Simcenter Flomaster Release Highlights

Software Version 2021.1
April 2021

SIEMENS

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Introduction

This document provides a high-level summary of this release. It includes a summary of the new features in this release, any authorization code changes required, any major installation changes, and any transitioning issues you should be aware of before installing. Additionally, any last-minute issues found in the final stages of testing are included.

Physics

Enhanced Concentration Tracking Using the Multi-Physics Pipe

Simcenter™ Flomaster™ software 2021.1 introduces a new pipe component called the Multi-Physics pipe. This pipe uses particle tracking methods to enable modelling of sharp temperature or concentration front without numerical diffusion that can lead to a smearing of results and can be used with both Newtonian and Non-Newtonian incompressible fluids. Applications include:

- Running multiple fluids through a line for batching, purging or cleaning process and tracking the fluid front through the system
- Priming and Depriming of Systems
- Drawing one fluid in and then expelling it as would be seen in a pipette.

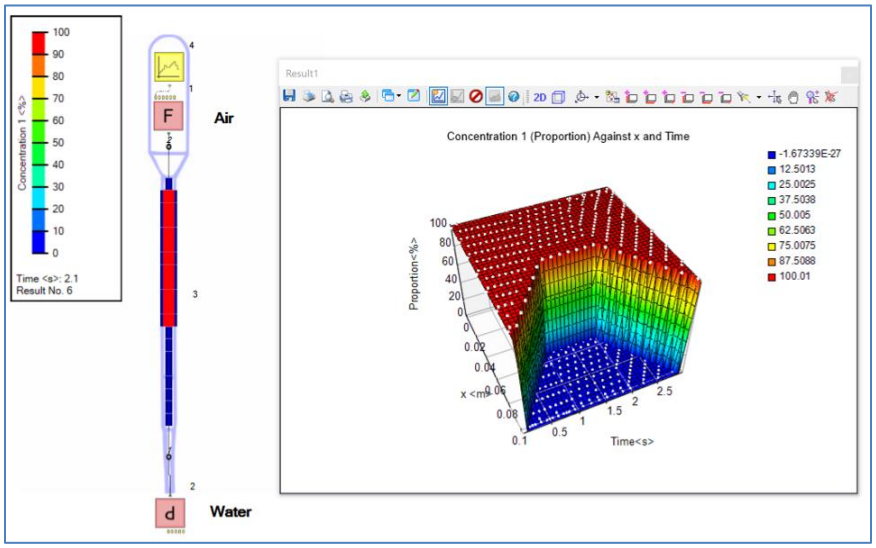


Figure 1 - Pipette Network Showing water being drawn in and expelled

Pump Curve Enhancements

Building on the Pump Head Curve Wizard introduced in Simcenter Flomaster 2019.2 Simcenter Flomaster 2021.1 adds three new features to aid in the creation of pump curves, these are:

- Expansion of the Wizard to Torque vs Flow Curves

This allows the pump Torque v Flow curve to be created using the new Wizard Framework, including the Extend to All Operational Modes function and the Curve Digitizer that are available for the Head v Flow curve. You can use the Extend to All Operational Modes function when only the forward flow/pressure rise quadrant of the pump curve is known, while the Curve Digitizer assists in creating the curve from supplied curve images.

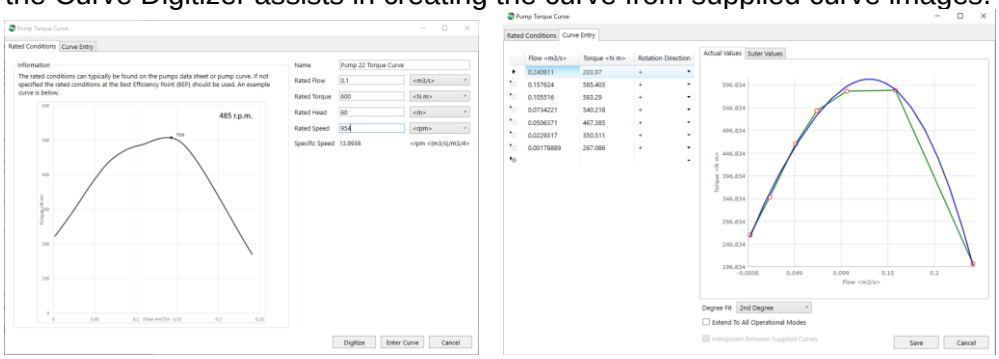


Figure 2 - Pump Torque Wizard

- Ability to view the Chebyshev polynomial coefficients for polynomial fits of the curves
- Enabling Curve Interpolation when the Extend to All Operational Modes function is selected
    - When using the Extend to All Operational Modes function the nearest pump curve is selected (Radial, Mixed or Axial) and data copied from it, this can lead to a data mismatch when the points are between the two regimes. The Curve Interpolation function takes a weighted average of the two curves either side of the data point (Radial-Mixed or Mixed-Axial) which can lead to better fitted curves

