



AVEVAWORLD
PARIS

AVEVAWORLD

OCTOBER 2024

AVEVA Industrial AI

Generate Impact to Achieve Greater Goals

Jim Chappell - VP & Global Head of AI
Lori Warda - AI Product Director

AVEVA



AVEVA Industrial AI

Generate Impact to Achieve Greater Goals

AVEVA

Industrial AI: The power shift that redefines industry norms

Innovative power in every day that elevates industrial performance to new heights

Industrial impact with AI

Unmatched speed

- Unprecedented speed and scalability in quantitative & qualitative data analysis
- Independent of data source
- Much faster than humans or traditional software



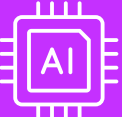

Navigate complexity

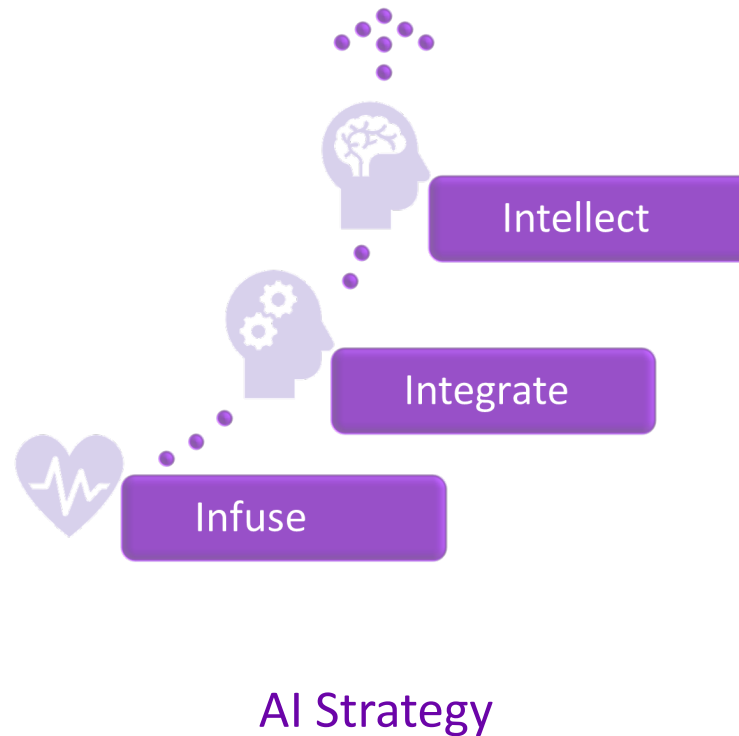
- Automate complex processes
- Analyze vast datasets
- Adapt to new information continuously
- Detect things that humans can't

Innovation on autopilot

- AI powered digital twins with real-time data
- Continuously learn, adapt, predict, simulate, and prescribe

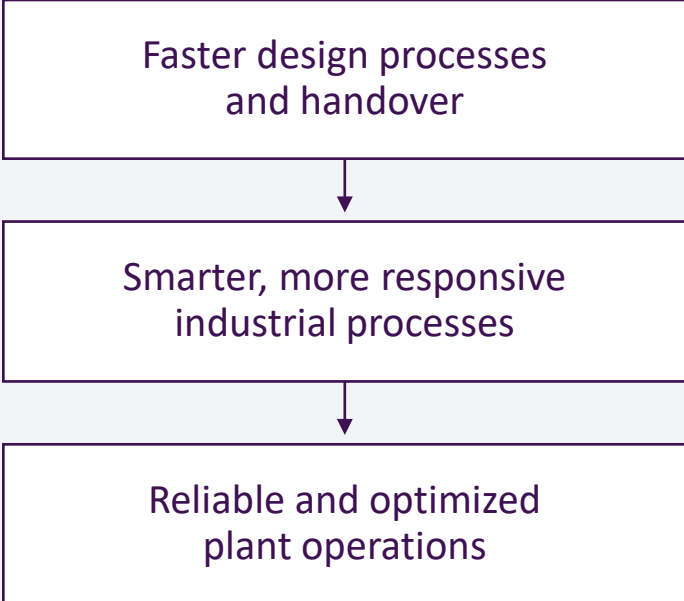
AVEVA and AI: Not just technology

-  20+ years experience in industrial AI
-  Strong domain and industry expertise
-  18 AI infused products
-  Sustainable and actionable insights



Data and analytics across the full lifecycle

Design | Operate | Optimize



The flowchart consists of three white rectangular boxes with black borders, connected by downward-pointing arrows. The first box contains the text 'Faster design processes and handover'. The second box contains 'Smarter, more responsive industrial processes'. The third box contains 'Reliable and optimized plant operations'.

Achieving Net Zero

It's a Journey

Today

- Improve asset & process efficiency
- Burn less fuel
- Reduce GHG emissions

Tomorrow

- Drive down the cost of green energy production
- Improve the reliability of green energy
- Cause green energy to become more economically viable than traditional sources of energy

Result: Net Zero

AI-driven Digital Twin



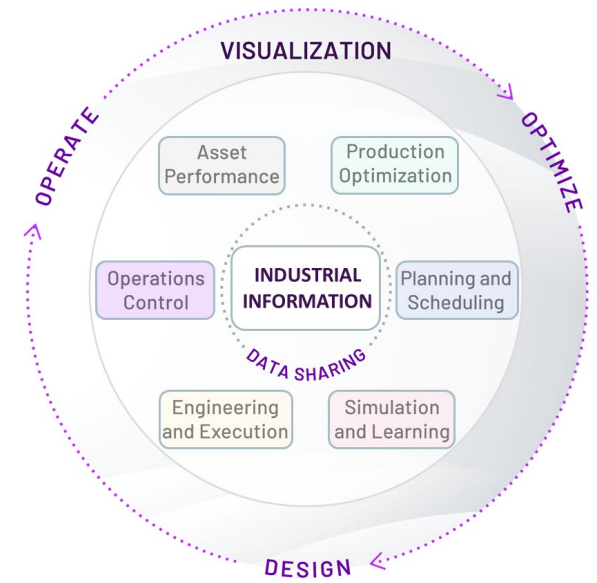
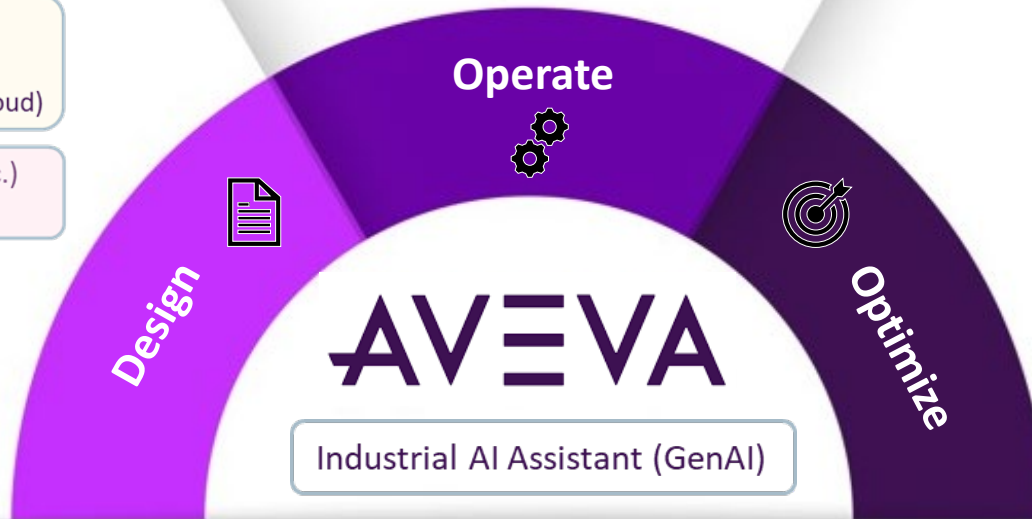
AVEVA AI Today

