Use of Tcl/Tk in Railway signalling simulation and maintenance software

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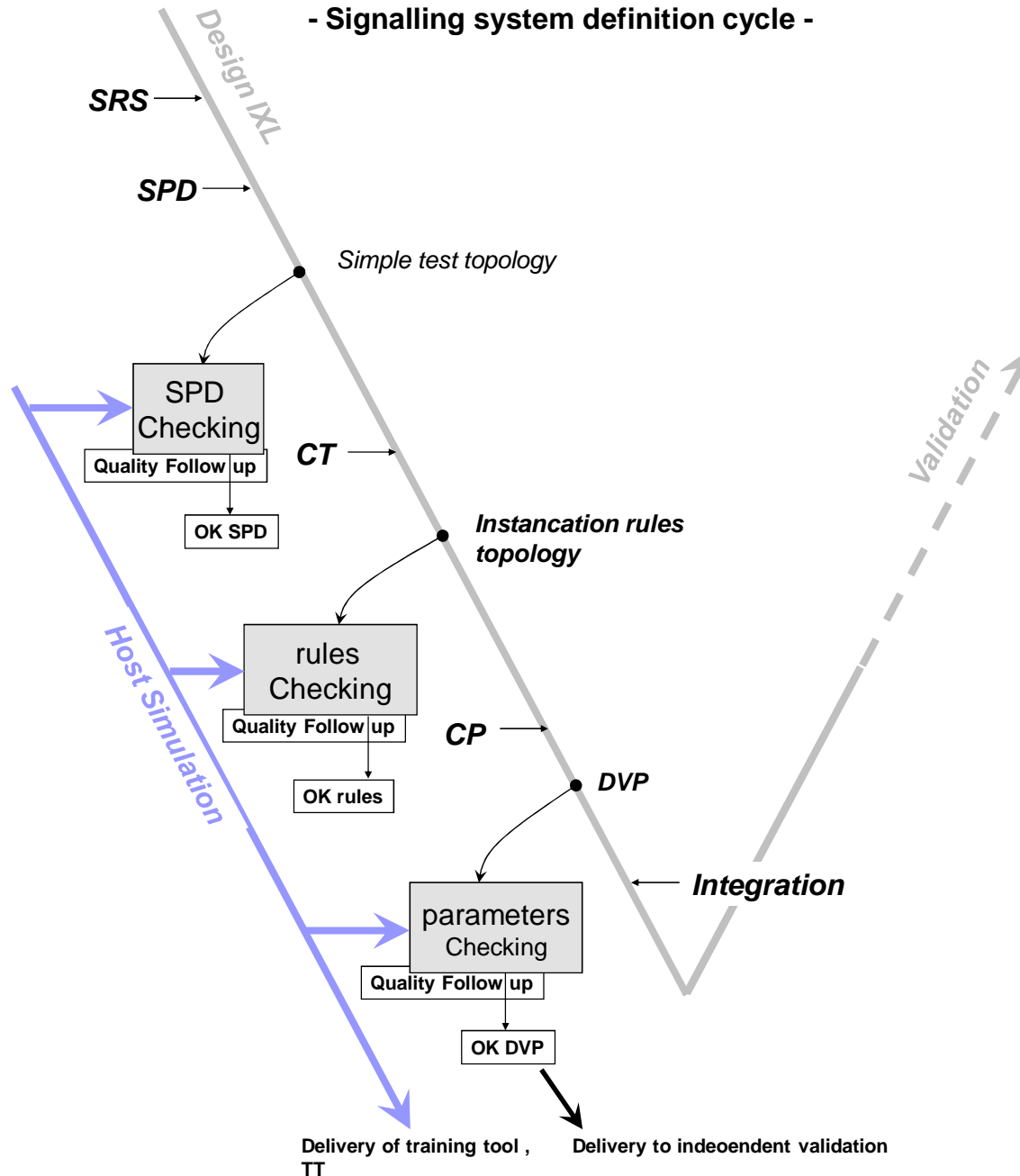
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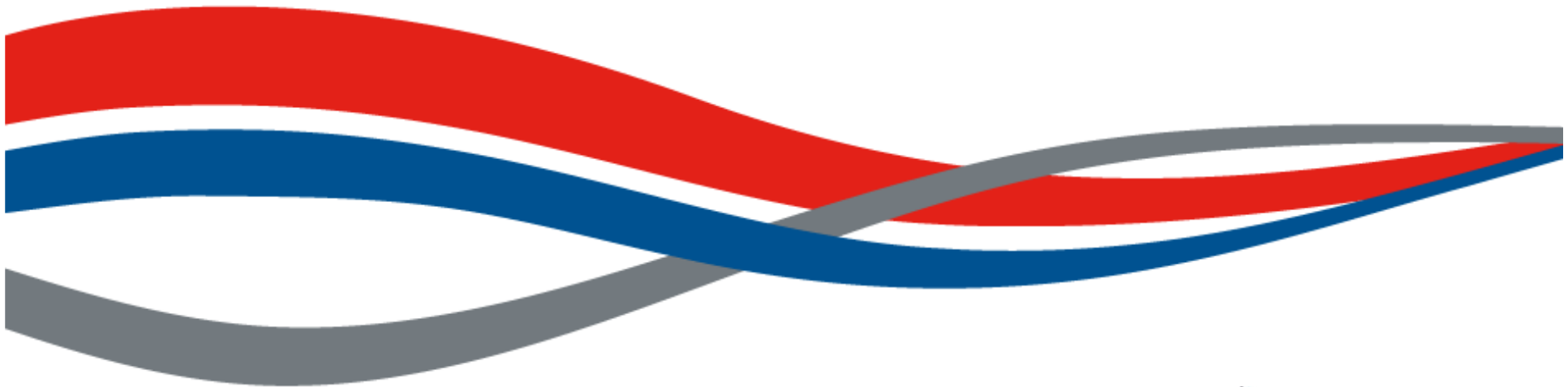
Sommaire

