NWC25
NAFEMS WORLD CONGRESS

Enhancing collaboration on multibody dynamics simulations with an SDM system

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SCALE
IT-Solutions for CAE

Multibody dynamics simulation in a SDM system

Simulation Setup

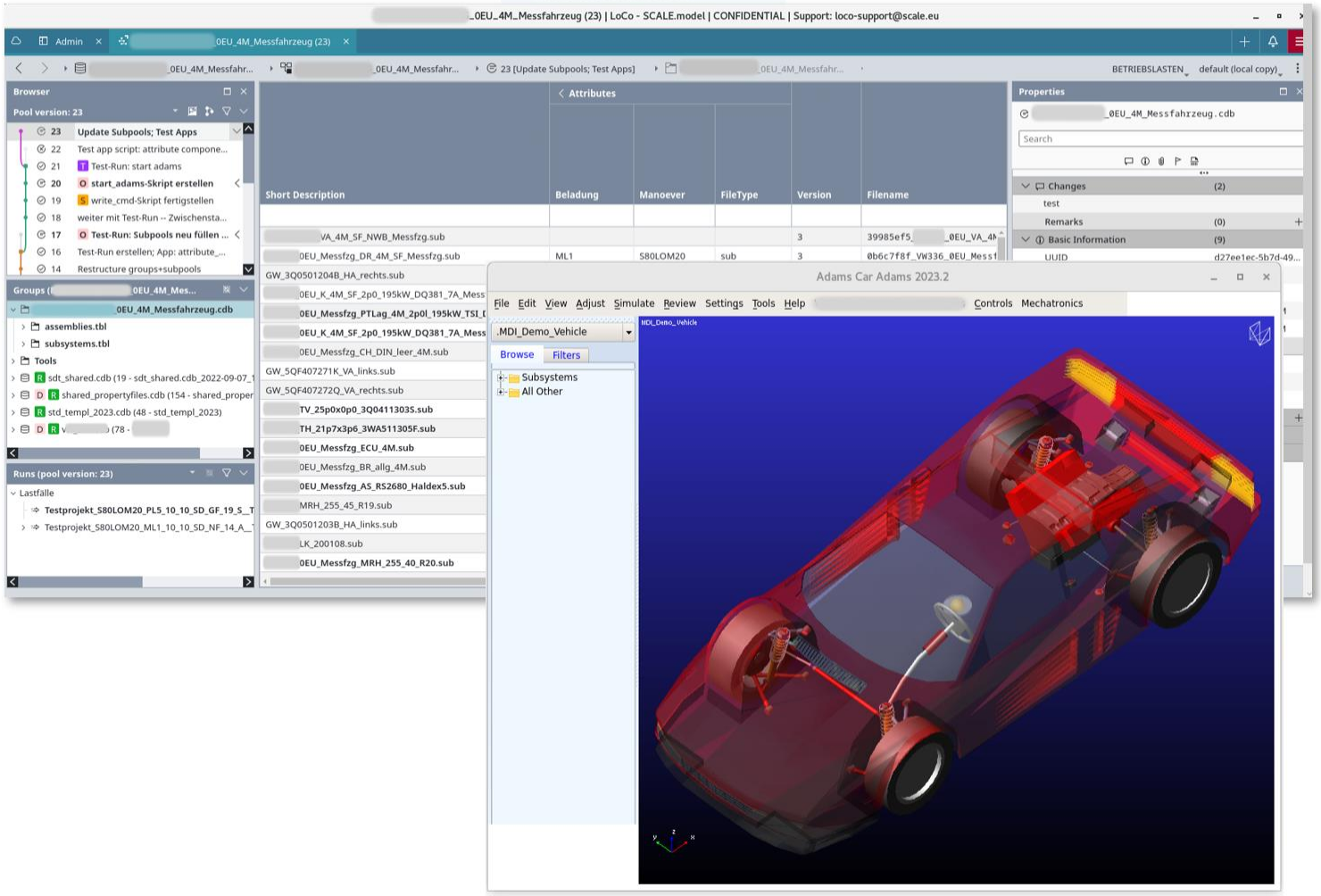
Input Data Handling

Result Data

Storage & Evaluation

Monitor

Project Targets



The SDM as a repository for ADAMS

models, roads and maneuvers

Complex model database structure

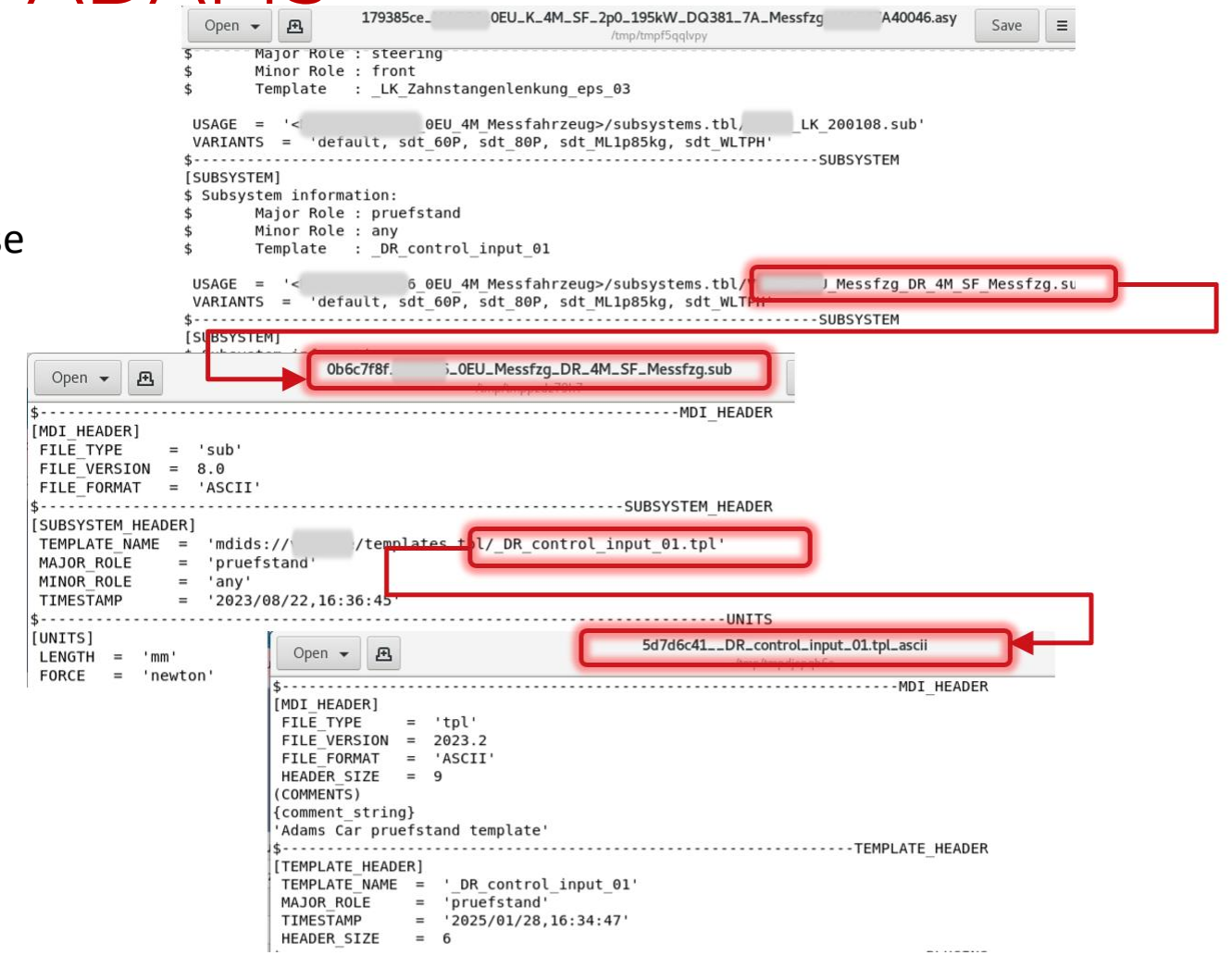
- Vehicle model with all files stored in a large .cdb database
  Over a 100 files make up an ADAMS vehicle model
- Include files hierarchically reference each other
  Assembly (.asy) - Subsystem (.sub) - Template (.tpl) - Property File (e.g. .bus, .dpr)

