13° FEBRUARY 2025

How to boost your plant productivity, safety and sustainability with first principle simulation and AI

Cristina Peretti, Principal Consultant Presales - AVEVA

AVEVA

AVEVA is a leader in sustainable industrial platforms and software

- AVEVA combines the world-leading industrial data management with AI-infused software that builds on more than fifty years of expertise

- Schneider Electric 100% shareholder and strategic partner

- Growing recurring revenue by 10%+

- Cloud growth accelerating

- Market capitalization > US $9BN

- Revenue > US $1.2BN

AVEVA

Our **vision** for the future
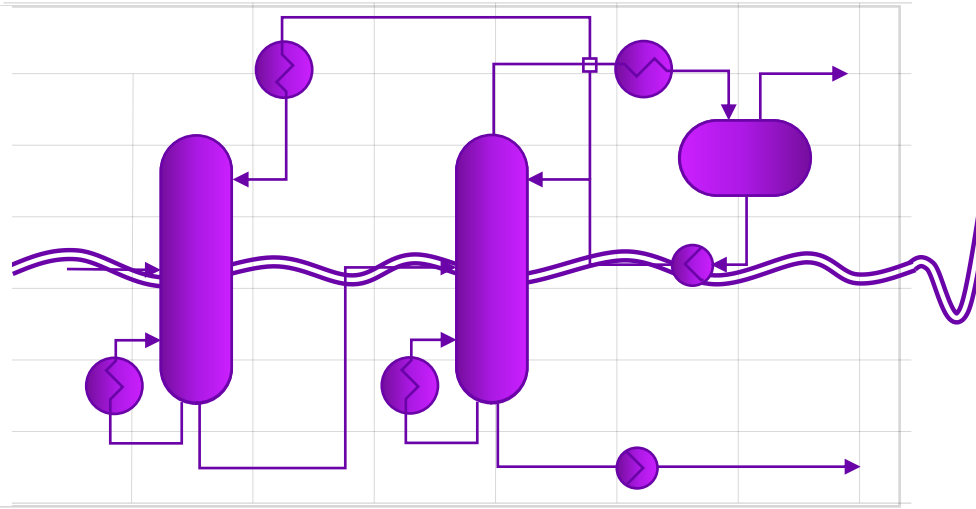
We spark industrial ingenuity

By connecting people with trusted information and insights

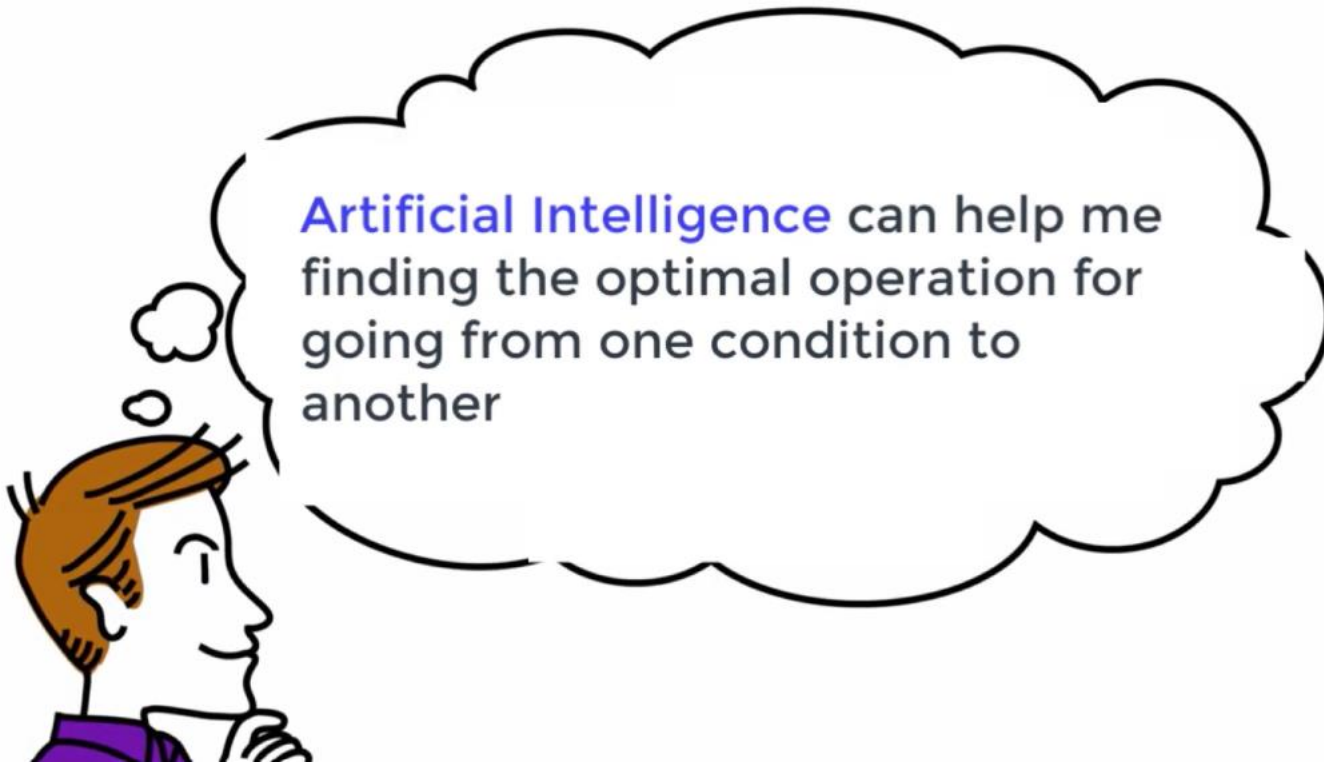To drive responsible use of the world's resources

