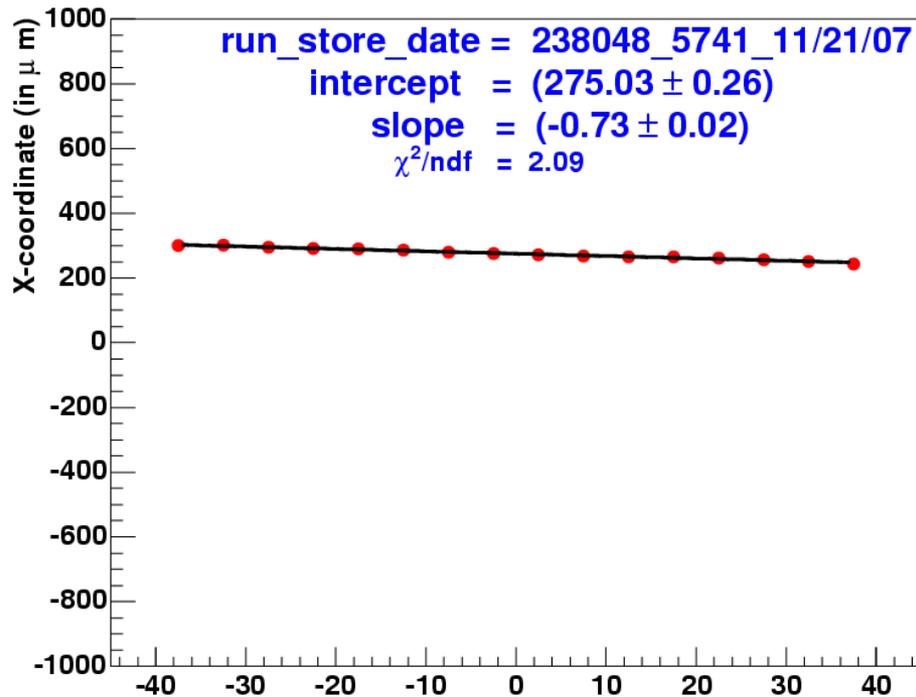
$$\sigma_i \rightarrow \beta_i^*$$

Red dots corresponds to beam width (in micron m)



$$\sigma^2 = \epsilon_{\text{eff}} \left[\beta^* + \frac{(z - z_0)^2}{\beta^*} \right]$$

