UNIVERSITY OF LIVERPOOL

VIRTUAL ENGINEERING CENTRE

Dr Antony Robotham - Executive Director

OPTIS China User Meeting 2011

18 October 2011, Shanghai, PR China

Supported by

Northwest REGIONAL DEVELOPMENT AGENCY

INVESTING IN englandsnorthwest

EUROPEAN REGIONAL DEVELOPMENT FUND

Case Study with Bentley Motors

Course Leader: Automotive Engineering Design

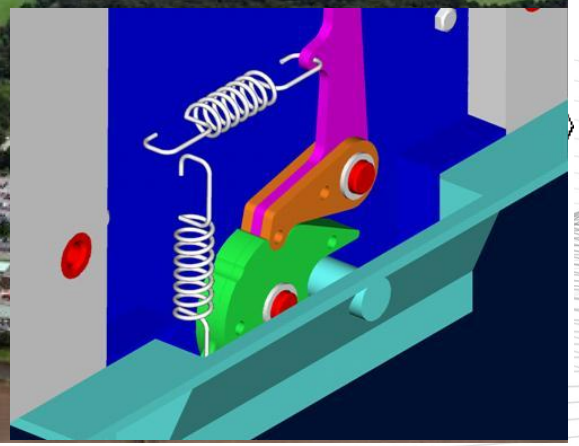
Coventry University

PhD: Aerodynamic Control of VAWTs

Open University

BSc: Mechanical Engineering

Leeds University & GEC Large Machines



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Designing is more than just creating a product...

...it is also about creating an emotional experience!

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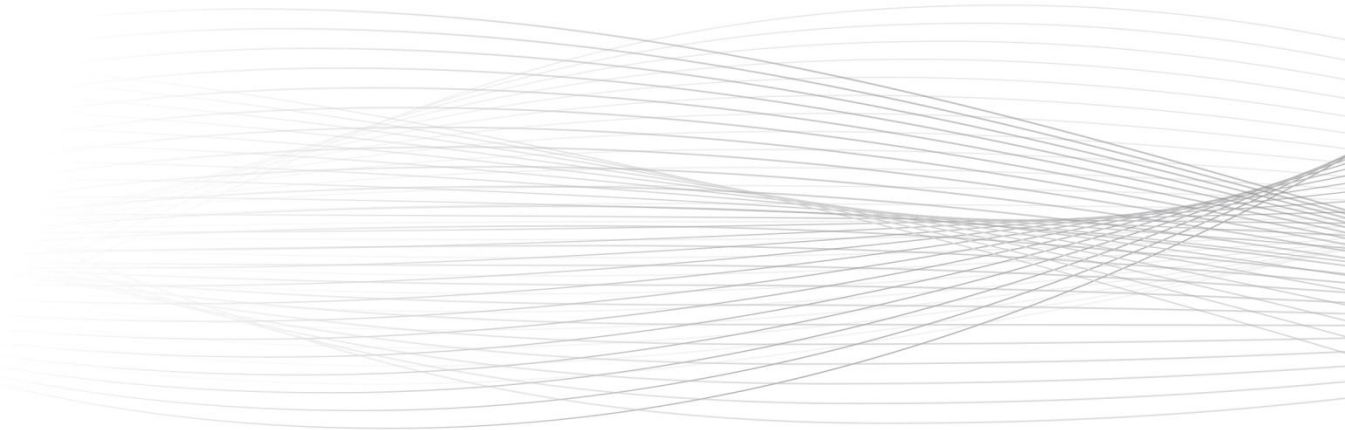
BENTLEY MOTORS

OPTIS + VEC = HIGH FIDELITY VIRTUAL PROTYPES



Content of Presentation

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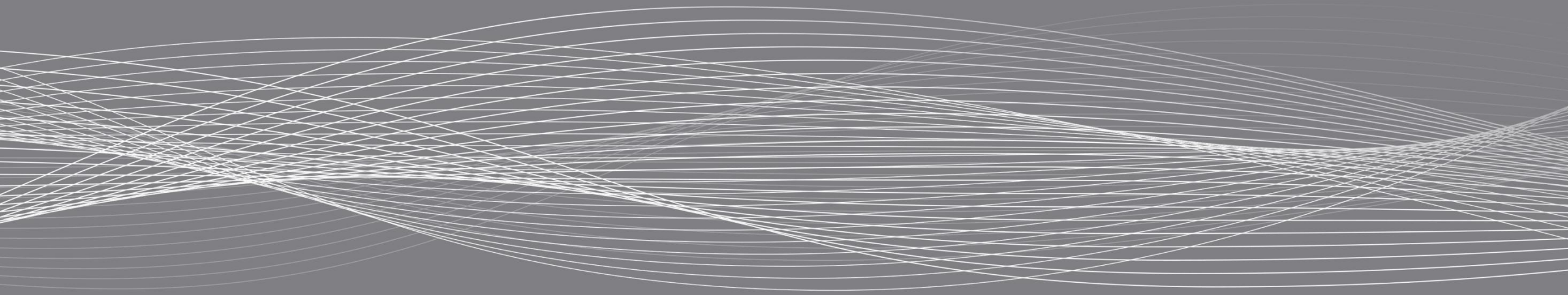

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VE - integration of product and process modelling using digital technologies

VE impacts product development performance

- Rapid response to customer requirements
- More comprehensive exploration of the solution space
- Higher quality products to market quicker
- Reduce the risk and cost of development
- Enabling the supply chain to collaborate

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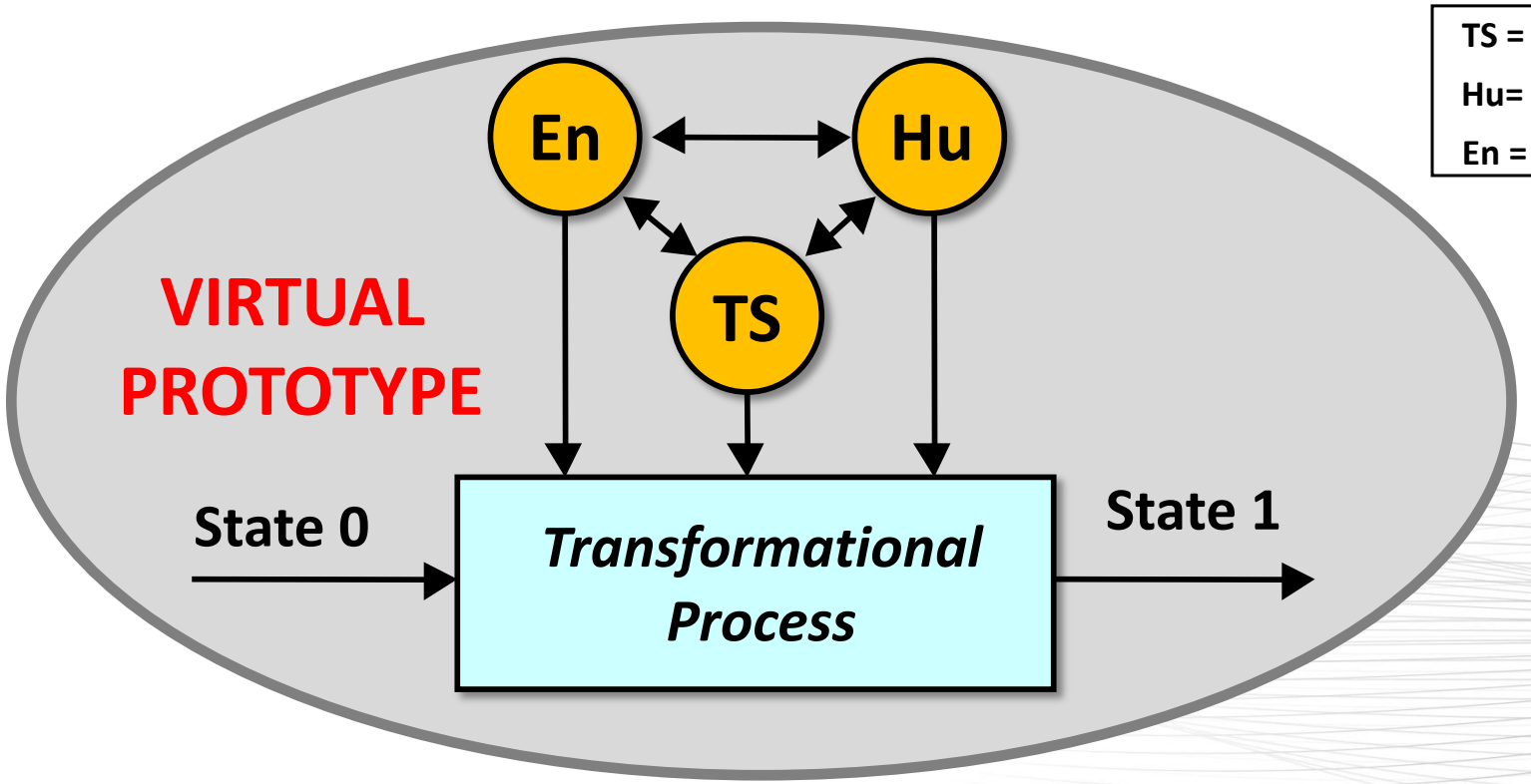
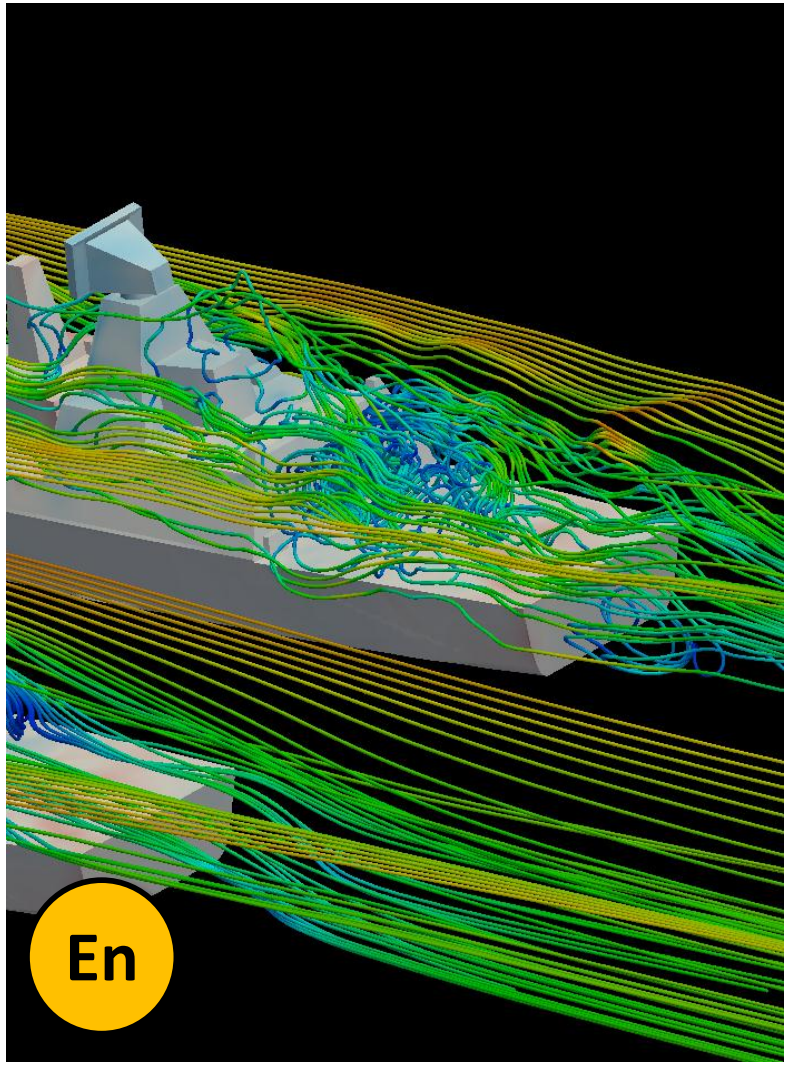
VIRTUAL PROTOTYPE - a product model embedded within a synthetic environment of the relevant life cycle phase enabled to simulate a task



