EUREKA-FACTORY UMBRELLA 2006

Mechatronic systems in sheet metal forming processes

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Partnerhip

ASCAMM TECHNOLOGY CENTRE

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DISTRIM2

EADS

FATRONIK

NMP2-CT-2005-014026

Fraunhofer ISC Institut Silicatforschung

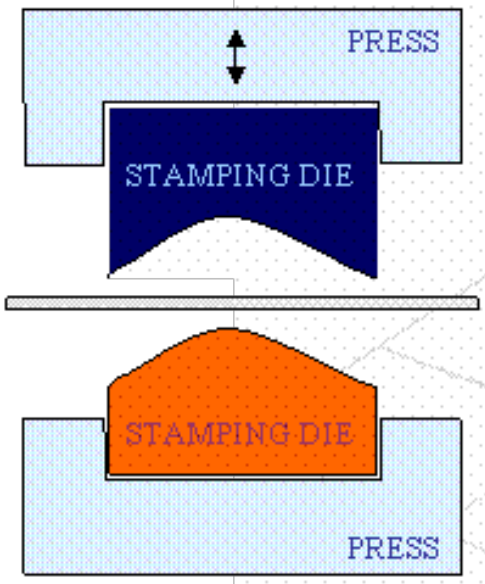
ensmm

IBF

MTA SZTAKI

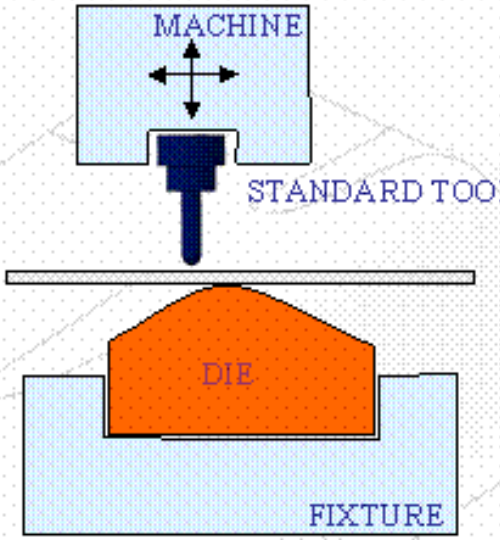
A research project supported by the European Commission under the Sixth Framework Programme

Milestones in sheet metal forming



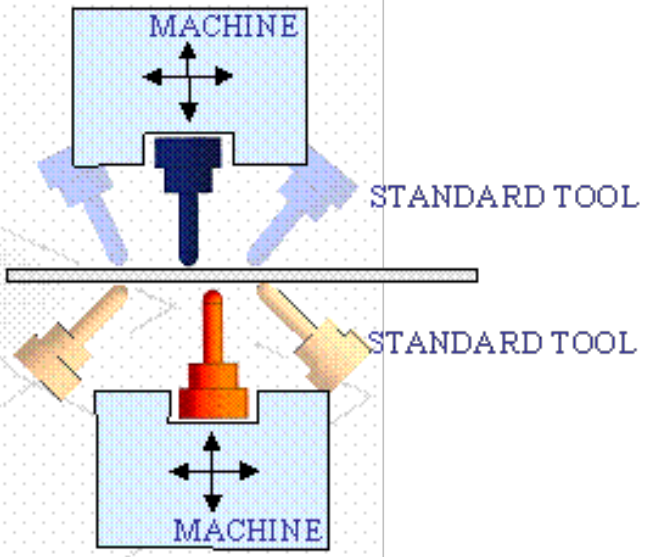
STAMPING

- INFLEXIBLE
- GLOBAL PLASTIC DEFORMATION
- LARGE SERIES PRODUCTION



INCREMENTAL SHEET FORMING

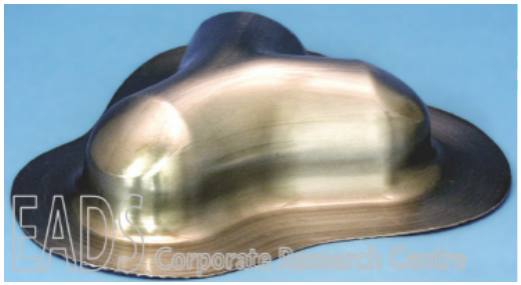
- SEMIFLEXIBLE
- GRADUALLY PLASTIC DEFORMATION OF FINITE AREAS
- LOW SERIES PRODUCTION