- Context

- User interface tools

- Tests tools

- Examples on current projects

- demos

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Context

- Signalling design has to adapt to different clients
  - New markets with their own practice
  - New system functions

- Internal debugging is necessary :
  - Generic kernel (System functions)
  - Instanciation rules
  - Topology

- System level view of the signalling equipments
  - Identical as the signaller view
  - High level (commands, controls, graphical animation)

- Simplicity to be used by projects team (not software engineers)

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- Signalling system definition cycle -

Design IXL

SRS →

SPD →

Simple test topology

SPD
Checking

Quality Follow up

OK SPD

CT →

Instancation rules topology

Host Simulation

rules
Checking

Quality Follow up

OK rules

CP →

DVP

Validation

parameters
Checking

Quality Follow up

OK DVP

Integration

Delivery of training tool , TT

Delivery to indeoendent validation

CT = control tables

CP = Production Tool – (chaine de production)

Goals :

- Process guidelines

- Automatisation of topology data.

- System functions verified and agreed.

-Instanciation rules tested.

- Good quality parameters.

- GUI mutualisation : views are integrated in the TT.

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Graphical objects editor

- Scanvas: layer over the Tk canvas with tkpath

- Graphical symbols are described in text file. A symbol is:
  - A group of atomic gadgets (polyline, oval, …)
  - Parameterized by attributes
  - Animated through an set of variables

- Graphical symbols are generated in Tcl code.

