

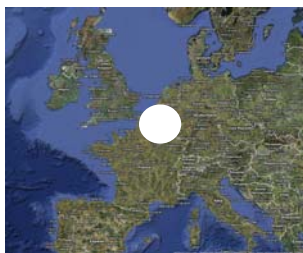
Experiences and future developments in EU FP7 projects in MIS technology

Speaker: Mauro Sette
 Robotic Assisted Surgery group, Katholieke Universiteit Leuven, Belgium
 Institute Mechatronic Systems – ZHAW, Winterthur, Switzerland
 Contacts:
 Mauro.Sette@mech.kuleuven.be



Presentation Outline

- Who I am, where I come from...
- Past experiences in EU projects - ARISER
- Ongoing project – SCATH
- The future...



Students

- 34940 students
- 4402 international students

Staff

- K.U.Leuven employs 8,017 people.
- The university hospitals employ 8,172 people.

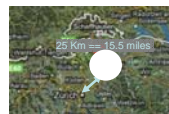
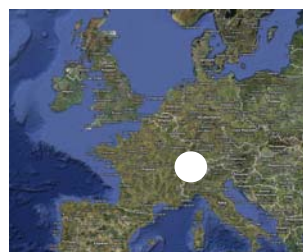
Research

- Research expenditures: EUR 296,7 million

The robotic assisted surgery (RAS) group - PEOPLE

Biomechanics
 Computer modeling
 Robot design
 Control
 Micromechanics
 Urology
 Cardiac Surgery
 Gynecology

Prof. Jos Vander Sloten, Nele Famaey, Mauro Sette, Gabriël Smollic, Vukasin Stribac, Joris De Schutter, Prof. Dominiek Reynaerts, Emmanuel Vander Poorten, Bert Willaert, Eric Demeester, Prof. Hendrik Van Brussel, Jan Peirs, Gianni Borghesan, Andy Gijbels, Alexander Huntemann, Pauwel Goethals, Dr. Ben Van Cleyenbruggel, Prof. Paul Herigiers, Prof. Philippe Koninckx



- Applied R&D
- R&D Services for Industry
- Education and
- Technology Transfer

Medtech people @ ZHAW



Key Competences

- Industrial software development
- Mechatronics System Integration
- Prototyping

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Past Experiences – ARIS*ER

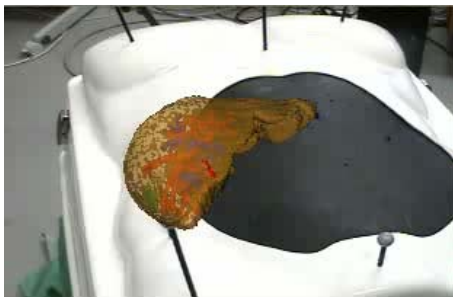


- New strategies for Medical Image processing
 - Segmentation
 - Registration
- New strategies for computer graphics in Medical environments
- Ergonomically driven concept development for medical and surgical applications
- Surgical robotics

www.ariser.info

Results

[VIDEO](#)



CREDITS

- Denis Kalkofen, Visualization, TU Graz, Austria
- Sergiy Milko, Registration, SIEMENS Oxford, England
- Laurent Massoptier, Segmentation, IFC-CNR Lecce, Italy
- Ashis Jalote, Human Factors, TUDelft, Netherlands
- Petter Risholm, Research Integration Workpackage Leader, UOslo, Norway



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Ongoing project - SCATH



A project funded by:



EC - 7th Framework Programme
ICT 4 - 2009.5.2 - ICT for Patient Safety
Specific Targeted Research Project (STREP)
G.A.n.248782

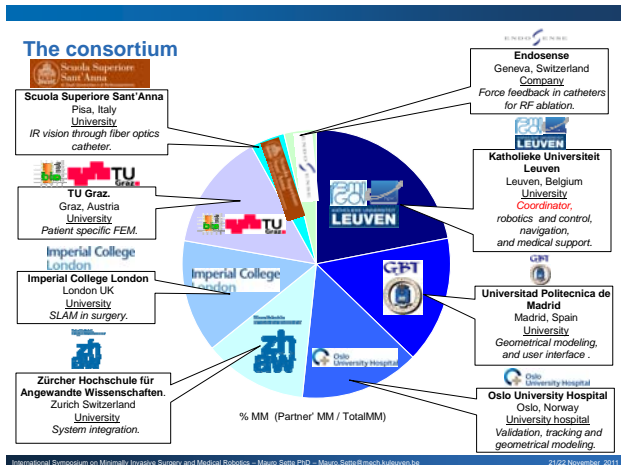
Project's Coordinator: **Jos Vander Sloten**