Commercial AI capabilities

- Advanced Process Control
- System Platform SCADA – integrated machine learning
- Vision AI Assistant

- E3D Whitespace Optimizer
- E3D Generative Design
- Point Cloud Manager (Intelligent Point Cloud)

- Grey-box Modeling (carbon capture, etc.)
- AI-infused Dynamic Simulation



- Automated Analytics
- Guided Analytics
- Predictive Analytics/Maintenance
- Asset Prescriptive Analytics

- Process Optimization
- Predictive Quality/Throughput (batch)
- Remaining Useful Life Estimation (RULE)
- Predictive Asset Optimization (risk-based)

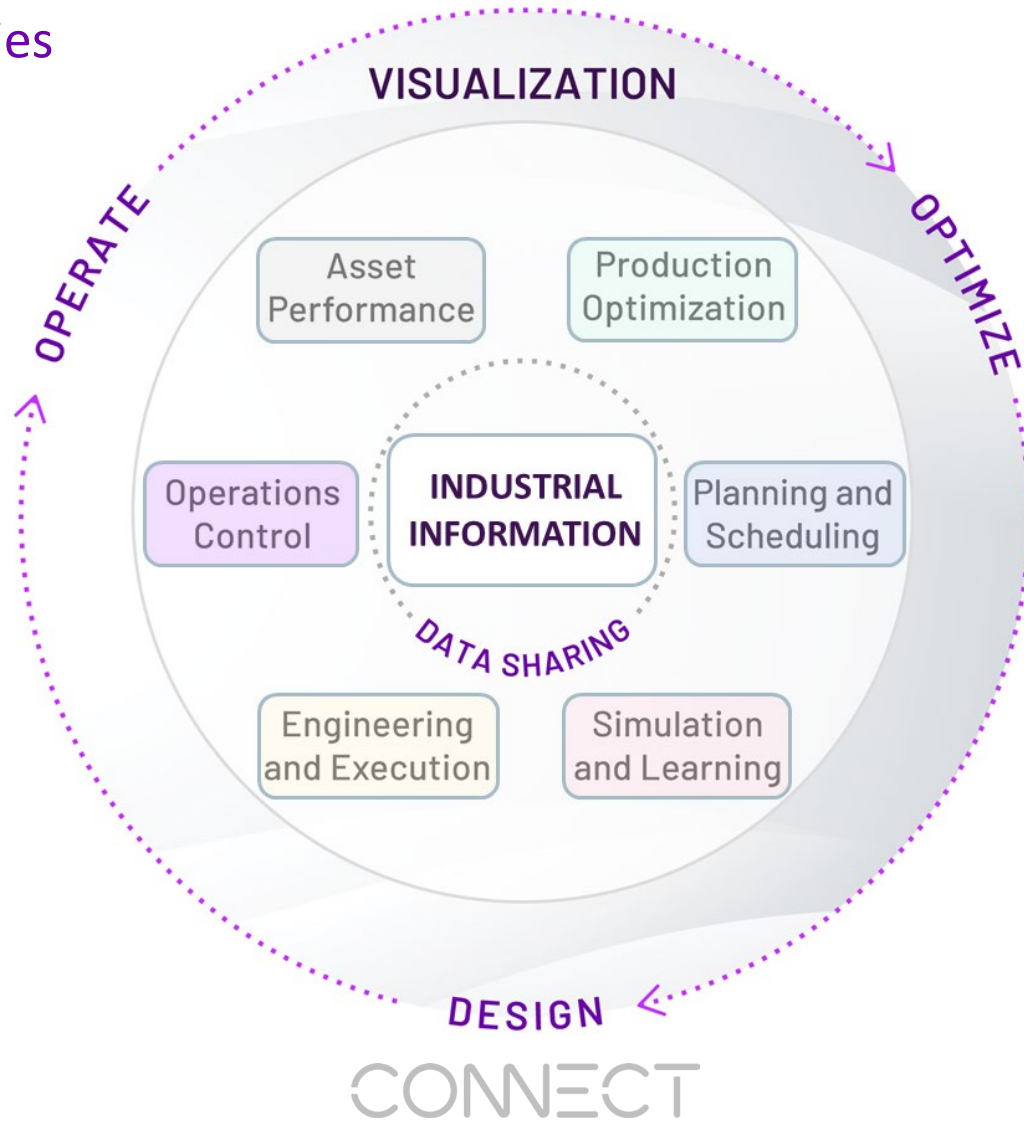
- Schedule AI Assistant
- Realtime Crude Assistant

CONNECT

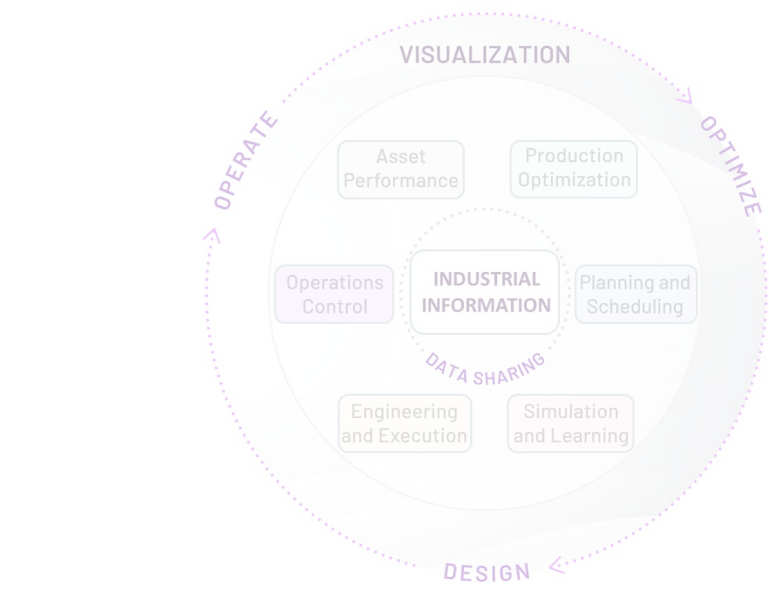
AVEVA

AVEVA AI Today

Commercial AI capabilities



- E3D Whitespace Optimizer
- E3D Generative Design
- Point Cloud Manager (Intelligent Point Cloud)
- Grey-box Modeling (carbon capture, etc)
- AI-infused Dynamic Simulation



