



VALIMAT



IMPETUS

4a Summer School Summary: Lessons learned, outlook and upcoming features

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Traboch, 10.07.2020



1st week - Introduction and outlook



07. July - Introduction to VALIMAT[®] from test to material card



08. July - Efficient dynamic testing with IMPETUS[®]



09. July - Material card generation: vonMises plasticity (*MAT_024), simple failure, setting up our Autofit



10. July - Summary: Lessons learned, outlook and upcoming features

Content

- Efficient dynamic testing with IMPETUS[®] summary
- Material card generation: vonMises plasticity (*MAT_024) with simple failure summary
- VALIMAT[®] 3.8 upcoming features
- Outlook on our advanced topics week
- Q&A

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VALIMAT



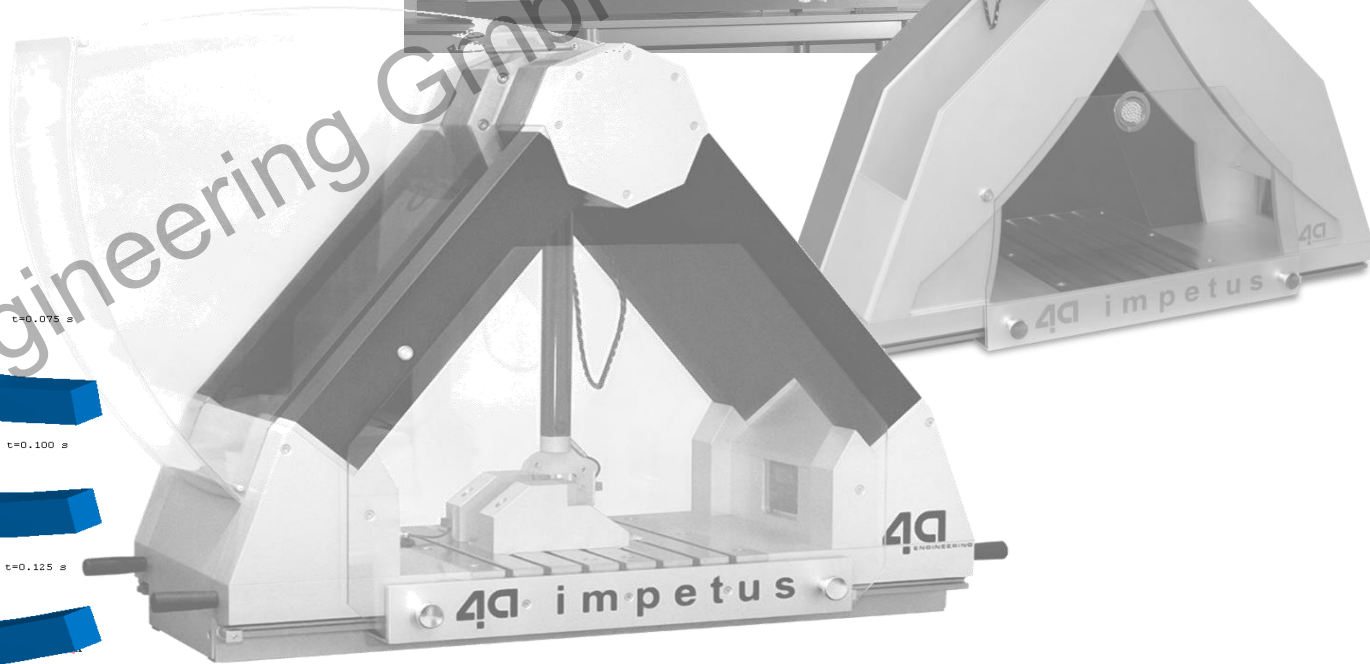
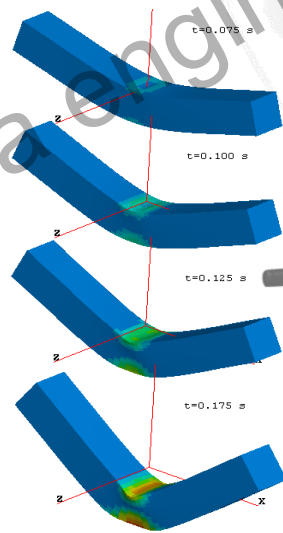
IMPETUS

4a Summer School Efficient dynamic testing with IMPETUS® summary



Efficient dynamic testing with IMPETUS®

- desktop testing device
- instrumented high-speed testing



IMPETUS[®] data specification



technical specifications

maximum energy	50J
length of swing arm	500mm
mass of swing arm	1.5 - 5.5kg
impact velocity	0.5 - 4.4m/s

weights and dimensions

L x W x H	1400 x 600 x 850mm
mass	165kg

desk load and dimensions minimum required

L x W x H	1500 x 800 x 800mm
minimum load	250kg

electrical supply data

230 VAC 50 Hz	0.5A
115 VAC 60 Hz	1.0A

5V camera trigger

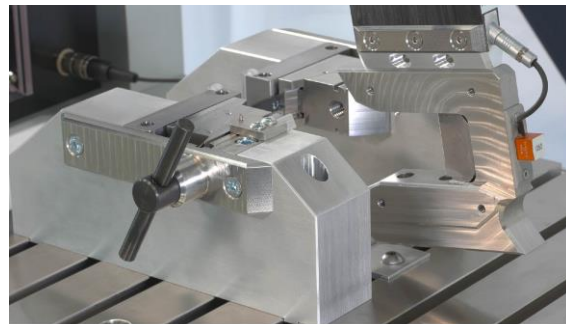
output level high	>2.5V
output level low	<0.5V

Highspeed camera is an optional equipment and can be ordered separately.

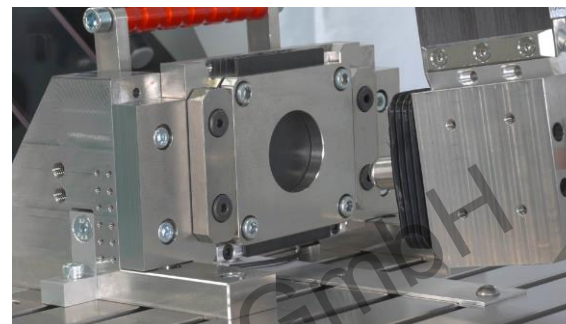
IMPETUS® - configurations



3 POINT BENDING



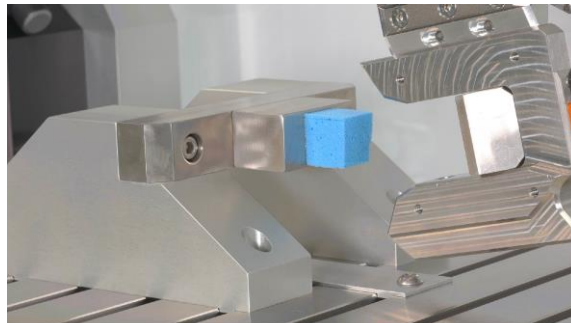
TENSION BENDING



PUNCTURE TEST



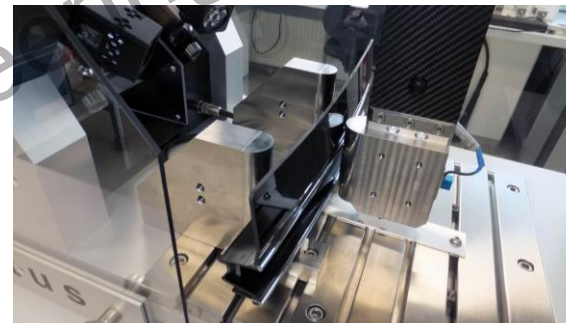
TENSION TEST



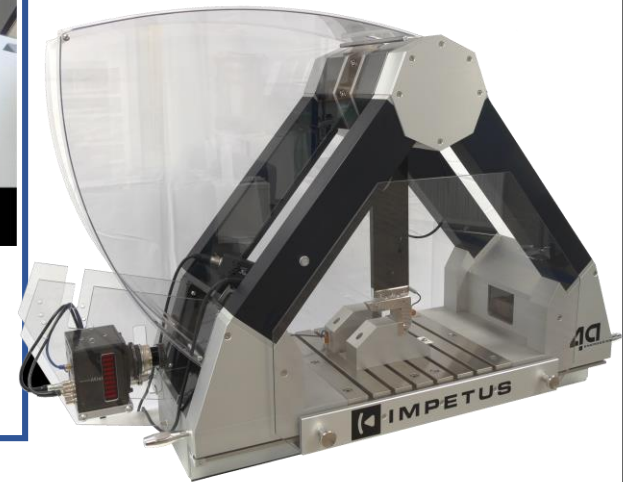
COMPRESSION TEST



SAMPLE MAGAZIN



COMPONENT TEST

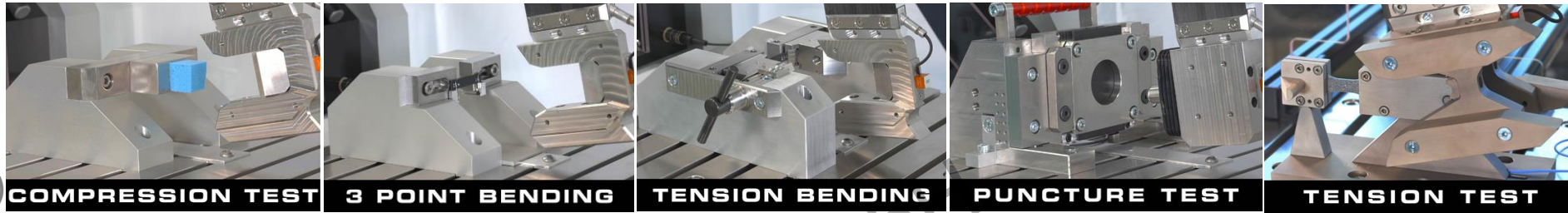


BASIC

STANDARD

PROFESSIONAL

efficient dynamic testing



Material (*Typical thickness*)

Plastic (*1 - 4 mm*)

Foam (*20 - 30 mm*)

Composite (*1 - 4 mm*)

Aluminum (*1 - 2.5 mm*)

Metals (*0.5 - 1.5 mm*)

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validated material cards - injection mold for plastics

Dom & Wall thickness



Melt- & Weldlines

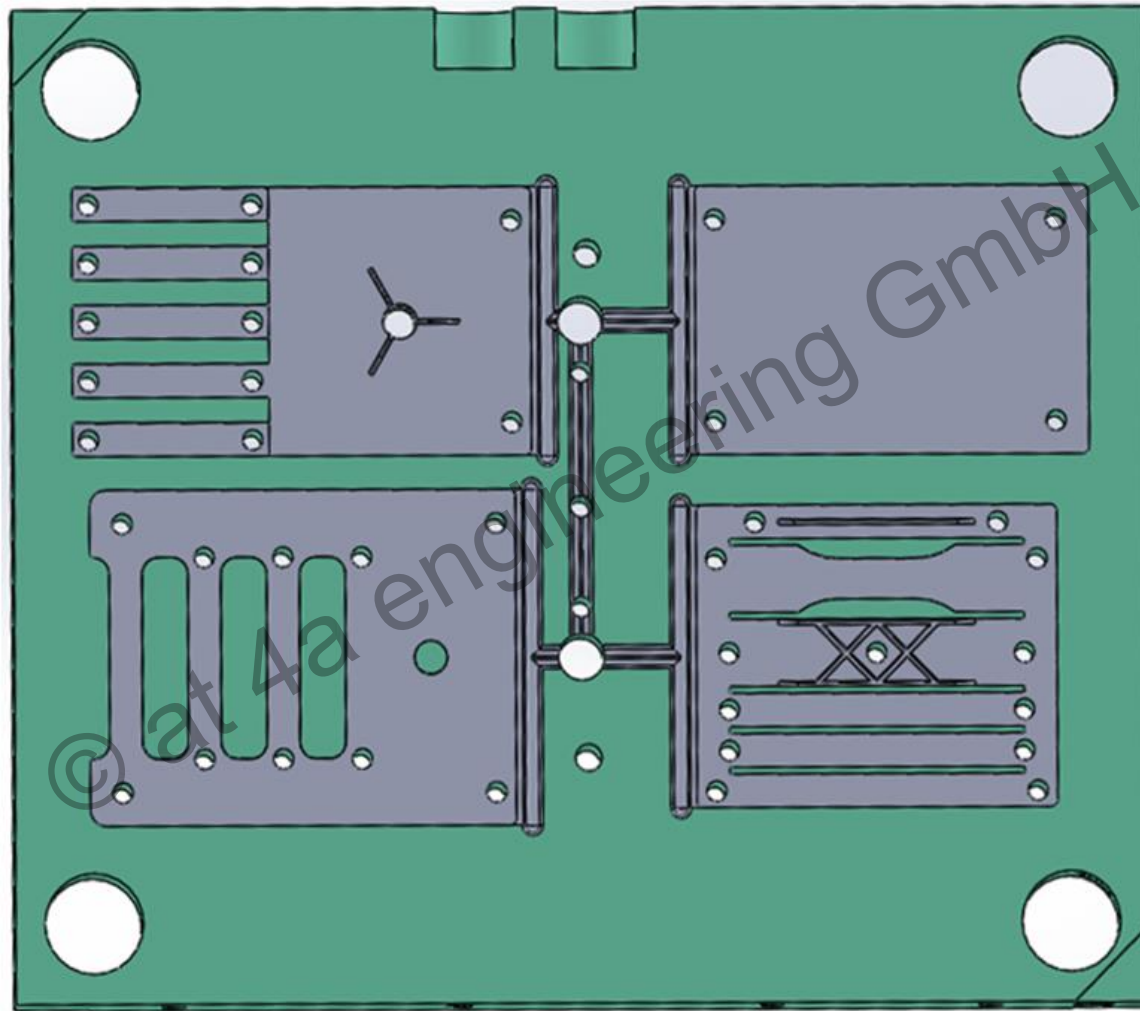
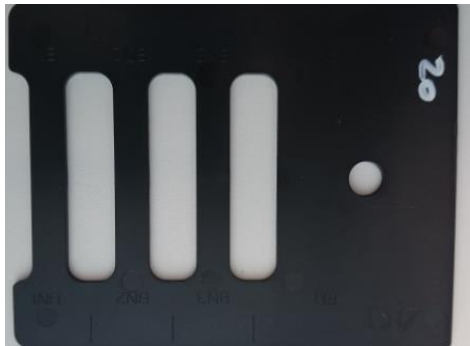
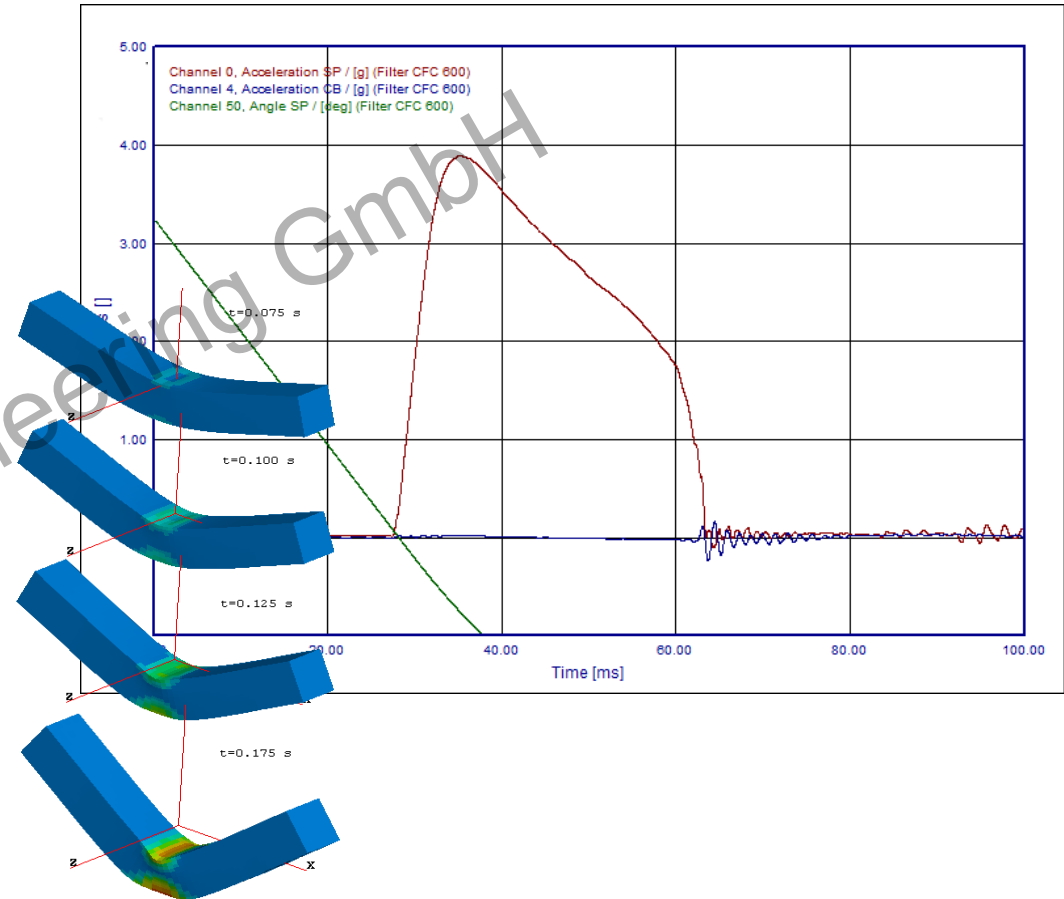


