Setting up the AEC on a GE LightSpeed 16 CT scanner

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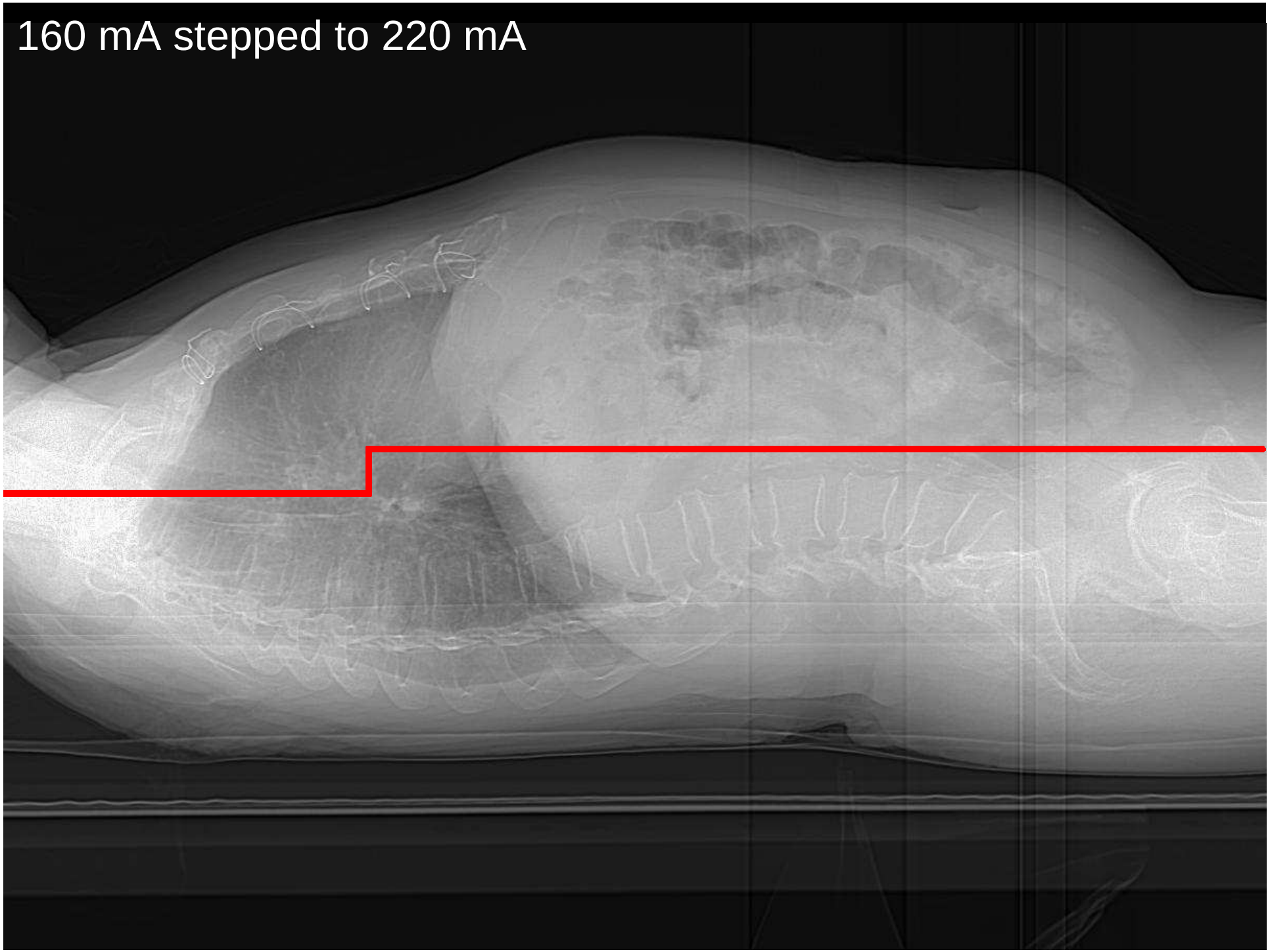
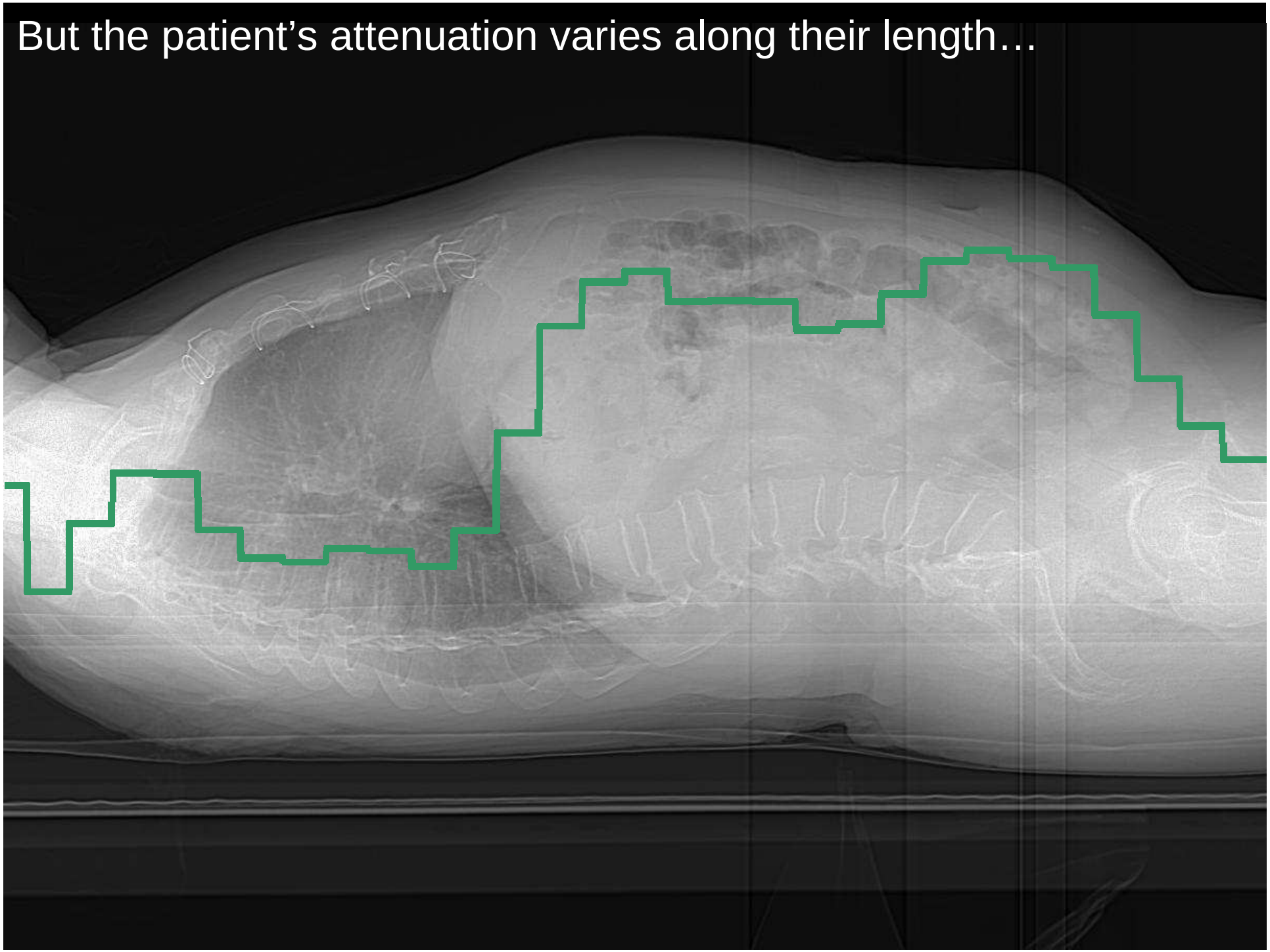
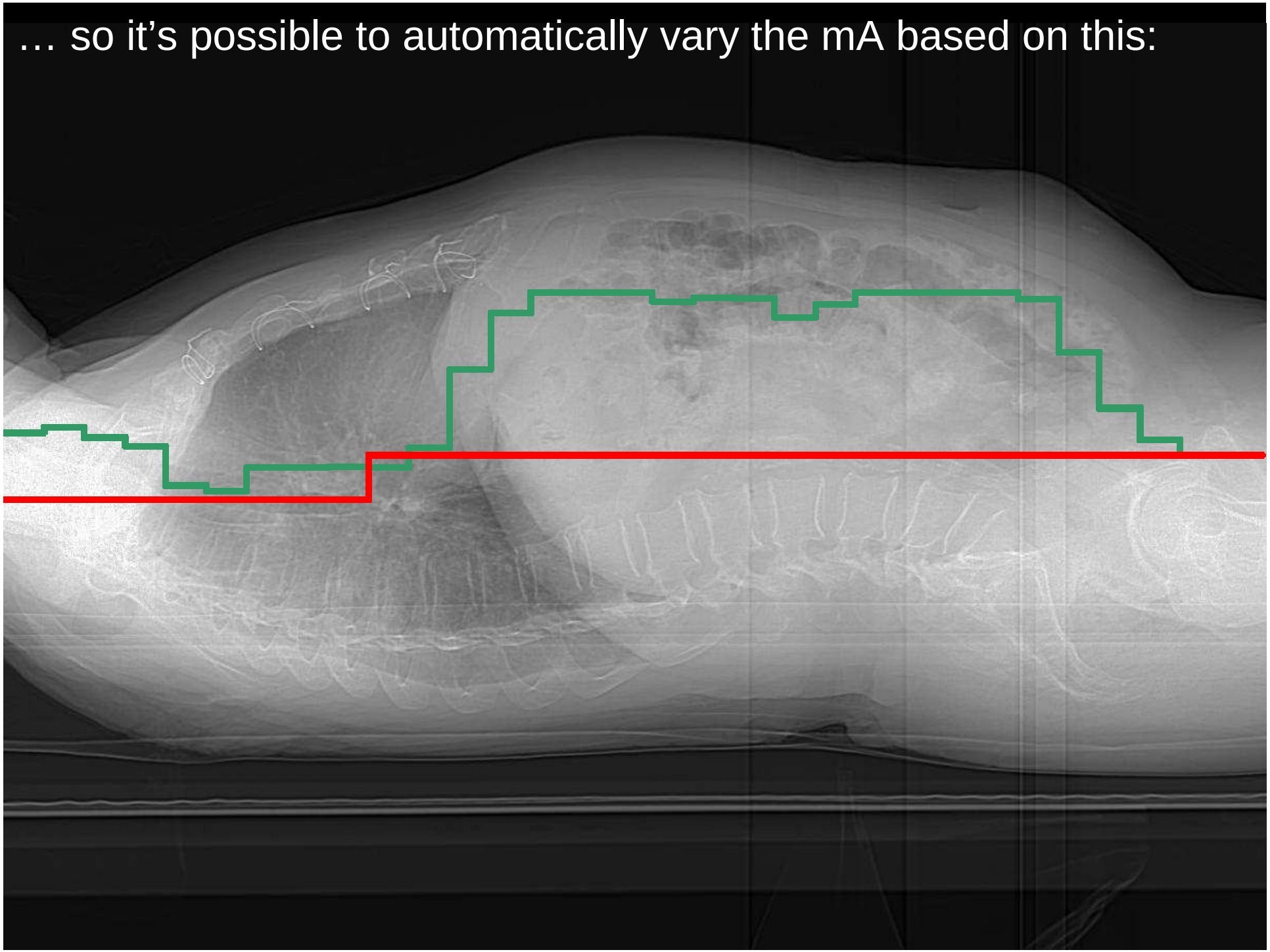
“Traditional” CT

- Scan along the patient using a fixed mA
- Often use different mA settings depending on anatomical region
  - Lower mA for chest
  - Higher mA for abdomen


160 mA stepped to 220 mA

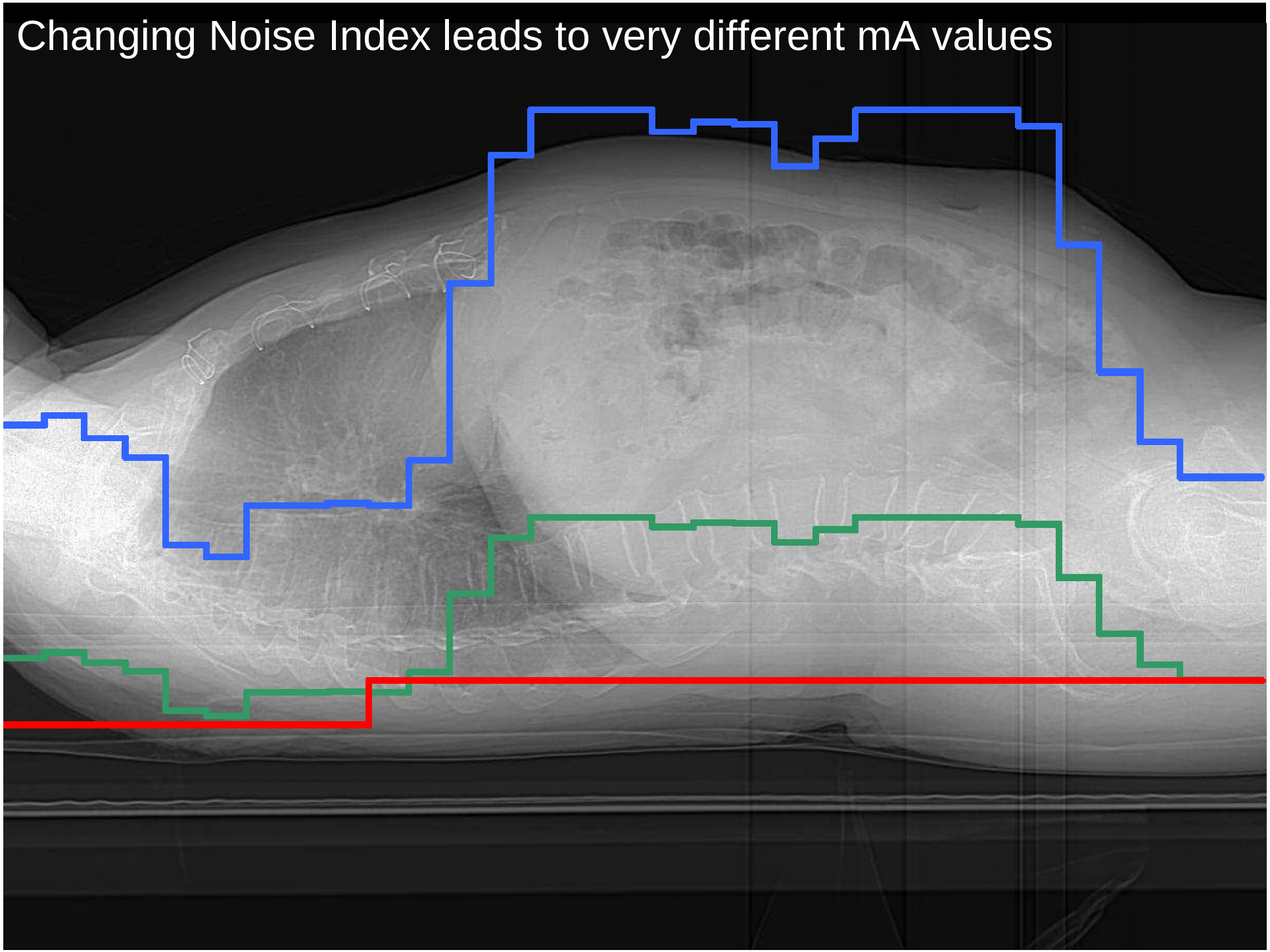

But the patient’s attenuation varies along their length…

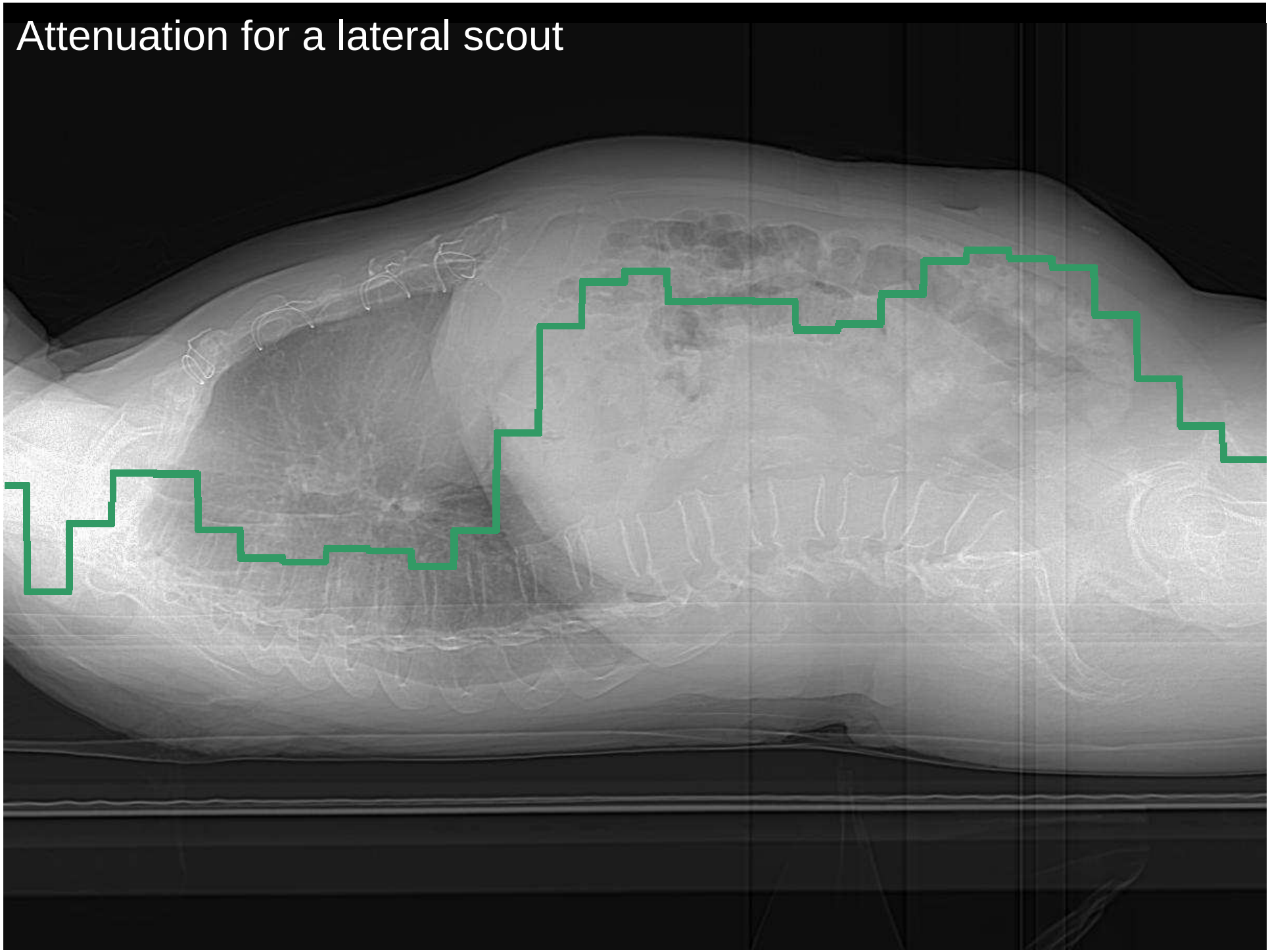
… so it’s possible to automatically vary the mA based on this:



