Recent optics studies for improving aperture at injection in IR2/8

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Thanks to Emanuele, Massimo, Stephane, Thys and Werner

Introduction

- Aperture bottle neck in IR2/8 injection optics
  - at MCBX (and vacuum marker close to MCBX)
  - due to crossing and separation bump
    - N1~6.4
- Possible solutions
  - Increase beta*
  - Improve crossing scheme

Increase beta*

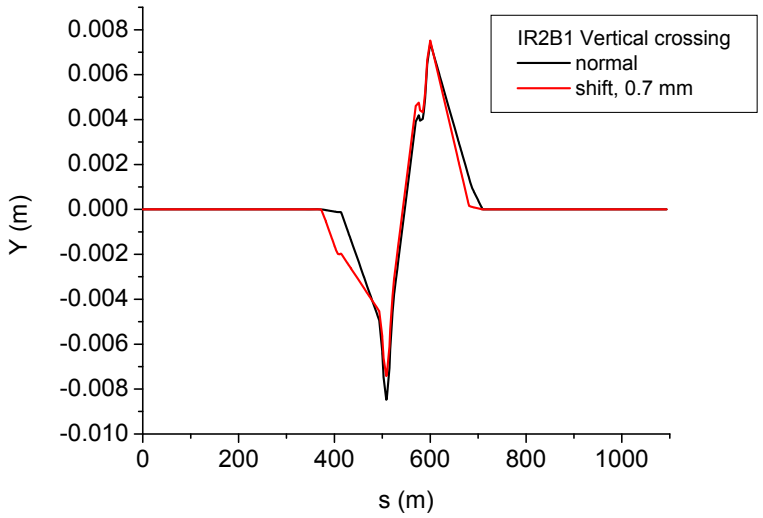
- Beta* 10 m → 11 m (Beta@MCBX2: ~270 m→~250 m)
  - Slightly deteriorate optics in terms of injection constraint
    - A few deg. for MKI-TDI and TDI-two auxiliary collimators phase advances
    - A few % beta/dispersion function at injection point
    - Need rematching of the injection line...
  - Improve aperture, dN1~0.3

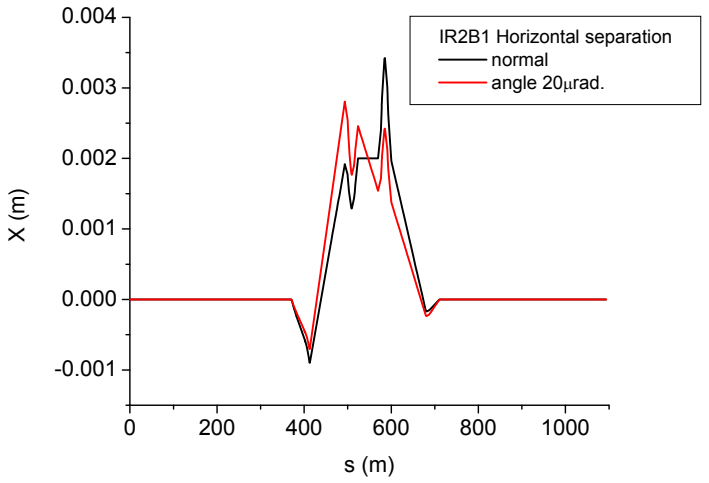
	VSSL.2L2/8.A.B2	VSSL.1R2/8.B.B2
IR2B1	6.49→6.76 (D)	6.45→6.72 (F)
IR2B2	6.47→6.74 (F)	6.49→6.77 (D)
IR8B1	6.41→6.68 (D)	6.52→6.80 (F)
IR8B2	6.46→6.74 (F)	6.33→6.60 (D)

* 2 mm (half) parallel separation, 170 μrad crossing

Improve crossing scheme (1)

- "Shift" and "Angle", ~0.5 mm and 10~20 μrad
  - "Shift"(John and Thys) — "Angle"





  - Shift+Angle improve aperture, dN1~ 0.4~0.5 (Next slide)

