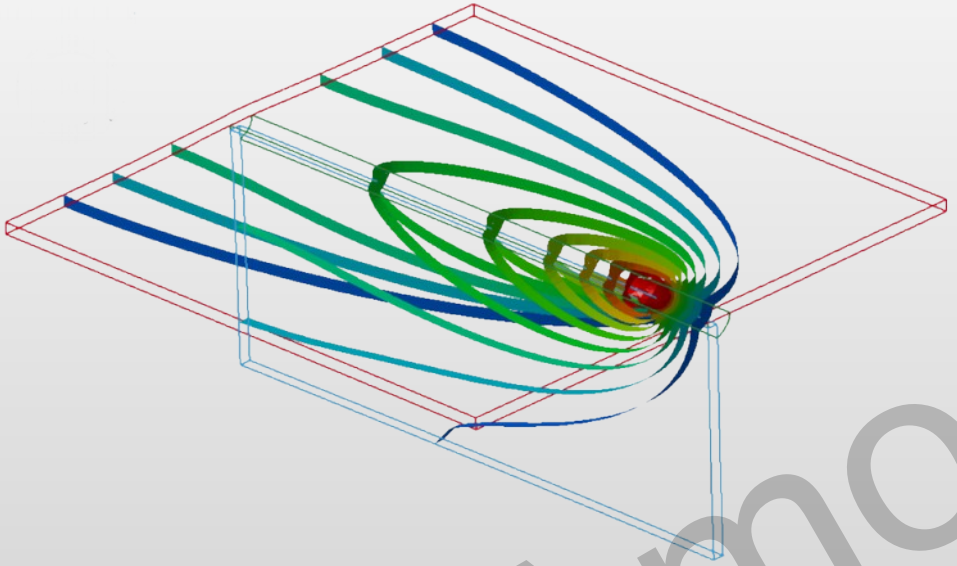
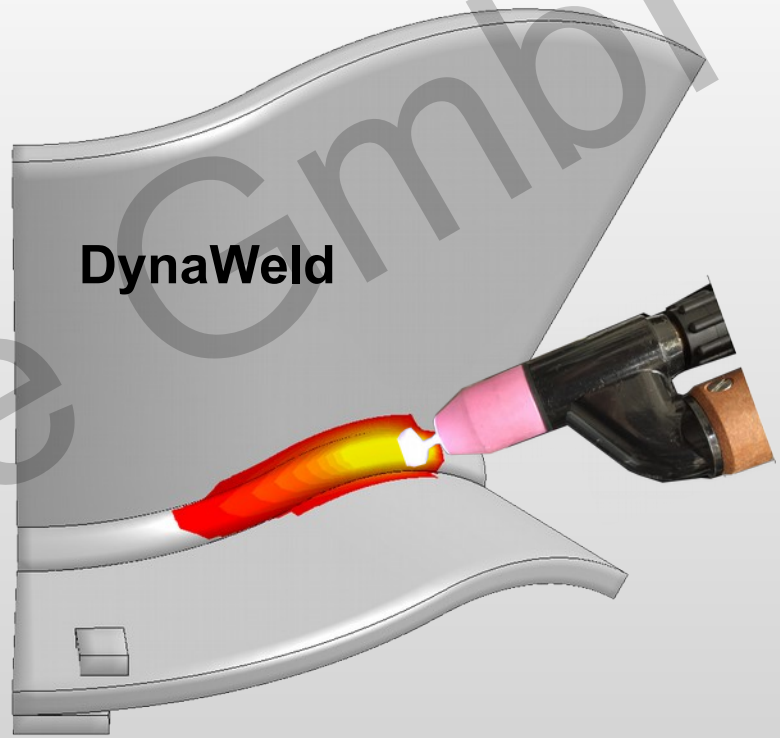
**Ingenieurbüro Tobias Loose**
Herdweg 13, D-75045 Wössingen Lkr. Karlsruhe
E-Post: loose@tl-ing.de Web: www.tl.-ing.eu
Mobil: +49 176 6126 8671, Tel: +49 7203 329 023

