NOV 2022, JAPAN

AVEVA Advisory Group Meeting 2022

Dynamic Simulation, OTS, Unified Learning

Andrea Macri – Senior Product Manager - Dynamic Simulation, OTS, Unified Learning

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AVEVA Dynamic Simulation

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AVEVA Dynamic Simulation Roadmap

2022 **Current Version**



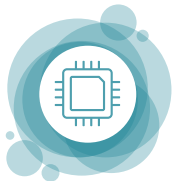
GUI

- Ribbon bar
- Simulation Status bar
- Light and dark themes



Model

- Stream with conductance
- Advanced Header option



Platform

- Tools to import intelligent P&IDs
- Learning Monitor
- Support 64bit for all components
- Integration with MS Bonsai (AI)



Thermo

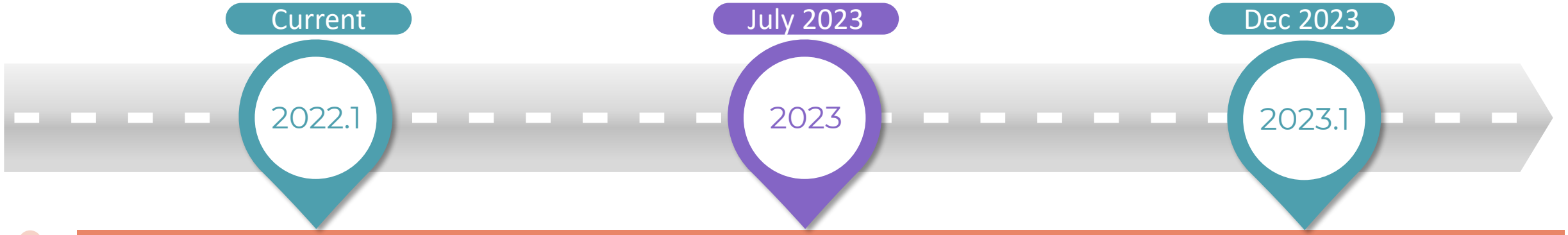
- Robust VLLE [1] algorithm
- Super Linear Local Flash for VLLE

[1] *VLLE = Vapor-Liquid-Liquid-Equilibrium*

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AVEVA Dynamic Simulation Roadmap

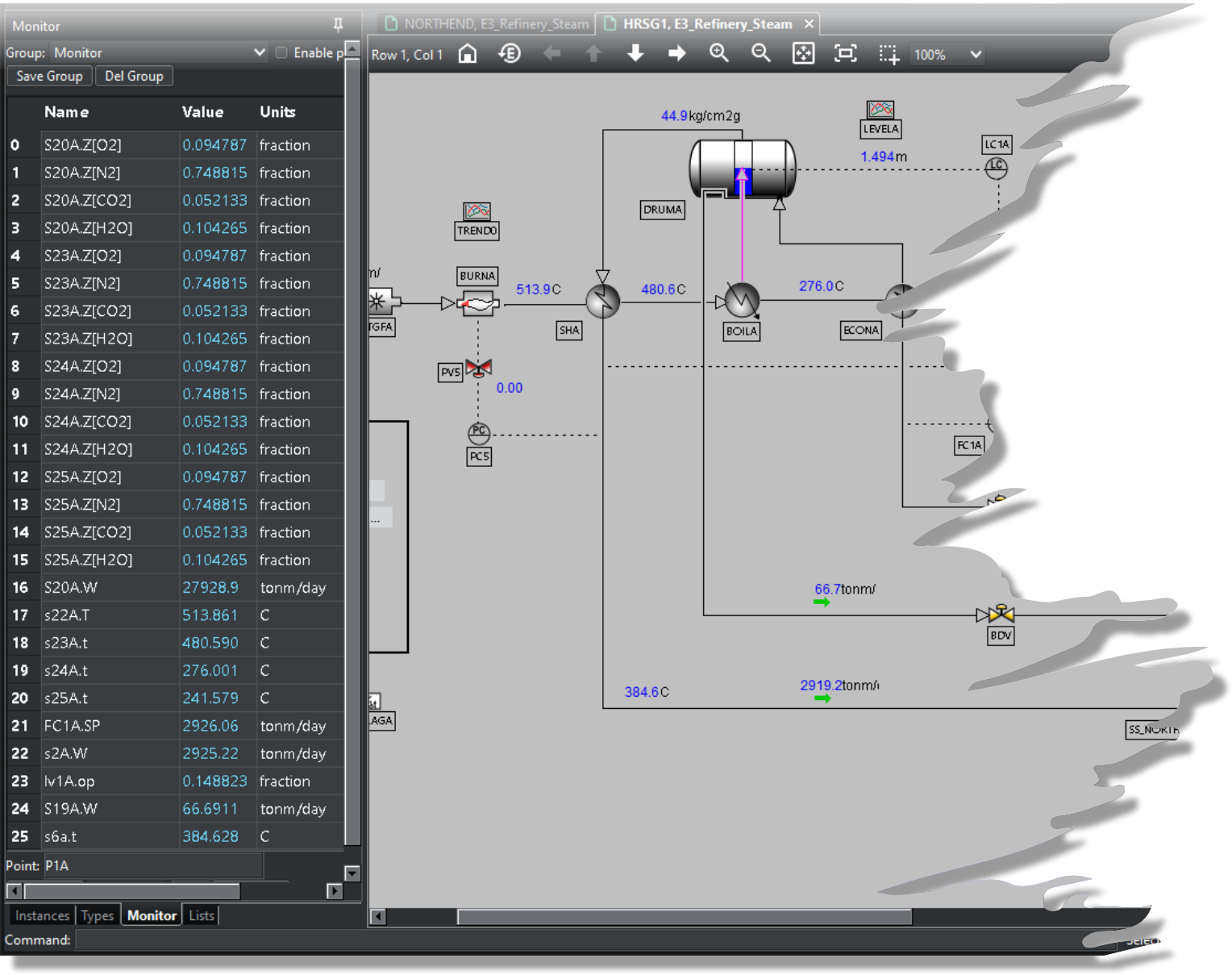


	Current (2022.1)	July 2023 (2023)	Dec 2023 (2023.1)
GUI	Improvements for Point Monitor Enhancements for Messages Better File Open Windows	Improved Search Tool Enhancements for Event Viewer Monitor the usage of the system	H&MB diamond for streams Implement flowsheet safeguard Track engineering changes
Model	Productize Shell CE library - Exchangers and Separator Renewable library - PEM electrolyzer	- Alkaline electrolyzer - StreamSend / StreamReceive	- RO - Ejector enhancements - Enhance Reboiler Object - Complete cryogenic exchanger
Platform	Easier patch installation Plant Data Link (link to PI)	Updated communication protocol Multi-threading phase I Launch simulation from folder Option to salve all ICs as text	GUI changes are autosaved in JSON Tighter integration with LM Target Module for LM
Thermo	VLLE [1] enhancements	Thread-safe thermo	Variable size for component slate

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[1] *VLLE = Vapor-Liquid-Liquid-Equilibrium*

AVEVA Dynamic Simulation 2022.1 – What's New



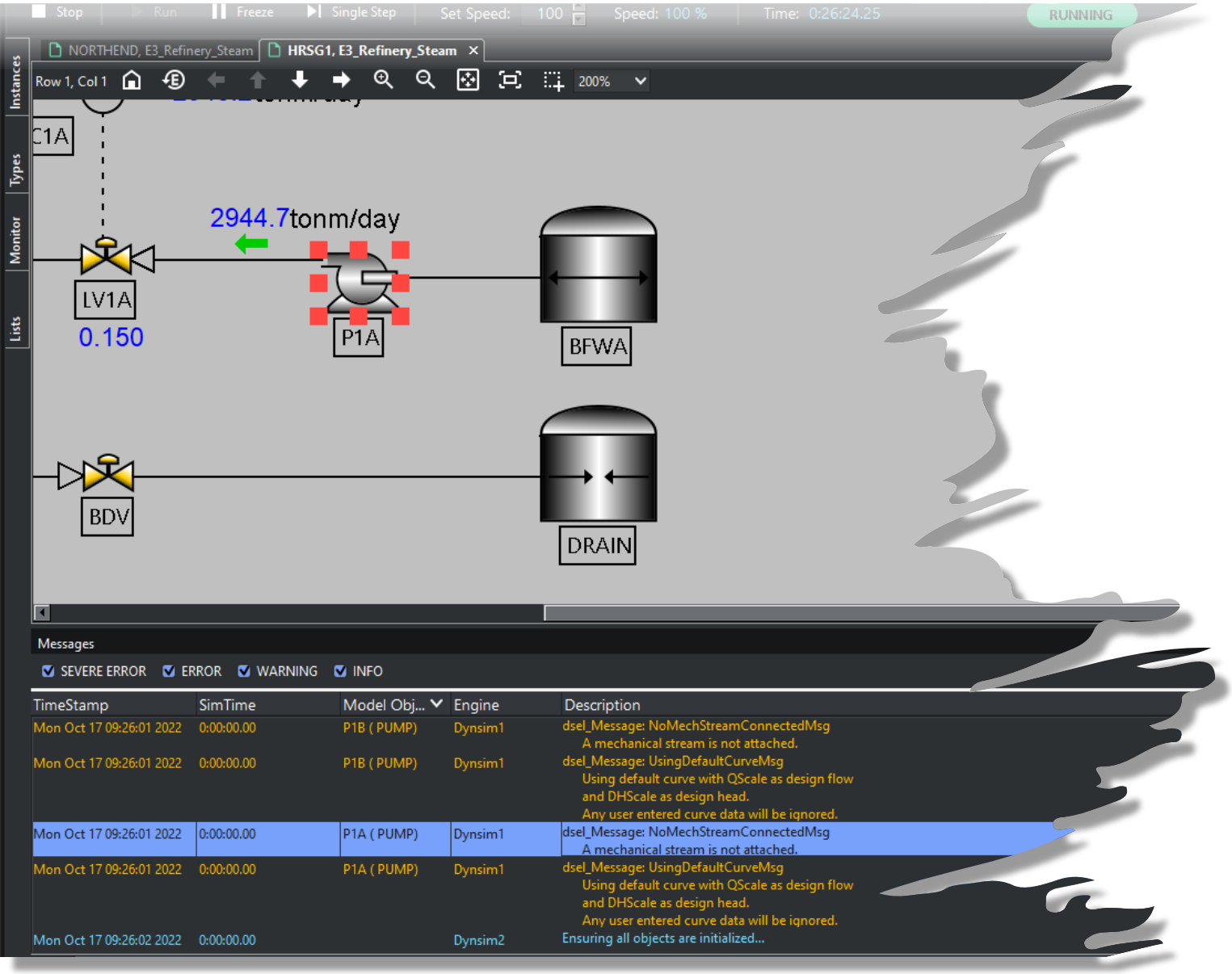
Improvements for **Monitor**

Monitor tables have now fixed heigh for Rows

This feature prevents rows from getting hidden

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AVEVA Dynamic Simulation 2022.1 – What's New



Enhancements for **Messages**

Message monitor is now displayed in tabular format

Click on the message to **navigate** to the associated object in the flowsheet.

Message monitor now includes online **filters** for Severe Errors, Errors, Warnings and Infos.

Colums can be **sorted**.