- Automated Analytics
- Guided Analytics
- Predictive Analytics/Maintenance
- Asset Prescriptive Analytics
- Process Optimization
- Predictive Quality/Throughput (batch)
- Remaining Useful Life Estimation (RULE)
- Predictive Asset Optimization (risk-based)
- Schedule AI Assistant
- Realtime Crude Assistant

AI

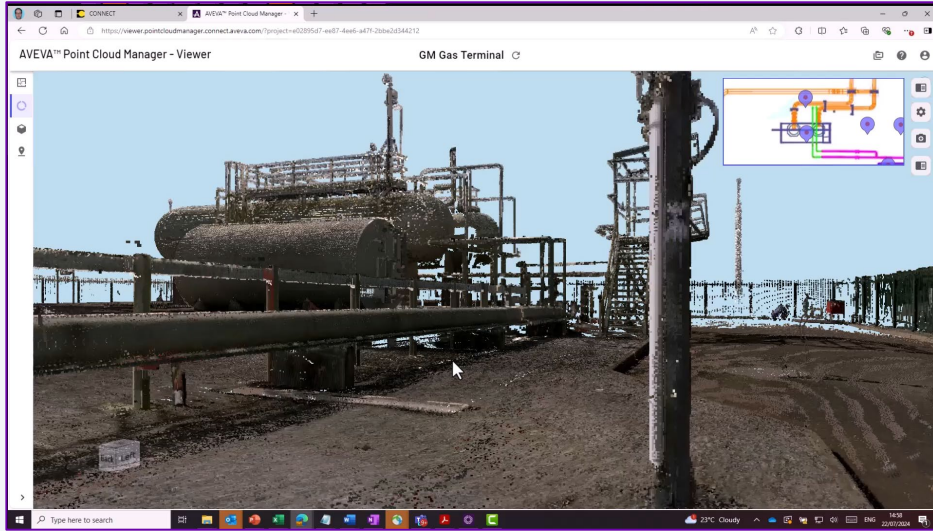
Design

AVEVA

The Future of Engineering Design

Design

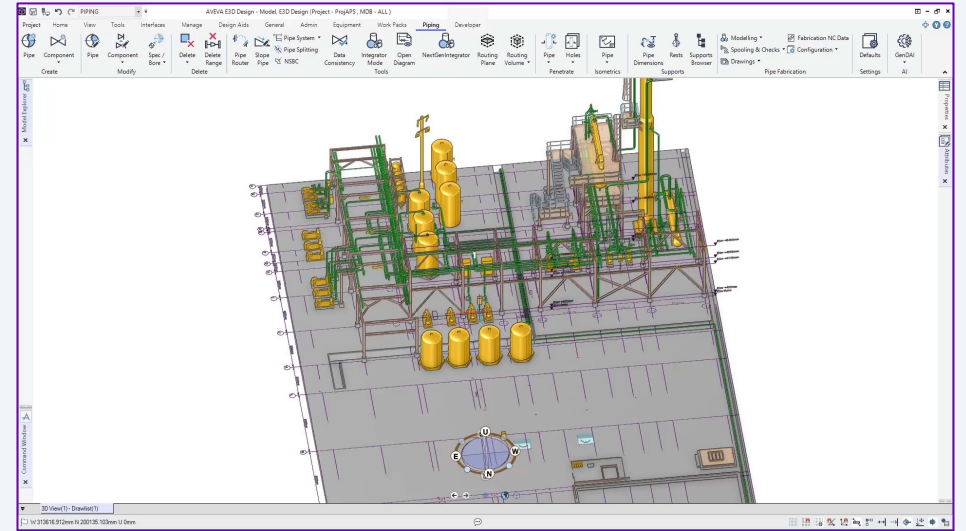
Intelligent Point Cloud



- Trawl through massive amounts of point cloud data
- Quickly & easily understand what you're looking at
- Automatically classify & tag identified objects
- Eliminate the time & pain of manually locating and tagging maintainable assets/equipment items

**Q1 2025 release (Point Cloud Manager)*

Generative Design AI (GenDAI)



- Generate feasible design options faster using an end-to-end, environment-aware AI design solution
- Minimize human labor in creating 3D models
- Clash free out-of-the-box that allows for visual comparison and modification
- Initial focus on automated 3D pipe routing*
- Future: detailed design stage and entire plant model

**Q4 2024 release (E3D)*


AI

Operate


AVEVA

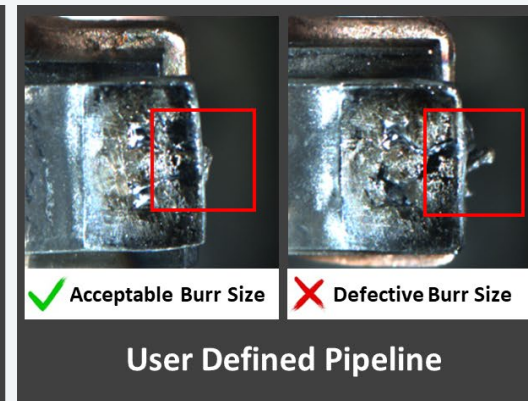
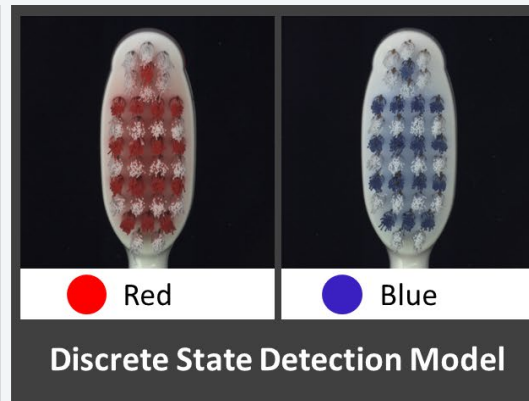
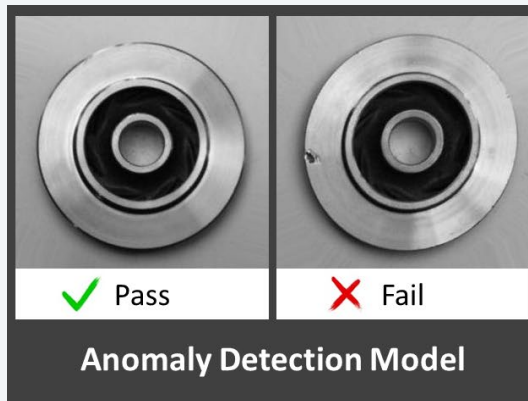
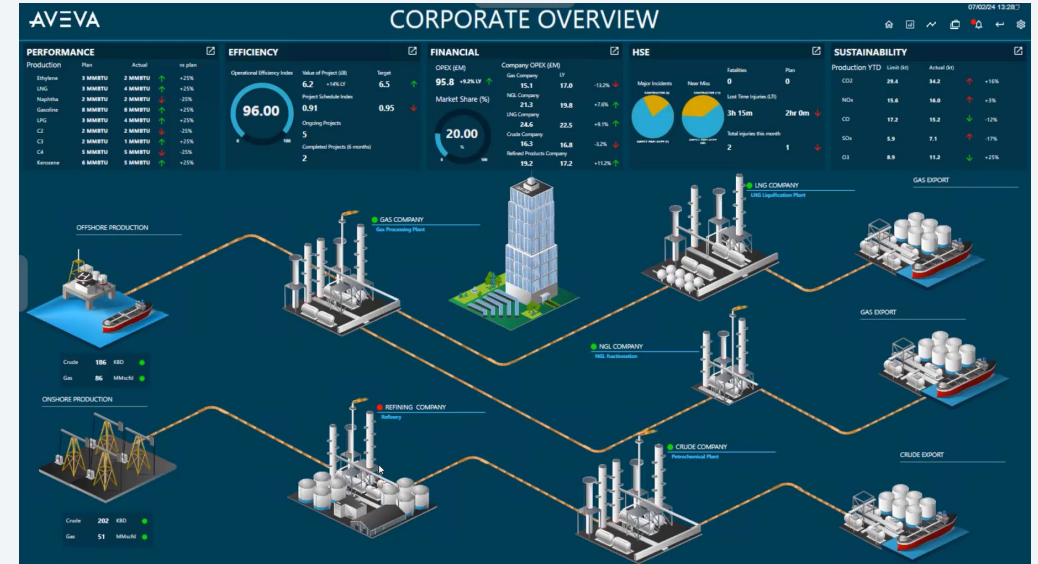
Vision AI Assistant