SCULPTOR

- FLEXIBLE
- GRADUALLY PLASTIC DEFORMATION OF FINITE AREAS
- LOW AND MEDIUM SERIES PRODUCTION
- TOOL ORIENTATION

ISF in the industry



Air duct component
(y-hose pipe) DC04 steel

Other products

Design Panel, A1050 1 mm

Soaker Tub, A1050 4 mm

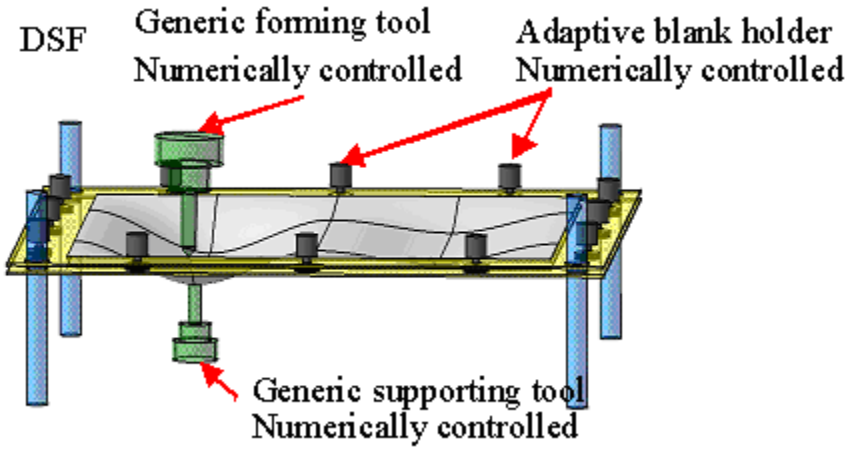
Tapered Cups, A1050 1 mm

Boat, A5052 2 mm

Applications

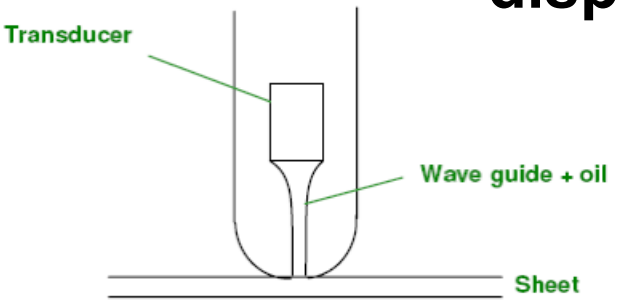
- Reduction in tool storage space and cost
- One machine to form a **multitude** of service parts
- Reduction in **development time** and tryout cost
- Download from **CAD/CAM** data to machine controller
- Production rate suitable from **1 to 500 pcs./month**

