

Computer Integrated Surgery – Introduction

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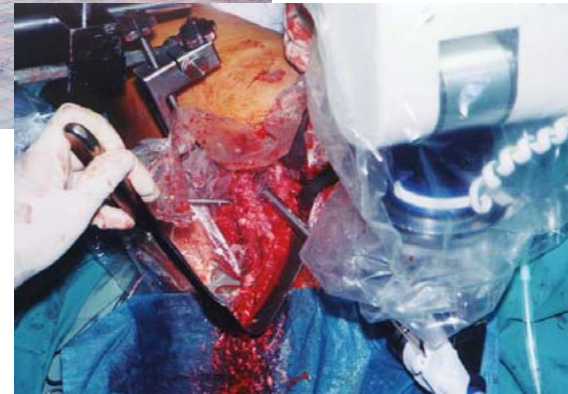
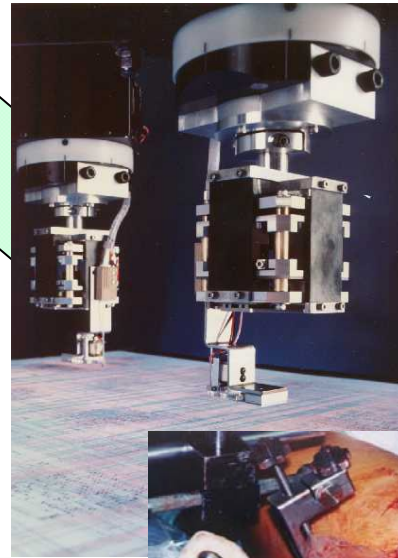
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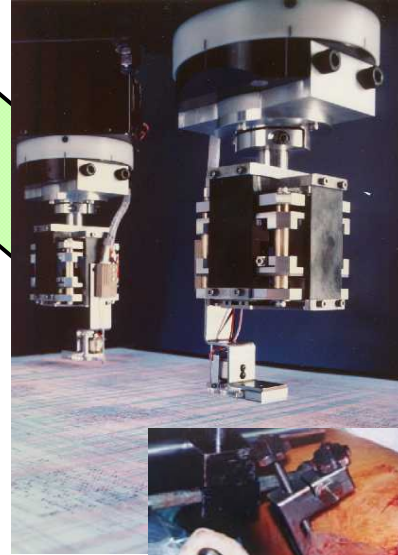
Prediction

The impact of aided interventional technology on medical care in the next 30 years will be as great as the impact of CAD/CAM systems and technology on industrial production over the past 30 years.



Mission Statement

Develop basic science, technology, and engineered systems working cooperatively with physicians to significantly change the way interventions and surgical procedures are planned, carried out, monitored, and assessed.



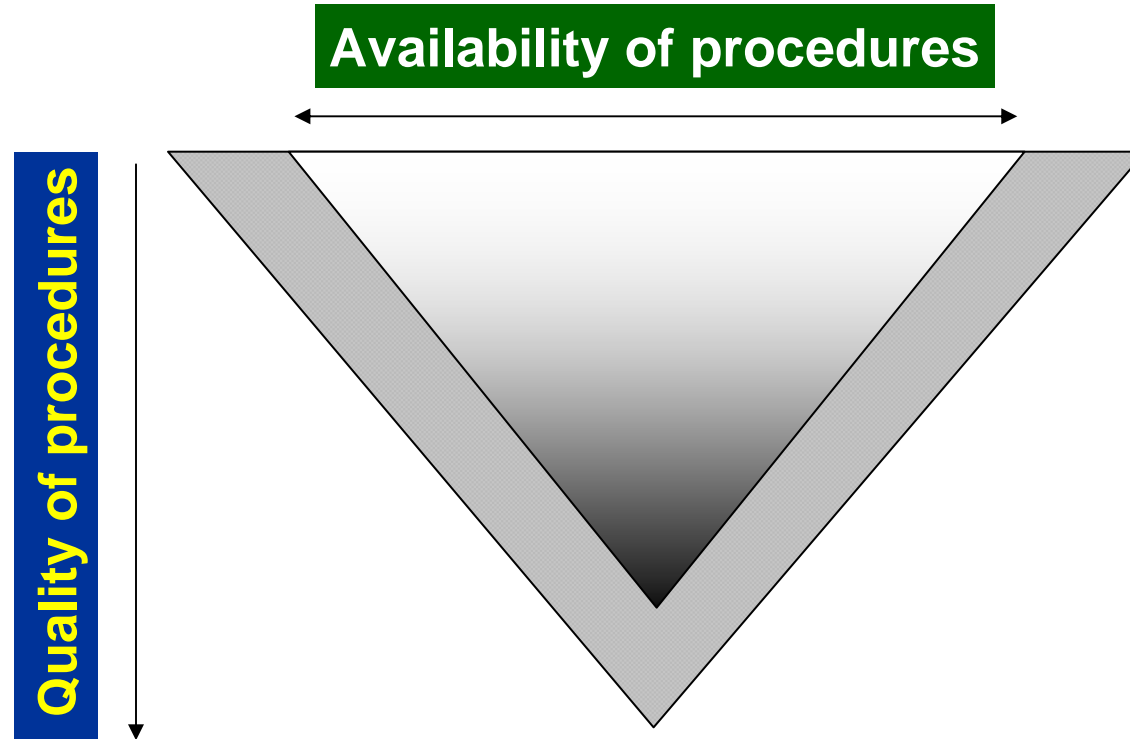
Couple the Information to Action



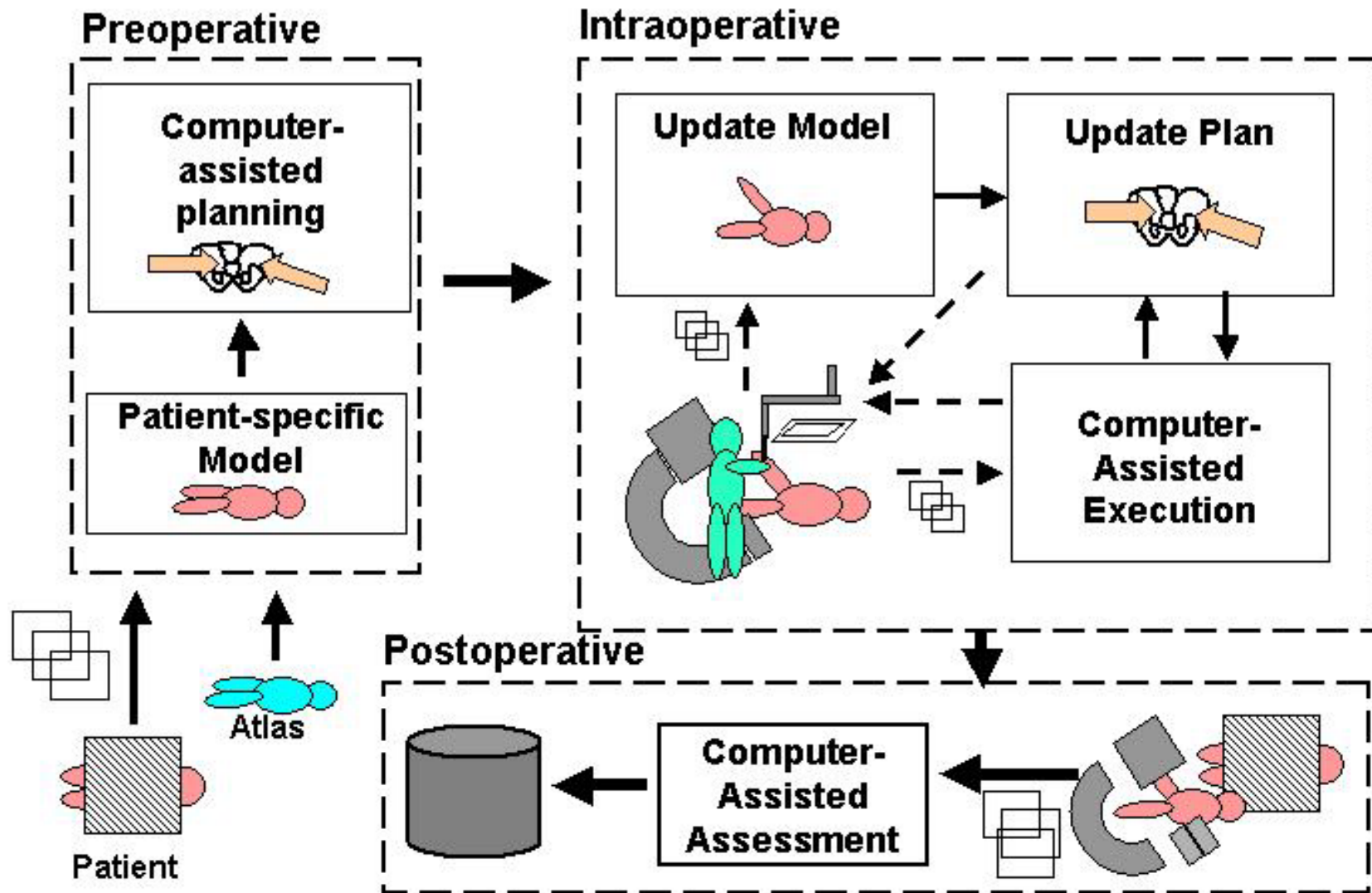
- **Mental computation**
- **Mental coupling of plan to action**
- **Hand-eye coordination**

