



KATHOLIEKE UNIVERSITEIT  
**LEUVEN**

**EMO – Belgian Beer and Cheese Evening**  
**Hannover, 20 September 2011**



## **Research on Intelligent Machine Tools & Manufacturing Processes in Belgium**

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# For those who do not know me... ?

- Full Professor, K.U.Leuven
- Research & Education in Manufacturing Processes and Digital Manufacturing
- Research topics (of my group)
  - Multi-axis Machining, Electrical Discharge Machining, Hybrid Processes,...
  - Machining of advanced materials (ceramics,..) & complex shaped
  - Advanced tool path planning and generation (CAD/CAM, CAPP)
  - ....



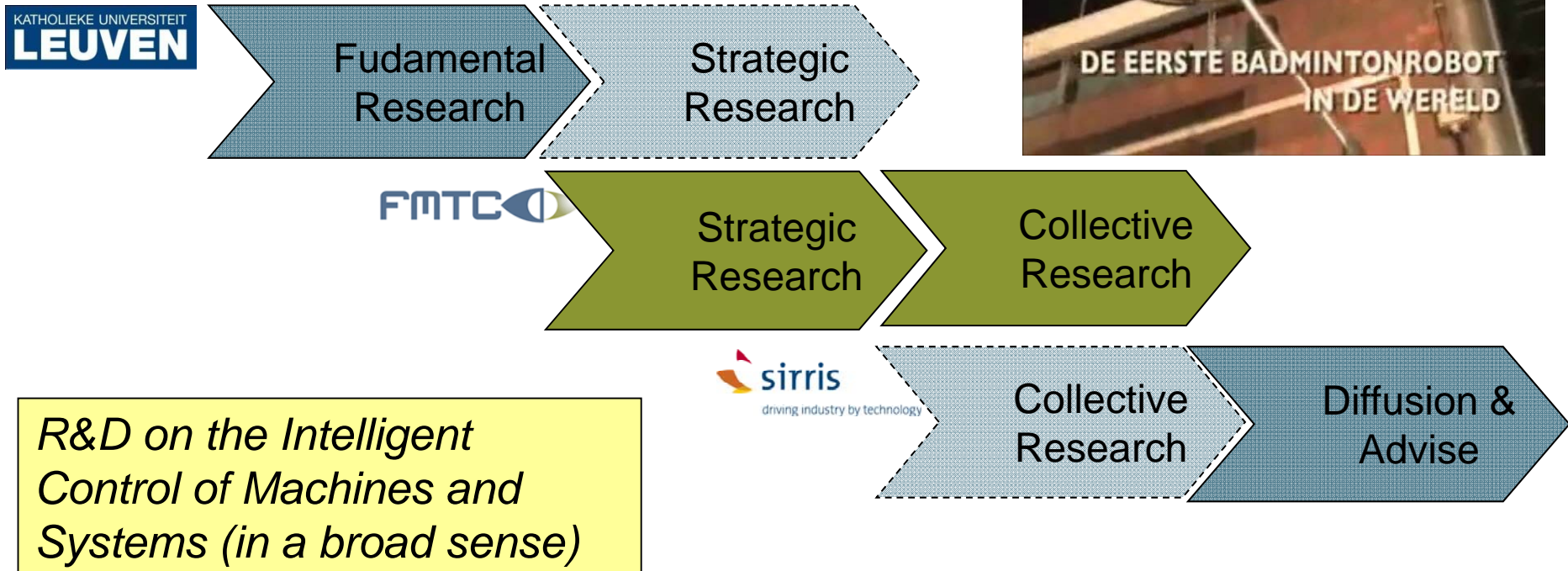
# Is Belgium active in the domain...?

- Large activities in countries like Germany, Italy, Switzerland, Spain,...
  - There are quite some machine tool manufactures
- What about Belgium
  - Are there activities ?
- Yes, there are quite some R&D activities related to Intelligent Machine Tools (elements) and Advanced Manufacturing Processes



