Beam Position at DØ

CDF/DØ/AD Luminosity Meeting

20th April 2004

Michiel Sanders

University of Manchester

Introduction

- Real time beam position at DØ needed for L2 and L3 triggering

- Beam position calculated in an "examine" program:

  * Takes real-time, triggered data
  * Runs L3 tracking algorithms on raw data
  * Finds beam position every $\sim$ 5 to 10 minutes from dca-ϕ fit:
    · Beam position x, y at $z = 0$
    · Beam tilt in xz and yz planes

- Precision:

  * $\sigma_{x,y} \sim 2.5$ μm, $\sigma_{xz,yz} \sim 10$ μrad
  * Statistics limited

- Caveat: Small bias suspected with respect to offline tracking

Beam Position

- Vertices on a line $\begin{cases} x = X_0 + A_x z \\ y = Y_0 + A_y z \end{cases}$
- Extra contribution to track impact parameter due to beam offset:

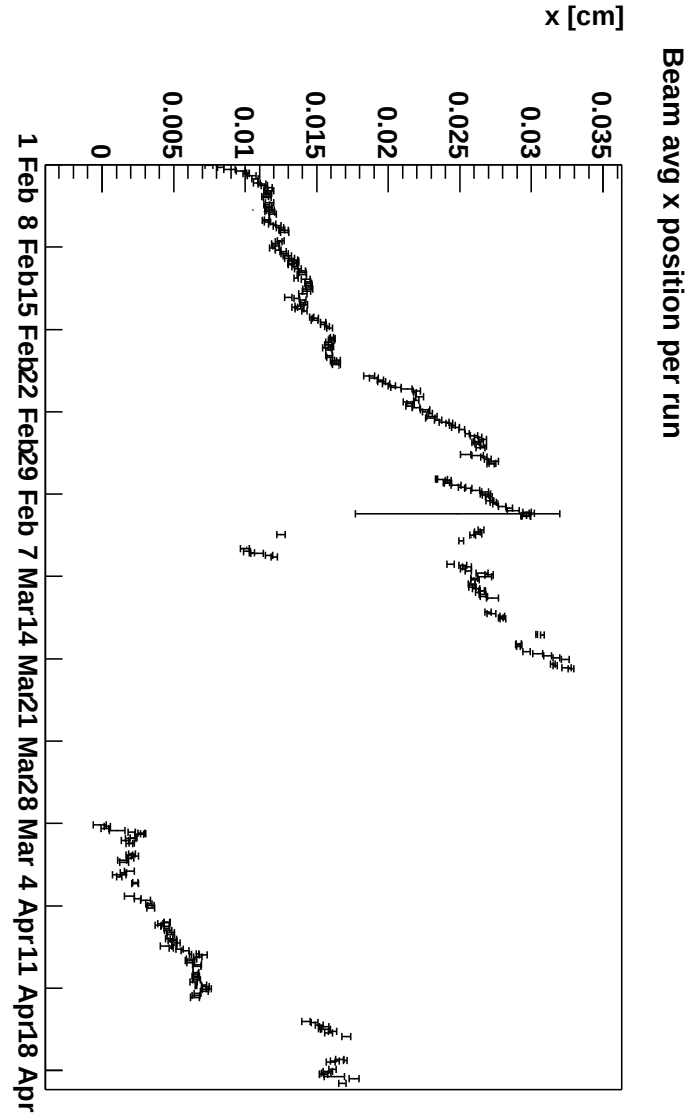
$$d(\phi_i, z_i) = (X_0 + A_x z_i)\sin\phi_i - (Y_0 + A_y z_i)\cos\phi_i$$

