Orbit Investigations with deGaussed Undulator Quads

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In the past we tried several times to get beam through undulator:

      - with quadrupoles off

      - with quadrupoles off + deGaussed

…unsuccessfully.
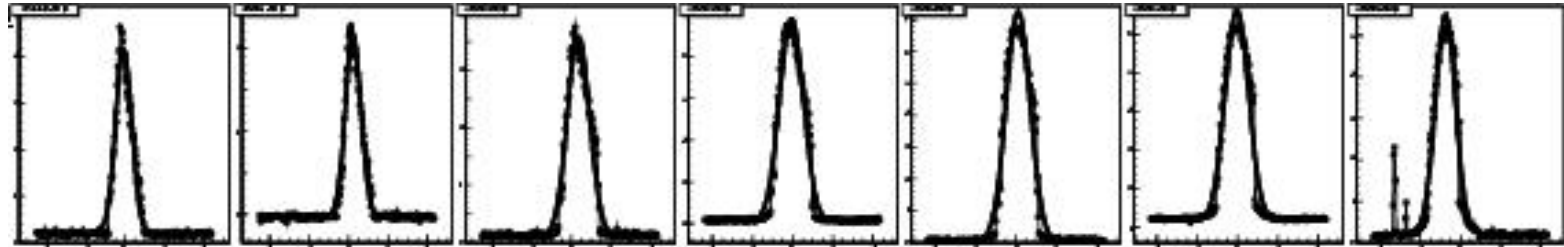
In the past we tried centering quads at the beam (BBA):

      - horizontally … unsuccessfully

      - vertically … successfully (resulting in all quads streering-free)

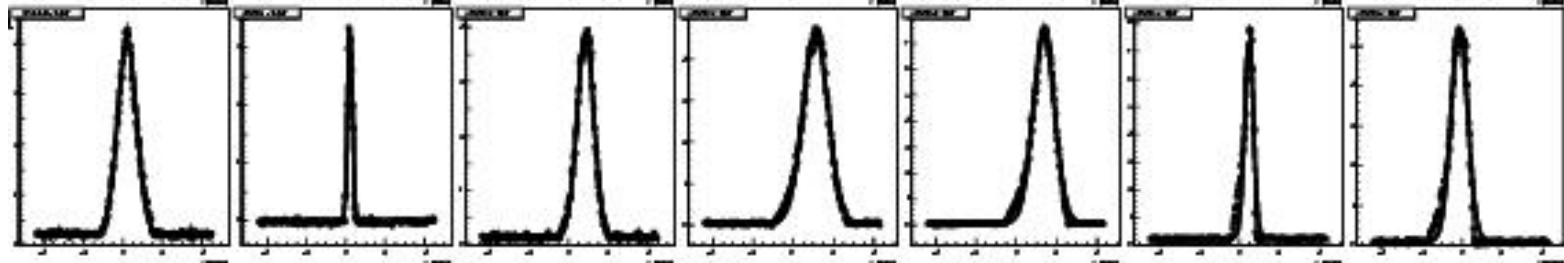# First time beam through undulator with quads deGaussed (off)

- NO undulator losses (recorded by photomultipliers + glass fibers)
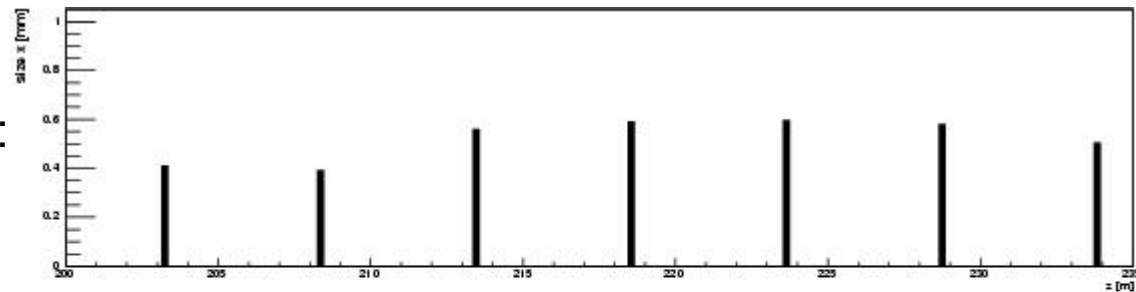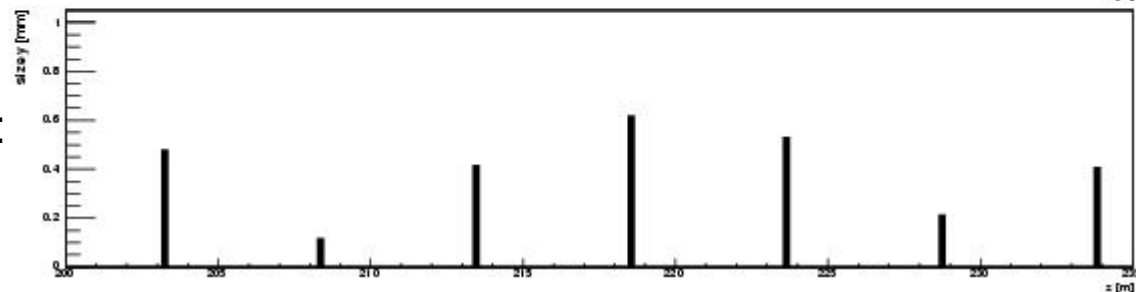
wirescanner profiles:

horizontal

vertical
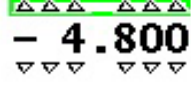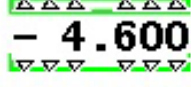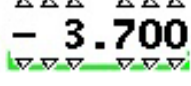
hor. beam size:

ver. beam size:
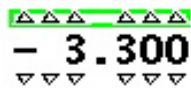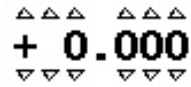
Using following steerer strengths (in Amperes):

|		
H3UND1	− 3.300	−3.301
H3UND2	+ 0.000	−0.010	← not working during the measurement
H3UND3	− 5.600	−5.578
H3UND4	− 4.800	−4.800
H3UND5	− 4.600	−4.587
H3UND6	− 3.700	−3.697

These are NOT steerers for orbit correction! They are NOT water cooled!

They are designed for exclusive use:

   -to measure the FEL gain exponential growth along the undulator section.
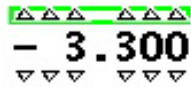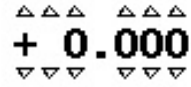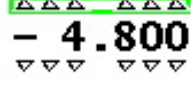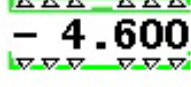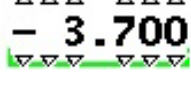
Horizontal orbit difference: (H3UND1 = -2.9 A   -   H3UND1 = -3.3 A)