Project's Manager: **Mauro Sette**

Duration: **36 Months**

Presentation Outline

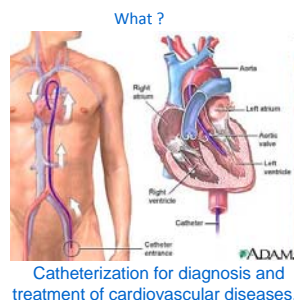
- Who I am, where I come from...
- Past experiences in EU projects - ARISER
- Ongoing project – SCATH
 - Consortium
 - Introduction and background
 - SCATH's Goals and Approach
- The future...



Presentation Outline

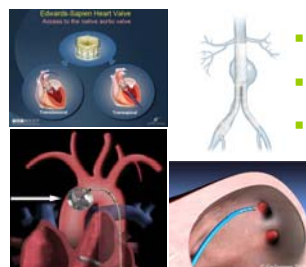
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Smart CATHeterization



Main goal? Improve the safety during surgery.

Case Studies



- Percutaneous aortic valve
- Aortic stent graft delivery
- Endocamp balloon placement
- Radio frequency ablation.

- Drawbacks**
 - Visualization (Xray)
 - Manipulation
 - Adverse events, i.e. ruptures and tamponade

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 - SCATH's Strategy**
- The future...

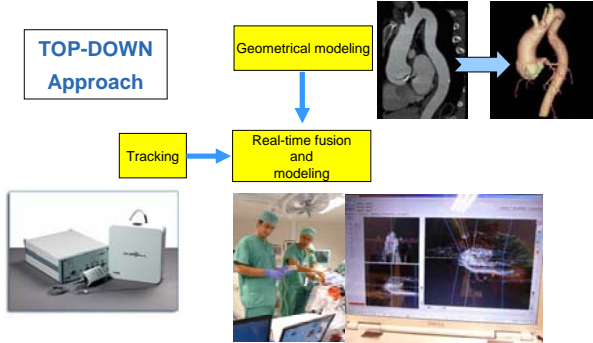
SCATH's Strategy



- Better visualization
- Better knowledge of the surgical environment
- Better control over the surgery

