

NOVEMBER 2022

Integrating Process Simulation and the AVEVA™ PI System™

Deep Dive

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AVEVA

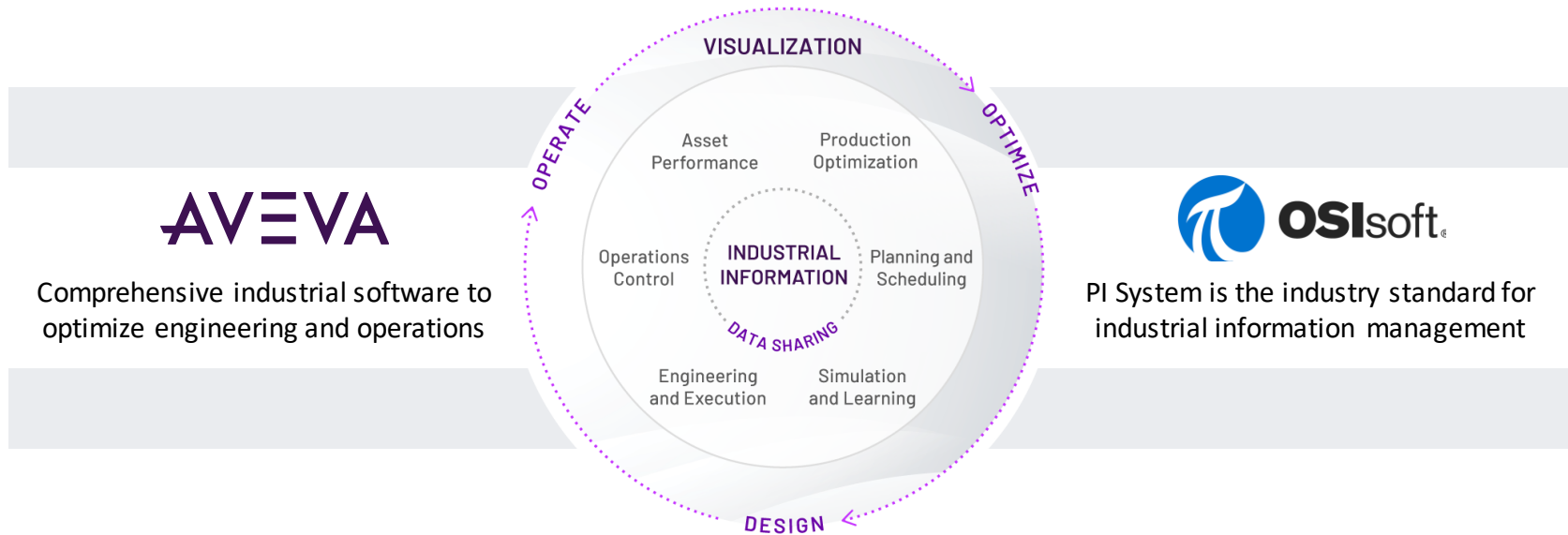
Agenda

1. Introduction
2. Digital Twin: Process Simulation + PI
3. Exploring Use Cases
 - Sustainability Monitoring
 - Process Troubleshooting
 - Predictive Asset Optimization
4. Getting Started
5. Q & A

