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Tips & Tricks

CT Working Group

Spectral shaping by tin prefiltration

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Key points

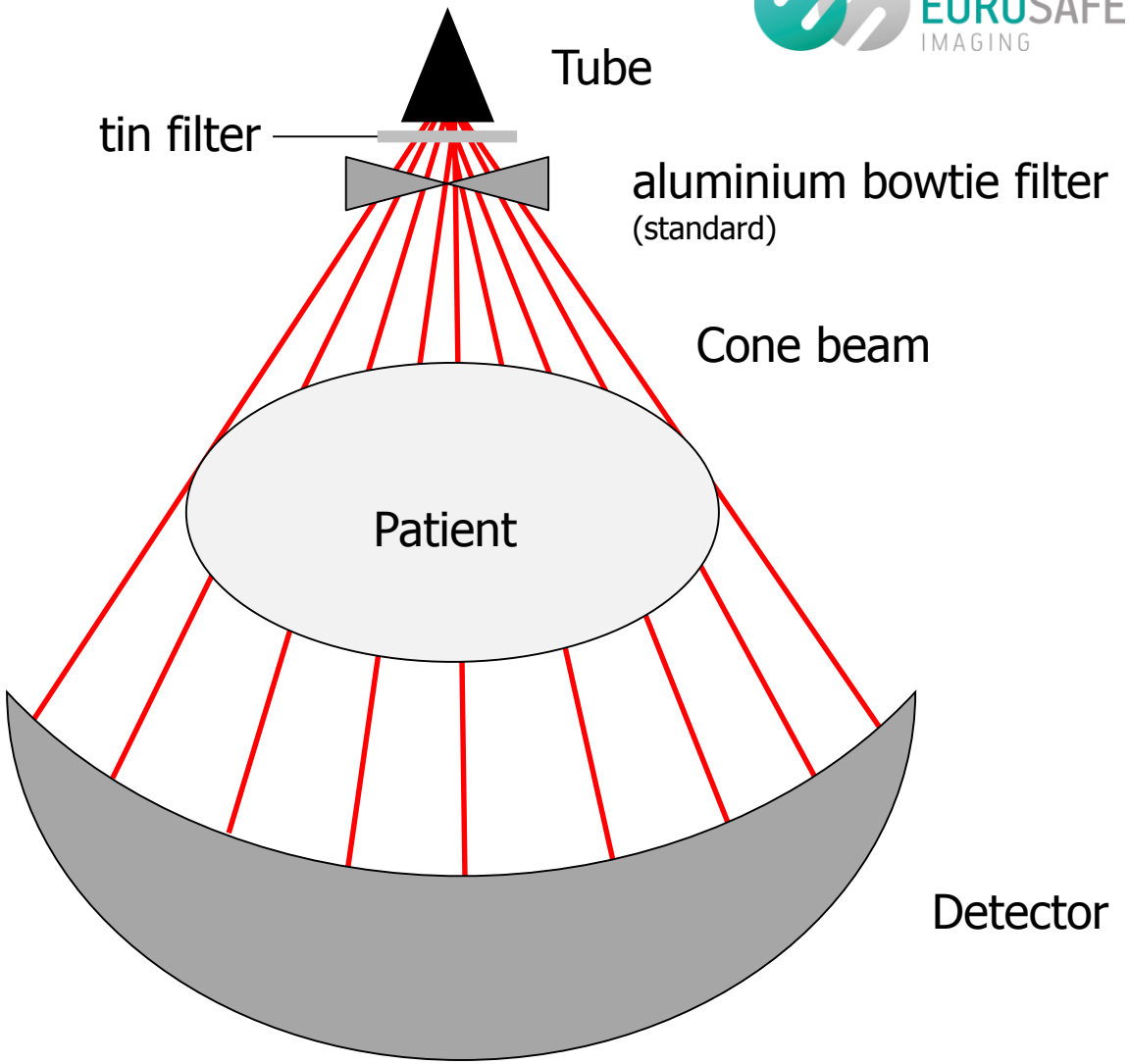
- High energy photons can decrease image noise and contrast.
- Whenever imaging of high contrast structures is aimed, such as bones vs. soft tissues vs. air, increasing the mean photon energy can help to reduce the required radiation dose.
- Tin prefiltration strongly reduces the radiation dose and increases the mean photon energy simultaneously.
- The lower edge of applicable radiation dose of a CT-system can be decreased by tin prefiltration.
- Radiation dose reductions of approximately 20% can be obtained in a clinical setting compared to examination protocols without tin prefiltration.
- Examples for CT-examinations suitable for spectral shaping protocols are:
    - Chest
    - Parasinus region
    - Colonography