Operate

 Use AI to detect operational issues (whether or not you have sensors)

- Increased equipment uptime
- Failure prevention
- Better quality
- Improved responsiveness

 Native integration to System Platform



AI

Optimize

AVEVA

Integrated AI

Predictive + Prescriptive + Prognostic

Optimize

✓ **Historical**

What Happened

Historical Domain

✓ **Real-Time**

What's Happening

Real-Time Domain

✚ **Predictive**

What If

Machine Learning Domain

✚ **Prescriptive**

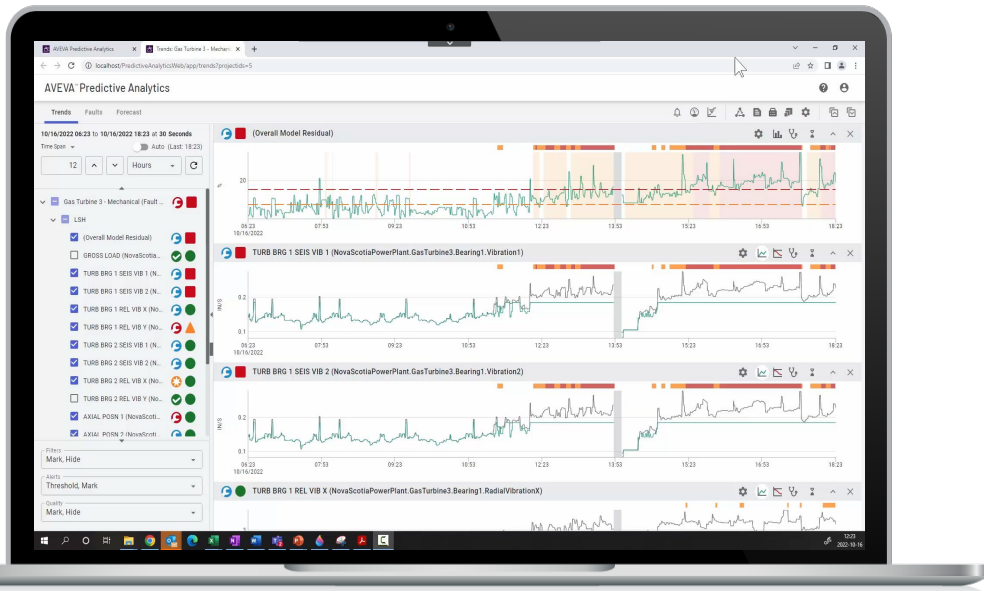
What to do

Maintenance Action Domain

✚ **Prognostics**

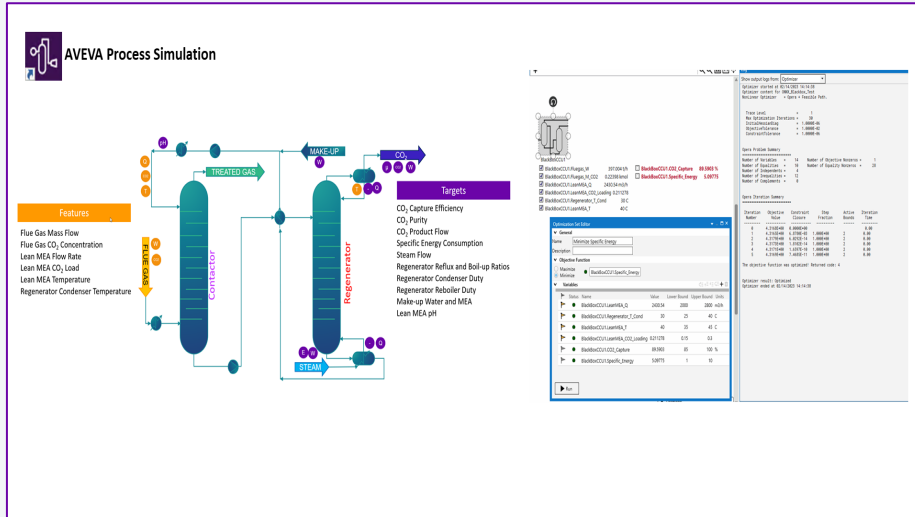
How bad will it get

Artificial Intelligence Domain



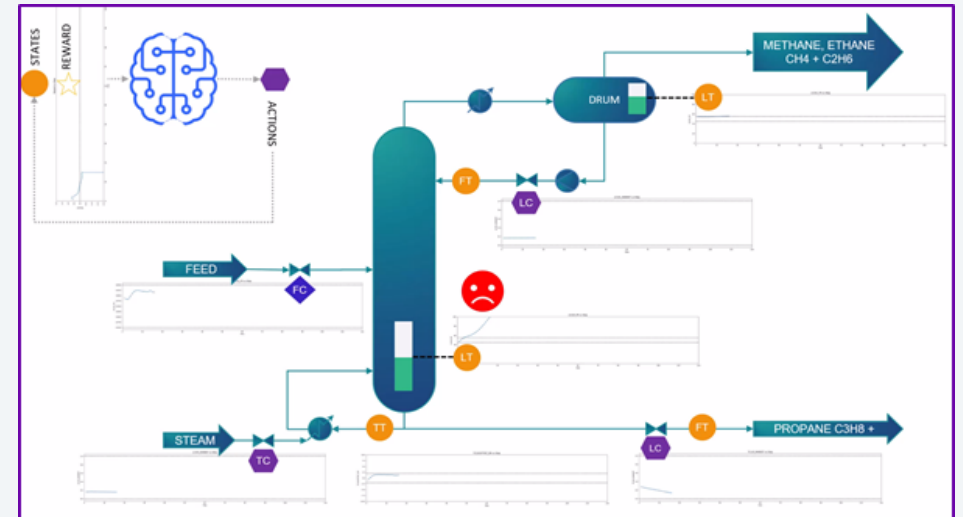
AI + Simulation

Optimize



- Combine AI models with physics-based to get the best of 'both worlds'
- Greatly improve speed
- Reduce deployment and tuning time
- Create a portable model that can be run on-prem, at the edge, or in the cloud