The new process with integrated sensors and actuators



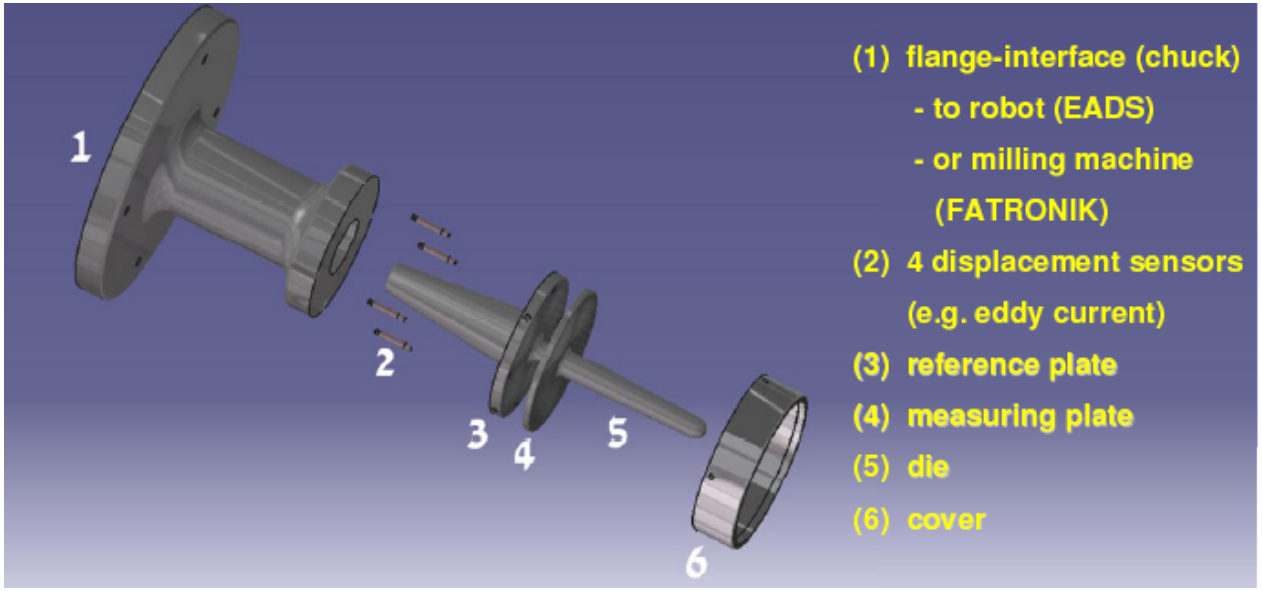
DiaForce® Sensor

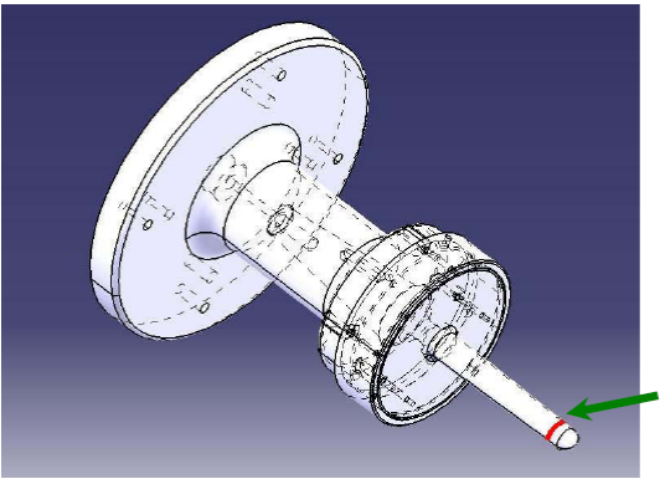
Eddy-current displacement sensors

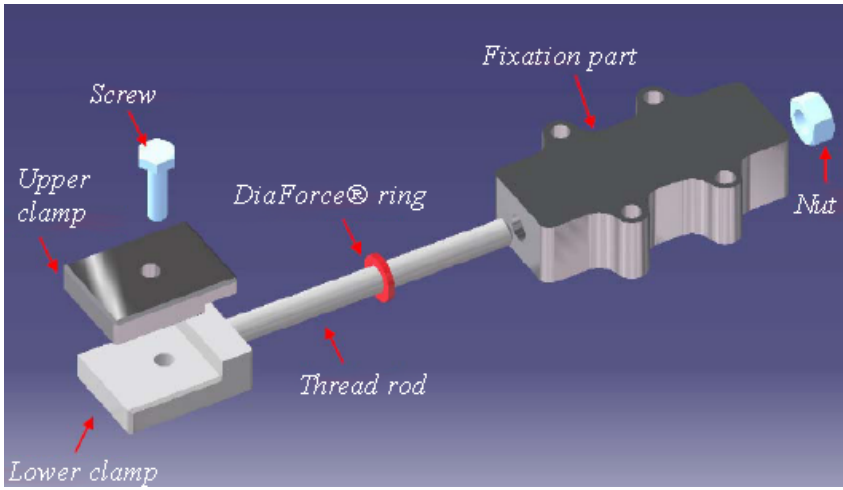


Ultrasonic sensor integrated in the tool

