PORSCHE

Virtual Prototyping

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Agenda

- Challenges
- Digital Product Development Process
- Modular Principle
- ANSA “150%” Model
- ANSA “generic” connecting technology
- Conclusion

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- **Challenges**
- **Digital Product Development Process**
- **Modular Principle**
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- **Conclusion**

Challenges!

- variant diversity
- high complexity
- a lot of digital prototyps
- different CAE-disciplines
- cross-linked timetable
- short set-up time

PORSCHE

Variant diversity

C2 Coupe

C2 Cabrio

C4 Coupe

C4 Cabrio

C4 Targa

markets | drivetrains | gearboxes | engines | chassis | seats

Top Coupe

Top Cabrio

GT2 RS

GT3 R Hybrid

Variant diversity

Boxster

C4 Cabrio

C4 Targa

markets

drivetrains

gearboxes

engines

chassis

seats

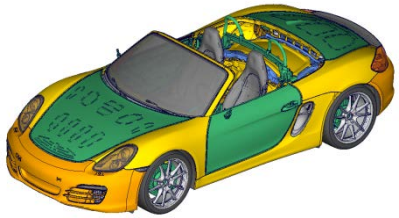
Top Coupe

Top Cabrio

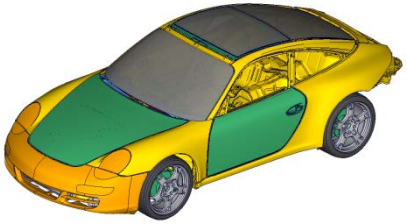
Cayman

A lot of digital prototypes







DPT Crash as example

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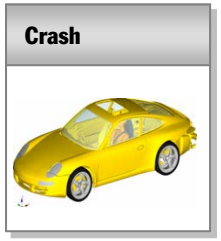
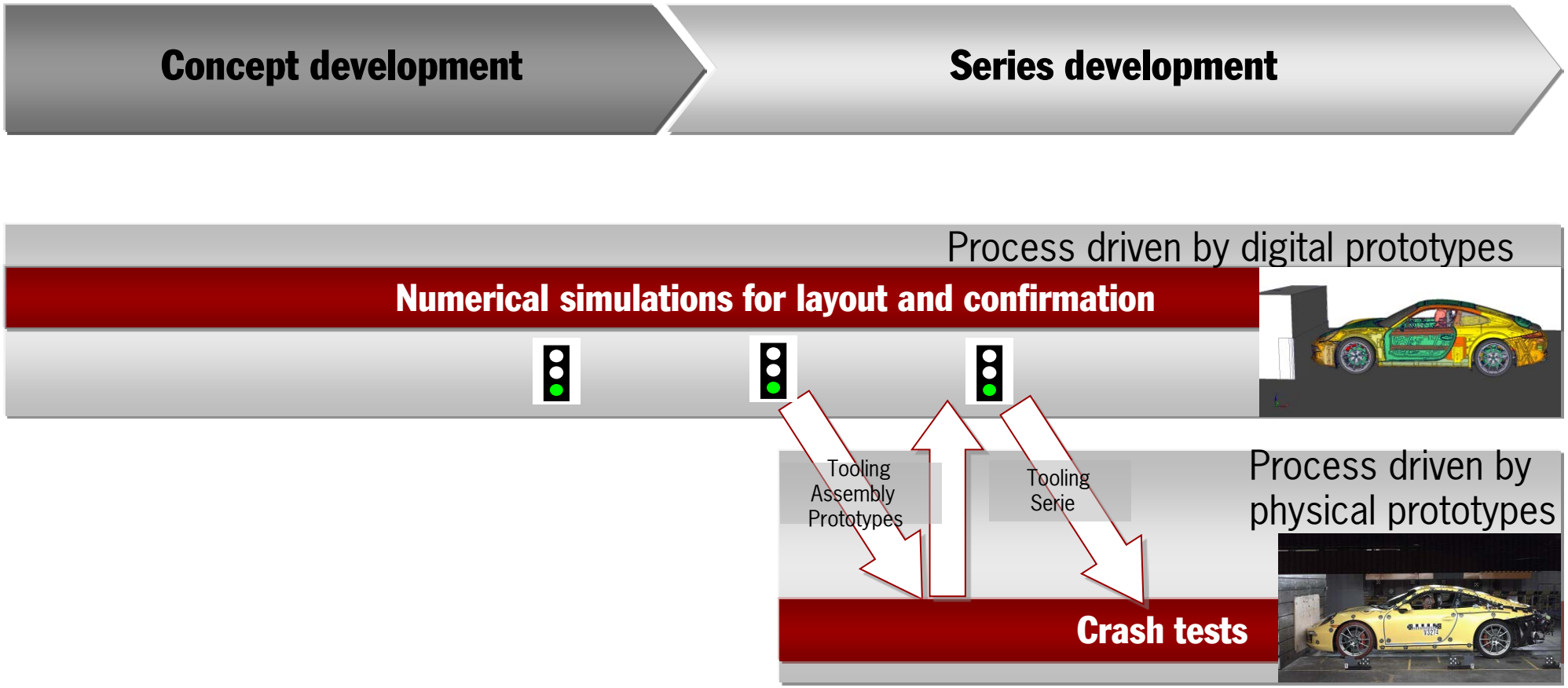
Philosophy

Concept development → **Series development**

- no concept confirmation without digital coverage
- no hardware without digital coverage
- no testing without digital coverage



