

LUCID

COMPROMISE **NOTHING**™



Lucid Motors at Aachen Automotive Colloquium 2026

Multi Attribute Optimization of an Electric Vehicle Chassis Architecture for Dynamics, Durability and NVH Performance

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More than a timeline. *History in the making.*



Atieva becomes
Lucid Motors

2016



Battery
Formula E

2017

2018

JUL 2021
IPO (Nasdaq: LCID)

2021

AUG 2023
Air Sapphire debuts as the
world's first EV sport sedan

SEPT 2023
AMP-2 factory opens
in Saudi Arabia

2023



APR 2024
Lucid Air GT becomes longest
range EV on the market
(512 miles of EPA est. range ⁽²⁾)

2024



Front Powertrain
Formula E Gen 3.5

Lucid delivers the first Gravity
and expands production

2025



Expected launch of
the robotaxi program

2026

Groundbreaking at our AMP-1
factory in Arizona



OCT 2021
Lucid Air deliveries begin



NOV 2023
Lucid Gravity debuts at
the LA Auto Show



JUL 2024
2024 Air Pure achieves
5.0mi/kWh ⁽¹⁾ efficiency

DEC 2024
Lucid Gravity deliveries begin

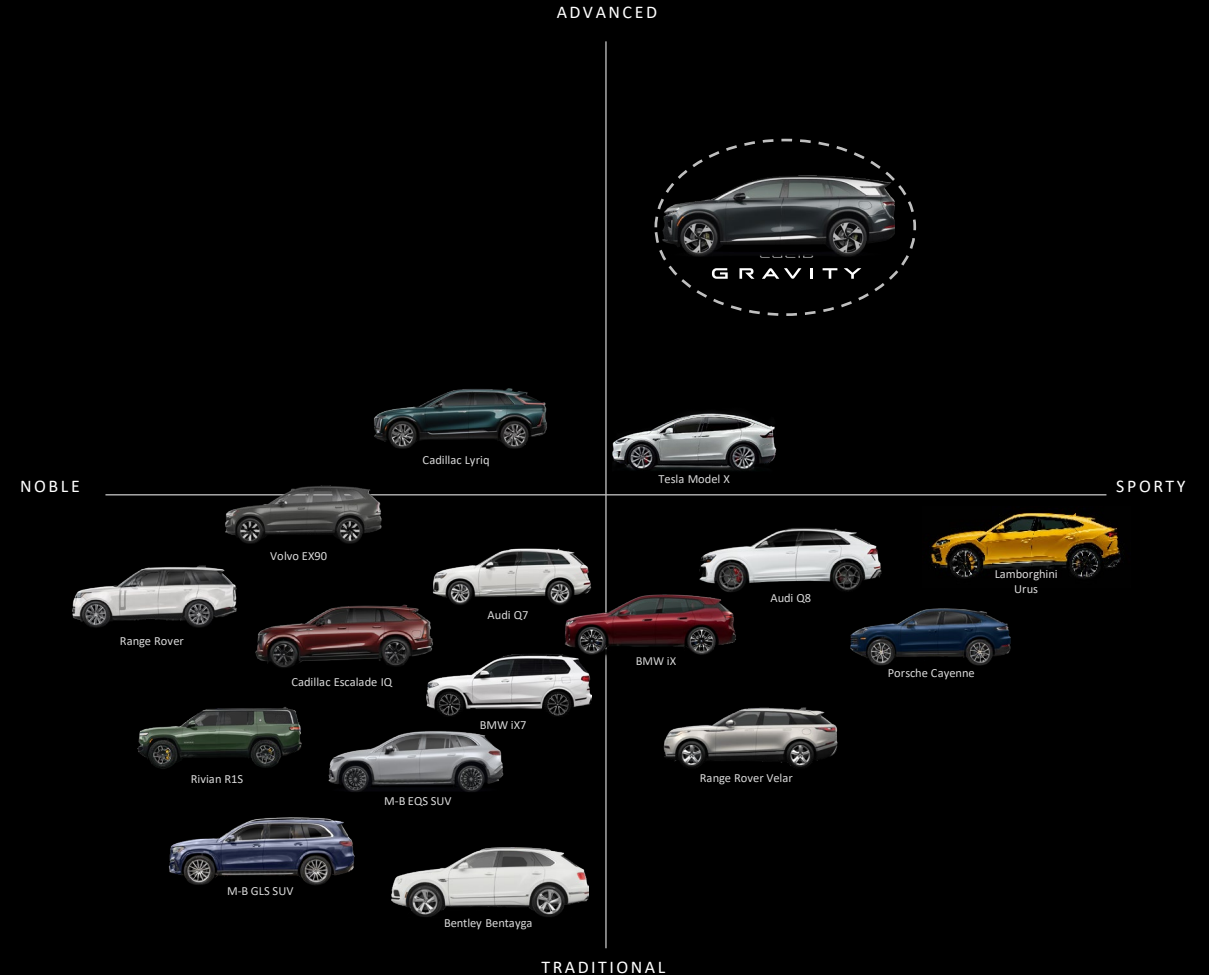
JUL 2025
Uber, Nuro, and Lucid
partner to launch a premium
global robotaxi program

(1) When equipped with 19" wheels;
as measured by miles of EPA-est.
range per kWh in battery pack. (2)
When equipped with 19" wheels;
range and battery power vary with
temperature, driving habits, charging
and battery condition and actual
results will vary.

Positioned to stand out from the crowd

Lucid Gravity is sleek, sporty, and advanced –definitively setting Lucid apart from the competition.

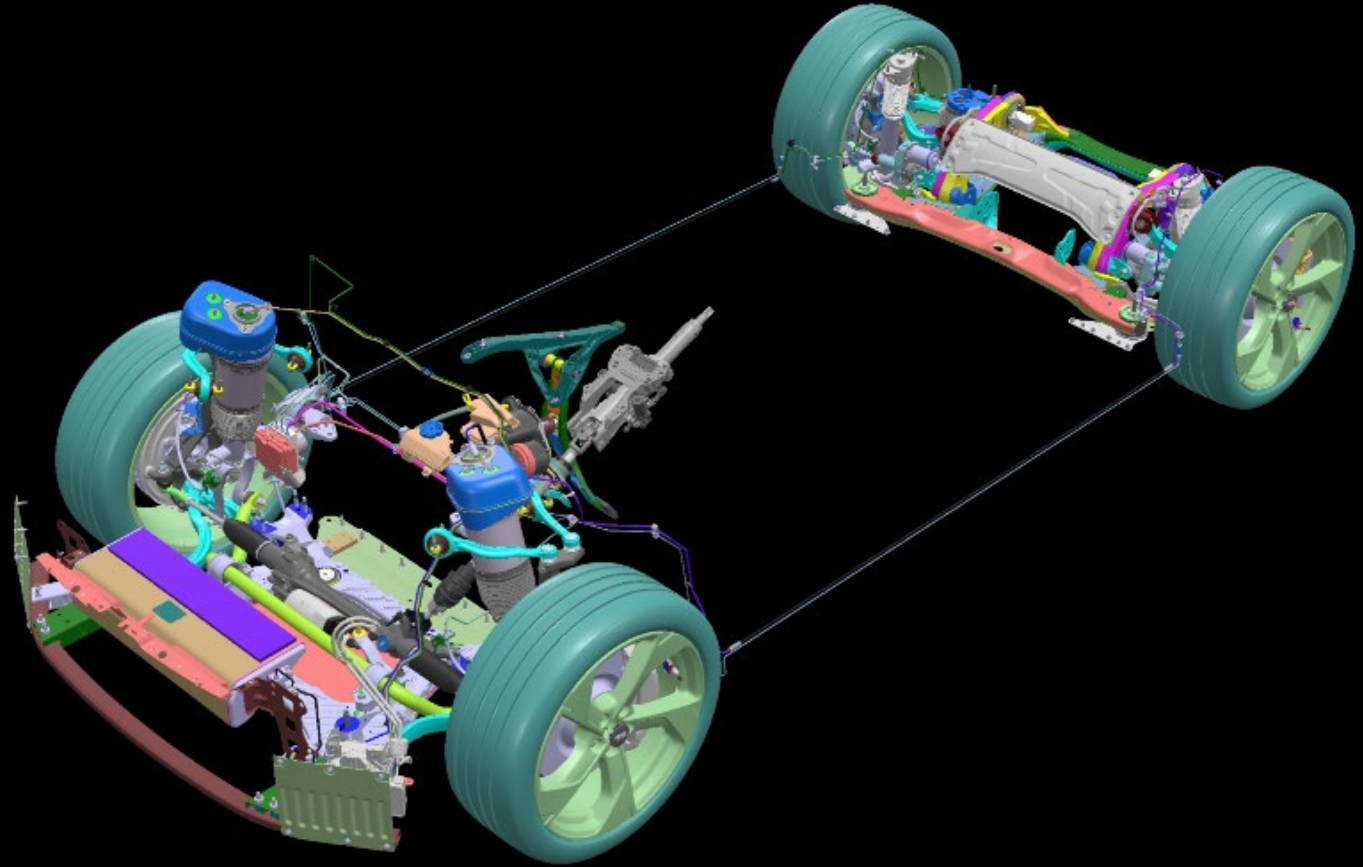
The bold, elegant exterior combines with the hi-tech and spacious interior— creating an ideal sequel to Air.



