



Summary of LHC Injection test S78

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Thanks to: M. Giovannozzi, S. Fartoukh, F. Schmidt, W. Herr

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Conclusions



Data 24 Aug 2008, for LHC sector 78

	Rama Calaga	Yipeng Sun & Frank Zimmermann
Sequence	Beam2+ '-' bv + reflect	Beam4 + flipped x YASP measured data
Questionable BPM	BPM.12R7.B2 (x-y inv); BPM.34R7.B2;	BPM.12R7.B2 (x-y inv); BPM.28R7.B2 (y); BPM.34R7.B2 (x); BPMSX.4L8.B2
Questionable correctors	BXV3;	BCH6(off-m); BXV3; BYH4(off-m)
Questionable magnets	QT11; QS; MSS; OD; QT13; SF[1] (amp)	OD; QT13; QS; MCS; MSS
Polarity OK	BCH6; BCV5; BYH4; BCH6 OF; MCS; QT12; SD[1,2]	BCH6(on-m); BCV5 OF; QT11; QT12; SD[1,2]; SF(?)
Polarity OK? (swap or?)	SD[1] <-> SD[2]	SD[2] -> SD[1,2] SF[1] -> SF[1,2]

Two examples for polarity check

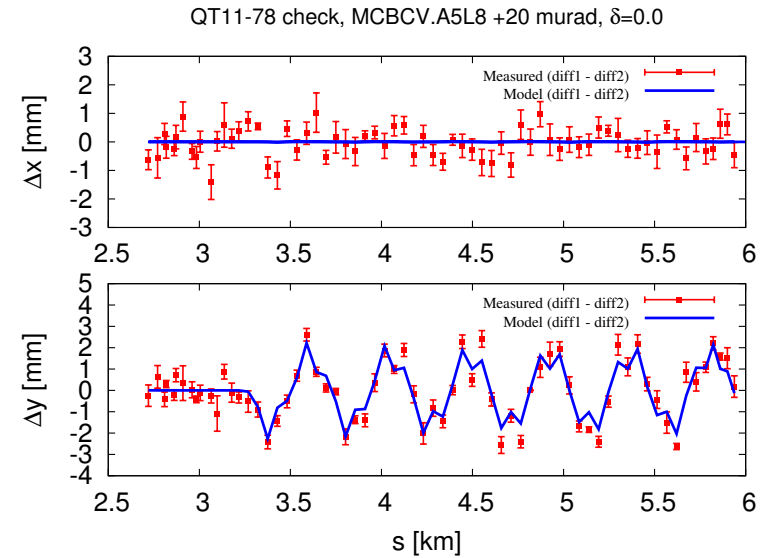
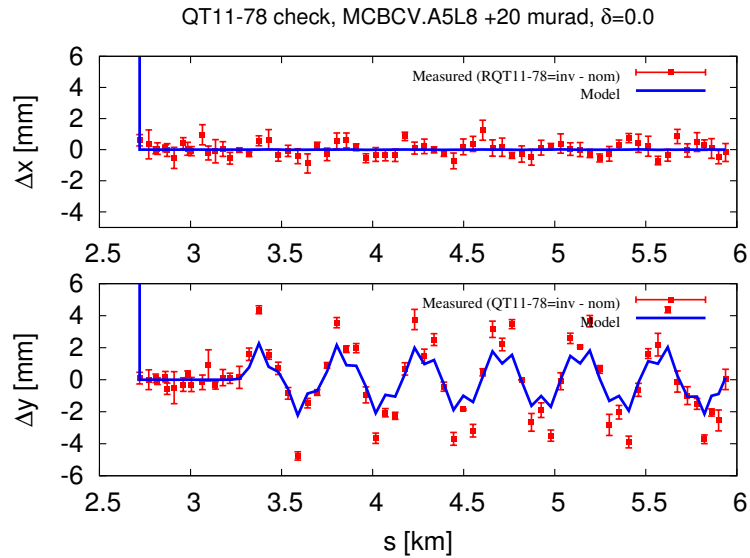
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FP6 "Structuring the European Research Area" programme (CARE, contract number
RII3-CT-2003-506395).

MQTL1.11L8.B2 (on-m)

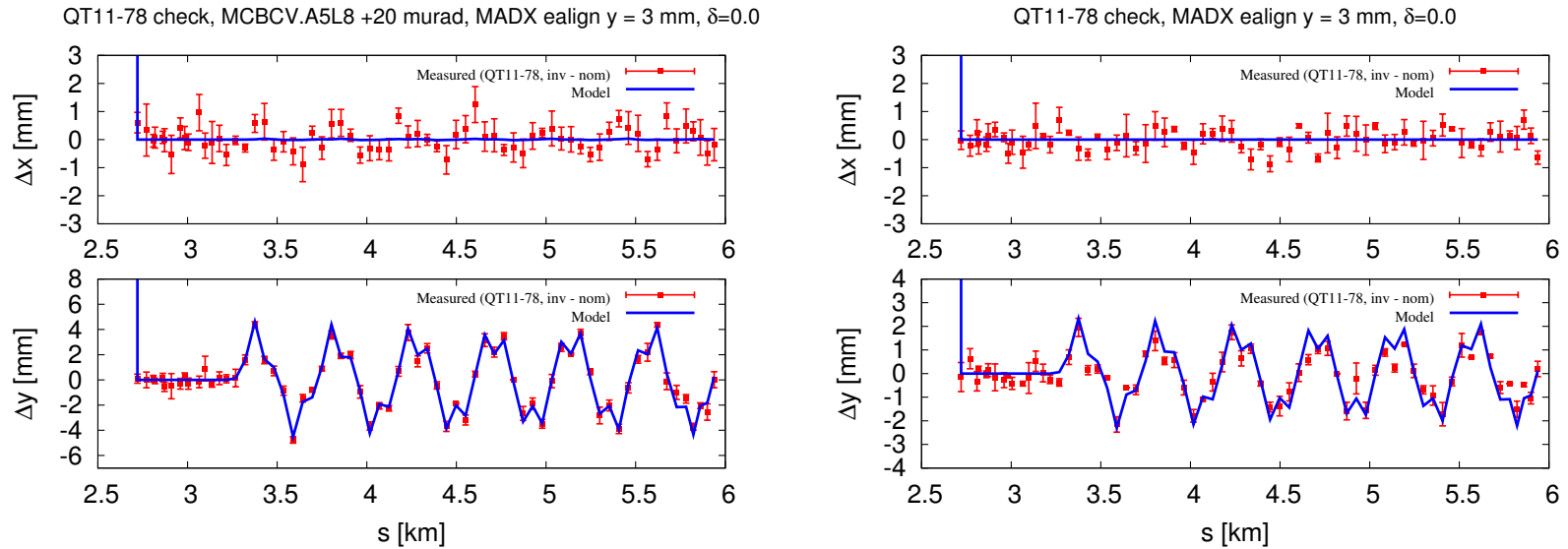


- Diff1(2): with(out) corrector, inv - nom (Left fig is diff1)

- $\theta = 2(k_{QT11} \cdot L)\Delta y \rightarrow$ Estimated Y offset: 4.7 mm

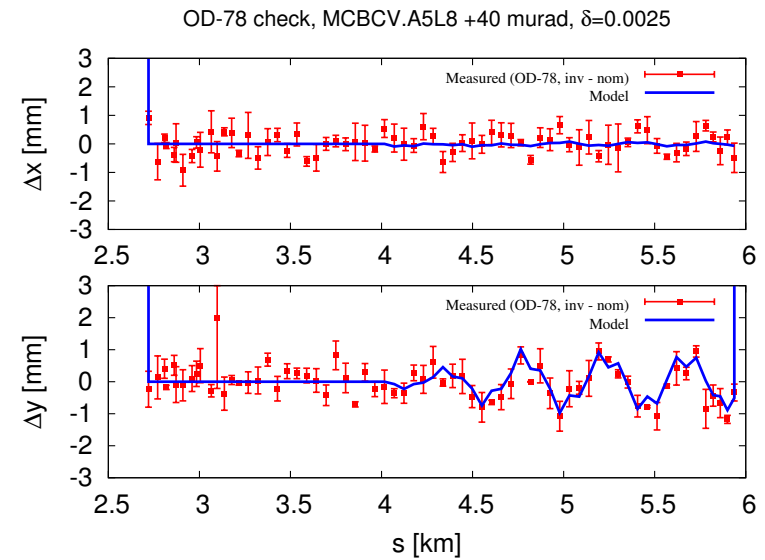
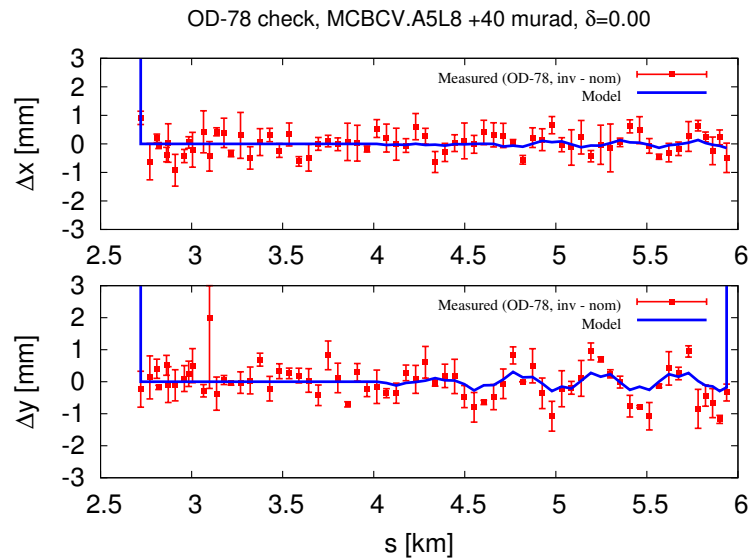
- nearby BPM.11L8.B2: -0.18 mm, BPM.10L8.B2: -1.13 mm, BPM.9L8.B2: -4 mm

MQTLI.11L8.B2 (cont'd)



- Left: with corrector, inv - nom; Right: without corrector, inv - nom
- In MADX, set MQTLI.11L8.B2 misaligned error y = 3 mm

OD.A78.B2 (off-m)



- No obvious effect in MADX model (Left fig)
- At Lhcinj.ti8, introduce: $dy = -0.179$ m (from measured [BPMYB.4R8.TI8](#)) (Right fig)

Polarity check S78 (24 Aug 2008)

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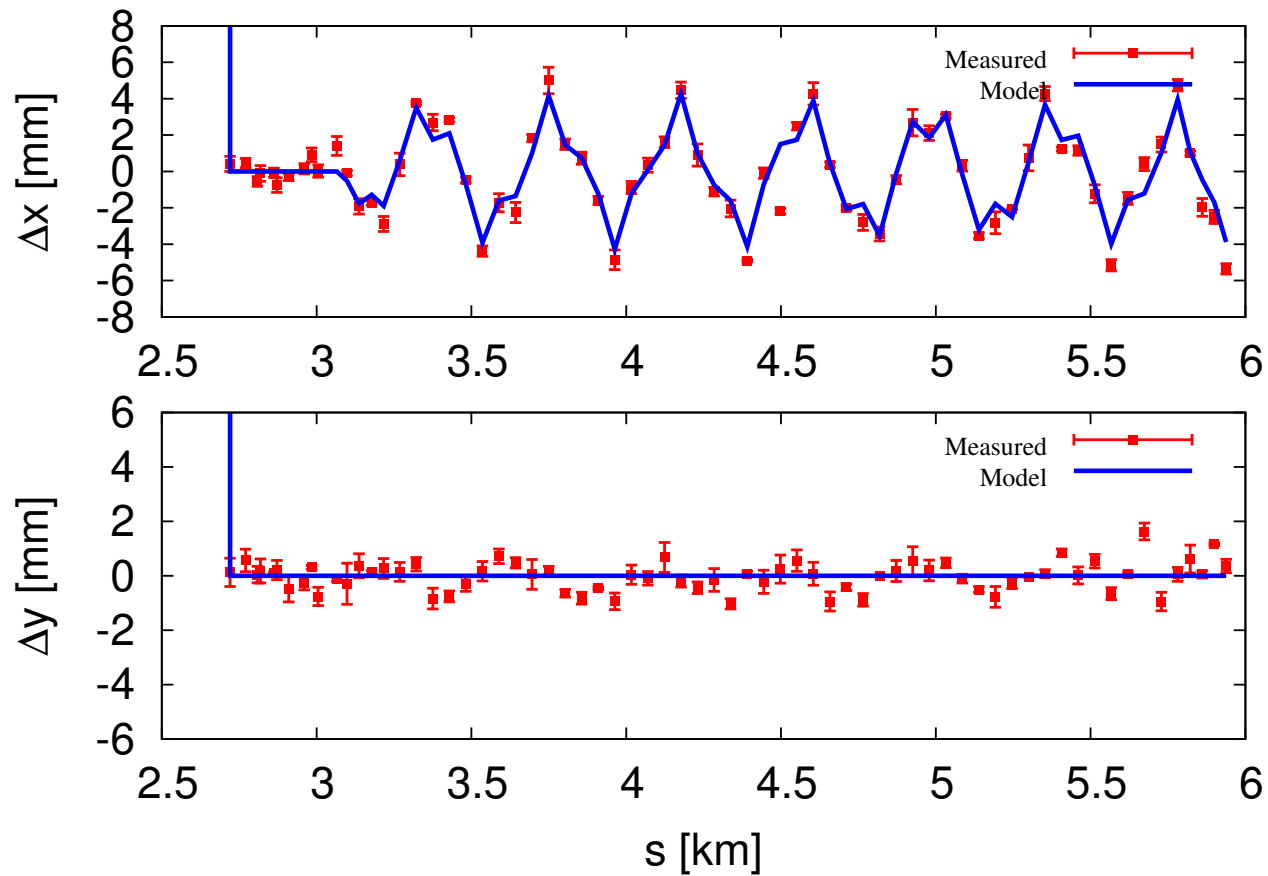
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Contents

- Polarity check of correctors
- Polarity check of magnets
- MADX model:
/afs/cern.ch/eng/lhc/optics/V6.503/beam_four.seq
- On-momentum (on-m) and off-momentum data (off-m)
- Summary

BCH6 (on-m)

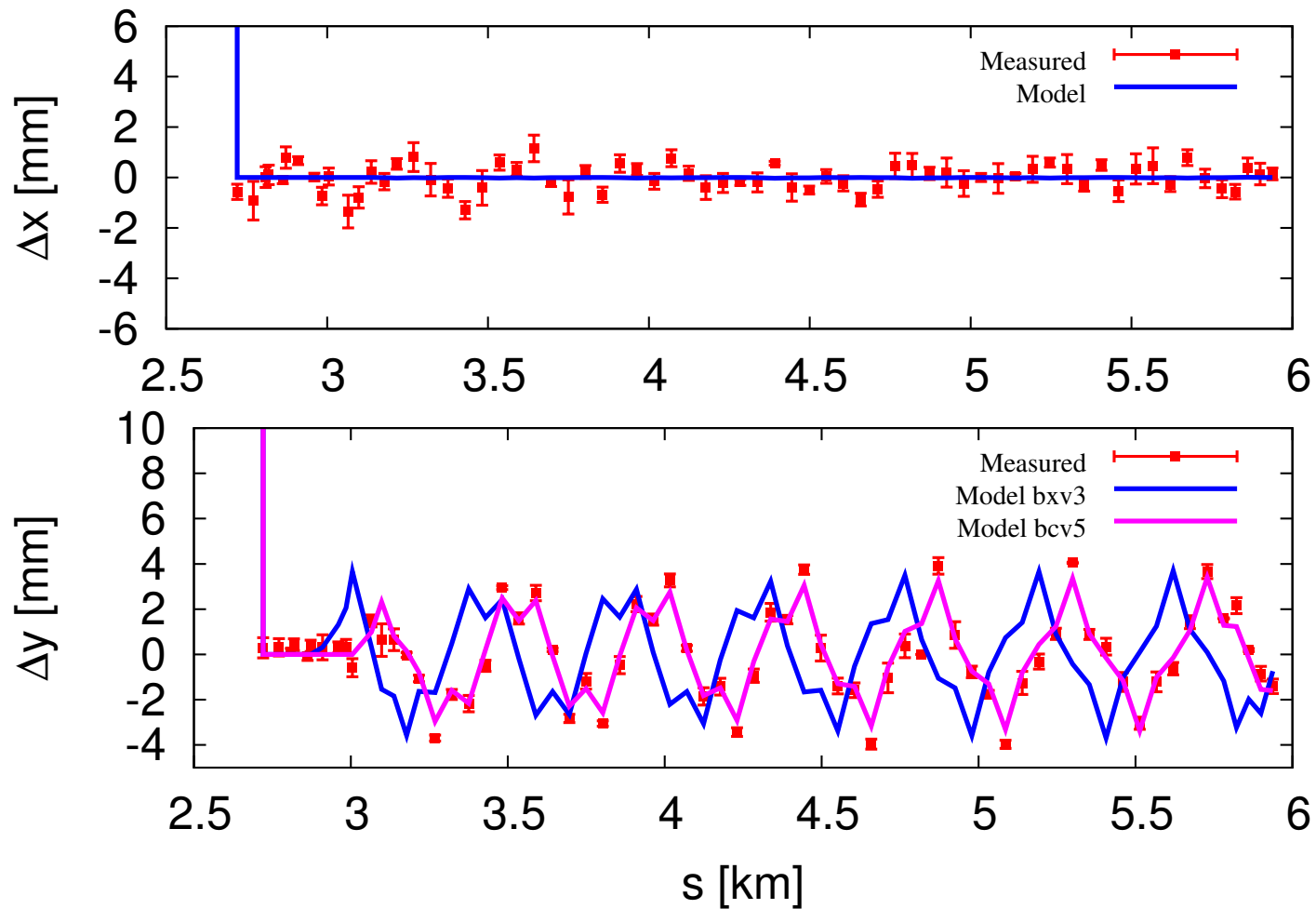
Check MCBCH.6L8 +20 murad, $\delta=0.0$



MCBCH.6L8.B2, KICK := -20 murad

BXV3 (on-m)

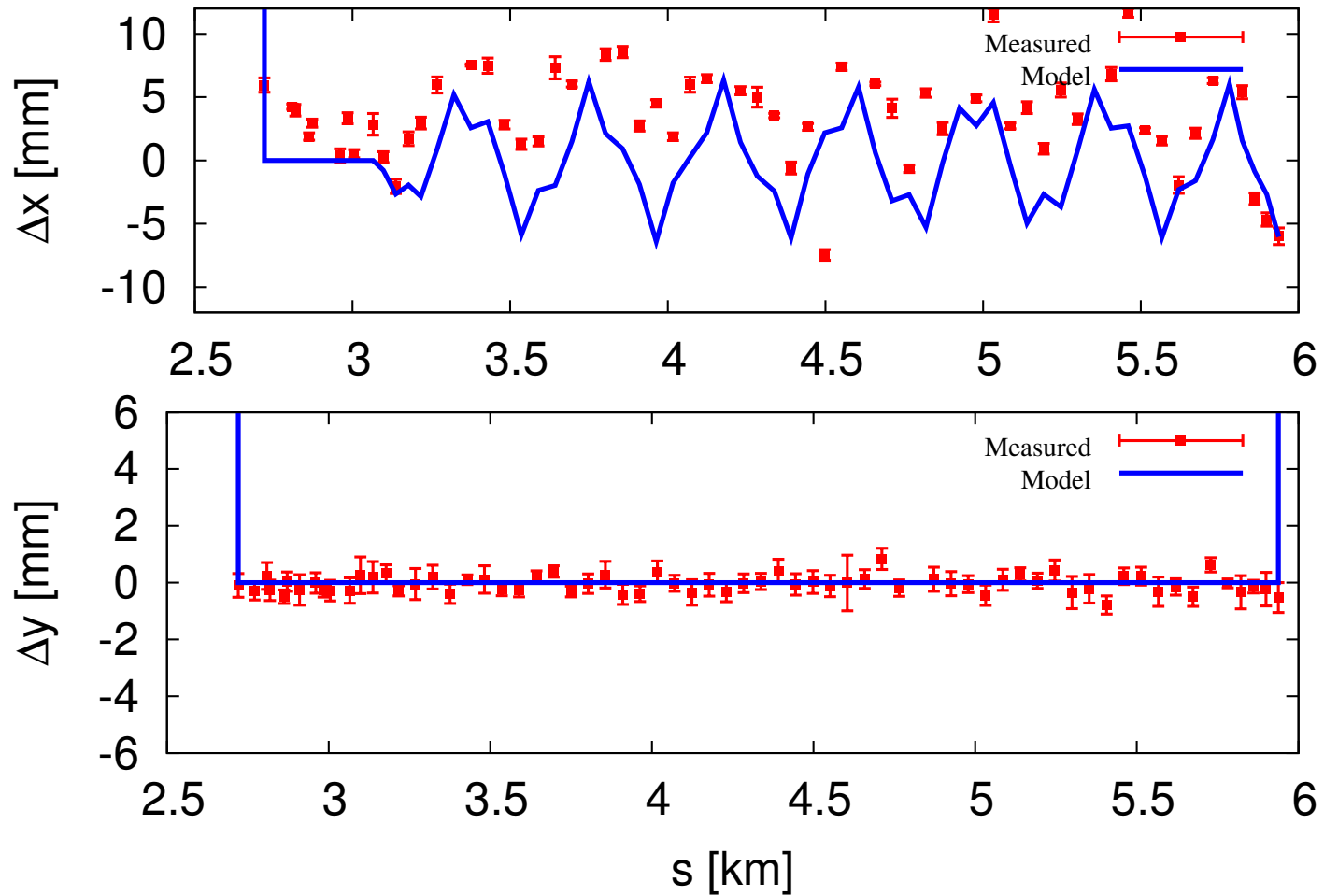
Check MCBXV.3L8 +20 murad, $\delta=0.0$



MCBX_v.3L8, VKICK := 20 murad (also BCV5)