Making the model drive with course and maneuver data

- Additional databases for files that specify where and how the vehicle will drive
  Detailed information about road, course and maneuver

The SDM as a repository

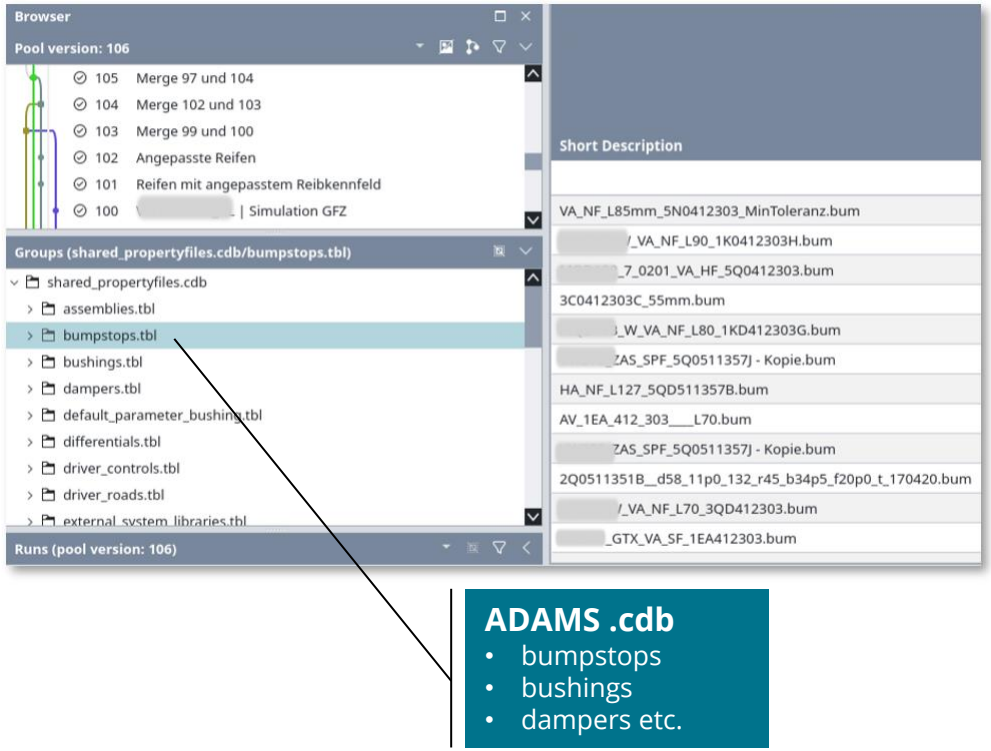
- Store the databases and perform further development
  Compact overview of model changes and version history in the SDM



Challenges for the SDM system

MBD with ADAMS in an SDM system

- Challenge: Models and simulations are set up as a whole
  Models are represented as a whole in complex directory structures
- Benefits: Version control, automation and collaboration
  Combining the advantages of SDM with the way how ADAMS works is not trivial
- Implementation needs to be done together with ADAMS users
  Various obstacles must be overcome in collaboration with the experienced ADAMS user. The goal is to find the best solution for the user.



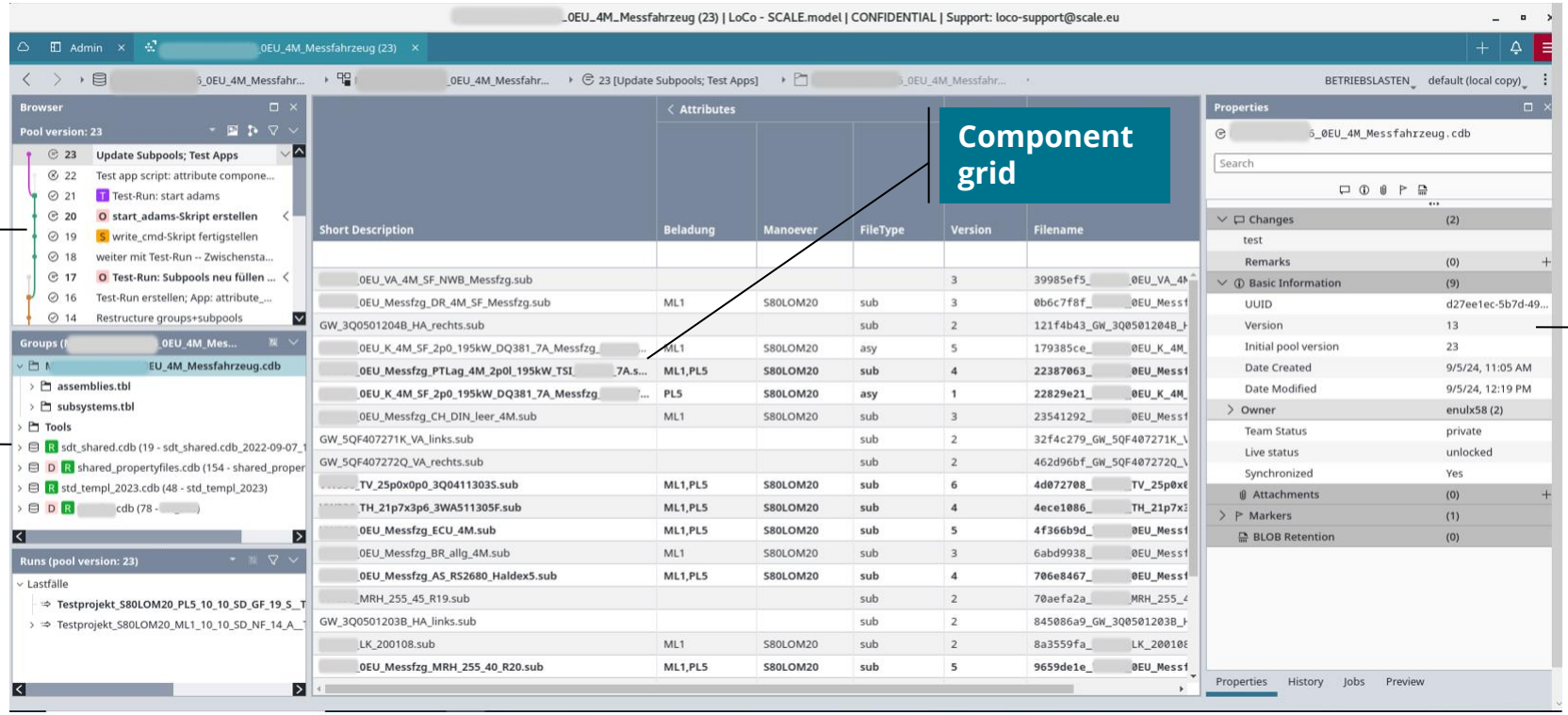
Challenge I

- Working on ADAMS models with data from the SDM requires reconstructing its specific file structure on the user's machine
  Complex scripts must be designed that export the correct files from the SDM to the correct place

