

# Application Technology (APT)

## Automated Glazing in the Final Assembly

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Dürr Systems GmbH

Montagesysteme 2011  
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# Agenda

- Dürr at a Glance
- Automated Glazing in the Final Assembly
- Requirements
- Measures and Solutions

# Global systems partner to the automotive and supplier industry



- World market leader in painting, balancing and cleaning technology, leading position in final assembly technology
- Appr. 60% of paint shops and appr. 50% of assembly plants are equipped with Dürr technology worldwide
- Globally represented:
  - subsidiaries in 21 countries
  - 48 locations
  - 31 production facilities
- Sales 2010: € 1300 million
- Employees 12/31/2010: 5,915
- Founded in 1895
- Initial public offering in 1989

# Global presence – in Europe...



## Germany

Bietigheim-Bissingen  
Bernried  
Braunschweig  
Darmstadt  
Filderstadt  
Grenzach-Wyhlen  
Monschau  
Ochtrup  
Püttlingen  
Stollberg  
Wolfsburg

## Austria

Zistersdorf

## Czech Republic

Oslavany-Padochov

## France

Cergy-Pontoise  
Loué  
Guyancourt  
Uxegney

## Great Britain

Warwick



## Italy

Beinasco  
Novogro di Segrate  
Paderno Dugnano  
Rodano

## Netherlands

Rotterdam

## Poland

Radom

## Slovakia

Bratislava

## Spain

Madrid  
San Sebastian  
Valladolid  
Viladecans

## Switzerland

Rheineck

## Turkey

Istanbul

# ...in North and South America



**Brazil**  
São Paulo

**Mexico**  
Queretaro

**USA**  
Auburn Hills, Michigan  
Bowling Green, Ohio  
Deer Park, New York  
Plymouth, Michigan  
Wixom, Michigan

# ...in Asia and Africa

## China

Beijing  
Shanghai

## India

Chennai  
Delhi

## Japan

Osaka  
Yokohama