**www.dynaweld.eu**






# DynaWeld

## Welding and Heat-Treatment with LS-DYNA

**Distortion – Residual Stress - Microstructure**

# DynaWeld - Motivation

## **Results** with high **Precision**

- **SOLVER**
  - **Robustness**
  - **Performance**
  - aktive and intensive development in welding and heat-treatment
  - strong in modeling with contact
  - commonly used in many companies
- **FLEXIBILITY in MODELLING**
  - Shell-models, solid-models TET-PENTA-HEX, hybrid models
  - Goldak heat source, arbitrary heat source,
  - SimWeld interface, fitting of user defined heat source
  - 3D / 2D / 2D axissymmetric
  - Transient method, metatransient method
  - User defined additions

# DynaWeld - Motivation

- **PROCESS CHAIN and ASSEMBLY**
  - Include parts with manufacturing history (distortion, stress, strain, microcstructure)
  - Export to further simulations
- **INTEGRATION in EXISTING SOFTWARE ENVIRONMENT**
  - DynaWeld has its focus on the welding or heat treatment task
  - free in the choise of pre- and postprocessor
  - adaptable to other pre- postprocessor (e.g. DYNAFORM)
- **FULL RANGE of WELDING or HEAT TREATMENT TASKS**
  - all welding processes
  - all heat treatment processes
  - full range of dimensions (from 1 µm to 1 m of plate thickness)
- **READY for LARGE STRUCTURES**
  - easy setup for models with large number of welds
  - large structures
  - ready for high performance computing
- **CUSTOMIZED SOLUTIONS**
  - Software editions fully adapted to the customer request

# DynaWeld
## Integration in Simulation Software Environment

**DynaWeld**
don't force a change
of your familiar
software
environment.

**DynaWeld**
is integrating!

**Meshing**
Favored Software

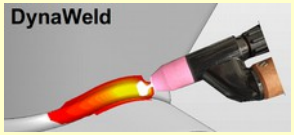
**Trajectory**
LS-PrePost or Favored Software

**Process Plan**
Libre Office or Excel

**Model Setup**
Favored Software

**Welding**


**Model Setup**




**Welding**


**Post Processing**
LS-PrePost or Favored Software

# DynaWeld – Modules

## Input Writer Welding and Auxiliary Modules – 09.03.2015

- **DynaWeld - Input Writer:**
  - Generates keyword files for welding structure analysis
  - Trajectory automatisation
  - Goldak heat-Source on solids
  - thermal – mechanical coupling, updated geometry for thermal analysis
  - Includable parts with history from previous simulation (e.g. Forming analysis)
  - Solid-, shell- or hybrid models
  - Tied and friction contact with the optional use of switches
  - user defined keywords
- **DynaWeld – Trajectory**
  - Calculation of trajectory length
- **DynaWeld – Simweld Import**
  - Imports equvialent heat source parameter from SimWeld analysis
- **DynaWeld – Performance Analysis**
  - Scans the LOG-file and creates *csv file for the performance analysis

# Workflow
## Mesh, Material, Heat Source

- Meshing
- Prepare Material Keyword File
  - *MAT_270 / *MAT_244
  - WeldWare, JMatPro
- Prepare Heat Source Parameter
  - Estimation of goldak parameters
  - Simulation with SimWeld and import with DynaWeld SimWeld import

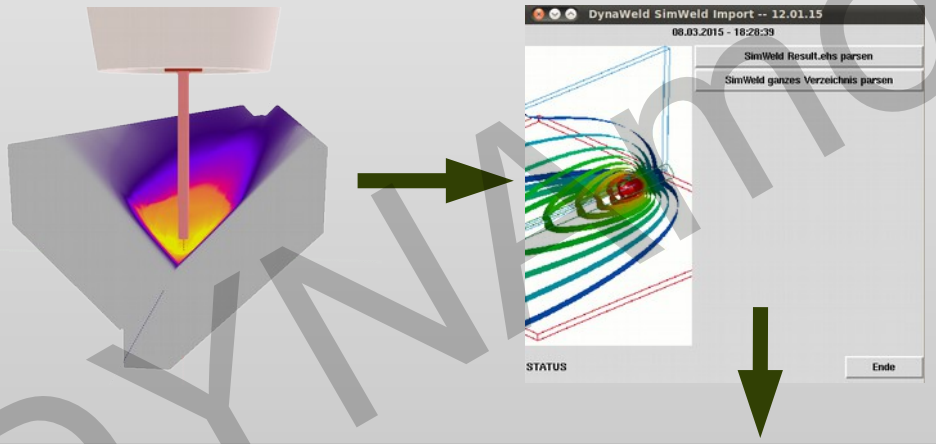
Current Tasks:

Improvement of the equivalent goldak heat source.