Challenge II

- Running ADAMS simulations from the SDM requires collecting a large number of input files and exporting them
  Over a 100 files need to be assigned to a single simulation run

Setting up the vehicle project



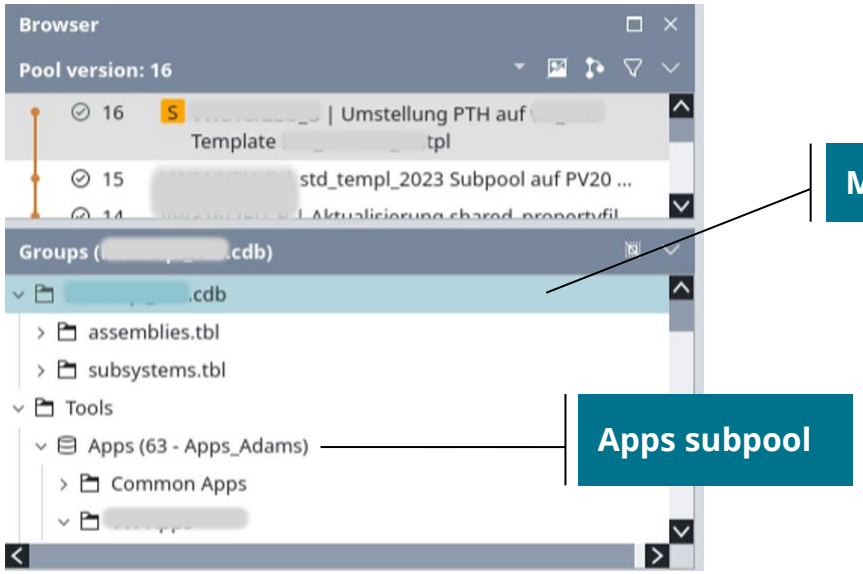
Main elements in the SDM system

- One pool for each vehicle project
  All data stored in one place
- Rail graph for version control
  Data can be versioned in form of pool versions (private or public)
- Group structure to organize the pool data
  Deposit components in form of databases (private/global)
- Grid with pool data on display
  User-defined overview of components and their properties
- Properties and history of each component in the pool
  Compact and detailed information about a component

Mapping the MBD structure

Group structure

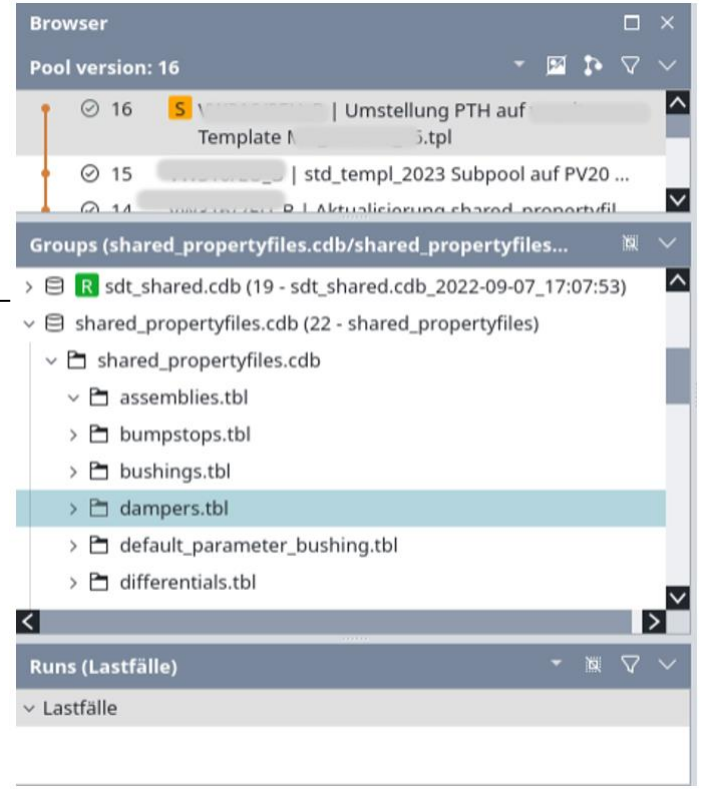
- ADAMS vehicle model .cdb as main group in the pool
  Assembly and subsystem files are stored and developed in the .cdb-directory
- Apps as library with tools and scripts
  Collection of tools & scripts that can be tailored to the user's needs
  - Apps are developed and maintained by few experts
    After publishing an app version, it can be distributed to all users



Main ADAMS .cdb

Apps subpool

Global databases
- Templates
- Property files
- Road, course and maneuver data



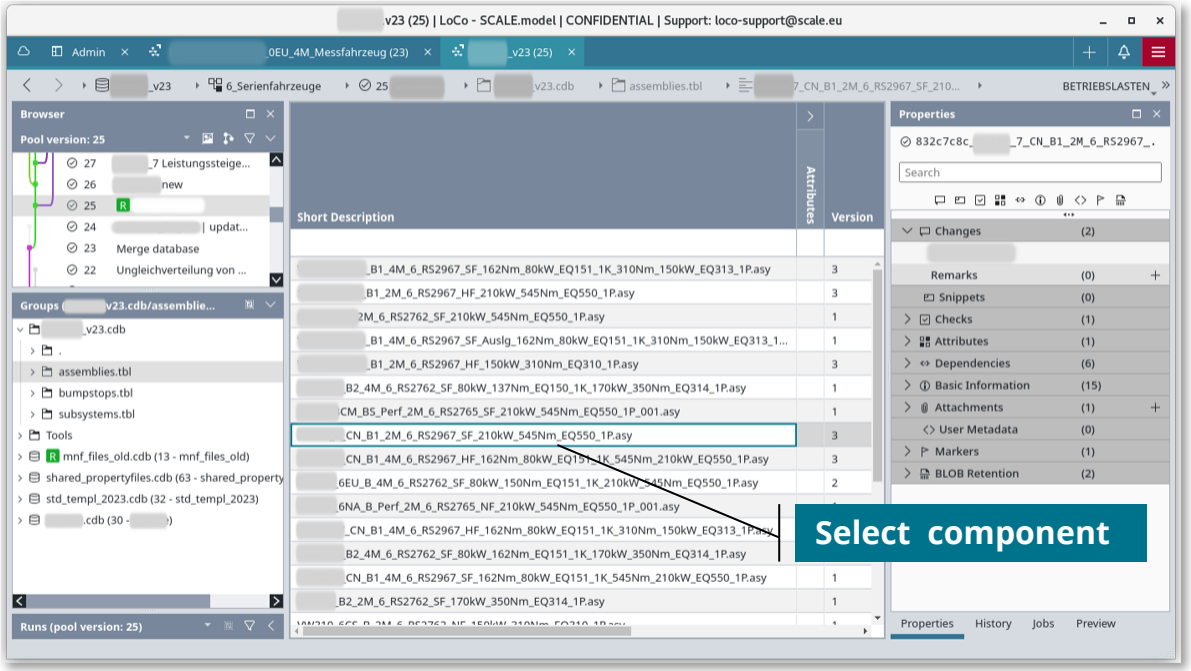
Group structure

- Additional libraries containing subordinate ADAMS files
  Templates, property Files, roads and maneuver files each as a library
- Subpools serve as global databases
  ADAMS files can be shared among different vehicle projects

