CADSIMulator

CADSIM Plus Process Simulation News

Volume 10, Issue 1

DCS Checkout & Operator Training Simulator with CADSIM Plus

Howe Sound Pulp & Paper Plans New Evaps

HSPP is a world leader in delivering outstanding quality Kraft pulp products. Originally established in beautiful Port Mellon, BC in 1909, the mill has grown into one of the finest, most efficient Kraft pulp producers in the world.

Aurel Systems was recently commissioned by HSPP to use its CADSIM Plus dynamic process simulation software suite to develop a Distributed Control System (DCS) checkout and basic Operator Training Simulator (OTS).

HSPP was installing a new vacuum evaporator train. They were aiming to increase their pulp production rate by 50%. However, they realized that their existing evaporator system would become a bottleneck to increased production. To overcome this, a second evaporator system was designed along with a new control system.

HSPP wanted to ensure that their startup would be trouble-free. Consequently, they chose CADSIM Plus to perform a thorough check of the DCS system, while developing an OTS to train operators in advance of startup.

This was an exciting and challenging project to work on. Of critical importance was the ability to run the simulation model with either internal CADSIM controls or through the external DCS.

A single model was developed which could be switched between the differing control methods. (*See the Tech Corner article on Page 3 for more info*) This greatly reduced the development time required in comparison to similar projects and was a major benefit of using CADSIM Plus.

DCS Checkout

The challenge was finding a way to test the new DCS system before it was live in the process. Errors in a new DCS can range from startup delays to potentially dangerous consequences if the process equipment and DCS do not respond to each other due to configuration errors. To reduce the chance of problems, CADSIM Plus was used to test the control system while the evaporator train was being built.

In particular, the dynamic sequences used to start the evaporators up, shut them down, and wash the effects were examined. As a result, problems were found including missing connection tags, and controller tunings/settings that had to be reconfigured.

Operator Training

After developing the model used to test the DCS, the application was easily transitioned to an OTS since the first step of OTS development is to develop a high-fidelity simulation. The model was designed to act as a proxy for the actual evaporator train using internal CADSIM Plus controllers. The operators were able to gain an understanding of how the real process would work using the same opera-

(Continued on page 2)

Inside this issue:

(HSPP continued from page 1)

tor screens they would see in the plant.

Each operator had an opportunity to run through full procedures in a simulated environment that may happen infrequently or last longer than a single shift. CADSIM Plus has the ability to run many times faster than real time, so events with longer time constants can be compressed for training purposes.

With the looming retirement of a generation of operators, there will be a need to train new operators. Training simulators, which utilize a fundamental model controlled by the actual operator interface, will be important tools to train these new operators while passing along the information of experienced operators.

> ***"The operators not only learned the control logic by training with the simulator, they also got a good feel for how the real process will work once we start up the plant."***
>
> ***Gerry Pageau, Sr. Process Engineer***

Methodology

P&ID drawings for the new HSPP evaporators were used as the basis for the simulation flowsheets which generated the initial mass and energy balance.

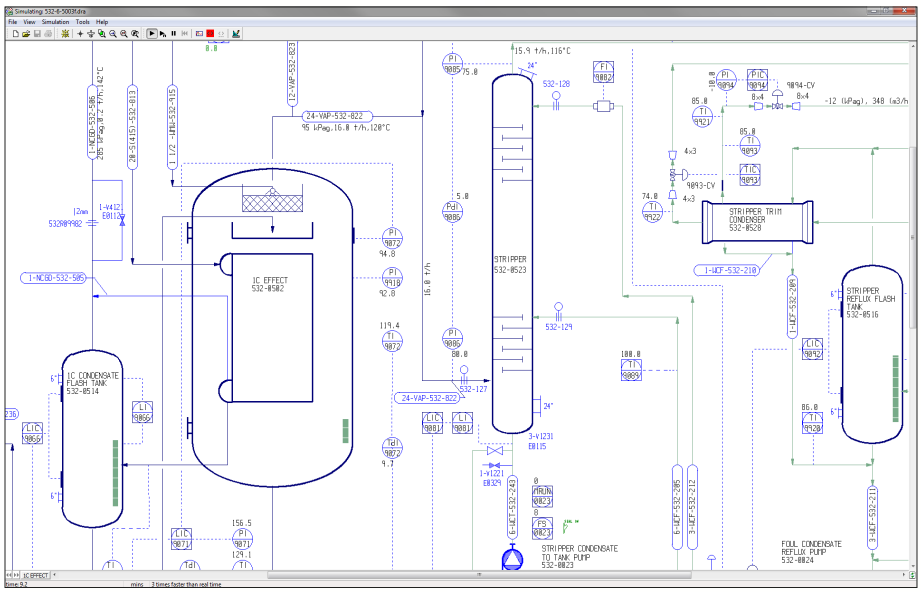
The simulation is driven by wide use of pressure flow networks in order to provide realistic process responses to DCS controller inputs and valve positions.

Of particular interest are the transmitter and receiver locations in the process. These simulated transmitters and receivers became the model's communication points to the external DCS.

