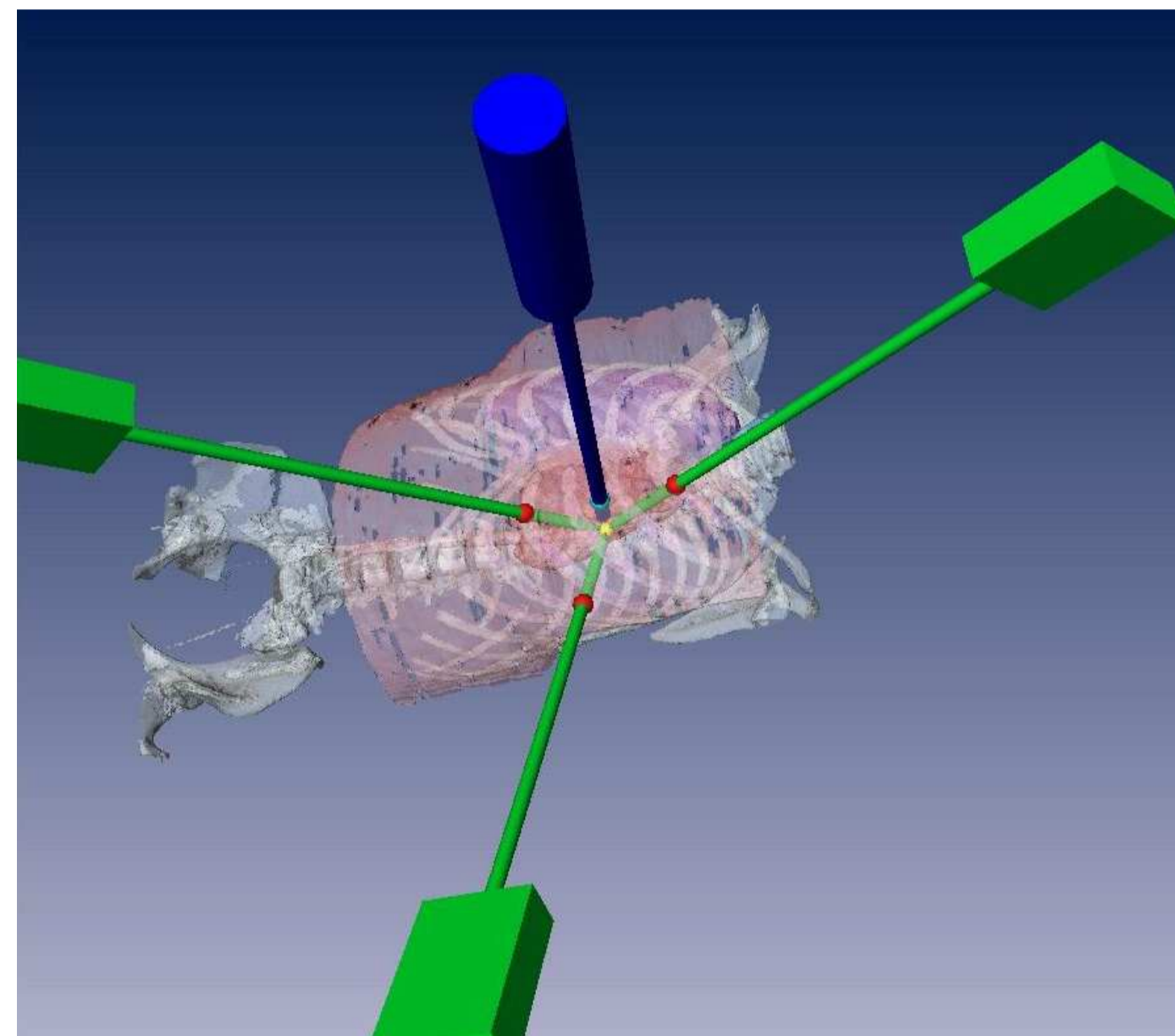


Optimal Planning and Intra-Operative Augmentation for Cardiovascular Surgery

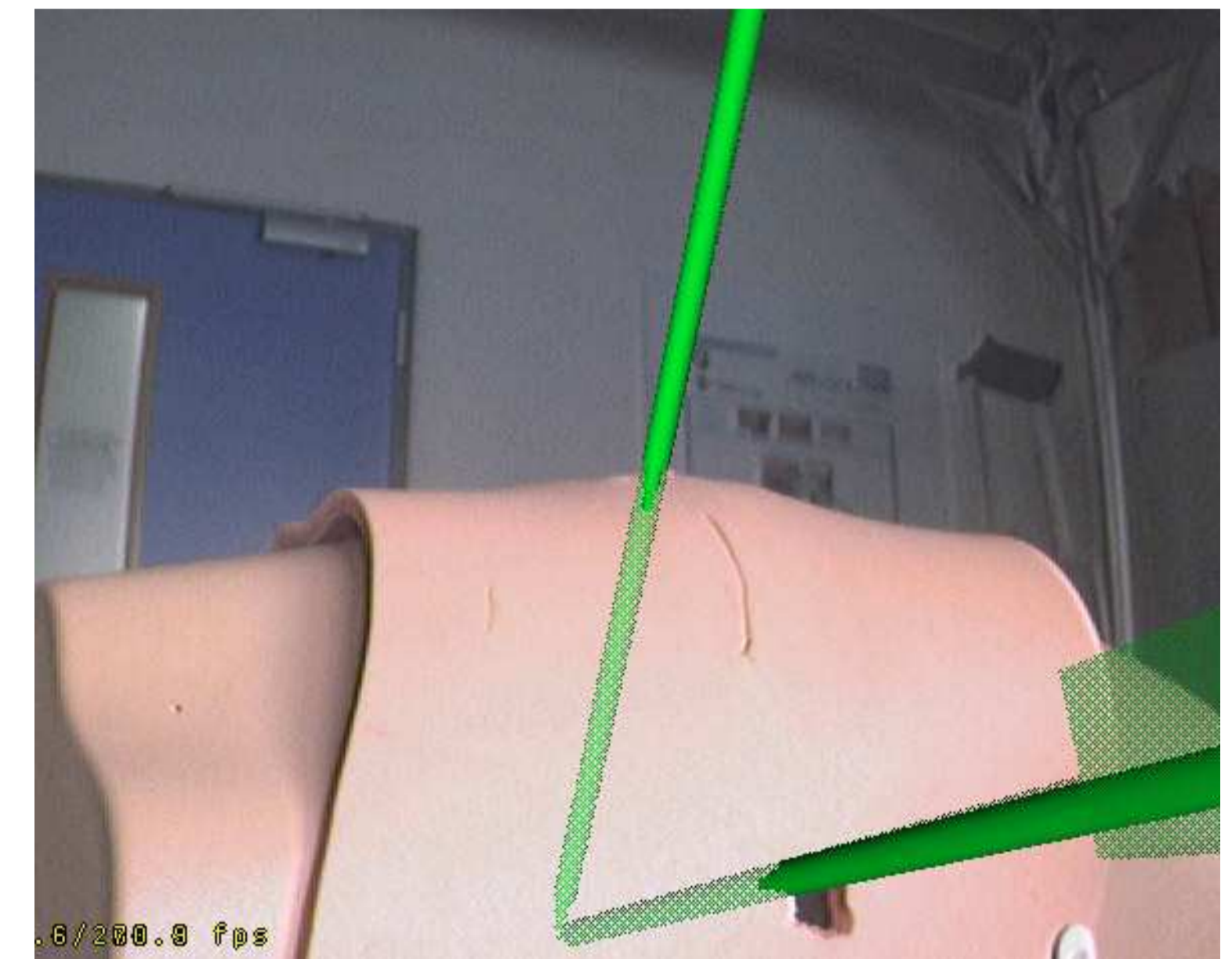
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Typical setup in the surgery room using the daVinci™ telemanipulator from Intuitive Surgical Inc. The surgeon controls the arms through a console (master-slave-system).