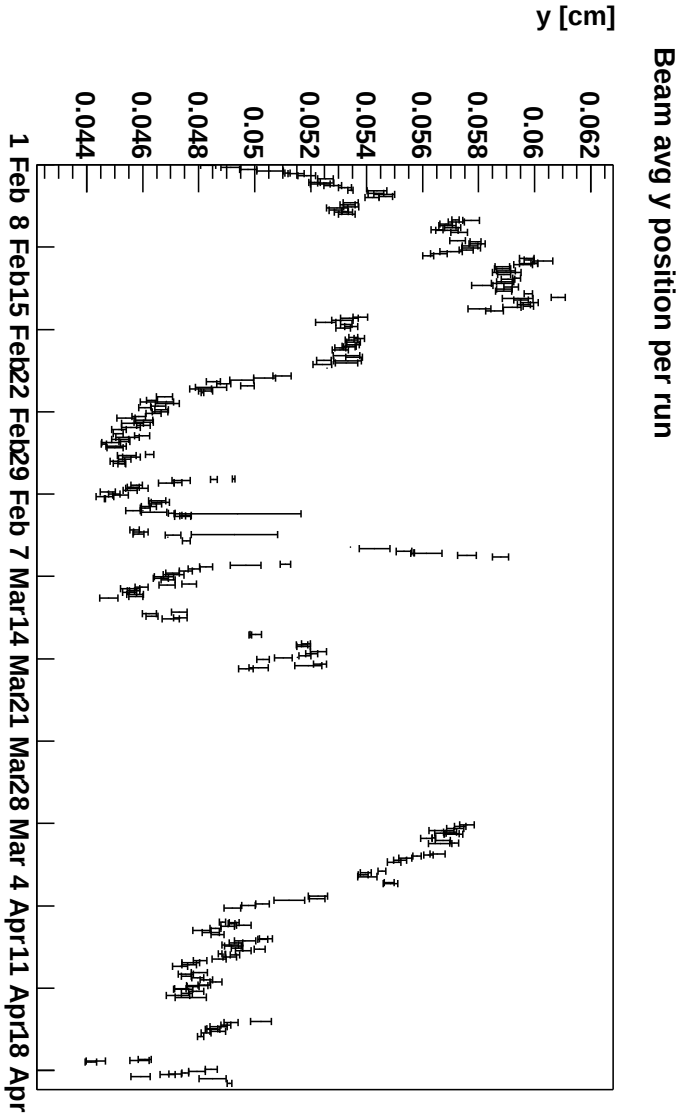
- Collect tracks from several events, and minimize average impact parameter (one matrix inversion):

$$\chi^2 = \sum_{i=1}^{n} \frac{(d_i - d(\phi_i, z_i))^2}{\sigma_i^2 + 2\sigma_{\text{beam}}^2}$$

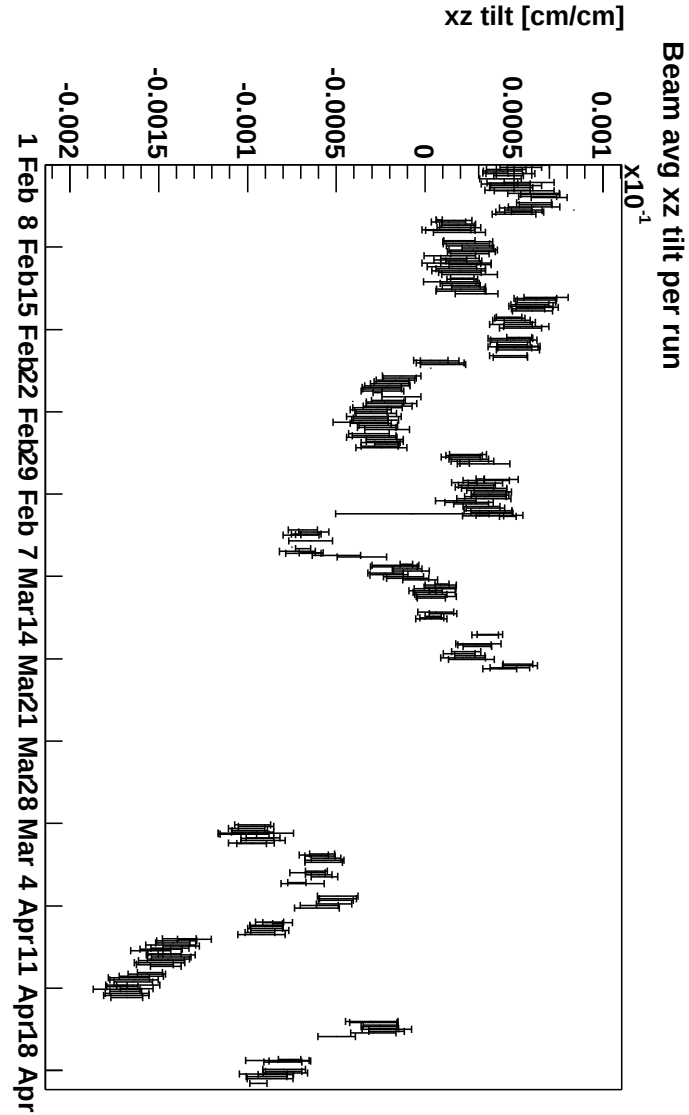
- First iteration: all tracks; Further iterations: tracks with $|d_i| < 0.1$ cm with respect to beam position from previous iteration, until no more tracks removed or less than 10% of tracks left

