imk automotive

FRAMO

ergon nomos

innovations methods koncepts

# Interactive Preproduction Planning and Ergonomic Assessment with ema –

## Introducing the “Editor for Manual Work Activities”

GOErgo presents
The 14th Annual applied ergonomics CONFERENCE 2011
Practitioners talking with practitioners

# Agenda

**1. imk automotive, Inc.**

2. ema[5] Approach

3. ema[5] Application

4. imk Services

# imk Guiding Principles

**innovations**

- **are our passion.**
  Creative thinking is embedded in our company culture.
  Innovation enables us to generate long-term competitive advantages for our customers.

**methods**

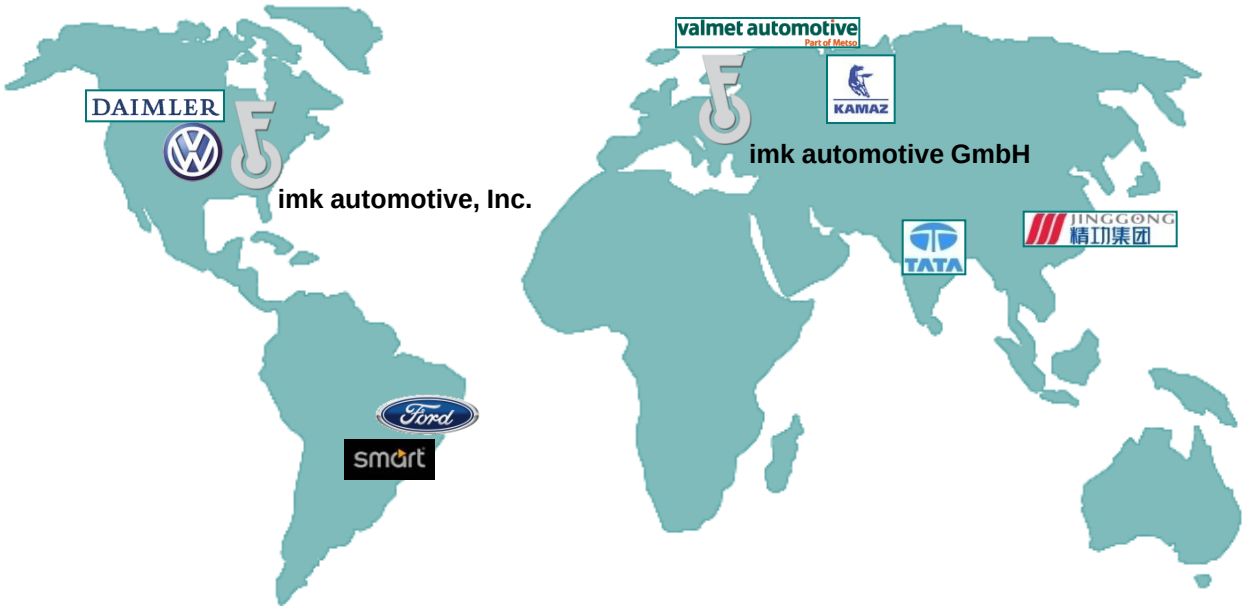
- **are our foundation.**
  They assure quality and ensure our project deadlines.
  We continuously improve our performance by developing and extending our range of methods.

**koncepts**

- **are our result.**
  They are created by the interaction of innovation, methods, and professional experience.
  Our success is defined by measurable customer success.

# imk Locations and Customers

**Worldwide dedicated to the success of our customers.**




Automotive industry, mechanical engineering, industrial commodities, renewable energies, information systems, and aerospace industry.