Impact of CIS

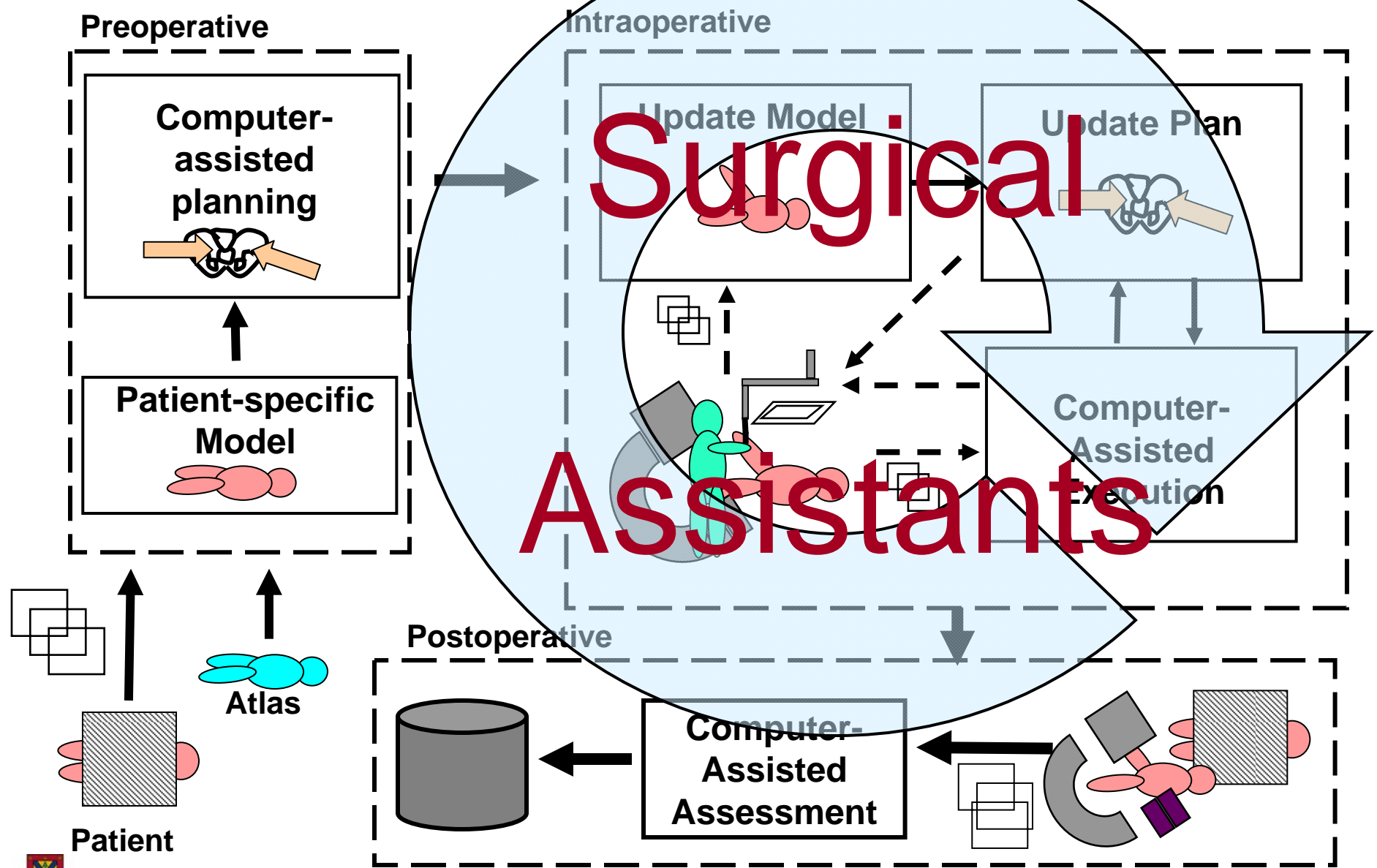
- Procedures performed “better”
- Availability increased



