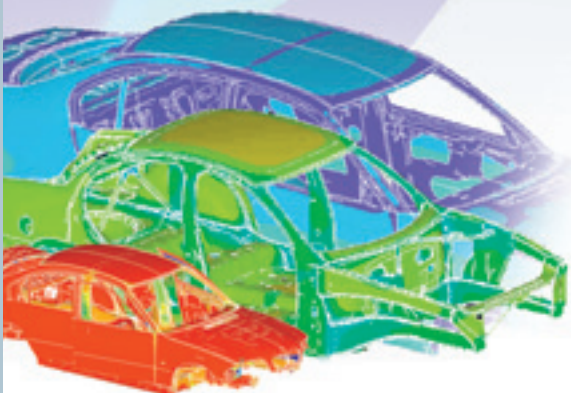
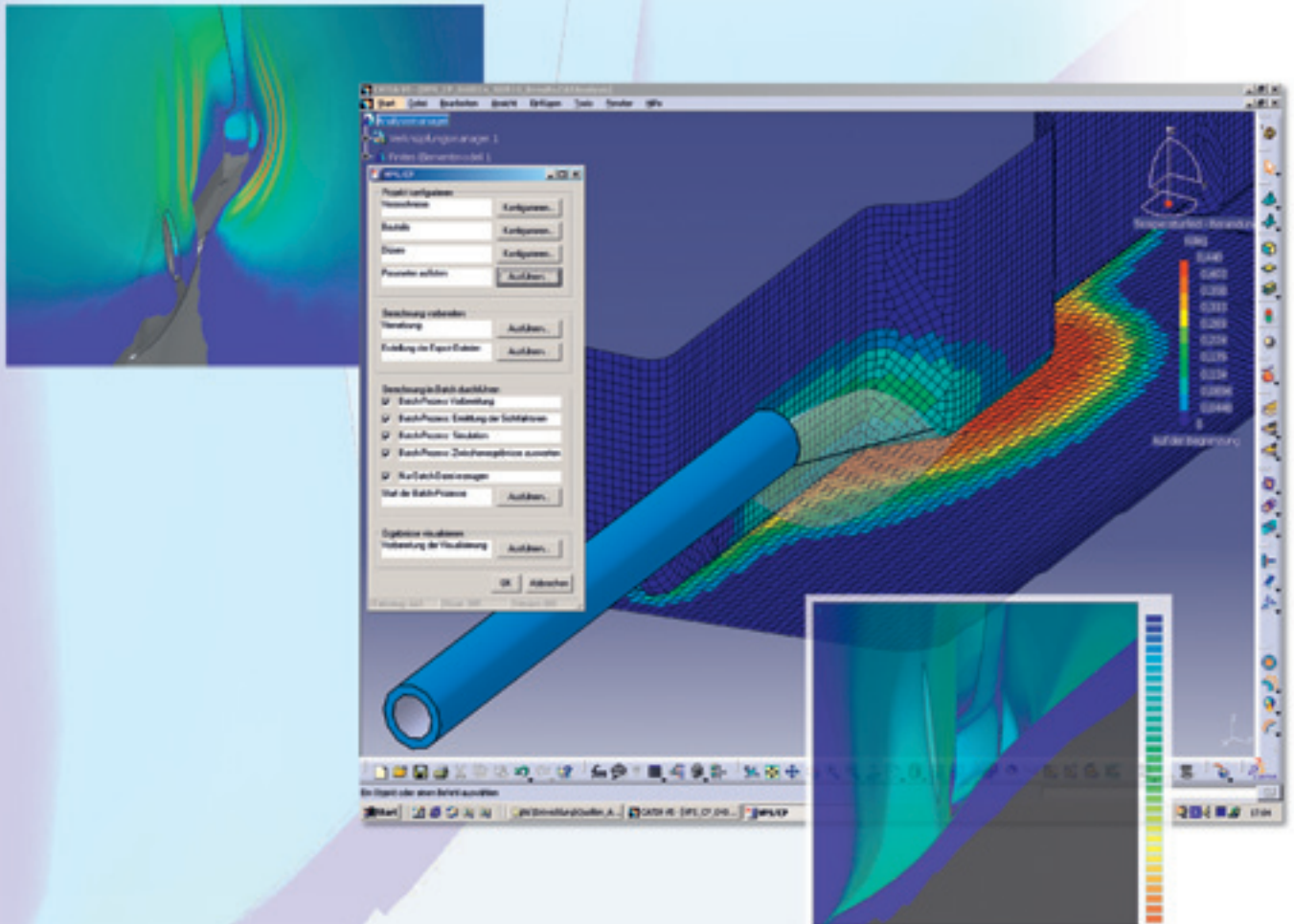


# VirtualPaintShop® VPS/CP

The Module to Support Nozzle Design by Simulation of Wax Spraying and Propagation for Cavity Preservation of Car Bodies



