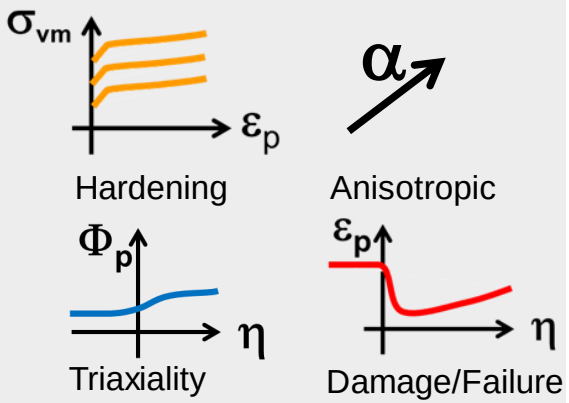
IMPETUS – Nicht immer zieht es sich in die Länge

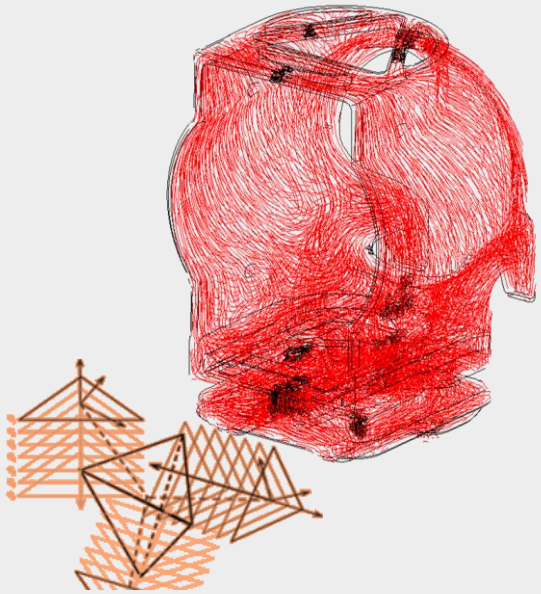
intelligent reliable solutions for plastics, composites, metals, foams, ...

VALIMAT



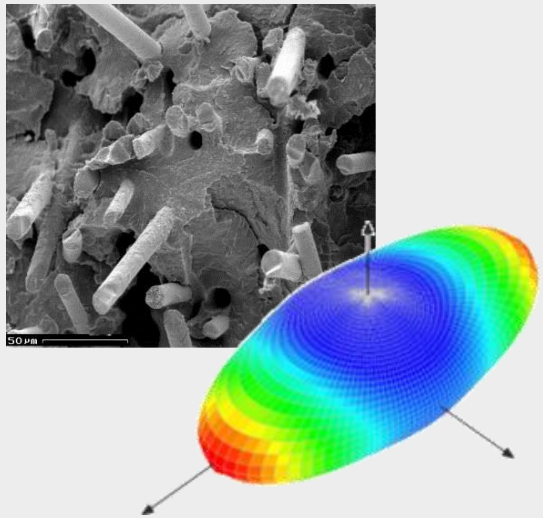
from test to validated material cards

FIBERMAP



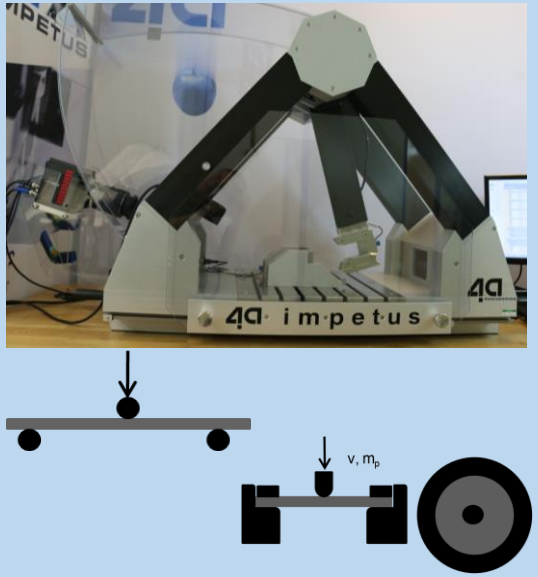
individual mapping process information

MICROMEC



3D anisotropic material cards

IMPETUS

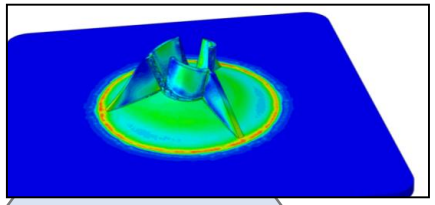


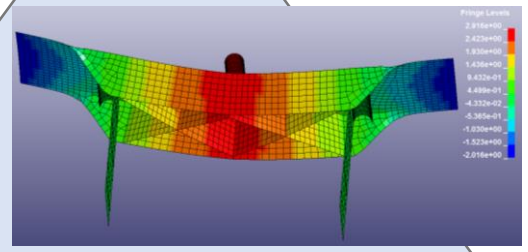
efficient dynamic testing

material characterization pyramid

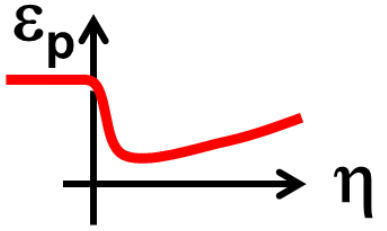
VALIMAT

Deformation → Failure
Creep → Static → Crash
ISOTROPIC → ANISOTROPIC



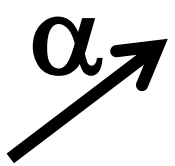


Triaxiality



Damage/Failure

Hardening



Anisotropic

IMPETUS

Versuchsarten

- 3PB
- 3PBG
- 3PB T-Specimen
- 3PB XX-Rib
- 4PB
- TT
- ST (Butterfly)
- CT
- PT
- PT Dome
- COT (Component Test)

