

Co-Simulation of Modern CAx Tools - Setup Guidelines and Usage Experiences

4th European HyperWorks Technology Conference
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FLUIDON
Gesellschaft für Fluidtechnik mbH



COMPETENCE IN FLUID POWER SYSTEMS SIMULATION
KOMPETENZ IN DER SIMULATION FLUIDTECHNISCHER SYSTEME

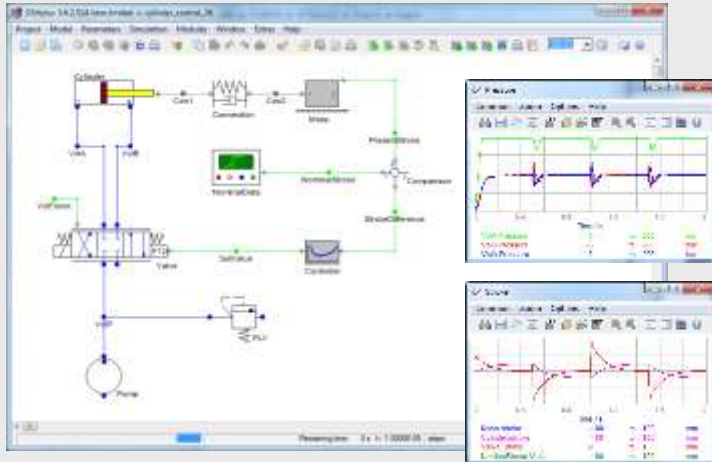
Outline

- 1 Introduction to Co-Simulation
- 2 DSH*plus* - MotionView and how it works
- 3 Model Setup
- 4 Examples

Why Co-Simulation?

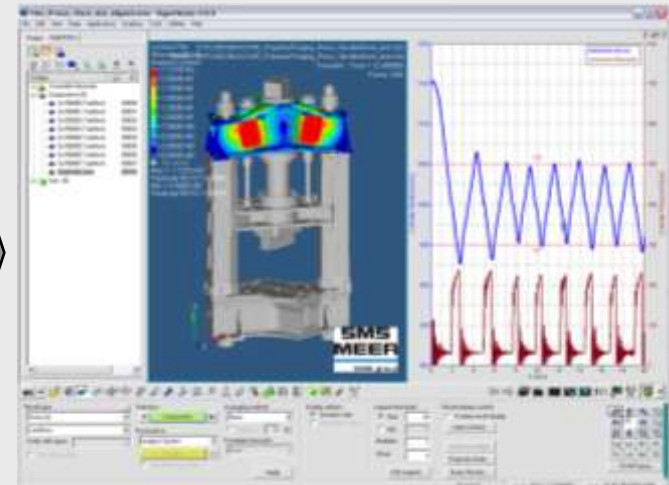
DSH^{plus}

one dimensional system simulation



HyperWorks

multibody system simulation



Co-Simulation
interface

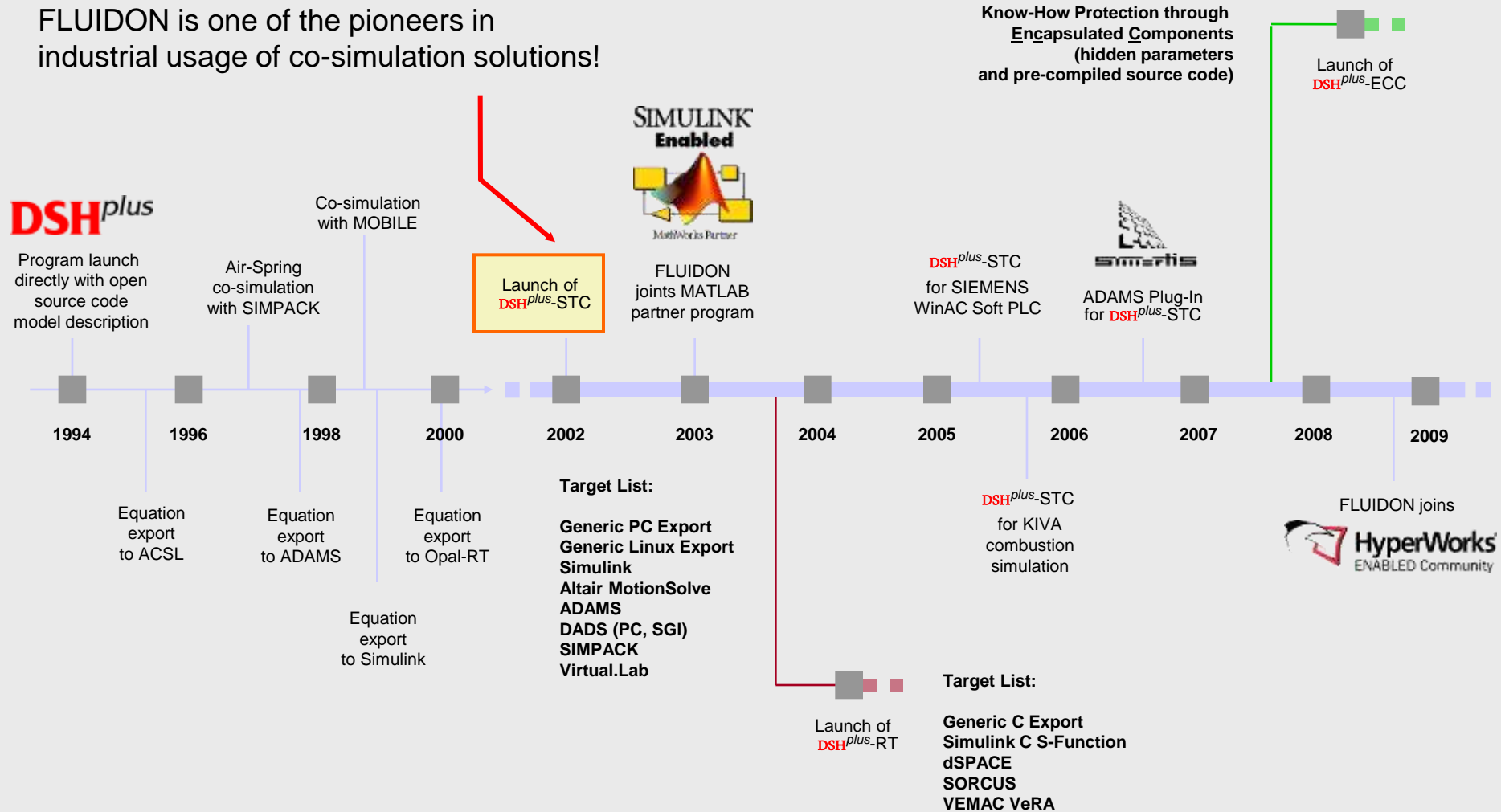
Control of:
• Calculations
• Data Exchange