**European Customers**

DAIMLER, smart, Audi, BMW, KIROW LEIPZIG, SOLARIS, HeiterBlick, KUNZE, indikar, Autoliv, FARMINGTONS AUTOMOTIVE, TAKATA, PRETTL electronics, KENERSYS, CLAAS, starragheckert the milling experts, CarTrim, Webasto Feel the drive, TESA, KUKA, Dräxlmaier, HELLA, KBA, ABB, SALZGITTER ANTRIEBSTECHNIK, PEGUFORM

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# imk Business Segments

## Cross-industry consulting and engineering solutions.

### Product Development
Dr. Jens Trepte

- Battery-electric Vehicles
- Mechatronic Systems
- Structural Components

### Production Process Development
Carsten Otto

- Process Design
- Manual Production & Assembly
- Body In White

### Information Technology
Gerson Heuwieser

- Software Development
- Training
- Support & Service

### Consulting
Ingolf Grüßner

- Production Strategy
- Product & Production Optimization
- Ergonomics

### Strategic Development
Dr. Wolfgang Leidholdt

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## Human work planning on its way into the 3D Virtual Factory?

### MTM / UAS Basic activities

| Get and Place | | | Dist. Rang. cm | <= 20 | > 20 to <= 50 | > 50 to <= 80 |
|---|---|---|---|---|---|---|
| | | | Code | 1 | 2 | 3 |
| <= 1 daN | Easy | approx. | AA | 20 | 35 | 50 |
| | | loose | AB | 30 | 45 | 60 |
| | | tight | AC | 40 | 55 | 70 |
| | Difficult | approx. | AD | 20 | 45 | 60 |
| | | loose | AE | 30 | 55 | 70 |
| | | tight | AF | 40 | 65 | 80 |
| | Handful | approx. | AG | 40 | 65 | 80 |
| > 1 to <= 8 daN | | approx. | AH | 25 | 45 | 55 |
| | | loose | AJ | 40 | 65 | 75 |
| | | tight | AK | 50 | 75 | 85 |
| > 8 to <= 22 daN | | approx. | AL | 80 | 105 | 115 |
| | | loose | AM | 95 | 120 | 130 |
| | | tight | AN | 120 | 145 | 160 |
| Place | | | Code | 1 | 2 | 3 |
| approximate | | | PA | 10 | 20 | 25 |
| loose | | | PB | 20 | 30 | 35 |
| tight | | | PC | 30 | 40 | 45 |
| Operate | | | Code | 1 | 2 | 3 |
| one single operation | | | BA | 10 | 25 | 40 |
| compound operation | | | BB | 30 | 45 | 60 |

| Handle Tool Get, Place and Place aside | Code | 1 | 2 | 3 |
|---|---|---|---|---|
| approximate | HA | 25 | 45 | 65 |
| loose | HB | 40 | 60 | 75 |
| tight | HC | 50 | 70 | 85 |
| **Motion Cycles** | **Code** | **1** | **2** | **3** |
| one motion | ZA | 5 | 15 | 20 |
| motion sequence | ZB | 10 | 30 | 40 |
| shift and one motion | ZC | 30 | 45 | 55 |
| Fasten or Loosen | ZD | 20 | | |
| **Body Motions** | **Code** | | | |
| walk / m | KA | 25 | | |
| bend,stoop,kneel incl. arise | KB | 60 | | |
| sit and stand | KC | 110 | | |
| **Visual Control** | **VA** | 15 | | |
| **Process times** | **Code** | | | |
| Process time restricted | PTU | 1 | | |
| Process time unrestricted | PTB | 1 | | |
| Process time | PT | 1 | | |

## How to achieve better results with less effort?

# Planning of Human Work Today

- Today's digital human models cannot understand standardized work instructions.
- Each particular movement has to be taught manually by highly qualified engineers.
- Compiling dynamic simulations of human work is complicated and costs a lot of time.
- Simulation models do not provide suitable tools for analyzing assembly time and ergonomics.

# What is ema?

- ema is the evolution from the unskilled digital human model to the virtual craftsman.
- ema is providing the human model the skills to understand and act according to standard work instructions.

