

Optimal milling data preparation for draw dies



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- Introduction to the process for tail gate inner
- Tool modification for milling data preparation



- Outlook, '**ultra light**' stamping die
- Summary

Sheet metal

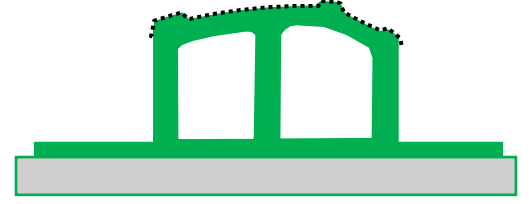
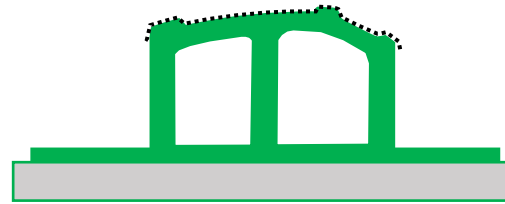
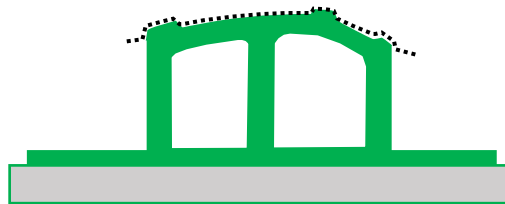
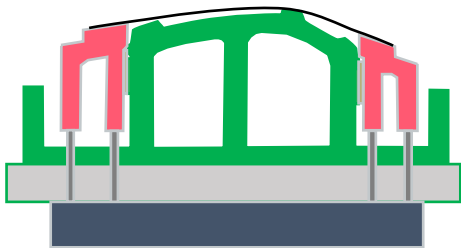
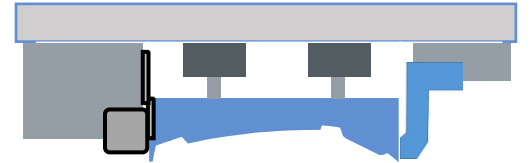
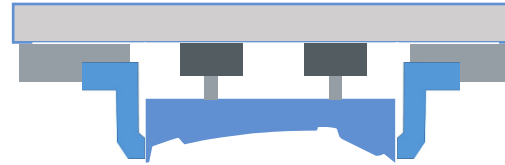
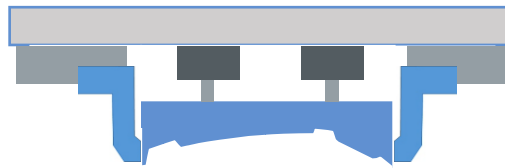
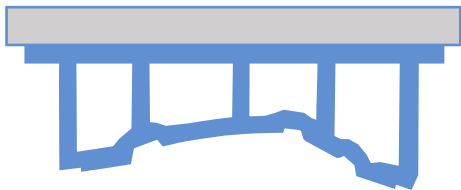
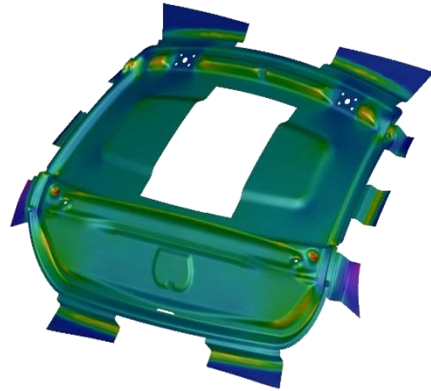
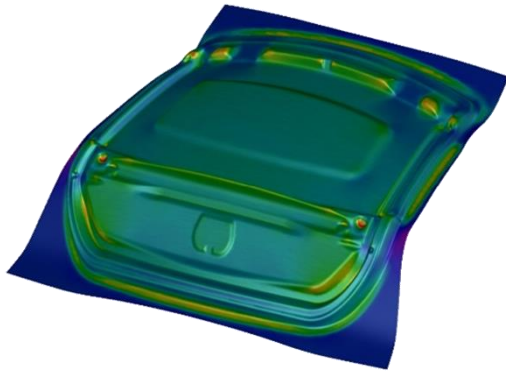
Tools

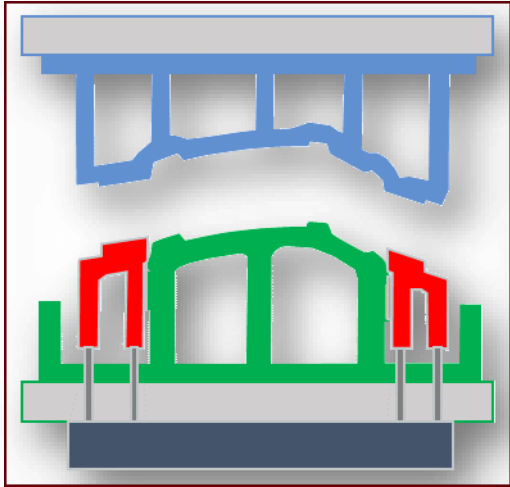
Draw

Trim

Trim

Form & Trim





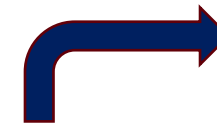
Tool Design



CNC Programming



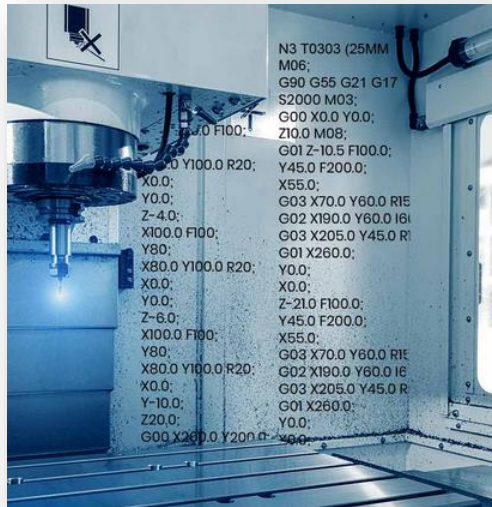
Milling



Verification



Corrections





Scaling

Compensation

Die-spotting

Over-crowning

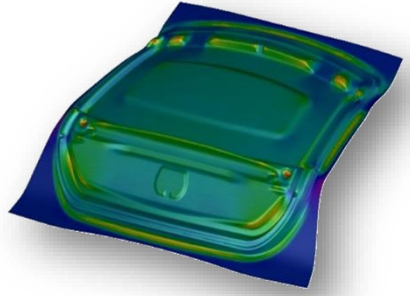
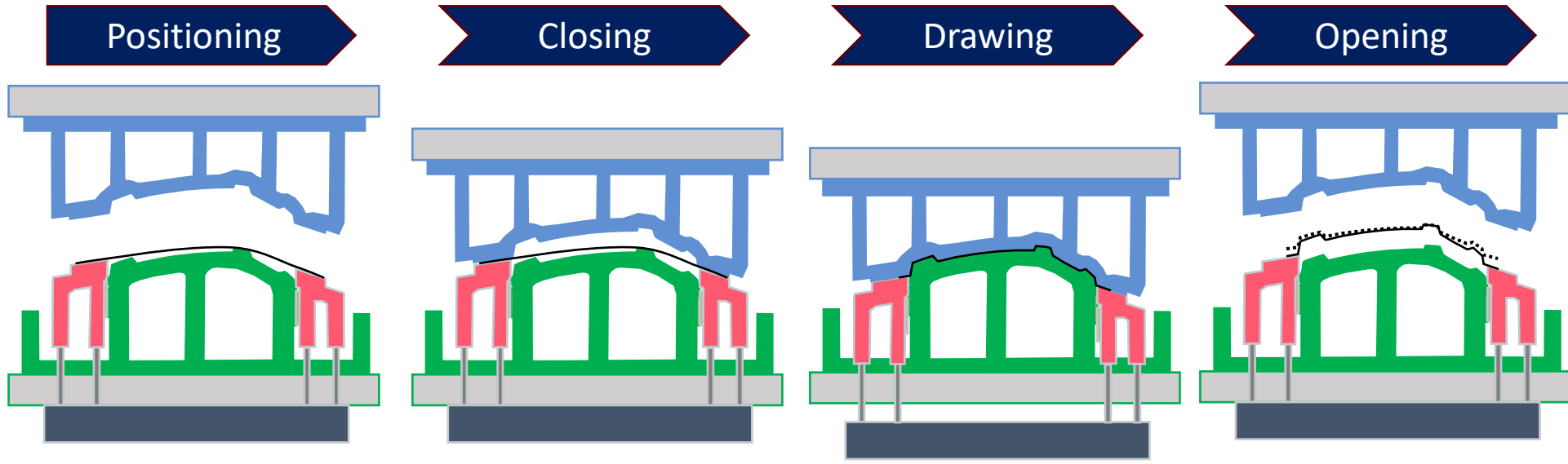
Tool Design

