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

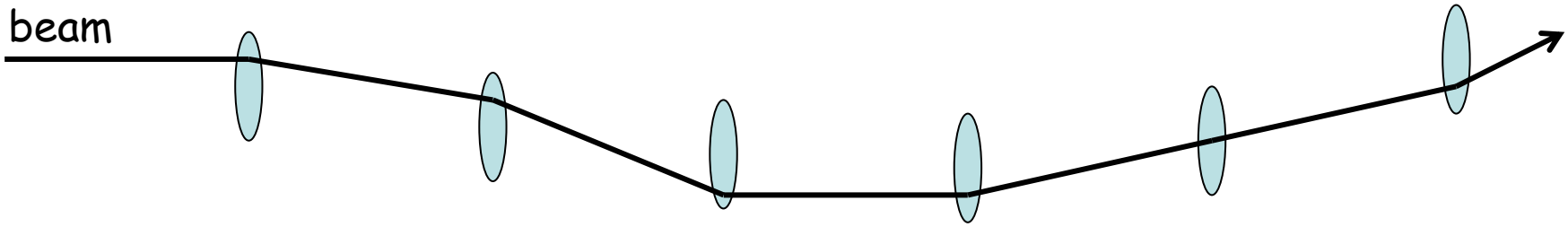
so that the SASE process can take place in the whole undulator section

BBA in undulator: steps (overall plan)

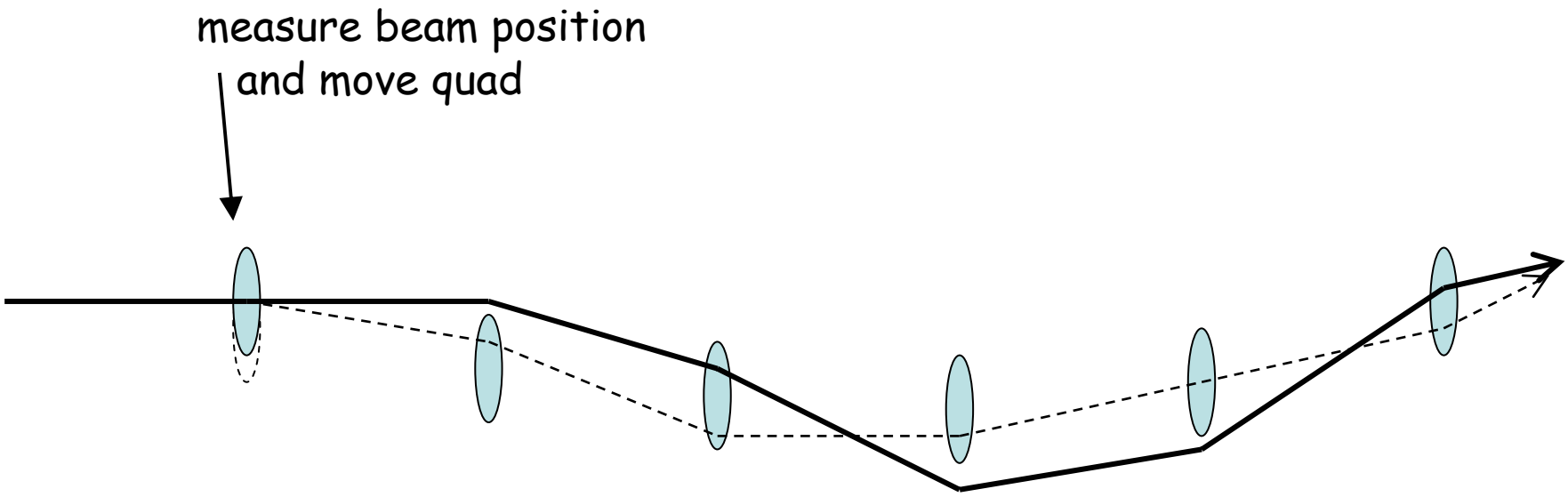
1) measure relative offset between quadrupoles and BPM (or wire-scanners)
2) align quadrupoles to the beam (after de-Gauss of undulator quadrupoles)
3) measure dispersion in undulator section (masking incoming dispersion) and correct

