Measurement of eye lens radiation doses to staff during percutaneous coronary interventional procedures

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Introduction

- In 2011 the International Commission on Radiological Protection (ICRP)
  - The dose limit for the eye reduced from 150mSv to 20mSv
  - Evidence of a lower dose threshold for radiation induced cataract

- Interventional clinicians a high risk group

- Eye lens dosimetry is challenging, measurement point at a remote position from the eye lens.

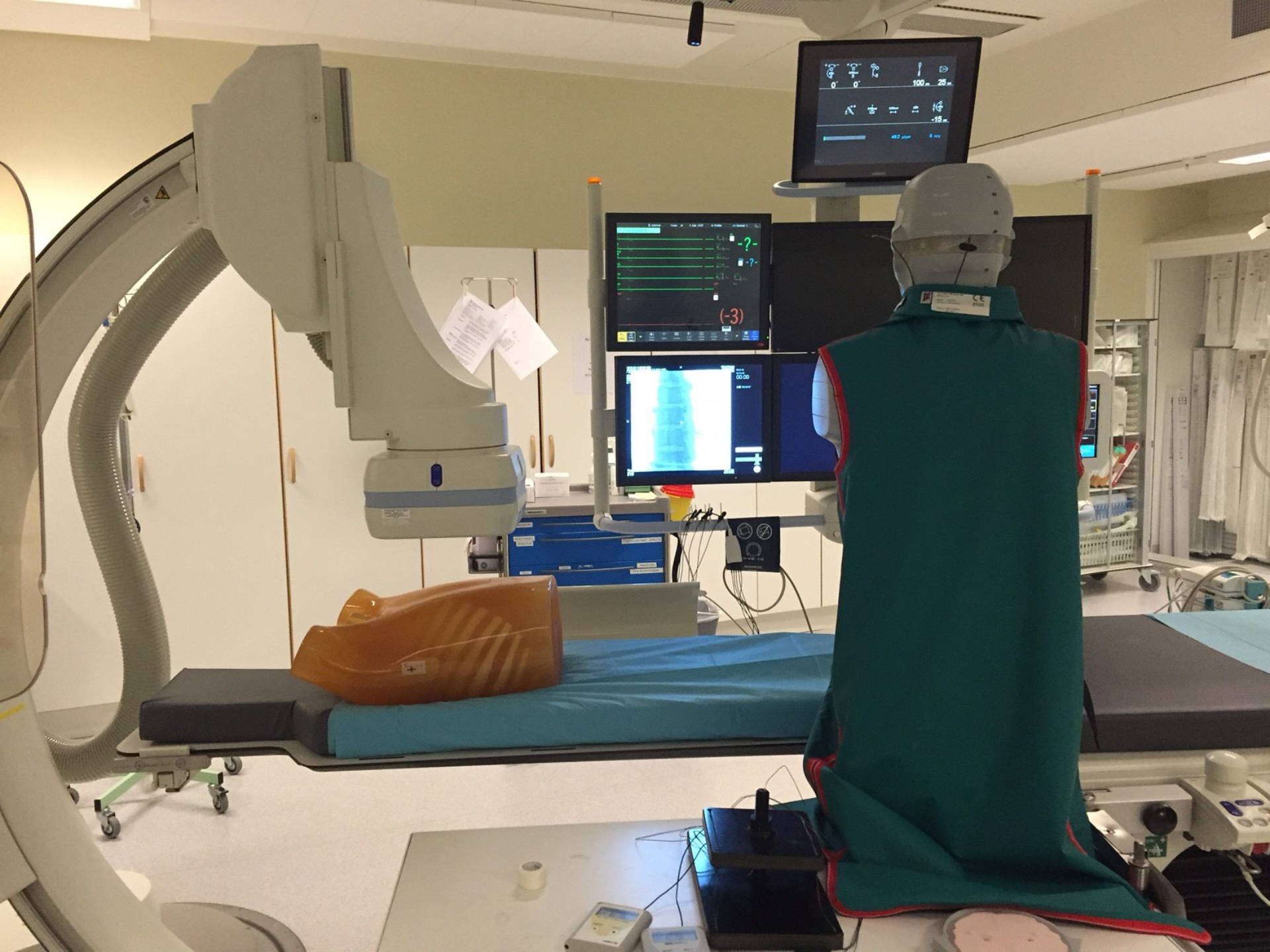
Objectives

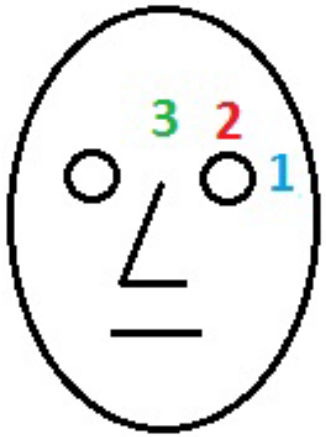
- Improve the accuracy of eye lens dose measurements
  - Establishing optimal measurement position
  - Evaluate the effect of projection angles and patient sizes

- Evaluate dose reduction ability of protective eyewear and protective shields in use

Method

- Initial field studies, following clinical procedures
- Phantom measurements in the PCI room
  - Dose measurements at different positions on the forehead and in eye lens
  - Measurements on protective eyewear and shields