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AVEVA Dynamic Simulation 2022.1

Express | File | Edit | View | Run | Tools | Settings | Draw | Users | Help

New | Open | Save | Close | Paste | Copy | Cut | Delete | Edit | Thermo | Cross Reference | Load Full | Load Engine | Load XRef | Undo | Redo | View | Messages | Units | Search | Home | Windows | Save IC | Load IC | Load Favorite IC | Load Backtrack | Trend | XY Plot | Scenario | Disable | Enable | Malfunctions

File | Edit | View | Run

Stop | Run | Freeze | Single Step | Set Speed: 100 | Speed: 100 % | Time: 0:00:53.50 | RUNNING | E3_Refinery_Steam | IC Summary | IC: 0 - | BKT: 0

Monitor

Group: Monitor | Enable p

Save Group | Del Group

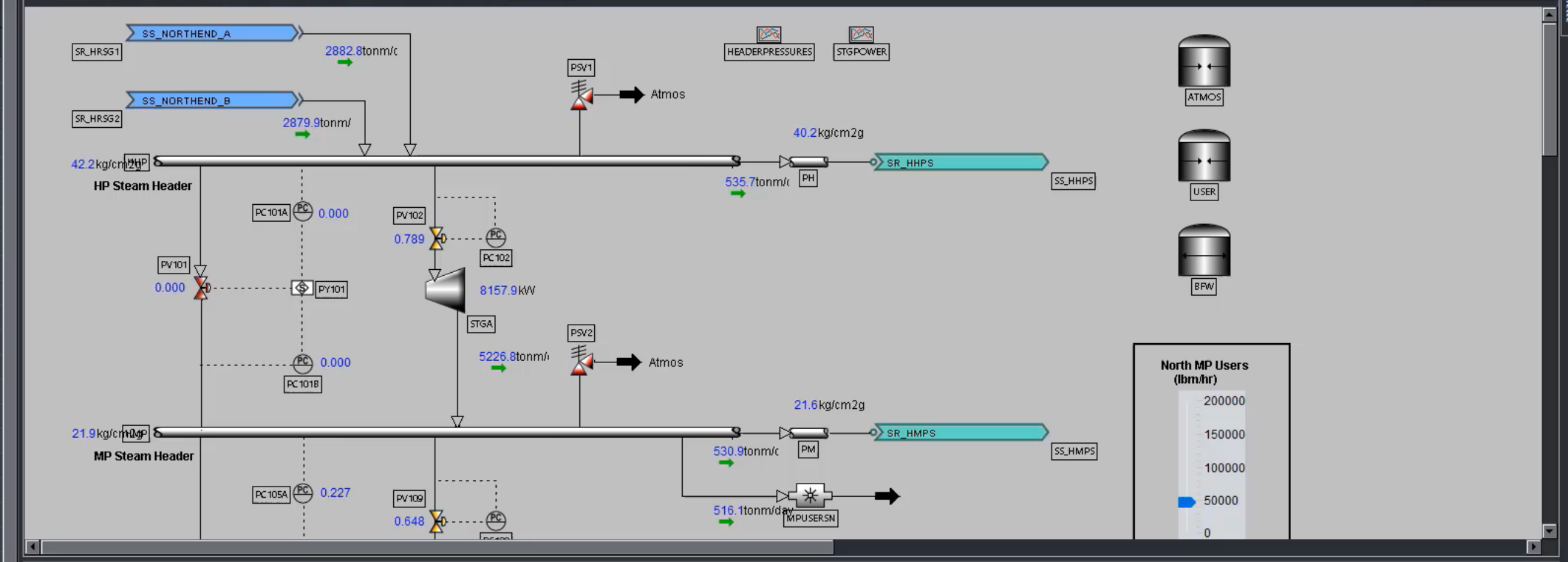
	Name	Value	Units
0	S20A.Z[O2]	0.094787	fraction
1	S20A.Z[N2]	0.748815	fraction
2	S20A.Z[CO2]	0.052133	fraction
3	S20A.Z[H2O]	0.104265	fraction
4	S23A.Z[O2]	0.094787	fraction
5	S23A.Z[N2]	0.748815	fraction
6	S23A.Z[CO2]	0.052133	fraction
7	S23A.Z[H2O]	0.104265	fraction
8	S24A.Z[O2]	0.094787	fraction
9	S24A.Z[N2]	0.748815	fraction
10	S24A.Z[CO2]	0.052133	fraction
11	S24A.Z[H2O]	0.104265	fraction
12	S25A.Z[O2]	0.094787	fraction
13	S25A.Z[N2]	0.748815	fraction
14	S25A.Z[CO2]	0.052133	fraction
15	S25A.Z[H2O]	0.104265	fraction
16	S20A.W	27928.9	tonm/day
17	s22A.T	513.861	C
18	s23A.t	480.729	C
19	s24A.t	275.928	C
20	s25A.t	241.317	C
21	FC1A.SP	3011.65	tonm/day
22	s2A.W	3009.91	tonm/day
23	lv1A.op	0.153178	fraction
24	S19A.W	66.6626	tonm/day
25	s6a.t	385.962	C

Point: S25A.Z[N2]

Instances | Types | Monitor | Lists

NORTHEND, E3_Refinery_Steam

Row 1, Col 1 | 100% | Model Editing



Messages

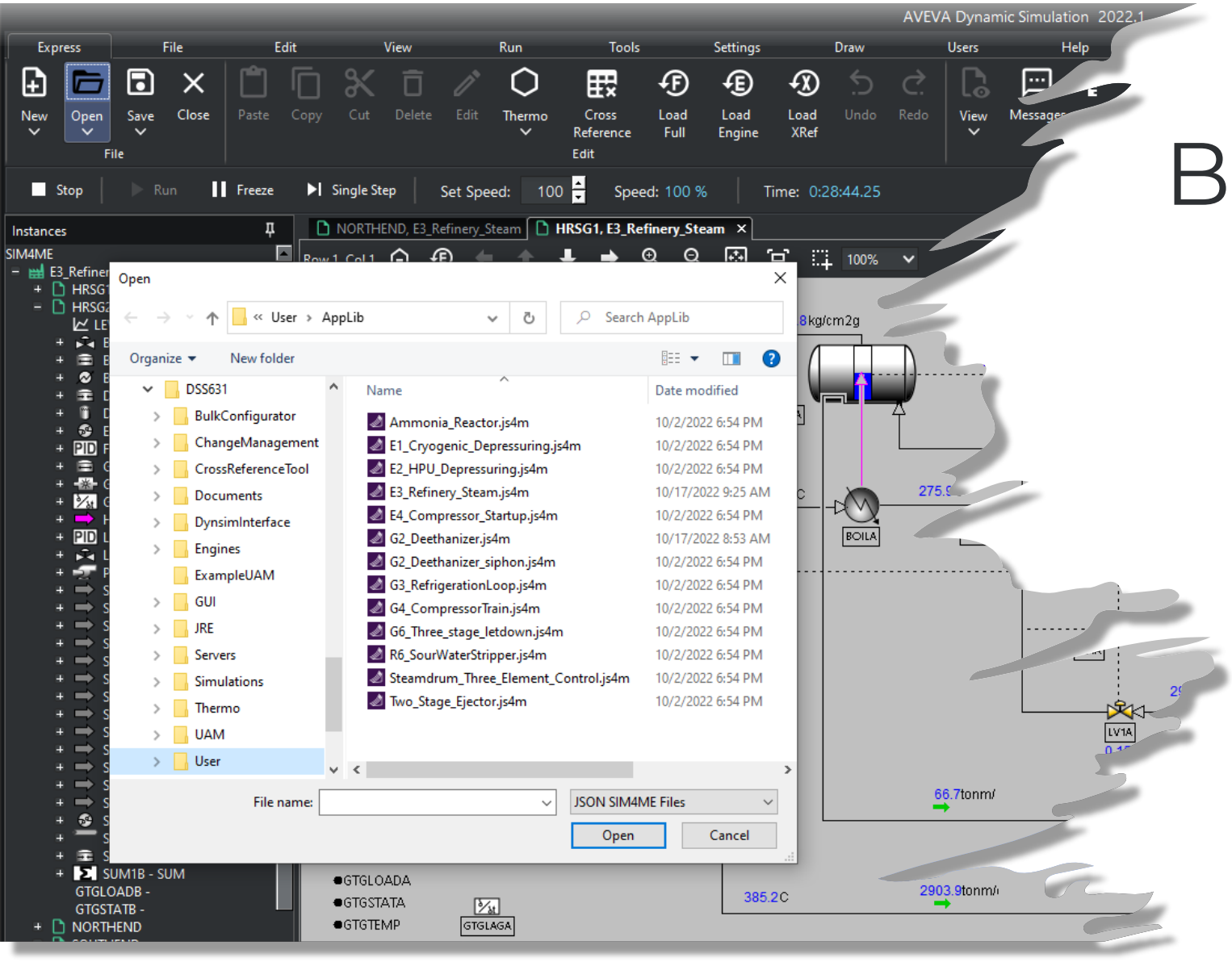
SEVERE ERROR | ERROR | WARNING | INFO | Clear Messages

TimeStamp	SimTime	Model Object	Engine	Description	Type
Mon Oct 17 09:26:02 2022	0:00:00.00		Dynsim2	The point class of the following parameters have been changed from STATIC to DYNAMIC. Their values in the running engine will not be changed to entry/database values on LF, but will be changed to snapshot values upon snapshot load. LPUSERSN.WB MPUSERSN.WB LPUSERSS.WB	INFO

Command:

Selection cleared | User: simsci | Environment: Engineer | SimExecutive: SimExecutive

AVEVA Dynamic Simulation 2022.1 – What's New



Better **File Open Window**

File Open window has been **modernized** to match current Windows Explorer look and functions.

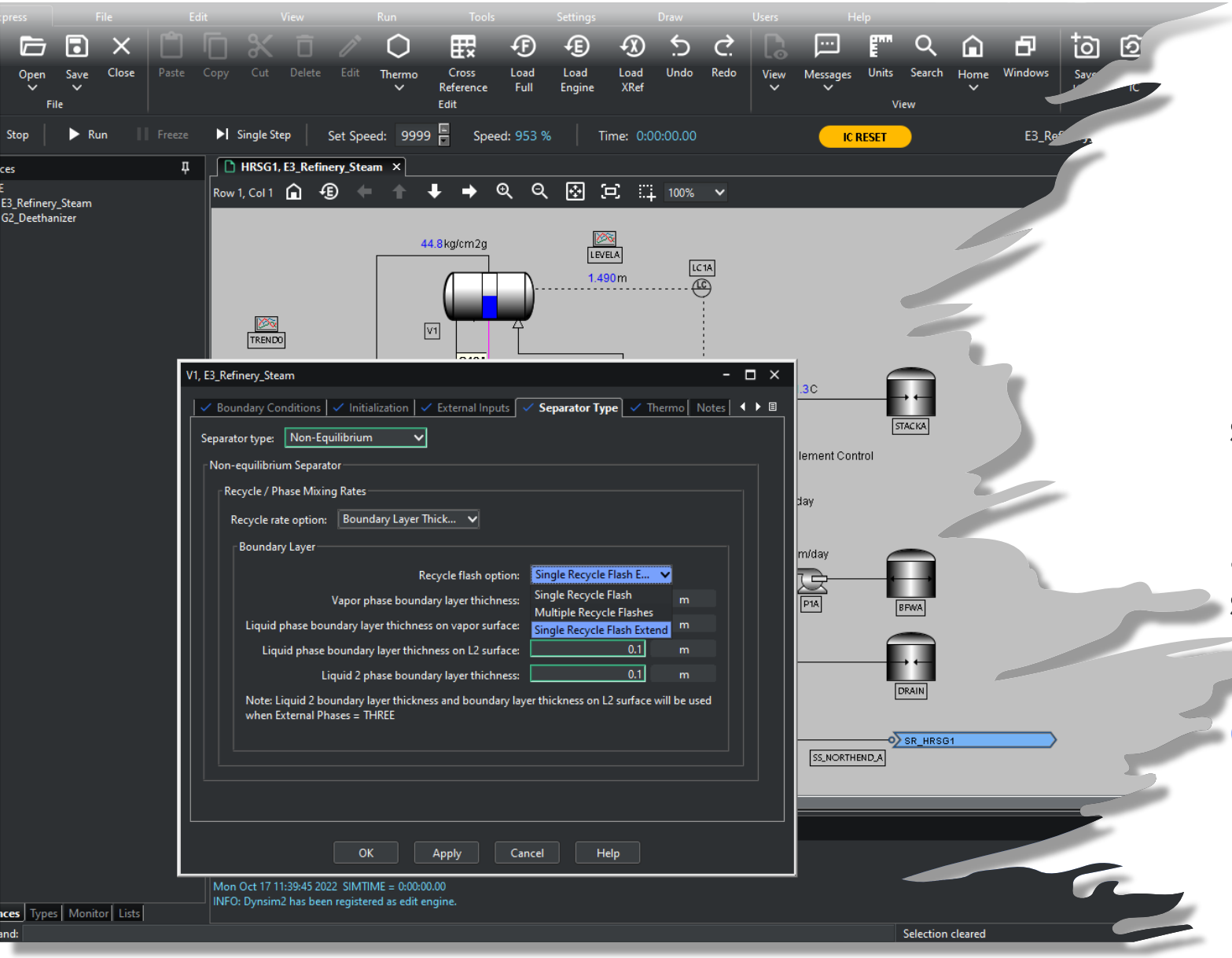
This applies to all windows for **browsing** or **saving** files.

