SCALE.sdm

Software Solution for Management of Simulation Data

SCALE

Overview

Introduction SCALE.sdm

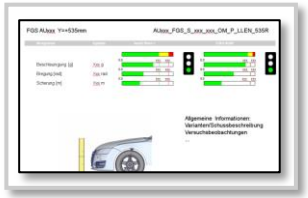
- Software modules
- Key Features
- Unique selling points

Decentralization of Vehicle Development

- Integration of suppliers and engineering providers
- Connecting multiple locations
- Version management

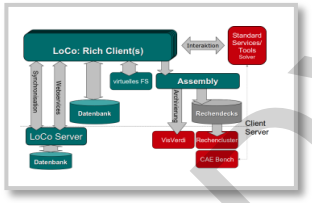
Graphical User Interfaces

- CadMe - Distributed Meshing Processes
- LoCo - Workbench for simulation engineers
- CAViT - Post data management



Result Assessment

- Access to simulation and test data
- Evaluation, comparison, visualization
- Report generation



Adaption and Customization *(open system)*

- Configuration
- Process integration *(support for solvers and CAE-disciplines)*
- Integration with existing IT-environments / 3rd party software
- Operation

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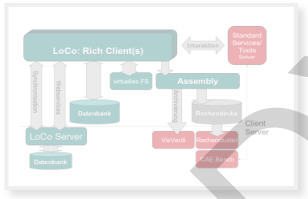

Adaption and Customization *(open system)*

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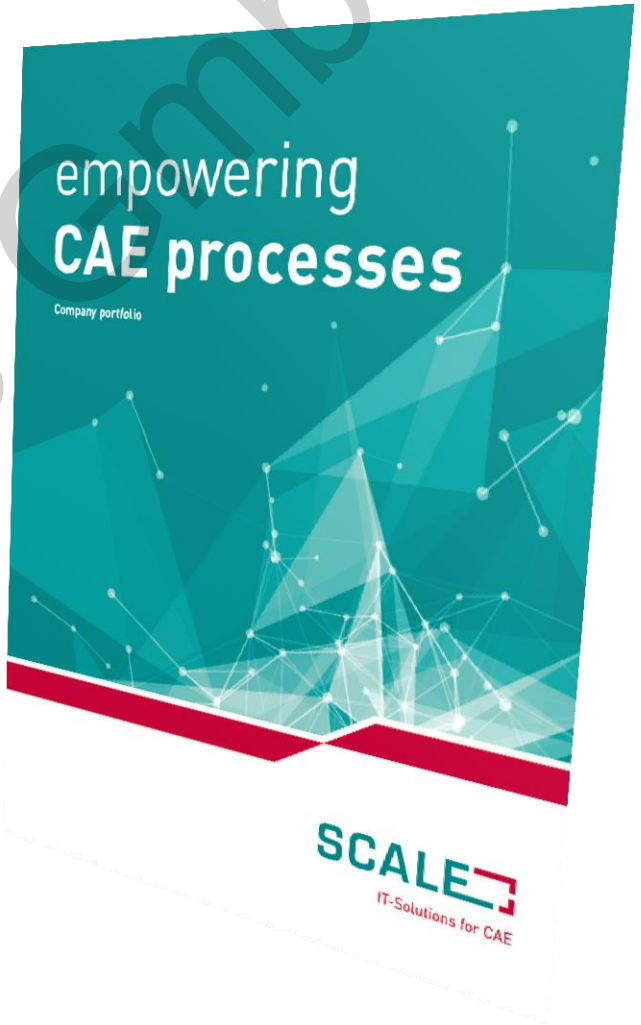
SCALE GmbH – IT Solutions for CAE

- Start of SCALE GmbH at 2014-09-01
- SCALE is a100% subsidiary of DYNAmore
- Currently ~35 people (engineers and computer scientists), dedicated to „CAE process-, and data management“
- Offices in Germany
  - Stuttgart
  - Ingolstadt
  - Dresden (Software development)
- SCALE stands for "Scalable Solutions in Simulation Data and Process Management"

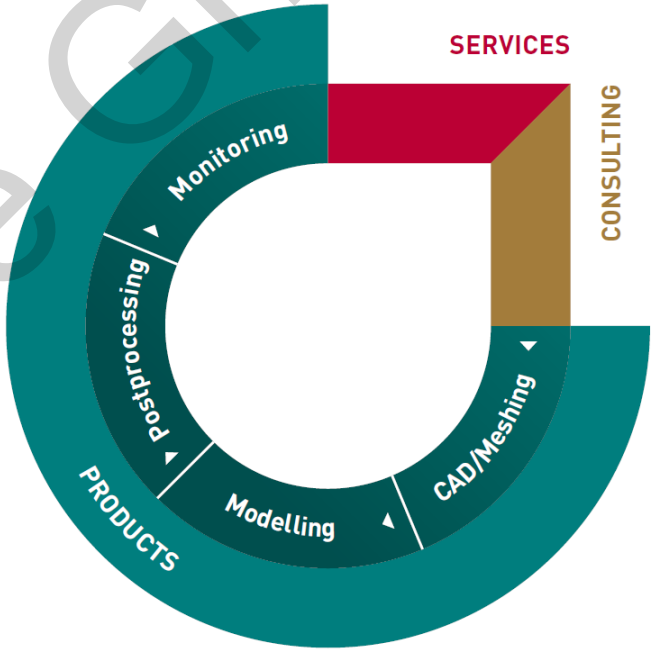


SCALE

SCALE GmbH – IT Solutions for CAE

Portfolio

- Standard software solutions for CAE process und data management
- Individual software projects on customer order
  - Requirement analysis
  - Consulting
  - Conceptual design, planning
  - Specifications
  - Implementation and project management
- FEM methods and processes
- Staff at SCALE are a mix of **experienced CAE engineers** and **professional computer scientists**



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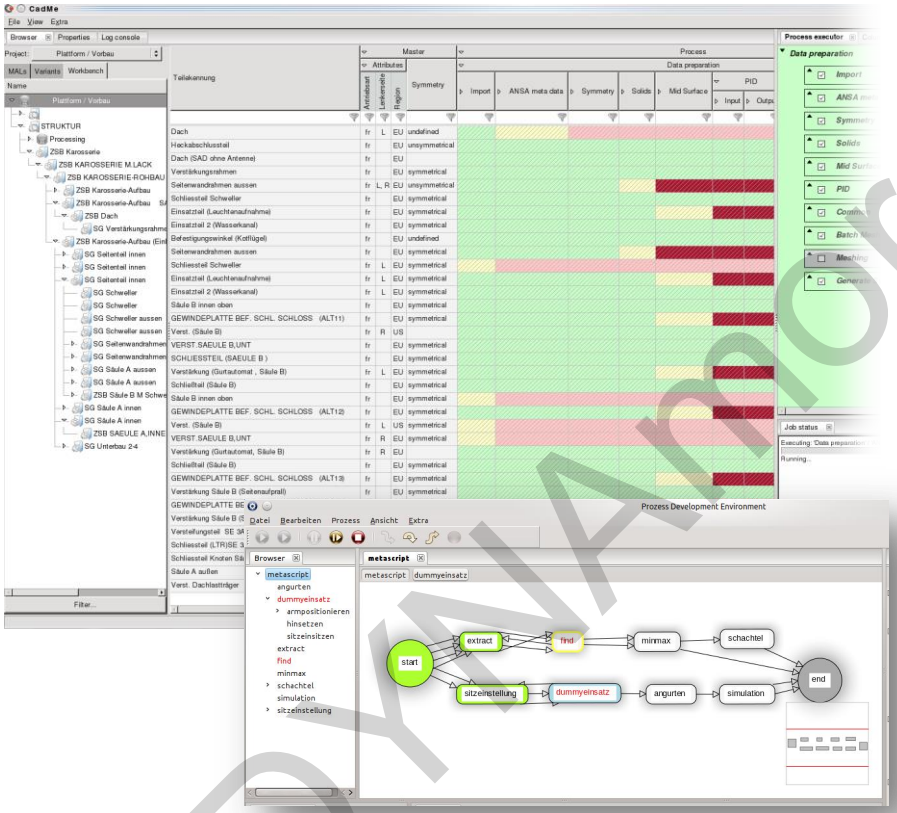
SCALE.sdm: *Components*

CadMe | LoCo | CAViT | Status.E

CAD/Meshing | Modelling | Solving | Results | Monitoring



- **CAD Interface**
  - Update and check of new CAD-versions with meshed parts
- **Meshing Process**
  - Support of meshing process
  - Provision of data
  - Flexible adaptable process
  - Integrated tools for process modeling
  - Integration of preprocessors *(ANSA, Hypermesh, ...)*
- **Data Management**
  - Synchronization of work flow for all participants *(internal and external)*
  - Changes appear instantly for all team members
  - Role and right management

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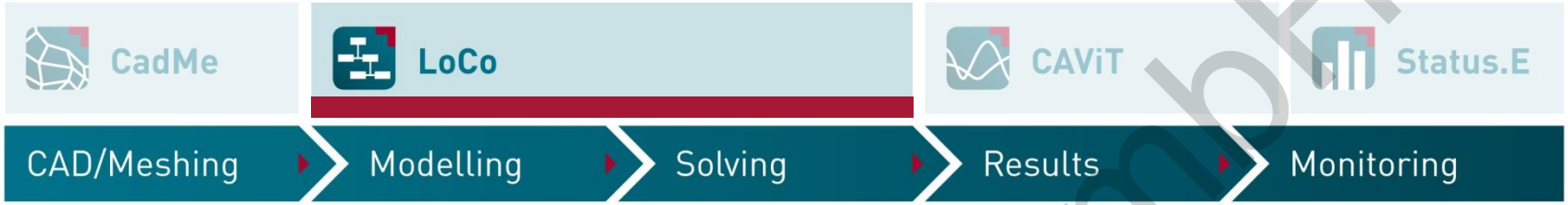
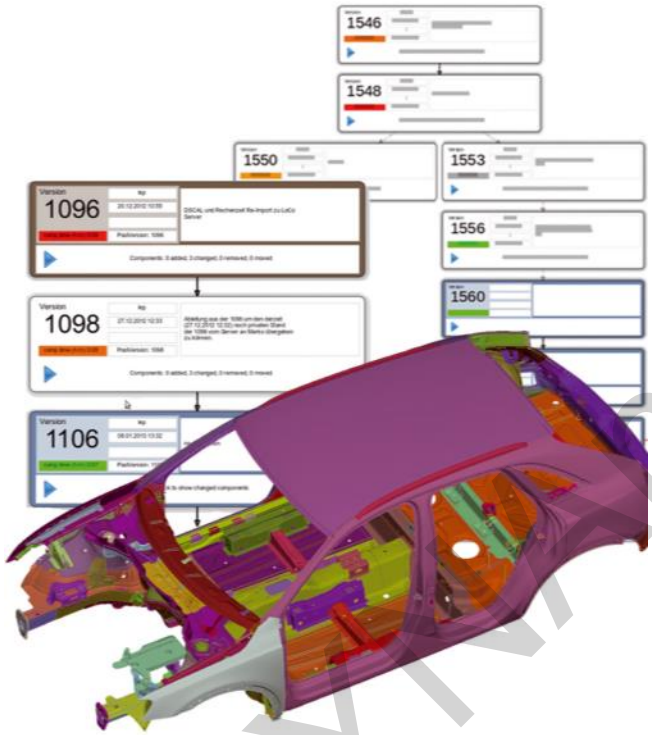
SCALE.sdm: *Components*





- **Simulation Data- / Variant Management**
  - Workbench for Simulation Engineers
  - Unique RichClient/Offline-concept with sync-mechanism *(internal/external)*
- **Workflows / Features**
  - Integration of arbitrary CAE processes
  - Solver: PAM-Crash, LS-DYNA, Nastran, Abaqus, ...
  - Job submit and monitoring
  - Optimization, robustness, DOE, ...
  - Quality checks of models
  - Advanced security features
    - Two factor authentication
    - Encryption
    - Sofisticated roles and rights management
  - Distributed, collaborative work environment
  - ....

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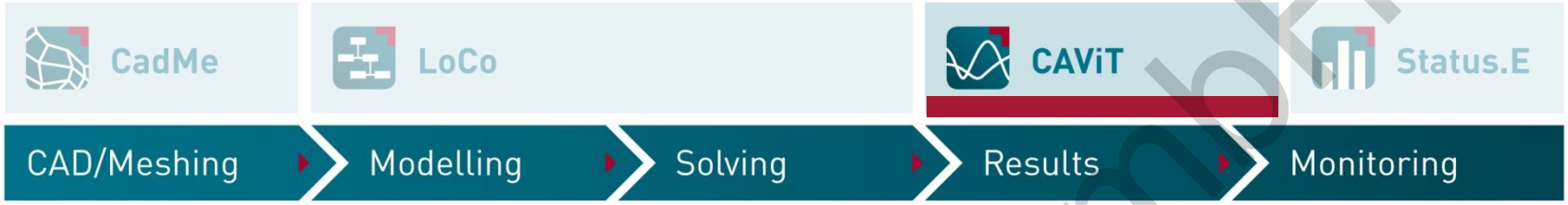
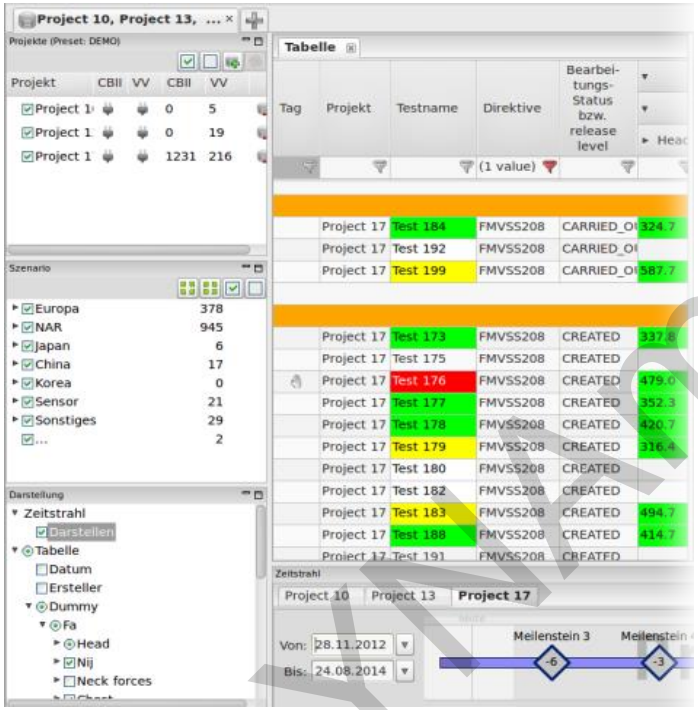
SCALE.sdm: *Components*





- **Post Data Management**
  - Procurement and provision of outcome data from **simulation** and **experiment**
  - Comparison and visualization of simulation and experimental data
- **Features**
  - Assessment of simulation and experimental results *(szenario based)*
  - Easy integration of any application and processes *(Plugins for e.g. Animator, Falcon,..)*
  - Automatic report generation
  - ...

