Parallel Robotics
From Research To Industry
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Topics

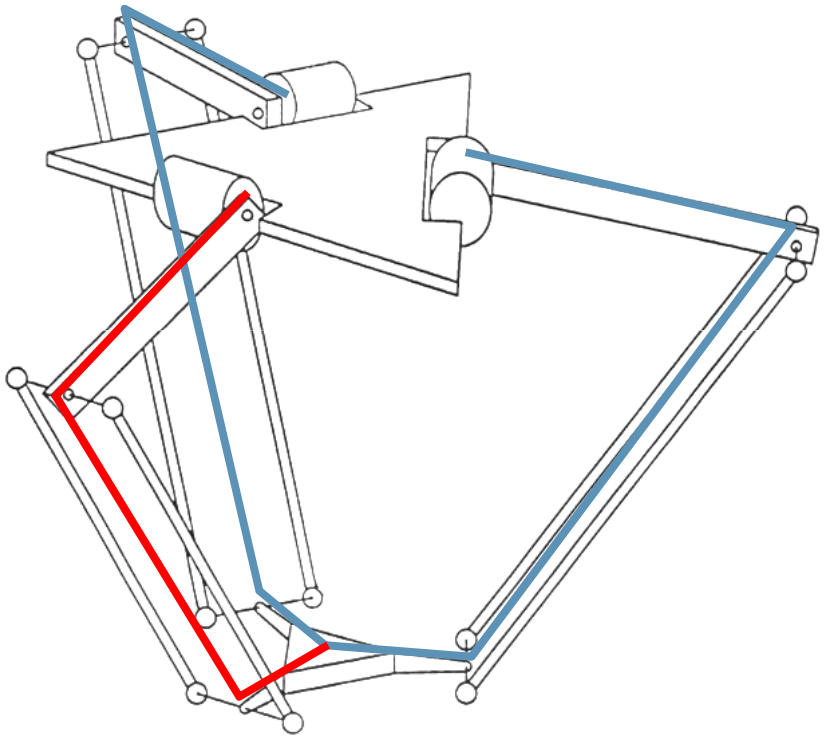
- LSRO (some values)
- The Delta robot story
- New developments : The Keops
- Parallel robotics in tool machining
- Parallel robotics in medical devices
- The challenges

LSRO

Laboratoire de Systèmes Robotique de l'EPFL

- 2 professors: Reymond Clavel and Hannes Bleuler
- 50 employees, including 24 PhD students
- ≈50 Master projects / year (semester & TPM)
- ≈50 publications / year
- More than 20 patents
- 7 spin-off
- Annual budget: 4'000'000 CHF (32'000'000 TD)
  more than 60% from third parties

Parallel Kinematics



Delta-Robot

Delta Success Story

- Translational Parallel robot,
- Very fast Pick and Place robot,
- Development started in 1983

  >> on an idea a light robot
- Patented in 1985
- 1986 industry started to be interested

  in the kinematics

Delta Success Story

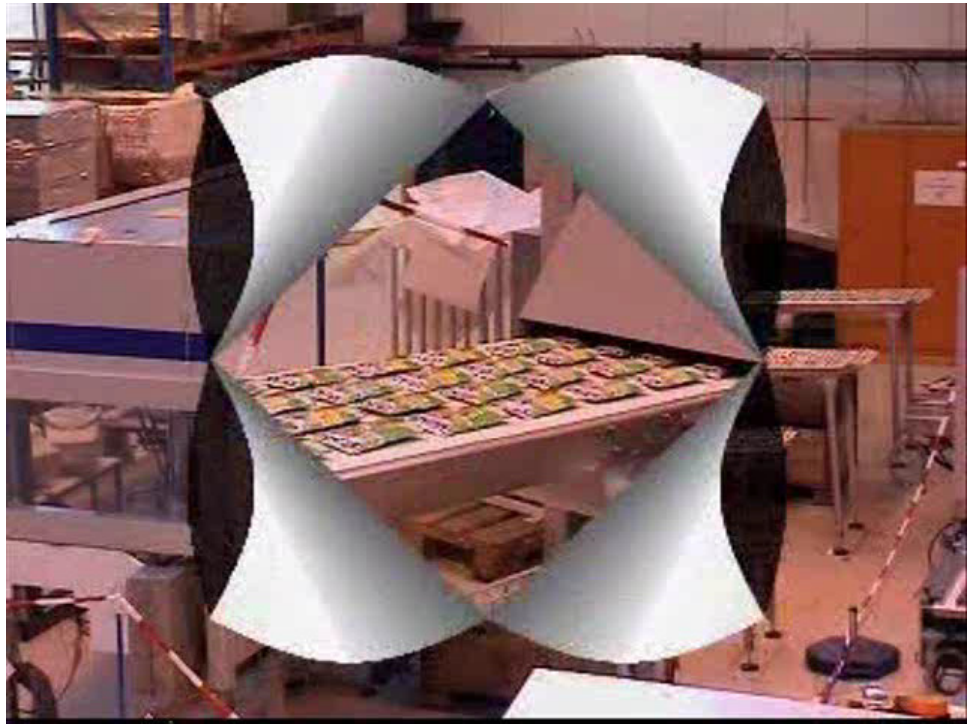
- Local industry is interested and bought the patent and started the industrialization of the robot in **1988**.
- The first customer has been Nestle.
- This company, Demaurex that is now Bosch Demaurex had and has a lot of success with this robot.
- Since more than 20 years, Bosch Demaurex has developed a lot of expertise and fast pick and place knowledge with the Delta robot.