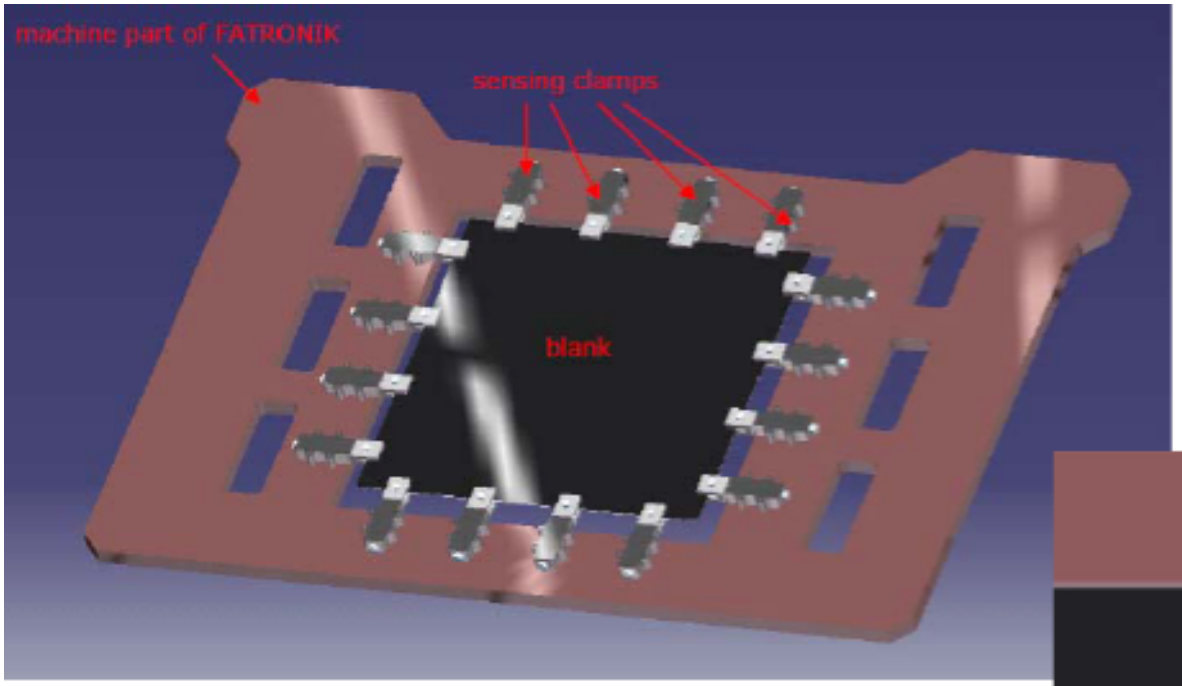
Place of the sensors



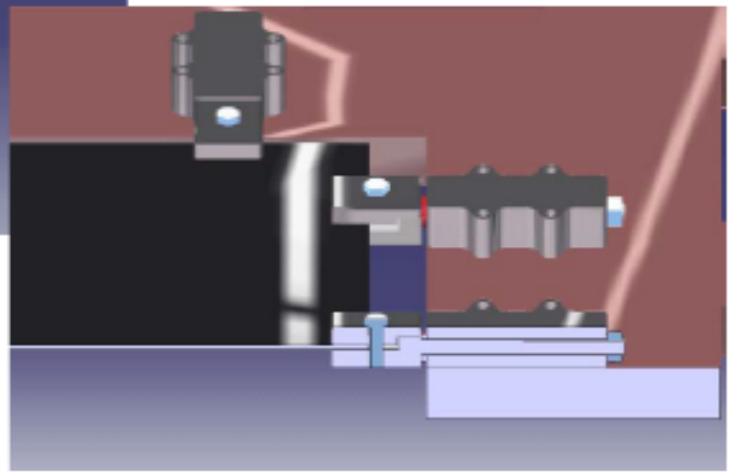




Smart blankholder



- ✓ Punctual clamping along the blank
- ✓ **DiaForce® sensors** with an upper and a lower electrode in each clamping