Extension to heat input on shells.

DynaWeld module **Heat Source Adjustment**
- by given temperature control point
- by energy input per time

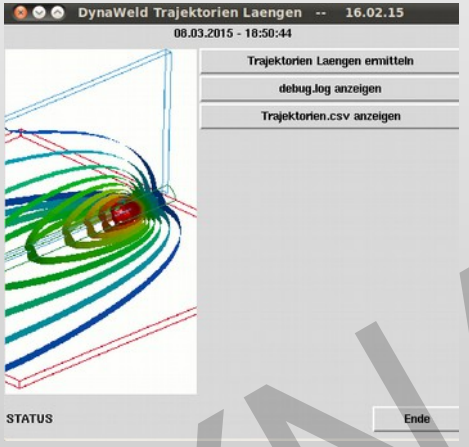
for a correctly defined heat source.



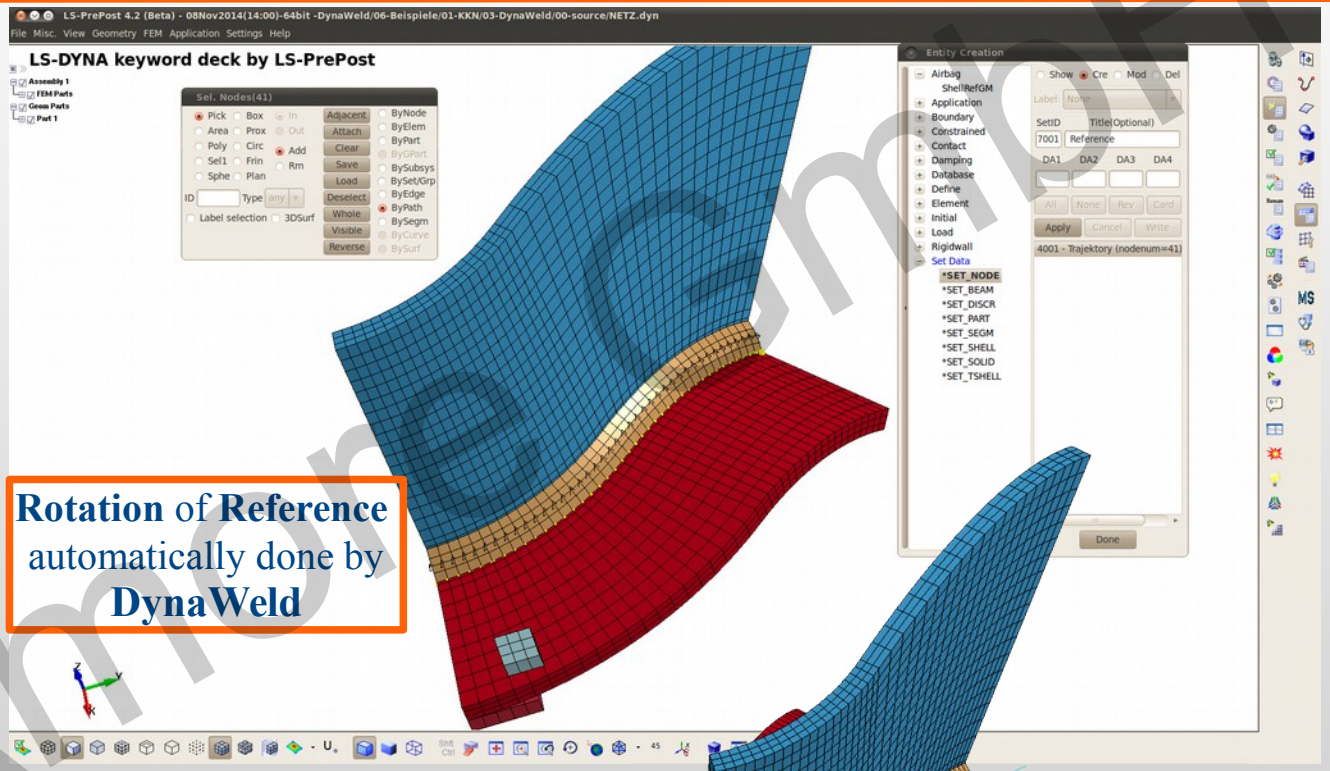

| v | Q | af | ar | b | c | ff | fr | ay | qf | qr | xo | z0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm/s | W | mm | mm | mm | mm | - | - | ° | W/mm³ | W/mm³ | mm | mm |
| 3 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 16 | 17 | 18 | 19 | 20 |