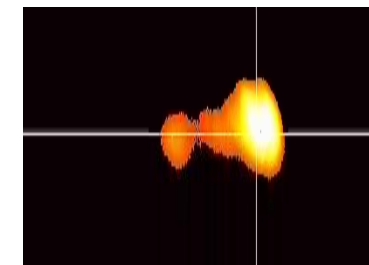
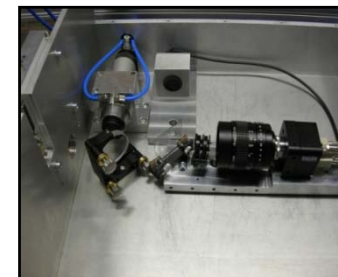
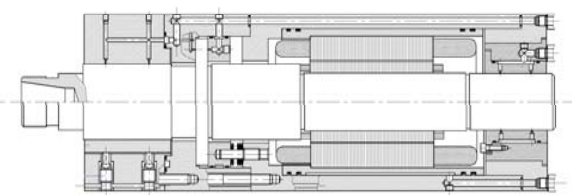
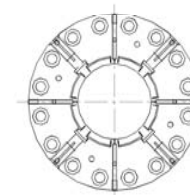
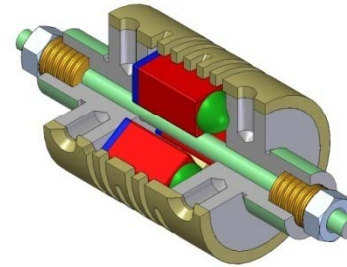
# Mechatronics and Machine Tools

- **Mechatronics** is the basis for the development of intelligent machine tools !
- Important players in Belgium !



# Mechatronics & Intelligent Machine Tools

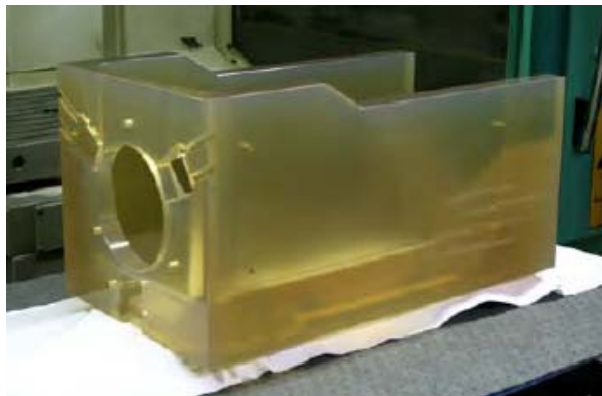
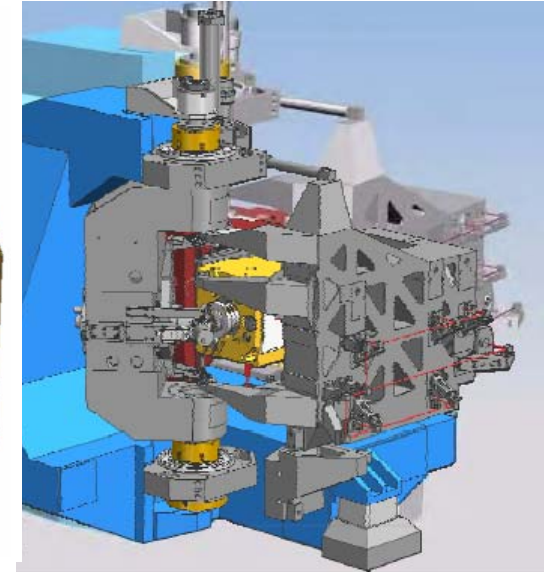
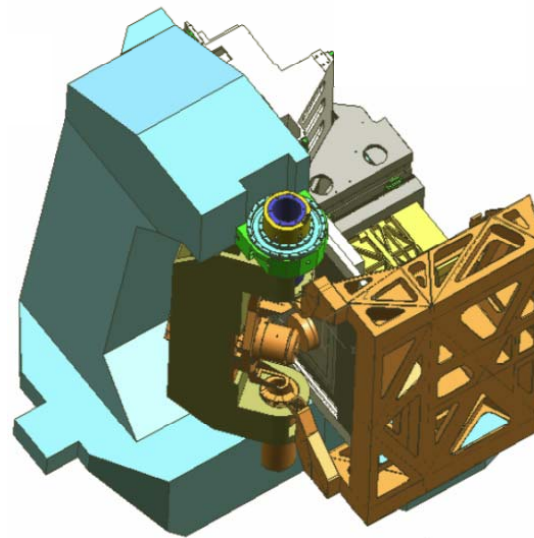
- Development of active (structural) elements
  - Piezo-driven structural elements
    - Adaption of machine tool structures !
- High speed control of drives and actuators
- High speed spindles (air bearings)
- Monitoring (sensing) and adaptive control
  - Monitoring (and control of manufacturing processes)
    - E.g. Laser cutting, Selective Laser Sintering, EDM,...
- ...and others...





