Configuration Management

CM focuses on **controlling outcomes**.

CM controls **change**, making sure that its impact is assessed and that every effort is made to prevent erosion of functionality or safety.

Applies to any complex system, but we will concentrate today on Tevatron magnet alignment and stability.

Process

1. Establish a baseline:
   What is known about Tevatron alignment.

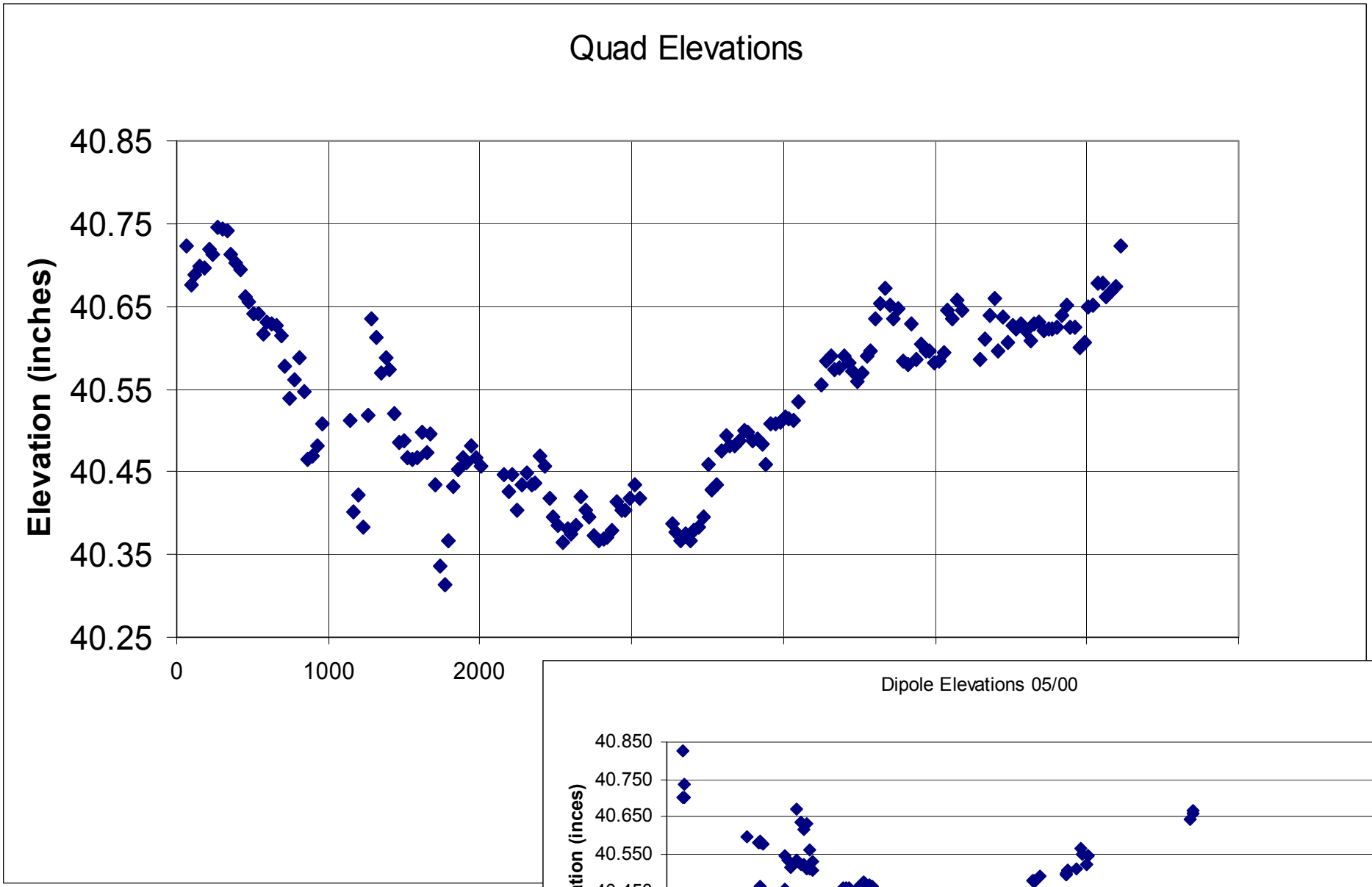
2. Check the baseline periodically:
   Measure the Tevatron at least once a year.

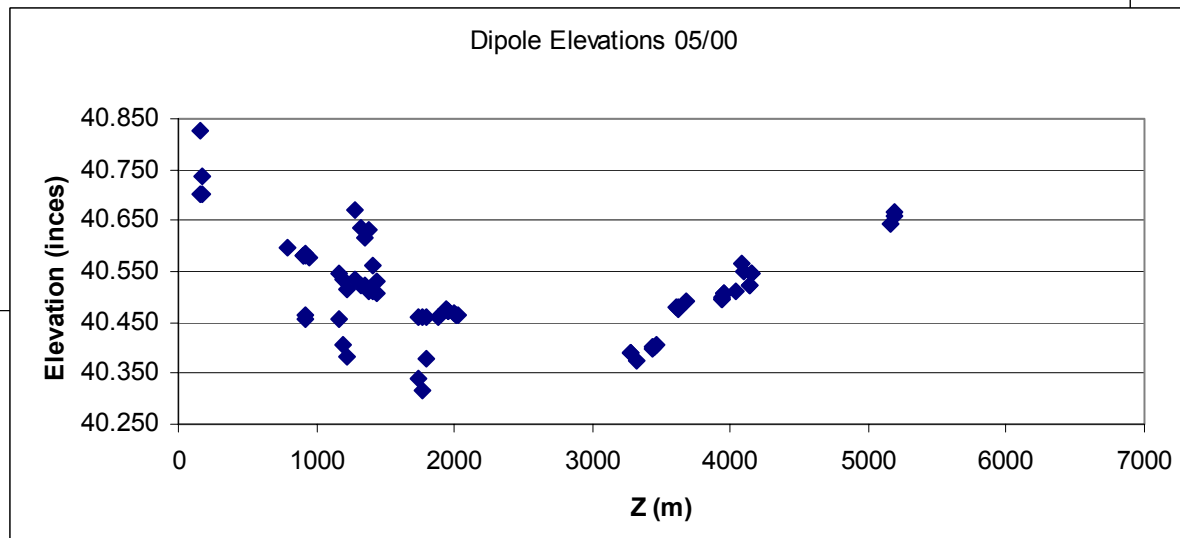
3. Manage Change:
   Record and Evaluate proposed changes.
   Formally approve the changes before they are implemented.
   Measure the position of Tevatron devices before they are removed.

Organization of this talk:

- What do we know about alignment in the Tevatron?
- How do we establish a baseline configuration?
- How do we manage the baseline configuration?

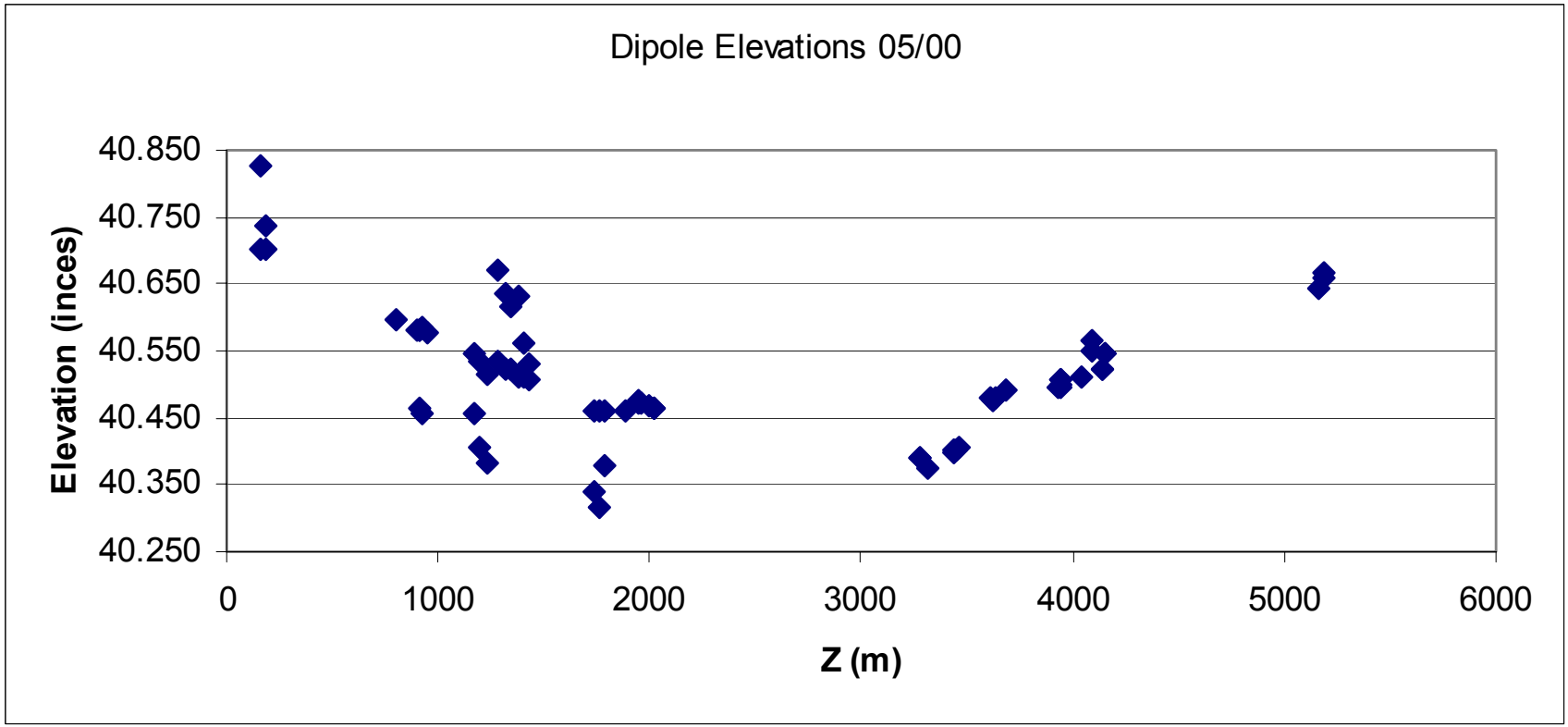
What do we know about alignment in the Tevatron?



