

NEW
PARTNERSHIP
ANNOUNCEMENT



***DEVELOPING FAIL-OPERATIONAL
L3, L4 AND L5 CHASSIS ACTUATION
SYSTEMS USING AN INTEGRATED
DIL AND HIL APPROACH***

PARTNERSHIP

CHASSIS AUTONOMY – VI-GRADE – CAE VALUE

- **Chassis Autonomy** develops actuation systems for highly automated (L3) and fully autonomous vehicles (L4 and L5)
- **VI-grade** plans to develop a new way to design, test and demonstrate chassis systems
- **CAE Value** offers its simulation expertise to implement DiL and HiL setups



SOFTWARE | SIMULATORS | HIL

ECOSYSTEM

- Another step towards our ZERO PROTOTYPES strategy
- Simulation, simulators and hardware-in-the-loop technologies are integrated to decrease time-to-market and eliminate full physical prototypes



SIMULATION DRIVEN DEVELOPMENT

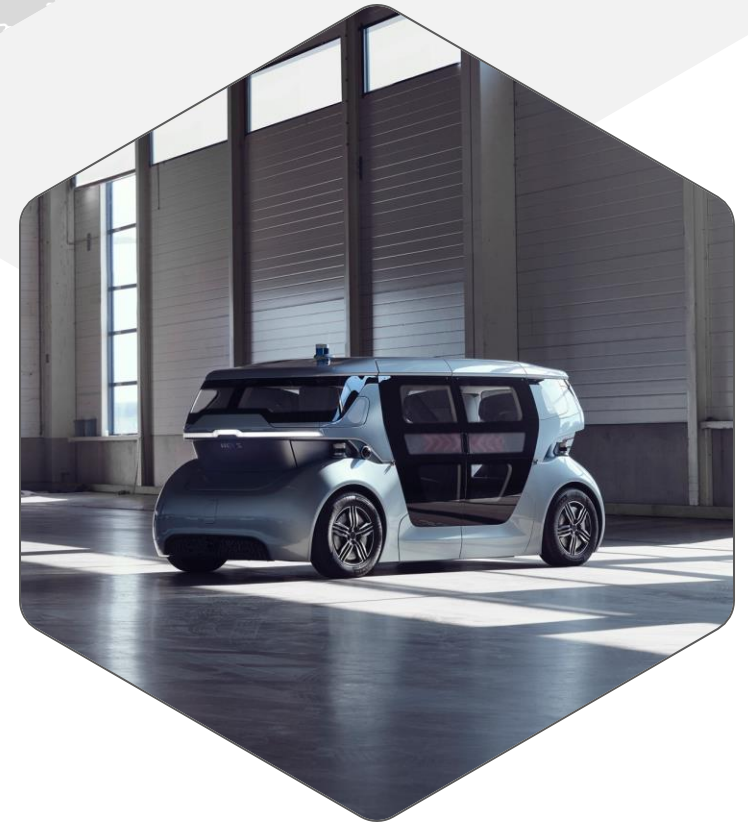
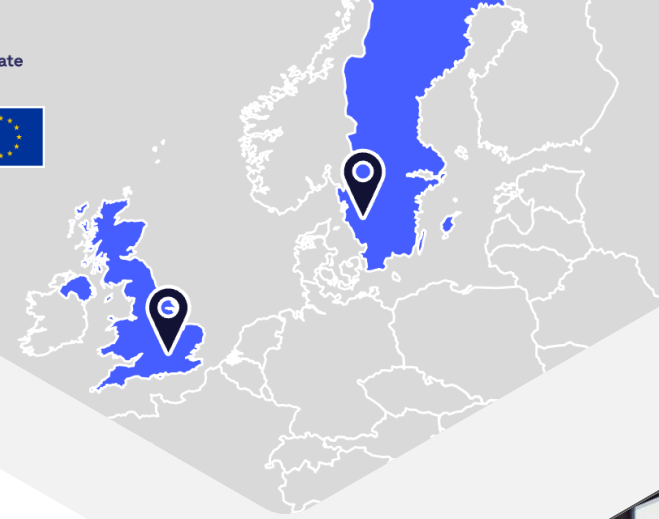
AGENDA

