# ANSYS CONFERENCE & CADFEM USERS' MEETING 2015

## Automatisierte Erstellung von Ergebnisberichten

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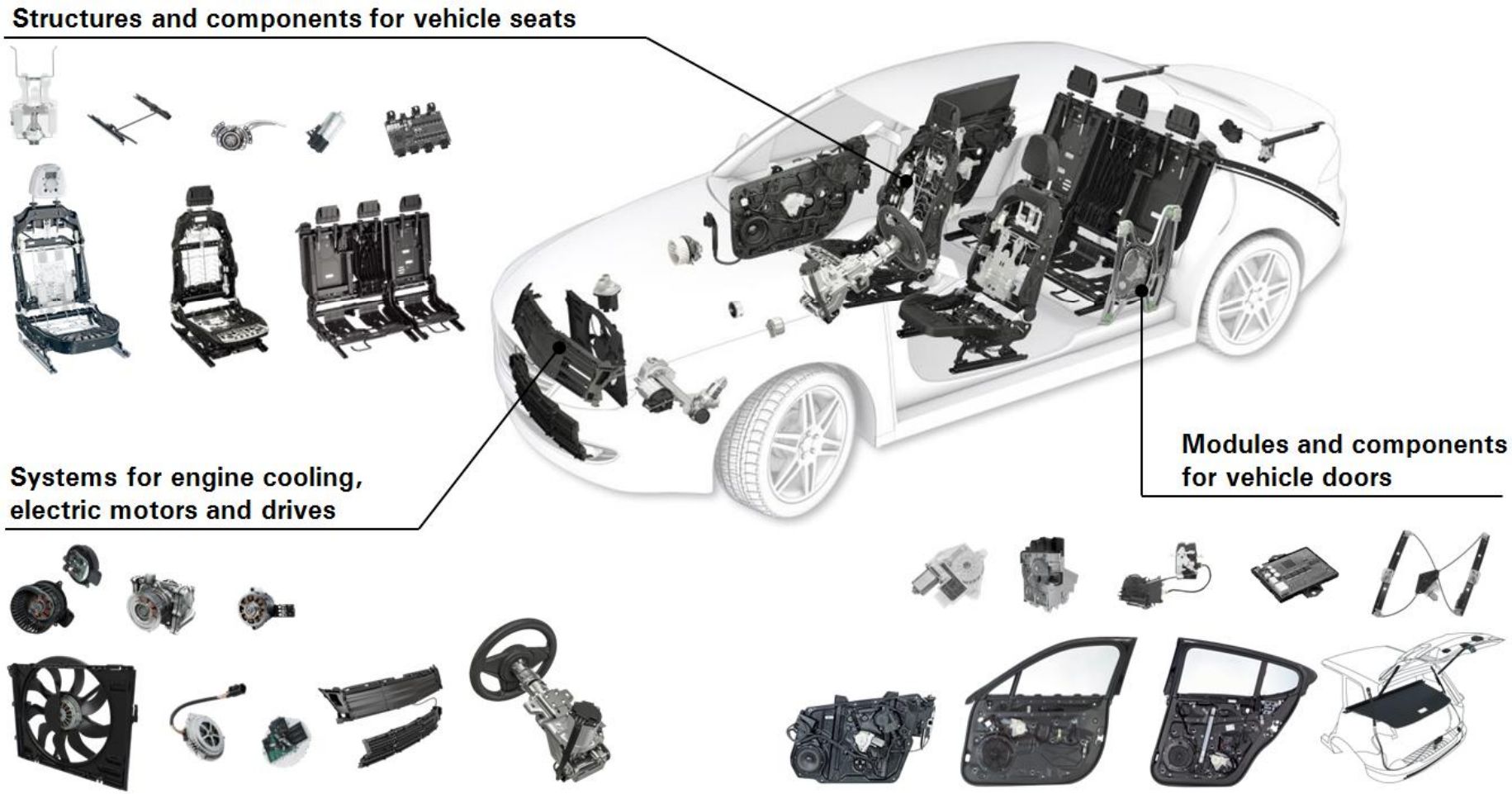
# Automatic report generation

- **Content**
  - FEA at Brose Doorsystems
    - Brose product portfolio
    - CAE in Brose development process
    - Motivation for automatic report
    - Report requirements
  - Project realization (CADFEM)
    - ANSYS Workbench Project Schematic customization
    - ANSYS Mechanical customization

