

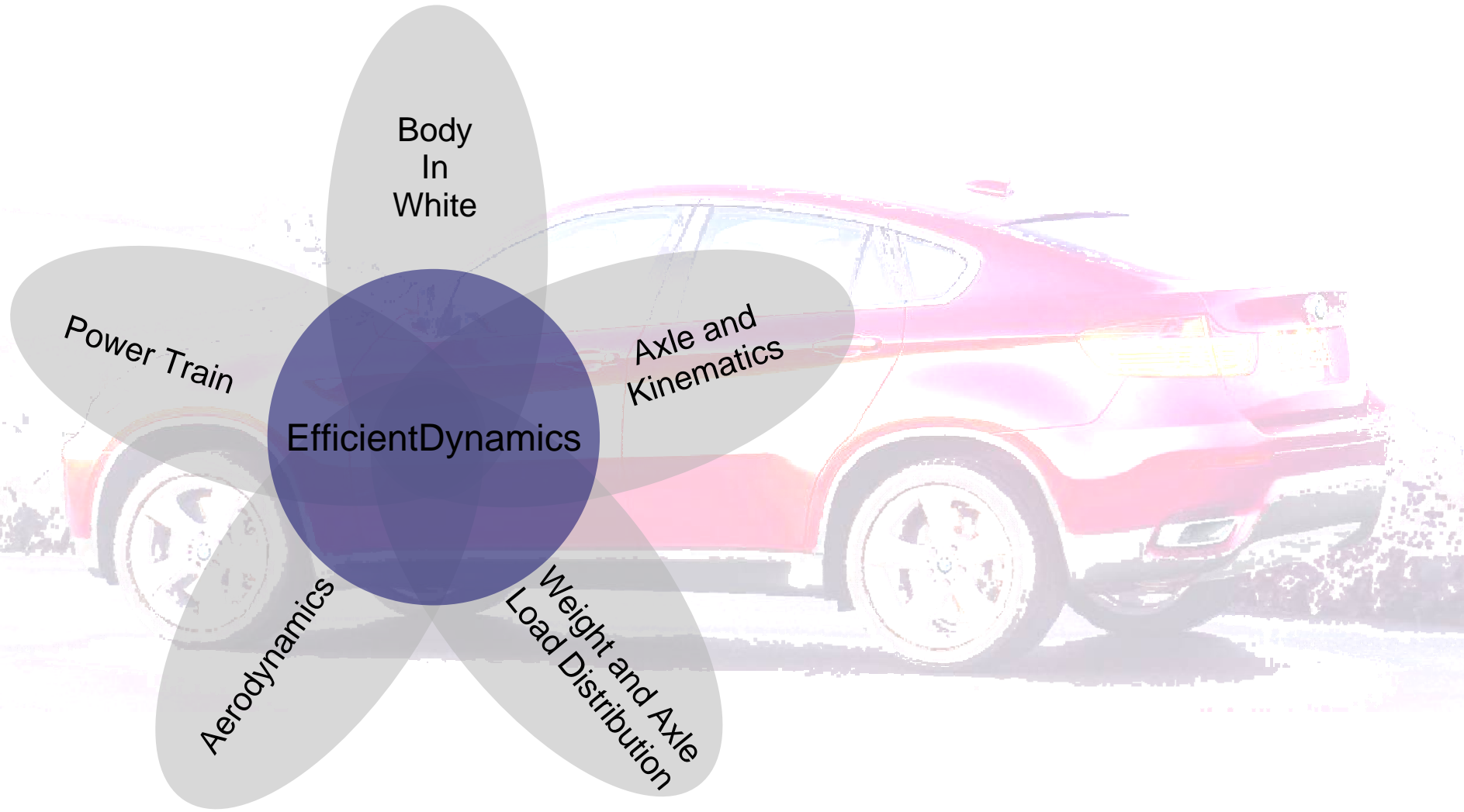
Technological Innovations in Body in White Manufacturing of the BMW X6

Markus Pfestorf
BMW Group
Duane Copeland
BMW MC

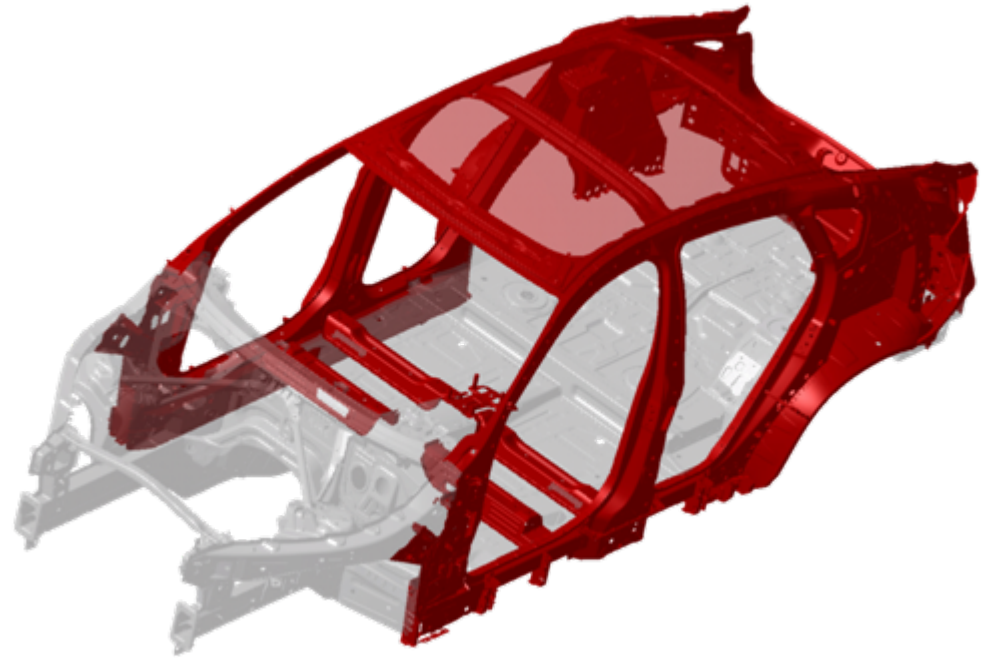


- Body in White Requirements for EfficientDynamics
- Body in White Materials
- Ultra High Strength Steel Grades
- Joining Technologies
- Conclusion





