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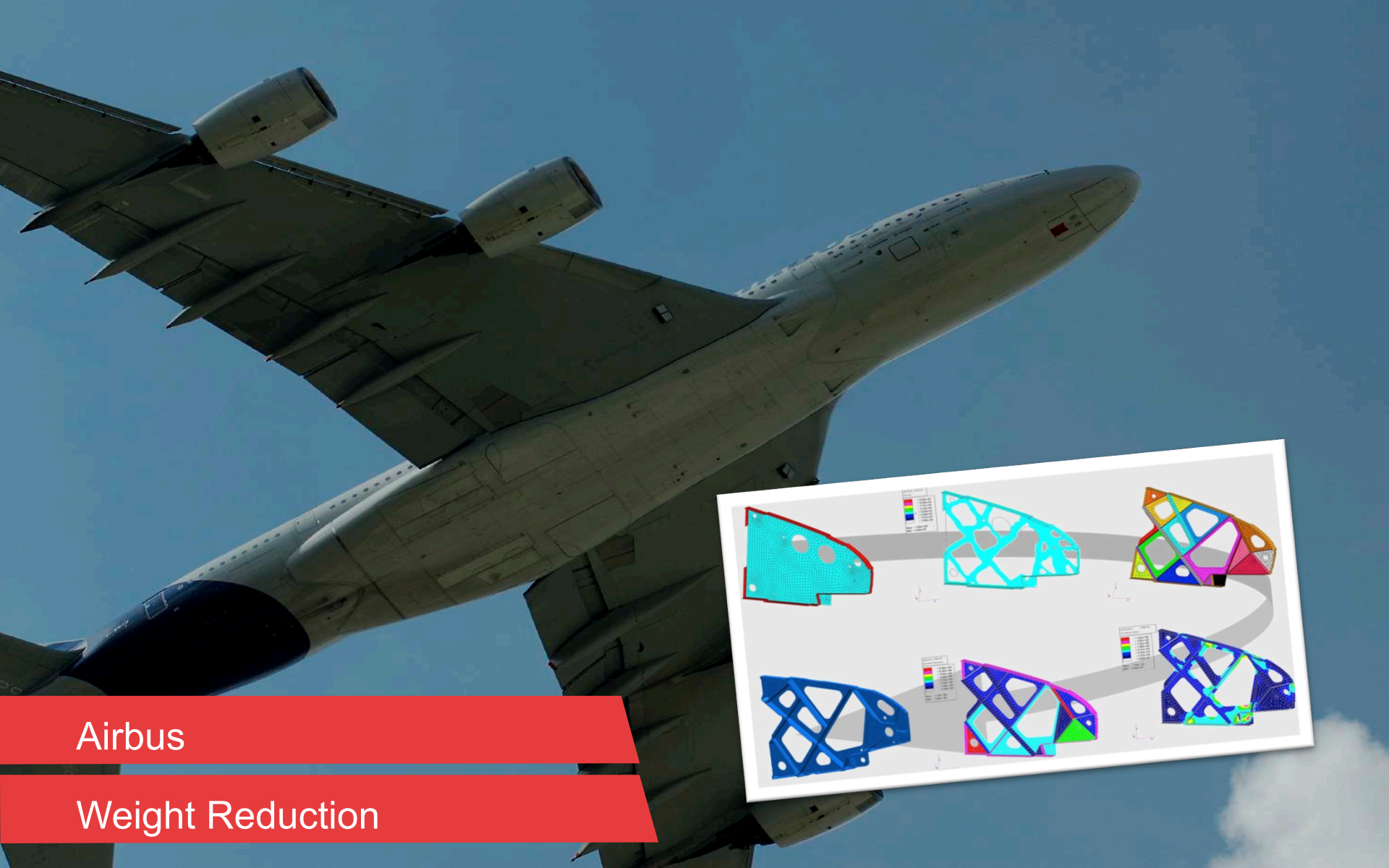
Innovation Intelligence®

Multi-Objective Optimization in the context of Body-In-White Development

Dr Michael Hoffmann
Sr. VP Math & Systems

Presented at:
Teratec Forum 2014

“Our vision is to radically change the way organizations design products and make decisions.”