# Automatic report generation

## Brose product portfolio



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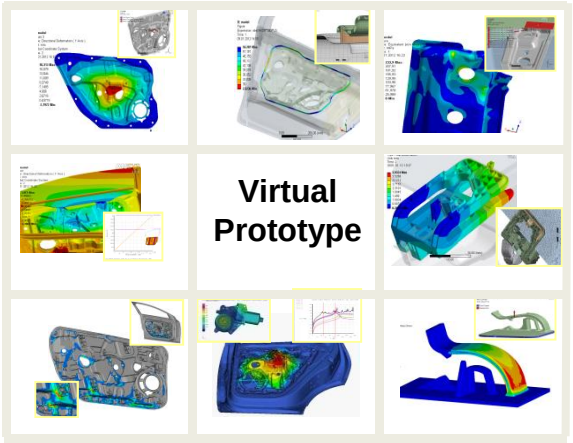
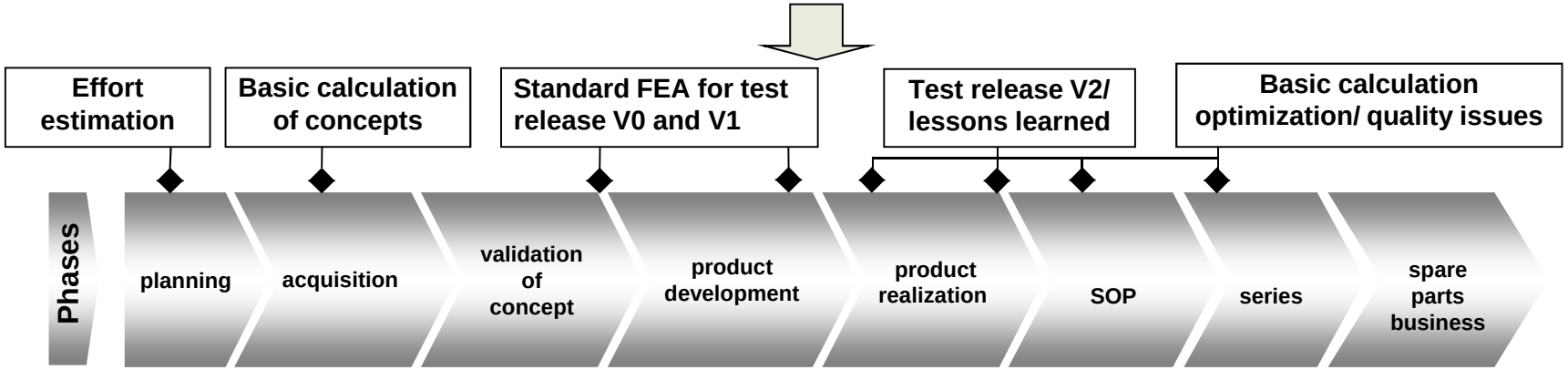
- **CAE in Brose development process**



# Automatic report generation

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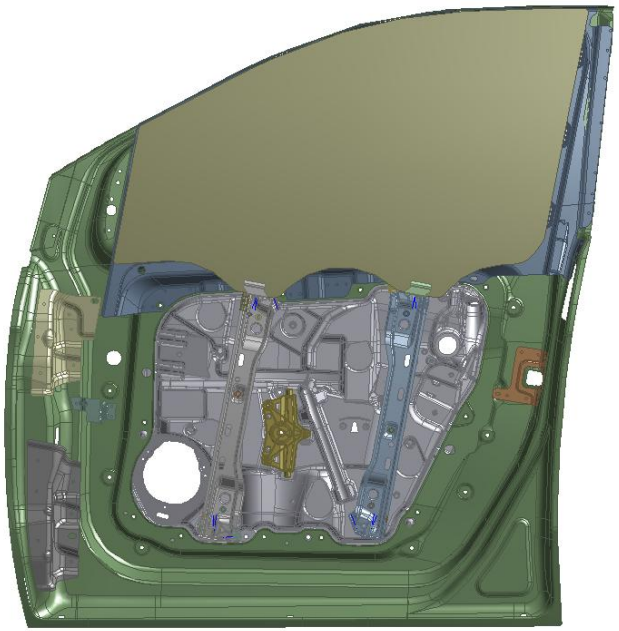


- **Motivation for automation**

  - About 120 window regulator calculations a year
  - About 300 reports a year

  - High potential for automation

  - Automation of model build up was done in 2012
    (ACUM 2013; Process automation with Jscript in ANSYS Workbench)

  - First automatic report was a „Quick and Dirty“ solution

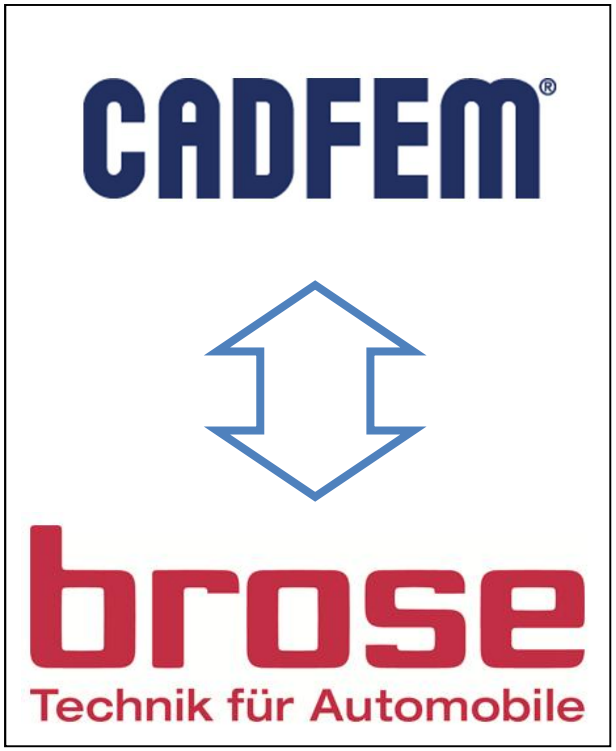
  - High quality automatic report for internal customers was missing

# Automatic report generation

- **Report requirements**
  - Use of Workbench images, figures
  - Input of project data
  - Report for single load case
  - Collected report for all required load cases
  - Editable
  - Standard layout
  - Automatic and individual caption
  - Automatic information generation (bill of materials…)
  - Input of load case evaluation
  - Sub model technology

# Automatic report generation

- **Project realization**
  - Definition of report requirements
  - Discussion with CADFEM how to realize
  - Necessary programming KnowHow does not exist at simulation department BROSE Hallstadt
    - JScript ✓
    - Python △
    - HTML + CSS ✗
  - CADFEM is able to combine all programming methods
    **è** CADFEM does the programming work



