Absolute quantitation of lutetium-177 with a SPECT/CT-imaging system for increasing attenuation thickness

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Aim

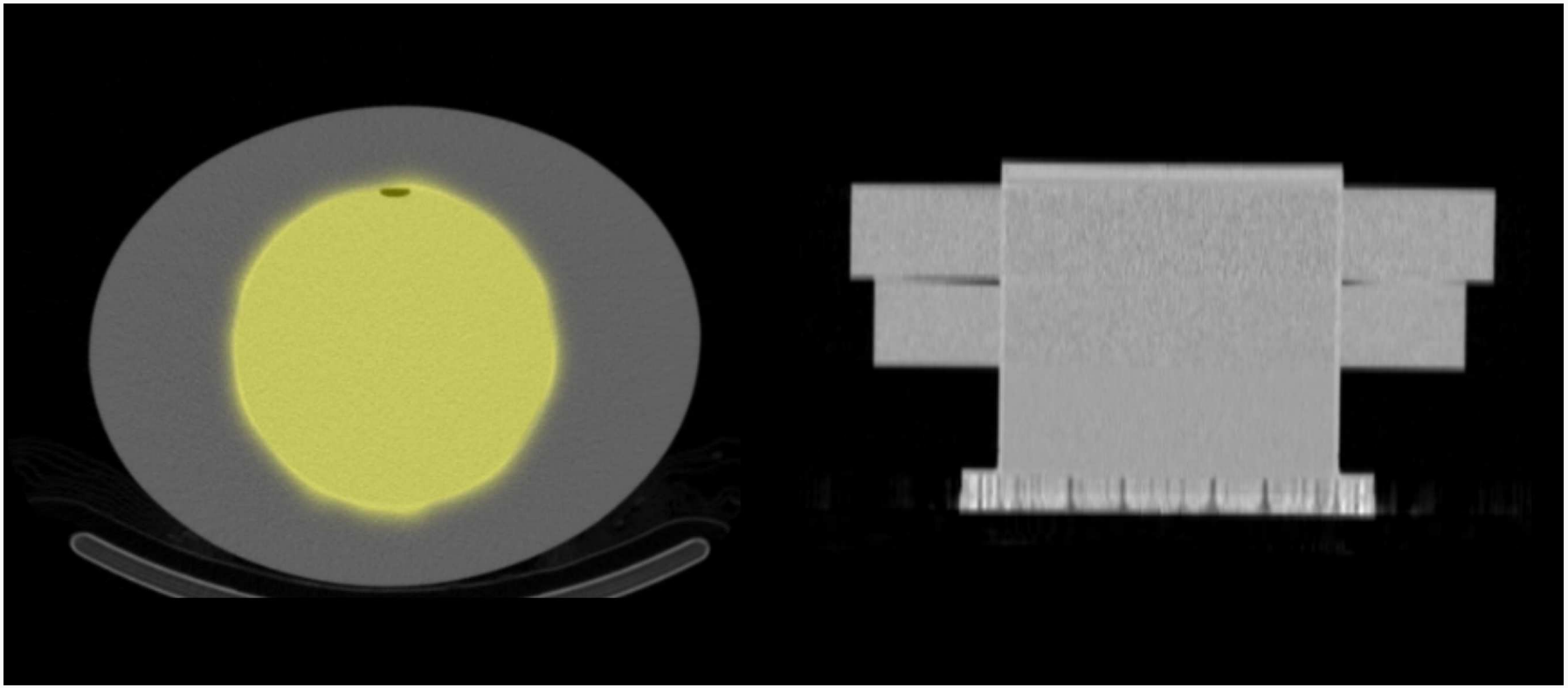
Absolute quantification should be absolute regardless of patient size.

We tested this with a phantom simulating different patient sizes on a SPECT/CT-imaging system.

The phantom used

- Cylindrical phantom - 20 cm in diameter
- Filled with 325.1 MBq in 5725 ml, 0.06 MBq/ml 177-lu
- Scanned five times

The phantom used



The phantom used - Physical dimensions

- "low": 20 cm in diameter
- "moderate": Annulus of 25/35 cm short/long-axis
- "high": Annulus of 30/38 cm short/long-axis

The phantom used - Physical dimensions - what does it mean?