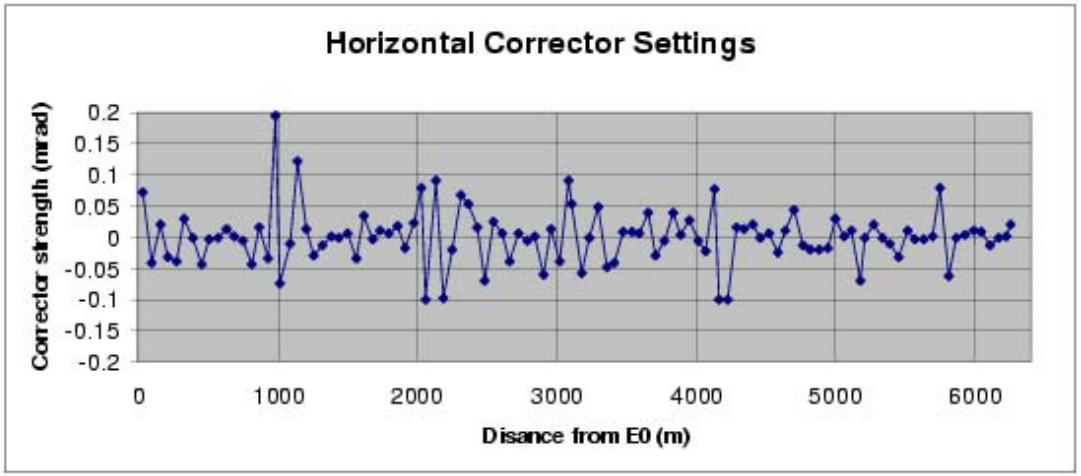


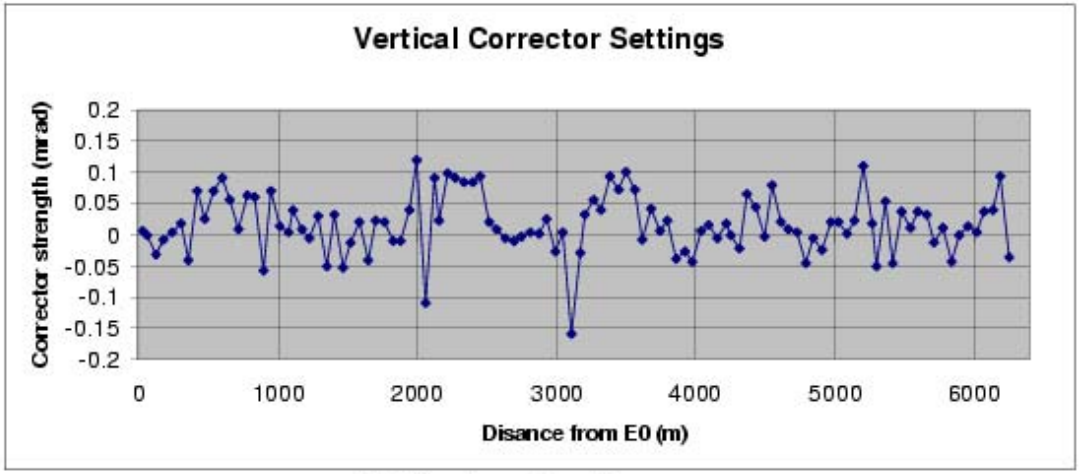
Quad Elevations from GW

Dipole Elevations from CB

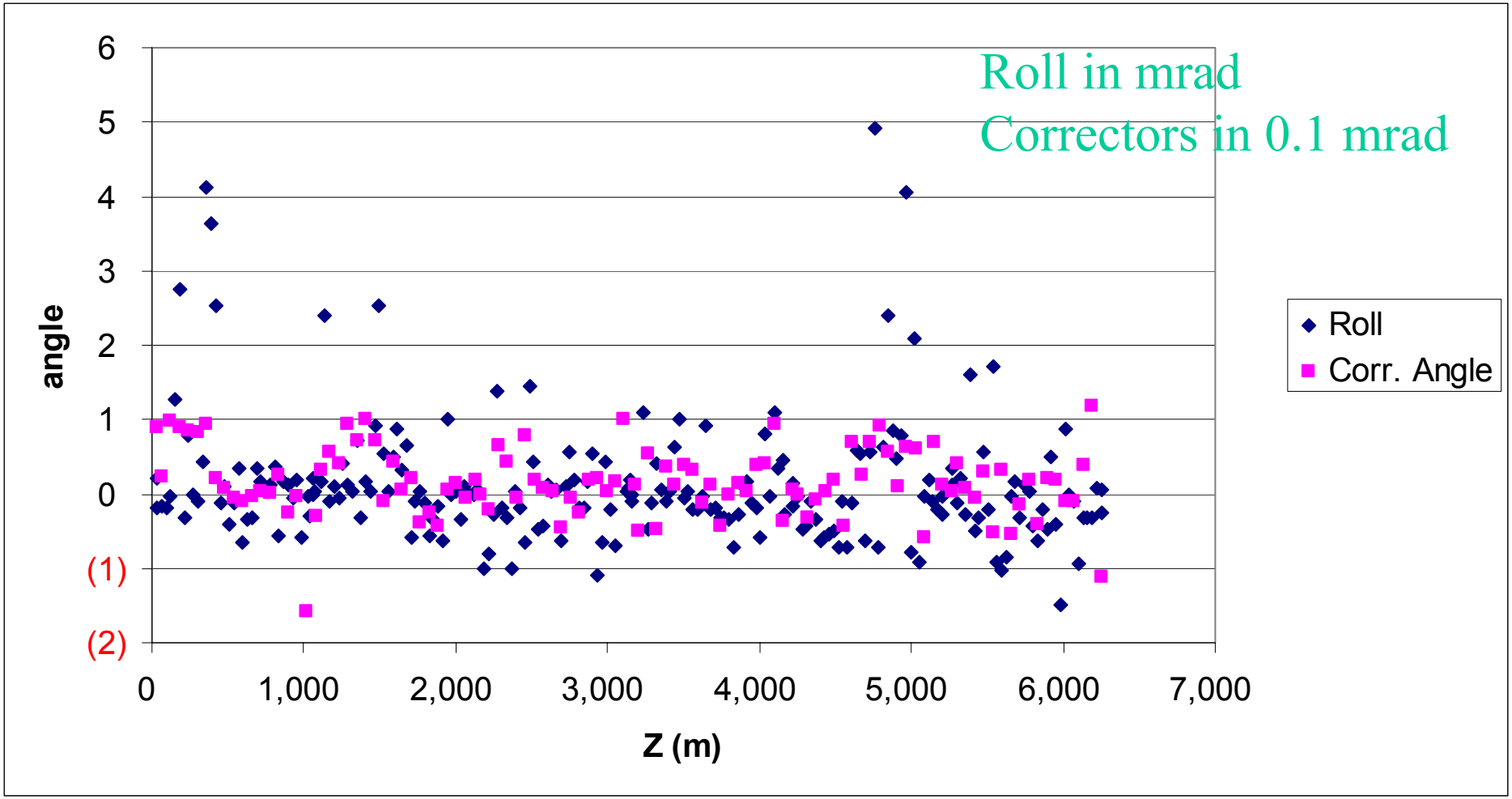


Tevatron Dipole Correctors