Autonomous Operations



- AVEVA Dynamic Simulation + Reinforcement Learning + GPUs
- Quickly optimize Setpoints for complex & transient processes
- Manage start-ups & shutdowns
- Quickly stabilize after changing feed levels
- Reduce GHG emissions

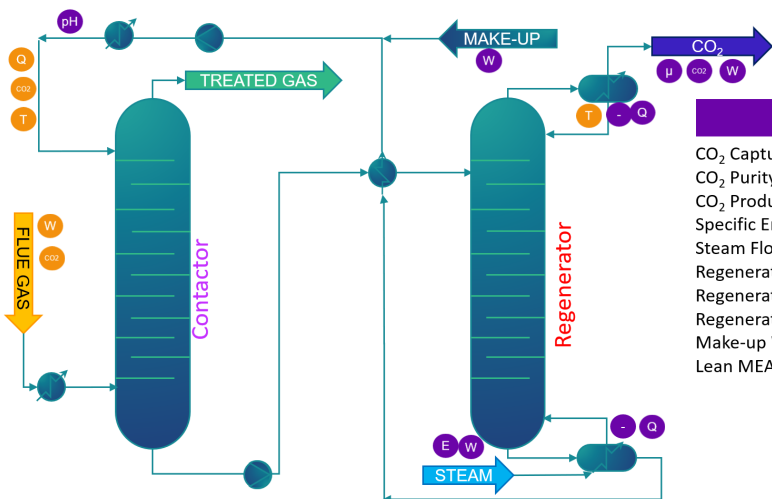
AI + Simulation



AVEVA Process Simulation

Features

- Flue Gas Mass Flow
- Flue Gas CO₂ Concentration
- Lean MEA Flow Rate
- Lean MEA CO₂ Load
- Lean MEA Temperature
- Regenerator Condenser Temperature



Targets

- CO₂ Capture Efficiency
- CO₂ Purity
- CO₂ Product Flow
- Specific Energy Consumption
- Steam Flow
- Regenerator Reflux and Boil-up Ratios
- Regenerator Reboiler Duty
- Make-up Water and MEA
- Lean MEA pH

AI-driven Carbon Capture

BlackBoxCCU1

- BlackBoxCCU1.Fluegas_W 397.004 t/h
- BlackBoxCCU1.Fluegas_M_CO2 0.22398 kmol
- BlackBoxCCU1.LeanMEA_Q 2430.54 m³/h
- BlackBoxCCU1.LeanMEA_CO2_Loading 0.211278
- BlackBoxCCU1.Regenerator_T_Cond 30 C
- BlackBoxCCU1.LeanMEA_T 40 C
- BlackBoxCCU1.CO2_Capture 89.5903 %
- BlackBoxCCU1.Specific_Energy 5.09775

Optimization Set Editor

Name: Minimize Specific_Energy

Objective Function: Minimize BlackBoxCCU1.Specific_Energy

| Status | Name | Value | Lower Bound | Upper Bound | Units |
|--------|----------------------------------|----------|-------------|-------------|-------------------|
| ● | BlackBoxCCU1.LeanMEA_Q | 2430.54 | 2000 | 2800 | m ³ /h |
| ● | BlackBoxCCU1.Regenerator_T_Cond | 30 | 25 | 40 | C |
| ● | BlackBoxCCU1.LeanMEA_T | 40 | 35 | 45 | C |
| ● | BlackBoxCCU1.LeanMEA_CO2_Loading | 0.211278 | 0.15 | 0.3 | |
| ● | BlackBoxCCU1.CO2_Capture | 89.5903 | 85 | 100 | % |
| ● | BlackBoxCCU1.Specific_Energy | 5.09775 | 1 | 10 | |

Optimizer Results:

Optimizer started at 02/14/2023 14:14:38
 Optimizer content for OWX_BlackBox_Test
 NonLinear Optimizer = Opera + Feasible Path.

Trace Level = 1
 Max Optimization Iterations = 30
 InitialMessingTag = 1.0000E-06
 ObjectiveTolerance = 1.0000E-02
 ConstraintTolerance = 1.0000E-06

Opera Problem Summary

| | | | |
|------------------------|------|------------------------------|------|
| Number of Variables | = 14 | Number of Objective Nonzeros | = 1 |
| Number of Equalities | = 10 | Number of Equality Nonzeros | = 28 |
| Number of Inequalities | = 4 | | |
| Number of Complements | = 0 | | |

Opera Iteration Summary

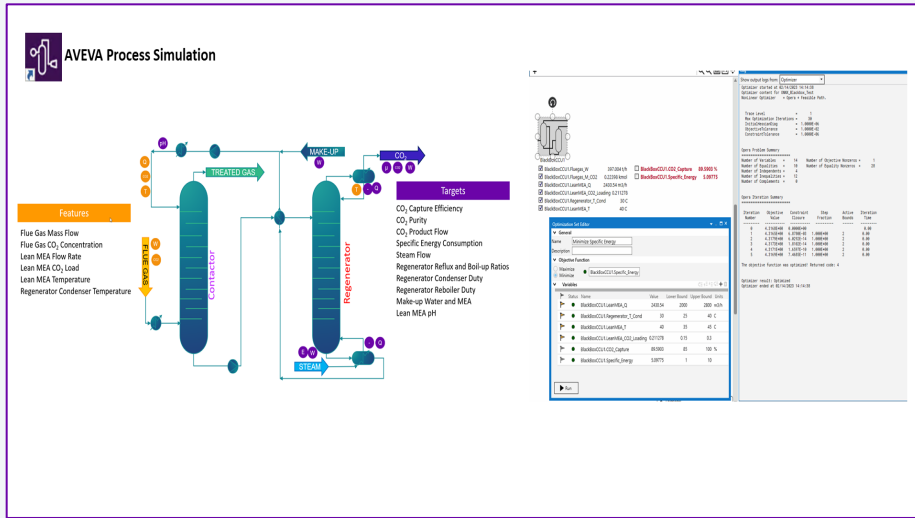
| Iteration | Objective Value | Constraint Closure | Step Fraction | Active Bounds | Iteration Time |
|-----------|-----------------|--------------------|---------------|---------------|----------------|
| 0 | 4.3165E+00 | 0.0000E+00 | | | 0.00 |
| 1 | 4.3165E+00 | 6.8780E-03 | 1.000E+00 | 2 | 0.00 |
| 2 | 4.3179E+00 | 6.0292E-14 | 1.000E+00 | 2 | 0.00 |
| 3 | 4.3173E+00 | 1.3102E-14 | 1.000E+00 | 2 | 0.00 |
| 4 | 4.3171E+00 | 1.6597E-10 | 1.000E+00 | 2 | 0.00 |
| 5 | 4.3169E+00 | 7.4685E-11 | 1.000E+00 | 2 | 0.00 |