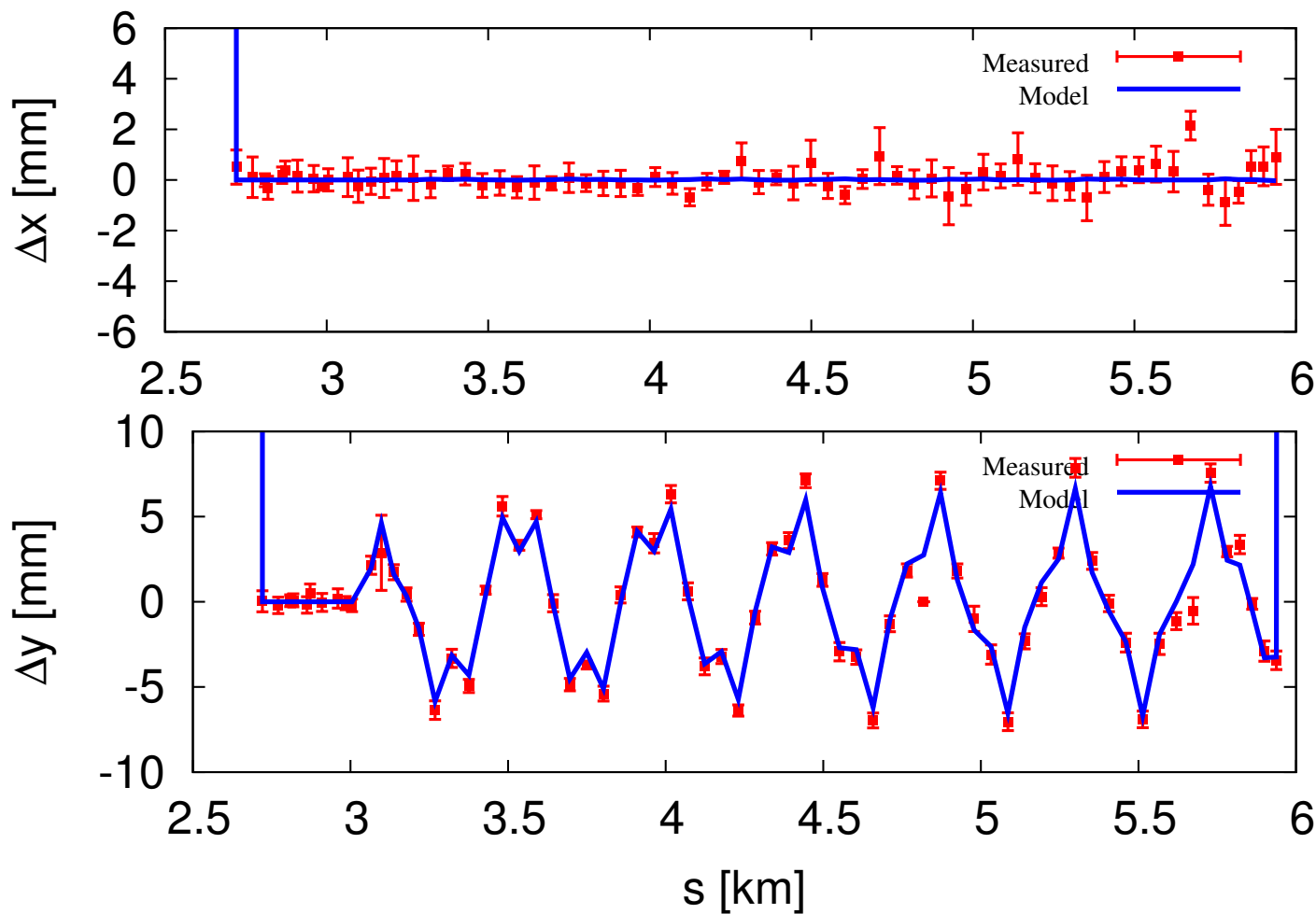
BCH6 (off-m)

Check MCBCH.6L8 +30 murad, $\delta=0.0025$



BCV5 (off-m)

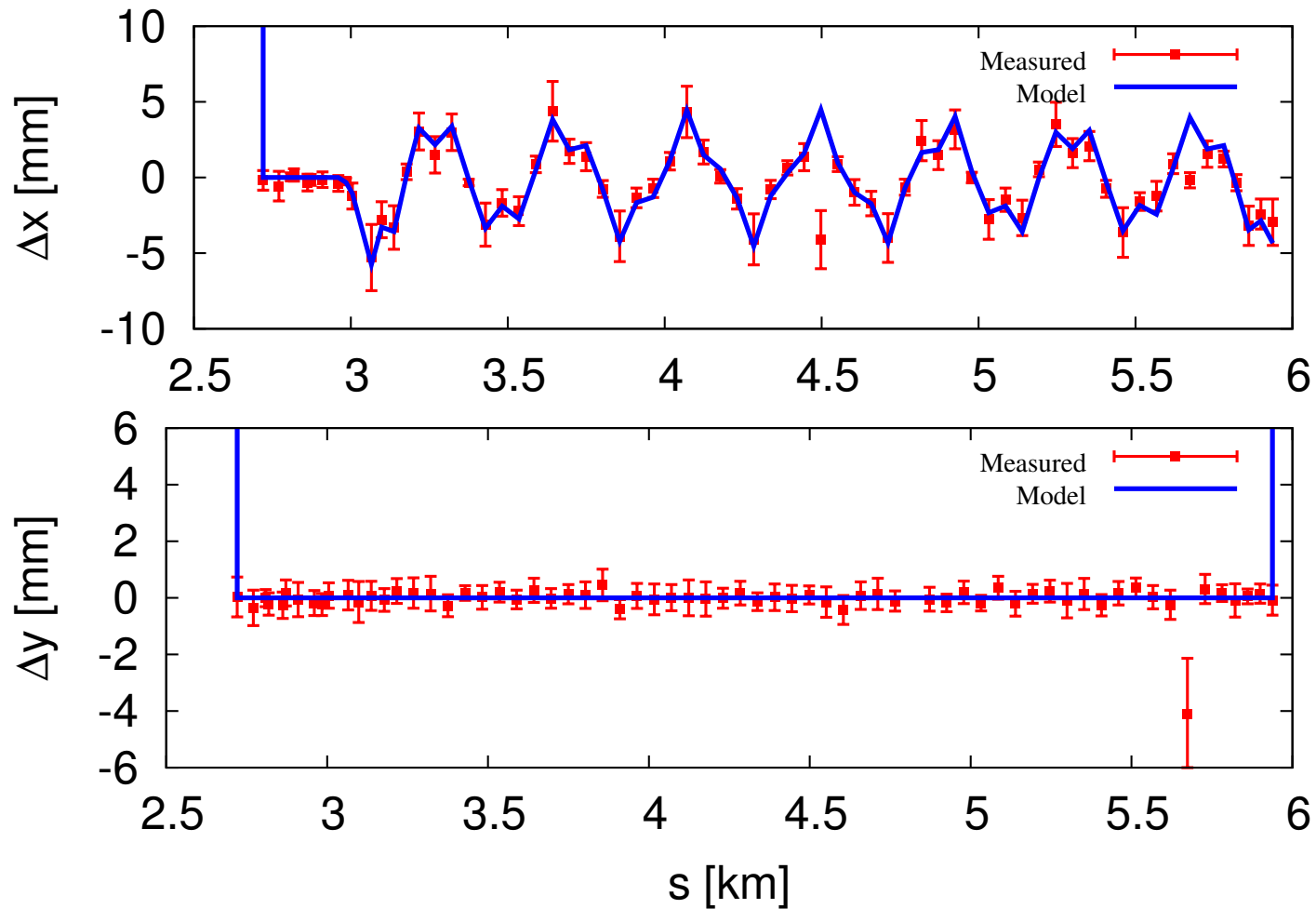
Check MCBCV.5L8 +40 murad, $\delta=0.0025$



MCBCV.B5L8.B2, KICK := 40 murad

BYH4 (off-m)

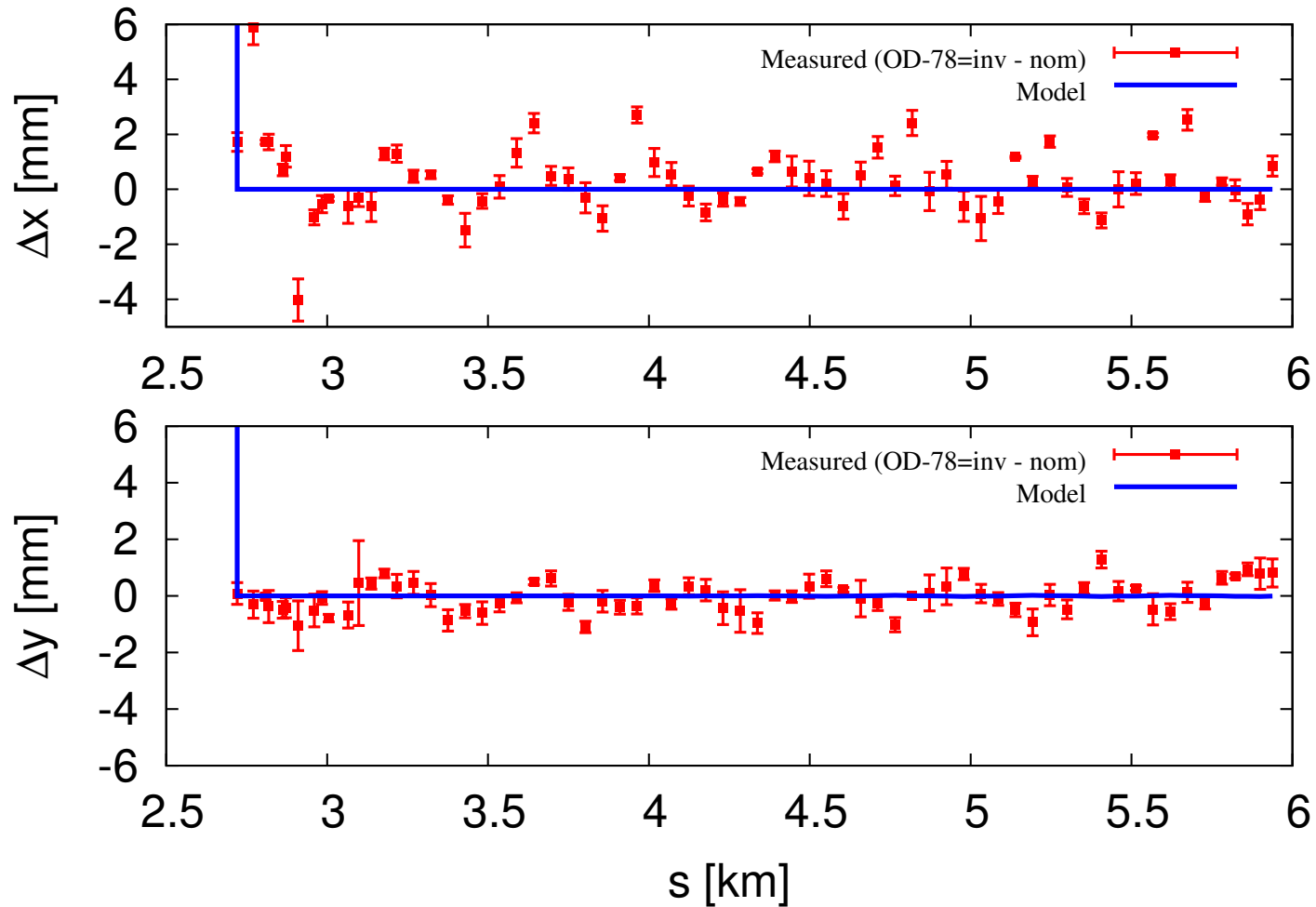
Check MCBYH.4L8 +40 murad, $\delta=0.0025$



MCBYH.B4L8.B2, KICK := -40 murad

Magnets: OD (on-m)

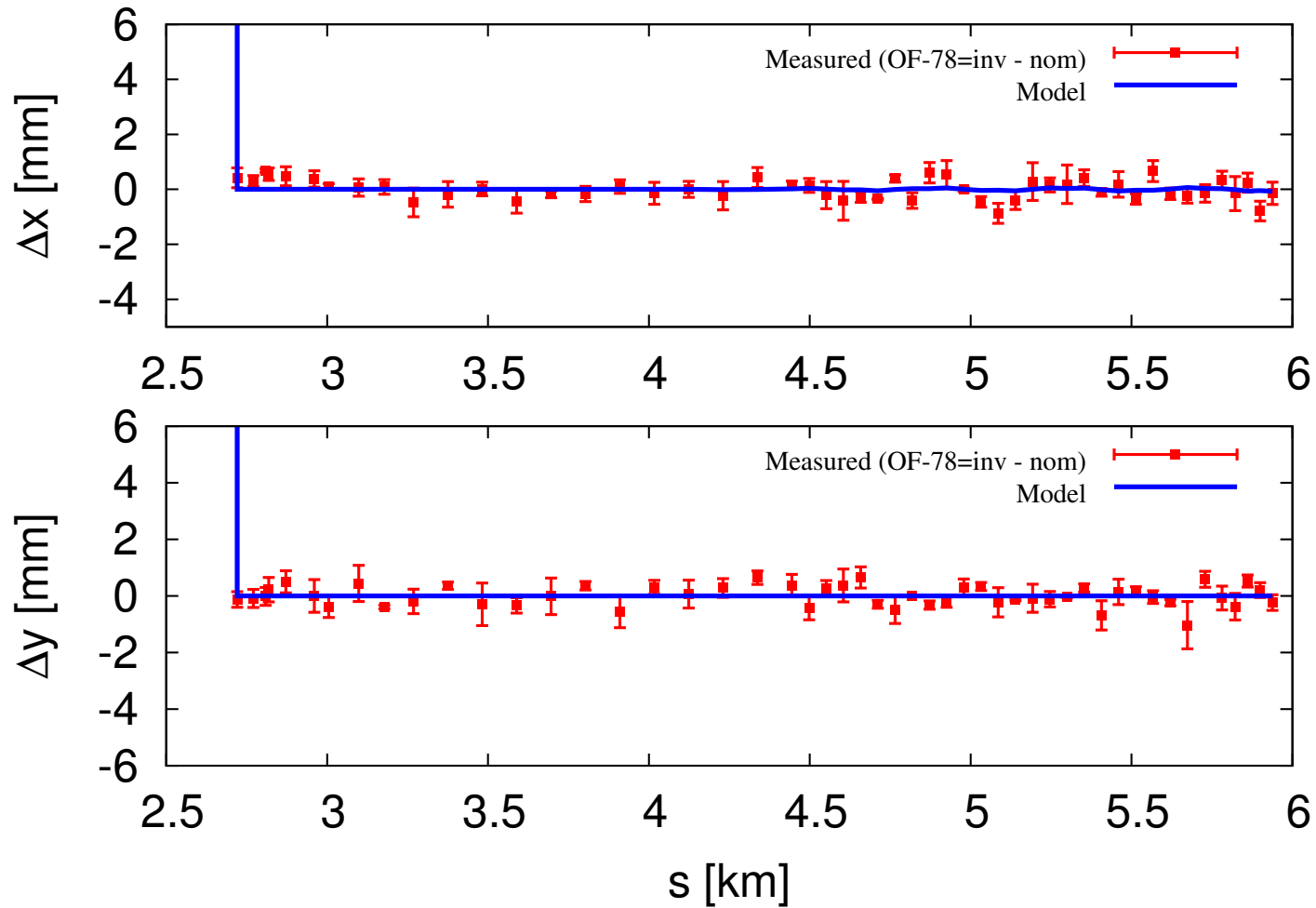
OD-78 check, MCBCV.A5L8 +20 murad, $\delta=0.0$



MO.29L8.B2, K3 := +kod.a78b2 (seq)

OF (on-m)

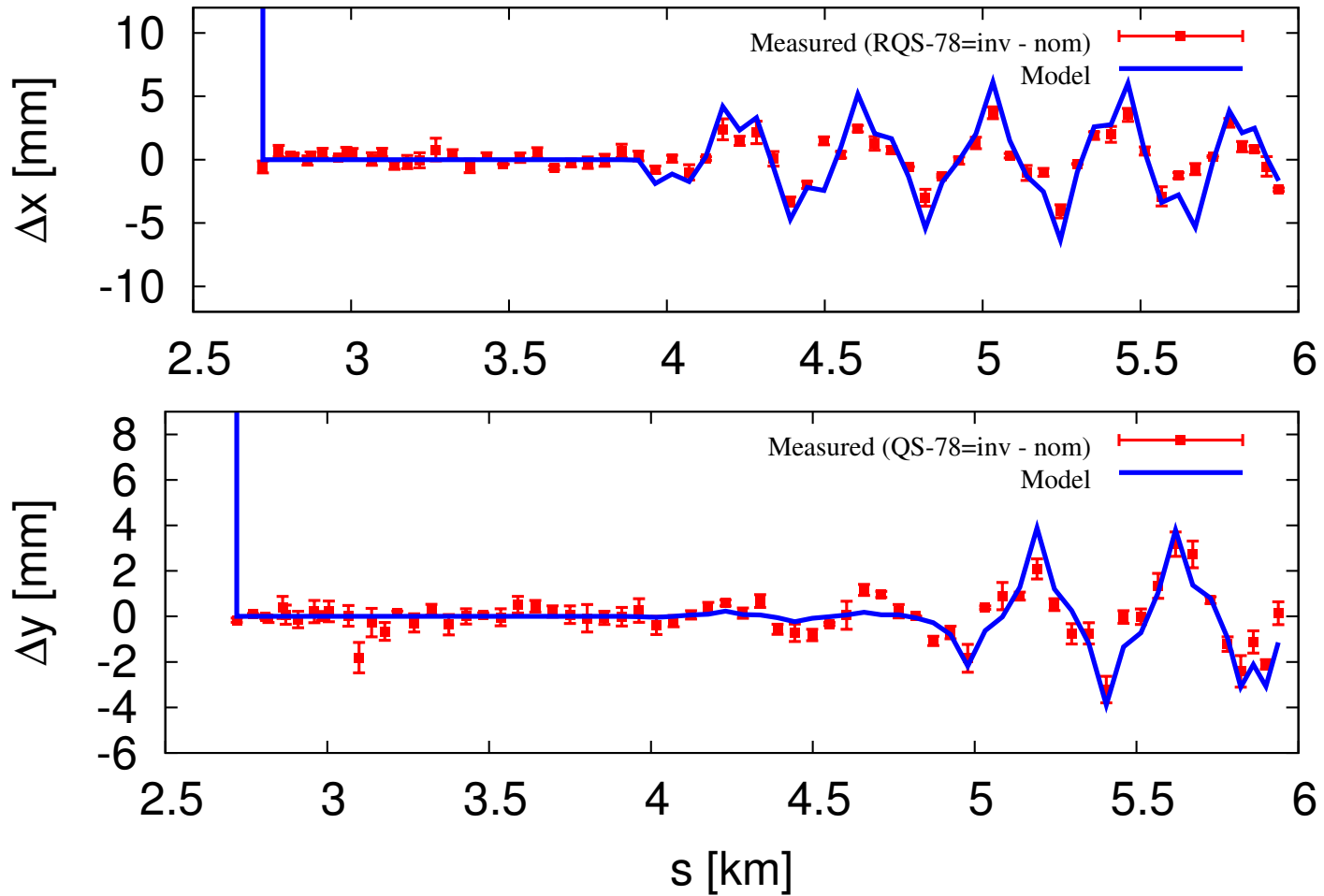
OF-78 check, MCBCH.6L8 +20 murad, $\delta=0.0$



MO.30L8.B2, K3 := +kof.a78b2 (seq)

QS (on-m)