| * | * | * | * | * | * | * | * | * | * | * | * | * |
| 6,000 | 6590,827 | 5,903 | 18,446 | 5,605 | 6,007 | 0,326 | 1,674 | 47,203 | 106,437 | 5,554 | 3,261 | 3,522 |

# Workflow
## Trajectory

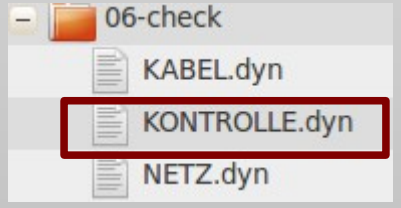
- Define Node Sets
  - for each Trajectory
  - for each Reference
- Trajektory length DynaWeld - Trajectory

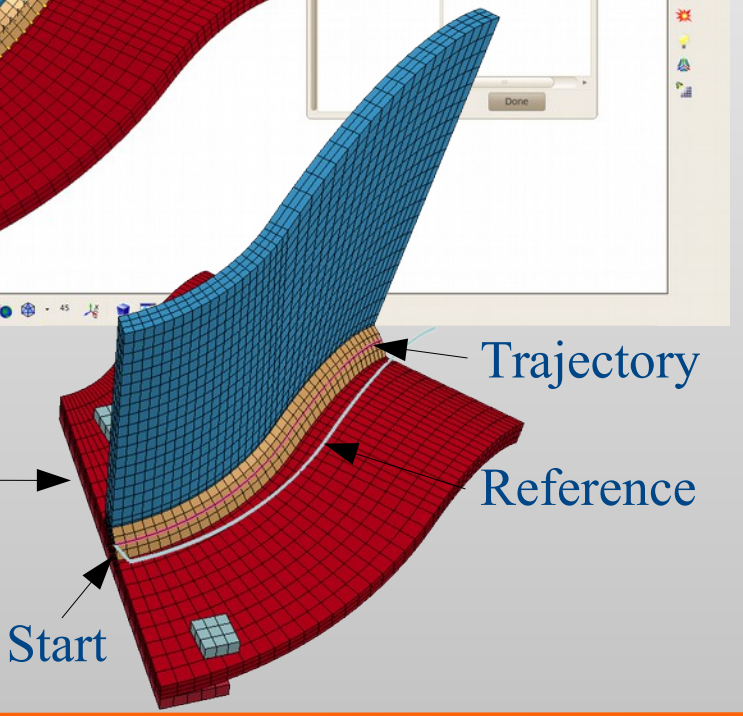



| Weld ID | Length | n_Ele |
|---|---|---|
| | mm | - |
| 1 | 2 | 22 |
| * | * | |
| 4001 | 123,689 | 40 |
| 7001 | 122,985 | 40 |