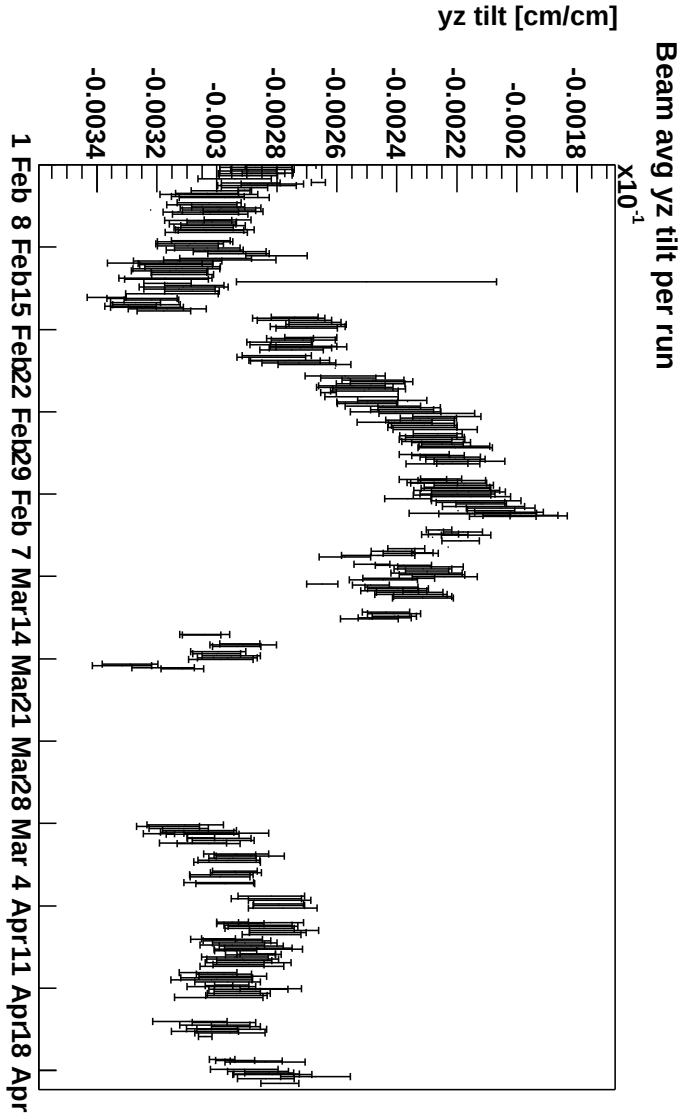
Beam Position since 1st February 2004



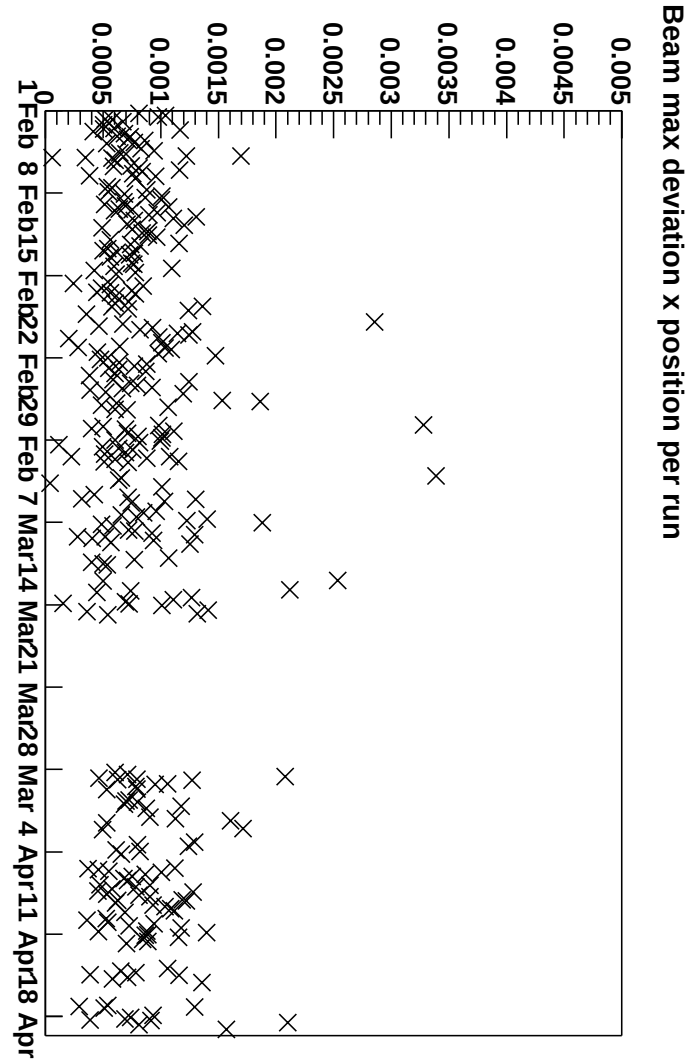


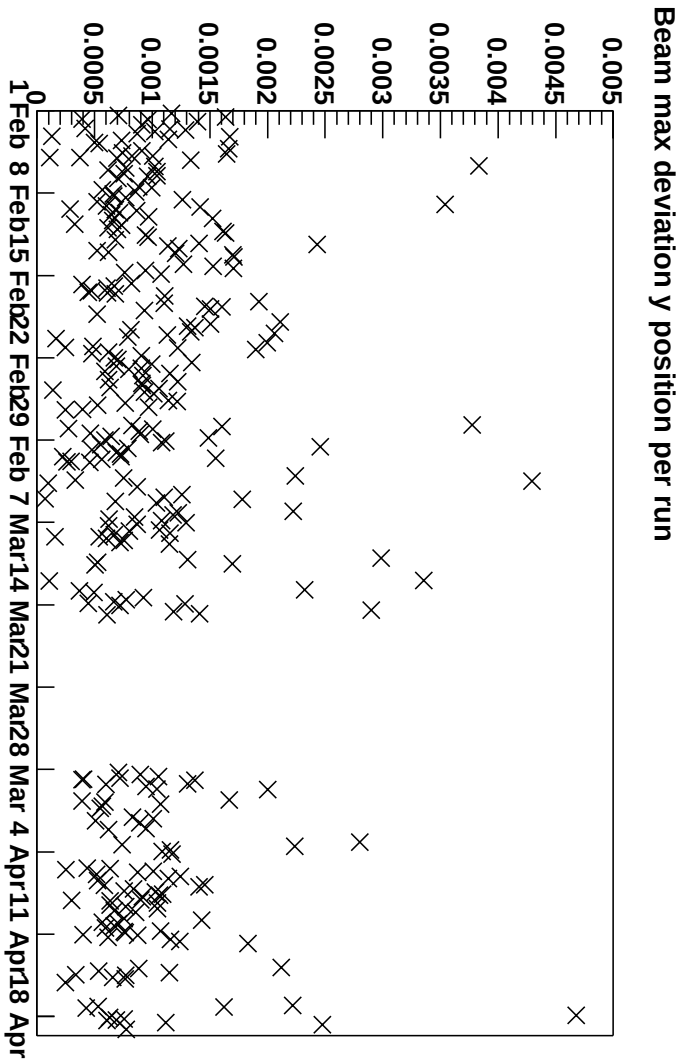
Beam Tilt since 1st February 2004