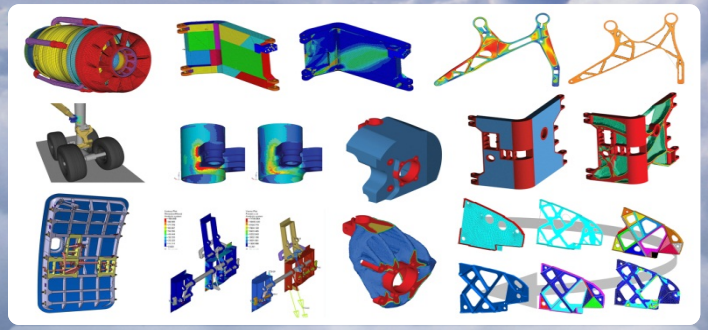


Airbus

Weight Reduction

Airbus

Optimization Center



OUR SOLUTIONS

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HyperWorks®

Engineering Simulation
and Optimization Software

ProductDesign Solutions

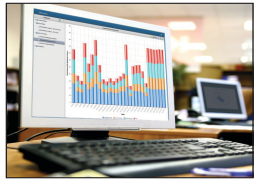
Product Innovation and
Development Consulting

solidThinking®

Simulation-driven Industrial
and Concept Design Software

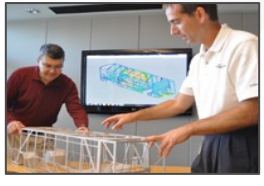
Enterprise Solutions

Cloud-based Business and Engineering
Analytics Software and Consulting



PBS Works™

High Performance Computing
Software and Consulting



Staffing Solutions

Technical Staffing and
On-premise Consulting

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An Engineer's Approach

Short version of a technical seminar given by

Dr. Royston Jones at the 7th EATC, Munich 2014

Experienced gained in multiple vehicle programs

MDO in the context of BIW-Development

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Challenges

100+ Design Variables and Responses

Quick turn-around to influence design

Dataflow

IT-Integration

Efficient Optimization Strategies