check Trajectory



# Workflow
## DynaWeld-Process-Plan

DynaWeld-Processplan-V0.01.ods - LibreOffice Calc

Datei Bearbeiten Ansicht Einfügen Format Extras Daten Fenster Hilfe

Liberation Sans 10

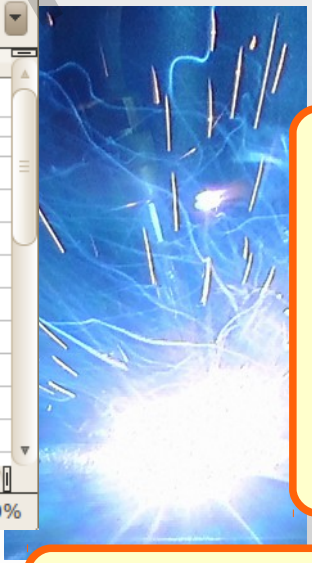
W8 18

**DynaWeld – Process plan**

| Process nr. | Weld ID | Length | v | Duration | Start | End | PAUSE | Q |
|---|---|---|---|---|---|---|---|---|
| | | mm | mm/s | s | s | s | s | W |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| * | * | * | * | * | * | * | * | * |
| 1 | 1001 | 55,6598698 | 4,166666667 | 13,3584 | 1000,0000 | 1013,3584 | 5,0000 | 5525,8223 |
| 2 | 1002 | 74,2131597 | 4,166666667 | 17,8112 | 1018,3584 | 1036,1695 | 5,0000 | 5525,8223 |

