

EPFL - LSRO:

Research & Innovation in parallel kinematics

Plan:

- The **LSRO** (Laboratoire de Systèmes Robotiques)
- Activities and research domains
- Innovations
- PC based Control

The LSRO

- 64 persons / 28 Phd students
- 2 prof.: Hannes Bleuler et Reymond Clavel
- \approx 50 student projects / year
- More than 15 deposited patents
- \approx 50 publications / year
- 6 created spinn-off
- 4,5 millions CHF of budget / year , with around. 60% from industrial financing (CTI, FNS, Europe, NCCR, ...)

Research Domains

- **Parallel kinematics** for high **precision** and high **dynamic** robots
- Nano- & micro-robotics
- High precision **Robot calibration**
- **Flexible joint** based structures
- Piezo actuators
- Magnetic bearing
- Micro- & nano-tooling
- Virtual reality
- **Medical robotic** & instrumentation

Exemples de recherche

- Parallel robotic



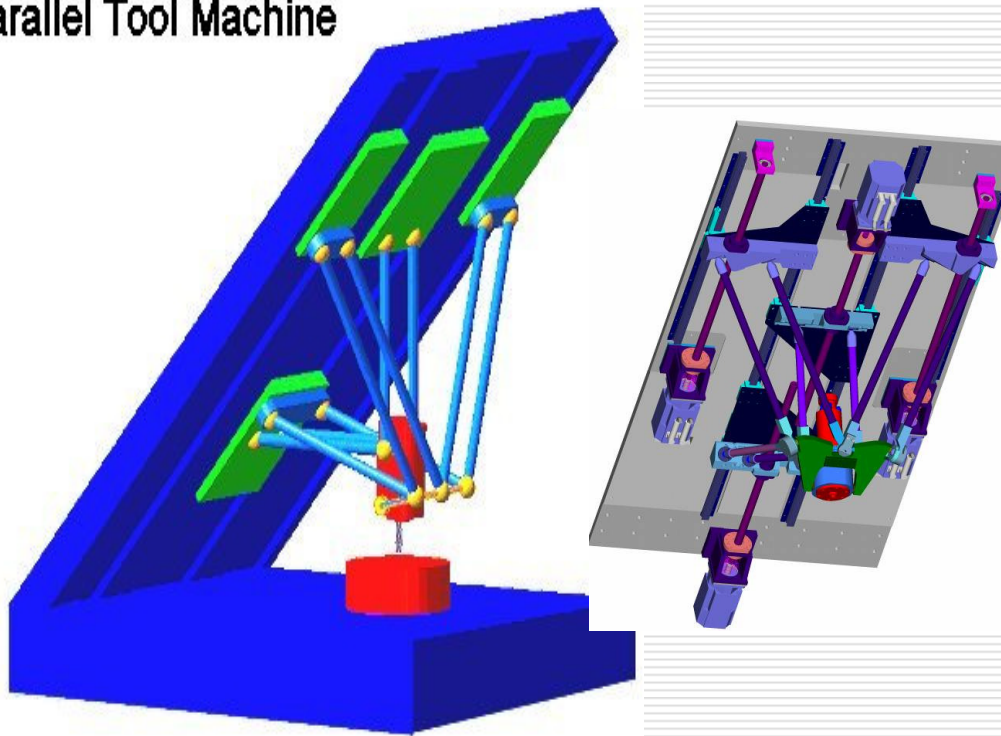
Research Examples

Parallel system for a
Positioning of a surgery
microscope

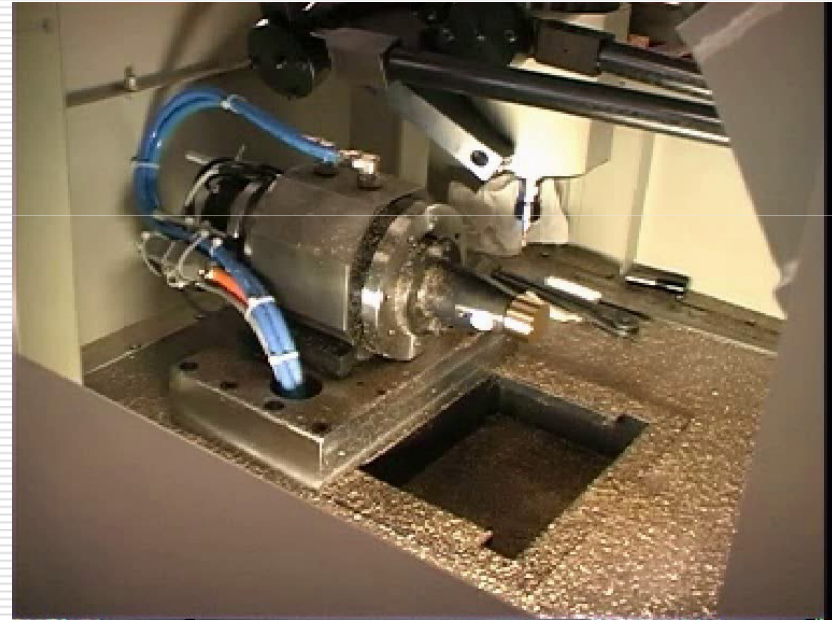


Research Examples

- Parallel Tool Machine
- Parallel Tool Machine



Research Examples

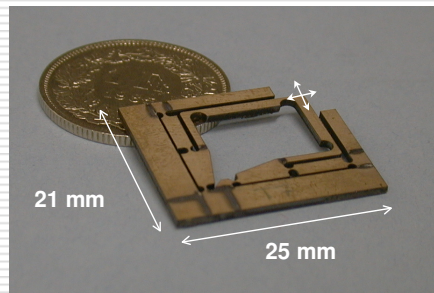


Research Examples

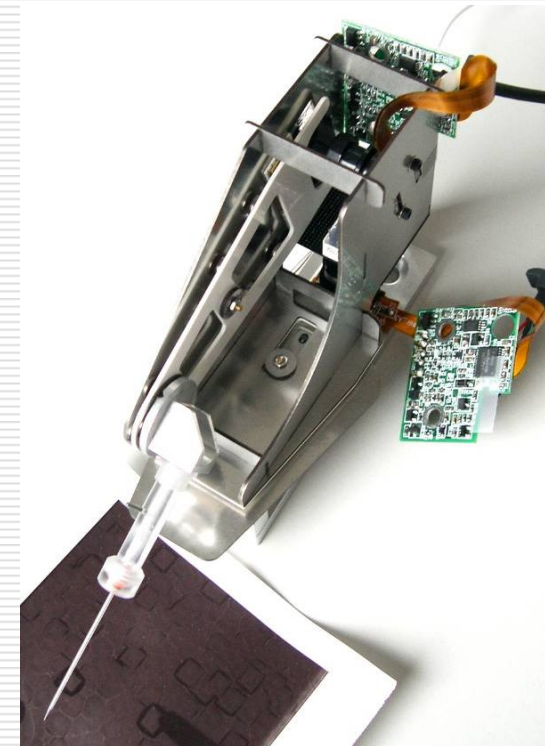
- High precision Robotics



3D Palper for metrology



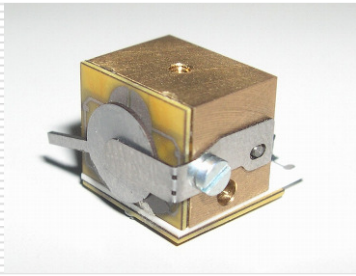
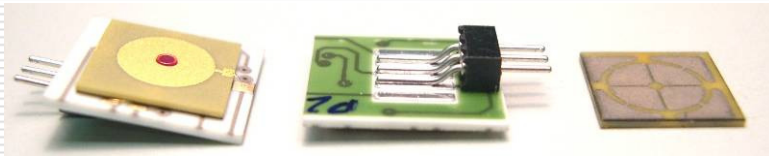
Bimorphe Actuator



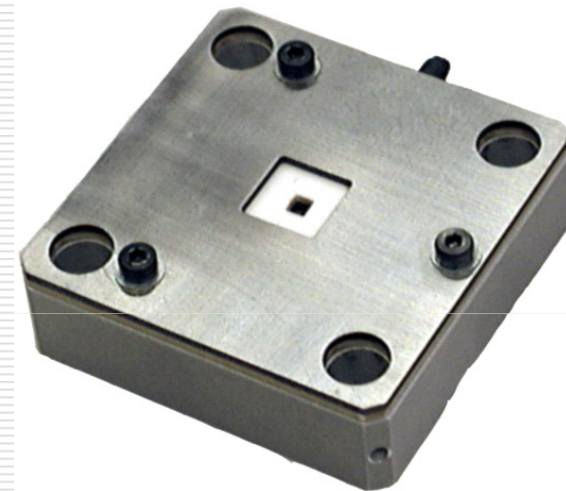
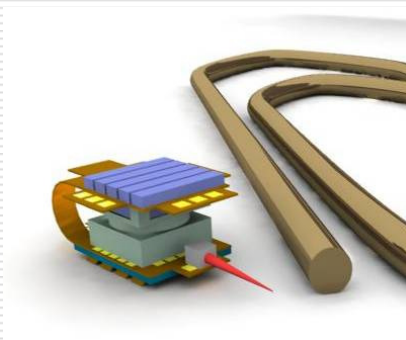
Micro-robot for biology