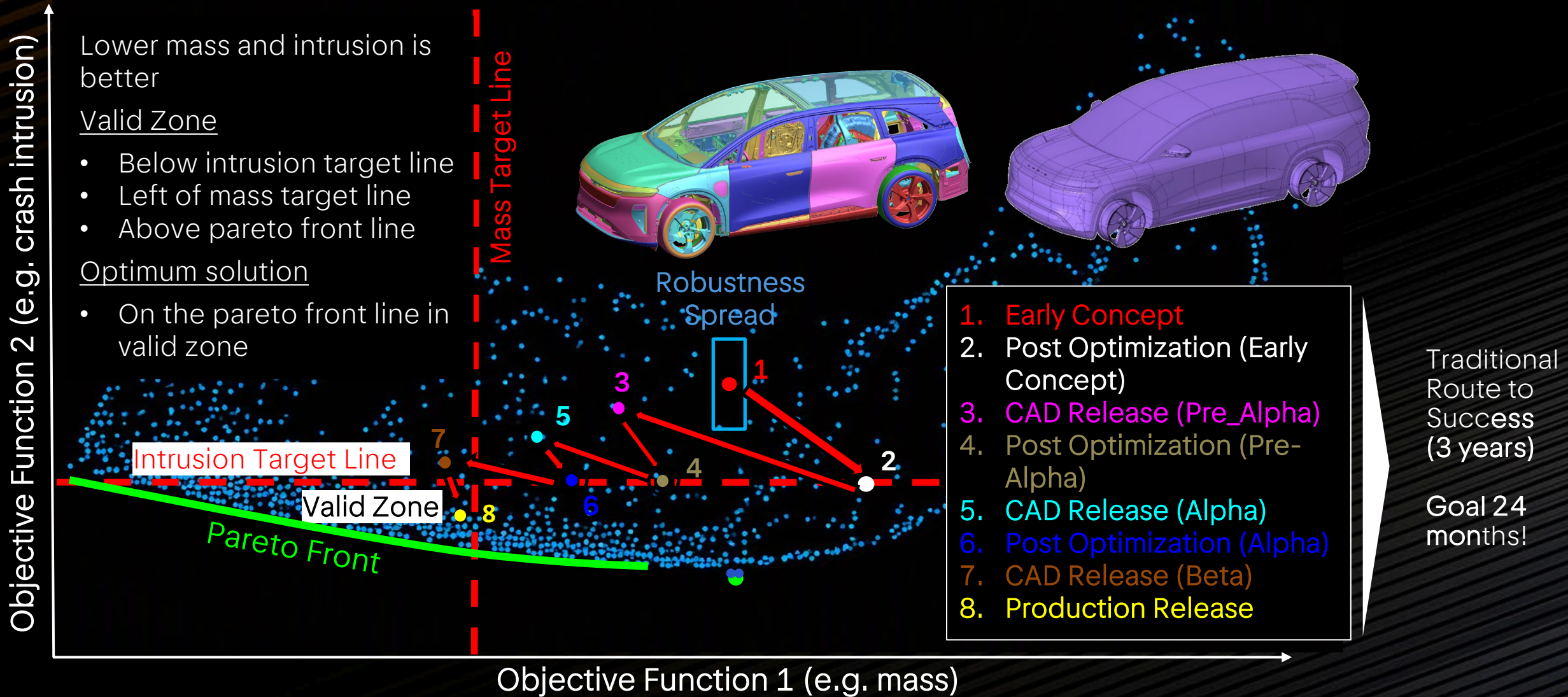
Lucid Gravity Chassis Systems

Capability of an SUV, refinement of a Lucid

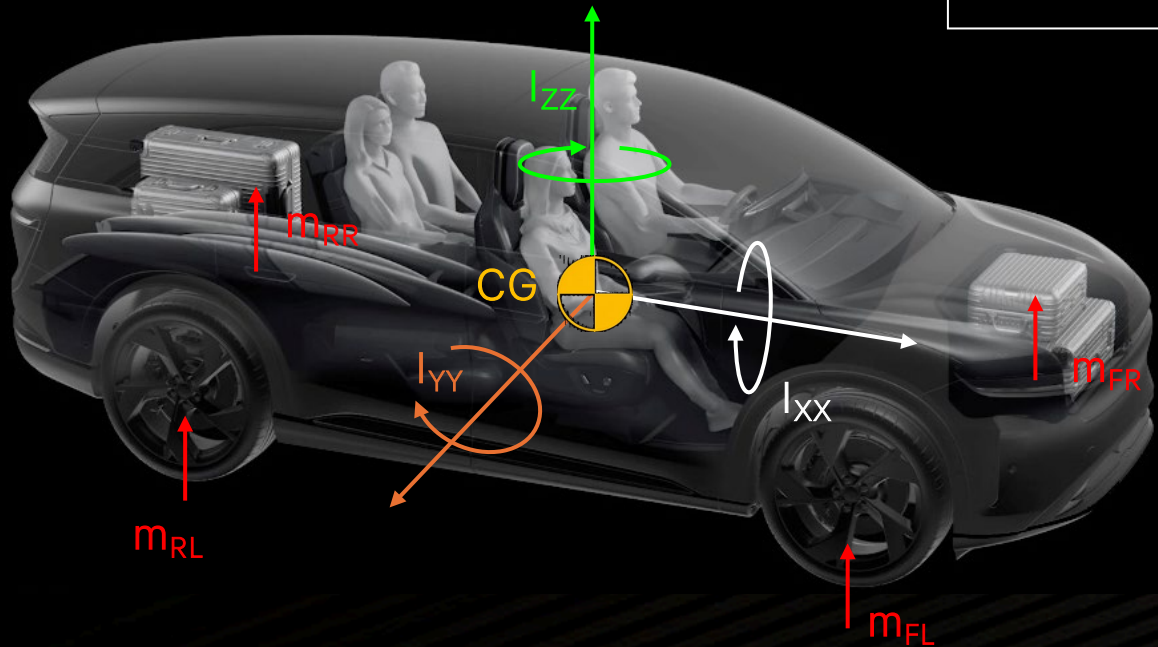
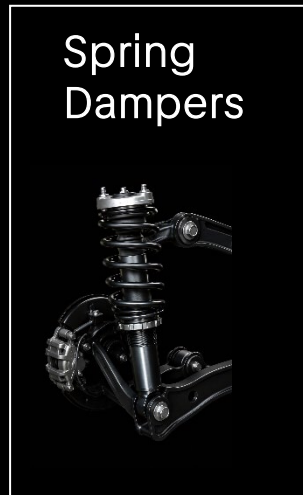
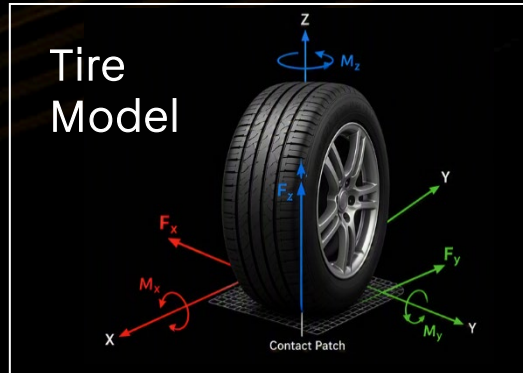
- Front virtual double-wishbone suspension
- Common DNA with Lucid Air sedan, optimized for Gravity
- Compact multi-link rear suspension enables excellent interior volume and dynamic characteristics
- Features two independent rear-steer actuators
- Industry first 3-chamber air springs with plastic sleeves
- Lucid's in-house traction control and torque vectoring solution
- Hands-free Drive Assist DreamDrive™ 2 Pro



