Large Volume Scan Trajectory for Mobile C-Arm CBCT Systems: A Simulation Study

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Introduction

- **The field of measurement (FOM) in C-arm CT scans is limited by detector size, angular range and scan trajectory.**

- **A limited rotation range can be compensated by using the rotate-plus-shift (RPS) trajectory, leading to a fully sampled FOM.**
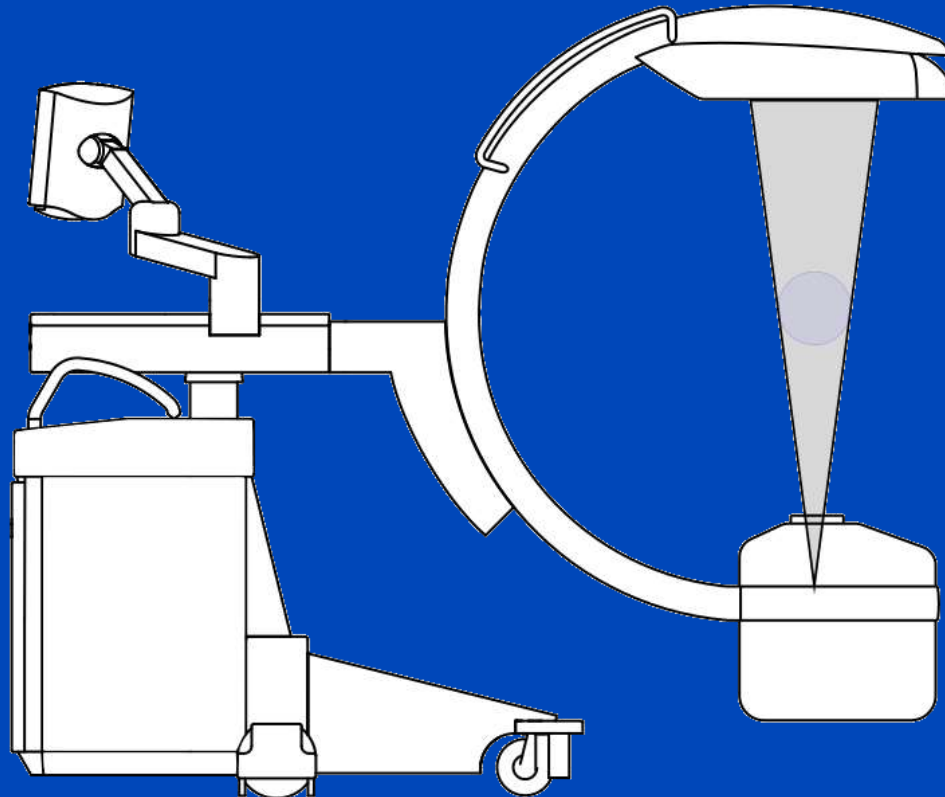
Introduction