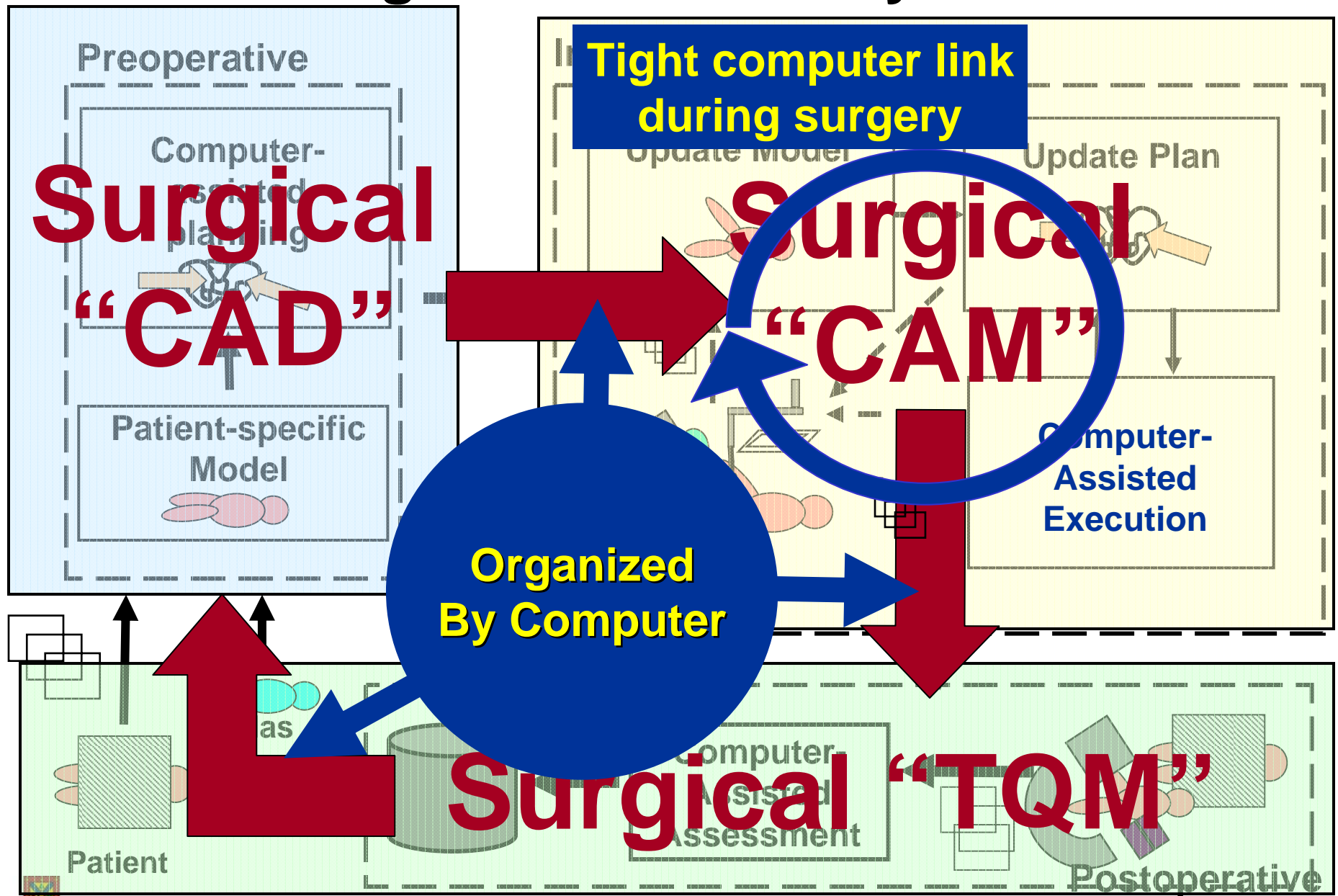
Computer Integrated Surgery Systems



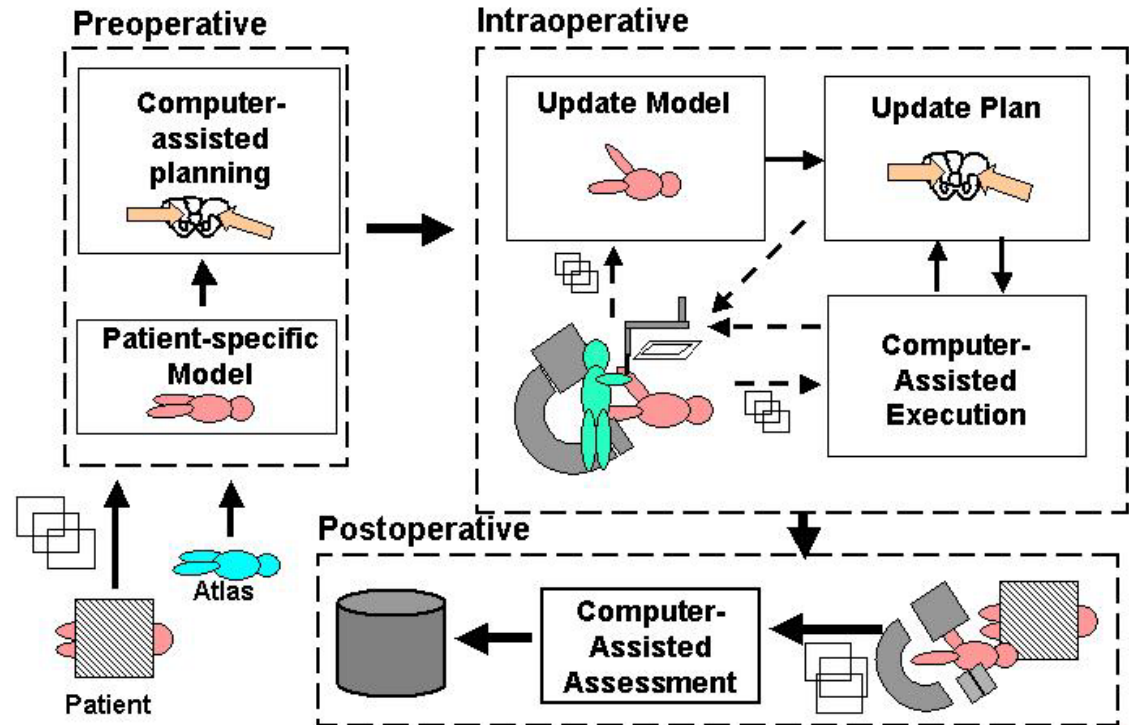
Surgical Assistant Systems



Surgical CAD/CAM Systems



Computer Integrated Surgery



Fundamental research barriers

Modeling & Analysis

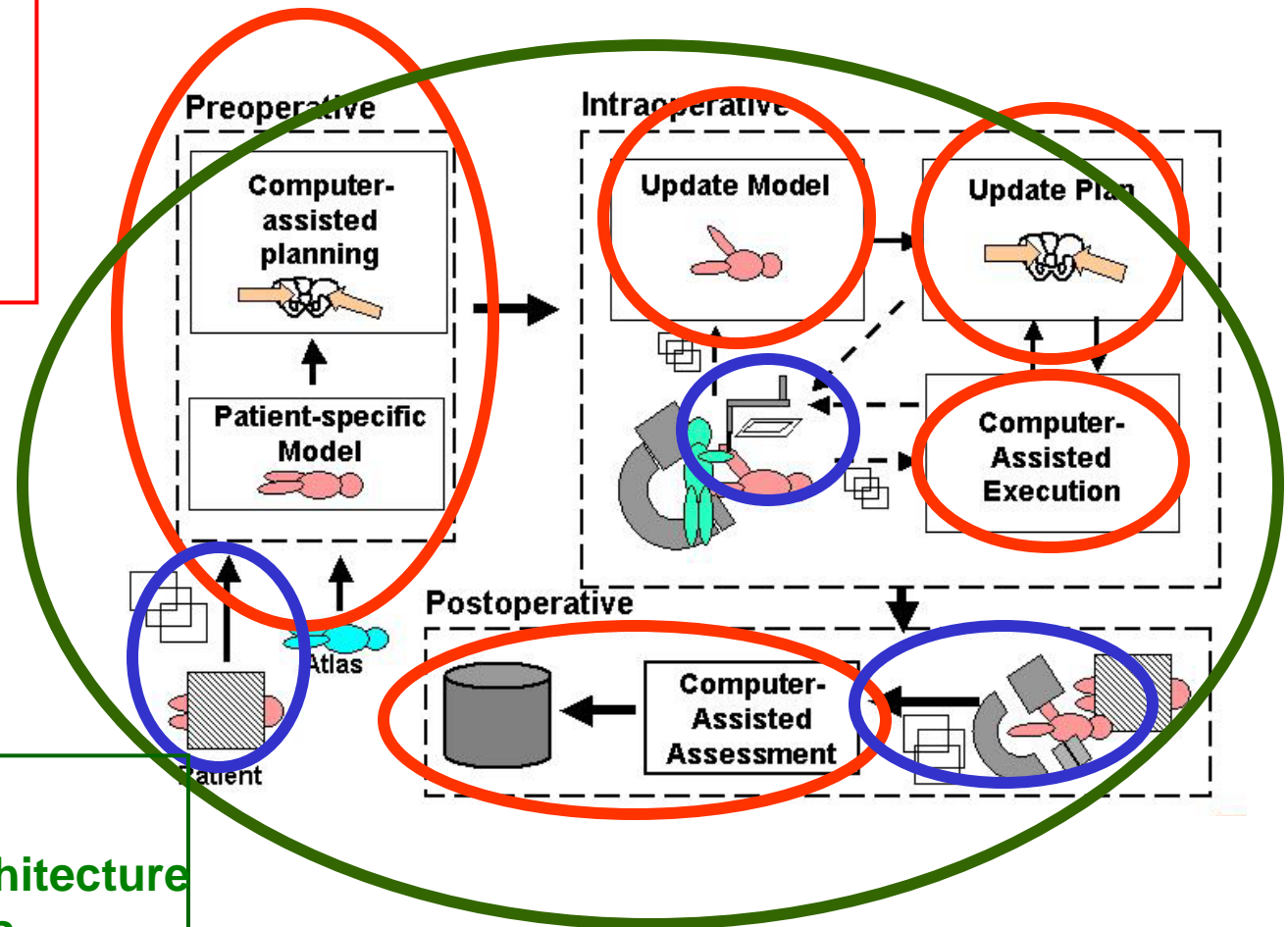
- Segmentation
- Reconstruction
- Data fusion
- Treatment planning

Physical Interfaces

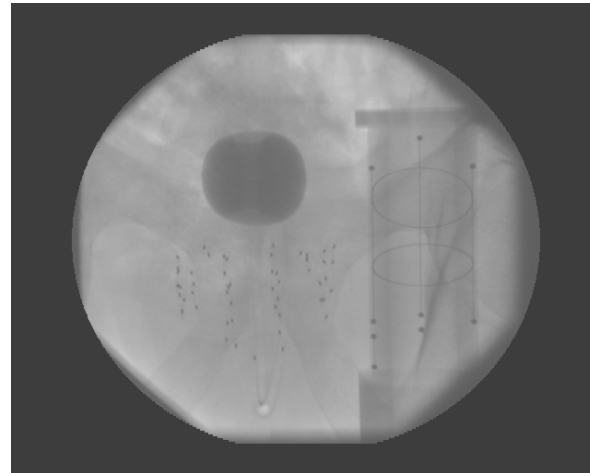
- Imaging
- Tracking & sensing
- Robotics
- Augmented reality

Systems Integration

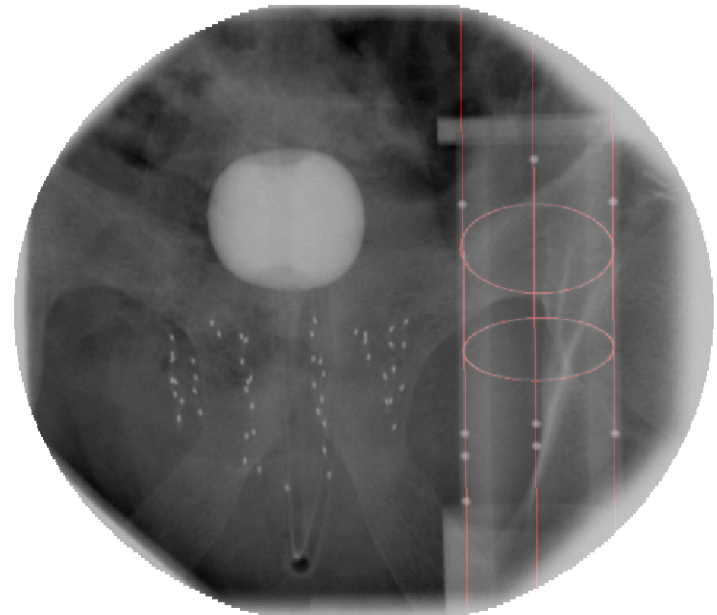
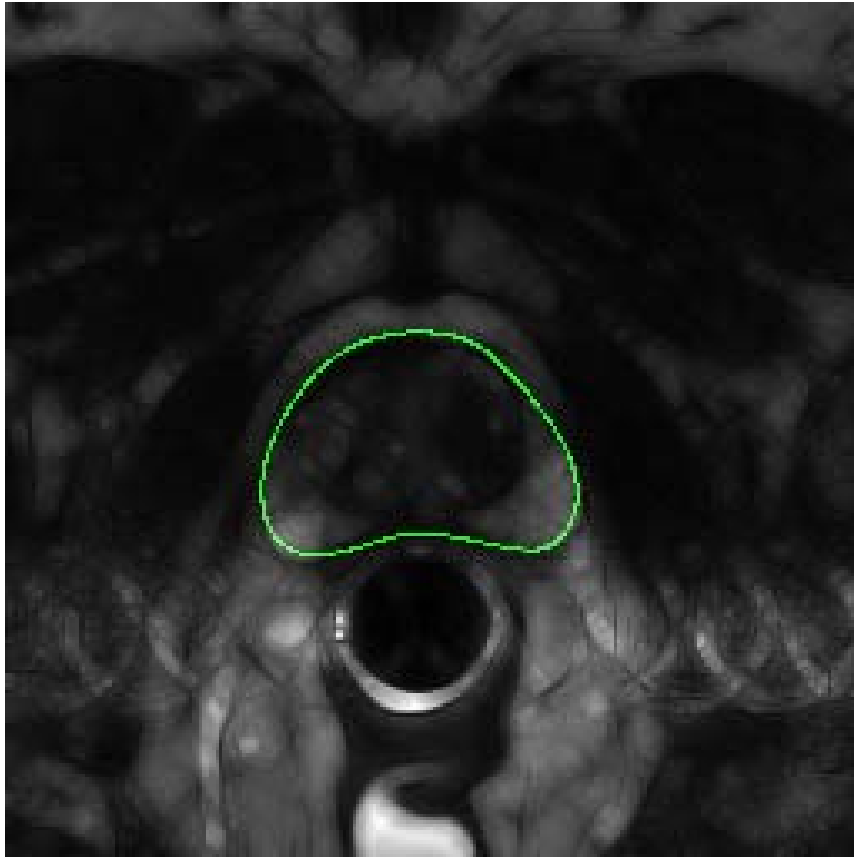
- System design & architecture
- Performance analysis
- Clinical applications