Delta Success Story

- ABB bought the license and started the industrialization of the structure under the name "**FlexPicker**" in 1998.
- The FlexPicker has a lot of success in the pick & place industry.

Delta Success Story

The movie



Main Prices

- The JIRA price (Japanese Industrial Robotics Association) in 1989.

- The Golden robot price given by the IFR (International Federation of Robotics) in 1999 for the success that the Delta has had in the industry.

Delta Success Story

The story has not finished !

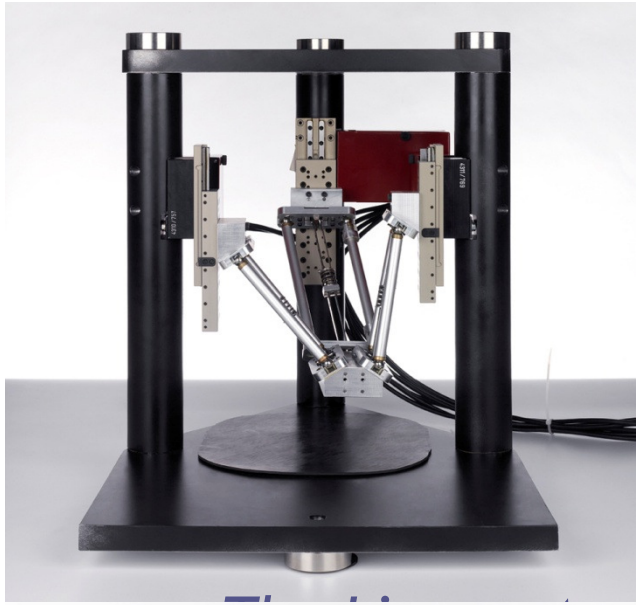
The Delta kinematics continue to be generate industrial partnerships.

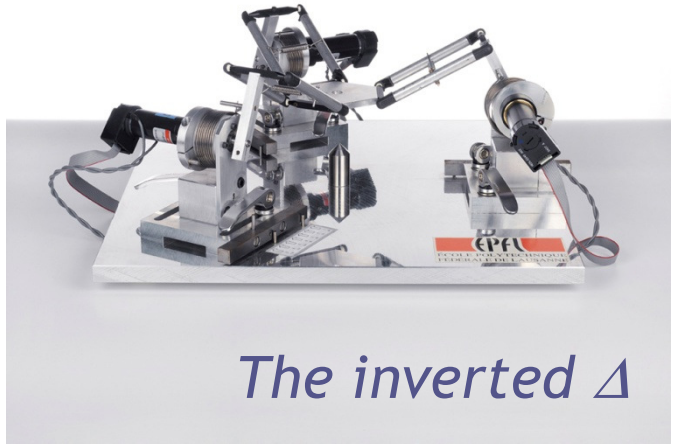
Reasons:

- **The industrials are less afraid with respect parallel kinematics.**
- **Our laboratory (LSRO) has proven its know how of parallel kinematics (innovation, design, control).**

