Unlock the Potential:

36 Ways Virtual Prototyping Drives Electric Vehicle Development

Innovation Without Compromise.

Why does Virtual Prototyping Matter for EVs?

As you navigate the rapidly evolving landscape of electric vehicle (EV) development, virtual prototyping enables you to simulate digital representations of products and systems, facilitating the design, testing, and validation of vehicle components and systems in areas such as:

- **Product Performance** - Ensuring vehicles are safe and structurally sound to survive a variety of conditions.
- **Smart Manufacturing** - Get confidence in your manufacturing processes before you even start.
- **Vibroacoustic Performance** - Addressing the interior and exterior acoustic challenges faced due to quieter engines.
- **Virtual Validation** - Using Virtual Reality technology to explore new vehicle concepts from a worker and operator perspective.

This approach offers numerous advantages over traditional physical prototyping methods, including reduced development time, enhanced safety, improved product quality, boosted sustainability through reduced physical testing, and enhanced manufacturing efficiency.

In today's dynamic EV market, virtual prototyping provides you with a competitive edge, unlocking the potential for faster innovation and more efficient product launches.

Read on to discover the 36 Ways In Which Virtual Prototyping Can Help Your EV Development...

Looking for a shortcut?

Product Performance Simulation Solutions

Vibroacoustic Performance Simulation Solutions

Smart Manufacturing Simulation Solutions

Virtual Validation of Human Centric Processes

Product Performance Simulation Solutions

01 Optimize vehicle design to enhance passenger protection and help achieve Mission Zero goals.

02 Model and analyze the crashworthiness of vehicle structures and components to ensure compliance with safety regulations.

03 Evaluate the strength of components under various dynamic loading conditions to improve both structural integrity and reliability.

04 Analyze handling, stability, and ride comfort to enhance the driving experience and meet performance expectations.

05 Optimize the design of vehicle seats to maximize passenger comfort and safety while minimizing weight and space requirements.

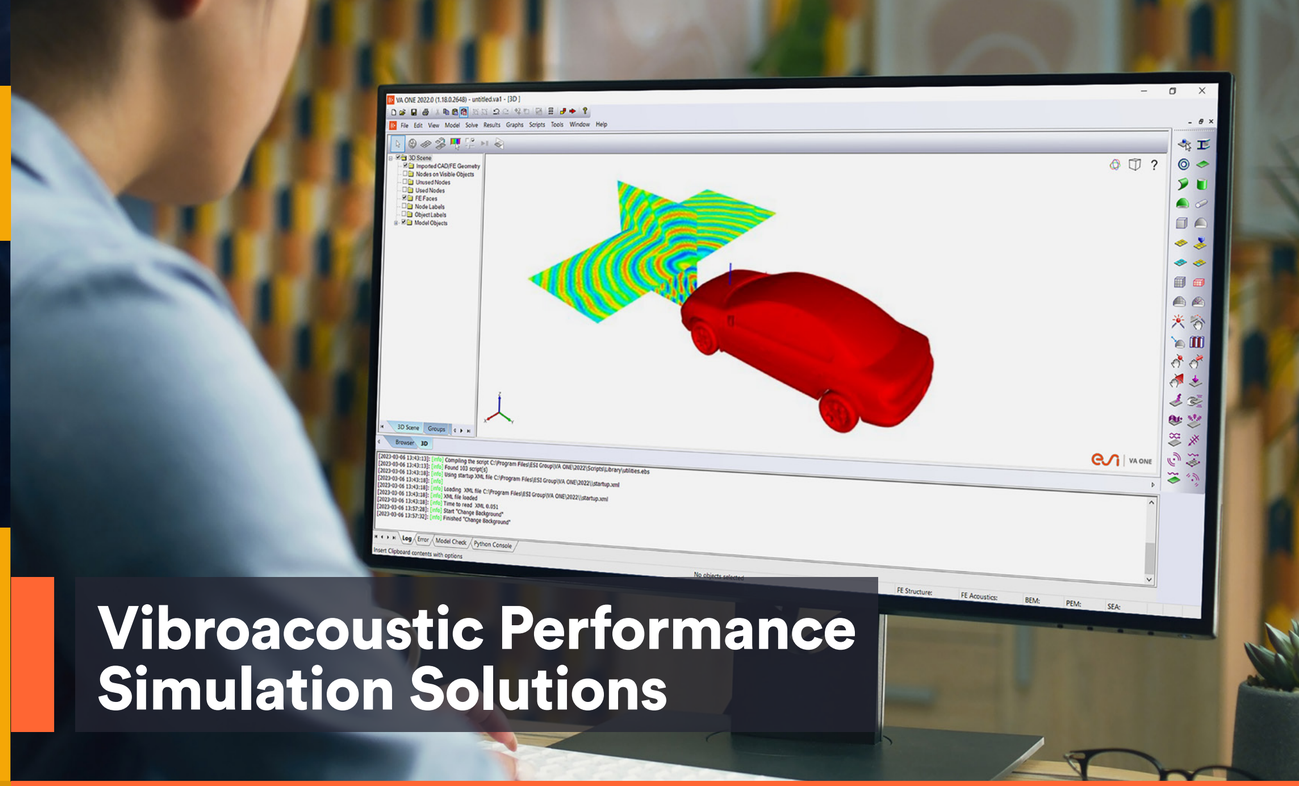
06 Accurately predict the real-world behaviour and safety integrity of vehicles in their as-manufactured states through the chaining of performance and manufacturing simulations.

