

Preliminary

# Results of beam-based alignment in undulator section

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Goal:

align all quadrupoles between undulator modules  
to get straight trajectory in undulator section  
to increase the overlap between electrons and  
photons

so that the SASE process can take place  
in the whole undulator section

# BBA in undulator: steps (overall plan)

- 1) measure relative offset between quadrupoles and BPM (or wire-scanners)
- 2) align quadrupoles to the beam (after de-Gauss of undulator quadrupoles)
- 3) measure dispersion in undulator section (masking incoming dispersion) and correct

up to now: step 1 done, step 2 (only vert. plane)

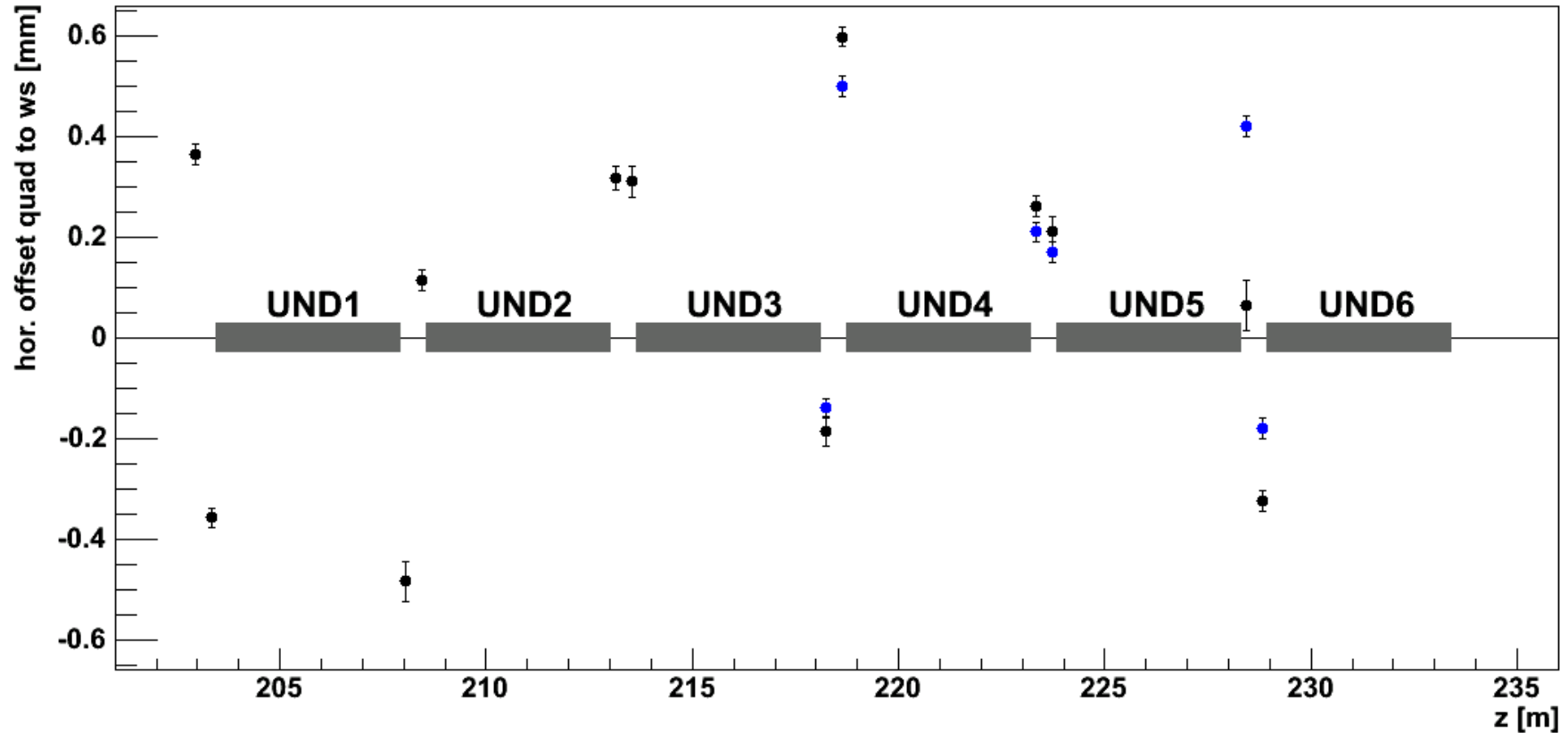
# Reproducibility of offset measurements