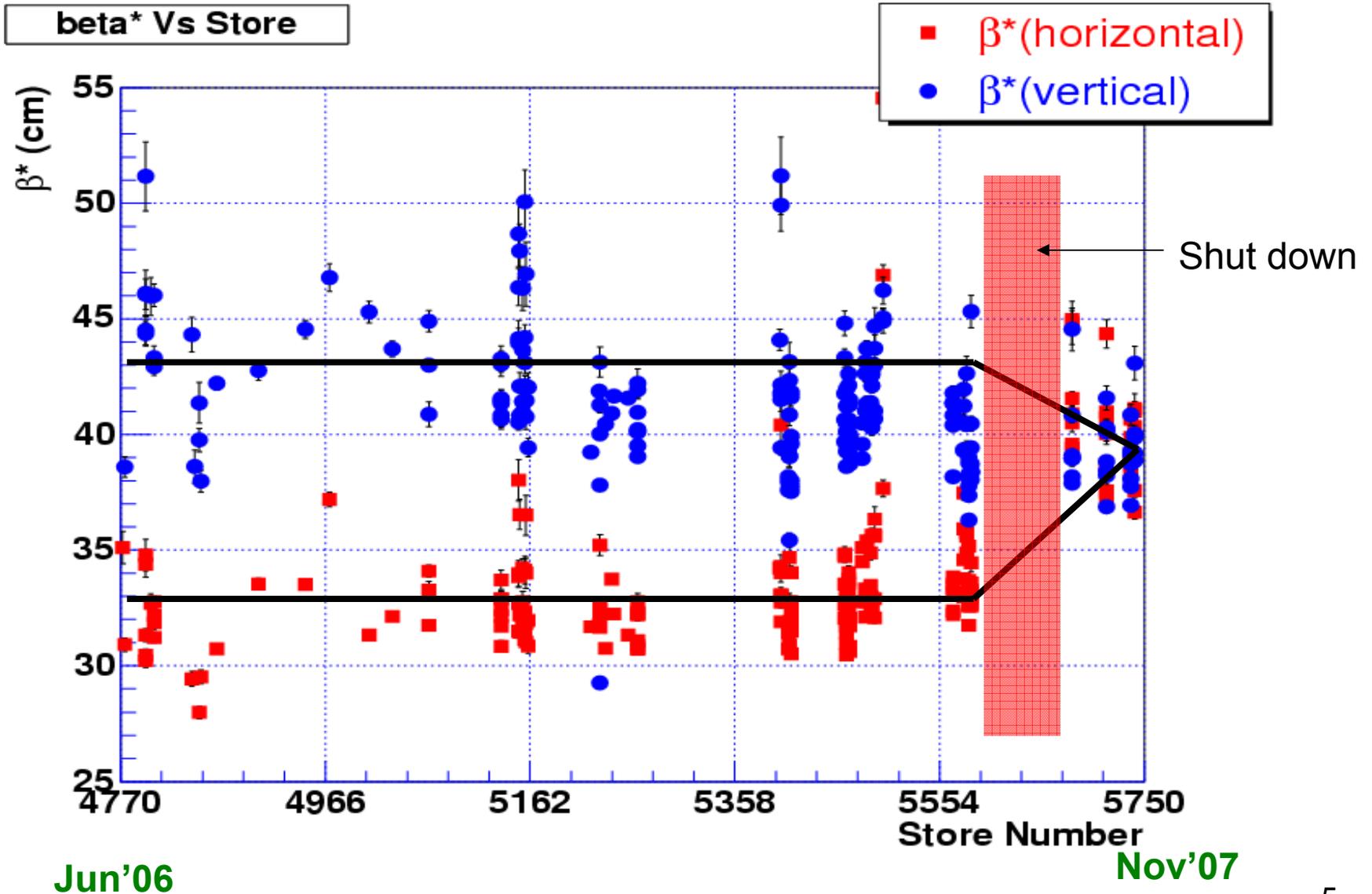
X/Y coordinate vs. Z



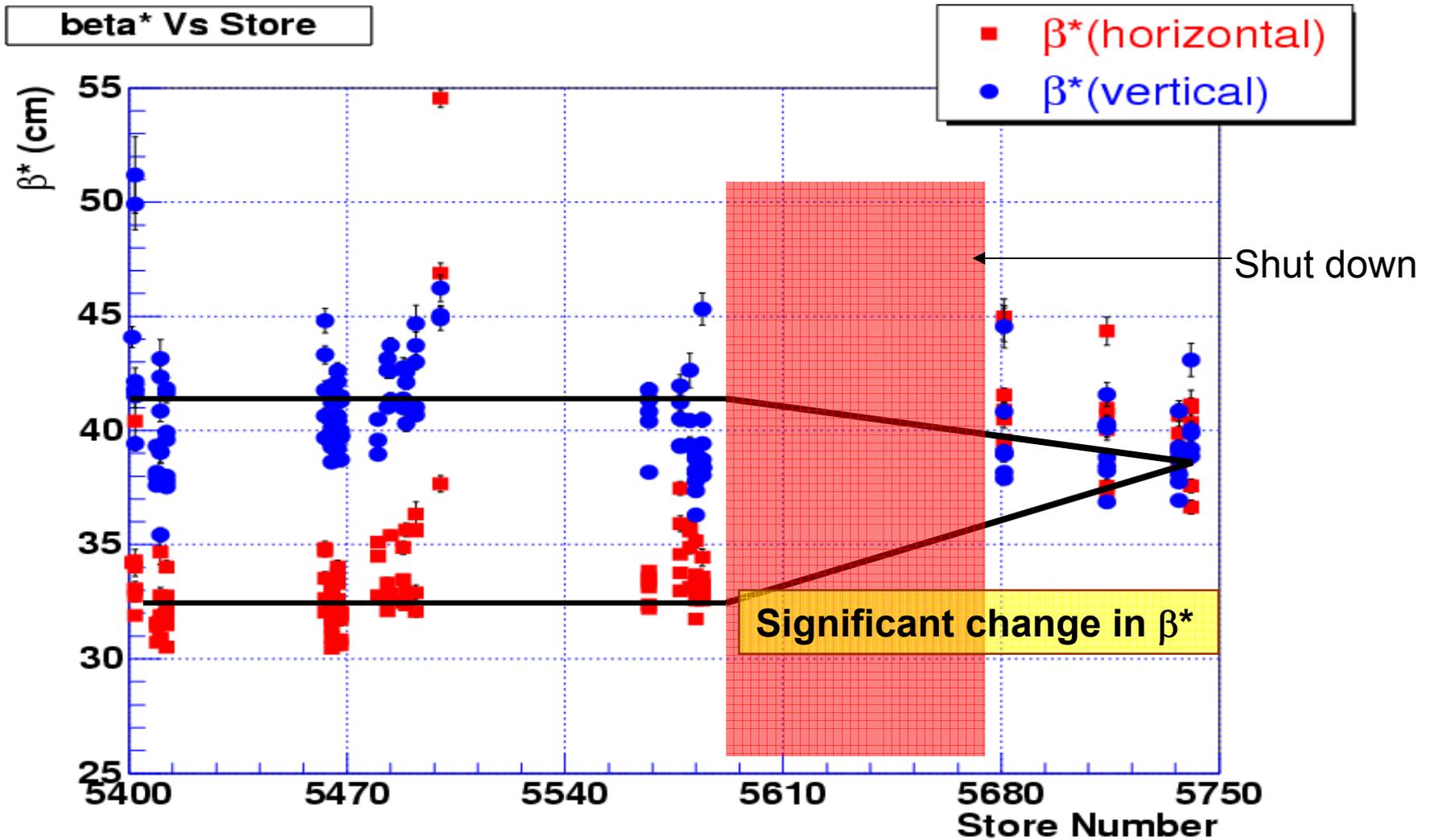
← Z-axis (cm) →

- Fitting dca vs ϕ histogram with a sinusoidal function of the form $A \sin(\phi+B)$ where A and B are fit parameters
- Using A and B, one can calculate beam position X & Y in each bin

