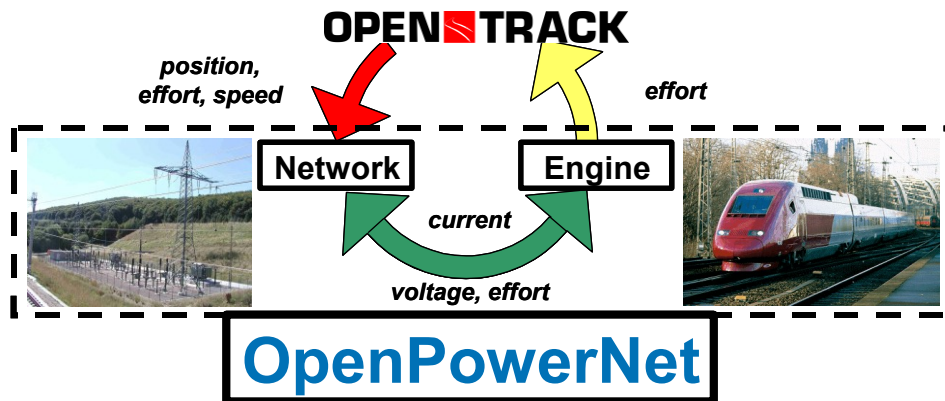
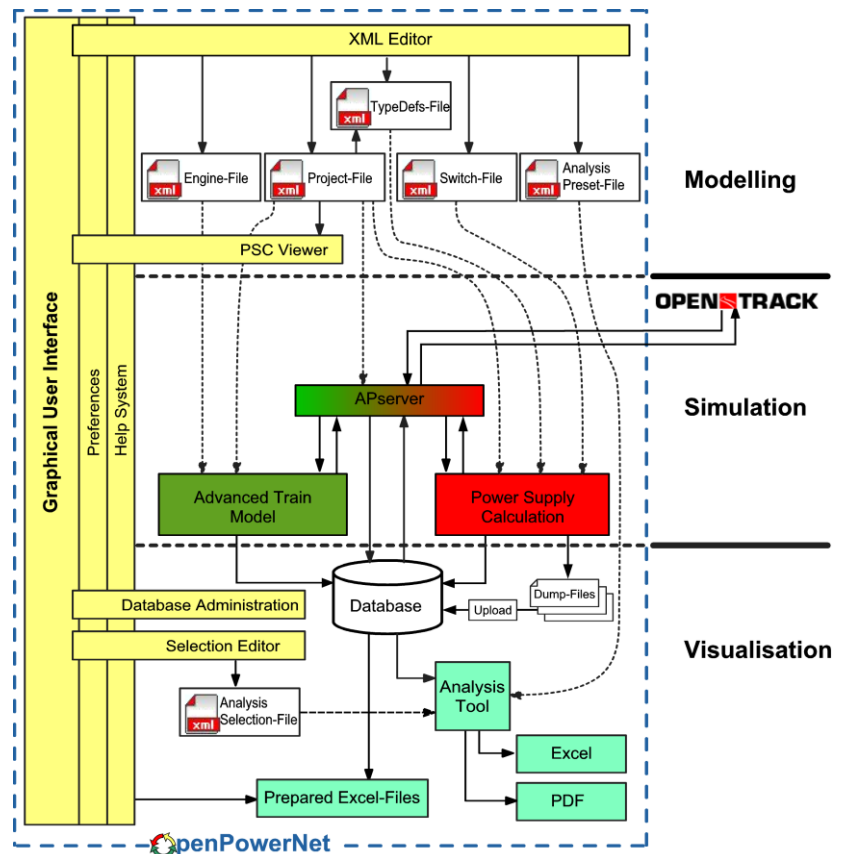


Simulation of Railway Power Supply Systems



- Calculation of electrical load flow
- Energy balance
- Load analysis of equipment
- Touch voltage
- Electromagnetic field
- Interaction of operation and design
- Examination of different layouts
- Simulation results provide a basis for rating