Latest folder will be **remembered**.

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AVEVA Dynamic Simulation 2022.1 – What's New



Improvements for **Separator**

Improved robustness when the separator is in liquid-filled state

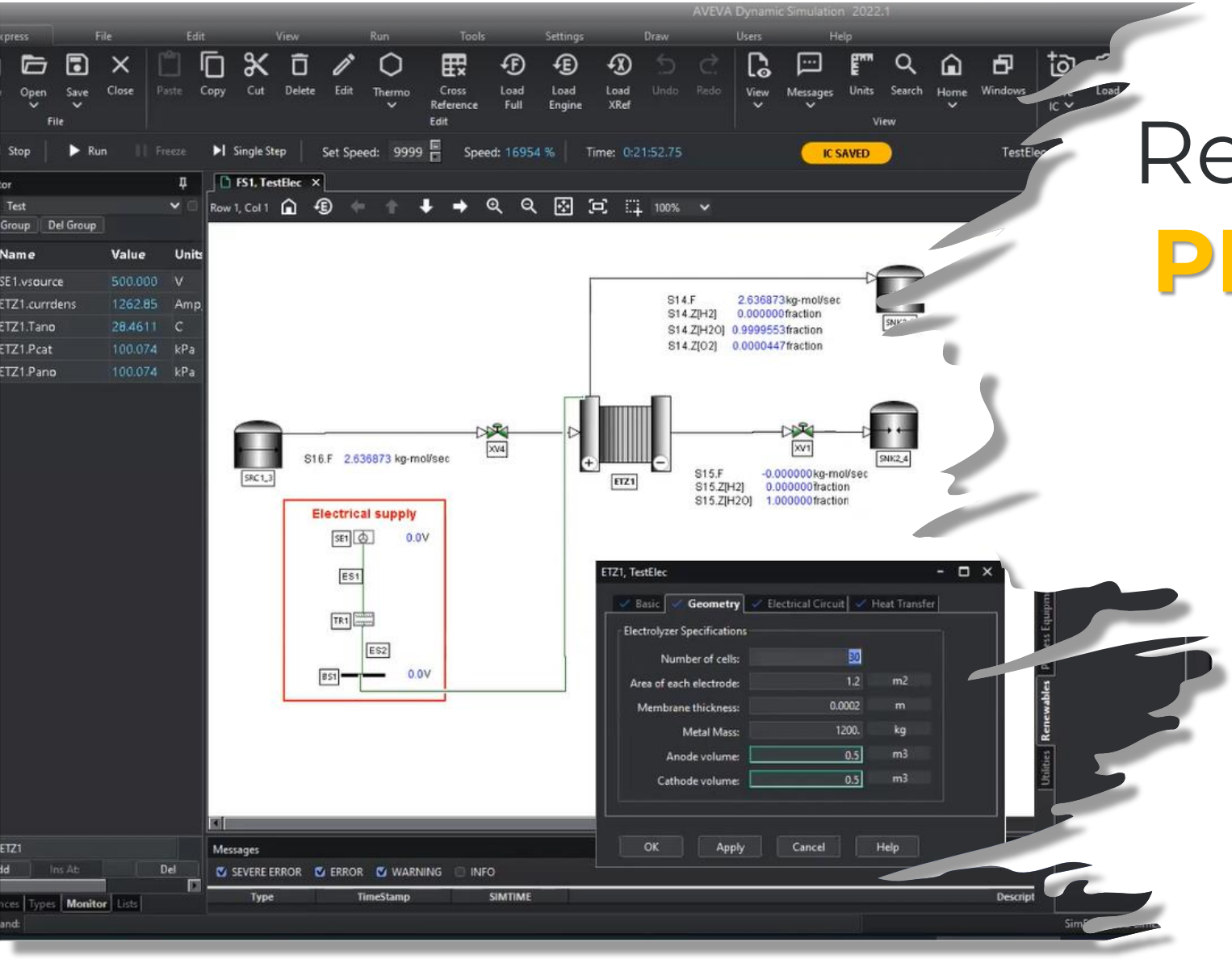
More accurate state properties and temperature when the system has multiple phases.

Included a new algorithm to overcome mass imbalance at nearly empty condition.

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AVEVA Dynamic Simulation 2022.1 – What's New



Renewable library

PEM Electrolyzer

PEM Electrolyzer is the first model object in the **Renewable** library.

This model is based on Proton Exchange Membrane (**PEM**) water electrolysis where water is electrochemically split into **Hydrogen** and Oxygen at their respective electrodes.

It can represent one or multiple **cells** of the electrolyzer.

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AVEVA Dynamic Simulation 2022.1

Express | File | Edit | View | Run | Tools | Settings | Draw | Users | Help

New | Open | Save | Close | Paste | Copy | Cut | Delete | Edit | Thermo | Cross Reference | Load Full | Load Engine | Load XRef | Undo | Redo | View | Messages | Units | Search | Home | Windows | Save IC | Load IC | Load Favorite IC | Load Backtrack | Trend | XY Plot | Scenario | Disable | Enable | Malfunctions

Stop | Run | Freeze | Single Step | Set Speed: 200 | Speed: 201 % | Time: 0:30:00.00 | BKTRK RESET | TestElec | IC Summary | IC: | BKT: 3

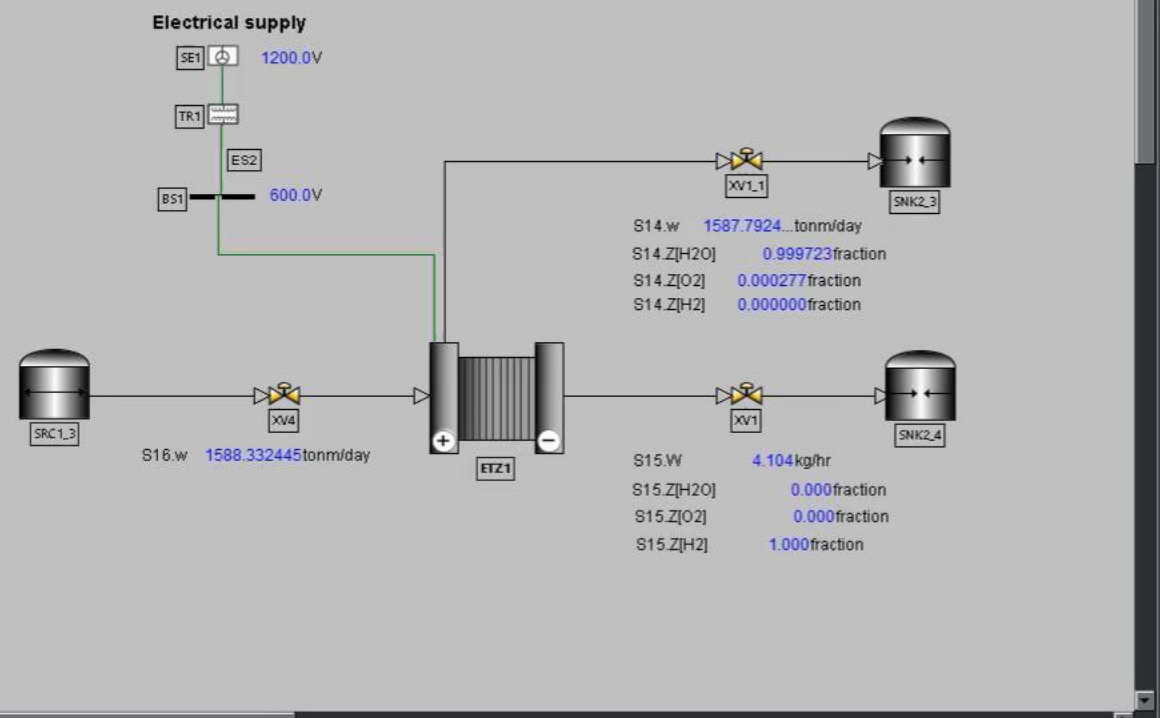
Instances

SIM4ME
- TestElec
  - FS1
    - TREND0
    - BS1 - BUS
    - ES1 - ELECSTREAM
    - ES2 - ELECSTREAM
    - ES3 - ELECSTREAM
    - ES4 - MISCEQTN
    - ETZ1 - ELECTROLYZER
      - Advanced
      - Base electrical parameters
      - Basic
      - Breaker Position
      - Breaker Position Control
      - Breaker Trip Configuration
      - Breaker Type
      - Calculated Values
      - Conductance in Stream
      - Derivatives
      - Electrical Circuit
      - External Inputs
      - Flow Path
      - Forward Flow
      - Heat Transfer
      - High/Low Side Voltage and Fre
      - Initialization
      - Internal Use
      - Object Connections
      - Reaction
      - Reverse Flow
      - States
      - Status And Control
      - SyncScope Interface
      - Thermo
      - Thermo Advanced
      - Thermo Mixed Phase
      - Thermo Solid
      - Thermo Temperature and Press
      - Topology
      - User Defined Power Usage
      - Voltage, Current and Frequency
    - S1 - STREAM
    - S14 - STREAM
    - S15 - STREAM
    - S16 - STREAM
    - S2 - STREAM
    - S3 - STREAM

Instances | Types | Monitor | Lists

FS1, TestElec

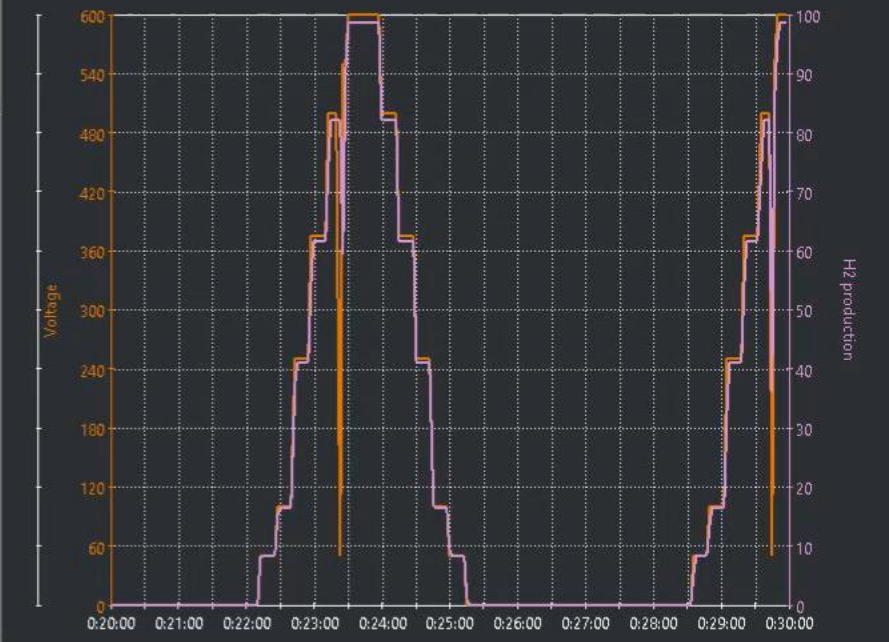
Row 1, Col 1 | 100% | Model Editing



TREND0 - need to Apply changes

OK | Apply | Cancel | CSV | Print | Show Configuration | Hide Table | Show Legend

