MyCar
Flexible assembly processes for the car of the third millennium

From single model   **…to multi-model**
production line …   **production line**
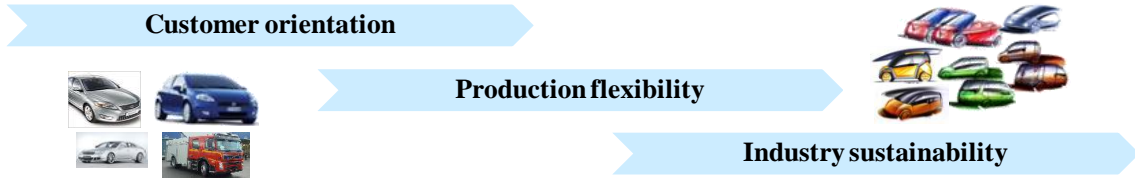
Long term sustainability of EU vehicle manufacturing considering the customer as the core element, offering personalisation to achieve market differentiation against non-EU competitors.

From traditional mass   **…to self adaptive**
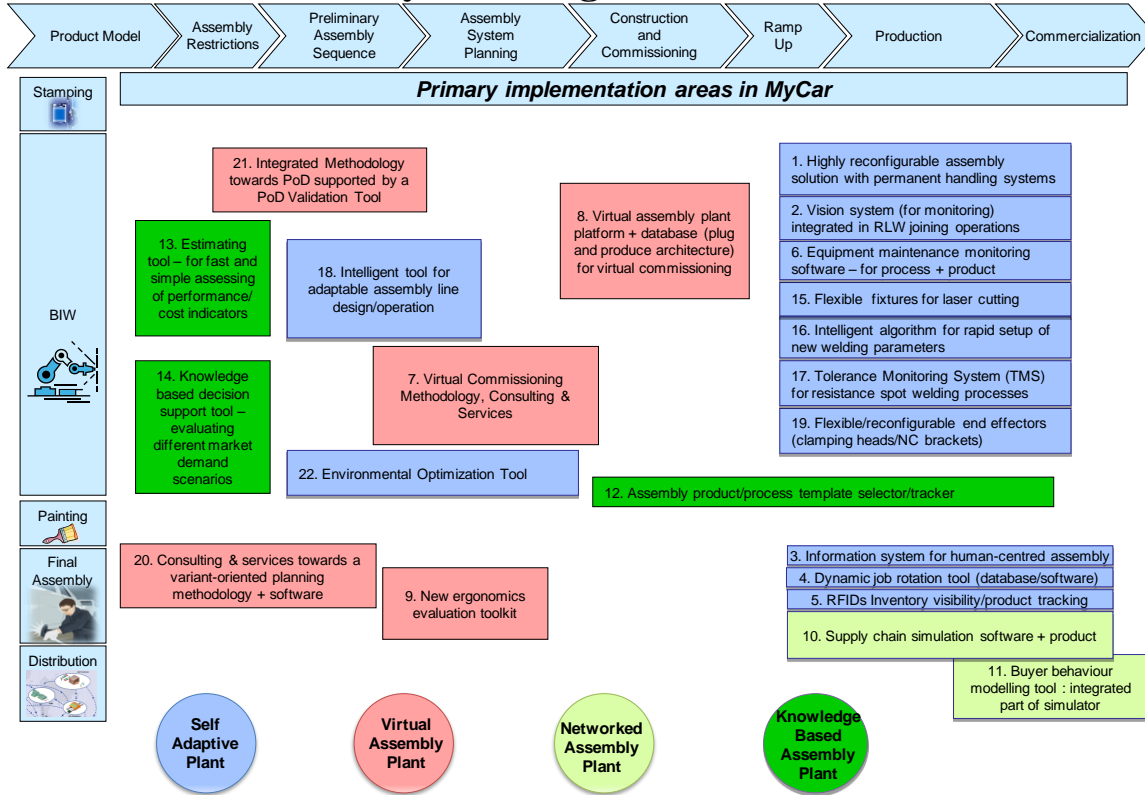**production plants…**   **production plant**

MyCar Objectives

Customer orientation

Production flexibility

Industry sustainability

MyCar Integrated Suite

| Product Model | Assembly Restrictions | Preliminary Assembly Sequence | Assembly System Planning | Construction and Commissioning | Ramp Up | Production | Commercialization |

Stamping

Primary implementation areas in MyCar

BIW

21. Integrated Methodology towards PoD supported by a PoD Validation Tool

13. Estimating tool – for fast and simple assessing of performance/ cost indicators

18. Intelligent tool for adaptable assembly line design/operation

8. Virtual assembly plant platform + database (plug and produce architecture) for virtual commissioning

1. Highly reconfigurable assembly solution with permanent handling systems

2. Vision system (for monitoring) integrated in RLW joining operations

6. Equipment maintenance monitoring software – for process + product

15. Flexible fixtures for laser cutting

16. Intelligent algorithm for rapid setup of new welding parameters

17. Tolerance Monitoring System (TMS) for resistance spot welding processes

19. Flexible/reconfigurable end effectors (clamping heads/NC brackets)

14. Knowledge based decision support tool – evaluating different market demand scenarios

7. Virtual Commissioning Methodology, Consulting & Services

22. Environmental Optimization Tool

12. Assembly product/process template selector/tracker

Painting

Final Assembly

20. Consulting & services towards a variant-oriented planning methodology + software

9. New ergonomics evaluation toolkit

3. Information system for human-centred assembly

4. Dynamic job rotation tool (database/software)

5. RFIDs Inventory visibility/product tracking

10. Supply chain simulation software + product

Distribution

11. Buyer behaviour modelling tool : integrated part of simulator

Self Adaptive Plant

Virtual Assembly Plant

Networked Assembly Plant

Knowledge Based Assembly Plant

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Exploitable Result #1: Highly reconfigurable assembly solution with permanent handling systems
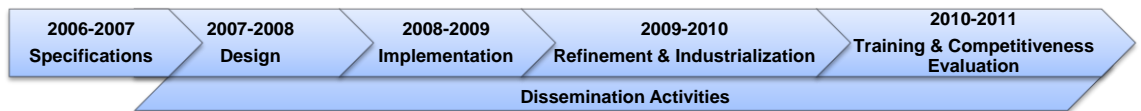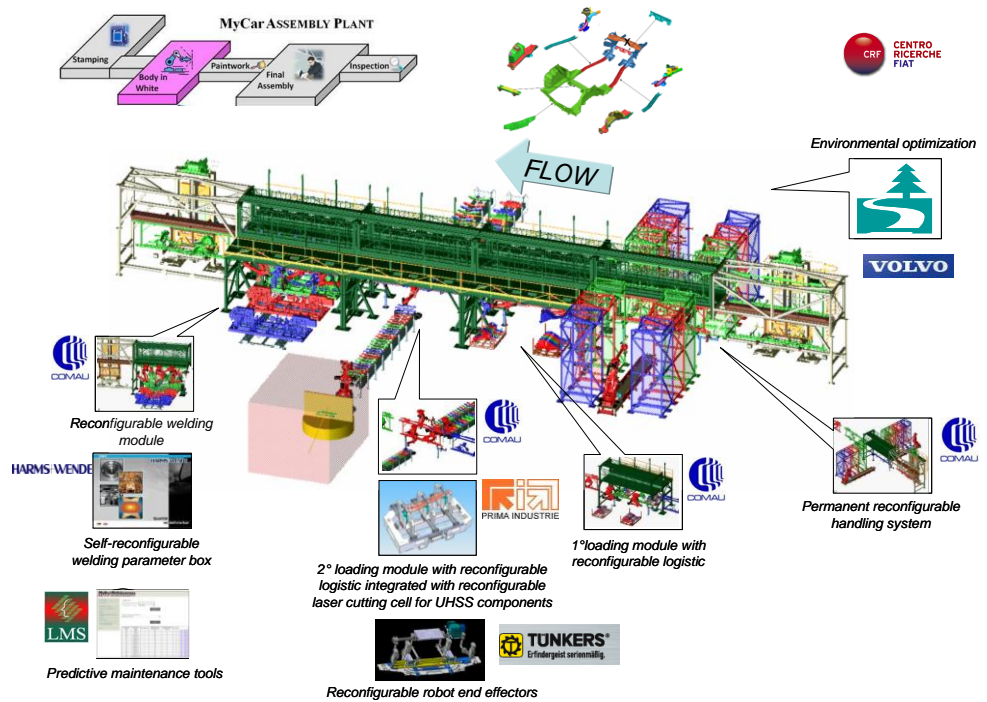
Contribution to MyCar vision

Development of an innovative bodyshop concept that represents a big part of the assembly system that integrates a number of flexible solutions such as flexible fixtures for welding and Laser cutting, RS Welding control algorithms, and equipment maintenance monitoring tools, having the following major benefits:

- Increase production flexibility, up to 5 models in the same body shop line;
- Model independent Bodyshop equipment, with full utilization of equipment, and reduced setup times;
- Reduction of running costs by 15%, and 20% of investment costs;
- Reduction of energy consumption and maintenance requirements, yielding higher efficiency and higher final product quality.