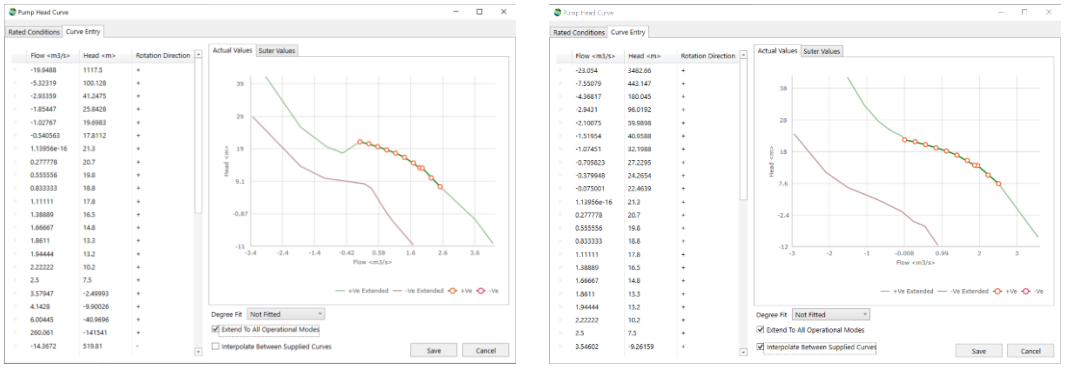


Figure 3 - Comparisons of Pump Head Curves with and without interpolation

CAPE-OPEN Enhancements

An accurate simulation result can only be achieved if the fluid properties correspond to those that will be used in the real system. Simcenter Flomaster 2020.2 introduced an interface to CAPE-OPEN (https://www.colan.org/) allowing fluids to be created using CAPE-OPEN fluid property providers. In Simcenter Flomaster 2021.1 the functionality has been extended as follows.

- Two phase fluids can be created in addition to the Liquid and Compressible fluids available in 2020.2.
- In Simcenter 2020.2 only 32 Bit Fluid property providers could be called, in Simcenter Flomaster 2021.1 this has been extended to allow both 32 and 64 bit property providers to be called. 32 bit property providers are explicitly marked as such

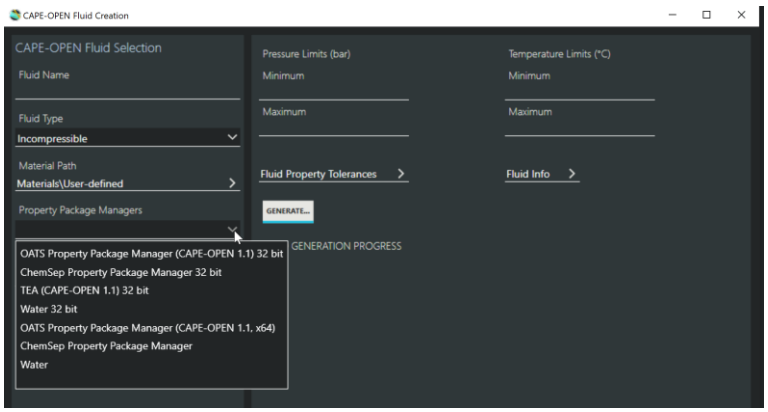


Figure 4- CAPE-OPEN Fluid Selection showing 32 and 64 Bit Fluids

New Map-based Compressor Component

Simcenter Flomaster 2021.1 introduces a new Map-based Compressor. This replaces the existing Compressor component with the following enhancements.

Data Entry

- When specifying reference conditions you may choose to set the inlet and outlet at Total or Static conditions. This reduces the need to pre-process test data to enter it into the component. Any combination of total or static at inlet and outlet can be set.
- Updated data form with all Reference Data grouped into a single sub-form meaning data is entered in a single place, reducing the likelihood of missing data.