Research Examples

- Piezoelectric Actuators



Mobile Micro-robot
/1 cm³ & 4 ddl



X-Y Positioner for micro-optical components

Innovations

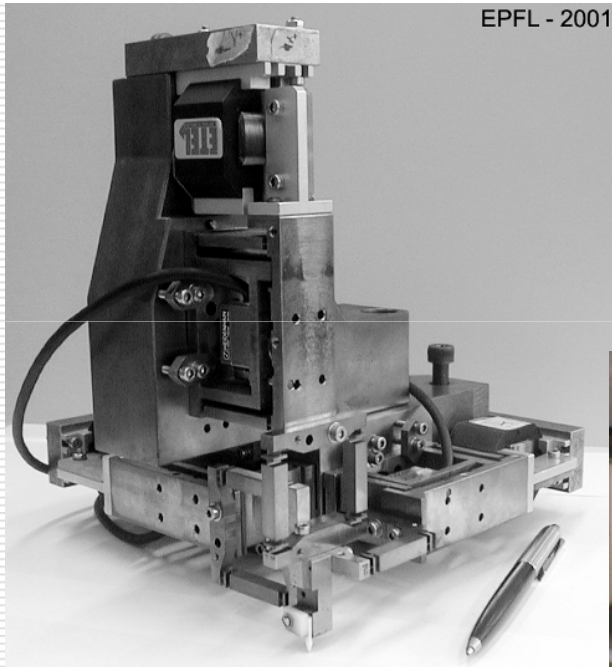


Haptic System
de ForceDimension

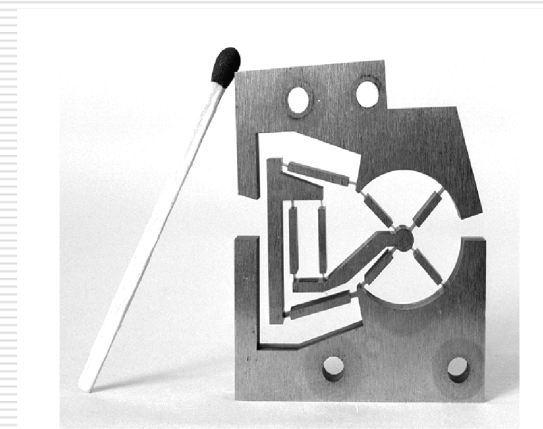
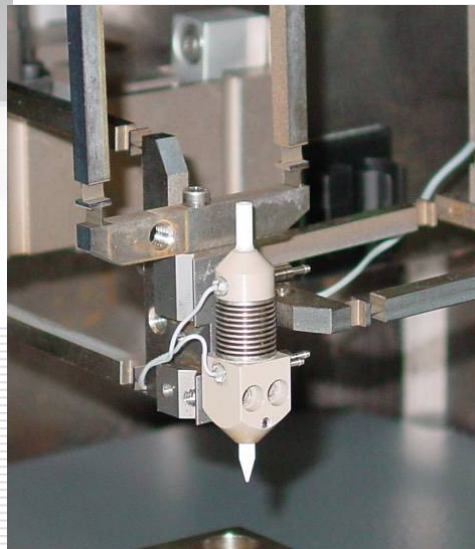
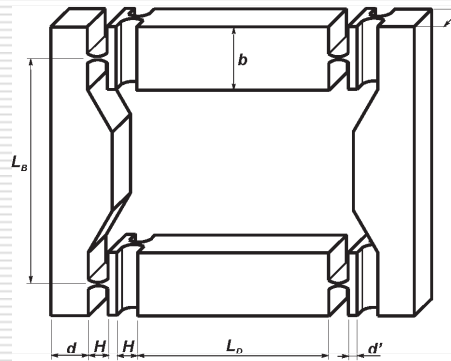


easyTrack from Atracsys

Innovations

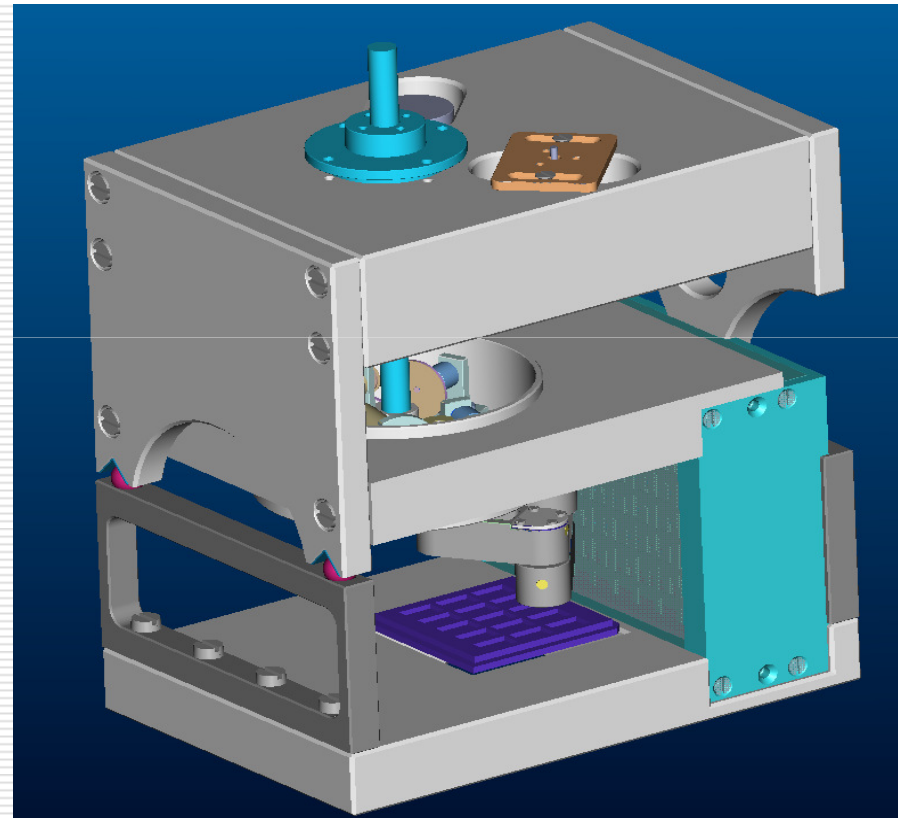


Delta³ for EDM
(Agie, Mecartex)