Plate 120 x 80 x 2 mm

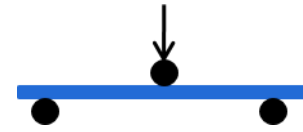


Multi-Specimen & XX-Rib & Component

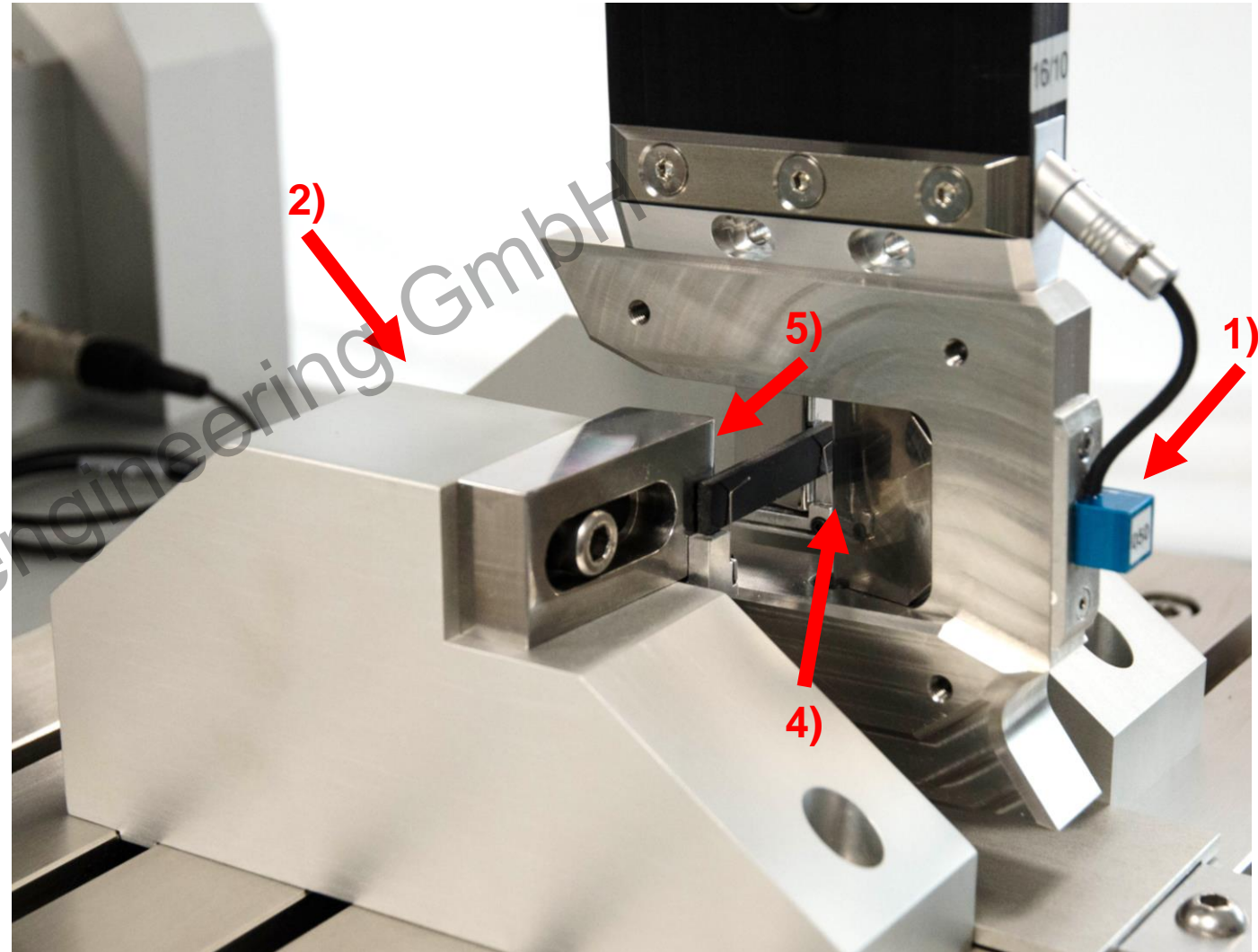
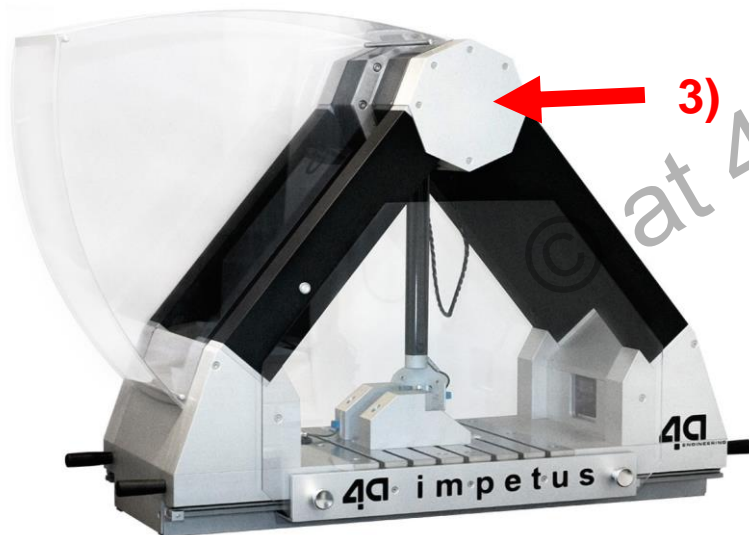




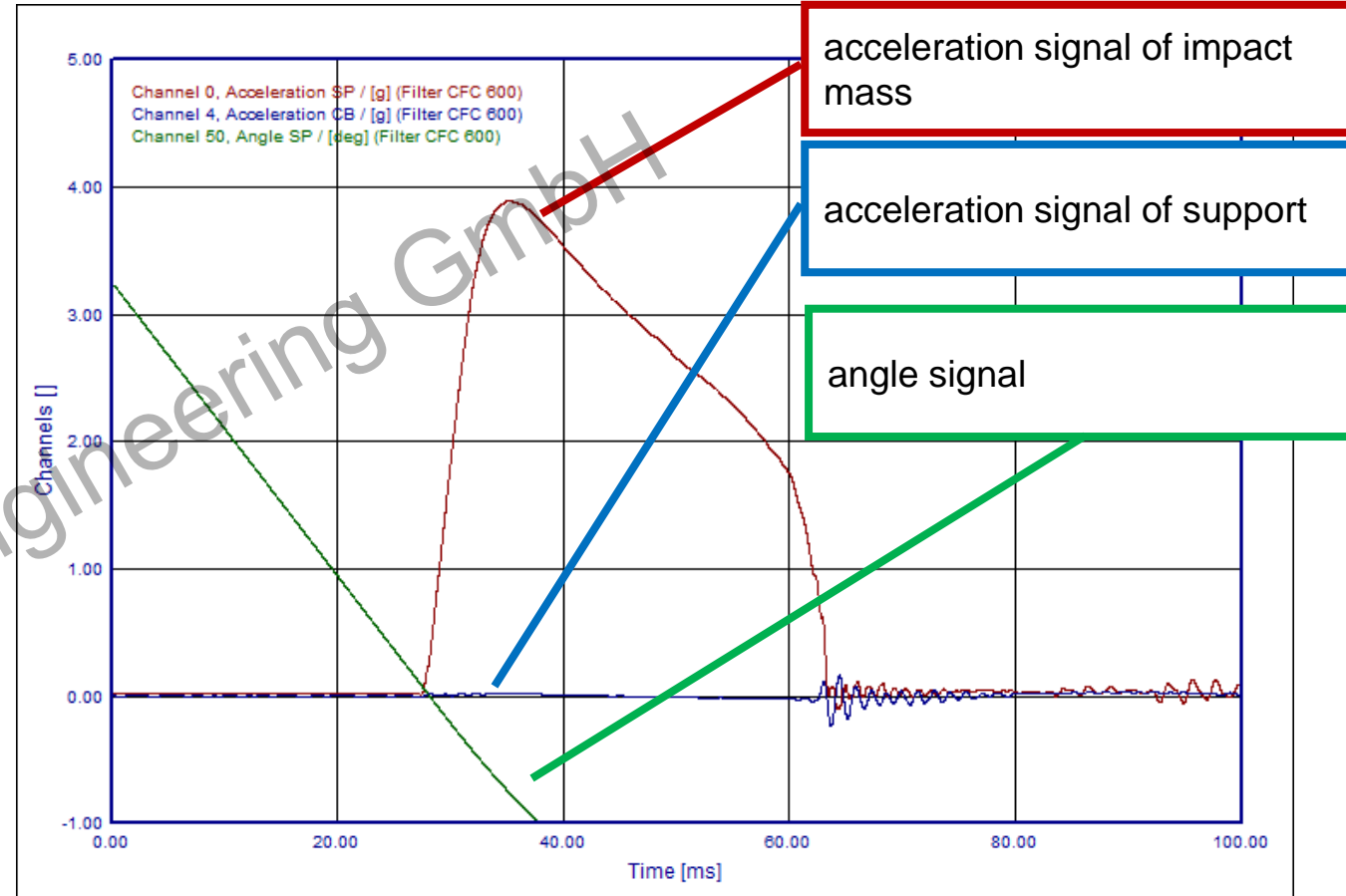
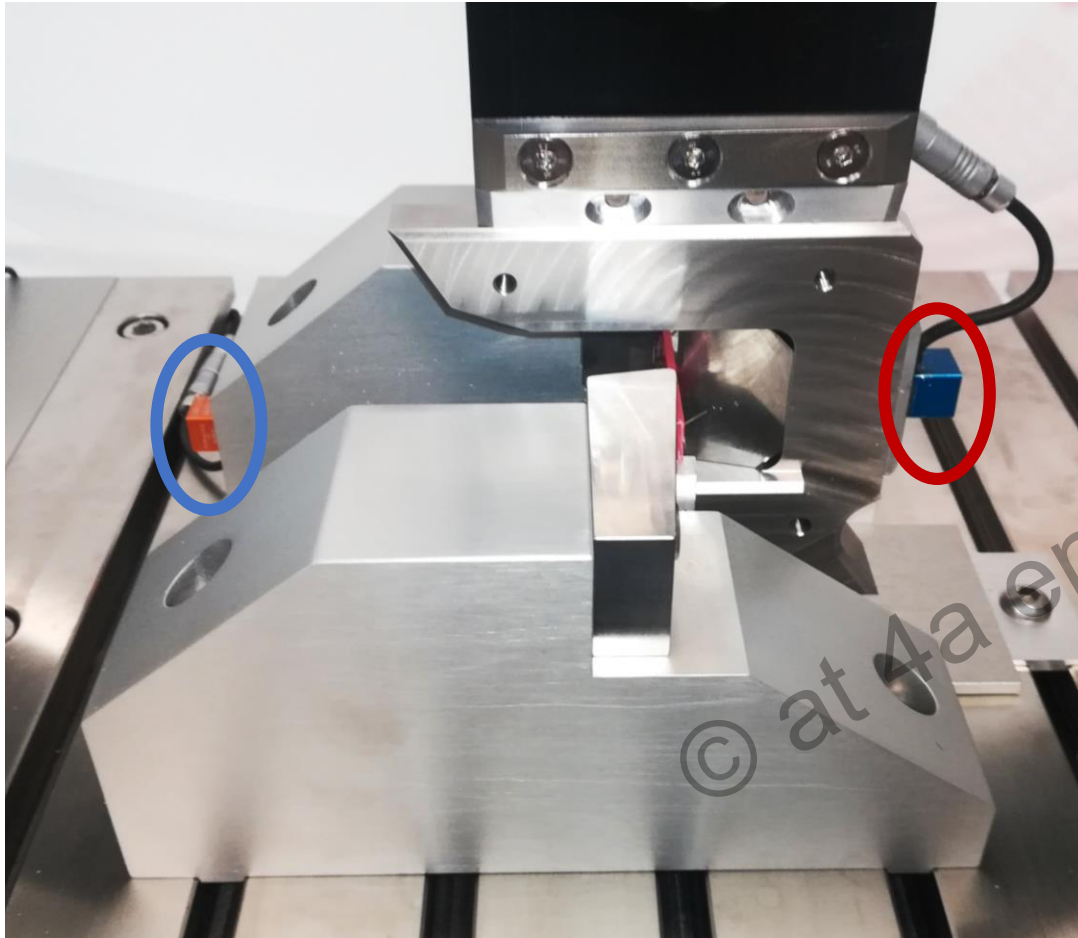
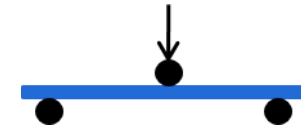
Test setup – IMPETUS® 3-Point-Bending



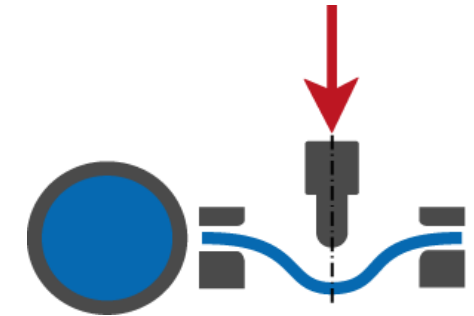
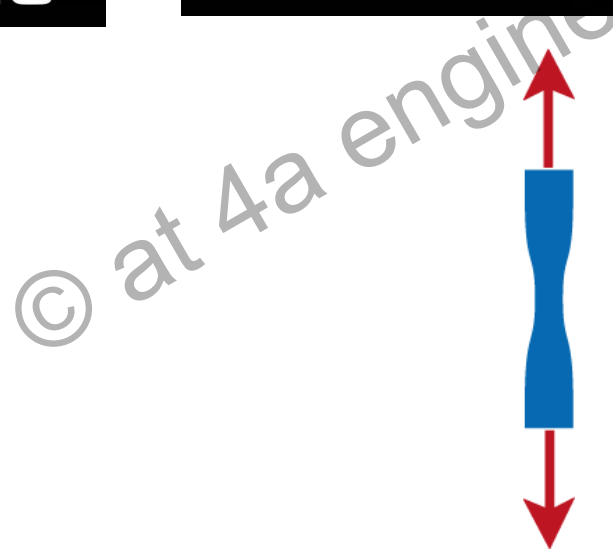
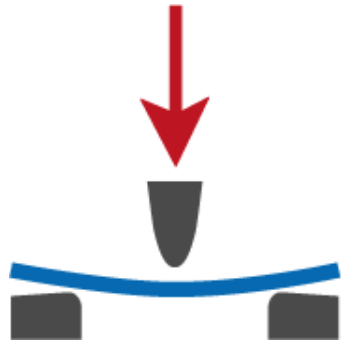
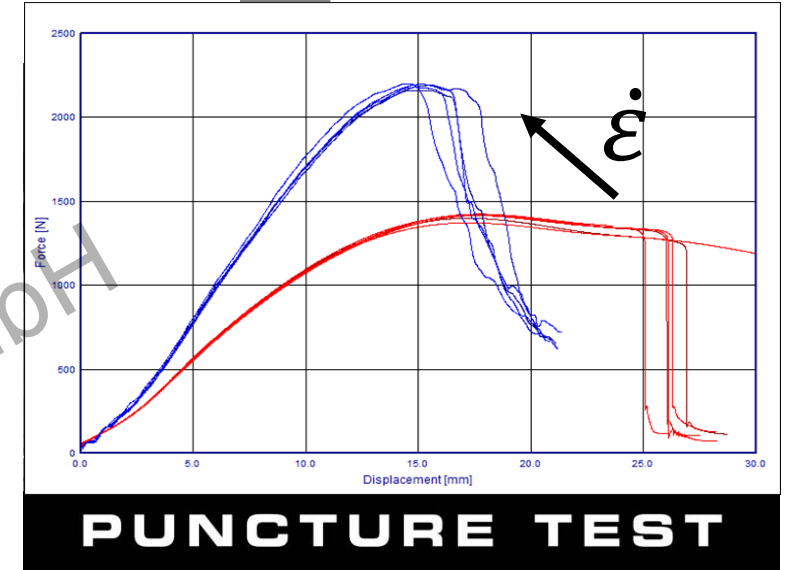
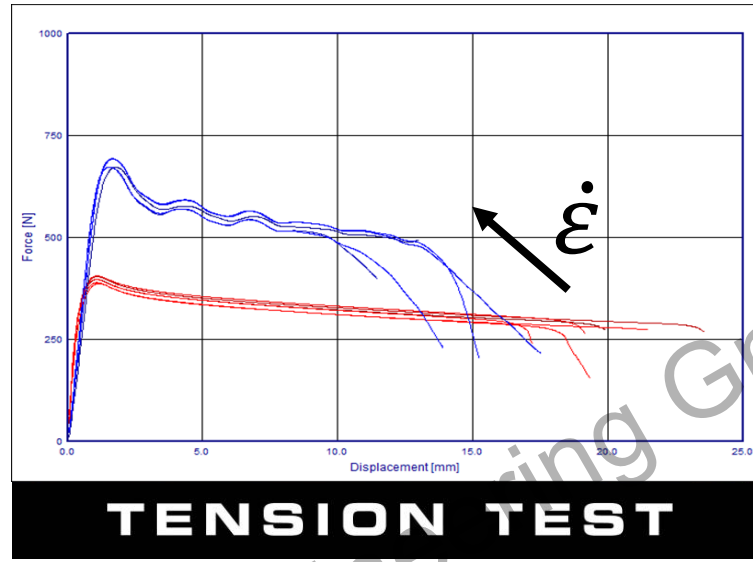
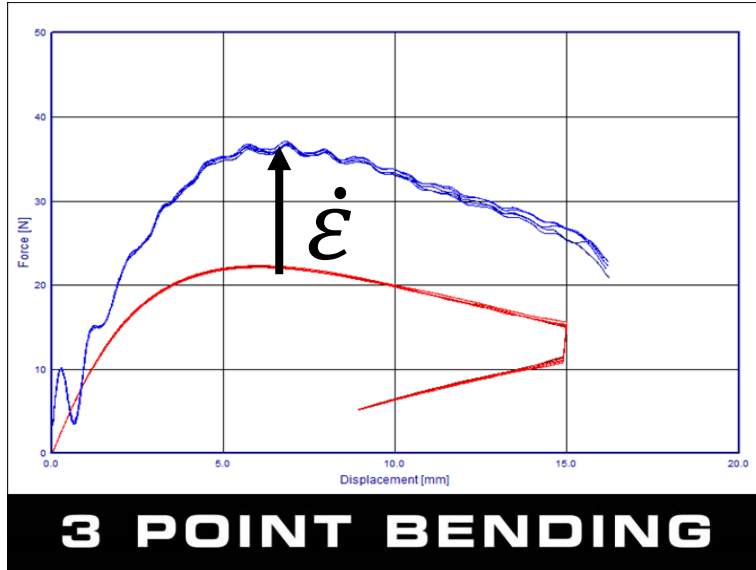
- 1) acceleration sensor on pendulum head
- 2) acceleration sensor on counter bearing
- 3) angle sensor
- 4) radius of the fin: 2 mm
- 5) support radius: 2 mm
- 6) swing hammer mass: 1580 g



Measurement signals – IMPETUS® 3-Point-Bending



IMPETUS[®] - efficient dynamic testing

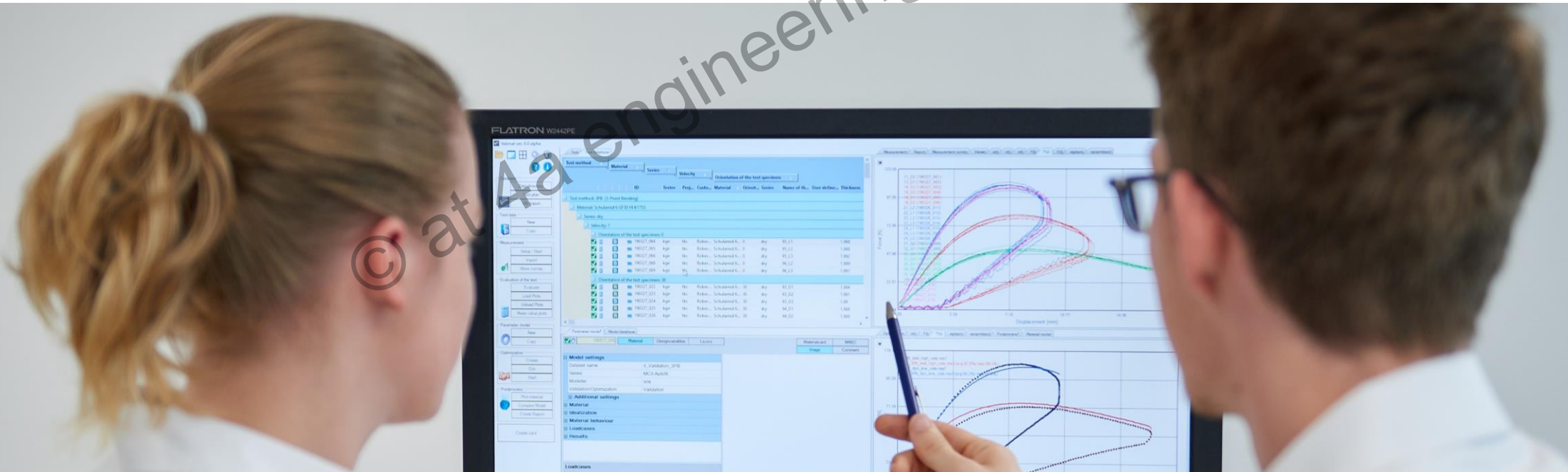


IMPETUS[™] ~ 3 m/s
static ~ 1mm/s

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Available material models!

