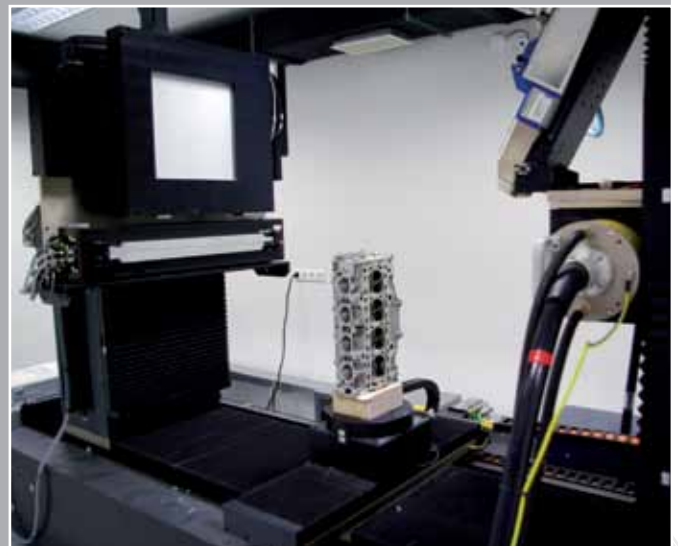


# NEW DIMENSIONS in

Industrial Metrology,  
Metal Working,  
Polymer Processing,  
Computer Simulation



Laboratory Equipment and Competencies



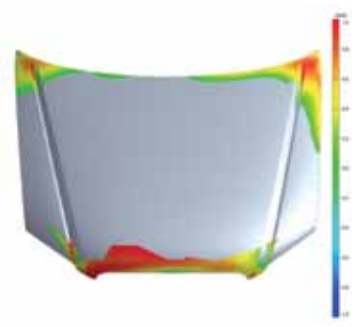
REGIONAL UNIVERSITY  
KNOWLEDGE CENTER  
FOR VEHICLE INDUSTRY



## DIGITAL OPTICAL SYSTEM

GOM ATOS

- 3D shape reconstruction
- CAD model
- Comparison of measured results with CAD model



## 3D MEASUREMENT

MAHR PMC 800 3D

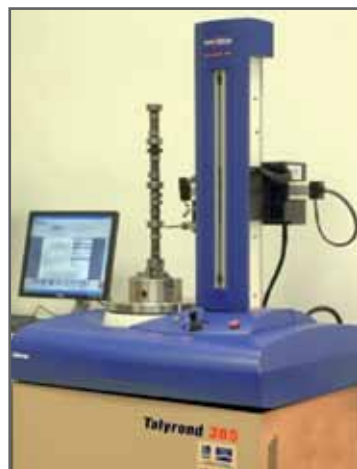
- Mechanical, optical and laser scanning
- CAD model
- Evaluation



## ROUNDNESS GEOMETRY

TAYLOR HOBSON  
TALYROUND 365

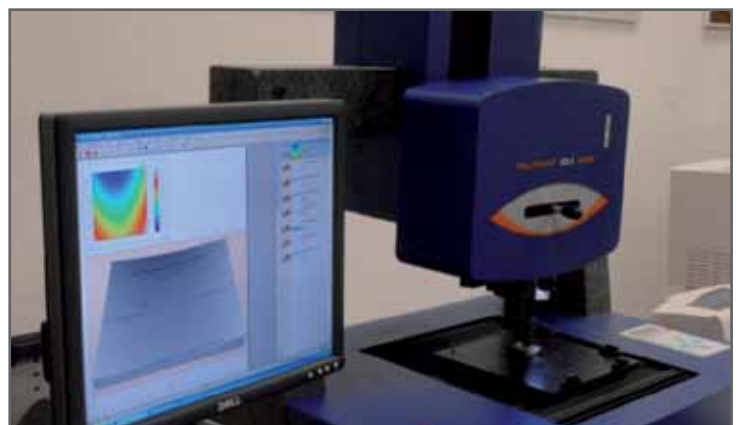
- Automated roundness geometry
- Measurement of concentricity, cylindricity, coaxiality



## SURFACE ROUGHNESS

TAYLOR HOBSON, TALYSURF CLI

- 10 nm resolution; 0,5  $\mu\text{m}$  scanning steps
- Conventional roughness parameters ( $R_a$ ,  $R_z$ , ...)
- Complex characterization of the surface ( $S_a$ ,  $S_z$ , ...)