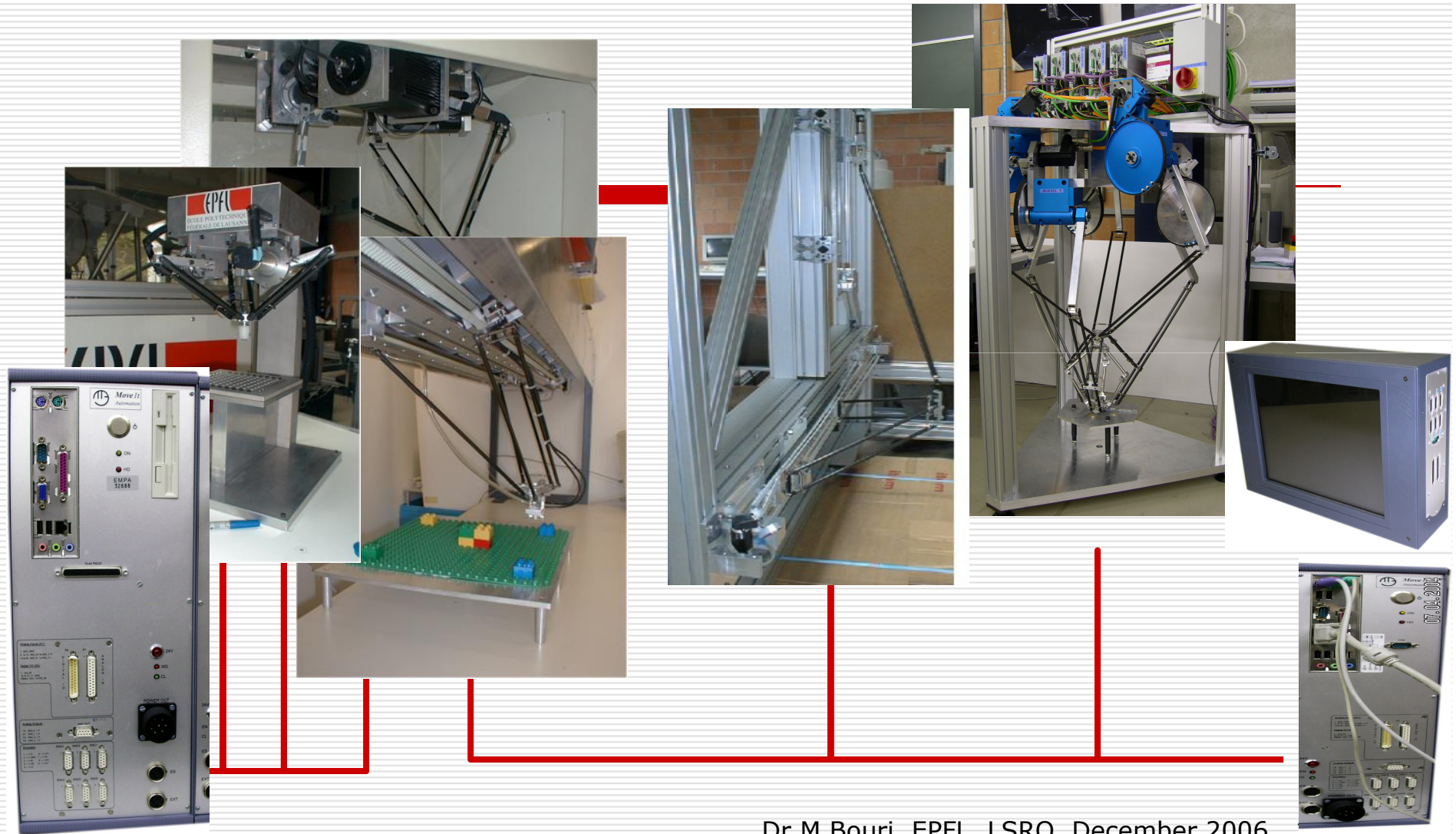


Innovations

MicroFactory



Control : the intersection topic of the laboratory



Dr M Bouri, EPFL, LSRO, December 2006, 11

What is an open architecture,

Open is a generic term used by a lot of robot control providers to describe the fact that the robot controller or a part of it may be modified.