The Traditional Route to a Successful Design



Critical inputs for CAE durability load prediction



HIGH INFLUENCE LOW INFLUENCE	1		Tires
	2		Corner Mass + Inertias
	3		Overall Mass (GVW)
	4		Suspension Architecture
	5		Wheelsbase + Vehicle Geometry
	6		Tunables (Spring + Dampers)
	7		Link Bushings
	8		Link Stiffness
	9		Subframe Stiffness
	10		BIW Stiffness

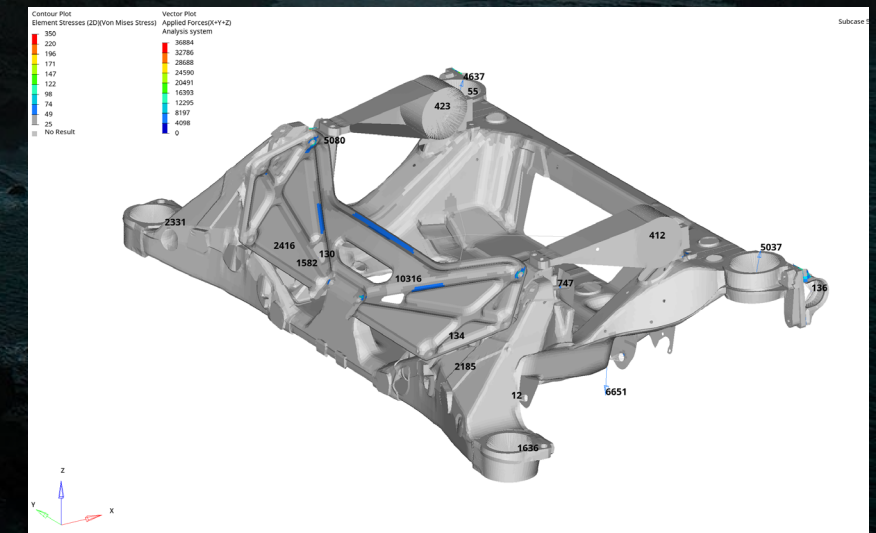
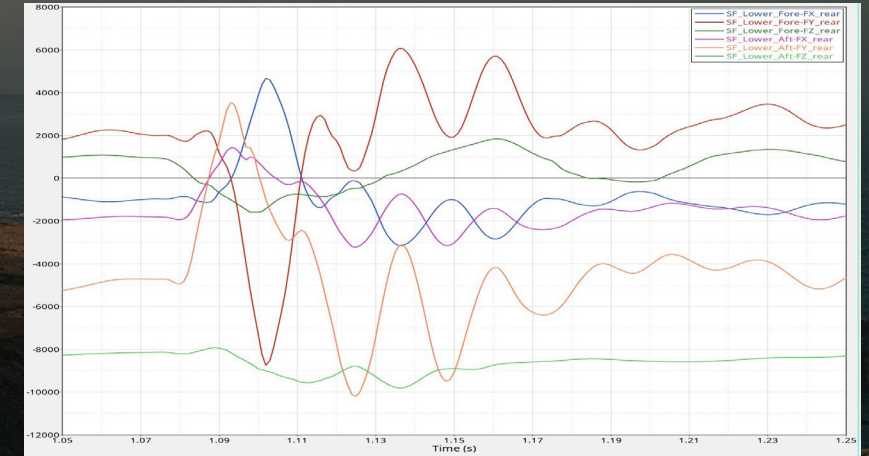
Modal Transient Analysis Method for Durability CAE

Why "Transient Analysis Method" ?

- Improved accuracy
- Loads and responses of BIW, subframes and other structures are inherently dynamic → transient analysis is more appropriate than static, quasi-static, or inertia relief methods.
- Extracting static loads is laborious, inaccurate and error prone

Why "Modal Transient Analysis Method" ?

- Modal Transient Analysis is much faster
- Retrieving eigenvalues and eigenvectors from modal analysis helps to further reduce the run time
- Faster, Efficient & enables process automation

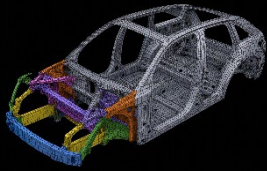


Lucid Gravity Chassis Systems

Direct Transient Analysis

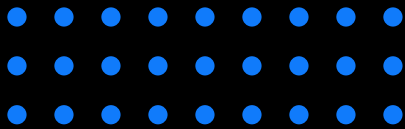
Solves full system of equation in physical domain without reduction.

1. Model the structure



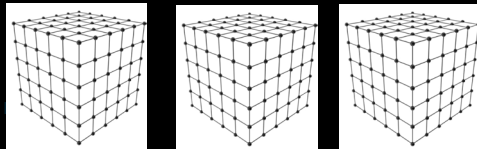
A detailed FE model with many degrees of freedom.

2. No mode selection



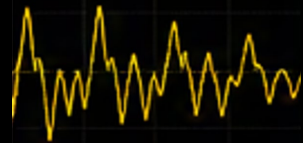
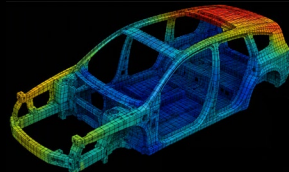
All DOFs are included (millions of DOFs)

3. Solved in physical domain



Full equations are solved

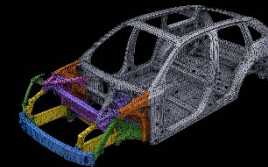
4. Get the real response



Modal Transient Analysis

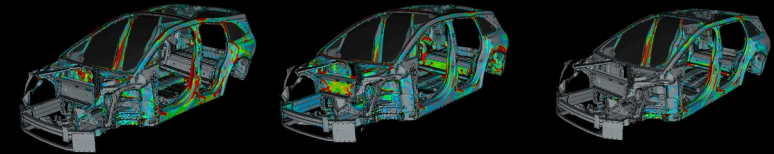
Uses a limited set of nodes to predict the response.

1. Model the structure

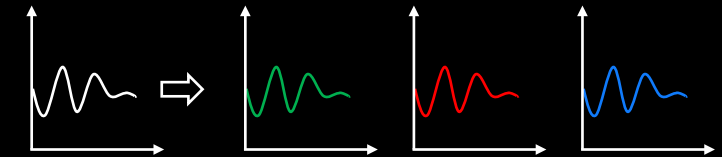


A detailed FE model with many degrees of freedom.

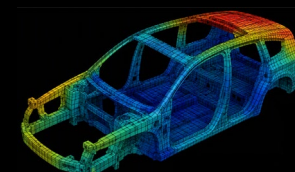
2. Find natural nodes



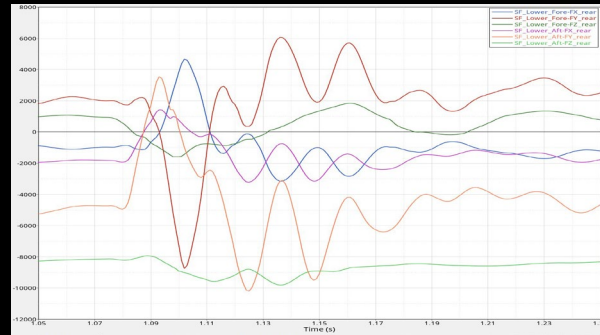
3. Solved in modal space (reduced number of DOFs)



4. Reconstruct the real response (modal superposition)



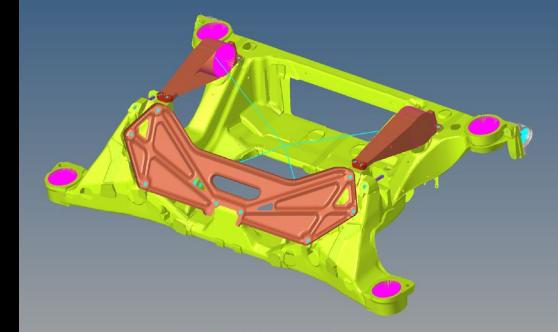
Modal Transient Analysis – CAE Workflow



Simulation of durability events in MBD solver

Durability loads vs result files (RSP files)

FEM



Modal Transient Analysis in Optistruct

Strength Analysis Results (abuse + misuse loads)

Post Processing (stresses, strains, neuber correct)

Fatigue Analysis

Post Processing (fatigue, damage & life)