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Problem Statement

The plant is changing feed weekly

It takes the operators 8 hours to stabilize back the plant

Several days of production are lost every year

Can AI help?

Artificial Intelligence can help me finding the optimal operation for going from one condition to another
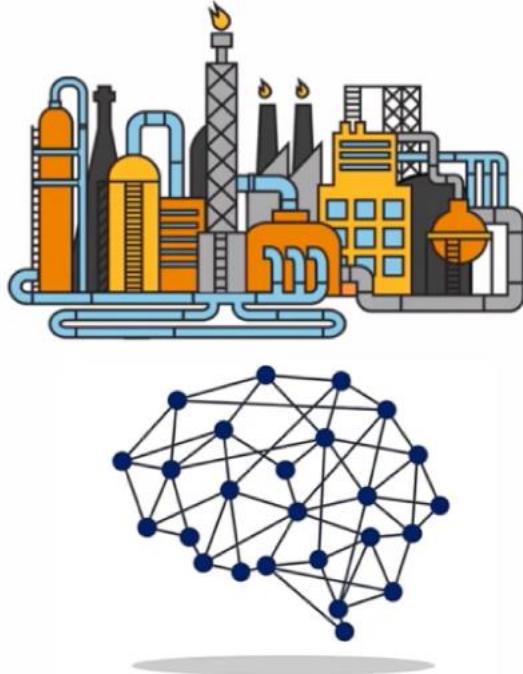
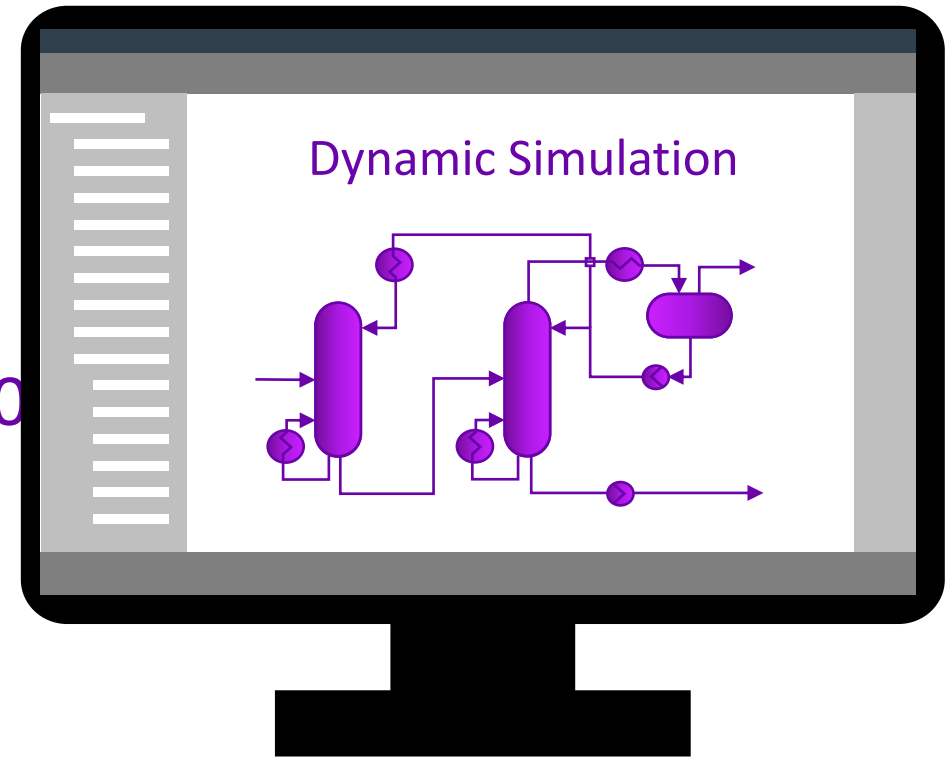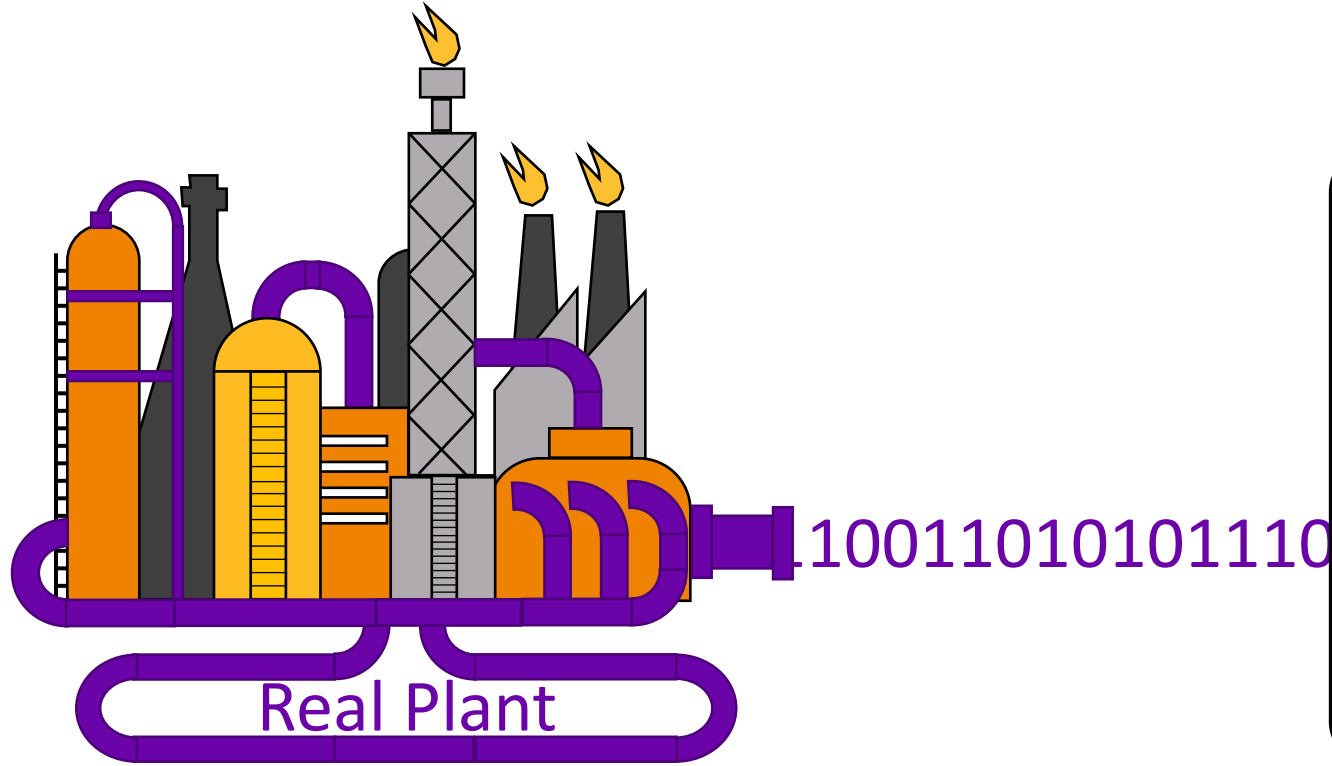**4** Crude Compositions to Handle

