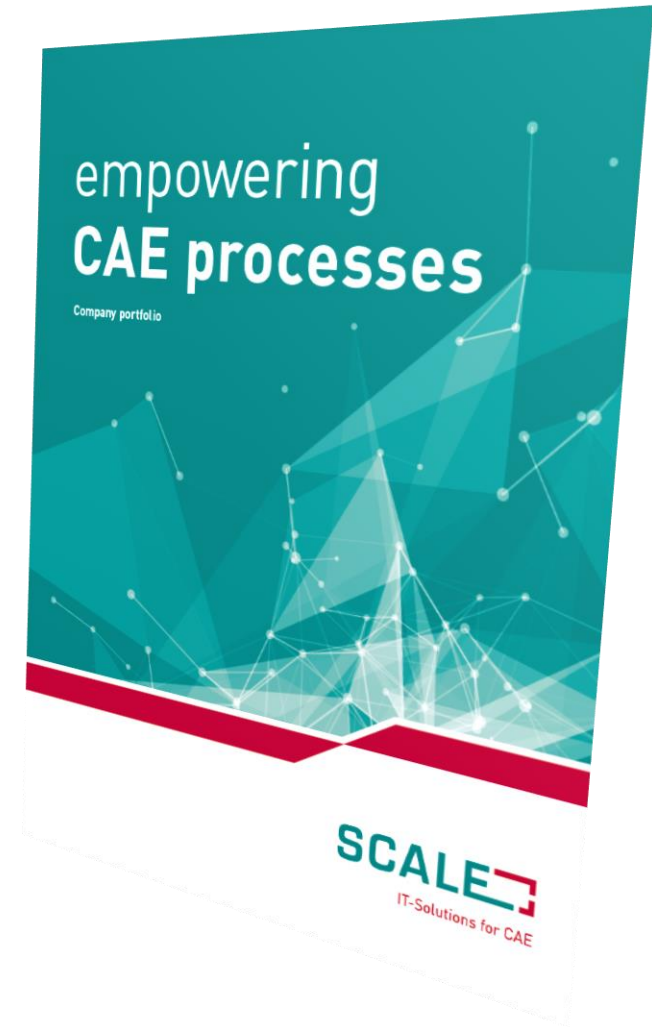


Software solution for the integration of test data (CAT) and simulation (CAE) in the system engineering process

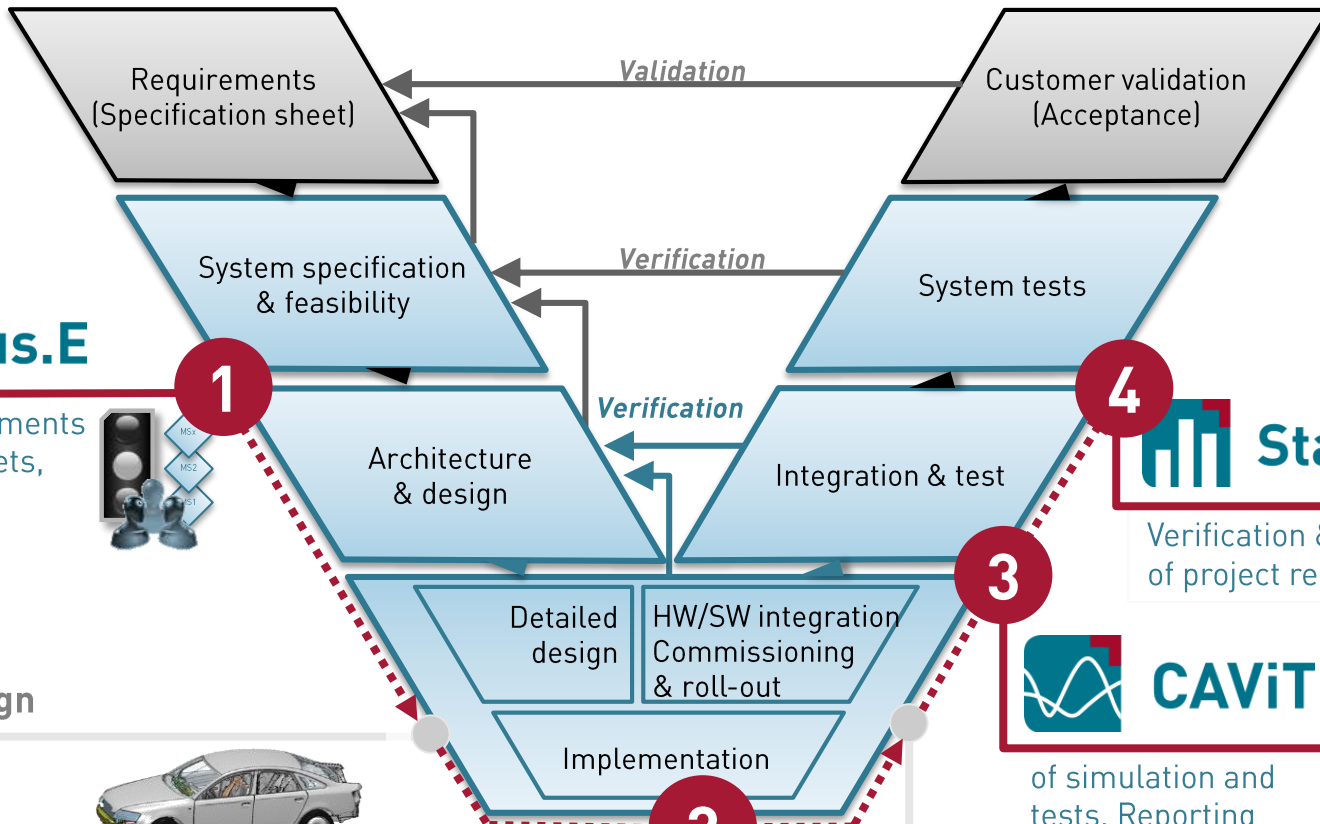
Dr. Heiner Müllerschön – SCALE GmbH

October 2018 - Copyright SCALE GmbH; Disclosure to third parties only in consultation with SCALE

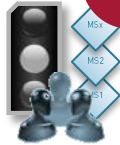
- Company is dedicated to „CAE process-, and data management“
- SCALE is subsidiary of DYNAmore Group
- Currently ~40 people
- Staff at SCALE are a mix of **experienced CAE engineers** and **professional computer scientists**
- Several offices in Germany
 - Ingolstadt
 - Stuttgart
 - Wolfsburg
 - Dresden (Software development)



Introduction - Systems Engineering Process



Setup of requirements and project targets, milestones and responsibilities



Verification & monitoring of project requirements

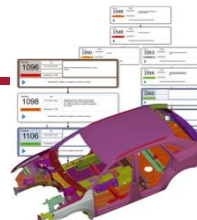


Detailed design

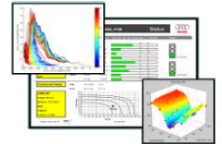
CAD / DMU



Setup of simulation models

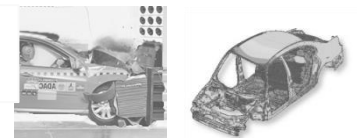


of simulation and tests, Reporting

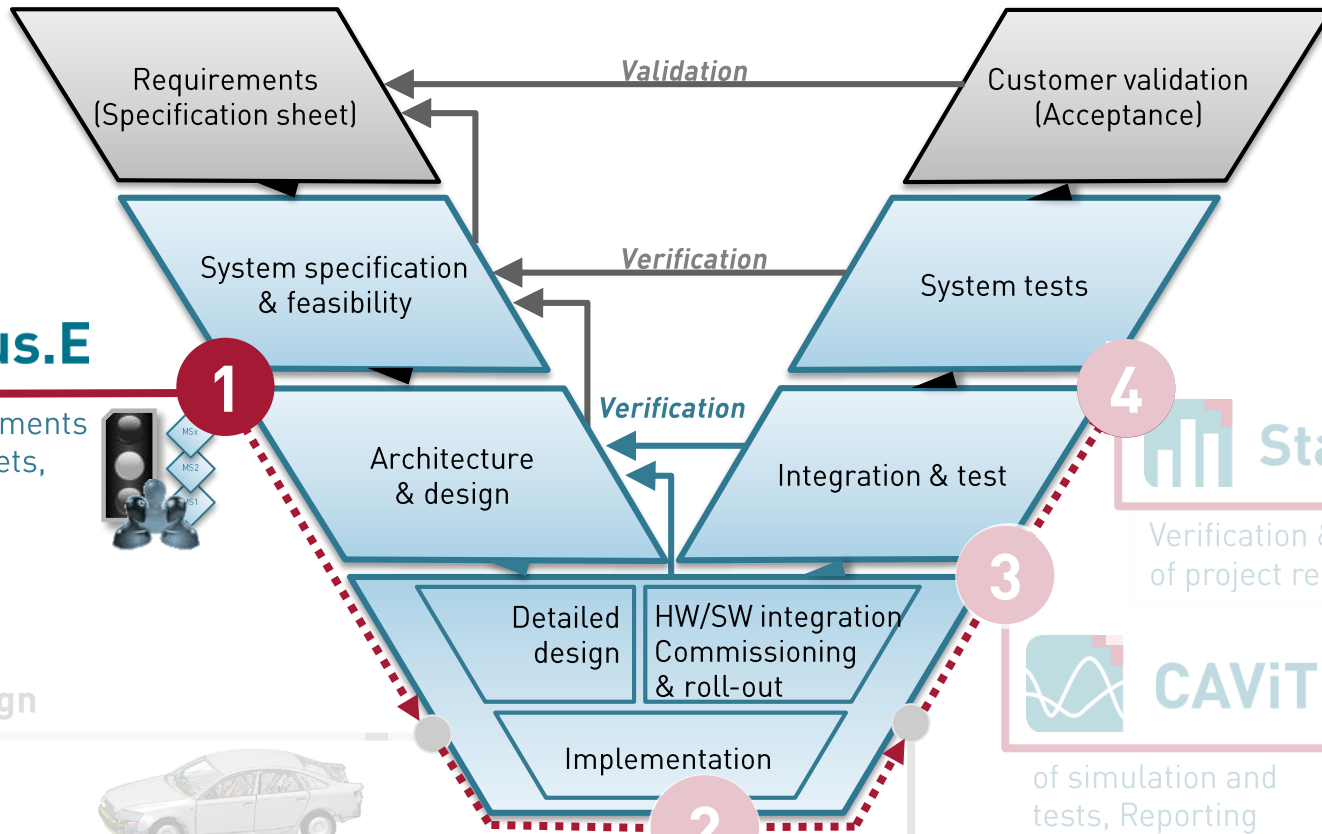


Solving / Testing

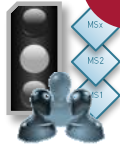
Perform simulation & test



Introduction - Systems Engineering Process



Setup of requirements and project targets, milestones and responsibilities



Detailed design

CAD / DMU



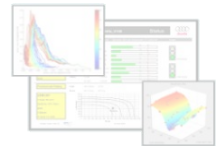
Setup of simulation models and test prototypes