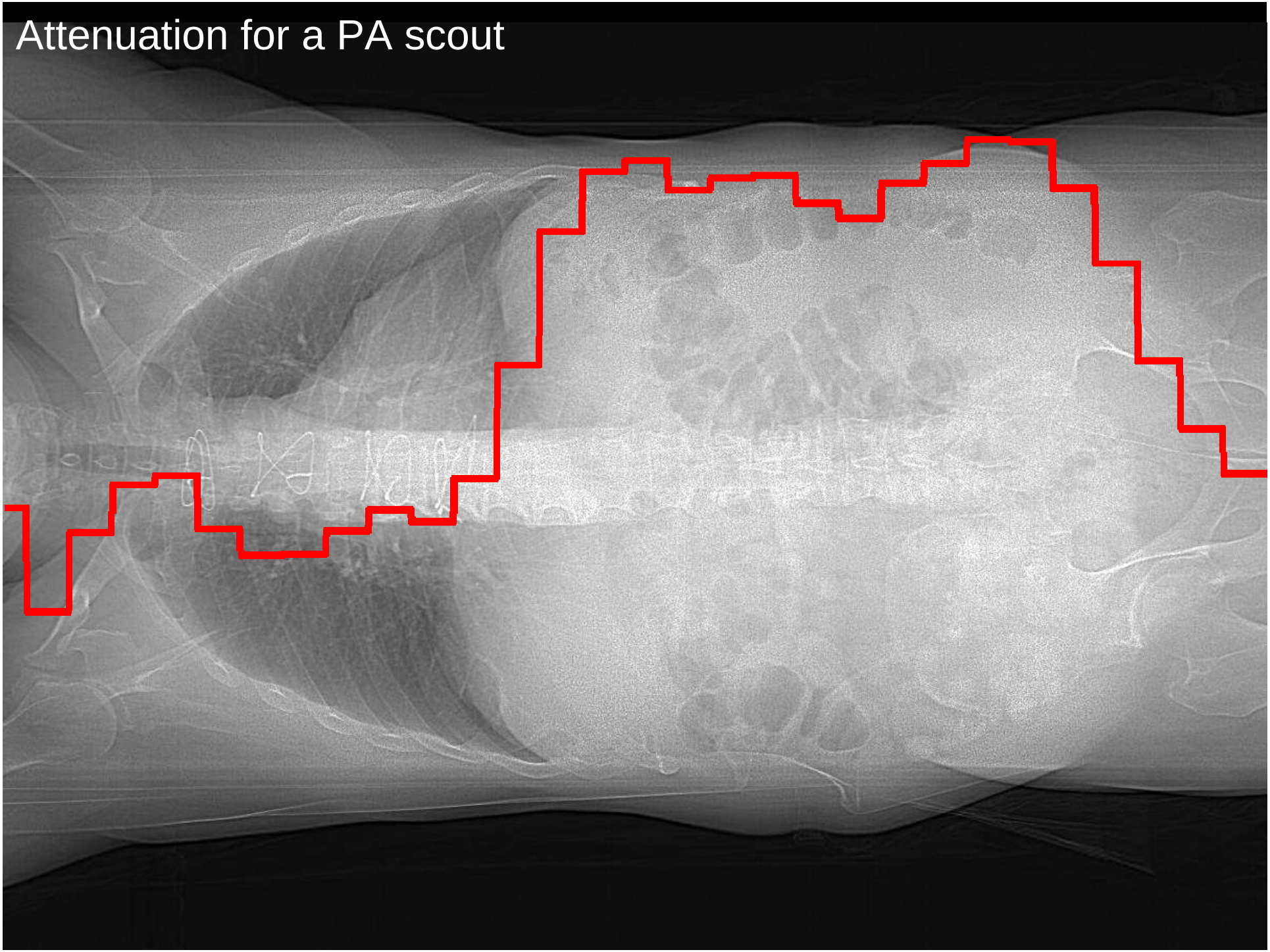
CT automatic exposure control

- GE’s Auto mA system uses a scout view and a “Noise Index” to determine what mA to use for each rotation
- The choice of Noise Index (NI) is important as it determines the image quality of the resulting images (and the radiation dose)
- The aim is that each image in the scan will have the same image quality, and also the image quality for large and small patients will be the same

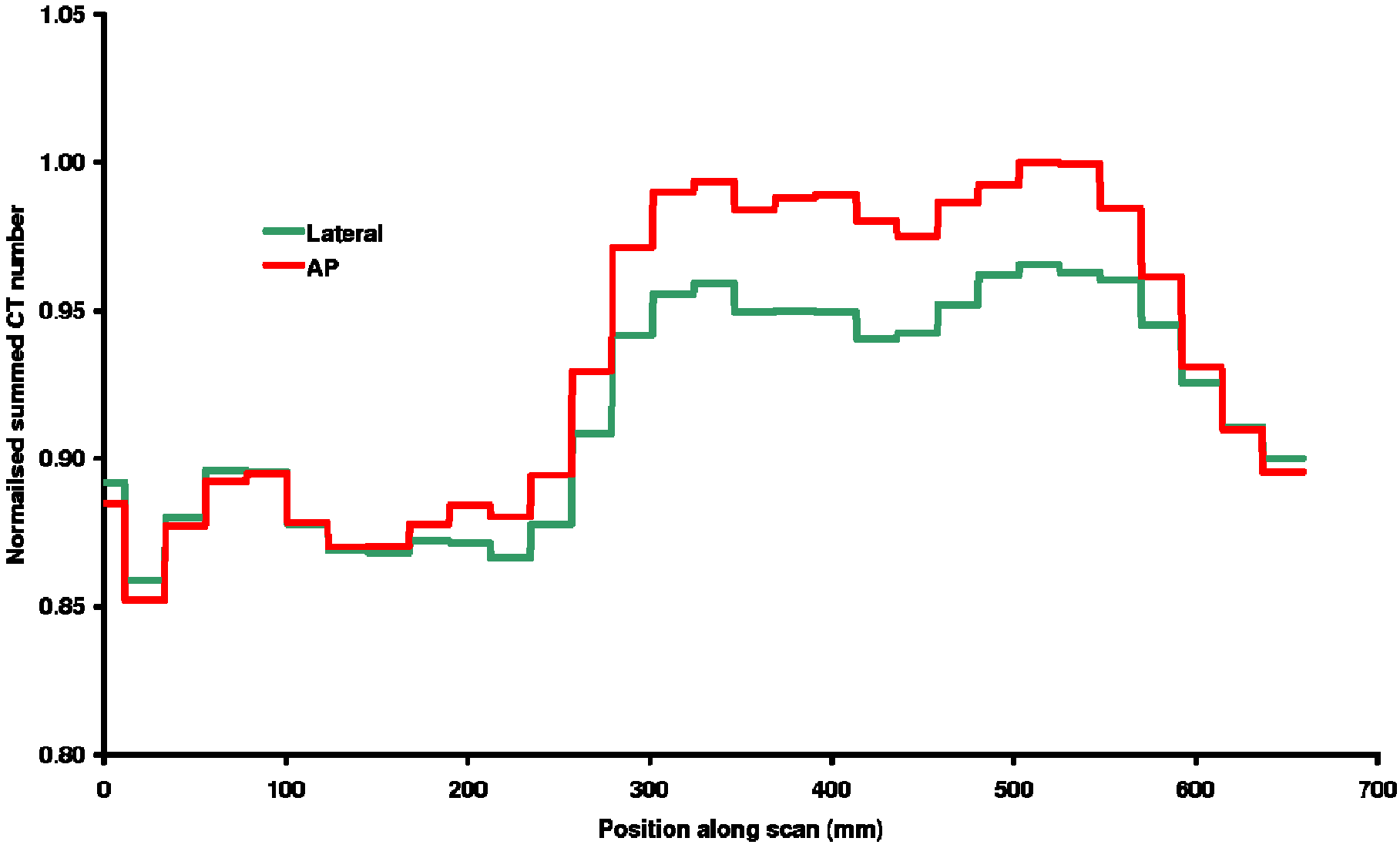

Changing Noise Index leads to very different mA values


Attenuation for a lateral scout

Attenuation for a PA scout

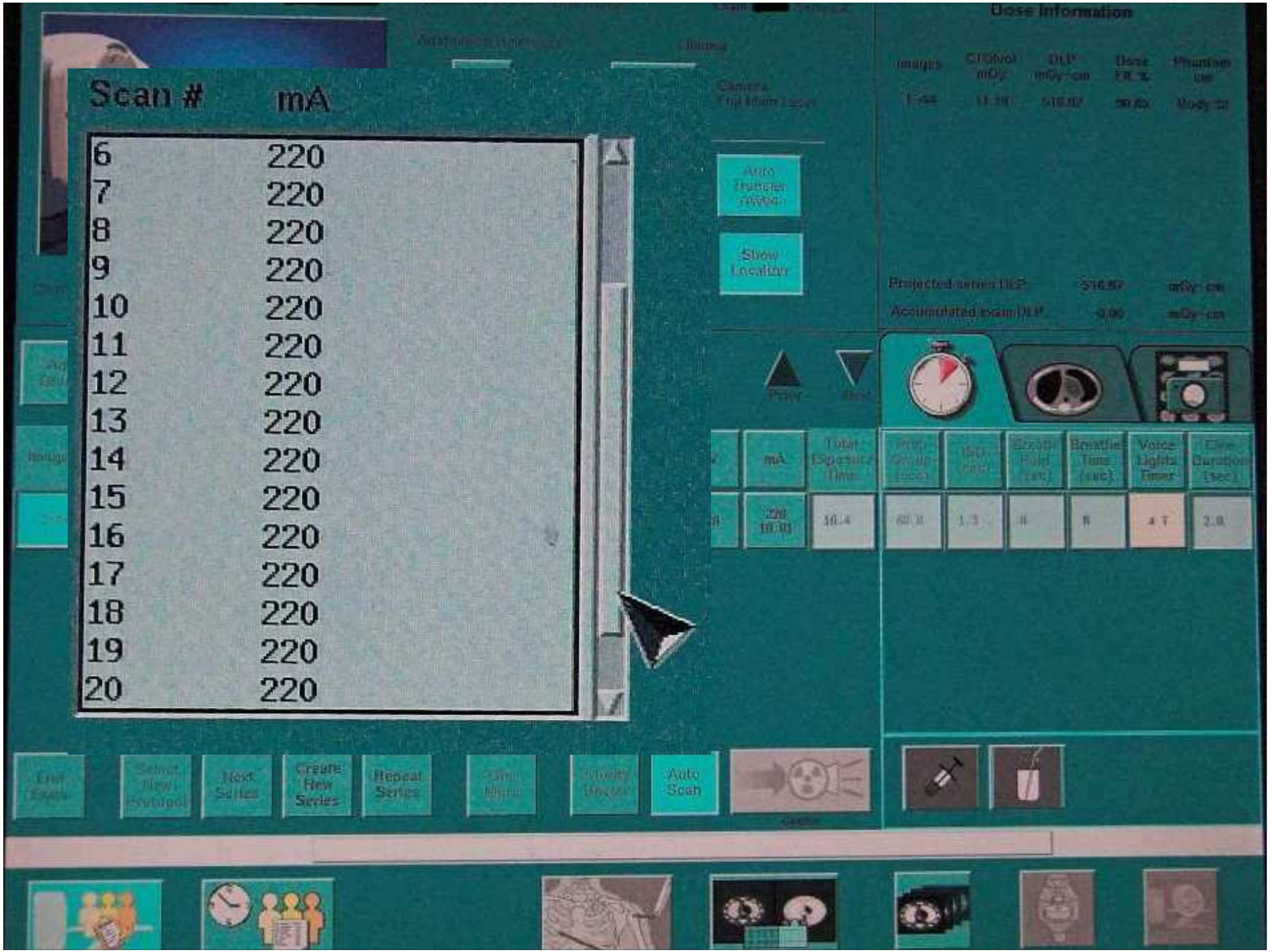


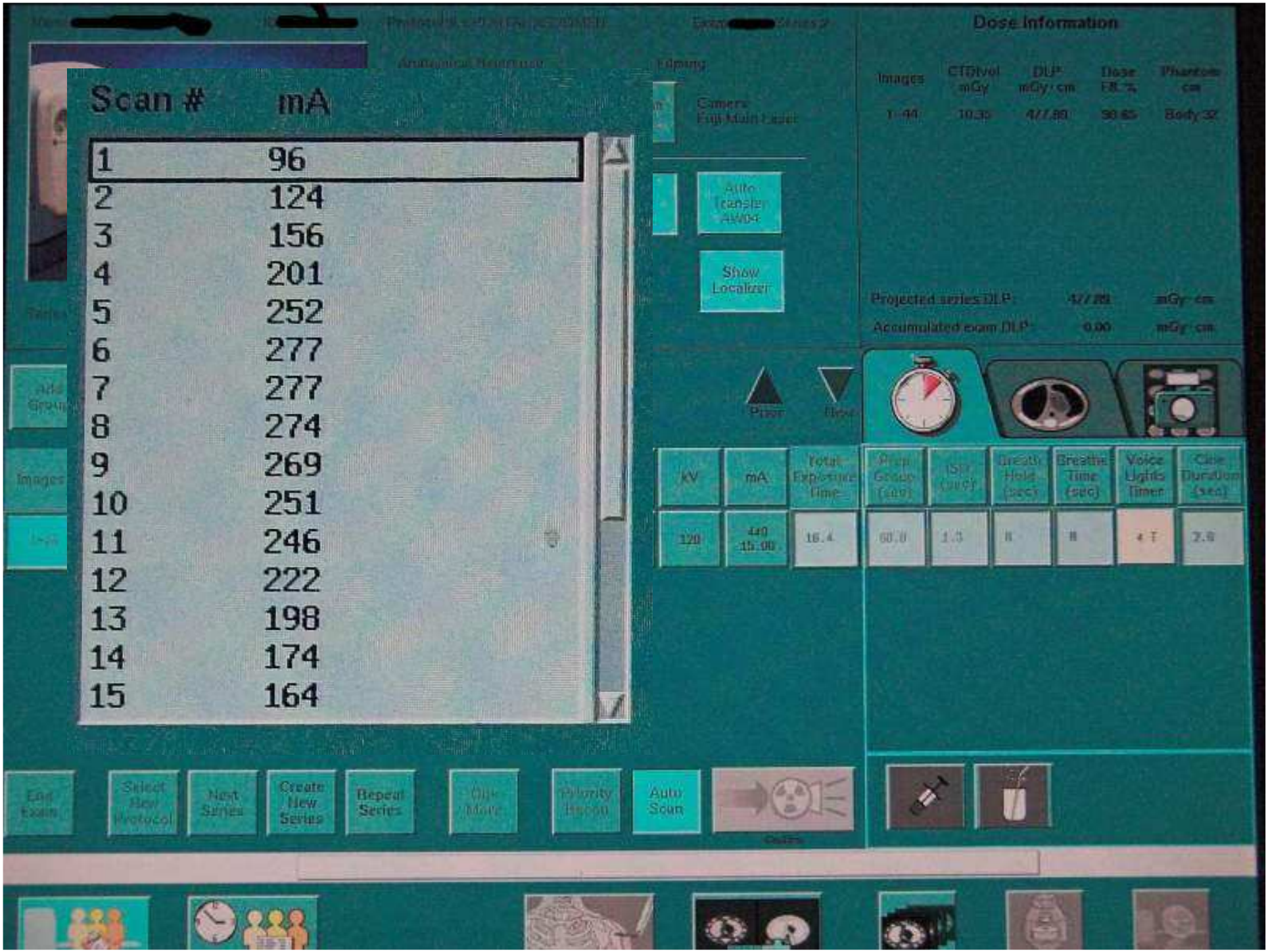
Attenuation from the two scouts is different



mA for changing Noise Index

- Perform a scout view on a patient
- Look at the mA table
  - Write down the values
- Change the AEC settings
  - Noise Index, max and min mA
- Look at the mA table again
  - Write down the values
- Repeat for Noise Index values you're interested in


Scan # mA
6 220
7 220
8 220
9 220
10 220
11 220
12 220
13 220
14 220
15 220
16 220
17 220
18 220
19 220
20 220
Dose Information
Auto Tolerance
Show Location
Prior
Next
mA
Total Exposure Time
Breath Hold (sec)
Breathe Tone (sec)
Voice Lights Timer
Cine Duration (sec)
Next Series
Create New Series
Repeat Series
Auto Scan


Scan # mA
1 96
2 124
3 156
4 201
5 252
6 277
7 277
8 274
9 269
10 251
11 246
12 222
13 198
14 174
15 164
Dose Information
Images
Show Localizer
Projected series DLP
Accumulated exam DLP
kV
mA
Total Exposure Time
Voice Lights Timer
End Exam
Select New Protocol
Next Series
Create New Series
Repeat Series
Auto Scan

