

# **SDM Solutions für Crash - Requirements in Software Development -**

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DYNAmore GmbH

## SDM-Solutions for Crash Simulations

Experience in Software Implementation

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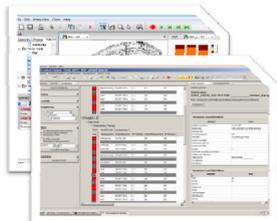
### Branch Office in Dresden



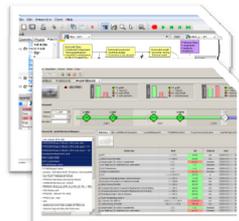
Branch office in Dresden...

- Since 2008
- Area: Software Engineering / Process automation / ...
- Team comprising of computer scientists and Engineers

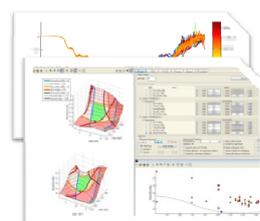
SDM-Solutions

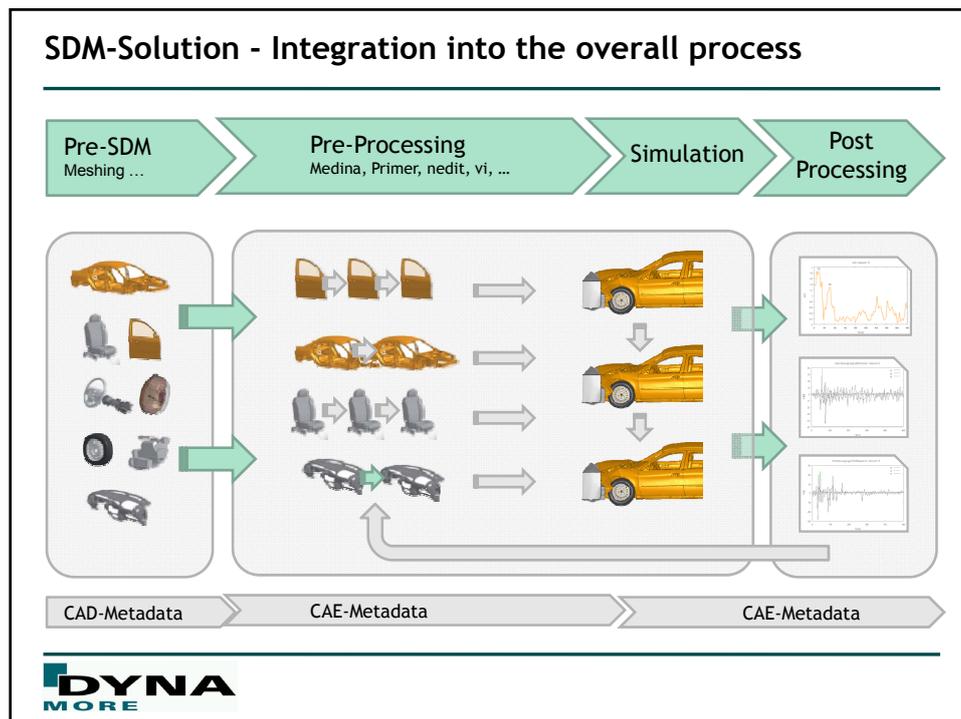


Processa.../Monitoring



Analysis/Optimiza...





### Development of models for crash simulations

...a few years ago



- One monolithic model
- Few load cases
- Very little variant investigations, optimization etc.

Today...



- Variety of load cases
- Frequent optimization and design variations
- Numerical simulations including basis for component approval
- No monolithic decks - breakdown in sub-models
- Teamwork
- Assembly of a specific input deck on demand
- Many load cases
- At the same level of development: Availability of parallel models for different solvers

**DYNA**  
MORE

## Objectives of SDM Solution

### Objectives...

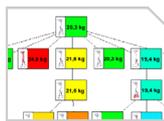
- To facilitate e.g. Definition of a single work process.
- Automation of work processes
- Coherence and quality of the project data: Integrated content and timely documentation of processes
- Co-optimization; project- and interdisciplinary sharing of common parts
- Synchronus data distribution to project participants

### Target groups...

- CAE Engineers
- Project Managers



## Aspects of SDM solutions



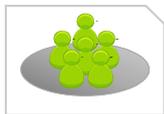
### Model management and -documentation

Includes data, Sub-models...  
Metadata, History



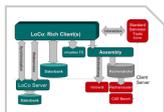
### Generation of complete model / Assembly

Assignment, Scenarios, Attributes etc.  
Assembler, Templates



### Team work

Data sharing, Local cache, Offline/Online working  
Flags, Status, ...