Theory of Technical Systems: V Hubka

Virtual Prototypes



Virtual Prototypes

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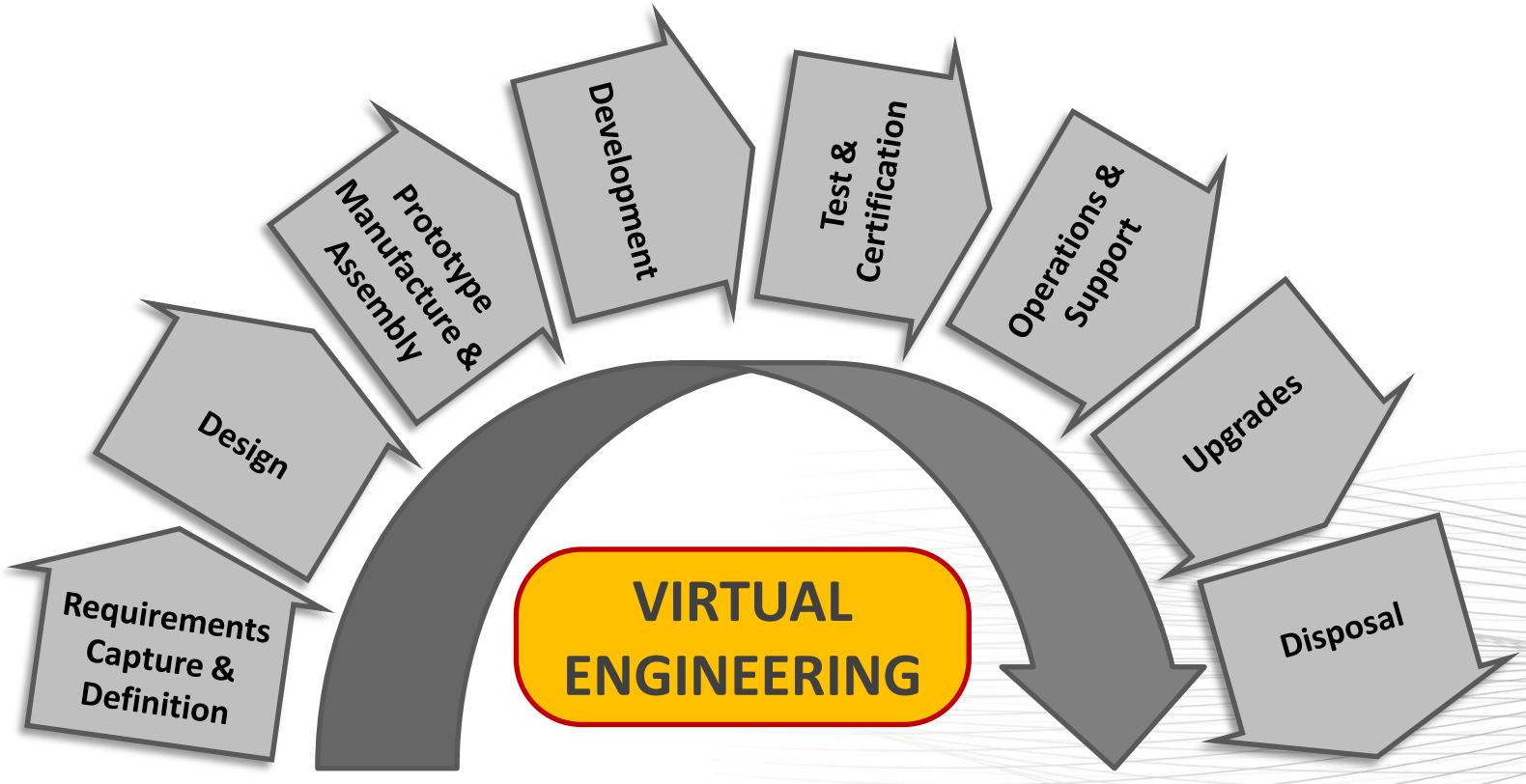
VIRTUAL ENGINEERING enables integration across the product life cycle



VE across the Product Lifecycle

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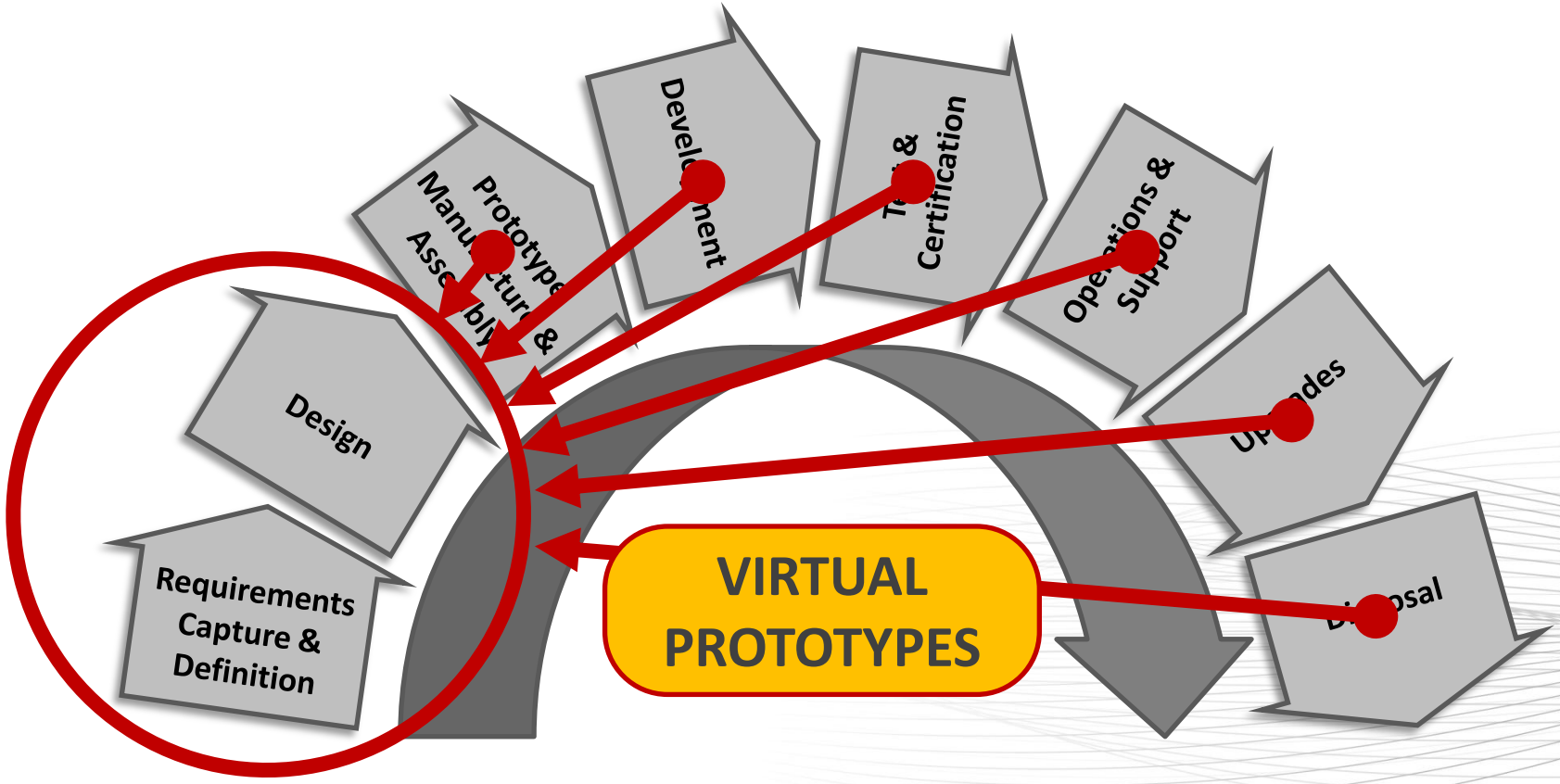
High fidelity VIRTUAL PROTOTYPES support early decision making in NPD



