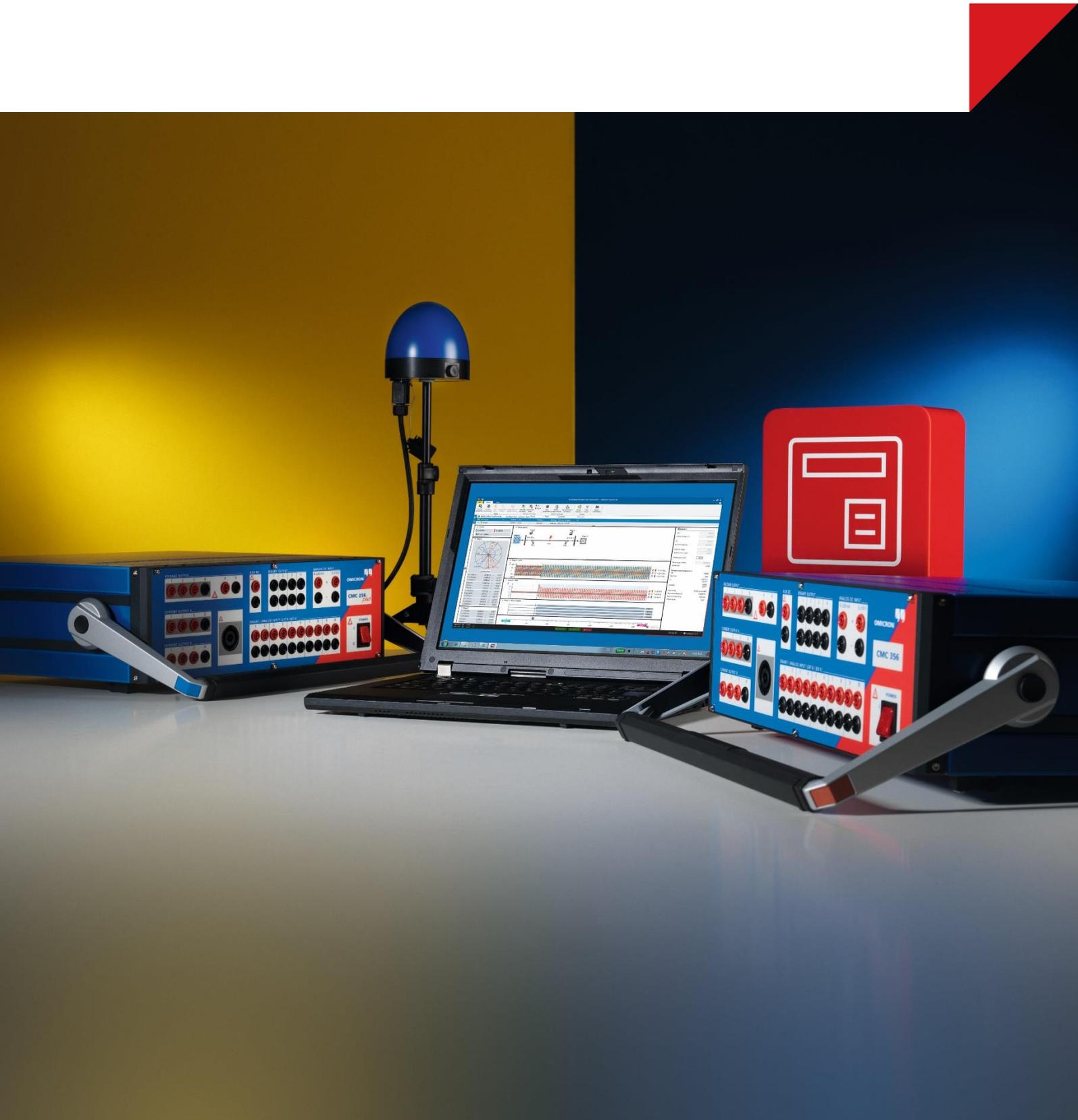RelaySimTest

What's New in Version 4.10
Compared to Version 4.00

1 Overview

With software version 4.10, we have improved *RelaySimTest* in several ways.