**TENSILE TEST**

## INSTRON 5582

- 100 kN capacity
- Bluehill 2 software
- Video Extensometer
- Clima Chamber (-100...+350°C)
- Furnace (max. 1000°C)

## INSTRON 3344

- 2 kN capacity

**HARDNESS MEASUREMENT**

## BUEHLER

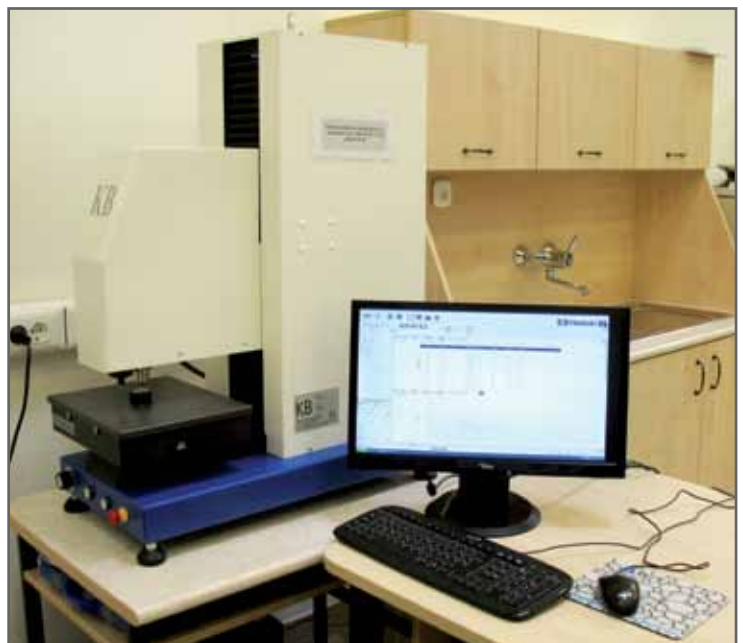
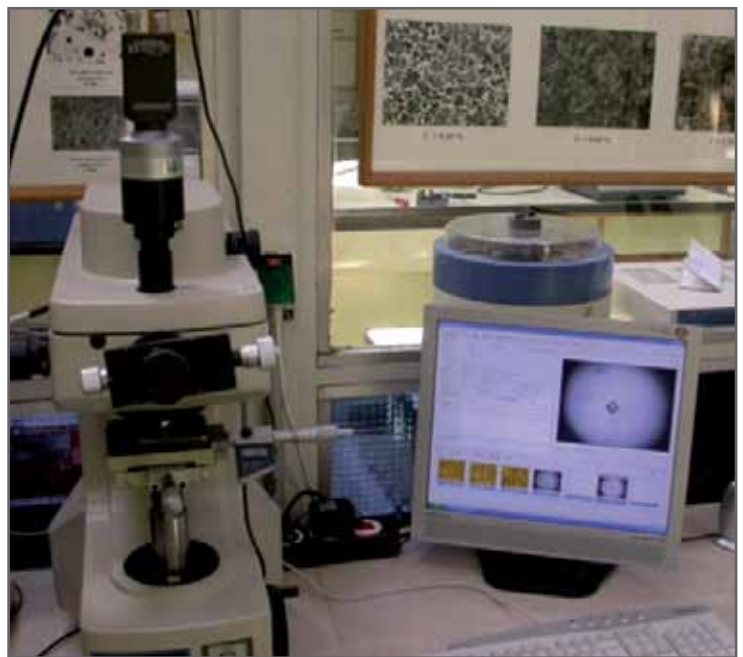
- Microhardness Tester