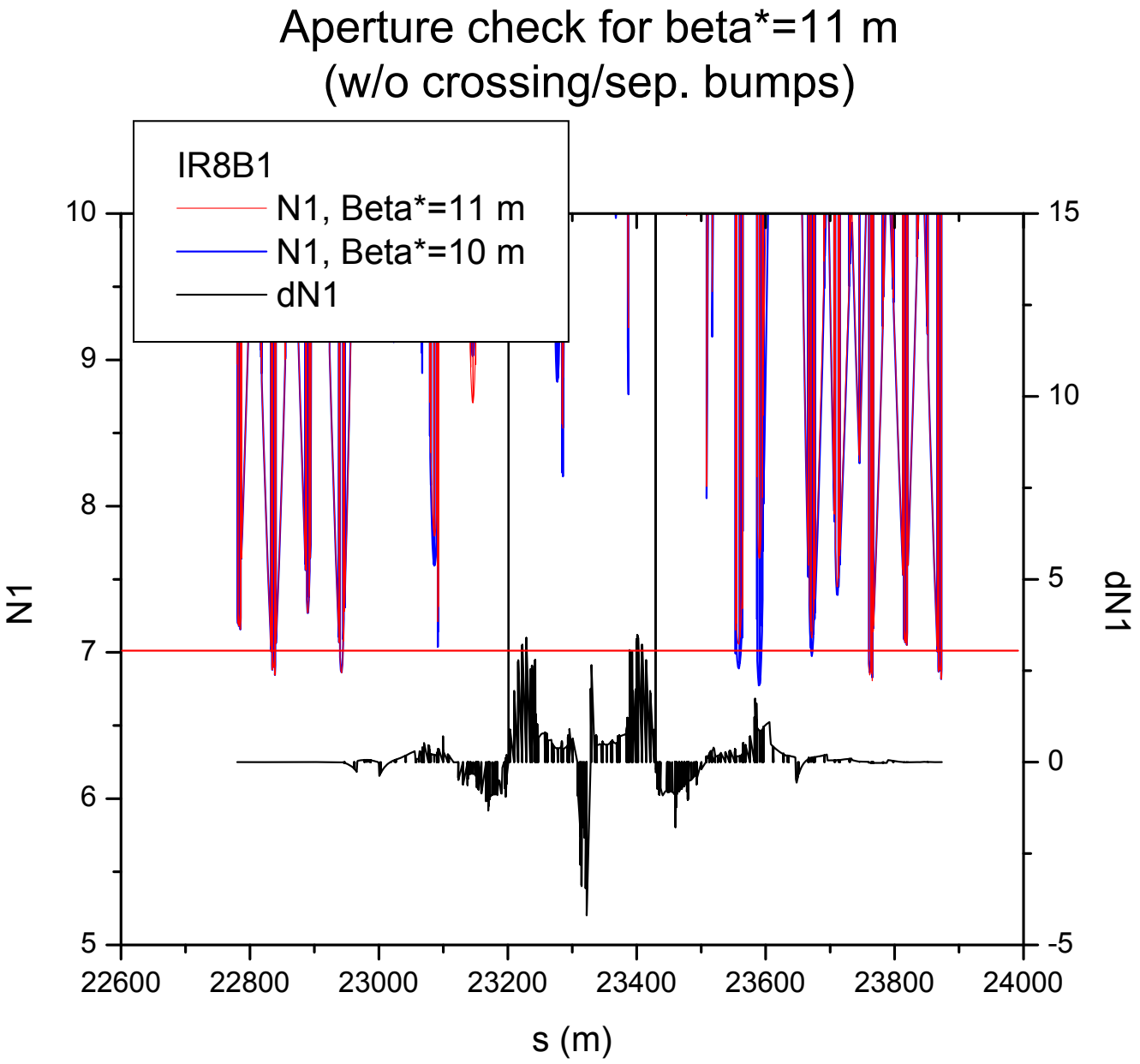
Improve crossing scheme (2)