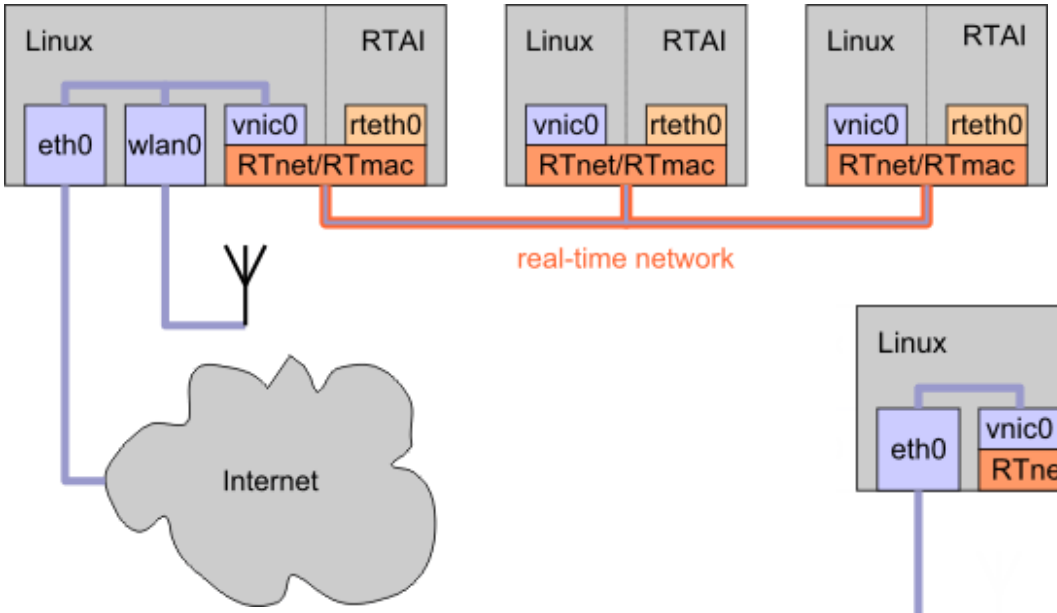


Hardware parts for the test environment

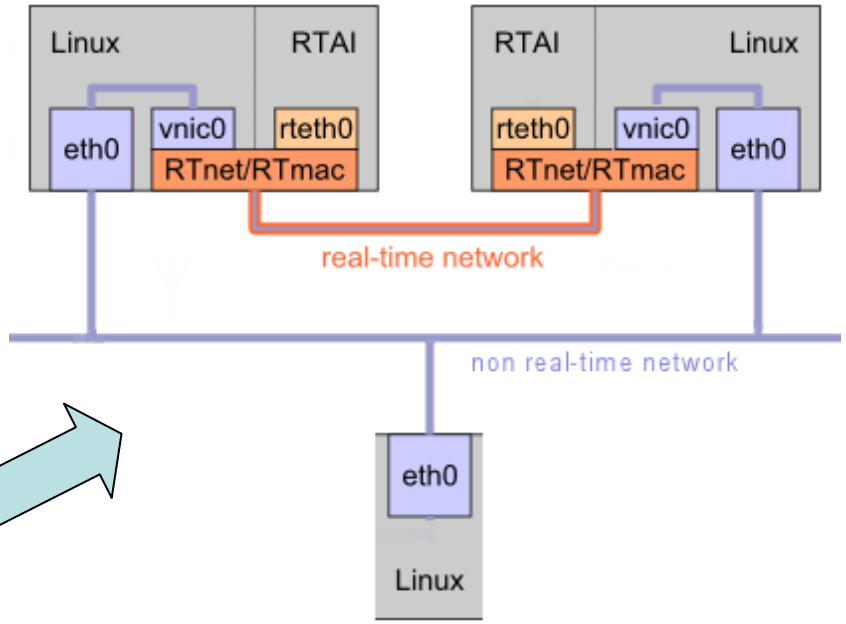
- PC with onboard Gigabit Ethernet card for TCP/IP remote connection using NML channels with simple UTP cable
- realtek8139 network card for real-time connection using RTnet with crosslink cabel
- MOTENC-Lite control card with Breakout boards