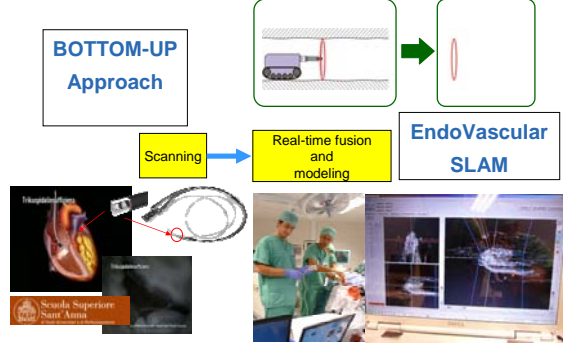
Improve Safety

- HOW? Reduction of the X ray delivered to the patient



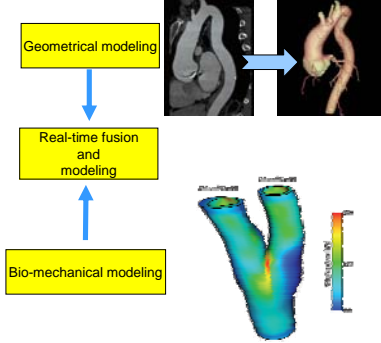
Improve Safety

- HOW? Reduction of the X ray delivered to the patient



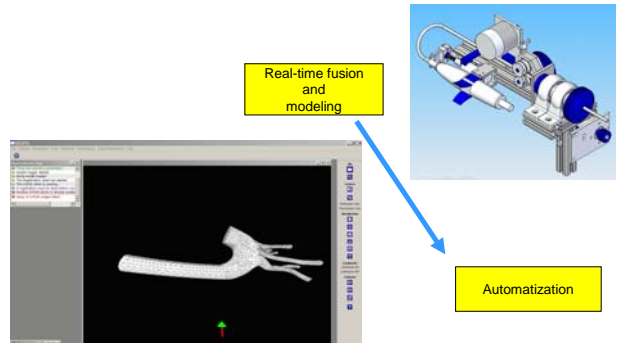
Improve Safety

- HOW? Introduction of Safety margins



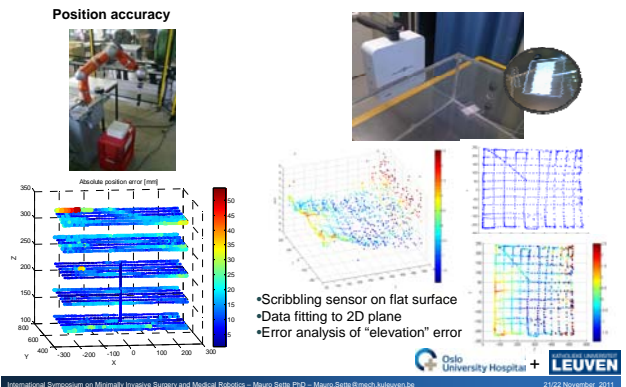
Improve Safety

- HOW? Mitigation of Operator's mental load

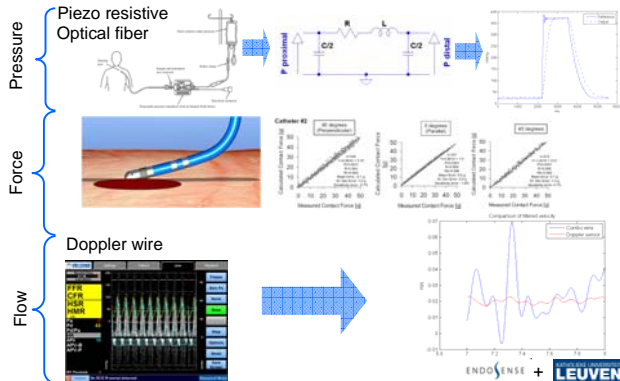


1st year results

Accuracy Assessment of EM Tracker: Aurora™, NDI



Evaluation, modeling and development of sensors

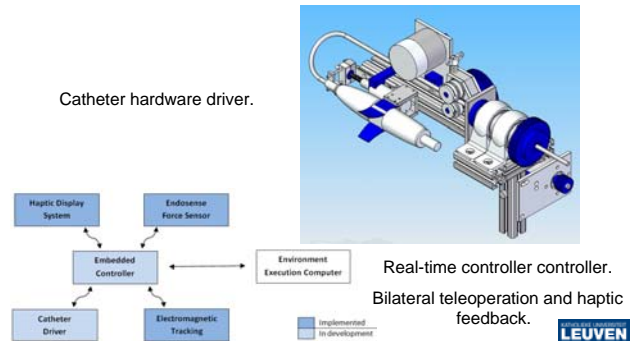


International Symposium on Minimally Invasive Surgery and Medical Robotics - Mauro Satta PhD - Mauro.Satta@mech.kuleuven.be

21/22 November 2011

Catheter control:

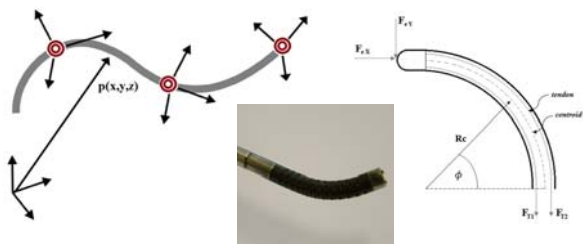
Software, Hardware and Teleoperation w. haptic feedback



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21/22 November 2011

Geometrical and Mechanical Modeling of the Catheter

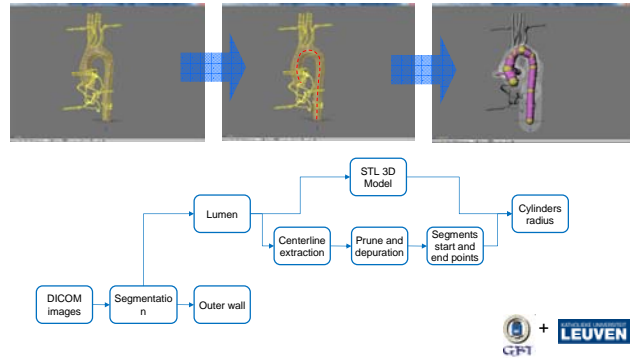


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Non-rigid registration:

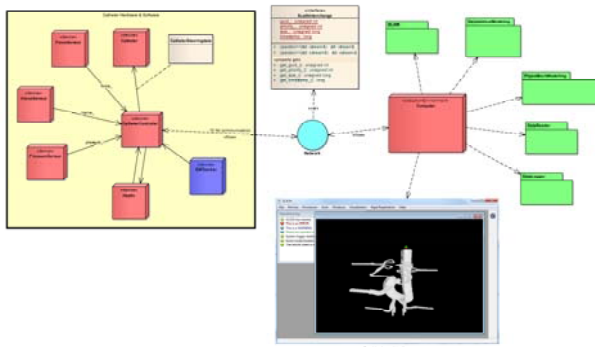
Geometrical modeling and Parameterization



International Symposium on Minimally Invasive Surgery and Medical Robotics - Mauro Satta PhD - Mauro.Satta@mech.kuleuven.be

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Definition and development the software framework



International Symposium on Minimally Invasive Surgery and Medical Robotics - Mauro Satta PhD - Mauro.Satta@mech.kuleuven.be

21/22 November 2011


Designing new concepts for catheters




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21/22 November 2011

The SCATH platform Integration

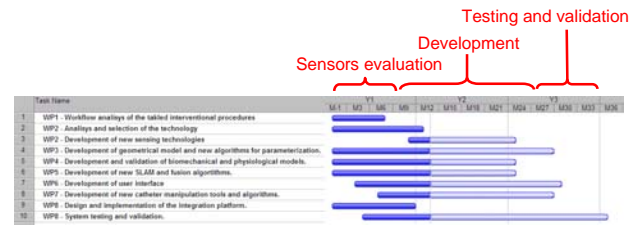


- Graphical User interface
- Data dispatcher



International Symposium on Minimally Invasive Surgery and Medical Robotics - Mauro Setti PhD - Mauro.Setti@mech.kuleuven.be 21/22 November 2011

What's next ?



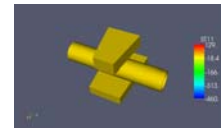
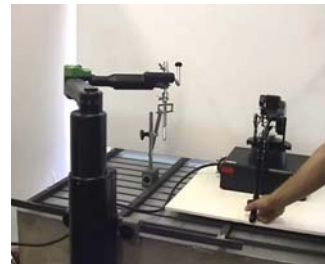
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Actual surgical robotics research trends

- Laparoscopic surgery, big margins for improvements.
 - Force feedback
 - Integration of biomechanical knowledge.



N. Famaey, J. Vander Sloten

KATHOLIEKE UNIVERSITEIT LEUVEN B. Willaert, H. Van Brussel

Actual surgical robotics research trends

- Natural orifice surgery and catheter based surgery.
 - Development of new devices
 - Development of new control schemes

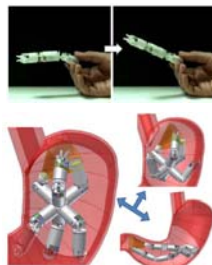


Fig.1 Possible topologies of the modular robot in the stomach

KATHOLIEKE UNIVERSITEIT LEUVEN T. Moers, D. Reynaerts K. Harada & P. Dario

Actual surgical robotics research trends

- Procedure specific new technologies
 - E.g. Vesalius robot
 - Eye surgery



E. Vander Poorten

KATHOLIEKE UNIVERSITEIT LEUVEN H.W. Tang, H. Van Brussel



Come to our Workshop!!!

謝謝您的關注

Mauro.Sette@mech.kuleuven.be

www.scath.net

http://cordis.europa.eu

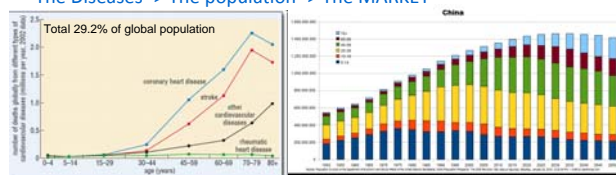


EC - 7th Framework Programme
ICT 4 - 2009.5.2 - ICT for Patient Safety
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問題 ?

Questions ?