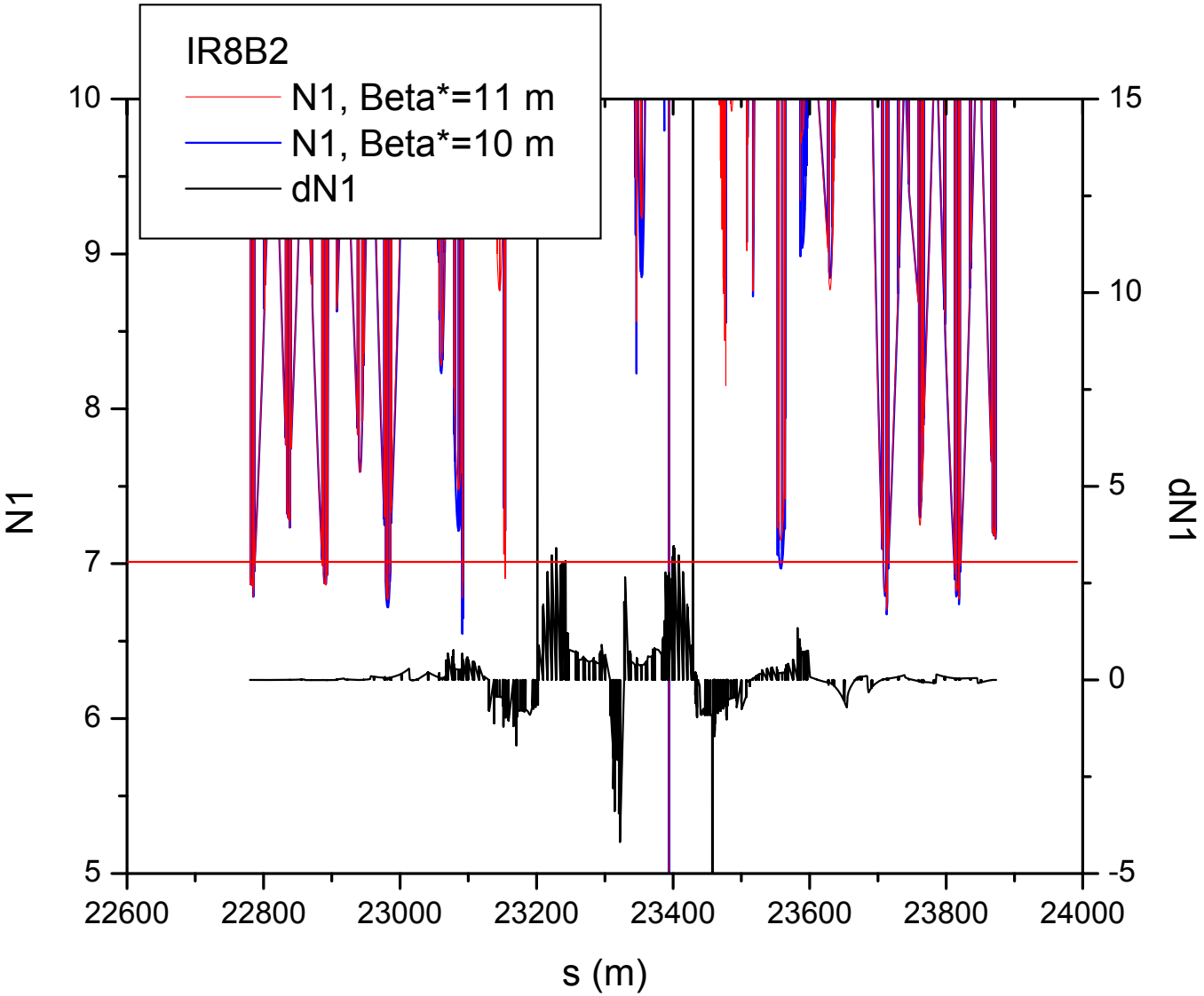
	VSSL.2L2/8.A.B2	VSSL.1R2/8.B.B2	
IR2B1	6.49→6.78 (D)	6.45→6.96 (F)	(20 μrad. / 0.5 mm)
IR2B2	6.49→6.92 (F)	6.49→6.78 (D)	(20 μrad. / 0.5 mm)
IR8B1	6.41→6.79 (D)	6.52→7.00 (F)	(15 μrad. / 0.7 mm)
IR8B2	6.46→6.92 (F)	6.33→6.72 (D)	(15 μrad. / 0.7 mm)