30,000 Runs to Train and Validate the AI Agent

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Can AI help?
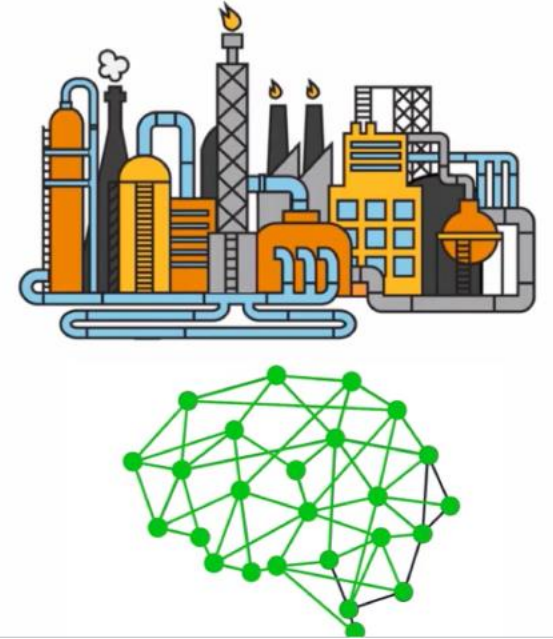
It will take **580** years to collect the required data for training the AI agent using only plant data

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First Principle Simulation

Real Plant

10011010101110

Dynamic Simulation

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AI Advisory Models

Operate & Maintain

Dynamic Case Studies

Control Design Studies

Schneider Electric ETAP

etap

Electrical Design Studies

Virtual Reality

AVEVA Extended Reality

AVEVA Dynamic Simulation

Operability Studies

Operator Training

Virtual Commissioning & Startup (VCSU)

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AVEVA Dynamic Simulation 2023

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: 9999 | Speed: 4135 % | Time: 0:29:37.50 | RUNNING | G2_Deethanizer | IC Summary | IC: 1 - Design Operating Conditions

Instances

SIM4ME
└ G2_Deethanizer

G2, G2_Deethanizer

Row 1, Col 1 | 100%

PSV101
SI_RELIEFVENT
PT101
PC101
PC101 RESPONSE
5369.6kg/hr
PV101
SI_OVHDPROD
FC101 RESPONSE
29.6barg -20.3C
E101
29.3barg -37.0C
D101
DYNAMIC RESPONSE
FT101
FC101
LC101
LT101
LC
LT
DrainVlv
SI_DRAIN
SO_FEED
13538.9kg/hr
FV101
3744.3kg/hr
M101
LV101
P101 PLOT
TC101 RESPONSE
LC101 RESPONSE
P101
T1
SO_D101VAP
2570.2kg/hr
E102
D102
30.4barg
112.9C
TT101
SO_E102_UTILITY
Feed Propane Composition
LC102
8181.7kg/hr
LV102

DYNAMIC RESPONSE

Color	Name	Value	Units	Custom Description	Min	Max
	S9.W	1.04009	kg/sec	Reflux flow rate	0.984	1.044
	S6.W	1.49156	kg/sec	Top product flow rate	1.478	1.498
	S13.W	0.713933	kg/sec	Steam flow rate	0.702	0.722
	S17.W	2.27271	kg/sec	Bottom product flow ra	2.262	2.292

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

Freeze

LC101 RESPONSE

Color	Name	Value	Units	Custom Description	Min	Max
	LC101.SP	0.390000	m	Set point	0.3	0.5
	LC101.OUT	0.097561	fraction	Output	0.0	1.0
	LC101.PV	0.390263	m	Process variable measu	0.3	0.5

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

LC101 Dynamic response

Freeze

Instances | Types | Monitor | Lists

Command:

Mon Jan 13 11:37:36 2025 | 0:00:00.00 | Dynsim | Dynsim Initialization Complete. | INFO
Engine integration time step: 0.25s.

