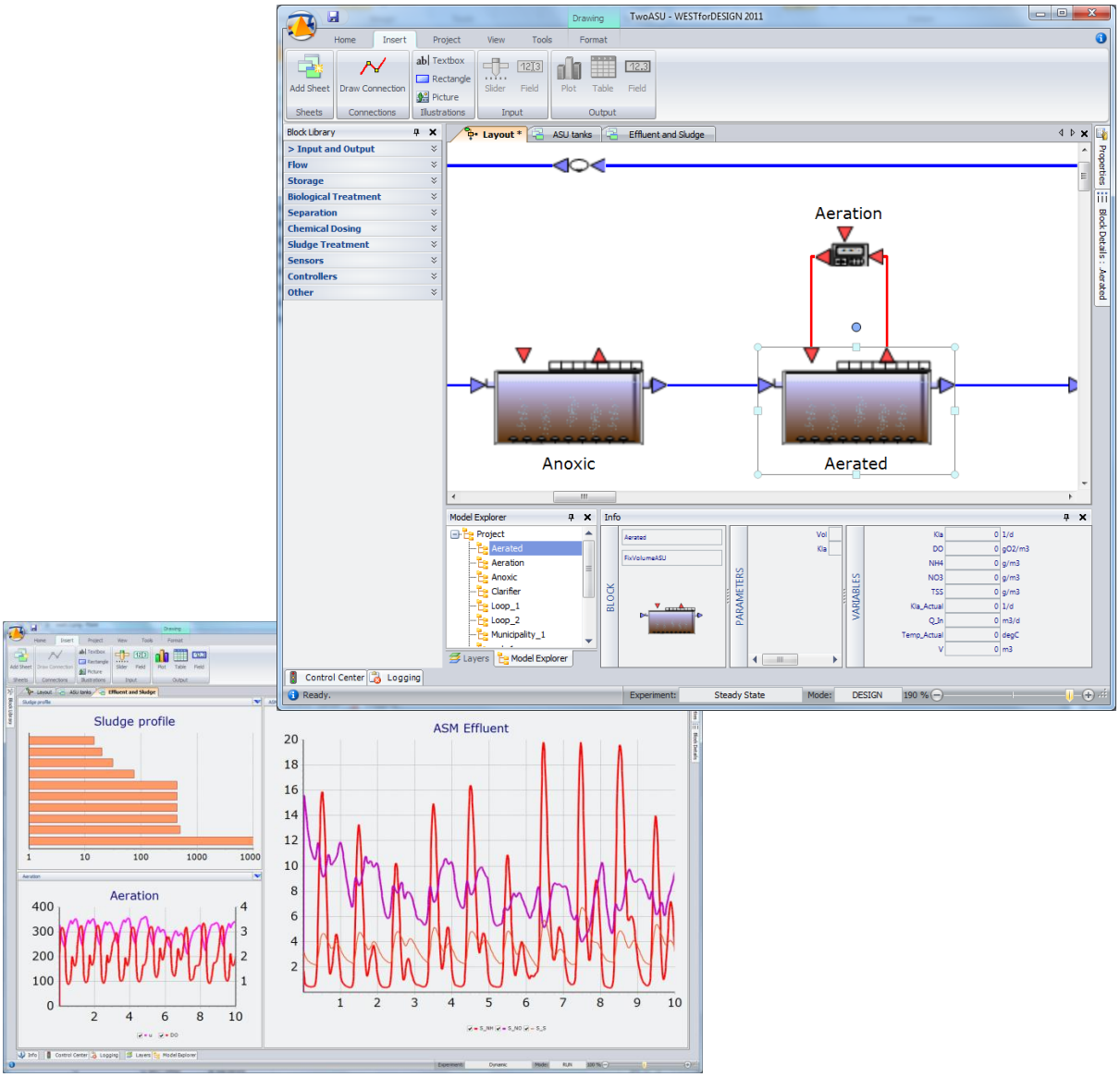

WEST

Modelling Wastewater Treatment Plants

Short Description

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CONTENTS

WEST
Short Description

1 GENERAL DESCRIPTION

WEST offers a user-friendly platform for dynamic modelling and simulation of water quality systems (such as wastewater treatment plants, rivers, sewers and urban catchments). The platform uses mathematical models as a representation of real-world systems.

The plant layout is set up in a graphical way, selecting the different units from a process library. Control strategies can very easily be implemented by selecting and placing sensor and controller units in the layout. No additional coding is required. TAB-separated files (e.g. from Excel) can be used as input for the simulations. The plot environment offers total flexibility in creating visually appealing plots of simulation results.

WEST has an extensive model library and an open structure that allows for implementing new models, or for modifying any of the existing models. A model editor, including a Gujer (Petersen) Matrix editor, is available in order to facilitate the modifications.