Better to think in circumference (magamål)

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$$h = \frac{(a-b)^2}{(a+b)^2} \tag{1}$$

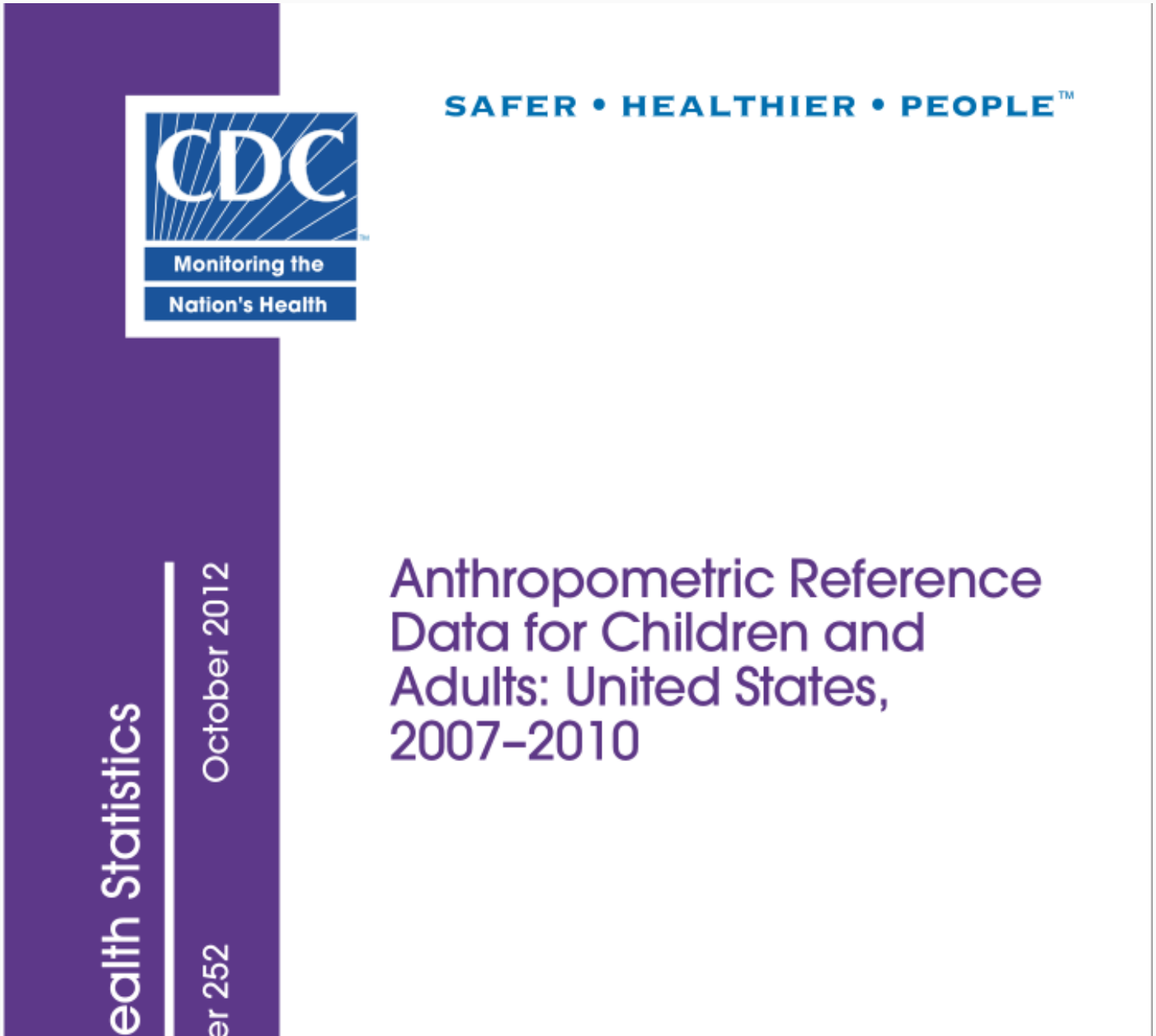
$$p = \pi(a+b)\sum_{n=0}^{\infty}\binom{0.5}{n}^2 h^n \tag{2}$$

The phantom used - Physical dimensions - what does it mean?