Exploitable Result Deliverable and Plan

2006-2007 Specifications	2007-2008 Design	2008-2009 Implementation	2009-2010 Refinement & Industrialization	2010-2011 Training & Competitiveness Evaluation

Dissemination Activities

Current status

– Virtual model of the main assembly line, integrating the relevant singular developments, is available
– Integration scenario between all the involved developments is consolidated

Innovative Aspects

– Increase production flexibility, up to 5 models in the same body shop line
– Model independent Bodyshop equipment with non robotic reconfigurable equipment solutions
– Permanent handling systems between and within the mainlines, realized with a fast and lean system

Organizational Information

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Website: www.mycar-project.eu
Priority area: NMP, EU Contract No: 26631

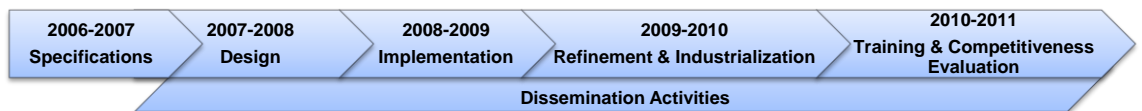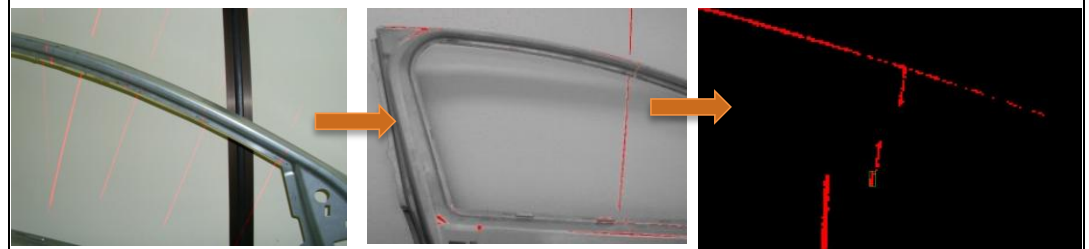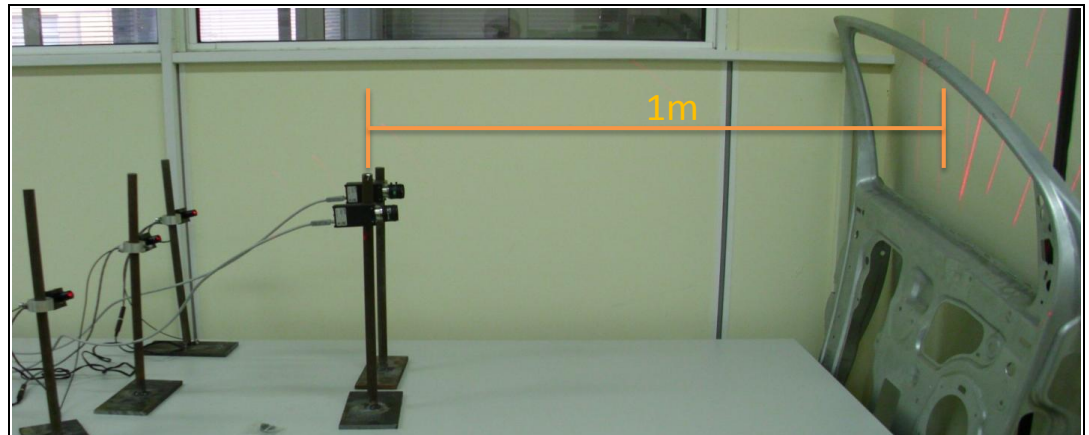# MyCar - Flexible assembly processes for the car of the third millennium

VOLVO

DAIMLER

Ford

CRF CENTRO RICERCHE FIAT

LMS

COMAU

SIEMENS

CASP

HARMS-WENDE

EDAG

TÜNKERS Erfindergeist serienmäßig.

emphasis TELEMATICS

Universität Karlsruhe (TH) Research University · founded 1825

UNIVERSITÄT DES SAARLANDES

UNIVERSITY OF SKÖVDE

CHALMERS

PRIMA INDUSTRIE

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Exploitable Result #2: Vision System (for monitoring) integrated in RLW joining operations

Contribution to MyCar vision

Low cost and fast elaboration vision system for wide range online real-time monitoring applications. The system is able to intervene and correct any possible errors or deviations (from the nominal welding path) during the Remote Laser Welding of a car door frame. This ER main benefits are:

- Help increase production flexibility by control of process in real time;
- Reduced assembly costs by 15% and higher efficiency by improving process/product quality;
- Decrease the number of undetected quality defects during assembly process by 15%.

Exploitable Result Deliverable and Plan

| 2006-2007 Specifications | 2007-2008 Design | 2008-2009 Implementation | 2009-2010 Refinement & Industrialization | 2010-2011 Training & Competitiveness Evaluation |

Dissemination Activities

Current status

- Algorithms for image analysis and feature detection implemented in 2D cases
- Experimental setups and tryouts on active triangulation technique
- Development of stereo vision concept for 3D application

Innovative Aspects

- Simple and low cost (one order of magnitude lower than current SoTA)
- Reconfigurable solution that can be applied to different sets of geometries
- Fast processing time relatively to the existing systems

Organizational Information

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Exploitable Result #3: Information System for Human-Centred Assembly
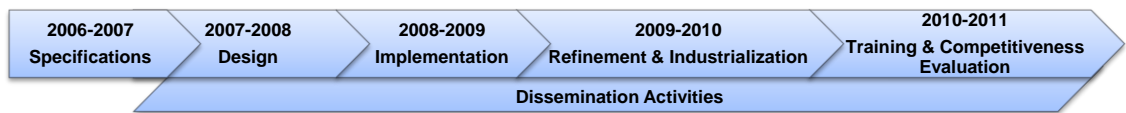
Contribution to MyCar vision

My Car aims at enabling the production of vehicles with extended degree of personalization.

A key objective is to integrate the human worker in the assembly process in a more flexible way by providing them the right instructions at the right time and at the right place, allowing them to perform different tasks. The Information system for human-centred assembly aims to:

- Support operators in managing variation – Reduce non value adding activities
- Reduce assembly cost
- Decrease the number of undetected quality defects during assembly

Exploitable Result Deliverable and Plan

2006-2007 Specifications	2007-2008 Design	2008-2009 Implementation	2009-2010 Refinement & Industrialization	2010-2011 Training & Competitiveness Evaluation

Dissemination Activities

Current status

- Front end (operator interface) and backend systems implemented & improved
- First successful pilot case run at VOLVO Tuve plant
- Quality benefits of mobile system confirmed
- Integration with the RFID automated identification system and dynamic job rotation tool
- Industrialization of information system at request of VOLVO

Innovative Aspects

- Mobility of assembly information using mobile wireless devices
- Assembly instructions in multiple formats (drawings, videos, photos etc)
- User centered interface that reduces effort to retrieve and understand instructions

Organizational Information

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Priority area: NMP,　EU Contract No: 26631

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PRIMA INDUSTRIE

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MyCar - Flexible assembly processes for the car of the third millennium

Exploitable Result #4: Dynamic Job Rotation Tool

Contribution to MyCar vision

My Car aims at enabling the production of vehicles with extended degree of personalization.
A key objective is to integrate the human worker in the assembly process in a more flexible way by providing instructions to perform alternative tasks. The dynamic job rotation tool aims to:

– Support operators in managing variation
– Reduce assembly cost
– Decrease the number of undetected quality defects during assembly

Exploitable Result Deliverable and Plan

| 2006-2007 Specifications | 2007-2008 Design | 2008-2009 Implementation | 2009-2010 Refinement & Industrialization | 2010-2011 Training & Competitiveness Evaluation |

Dissemination Activities

Current status

– Web based application available and tested during airtank assembly pilot case
– Integration with the MyCar operator support system (mobile devices) for direct operator access
– Design of the integration with SP3 Ergotoolkit for adding ergonomic criteria to the decision making

Innovative Aspects

– Multiple criteria approach for job rotation
– Balanced workload distribution among operators , multi-skilled workforce
– Dynamic allocation of human resources based on shop floor conditions

Organizational Information

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Exploitable Result #5: RFID Inventory Visibility/Product Tracking

Contribution to MyCar vision

My Car aims at enabling the production of vehicles with extended degree of customization. By automating the part and the operator identification as well as the process recognition, operators spent less time to access to the assembly instructions and furthermore operator errors during the assembly are reduced. The MyCar RFID inventory visibility / product and operator tracking system aims to:

– Reduce assembly cost
– Decrease the number of operator errors during assembly
– Support flexibility to custom requirements

Exploitable Result Deliverable and Plan

| 2006-2007 Specifications | 2007-2008 Design | 2008-2009 Implementation | 2009-2010 Refinement & Industrialization | 2010-2011 Training & Competitiveness Evaluation |

Dissemination Activities

Current status

– RFID portal for chassis and airtank identification
– Software solution for automated process detection (air tank picking)
– Operator identification and location finding
– Successful Pilot case run at VOLVO Tuve plant
– Integration with the MyCar information system and dynamic job rotation tool

Innovative Aspects

– Automatic inventory visibility & product tracking
– Automatic process recognition
– Automatic operator identification and location finding

Organizational Information

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Priority area: NMP, EU Contract No: 26631

MyCar - Flexible assembly processes for the car of the third millennium

Exploitable Result #6: Equipment Maintenance Monitoring Software – for Process + Product

Contribution to MyCar vision

A holistic approach that includes the identification, the monitoring and the interpretation of the necessary parameters, fosters the maintenance-relevant information flow by preventing the failures and facilitates the management of resources and maintenance task execution. Therefore, contributing to the reduction of failures, increasing the efficiency of flexible assembly lines. The introduction of a measure to characterize and prioritize the machines based on their needs for maintenance and their importance in the production flow. This ER main benefits are:

- Help/support in handling unscheduled failures;
- Helps efficient short term maintenance planning/execution;
- Enables/enhances monitoring equip. sensor health-improvement/indicator of utilization & distribution;
- Facilitates, improves, and accelerates data flow for transmitting information (status, disturbances, failures, defective parts etc).

Exploitable Result Deliverable and Plan

Clamping device installation

Equipment view

Remaining Useful Life Estimation

| 2006-2007 Specifications | 2007-2008 Design | 2008-2009 Implementation | 2009-2010 Refinement & Industrialization | 2010-2011 Training & Competitiveness Evaluation |

Dissemination Activities

Current status

- Web based application available
- Communication with monitoring sensors installed in the clamp
- SW monitors the condition of the clamp alerting the engineers in case of a possible breakdown and captures the clamp deterioration and estimates the Remaining Useful Life SW

Innovative Aspects

- Enhances preventive maintenance strategies
- Facilitates the avoidance of unexpected breakdown
- Estimates the Remaining Useful Life

Organizational Information

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# MyCar - Flexible assembly processes for the car of the third millennium

Exploitable Result #7: Virtual commissioning methodology for line and cell level, consulting & services

Contribution to MyCar vision

MyCar (SP3) is focused on conceiving, designing and implementing a framework for virtual assembly platform. The line and cell level virtual commissioning contributes to following objectives:

- Reduction of investment costs by 20%
- Shortening of ramp-up time by 20%

Goal: Verification of mechanical behavior of the line in conjunction with PLCs in loop and the virtual commissioning of interacting production cells in a virtual line environment to enhance the maturity and quality of control engineering components prior to their real commissioning.

Exploitable Result Deliverable and Plan
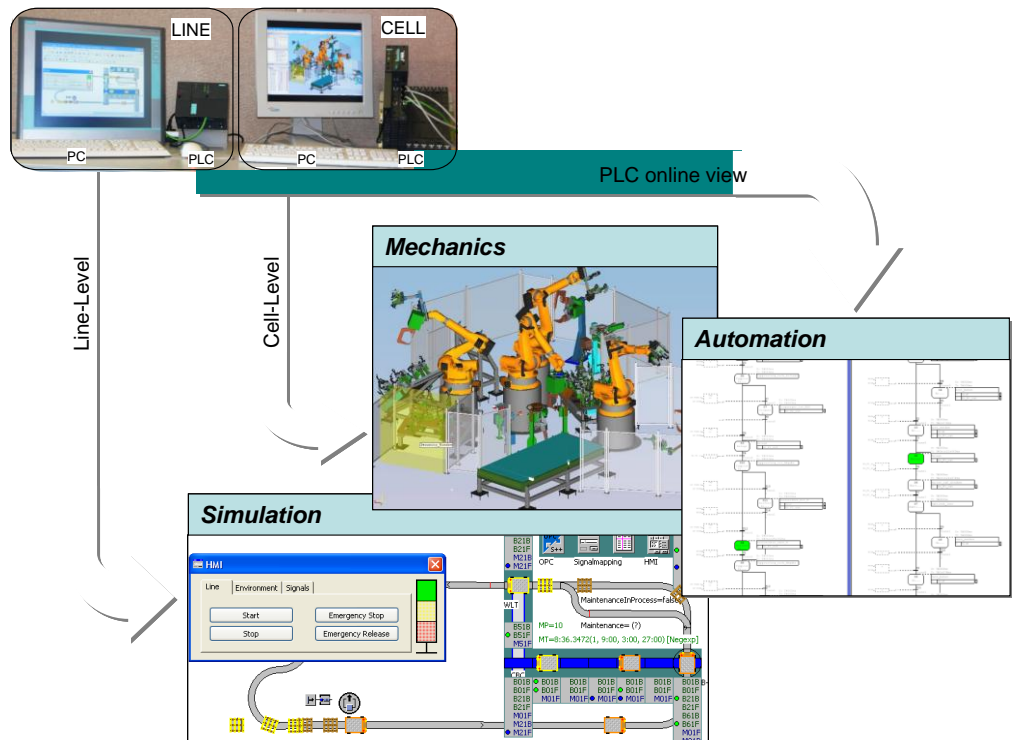
Current Status

- Combined virtual commissioning of line and cell level completed
- Guideline for modelling, processes and workflow for a tool independent VC available
- Method for behaviour modeling to a standardized data exchange format contributed

Innovative Aspects

- Verification of PLC engineering in conjunction with the virtual line and cell
- Provisioning of a virtual platform that serves as the basis for the optimization of the line and verification of planned changes in a virtual environment without interrupting existing production
- Description of a generic methodology to perform virtual commissioning of complex lines

Organizational Information

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Exploitable Result #8: Virtual Assembly Plant Platform (VAPP) & Database for Virtual Commissioning
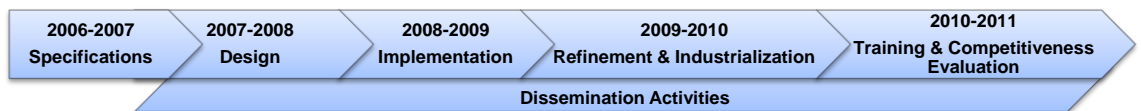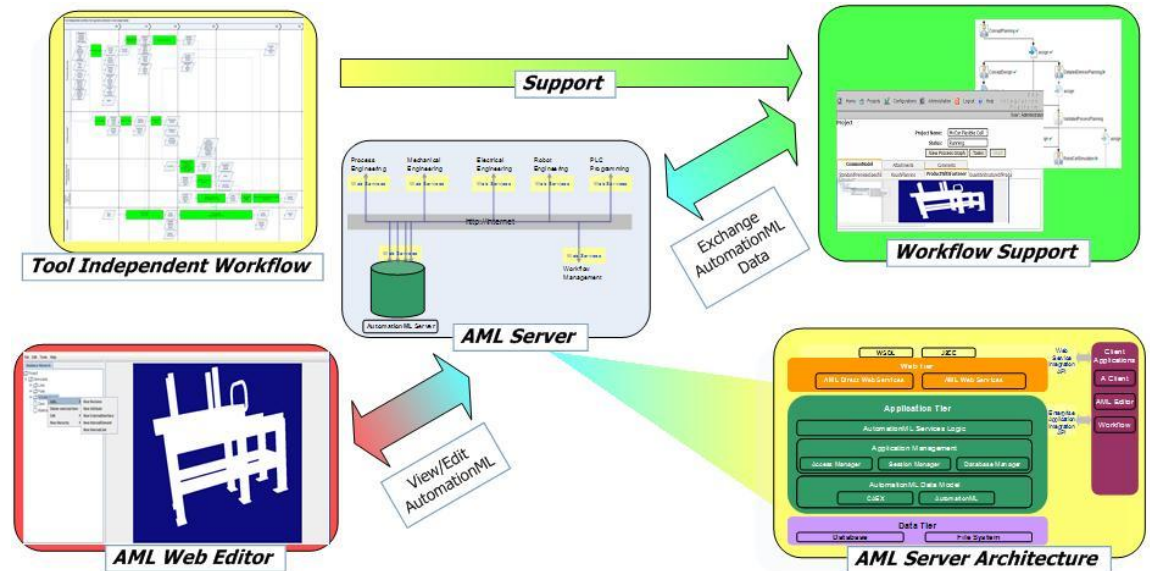
Contribution to MyCar vision

My Car aims at decreasing the ramp-up time by 20%.

