



**Ground breaking  
Simulation Solutions**

*physics on screen*

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# Advancements in batch model preparation with the SDM-Console

Michael Tryfonidis

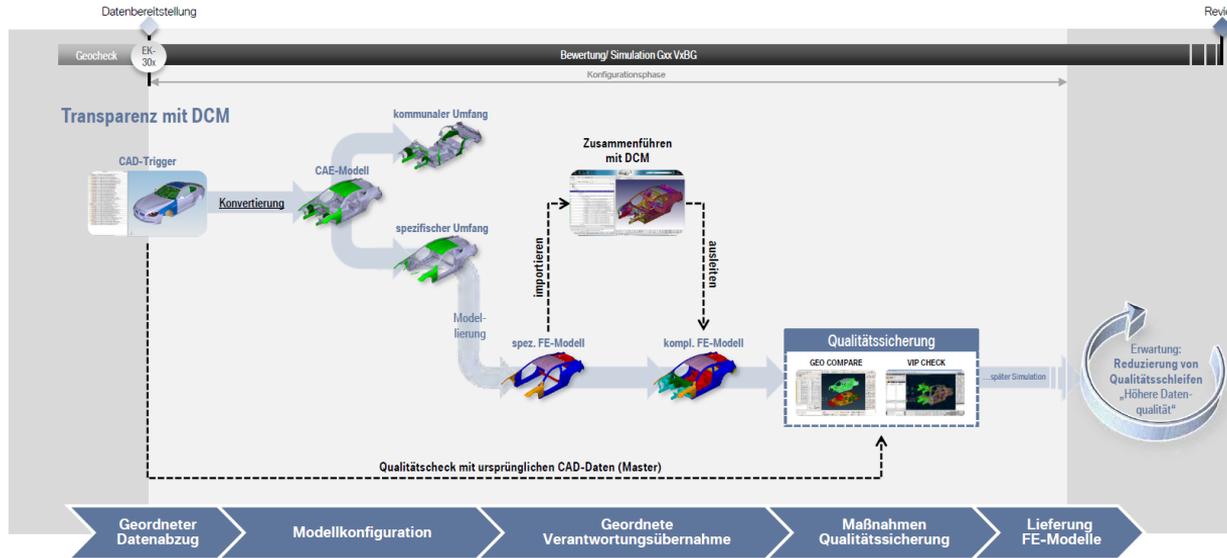
## Contents

- Process Proposal
- Stamp-mapping
- Compare
- Data transfer from CAD to CAE
  - Model Structure
  - CAD2ANSA
- Batch Meshing
  - Pressed elements
  - Tailor blank recognition & treatment

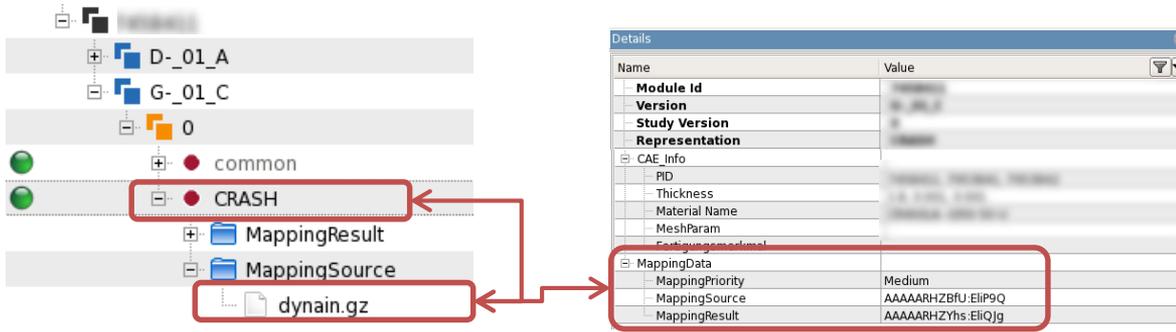
# DURCHGÄNGIGER CAE-MODELLAUFBAU INTEGRATION IN PROZESSKETTE VIRTUELLES FAHRZEUG

(1)

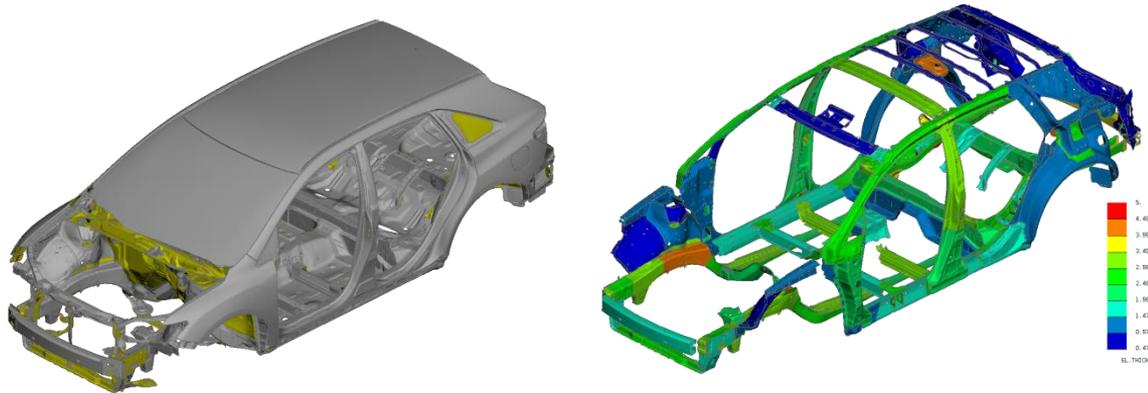
## Process proposal



(1) Meder, M., Daunert H. P. (2016). *Durchgaengiger CAE-Modellaufbau*: BMW Group



Crash Representation has been linked to source-data coming from stamping simulations



Automated mapping process

# Process proposal

New process link:  
Stamp-data mapping

TUESDAY MAY 21, 2019 - Afternoon Sessions

14:00 - 14:30

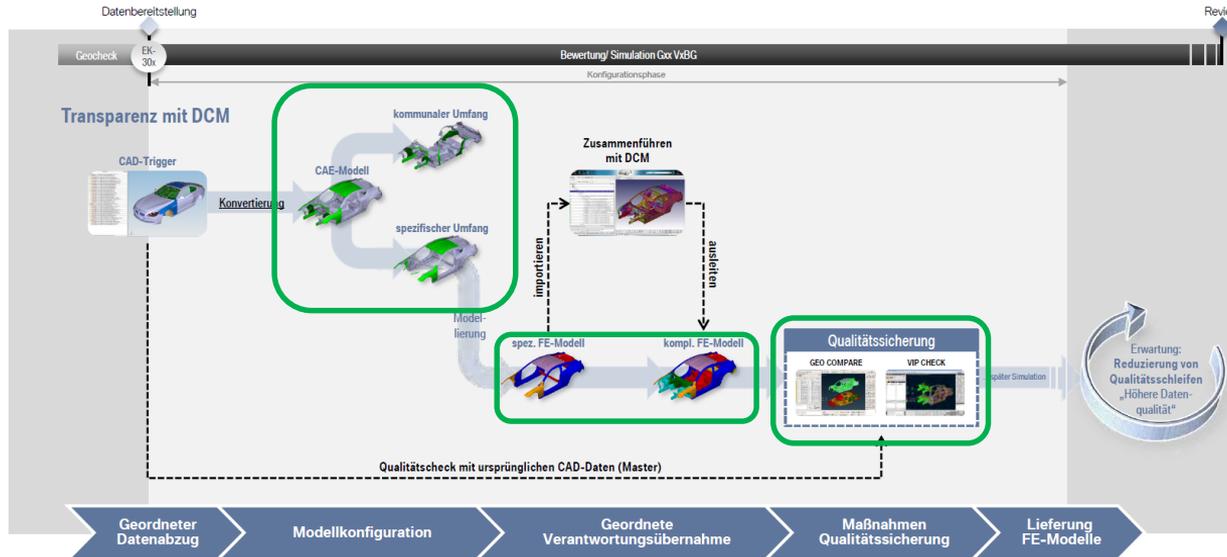
**Stamp-Crash process: coupling of Forming and Crash Simulations at BMW**