Patient 1

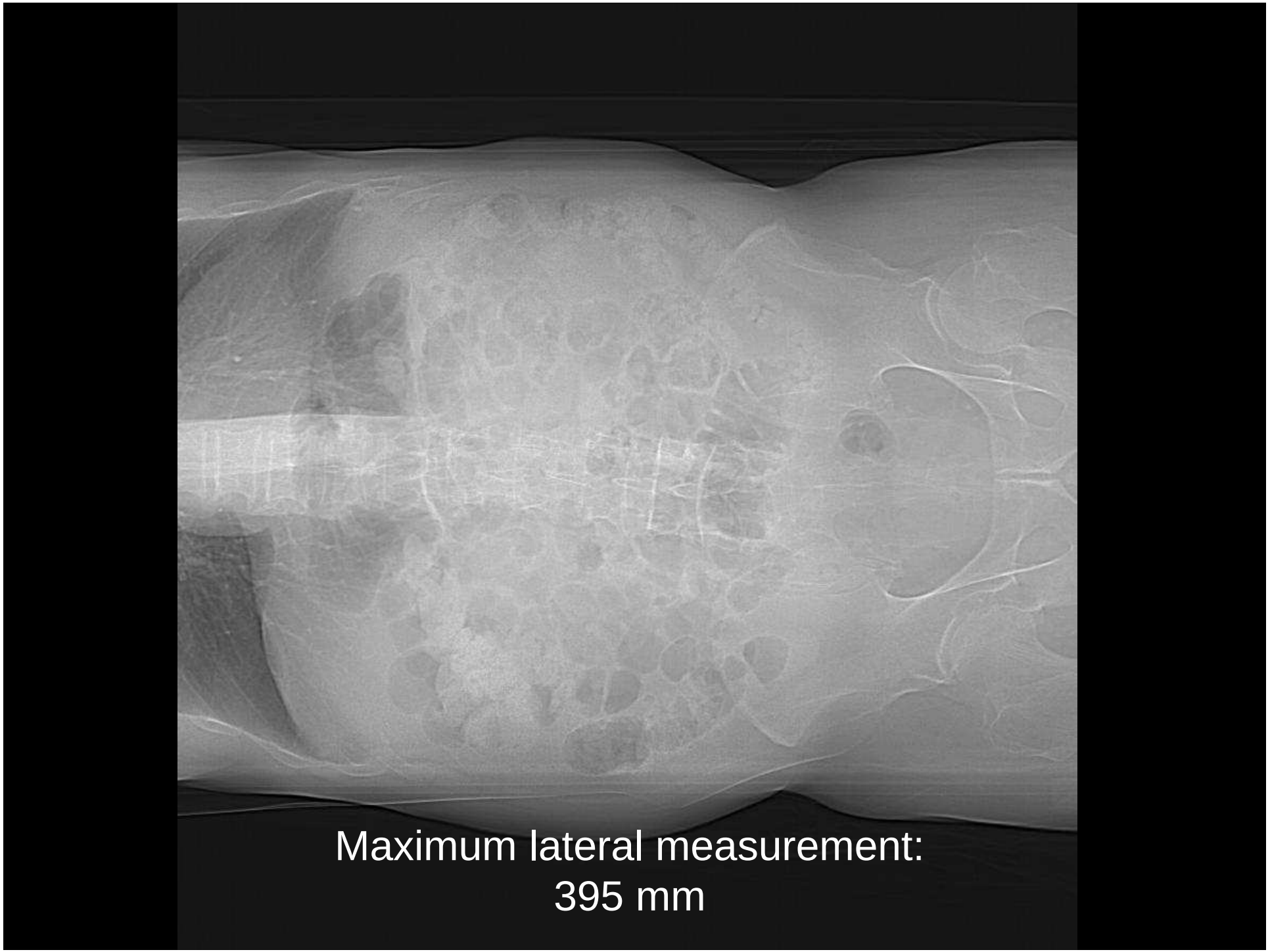
Portal abdomen

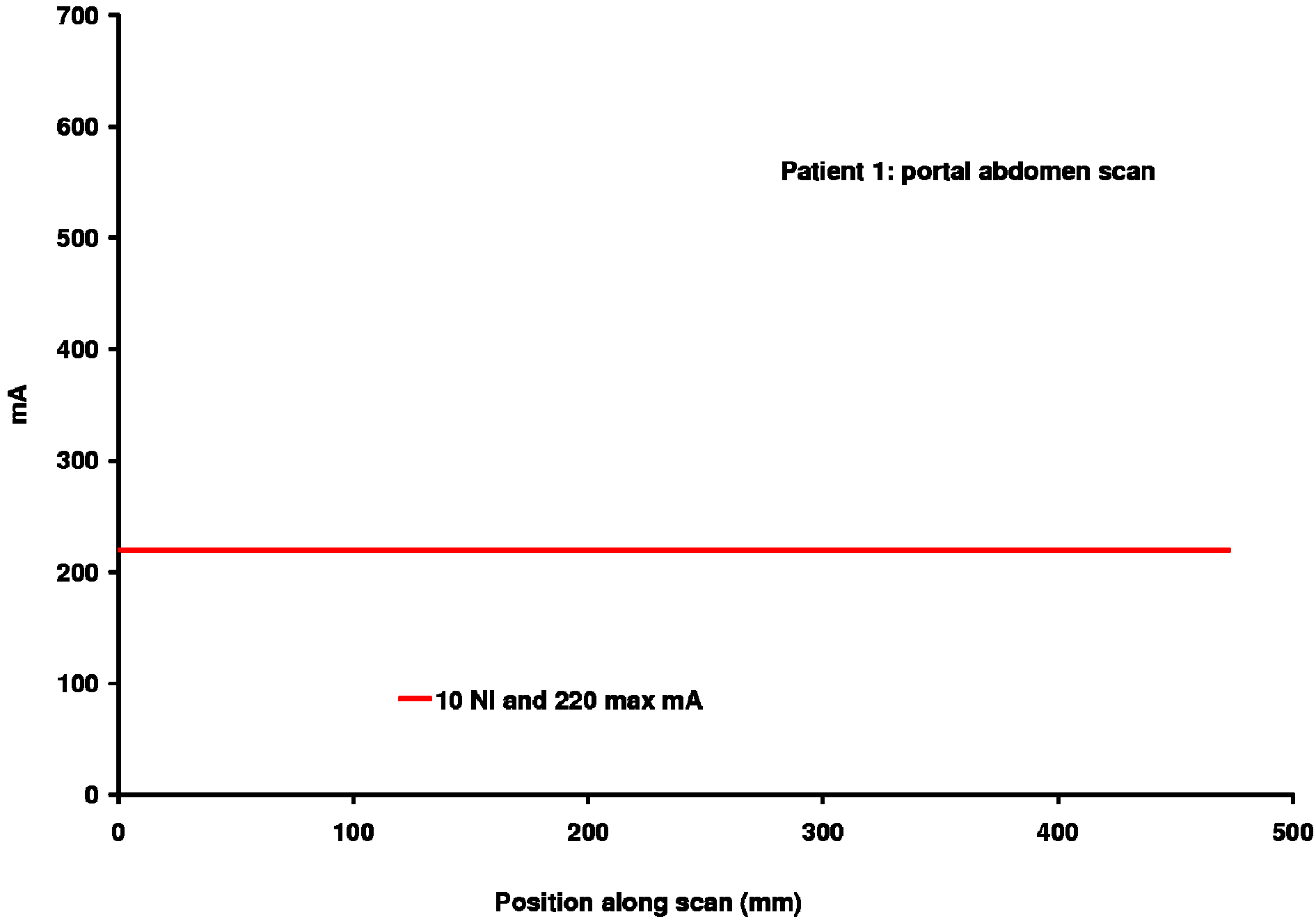
Smart mA used by default

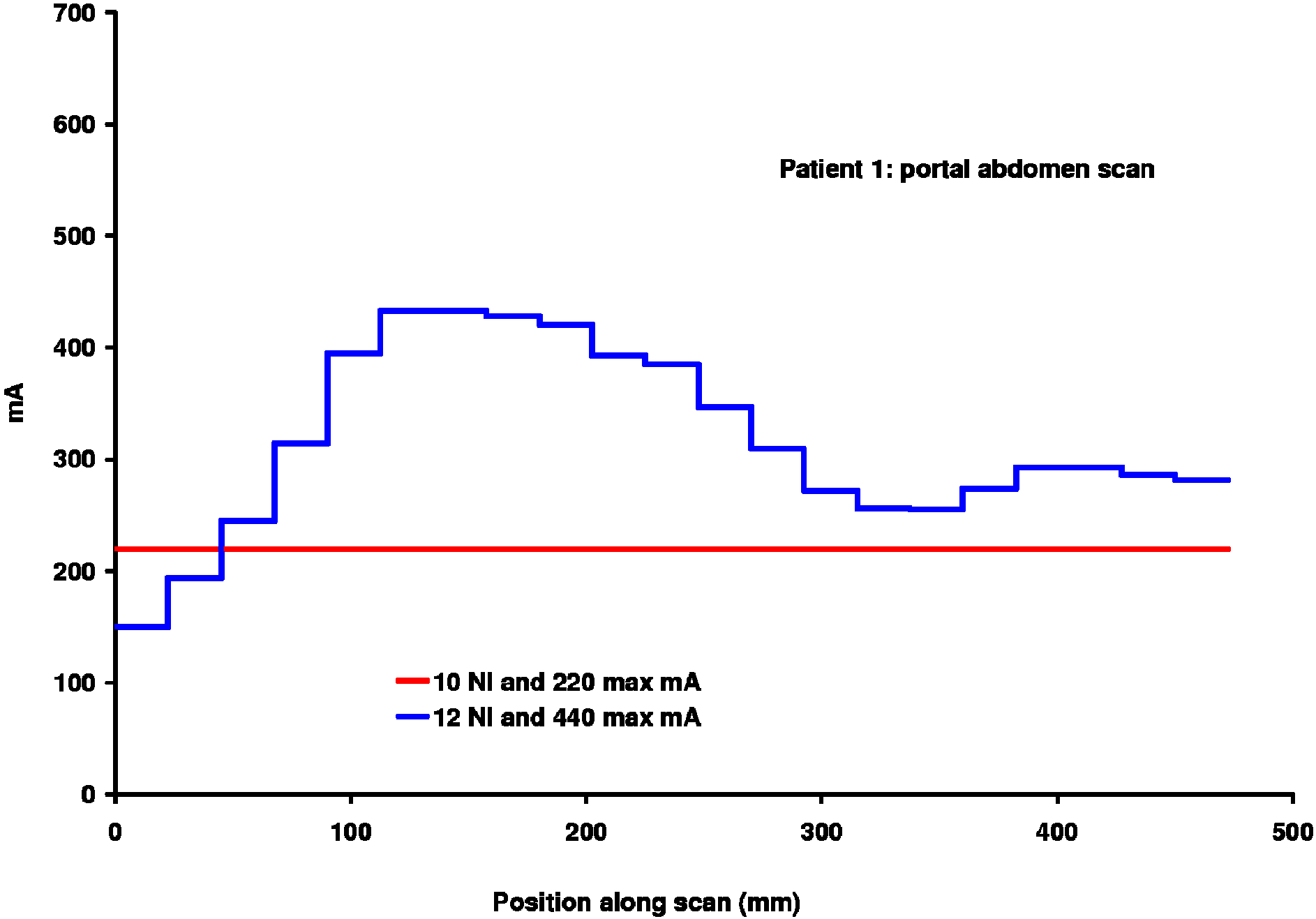
Noise Index of 10

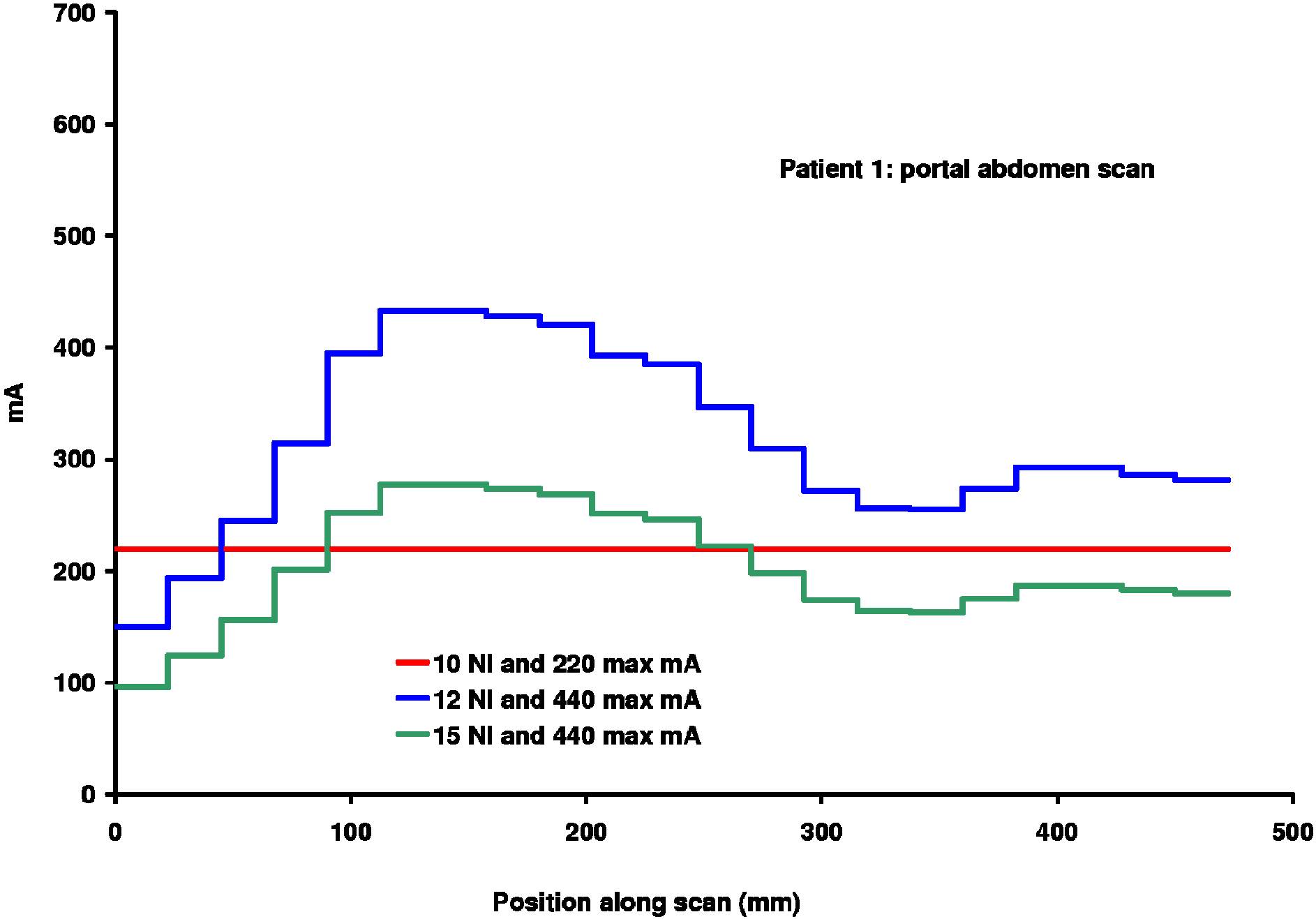
Max mA limit of 220

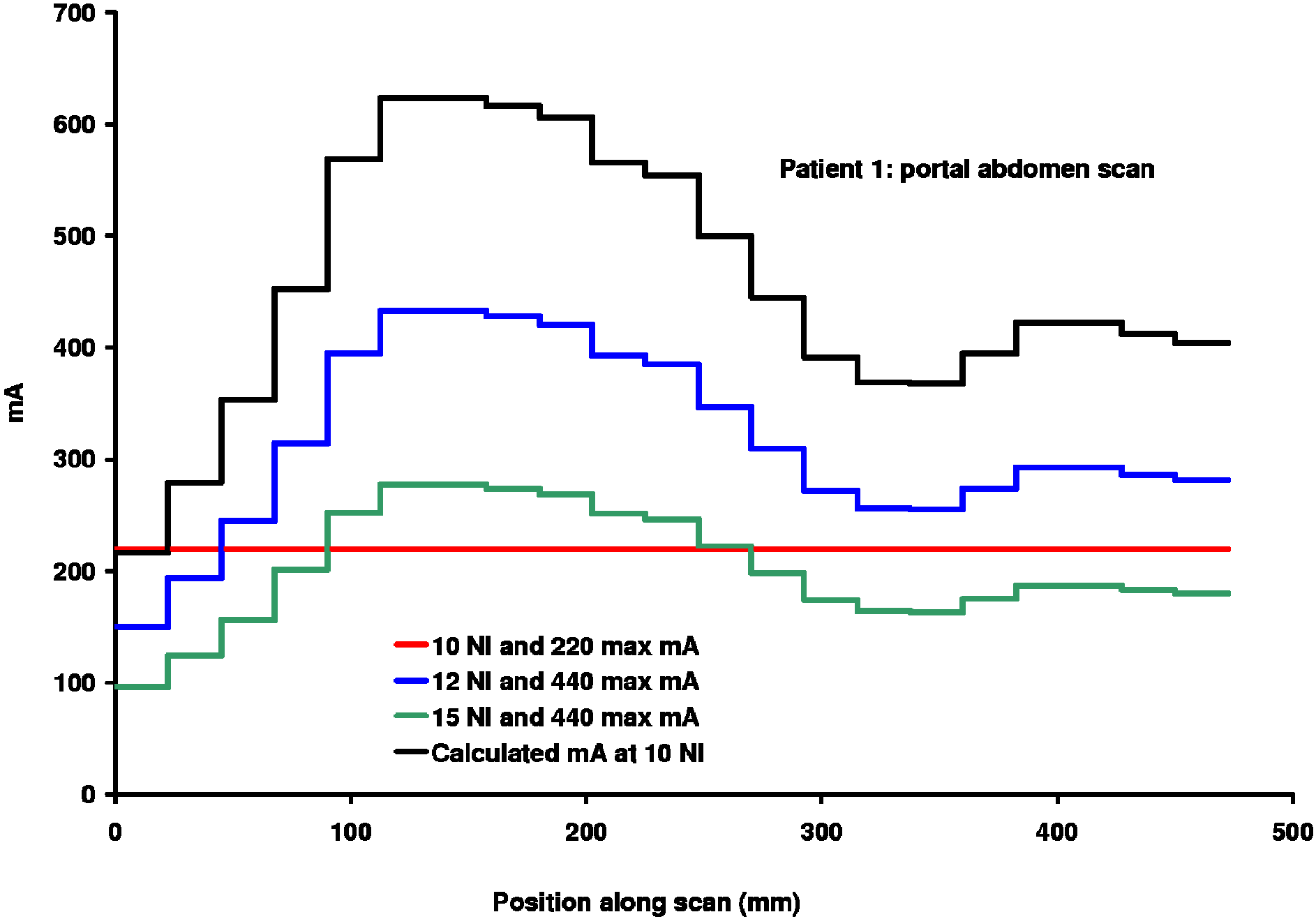

Maximum AP measurement:
320 mm


Maximum lateral measurement:
395 mm


Patient 1: portal abdomen scan
mA
700
600
500
400
300
200
100
0
0
100
200
300
400
500
Position along scan (mm)
10 NI and 220 max mA


Patient 1: portal abdomen scan
mA
700
600
500
400
300
200
100
0
0
100
200
300
400
500
Position along scan (mm)
10 NI and 220 max mA
12 NI and 440 max mA


Patient 1: portal abdomen scan
mA
700
600
500
400
300
200
100
0
0
100
200
300
400
500
Position along scan (mm)
10 NI and 220 max mA
12 NI and 440 max mA
15 NI and 440 max mA


Patient 1: portal abdomen scan
mA
Position along scan (mm)
0
100
200
300
400
500
600
700
10 NI and 220 max mA
12 NI and 440 max mA
15 NI and 440 max mA
Calculated mA at 10 NI