A key objective that will contribute to the decrease of ramp-up time is to take advantage of existing CAx tools by integrating them into one workflow (tool-independent workflow) and into a common data model. This approach (**Virtual Assembly Plant Platform**) aims at:

– Provide a cross-tool communication platform.
– Complete representation of Virtual Plant in AML-format.

Exploitable Result Deliverable and Plan

2006-2007 Specifications	2007-2008 Design	2008-2009 Implementation	2009-2010 Refinement & Industrialization	2010-2011 Training & Competitiveness Evaluation
		Dissemination Activities		

Current status

– Stand alone web application available
– Tool independent data exchange framework (workflow implementation)
– AutomationML manual integration

Innovative Aspects

– CAx interoperability supporting emerging standards (AutomationML is going to be submitted to International Electrotechnical Commission for standardization, "bpel4people" and "ws-humantask" specifications have been recently submitted to OASIS for standardization)
– Complete representation of Virtual Assembly Plant

Organizational Information

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MyCar - Flexible assembly processes for the car of the third millennium

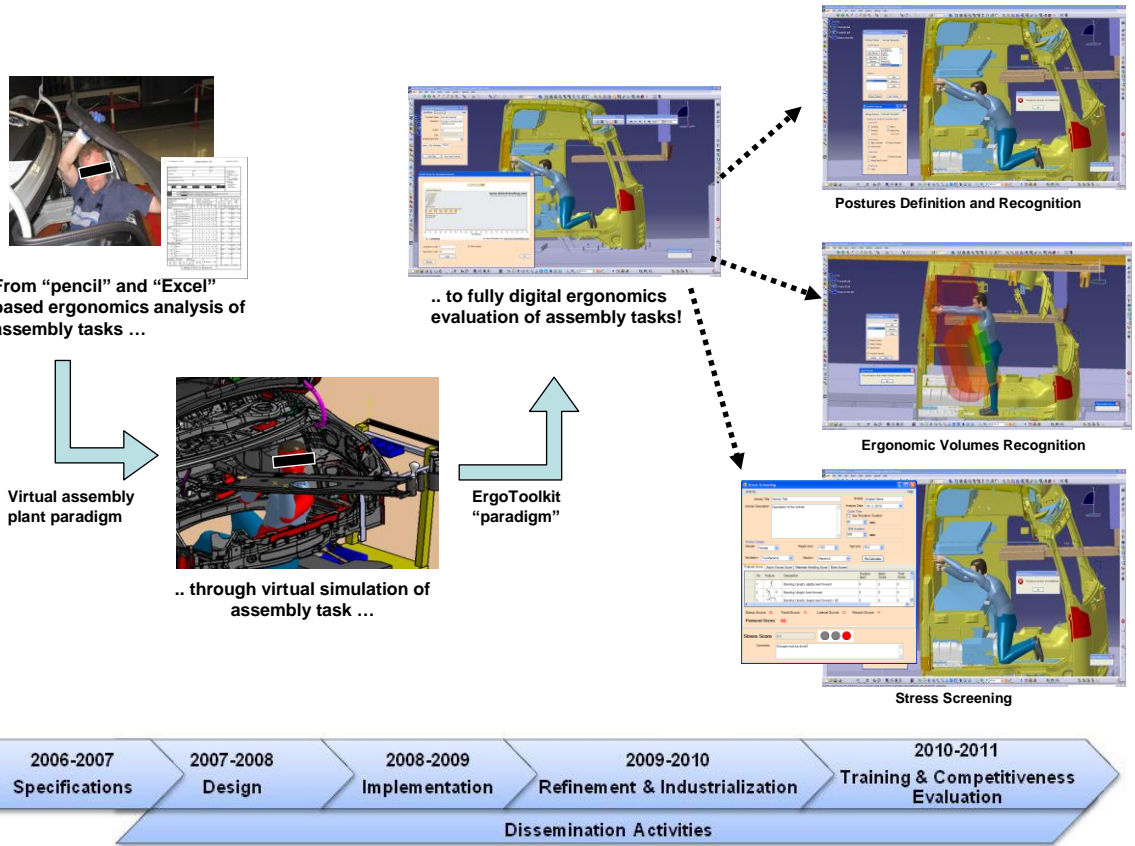## Exploitable Result #9: New ergonomics evaluation toolkit

Contribution to MyCar vision

My Car aims at enabling the production of vehicles with extended degree of personalization.

A key objective is to **integrate the human worker** in the assembly process in a more efficient way by **improving the workplace and process design** for performing alternative assembly tasks. The new ergonomics evaluation toolkit (**ErgoToolkit**) aims at:

– Reducing assembly costs related to injuries of human that perform assembly tasks
– Improving human aspects of work in virtual manufacturing with early and accurate integration of human factors in virtual manufacturing (e.g. design of assembly cells/lines).
– Keeping the worker (human resource) flexible by decreasing health risks.

Exploitable Result Deliverable and Plan

From "pencil" and "Excel" based ergonomics analysis of assembly tasks …

Virtual assembly plant paradigm

.. through virtual simulation of assembly task …

ErgoToolkit "paradigm"

.. to fully digital ergonomics evaluation of assembly tasks!

Postures Definition and Recognition

Ergonomic Volumes Recognition

Stress Screening

2006-2007 Specifications	2007-2008 Design	2008-2009 Implementation	2009-2010 Refinement & Industrialization	2010-2011 Training & Competitiveness Evaluation
		Dissemination Activities		

Current industry situation

– Current tools support assembly operation simulation but do not provide adapted evaluation method.
– No dynamic analysis/evaluation is available.

Innovative Aspects

– New digital tools for ergonomics evaluation of manual assembly processes.
– Ergonomics evaluation using dynamic simulation.
– Digital ergonomics assessment using automotive corporate standards.
– Faster and easily-repeatable ergonomics analyses of the same tasks with different variants of the products. Faster check of process/ workplace design alternatives contributes to process flexibility.

Organizational Information

MyCar - Flexible assembly processes for the car of the third millennium

Exploitable Result #10: Supply Chain Simulation Software

Contribution to MyCar vision

MyCar aims at enabling the production of vehicles with extended degree of personalization. This exploitable result supports MY-CAR objective of supplying a highly customised vehicle by:
- Simulating the availability of parts in the supply chain enabling late vehicle specification changes
- Notifying customer/dealer of expected delivery date and cost at date of request
- Allowing changes to vehicle specification leading to 'earliest feasible date' ethos

Exploitable Result Deliverable and Plan

2006-2007 Specifications	2007-2008 Design	2008-2009 Implementation	2009-2010 Refinement & Industrialization	2010-2011 Training & Competitiveness Evaluation

Dissemination Activities

Current status
- Stand alone application available
- Implemented in the passenger vehicle customisation scenario

Innovative Aspects
- Automated evaluation of feasibility of supply plus financial viability to change scheduled build date
- Provide visibility of suppliers' ability to supply through to n'th tier, considering capacities/inventories
- Automated supply chain visibility through EDI links to supplier data and automated visibility of material in transit

Organizational Information

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MyCar - Flexible assembly processes for the car of the third millennium
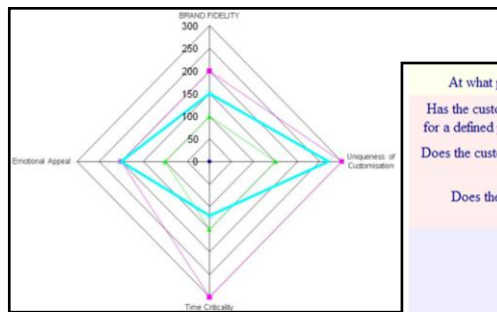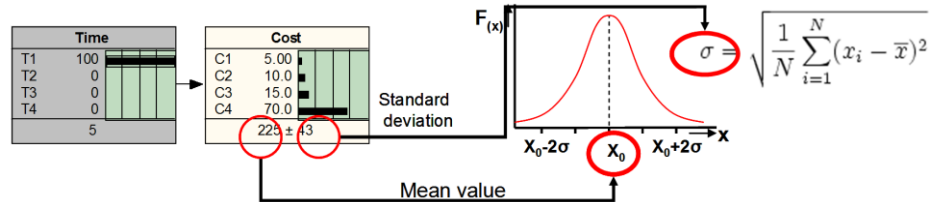
Exploitable Result #11: Buyer Behaviour Modeling Tool
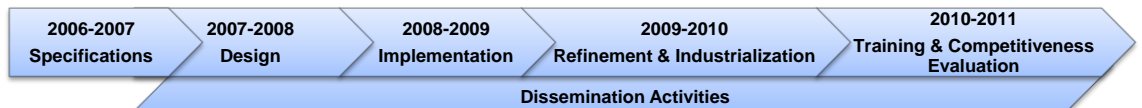
Contribution to MyCar vision

My Car aims at enabling the production of vehicles with extended degree of personalization.