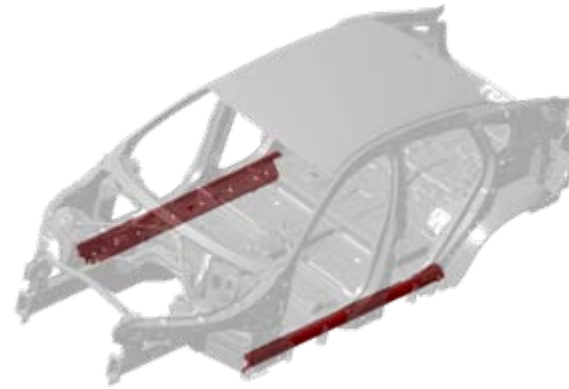
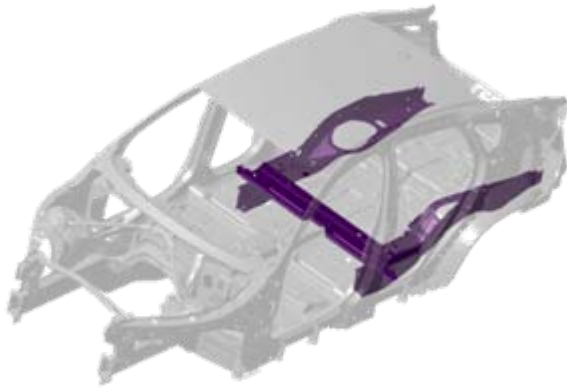
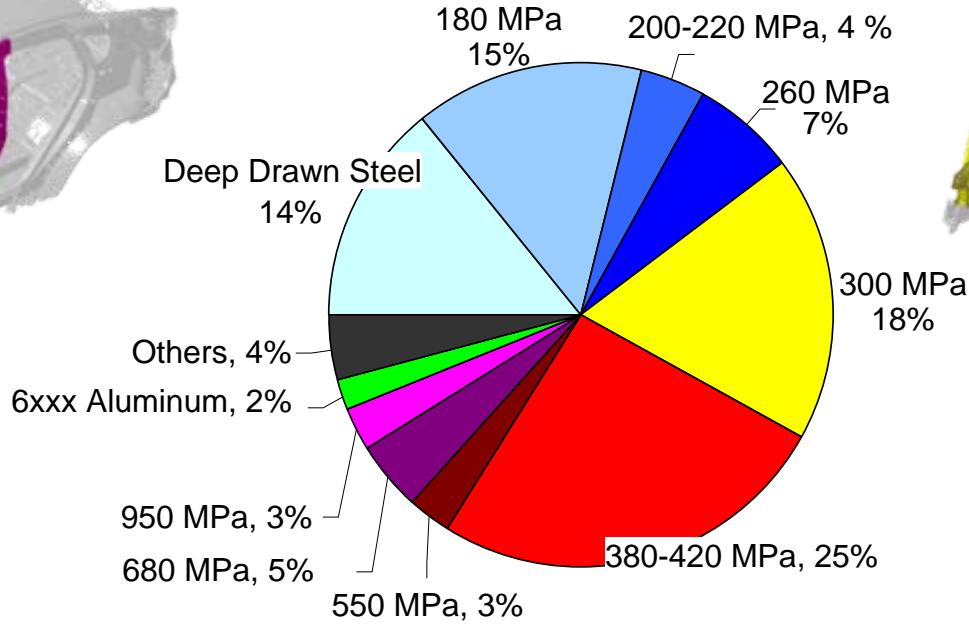
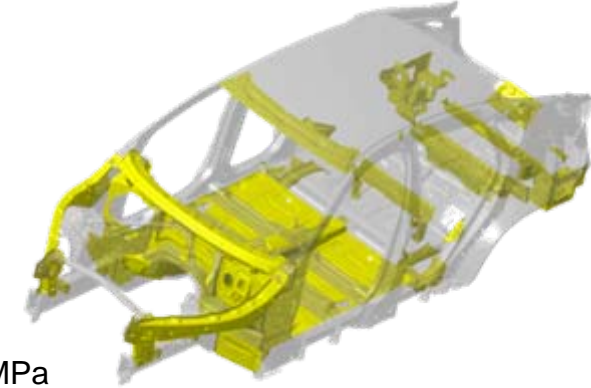
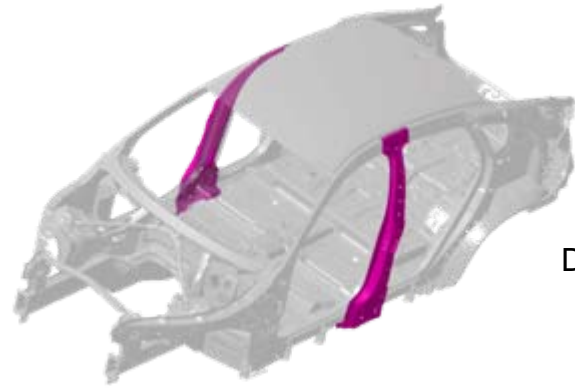
Body in White Requirements Cost Efficient Light Weight Design



