

Cornell University
Laboratory for Elementary-Particle Physics



Beam Based Survey and Alignment of Ring Magnets

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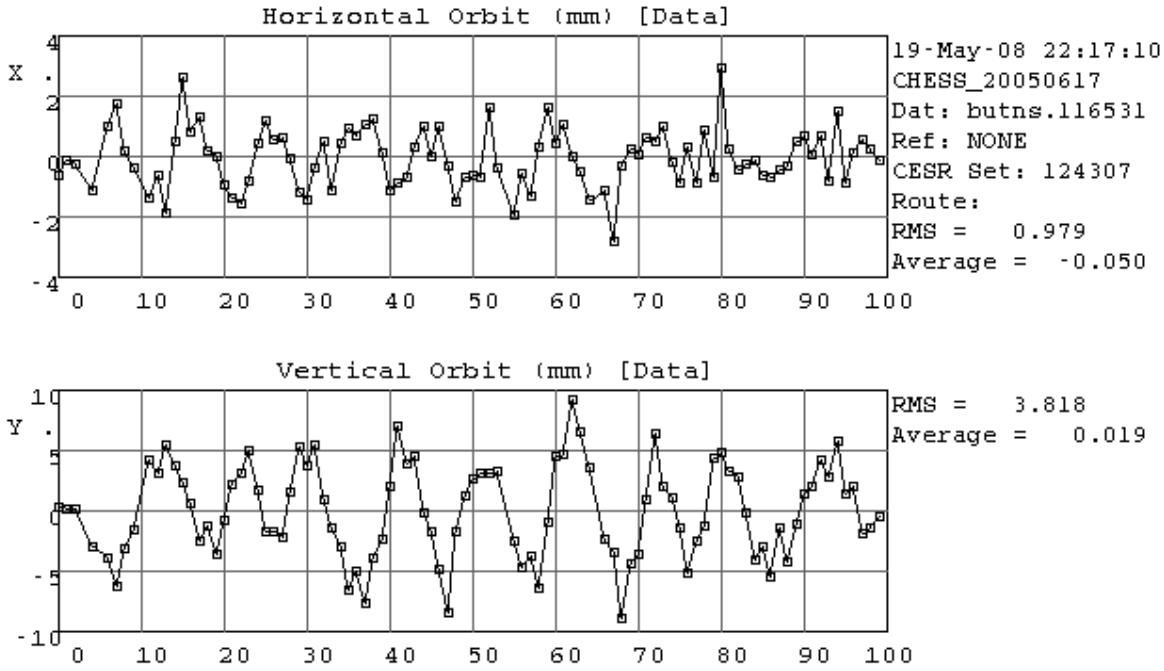


Beam based alignment

- Measure zero vertical corrector orbit
- Use analysis tools to identify offset quadrupoles and tilted bends
  and to quantify
- Move magnets and repeat.