Graphical objects editor
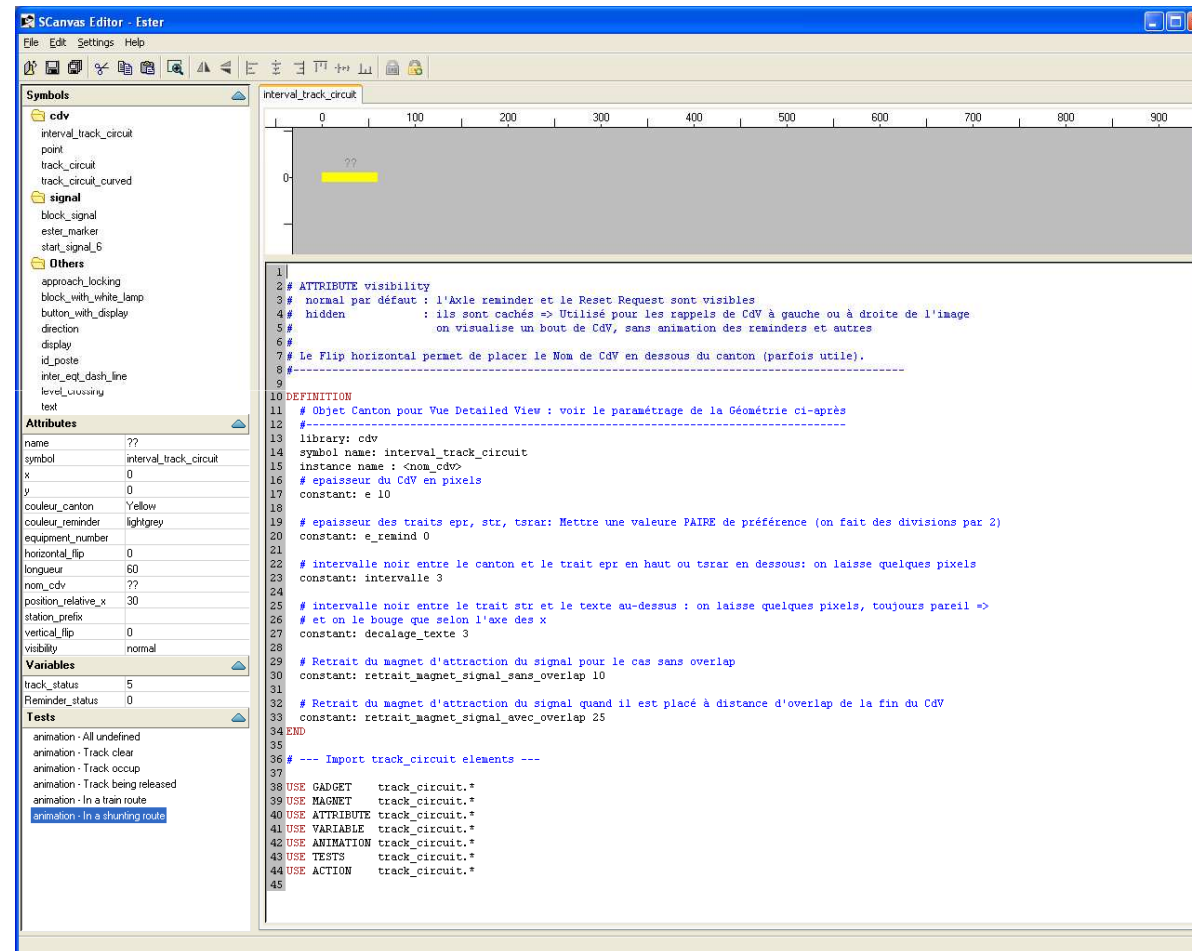
View edition
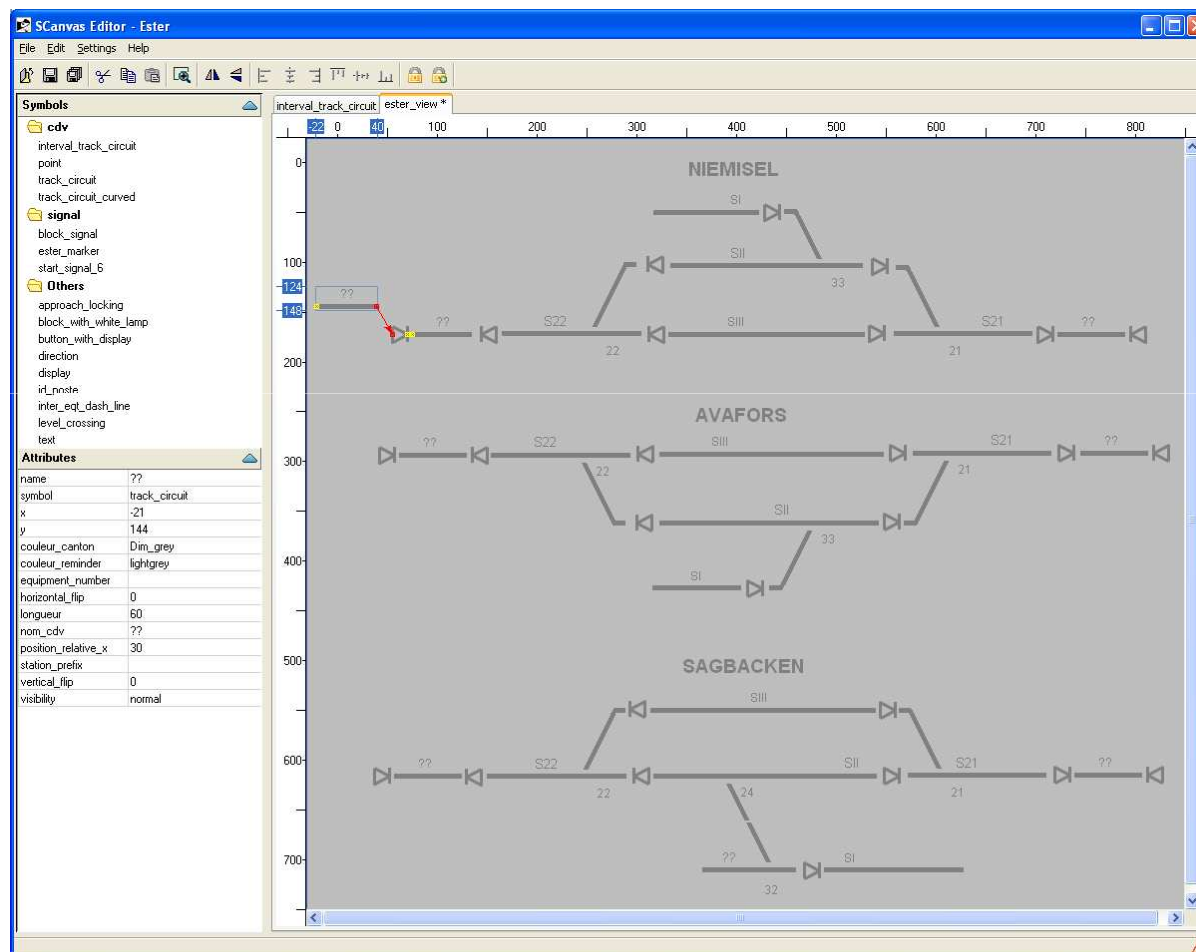