The two most important changes include
1. the addition of a new simulation model for an induction motor or **asynchronous motor** and
2. the possibility to simulate **infeed events**

With these major additions, you can now test Motor Bus Transfer schemes, Motor protection, or Rate of Change of Frequency (ROCOF) protection using the system-based testing approach.

Besides these big changes, a number of smaller improvements have also been made, including improvements of the Interactive System Simulation and the capabilities of *RelaySimTest* in terms of testing IEC 61850 protection systems. Please find more details in the following pages.

2 New Asynchronous Motor Model

The new motor model integrated in *RelaySimTest 4.10* enables you to realistically simulate a network including induction or asynchronous motors. Network topologies including such motors can be created in the network editor from scratch or adapted using new templates.

2.1 Input of motor parameters

The motor parameters that you need to enter are limited to data from the nameplate and manufacturer data sheets, i.e. pieces of information that should be easily accessible. The mechanical load behavior can be defined by specifying three points of the load torque characteristic.

The software then displays curves showing the steady-state representation of
- the motor current characteristic,
- the motor torque characteristic, and
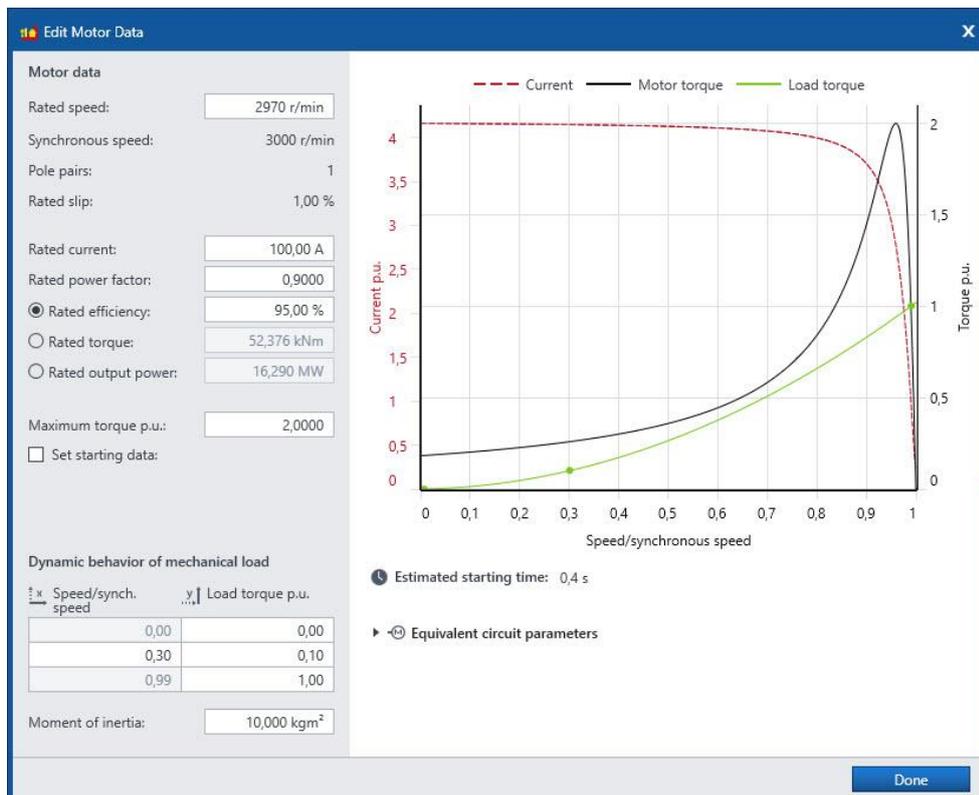- the load torque characteristic.