Bringing together two world-class software experts

Delivering end-to-end customer value with best of breed industrial software

AVEVA Connect cloud services platform and AVEVA Flex subscription program



1 Better data
Accuracy, reliability, context, scope and scale

2 Smarter solutions
With better integration, while maintaining neutrality

3 Proven results
Efficiency, agility, reliability, sustainability



Big Data



Industrial IoT/Edge



Cloud



Artificial Intelligence

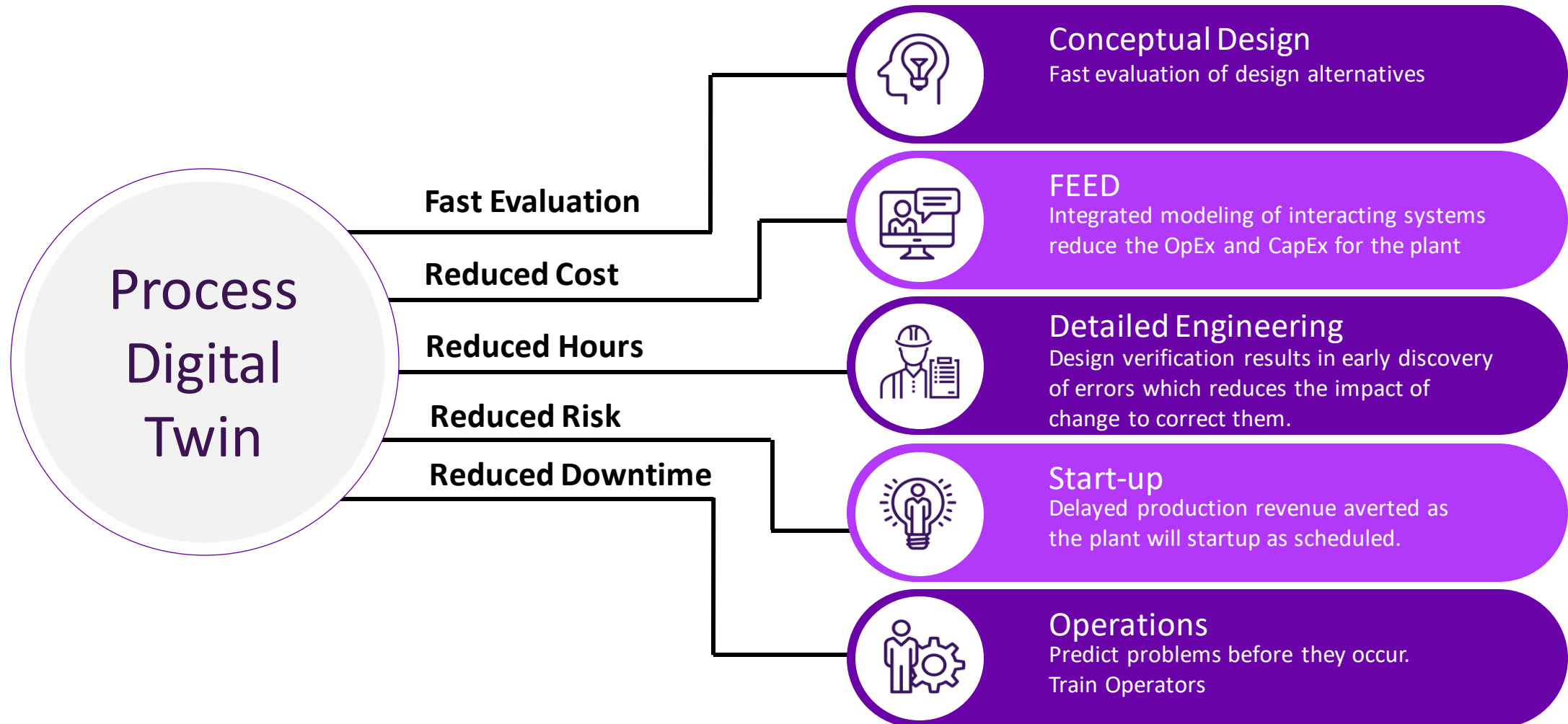


Digital Twin



Connected Worker

Improved business decisions throughout the process lifecycle



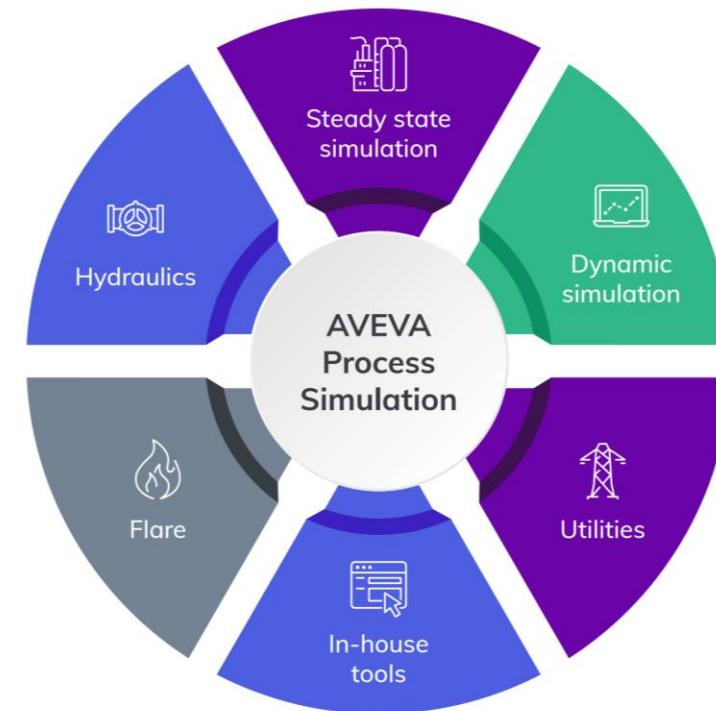
AVEVA Process Simulation brings a transformational approach to process simulation

Reduce simulation effort by 50%

As the value of a smartphone is greater than the sum of the separate devices...

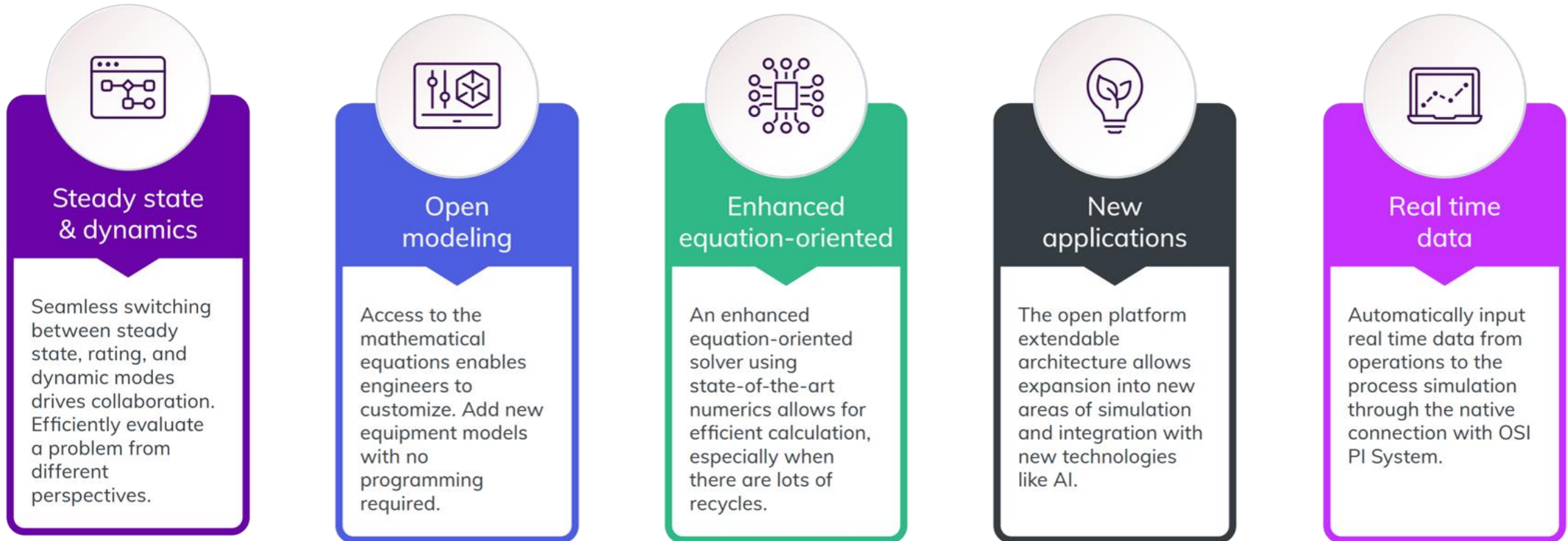


...so too is a platform approach that can replace up to 50 applications used by different process departments



