



Josef Fürfänger, 5.6.2013

# 5TH ANSA & META INTERNATIONAL CONFERENCE

**AN INSIGHT TO APPLICATIONS BASED ON ANSA TO THE BMW CAE PROCESSES**

**BMW  
GROUP**



# APPLICATIONS BASED ON ANSA TO THE BMW CAE PROCESSES

## AGENDA



1

**History of BMW – BETA Cooperation**

2

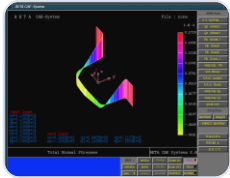
**Mapping Deep-Drawing Simulation**

3

**Convertible Top Lid Kinematics**

# APPLICATIONS BASED ON ANSA TO THE BMW CAE PROCESSES

## HISTORY OF BMW – BETA COOPERATION



BMW starts working with the Software tool BETA

Late 1980's

1995

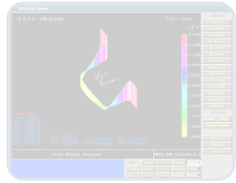
2005

2007

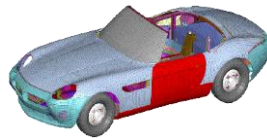
2008

# APPLICATIONS BASED ON ANSA TO THE BMW CAE PROCESSES

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BMW starts using ANSA v5 as a mesher for complete models

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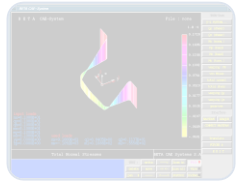
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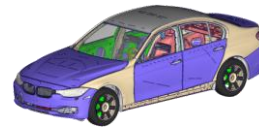
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Start of intensive Abaqus Explicit Support in ANSA

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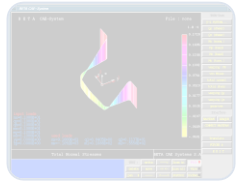
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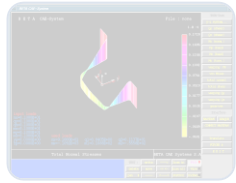
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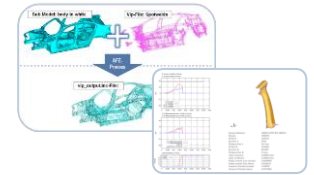
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BMW switches all crash projects to work with Abaqus Explicit