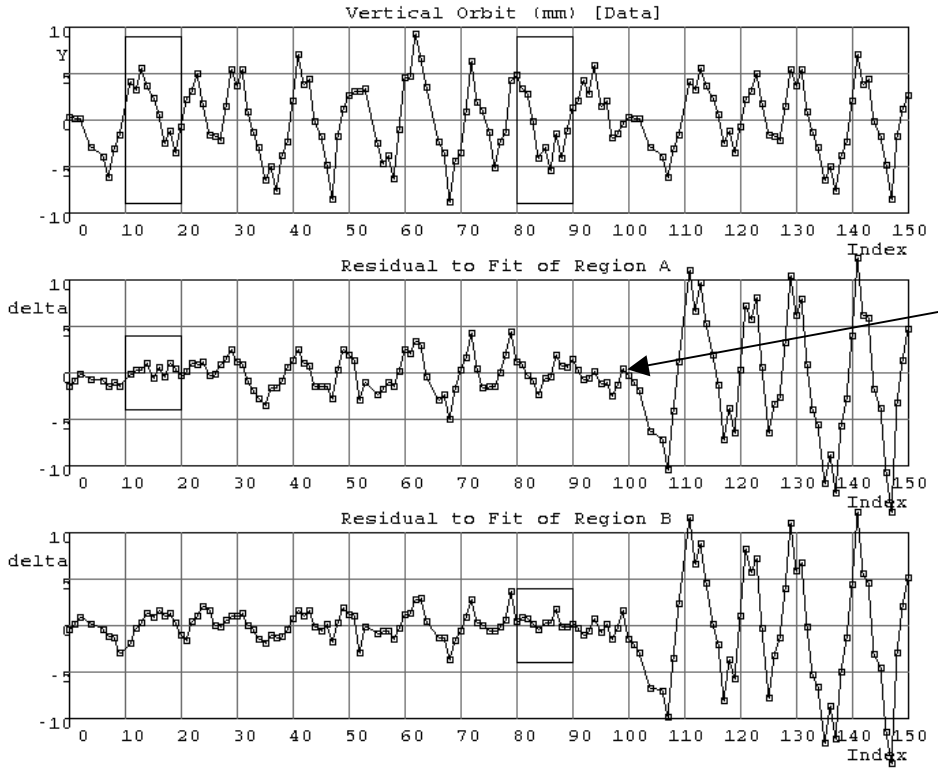
Zero corrector orbit

Data: zero vertical corretor



Wave analysis

Data: zero vertical corretor



Interaction region

A Region Sig/A: 0.083
B Region Sig/A: 0.089
Kick Sig_K/K: 0.298 Sig_phi: 0.287

Kick: delta_Y' * sqrt(beta) [urad * sqrt(m)]

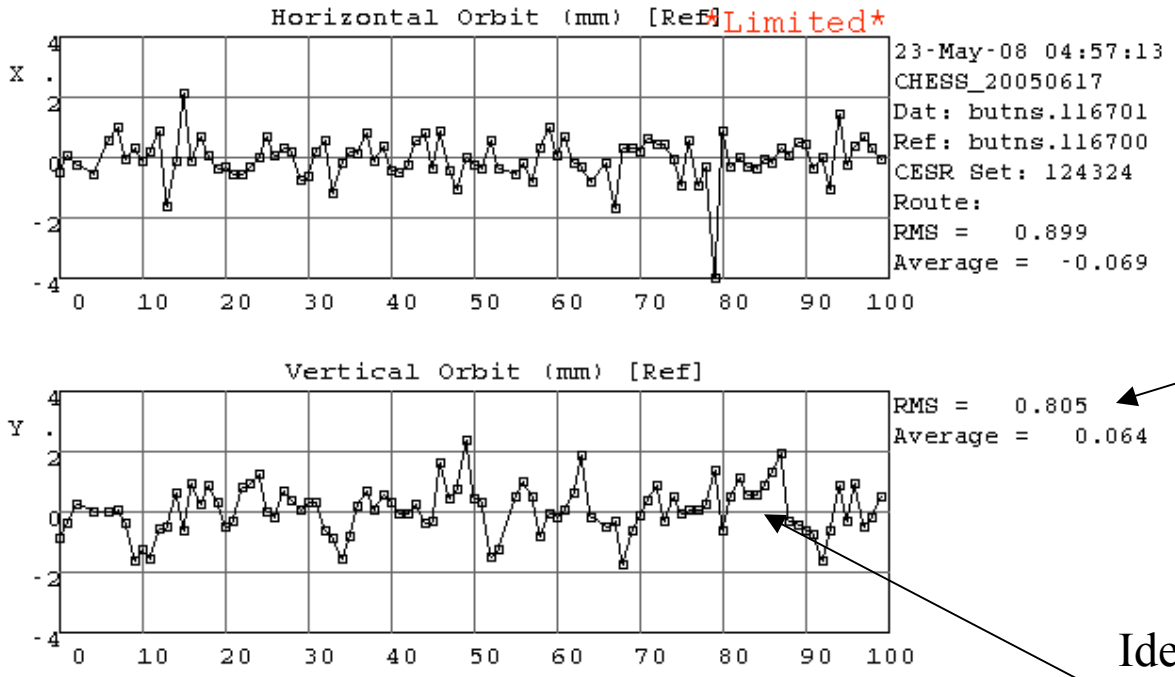
After Det#	Kick	phi_Y
22	-299.13	13.129
26	299.13	16.271
30	-299.13	19.413
37	299.13	22.554
41	-299.13	25.696

19-May-08 22:17:10
CHESS_20050617
CESR_MNT:[orbit.16]
Dat: butns.116531
Ref: NONE
CESR Set: 124307

IX_A1, IX_A2: 10 20
IX_B1, IX_B2: 80 90

Identify misaligned magnet

"Correct" for misalignment in IR with nearby steerings (1E,1W)