Product Performance Simulation Solutions

07 Assess the potential impact to a vehicle and its battery system due to **exposure to water**, including damage caused by water crossing or internal water ingress.

08 Analyze accurate **fluid/structure interaction** to optimize **airbag** folding and deployment.

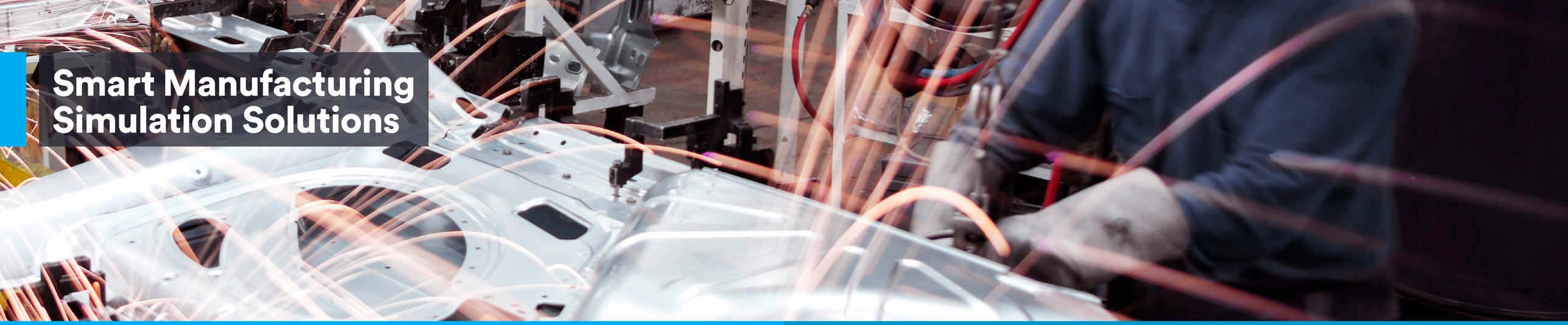
09 Predict **battery safety, energy management, range, and performance** under a variety of conditions.



Vibroacoustic Performance Simulation Solutions

10 Manage interior noise by analyzing the **effectiveness of sound packages** against road, tire, wind, HVAC, and EPWT noise.

11 Comply with **Acoustic Vehicle Alerting Systems** (AVAS), pass-by noise, and other exterior noise safety regulations.



Smart Manufacturing Simulation Solutions

12 Assess different materials to identify the optimal combination of strength and weight that doesn't compromise structural integrity or manufacturability.

13 Accelerate development and innovation by enabling an iterative design process so engineers can quickly evaluate and fine-tune multiple design variations.

