Q’’ knob - optics corrections

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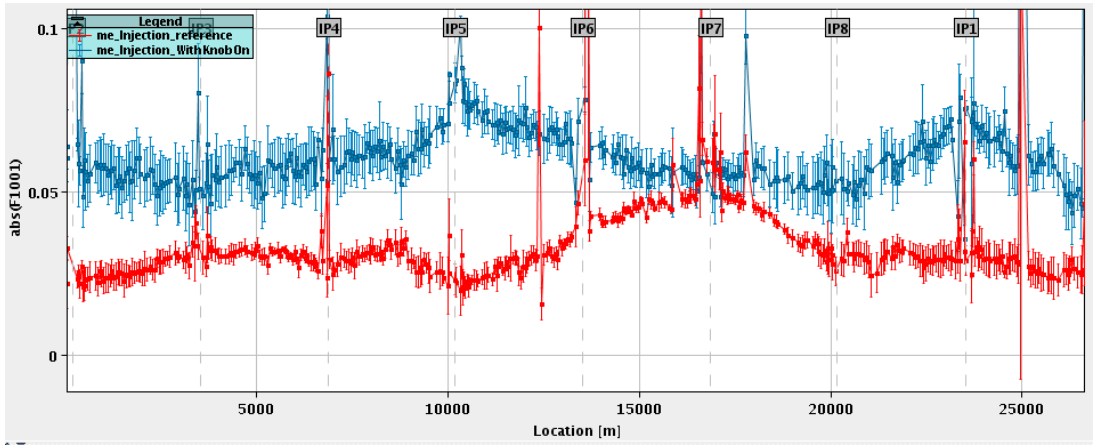
Q’’ knob

- 4 sextupole families ~10 times stronger than nominal
  - ksf2.a12b1 ksf2.a45b1 ksd2.a81b1 ksd1.a56b1
- Optics measurement in June shown optics distortion when similar knob was used ~20% beta-beating and coupling (how much?)
- Due to feed-downs horizontal orbit offset :beta-beating
- vertical orbit offset: coupling
- Same mechanism proposed for the optics correction
- Feed-downs at sextupoles via orbit bumps

