Customized 3d Imaging!
Collision Avoidance Cone Beam Ct For Interventional Radiology

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What and Why

CBCT facilitates intraoperative 3D imaging

- Better access, lower radiation and cost compared to the clinical CT.

Typically, circular trajectory required, but:

- Circular trajectories not always physically possible due to collisions with patients or equipment.
- 3D imaging option not possible and 2D images the only solution.
- Can lead to wrong decisions during the surgery (e.g., wrong placement of the screw in spinal surgery due to lack of 3D view which can paralyze the patient) or subsequent surgery required.

Solution: Enable case specific non-circular trajectories

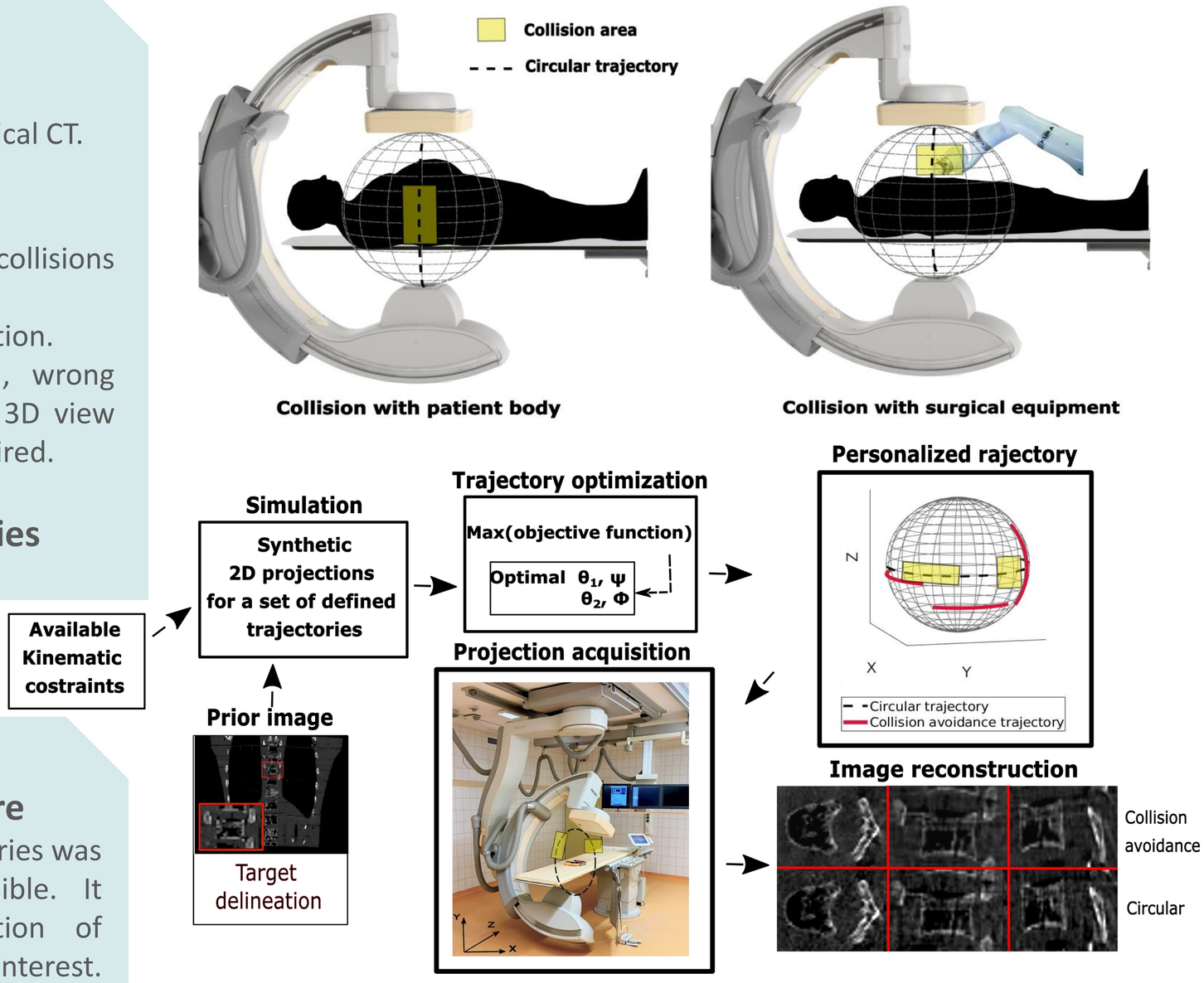

Figure 1. Collision avoidance trajectory optimization framework

Solution and Results

Algorithmic solution to physical problem => Software

- An algorithm to design collision-free, patient-specific trajectories was proposed for cases where circular CBCT is not feasible. It personalizes 3D source-detector trajectories (combination of multiple small arcs) to enhance image at target regions of interest. Kinematic constraints are taken into account on-the-fly. Similar imaging performance as the circular trajectory was achieved.