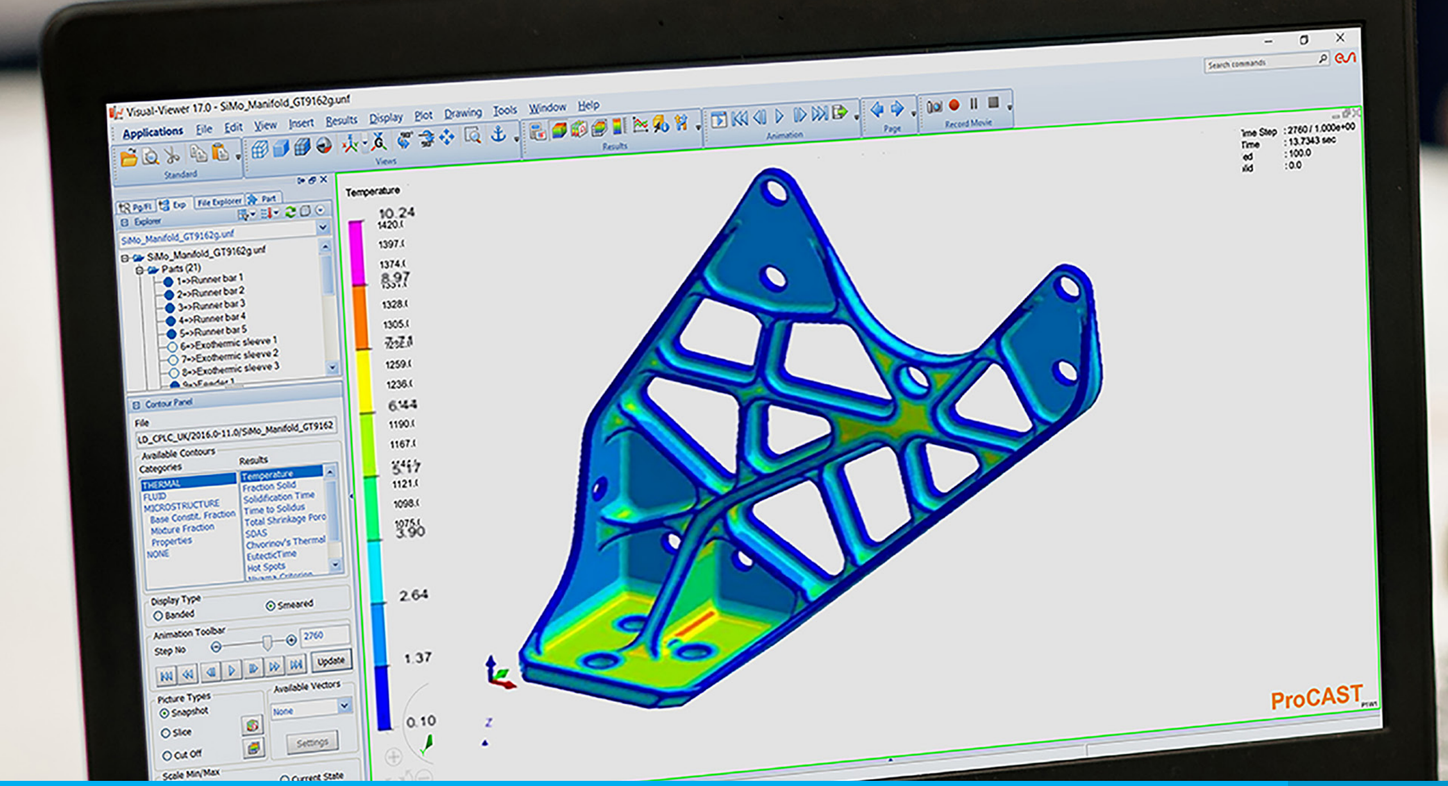
14 Optimize the design of complex cast components - including mega castings – to achieve the optimal balance of strength, durability, and lightweight properties.

15 Optimize casting processes to reduce trial runs, rework, material waste, and energy consumption.

16 Assist product designers in finding sheet stamping geometries that reduce weight and enhance the strength and stiffness of components while ensuring its manufacturability.

17 Optimize the mechanical properties and strength of composite structures such as carbon fiber reinforced polymers (CFRP) and understand how the component will behave under different load conditions.

Smart Manufacturing Simulation Solutions



18 Optimize composite manufacturing processes, such as pre-forming, resin infusion and autoclave curing to reduce production time, minimize waste, and improve efficiency.

19 Assess the weldability of different materials including aluminium, high-strength steel, and various alloys so they can be joined/welded effectively without compromising structural integrity.

20 Understand the thermal effects of the welding process to predict distortions, warping, and thermal-induced stresses.

21 Create a virtual manufacturing process chain, chaining stamping, casting, and composites to welding and assembly reducing lead times and costs for new lightweight designs.

Virtual Validation of Human-Centric Processes

22 Validate packaging and space claims of electric drive train components and vehicle architecture and topology.

23 Evaluate and improve cable and wire harness routing with real-time physics for more agile and accurate planning of cable routes and installation paths.