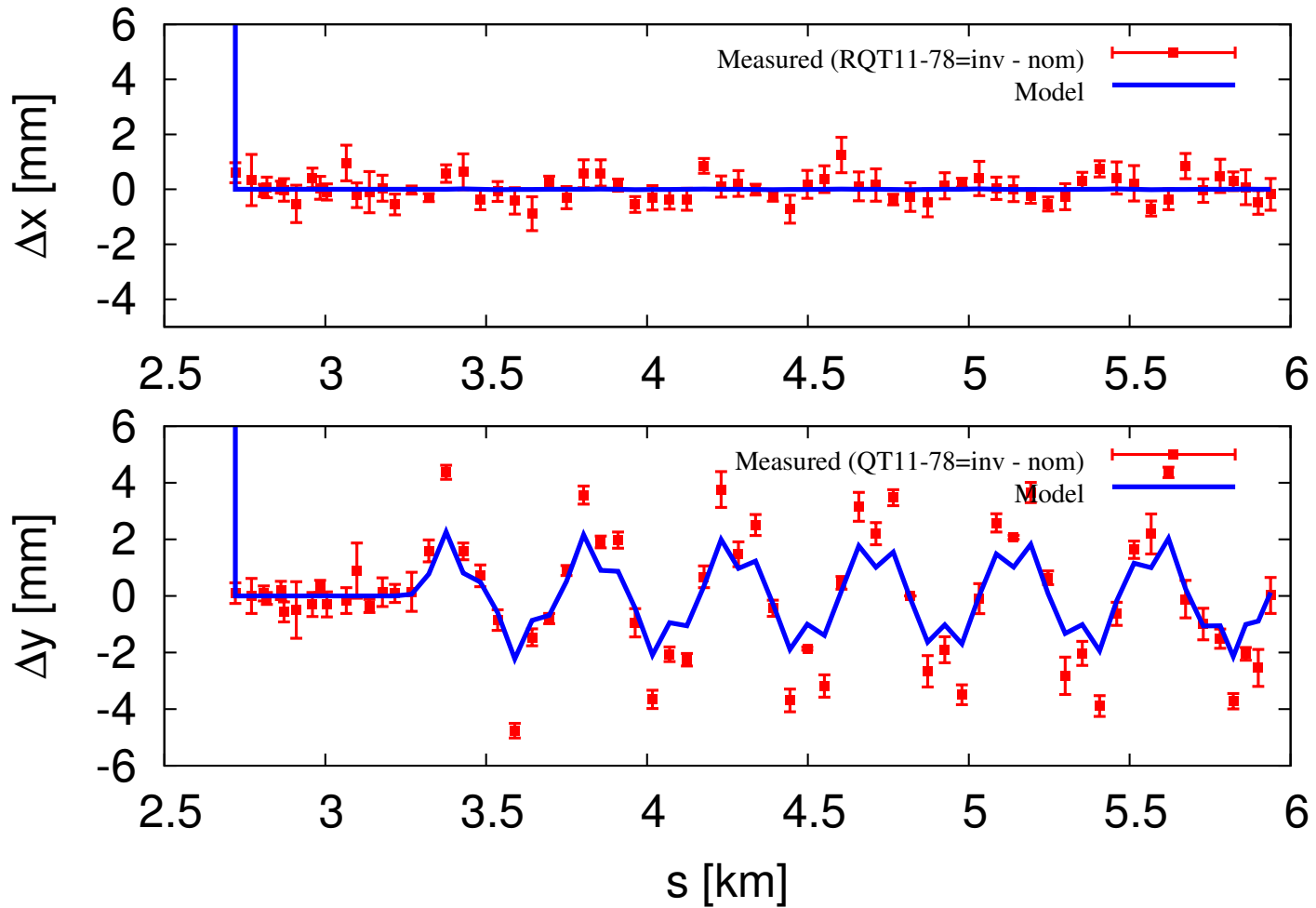
QS-78 check, MCBXV.3L8 +40 murad, $\delta=0.0$



MQS.23L8.B2, K1S := -kqs.a78b2 (seq)

QT11 (on-m)

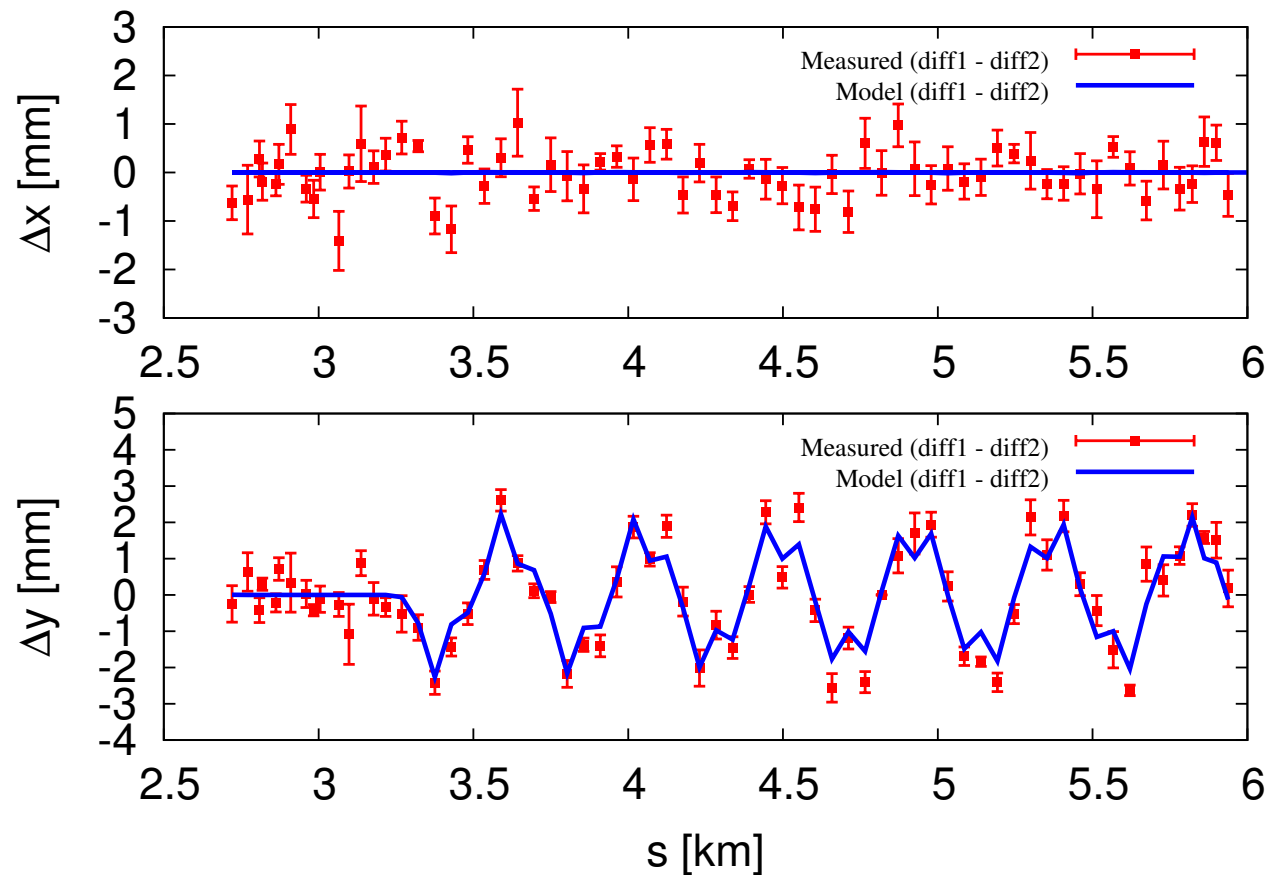
QT11-78 check, MCBCV.A5L8 +20 murad, $\delta=0.0$



MQTLI.11L8.B2, K1 := kqtl11.18b2 (seq)

QT11 (on-m) cont'd

QT11-78 check, MCBCV.A5L8 +20 murad, $\delta=0.0$

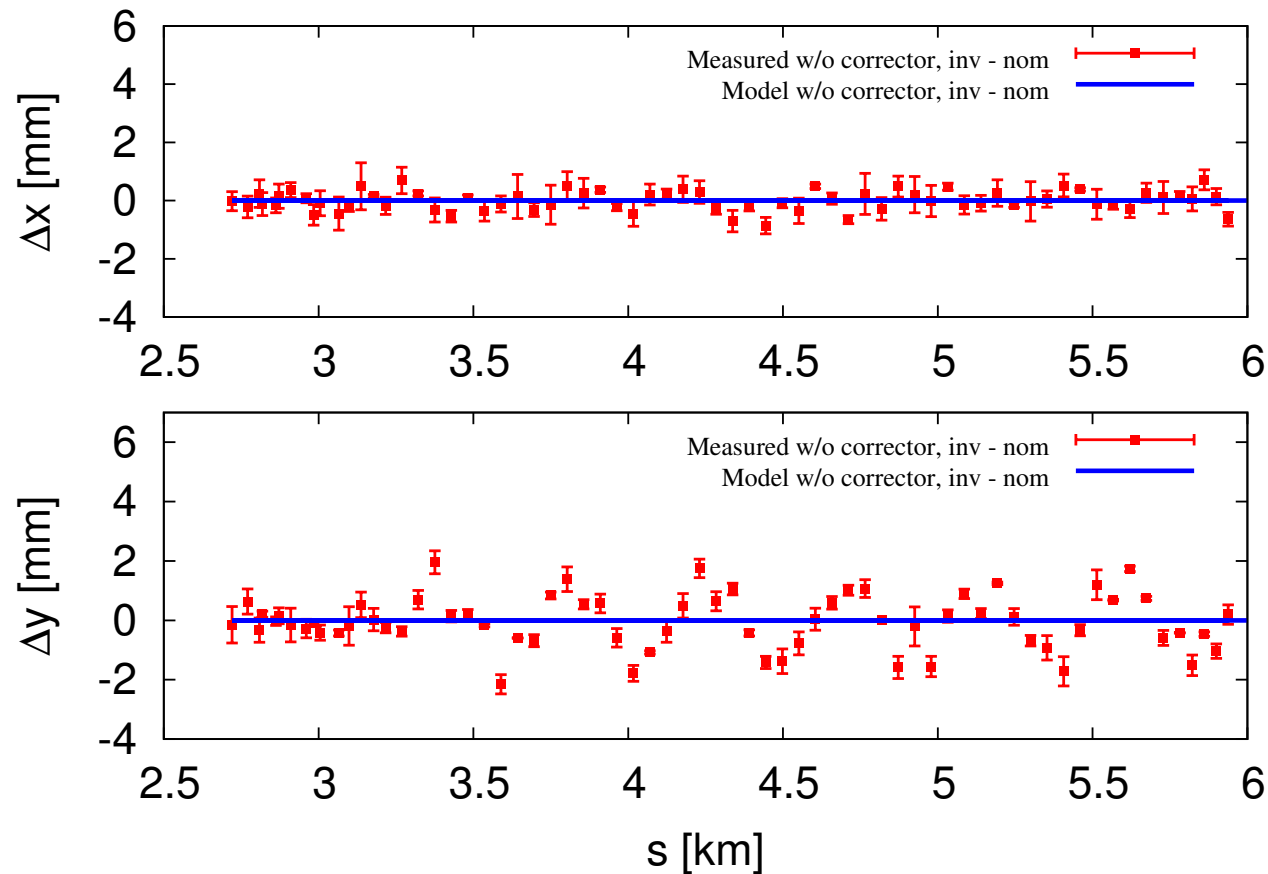


Diff1: with corrector (oscillation), inverted - nominal

Diff2: without corrector (oscillation), inv - nom

QT11 (on-m) offset

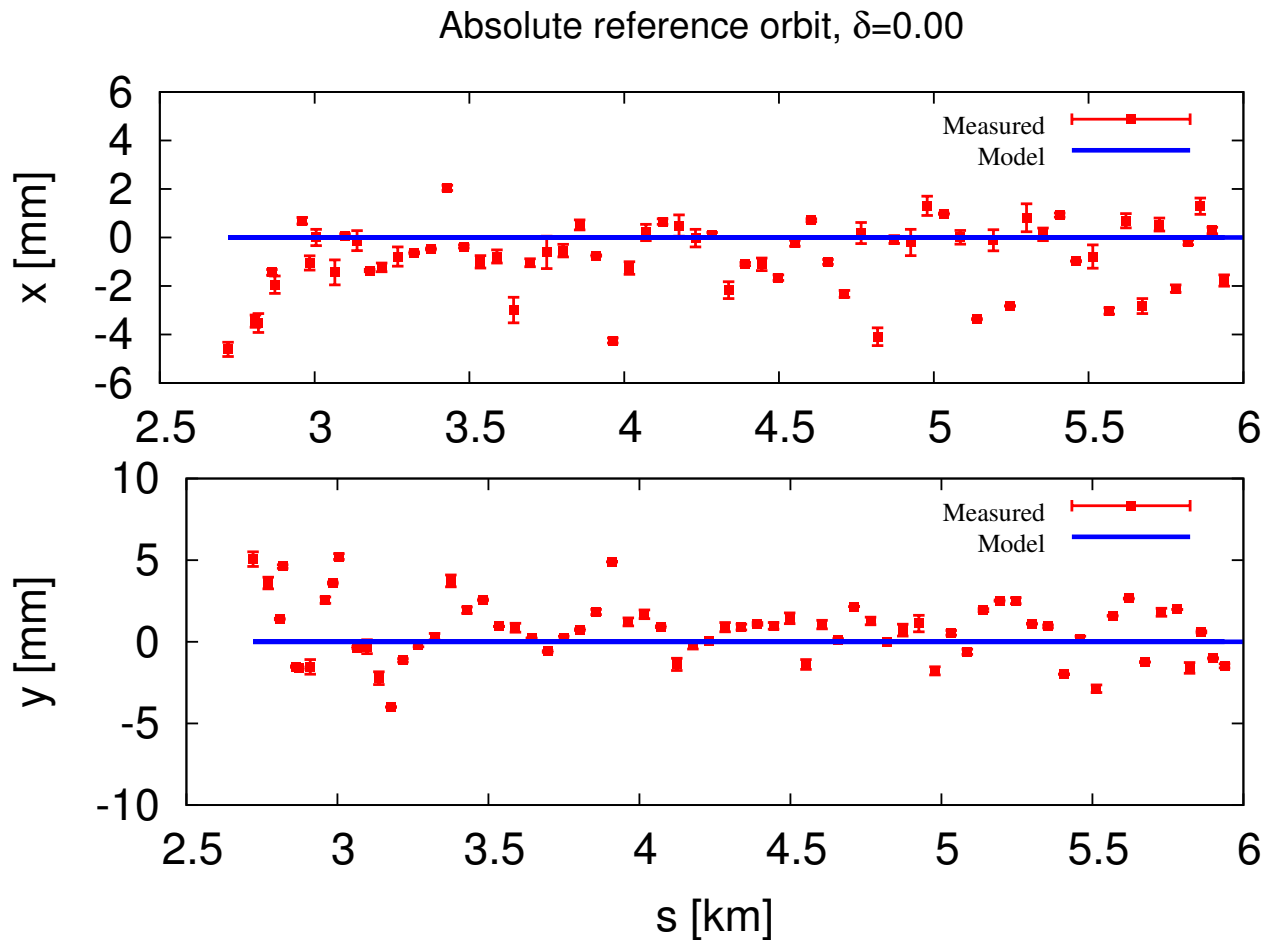
QT11-78 check, MCBCV.A5L8 +20 murad, $\delta=0.0$



$$\theta = 2(k_{QT11} \cdot L)\Delta y$$

Estimated Y offset: 6.2 mm

QT11 (on-m) absolute orbit

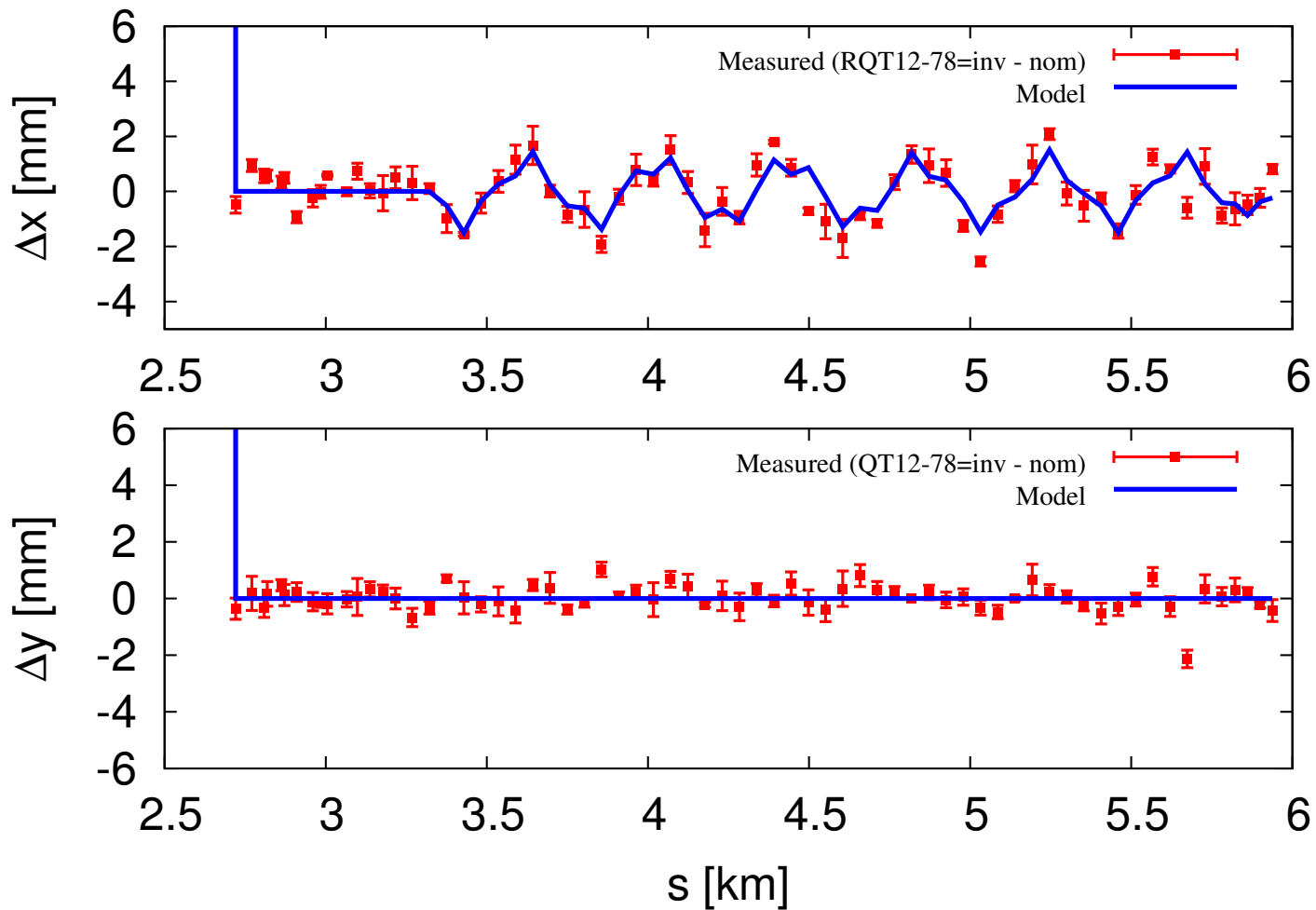


MQTLI.11L8.B2, nearby BPM.11L8.B2: -0.18 mm

BPM.10L8.B2: -1.13 mm; BPM.9L8.B2: -4 mm

QT12 (on-m)