Verification & monitoring of project requirements

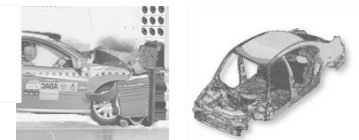


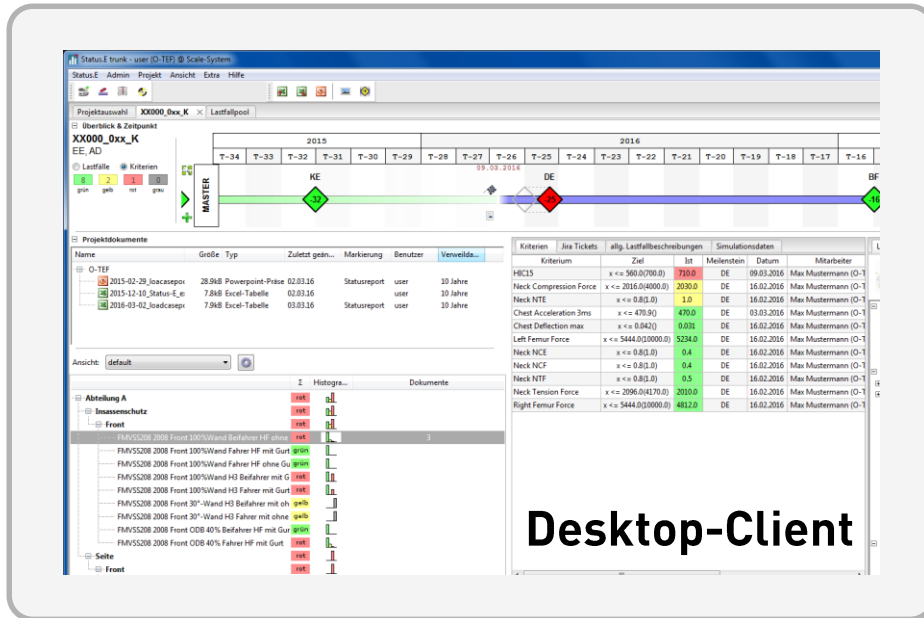
of simulation and tests, Reporting



Solving / Testing

Perform simulation & test





Characterization

- Requirement and Test Case Management
- Status Monitoring
 - Track fulfillment of project targets / requirements with respect to project milestones
 - Status aggregation for projects
- Reporting - generation of status reports (ppt, doc, pdf)
- Documentation - Integrated document management system



Project Setup: Define Project & Responsibilities



Define Project



Project Milestones



Test Cases
(Load Cases)

• Create and define new project

• Provide general information & documents

Define project members and roles

Project Setup: Milestones



Define Project



Project Milestones



Test Cases

The screenshot shows the Status.E software interface. The top part displays a Gantt chart for project 'XX000_0xx_K' with milestones 'KE' (green diamond) and 'DE' (red diamond) plotted against a timeline from 2015 to 2016. Below the Gantt chart is a table of project documents. A dialog box titled 'Anlegen eines neuen Projekts' is open, showing a 'Produktentwicklungsplan' with a list of milestones and their dates.

Name	Größe	Typ	Zuletzt geän...	Markierung	Benutzer	Versenda...
2015-02-29_Joacasepor	28.9kB	Powerpoint-Präse	02.03.16	Statusreport		
2015-12-10_Status-E_e	7.8kB	Excel-Tabelle	02.03.16			
2016-03-02_Loadcasepr	7.9kB	Excel-Tabelle	03.03.16			

Kriterium	Ziel	Ist	Mileistein	Datum	Max
HC15	x <= 560.0(700.0)	710.0	DE	09.03.2016	Max
Compression Force	x <= 2016.0(4000.0)	2030.0	DE	16.02.2016	Max
	x <= 0.8(1.0)	1.0	DE	16.02.2016	Max
	x <= 470.90	470.0	DE	03.03.2016	Max
	x <= 0.0420	0.031	DE	16.02.2016	Max
Left Femur Force	x <= 5444.0(10000.0)	5234.0	DE	16.02.2016	Max
Neck NCE	x <= 0.8(1.0)	0.4	DE	16.02.2016	Max
Neck NCF	x <= 0.8(1.0)	0.4	DE	16.02.2016	Max
Neck NTF	x <= 0.8(1.0)	0.5	DE	16.02.2016	Max
Neck Tension Force	x <= 2096.0(4170.0)	2010.0	DE	16.02.2016	Max

Name	Plan-Datum	Referenz
SOP:	KW 10/2016	-
PVS:	KW 37/2015	SOP
VFF:	KW 28/2015	SOP
BF:	KW 37/2014	SOP
DF:	KW 15/2014	SOP
DE:	KW 49/2013	SOP
KE:	KW 23/2013	SOP

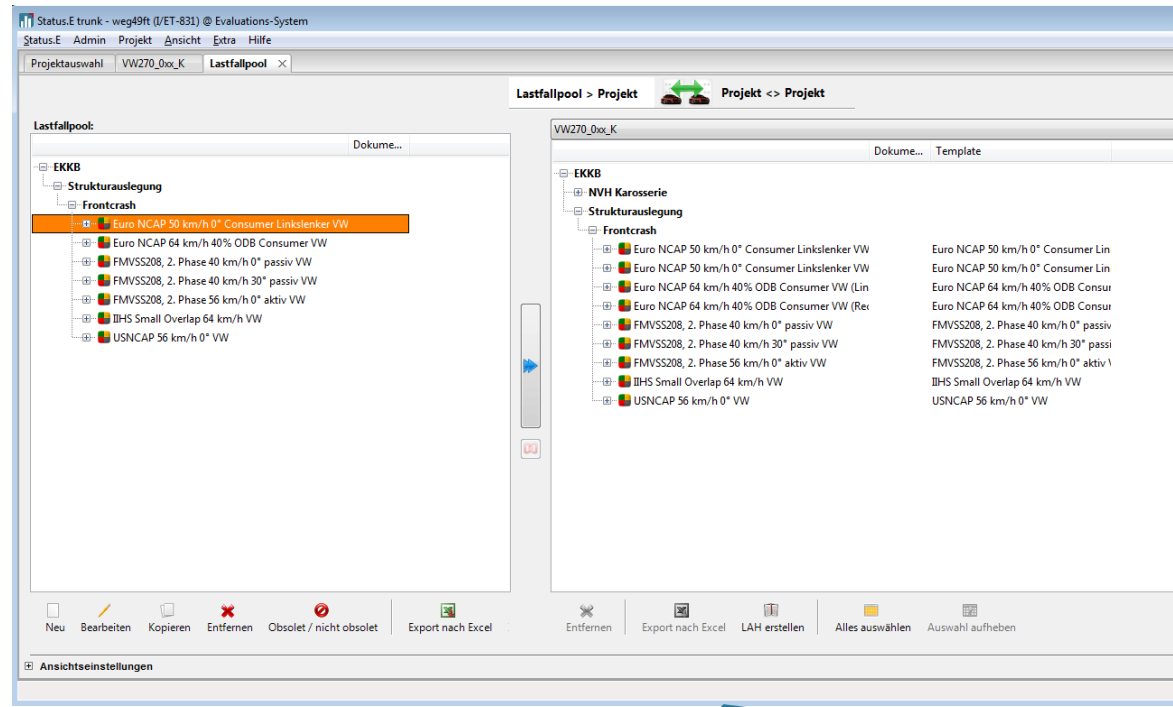
General product milestones and sub milestones for disciplines

Project Setup: Test Cases and Project Targets



Test Cases (Pool)

Test Cases (Project)



Define relevant Test Cases for project from a pool of predefined Test Cases / regulations (per project milestone and discipline)

Project Setup: Finished



Status.E trunk - user (O-TEF) @ Scale-System

Projekt auswahl: XX000_0xx_K x Lastfallpool

Überblick & Zeitpunkt
XX000_0xx_K
EE, AD

2015: T-34, T-33, T-32, T-31, T-30, T-29, T-28, T-27, T-26, T-25, T-24, T-23, T-22, T-21, T-20, T-19, T-18

09.03.2016

MASTER

KE 32

DE 26

Projekt dokumente

Name	Größe	Typ	Zuletzt geän...	Markierung	Benutzer	Verweilda...
O-TEF						
2015-02-29_loacasepor	28.9kB	Powerpoint-Präse	02.03.16	Statusreport	user	10 Jahre
2015-12-10_Status-E_e	7.8kB	Excel-Tabelle	02.03.16		user	10 Jahre
2016-03-02_loadcasepr	7.9kB	Excel-Tabelle	03.03.16	Statusreport	user	10 Jahre