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

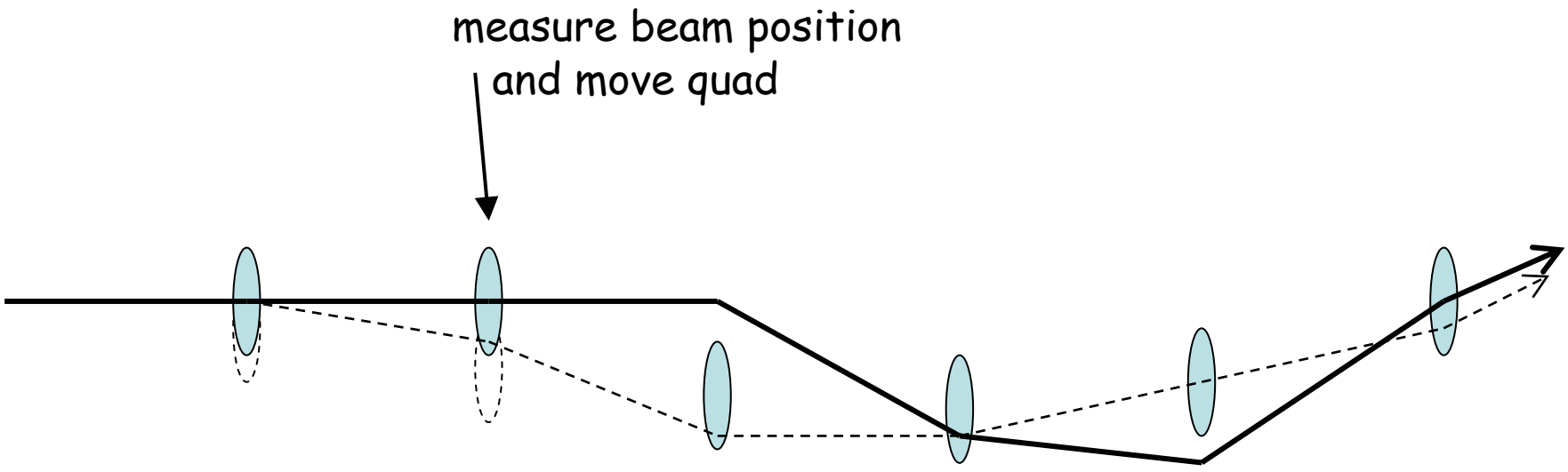
Procedure



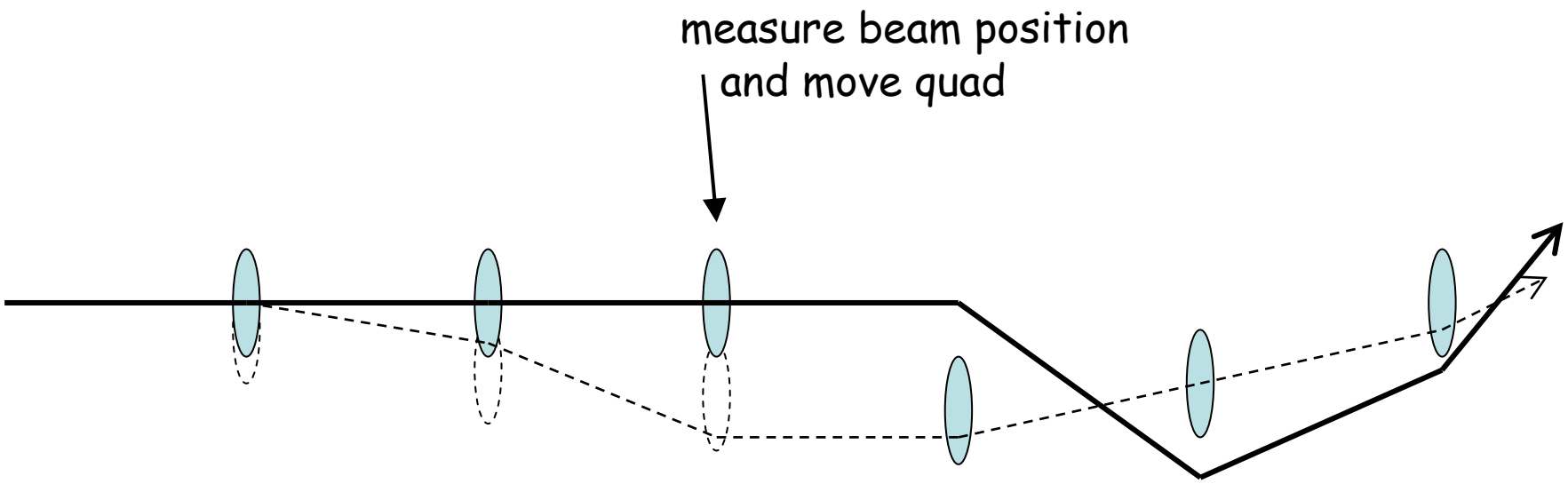
Procedure



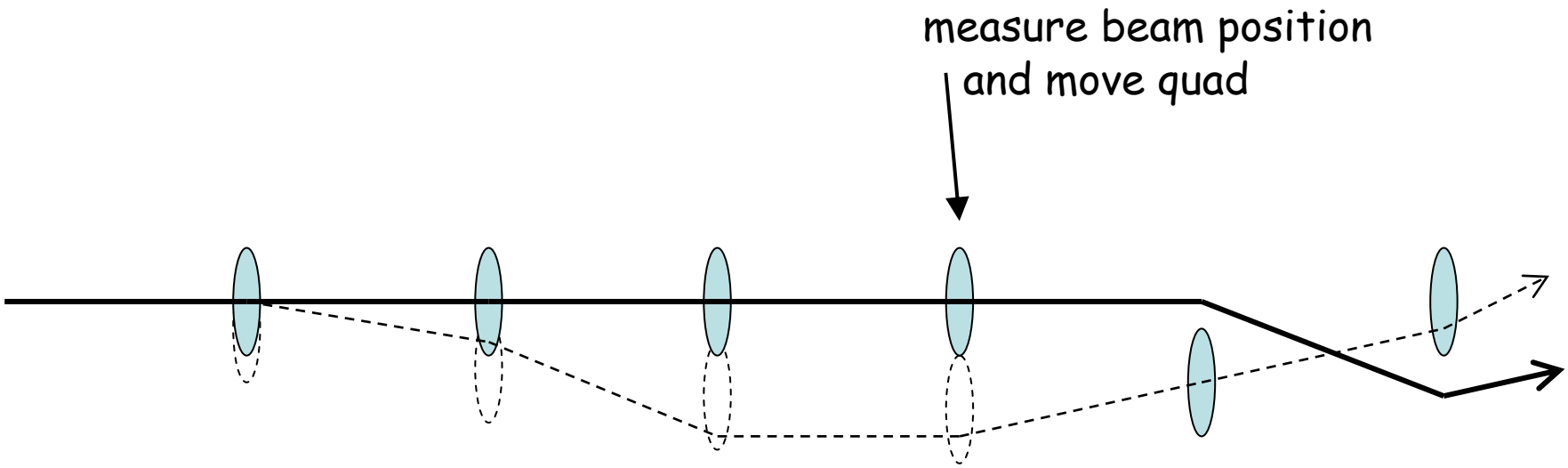
Procedure