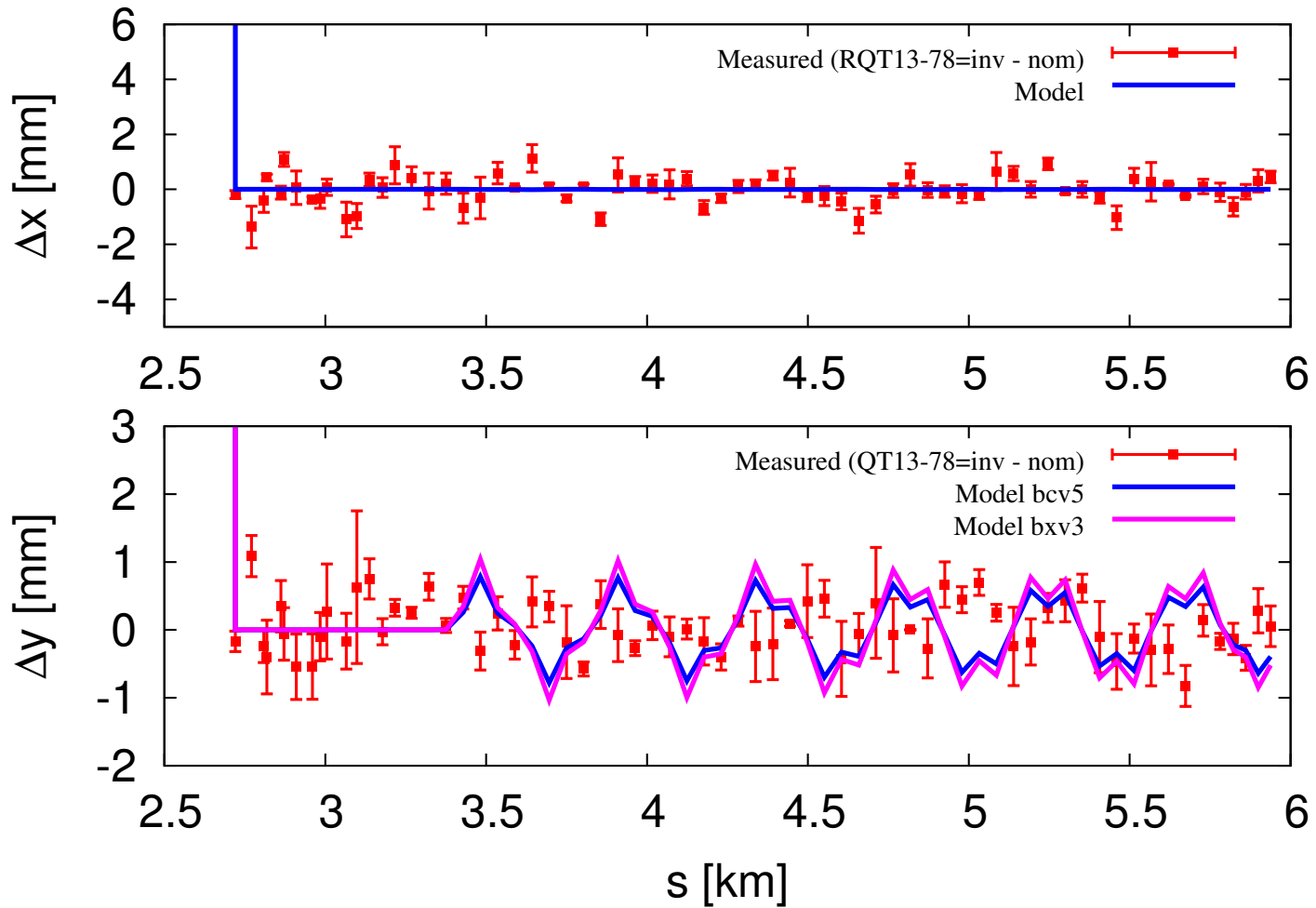
QT12-78 check, MCBCH.6L8 +20 murad, $\delta=0.0$



MQT.12L8.B2, K1 := kqt12.18b2 (seq)

QT13 (on-m)

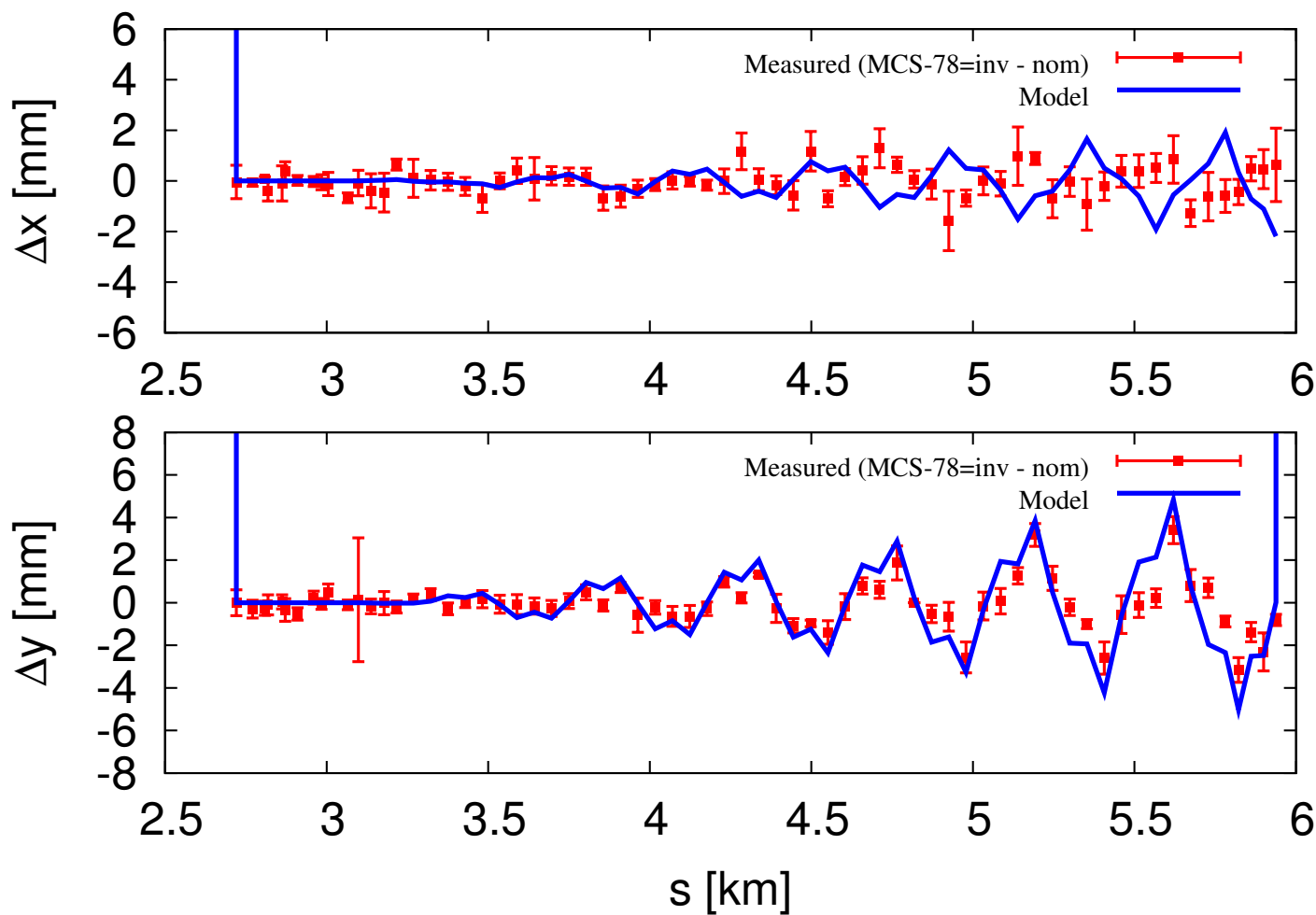
QT13-78 check, MCBXV.3L8 +20 murad, $\delta=0.0$



MQT.13L8.B2, K1 := kqt13.18b2 (seq)

MCS (off-m)

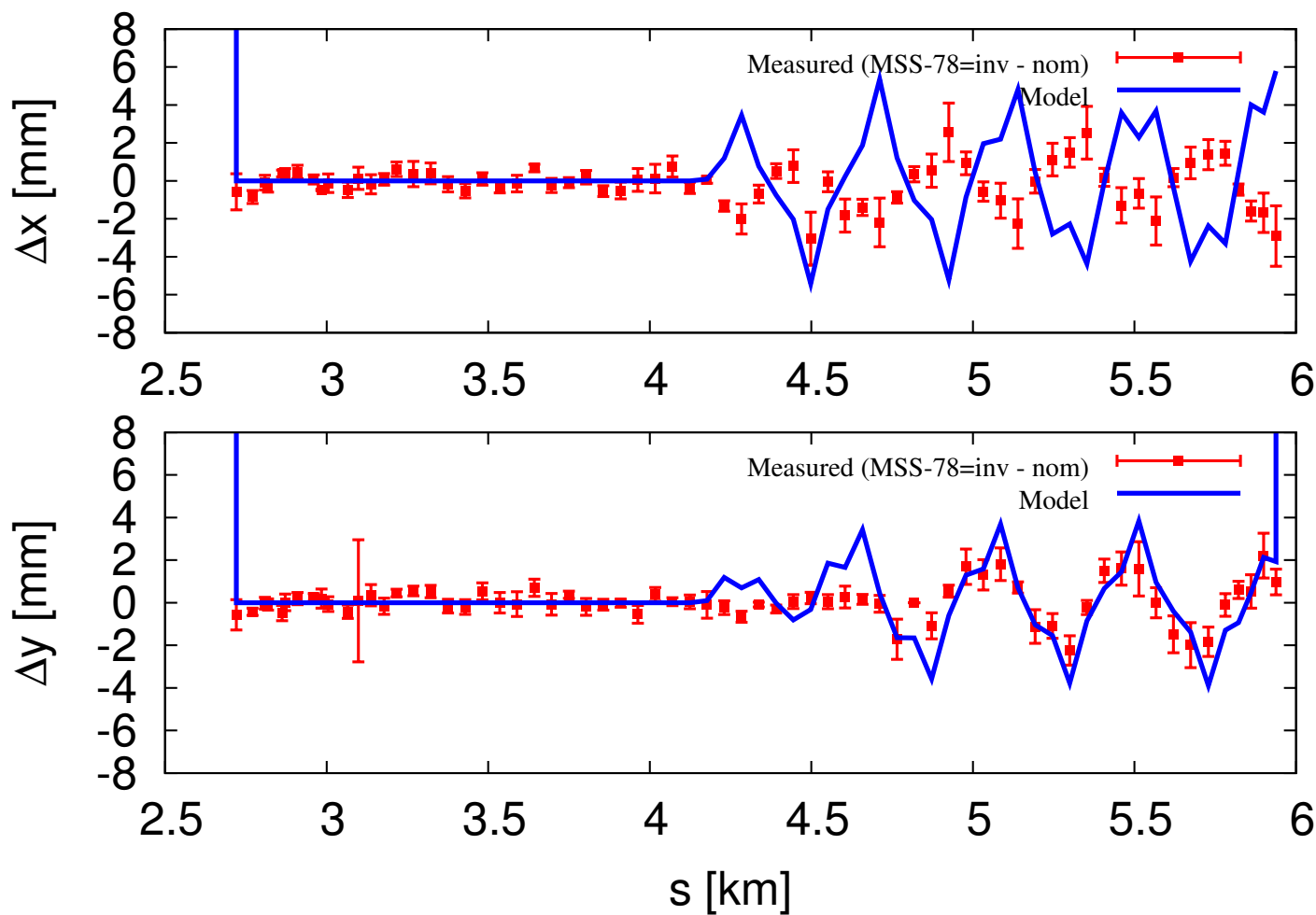
MCS-78 check, MCBCV.5L8 +40 murad, $\delta=0.0025$



MCS.A8R7.B2, K2 := -kcs.a78b2 (seq)

MSS (off-m)

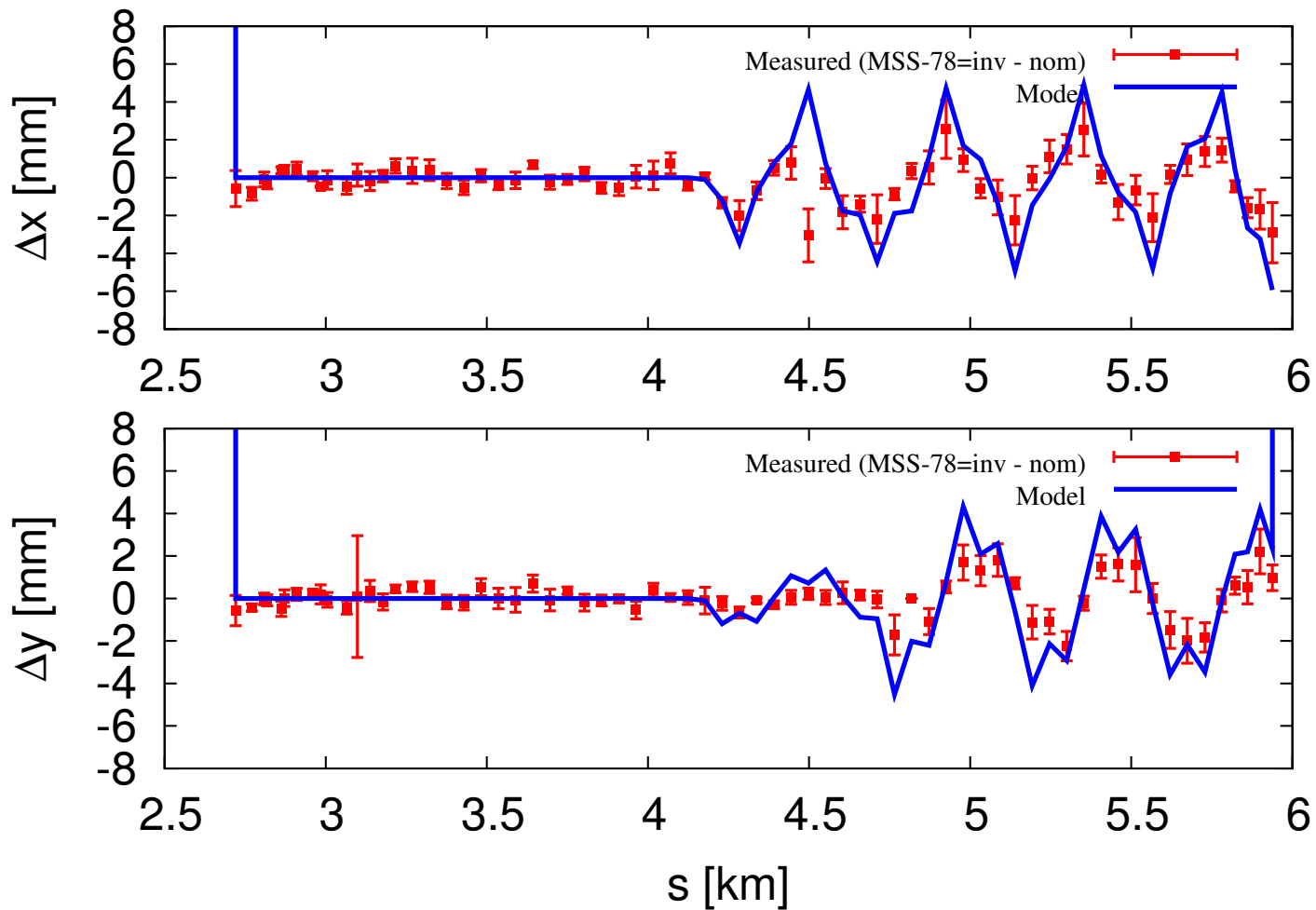
MSS-78 check, MCBCV.5L8 +40 murad, $\delta=0.0025$



MSS.34L8.B2, K2S := +kss.a78b2 (seq)

MSS inverted (off-m)

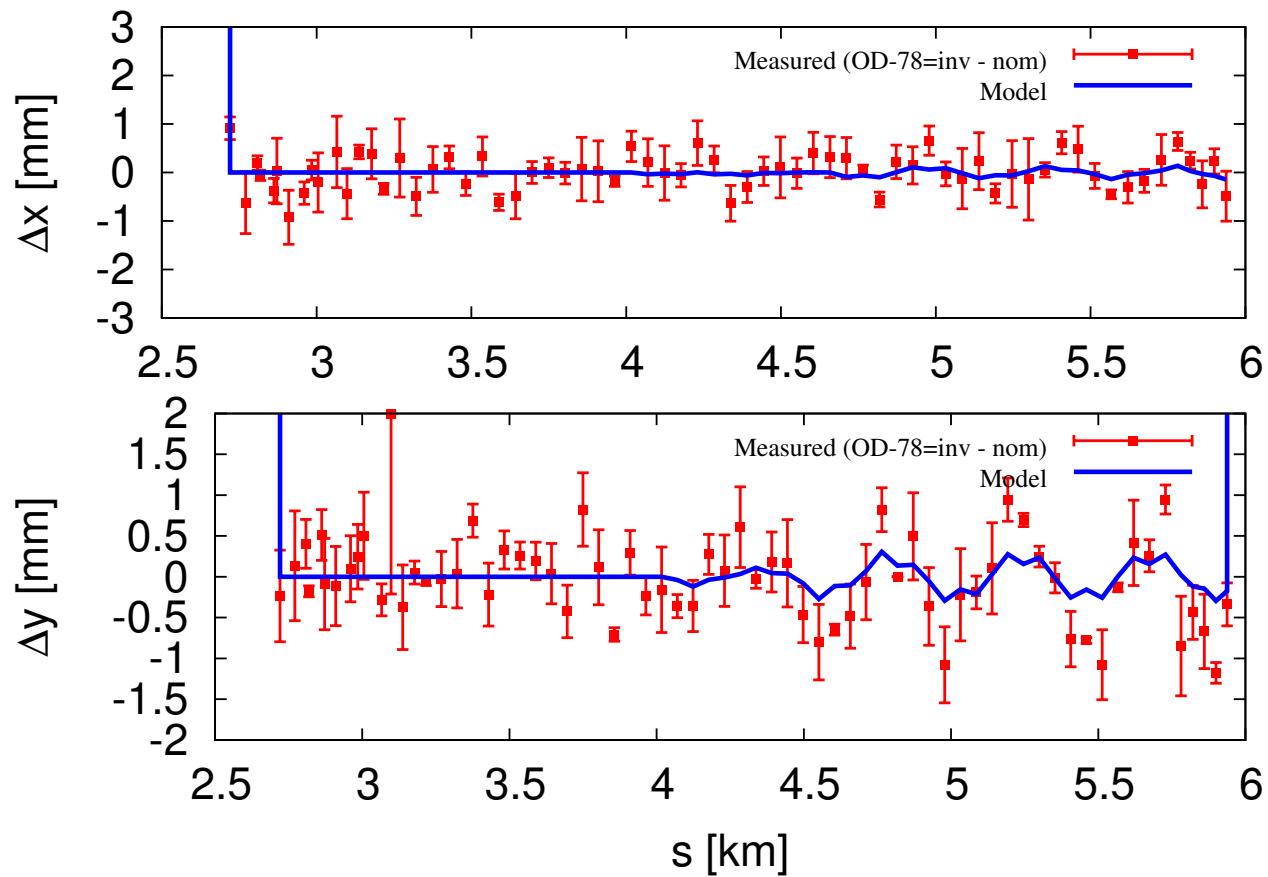
MSS-78 check, MCBCV.5L8 +40 murad, $\delta=0.0025$



MSS.34L8.B2 inverted in MADX model

OD (off-m)

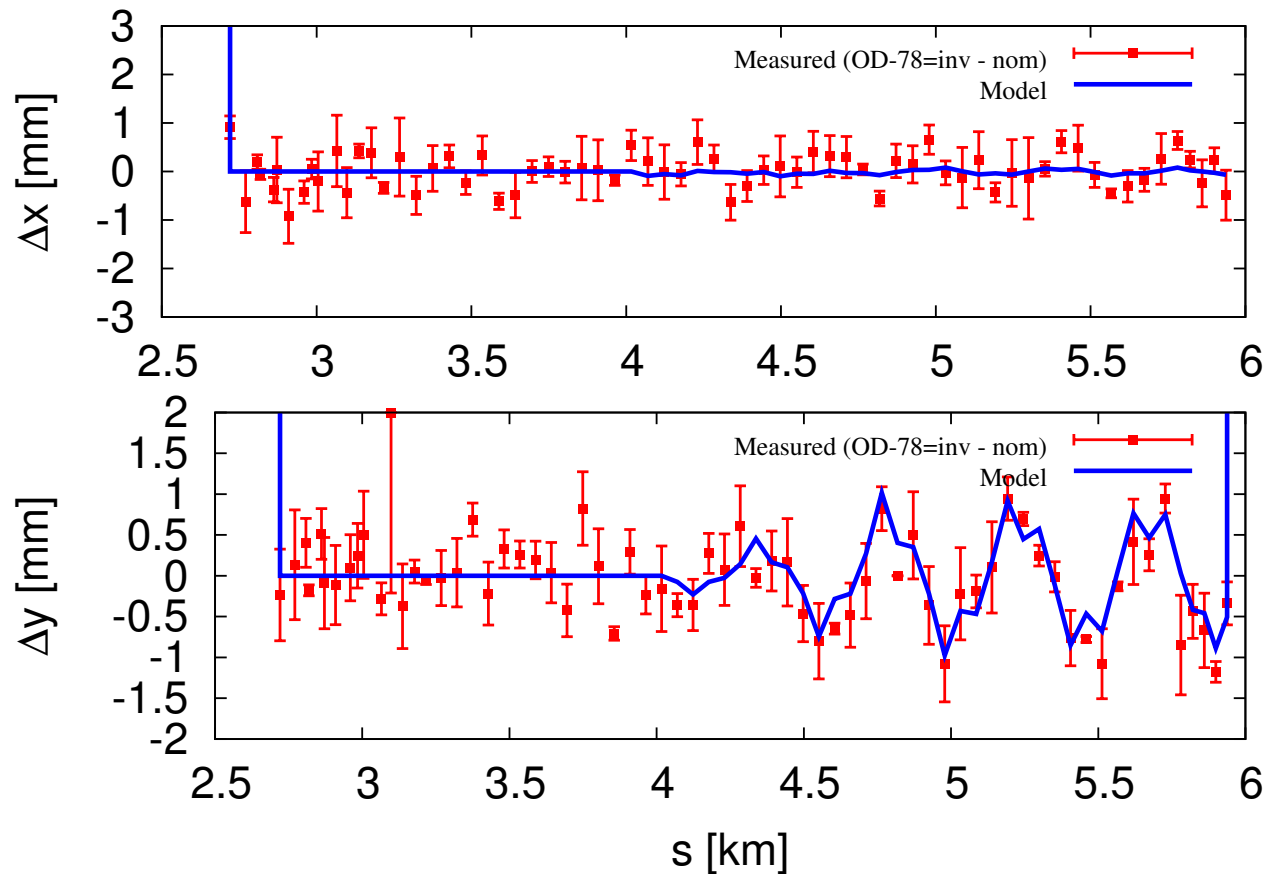
OD-78 check, MCBCV.A5L8 +40 murad, $\delta=0.00$