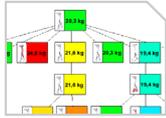


### IT-Integration

Tools, Optimization support  
CAE-Bench, Status monitoring



### Aspects of SDM solutions



#### Model management and -documentation

Includes data, Sub-models...  
Metadata, History



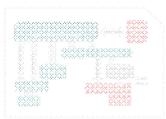
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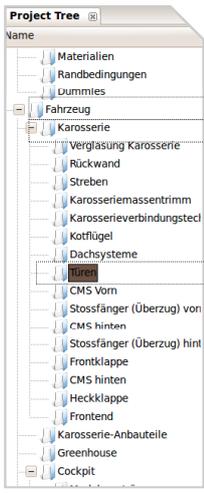
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Tools, Optimization support  
CAE-Bench, Status monitoring

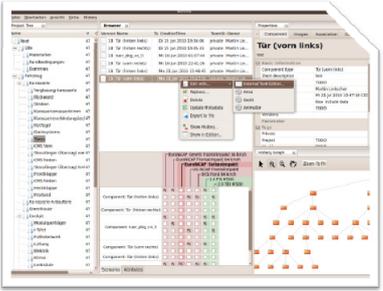


### Model management and -documentation

Logically configurable structure



- Hierarchical structure of the complete vehicle
- Logically assignment into groups according to the functional Aspects and disciplines (Operating department)
- Simplified referencing / Handling
  - Used Cockpit status 83, Door status 03 etc.
  - Door status can be treated as an include



Tür (hinten links)			
<input type="checkbox"/>	Tür (hinten rechts)	03	Di 15 Jun 2010 19:34:06 private
<input type="checkbox"/>	tuer_pkg_vo_li	12	Di 15 Jun 2010 19:35:33 private
<input type="checkbox"/>	Tür (vorn rechts)	05	Mi 16 Jun 2010 01:07:44 private
<input type="checkbox"/>	Tür (vorn links)	02	Mi 16 Jun 2010 22:41:26 private



## Model management and -documentation

### Maintenance of Basic Information

**Karosserie**

Stand 16. Februar, B-freigegeben

Basicinformationen

Includetyp	Autoschale
Datenformat	PAM Crash Include
Eigentümer	Torsten Landschoff
erstellt	12. Januar 2010
Formulierung	Rohdaten

Übersicht PID 4000-5000 PID 370000-370101

ANSYS Report

Pam Checker

DATE	Mon
DECK	
FILENAME	/home/weg49ft/PROJEKTE/LoCoMeta
APPLIED	
ON	

**Material Querträger**

Tim Peters, am 2010-03-01 11:53:09.771339

Die Materialbeschreibung haut so nicht hin. Bitte Rücksprache!

- Creator, Timestamp, ...
- Development status, Predecessor
- Submodel type (Solver/Formulation)
- Parameterization (which parameter, which default value)
- Automatic generation of previews
- Highlighted modified geometry/parts
- Generation of reports as additions
- Addition of Documents (PPTs, DOCs usw.)
- Addition of data source e.g. ANSA Data
- Annotations on the development status
- Changes compared to the version



## Model management and -documentation

### Tracking of changes / History

**Material Querträger**

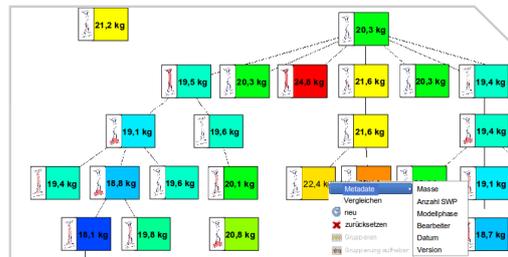
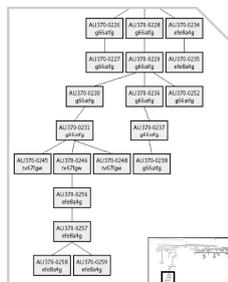
Tim Peters, am 2010-03-01 11:53:09.771339

Die Materialbeschreibung haut so nicht hin. Bitte Rücksprache!