2007



**AFE – Spotwelding with Failure + Postprocessing**

2008

# APPLICATIONS BASED ON ANSA TO THE BMW CAE PROCESSES

## HISTORY OF BMW – BETA COOPERATION



Dummy/seat  
kinematics

**2008**

2008

2009

2010

2011

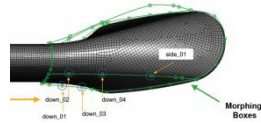


# APPLICATIONS BASED ON ANSA TO THE BMW CAE PROCESSES

## HISTORY OF BMW – BETA COOPERATION



Dummy/seat kinematics



Morphing & Optimization

2008

2008

2009

2010

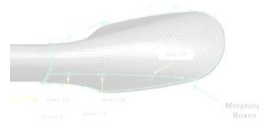
2011

# APPLICATIONS BASED ON ANSA TO THE BMW CAE PROCESSES

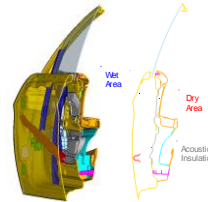
## HISTORY OF BMW – BETA COOPERATION



Dummy/seat kinematics



Morphing & Optimization



Doorbag Generation Sideimpact

2008

2008

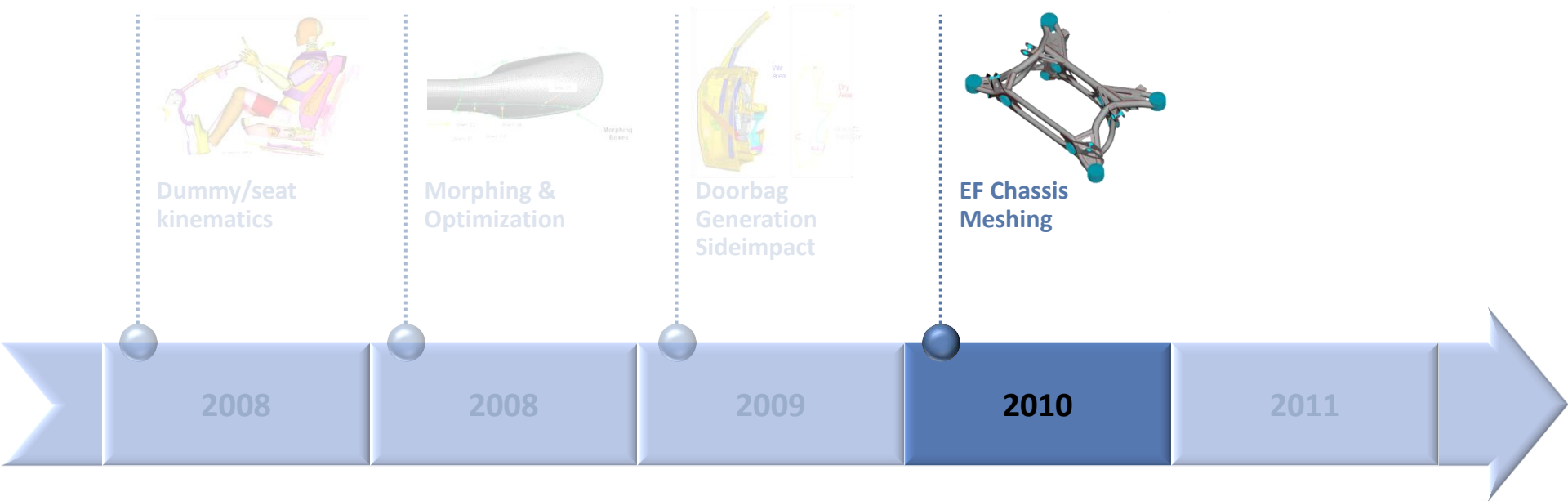
2009

2010

2011

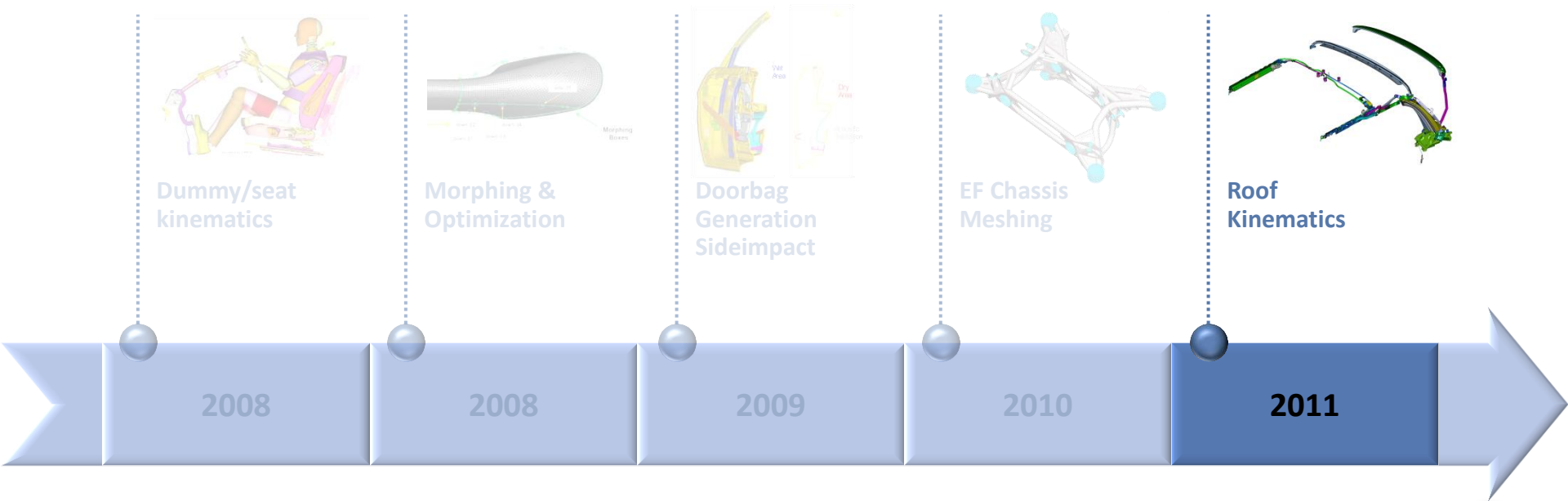
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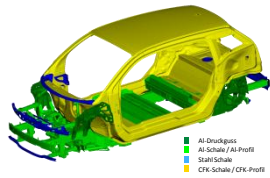
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## HISTORY OF BMW – BETA COOPERATION