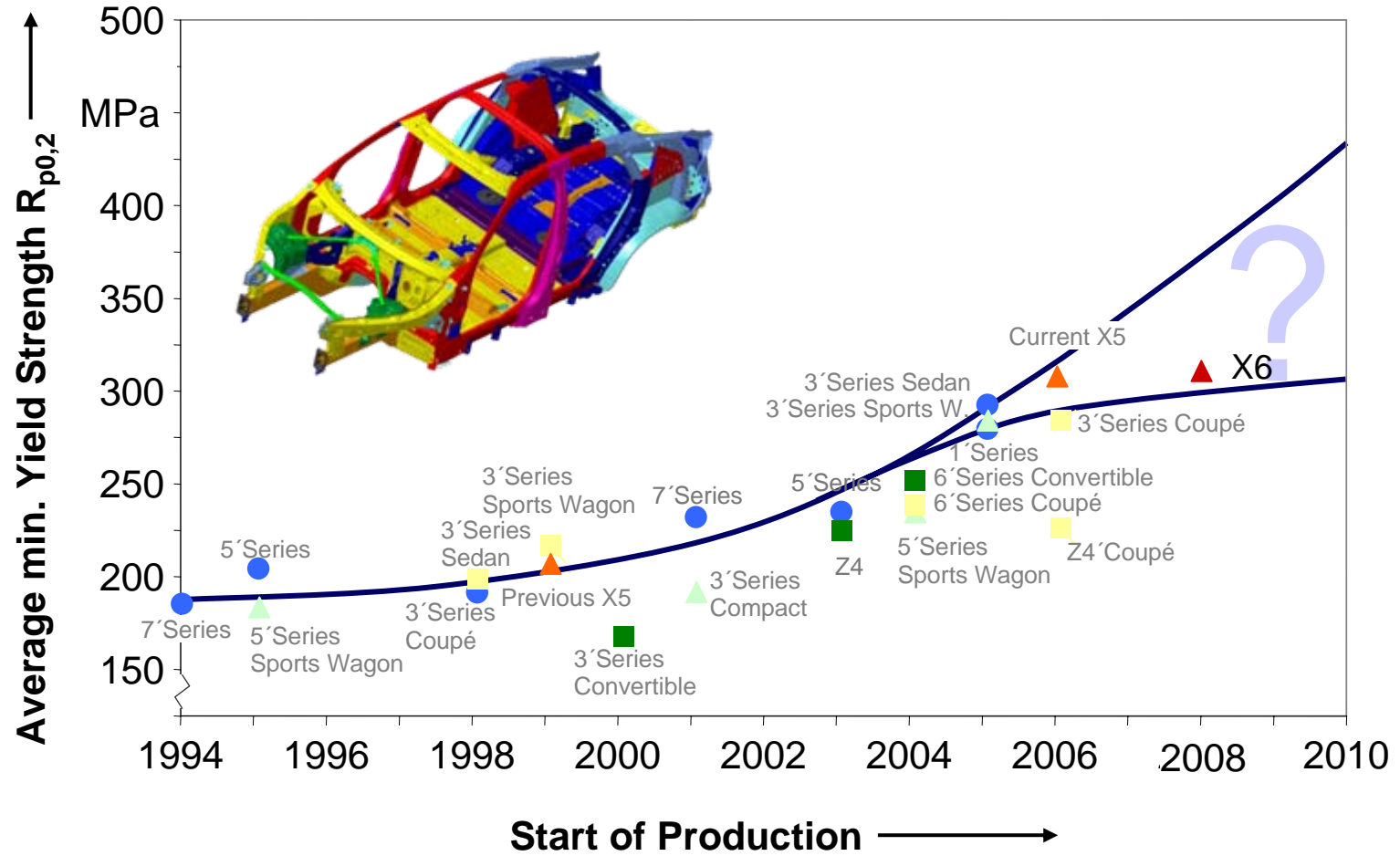
■ Specific Panels
■ Shared Panels

- Torsional Stiffness of 29.000Nm/°
- Implementation of Ultra High Strength Steel Grades
- Mixed Material Concept (Steel, Aluminum, Thermoplastic)
- Cost Efficient Engineering using existing Panels with a maximum Design Differentiation