Solver, Elementform, …

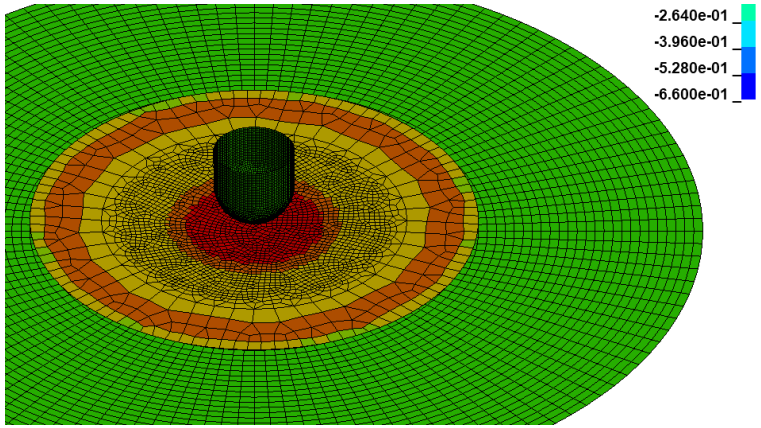
- LS-Dyna
- PAM-Crash
- Abaqus

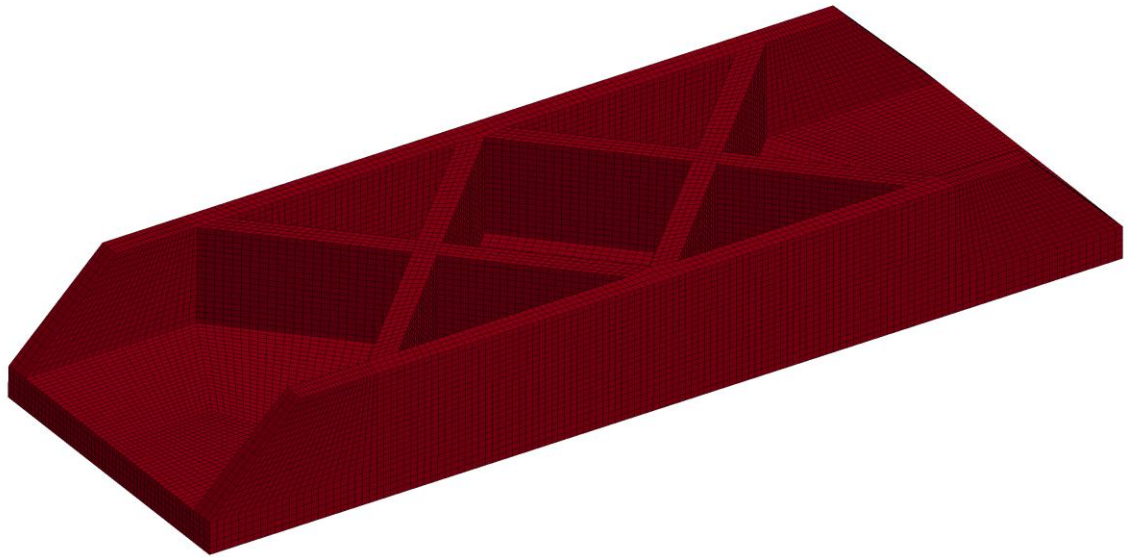
- Shell
- Solid

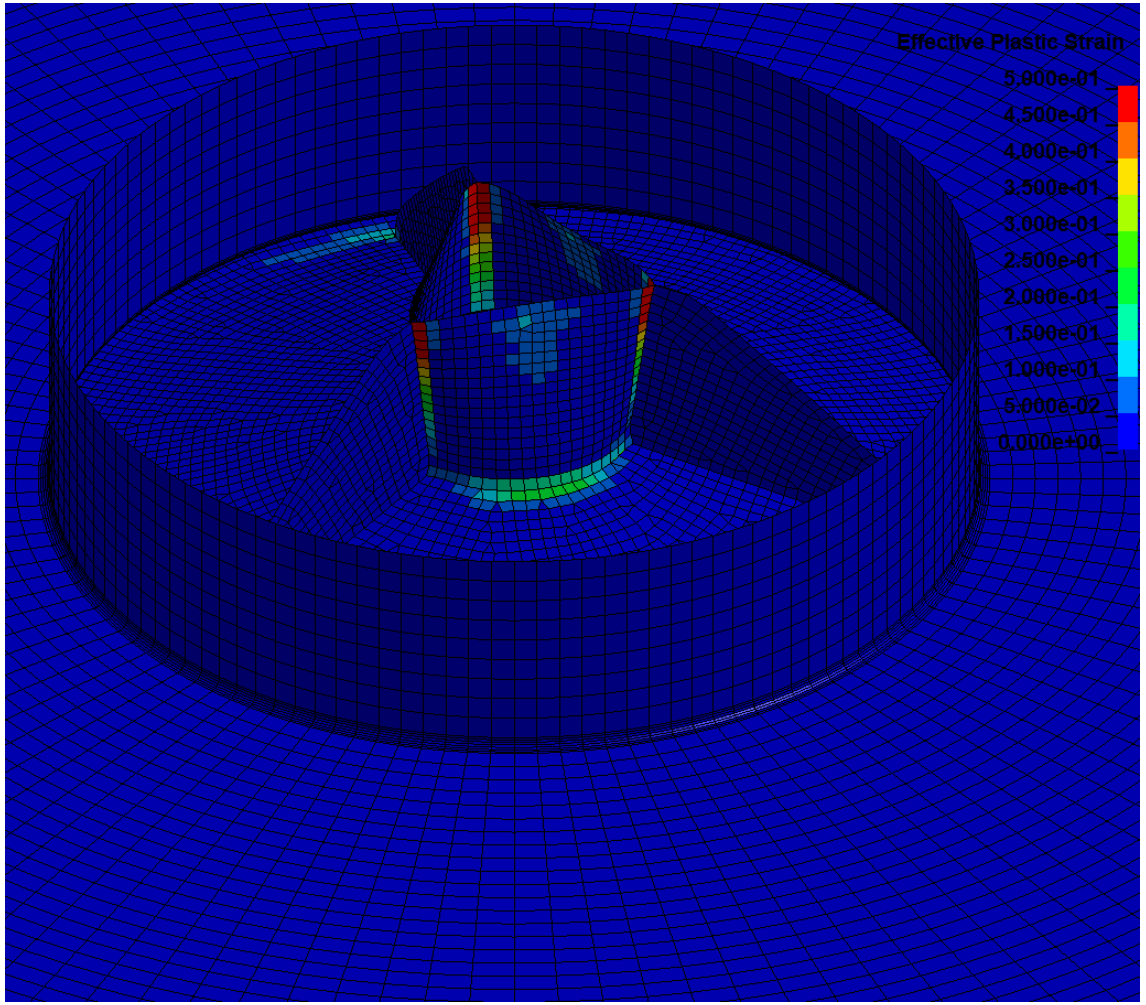
- Fullmodel
- Halfmodel
- Quartermodel
- One Elementsimulation

Standard Simulationen

- Neue Unterstützung für
  - Durchstoß
  - DOM
  - XX-Rippe

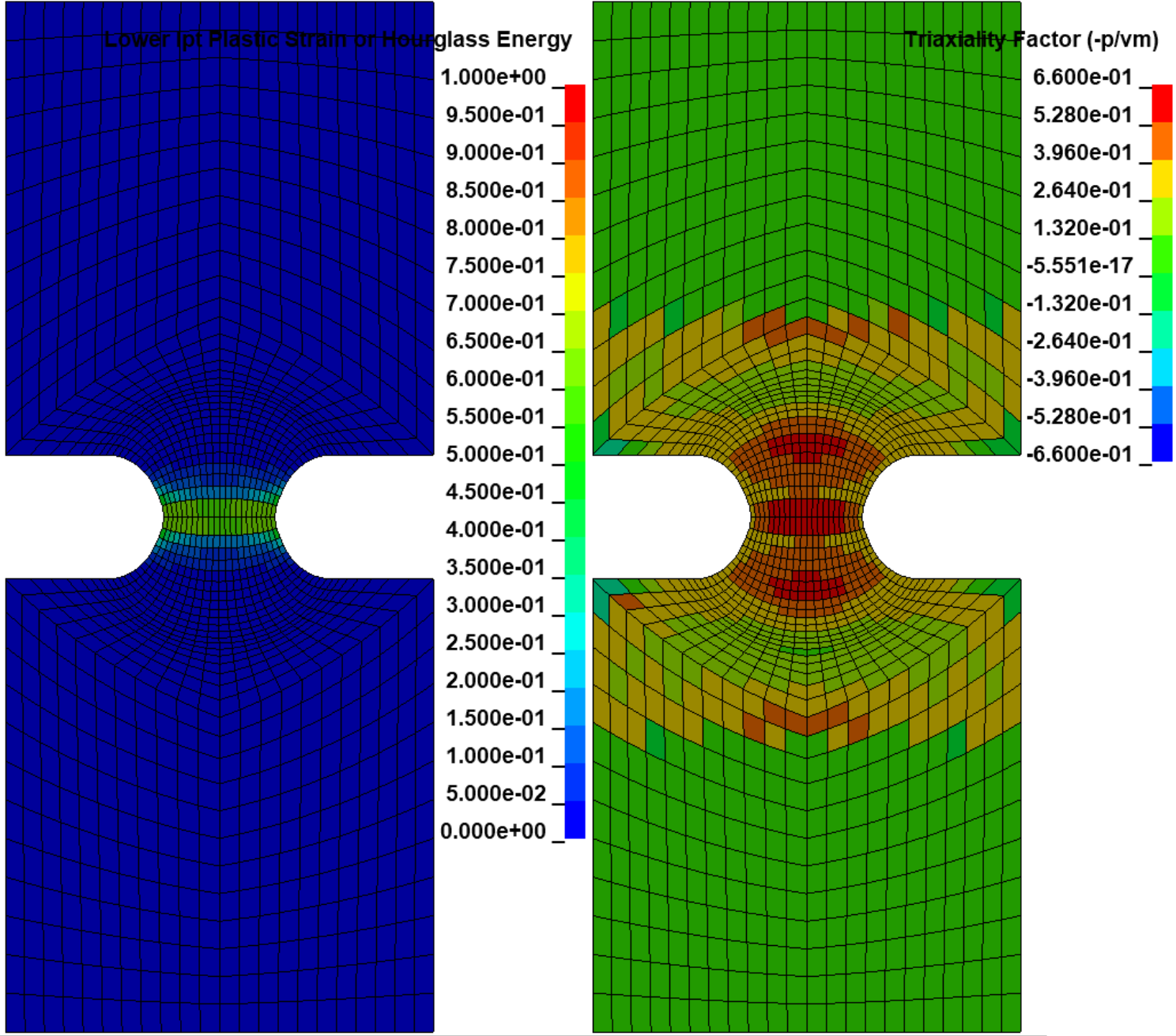






Userdefined Specimen – Zug

- Besteht aus
  - Knoten
  - Elementen
  - Sets
- Rest erstellt von VALIMAT
  - Einspannung
  - Geschwindigkeitsabhängig
  - Knoten und Elementergebnisse