# APPLICATIONS BASED ON ANSA TO THE BMW CAE PROCESSES

## HISTORY OF BMW – BETA COOPERATION



Composites  
Modeling

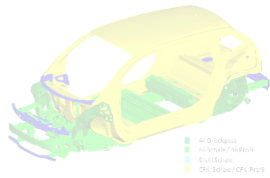
2011

2011

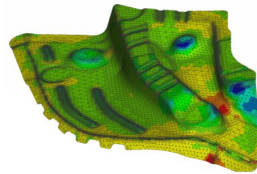
2012

# APPLICATIONS BASED ON ANSA TO THE BMW CAE PROCESSES

## HISTORY OF BMW – BETA COOPERATION



Composites Modeling



Mapping Deep-Drawing Simulation

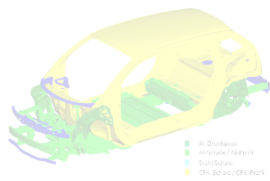
2011

2011

2012

# APPLICATIONS BASED ON ANSA TO THE BMW CAE PROCESSES

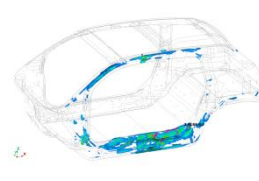
## HISTORY OF BMW – BETA COOPERATION



Composites Modeling



Mapping Deep-Drawing Simulation



CFK Post Processing

2011

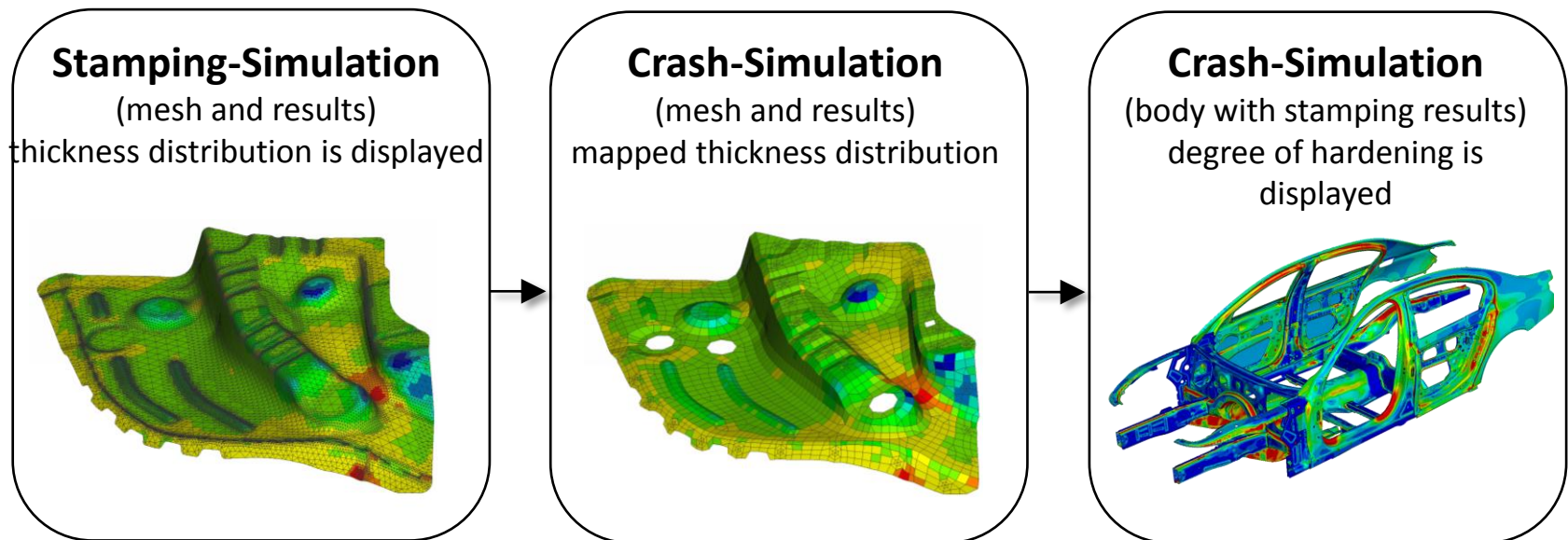
2011

2012

# MAPPING DEEP-DRAWING SIMULATION THICKNESS AND HARDENING RESULTS

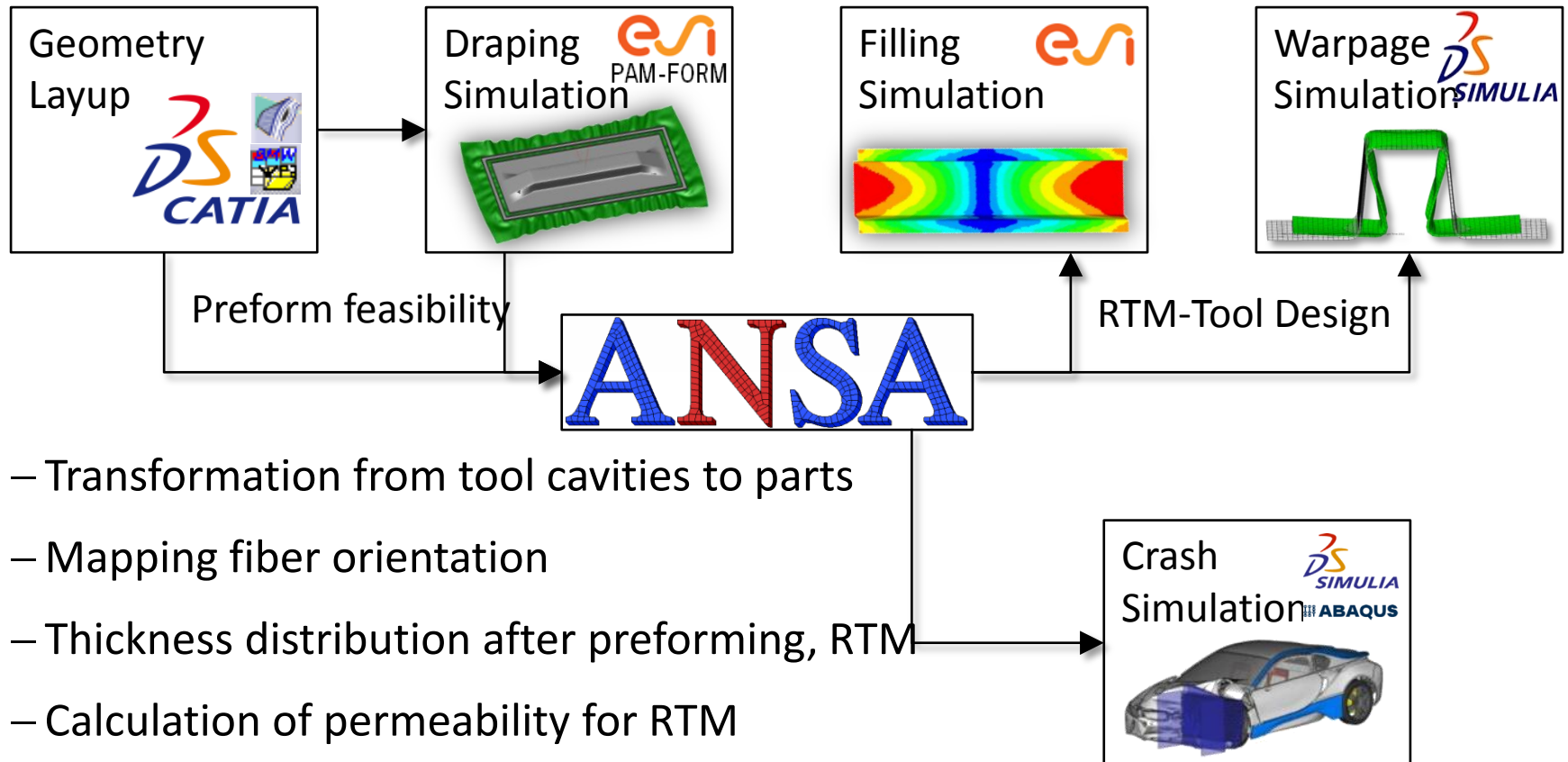
## Influences on crash simulation

Using the deformation history of the material as input in a crashsimulation, provides significantly better simulation results (deformation and cracks) and helps to reduce material consumption and to optimize the weight of the part