Dr. Janine Mergel<sup>1</sup>, Andreas Ickes<sup>1</sup>,  
Marcel Meder<sup>1</sup>, Michael Tryfonidis<sup>2</sup>,  
Helga Reith<sup>1</sup>

<sup>1</sup>BMW Group, <sup>2</sup>BETA CAE Systems

# DURCHGÄNGIGER CAE-MODELLAUFBAU INTEGRATION IN PROZESSKETTE VIRTUELLES FAHRZEUG

(1)

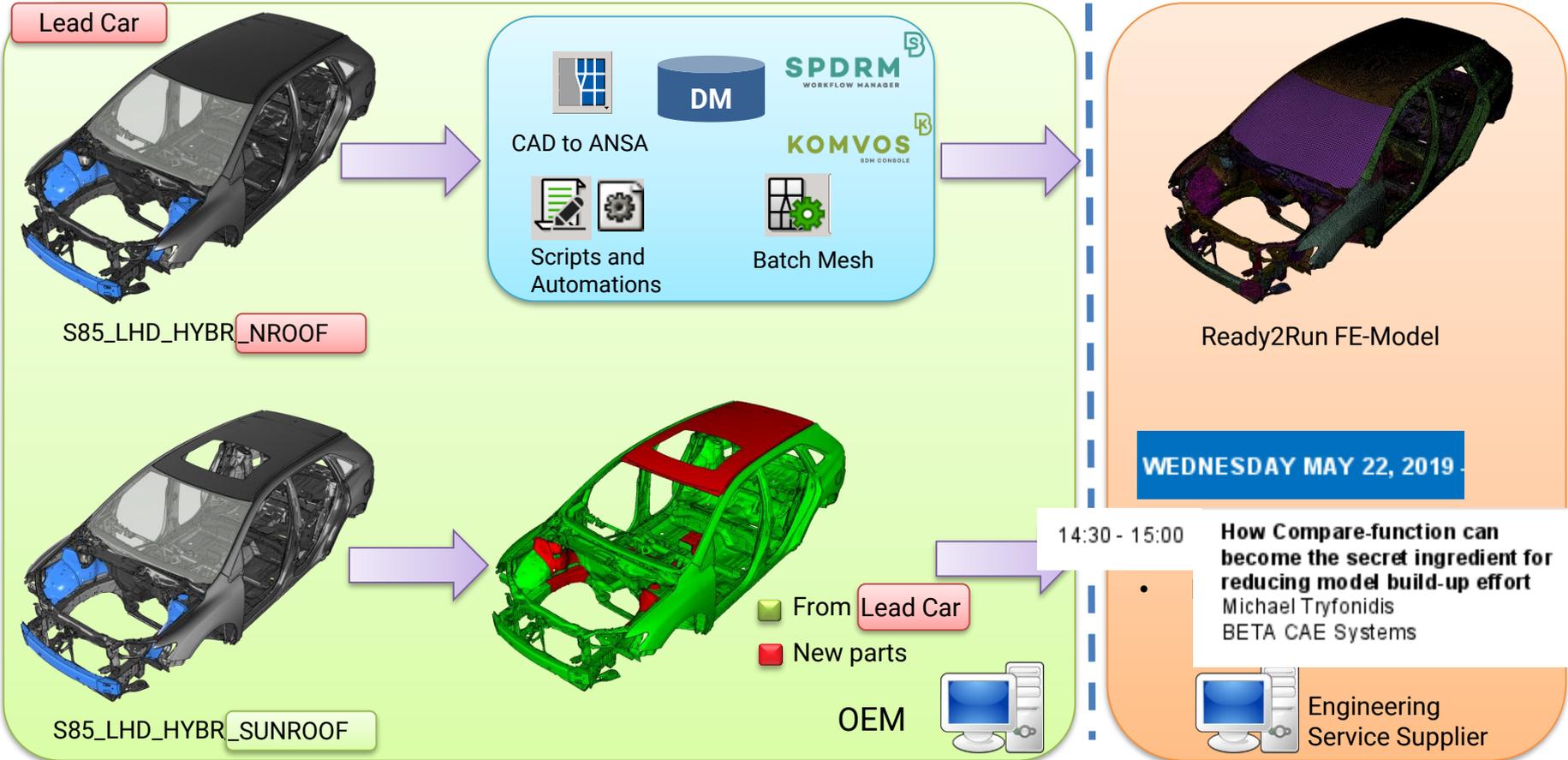


## Process proposal

### Focus on CAE Model preparation

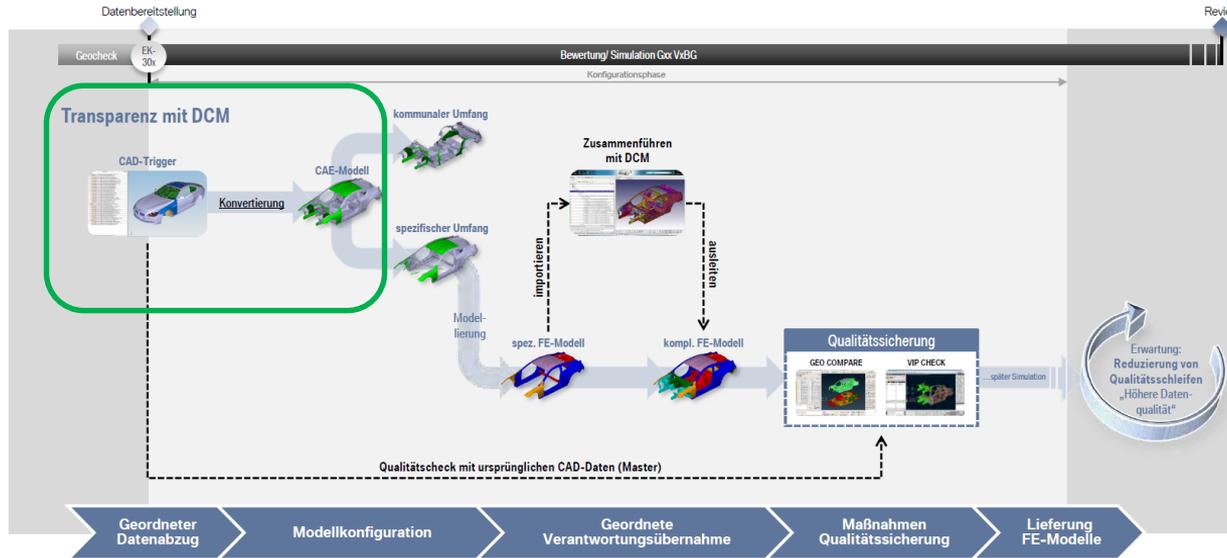
(1) Meder, M., Daunert H. P. (2016). *Durchgaengiger CAE-Modellaufbau*: BMW Group

# Compare



# DURCHGÄNGIGER CAE-MODELLAUFBAU INTEGRATION IN PROZESSKETTE VIRTUELLES FAHRZEUG

(1)