Tin prefiltration

The tin filter is added to the standard aluminium filter between the X-ray tube and the patient for spectral shaping.

Tin filters are available in most Dual Source and also in recent Single Source systems.

They have a thickness of 0.4 or 0.6mm, depending on the X-ray tube capacity.



Tin prefiltration

X-ray spectra:

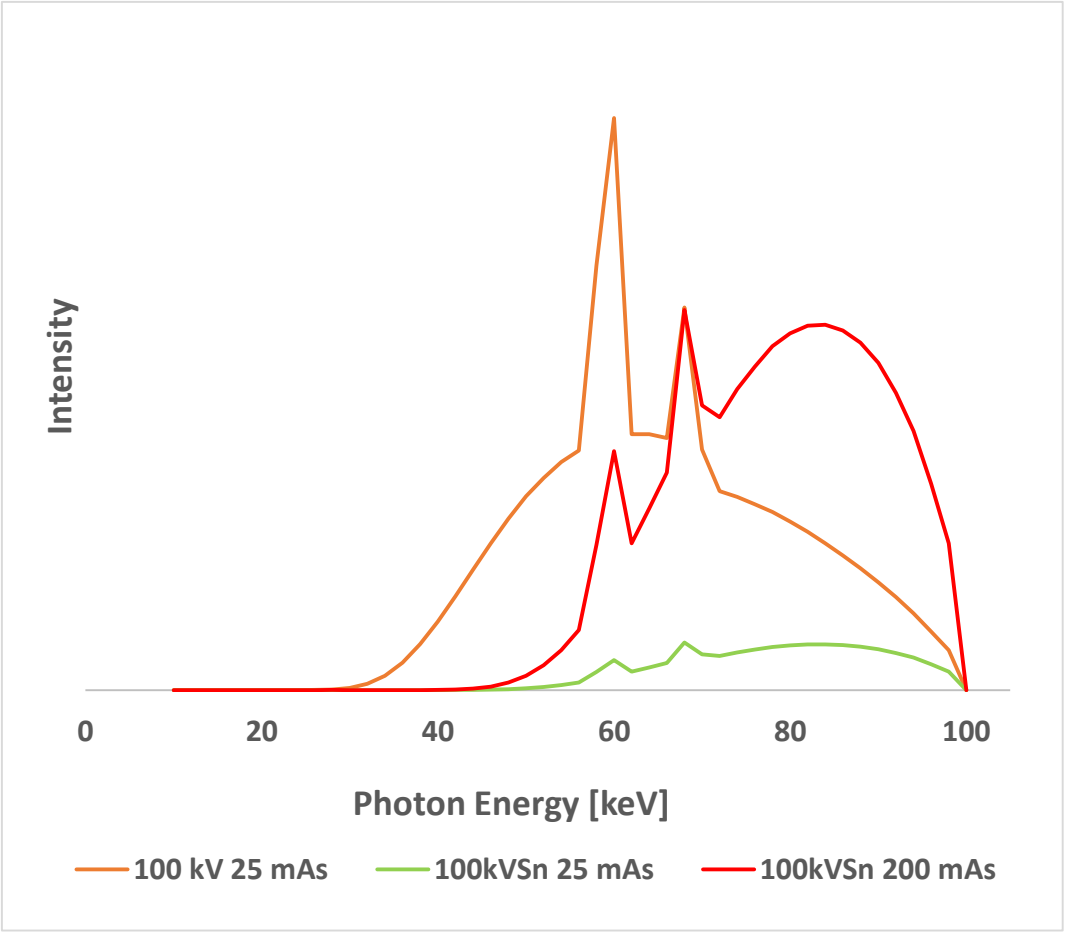
100kV, 25mAs

Adding a tin prefiltration reduces the proportion of low energy photons in the X-ray spectra and substantially decreases the total radiation dose.