Preliminary
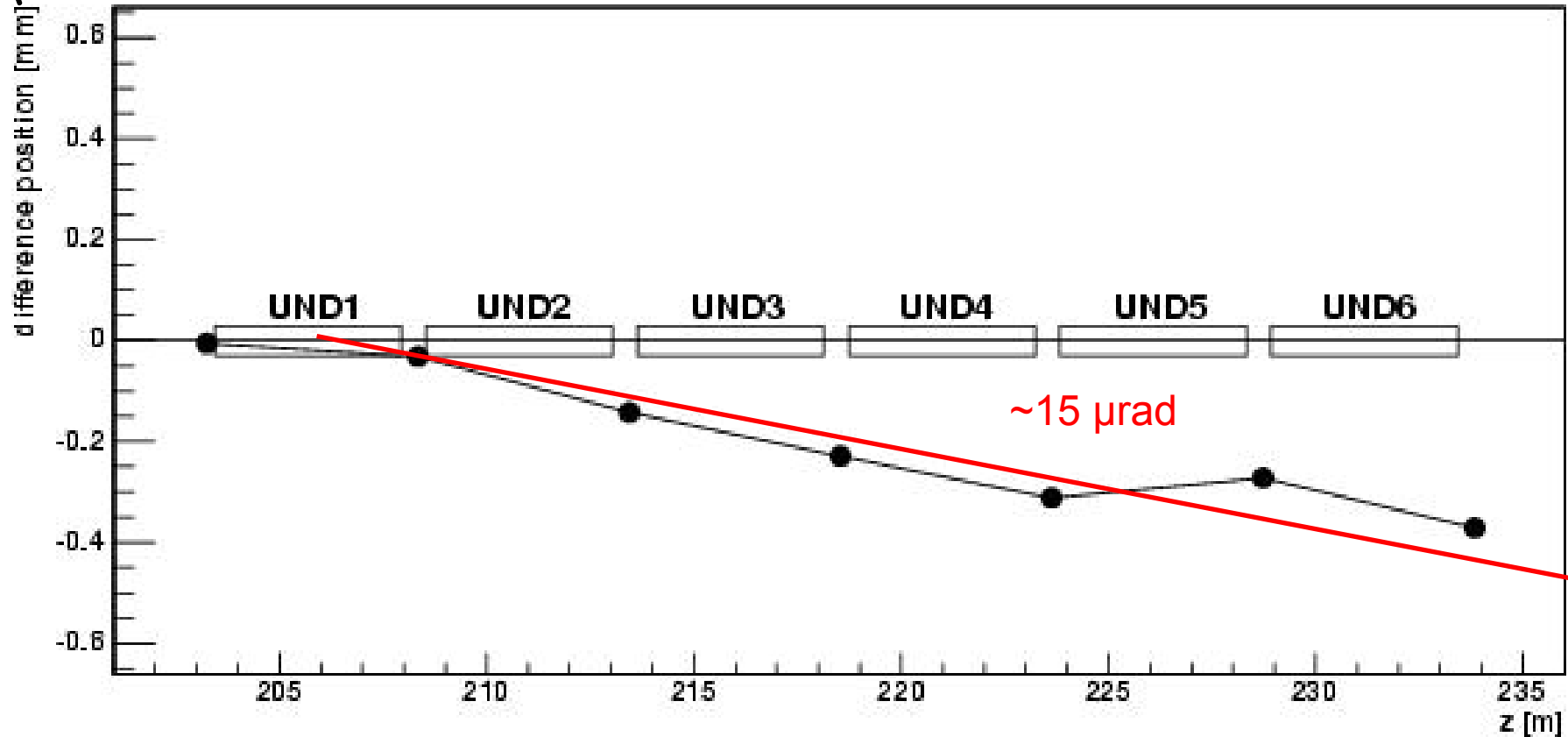
- wrong polarity : for ΔI = +0.4 → beam moves to negative (to the left)

- strength: about 40 *μ*rad / A at 700 MeV   or   about 0.1 T mm / A

Using following steerer strengths:

	Setpoint	Readback		Deflection	Integrated field
H3UND1	− 3.300	−3.301 A		+0.13 mrad	0.33 T mm
H3UND2	+ 0.000	−0.010 A		0 mrad	0 T mm
H3UND3	− 5.600	−5.578 A		+0.22 mrad	0.56 T mm
H3UND4	− 4.800	−4.800 A		+0.19 mrad	0.48 T mm
H3UND5	− 4.600	−4.587 A		+0.18 mrad	0.46 T mm
H3UND6	− 3.700	−3.697 A		+0.15 mrad	0.37 T mm

strong correction in same direction (to the right)