No effect in model

OD (off-m) cont'd

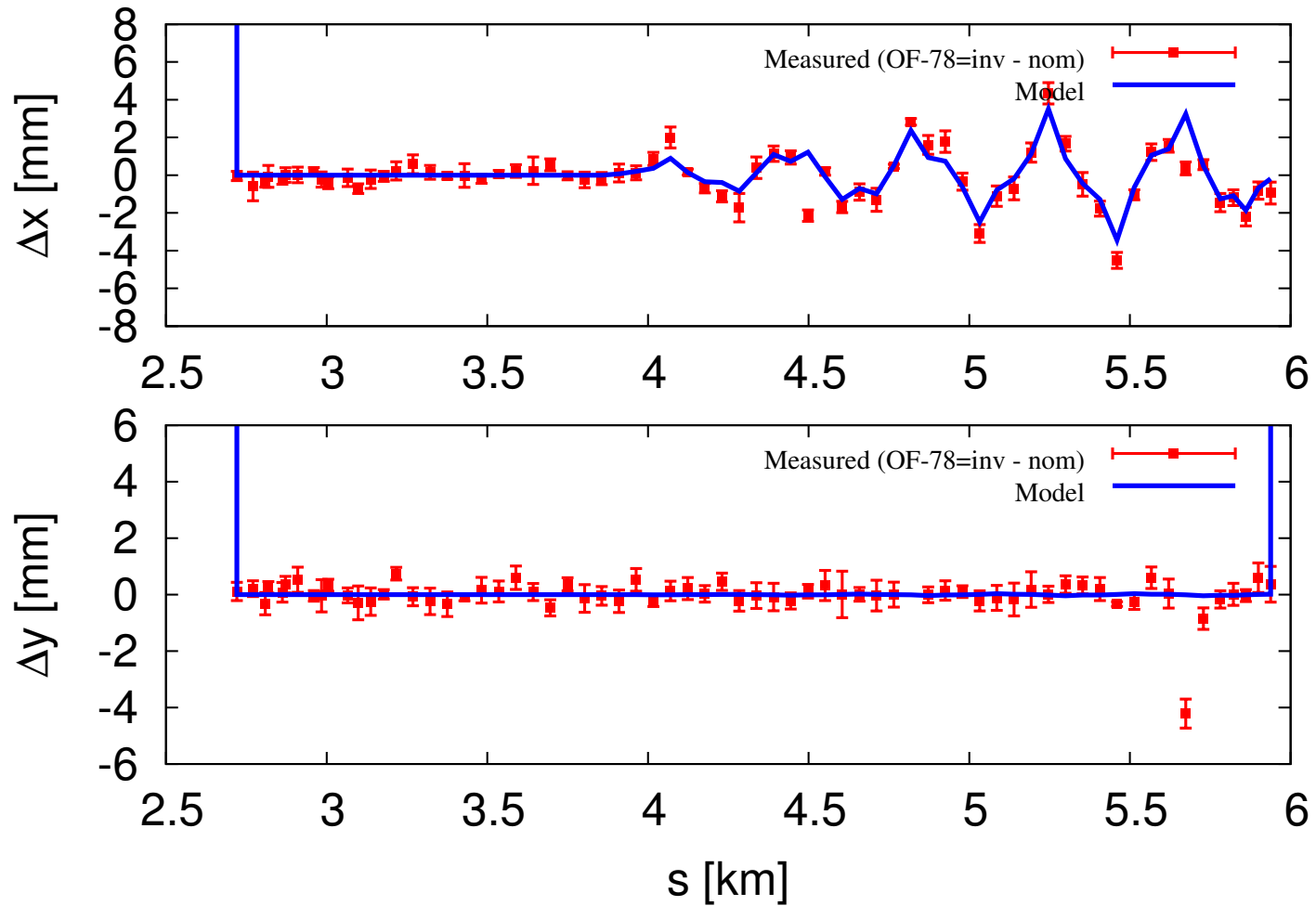
OD-78 check, MCBCV.A5L8 +40 murad, $\delta=0.0025$



At Lhcinj.ti8, introduce: $dy = -0.179$ (from measured BPMYB.4R8.TI8)

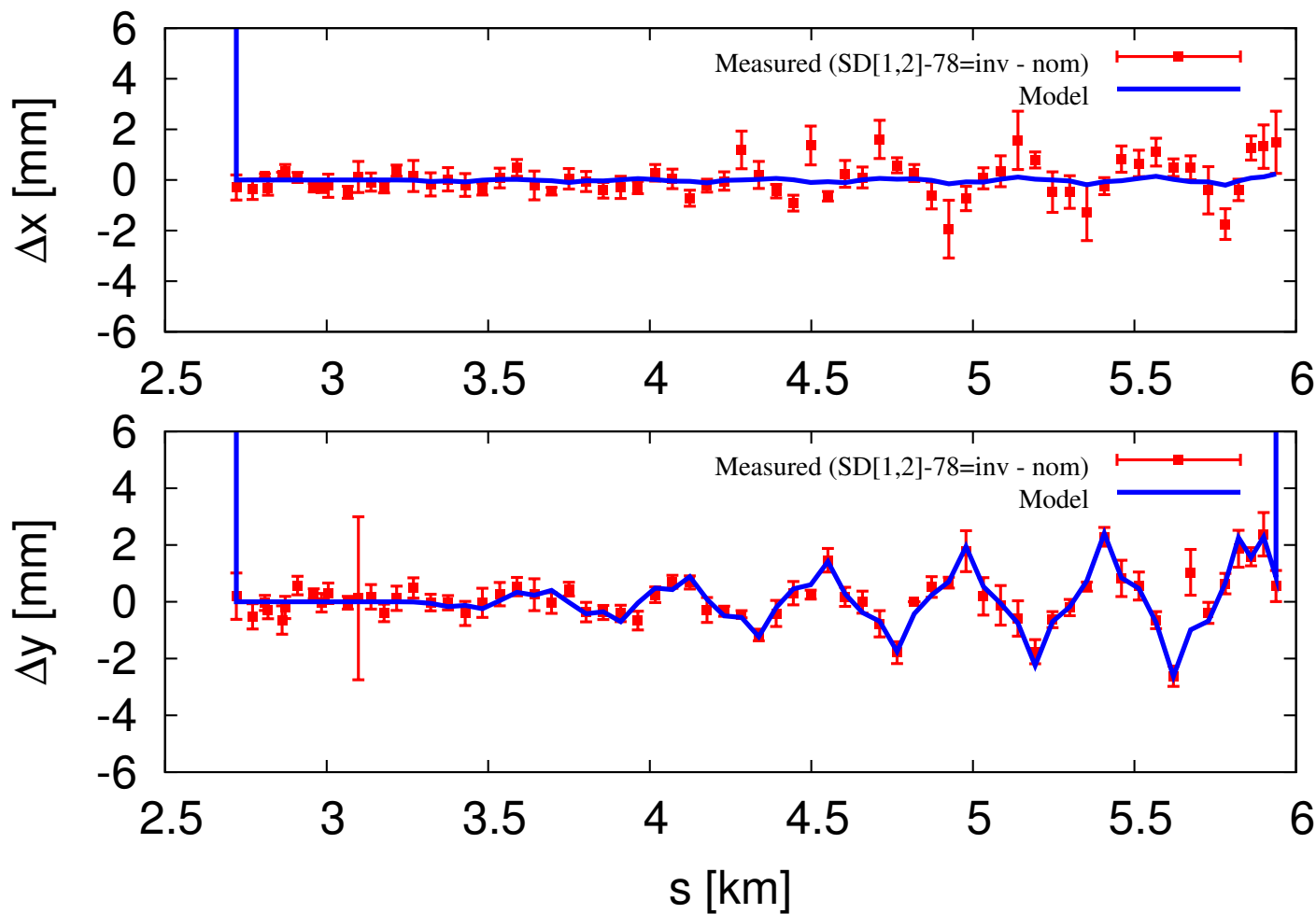
OF (off-m)

OF-78 check, MCBCH.6L8 +30 murad, $\delta=0.0025$



SD[1,2] (off-m)

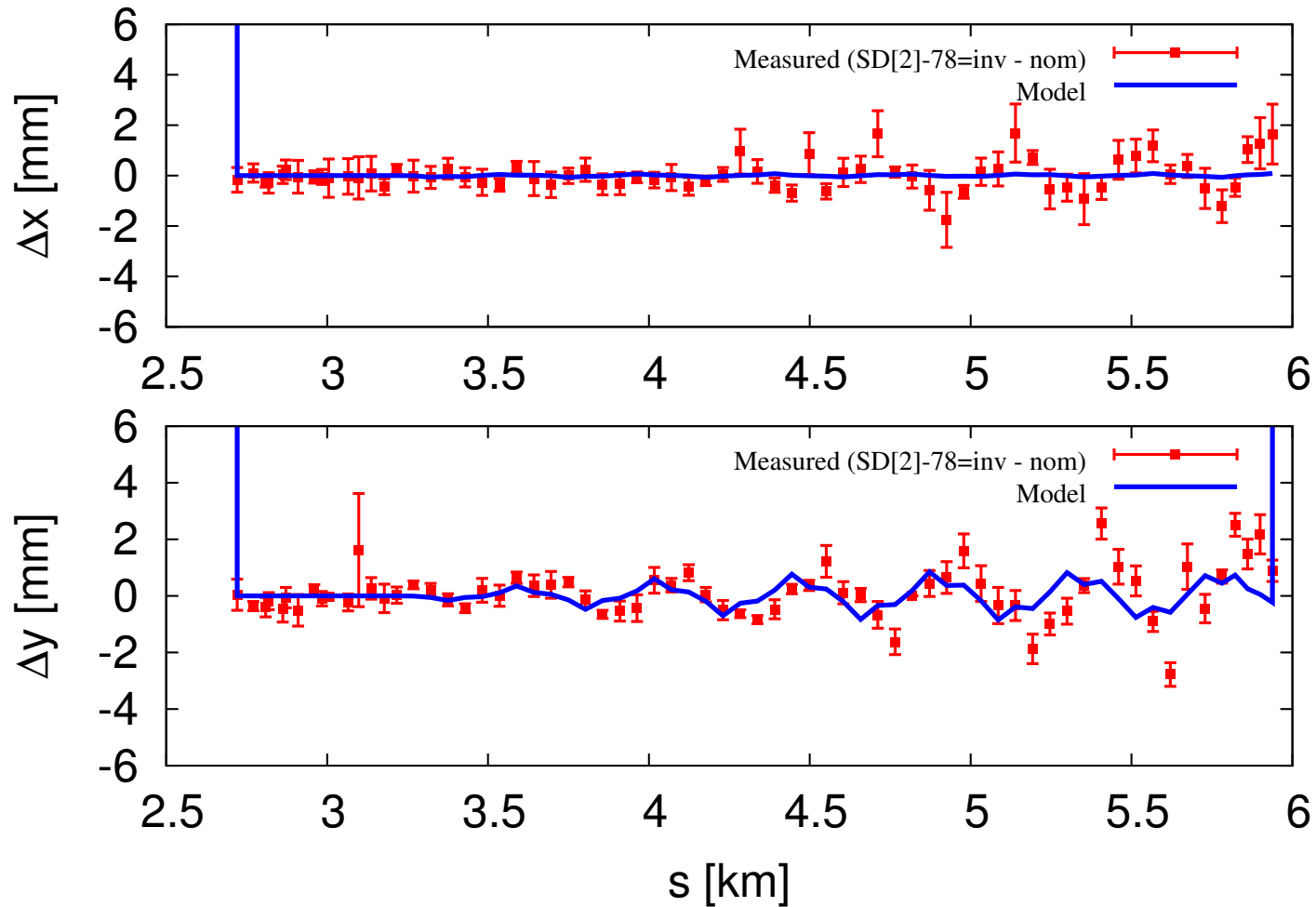
SD[1,2]-78 check, MCBCV.A5L8 +40 murad, $\delta=0.0025$



Data 20-40-46 to 20-42-22

SD[2] (off-m)

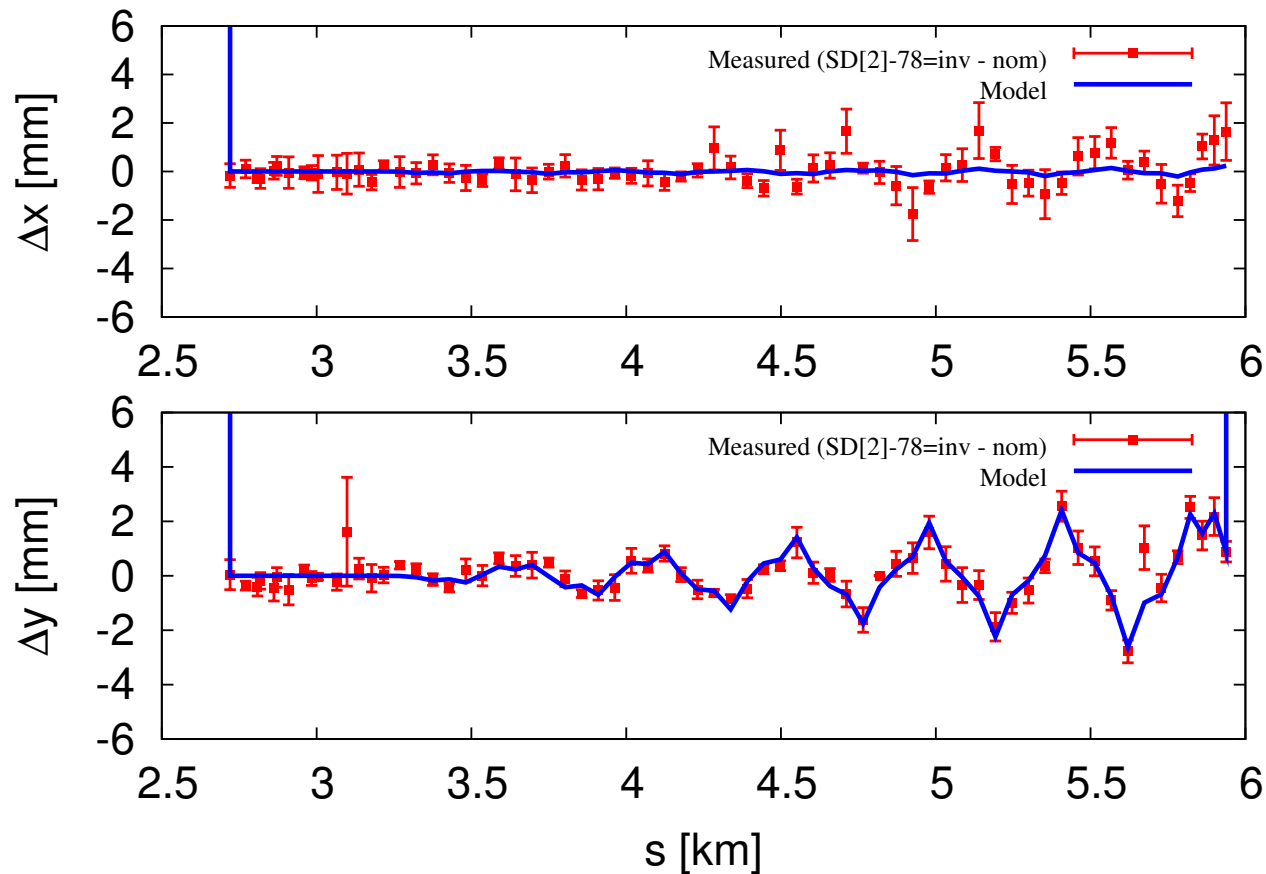
SD[2]-78 check, MCBCV.A5L8 +40 murad, $\delta=0.0025$



Data 19-33-34 to 19-35-10; MADX model: SD[2]

SD[2] (off-m) \rightarrow SD[1,2]

SD[2]-78 check, MCBCV.A5L8 +40 murad, $\delta=0.0025$

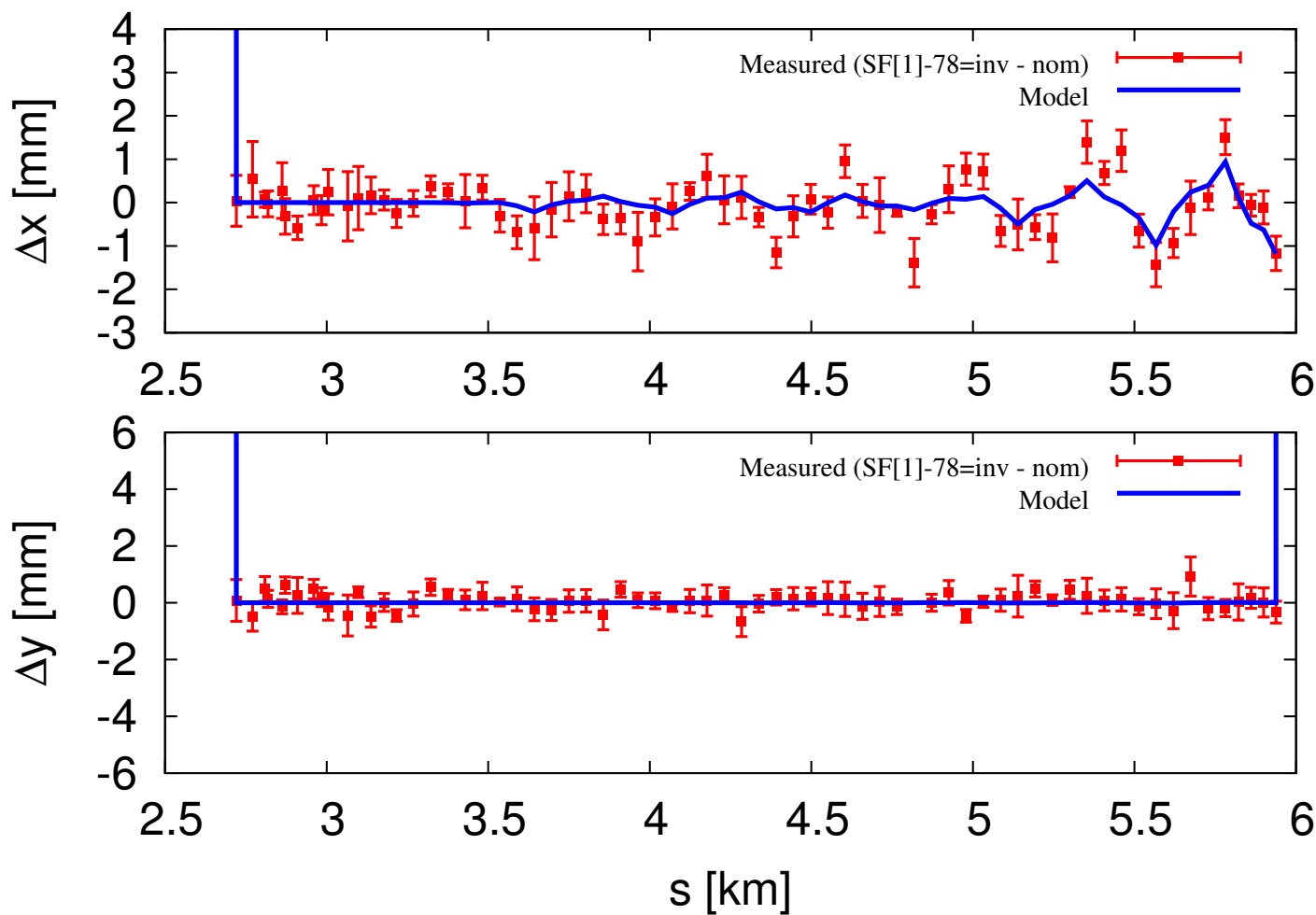


Data 19-33-34 to 19-35-10; MADX model: SD[1,2]

Wrong notebook?