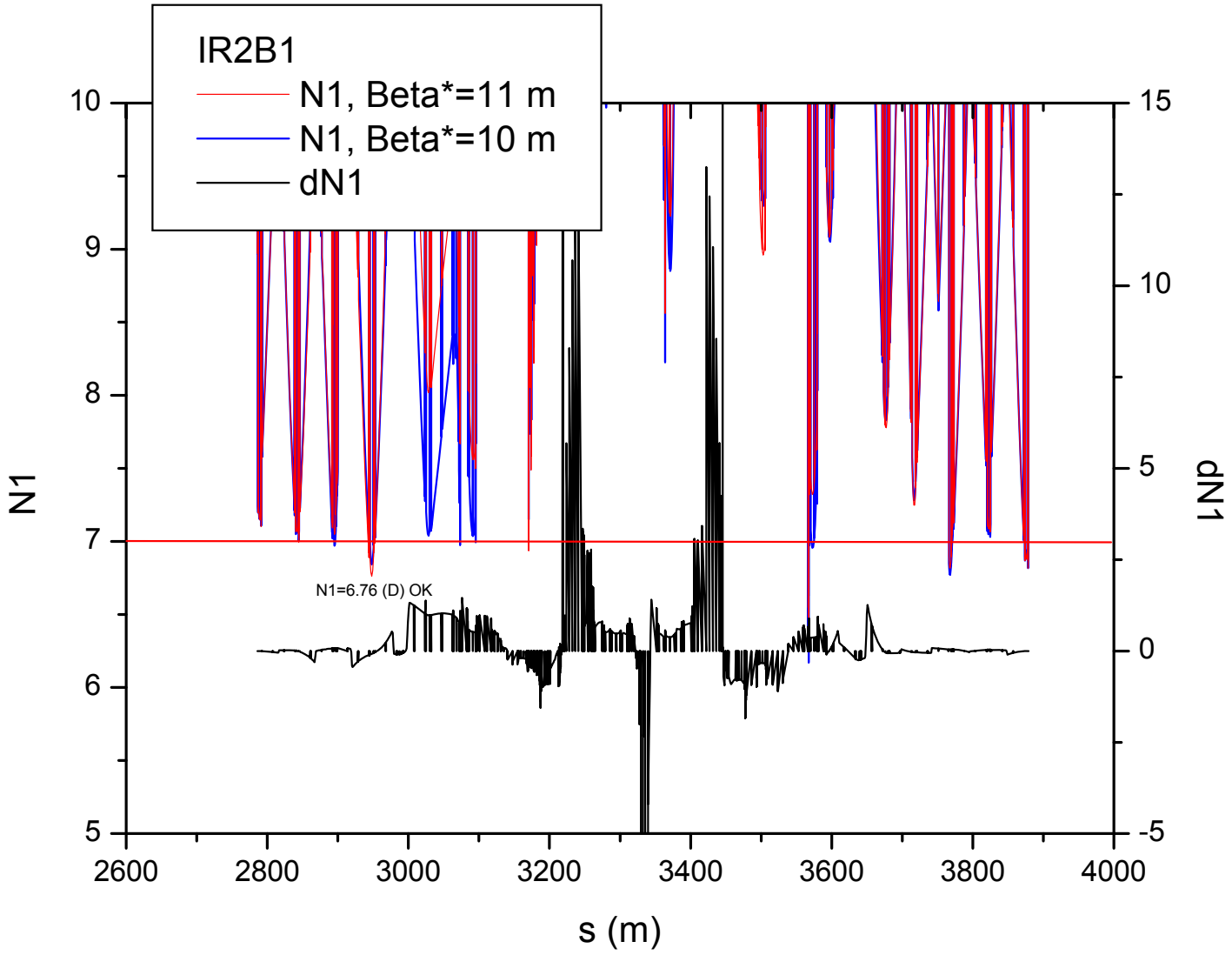
Summary

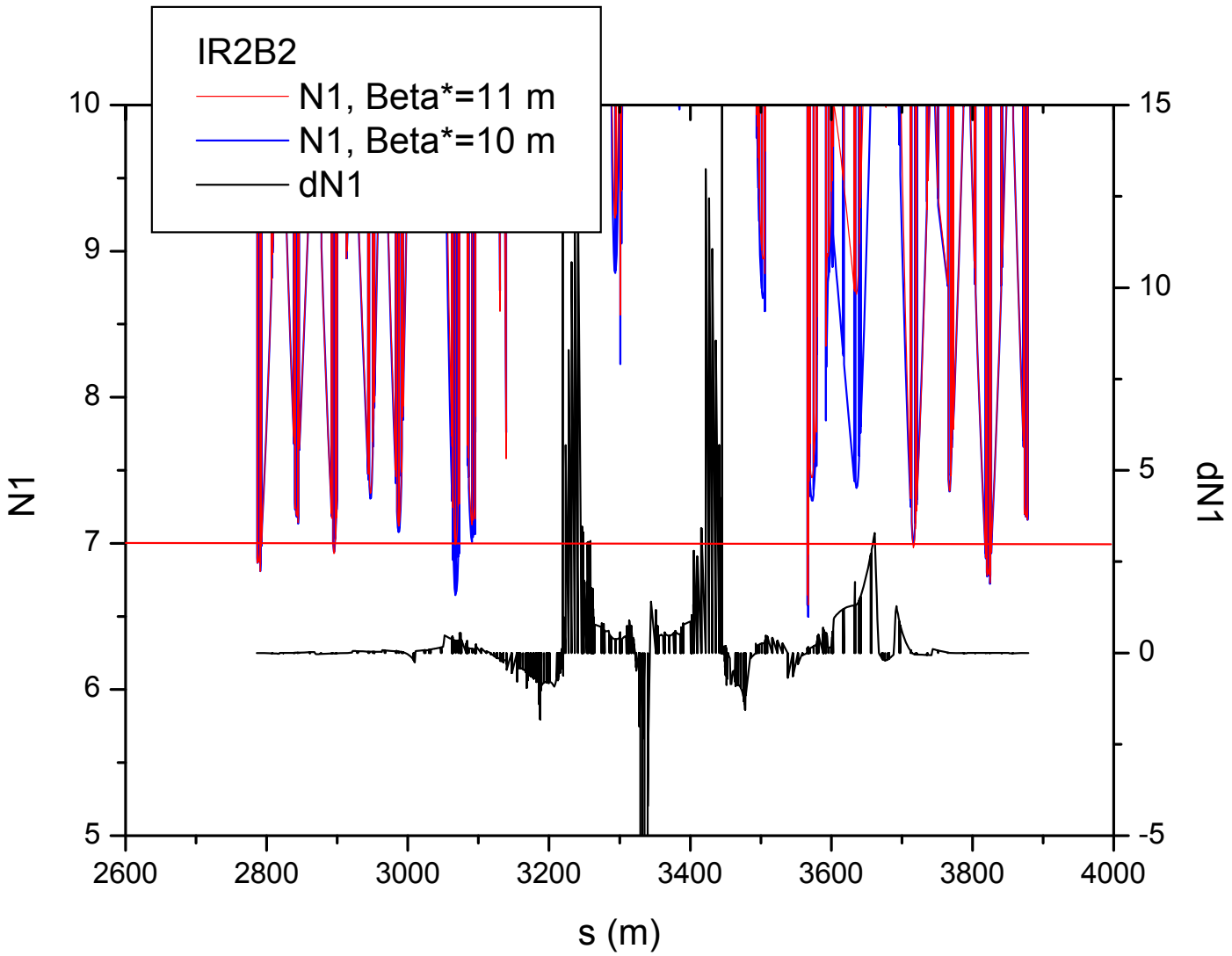
- Aperture in IR2/8 injection optics at MCBX (and Vacuum marker)
  - Could be improved with beta*=11 m
  - Could be fixed with new crossing/separation scheme
  - Could be maximized with both

