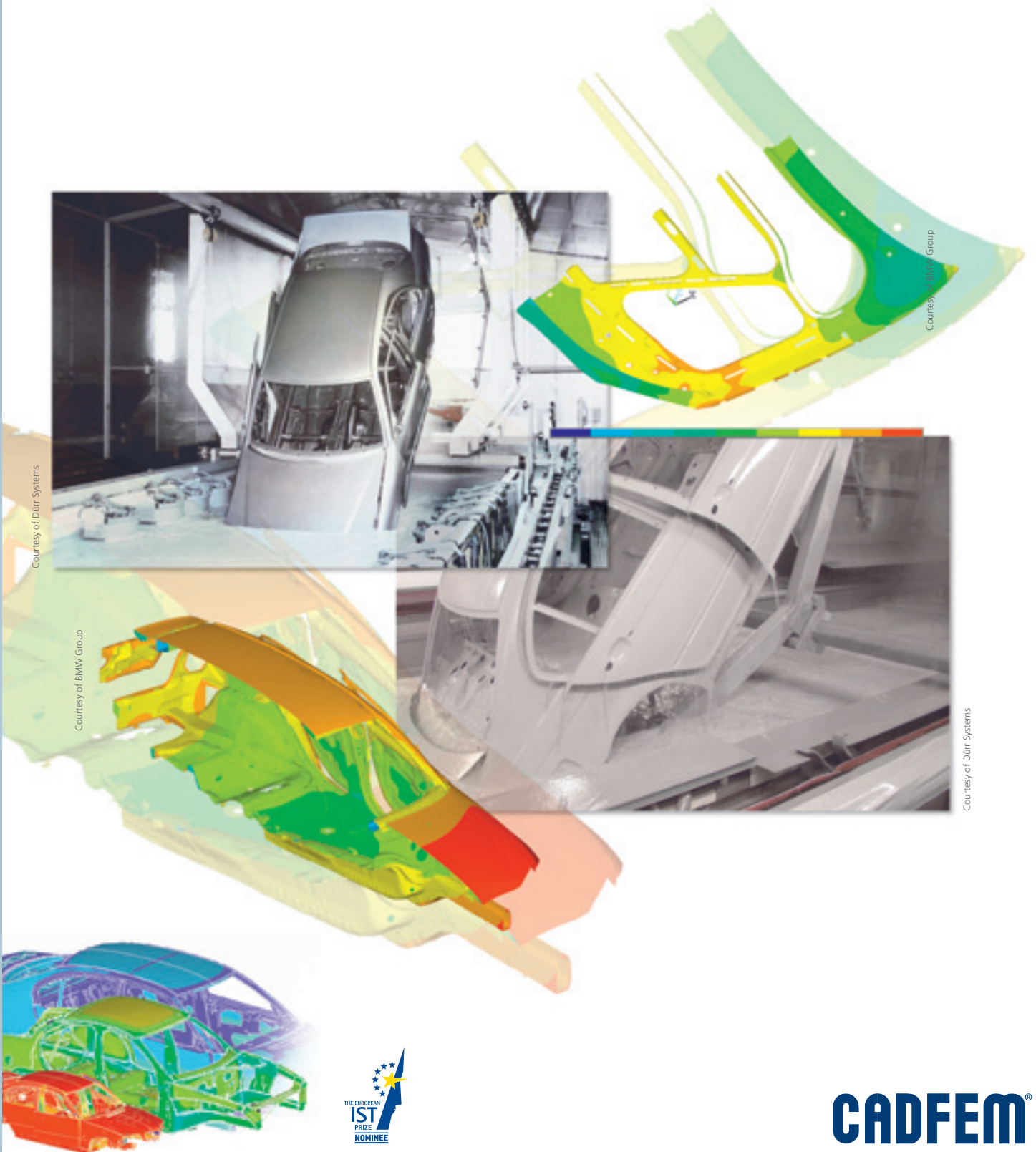


# VirtualPaintShop® VPS/EDC

The Module for the Simulation of Electrodeposition Coating of Car Bodies



## VirtualPaintShop® – VPS/EDC

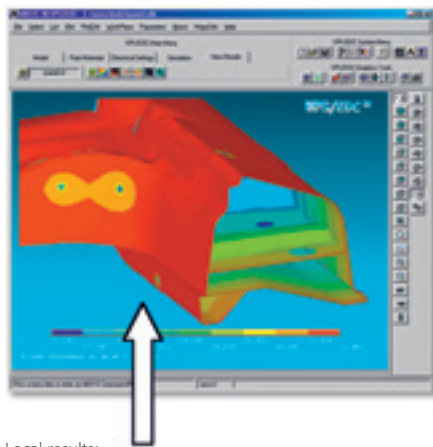
Computational prediction of anti-corrosive base coat as well as optically effective top or clear coat layers has become a key aspect in virtual prototyping of automotive design processes. VPS/EDC simulates electro-deposition of base coat layers on car bodies under the influence of electric current flow within the e-coat basin. It is part of the VirtualPaintShop® (VPS) software suite – a bundle of modules offered by CADFEM GmbH for the simulation of various steps of the complex coating process of a body-in-white.