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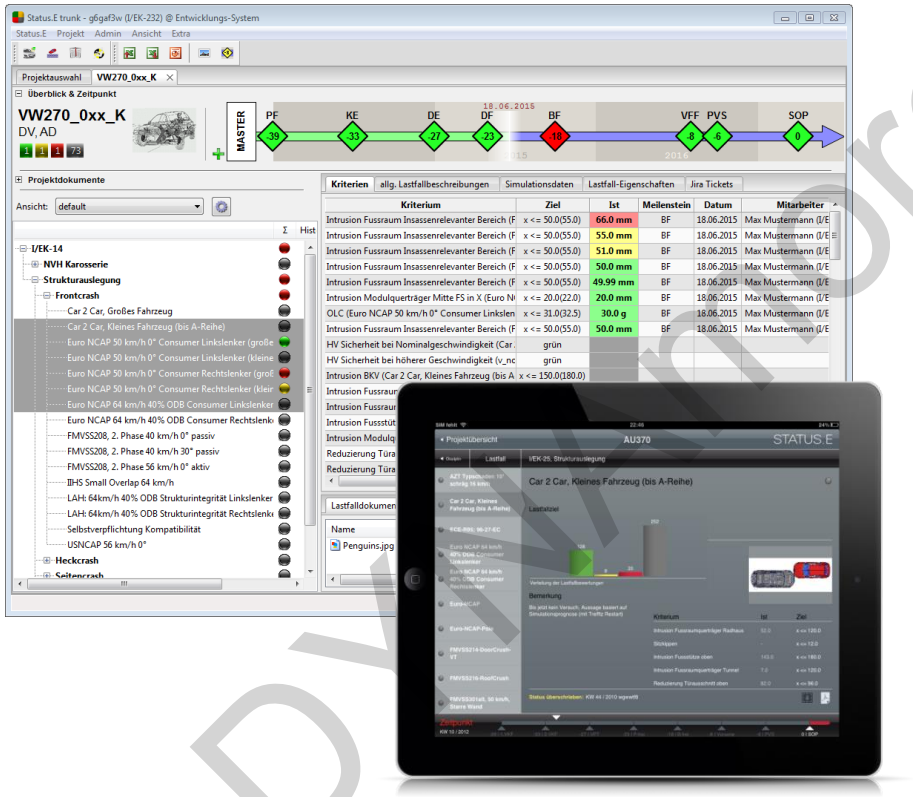

Requirements Management

- Management of project and milestone specific Requirements
- Automatic generation of specifications
- Change management

Status Monitoring

- Monitoring of the performance of simulation and test requirements with respect to project milestones
- Aggregated review over CAE-disciplines and simulation departments

Documentation

- Integrated document management system
- Automatic generation of status reports *(ppt, doc, pdf)*

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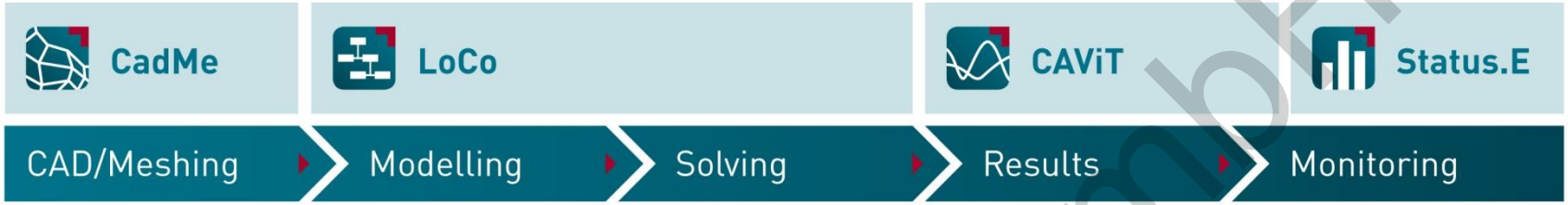
SCALE.sdm: *Software Solution for Management of Simulation Data*



SCALE

Focused

- One dedicated App for each user group
- Reduced to meet the requirements of the use cases in question

Flexible

- Software components can be combined as required
- Easy integration of new disciplines and processes

Integrated

- All software components work seamless together
- Performant integration of pre and post processors

Decentralized

- Unique synchronizing technologies for distributed teams

Scalable

- Business logic close to the users
- Advanced compression techniques to reduce bandwidth and storage requirements

Customers

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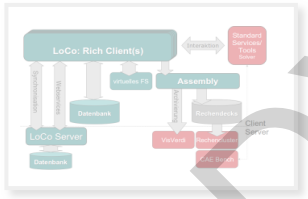

Adaption and Customization *(open system)*

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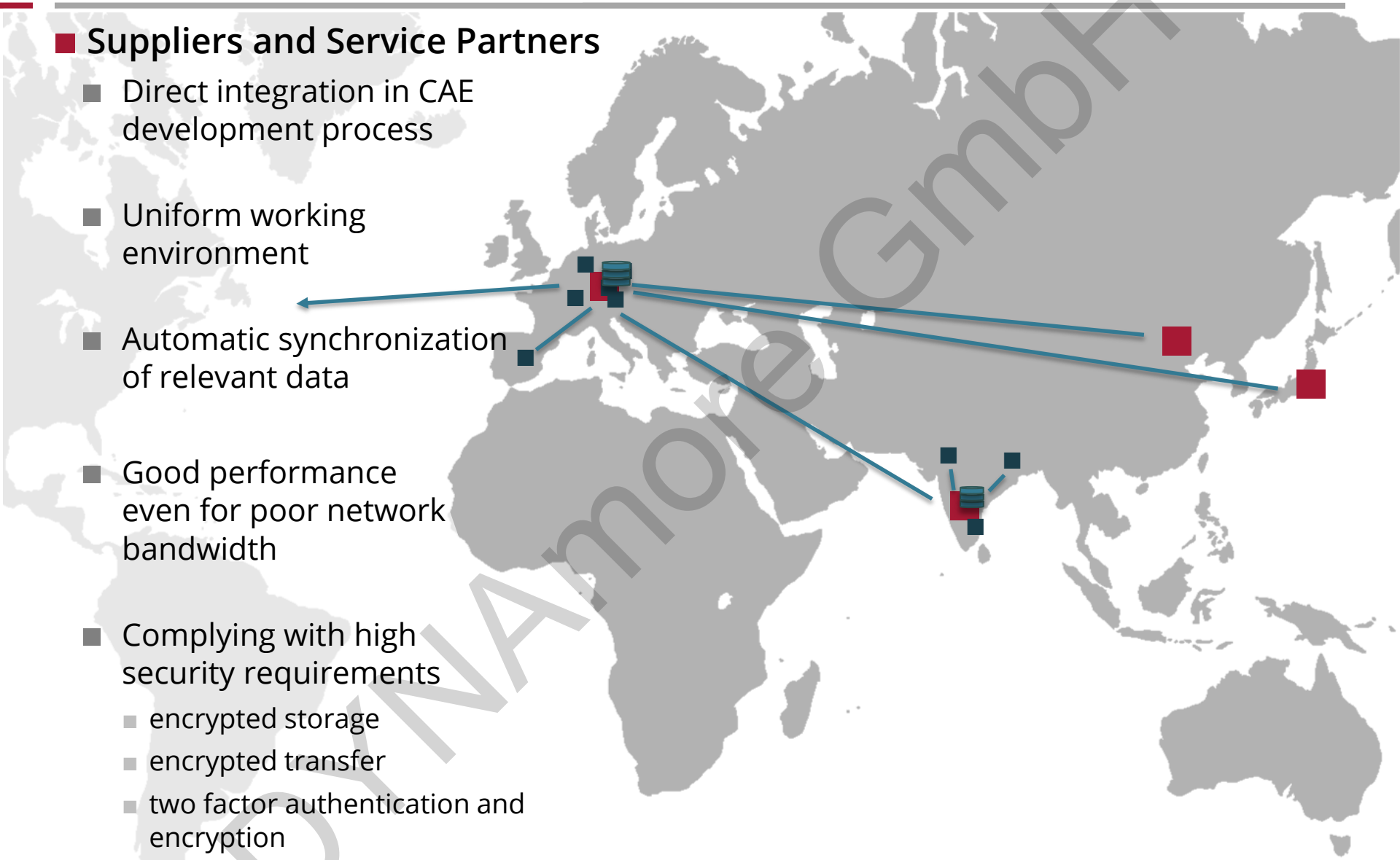
SCALE.sdm: *scaling development by decentralization*

Suppliers and Service Partners

- Direct integration in CAE development process
- Uniform working environment
- Automatic synchronization of relevant data
- Good performance even for poor network bandwidth
- Complying with high security requirements
  - encrypted storage
  - encrypted transfer
  - two factor authentication and encryption



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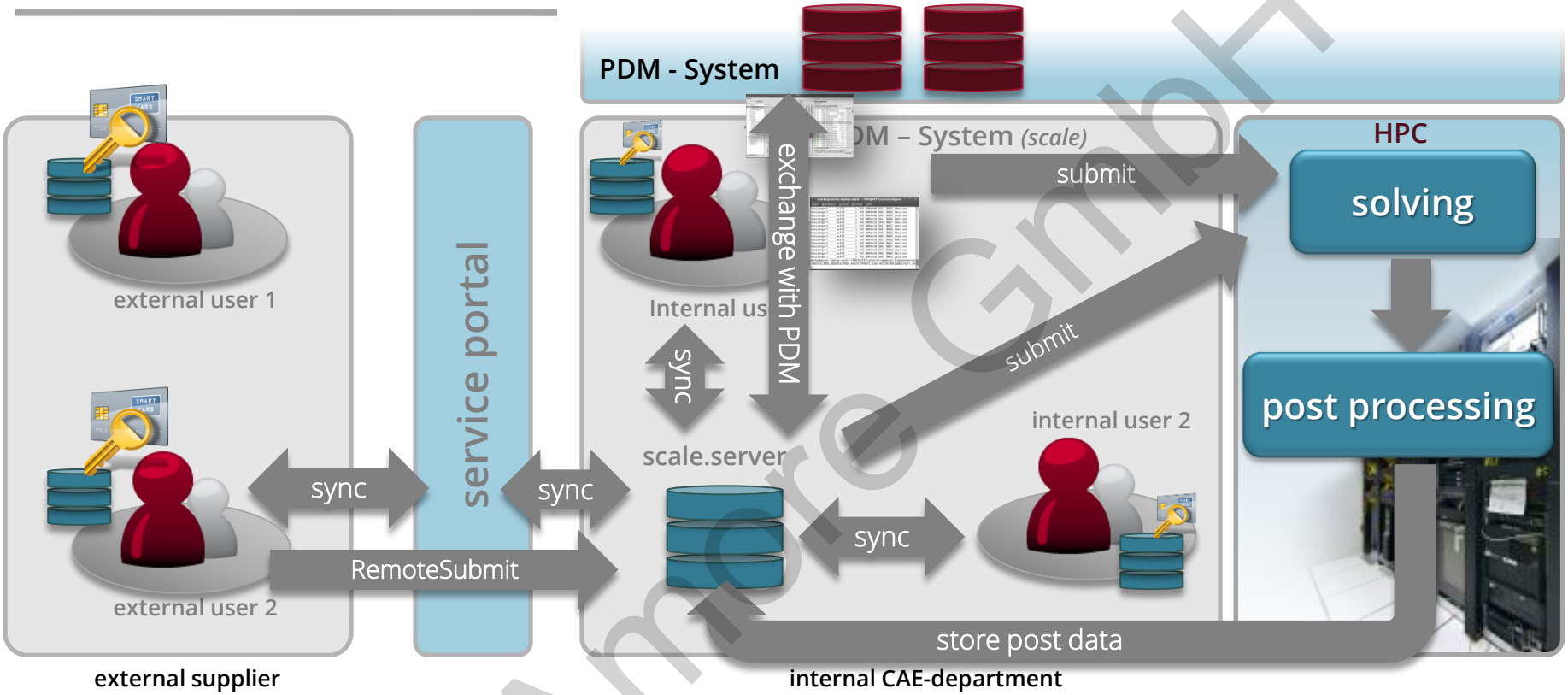
SCALE.sdm: *Workflow, Teamwork and Synchronization*



Sync
decentralized

- Central data storage, synchronization with local workstations *(cloud like infrastructure)*
- Encrypted transfer, encrypted storage *(two factor authentication and encryption)*
- Offline handling of data *(RichClient)*

Offline / Online
performance

- Users/Teams are independent of servers and infrastructure
- Users work with local data
- Good performance while application of preprocessing tools

Integration

- **Integration with existing PDM Infrastructure as TDM-System** *(Team Data Management)*

