

Optimierung mit ANSA, LS-Opt & Meta: Prozesskopplung & praxisnahe Beispiele

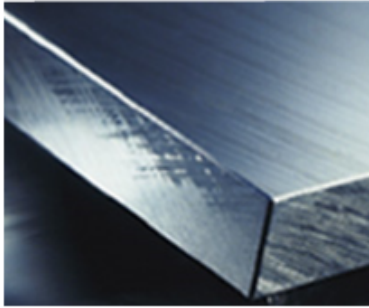
29. Februar 2016



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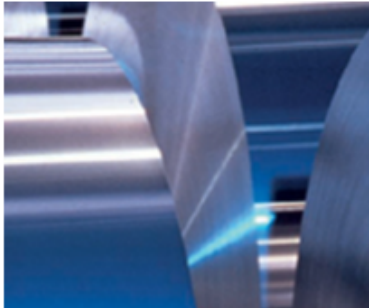
- Firmenvorstellung Constellium
 - Strukturierung in 3 Kernbereiche
 - Produkte Automotive Structures
- Crashmagagementsysteme & Anforderungen
- Optimierung = Automatisierung des FE-Arbeitsprozesses
- Signalverarbeitung & Datenfluss im Optimierungsprozess
- Arbeitsschritte beim Aufbau eines Optimierungsprozesses
 - Aufbereitung + Parametrisierung ANSA-File
 - Bereitstellung des META-Auswertefiles
 - Prozesskopplung ANSA / META / Solver / LS-Opt
- Ergebnisvisualisierung

Constellium: Strukturierung in 3 Kernbereiche



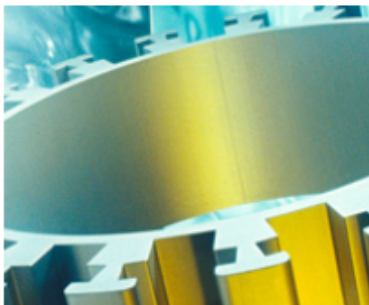
Aerospace and Transportation

- **€ 1.197 billion** in revenues
- **#1 worldwide** for aerospace plates
- **#1 in the USA** for large coils



Packaging and Automotive Rolled Products

- **€ 2.573*** billion in revenues
- **#1 worldwide** in closure stock
- **#2 in Europe** for can body stock and **#3 in North America**
- Major player in auto body sheet: **#4 worldwide**



Automotive Structures and Industry

- **€ 921 million** in revenues
- **#1 in Europe** for large profiles
- **#1 in Europe** for hard alloy extrusions
- **#2 worldwide** in crash management systems

* The combined unaudited pro forma revenue information for the year ended December 31, 2014 presented above gives effect to the acquisition of Wise as if it had occurred on January 1, 2014. This information is presented for information purposes only and does not purport to represent what Constellium actual revenues would have been had the acquisition occurred on the date indicated, nor is it necessarily indicative of future results.

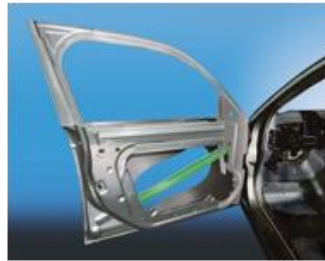
Constellium: Produkte Automotive Structures

Main products

Crash Management Systems
• ~ 70% of sales



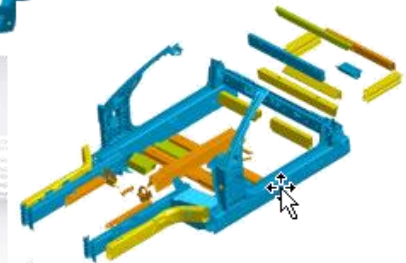
Side Impact Beams, other Safety Systems
• ~ 10% of sales



Cockpit carriers
• ~ 10% of sales

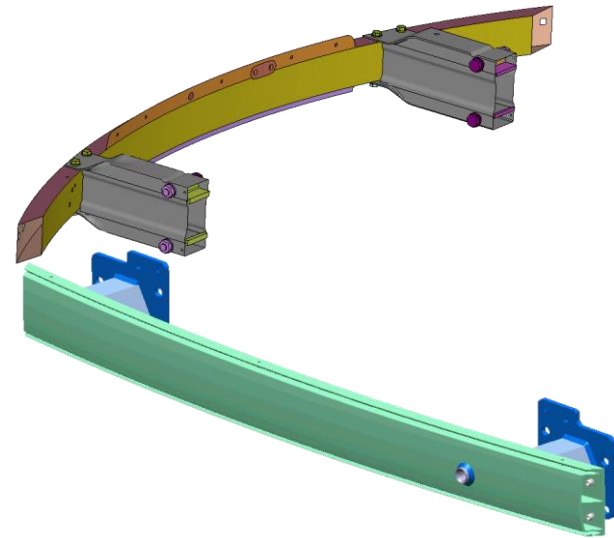


BIW Structural Parts
• ~ 10% of sales



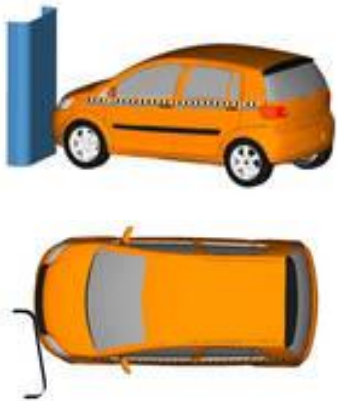
Crashmanagementsysteme & Anforderungen

- Crashmanagementsystem = auswechselbare Baugruppe
- Dient der Energieabsorption im Low-Speed-Crash
- Schützt die Rohkarosserie vor plastischer Verformung
- Aufnahme und Lasteinleitung beim Abschleppen
- Kosteneffizienz
- Funktionsintegrierte Leichtbauweise

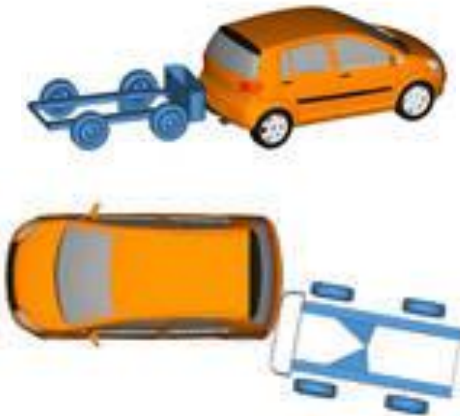


Lastfälle:

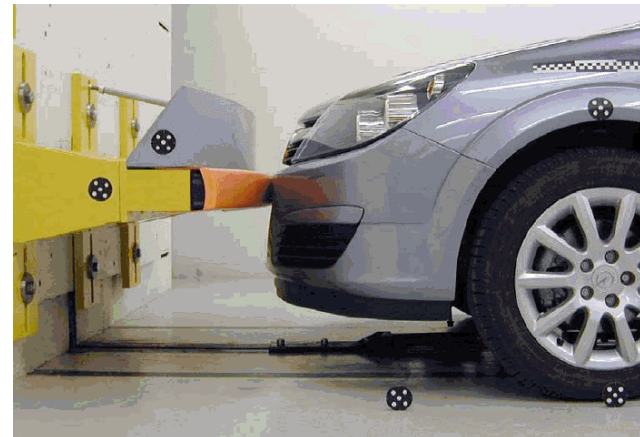
RCAR-Struktur Front:



RCAR-Struktur Heck:

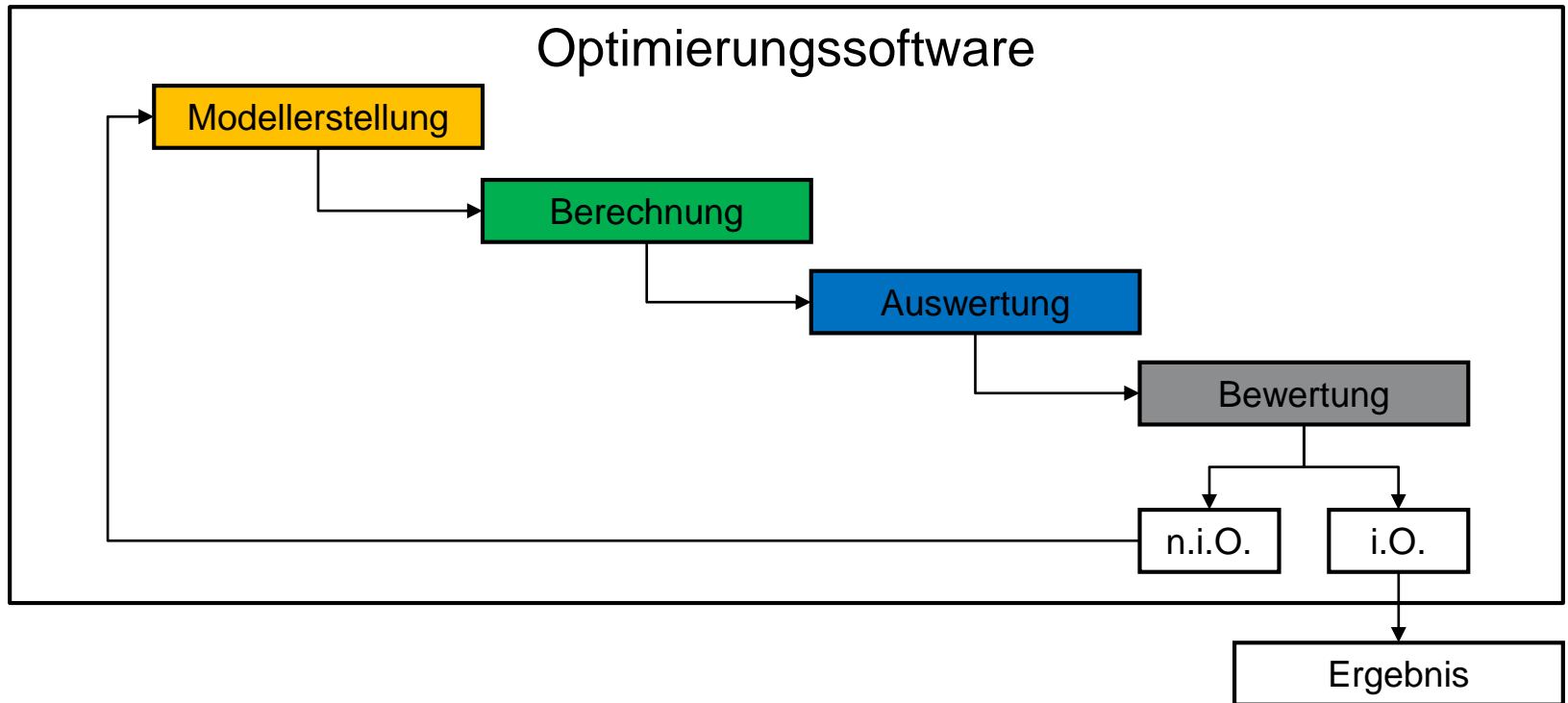


RCAR-Bumper Front & Heck:



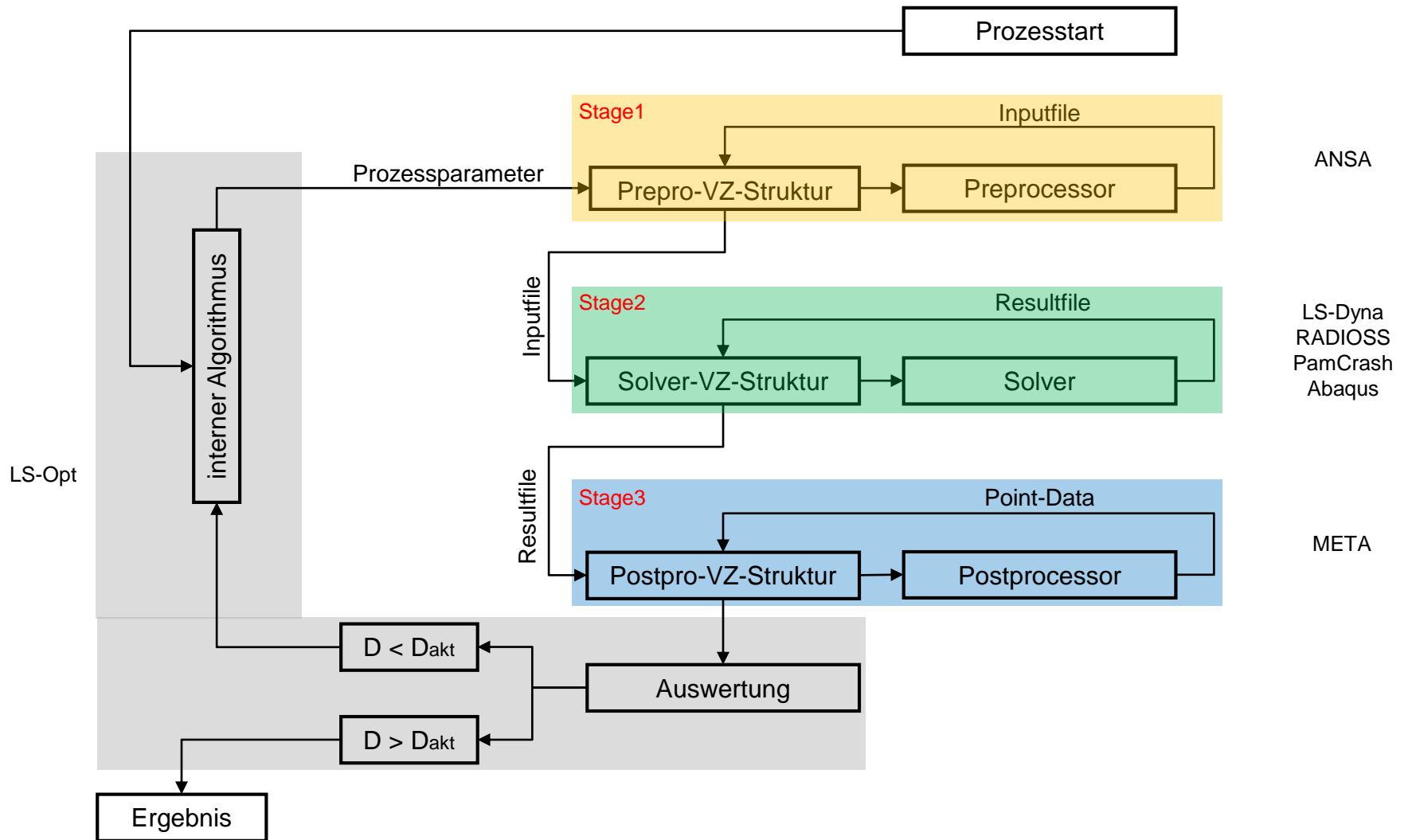
Optimierung = Automatisierung des FE-Arbeitsprozesses

→ Wie arbeitet ein Optimierungstool?