This tool quantifies the likelihood for a customer to place an order for a vehicle given a specific delivery date and customisation level.

Exploitable Result Deliverable and Plan

$$\sigma = \sqrt{\frac{1}{N}\sum_{i=1}^{N}(x_i - \overline{x})^2}$$

	2006-2007 Specifications	2007-2008 Design	2008-2009 Implementation	2009-2010 Refinement & Industrialization	2010-2011 Training & Competitiveness Evaluation

Dissemination Activities

Current status

– Stand alone application available
– Considering 18 factors influencing a customer's likely response

Innovative Aspects

– Current uncertainty whether customer can get vehicle regarding time/cost/availability mix but the tool can predict customers' likely response to offered date

Organizational Information

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# MyCar - Flexible assembly processes for the car of the third millennium

Exploitable Result #12: Assembly Product and Process Template Selector & Tracker

Contribution to MyCar vision

The knowledge which is derived from past projects, has never been systematically categorized in a simple and efficient way. MyCar product and process template selector & tracker development aims to manage Process and Product Templates, taking into account flexibility issues, and allowing for the systematic organization and classification of the information; furthermore, tracking and capturing of all design and engineering changes taking place from the initial phase of the assembly line development till the commissioning phase. This development will sustain the industry by:

- Decreasing investment costs by 20%;
- Decreasing the number of undetected quality defects during assembly process by 15%;
- Shorten time to market by 15%.

Exploitable Result Deliverable and Plan
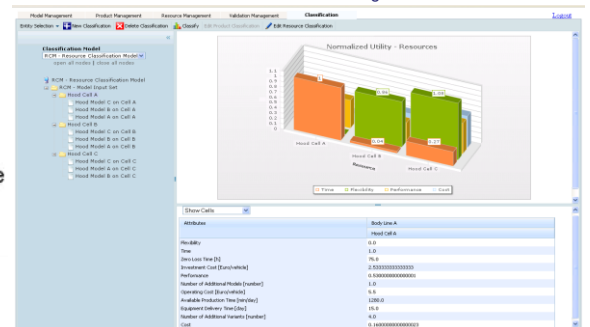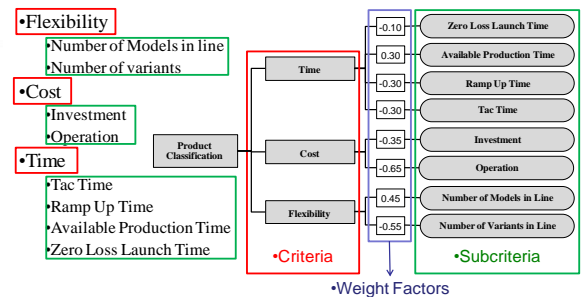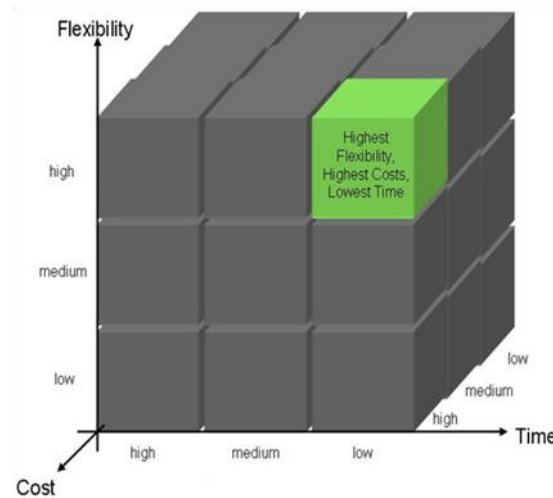
Current status

– Web-based stand alone application available
– Web services to link to other models developed in MyCar, to reach a final integrated suit

Innovative Aspects

– Manage and utilize past accumulated know-how in new projects
– Classification and categorization of available product and process templates with respect to the projected performance regarding new projects

Organizational Information

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MyCar - Flexible assembly processes for the car of the third millennium

Exploit. Result #13: Knowledge Based Performance Indicators Estimation Tool

Contribution to MyCar vision

My Car aims at enabling the production of vehicles with extended degree of production flexibility, fostering product/customer orientation, developing and implementing simple and effective tools; a Performance Estimation Model for the calculation of production key factors such as cost, weight, and cycle time of a new product, based on data from past projects, is one of them. The new estimation model requires minimum amount of input data, and utilizing knowledge from past projects, allows fast preliminary assessment of new possible solutions. This tool aims to:

– Decrease investments costs by 20%
– Shorten time to market by 15%

Exploitable Result Deliverable and Plan

Current status

– Web based stand alone application available
– Developed and tested on a side door scenario
– Partially Integrated to the MyCar SW Integrated Suit

Innovative Aspects

– Minimum amount of input data, in order to be useful as support tool during design phase
– Utilizing past knowledge from past projects
– Allows fast preliminary assessment of new possible solutions, in terms of cost and time

Organizational Information

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MyCar - Flexible assembly processes for the car of the third millennium

Exploitable Result #14: Knowledge-Based Decision Support Method for Evaluating Different Market Demand Profiles

Contribution to MyCar vision

Human experience is utilized, usually in a non-systematic way, in order to allow the project manager to decide where production of a new product (e.g. subassembly, a whole BIW, etc.) should be placed. My Car development would like to propose the best assembly line configuration to be preferred for coping with a series of different market demand profiles, allowing for the preliminary investigation of "what-if" scenarios in an efficient way. This tool aims to sustain industry by:

– Decrease investments costs by 20%;
– Shorten time to market by 15%.

Exploitable Result Deliverable and Plan

Current status

– Web based stand alone application available
– Developed and tested on side door scenario
– Partially integrated to MyCar SWs suite

Innovative Aspects

– Utilizing past knowledge from past projects to get fast and efficient information to support decision making
– Allows fast preliminary assessment of new possible solutions

Organizational Information

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Priority area: NMP, EU Contract No: 26631

MyCar - Flexible assembly processes for the car of the third millennium

Exploitable Result #15: Flexible Fixtures For Laser Cutting

Contribution to MyCar vision

The development involves the implementation of a flexible and reconfigurable laser cutting cell, using the flexible fixtures developed in the previous tasks of MyCar SP2, for cutting in real time and in sequence the under floor longitudinal rails for different models, running in the main line. This exploitable result's main benefits are:

- Greatly enhanced flexibility of body in white components' manufacturing process enabling optimization of the whole manufacturing process.
- Reduced costs: reduction of fixtures at plant level.
- Reduced space (less fixtures for same production).
- Reduced time for re-tooling of machines.

Exploitable Result Deliverable and Plan
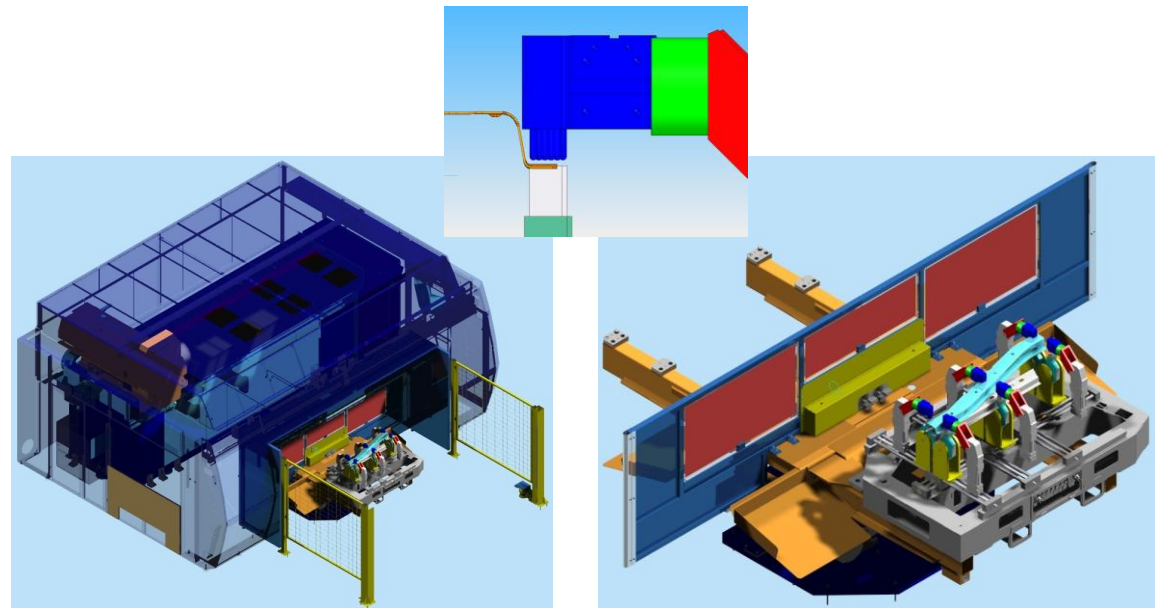
Current status