Figure 1: The motor element definition dialog

2.2 Mechanical load events

In order to simulate dynamic load changes within **Simulation test cases**, such as load jumps or load jams, you can add **load step event** to change the operating point on the load torque characteristic.
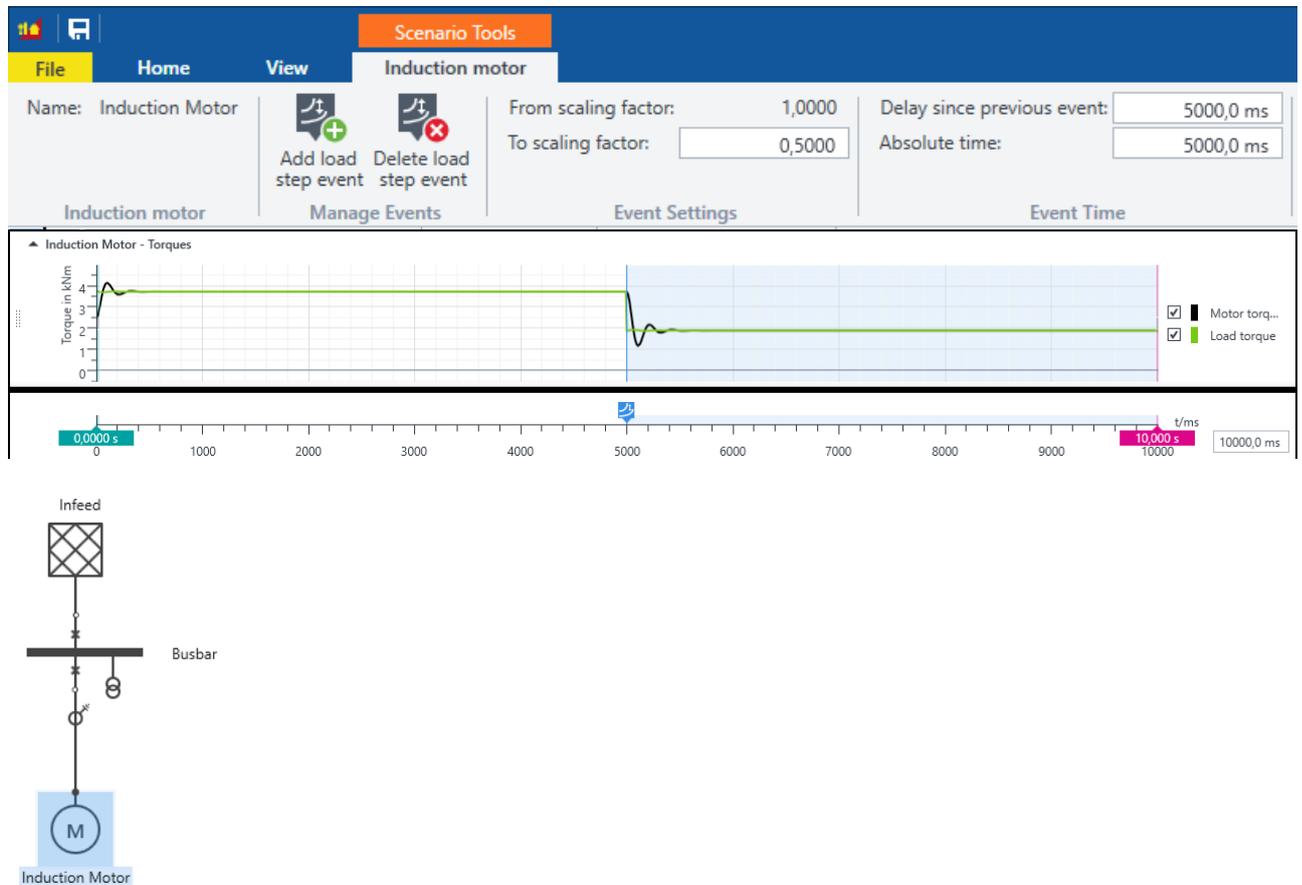

Figure 2: Simulation test case with load jump

2.3 Visualization of various motor parameters

Various views allow you to visualize the performance of the motor and the mechanical load. The speed and the torque of the motor over time can be displayed using the time signal view.
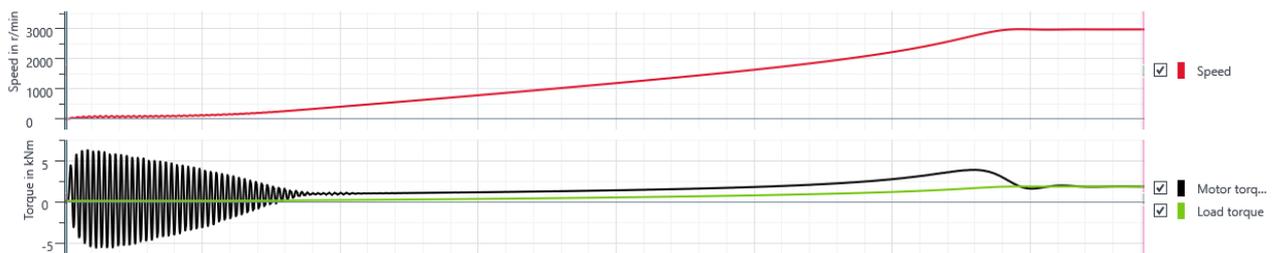