- **Cone-beam geometry in a circular scan trajectory results in a FOM whose diameter is approximately half of the detector size.**
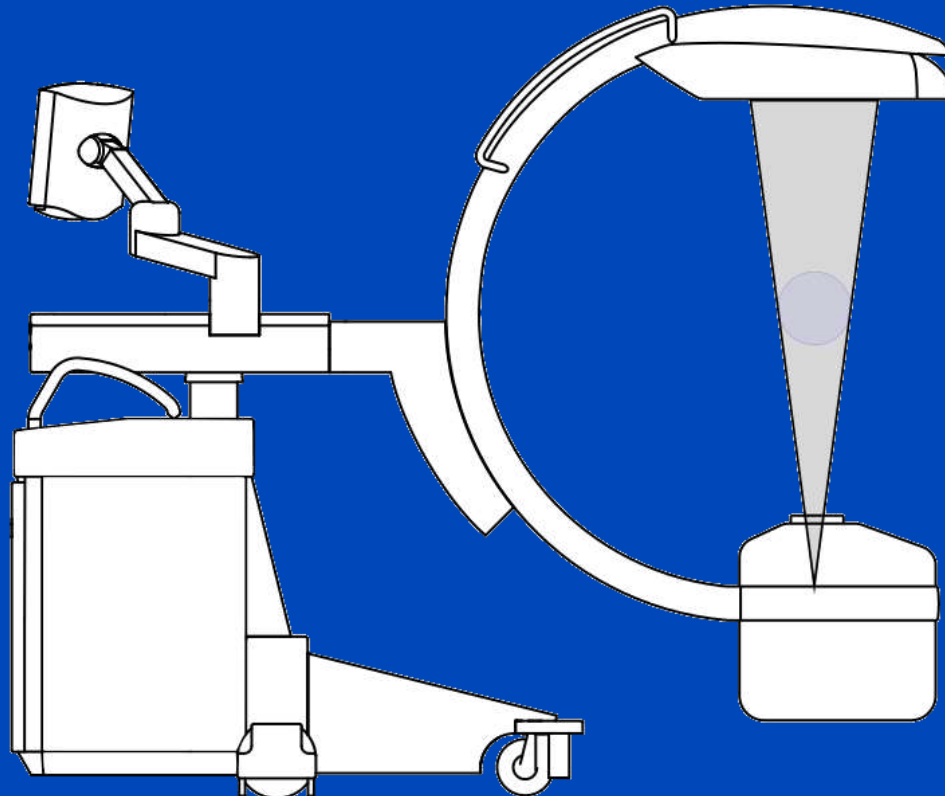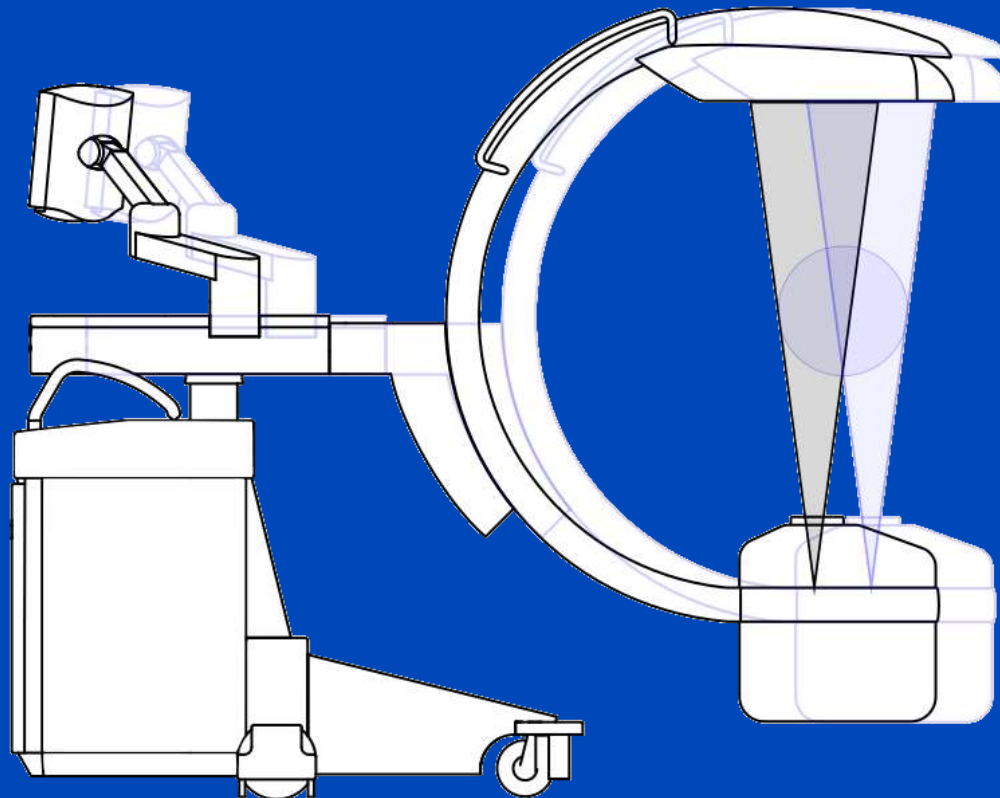
Introduction