**Fullkommentar**

Amo Npm, am 2010-03-01 11:53:09.771461

Lorem ipsum dolor sit amet, consectetur



## Model management and -documentation

### Quality Assurance



- Calculation of the quality index after each update
  - Enforce checks for numbering
  - Element quality
  - Prediction of timestep / timestep limit
  - ...
- Sub-model evaluation



Critical

Acceptable

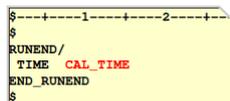
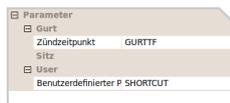
Ok

- possible disabling of the partial model for specified actions, e.g.
  - May not be used in a simulation model
  - May not have special status / obtain approval
  - ...



## Model management and -documentation

### Parameterization



- Identification of parameters during update of a sub-model
- Parameter can be e.g.:

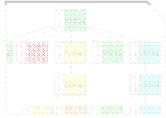
- Ignition points
- Impact points
- Sheet thickness
- Material properties
- ...

- Parameters are defined, based on placeholders and/or in solver specific format in Include (before updates)
- Pre-definition of mandatory parameters is possible
- User defined parameters
- Provision of default values



### Aspects of SDM solutions

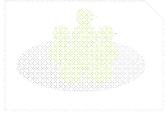
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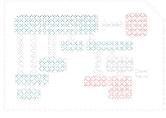
**Model management and -documentation**  
 Includes data, Sub-models ...  
 Metadata, History



**Generation of complete model / Assembly**  
 Assignment, Scenarios, Attributes etc.  
 Assembler, Templates



**Team work**  
 Data sharing, Local cache, Offline/Online working  
 Flags, Status, ...



**IT-Integration**  
 Tools, Optimization support  
 CAE-Bench, Status monitoring

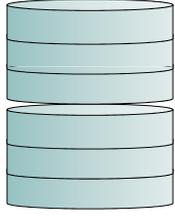
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### Generation from Simulation models (Assembly)

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Pool Sub-models



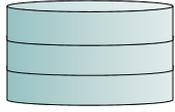
Selecting sub-models



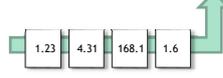




Pool Parameter



Selecting parameters



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### Generation from Simulation models (Assembly)

Sub-model assignment - Attribute and scenarios applicable in parallel

Pool

Region	Zone	Side	Dummy	Szenario (Load case)
Europa				Euro NCAP Front, Side, ...
USA				US NCAP Front, Side
	Front	Fahrer	H3 50%	Euro NCAP Front (Driver)
	Front	Beifahrer	H3 50%	Euro NCAP Front (Passanger)
	Front	Fahrer		Euro NCAP Front (Driver)
	Front	Beifahrer		Euro NCAP Front (Passanger)
	Seite	Fahrer		Euro NCAP Side (Driver)
	Seite	Beifahrer		Euro NCAP Side (Driver)