Figure 3: Time signal display showing motor speed and torque

2.4 Typical Applications

This expands the range of applications of *RelaySimTest* to include:
- testing Motor Bus Transfer (MBT) schemes
- testing motor protection
- testing protection schemes used in topologies including motors

2.4.1 Efficient Testing of Motor Bus Transfer schemes

The goal of an MBT scheme is in case of a lost source on the motor bus, to transfer the bus & loads to a different source as fast as possible, to avoid production losses. The challenge for these schemes is to close the breaker under synchronous conditions, while the motor loads on the bus are still acting as generators and thus feeding a voltage. This voltage is decaying in amplitude and frequency over time, which represents a great challenge for the relay algorithms.

Testing Motor Bus Transfer (MBT) schemes becomes much simpler with *RelaySimTest 4.10* than with other tools. The model allows to evaluate the performance of a MBT scheme regarding a fast and stable execution of the transfer from the lost to the new source.
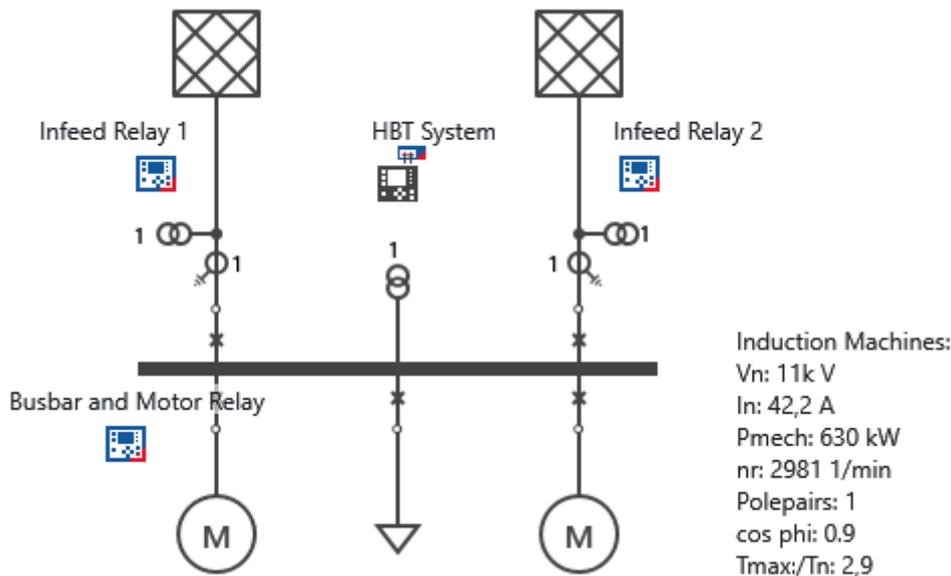

Figure 4: MBT scheme template topology

The new MBT scheme template installed with *RelaySimTest 4.10* helps to quickly arrive at a network topology typical for an industry application by loading and adapting it to your individual topology.

2.4.2 Motor Protection Testing

Testing motor protection relays is often challenging due to the many functions in operation. With *RelaySimTest 4.10*, testing motor protection relays under realistic conditions can be done with comparatively little effort in preparation.

If required, RelaySimTest can also test the motor protection as part of a larger protection system, for example by including feeder relays in your test. For instance, you may want to verify if the motor protection stays stable during a source transfer.