100kVSn, 25mAs

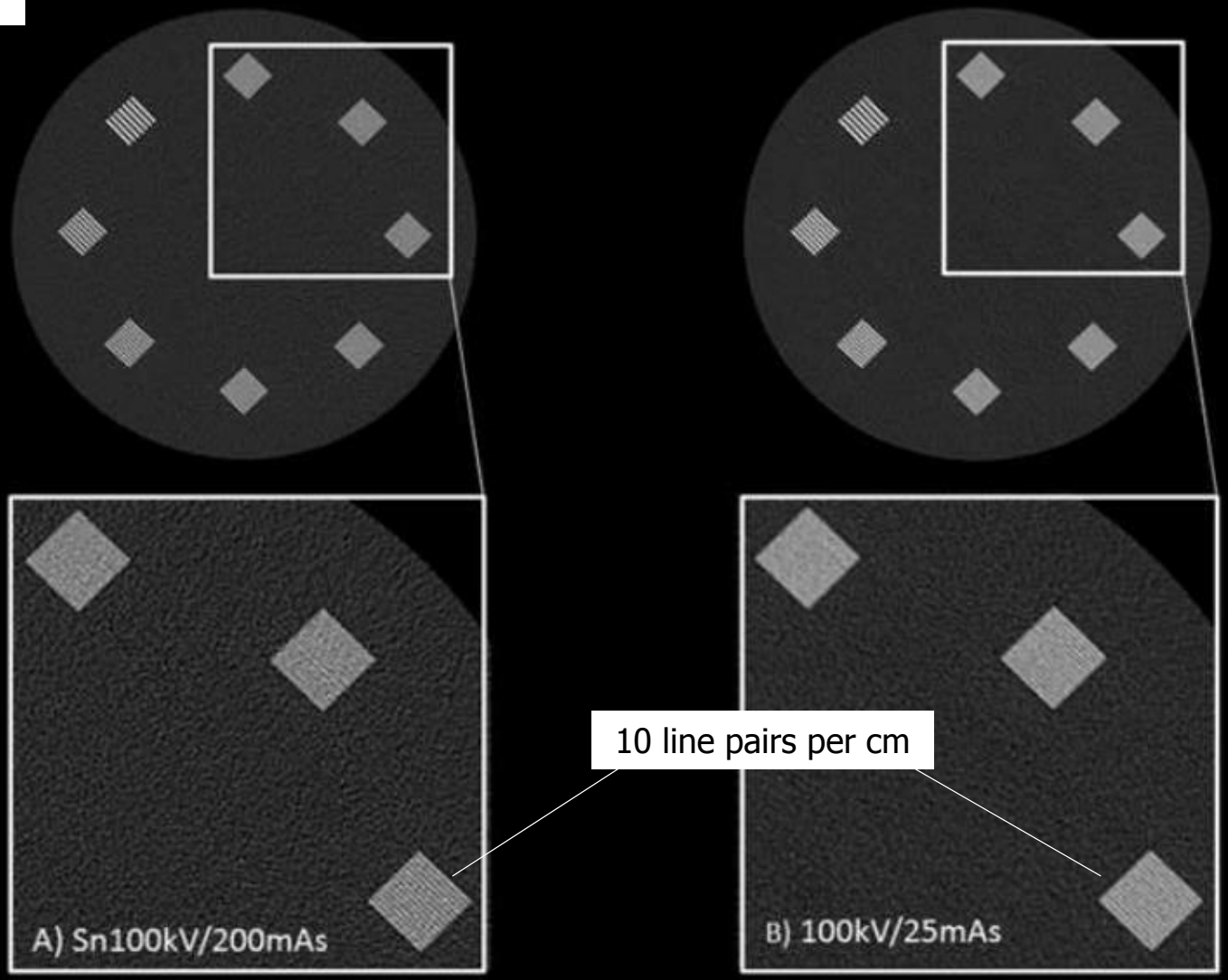
Image noise can be balanced to the initial level by increasing the tube current. The resulting radiation dose is approximately 20% less than without tin prefiltration.