Better to think in circumference (magamål)

$$p \approx \pi(a+b)\left(1+\frac{1}{4}h+\frac{1}{64}h^3+\frac{1}{256}h^3+...\right) \tag{1}$$

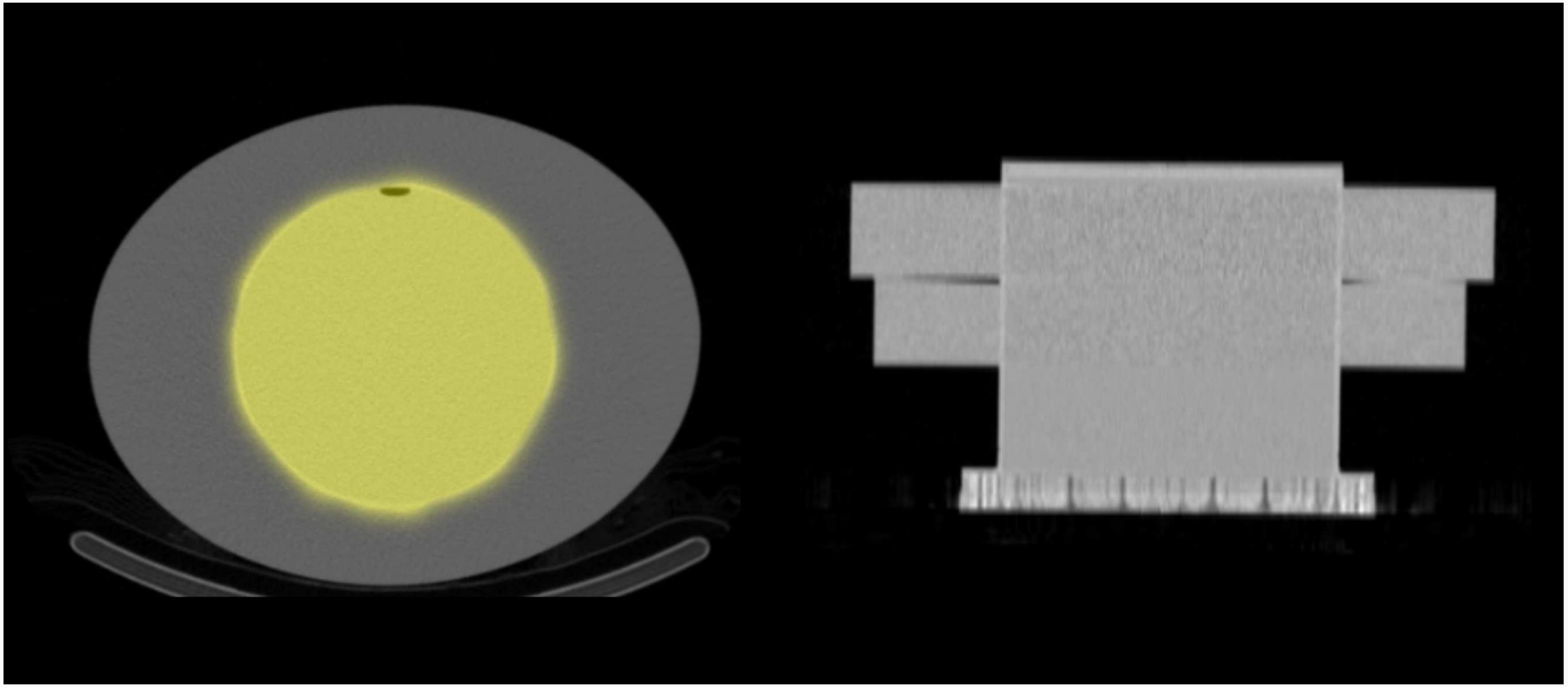
The phantom used - Physical dimensions