- + detailed fluid power calculation
- + domain specific pre- and postprocessing
- simplified 1D modeling of mechanics
- neglect of interactions within the overall system






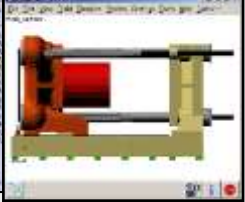

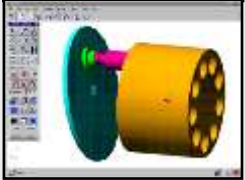
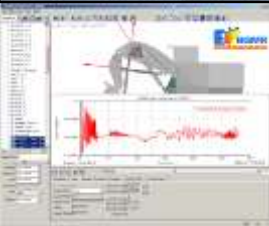
- + complex mechanical system dynamics
- + easy implementation of flexible structures
- Static load cycle assumptions
- look-up tables
- simplified equations

Over 10 Years Experience in Co-Simulation!

FLUIDON is one of the pioneers in industrial usage of co-simulation solutions!

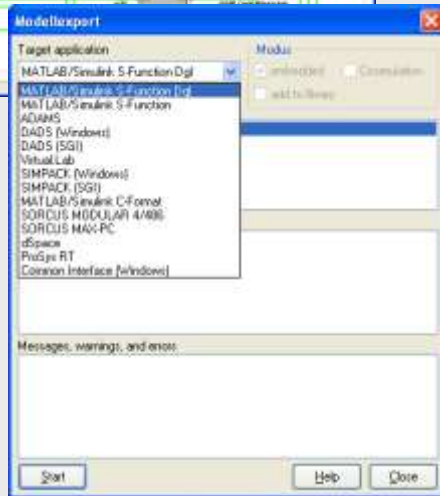
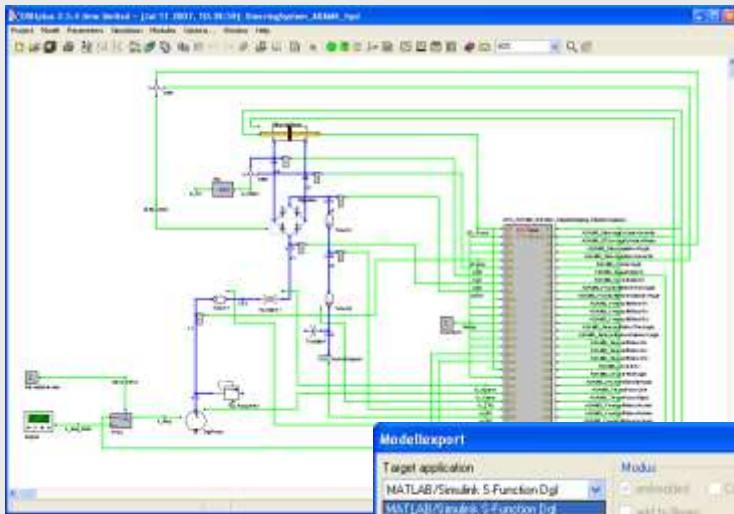


Fields of Application for **DSH^{plus}**-STC

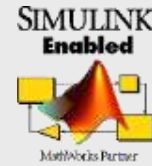
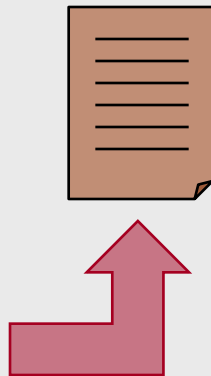
Car	Truck / Trailer	Tractor/ Construction	Engine	Railway	Aero	Industry
				<ul style="list-style-type: none"> • Suspension • Brake • Active Roll System • Axle Steering System 	<ul style="list-style-type: none"> • Landing gear suspensions • Actors & controls in flaps and slats • Controls & hydraulics 	<ul style="list-style-type: none"> • Presses and Roller Mills • Injection molding machine • Component development
<ul style="list-style-type: none"> • Function: Power Steering, Power Braking • Safety: ABS, ESP • Comfort: Air springs, semi-active dampers 	Seat- and cabin suspensions					
Active body control	Hydro bushings					
		<ul style="list-style-type: none"> • Power tools • Implement actors & controls • Hydraulic 	<ul style="list-style-type: none"> • Hydraulic lash adjuster • Torque converters • Injection pumps & nozzles • Belt / Chain Tensioners 			
						
						

...and many more to find in your application!