## Russia

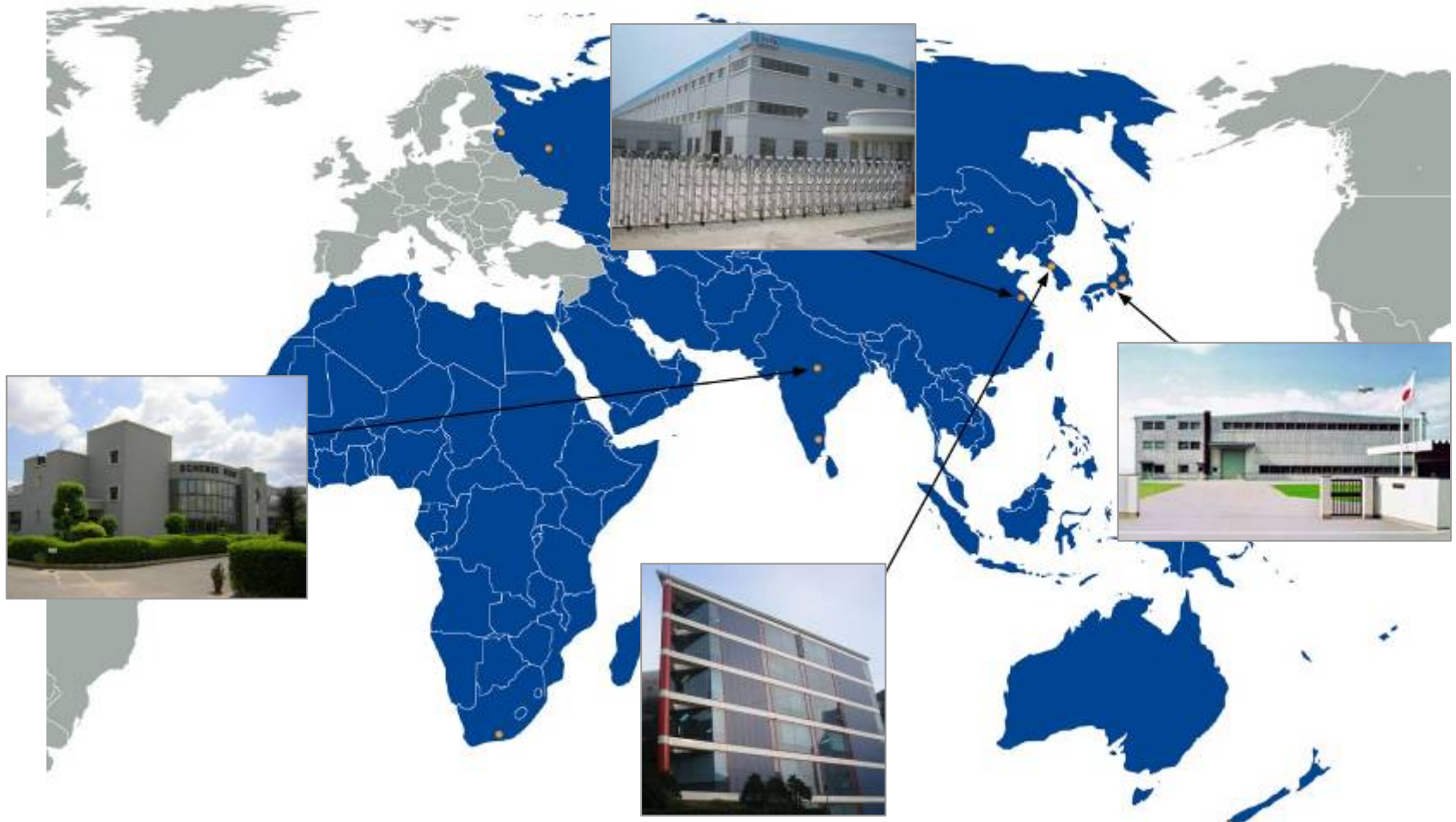
Moscow  
St. Petersburg

## South Africa

Port Elizabeth

## South Korea

Seoul



# Main activities of our Business Units



Paint and Final Assembly Systems (PFS)	Application Technology (APT)	Environmental & Energy Systems (EES)	Aircraft and Technology Systems (ATS)	Balancing and Assembly Products (BAP)	Cleaning and Filtration Systems (CFS)
<p>Turnkey paint shops and final assembly plants; service and modernization of existing facilities.</p>	<p>High-tech systems and software for automated paint, sealing and gluing application.</p>	<p>Technology for exhaust-air purification and for disposing of liquid residues as well as energy management.</p>	<p>Assembly and paint systems for the aviation industry.</p> <p>Consulting for automotive/ aircraft manufacturing and general industry.</p>	<p>Balancing and diagnostic systems. Assembly, testing and filling technologies for final vehicle assembly.</p>	<p>Cleaning, filtration and automation systems for engine and transmission production as well as for metal-cutting and other metalworking processes.</p>
					

# APT - Our Markets



Automatic paint application for car bodies



more than 4900 robots

Paint shops for plastic parts for cars and for the general industry



plastic parts

Automatic sealing application for car bodies  
Gluing in final assembly



more than 700 robots

sealing



trucks



e.g. aviation and space industries



more than 360 robots

gluing/glazing

Including all paint and material supply systems

# Gluing in Car Production

## Properties of bonded joints

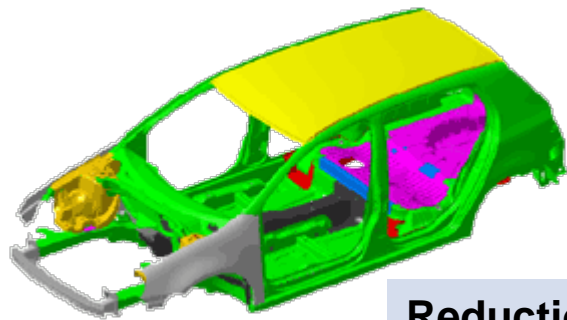


Source: Henkel

Decrease of costs due to automation



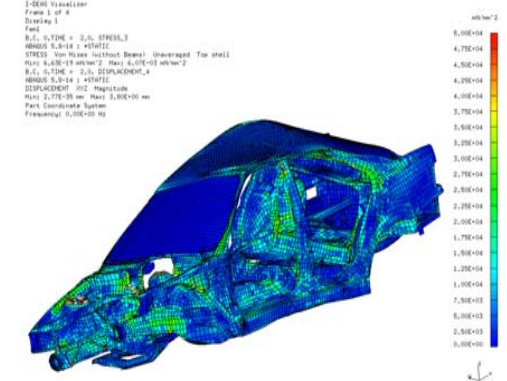
Increase of comfort due to damping of adhesive