- **Neither the detector size nor the rotation range can be increased without restricting compactness, mobility and flexibility of mobile C-arm CT systems.**

Purpose

- **To increase the FOM acquired with mobile C-arm CT systems using a shifted detector option.**
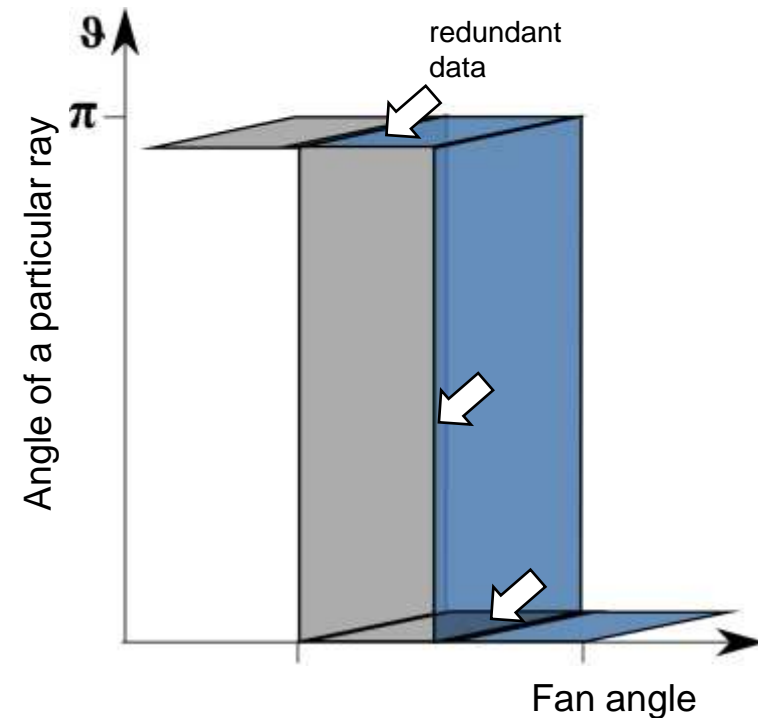
SDRPS Trajectory

Combining the shifted detector (SD) technology with the RPS trajectory yields the new shifted detector rotate-plus-shift (SDRPS) trajectory can:

- Increase the FOM by almost a factor of two

- Sample the whole FOM correctly with 180°

- Result in high quality datasets without limited angle artifacts

Rawdata Weighting for the SDRPS Trajectory

- **Overlap of projection data leads to a region of redundant rays in the sinogram (arrows).**

