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Ganzheitliche Betrachtung der Verzugskompensation beim Zusammenbau geschweißter umgeformter Blechkomponenten aus hochfesten Stählen

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Dipl.-Ing. Jens Rohbrecht

Technischer Arbeitskreis
„Kaltumformung moderner Stahlwerkstoffe“

21.02.2019

Walter Neff GmbH, Karlsruhe

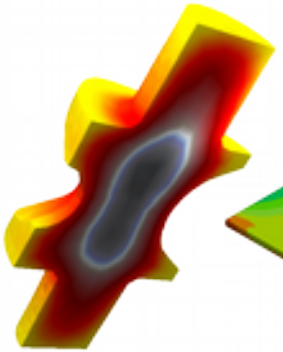
18.02.2019

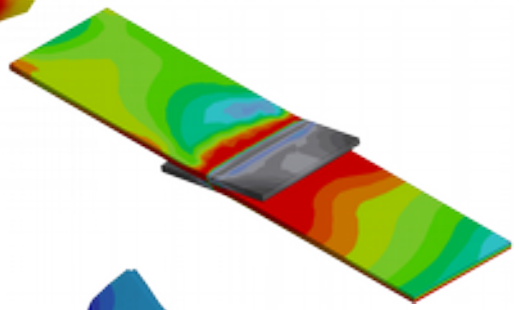
- Process Optimization
- Distortion Compensation
- Quality Optimization

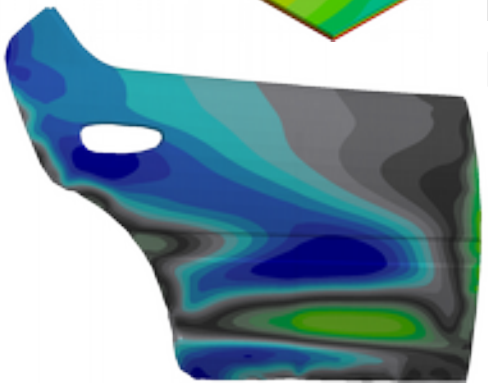
- Heat Tratment
- Welding
- Hotforming

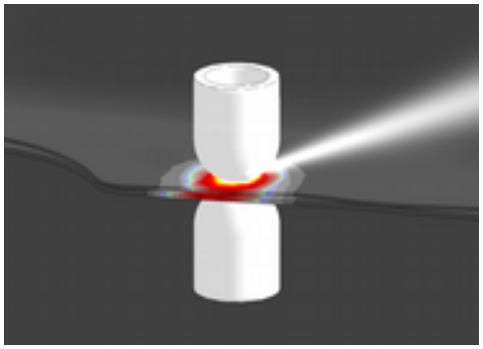
- Distortion
- Residual Stress
- Metallurgy
- Crack And Strength

- Material Management



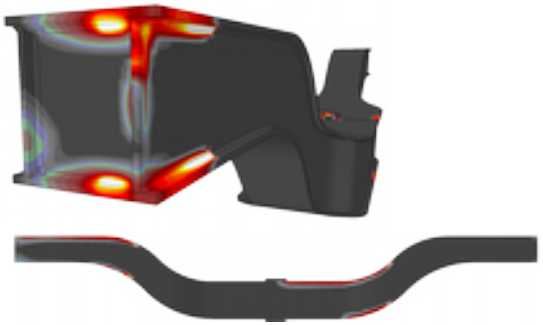






DynaWeld is more than 20 Years of experience in

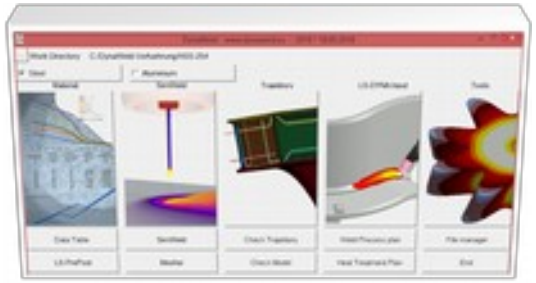
simulation of all kinds of thermal related manufacturing and material processes



Consulting And Research

DynaWeld's Development

DynaWeld®



- Preprocessor
- Environment And Material Data Manager
- Welding, Heat Treatment, Forming
- High Sofisticated Simulations

- **Simulation of Assembly**

MatplusHQ

- Simulation Tool
- Pre- Postprocessor And Solver
- Heating And Quenching
- Very Easy Usage For Everyone