Source: ika

Reduction of vehicle weight due to joining of different materials

Increase of car body stiffness



Source: BMW, Sika

# Gluing Processes in the Final Assembly



**Glazing**



**Roof module insertion**



**Cockpit assembly with gluing**



**Spare tire storage area/ battery box gluing**



**Interior roof cover insertion**

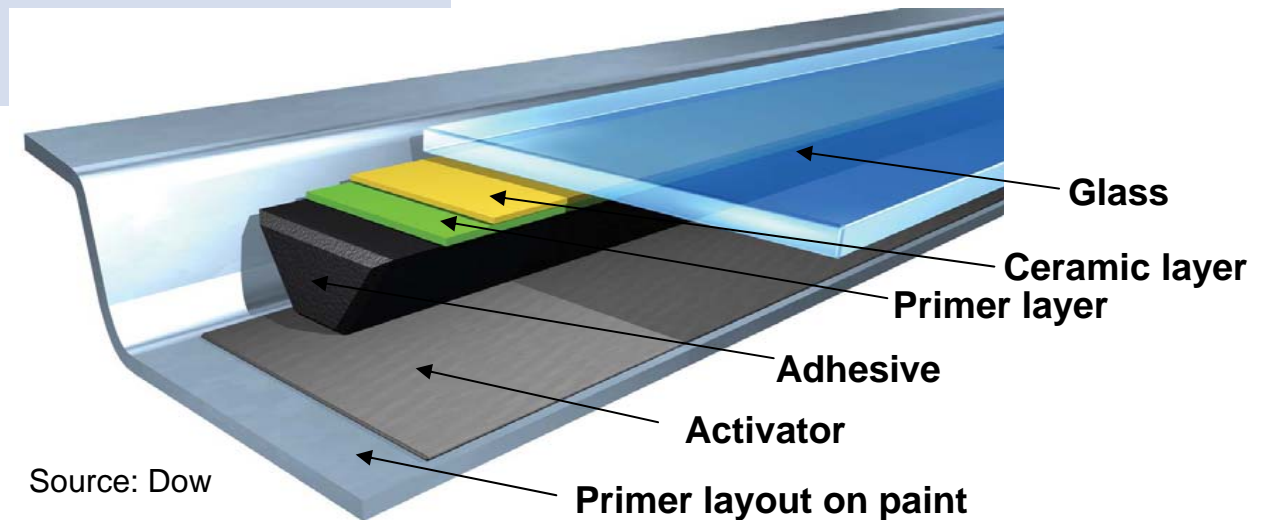
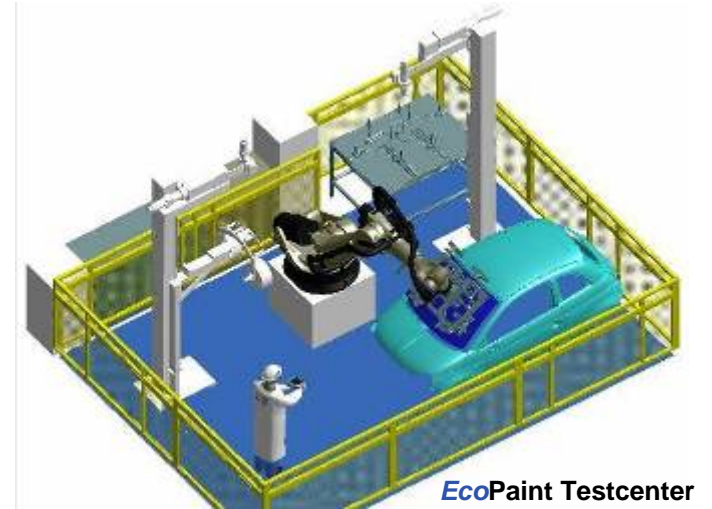


# Glazing

## Process description of glazing

### Process steps

- Glasses handling and centering
- Surface preparation
- Application of moisture curing adhesive, highly viscous to avoid displacement after joining
- Assembling
- Fixing / curing
- Quality measurements



# Requirements

## Automated Glazing in the Final Assembly



# Quality

- Accuracy and repeatability
- Mechanical properties - safe bonding - crash relevant components
- Integrity of the bond

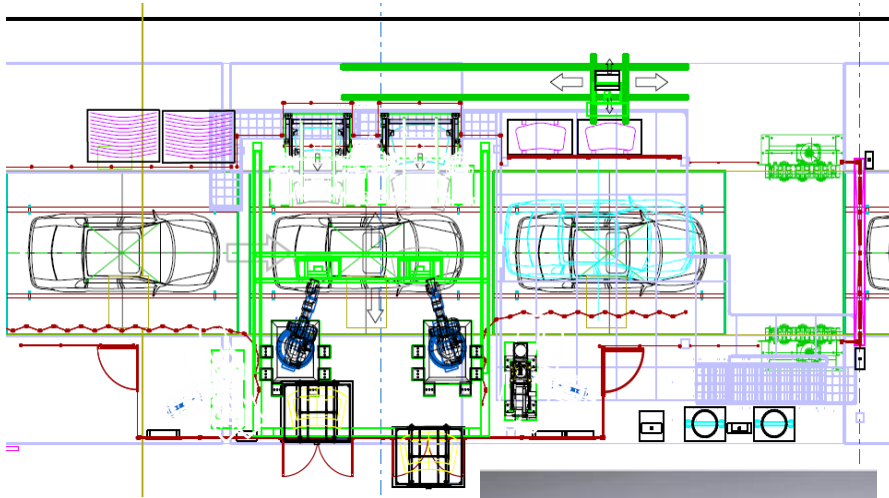


**High-precision position and geometry of the bond**



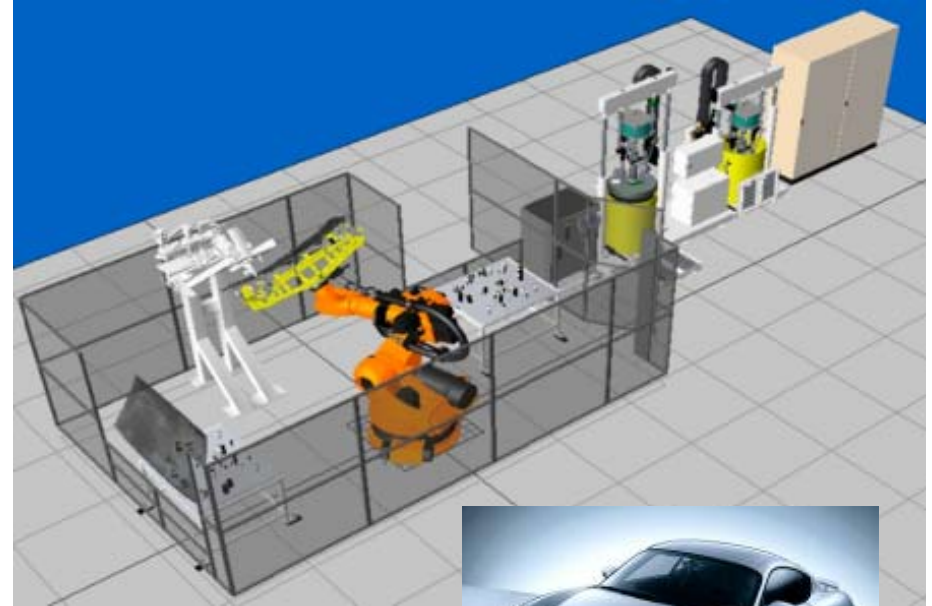
**Safety relevant bonding (crash relevant)**