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Material Model Selection

LS-DYNA has many material models implemented currently 265 materials (01.07.2020)
most of them won't fit in our use case

The most used material model is ***MAT_024**.

Other interesting material models for thermoplastic polymers are ***MAT_124** and ***MAT_187**.

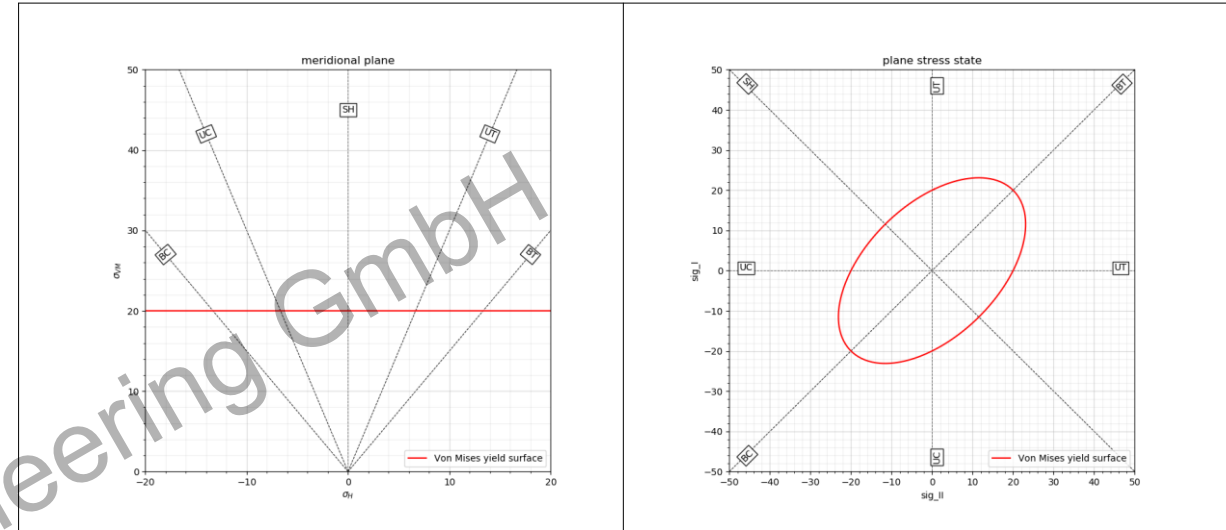
Table: number of available material models for subset of filters
<http://www.lstc.com/dynamat/> (01.7.2020)

Element	Material family	Nr. of material models
Any element	Any family	265
Shell element	Any family	23
Solid element	Any family	179
Any element	Plastics	33
Shell element	Plastics	23
Solid element	Plastics	29

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Commonly Used Material Models For Plastics

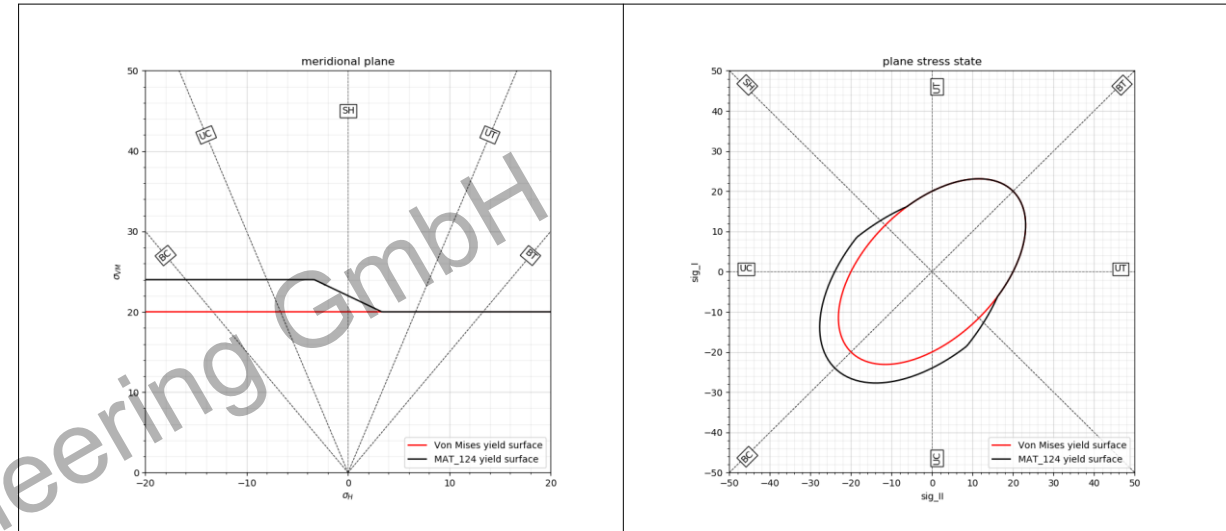
- ***MAT_024 - The workhorse**
 (*MAT_081, *MAT_089, *MAT_123, ...)



Material model	yield surface	Visco-elasticity	Visco-plasticity	Comp./tension asymmetry	plastic Poisson's ratio
*MAT_024	von Mises	x	✓	x	0.5

Commonly Used Material Models For Plastics

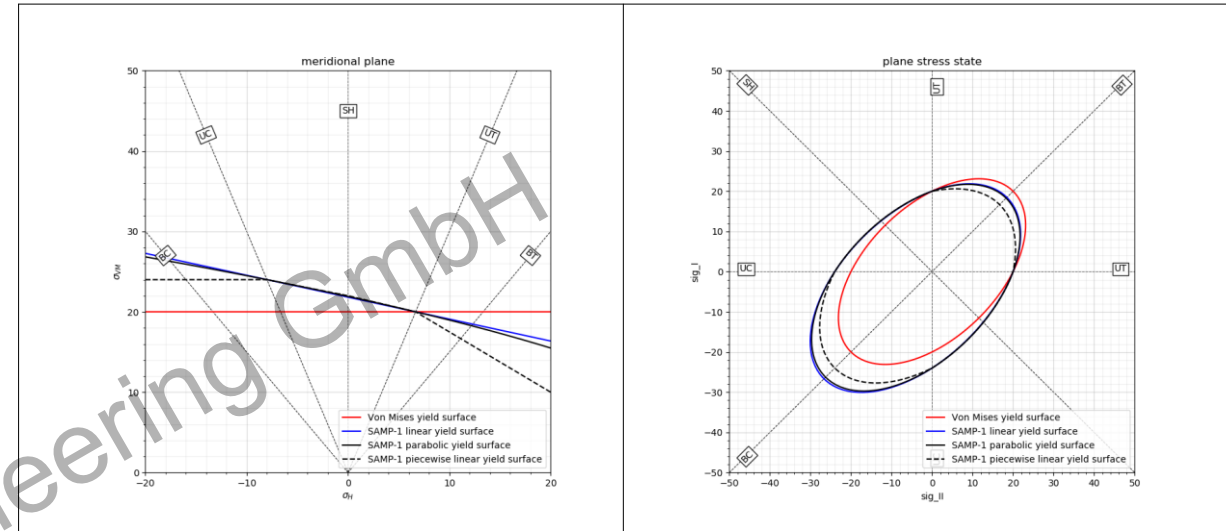
- ***MAT_024 - The workhorse**
(***MAT_081, *MAT_089, *MAT_123, ...**)
- ***MAT_124 - The hidden**



Material model	yield surface	Visco-elasticity	Visco-plasticity	Comp./tension asymmetry	plastic Poisson's ratio
*MAT_024	von Mises	✗	✓	✗	0.5
*MAT_124	2x von Mises	✓ Pronyseries	✓	✓	0.5

Commonly Used Material Models For Plastics

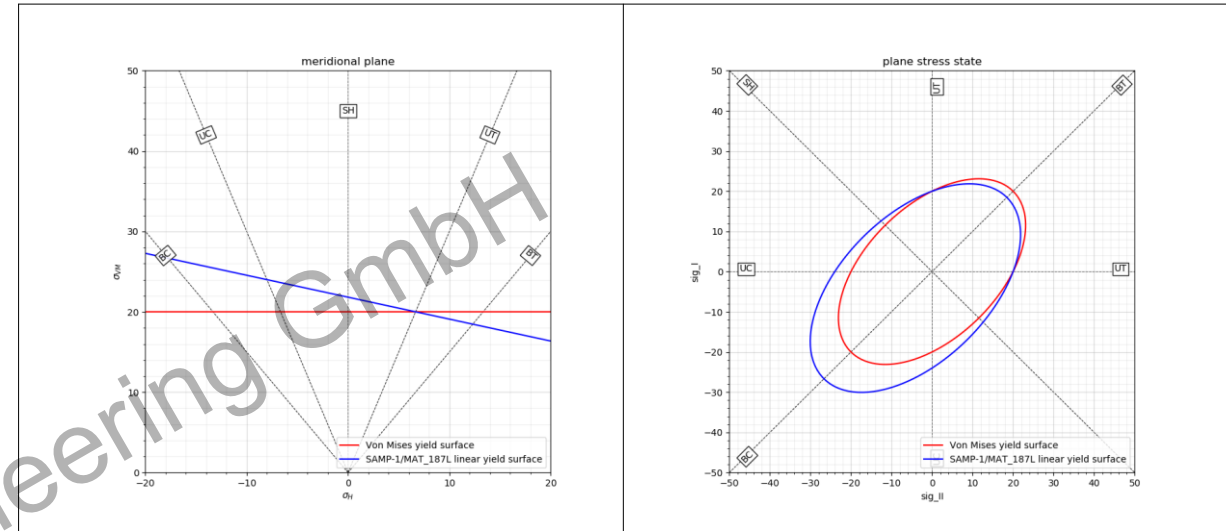
- ***MAT_024 - The workhorse**
(***MAT_081, *MAT_089, *MAT_123, ...**)
- ***MAT_124 - The hidden**
- ***MAT_187 - The plastic expert**



Material model	yield surface	Visco-elasticity	Visco-plasticity	Comp./tension asymmetry	plastic Poisson's ratio
*MAT_024	von Mises	✗	✓	✗	0.5
*MAT_124	2x von Mises	✓ Pronyseries	✓	✓	0.5
*MAT_187	linear; parabolic; piecewise linear	✓ $E(\dot{\epsilon})$	✓	✓	✓ $\nu_p(\epsilon)$

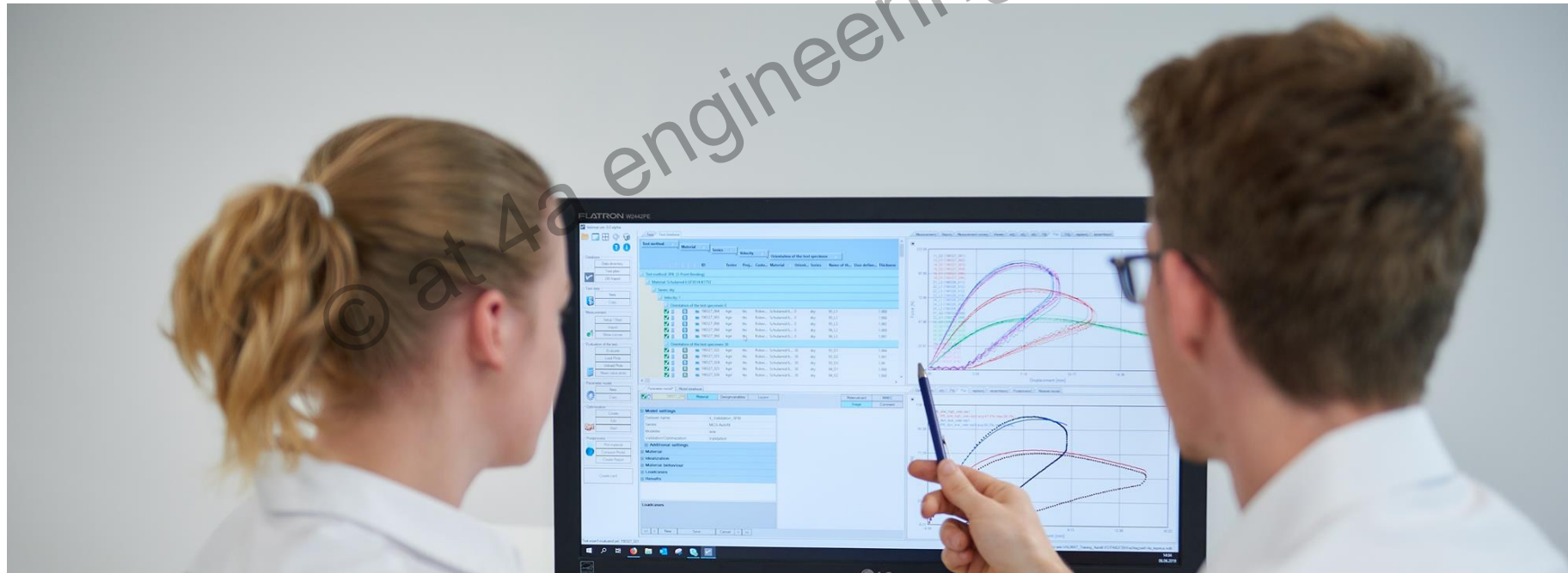
Commonly Used Material Models For Plastics

- ***MAT_024 - The workhorse**
(***MAT_081, *MAT_089, *MAT_123, ...**)
- ***MAT_124 - The hidden**
- ***MAT_187 - The plastic expert**
- ***MAT_187L – efficient version (R12)**



Material model	yield surface	Visco-elasticity	Visco-plasticity	Comp./tension asymmetry	plastic Poisson's ratio
*MAT_024	von Mises	✗	✓	✗	0.5
*MAT_124	2x von Mises	✓ Pronyseries	✓	✓	0.5
*MAT_187	linear; parabolic; piecewise linear	✓ $E(\dot{\epsilon})$	✓	✓	✓ $\nu_p(\epsilon)$
*MAT_187L	linear	✓ $E(\dot{\epsilon})$	✓	✓	✓ $\nu_p(\epsilon)$

*MAT_024 Summary



*MAT_024 introduction



***MAT_024** (*MAT_PIECEWISE_LINEAR_PLASTICITY) is the most commonly used material card for crash simulations in LS-DYNA.