Topology data extraction
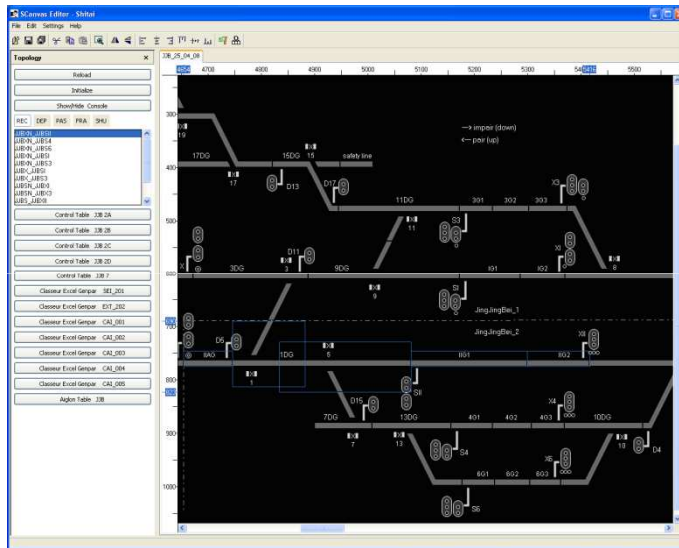
Control Tables generation