# Production - Volume / Flexibility



**High number of units - max. production rate**

Fully automated glazing and insertion  
for „Highrunner“ models



**High variation of units - more flexibility**

Automated gluing and manual insertion  
for small series

# Cost Reduction

- **Material costs**

Reduction in material consumption due to synchronized, high-precision dosing and motion

- **Manpower costs**

Reduction in manual scope of work and rework due to automation

- **Increase in productivity**

Increased uptime, reduction of non-productive time, minimized cycle time due to high dynamics

- **Operating costs**

Reduction of energy consumption due to optimum equipment concepts, low-maintenance hardware

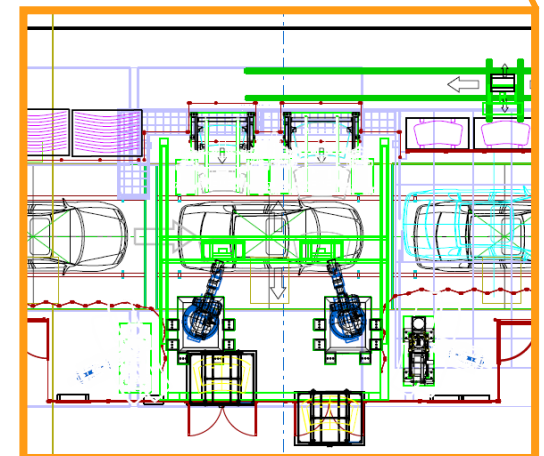
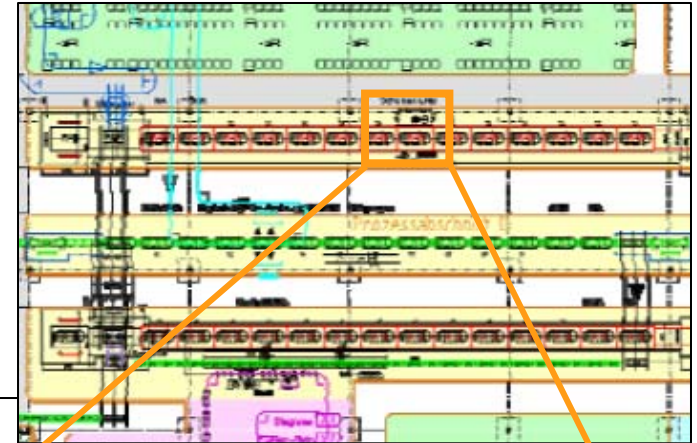
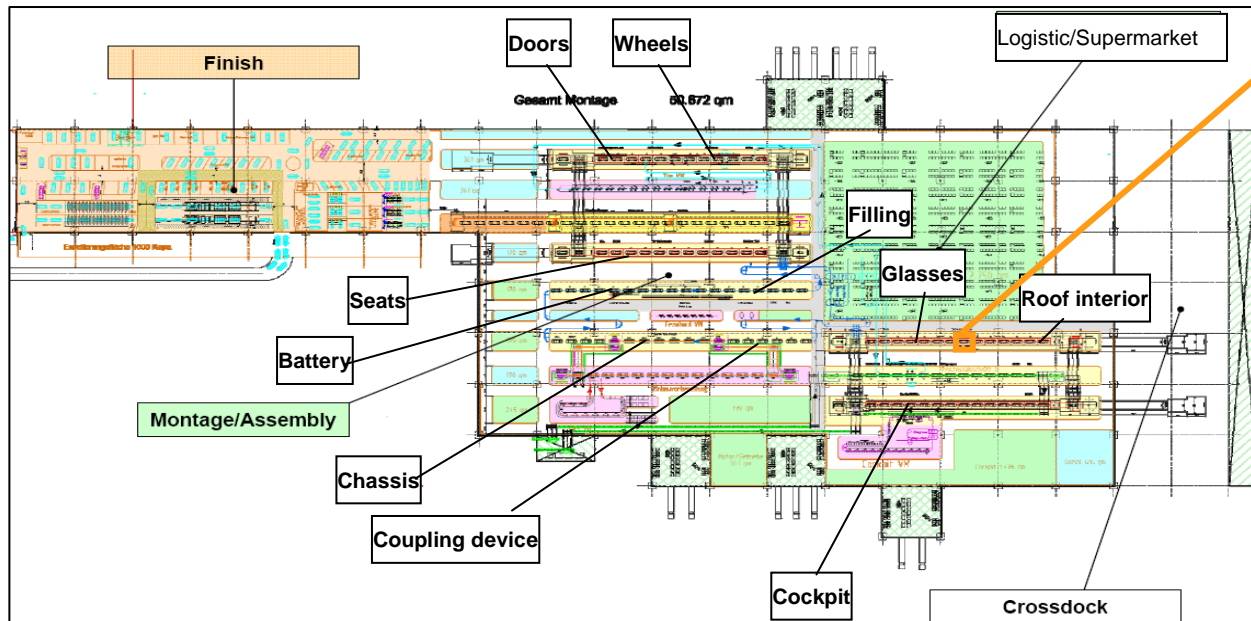
- **Investment costs**