Description

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

The Process Digital Twin meets AI

With just **15 clones** it took **41 days** to collect the equivalent amount of data of **580 years**
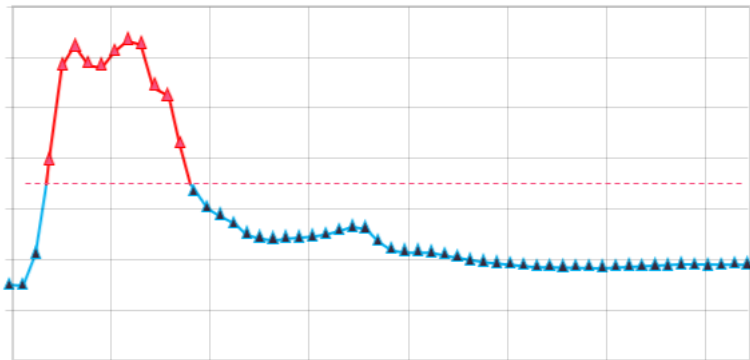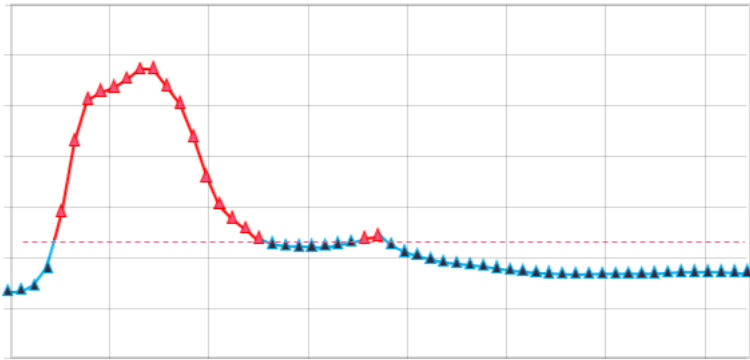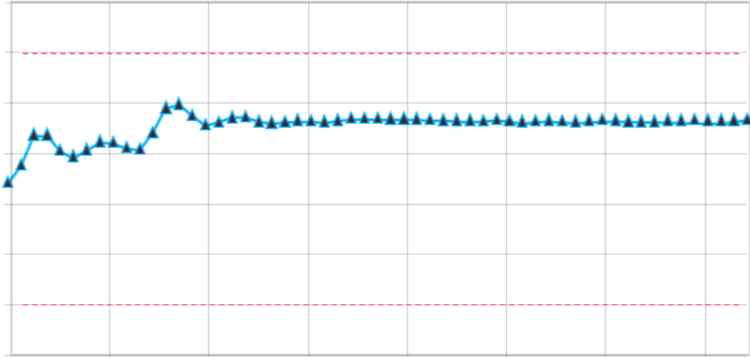
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Problem definition
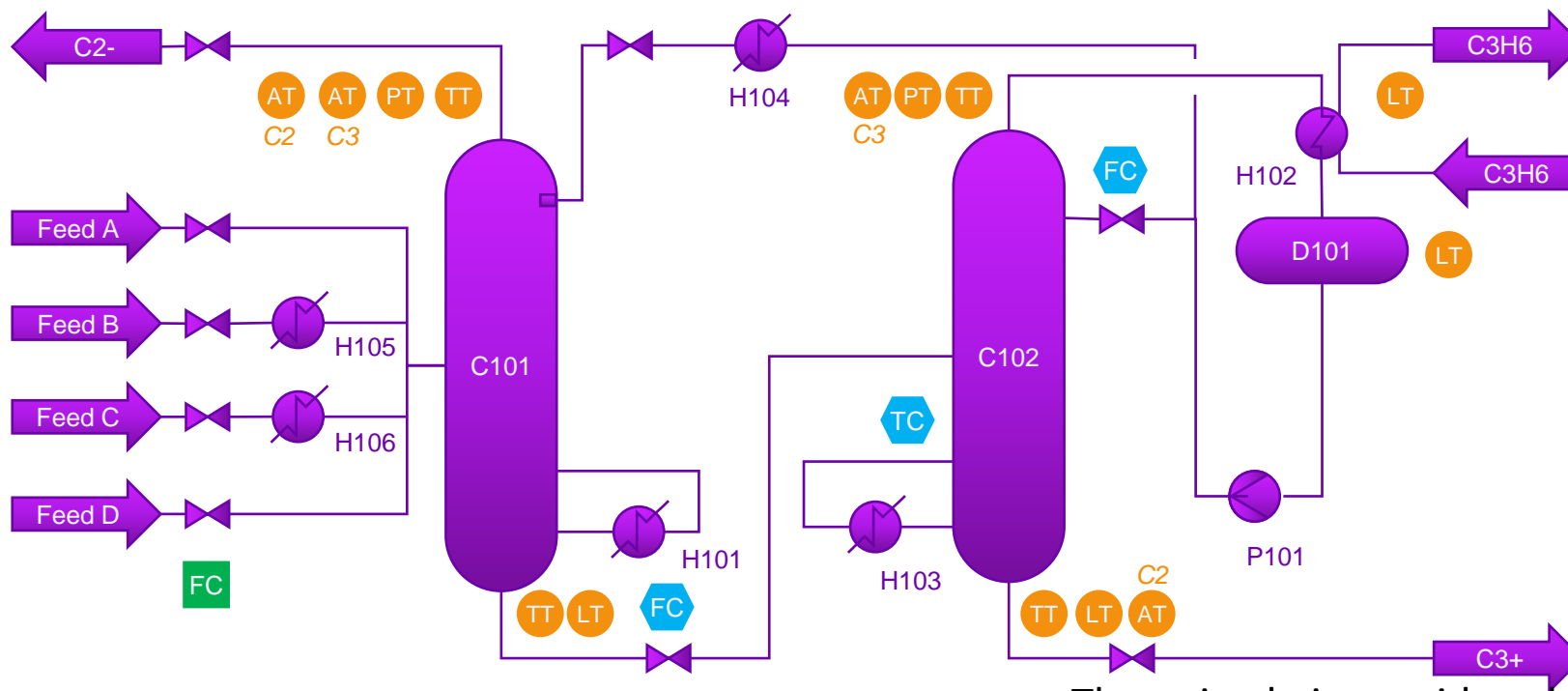
The objective is to stabilize the unit after a change in the raw feed condensate (Feed D) in the lowest time possible