VPs across the Product Lifecycle

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A Centre of Excellence in Virtual Engineering…

- VE best practice demonstration
- VE business development and research
- VE education and skills development

… providing VE support to the aerospace supply chain and other high valued added manufacturing sectors

Virtual Engineering Centre

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Located in North West region of UK

- Largest manufacturing region in the UK by GVA
- Manufacturing generates 20% of the region's GVA
- Employs 400,000 people in the region

AstraZeneca

Unilever

SIEMENS

Rolls-Royce

BAE SYSTEMS

Kellogg's

BENTLEY

JAGUAR

LAND ROVER

VAUXHALL

Virtual Engineering Centre

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Project Partners

- University of Liverpool
- STFC Daresbury Laboratory
- NWAA
- Morson Projects
- BAE Systems
- Airbus (Associate)

Funding

- NWDA
- ERDF

VEC Project Partners

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OPTIS

Wilde

j2

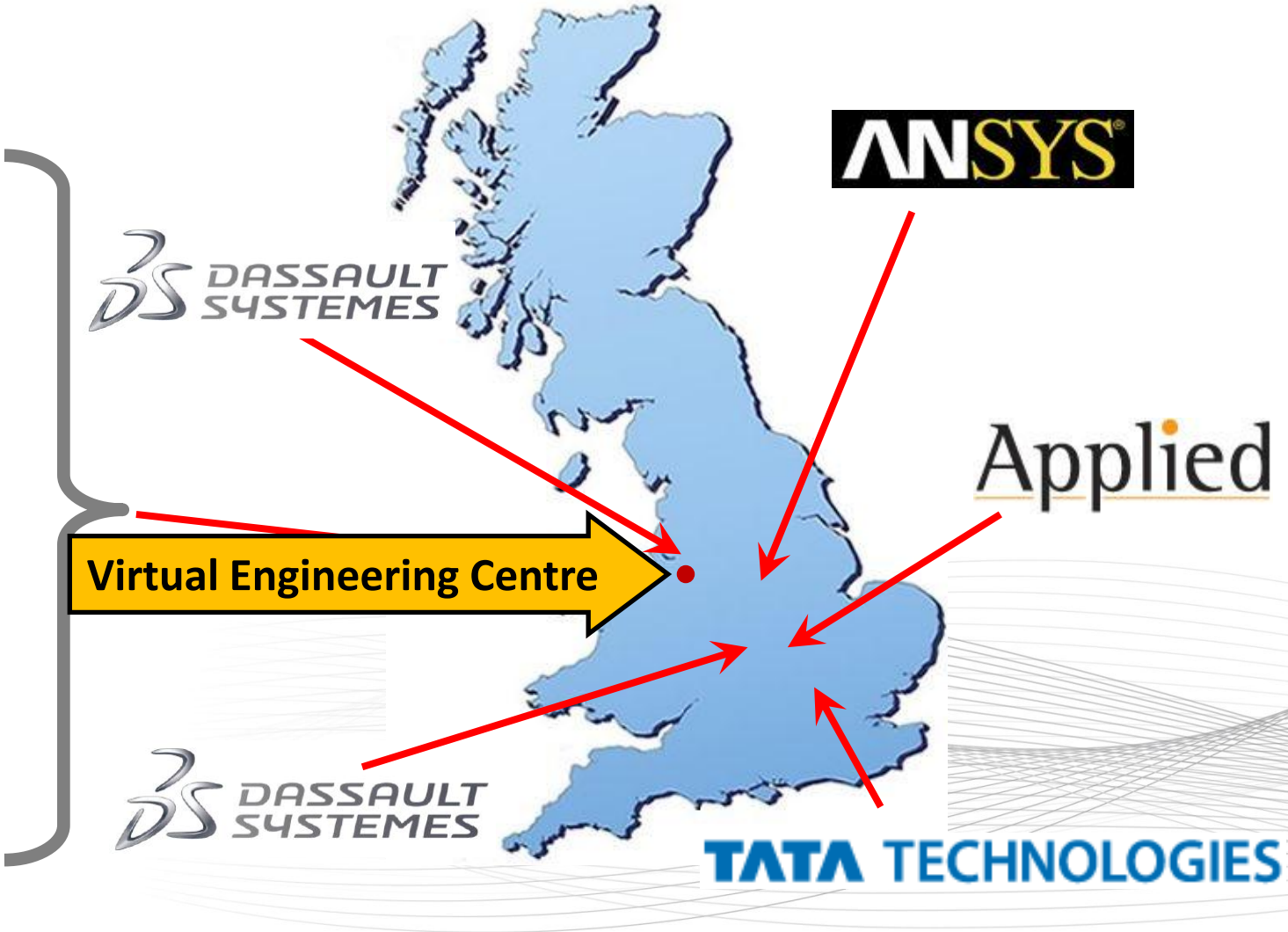
TECIT

VIRTALIS

structure VISION

SimX Simulation eXpertise

Applied Computing & Engineering Ltd



VEC Technology Suppliers

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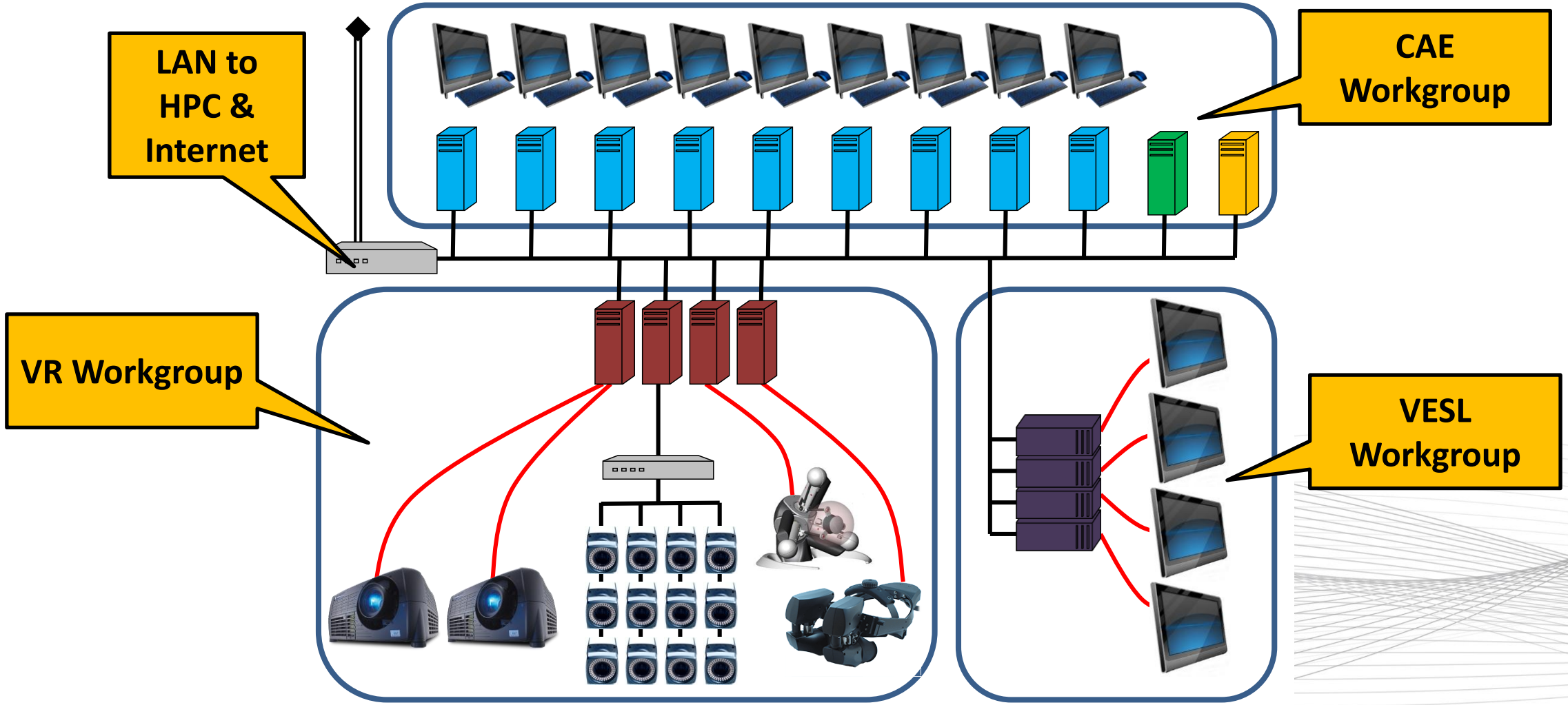

