Robotic Assistance for Interventional Radiology

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Robotics in the 21st Century: New Frontiers

Panel: Medical Robotics – Born in space

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- **Development of new technology approaches for „Minimally Invasive Procedures“ and modern therapies in an integrative way**
- **Research and innovation center for collaborative and translational research between science and industry**
- **Key data:**
  - 1st funding period (2010-2014): overall budget of 18MEUR
  - 2nd funding period (2014-2017): overall budget 13MEUR
  - International network:
    25 industry partners
    27 research partners (technical + clinical)
  - Match funding

Medical Robotics

- **Surgical Robotics ⇔ Medical Robotics?**
  - Laparoscopy (daVinci, Surgenius, TeleLap ALF-X, Raven)

  - Strong and increasing presence in the commercial and academic arenas
  - Established research groups and strong companies

Medical Robotics

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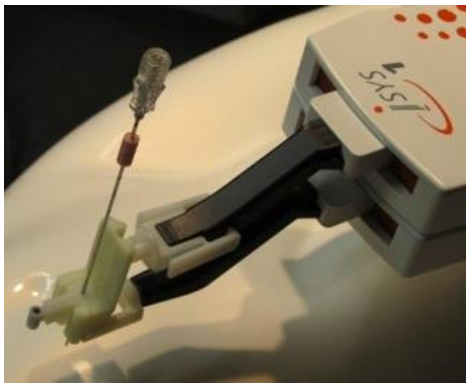
- **Surgical Robotics**
  - Laparoscopy (daVinci, RAVEN), Orthopedics (MAKO, SpineAssist)
  - Strong and increasing presence in the commercial and academic arenas
  - Established research groups and strong companies

- **Interventional Robotics**
  - Active academic interest; variable commercial experience
  - Still to make a breakthrough

Innomedic

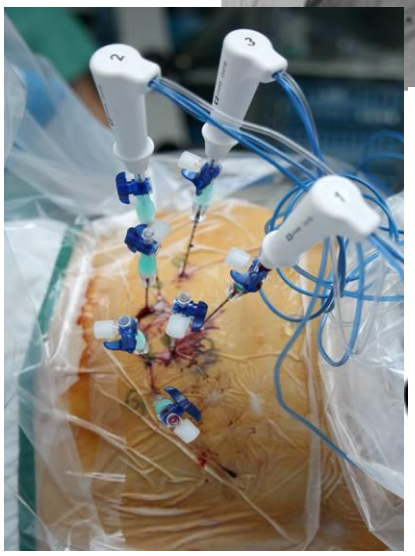
Perfint



iSYS Medizintechnik

Interventional Radiology

- **Access the site of treatment percutaneously, with the use of tubular, flexible devices (needle, ablation probe, etc.) under control by intra-operative imaging**
  - Ultrasound
  - CBCT, CT (volumetric, flouro mode)
  - MRT
- **Wide range of applications**
  - Biopsy
  - Brachytherapy
  - Cryotherapy
  - Injection of agents
  - Tumor ablation



Interventional Radiology

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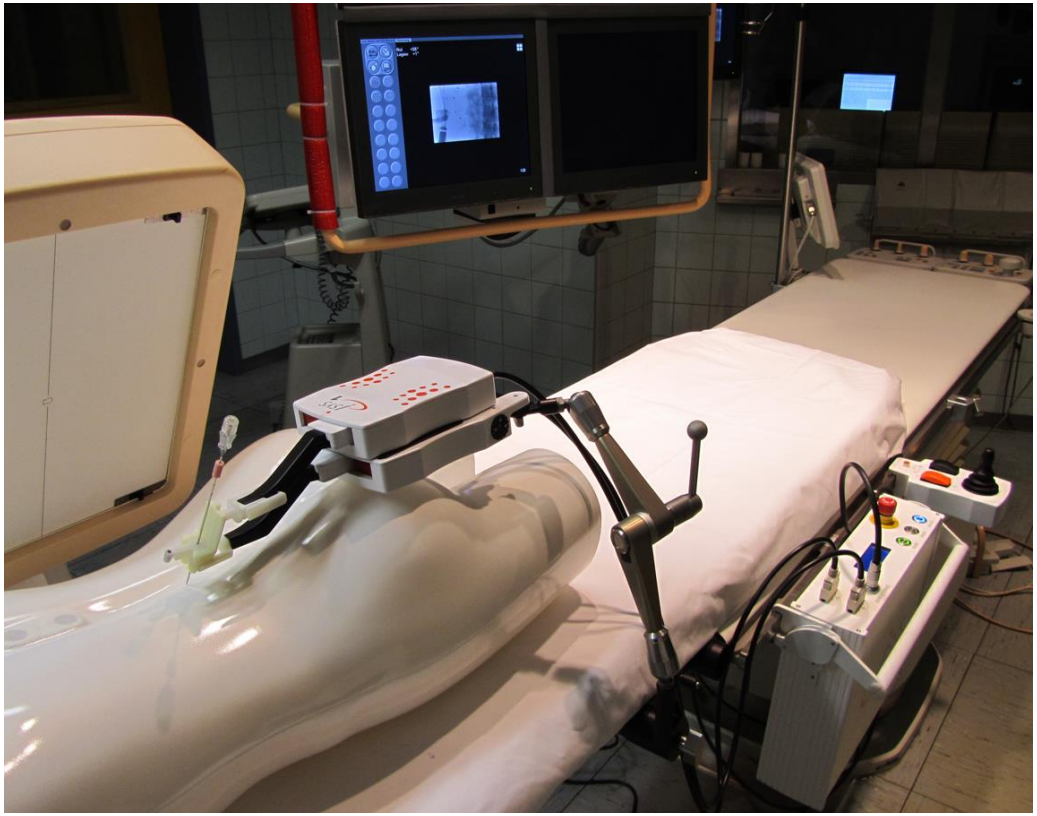
+ **Some difficulties …**
  - Exact planning to avoid critical structures
  - Requires mental registration of the patient's anatomy to the image during targeting
  - Precise hand-eye coordination
  - Stable positioning during insertion while penetrating tissues with heterogeneous stiffness
  - Physician exposed to radiation

+ **… and how robots could help**
  - "Third hand" during intervention
  - Exact tool positioning in 3D space
  - Keeping hands out of beam
  - Stable positioning over time

InnoMotion: Innomedic

ROXIO: Perfint

iSYS1: iSYS Medizintechnik GmbH



Requirements for an Interventional Robot System

- **Registration robot and image**
  - Coordinate transformation between imaging system ⇔ Robot ⇔ Tool
- **Planning system / Monitoring**
  - Tool tracking
- **Robot**
  - Compatible to imaging modality (US, CBCT, CT, MRT)
  - Integration to imaging device
  - Compact
  - High degree of dexterity
  - Precision
  - Working in sterile field
- **Patient/target movement**
  - Immobilisation
  - Monitoring
  - Stable guidance of tool vs free angulation?

Robots in Interventional Radiology

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Potential

+ **Advantages:**
  - Robot serving as a “third hand” during intervention
  - Improved visualisation and planning of the needle trajectory in order to avoid critical structures
  - Improved accuracy and consistent results of needle placement
  - Optimal support for complex (double-)oblique access routes
  - Shortening of interventional procedure
  - Reduced radiation dose for radiologist and patient
  - Improved safety and lower risk of complications

Source: SIP Lab

Thank you!

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