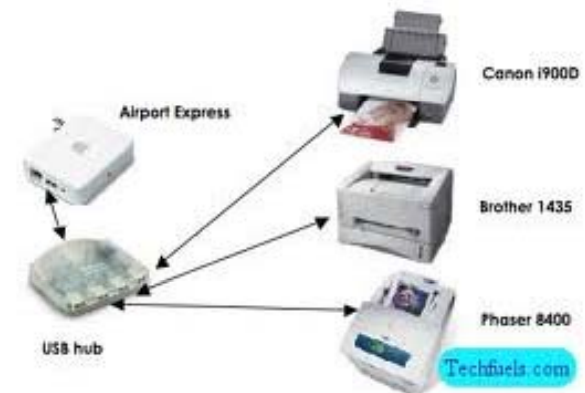
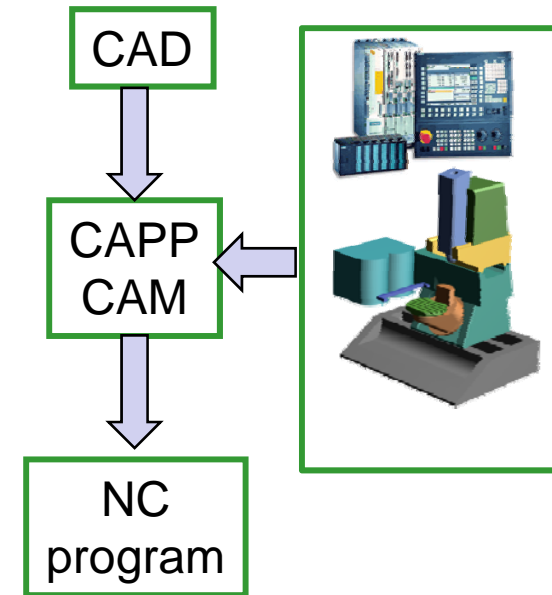
# Example: High Precision Machine Tool

- Precision Grinding
  - Materials
  - Measuring Frames
  - Machining accuracy within 300nm



# The Autonomous Machine Tool

- The Intelligent (autonomous) Machine Tool within the **Digital and Smart Factory**
  - Robots in manufacturing
  - High Level programming
- Machine tools / production systems are intelligent, stand-alone and act like “printers”
  - Machine tool behaviour is known to the system (even outside the company) after plug-in
    - “Add Machine Tool”



# R&D on Manufacturing Processes

- K.U.Leuven & Sirris are important players



- We follow the international vision
  - (1) Sustainable Manufacturing
  - (2) ICT-enables intelligent Manufacturing
  - (3) High-productivity Manufacturing
  - (4) Materials in Manufacturing

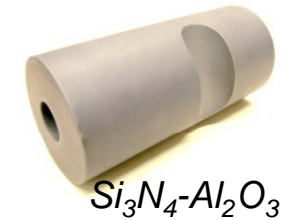


# R&D on Manufacturing Processes

- Development and Machining of new materials in Manufacturing

- Ceramics and composites

- Various Ceramic Materials (WC-ZrO<sub>2</sub>, Borides,..)
- Plastics
- Ti-alloys



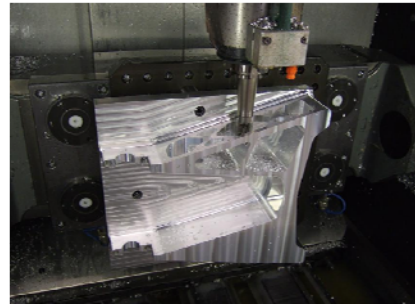
- Advanced Process Technologies

- Additive Manufacturing (SLM, 3D-printing,..)
- Vibration Assisted Machining
- Electrical Machining (EDM, ECM,..)
- Diep drawing and pressing
- ....

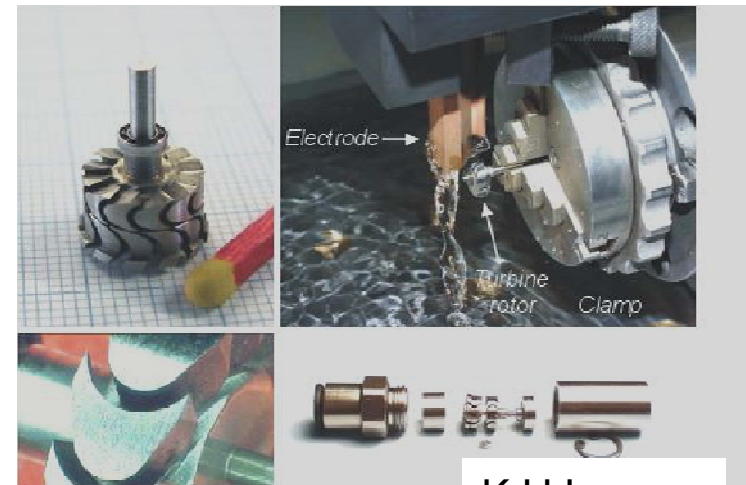


# R&D on Manufacturing Processes

- High precision and complex shaped manufacturing
  - Multi-tasking & Multi-axis machine tools