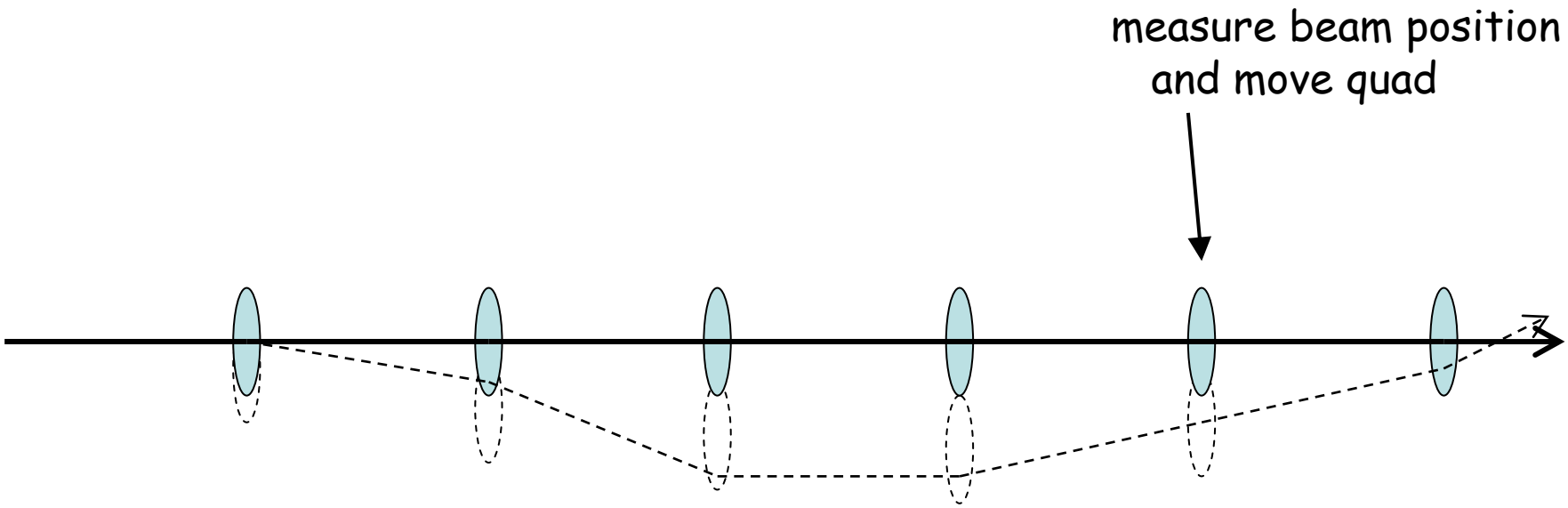
Procedure



Procedure



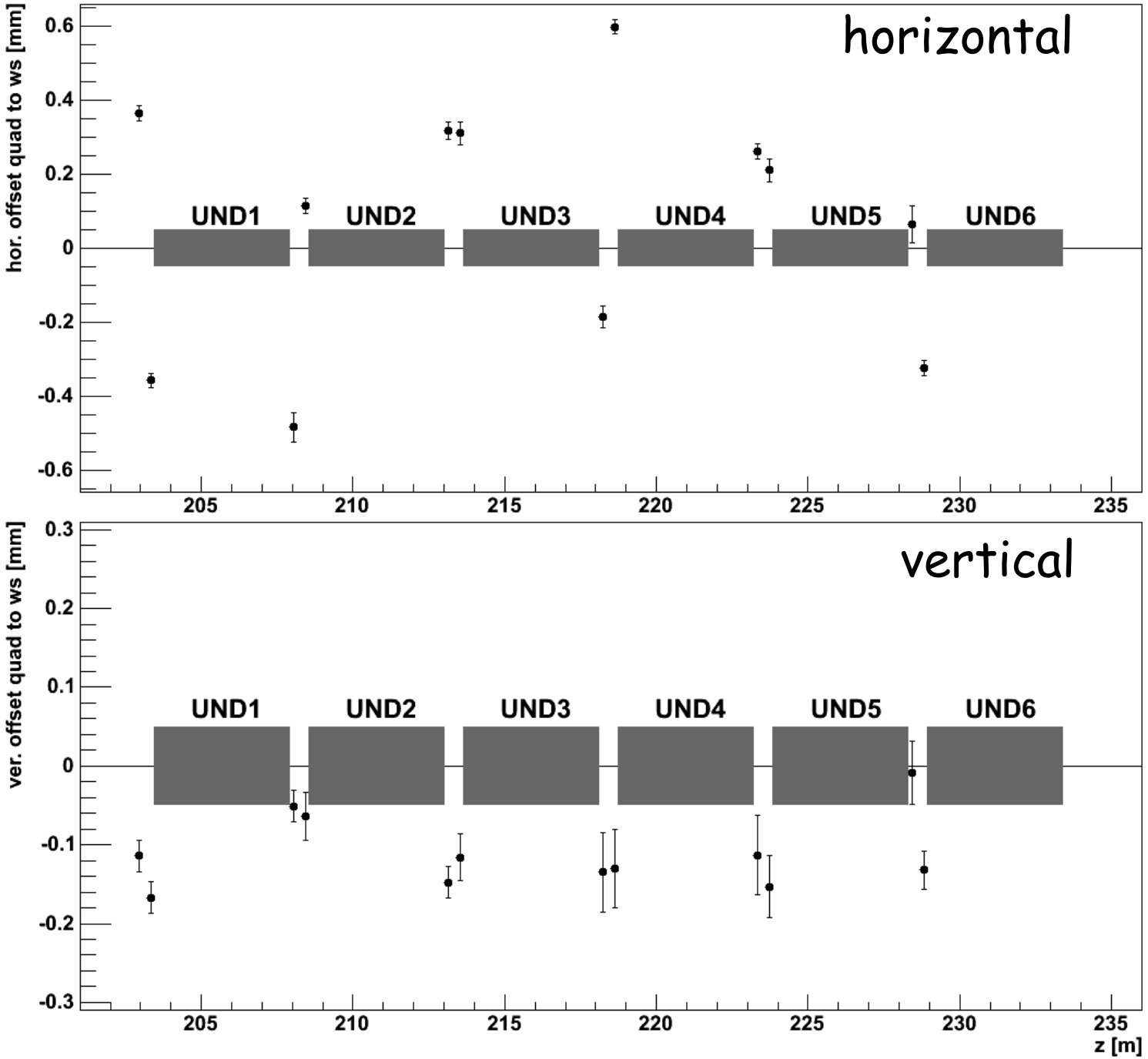
Procedure



→ all quads are steering free

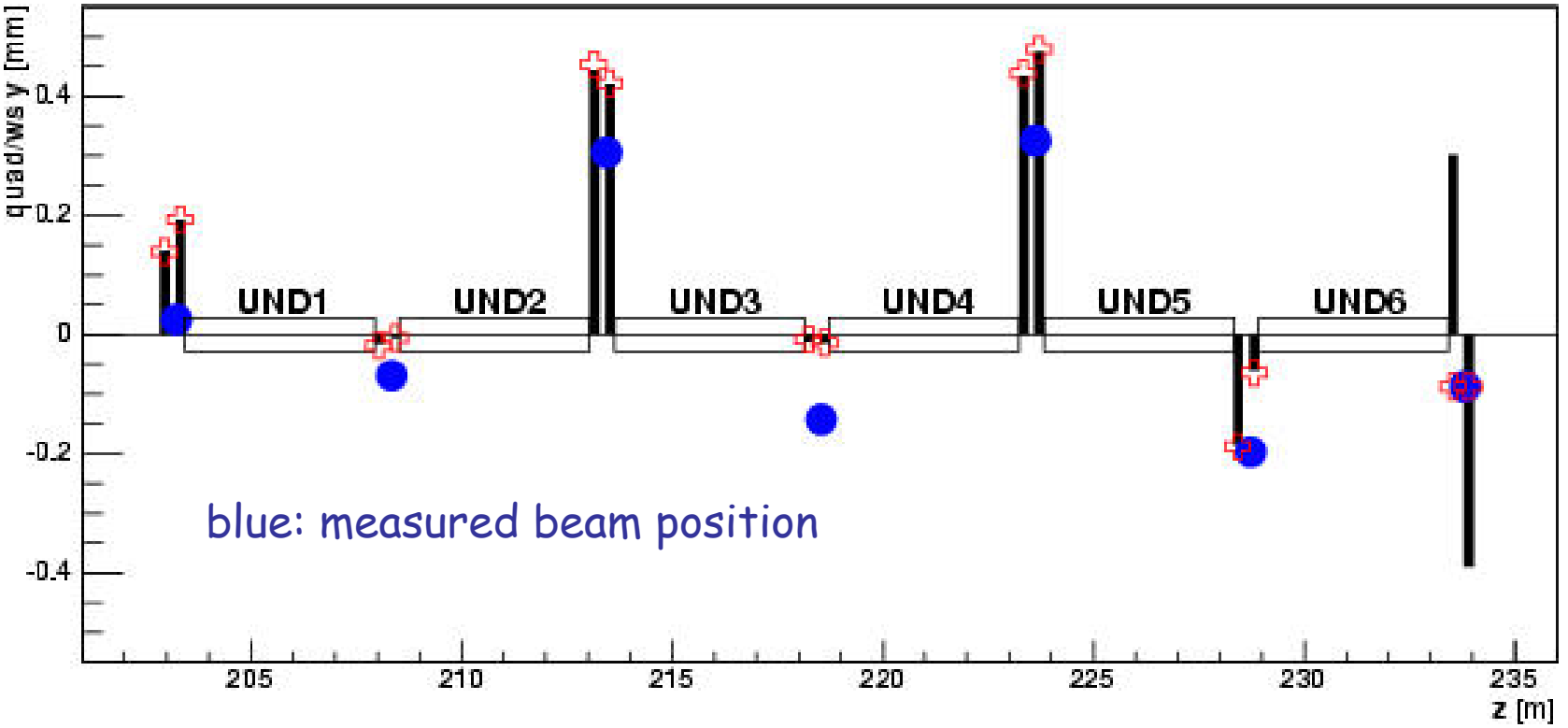
→ no dispersion generated by quads