Application Examples of DSH^{plus}-STC



By means of the DSH^{plus}-STC – CIF ready to use interfaces to external programs are automatically generated



Customer specific solutions for Unix on SGI and for Linux on PC and SGI

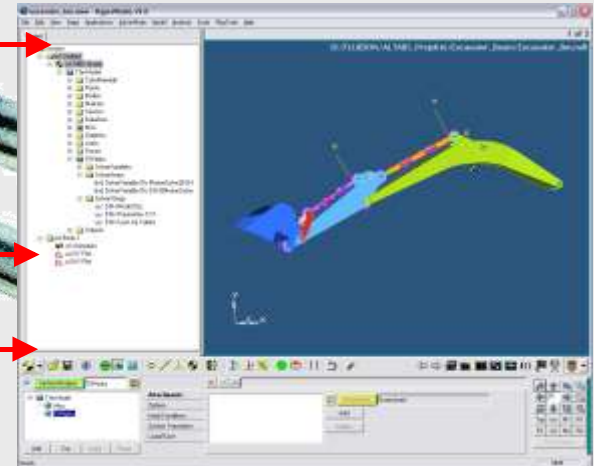
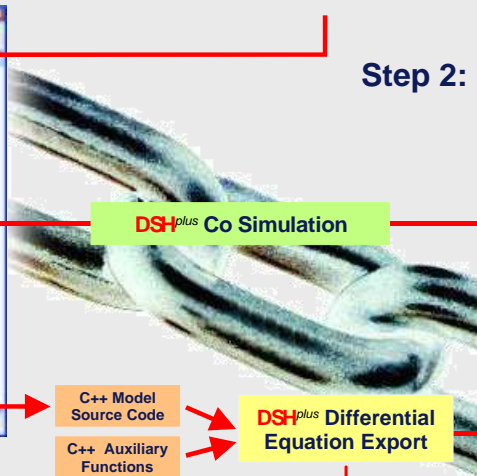
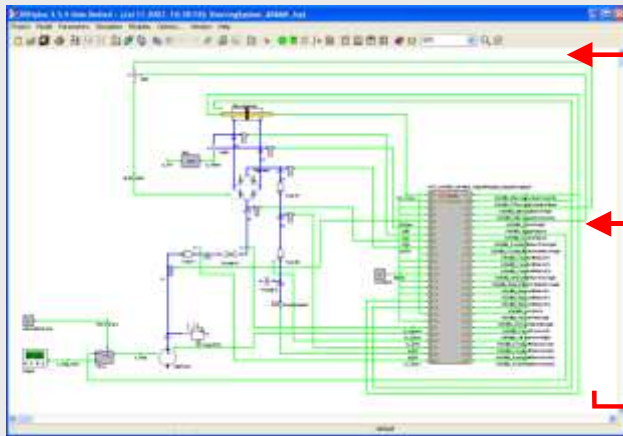
Whatever additional interface is required

Every DSH^{plus} model with signal input and signal output components can be exported as DSH^{plus}-STC Embedded Module

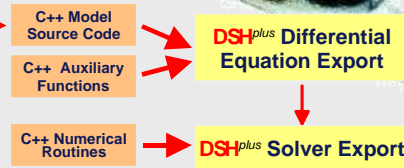
The Application Steps of **DSH^{plus}**-STC

Step 1: Initial simulation of the fluid power system in **DSH^{plus}**

Step 2: Optimization and Verification of the fluid power System by means of a co-simulation



DSH^{plus} Co Simulation



Step 3: Export of the fluid power system as embedded system in a different simulation domain or on a different hardware

Online co-simulation:

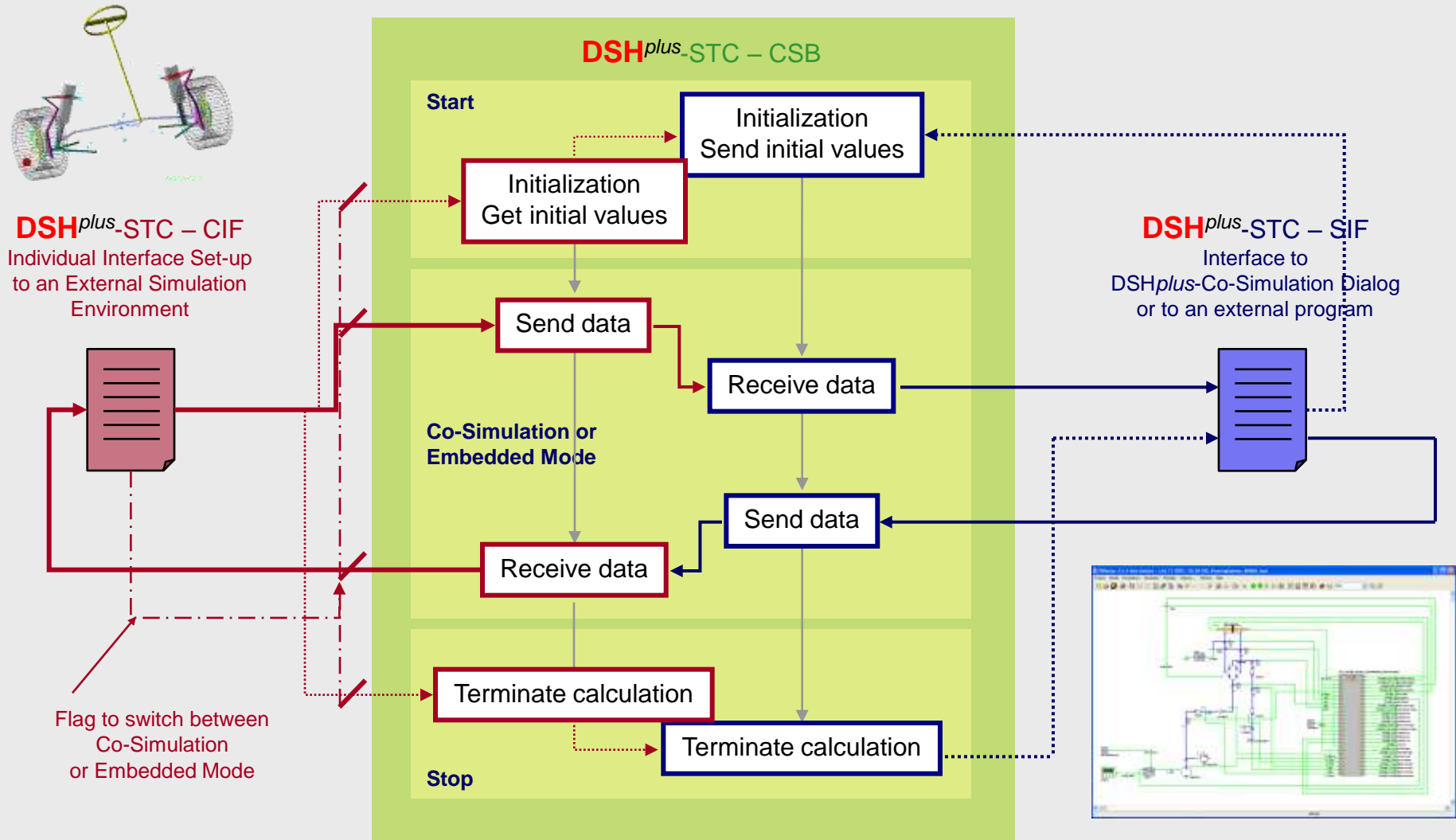
- Online manipulating of **DSH^{plus}** model
- Online post-processing in **DSH^{plus}**
- Huge number of predefined models in libraries

