



# Project „Flexible Assembly Processes for the Car of the Third Millennium (MyCar)“

## **Methodology Description (High Level)**

New ergonomics evaluation toolkit



DAIMLER



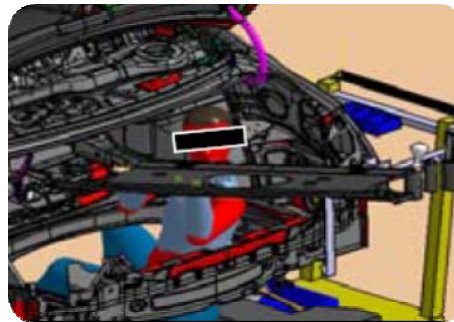
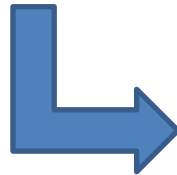
## **Methodology Description (High Level)**

**... new methods for ergonomics assessment  
of workplaces integrated in virtual manufacturing...**

## ErgoToolkit Approach



From pencil and excel based ergonomics analysis of manufacturing tasks...



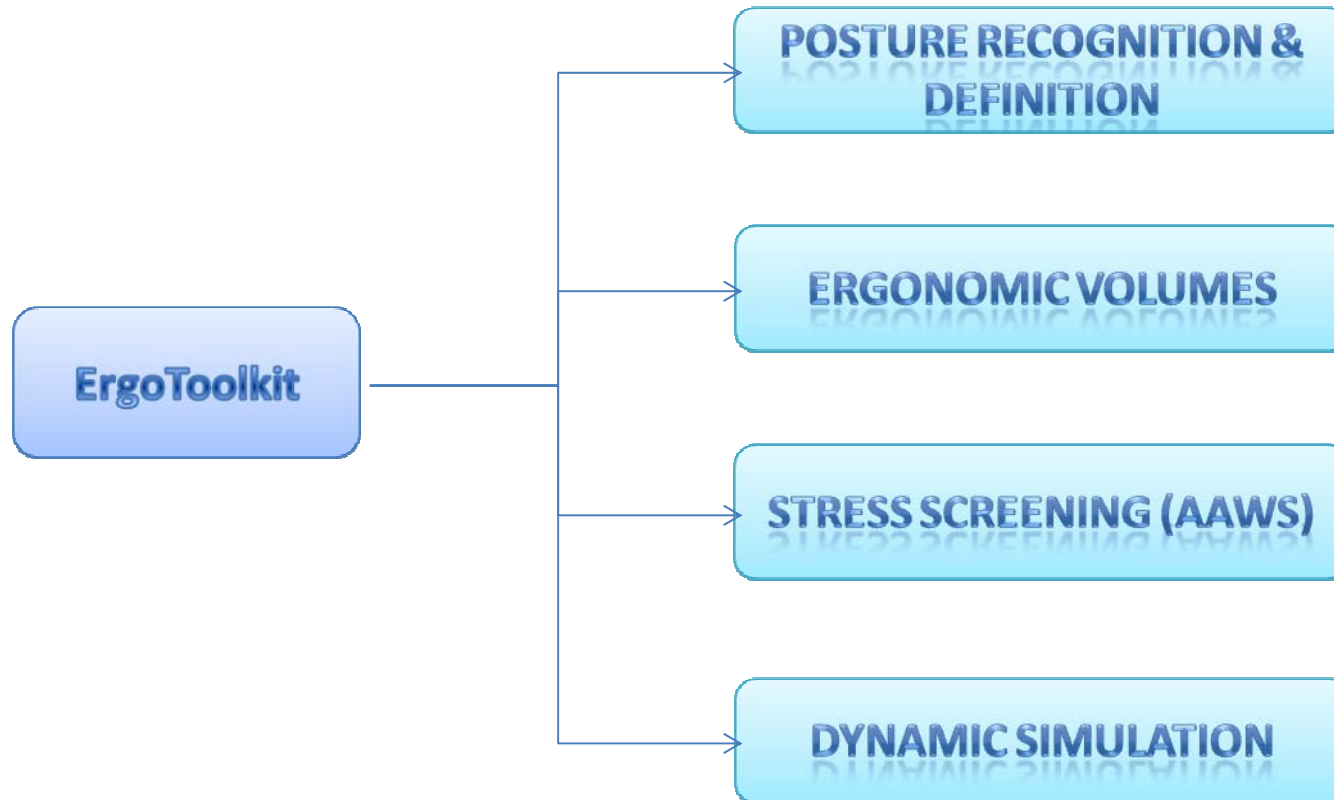
...through virtual simulation of task...