Technical
Note 05-04

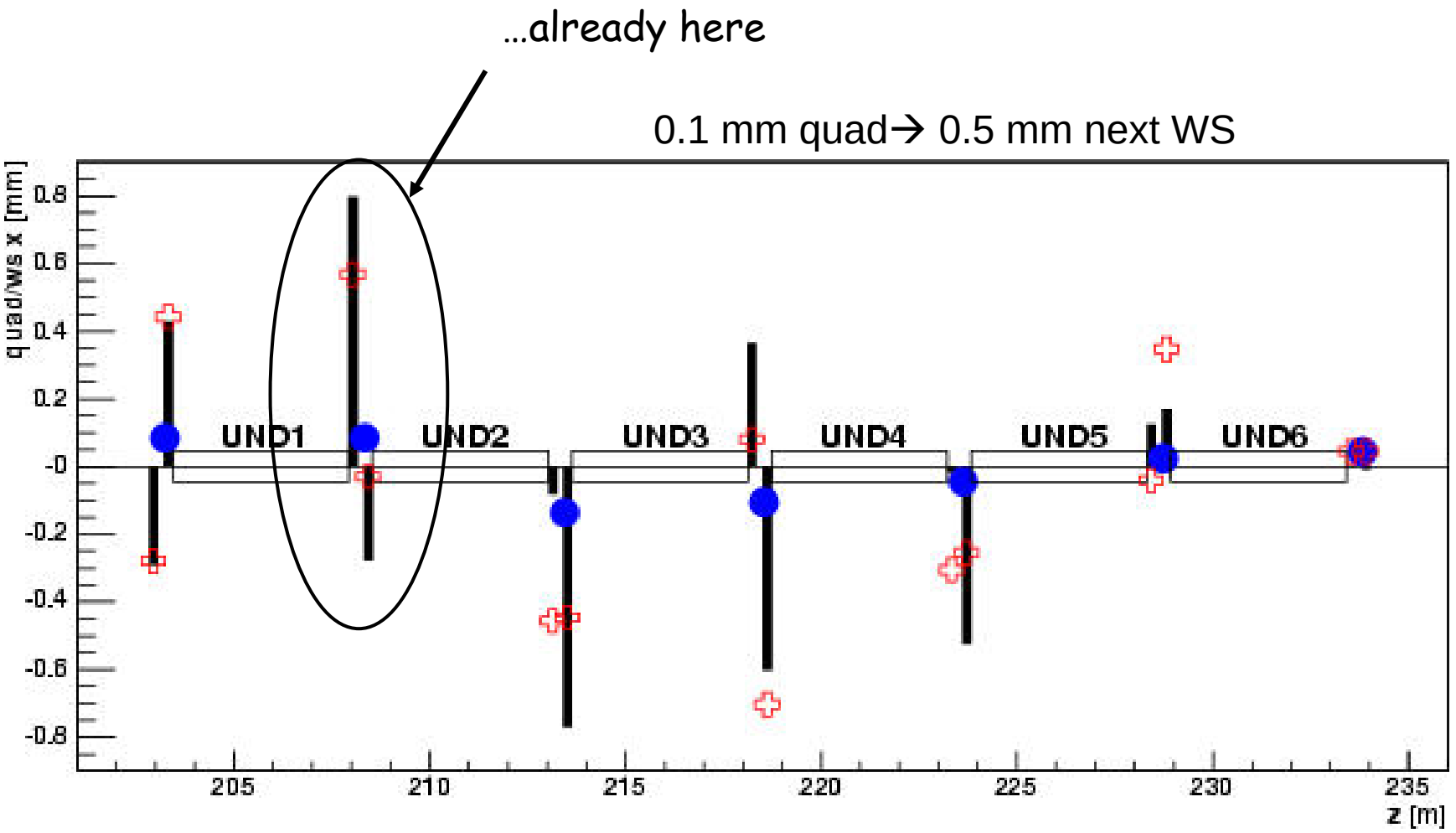


Results from BBA in the vertical plane

red: Soll position of quads (for steering free) = black: Ist position of quads

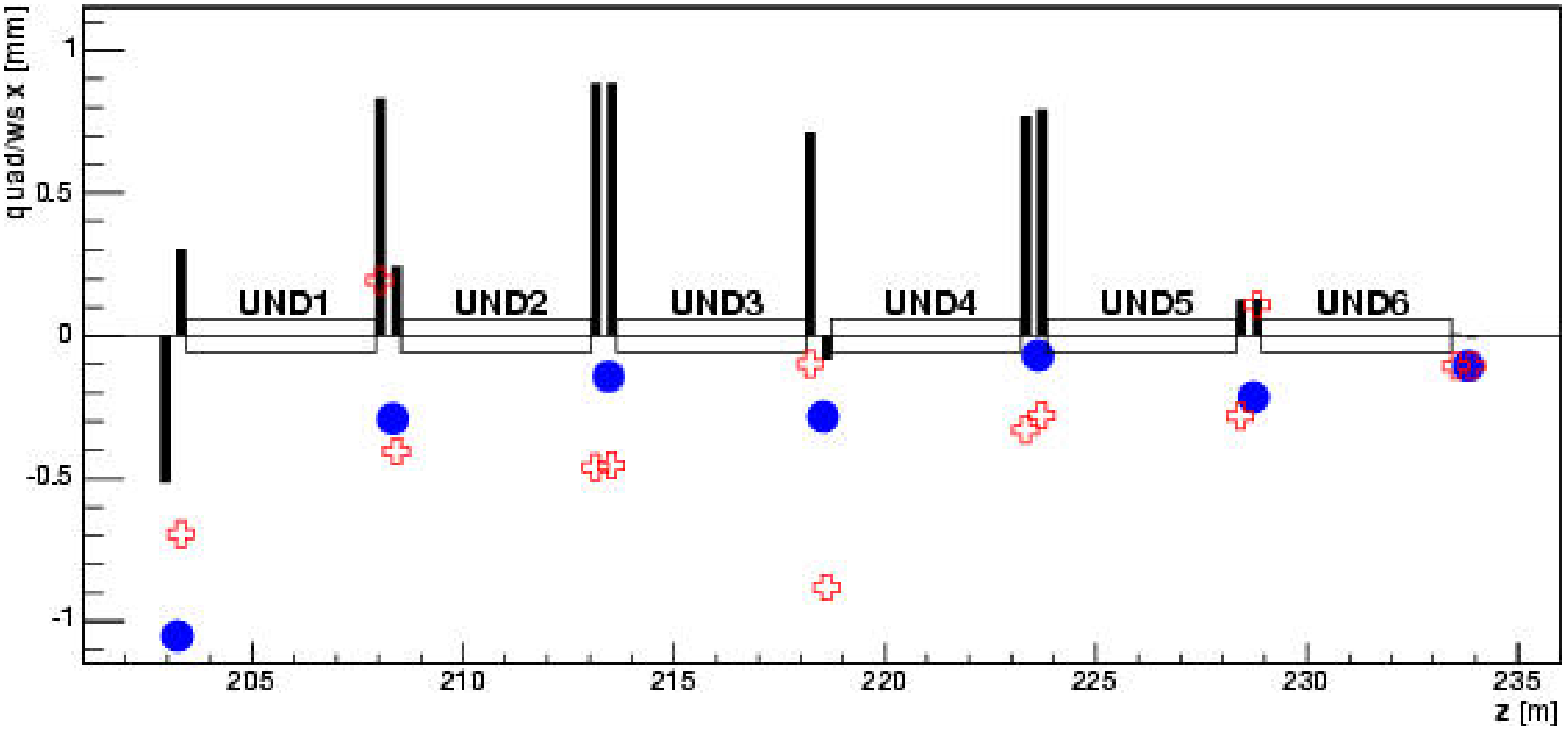