Cost-optimized automation solutions

# Layout Optimization



Maximum productivity, on minimal required space



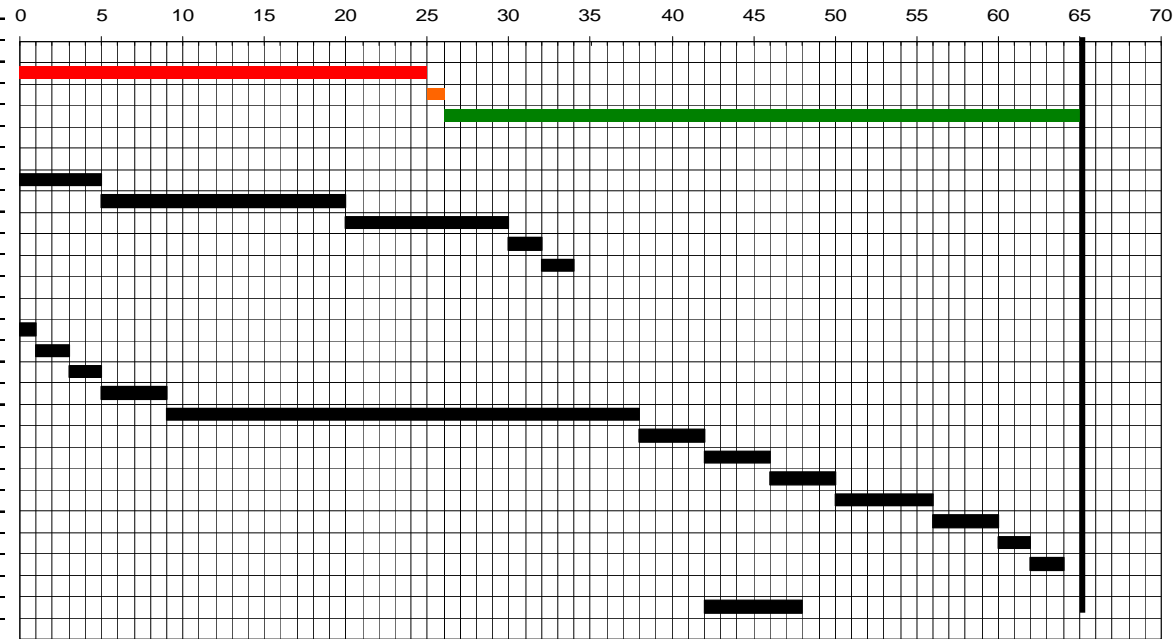
# Cycle Time

## Diagram

Cycle time = 65 sec

Application time = 29 sec

Task	Dur.	Time
Glass roof assembly		
Entrance carbody	25,0	25,0
Measuring carbody by sensor	1,0	26,0
Carbody standstill	39,0	65,0
<b>Manual Operation:</b>		
Take up windshield from container	5,0	5,0
Go to glazing cell	15,0	20,0
Upload windshield in centering unit	10,0	30,0
Return to collisionfree position	2,0	32,0
Center windshield	2,0	34,0
<b>Automatic Operation</b>		
Start robot	1,0	1,0
Gripper to centering station	2,0	3,0
Pick up windshield	2,0	5,0
Movement to adhesive nozzle	4,0	9,0
Adhesive application	29,0	38,0
Movement to carbody	4,0	42,0
Measurement of carbody cut-out	4,0	46,0
Insertion of windshield	4,0	50,0
Press on windshield	6,0	56,0
Measurement of post assembly position	4,0	60,0
Return of robot to collisionfree position	2,0	62,0
Return of robot to base position	2,0	64,0
Nozzle cleaning	6,0	48,0



**Minimal cycle times, require optimal coordinated processes**

# Environment

- Reduction of emission
- Reduction of material consumption
- No material wastage
- Energy saving



Blue mussel with fibers of high strength and elastic adhesive



Insect-eating plant with adhesive for catching prey

## Gluing in nature ...

... and in industry



Material wastage



Energy consumption

# Measures and Solutions

## Additional Requirements of Gluing Processes



**From the point of view of a system manufacturer**

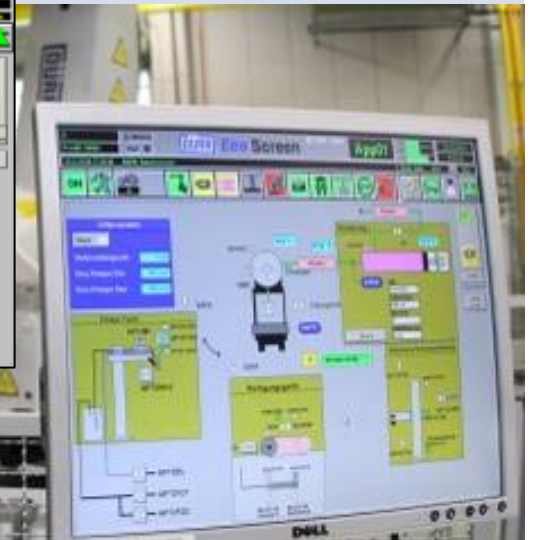
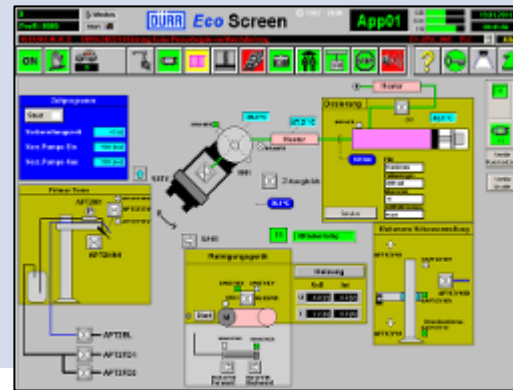
- **Engineering and Planning**
- **Testcenter**
- **Surface pre-treatment**
- **Surface pre-treatment with hydro-activator**
- **Application technology**
- **Glass handling**
- **Operator interface**

