Industrial AI From Aspen Technology Inc.

Accelerating Decarbonization & Operational Excellence With Safe and Responsible AI

Ron Beck, Senior Director, Solutions Marketing

TNChE Asia 2024

TnCHE 2024, Pattaya, June 21, 2024

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Impact of AI on Industry

> “ 79% of leaders in industry say they expect generative AI to drive substantial transformation in their organization and industry over the next three years * “

- Deloitte, January 2024

* 2800 leaders surveyed

Defining Artificial Intelligence for Industrial Spaces

Artificial Intelligence (AI) is defined as technology that allows software to perform tasks that normally require human intelligence, including learning, problem solving and decision making.

Industrial AI is the combination of AI with domain expertise in engineering fundamentals, asset and industry knowledge to provide guardrails, robustness and trusted results.

AspenTech focuses on Industrial AI to drive improved agility, guidance and automation capabilities across its products and solutions.

Data Insights

Advanced Analytics, AI – ML,
Deep Learning, Generative AI

Domain Expertise

Engineering Fundamentals, Asset
Knowledge, Industry Experience

Industrial AI

Agility | Guidance | Automation

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AspenTech Industrial AI Strategy

Customer Value Focus

Adapt to Business Conditions & Opportunities
Agility

Enable Users to Perform at a Higher Level
Guidance

Advance User Productivity
Automation

Industrial AI

Leveraging Engineering Fundamentals, Asset Knowledge and Industry Experience
Guardrails

Performant as Required for Applications and Enables Extrapolation to New Operational States
Robustness

Explainable so Users Understand What Actions are required; Expert Guided Creation of Models
Trust

Purpose-Built AI

- Leverage Industrial Data Scientists
- Use simplest suitable method for each problem
- Broad Coverage of Machine Learning Types, Technologies & Tools

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Industrial AI Key Areas of Focus

Example

Agility:
AI helps Organizations quickly adapt to business conditions and opportunities to achieve higher levels of value

(Hybrid Models)

Guidance:
AI uplevels the workforce to guide them through everyday and complex decisions faster

(Prescriptive Maintenance)

Automation:
AI frees up engineers for more critical activities by optimizing everyday and complex tasks to drive higher level efficiencies

(Geophysical interpretation)

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Value Created by Industrial AI

Agility

Guidance

Automation

Benefits

AI helps Organizations quickly adapt to business conditions and opportunities to achieve higher levels of value