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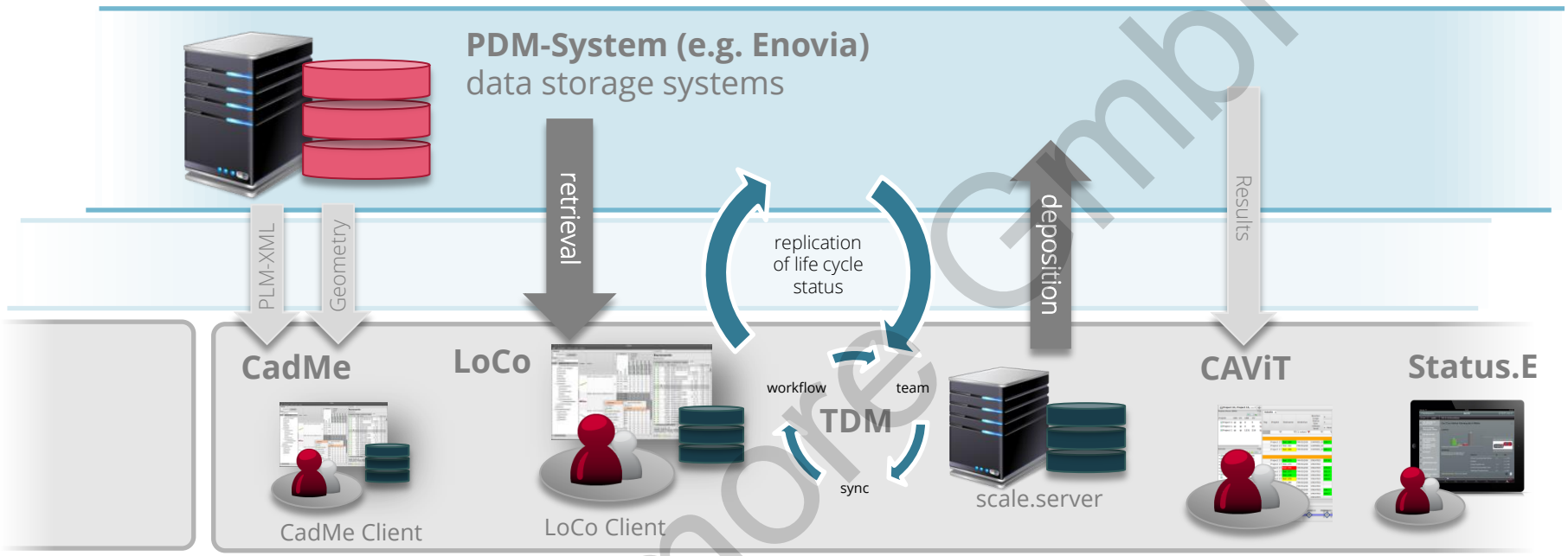
SCALE.sdm: *Integration with PDM Systemen (Team Data Management)*



- **Automated / integrated data deposition and retrieval from connected Storage and PDM-Systems**
  - Automatic deposition of important variants from LoCo
  - Easy retrieval of stored variants
  - Usage of system APIs for access to
- **Automatic cleanup: storage space in SCALE.server might be restricted** *(by time and/or size)*
- **Replication of life cycle status** *(reference, status, ...)*

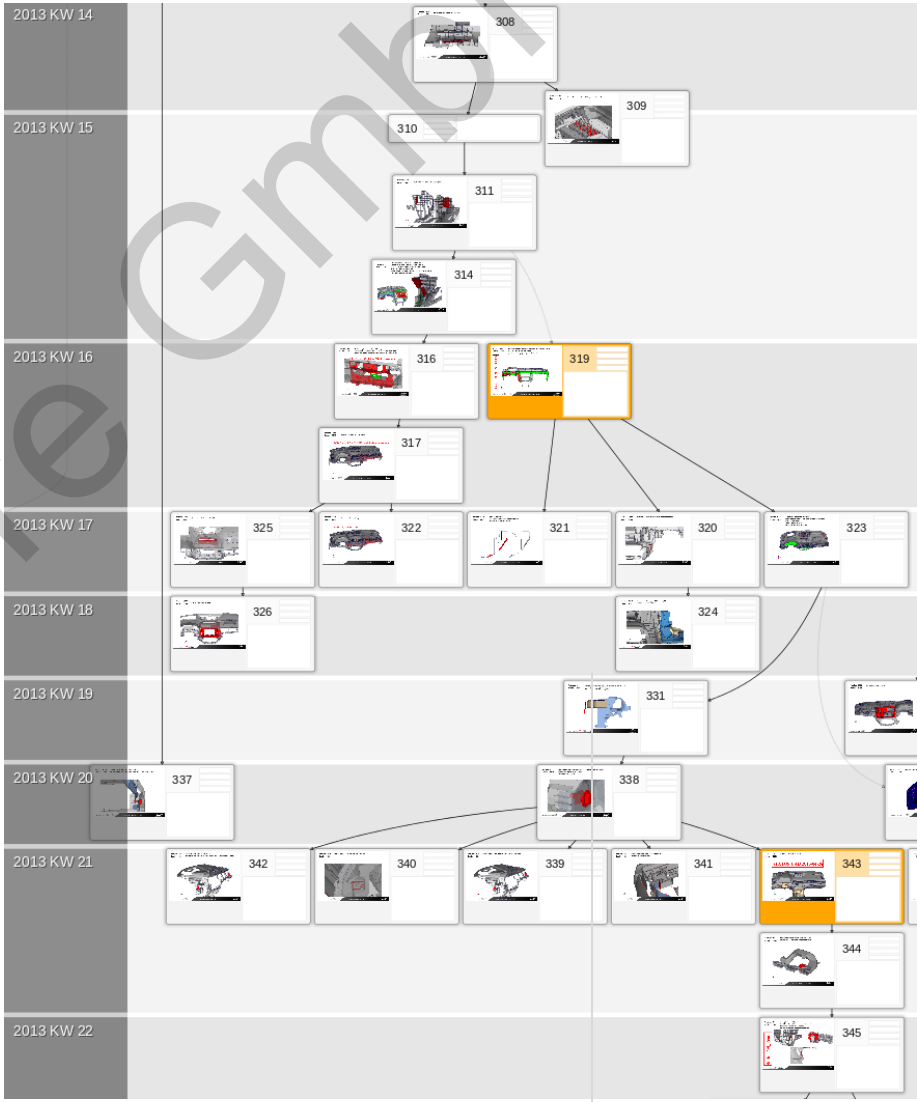
SCALE.sdm: *Version management*

- **Every object is versioned**

Simulation Runs
Scripts **Modules** Folders
Geometries
Meshes Parameters

- **Motivation**
  - Simulation is change driven
  - Simultaneous work on the same files
  - Each action is documented
  - Powerful features to merge changes

- **Audit trail and Versioning**
  - Versioning extends audit trail over time
  - Audit trail represented by data structure
  - The audit trail becomes multi dimensional



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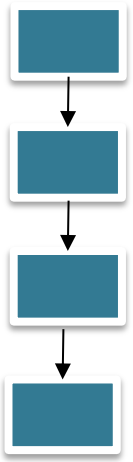
SCALE.sdm: *Version management*

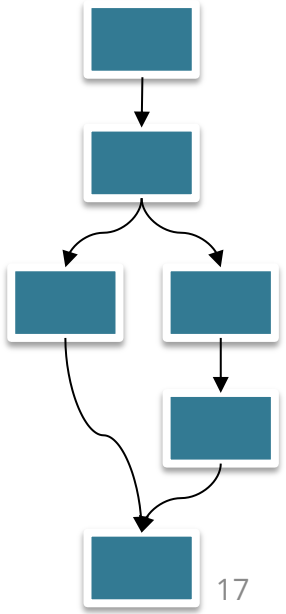
- **„Lock Modify Write“** *(classical PDM Systems)*
  - Objects are locked if one person is working with them
  - After the work is done users need to check in the changed items
  - Problematic in situations where team members need to work independently
  - No simultaneous working with the same objects
  - Instant access to changes of coworkers
  - Always consistent data *(no merging of data required)*

CadMe



- **„Copy Modify Merge“** *(LoCo, git, svn, …)*
  - Objects can be used instantly *(on changes a copy will be created)*
  - No „check in“ – „check out“ necessary
  - Users can act independently from other users and servers
  - Simultaneous work on the same objects is possible
  - It might be required to merge branches

LoCo



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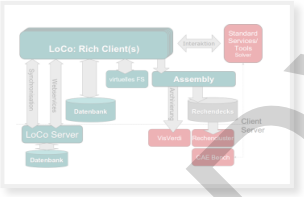

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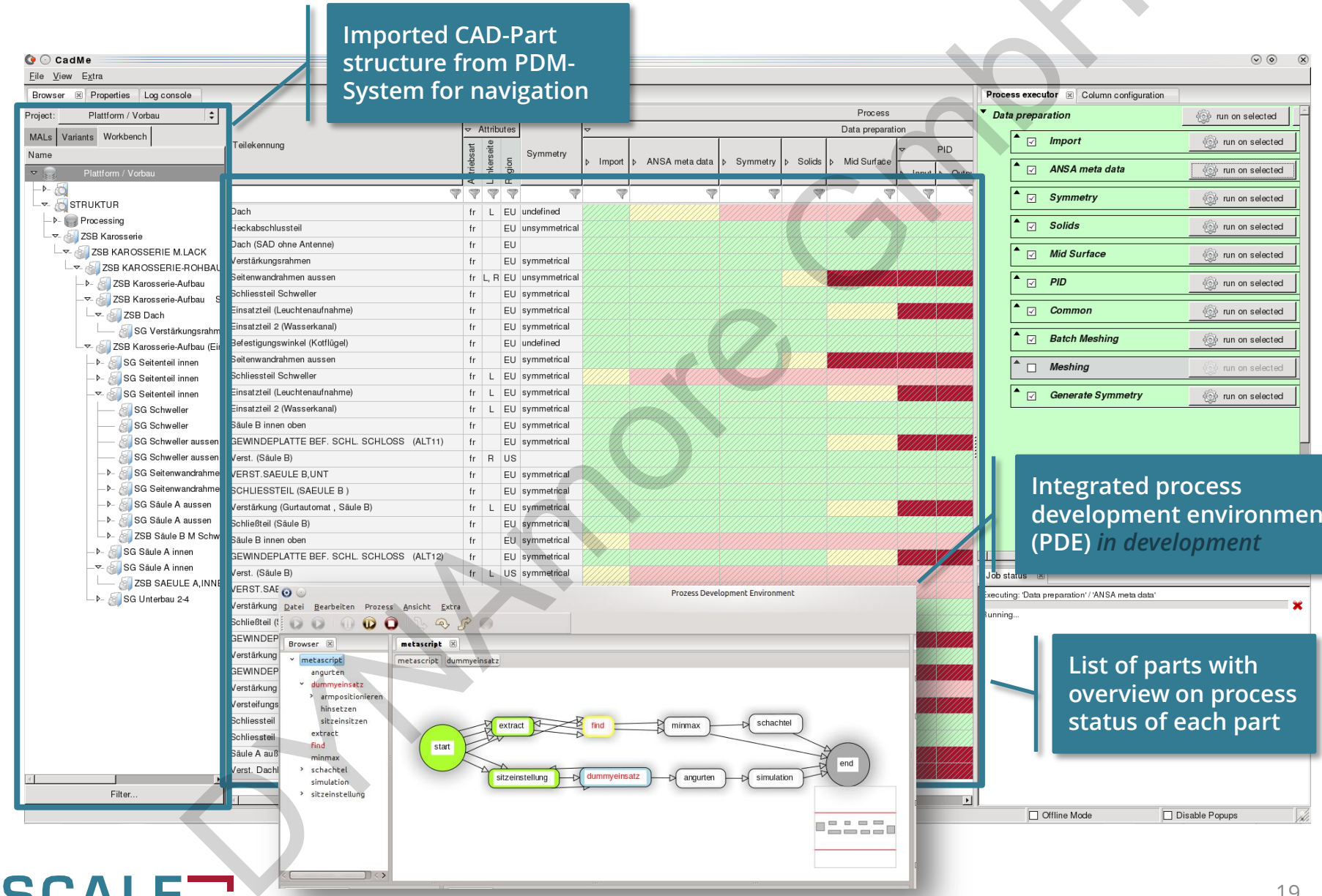
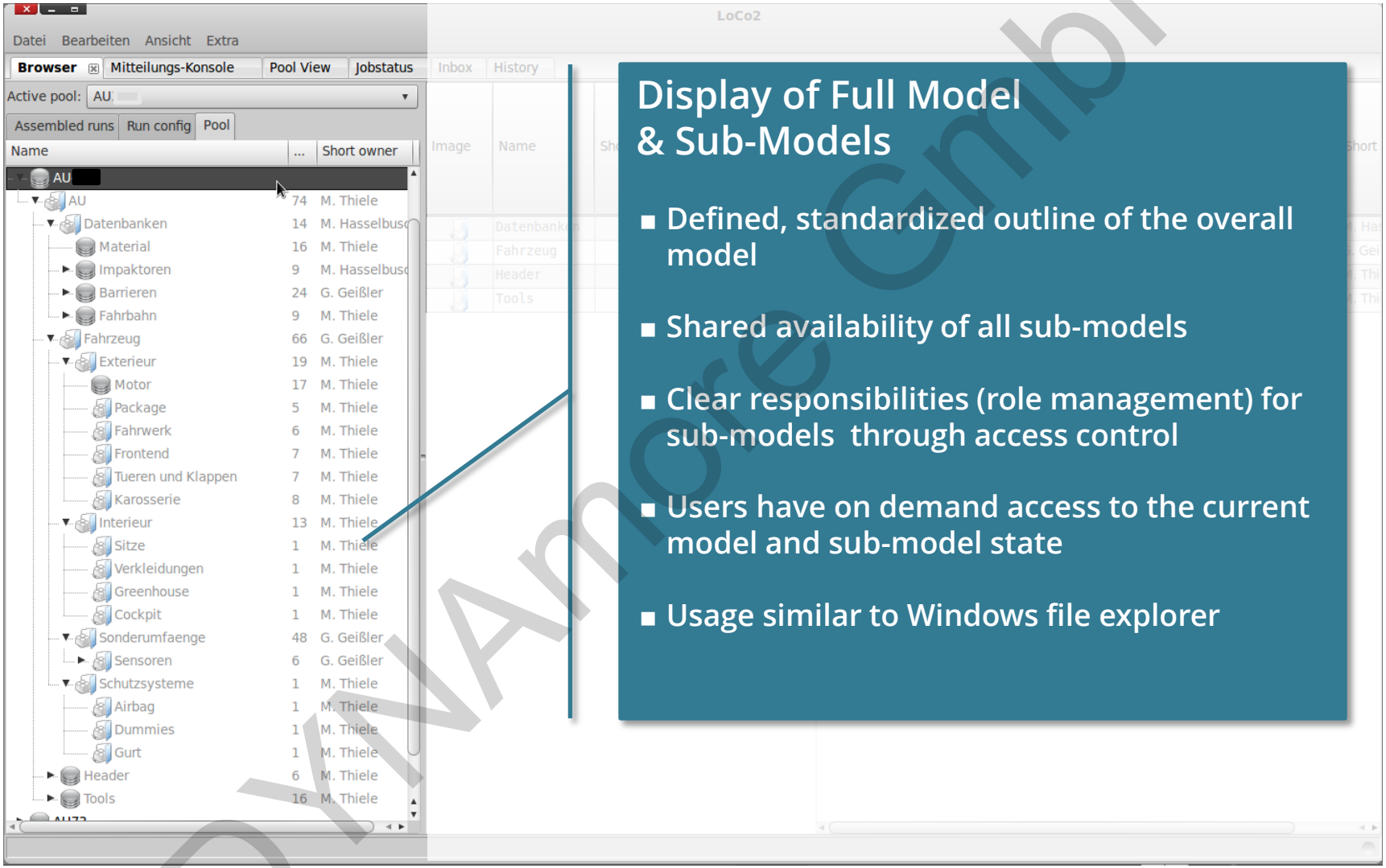
CadMe: *Distributed Meshing Processes*