β^* vs. Stores



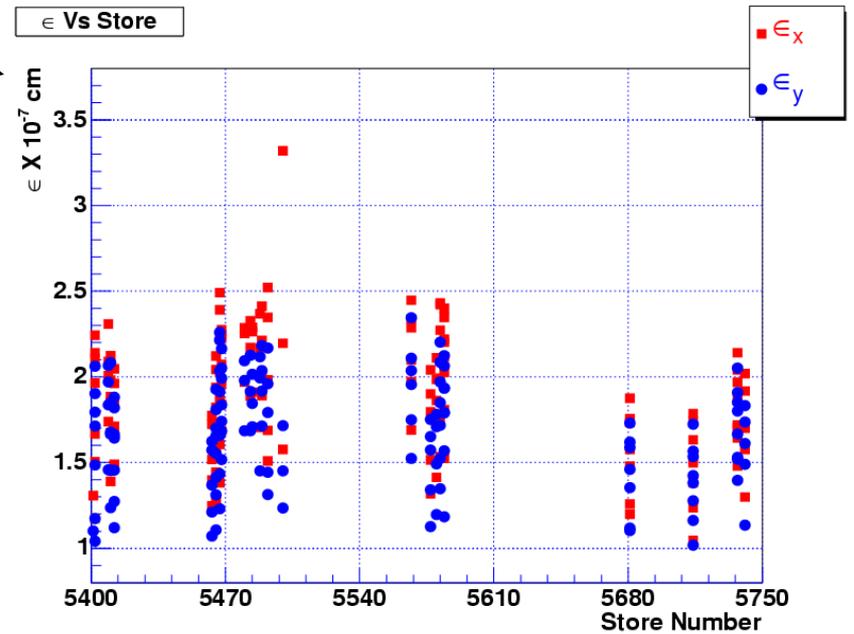
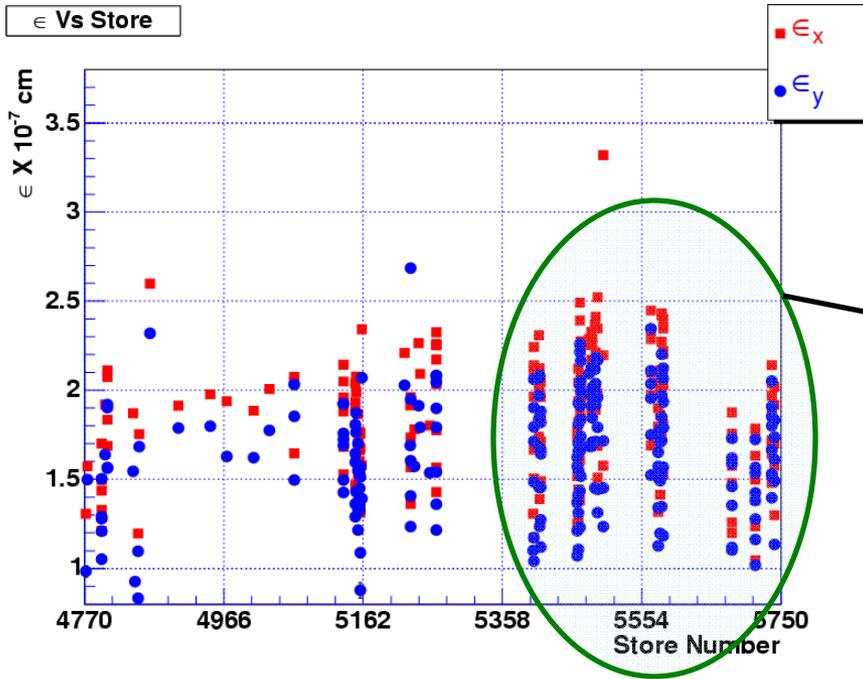
β^* vs. recent stores