The digital process is key during the development phase



Crash testing as example

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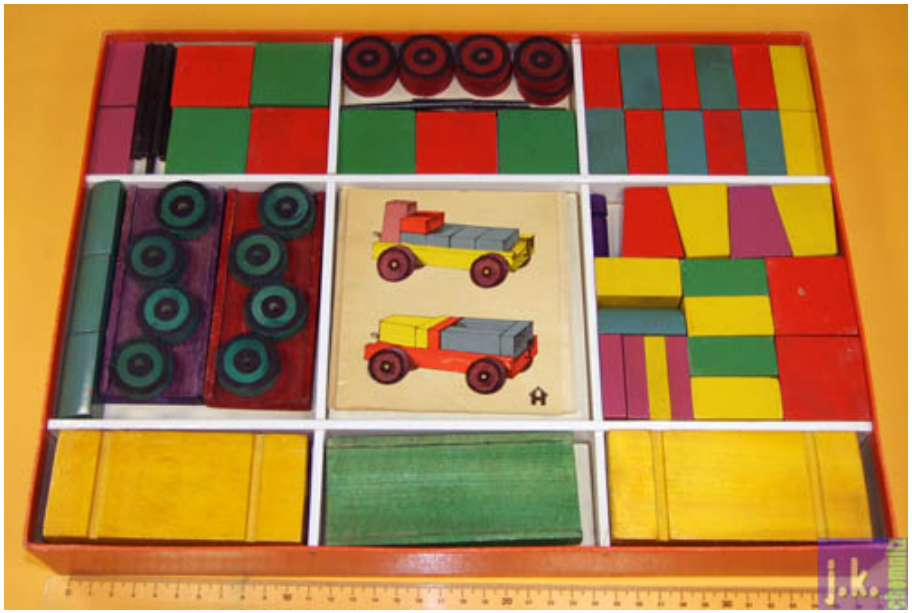
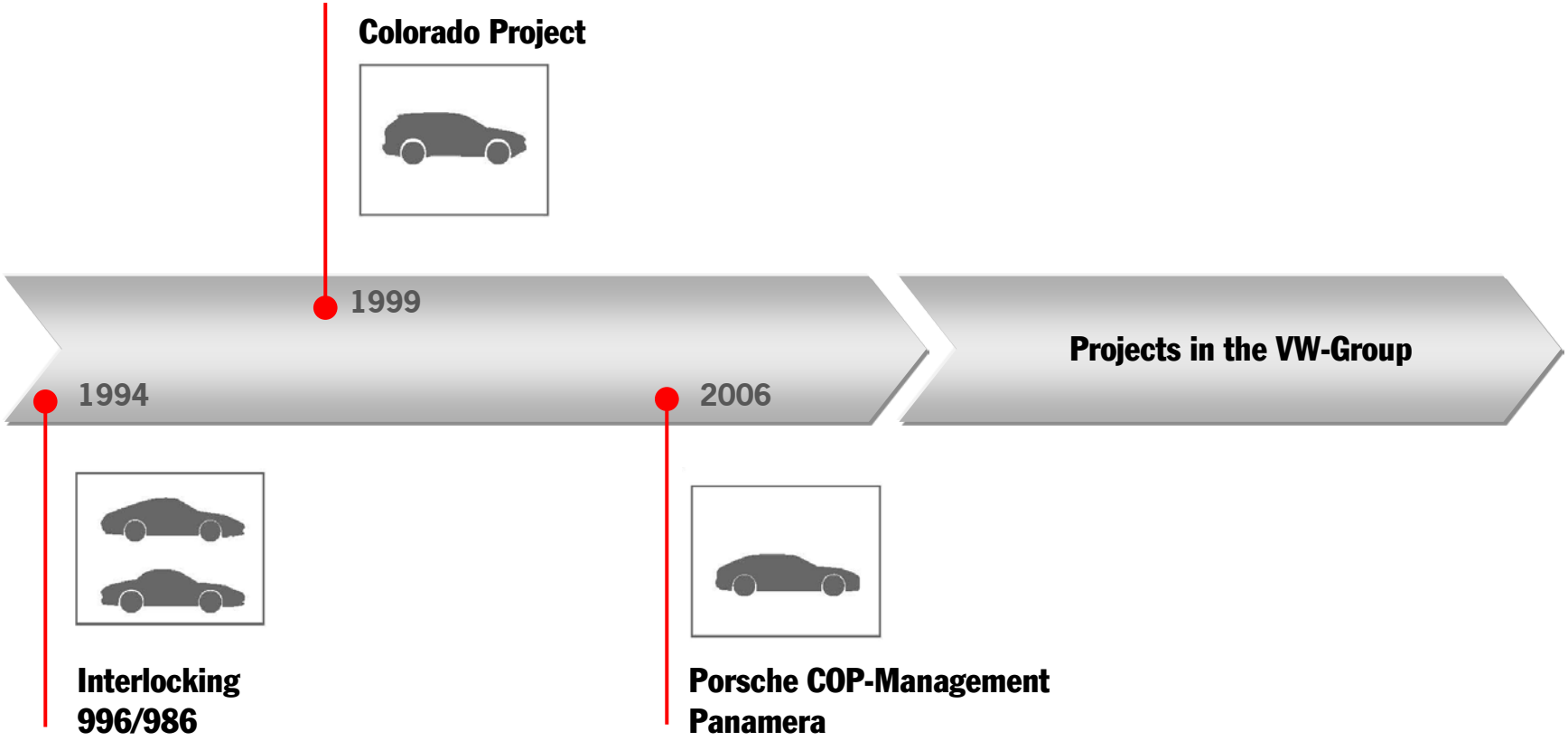
Modular principle “an old idea”



Modular principle at Porsche



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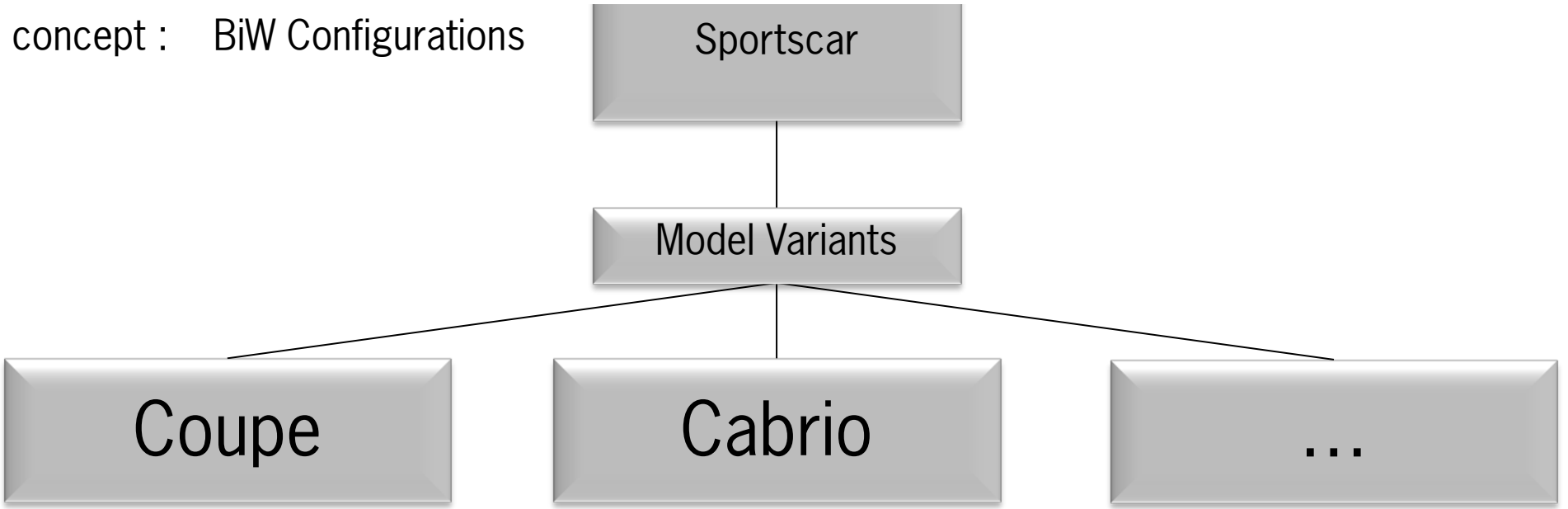
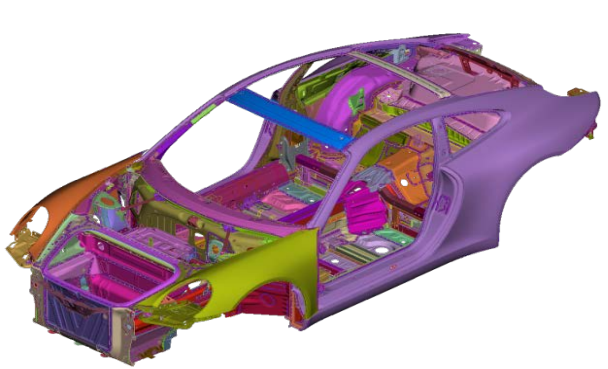
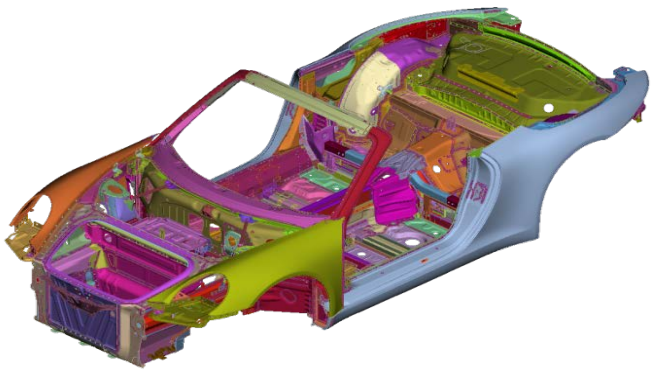
Modular principle with ANSA

The concept : BiW Configurations





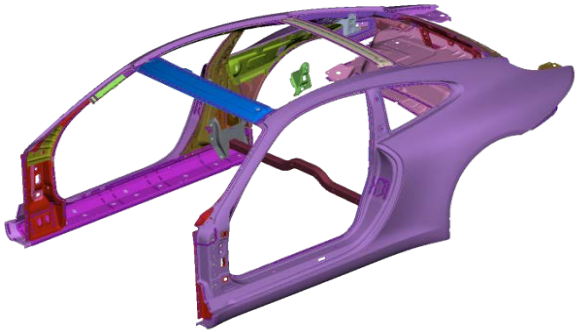


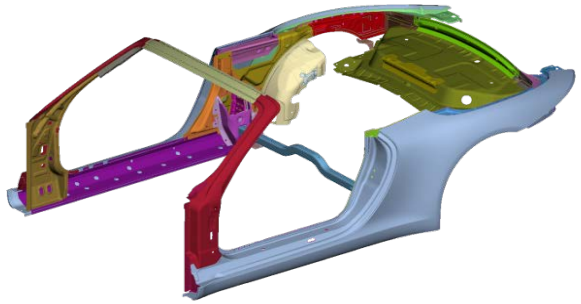
Modular principle with ANSA

Z1
Platform

Common parts

Z2
Platform framing





Mutual exclusive parts

Z3

In case of long & short variants of a model
(not existing in this example)