.. to fully digital ergonomics evaluation of tasks!



## ErgoToolkit Modules



# Ergonomics Volumes

## Problem

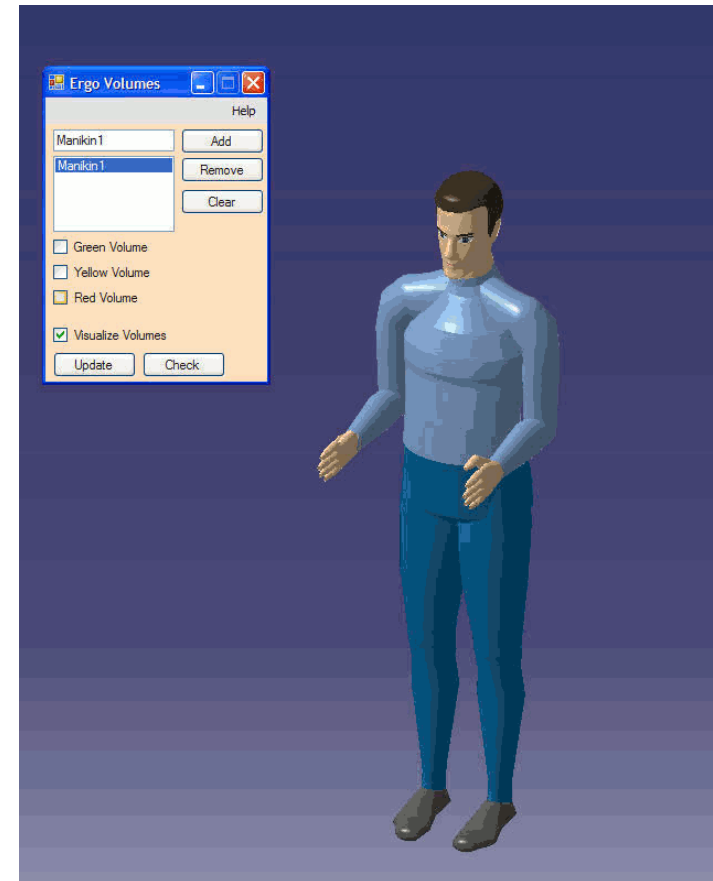
- Identify working volumes around the digital manikin.
- The bigger the distance of the working volume from the body the more prone to injuries it might be (e.g. during a carrying task).

## Solution

- A tool for definition of ergonomic volumes fully integrated in virtual manufacturing environment.

## Functionality

- Visualization / coloring of the volumes around the digital manikin
  - Non-injurious (green)
  - Possibly injurious (yellow)
  - Injurious (red)
- Adaptation to manikin's anthropometrics
- Calculation of the hands working area.