- Chassis Autonomy introduction
- CAE Value introduction
- Chassis Autonomy technology
- Zero prototype development process
 - DiL and HiL rig
 - CAE
 - Mechanical
 - Software and mechatronics

CHASSIS AUTONOMY

INTRODUCTION

- Deep technology start-up
- HQ in Trollhättan with a division in London
- Spun-off following a 2.5 year POC development at an OEM
- Developing ground-up steer-by-wire systems for L3 and L4/L5 applications
 - Enable true automated mobility



INTRODUCTION

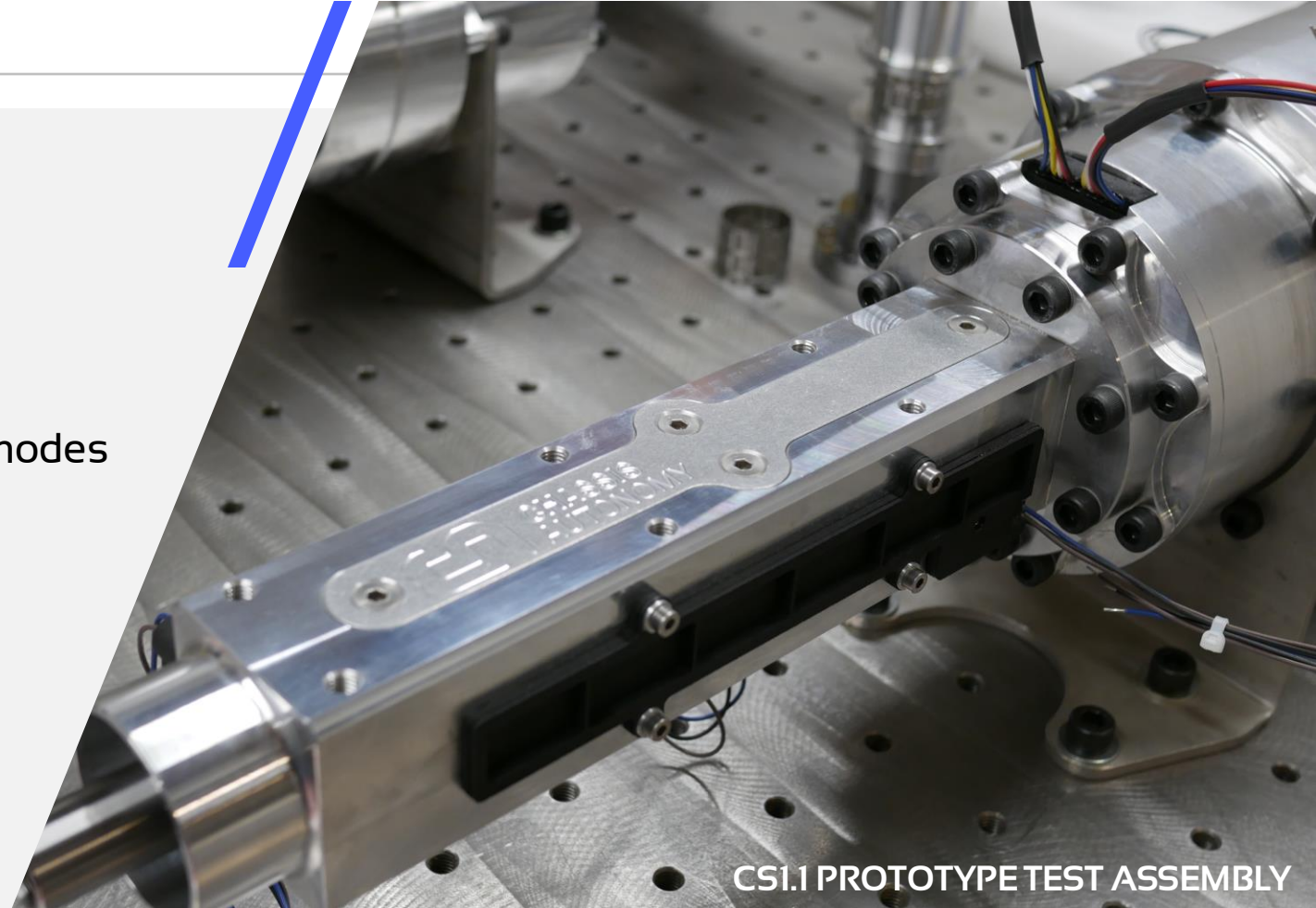
- Efficient virtual vehicle development
- Distributor and specialist partner
 - VI-grade
 - Siemens (HEEDS MDO and Simcenter Amesim)
 - Chassis Autonomy
 - Stackpole Engineering
- Expert services
 - Applied optimisation = design space exploration that really delivers
 - Rapid process automation to integrate CAE tools in MDO
 - Translating engineering challenges into efficient optimisation loops
 - Vehicle modelling
 - K and C
 - Full vehicle handling, ride comfort, NVH, durability
 - Motion control
 - Energy management
 - High-end component modelling
 - Proprietary software and workflow for rapid project execution