Ansicht: default

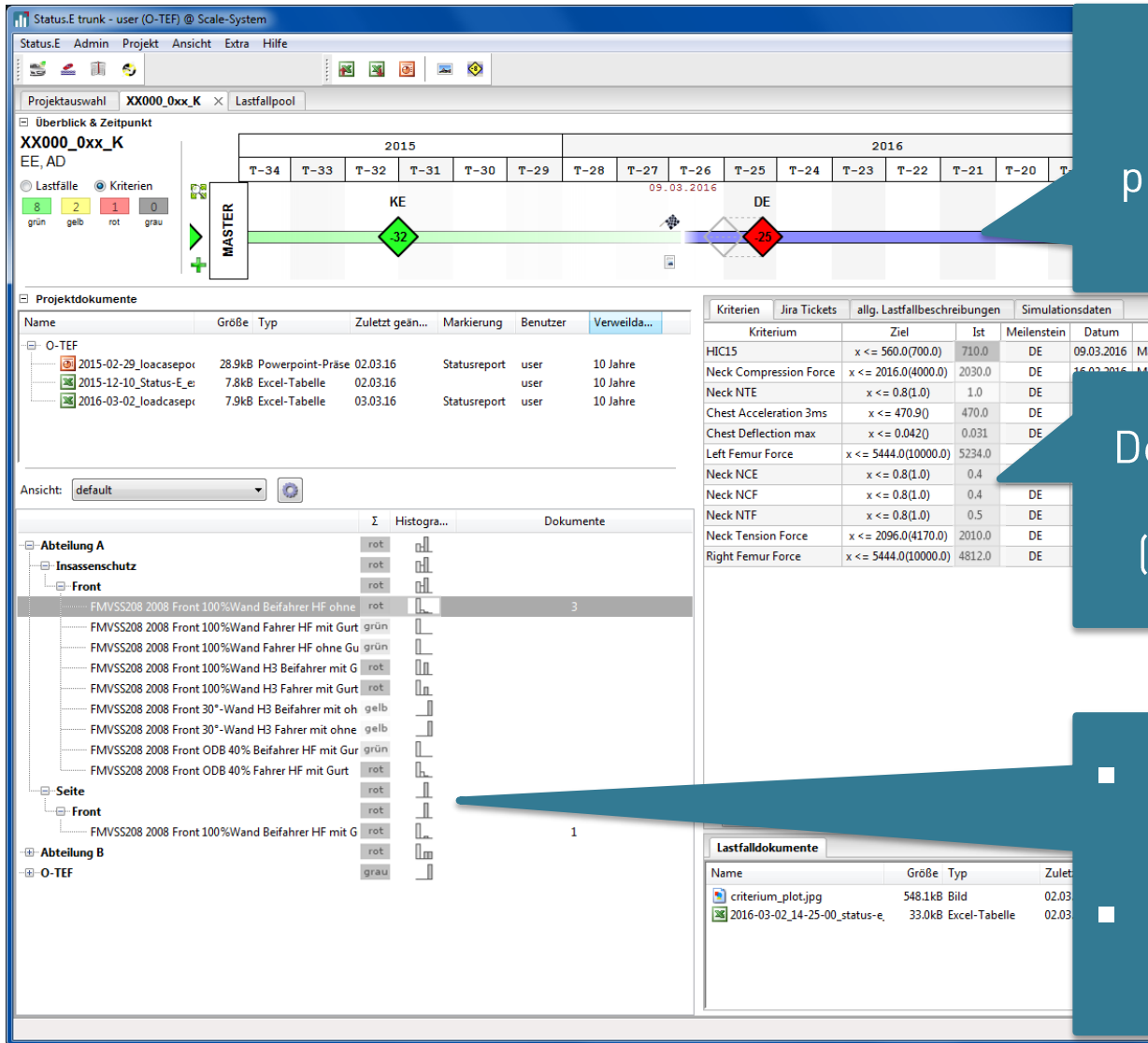
Abteilung	Σ	Histogra...	Dokumente
Abteilung A	rot		
Insassenschutz	rot		
Front	rot		
FMVSS208 2008 Front 100%Wand Beifahrer HF ohne	rot		3
FMVSS208 2008 Front 100%Wand Fahrer HF mit Gurt	grün		
FMVSS208 2008 Front 100%Wand Fahrer HF ohne Gu	grün		
FMVSS208 2008 Front 100%Wand H3 Beifahrer mit G	rot		
FMVSS208 2008 Front 100%Wand H3 Fahrer mit Gurt	rot		
FMVSS208 2008 Front 30*-Wand H3 Beifahrer mit oh	gelb		
FMVSS208 2008 Front 30*-Wand H3 Fahrer mit ohne	gelb		
FMVSS208 2008 Front ODB 40% Beifahrer HF mit Gur	grün		
FMVSS208 2008 Front ODB 40% Fahrer HF mit Gurt	rot		
Seite			
Front	rot		
FMVSS208 2008 Front 100%Wand Beifahrer HF mit G	rot		1
Abteilung B	rot		
O-TEF	grau		

Kriterien	Jira Tickets	allg. Lastfallbeschreibungen	Simulationsdaten
Kriterium	Ziel	Ist	Meilenstein Datum
HIC15	x <= 560.0(700.0)	710.0	DE 09.03.2016 Max
Neck Compression Force	x <= 2016.0(4000.0)	2030.0	DE 16.02.2016 Max
Neck NTE	x <= 0.8(1.0)	1.0	DE 16.02.2016 Max
Chest Acceleration 3ms	x <= 470.9(0)	470.0	DE 03.03.2016 Max
Chest Deflection max	x <= 0.042(0)	0.031	DE 16.02.2016 Max
Left Femur Force	x <= 5444.0(10000.0)	5234.0	DE 16.02.2016 Max
Neck NCE	x <= 0.8(1.0)	0.4	DE 16.02.2016 Max
Neck NCF	x <= 0.8(1.0)	0.4	DE 16.02.2016 Max
Neck NTF	x <= 0.8(1.0)	0.5	DE 16.02.2016 Max
Neck Tension Force	x <= 2096.0(4170.0)	2010.0	DE 16.02.2016 Max
Right Femur Force	x <= 5444.0(10000.0)	4812.0	DE 16.02.2016 Max

Lastfalldokumente

Name	Größe	Typ	Zuletzt geändert am
criterium_plot.jpg	548.1kB	Bild	02.03.16
2016-03-02_14-25-00_status-e	33.0kB	Excel-Tabelle	02.03.16

Verification: Monitor & Report Project Status

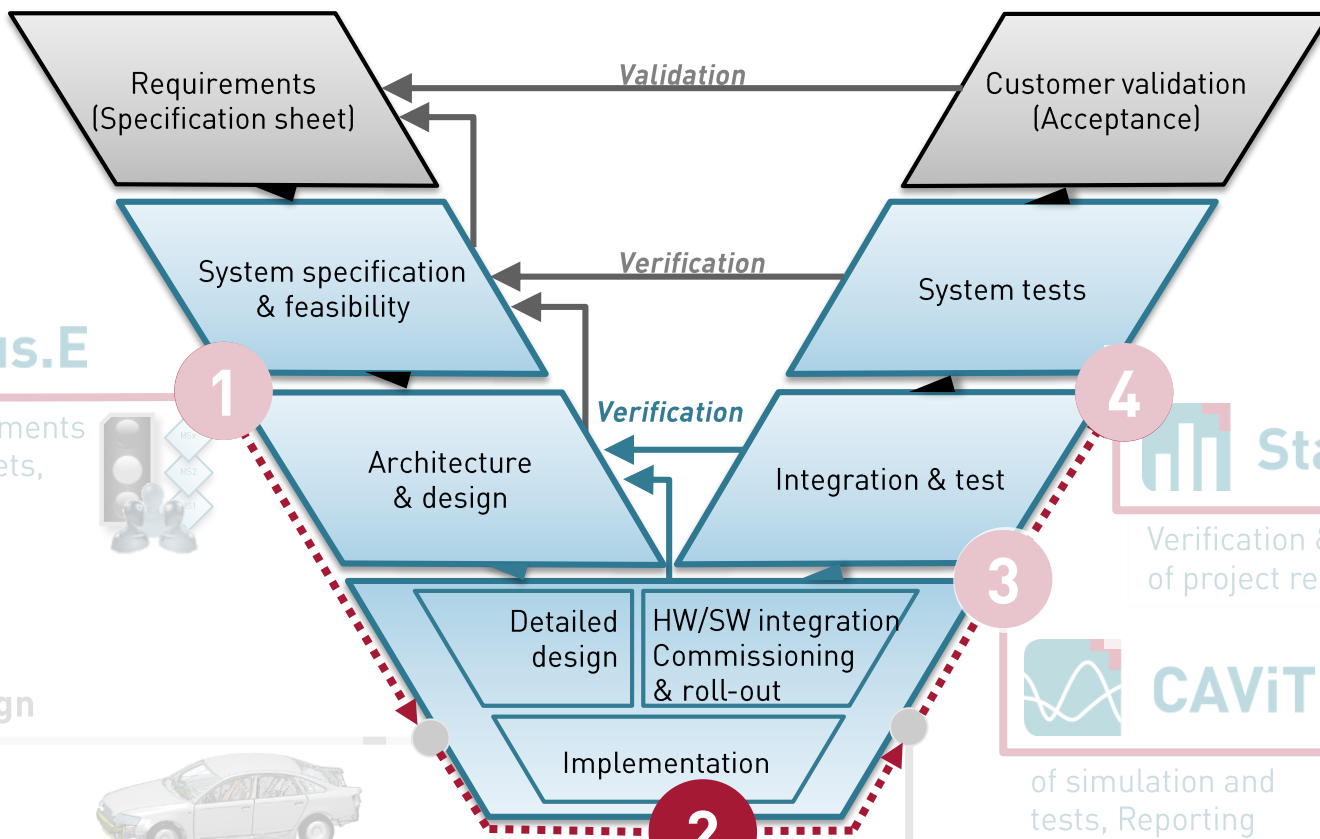


Report status for project milestone or date

Detailed view of individual test case criteria (e.g. reported by CAViT)