Working on the MBD model from the SDM system

Open in ADAMS

- Open and modify ADAMS models directly from SDM
  assemblies, subsystems, templates
- ADAMS file structure is created on files system
  ADAMS project is opened and can be modified by ADAMS
  Changes are synchronized with the SDM system upon closing ADAMS
- Flexible configuration of ADAMS .cfg and .cmd files
  Define databases, load additional plugins, set solver settings etc.
- Assembly variant can be chosen by user
  Variants are read from the selected assembly file.
- Developed together with expert ADAMS users



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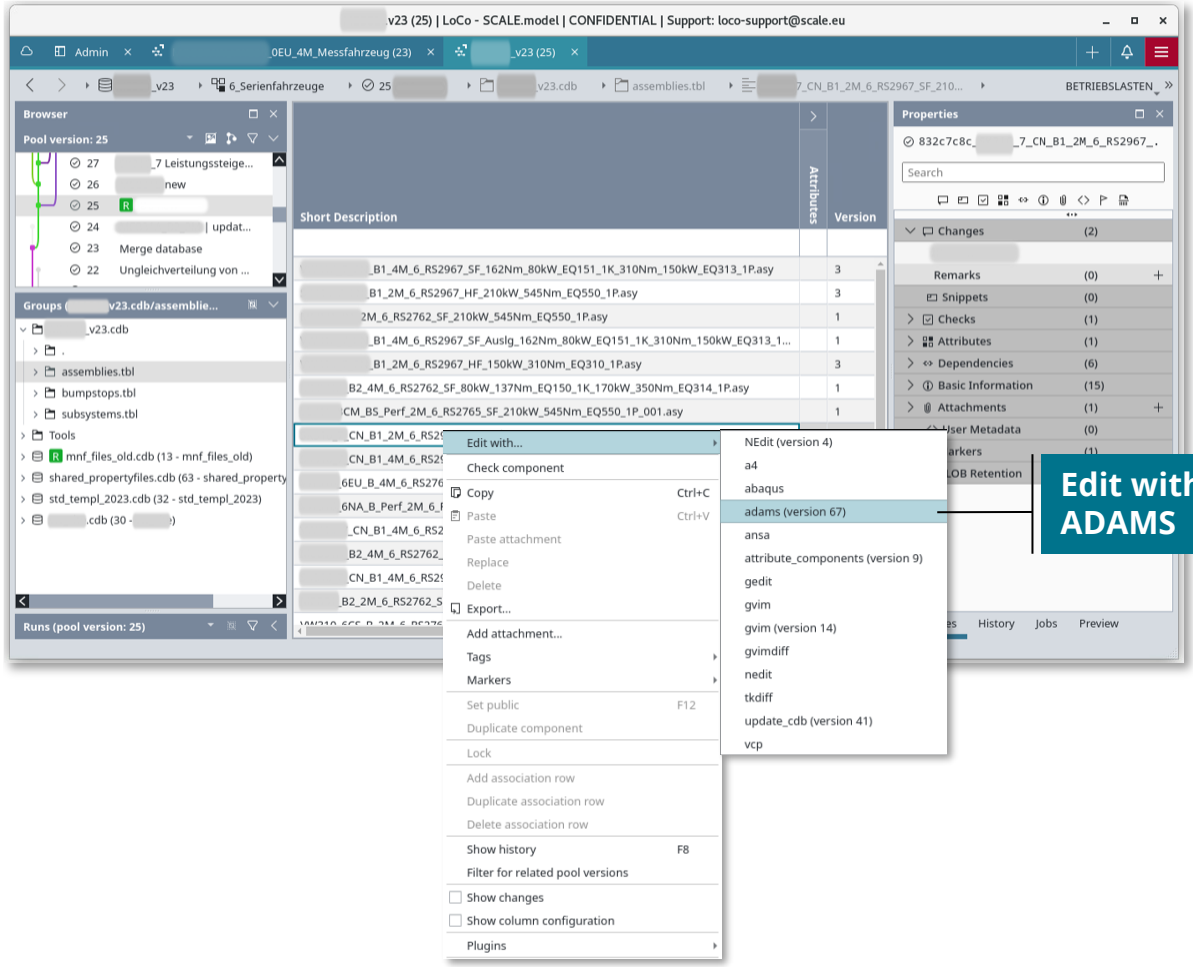

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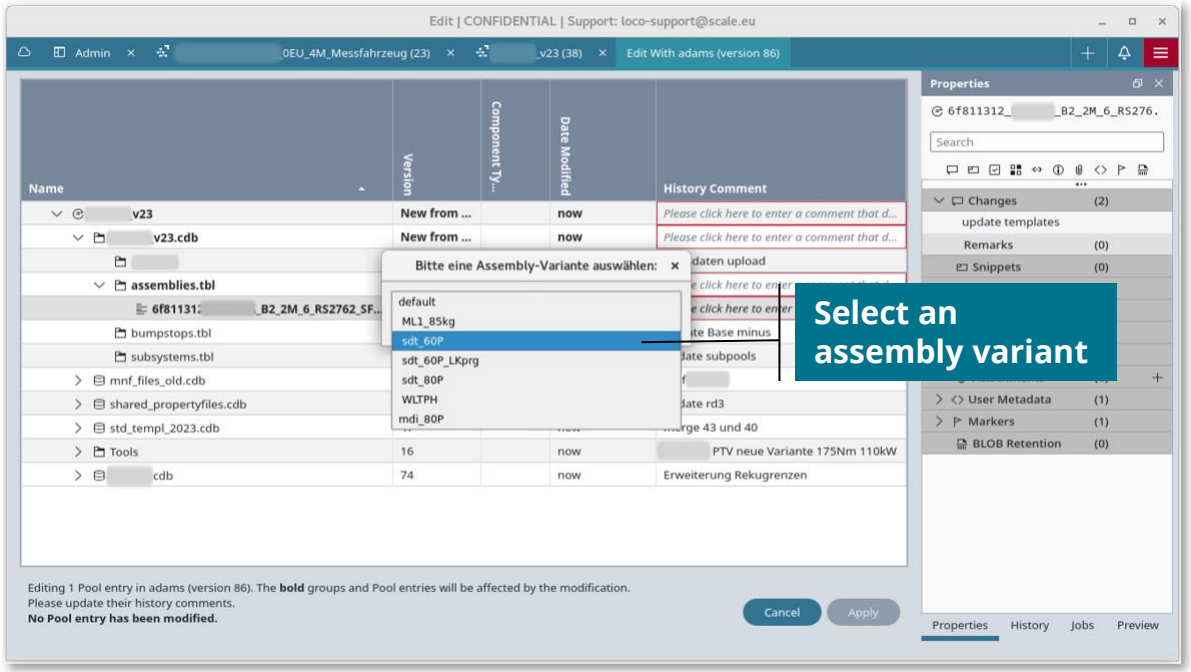