Load extraction for joints (spot welds, bolts)

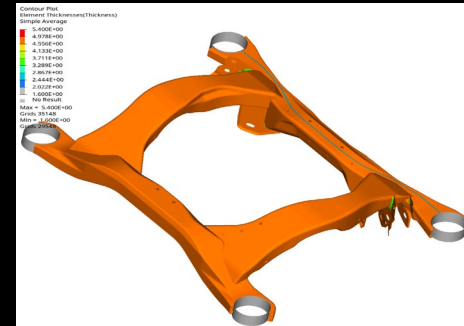
Margin of safety for joints

Global – Local Analysis Method

Detailed stress analysis of individual parts

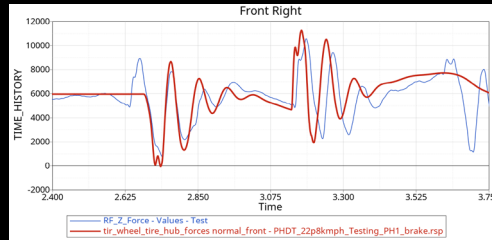
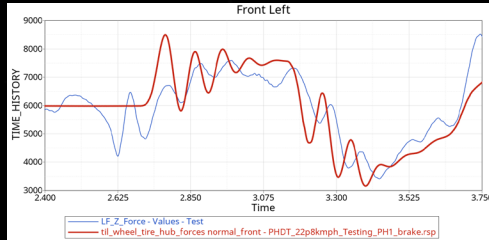
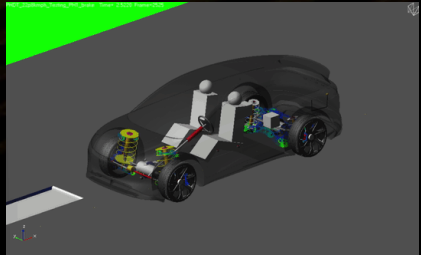
Equivalent static load method for optimization

Component level optimization with transient loads

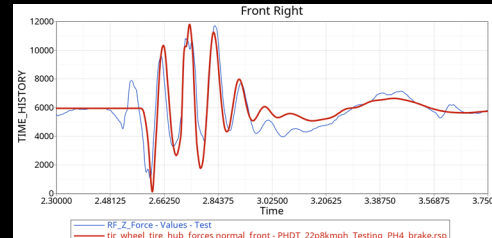
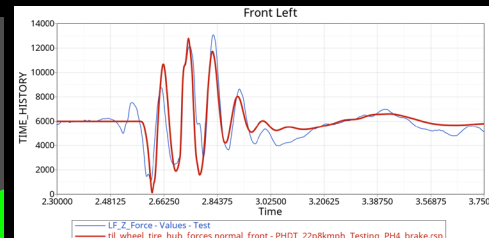
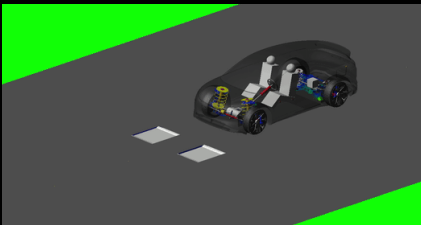


Gravity CAE Loads vs Test Data

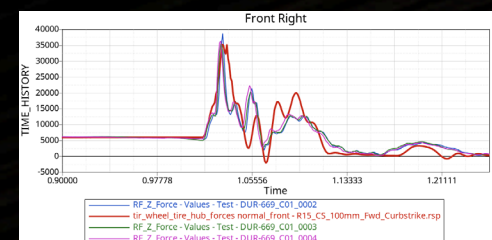
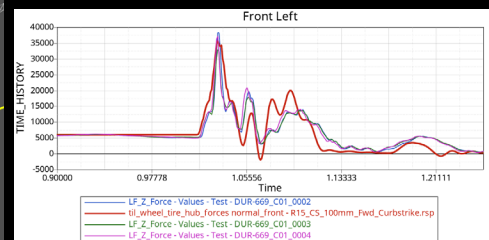
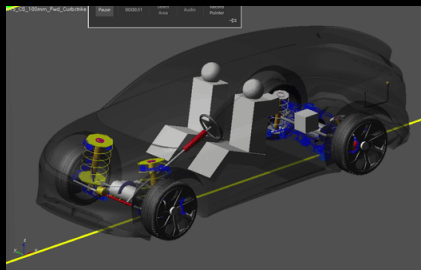
Pothole PH1



Pothole PH4

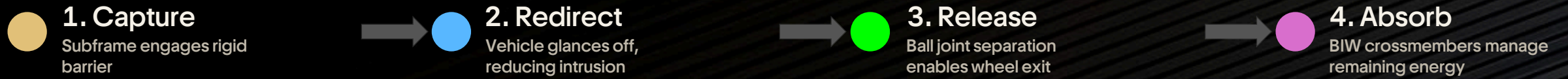
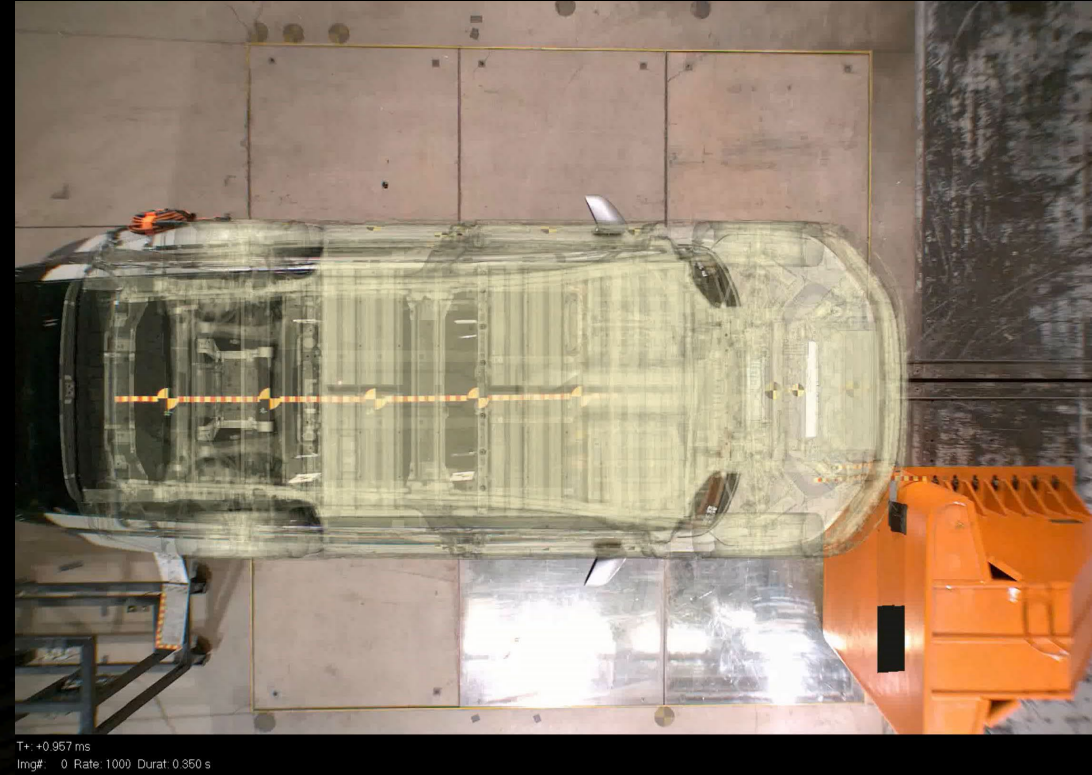
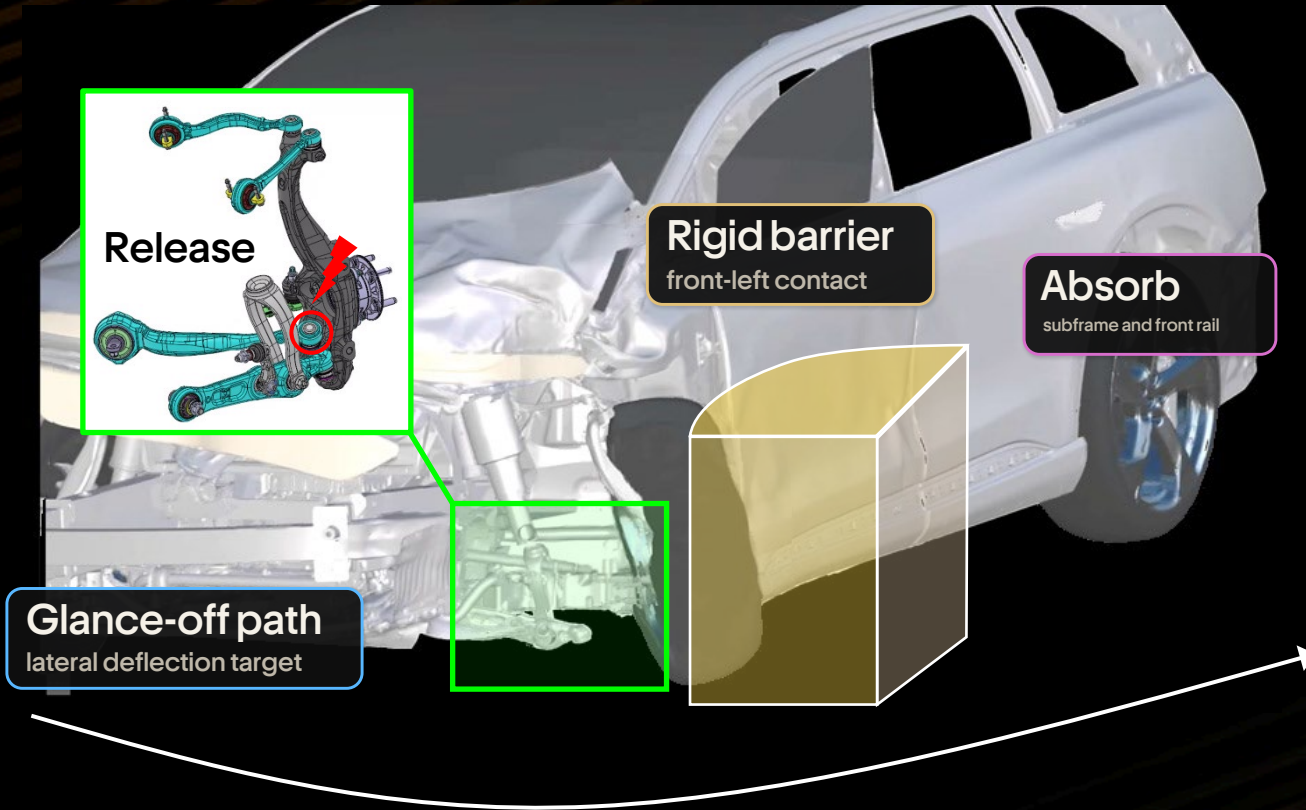