- Fulfillment of test cases at selected date
- Hierarchical status aggregation

Introduction – Systems Engineering Process



Setup of requirements and project targets, milestones and responsibilities



Verification & monitoring of project requirements

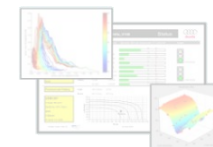


Detailed design

CAD / DMU



of simulation and tests, Reporting

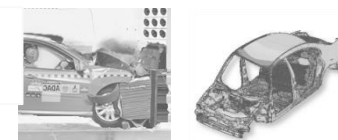


Setup of simulation models and test prototypes



Solving / Testing

Perform simulation & test



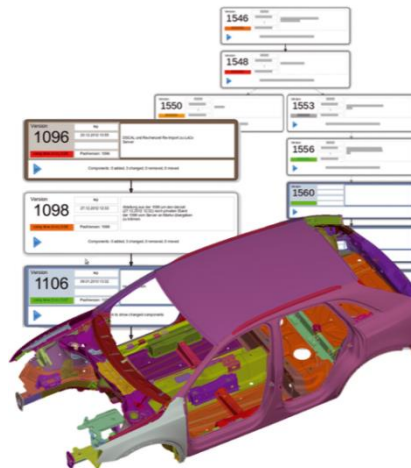
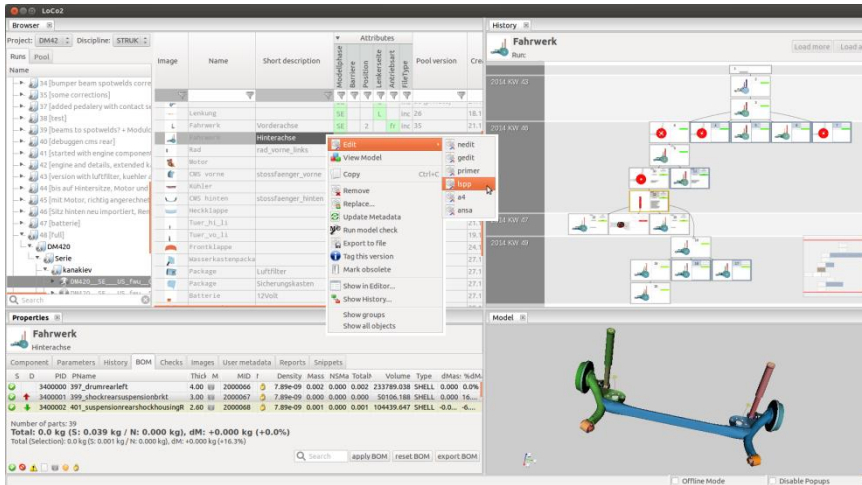
Characterization

■ 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, ...
- Data and version management
- History tracking
- Job submit and monitoring
- Quality checks of models
- Advanced security features
 - Two factor authentication
 - Encryption
- Distributed, collaborative work environment
- Access-, roles and rights management
- Optimization, robustness, DOE, ...
- ...



LoCo – Collaborative Product Development



■ Distributed locations

- Direct integration in CAE development process of all partners

- Uniform working environment

- Automatic synchronization of relevant data

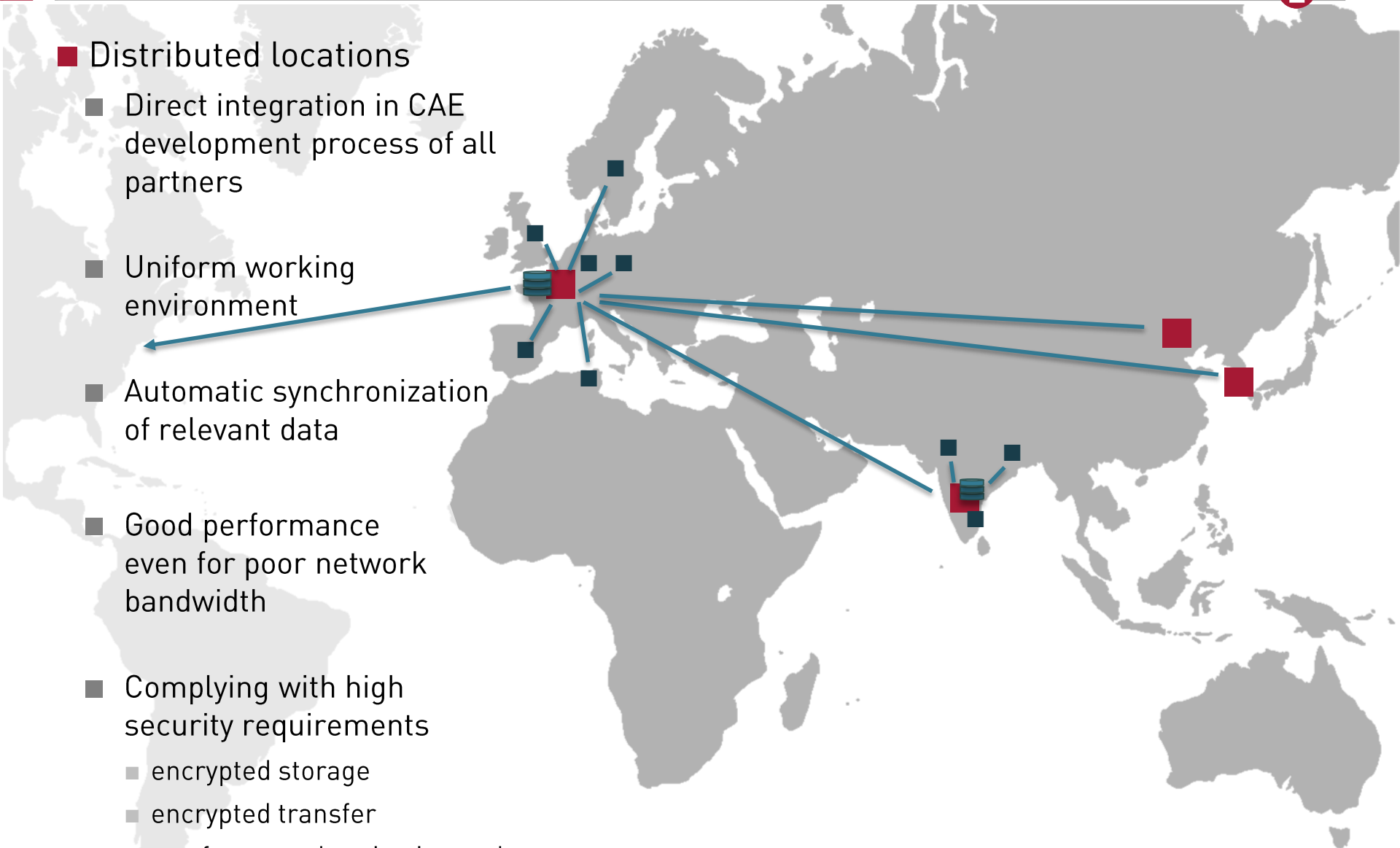
- Good performance even for poor network bandwidth

- Complying with high security requirements

- encrypted storage
- encrypted transfer
- two factor authentication and encryption