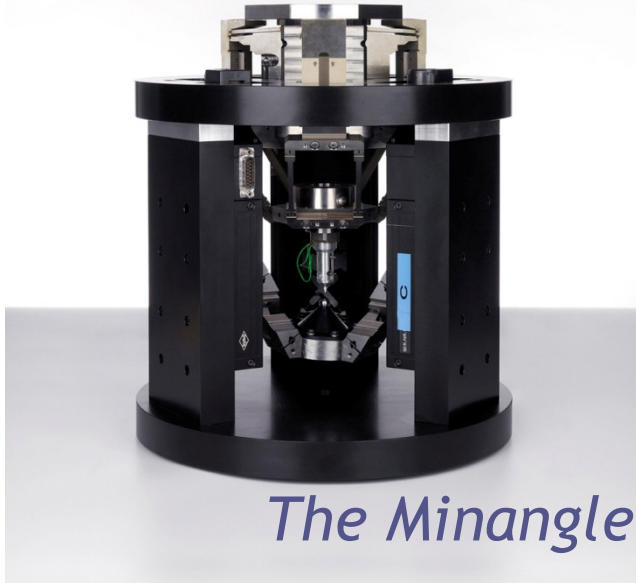
Some examples

The Δ Thales



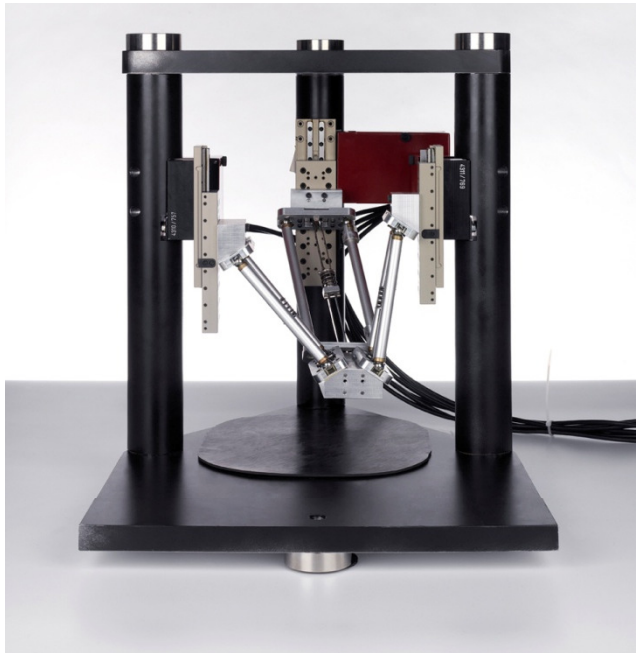


The inverted Δ

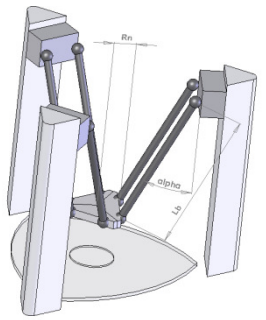


The Minangle

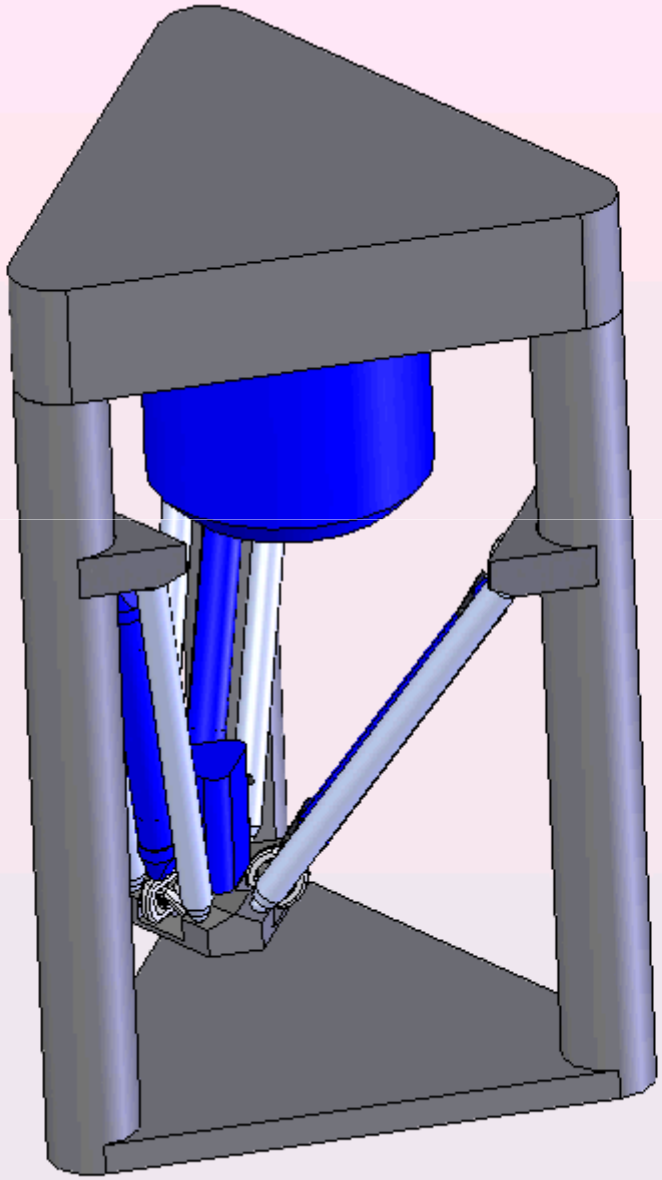
The Linear Delta



- Started with an internal Development as a diploma project.
- Continued with a project with an industrial partner.
- This project has finished in December 2007.
- Application is unfortunately confidential up to the end of industrialization