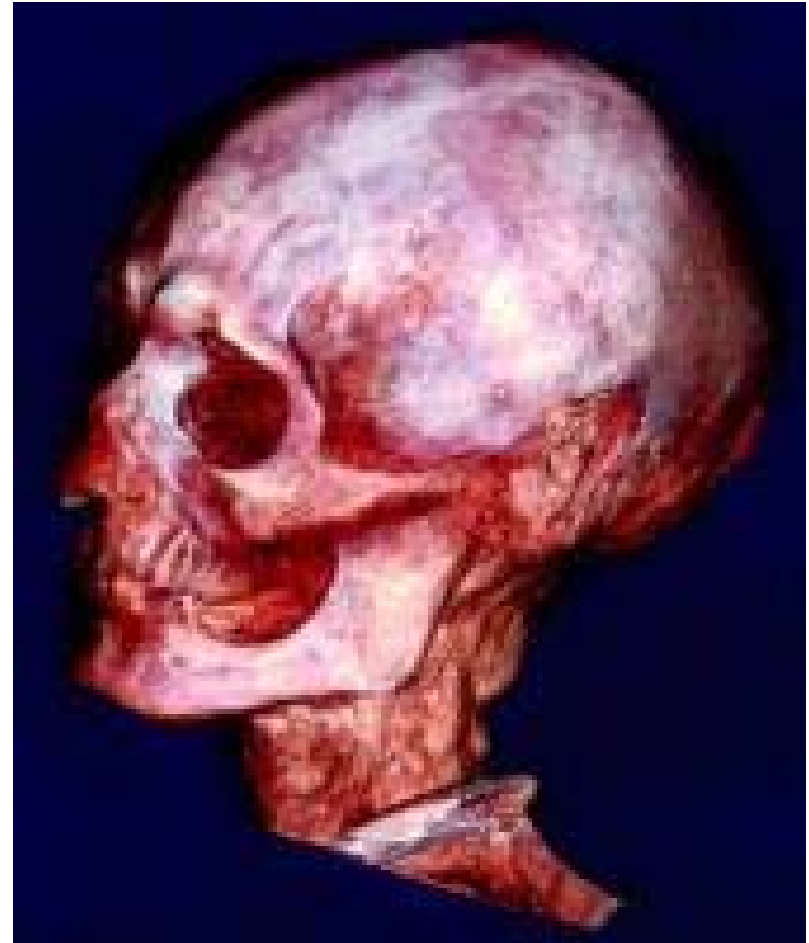
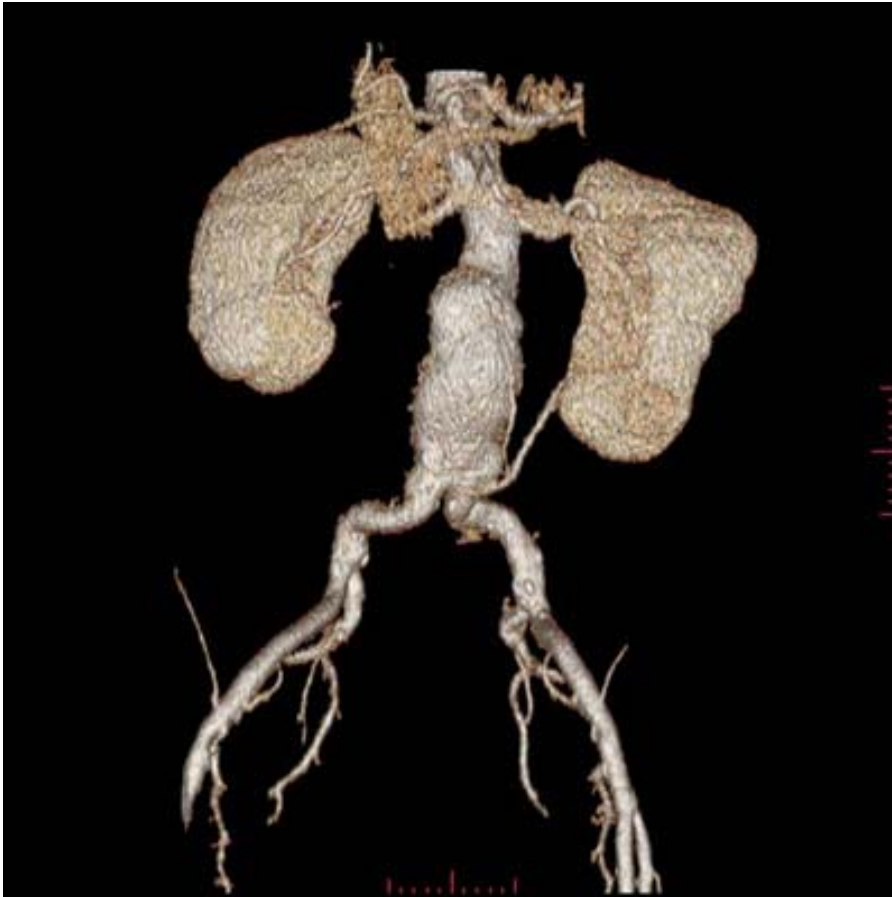
Imaging



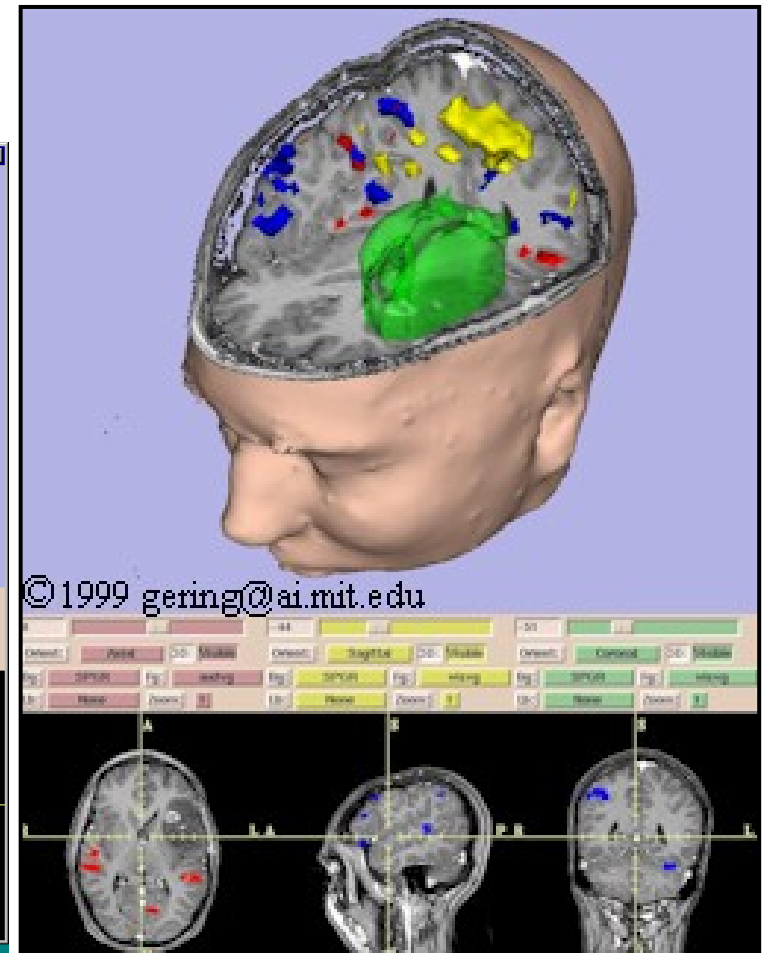
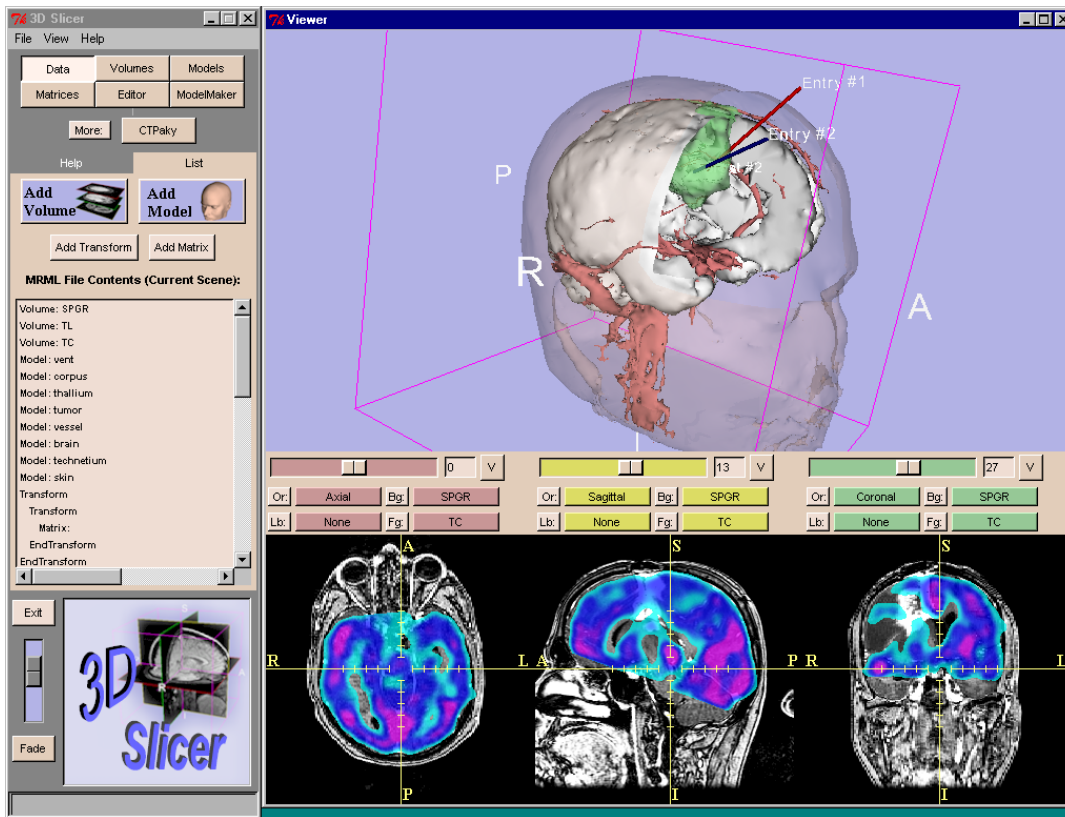
Segmentation