SCALE

- external partners
- sites

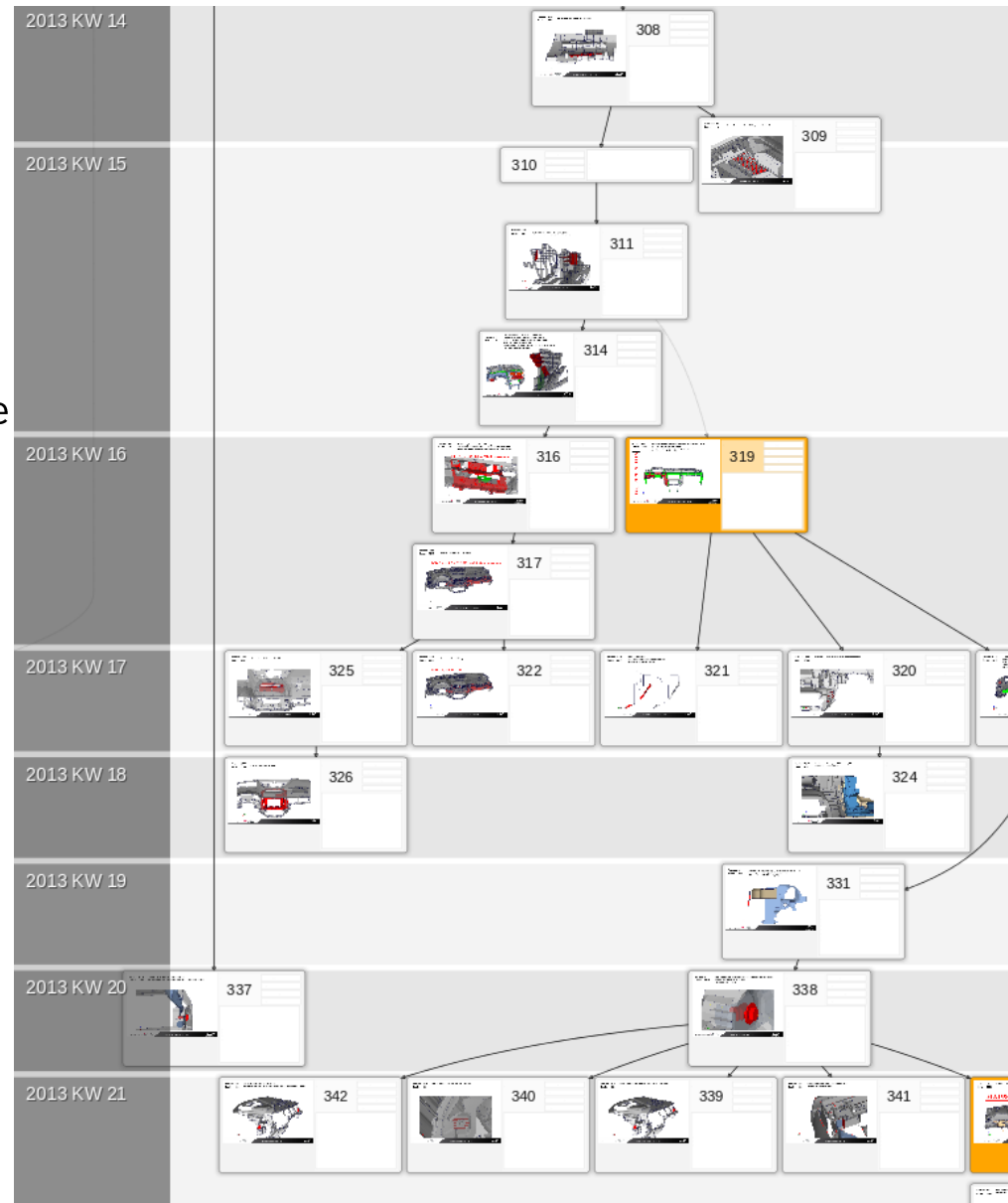


LoCo: Version Control

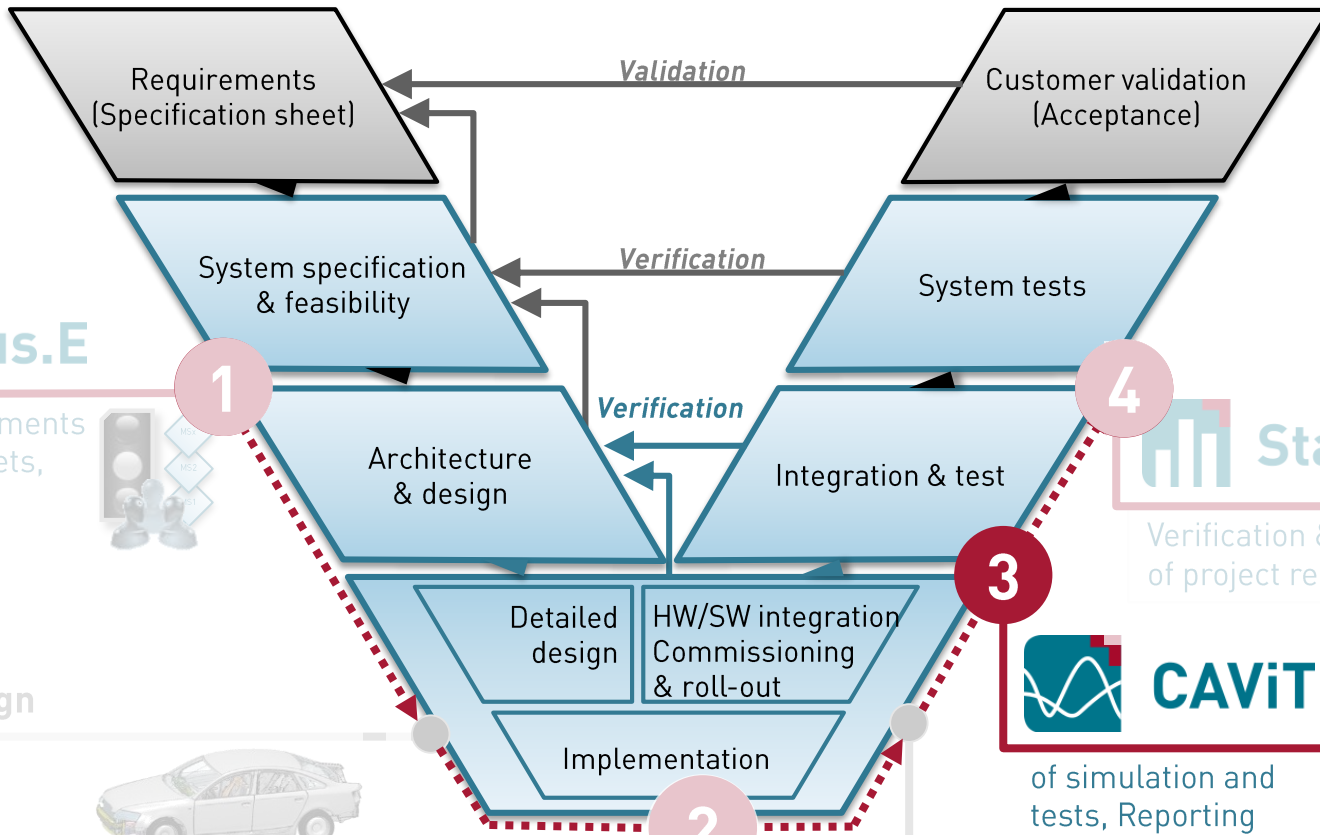


- Version control is the management of changes to data
- Motivation:
 - Simulation is change driven
 - Changes need to be documented
 - Engineers need to work on the same
- In LoCo every object is versioned

Simulation Runs
Scripts **Modules** Folders
Meshes Parameters



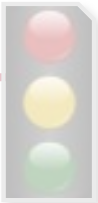
Introduction – Systems Engineering Process



Setup of requirements and project targets, milestones and responsibilities



Verification & monitoring of project requirements



Detailed design

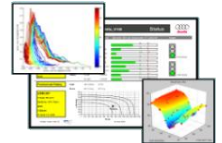
CAD / DMU



Setup of simulation models and test prototypes

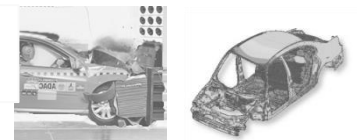


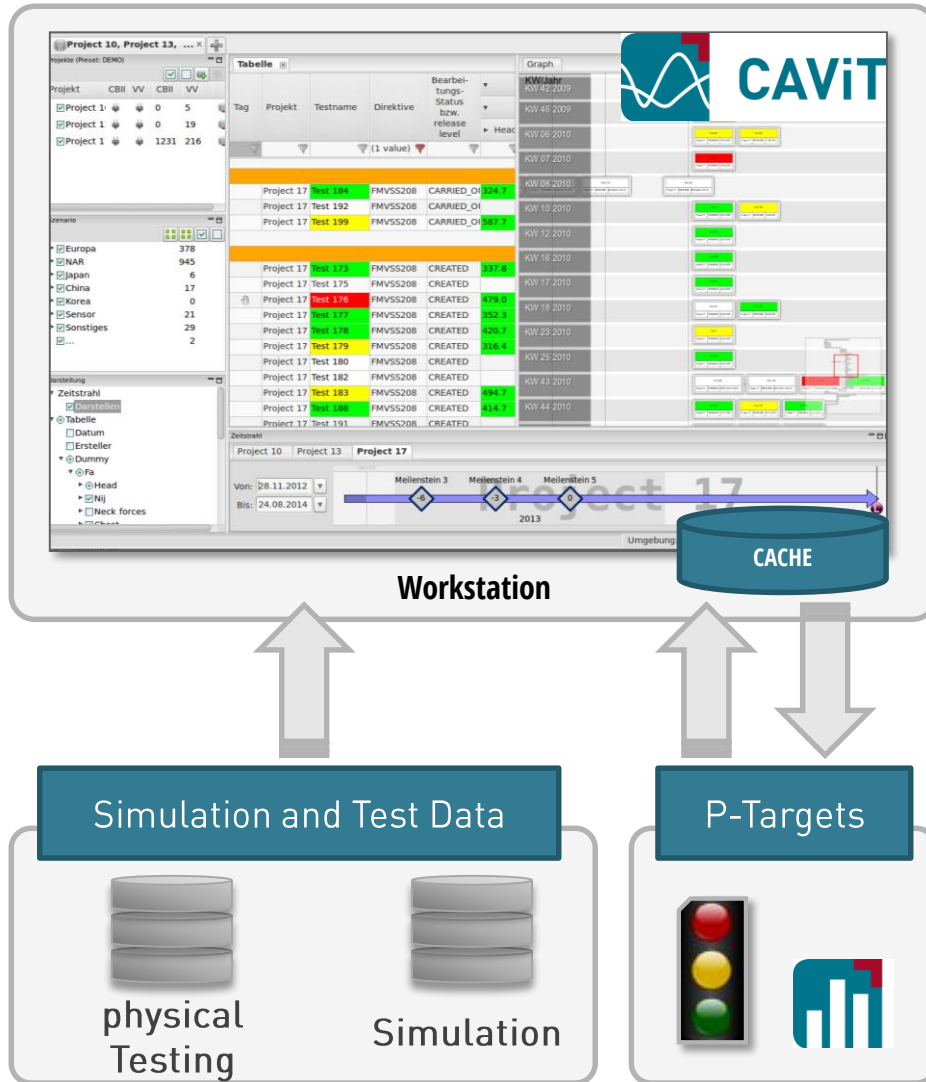
of simulation and tests, Reporting



Solving / Testing

Perform simulation & test





Characterization

- Data collection from several backend systems
- Provide easy and fast access to physical test and simulation results
- Uniform handling of test and simulation data
- Provide workflow automation and reporting capabilities
- Interfacing with Status.E for test cases and assessment criteria

Project 10, Project 13, ...

Projekte (Preset: DEMO)

Projekt	CBII	VV	CBII	VV
Project 1	0	5		
Project 1	0	19		
Project 1	1231	216		

Szenario

- Europa: 378
- NAR: 945
- Japan: 6
- China: 17
- Korea: 0
- Sensor: 21
- Sonstiges: 29
- ...: 2

Darstellung

- Zeitstrahl
 - Darstellen
 - Tabelle
 - Datum
 - Ersteller
 - Dummy
 - Fa
 - Head
 - Nij
 - Neck forces
 - Chest

Tabular view
of physical tests and simulations

Tag	Projekt	Testname	Direktive	Bearbeitungs-Status bzw. release level	Value
	Project 17	Test 184	FMVSS208	CARRIED_OI	324.7
	Project 17	Test 192	FMVSS208	CARRIED_OI	
	Project 17	Test 199	FMVSS208	CARRIED_OI	587.7
	Project 17	Test 173	FMVSS208	CREATED	337.8
	Project 17	Test 175	FMVSS208	CREATED	
	Project 17	Test 176	FMVSS208	CREATED	
	Project 17	Test 177	FMVSS208	CREATED	
	Project 17	Test 178	FMVSS208	CREATED	
	Project 17	Test 179	FMVSS208	CREATED	
	Project 17	Test 180	FMVSS208	CREATED	
	Project 17	Test 182	FMVSS208	CREATED	
	Project 17	Test 183	FMVSS208	CREATED	
	Project 17	Test 188	FMVSS208	CREATED	414.7
	Project 17	Test 191	FMVSS208	CREATED	

Graph view
of physical tests and simulations

Time Line / Milestones

Zeitstrahl

Project 10 | Project 13 | **Project 17**

Von: 28.11.2012 | Bis: 24.08.2014

Meilenstein 3 (-6) | Meilenstein 4 (-3) | Meilenstein 5 (0)

2013 | 2014

Umgebung: Unknown | Offline Modus

CAViT - V2.

