AI & Simulation

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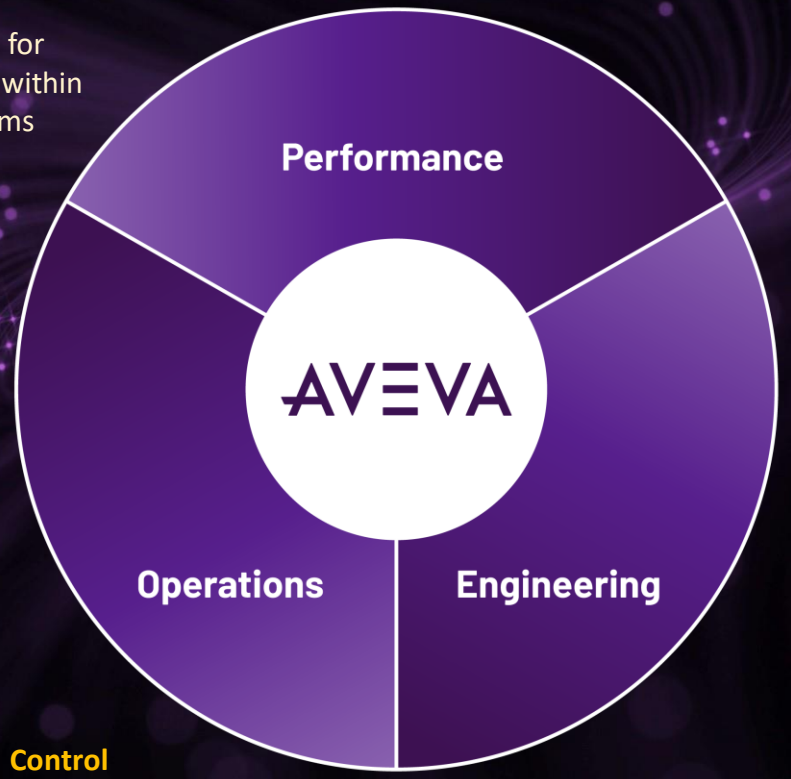
Industrial AI Overview

Engineering / Operations / Performance

- **Predictive**
- **Performance**
- **Prescriptive**
- **Prognostic**
- **Perceptive**

Maintain
Increased longevity and performance of assets while ensuring a safe, reliable environment for the workforce through predictive, prescriptive, prognostic analytics

Operate | Optimize
Improved Optimization & OEE for safe and profitable operations within constraints and regulatory norms



Plan | Schedule
Self-learning approach to model planning, scheduling in order to maximize profitability and efficiency

Engineer
Analysis and automated design generation enabling lower total cost, time, risk in capital project engineering

Monitor | Control
Predictive and autonomous operational control to ensure safety, performance

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Simulation Overview

Process Modeling & Simulation

- Validate and improve design
- Monitor & analyze running processes for correct operation
- Provide input for real-time process control
- Optimize existing processes
- Simulate processes for operator training
- Predict failure
- Optimize operations & maintenance



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The Value of Combined AI & Simulation

	Simulation (physics driven)	AI (data driven)
Data:	Small Data	Big Data (for training)
Domain expertise:	High reliance upon deep domain expertise	Can provide useful results with little domain knowledge
Fidelity & robustness:	Universal algorithms can handle highly non-linear and complex relations	Limited to the range of values spanned by the training set
Adaptability & deployability:	Requires complex and time-consuming derivation to account for new relations	Rapid adaptation to new situations and data relationships
Interpretability:	Consistent, physically meaningful link between parameters	Statistical, not physical, correlation

- **Complement** – overall solution can be a combination of both models
- **Supplement** – one model can improve upon the accuracy of the other
- **Embed** – one model can be embedded in the other
- **Integrate** – output of one model can be the input to another