# Automatic report generation

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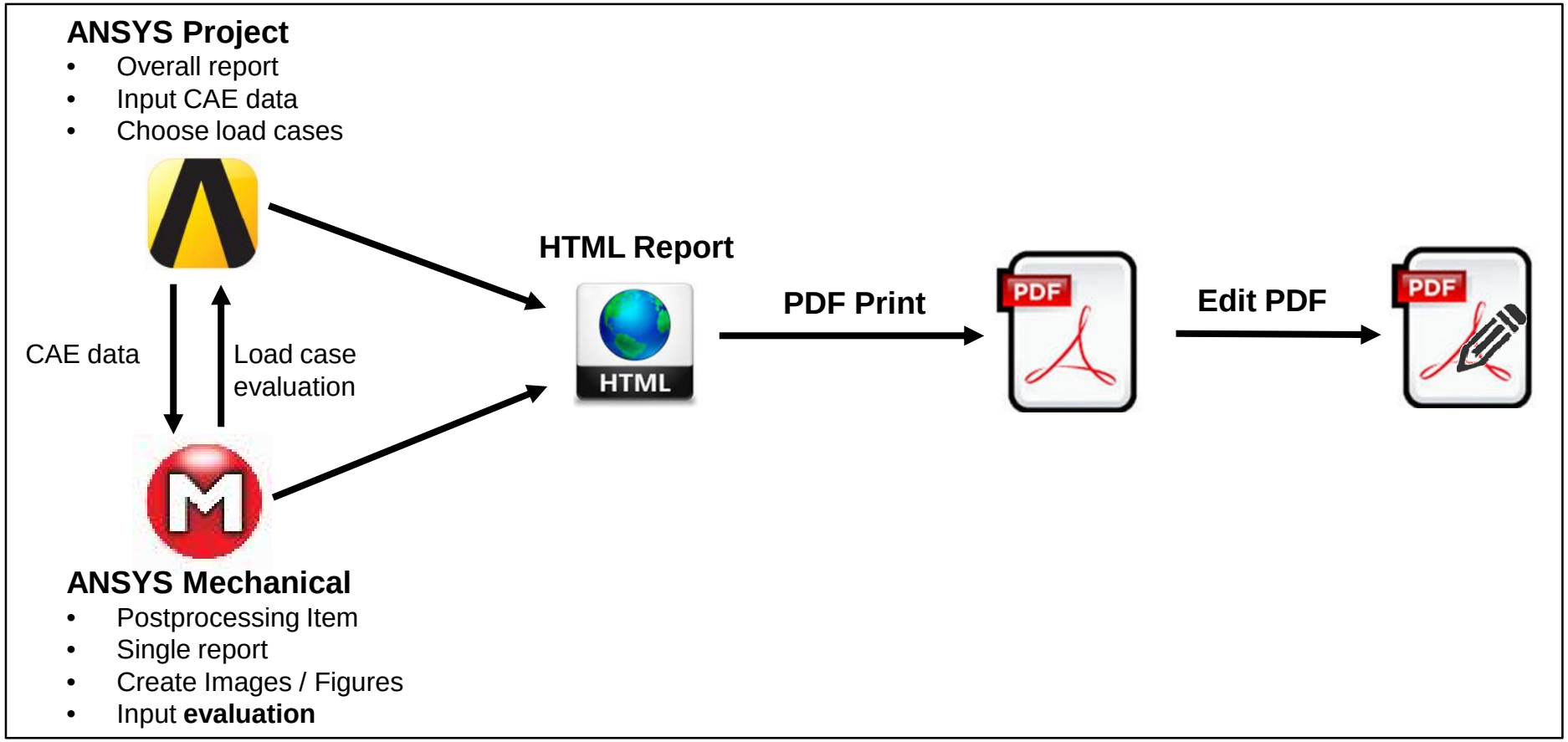
- **Report built up**