Preliminary

black dots: meas. from Oct. 2005

blue dots: meas. from Jan. 2006

horizontal plane



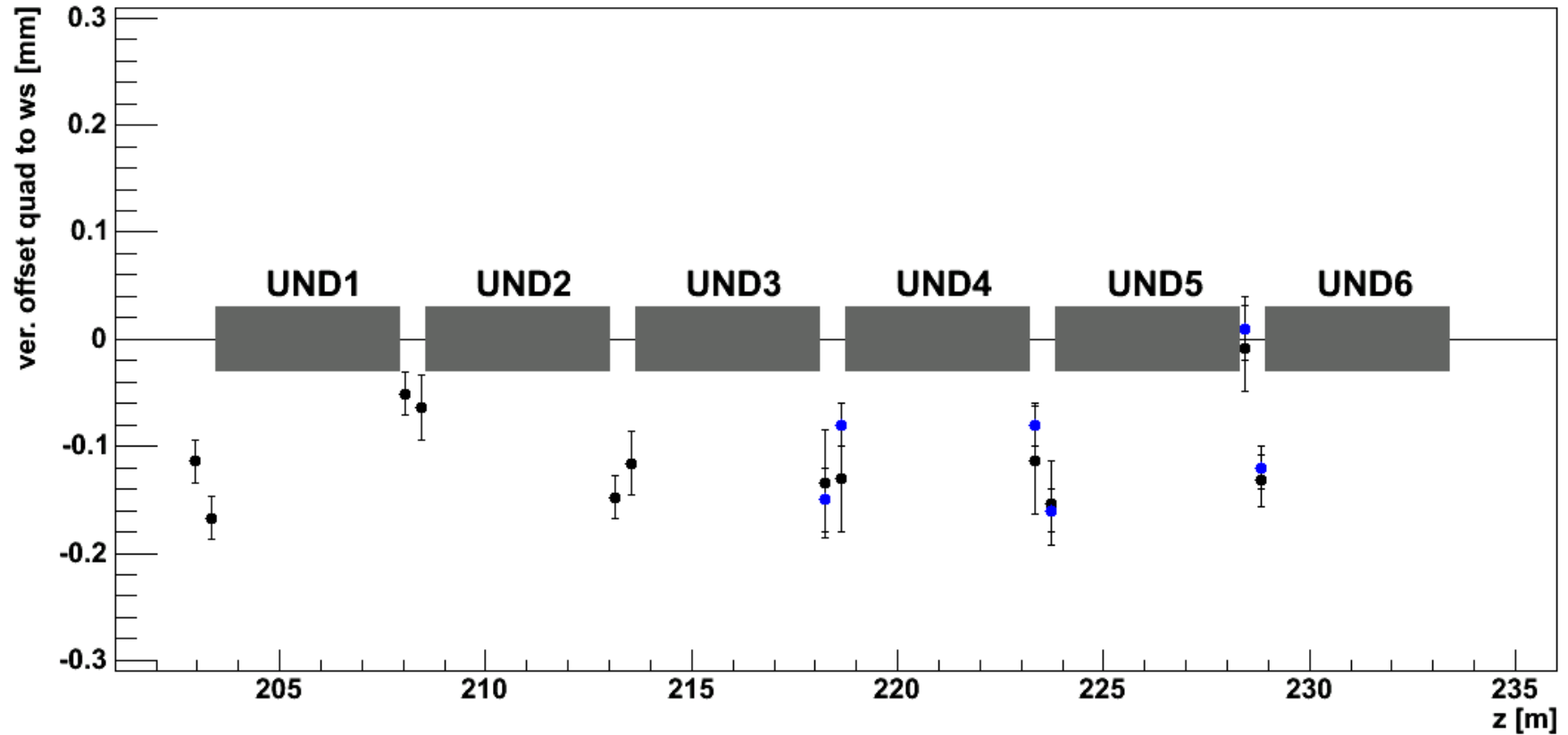
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vertical plane