SF[1] (off-m)

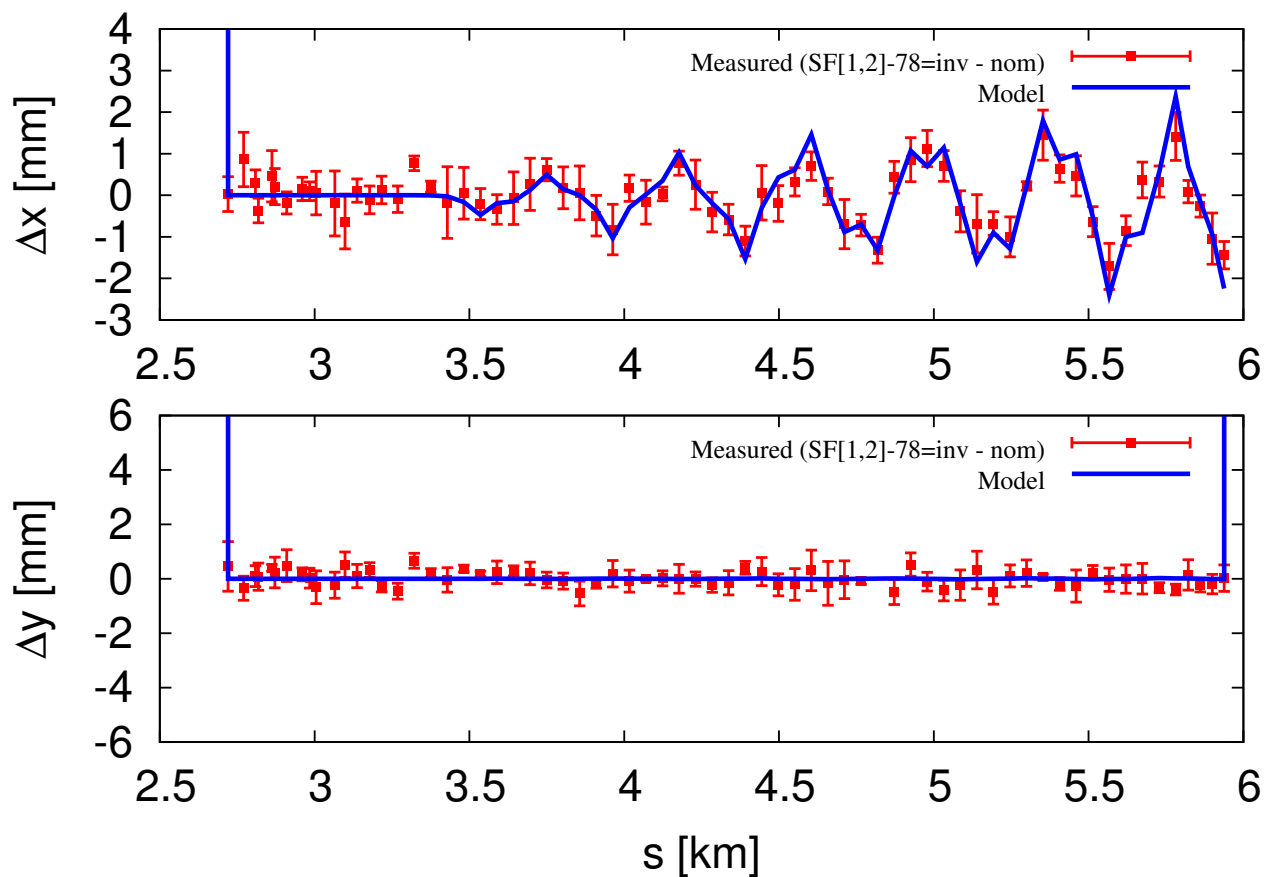
SF[1]-78 check, MCBYH.B4L8 +40 murad, $\delta=0.0025$



Data 19-40-46 to 19-42-22; MADX model: SF[1]

SF[1] (off-m) \rightarrow SF[1,2]

SF[1,2]-78 check, MCBYH.B4L8 +40 murad, $\delta=0.0025$



Data 19-40-46 to 19-42-22; MADX model: SF[1,2]

Wrong notebook?

Summary

- BPM x-y inverted: BPM.12R7.B2
- Questionable BPM: BPM.28R7.B2 (y);
BPM.34R7.B2 (x); BPMSX.4L8.B2
- Correctors: definition in MAD and YASP?
YASP x orbit inverted; set H corrector strength to be "-", V corrector to "+"
BXV3 is signed "-" in the beam4 (database)
- Questionable magnets
 - Correctors: BCH6(off-m); BXV3;
BYH4(off-m)
 - OD; OF
 - QT13, QS, MCS, MSS

Polarity check S23 (07 Sep 2008)

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Frank Zimmermann**

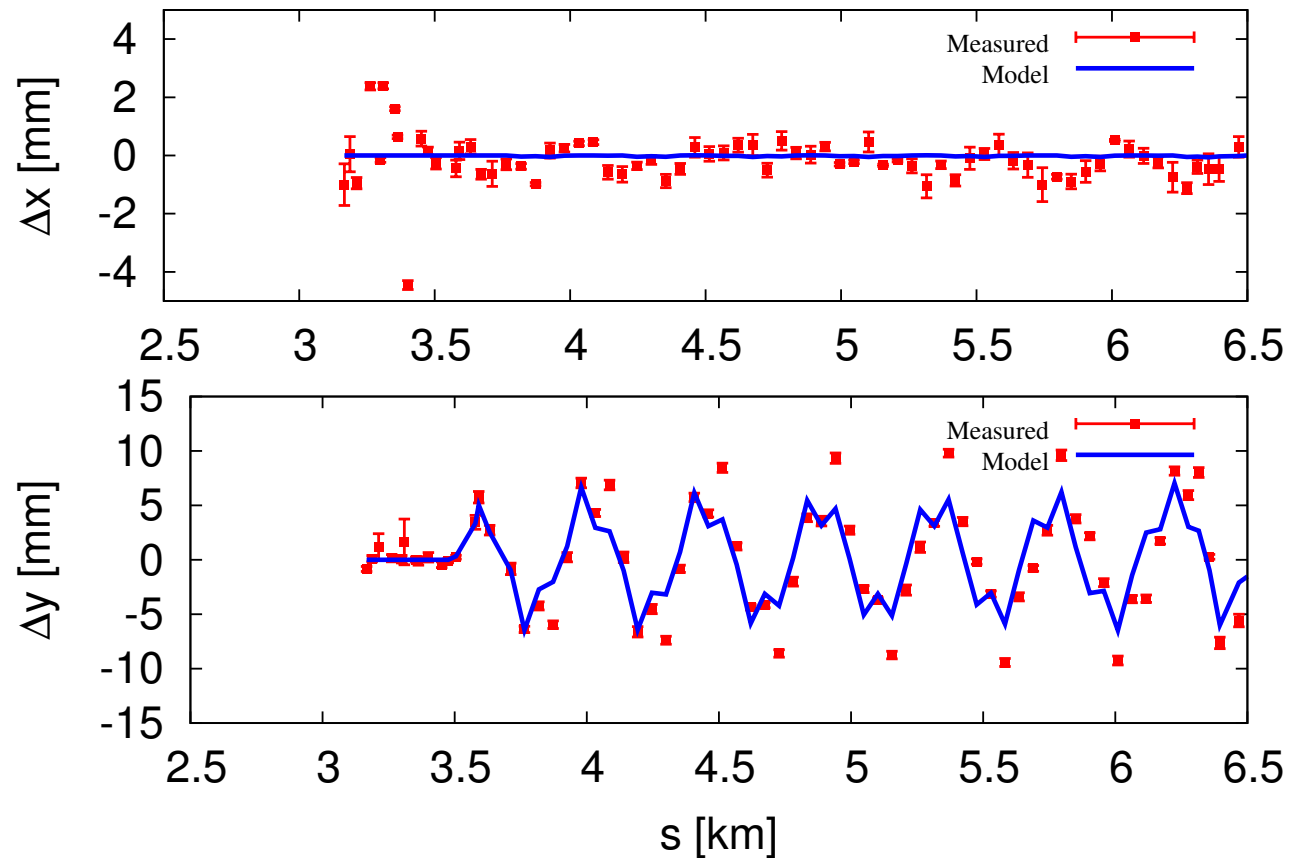
AB/ABP, CERN

Contents

- Polarity check of correctors
- Polarity check of magnets
- MADX model:
</afs/cern.ch/eng/lhc/optics/V6.503/V6.5.seq>
- TI2+LHCB1
- Summary

BCV5 (on-m)

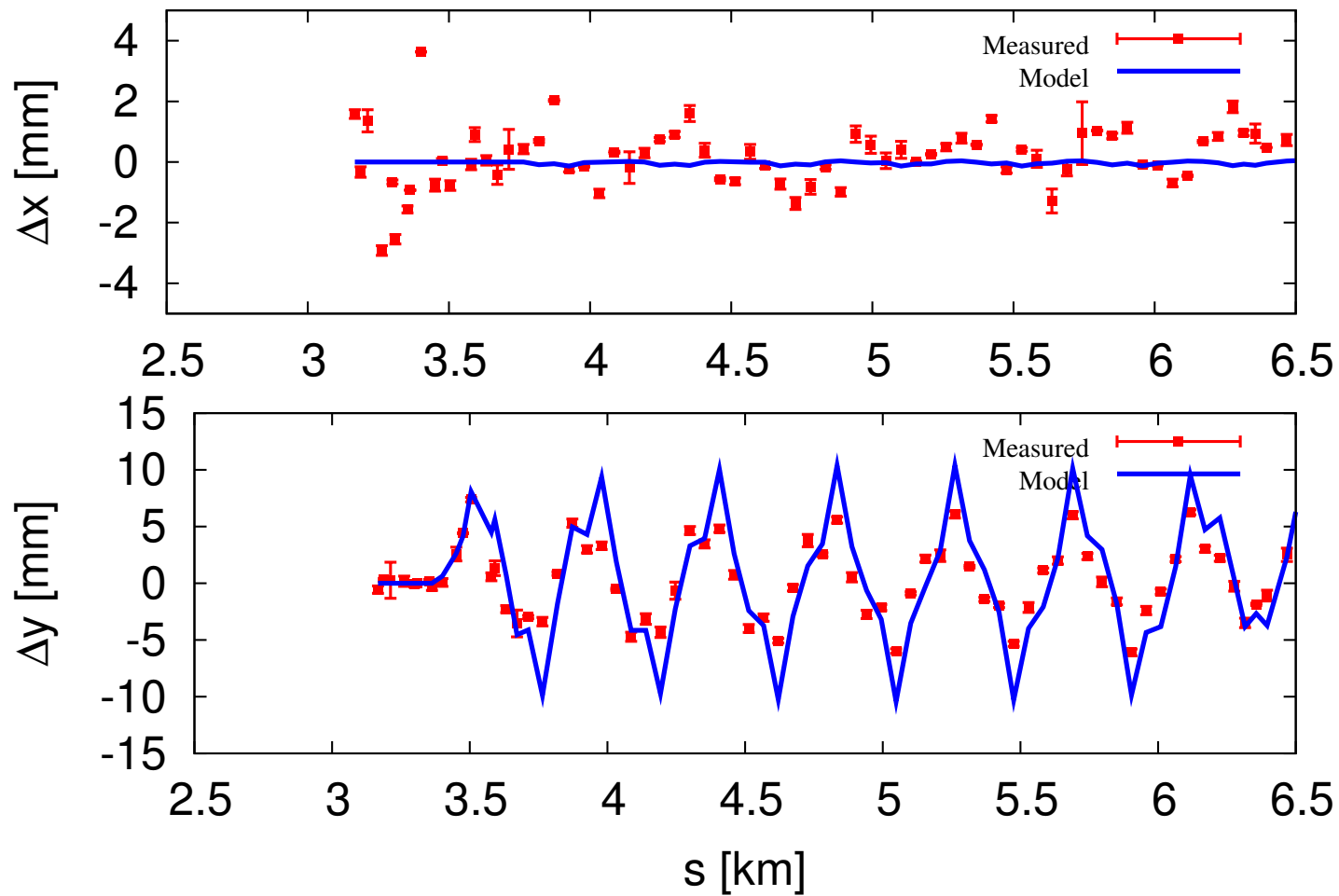
MCBCV.B5R2 +40 murad check, $\delta=0.0$



some BPM data missing between 3.2 to 3.6 km

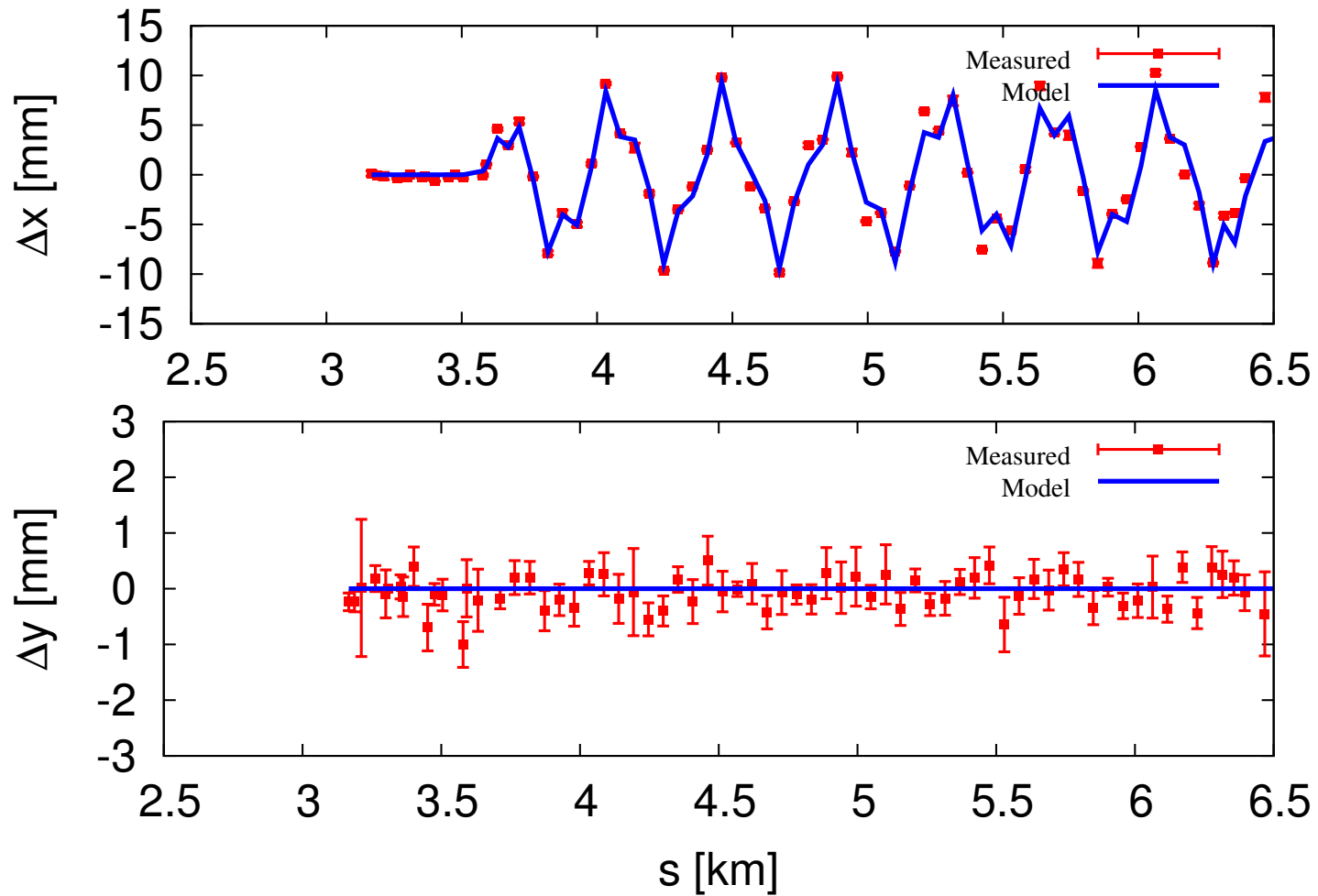
BXV3 (on-m)

MCBXV.3R2 +40 murad check, $\delta=0.0$



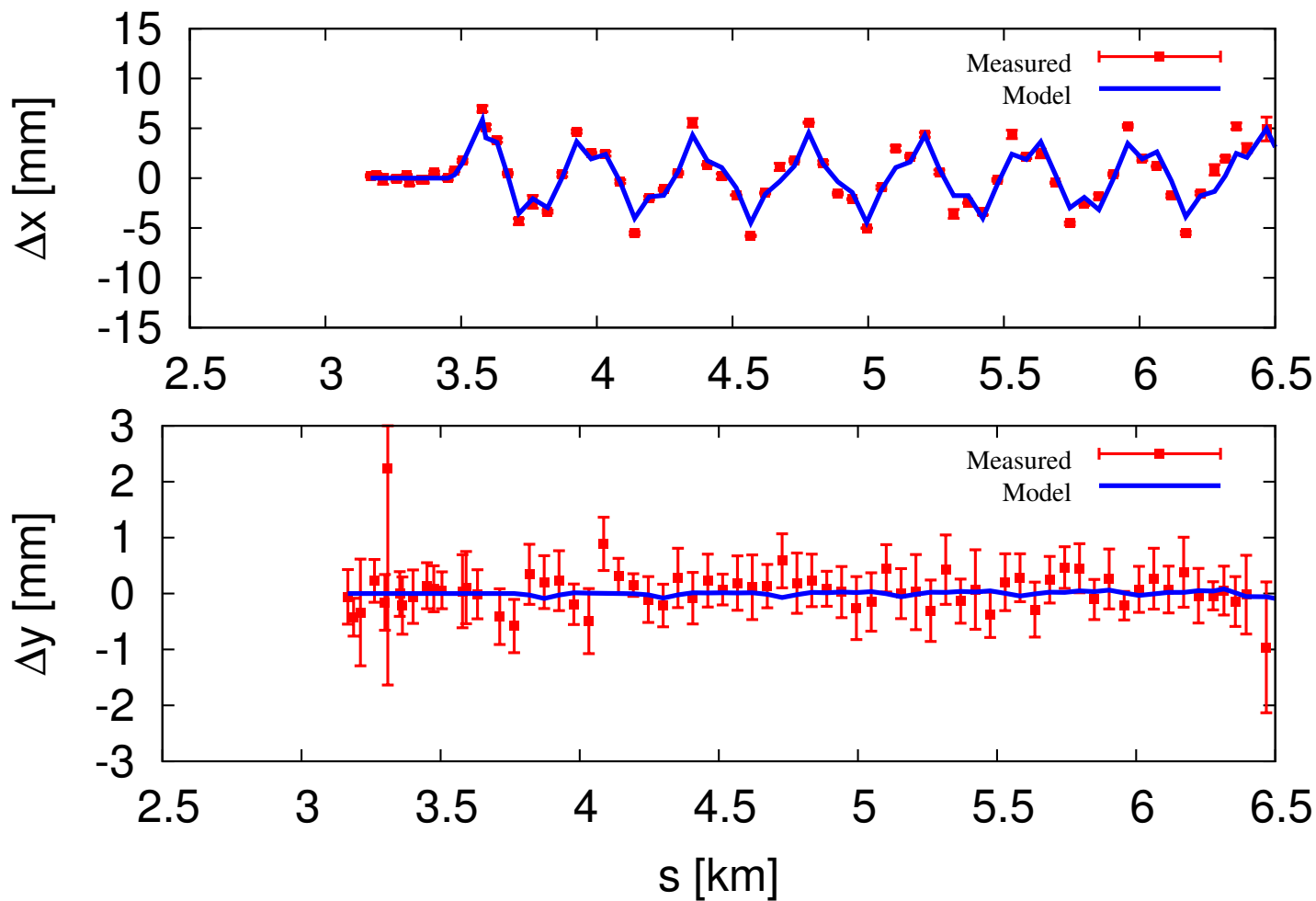
BCH6 (on-m)