## Process proposal

### Focus on CAE Model preparation

(1) Meder, M., Daunert H. P. (2016). *Durchgaengiger CAE-Modellaufbau*: BMW Group

OLD PROCESS

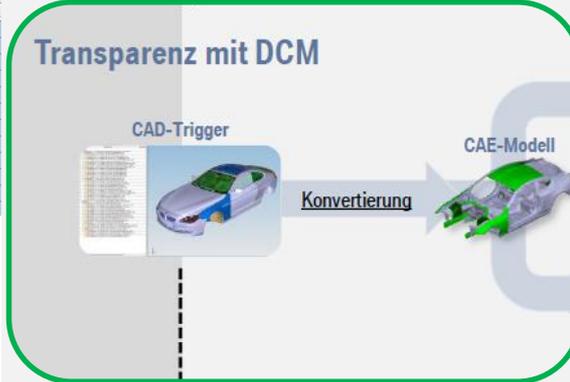
# Data transfer from CAD to CAE Focus Structure

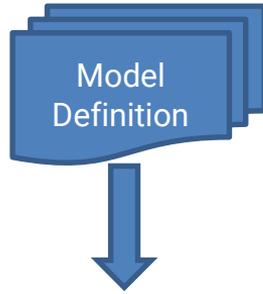
The screenshot shows a PDM System interface with a list of parts. A database icon is overlaid on the top left. The list includes columns for Status, NEO, NE, N, N, verlinkt, Datenpalettyp, Produkt, Bauphase, Derivat, Konfiguration, and Liefertermin. A blue arrow points from the PDM System icon to the CAD-Trigger section of the diagram on the right.

The screenshot shows a CAD software interface with a tree view of parts and a table of material properties. The tree view includes parts like P01G9F4 A 1 A G20 KH03 SE KOPFSTUETZE, ARMLEHNE, ANBAU, P01G9F9 A 1 A G20 KOGR 5220/005 MITTELARMLEHNE/EINSATZ, 71606011 1 A ZYLINDERSCHRAUBE M.ANSATZ SELBSTSCHNITT, 71606011 1 A ZYLINDERSCHRAUBE M.ANSATZ SELBSTSCHNITT, P01G9F8 A 1 A G20 KOGR 5210/005 SITZRUECKWAND/DEKOR, 7415102 E 1 A MD RUECKWAND MIT NETZ A.F., 7415102 E 1 A MD RUECKWAND MIT NETZ A.F., P01G9F7 A 1 A BEFESTIGUNG RUECKWAND, 9907470 A 1 A BLECHSCHRAUBE ST4,2X13-R-ZNS3, P01G9F8 A 4 A G20 KOGR 5220/003 BLENDEN/ABDECKLUNGE, 7455211 A 1 A MD BLENDE ISOFIX ECE A.F., 7455211 A 1 A MD BLENDE ISOFIX ECE A.F., 7455211 A 1 A MD BLENDE ISOFIX ECE A.F., 7455211 A 1 A MD BLENDE ISOFIX ECE A.F., P01G9G0 A 4 A G20 KOGR 5220/008 KOPFSTUETZEN HINTEN.

Sac.	Zi	DT	A	DF	D...	R...	Ben...	Kl	Doc...	Co...	Vers...	#Ma...	Mat...	Baut...	Material...	e-M...	Mat...	St...	We...
✓	P0...	A	4	A	ST	S...	P...	G20...	-9	p45...	0	01.0...	0	0	0	0	0	0	0
✓	P0...	A	4	A	ST	S...	P...	G20...	-9	p45...	0	18.0...	0	0	0	0	0	0	0
✓	P0...	A	4	A	ST	S...	P...	G20...	-9	p45...	0	26.0...	0	0	0	0	0	0	0
✓	P0...	A	4	A	ST	S...	P...	G20...	-9	p45...	0	27.0...	0	0	0	0	0	0	0
✓	PZ...	A	4	A	ST	S...	P...	G20...	-9	p45...	0	29.0...	0	0	0	0	0	0	0
✓	716...	I	1	A	5P	F...	P...	ZYL...	-9	p45...	0	04.0...	1	9647	0	Festgk...	21...	0,37	8...
✓	P0...	A	1	A	ST	S...	P...	G20...	-9	p45...	0	01.0...	0	0	0	0	0	0	0
✓	741...	E	1	A	5P	F...	V...	MD...	-9	p45...	0	17.0...	0	0	0	0	0	0	0
✓	741...	E	1	A	5P	F...	V...	MD...	-9	p45...	1	17.0...	0	0	0	0	0	0	0
✓	990...	A	1	A	5P	F...	P...	BLE...	-9	p45...	0	13.0...	0	0	0	0	0	0	0
✓	990...	A	1	A	5P	F...	P...	BLE...	-9	p45...	1	13.0...	0	0	0	0	0	0	0
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PDM-System

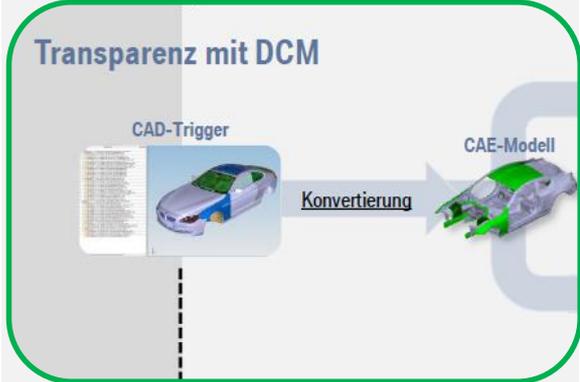




OLD PROCESS



Data transfer from  
CAD to CAE  
Focus Structure





PDM System



Model Definition

OLD PROCESS

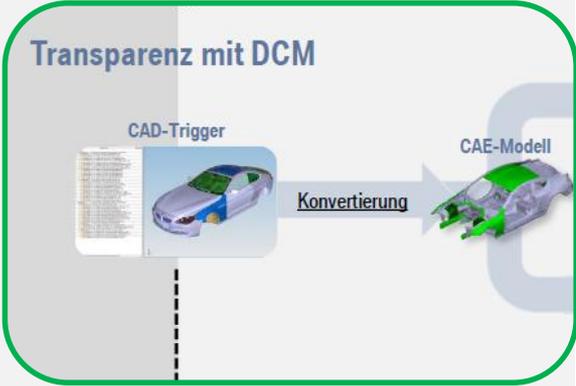
# Data transfer from CAD to CAE Focus Structure

**CAE STRUCTURE**

**CAD STRUCTURE**

DM Name	Version	Module Id	Transformation Matrix	Instances	Part Files	Product Revision Id
10011PM13_001_A0426_PLA90_EPS_Prodakt	001	10011PM13	1.0.0.0.1.0.0.0.1.0.0.0.0.1.1	0	4056	
10011PM13_001_000_000	001	10011PM13	1.0.0.0.1.0.0.0.1.0.0.0.0.1.1	0	4097	
10011PM13_001_000_001	001	10011PM13	1.0.0.0.1.0.0.0.1.0.0.0.0.1.1	0	4017	
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10011PM13_001_000_003	002	10011PM13	1.0.0.0.1.0.0.0.1.0.0.0.0.1.1	0	4053	
10011PM13_001_000_004	006	10011PM13	1.0.0.0.1.0.0.0.1.0.0.0.0.1.1	0	4080	
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10011PM13_001_000_007	002	10011PM13	1.0.0.0.1.0.0.0.1.0.0.0.0.1.1	0	404701	
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10011PM13_001_000_036	002	10011PM13	1.0.0.0.1.0.0.0.1.0.0.0.0.1.1	0	4090	
10011PM13_001_000_037	001	10011PM13	1.0.0.0.1.0.0.0.1.0.0.0.0.1.1	0	4090	

