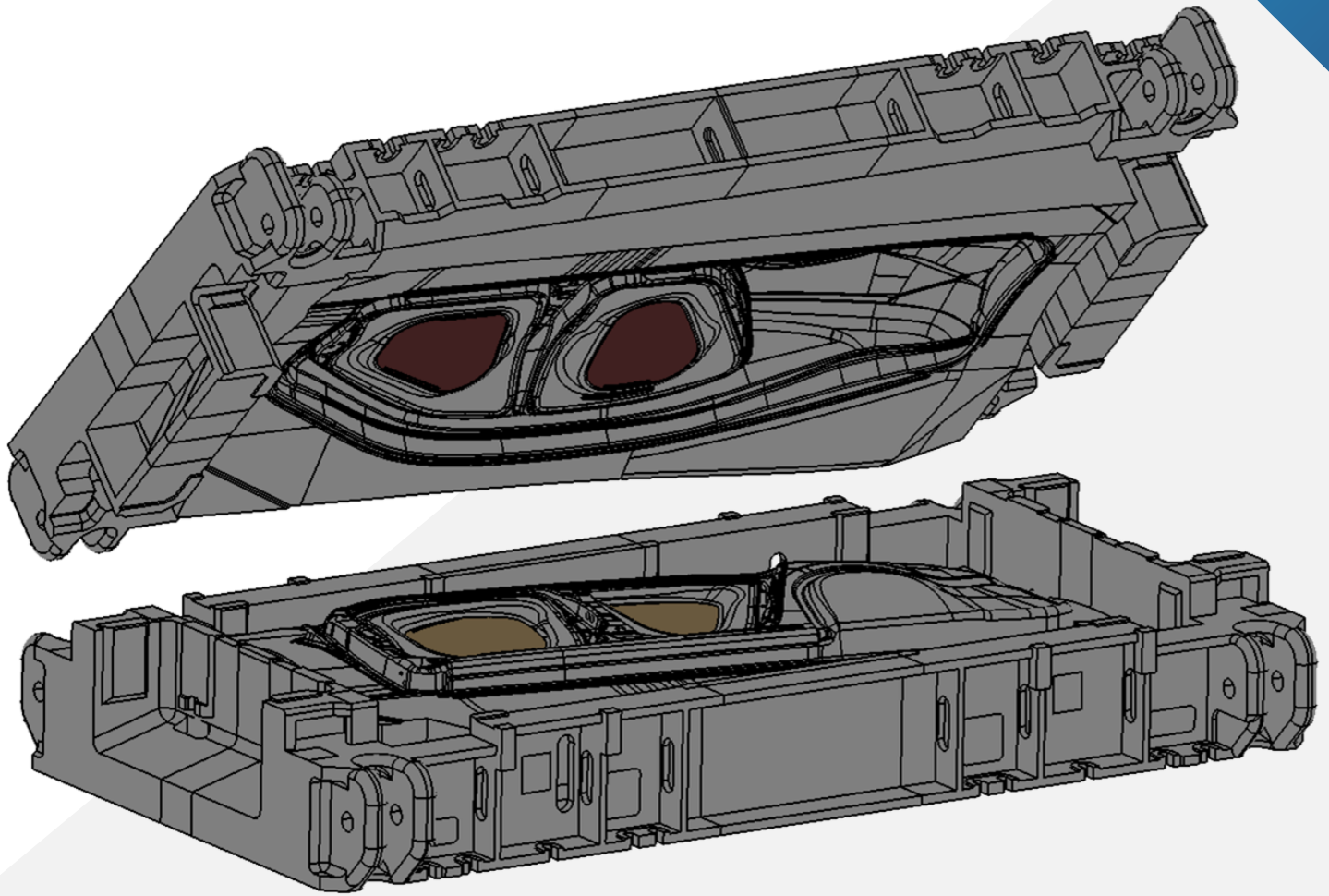
Incorporating tool and press deformations in stamping simulations to enhance part quality assurance

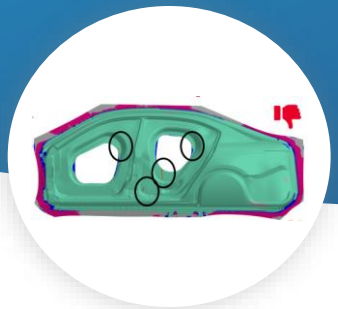


May 20th 2026

AGENDA

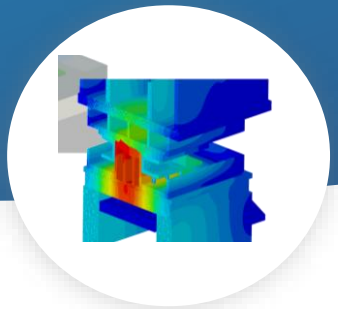
GDIS

Introduction
&
Current Stamping Trends



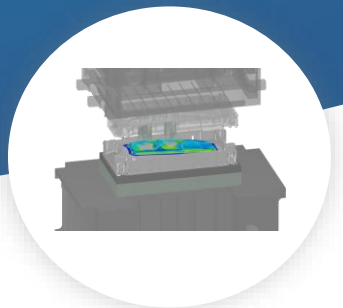
Stamping Process

Deformable Analysis
Present & Future



Deformable Analysis workflow

Keysight Application
Process & Results



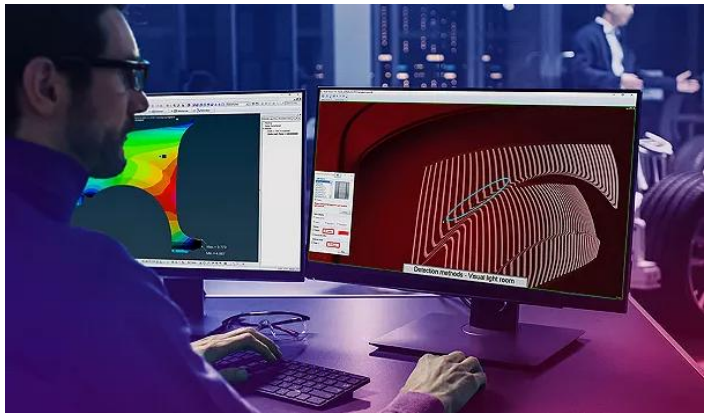
Applications
&
Key Takeaways

Current
Trends in Stamping analysis

GREAT DESIGNS IN STEEL™

Recent Industry Trends – High Strength Material & Grouping Tools

Increase in Press Forces

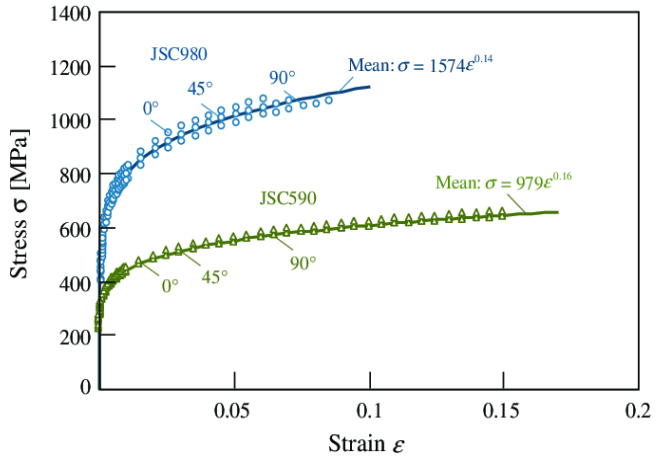


KEYSIGHT CAE

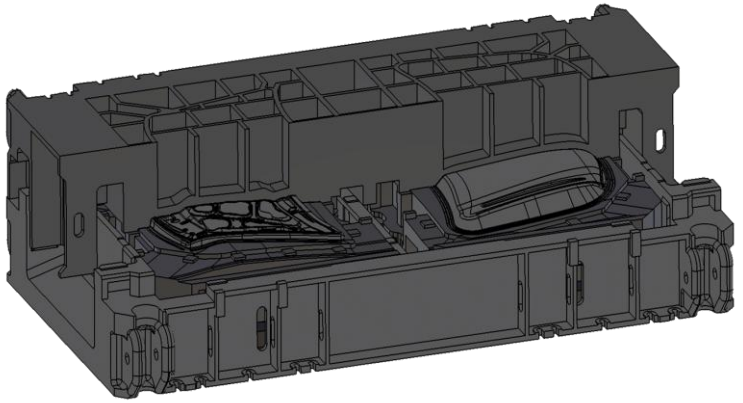
Formerly known as ESI Group, Keysight CAE is the result of over 50 years of engineering innovation from world's first virtual crash test to maintaining a legacy of precision, technical advancement, and trust.