Userdefined Specimen – Zug

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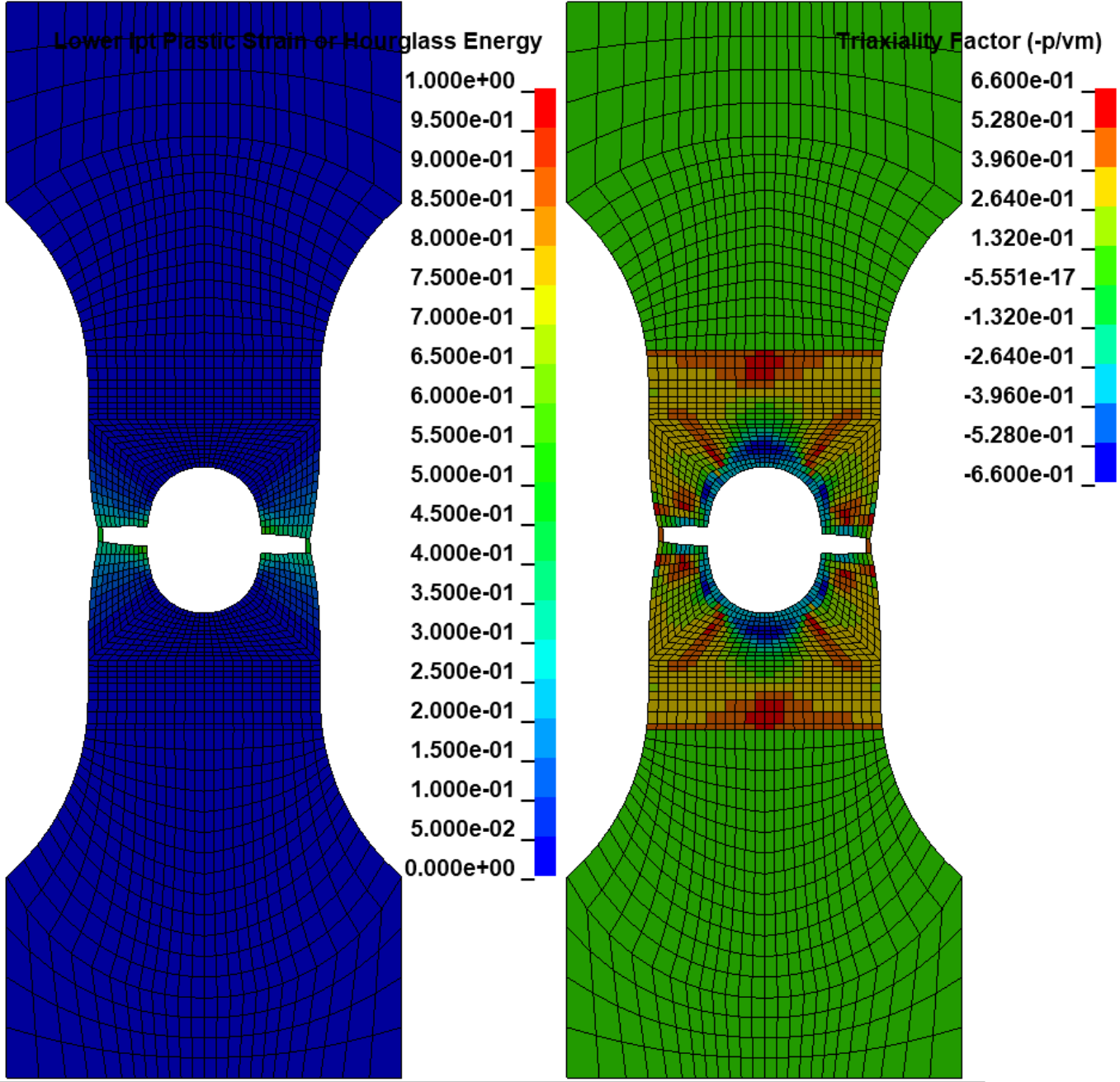

Userdefined Specimen – Zug

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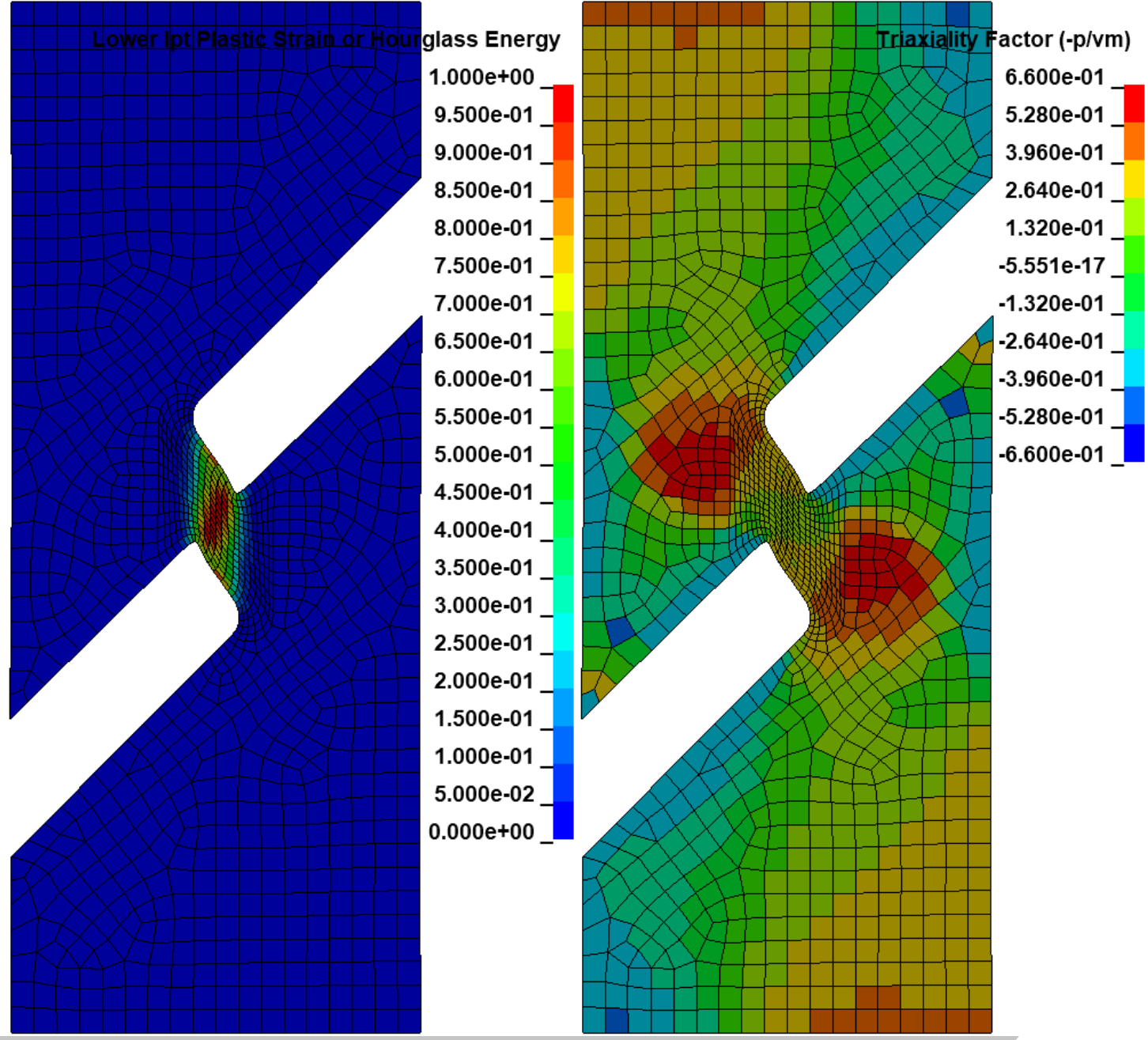
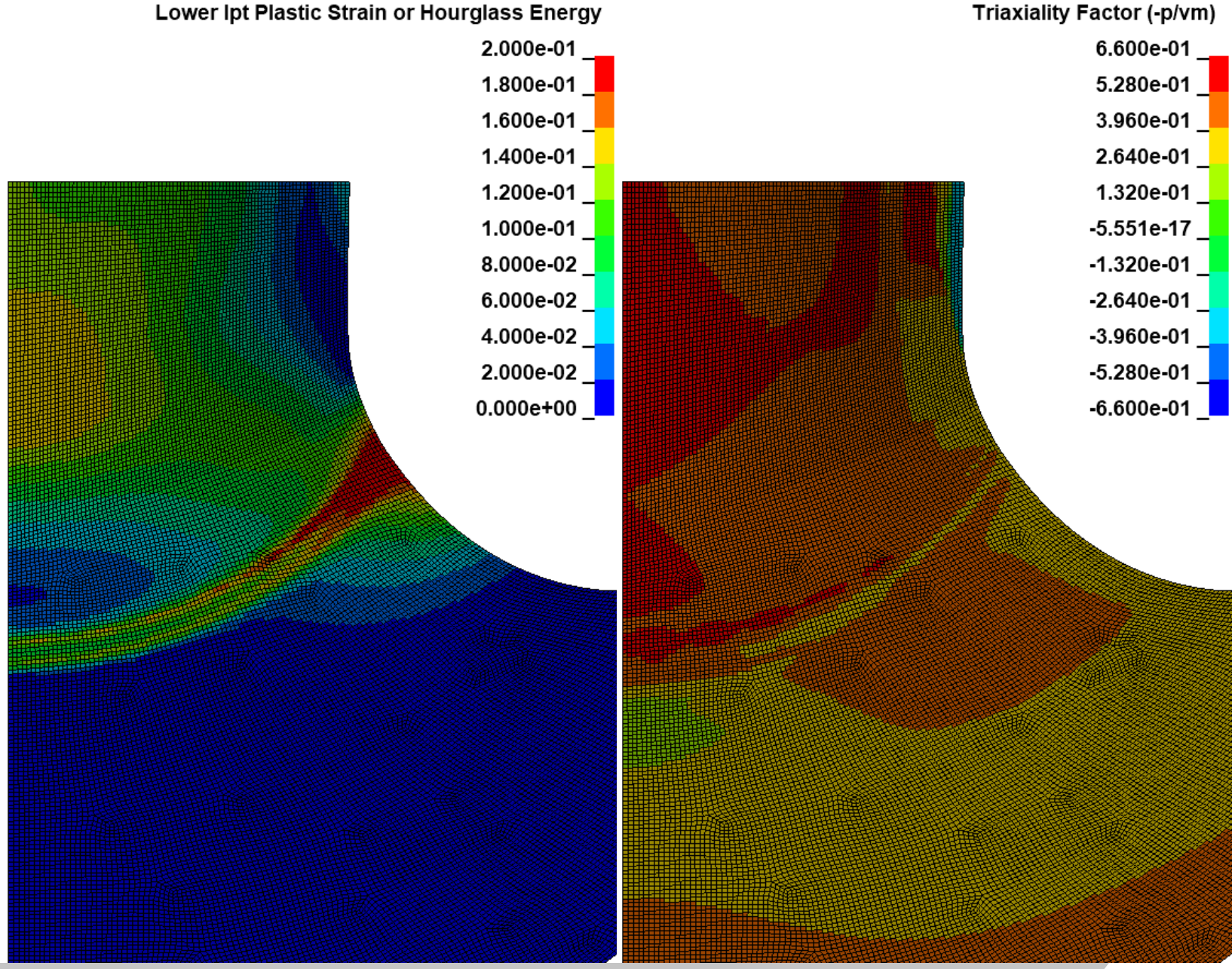
  - Einspannung
  - Geschwindigkeitsabhängig
  - Knoten und Elementergebnisse