CHASSIS AUTONOMY SBW TECHNOLOGY

SETTING THE NEW STATE-OF-THE-ART FOR FAIL-OPERATIONAL ACTUATION

- Underpinned by functional safety
- Led by a world-class engineering team
- Robust design eliminates single point failure modes
 - Concentric direct-drive (no belt drive)
 - True steer-by-wire (no rack-and-pinion)
- Advanced sensor and control strategy
- 10 pending patents

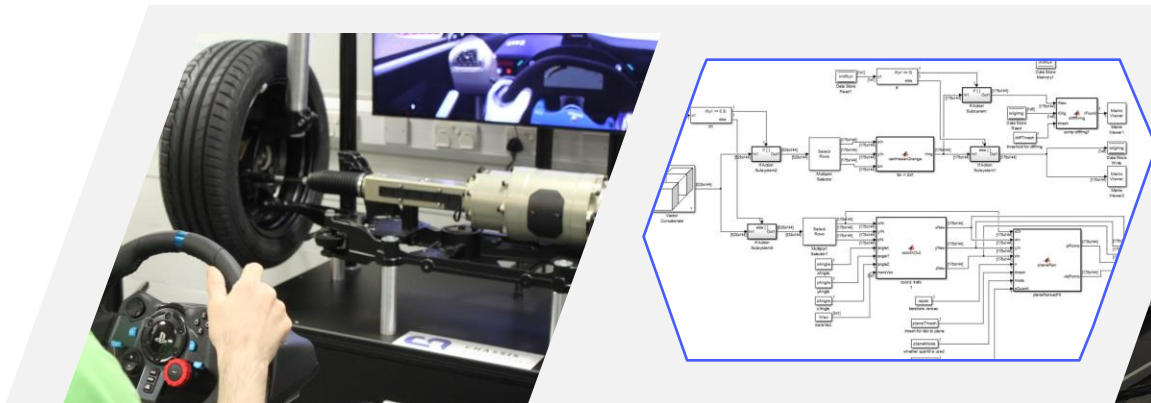
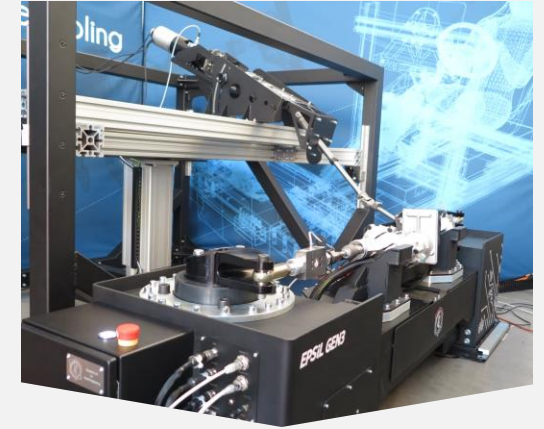