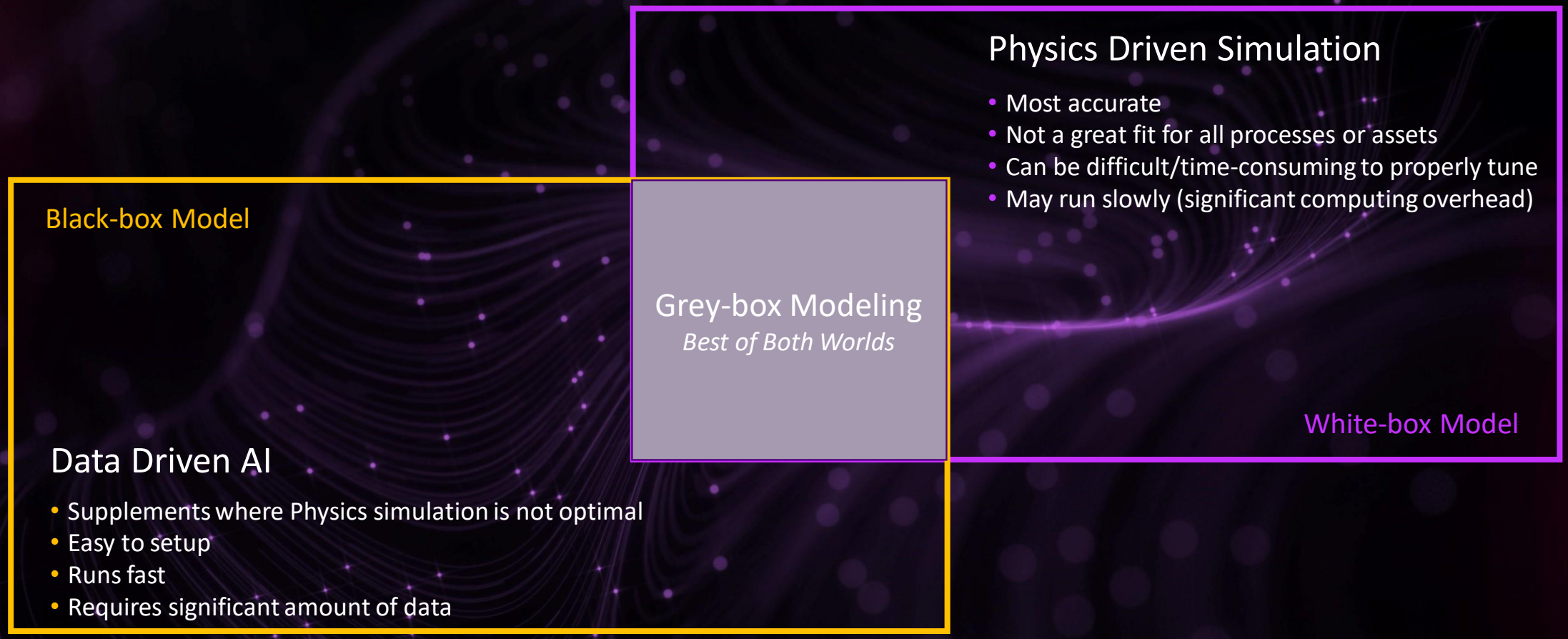
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The Value of Combined AI & Simulation

- Grey-box Modeling [AI improving Simulation]
- Next-generation Predictive Analytics [Simulation improving AI]