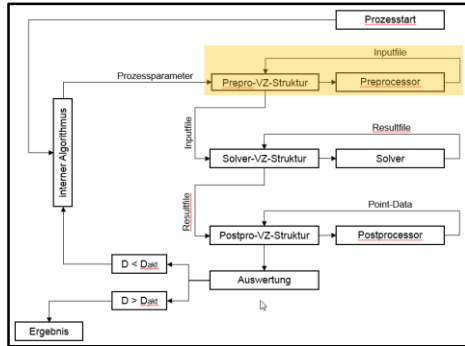


Signalverarbeitung & Datenfluss im Optimierungsprozess

→ Kommunikation zwischen Preprozessoren, Postprozessoren, Solvern & LS-Opt:

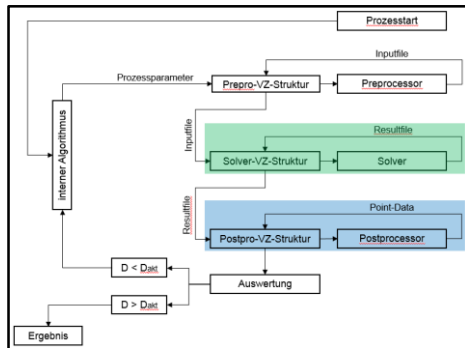
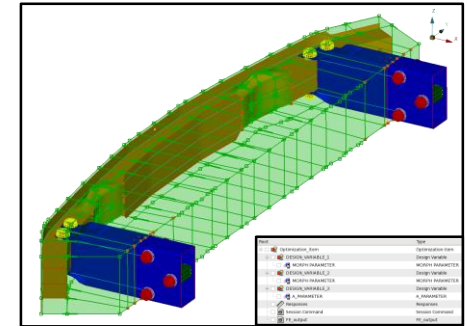


Arbeitsschritte beim Aufbau eines Optimierungsprozesses



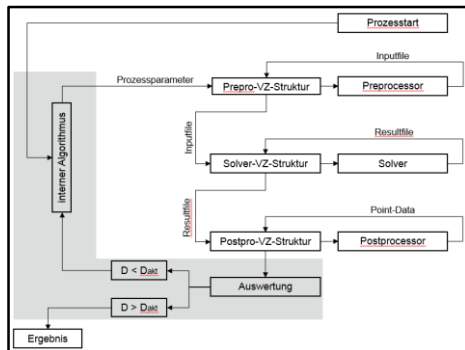
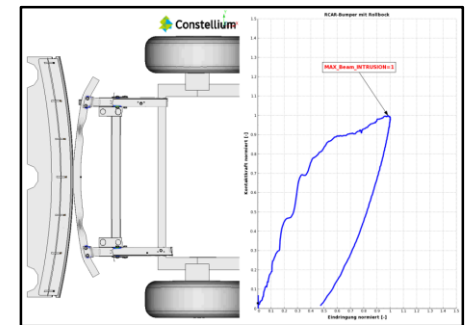
(1) Aufbereitung & Parametrisierung ANSA-File:

- Konstruktion & Anpassung Morphingboxen
- Morphingparameter (MP) & Optimization Task
- Nested Elements
- A_Parameter zur Definition von Wanddickenänderungen



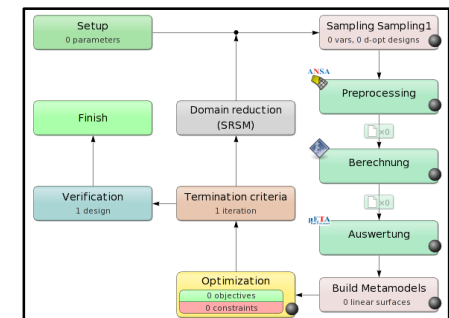
(2) Bereitstellung des META-Auswertefiles

- Lastfallberechnung "von Hand"
- Programmierung Sessionfile
- Erzeugung Diagramm-Annotations
- Optimizer-Setup



(3) Prozesskopplung ANSA / META / Solver / LS-Opt

- Stage-Setup, Startskripte & Kopplungsfiles
- Strategie, Optimierungsziel & Randbedingungen



Aufbereitung & Parametrisierung ANSA-File

ANSYS v15.3.2 64-bit (/home/kutschc/LSOPT_PPT_20160229/Animationen/MORPH1_Boxmorphing.ans)

File Windows Containers Tools Utilities Assembly Help

Database

| Name | Number |
|---------------------|--------|
| ANSAPART | 1 |
| ASSIGN_VAL_TO_FIELD | 44 |
| A_PARAMETER | 29 |
| CONTACT | 4 |
| CUTTING_SURFACE | 17 |
| DEPENDENCY | 6 |
| EDGEF | |
| ELEMENT | 67353 |
| GEOMETRY | 7 |
| MATERIAL | 6 |
| NOE | 68379 |
| OPTIMIZATION_TASK | 1 |
| PROPERTY | 83 |
| SET | 30 |
| SOLIDFACET | |
| STEP | 2 |

MORPH1_Boxmorphing.ans, Current Part: MORPH1_Boxmorphing

Sweep - Glide

Guideline
Cross-section
Box creation

Define the Sweep/Glide guideline

Curves
 Points

< Back Next > Cancel

→ **Konstruktion & Anpassung Morphingboxen**

New>Sweep/Glide Select CURVE,EDGE,SOLID,EDGEF

Current distortion distance: 20% (old: 20%)
Current distortion angle: 0 (old: 0)
LS-Dyna definition style for current SECTION

Geo. FE-M. Volu. Grids Cross. Conn.

Faces Cross. Perim. Perim. Slice Doubl. Triple

Box Srad. Hatch

Auxil. Pair Ls Curve W.K.F.

Modules Buttons

Boxes

New Offset Links
2D Morph 1D Morph Cylindrical
Split Convert Release
Load Delete Unhide

Controls Parameters
History Nestec Deform Map

Control Points Info
Insert Number Rem Double
Delete

Edges Info
Tangency Concentric ToCurve

Hatches Info
Join Paste Topo
Adjust ToFace

Box Morphing
Move Ht Slide
Extend Angle Offset
Project Direct Cylindrical

Direct Morphing
Direct Create Holes
Slide DFM Normal/Real

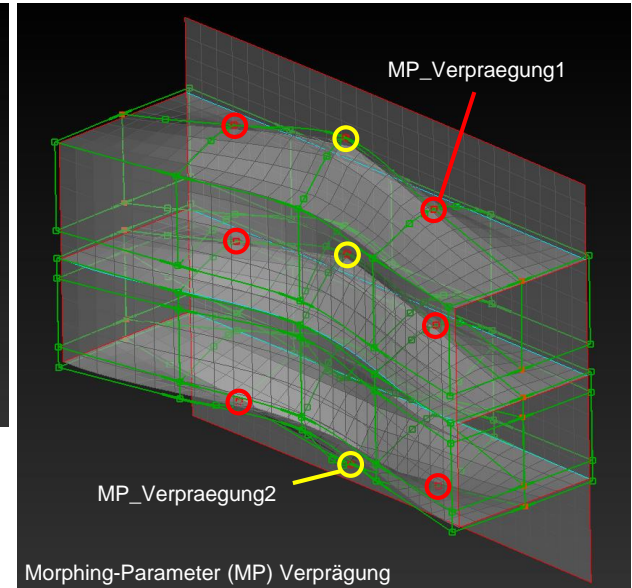
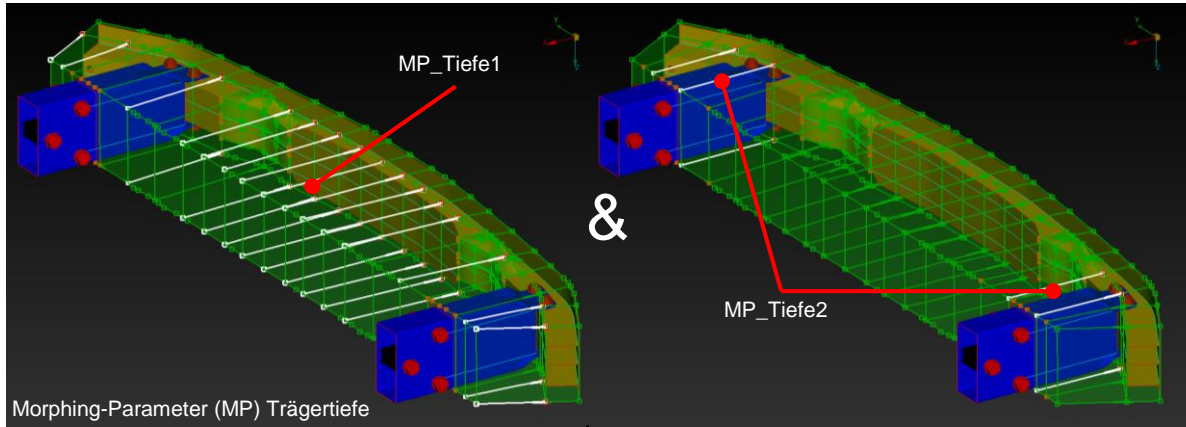
Checks Geometry Check
Not Loaded Intersecting ele. Distorted morph