Shifted parts

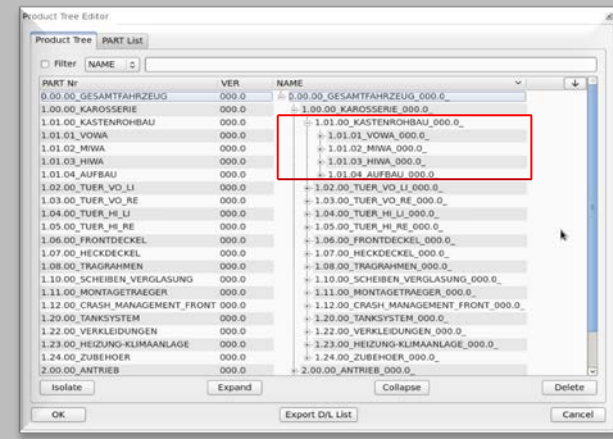
Workflow

ANSA

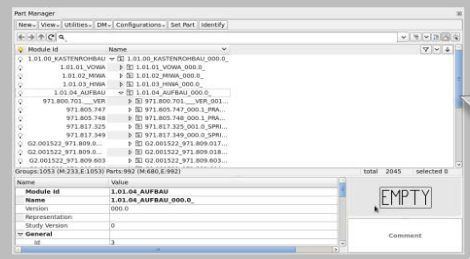
CSV file
Vehicle-variant
Product tree

Custom developed ANSA script

Product tree editor



Part Manager
Model tree



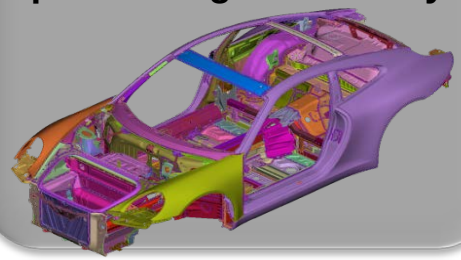
CAD Data pool

Translation of CAD Data with automatic assignment of part attributes

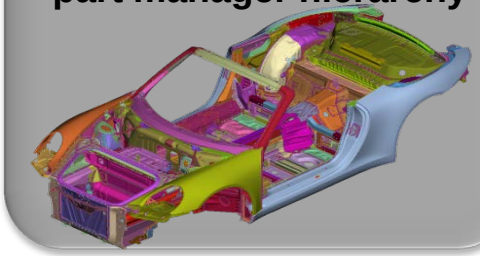
Variant BiW ANSA db

Example

Coupe ANSA db – part manager hierarchy

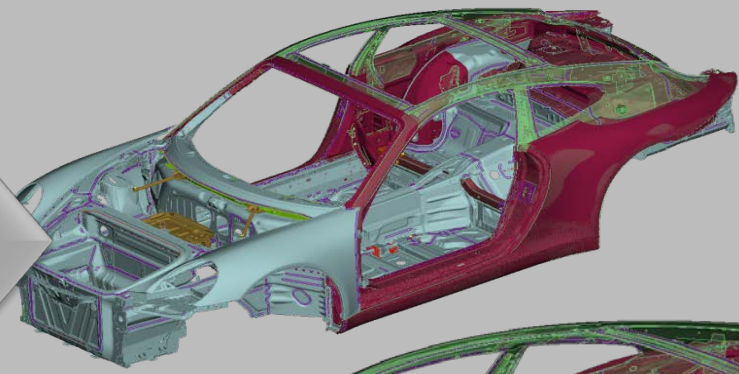


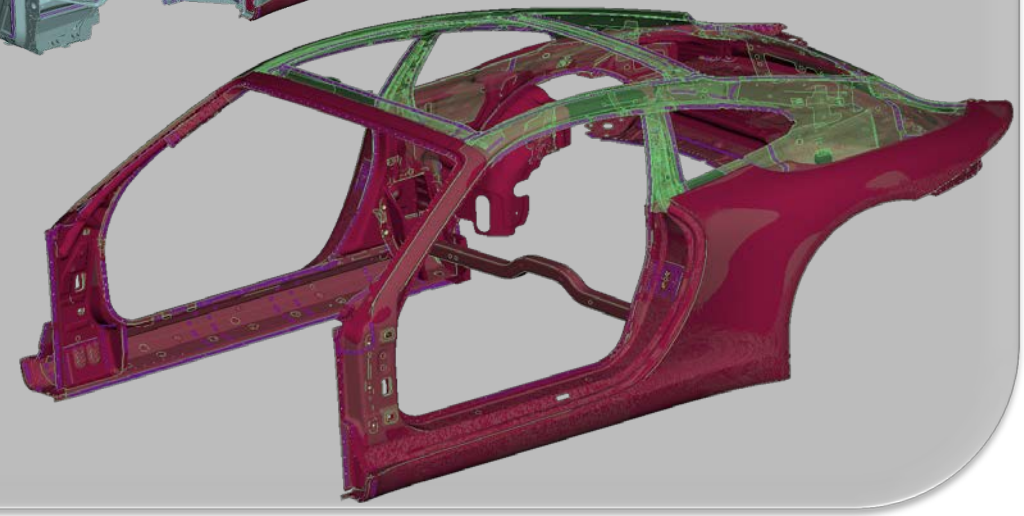
Cabrio ANSA db – part manager hierarchy



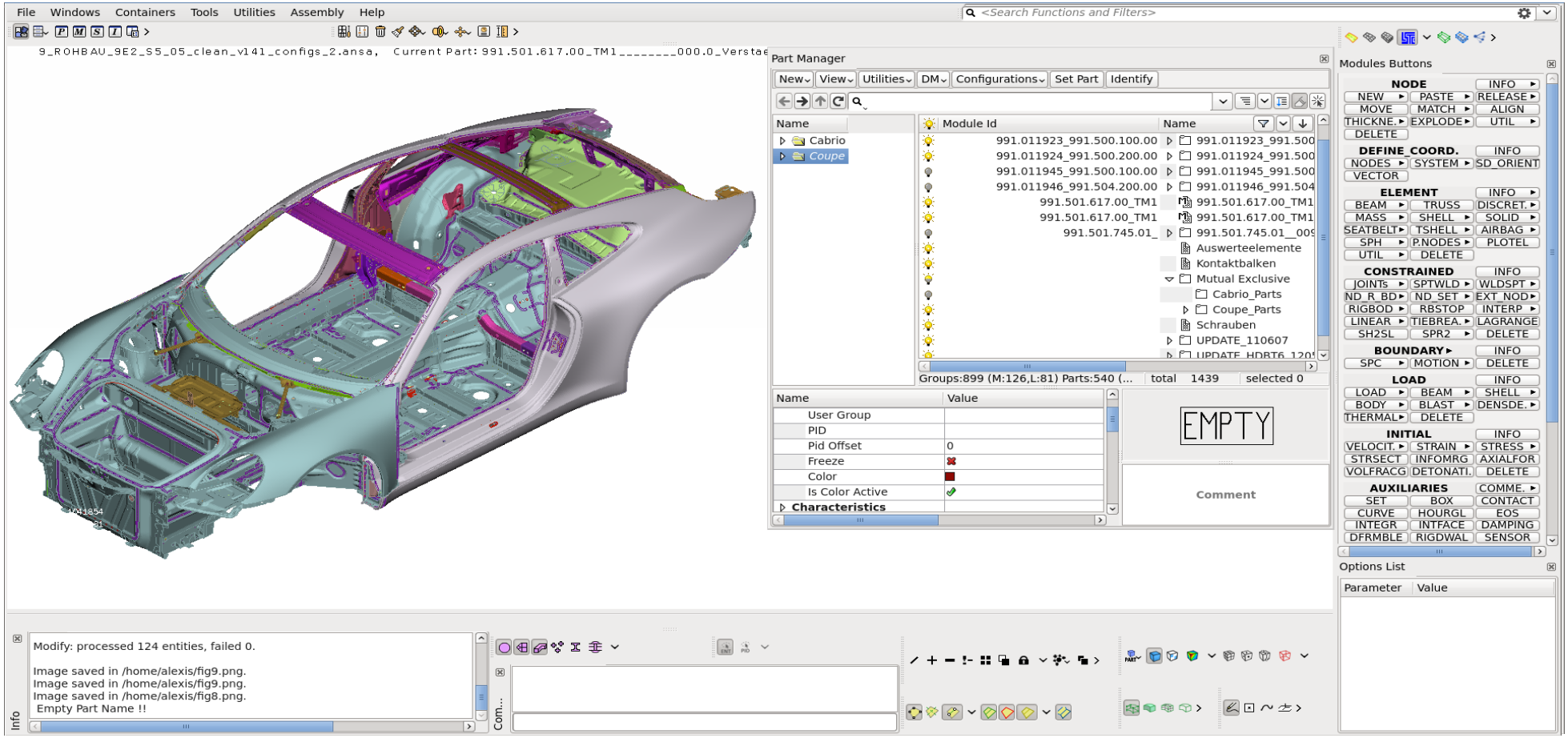
Compare Tool

150% Model
Part Manager hierarchy





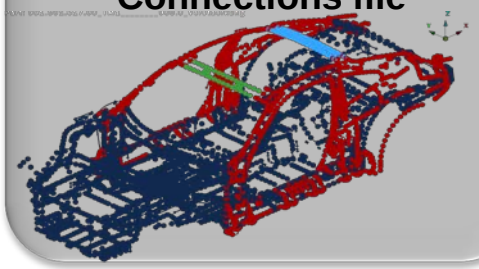
Example


File Windows Containers Tools Utilities Assembly Help
<Search Functions and Filters>
Part Manager
New View Utilities DM Configurations Set Part Identify
Name
Cabrio
Coupe
Module Id
Name
Groups:899 (M:126,L:81) Parts:540 (... total 1439 selected 0
Name Value
User Group
PID
Pid Offset 0
Freeze
Color
Is Color Active
Characteristics
EMPTY
Comment
Modules Buttons
NODE
ELEMENT
CONSTRAINED
BOUNDARY
LOAD
INITIAL
AUXILIARIES
Options List
Parameter Value
Modify: processed 124 entities, failed 0.
Image saved in /home/alexis/fig9.png.
Image saved in /home/alexis/fig9.png.
Image saved in /home/alexis/fig8.png.
Empty Part Name !!
Info
Com...