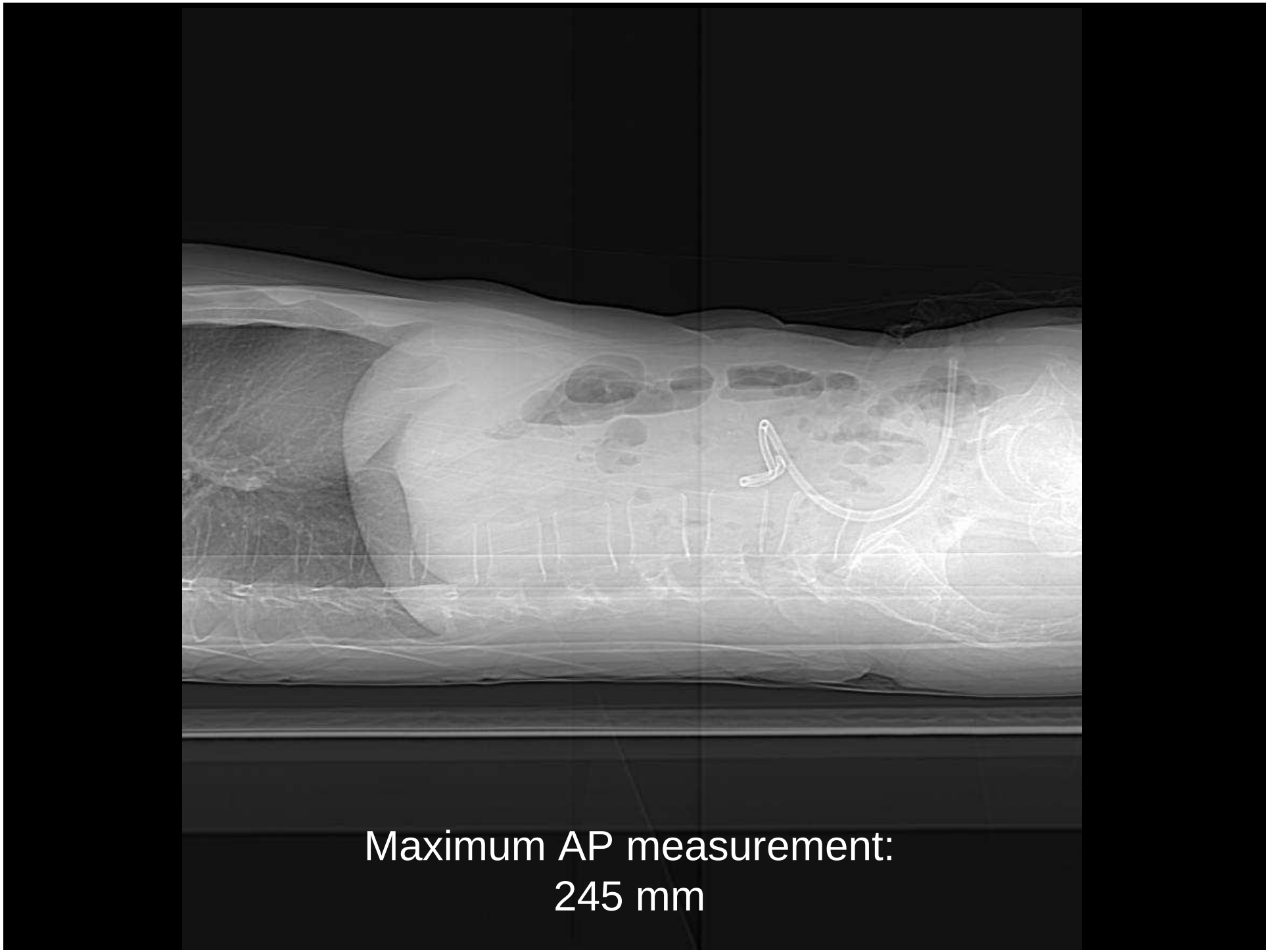
Patient 2

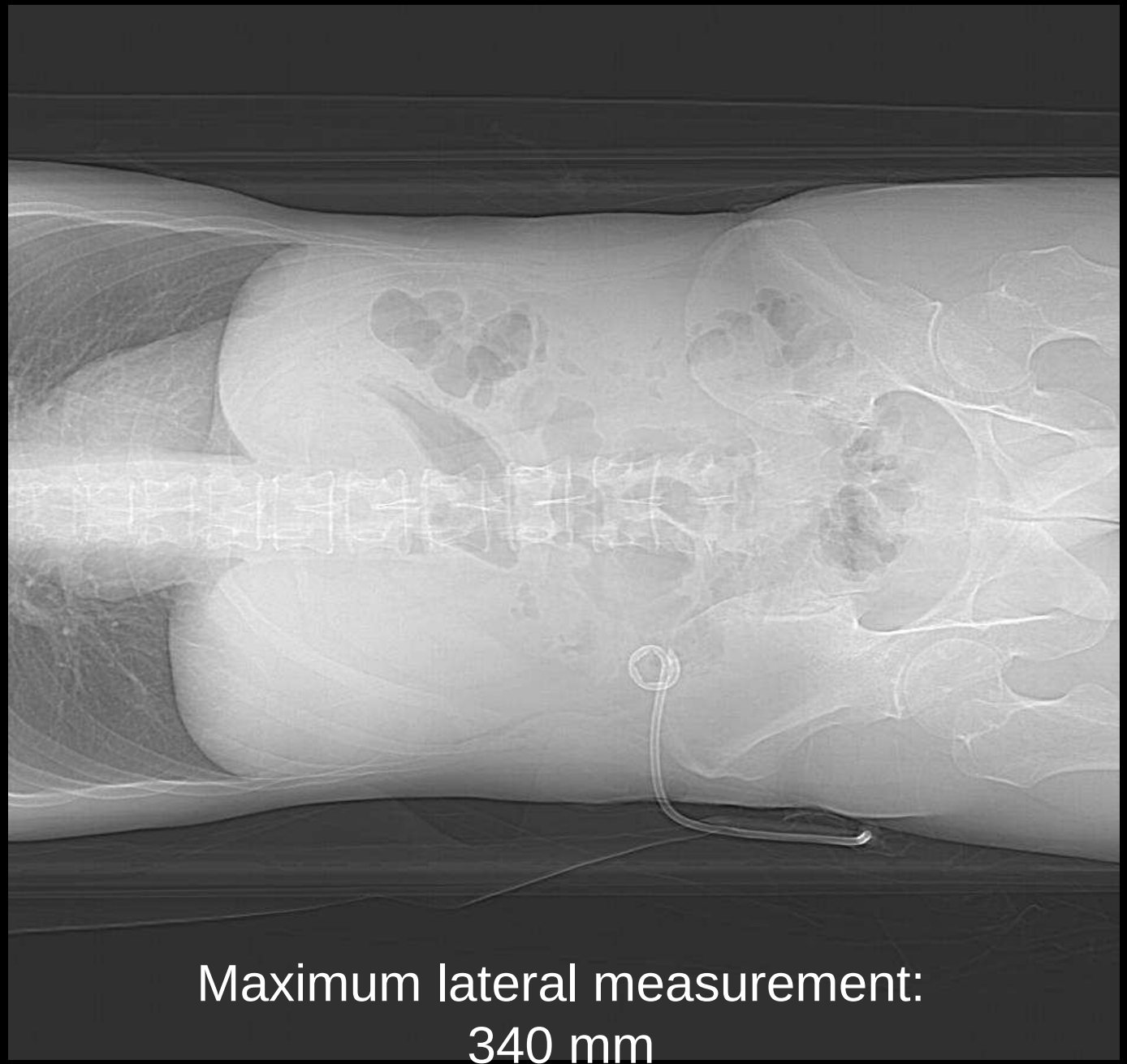
Portal abdomen

Smart mA used by default

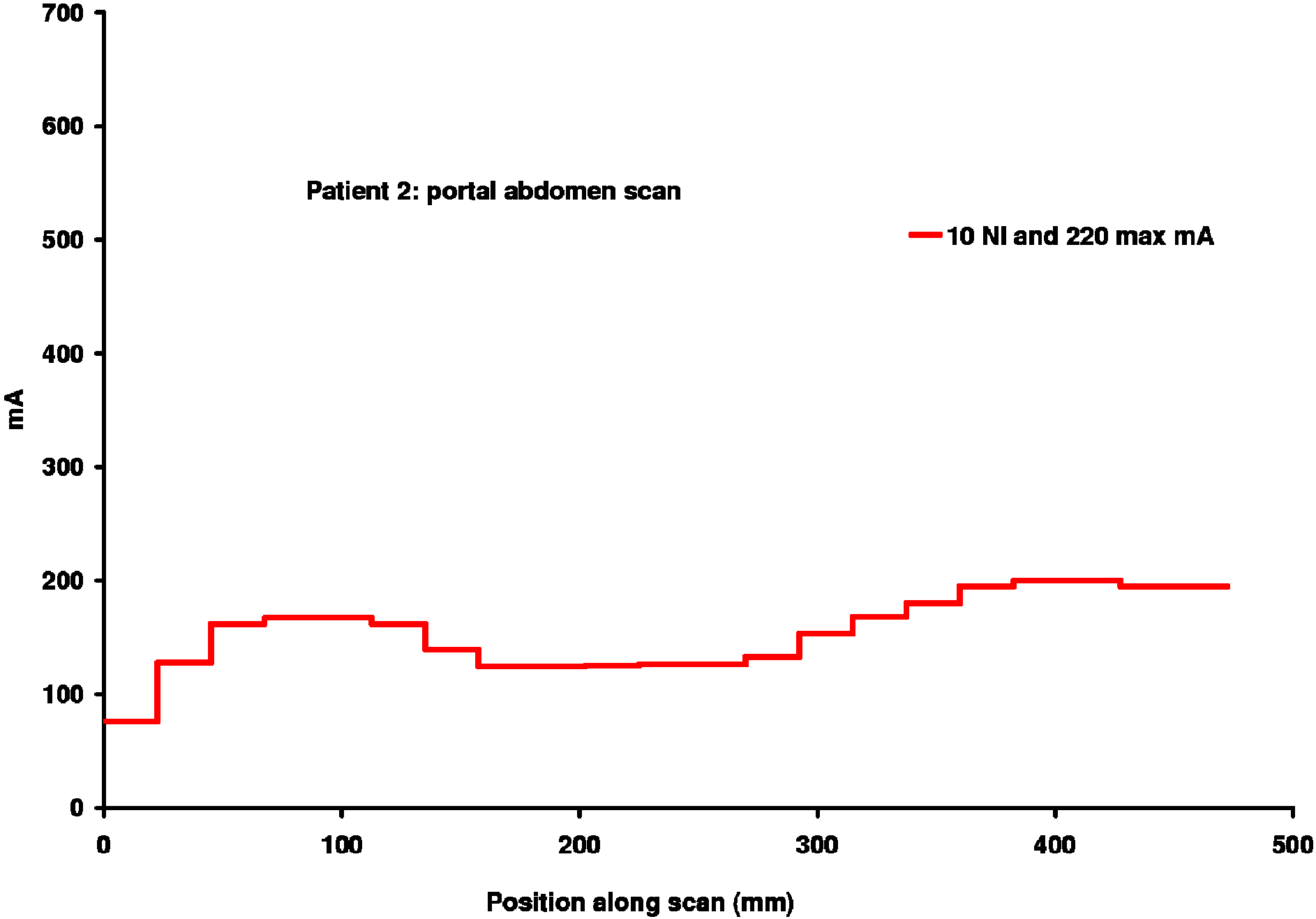
Noise index of 10

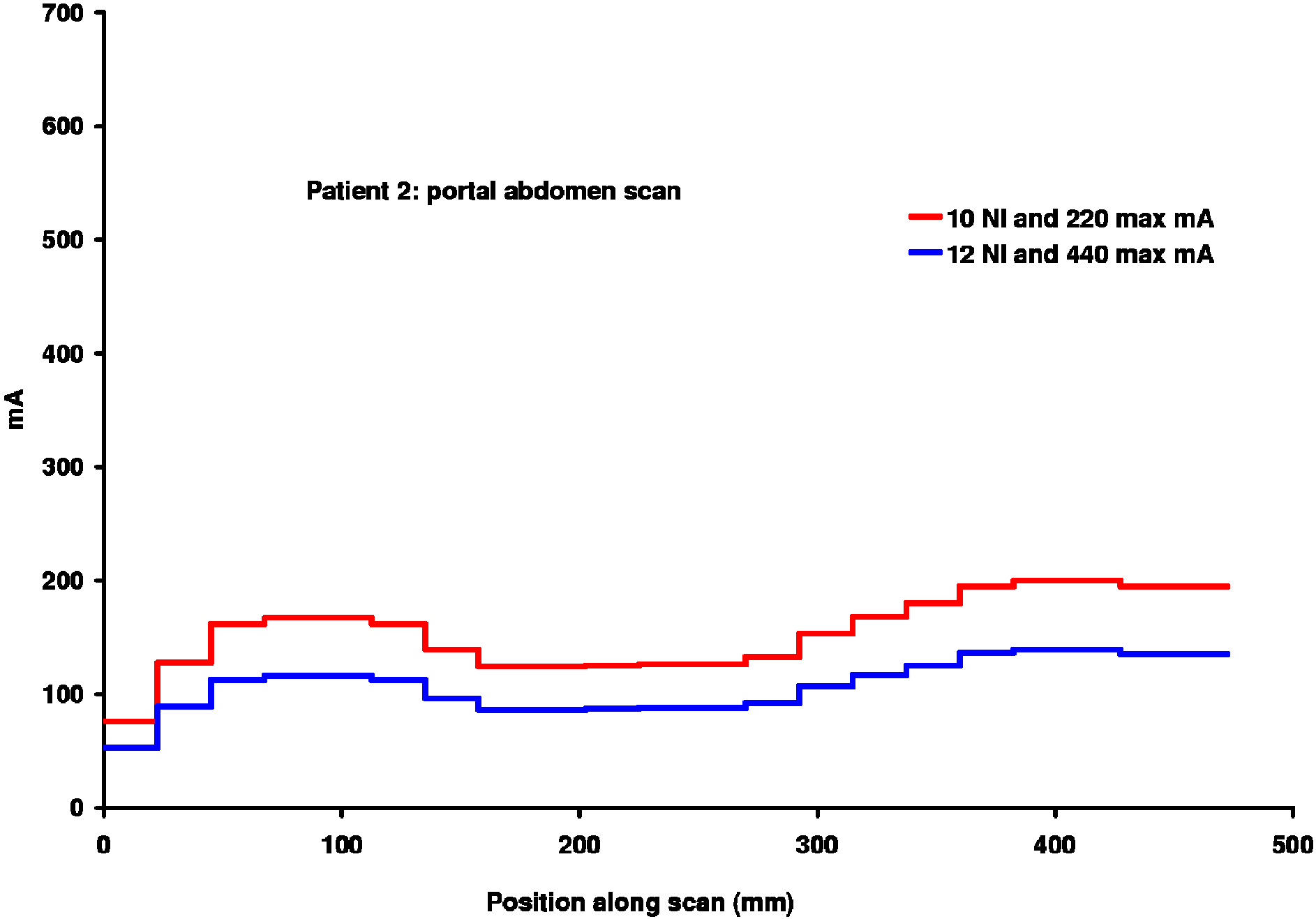
Max mA limit of 220

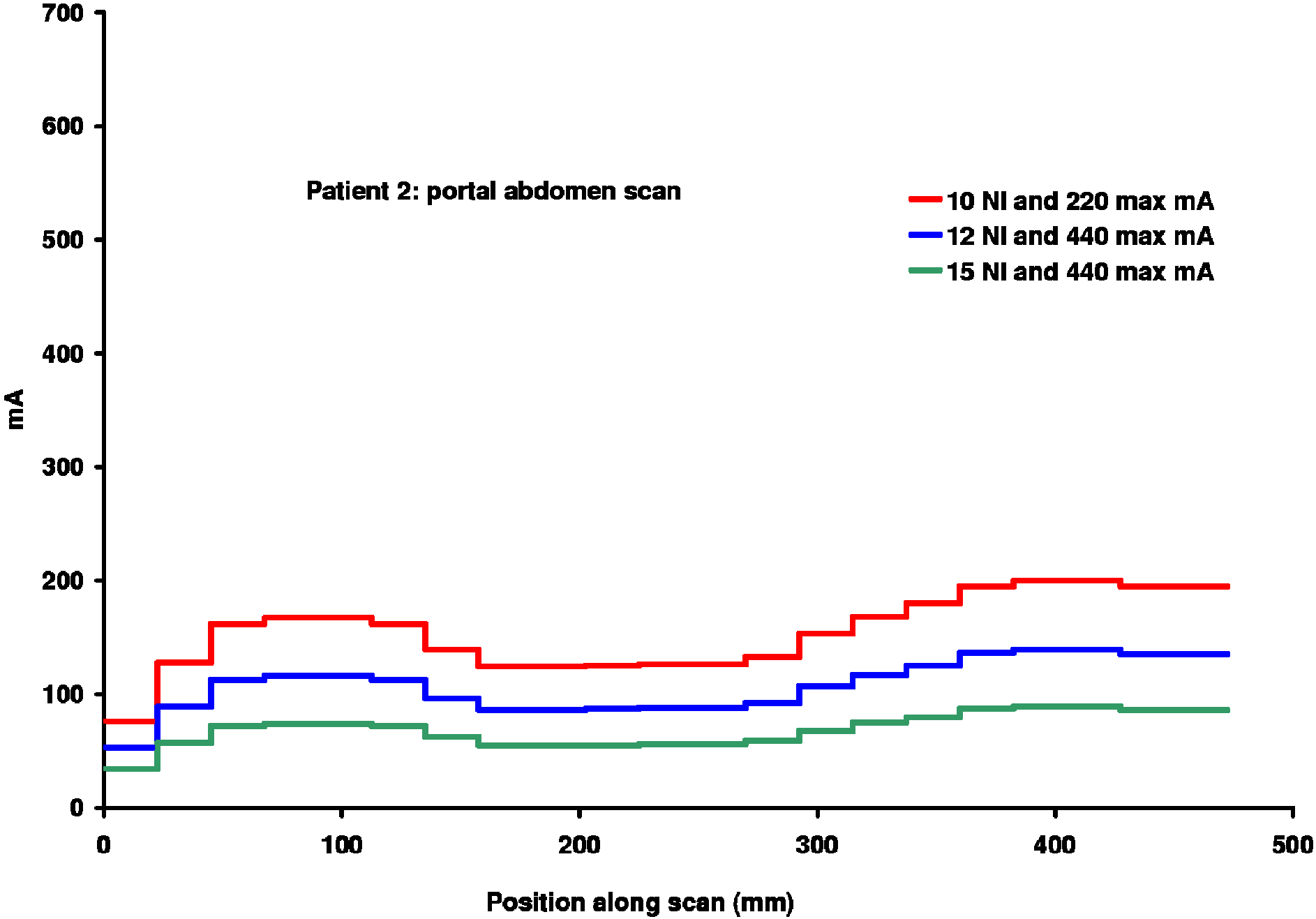

Maximum AP measurement:
245 mm

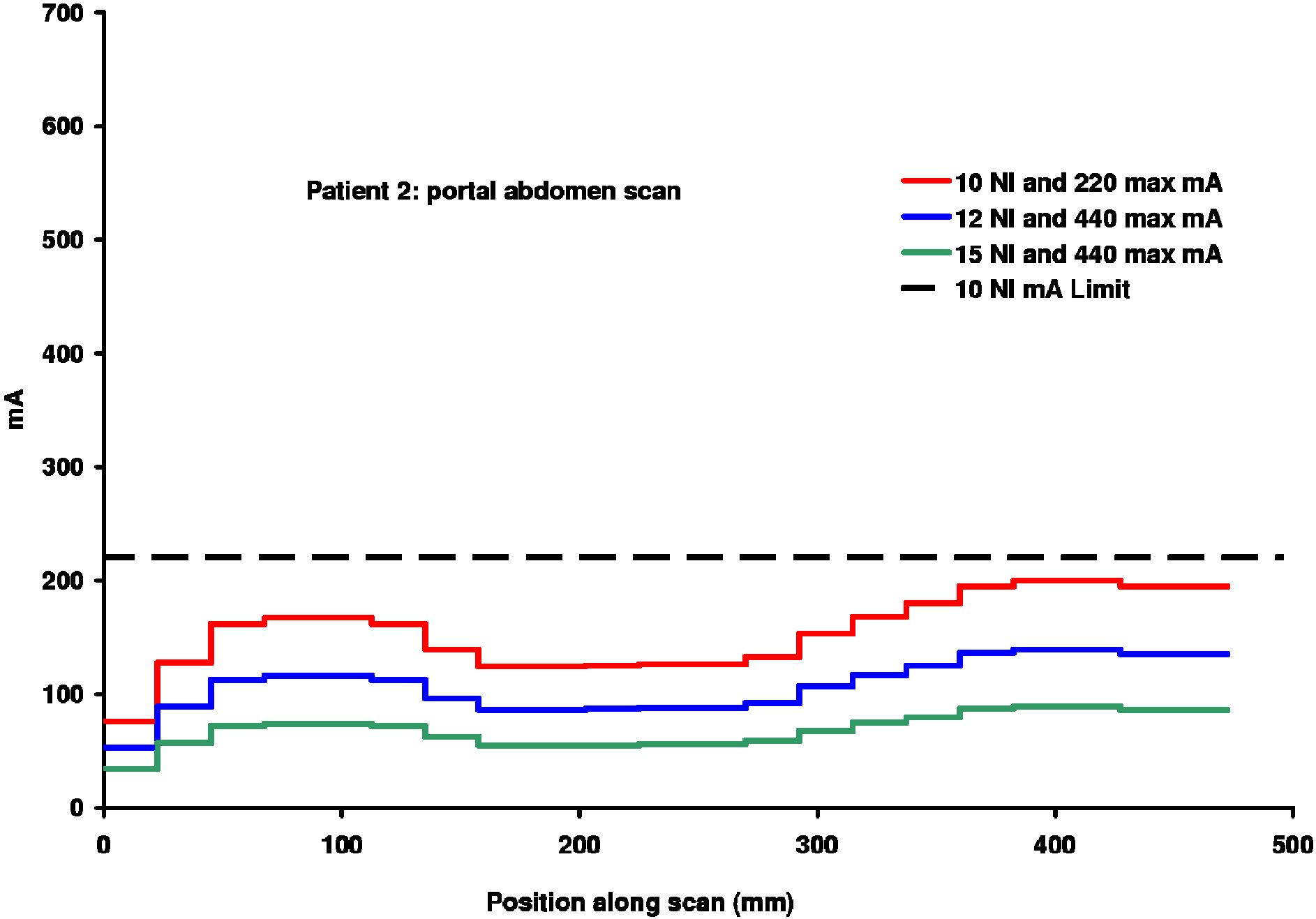


Maximum lateral measurement:
340 mm


Patient 2: portal abdomen scan
10 NI and 220 max mA
mA
700
600
500
400
300
200
100
0
0
100
200
300
400
500
Position along scan (mm)