CS1.1 PROTOTYPE TEST ASSEMBLY

L3 ATTRIBUTE DEVELOPMENT

TUNING WITH ZERO VEHICLE PROTOTYPES

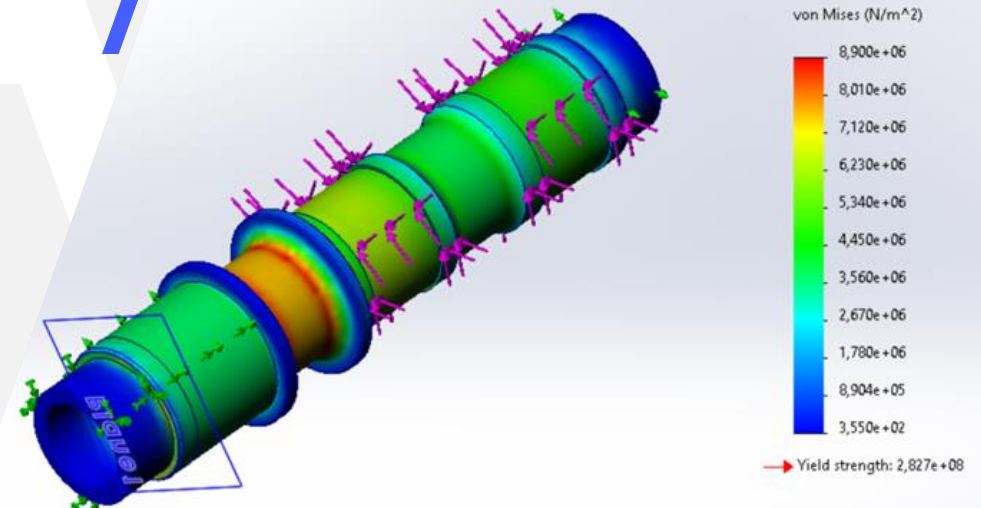
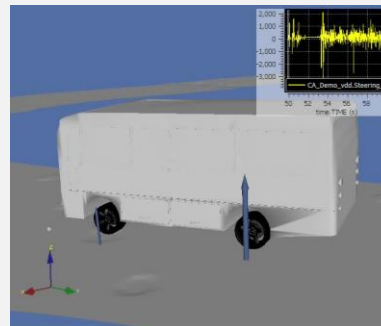
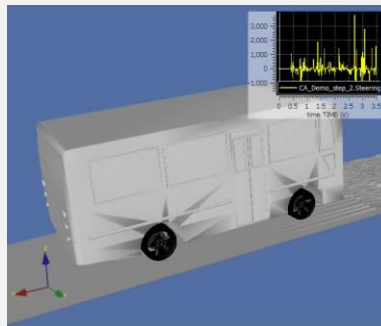
- Accelerate time to market by leveraging advanced simulation
- Realise rapid development cycles with advanced HiL simulators (both in-house and Meccanica 42 developed)
- Employ world-class VI-grade DiL simulators for verification
- Eliminate time intensive and cost prohibitive physical vehicle testing