The Linear Delta

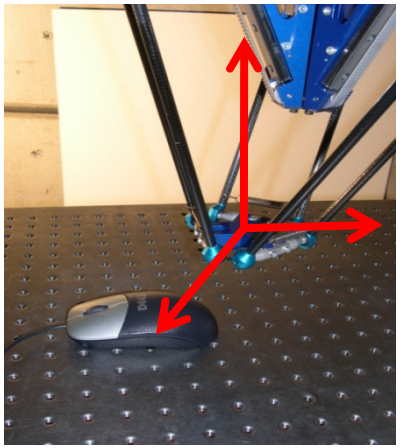


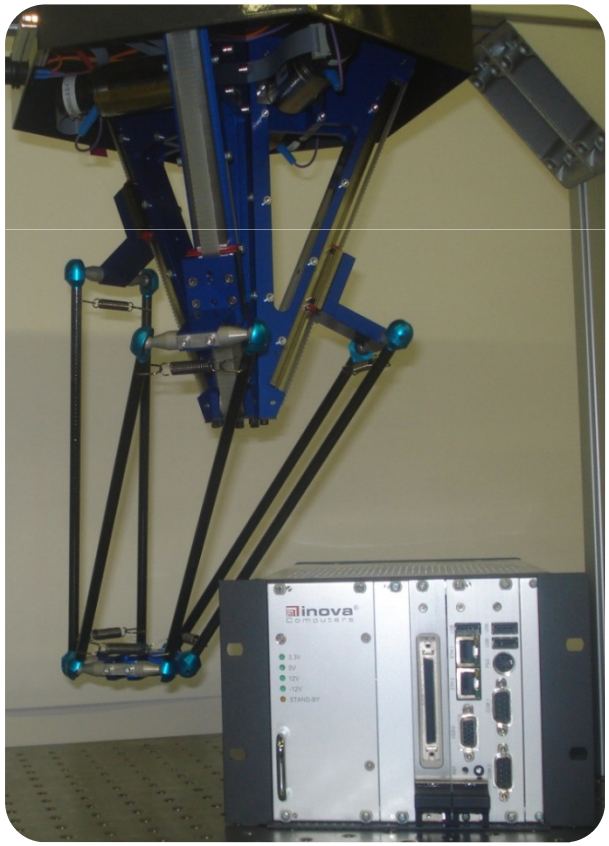
What is the Keops?

(New since November 2007)

The Keops is a 3 axes XYZ robot dedicated to:

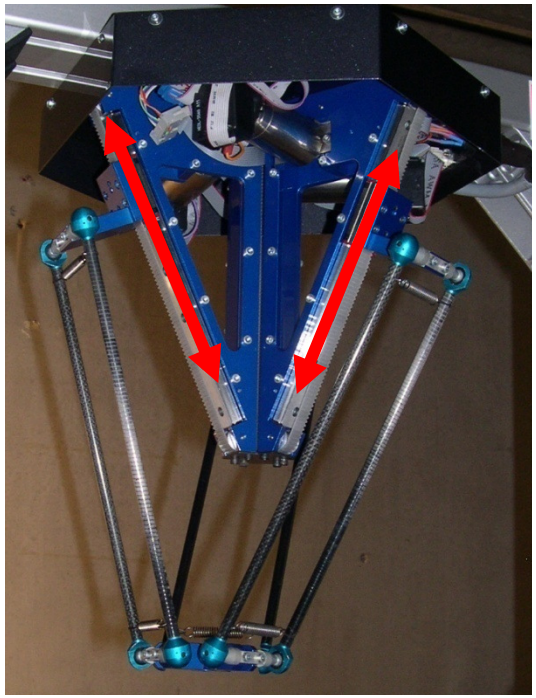
- pick & place operations
- positioning systems
- …
- assembly operations





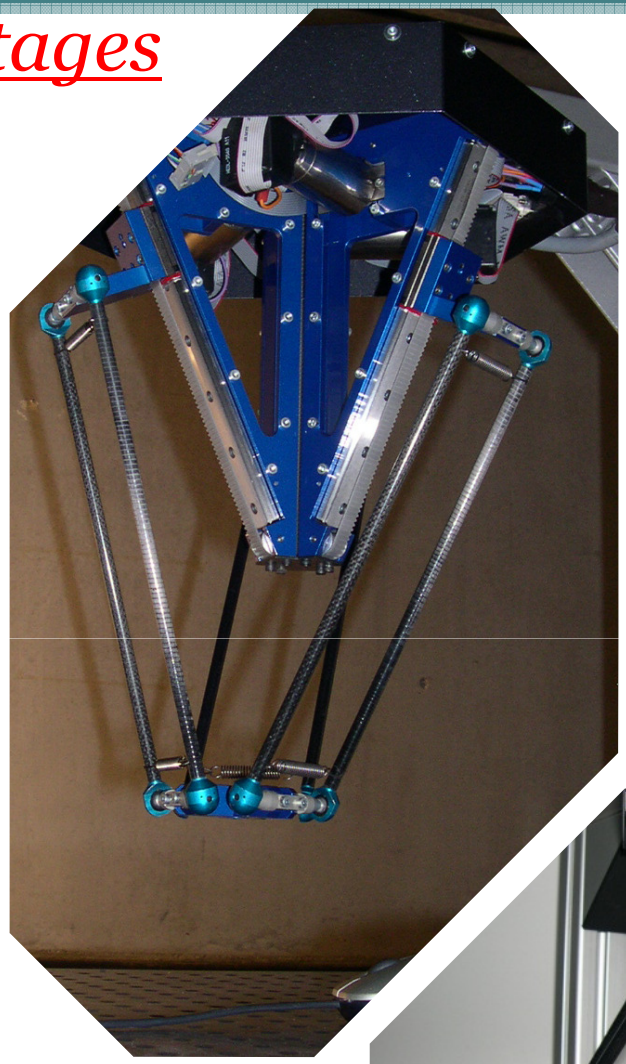
The Keops is **a robot designed as a "Component"**