Color	Name	Value	Units	Custom Description	Min	Max
	BS1.V	600.000	Default (V)	Voltage	0.0	600.0
	S15.W	98.5021	kg/day	H2 production	0.0	100.0



Freeze

Icon Palette

Messages

SEVERE ERROR | ERROR | WARNING | INFO | Clear Messages

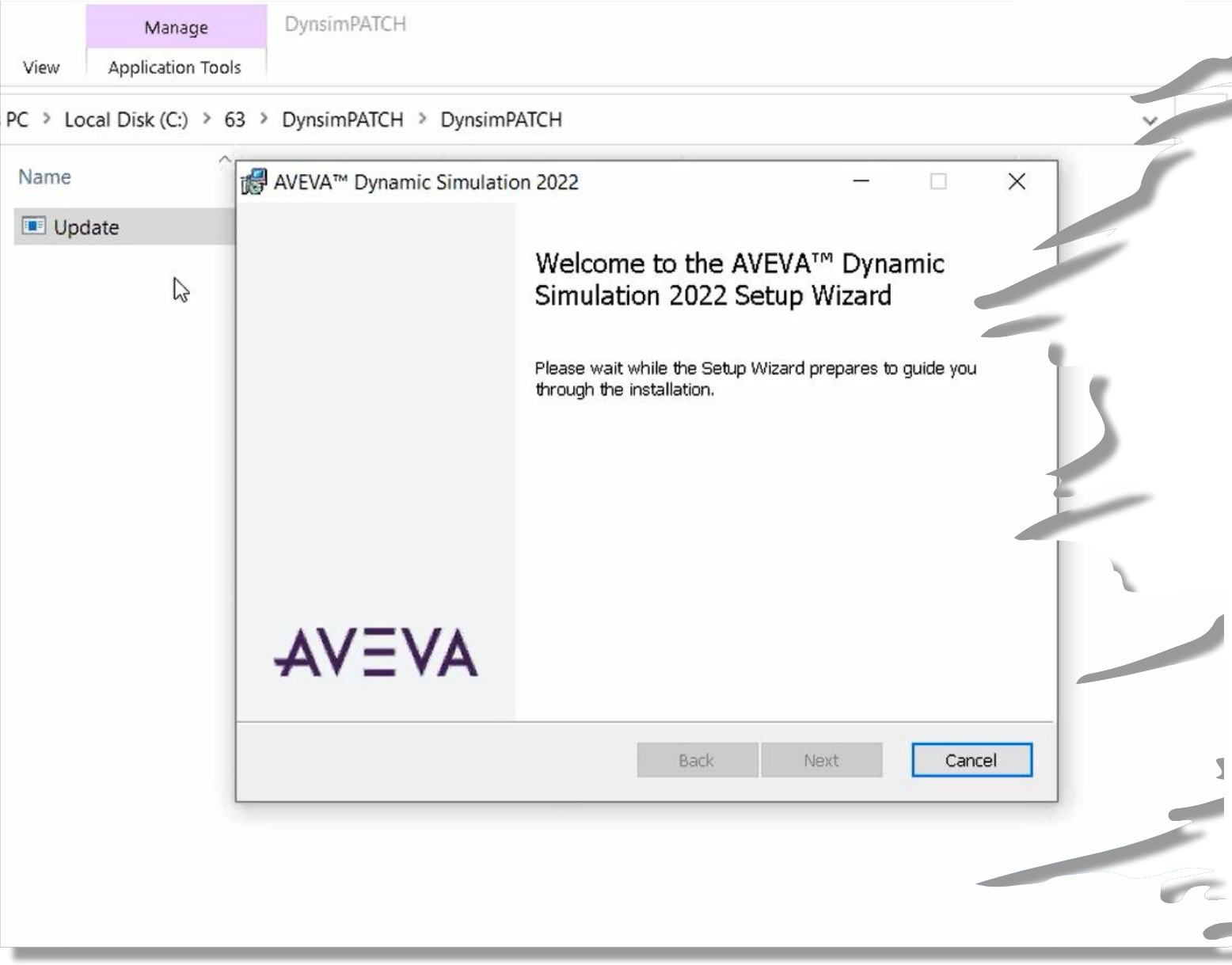
TimeStamp	SimTime	Model Object	Engine	Description	Type
Mon Oct 17 14:28:44 2022	0:00:00.75			Simulator resumed	INFO
Mon Oct 17 14:29:44 2022	0:03:04.75			Simulator frozen	INFO
Mon Oct 17 14:31:39 2022	0:03:04.75			Simulator resumed	INFO

Command:

Selection cleared

User: simsci | Environment: Engineer | SimExecutive: SimExecutive

AVEVA Dynamic Simulation 2022.1 – What's New



Easier **patch installation**

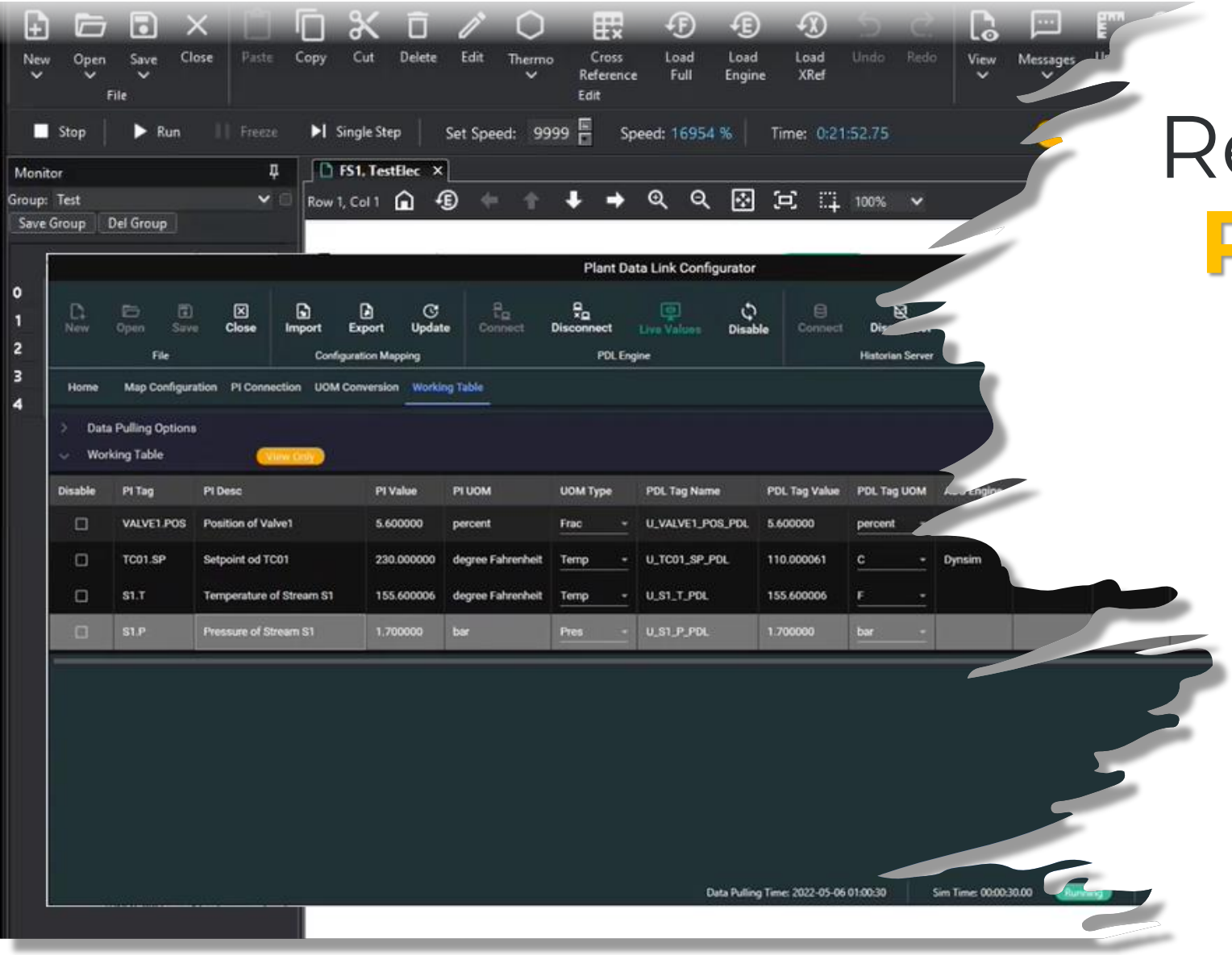
Patches can now be installed easily **directly** on top of the same version

It is not required to **uninstall** the software before installing the patch

Reboot is not required

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AVEVA Dynamic Simulation 2022.1 – What's New



Read from PI with **Plant Data Link**

Plant Data Link enable **read/write** access to the plant operating data database.