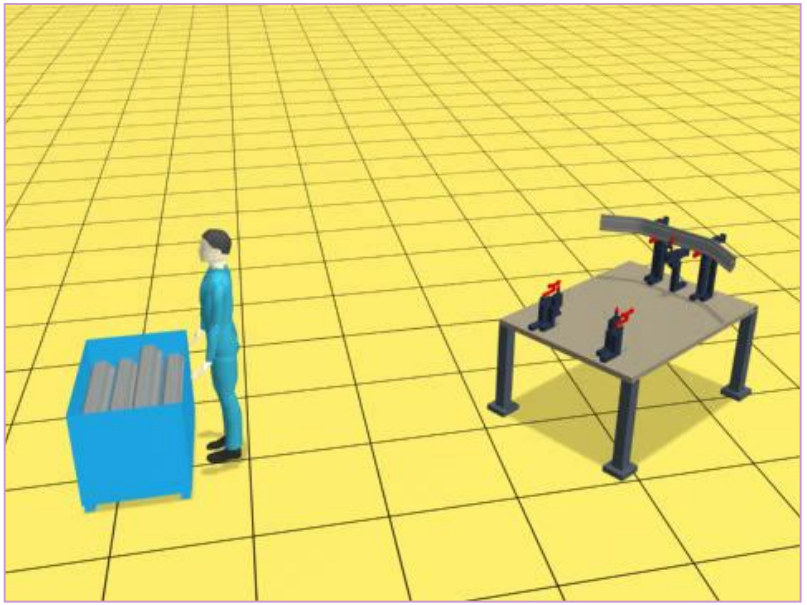
## How is that possible?

# What is ema[5]?

The production planner is not a **Pixar™ animator!**

Instead of teaching each single posture ema[5] uses **complex operation steps**, e.g.

- get and place object
- use hand tool / screw
- ingress / egress car
- etc. (~300 operations)

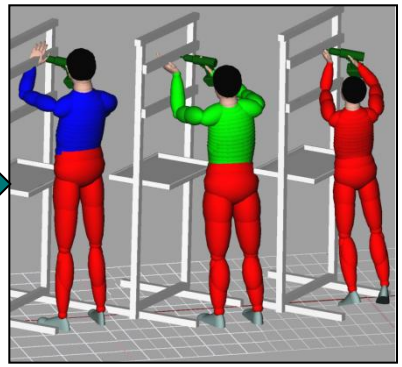


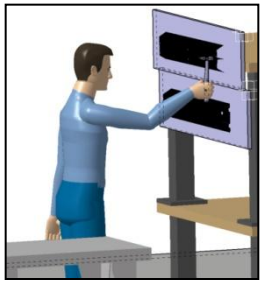
**Not:** Step(s) forward → stand upright → bend → hand to the object → pick → object to body → step(s) sideways → turn → step(s) forward → bend → object to target → let loose → hand back

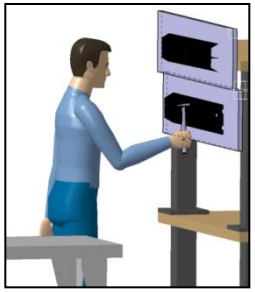
**But:** take part out of box and place to corresponding appliance

# What is ema[5]?

**Complex operation steps** are based on intensive research studies recording experienced workers with motion capturing technologies.





# What makes ema unique?

**ema brings human life into the virtual factory.**

- ema understands work instructions.
- ema moves just like real humans do.
- ema is based on MTM standard times.
- ema allows reliable ergonomic evaluations.
- ema can be adapted to any PLM infrastructure.