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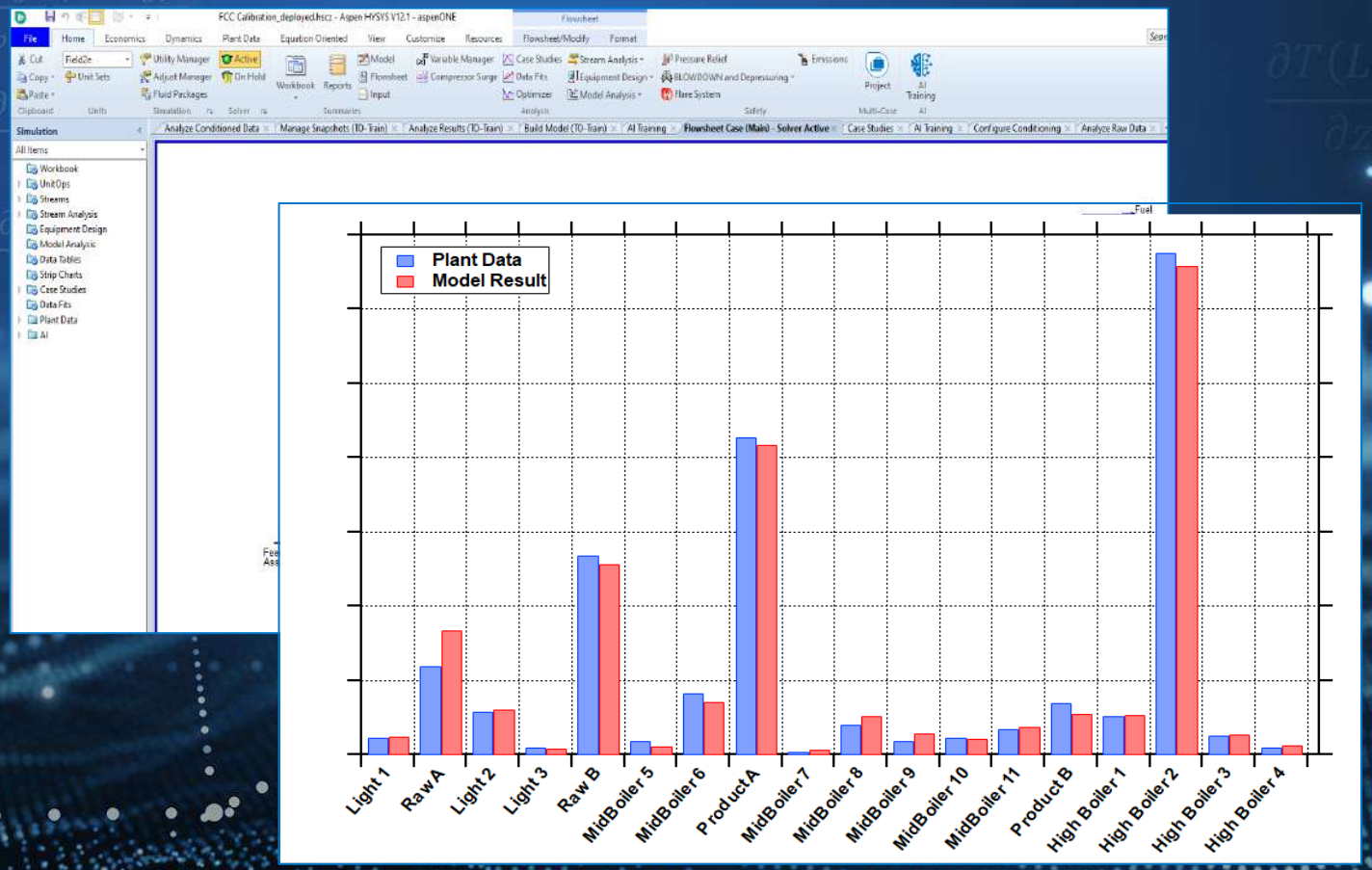
Hybrid Models



Before

- 1st Principles Model
- Simulation-Reality Gap
- Caped Optimization

Benefits

- Adapt to Changing Conditions
- Improve Economics
- Enable Next Gen Users
- Solve Complex Problems

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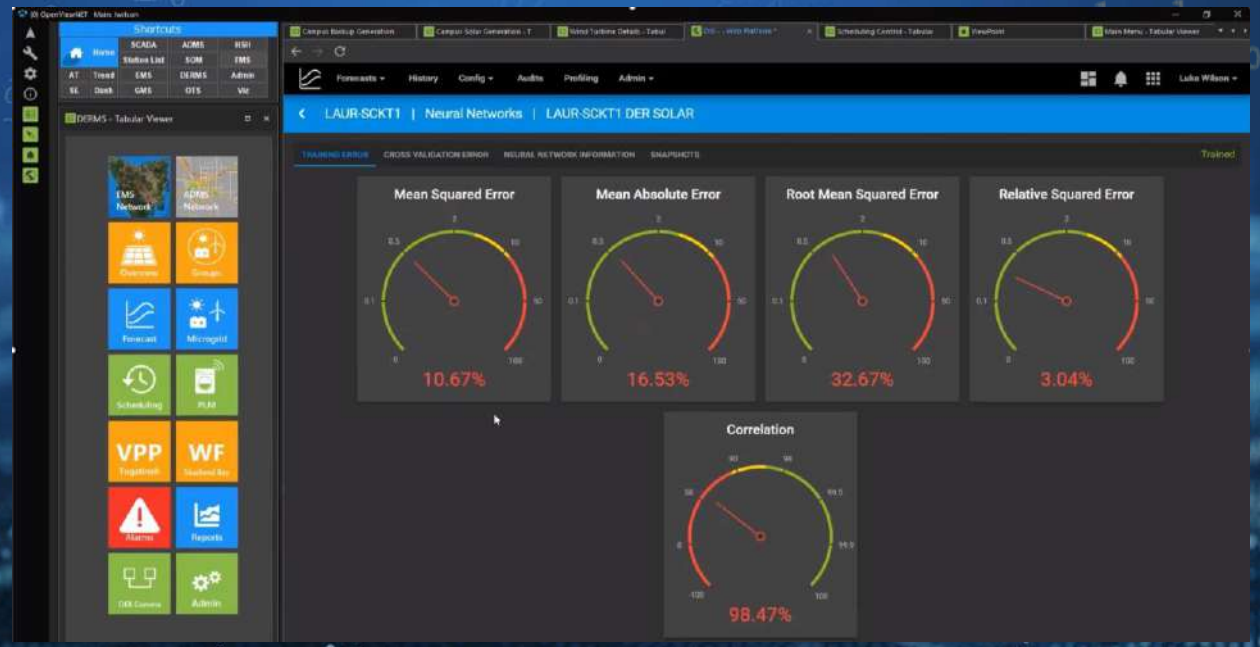
Renewable Power Forecasting



