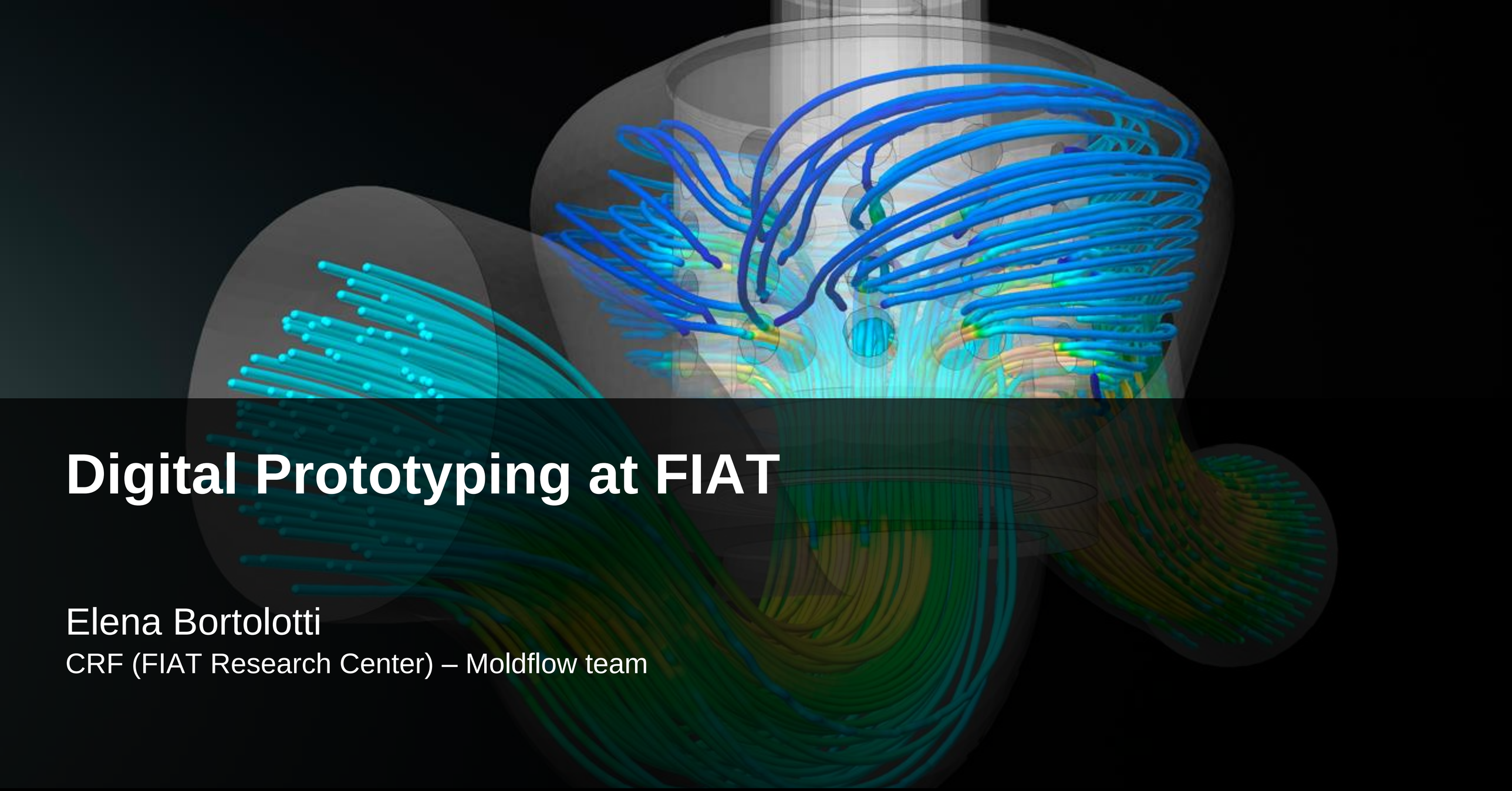

Digital Prototyping at FIAT

Elena Bortolotti
CRF (FIAT Research Center) – Moldflow team

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Class Summary

In this class you explore how Autodesk® Moldflow® and Autodesk® Showcase® software can visualize manufacturing defects in plastic parts and how Moldflow® results can improve SIMULIA® Abaqus® simulation of thermal load.

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Learning Objectives

At the end of this class, you will be able to:

- Visualize part defects using Autodesk® Showcase® rendering capabilities with homemade graining database
- Improve the thermal load simulation of plastic assemblies with injection molding residual stresses results

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Visualization as an engineering communication tool

FIAT Punto Evo

Interior Sink Marks Visualization

Alfa Romeo Giulietta

Dashboard Flush Gap Simulation under Thermal Load

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Interiors Sink Marks Visualization

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Interiors Sink Marks Visualization

- Dashboard upper cover - sink mark estimate
- Glove box - comparison between simulated and real part
- Door panel - comparison between simulated and real part

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Interiors Sink Marks Visualization

We have studied
three interior parts…

- Dashboard upper cover
- Glove box
- Door panel

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Interiors Sink Marks Visualization

…and made a comparison
with real parts

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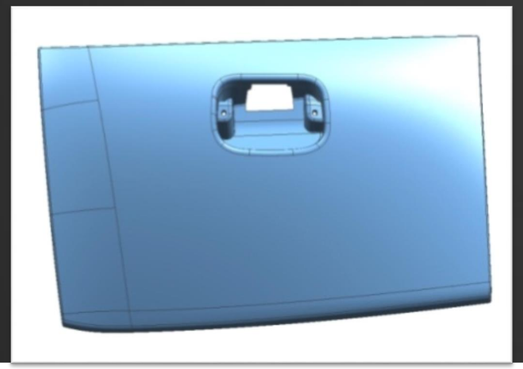
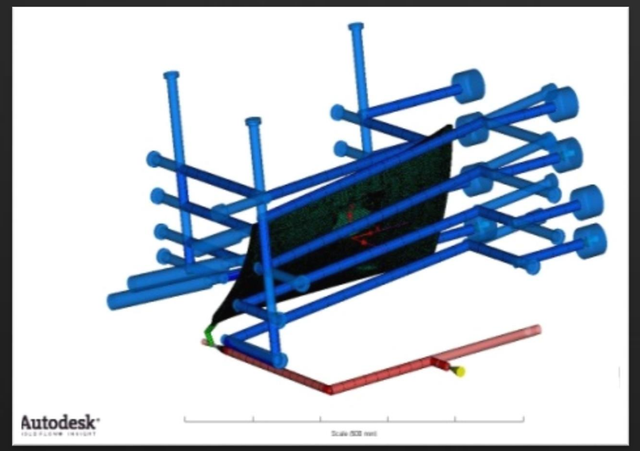
Interiors Sink Marks Visualization

