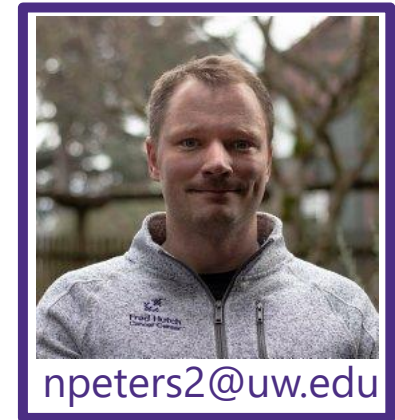


Split-Beam and Dual-Spiral Dual-Energy CT for Radiotherapy Treatment Planning

Nils Peters, Claire Chen, Stephanie Schaub, Dominic Maes, Jatinder Saini, Eric Ford, Clemens Grassberger, Stephen Bowen
University of Washington & Fred Hutch Cancer Center, Seattle



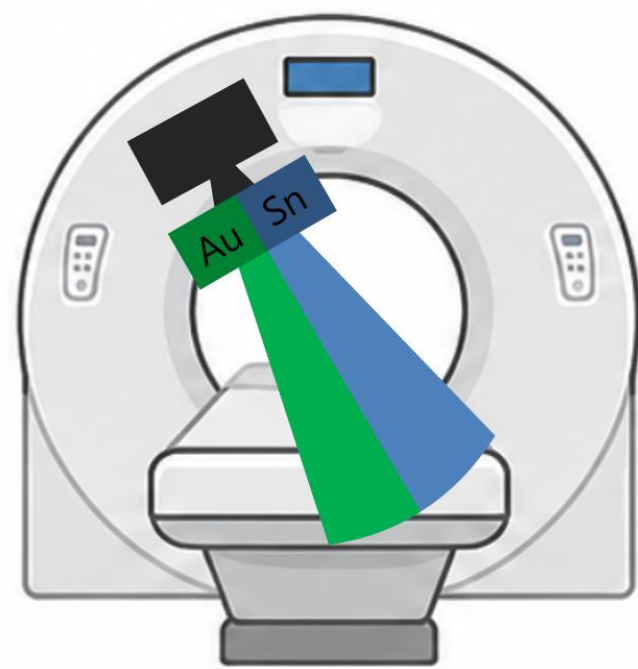
Synopsis

Dual-energy CT is gaining traction in radiation oncology due to

- more accurate tissue characterization,
- better soft tissue contrast, and
- the ability to reduce metal artifacts

Limited guidance exists for split-beam and dual-spiral DECT protocol definition. Here, we provide a comprehensive assessment of scan and reconstruction parameter influence for a novel DECT scanner, providing essential guidance for radiotherapy clinics introducing this new technology.