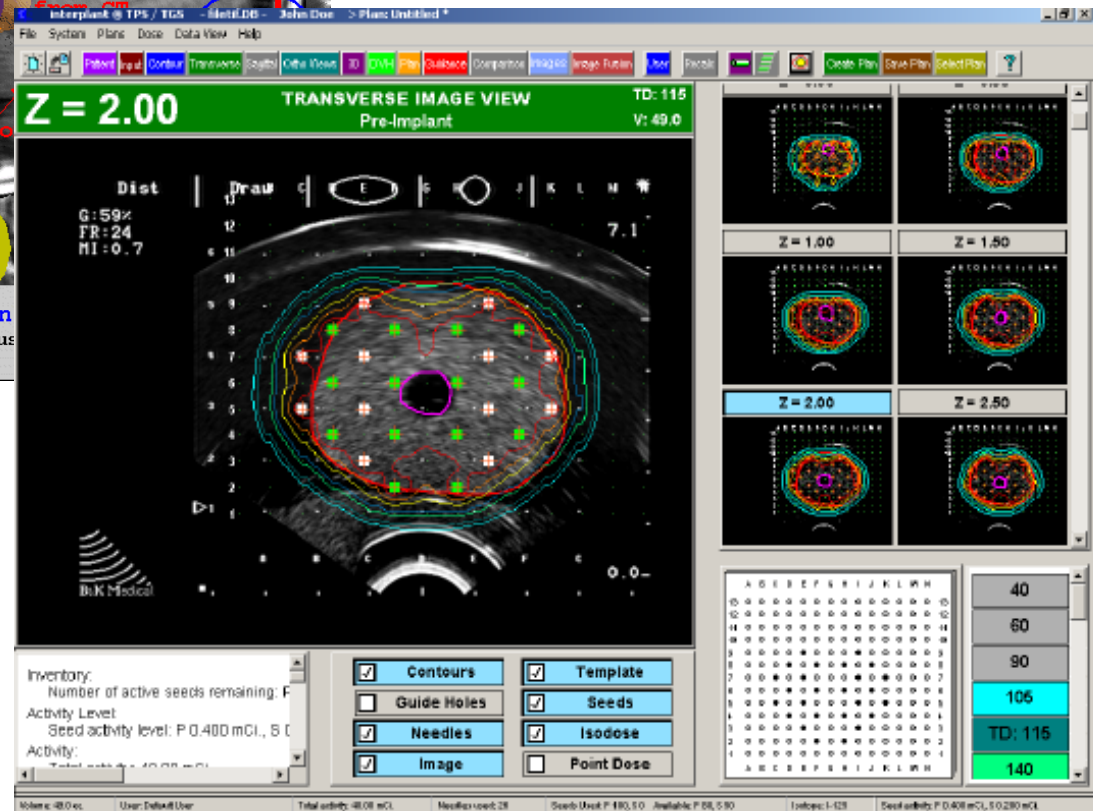
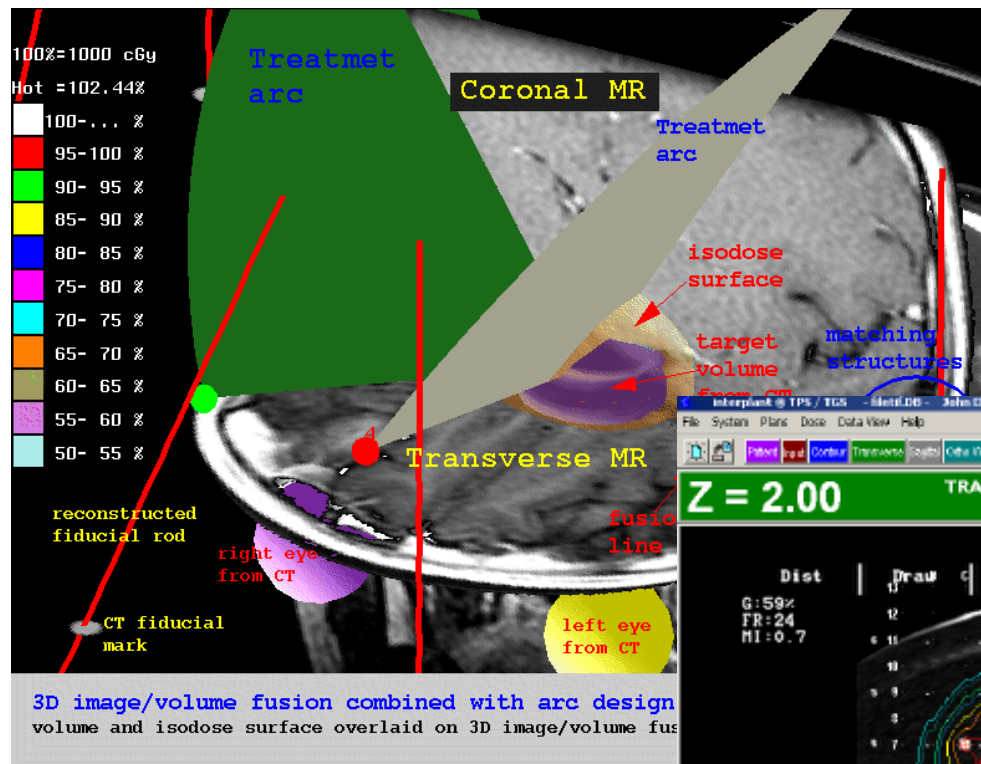
Reconstruction