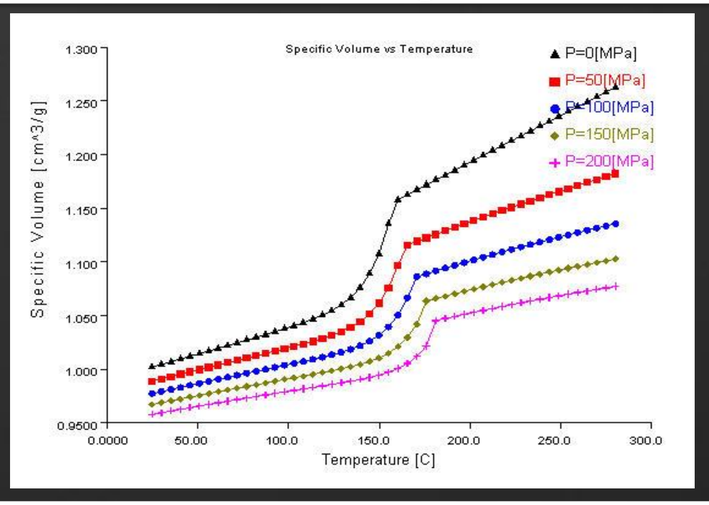


Material database

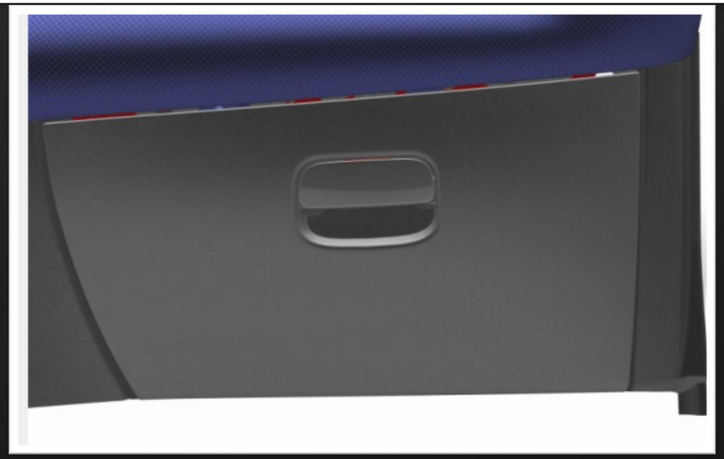


Visualization

Design



Process conditions



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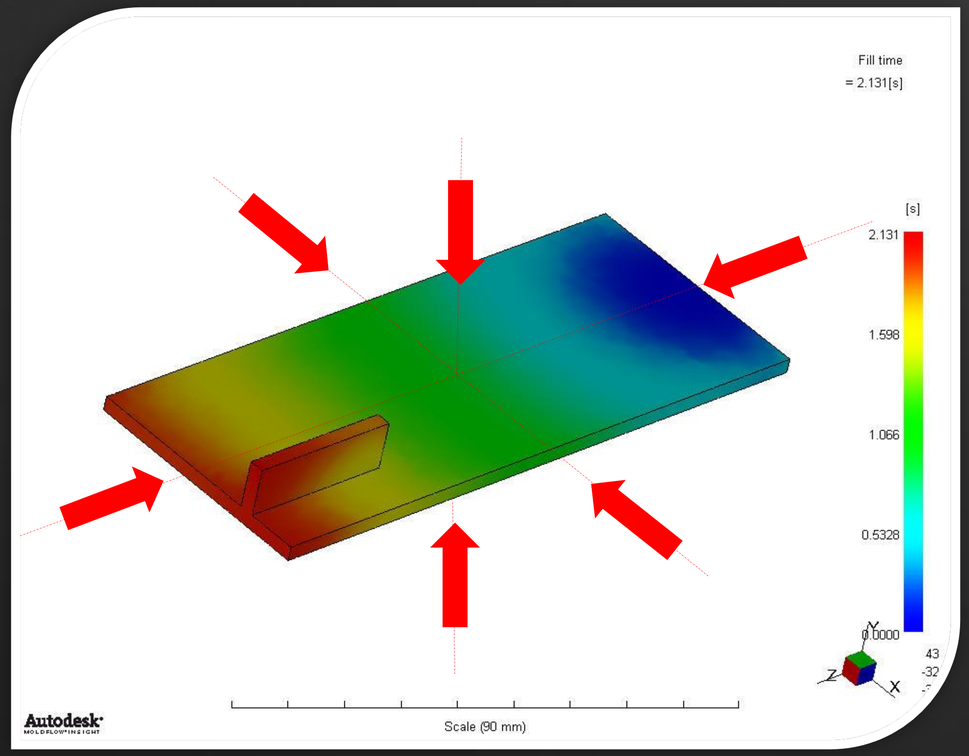
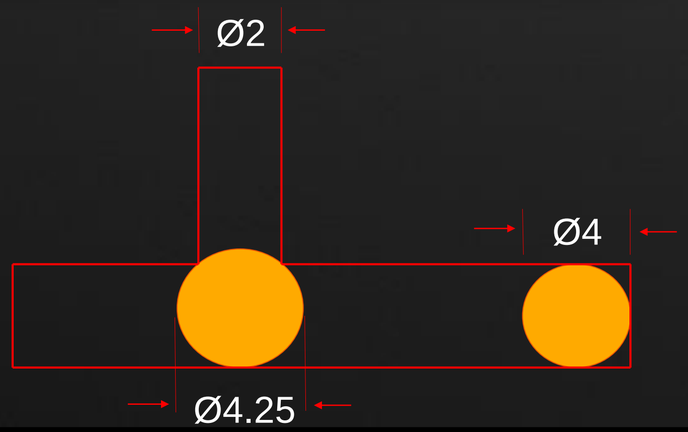
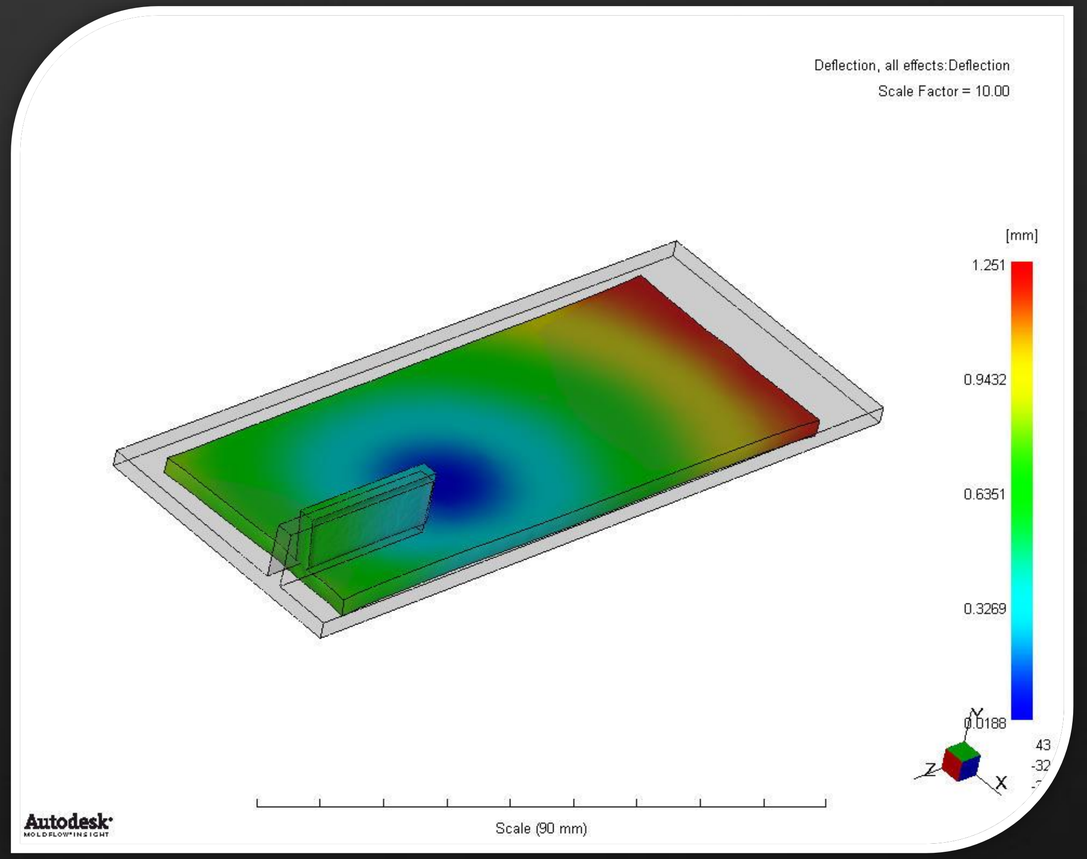
Interiors Sink Marks Visualization







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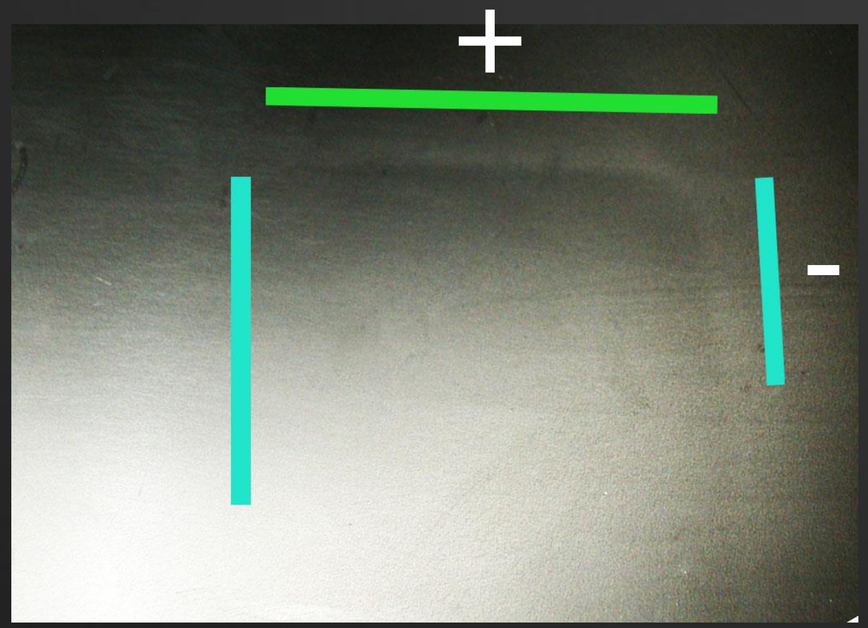
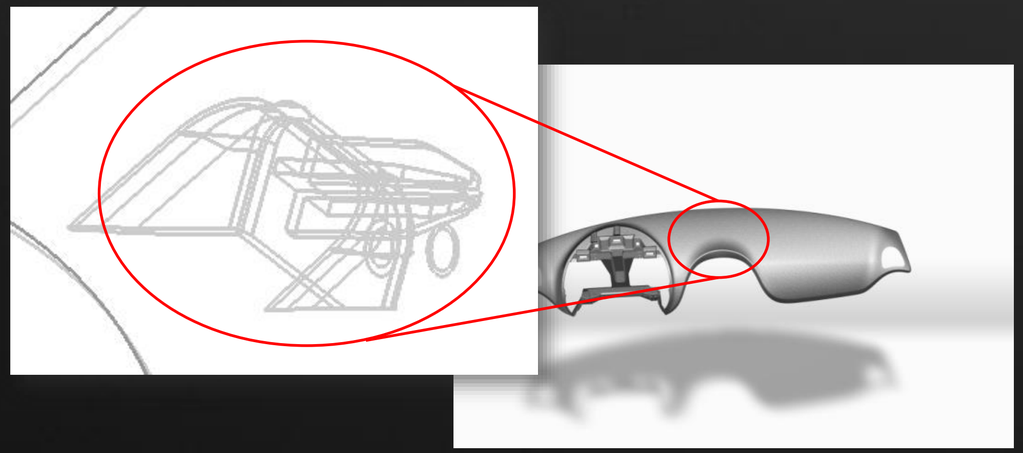
Interiors Sink Marks Visualization