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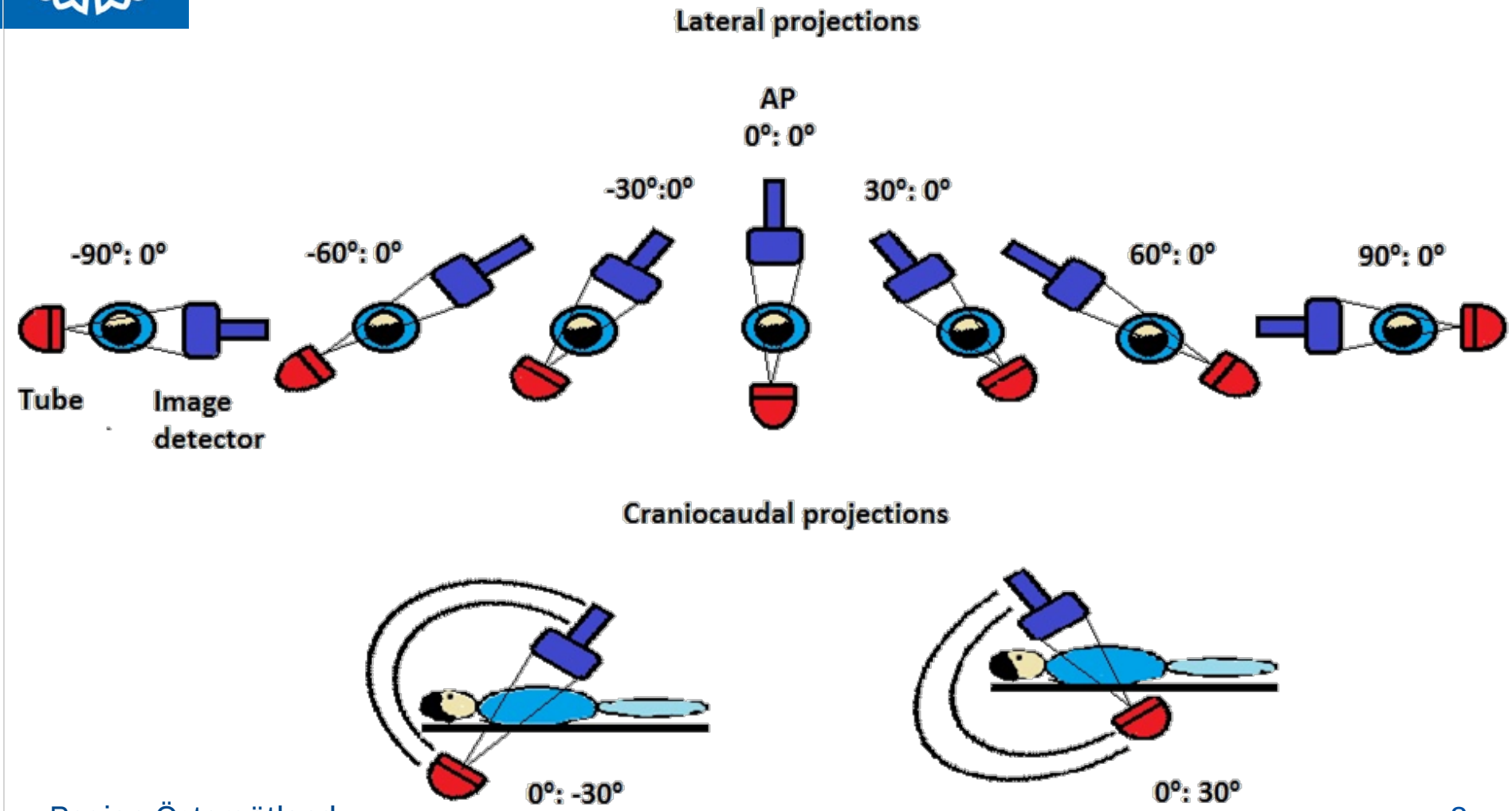