### Generation from Simulation models (Assembly)

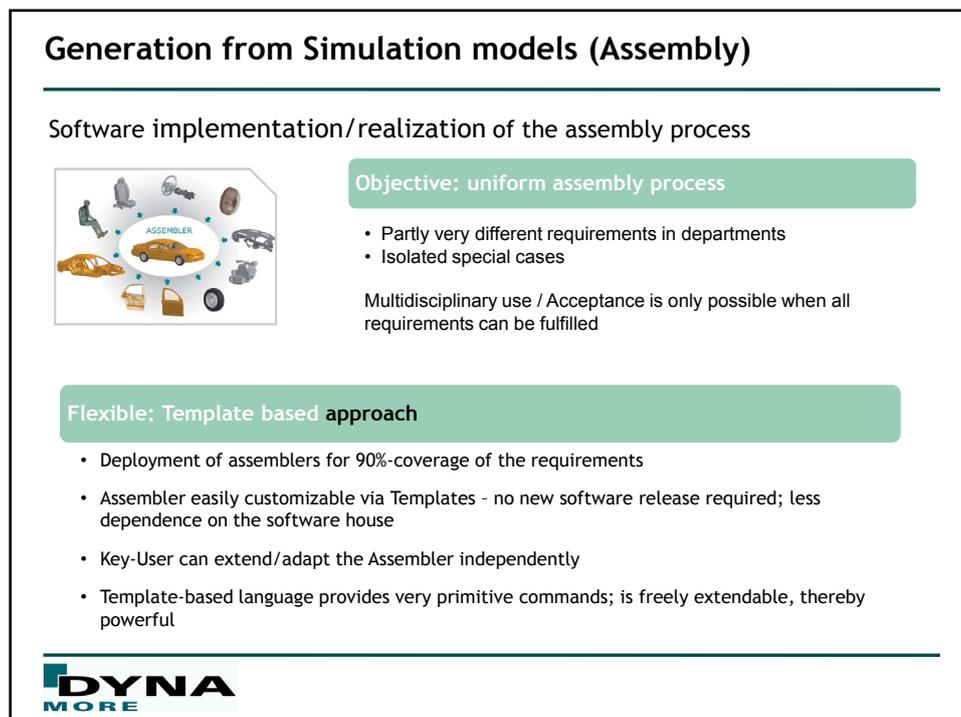
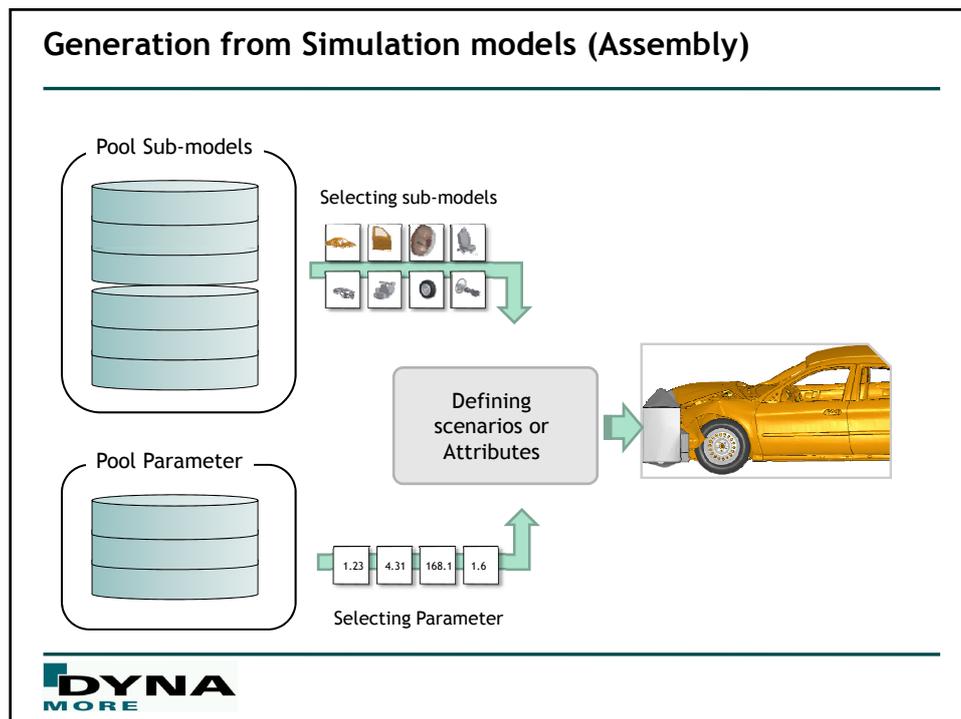
Sub-model assignment - Attribute and scenarios applicable in parallel

Pool

Euro NCAP Front = Region: Europe  
Zone: Front  
Dummy: H3  
...

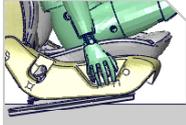
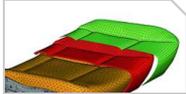
Euro NCAP Side = Region: Europe  
Zone: Side  
Dummy: H3  
...