	VSSL.2L8.A.B1	VSSL.1R8.B.B1
IR8B1	6.41→6.88 (D)	6.52→7.29 (F)

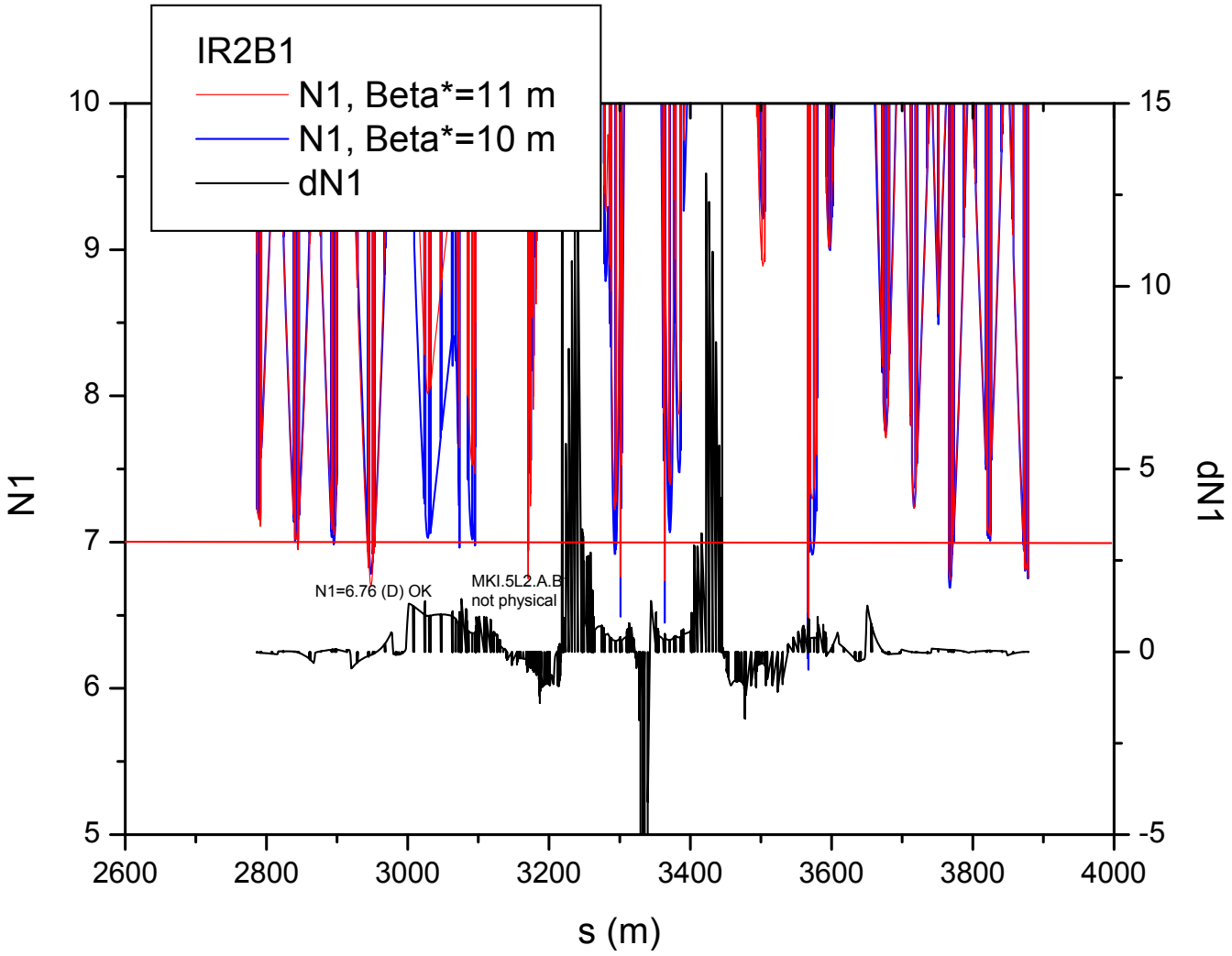

Aperture check for beta*=11 m
(w/o crossing/sep. bumps)
IR8B1
N1, Beta*=11 m
N1, Beta*=10 m
dN1
N1
dN1
s (m)
10
9
8
7
6
5
15