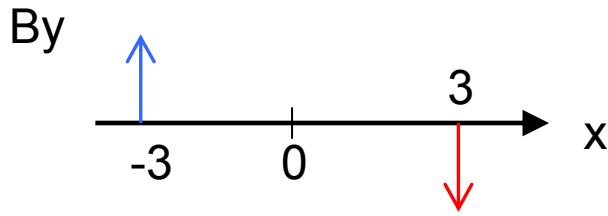


# BBA in undulator: steps (overall plan)

- 1) measure relative offset between quadrupoles and BPM (or wire-scanners)
- 2) align quadrupoles to the beam (**after de-Gauss of undulator quadrupoles**)
- 3) measure dispersion in undulator section (masking incoming dispersion) and correct

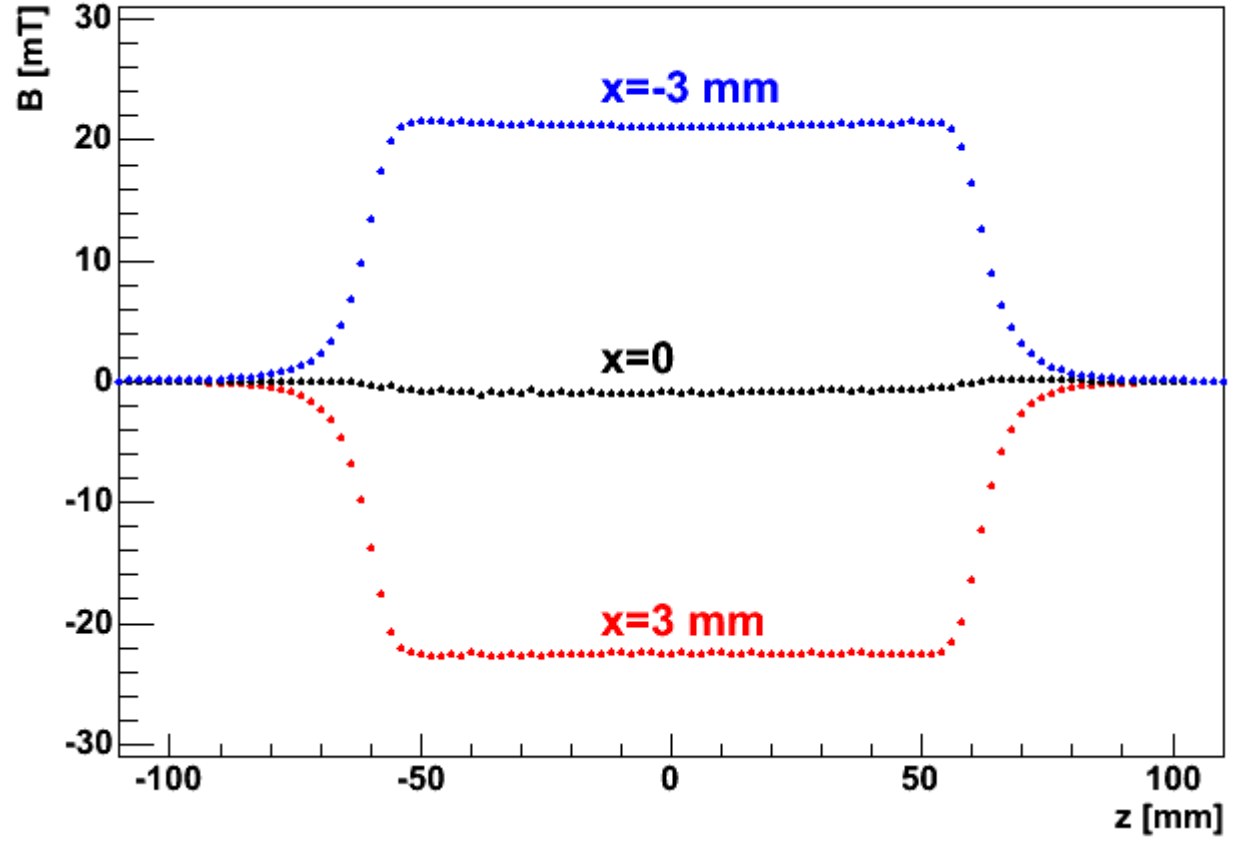
up to now: step 1 done, step 2 (only vert. plane)