Today, our solutions help leading manufacturers accelerate time to market, improve product integrity, and advance sustainability goals —by making smarter decisions earlier in the development process.

KEYSIGHT Stamping
Deformable Tools & Press analysis



Lightweighting
High strength steels

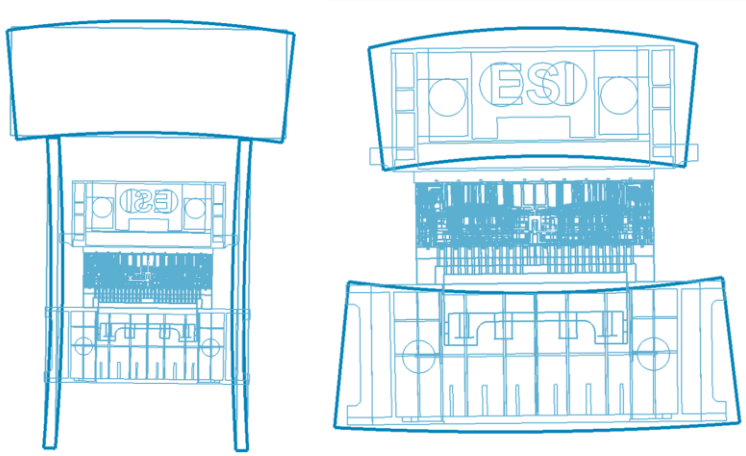


Increase productivity
Tool grouping in large die sets

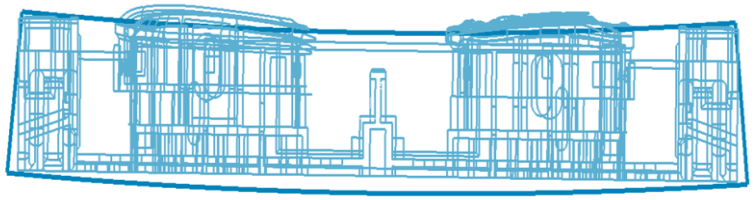
High Press Tonnage leads to Tool and Press deformation resulting in
inaccurate springback, cosmetic issues and decreased formability predictions

Impact due to Higher Press Tonnages

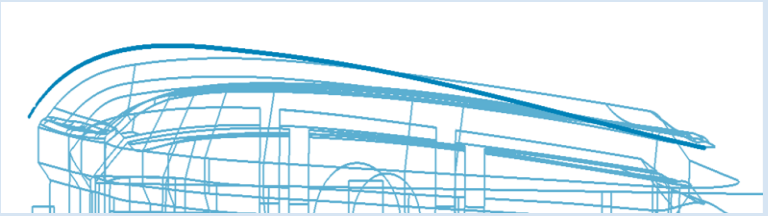
Experience Deformations : Press frame → Press →Tool →Tool Surface



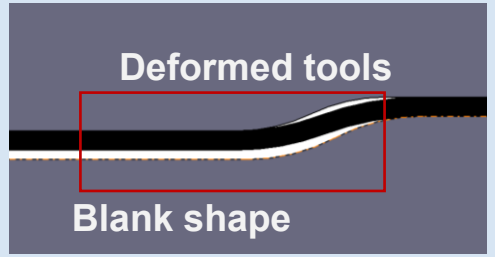
Press deformation



Tool deformation



Tool-surface deformation



Inaccurate prediction
Contact pressure & Stress field

Springback & Surfaces Quality

Deformation occurs in major cases with imbalanced parts

- Increase in physical try-out iterations
  - Longer Lead times → Huge Cost

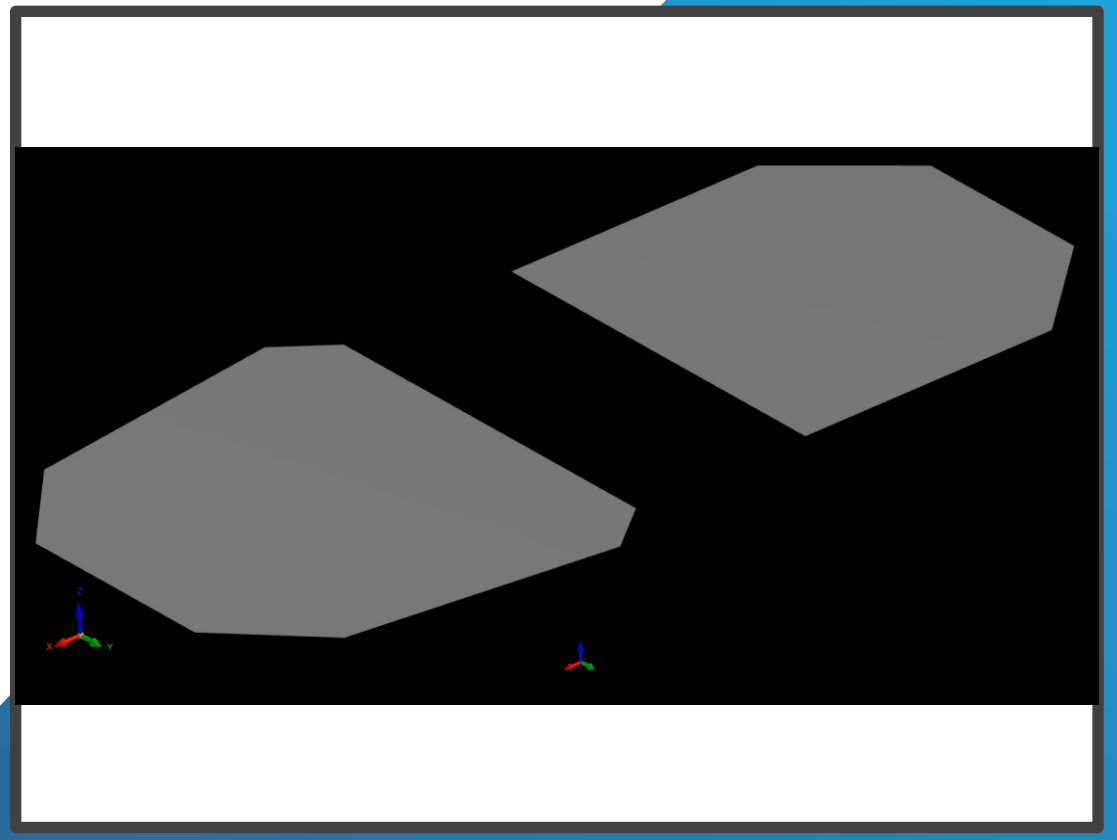
Application workflow

KEYSIGHT Stamping

Deformable Tools and Press Analysis

integrates full 3D die geometry and press details into simulations, capturing small elastic deformations for precise contact conditions.

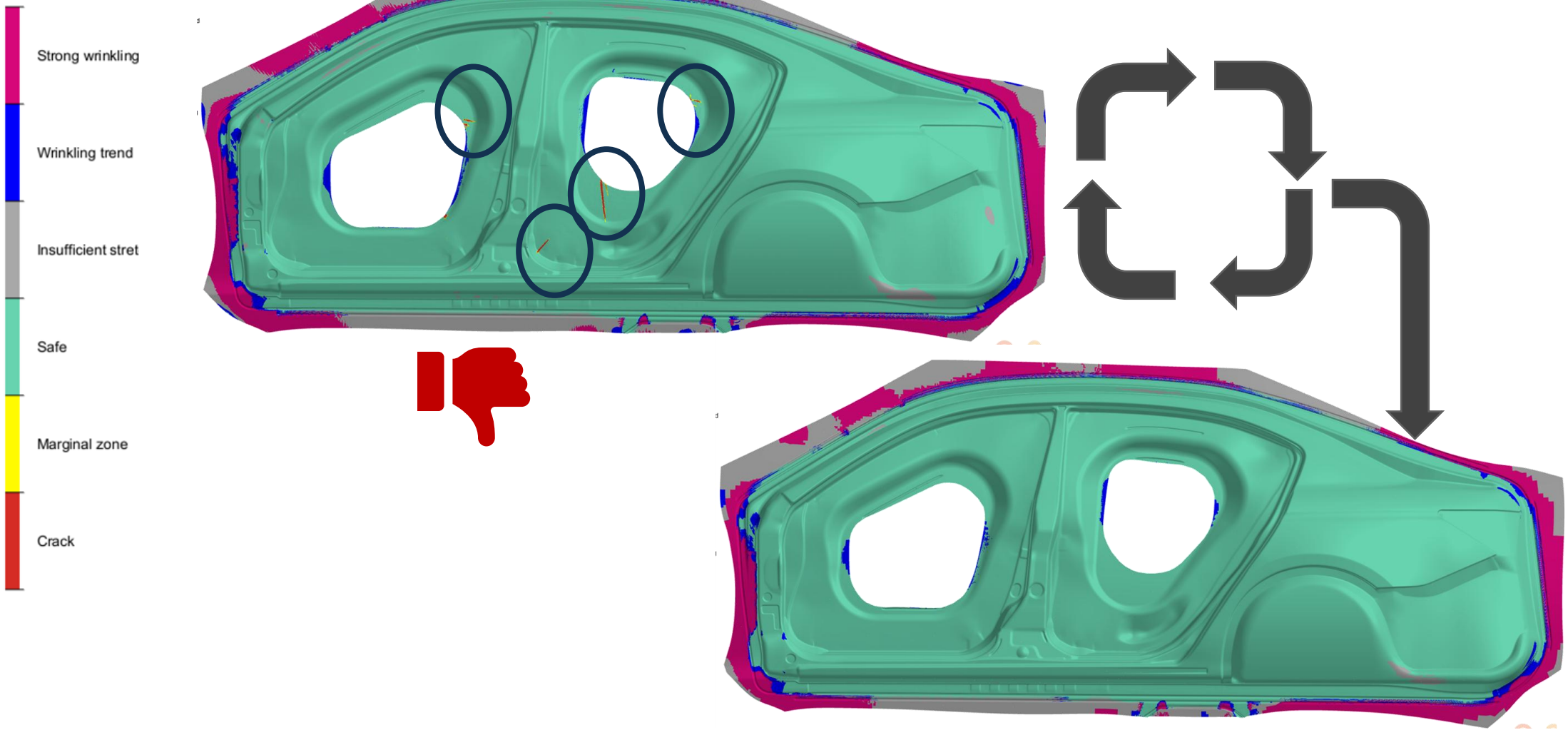
- Stamping workflow
- Deformable Analysis – Present
- Deformable Analysis – Future