Raw Parameters generation

Topology data extraction

- Tcl scripts loaded as plugin of the editor

- Use the Scanvas API and the magnets to build topology

- Use of Tcom for Excel management

WhiteBox Simulator

- Import of production tool data

- Loading of simulation models
    - Automatic links between models
    - Defined or automatic links between models and graphical object
    - Models management with enhanced view (inputs/outputs, filters, graphs, model browser)

- Simulation management
    - Inputs setting / outputs getting.
    - Initialisation phase, environment simulation.
    - Running management (play, step-by-step,pause, fast forward, reset)

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Simulation GUI – Graphical view
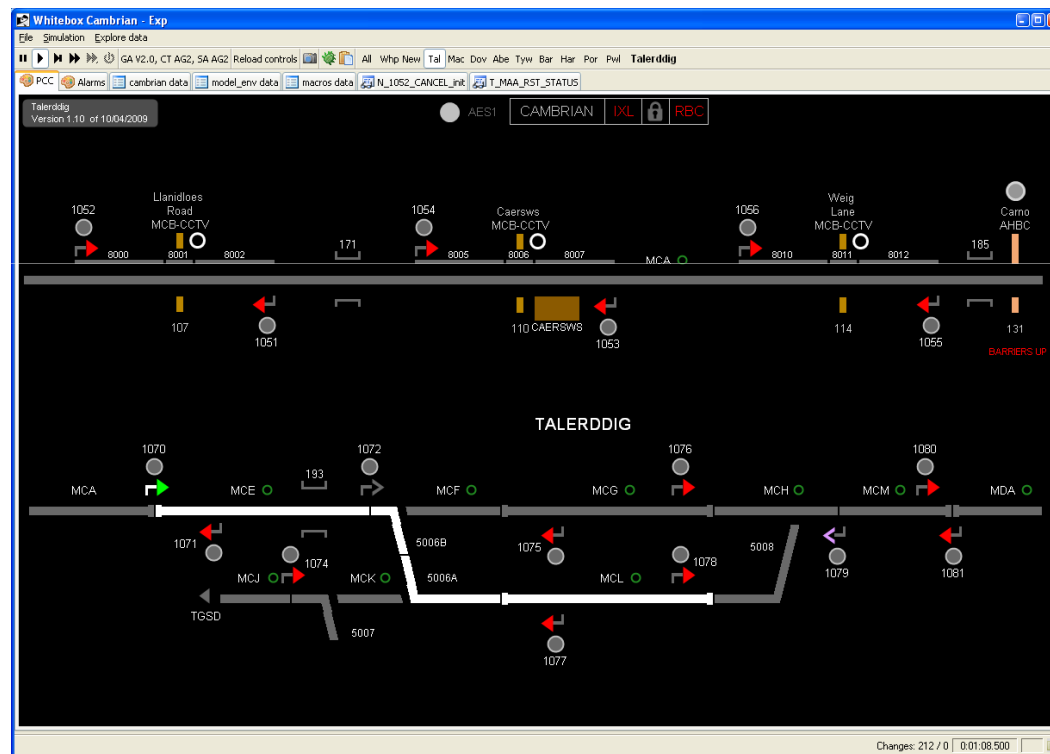
- Interactivity,
- Overview,
- Graphical objects finding tool

Simulation GUI – Data view

Use TkTable: thousands of variables in the table without any
response time issue

- Filters and data selection
- Custom tables
- Change simulation inputs

Simulation GUI – Strip chart

- Custom set of variables,
- Enhanced controls: zoom, value display, etc.
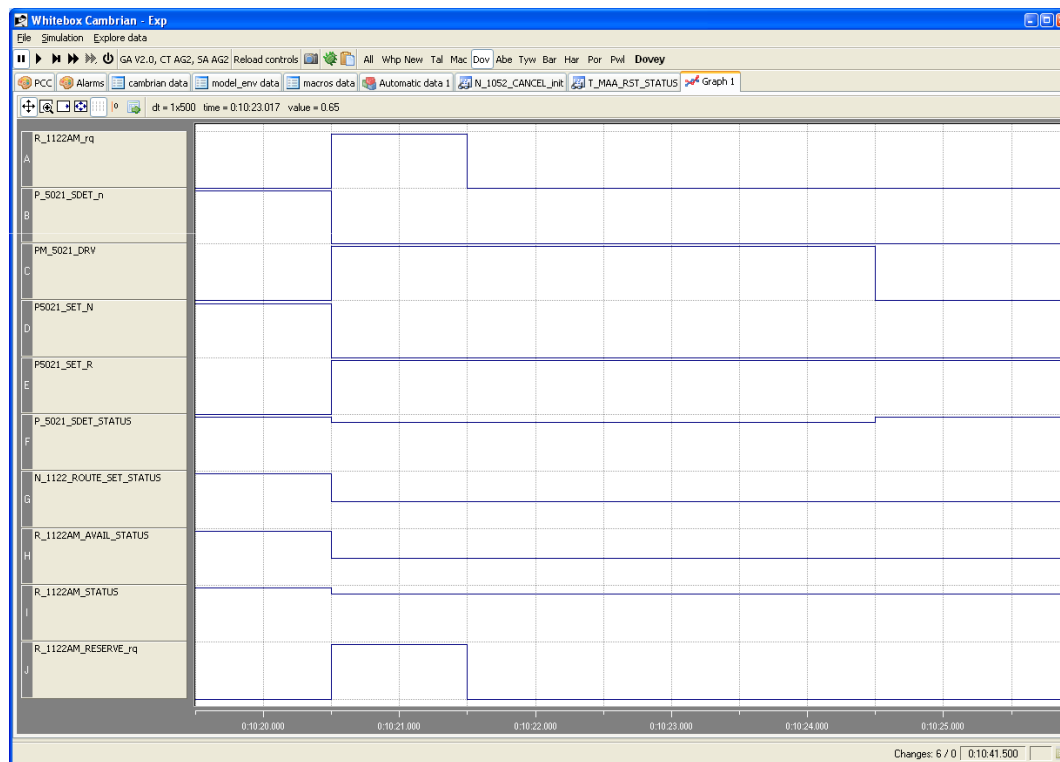
Tests and validation use