# Posture Definition and Recognition

## Problem

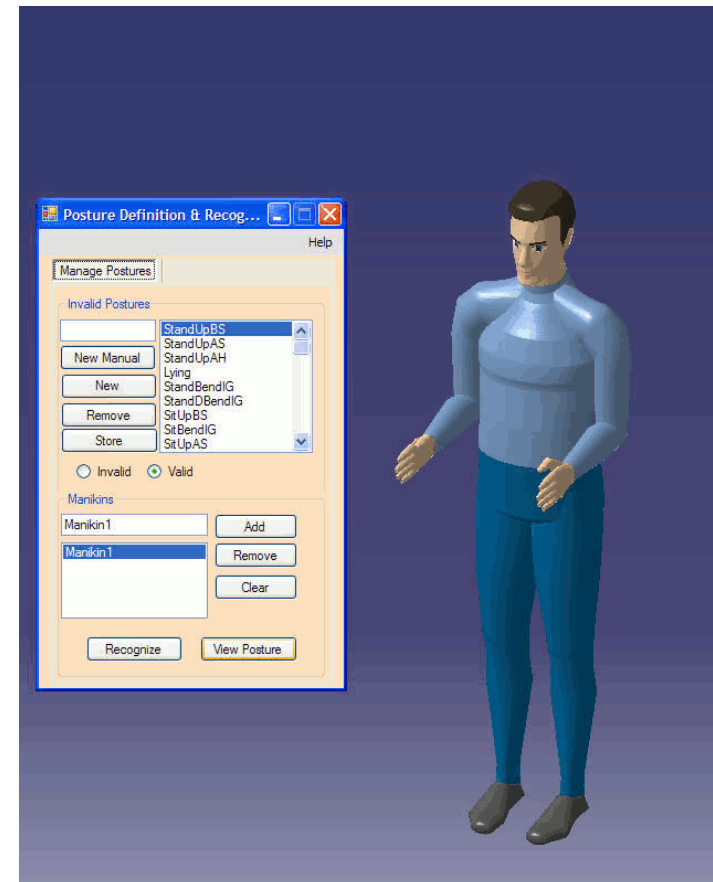
- In manual work (e.g. lifting, fitting etc) the physical stress is caused mainly by unfavorable postures of the operator
- Ergonomically unfavorable postures (e.g. kneeling, deep bending etc) are identified by the experts by "looking at" the execution of the assembly process (digital simulation, photos, documents etc) and utilizing their knowledge and experience.

## Solution

- Capture this ergonomics knowledge within the virtual manufacturing environment.

## Functionality

- Definition of postures
  - Manual posture definition
  - Predefined sets
  - Valid/invalid
- Recognition of postures
- Visualization of stored postures in the virtual environment



# Stress Screening

## Problem

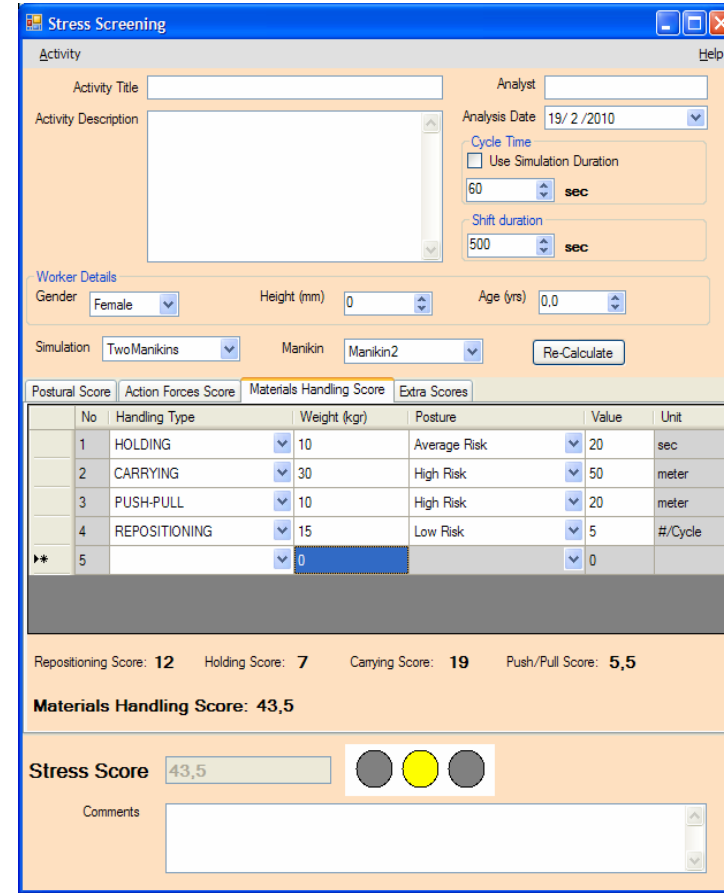
- Provide a measurable ergonomics assessment
- Consider more stress factors, apart from unfavorable postures (e.g. application of forces, handling of materials)

## Solution

- Stress Screening tool - Automotive Assembly Work-Sheet method in the virtual manufacturing environment.