L4 DESIGN FOR DURABILITY

EXTENDED DUTY CYCLES WITH MINIMAL ABUSE CASES

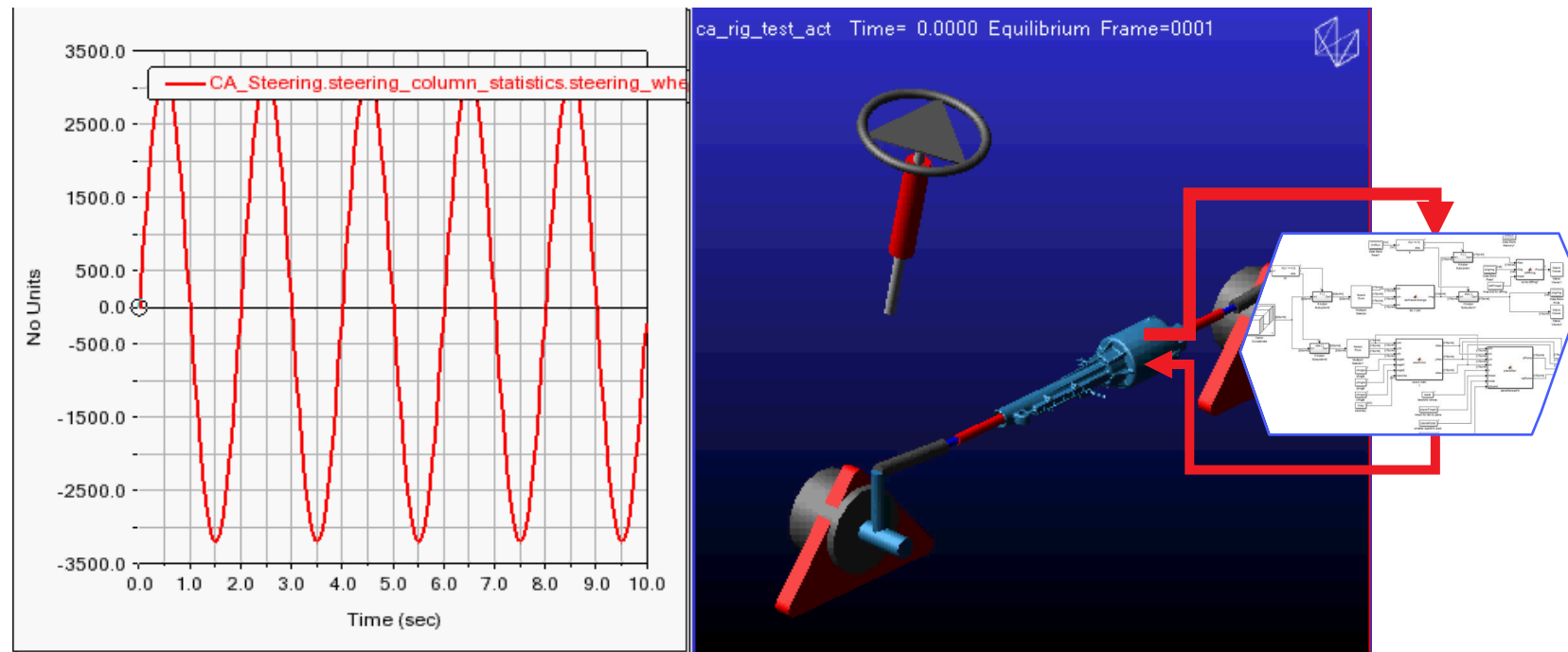
- L4 presents an entirely new vehicle use case, often with brand new OEMs
- Steering feel attributes are eliminated and abuse cases no longer exist
- Passenger comfort and industrial levels of durability and system availability become paramount
- Simulation led development enables accurate determination of drive and duty cycles to optimise and size components