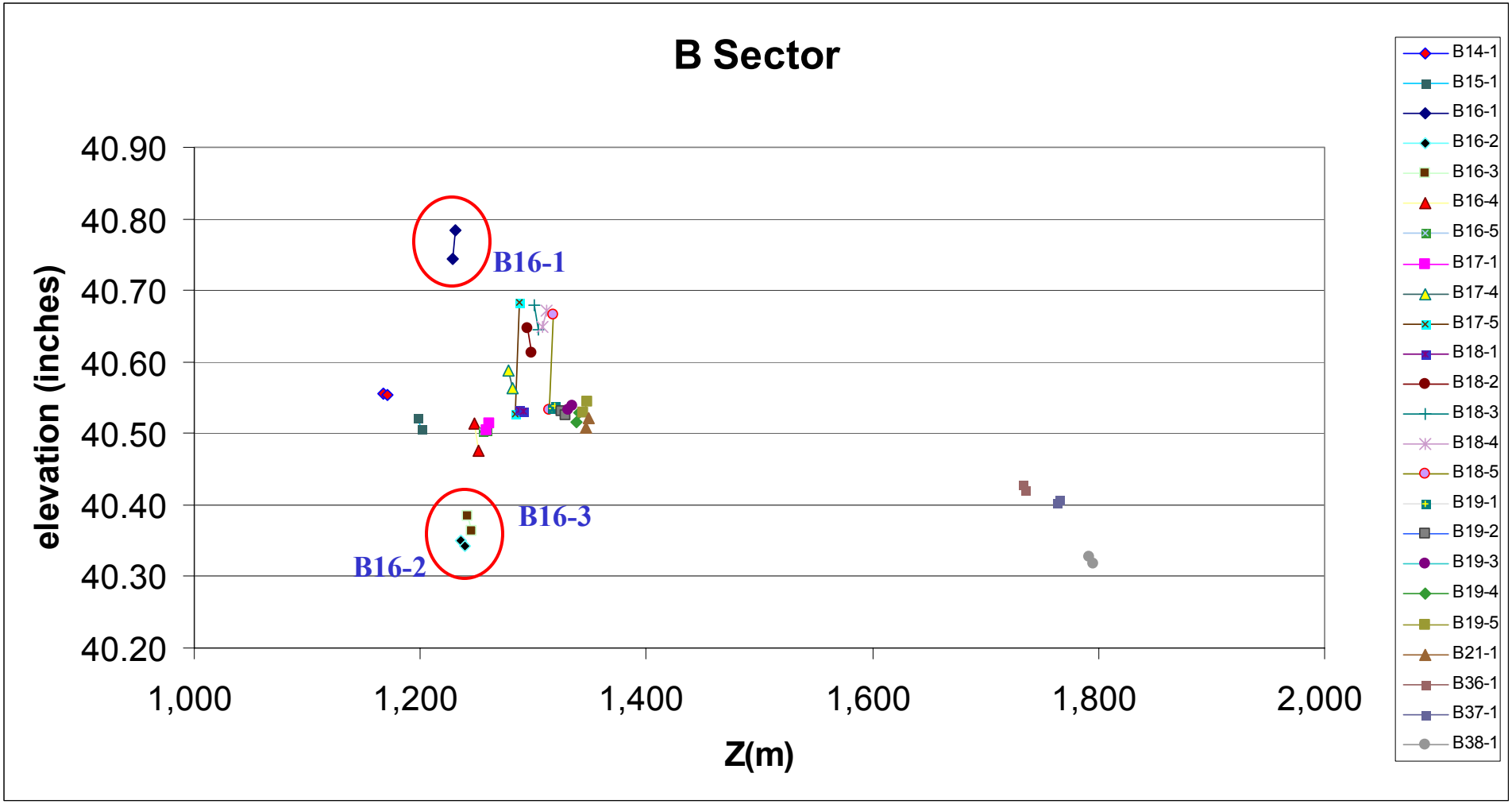


Comparison to Vertical Trims

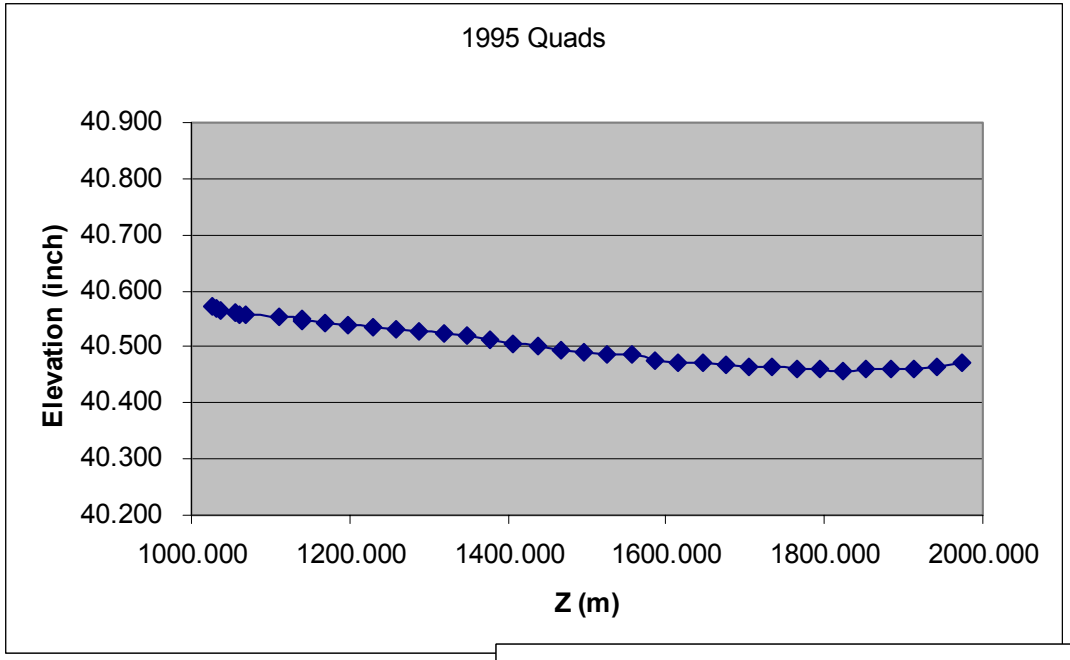


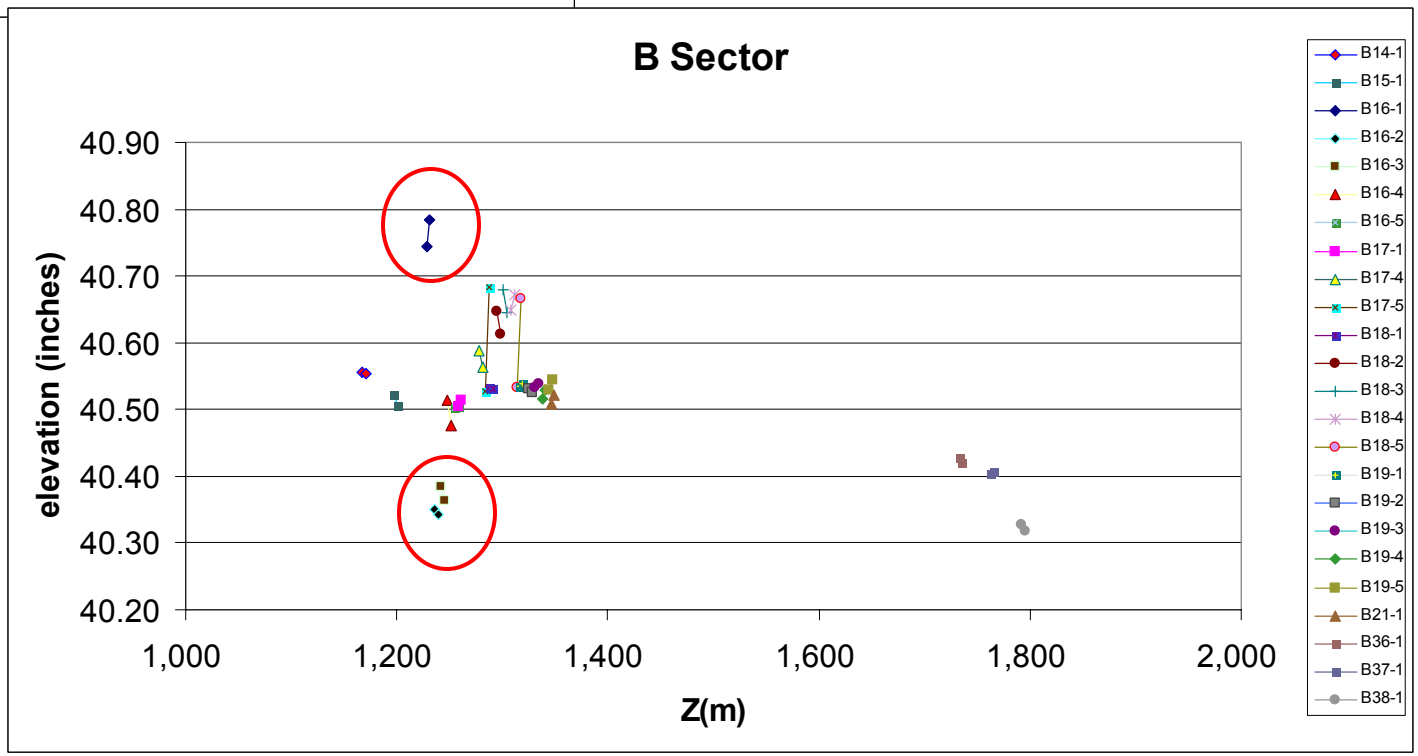
Bruce Hanna guides us here!