The AI agent can change the setpoint of the C101 bottom flow rate, C102 reflux flow rate and C102 temperature
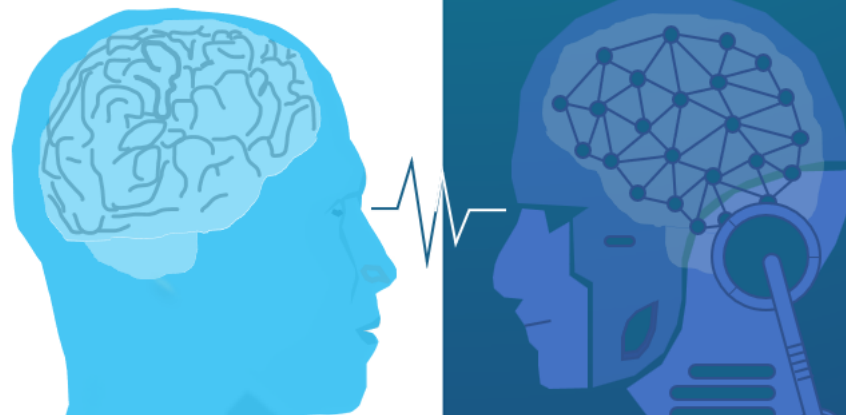
The episode is considered successfully completed when all 14 key process variables are stabilized (fluctuations drop below 2% of their range) and no alarm is triggered during the operation

Initial Change

FC — Raw Condensates Feed

Action Space

FC — C102 reflux flow controller (set point)
FC — C101 bottom flow controller (set point)
TC — C102 temperature controller (set point)