## KB PRÜFTECHNIK

- Automated microhardness tester
- HB, HV, HRC

## KB PRÜFTECHNIK

- Hardness Tester
- 750 kgf
- automatic evaluation of hardness



## SPECIMEN PREPARATION

BUEHLER Delta Abrasimet

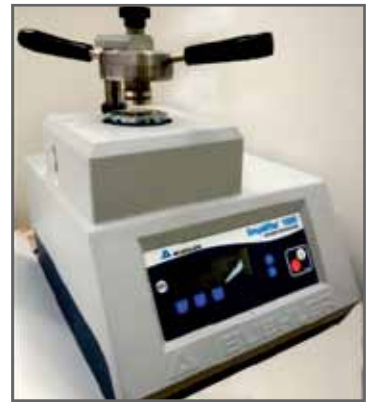
- Cutting, metals

MANUAL ROTARY MICROTOME LEICA

- Cutting, polymers

SIMPLIMET 1000

- Embedding



## GRINDING AND POLISHING

BUEHLER

- Beta Grinder- Polisher with Vector LC Power head

BUEHLER POLIMAT

- Electrolytic Polisher



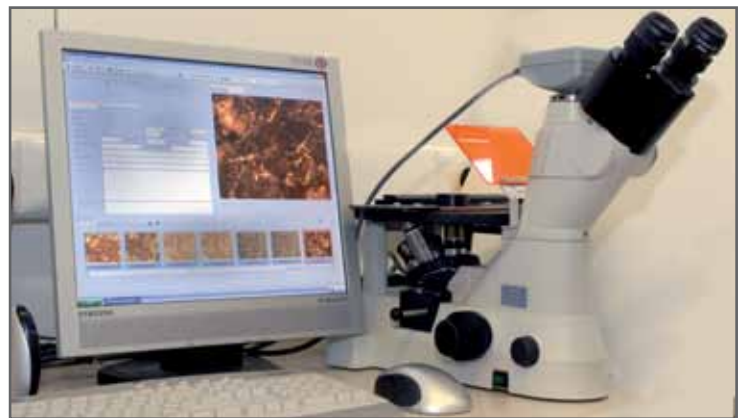
## OPTICAL AND STEREO MICROSCOPE

NIKON ECLIPSE

- Optical microscope

NIKON SMZ 80

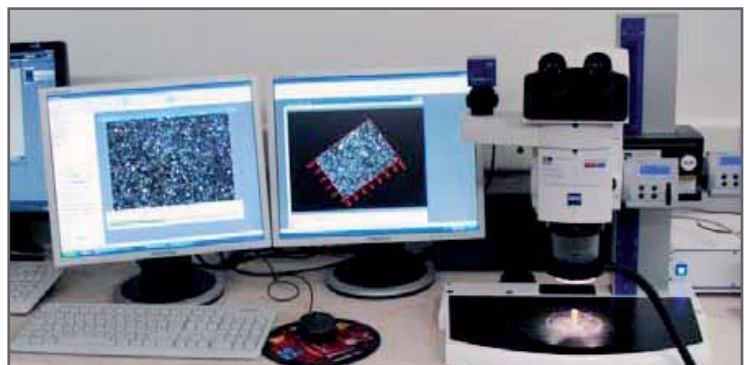
- Stereo microscope



## AUTOMATED STEREO MICROSCOPE

ZEISS DISCOVERY STEREO V 20

- Camera AxioCam
- ICc3AxioVision 4.7 software
- Motorized focus
- Image processing
- Topography module



## MULTI-FUNCTIONAL MICROSCOPE

### OPTICAL MICROSCOPE

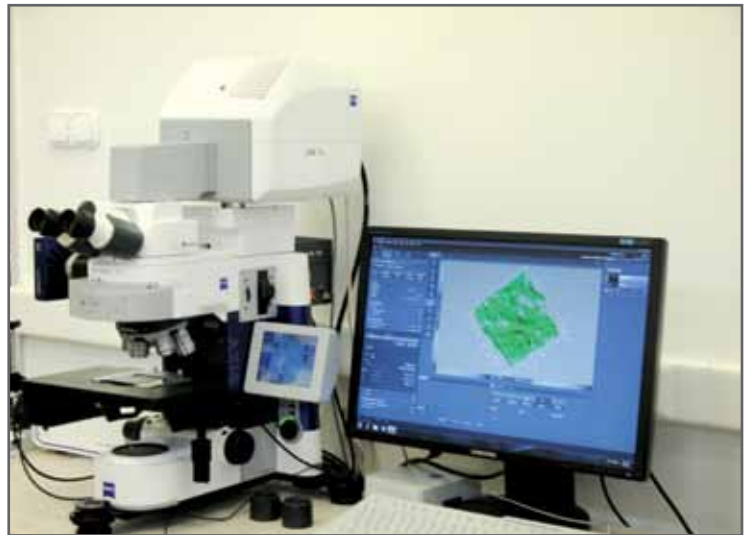
ZEISS AXIO IMAGER M 1

- Camera AxioCam MRc5
- AxioVision 4.8 Software
- AutoMeasure, MosaiX
- Particle Analyzer (Grains, Graphite)

### CONFOCAL LASER SCANNING MICROSCOPE

ZEISS LSM 700

- Confocal principle
- 120 nm resolution
- Reflection mode



## SCANNING ELECTRON MICROSCOPE

HITACHI 3400

- High and low vacuum, testing of conductive and nonconductive surfaces
- Resolution 3 nm