Development - Training - Support - Customer related software solutions

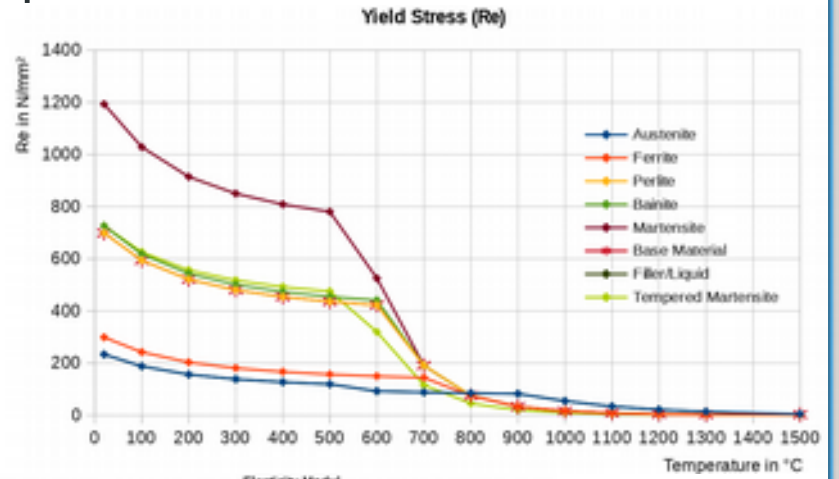
HCT980X
Material Properties for Welding Analysis

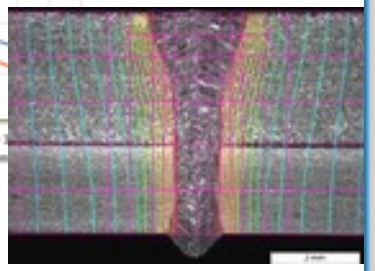
Material properties and material model for welding analysis needs to take into acount thermal dependend behaviour,

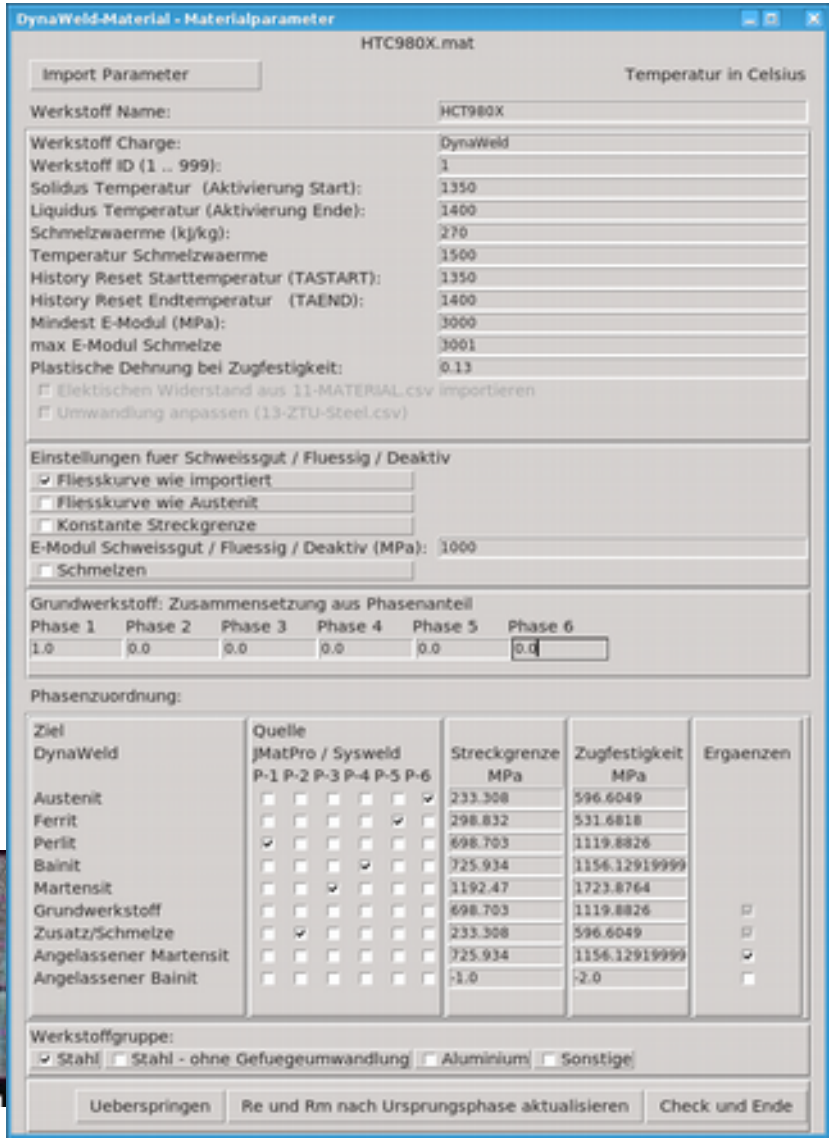
in certain cases the metalurgical behaviour too.

Apart from expensive measurements a material simulation can provide the necessary data too.