Observation Space

TT — C101 top temperature
TT — C101 bottom temperature
PT — C101 top pressure
AT — C101 top C3 concentration
AT — C101 top C2 concentration
LT — C101 level
TT — C102 top temperature
TT — C102 bottom temperature
PT — C102 top pressure
AT — C102 top C3 concentration
AT — C102 bottom C2 concentration
LT — C102 level
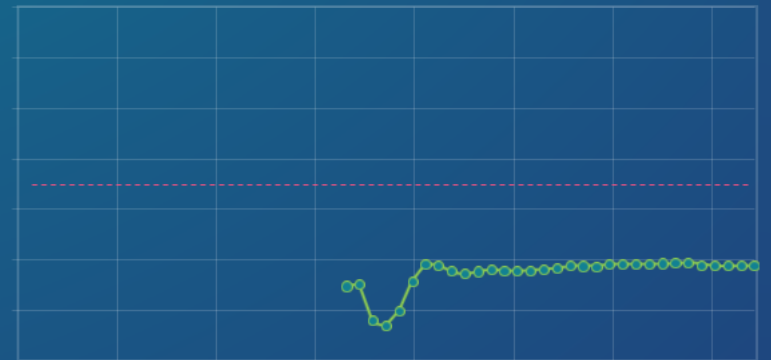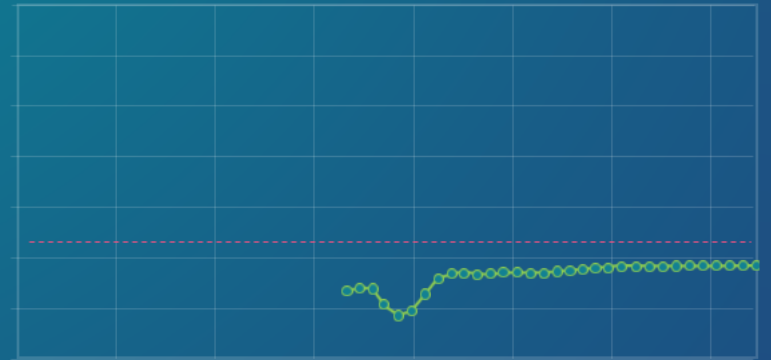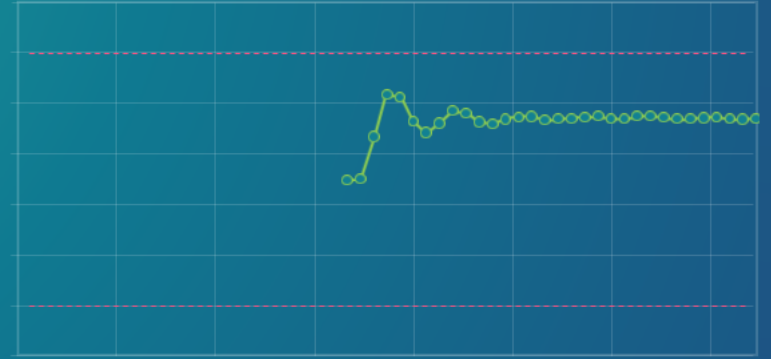LT — H102 level
LT — D101 level