Address challenges that you could not solve before

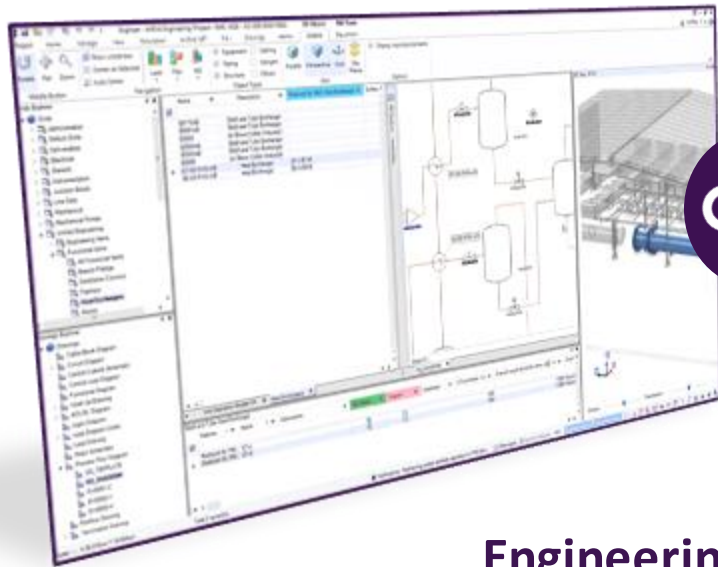
AVEVA Process Simulation is revolutionizing the way to solve engineering problems



What is the Digital Twin?

Use the same process model for engineering and operations

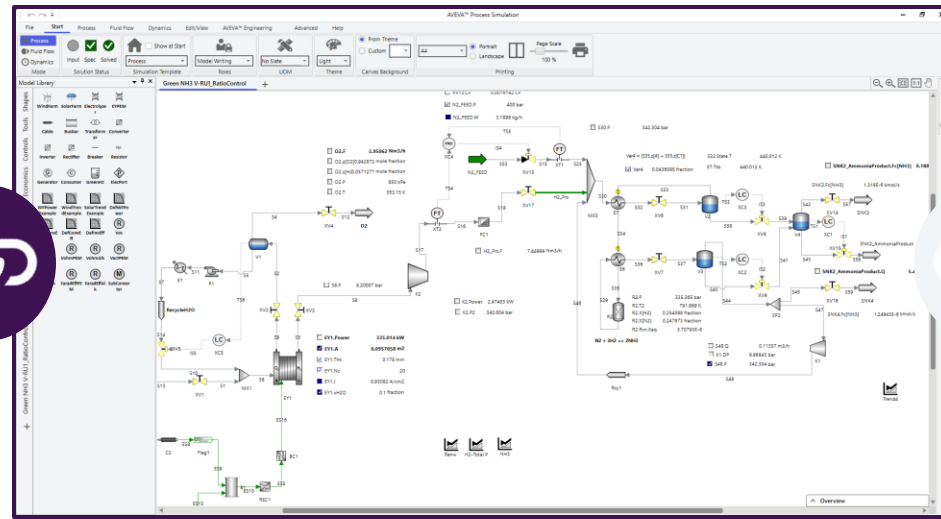
2D / 3D Engineering Data



Engineering Digital Twin

- Design verification and validation
- Apply changes across all designs
- Global cloud collaboration
- Automated case execution

Process Simulation



Operating Digital Twin

- Troubleshoot past operations
- Provide soft sensors
- Improve future operation and efficiency
- Predict equipment degradation and failure