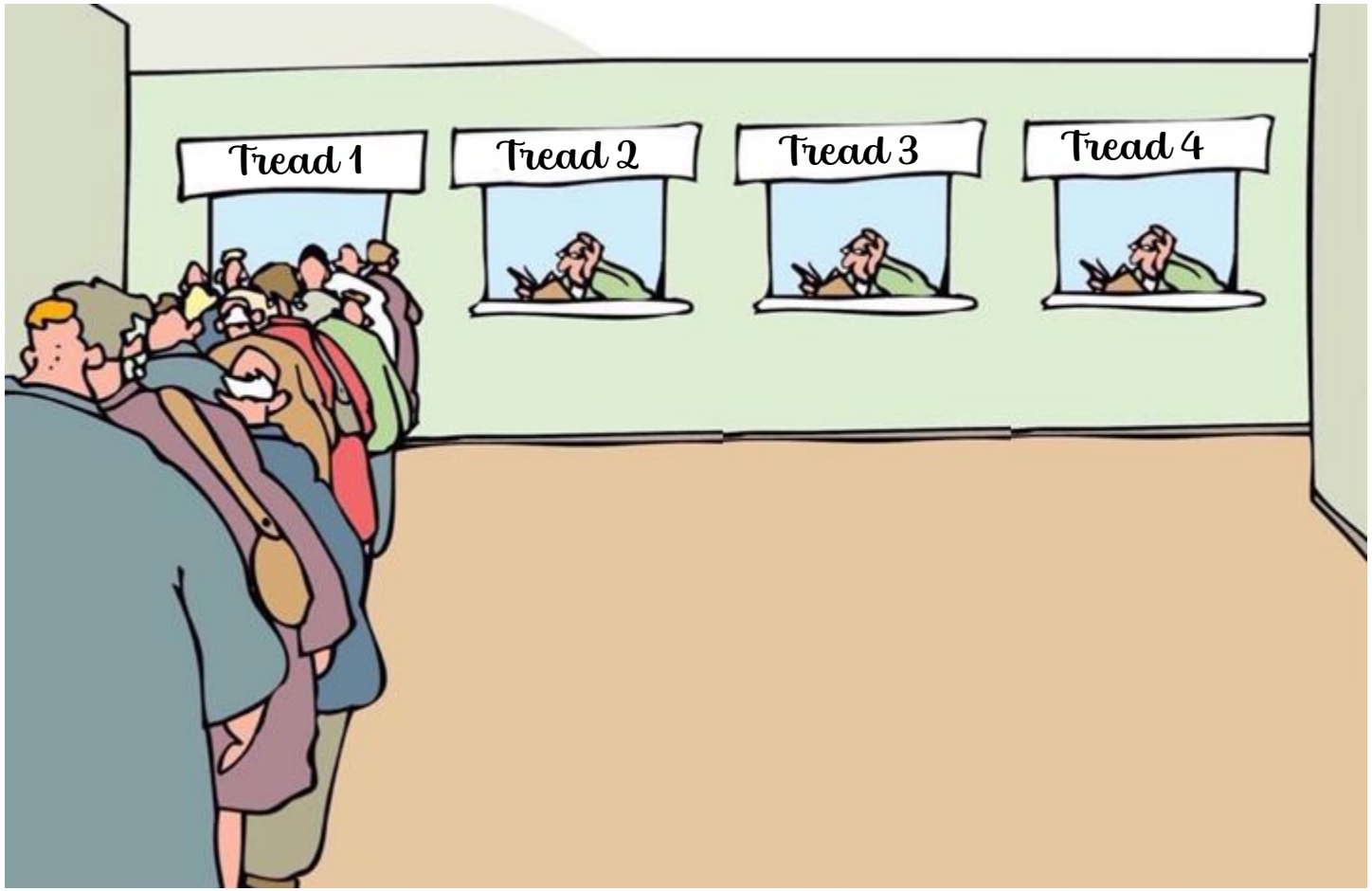
The initial version is compatible with **AVEVA PI**. In the future we will enable other plant historians.

This allows the simulation to access and use **historical** or **real time data**

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Multi-threading today

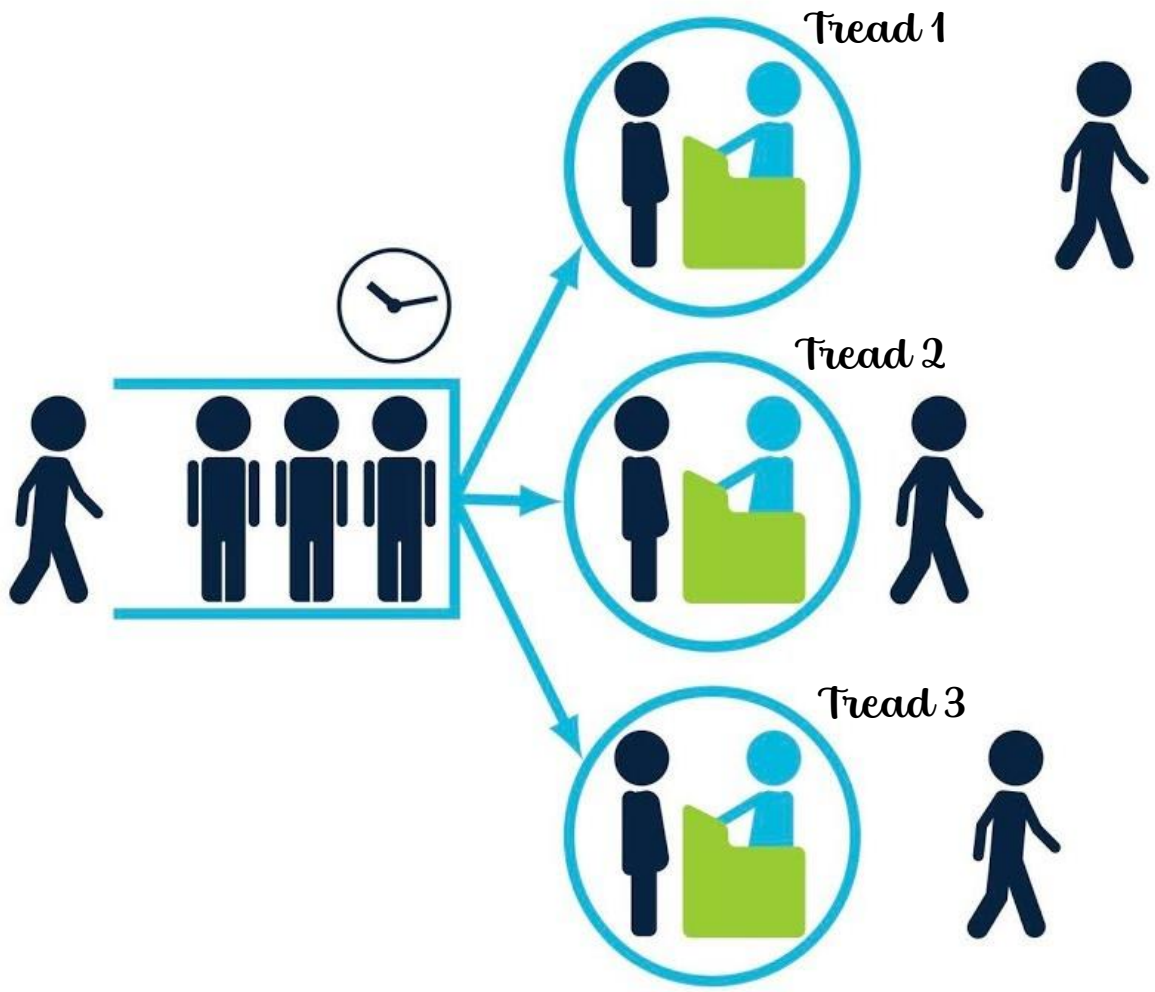


- Today multi-threading in ADS is manually configured by the users by splitting the model into engines
- Flashes are calculated sequentially in the same thread
- If one flash is struggling to solve then all other flashes in the same engine will have to wait even if other threads are free
- Thermo is not thread safe so two flashes cannot call the same thermo set at the same time

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Multi-threading tomorrow



- The new ADS multi-threading will manage flash calculations in a queue and the next flash will be executed in the firstly available thread
- Flashes are calculated sequentially but they can be executed by any thread
- If one flash is struggling to solve then all other flashes don't have to wait but they can utilize the threads which are free
- The same flash can be calculated in a different thread at the next step.
- Thermo is thread safe so two flashes can call the same thermo set at the same time

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Multi-threading benefits

Performance



Higher performance (simulation speed) as we can take advantage of the full CPU power available in the machine.

Robustness



Less P-F instabilities will also result in a more robust solution.

Efficiency



The engineer will not need to split the model into multiple engines and spend time in trying to achieve the desired performance

Stability



Pressure – Flow network will not be splitted and therefore solution will be mathematically more stable

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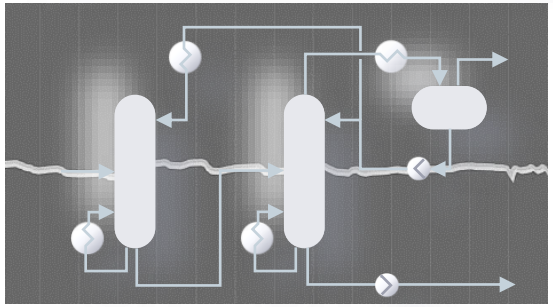
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AVEVA OTS and advanced applications

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Dynamic Simulation and AI

Dynamic Simulation



Artificial Intelligence

Online Advisor

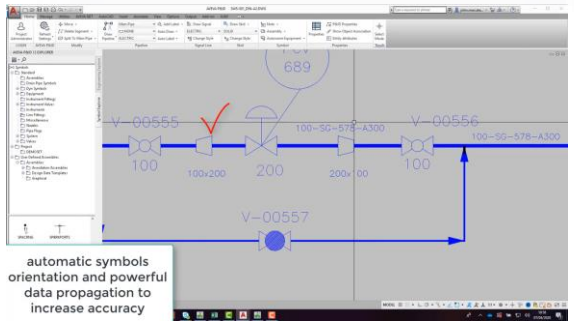


- AVEVA dynamic simulation is used to train AVEVA artificial intelligence agent to identify the optimal trajectory between two operating conditions.
- The AI tries different operations using parallel sessions of the model on the Cloud to identify the one which can be completed in less time, with less alarms and with lower emissions.
- The AI agent is finally used in the plant to advise the panel operator on the same operation.
- This could translate into higher production, safer operations, and low environment impact.
- Examples: Crude feed changeover, plant load change

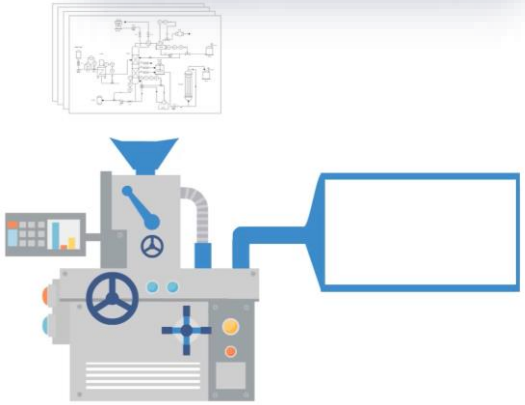
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Convert P&IDs and Engineering Data into Simulation

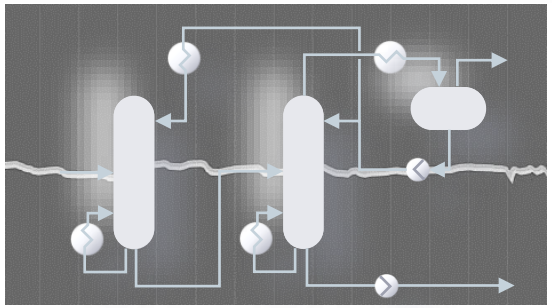
Intelligent P&IDs



Model Generator



Dynamic Simulation



- Convert intelligent P&ID's (as SVG or DEXPI format) into an equivalent dynamic simulation
- The tool also can import data from AVEVA Engineering database
- This can save up considerable time when developing a dynamic simulation
- This ensures the correct transfer of design data

This is an INTERNAL tool used in selected projects

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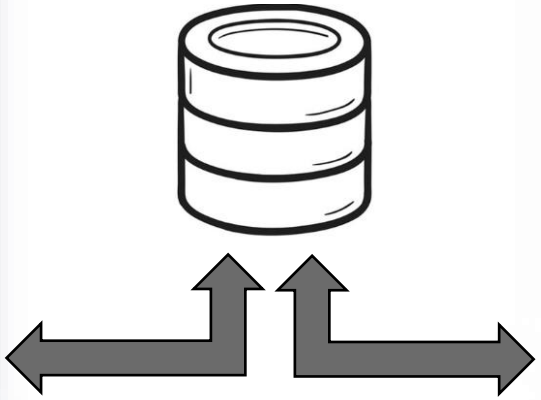
AVEVA

AVEVA Plant Data Link

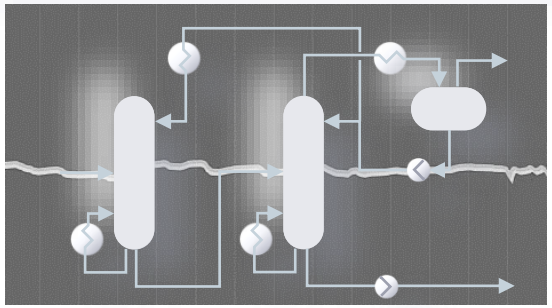
Plant



Plant Historian



Dynamic Simulation



- Plant Data Link enable read/write access to the plant operating data database.
- The initial version is compatible with AVEVA PI. In the future we will enable other plant historians.
- This allows the simulation to access and use historical or real time data
- Some examples:
  - Use the simulation as soft sensor for the plant
  - Use the simulation for look-ahead (we are developing the function to write to future tags in PI)
  - Recreate conditions which happened in the plant for offline troubleshooting
  - Compare simulation results with plant data