Effect on the optics



Optics Correction

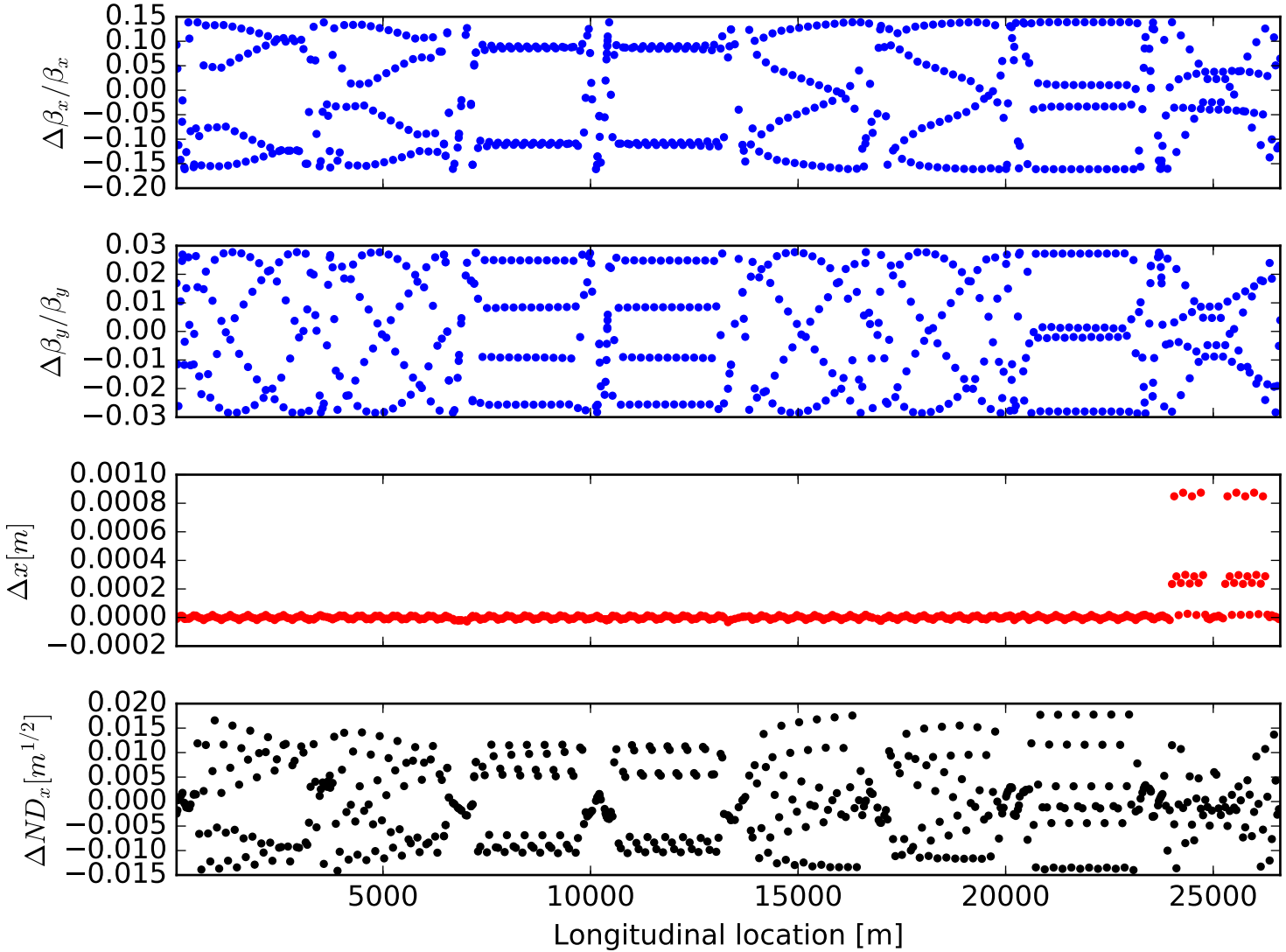
- Response matrix- based correction
- Combined orbit bumps for each sextupole family
- Neglecting the effect of single sextupole (should be well compensated since the phase advance between them is pi)
- Neglecting the other families at nominal power
- 4 horizontal bumps (~10 correctors each) to correct beta-beating
- ~~4 vertical bumps (~10 correctors each) to correct coupling~~
- There are holes in bumps (sextupoles replaced by octupoles)
- Each bump is a combination of several pi-bumps