GREAT DESIGNS IN STEEL™

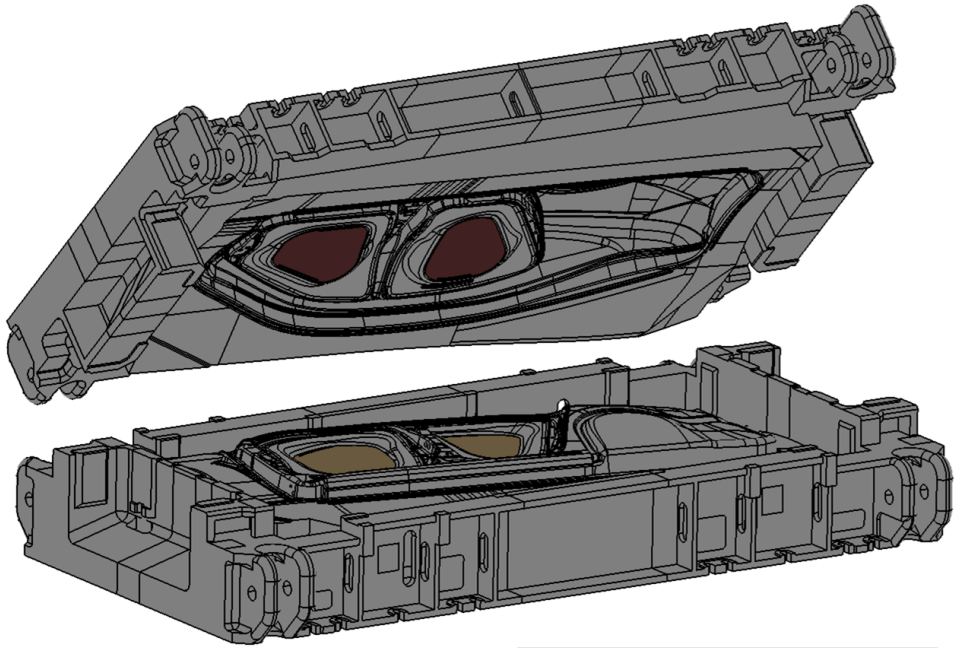
Stamping Workflow - Iterate Stamp Process until Validation

Through standard ‘shell’ model with rigid tools

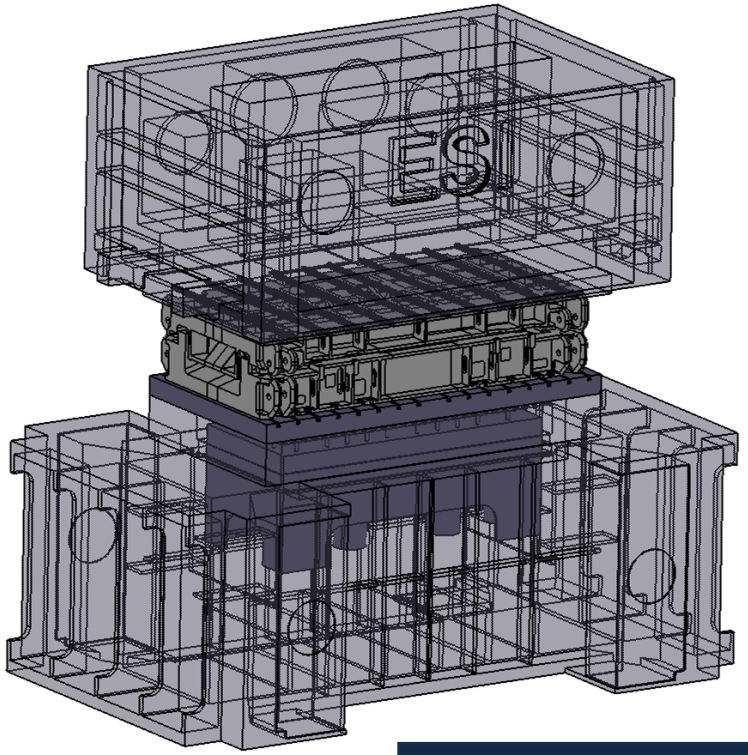


Deformable Press & Tools Workflow

Ultimate Security: Include Solid Tools & Press



End of stroke ONLY



During forming process

Current State

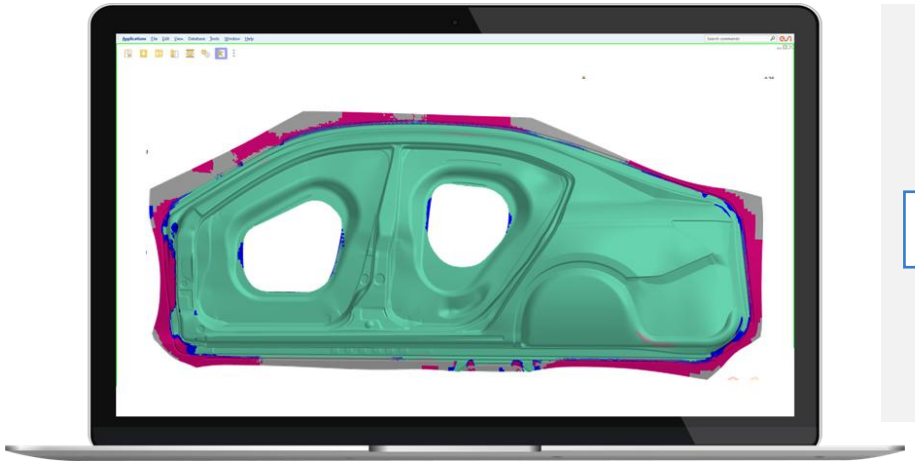
Simulate Tool deformation @ End of Stroke