Userdefined Specimen Nakajima

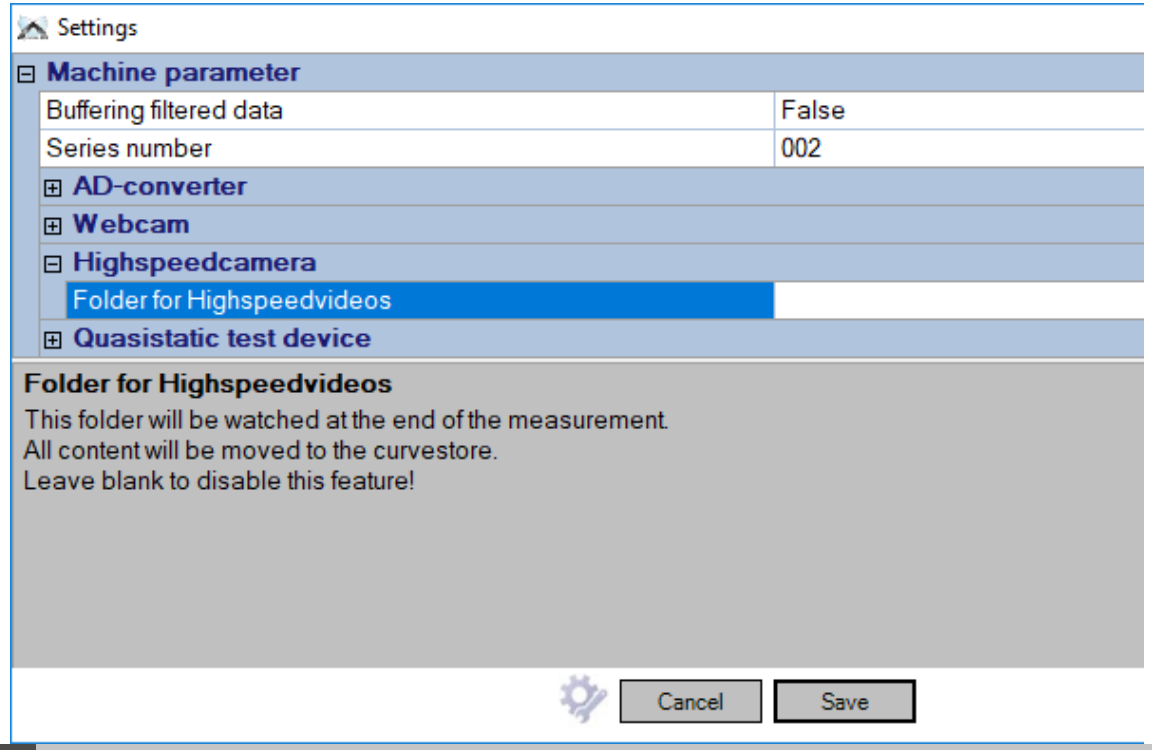
- Kompletter Benutzerdefinierter Aufbau
- Auswertung von VALIMAT
  - Kraft
  - Weg
  - Spannung
  - Dehnung
  - Dehnrate



Highspeed Kamera

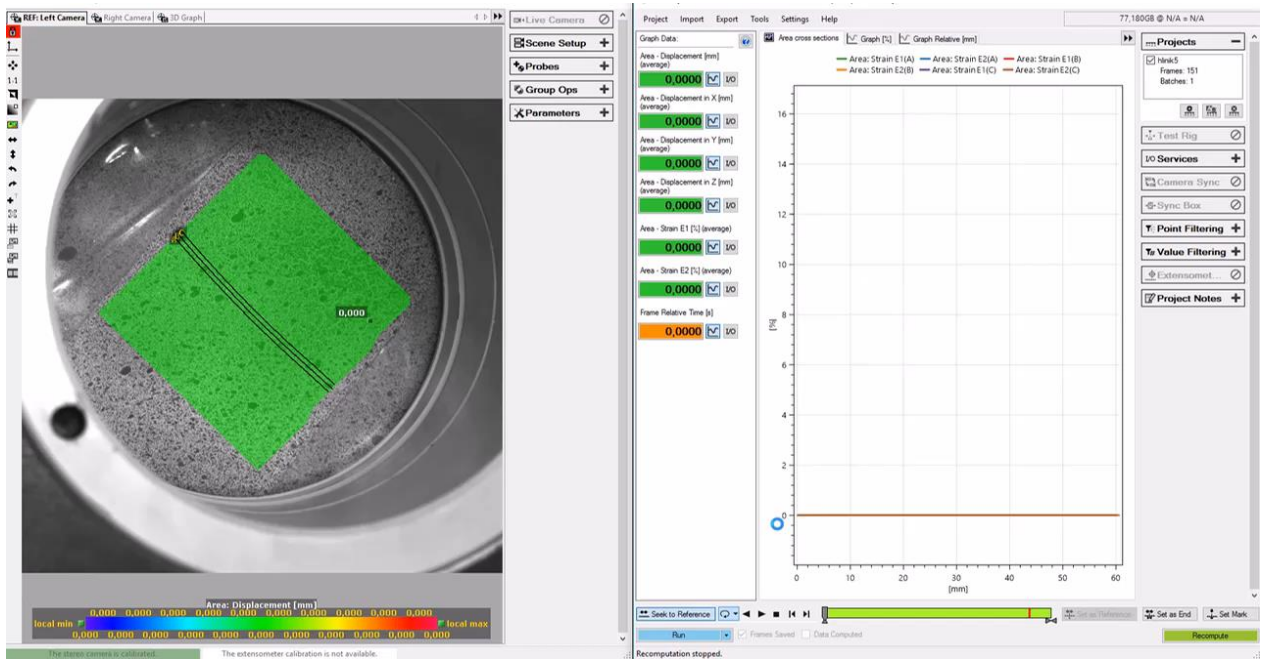
- Triggerausgang in IMPETUS verfügbar

- Automatisch konsistente Ablage der Bilder und Videos in der VALIMAT-Datenstruktur