VEC Technical Facilities

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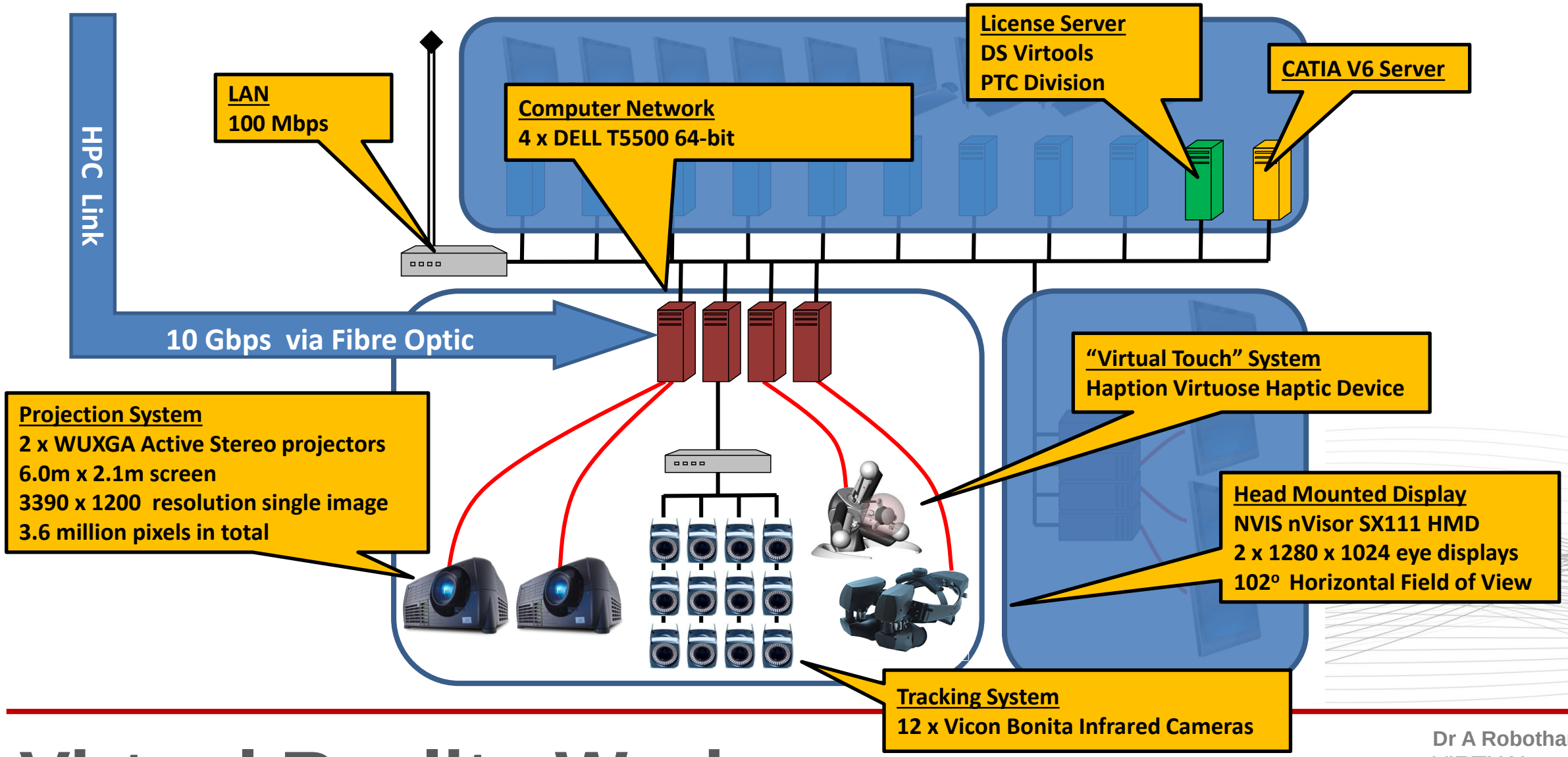

Virtual Reality Workgroup

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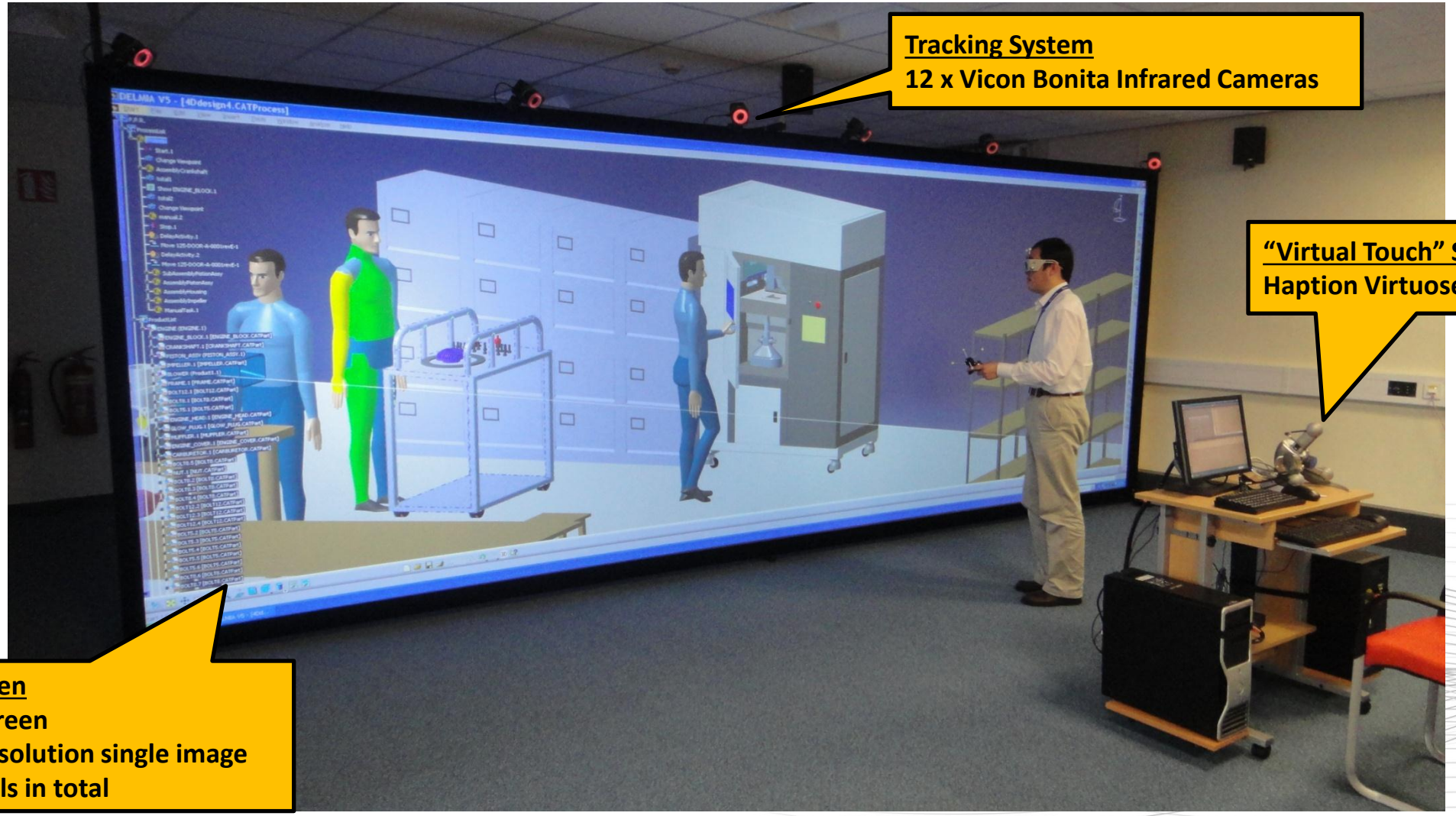