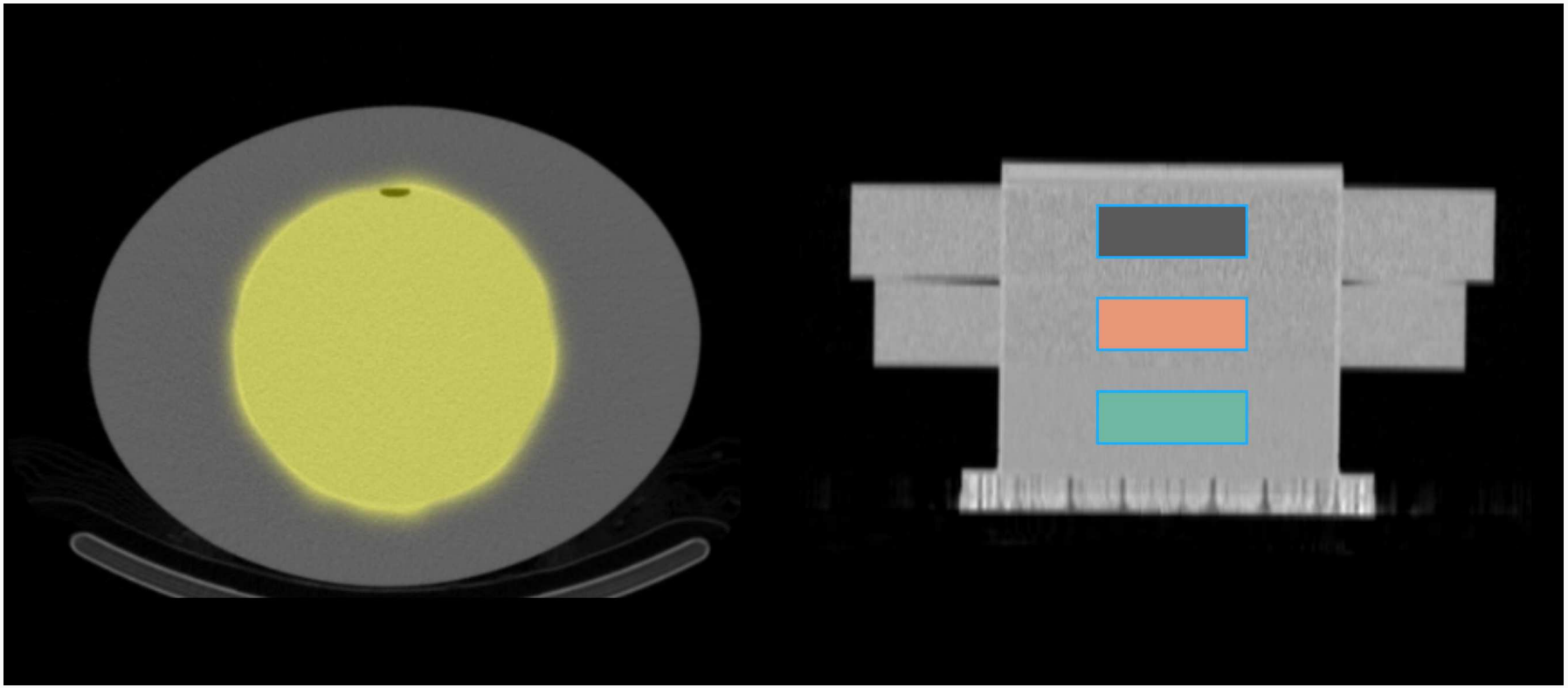
The phantom used - Physical dimensions

- "low": Circumference of 63 cm
- "moderate": Circumference of 95 cm (average female 40-49 years old in USA)
- "high": Circumference of 107 cm (average male 70-79 years old in USA)