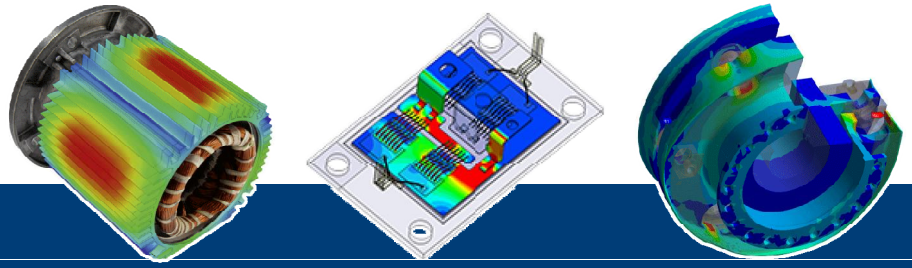


CADFEM®

ANSYS

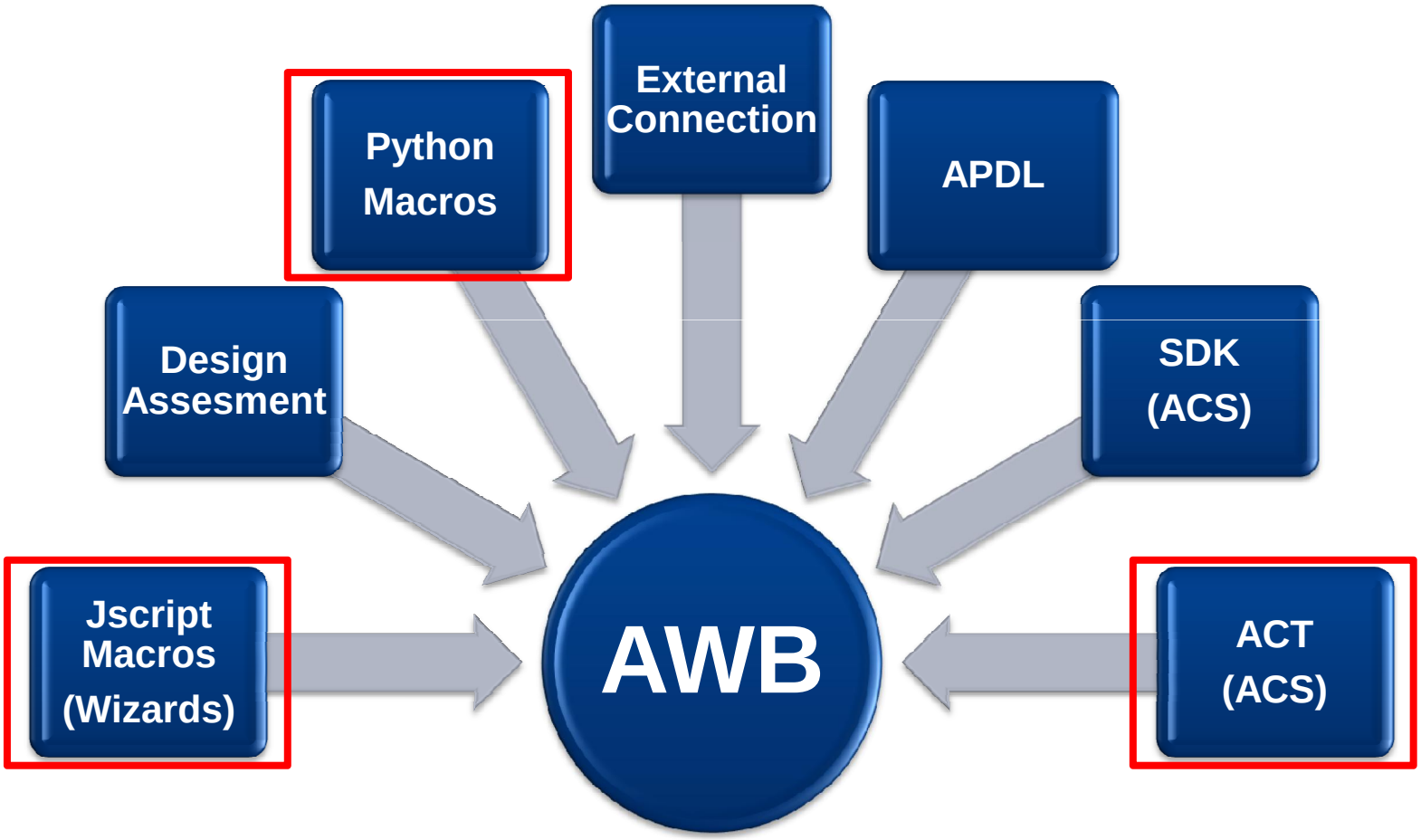
Competence Center FEM

Simulation ist mehr als Software®



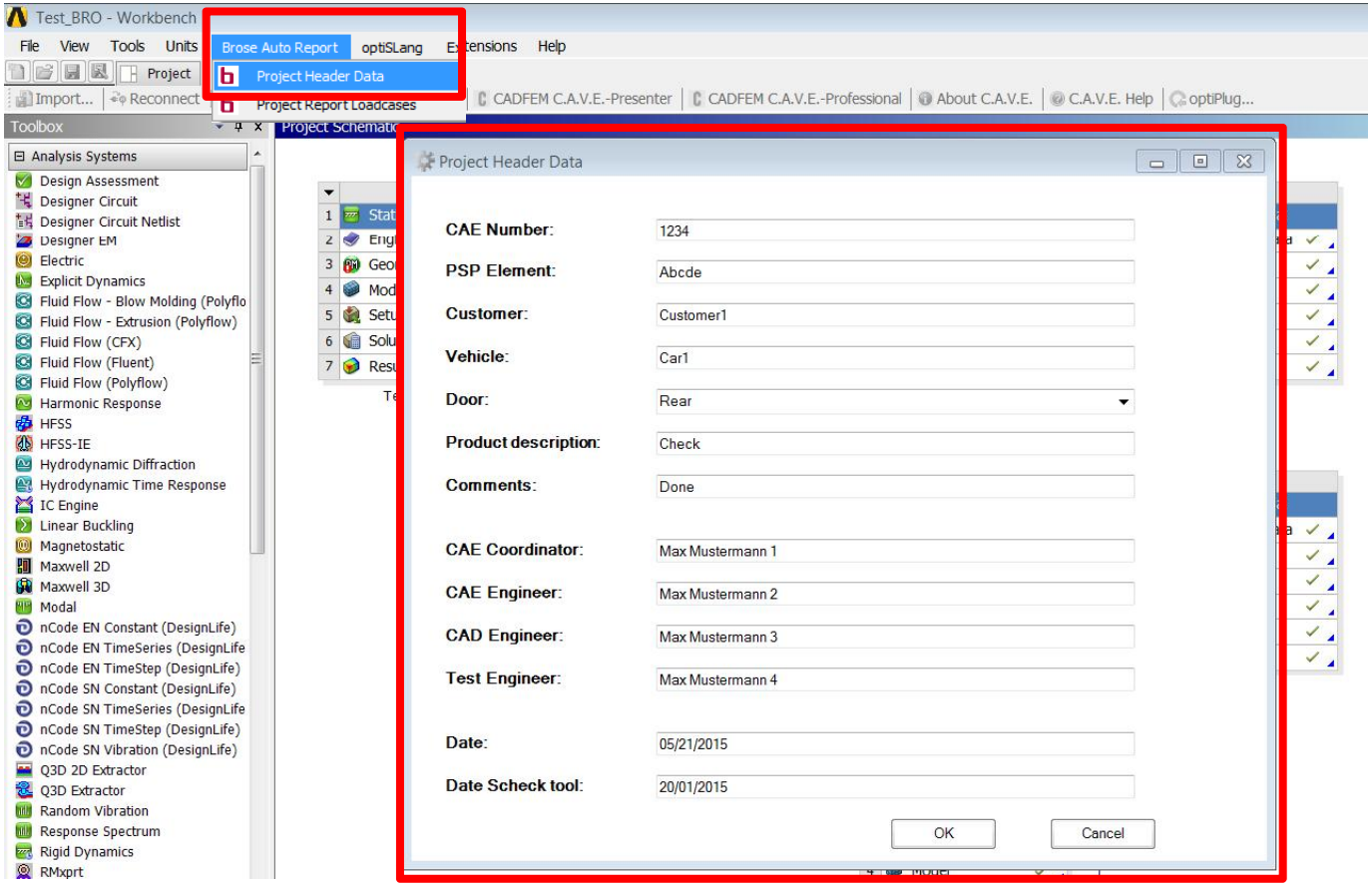
# Automatic generation of reports - Customization by CADFEM