Curb Strike Wheel Z-Force Curb Strike 100 mm

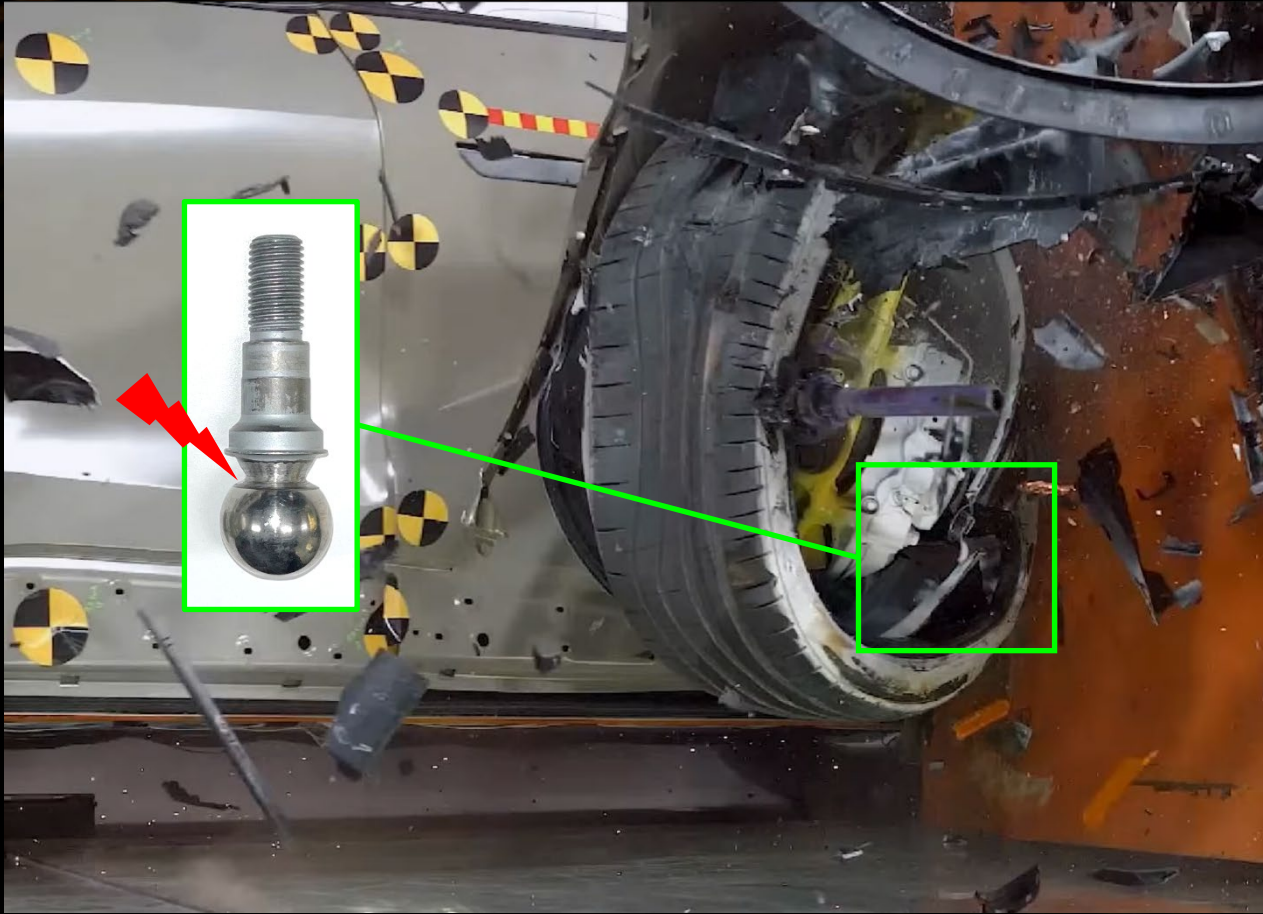


Axle	Link	Case	Accuracy
Front Link	Tension	Min	Below 15%
		Max	Between 15% and 20%
	Camber	Min	Below 15%
		Max	Between 15% and 20%
	Fore UCA	Min	Below 15%
		Max	Below 15%
	Aft UCA	Min	Between 15% and 20%
		Max	Below 15%
Rear Links	Fore UCA	Min	Below 15%
		Max	Below 15%
	Aft UCA	Min	Between 15% and 20%
		Max	Between 15% and 20%
	Fore LCA	Min	Between 15% and 20%
		Max	Between 15% and 20%
	Aft LCA	Min	Between 15% and 20%
		Max	Between 15% and 20%
	Toe Link	Min	Below 15%
		Max	Below 15%

25% Small Overlap Rigid Barrier Strategy



25% Small Overlap Rigid Barrier



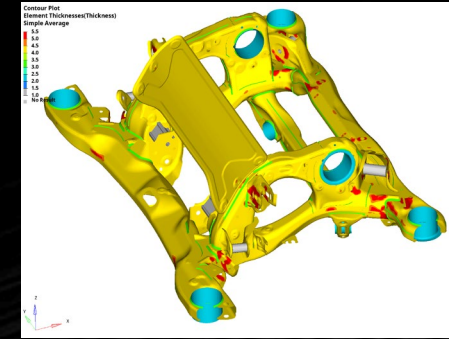
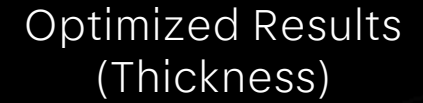
Objective:

- Achieve SORB rating by enabling early front wheel release through controlled tension link separation.

Solution

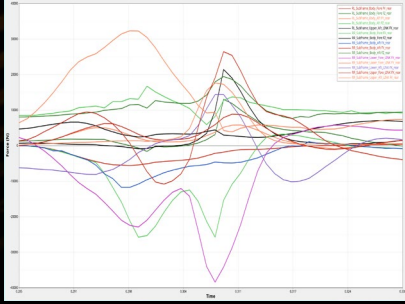
- Introduced a mechanical fuse by reducing the front tension link ball stud neck diameter.
- Durability ensured for the most aggressive longitudinal load event (ABS Pothole event)
- The selected production neck diameter and hardening specification were established through simulation and a cubic-fit analysis of batch variation data, ensuring target break load performance across expected production variability.