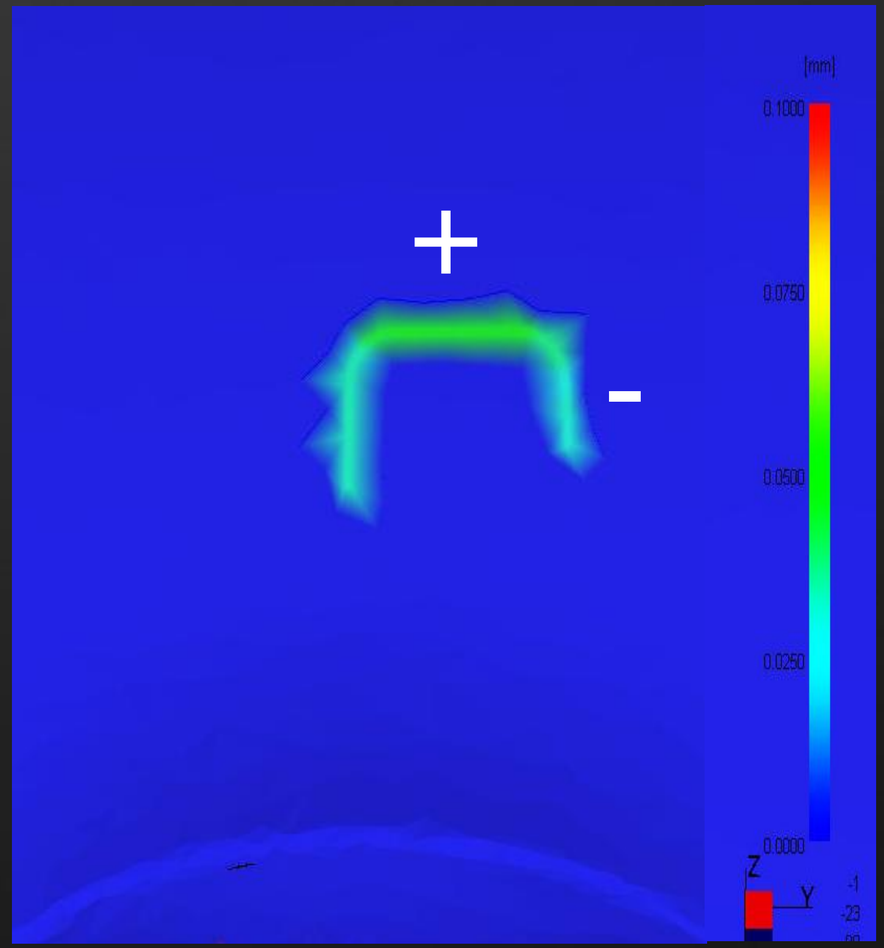


Dashboard upper cover

Real part
Without graining



Sink mark estimate
(through process simulation)



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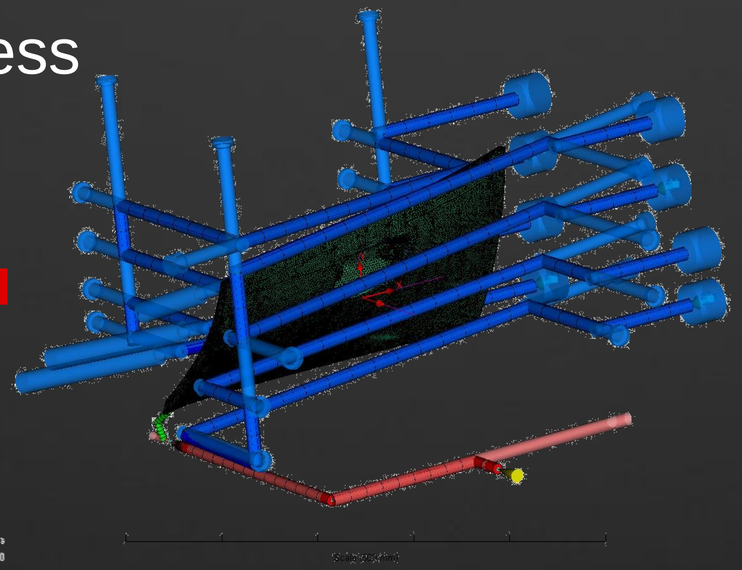
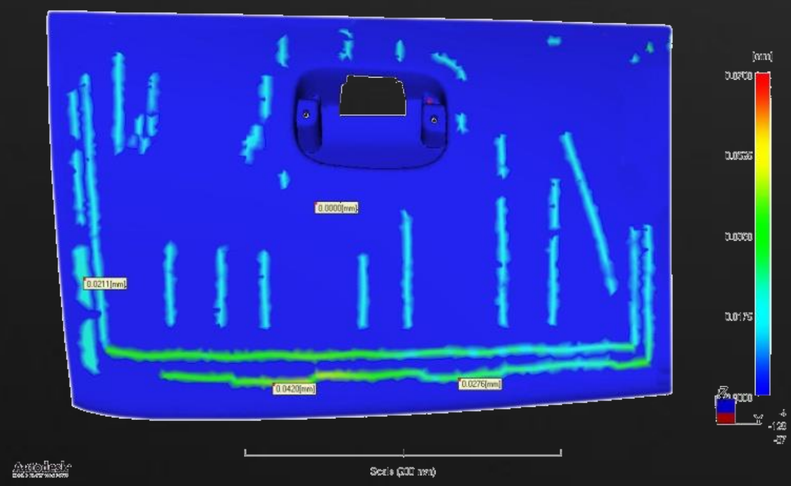
Interiors Sink Marks Visualization

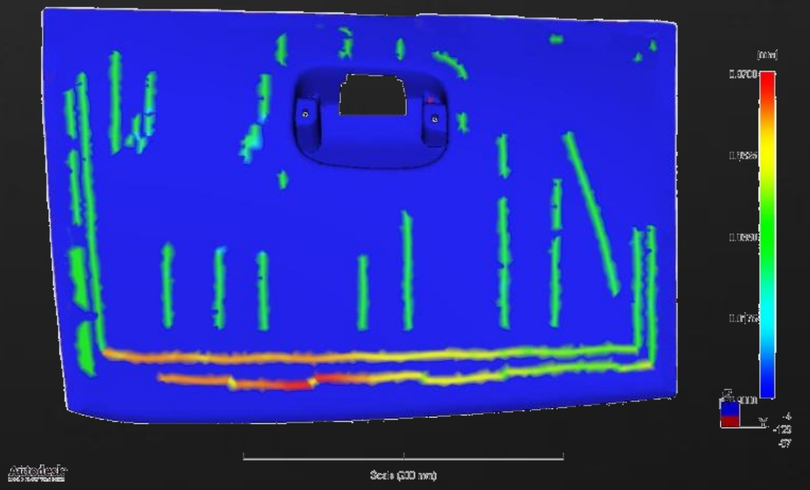
Glove box - Process



Sink mark estimate [mm]
Mid Pressure



Sink mark estimate [mm]
Low Pressure



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Interiors Sink Marks Visualization