# Overview – Automatization in ANSYS Workbench



# Description of software customization for BROSE

- ANSYS Workbench Project Schematic customization
  - **Project Header Data** programming – customized menu “Brose Auto Report”



# Description of software customization for BROSE

- ANSYS Workbench Project Schematic customization
  - **Project Header Data** programming – customized menu “Brose Auto Report”
    - Applied languages: **Python + Windows Forms**
      - Code sequences in Python script

```
import os
import clr
clr.AddReference("System.Windows.Forms")
clr.AddReference("System.Drawing")
from System.Windows.Forms import *
```

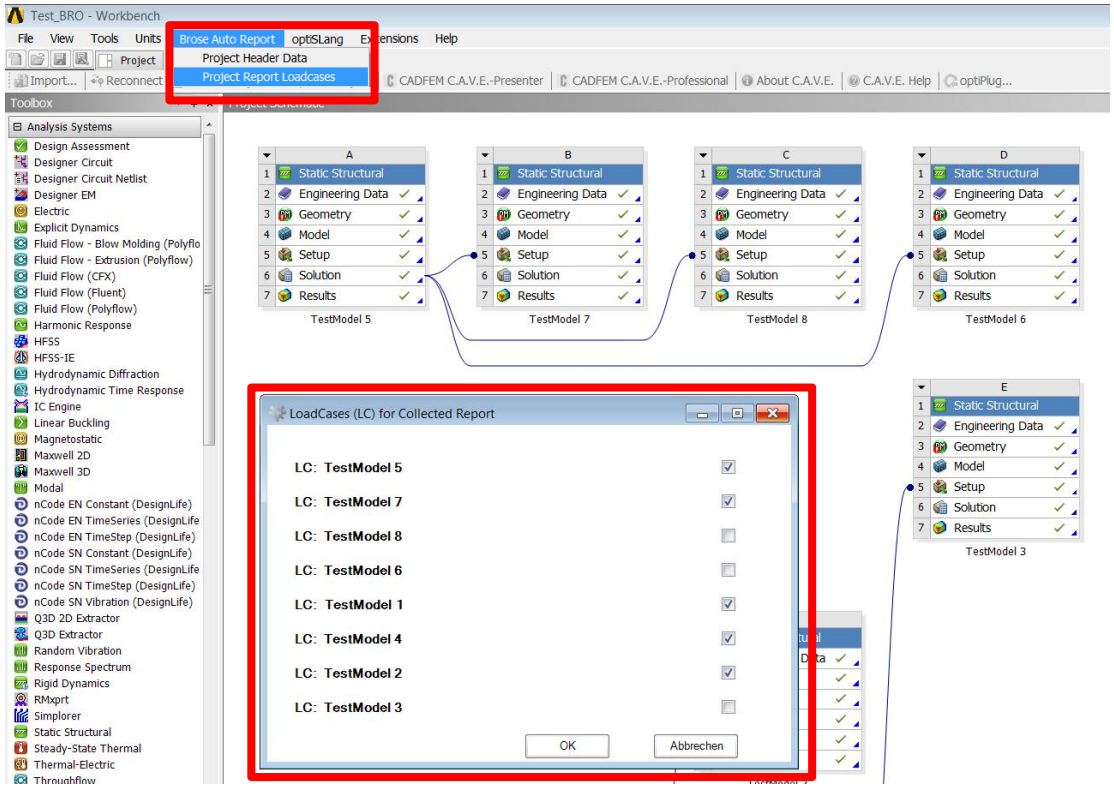
Importing Windows Forms capabilities to create and fill window- see previous slide with content

```
class IForm(Form):
   def __init__(self):
        Form.__init__(self)

      #Ueberschrift des Fensters
        self.Text = 'Project Header Data'
        self.BackColor = Color.White

      #Icon oben links im Fenster
        self.Icon = Icon("\\Images\\process.ico")

      #---------     System 1: CAE Number    ----------
      label1 = Label()
      label1.Text = "CAE Number:"
      label1.Size = Size(sizeLabel, height)
      label1.Location = Point(dist_l,dist_h)
```

Specifications on window content - see previous slide e.g.
- header,
- images,
- systems details,
- …

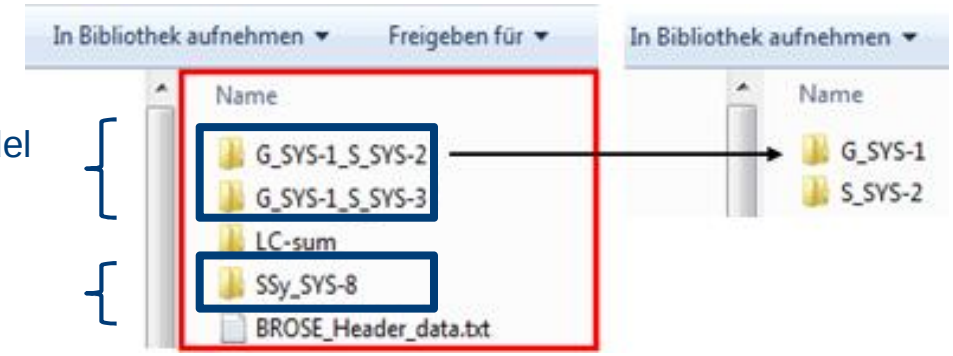
# Description of software customization for BROSE