B Sector 12/17/02



B Sector 1995





Some history of B16-1 and its neighbors.

Elevation of B16-1 is 40.76” measured on 11/19/02.

- Memo dated 05/24/99 Mike Church to Alignment Group:
- Elevation of B-16-1 increased from 40.387” to 40.443” on 05/25/99.
- Elevation of B-16-1 increased to 40.541” on 03/15/00. US of D-15-5 changed to 40.517”.

location	vertical change requested from 5/24/99 as-found	date completed
b11(low beta Q!)	0	
b12(low beta Q5)	0	
B13-1	0	
B14-1	+.060"	05.25.99
B15-1	+.060"	05.25.99
B16-1	+.060"	05.25.99
B17-1	0	
B18-1	-.060"	05.25.99
B19-1	-.060"	05.25.99
B21-1	-.040"	05.25.99
B22-1	-.040"	05.25.99
B23-1	-.040"	05.25.99
B24-1	0	
B25-1	0	

Thanks to Terry Sager.

Aperture Scan
01/07/03

Typical Tev apertures:
Quad 3 inch
Dipole 2.7 inch
C0 lambs ~1 inch
B16-1 = 1.36 inch

Aperture Scan looks ok!

Aperature scans at 150GeV for the long straight sections also including E17 and B16					
Location:		vertical bump reading	vertical measured (bpm)	horizontal bump reading	horizontal reading (bpm)
B16	hpos inner			C50=18mm	B15=16.6mm, b17=19.04mm
	hpos outer			C50=-20mm	B15=-17.33, B17=-19.34mm
	vpos upper	C50=+19.00	B16=+18.45		
	vpos outer	C50=-20.5	B16=-16.05		
C0	hpos inner			16.802mm	B49= 25.1mm,C11=11.15mm
	hpos outer			12.167mm	B49= -14.93mm,,C11=-6.33mm
	hang inner			.4199mrad	B49=-21.79mm, C11=+12.13mm
	hang outer			.4997mrad	B49=21.15mm,C11=-8.08mm
	vpos upper	6.8mm	B49=+5.57, C11=+8.94		
	vpos lower	3.2mm	b49=-3.39,c11= -5.68		
	vang upper	.2734mrad	B11=-6.43mm,C11=+12.22mm		
	vang lower	.356mrad	B49=+8.94mm, C11= -17.35mm		
E17	hpos inner			C50=15mm	E15=29.9mm, E17=30.93mm
	hpos outer			C50=-20mm	E15=-19.31mm, E17=-20.26mm
	vpos upper			C50=15mm	E16=14.77mm, E18=15.76mm
	vpos lower			C50=-14mm	E16=-13.4mm, E18=-14.81mm

Thanks to Dan Bollinger and Todd Johnson.

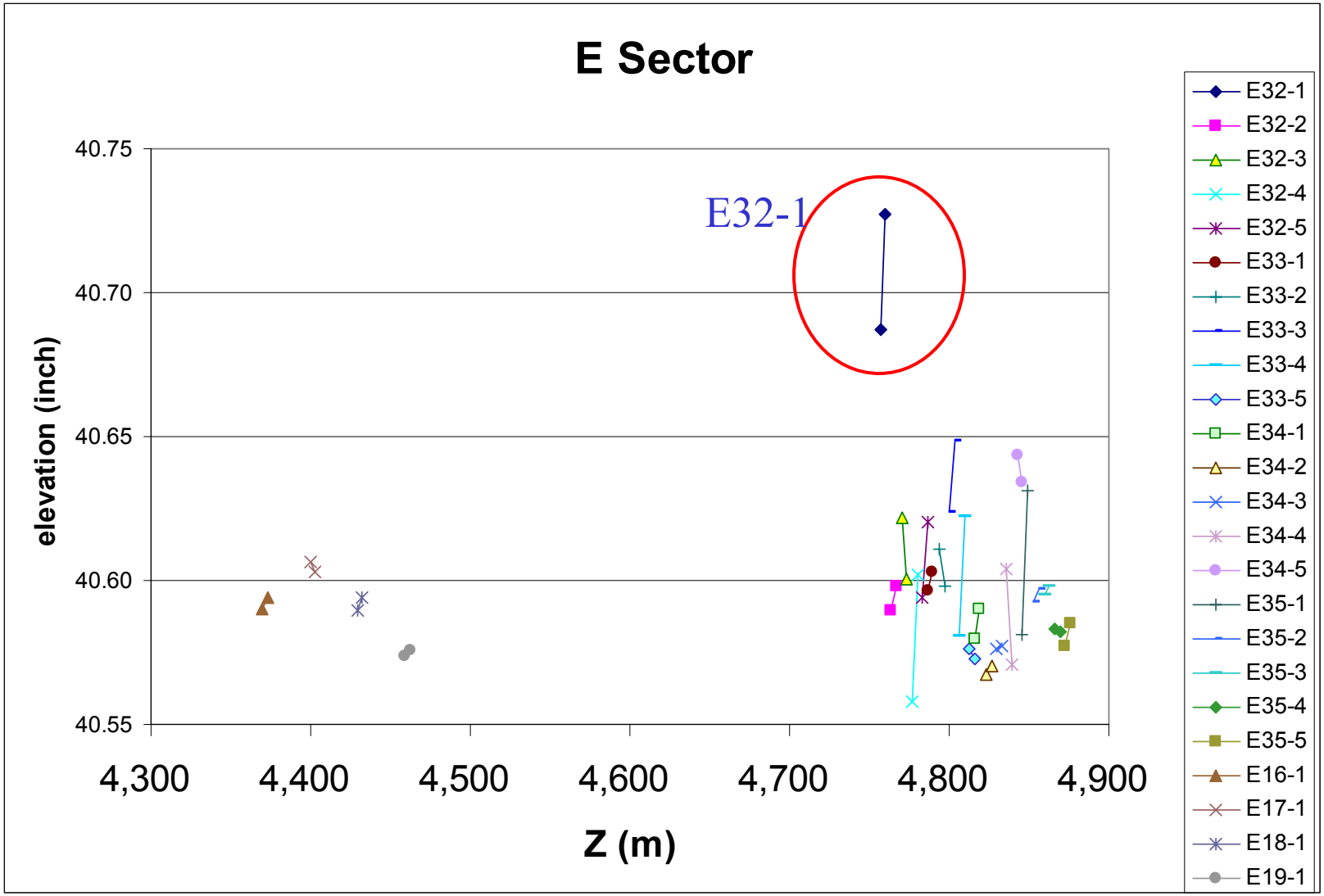
B16-1 from the bottom

Not visible from the tunnel!