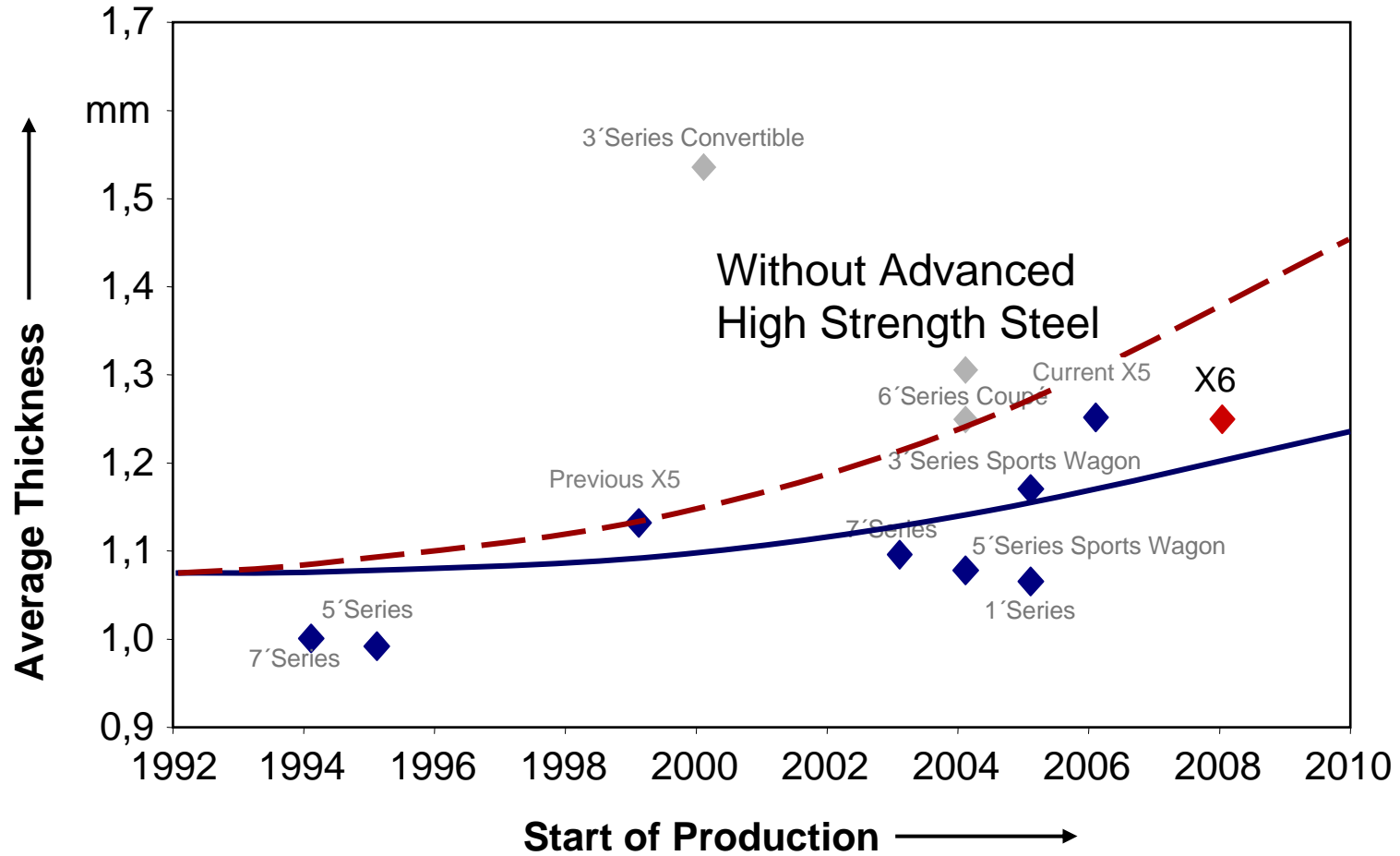
Body in White Materials Yield Strength



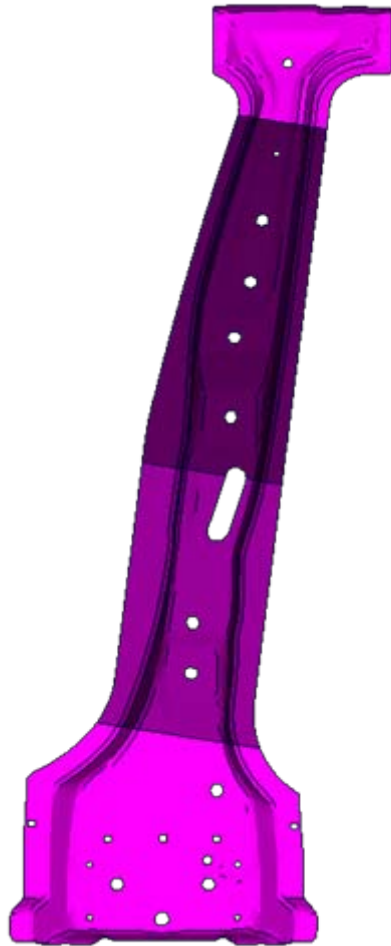
Body-In-White Materials Average Minimum Yield Strength



Body-In-White Materials Average Thickness



UHSS – Hot Stamped 22MnB5 Side Crash



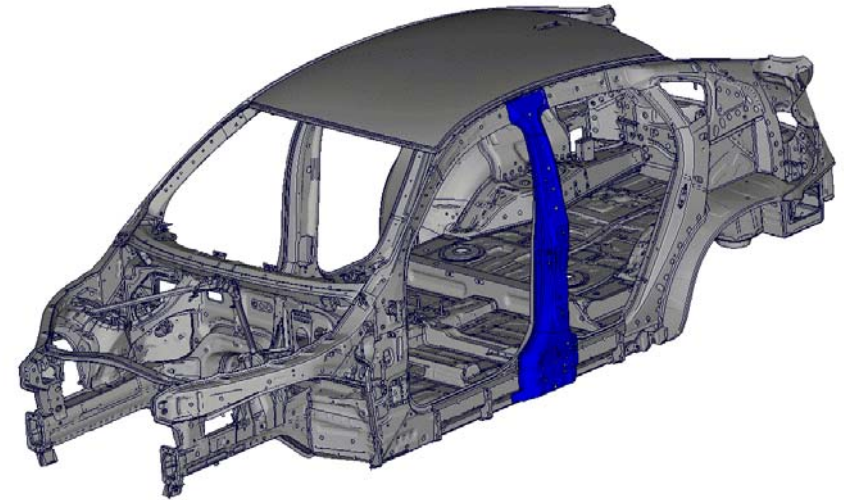
Thickness (t)

t = 1.2 mm

t = 2.2 mm

t = 1.4 mm

t = 1.2 mm

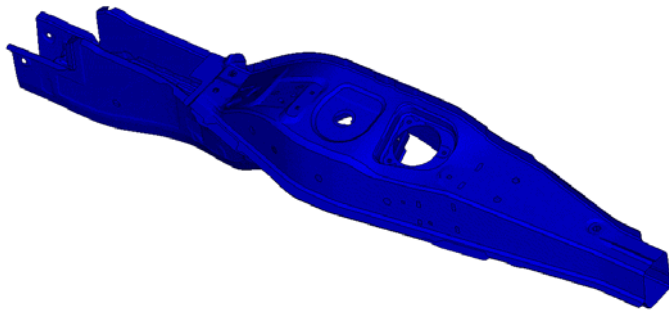
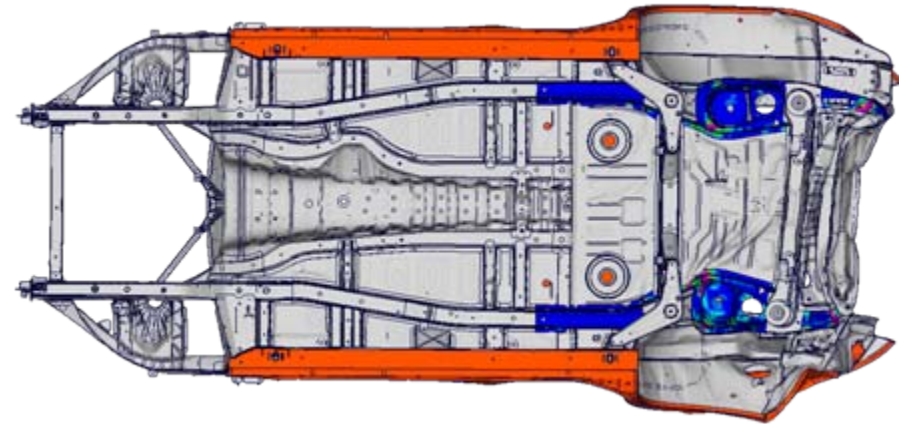


Weight Savings: 2 kg/side
(compared to a hot stamped part
with a constant thickness)

Mechanical Values:

Yield Strength $R_{p0,2}$: > 950 MPa

Tensile Strength R_m : > 1300 MPa



(Complete Longitudinal rear member including other steel grades)

Weight Savings for the
Longitudinal Rear Member:
4,4 kg

Mechanical Values:

Yield Strength $R_{p0,2}$: 680 - 830 MPa

Tensile Strength R_m : 800 - 980 MPa

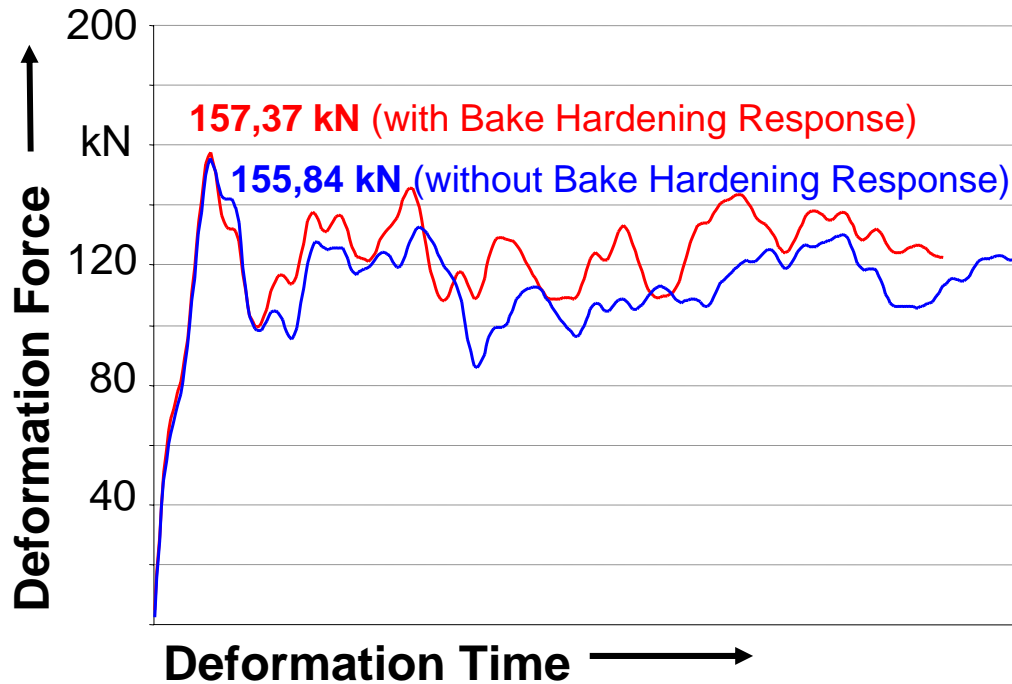
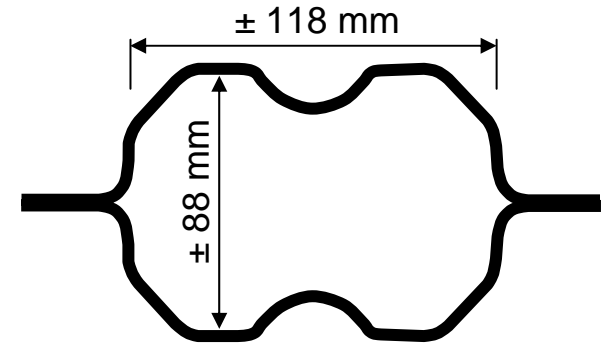
Elongation A_{80} : > 10%



E71CH1607

-0.020 s

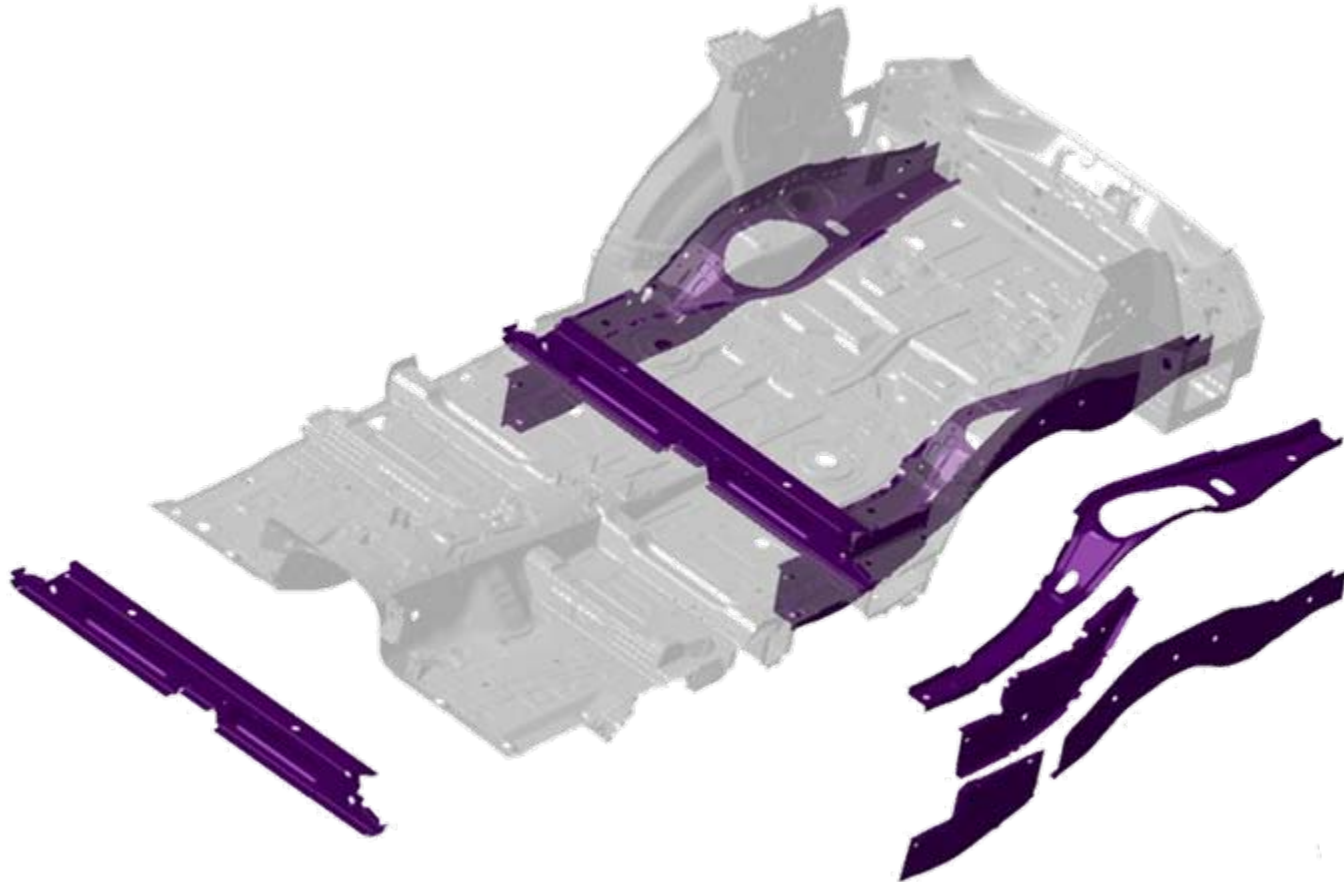
	Mech. Properties (as delivered)	Mech. Properties (180°C, 60 min.)
Yield Strength $R_{p0,2}$	692 MPa	796 MPa
Tensile Strength R_m	901 MPa	923 MPa
Elong. after Fracture A_{80}	11,4	10,8
Thickness	0,99	0,99