- − Finalization of mechanical aspects on virtual model
- − Control software embedded on 3D PRIMA INDUSTRIE laser machines
- − Starting feasibility study for different families of pieces

Innovative Aspects

- − Different variants of same vehicle possible on the same fixture: easier production change and mix
- − High reliability: reduction of electrical/pneumatic components and possibility of backup fixtures
- − Same parts of different vehicles possible on the same fixture

Organizational Information

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# MyCar - Flexible assembly processes for the car of the third millennium

Exploitable Result #16: Intelligent algorithm for rapid setup of new welding parameters

Contribution to MyCar vision

The "**R**apid **S**etup **S**ystem" is a new kind of PC & microcontroller based system for a rapid finding of welding parameters for resistance spot welding processes. Whereas nowadays usually a huge amount of test welds are necessary in order to find proper parameters for a certain welding job, depending on material combinations and requirements for the welding parameters to be used (e.g. max welding time), 10 ÷ 50 tests are needed to find proper welding parameters (very time intensive, and material and energy consuming). By the implementation of the RSS, the amount of welding tests needed is drastically reduced - only 3 tests are needed! This leads to a drastic reduction of time consumption for performing the tests. As a result, costs are reduced and a better time to market ratio for new production is reached. By the reduction of the tests, also material (test sheets) is saved and less energy is consumed. Those factors lead to positive impact to the environment.

Exploitable Result Deliverable and Plan
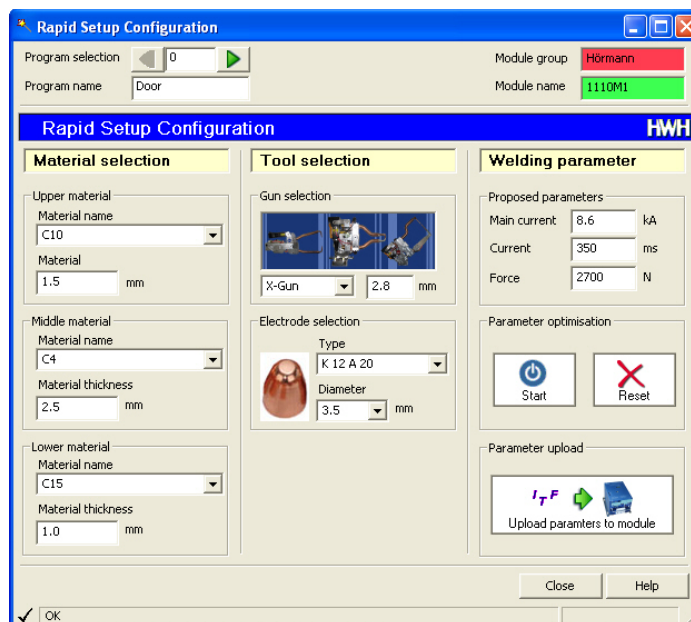
Current status

- Advanced physical process models for parameter finding of different materials are implemented the embedded platform;
- On PC side a database provides basic parameter sets for welding processes; Automatic parameter optimization and upload to the welding timer guarantees user-friendly operation.

Innovative Aspects

- The amount of welding tests for finding proper welding parameters is drastically reduced (only 3 tests are needed) fostering drastic reduction of time for performing the tests, reduction of costs, and a better time to market ratio for new production;
- Reduction of tests, and hence material (test sheets) and energy savings (less consumption), promote positive impact to the environment.

Organizational Information

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MyCar - Flexible assembly processes for the car of the third millennium

Exploitable Result #17: Tolerance Monitoring System (TMS) for resistance spot welding processes

Contribution to MyCar vision

A new innovative type of detection of welding process disturbances was developed. Compared to state of the art monitoring systems, minimal effort for configuration is needed.

The new monitoring system is in its algorithm real time front end directly integrated in the welding control. In the background, a PC database is used, as an archive of process data.

For every weld point one Quality Value is generated. In addition splash information is added.

For automated report generation this quality value can be used to get an estimate on disturbance differentiation. E.g. reason for disturbance is the gun or the reason can be found in the welding point but the gun is ok.

Exploitable Result Deliverable and Plan
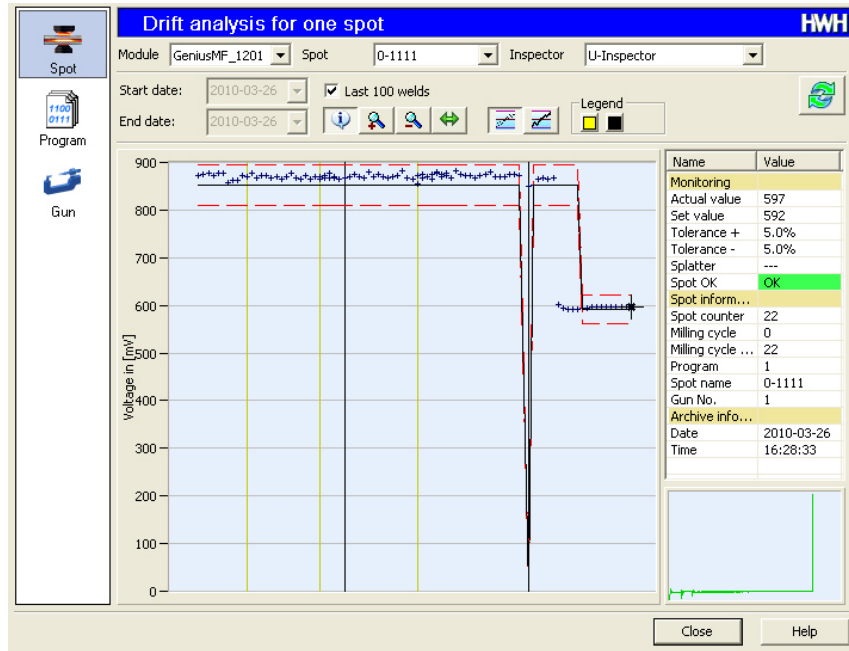
Current status

- The TMS has been extended by a Process Monitoring System to detect process drifts. In addition, monitoring of voltage, current, force and displacement signals is available
- A Problem Solution Wizard is available for rapid finding and correction of the most important process defects

Innovative Aspects

- Minimal effort is needed to configure the system: 1) Activate system; 2) Select reference weld
- There is no need to determine timing tolerances or thresholds. The system is configured automatically
- The Problem Solution Wizard significantly reduces machine down-time

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MyCar - Flexible assembly processes for the car of the third millennium

MyCar ★
Flexible Assembly Processes for the Car of the 3rd Millennium

VOLVO

DAIMLER

Ford

CRF CENTRO RICERCHE FIAT

LMS

COMAU

SIEMENS

CASP

HARMS|WENDE

EDAG

TÜNKERS Erfindergeist serienmäßig.

emphasis TELEMATICS

Universität Karlsruhe (TH) Research University · founded 1825

UNIVERSITÄT DES SAARLANDES

UNIVERSITY OF SKÖVDE

CHALMERS

PRIMA INDUSTRIE

cenit

Exploitable Result #18: Intelligent Tool for Adaptable Assembly Line Design/Operation

Contribution to MyCar vision

This ER consists of a software model used for decision making support in the design and operation stages, of self adaptive lines. The result is a standalone tool capable of generating design alternatives and evaluating them against multiple user defined criteria. The ease of application combined with the existing low cost/high performance computational solutions makes this tool a good decision making supporting tool, especially in the case of green-field projects where it can provide the guidelines for utilizing most efficiently the existing resources. As refined in the 4th year of the project, the tool is also used to assist production engineers in configuring the operation of the manufacturing system considering the manufacturing specifications of the production elements and the current and expected demands (number of models, mix ration and so on).