First try of BBA in the horizontal plane …failed…



Last try of BBA in the horizontal plane …failed…

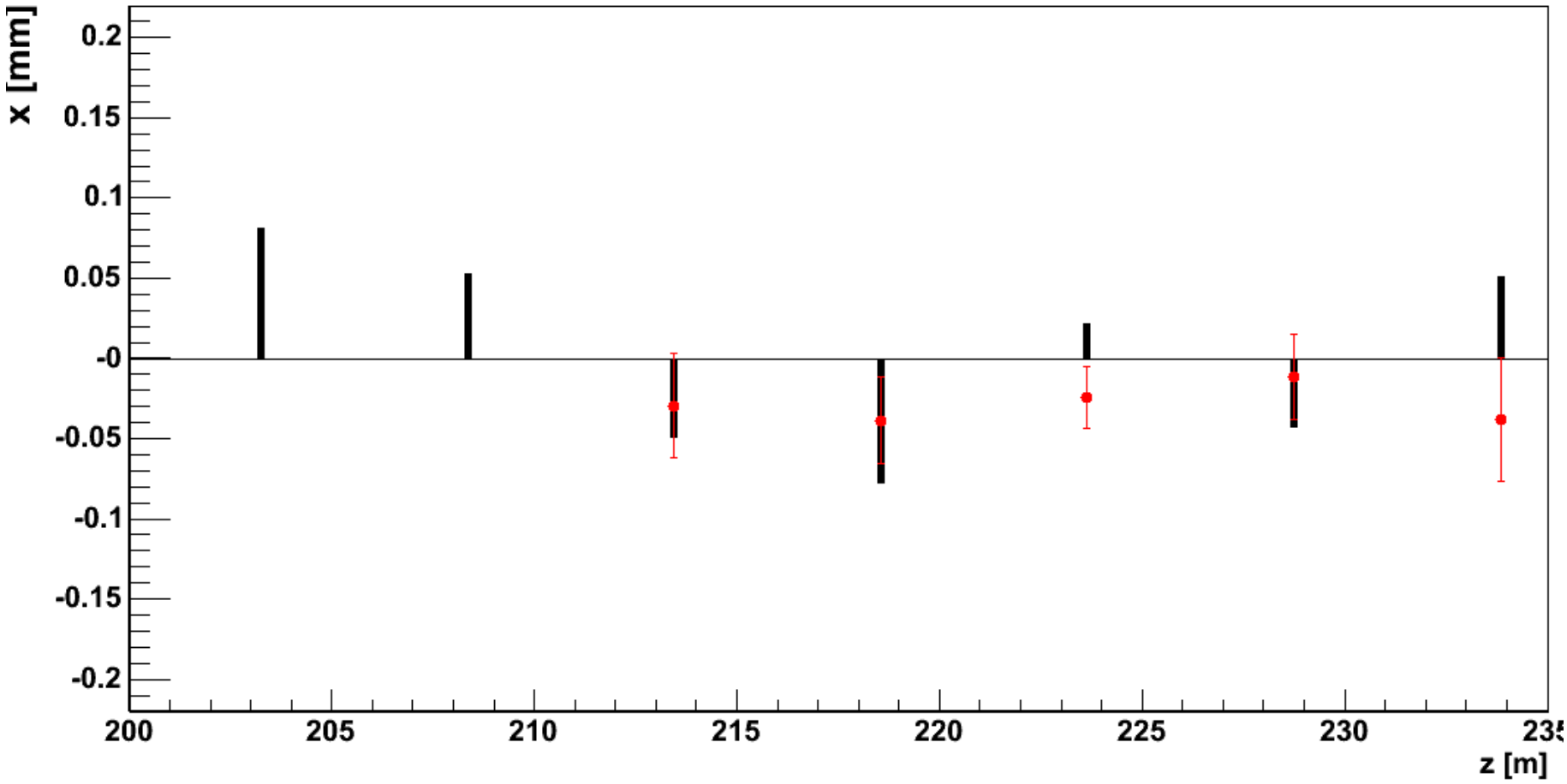
… BUT the relative distance between quads is same as SOLL