MDO in the context of BIW-Development

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Goals

MDO Set-up < 4hrs

Optimization runs < 5 days on 250 CPUs

Assessment < 4hrs

Focus on size and shape optimization

Work with multiple CAE models

GENERIC PROCESS

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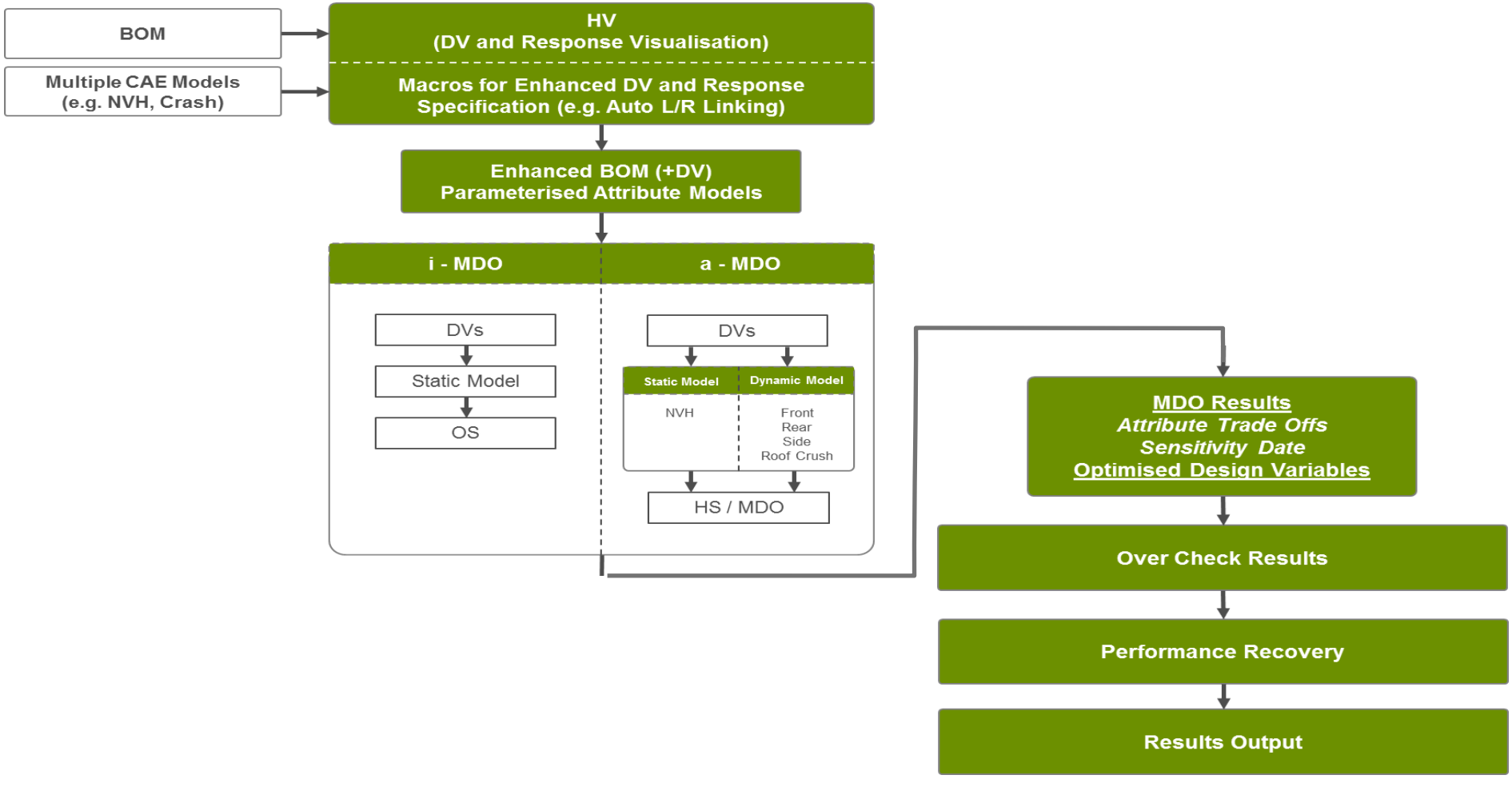
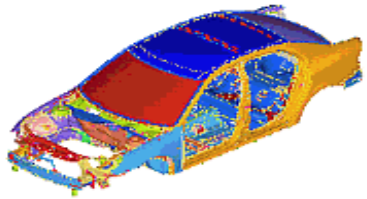


ols Preferences Safety Tools Applications Help

1 of 1

Model file: C:/WORK_FOLDER/MDO_TEST_AREA/MDO_DEMO/aMDO/ATC_DEMO/includes/b...
Label: NVH



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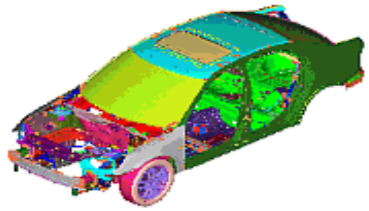

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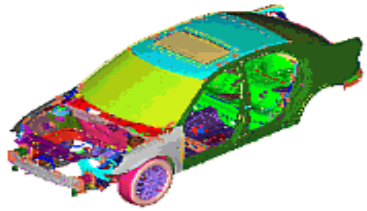

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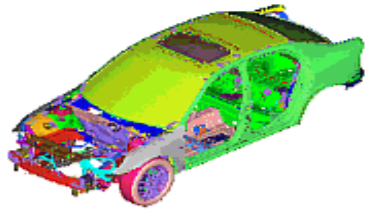
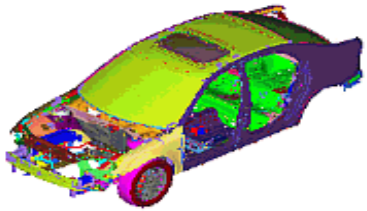


Model file: C:/WORK_FOLDER/MDO_TEST_AREA/MDO_DEMO/aMDO/ATC_DEMO/include...
Label: SPI



Model label: SPI Update

Optimisation model Overcheck model

Model name: C:/WORK_FOLDER/MDO_TEST_AREA/MDO_DEMO/aMDO/ATC_DEMO/includes/MERGED_BIW_FRONT_SUB_spi2 Browse...