Optimization

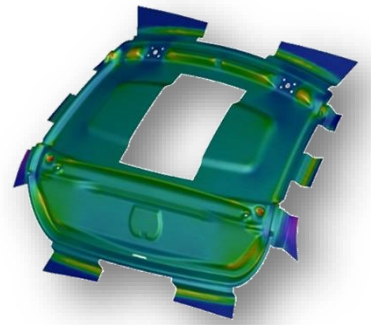
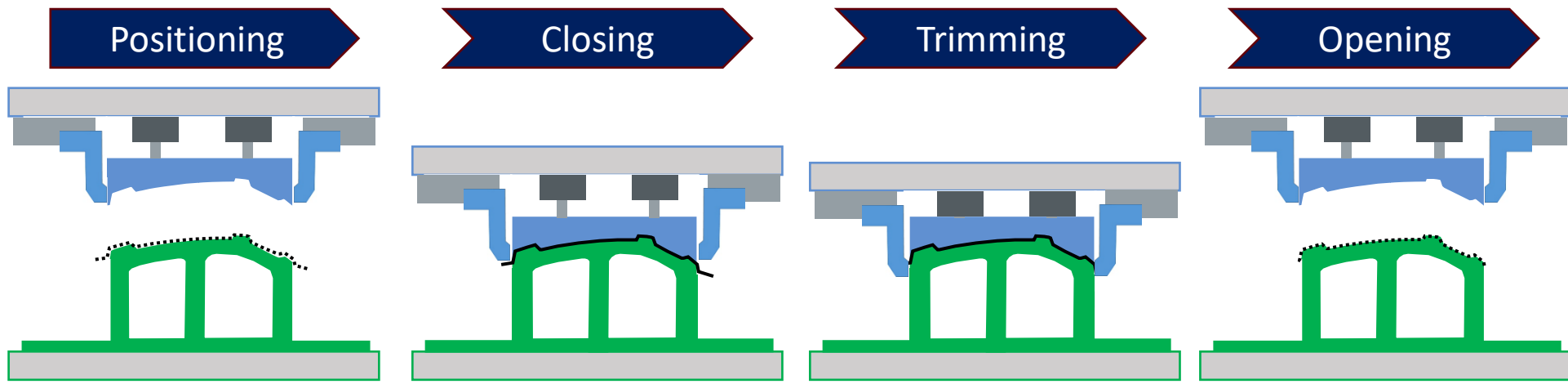
Corrections

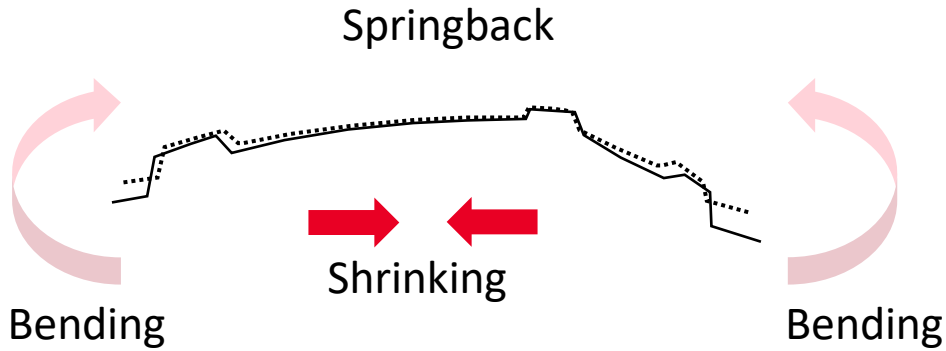


Draw Operation D20

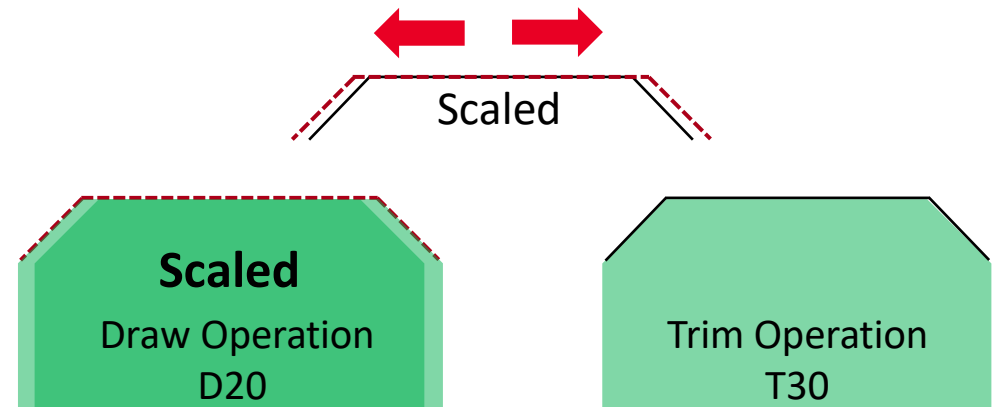
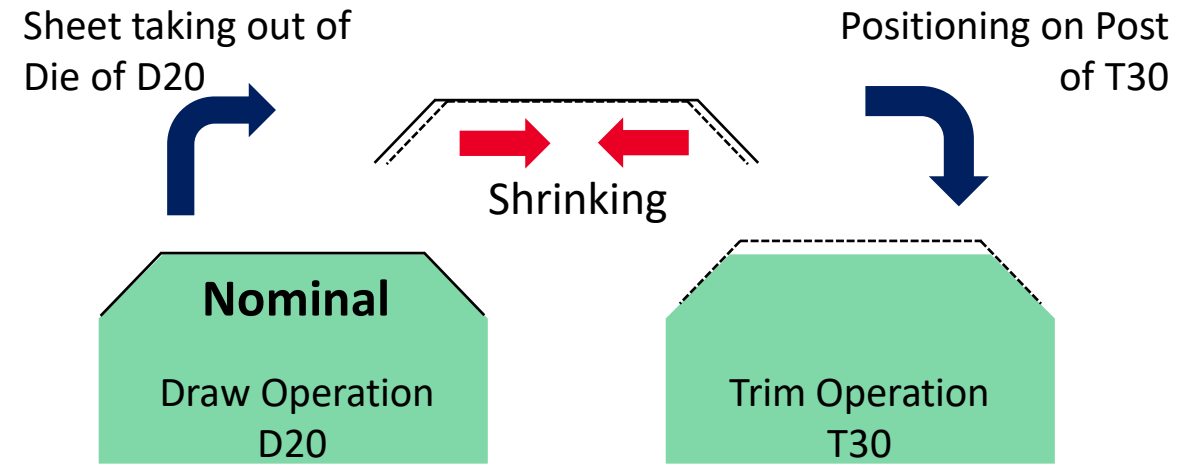
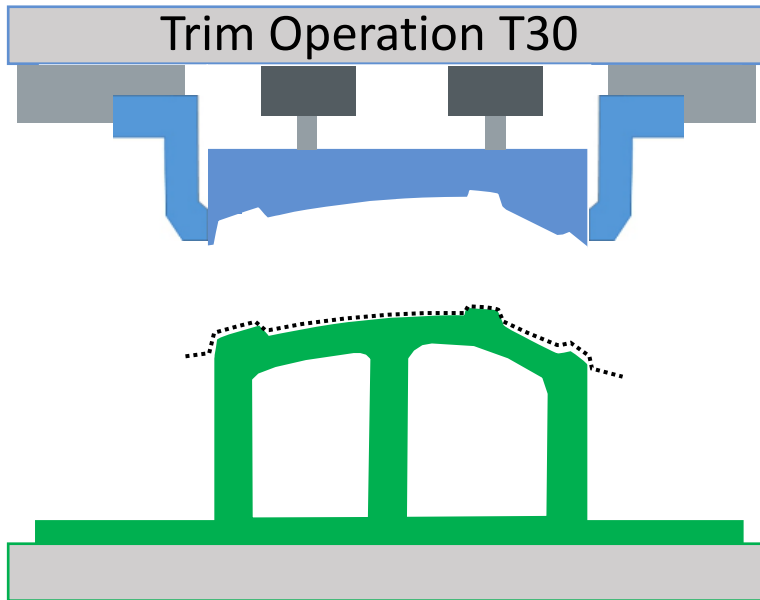


Trim Operation T30





Due to shrinkage of the part when taking out of D20, it doesn't properly fit on the post of T30