Future State

Simulate Press & Tool deformation throughout the Stroke

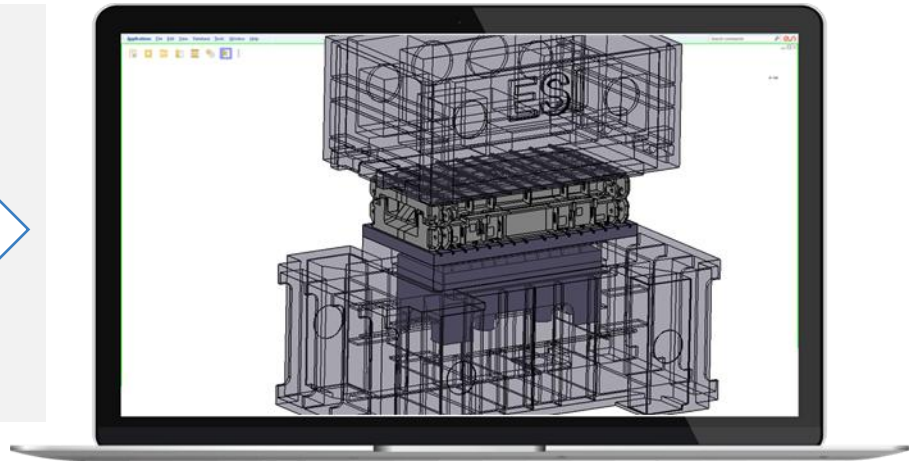
Tool Deformation Analysis

Simulating Tool deformation Analysis @ End of stroke



At the END of forming simulation

forces



Software 1 : Forming simulation

Deflection - Not considered

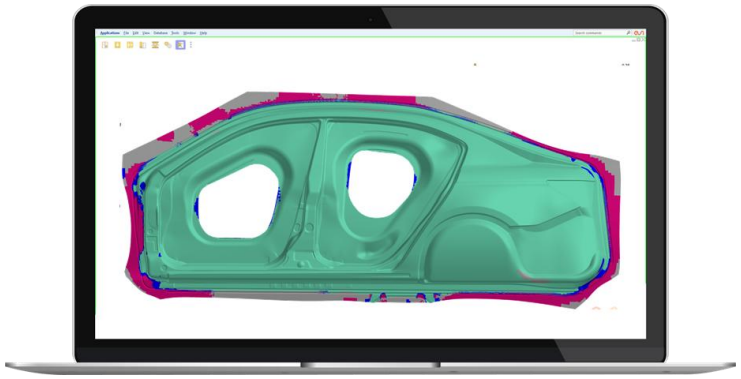
Software 2 : Press/Tool deformation simulation

Actual forces from deformed tools - Not considered

Absence of incorporating Press deformation results in stamping simulations
Leads to poor prediction of real condition

Press & Tool Deformation Analysis

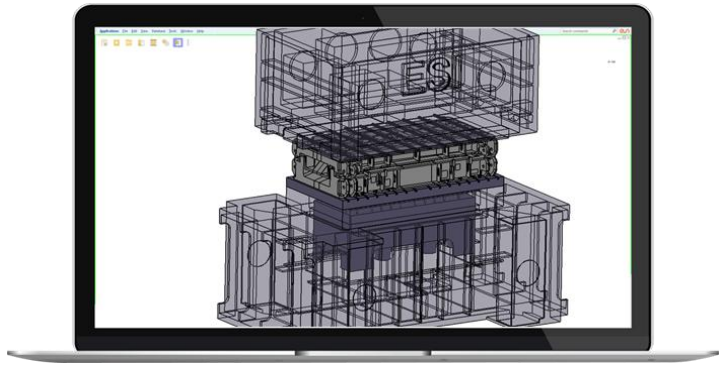
Keysight Stamping - Simulate coupled Press & Tool deformation through out the Stroke



During entire forming simulation

Actual forces

deformation



Run 1: Forming simulation

Press& Tool Deflection - Considered

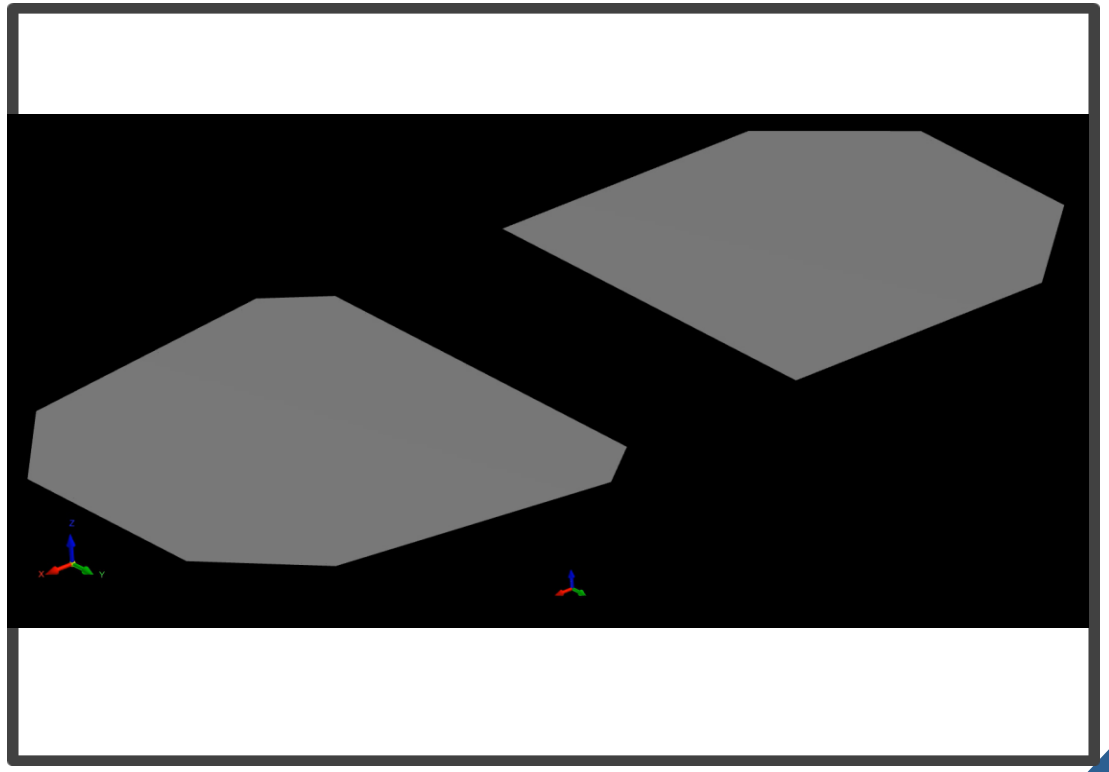
Run 2: Press deformation simulation

Actual forces from deformed tools - Considered

Repetitive feedback loops of updating forces and Press deformation results in stamping simulations