- ANSYS Workbench Project Schematic customization
  - **Load case selection** programming for Overall Report (HTML) – customized menu “Brose Auto Report”
    - Applied languages: **Python + Windows Forms**



# Description of software customization for BROSE

- ANSYS Workbench Project Schematic customization
  - **Overall report** (HTML) programming
    - Applied languages: **Python + JScript + HTML + CSS**
    - Workflow in **Python**:
      - Store connectivity of systems with global-submodel relation
      - Loop through all selected systems
        - Save user-specified data:
          - Images, material data, temperature settings, CAE information of systems with global-submodel connectivity to folders
          - Images, material data, temperature settings, CAE information of single systems to folders.
          - Folder structure:




Global-submodel systems

Single systems

# Description of software customization for BROSE

- ANSYS Workbench Project Schematic customization
  - **Overall report** (HTML) programming
    - Workflow in **JScript**:
      - Retrieve user-specified data  from ANSYS Mechanical by JScript;
      - JScript function call from Python via “SendCommand()” function;

Example Code Python Call of JScript for Single systems:

```
# Send JScript Code to Mechanical Simulation via Python Script
myCommand = ""
f=open("BROSE_SingleModel_Data.js",'r')
myCommand+=f.read()
f.close()
setupSingleSystem.SendCommand(Command=myCommand)
setupSingleSystem.Exit()
```

Application of different JScript files (*.js) for global systems, submodel systems and single systems due to different data extraction

# Description of software customization for BROSE

- ANSYS Workbench Project Schematic customization
  - **Overall report** (HTML) programming
    - Workflow in **HTML**:
      - HTML Code written inside Python overall report file

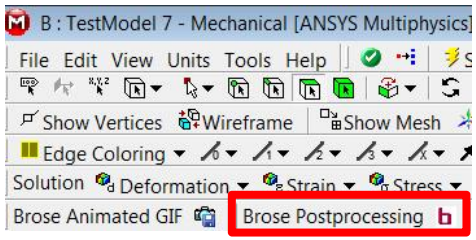
```
msg = ''
msg += '<html>\n'
msg += '<head>\n'
msg += '<style type="text/css">\n'
cssFilePath= customiziationDir + "\\Scripts\\Brose_report_NEW.css"
cssFile=open(cssFilePath,'r')
msg += cssFile.read()
cssFile.close()
msg += '</style>\n'
msg += '</head>\n'
msg += ' <body>\n'


msg += ' <div class="firstPage">\n'
msg += ' <div class="pageContent">\n'
msg += ' <div class="firstPageContent">\n'
pagecounter = pagecounter + 1
# insert Brose Logo
msg += '<div class="headerimage"><img src="{0}"/></div>\n'.format(filepathLogo)
# header
msg += '<h1>BROSE Collected Customized Report</h1>\n'
    :
```

HTML layout structuring via CSS (Cascading Style Sheets):

```
.firstPage
{
    margin-top:0.5cm;
    padding-left: 0.5cm;
    padding-right: 0.5cm;
    page-break-after: always;
    border: 2px solid #777777;
    min-height: 26cm;
    height: 28cm;
    width: 19cm;
}

.headerimage
{
    text-align: right;
    padding-bottom: 0.25cm
}
```

# Description of software customization for BROSE

- ANSYS Mechanical customization
  - **Single report** (HTML) programming – customized toolbar “Brose Postprocessing”
    - Applied languages: **Python +XML+ JScript + HTML + CSS**
      - ACT Postprocessing Toolbar feature: Automatic project header data import, additional user input, report generation: **Python +XML**:




- XML: Defines + configures content of extension,
- Python: Respond to user / GUI interactions, implementation of behavior/ functionalities of extension;

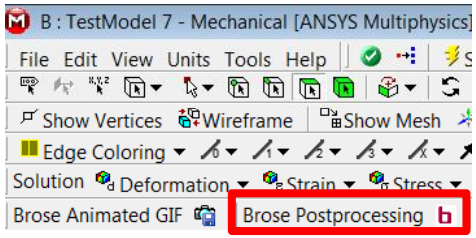
- **XML** Code Sequence:

```
<extension version="1" name="BrosePP">
  <script src="[ext.Folder]\main.py" />
  <interface context="Mechanical">
    <images>[ext.Folder]\images</images>
    <toolbar name="BrosePP" caption="Brose Postprocessing">
      <entry name="Brose Postprocessing" icon="Brose_1">
        <callbacks>
          <onclick>createPPFeature</onclick>
        </callbacks>
      </entry>
    </toolbar>
    <callbacks>
      <onpostfinished>callJScript</onpostfinished>
    </callbacks>
  </interface>
```

Call Python functions

# Description of software customization for BROSE

- ANSYS Mechanical customization
  - **Single report** (HTML) programming – customized toolbar “Brose Postprocessing”
    - ACT Postprocessing Toolbar feature: Automatic project header data import, additional user input, report generation: **Python +XML**:




- XML file: Defines +configures content of extension.
- Python script: Respond to user / GUI interactions, implementation of behavior/ functionalities of extension;

    - **Python** functions invoked by XML callbacks

```python
def createPPFeature(currentAnalysis):
    load = currentAnalysis.CreateResultObject("BrosePP")
```