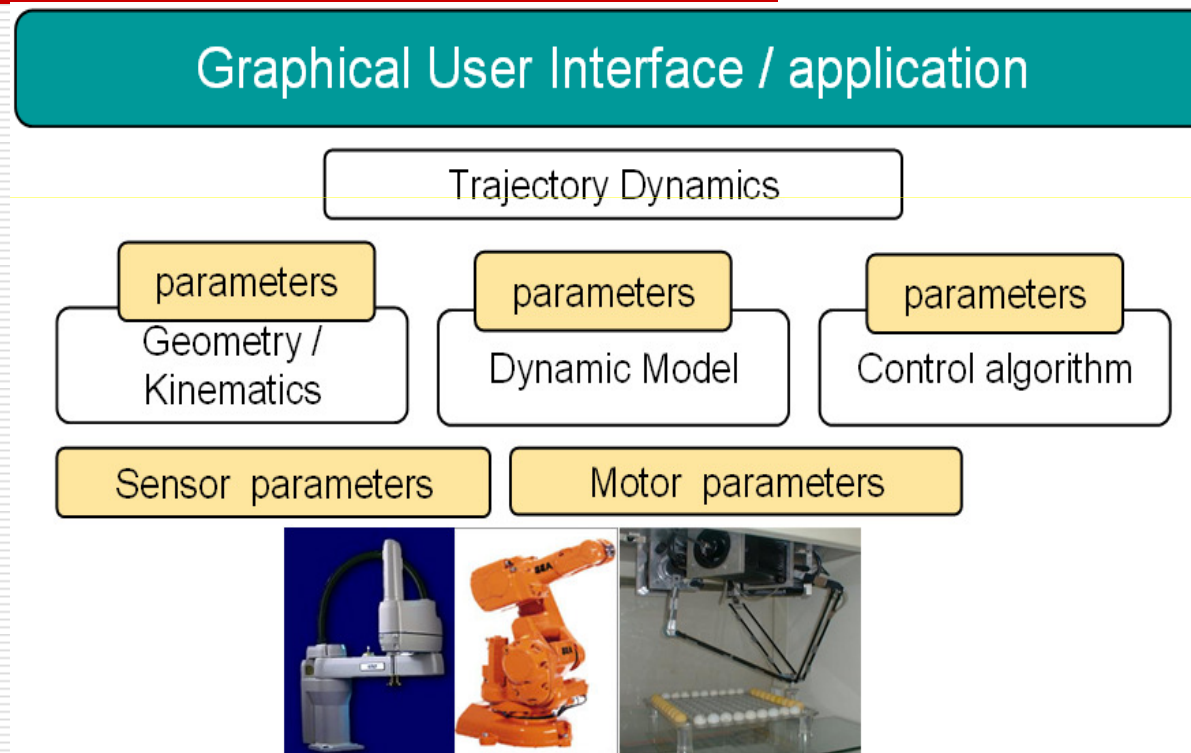
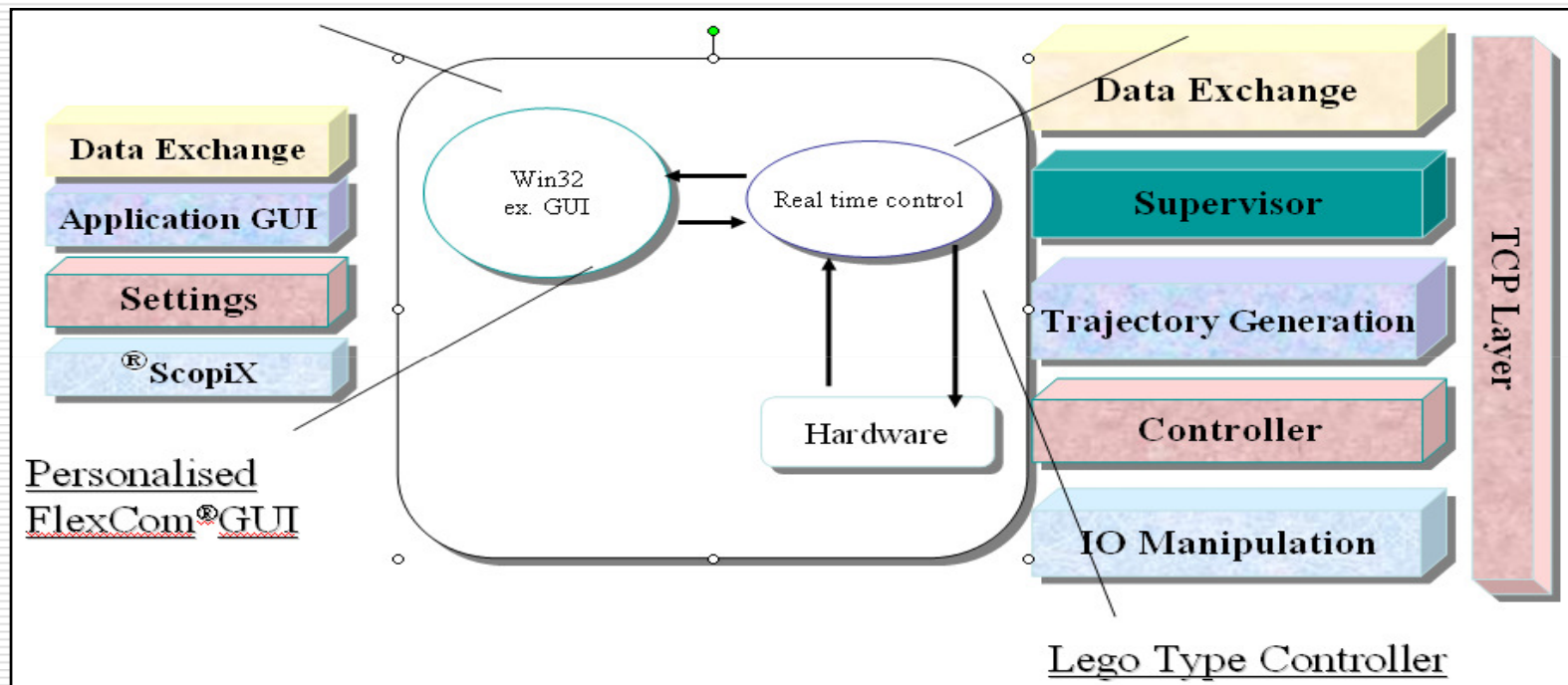
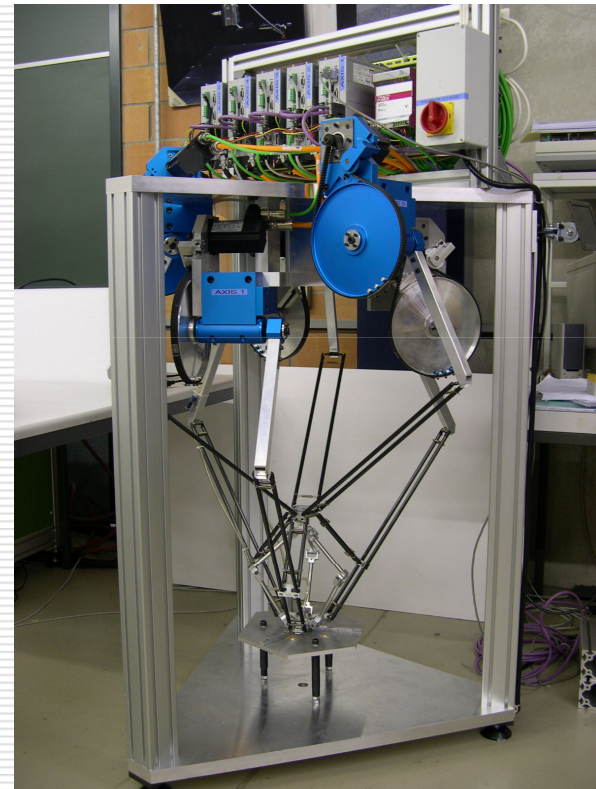
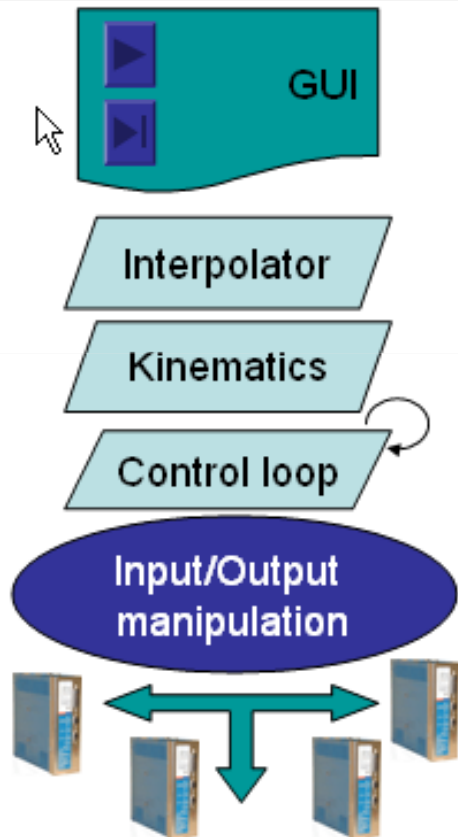