# Additional Requirements for Gluing Processes



An adhesive bond integrates multiple functions, but this also increases requirements for the system manufacturer

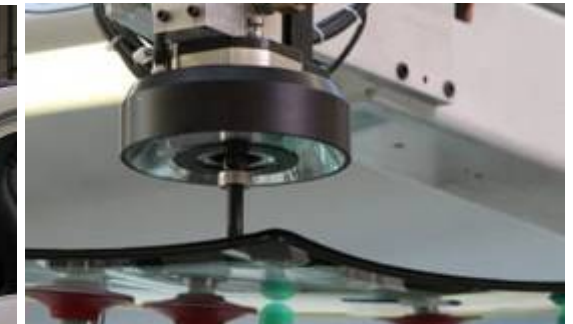
- Application monitoring
- Pot life and temperature control
- Quality measurement
- Monitoring of setting parameters



## Fulfillment of the additional requirements

- Crash stability
- Durability
- Stiffness, strength, mechanical properties
- Integrity of the bond

 **Increase of quality**



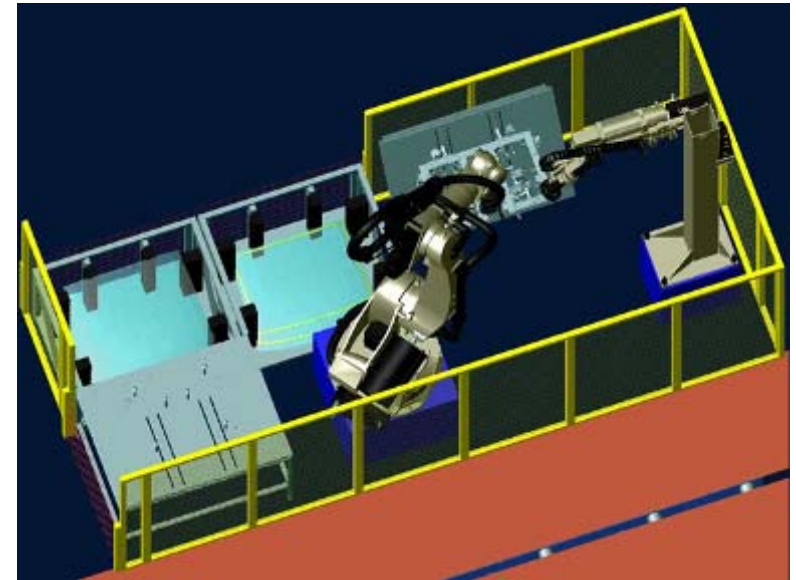
# Engineering and Planning

Process simulation = **3D-Offline Analysis**

- Modeling of robot and gluing cell for layout
- Offline analysis for free movement and accessibility
- Dynamic model for cycle time analysis

- ➔ **Layout optimization**
- ➔ **Reduction of cycle time**
- ➔ **Increase of production volume**

[For Video click here](#)



# Testcenter



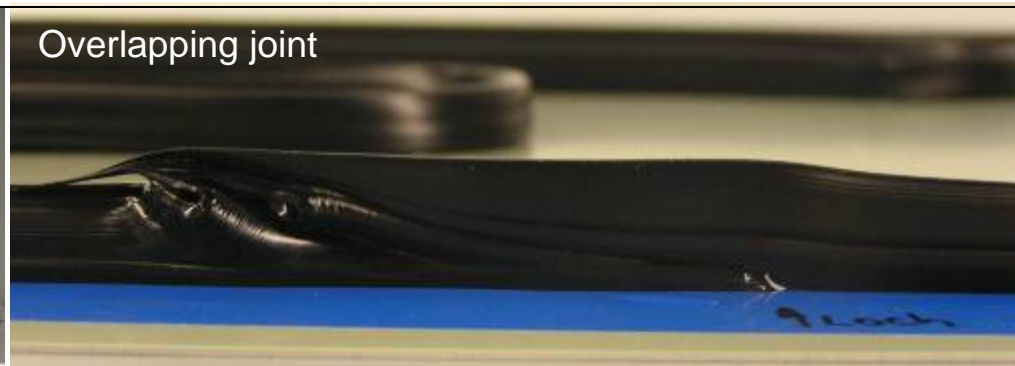
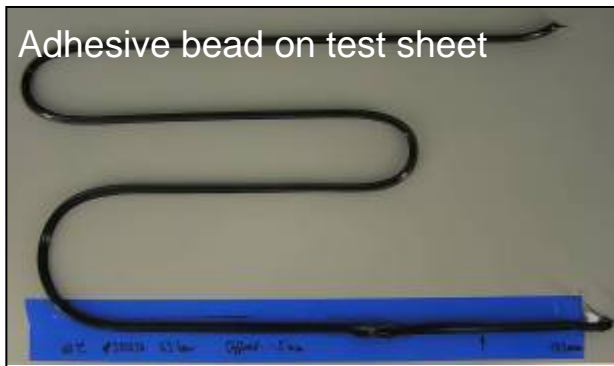
Validation of new processes by testing  
close-to-production conditions