Parts: 125 Part Files: 392  
 # Found in DM: 7 # File exists: 392  
 # Not found in DM: 7 # File does not exist: 0  
 # Missing: 0



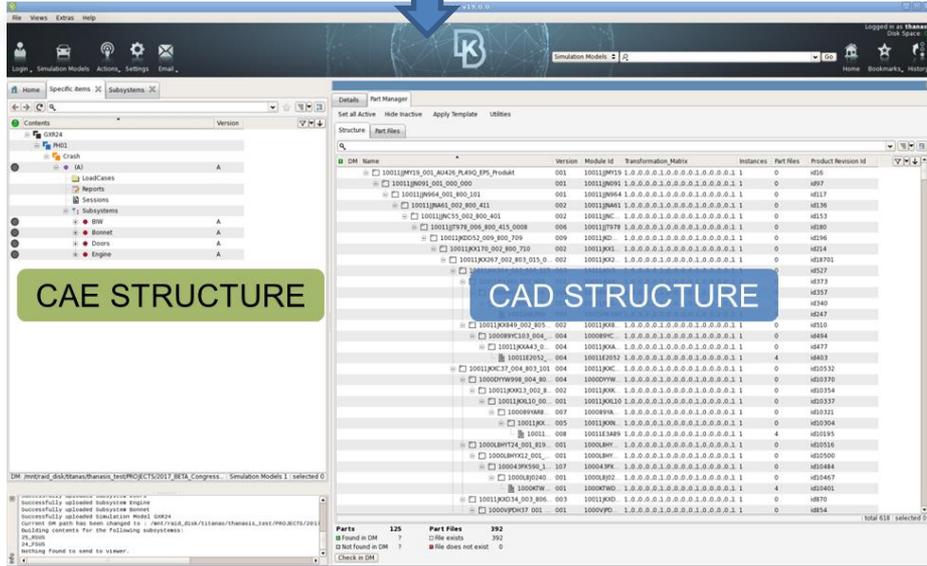


PDM System



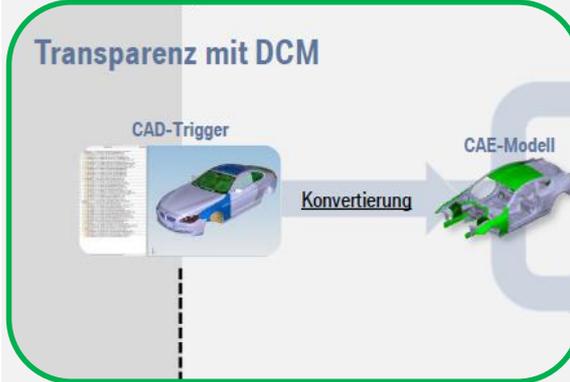
Model Definition

OLD PROCESS



Data transfer from CAD to CAE  
 Focus Structure

- Time consuming
- Not flexible
- User unfriendly



Name	Value
Module Id	
Version	
Study Version	
Representation	
Secondary Attributes	
Name	7333407_H-01_A_LI-AUFNAHME-HA
Status	OK
Created	19-SEP-2018 16:46:31
Last_Edit	19-SEP-2018 16:46:33
User	demo
Is Instance	
MaturityLevel	VERF
Id	250
Transformation_Matrix	
x0, y0, z0	0., 0., 0.
dx1, dy1, dz1	1., 0., 0.
dx2, dy2, dz2	0., 1., 0.
dx3, dy3, dz3	0., 0., 1.
CAD_FILE	
PDM/Part Files/Part File 1/CAD File Name	7333407_H-01_A_5P_FRGMOD_LI-A
PDM/Part Files/Part File 1/CAD File Path	/home/demo/BMW/00_MarcelModels
PDM/Part Files/Part File 1/Download Link	
CAD_Thickness	
CAE_Info	
PID	2, 3, 7333407
Thickness	0.001, 0.001, 2.3
Material Name	CR210BH--GI50-50-U
MeshParam	4mm
Fertigungsmerkmal	Blech
MappingData	
MappingPriority	Medium
MappingSource	
MappingResult	

Part Info

OLD PROCESS

- ## Data transfer from CAD to CAE
- ### Focus CAD2ANSA
- Only capable under Linux
  - Original cad files exposed
  - Limited traceability

Transparenz mit DCM





NEW PROCESS

# Data transfer from CAD to CAE Focus Structure

## Transparenz mit DCM





NEW PROCESS

# Data transfer from CAD to CAE Focus CAD2ANSA

TranslateJob Karosseriegerippe

Details TranslateJob Karosserieg...

Work Dir c:\users\tchara~1\appdata\local\temp\L3\_R55\_DEFAULT\_EK\_Karosseriegerippe\_20190315\_150247\

Name	Translation Status	CAD-File	DokuId	Part Nr
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F000444_N_01_A_F000444_N_01_A_11-VERSTAERKUNG-SCHARNIER	<input type="radio"/> Not translated yet		18849541	<input type="checkbox"/> Version
F000684_O_01_A_F000684_O_01_A_11-VERSTAERKUNG-SCHARNIER	<input type="radio"/> Not translated yet	R-VORN-F30-F31	48483820	<input checked="" type="checkbox"/> Translation Status
F000685_Q_01_A_F000685_Q_01_A_11-VERSTAERKUNG-SCHARNIER	<input type="radio"/> Not translated yet	R-VORN-F30-F31	48483805	<input checked="" type="checkbox"/> CAD-File
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F000755_S_01_A_F000755_S_01_A_11-VERSTAERKUNG-SCHARNIER	<input type="radio"/> Not translated yet	NTEN-F30-F31	42315483	<input type="checkbox"/> DokuId: Error
F000756_S_01_A_F000756_S_01_A_11-VERSTAERKUNG-SCHARNIER	<input type="radio"/> Not translated yet	NTEN-F30-F31	42315477	<input type="checkbox"/> DokuId: Response
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F001254_K_01_A_F001254_K_01_A_VERSTAERKUNG-SCHLISSBUEGEL	<input type="radio"/> Not translated yet		18893125	
1164653_F_01_A_1164653_F_01_A_LEITUNGSCCLIP	<input type="radio"/> Not translated yet		16587794	
1176747_G_01_A_1176747_G_01_A_KUNSTSTOFFMUTTER	<input type="radio"/> Not translated yet		17478235	
1374075_E_01_A_1374075_E_01_A_SPREIZMUTTER	<input type="radio"/> Not translated yet		809932	
1378908_A_01_A_1378908_A_01_A_HALTER-FUER-STECKVERBINDUNG	<input type="radio"/> Not translated yet		5470696	
1855009_G_01_A_1855009_G_01_A_VERSCHLUSSSTOPFEN	<input type="radio"/> Not translated yet		729932	

Pending: 884, OK: 0, WARNING: 0, ERROR: 0 | total 884 | selected 1

Start CATIA->ANSA Conversion Refresh

CAD4CAE: Query for Plmxml file

TSS-Kennung hendrix

TSS-Passwort \*\*\*\*\*

OEDE-Name P123456#A#01#A#ST#PACKAG

Dokuld

OK Cancel

## Benefits

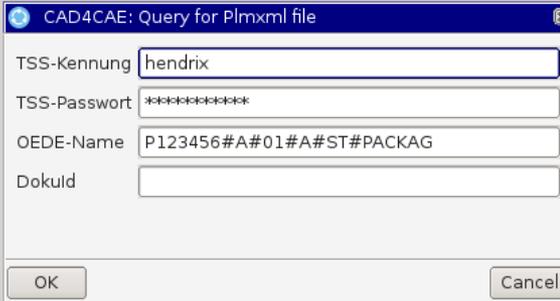
- Reading the hierarchy structure requires minutes instead of multiple hours
- No redundant cad-data exchange
- Transparent error handling
- CAD-Data get automatically cleared
- Model build process becomes function-able under Windows-OS
- User does everything in one tool -> KOMVOS