- It is an elastic, viscoplastic material model
 - Von Mises yield surface
 - associated flow rule
- hardening curves can be defined arbitrarily for selected strain rates
- interpolation between the hardening curves of different strain rates can be performed either linear or logarithmic

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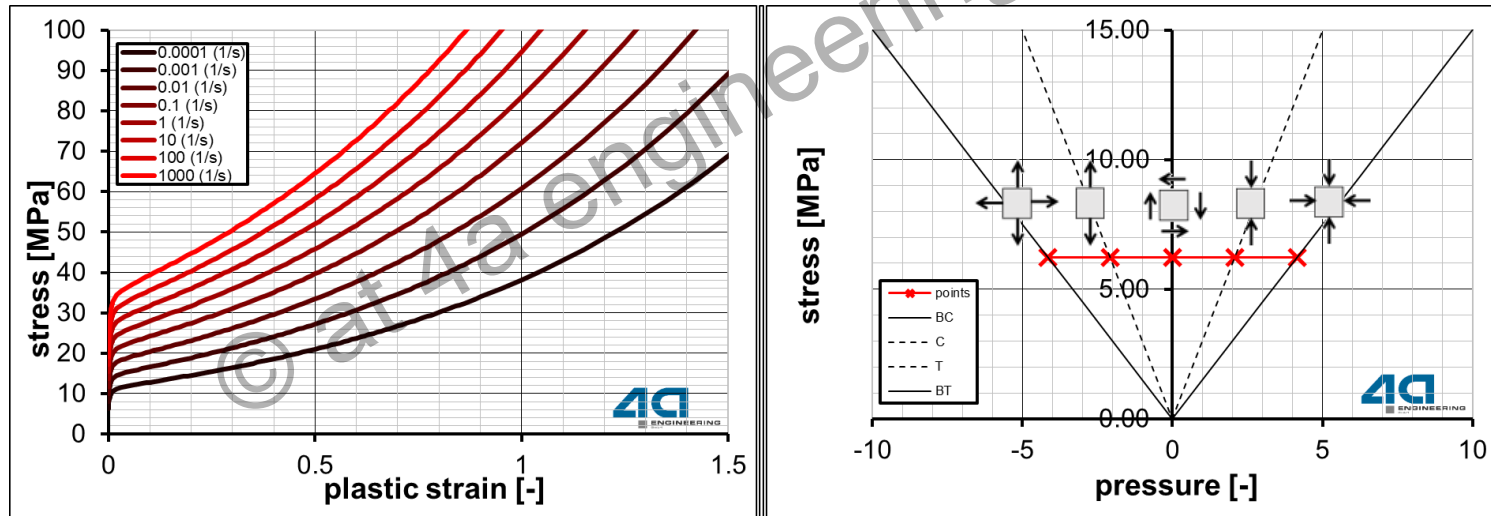
more information:

- "LS-DYNA_Manual_Volume_II_R11.pdf"

*MAT_024 introduction

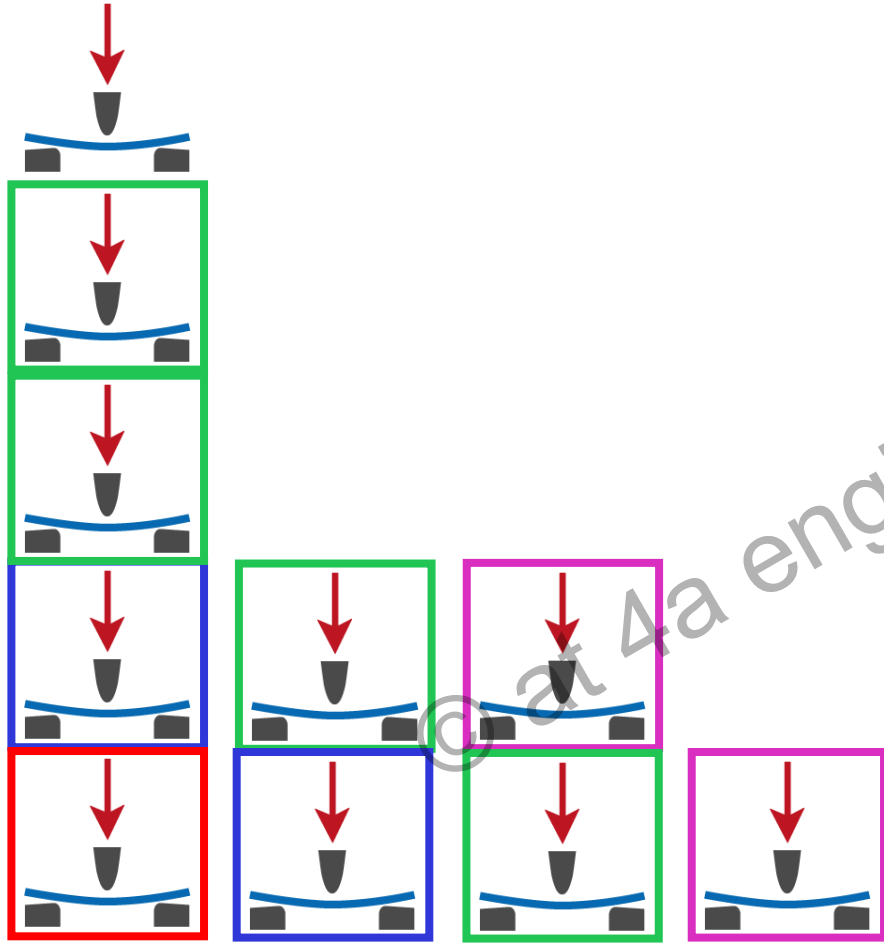
material card overview

- **Material:** PPEG107HP
- ***MAT_024** material card:
 - Deformation: elastic, viscoplastic
 - Von Mises yield surface
 - associated flow rule → plastic deformation at constant volume

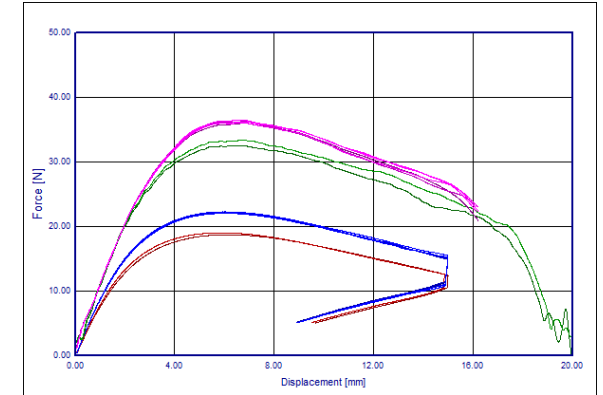


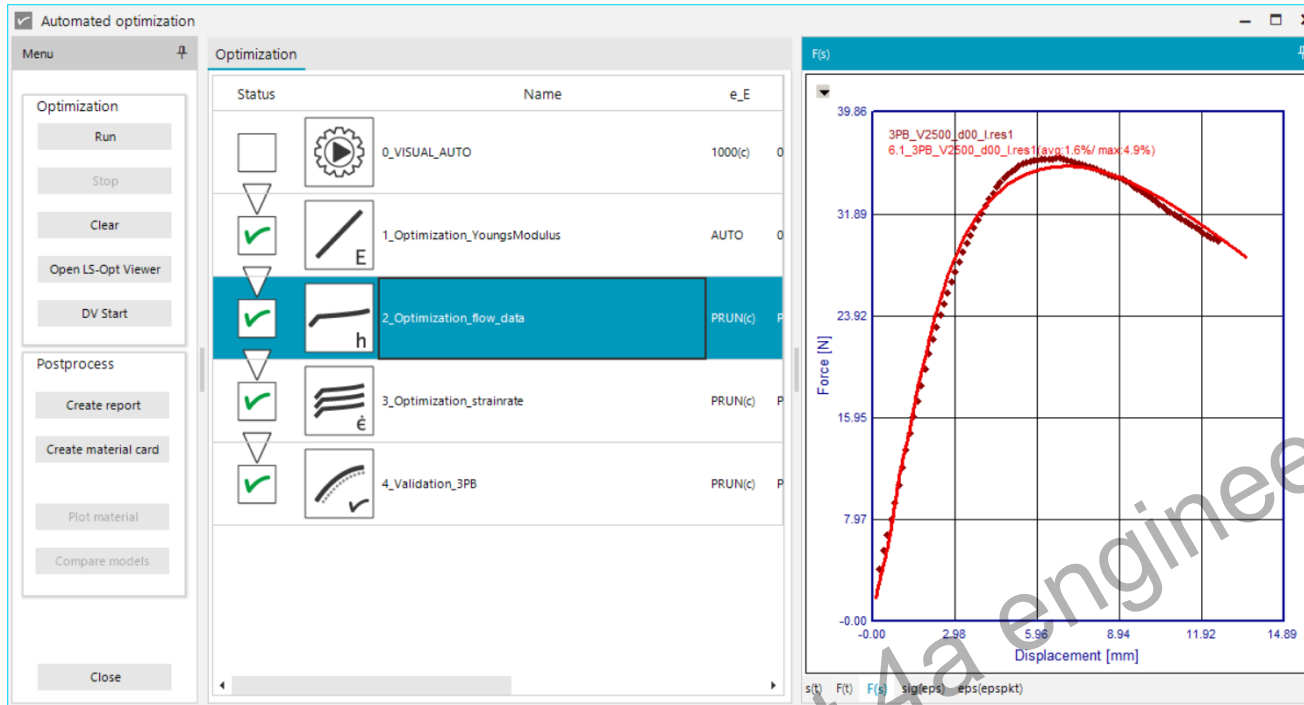
AutoFit Strategy

MAT_024

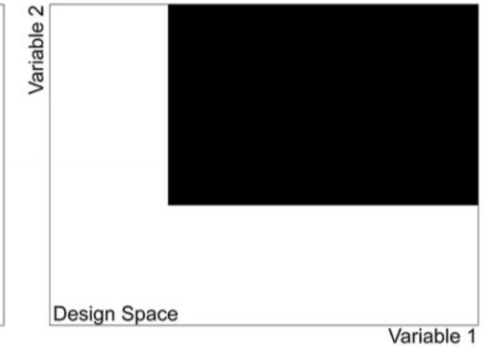
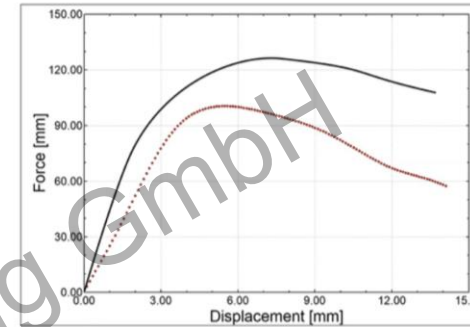


without border all velocities
quasistatic low velocity
quasistatic high velocity
dynamic low velocity
dynamic medium velocity

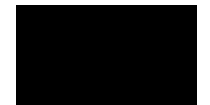
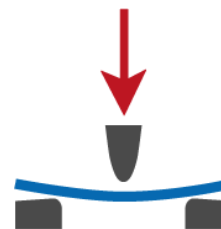
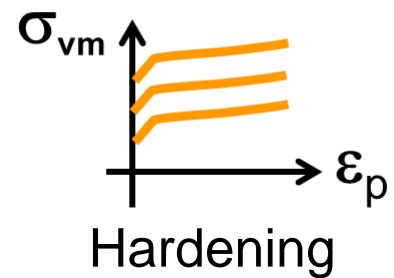




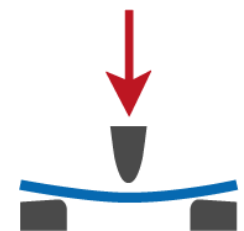
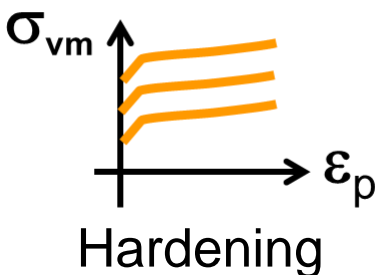
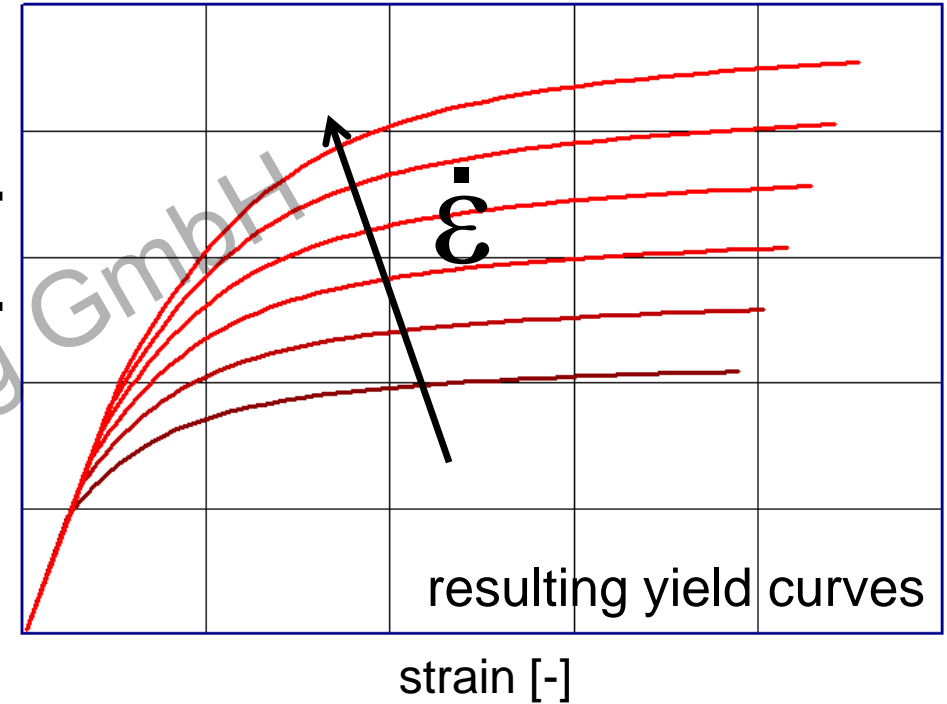
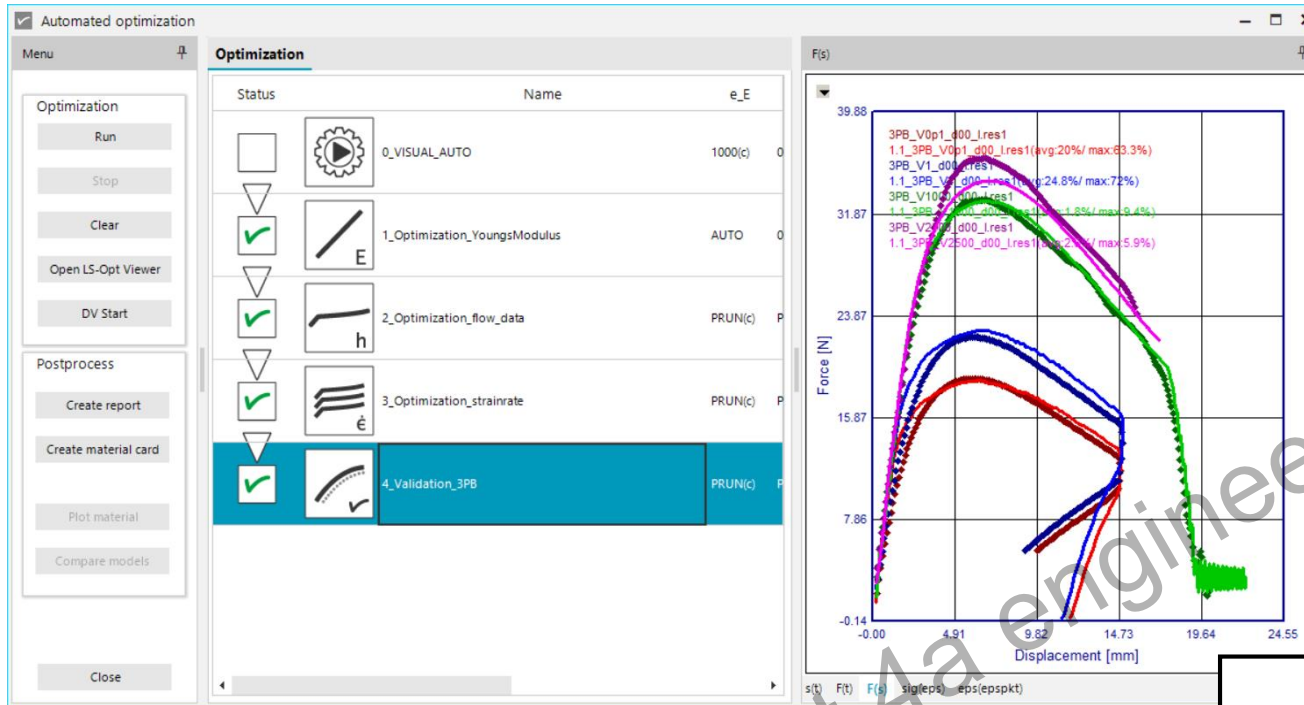
optimization – successive response surface method



hardening function
 $= f(\text{Variable 1}, \text{Variable 2})$

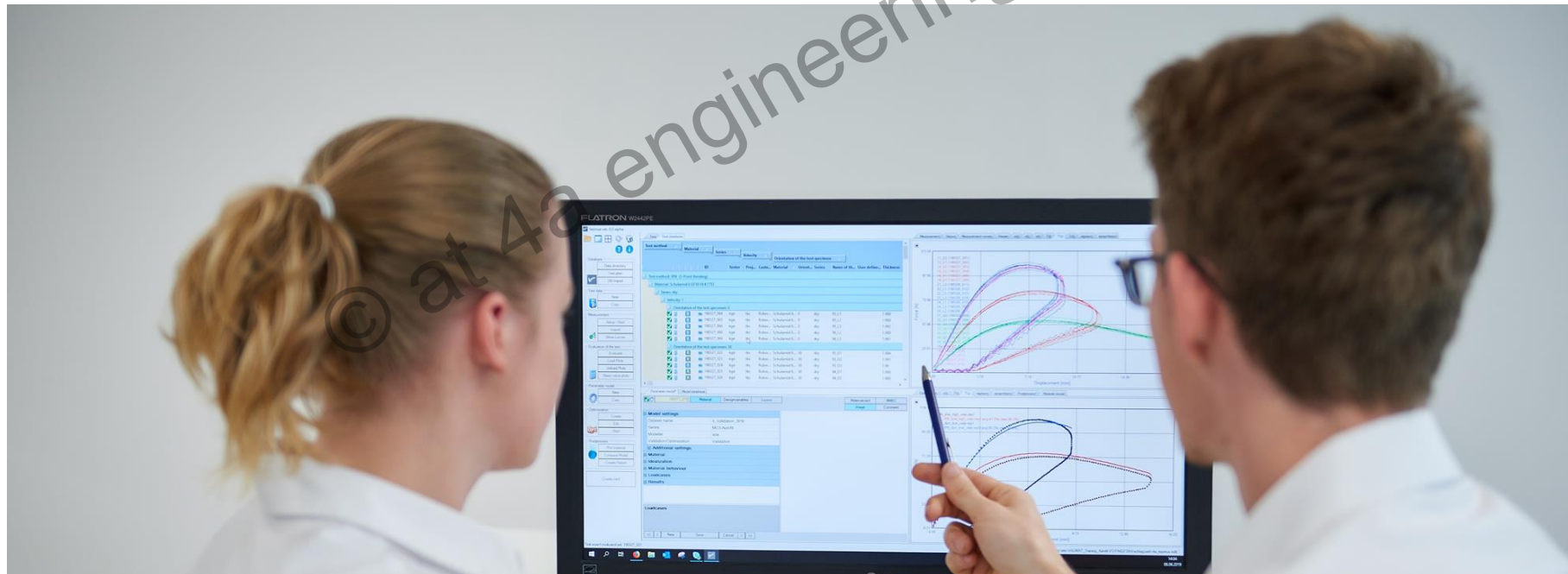


Workflow for Material Card Generation - AUTOFIT



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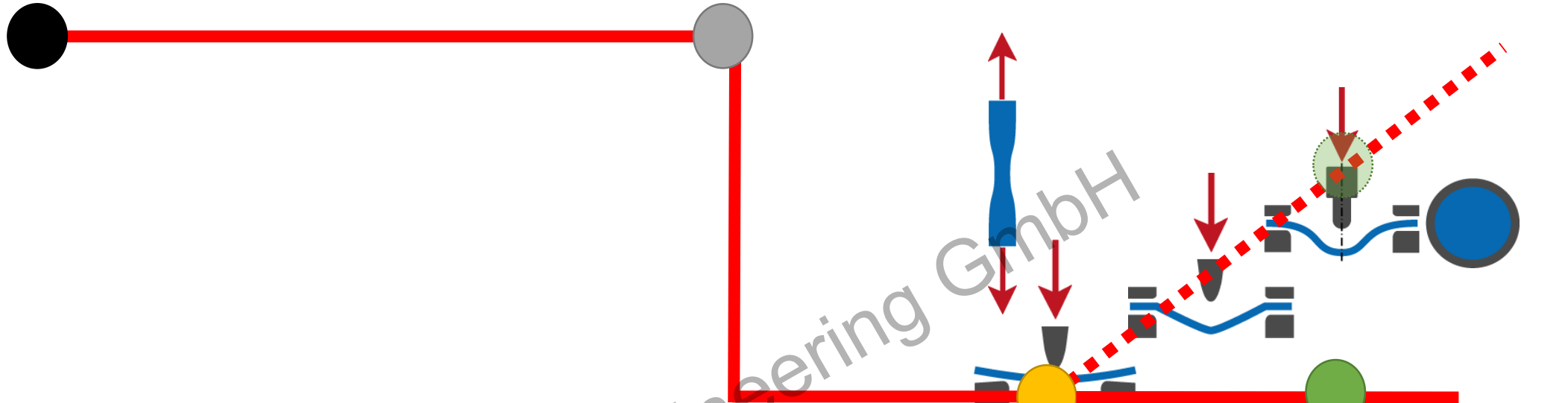
Simple Failure