STEERING RIG – DIGITAL TWIN

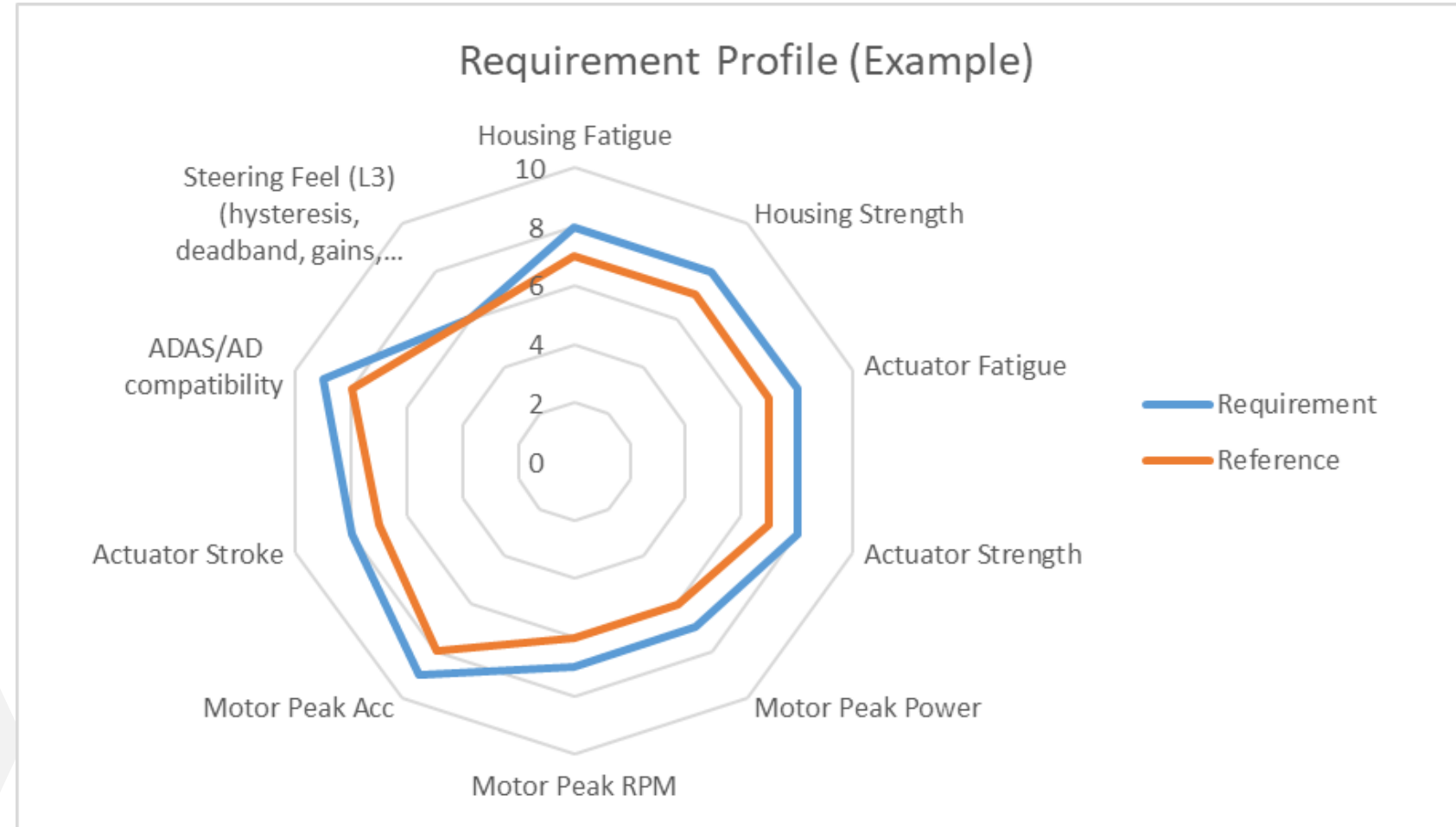
SECURING BOTH HARDWARE AND SOFTWARE PERFORMANCE

- The digital twin of the rig set-up enables detailed prediction of controller signals, feedback torque, road wheel actuator loads and overall system dynamics during the DiL and HiL activities