Glove box - Low pressure - Visualization

Part weight 362 g
not ok with D21 graining

Glove box - Low pressure - Real part

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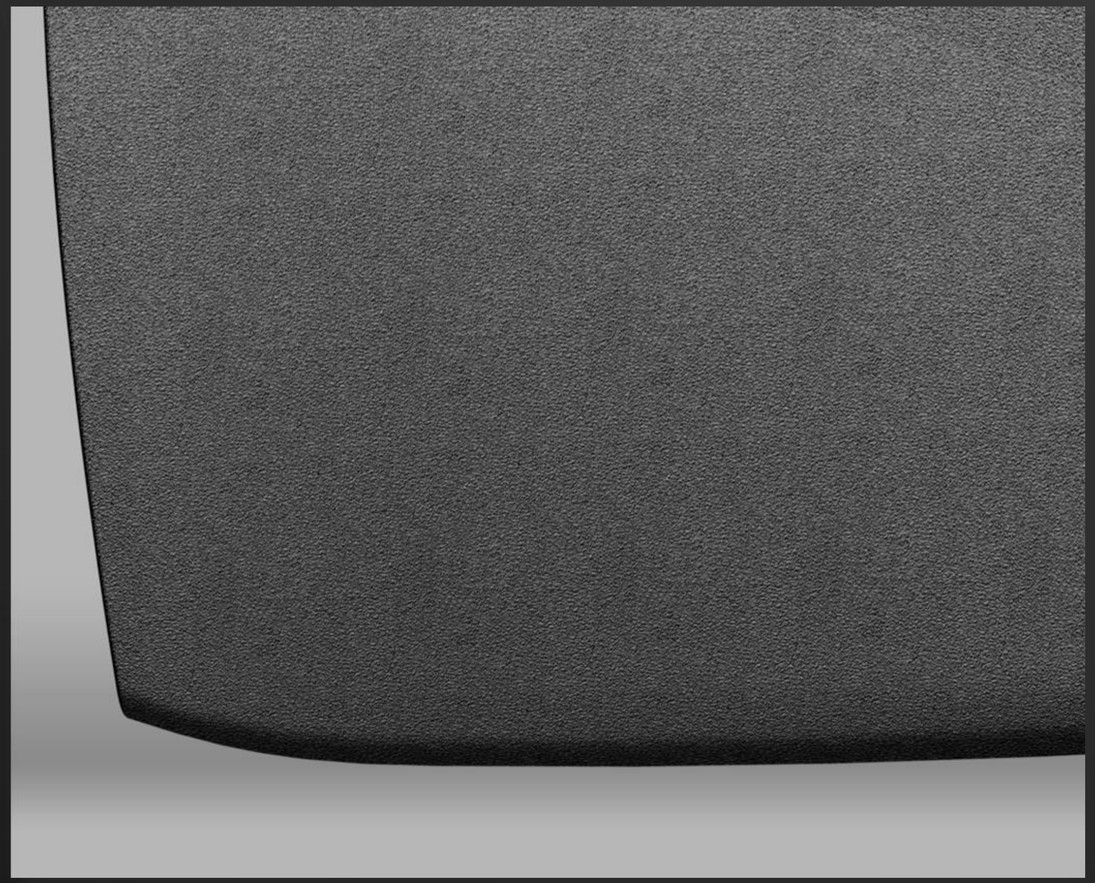
Interiors Sink Marks Visualization



Glove box - Mid pressure - Visualization

Part weight 372 g
ok with D21 graining

Glove box - Mid pressure - Real part

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Interiors Sink Marks Visualization

Glove box - Mid pressure
Without graining

Glove box - Mid pressure
Lighter emboss than D21 not cover defects

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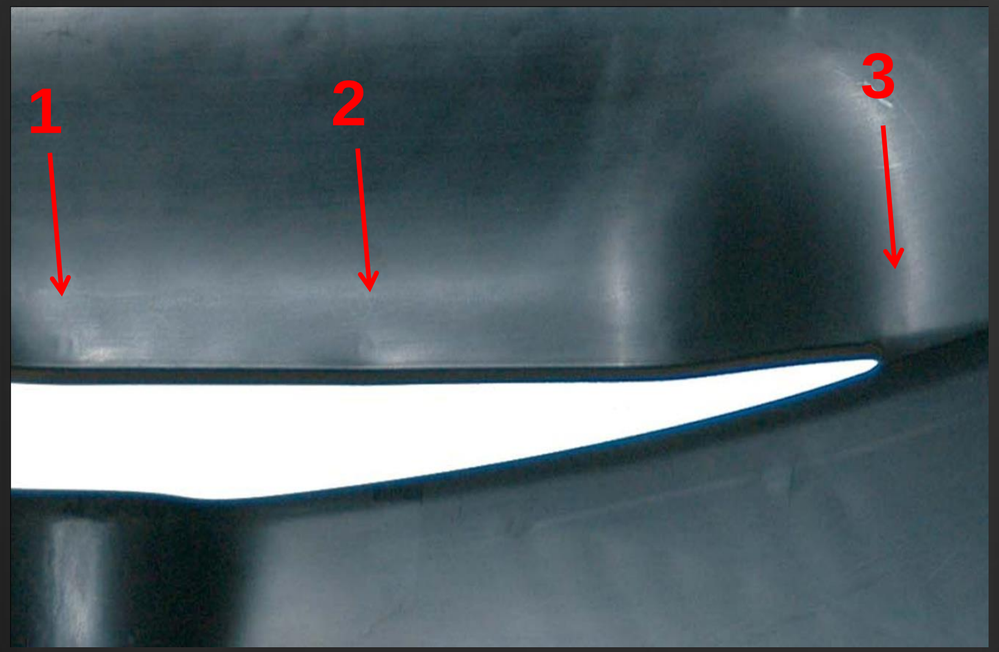
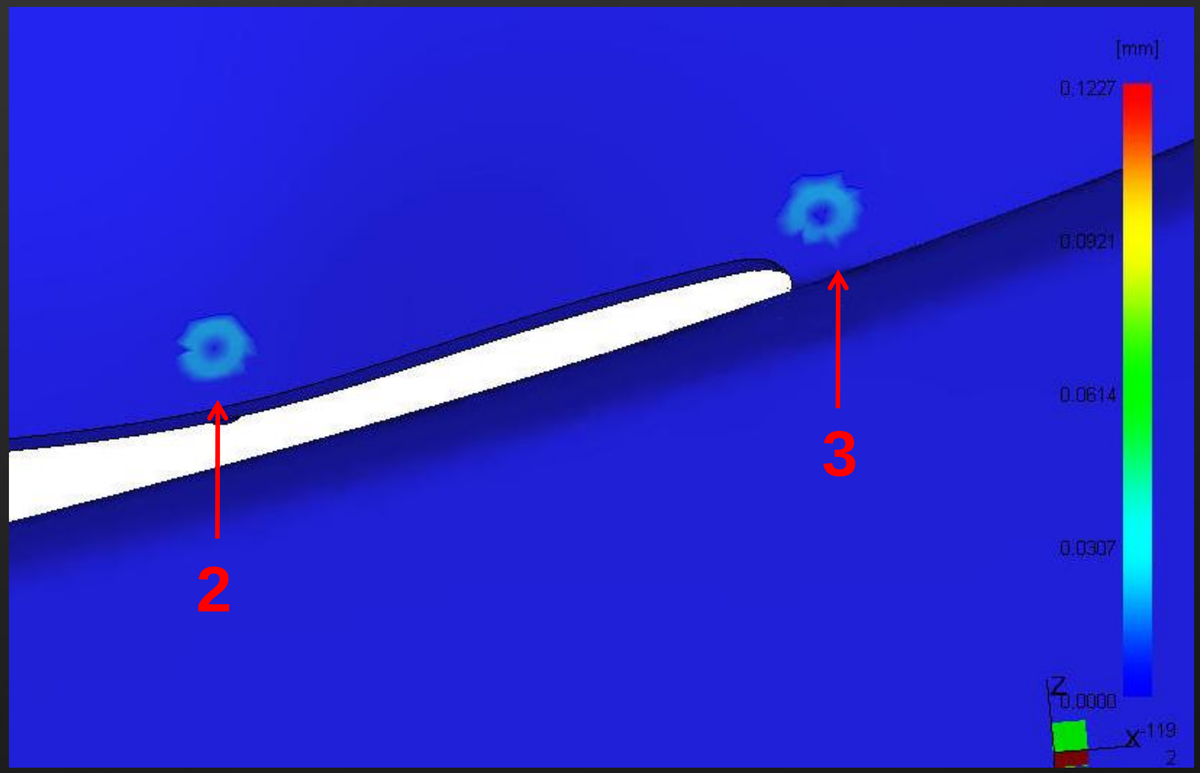
Interiors Sink Marks Visualization



Real door panel
Without graining

Sink mark estimate
(through process simulation)