**ema enhances simulation quality, enables quick simulation updates, and saves up to 90% time.**

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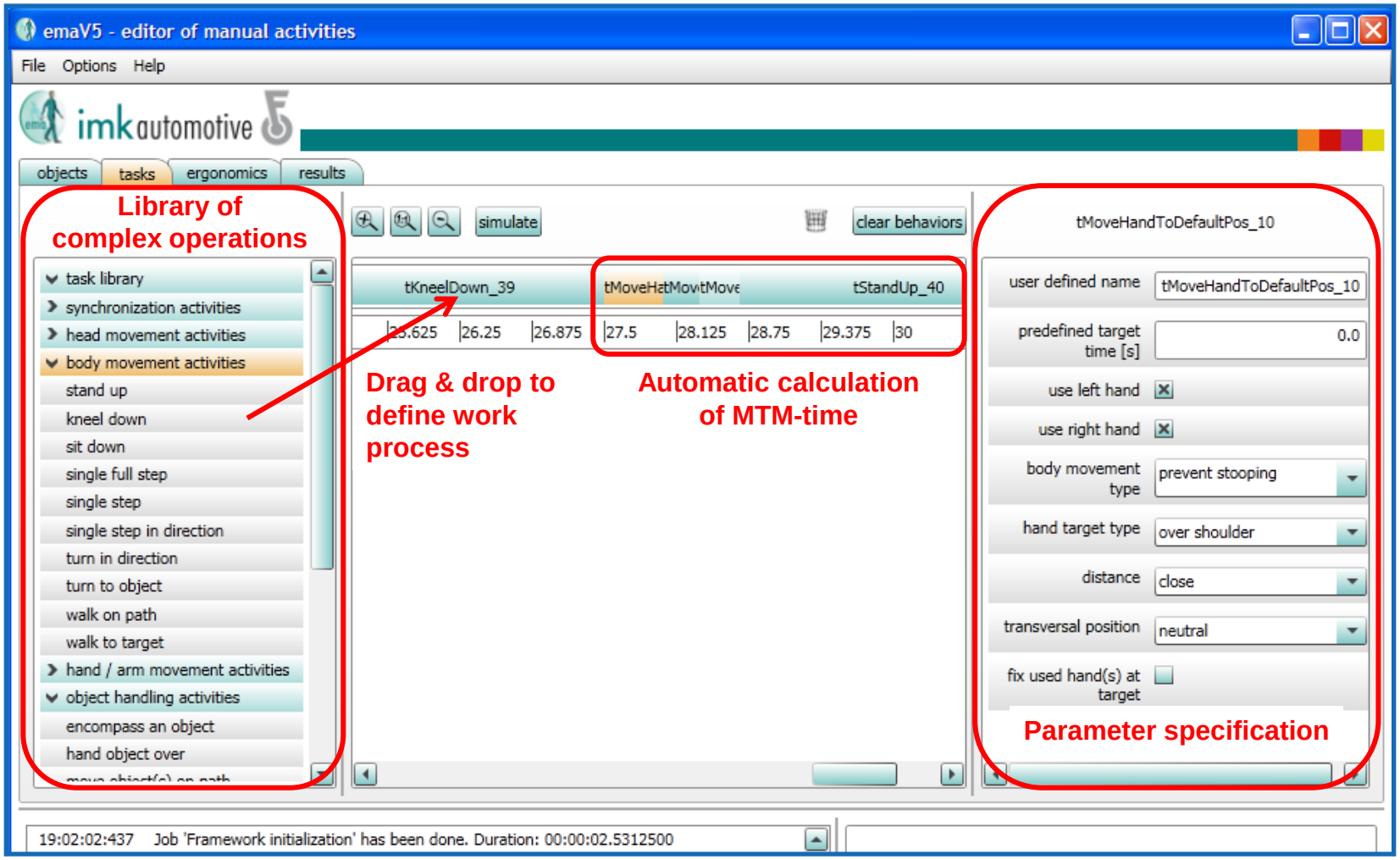