The next step was to tie the transmitter and receiver modules in CADSIM Plus, into the DCS Input-Output (IO) list. The IO list was interpreted into configuration and map files which could be read by the proprietary CADSIM Plus OPC Launcher that Aurel Systems has developed.

The external control system was then able to receive signal information from CADSIM Plus, such as temperatures and pressures. The control system could then respond to this input by transmitting an output signal (such as a valve position) back to CADSIM Plus. In this way, CADSIM Plus and the control system would communicate and interact between simulation time steps.

A set of approximately 250 IO tags were connected to the simulation model. The connection process alone exposed many inaccuracies in the control system and associated documentation which served as a valuable cross-check for the real process. Following this setup, the control system and simulation were tested through startup, shutdown, and washing sequences.



With the CADSIM Plus simulation and DCS system connected and tested, it was a simple task to convert the DCS checkout into a basic operator training simulator. The operator trainee used the actual control hardware from the DCS system (the one that would be used during operation) to train on control procedures before startup.

Results

Gerry Pageau, a HSPP senior process engineer on this job said, "The high fidelity simulation of our new seven effect vacuum evaporator train has allowed a thorough checkout of the DCS logic including the complex washing sequences. These would be difficult to troubleshoot and debug manually because of their dynamic nature."

Mr. Pageau also stated, "Sequence logic is difficult to debug in the real plant because the cost of errors is very large. With the CADSIM Plus simulator, we could just run the sequences over and over again until all the errors had been discovered and removed."

Given the complexity and importance of a modern DCS, testing it before implementation is obviously an important task to mitigate risk. Using a CADSIM Plus simulation to act as a proxy for the actual process is an effective method to test a control system, improve understanding of the control strategy, and train operators.

Development time for theses projects was significantly reduced by using a single simulation model, made possible by CADSIM Plus' ability to be run with internal soft controllers or with external DCS hardware.

Tech Corner: Active and Dormant Layers in CADSIM Plus

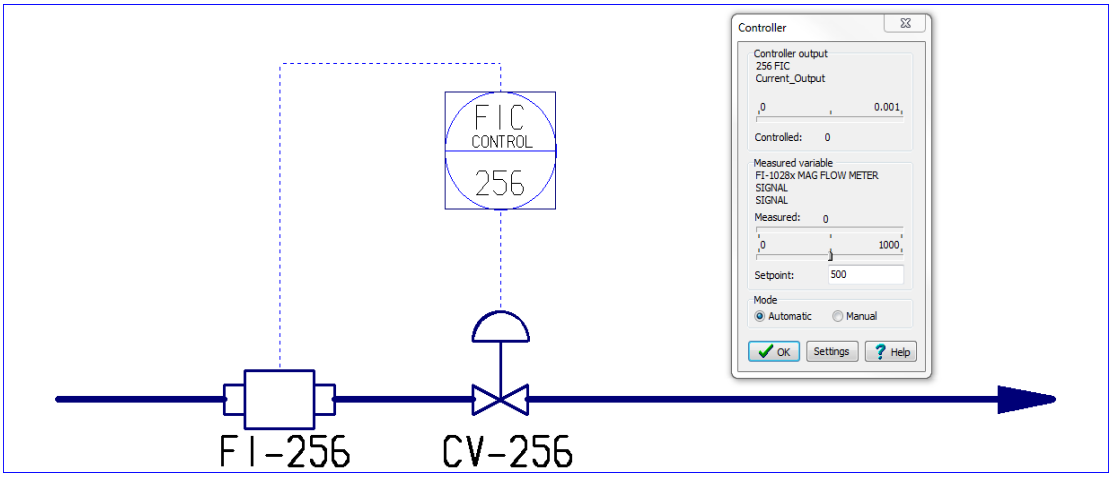
A central feature of CADSIM Plus is its ability to represent a mass and energy balance on a P&ID quality drawing. Having a clear representation of your simulation improves the understanding of your work by those who are not familiar with process simulation. An operator or executive will more easily interpret a P&ID drawing than a complex spreadsheet model, allowing you to demonstrate your ideas for the process clearly.

During the development of a recent project to produce DCS checkout and operator training simulators, a CADSIM drawing required two different control strategies. The first control strategy used an external DCS system to drive the simulation, however this required access to the DCS server which was not always available. The second control strategy used internal CADSIM controllers to mimic the external DCS, but allowed for development of the simulation without requiring a connection to the external DCS.

This challenge was overcome by using Dormant Layers in CADSIM Plus. If a drawing layer in CADSIM Plus is set to dormant, the process lines and polygons will not participate in the simulation model. This allows a user to quickly switch between the two strategies by setting layers to dormant or active.