Split-Beam



Scanmodes:
AuSn120 kVp
AuSn140 kVp

DECT

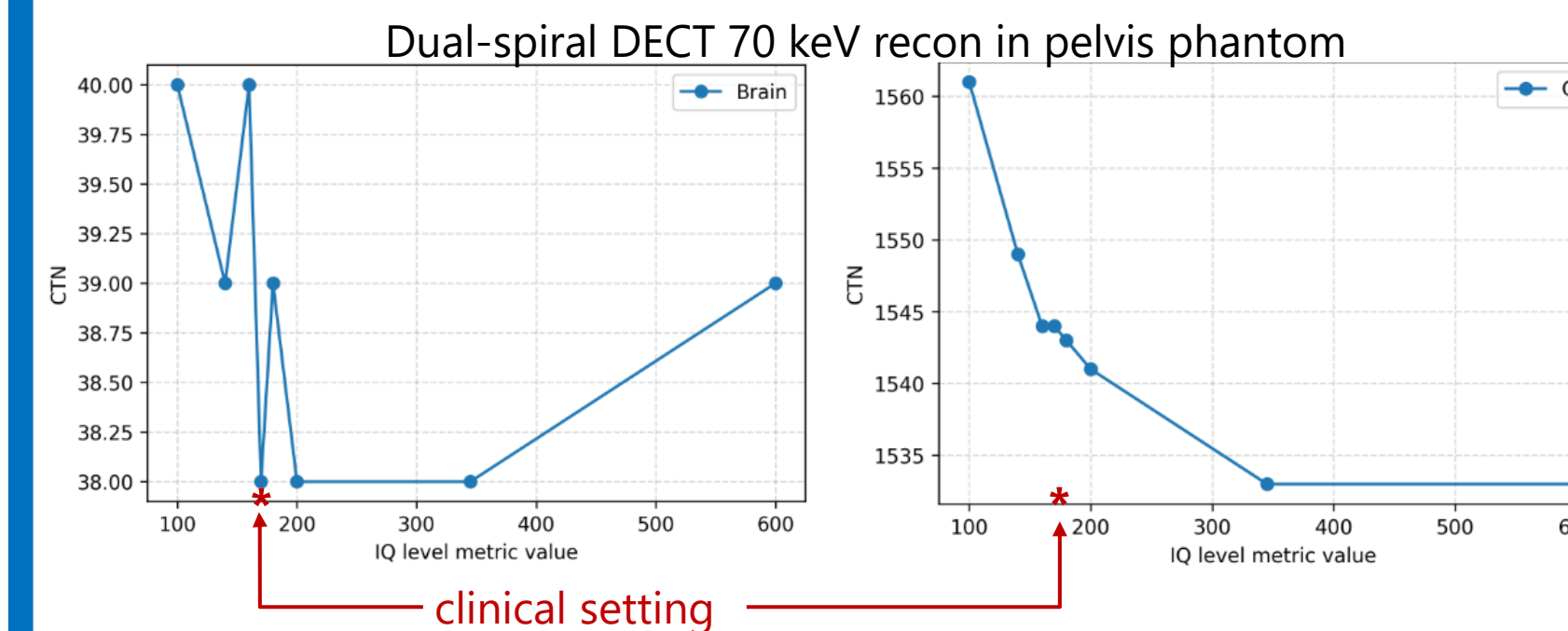
Dual-Spiral



Scanmodes:
80/Sn150 kVp
100/Sn150 kVp

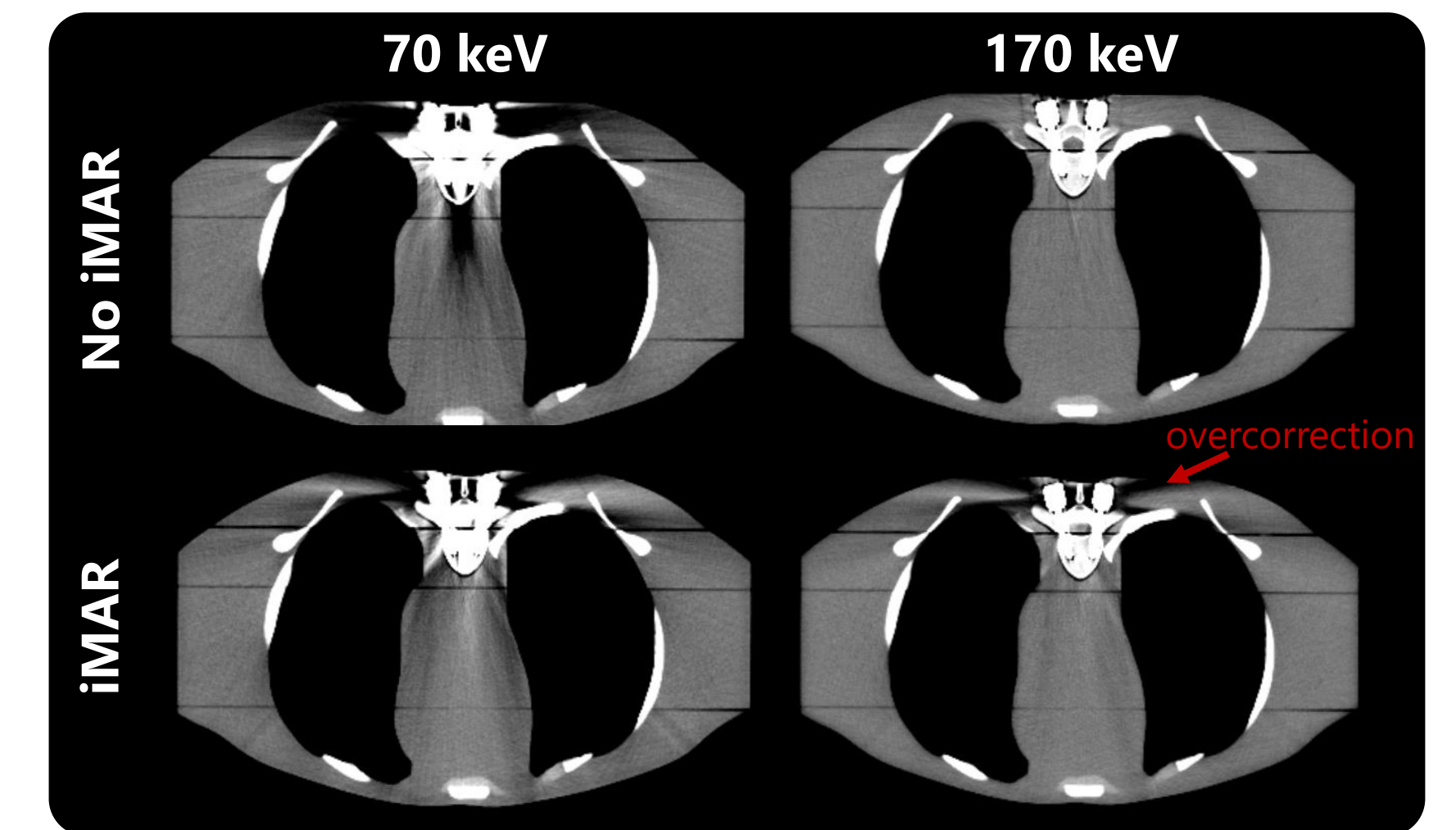
Aim: Ensure CT number stability for different dose levels