Options List

| View mode | Toog |
|-----------|-------------------------------------|
| Preview | <input checked="" type="checkbox"/> |

Aufbereitung & Parametrisierung ANSA-File

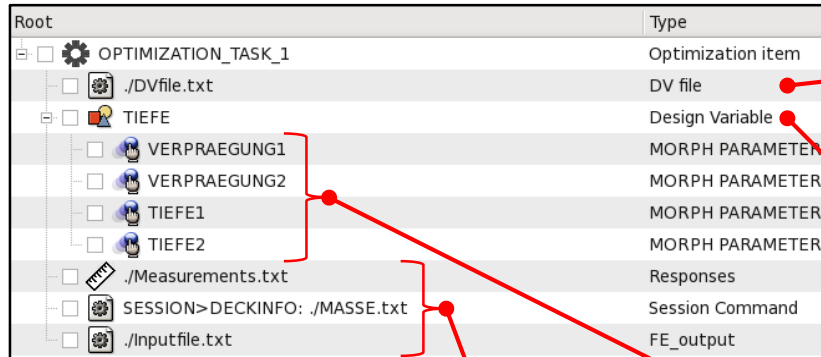
→ Morphingparameter & Optimization Task



| Root | Type |
|-------------------------------|-------------------|
| OPTIMIZATION_TASK_1 | Optimization item |
| ./DVfile.txt | DV file |
| TIEFE | Design Variable |
| VERPRAEGUNG1 | MORPH PARAMETER |
| VERPRAEGUNG2 | MORPH PARAMETER |
| TIEFE1 | MORPH PARAMETER |
| TIEFE2 | MORPH PARAMETER |
| ./Measurements.txt | Responses |
| SESSION>DECKINFO: ./MASSE.txt | Session Command |
| ./Inputfile.txt | FE_output |

Aufbereitung & Parametrisierung ANSA-File

→ Morphingparameter & Optimization Task



Kopplungsfile

```
#
# DV-File.txt
#
# DESIGN VARIABLES
#-----
# ID      DESIGN_VARIABLE_NAME  TYPE  RANGE  CURRENT VALUE  MIN VALUE  MAX VALUE
#-----
# 1,      TIEFE,                    REAL,  BOUNDS, 0.,      -5.,      18.5
```

DESIGN VARIABLE [DESIGN_VARIABLE]

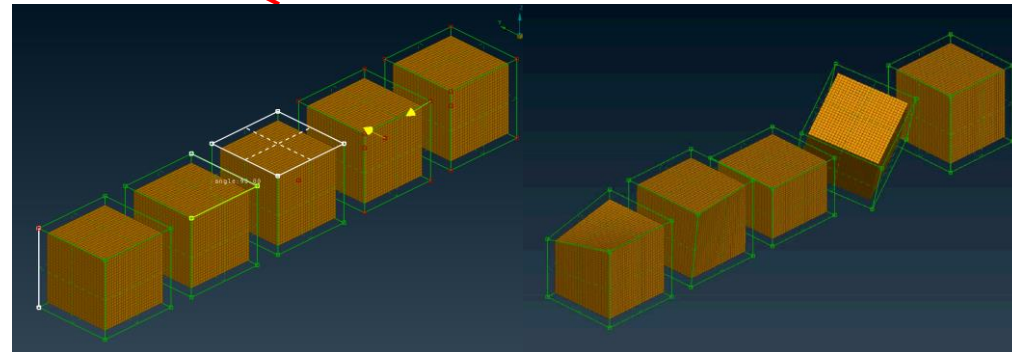
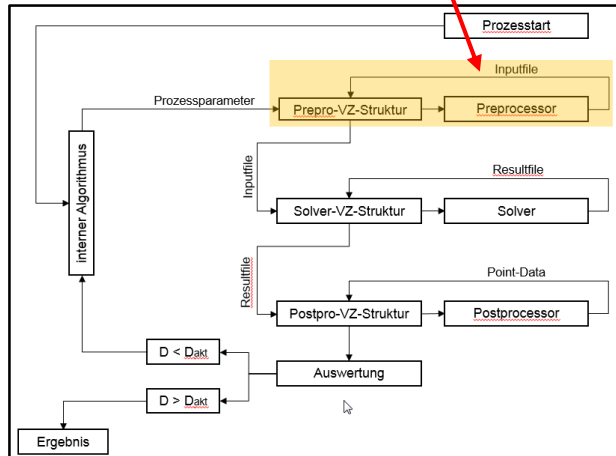
Name: TIEFE

| ID | TYPE | RANGE |
|-----------|---------------|-----------|
| 1 | REAL | BOUNDS |
| Min Value | Current Value | Max Value |
| MIN | AKT | MAX |