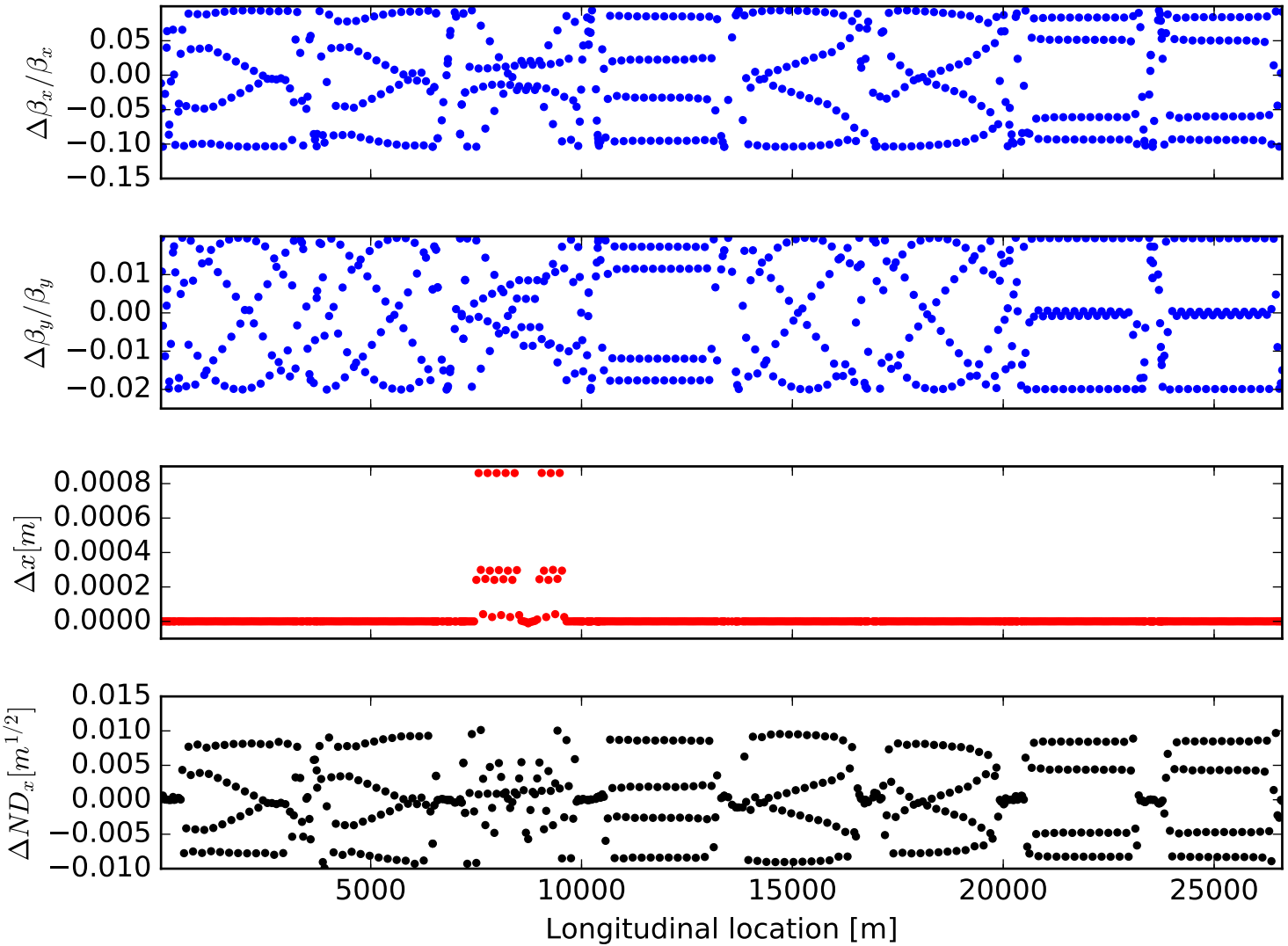
Use instead standard skew quadrupole knobs