## VirtualPaintShop® – VPS/CP

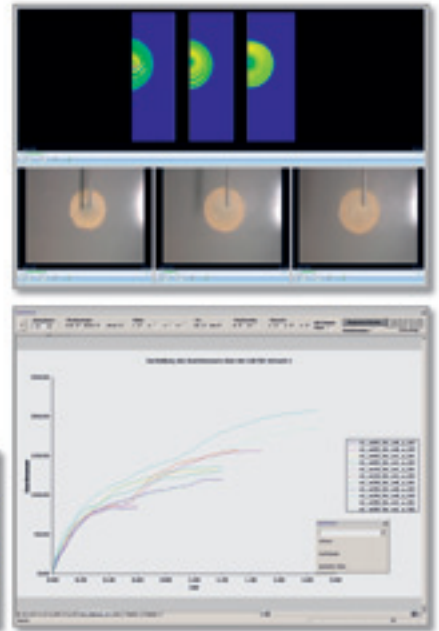
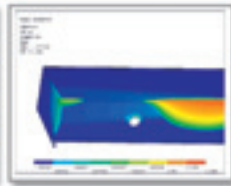
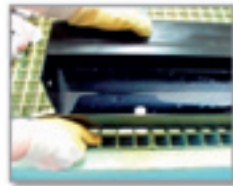
Effective cavity preservation of vehicles requires that the sprayed wax reliably reaches all target locations. The surface coverage is not limited to those locations hit by the direct nozzle jet. Jet kinetic energy and air flow, gravity as well as capillarity continue to drive the fluid across the surface during and after the spray pulse.

For increasing geometric complexity of car bodies it becomes hard to predict surface coverage with experience-based methods. VPS/CP provides computational prediction of the wax thickness distribution at arbitrarily shaped objects. It simulates time-dependent wax spreading driven by the physical effects mentioned above. Thus, its sophisticated mathematical methods offer much more than geometrical "light beam" based approaches. The module is part of CAD-FEMs VirtualPaintShop® (VPS) software suite and supports you in deliberate nozzle positioning and setting of process parameters.

- Predict wax propagation across areas adjacent to the directly hit surface, including shadowed areas.
- Identify surface locations with missing coverage or insufficient film thickness.
- Select appropriate nozzle designs and optimize spray time, wax type, wax flow and other parameters.
- Revise structures in order to improve access for nozzles.
- Reduce the amount of "shots" to the required minimum.

## Calibration of wax material parameters

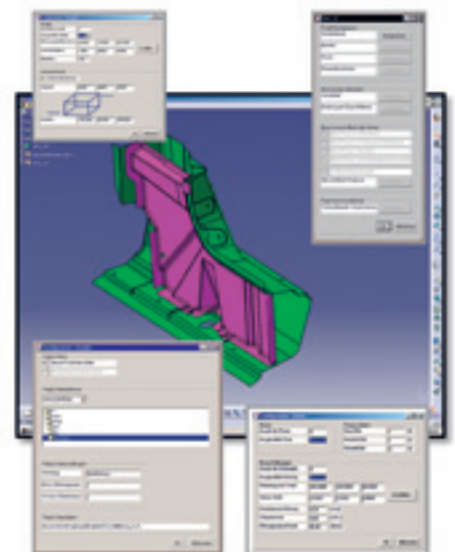
VPS/CP uses a set of empirical parameters to describe the flow behaviour of the wax material. These parameters are calibrated using a series of spray experiments to be done in a laboratory at test objects of elementary shape. High-speed camera recordings of the spray pulse and subsequent wax flow form the basis for the parameter calibration.



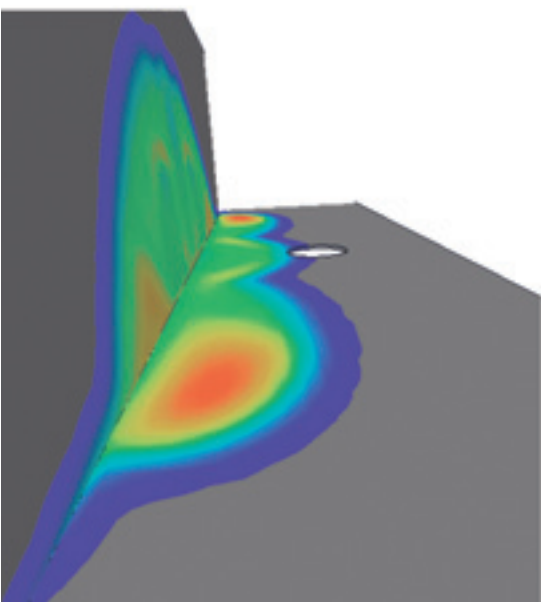
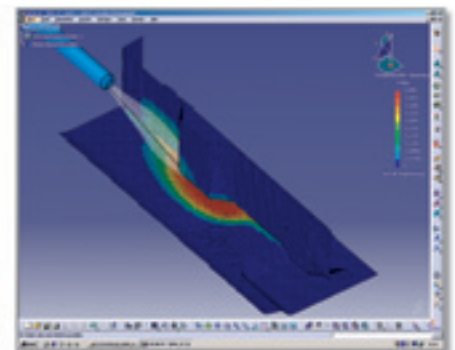
VPS/CP is a finite element based simulation tool requiring a shell-type mesh of your sheet structure. An interface to CATIA V5 (alternative CAD-systems on demand) enables interactive model preparation and definition of process parameters within your CAD environment. The designer for nozzles is thus supported directly in his CAD environment. The software can as well work as a stand-alone tool using finite element models of other origin.