Import new model
Replace active model

Duplicate active model

Apply
Prev
Next

i-MDO

i-MDO PROCESS STAGES

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Step 1: OptiStruct Analysis – General Mass Optimization

Step 2: Automatic Overcheck Analysis Runs

Imports Optimised Results into Overcheck Input Decks

Executes Overcheck Runs

Step 3 : Performance Recovery

Engineering Assessment to Recover Performance

Ability to Perform small a-MDO assessments

STEP 1: GLOBAL MASS OPTIMIZATION

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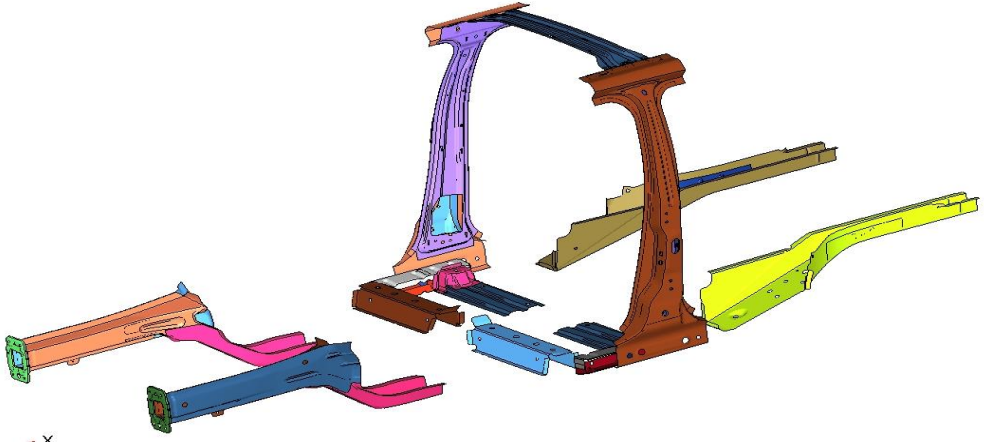
Panels / Components Selection for Mass Distribution

As the iterative process progresses – more panels are either frozen or have increased lower bound thickness values to protect attribute performance



Typical Frozen or Increased Lower Bound Panels

STEP 1: GLOBAL MASS OPTIMIZATION

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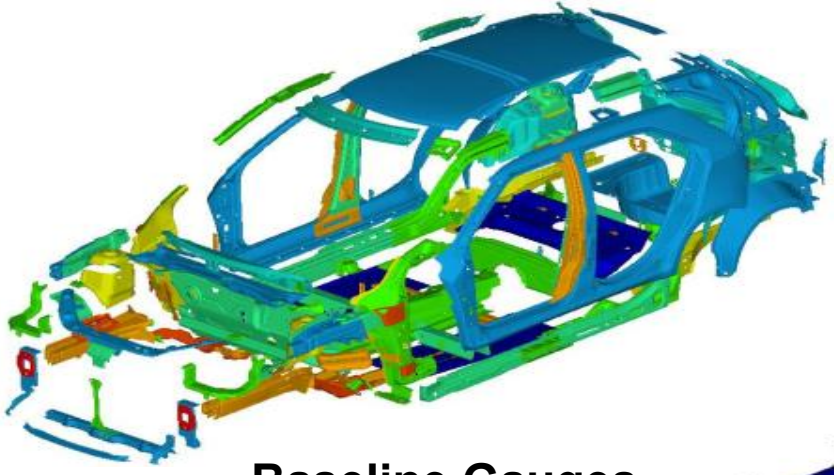
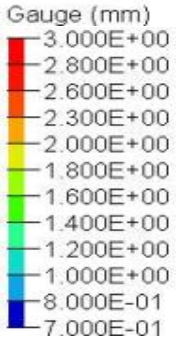
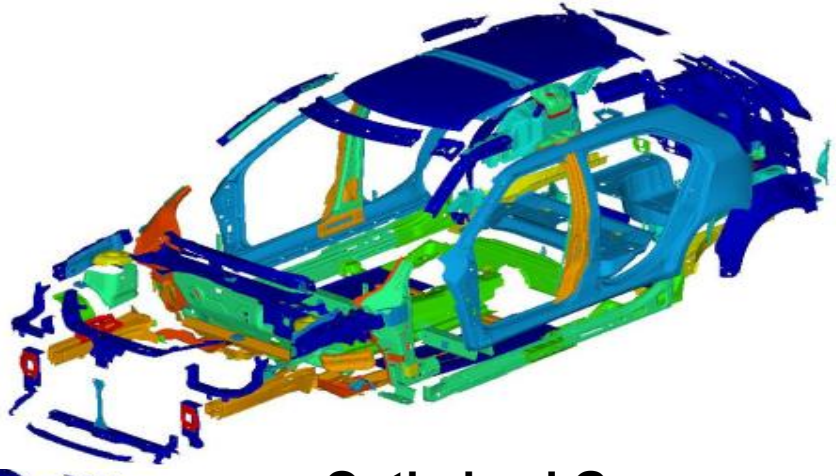