01-PROZESS 02-ZEIT 03-BOUNDARY 04-PART 05-KONTAKT 06-START

Tabelle 1 / 6 mp1 Summe=18 120%



Components

Welds

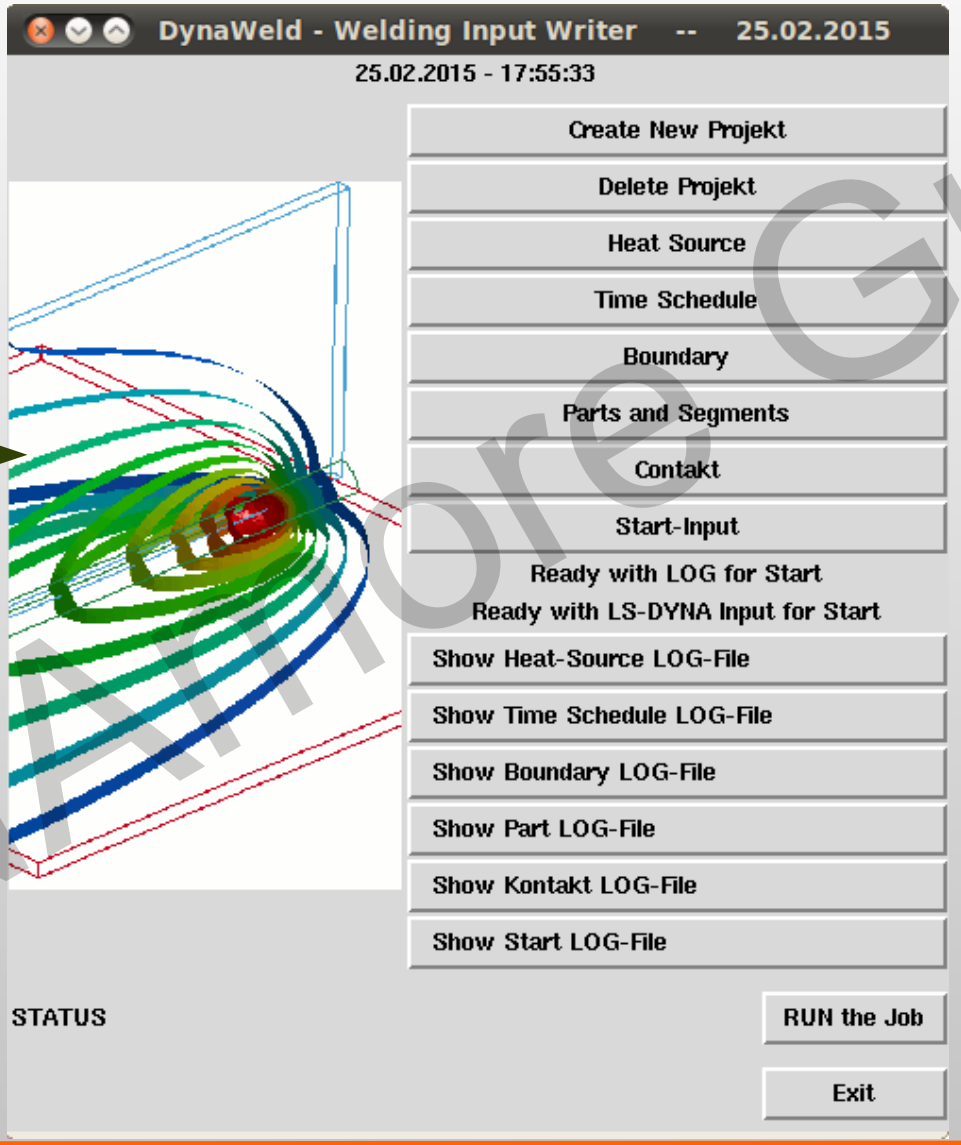
Clamps

- Setup the Process
  - Complete information in one file
  - Libre Office or MS Excel
  - Documentation