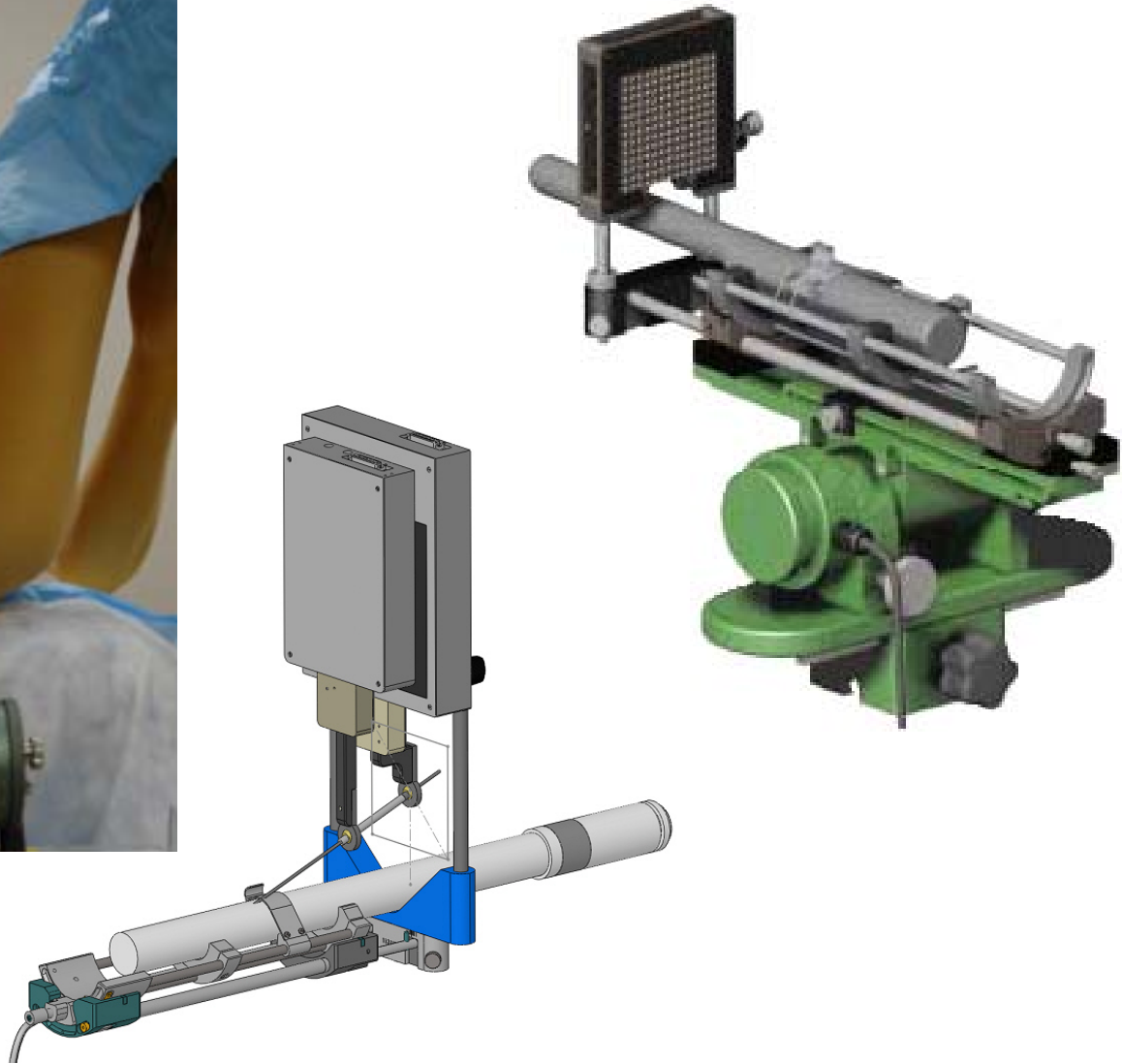
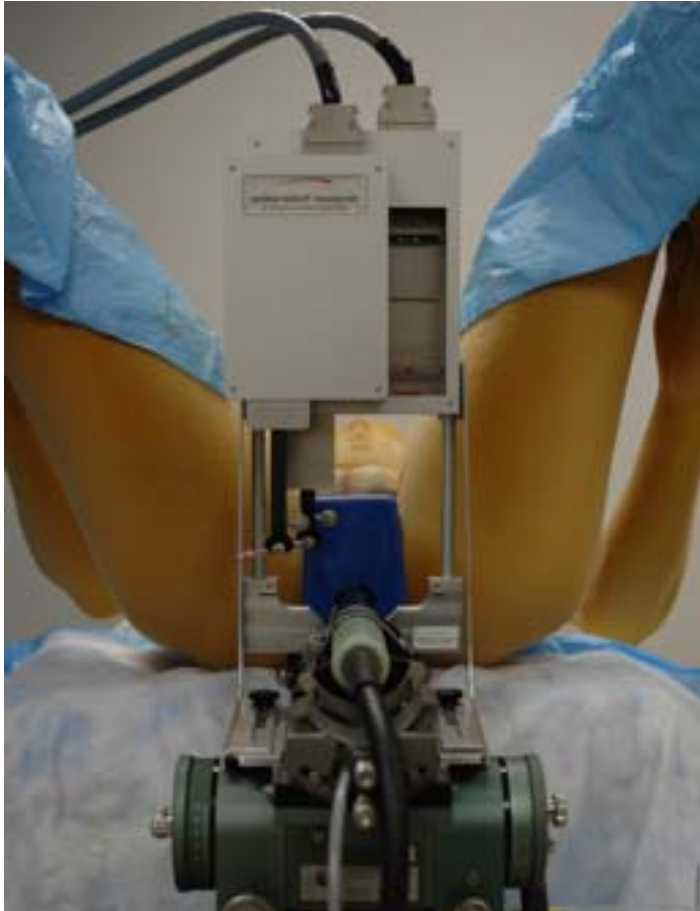
Data fusion



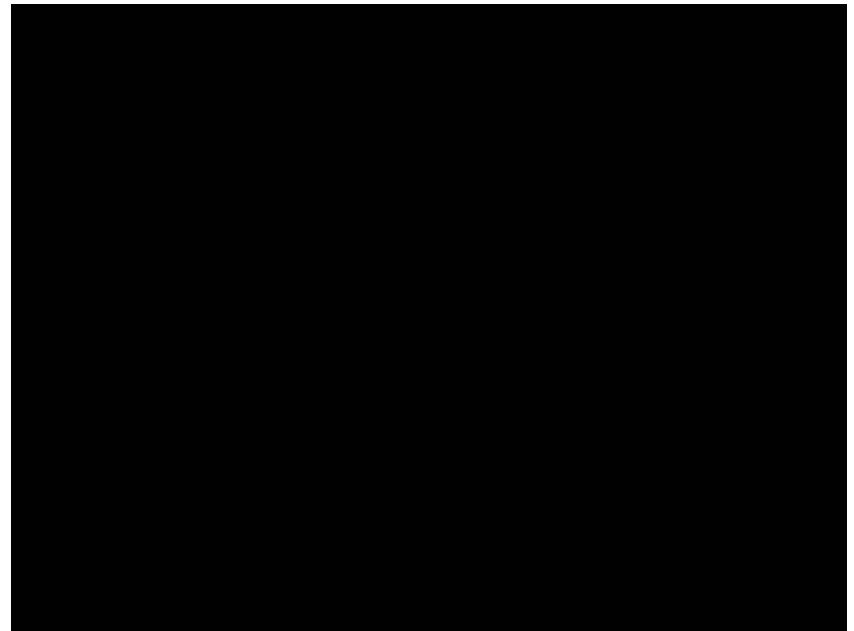
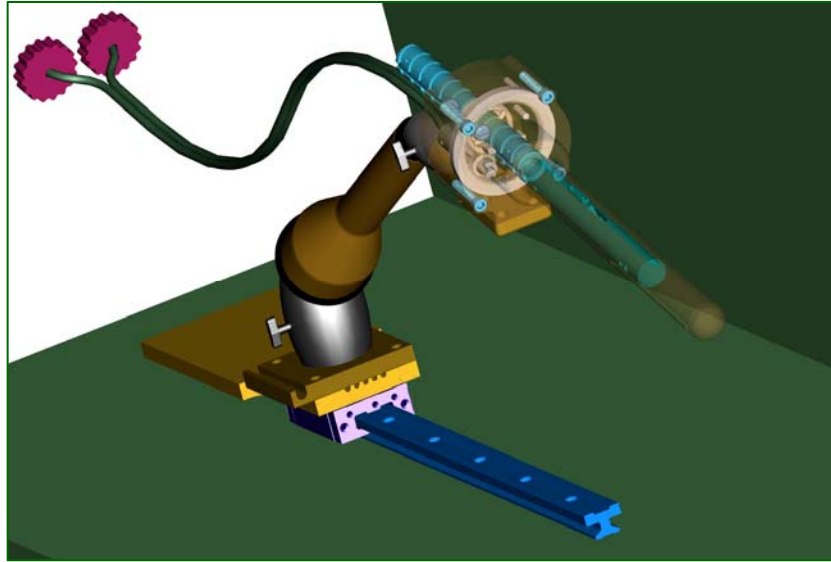
Treatment planning