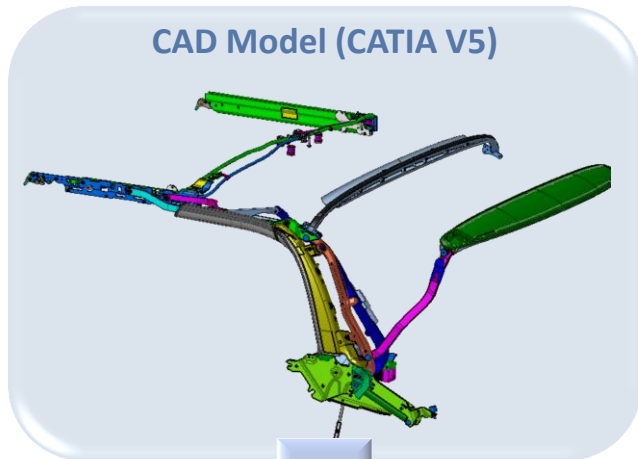


# END-TO-END CAE PROCESSES FOR COMPOSITE CRASH, DRAPING, FILLING AND WARPAGE MODELS



# APPLICATIONS BASED ON ANSA TO THE BMW CAE PROCESSES

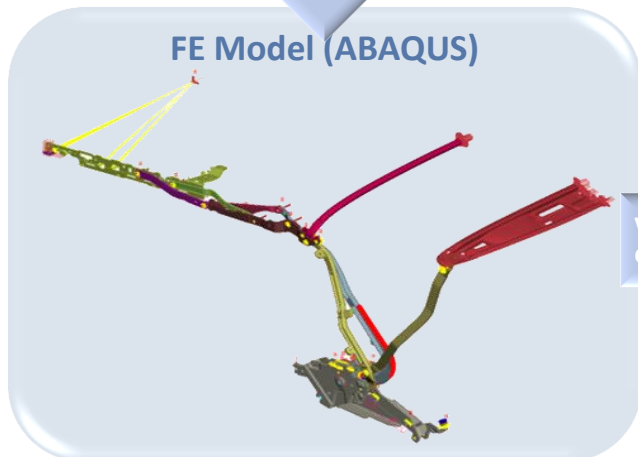
## PROCESS OVERVIEW. ROOF KINEMATICS.



### Disadvantages

- Convertible hood "only" consists of independent parts (Dead GEO)
- Connections are "not" converted (CAE) acceptably
- CAE starts again right from the beginning
- Every modeling step by hand

translate



virtual dimensioning

NVH

- Stiffness
- Acoustics

KINETMATIC

- Opening process
- Closing process

STRENGTH

- Dimensioning Conv. parts
- Joint loads

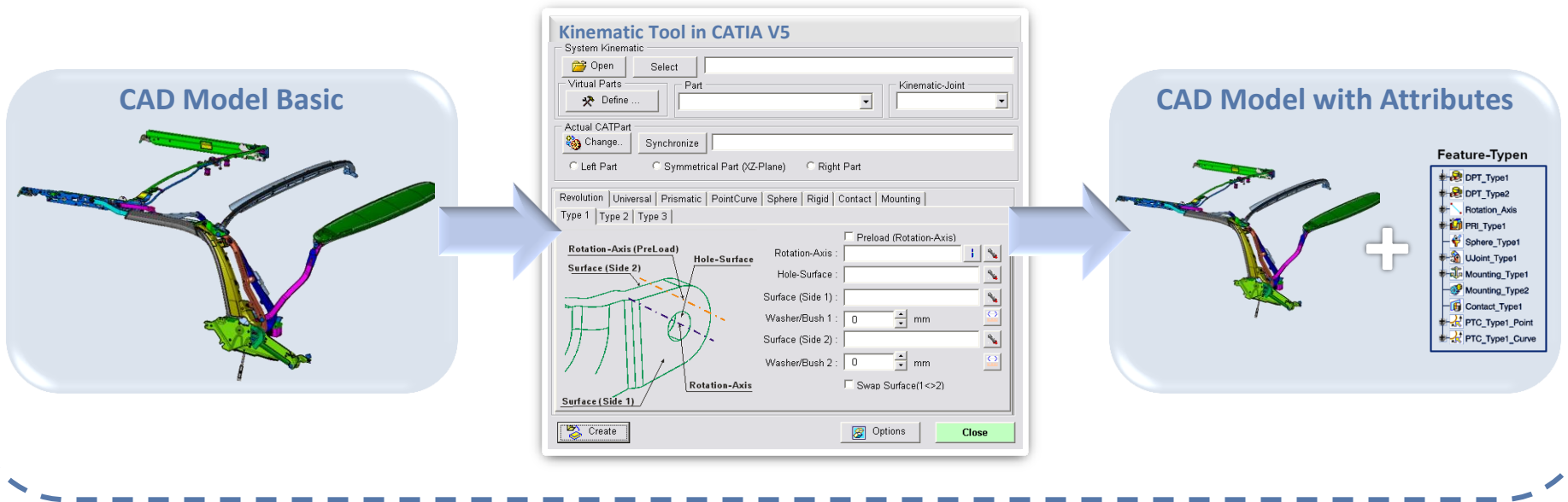
CRASH

- High Speed Crash (Front, Side, Rear)