Patient 2: portal abdomen scan
10 NI and 220 max mA
12 NI and 440 max mA
mA
700
600
500
400
300
200
100
0
0
100
200
300
400
500
Position along scan (mm)


Patient 2: portal abdomen scan
10 NI and 220 max mA
12 NI and 440 max mA
15 NI and 440 max mA
mA
700
600
500
400
300
200
100
0
0
100
200
300
400
500
Position along scan (mm)


Patient 2: portal abdomen scan
10 NI and 220 max mA
12 NI and 440 max mA
15 NI and 440 max mA
10 NI mA Limit
mA
700
600
500
400
300
200
100
0
0
100
200
300
400
500
Position along scan (mm)

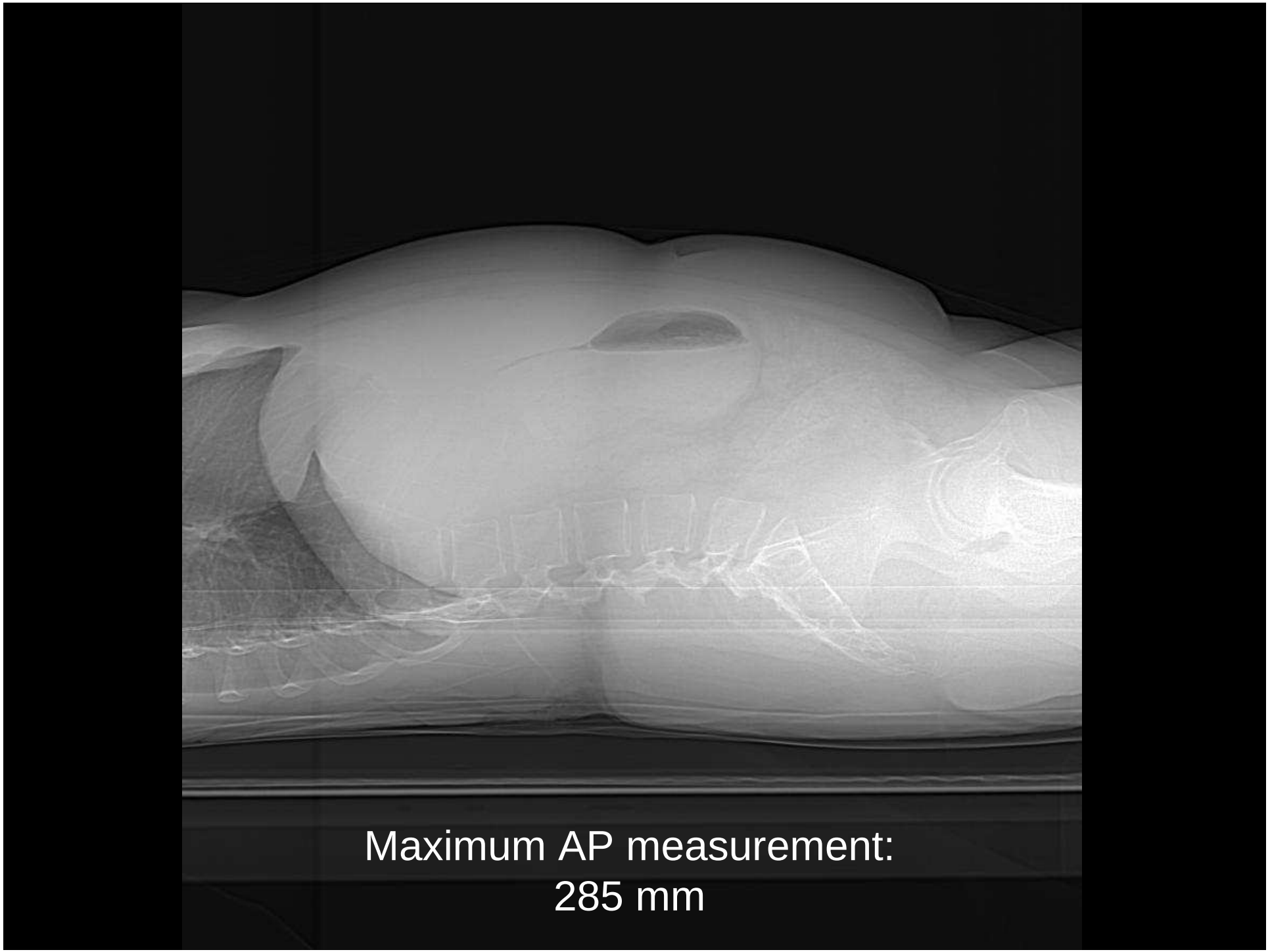
Patient 6

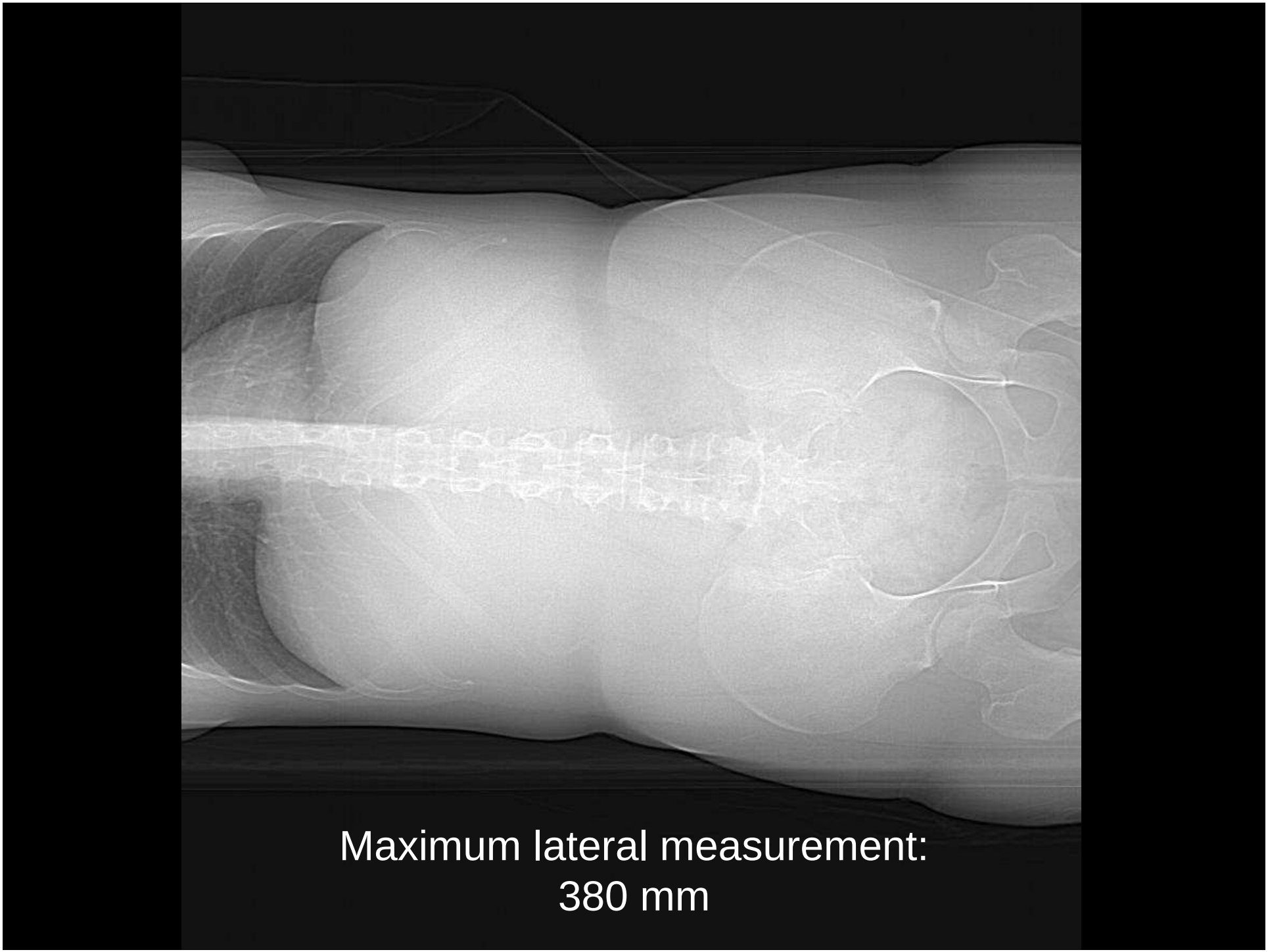
Portal abdomen

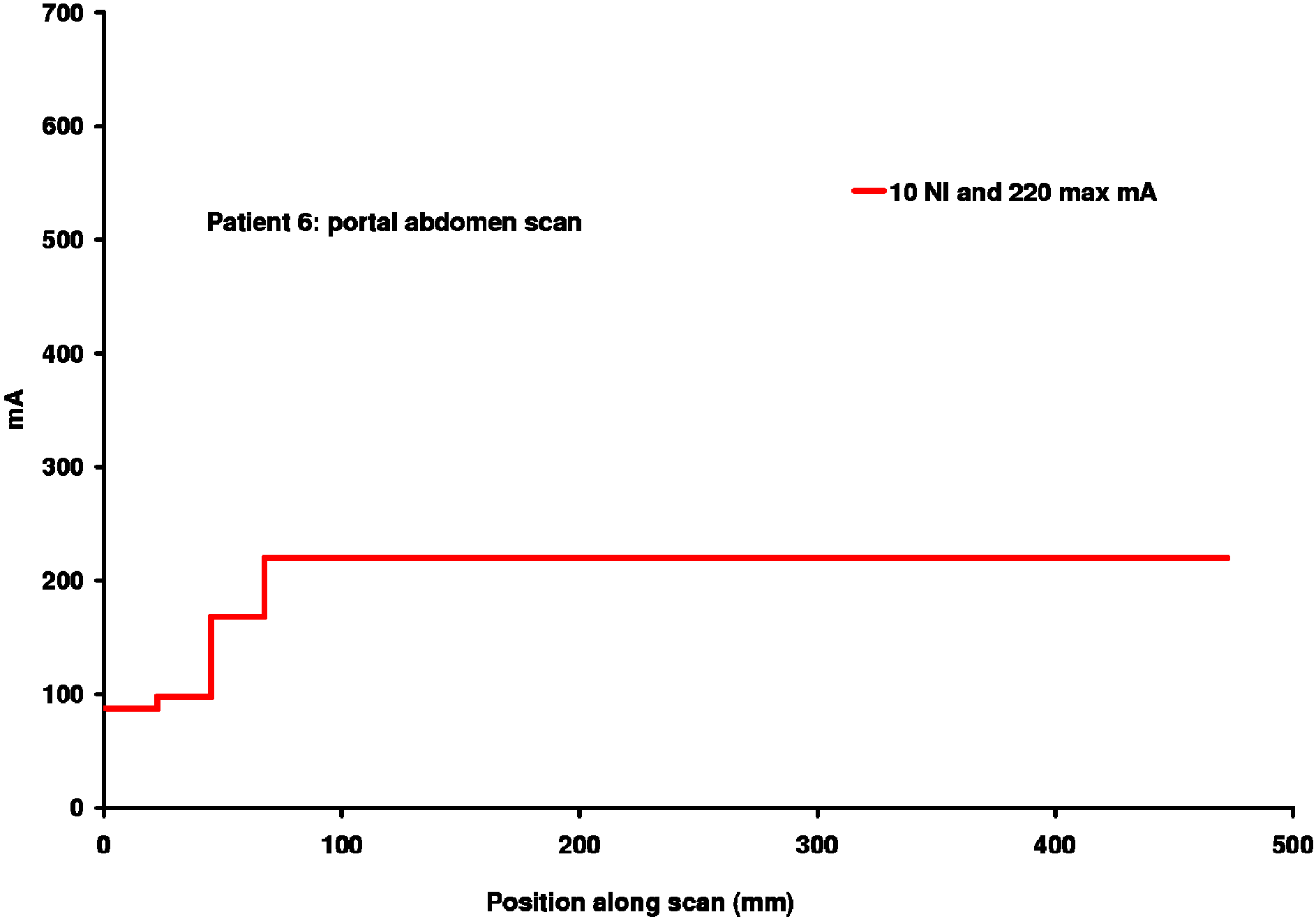
Smart mA used by default

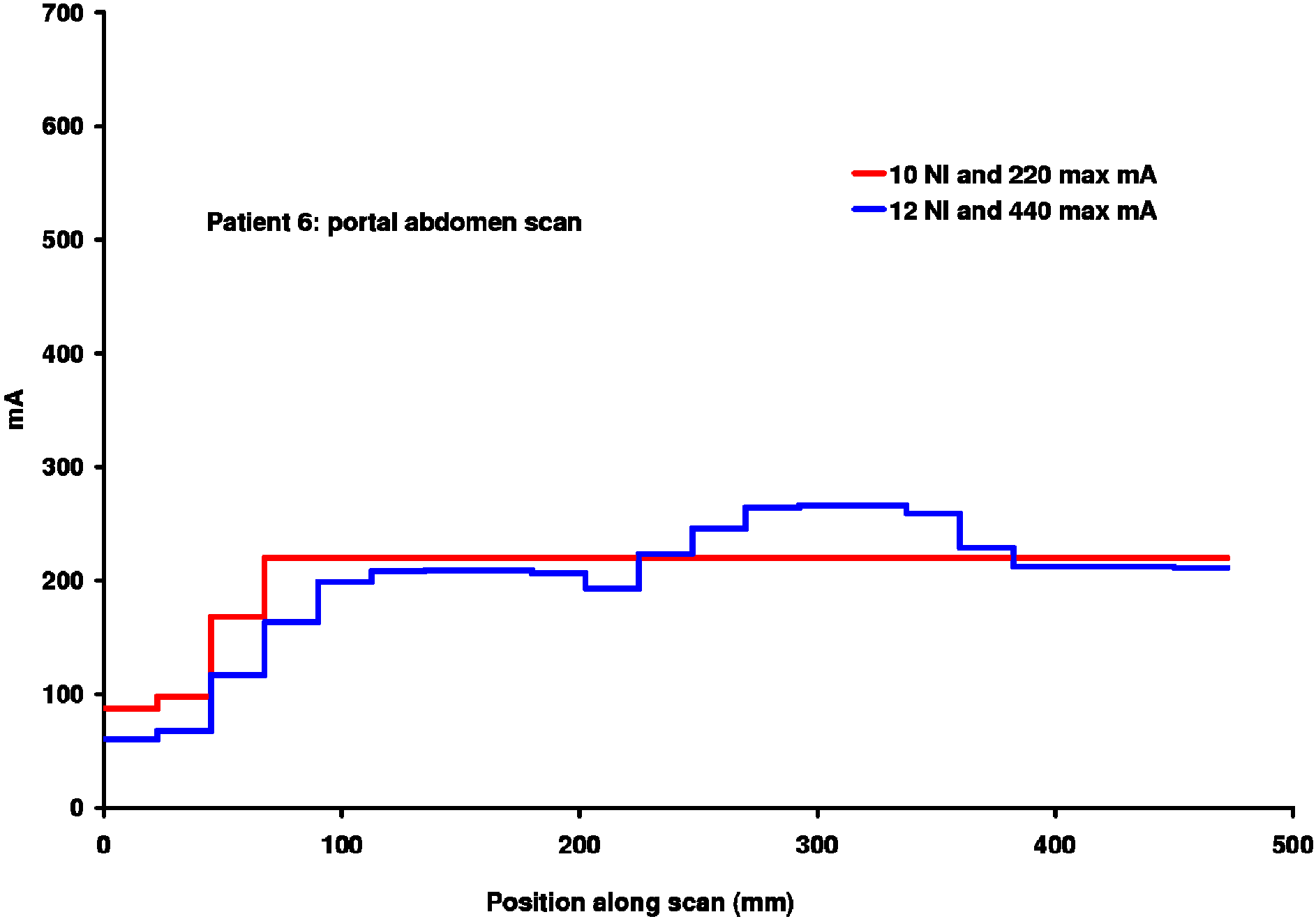
Noise index of 10

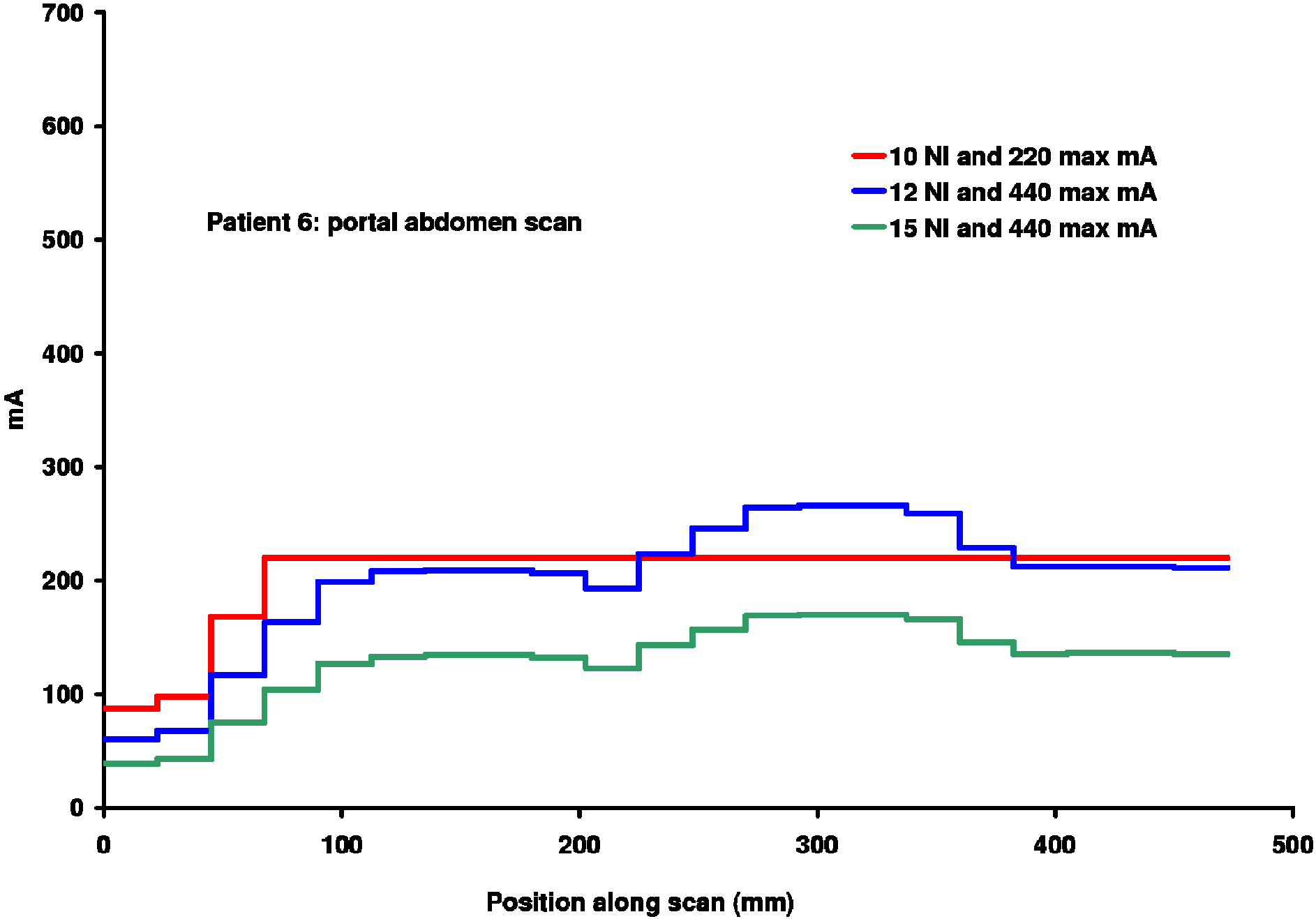
Max mA limit of 220

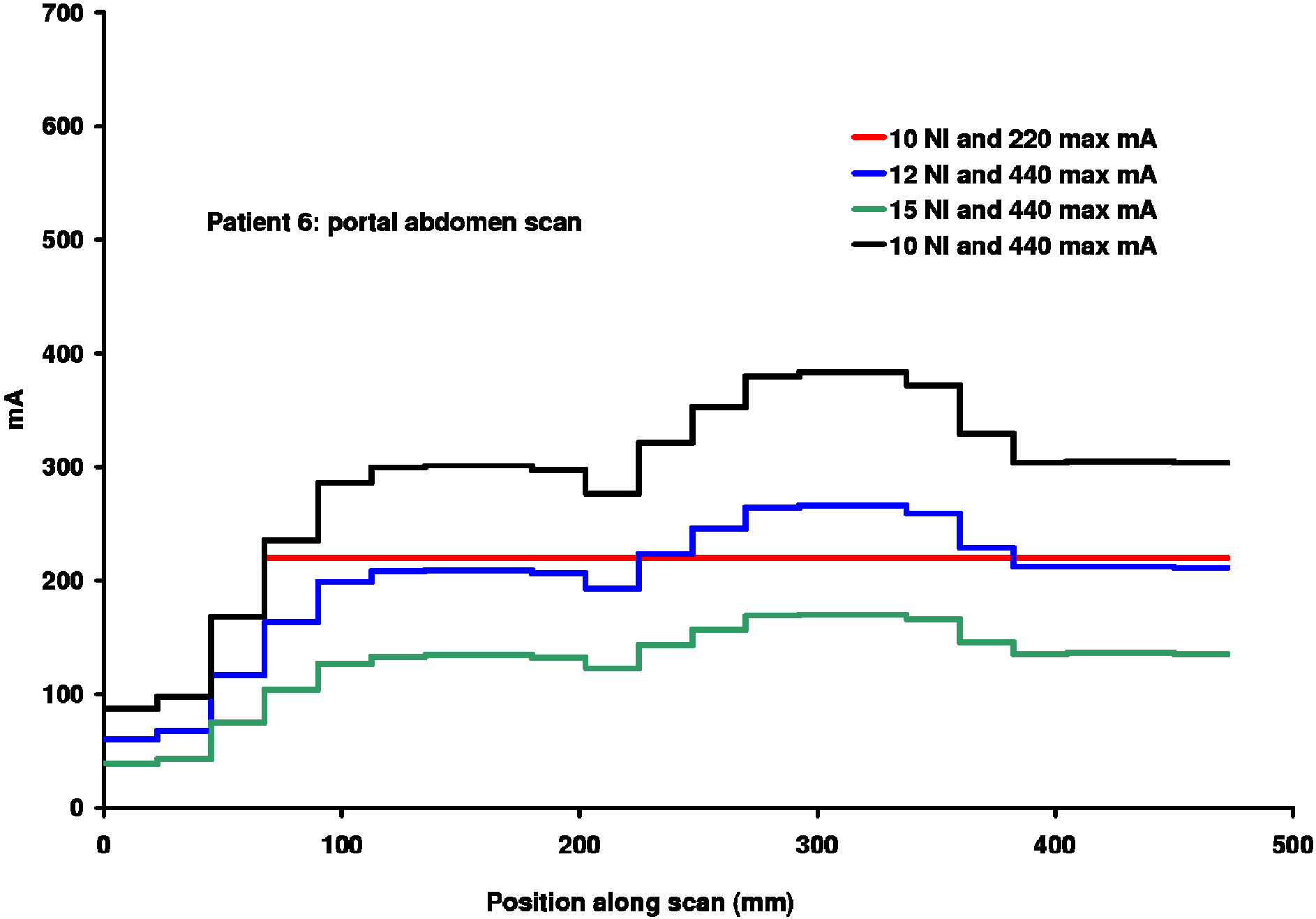

Maximum AP measurement:
285 mm


Maximum lateral measurement:
380 mm


Patient 6: portal abdomen scan
10 NI and 220 max mA
mA
700
600
500
400
300
200
100
0
0
100
200
300
400
500
Position along scan (mm)


Patient 6: portal abdomen scan
10 NI and 220 max mA
12 NI and 440 max mA
mA
700
600
500
400
300
200
100
0
0
100
200
300
400
500
Position along scan (mm)


Patient 6: portal abdomen scan
10 NI and 220 max mA
12 NI and 440 max mA
15 NI and 440 max mA
mA
700
600
500
400
300
200
100
0
0
100
200
300
400
500
Position along scan (mm)


Patient 6: portal abdomen scan
10 NI and 220 max mA
12 NI and 440 max mA
15 NI and 440 max mA
10 NI and 440 max mA
mA
Position along scan (mm)
0
100
200
300
400
500
600
700