Leads to accurate prediction of real condition

Keysight Application : Hood inner + Hood outer



GREAT DESIGNS IN STEEL™

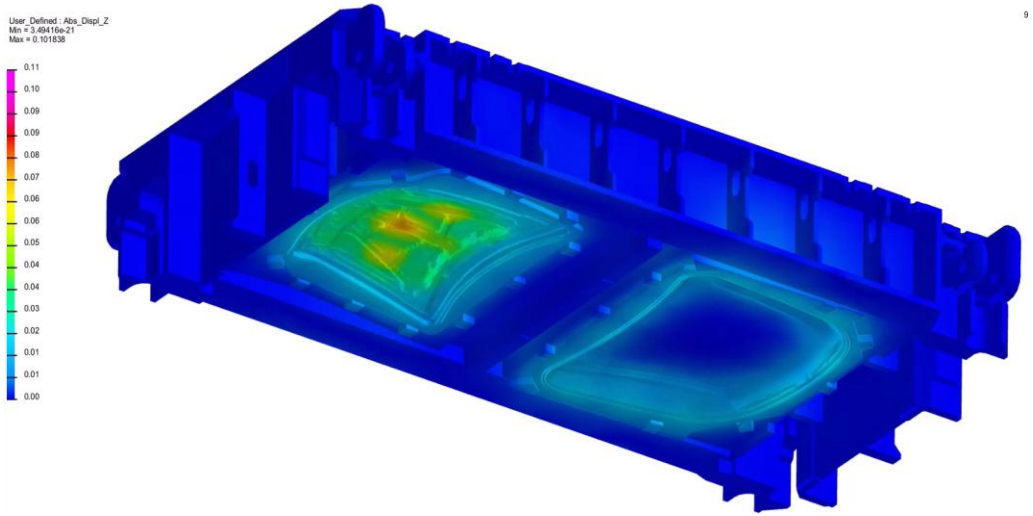
Tool Deflection analysis – Case 1

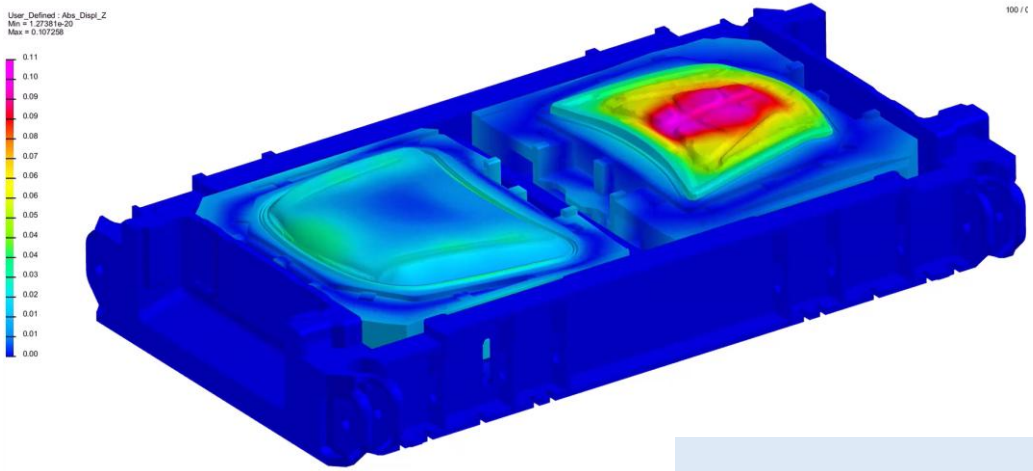
During the stamping process

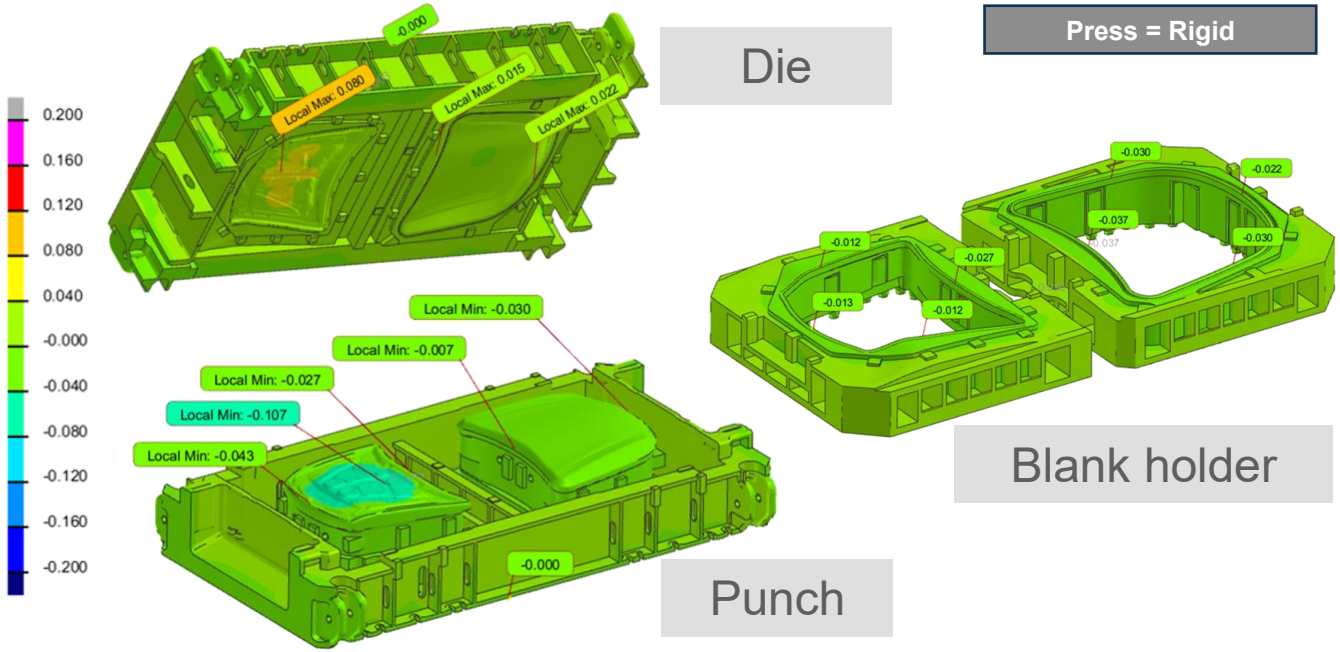
Blank = Deformable

Tools = Deformable

Press = Rigid







Die

Blank holder

Punch

Objects	Deflection (mm)
Die	0.08
Punch	0.107
Blank holder	0.04 (negligible)

Deflection → complete forming process

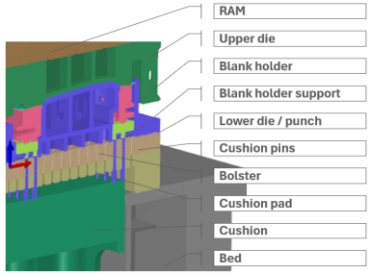
Tool & Press Deflection analysis – Case 2