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Advanced applications roadmap - 2023

PDL

- Writing back to PI server
- Support for “future tags”
- Possibly add support for WW Historian

Model Generator

- Continued improvements

ADS comparison utility

Proteus

- Conversion to web application

OPC UA

- Server update to new toolkit
- OPC UA Client engine

OPC DA Configurator

ETAP engine

LMT

- Feature additions/improvements

Misc. Engine updates

- Update as necessary based on upcoming projects

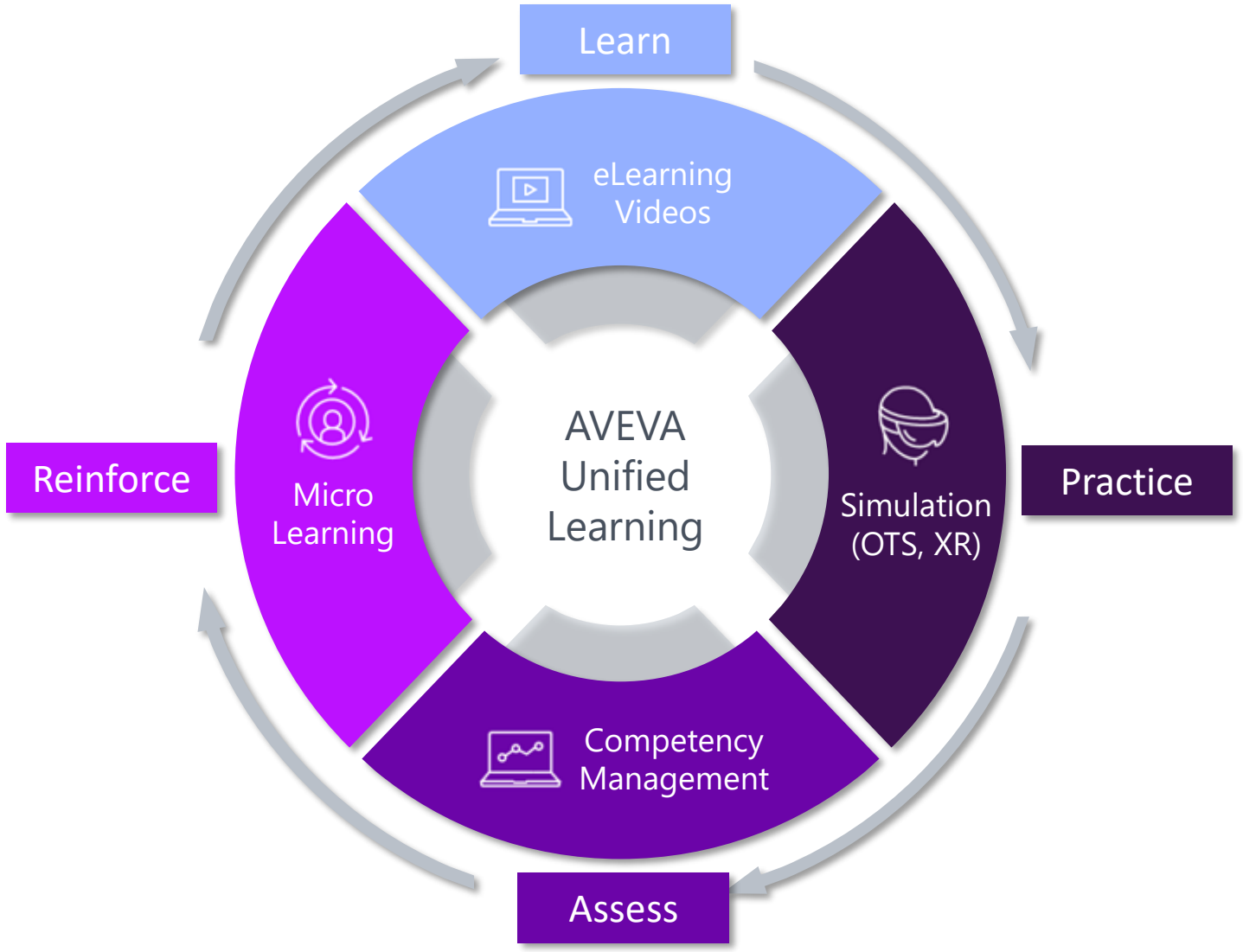
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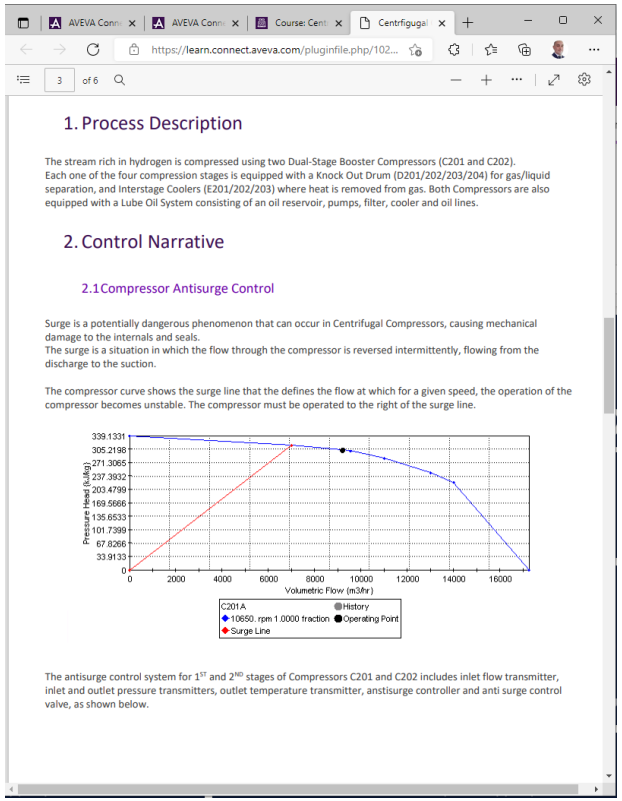
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AVEVA Unified Learning

Workbooks and documentation



1. Process Description

The stream rich in hydrogen is compressed using two Dual-Stage Booster Compressors (C201 and C202).
Each one of the four compression stages is equipped with a Knock Out Drum (D201/202/203/204) for gas/liquid separation, and Interstage Coolers (E201/202/203) where heat is removed from gas. Both Compressors are also equipped with a Lube Oil System consisting of an oil reservoir, pumps, filter, cooler and oil lines.

2. Control Narrative

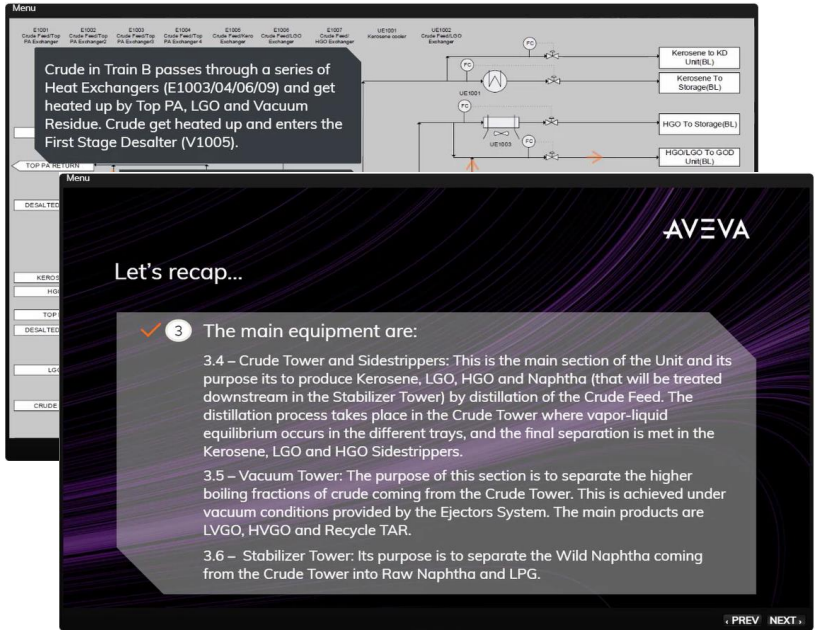
2.1Compressor Antisurge Control

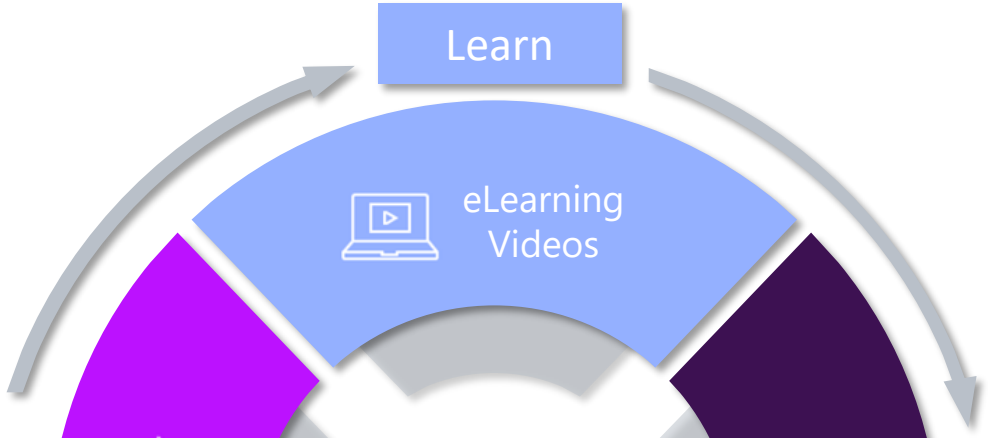
Surge is a potentially dangerous phenomenon that can occur in Centrifugal Compressors, causing mechanical damage to the internals and seals.
The surge is a situation in which the flow through the compressor is reversed intermittently, flowing from the discharge to the suction.

The compressor curve shows the surge line that the defines the flow at which for a given speed, the operation of the compressor becomes unstable. The compressor must be operated to the right of the surge line.