Live / Archived Process Data



Process Simulation in Operations

Beyond data, provides knowledge



Powerful Predictive Engine



Versatile Platform



Designed for Easy Deployment

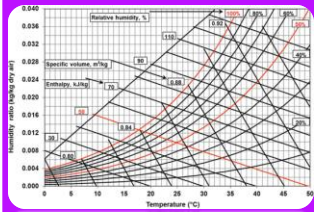
Multi-Purpose Engine

Versatility of Process Simulation



Performance

Adv. KPI

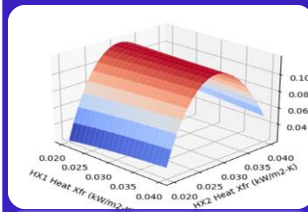


Soft Sensing



Optimisation

Maximum

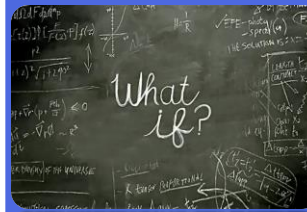


Asset Optimization



What If Analysis

Predictive

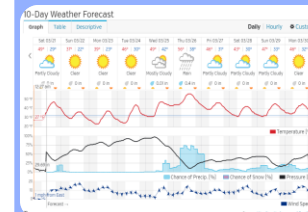


Operate with confidence



Forecasting

Visibility



Accurate Predictions



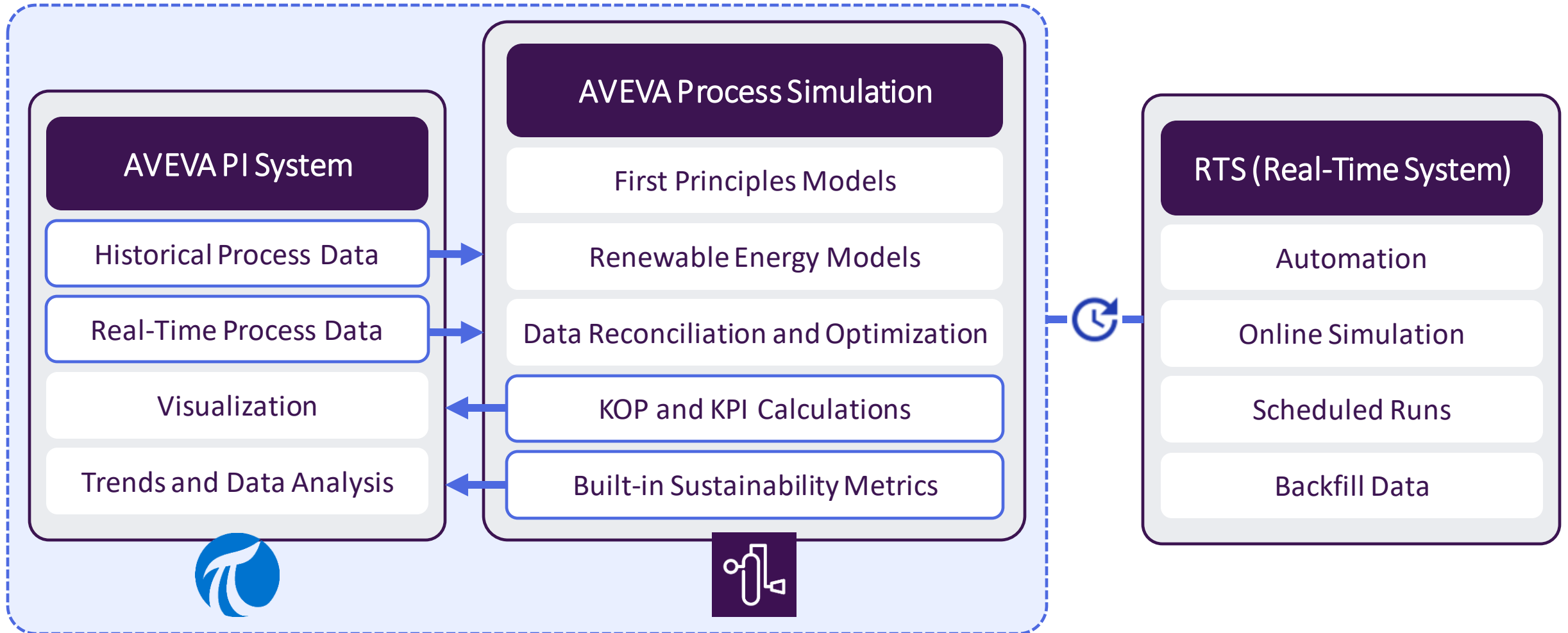
Look Ahead

Insights



Anticipate Events

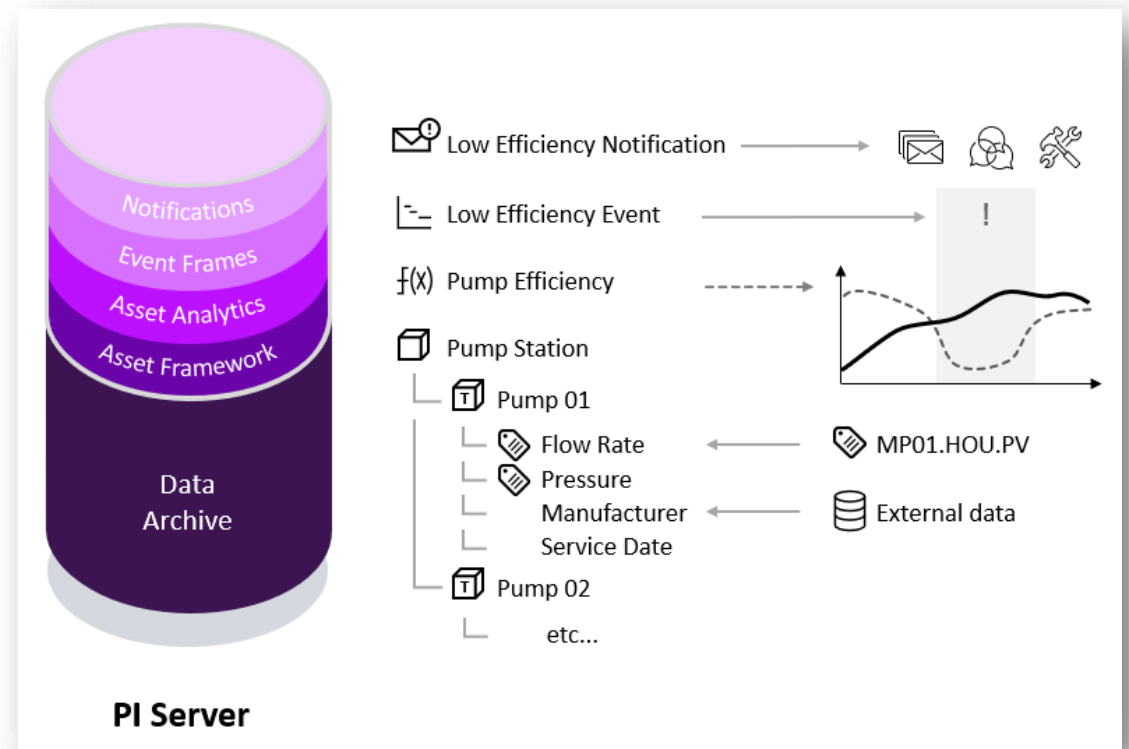
Operating Digital Twin: Process Simulation + PI