- Attribute representation / scenario representation interconvertible
- ..so that the application of both the cases is possible at the same time and can be swapped anytime



### Generation from Simulation models (Assembly)

Extended possibilities of template based assemblers

Update and Management of Seat, Belt und Dummies solely as base model versions

- Occupant and seat positioning is initialized by the assembler when assembling
- Specific Dummy-Belt-Seat sub-model is used in the overall simulation

**Assembly**

Selecting sub-models

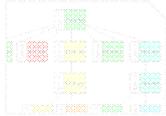
Flow calculation

Overall Model





### Aspects of SDM solutions



**Model management and -documentation**

Includes data, Sub-models...  
Metadata, History



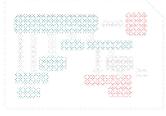
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**Team work**

Data sharing, Local cache, Offline/Online working  
Flags, Status, ...



**IT-Integration**

Tools, Optimization support  
CAE-Bench, Status monitoring



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### Teamwork - Synchronisation Intern, Extern, Teams...

externe Dienstleister      interne Fachabteilungen

**Sync**

- Centralized/Decentralized
- Offline/Online Working

- Centralized data handling and synchronisation with central server (potential bottleneck); Server data status is the reference data set
- Decentralized synchronisation is also possible between the teams and within the teams
- Offline processing of the data (Rich Client) - person/teams are independent from server; avoids bottleneck and increases performance through lokal caches of data
- Internal/external transfer of data over Webservices (Standard protocols http/https)

### Teamwork - local Data Storage (Rich Client)

Possibility: Local data storage (cache) in file system

... in File system

... Shell

**Pros**

- Low threshold, little change in the operation for the CAE Engineer
- Access using OS tools (Terminal, File browser etc.)

**Cons**

- Data integrity must be constantly verified; Changes outside the application should be monitored; Data integrity cannot be ensured
- Performance not optimal (due to constant scanning, monitoring)
- Management of metadata is problematic

➔ Data storage in the file system is not optimal

## Teamwork - local Data Storage (Rich Client)

### Possibility: Local data storage (cache) in database



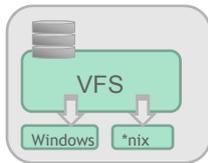
... in Database

#### Pros

- Performance
- Data integrity ensured
- Efficient management of Metadata is possible

#### Cons

- No direct access, only using application
- (particularly no access over file system)



... virtuelles Dateisystem



#### Provides a virtual file systems

- Access is possible in a usual way using OS tools (Terminal, File browser etc.); Performance loss
- Comparable to a mounted network drive
- Data integrity is ensured using VFS



## Teamwork - More Features



#### Rights management

- Enabling (read/write) of sub-models / projects / sections for user, user groups
- Private/public status of one's own data



#### Tags

- Highlight data / assignment of properties
- Examples: Status variant/Mile stones; obsolete, invalid, ..



#### Data compression

During the data transfer, only the difference from the previous version is conveyed



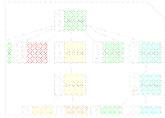
#### News / Comments

Addition of Status-Information to sub-models upon user actions



### Aspects of SDM solutions

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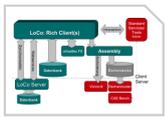
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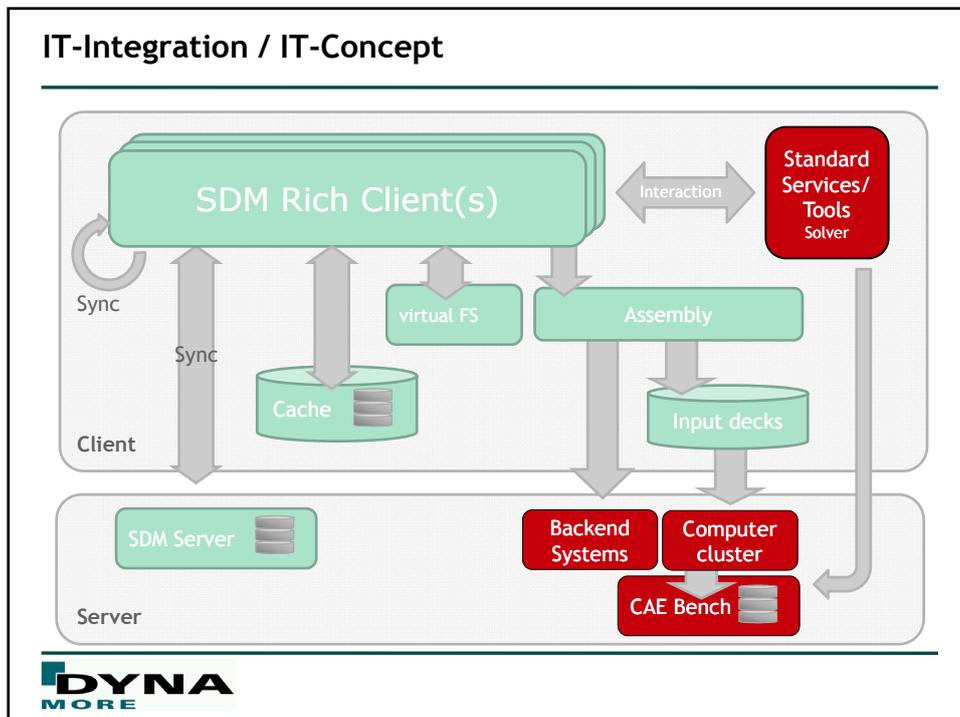