CBCT under kinematic constraints comes to the reality for the first time!

- **USP:** paves the way for the next generation, patient-specific collision avoidance 3D CBCT imaging, no hardware modification required, suitable to be implemented on all commercial CBCT devices
- Collaboration between ACMIT, Medical University of Vienna and Wiener Neustadt hospital

Product Potential > all commercial CBCT devices

First verification performed

- Allura FD20 (Philips) C-arm at Landesklinikum Wiener Neustadt (Fig. 2 a)

Knowledge transfer through ACMIT network

- In particular to Lower Austria (e.g, MedAustron) and Austrian institution (ImagingRing, medPhoton, Fig. 2 b)

Other candidates for novel trajectories

- Artis Zeego (Siemens) (Fig. 2 c) or Loop-X (Brainlab) (Fig. 2 d)
- **SDG:**The software addresses the SDG 'Good health and well-being' with focus on improving surgery output

Way to Market

Steps required for market-ready solution:

- Further acceleration by means of multiple GPUs parallelization
- Adaptation with different interfaces of different imaging devices
- Automatic execution of novel trajectories to be discussed with providers of imaging technology
- Adaption with different types of sensor input to sense the collisions
- Creation of a comprehensive business model (B2B)
- Software-development process based on certified ISO 13485 quality management system in ACMIT and later EN 62304 for implementation

- ACMIT belongs the IP and predicts a 2-3 years time-line for a market-ready solution, ACMIT will license the IP to different imaging companies

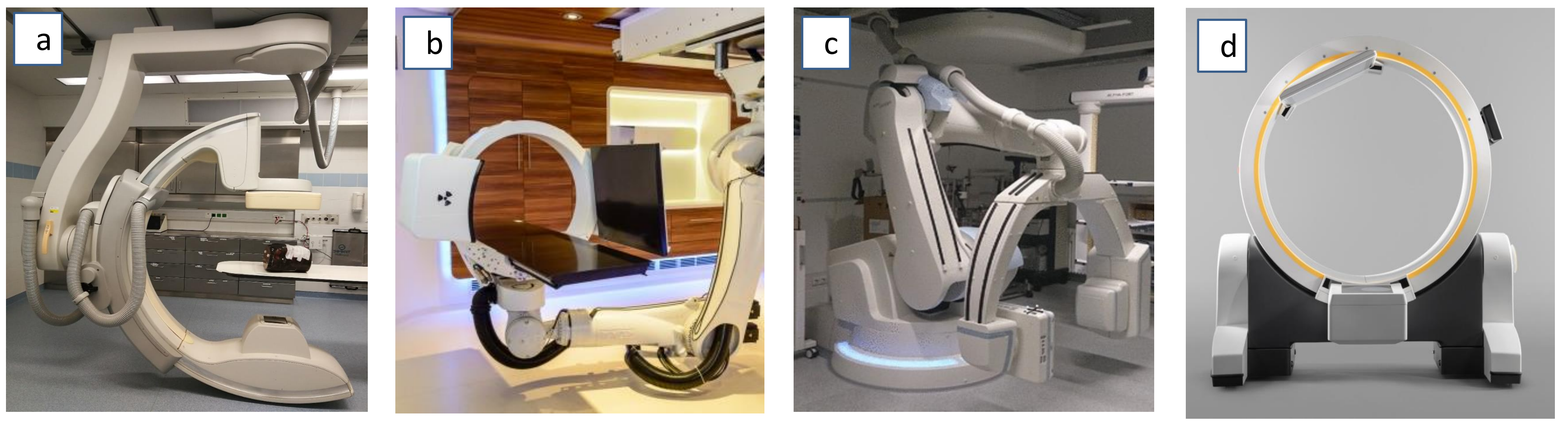

Figure 2. Different advanced CBCT systems which are candidates for implementations of customized trajectories.

Potential Clinical and Social Benefit

- Main clinical benefit for obese patients and for interventions where collisions can be avoided
- Enormous clinical applications e.g, pedicle screw insertions, percutaneous needle placement, angiography and many more would benefit
- A strong driver for a more extensive utilization of CBCT imaging with a very positive impact to all stakeholders along the treatment chain

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