Next steps

Increase Noise Index to 12

Leave max mA

Set min mA to 75

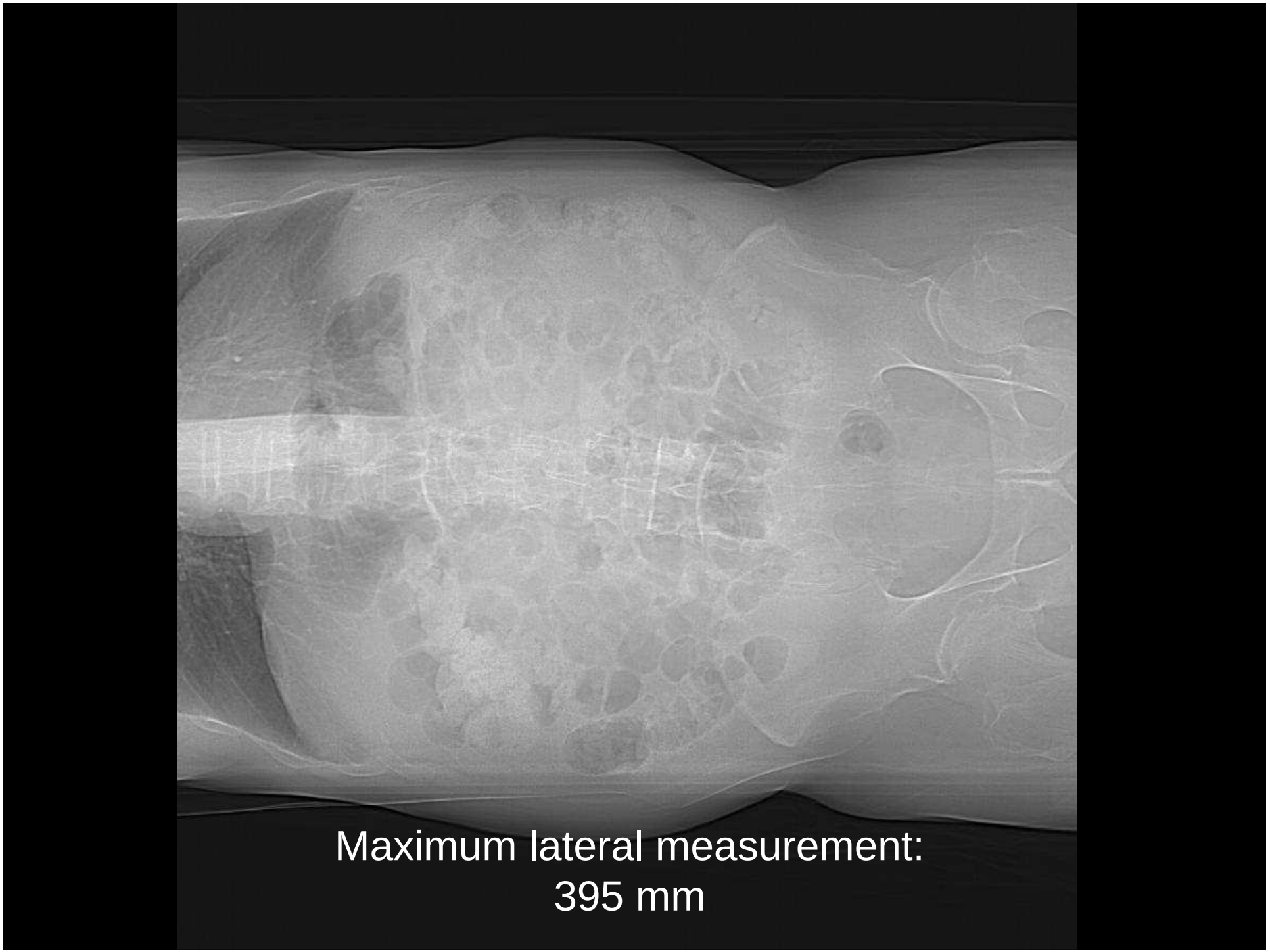
Patient 1

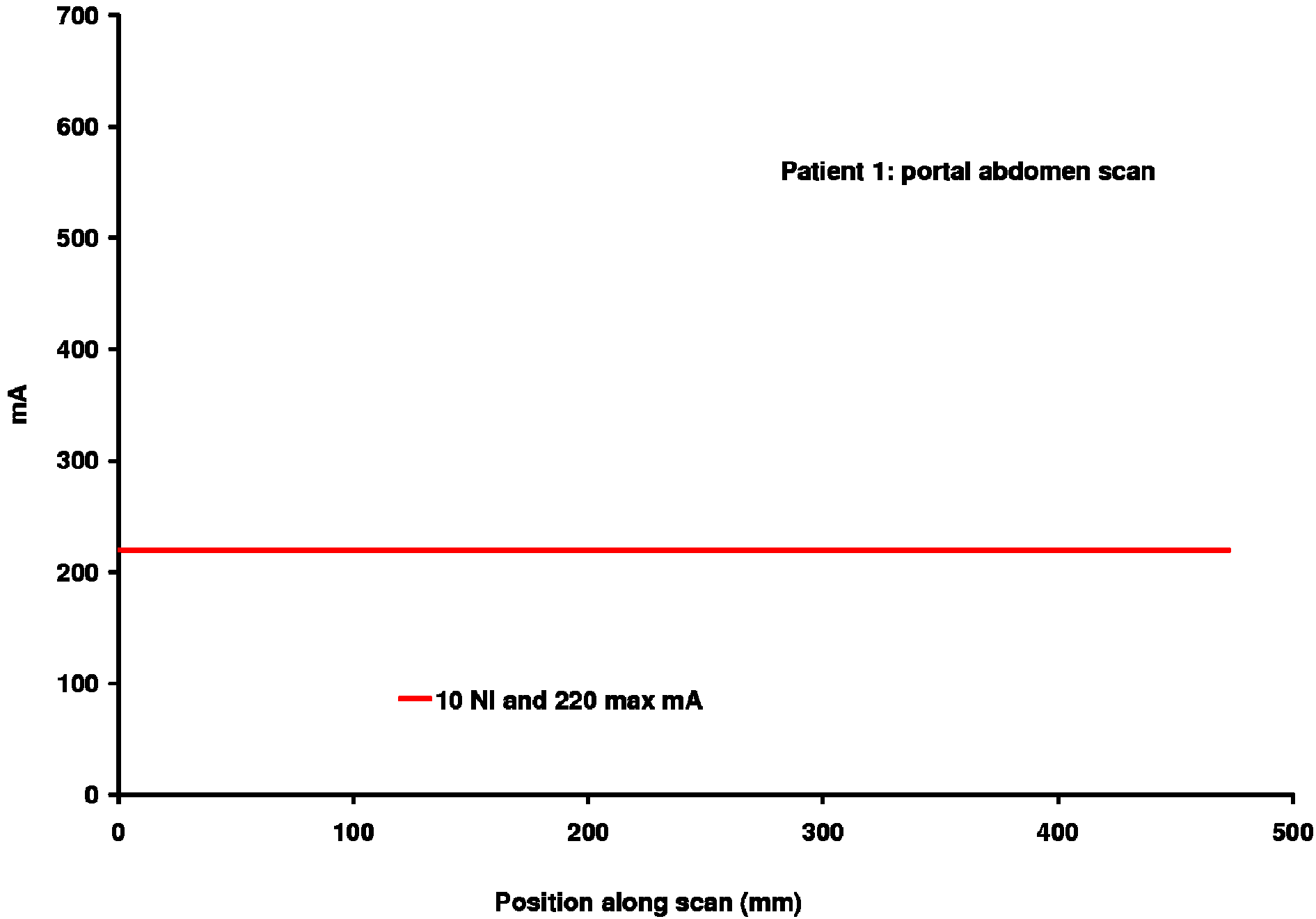
Portal abdomen

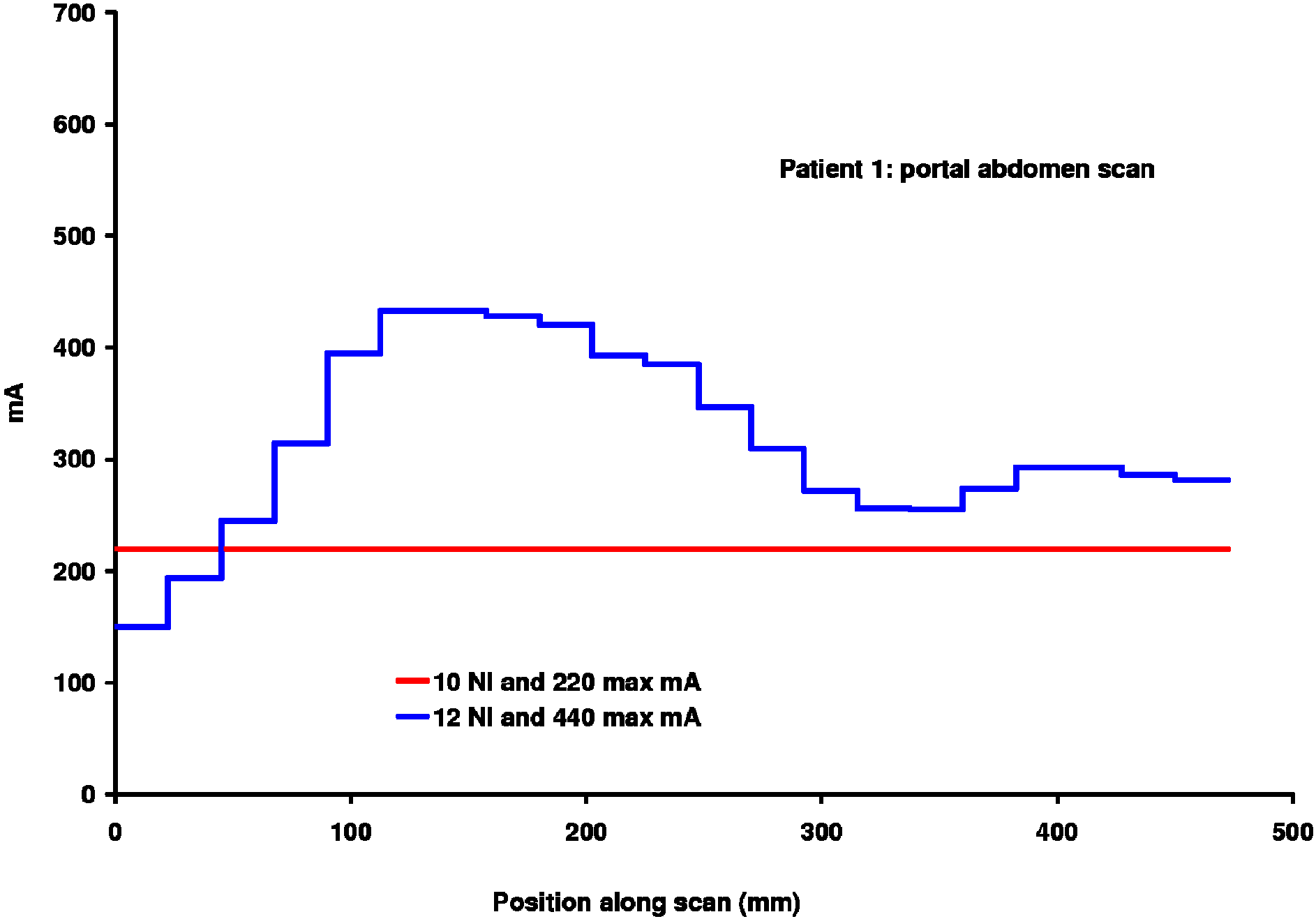
Noise Index 10 $\rightarrow$ 12

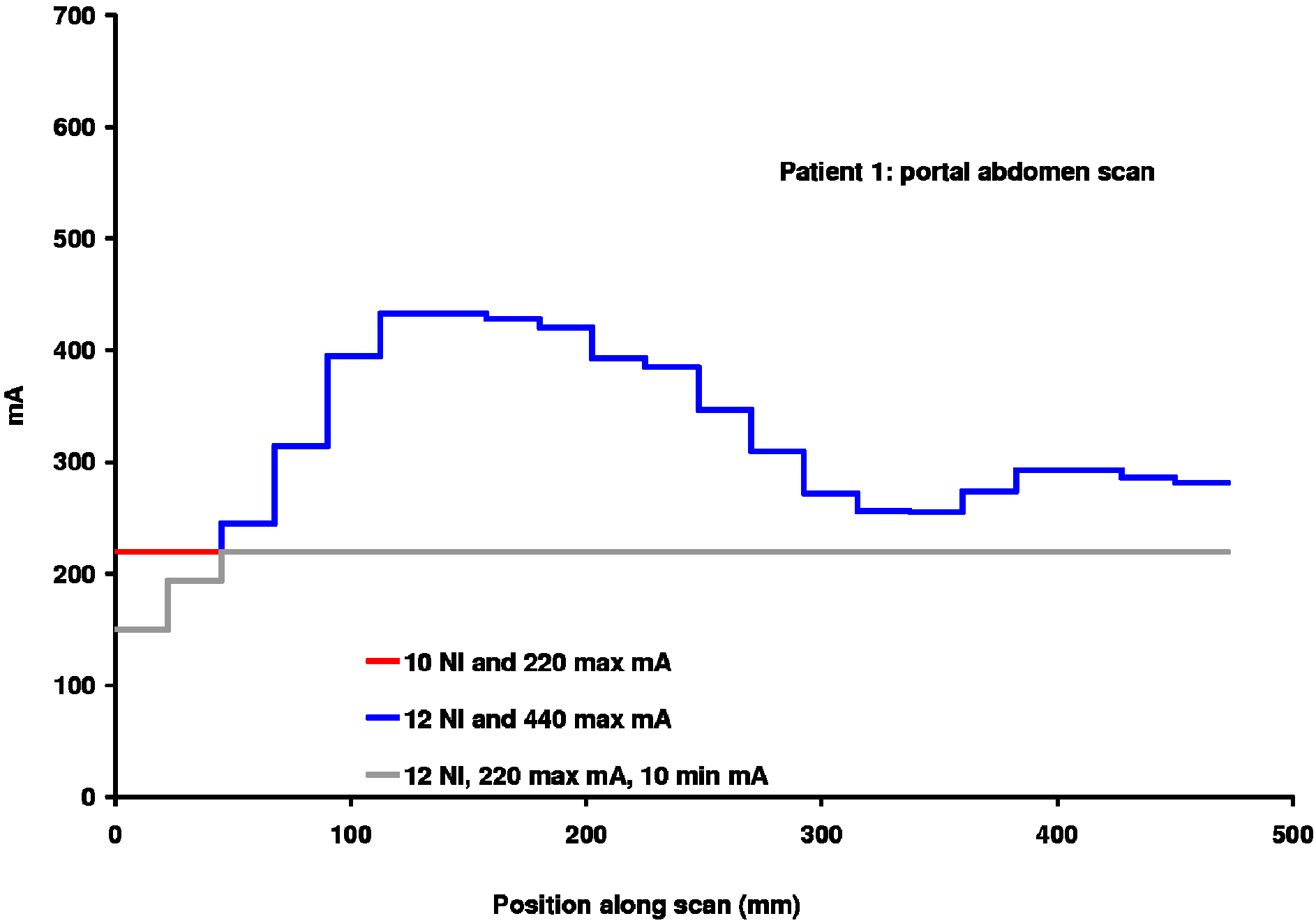
Min mA 10 $\rightarrow$ 75

Max mA remains at 220


Maximum lateral measurement:
395 mm


Patient 1: portal abdomen scan
mA
700
600
500
400
300
200
100
0
0
100
200
300
400
500
Position along scan (mm)
10 NI and 220 max mA


Patient 1: portal abdomen scan
mA
700
600
500
400
300
200
100
0
0
100
200
300
400
500
Position along scan (mm)
10 NI and 220 max mA
12 NI and 440 max mA


Patient 1: portal abdomen scan