VPS/EDC enables you to improve the quality of your final product as well as the efficiency of the production process. By predicting coating results at any location of the body-in-white before a physical prototype is available it allows you to save valuable resources in terms of time and materials:

- Find critical locations of poor final layer thickness.
- Revise structures in order to improve access of electric current into cavities.
- Adapt the electric voltage program or anode placement in the tank.
- Predict the effect of a change of the paint material type.
- Predict consumption of resources like electric work or paint material per body-in-white.
- Reduce production losses by fail-safe design.
- Reduce expenses of in-process quality inspection.

Finite element models for VPS/EDC are created using the CATIA Toolkit software from the CAD source model.

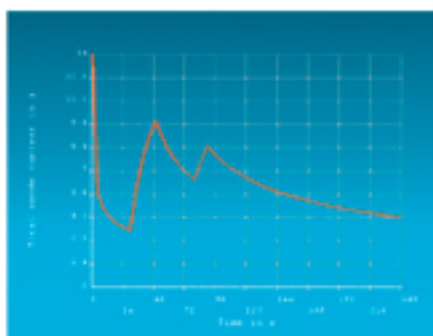
The entire liquid paint volume is meshed with a tetrahedron finite element mesh. VPS/EDC uses this mesh for calculation of the spatial electric current flow. The growth of paint layer is calculated at the surface of the structure as a function of local current density.



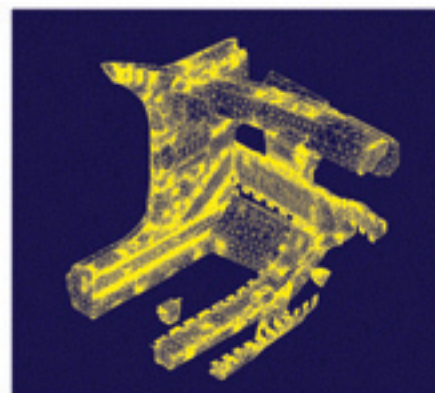
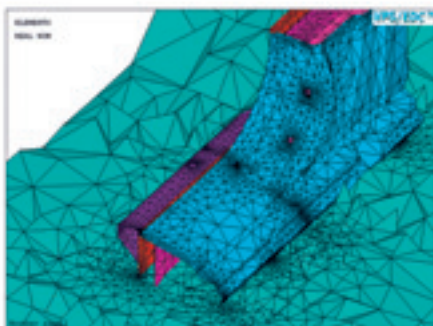
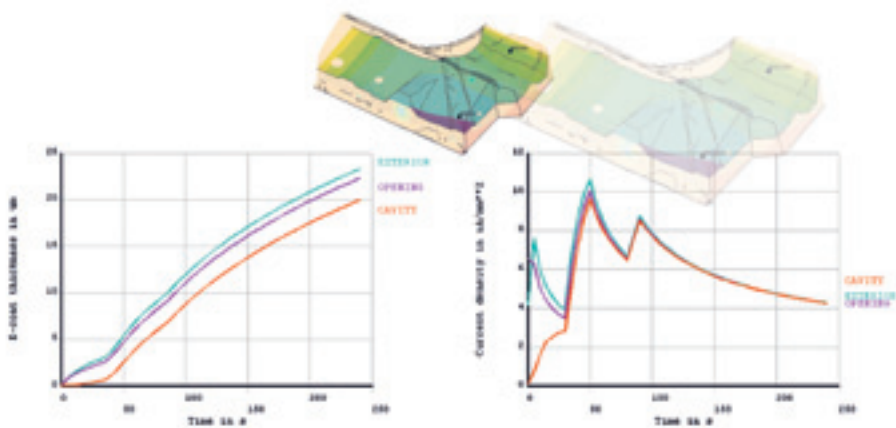
Local results:  
 E-coat thickness  
 Surface resistance  
 Current density  
 Charge density