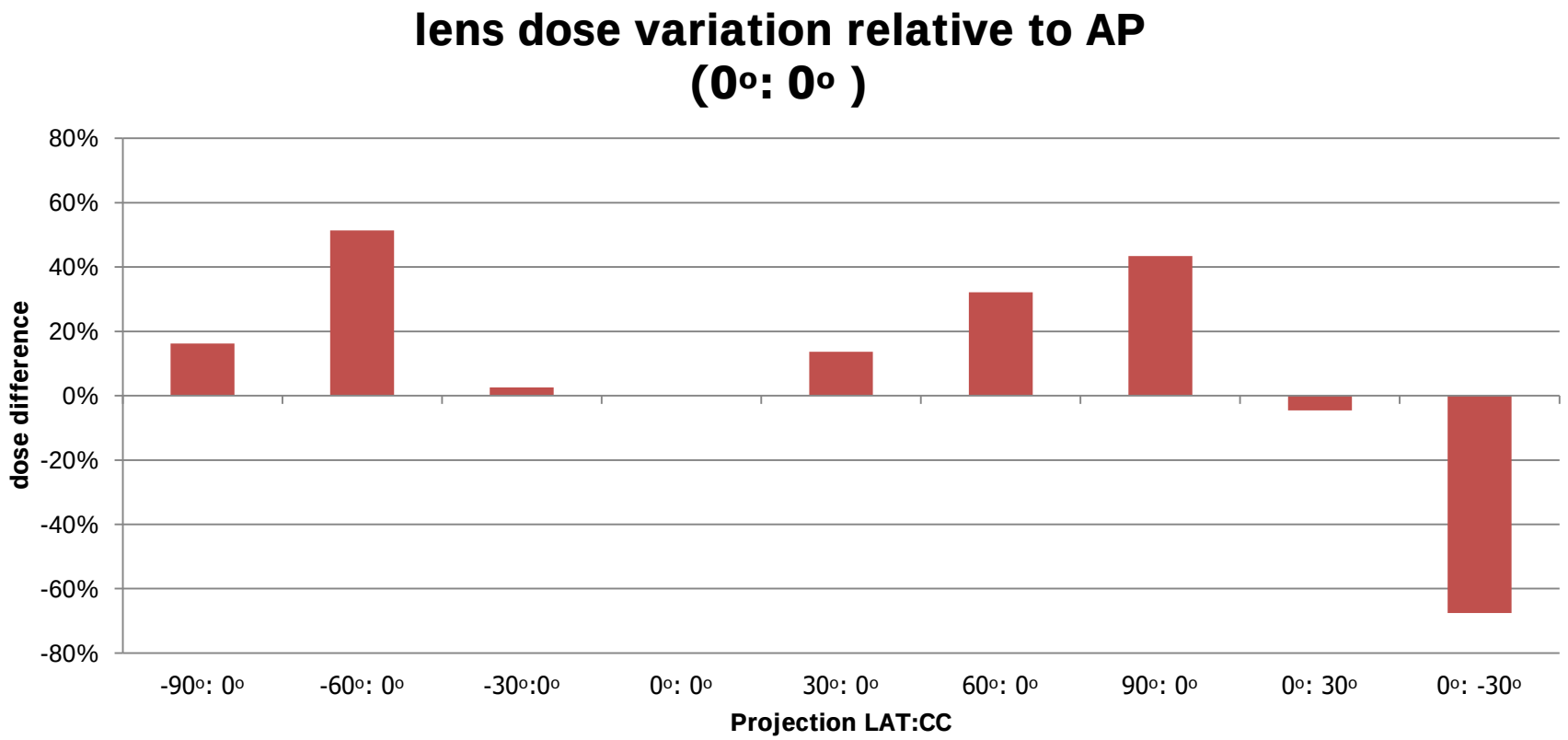
Measurement equipment