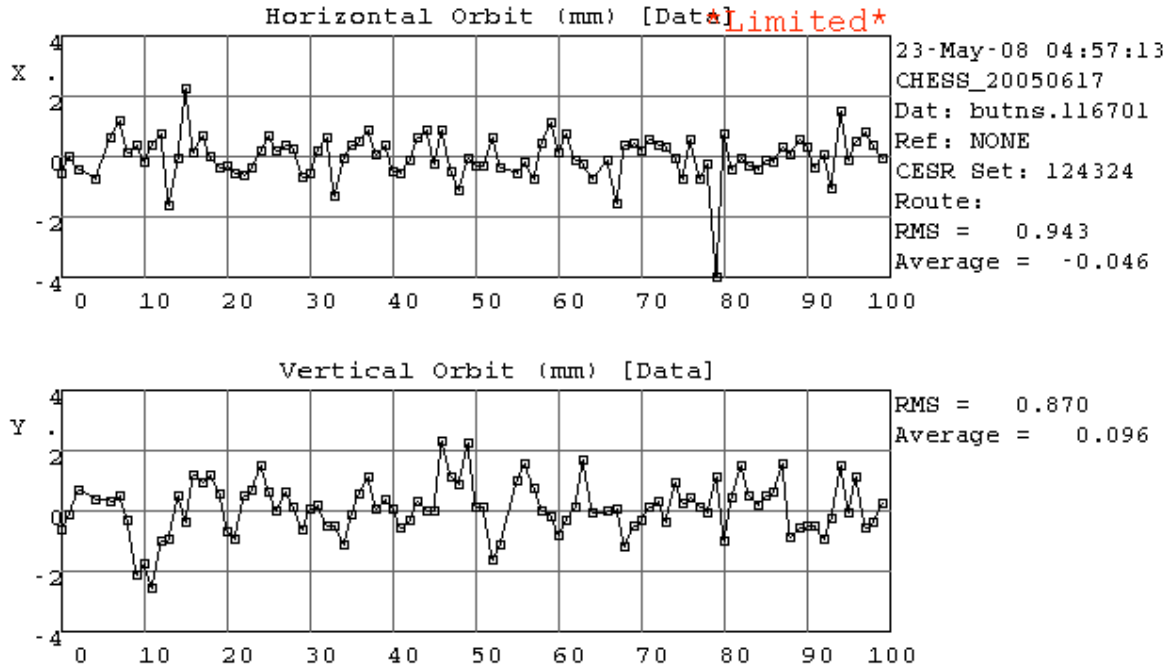


Identify 17E as source of vertical orbit error (y_offset = +300 microns)