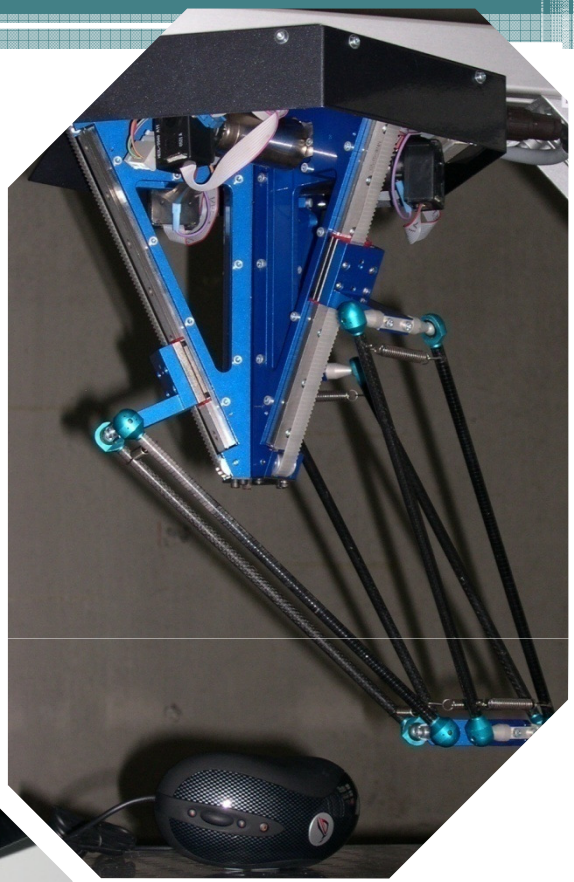
- Without a chassis
  can be integrated in any machine