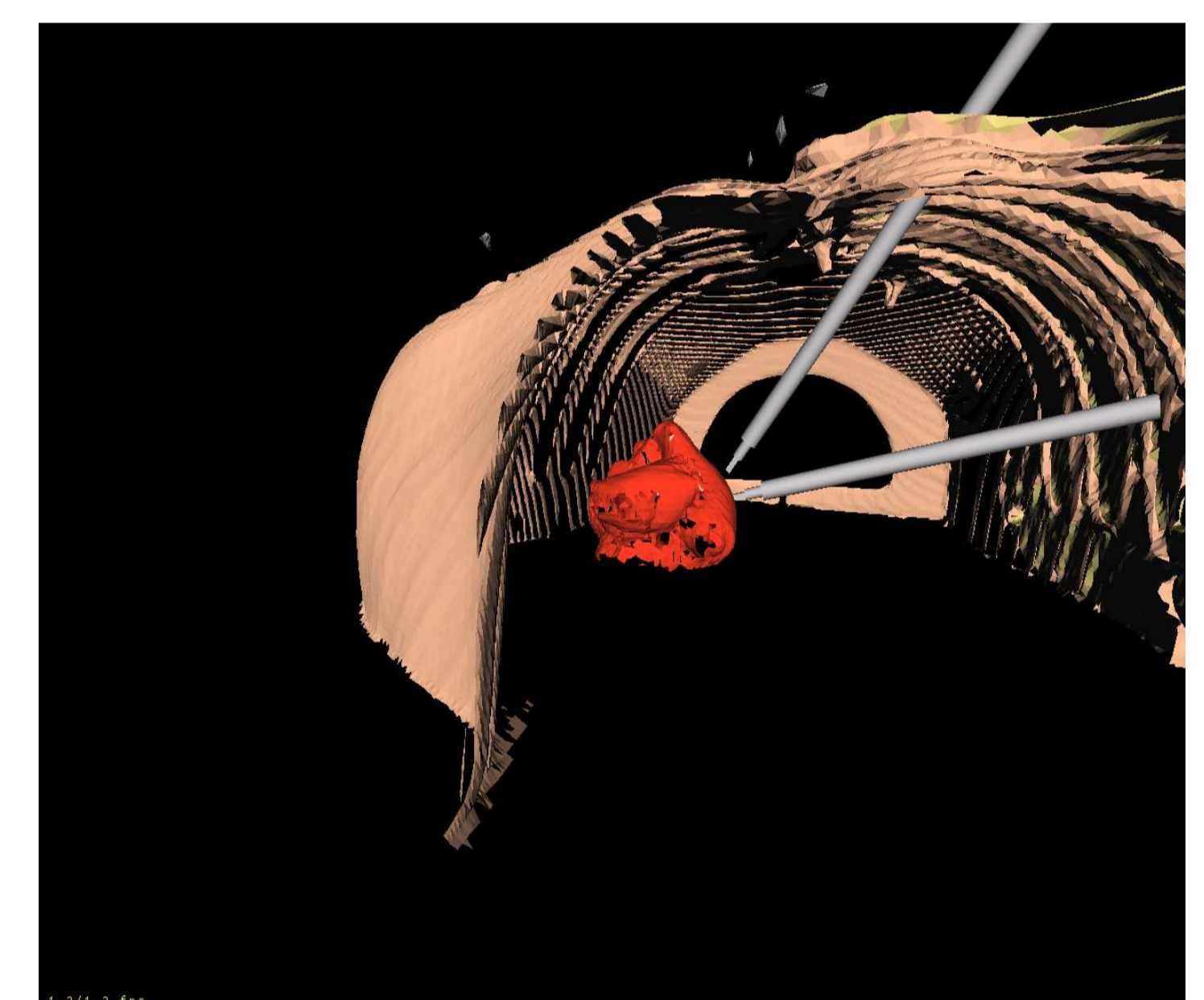
A visual planning tool allows for defining adequate incision sites for the robot arms; avoidance of collisions is guaranteed.



The planned data are transferred to the surgery room. The incision sites are visualized intra-operative using augmented reality techniques.

Robotically assisted minimally invasive and totally endoscopic surgery, respectively, has an enormous benefit to the patient by reducing the pain, trauma, and recovery time. Nevertheless, a number of disadvantages such as extended operation time and lacking view of the patient's interior remains to the physician.

The proposed system aims to improve the tedious process of planning the placement of the ports for the teleoperator arms in an optimal pose. Furthermore, it provides an interface to interactively validate the computed placement of the ports. Based on the previously planned data, augmented reality techniques enable enhanced intra-operative guidance of the physical port placement in the patient's thorax.