Traditional optimization methods does not work with Transient load cases.

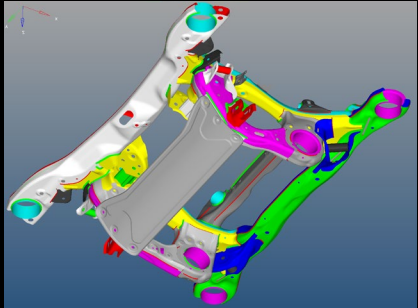


Equivalent Static Load Method establishes set of equivalent static load cases and enables traditional optimization workflow.

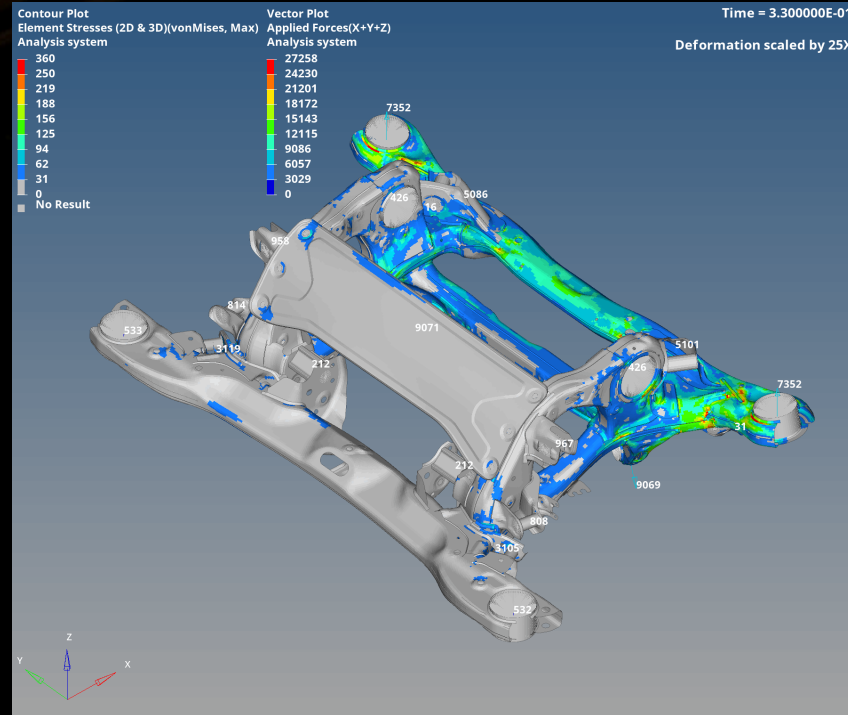
ESL Rear Subframe Optimization



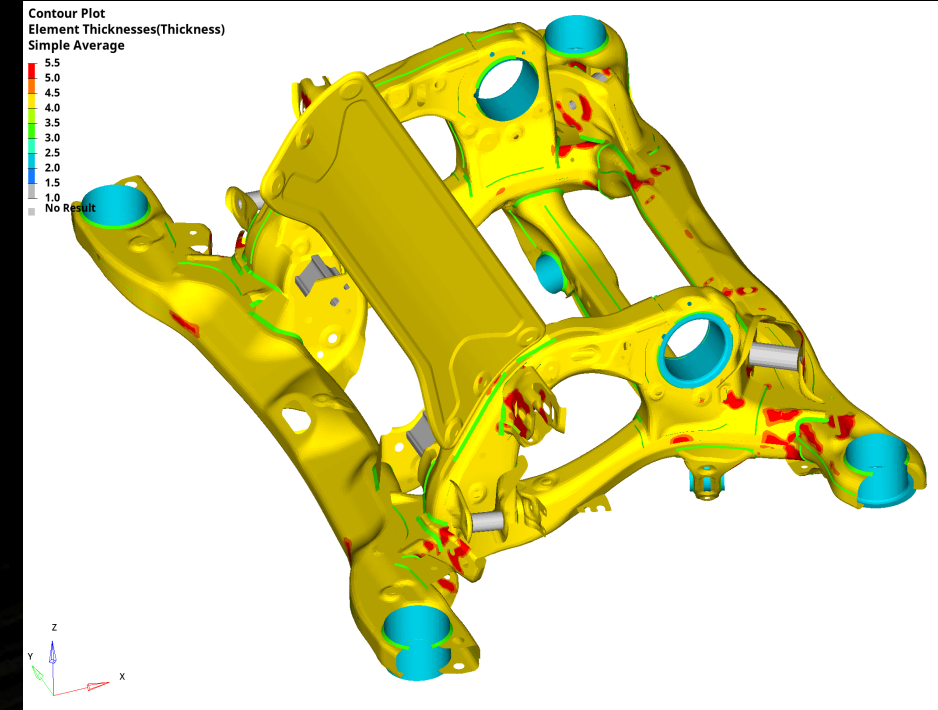
Transient Loads



Design space



Transient Analysis

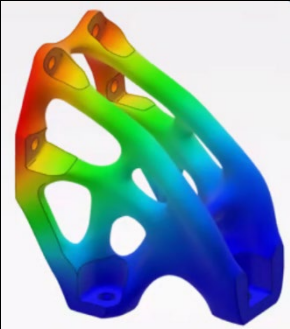


Optimization with ESL, Equivalent Static Load Method

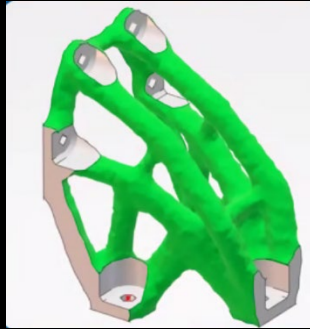
- The Equivalent Static Load Method is a structural optimization approach that converts a dynamic or nonlinear analysis problem into a set of equivalent static load cases that can be optimized using linear optimization techniques.
- Its biggest value is it allows to combine dynamic transient load cases from Durability, Vehicle Dynamics & NVH