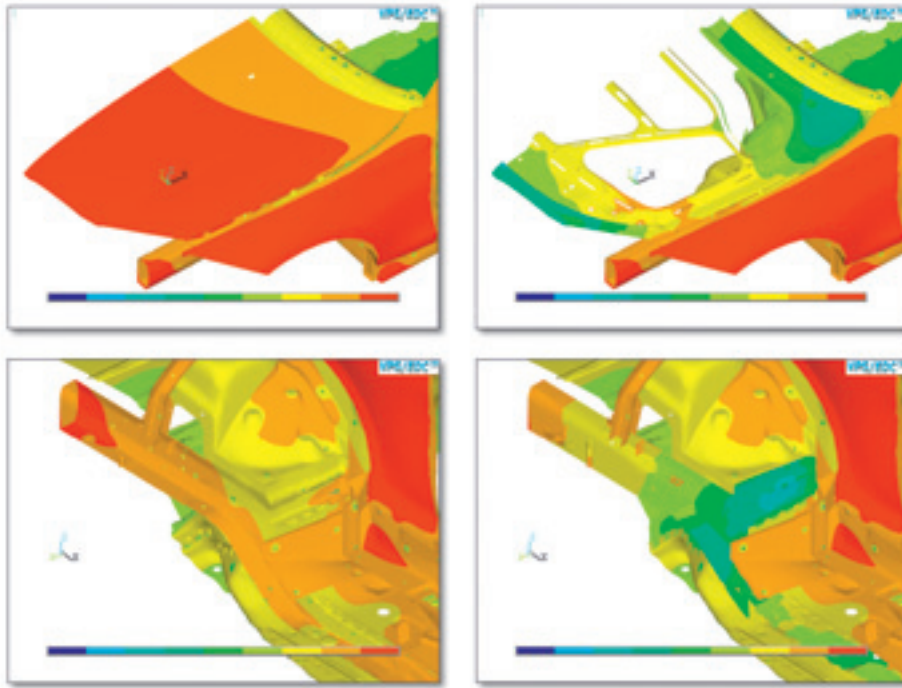


Integral results:  
 Total anode current  
 Total supplied charge  
 Total electric power  
 Total supplied el. work  
 Paint usage



The development of local quantities may be observed over process time.





Predict e-coat layers in hidden cavities with limited access for the electric current flow.

#### TECHNICAL OVERVIEW OF VPS/EDC (VALID OCT. 2007)

- Powerful simulation capability for full-scale bodies-in-white
- Parameter based tank modeling
- Import of VPS/EDC-compatible finite element mesh files
- Integrated model check and detailed check report
- Collecting paint material data into paint material libraries.
- Temperature-sensitive paint deposition properties
- Different deposition properties on different substrates realized within one simulation run
- Definition of insulating parts
- Piecewise linear voltage-vs. time functions at anodes; Moving anodes
- Nonlinear iterative simulation
- Result files compatible with other postprocessing tools commonly used in the automotive design and simulation process
- Export of results into ASCII data files
- Setup of batch jobs for remote compute servers within the graphical user interface

#### Calibration of paint deposition parameters

VPS/EDC uses a set of parameters describing the deposition properties of the paint material during the e-coat process. In order to find these parameters a series of e-coat experiments has to be done in a laboratory. CADFEM has designed a standard e-coat experiment and offers an easy-to-use test box (left picture) for the automotive user's or the paint supplier's laboratory. The deposition parameters are obtained by calibrating a VPS/EDC simulation to experimental results using an equivalent VPS/EDC model of this experiment.



Parameters of a paint material may be calibrated for various substrates if expected to be substrate-dependent. Once obtained the properties of a paint material may be stored in a library to be used for simulation of arbitrary bodies-in-white.

#### THE MODULES OF VirtualPaintShop®:

- VPS/DIP** Simulation of transient air inclusions and resulting carry over of fluids due to immersion in basins
- VPS/EDC** Simulation of electro-deposition coating
- VPS/DRY** Simulation of thermal heat up and cool down of structures; curing of paint layers or adhesives
- VPS/UV** Simulation of ultraviolet curing of coatings
- VPS/ESC** Simulation of electrostatic or pneumatic coat application
- VPS/CP** Simulation of cavity preservation by wax spraying and propagation

#### CATIA BASED SOLUTIONS

(some modules require customization to customer specifics for implementation)

- CATIA Toolkit** Preparation of Simulation Models for VPS/EDC, VPS/DIP, VPS/ESC, CFD or AcousticPathAnalyzer
- AcousticPathAnalyzer** Simulation of acoustic paths within car body cavities

Further information can be found on [www.virtualpaintshop.de](http://www.virtualpaintshop.de)

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## EVALUATE BY PILOT PROJECT

For evaluation of the VPS/EDC capabilities as well as its suitability for your product and process design environment a pilot project conducted in cooperation with CADFEM is recommended. Using your CAD data of the car body, process and basin description as well as paint material properties CADFEM will provide the entire modeling and simulation workflow at a real automobile structure out of your current or prospective product line.

## CADFEM SERVICES

- Preparation of the finite element mesh for VPS/EDC using CATIA Toolkit
- Support of laboratory experiments for paint material evaluation. Calibration of paint deposition parameters
- VPS/EDC simulation and results evaluation
- VPS/EDC training for your computational or paint technology specialists
- Customization of VPS/EDC to your specific requirements

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