- Real time simulation mode: the user controls the running and actions.

- Record/replay mode: scenarii can be recorded and play again.

- Validation Scenarii mode: high level scenario (include macros) run with the help of the simulator.

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Maintenance Use: TT GUI

- Track views reused for the maintenance application
- First use TclOO
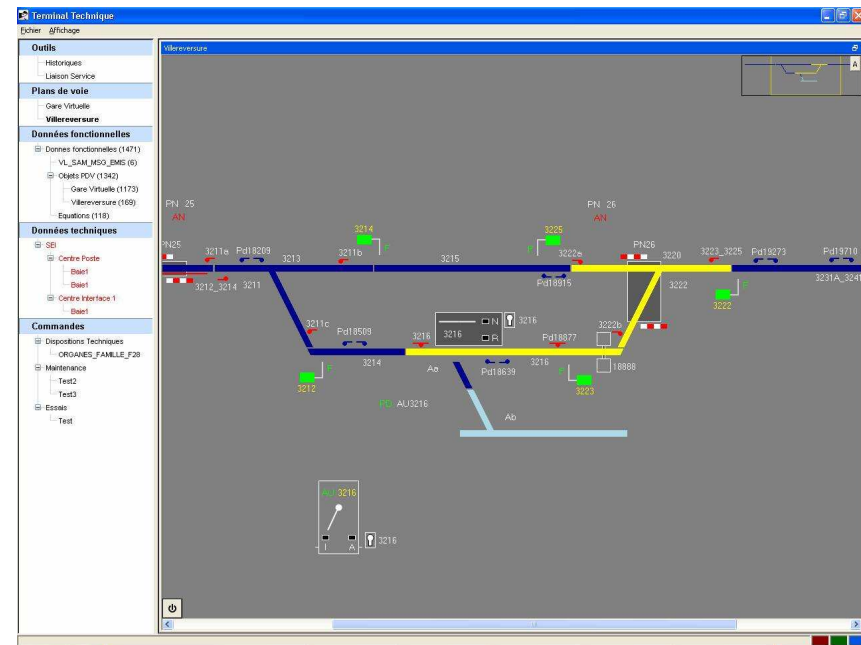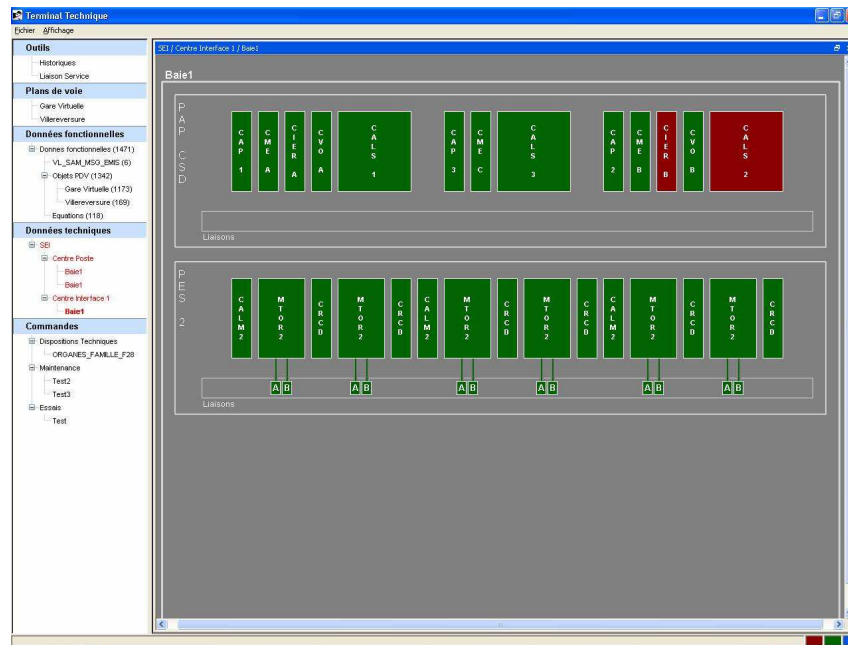
Other application: BlueBox Simulator