## Future Steps

- Preview cad-data in 3d by exploiting view-files (cgr, jt etc.)
- Perform CAD-conversion on a server
- Automation of CAD->CAE model definition process

## Data transfer from CAD to CAE

Benefits and  
opportunities of new  
process



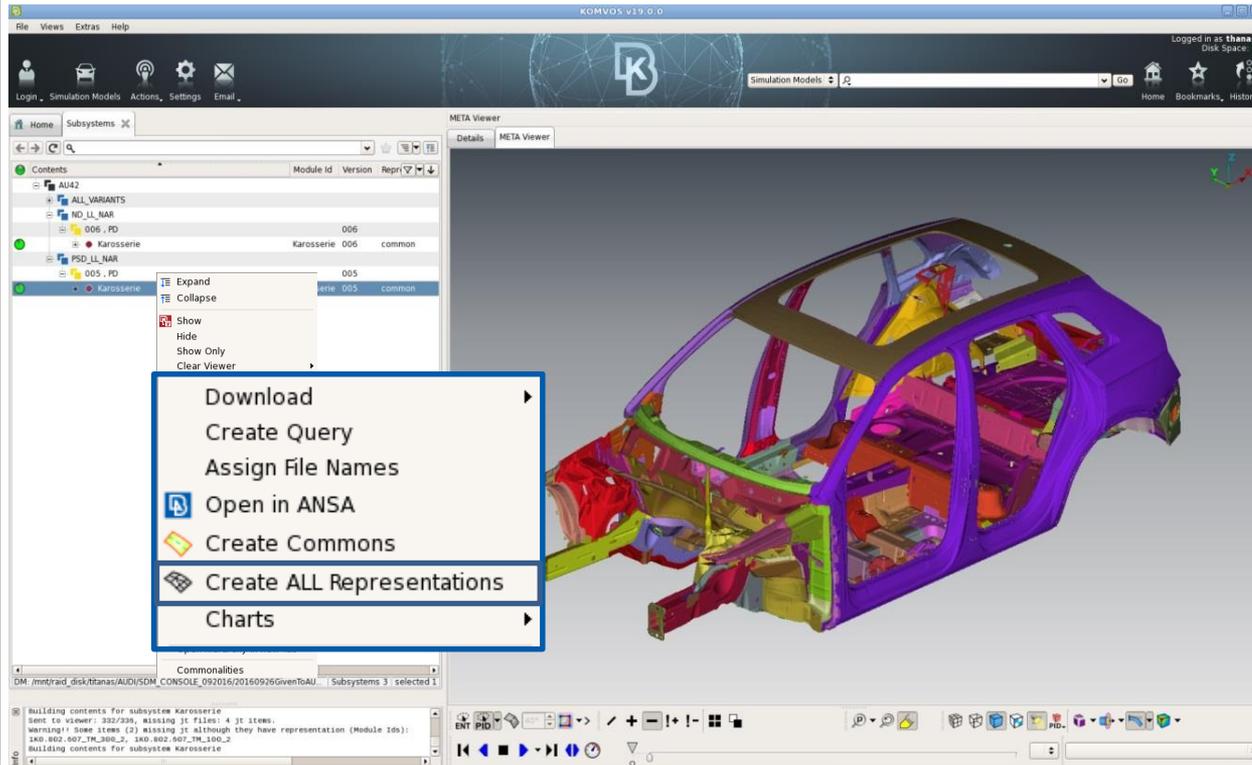
CAD4CAE: Query for Plmxml file

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TSS-Passwort	<input type="password" value="*****"/>
OEDE-Name	<input type="text" value="P123456#A#01#A#ST#PACKAG"/>
Dokuid	<input type="text"/>

OK Cancel

# Batch Meshing

- Triggered through SDM-Console 



## Transparenz mit DCM

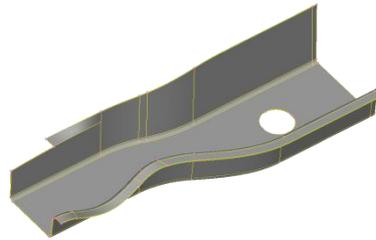




Bolts/Screws/etc.



Underbody covers, montage plates etc.

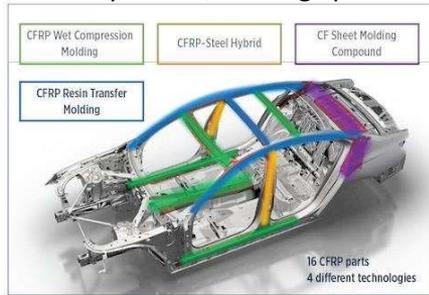


Shell parts constant thickness

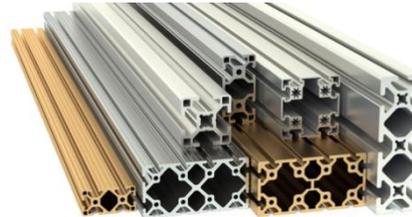
# Batch Meshing Parts types to deal with in the BiW domain



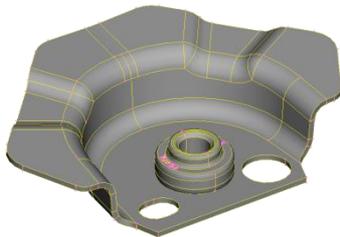
Aluminum Casted



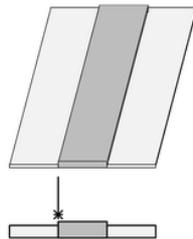
Carbon fiber parts (multiple types)



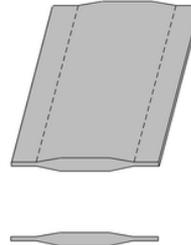
Elongated aluminum parts



Shell parts with Pressed elements



Tailor Welded blank



Tailor Rolled blank

## Transparenz mit DCM

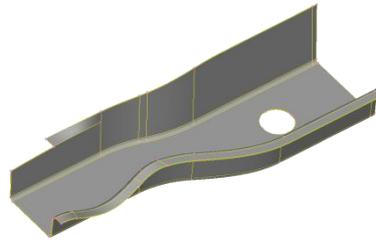




Bolts/Screws/etc.



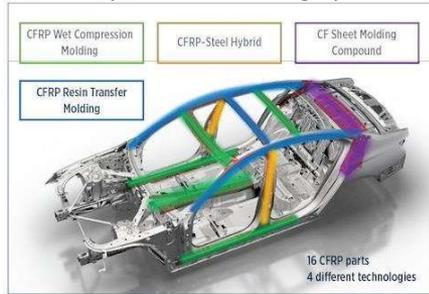
Underbody covers, montage plates etc.