- **A dedicated rawdata weight for SDRPS scans was derived.**

180° data completeness in parallel sinogram

redundant data

Angle of a particular ray

Fan angle

Shifted Detector Trajectory for Mobile C-Arm Systems
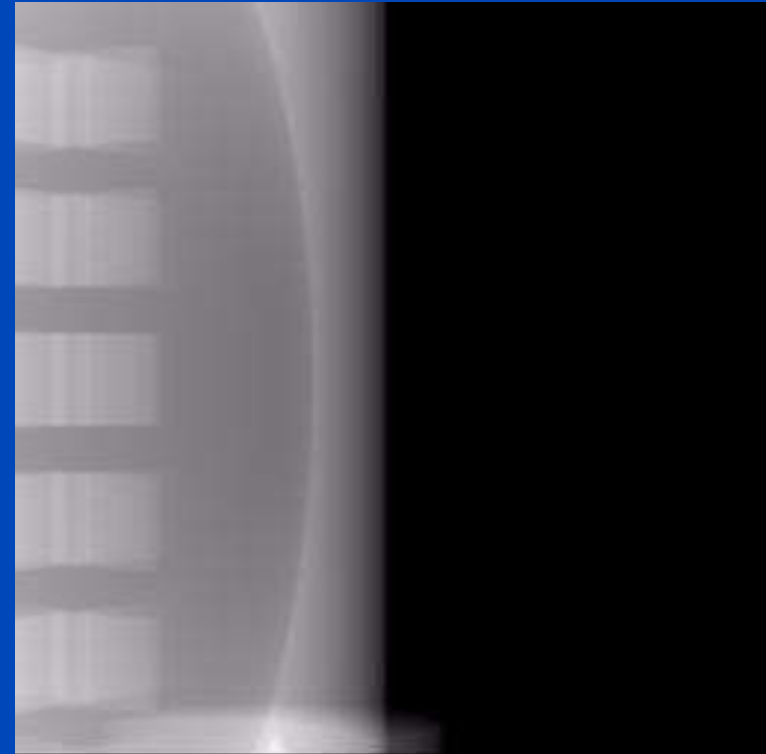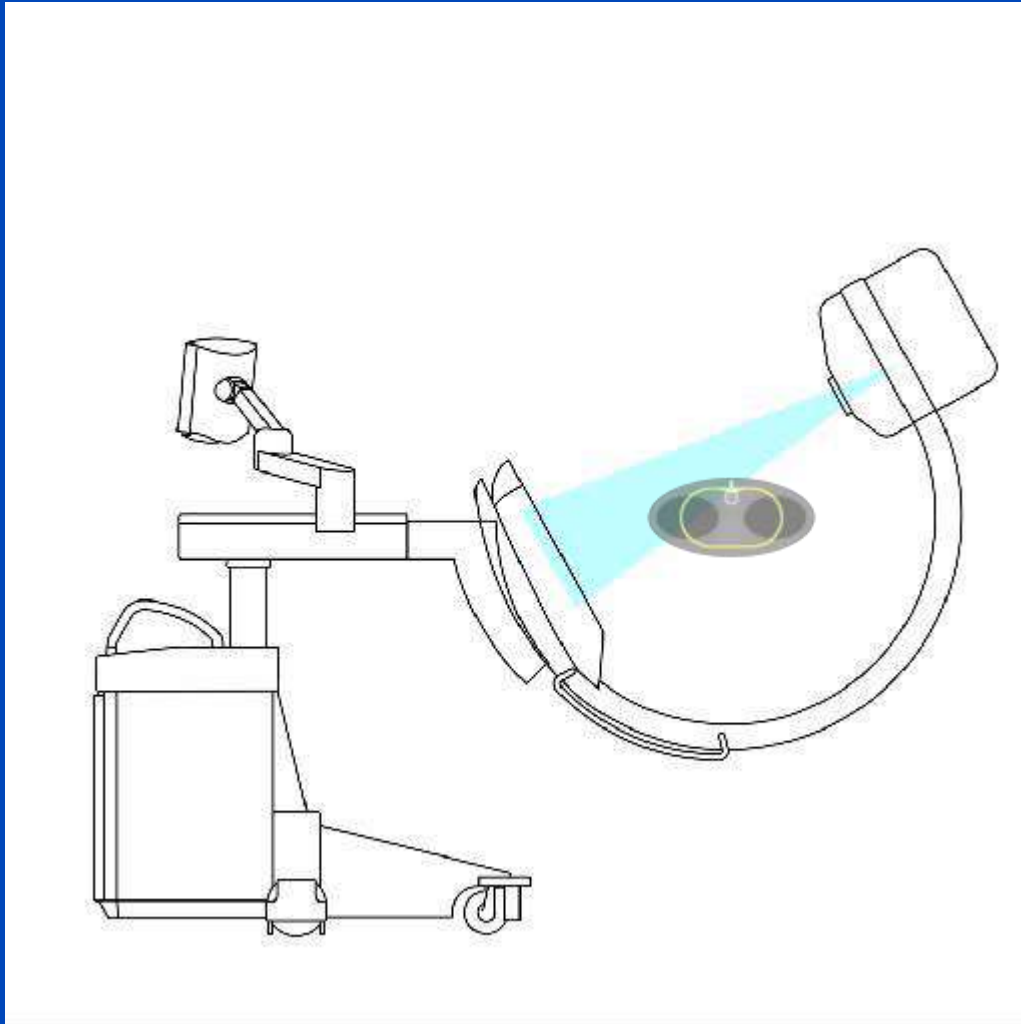
Reconstructions of
RPS and SDRPS Simulations