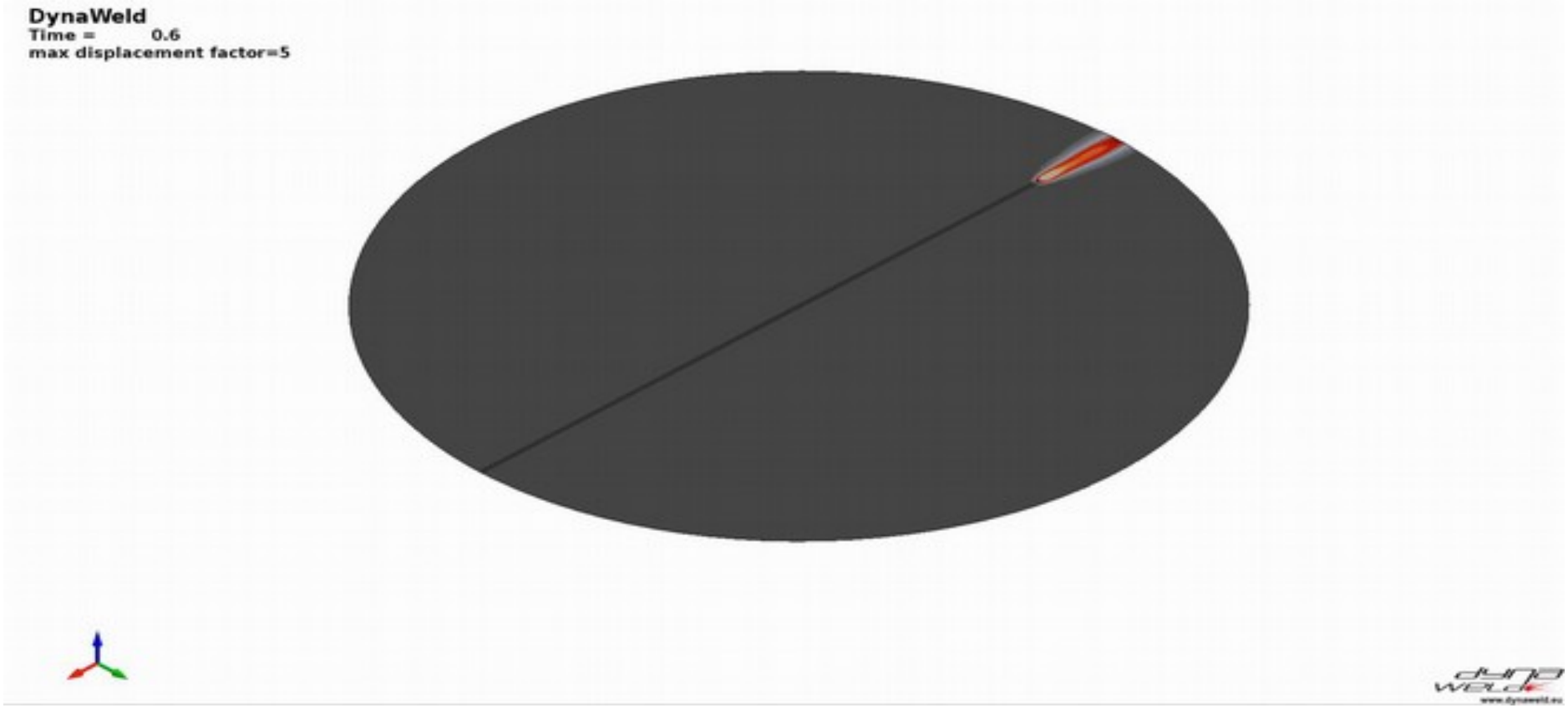
DynaWeld Material provides import of JMatPro data from material simulation.