Embedded co-simulation:

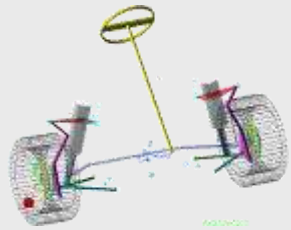
- No local license of **DSH^{plus}** necessary
- Manipulate pre-selected parameters of **DSH^{plus}** model
- Incorporate as any feature else

AVI

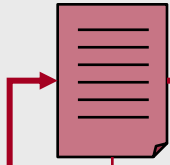
DSH^{plus}-STC Co-Simulation: Coupling Procedure



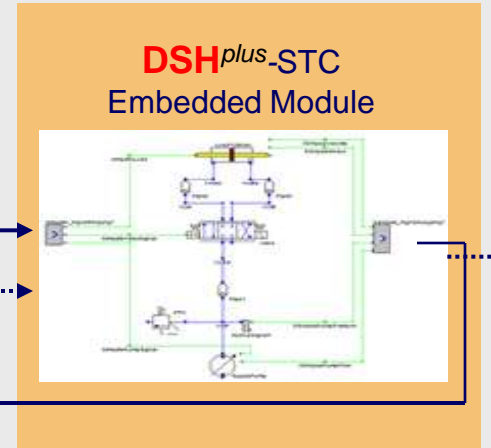
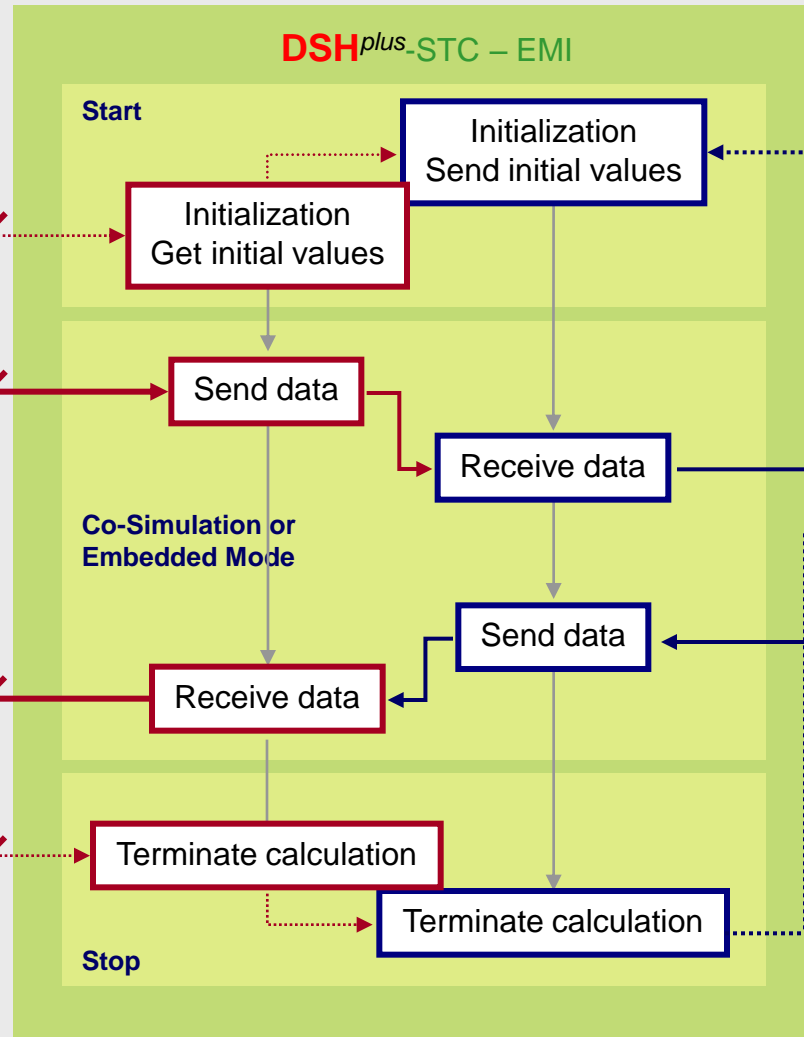
DSH^{plus}-STC – Embedded Module: Coupling Procedure



DSH^{plus}-STC – CIF
Individual Interface Set-up
to an External Simulation
Environment