100kVSn, 200mAs



Line pair resolution

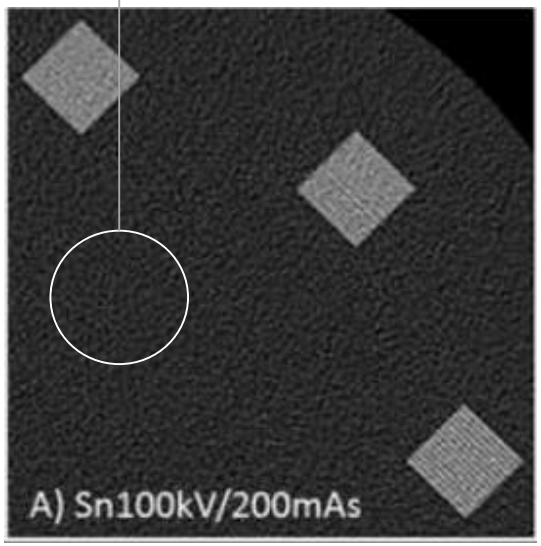
The resulting line pair resolution is comparable between the protocol with and without tin prefiltration, with slight advantages using Sn100kV.



Radiation dose and image noise

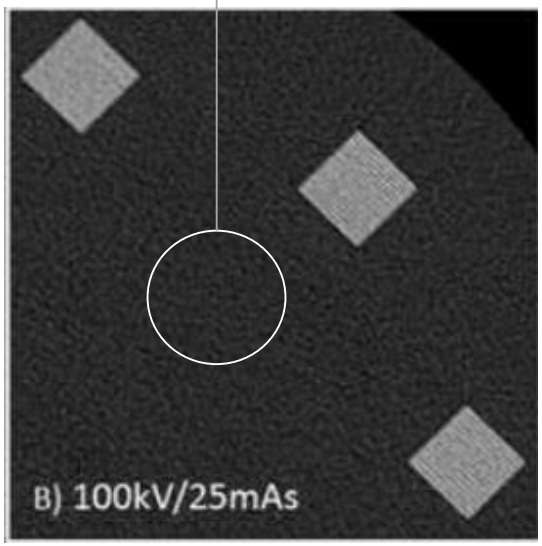
- Results from repetitive phantom measurements using a 100kVSn/200mAs and a 100kV/25mAs protocol.