CAViT Ansicht Extra Hilfe

Sitzungen Mitteilungs-Konsole

Project106 Project106 x Project106

Seitenschutz (ver. 1.1.9)

- Projekte 71
 - Project106 71
 - CAE-Bench 25
 - VisVerdi/Falcon 46
 - Ordner

Szenario

- RdW Gesetz 5
 - ECER95 Barriere 5
- RdW Consumer 24
 - EuroNCAP 2014 18
 - EuroNCAP 2015 2
 - JapanNCAP 1
 - ChinaNCAP 2
 - KoreaNCAP 0
 - AE-MDB Barriere 1
- NAR Gesetz 6
 - FMVSS214 Barriere 1
 - FMVSS214 Pfahl E52re 3
 - FMVSS214 Pfahl SID2s 1
 - FMVSS214 Pfahl WS 50% 0
 - FMVSS214 Pfahl WS 5% 0

Tabellenkonfiguration

- Name
- Versuchsgrund
- Label
- Datum
- Allgemeine-Info
- Versuchs-Info
- Simulations-Info
- Insassen
 - vorne
 - DUMMY Typ

Property panel

Visualization of simulation / test data

- Attributes / Key results
- Channels
- Images
- Movies/Solver output files
- Documents
- Measure data

Eigenschaften

Search

Isocode Name Wert

Test_5134 (93 Elemente)

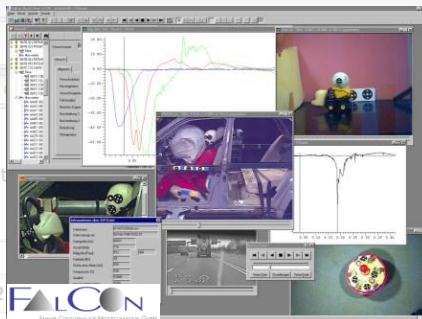
- B_Saeule_mitte.picture.png 2,5 kB
- B_Saeule_oben.picture.png 37,5 kB
- B_Saeule_unten.picture.png 42,7 kB
- C_Saeule_ob.picture.png 31,8 kB
- C_Saeule_un.picture.png 20,6 kB
- Fersenblech.picture.png 19,7 kB
- ont_Occupant_Rating.picture.png 131,7 kB
- Rear_Occupant_Rating.picture.png 132,7 kB
- Schweller_SQT.picture.png 17,3 kB
- Sitz_vo_Lehne.picture.png 41,7 kB

Name	Value 1	Value 2	Value 3	Value 4	Value 5
Test_5281					
Test_5274					
Test_5250	42.7		19.2	675.3	
Test_5251	34.0		1.2	676.8	
Test_5270					
Test_5252	429.2	1276.1	1227.0	51.4	
Test_5253					
377	23.0		314.8	15.9	261.5

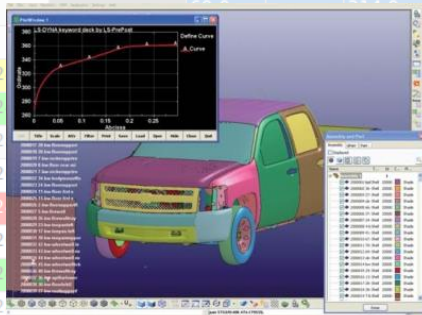
Evaluation: Access Result Data



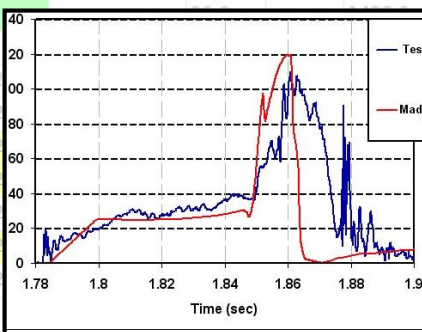
Access and open movies and media data with external viewers



Integration of Postprocessors: Analyze simulation results



Quick preview of curves and measure data and documents



Eigenschaften

Search

Isocode	Name	Wert
Test_5134 (93 Elemente)		
	B_Saeule_mitte.picture.png	32,5 kB
	B_Saeule_oben.picture.png	37,5 kB
	B_Saeule_unten.picture.png	42,7 kB
	C_Saeule_ob.picture.png	31,8 kB
	C_Saeule_un.picture.png	20,6 kB
	Fersenblech.picture.png	19,7 kB
	Front_Occupant_Rating.picture.png	131,7 kB
	Rear_Occupant_Rating.picture.png	132,7 kB
	Schweller_SQT.picture.png	17,3 kB
	Sitz_vo_Lehne.picture.png	41,7 kB

Evaluation & Reporting: Run Tools and Reports



Extensive support for Reporting

- Generation of Word documents based on docx templates
- Dedicated support for Reporting via GNS Animator

Extendable via plugins

Flexible customization

CAViT - V2.

ct106 +

Tabelle Graph

Tag	Variante	Bewertung	Kopf	Hals	Schulter	Rippen
Test_5258						
Test_5497						
★ 377		69.0		314.9	18.6	402.6
377		222.4				40.5
Test_5244		244.0	811.6	654.5		31.1
Test_5245						
Test_5283						
Test_5269						
Test_5246		521.5			28.4	170
Test_5265						
Test_5247						24.5
Test_5282						
Test_5264						
377			1		25.1	562.1
377						30.1
Test_5281						
Test_5274						
Test_5250						19.2
Test_5251						1.2
Test_5270						
Test_5252		429.2	1276.1	1227.0		51.4
Test_5253						
377		23.0		314.8		15.9

Werkzeuge...
Kennzeichnen als...
Bewerten
Auswahl neu laden...
Ausblenden...
Zu Ordner hinzufügen...

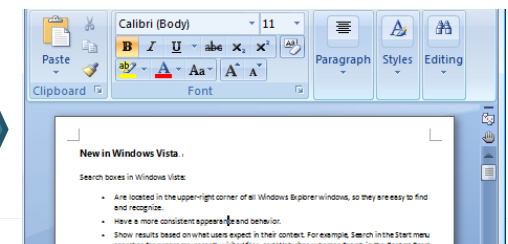
[PDF/PPTs Reports]

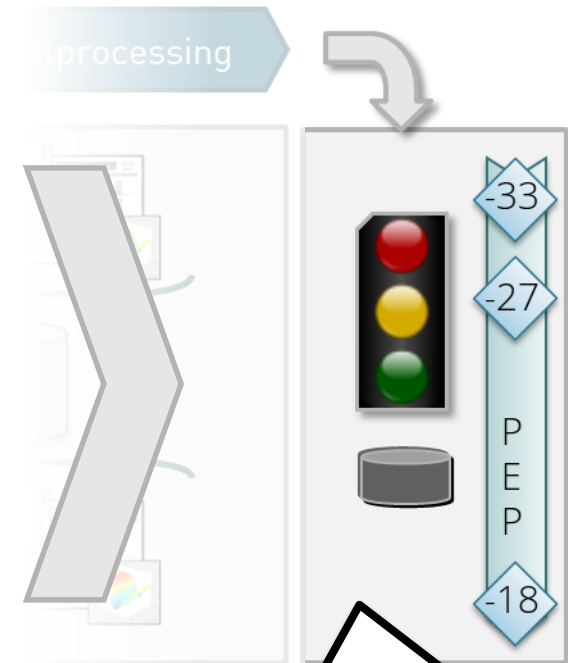
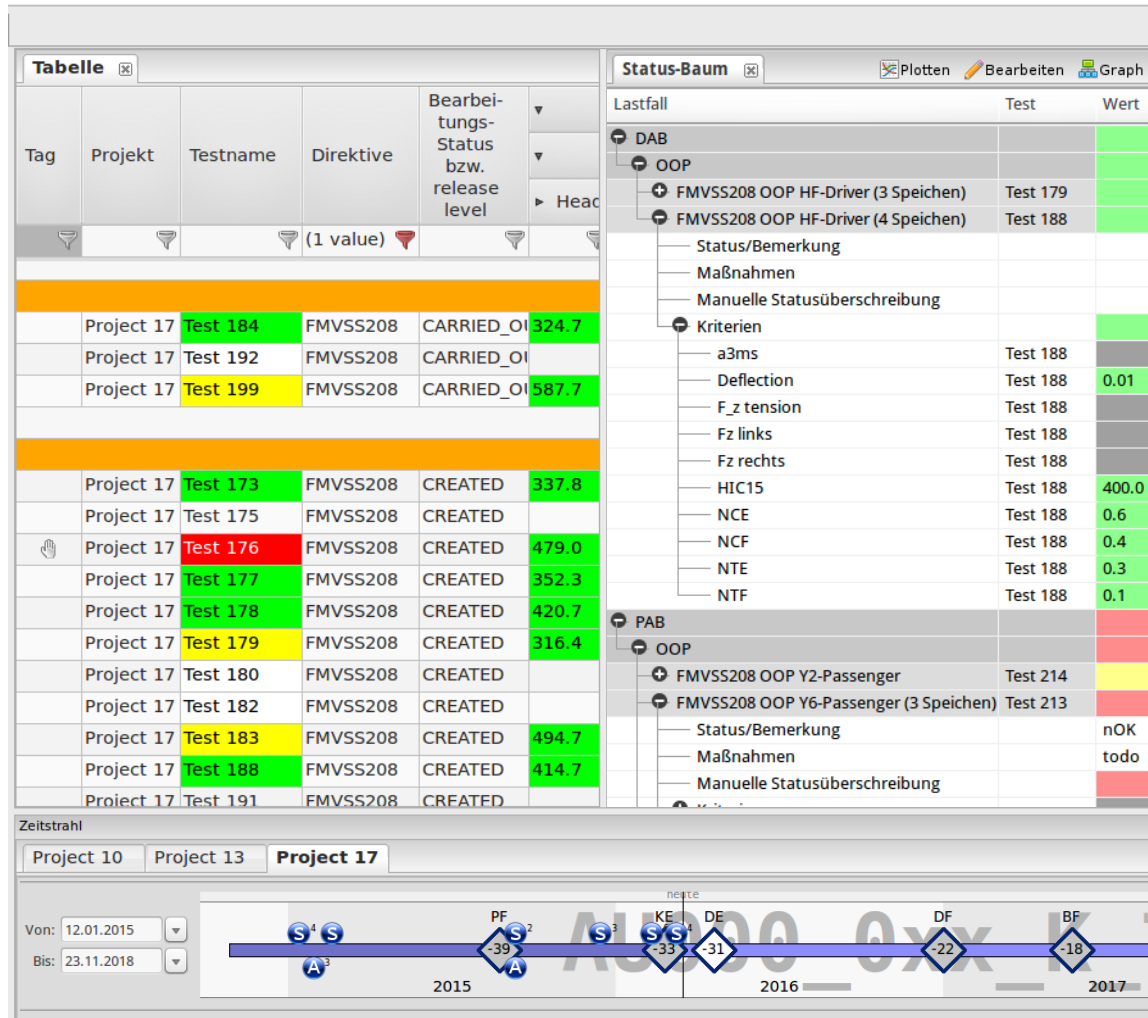