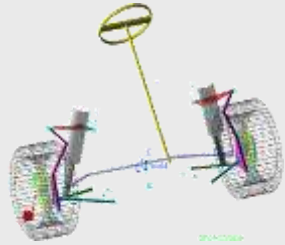


Flag to switch between
Co-Simulation
or Embedded Mode

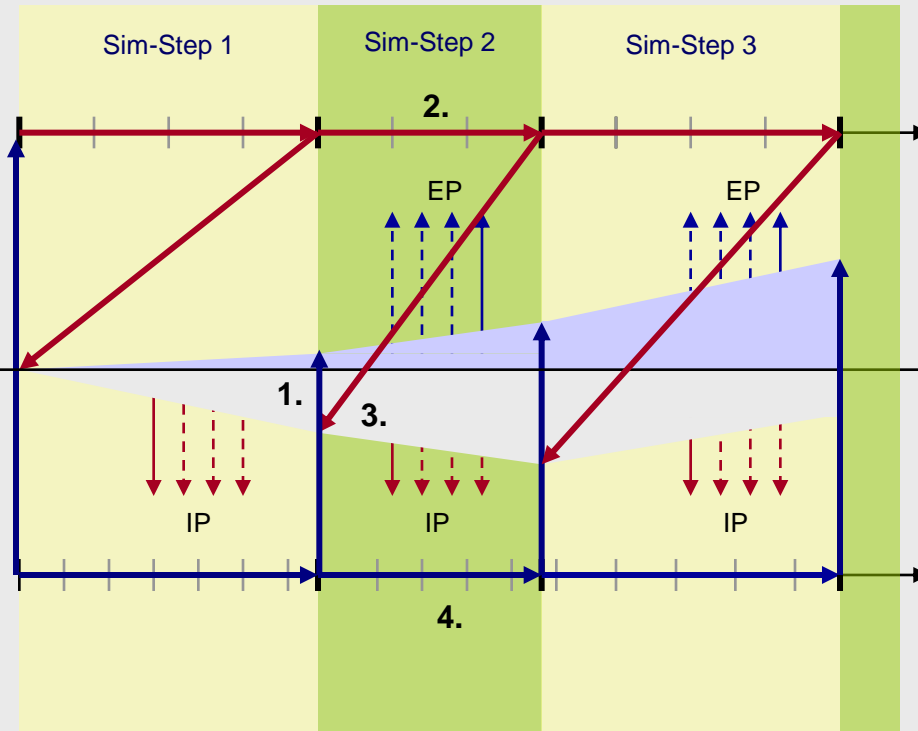
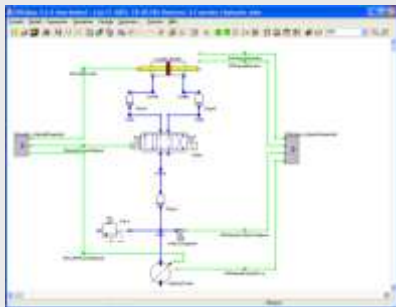


DSH^{plus}-STC Co-Simulation: Inter- & Extrapolation of Exchanged Values

Client



Server



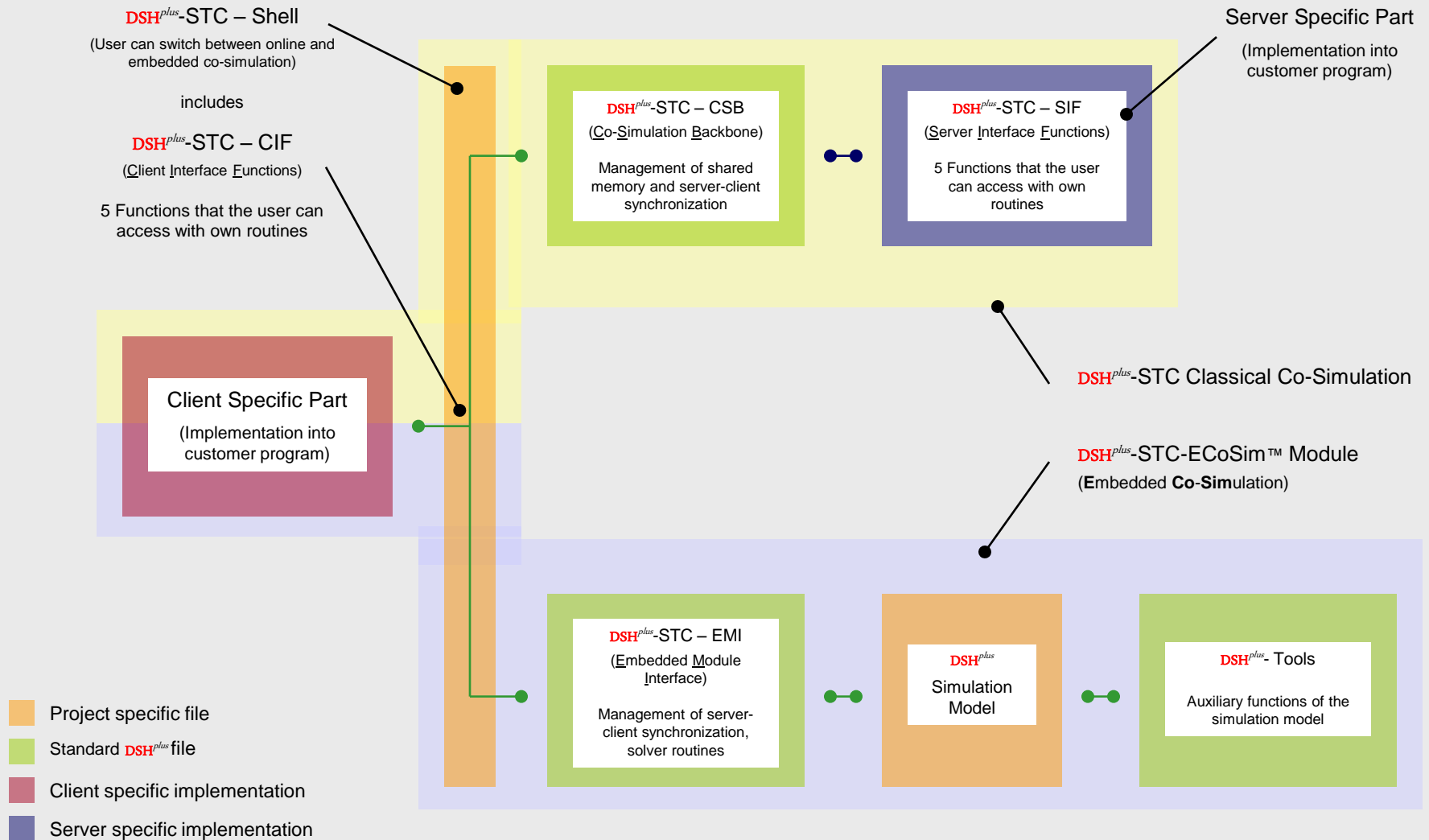
Data Exchange Cycle

1. Client model receives server model data
2. Simulation step of the client model. Intermediate values for server variables are extrapolated during predictor steps of the client.
3. Server model receives data of the client model
4. Simulation step of the server model. Intermediate values of the client data are interpolated during the server steps.