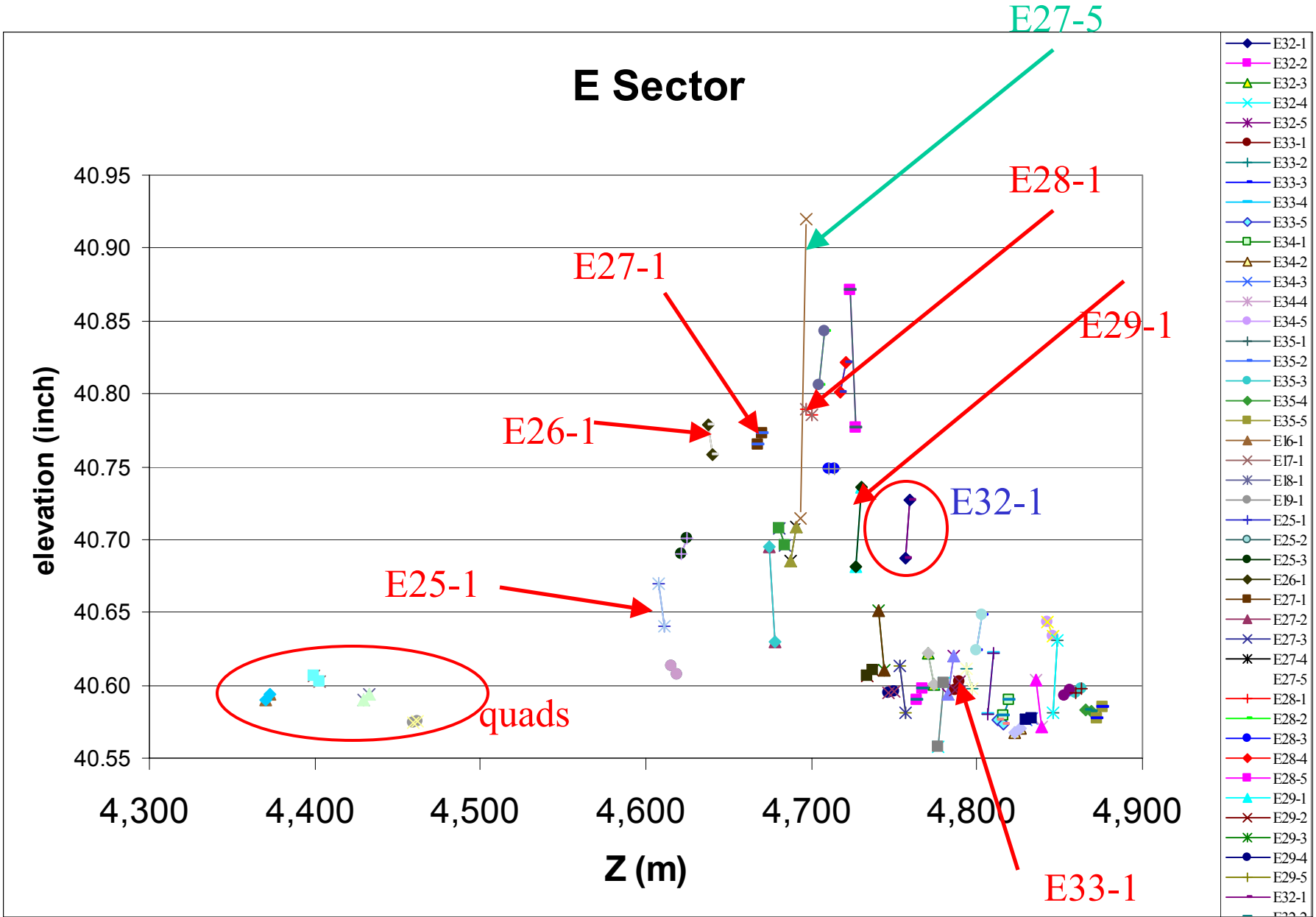
Photos from B sector:

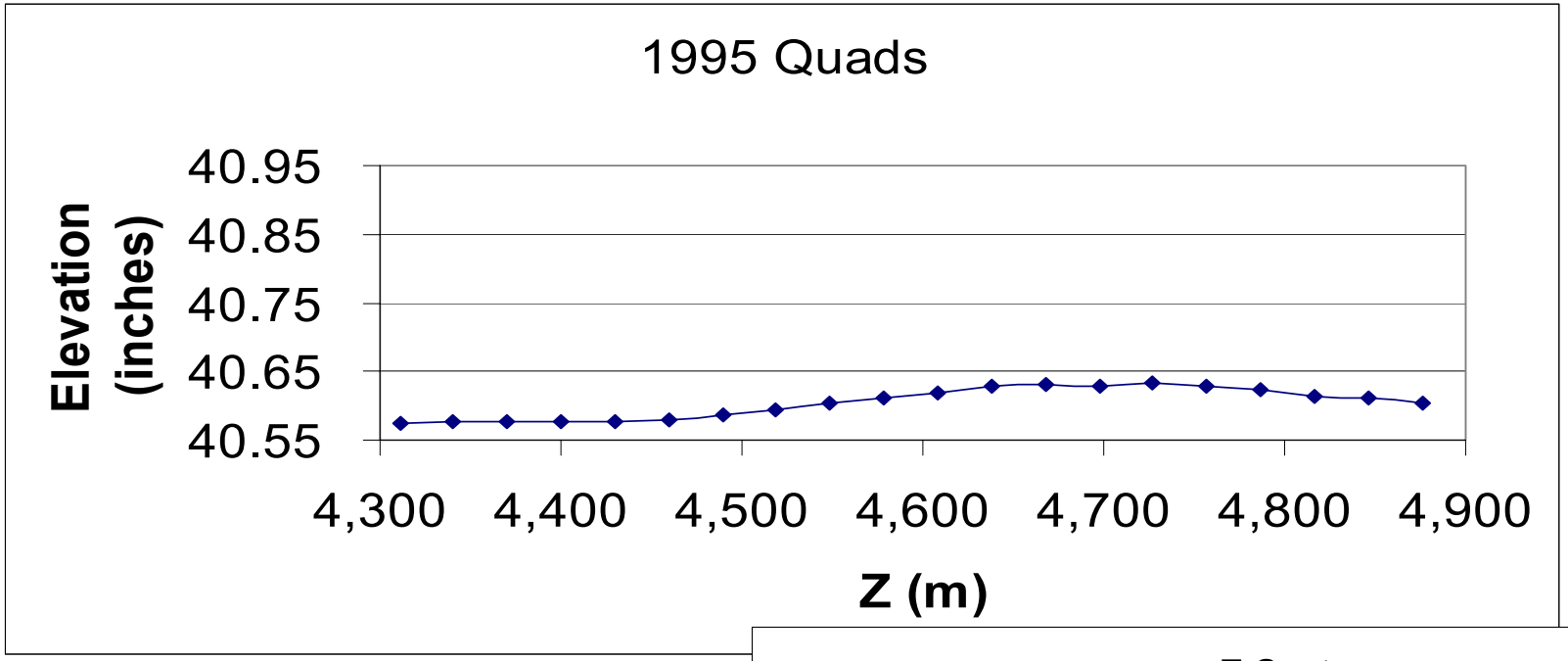
To Do:
E25-1, **E25-2**, **E25-3**, E26-1,E27-1, E27-2, **E27-3**, **E27-4**, E27-5, E28-1, E28-2, E28-3, E28-4, E28-5, E29-1, E29-2, E29-3, E29-4, E29-5.