Background: Siemens introduced IQ metric as patient-specific dose modulation levels



- Stable CT numbers in lung and soft tissue
- Large variations in dense bones

Aim: Determine best combination of monoenergetic CT reconstruction with metal artifact reduction (iMAR)



- 170 keV provides best image quality, iMAR overcorrects
- For larger metal implants: 170 keV + iMAR best

MonoCT matching

CT number stability

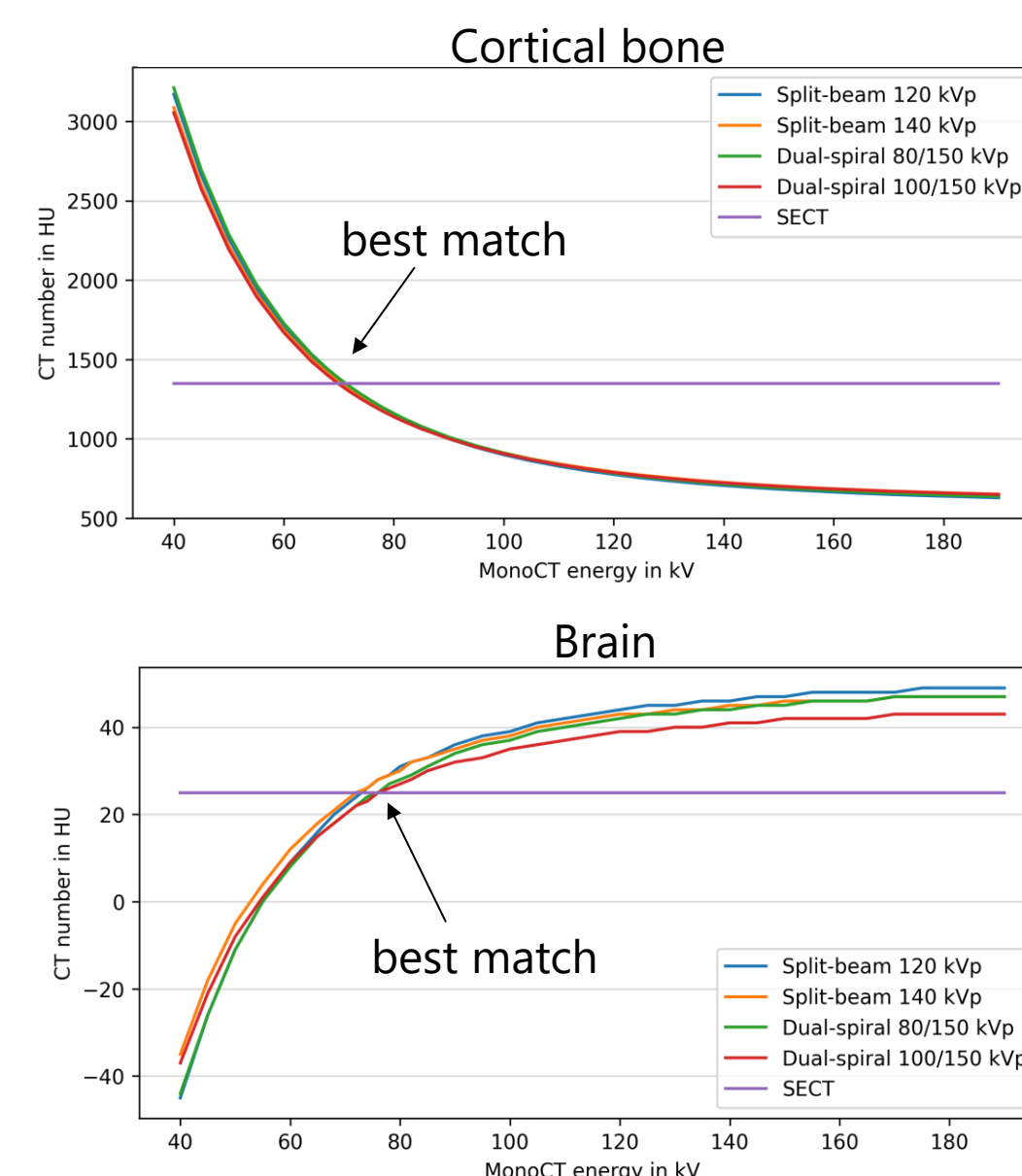
Contrast optimization

Metal artifact reduction

Experimental validation

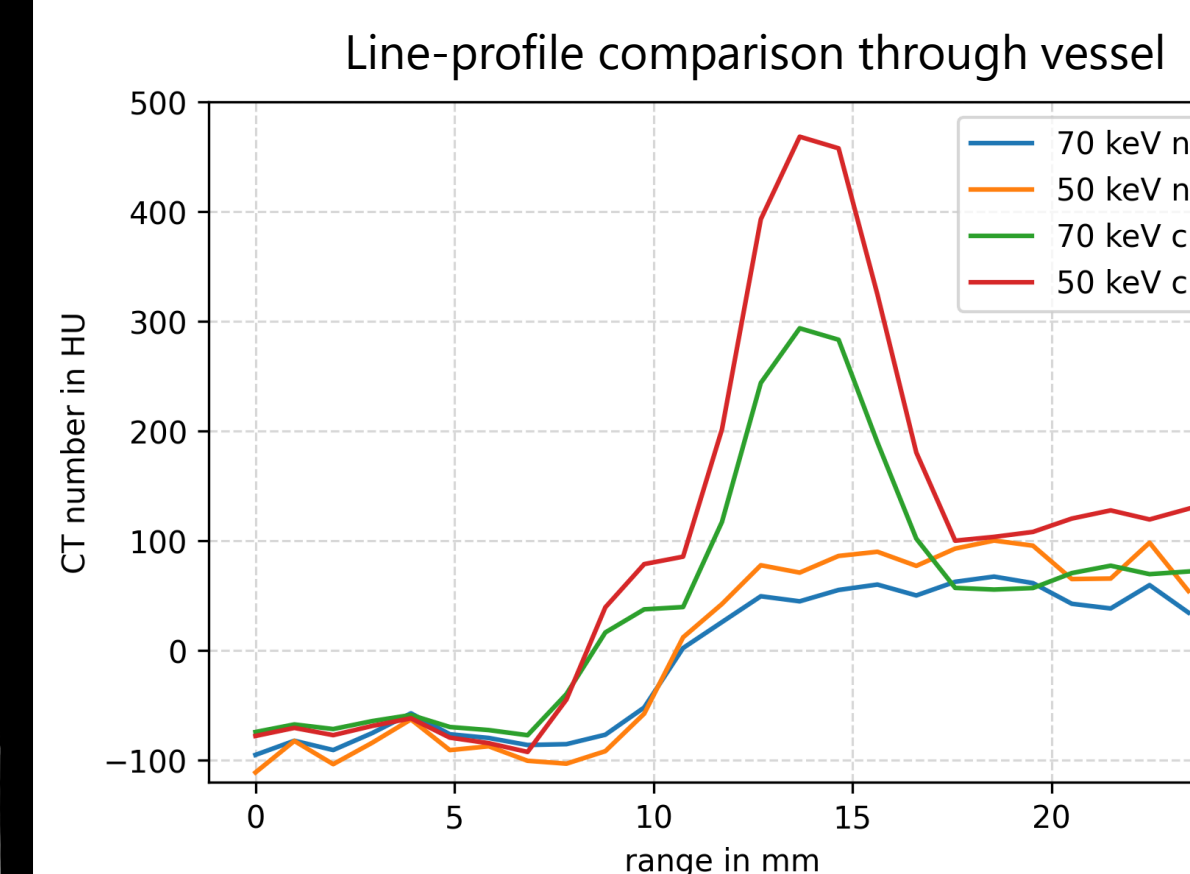
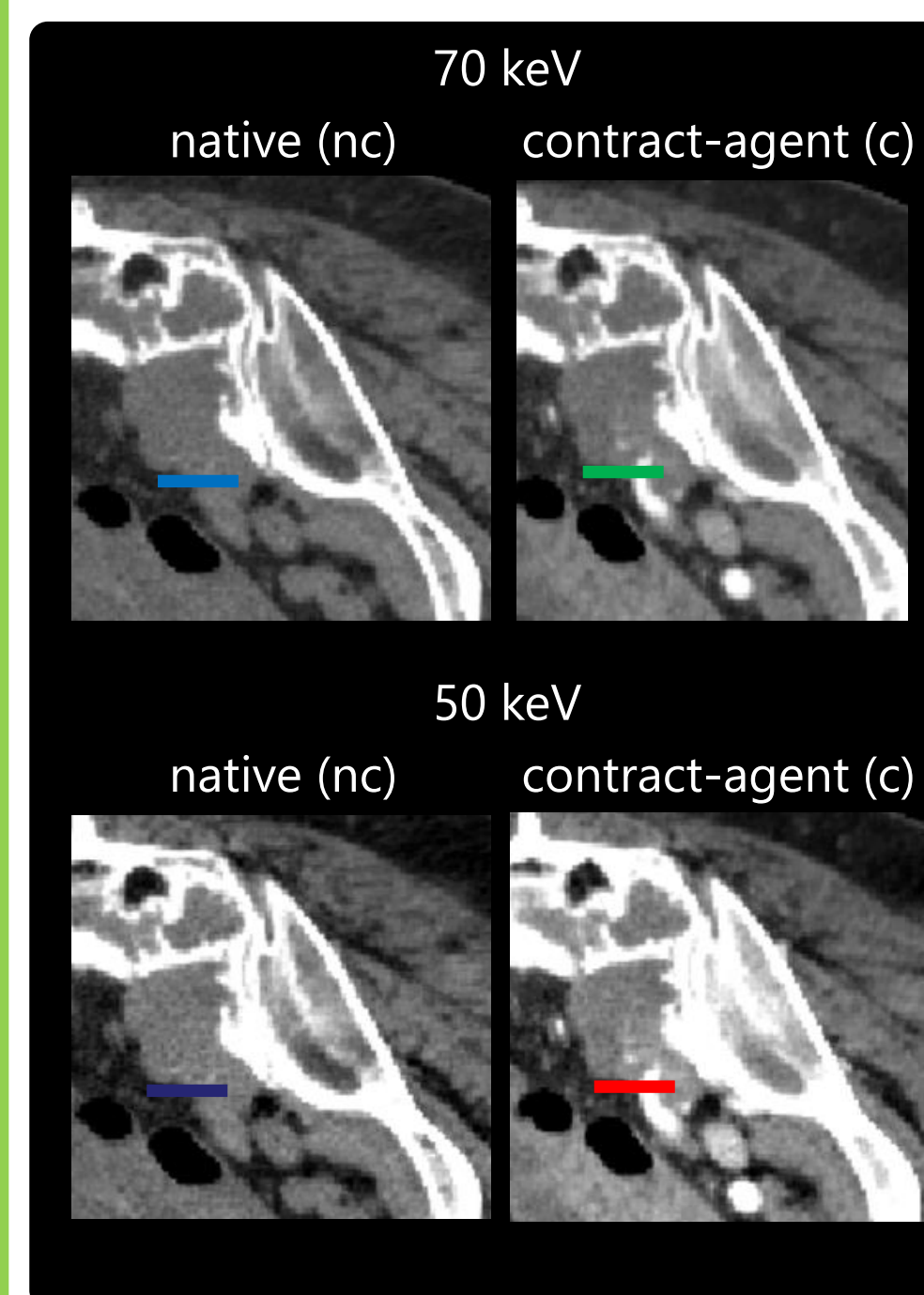
Full clinical implementation