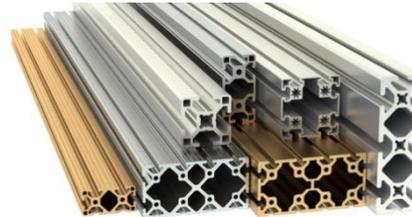
Shell parts constant thickness



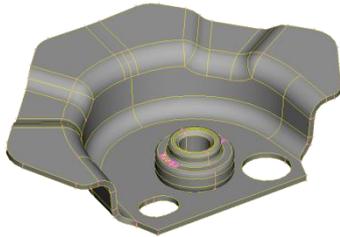
Aluminum Casted



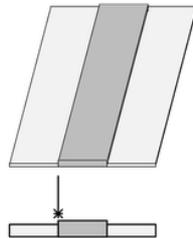
Carbon fiber parts (multiple types)



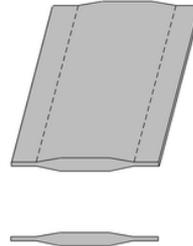
Elongated aluminum parts



Shell parts with Pressed elements



Tailor Welded blank



Tailor Rolled blank

Batch Meshing  
Parts types to deal  
with in the BiW  
domain  
- for up to ~30% parts  
manual input required

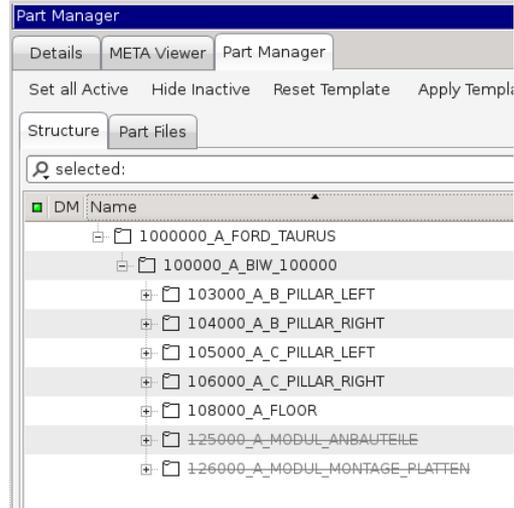
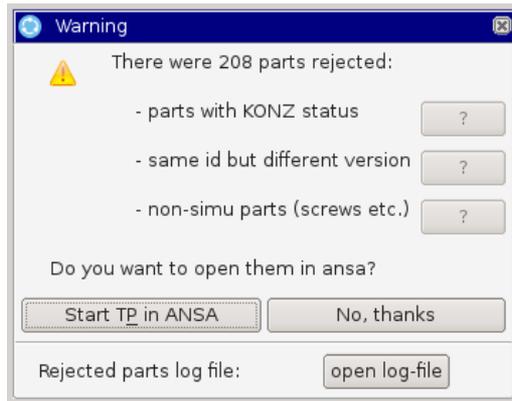
### Transparenz mit DCM





Bolts/Screws/etc.

Underbody covers, montage plates etc.



Using Smart string filters and submodel selection templates

## Batch Meshing Strategies depending on part type

- CAE-irrelevant parts  
are filtered out

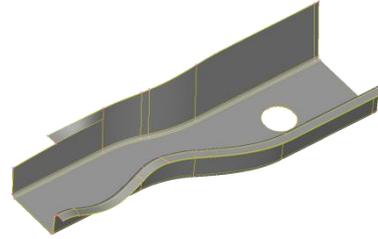
### Transparenz mit DCM



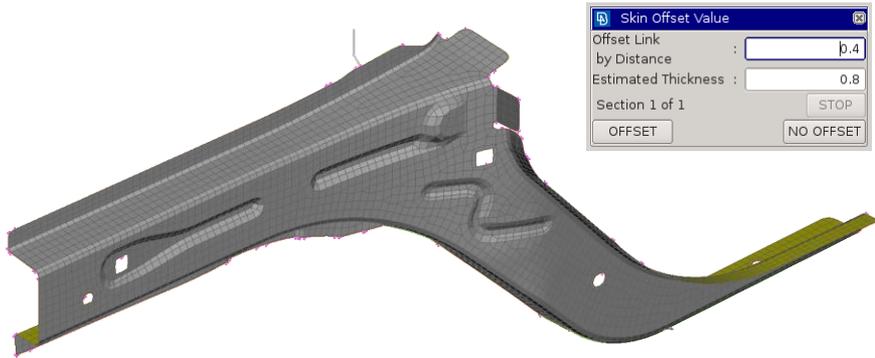
No user input required for their recognition.

Key functions used:

- Skin for mid-surfacing
- Batch Mesh tool for meshing

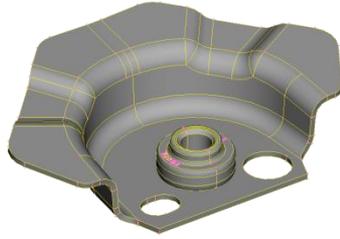


Shell parts constant thickness

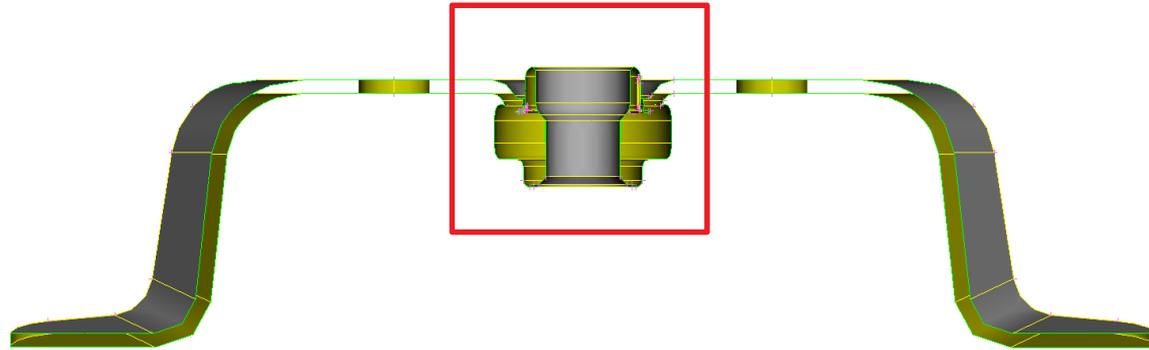


## Batch Meshing Shell Parts constant thickness

- Shell Midsurfacing +  
Batch meshing

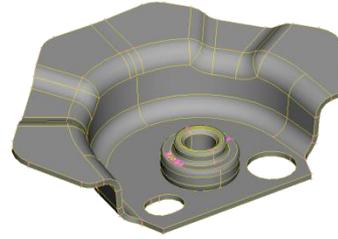


Shell parts with Pressed elements



## Batch Meshing Shell Parts with Pressed elements

- Pressed elements lead to failure with regards to mid surface extraction
- Can be 10%-30% of BiW Parts

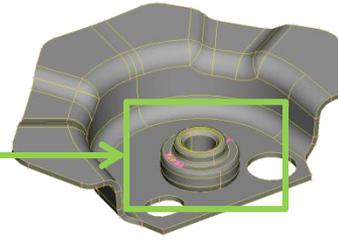


Shell parts with Pressed elements

# Batch Meshing Solution for Shell Parts with Pressed elements

- Library of pressed elements geometries

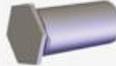
<p><b>Einpressmutter</b> TR-S TR-CLS TR-CLA</p> 	<p><b>Einpress-Gewindebolzen</b> TR-FH TR-FHS TR-FHA</p> 	<p><b>Einpress-Gewindebuchse offen</b> TR-SO TR-SOS TR-SOA</p> 	<p><b>Einpress-Gewindebuchse geschl.</b> TR-BSO TR-BSOS TR-BSOA</p> 
<p><b>Einpressmutter beidseitig bündig</b> TR-F</p> 	<p><b>Einpressmutter "geschl."</b> TR-B TR-BS</p> 	<p><b>Einpressbolzen</b> TR-TPS - MS TR-TPS</p> 	<p><b>Einpress-Gewindebolzen für Blechstärken ab 0,51 mm</b> TR-TFH TR-TFHS</p> 
<p><b>Einpress-Gewindebolzen für höhere Belastbarkeit</b> TR-HFH TR-HFHS</p> 	<p><b>Bewegliche Einpressmutter</b> TR-AS TR-AC</p> 	<p><b>Bewegliche Einpressmutter</b> TR-LAS TR-LAC</p> 	<p><b>Einpressbarer Distanzhalter</b> TR-SSS TR-SSC TR-SSA</p> 
<p><b>Einpress-Distanzhalter offen</b> TR-SOSG TR-SOAG</p> 	<p><b>Einpress-Gewindebuchse offen</b> TR-SOSG TR-SOAG</p> 	<p><b>Einpress-Gewindebuchse offen</b> TR-DSO TR-DSOS</p> 	<p><b>Einpress-Gewindebolzen</b> TR-FHL TR-HFHD TR-Sonderteile</p> 