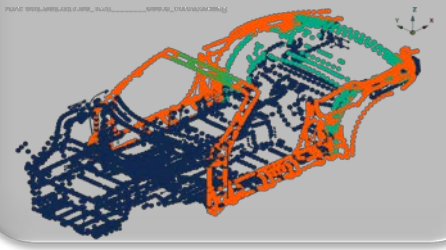
Modular principle Connections

Creating the 150% model connection information

Coupe xml Connections file

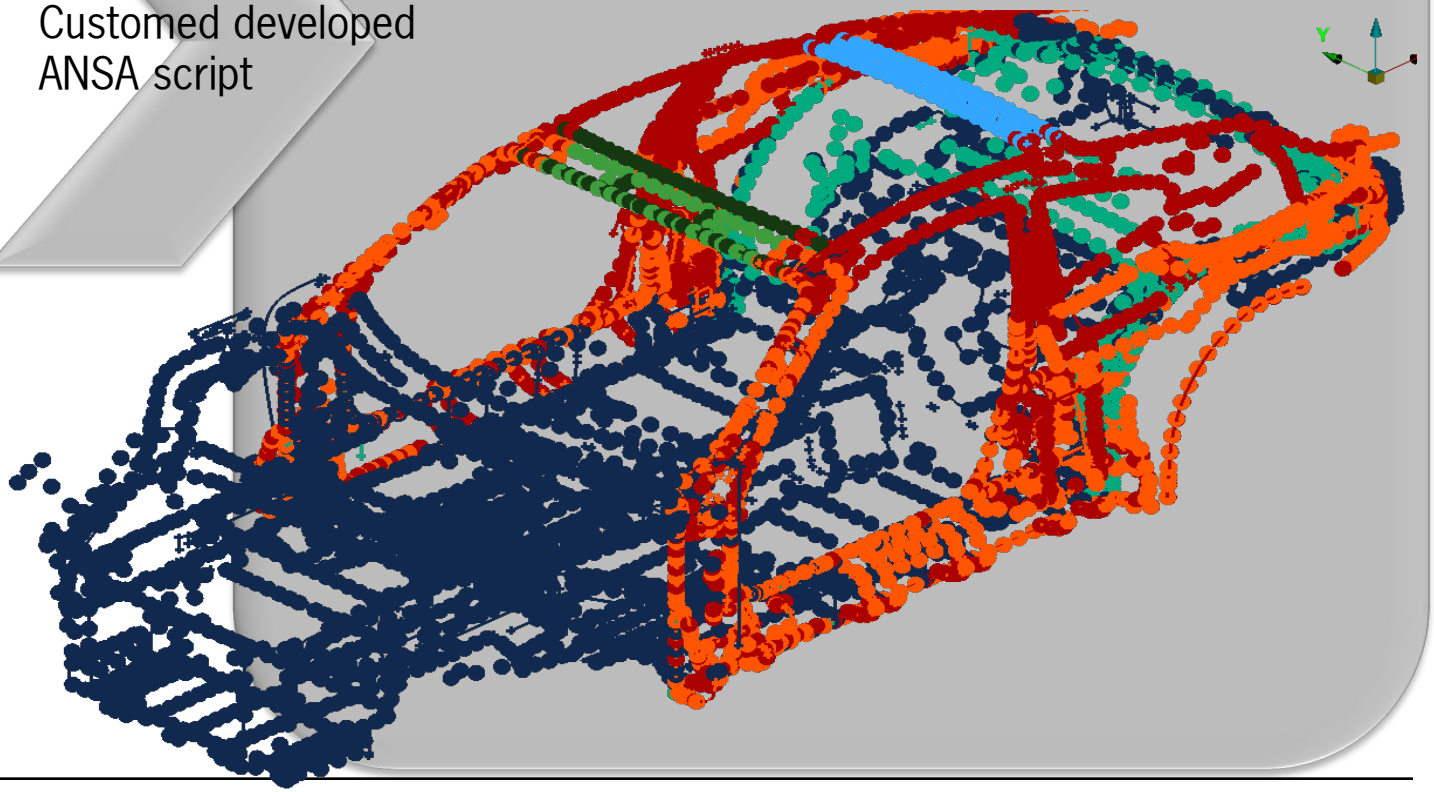


Cabrio xml Connections file



Customed developed ANSA script

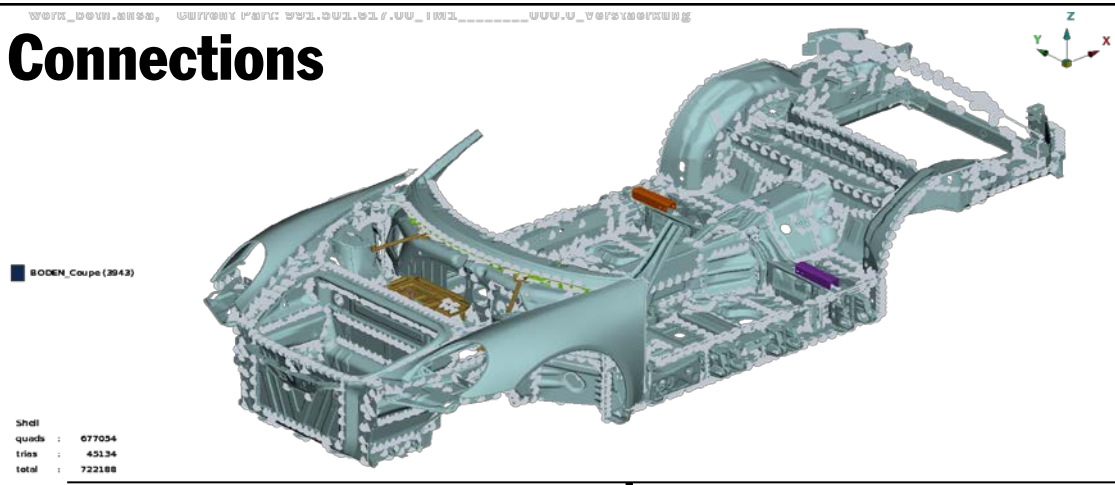
150% Model
Connection File



Modular principle Connections

Z1

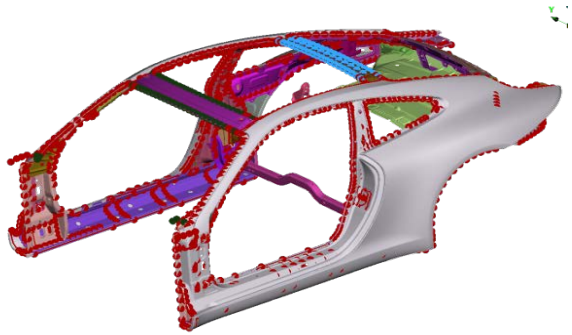
Platform

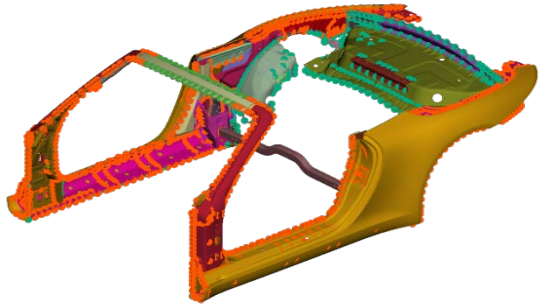


Common
Connection points

Z2

Platform framing





Mutual exclusive
Connection points

Z3

In case of long & short variants of a model (not existing in this example). They are shifted automatically if the parts they connect are also shifted.

Shifted
Connection points

Modular principle Connections

- The ANSA DM Configurator activates/deactivates the connection points automatically, taking into consideration the participation of the connected parts to the active configuration
- A connection point is activated only when all the parts it connects belong to the active configuration
- The connection points connecting only common parts are defined once