- A field simulator
  - Modbus standard communication with PLC (Triangle Research / Beckhoff)
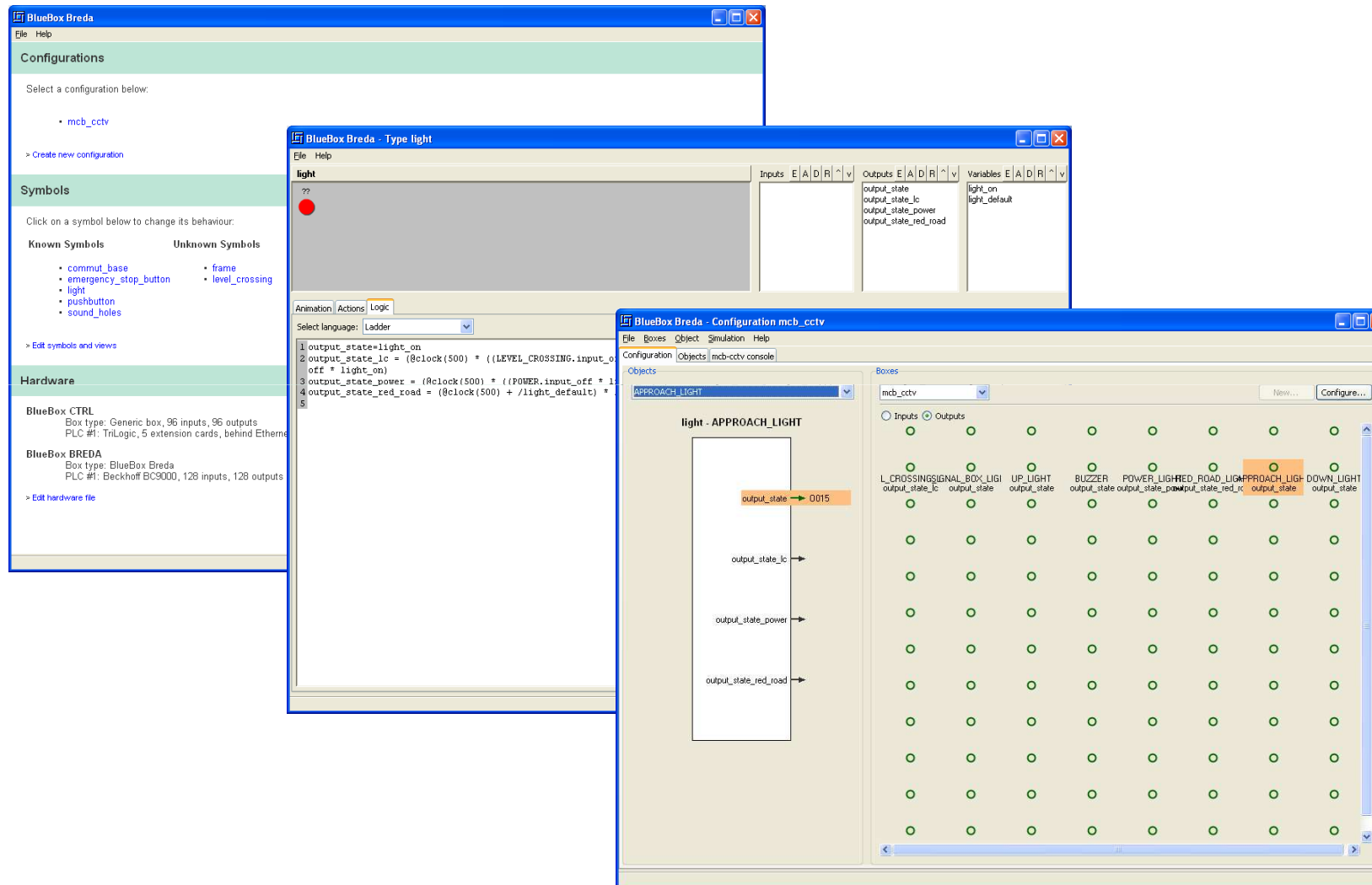 - Configuration management (inputs/ouputs affectation + Ladder code generation)
  - Use graphical views to map objects in the PLC.
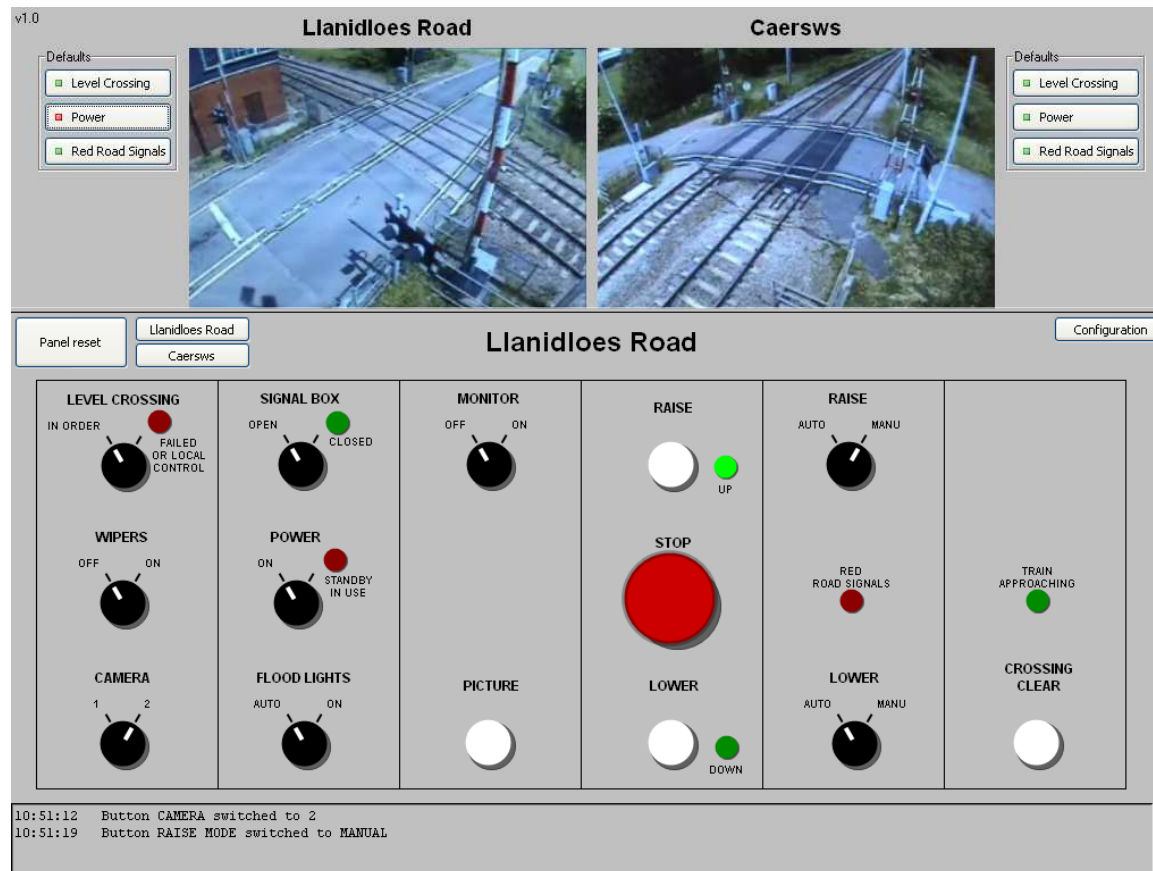
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Other application: BlueBox Simulator

Other application: BlueBox Simulator

- ## Use of TkVideo

Tcl/Tk in the industry: advantages

- Modular development: from a simple software up to a complex one.
- Maintenability, glue language
- Easier to use with TclOO
- Tk scanvas power
- Use of C/Tcl API for C dlls
- Easy deployment thanks to TclKit

Current projects

- SNCF resignalling in France: simulation and TT.

- ERTMS in UK: modelling and simulation up to the training tool and TT. On-board data management tool.

- CTCS in China: modelling and simulation, topology data extraction from the track view, gateway with the production tools.

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Demos

- Scanvas editor (objects + views)

- Cambrian simulator + Level crossing simulator + on-board data management tool

- Shitai topology + simulator