= **Ecopaint Testcenter**

- Customer tests
- Product- and process development
- Testing of new materials

Detection of process parameters and  
programming of robot track in customer projects  
= reduction of commissioning time  
= reduction of investment costs

- ➔ **Cost reduction**
- ➔ **Cycle time**
- ➔ **Higher quality**



Example: Selection of a new adhesive to avoid slipping of window panels after joining

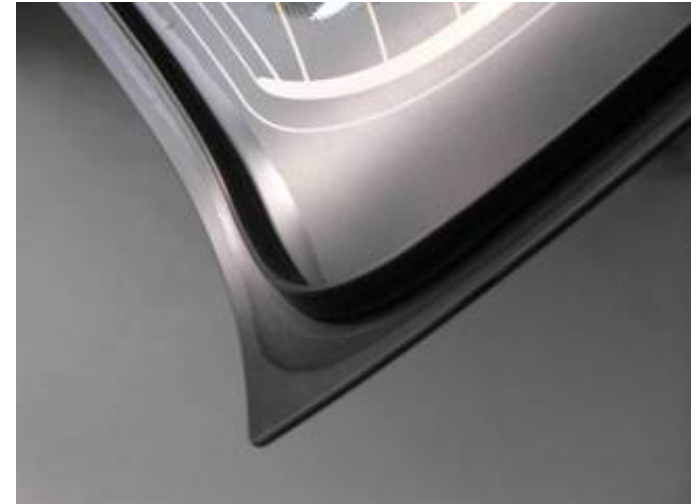
# Surface pre-treatment

Primer or activator = **EcoGun Gluing N** or **EcoGun Gluing S**

- Adhesion enhancement
- UV protection
- Durability improvement

## Possible processes

- Felt application
- Spray application



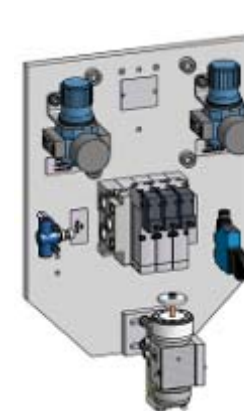
Dosing with highest accuracy = minimal material consumption

➔ **Higher environmental acceptability**

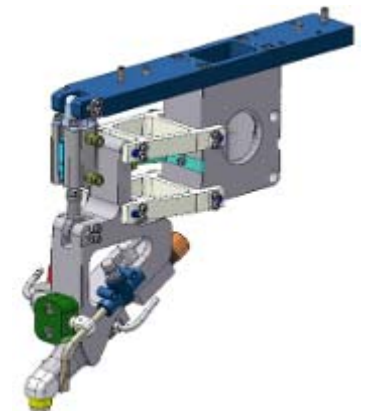
➔ **Cost reduction**

Improve process stability and reliability

➔ **Higher quality**



**EcoGun Gluing S**  
Process head for spray application



**EcoGun Gluing N**  
Process head for felt application

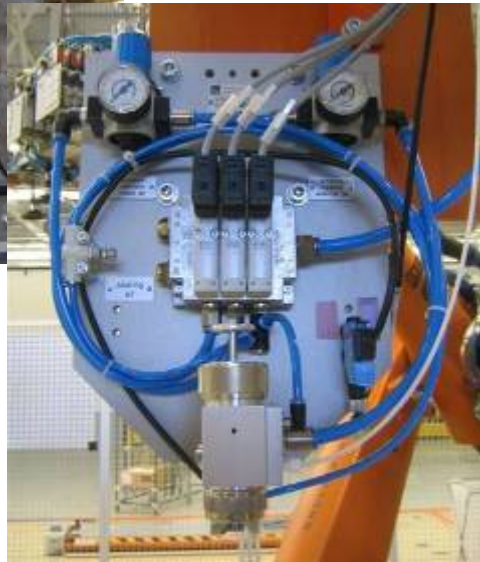
# Surface pre-treatment with hydro-activator

Hydro-activator = **EcoGun Gluing S**

- Adhesion enhancement
- Durability improvement



**EcoGun Gluing S**  
Process head for spray application



Free of solvents = no extraction required = no solvent emission

➡ **Maximum environmental acceptability**

Less material consumption = coat thickness reduces by 2/3 to conventional primer

➡ **Cost reduction**

# Application Technology

Piston dosing unit = **EcoShot Meter**

- Electrical drive
- Quick maintenance by modular construction
- Needle valves (durable, higher precision, easy change)
- Very high life time
- High accuracy

➔ **Higher quality**

No hydraulic aggregate or high pressure air  
Supply necessary, due to use of electrical drives

➔ **Cost reduction**

➔ **Environmental acceptability**



# Glass handling

Vacuum gripper with vision system for the handling of glass panels and roof modules = **EcoGripper**