OS, interfaces and the network

Linux with Real-Time Application Interface and Real-time Ethernet

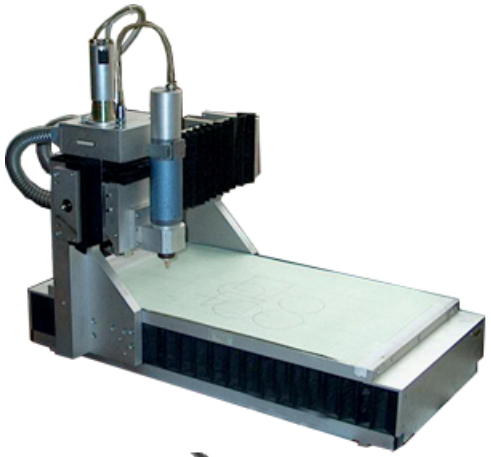


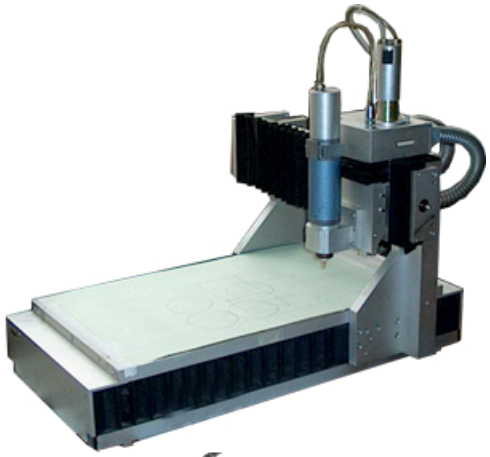
Typical RTnet connection



SCULPTOR test RTnet connection with Dual GUI

RT Control System





Power PC1
with control
cards

UTP Cross Link

Cable

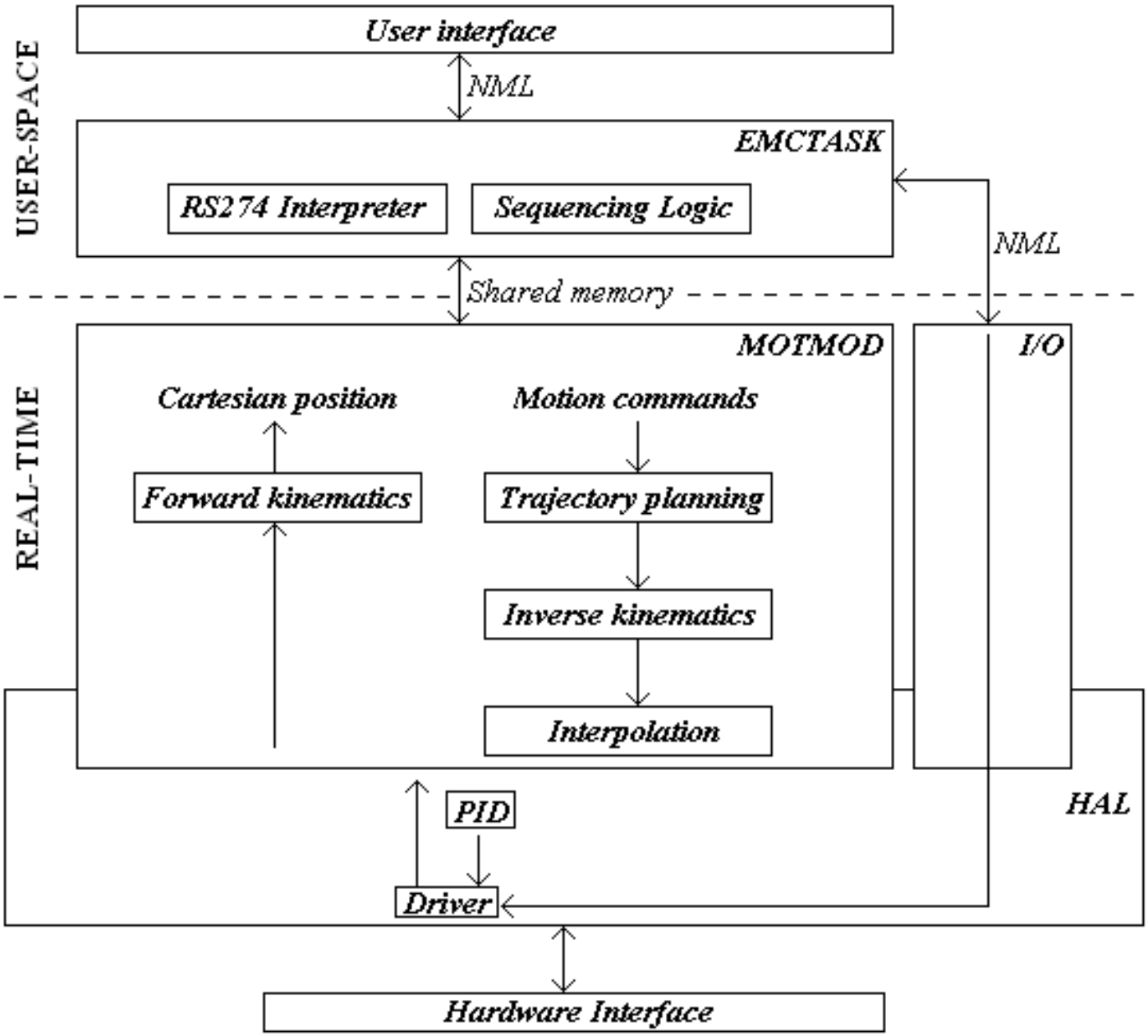
Power PC2
with control
cards

TCP/IP

TCP/IP

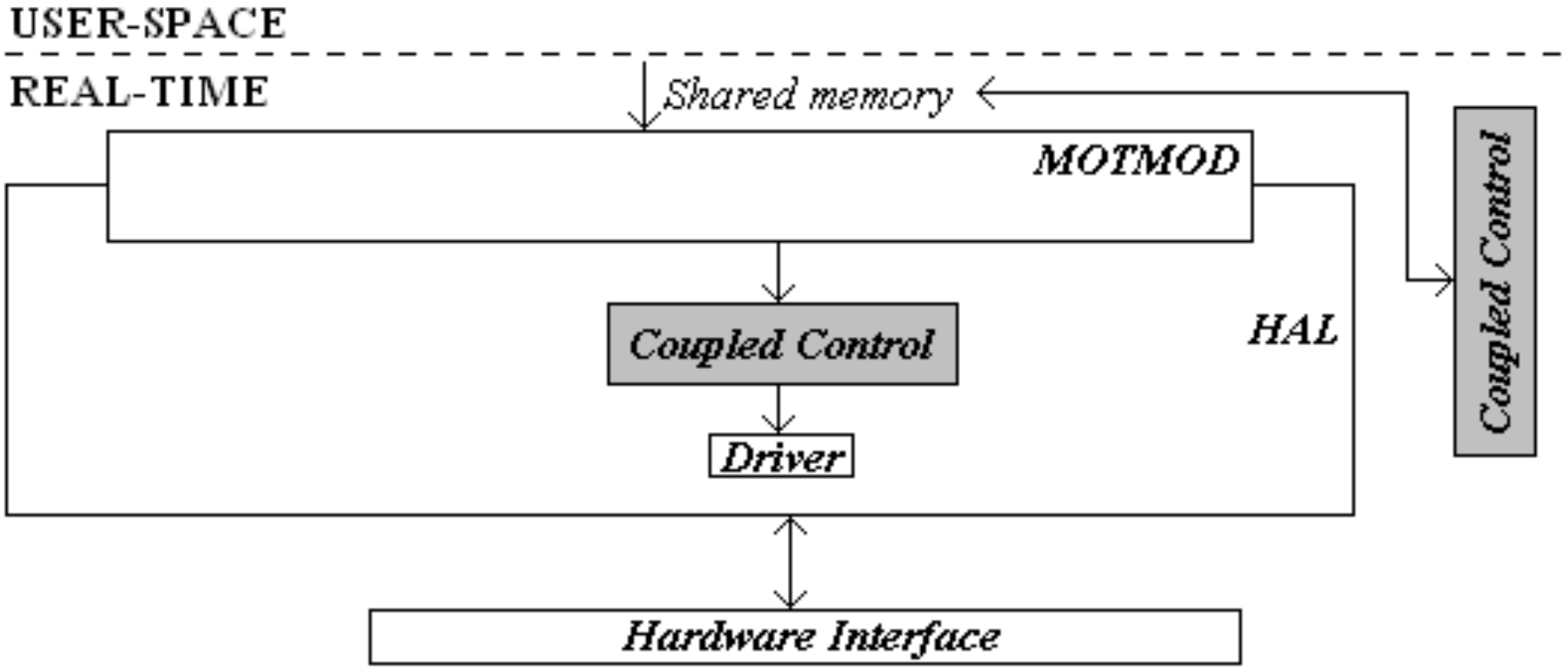