Advanced Key Performance Indicators

Leverage Thermodynamic and Chemistry Laws to deliver enhanced KPI

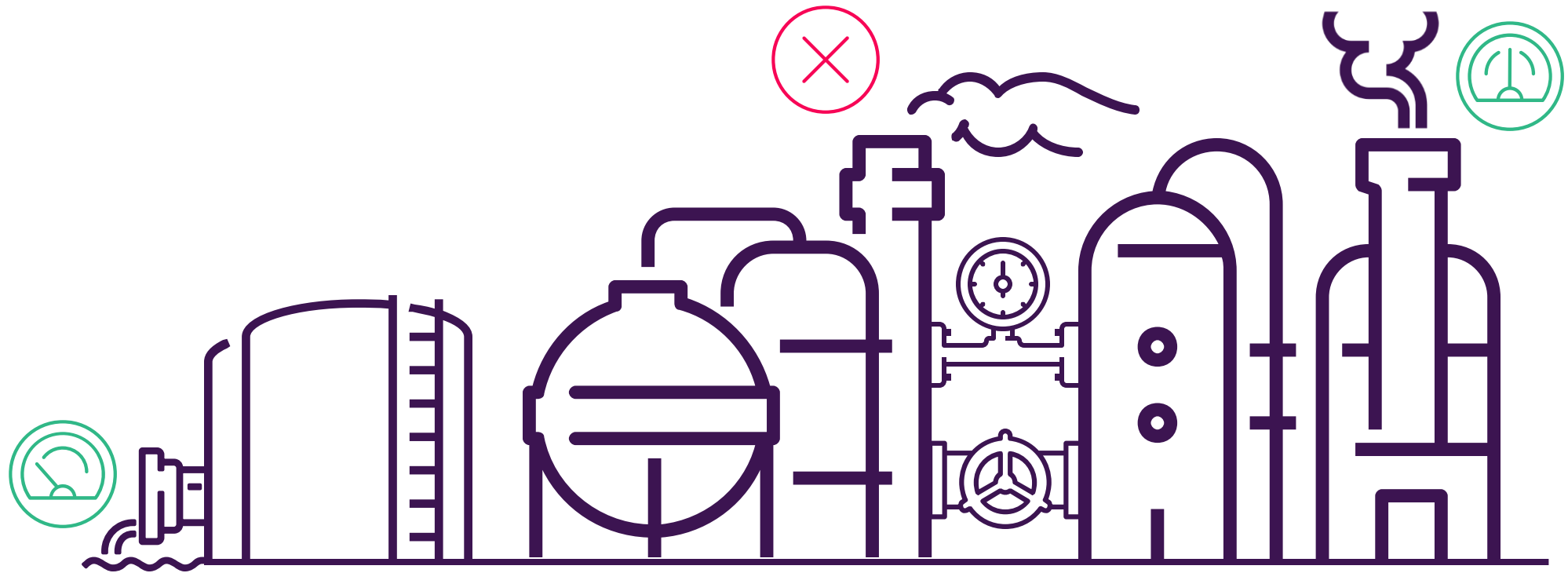
- Rotating Equipment
 - Multistage Efficiencies
 - Intermediate Temp.
- Separation Unit
 - Distillation Efficiency
 - Compositions
- Reactors
 - Equilibrium approach
 - Conversion
 - Catalyst Activity
 - Energy consumption
- Heat Transfer
 - Fouling
 - Temperature approach
 - Dew Points
- Process
 - Mass balance
 - Exergy Efficiency
 - Emissions
 - Operating Cost or Margin
 - ...



Sustainability Monitoring

Monitor

How do we monitor emissions for sources without instrumentation?



Monitor – Digital Twin



Monitor – Digital Twin

Unlocking new value

- Combine real-time process measurements and simulation to create an **Operating Digital Twin**
- Understand the source and magnitude of every emission in your process
- Calculate emissions for sources lacking instrumentation (soft sensing)
- Reduce CapEx requirements by leveraging soft sensors in place of physical sensors and transmitters



Monitor

Real-time monitoring

- Combine real-time process data with Digital Twin results to create an integrated dashboard
- Monitor KPIs that can't be measured in the plant
- Be alerted when abnormal process conditions are detected, or sustainability goals are at risk

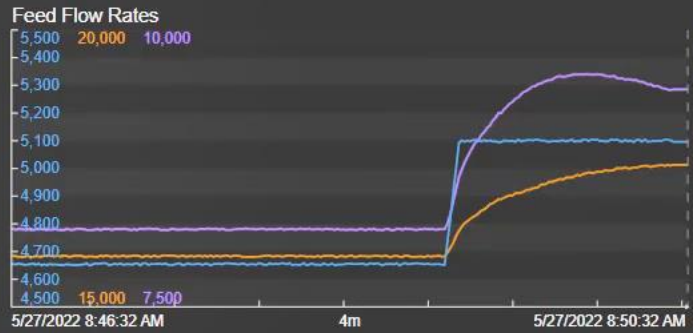


Cumene Production Plant

Overall Global Warming Potential (GWP)
 0.95652 kg/kg
 5/27/2022 8:50:26 AM

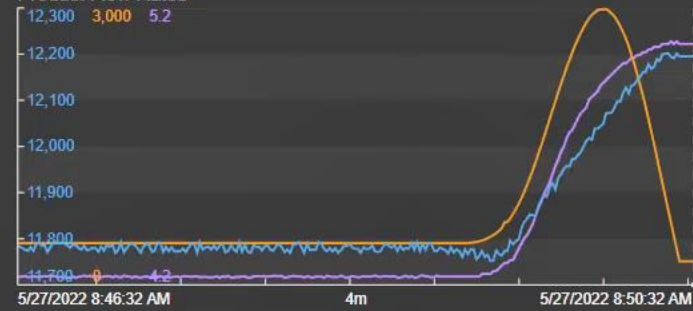
Overall Profit
 3409.8 USD/h
 5/27/2022 8:50:32 AM