Virtual Reality & Visualisation

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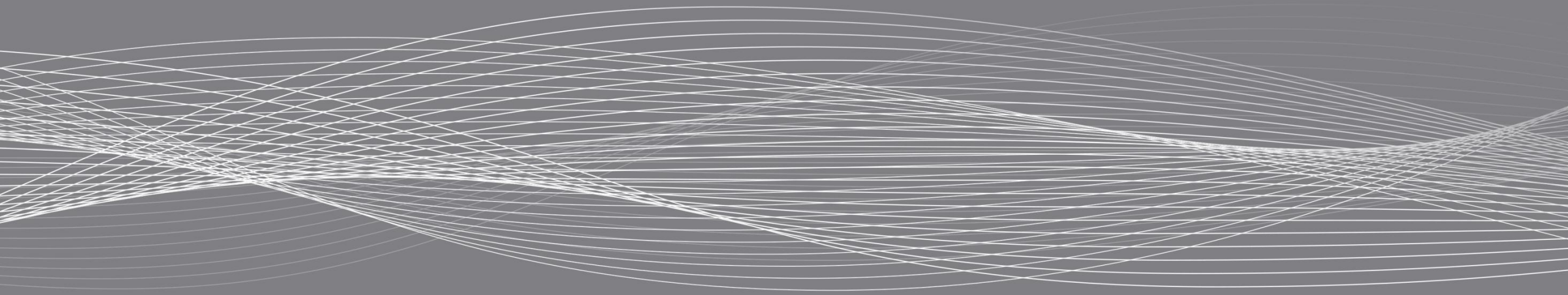

BENTLEY MOTORS

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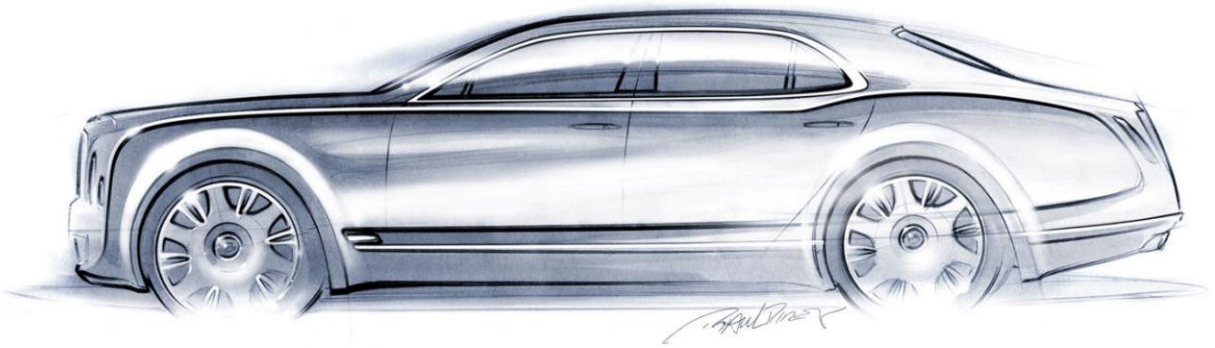
Founded by W.O. Bentley in 1919

Located in Crewe, England since 1946

Owned by Volkswagen AG since 1998



Bentley Motors

BENTLEY

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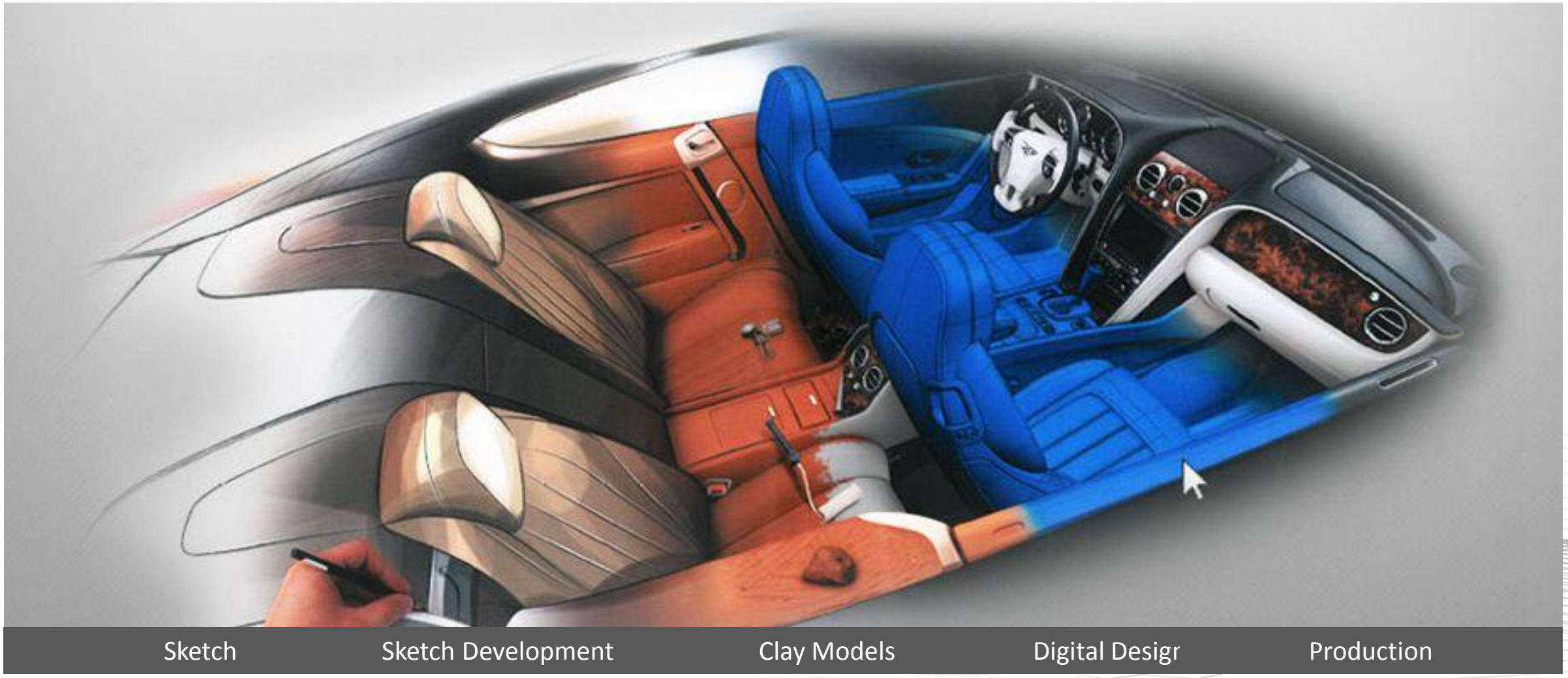
"To build a good car,

a fast car,

the best in class"

W.O. Bentley



Design Development

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Concept

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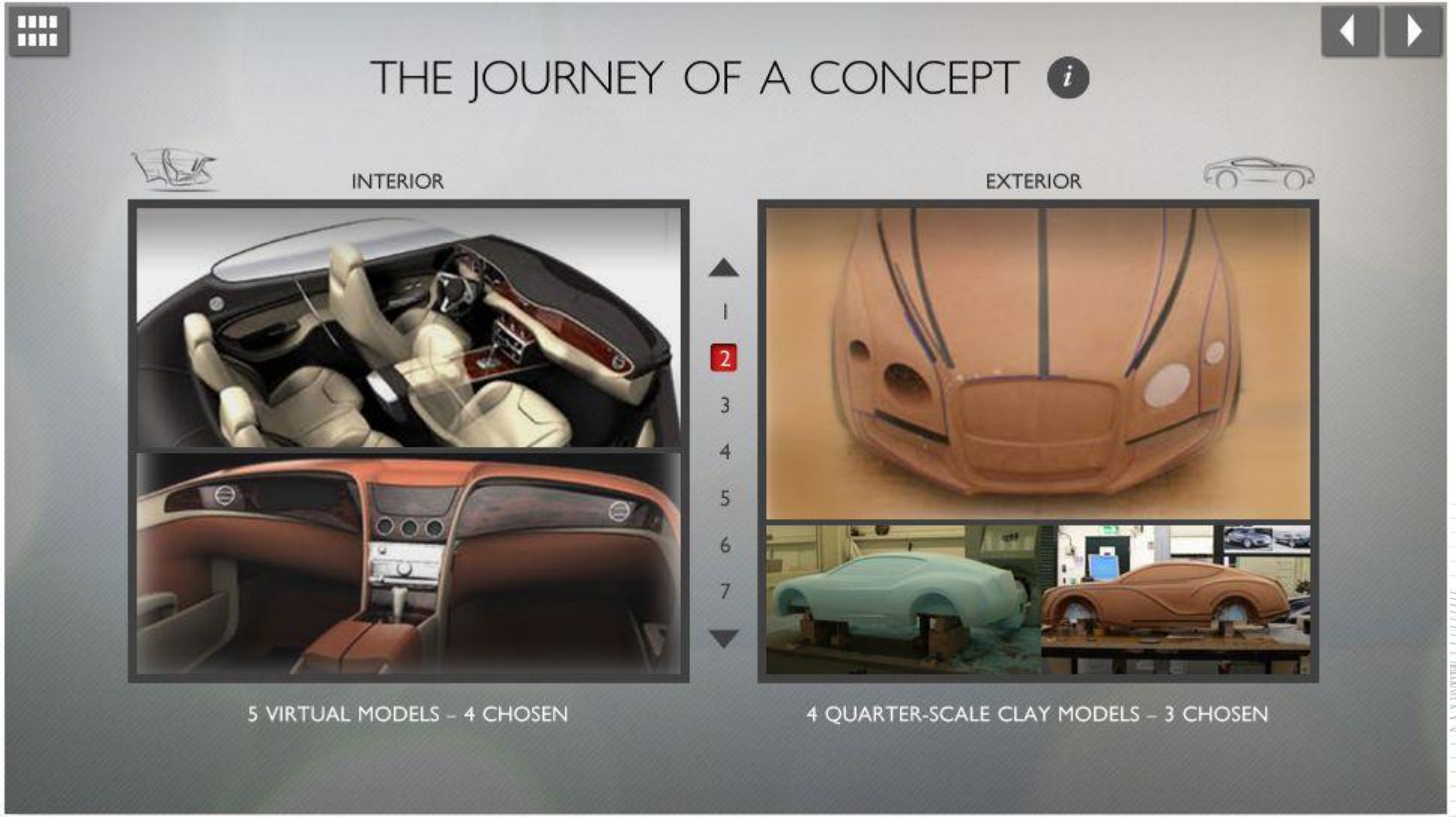