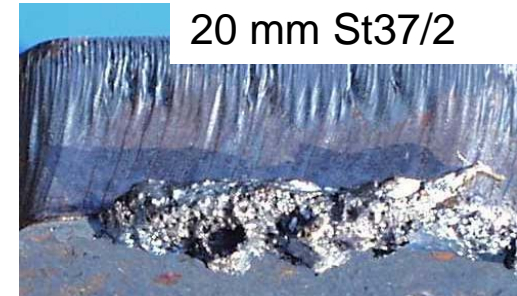
- Micro Manufacturing
  - Micro EDM, micro Milling, Micro RPT,...



# R&D on Manufacturing Processes

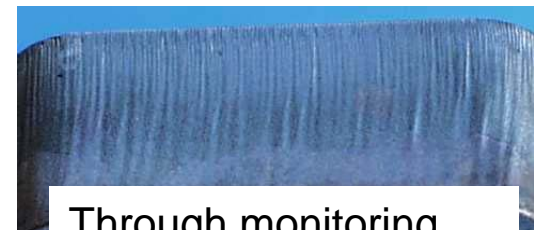
- **Sheet Metal Manufacturing**

- Laser cutting

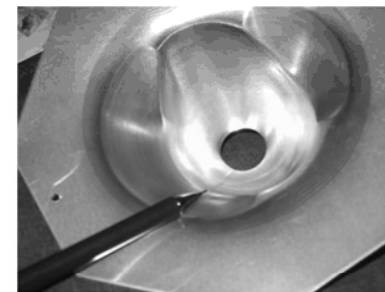


20 mm St37/2

- Incremental Forming



Through monitoring and feedback





# R&D on Manufacturing Processes

- Research (K.U.Leuven) & Advise/Support (Sirris) in the area of **Dimensional Metrology**

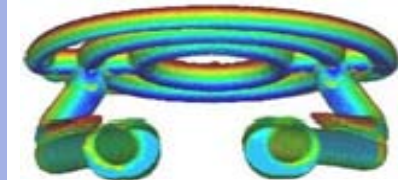
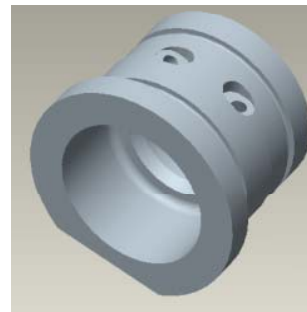
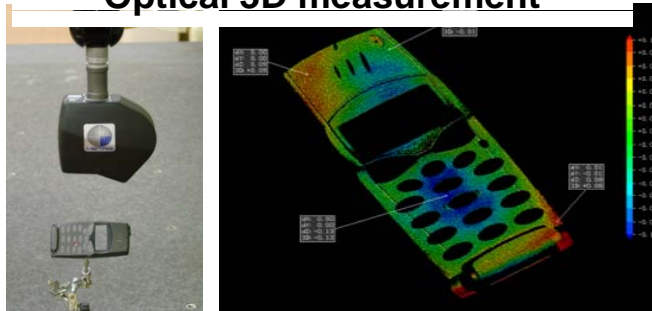