Feed and Product Rates



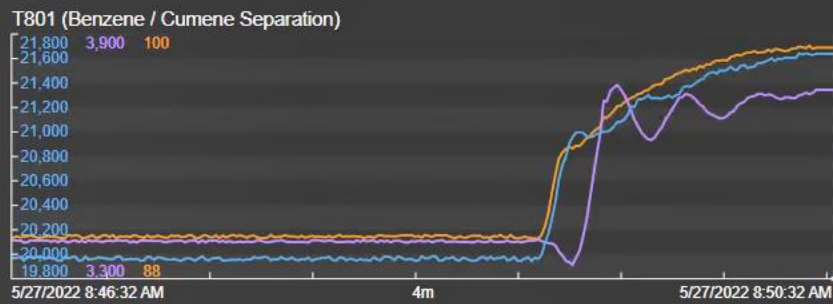
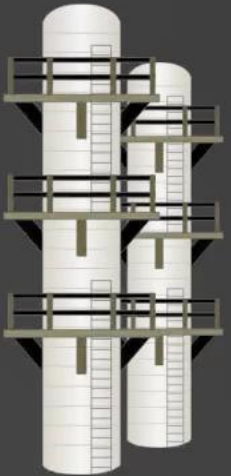
CC2.FT1 - Propene feed mass flow rate
 5,096.2 kg/h
 CC2.FT11 - Total benzene feed mass flow rate
 17,567 kg/h
 CC2.FT2 - Fresh benzene feed mass flow rate
 9,463.5 kg/h

Product Flow Rates

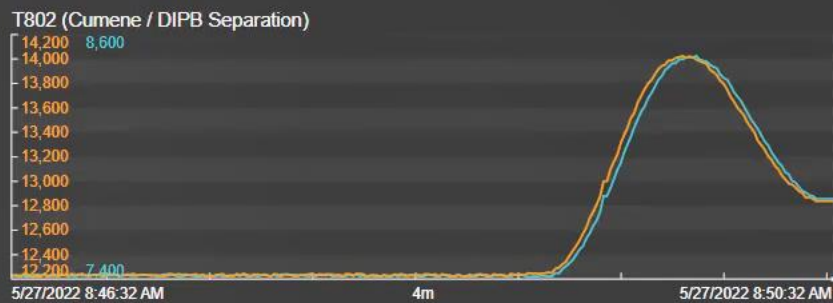
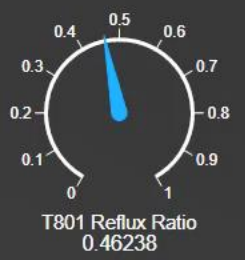


CC2.FT7 - Cumene product mass flow rate
 12,195 kg/h
 CC2.FT8 - DIPB side product mass flow rate
 256.61 kg/h
 CC2.FT9 - Column T802 overhead vent flow rate
 5.07 m3/h

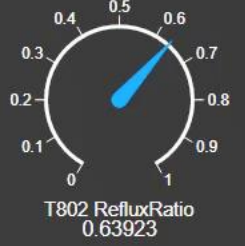
Separation Units



CC2.FT3 - Column T801 feed mass flow rate
 21,640 kg/h
 CC2.FT4 - Column T801 reflux mass flow rate
 3,763.6 kg/h
 CC2.XT2 - Column T801 feed temperature
 99.34 C



CC2.FT5 - Column T802 feed mass flow rate
 12,837 kg/h
 CC2.FT6 - Column T802 reflux mass flow rate
 7,793.7 kg/h



Process Monitoring

Troubleshoot processes with insights from the Digital Twin

- Monitor KPIs for your process with a connected digital twin
- Use soft sensing to gain insights into areas of the process where physical transmitters are not available
 - Column flooding, reactor temperature profiles, etc.
- Replicate process conditions in the Digital Twin to identify problem areas and help with troubleshooting
 - Pipe fouling, column tray plugging, etc.

Covestro

Germany

How process simulation is driving deeper insights with less effort, delivering greater accuracy and driving operational improvements and profitability for global chemicals giant

Goals

- Replace existing, limited online process simulation with a more efficient approach to improve tracking of so-called “non-measurable phenomena” and optimize performance throughout the value chain

Challenges

- Maintenance and replication of simulation models required significant time and effort, which outweighed the value delivered
- Required set-up was tedious and complex
- Lack of graphical user interface hampered troubleshooting and forced reliance on time-based maintenance processes
- Lack of transparency made data interpretation difficult

Results

- Simplified set-up and interpretation of data in real-time enabled more accurate diagnostics and more agile decision-making
- Anticipated reduction in model maintenance effort of 20%
- Ability to easily scale up to use in many more plants, driving comparative value and economies of scale across the business



Industry: Chemicals

Solution: AVEVA™ Process Simulation, AVEVA PI System

“We see opportunities in using PI Asset Framework for easier maintenance of our online models because of the template design, using PI Vision to simplify set-up of the visualizations and reduce maintenance. We plan to use AVEVA Process Simulation which should reduce our maintenance effort of the models by roughly 20%.”