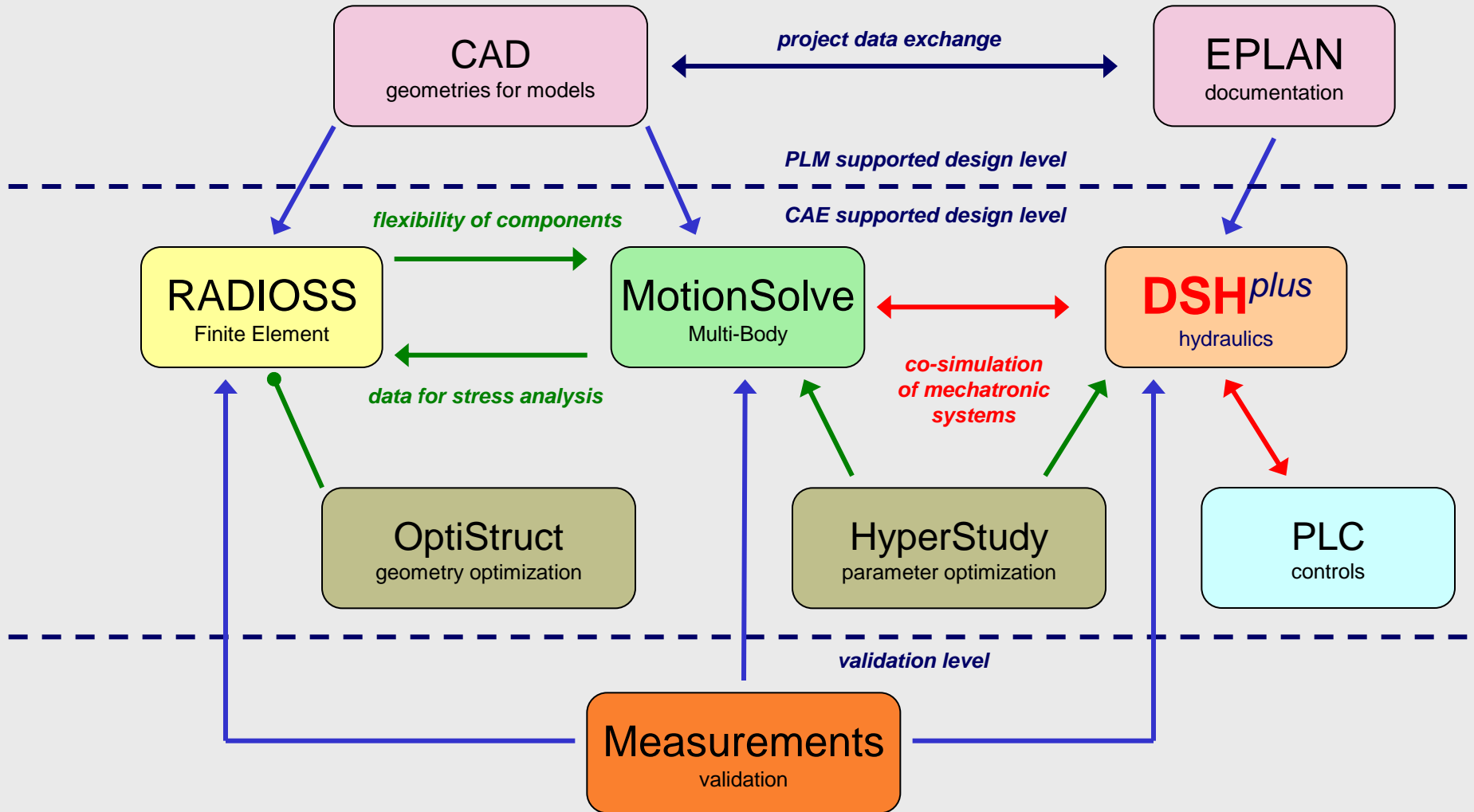
EP: Polynomial extrapolation of Server Data
 IP: Polynomial interpolation of Client Data