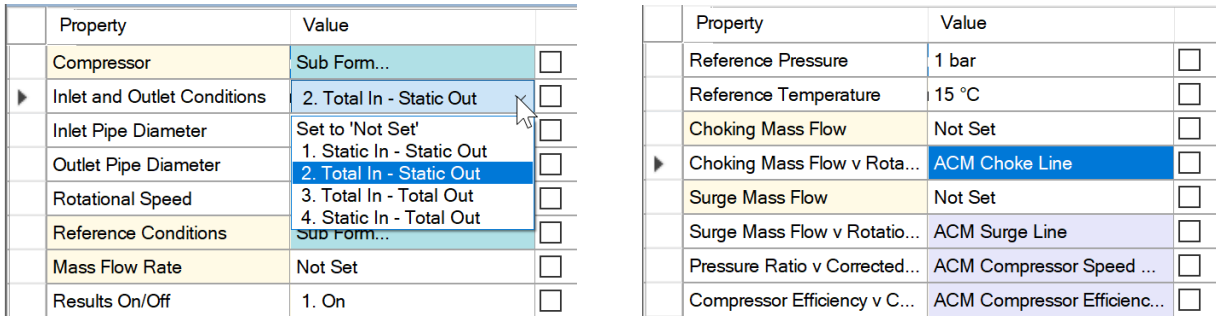


Figure 5 - Updated Compressor Data Forms showing Inlet\Outlet Condition Selection

Modelling

- New controller input for Torque in addition to the existing Power and Speed inputs
- Better handling of surge and stall conditions

Non-Newtonian Flow - Casson Model

In Simcenter Flomaster 2020.2 an extension to Incompressible fluids was made to allow Non-Newtonian fluid properties to be defined at fluid level rather than having to be specified at a component level in the Non-Newtonian pipe making use of the Power Law. In Simcenter Flomaster 2021.1 the properties have been extended to implement the Casson Model which may be more appropriate for modelling of shear thinning liquids that are assumed to have an infinite viscosity at zero rate of shear. The Yield Stress of the liquid is required for this model to be enabled.

Bulk Loss Component

At the early design stage detailed information on pipe layout and geometry is often not yet defined or unavailable but early estimates of flow rate and associated pressure losses are required. To ease modelling at this early design point Simcenter Flomaster 2021.1 introduces a new Bulk Loss component enabling pipe, bend and fitting losses to be modelled in a single component with the user being able to specify.

- Pipe Length, Diameter and Roughness
- Number of Bends and the ratio of radius to diameter
- A fitting loss as a percentage of the pipe loss

The losses from each element will be added together to give a total loss.

Zero Flow Heat Transfer Enhancements

Zero Flow Heat Transfer (ZFHT) allows for the transmission of heat in the Axial (through the liquid) and radial (through the pipe wall) directions when the fluid in a component has near zero velocity. In Simcenter Flomaster 2021.1 the capability has been extended to include the effects of insulation and the thermal capacity of the pipe wall.

User Experience

Visualization of Fluid Type and Concentration for Network Results Display & Sensors

When working with Multi-Fluid simulation or systems with different fluids in different circuits understanding concentrations or which fluid is in which circuit can be crucial. It is now possible to display the results for Fluid Type and Concentration of each component in a fluid stream using both the Network Results Display and Live Sensors in both live mode (during the simulation) and post-simulation for post-processing. As with all visualization results, the resulting output can be captured as both images or video showing changes with time.