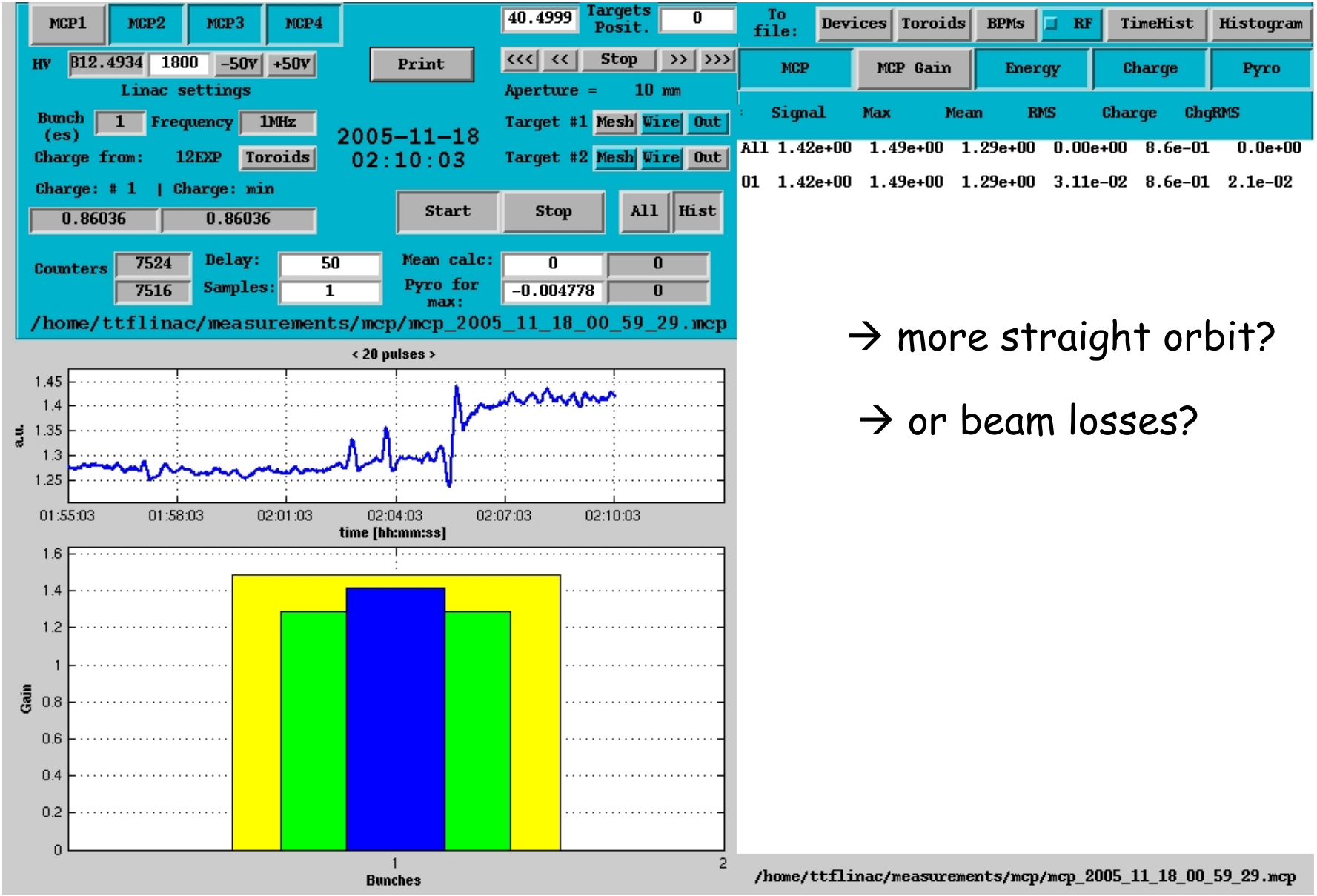
The horizontal trajectory can be made flat

black: beam position measured with wirescanners

red: beam position measured with BPMs (averaged over 100 points)



→ spontaneous emission increased in forward direction



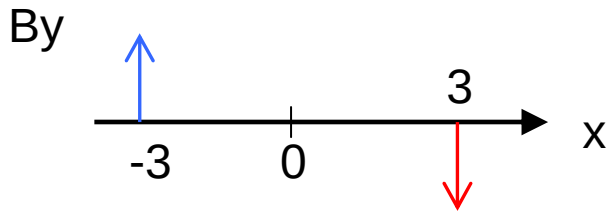
→ more straight orbit?

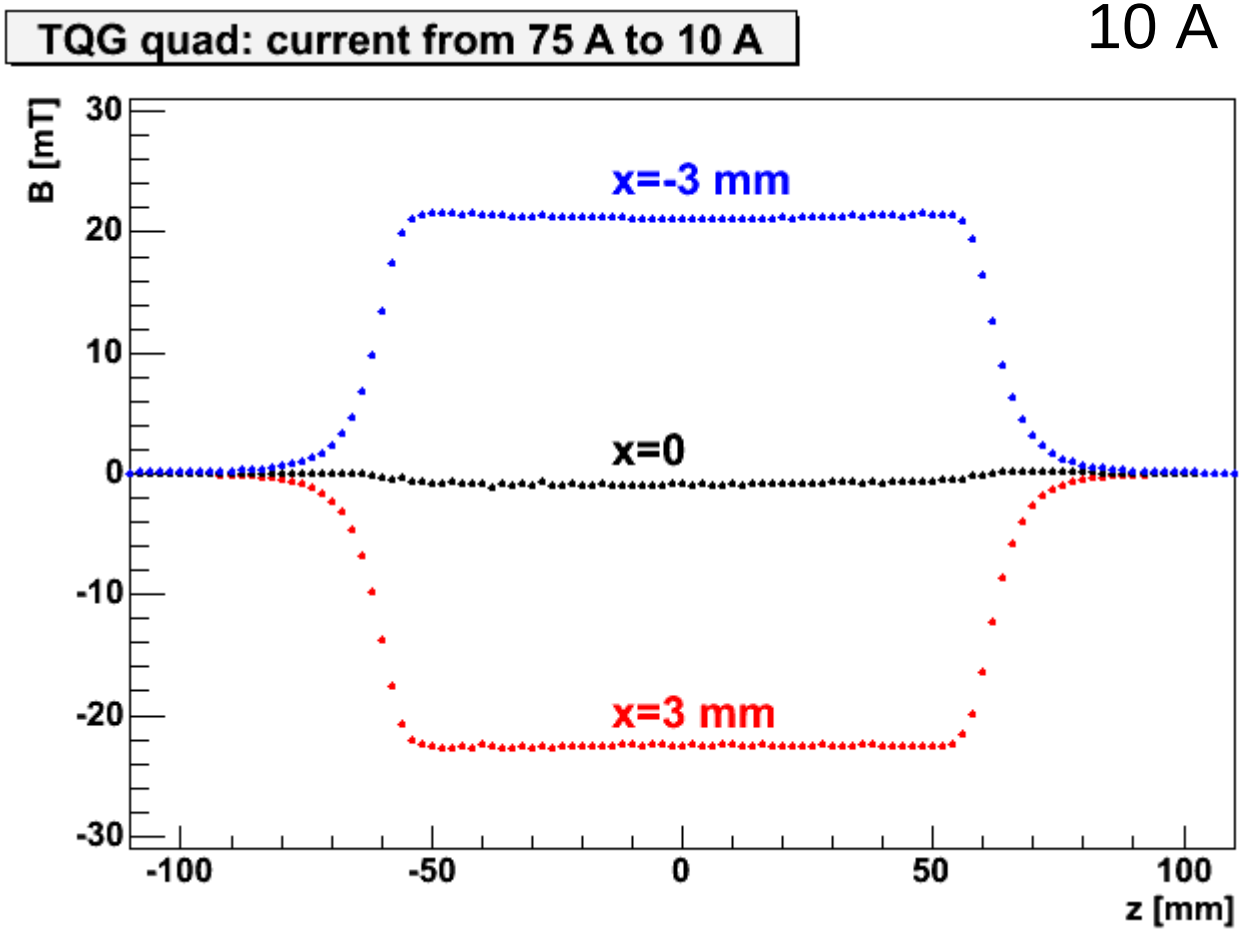
→ or beam losses?