about same correction strength in each undulator

Orbit kick from H3UND1 = -3.3 A only:
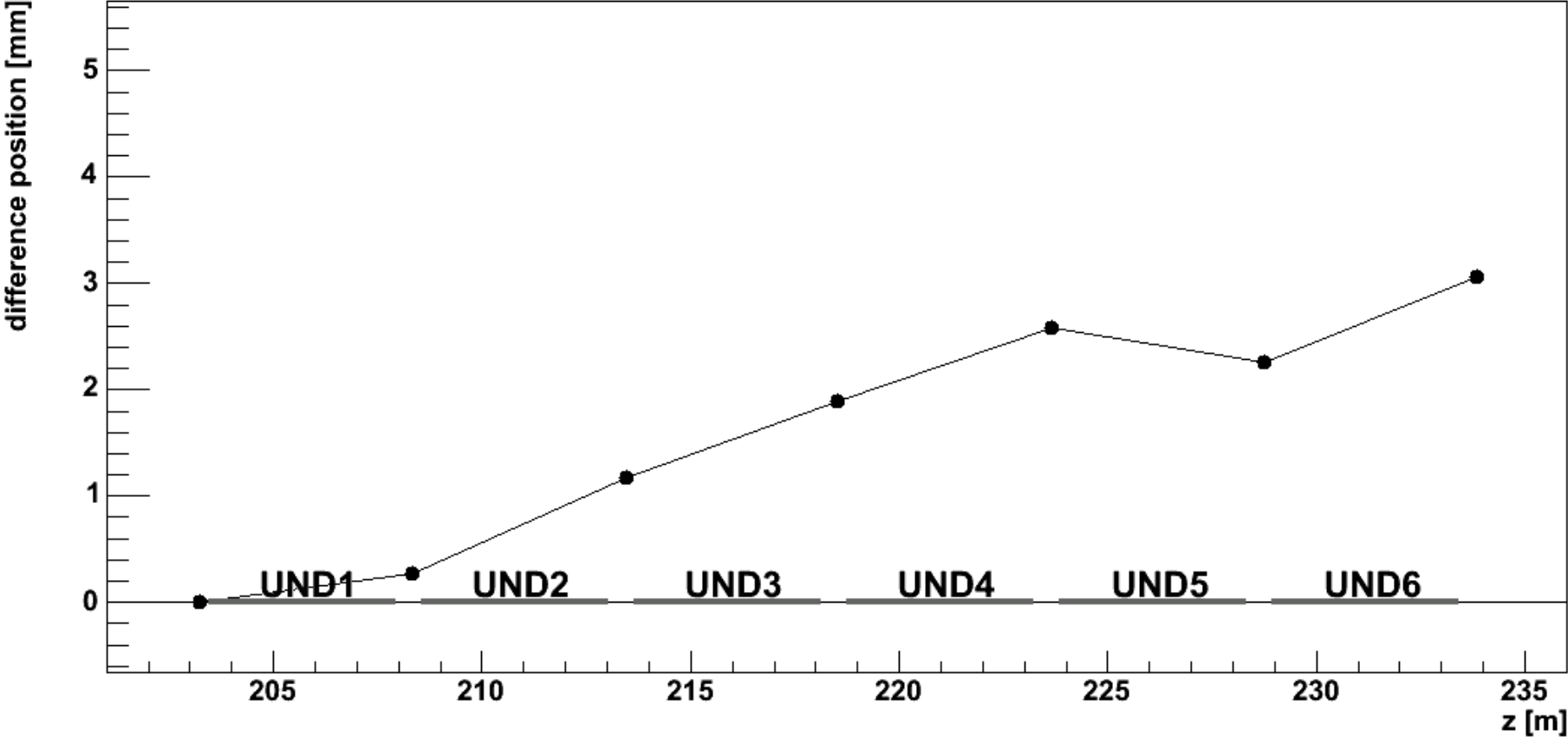
Orbit kick all H3UND1,3,4,5 :