PC for remote control

The modularity of the Enhanced Machine Controller



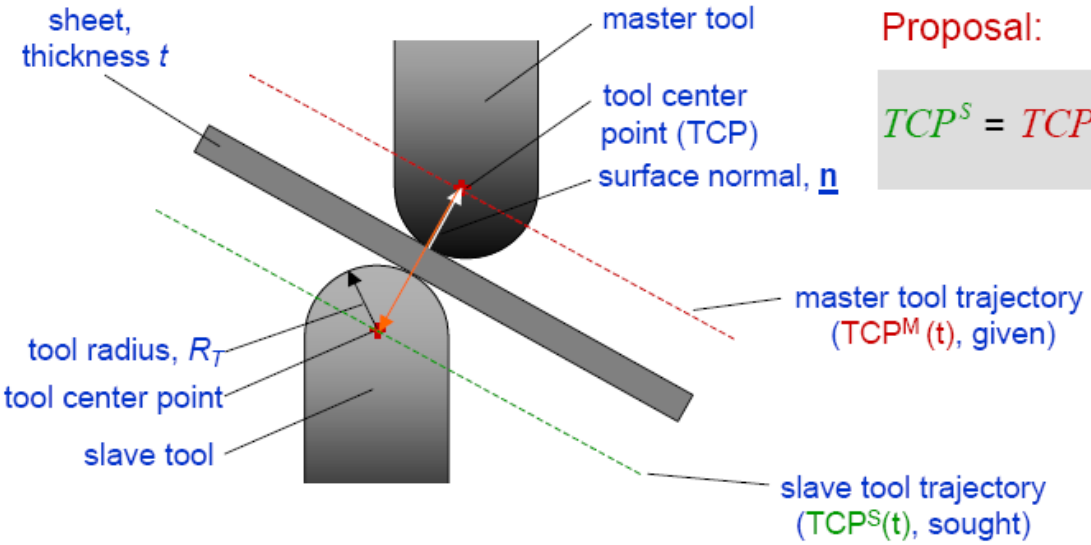
Implementing the Coupled Control Framework

- Timing constraints: real-time interventions
  - Either before EMC motion control
  - Or after EMC motion control



Tool path generation

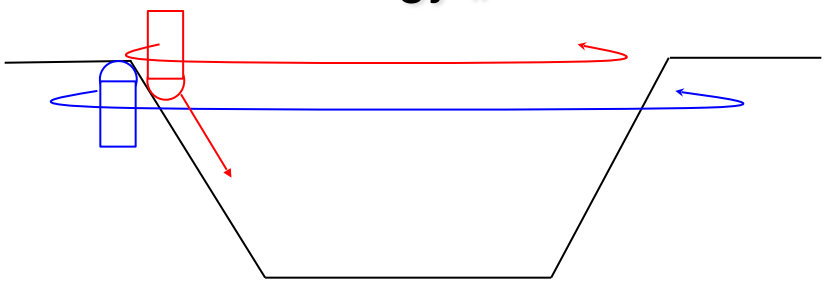
Slave tool path calculation with a C++ program
Path verification with CATIA