The objective function was optimized! Returned code: 4

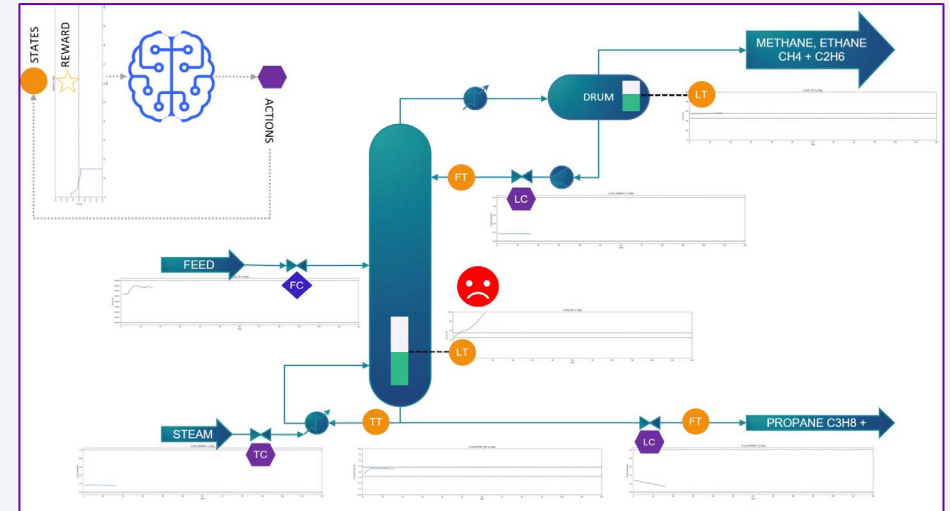
Optimizer result: Optimized
 Optimizer ended at 02/14/2023 14:14:38

AI + Simulation

Optimize



- Combine AI models with physics-based to get the best of 'both worlds'
- Greatly improve speed
- Reduce deployment and tuning time
- Create a portable model that can be run on-prem, at the edge, or in the cloud



Autonomous Operations

- AVEVA Dynamic Simulation + Reinforcement Learning + GPUs
- Quickly optimize Setpoints for complex & transient processes
- Manage start-ups & shutdowns
- Quickly stabilize after changing feed levels
- Reduce GHG emissions



Unify & Humanize

Industrial AI Assistant on CONNECT

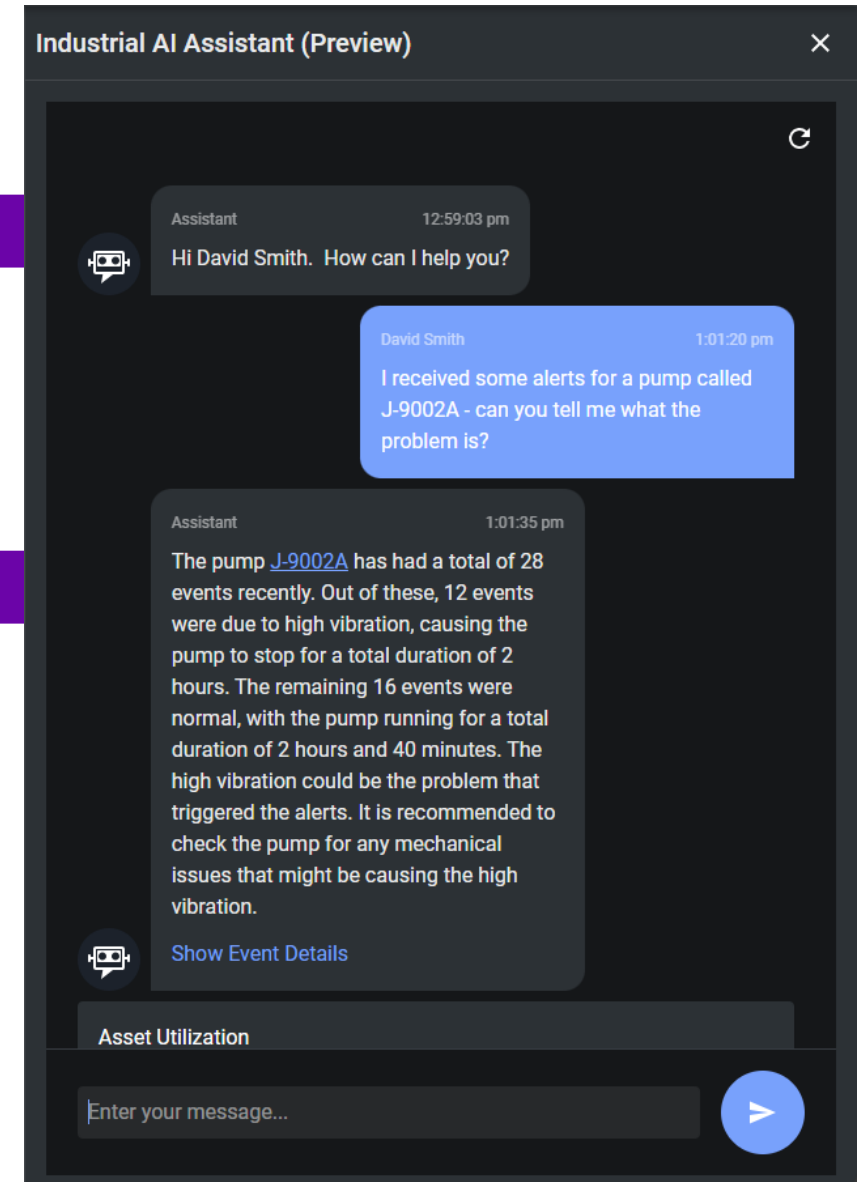
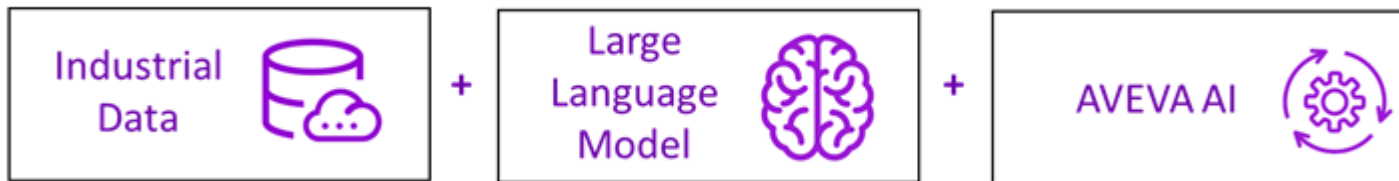
...partnered with  Microsoft | AVEVA AI infused | Patent-pending