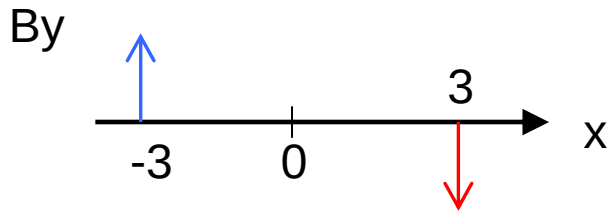
Why de-Gauss of quads?

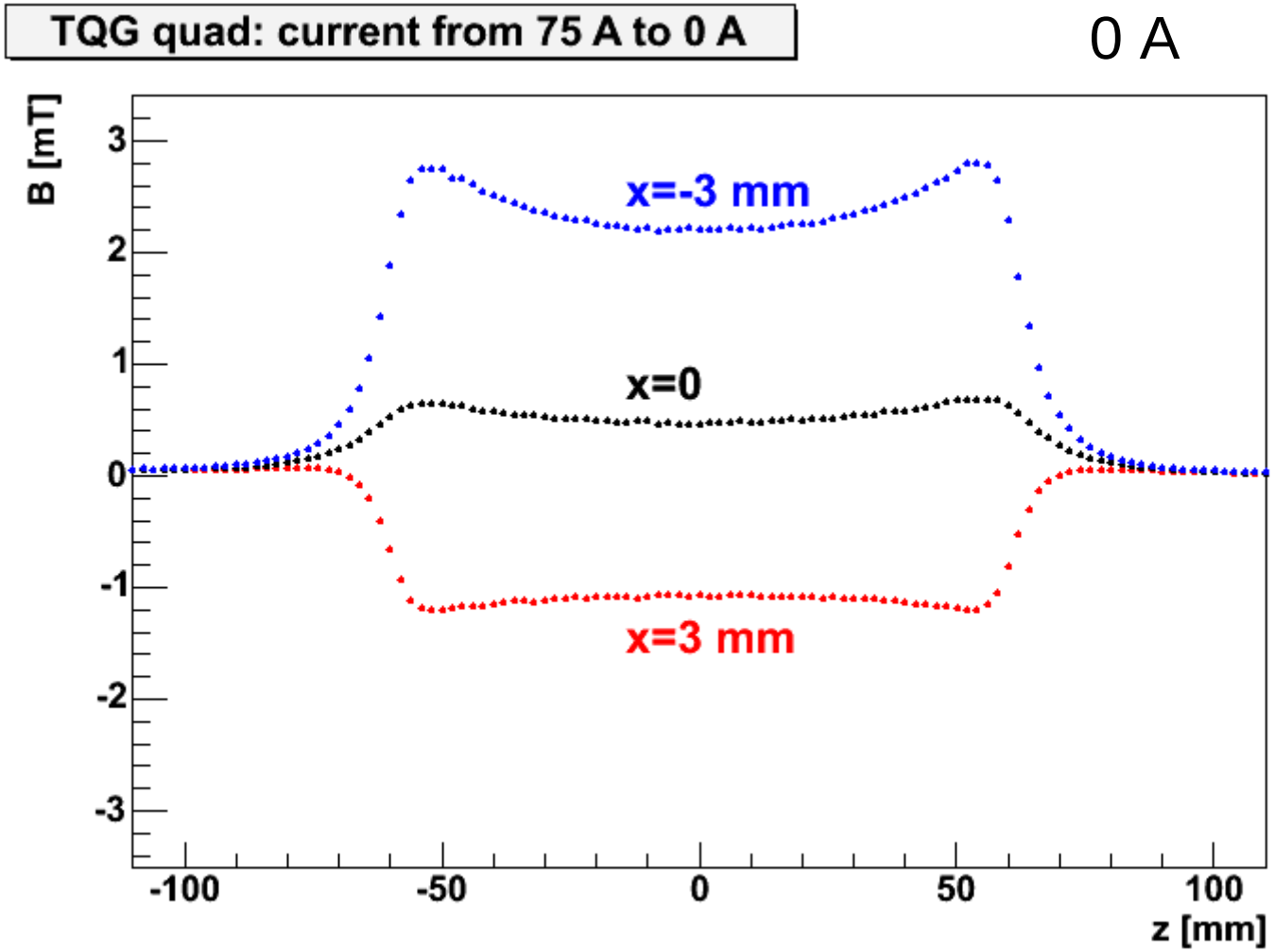
to get rid of the dipole component

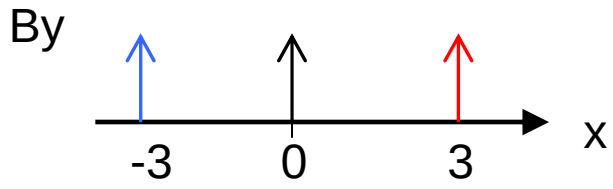
Typical quad field



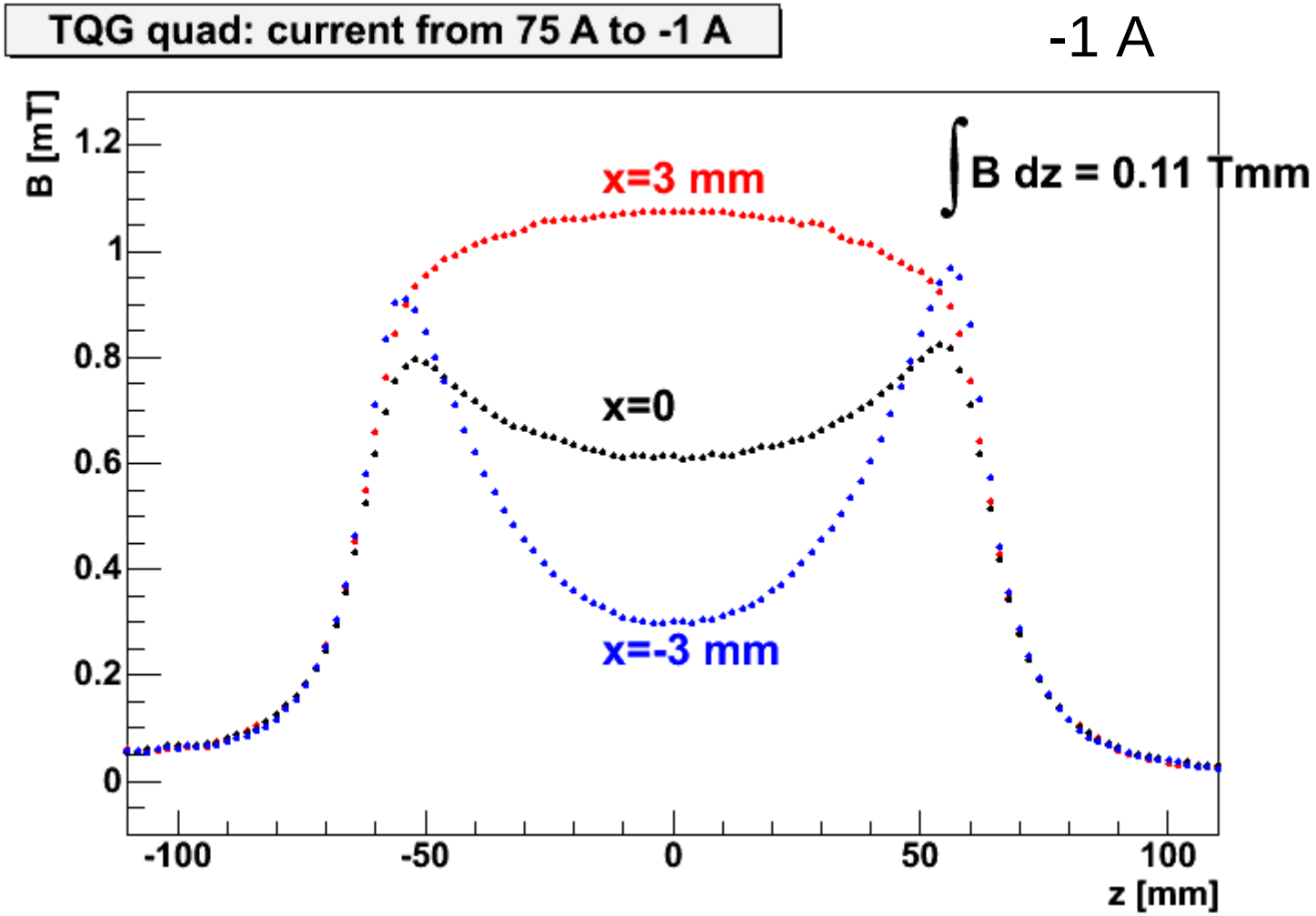


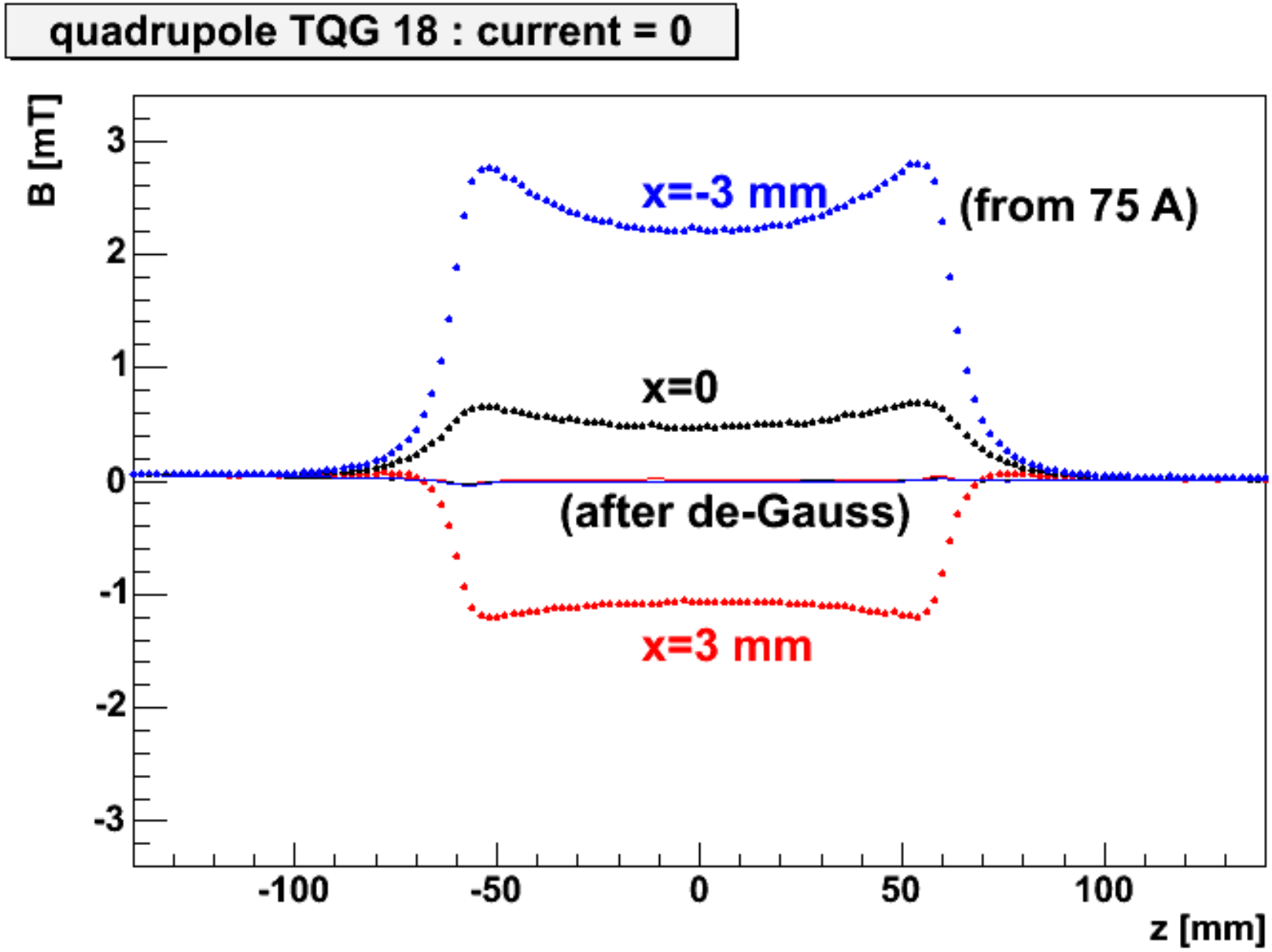

By
3
x
-3
0


TQG quad: current from 75 A to 0 A
0 A
B [mT]
3
2
1