EDS ANALYSIS

- Point, line and map (Bruker)

MINI SPUTTER COATER (GOLD TARGET)



## CHEMICAL COMPOSITION

WAS FOUNDRY MASTER

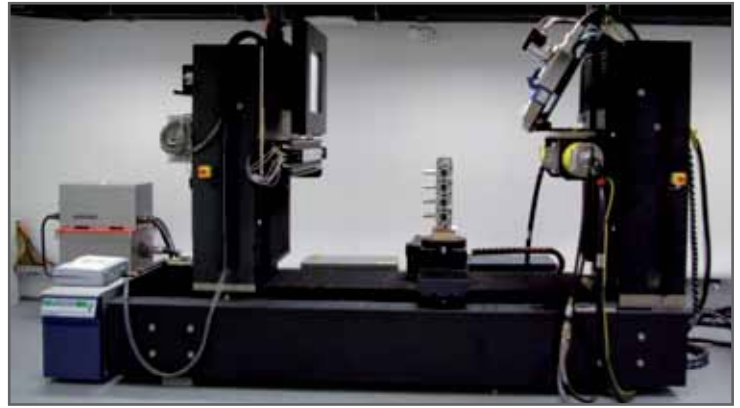
- Analysis of Fe, Al, Cu, Ti, Ni alloys and the most important chemical elements



## CT X-RAY SYSTEM

### YXILON CT MODULAR

- LineScan Line Detector
- Digital Flat Panel Detector
- 450 KV tube
- Microfocus tube 225 KV
- Test specimen dimensions: Ø800x1200 mm



## PHASED ARRAY ULTRASONIC TESTING EQUIPMENT

### OLYMPUS OMNI SCAN MX

- Phased Array US-probe 20-80°
- AVG and ÖRG evaluation

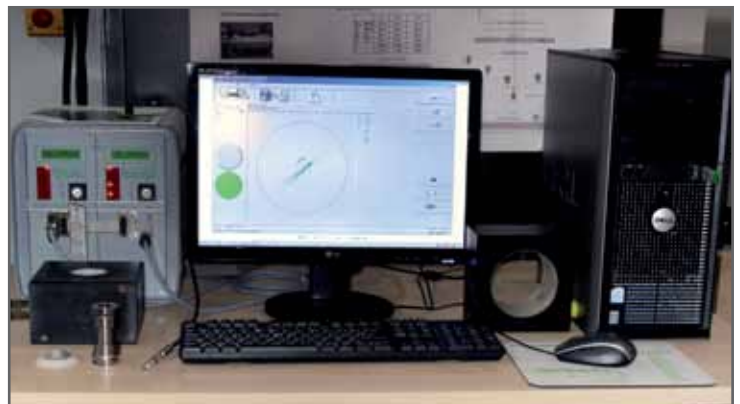
### SOMATEST 250



## MAGNETO-INDUCTIVE TESTING EQUIPMENT

### FOERSTER MAGNATEST ECM

- Magneto-inductive mode  
Frekvency: 2-128 kHz in 17 steps Single-coil absolute mode; two-coil differential mode
- Eddy-current test  
Frekvency 1-3 MHz



## FERROTEST MAGNETIC CRACK DETECTOR

### TIEDE FERROTEST

- AC/DC test current
- Effective test current: 2000 A
- Specimen length: 400 mm



**RHEOMETER**

CEAST 7026

- Range of temperature: 30-300°C
- Set of weights: 2.16; 5; 10 kg
- Standards:
  - ISO 1133
  - ASTM D1238

**FIRE TEST EQUIPMENT**

TBB

- Determination of the burning behaviors for floorings
- Standards:
  - EN ISO 9239-1
  - ASTM E678
  - ASTM E970

**LINEAR ABRASER**

TABER LINEAR ABRASER 5750

- Testing lengths: 0,5; 1; 2; 3; 4"
- Set of weights : 500, 750, 1000, 1250, 1500 g
- Standards:
  - GMW 14125
  - ASTM D2197
  - ASTM D6297
  - ASTM D5178



### TWIN SCREW EXTRUDER

LABTECH SCIENTIFIC

- Screw diameter 20 mm
- Variable configurationally set of screw
- LABTECH LW100 water bath
- LABTECH LZ120 cutter



### INJECTION MOLDING MACHINE

- Screw diameter 35 mm
- Clamp force 100t
- Shot size 144 cm<sup>3</sup>
- Injection pressure 2000 bar
- Mold temperature controller range of temperature 30-95°C
- Dryer range of temperature 60-160°C