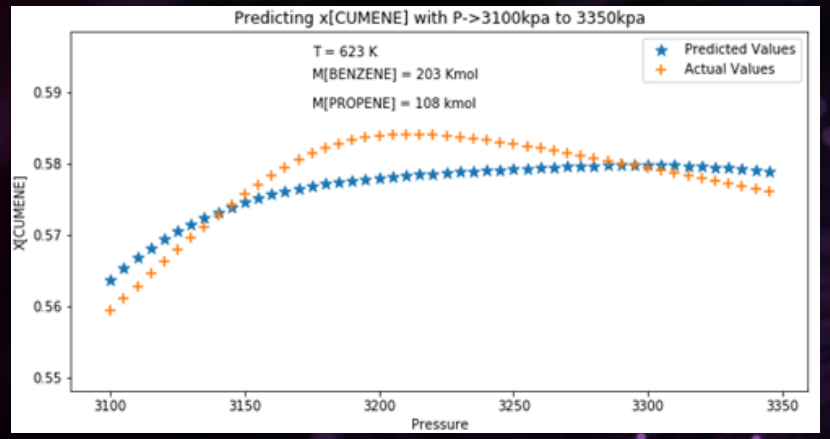
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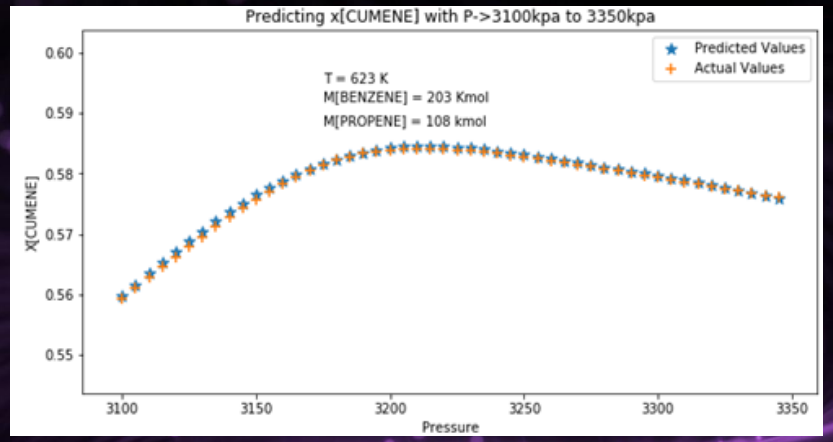
Grey-box Modeling

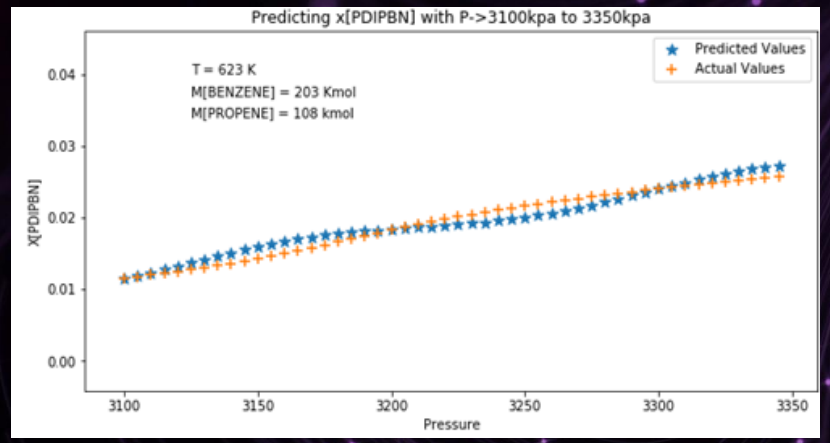


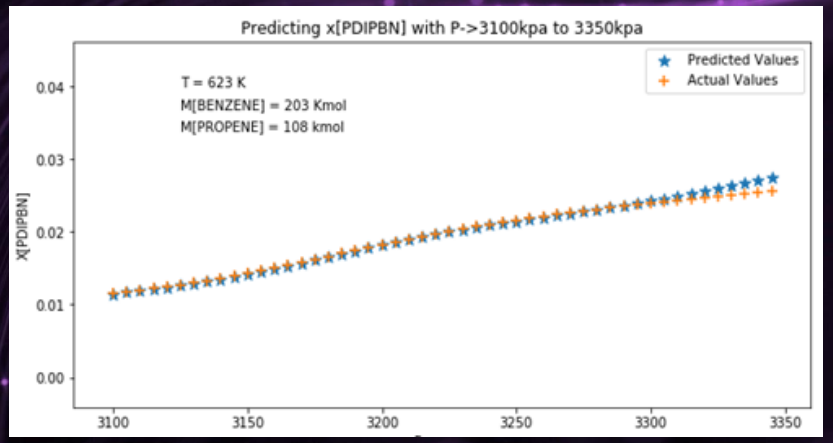
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Cumene Reactor AI Model