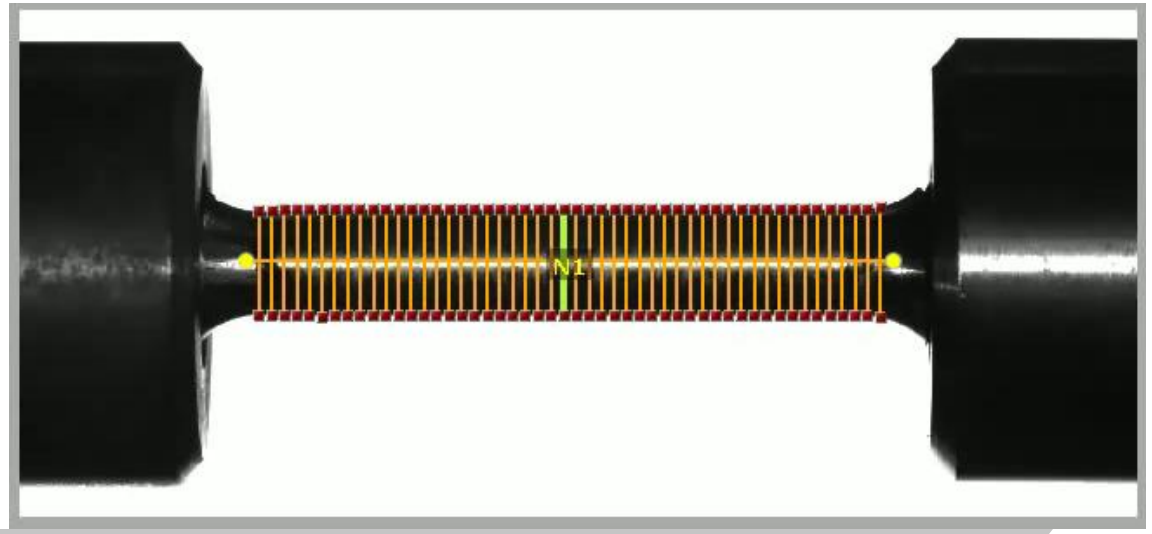
Ausblick v3.6 – DIC Integration

- Integration von Mercury
- Automatische Auswertung
- Verbesserter Vergleich von Simulation und DIC



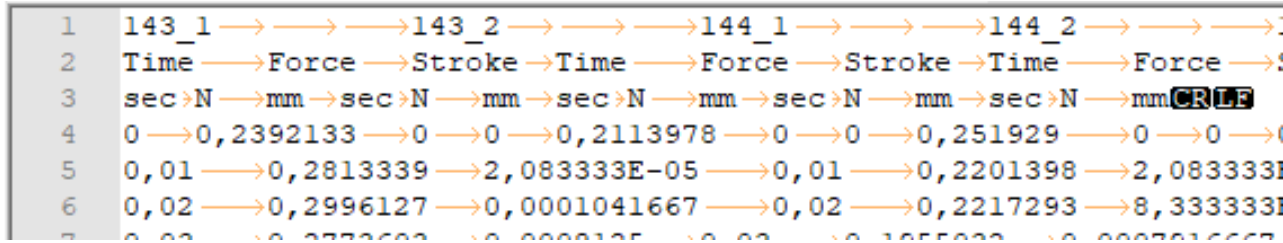
MERCURY® RT
REAL-TIME TRACKING SYSTEM

SOBRIETY



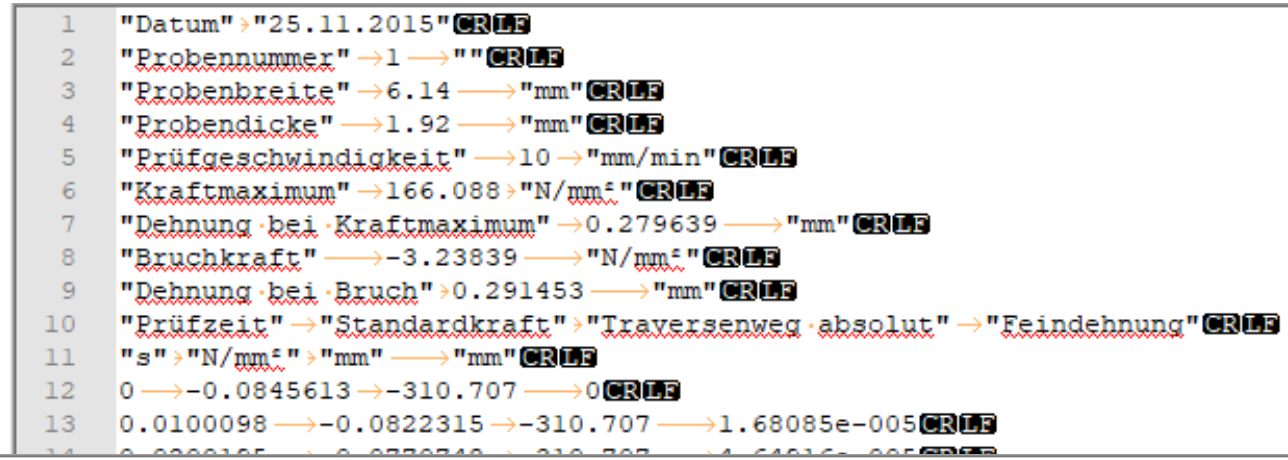
Ausblick v3.6 – Verbesserter Import

- Vielzahl an Dateiformaten
- Synchronisierung von DIC und Maschinendaten
- Unterschiedliche Formate von DIC und Maschine

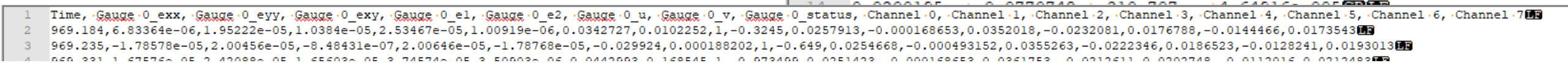


```
143_1;;;143_2;;;144_1;;;144_2;;;
Time;Force;Stroke;Time;Force;Stroke;Time;Force;
sec;N;mm;sec;N;mm;sec;N;mm;sec;N;mm;sec;N;mm
0;0,2392133;0;0;0,2113978;0;0;0,251929;0;0;
0,01;0,2813339;2,083333E-05;0,01;0,2201398;2,083333
0,02;0,2996127;0,0001041667;0,02;0,2217293;8,333333
```

- Automatische Erkennung von Dateiformaten
  - Trennzeichen
  - Dezimaltrennzeichen
  - Header
- Import von Metadaten
  - Probekörpername, Dicke, Breite, …



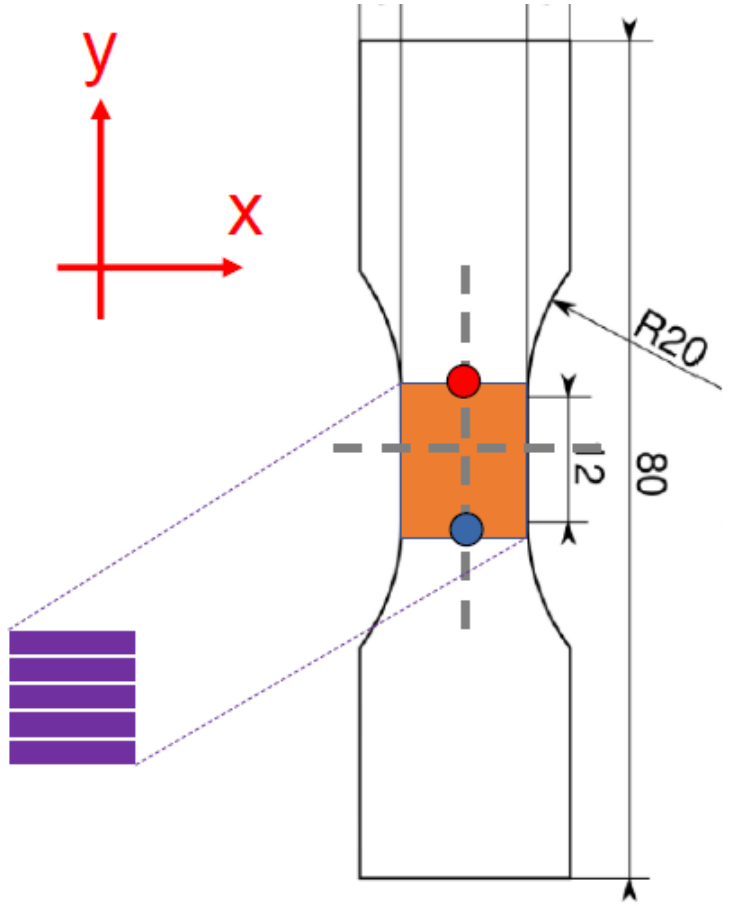
```
"Datum";"25.11.2015"
"Probennummer";1;""
"Probenbreite";6.14;"mm"
"Probendicke";1.92;"mm"
"Prüfgeschwindigkeit";10;"mm/min"
"Kraftmaximum";166.088;"N/mm²"
"Dehnung bei Kraftmaximum";0.279639;"mm"
"Bruchkraft";-3.23839;"N/mm²"
"Dehnung bei Bruch";0.291453;"mm"
"Prüfzeit";"Standardkraft";"Traversenweg absolut";"Feindehnung"
"s";"N/mm²";"mm";"mm"
0;-0.0845613;-310.707;0
0.0100098;-0.0822315;-310.707;1.68085e-005
```



```
Time, Gauge 0_exx, Gauge 0_eyy, Gauge 0_exy, Gauge 0_e1, Gauge 0_e2, Gauge 0_u, Gauge 0_v, Gauge 0_status, Channel 0, Channel 1, Channel 2, Channel 3, Channel 4, Channel 5, Channel 6, Channel 7
969.184,6.83364e-06,1.95222e-05,1.0384e-05,2.53467e-05,1.00919e-06,0.0342727,0.0102252,1,-0.3245,0.0257913,-0.000168653,0.0352018,-0.0232081,0.0176788,-0.0144466,0.0173543
969.235,-1.78578e-05,2.00456e-05,-8.48431e-07,2.00646e-05,-1.78768e-05,-0.029924,0.000188202,1,-0.649,0.0254668,-0.000493152,0.0355263,-0.0222346,0.0186523,-0.0128241,0.0193013
```