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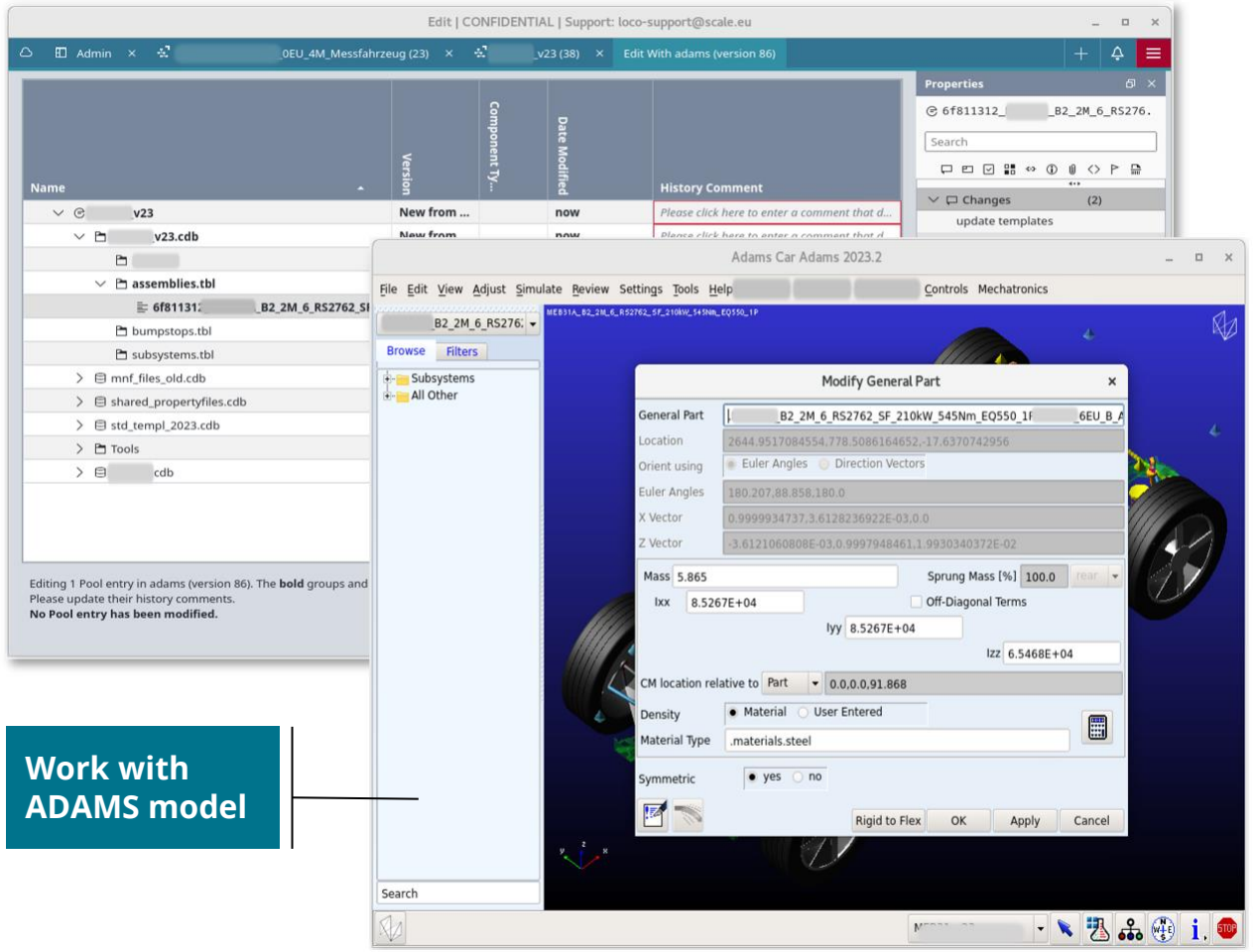

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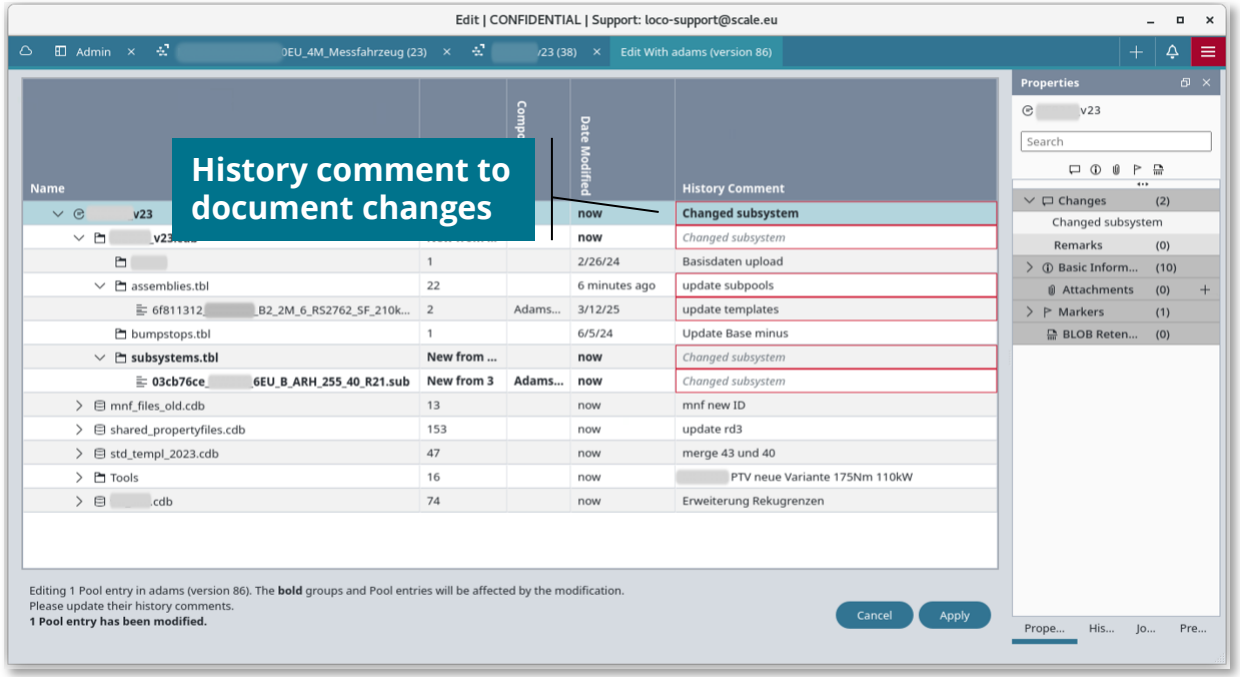
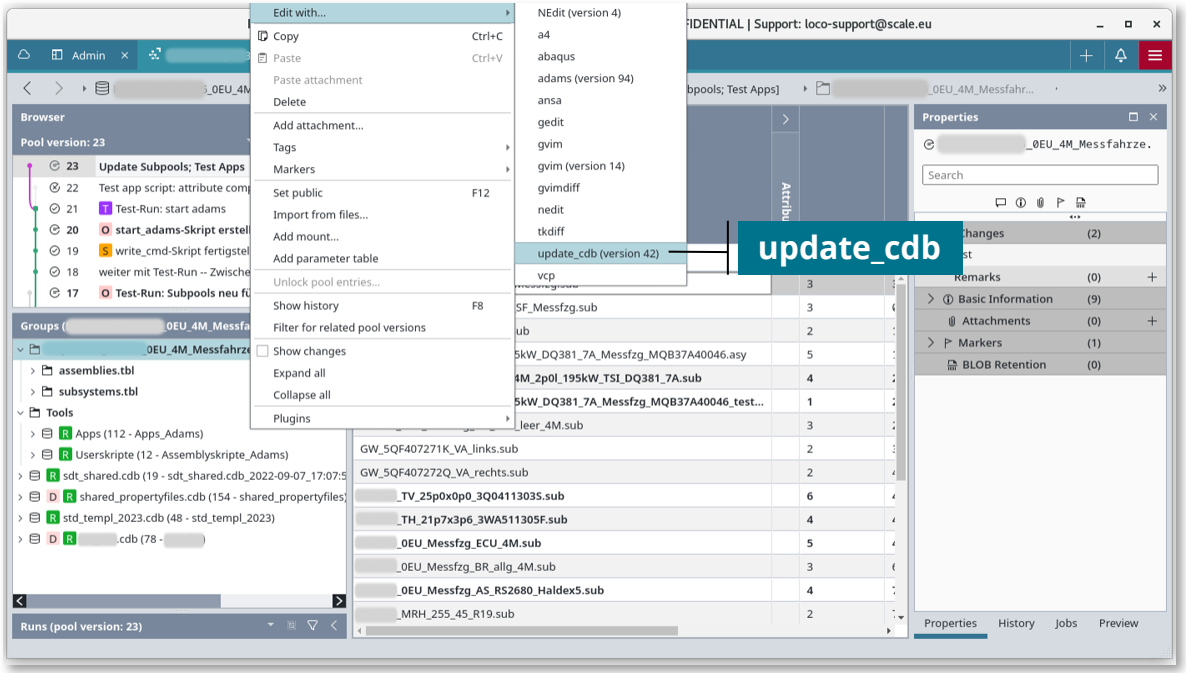