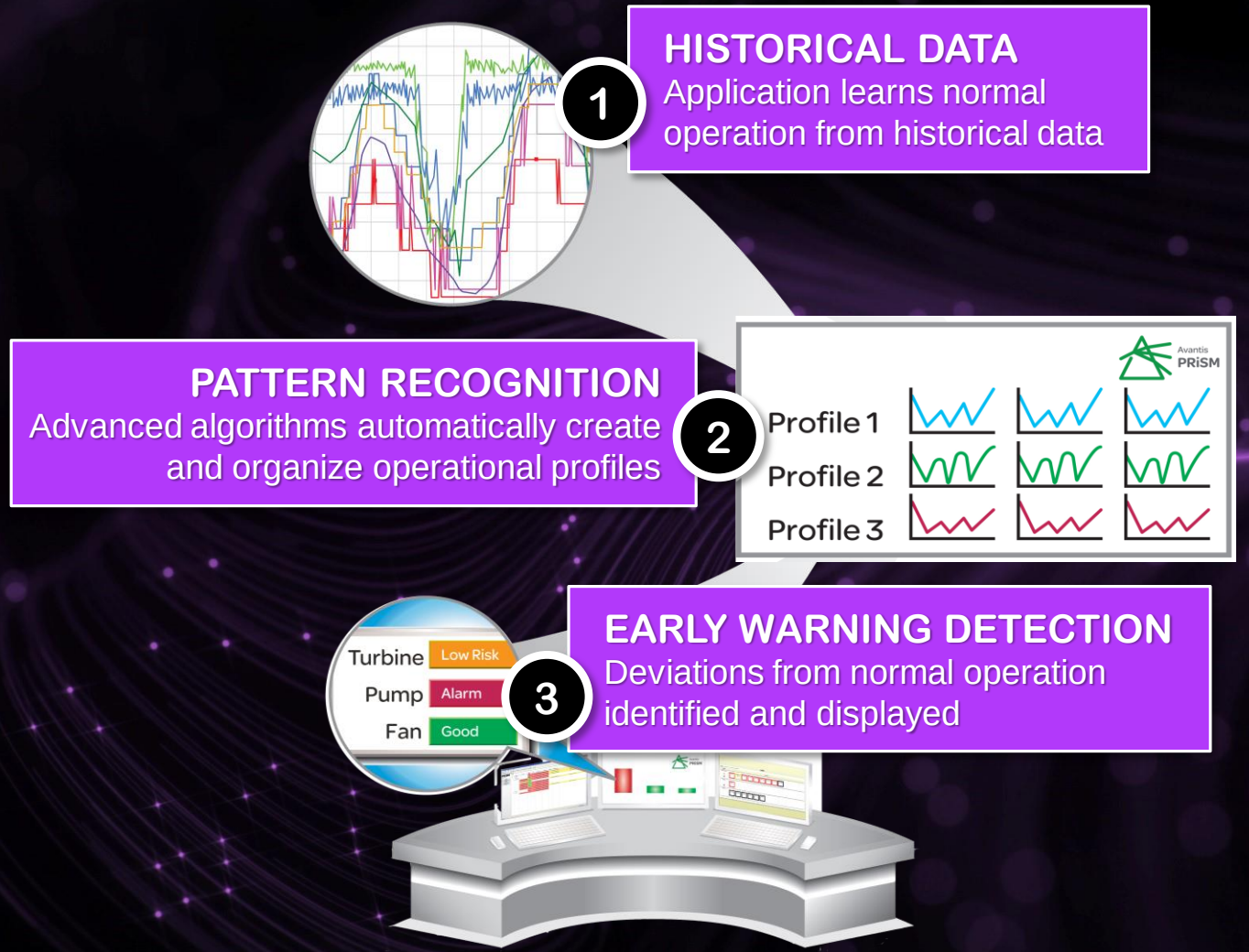


Models improve with additional training data

Data

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Predictive Analytics: How Does It Work?