Move magnet and remeasure

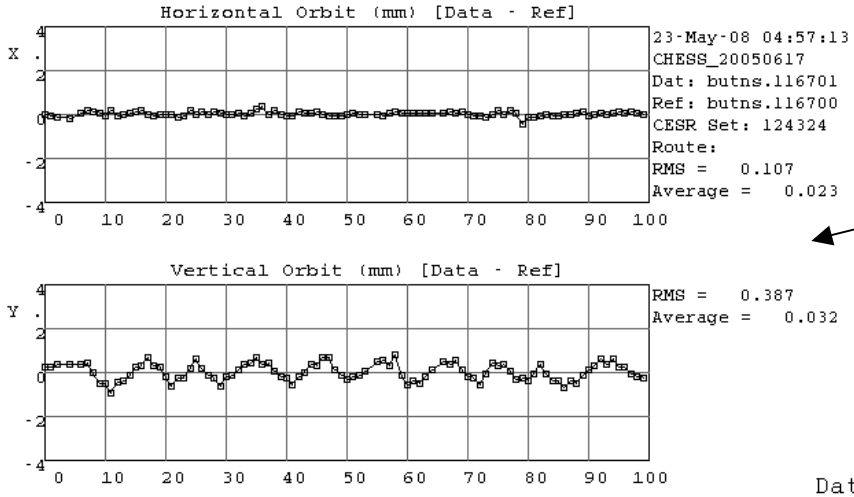
After 300 micron move

Data: after moving q17e



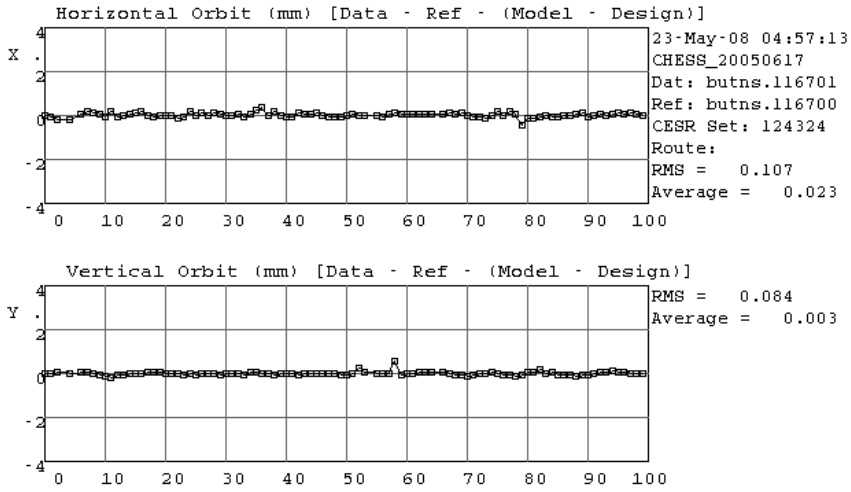
Change in vertical orbit

Data: after moving q17e



Orbit difference
data: after move
ref: before move

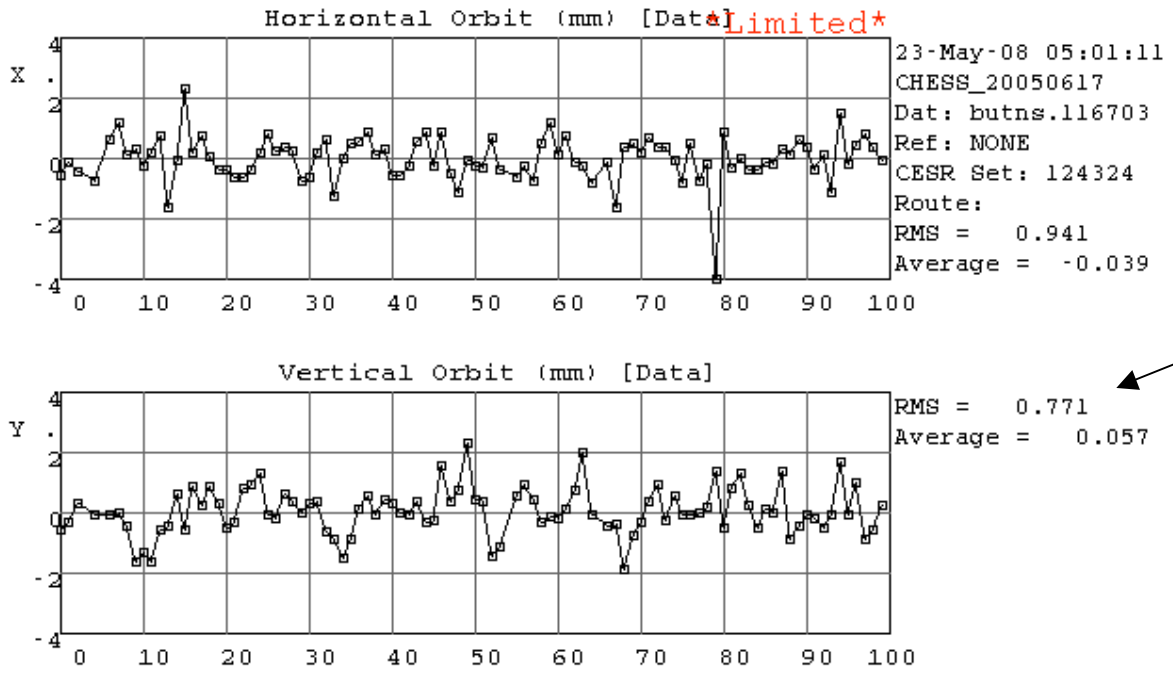
Data: after moving 17E
Ref: before moving 17E Model: Q17E y_offset = 0.3mm



(data-ref)-model
The model is the orbit with a 300 micron offset of Q17E

Optimize IR correction

after moving q17e and optimizing with 1E 1w



We managed to reduce RMS from 0.805mm to .771mm

Conclusions

-With wave analysis we can effectively identify "biggest" misalignments

-Combination of wave analysis, fitting, and survey data can identify more subtle errors

-Magnet moves have predictable outcomes

Future plans
- SVD analysis to identify misaligments?
- Include dispersion as a constraint (insensitive to BPM offset)

Limited by performance of BPM system
- so looking forward to upgrade