10
5
0
-5
22600
22800
23000
23200
23400
23600
23800
24000

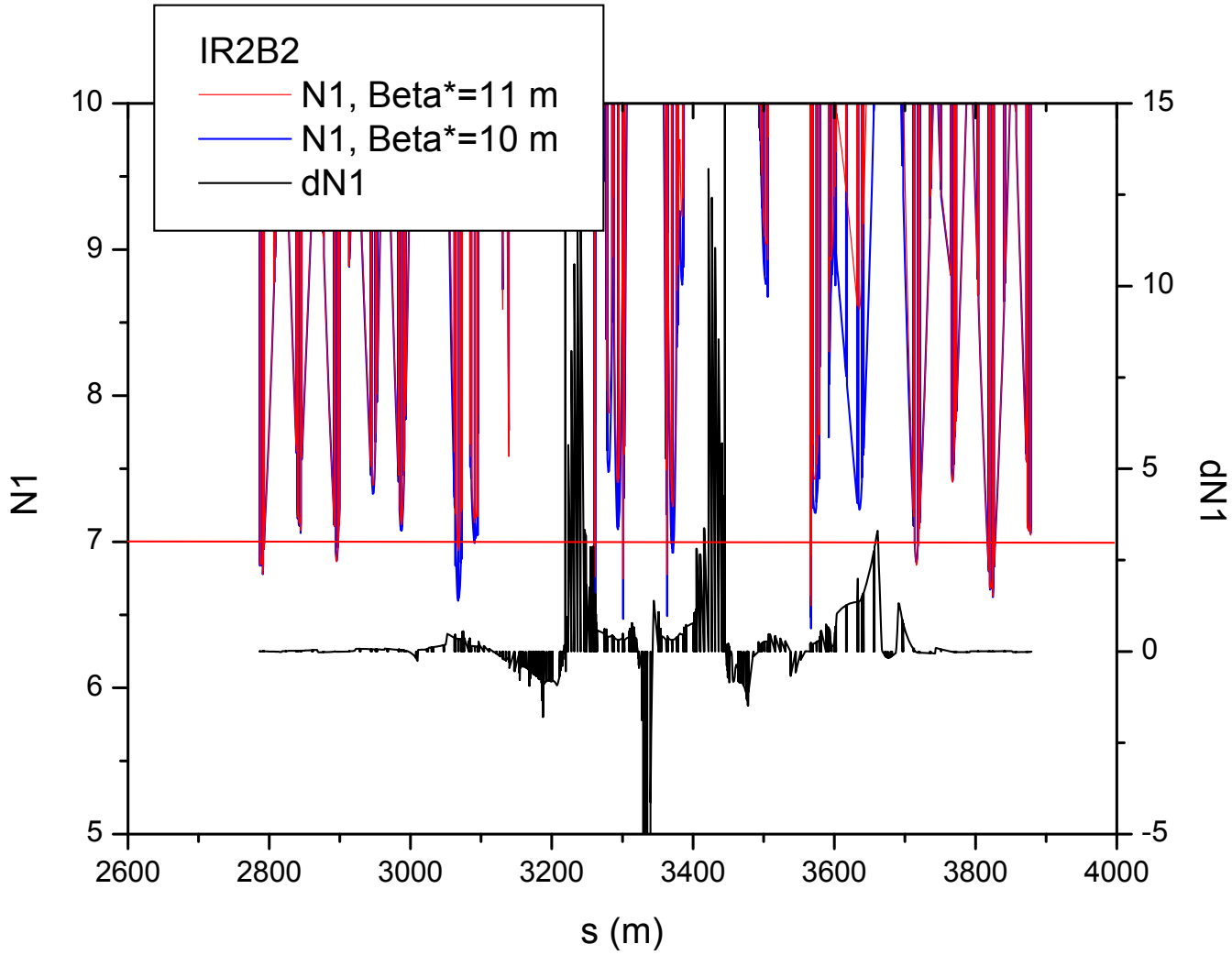

IR8B2
N1, Beta*=11 m
N1, Beta*=10 m
dN1
N1
dN1
s (m)
10
9
8
7
6
5
15
10
5
0
-5
22600
22800
23000
23200
23400
23600
23800
24000