Synchronizing ADAMS databases with the SDM

Import and sync Application for ADAMS

- For transition phase from working on file system to working in SDM system
  Local changes can be imported to the SDM system on a .cdb-database level
- User chooses local ADAMS database on file system
  This database will be synchronized with the SDM system
- True synchronization
  New files are imported, changed files are updated



Option to fully import new local databases

- Import whole .cdb-database in empty pool version
  In this case, no comparison with the SDM system contents is performed

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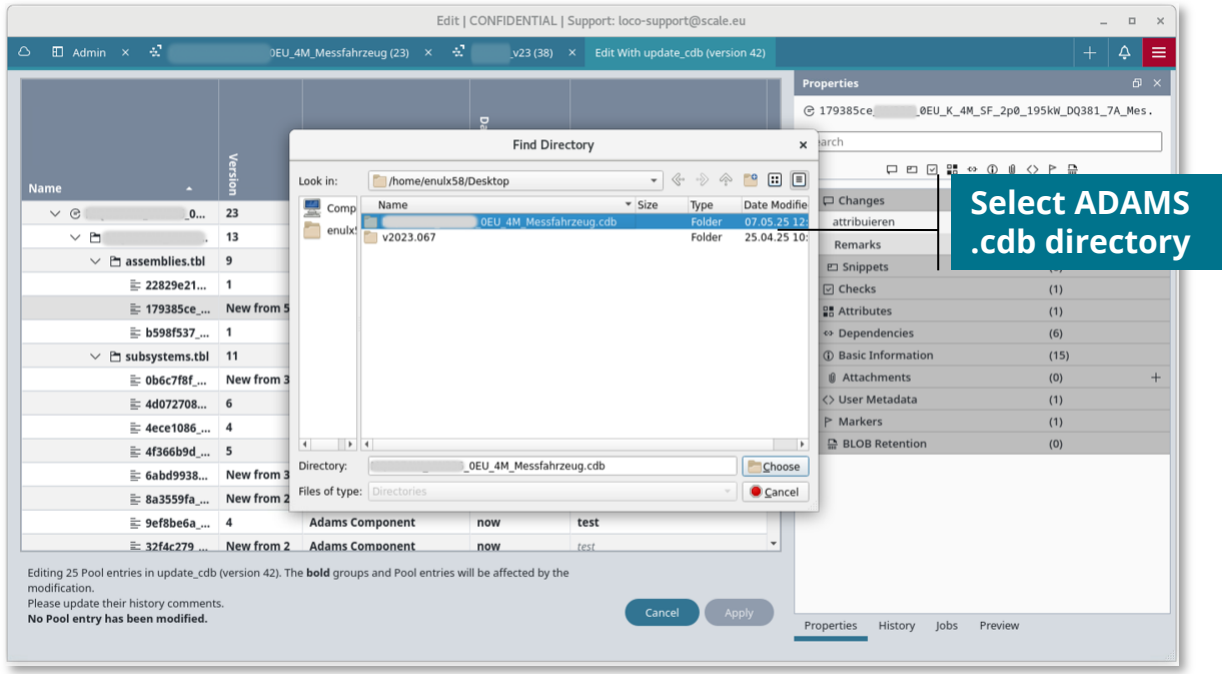

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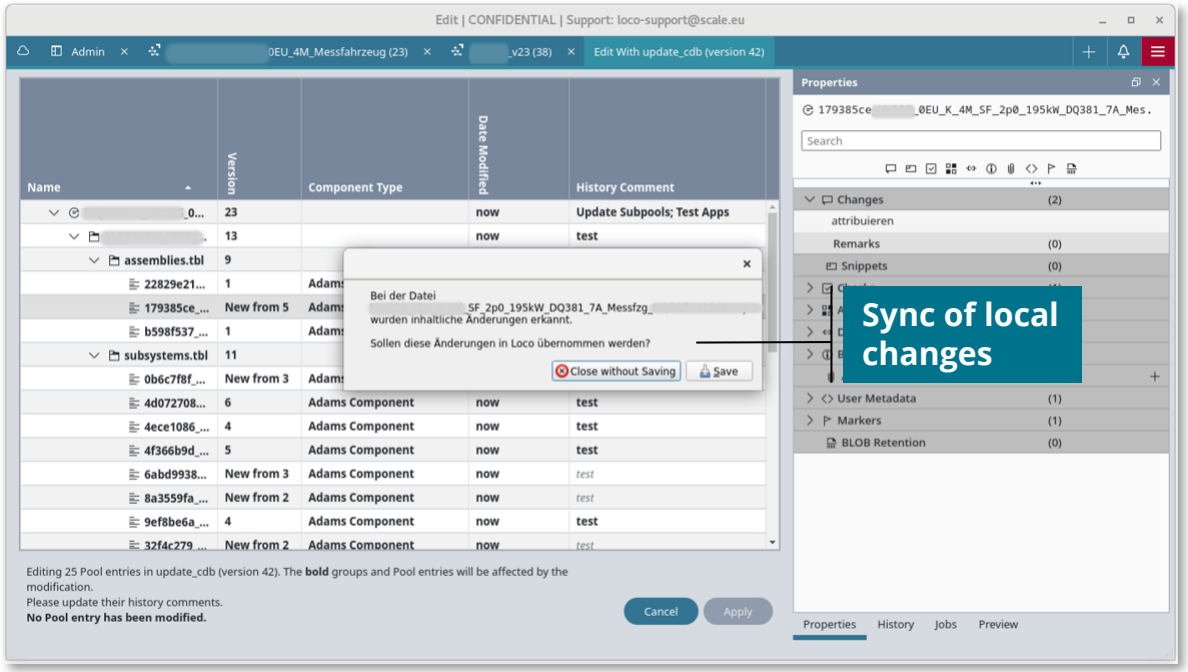