with **scaled** Draw die D20

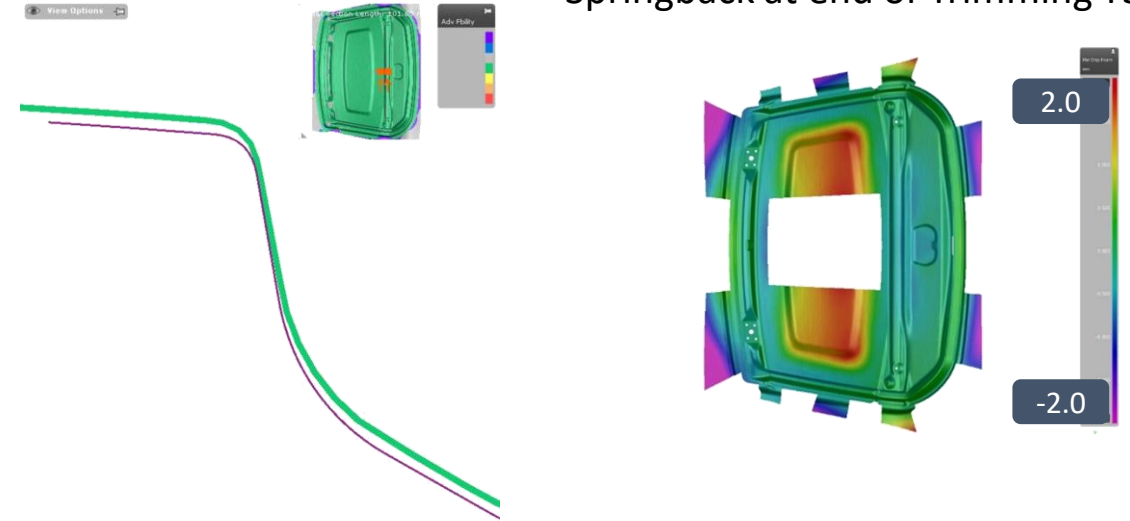
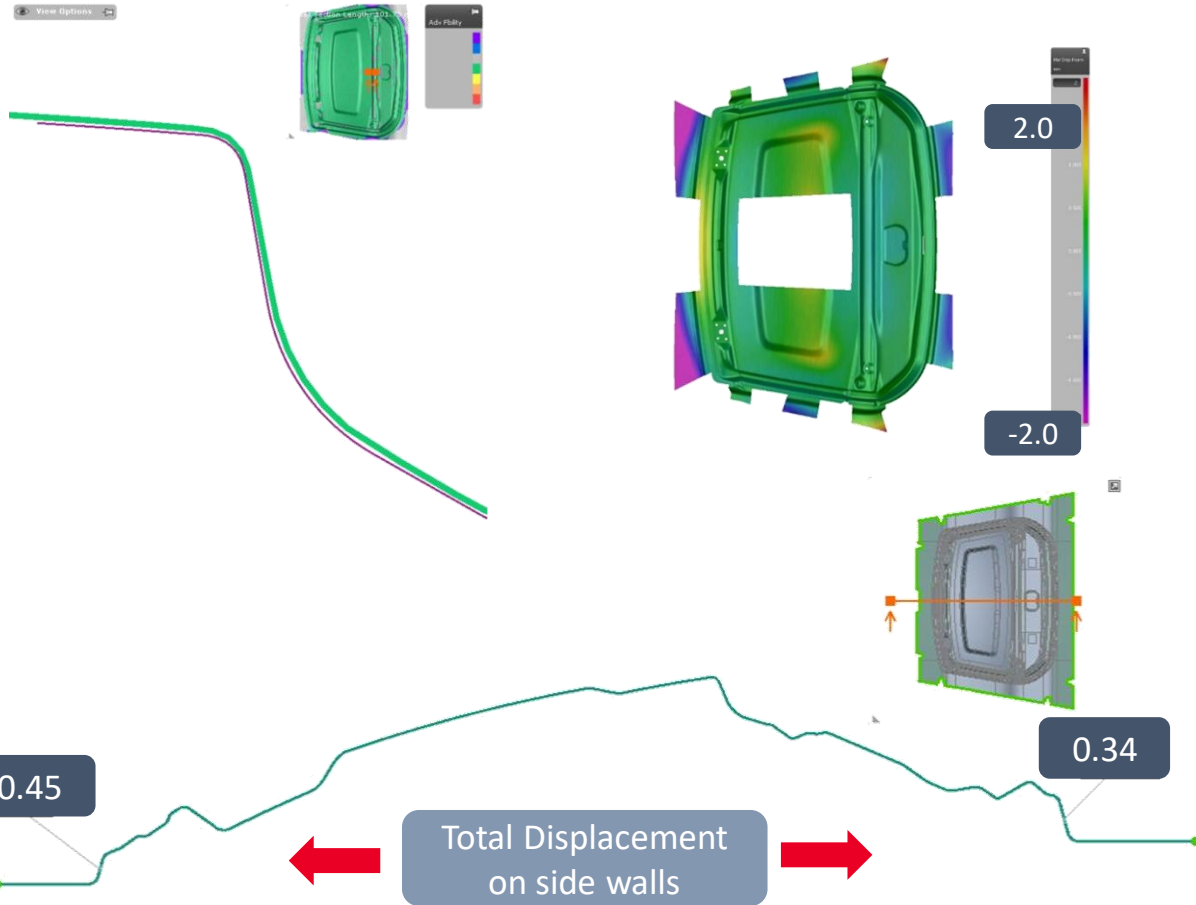
with **nominal** Draw die D20

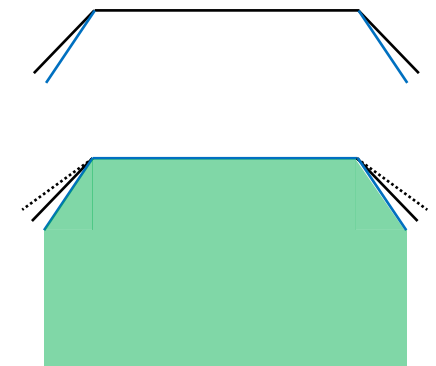
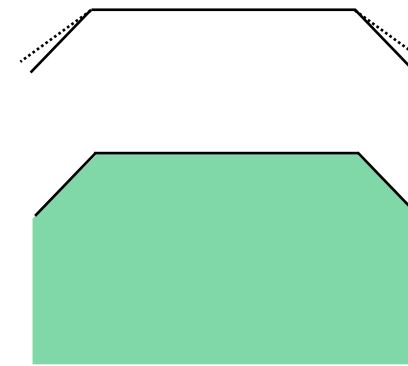
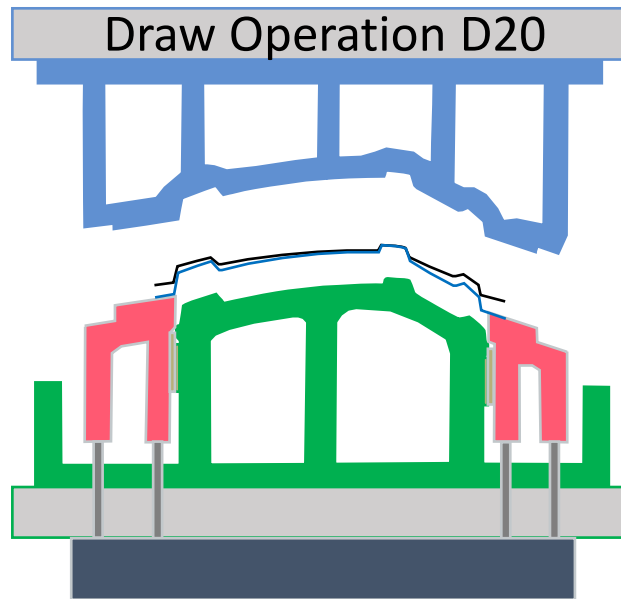
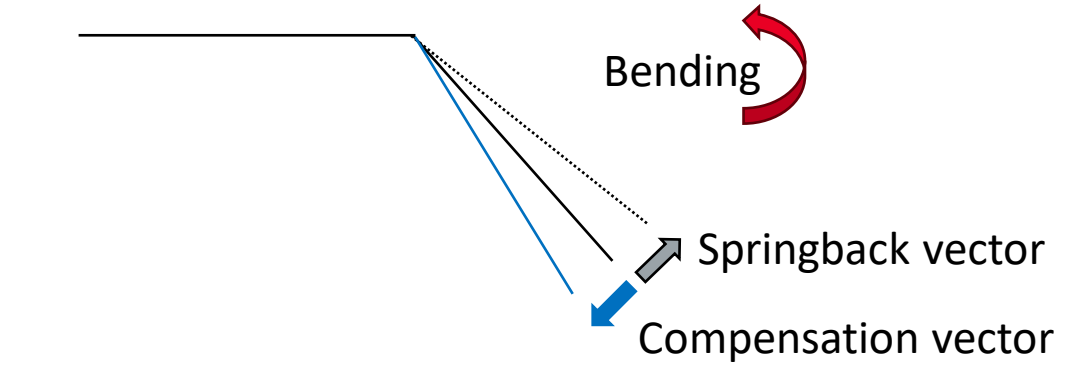
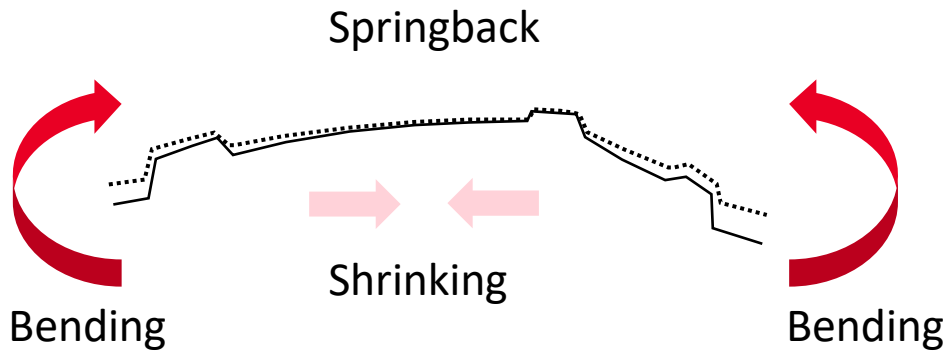
Positioning of sheet on T30 post