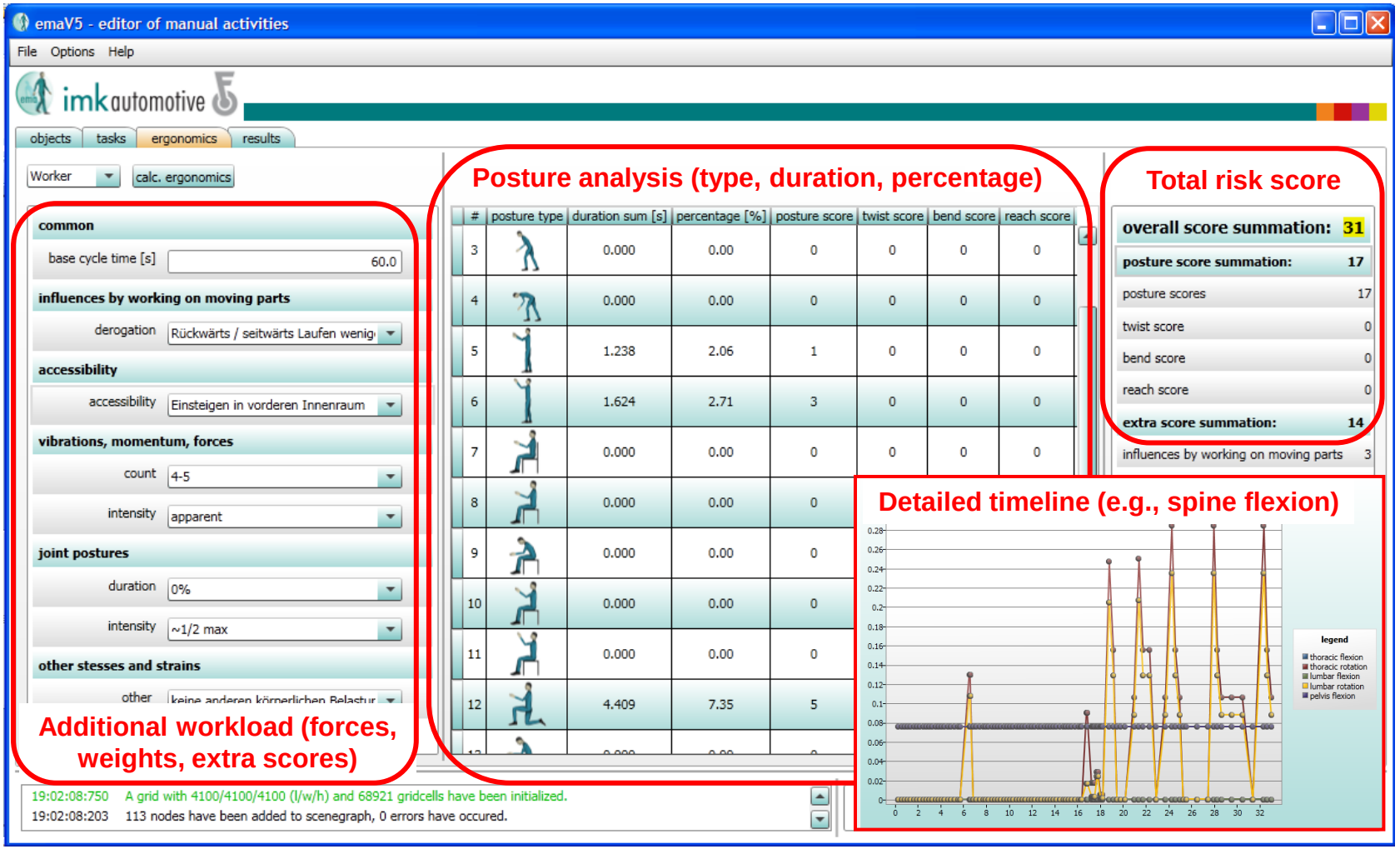
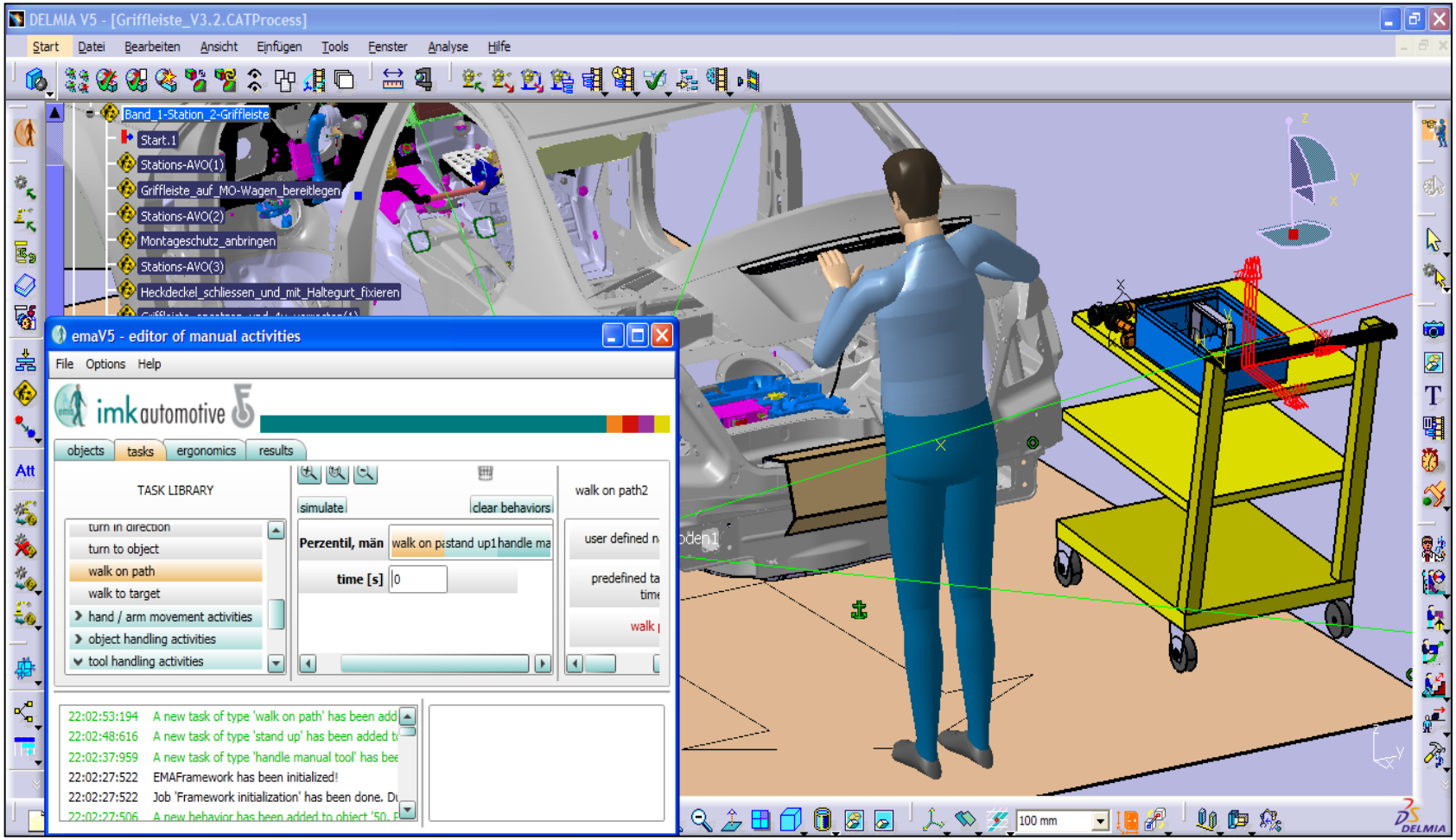
# ema⁵ GUI for Task Definition