# APPLICATIONS BASED ON ANSA TO THE BMW CAE PROCESSES

## PROCESS OVERVIEW. ROOF KINEMATICS.

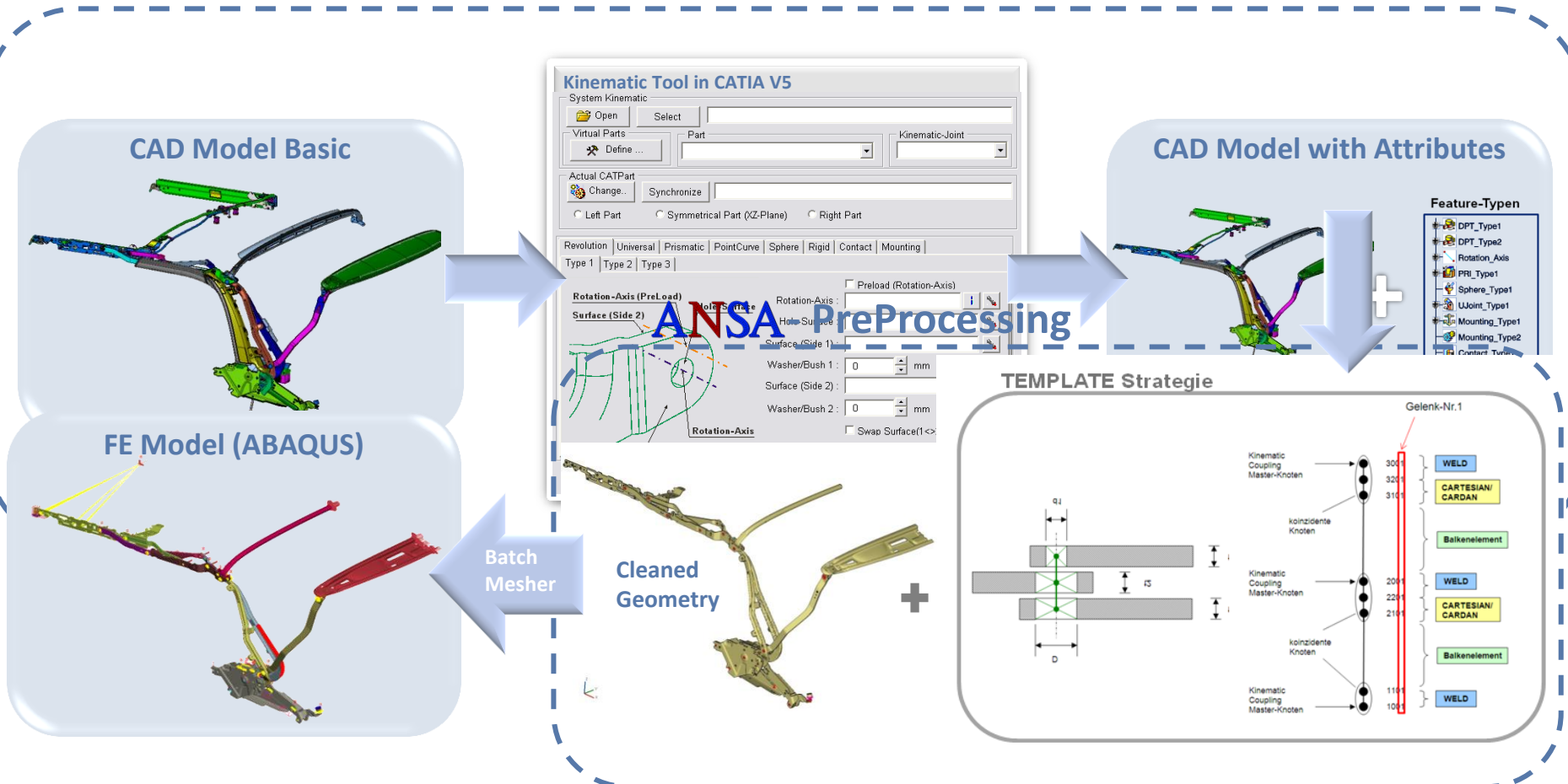
Add intelligence to the system



# APPLICATIONS BASED ON ANSA TO THE BMW CAE PROCESSES

## PROCESS OVERVIEW. ROOF KINEMATICS.

Add intelligence to the system



# APPLICATIONS BASED ON ANSA TO THE BMW CAE PROCESSES

## PROCESS OVERVIEW. ROOF KINEMATICS.

Starting with a Task template

# APPLICATIONS BASED ON ANSA TO THE BMW CAE PROCESSES

## PROCESS OVERVIEW. ROOF KINEMATICS.

Applications Places System ANSA 13.2.4 64-bit (/media/OS/unified\_ANSA\_TRANS/20111129\_NewKinematics/new\_presentation/05\_improved\_bm.ansa) Thu May 23, 17:58 Michael TRYFONIDIS