**Metrology  
lab with  
3D CMMs,  
etc.**

**X-ray CT tomograph for  
dimensional measurement  
(450kV)**



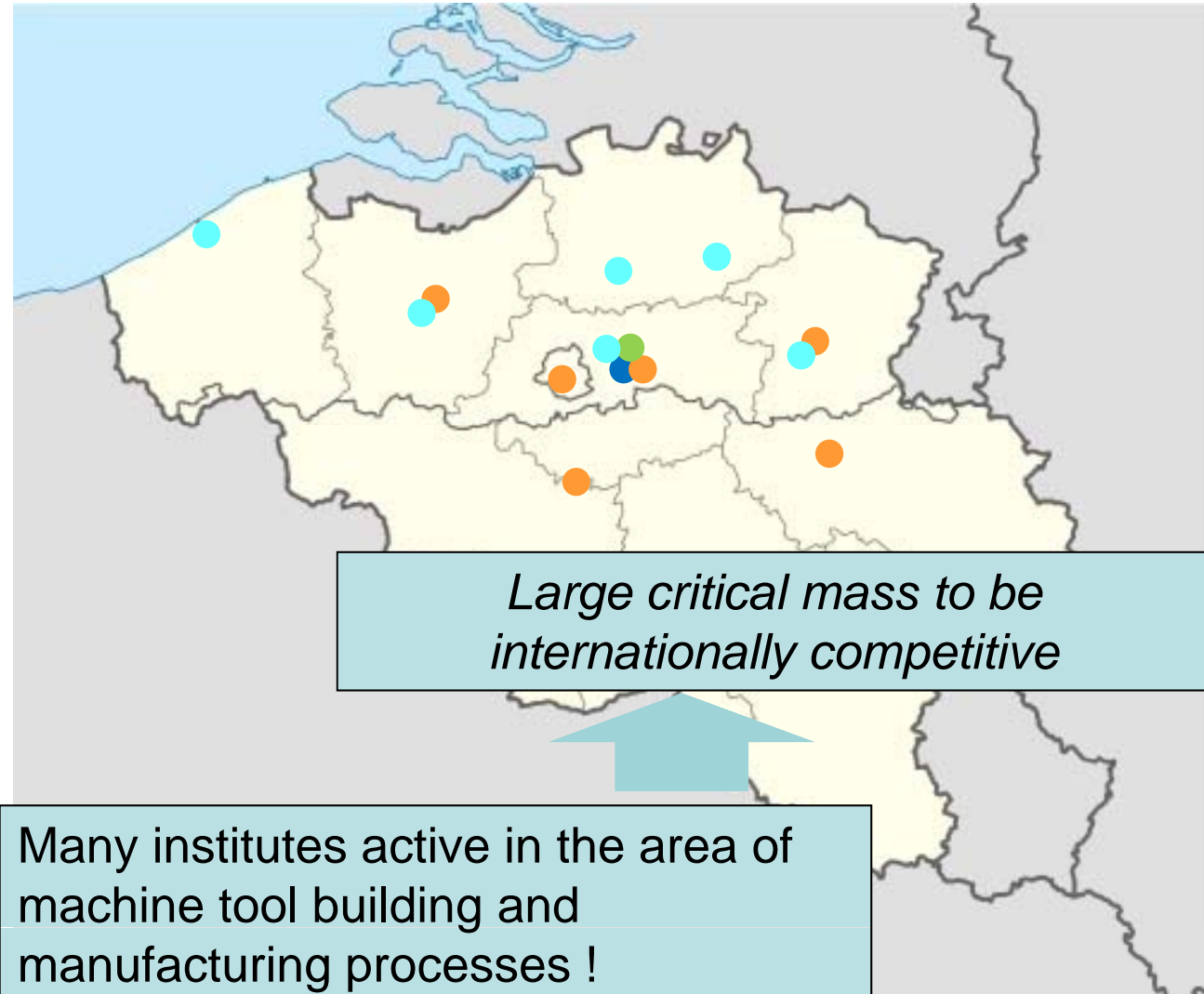
**Optical 3D measurement**



# There is much more in Belgium



*K.U. Leuven  
University  
+ 4 clusters of  
university colleges*



*Large critical mass to be  
internationally competitive*

Many institutes active in the area of  
machine tool building and  
manufacturing processes !



# There is expertise, even in..

- Belgium is (was) known for a large number of small **family breweries** !



- Small breweries group together to be **internationally known** and competitive !!

# Even R&D in beer making

ASSOCIATIE  
K.U.LEUVEN

KATHOLIEKE UNIVERSITEIT  
LEUVEN

- K.U.Leuven Association introduces a new beer
  - Result of a co-operation between several research labs (K.U.Leuven Association) and small companies !!!



## Succesvolle samenwerking

Het samenvloeien van de universitaire kennis en de knowhow van de hogesch...  
K.U.Leuven als een open en dynamisch netwerk van hogeronderwijsinstelling

'Definitely the best beer in the World' (

Surplus is het resultaat van een interessante samenwerking tussen de KAHO  
domeinen:

[www.surplus-bier.be](http://www.surplus-bier.be)

# As a conclusion....

- Belgium is perhaps small, but active in the area of intelligent machine tool building (in a broad sense) and manufacturing technologies
- Large number of institutes where grouping/clustering is going on to have the critical mass to be competitive within an international context

*Thank you  
and  
enjoy your evening*