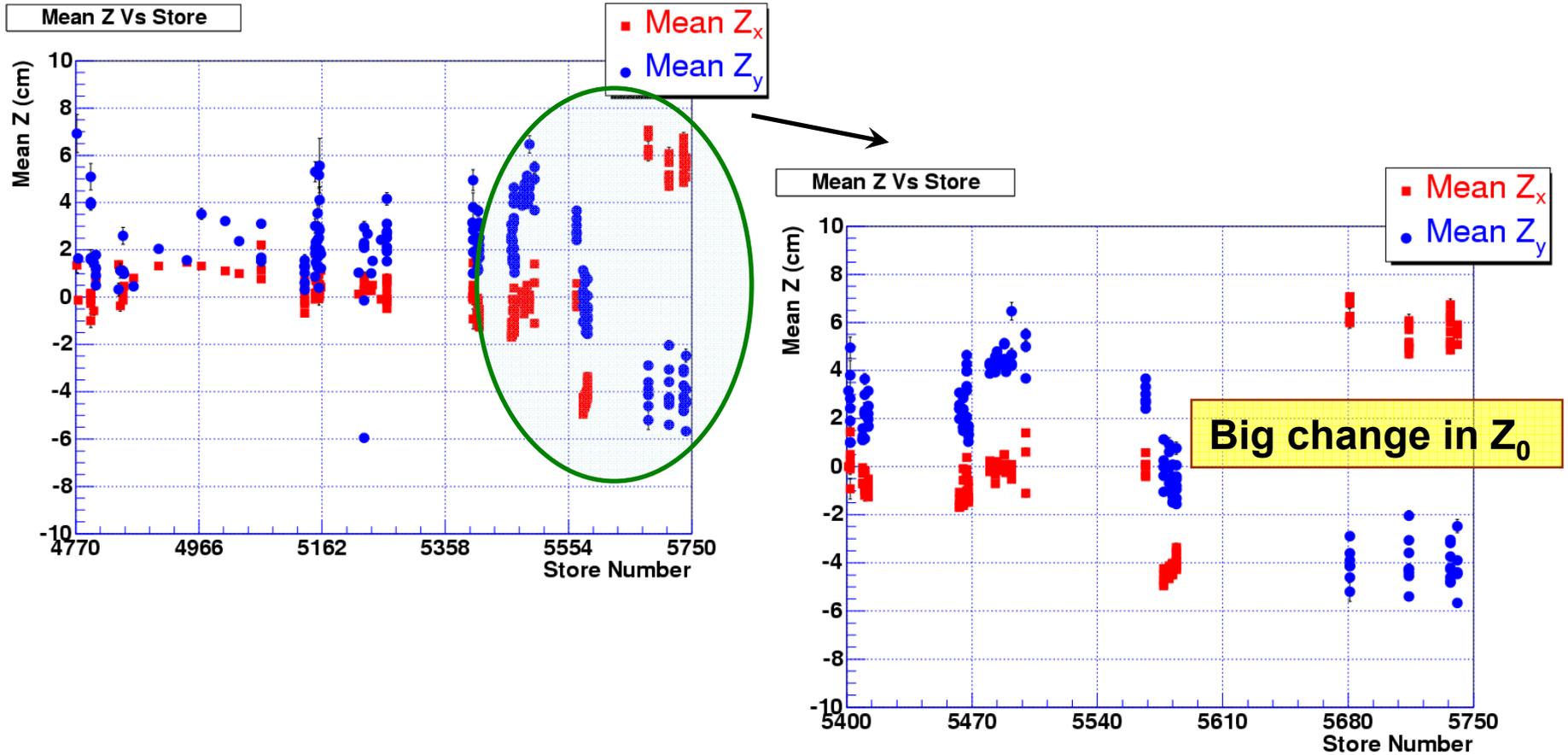
Early
May'07

Early
Nov'07

ϵ vs. Stores



Z_0 vs. Stores



In a Store

Nov 20, 07

5737

$Z_0 / \epsilon \times 10^7 / \beta^*$ Vs Run

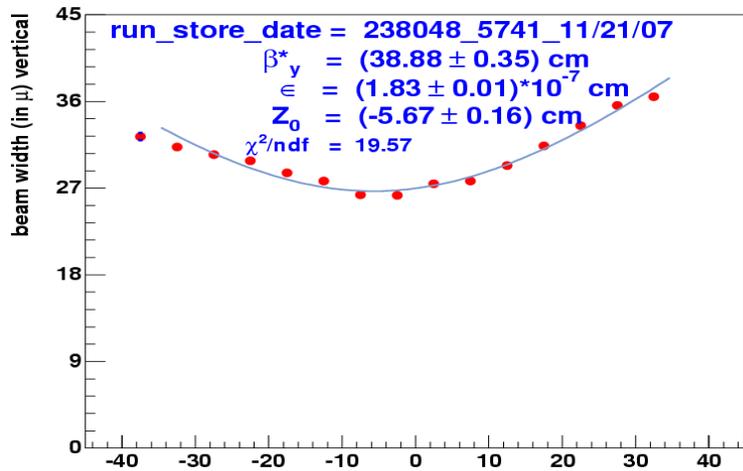
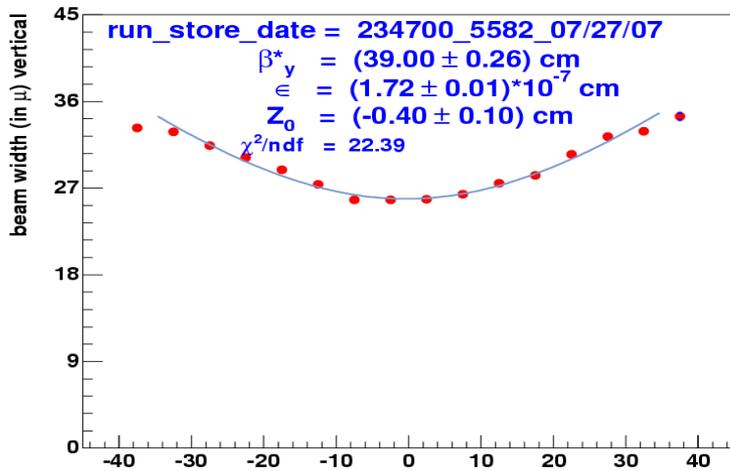
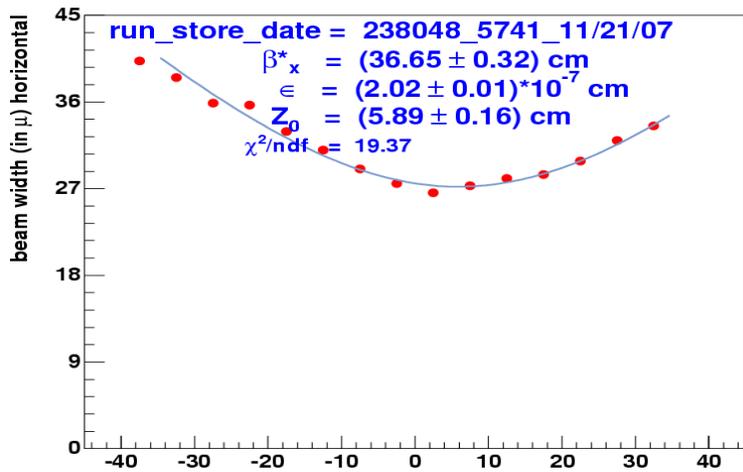
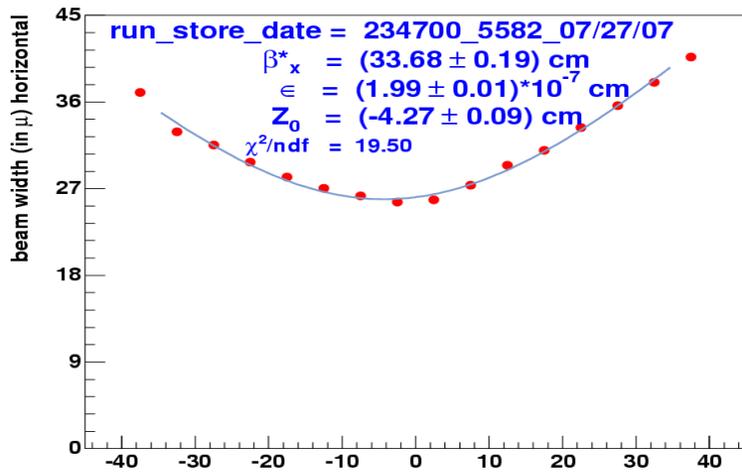