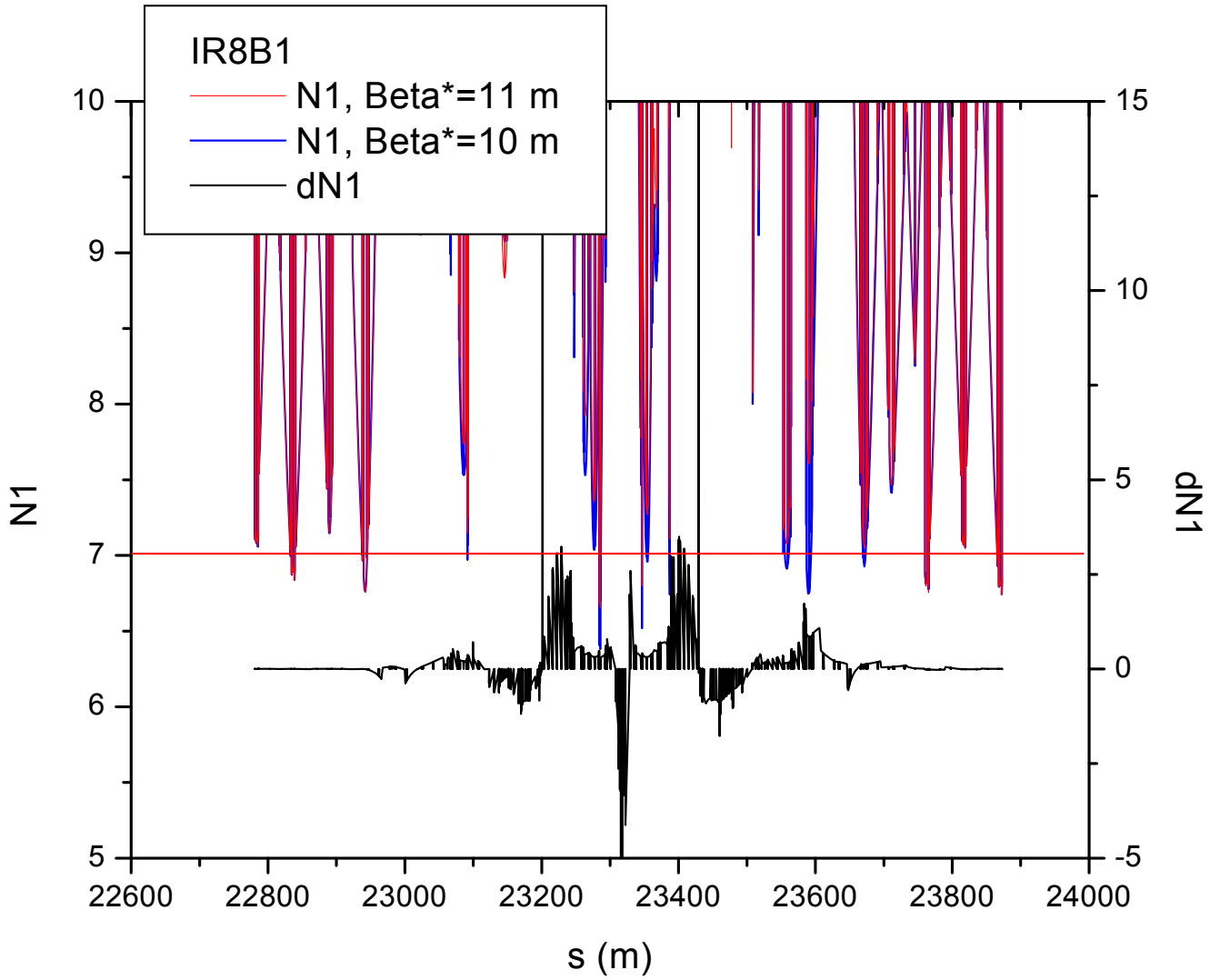

IR2B1
N1, Beta*=11 m
N1, Beta*=10 m
dN1
N1=6.76 (D) OK
N1
dN1
s (m)
10
9
8
7
6
5
15
10
5
0
-5
2600
2800
3000
3200
3400
3600
3800
4000