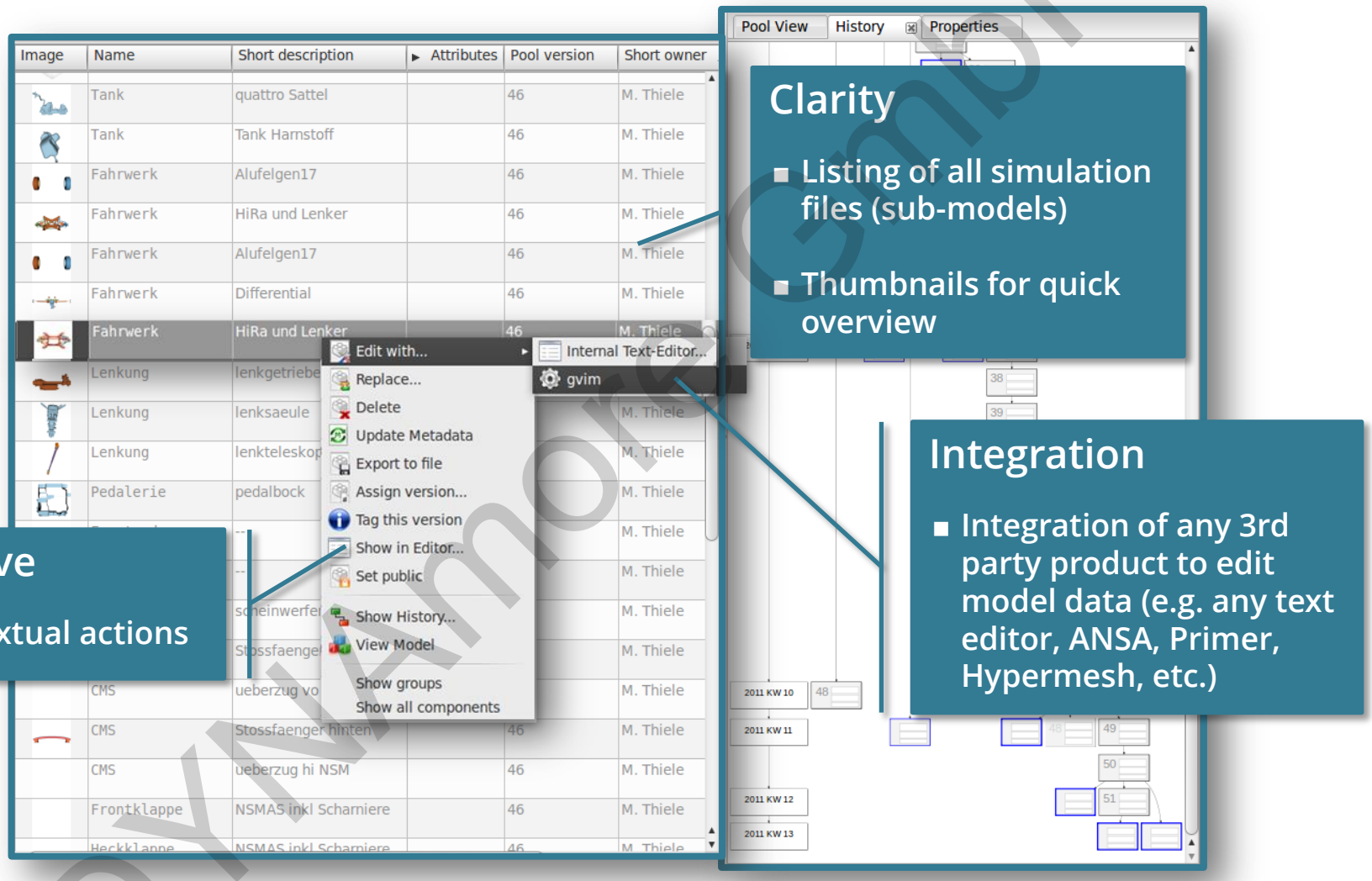
LoCo: *Workbench for Simulation Engineers*



Display of Full Model & Sub-Models

- Defined, standardized outline of the overall model
- Shared availability of all sub-models
- Clear responsibilities (role management) for sub-models through access control
- Users have on demand access to the current model and sub-model state
- Usage similar to Windows file explorer

LoCo: *Workbench for Simulation Engineers*



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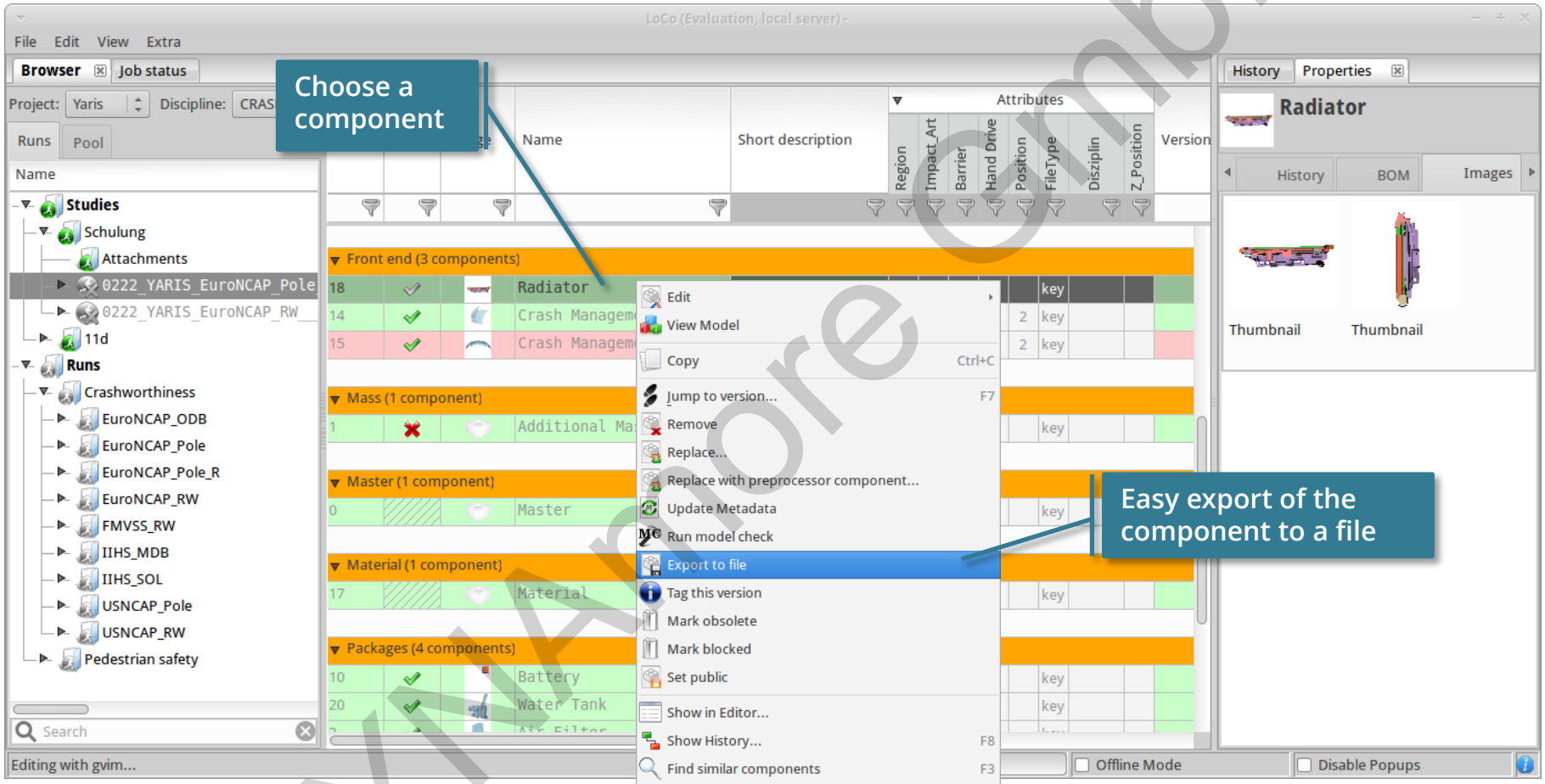

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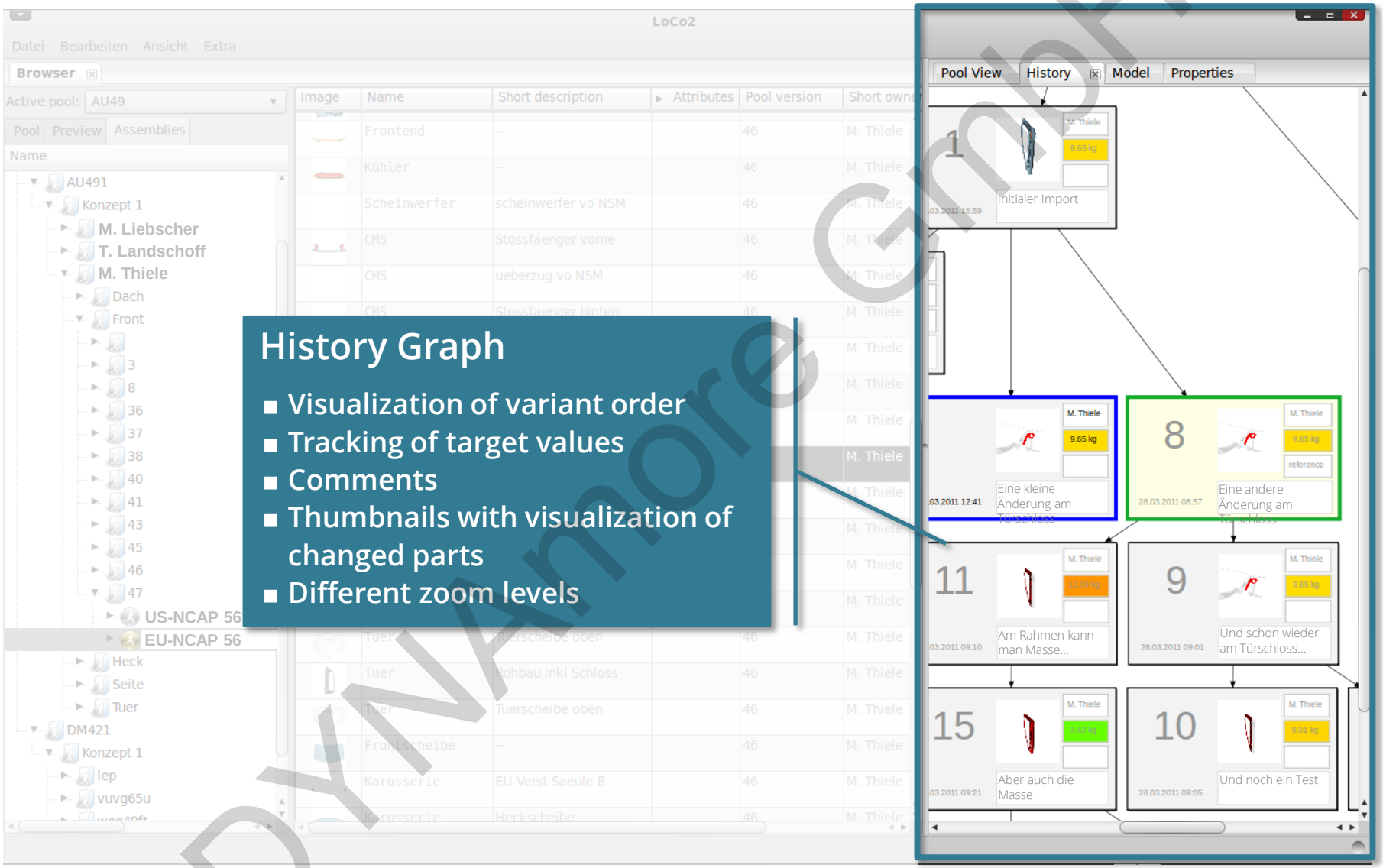
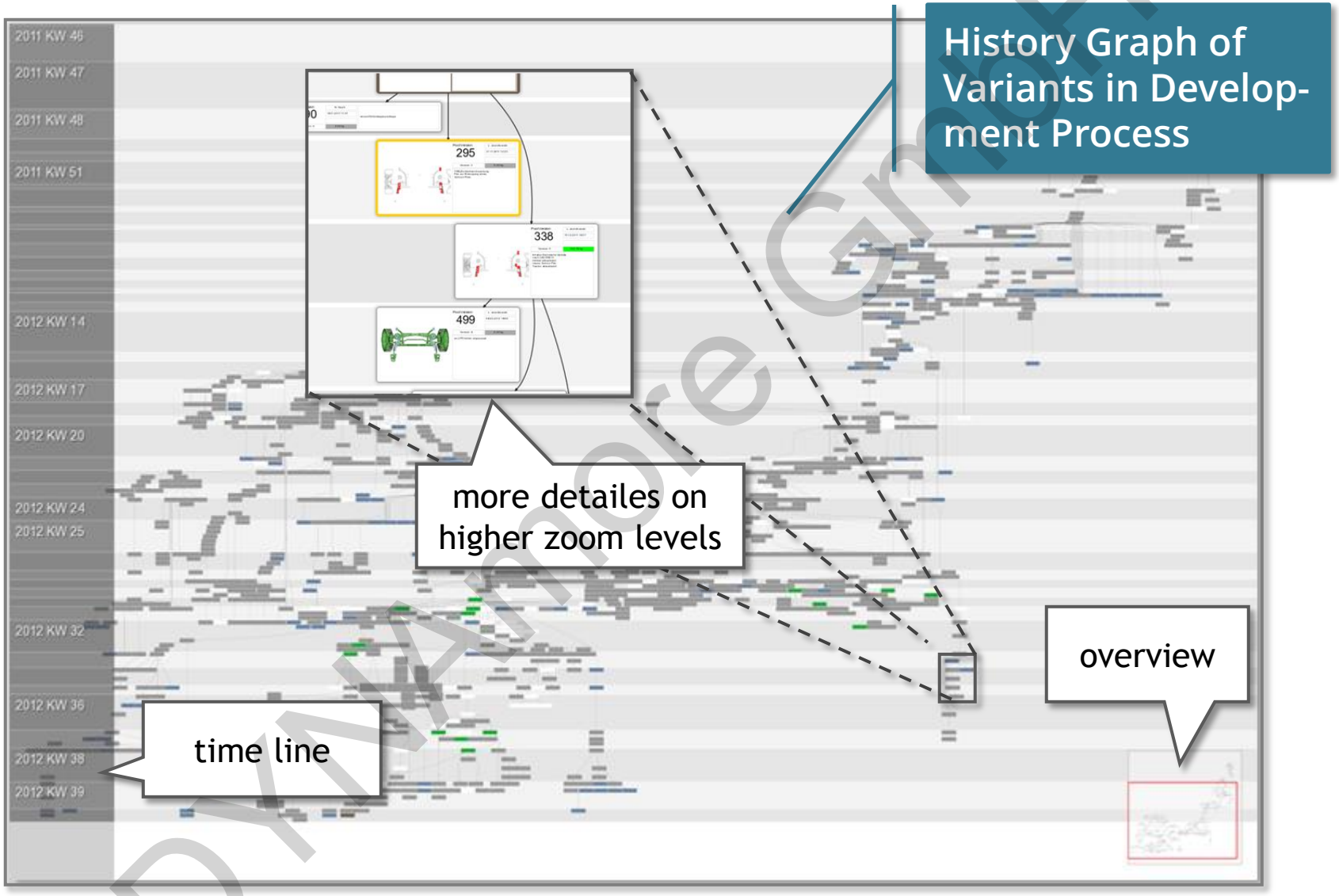