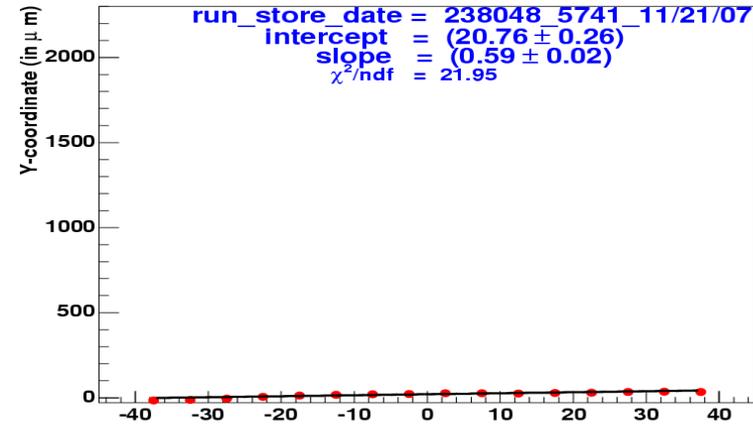
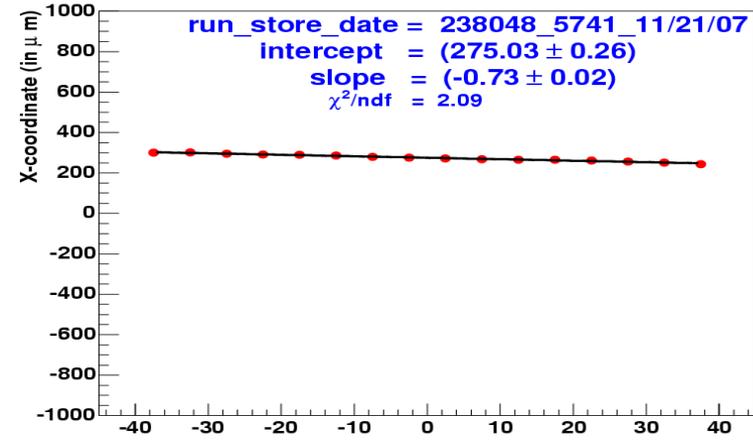
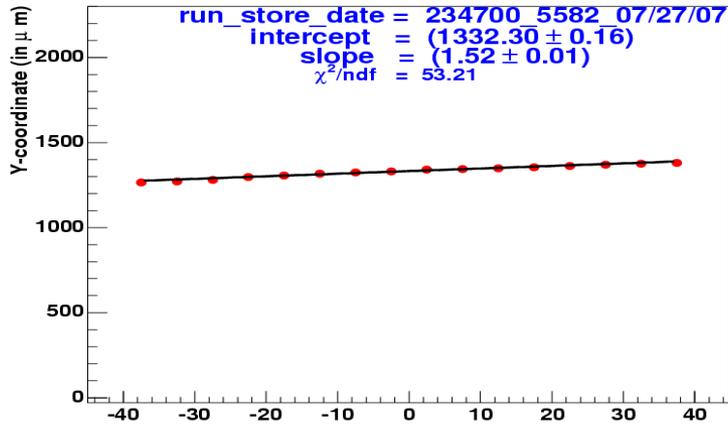
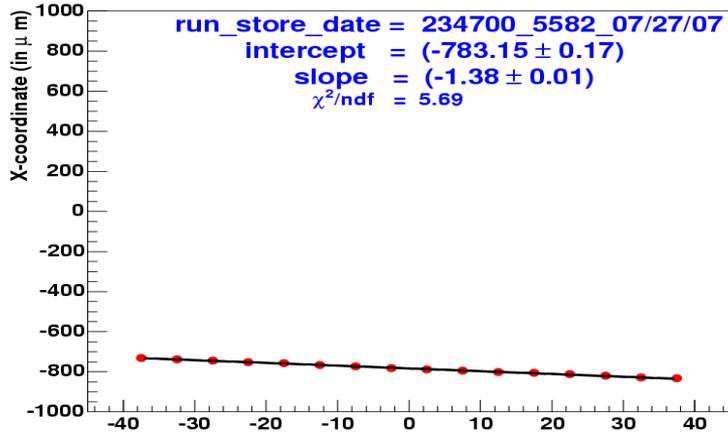
Before