Mean image noise = 17.6 HU



CTDIvol = 1.7 mGy

Mean image noise = 17.5 HU

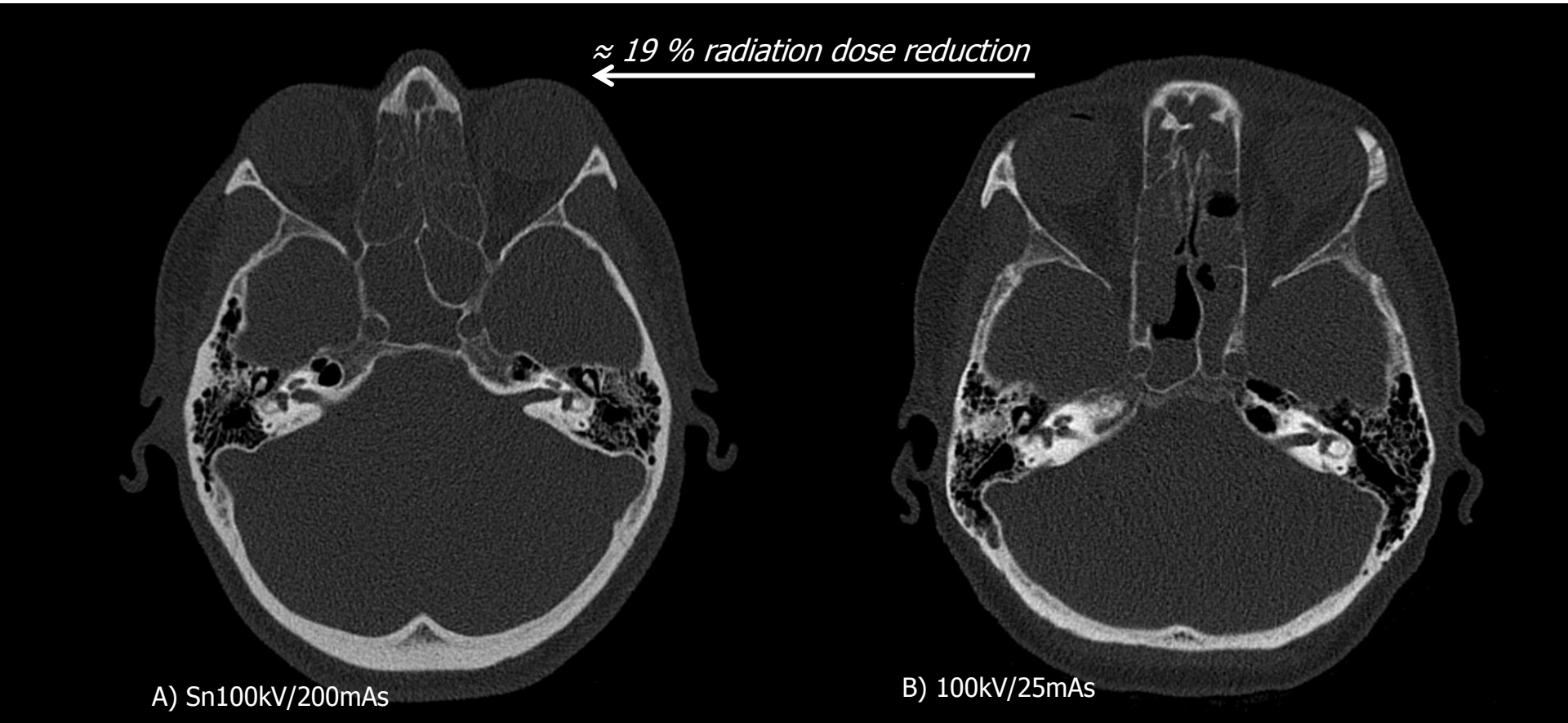


CTDIvol = 2.1 mGy

Examples

- Evaluation of both protocols for the parasinus region in 100 patients: Two representative examples of different patients suffering from pansinusitis

Effective dose = 0.053 mSv	p<0.01	Effective dose = 0.065 mSv
Mean image noise = 15.9 HU	p=0.70	Mean image noise = 15.8 HU