Knowledge-Linking

- AI-driven data inferencing
- Automatic relationships across structured and unstructured data
- No data hierarchy or model needed
- Fast on-boarding

Objective-Driven

- Ask complicated questions (“why is my compressor operating worse now than it did last week?”)
- Breaks down the question into sub-queries behind the scenes, using focused guardrails
- Consolidates the response back to the user
- Transparent & traceable through Citations

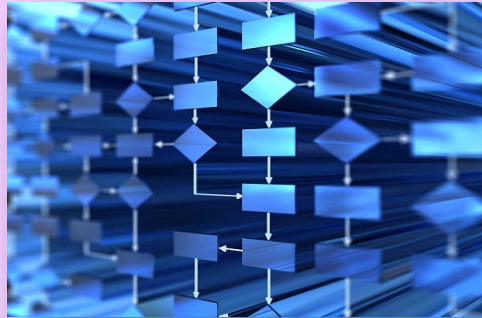
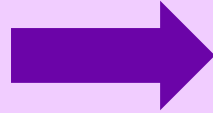


Where are We Headed?



Data & Information Level
“ask a question”

Today



Functional Software Level
“tell it what you want it to do”
(connected to other types of AI)

Tomorrow



Unified User Experience
“convergence”

Future

AI

Industrial AI Assistant

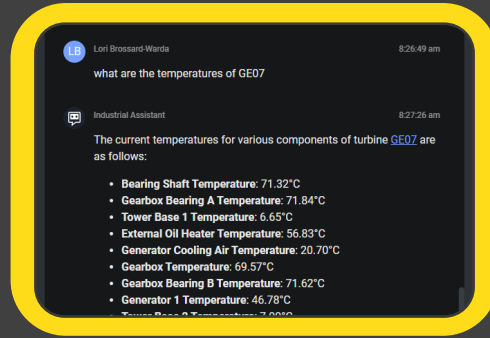
AVEVA

Industrial AI Assistant Key Features

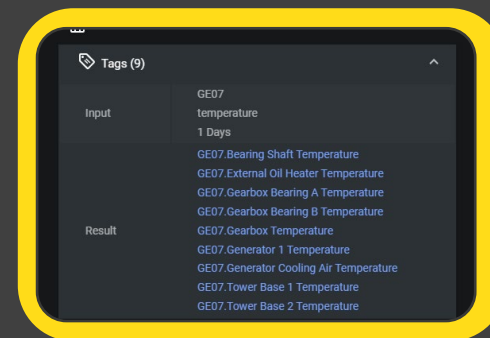
Secure access to your information using CONNECT



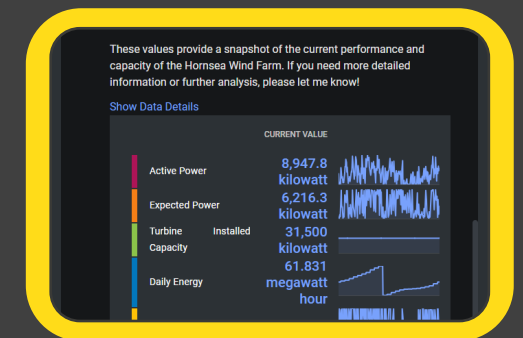
Natural Language Interface



Content Search and Summarization

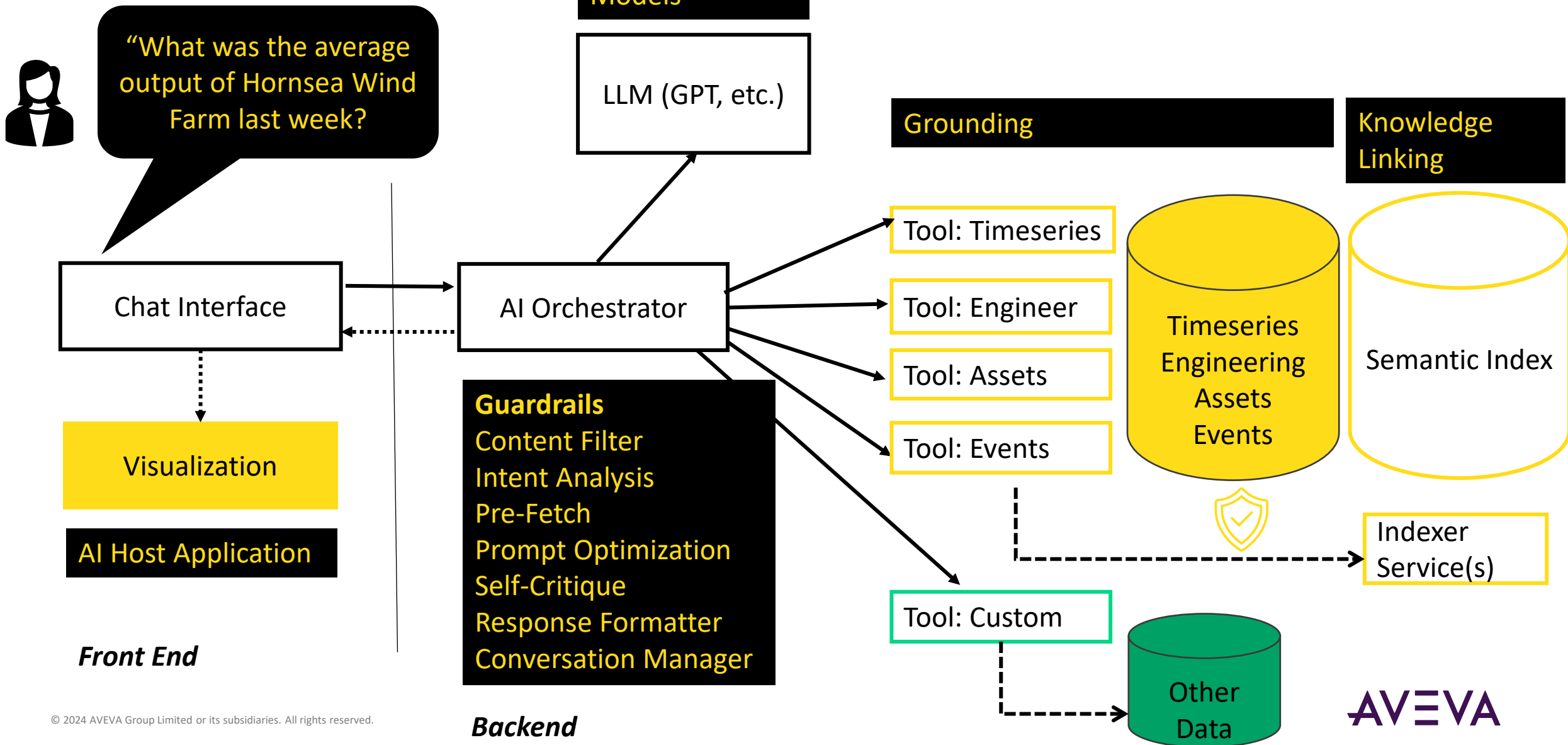


Citations to show our work (Transparency and Traceability)