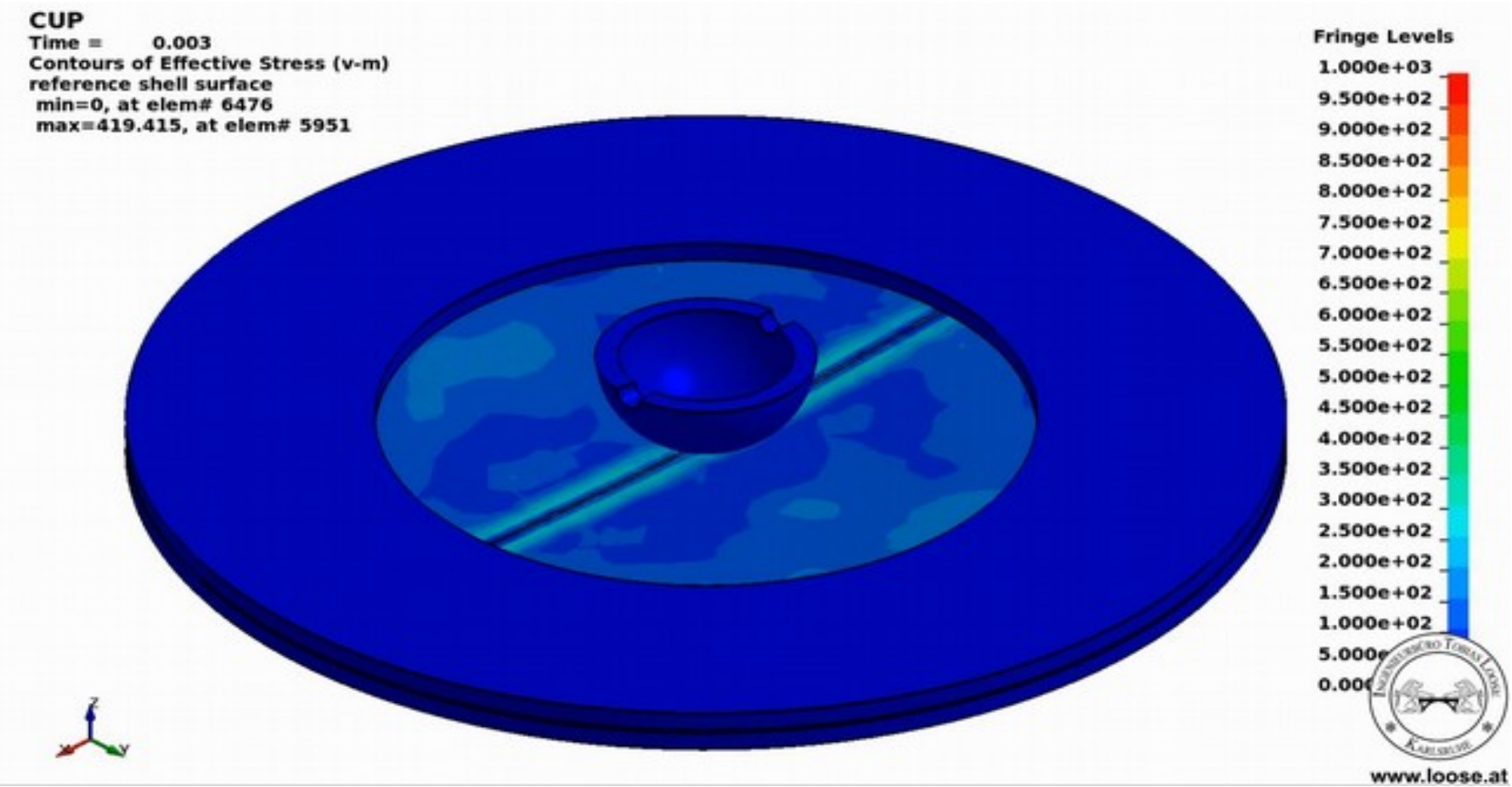




Distortion by Welding



Forming Simulation after Welding Simulation



The old state of the art

- Forming simulation and optimization of forming process
- Welding simulation and optimization of welding process

The new state of the art

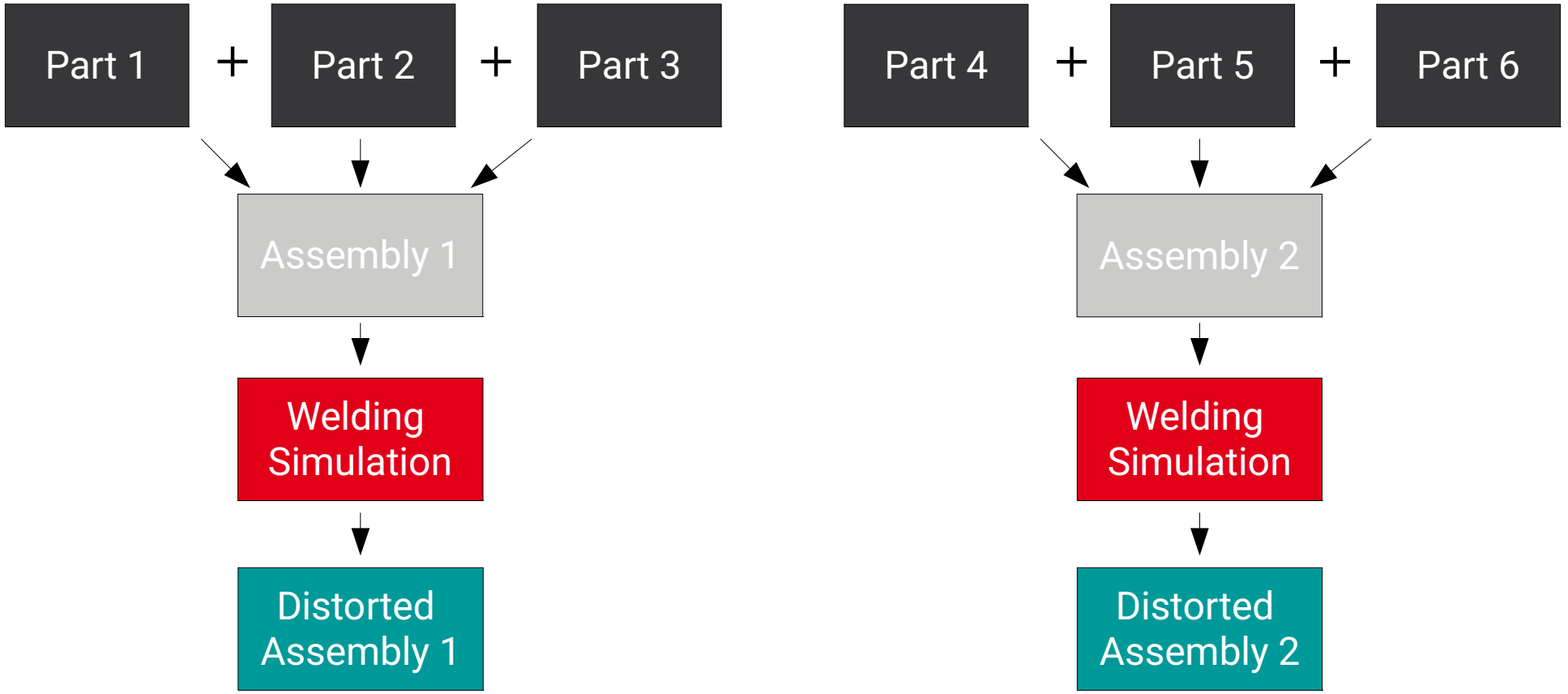
- Assembly simulation and optimization of the manufacturing process