- The connection points connecting mutually exclusive parts to common parts should be defined multiple times (once for each configuration)
- The status of the connection points remains intact regardless of their activation status

Advantages of ANSA DM Configurator

- During the build-up of the models, we avoid performing multiple times all the time-consuming processes concerning the common parts of the models (such as connection points check, penetration check, definition of solver dependent entities)

- During the database maintenance, it is easier to maintain one database instead of multiple (for example, when exchanging one version of a common part with a newer one)

- The automatic activation and deactivation of connection points according to the configuration

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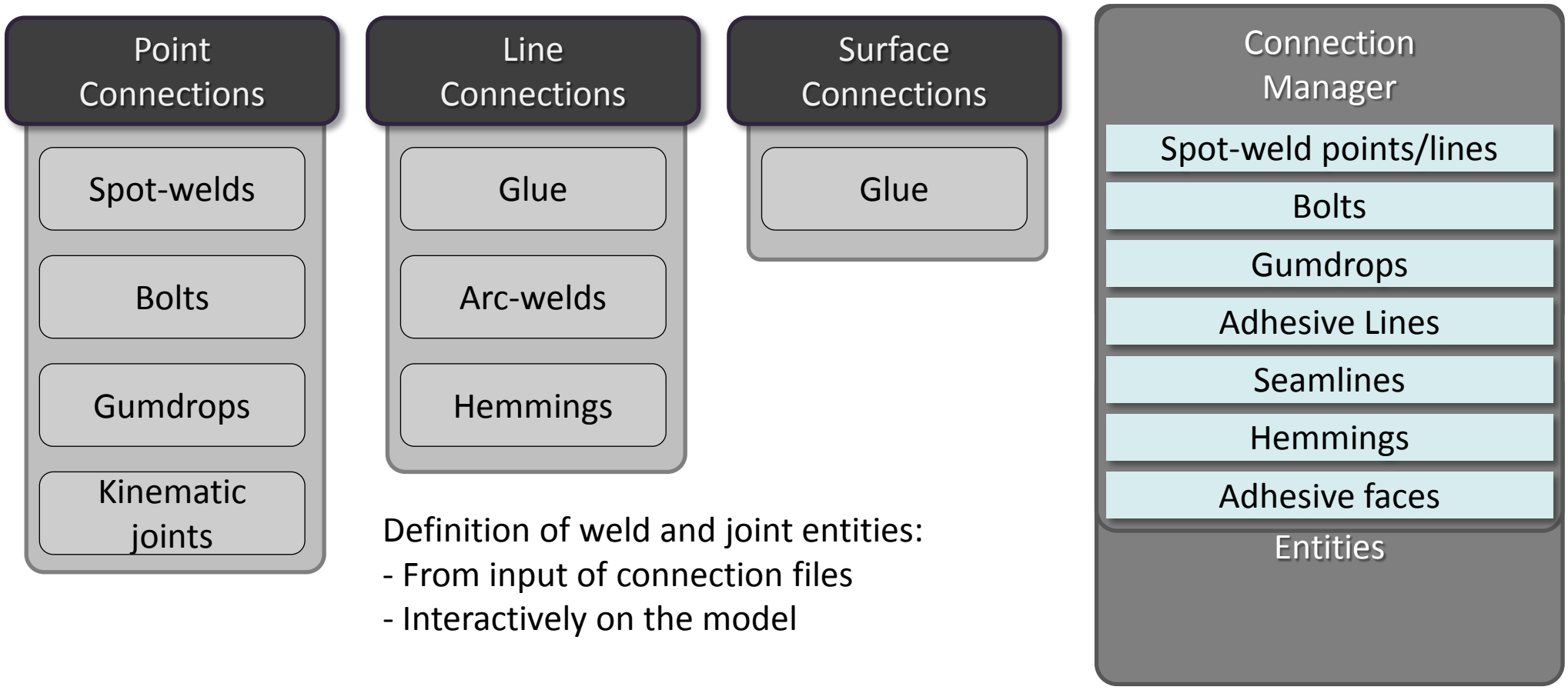
Connection Manager

Weld and Joint Entities and Assembly Tools

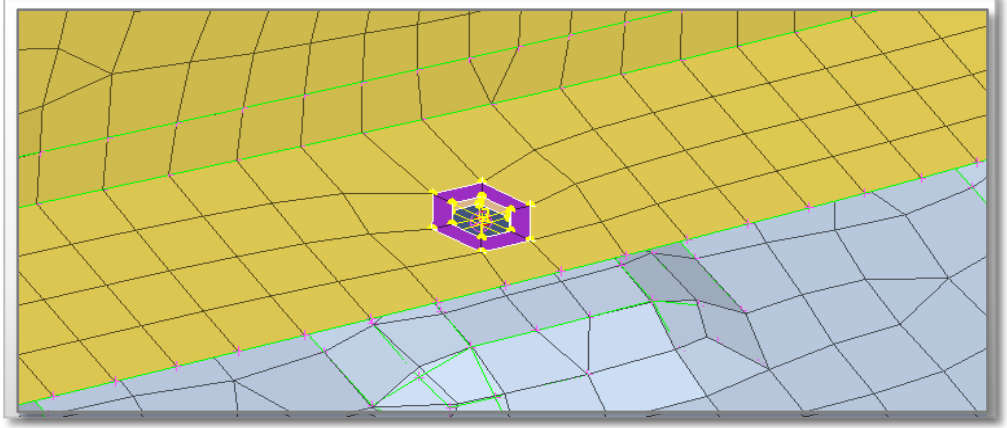


Definition of weld and joint entities:
- From input of connection files
- Interactively on the model