### HYDRAULIC PRESSING MACHINE

LABTECH LP-20B

- 200x200 mm hot-plate press
- Max. pressure 160 bar
- Max. temperature 300°C





**LABORATORY ATTRITOR****MODEL 01-HD/HDDM  
(UNION PROCESS)**

- Tank Capacity: 750 and 1400 cm<sup>3</sup>
- Grinding tank, balls: Stainless steel and Zirconiumoxide
- Equipped for grinding under inert gases and for Cryogenic grinding
- HD mode: RPMs from 100 to 650, both wet and dry grinding
- HDDM mode: RPMs from 1,500 to 3,000, wet grinding only

**MODEL 1-S FOR CRYOGENIC GRINDING**

- Small production or pilot plant work
- Tank capacity: 5.7 liter
- Working capacity: 3 liter
- Grinding under inert gases and Cryogenic grinding
- Runs at RPMs from 100 to 500, both wet or dry grinding

**MINISPRAY DRYER B-290 /  
DEHUMIDIFIER B-296****BÜCHI**

- For aqueous solutions or organic mixtures
- Spray gas: compressed air or nitrogen
- Max. temperature input: 220 °C
- Evaporative capacity: 1.0 liter/hr H<sub>2</sub>O
- Particle diameter range: 1–25 µm



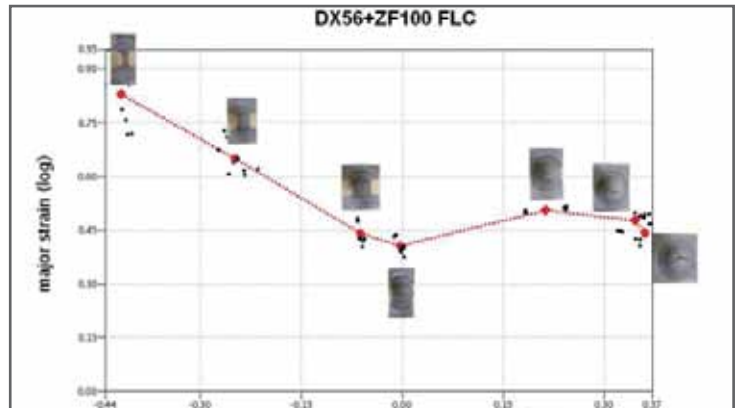
## SHEET METAL TESTS

HYDRAULIC TESTING MACHINE, 600 KN

- Strain analysis (GOM ARAMIS)
- Cup drawing test
- Nakajima test

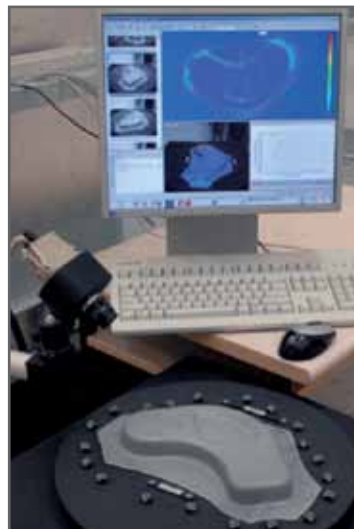


- Forming limit curve



INSTRON 5582

- Tensile Test
- Flow stress curve (K, n)
- Planar anisotropy (r, rm)



GOM ARGUS

- Local strain analysis

## SHEET METAL FORMING

- 2000 kN Hydraulic press
- Ram speed up to 200 mm/s
- Experimental tools for low batch sizes (polymer, galvanized polymer tool materials)
- 250 kN Crank press



**CUTTING PROCESSES**

## DECKEL MAHO 70 EVOLUTION

- PowerMill planning software
- 5D machining

CNC turning center  
GILDEMEISTER

- 4 axes
- Rotating tools

**ROBOTICS**

- Robot cell
- Training laboratory
- Programming tools

**WELDING**

- Welding robot +
- 2D rotating table
- Analysis of welding processes
- Microplasma welding

**WATER JET CUTTING**

## FLOW IFB2

- Table: 1,2 \* 2,4 m
- Cut almost all materials



## VIBRATION TEST CHAMBER

- Combination of a shaker with an environmental test chamber
- Useful capacity: 600 l
- Temperature range: - 75°C/+180°C
- Heating and cooling speed: 10°C/min
- RH range: 10%..98%
- PC control