Christian Bratfisch, Computer Aided Process Engineering Software & Modeling Expert, Covestro

LEARN MORE

AVEVA

Process Mode Solution Status Analyze in Manual Solve Snapshots Scenarios Optimization External Data Undo/Redo

Model Library

Shapes Tools Controls Fluids Economics Preview Submodels Lib

- Source Sink Valve Pipe
- Turbine ExtTurb ParTurb Header
- Drum Pump Desup HX
- ParHX HXC HXSC Orifice
- PSV Shaft GasSource GasSink
- HeatSource HeatSink Generator Stream
- PipeRig Recycle ClosedLoop Seq
- NoMotivePwr MotiveAir SubTurbine SubSplit
- CombGas Steam ValveExample DefPump
- PumpExample PumpMapExample TurbEff GTEExample

SteamTurbineOnline

Read/Write External Data

General
 Name: KPIs
 Description: KPI collection to write

Time Selection
 Start Date & Time: 04/07/2022 02:29 PM
 Time Span: -1 Minutes

Tag List
 Server: APS-RTSSERVER-V

Quality	Tag Name	Tag Value	Tag Units	Sim Variable	Sim Value	Sim Units	Screened Value	Last Good Value	Min	Max	If Under Min	If Over Max	If B...
	ST1.power			T1.Power	17.3302	MW					Clip	Clip	Use
	ST1.eta			T1.eta	75.7044	%					Clip	Clip	Use

Input Processing: Read, Screen, Set

Output Processing: Get, Write

Update Last Good

Data Manager

Name	Time Selection	Description
Measurements	4/7/2022 2:32 PM -1 minutes	Measurement collection to read
KPIs	4/7/2022 2:29 PM -1 minutes	KPI collection to write
AssetRunning	4/7/2022 2:29 PM -1 minutes	Speed > 4500rpm
SimStatus	3/18/2022 9:04 AM -1 minutes	Simulation Status
Data Rec Outputs	4/7/2022 2:29 PM -1 minutes	

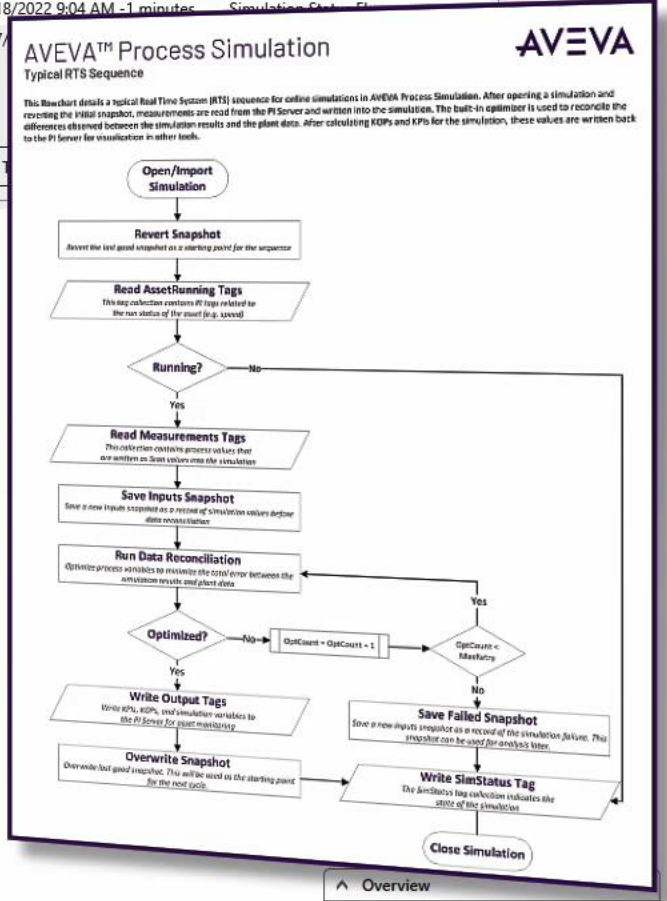
- TT1001.Scan 717.92 F Feed.T 717.92 F
- PT1002.Scan 74.3246 psig Exhaust.P 74.3246 psig
- TT1002.Scan 376.19 F Exhaust.T 376.19 F

Pis to PI

17.3302 MW

75.7044 %

405.124 Cv

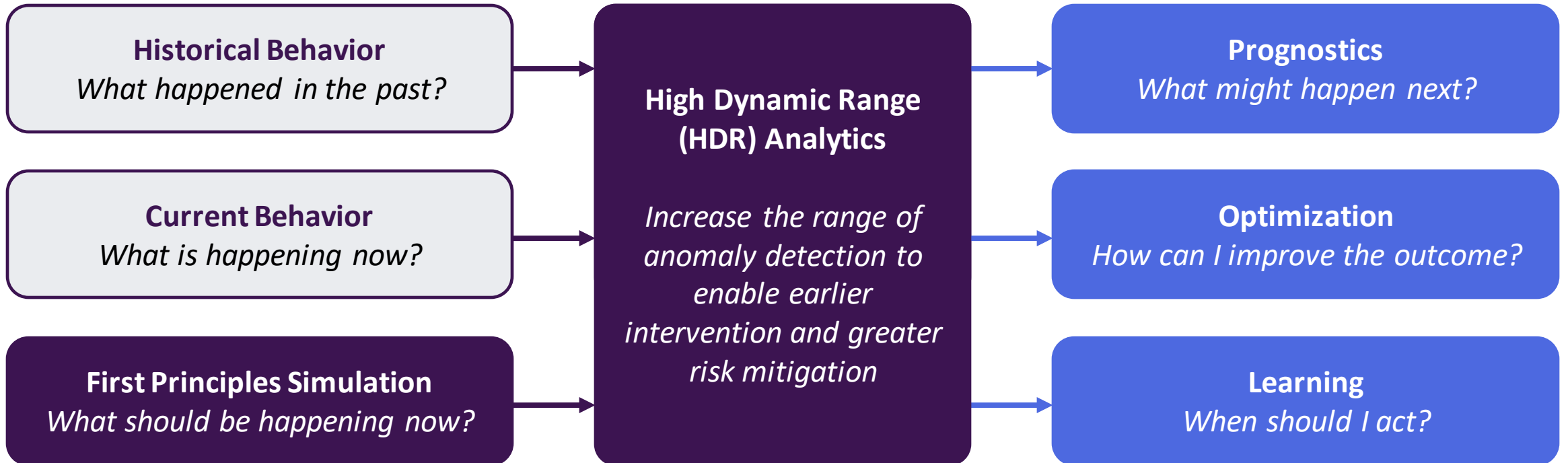


Predictive Asset Optimization

AVEVA

What is Predictive Asset Optimization (PAO)?