For efficient model calibration, a number of additional modules are available to automate several tasks, i.e. sensitivity analysis, parameter estimation, Monte Carlo simulation and scenario analysis.

WEST has an open structure that allows for integration with supervisory systems (SCADA) and data management systems on the WWTP. Using this approach one can implement an operator decision support system aiding in day-to-day plant management, while saving on operational costs and guaranteeing the required effluent quality.

2 PRODUCT SUITE

2.1 WESTforDESIGN

Based on state-of-the-art software technology, WESTforDESIGN allows for validation of design options and evaluation of different plant layouts in dynamic conditions. This is done by running scenarios, e.g. for high load and low load conditions, and by evaluating the effect of complex control strategies.

Figure 2.1 WESTforDESIGN

Features

- Quick set-up
  - One single application (for modelling and simulations)
  - Predefined layouts with output (templates)
  - Custom layouts with output (from scratch or from templates)
  - Automatic generation of simulation experiments (steady state and dynamic)
  - Models preselected and initialized
- Easy access to web resources and user community
- **Unparalleled simulation speed** by automatic generation of optimized code
- Customizable user interface (dockable windows)
- Plant layout with unlimited size and complexity, including multiple controllers

- extensive model and process library (including realistic and fast models for MBR, IFAS…)
- Easy implementation of complex control strategies in the process layout
- Influent fractionation and data evaluation
  - Default fractionation models
  - Graphical set-up of the fractionation models
  - Graphical and tabular display of influent data
- Dynamic and interactive simulation runs
- Graphical and tabular display of results during simulation runs

2.2 WESTforOPERATORS

Based on state-of-the-art software technology, WESTforOPERATORS allows to perform short-term (e.g. storm events) and long-term (e.g. consistent nutrient removal) evaluations of WWTPs . This approach makes it possible, for operators, to re-use the modelling efforts of their consultants in a flexible and customizable tool. The evaluations are done for bottleneck identification, running scenarios for specific influent and operational conditions, and for evaluation of costs. The tool is most useful to improve understanding of the WWTP and hence for operator training.

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- Unparalleled simulation speed
- Customizable user interface (dockable windows)
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  - Default fractionation models
  - Graphical and tabular display of influent data
- Dynamic and interactive simulation runs
- Graphical and tabular display of results during simulation runs.

2.3 WESTforOPTIMIZATION

Based on state-of-the-art software technology, WESTforOPTIMIZATION allows consultants and engineers to optimize the (waste)water treatment processes. The flexibility and the truly open model structure (one can change any model in the model library without limitations) in combination with add-on modules for easier calibration (sensitivity analysis, automatic parameter estimation, scenario analysis and uncertainty analysis) makes WESTforOPTIMIZATION the most powerful tool available.