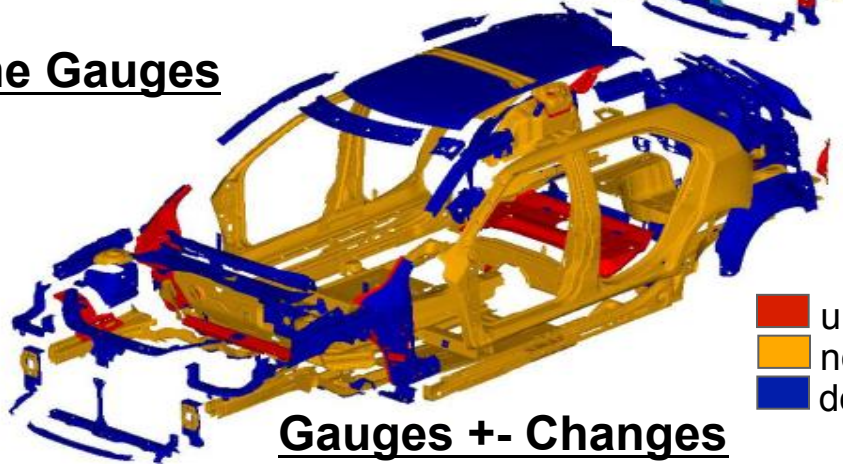


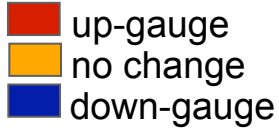


Baseline Gauges

Optimised Gauges

-20.5kg





Gauges +- Changes

STEP 2 : AUTOMATIC OVERCHECKING

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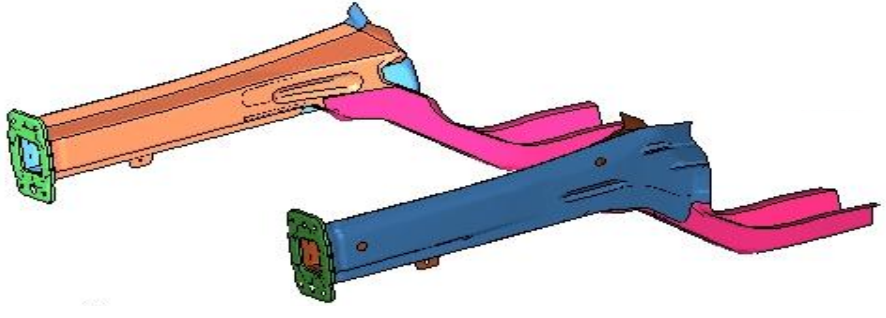
Perform Attribute Performance OverChecks

Dynamic NVH

Durability

Crash

Obtain an Engineering Understanding of Mass Redistribution and the Effects on Attribute Performance



STEP 3: Attribute Performance Recovery

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Engineering the Performance back into the Structure