The phantom used

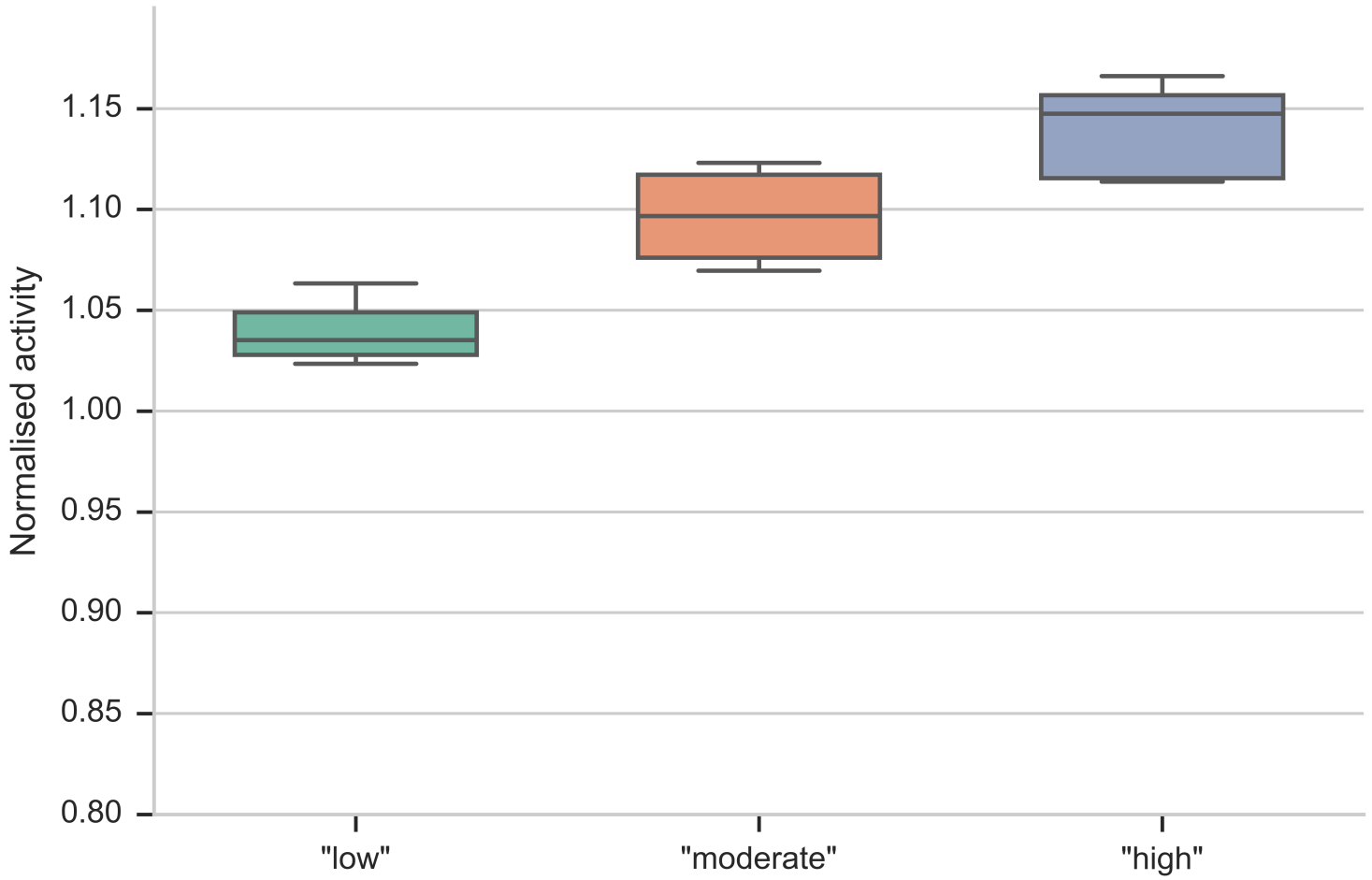


The phantom used



Results

Results


Normalised activity
1.15
1.10
1.05
1.00
0.95
0.90
0.85
0.80
"low"
"moderate"
"high"

Results

- Statistical difference between the average activity concentration in the volumes of interest (Kruskal-Wallis-test and Mann-Whitney-U-test)
- Average normalized activity concentrations were found to be 1.04, 1.10 and 1.14 for increasing attenuation thickness.

Conclusion

- A small, systematic increase in measured activity concentration for increasing attenuation thickness was found.
- Should be further investigated.

End

Thank you for your kind attention! (email: johbla@ous-hf.no)

Slides

Research grp