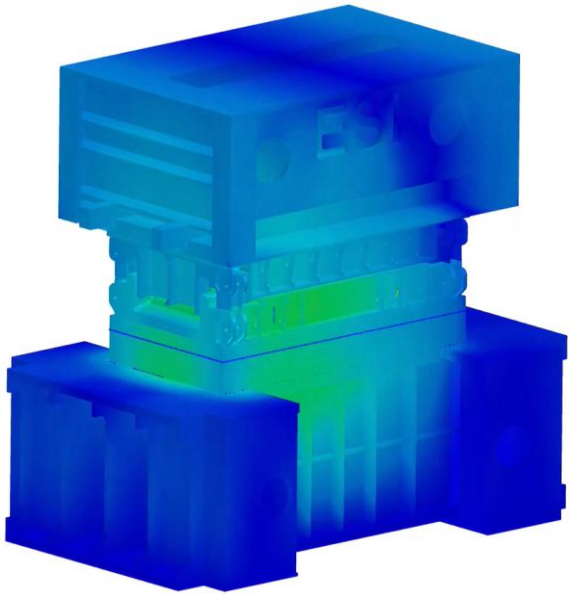
During the stamping process

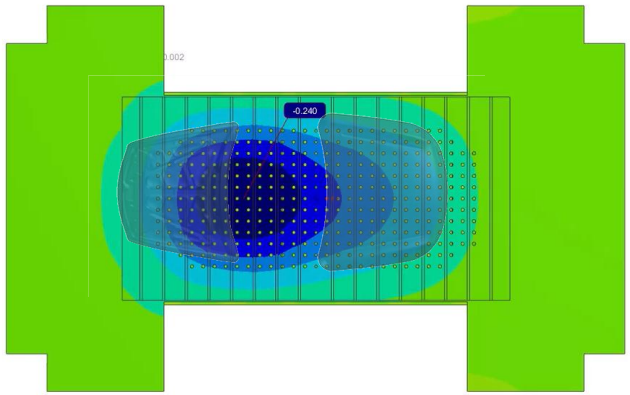
Blank = Deformable

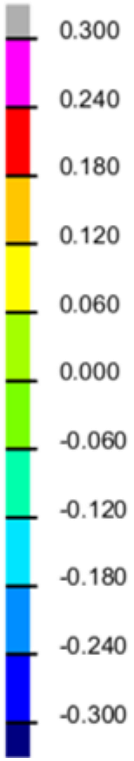
Tools = Deformable

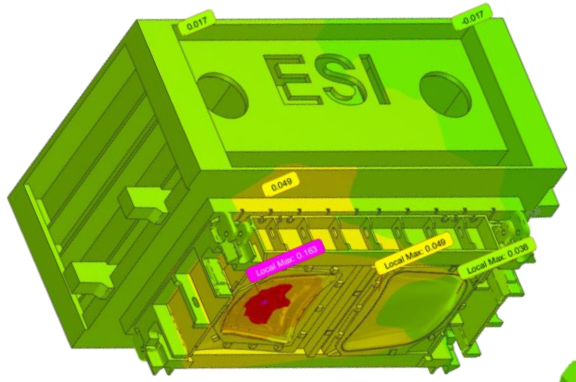
Press = Deformable



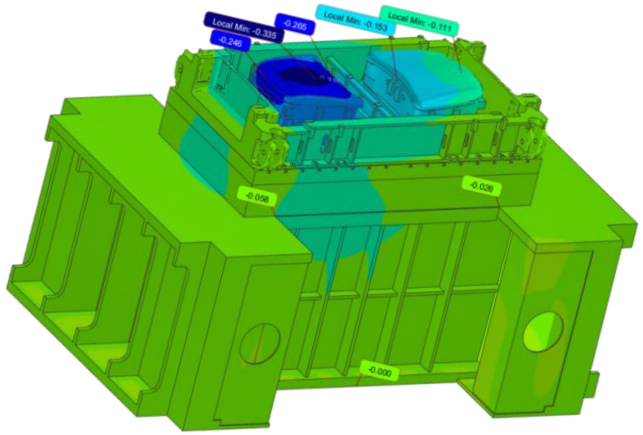




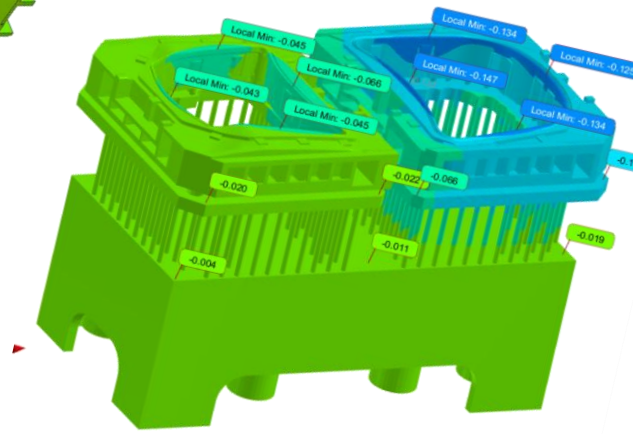




Die & Ram



Punch & Bed

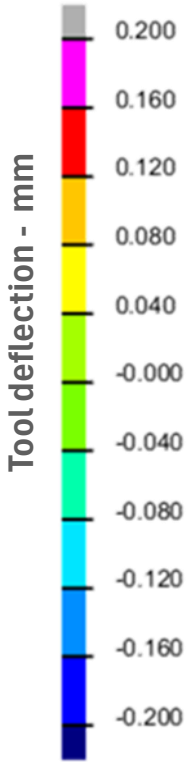


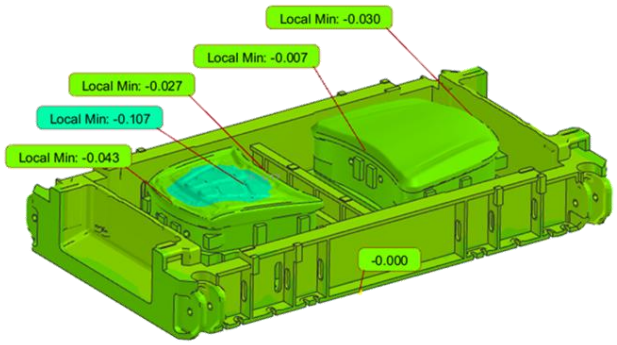
Blank holder & Cushion pins

Objects	Deflection (mm)
Die & Ram	0.08 → 0.102
Punch & Bed	0.107 →0.335
Binder & Cushion pins	0.04 (negligible) → 0.147

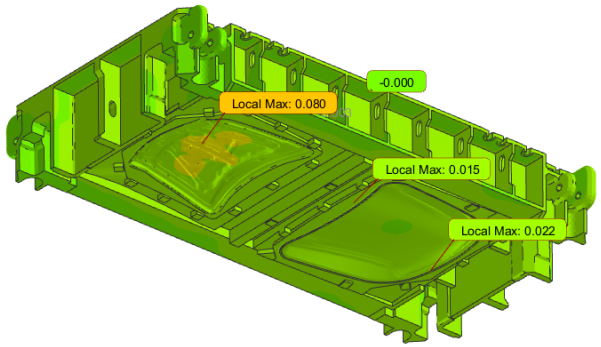
Deformation Analysis - Results

Tool vs Press & Tool Deflections

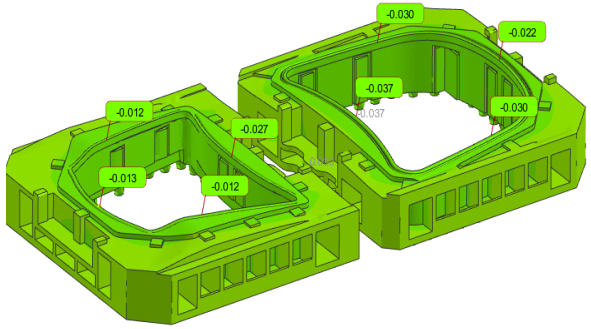




Punch – 0.107 mm



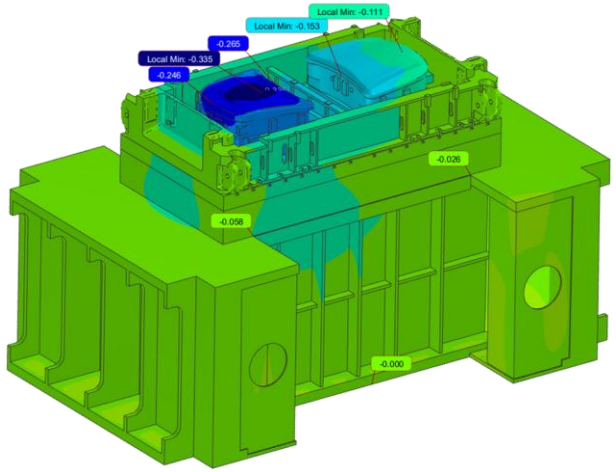
Die – 0.08 mm



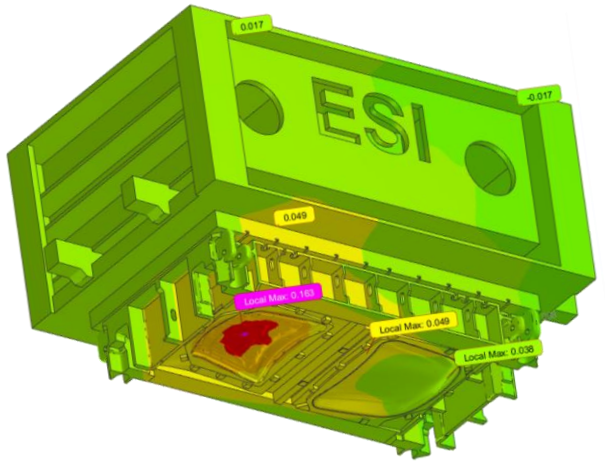
Binder – 0.04 mm

Case 1

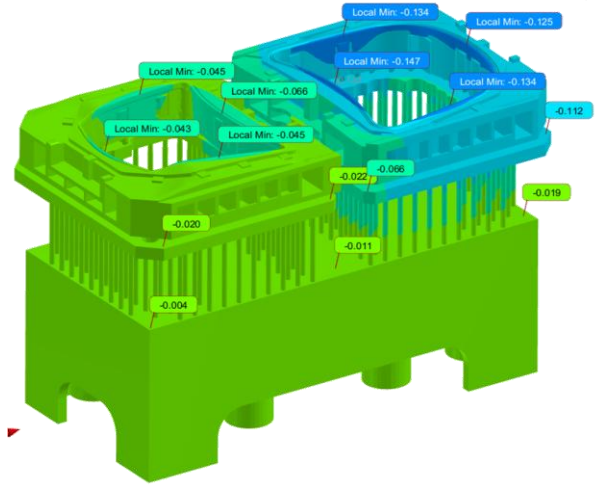
- Blank = Deformable
- Tools = Deformable
- Press = Rigid



Punch & Bed – 0.335 mm



Die & Ram – 0.102 mm



Blank holder & Cushion pins – 0.147 mm

Case 2

- Blank = Deformable
- Tools = Deformable
- Press = Deformable

Results

Contact Pressure

Blank = Deformable
Tools = Rigid
Press = Rigid

Max – 0.14

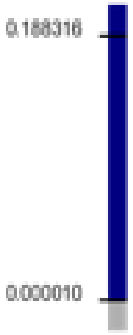
Blank = Deformable
Tools = Deformable
Press = Rigid

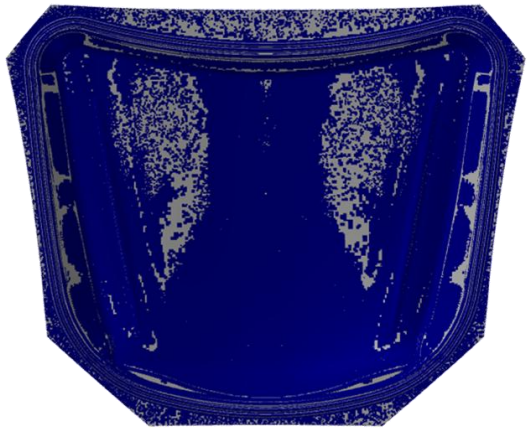
Max – 0.135

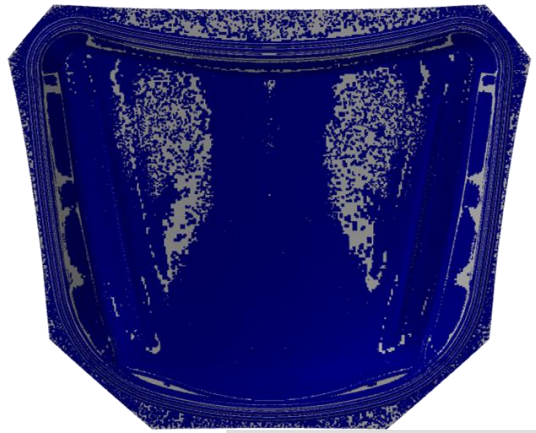
Blank = Deformable
Tools = Deformable
Press = Deformable