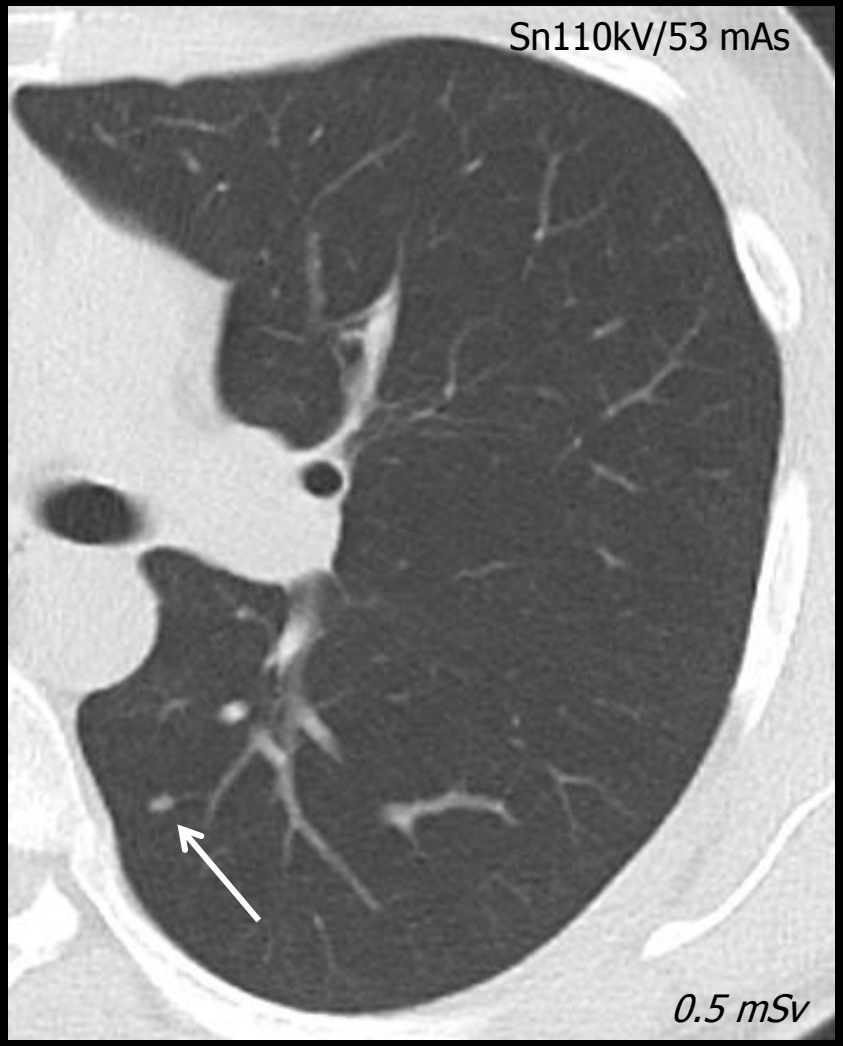


Examples

- Chest: Further radiation dose reduction can be achieved if an increased image noise is accepted. Many of the common pathological changes in the lungs can be sufficiently delineated with examination protocols close to radiation dose of a chest radiograph in two planes. For example, in this patient suffering from pneumonia, the ground glass opacities are comparably reproduced in the low-dose follow up examination using a tin prefiltration.