Workflow



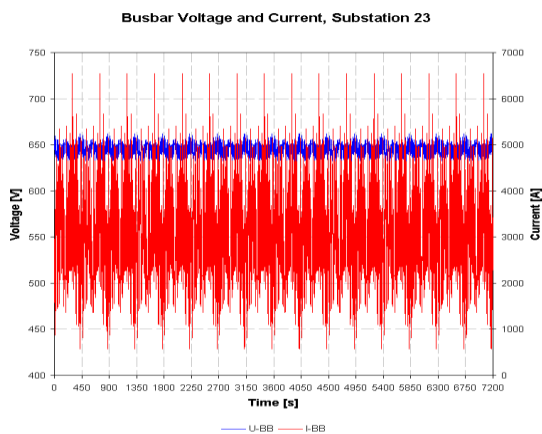
Key Features

- Specialised network and engine simulation extends the well known railway operation simulator OpenTrack (co-simulation)
- Interdependence of driving dynamics, electrical network and engine simulation in each time step
- Tractive effort calculated by the power supply simulator affects the driving dynamics in the operation simulator
- Electrical network simulation
 - different power supply systems (e.g. DC, 1AC, 2AC)
 - built-in determination of inductive coupling of the conductors (no fixed line impedances)
 - multiple switching states, changeable during simulation
- Engine simulation
 - various performance characteristics
 - modelled by efficiencies, e.g. vs. speed and tractive effort

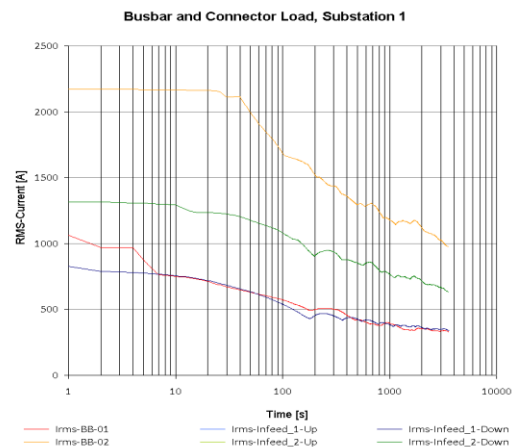
Output

The simulation results can be visualised by preconfigured Excel sheets or customised reporting sheets. All results are stored in a relational database.

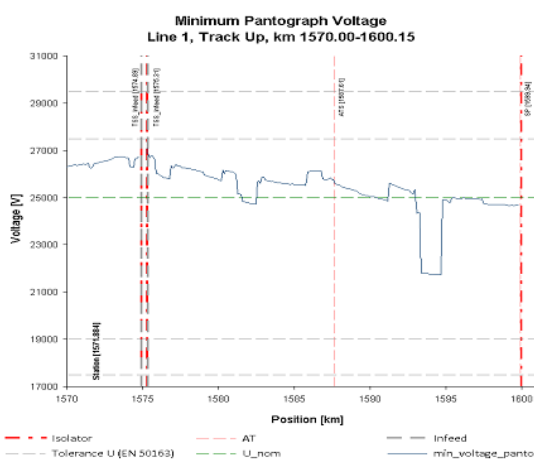
Excel charts and summary tables for common aspects in power supply analysis can also be generated automatically by a post processing tool.



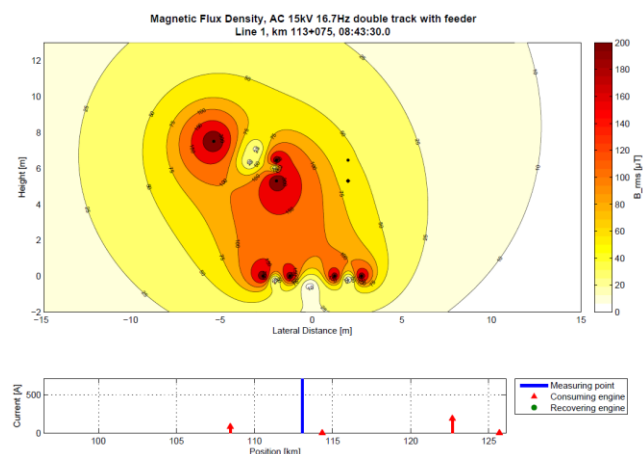
busbar voltage and current of a traction power substation versus time