After

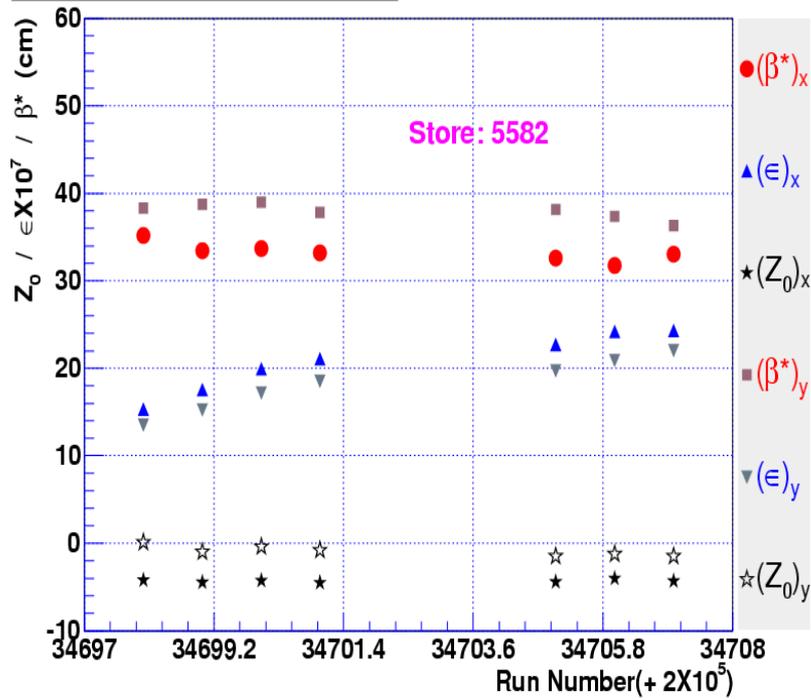
Shutdown

Aug 05, 07 → Oct 27, 07

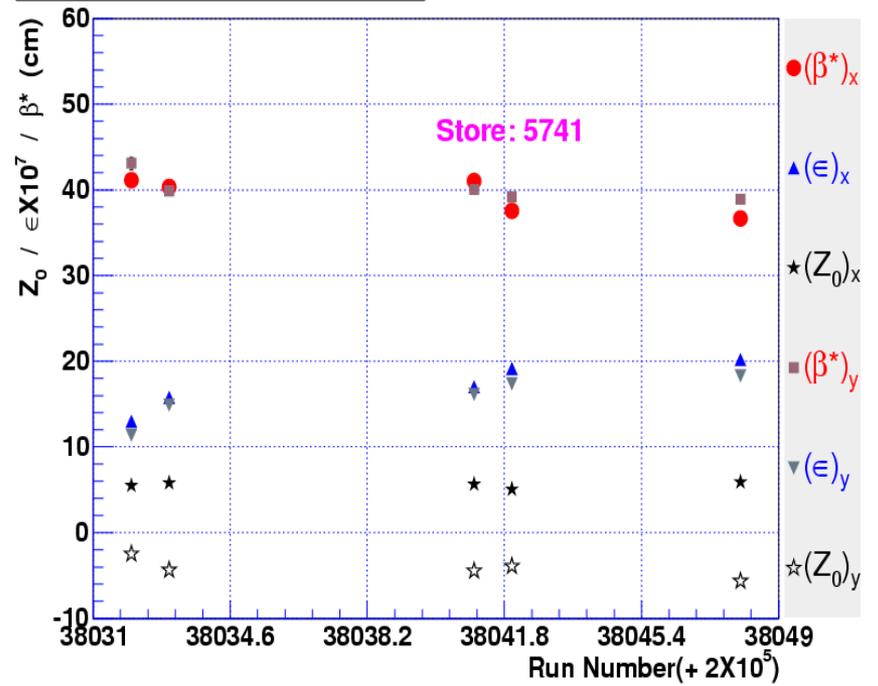




$Z_0 / \epsilon X 10^7 / \beta^*$ Vs Run



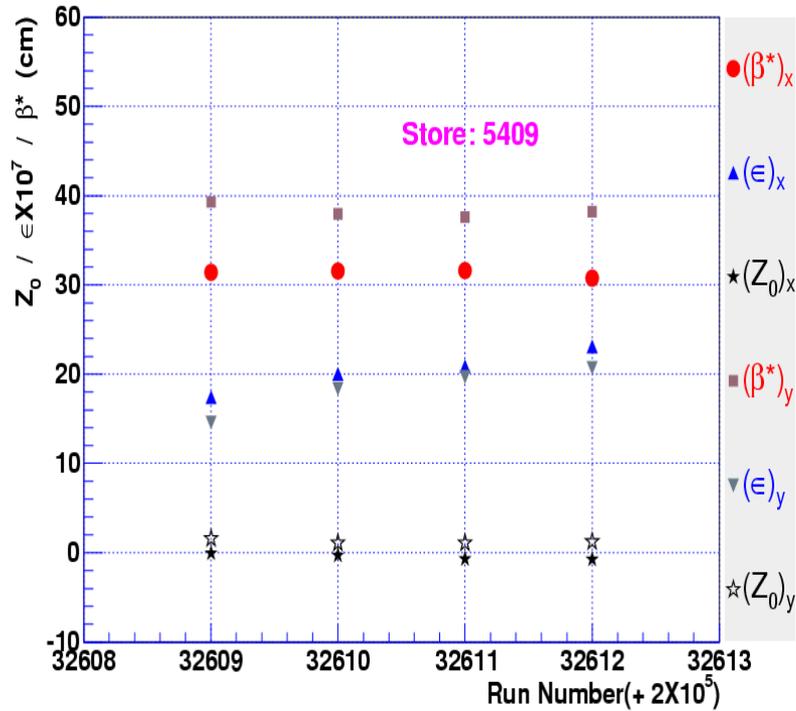
$Z_0 / \epsilon X 10^7 / \beta^*$ Vs Run



May 03, 07

5409

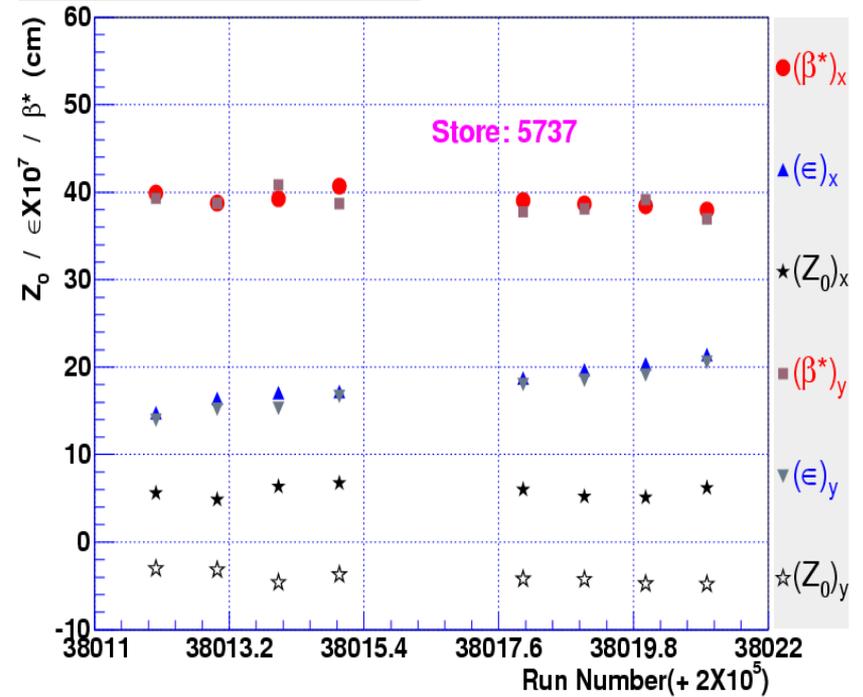
$Z_0 / \epsilon X 10^7 / \beta^*$ Vs Run