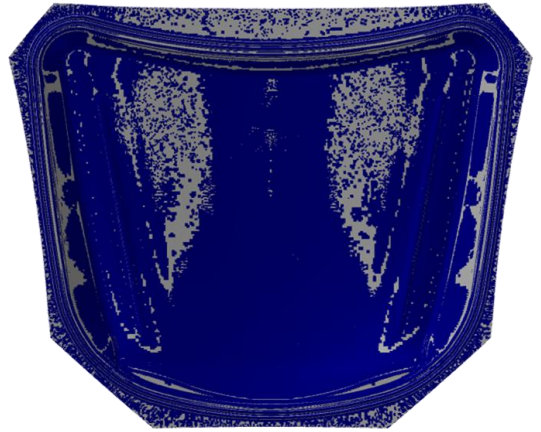
Max – 0.11

Max Contact Pressure









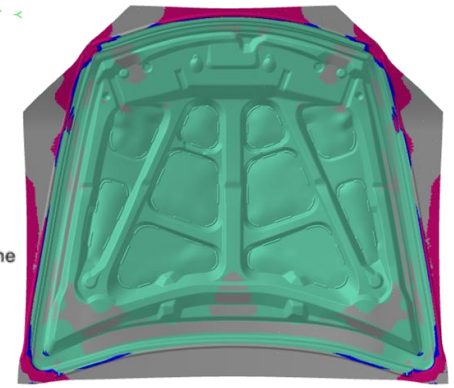
Grey region – No contact Pressure
Blue region – Contact Pressure

Decrease in contact pressure zones → Affects formability results

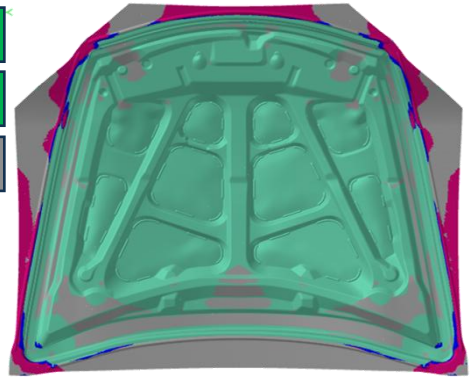
Results

FORMABILITY

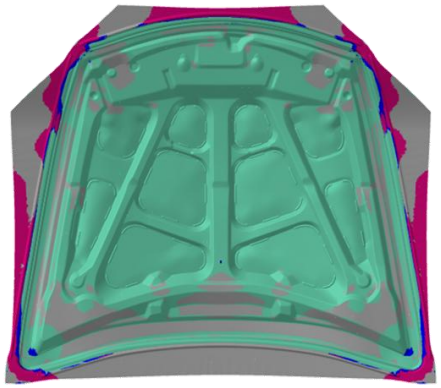
Blank = Deformable
Tools = Rigid
Press = Rigid

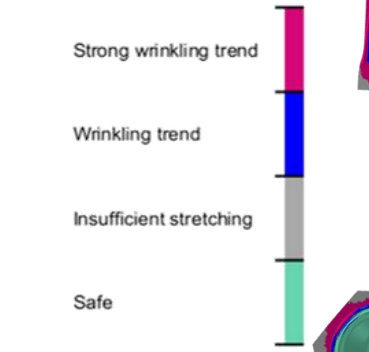


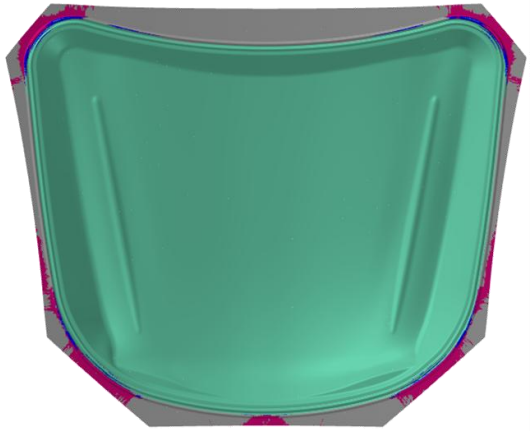
Blank = Deformable
Tools = Deformable
Press = Rigid

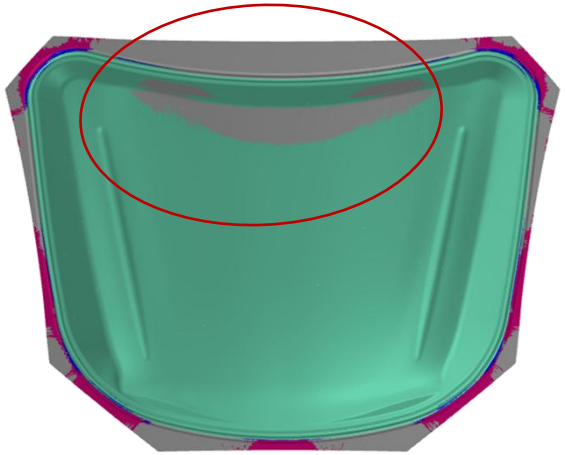


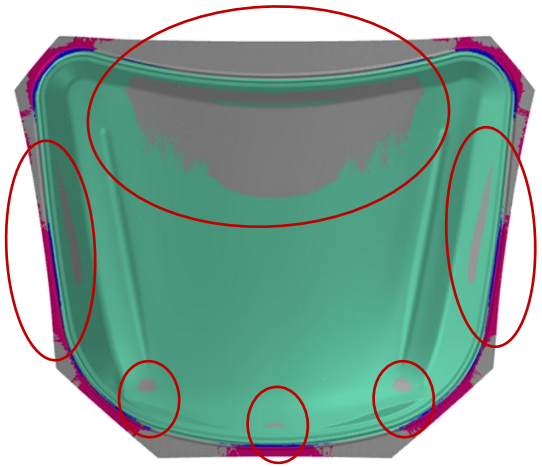
Blank = Deformable
Tools = Deformable
Press = Deformable











Decrease in contact pressure zones → Affects draw-in →Increase in insufficient stretching