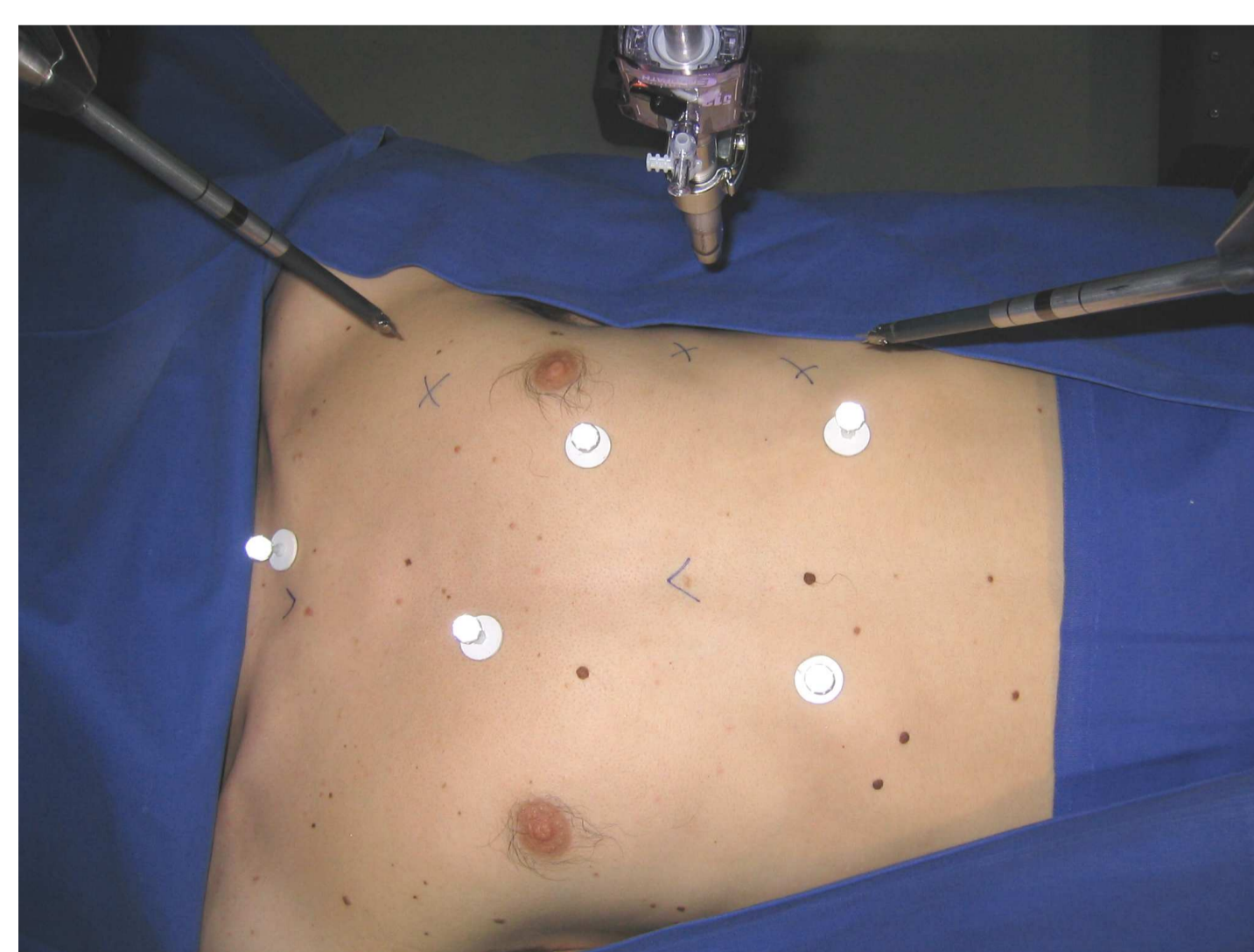
The telemanipulator arms are tracked and visualized in the virtual model of the thorax. This can be used as a virtual endoscope.