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From test to material card

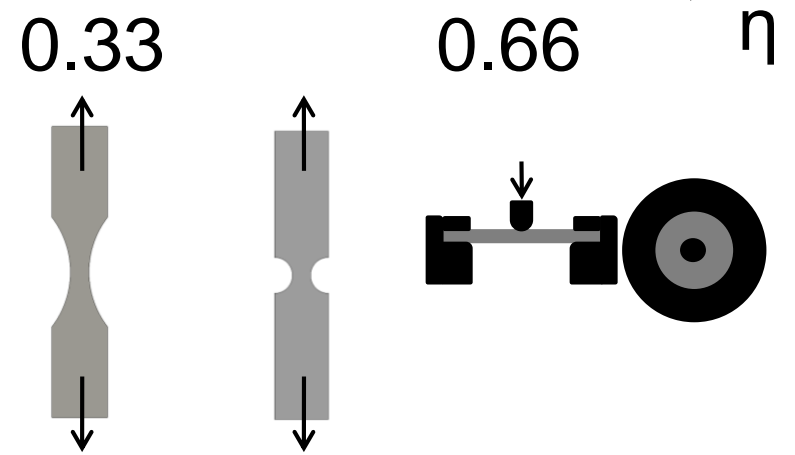
DIEM



GroupName: 51_failure

xf_NUMFIP	-75	<input checked="" type="checkbox"/>	(NULL)	(NULL)	(NULL)	Number of failed integration points pr...
fd_FC_m0p66	2	<input checked="" type="checkbox"/>	0.1	1	(NULL)	Failure curve point at TRIAX -0.66
fd_FC_m0p01	2	<input checked="" type="checkbox"/>	0.1	1	(NULL)	Failure curve point at TRIAX -0.01
fd_FC_0p0	0.4	<input checked="" type="checkbox"/>	0.8	1.3	(NULL)	Failure curve point at TRIAX 0.0
fd_FC_0p11	0.4	<input checked="" type="checkbox"/>	0.8	1.3	(NULL)	Failure curve point at TRIAX 0.11
fd_FC_0p22	0.4	<input checked="" type="checkbox"/>	0.8	1.3	(NULL)	Failure curve point at TRIAX 0.22
fd_FC_0p33	0.4	<input type="checkbox"/>	10%	10%	(NULL)	Failure curve point at TRIAX 0.33
fd_FC_0p44	0.4	<input checked="" type="checkbox"/>	0.8	1.3	(NULL)	Failure curve point at TRIAX 0.44
fd_FC_0p55	0.4	<input checked="" type="checkbox"/>	0.1	1	(NULL)	Failure curve point at TRIAX 0.55
fd_FC_0p66	0.4	<input checked="" type="checkbox"/>	0.1	1	(NULL)	Failure curve point at TRIAX 0.66

GroupName: 52_failurerstrainrate



Fracture models → *MAT_ADD_EROSION



Parameter model* Model database

170503_024 Material Designvariables Layers

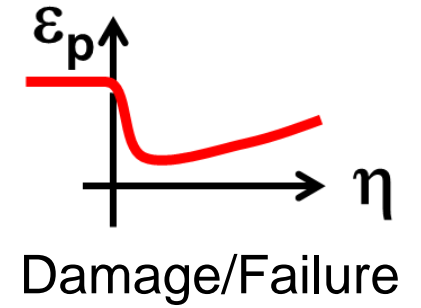
Materialcard MMEC
Image Comment

- Material behaviour
 - Material source
 - Elasticity
 - Plasticity
 - Failure/Damage
 - Material card
 - Materialcardcase
 - Damage/Failurecase
 - Materialcard id
 - Density
 - Plasticity
 - Function (Hardening, Elastic curve form)
 - Curve 1
 - Curve 2
 - Strain range upto
 - Sampling points
 - Bias factor
 - Strain rate dependency
 - Strain rate dependency
 - Fracture
 - Ductile Damage Settings
 - Shear Damage Settings
 - FLC Damage Settings
 - Strainrate Settings
 - Postfracture
 - Loadcases
 - Results

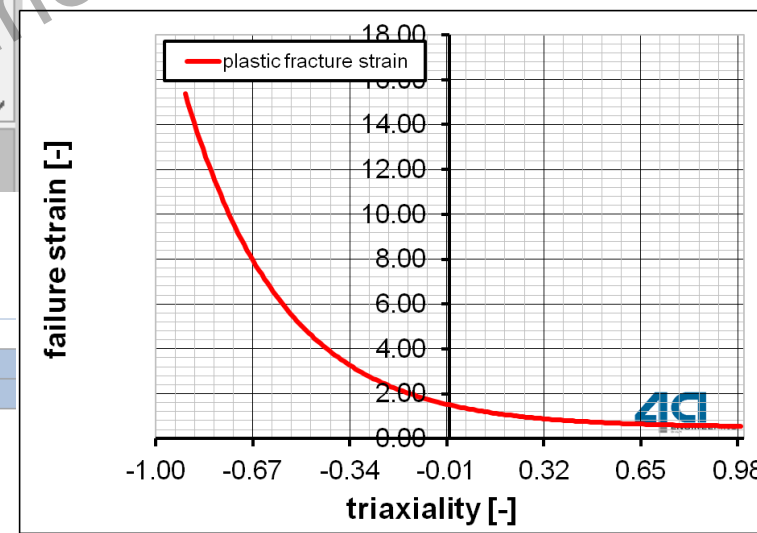
Density	-1
Plasticity	vonMISES
Function (Hardening, Elastic cur	
Strain rate dependency	Table
Fracture	Damage
Ductile Damage Settings	Johnson Cook
Shear Damage Settings	None
FLC Damage Settings	plastic equivalent strain
Strainrate Settings	simple criteria
Postfracture	4a picewise linear
Loadcases	Johnson Cook
Casename	mod Xue-Wierzbicki
Tests	Xue-Wierzbicki
Settings optimization	Mohr-Coulomb
Weighting case	1

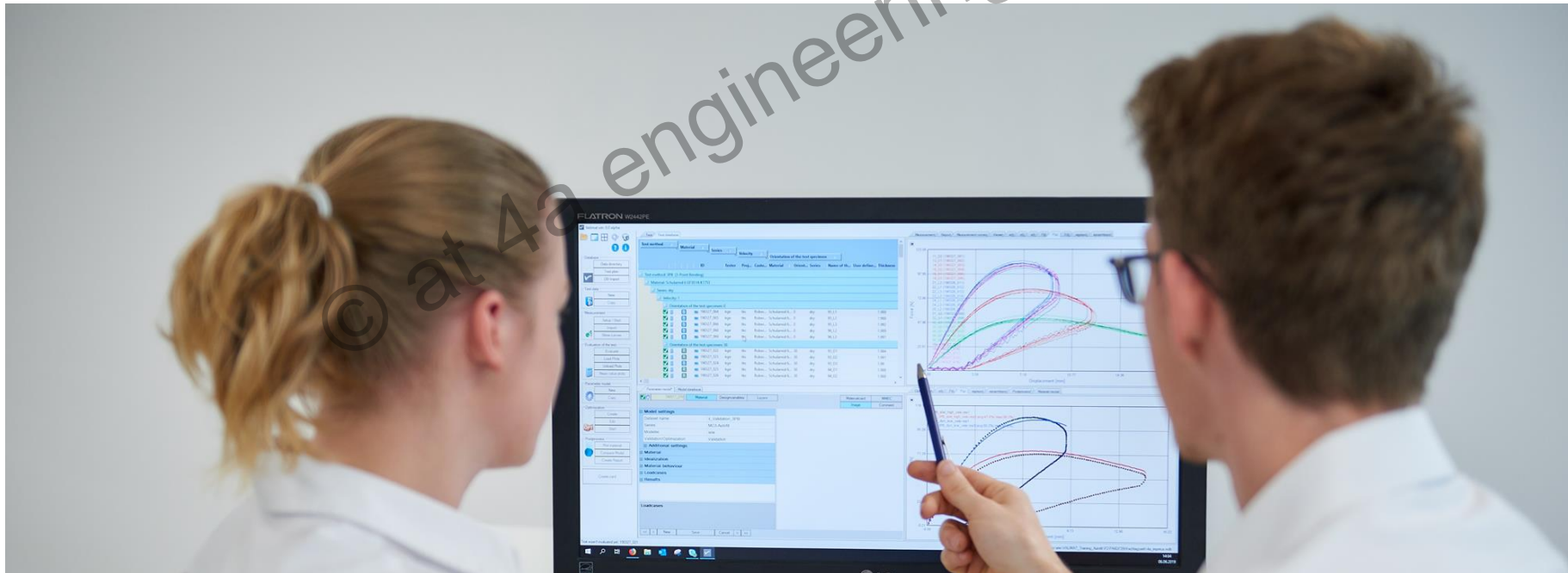
Ductile Damage Settings

lower triax value	0.33	Johnson Cook
upper triax value	None	mod Xue-Wierzbicki
step size triax	None	Xue-Wierzbicki
Shear Damage Settings	None	Mohr-Coulomb
FLC Damage Settings	None	
Strainrate Settings	Johnson Cook	
Postfracture	Fracture Energy (TRIAX)	

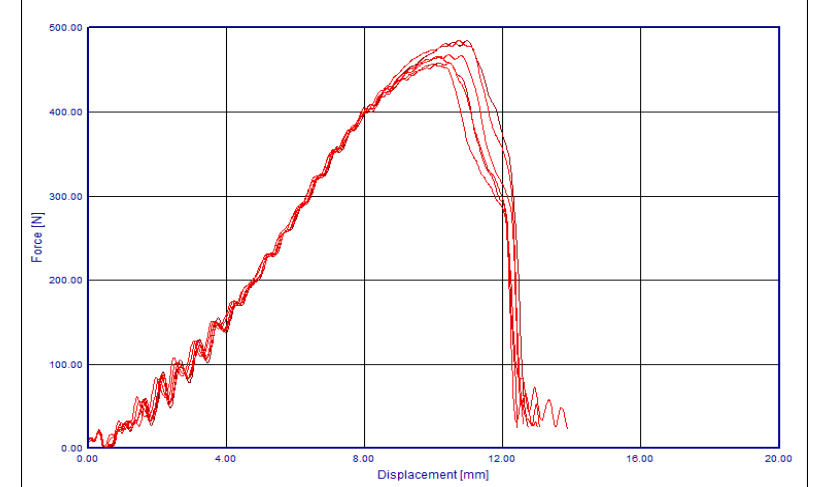
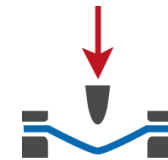
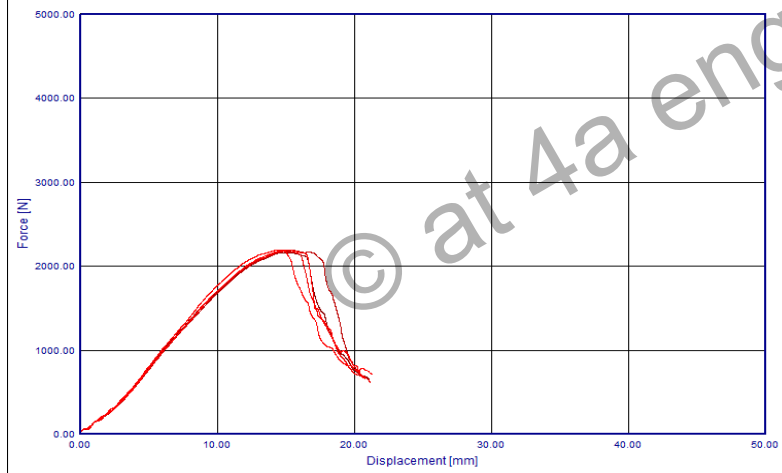
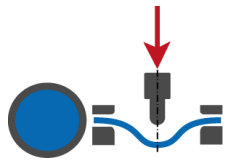
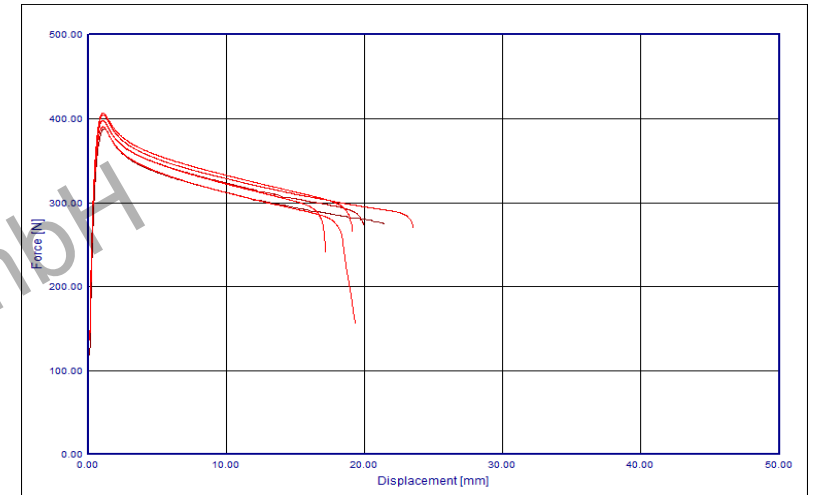
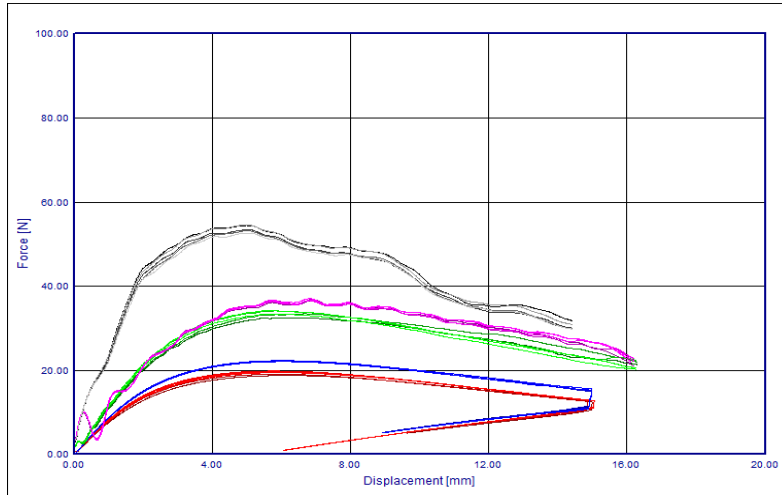
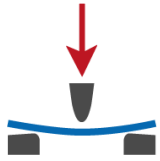