History Graph

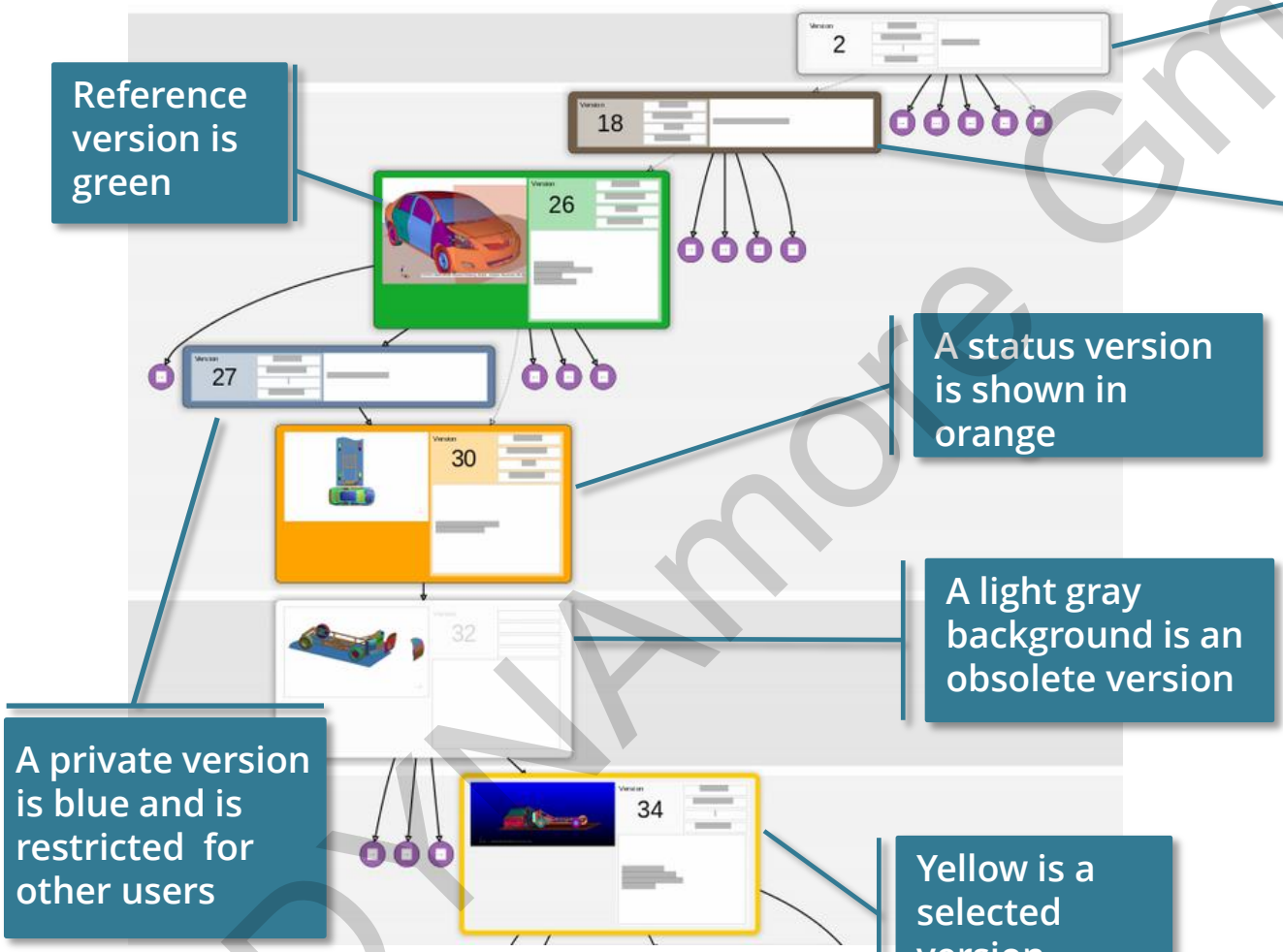
- Visualization of variant order
- Tracking of target values
- Comments
- Thumbnails with visualization of changed parts
- Different zoom levels

SCALE

LoCo: *Workbench for Simulation Engineers*



History Graph – Meaning of Colors



White background is a released ("public") version

Reference version is green

Dark background is the current working version

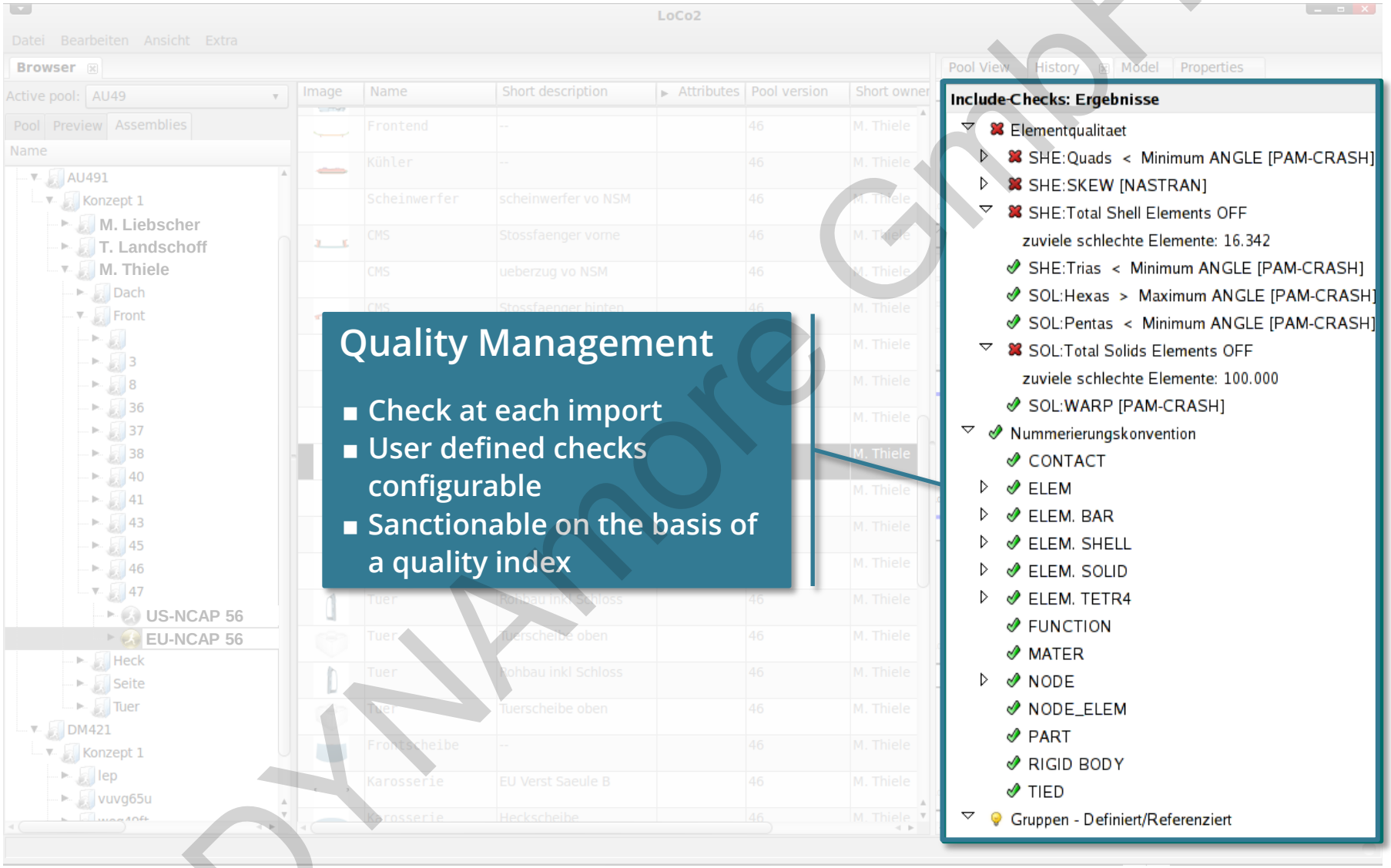
A status version is shown in orange

A light gray background is an obsolete version

A private version is blue and is restricted for other users

Yellow is a selected version

LoCo: *Workbench for Simulation Engineers*

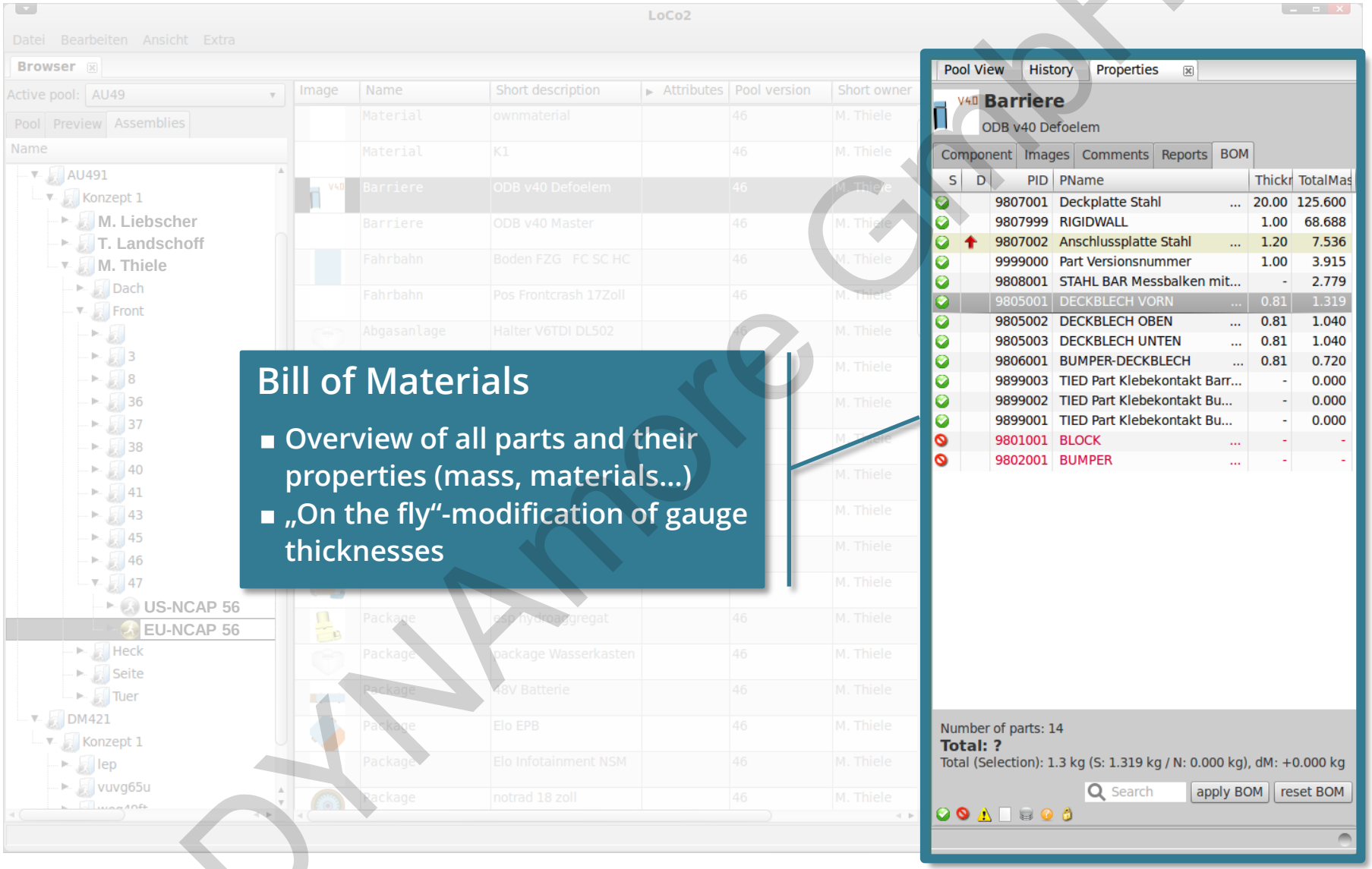


Quality Management

- Check at each import
- User defined checks configurable
- Sanctionable on the basis of a quality index