## THERMAL SHOCK CHAMBER

- Temperature range: - 80°C/+220°C
- Two-cabinet system
- Two temperature method



## DRY CORROSION TEST CABINET (1200 L)

- Dry corrosion test
- Continuous and alternate salt spray
- Control via PC (temperature, cycle time and number)

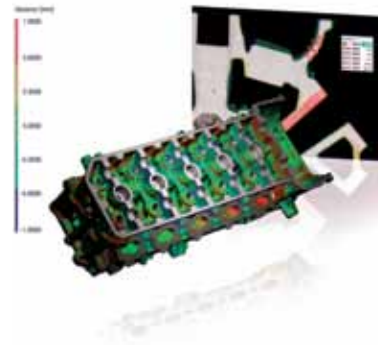


**REVERSE ENGINEERING TOOLS****SURFACE MODEL USING GOM ATOS**

- Digital optical scanning
- Part size from 20 mm to 5 m
- Supports all CAD file formats

**3D MODEL USING CT X-RAY SYSTEM**

- Wall thickness up to 70 mm (steel) or 120 mm (aluminium)
- Real 3D model

**DIRECT METAL LASER SINTERING****EOSINT M270; EOS GMBH**

- Rapid prototyping of the most complex geometries from 3D CAD data, without any metal tooling
- Very good metal surface quality
- Powdered metal (SS 316L and CoCrAlloy) is sintered at 20 micron layers
- ~100% density



## THERMAL ANALYSIS

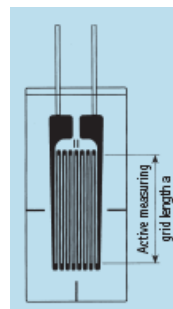
THERMO CAMERA  
CYCLOPS TI 814 PAD

- Temperature range: -20...1500 C°



## STRAIN, STRESS MEASUREMENT

- Strain gage applications
- Measuring Amplifier (Hottinger Baldwin Spider 8)



## FORCE, TORQUE, DISPLACEMENT MEASUREMENT

- Wide range of transducers
- Measuring amplifier, data acquisition system



## MEASUREMENT OF COATINGS, PAINTINGS

KRAUTKRÄMER CTM 20

- Layer thickness: 0,01...0,5 mm
- Base material: metal or polymer



## HARDWARE

- HP supercomputer, Workstations
- A0 Plotter

## SOFTWARE

### PRIMARY SHAPING PROCESSES

- Sheet metal forming (AutoForm)
- Bulk forming (Simufact Forming)
- Polymer processing (Moldflow)

### SECONDARY PROCESSES

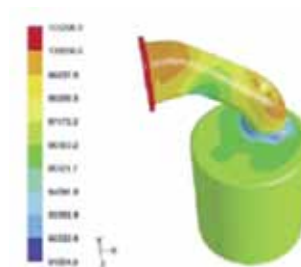
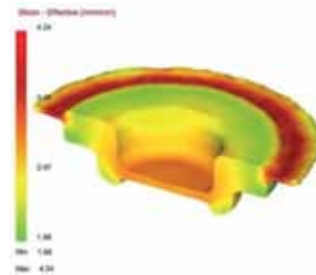
- Cutting
- Heat treatment
- Surface treatment
- Welding

### HEAT TRANSFER AND FLOW, STRESS ANALYSIS

- Fluent
- Hyper Works
- Abacus

### CAD SOFTWARE

- ProEngineer Wildfire
- Catia V5
- Unigraphics NX4



## PROCESS PLANNING

### CUTTING PROCESS PLANNING

- TDM software
- Manufacturing process planning
- Tooling
- Timing



### PRODUCTION PROCESS CONTROL

- Tecnomatix Plant Simulation – Siemens PLM
- Jack (Analysis of Assembly Cells) – Siemens PLM
- VisTable (3D Planning Tool)



# RESEARCH COMPETENCIES

## VEHICLE UNIT DESIGN AND DIAGNOSTICS

- Finite Element Techniques – gas and fluid flow, stress analysis
- Analysis of vehicle units
- Noise, vibration measurements, mechanical losses
- Development of various testing equipment

## MANUFACTURING: PROCESS AND TOOL DESIGN

- Primary shaping processes (casting, bulk and sheet metal forming, polymer processing – computer simulation and experiments)
- Secondary processes (cutting, heat treatment, surface treatment – computer simulation and modelling)
- Rapid prototyping (5D machining, Selective Laser Sintering of Metals)

## EFFICIENCY AND QUALITY

- Simulation of production and assembly processes
- Logistic process planning



## CONTACTS

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