Next measurements (proposal):
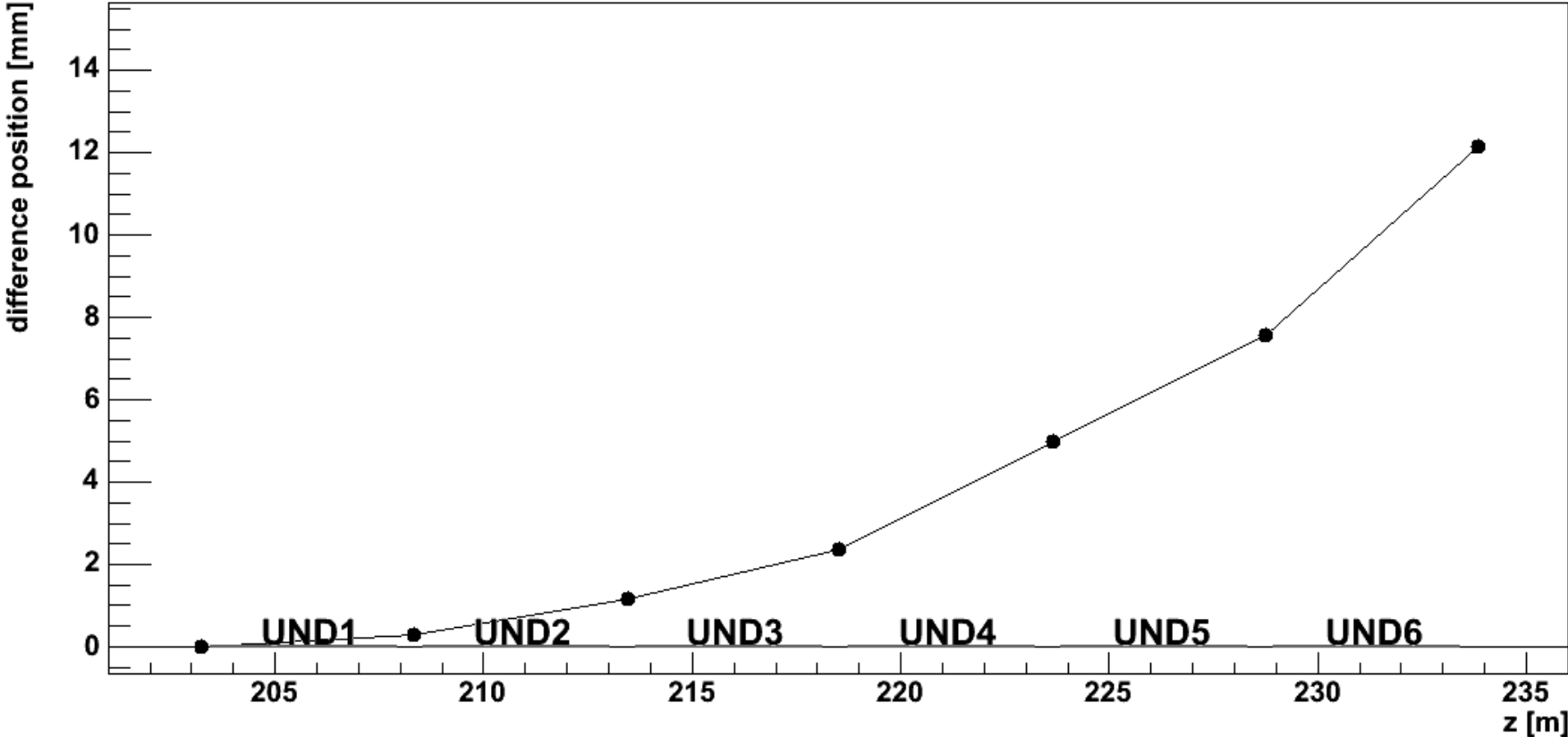
- repeat same measurements + corrections with H3UND2

- repeat for two different energies: 450 MeV and 700 MeV

- (with quads off) measure orbit changes in undulator during PETRA ramp

Proposal for SASE run:

1) try SASE with deGaussed quads and undulator steerers on

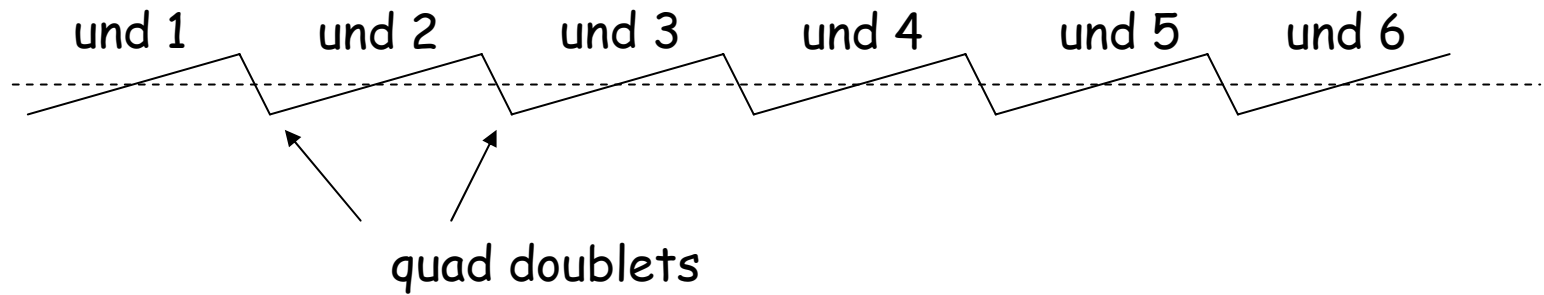2) try SASE with nominal quad strength (after deGaussing)

Option A:

with undulator steerers off

using quads to correct the orbit

Option B:

with undulator steerers on (same strengths as with quads off)

with quads centered at the beam

Assuming that kick is uniformly distributed:

Option A:

und 1   und 2   und 3   und 4   und 5   und 6

quad doublets

Option B:

und 1   und 2   und 3   und 4   und 5   und 6

steerers in undulator