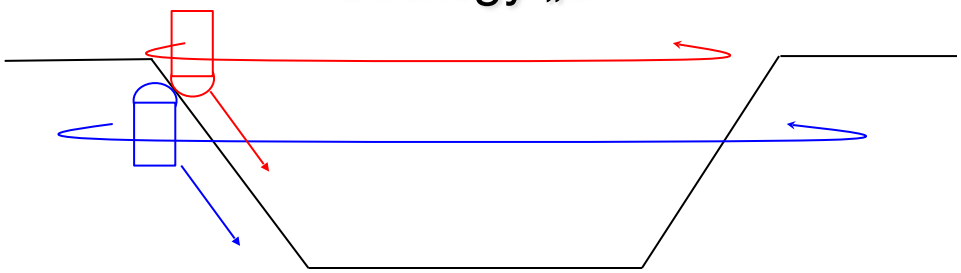
Proposal:

$$TCP^S = TCP^M + (2R_T + t)\frac{\underline{\mathbf{n}}}{\|\underline{\mathbf{n}}\|}$$

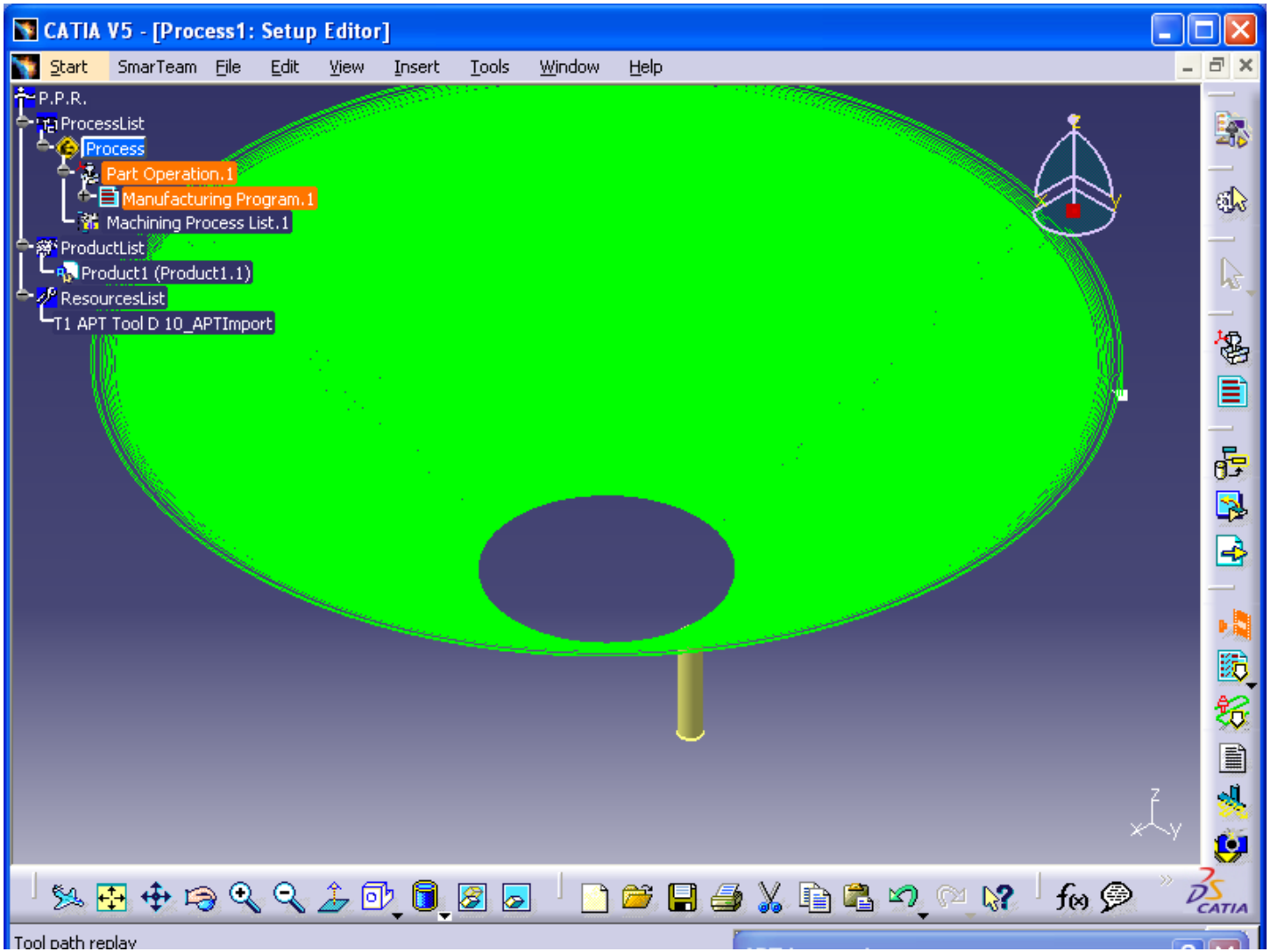
Strategy „A”



Strategy „B”



Catia simulation screen shot and the proptotype



Conclusions

This technology is very good for

- **areas where stamping or ISF is useless**
- **small and unique production series**
- **rapid prototyping**
- **SMEs**

Thank you for your kind attention!