3 Infeed events

RelaySimTest 4.10 now also allows to dynamically change the following infeed parameter in the **Simulation test cases**:
- Frequency (ramp),
- Phase (ramp and slip), or
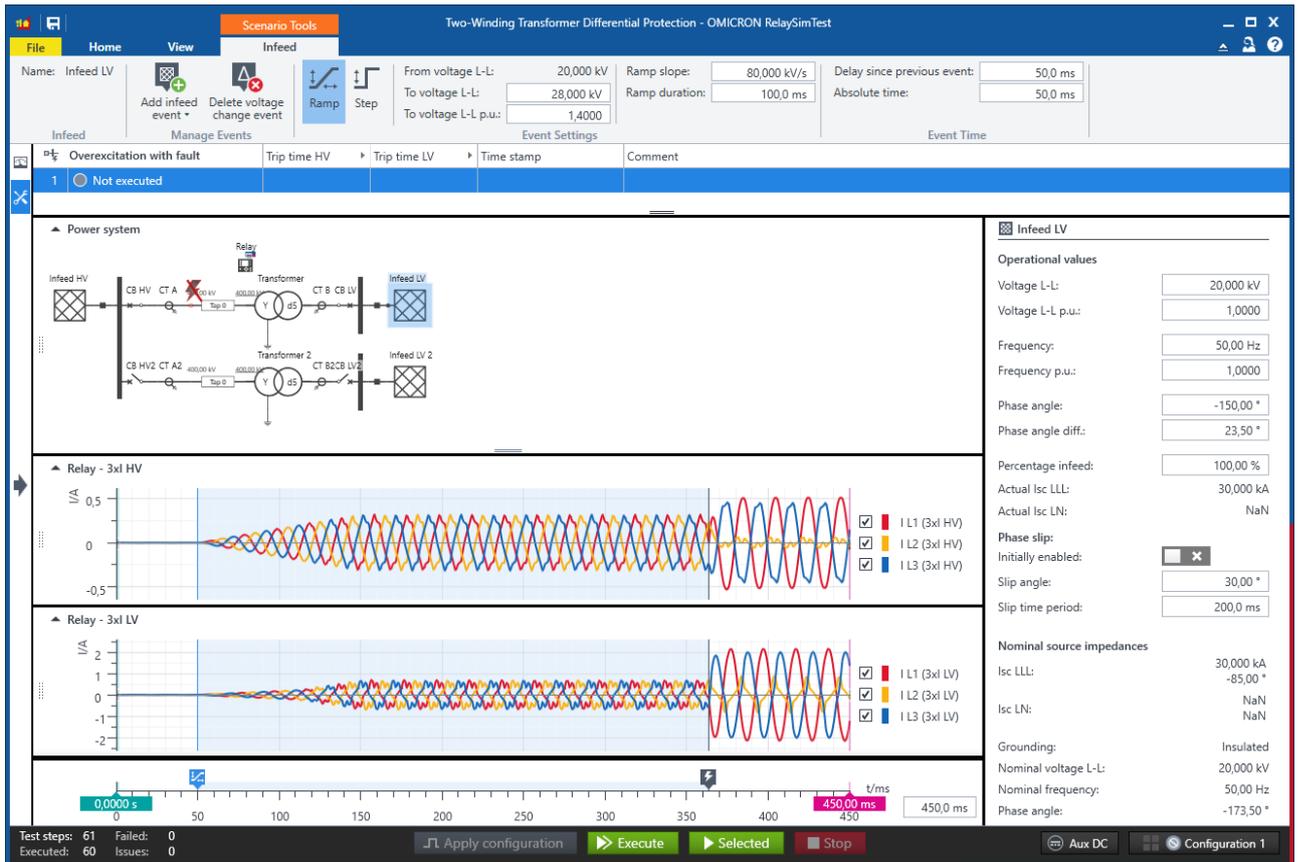- Voltage (step, ramp).