MCBCH.6R2 +40 murad check, $\delta=0.0$



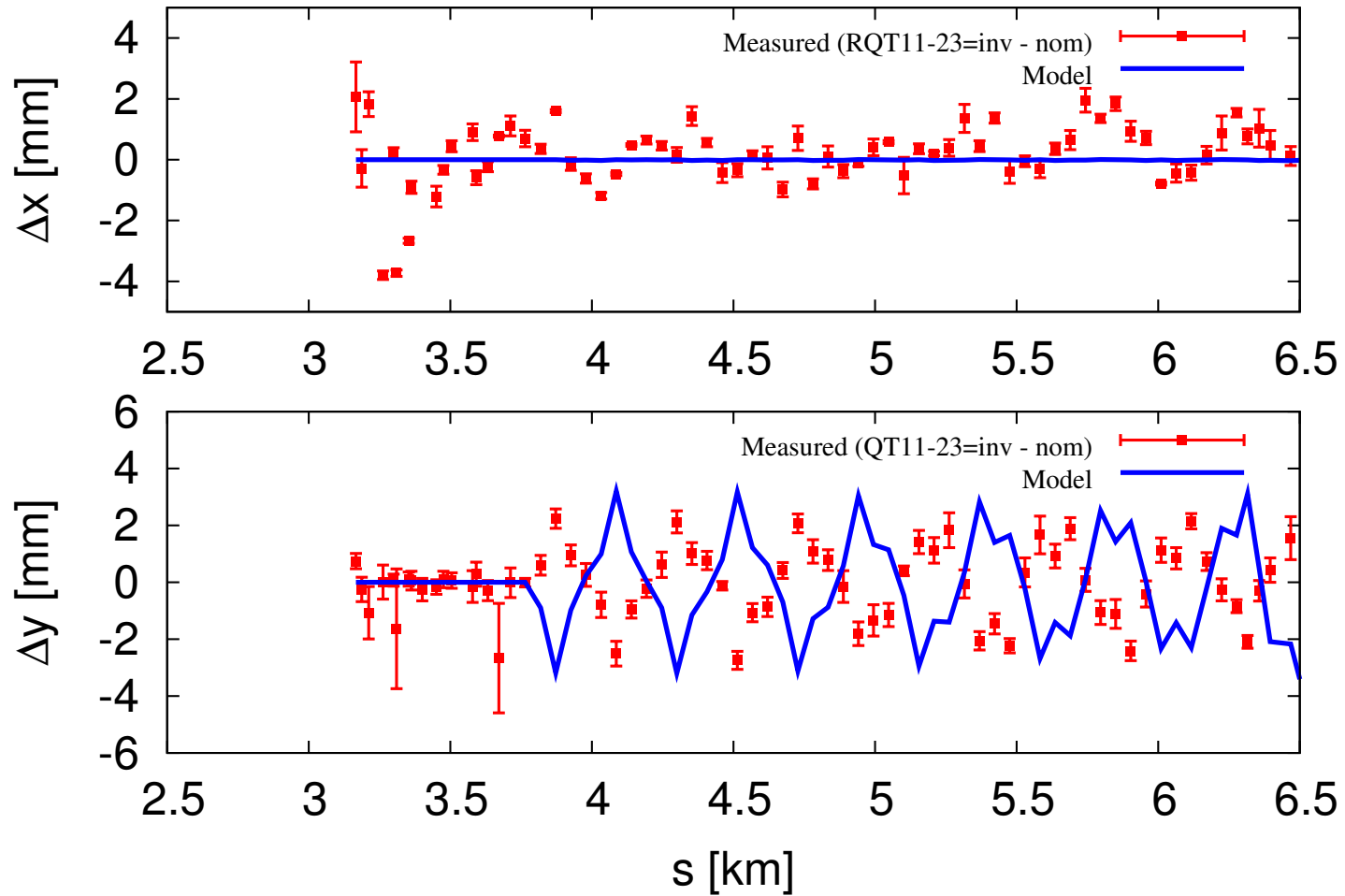
BYH4 (off-m)

MCBYH.4R2 +40 murad check, $\delta=0.002$



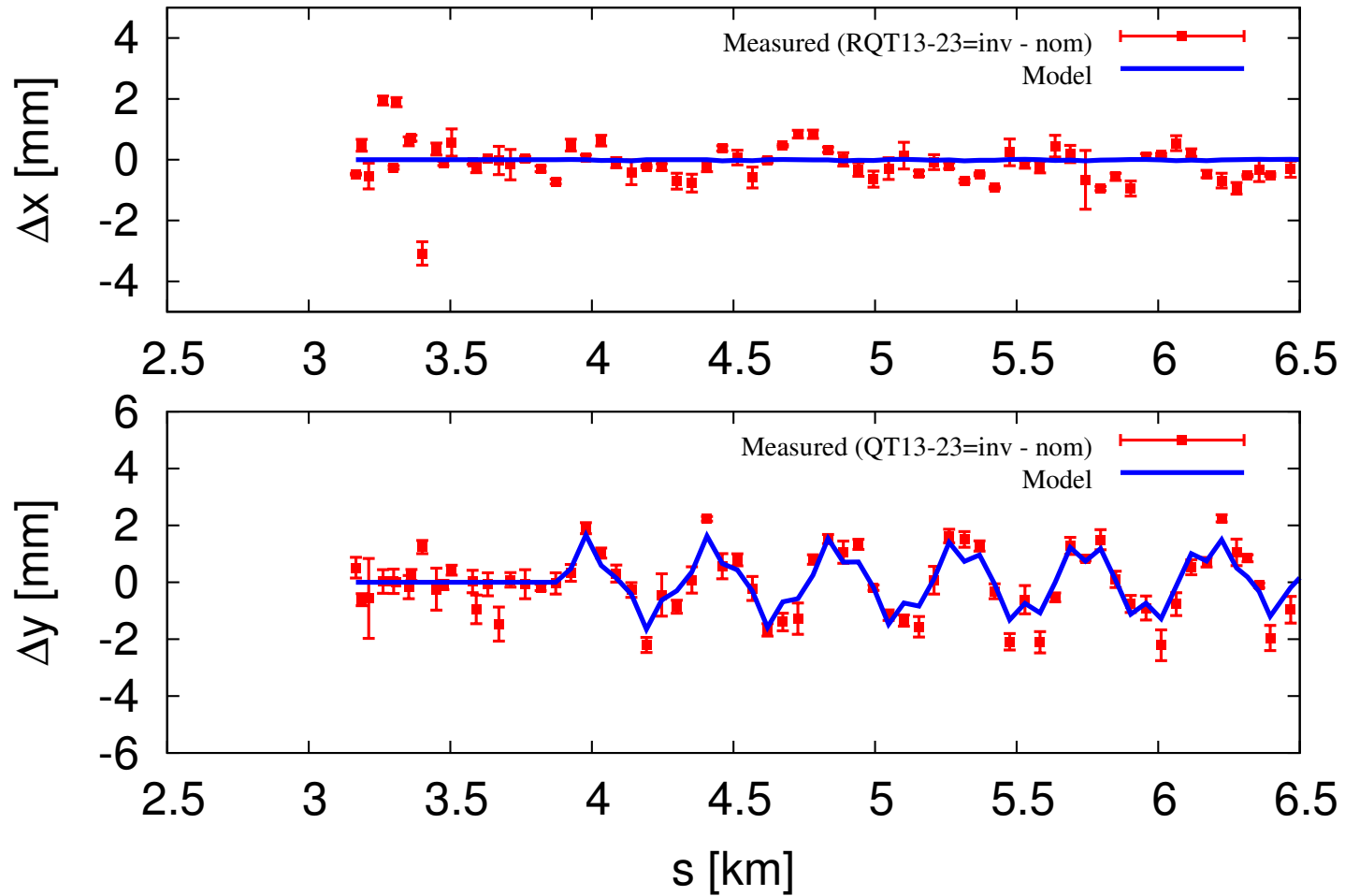
Magnets: QT11 (on-m)

QT11-23 check, MCBCV.B5R2 +40 murad, $\delta=0.0$



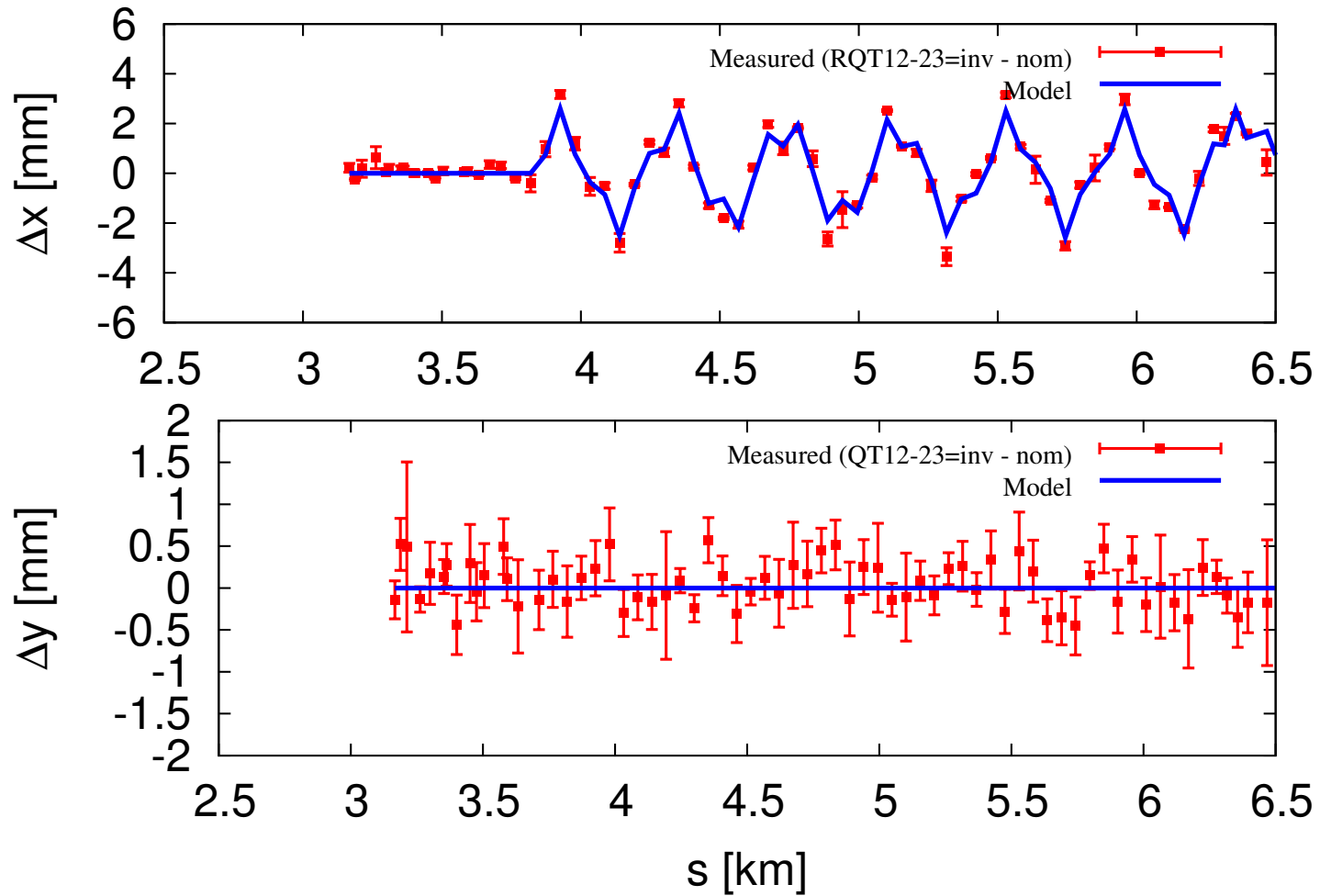
Magnets: QT13 (on-m)

QT13-23 check, MCBXV.3R2 +40 murad, $\delta=0.0$



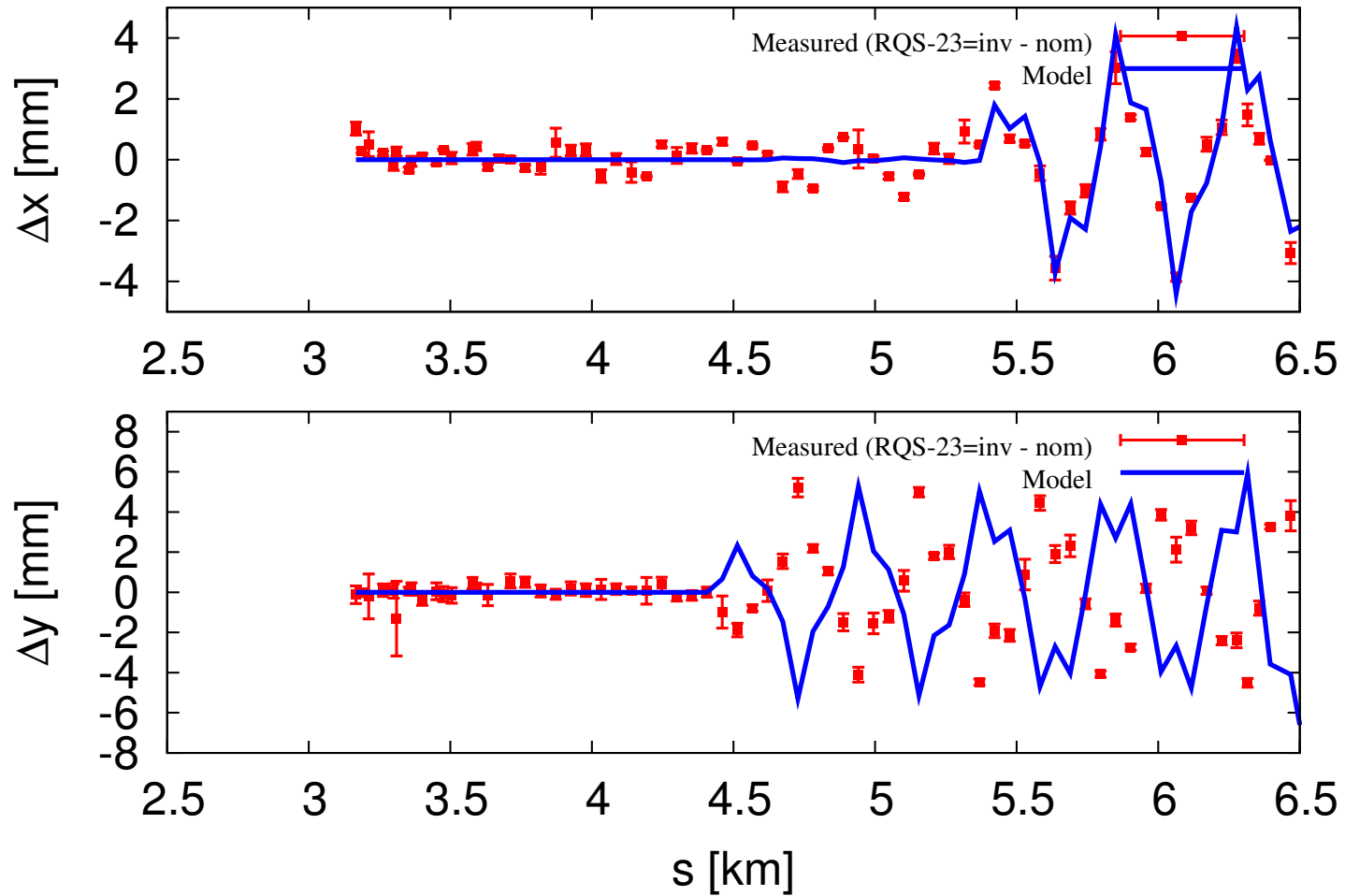
Magnets: QT12 (on-m)

QT12-23 check, MCBCH.6R2 +40 murad, $\delta=0.0$



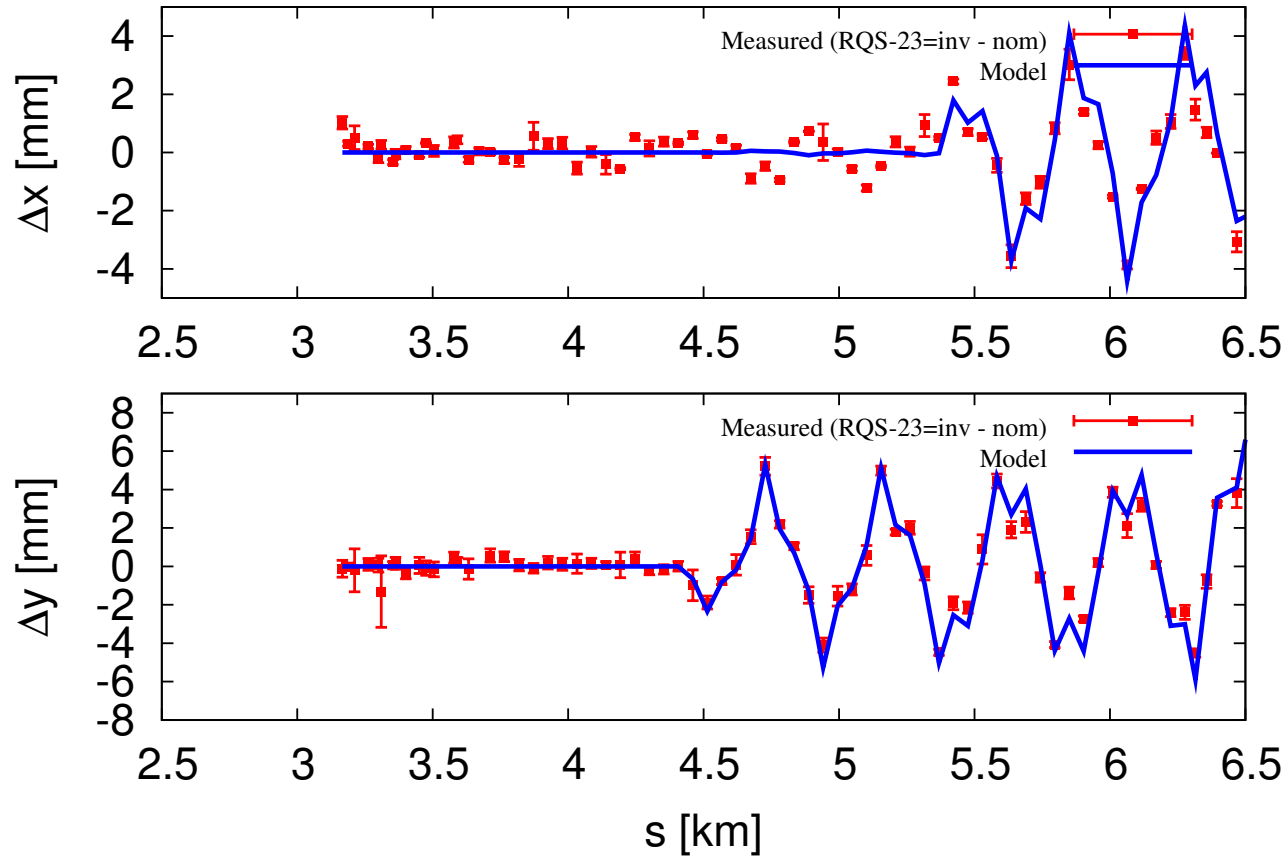
Magnets: QS (on-m)

QS-23 check, MCBCH.6R2 +40 murad, $\delta=0.0$



Magnets: QS inverted (on-m)

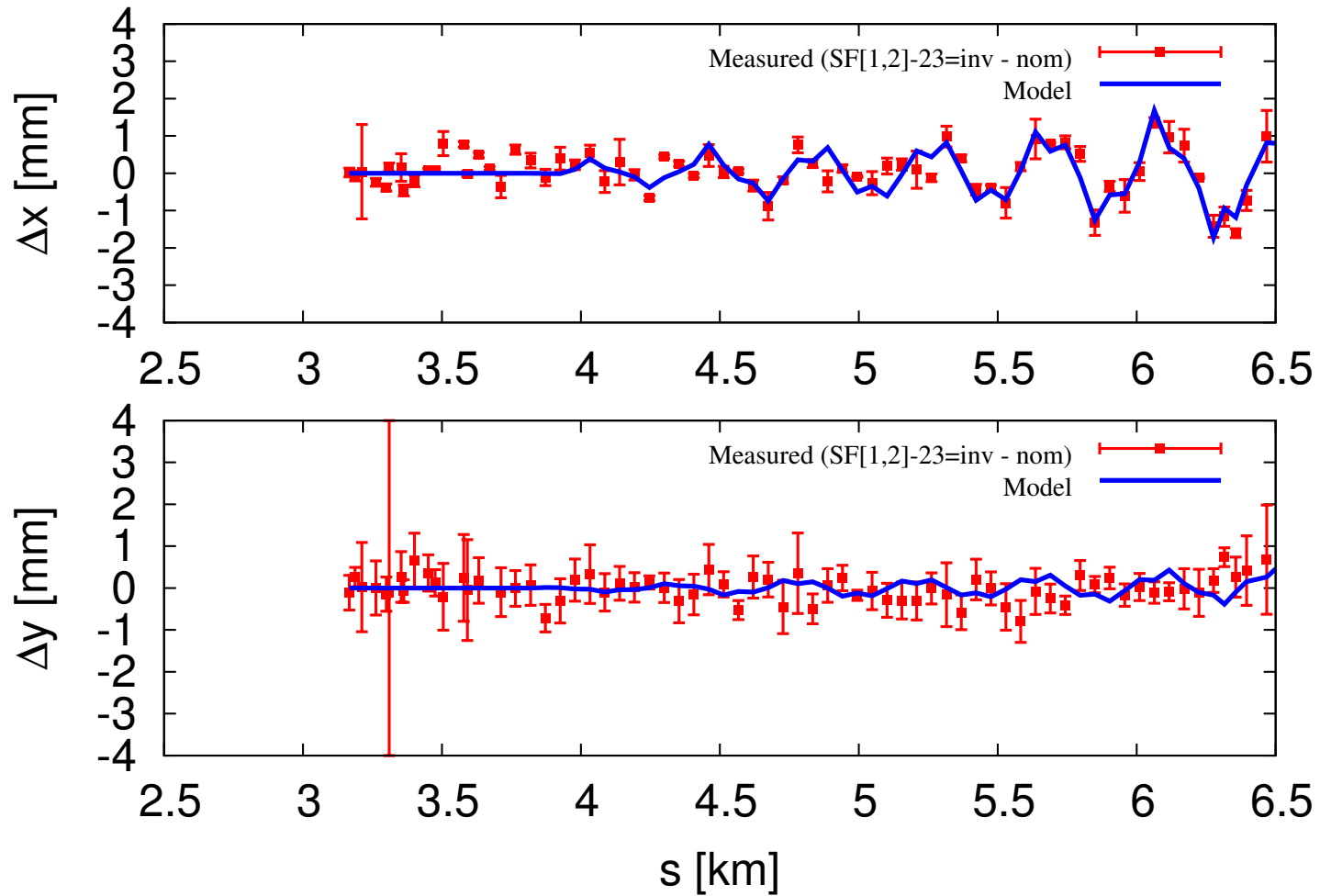
QS-23 check, MCBCH.6R2 +40 murad, $\delta=0.0$