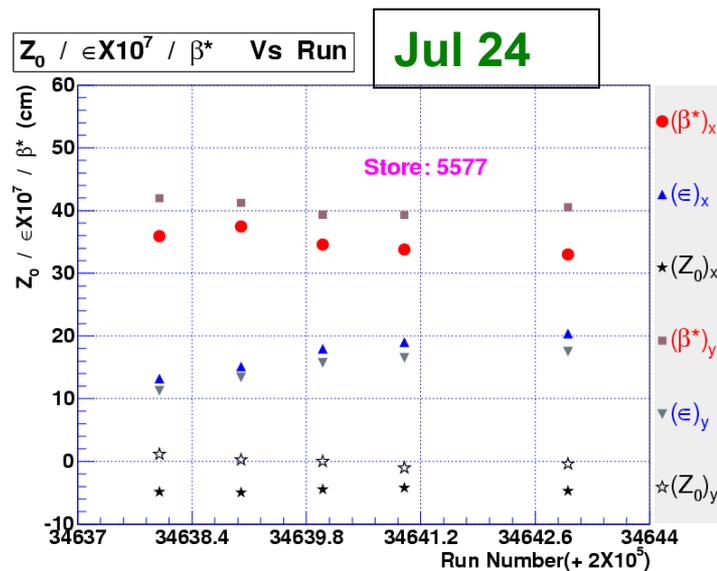
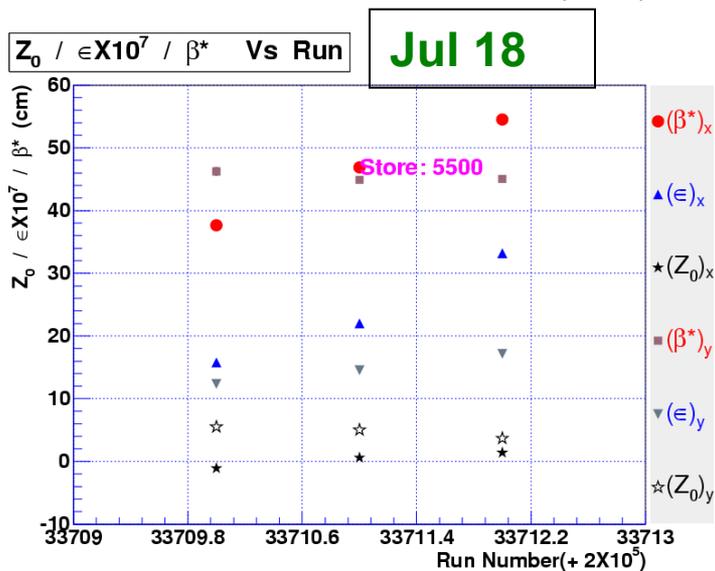
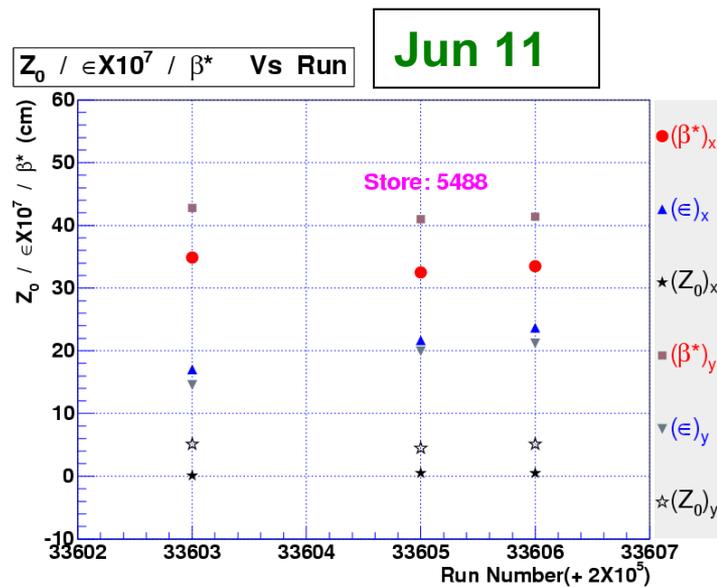
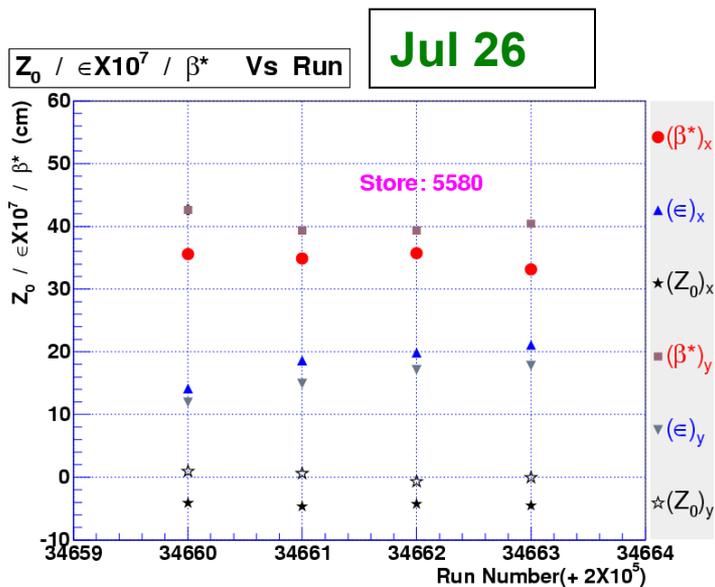
Nov 20, 07