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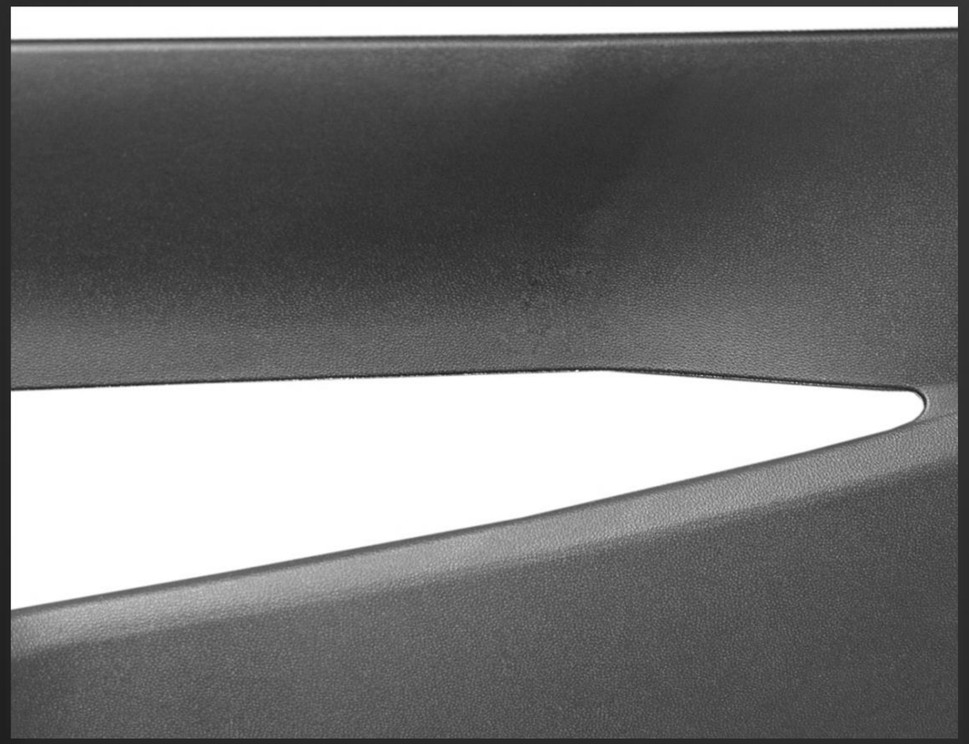
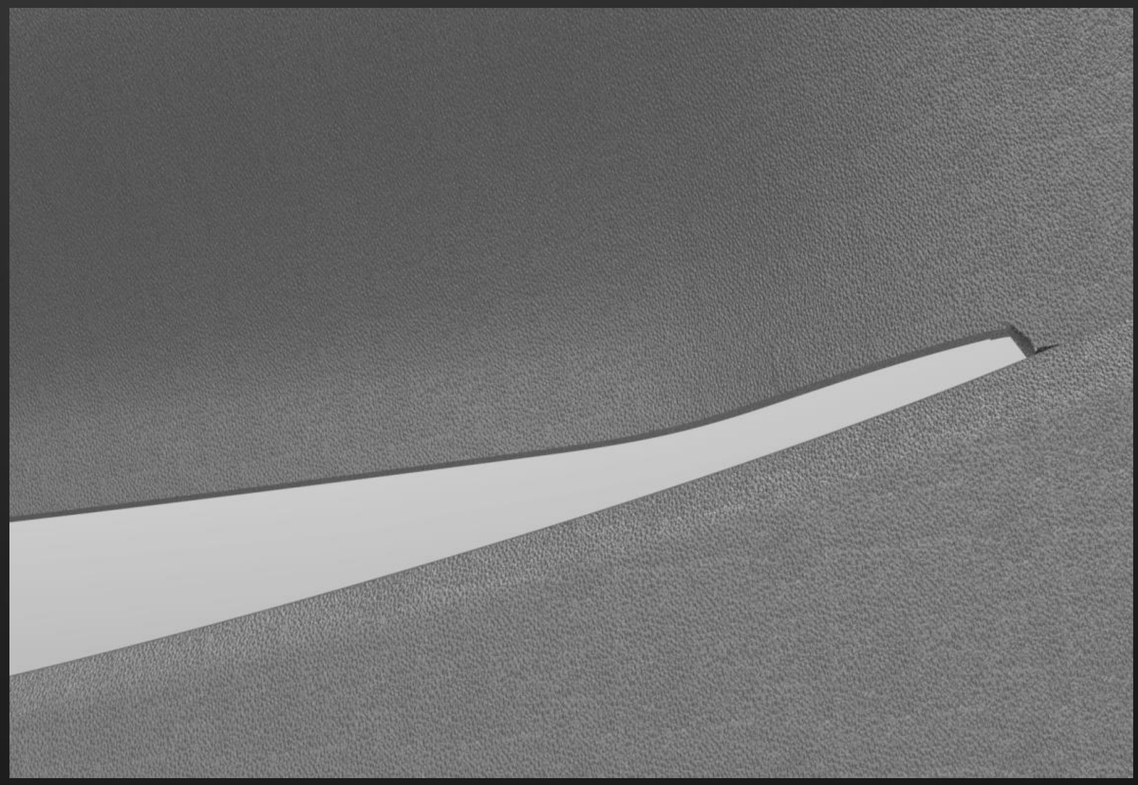
Interiors Sink Marks Visualization



Real door panel
With graining

Visualization

OK! Graining and process have been tuned to cover defects!



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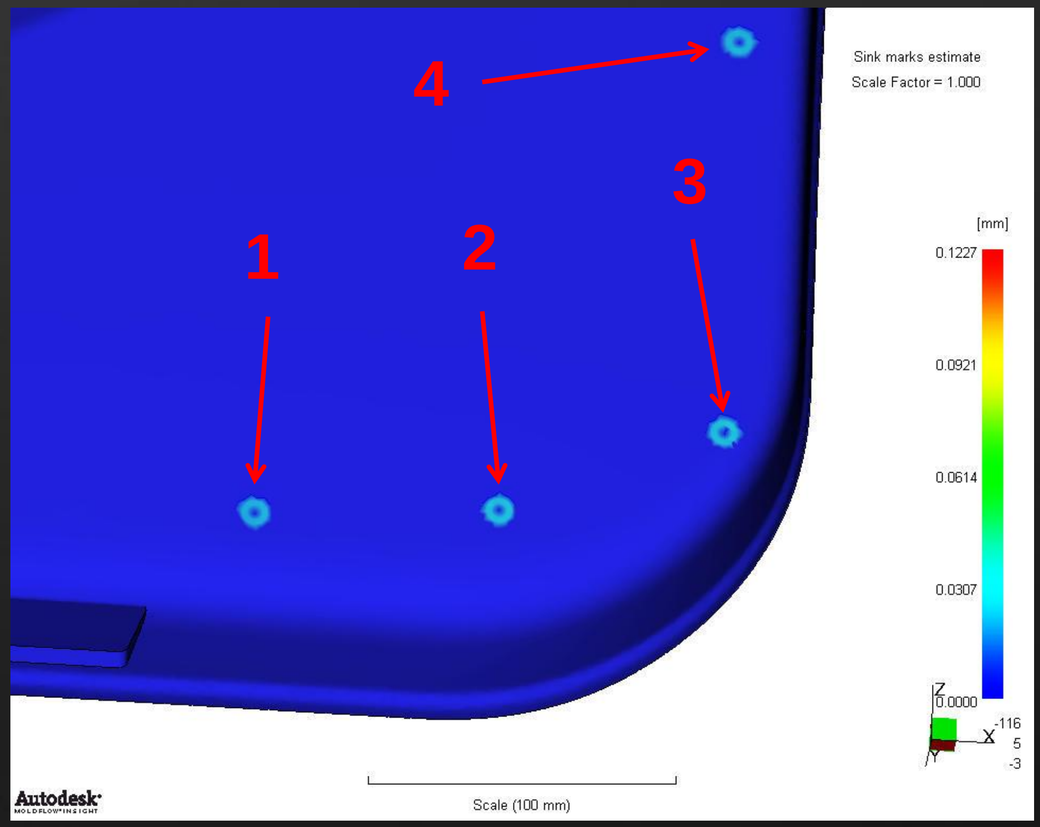
Interiors Sink Marks Visualization

Real door panel
Without graining

Sink mark estimate
(through process simulation)