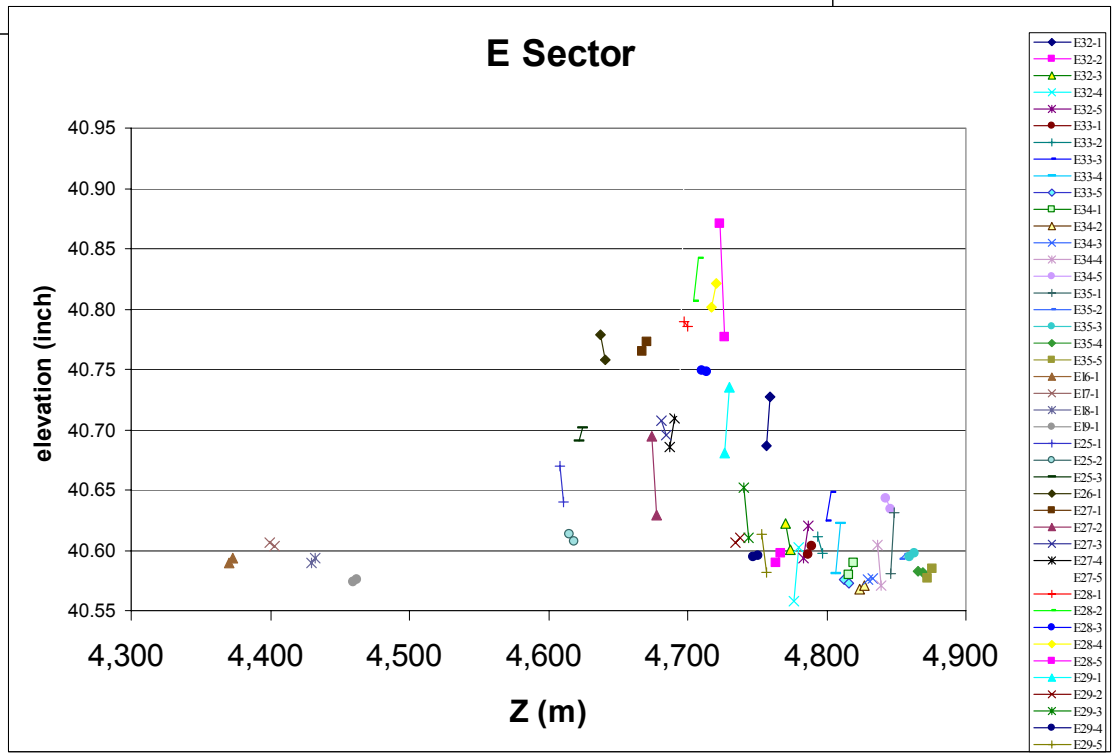
E Sector 12/17/02



E Sector 01/06/03



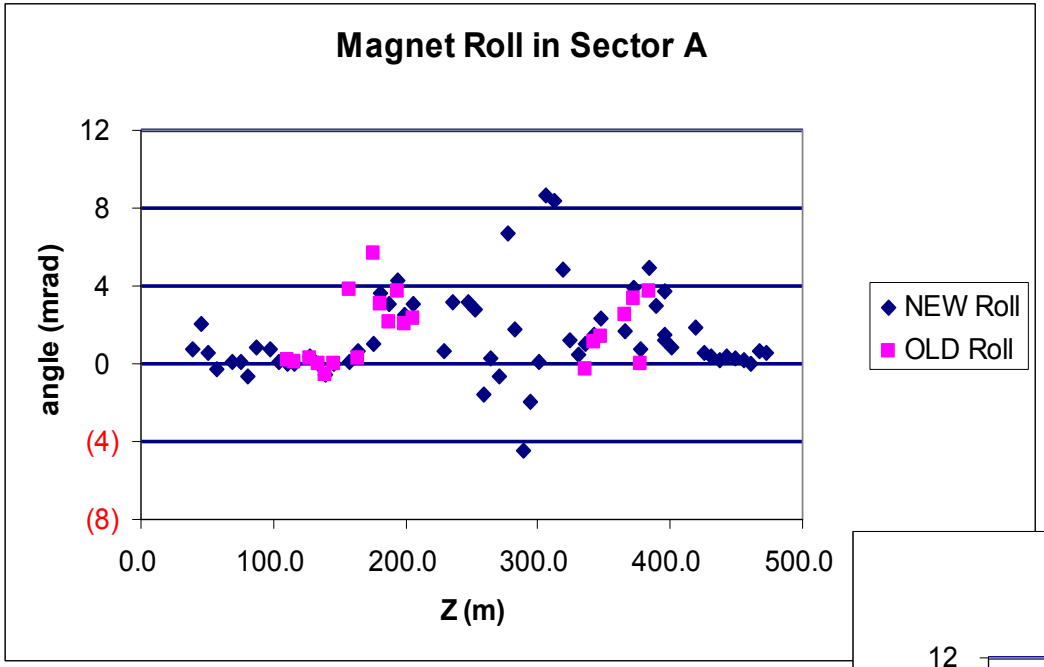




E Sector 1995

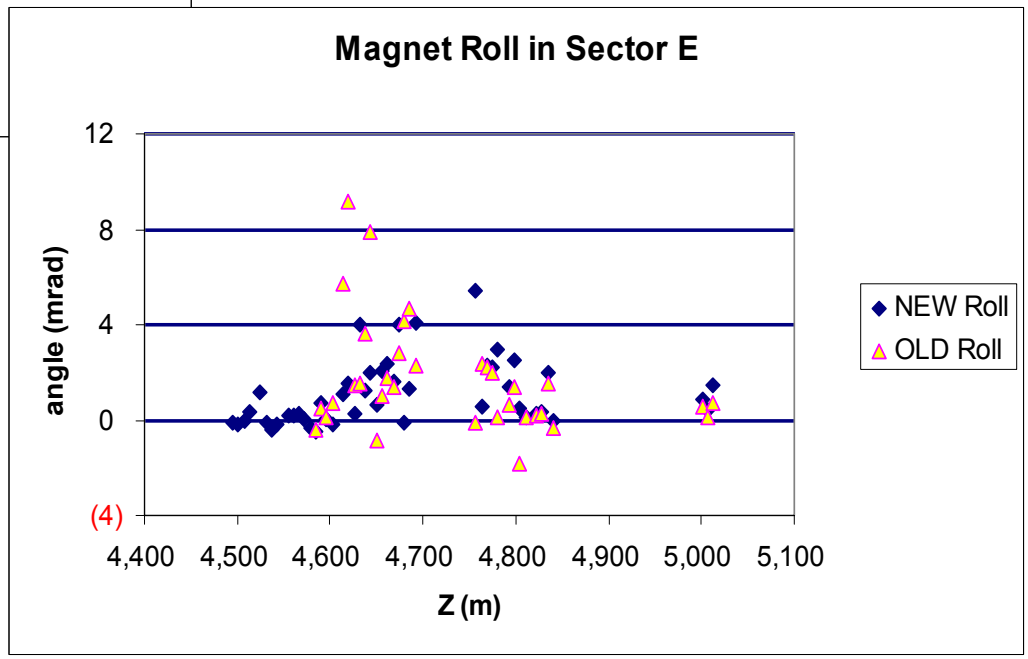
E-17

General alignment work

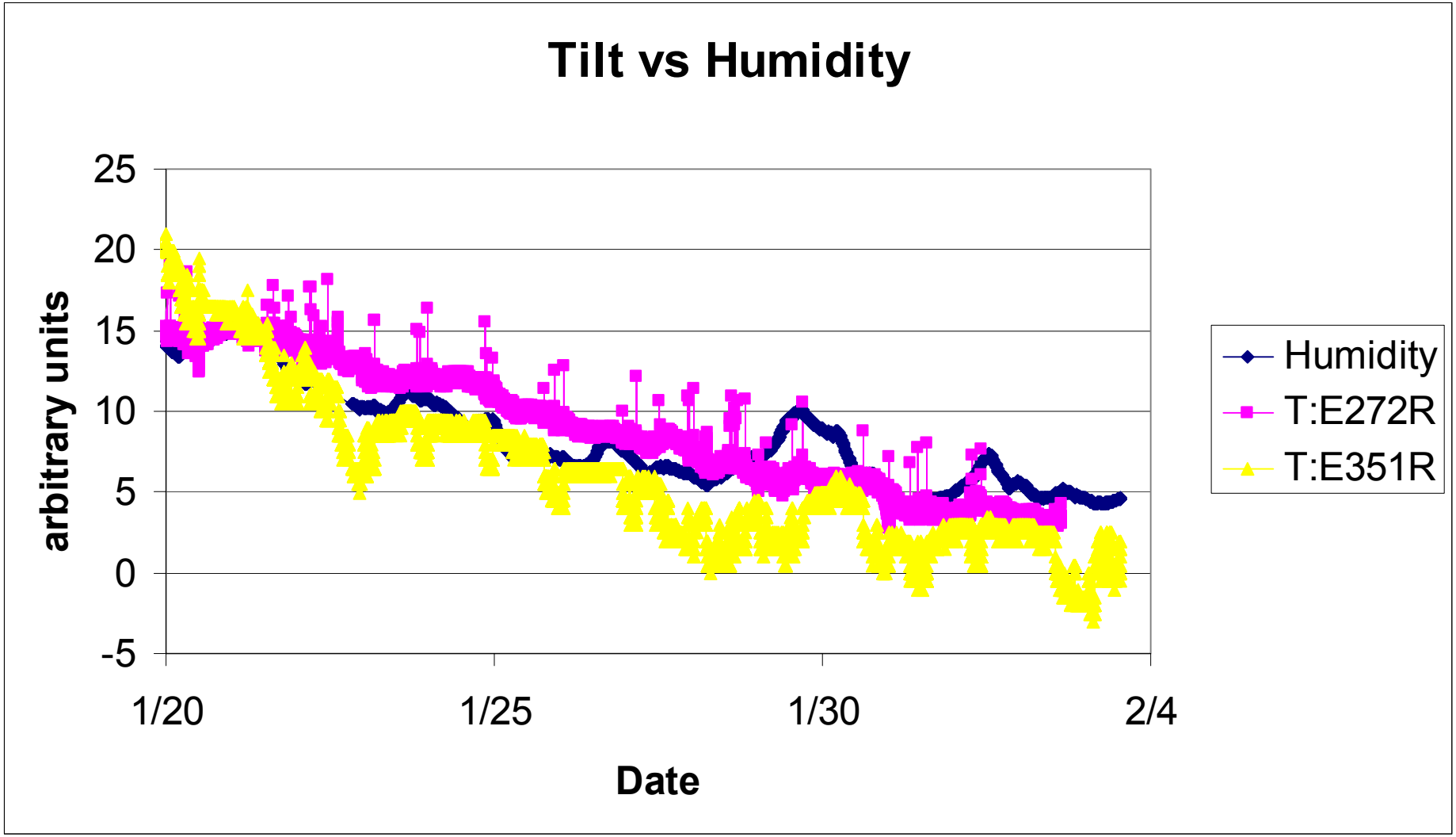


Look at correcting magnets with roll greater than 4 mrad. May require we warn A and E sector. Do we know of any other magnet corrections needed?