5737

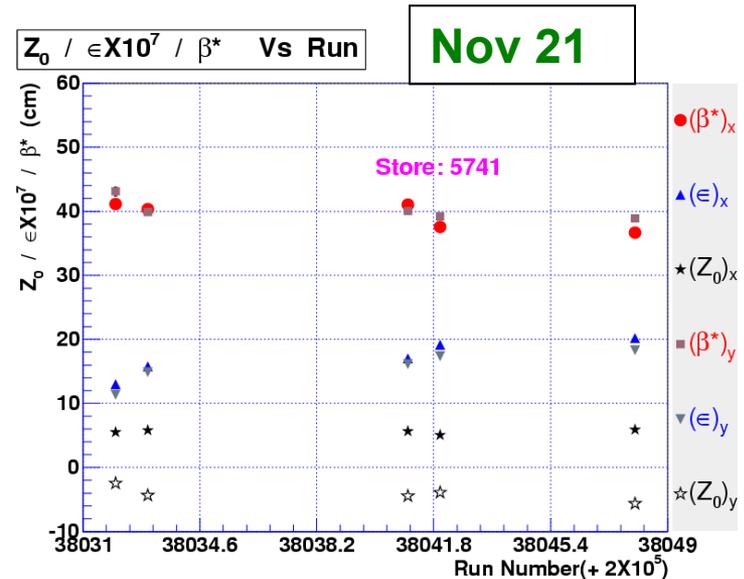
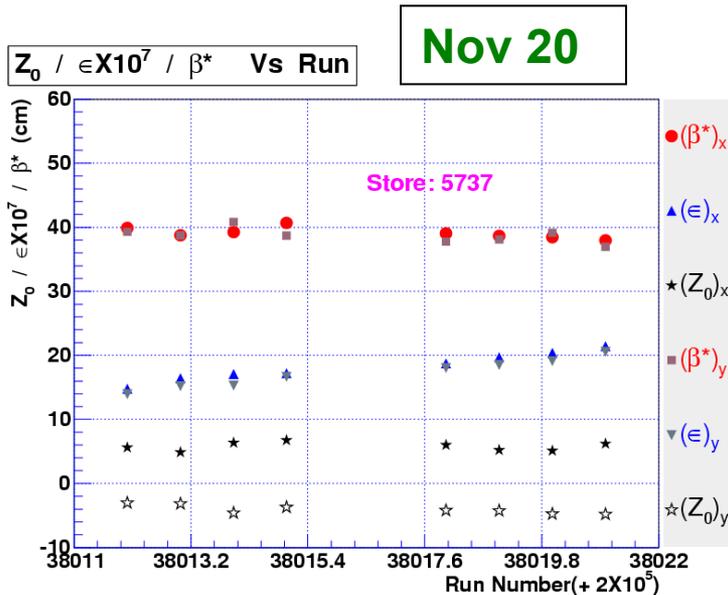
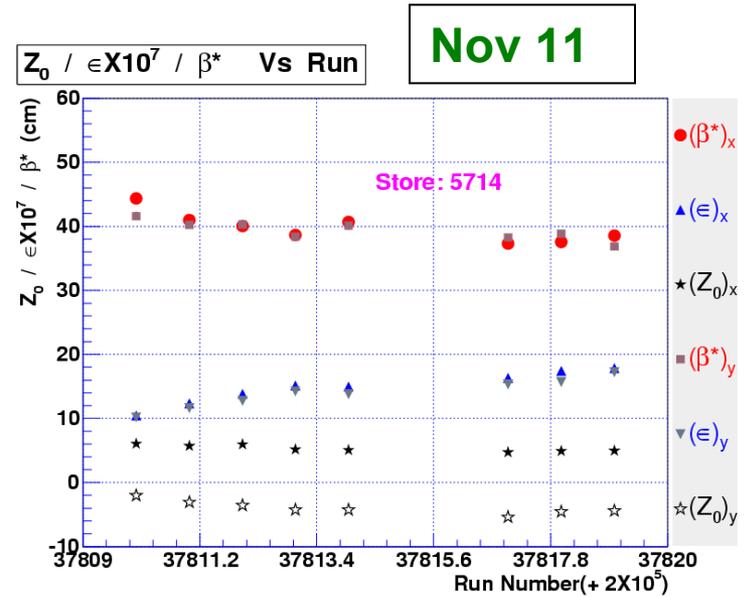
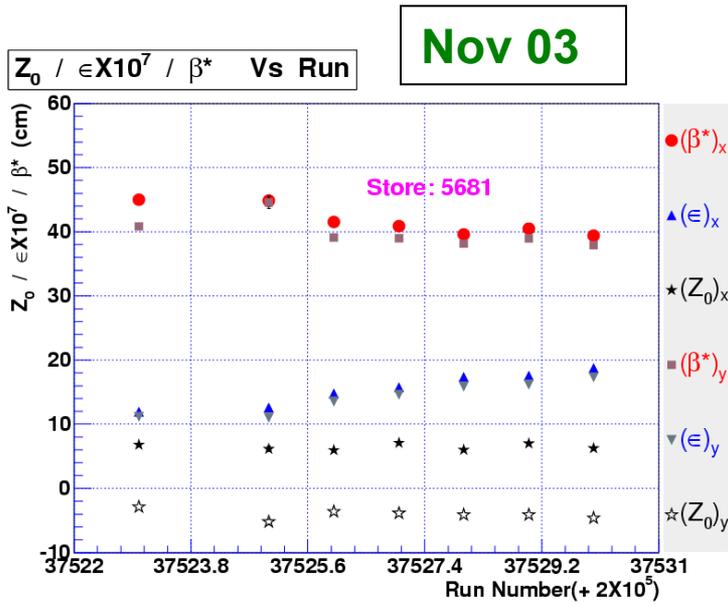
$Z_0 / \epsilon X 10^7 / \beta^*$ Vs Run



Before Shutdown



After Shutdown



Summary

- ❖ Measurement shows that β^*_x and β^*_y change significantly from last reported measurement before shutdown.
- ❖ Big change in mean Z_0 and beam position.
- ❖ The average value of β^*_x and β^*_y is $\sim 40\text{cm}$ with some fluctuations, these values were $\sim 35\text{cm}$ and $\sim 39\text{cm}$.
- ❖ Updated results with many more store are available at:
http://www-clued0.fnal.gov/~avdhash/Beam_main.html