Positioning of sheet on T30 post

Springback at end of Trimming T30

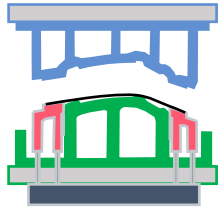
Springback at end of Trimming T30



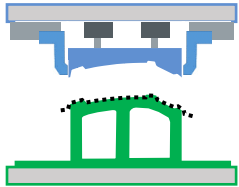


Compensation

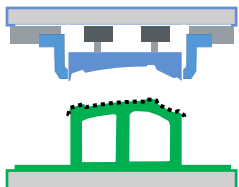
Draw



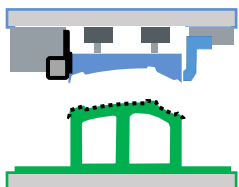
Trim



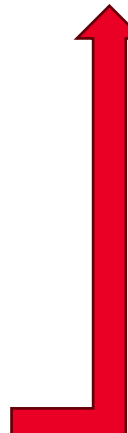
Trim



Form & Trim



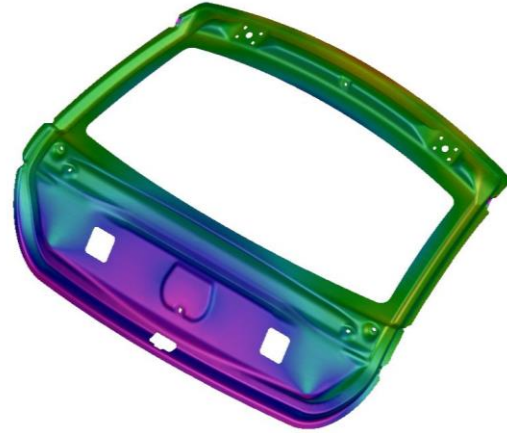
Springback



Compensation

Nominal

Distance from Reference



1.0

0.0

-1.6

Compensated

Distance from Reference

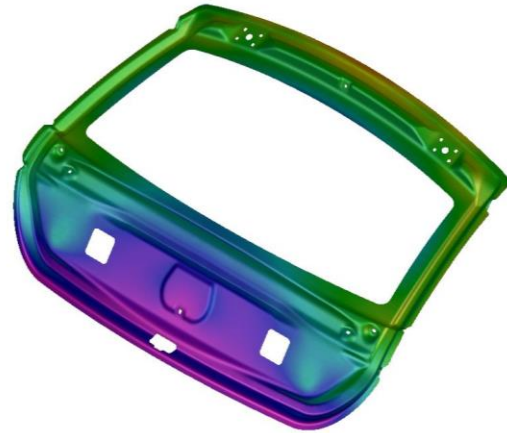


1.0

0.0

-1.6

Material Displacement



1.0

0.0

-1.6

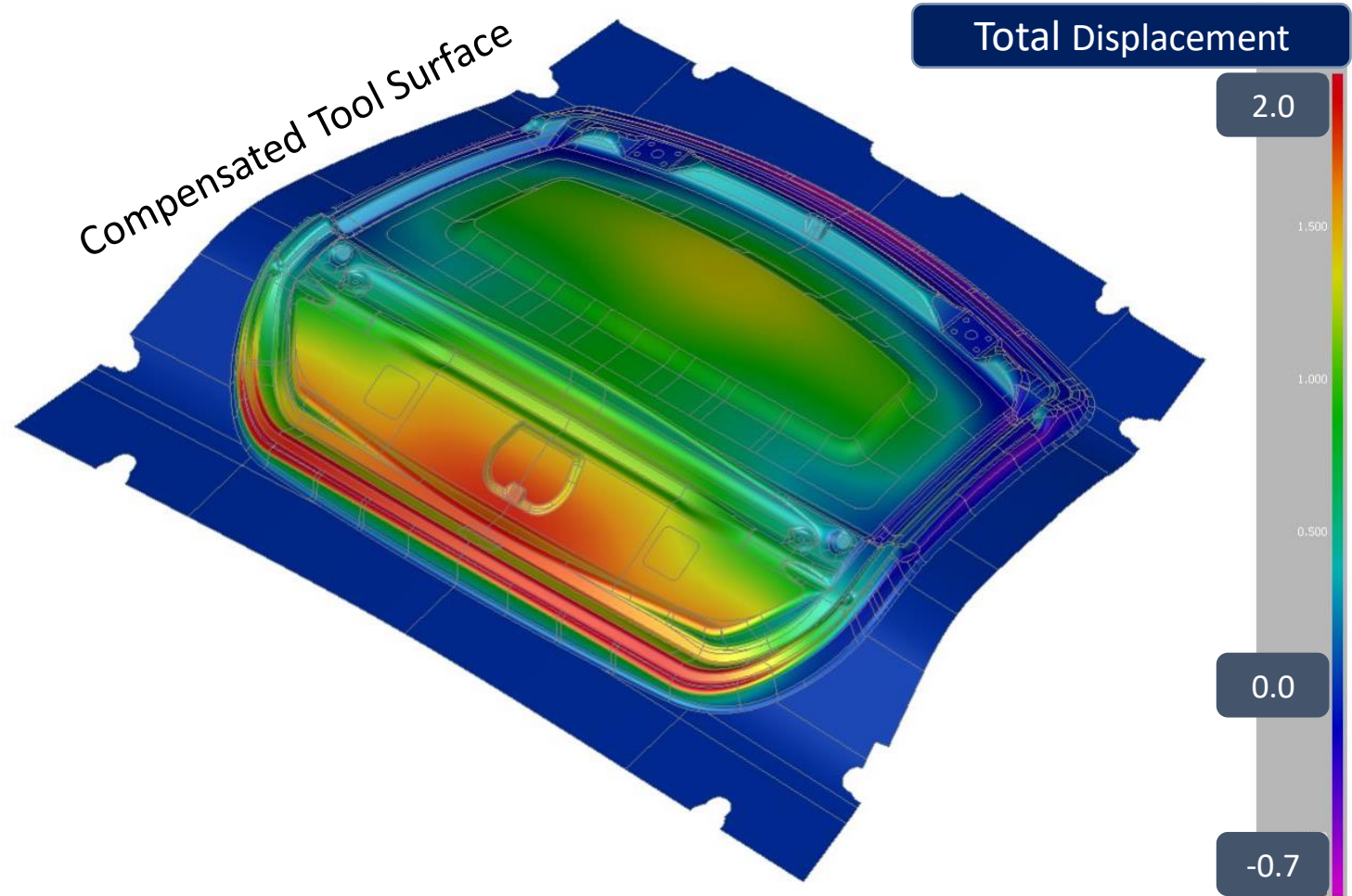
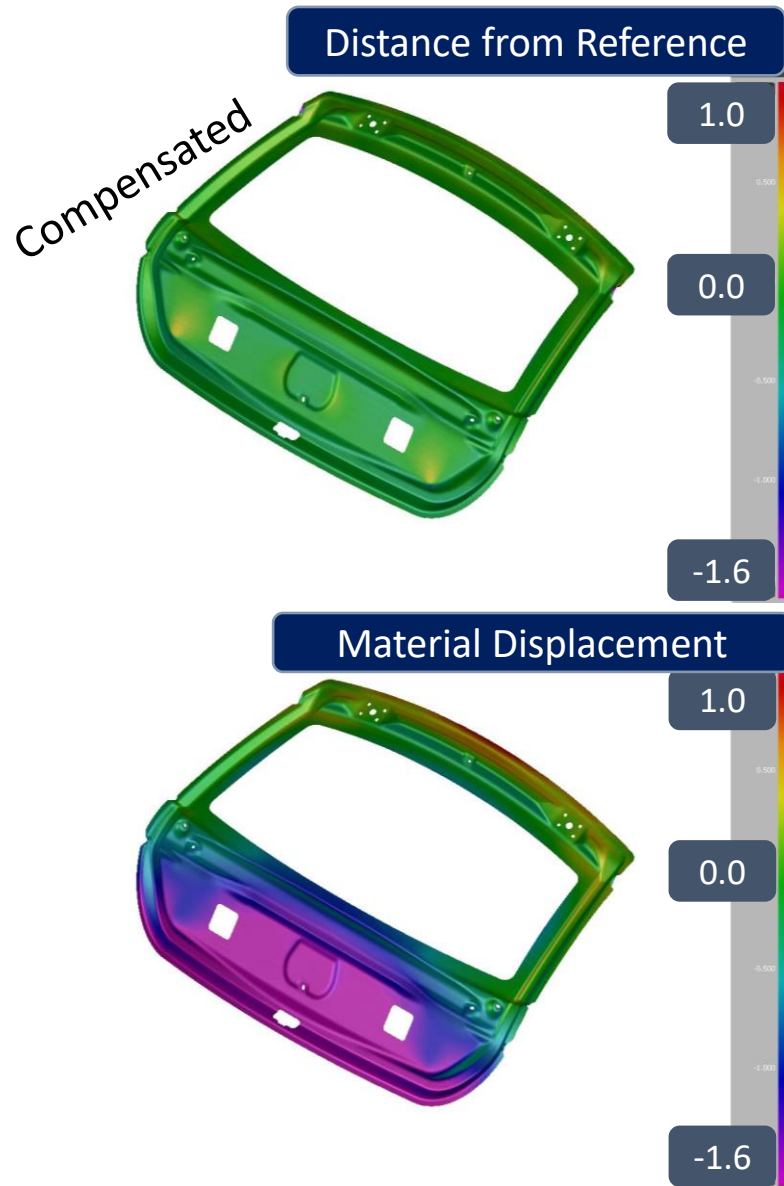
Material Displacement