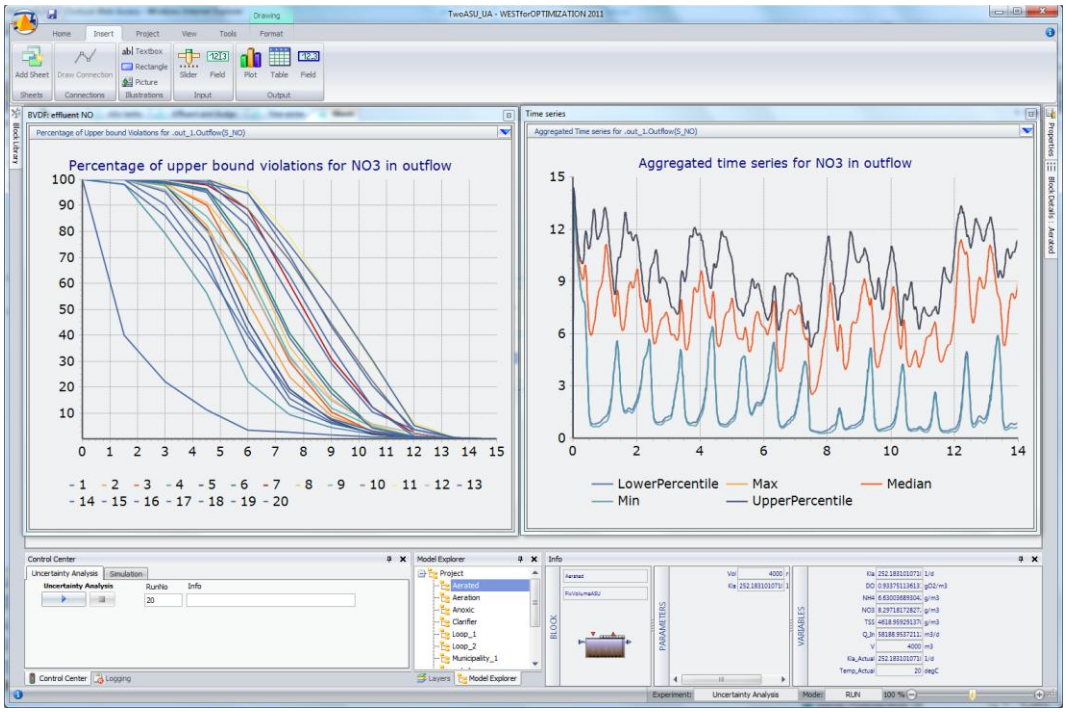

Figure 2.2 WESTforOPTIMIZATION

Features

- Quick set-up
  - One single application (for modelling and simulations)
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  - Custom layouts with output (from scratch or from templates)
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2.4 WESTforAUTOMATION

Based on state-of-the-art software technology, WESTforAUTOMATION, an extended toolkit that allows for fast integration of modelling and simulation in custom applications by automation or software engineers. Different SDKs containing comprehensive and extensive documentation and sample sets, allow for linking WEST with SCADA systems or other modelling software (Matlab, CFD, MIKE URBAN, ...)

Features

- Unparalleled simulation speed
- Extensive documentation and sample sets
- .NET API (standard)
- C & C++ API (on project basis only)
- Matlab MEX API (on project basis only)
- OpenMI API (on project basis only)
- COM API (on project basis only)
- JNI API (on project basis only)

2.5 WESTforIUWS

Based on state-of-the-art software technology, WESTforIUWS allows for:

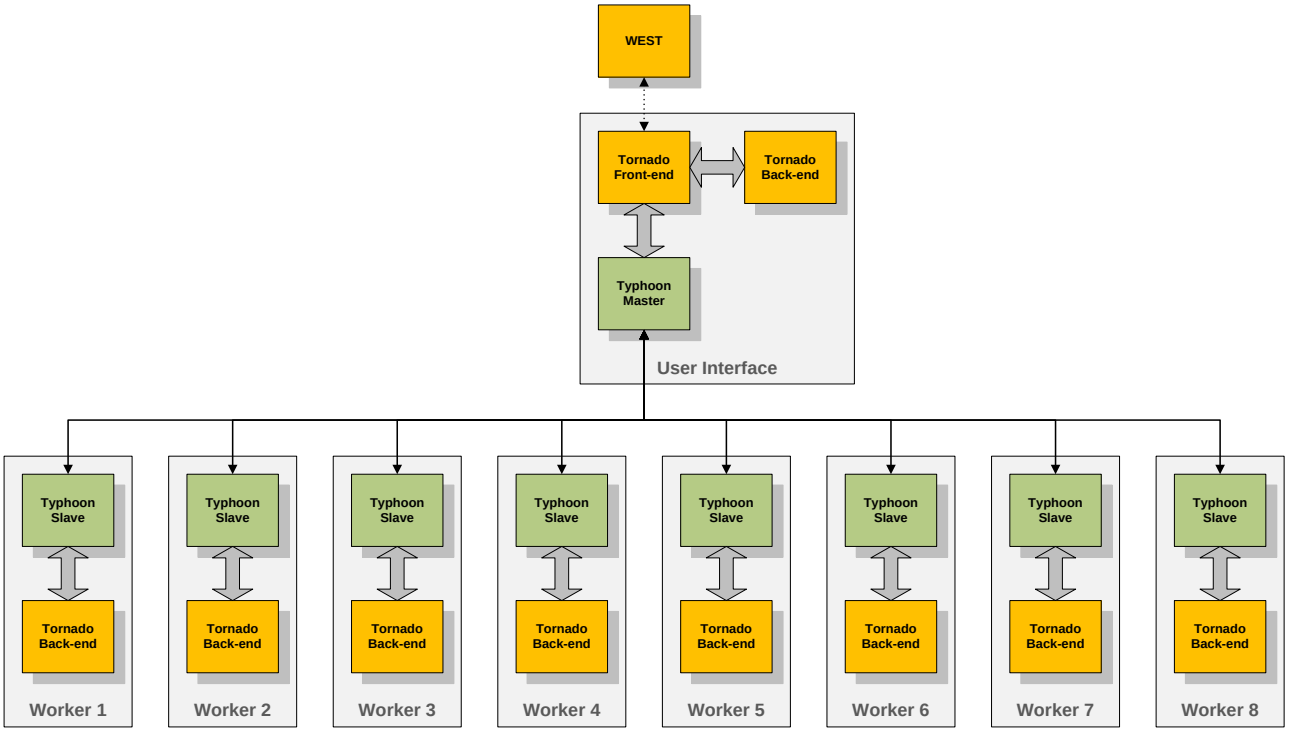
- Exploration of specific water quality scenarios developed by the system manager (e.g. flow diversions, introduction of tanks, changes in operation, etc.)
- Automatic optimization of the operating parameters.
- Performing short-term and long-term evaluations.
- Uncertainty and sensitivity analysis of the model to spot the most influential operating parameters and to assess the risk of non-compliance with regulations.