SCALE

LoCo: *Workbench for Simulation Engineers*



Bill of Materials

- Overview of all parts and their properties (mass, materials...)
- „On the fly"-modification of gauge thicknesses

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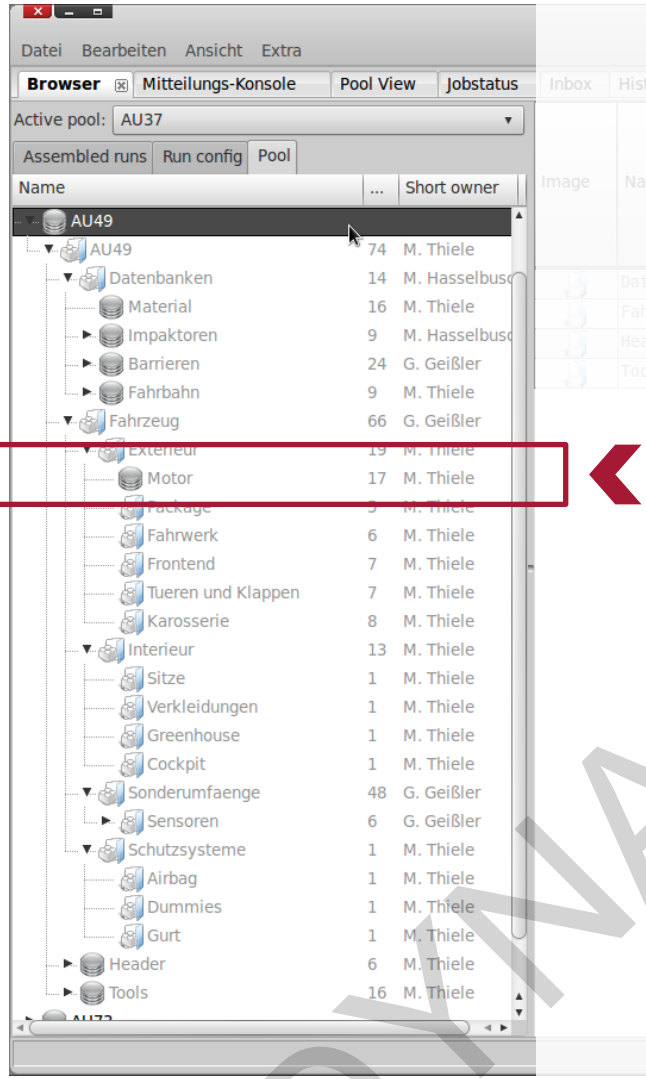
LoCo: *Component Management / Modeling Aspects*



- **Homogeneity:** Common components wherever possible
- **Libraries:** Direct access and integration
  - Materials
  - Barriers
  - Impactors
  - Engines
  - Dummies
  - ...
- **Access Control:** Not everybody can edit any component *(e.g. materials)*
- **Uniform structure for all projects**

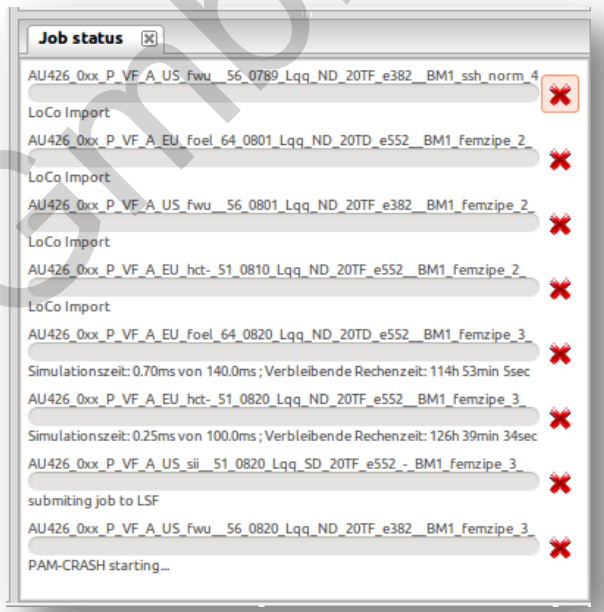
SCALE

LoCo: *Submitting and monitoring of jobs*

Job Submit

Instant start of jobs on the HPC-cluster

- Models are assembled directly in the datacenter at the HPC-cluster
- A minimum of data has to be transferred
- Jobs start instantly



Job Control

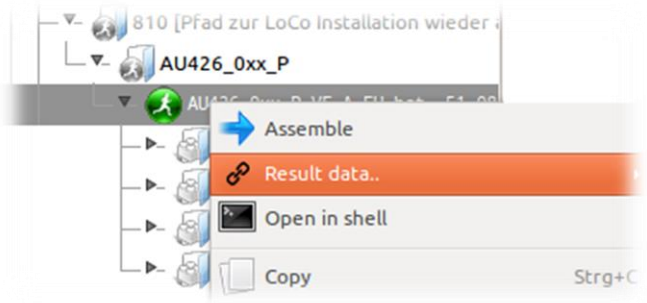
Monitoring job progress on the HPC-cluster

- Continuous feedback on job progress
- Stopping of jobs

Result Access

Retrieving and accessing result data

- Automatic download of result data
- Access to result data of other users
- Direct integration with post processors



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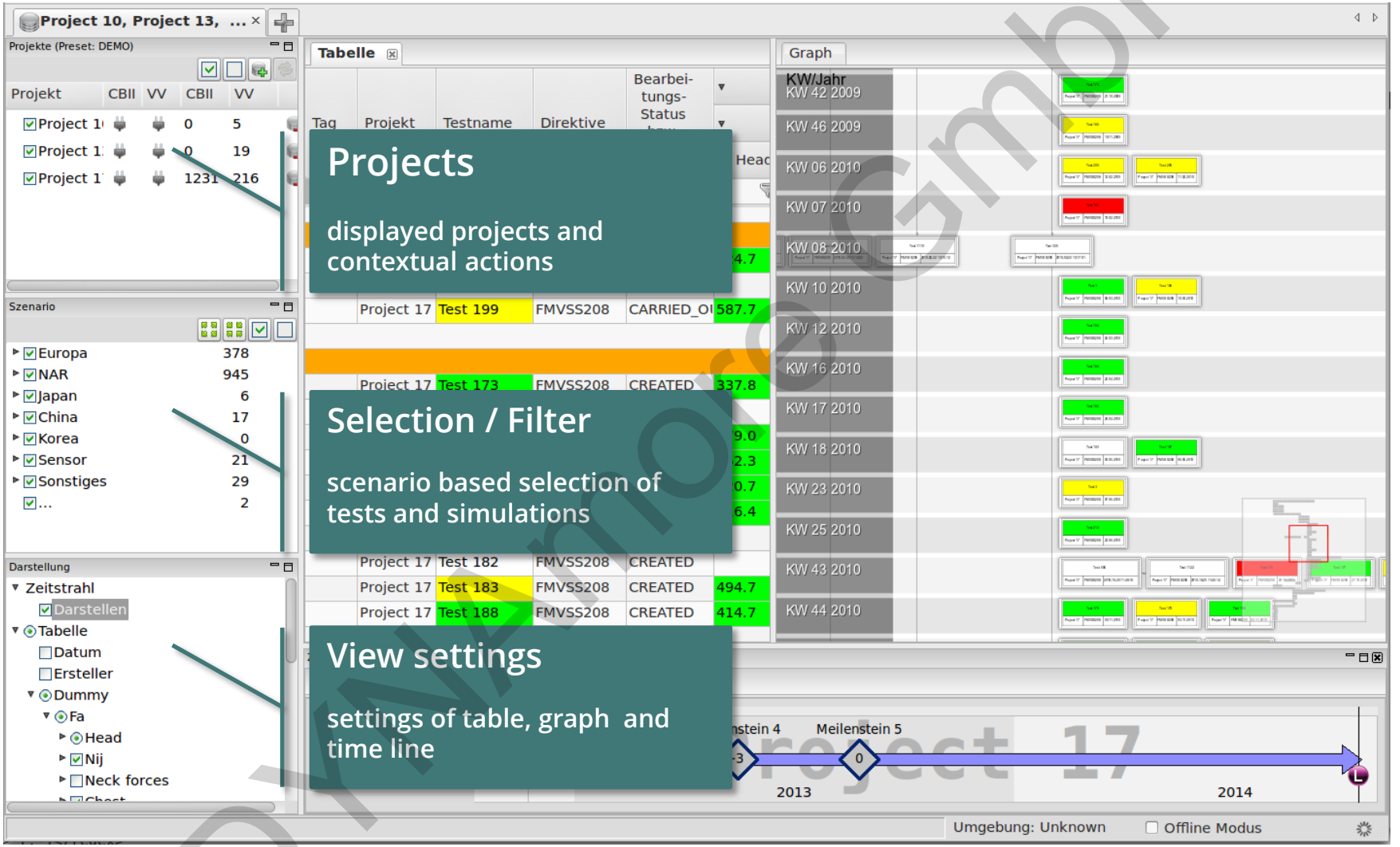
CAViT: *Post data management - GUI Overview*



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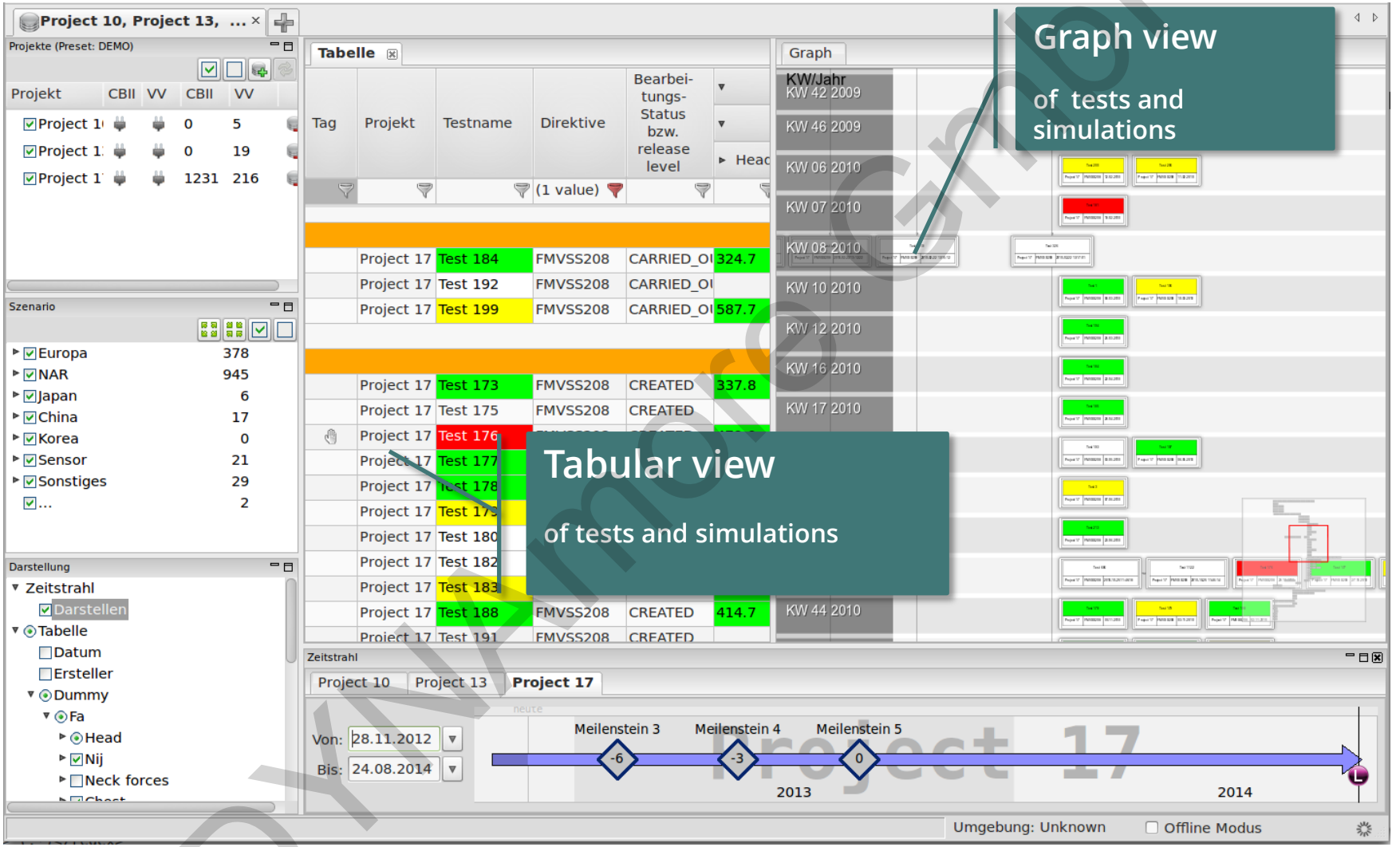