The Diseases -> The population -> The MARKET



How much ? 192*G€ (10⁹) (2006 only in EU)



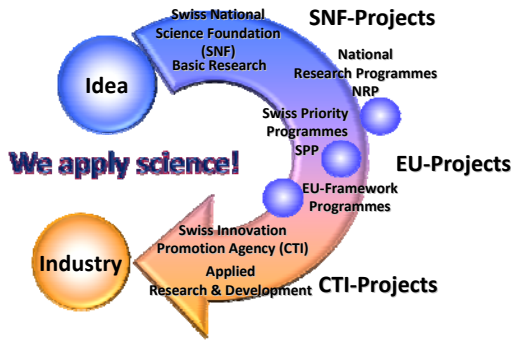
FP7: Framework Program 7th



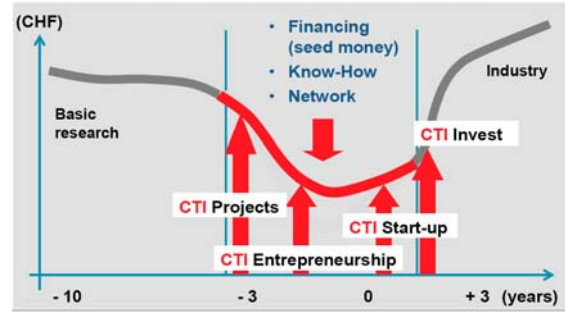
What is FP7?

- The FP main financial tool through which the EU support research and development activities covering almost all scientific disciplines.
- What may be financed? *Frontier of knowledge*, technologic development, demonstration activities, innovation activities, improvement of European infrastructures of research, formation of research; *almost anything remotely related with science*.
- Universities, big companies, SME, public administration, (individual) researchers, (research) institutions, non-European-countries scientists, etc.

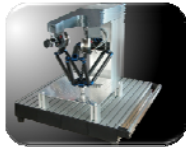
Paving the way from basic research to real industrial solutions



CTI: Assisting Start-ups in the Death Valley



Mechatronics @ ims
IMS key areas of applied R&D



Robots and robot based systems

- Pick and Place and handling systems
- Robotics for manufacturing & automation
- Highly flexible self learning systems
- Service robotics
- Assistant robotics
- Autonomous systems



Vision & Navigation

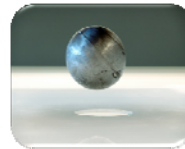
- 2D & 3D optical measurement systems
- Development of complex 2D und 3D Algorithms
- High definition feature extraction
- Ultra precise positioning and orientation
- Sensor fusion (IMU & GNSS)
- Realtime positioning & navigation

Mechatronics @ ims
IMS key areas of applied R&D



Medical Systems & Instrumentation

- Minimal invasive Surgery
- Medical Micro Systems
- Medical Sensors
- Intelligent Implants
- Medical Robotics
- Rehabilitation Technology



Control & Automation

- Control & Modelling
- Identification & Simulation
- Neural Networks & Fuzzy Control
- CNC and Motion Control Technology
- Power Electronics & Drives
- Simulation of CNC controlled Systems

Case study 1 – Positioning Endovascular grafts



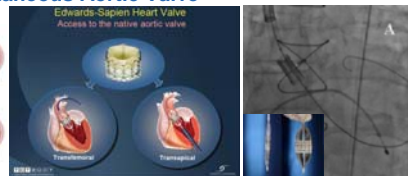
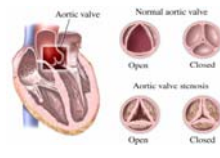
Advantages

- Minimally Invasive procedure
- Saving life procedure

Risks

- Misplacement → Paraplegia (32% incidence in type I and II TAAA)
- Aneurism rupture
- Embolism
- Fluoroscopy

Case study 2 – Percutaneous Aortic Valve



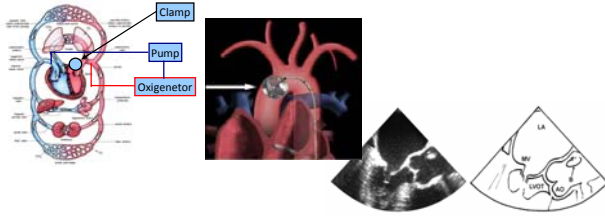
Advantages

- Minimally Invasive Procedure
- No cardio pulmonary bypass (CPB)

Risks

- Guidewire-induced laceration.
- Cardiac tamponade.
- Misplacement (or suboptimal placement)
- Inability to cross the diseased valve.
- Fluoroscopy