Fully Integrated Optimization

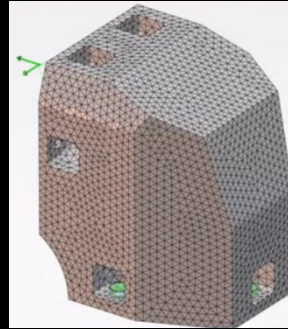
FE Validation Solid Generation



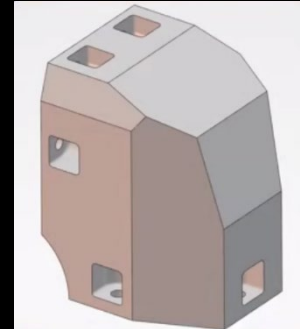
Optimizing



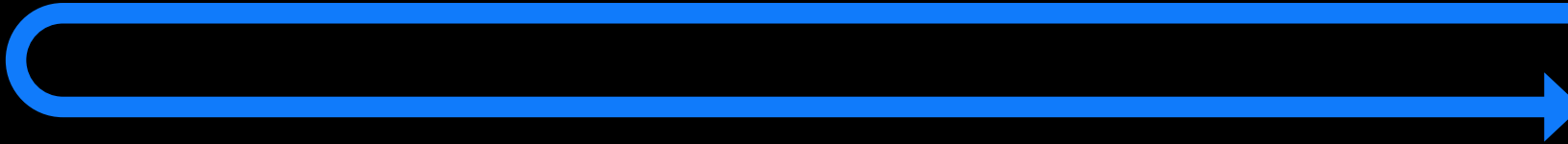
Meshing



Design Space



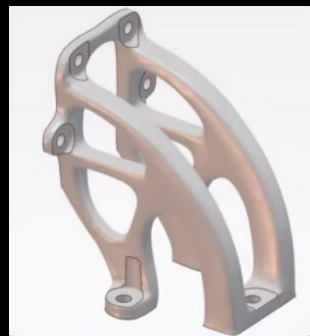
Start



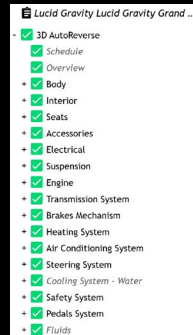
Printing



Milling

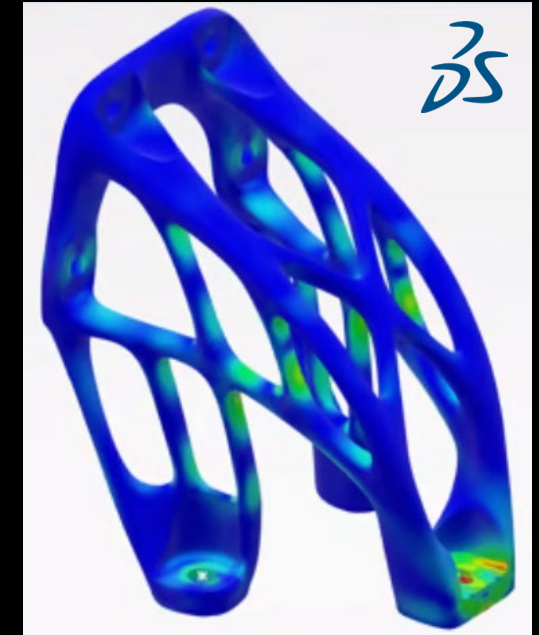


Casting

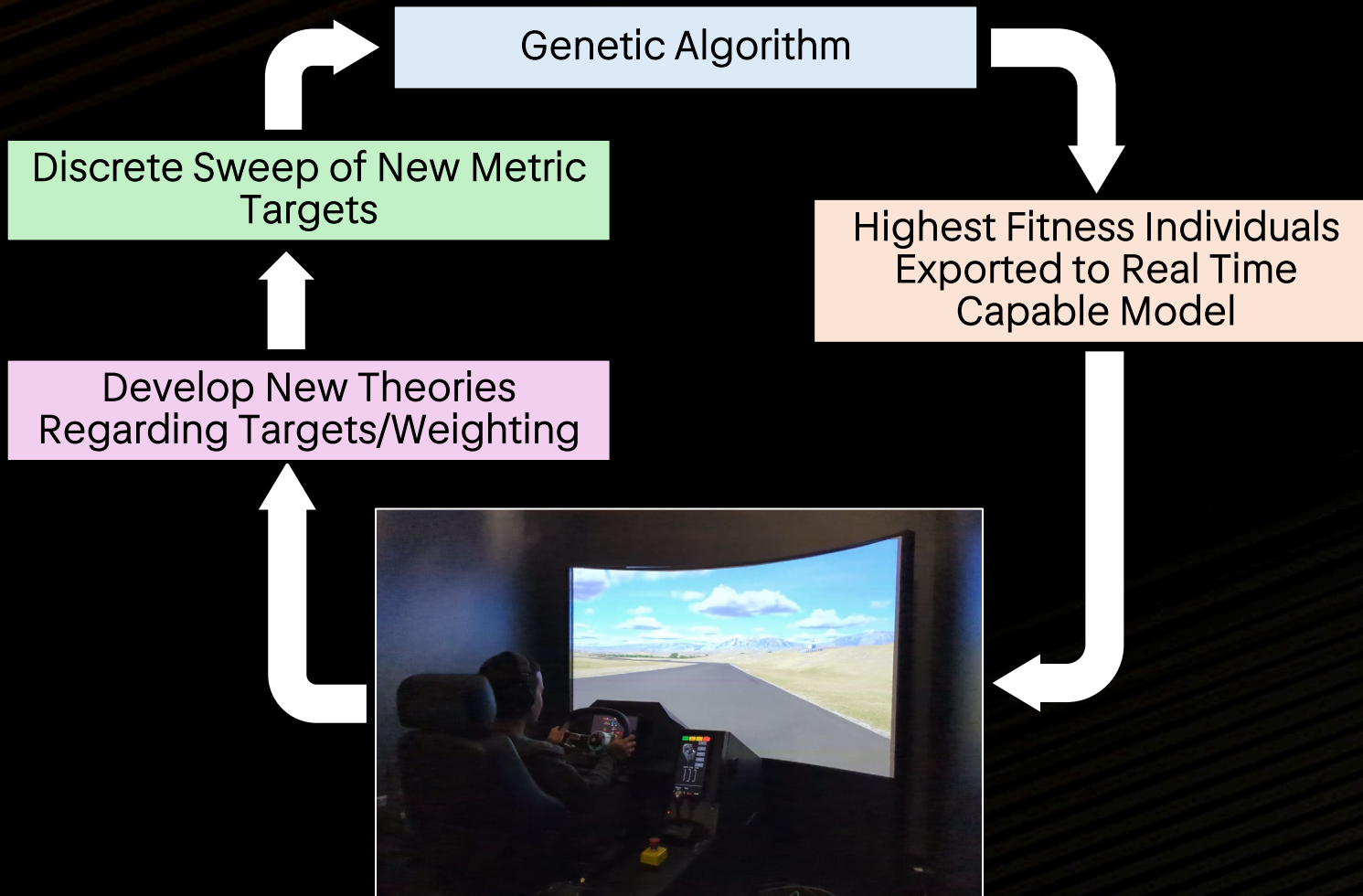


Costing

Finish

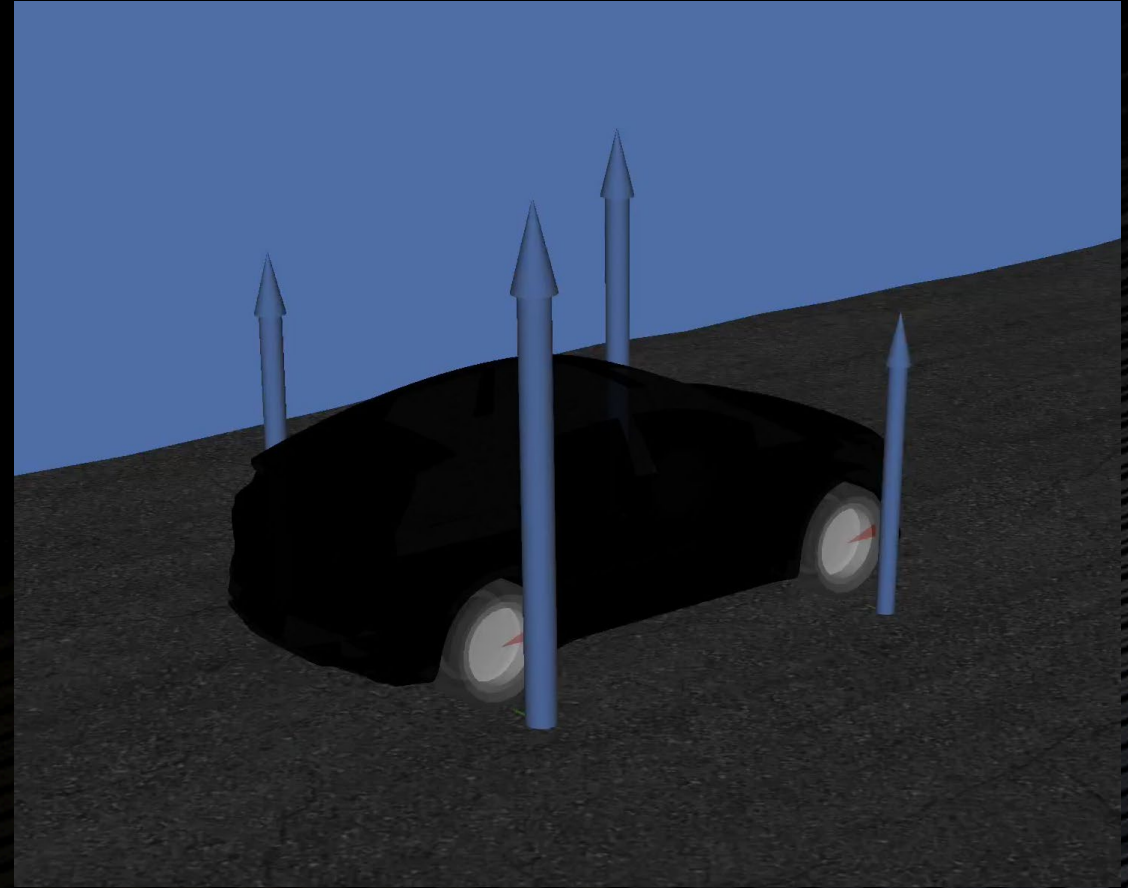
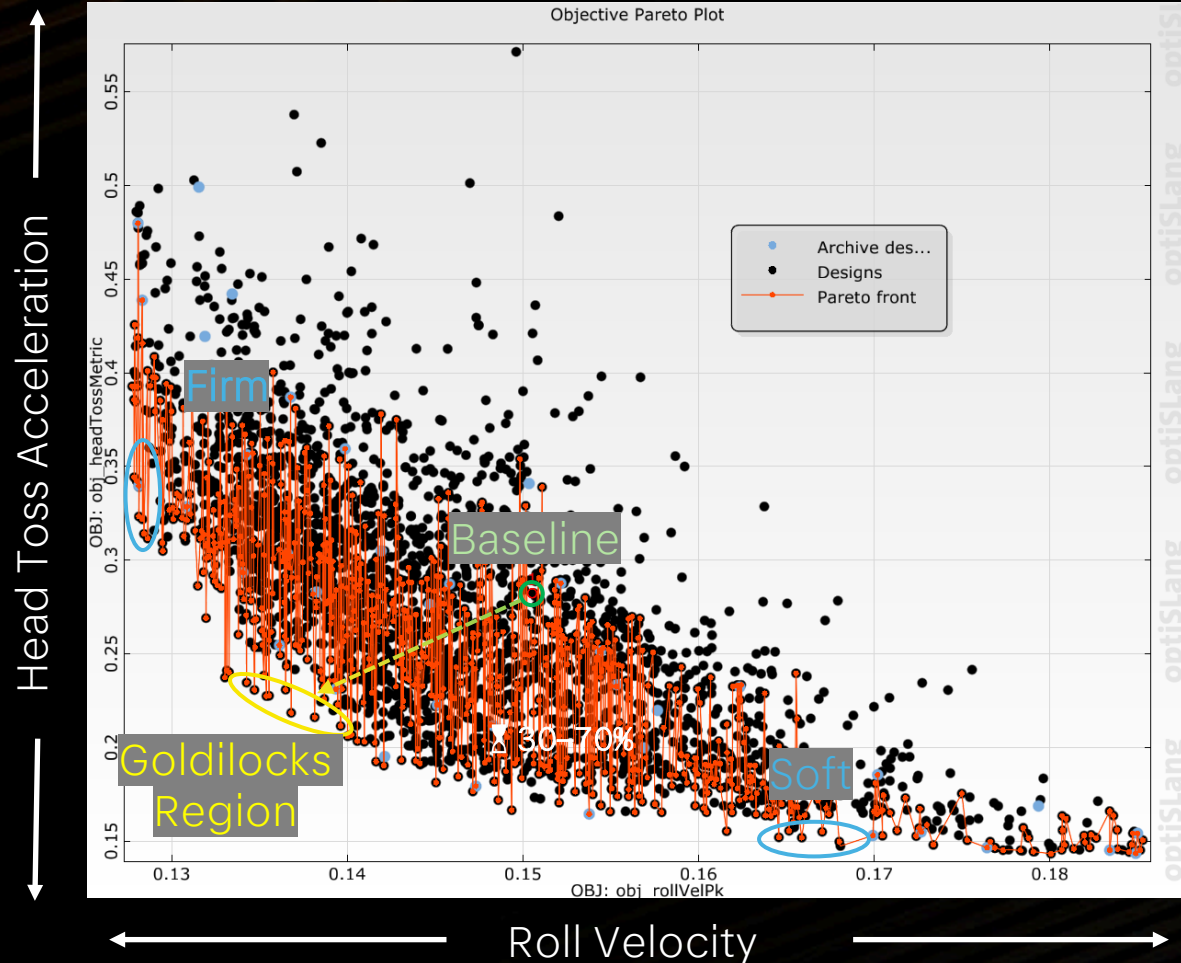


Kinematics Synthesis and Optimization via Genetic Algorithm and Driver in the Loop



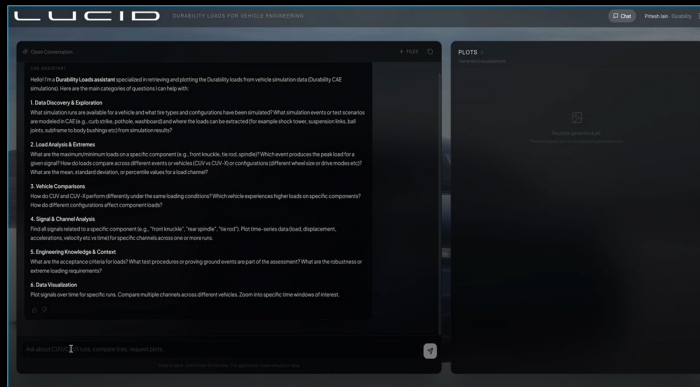
- Suspension kinematics defined by equations of motion with over 170 symbolic variables (hardpoint coordinates, velocities, and accelerations)
- Packaging constraints defined by early architecture (BIW, wheel envelope, rotor location, general hardware sizing, etc.)
- Metrics developed for use in optimization cost function (KPO, mechanical trail, RCH, and associated derivatives to bump/steer)
- Weightings of the cost function allow an over constrained problem to find appropriate compromises in the solution

Objective Metric Optimization of Competing Parameters Using Offline Models and OptiSLang



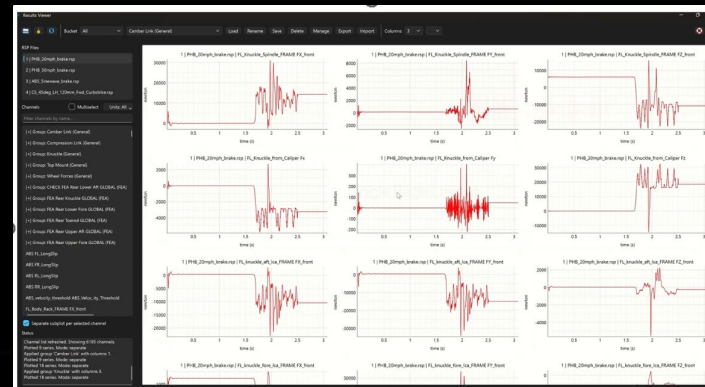
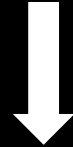