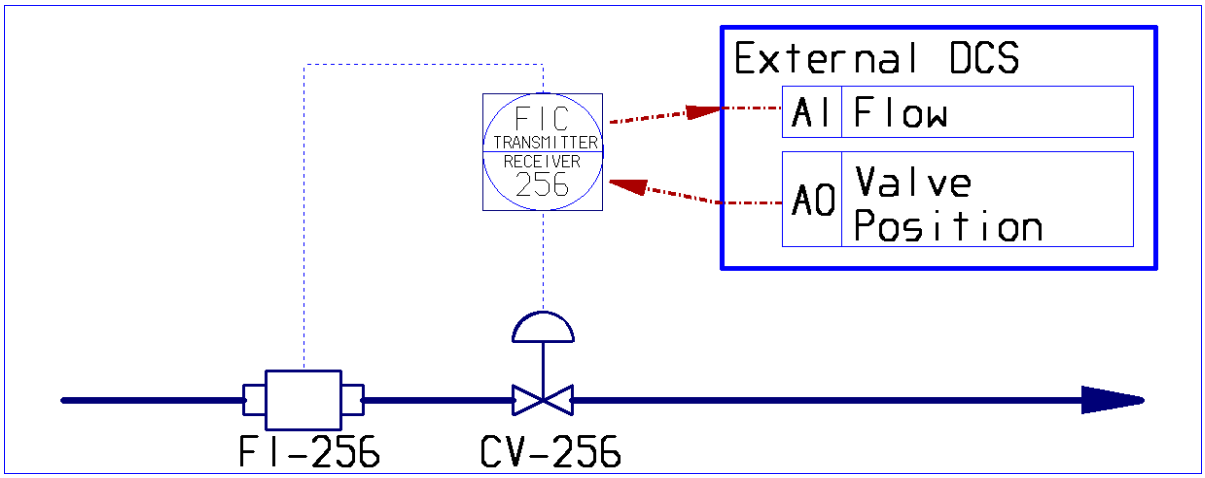
The user can place simulation components of different layers on top of one another, and by toggling the various layers between dormant and active (and visible and invisible) they can serve two completely different purposes. CADSIM Plus allows up to 255 different drawing layers.

As an example, the figures here show a simple flow controller with two control setups. In the top figure, CADSIM Plus uses its internal PID controller, and in the bottom figure, an external DCS system is used to do the control. Two different layers are used for this on the same drawing.



In the examples, the internal control element (the CONTROL module) is placed on layer 28. The external control elements (the TRANSMITTER and RECEIVER) is placed on layer 29. When layer 29 is dormant (and invisible) and 28 is active (and visible) CADSIM's internal PID controller is used, and when layer 28 is dormant (and invisible) and 29 is active (and visible), the external DCS controller is used.

Using this concept, you can overlap the internal control and external control elements directly over one another. This way we maintain the P&ID as a single drawing which reduces upkeep overhead.



The benefit of internal CADSIM Plus PID controllers is that a user can work on the simulation and run the model without having to connect to the DCS system.

Aurel Systems Inc.
7197 Ridgeview Drive
Burnaby BC Canada V5A 4S1

Phone: +1 604.299.7707
Fax: +1 604.299.8178
Email: mail@aurelsystems.com
Web: www.aurelsystems.com

AUREL

Your practical solution for process improvement and operation.

Visit us on the web at www.aurelsystems.com

CADSIMPLUS

Did you know...?

You can quickly change the size of specification icons using the **Change Specification Size** tool. Simply right click on the specification, select **Change Specification Size**, and choose a new size. You can select from double the default size to minuscule.

This is helpful for:

- Freeing up space on your drawing for other details
- Miniscule specifications can be used to hide unimportant specs on a formal P&ID drawing
- Maintaining consistent specification sizes throughout your drawing

Announcing CADSIM Plus v3.2

Improvements to Drawing Mode

- Now you can edit both the **free** and **specified variables** in multi-specification type specs
- Improved **OPC browsing** performance
- **Text entry box** now includes options to change **color**, **layer**, **angle** and **text type** while editing
- New **Ungroup Part** feature
- New tools to **locate and open stream definitions** by selecting a process number from a dropdown list
- An improved tool that allows you to **Removing Line Segments** without breaking polygon or process lines
- A new **Align Selection** tool for cleaning up imported drawings
- A new **Change Specification Size** tool that allows you to quickly resize spec icons to preset sizes

Improvements to Simulation Mode

- New display options for **formatting** the display of **elapsed simulation time**
- New **hide and restore charts** feature
- New **AutoTune** feature allows you to take over **manual control** of the controller tuning process
- A new, simplified visual display for the **Change Order of Execution** feature
- A new global settings option for the **Convergence Monitor** to simplify working with project files
- New option to select a **text color** for **Inserted Results Records**

New & Improved Unit Modules

- **Efficiency calculations** have been added to the **Recovery Furnace** and **Burner** modules
- A new (optional) **dilution stream** has been added to the **High Density**, **Tower**, **DStage**, **EOP**, **EStage** and **O2delig** storage unit modules
- New **Digester** unit added to the optional **Fiber** library
- New **Cyclone** unit added to the optional **Mineral** library

Improvements to Stream Chemistry

- New ability to handle bound IONs has been added. **Bound IONs** can be attached to follow a mass component, such as **FIBER**.