ADDRESSING COMPLETE SYSTEM REQUIREMENTS

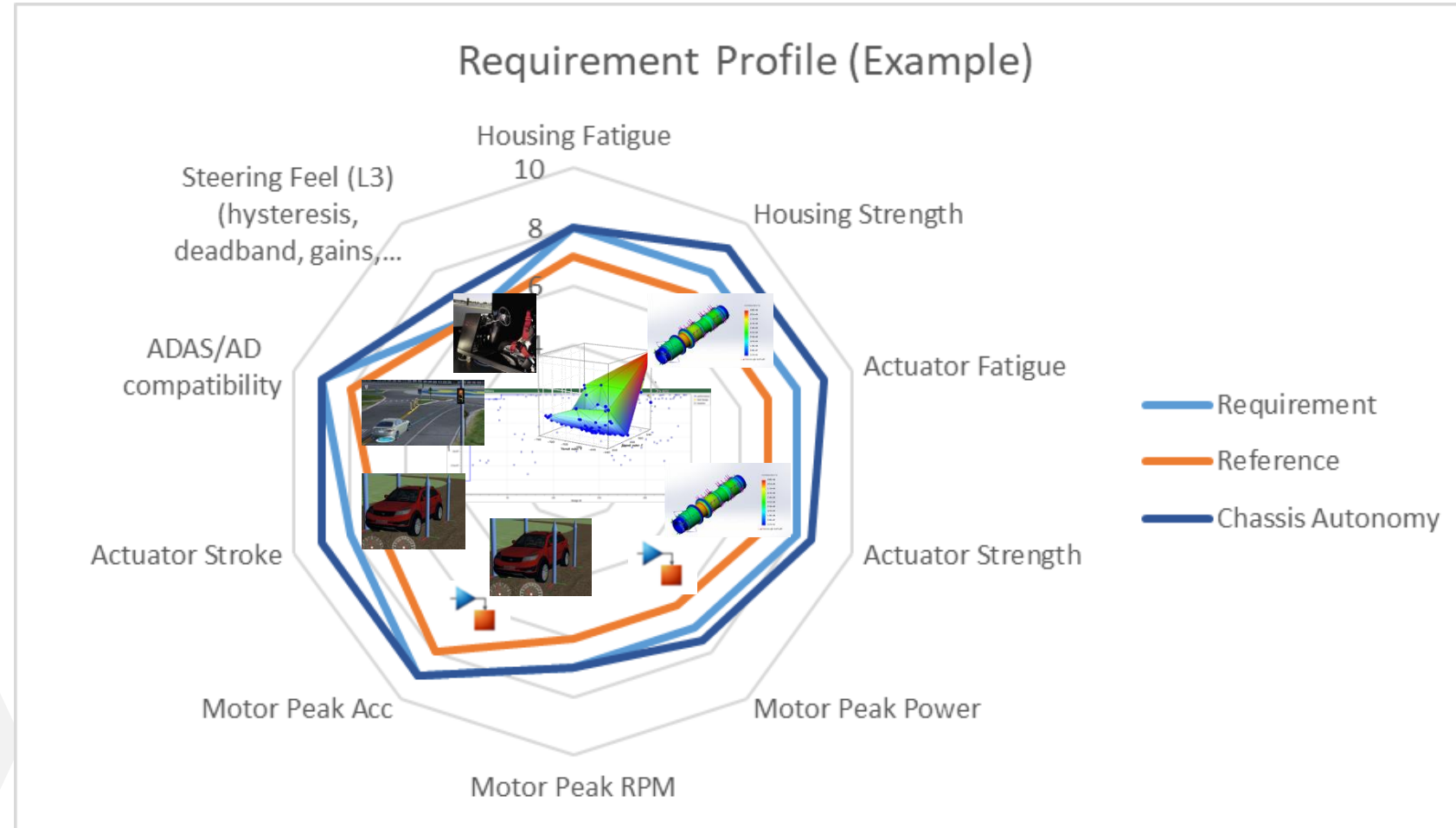
SECURING BOTH HARDWARE AND SOFTWARE PERFORMANCE



ADDRESSING COMPLETE SYSTEM REQUIREMENTS

SECURING BOTH HARDWARE AND SOFTWARE PERFORMANCE

- CAE methods
- MDO-ready toolchain
- DIL/HIL rig



A NEW STRATEGIC PARTNERSHIP



- Rapid simulation cycles
- Zero prototypes
- Bringing true steer-by-wire to highly automated and fully autonomous vehicles