Assembly Simulation:

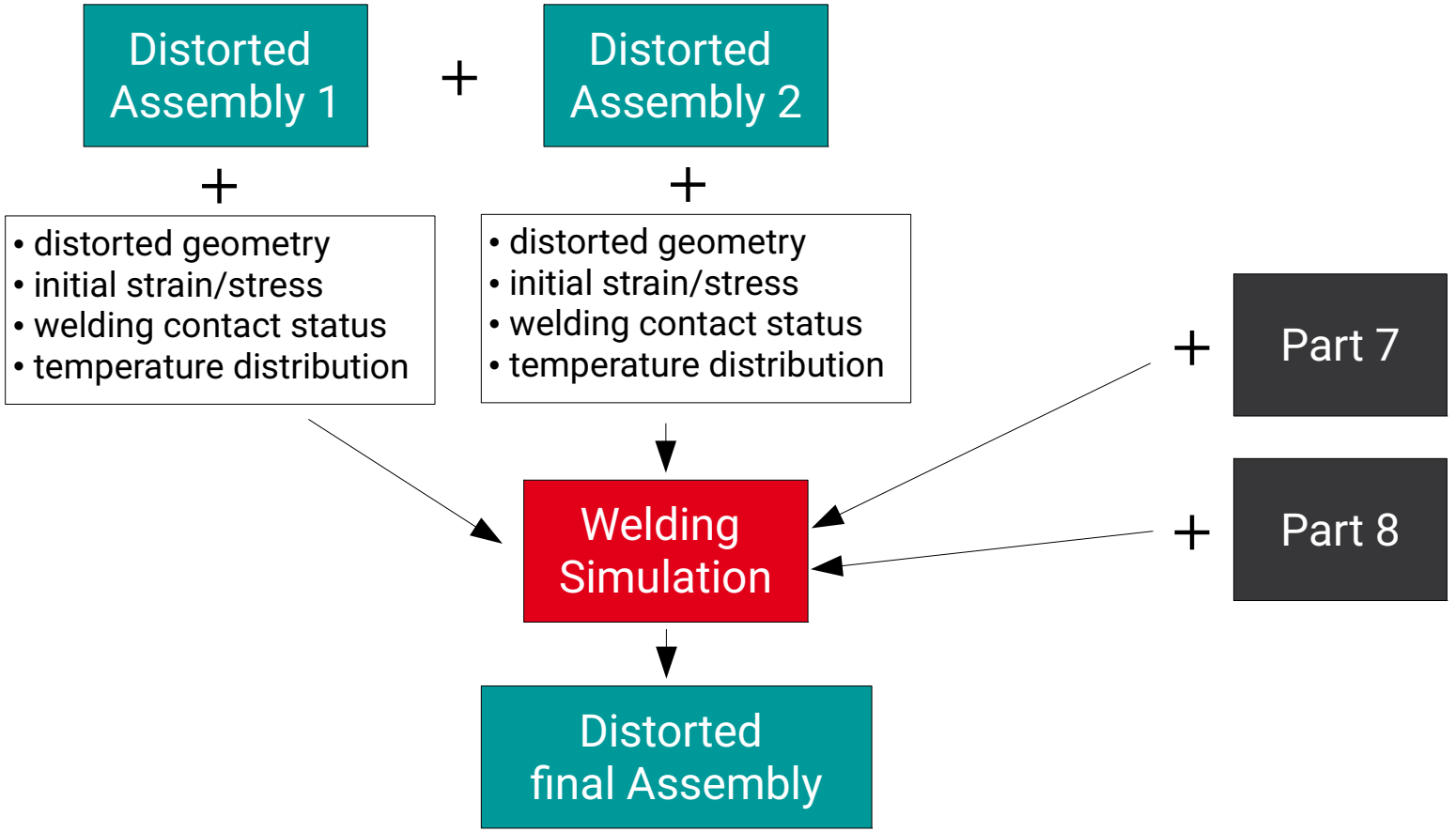
- take into account imperfect geometry of assembled parts
  - imperfect forming specimem - geometry definition by simulation
  - imperfect forming specimem - geometry definition by measurement
  - imperfect subassembly - geometry definition by simulation
- take into account
  - deformation due to clamping of imperfect parts
  - deformation due to welding
- Enables the the integrated view of process
  - optimization at stages with highest compensation effort