[Video Overlay]



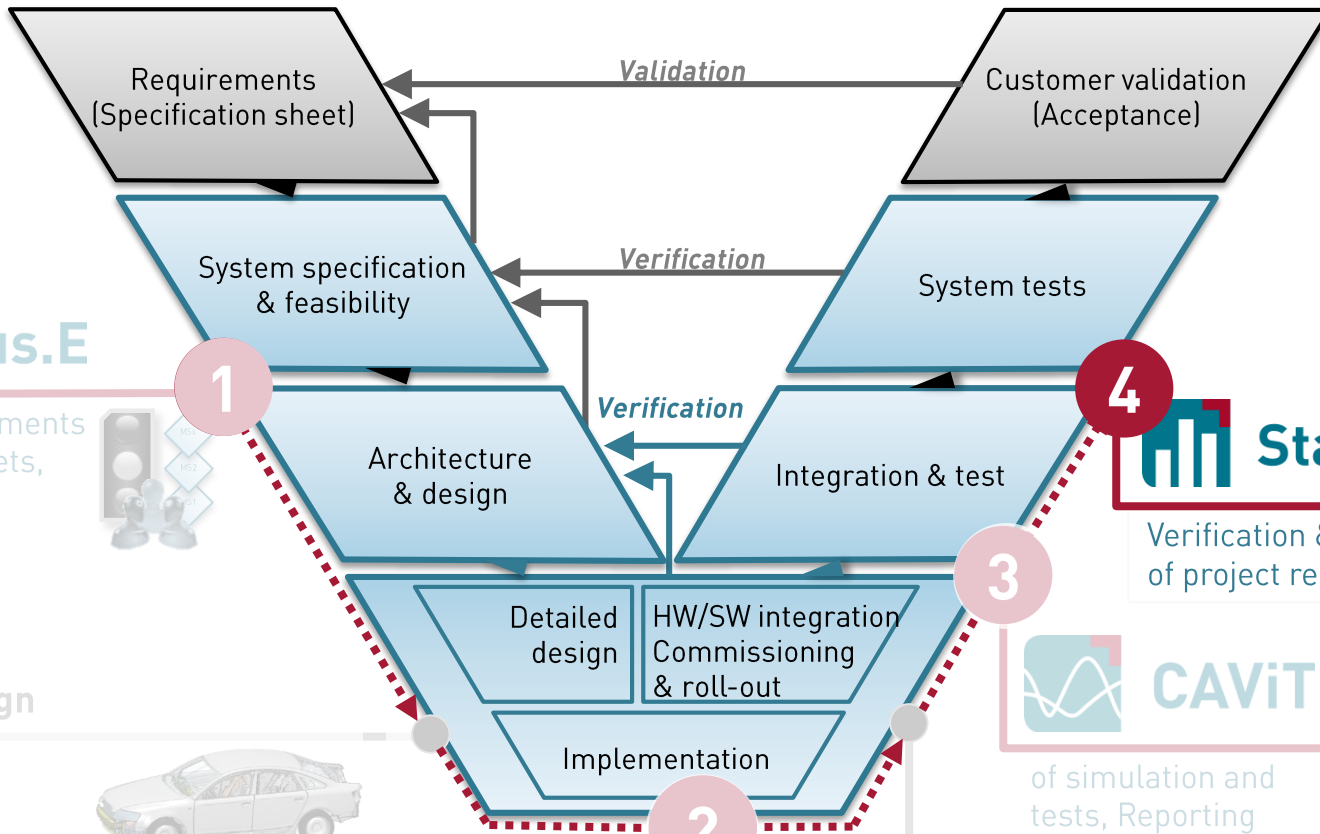
[docx Reports]





Report to Monitoring Application

Introduction – Systems Engineering Process



Setup of requirements and project targets, milestones and responsibilities



Verification & monitoring of project requirements



Detailed design

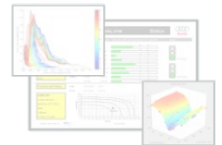
CAD / DMU



Setup of simulation models and test prototypes

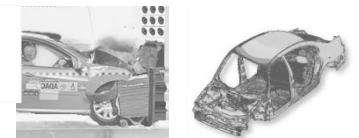


of simulation and tests, Reporting

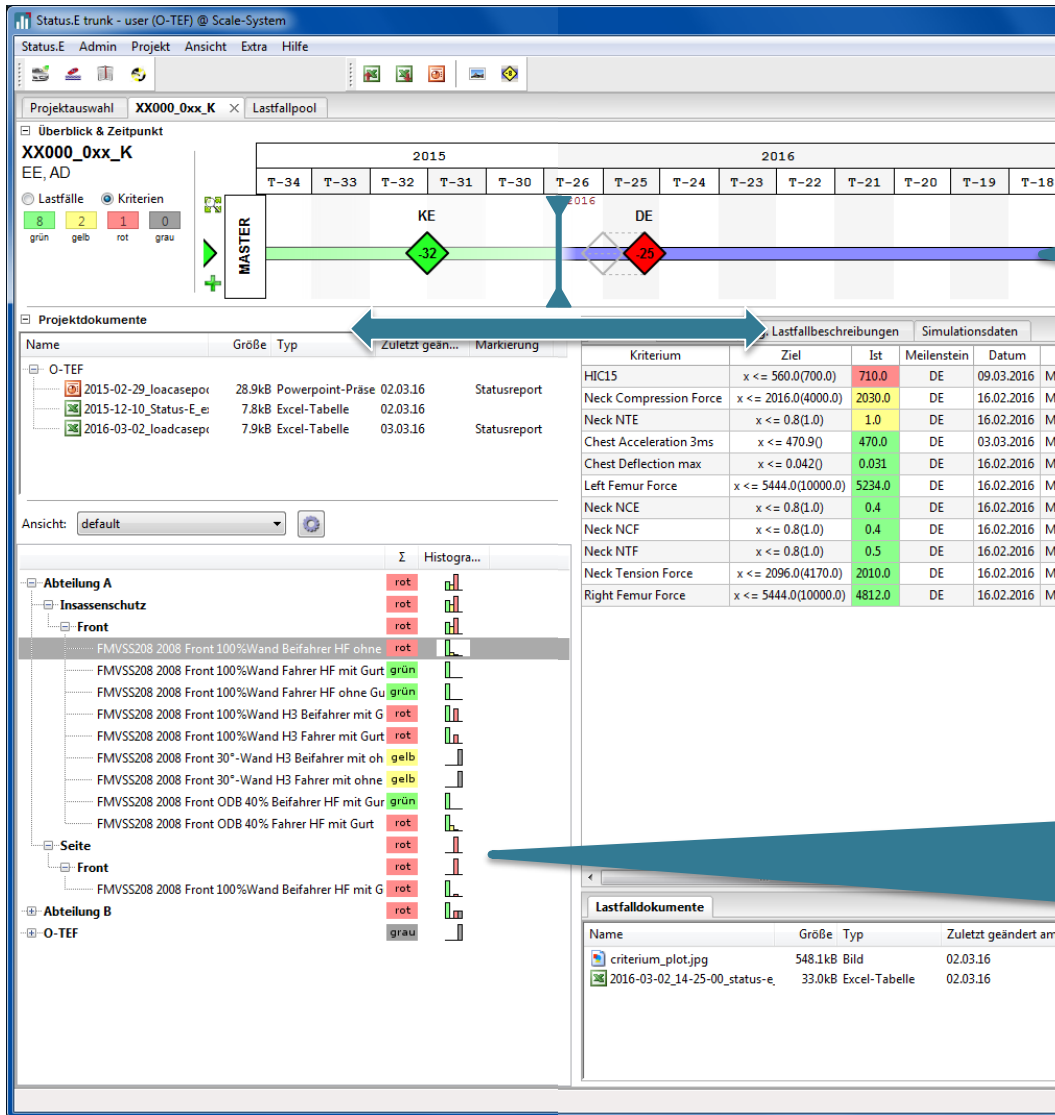


Solving / Testing

Perform simulation & test



Verification: Monitor & Report Project Status



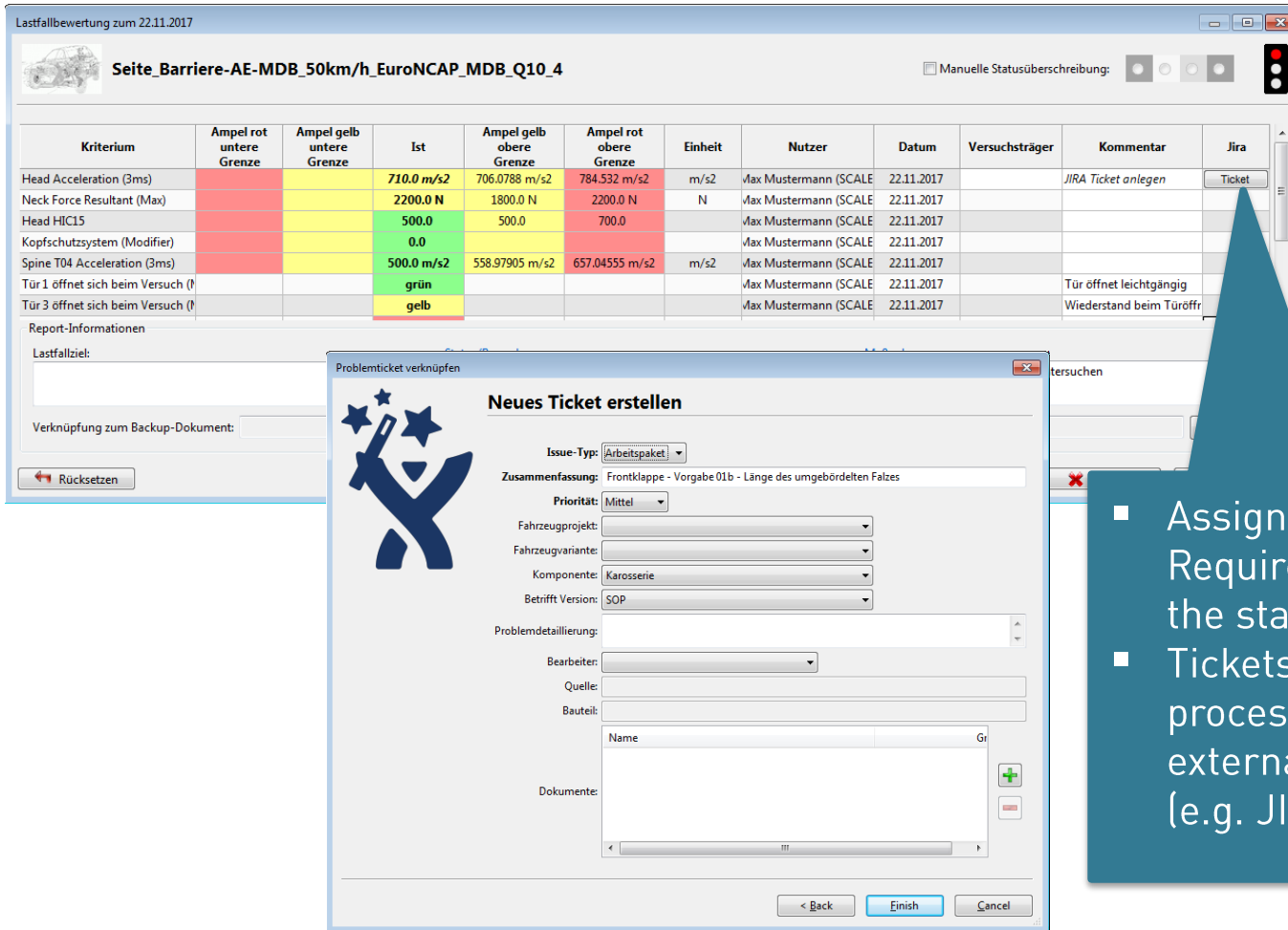
Report status for a specific project milestone or date