time weighted current in busbars and feeders of a substation

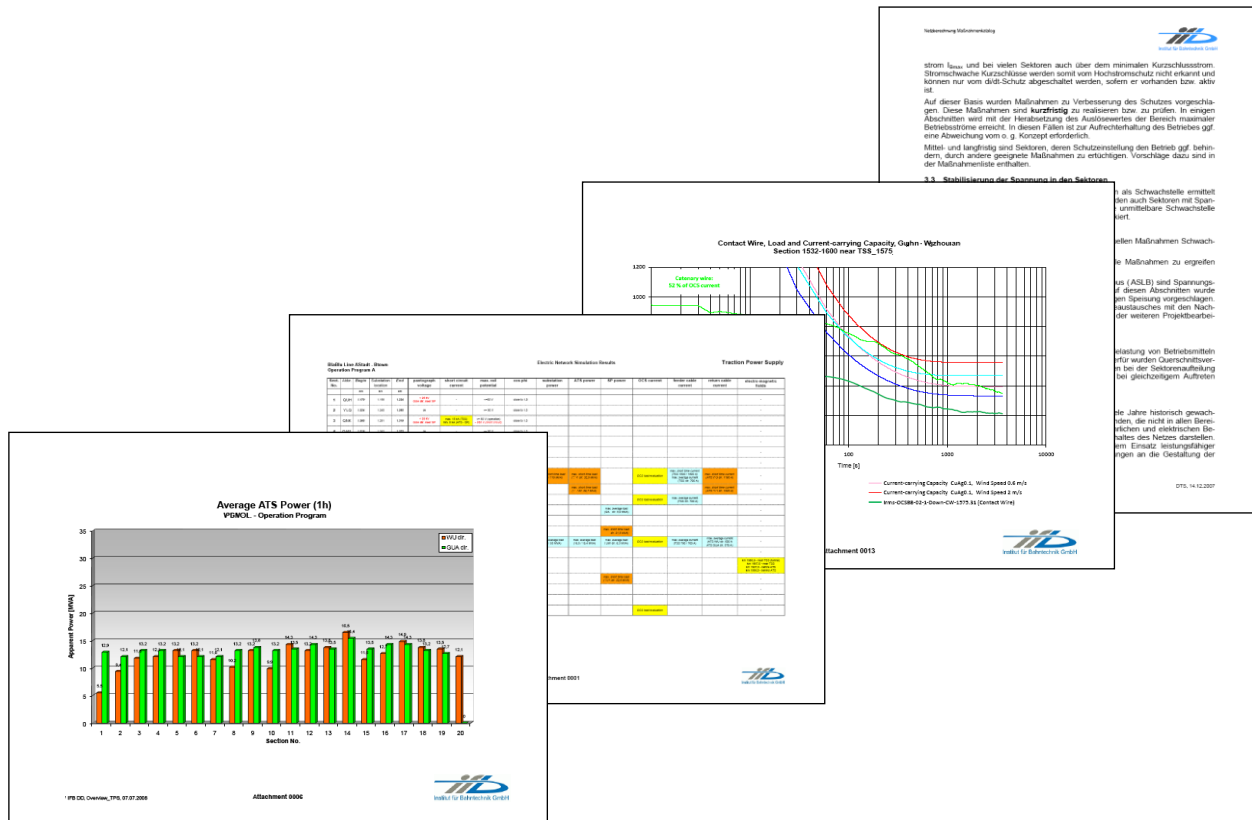


minimum voltage at pantograph of all trains versus position on a railway line



magnetic field intensity of cross-section of a railway line at particular position and time step

Report



- Simulation service will be provided.
- Operation modelling can be included or excluded (existing OpenTrack models can be used).
- Analysis of calculation results, conclusions and recommendations will be given.
- A report collects and presents all information for the customer.