mA
700
600
500
400
300
200
100
0
0
100
200
300
400
500
Position along scan (mm)
10 NI and 220 max mA
12 NI and 440 max mA
12 NI, 220 max mA, 10 min mA

Patient 1 DLP values

NI	Max mA	Min mA	DLP (mGy.cm)
10	220	10	517
12	440	10	748
12	220	75	507

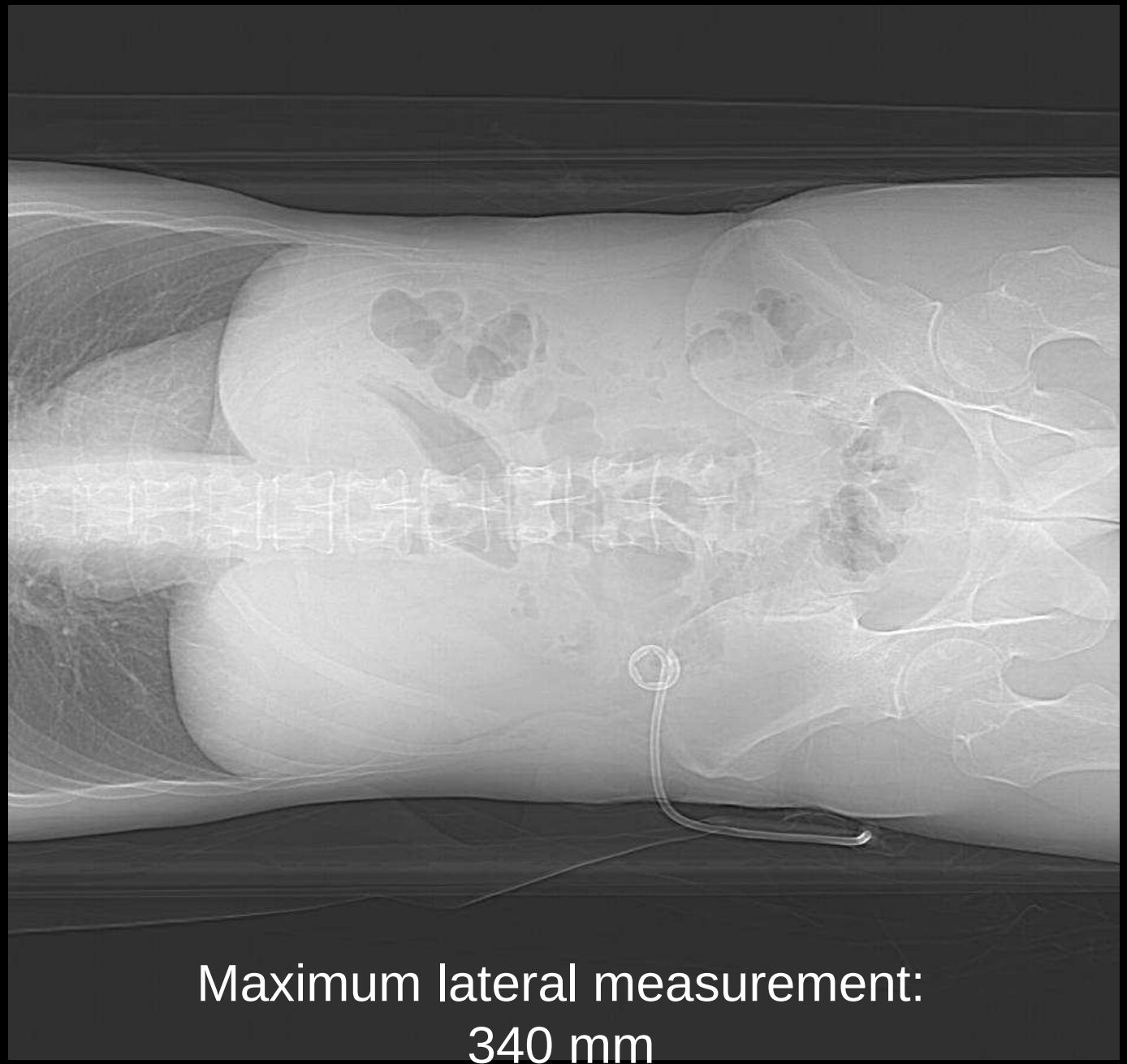
Patient 2

Portal abdomen

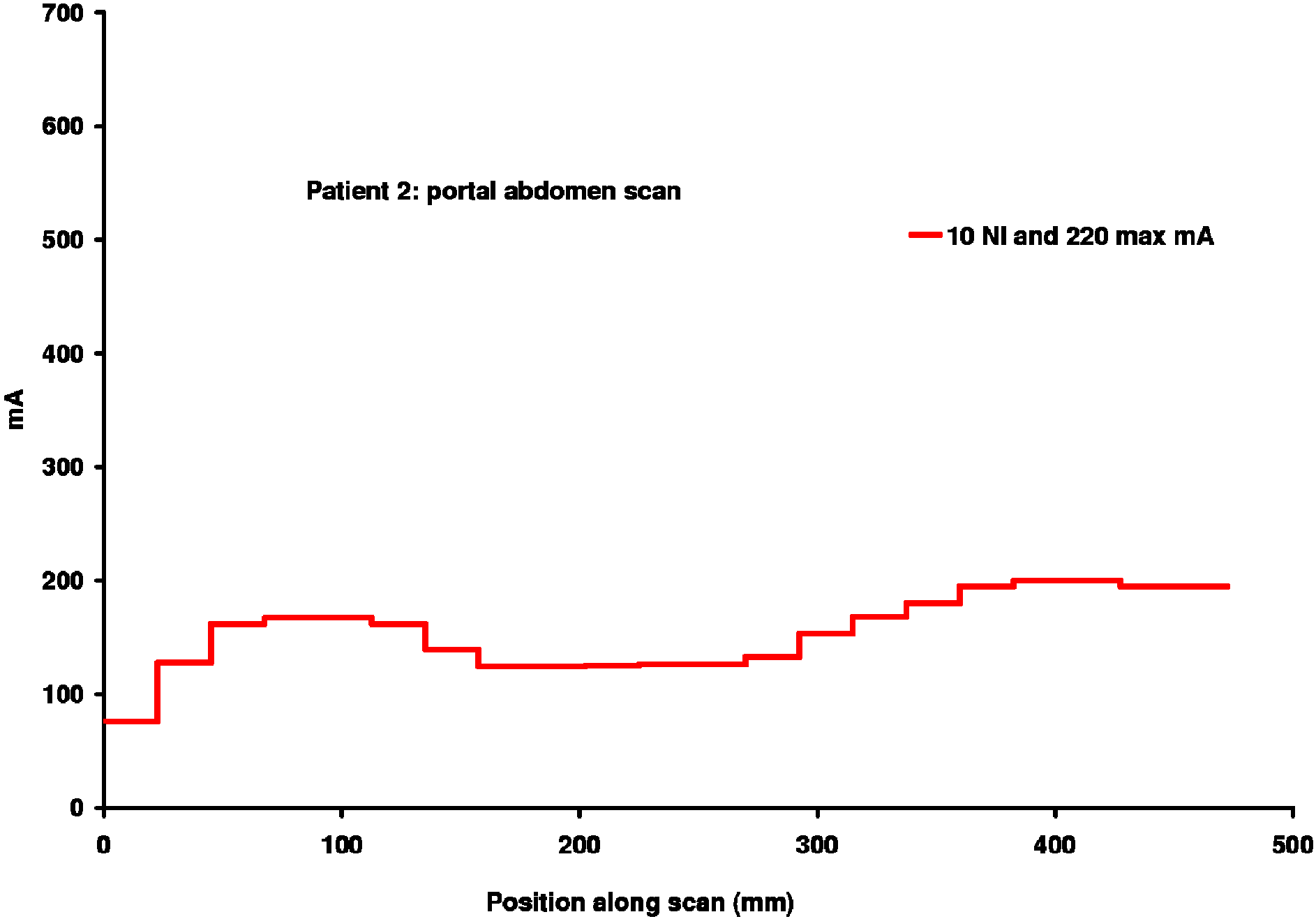
Noise Index 10 $\rightarrow$ 12

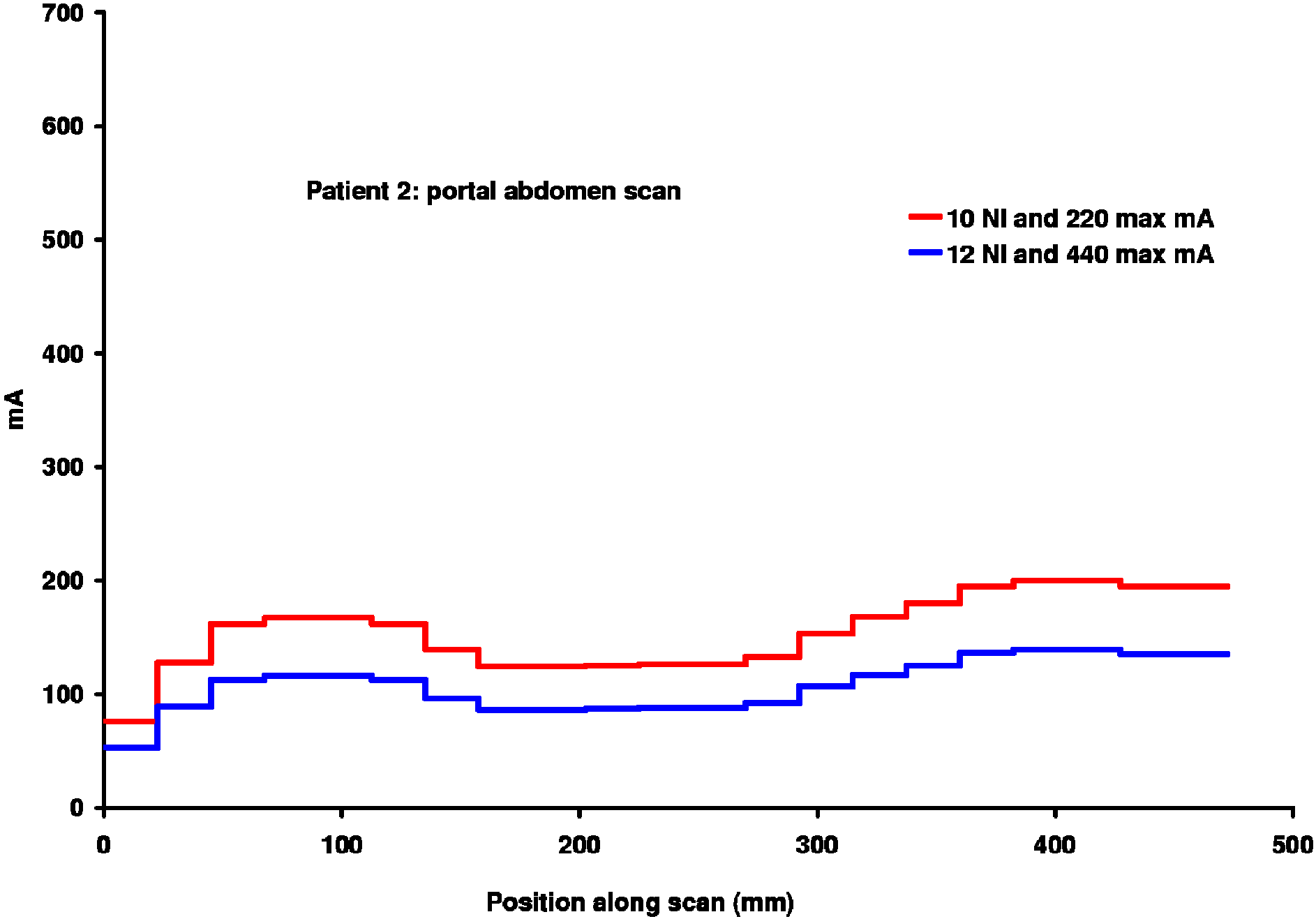
Min mA 10 $\rightarrow$ 75

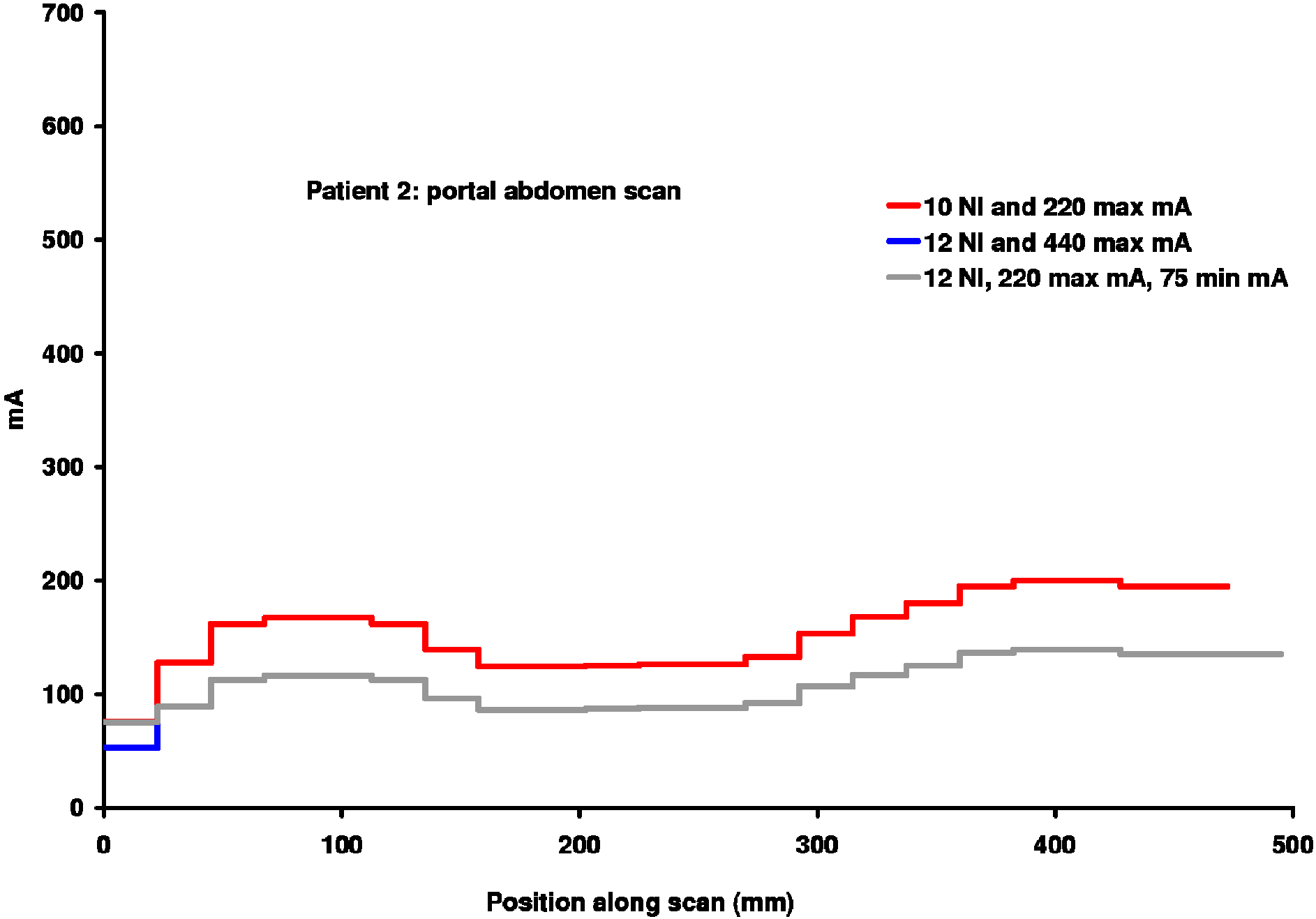
Max mA remains at 220



Maximum lateral measurement:
340 mm


Patient 2: portal abdomen scan
10 NI and 220 max mA
mA
700
600
500
400
300
200
100
0
0
100
200
300
400
500
Position along scan (mm)