The assembly simulation takes into account prior stages

Assembly procedure



Assembly procedure



Assembly procedure

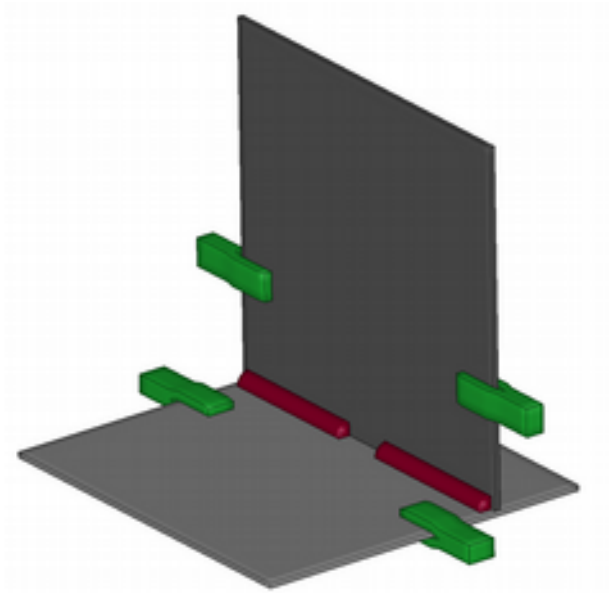
Step 1:
Welding 1,
2 weld seams

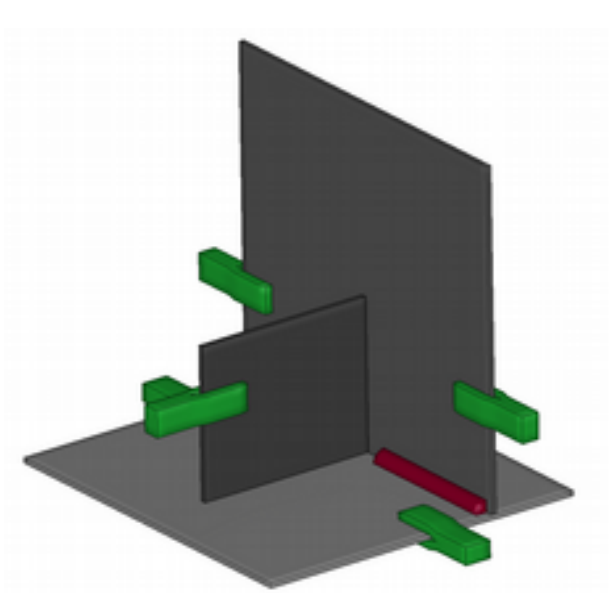
+

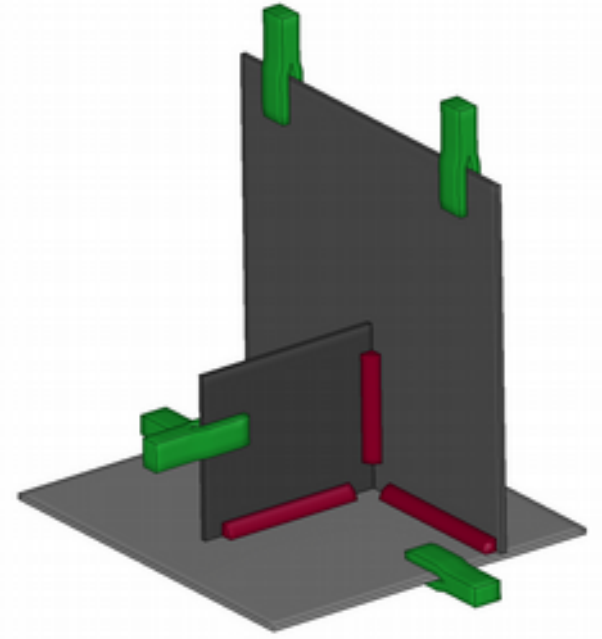
Step 2:
Assembly, adding a
stiffening plate