- Semiconductor-type dosimeters
- Calibrated Hp(0.07) in N80 field
- Suitable for energy range 14-120 keV

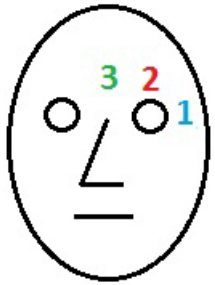
X-ray projections

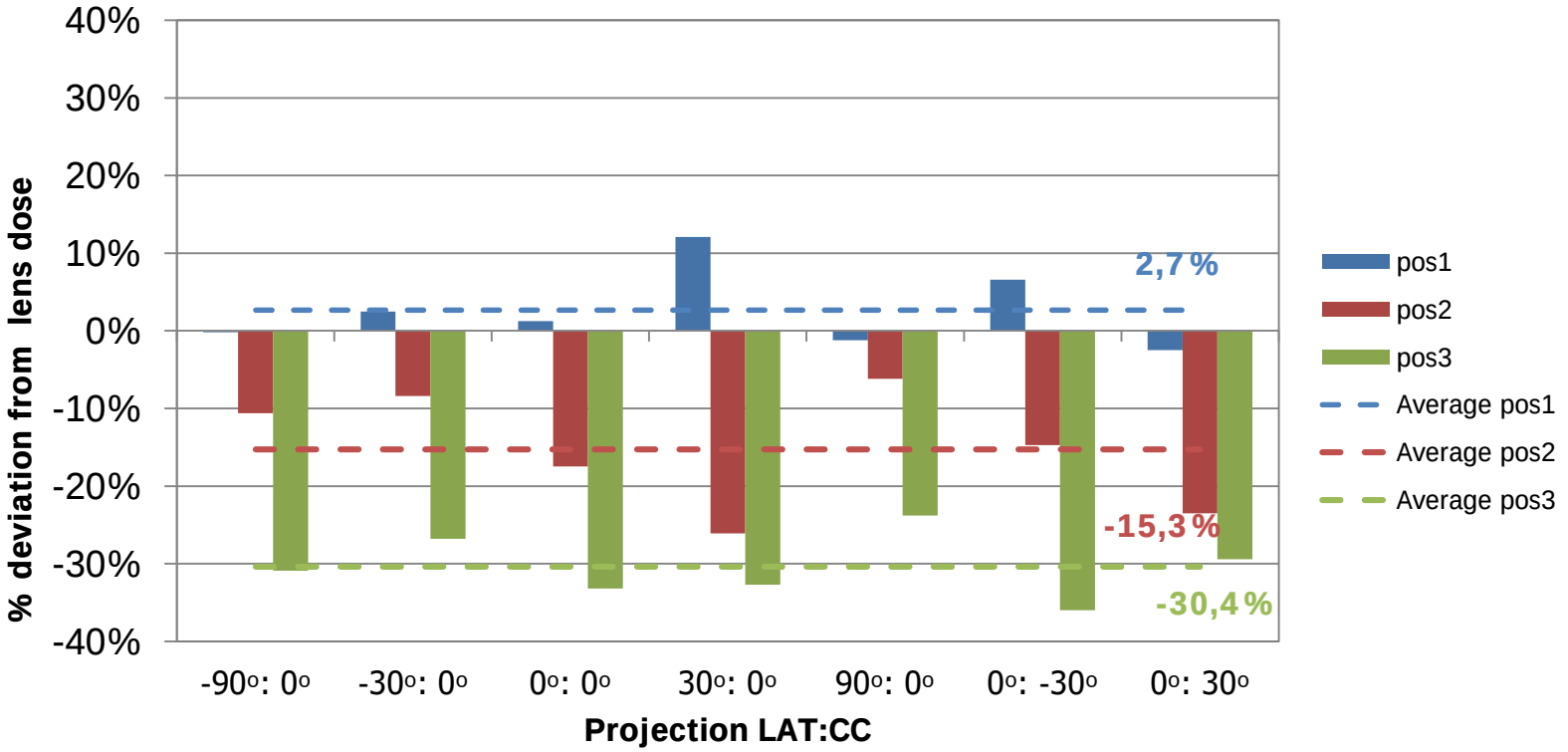


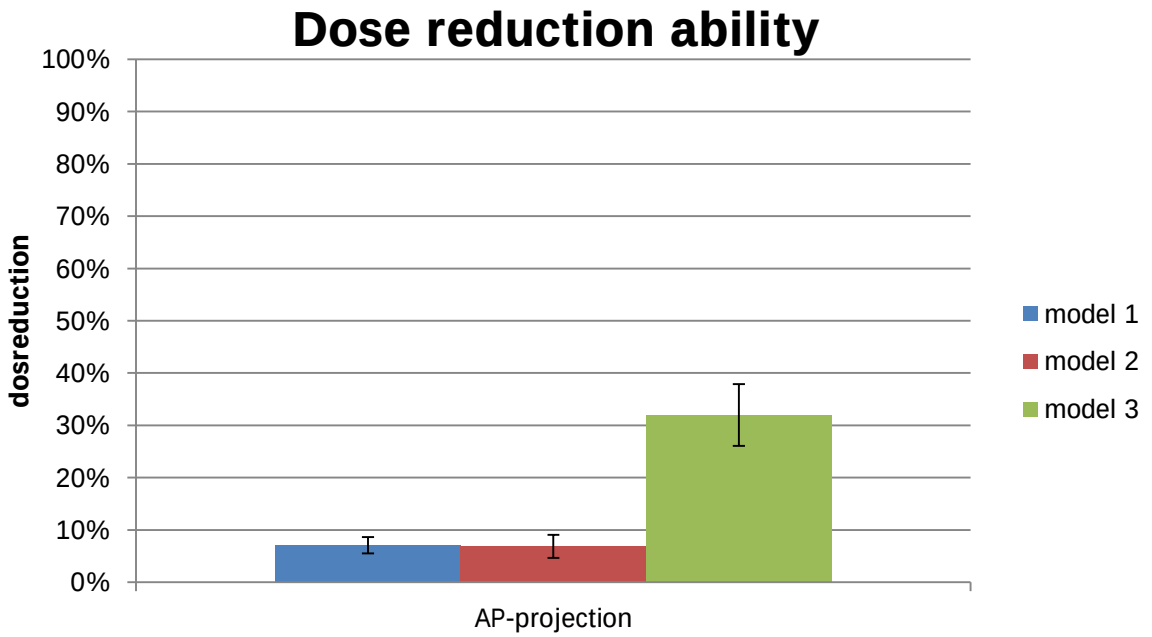
Lens dose variation with projection angle