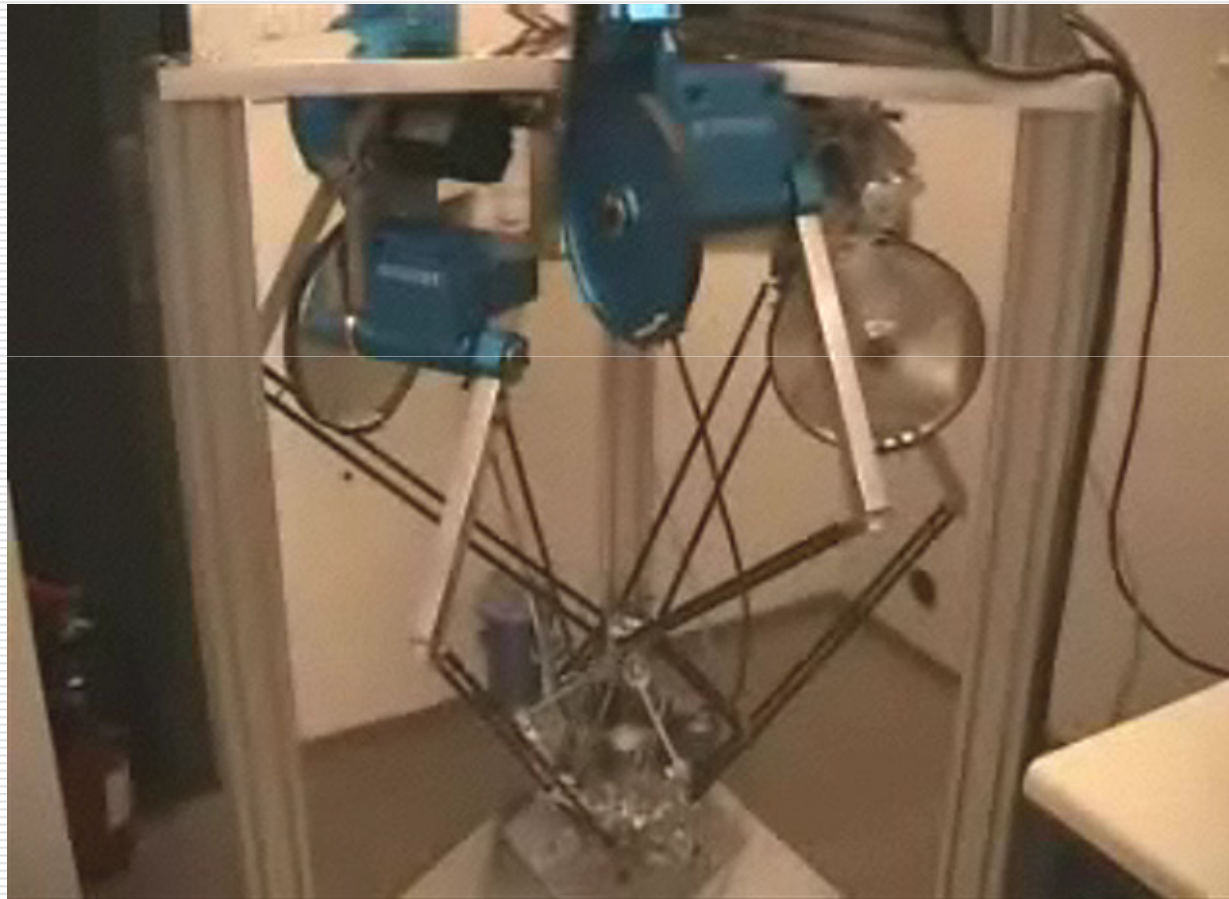
Figure 1. Robot controller components

One Controller – One Hardware – Two worlds



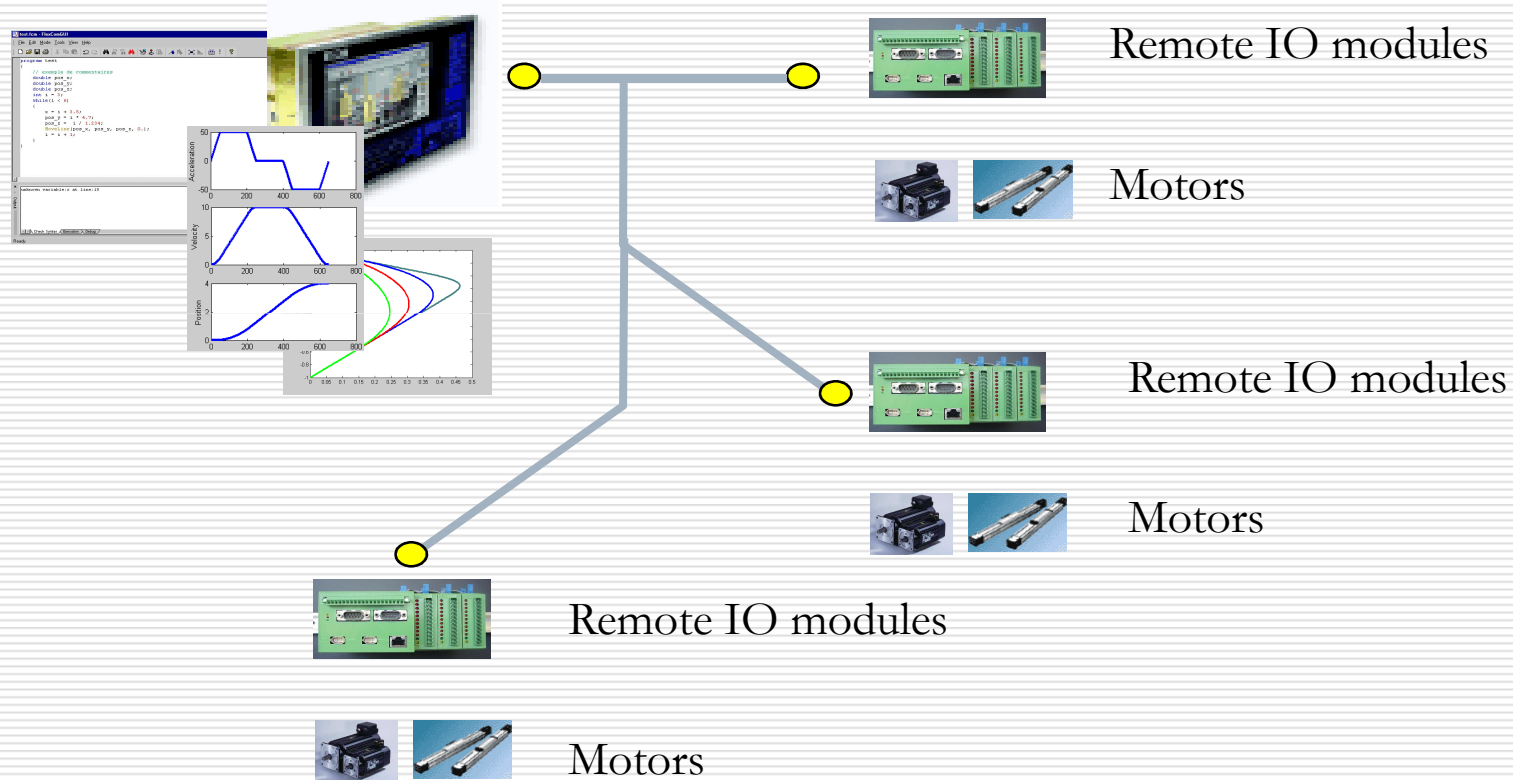
Profibus Use



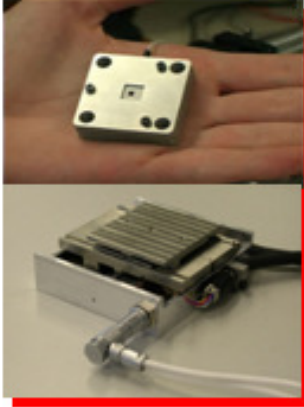


FireWire remote robot control

Industrial PC



Stick Slip micro robots control (EMPA Thun,..)