$$f_{dJCD1} + f_{dJCD2} \cdot e^{-f_{dJCD3} \cdot \eta}$$



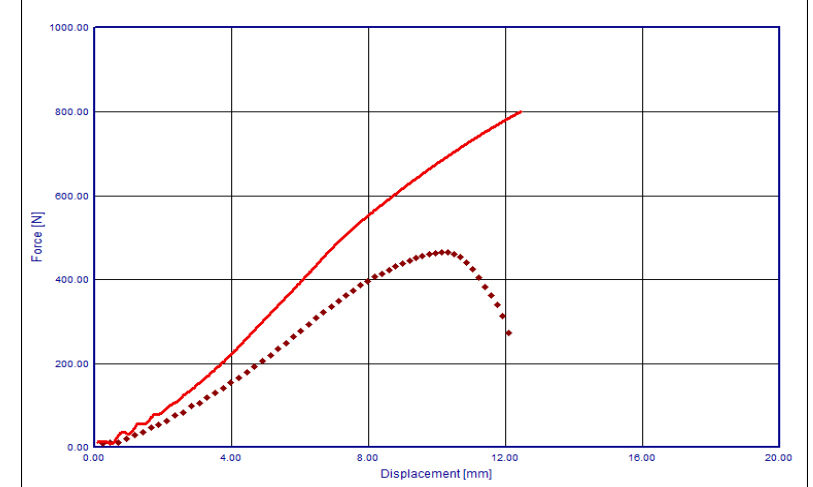
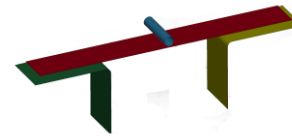
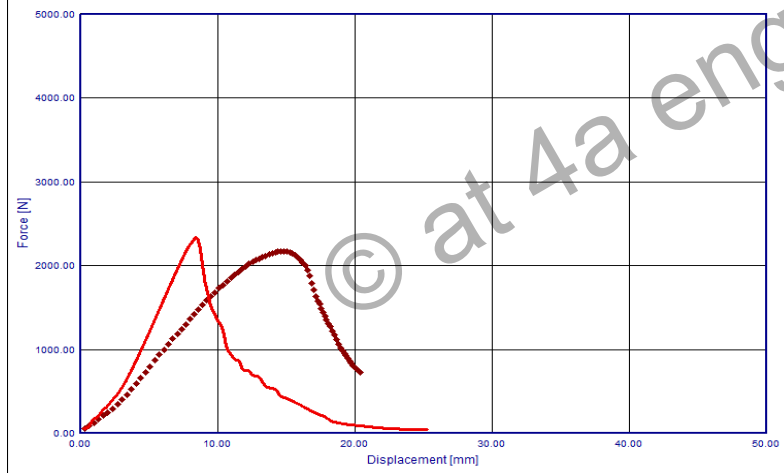
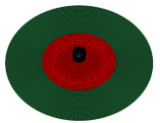
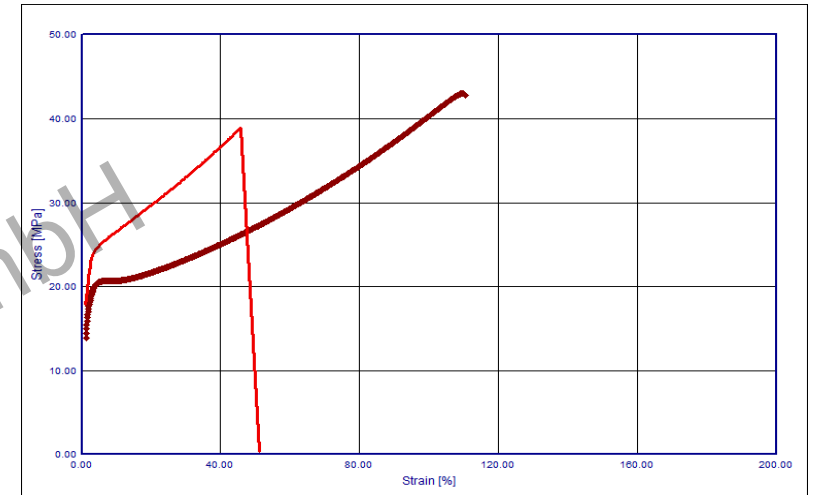
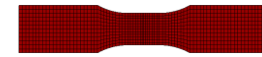
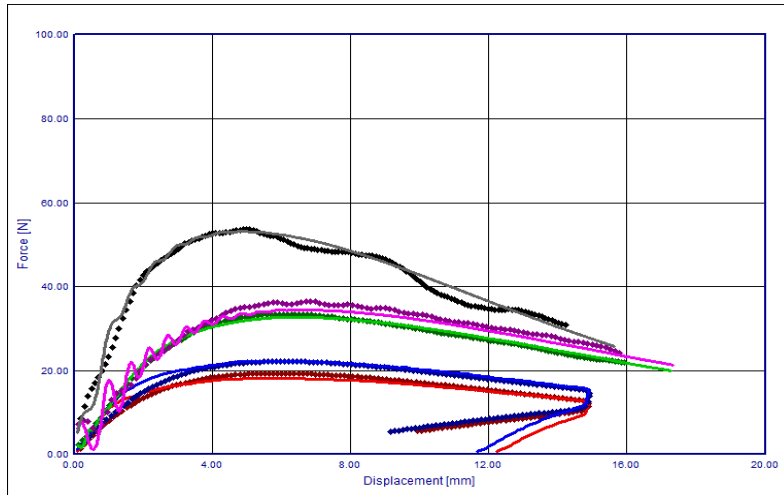
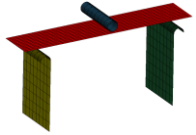


Measurement results, 23°C, PPEG107HP overview



© at 4a engineering GmbH

Validation results, 23°C, PPEG107HP overview



© at 4a engineering GmbH



VALIMAT



IMPETUS

VALIMAT® 3.8 upcoming features



Content

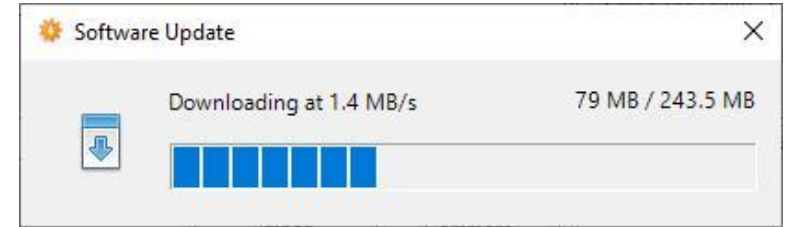
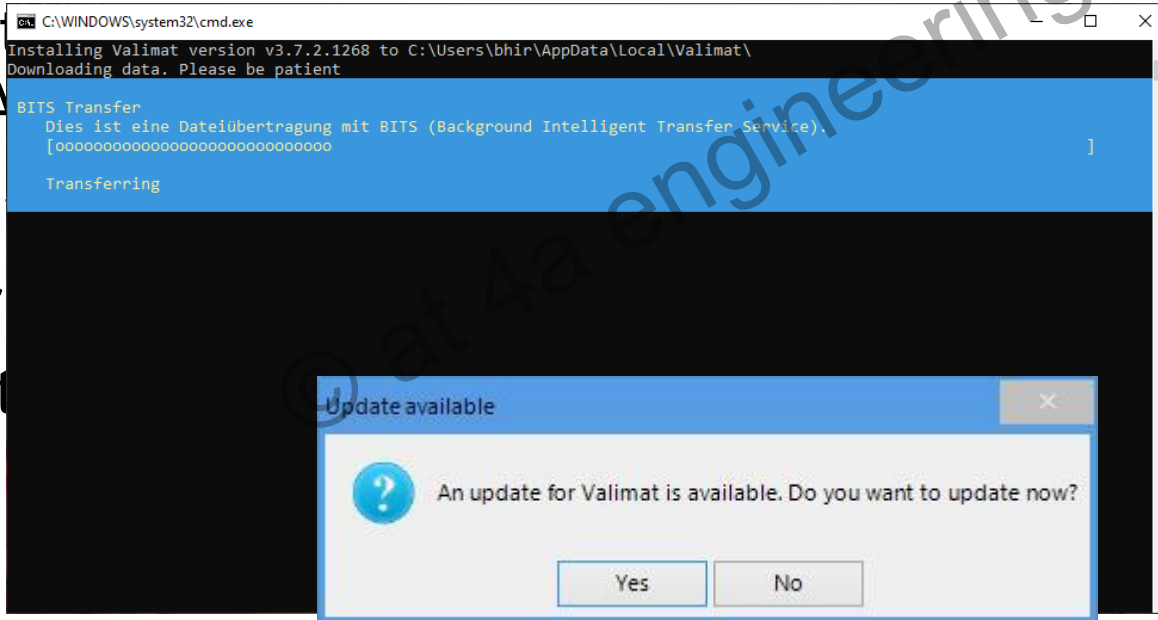
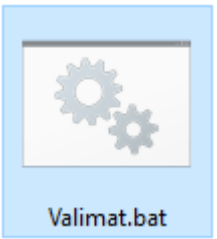
- New Software Installation and Automated Updates
- Included Python 3.8 with VALIMAT Python Module
- New Auto Report Features
- AutoFit Failure Parameter Evaluation
- Quick Filter Shortcut
- Reload Parameter Model Button
- Network changed warning
- Added non-scaled graphing on time-scaled simulations

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VALIMAT® 3.8 - new Software installation and automated updates

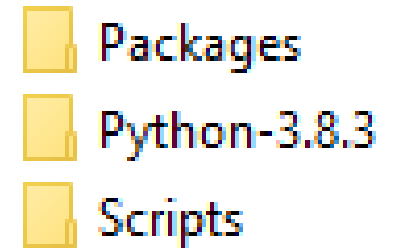
- 4a will provide a batch script for the users
- This batch script is used to start the software and to install it (ex. place on desktop)
- Upon first call the installation of VALIMAT® starts.
 - installation directory: "C:\Users\username\AppData\Local\Valimat"

- E that VA closes and that the start up
- p VA
- V Valimat.bat ® startup
■ the user talled
■ If accept



VALIMAT® 3.8 - Included Python 3.8 with VALIMAT python module

- VALIMAT installs with a Python 3 version
 - Located in C:\Users\username\AppData\Local\Valimat\Python
- There we have:
 - Packages: containing modules
 - Python-3.8.3: containing the python executable
 - Scripts: containing Internal Scripts and Test and Modell Scripts
- For better database access a python module “VALIMAT” is included.



VALIMAT® 3.8 – New Auto Report Features

- Auto Reporting Feature greatly enhanced.
- Allows indexing other model curves and data
 - In Tables: <<case_1;index:1>> or <<case_2;index_r:-1>>
 - In Textboxes: <<db_va;index:1>> or <<db_va;index_r:-1>>
 - In Images: <<img_tc_F(s);index:1>> or <<img_tc_F(s);index_r:-1>>
- Access to DV in Reports:
 - <<DV_e_E>>
- Formatting the output
 - fx: Fixed number of decimal values (e.g. <<DV_e_E;f3>> yields 2341.342)
- Current Date
 - <<Date;Format>> (For detailed information about the possible values of “Format” see [link1](#))

simulation results, <<db_mattyp>>, <<db_T_case_1>>°C

<<Date;d>>

AutoFit overview – MAT_024



<<img_tc_F(s);0:auto;0:auto;legend_off>>



<<img_sc_F(s);0:auto;0:auto;legend_off;index:2;0>>

e_E e_nue
<<DV_e_E;f0;index:2>> <<DV_e_nue;f2;index:2>>



<<img_sc_F(s);0:auto;0:auto;legend_off;index:3>>

h_y h_h h_ET v_p v_epspkt
<<DV_e_E;f0;index:3>> <<DV_e_nue;f2;index:3>>
<<DV_h_h;f2;index:3>> <<DV_h_ET;f0;index:3>>
<<DV_v_epspkt;index:3>>



<<img_sc_F(s);0:auto;0:auto;legend_off;index:4>>

<<DV_e_E;f0;index:4>> <<DV_e_nue;f2;index:4>> <<DV_h_y;f2;index:4>>
<<DV_h_h;f2;index:4>> <<DV_h_ET;f0;index:4>> <<DV_v_p;f2;index:4>>
<<DV_v_epspkt;index:4>>



<<img_sc_F(s);0:auto;0:auto;legend_off;index:5>>

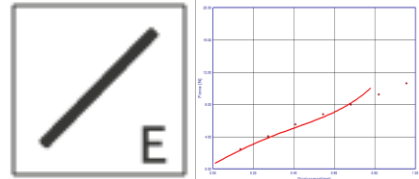
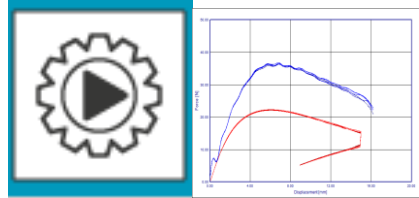
<<DV_e_E;f0;index:5>> <<DV_e_nue;f2;index:5>> <<DV_h_y;f2;index:5>>
<<DV_h_h;f2;index:5>> <<DV_h_ET;f0;index:5>> <<DV_v_p;f2;index:5>>
<<DV_v_epspkt;index:5>>

Case	v ₀ [m/s]	l _w [mm]	m ^{Pendulu} m [g]
<<case_1;index:5>>	<<db_va>>	<<db_lw>>	<<db_mmp>>
<<case_2;index:5>>			
<<case_3;index:5>>			
<<case_4;index:5>>			
<<case_5;index:5>>			

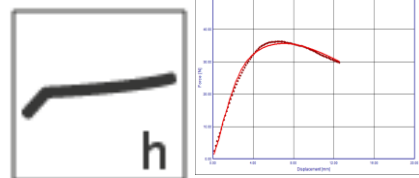
simulation results, PPEG107HP, 23°C

09.07.2020

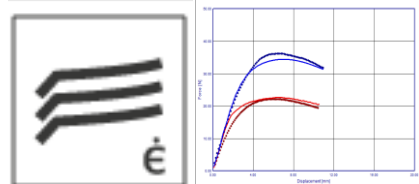
AutoFit overview – MAT_024



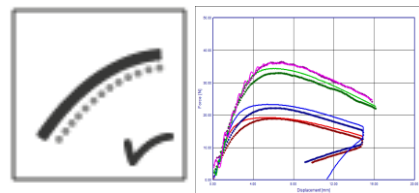
e_E e_nue
2193 0.30



2193 0.30 h_y h_h h_ET v_p v_epspkt
10.61 3.48 1096 7.89 0.0001



2193 0.30 10.61 3.48 1096 8.46 0.0001



2193 0.30 10.61 3.48 1096 8.46 0.0001

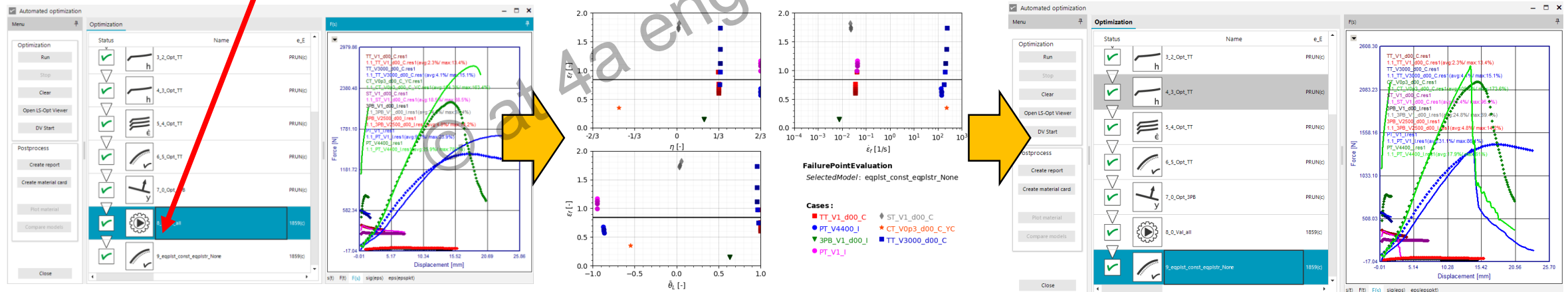
Case	v ₀ [m/s]	l _w [mm]	m ^{Pendulu} m [g]
3PB_V0p1_d00_I	0.0001	40.01	0
3PB_V1_d00_I	0.001	40.01	0
3PB_V1000_d00_I	1	40.01	1580
3PB_V2500_d00_I	2.5	40.01	1580

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VALIMAT® 3.8 – AutoFit Failure Parameter Evaluation

- Added a Model setting for the AutoFit which evaluates failure model parameters on the model results
- The evaluated parameters are available for all following models in the AutoFit

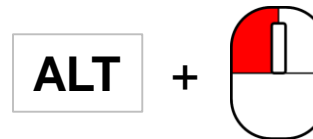
Model settings	
Dataset name	8_0_Val_all
Series	TT_based_AutoFit_MAT_187
Modeller	bhir
Validation/Optimization	Failure evaluation



VALIMAT® 3.8 - Quick Filter Shortcut

- A Filter can be added by pressing **ALT+LMB** on an element in the table
- For example: select only 1-Element or more complex in Symmetry

ID	Dataset na...	Mod...	Series	Validation/O...	Material n...	Solver	Inputdeck	Symmetry o...	Ele...	Material so...
Series: 1_1_RT_MAT024										
190912_014	0_VISUAL_A...	bhir	1_1_RT_MAT...	AutoValues	PPEG107HP	LS DYNA	Implemented	Fullmodel	2	Implementec
190912_015	00_Validatio...	bhir	1_1_RT_MAT...	Validation	PPEG107HP	LS DYNA	Implemented	Quartermode...	2	Implementec
190912_016	01_01_Opti...	bhir	1_1_RT_MAT...	Optimization ...	PPEG107HP	LS DYNA	Implemented	1-Element	2	implemented
190912_017	01_02_Opti...	bhir	1_1_RT_MAT...	Optimization ...	PPEG107HP	LS DYNA	Implemented	1-Element or ...	2	Implementec
190912_018	01_03_Opti...	bhir	1_1_RT_MAT...	Optimization ...	PPEG107HP	LS DYNA	Implemented	1-Element or ...	2	Implementec
190912_019	01_04_Valida...	bhir	1_1_RT_MAT...	Validation	PPEG107HP	LS DYNA	Implemented	Fullmodel	2	Implementec
Series: 1_5_RT_MAT187_3PB_TEMPLATE										
Series: 1_1_RT_MAT024										
190912_016	01_01_Opti...	bhir	1_1_RT_MAT...	Optimization ...	PPEG107HP	LS DYNA	Implemented	1-Element or ...	2	Implemented
190912_017	01_02_Opti...	bhir	1_1_RT_MAT...	Optimization ...	PPEG107HP	LS DYNA	Implemented	1-Element or ...	2	Implemented
190912_018	01_03_Opti...	bhir	1_1_RT_MAT...	Optimization ...	PPEG107HP	LS DYNA	Implemented	1-Element or ...	2	Implemented
Series: 1_5_RT_MAT187_3PB_TEMPLATE										



added Filter

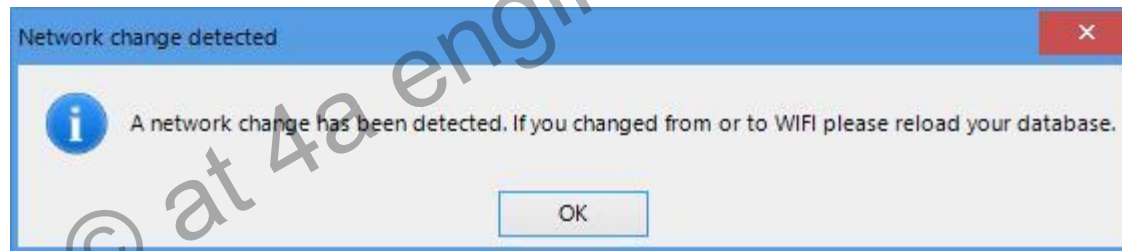
VALIMAT® 3.8 - Reload Parameter Model Button

- Reloading the Model can now be done through the new Reload Button located in the Parameter model side view
- Example usage: cleared all curves → want the model results displayed again

The image illustrates the process of reloading a parameter model in VALIMAT 3.8. On the left, a mouse cursor points to the 'Reload' button in the 'Parameter model' side view. The side view is divided into three sections: 'Parameter model' (with 'New', 'Copy', and 'Reload' buttons), 'Optimization' (with 'Create', 'Edit', and 'Start' buttons), and 'Postprocess' (with 'Plot material', 'Compare Model', and 'Create Report' buttons). A red box highlights the 'Reload' button. A red arrow points from the 'Reload' button to the 'Parameter model' section of the main software interface. The main interface shows the 'Parameter model' section with 'New', 'Copy', and 'Reload' buttons. A red box highlights the 'Reload' button. A yellow arrow points from the 'Reload' button to the 'Material behaviour' plot. The plot shows Force [N] on the y-axis (ranging from -0.14 to 39.85) and Displacement [mm] on the x-axis (ranging from -0.00 to 22.32). The plot displays several curves representing different material behaviors, with a legend indicating various material types and their properties.