Detailed view of individual test case criteria Imported from CAViT

■ Fulfillment of test cases at selected date

■ Hierarchical status aggregation

- Task management system integration
 - Tickets can be generated and tracked per requirement



The screenshot displays a software interface for monitoring and reporting project status. The main window, titled 'Lastfallbewertung zum 22.11.2017', shows a table of test results for 'Seite_Barriere-AE-MDB_50km/h_EuroNCAP_MDB_Q10_4'. The table includes columns for 'Kriterium', 'Ampel rot untere Grenze', 'Ampel gelb untere Grenze', 'Ist', 'Ampel gelb obere Grenze', 'Ampel rot obere Grenze', 'Einheit', 'Nutzer', 'Datum', 'Versuchsträger', 'Kommentar', and 'Jira'. A 'Ticket' button is visible in the 'Jira' column for the 'Head Acceleration (3ms)' row.

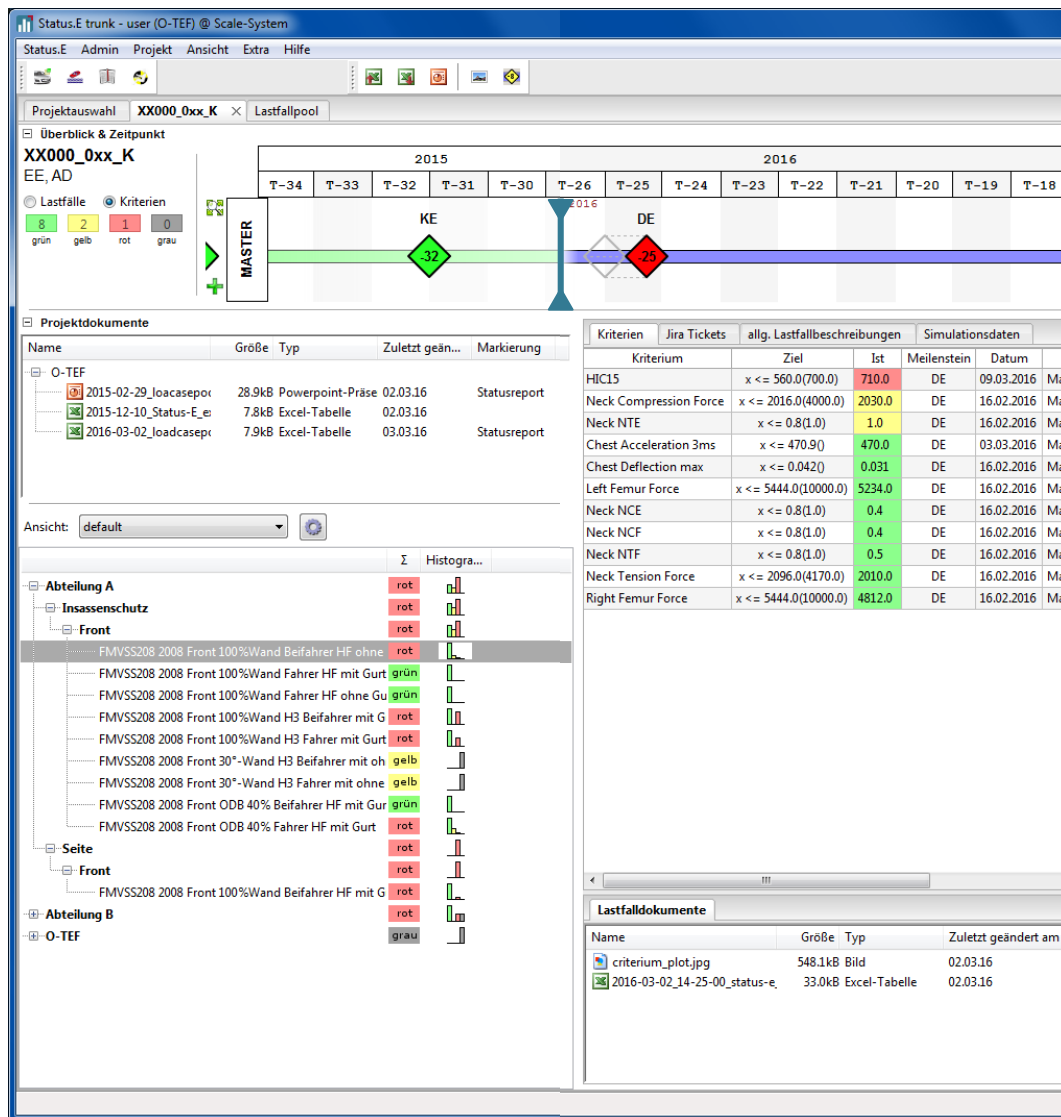
Overlaid on the main window is a dialog box titled 'Neues Ticket erstellen'. The dialog contains the following fields and options:

- Issue-Typ: Arbeitspaket
- Zusammenfassung: Frontklappe - Vorgabe 01b - Länge des umgebördelten Falzes
- Priorität: Mittel
- Fahrzeugprojekt: [Dropdown]
- Fahrzeugvariante: [Dropdown]
- Komponente: Karosserie
- Betrifft Version: SOP
- Problemdetaillierung: [Text area]
- Bearbeiter: [Dropdown]
- Quelle: [Text field]
- Bauteil: [Text field]
- Name: [Text field]
- Dokument: [Text area]

Buttons at the bottom of the dialog include '< Back', 'Finish', and 'Cancel'.

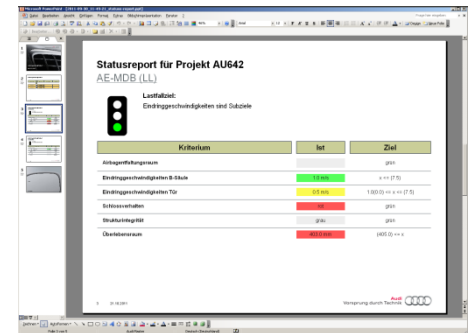
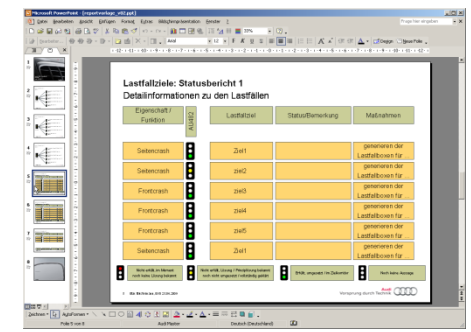
- Assign Tickets to Requirements and follow the status
- Tickets and the further process are handled by an external ticket system (e.g. JIRA)

Verification: Monitor & Report Project Status



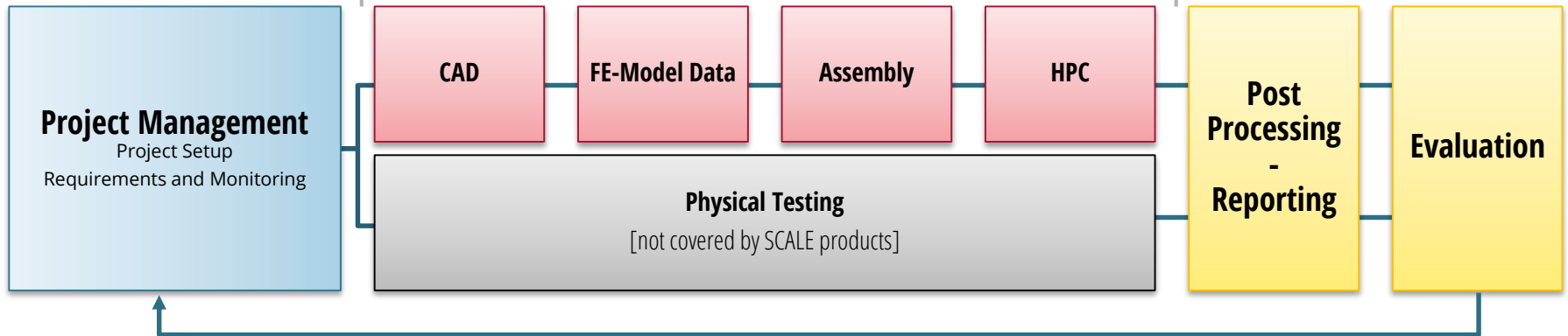
Generation of project status slides

[PPTX]



SUMMARY - SCALE Tools in Process

SCALE Tools



Vielen Dank!

SCALE 