- **The proposed SDRPS trajectory increases the FOM significantly, which is advantageous for spinal and thoracic surgery.**

Rotate-plus-shift
mobile C-arm trajectory

150 mm

RPS

Shifted detector rotate-plus-shift
mobile C-arm trajectory

250 mm
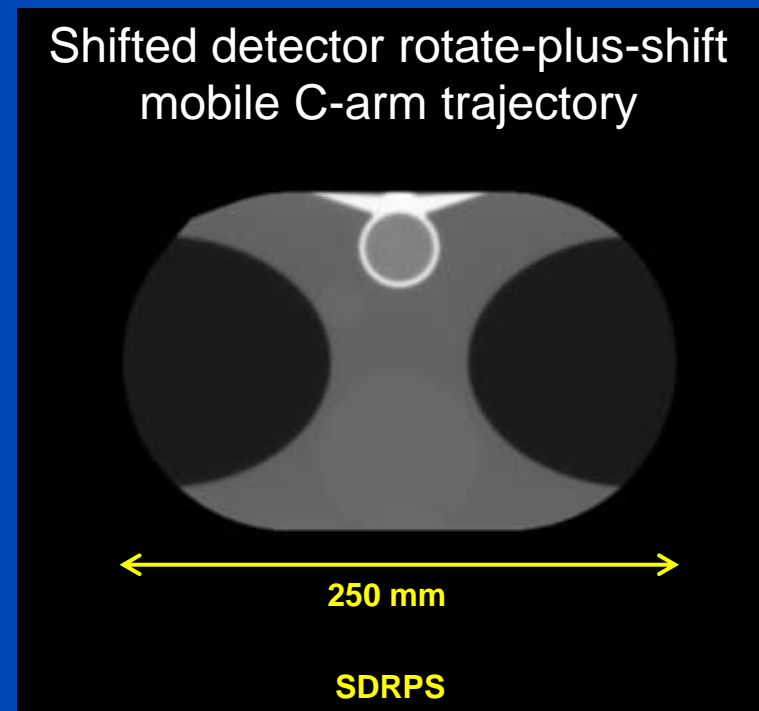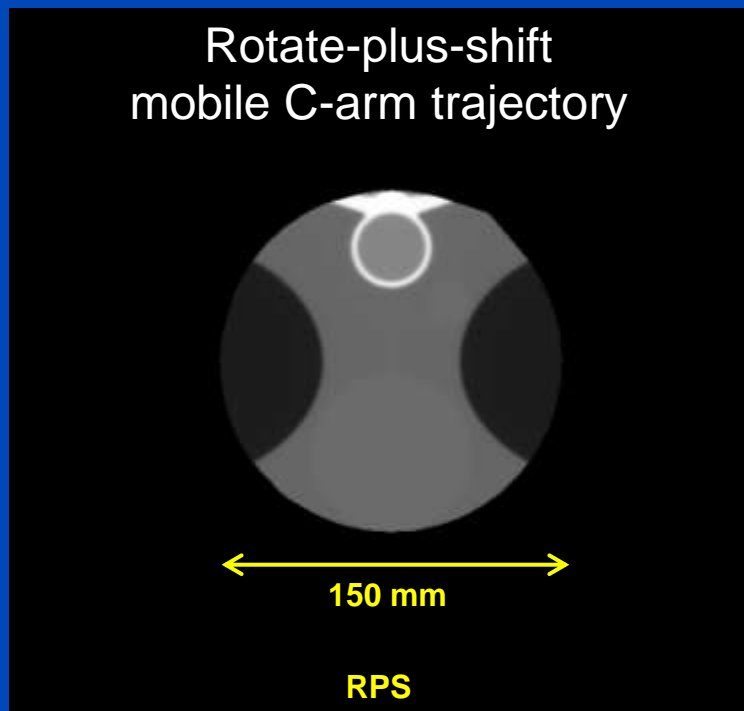
SDRPS