24 Collaborate virtually for faster consensus on design changes and improvements and reduce the negative impact of travel.

25 Prevent wear, abrasion, or pinching of cables, hoses, or wires during operation when mounted on articulated parts of the vehicle or in areas of consistent vibration or motion.

26 Experience the integration of complex systems and components for maintenance and service tasks, ensuring proper fit, clearance, and accessibility.

27 Avoid inadvertent shorts and electrical shocks by ensuring critical clearances and accessibility of high voltage EV components and tool contact (intentional and unintentional).

Virtual Validation of Human-Centric Processes

28 **Validate assist tooling** for assembly and installation of batteries or modules that require human intervention or assistance.

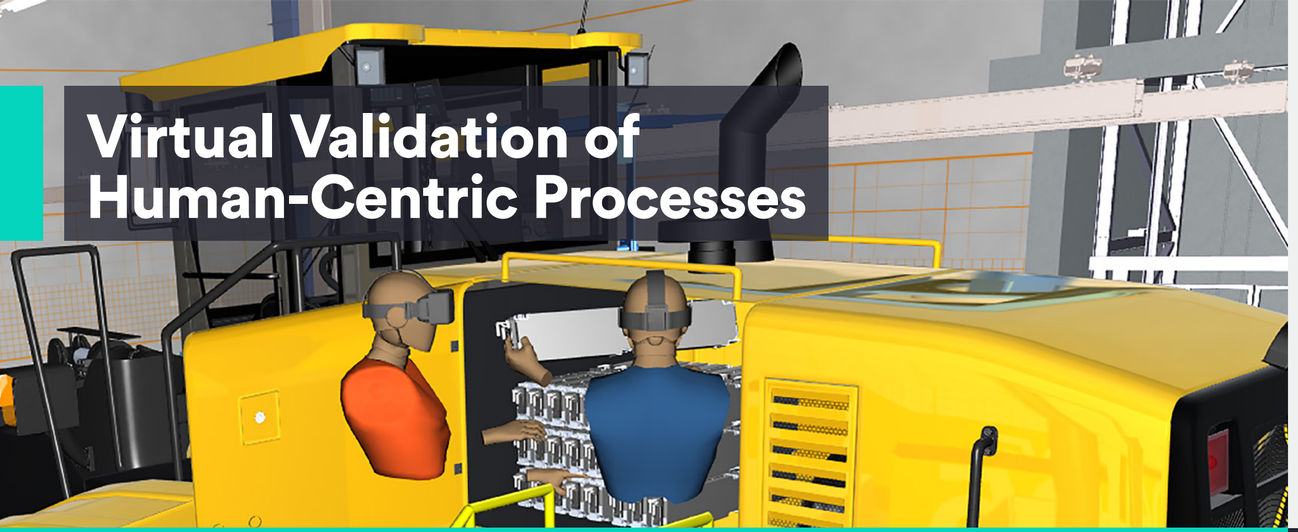
29 Provide an **agile environment** to discover new repair or replacement methods.

30 **Validate assembly line layout and processes**, specific to new and sometimes unique components, materials, and vehicles.

31 **Optimize workflow and production line efficiency** to reduce assembly time and **minimize the risk of rework**.

32 **Evaluate, resolve, and optimize – from first person PoV - issues of proposed assembly or production workspaces.**

33 **Identify and address potential design issues or ergonomic challenges early in the development process, minimizing the need for costly physical prototypes and design iterations.**



Virtual Validation of Human-Centric Processes

34 Deliver a virtual environment to improve workforce communication, reduce ramp-up costs, and ensure effective production or service environments.

35 Determine, evaluate, and optimize service processes - disassembly, removal, and replacement - through an open exploration in VR.

36 Ensure serviceability, access, and inspectability of unfamiliar parts within unfamiliar vehicle architecture.

Want to know more about using Virtual Prototyping to drive your EV development into the future?

Visit our EV webpage

About ESI

ESI Group, a part of Keysight Technologies, provides reliable and customized solutions anchored on predictive physics modeling and virtual prototyping expertise. Acting principally in automotive, land transportation, aerospace and defense, and heavy industry, ESI software enables engineers to simulate mechanical designs, smart manufacturing processes, and human-centric workflows to make better decisions earlier in the product lifecycle. Keysight is an S&P 500 company delivering market-leading design, emulation, and test solutions to help engineers develop and deploy faster, with less risk, throughout the entire product lifecycle.

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