Tested profile

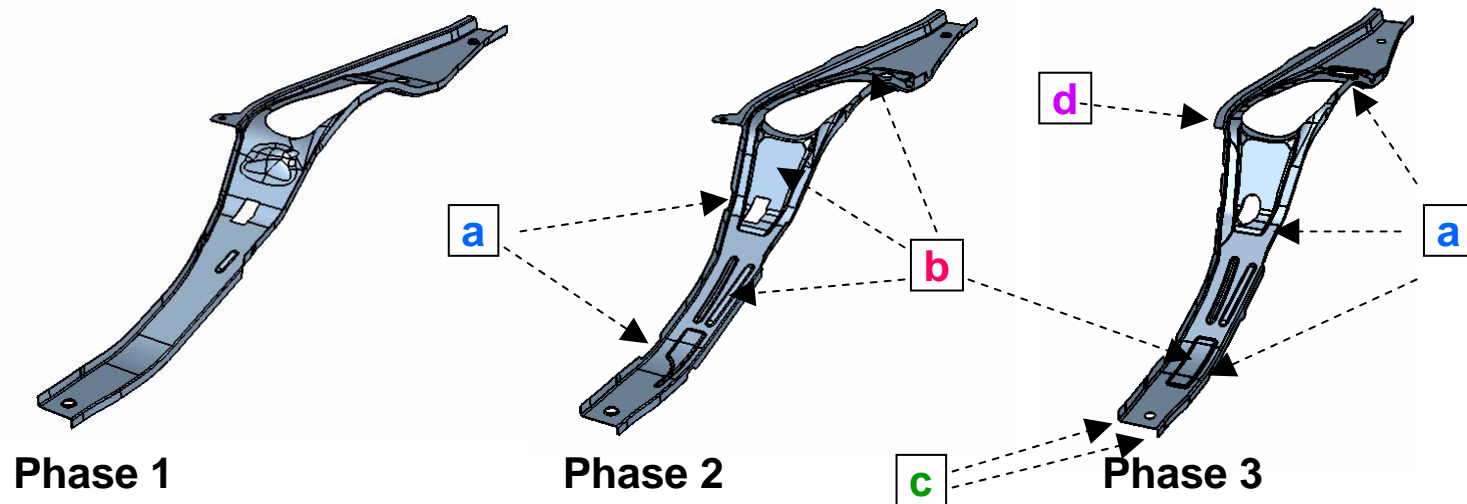


Specimen after Drop Test



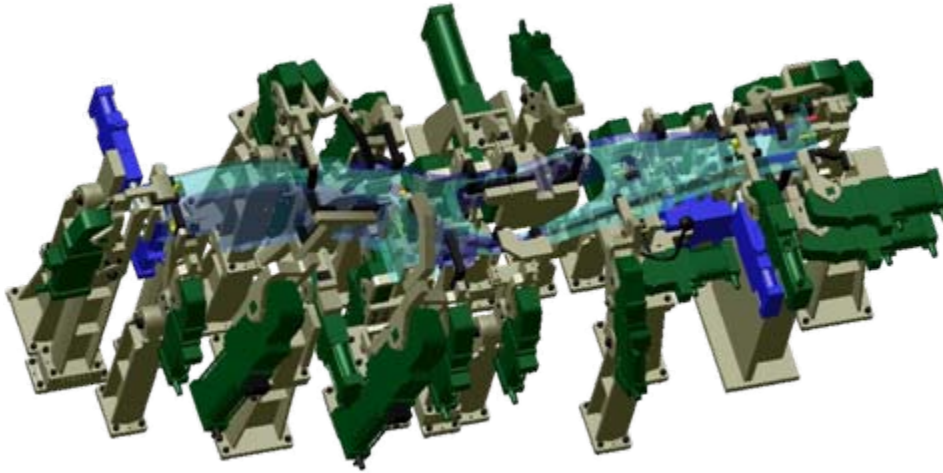
Thickness of all Parts: 1,5 mm





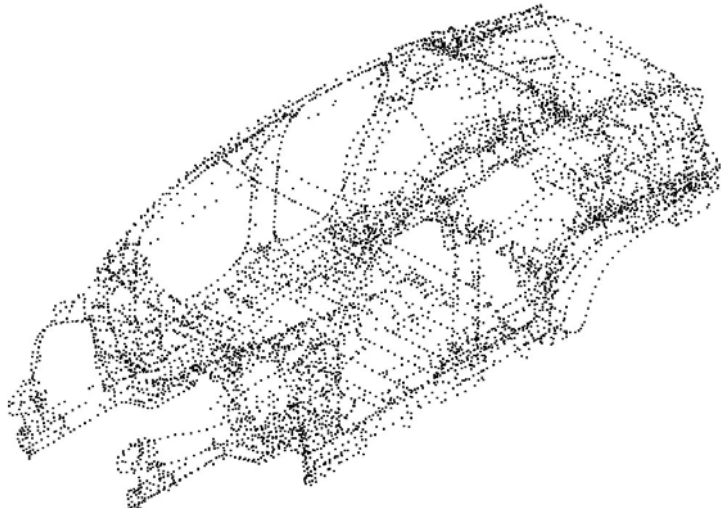
Tool Change Content :

- a) Optimize the release of flange form
- b) Optimize the draw of the embossments
- c) Increase the radii if necessary
- d) Optimize the trim