Comment: AKT

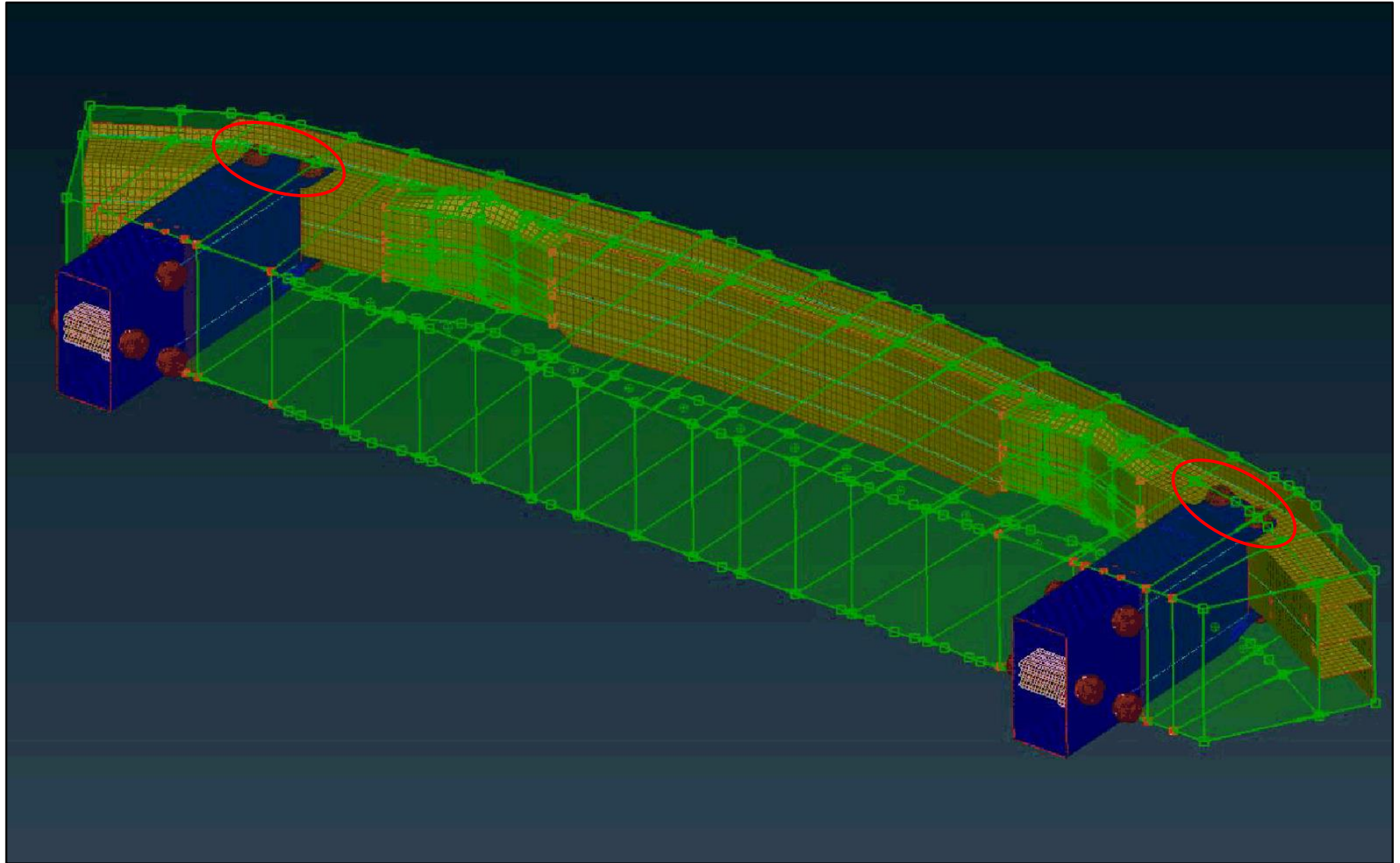
OK **= ÄNDERUNGSBETRAG** Cancel

Kopplungsfiles



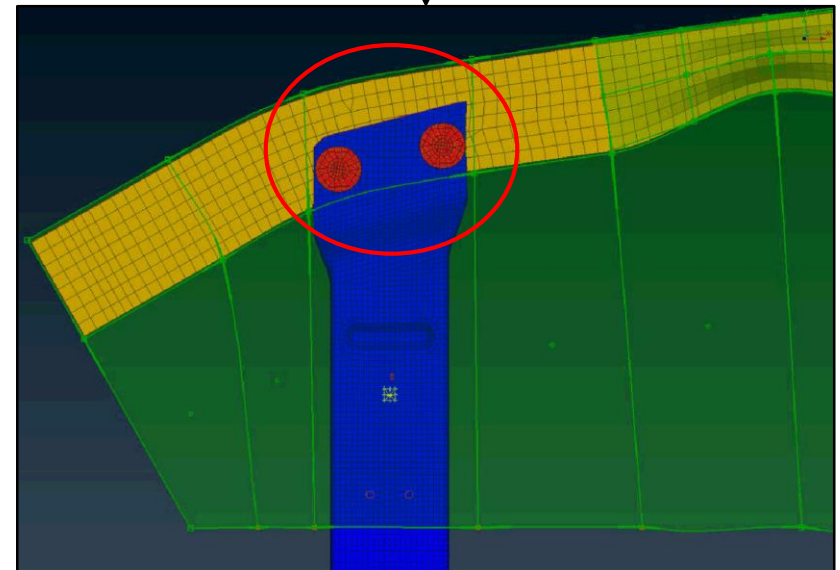
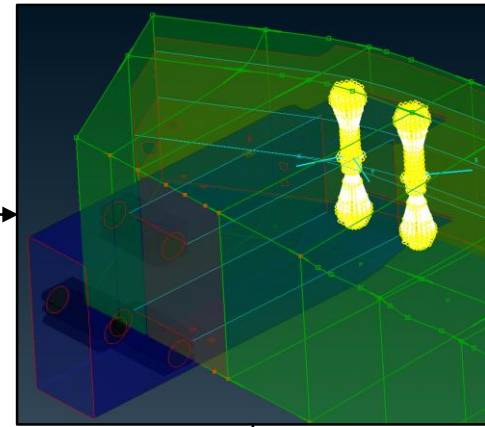
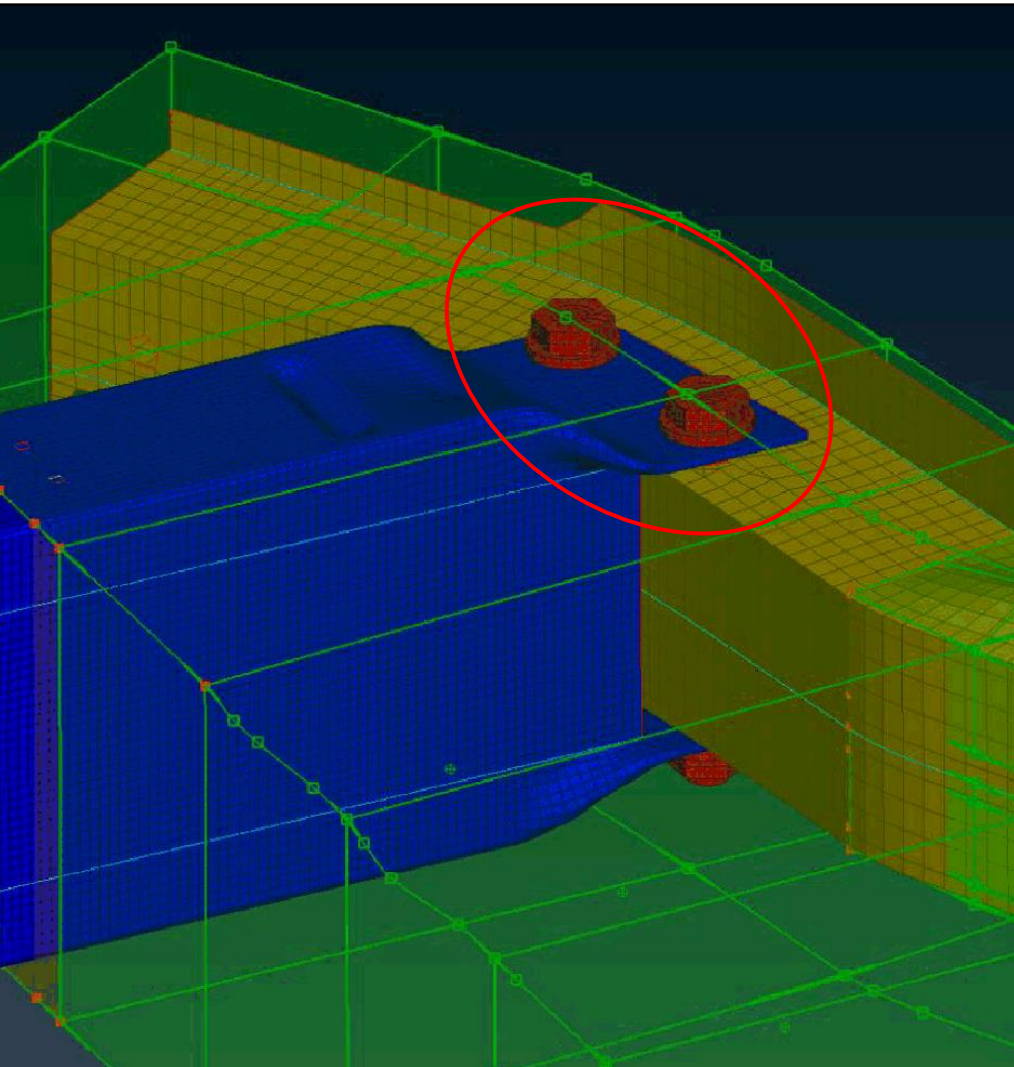
Aufbereitung & Parametrisierung ANSA-File