Reconstructions of SDRPS Simulations

- **The proposed SDRPS trajectory increases the FOM significantly, which is advantageous for spinal and thoracic surgery.**

- **Axial slices do not suffer from limited angle artifacts while cone-beam artifacts are similar to those of conventional short scans.**

axial

sagittal

coronal
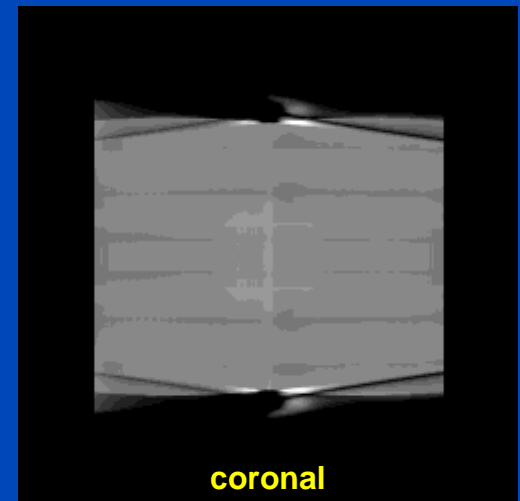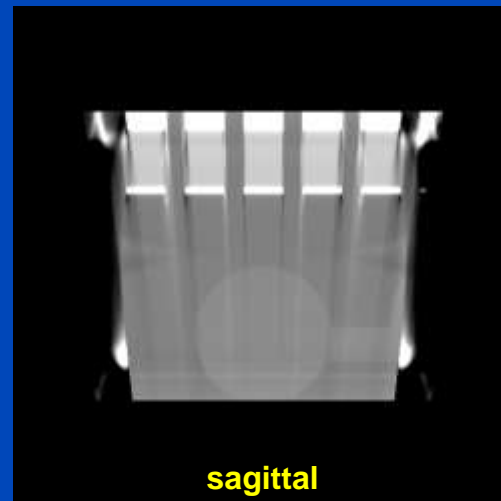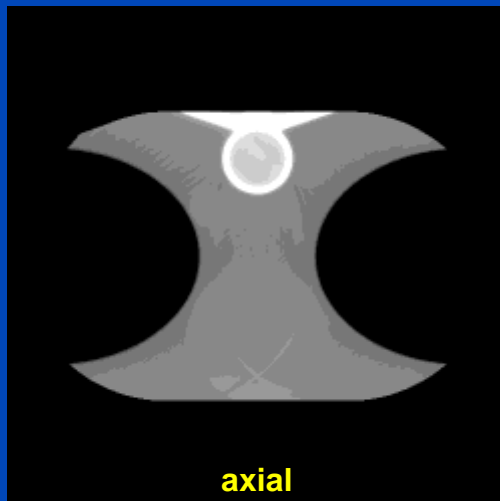
Conclusion

- **The SDRPS trajectory can extend the FOM and thus provide intraoperative 3D images of a larger anatomical area.**

- **It can be implemented in fully motorized C-arm CT systems without restricting their compact mechanics and the flexibility in their use.**

- **The SDRPS trajectory may replace follow up scans in a diagnostic CT system and thus increase the patient safety.**

Thank You!

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Conference Chair
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