Aspen OSI Monarch™

Before

- Limit Renewable Sources
- Reactive, Inefficient Process

Benefits

- Higher Renewable Utilization
- Improved Efficiency
- Enhanced Grid Stability

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Industry: *Bulk and Performance Chemicals*

Model Accuracy and Sustainment with Aspen Hybrid Models & Aspen Plus

> "Aspen Hybrid Models are a breath of fresh air. AI alone cannot solve this kind of operating challenge. By placing the AI model within the complete Aspen Plus simulation, we achieved a fantastic, practical result. " - Dr. Reza Haghpanah, Process Engineering Fellow, Dow Chemical

10% Yield improvement

CHALLENGE

- Reactor processing high value chemical hard to control
- First principles models alone can't solve operating challenge
- Model of Balance of plant available in Aspen Plus
- Operating data available across a range of conditions

SOLUTION

- Cleaned Historical data from several years of operation and different conditions
- Built hybrid model of challenging reactor with Aspen AI Model Builder
- Optimized Process, with full balance of plant model
- Achieved 10 % incremental product yield of high value product

Product(s):

Aspen Plus, AIMB, Hybrid Models

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Industry: *Bulk and Performance Chemicals*

Rapidly Optimize Ammonia Plant With Steam Methane Reforming, Using Industrial AI Hybrid Models

Nissan Chemical CORPORATION

> "Using the **Industrial AI Hybrid Model**, with a native AI builder, we created a model that reproduces the real plant more accurately than the conventional reformer model. By creating a highly accurate model in a short period of time, we solved a difficult operating challenge."
>
> – Mr. Takuto Nakai, Production Dept, Nissan Chemicals

2% reduction in steam use; <1% costs

CHALLENGE

- Economically crucial reactor is hard to model
- Accurate Steam Reformer(SMR) Model will improve ammonia economics
- Conventional rigorous modeling for SMR requires difficult-to-measure process fluid temperatures
- Objective is accurate prediction of furnace temperature

SOLUTION

- Native-builder Industrial AI Hybrid Models combines:
  - Aspen Plus first-principles model
  - Synthetic correlations for unknown phenomena
- Reaction rates calculated using a neural network AI learning method
- Model with excellent correlation coefficient created 50% faster
- Accurate operator guidance

Product(s):

Aspen Plus (Aspen Industrial AI Hybrid Models)

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Value Created by Industrial AI

Agility

Guidance

Automation

Benefits

AI uplevels the workforce to guide them through everyday and complex decisions faster