- On-premises
- Cloud / SaaS
- Hybrid architectures

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AI-Driven Next-Gen Predictive Analytics

Integrated Simulation and Machine Learning

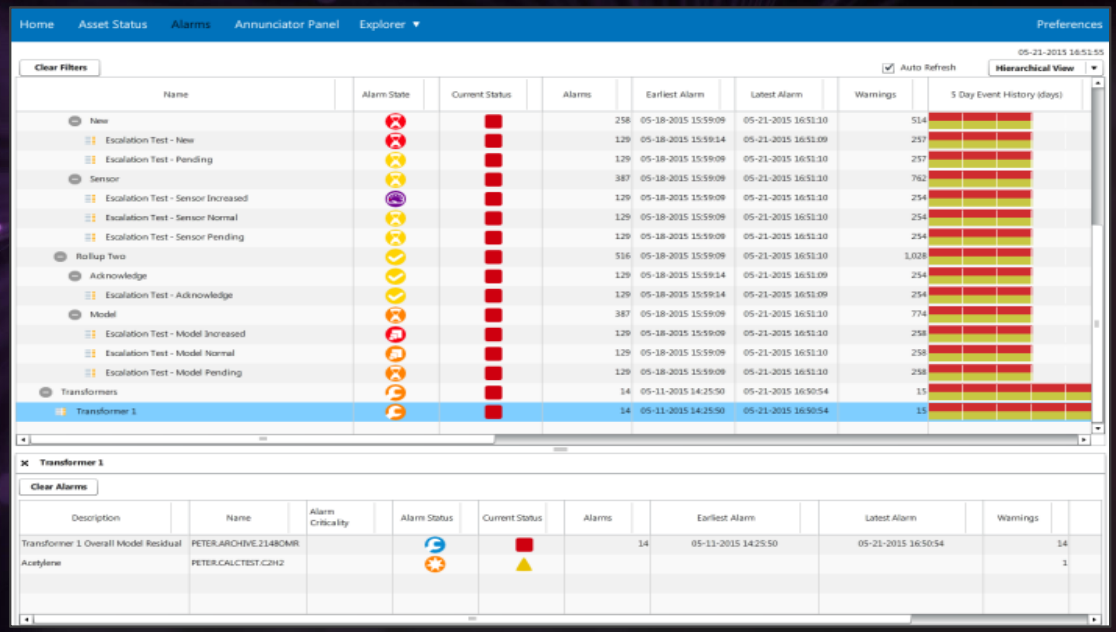
Asset Performance

Operate and Optimize