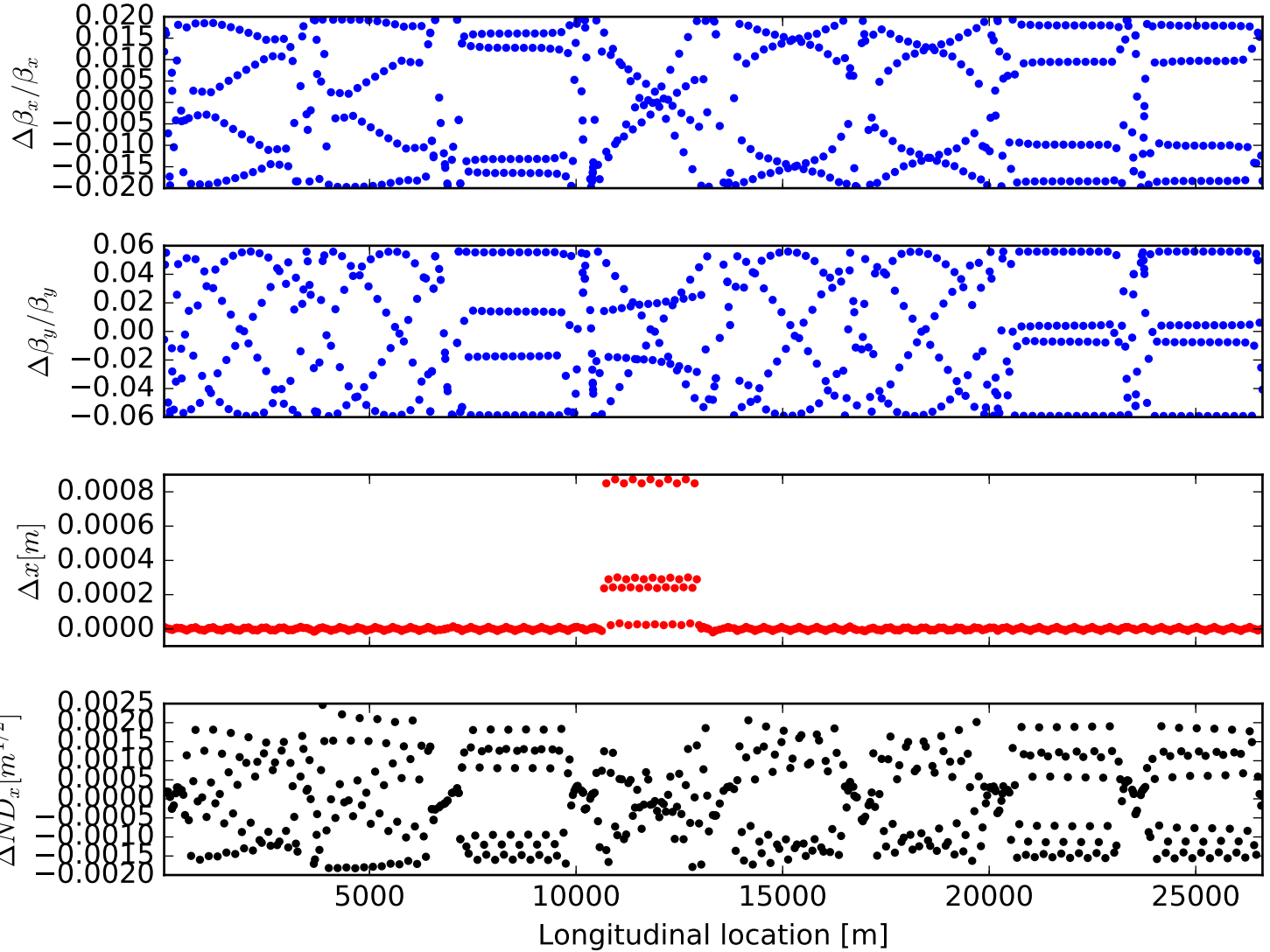
Strength of corrections

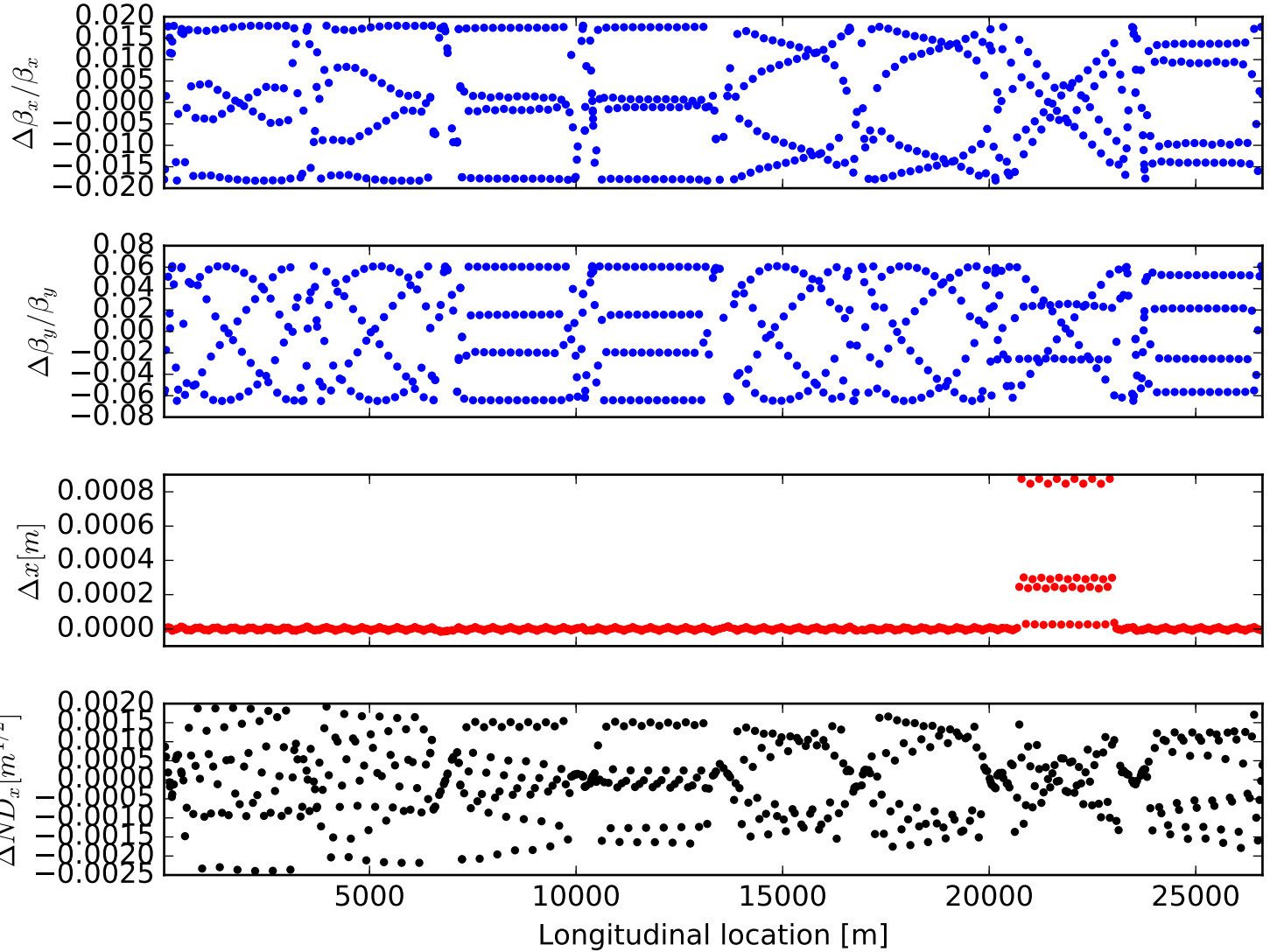
- Sextupoles are of similar length as MQTs and k2 = ~0.6
- Expect slightly larger correction K1L ~ 1e-4
- Average orbit change ~0.5 mm, i. e. kicks of ~10 urad