# Workflow
## DynaWeld – Input Writer

**DynaWeld Writer**
creates LS-DYNA
solver files in
**1 Minute**

**Process Plan**



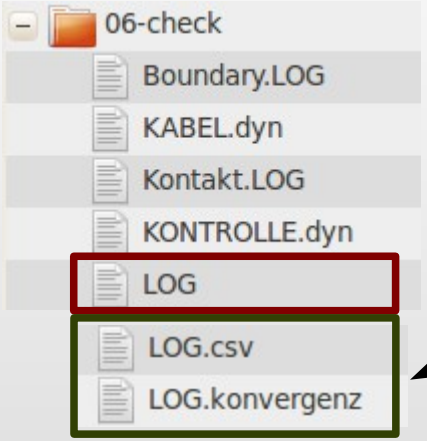

**New Project**

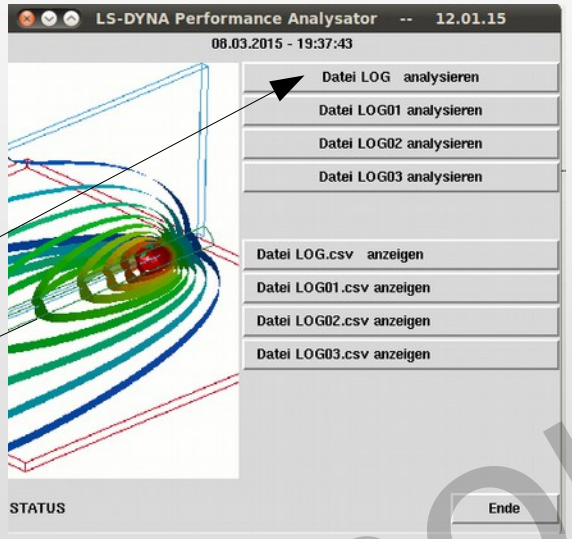
**Create**

**Check**

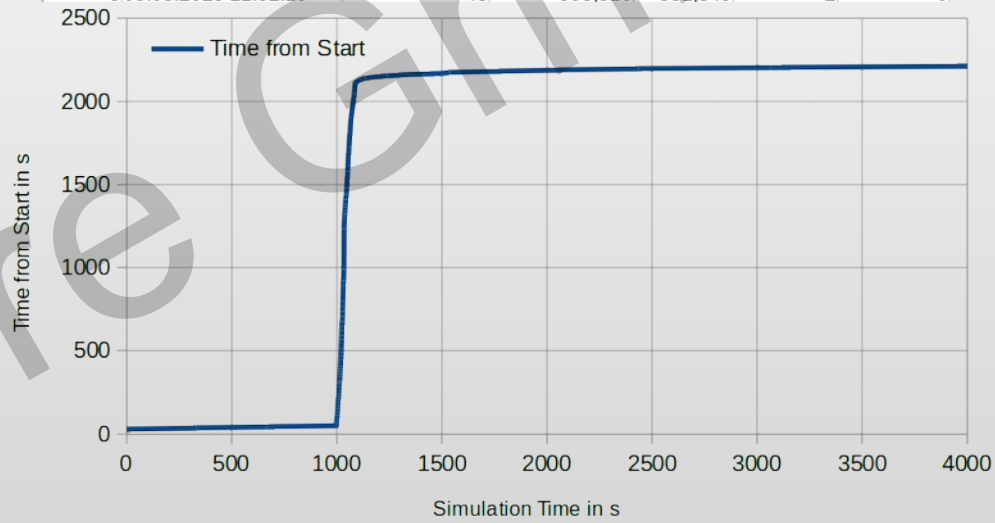
**RUN**

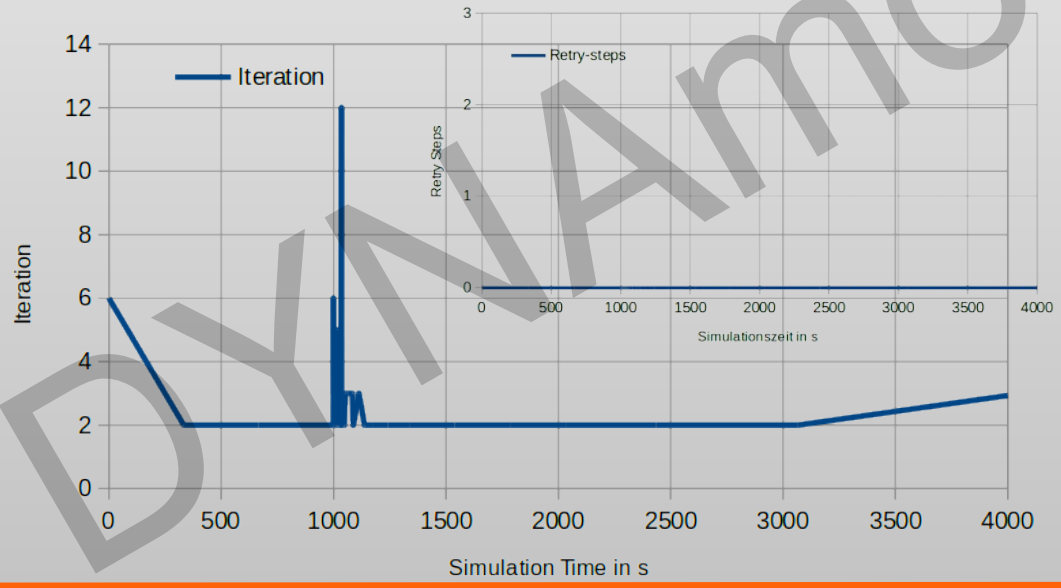
# Workflow
## DynaWeld Performance Analysis