File Windows Modules Help <-Search Functions and Filters>

Task Manager

Tasks

- Root
  - Roof Building process
    - Select CATProduct User Script
    - ConvertSubmodels User Script
    - Topology Check / Midsurface... User Script
    - Batch Meshing User Script
  - Kinematic Definition User Scripts
    - Select Kinematics csv file User Script
    - Generate Contacts User Script
    - Generate MNT User Script
    - Generate RIG User Script
    - Generate Joints User Script
  - Common Model Common Model
    - Sub Model Sub Model
  - BMW-Connections BMW-Connection
  - Abaqus Standard Common Model Abaqus Standar
  - ABAQUS Standard Load Case Abaqus Standar

Current Part: 0

Shell  
quads : 17887  
trias : 54146  
total : 72033  
Unchecked : 3

Volume  
tetras : 134104  
total : 134104

step 5a: Select Kin-attr file

Code generation completed.  
Different CONS Resolution settings read (keep new):  
Current perimeter length: 4. (old: 3.)  
Current distortion distance: 20. % (old: 20. %)  
Current distortion angle: 0. (old: 0.)

General

FOCUS	OR	AND	INVERT	GEOMETRY	D.UTIL	ASSEMB.	REALIZE	VISIB	HIDDEN	GEOM.	PERIMs	HOT PNT	CURVES	MORPH
PID	NOT	ALL	ISOLATE	TRANSF.	CHECK	ENT	TEMPLATE	ENT	SHADOW	FE-Mod.	SINGLE	GRIDS	POINTS	MEAS.
C. PLANE	INOT	NEAR	NEIGHB	FINE	D.INFO	DEF.CNCT	CONNECTOR	CROSH	WIRE	MACROs	DOUBLE	SPOTS	WRK. PLN	SIZEBOX
LOCK	EXTREME	UCHECKED	UNMESH.	DELETE	RENUMBER	CONVERT	ERASE	CNCTN	BOUNDS	VOLUM.	TRIPLE	M.Pnt.	CRS.SCT	C.NODE

email web dolphin bmw bmw bmw fcm dcx opel etc

# APPLICATIONS BASED ON ANSA TO THE BMW CAE PROCESSES

## PROCESS OVERVIEW. ROOF KINEMATICS.

Applications Places System en 800MHz Thu May 23, 19:42 Michael TRYFONIDIS

ANSA 13.2.4 64-bit (/media/OS/unified\_ANSA\_TRANS/20111129\_NewKinematics/new\_result.ansa)

**Task Manager**

- Root
- Roof Building process
- Kinematic Definition
  - Select Kinematics csv file
  - Generate Contacts
  - Generate MNT
  - Generate RIG
  - Generate Joints
- Common Model
- Abaqus Standard Common Model
- ABAQUS Standard Load Case
- Manual Items
- FE Model
- Step Manager
- Model Checks/Fixes
- Output
- Run Solver