VALIMAT® 3.8 - Network changed warning

- In **some cases** if the user changes the network with a running instance of VALIMAT® and an open database on a **network drive**, the database **could be corrupted**.
- To avoid this VALIMAT now gives a warning message if the network is changed and **recommends to reopen** the database.

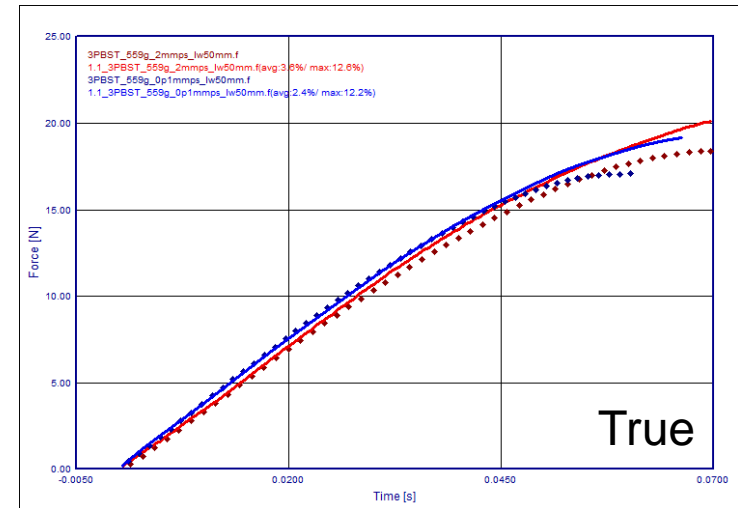
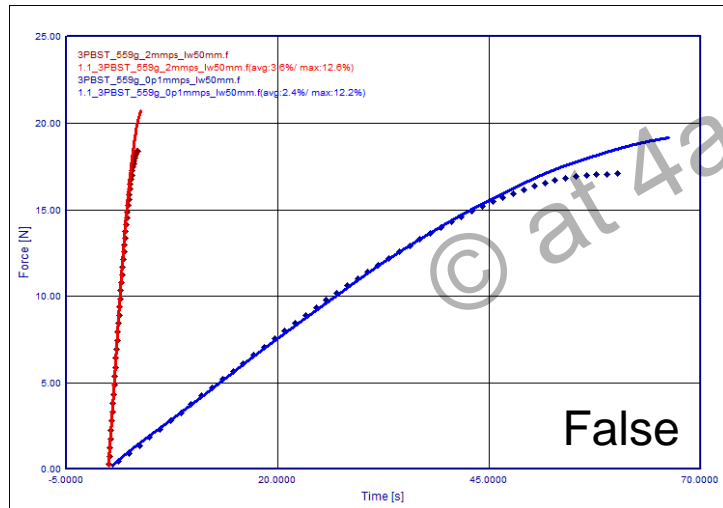


VALIMAT® 3.8 - Added non-scaled graphing on time-scaled simulations

Feature to use the **simulation time** of time-scaled models instead of actual time in the **graph**

An **improper**, but convenient method to compare time curves of static and dynamic tests

Postprocessing	
Deviation	1
Number of animation plots	10
Trim resultcurves?	False
Plot resultcurves timescaled?	True
Averaging	
True	
4a Solver Settings	
False	
Links/references	

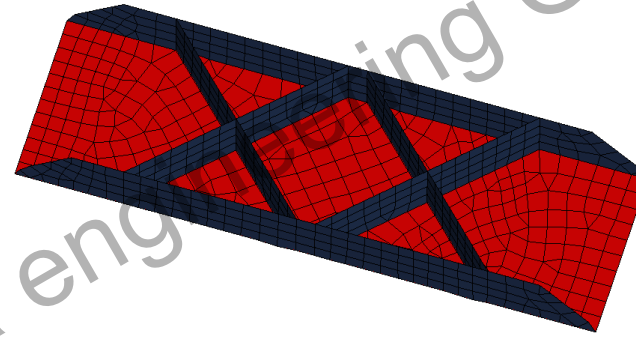
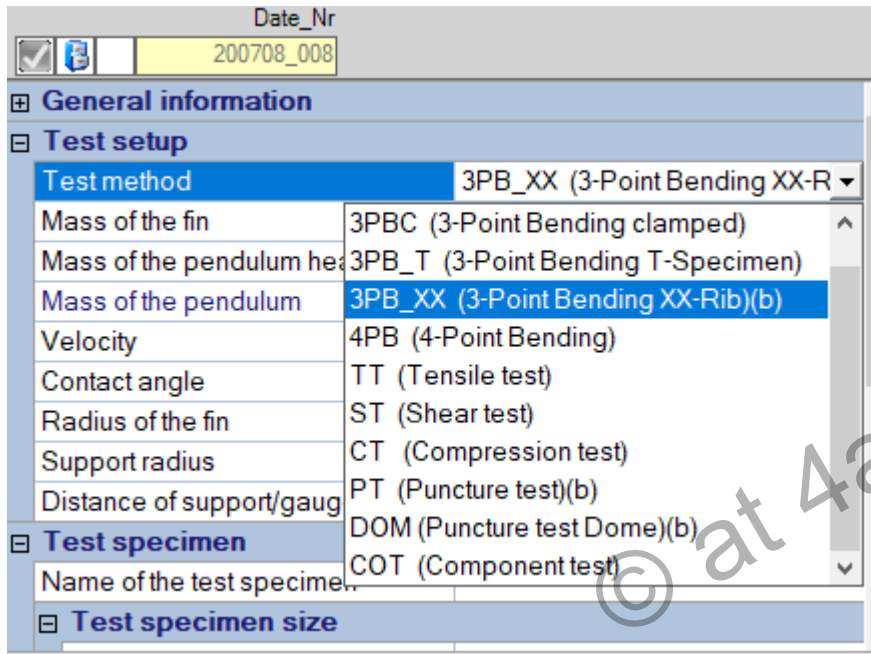


VALIMAT® 3.8 - Mesh Folder

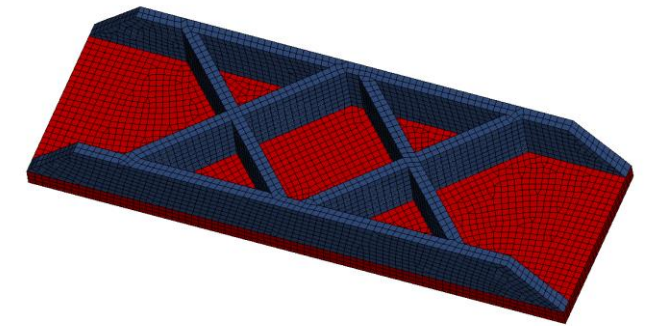
- For the following test types the used mesh will be taken from the mesh folder in the VALIMAT directory
 - location: C:\Users**username**\AppData\Local\Valimat\Mesh
- The subdirectories have the following structure:
 - Dome|Puncturetest|XX-Rib
 - ABAQUS|LSDYNA|PAMCRASH
 - HEX8|SHELL|TET4|TET10
 - sample_(elementsize)mm.inp
- Elementsize can be 0k5, 1, 2 or 4.

VALIMAT® 3.8 - New Test Type 3PB_XX

- The 3-point bending of the double XX rib reinforced specimen is included



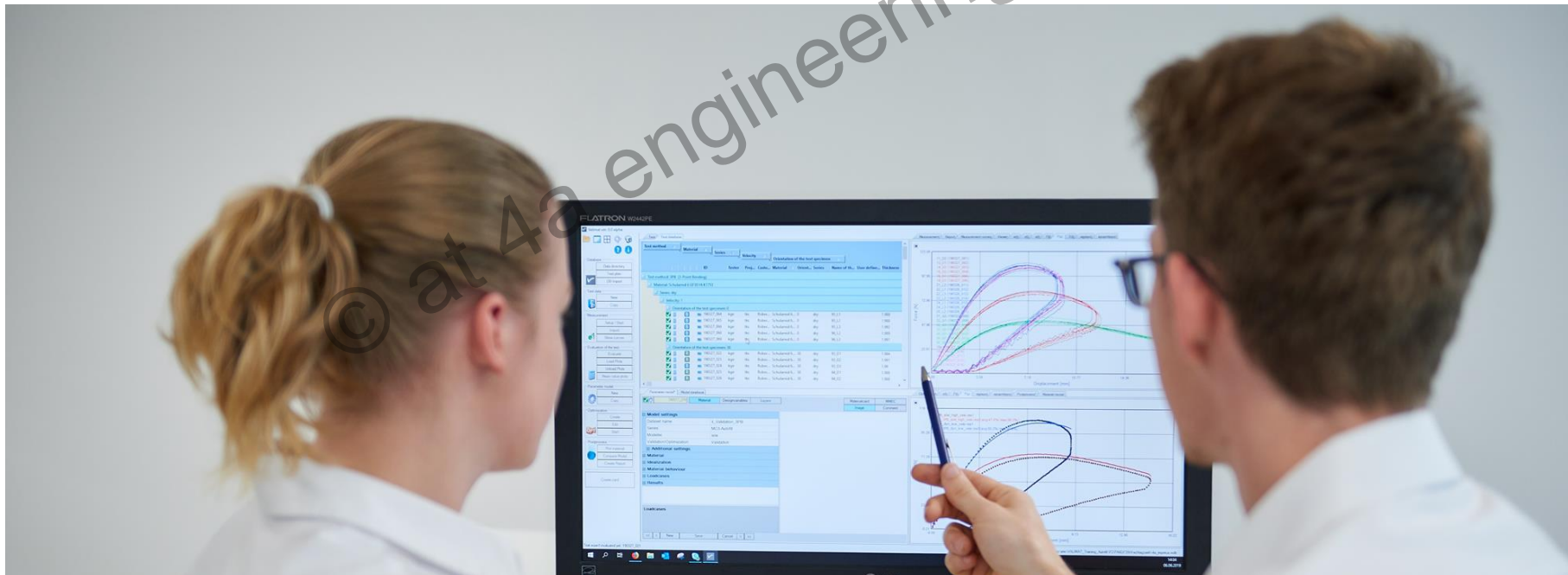
../ SHELL/sample_2mm.key



../HEX8/sample_0k5mm.key



Outlook upcoming week
14.07. – 17.07.



2nd week - Advanced topics



14. July - Evaluating and checking test data
interpretation of typical results



15. July - general yield surface (*MAT_187) and other material models,
failure approaches and comprehensive Autofit setup



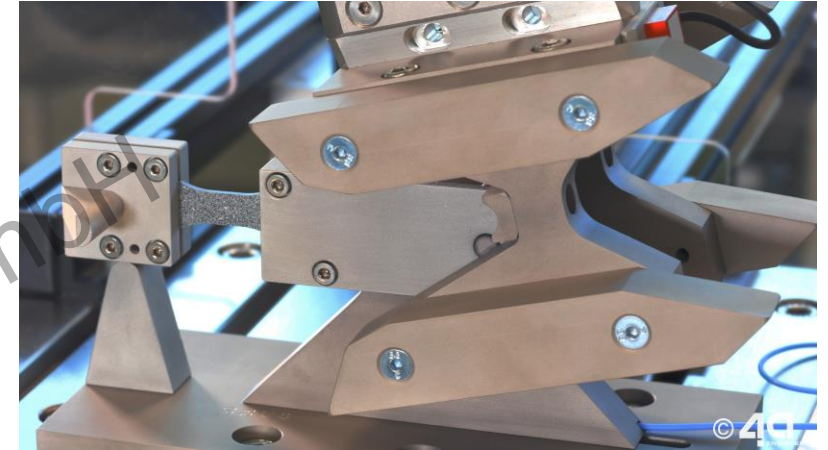
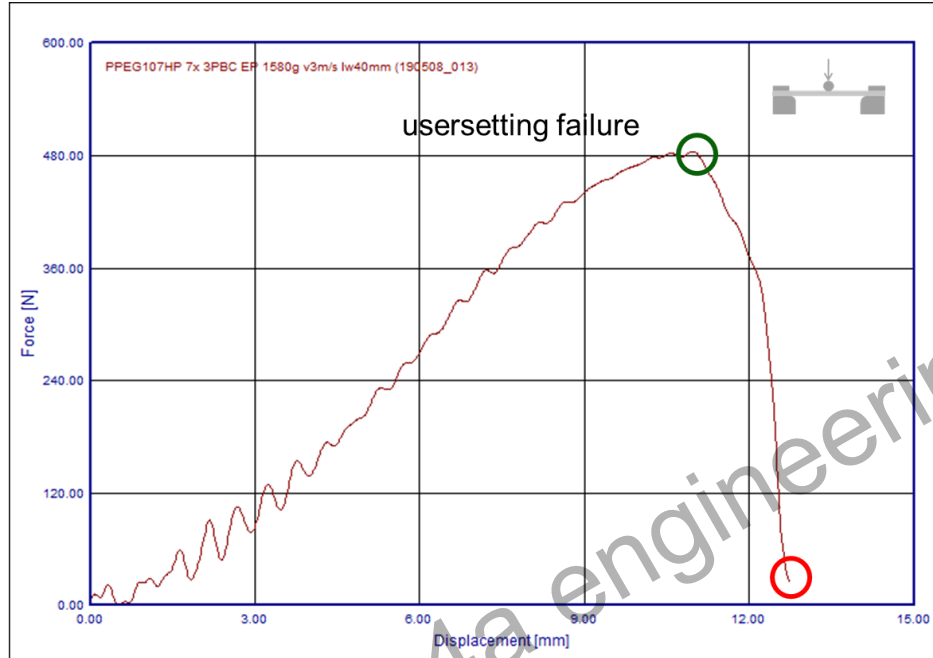
16. July - Fiber reinforced plastics and their modelling approach
an extensive guide



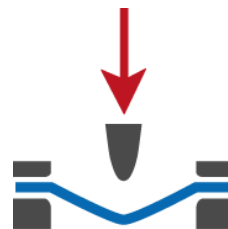
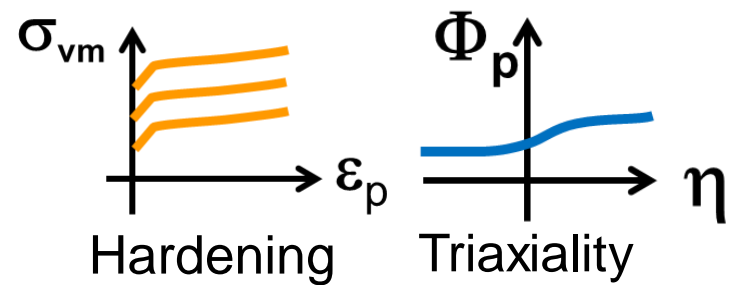
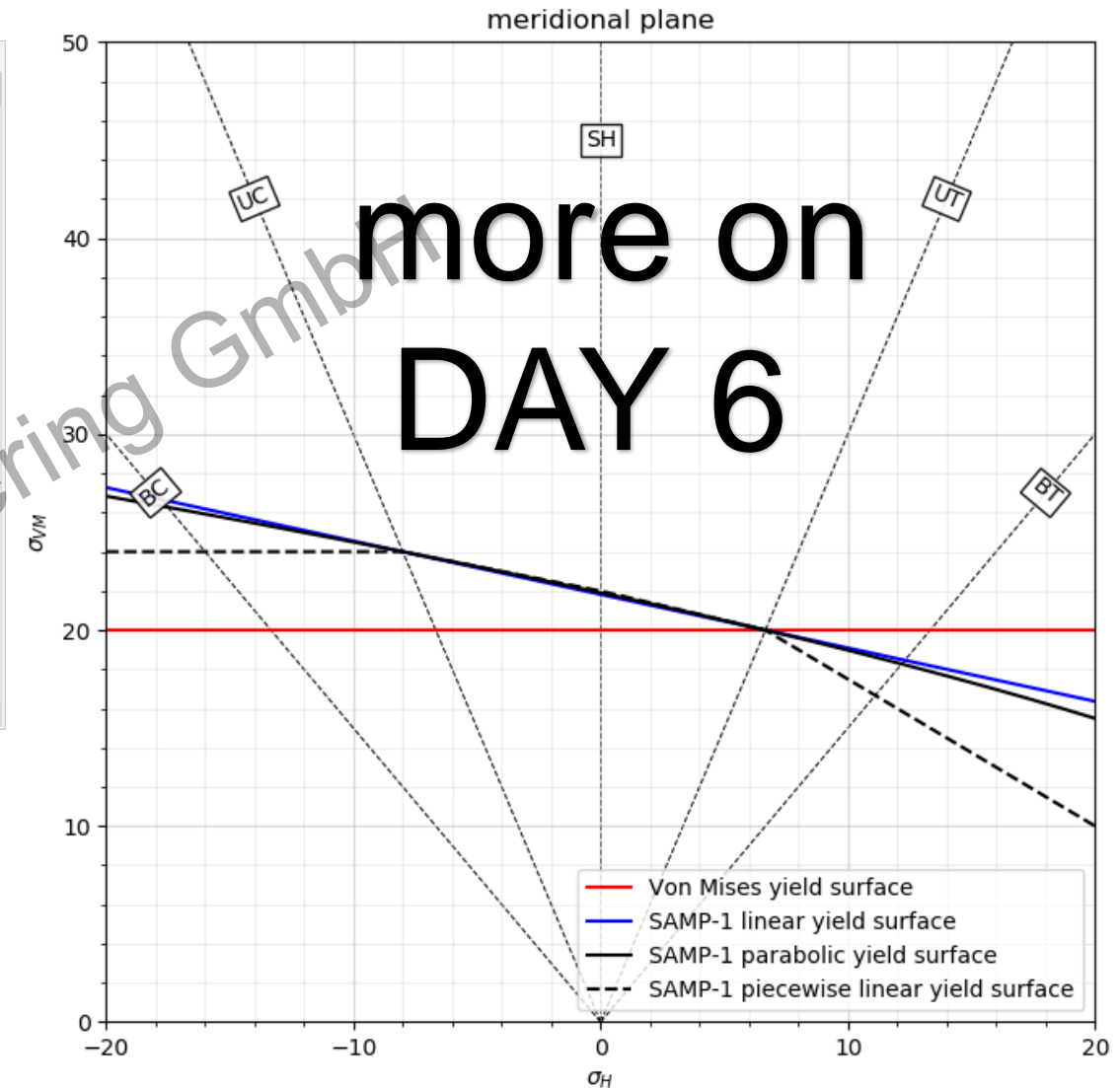
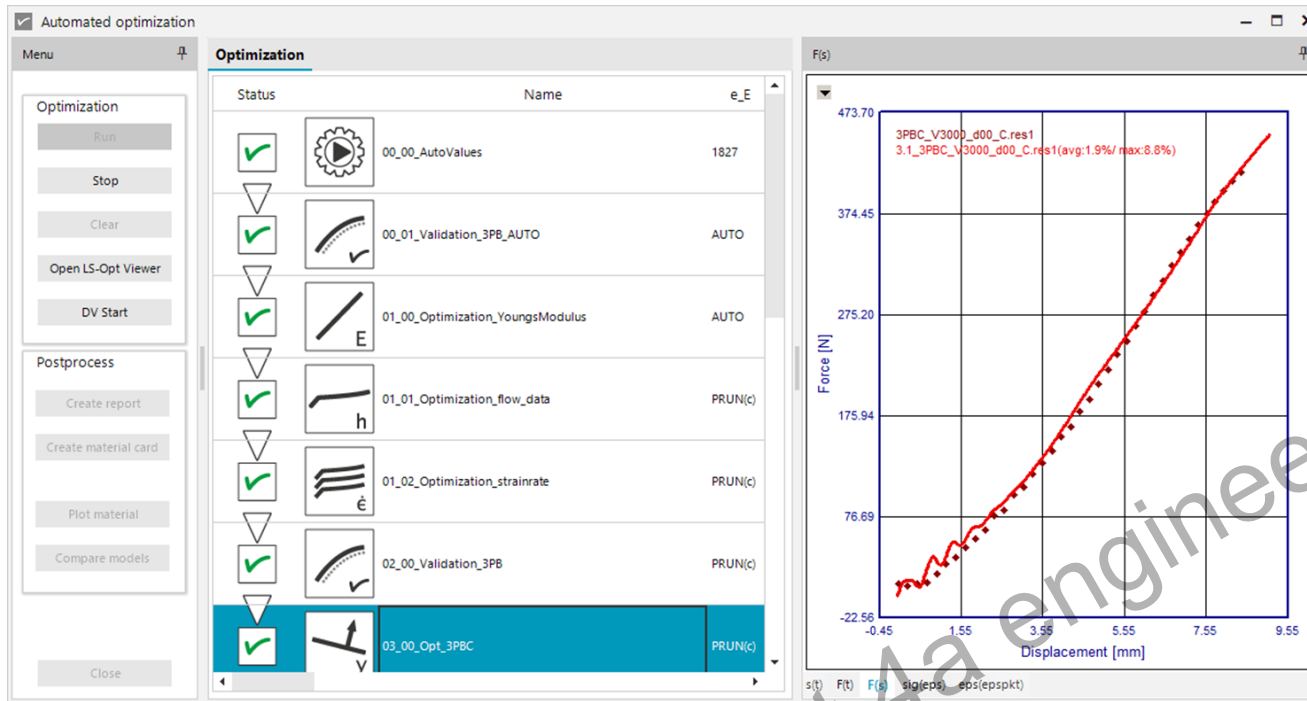
17. July - Python: a powerful tool with VALIMAT®,
user defined material cards/specimen