In MADX model use inverted QS

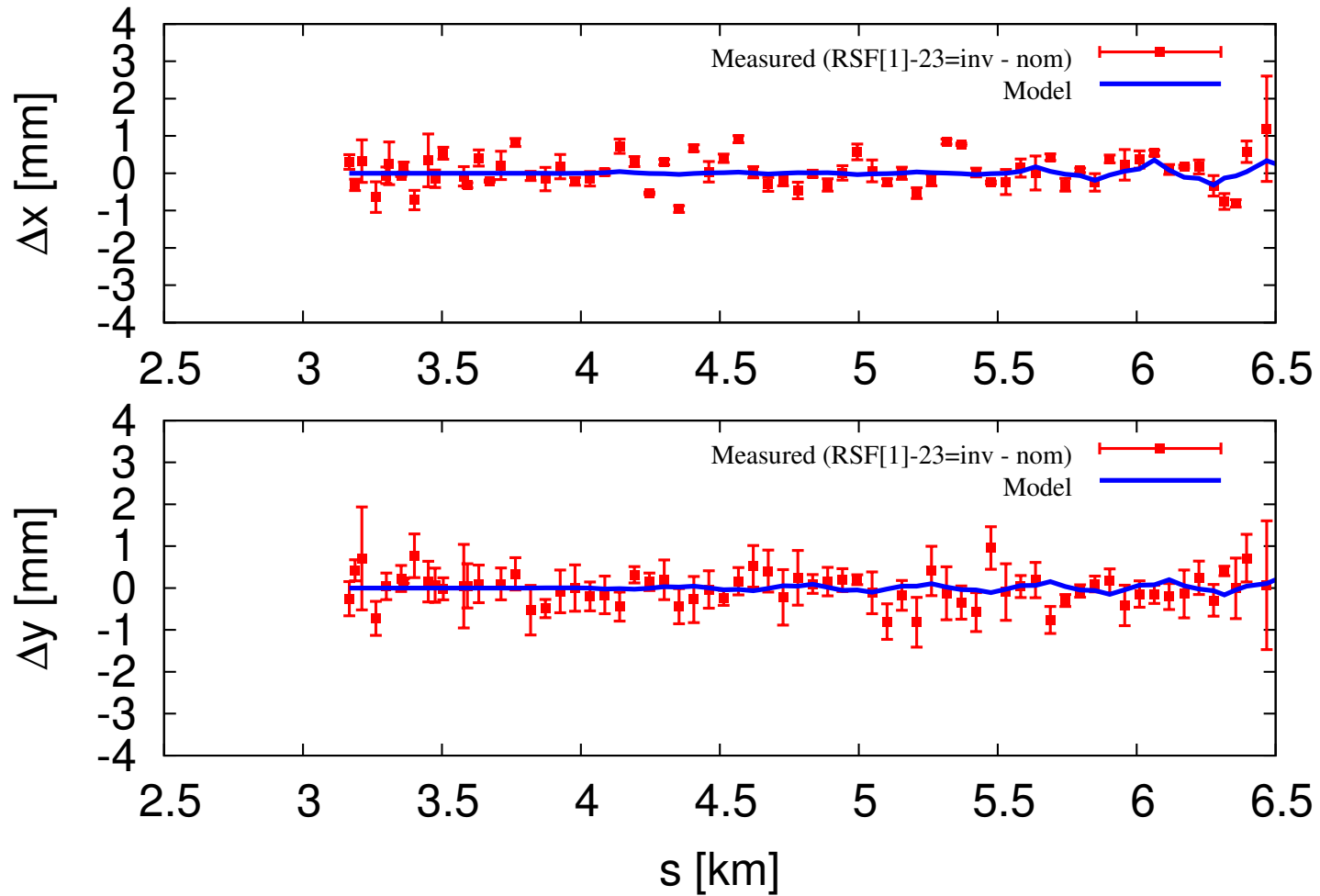
Magnets: SF[1,2] (off-m)

SF[1,2]-23 check, MCBYH.4R2 +40 murad, $\delta=0.002$



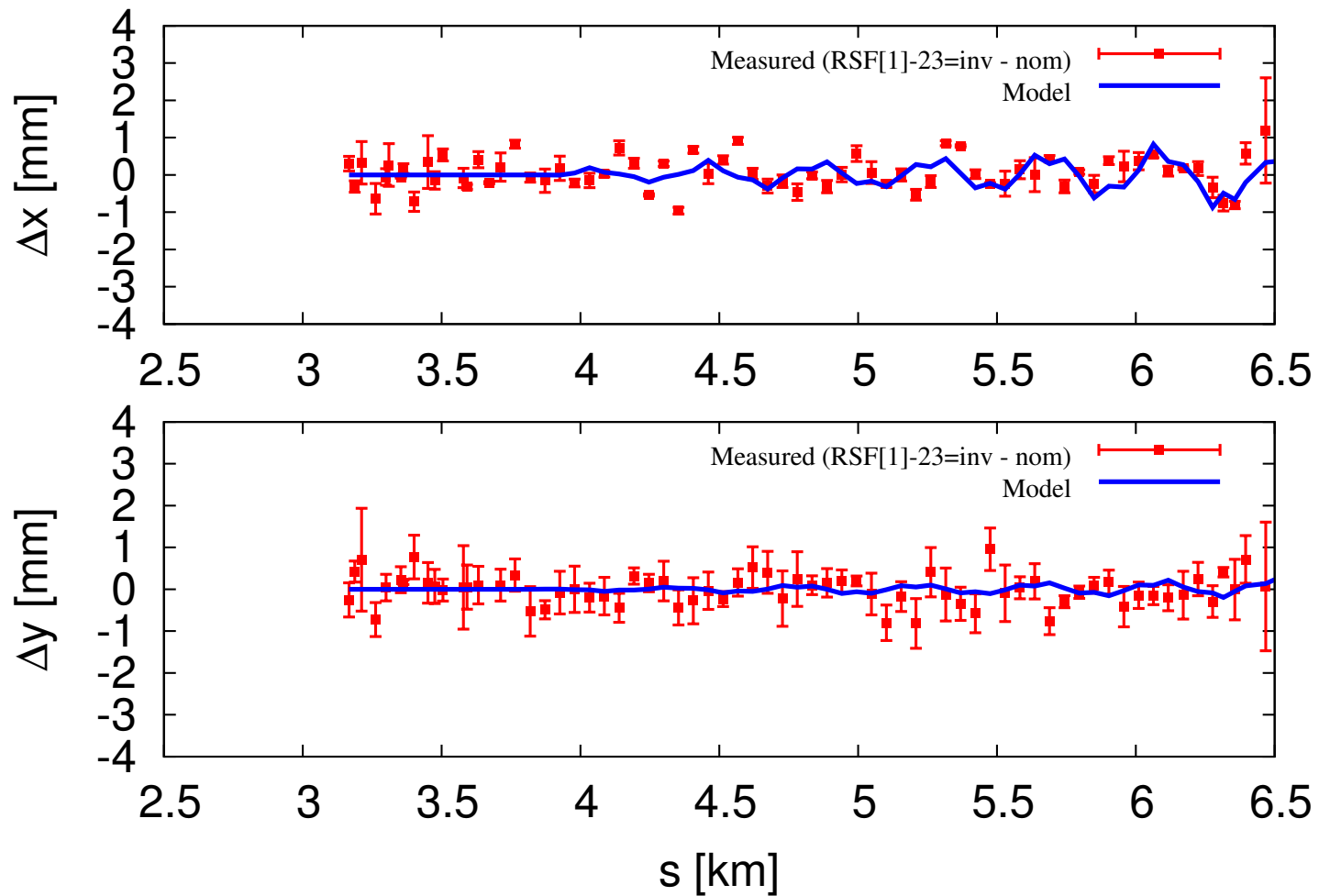
Magnets: SF[1] (off-m)

SF[1]-23 check, MCBYH.4R2 +40 murad, $\delta=0.002$



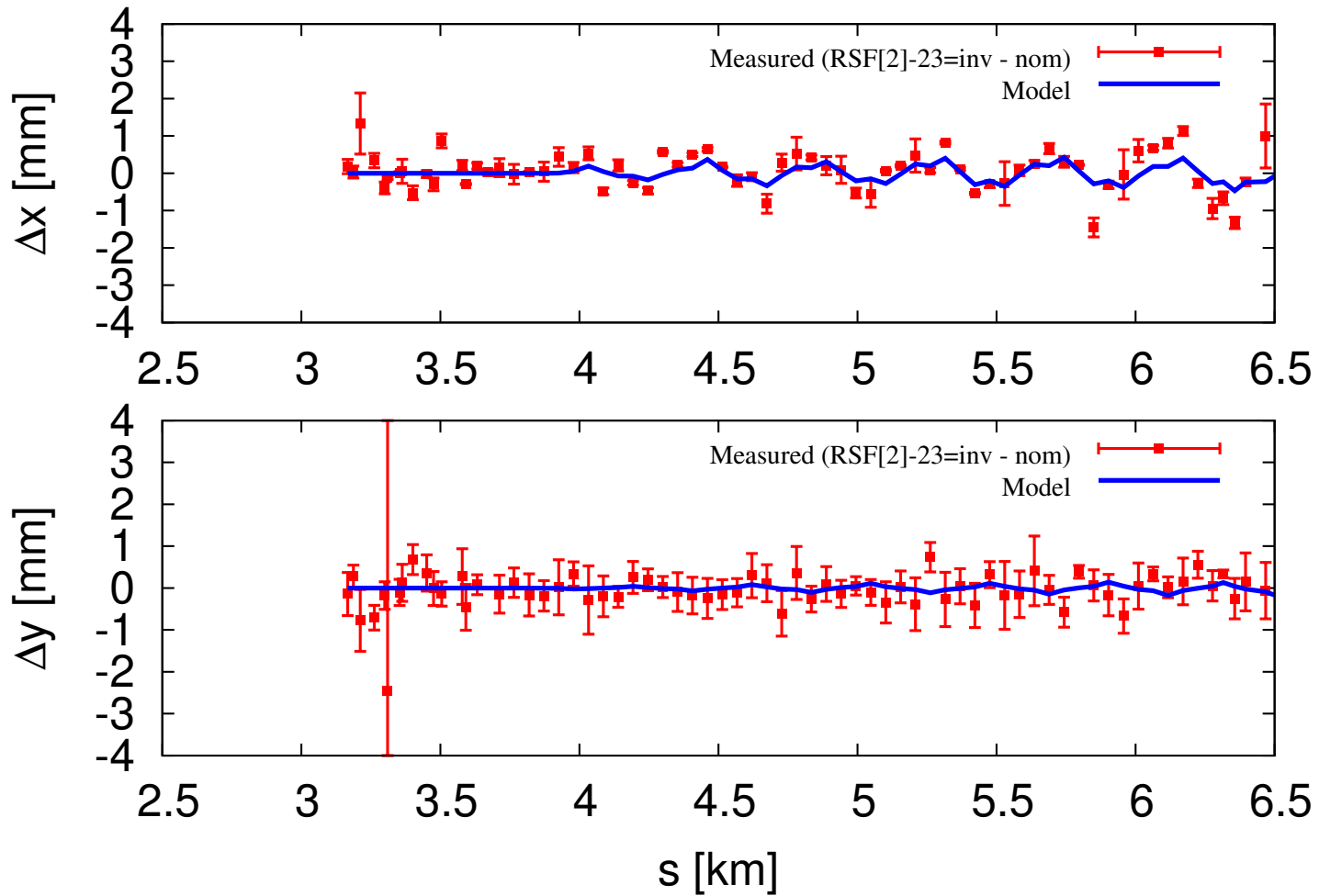
Magnets: SF[1] \rightarrow SF[1,2] (off-m)

SF[1]-23 check, MCBYH.4R2 +40 murad, $\delta=0.002$



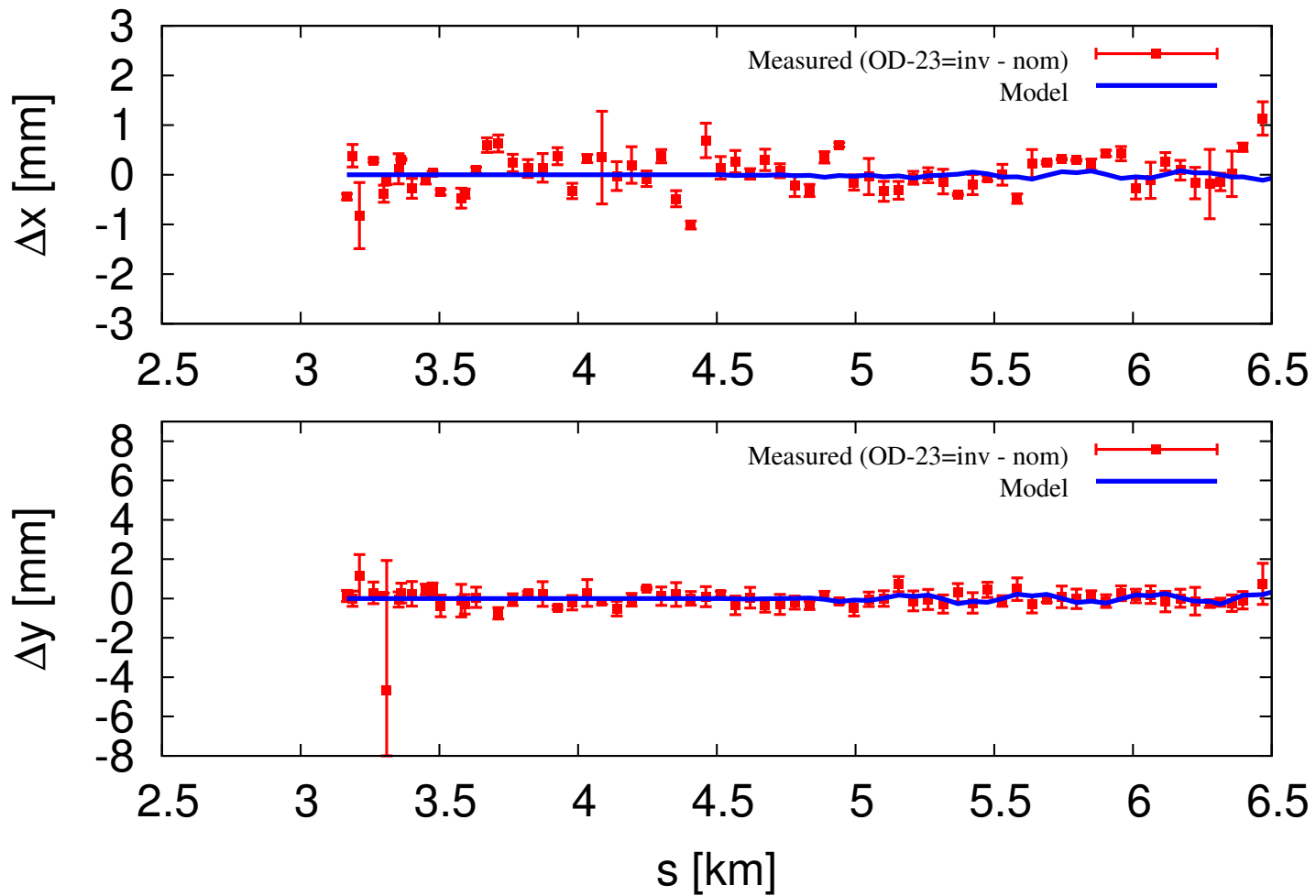
Magnets: SF[2] (off-m)

SF[2]-23 check, MCBYH.4R2 +40 murad, $\delta=0.002$



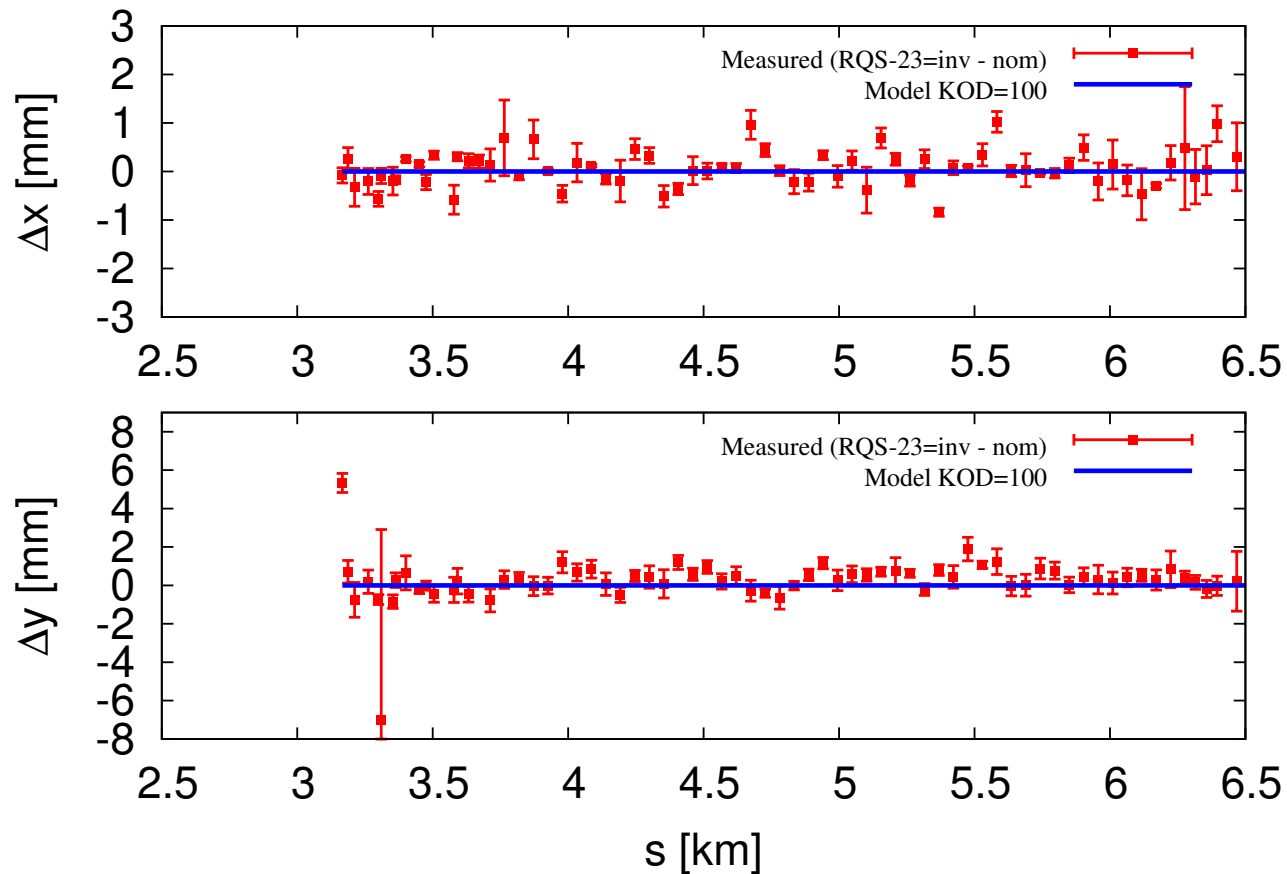
Magnets: OD (off-m)

OD-23 check, MCBCV.5R2 +40 murad, $\delta=-0.002$



Magnets: OD (off-m) cont'd

OD-23 check, MCBCV.5R2 +60 murad, $\delta=-0.002$



(1) OD+60 murad corrector

(2) 40 murad corrector orbit * 1.5

Summary

- Questionable BPM: 9R2
- Questionable magnets
 - Correctors: BCV5
 - QT11, QS, OD