High Dynamic Range Models (earlier detection of issues through physical and "soft" sensors)

Risk-based AI Analysis

Single Enterprise Notification System



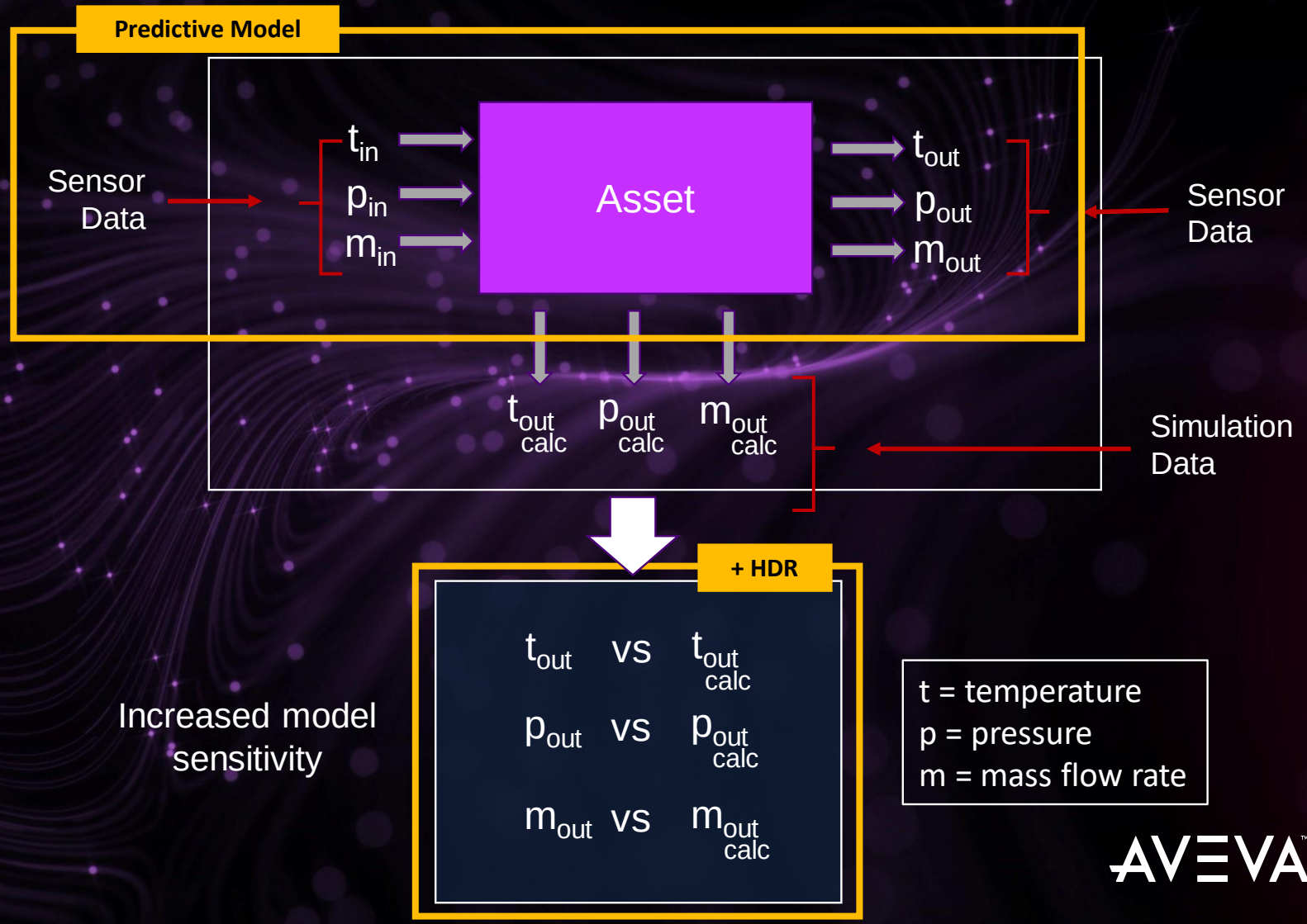
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High Dynamic Range (HDR) Models