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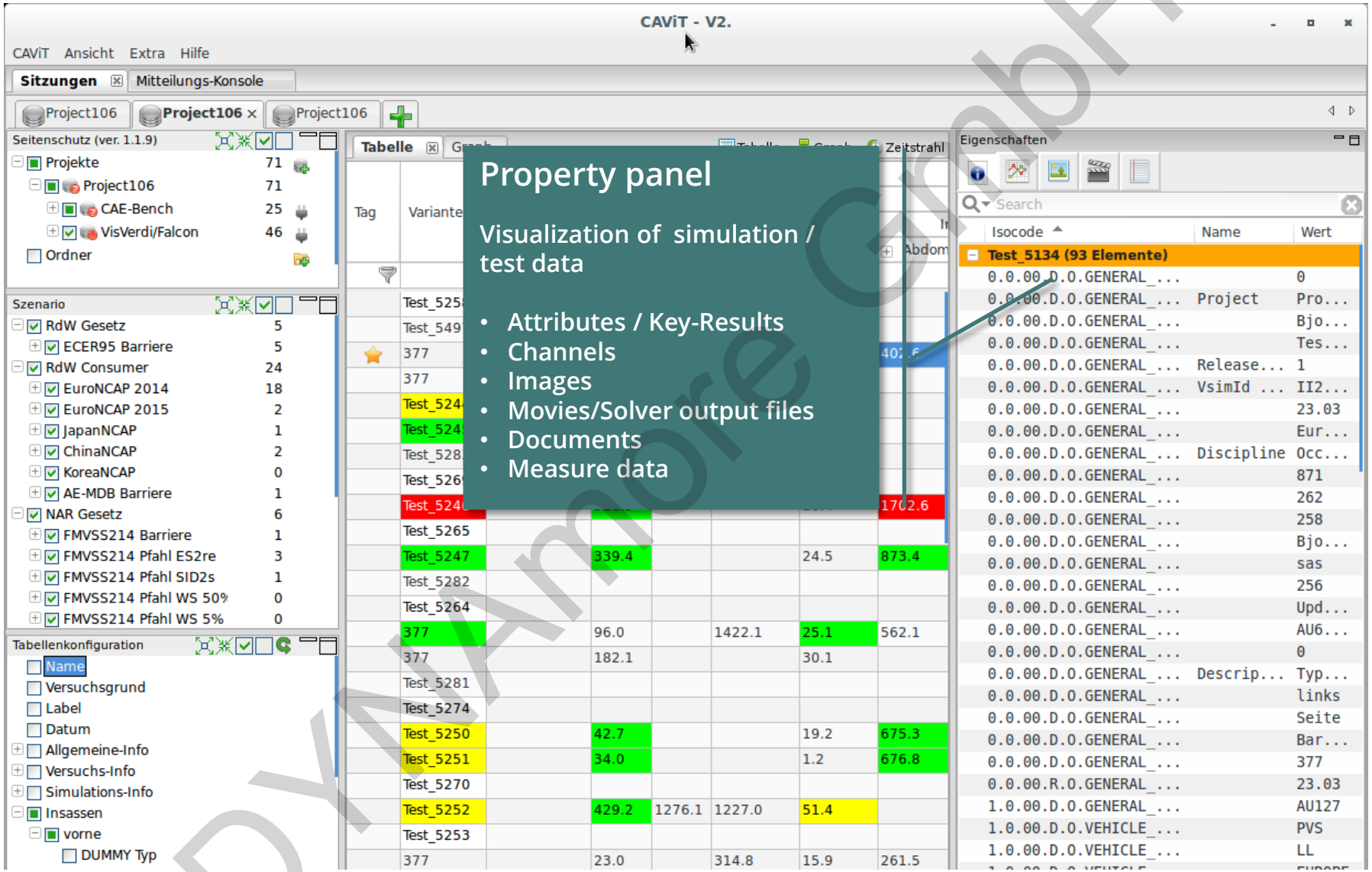

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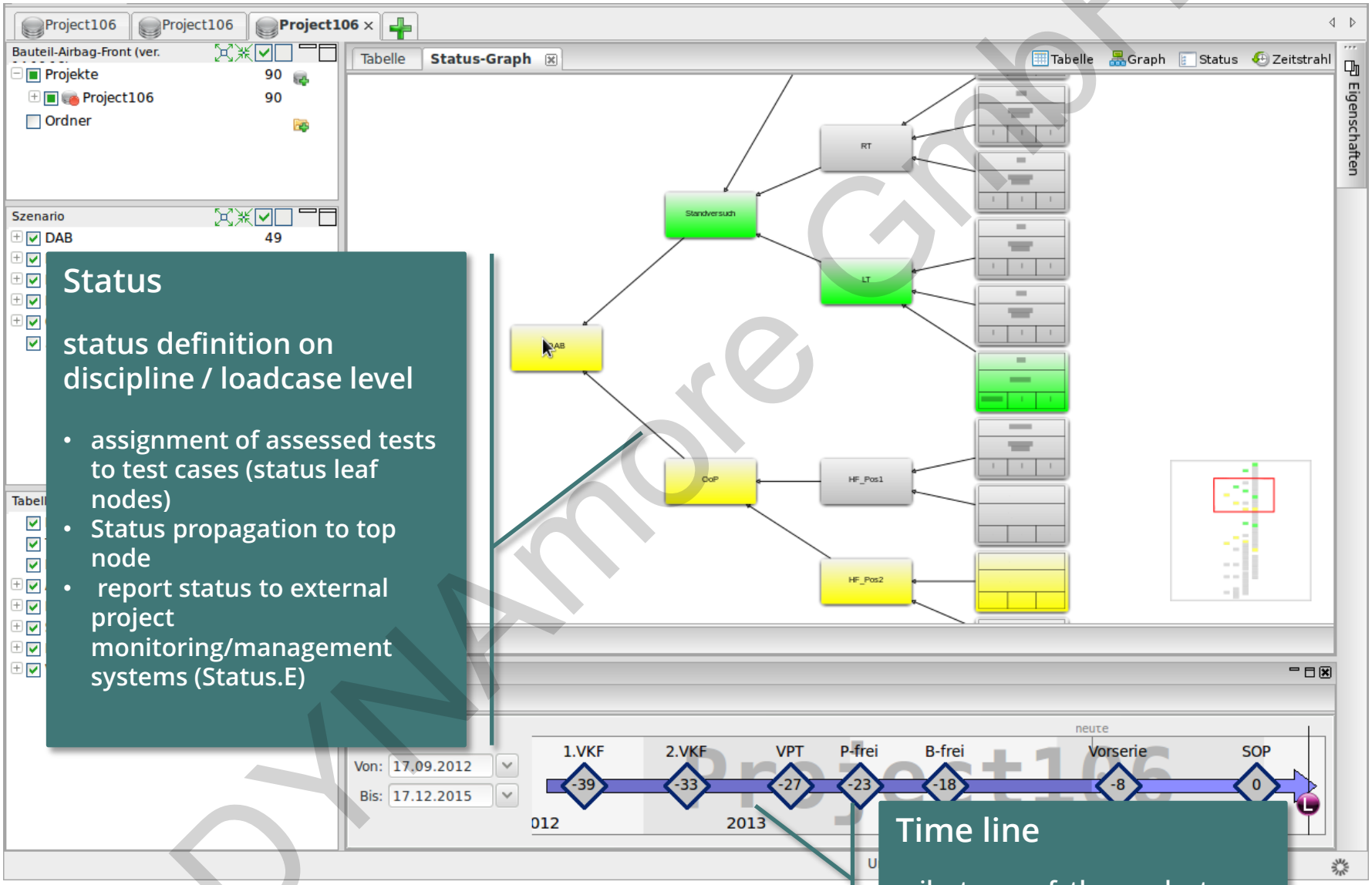

Status

status definition on discipline / loadcase level

- assignment of assessed tests to test cases (status leaf nodes)
- Status propagation to top node
- report status to external project monitoring/management systems (Status.E)

Time line

milestones of the product development plan

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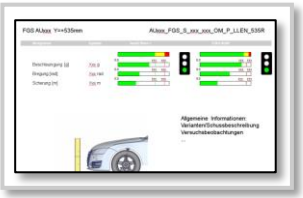

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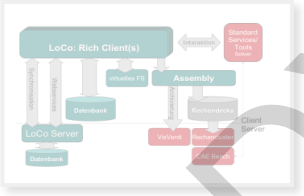

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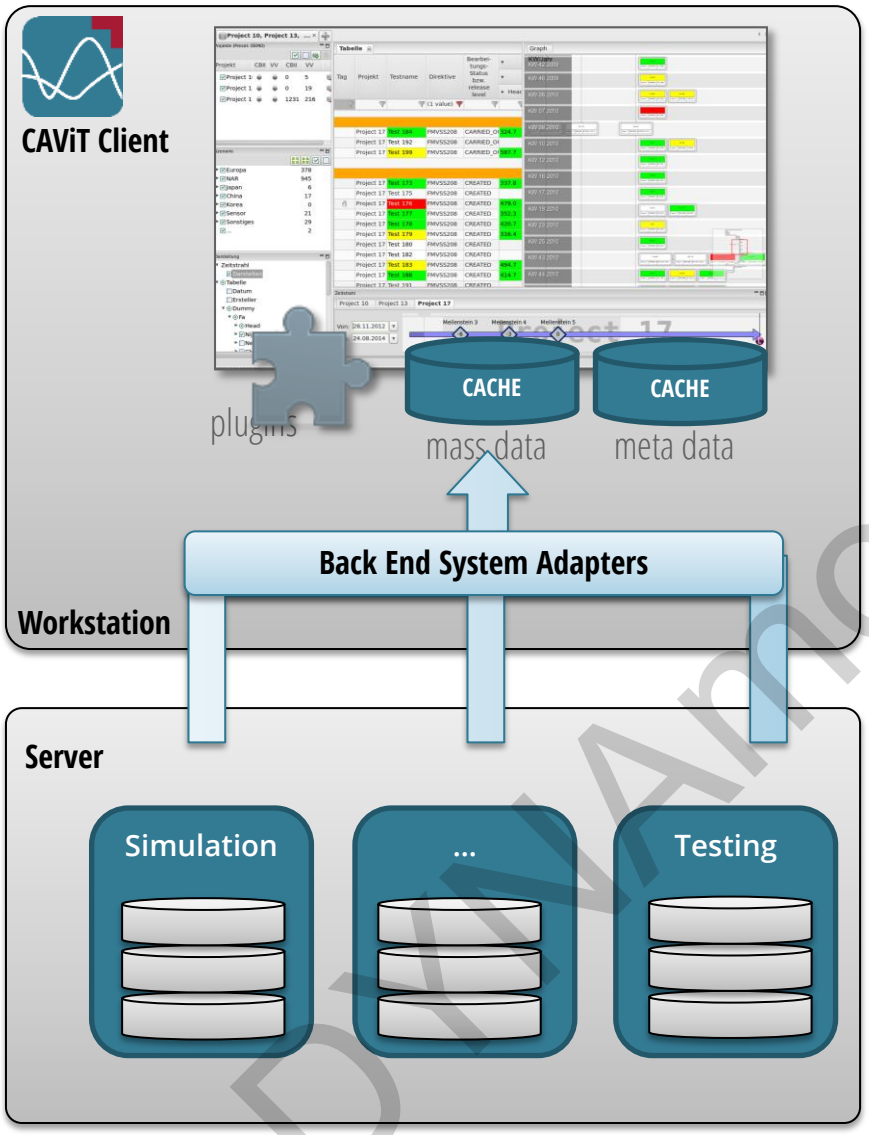
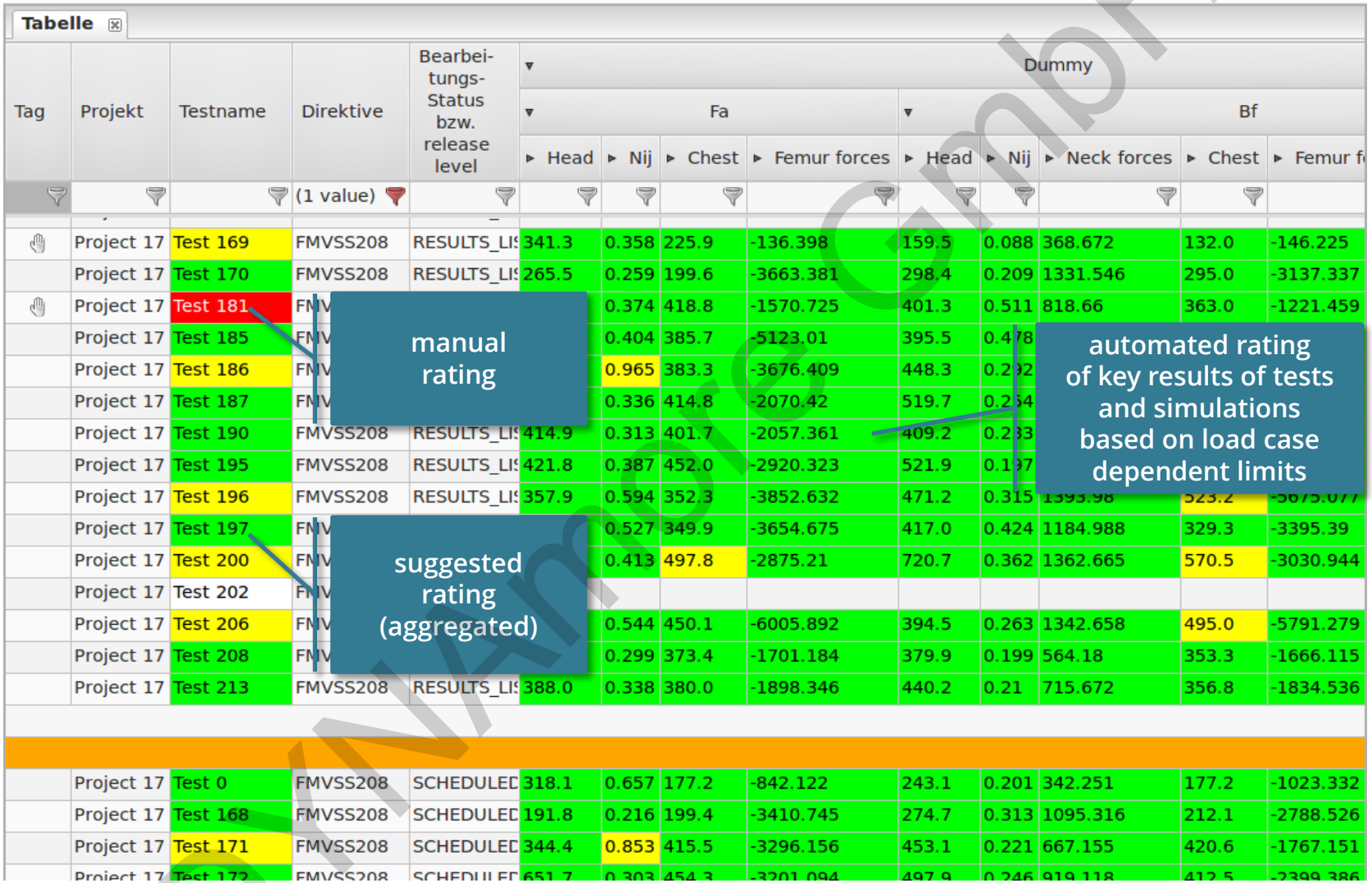
SCALE