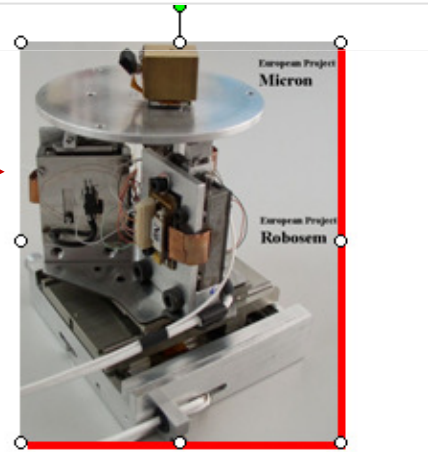


RS232

Amplifiers



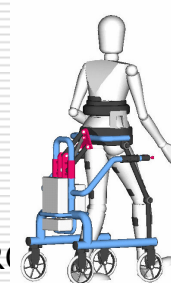
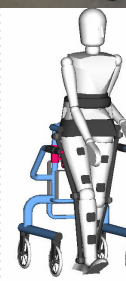
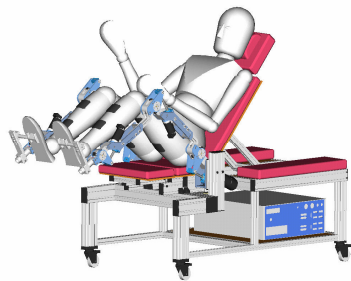
Encoders



5 dof, Ztilt SSlip robot

Medical Robotics: Systems for reeducation of handicapped people (Fondation Suisse pour Cyberthèses et Swortec SA)