AI Agent for Durability Loads Engineering Cycle-Time Reduction Potential

Simple Questions and Answers,
Plots, tables



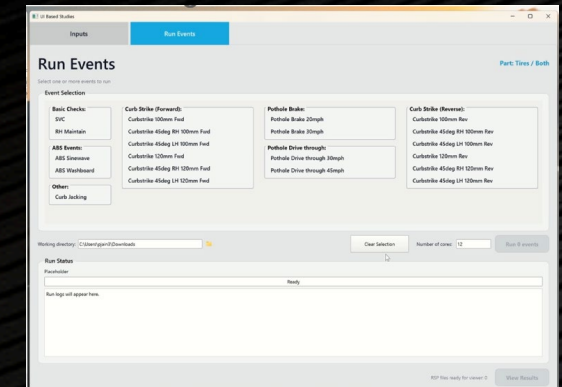
Durability Loads Agent

Durability Loads Viewer,
Preloaded templates & Custom
templates



Durability Loads Viewer

Durability events simulator,
New CAE runs, "What-if"
Studies



Durability events simulator

AI Agent for Durability Loads

What does the agent do?

- "Answer questions"
- Plots, Tables, Text summary
- Decipher different names, synonyms, acronyms, etc.
- File names, File location, Channel names, Coordinate Systems
- Specialized CAE tools for viewing data



Engineering Cycle-Time Reduction Potential

LOCAL WORKFLOW SAVINGS

Modal Transient	⌚ 80–95%
ESL Optimization	⌚ 80–95%
AI Clustering	⌚ 70–90%
OptiSLang Automation	⌚ 50–90%
AI Agent	⌚ 70–90%
Kinematics Synthesis	⌚ 60–90%
Driver-in-the-Loop	⌚ 30–60%
GA + DIL Workflow	⌚ 50–75%
MODSIM	⌚ 30–70%
Mule Phase Elimination	⌚ 10%

WEIGHT BY

- 1 Share of total program affected
- 2 Adoption across programs and teams
- 3 Overlap between improvement levers
- 4 Critical-path conversion

PROGRAM OUTCOME

30%

POTENTIAL PROGRAM-CYCLE REDUCTION

ILLUSTRATIVE CONVERSION

**20% digital workflow reduction
+ 10% mule phase elimination**

Mule phase elimination: +10 percentage points*
20% digital workflow + 10% mule elimination = 30%

≥ 30% PROGRAM SAVING