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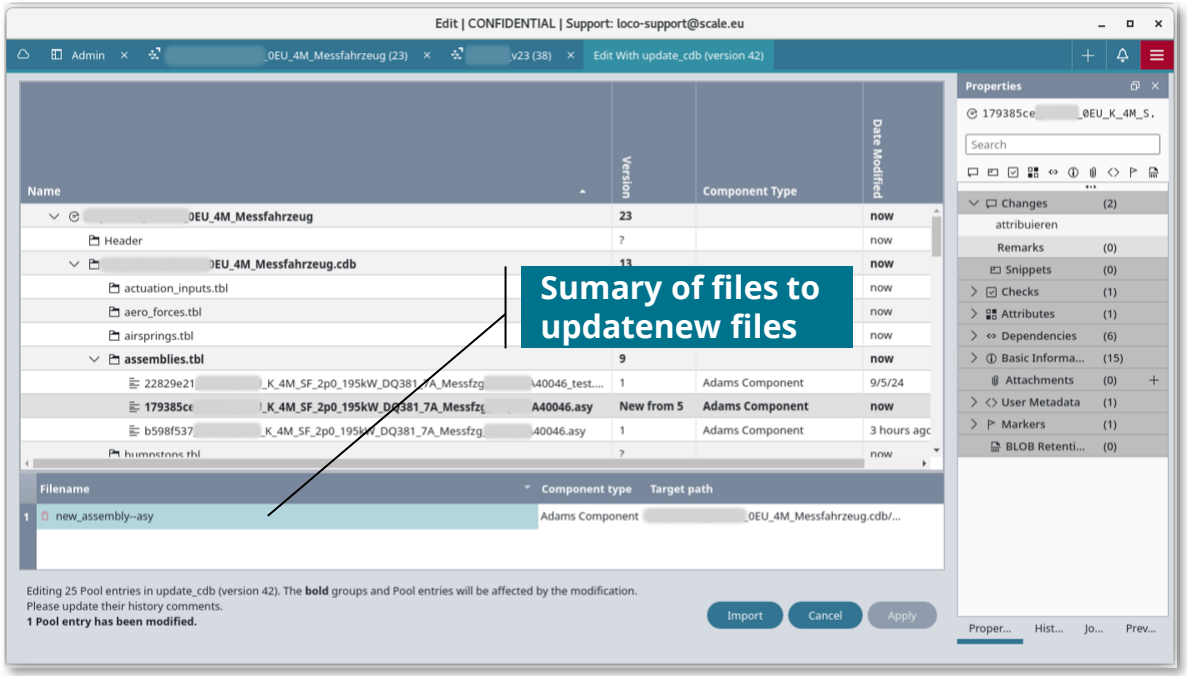

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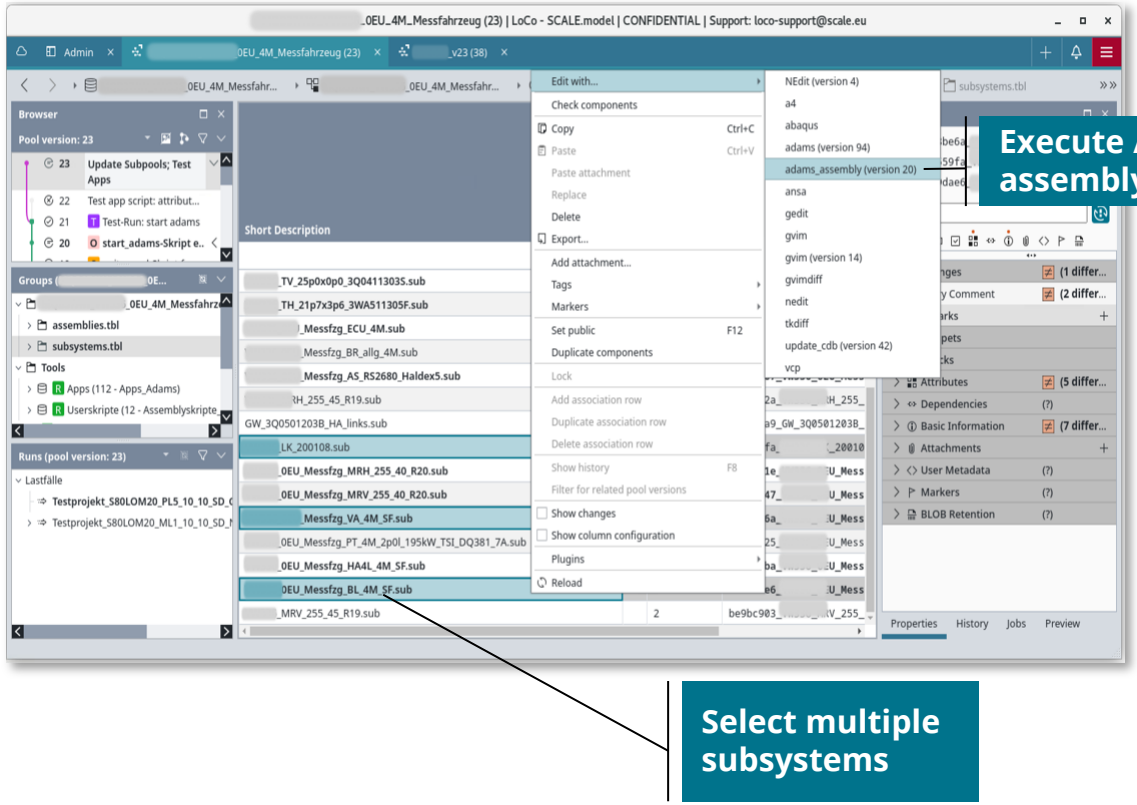
Creating new MBD models from the SDM system

Create ADAMS Assemblies

- From a set of selected subsystems, create a new suspension assembly file
  Select several files from the SDM system and execute the app on all of them
- Front axle or rear axle assembly file automatically created
  The app recognizes the type of subsystems selected by the user
- Additional subsystems may be included
  The resulting assembly can be equipped with an extra number of non-axle subsystem files



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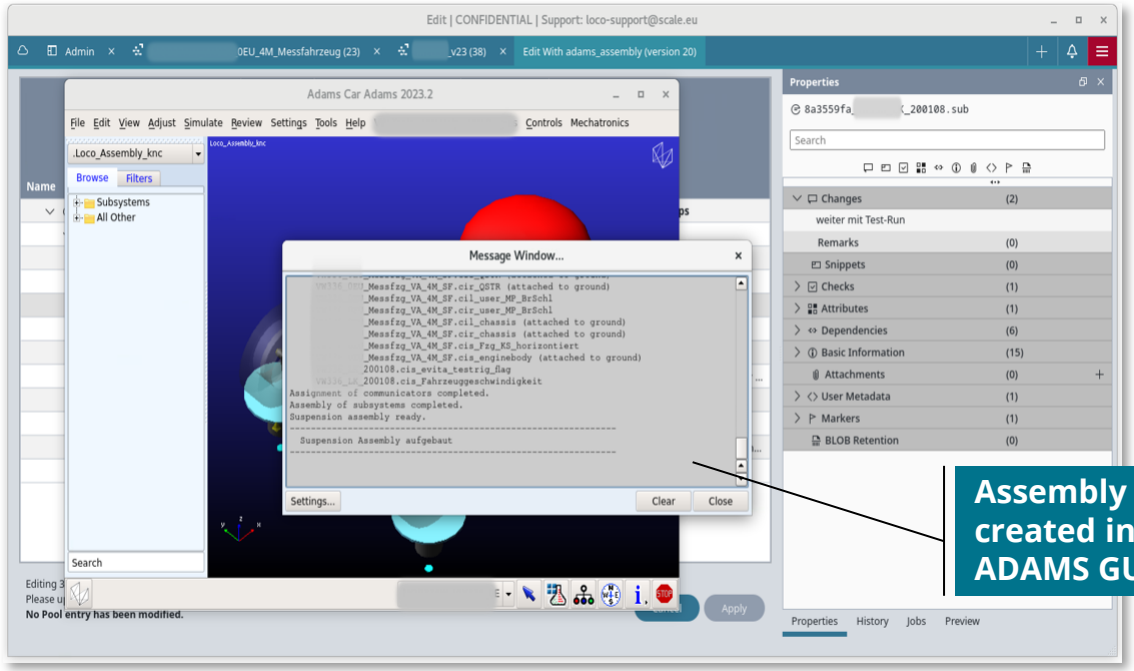