→ Morphingparameter & Optimization Task



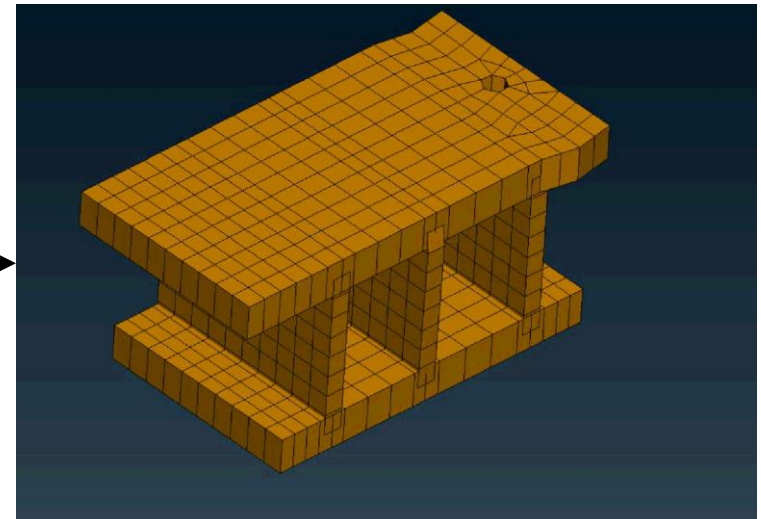
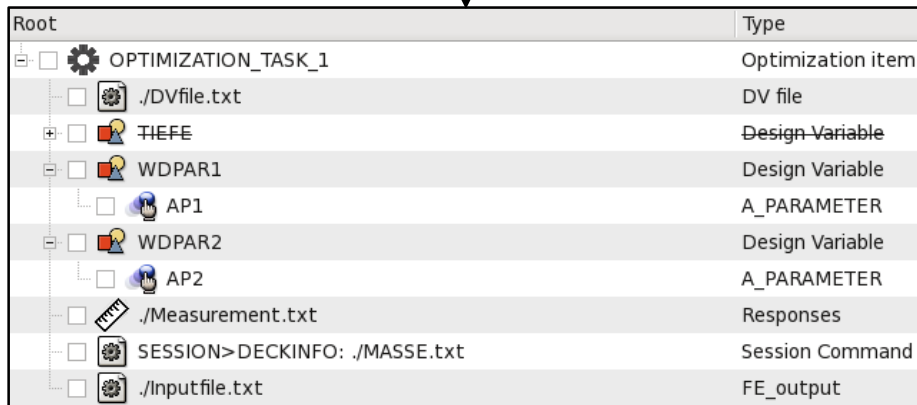
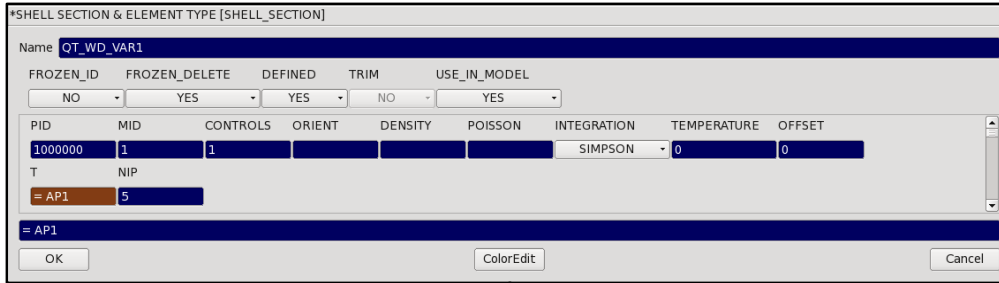
Aufbereitung & Parametrisierung ANSA-File

→ Nested Elements



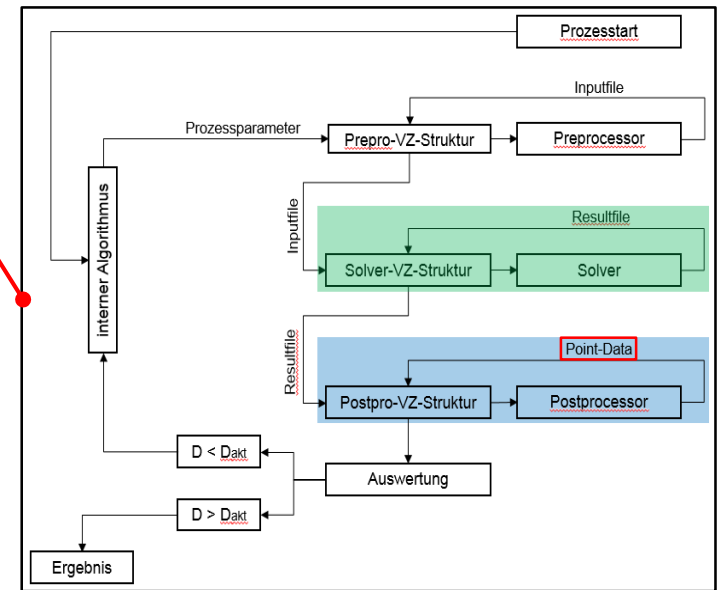
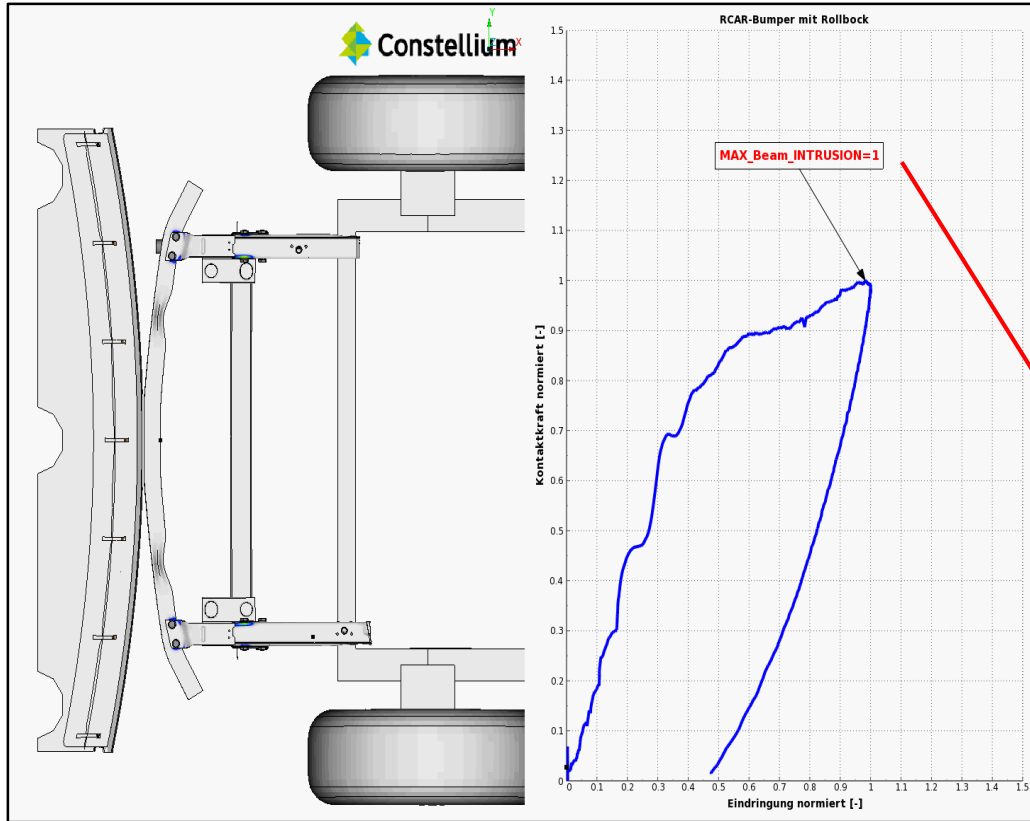
Aufbereitung & Parametrisierung ANSA-File