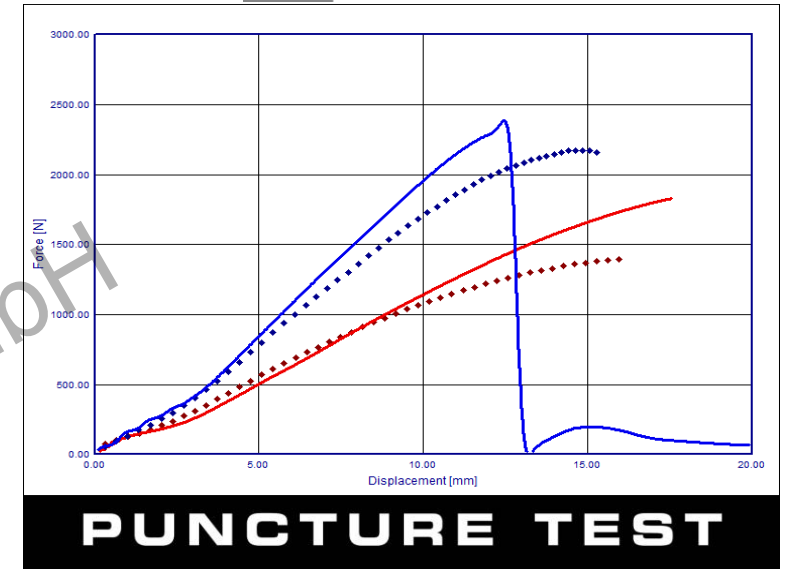
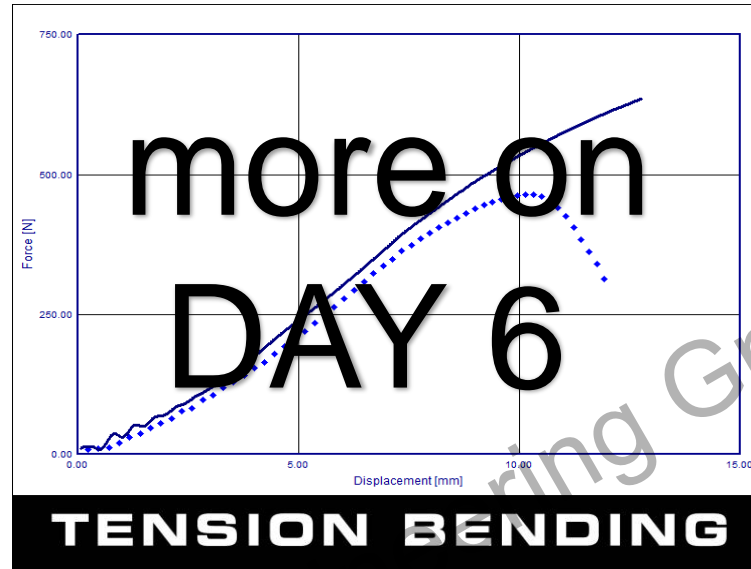
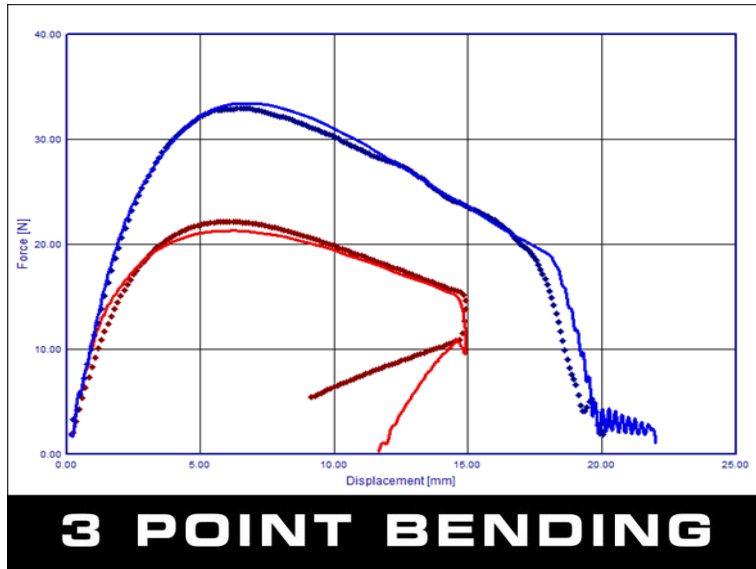
DAY 5 – 14th July 2020

190508_013	
General information	
Test setup	
Test method	3PBC (3-Point Bending clamped)
Mass of the fin	104-SP16 3PB R2 steel
Mass of the pendulum head	128-EP16
Mass of the pendulum	1580
Velocity	3
Contact angle	0.59
Radius of the fin	2
Support radius	1
Distance of support/gauge length	40.02
Sensor SP	ASC 4211LN-400-0HB76 17-33677
Sensor Sup	ASC 4211LN-005-0HB76 15-17565
Test specimen	
Evaluation	
Filter	5 CFC SAE velocity optimum
Evaluation of displacement	Angle
Evaluation of the velocity	1 - Angle sensor
Zero-point evaluation	5 - Accelerationsignal (without filter)
Identification of failure	
tend	0.011793
tfail	0.011793
alphamax_ep	-5
alphamax_dp	-5
Ffail	0.05
tfailfac	10
Fperc	0.8
trecovfac	20
b_criterion	0
Stress evaluation	
Evaluation bending	No evaluation
Stiffness evaluation	
fperc_lo	0.1
fperc_up	0.3
Results	

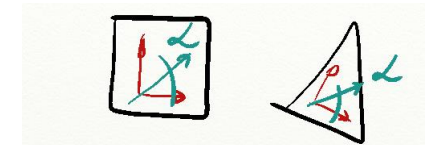
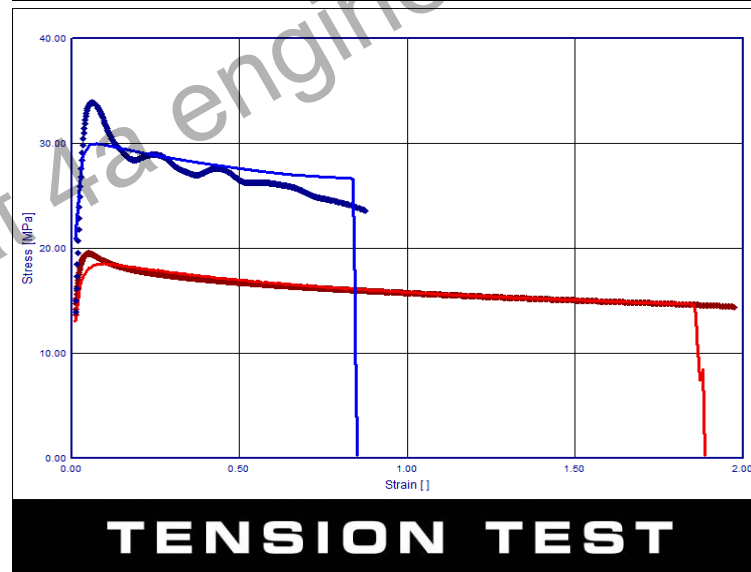


Evaluation methods and interpretation of typical test results



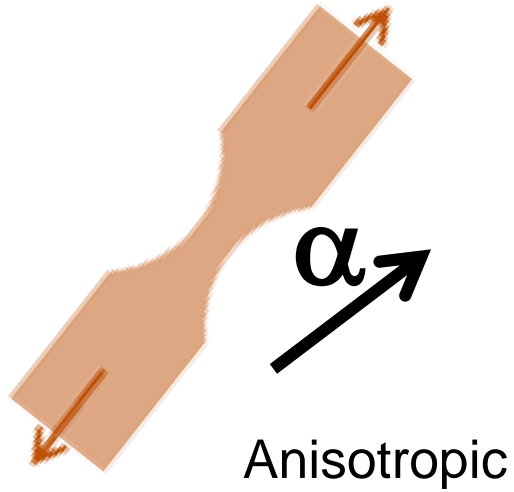


IMPETUS® ~ 3 m/s
static ~ 1 mm/s

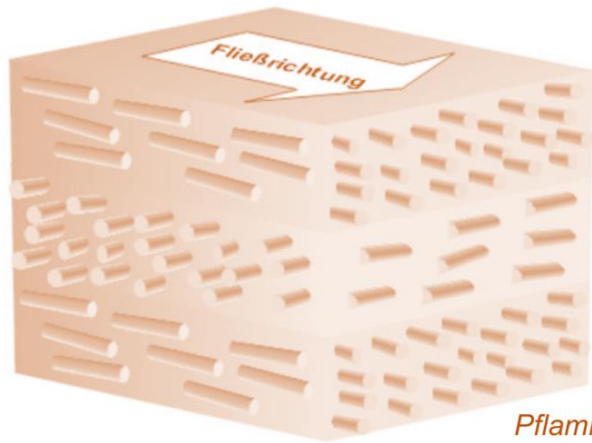
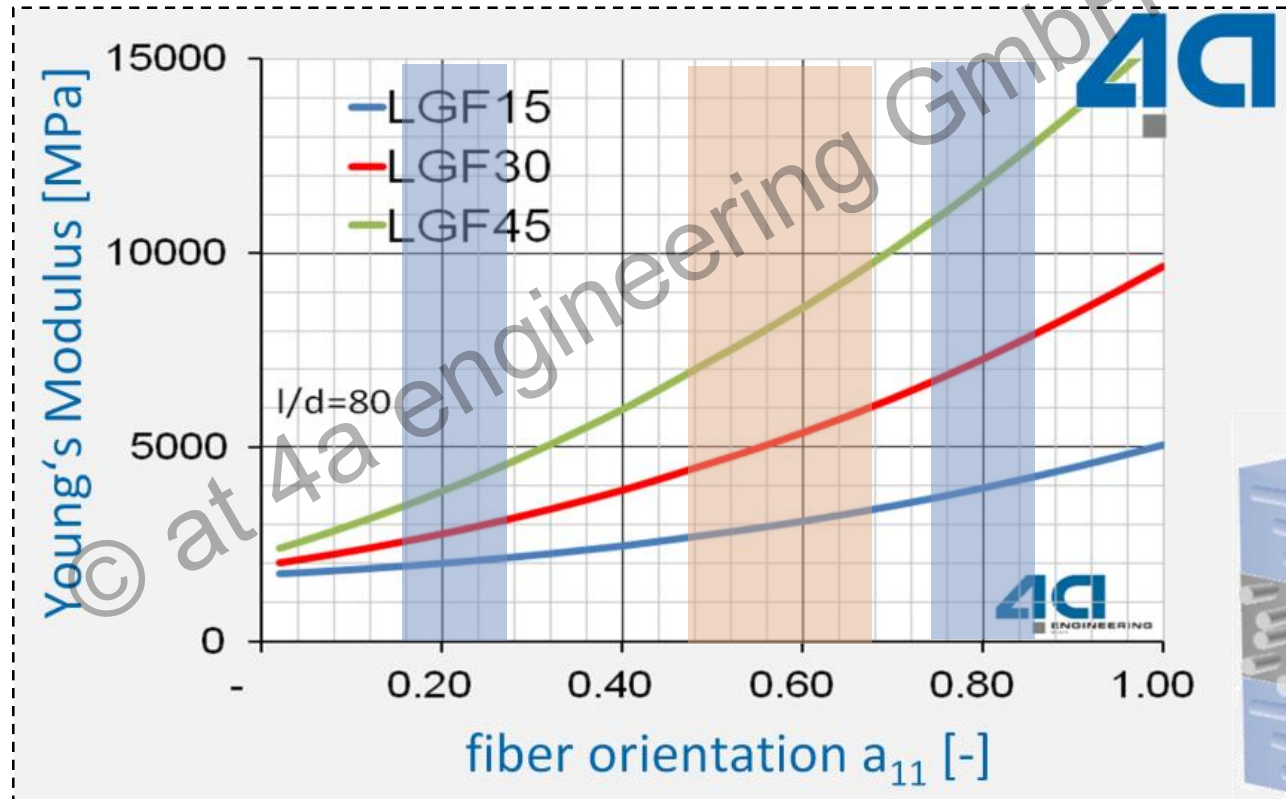


..... averaged test curves
— result of simulation

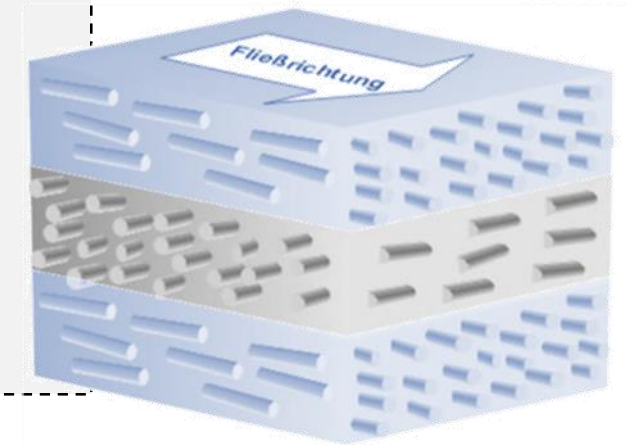
source: Benjamin Hirschmann, master thesis



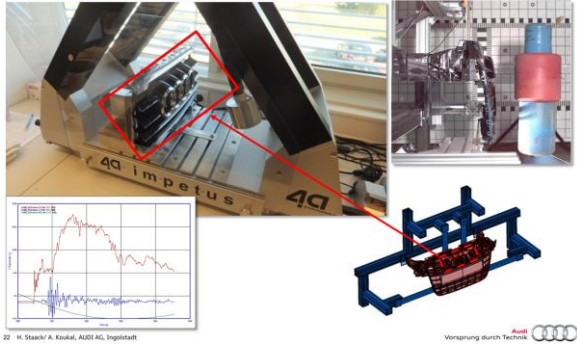
Why not tension (only)?



Pflamm-Jonas 2001



DAY 8 – 17th July 2020



User-defined specimen/input decks
User-defined material cards



VALIMAT

Hardening: σ_{vm} vs ϵ_p

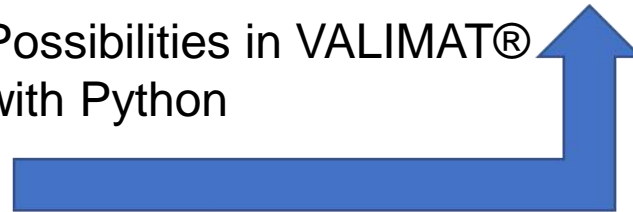
Triaxiality: Φ_p vs η

Damage/Failure: ϵ_p vs η

Anisotropic: α



Possibilities in VALIMAT[®]
with Python



Thank you for your Attention!

4a summer-school - webinar and training
Material characterization with VALIMAT® and IMPETUS®

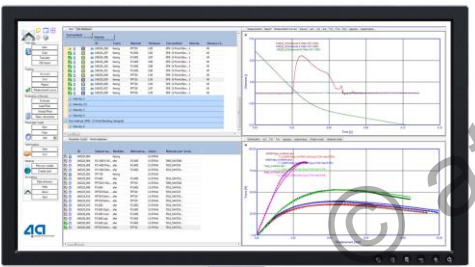
SAVE THE DATE

**09. July - Material card generation:
vonMises plasticity (*MAT_024),
simple failure, setting up our Autofit**

 VALIMAT

 IMPETUS

more information on our software



α
Anisotropic

ϵ_p
Damage/Failure

Φ_p
Triaxiality

σ_{vm}
Hardening

η

www.4a-engineering.at/valimat

comprehensive test package overview



www.4a-engineering.at/test-packages