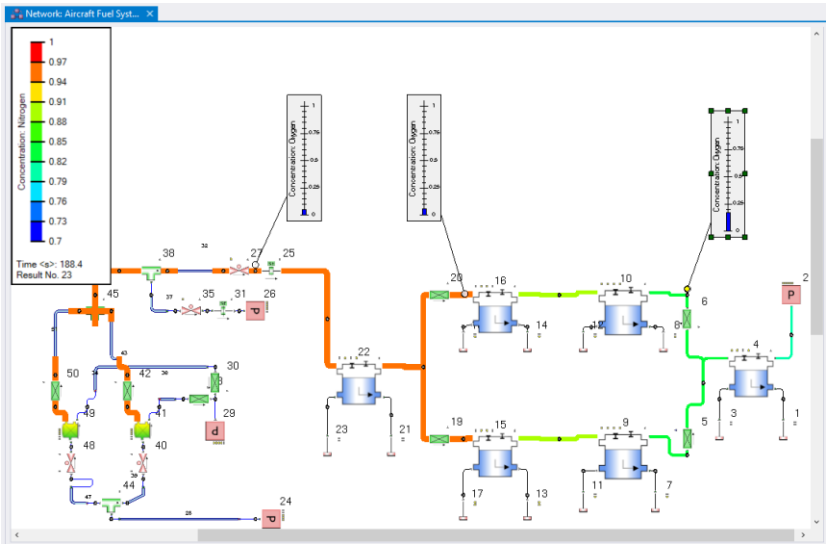


Figure 6 - Network Results Display Showing Concentration of Nitrogen with Sensors showing Oxygen

Dashboard - Create Data by Component ID

Dashboards can be used in Simcenter Flomaster to display plots of results that can be saved between sessions and reopened for different result sets. In response to user feedback a new mode of selecting results has been added, allowing the user to select a component, component arm or node and then select results from it. This is in addition to the existing option of selecting a result and the components that have the results being available for plotting.

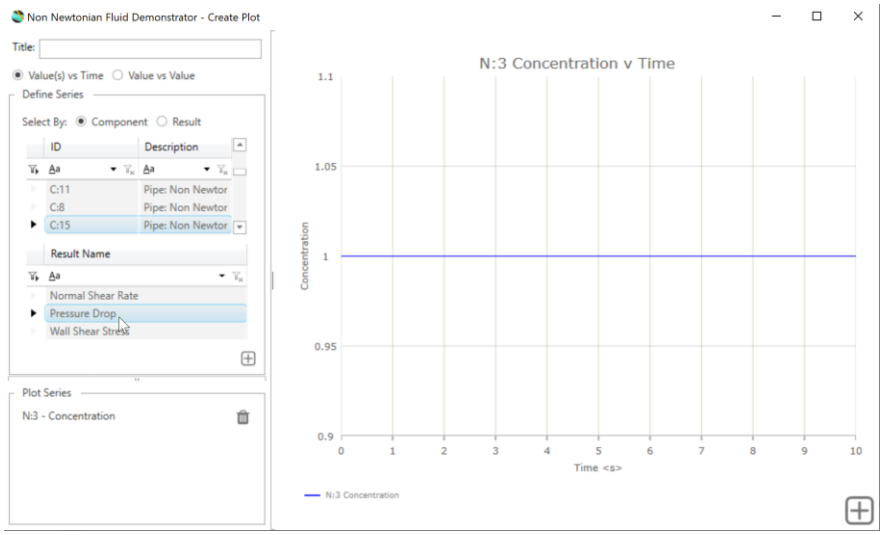


Figure 7 - Adding a Dashboard Plot in Component Selection Mode

The user can toggle between the two modes as required for maximum efficiency with the new mode being most appropriate when multiple results from a single component are required and Result mode being appropriate when the same results from multiple components are to be plotted.

Create & Edit Script from Feature

To streamline the workflow when working with scripts in components in Simcenter Flomaster 2020.1 scripts can be created and edited directly from the data forms of the components in which they will be used has also been added.

To create a new script, launch the script selection window from a script feature of a controller or gauge and select ‘Create’ and a new work flow is added. The script can be edited by selecting ‘Edit Script’ from the feature Right Click menu or the ‘E’ button on the data form.

Edit Performance Data from Feature

In addition to the ability to edit a script from a feature in Simcenter Flomaster 2021.1 performance data can also be edited directly from a component feature allowing direct editing in the network.

When data is edited in this way the user will be asked if they want to update all other components using the data in the network to use the new version of the curve or just the component that was updated.

Enhanced Simulation Messages

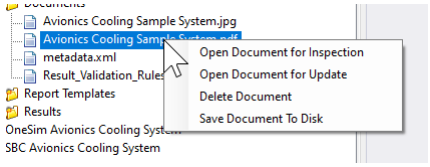
Building on the Enhanced Messaging Display introduced in Simcenter Flomaster 2020.2 a full review of the warning messages generated during a simulation has been conducted of both content and context. As a result of the review:

- Messages are now categorized as either Warning or Info:
    - Warning messages inform the user about information that may be relevant to the simulation results and should be reviewed. Examples might included performance data being out of range or pressures being below vapour pressure at nodes
    - Information messages inform the user about model options selected or data choices made. Examples would include performance data being used over constants in a component model or the thermal model selected in a pipe

In addition, all messages have been updated to allow the component outputting the message to be added to the collection for review.