→ A_Parameter zur Definition von Wanddickenänderungen



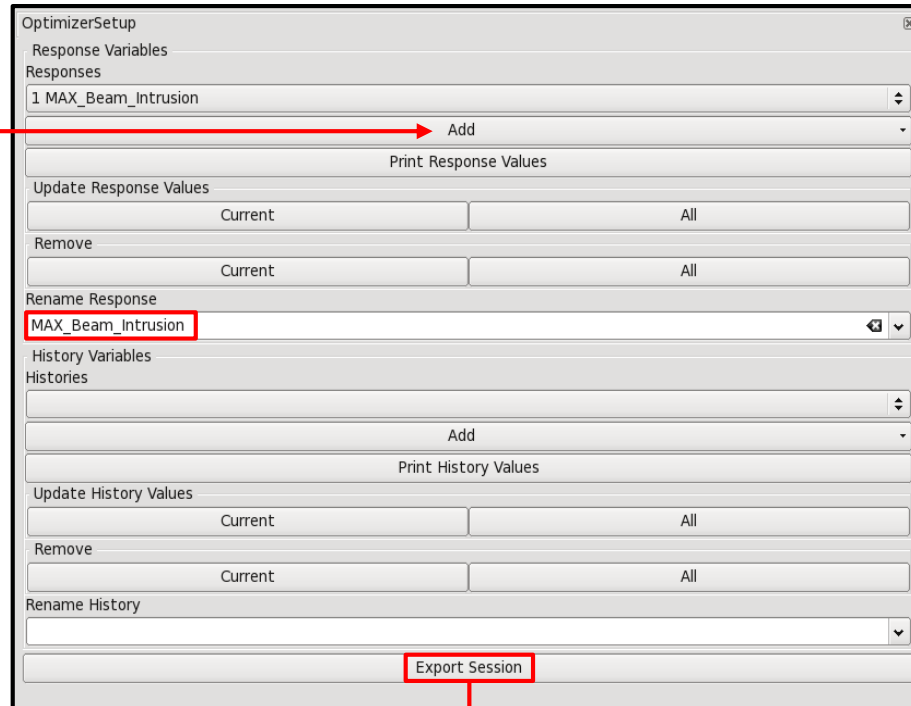
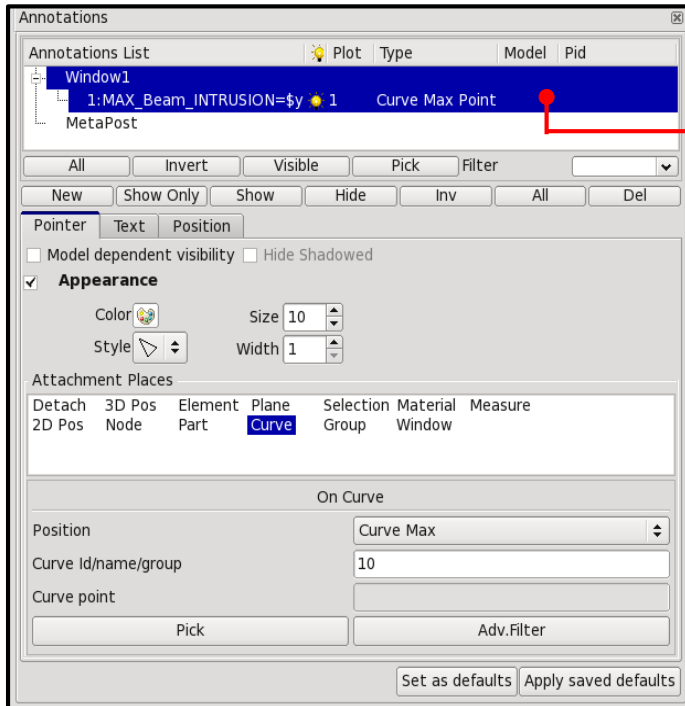
Bereitstellung der META-Auswertefiles

- Lastfallberechnung “von Hand”
- Programmierung Sessionfile
- Erzeugung Diagramm-Annotations
- Optimizer-Setup



Bereitstellung der META-Auswertefiles

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Kopplungsfiles:

- sessionfile.ses
- sessionfile.ses.results

Prozesskopplung ANSA / META / Solver / LS-Opt

→ Stage-Setup, Startskripte & Kopplungsfiles

Stage Preprocessing

Setup Parameters Histories Responses File Operations

General

Package Name ANSA

Command startbefehl_ANSA + Optionen (z. B. "lm_retry" bei Lizenzmangel) Browse

Do not add input file argument

DV File DV-File.txt Browse

copies DV-File.txt (0 includes) to Preprocessing/it.run/ANSAOpt.inp and substitutes parameters

Extra input files

Model Database ansafile.ansa Browse

Execution

Resources

| Resource | Units per job | Global limit | Delete |
|----------|---------------|--------------|--------|
| ANSA | 1 | 1 | x |

[Create new resource](#)

Use Queuing
 Use LSTCVM proxy
 Environment Variables
 Run Jobs in Directory of Stage

OK

Measurements.txt
Masse.txt

```
#!/bin/bash
Startbefehl + Optionen Solved UserOpt.inp
while [ ! -f UserOpt.sta ]
do
    sleep 10
    if cat UserOpt.sta | grep "THE ANALYSIS HAS COMPLETED SUCCESSFULLY" ; then
        echo 'W o r k a l l'
    else
        echo 'E r r o r'
    fi
done
```

Stage Berechnung

Setup Parameters Histories Responses File Operations

General

Package Name User-Defined

Command /solverskript.sh Browse

Do not add input file argument

Input File inputfile.txt Browse

copies Inputfile.txt (0 includes) to Berechnung/it.run/UserOpt.inp and substitutes parameters

Extra input files

Execution

Resources

| Resource | Units per job | Global limit | Delete |
|------------|---------------|--------------|--------|
| Berechnung | 1 | 1 | x |

[Create new resource](#)

Use Queuing
 Use LSTCVM proxy
 Environment Variables
 Run Jobs in Directory of Stage

OK

Stage Auswertung

Setup Parameters Histories Responses File Operations

General

Package Name METAPost

Command startbefehl_META Browse

Session File sessionfile.ses Browse

Output File sessionfile.ses.results Browse

Database File Browse

Execution

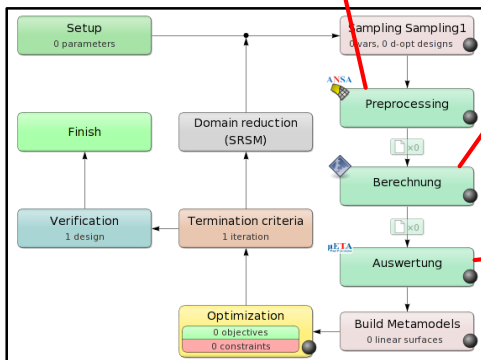
Resources

| Resource | Units per job | Global limit | Delete |
|----------|---------------|--------------|--------|
| METAPost | 1 | 1 | x |