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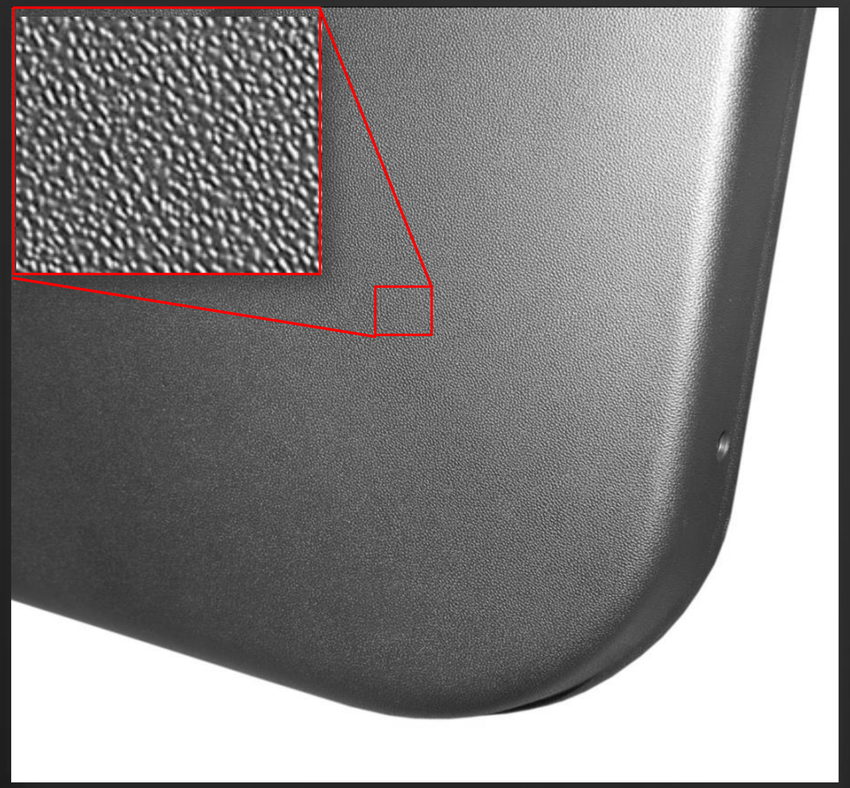
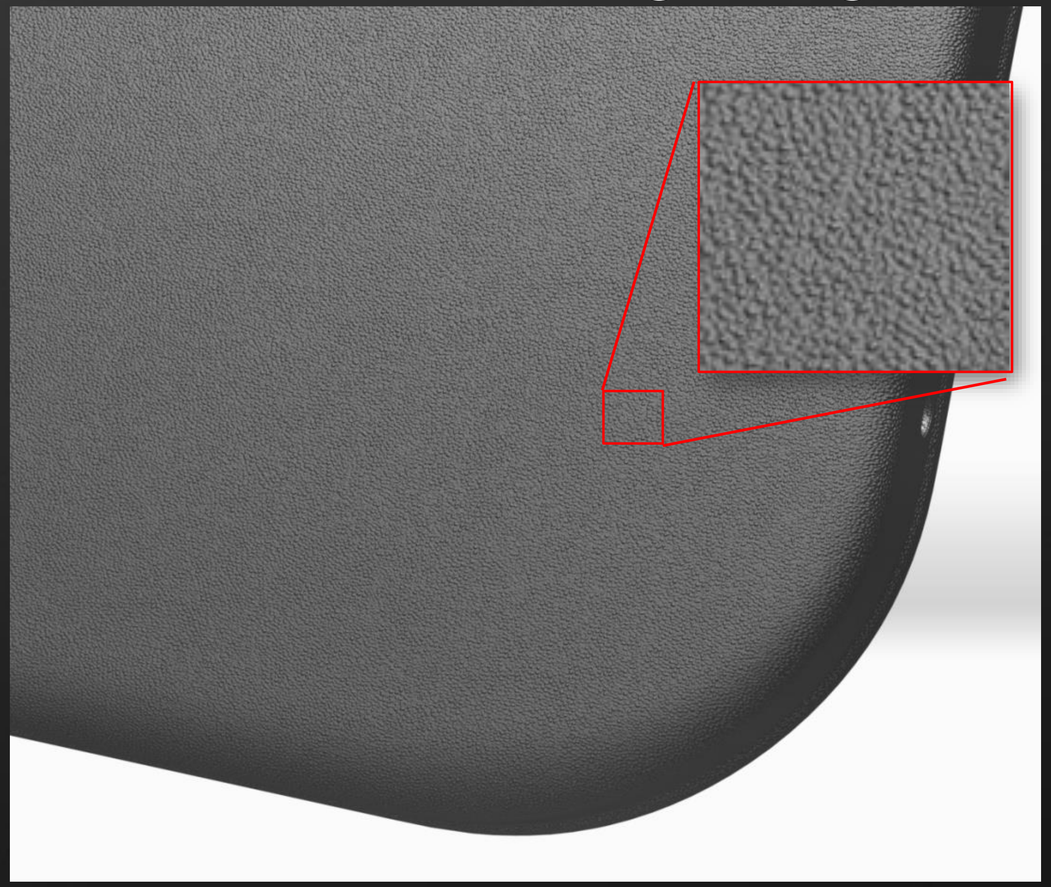
Interiors Sink Marks Visualization



Real door panel
With graining

Visualization
Ok with D21 graining



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Dashboard Flush Gap Simulation under Thermal Load

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Dashboard Flush Gap Simulation under Thermal Load

- Classical simulation
- Process oriented simulation
- Glove box: comparison of calculated and experimental data
- Fuse box: comparison of calculated and experimental data

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Dashboard Flush Gap Simulation under Thermal Load

Classical Simulation

3D CAD data → FEM model for every component → Dashboard assembly → Thermal load (gravity) → Flush gap → Comparison with cockpit flush gap

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Dashboard Flush Gap Simulation under Thermal Load

Process Oriented Simulation

3D CAD data → FEM model for every component → Dashboard assembly → Thermal load (gravity) → Flush gap → Comparison with cockpit flush gap

FEM model for every component → Injection molding simulation → Thermal load (gravity)

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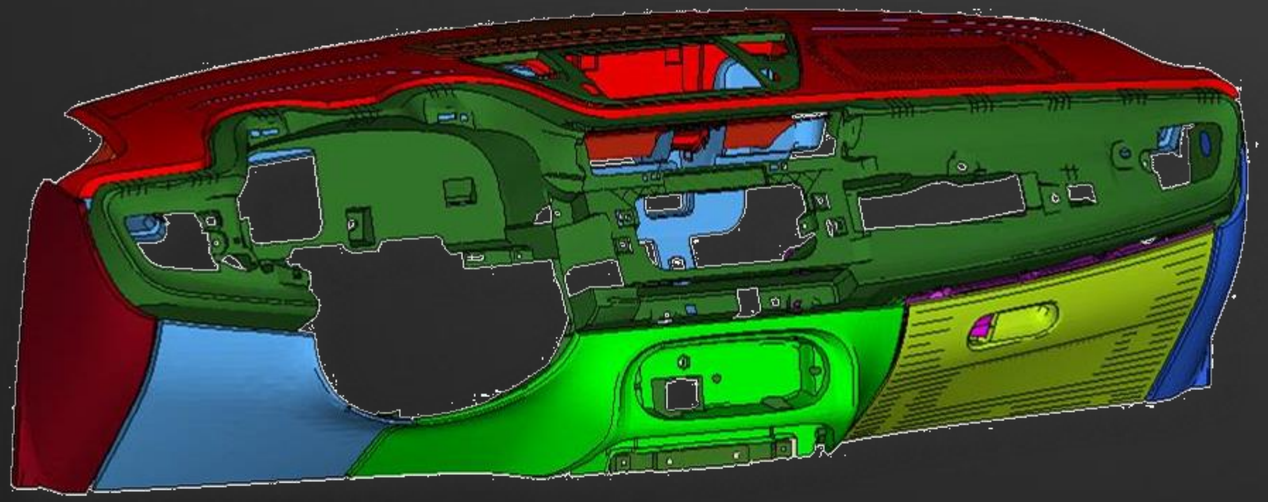
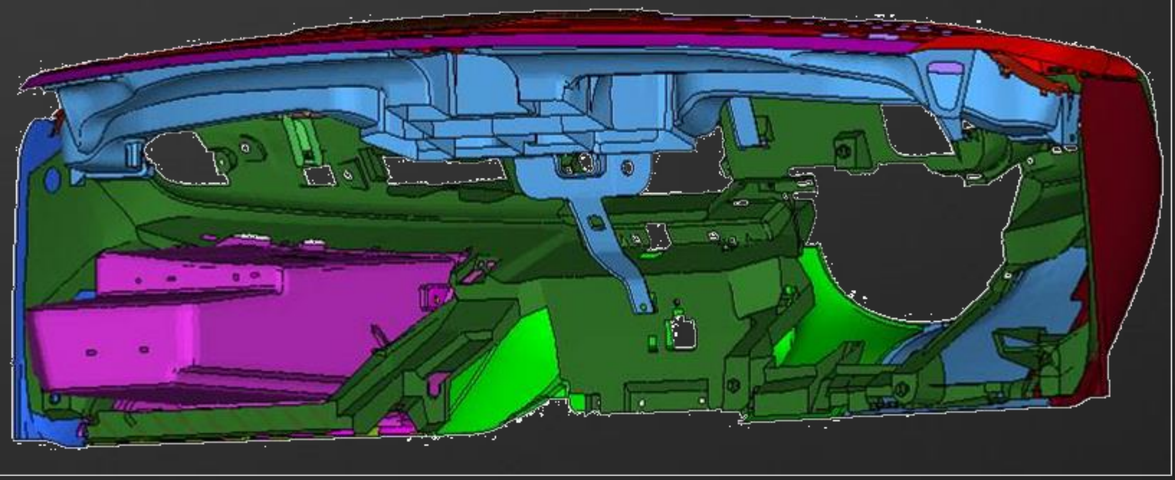
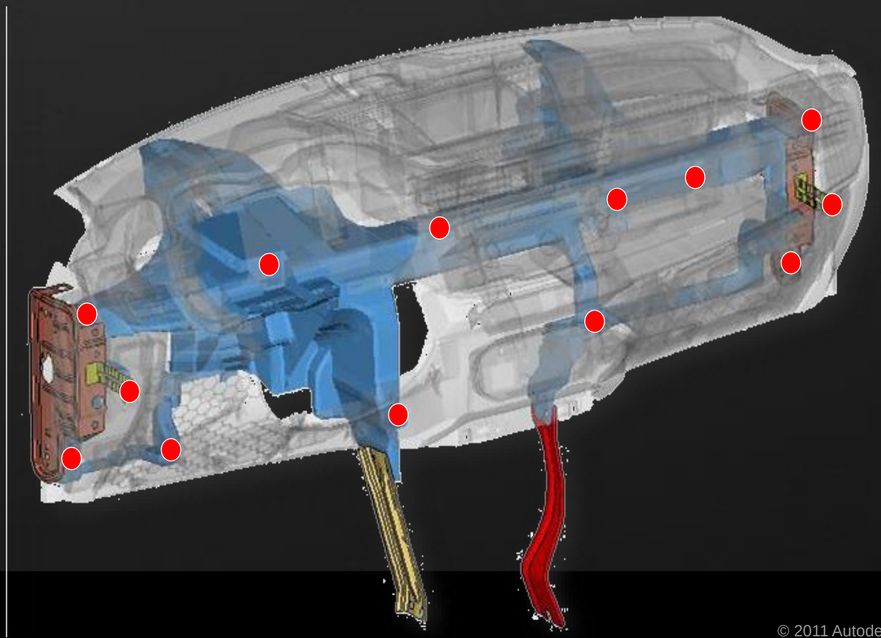
Dashboard Flush Gap Simulation under Thermal Load