DSH^{plus} Co-Simulation or
 Embedded Model

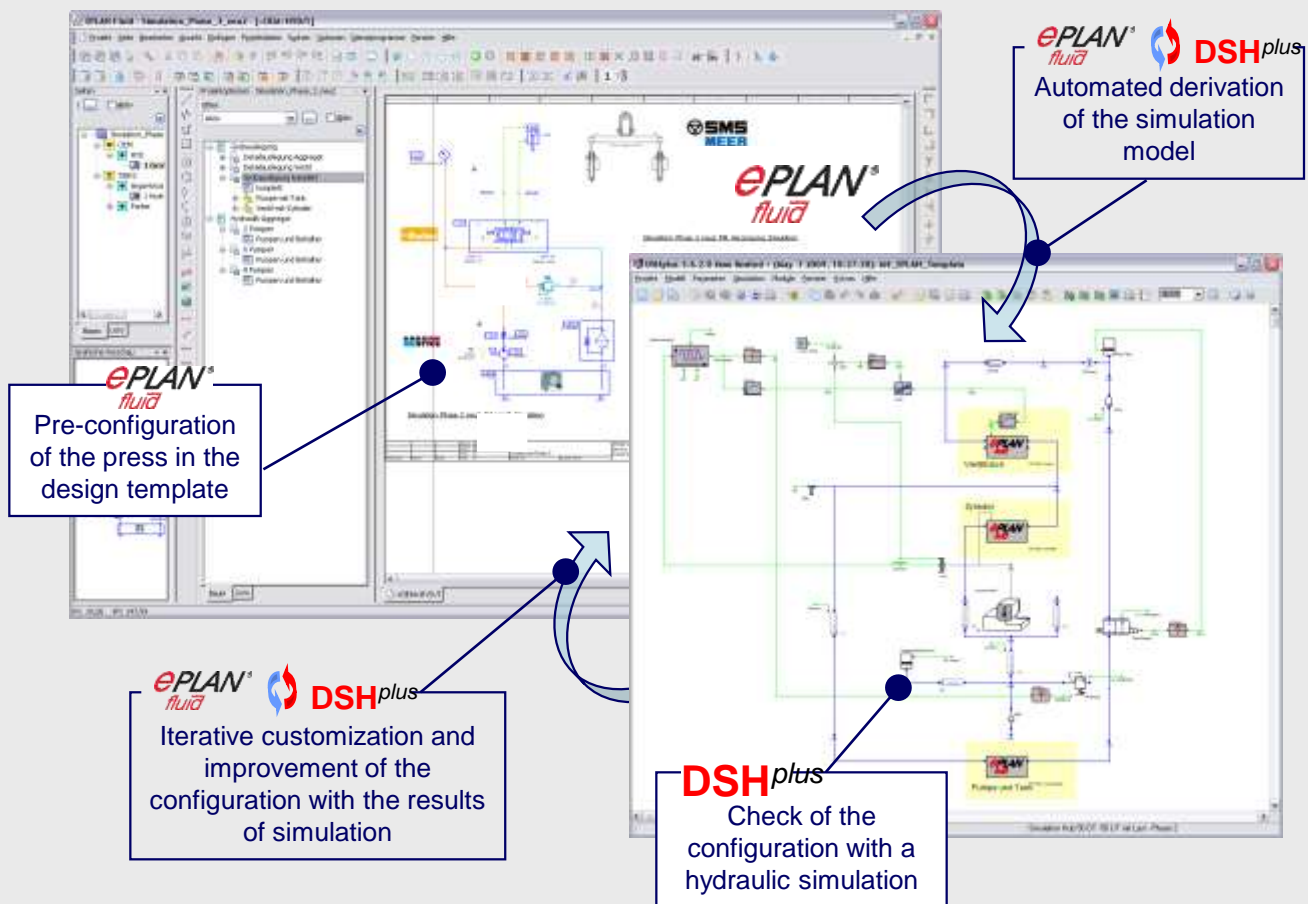
DSH^{plus}-STC: Structural Setup



A vision for a CAE-driven development of production machines



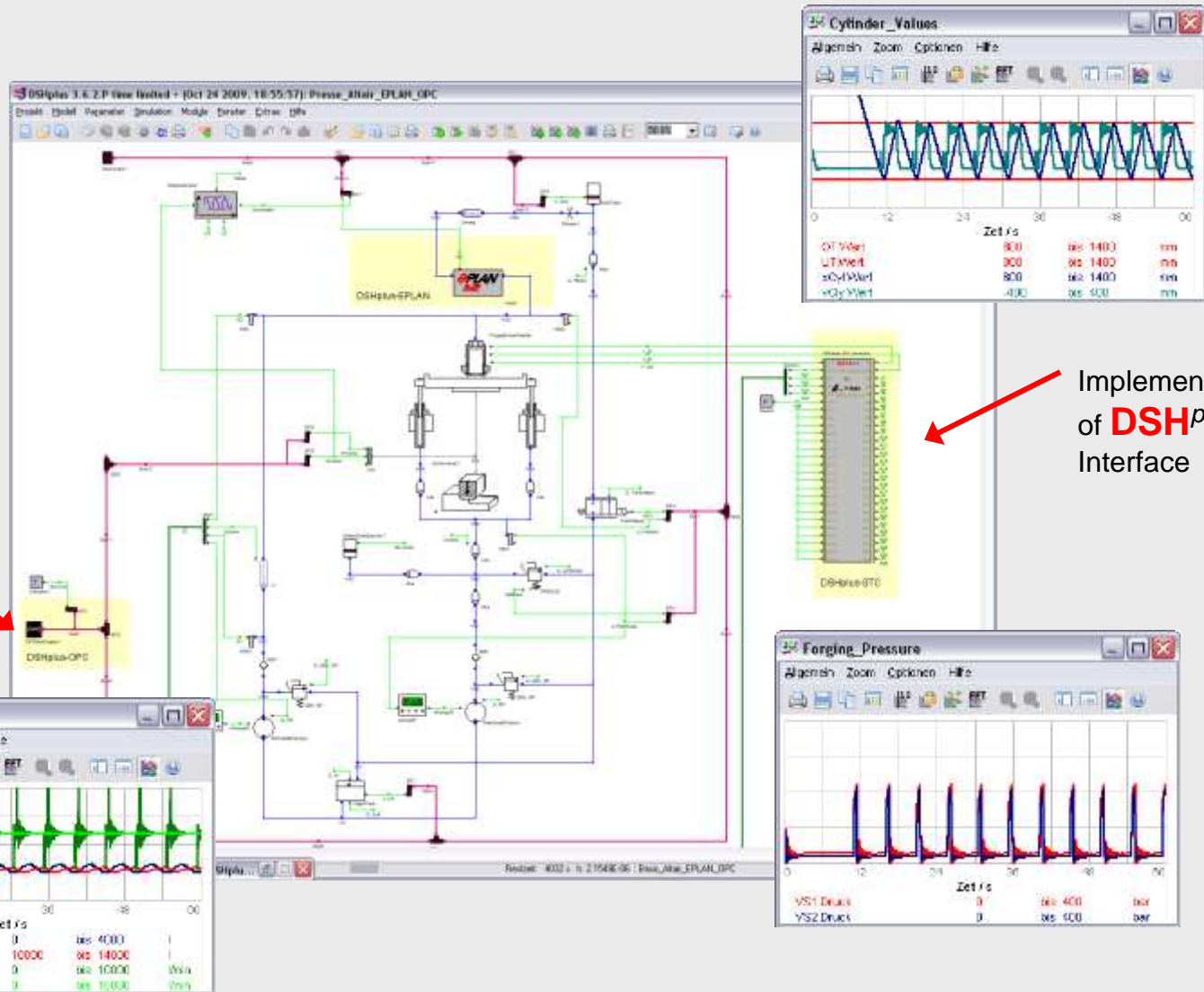
Step1: Initial System Design with EPLAN Fluid System Documentation