Save Document to Disk

A new option has been added to the right click menu for documents attached to networks to enable them to be quickly saved to disk without the requirement to open them first.



This can ease editing when a default editor for the file type is not specified in the system preferences or a different editor to the default is required.

New Script Editor

Simcenter Flomaster 2021.1 introduces a new script editor for the creation of Controller scripts, Scripted N-Arm scripts, and macros. It offers a simplified interface focused on the creation of scripts to be consumed in Simcenter Flomaster including:

- Live updates of errors in the code as you type to give early indication of problems
- The display of the code used for the test compile prior to saving the script to aid understanding
- Script Formatting to give more readable code

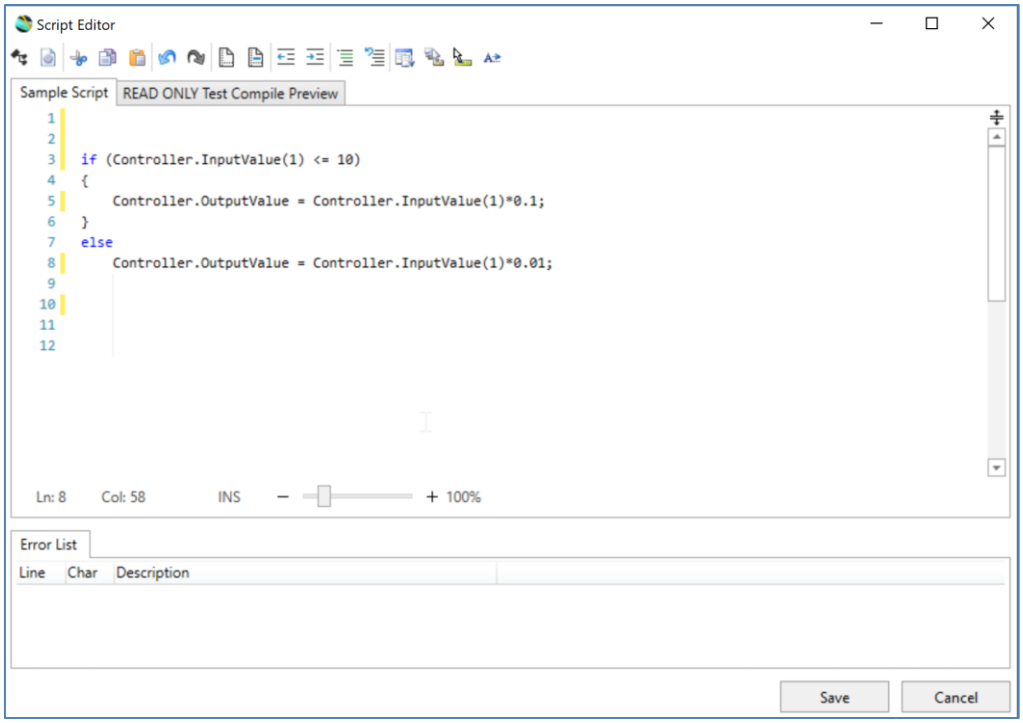


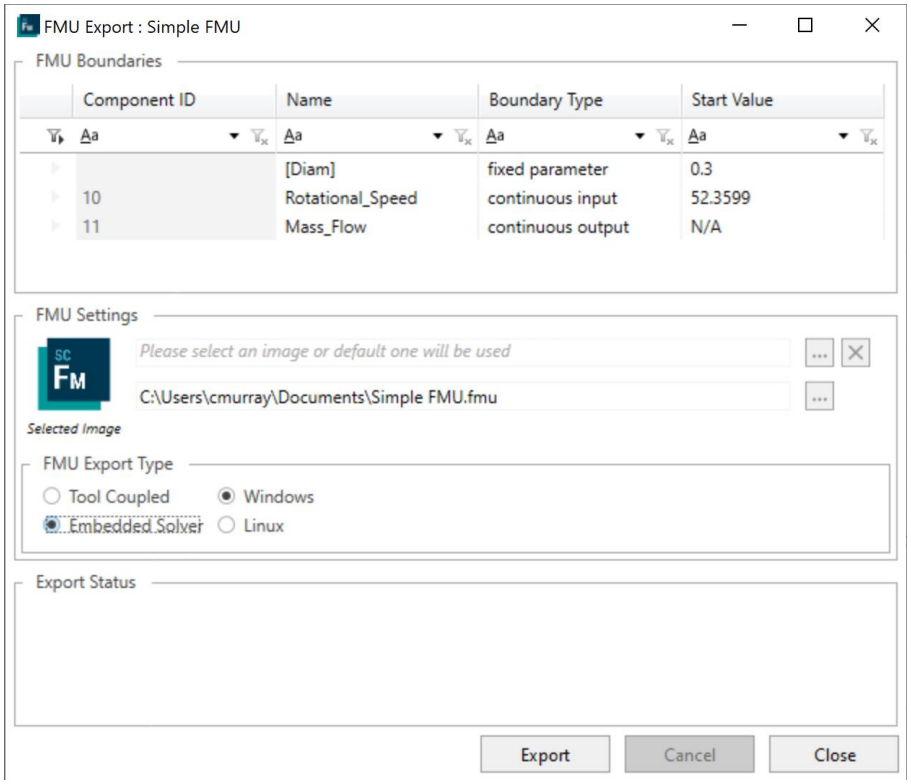
Figure 8 - New Script Editor Window

Connectivity

Cross-Platform Portable FMU

Simcenter Flomaster 2021.1 introduces an additional option when exporting a network as a Functional Mockup Unit (FMU) that complements the existing export capabilities. This option allows the network, associated data and the libraries required to solve the network to be exported as an FMU compatible with version 2 of the Functional Mockup Interface (FMI) (https://fmi-standard.org/) standard that supports both Windows and Linux platforms.

The FMU can then be imported into an FMI master application. It runs as a co-simulation FMU with an embedded solver and run with no requirement for Simcenter Flomaster to be installed on the machine running the FMU.



The export makes use of the same FMI Co-Simulation Input and Output boundary components introduced in Flomaster 9.1 as the existing export along with input parameters allowing the same model to be exported as a FMU for Co-Simulation or Model Exchange at different stages of the design. When exporting the user now has the following options:

- Tool Coupled (Windows Only) – In this mode, an exported FMU will run a Tool Coupled Co-simulation with Simcenter Flomaster installed on the same machine. This option allows for the model being called to be changed after export as long as the inputs and outputs remain the same.

- Embedded Solver (Windows or Linux) – In this mode, the exported FMU will be exported as a co-simulation FMU with an embedded solver. The network (schematic and input data) will be embedded in the FMU and cannot be changed. To run the FMU there is a requirement for access to a Simcenter Flomaster solver license.

P&ID Import

In many industries, Piping and Instrumentation Diagrams (P&ID) are used to describe the interconnection of process equipment, instrumentation, control and associated pipework in a schematic form. These diagrams can then be used as the basis for a Simcenter Flomaster network. In Simcenter Flomaster 2021.1, a network schematic with associated data can be created using an import file generated using Siemens NX™ P&ID Designer software & Siemens COMOS P&ID allowing the network to be generated automatically reducing the time to build and potential for errors.

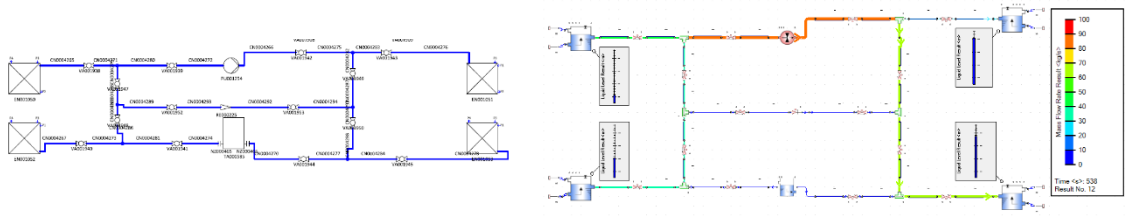


Figure 9 - P&ID and Resulting Imported Network

Co-Simulation with Simcenter 3D

This feature enables Co-Simulation with Simcenter™ 3D software for the modelling of conjugate heat transfer between fluid systems modelled in Simcenter Flomaster and solid bodies modelled in Simcenter 3D. To enable the Co-Simulation the user adds the Simcenter 3D boundary components to the Simcenter Flomaster network, and added to a pipe run. The network is then exported for Simcenter 3D and mapped as thermal convecting zones on import into the Simcenter 3D model. The export file includes all information required to start Simcenter Flomaster and select the model for the co-simulation.