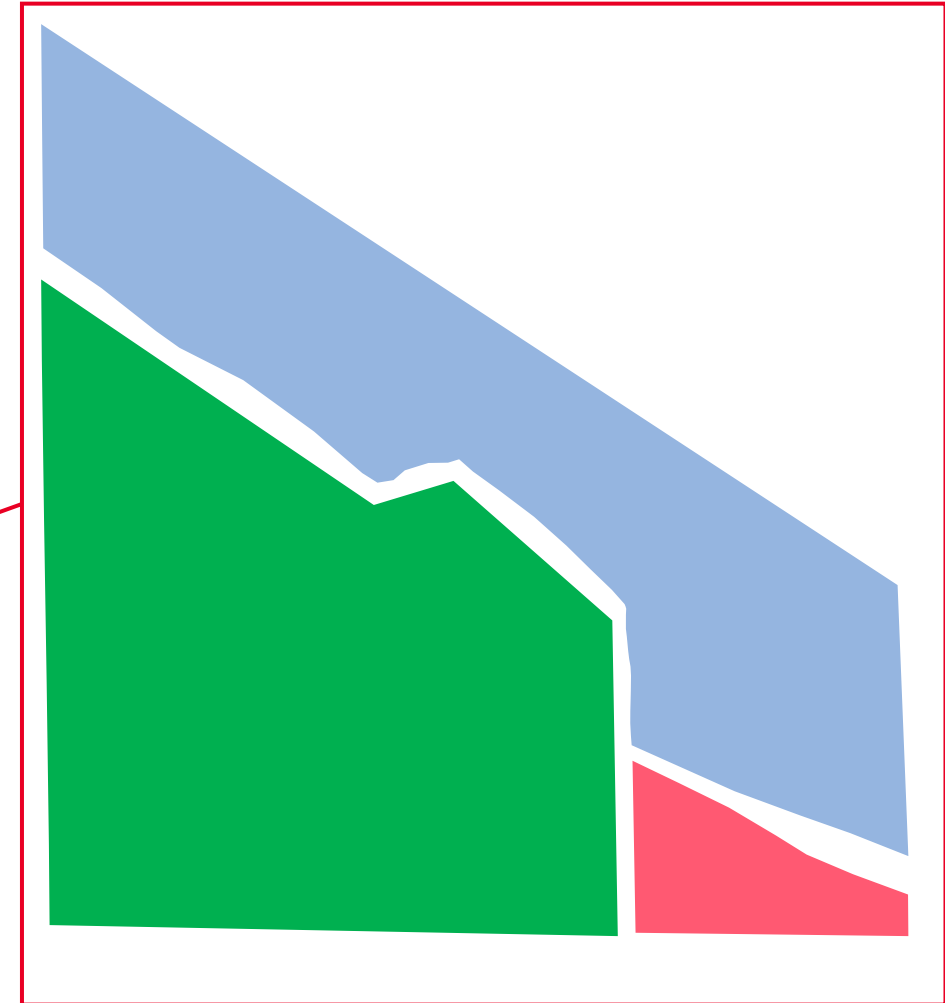
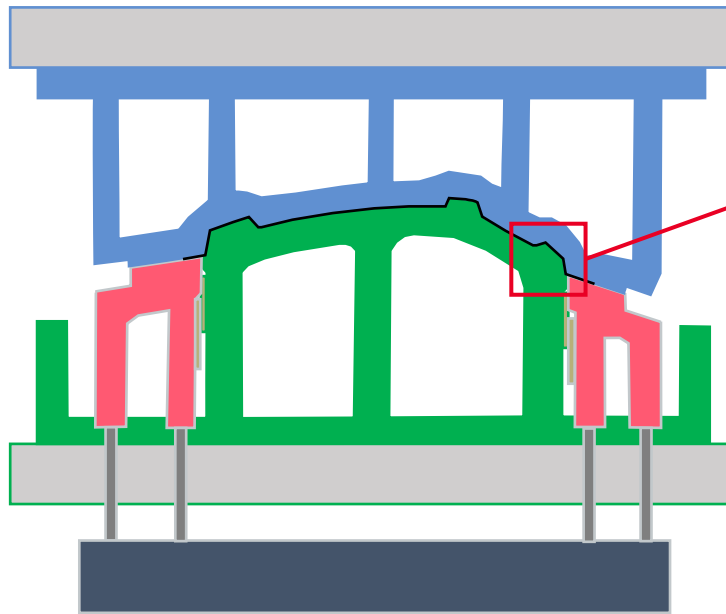
1.0