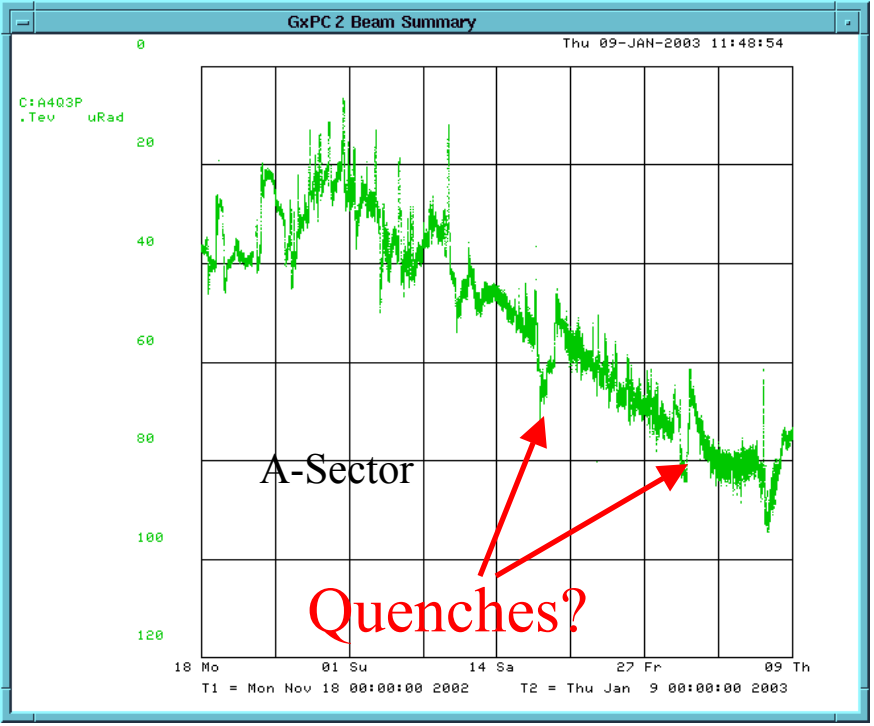
Data from Bruce Hanna And George Wojcik.

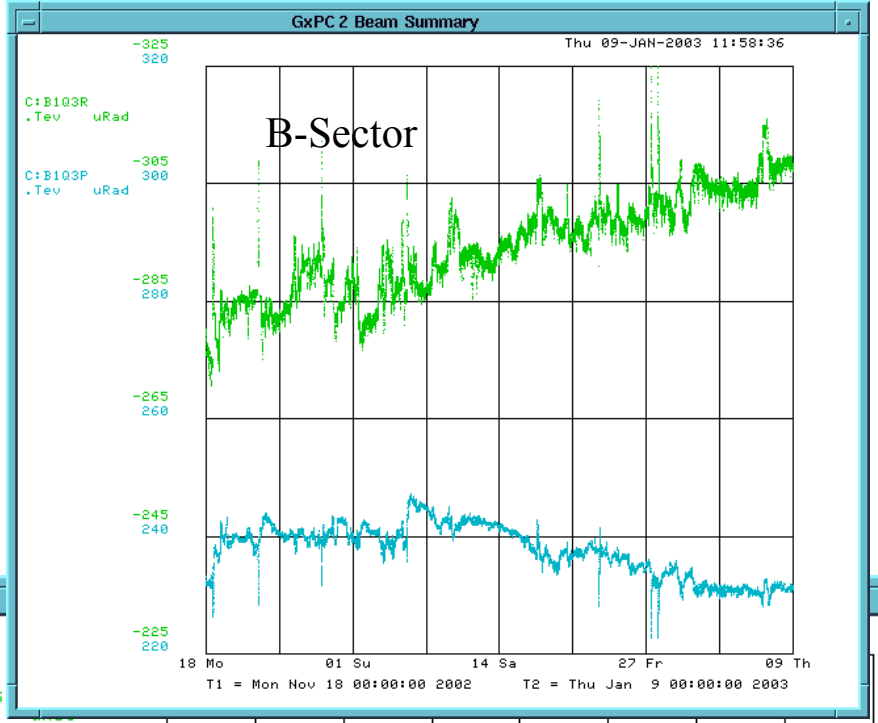


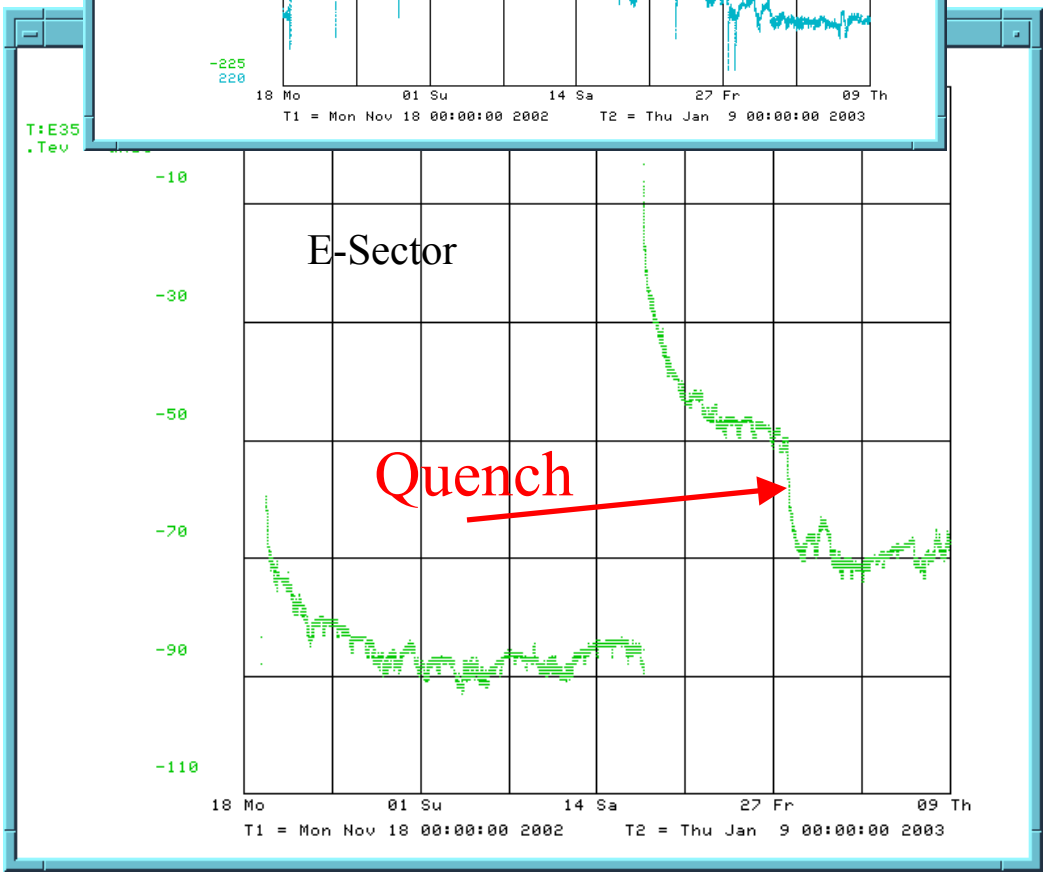
Other Factors Affecting the Baseline:



Thanks to Todd Johnson.