Enhanced GIS Import Shape File Import

Simcenter Flomaster can create networks based on a GIS shape file, in Simcenter Flomaster 2021.1 the following enhancements have been made.

- The scaling of networks has been improved to reduce the likelihood of components being drawn on top of each other

- The speed of import has been improved

FMU Signal Simplification

When an FMU is imported all Continuous Inputs signals will now be mapped to a single port that can accept multiple controller connections. This has two effects:

- Reduces the visual clutter of multiple signals around the symbol on the schematic
- Removes the limit of 45 Continuous inputs that could be mapped in previous releases

Once connected, the signal can be seen using a tool tip over the connection or from the signals right click menu.

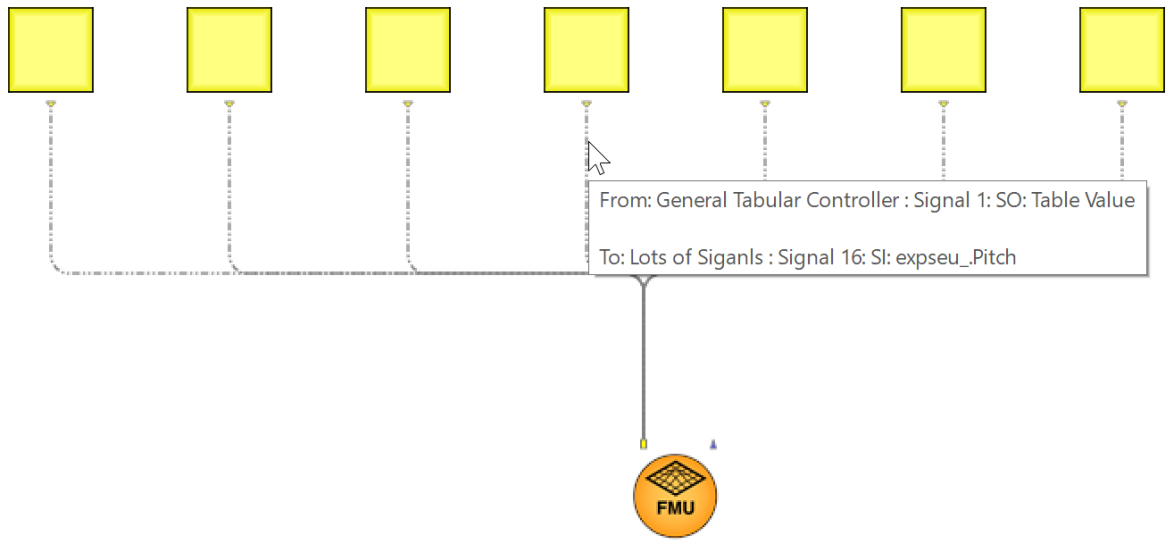


Figure 10 - Imported FMU connected to 7 controllers using Multiplex Input Connection

Flomaster Architecture

64 bit (Including 64 bit FMU Import)

Simcenter Flomaster 2021.1 will introduce a change to the architecture of the product, this being:

- A move to being supplied as 64 bit binaries rather than the existing 32 bit binaries

The move to 64 bit binaries has several benefits including removing the memory limit caused by being a 32 bit app when post-processing large results sets and connecting with other simulation tools that have made the move to 64 bit.

In addition, the change in architecture allows 64 bit Binary only FMUs to be imported, to allow source-based FMUs to be imported a 64 bit compiler is now optionally included in the Simcenter Flomaster installation.

Sample Systems

Sample Systems provide a quick way to get started with pre-build models and accompanying descriptions. Simcenter Flomaster 2021.1 adds three new sample systems:

One Dimensional Heat Transfer

This Sample System introduces the One Dimensional Heat Transfer (1DHT) Technology in Simcenter Flomaster and explains major components involved for running 1DHT simulations. The Sample System consists of three basic networks and explains various ways in which 1DHT could be used, for example, heat interaction between two pipes having opposite flows.

Chemical Spill

This Sample System models Chemical Spill of Benzene and Propane and studies the pressure surge, hydrodynamic force and cavitation as a result of closure of emergency valve.

Desalination Plant

This Sample System demonstrates a desalination plant system which is used in the process of purifying and removing salt from sea water. With the use of fluid modifiers in a Simcenter Flomaster network, it allows the user to change the fluid properties according to the requirement during the simulation.