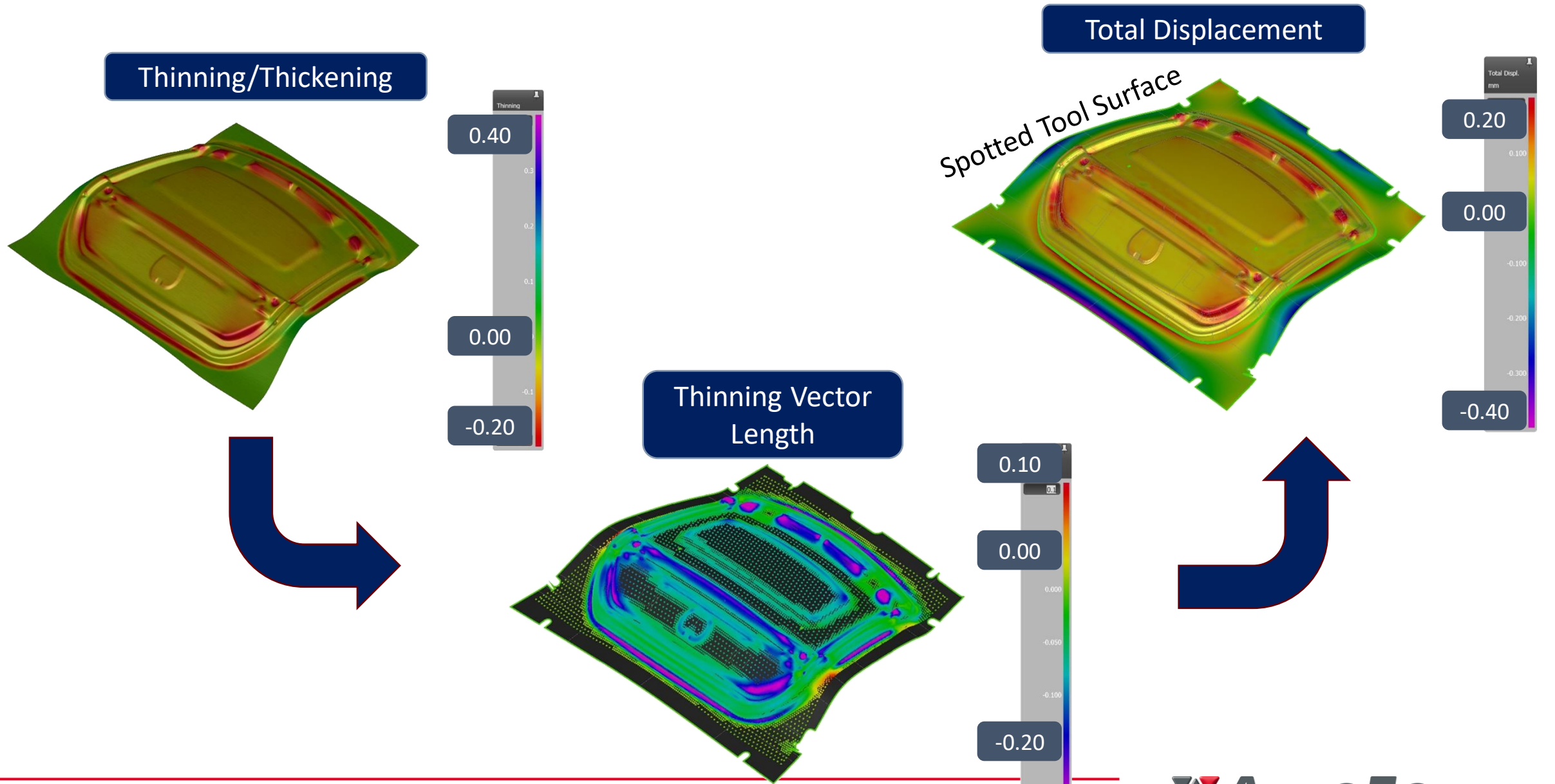
0.0

-1.6



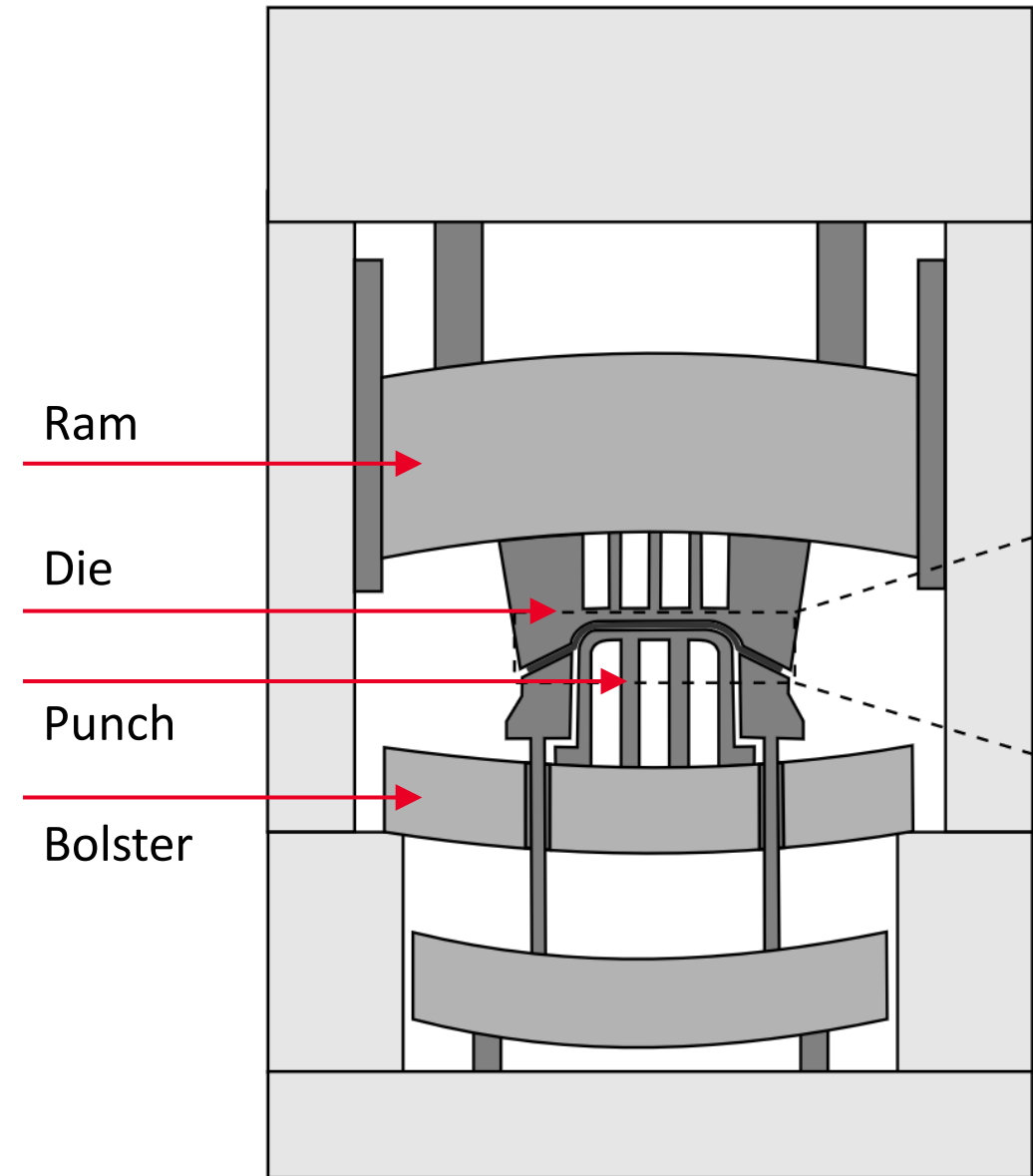
- **Die spotting** is necessary **to compensate the clearance** between the tools so a uniform contact is achieved
- In other words, the gap between the tools matches the actual sheet thickness, usually at the bottom stroke





Background:

- **Press and Tools deflects.**
- **Part shape gets also deflected** tool shape at bottom dead center.
- Compensation/ overcrowning of tools is needed to avoid additional spotting time.



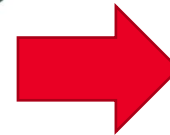
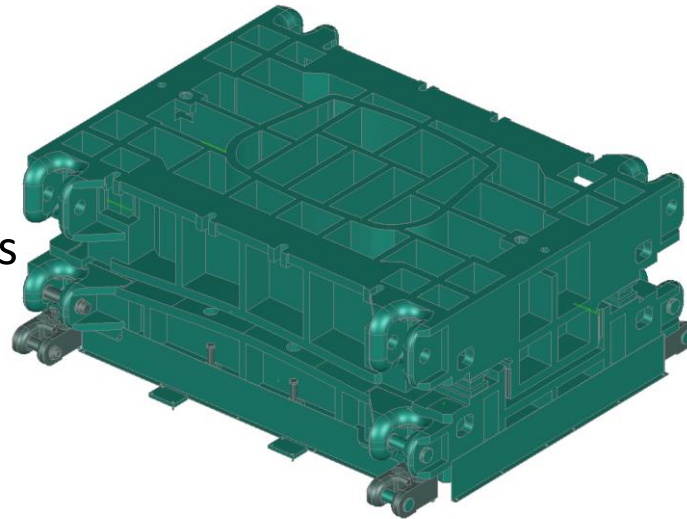
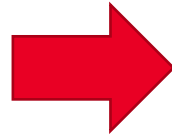
Forming simulation

Calculation of Elastic deformation

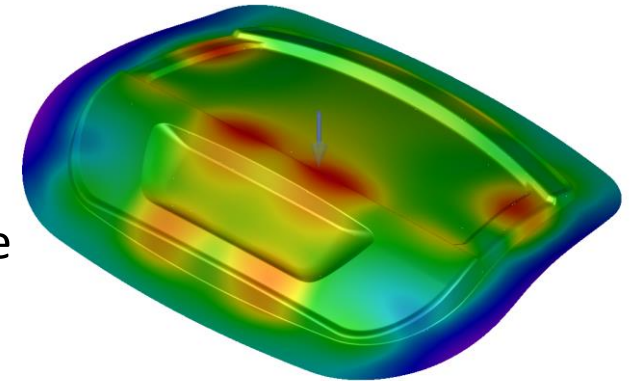
Elastic deformation results



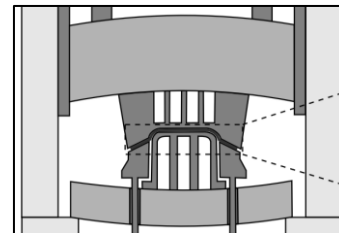
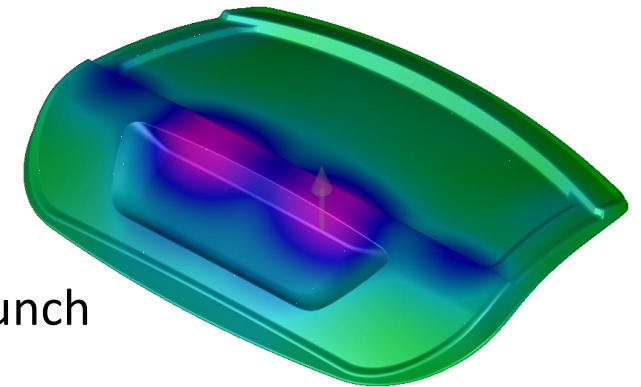
Contact Forces