Development template = EPLAN design template and DSH^{plus} simulation template

Step 2: Set-up of the **DSH^{plus}** Hydraulic Model of the Forging Press

Implementation of **DSH^{plus}_OPC** Interface

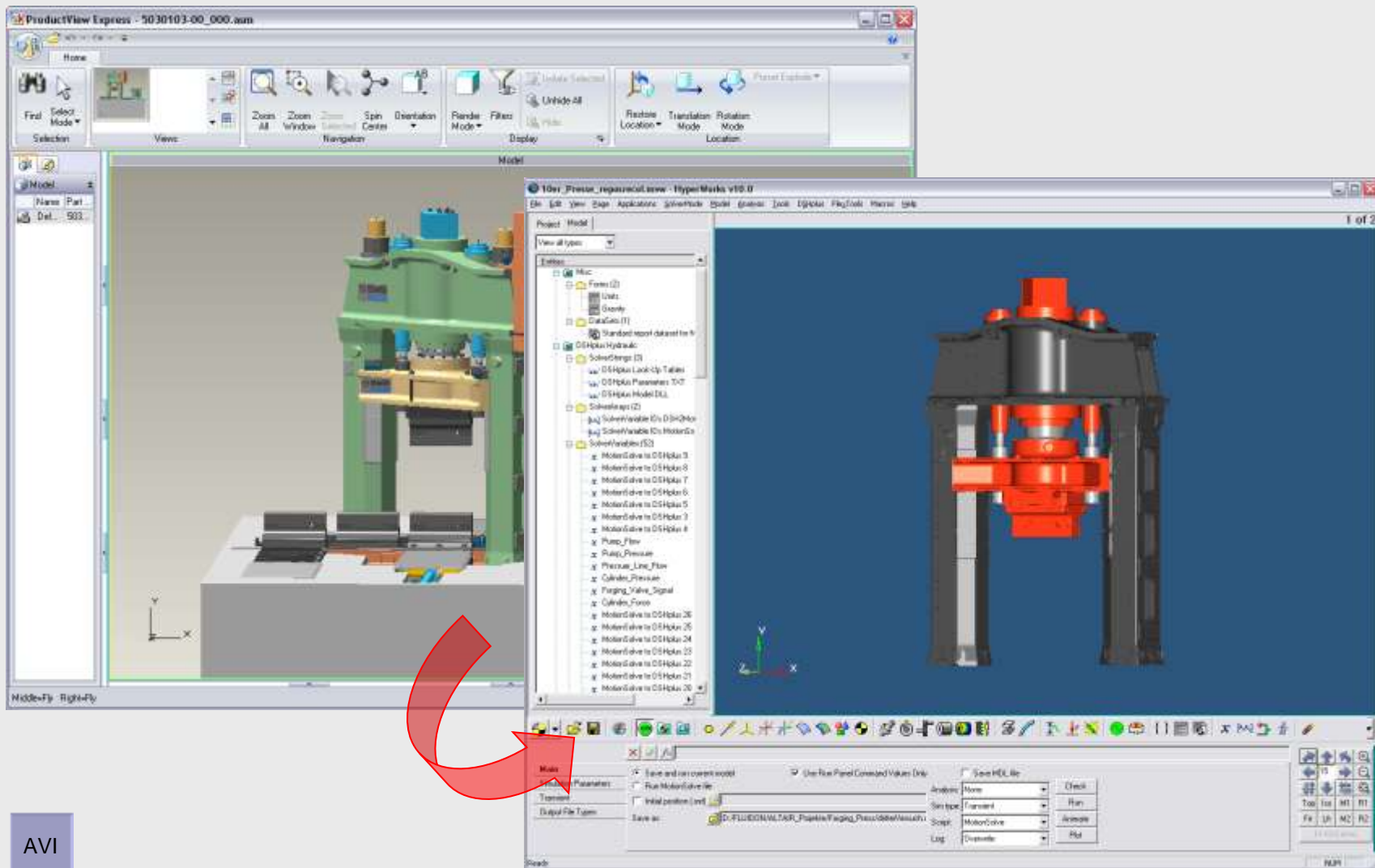


Step 3: Preparation of the CoDeSys PLC-Controller and Visualization

The image displays three overlapping windows from the CoDeSys software suite:

- Top Window (CoDeSys - Minipresse_OPC_V5.pro):** Shows the PLC program editor with a ladder logic diagram. It includes a 'Start' button (green circle) and a 'Stop' button (red circle). The program logic involves variables like `V_Bockdruck`, `V_Bockdruck_Min`, `V_Bockdruck_Max`, and `V_Soll_1`.
- Middle Window (CoDeSys - Minipresse.pro):** Shows a 3D visualization of a hydraulic press. It features a pressure gauge (0-120 bar), a position gauge (0-1000 mm), and a 'Start' button. The visualization includes logos for FLUIDON, Parker, and Fluidtec.
- Bottom Window (PLCWinNT - V2.4.7.8 Build: Jul 30 2008 (DEMO)):** Shows the PLC control interface. The state is 'STOPPED' and the program is loaded. It displays project information: 'Project Name = Minipresse_OPC_V5.pro', 'Date = 28.7.09 13:53:17', and 'Author ='. It also shows TCP/IP and RS232 settings and buttons for 'Start', 'Reset', 'Tasks...', 'IO-List...', and 'Shutdown'.

Step 4: Set-up of the MotionView Mechanical Model



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Thank you for your attention!



Jülicher Straße 338a
52070 Aachen, Germany
phone: +49 (0)241-9609260
fax: +49 (0)241-9609262
✉ info@fluidon.com