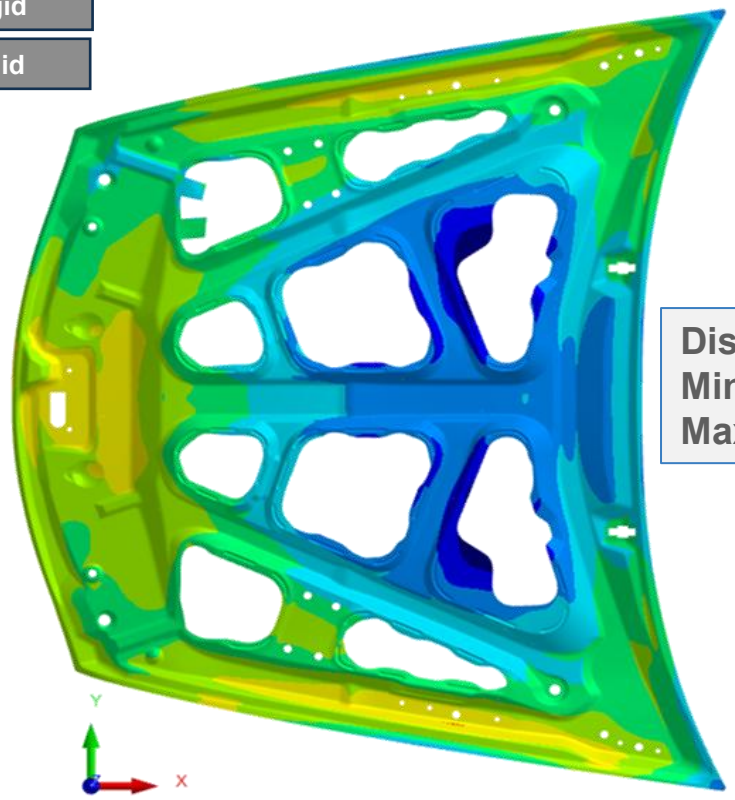
Results

Springback

Blank = Deformable

Tools = Rigid

Press = Rigid

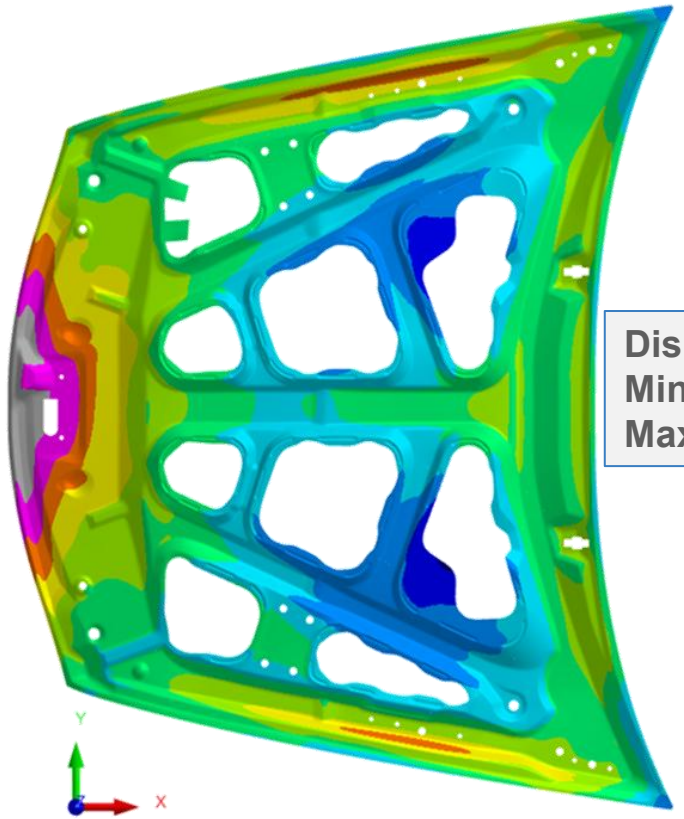


Displacement
Min = -1.84
Max = 2.27

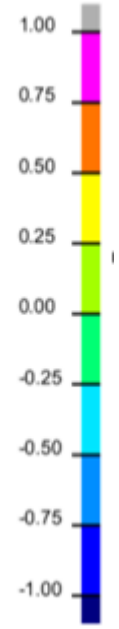
Blank = Deformable

Tools = Deformable

Press = Deformable



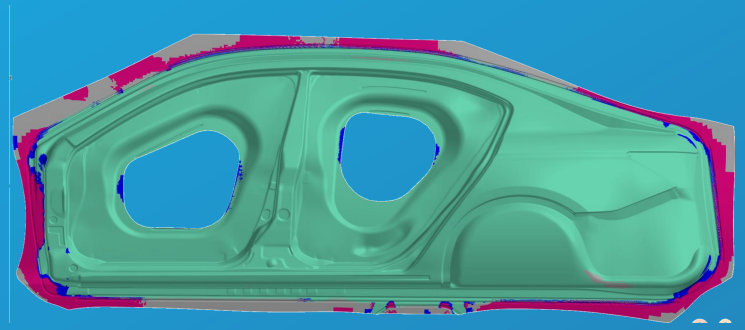
Displacement
Min = -2.59
Max = 3.13



Tilted tools → Decrease in contact pressure zones → Affects draw-in → insufficient stretching → Increase in springback distance

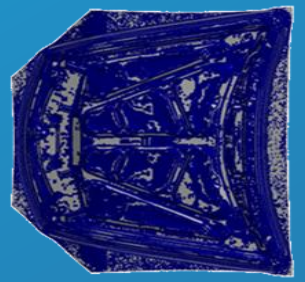
Deformable Press Analysis – Applications

GDIS

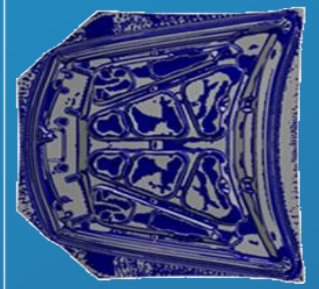


Accurate Result Prediction

Depending on tool structure design & press selection



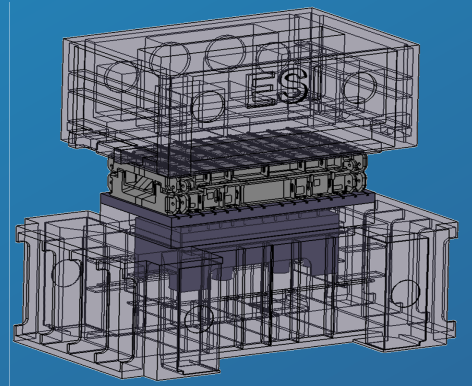
Rigid tools



Deformable tools

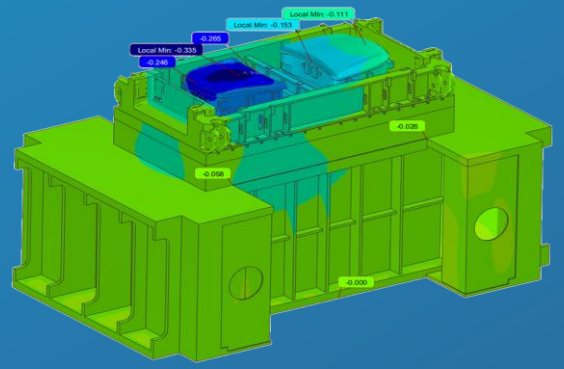
Virtual die spotting

Morphing diefaces to compensate tools & press elasticity



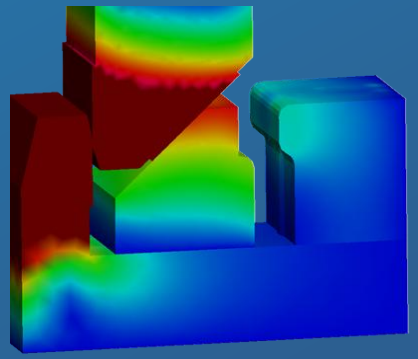
Digital try-out

Reduce time between try-out & production press



Press balancing analysis

Influence of tool grouping



Sliding CAM closure

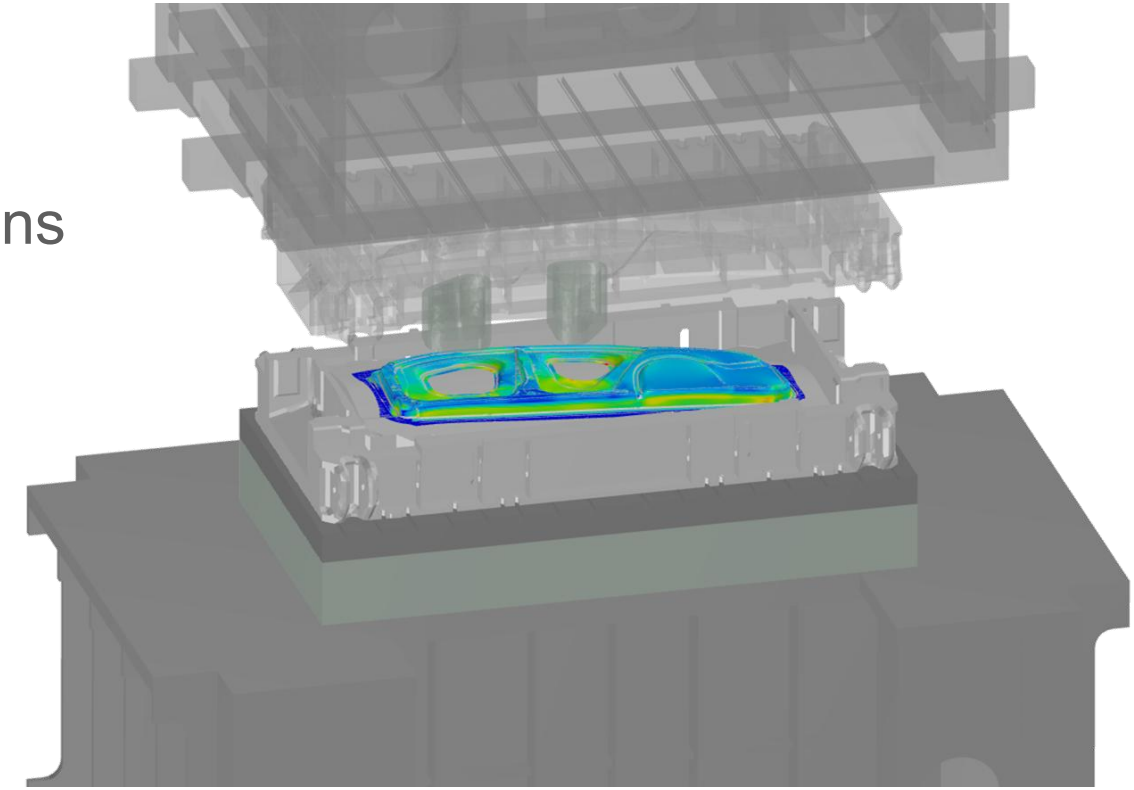
Based on tool/tool contact

Key Takeaways

Reduce risk, time and cost during physical offline and inline try-out

Solution - Virtual Try-Out Exploration

Include elastic tool & press deformation analysis in standard stamping simulation runs



Benefits

- Increased accuracy
  - Using Single software for coupled simulations
  - Under acceptable calculation time

Enhance part quality assurance