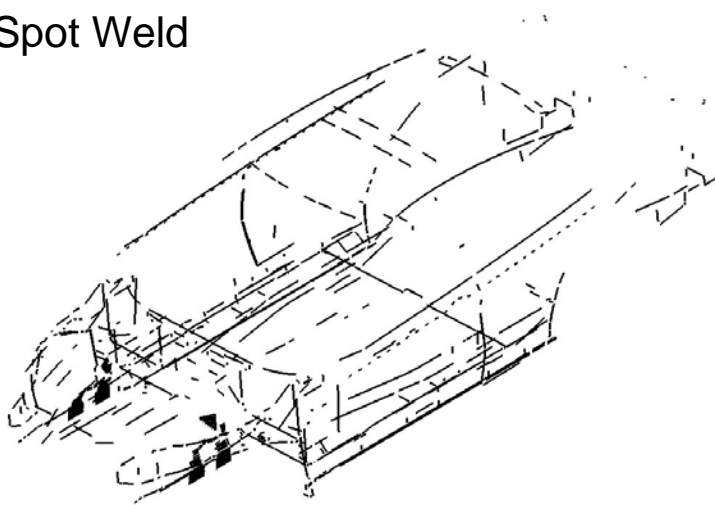


Secure the part fastening assembly process in the Prototype Phase.

- Testing the Series assembly Tools with the Prototype Parts and early Optimization of the Clamping Technology.
- Higher Measurement Stability in the BIW.



Spot Weld



Adhesive Bonding

Main Joining Technologies:

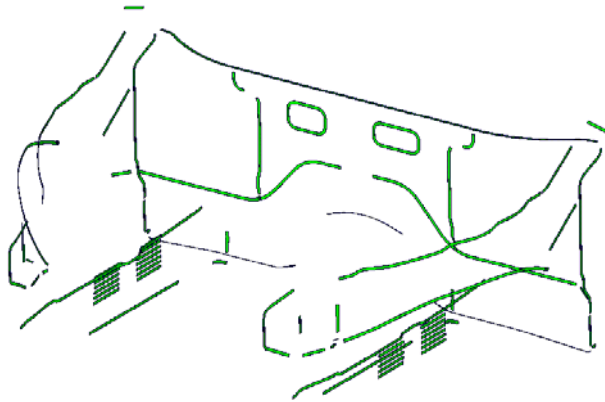
- Resistant Spot Welding (6643 Spot Welds)
- Adhesive Bonding (116999 mm)

Other Joining Technologies:

- Self Pierce Riveting (82)
- Clinching (53)
- Mig Welding and Brazing (8053 mm)
- Capacitance Discharge Welding

Joining Technologies

Benefit of Structural Adhesives

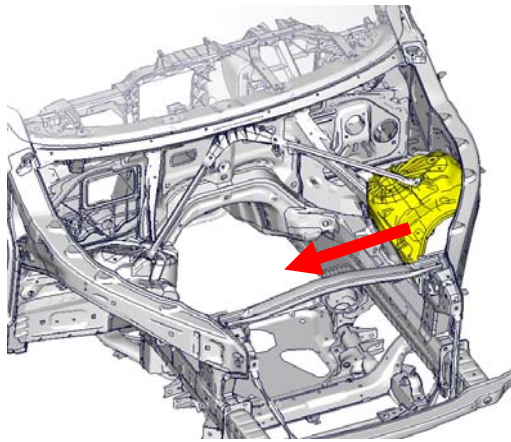


Applied Adhesives



Local Static Stiffness Upper Control Arm	+ 12%
Static Torsional Stiffness	+ 2%
Dynamic Stiffness	+ 0.1Hz to + 0.3Hz

Benefit on Stiffness



Local Static Transversal Stiffness of
the Upper Control Arm

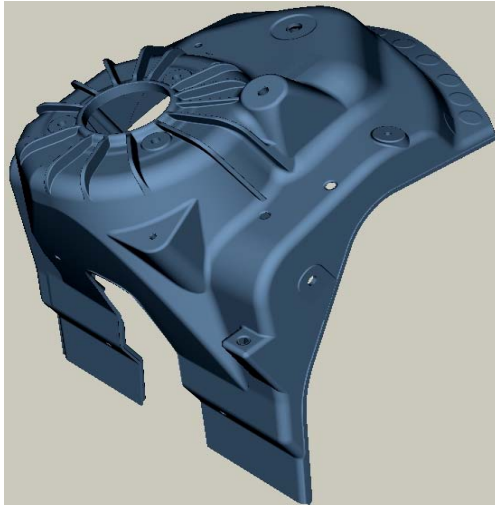


Difference of Displacements of the
Spring Support with and without Adhesive
Application

Joining Technologies

Aluminum Casted Front Shock Tower

Supplier



- High Pressure Vacuum Casting
- Heat Treated
- Machined
- Cathodic Painting

Body In White



- Bonding (ca. 5.4 m)
- Self Pierce Rivets (82 times)