Ausblick v3.6 – DIC Standardformat

- Definition eines Standardformates für DIC – Daten
- Einfacher und schneller Import
- Spalten durch VALIMAT automatisch zuordenbar durch einheitliche und eindeutige Spaltenheader

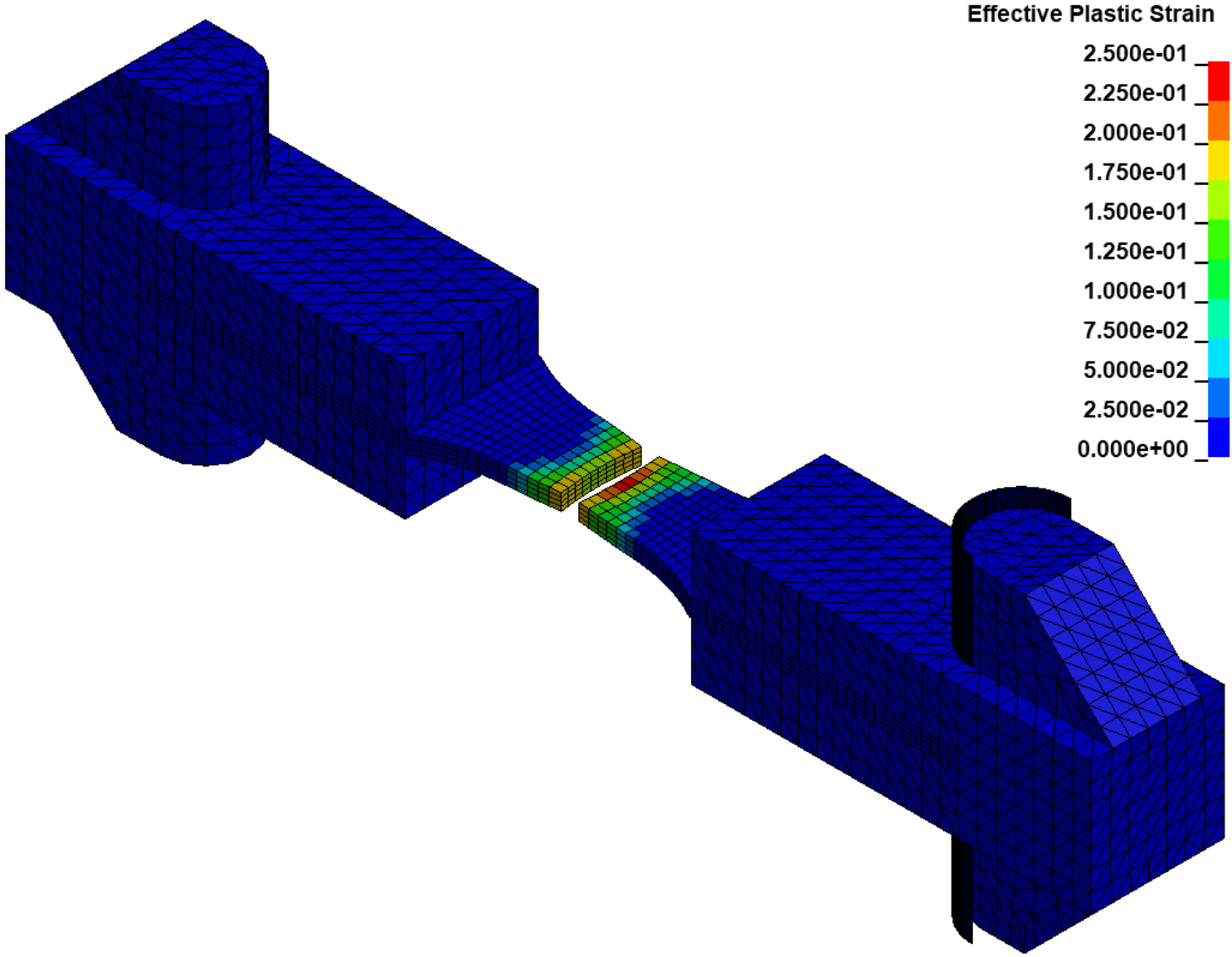



```
(?<id>\d{3})_(?<what>Time|Force|Displacement|Strain|Stress|Strainrate)(?:_(?<where>Crosshead|2P|Paralellarea|Point[1-2]|Area[1-6]))?(?:-(?<type>tech|true))?(?:\.(?<direction>X|Y|Z|XY))?(?:\[(?<unit>s|N|mm|%|-|MPa|1\/s|%\/s)\])
```

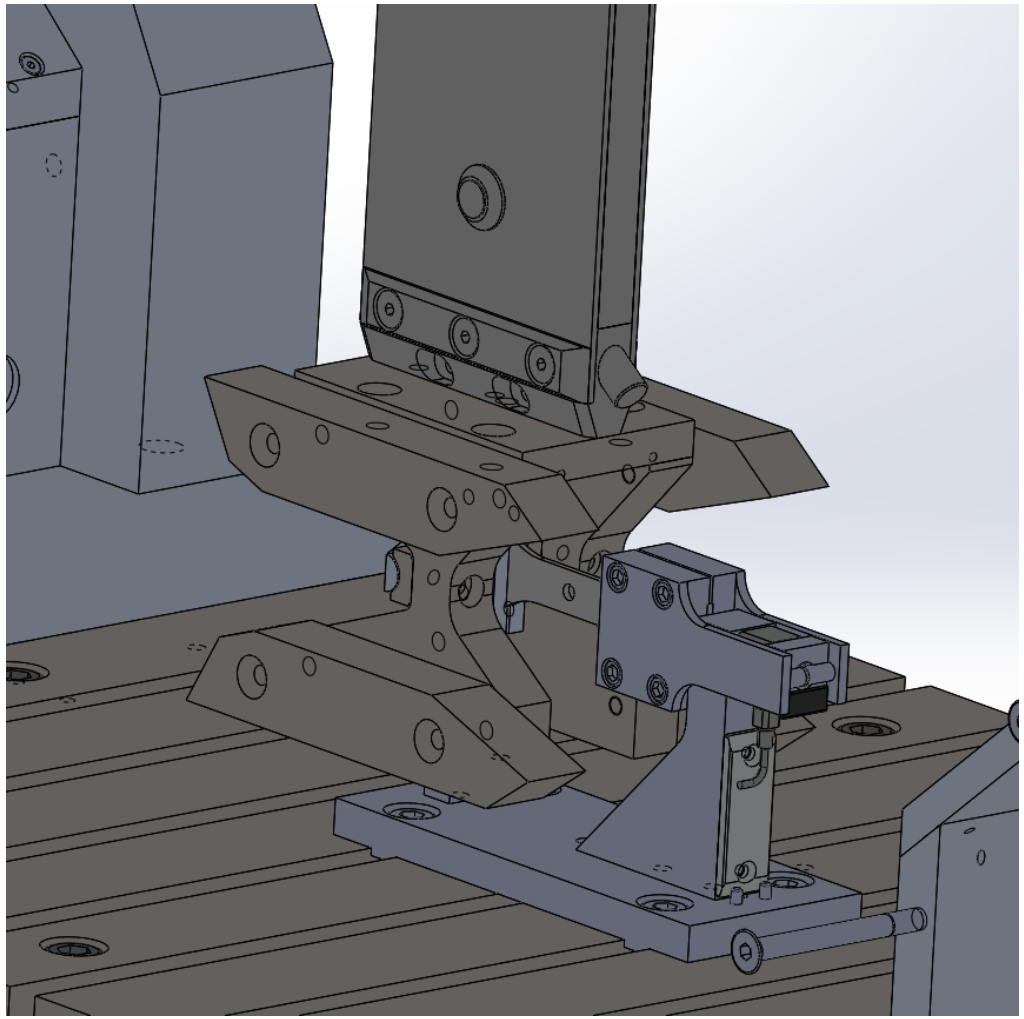
Spaltenbezeichnung
000_Time [s]
022_Force [N]
010_Displacement_Crosshead.Y [mm]
042_Strain_2P.Y [xxx]
030_Stress_Parallelarea-tech [MPa]
032_Stress_Parallelarea-true [MPa]
110_Displacement_Point1.X [mm]
111_Displacement_Point1.Y [mm]
112_Displacement_Point1.Z [mm]
120_Displacement_Point2.X [mm]
121_Displacement_Point2.Y [mm]
122_Displacement_Point2.Z [mm]
011_Displacement_2P.Y [mm]
401_Strain_Parallelarea-true.X [xxx]
402_Strain_Parallelarea-true.Y [xxx]
403_Strain_Parallelarea-true.Z [xxx]
404_Strain_Parallelarea-true.XY [xxx]
411_Strain_Area1-true.X [xxx]
412_Strain_Area1-true.Y [xxx]
413_Strain_Area1-true.Z [xxx]
414_Strain_Area1-true.XY [xxx]
421_Strain_Area2-true.X [xxx]
422_Strain_Area2-true.Y [xxx]
423_Strain_Area2-true.Z [xxx]
424_Strain_Area2-true.XY [xxx]
431_Strain_Area3-true.X [xxx]
432_Strain_Area3-true.Y [xxx]
433_Strain_Area3-true.Z [xxx]
434_Strain_Area3-true.XY [xxx]
441_Strain_Area4-true.X [xxx]
442_Strain_Area4-true.Y [xxx]
443_Strain_Area4-true.Z [xxx]
444_Strain_Area4-true.XY [xxx]
451_Strain_Area5-true.X [xxx]
452_Strain_Area5-true.Y [xxx]
453_Strain_Area5-true.Z [xxx]
454_Strain_Area5-true.XY [xxx]
461_Strain_Area6-true.X [xxx]
462_Strain_Area6-true.Y [xxx]
463_Strain_Area6-true.Z [xxx]
464_Strain_Area6-true.XY [xxx]
500_Strainrate_2P.Y [xxx/s]
502_Strainrate_Parallelarea.Y [xxx/s]