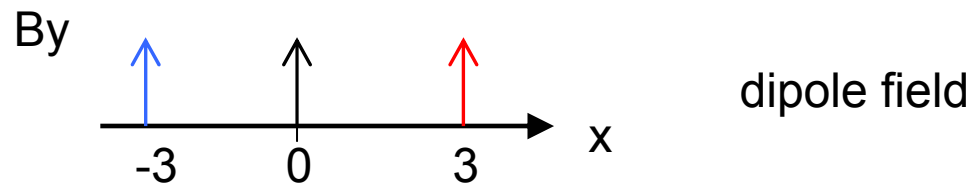
# Typical quad field



TQG quad: current from 75 A to 10 A

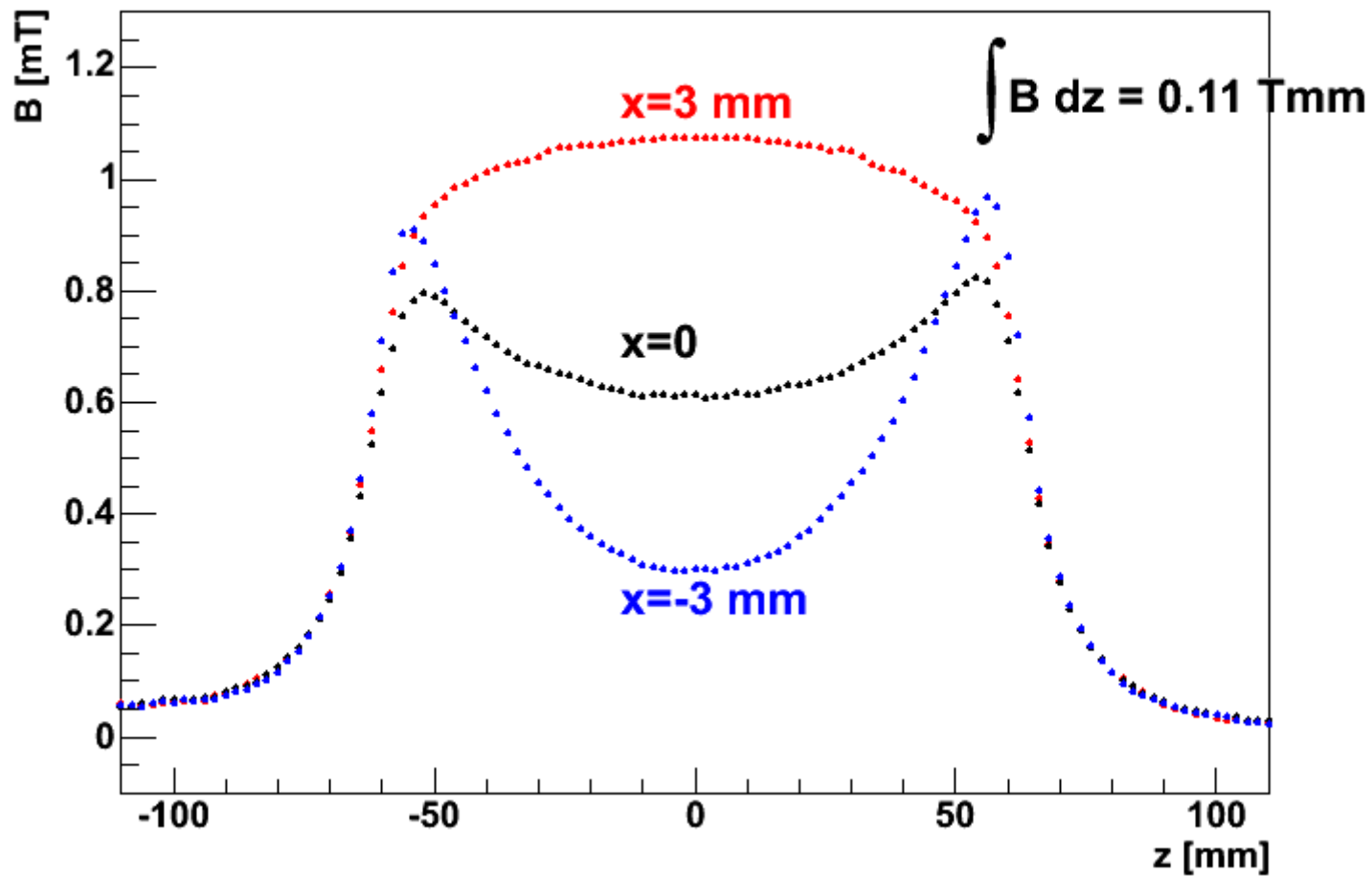
10 A