# ema GUI for Ergonomic Evaluation



# ema Video Example: Deck Lid Assembly



# ema Features V1.0

## Standard features of ema V1.0

- Library of elementary complex operation steps
- Full integration into PLM infrastructure of DELMIA V5
- Intuitive graphical user interface in German & English language

## Analysis functions of ema V1.0

- Collision avoidance based on bounding volumes
- Plausibility check regarding the logical sequence of operations
- Automatic determination of walking paths and grip points on objects
- Calculation of standard times (MTM1) and automatically generated times
- Full ergonomic assessment based on standard “Automotive Assembly Worksheet”
- Synchronization points for the temporal coordination of activities for multiple workers

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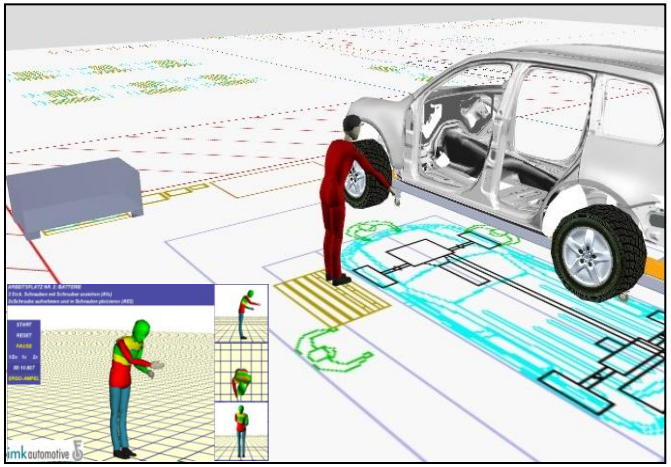
# imk Services in the United States

**Experts in integrating human Workforce into efficient production processes.**

- Ergonomic analysis and consulting
  - Preventive production planning:
    identification of ergonomic weaknesses in the design of products, processes, and equipment
  - Optimization of series production:
    improvement of ergonomic conditions to keep workers' health and increase efficiency
- Customized trainings in Ergonomics
- Customized pilot applications of ema
- Digital Production Planning / 3D validation
- Lean manufacturing & Industrial engineering



# imk Reference Volkswagen Chattanooga

**Ergonomic workplace design for ramp-up of entire VWGoA Chattanooga plant.**

- Ergonomic evaluation of all manual work in Assembly, Body, Paint, and Logistics
- Status visualization on “Ergonomic Map”
- Development of counter measures for improving ergonomic conditions (e.g., work process optimization, tools & parts design)
- Follow-up workshops to test and facilitate implementation of counter measures
- Documentation and continuous status reporting to Plant Management

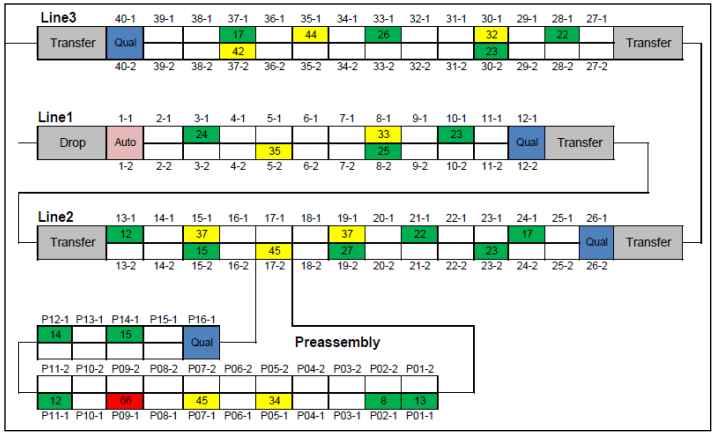



*Figure 1: Status visualization on Ergonomic Map*

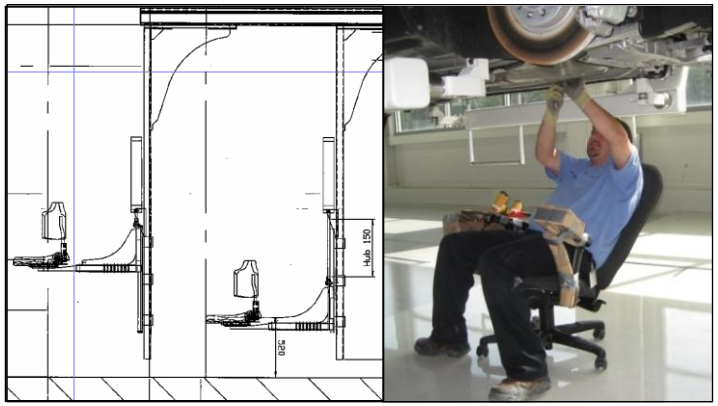


*Figure 2: Development and testing of counter measures*

# imk Contact Information

**We're here to help! For more information please contact:**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