+

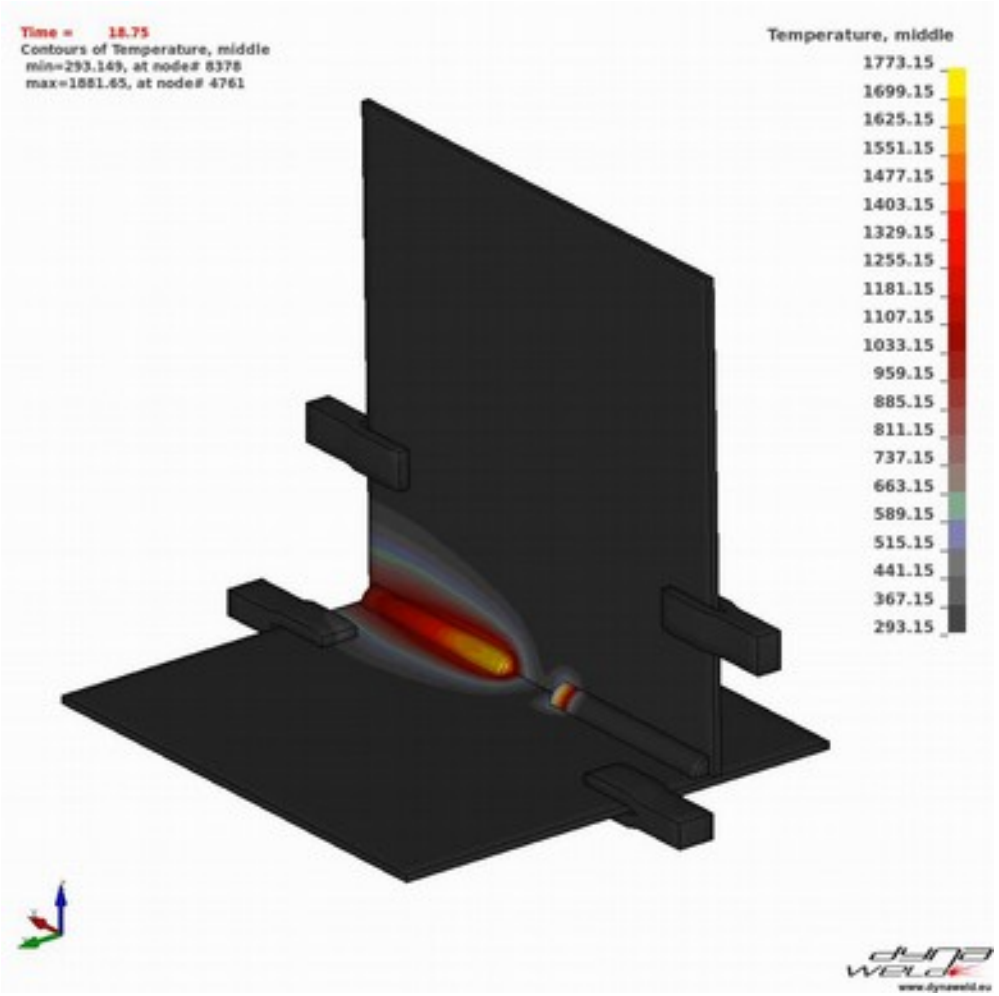
Step 3:
Welding 2,
adding 2 new weld seams