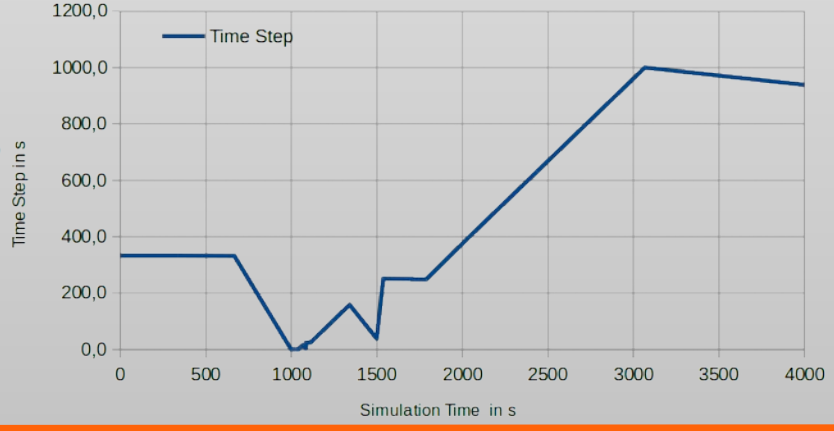


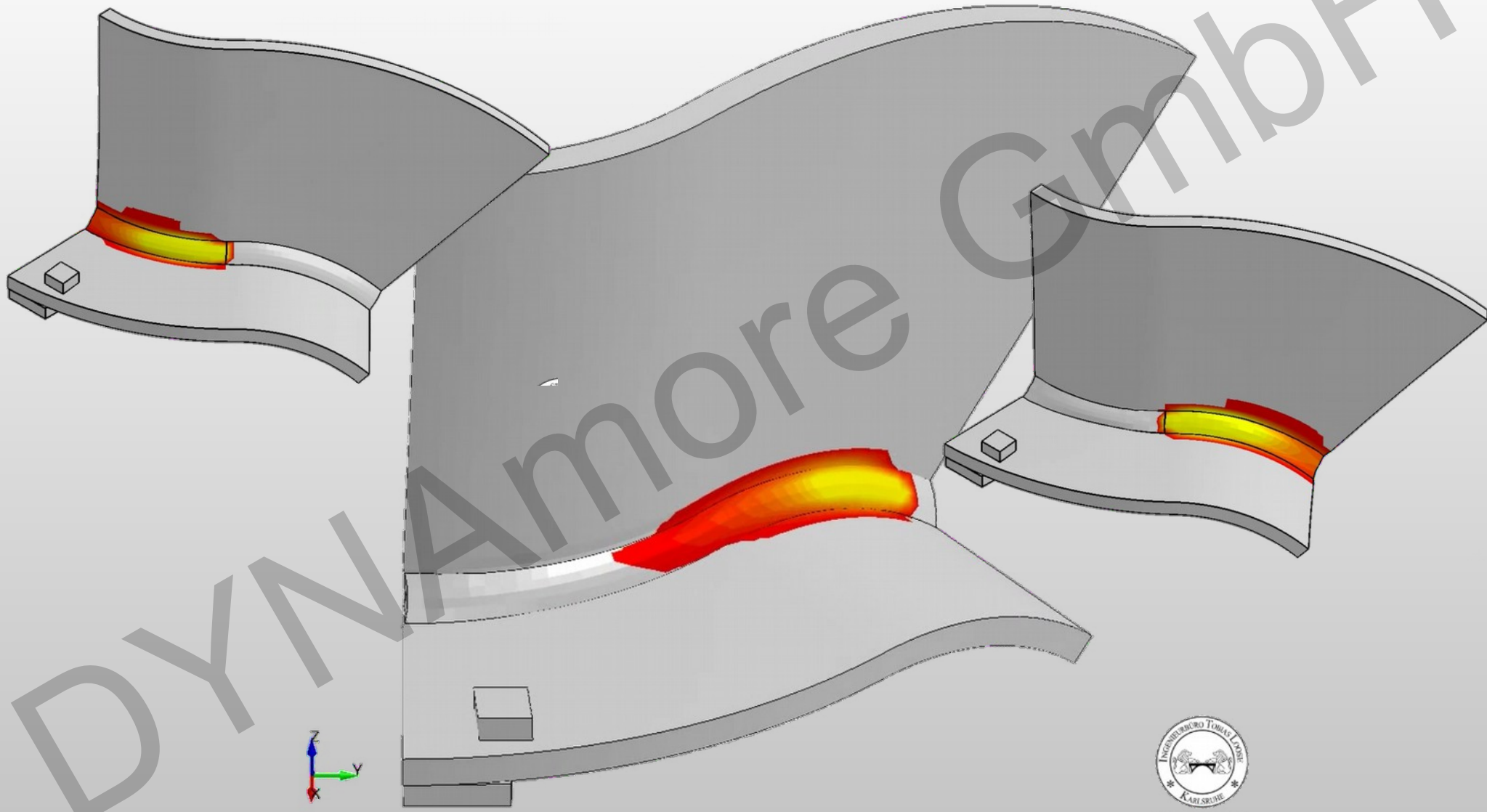

| Step ID | Absolutzeit | Zeit seit Beginn | Simulationszeit | Zeitschritt | Iterationen | Retry-steps |
|---|---|---|---|---|---|---|
| - | TT:MM:JJJJ HH:MM:SS | s | s | s | - | - |
| 0 | 05:03:2015 12:51:36 | 0 | 0 | | | |
| 1 | 05:03:2015 12:52:04 | 28 | 333,333 | 333,333 | 6 | 0 |
| 2 | 05:03:2015 12:52:12 | 36 | 666,667 | 333,333 | 2 | 0 |
| 3 | 05:03:2015 12:52:19 | 43 | 998,516 | 331,849 | 2 | 0 |



# Workflow
## Results and Postprocessing



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