Virtual Models

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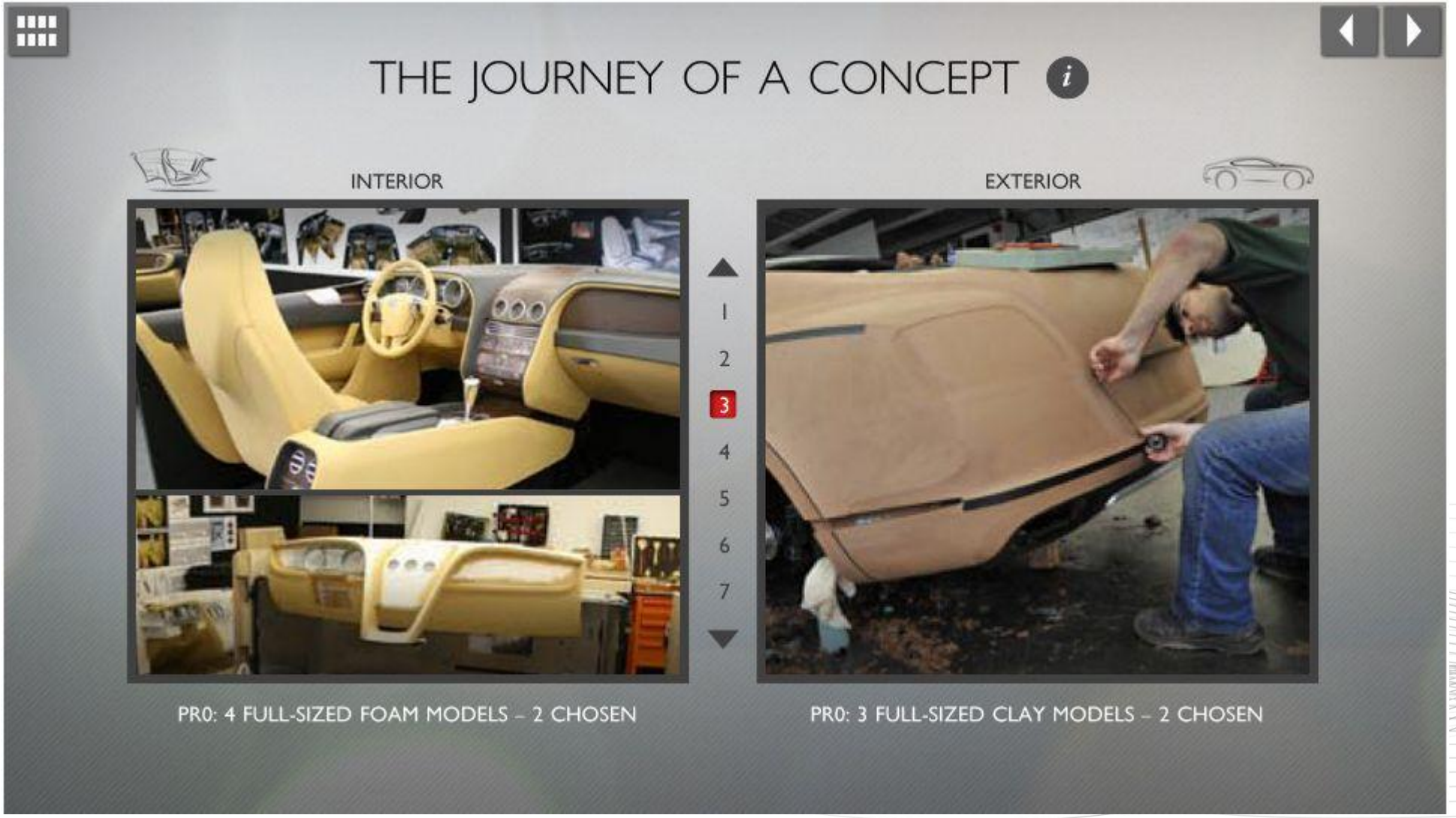

PR0 Gateway

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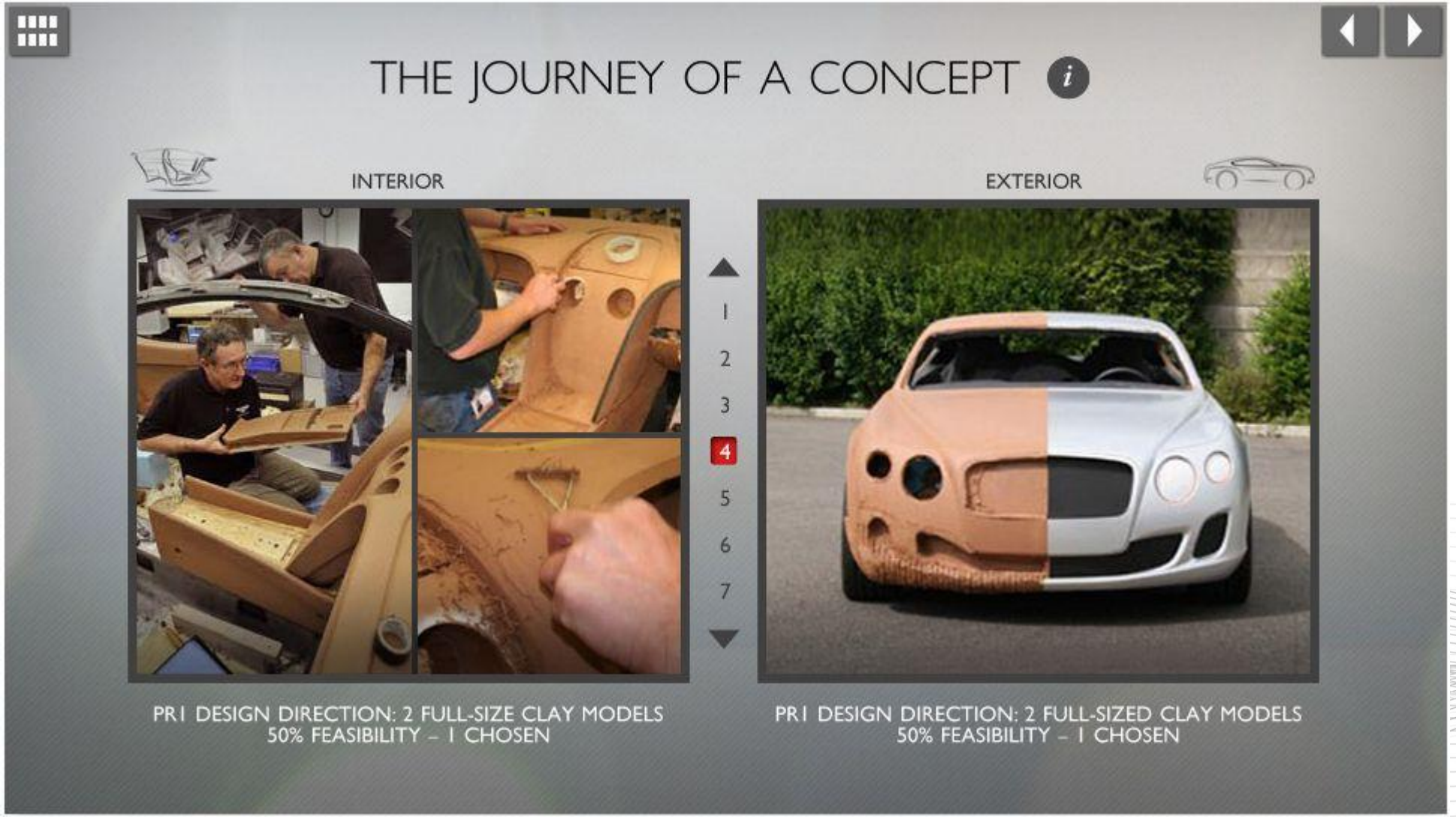

PR1 Gateway

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PR2 Gateway

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IDKM & EDKM

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Production

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Objectives

- Improve the quality of the design solution
- Reduce time and cost of new vehicle design
- Replace physical mock-ups with virtual prototypes

Surface and Build

- Virtual surface validation

Ergonomics

- Ergonomic Validation – vision/reflections
- Lighting Development – illumination

Priorities for Bentley Motors

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Demonstration Project

- Vehicle CAD data of Mulsanne — **Bentley Motors**
- Virtual Reality technologies — **VEC**
- Optical behaviour — **Optis**

Common technology challenges include:

- Immersion and auditor tracking
- Physics based real-time visualisation
- Realistic exterior environments
- Augmented physical reality
- Actual visibility of variation

Demonstration Project

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Health Warning – Everything you are about to see is a simulation

VEC + OPTIS = HIGH FIDELITY VPS

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Start with Basic Geometry…..Catia, Alias, ICEM…..IGES

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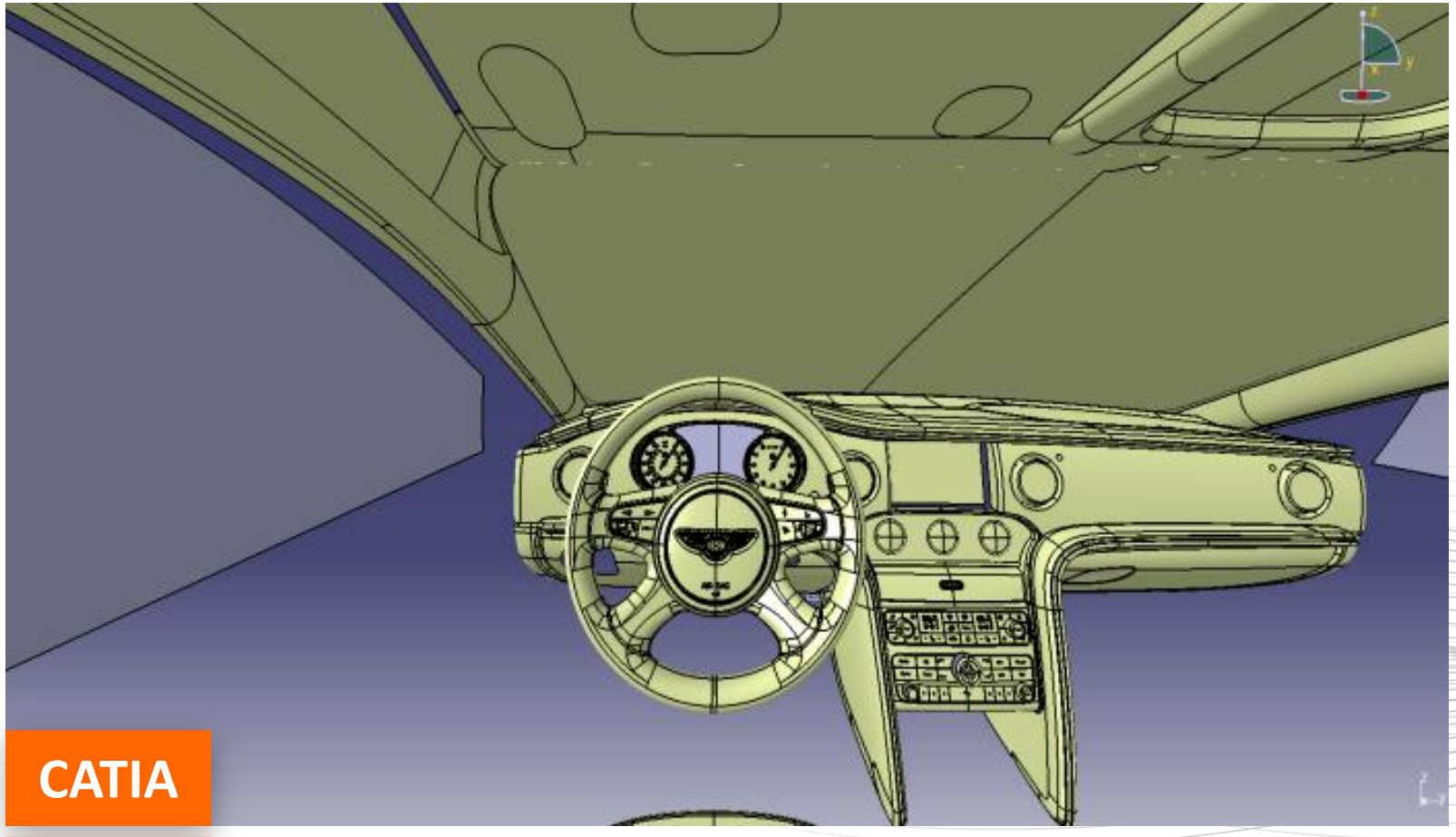

Step 1: CAD Geometry

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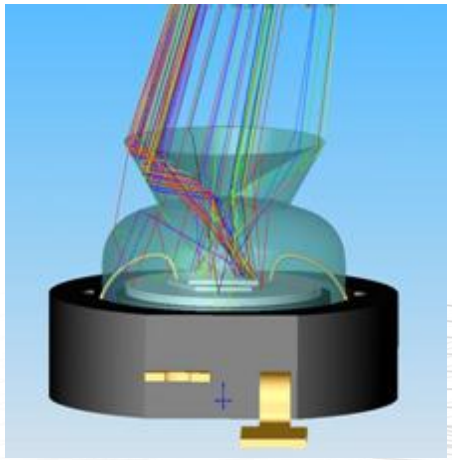
Capture and measure properties

- Materials
- Light emitting sources



Step 2: Material Properties

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Add measured information using SPEOS for CATIA

- Light sources
- Materials
- Sensors
- Environments (any location and time)

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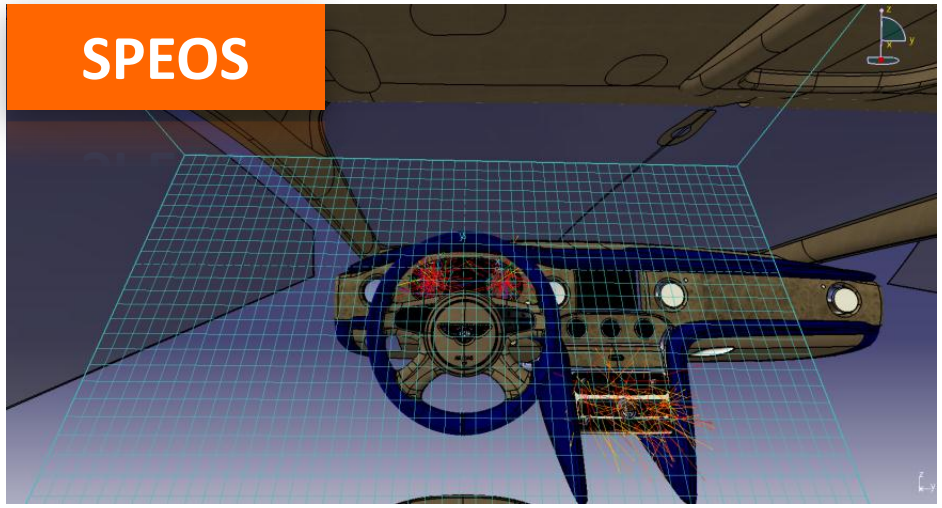

Step 3: Integrate into One Model

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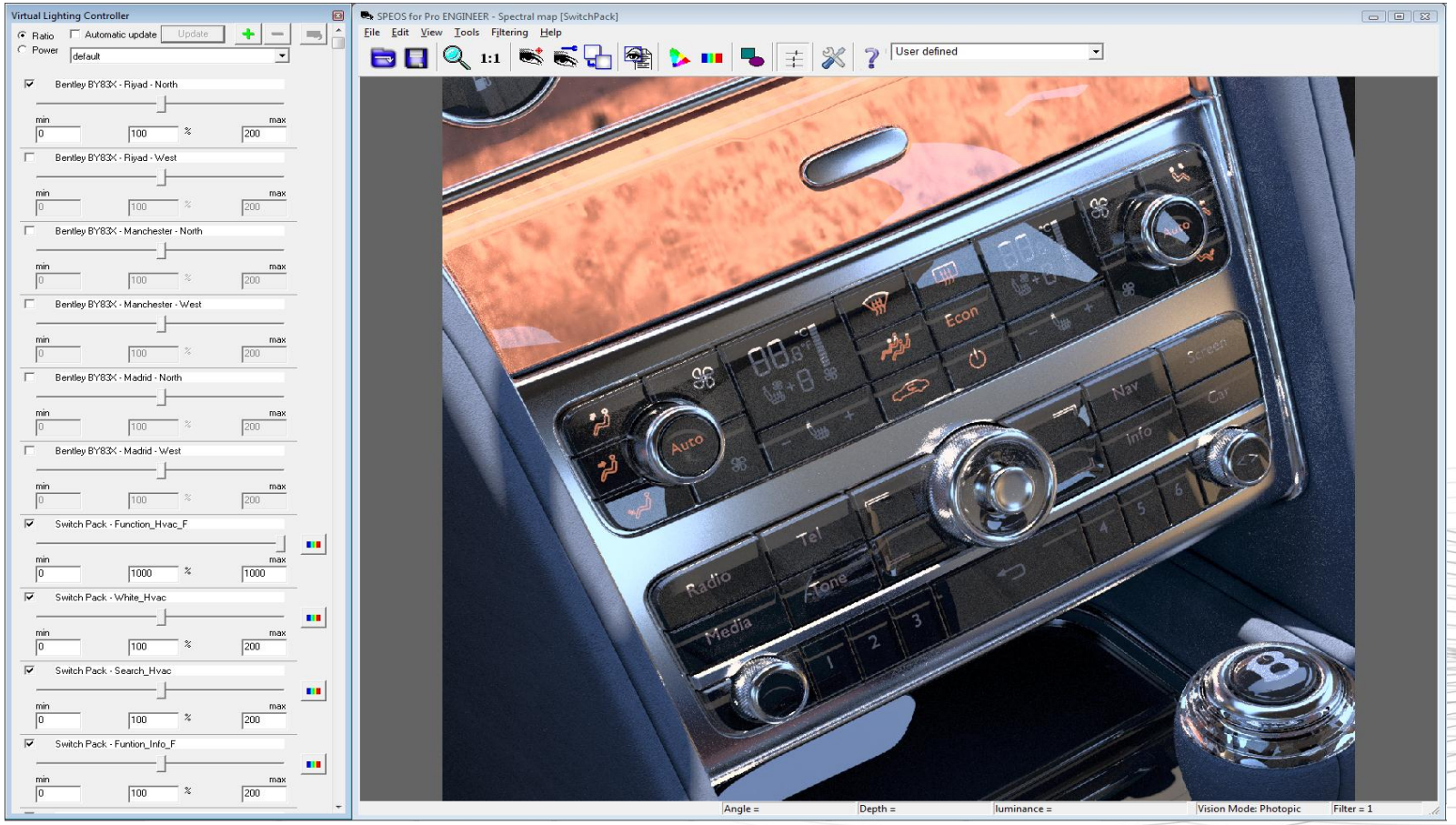
Run simulation and post-process data