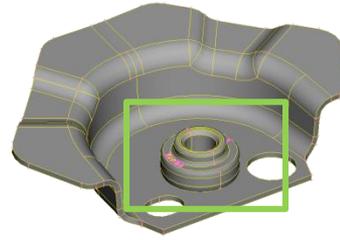


Shell parts with Pressed elements

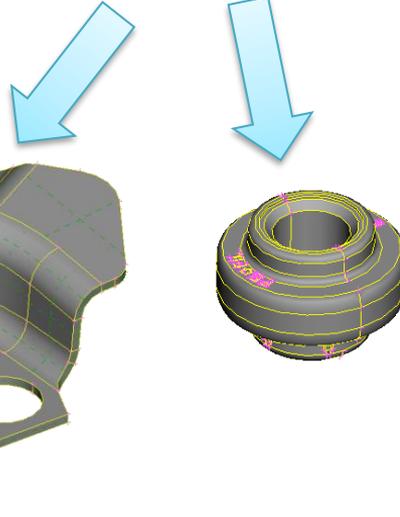
# Batch Meshing Solution for Shell Parts with Pressed elements

- Library of pressed elements geometries
- Automatic recognition

<b>Einpressmutter</b> TR-S TR-CLS TR-CLA 	<b>Einpress-Gewindebolzen</b> TR-FH TR-FHS TR-FHA 	<b>Einpress-Gewindebuchse offen</b> TR-SO TR-SOS TR-SOA 	<b>Einpress-Gewindebuchse geschl.</b> TR-BSO TR-BSOS TR-BSOA 
<b>Einpressmutter beidseitig bündig</b> TR-F 	<b>Einpressmutter "geschl."</b> TR-B TR-BS 	<b>Einpressbolzen</b> TR-TPS - MS TR-TPS 	<b>Einpress-Gewindebolzen für Blechstärken ab 0,51 mm</b> TR-TFH TR-TFHS 
<b>Einpress-Gewindebolzen für höhere Belastbarkeit</b> TR-HFH TR-HFHS 	<b>Bewegliche Einpressmutter</b> TR-AS TR-AC 	<b>Bewegliche Einpressmutter</b> TR-LAS TR-LAC 	<b>Einpressbarer Distanzhalter</b> TR-SSS TR-SSC TR-SSA 
<b>Einpress-Distanzhalter offen</b> TR-SOSG TR-SOAG 	<b>Einpress-Gewindebuchse offen</b> TR-SOSG TR-SOAG 	<b>Einpress-Gewindebuchse offen</b> TR-DSO TR-DSOS 	<b>Einpress-Gewindebolzen</b> TR-FHL TR-HFHD TR-Sonderteile 



Shell parts with Pressed elements



## Batch Meshing Solution for Pressed elements:

- Library of pressed elements geometries
- Automatic recognition
- Pressed elements get removed
- Remaining geometries are healed
- Mid-surface extraction can now proceed

WEDNESDAY MAY 22, 2019

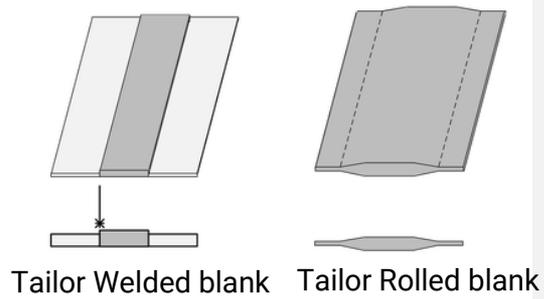
Getting the most from  
a library with  
standard parts

M. Skordeli

11:00 - 11:30

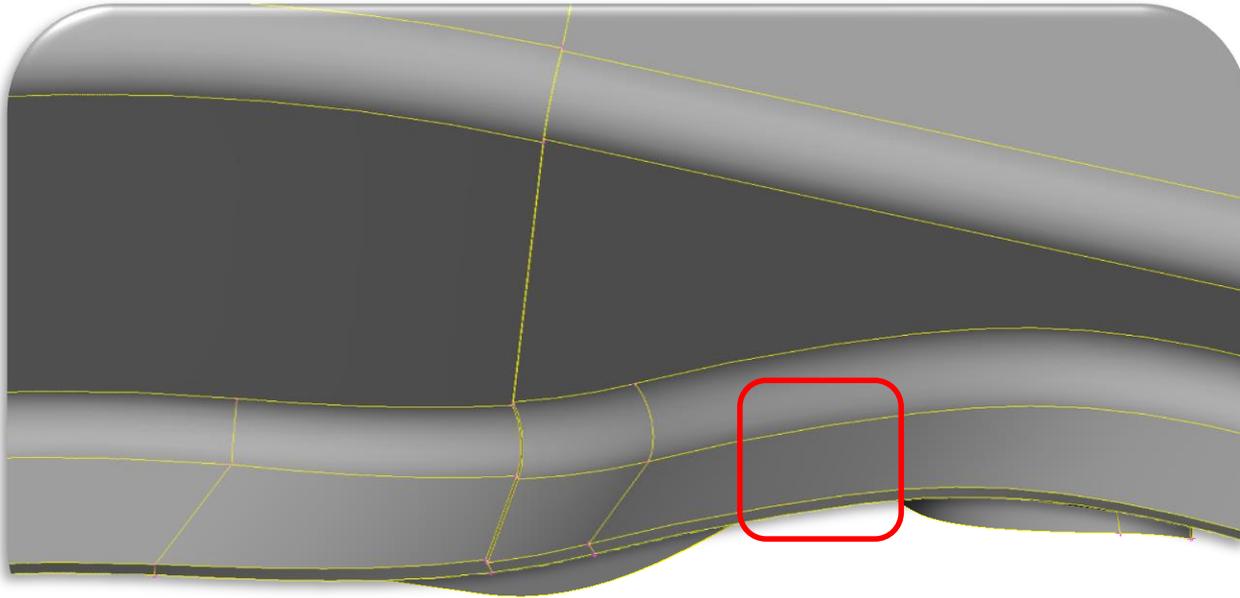
Tailor blank recognition developed.  
Key functions that includes this