Exploitable Result Deliverable and Plan

Available Resources

Design/Operation Tool

System Layout

Main Line

Sub – assembly Line

Design alternatives

Final System

| 2006-2007 Specifications | 2007-2008 Design | 2008-2009 Implementation | 2009-2010 Refinement & Industrialization | 2010-2011 Training & Competitiveness Evaluation |

Dissemination Activities

Current status

– Integration of the design and operation models into a single tool finalized
– Refinement of user interface to host the operation tool functionalities
– Interface design with SP5 models for automated data retrieval

Innovative Aspects

– Generation and evaluation of design alternatives based on multiple user defined criteria
– Ability to select the most appropriate flexibility, productivity and cost metrics depending on the situation under examination
– Consideration of the applied and expected market demands (product mix, number of models etc.) of a production system

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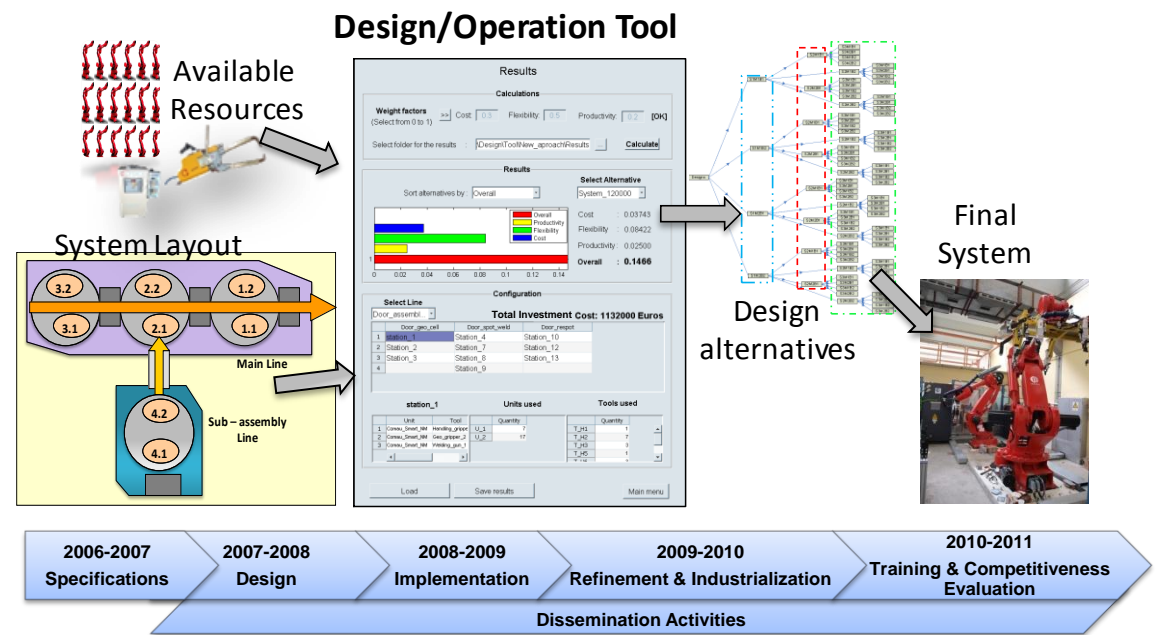# MyCar - Flexible assembly processes for the car of the third millennium

Exploitable Result #19: Flexible/reconfigurable end effectors (clamping heads/NC brackets)

Contribution to MyCar vision

The exploitable result involves the development of modular structures and reconfigurable clamping devices which can be used for positioning a wide range of components. The flexible blocking systems present:

- Simple NC block surface/contour change in accordance to part change (ability to align itself on the real panel);
- NC-Brackets can be locked in all desired position with high precision and small volume impact;
- Flexible clamping of different model parts;
- Setup with master/reference part;
- Locking of the form needles by pneumatic locking cylinder;
- Integrated ET-detection-set gives simple I/O signal for each position by teach function;
- Short term maintenance planning/execution;
- The Flexible blocking system could be installed also on a handling gripper system.
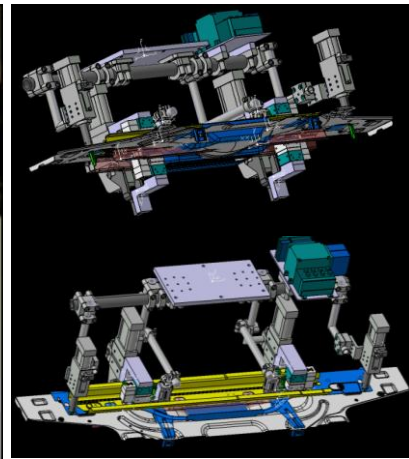
Exploitable Result Deliverable and Plan

2006-2007 Specifications	2007-2008 Design	2008-2009 Implementation	2009-2010 Refinement & Industrialization	2010-2011 Training & Competitiveness Evaluation
Dissemination Activities				

Current status

- Physical elements exist as basic samples
- Development of the special application in the MyCar pilot cases is undergoing
- Running synergies with other pilot cases from other SPs
- Development of electro-mechanic control of the pins with linear motor for a precise position control

Innovative Aspects

- Ability to align its contour from sequence to sequence
- The control of each single pin which means a full flexibility in handling
- Ability to align itself not based on panel data but the real panel
- Compact, self-locking, easy adjustable, compatible to existing clamping devices / arms

Organizational Information

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MyCar - Flexible assembly processes for the car of the third millennium

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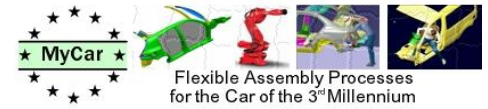
Exploitable Result #20: Variant-oriented Planning Methodology, Consulting & Services
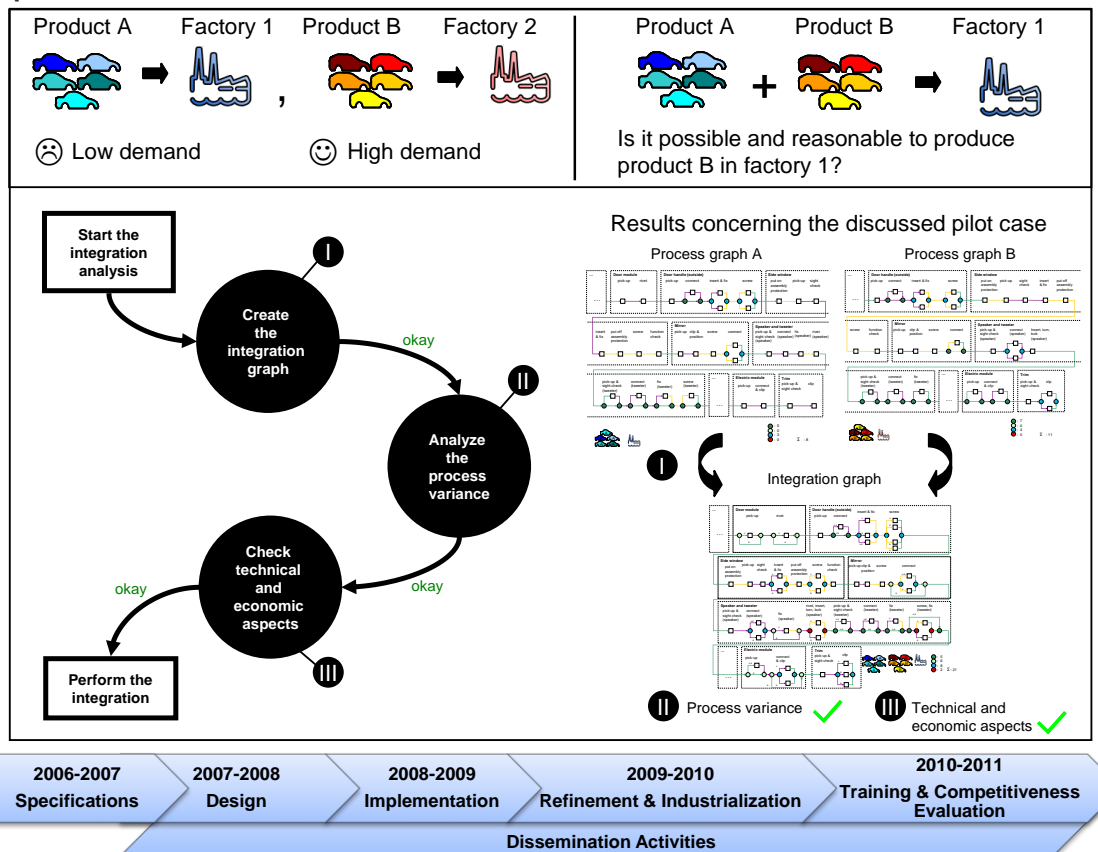
Contribution to MyCar Vision

The objective of MyCar is to achieve an ultimate degree of customization in car manufacturing. In order to be able to produce vehicles in different configurations and different quantities, flexible production lines are necessary. In general, flexibility aspects have to be considered within the planning phase of new assembly lines as well as in connection with the running production in case the demand for vehicles changes. The variant-oriented planning methodology supports car manufacturers in

- Increasing the number of variants produced in a <u>final assembly line</u> by at least 30%
- Checking flexibility aspects of <u>final assembly lines</u>

Exploitable Result Deliverable and Plan

Product A   Factory 1   Product B   Factory 2

☹ Low demand   ☺ High demand

Product A   +   Product B   →   Factory 1

Is it possible and reasonable to produce product B in factory 1?