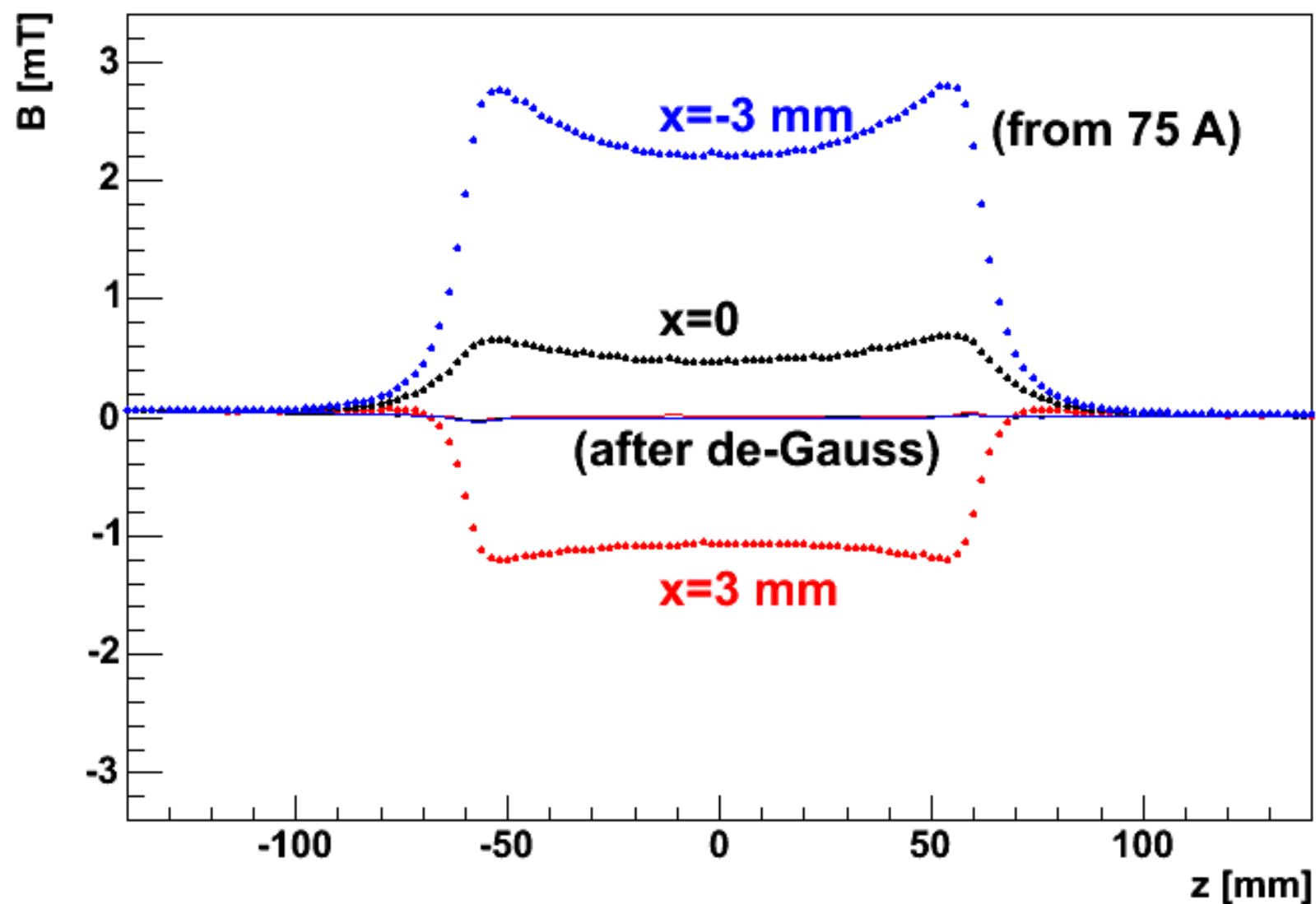


TQG quad: current from 75 A to -1 A

-1 A



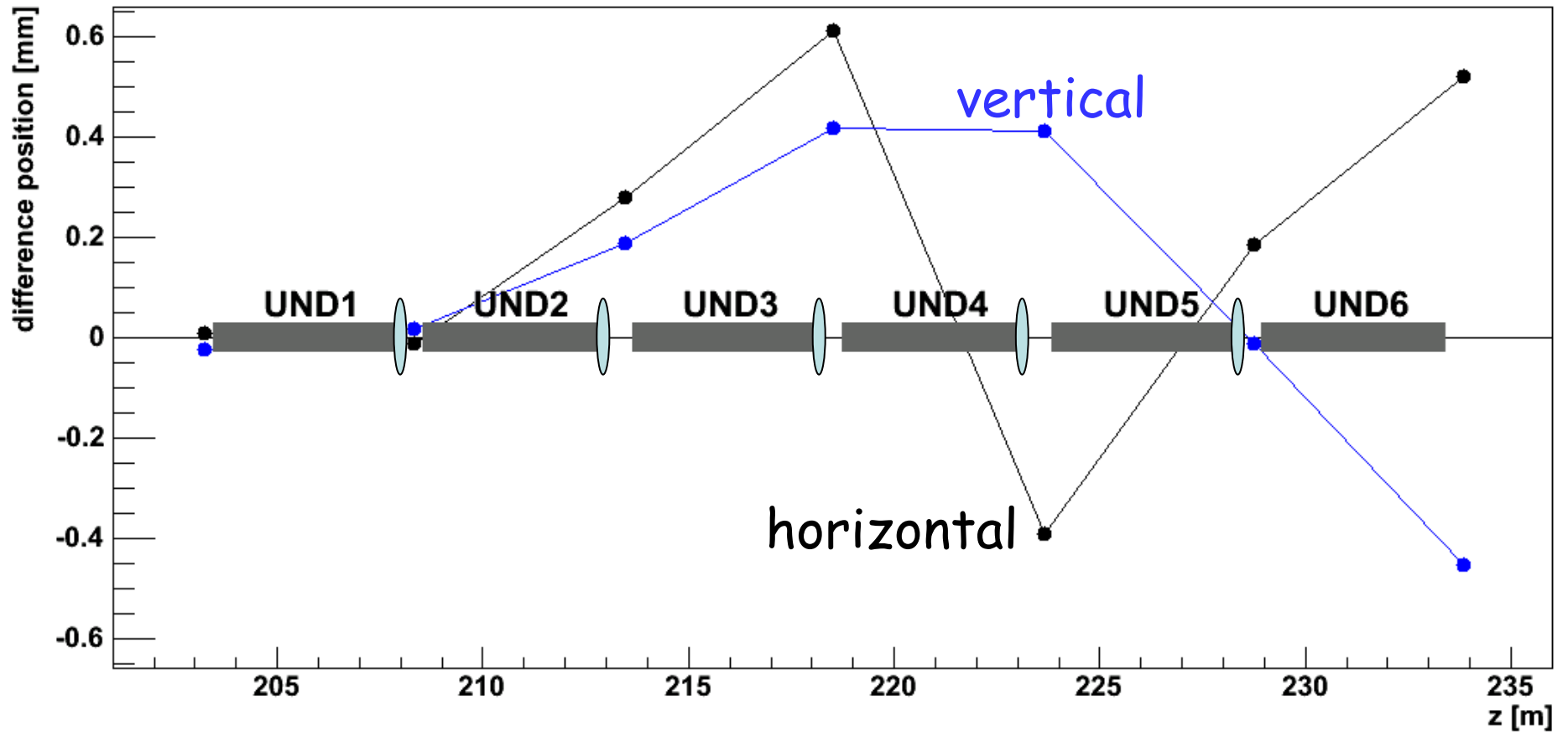
quadrupole TQG 18 : current = 0





# Difference orbit:

- 1) all quadrupoles de-Gaussed (as reference orbit)
- 2) cycling of Q5UND1,2,3,4,5 (one power supply)