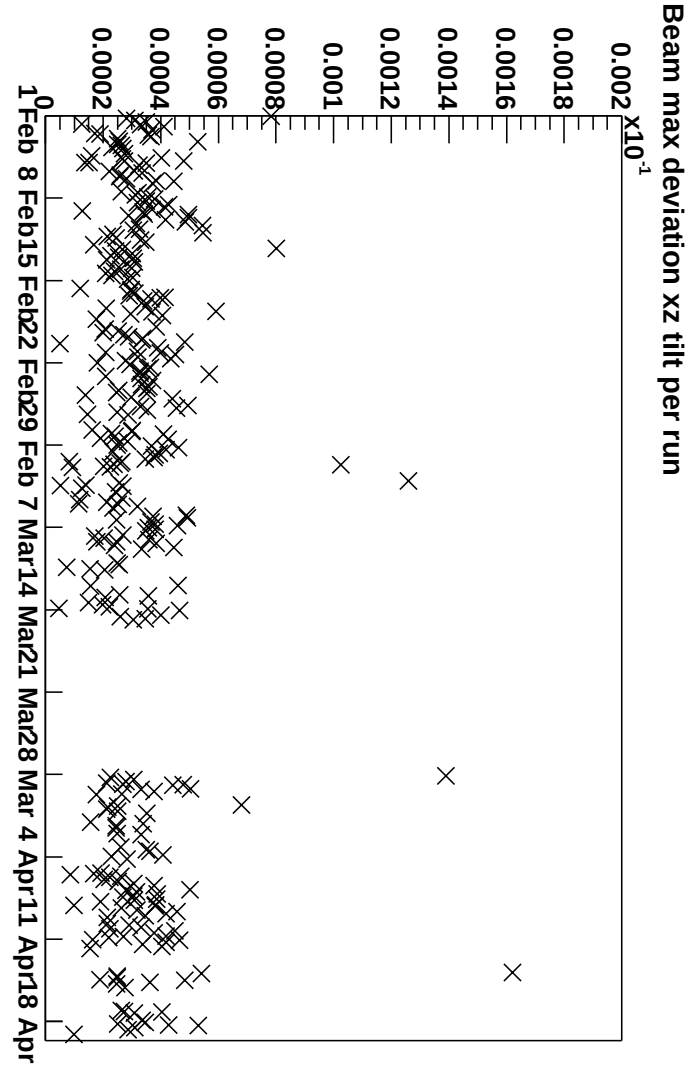


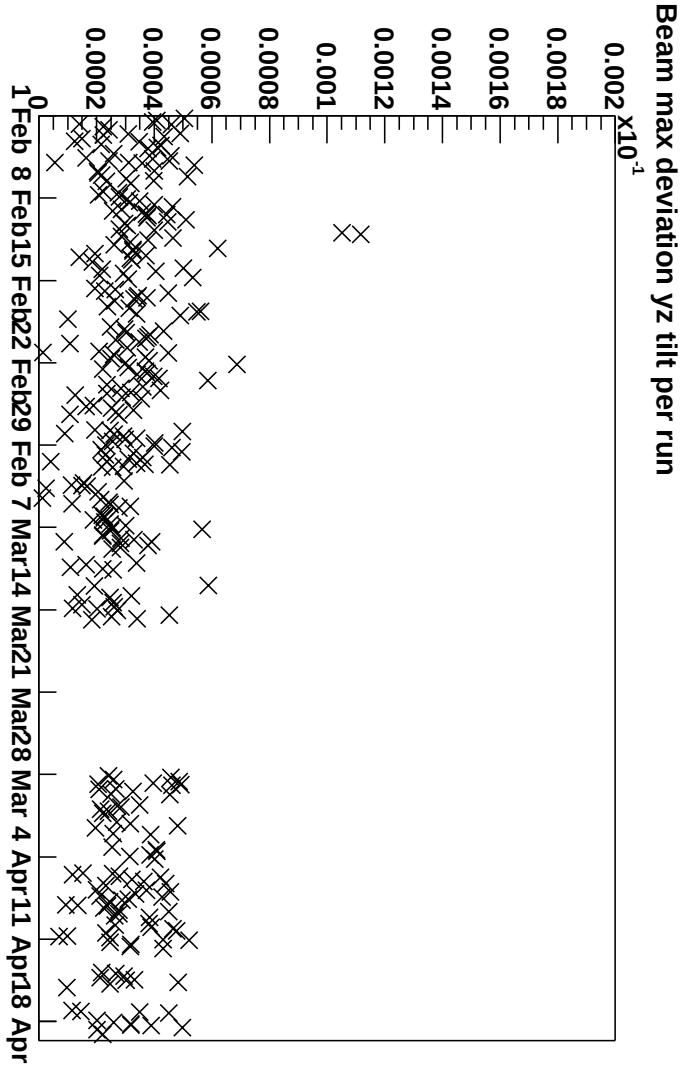
Beam Position Movement since 1st February 2004





Beam Tilt Movement since 1st February 2004





Summary

- Beam position quite stable, during stores
- Large jumps ($\Delta_{x,y} > 50\ \mu$m) during store since 1st February 2004: 1st March, 3rd March
- These measurements will be sent to ACNET in the near future