Preview Features

Simcenter Flomaster 2021.1 includes the Preview Features listed below.

It should be noted that Preview Features are subject to the Beta Code Terms.

Entry Impulse

In a gas turbine secondary air system, there are rotating components including orifices, passages and losses, which have a limited size in the circumferential dimension and it is assumed that the flow inside such components is rotating with the component. When flow is entering such a component and the rotational speed of the flow is different from the component rotation speed, there will be a step change of flow rotation speed at the component entry and correspondingly an impulse change of angular momentum and impulse work between the flow and the component walls. When enabled, the Entry Impulse preview feature allows to account for this impulse work. This effect is significant for correctly modelling the secondary air system. One pertinent application example of this impulse work effect being the correct modelling of the pre-swirl system and its effect on the cooling effectiveness of the pre-swirl system design.

Parametric Analysis Timeout

This preview feature enables a timeout to be set that will stop the running of a simulation in an experiment if the simulation hasn't completed within the specified time. The value should be in seconds and if not required a time value of zero should be set.

Run Component Models Concurrently

This preview feature enables concurrent solving of Simcenter Flomaster components in a simulation.

Licensing

This release uses the Mentor Standard Licensing 2020_1_patch1. V 2020_1_patch1 requires a FLEXnet license server running at version 11.16.4 or higher. If you use floating licenses, you will need to update the license server accordingly. Download the latest licensing software from Support Center. Alternatively, the license server is available from product installation.

Authorization Codes

No changes to authorization codes are required for this release for users using a version of Simcenter Flomaster between FloMASTER V8.0 & Simcenter Flomaster 2020.2.

Simcenter Flomaster 2021.1 uses the Mentor Graphics Licensing System (MGLS). FloMASTER V8.0 was the first release to use this system. The packaging of the product was comprehensively revised to better reflect the value it offers and re-position Flomaster in a manner which makes sense for users. As a consequence, those users with an existing Flowmaster installation prior to FloMASTER V8.0 will need to obtain new authorization codes (license file) for this release.

You can download your existing authorization codes from Support Center -> Account Center -> Licenses:

account.sw.siemens.com/licenses

For additional information on licensing, refer to the *Mentor Standard Licensing* Manual.

Product Transition

As previously mentioned Simcenter Flomaster 2021.1 succeeds Simcenter Flomaster 2020.2

FloMASTER V8.0 and onwards represented a substantial repackaging of the product compared with earlier, V7.x releases. If you are currently a Flowmaster V7 user, please contact your account team for further information (see support information below) on what is available in Simcenter Flomaster 2021.1 and how you can migrate to it.

Supported Platforms

Simcenter Flomaster 2021.1 requirements:

Operating system support:

- Windows 10 build 1809, 1909, 2004, 20H2 - x64

Simcenter Flomaster's Windows 10 support policy can be view here –

https://support.sw.siemens.com/kbassets/external/MG595757/files/Simcenter_Flomaster_Policy_for_Supporting_Windows_10_Aug20.pdf

Operating systems should include the latest Microsoft published updates.

- Microsoft .NET 5.0 or higher is required
- 5 GB available hard drive space for full installation
- Minimum screen resolution of 1280 x 1024 with normal font size selected and scaling set to 100% (this is the same as setting DPI to 96 pixels per inch).

Database server support:

- Microsoft SQL Server 2019
- Microsoft SQL Server 2017
- Microsoft SQL Server 2016 SP1
- Microsoft SQL Server 2014 SP2

Note:

It is not possible to upgrade databases from releases prior to Flomaster V7.9.4 to Simcenter Flomaster 2021.1 using Simcenter Flomaster 2021.1. For information on how to upgrade from versions prior to V7.9.4 please raise a service request in Support Center.

Compatible releases

The following releases are compatible with Simcenter Flomaster 2021.1

- Simcenter FLOEFD 2020.2
- Simcenter Motorsolve 2020.1, 2020.2, 2021.1.
- Simcenter Amesim 17.0, 2019.1, 2019.2, 2020.1, 2020.2, 2021.1
- NX – 1953 Series

- COMOS – 10.3.3
- Team Center for Simulation – Active Workspace 5.2, 5.3
- Simcenter 3D – 2021.1

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https://community.sw.siemens.com/s/topic/0TO4O000000IN0eWAG/simcenter-flomaster

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