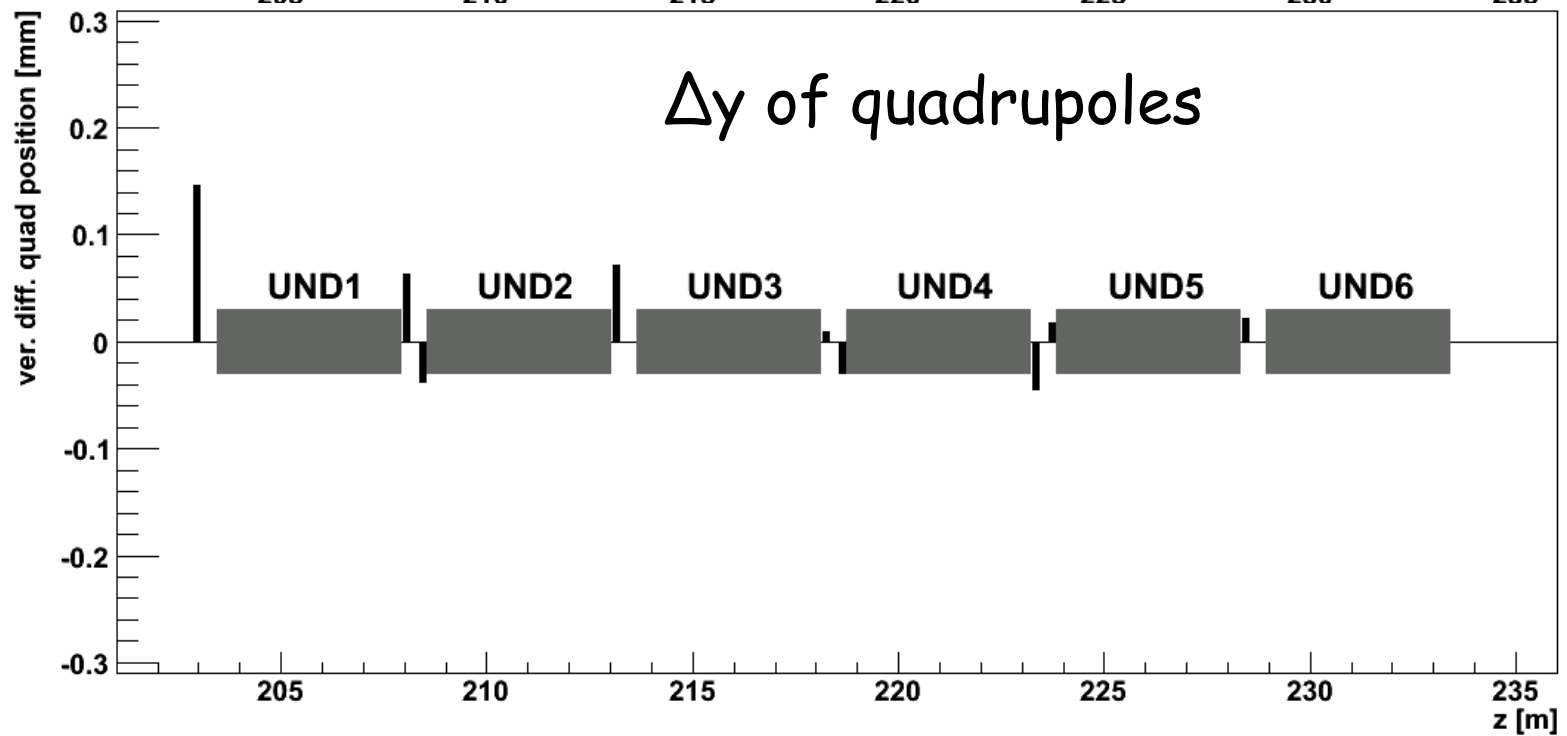
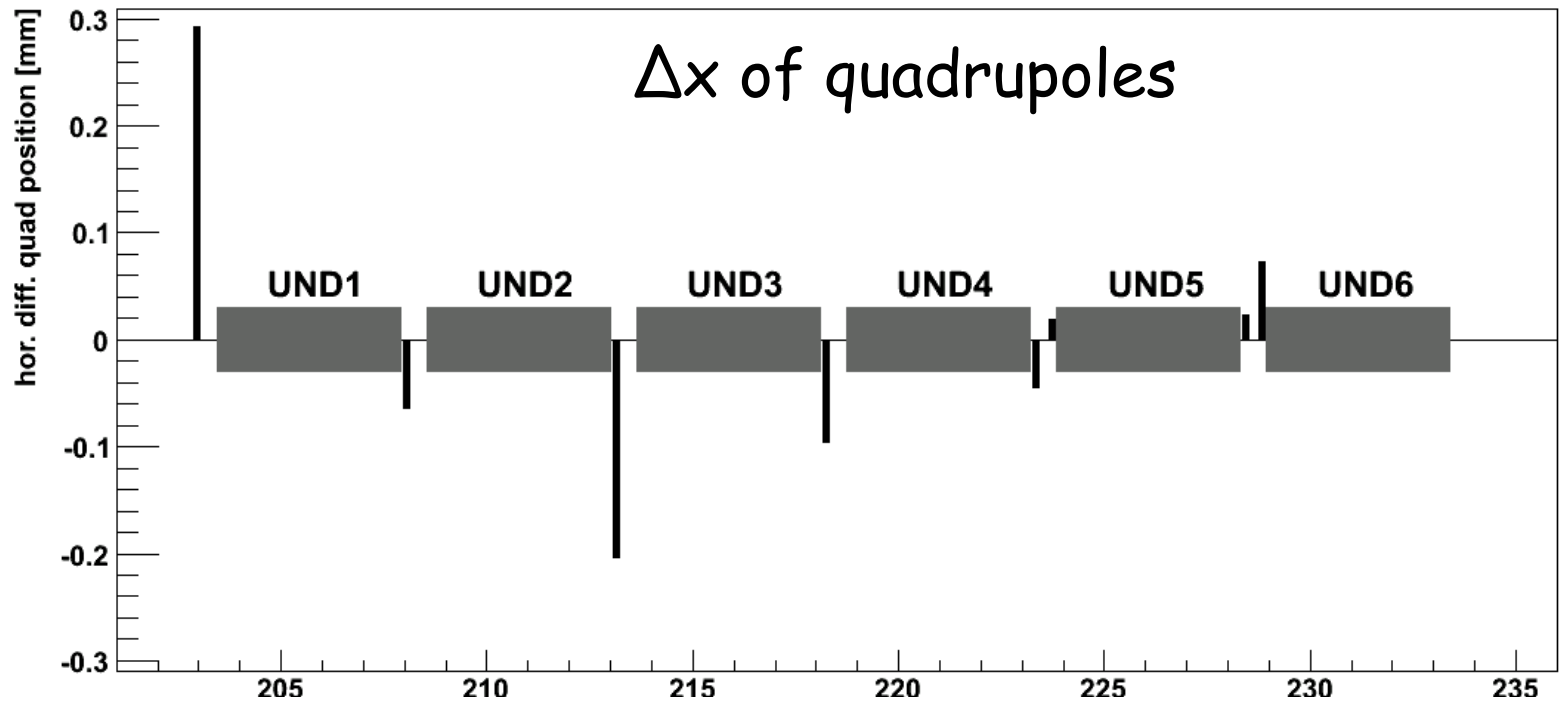


## Procedure:

- 1) take reference orbit (all quadrupoles de-Gaussed)
- 2) cycle Q5UND1,2,3,4,5 (one power supply)
- 3) move Q5UND1,2,3,4,5 to correct to ref. orbit
- 4) cycle Q6UND1,2,3,4,5 (one power supply)
- 5) move Q6UND1,2,3,4,5 to correct to ref. orbit
- 6) cycle Q21SEED
- 7) move Q21SEED to correct to ref. orbit


## Advantages:

- independent of BPM calibration
- independent of transfer matrix



$$\Delta x * \text{grad} = - \text{dipole field}$$

$$x_2 * \text{grad}_2 - x_1 * \text{grad}_1 = - \text{dipole field}$$

cycled  


de-Gauss  


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