Figure 5: Infeed event: voltage change

Typical applications include the testing of:
- The undervoltage or the overvoltage protection element using an infeed voltage ramp event
- the overexcitation harmonic blocking function during transformer protection testing using a voltage step event
- the power swing blocking function with realistic prefault and post-fault states using a phase slip event on one of the infeeds
- the Rate of Change of Frequency (ROCOF) protection element using a continuous frequency ramp
- Under Frequency Load Shedding (UFLS) schemes

4 Improved IEC 61850 testing capabilities

R-GOOSE (routable GOOSE via UDP/IP) is now fully supported. *RelaySimTest* can subscribe to R-GOOSE and simulate R-GOOSE. You can import R-GOOSE from a SCL file. The DA mapping works as with GOOSE and has also been improved (see below).
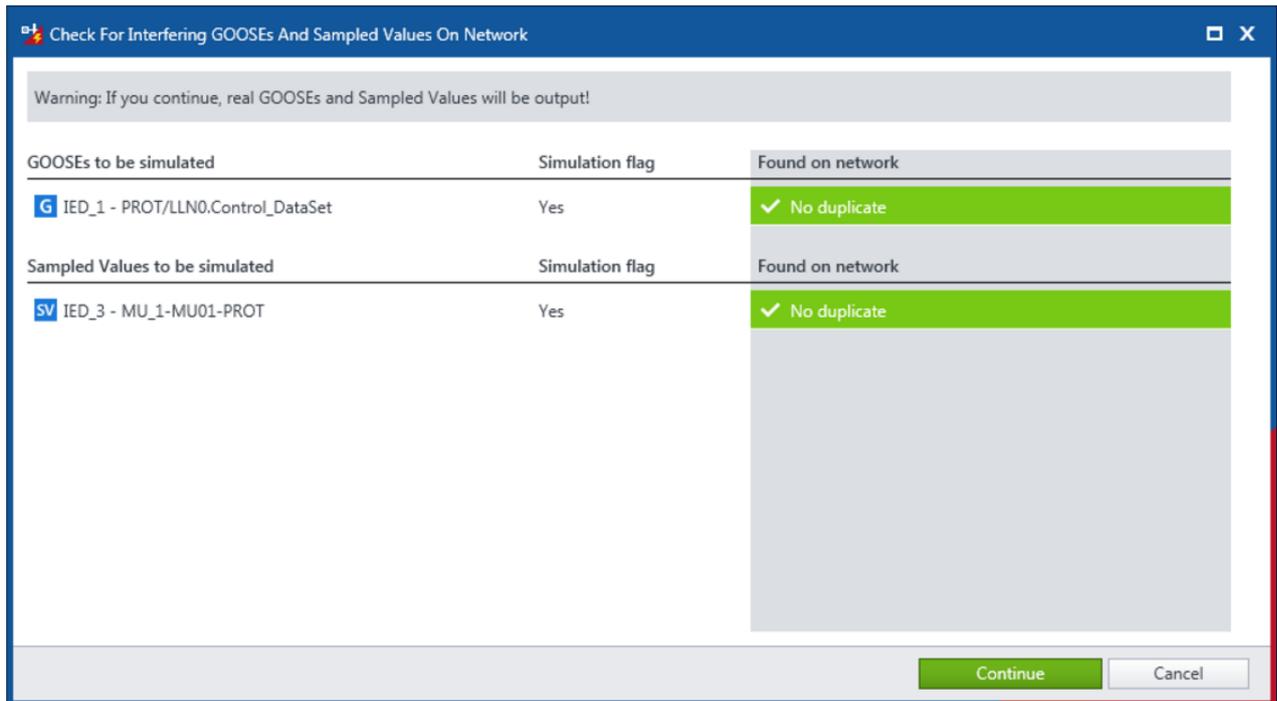
Figure 6: Preparation of R-GOOSE simulation

Furthermore, the mapping of Sampled Values DA to triples has been improved:
- The sequence of phases is considered (1 to max 4) for the grouping;
  prefixes are ignored, as these have often led to errors as they were not used to reflect triples
- <SubEquipment> can be used in a<Substation> section of SCL file for an unambiguous mapping
  (as of this writing, this is supported by Siemens)

5 Improved Interactive System Simulation

The Interactive System Simulation can continuously output the current state of the power system simulation. Version 4.10 brings a number of usability improvements and additional features that now allow you to:
- set unbalanced infeed conditions for wiring checks,
- rearrange relays,
- comment on event entries,
- add the event list to your report, and
- copy settings between states.

6 Other Improvements

- Message boxes were improved
- Time synchronization can be faster now (used to be fixed to 3s) with a resolution of 100µs
- Several performance improvements
- Bug fixes, including:
  - Calculation error of p.u. setting variants, when system voltage deviated from equipment voltage

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