- Thermoplastic parts modeled for accomplish both software programs mesh request
- Parts fixed to the body in white



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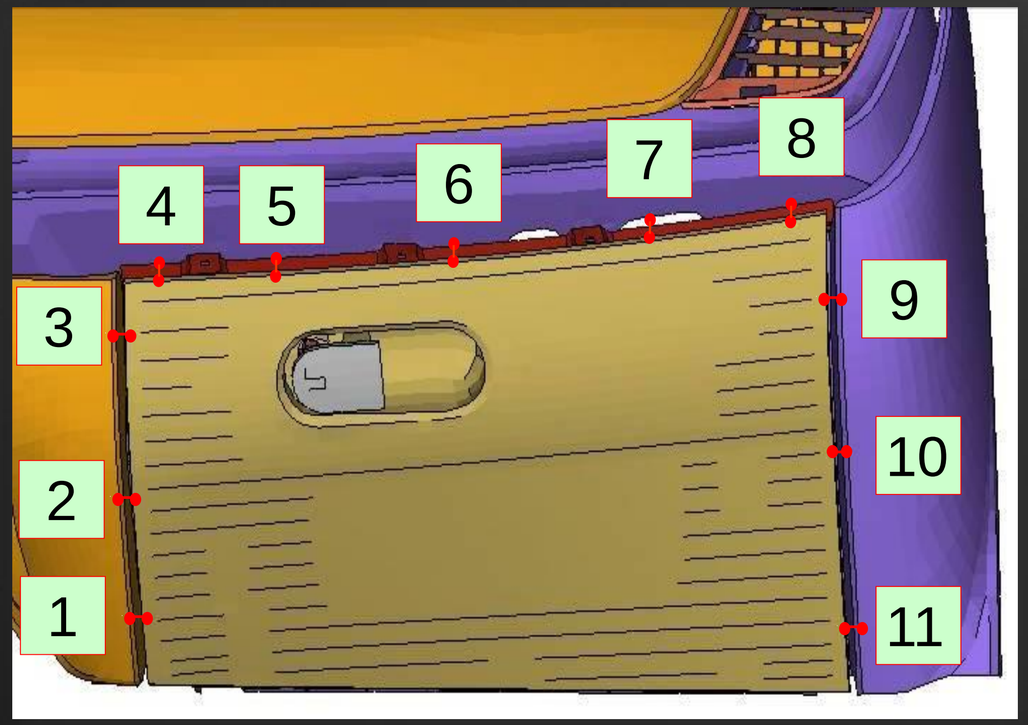
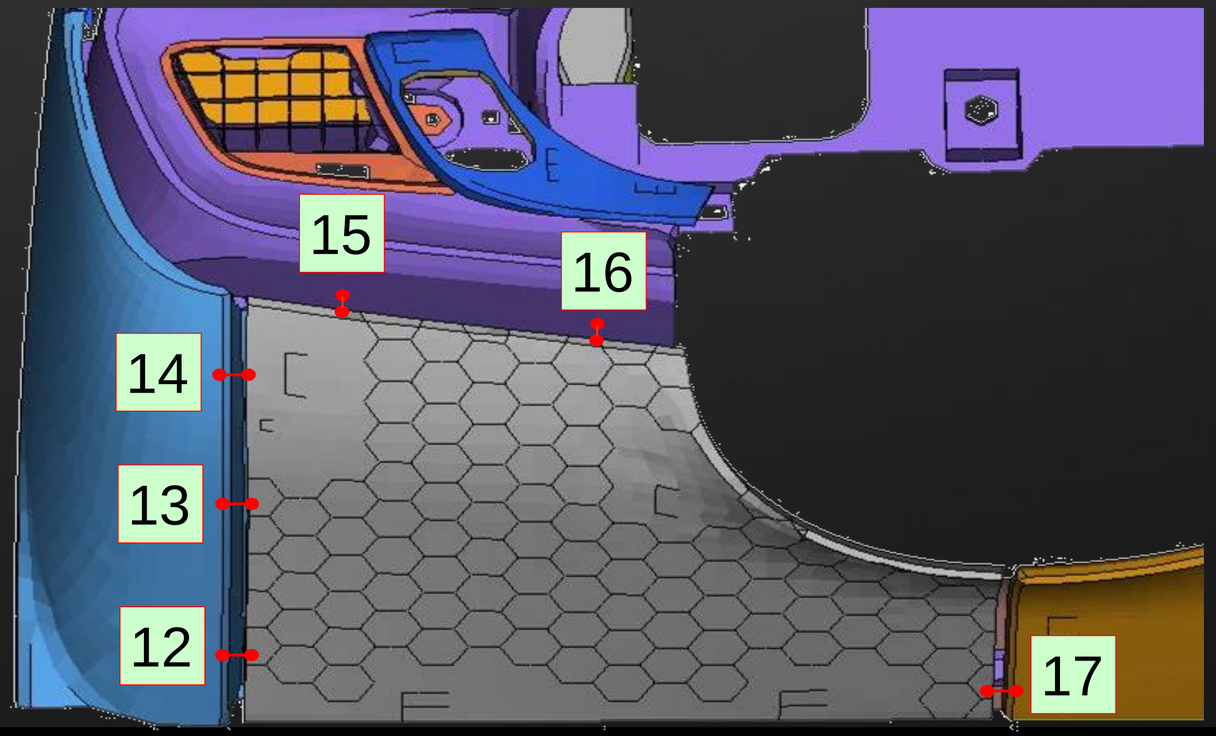
Dashboard Flush Gap Simulation under Thermal Load