Perform Local Optimization to Recover Attribute Performance

NVH Local OptiStruct Runs

Crash – small a-MDO Studies

TYPICAL i-MDO ITERATIONS

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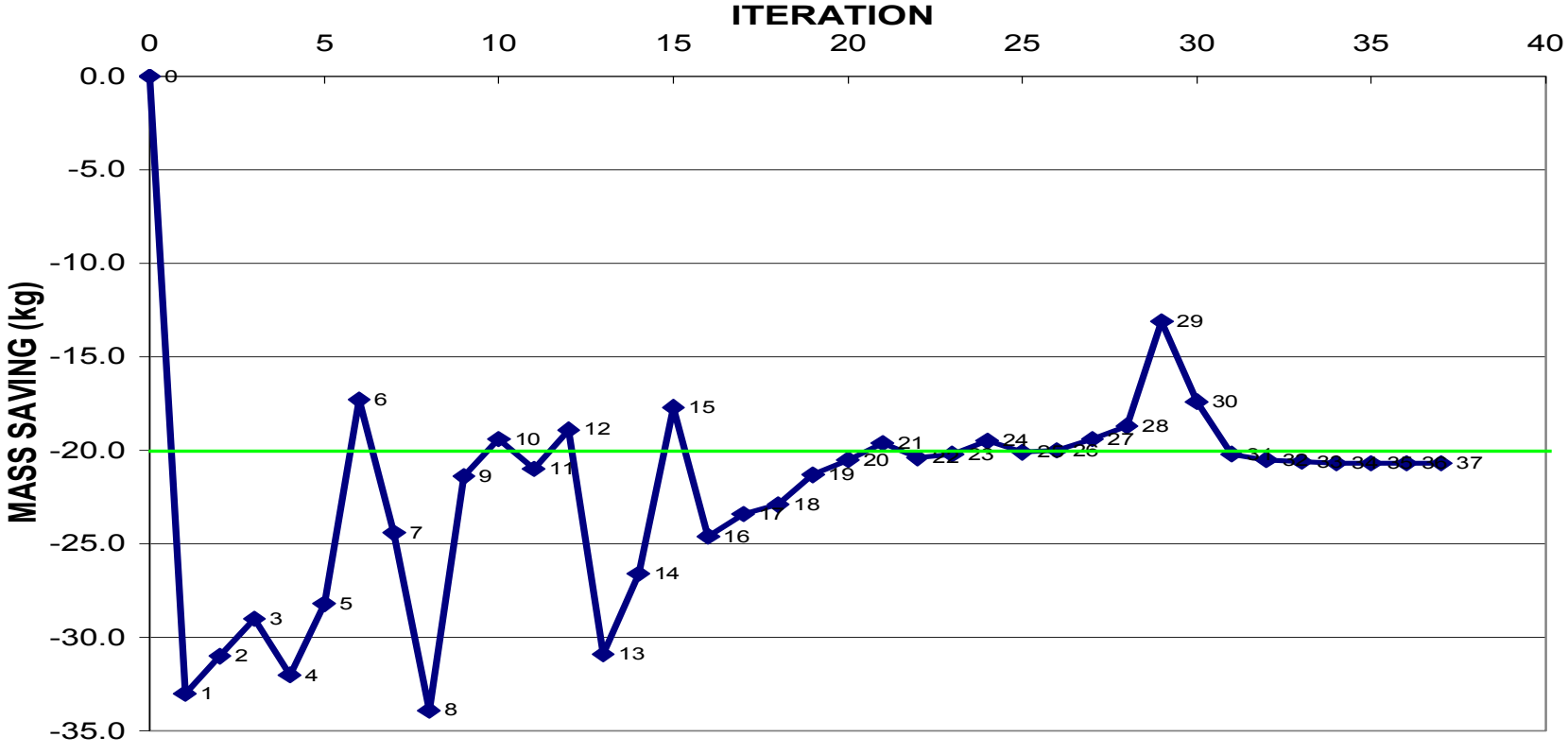
Typical Iteration Time – 1 to 2 Weeks



a-MDO

a-MDO OVERVIEW

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Response Surface Approach

For each load case separately

Nested Uniform Latin HyperCubes

Upper and lower bounds for model robustness checking

Satisfy Constraint of Hardware and Software Resources

Time required to deliver design input

MDO in the context of BIW-Development

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Tools and Processes for

MDO Set-up < 4hrs

Optimization runs < 5 days on 250 CPUs

Assessment < 4hrs