Robots – for prostate cancer implants



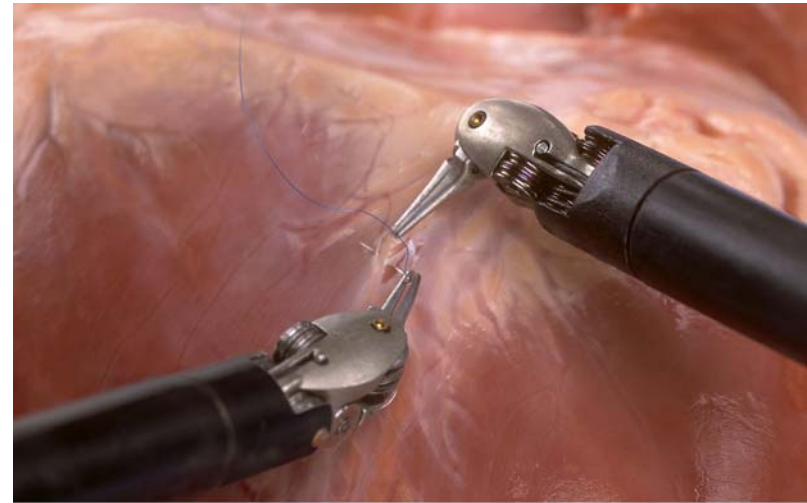
Robots – for prostate cancer biopsy



Robots – for total hip/knee replacement



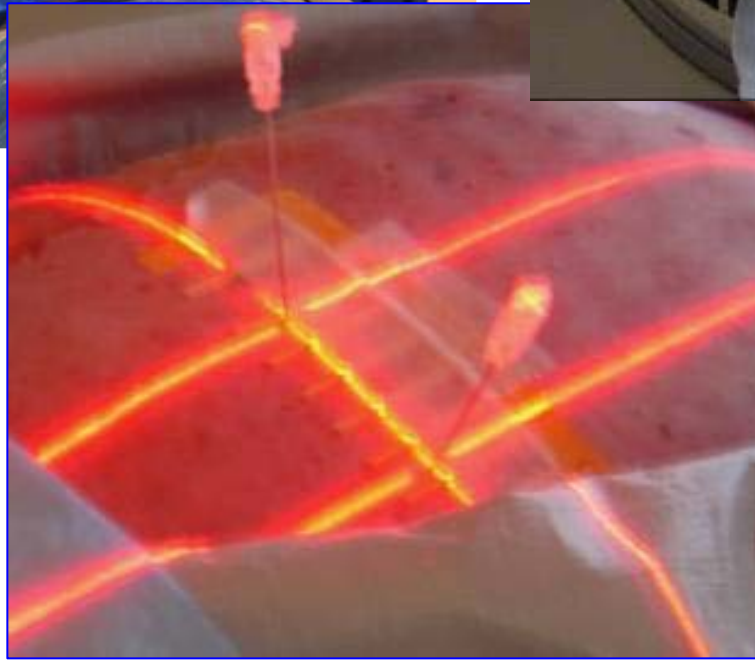
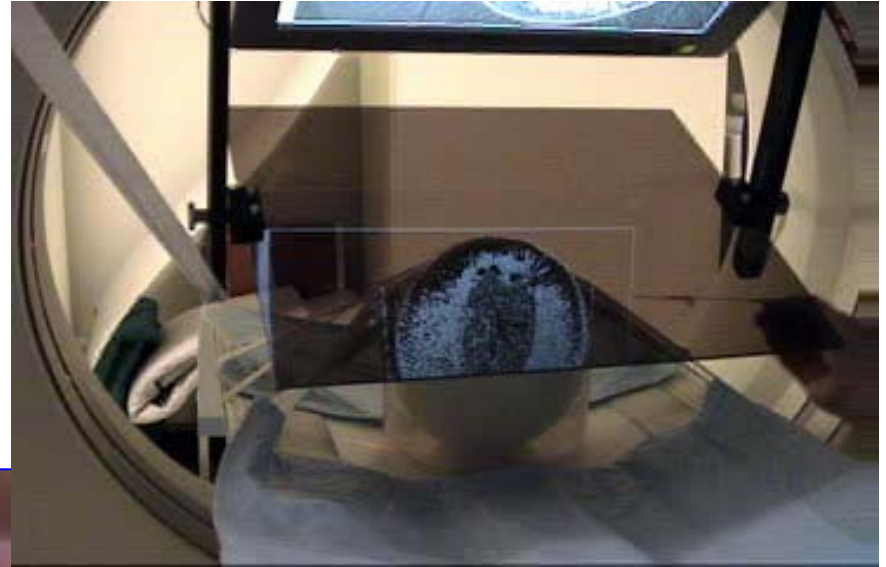
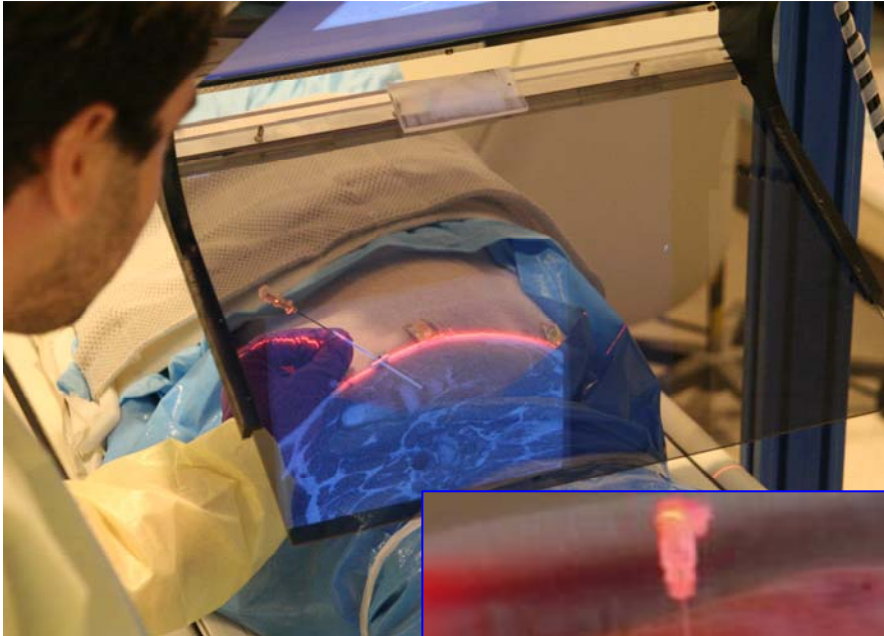
Robot – for laparoscopic telesurgery