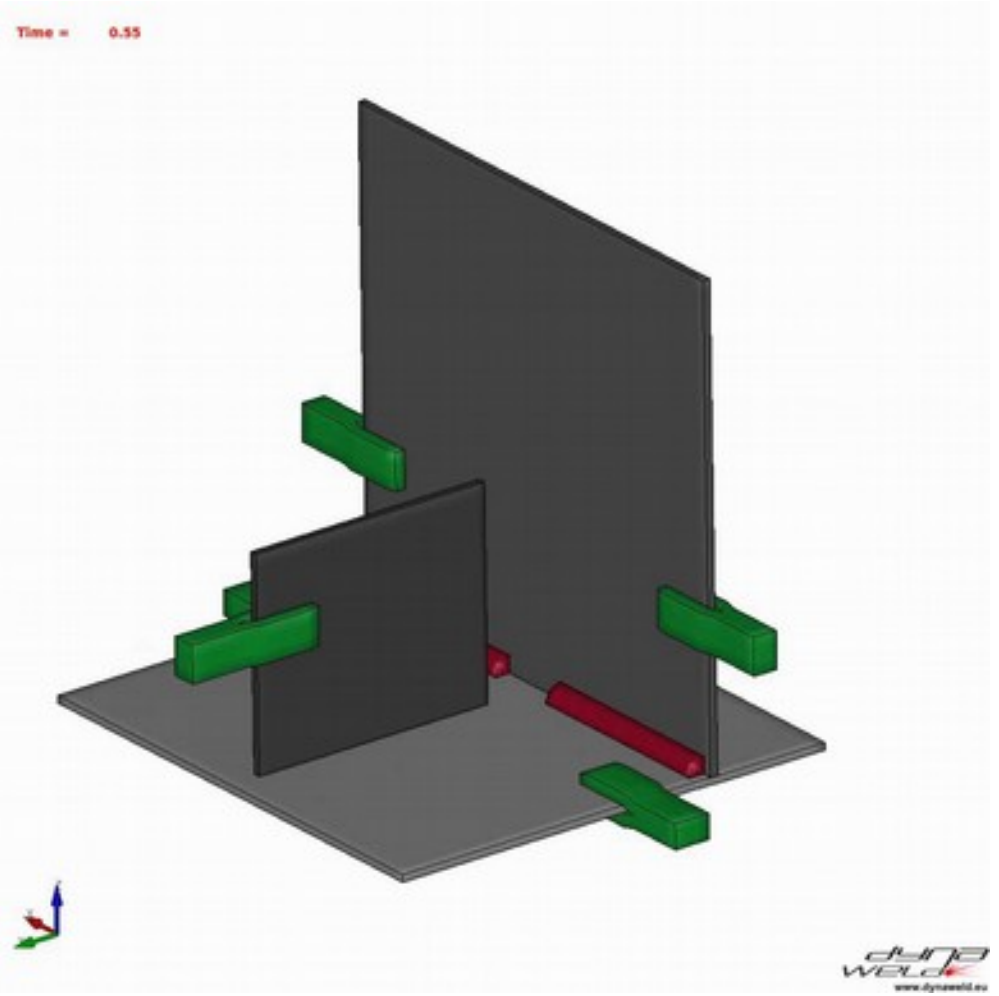






Example of Assembly Simulation

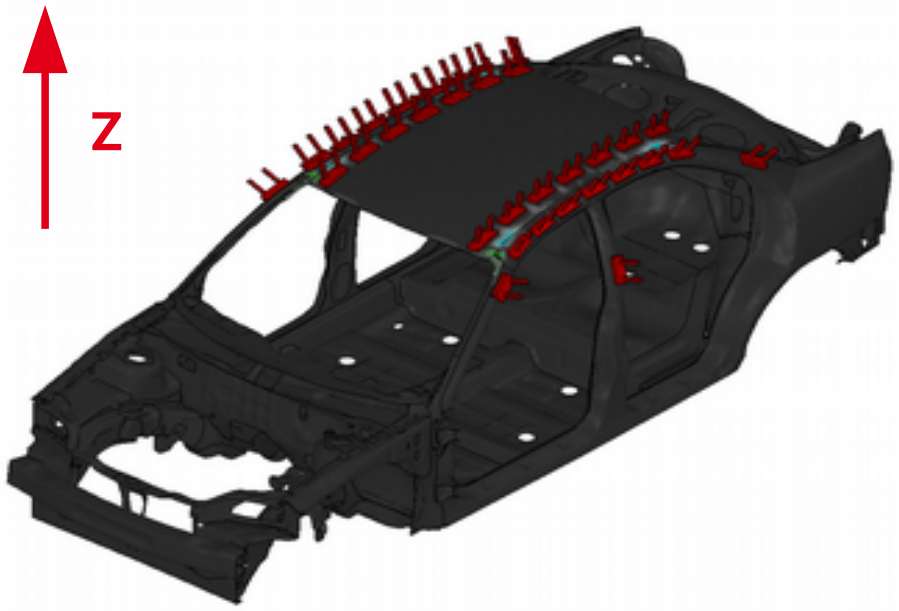




DynaWeld Car:
Welding process of the roof

DynaWeld Car:
Motion of the clamping tools

DynaWeld Car:
Z-Distortions before unclamping



DynaWeld Car:
Z-Distortions after unclamping and cooling

Conclusion

Distortion Analysis Welding

- finding the reasons for certain distortion evolution
- virtual testing of variations

Best practice would be the application of simulation in earlier states for:

- approvement of the prearranged production
- intervention in early states of development,
  if tolerances are not reached or visible distortions problems appear

Assembly Analysis and integrated view of manufacturing

- Difference from target geometry by entire process
- Identification of the significant manufacturing steps for distortions and deviations for targeted intervention
- Design of compensation method
- Approval of compensation method or
- Approval of new designed manufacturing process

Thank you very much!