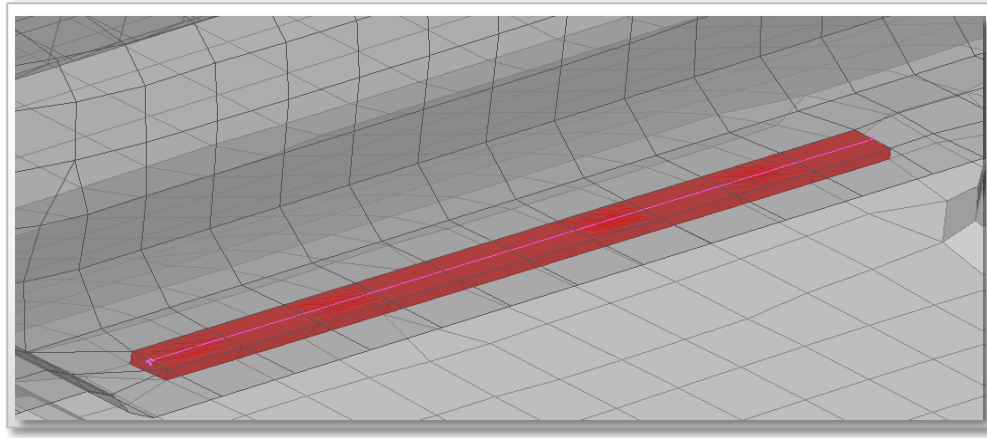
Connection Manager

Weld points and lines FE-representations

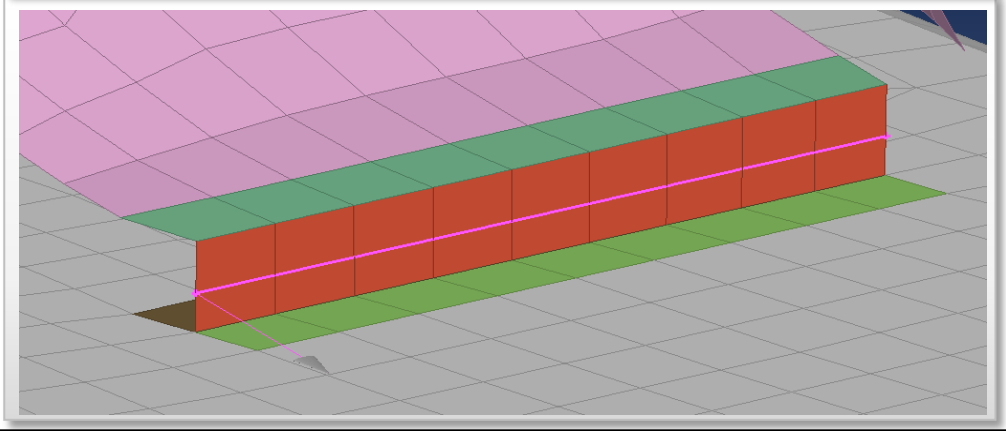
Spotwelds - Mesh independent



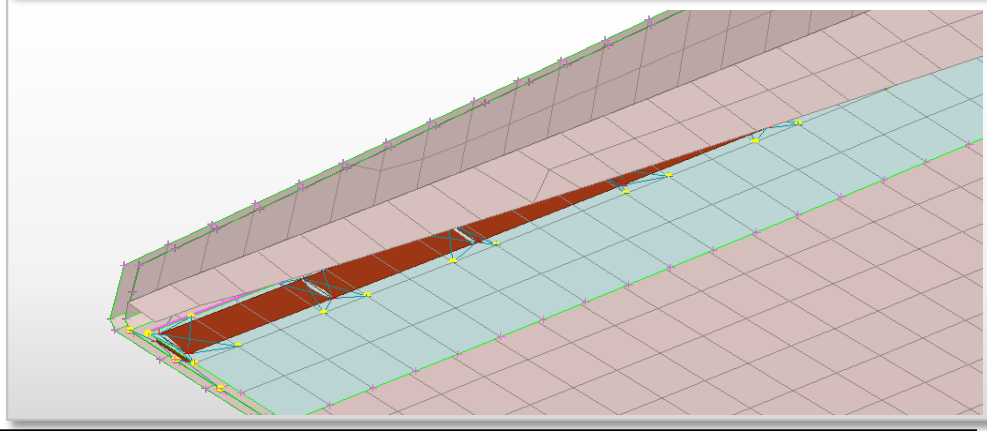
Adhesives – Hexas



Seamlines - Elements arc-weld

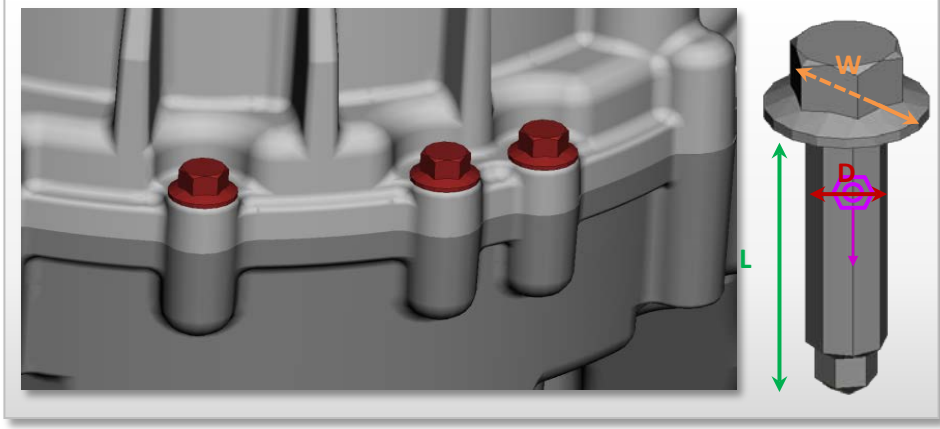


Hemmings - Folded shell elements

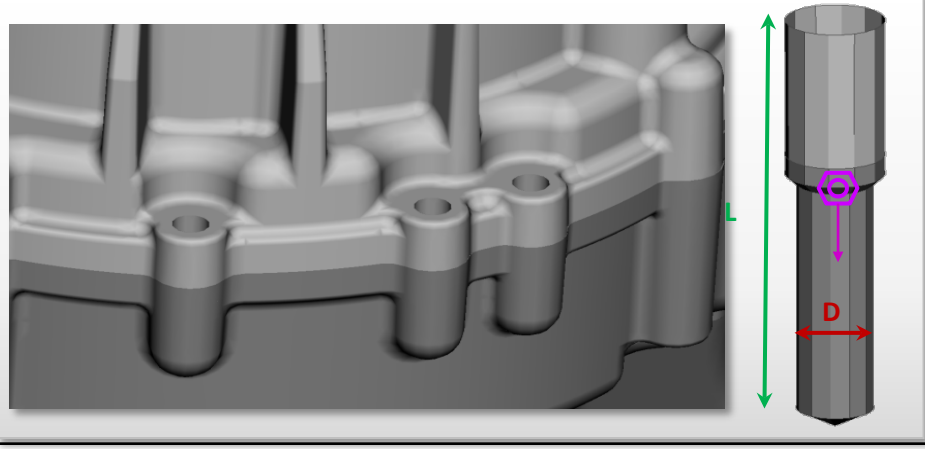


Connection Manager

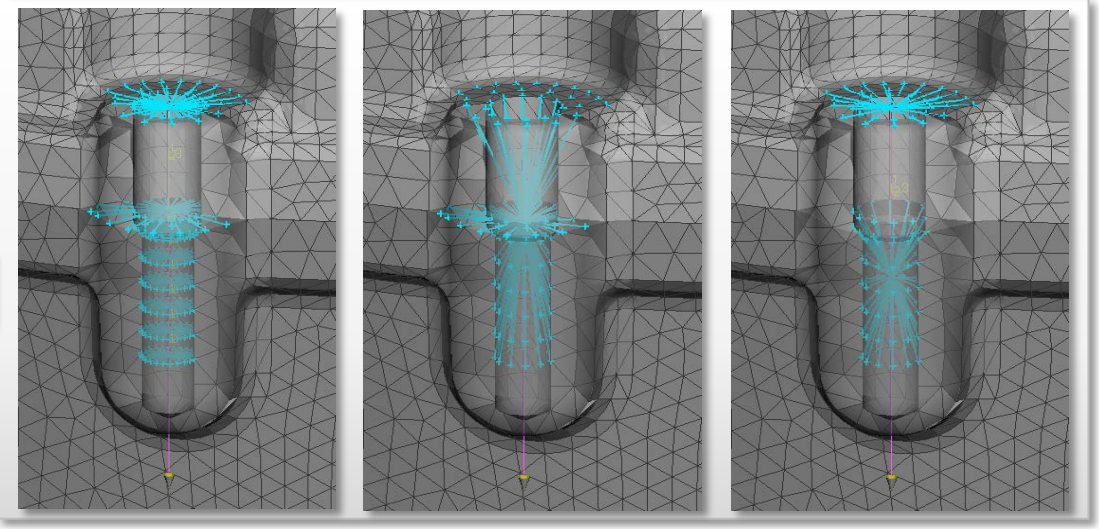
From bolt geometry



From tubes

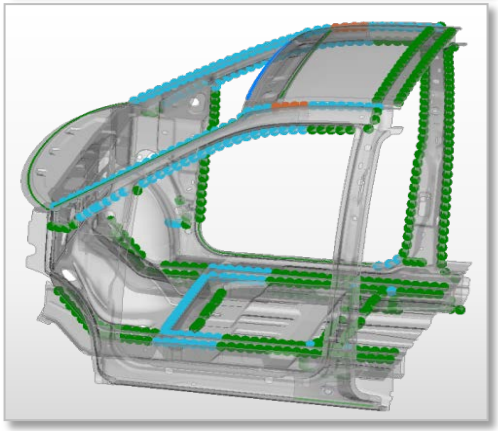


Numerous realization patterns

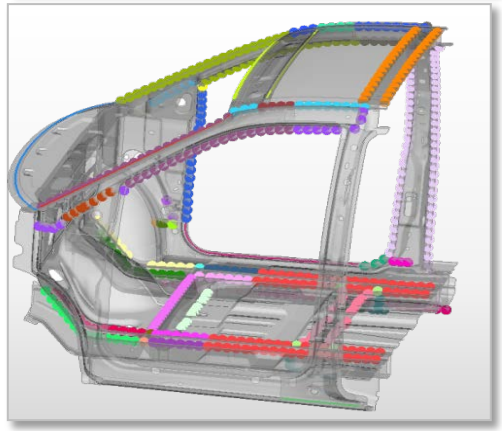


Connection Manager

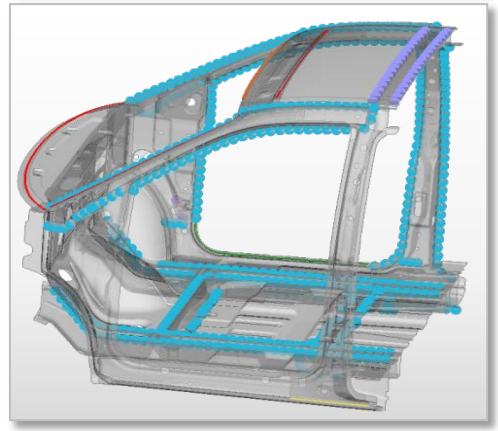
By number of parts



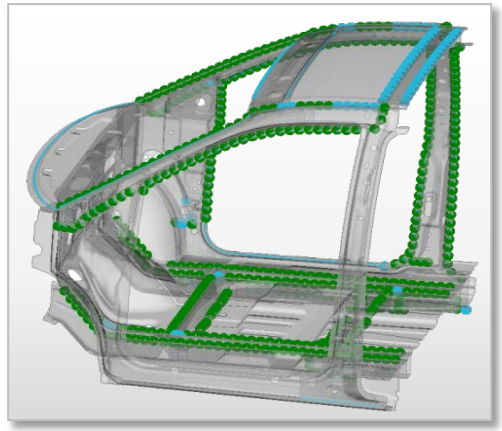
By connectivity



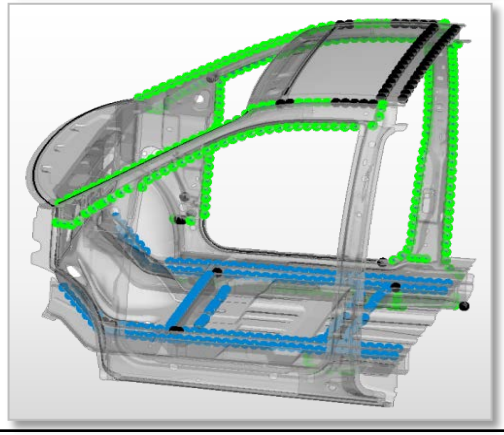
By type



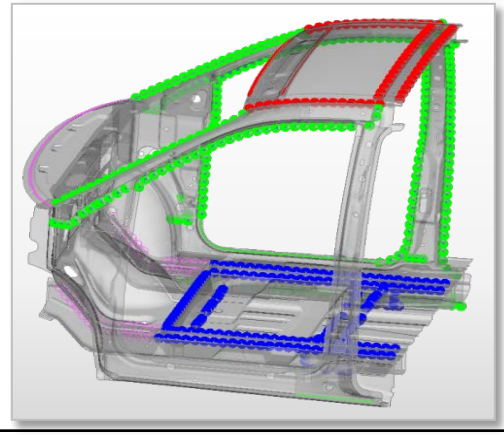
By status



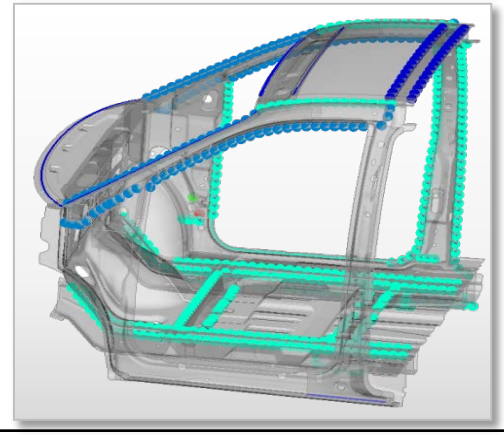
By FE-representation



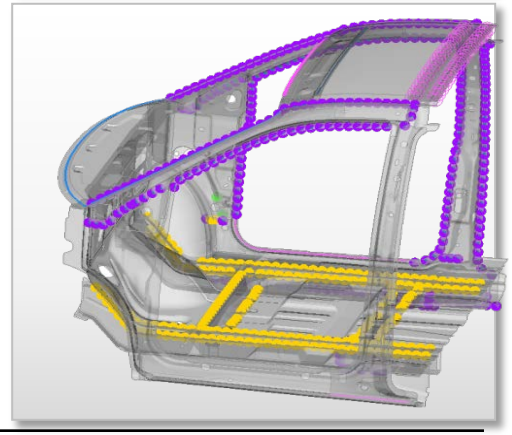
By connection file



By diameter

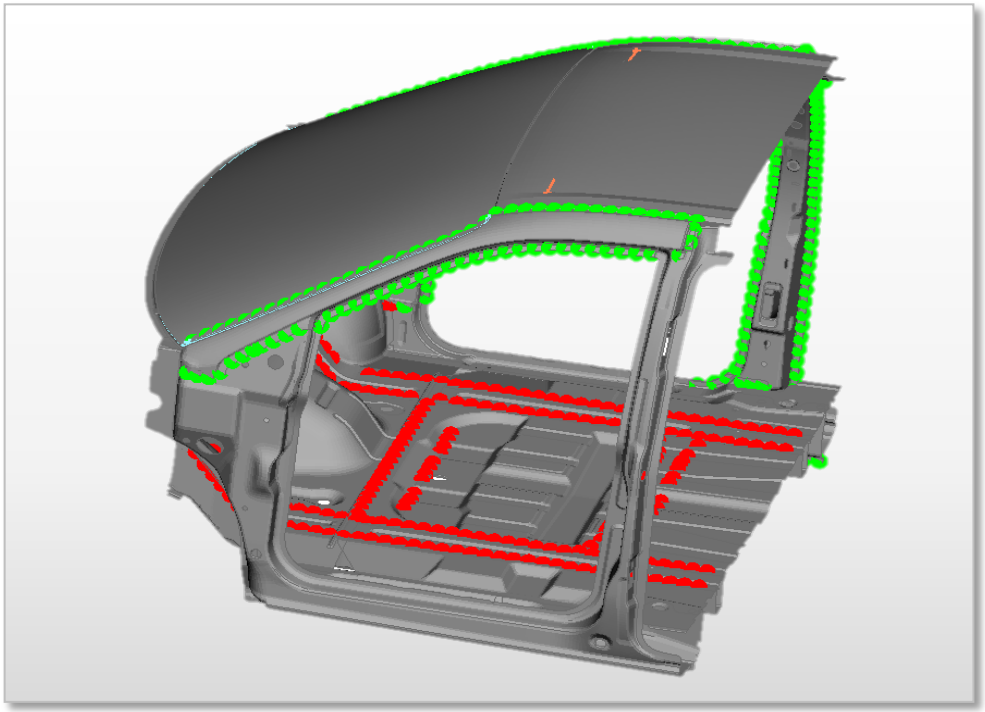