Result Assessment: *Data Acquisition with CAViT*



- **Obtaining data**
  - data source can be existing storage solutions, typically different ones for test and simulation results
  - CAViT acquires data through specific interfaces provided by the storage solutions *(e.g. LoCo, CB, Midas, TestDBs, ...)*
  - CAViT as a viewing tool does not have its own central storage and does not introduce additional redundancy
- **Data formats**
  - CAViT provides a uniform presentation of simulation and test data
  - Test/simulation data are converted or mapped if necessary
  - CAViT can handle various data standards used in testing e.g. ASAM ODS data types and ISO-MME representations of mass data

Result Assessment: *Rating with CAViT*



Tabelle

Tag	Projekt	Testname	Direktive	Bearbei-tungs-Status bzw. release level	Dummy								
					Fa				Bf				
					Head	Nij	Chest	Femur forces	Head	Nij	Neck forces	Chest	Femur f
			(1 value)										
	Project 17	Test 169	FMVSS208	RESULTS_LIS	341.3	0.358	225.9	-136.398	159.5	0.088	368.672	132.0	-146.225
	Project 17	Test 170	FMVSS208	RESULTS_LIS	265.5	0.259	199.6	-3663.381	298.4	0.209	1331.546	295.0	-3137.337
	Project 17	Test 181	FMV			0.374	418.8	-1570.725	401.3	0.511	818.66	363.0	-1221.459
	Project 17	Test 185	FMV			0.404	385.7	-5123.01	395.5	0.478			
	Project 17	Test 186	FMV			0.965	383.3	-3676.409	448.3	0.292			
	Project 17	Test 187	FMV			0.336	414.8	-2070.42	519.7	0.264			
	Project 17	Test 190	FMVSS208	RESULTS_LIS	414.9	0.313	401.7	-2057.361	409.2	0.283			
	Project 17	Test 195	FMVSS208	RESULTS_LIS	421.8	0.387	452.0	-2920.323	521.9	0.197			
	Project 17	Test 196	FMVSS208	RESULTS_LIS	357.9	0.594	352.3	-3852.632	471.2	0.315	1393.98	523.2	-5675.077
	Project 17	Test 197	FMV			0.527	349.9	-3654.675	417.0	0.424	1184.988	329.3	-3395.39
	Project 17	Test 200	FMV			0.413	497.8	-2875.21	720.7	0.362	1362.665	570.5	-3030.944
	Project 17	Test 202	FMV										
	Project 17	Test 206	FMV			0.544	450.1	-6005.892	394.5	0.263	1342.658	495.0	-5791.279
	Project 17	Test 208	FMV			0.299	373.4	-1701.184	379.9	0.199	564.18	353.3	-1666.115
	Project 17	Test 213	FMVSS208	RESULTS_LIS	388.0	0.338	380.0	-1898.346	440.2	0.21	715.672	356.8	-1834.536
	Project 17	Test 0	FMVSS208	SCHEDULED	318.1	0.657	177.2	-842.122	243.1	0.201	342.251	177.2	-1023.332
	Project 17	Test 168	FMVSS208	SCHEDULED	191.8	0.216	199.4	-3410.745	274.7	0.313	1095.316	212.1	-2788.526
	Project 17	Test 171	FMVSS208	SCHEDULED	344.4	0.853	415.5	-3296.156	453.1	0.221	667.155	420.6	-1767.151
	Project 17	Test 172	FMVSS208	SCHEDULED	651.7	0.303	454.3	-3201.094	497.9	0.246	919.118	412.5	-2399.386

manual rating

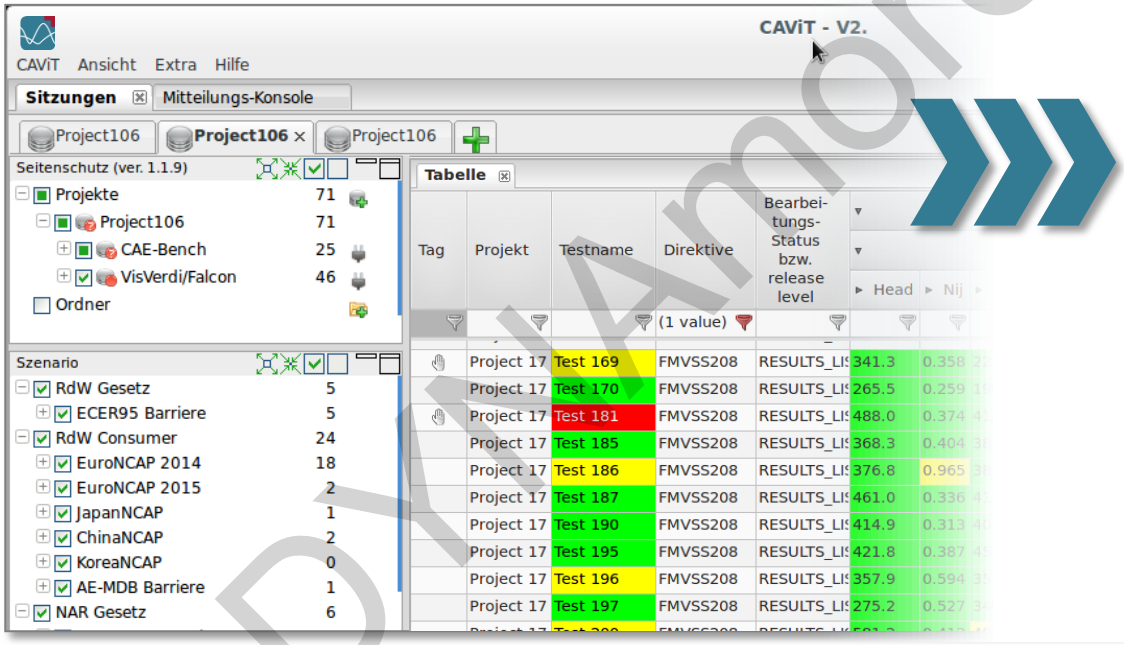
suggested rating (aggregated)

automated rating of key results of tests and simulations based on load case dependent limits

Result Assessment: *Rating Aggregation*

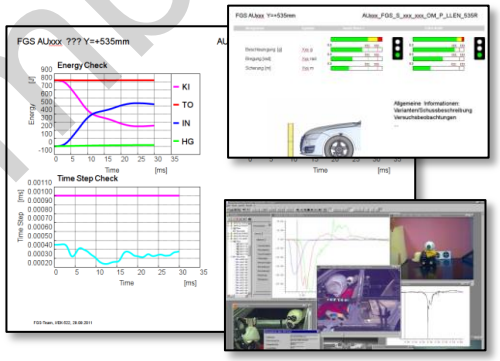
CAViT: *Plugin / Scripting Interface*

- Interfacing
  - Integration of post processors, third party tools
  - Report generation with external tools (e.g. GNS Animator)
- Plugin
  - Plugin concept for customization, proprietary code or user defined scripts
  - Python (interpreter is built in) or any other script language may be used



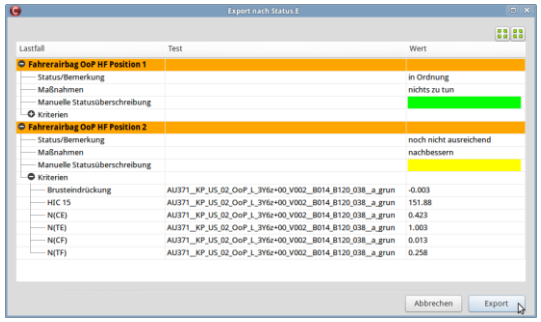
PDF/PPTs Reports

Report generation with external tools and viewers

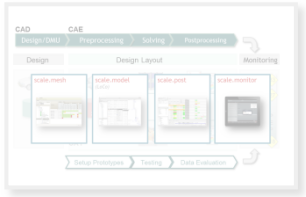


Status.E Project Monitoring

Exporting assessed results to Status.E



Agenda



Introduction SCALE.sdm

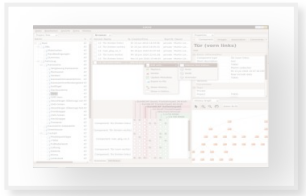
- Software Components
- Key Features
- Unique selling points

Decentralization of Development

- Integration of suppliers and engineering providers
- Connecting multiple locations
- Version management

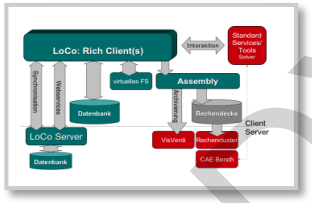
Modell Generation and Assembly

- Assembly processes
- Attribute based allocation of content
- Jobsubmit and monitoring



Result Assessment

- Accessing simultaneously Simulation and Test Results *(rich client)*
- Report Generation



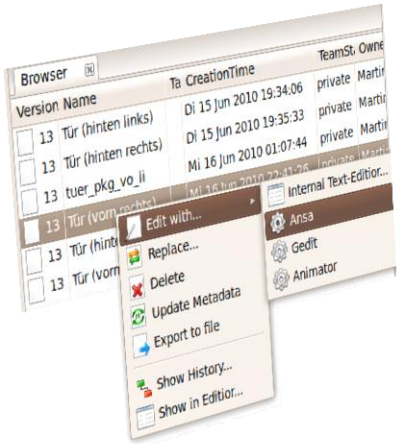
Adaption and Customization *(open system)*

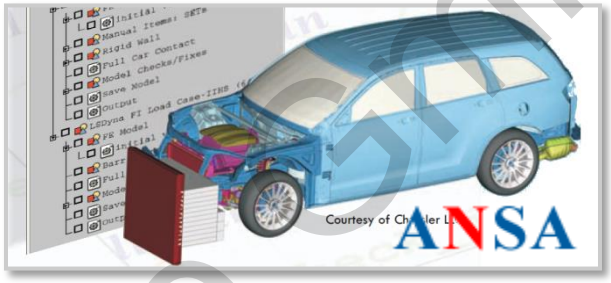
- Configuration
- Process integration *(support for solvers and CAE-disciplines)*
- Integration with existing IT-environments / 3rd party software
- Operation

SCALE

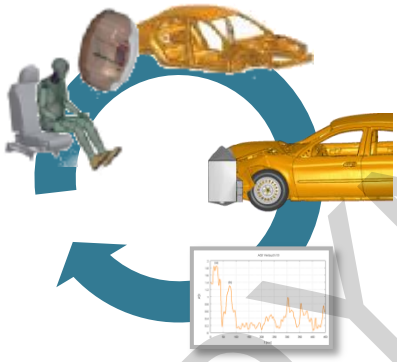
SCALE.sdm: *Focus on integration of 3rd party tools*

Direct application of any external tools *(Ansa, Animator, nedit, vi, user scripts, etc...)*

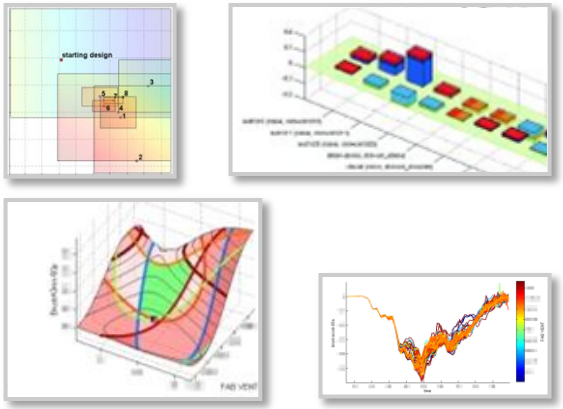




Integration of DOE Studies / Optimization

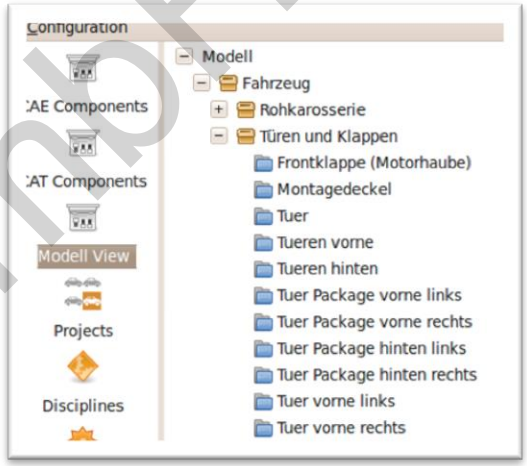


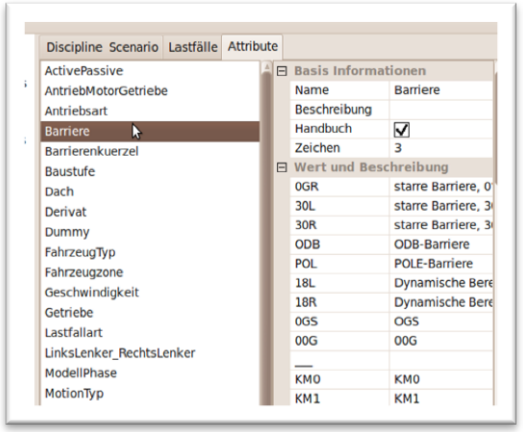
- Models are parameterized within the data management system
- Simulation models are assembled automatically
- Access to optimization software such as LS-OPT



SCALE.sdm: *Configurability*

- **System is completely configurable by customer**
  - No involvement of IT-departments or developers required to implement or change processes
- **Specific configurations for individual user groups**
  (Department, Discipline, Project, …)
  - Project structure
  - Attributes / Metadata
  - Filters
- **GUI for KeyUsers**
  - Fast response times upon user requests
  - Independence from developers
- **XML syntax for advanced configuration**
  - Covers full feature set of application
- **Scripting for individual processes**
  - Tightly integrated with full version control for each script
  - Rich Python API





SCALE.sdm: *Solvers and disciplines*

- **Flexibility for easy and fast integration of processes**
  - New disciplines, processes, solvers
  - Fast response times to user requests

- **Integrated scripting interface and version management**
  - Advanced process development
  - Independent from code changes of the core software

- **Solver independent**
  - Any simulation solver can be used
  - Existing solver related inhouse scripts can be integrated

- **Simple adaption to new CAE disciplines**
  - Can be performed by user / customer
  - No code changes in SCALE.sdm necessary

Main current development priorities, upcoming features

Enhanced Data Compression [input/results]

storage cost reduction and minimum transmission time

Web Client

convenient access to data, particularly for monitoring

Integration with Collaboration and Ticket Systems

Jira, Open Project, ... for SDM related task management

UI Redesign of SDM-Client

more intuitive, more efficient, more modern appeal

http://www.scale.eu