Aim: Find pseudo-monoenergetic CT energy matching SECT for streamlined clinical workflow



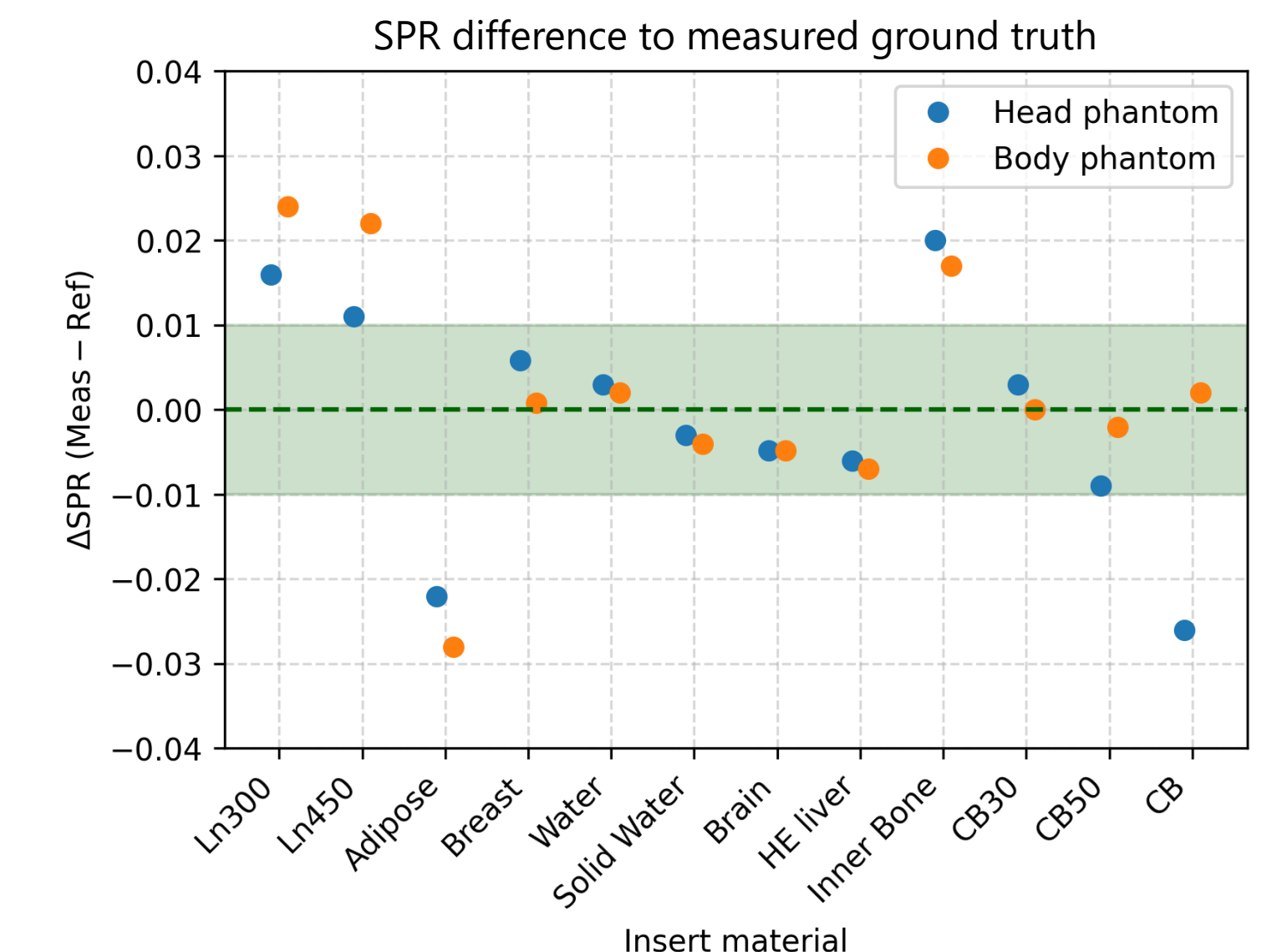
- Overall good agreement between scan modes
- Best match over all tissues for 70 keV

Aim: Quantify the increase in contrast from using low-energy monoenergetic CT reconstruction (50 keV)



→ 50 keV contrast enhancement in dominant vessel of +70%

Aim: Evaluate stopping-power prediction accuracy of vendor-provided algorithm



- Good agreement in soft tissues
- Some deviations for bone in head setup