Start the integration analysis

Create the integration graph — okay →

Analyze the process variance

Check technical and economic aspects — okay

Perform the integration

Results concerning the discussed pilot case

Process graph A   Process graph B

Integration graph

Ⅰ

Ⅱ Process variance ✓   Ⅲ Technical and economic aspects ✓

2006-2007 Specifications	2007-2008 Design	2008-2009 Implementation	2009-2010 Refinement & Industrialization	2010-2011 Training & Competitiveness Evaluation

Dissemination Activities

Current Status

- Prototype available for the creation of digital graphs (DELMIA Process Engineer)
- Connection to a digital line balancing tool (DELMIA Automatic Line Balancing)
- Pilot case (side-door scenario) implemented in the digital environment and evaluated

Innovative Aspects

- Transparent process/resource graphs which support planners as well as decision makers
- Improved cooperation between process planning and line balancing
- Methodology to systematically assess intended integration scenarios in a fast way

Organizational Information

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MyCar - Flexible assembly processes for the car of the third millennium

Exploitable Result #21: *Methodology for production-oriented product validation supported by a web-based software tool*

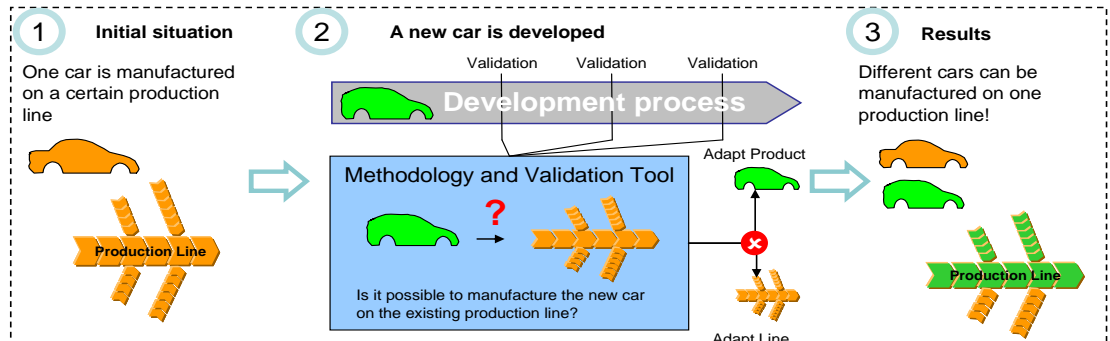### Contribution to MyCar vision

My Car aims at enabling the production of vehicles with extended degree of personalization.
A key objective is the integration of new developed products on existing production line while extending the flexibility of according production facility. The methodology aims to:

– Avoiding of costly design modification or improvement iterations
– Suppression of the gap between product design and production
– Contribution to lifecycle development cost and time reduction

Exploitable Result Deliverable and Plan

1 Initial situation

One car is manufactured on a certain production line

2 A new car is developed

Validation   Validation   Validation

Development process

Methodology and Validation Tool

?

Is it possible to manufacture the new car on the existing production line?

Adapt Product

Adapt Line

3 Results

Different cars can be manufactured on one production line!

Product / Production Engineer:
Reuse of production equipment ?

Production-oriented design graphical interface

1 Define Product Process Resource (PPR) data
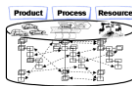
Via AutomationML interface

2 Assign validation model

Validation model configuration

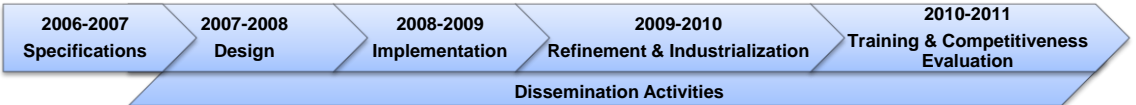Generation of **PPR-Validation** Tree
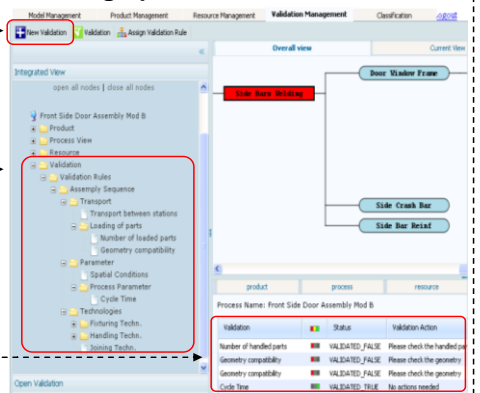
3 Execute validation procedure

Rule & constraint based validation of PPR-attributes

Aggregation & visualization of validation results

4 Identification of alternative solutions

Identification of possible problems

| 2006-2007 Specifications | 2007-2008 Design | 2008-2009 Implementation | 2009-2010 Refinement & Industrialization | 2010-2011 Training & Competitiveness Evaluation |

Dissemination Activities

Innovative Aspects

– Validation of production process regarding flexible production line
– Consideration of design decisions impact on production process during the product development
– Early and systematic application of validation methods
– Validation model extending the PPR- tree by a set of rules and constraints representing the validation methods

Organizational Information

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MyCar - Flexible assembly processes for the car of the third millennium

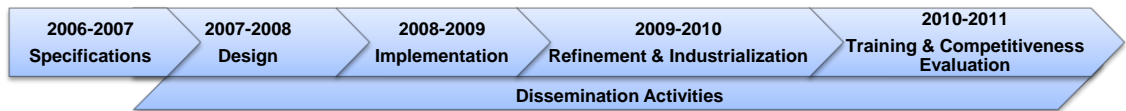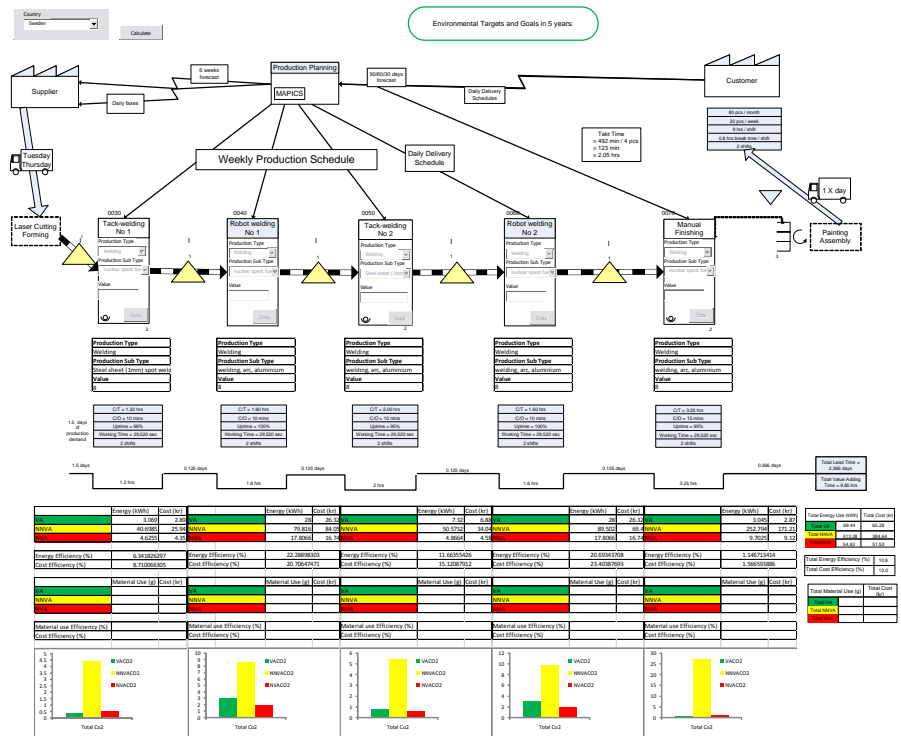## Exploitable Result #22: Environmental Optimization Tool

Contribution to MyCar vision

MyCar aims at enabling flexible production equipment with a environmental awareness leading to better manufacturing concepts and more environmental responsible OEMs.

A key objective is to evaluate new proposed flexible manufacturing solutions against the environmental impact that they will have alongside flexibility and cost. The Environmental Optimization Tool aims to:

- – Enable and support the use of LCA data when designing a new manufacturing line or cell.
- – Compare solutions on environmental impact
- – Facilitate the elaboration of alternative solutions with the aim of better sustainability

Exploitable Result Deliverable and Plan

| 2006-2007 Specifications | 2007-2008 Design | 2008-2009 Implementation | 2009-2010 Refinement & Industrialization | 2010-2011 Training & Competitiveness Evaluation |

Dissemination Activities

Current status

- – User interface implemented based on MS Visio
- – Front end connected to several LCA databases
- – New Value Stream Mapping stencil developed with connection to the LCA data
- – Ability to graphically display differences comparing two models both syntactically and semantically

Innovative Aspects

- – Graphical model comparison with color coding
- – Automatic calculation of the environmental impact using LCA data
- – Based on Value Stream Mapping notation

Organizational Information

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