Deviation from lens dose





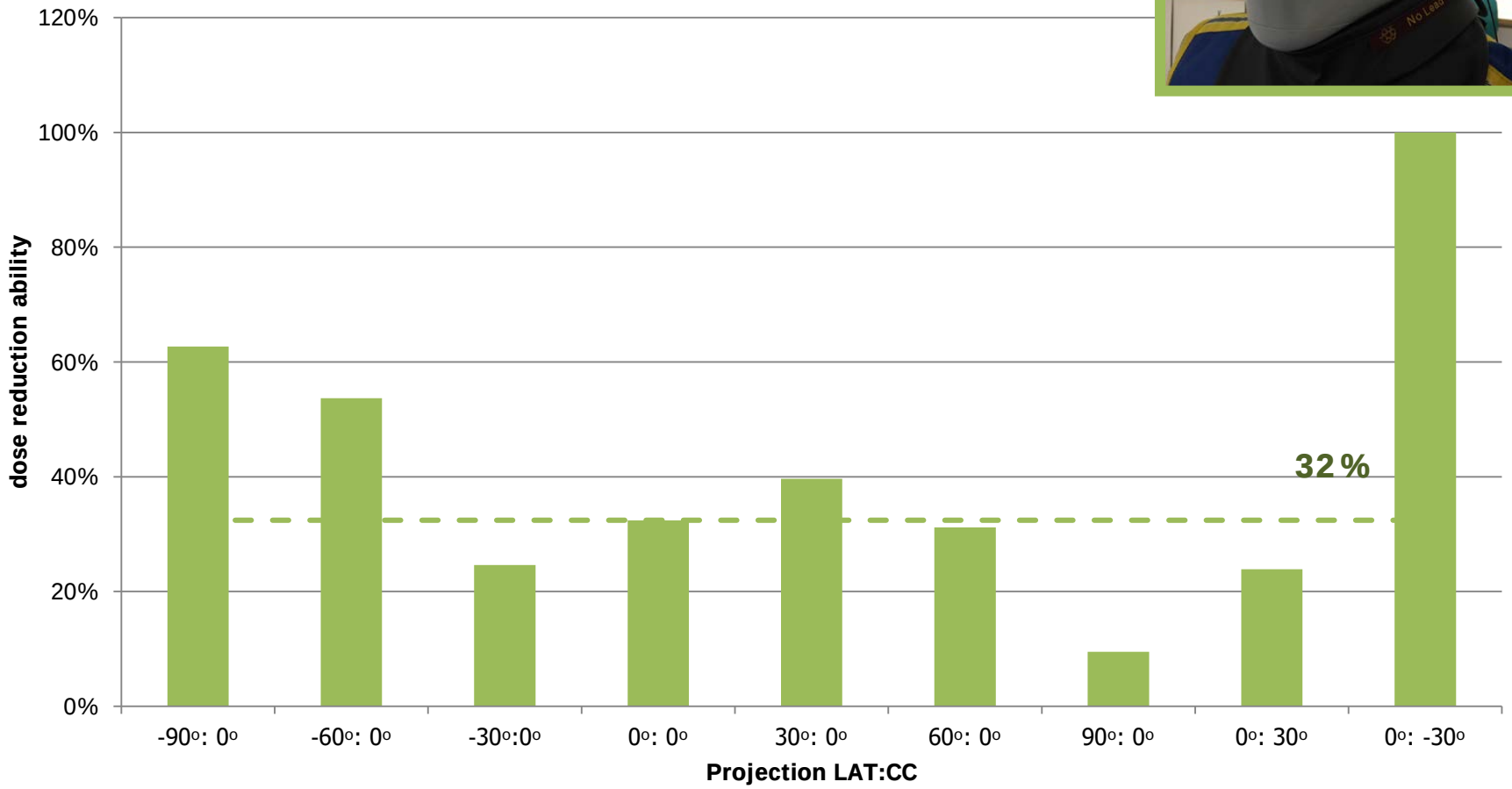


Model 1

Model 2

Model 3

Dose reduction ability over a range of projection angles



Protective shield

Ceiling suspended radiation shield, 0.5 mm lead equivalent

≈ 100% dose reduction

Conclusions

- **Optimal measurement point: left side of the face at eye level**
  - Mean deviation from dose in eye lens 3%
  - < 12% variation between different projection angles
  - Patient size did not affect the choice of position
- **Protective eyewear**
  - lower than expected dose reduction ability
  - size and curvature of frame of importance
  - dose reduction ability varied signficantly with projection angle
- **Protective shields provide the best shielding ability**

Future work

- Establish routine for eye lens dose monitoring
- Test different models of protective eyewear
- How does eyewear affect our dose estimate and can we correct for it using a fixed dose reduction factor?

Thank you for listening!

Special thanks to my coauthors Erik Tesselaar, Magnus Gårdestig, Håkan Petterson