In the following 4 plots: Model calculations with bumps of 5 urad at locations of the sextupoles, in arcs 12, 45, 56, 81


$\Delta\beta_x/\beta_x$
0.15
0.10
0.05
0.00
−0.05
−0.10
−0.15
−0.20
$\Delta\beta_y/\beta_y$
0.03
0.02
0.01
0.00
−0.01
−0.02
−0.03
$\Delta x[m]$
0.0010
0.0008
0.0006
0.0004
0.0002
0.0000
−0.0002
$\Delta ND_x[m^{1/2}]$
0.020
0.015
0.010
0.005
0.000
−0.005
−0.010
−0.015
5000
10000
15000
20000
25000
Longitudinal location [m]


$\Delta\beta_x/\beta_x$
0.05
0.00
−0.05
−0.10
−0.15
$\Delta\beta_y/\beta_y$
0.01
0.00
−0.01
−0.02
$\Delta x[m]$
0.0008
0.0006
0.0004
0.0002
0.0000
$\Delta ND_x[m^{1/2}]$
0.015
0.010
0.005
0.000
−0.005
−0.010
5000
10000
15000
20000
25000
Longitudinal location [m]


$\Delta\beta_x/\beta_x$
0.020
0.015
0.010
0.005
0.000
−0.005
−0.010
−0.015
−0.020
$\Delta\beta_y/\beta_y$
0.06
0.04
0.02
0.00
−0.02
−0.04
−0.06
$\Delta x[m]$
0.0008
0.0006
0.0004
0.0002
0.0000
$\Delta ND_x[m^{1/2}]$
0.0025
0.0020
0.0015
0.0010
0.0005
0.0000
−0.0005
−0.0010
−0.0015
−0.0020
5000
10000
15000
20000
25000
Longitudinal location [m]


$\Delta\beta_x/\beta_x$
0.020
0.015
0.010
0.005
0.000
−0.005
−0.010
−0.015
−0.020
$\Delta\beta_y/\beta_y$
0.08
0.06
0.04
0.02
0.00
−0.02
−0.04
−0.06
−0.08
$\Delta x[m]$
0.0008
0.0006
0.0004
0.0002
0.0000
$\Delta ND_x[m^{1/2}]$
0.0020
0.0015
0.0010
0.0005
0.0000
−0.0005
−0.0010
−0.0015
−0.0020
−0.0025
5000
10000
15000
20000
25000
Longitudinal location [m]