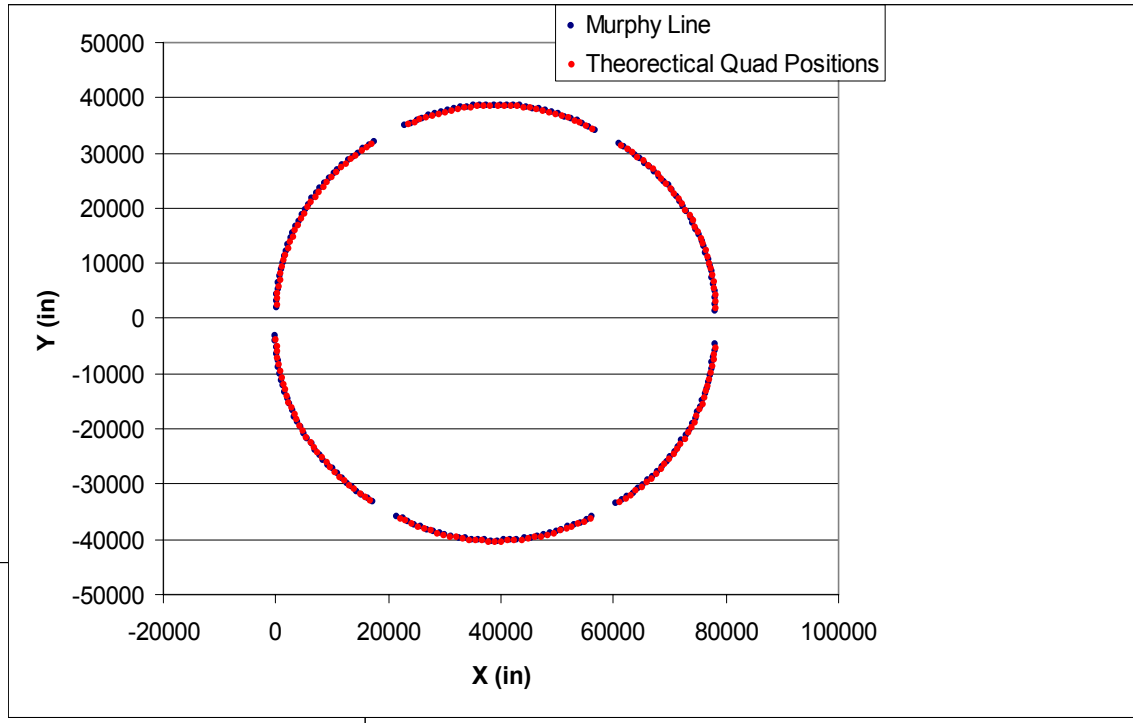


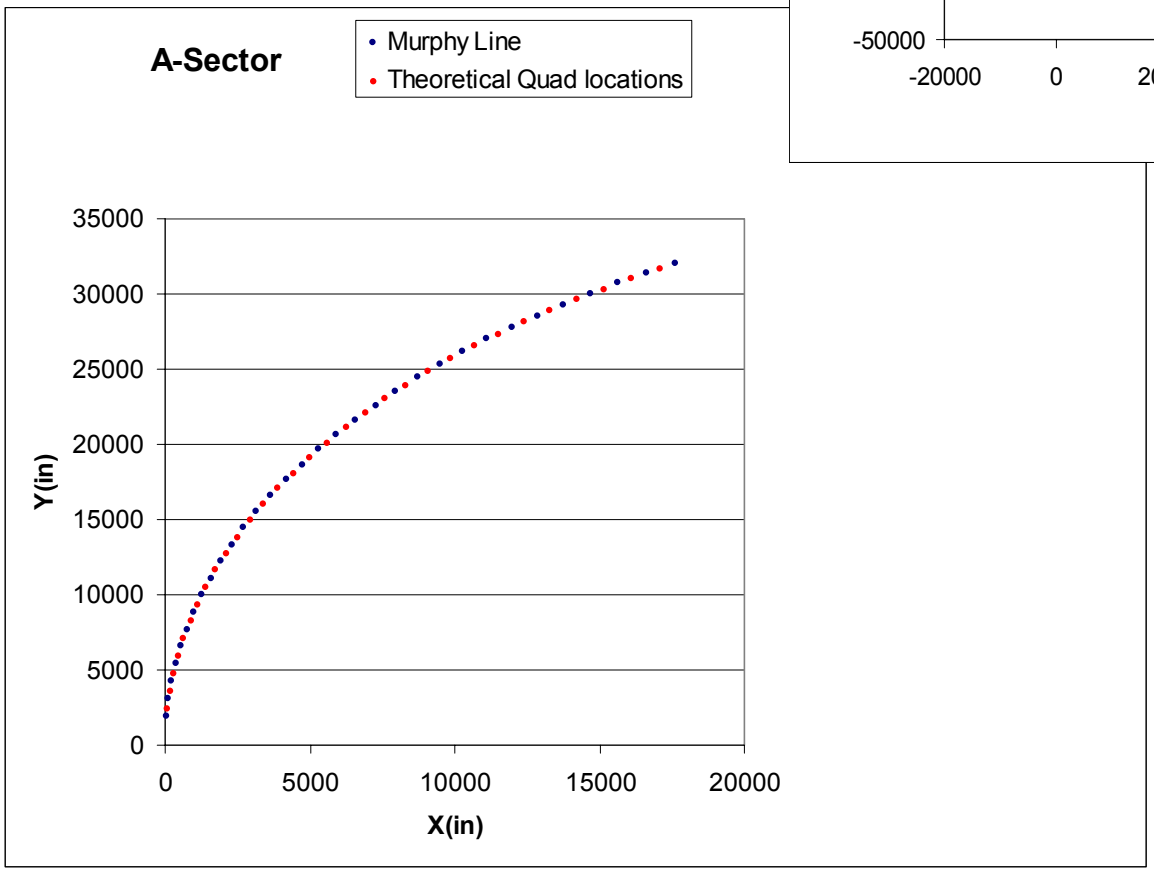
Some recent history from Todd Johnson's Tilt Meters.

How do we establish a baseline configuration?

Update From Aimin

Murphy Plug	del X	del Y
	inches	inches
A17.5	-3.992	0.878
B17.5	-1.236	3.897
C17.5	2.756	3.019
D17.5	3.992	-0.878
E17.5	1.236	-3.897
F17.5	-2.756	-3.019
Total	0.000	0.000





Upgrade the alignment system:

- Establish vertical location of tie rods in January.
  - Tie the vertical into a lab-wide reference frame.

- Establish the horizontal location of the Murphy Line in August.
  - Tie the horizontal Murphy Line Targets into a Lab-wide Reference frame.

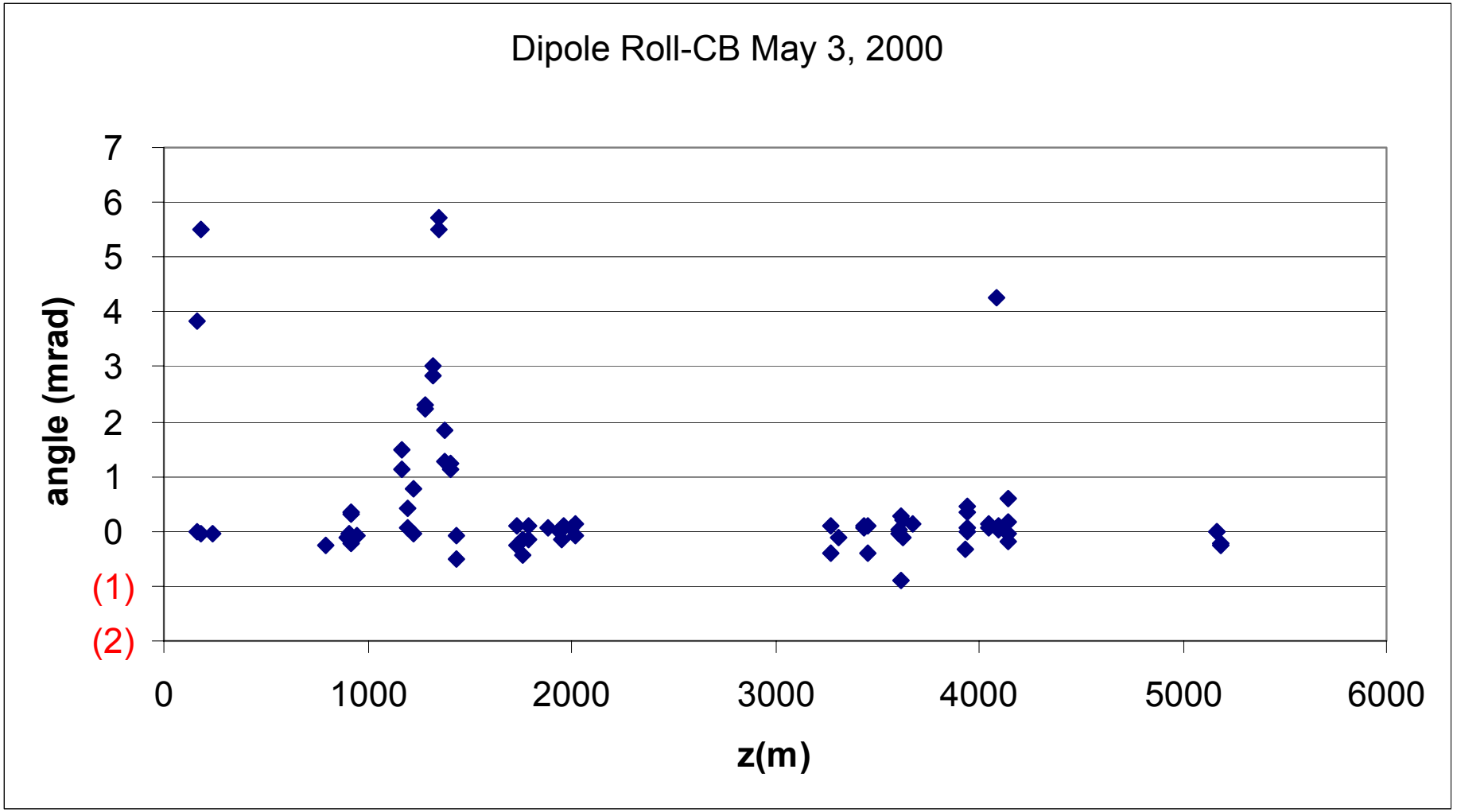
- This well help establish a software baseline, and also correlate the Tevatron sectors to each other.

How do we manage the baseline configuration?

This is where we need to get creative.

- We need to measure magnet positions often, at least once per year.
  - To follow changes as they take place, we had to monitor what The magnets are doing over time.
  - Keep track of changes in corrector magnet currents.
  - The tilt monitors give a measure of short term changes: We need a cheap way to put 1,000 of these in the ring.
  - Hans Jostlein has come up with a quick roll measuring device: We hope to do the entire ring in January, in 2-3 days.
  - In a similar vein, we'll need some way to quickly measure pitch and yaw. These three angles do not fix a magnet's position, but they can help identify problem spots.

Summary

- Should we realign B16-1 and nearby magnets?
- What's going on in E-Sector; is this a tie-rod issue?
- How far can we go with Configuration Management for the Tevatron?
  1. Track changes in magnet currents closley.
  2. Continue to develop new quick monitoring devices.
  3. Bring the MAD files up-to-date, make them into a useful diagnostic tool.

Roll all Dipoles