Current Part: F001334\_A\_1\_A\_5P\_FRGMOD\_LENKER\_FRONTSPRIEGEL\_BODY1

**Modules Buttons**

**NODE** ▶ INFO ▶

NEW ▶ PASTE ▶ RELEASE ▶

MOVE ▶ MATCH ▶ ALIGN ▶

EXPLODE ▶ UTIL ▶ THICKNESS ▶

---

**COORDs** ▶ INFO ▶

**ELEMENTs** ▶ INFO ▶

BEAM ▶ TRUSS ▶ SPRING ▶

MASS ▶ DASHPOT ▶ CONN3D2 ▶

SHELL ▶ UTIL ▶ DELETE ▶

**CONSTRAINTs** ▶ INFO ▶

COUPLING ▶ MPC ▶ EQUATION ▶

FASTENER ▶ DELETE ▶

**BOUNDARY** ▶ INFO ▶

BOUNDARY ▶ CON.MOTION ▶ DELETE ▶

**LOADs** ▶ INFO ▶

CLOAD ▶ DLOAD ▶ DELETE ▶

**INIT.CONDIT.** ▶ INFO ▶

INIT.COND. ▶ IMPERF. ▶ DELETE ▶

**AUXILIARIES** ▶ COMMENT ▶

SET ▶ STEP ▶ D.TABLE ▶

CONTACT ▶ LAMINATE ▶ AMPLTD ▶

SECTION ▶ AIRBAG ▶ NMAP ▶

BOLT ▶ PRTENS ▶ SUBSTR ▶

C.PLANE ▶ APARAM ▶ IMPACTOR ▶

GEB ▶ CONNECTOR ▶ RES.MAP ▶

**SAFETY** ▶ AutoMech ▶

Mech from S. ▶ Dummy ▶ Seat Depene. ▶

SeatBelt ▶ Pedestrian ▶ Interior ▶

---

**Options List**

Parameter	Value

Shell  
quads : 8845  
trias : 83215  
total : 92060  
Unchecked : 2

Output:

S3RS: element type converted or suppressed.  
S4RS: element type converted or suppressed.  
warning: 19 MATERIAL(s) were not output (undefined)  
warning: 1 PROPERTIES were not output (undefined)  
Output Completed.

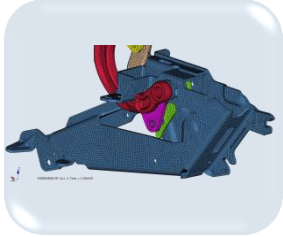
**General**

<b>FOCUS</b> ▶	OR	AND	INVERT	<b>GEOMETRY</b>	<b>D.UTIL</b>	<b>ASSEMB.</b> ▶	REALIZE	<b>VISIB</b> ▶	<input type="checkbox"/> HIDDEN	<input type="checkbox"/> GEOM.	<input type="checkbox"/> PERIMs	<input type="checkbox"/> HOT PNT	<input type="checkbox"/> CURVES	<input type="checkbox"/> MORPH
PID ▶	NOT	ALL	ISOLATE ▶	TRANSF. ▶	CHECK ▶	ENT ▶	TEMPLATE	PID ▶	<input type="checkbox"/> SHADOW	<input type="checkbox"/> FE-Mod.	<input type="checkbox"/> SINGLE	<input type="checkbox"/> GRIDS	<input type="checkbox"/> POINTs	<input type="checkbox"/> MEAS.
C.PLANE ▶	INOT	NEAR	NEIGHB ▶	FINE	D.INFO	DEF.CNCT ▶	CONNECTOR	<input type="checkbox"/> CROSH	<input type="checkbox"/> WIRE	<input type="checkbox"/> MACROs	<input type="checkbox"/> DOUBLE	<input type="checkbox"/> SPOTs	<input type="checkbox"/> WRK.PLN	<input type="checkbox"/> SIZEBOX
<input type="checkbox"/> LOCK	EXTREME ▶	UCHECKED	UNMESH. ▶	DELETE	RENUMBER ▶	CONVERT ▶	ERASE	<input type="checkbox"/> CNCTN	<input type="checkbox"/> BOUNDS	<input type="checkbox"/> VOLUM.	<input type="checkbox"/> TRIPLE	<input type="checkbox"/> M.Pnt.	<input type="checkbox"/> CRS.SCT	<input type="checkbox"/> C.NODE

# APPLICATIONS BASED ON ANSA TO THE BMW CAE PROCESSES

## PROCESS OVERVIEW. ROOF KINEMATICS.

### Model Meshing

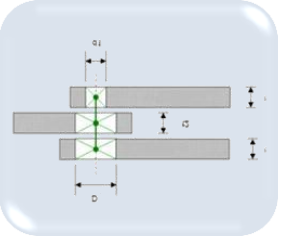


3,5 weeks

2 days

Old Process  
New Process

### Add Kinematics



2,5 weeks

1 d

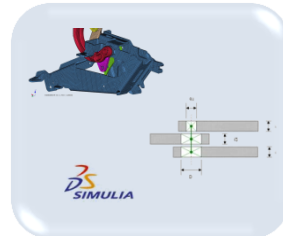
### Start of Simulation



4 days

1 d

### Total Time



ca. 5,5 weeks

4 days





# APPLICATIONS BASED ON ANSA TO THE BMW CAE PROCESSES

## THANK YOU FOR YOUR ATTENTION!

roof\_for\_tryfon\_bmw.ansa, Current Part: @08000\_A\_MODEL\_SOLID5