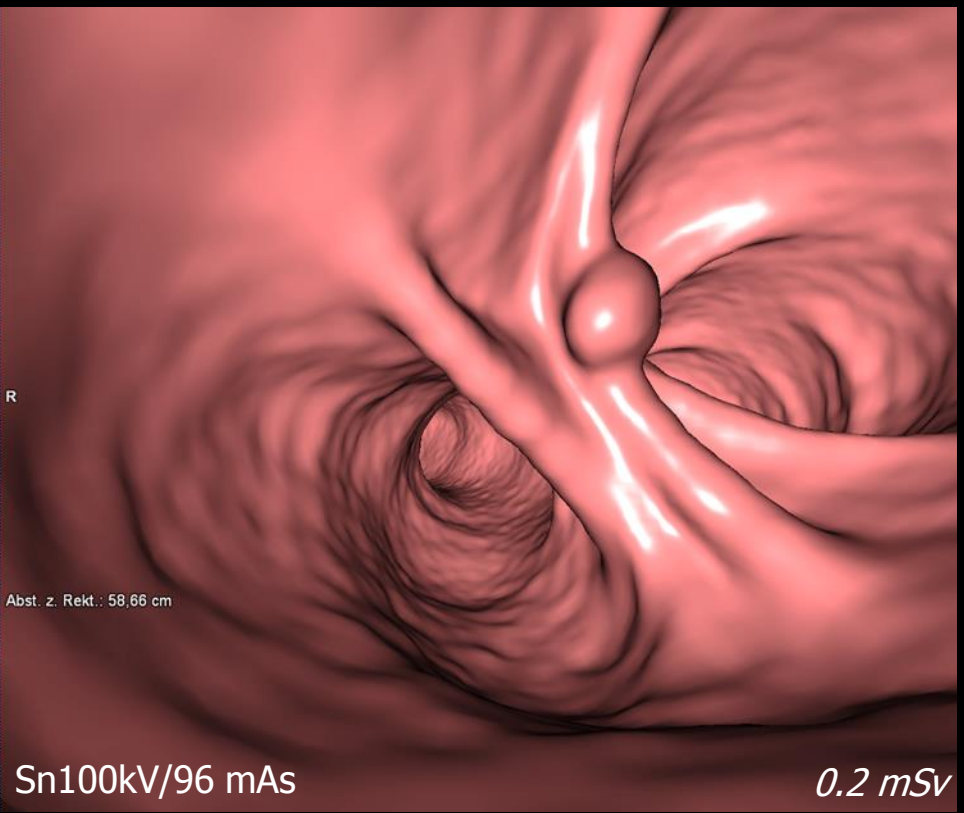
Examples

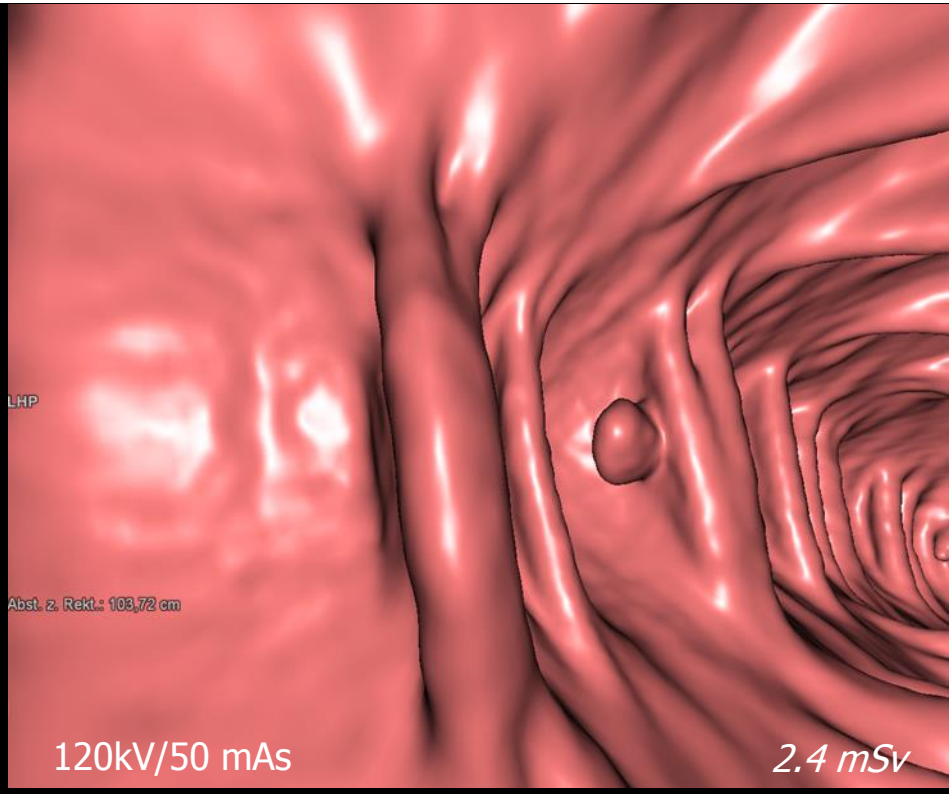
- Chest: Identical reproduction of a small pulmonary nodule in a follow up examination of a patient with metastatic disease (white arrows).



Examples

- Colonography: Polypoid lesions can still be detected with very low radiation dose settings.





References

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