Features

- Plant layout set-up (unlimited size and complexity) using the extensive model and process library (including components for sewer, WWTP and surface water).
- **Unparalleled simulation speed** by automatic generation of optimized code
- Dynamic and interactive simulation runs
- Graphic display of data during simulation runs.
- Linking with GIS systems.
- Model Editor
  - Custom model development.
  - Full editing capabilities for the processes and components in the Gujer (Petersen) Matrix.
- Parameter estimation
  - Parameter estimation based on comparison of simulated data with measured values.
  - Multi-criteria optimization.
- Scenario analysis
  - Automatic execution of a set of simulations with different parameter values.
  - Parameter and range selection.
  - Parameter values can be manually placed, automatically spaced (linearly or logarithmically) or sampled from standard statistical distributions.
- Sensitivity analysis
  - Calculation of the absolute or relative local sensitivity of a variable towards a change in a certain parameter.
  - Calculation of global sensitivity by means of Monte Carlo simulation.
  - Automatic determination of the important model parameters.
- Uncertainty analysis
  - Automatic execution of a Monte Carlo simulation in order to evaluate uncertainty in the model predictions.

2.6 WESTforCLUSTERS

WESTforCLUSTERS is a lightweight distributed execution system that allows for distributing the workload generated by some of WEST's computationally intensive virtual experiment types (typically scenario and Monte Carlo analysis) over a number of (idle) work nodes (PCs). The software consists of a Master component that processes job descriptions and assigns them to work nodes. Each of these work nodes is equipped with a Slave component that accepts job descriptions and executes them as a background task.



Features

- Maximum usage of idle computation power within the company's computer network
- Fault-tolerant execution of simulations
- Platform-independent (Windows / Linux) execution of simulations

2.7 WEST Encrypted Models

2.7.1 SBRFullReactive

Model for a sequencing batch reactor process, with reactions during all phases (also during the settling phase).

2.7.2 Rauch

Implementation by BIOMATH - Ghent University of a trickling filter model based on the biofilm model of Rauch et al. (1999, Water Res., 33, 2148-2162). The model uses a two-step calculation procedure: it disconnects the diffusion process from the biokinetic reactions. For each conversion process, the active fraction of the biofilm is calculated from a simple analytical solution of the overall process. Then the conversions are calculated.

2.7.3 Reactive settling

Implementation by BIOMATH - Ghent University of a settling model based on the Takacs settling equations, including biological reactions according to ASM1, ASM2, ASM2d and ASM3. The model can easily be extended for other models implemented in Gujer (Petersen) matrix format (e.g. using the WEST Petersen editor).

3 SERVICES

DHI provides model-based services for the optimization of wastewater treatment plants and integral water basin management (WWTP modelling - River modelling - Sewer modelling - IUWS modelling), based on the WEST software. These services include:

- Modelling of water infrastructures, i.e. sewers, treatment plants, water reuse, drinking water production and rivers. A modelling project will include the following steps:
  - Step 1: Defining the goal
    During this first step, an overview is given on the principles of modelling and simulation of water related processes. Subsequently, the goal of the project is defined in cooperation with the client.
  - Step 2: Implementing the model
    The model is implemented on the basis of the historical (and new) data, the plant layout, the different control implementations and discussion with the operators.
  - Step 3: Calibration
    The model is calibrated with the required accuracy to meet the goals of the project.
  - Step 4: Validation
    The calibrated model is validated based on an independent data set, to confirm the validity of the model.
  - Step 5: Reporting
    The client receives a report of the project. The client can also receive the developed model of the system to further explore possible improvements of the system.
  - Step 6: Closure
    The final report is discussed with the client.
- Assistance in model building. The client can be guided in all steps of the modelling process, i.e. set-up of a measurement campaign, set-up of the model, calibration of the model, set-up of scenarios, ...
- Setting up a model-based decision support system. A model-based decision support system has a great added value for wastewater treatment operators and managers. Software linking the supervisory system and the simulation software is developed according to the client's wishes.

Training in the modelling of water infrastructure (WWTP modelling - River modelling - Sewer modelling - IUWS modelling). Training courses are organized on a regular basis. Custom training courses (basic or advanced) can be provided in the offices of DHI or at the offices of the client.

4 SOFTWARE REQUIREMENTS

Windows XP Professional (32 and 64 bit),
Windows Vista Business (32 and 64 bit), or
Windows 7 Professional (32 and 64 bit).