Die

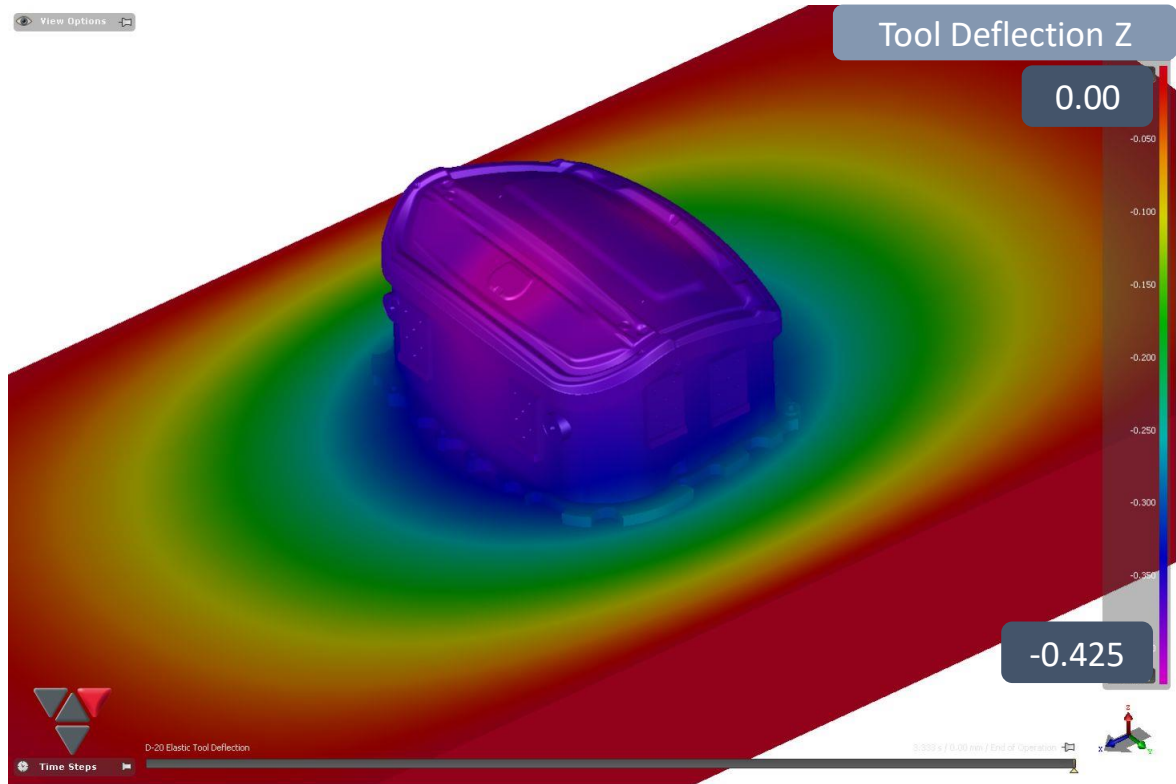


Punch



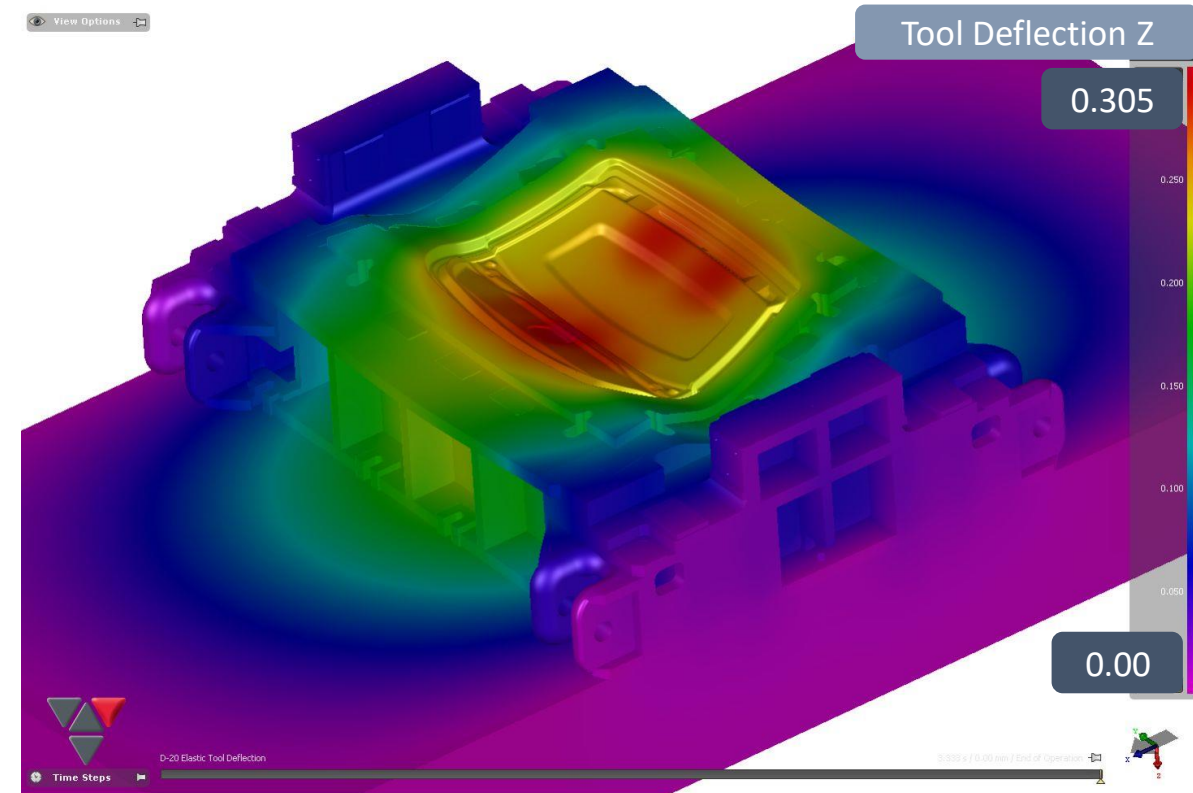
Ram and Bolster are modelled with a substitution model which represents the total press deflection

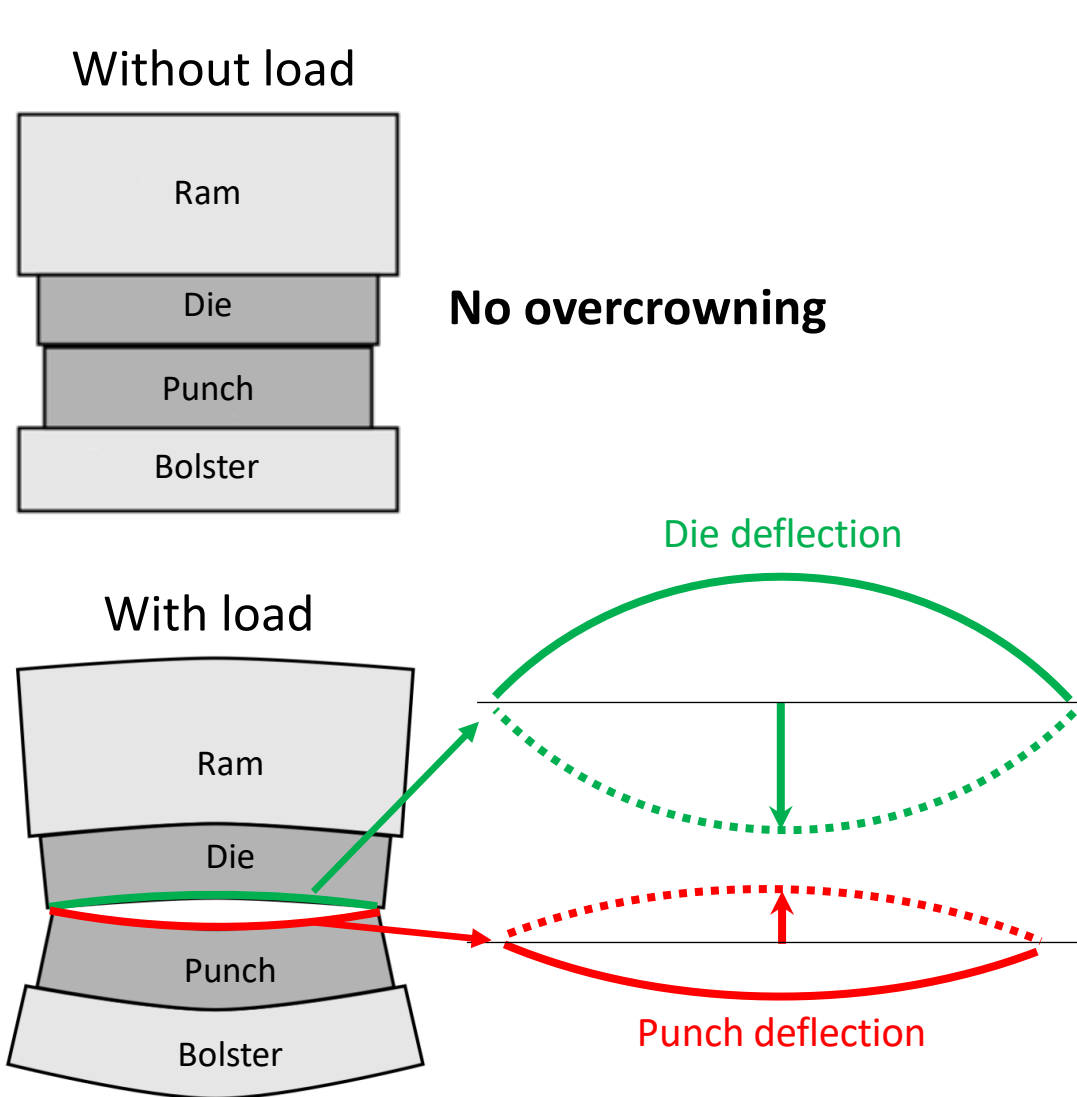
Punch



Die

Rotated 180° around x

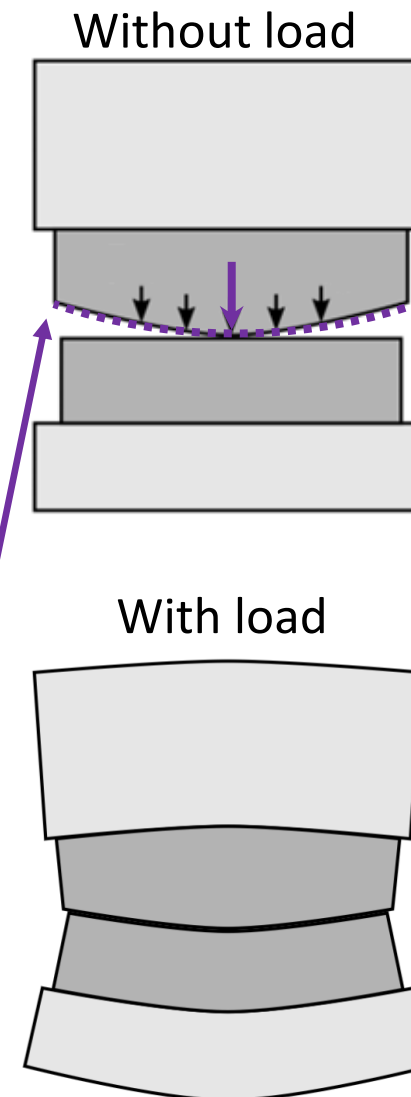
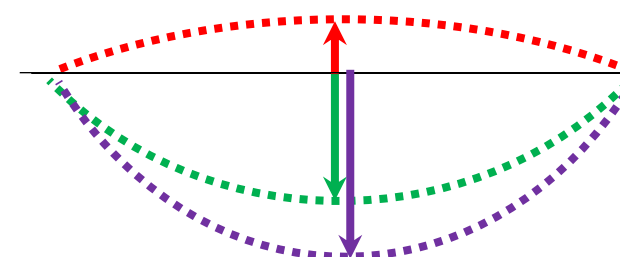