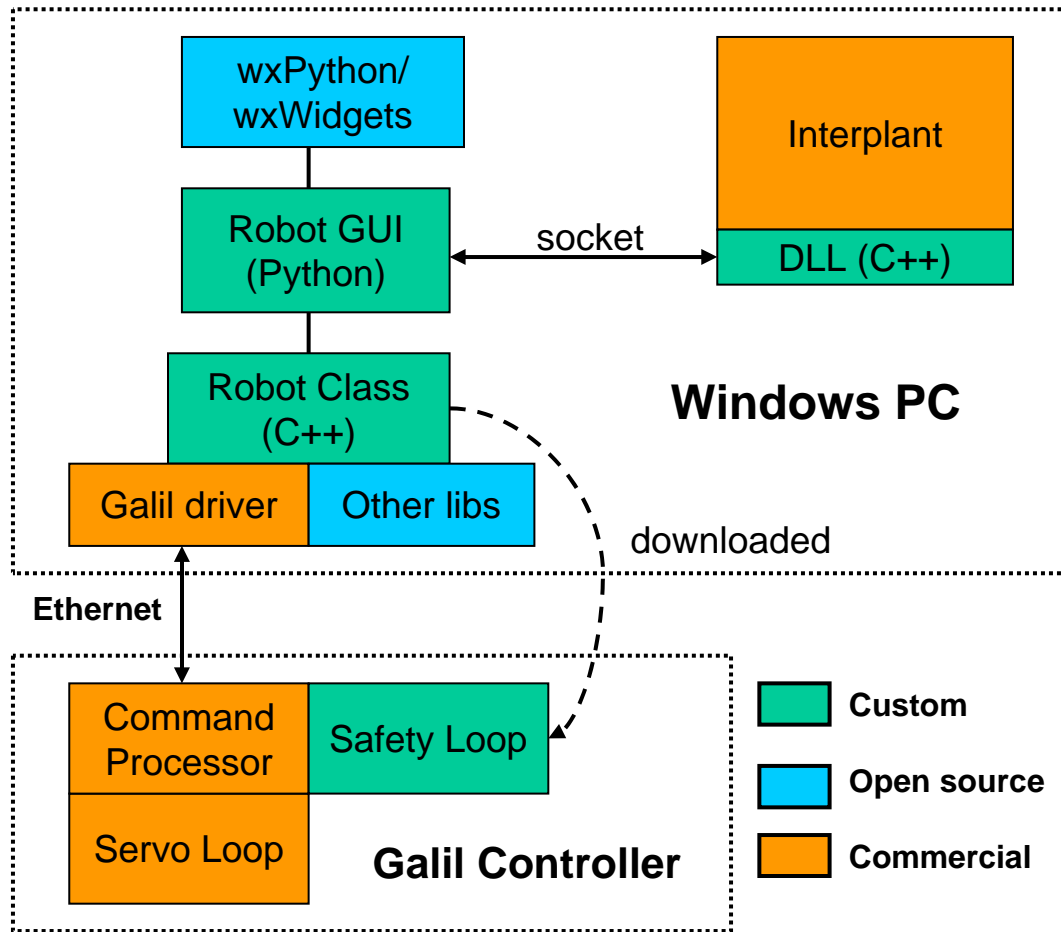
Robot – Steady Hand microsurgery



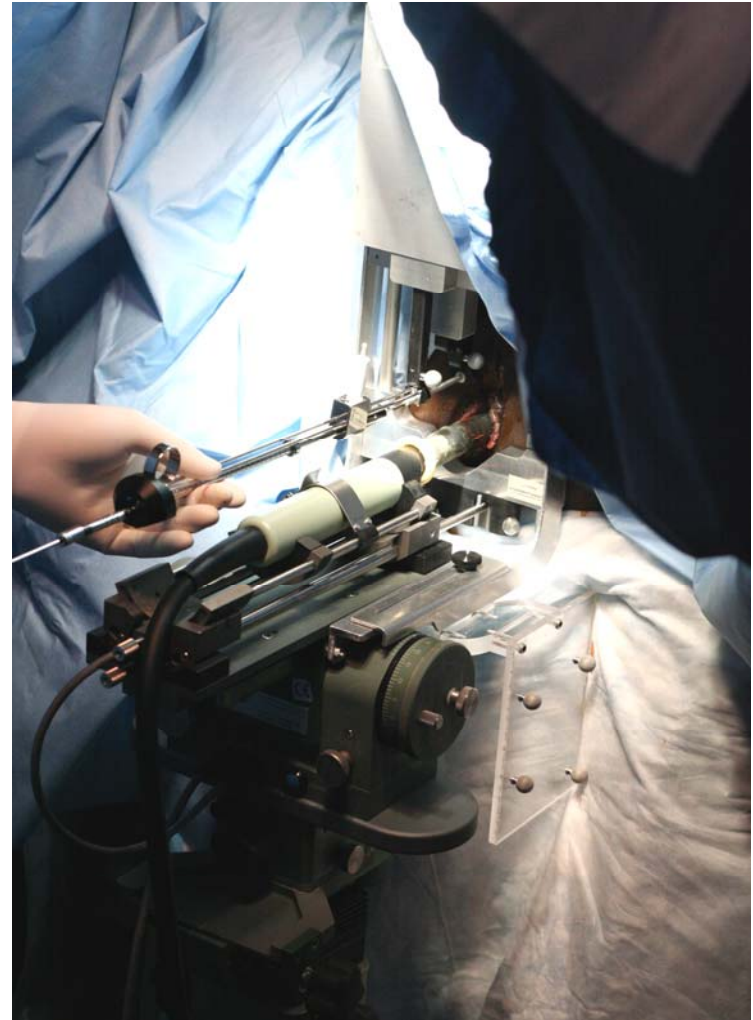
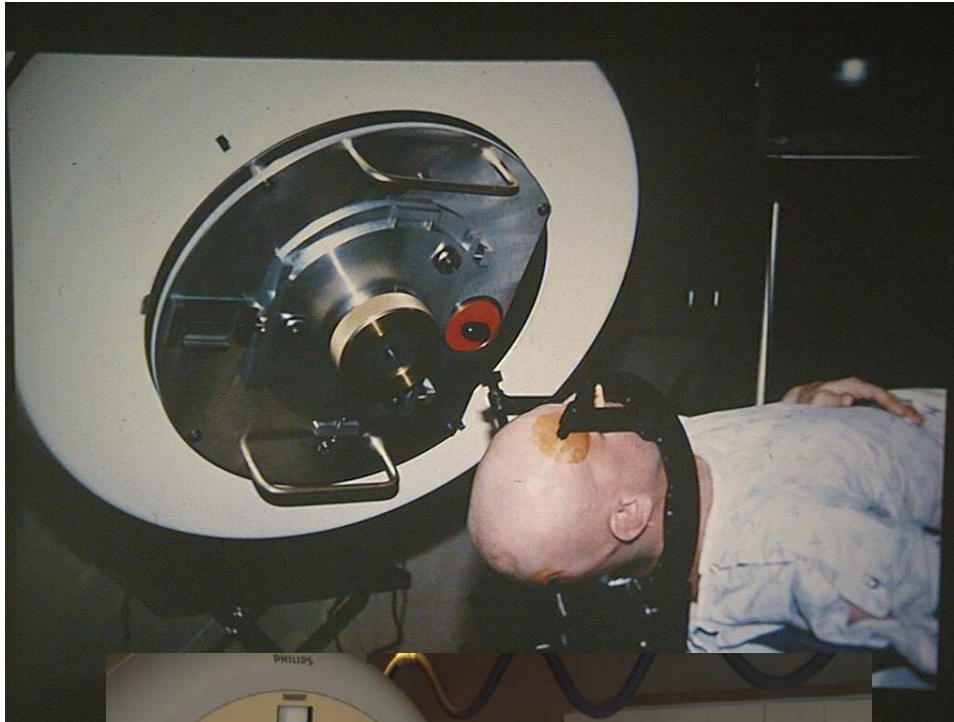
Augmented reality



System architecture



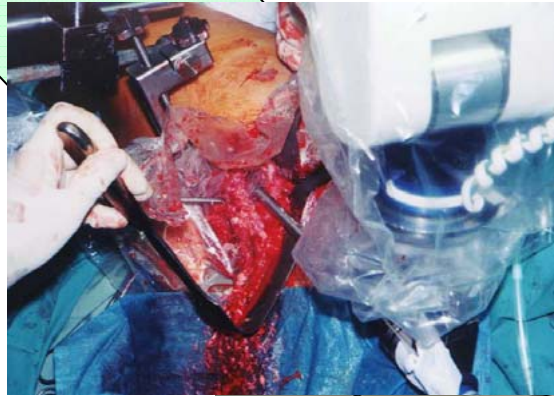
Clinical applications



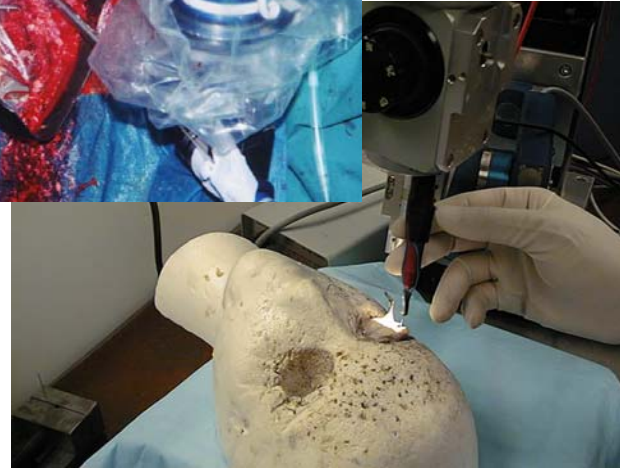
How can we get there?

Strong and committed teams

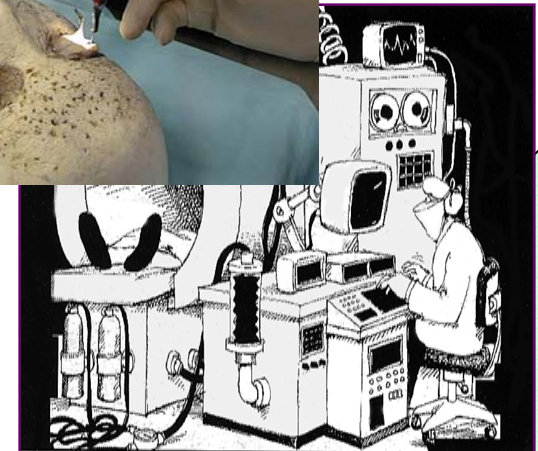
- Surgeons
- Engineers
- Industry



Focus on systems that address important needs



Rapid iteration with measurable goals



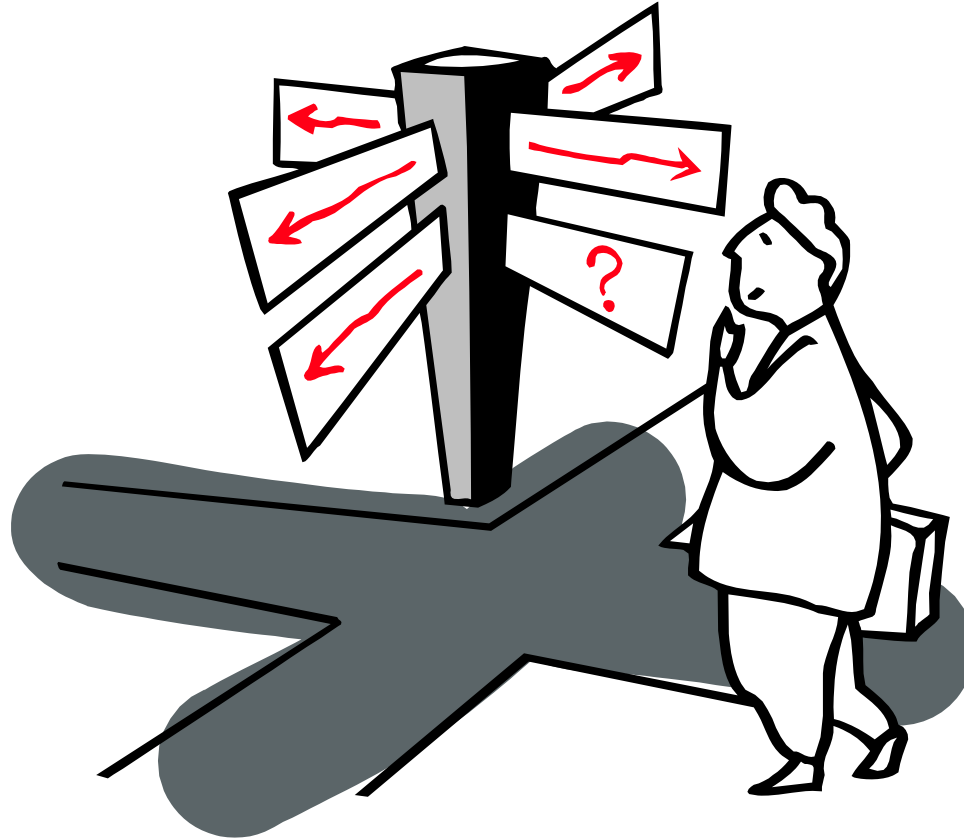
Have fun!

The real bottom line: patient care

- Provide new capabilities that **transcend human limitations** in surgery
- Increase **consistency and quality** of surgical treatments
- Promote **better outcomes** and more **cost-effective** processes in surgical practice



Thank you !



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