What is PAO? Real-time Data + Artificial Intelligence + Simulation + Optimization



Enabling better outcomes

Analytics that enable a 360° Risk Assessment of processes

Detect heat exchanger fouling
in a preheat train exchanger



HDR Models

Detect issues
earlier and with
greater clarity

Impact

Assess the impact
of the issue on
your process



Model the impact on required
fuel feed, GHG emissions, and
process performance

Determine when to service
the exchanger based on the
RUL estimate



Remaining Useful Life

Determine the
urgency and
intervention
window

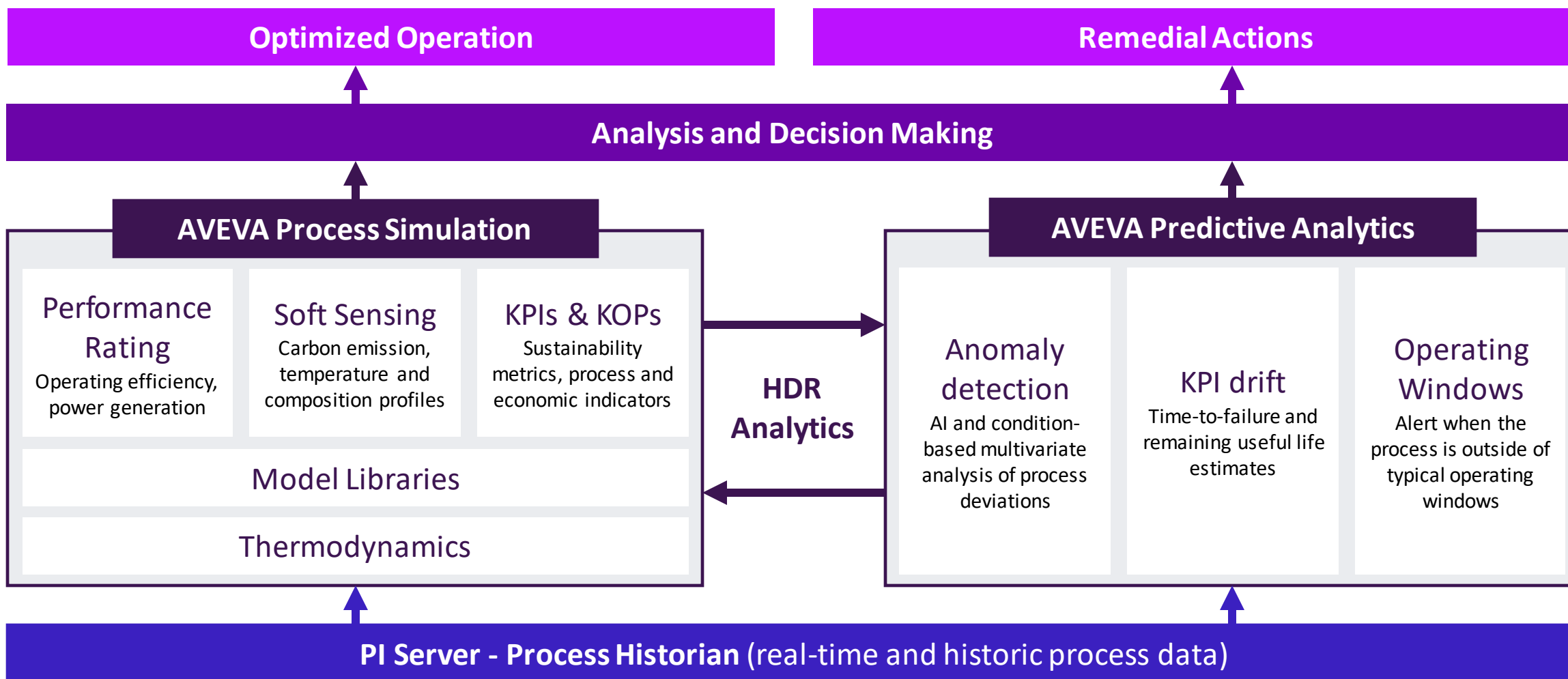
Optimize

Improve outcomes
with optimized
corrective
actions



Leverage recommended
corrective actions to determine
an optimal path forward

Predictive Asset Optimization (PAO) Architecture



Getting Started with Digital Twins



Getting Started

Building and deploying a digital twin is easier than you think

1. Identify processes where a digital twin can provide value

- What are some areas where you would like more insight?
- Where do production/process engineers spend most of their time?
- What areas are most critical for process sustainability and equipment reliability?

2. Consider what data is already available

- Do you have a simulation model for these processes already? Engineering data?
- Where is the real-time and historic process data saved?

3. Integrate the elements of your digital twin

- Process simulation models, real-time process data (Operating Digital Twin), and engineering data (Engineering Digital Twin)

4. Recognize the value of your new digital twin!



AVEVA is here to help you identify and build your digital twin solutions



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Principal Enterprise Architect

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- ryan.muir@aveva.com



Questions?

Please wait for the microphone.
State your name and company.



Please remember to...


Navigate to this session in the mobile app to complete the survey.



Thank you!

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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.

Learn more at www.aveva.com