Advantages

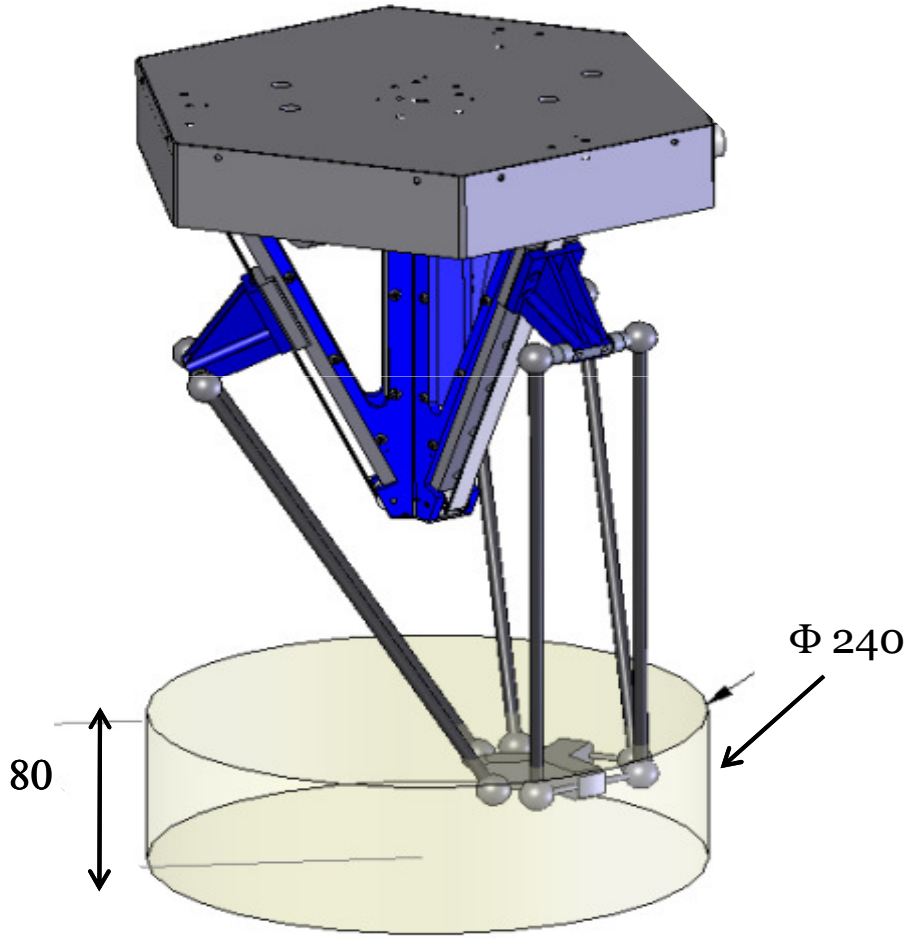
Workspace .vs. robot size





Advantages

Workspace

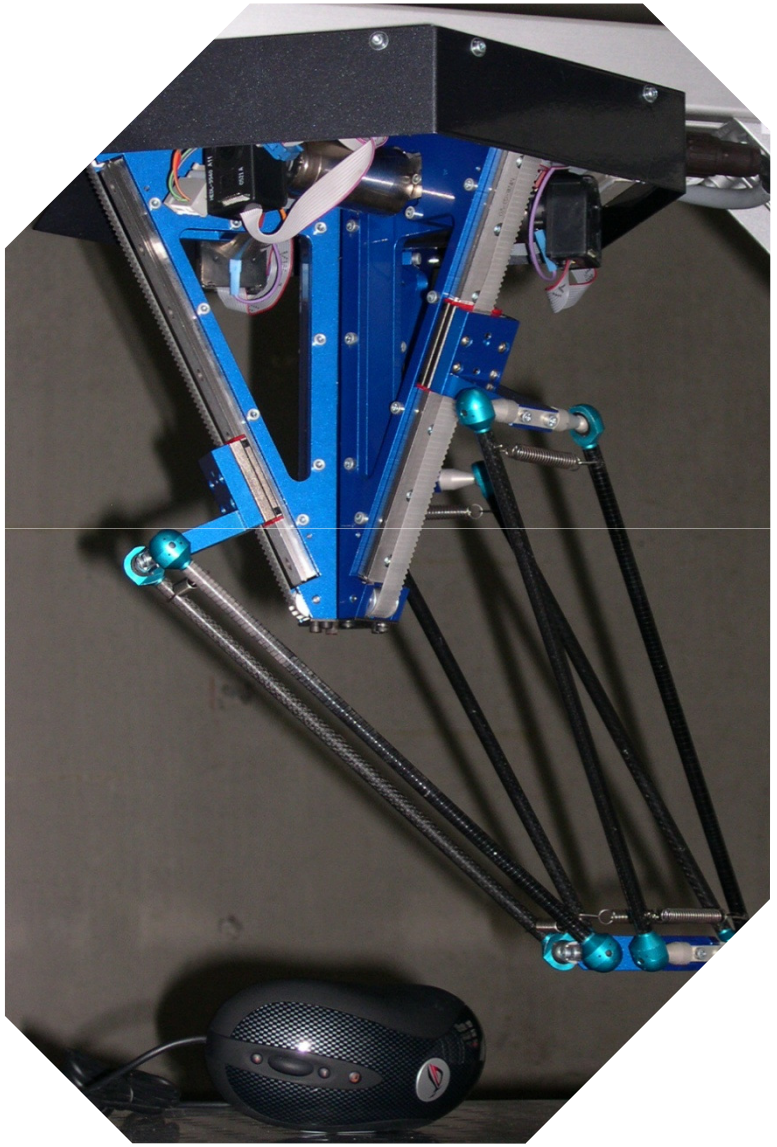


Advantages

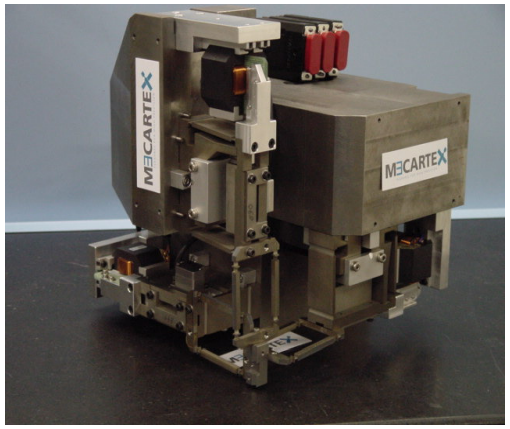
Stiffness

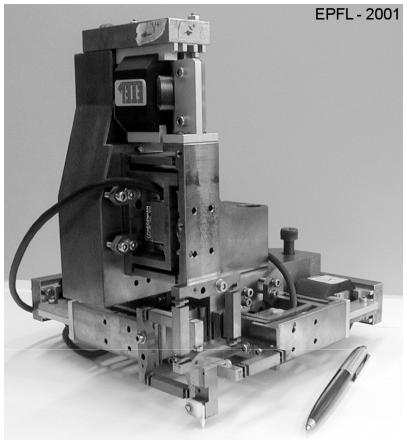
Advantages

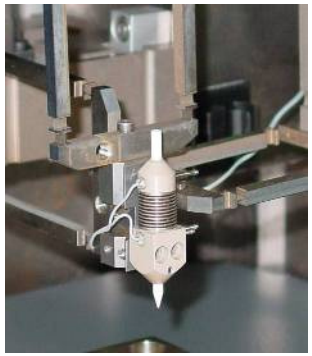
Precision via linear sensors

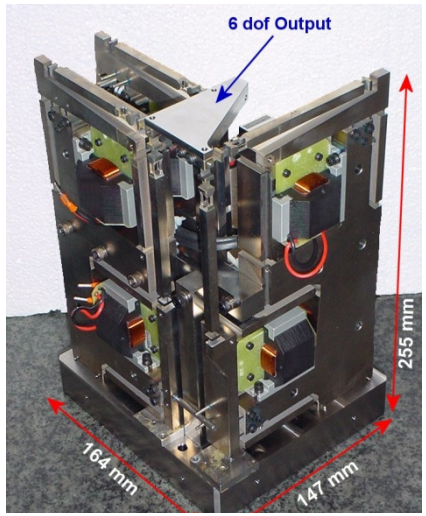


Parallel structures using flexible joints Industrialized by Mecartex SA since 2001