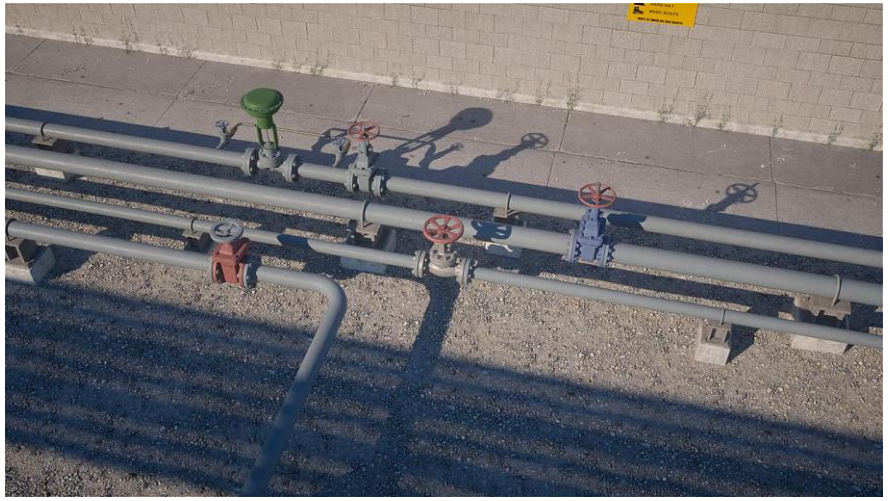
The antisurge control system for 1ST and 2ND stages of Compressors C201 and C202 includes inlet flow transmitter, inlet and outlet pressure transmitters, outlet temperature transmitter, anstisurge controller and anti surge control valve, as shown below.

eLearning



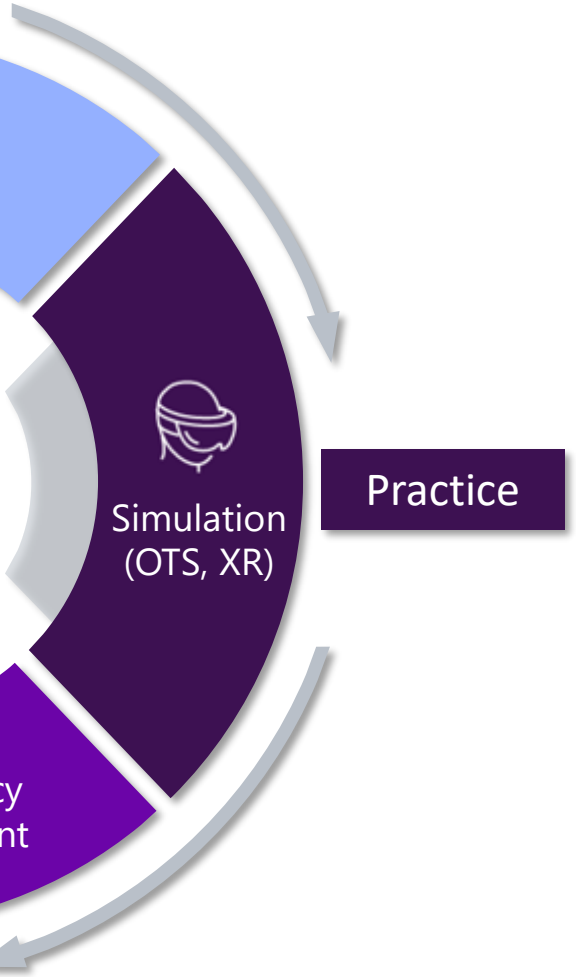


Engaging 3D videos

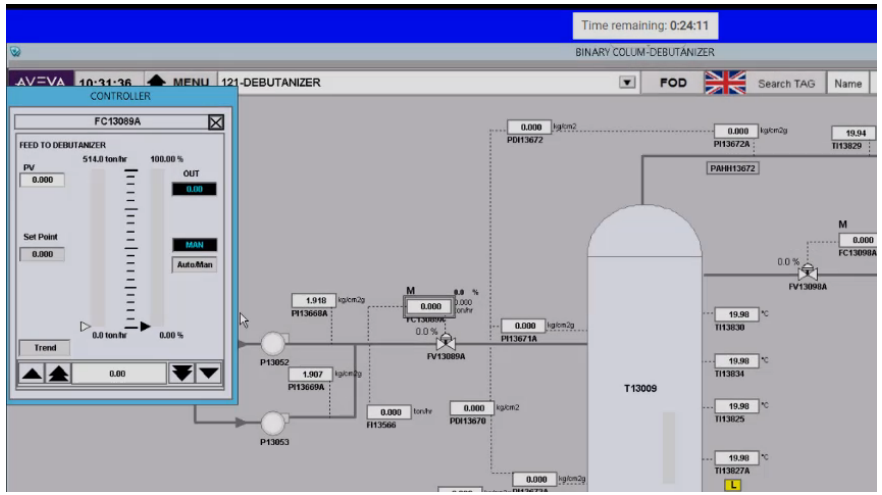


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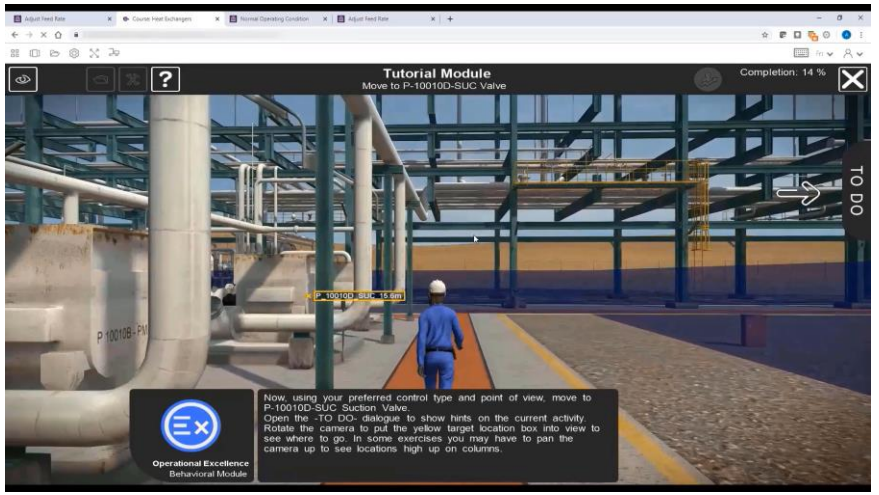
AVEVA Unified Learning



Operator Training Simulator



XR for Training



Master fundamentals with generic content

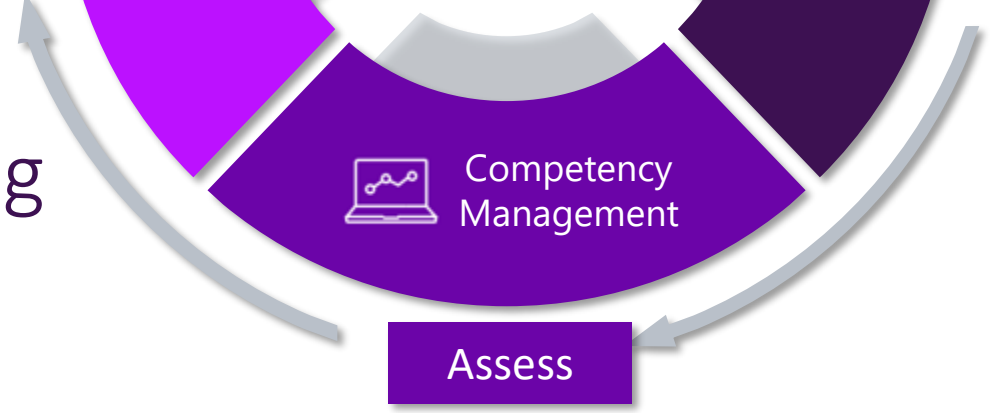
- Process Competency Training
- Pipeline Competency Training
- Operational Excellence (XR based)

Improve operations and safety by training on customized solutions

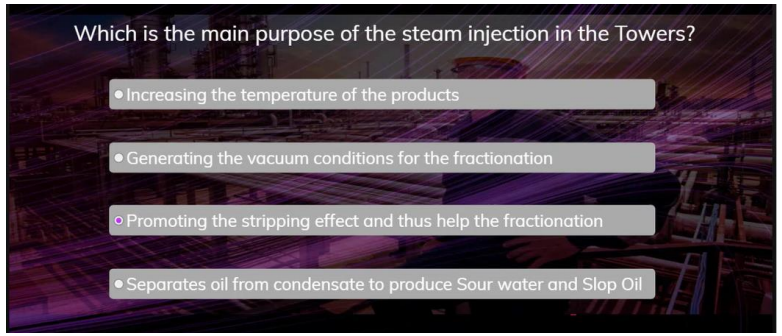
- Custom emulated or stimulated OTS
- Custom XR for training

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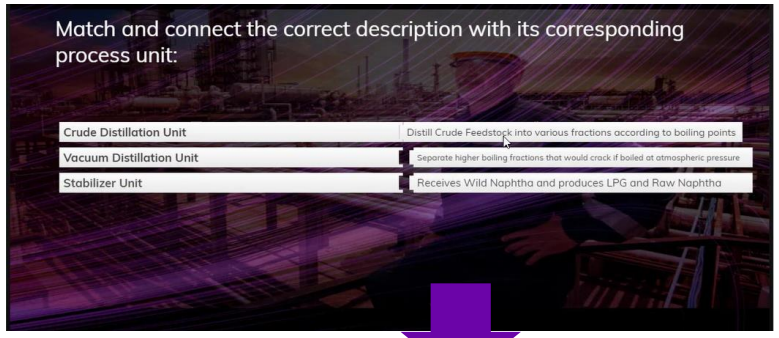
AVEVA Unified Learning