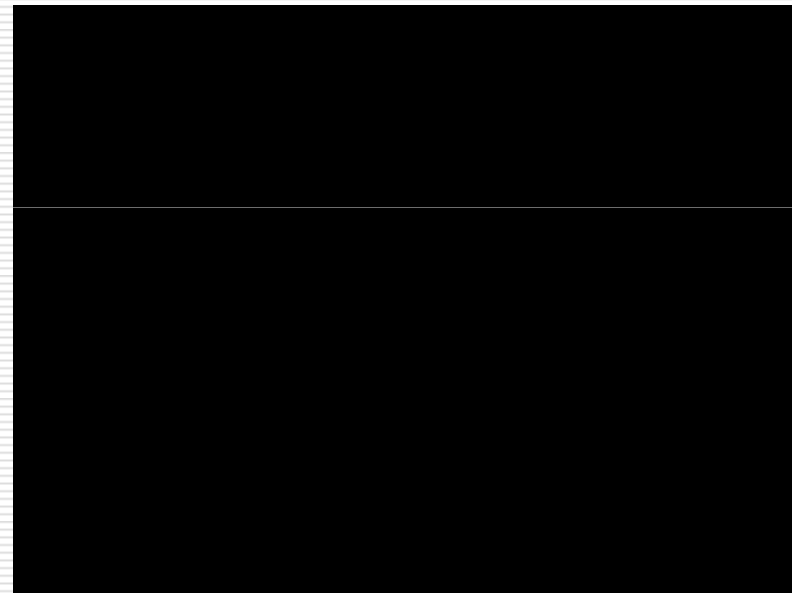
- Combining electro-stimulation and actuated mechanics



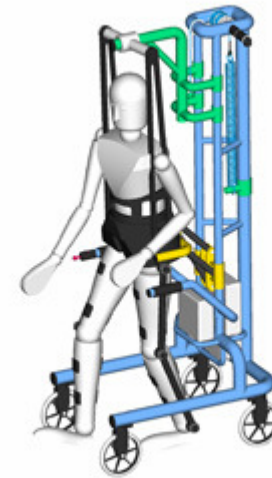
MotionMaker™

Dr M Bourj, EPFL, LSR, WalkTrainer™, October 2006, 20

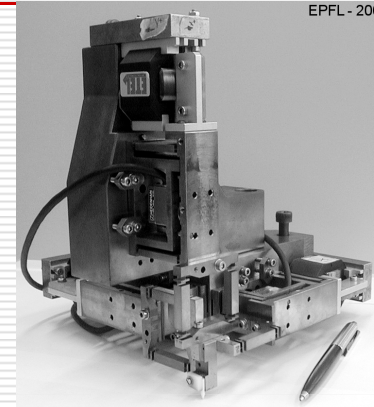
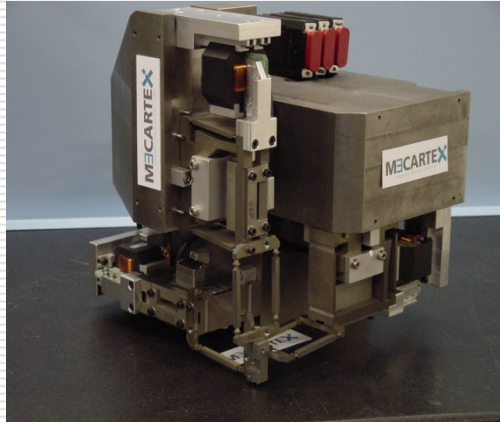
MotionMaker



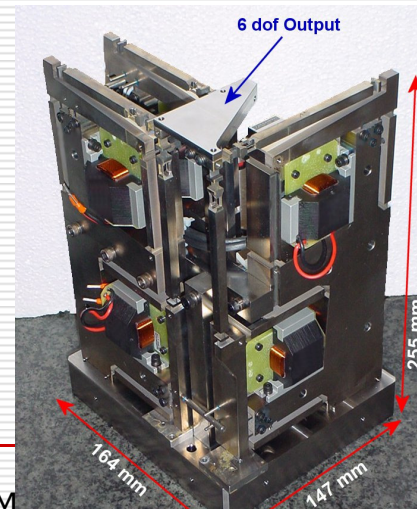
WalkTrainer



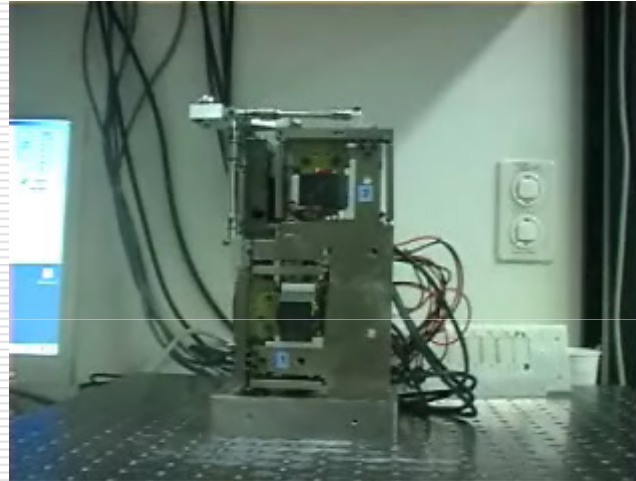
Flexible structures & security aspects



- ✓ *Inner loop to test if the robot variables belong to their workspaces,*
- ✓ *Error limits*
- ✓ *Sensor redundancy,*
- ✓ *Watchdog support*
- ✓ *Customer support security strategy*



Flexible structures & security aspects



Thank you