Glove box flush gap points of measure



Fuse box flush gap points of measure

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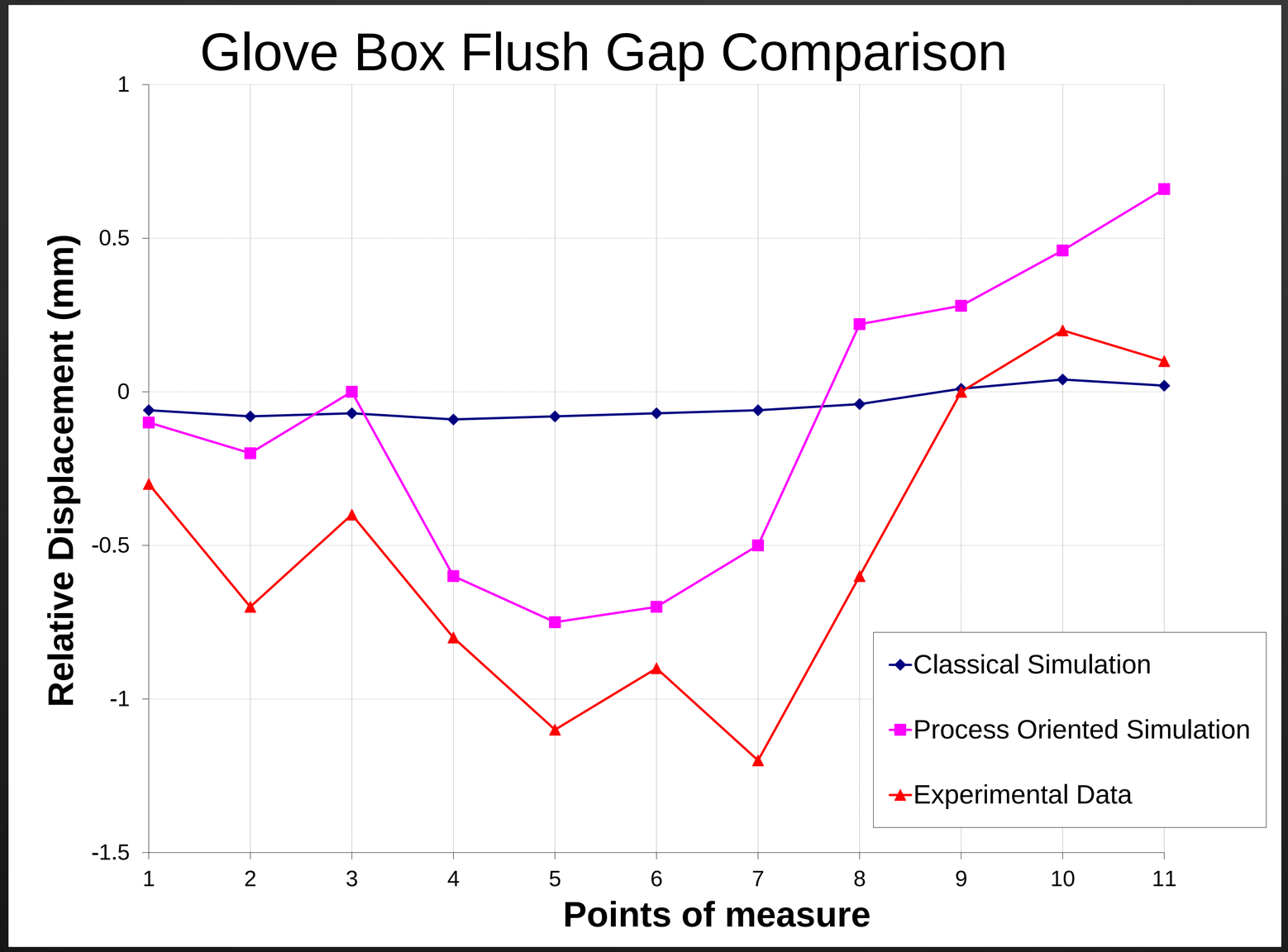
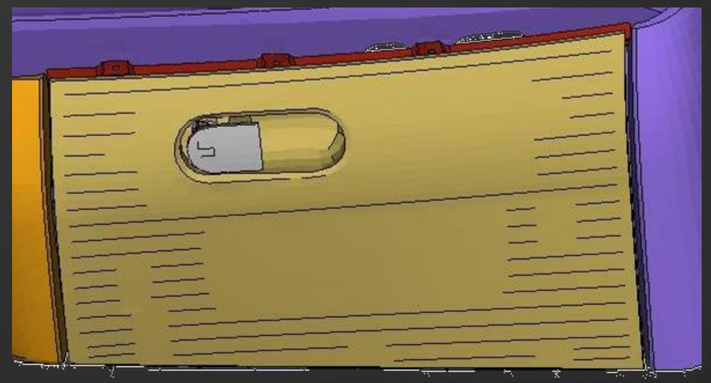
Dashboard Flush Gap Simulation under Thermal Load





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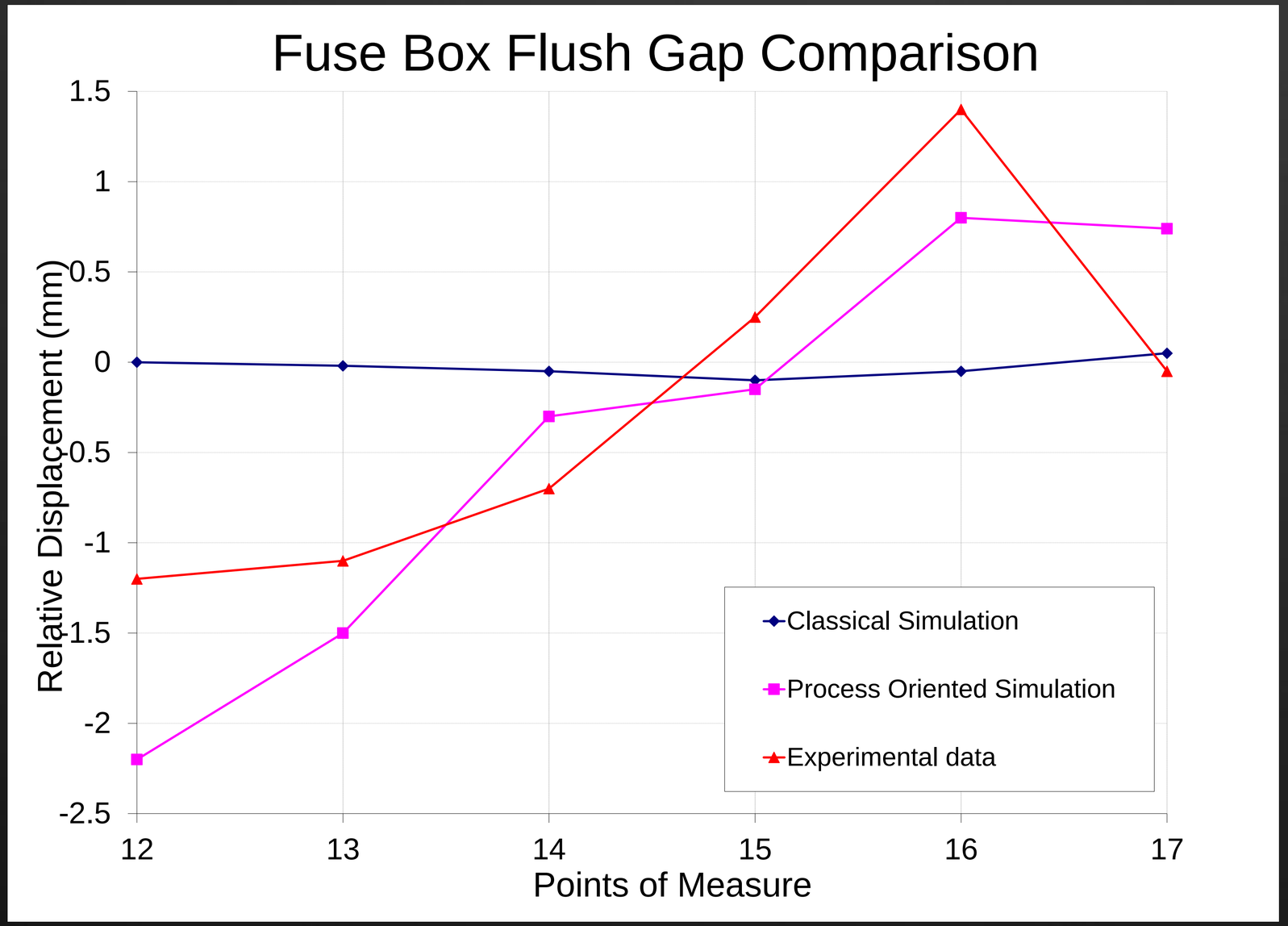
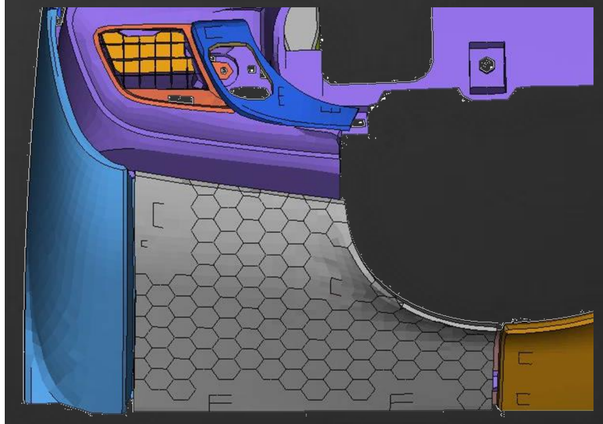
Dashboard Flush Gap Simulation under Thermal Load





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