Quizzes



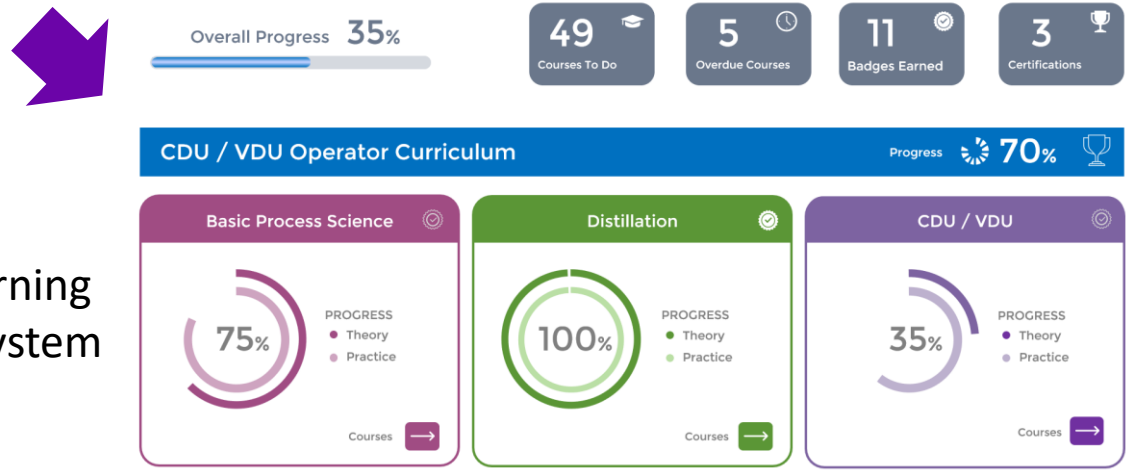
Games



Practice



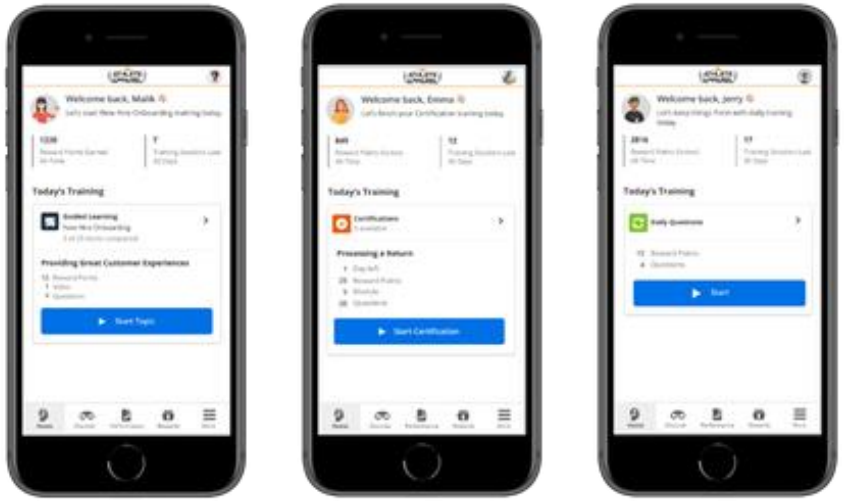
Embedded Learning Management System

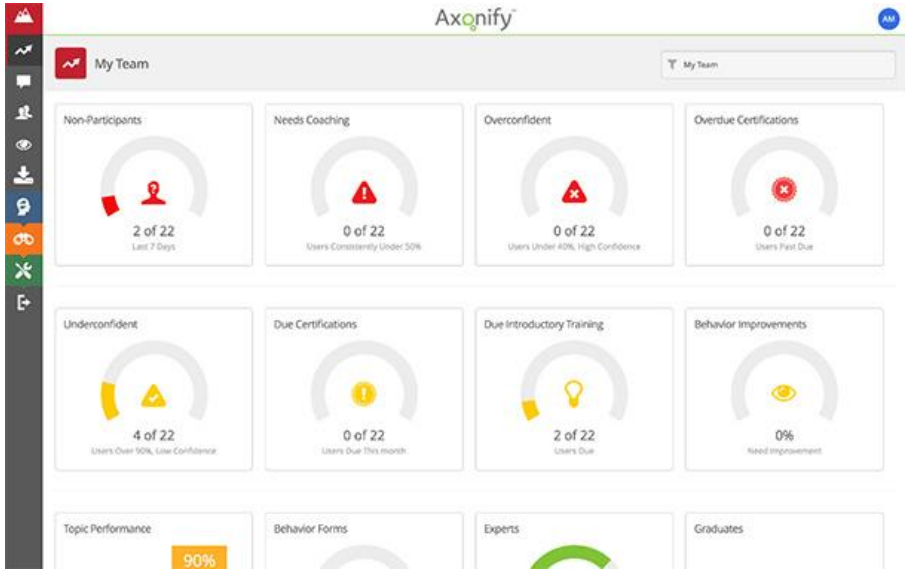


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AVEVA Unified Learning

Sustain competence and drive behavior change with short, frequent **reinforcement** sessions that fit into the daily workflow







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Our Generic Content



AVEVA Unified Learning - Process Competency Training modules + OEG

860+

hours of content

OEG eLearning Content

Course	N° of Modules	Duration
Basic Process Science	8	135 Minutes
Heat Exchanger	5	80 Minutes
Valves	10	165 Minutes
Centrifugal Pumps	17	270 Minutes
Fired Heaters	14	230 Minutes
Distillation	3	50 Minutes
Midstream	6	100 Minutes

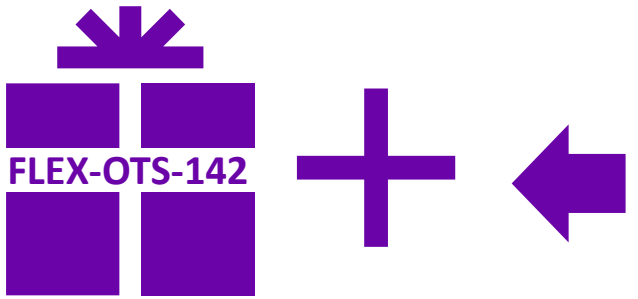
Process and Pipeline Competency Training Content

Model Category	Process	Completion	Duration
Basic Learning Modules	Forced Draft Furnace	CY2023	8 hours
	Binary Column	Ready	8 hours
	Process Control and Instrumentation	Ready	4 hours
	Centrifugal Compressor	Ready	8 hours
	Reciprocating Compressor	CY2023	8 hours
Oil & Gas	Crude/Vacuum Distillation Unit	Ready	40 hours
	Naphtha Hydrotreater CCR	Ready	24 hours
	Diesel Hydrotreater	Ready	40 hours
	Sulphur Management Unit (ARU/SWS/SRU)	Ready	20 hours
	Hydrocracker Unit	Ready	32 hours
	Fluidized Catalytic Cracking	Ready	30 hours
	Delayed Coker Unit	Ready	40 hours
	Hydrogen Generation Unit (KTI)	CY2023	40 hours
	Continuous / Catalytic Reforming Unit	CY2023	40 hours
	Vis-Breaker Unit	CY2023	40 hours
	Motor Spirit Quality Upgradation/ Prime-Gasoline Unit	CY2023	40 hours
	C4 Hydrogenation Unit	CY2023	40 hours
	Pyrolysis Gasoline / Hydrogenation Unit	CY2023	40 hours
	ButaDiene Extraction Unit	CY2023	40 hours
	Benzene Extraction Unit	CY2023	40 hours
Polymers	SWING (HDPE/LLDPE)	CY2023	40 hours
	PolyPropylene	CY2023	40 hours
	HDPE	CY2023	40 hours
	MEG	CY2023	40 hours
Power	Combined Cycle/Simple Cycle Power Plant	Ready	30 hours
	Generic Drum (gas conversion)	CY2023	30 hours
Chemical	Ammonia Unit	Ready	10 hours
Midstream	Crude Pipeline System	Ready	10 hours
	Natural Gas Pipeline System	Ready	7 hours
	Refined Products Pipeline System	Ready	10 hours
Mining	Copper Concentrator Plant	Ready	13 hours

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Custom Content which can be added



Custom Operator Training simulator

Supported: Emulated | Stimulated with SE controls

Unsupported: Stimulated with 3° party controls

Custom XR simulator

Supported: XR application | ITS with common operator station

Unsupported: 3D visors | gamepad

Custom OEG videos

Software supported: AVEVA Dynamic Simulation, Control Emulation (SE stimulation), AVEVA PLC Simulation, AVEVA Pipeline Simulation, AVEVA XR for Training, Schneider Electric controls products

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What’s coming

1. **Schedule instructor-led activities** (with instructors and trainees) in the calendar as you would set a calendar meeting with MS Teams. The simulator will be automatically launch to be ready at the preset date and time.

2. Administrators can define **curriculum** programs and enroll those to groups of trainees/instructors. A curriculum is a set of courses required to achieve a competency or certification.

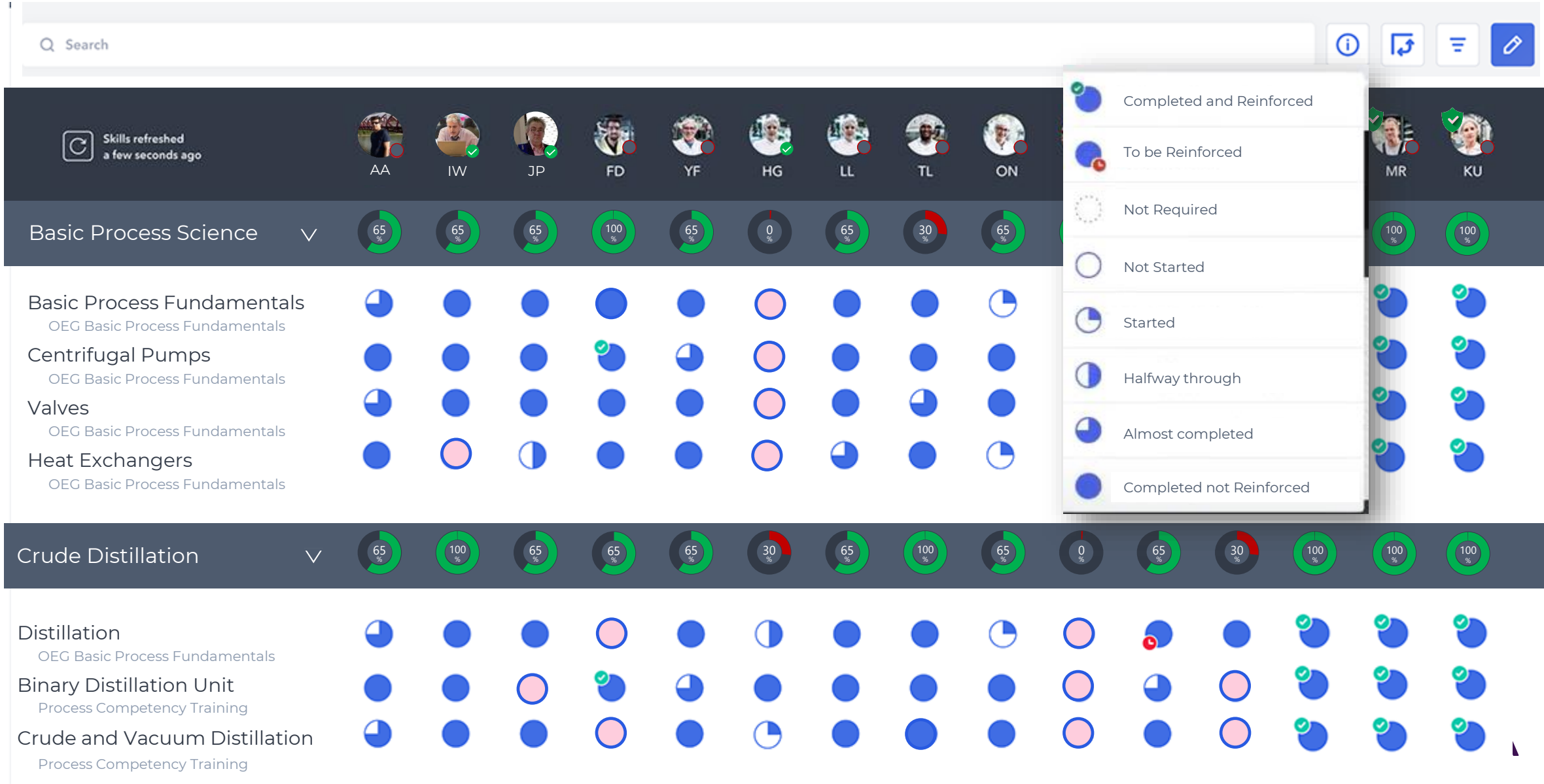
3. Major improvement for instructor and learner **dashboards**.

4. Support **engineering** activities on the cloud for developing and maintaining an OTS.

5. Enable Unified Learning in **Azure Marketplace.**

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Curriculum


Search
Skills refreshed a few seconds ago
AA
IW
JP
FD
YF
HG
LL
TL
ON
MR
KU
Basic Process Science
Basic Process Fundamentals
OEG Basic Process Fundamentals
Centrifugal Pumps
OEG Basic Process Fundamentals
Valves
OEG Basic Process Fundamentals
Heat Exchangers
OEG Basic Process Fundamentals
Crude Distillation
Distillation
OEG Basic Process Fundamentals
Binary Distillation Unit
Process Competency Training
Crude and Vacuum Distillation
Process Competency Training
Completed and Reinforced
To be Reinforced
Not Required
Not Started
Started
Halfway through
Almost completed
Completed not Reinforced

Unified Learning is now available in Azure Marketplace

Buying AVEVA products using MACC credits

1. AVEVA Edge
2. AVEVA Insight - Asset Performance - Predictive Maintenance
3. AVEVA Integration Studio
4. **AVEVA Unified Learning**
5. AVEVA Unified Operations Center - Energy Management
6. AVEVA Unified Supply Chain
7. AVEVA Data Hub
8. AVEVA Process Simulation
9. AVEVA Operations Control



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ABOUT AVEVA

AVEVA is a global leader in industrial software, sparking ingenuity to drive responsible use of the world's resources. The company's secure industrial cloud platform and applications enable businesses to harness the power of their information and improve collaboration with customers, suppliers and partners.

Over 20,000 enterprises in over 100 countries rely on AVEVA to help them deliver life's essentials: safe and reliable energy, food, medicines, infrastructure and more. By connecting people with trusted information and AI-enriched insights, AVEVA enables teams to engineer efficiently and optimize operations, driving growth and sustainability.

Named as one of the world's most innovative companies, AVEVA supports customers with open solutions and the expertise of more than 6,400 employees, 5,000 partners and 5,700 certified developers. With operations around the globe, we are headquartered in Cambridge, UK and listed on the London Stock Exchange's FTSE 100.

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