[Create new resource](#)

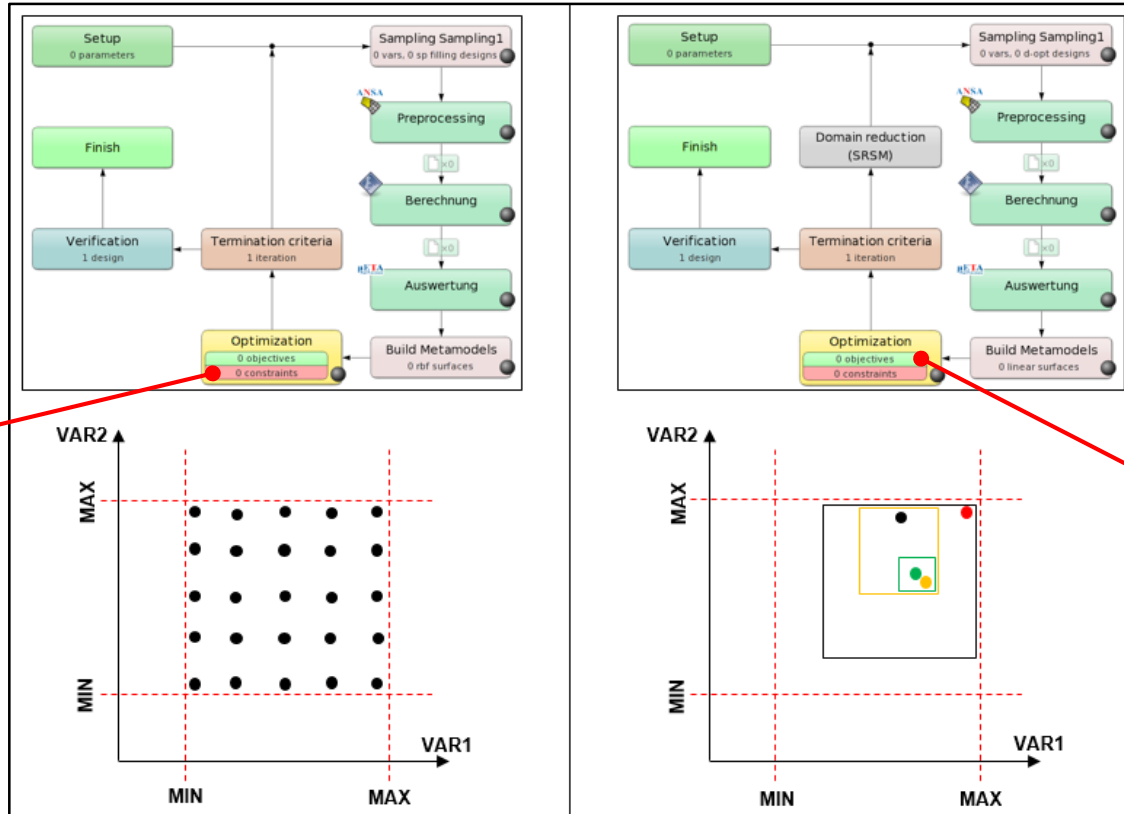
Use Queuing
 Use LSTCVM proxy
 Environment Variables
 Run Jobs in Directory of Stage

OK



Prozesskopplung ANSA / META / Solver / LS-Opt

→ Strategie, Optimierungsziel & Randbedingungen

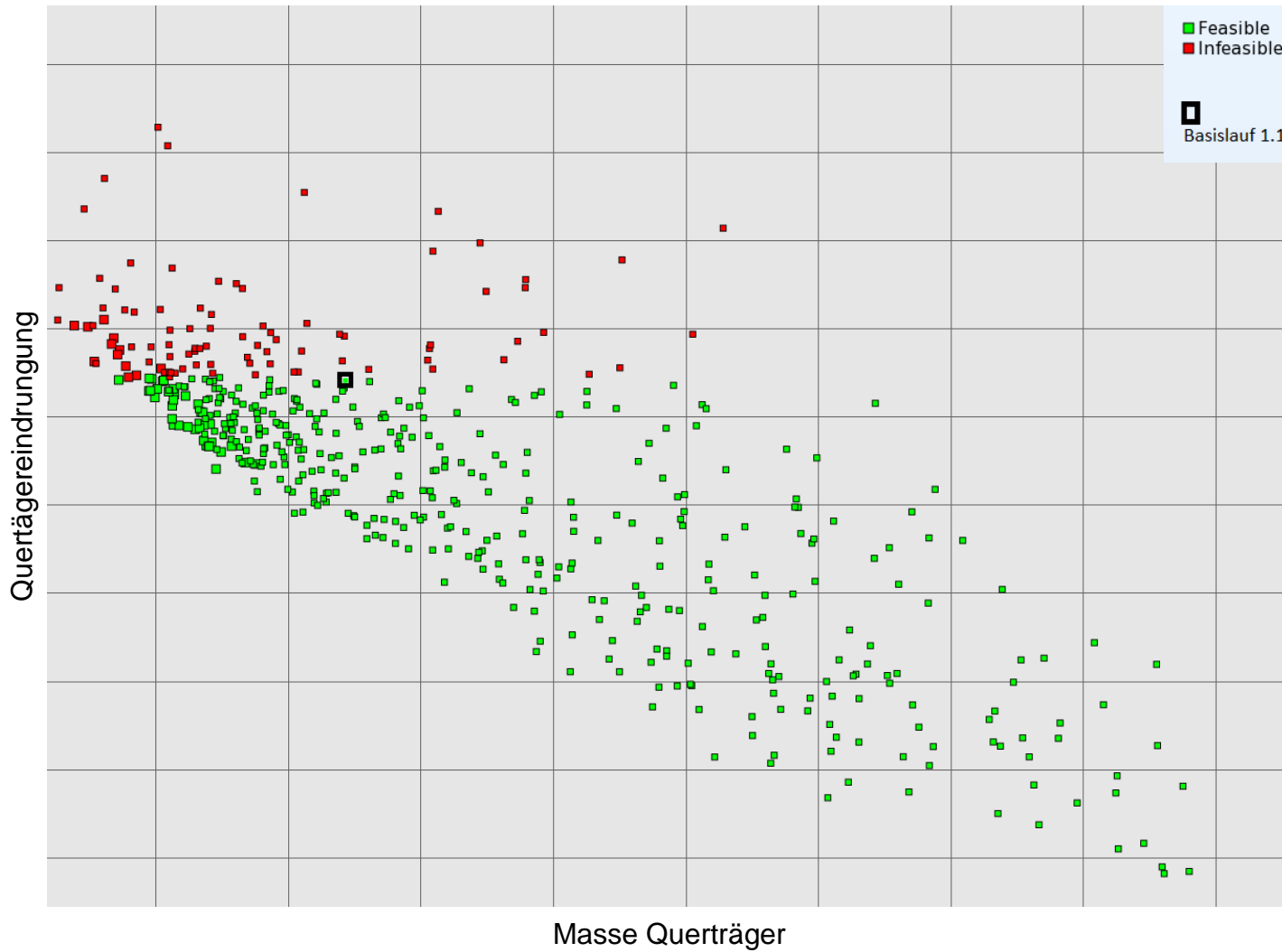


MAX_Beam_Intrusion

Reduktion MASSE

Ergebnisvisualisierung

→ Beispiel Scatterplot RCAR-Bumper mit LS-Opt-Viewer





Constellium

website: www.constellium.com