Solution Overview

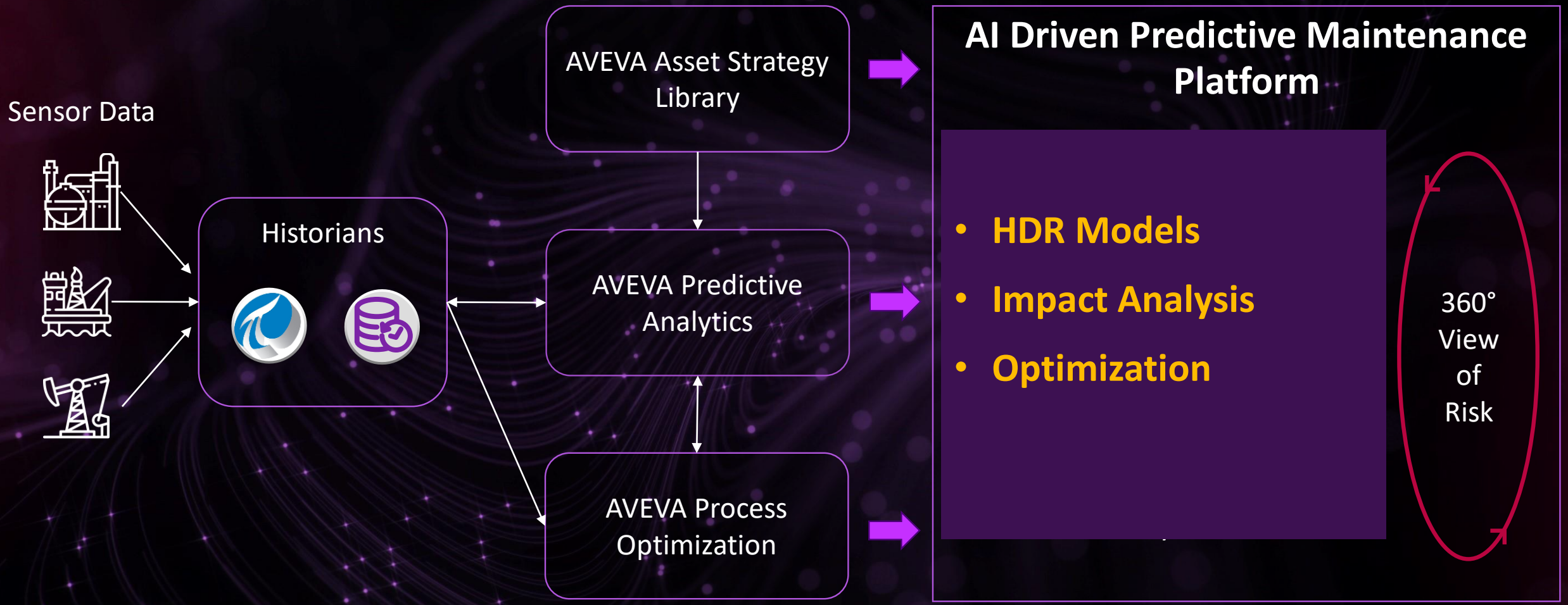
BENEFITS

- Earlier Warning of Equipment and Process Issues than Predictive alone
- Modeling for greenfield sites
- Modeling for remanufactured equipment
- Modeling for assets with limited historical data



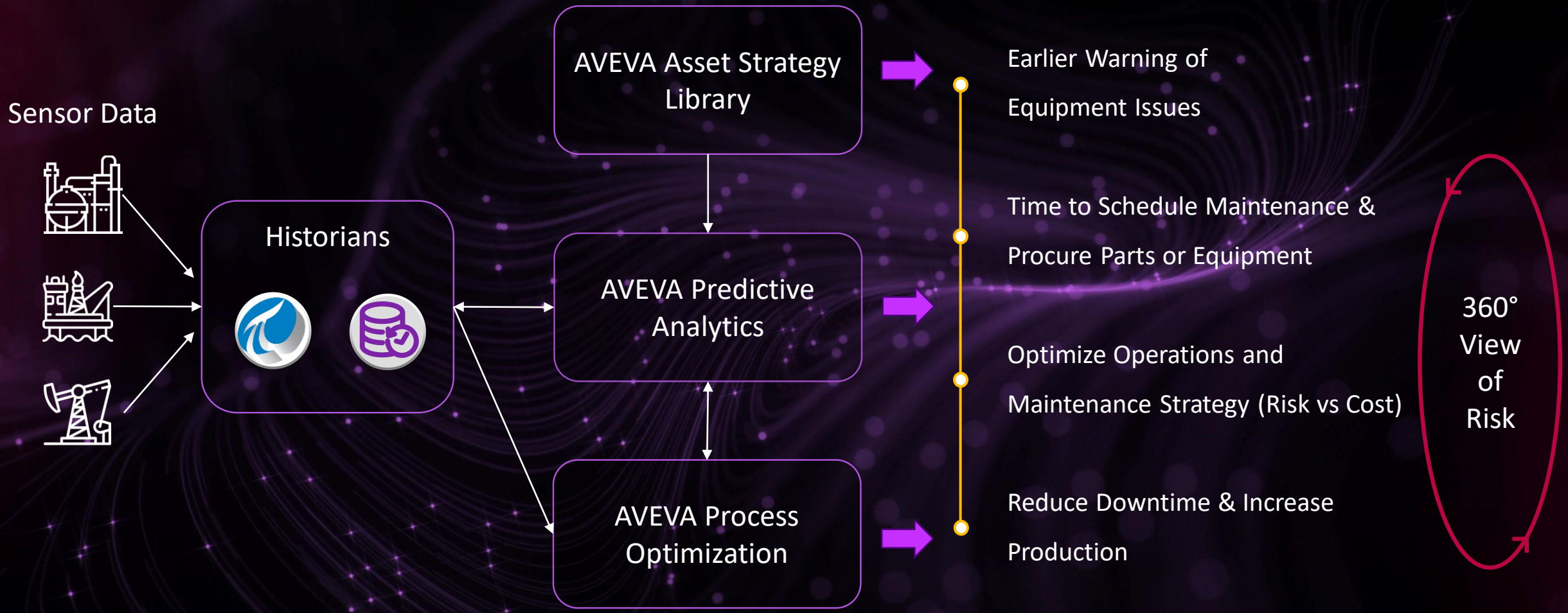
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Taking Predictive Analytics to the Next Level with Simulation



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Questions?

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