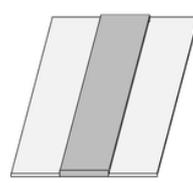
- Skin
- Casting



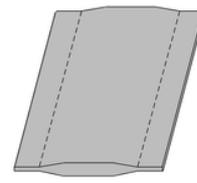
## Batch meshing Tailor Blanks

- Recognition function





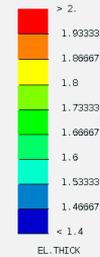
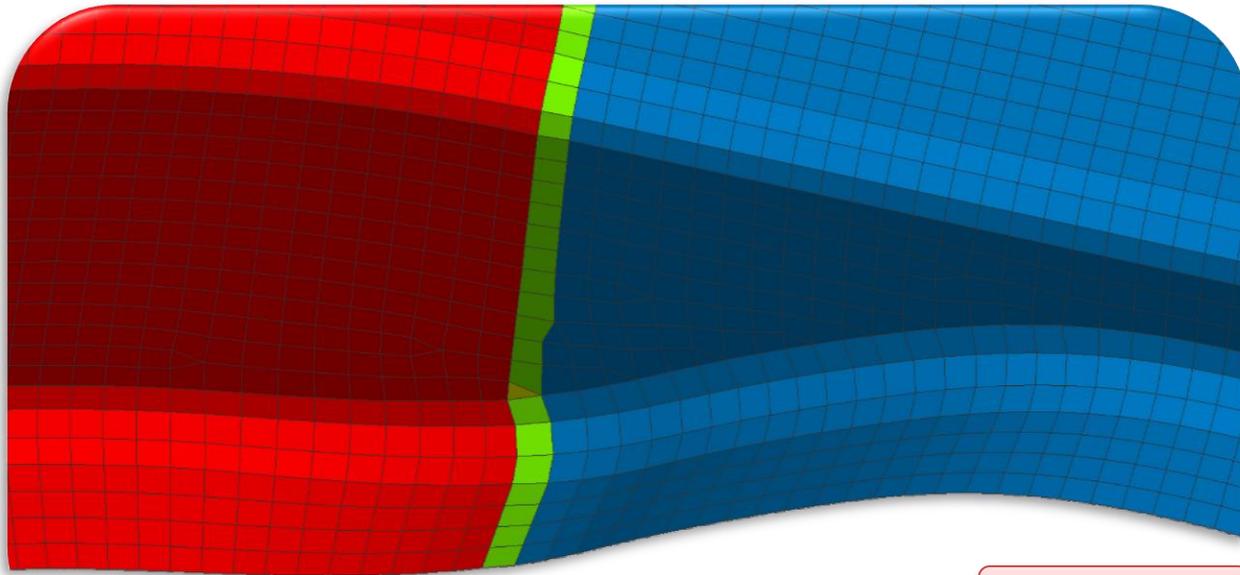
Tailor Welded blank



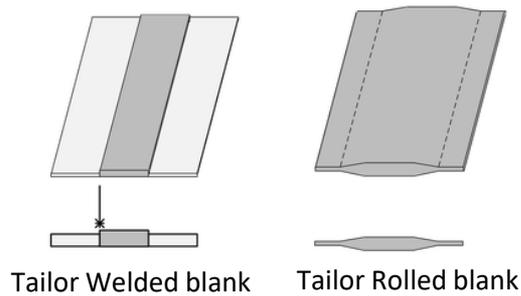
Tailor Rolled blank

# Batch meshing Tailor Blanks

- Recognition function

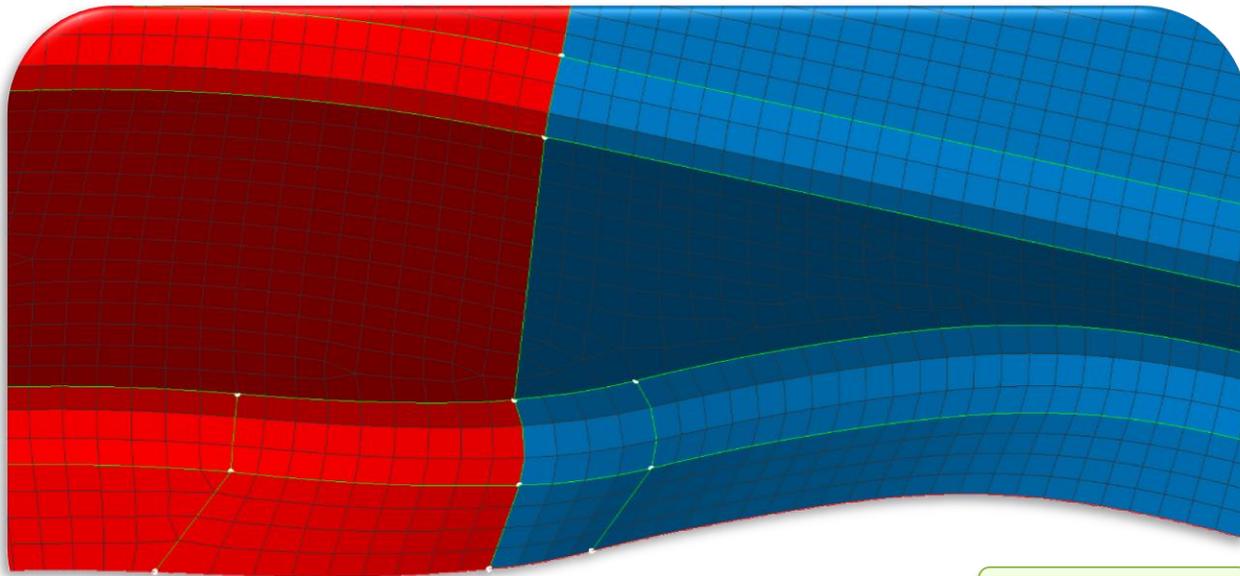


OLD RESULT



## Batch meshing Tailor Blanks

- Recognition function
- Improved Thickness calculation
- Exact positioning of thickness jump



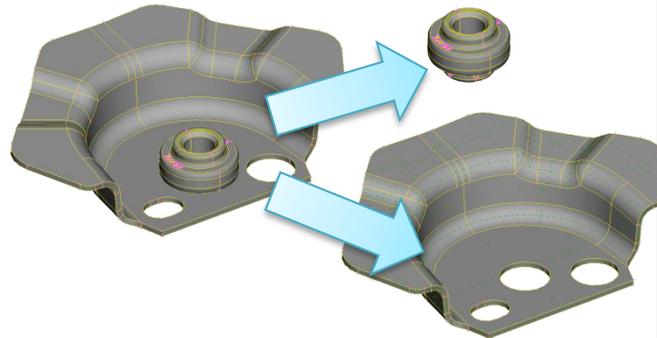
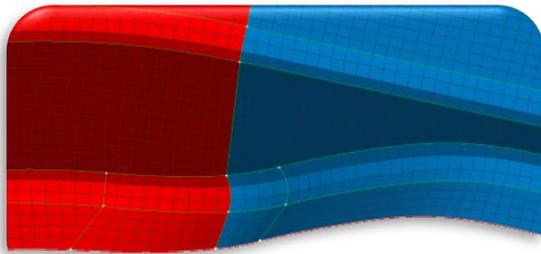
NEW RESULT

## Benefits

- Increased automation: from >70% to >90%.
- Batch Mesh process overall not affected in terms of performance
- Pressed elements are marked as such and kept
- Distinction between welded or rolled blanks

## Future Steps

- Expand recognition to further geometries
  - Small sized libraries: clips, springs etc.
  - New part types: casting, extrusion geometries etc.
- Apply predefined mesh patterns for recognized parts/elements



# Batch Meshing Pressed Elements Tailor Blanks

## Benefits and opportunities

TODAY

17:30 - 18:00

**Exploration of meshing  
strategies for highly complex  
parts**

Dimitris Zafeiropoulos<sup>1</sup>, Stylianos  
Karditsas<sup>2</sup>, Christos Sachanas<sup>2</sup>,  
Lazaros Adamoudis<sup>2</sup>, Michael  
Tryfonidis<sup>2</sup>

<sup>1</sup>BETA CAE Systems International,

<sup>2</sup>BETA CAE Systems



**Stay connected**

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