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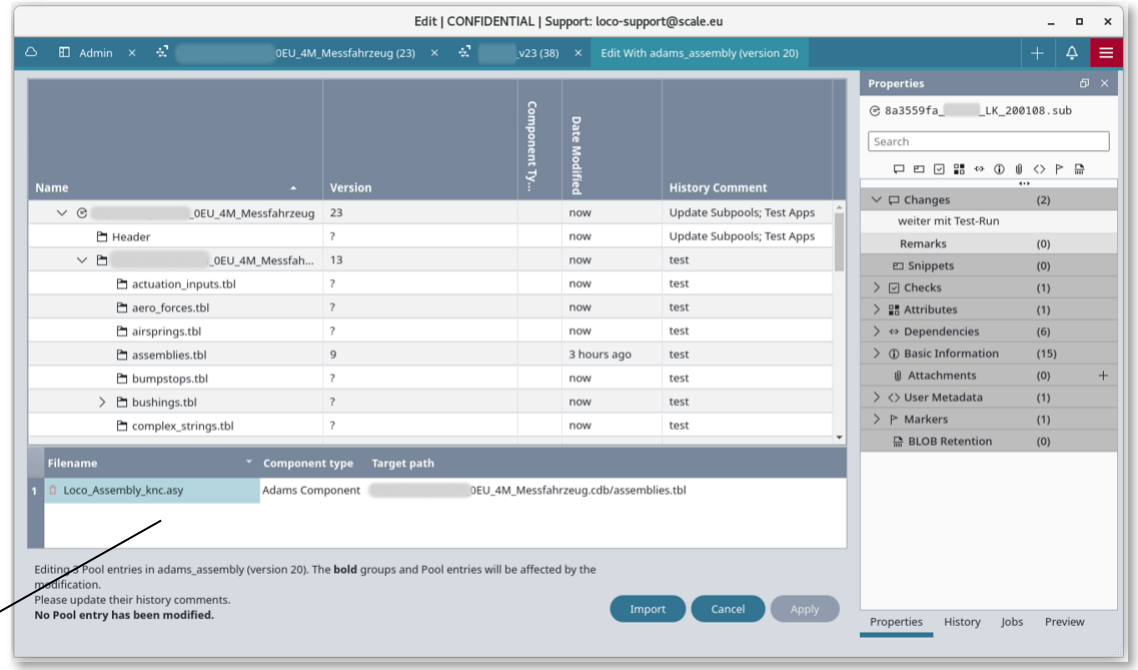


Running simulations: MBD load cases in the SDM system

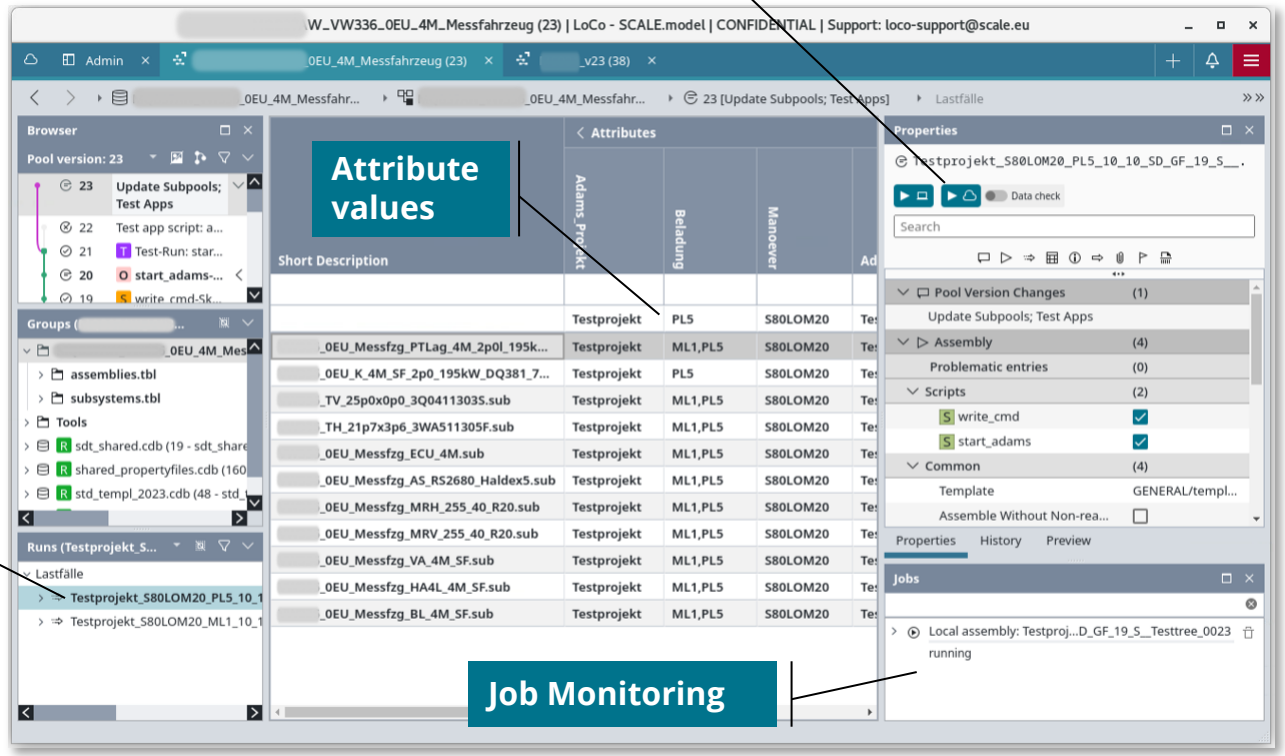
Setting up simulation runs for ADAMS load cases

- Load cases are configured by Run-Configurations
  A Run-Configuration with attributes defines a recipe for a load case
- Files are assigned to a run by attribute values
  Attributes set on the files are matched to the attributes on the Run-Configuration
- Files are drawn from the main .cdb-directory and also from the global databases
  The load case consists of the model and the driving situation
- Userscripts library
  Contains templates and scripts for assembly and job submit

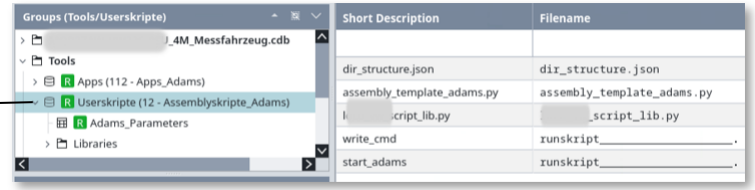
Starting the simulation run

- Generate the ADAMS .cmd file and start the simulation
  Parameters defined in the SDM system will be used for the .cmd file
- Clicking the local assembly-button will start the whole job from the SDM system
  Job is assembled and run on the user's machine or on the HPC system
- The job can be monitored in the Jobs tab
  Job feedback gives insights to the status of the job

Assembly & Job Submit
- Local Assembly
- Remote submit to HPC



Userscripts
- write_cmd
- start_adams



Outlook & Conclusion

Outlook

- Productive implementation of running simulations from the SDM system
  Finalizing integration with the user's machine and storing ADAMS result files
- Provide scripts to the SDM system for running the simulations on an HPC
  Both local and remote assembly are supported with the respective scripts and settings
- Combine model development and simulation in one step
  Examine changes and reimport model data after starting a specific simulation run

Conclusion

- MBD Solver ADAMS has been integrated in an SDM system, with model development already in productive use and a test integration for creating and running simulations.
  Vehicle project organization with pool versions, global include databases and tools pools with apps and scripts allows for efficient collaboration.

SO LONG, AND THANKS

FOR ALL THE FISH

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