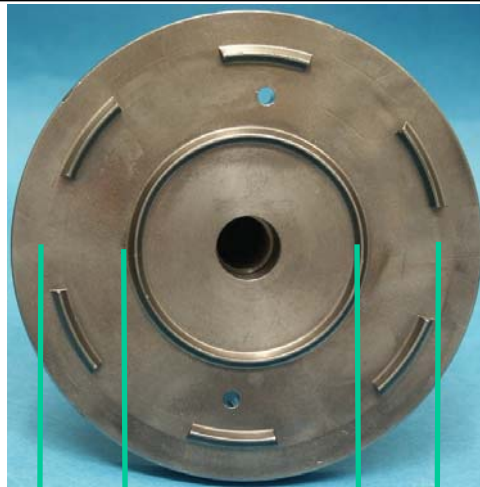


Paint Shop



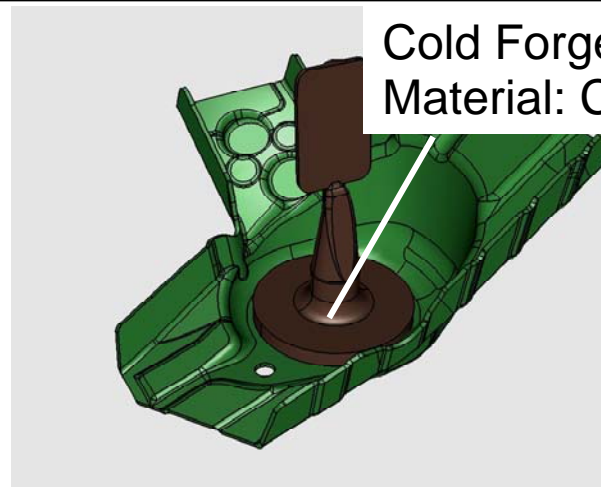
- PVC Sealant

Joining Technologies Capacitance Discharge Welder

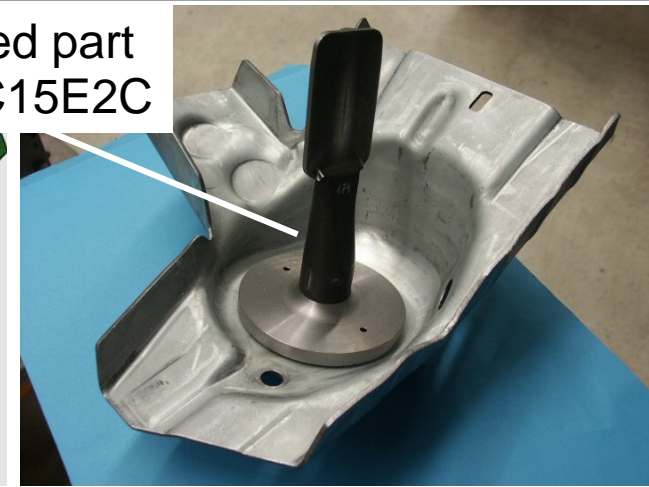


Ø 52 mm

Ø 90 mm



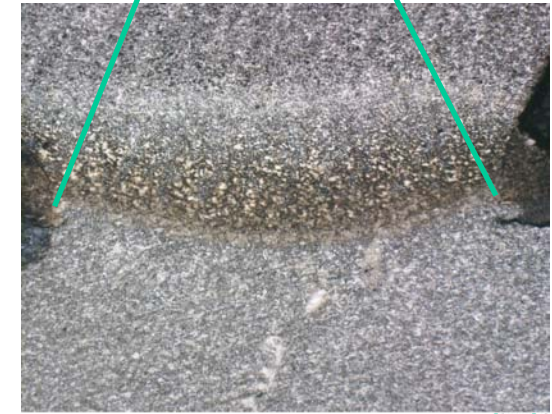
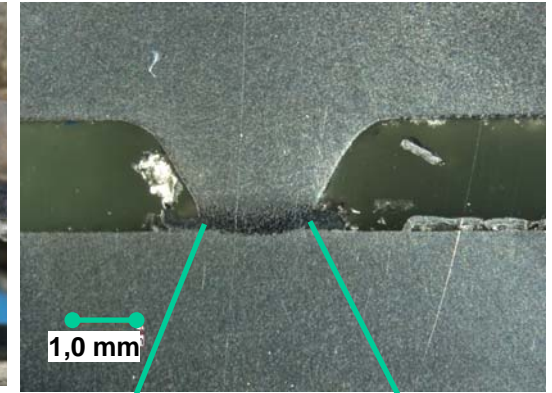
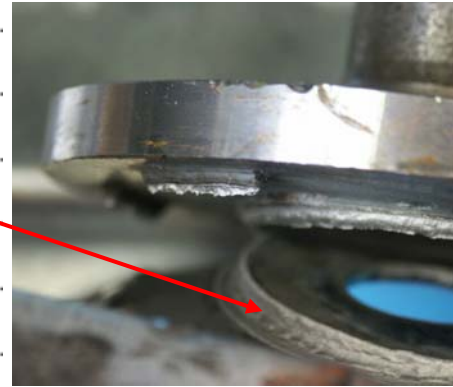
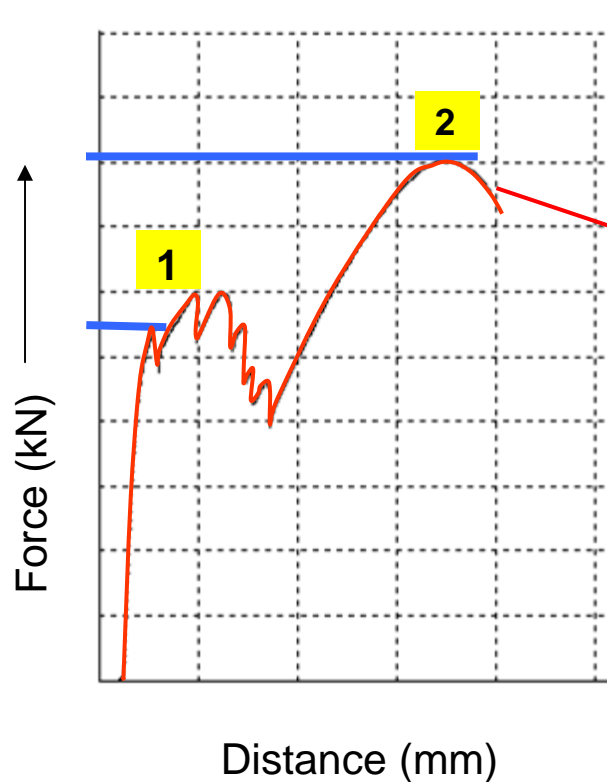
Cold Forged part
Material: C15E2C



Advantages:

- More economical Process
- Less Weld Splatter
- High local connection Stiffness
- Smaller amount of Heat introduced in Parts during the welding Process
- No Process induced Material Structure Change.

Joining Technologies Capacitance Discharge Welder



Force vs. Distance Relationships:

- 1 Outer projection
- 2 Inner projection

Internal Weld Seam Evaluation:

- Small Fusion Zone
- Small heat induced Zone
- Continuous Material Connection

- Mixed Material light weight Concept for the Body in White
 - 8% Ultra High Strength Steel Grade
 - 46% Advanced High Strength Steel Grade
- Significant Weight Savings by UHSS
 - Hot Formed B- Pillar Reinforcement with tailor rolled Blank
 - CP800 for Longitudinal Rear Member
- Capacitance Discharge Welding for Bushings
 - High local stiffness
 - Extreme short Process Time



Thank You for Your Attention