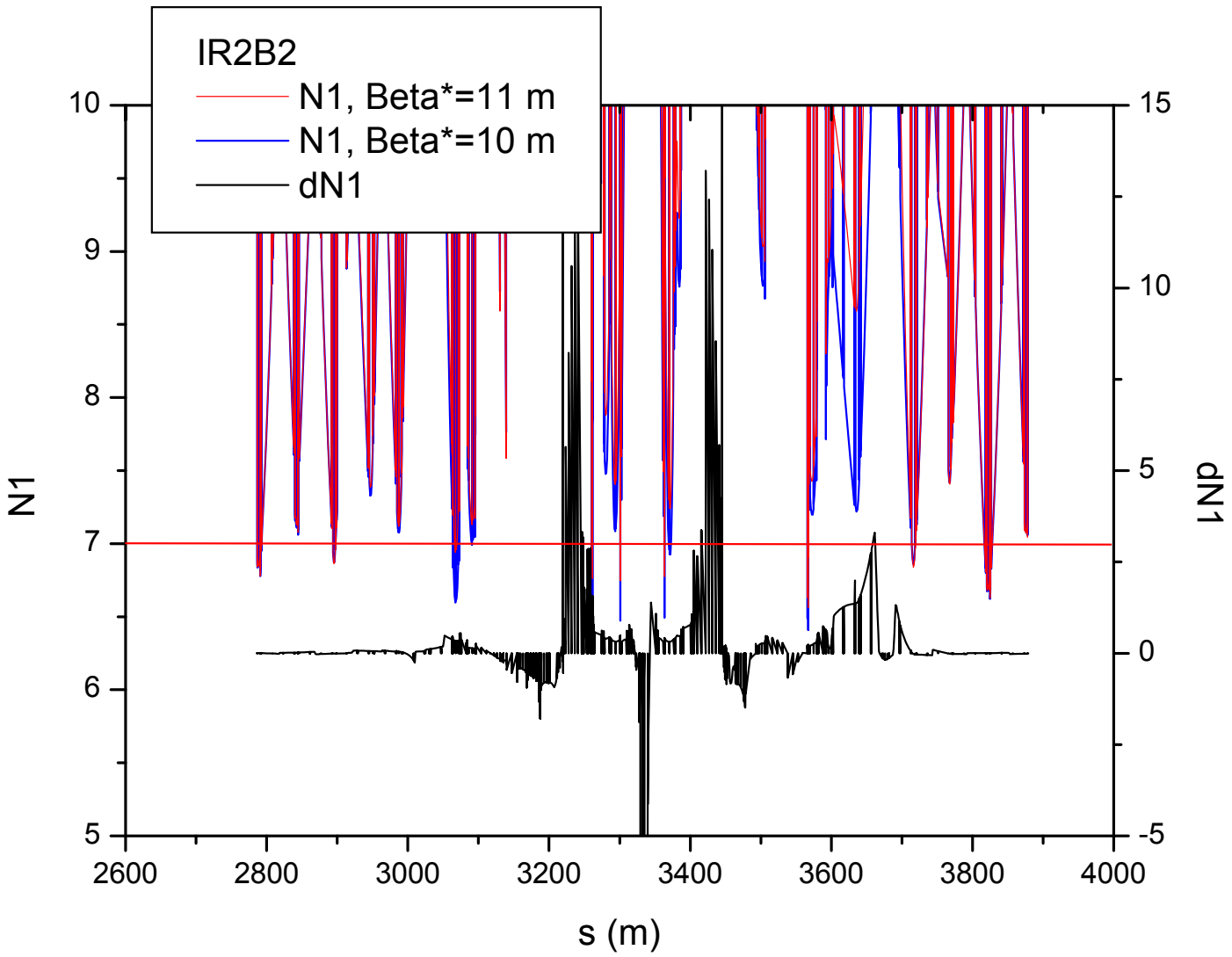

IR2B2
N1, Beta*=11 m
N1, Beta*=10 m
dN1
N1
dN1
s (m)
10
9
8
7
6
5
15
10
5
0
-5
2600
2800
3000
3200
3400
3600
3800
4000

Aperture check for beta*=11 m
(with normal crossing/sep. bumps in IR1/2/5/8)




IR2B2
N1, Beta*=11 m
N1, Beta*=10 m
dN1
N1
dN1
s (m)
10
9
8
7
6
5
15
10
5
0
-5
2600
2800
3000
3200
3400
3600
3800
4000


IR8B1
N1, Beta*=11 m
N1, Beta*=10 m
dN1
N1
dN1
s (m)
10
9
8
7
6
5
15
10
5
0
-5
22600
22800
23000
23200
23400
23600
23800
24000


IR2B2
N1, Beta*=11 m
N1, Beta*=10 m
dN1
N1
dN1
s (m)
10
9
8
7
6
5
15
10
5
0
-5
2600
2800
3000
3200
3400
3600
3800
4000