0
-1
-2
-3
x=-3 mm
x=0
x=3 mm
-100
-50
0
50
100
z [mm]

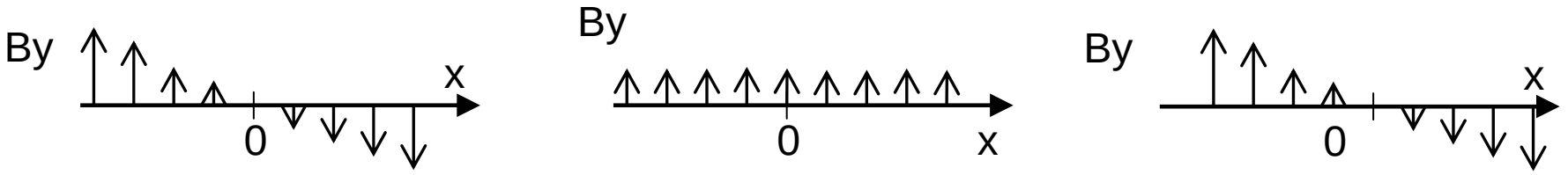


dipole field




quadrupole TQG 18 : current = 0
B [mT]
3
2
1
0
-1
-2
-3
x=-3 mm
(from 75 A)
x=0
(after de-Gauss)
x=3 mm
-100
-50
0
50
100
z [mm]

Measurements of the quad center vs current (on spare quad)



quad field + dipole field = quad field (shifted)