## Functionality

- Utilizes human task simulation records and posture definition/recognition
- Postural score tab
- Action Forces Score
- Materials Handling Score



The screenshot shows the 'Stress Screening' software interface. It includes fields for Activity Title, Analyst, Analysis Date, Cycle Time, Use Simulation Duration, Shift duration, Worker Details (Gender, Height, Age), Simulation (TwoManikins, Manikin, Manikin2), and a Re-Calculate button. Below these is a table with tabs for Postural Score, Action Forces Score, Materials Handling Score, and Extra Scores. The Materials Handling Score tab is active, showing a table with columns: No, Handling Type, Weight (kgr), Posture, Value, and Unit. The table contains five rows of data. Below the table, there are summary scores: Repositioning Score: 12, Holding Score: 7, Carrying Score: 19, Push/Pull Score: 5,5, and Materials Handling Score: 43,5. At the bottom, there is a Stress Score field showing 43,5, a color-coded indicator (yellow circle), and a Comments field.

No	Handling Type	Weight (kgr)	Posture	Value	Unit
1	HOLDING	10	Average Risk	20	sec
2	CARRYING	30	High Risk	50	meter
3	PUSH-PULL	10	High Risk	20	meter
4	REPOSITIONING	15	Low Risk	5	#/Cycle
5		0		0	

Repositioning Score: 12   Holding Score: 7   Carrying Score: 19   Push/Pull Score: 5,5

**Materials Handling Score: 43,5**

**Stress Score** 43,5

Comments

# Dynamic Simulation

## Problem

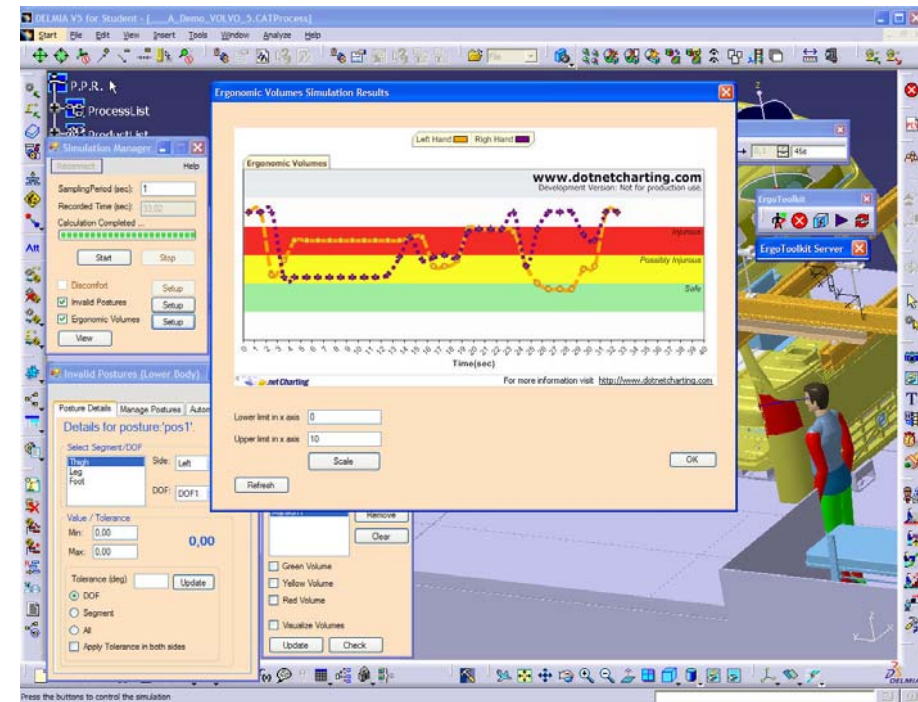
- Ergonomics evaluation tools mostly provide static ergonomics analysis of the task at hand.

## Solution

- ErgoToolkit can be used in dynamic simulation mode. The user runs a dynamic simulation in DELMIA, and at the same time configure ErgoToolkit to record values (i.e. postures, ergonomic volumes) during the simulation that can be used for future analysis.

## Functionality

- A time plot identifying the volume, in which the left and right hands were placed/moving during the simulation playback.
- A time plot indicating the postures of the lower body.
- A segmentation of the motion into a list of 'static' postures.





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## Benefits

- Reduce assembly costs related to injuries of human that perform assembly tasks
- Gain of time in ergonomics evaluation. Faster and easily-repeatable ergonomics analyses of the same tasks with different variants of the products.
- Improvement of ergonomics assessment process and better traceability of results; results can be documented in a standardized form.