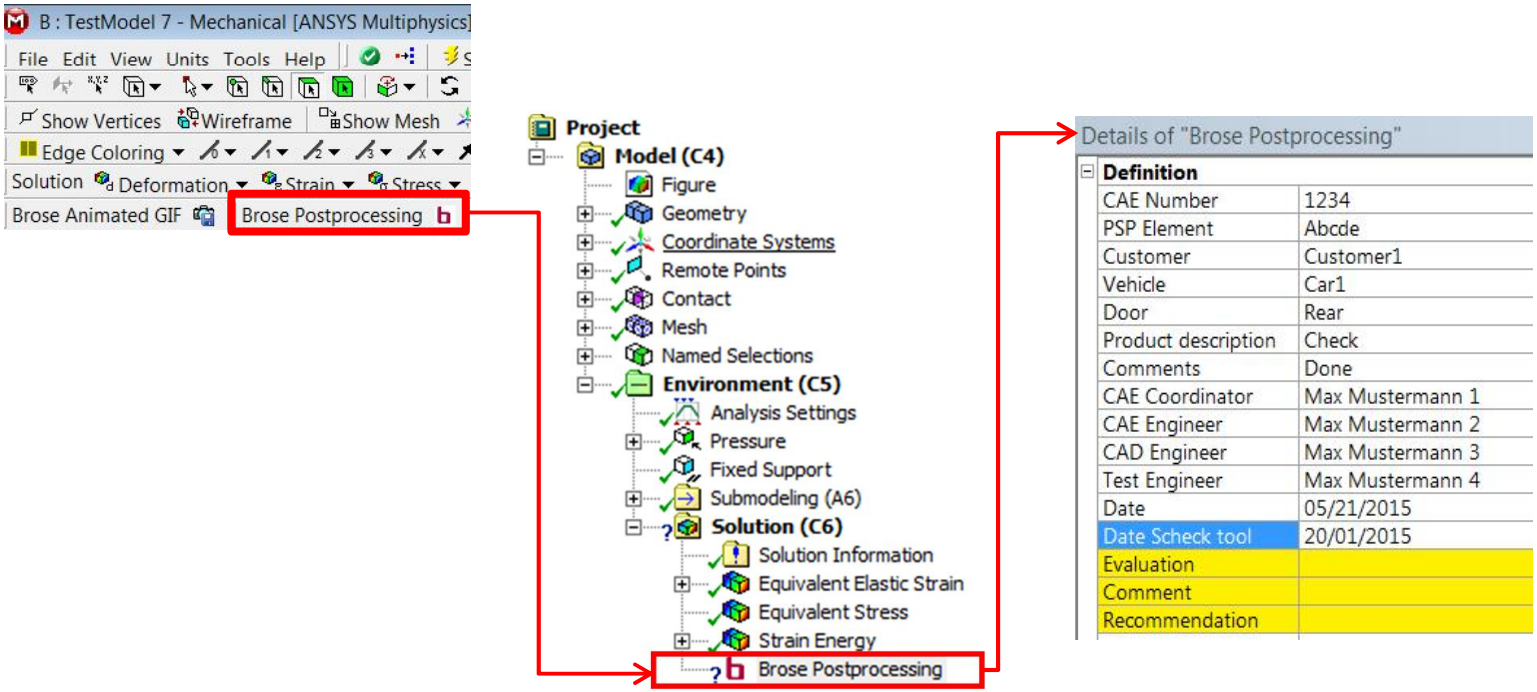
Creates “Brose Postprocessing” postprocessing object in tree

```python
def callJScript(analysis):
    for result in analysis.ResultObjects:
        compare_header_file(result)
    installDir = ExtAPI.ExtensionManager.CurrentExtension.InstallDir
    filePath = installDir + "\\" + "SingleReport.js"
    filePath = filePath.replace("\\","\\\\")
    sCmd1 = "fso = new ActiveXObject(\"Scripting.FileSystemObject\");var

    ExtAPI.Application.ScriptByName("jscript").ExecuteCommand(sCmd1)
    ExtAPI.SelectionManager.ClearSelection()
```

Calls JScript file “SingleReport.js” from Python for HTML report same way as for overall HTML report

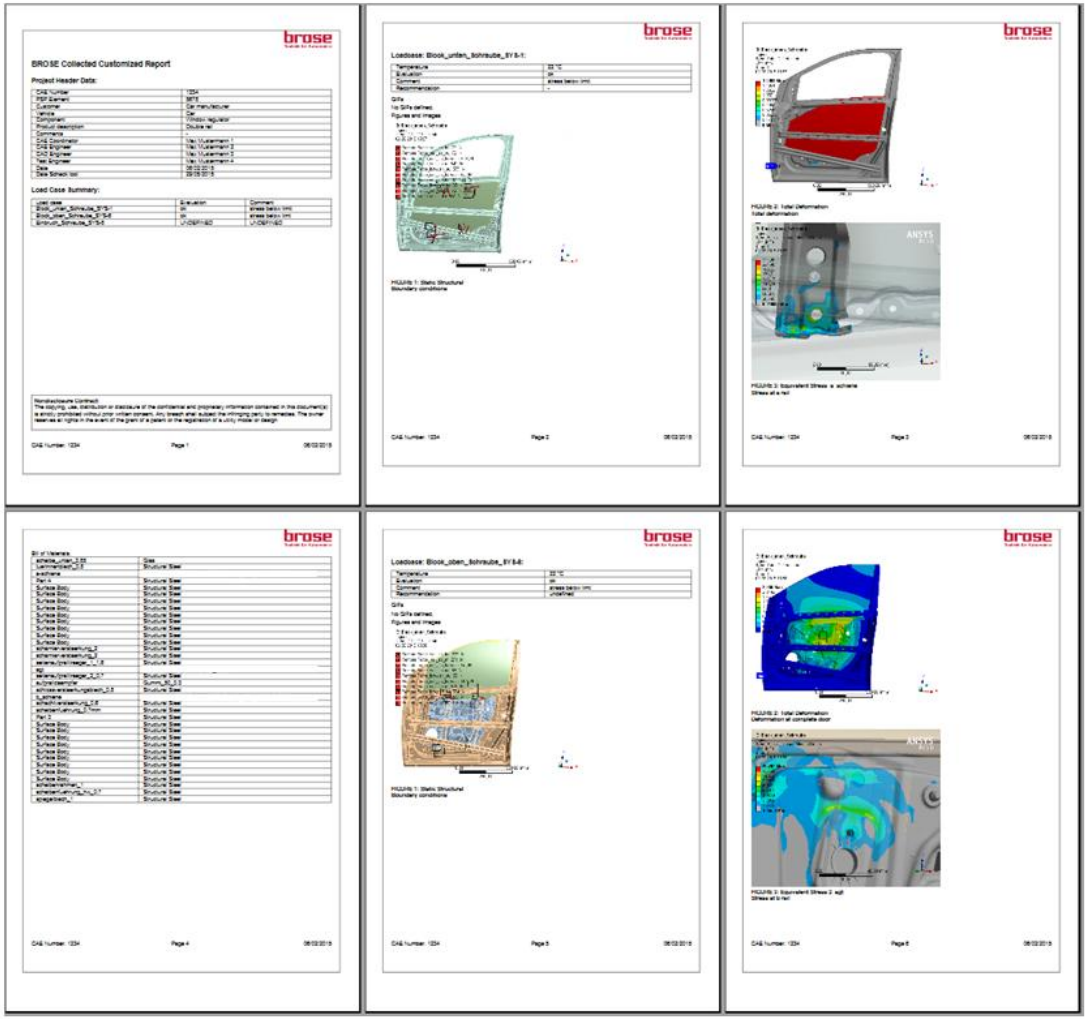
# Description of software customization for BROSE