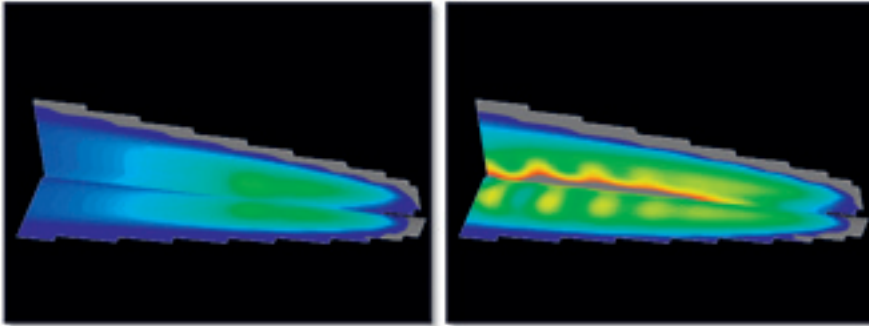
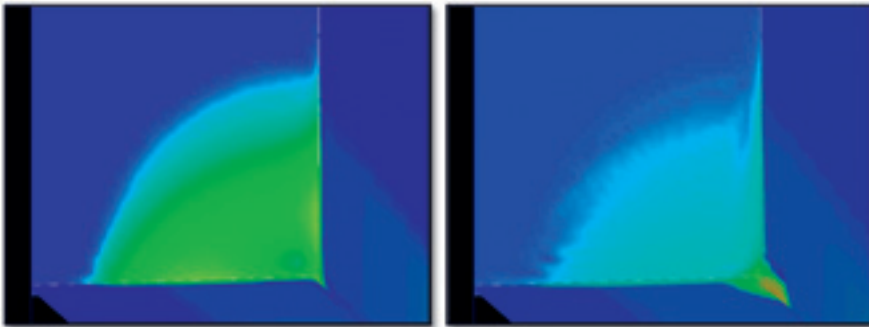
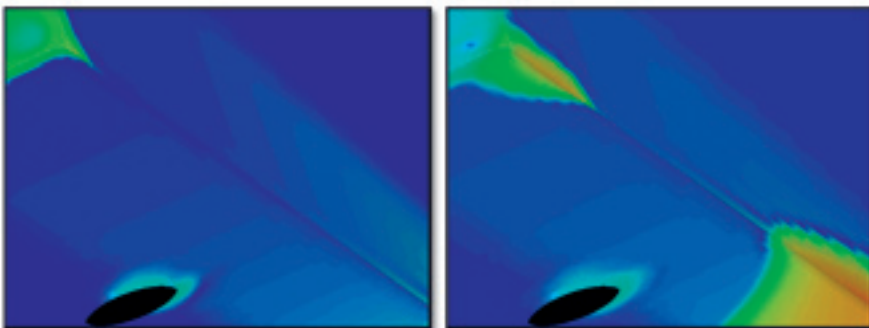
Nozzle configuration is defined by

- Position and size of orifices
- Spatial orientation
- Wax flow rate
- Spray pulse time
- Other



After the VPS/CP simulation visualize wax thickness distribution either within CATIA or within the finite element solver utilized by VPS/CP.



**Air driven wax propagation****Gravity driven wax propagation****Capillarity driven wax propagation****TECHNICAL OVERVIEW OF VPS/CP (VALID OCT. 2007)**

- User interface coupled to CATIA V5 for model preparation, process definition and results visualization
- Stand-alone option with ability to read VPS/CP-compatible finite element models from other origin than CATIA
- Definition of wax properties based on calibration
- Multiple nozzles, each with multiple orifices in one simulation
- Included physical driving effects:
  - Droplet jet kinetic energy
  - Viscous self-displacement
  - Air flow across deposited fluid
  - Gravity
  - Capillarity
- Nonlinear iterative simulation based on advanced finite element methods running as a background batch job
- Visualization of wax thickness distribution within CATIA or ANSYS, animation of re-distribution process
- Export of results into ASCII data files
- CAD interface to CATIA V5  
FEM interface to ANSYS 9.0  
Operating system for user interface:
  - Windows 2000/XP 32bit
 Operating systems for background FEM simulation jobs:
  - Windows 2000/XP 32bit
  - HP-UX 64bit (PA8000 or ITANIUM)

**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/CP 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 object to be protected, wax material properties as well as nozzle configuration CADFEM will provide the entire modeling and simulation workflow at a real automobile structure out of your current or prospective product line.

## CADFEM SERVICES

- Performing VPS/CP pilot projects for validation or implementation of VPS/CP
- Support of laboratory experiments for wax material evaluation. Calibration of wax material parameters
- VPS/CP consulting service. Optimization of CP spray steps in terms of your aimed results and process windows, e.g. for wax usage, throughput of parts etc.
- Licensing and training on VPS/CP
- Customization of VPS/CP to your specific requirements

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