Generate charts inline

Architecture



Ensuring good results by using Best Practices

- **Prompt Engineering:** We tell it what it is and how it should behave “You are a friendly, truthful, informative, industrial AI analystIf you don't get any data back from the tool just tell the user you don't have the data for their question.”
- **Critique:** the orchestrator critiques its own plan

Guardrails



- **Citations:** We show the data used to make the decisions which the system thinks is relevant
- **Real Data:** The LLM is the communication conduit, but the workflow has to use tools and real data. If it can't find the answer using those tools it can't just supplant its own answer.

Grounding



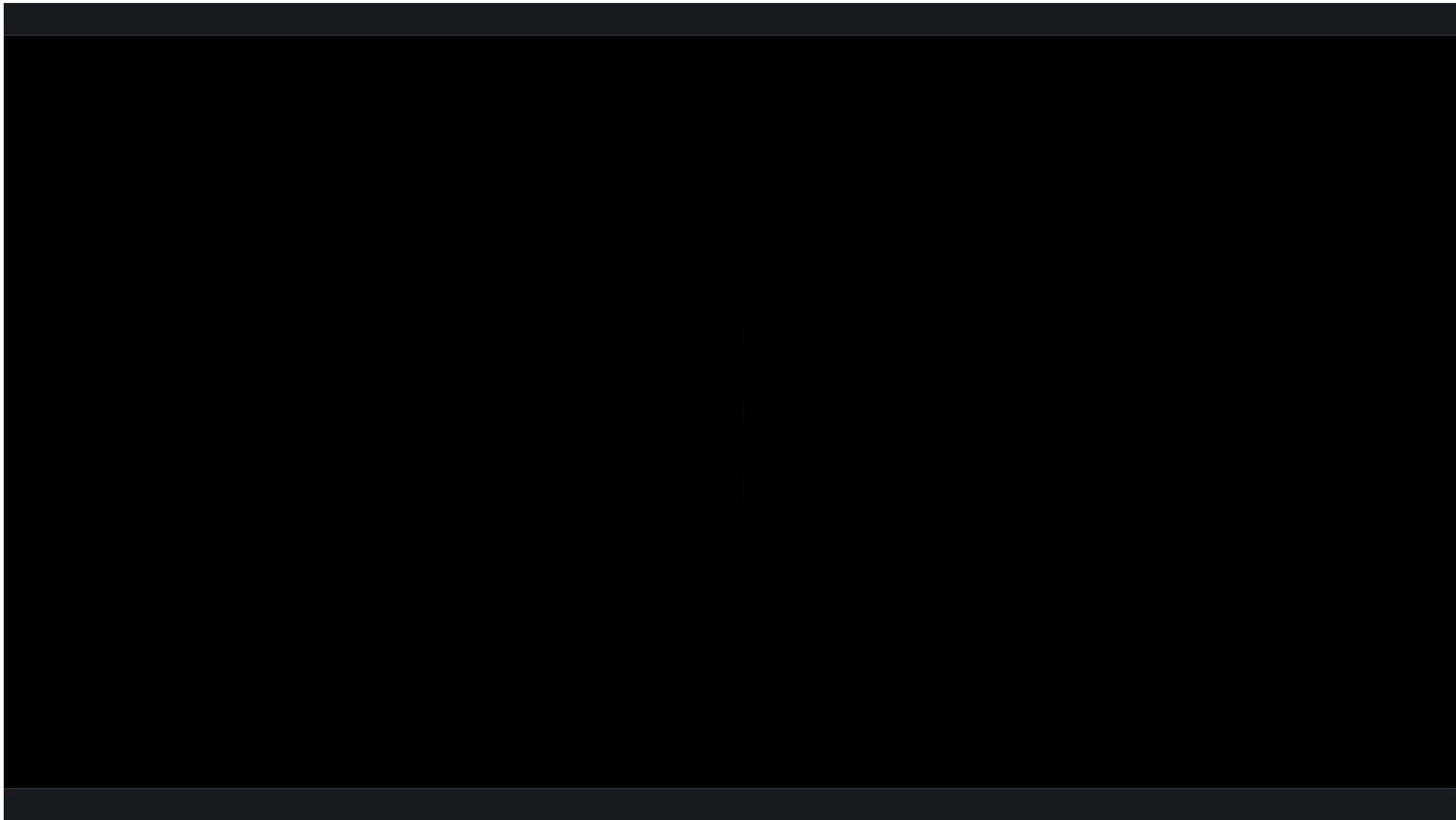
- **User Context:** All data access is using your existing security context
- **Throw away:** LLM is never trained with your data – its stateless. All requests sent to the LLM are ‘thrown away’

Security / Property





Demo





Industrial AI Assistant Release Plan

Released as part of CONNECT visualization

Sep 2024

- Finding and summarizing data by name / asset
- Simple Analysis of Time Series Data
- Finding Events related to an asset

Oct 2024

- Asking questions about a specific document
- Asking questions about CONNECT help
- Chat History Management
- Guided Examples
- Voice to Text

Dec 2024

- Continuous releases of new features / improvements / feedback
- Generative Capabilities

2025+

- Enhanced Document Capabilities
- Additional CONNECT data sources
- Integration with applications / API Support
- Search integration

Thank you!

To learn more about AVEVA AI, check out these sessions:

Wednesday

9:45 AM - 10:15 AM

Session Name

AVEVA & NVIDIA: AI-Driven Autonomous Operations

2:00 PM - 2:30 PM

Microsoft: Unlocking ESG Value with AI - A

2:45 PM - 3:15 PM

AVEVA's Predictive Analytics helps maintain reliable, low carbon power generation by Drax

This presentation may include predictions, estimates, intentions, beliefs and other statements that are or may be construed as being forward-looking. While these forward-looking statements represent our current judgment on what the future holds, they are subject to risks and uncertainties that could result in actual outcomes differing materially from those projected in these statements. No statement contained herein constitutes a commitment by AVEVA to perform any particular action or to deliver any particular product or product features. Readers are cautioned not to place undue reliance on these forward-looking statements, which reflect our opinions only as of the date of this presentation.

The Company shall not be obliged to disclose any revision to these forward-looking statements to reflect events or circumstances occurring after the date on which they are made or to reflect the occurrence of future events.

 [linkedin.com/company/aveva](https://www.linkedin.com/company/aveva)

 [@avevagroup](https://twitter.com/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