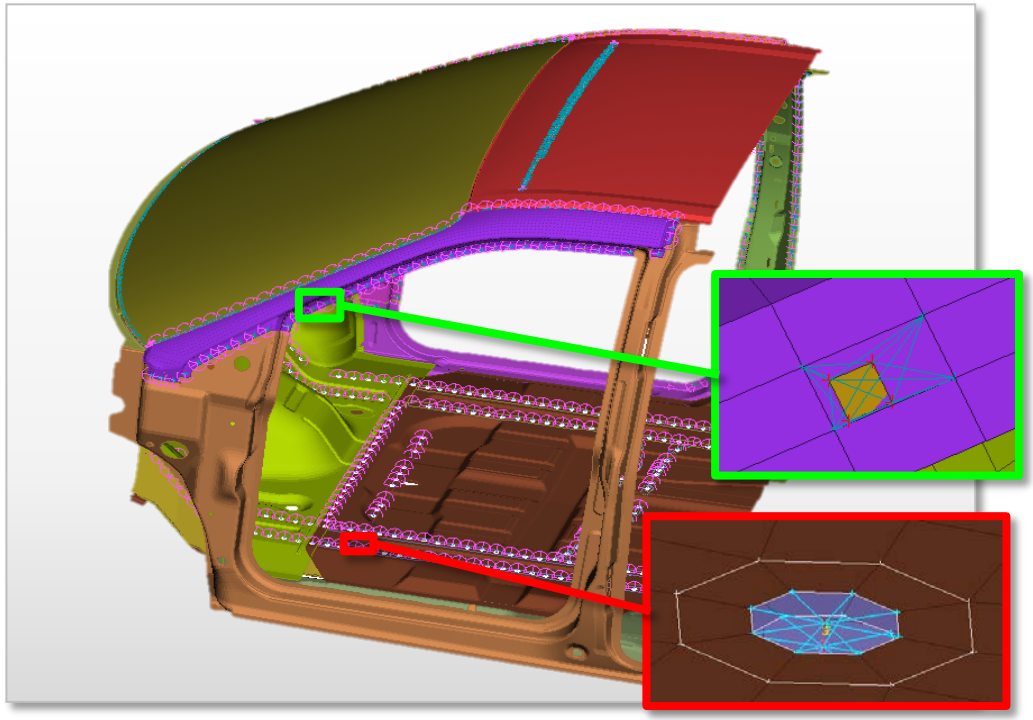
By template



Connection Manager

Assembly scenario and realization for different disciplines and solver





1

Connection grouping

- Location
- Connected parts
- Diameter etc.

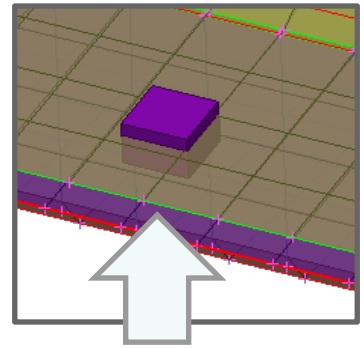
2

FE-rep templates assignment

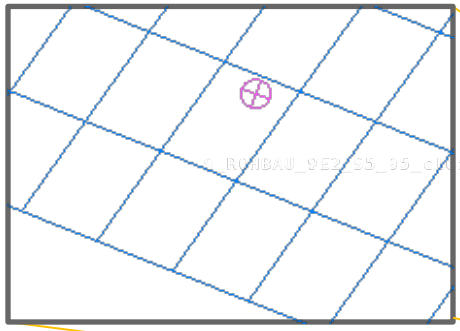
- Standardized settings
- Direct realization
- Library of scenarios for each discipline/solver

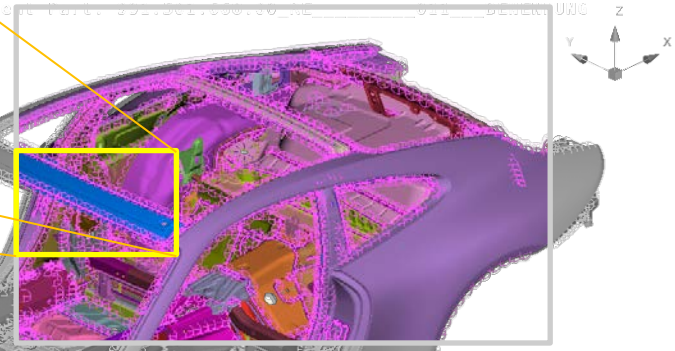
Connection Manager

Realization for different disciplines and solver

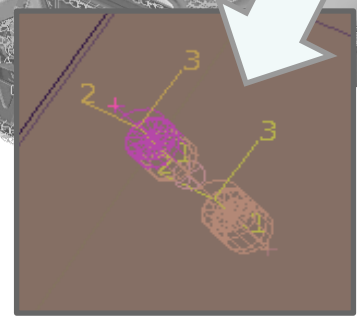


Crash Template for LS-DYNA

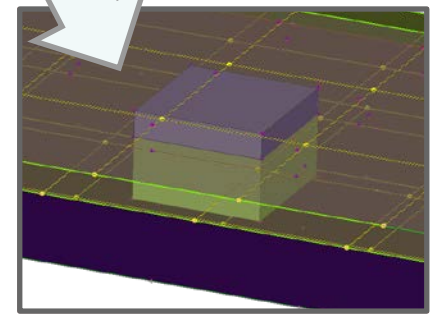




NVH Template for PERMAS



Fatigue Template for PERMAS



Advantages of ANSA Connection Manager

- Possibility to enter and maintain in our CAE model a variety of additional attributes that concern the connection itself. (e.g. at adhesive line we are able to store the glue material)

- By organising our connections with ANSA templates we are able to group them according to the FE representation that we will use for them in the model. (e.g. different templates for spotwelds, clinchen and rivets although all of them belong to the same connection type "Connection Points".

- By using assembly scenarios we are able to assign our connection generic entities various templates, depending on the discipline (crash, NVH, etc) in a fast and error free way.

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- Modular Principle
- ANSA “150%” Model
- ANSA “generic” connecting technology
- **Conclusion**

Conclusion

- The variant diversity, the number of digital prototypes and the cross-linked situation is a big challenge for the CAE disciplines
- It is necessary to translate the modular principle into the virtual world
- We need multi-discipline-solutions in the model-setup phase
- There are solutions in ANSA for the modeling-process
- This means high requirements to the surrounding processes CAD, DMU, SDM, PDM, ...
- We need high experienced people with a high responsibility to run this process