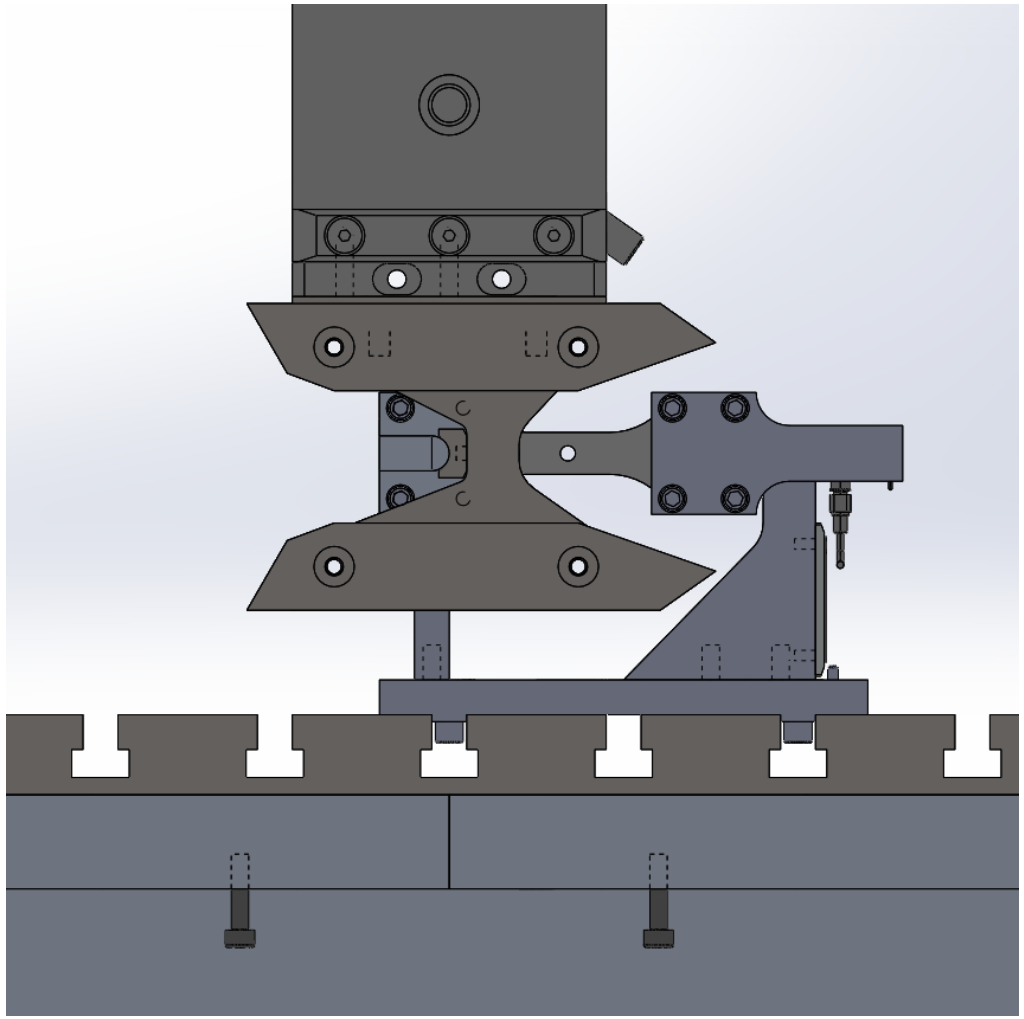
Ausblick v3.6 – Schlagzug

- Simulative Entwicklung
- Piezokraftmessdose für hohe Dynamik bei hohen Lasten
- Freie Sicht für DIC Aufnahmen
- Möglichkeit zu Hoch- und Tieftemperatur-Messung
- Anpassbar an verschiedene Probekörpergeometrien