- ANSYS Mechanical customization
  - **Single report** (HTML) programming – customized toolbar “Brose Postprocessing”
    - Applied languages: **Python + JScript + HTML + CSS**
      - ACT Postprocessing feature: Automatic project header data import, additional user input, report generation:



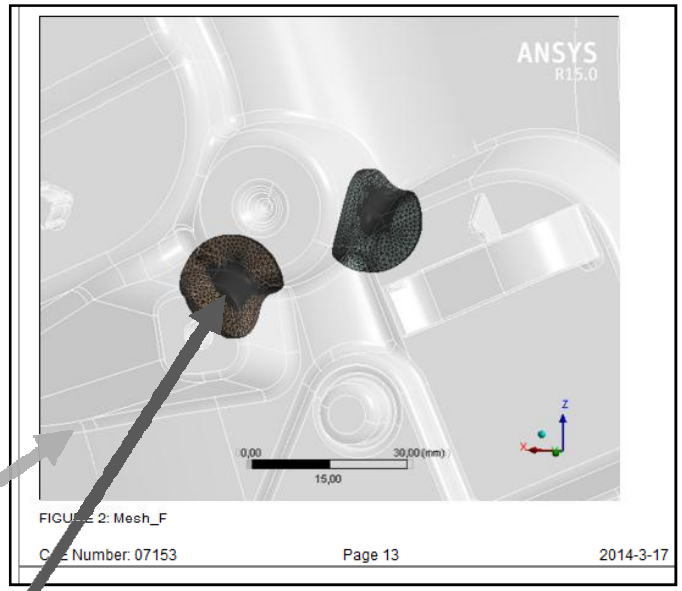
# Automatic report generation

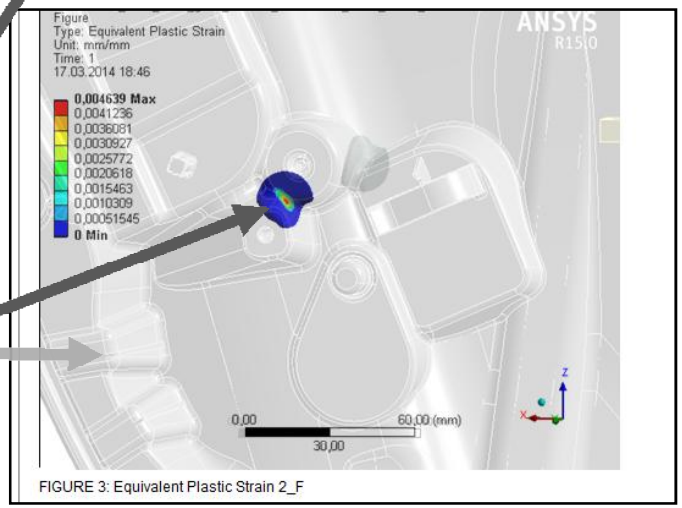
- **Report layout**
  - Standard layout for each report
    - CAE input data
    - Evaluation summary
    - Nondisclosure contract
    - First load case, evaluation
    - First load case, images…
    - First load case, bill of materials
    - Second load case….

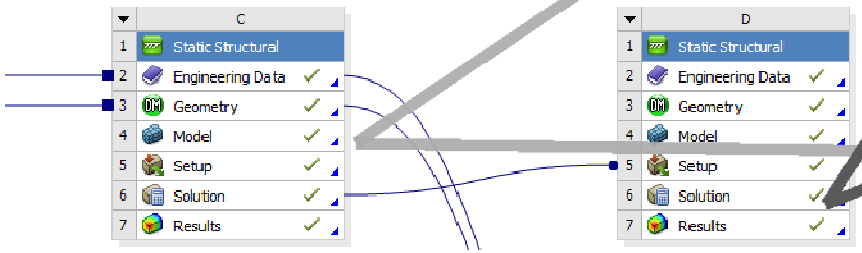


# Automatic report generation

- **Report layout**
  - Sub model technology is visible
  - Linked rough model transparent behind sub model



# Automatic report generation

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- **Automatic report build up summary**