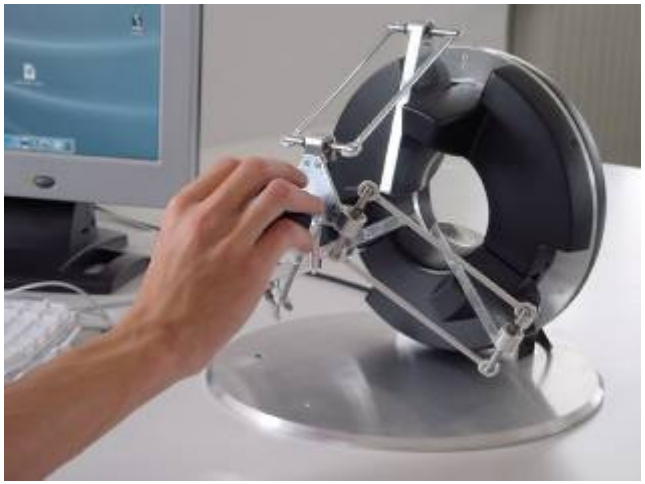


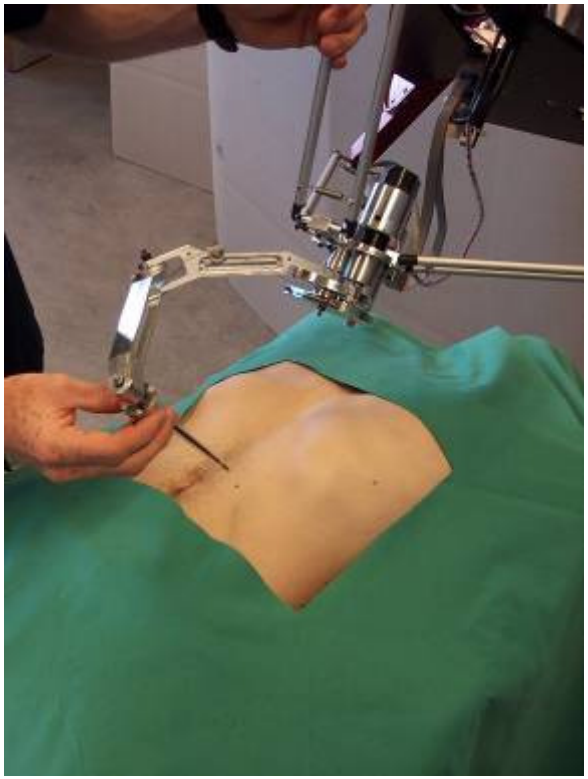




ÉCOLE POLYTECHNIQUE FÉDÉRALE DE LAUSANNE

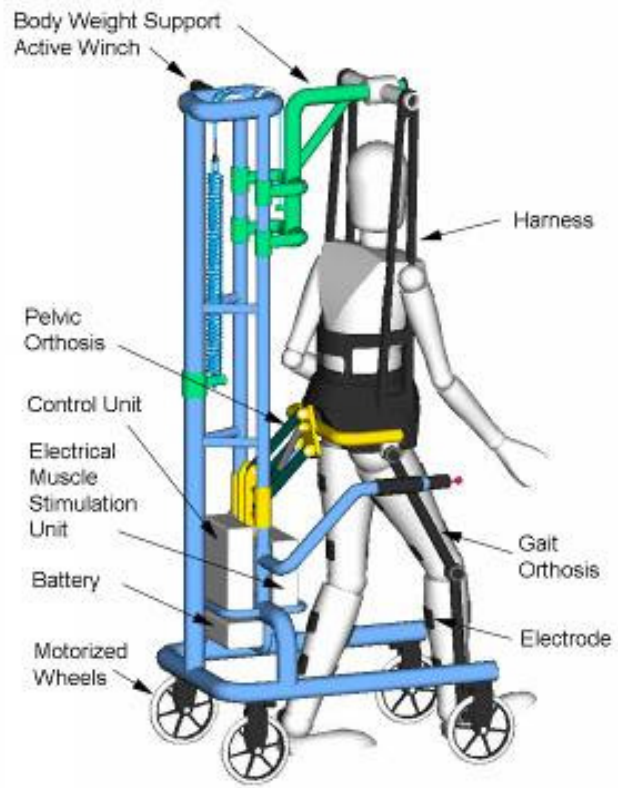
Parallel kinematics for medical devices



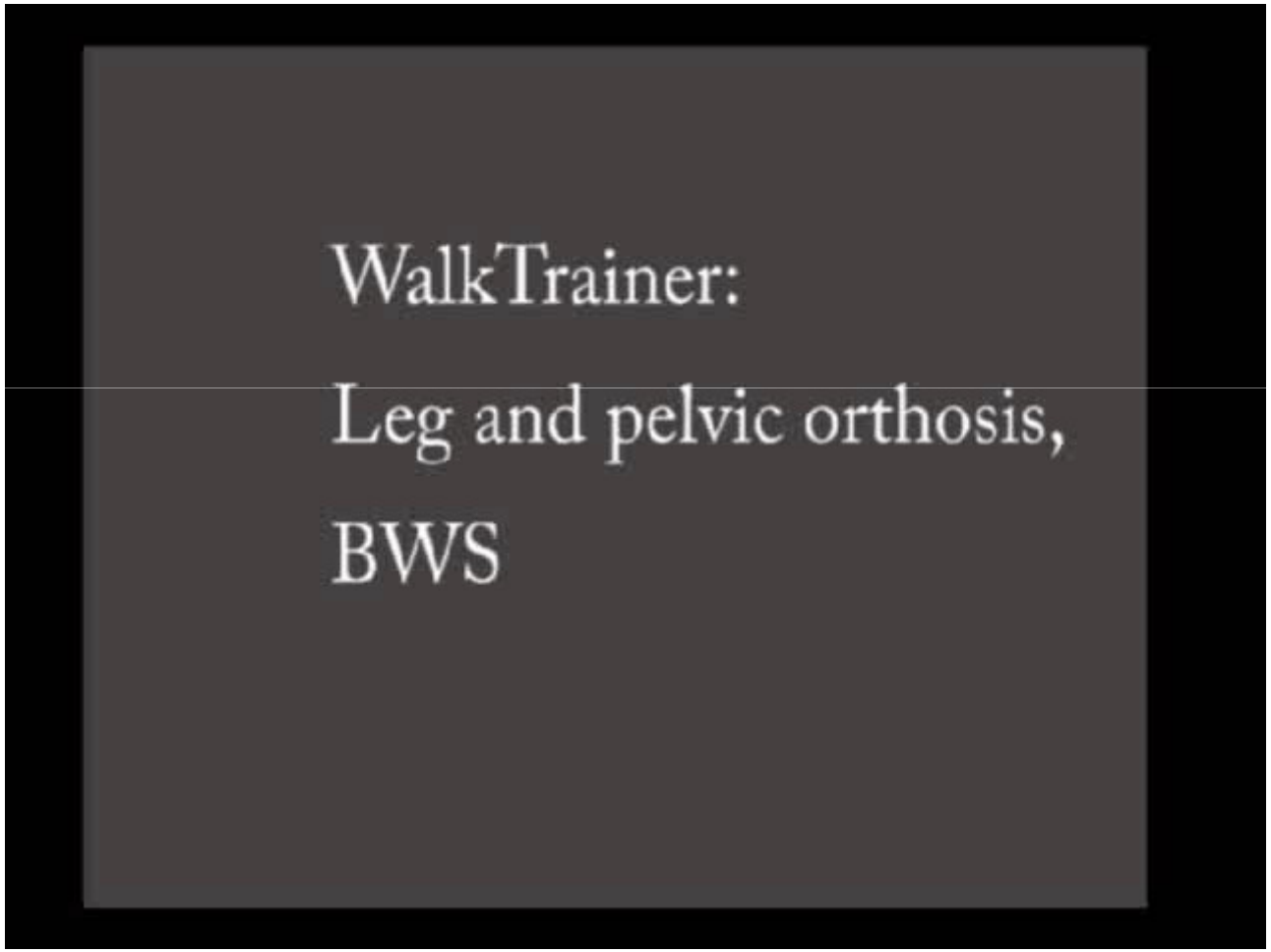


Haptic device (force feedback)
by ForceDimension SA for biopsy

Parallel kinematics for medical devices : The WalkTrainer™ developed with Swiss foundation of paraplegics (www.fsc-sfc.org)



Parallel kinematics for medical devices :
The Movie



Parallel kinematics for industry: The Challenges

- Parallel kinematics has proved their efficiency for **fast applications** with **stiff capabilities.**
- The know how for **calibration** make industry less afraid to go ahead or parallel kinematics design.
- Acquire more expertise on **calibration** and tool **measurement**.
- More ideas are investigated to improve the **workspace** .
- A **lot of projects with industry** are now in development in the LSRO and we are quit satisfied with the results.

Thanks

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