Case study 3 – Positioning of Endoclamp balloon



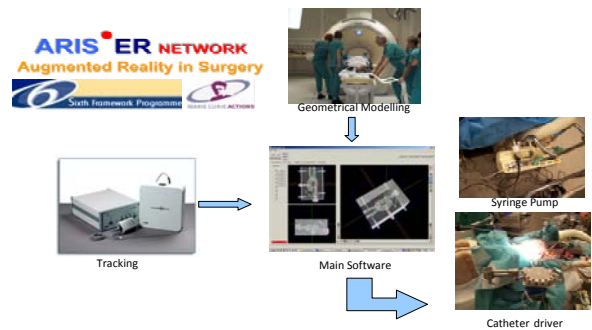
Advantages

- Minimally Invasive Procedure.
- Better administration cardioprotection.

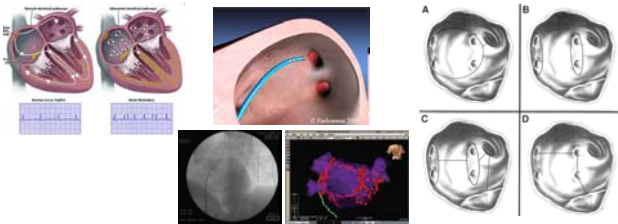
Risks

- Long time required for initial positioning.
- Poor visualization.
- Possible mobilization during the procedure (high risk).

Case study 3 – Positioning of Endoclamp balloon – Previous work



Case study 4 - Radio frequency ablation



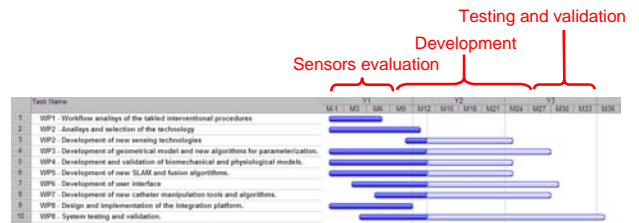
Advantages

- Minimally Invasive Procedure.
- Better administration cardioprotection.

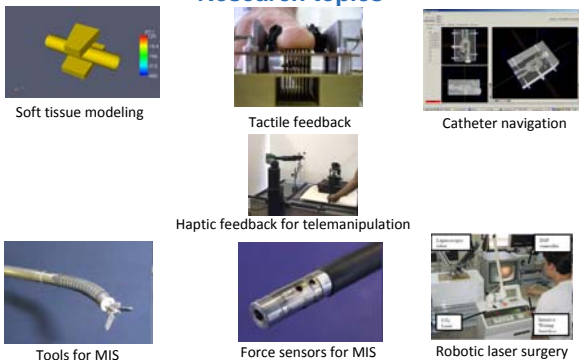
Risks

- Non successful ablation.
- Too high or too small force applied while ablating.
- Fluoroscopy.

SCATH-Roadmap



The robotic assisted surgery (RAS) group Research topics



Institute of Mechatronic Systems IMS



- Applied R&D
- R&D Services for Industry
- Education and
- Technology Transfer

About 45 employees including: Lectures, scientific co-workers, assistants, master students, technical staff

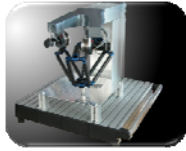


IMS-Building Villa Forrer

- Bachelor & Master Studies in Mechatronics and Medical Technology
- Master Research Unit MRU

About 30 Student projects and 15 bachelor theses per year

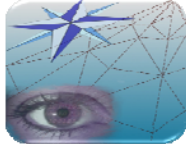
IMS ZHAW - Areas of expertise



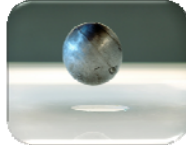
Robotics



Medtech



Vision and navigation



Control and automation

SCATH's Strategy



Improved surgery	Expanded possibilities for treatment Increase the amount of eligible patient for endovascular treatment
Improved safety	Drastic reduction of the absorbed radioactive dose for the patient and the interventionalist. Implementation of safety margins on the catheter tools. Mitigation of the surgeon's mental load through partial automatization and more intuitive control over the procedure
Improved Training	Possibility to reproduce all pre-operative and intra-operatively recorded multi-modal data in a training modality to provide realistic information for training .
Improved Pre operative planning	Pre-operative size and final position identification for prosthetic and catheter devices. Pre-operative identification of safety margins for delicate anatomical structures.
Economical Impact	Competitiveness of Europe Cost Effectiveness SME Leading Innovation