Patient 2: portal abdomen scan
10 NI and 220 max mA
12 NI and 440 max mA
mA
700
600
500
400
300
200
100
0
0
100
200
300
400
500
Position along scan (mm)


Patient 2: portal abdomen scan
10 NI and 220 max mA
12 NI and 440 max mA
12 NI, 220 max mA, 75 min mA
mA
700
600
500
400
300
200
100
0
0
100
200
300
400
500
Position along scan (mm)

Patient 2 DLP values

NI	Max mA	Min mA	DLP (mGy.cm)
10	220	10	381
12	440	10	265
12	220	75	267

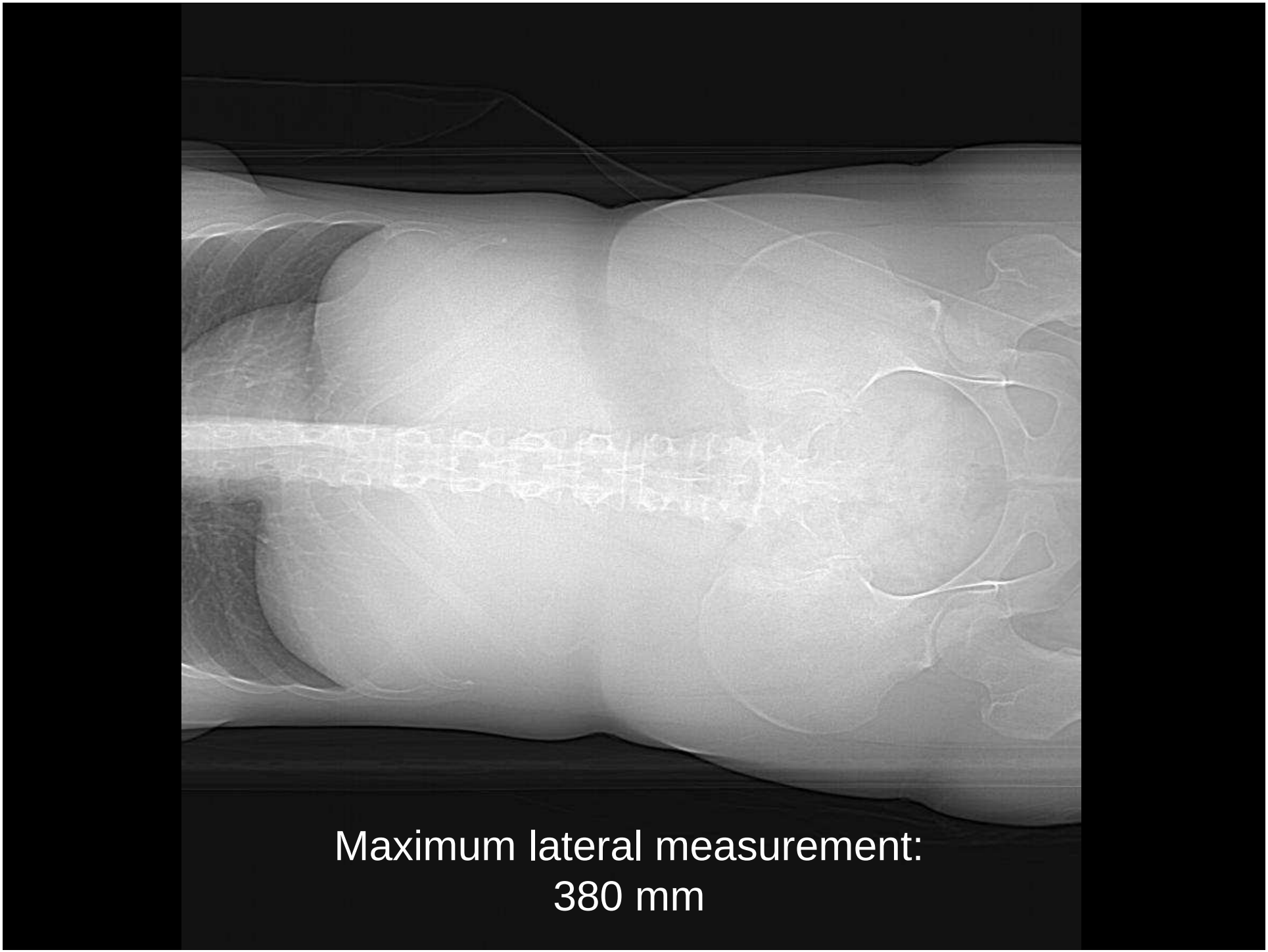
Patient 6

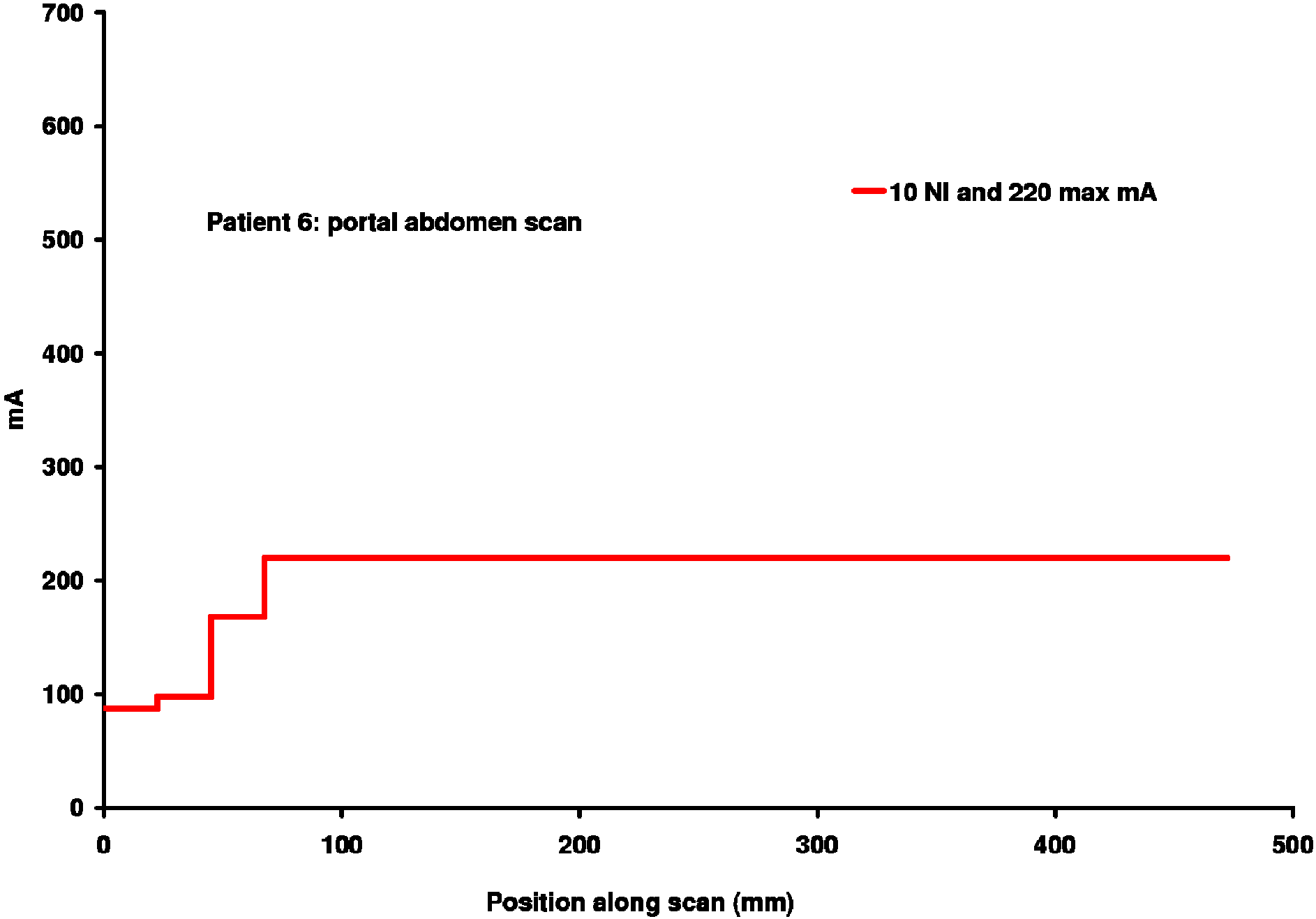
Portal abdomen

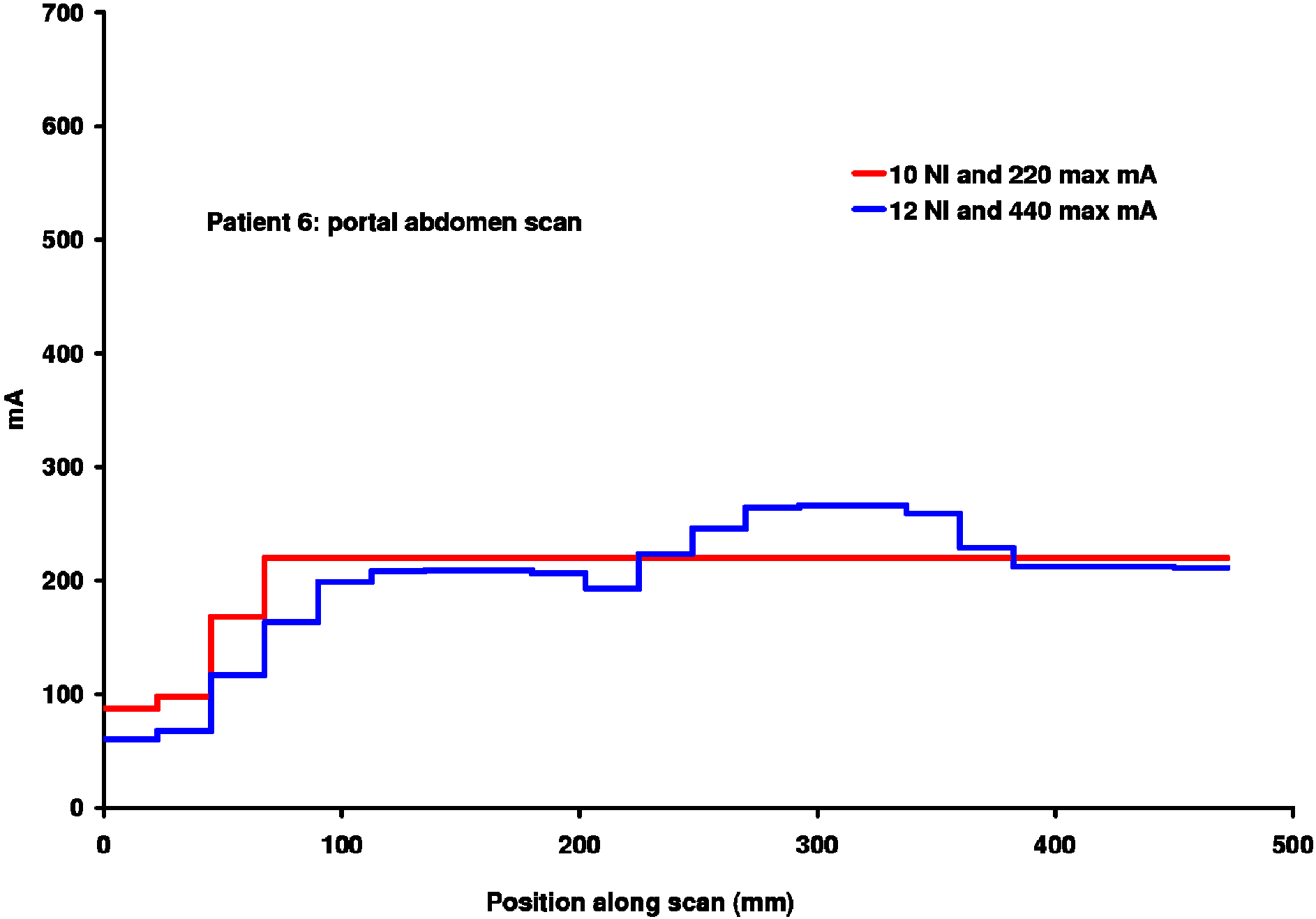
Noise Index 10 $\rightarrow$ 12

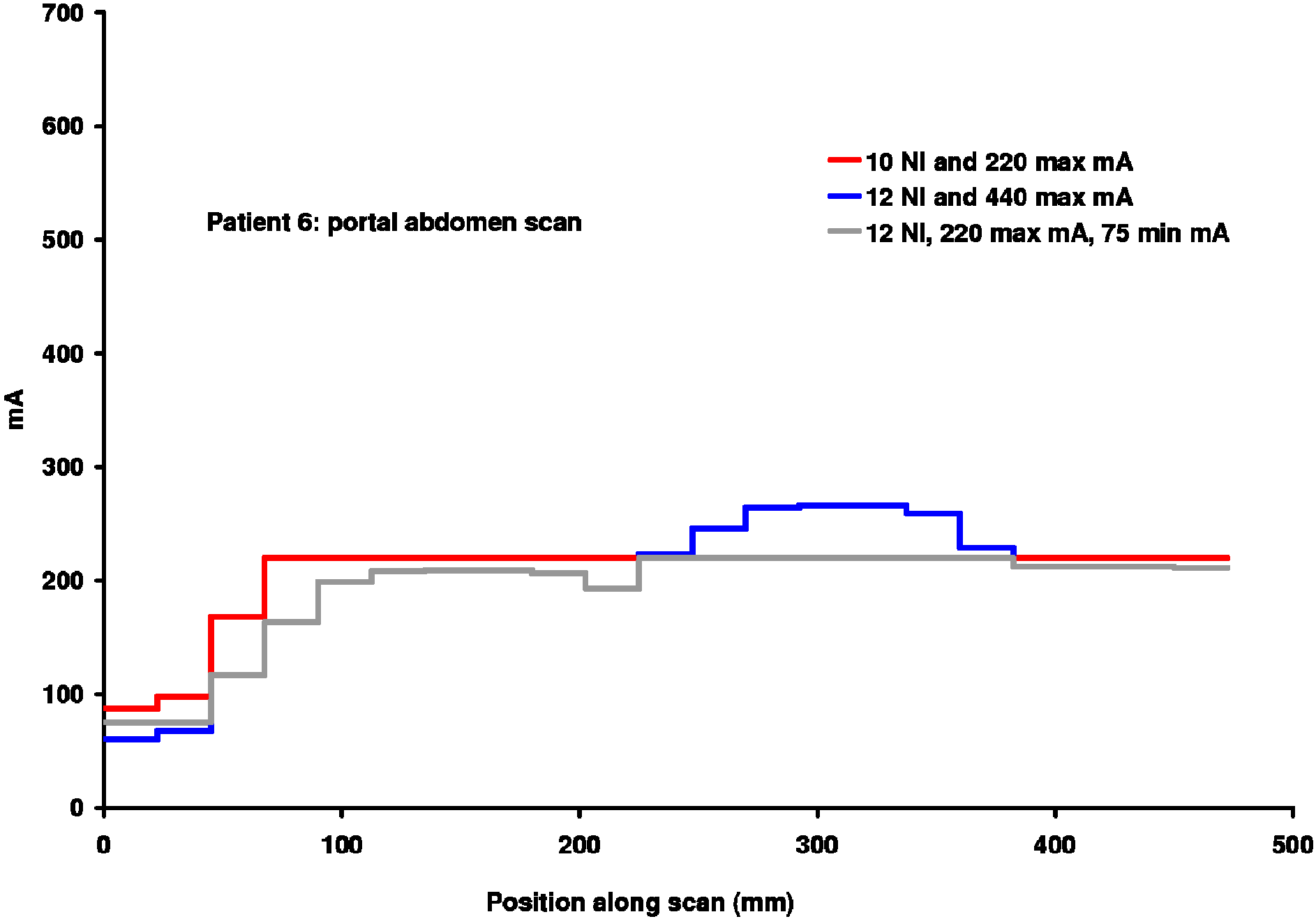
Min mA 10 $\rightarrow$ 75

Max mA remains at 220


Maximum lateral measurement:
380 mm


Patient 6: portal abdomen scan
10 NI and 220 max mA
mA
700
600
500
400
300
200
100
0
0
100
200
300
400
500
Position along scan (mm)


Patient 6: portal abdomen scan
10 NI and 220 max mA
12 NI and 440 max mA
mA
700
600
500
400
300
200
100
0
0
100
200
300
400
500
Position along scan (mm)


Patient 6: portal abdomen scan
10 NI and 220 max mA
12 NI and 440 max mA
12 NI, 220 max mA, 75 min mA
mA
700
600
500
400
300
200
100
0
0
100
200
300
400
500
Position along scan (mm)

Patient 6 DLP values

NI	Max mA	Min mA	DLP (mGy.cm)
10	220	10	493
12	440	10	484
12	220	75	462

Final (?) step

Increase NI to 15

Set max mA to 440

Set min mA to 75

Patient 1 DLP values

NI	Max mA	Min mA	DLP (mGy.cm)
10	220	10	517
12	440	10	748
12	220	75	507
15	440	75	478

Patient 2 DLP values

NI	Max mA	Min mA	DLP (mGy.cm)
10	220	10	381
12	440	10	265
12	220	75	267
15	440	75	191

Patient 6 DLP values

NI	Max mA	Min mA	DLP (mGy.cm)
10	220	10	493
12	440	10	484
12	220	75	462
15	440	75	317

Conclusions

- The current AEC setup is inadequate
- The image quality of many patients is below the requested Noise Index of 10
- Scans of ‘small’ patients achieve the Noise Index of 10 – but this level of image quality is probably not justified
- Increasing the NI to 12 as a 1st step
- Increase NI to 15 and max mA to 440 with Radiologist involvement as a 2nd step

Beware

mA used for a particular Noise Index depends on the reconstructed slice-thickness.

The protocol in this talk uses 7.5 mm

NI with slice-thickness

Slice width (mm)	Relative dose	Noise Index
0.625	1.0	34.6
1.25	1.0	24.5
2.5	1.0	17.3
5	1.0	12.2
7.5	1.0	10.0

Dose with slice-thickness

Slice width (mm)	Relative dose	Noise Index
0.625	1.00	10.0
1.25	0.50	10.0
2.5	0.25	10.0
5	0.13	10.0
7.5	0.08	10.0

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- Radiography staff at Milton Keynes
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Comments please….

How are your scanners setup?

Do you have this problem?

Am I tackling it in a sensible way?!?