Modular system for flexible adjusting to different glass panel geometries

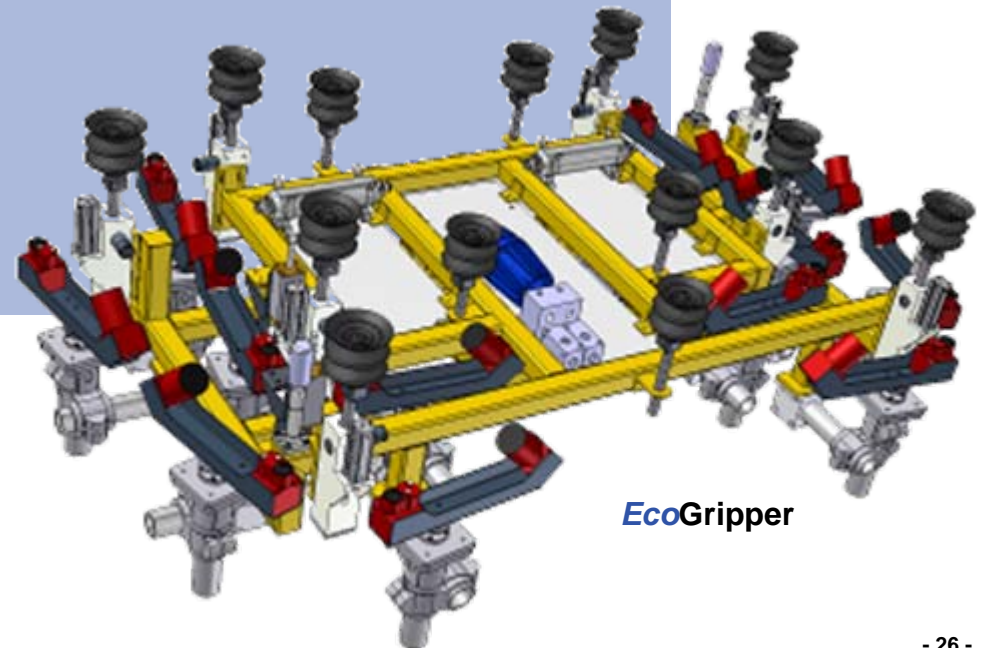
➔ **Higher production flexibility**

Handling with minimal mechanical stress (deformation) by automated adaption of suction pad positions, simple fixation of cameras

➔ **Increase of quality**

Low weight, modular construction with standard profiles, easy to maintain

➔ **Cost reduction**



# Operator Interface

Visualization and programming software for 3D-illustration = **EcoScreen 3D-OnSite**

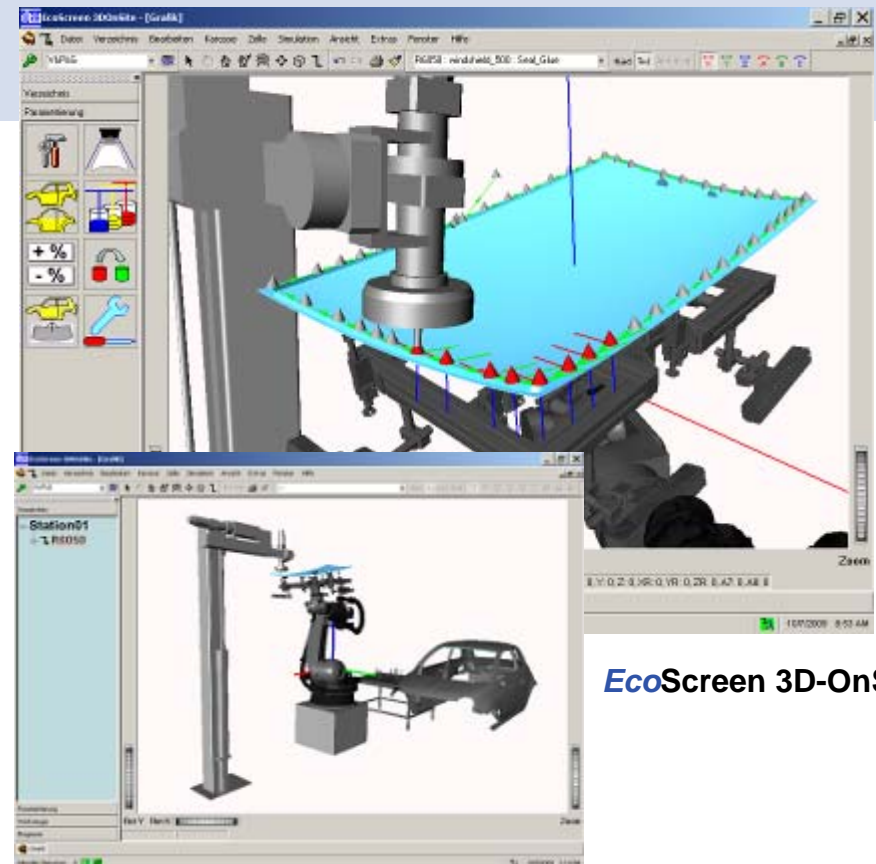
- A tool with integrated track-editor and process-editor
- On- and offline programming possible
- Robot cell and car body in 3D
- Simulation of the complete run

Quick and easy program modification,  
no production-stop for online-parameterization  
= Reduce downtime

➡ **Increase of production volume**

Visualization and evaluation of programmed  
tracks

➡ **Increase of quality**



**EcoScreen 3D-OnSite**

**Thank you for your  
attention**

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