Human VS AI Agent

Time to stabilize — HRS MIN
Human: 07 28
AI Agent: 04 06

Number of alarms
Human: 03
AI Agent: 00
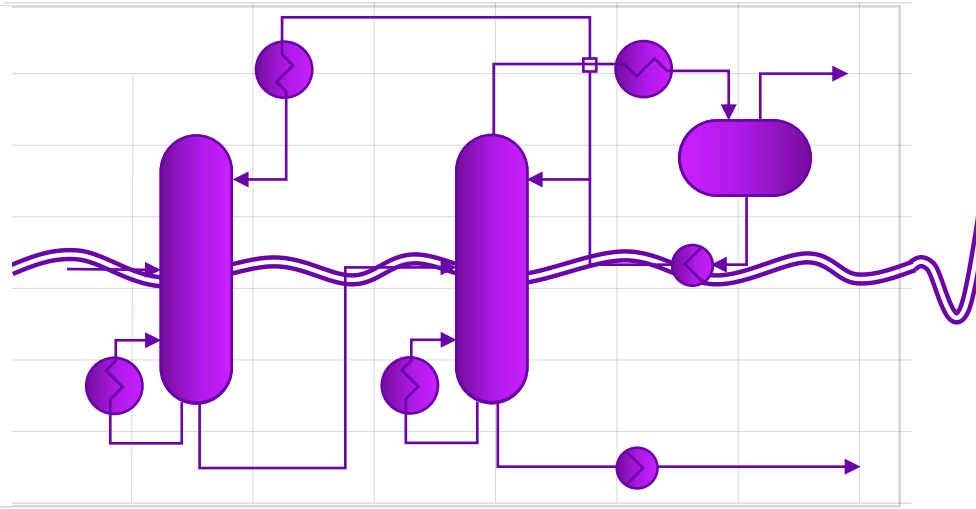
What are the benefits?

25%
Less Time for Completing the Operation

2
Additional Days of Production in One Year
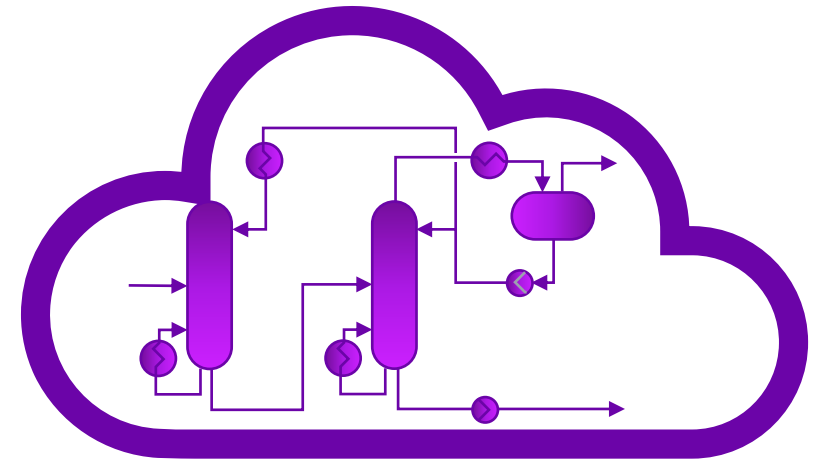
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Problem Statement and Solution

The plant is changing feed weekly

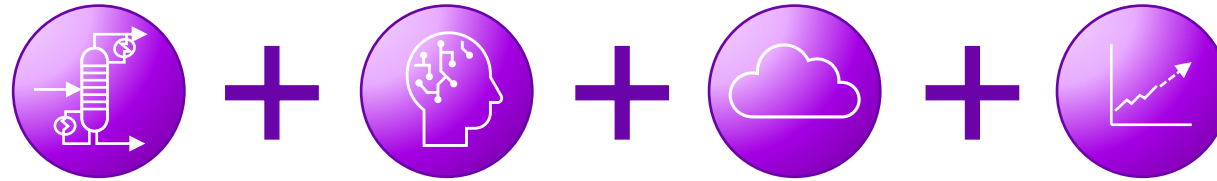It takes the operators 8 hours to stabilize back the plant

Several days of production are lost every year

HOW CAN WE IMPROVE?

AI agent can be trained to optimize the operation using a digital replica of the plant on the cloud

Takeaways

This work demonstrates the benefits of using in the same workflow **first-principles models**, **AI** and **cloud**
to achieve:

Higher **profitability**	Improved **stability**	Improved **safety**	Higher **sustainability**
45% time saved	Plant **stabilized** faster	**No alarm** triggered	**Emissions** can be minimized

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@avevagroup

ABOUT AVEVA

AVEVA is a world leader in industrial software, providing engineering and operational solutions across multiple industries, including oil and gas, chemical, pharmaceutical, power and utilities, marine, renewables, and food and beverage. Our agnostic and open architecture helps organizations design, build, operate, maintain and optimize the complete lifecycle of complex industrial assets, from production plants and offshore platforms to manufactured consumer goods.

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. The company is headquartered in Cambridge, UK.

Learn more at www.aveva.com

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