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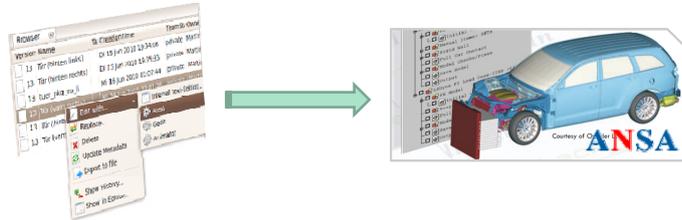
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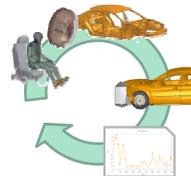



### IT-Integration - Linkage Tools

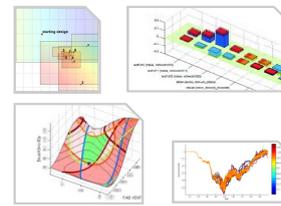
Direct calls to external tools, user scripts, link-up CAE-Bench



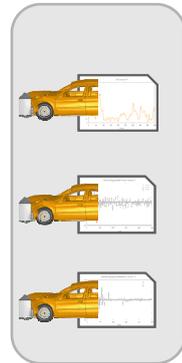
Integration optimization support



- Models are parameterized
- Simulation models are assembled automatically
- Linkage to Optimization software like LS-OPT



### IT-Integration - Linkage Status monitoring



Kriterium	Ziel	Ist	Einheit	Uner	Dat
1 LVC	$x < 7.5$	6.55	ms		
2 Ablenkung Schwelger	$x < 30.0$	26.19	mm		
3 Langträger (Drücker) schadenfrei	I.O.	0.00	boolean		
4 Inn. Teile aus Schadensbereich pl. deformiert	I.O.	I.O.			
5 SOT Überfahren	I.O.	I.O.	boolean		
7 OCC	$x < 32.00000$	27.90	g		
8 Inertion: Produktivitätsgewinn mittels Lenksäule	$x < 20.0$	17.48	mm		
9 Inertion: Stimmend vor Gelenk-Lenkstelle	$x < 100.0$	97.27	mm		
10 Ablenkung Schwelger	$x < 35.0$	30.55	mm		
11 Inertion: Inertion Fussaufschlagsbereich ohne Padding	$x < 30.0$	26.19	mm		
12 Inertion: Inertion Fussaufschlagsbereich mit Padding	$x < 50.0$	43.44	mm		
13 Produktivitätsgewinn mittels Lenksäule	$x < 25.0$	21.85	mm		
14 Rücklenkung Schwelger	$x < 20.0$	17.45	mm		
15 Versatz bei 100 ms	$-100.0 < x < 100.0$	-132.73	mm		
16 Inertion: Schwelger	$-90.0 < x < 90.0$	-66.36	mm		
17 Langträger (Drücker) schadenfrei	I.O.	I.O.	boolean		
18 Inn. Teile aus Schadensbereich pl. deformiert	I.O.	n.I.O.	boolean		



Fini