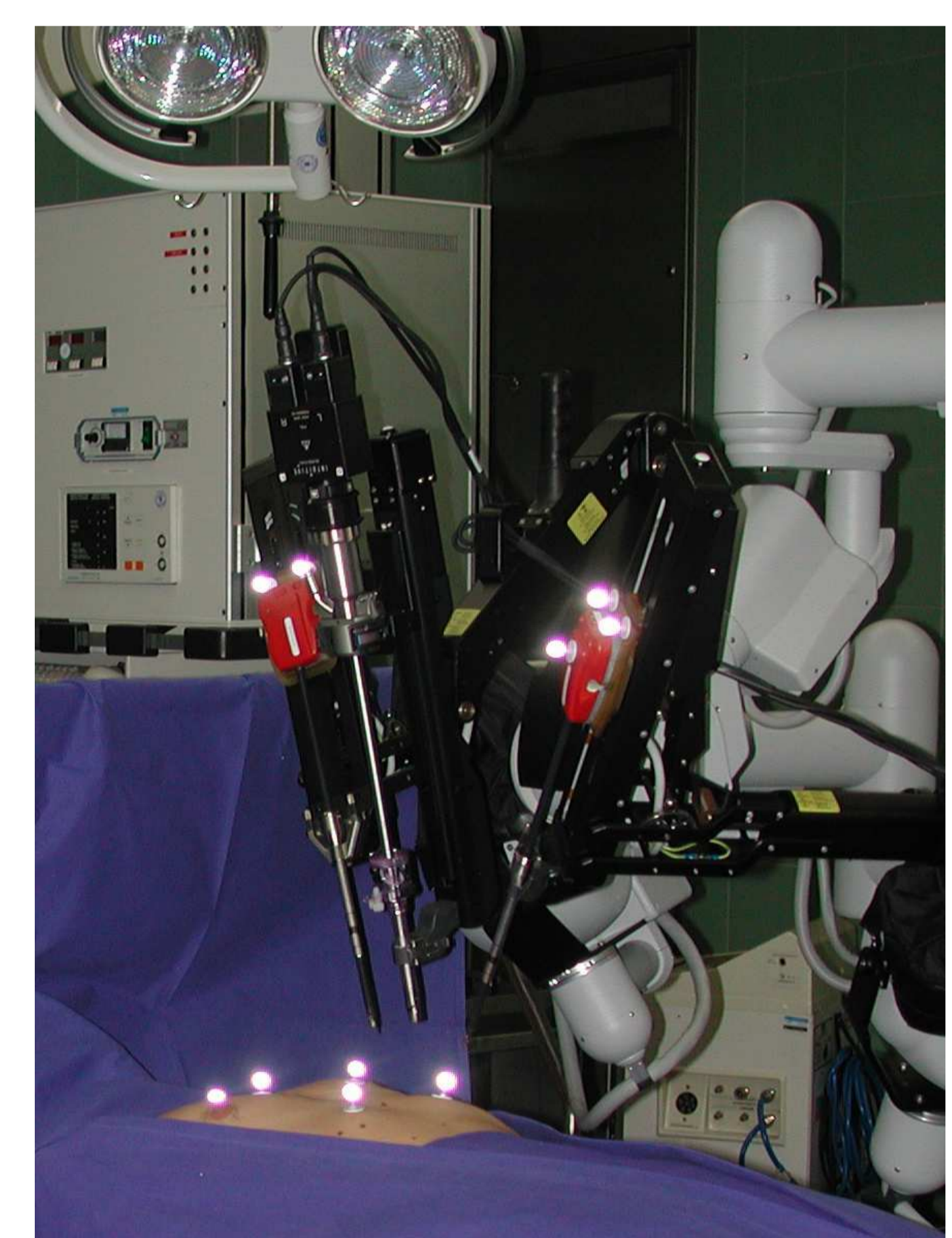
The tracking system used for the model positioning and instrument arm/endoscope tracking in real time.



The different modalities real and virtual require different fiducial markers. Steel spheres are visible in the CT data – Infrared marker in the physical real world space.



The fiducial markers on the patient's thorax are used to merge the real and virtual world.



The da Vinci™ extended by infrared markers is performing telesurgery. Thus, the arms can be tracked and visualized.

Special thanks to our partner, Advanced Realtime Tracking GmbH (www.ar-tracking.de)

HEART

Heart surgery Enhanced by Augmented Reality Techniques
<http://www.bruegge.in.tum.de/projects/lehrstuhl/twiki/bin/view/DWARF/ProjectHeart>