Step 4: Physics-based Simulation

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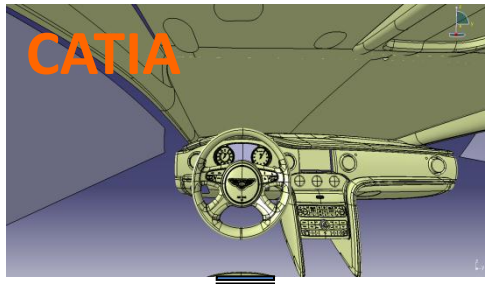
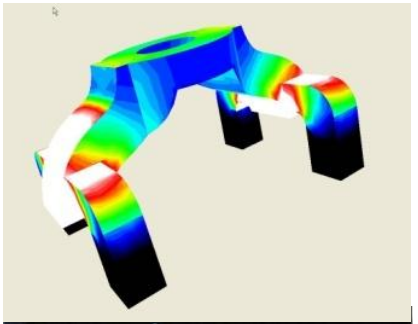
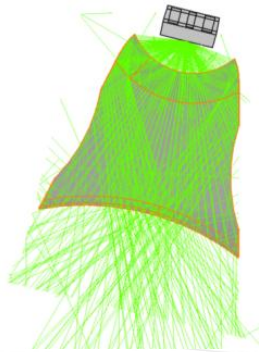


Speos





SPEOS

- Photometric studies

Used to design lighting solutions

- Waterfall lights, Reading lights, Switches, Gauges, Needles, Headlamps

Review VE results with Human vision

Step 5: Evaluate in CAD (Speos)

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Step 5: Optis SPEOS

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Step 5: Optis SPEOS

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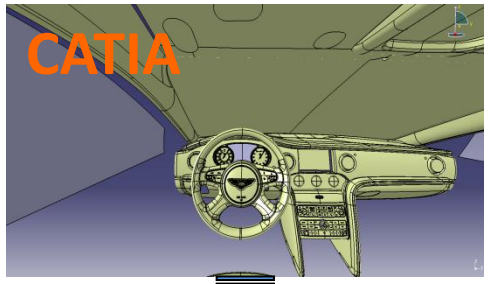

RTLab

RT Lab

- Interactive (real time) assessment of components and assemblies, modify viewpoint, change lighting conditions, change materials, evaluate glare, reflections, ergonomics in a real time environment.
- Not pre-calculated

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Used for early design review to assess lights, materials, positioning, reflections & glare

Step 6: Evaluate in RT Lab

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Step 6: Evaluate in RT Lab

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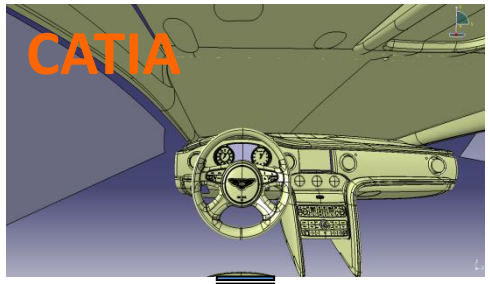
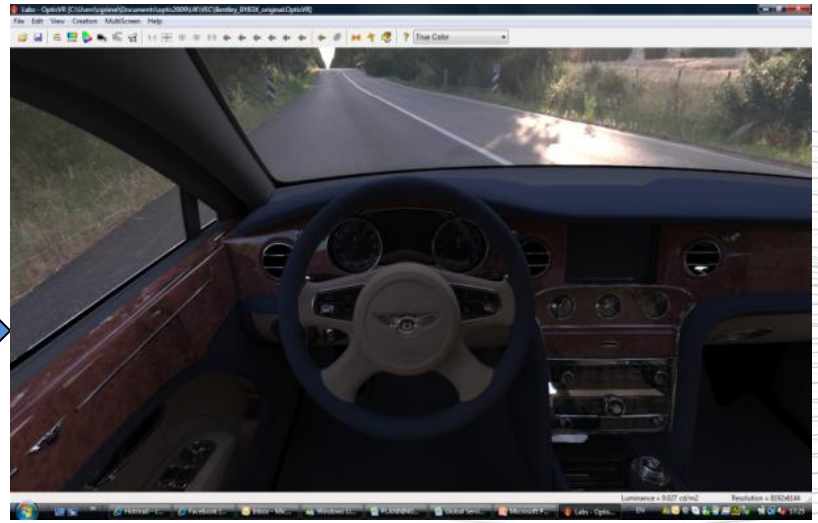


VRLab

VR Lab,

- Full 3xDOF assessment of reflections, lighting conditions, spectrum changes, from a
- Hi-fidelity full physics based rendering
- Pre-calculated view point

Used for design review, communication and decision making on lighting levels, sunlight impact, veiling glare, and reflections



Step 7: Evaluate in VRLab

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Step 7: Evaluate in VRLab

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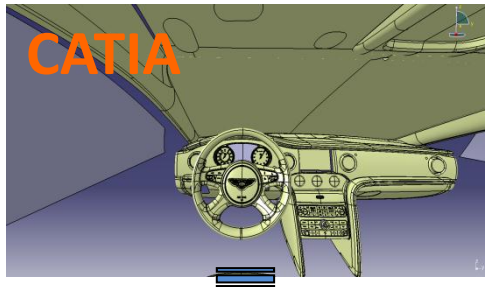
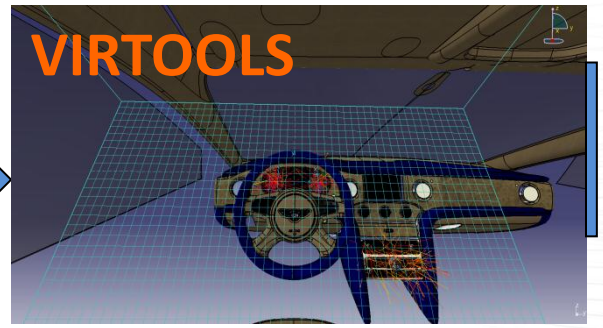
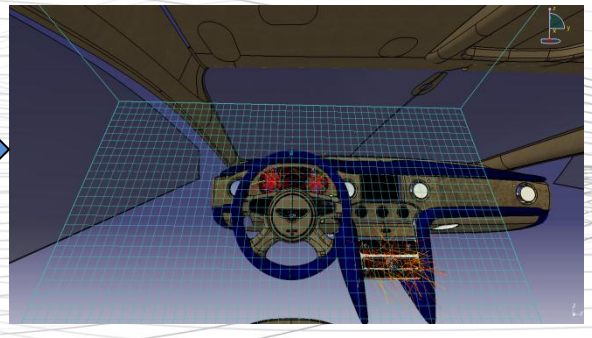


VIRTOOLS

- Real time immersive tool to enable interaction between ‘designers/engineers’ with virtual products models and virtual environments.
- Uses CAD data from CATIA (3DXML)
- Material properties
- Real time tracking
- Physics-based behaviour
- Programmable capabilities



Optis rendering engine



Step 8: Evaluate in VR (Virtools)

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OPTIS

Step 8: Evaluate in VR (Virtools)

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Capability to perform full vehicle reviews (physics based) before physical prototypes have been built

Real time, dynamic design review with the flexibility to accommodate different user viewpoints

Full physics based analysis of vehicle interiors and exteriors

Inspection capability for exterior examination

A facility with technical partners to develop a process that can be used within Bentley Motors

Demonstrator Outcomes

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Future plan to create an augmented seating & steering column module to interact and enhance the immersive environment

Reduce rendering calculation time by use of CPU & GPU clusters

Future Plans

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Virtual Prototypes have an important role to play in NPD

Immersive, user experiences require hi-fidelity physics-based models of the product and the active environment

Interaction with VPs must be intuitive and non-invasive

Exploration of the total design space will be expensive

Concluding Remarks

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Thank You

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