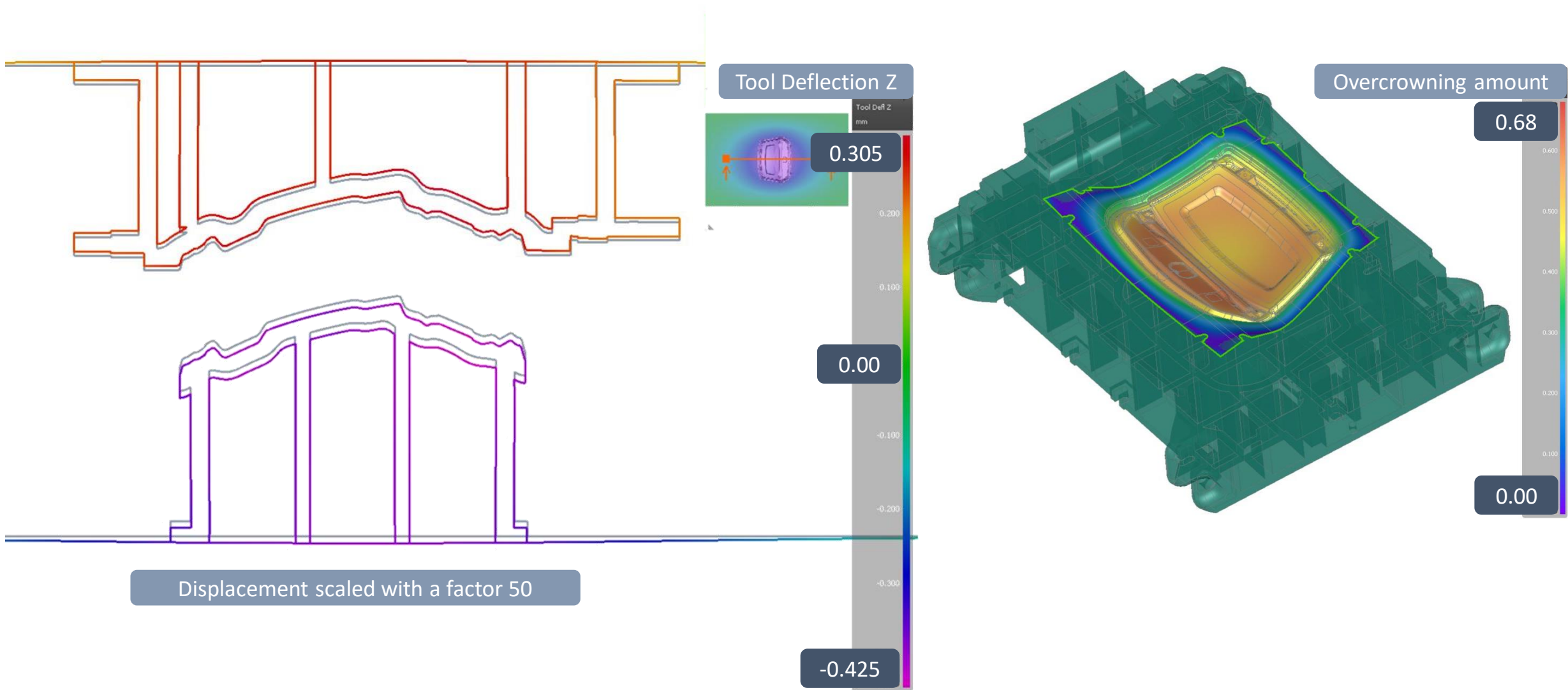


Only Die is overcrowned with Punch and Die deflections

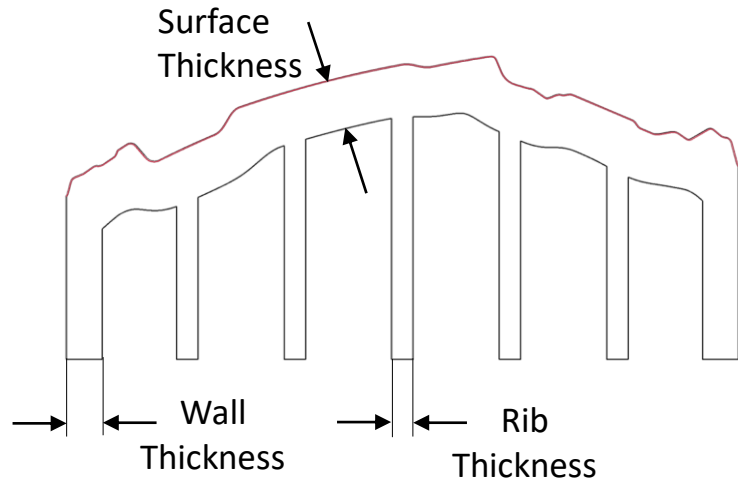
With overcrowning

$$\text{Die overcrowning} = |\text{Die deflection}| + |\text{Punch deflection}|$$

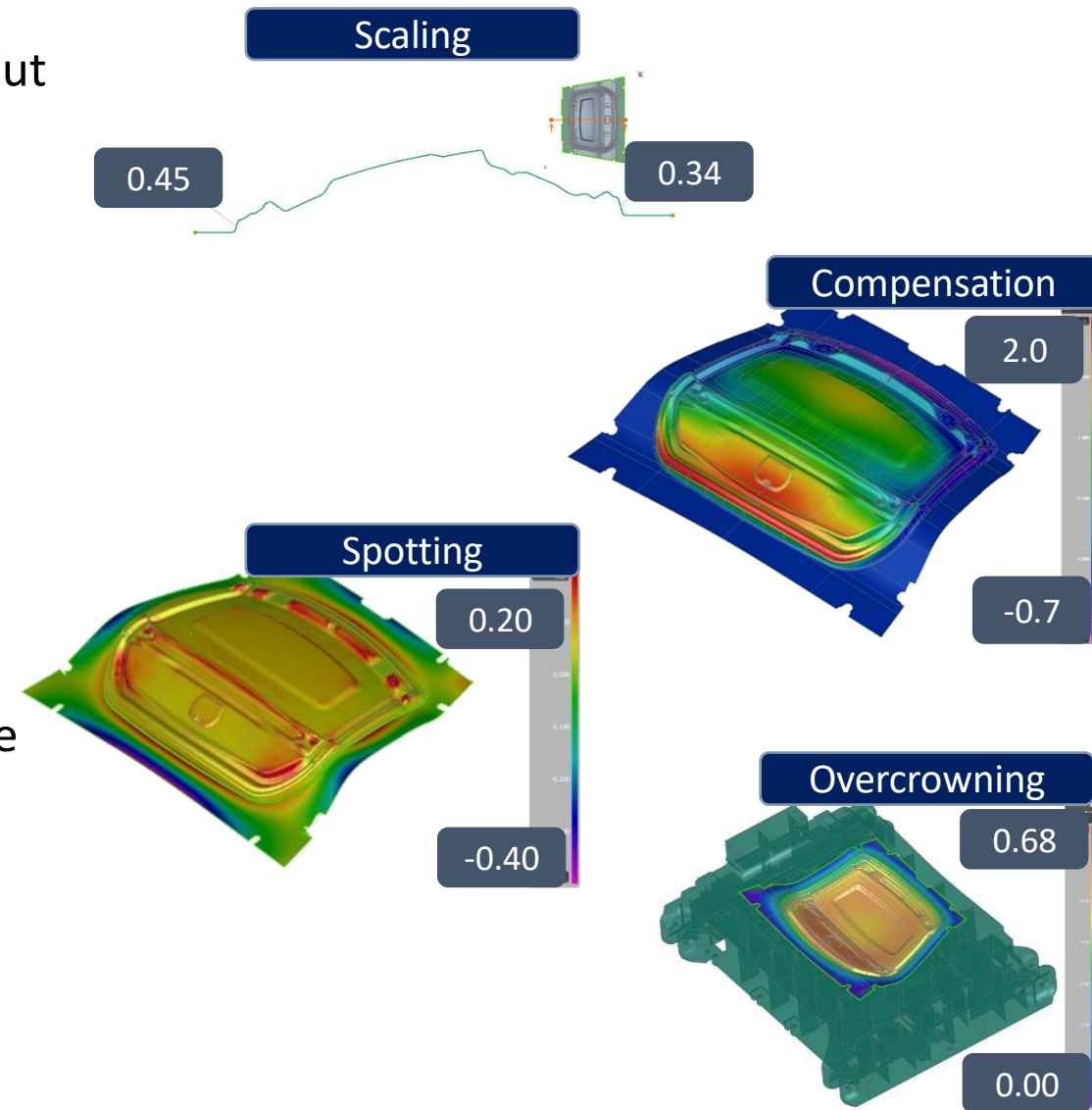




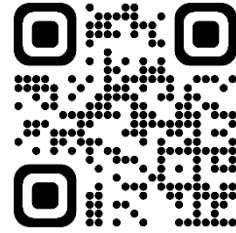
	1	2	3	4	5	6	7	8	9	10
Surface Thickness in mm	30	37.5	45	52.5	60	67.5	75	82.5	90	97.5
Wall Thickness in mm	25	31.25	37.5	43.75	50	56.25	62.5	68.75	75	81.25
Rib Thickness in mm	20	25	30	35	40	45	50	55	60	65
Tool Weight in kg	835	1046	1257	1470	1683	1897	2112	2328	2545	2763
Z deflection in mm	-0.85	-0.66	-0.552	-0.51	-0.47	-0.45	-0.43	-0.42	-0.41	-0.4



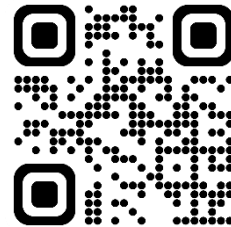
- Several tool modifications applied in tool design, tool tryout and tool quality loops can be defined with help of the simulation models:
- Scaling
- Compensation
- Spotting
- Overcrowning
- The consideration of the defined tool modifications can significantly reduce the tool development time
- The simulation technology can be used to further optimize stamping tools to make our industry more sustainable



**Thank you for your
attendance!**



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