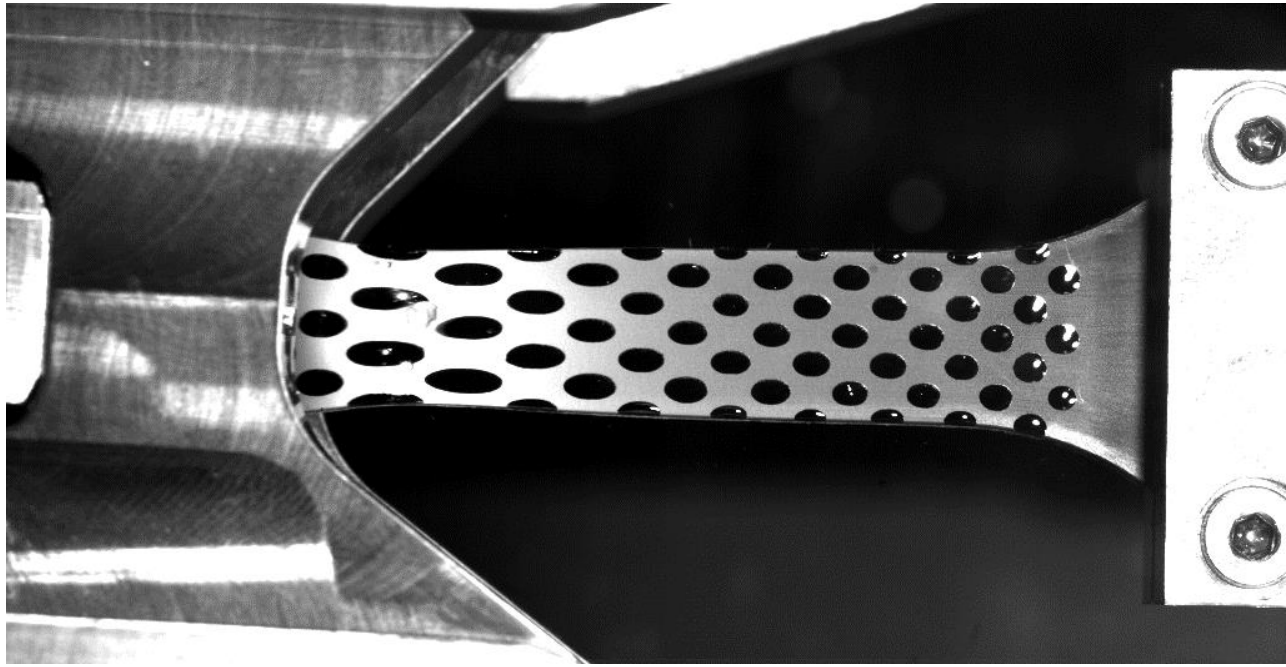
Ausblick v3.6 – Schlagzug





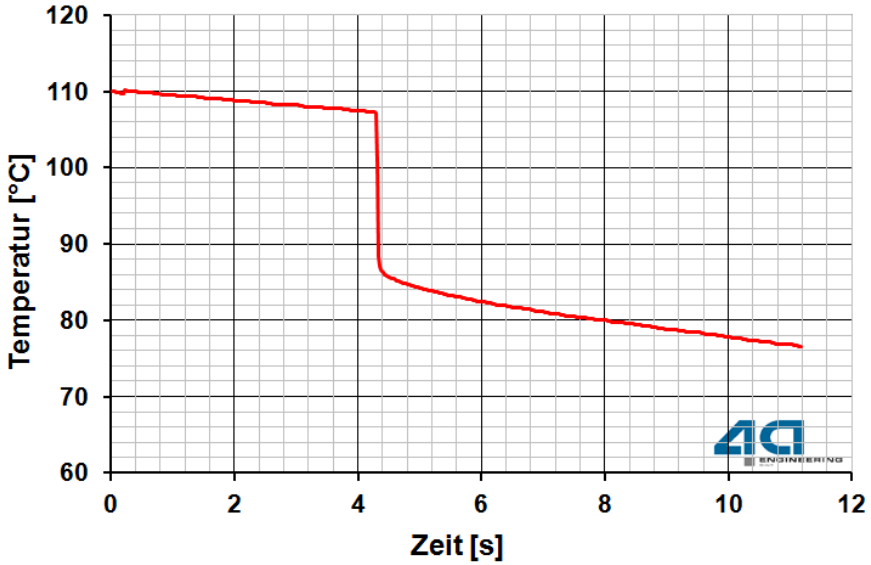
Ausblick v3.6 – Schlagzug

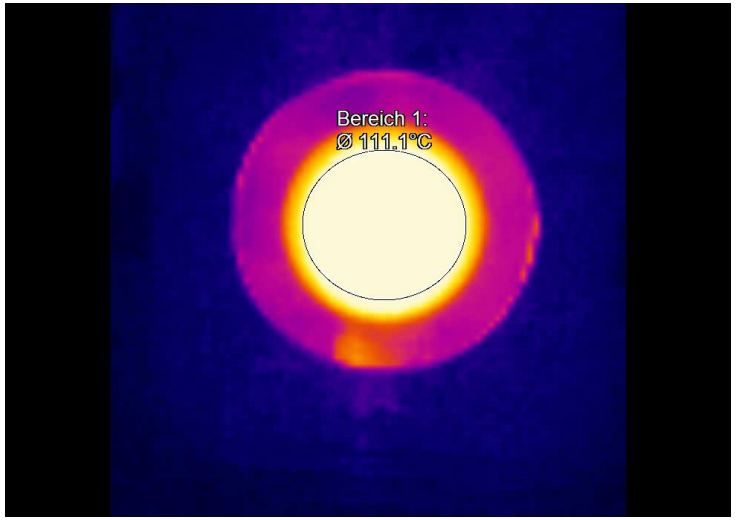
- Vergleich mit kommerziell erhältlichen Maschinen
- Vergleich mit Simulation
- Ziel:
  Automatische Auswertung der Dehnungen

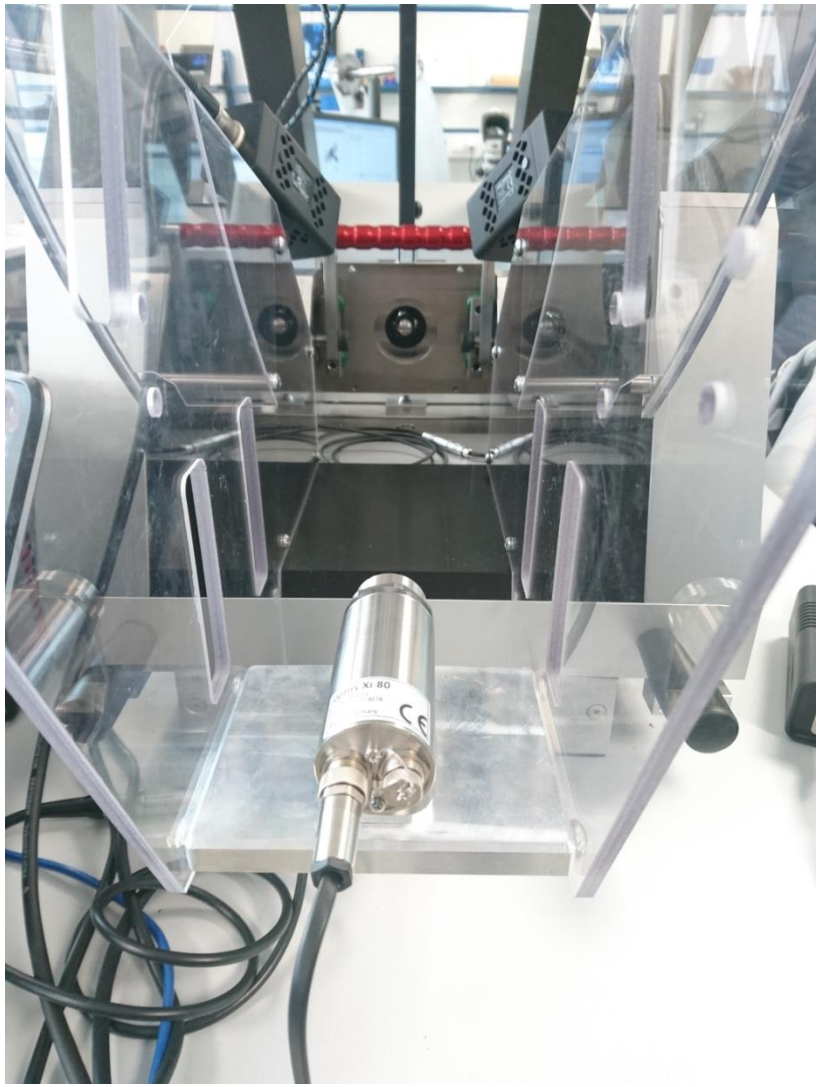


Ausblick v3.6 – IR Kamera

- 80x80 Pixel
- -20°C (-30°C) bis 900°C
- Triggerung über IMPETUS
- Kompakte Bauweise (Ø 36 mm, 90 mm lang)
- Erster Testlauf am Durchstoßaufbau





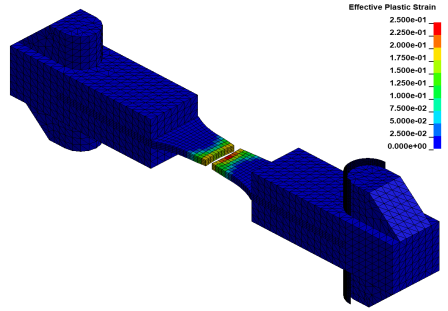


VALIMAT

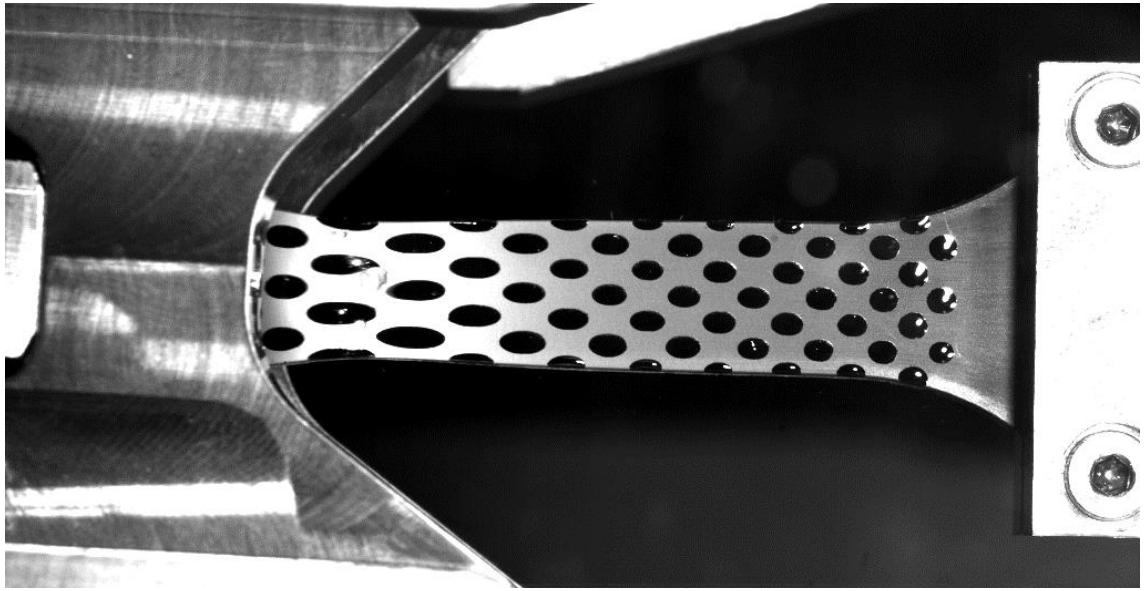
Version: 3.5

- Standard Modelle erweitert
  - Durchstoß, Dom, XX-Rippe
- Benutzerdefinierte Probekörper (auch mit Durchstoß)
- Photron (Highspeed Kamera) Anbindung verbessert
- Materialmodellpflege/-updates
  - LS-DYNA: GISSMO, …
  - PamCrash: MMATER, …

Version: 3.6



- DIC Workflow mit Mercury
- Verbesserter Import
- DIC Datenstandard
- Schlagzug



IMPETUS

Fragen?