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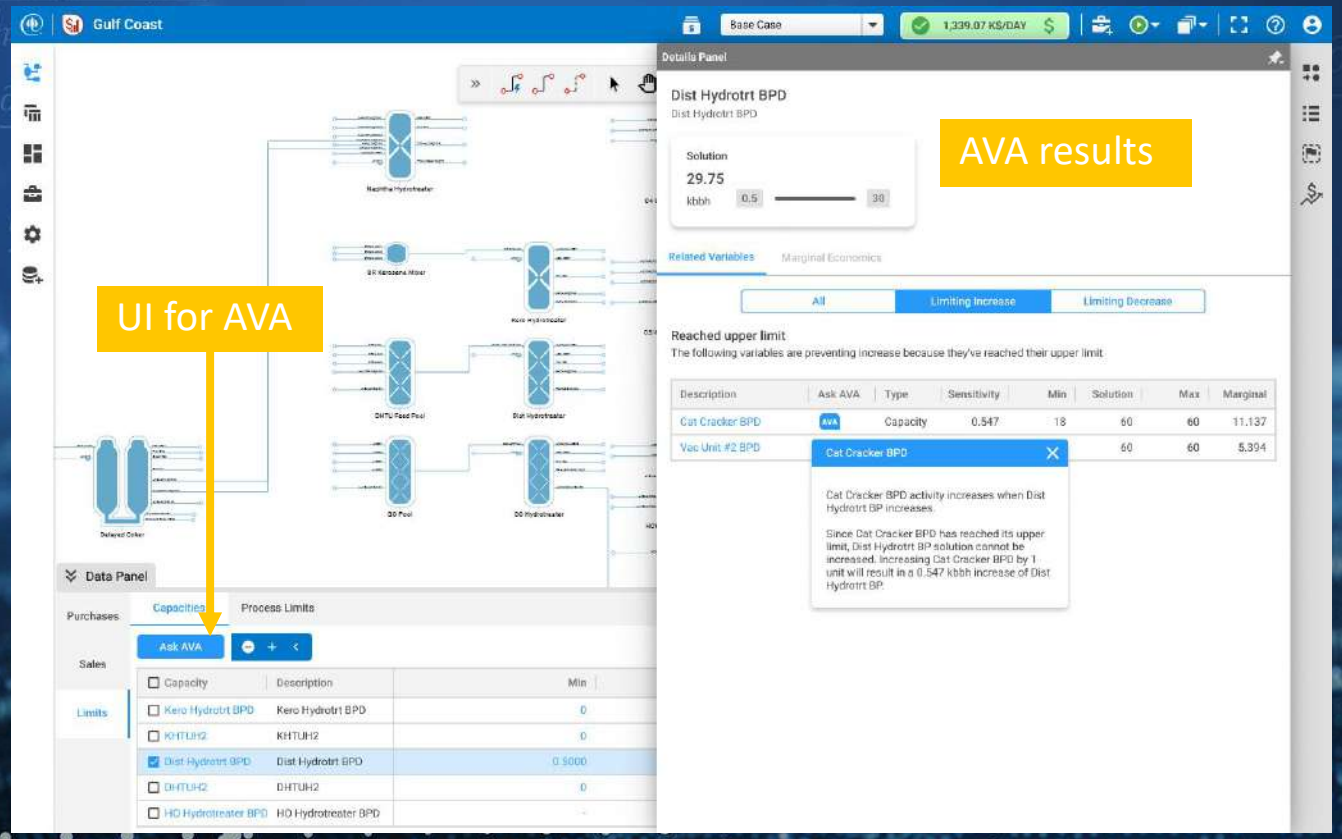
Aspen Virtual Advisor



Aspen AVA for DMC3/Unified PIMS

Before

- Potential Optimization Gap
- Higher Learning Curve

Benefits

- Planner Productivity
- Better Plan Outcomes:
  - Higher Margins
  - Reduced Emissions
  - Improved Yields
- Reduced Complexity

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Industry: *Renewable Power Generation*

Early, accurate detection of degradation improves productivity of wind farm

SARDEOLICA Renewable Energy

INDUSTRIAL AI

> "By providing six months warning of equipment degradation–via Aspen Mtell prescriptive maintenance–power production is increased by scheduling maintenance during lower wind periods, and equipment replacement and repair costs are reduced through advanced planning."
> - Giuseppe Citterio, Chief Energy and Sustainability Officer, Saras SpA

Reduction of maintenance costs of up to 10% per year

CHALLENGE

- Gearbox and generator failures frequently happen in high wind period resulting in a long downtime and high loss of production
- Extend lifetime and reduce maintenance costs of wind farm
- Lead time-to-failure prediction must be sufficient to plan up-tower maintenance work

SOLUTION

- Aspen Mtell® determines early signs of mechanical failure to avoid catastrophic damage
- Provides up to 6 months of advance warning of issues providing guidance needed to schedule maintenance during low-wind periods
- In one year, Mtell was deployed across 48 assets through Maestro & transfer learning capabilities

Product(s):

Aspen Mtell

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Value Created by Industrial AI

Agility

Guidance

Automation

Benefits

AI frees up engineers for more critical activities by optimizing everyday and complex tasks to drive higher level efficiencies

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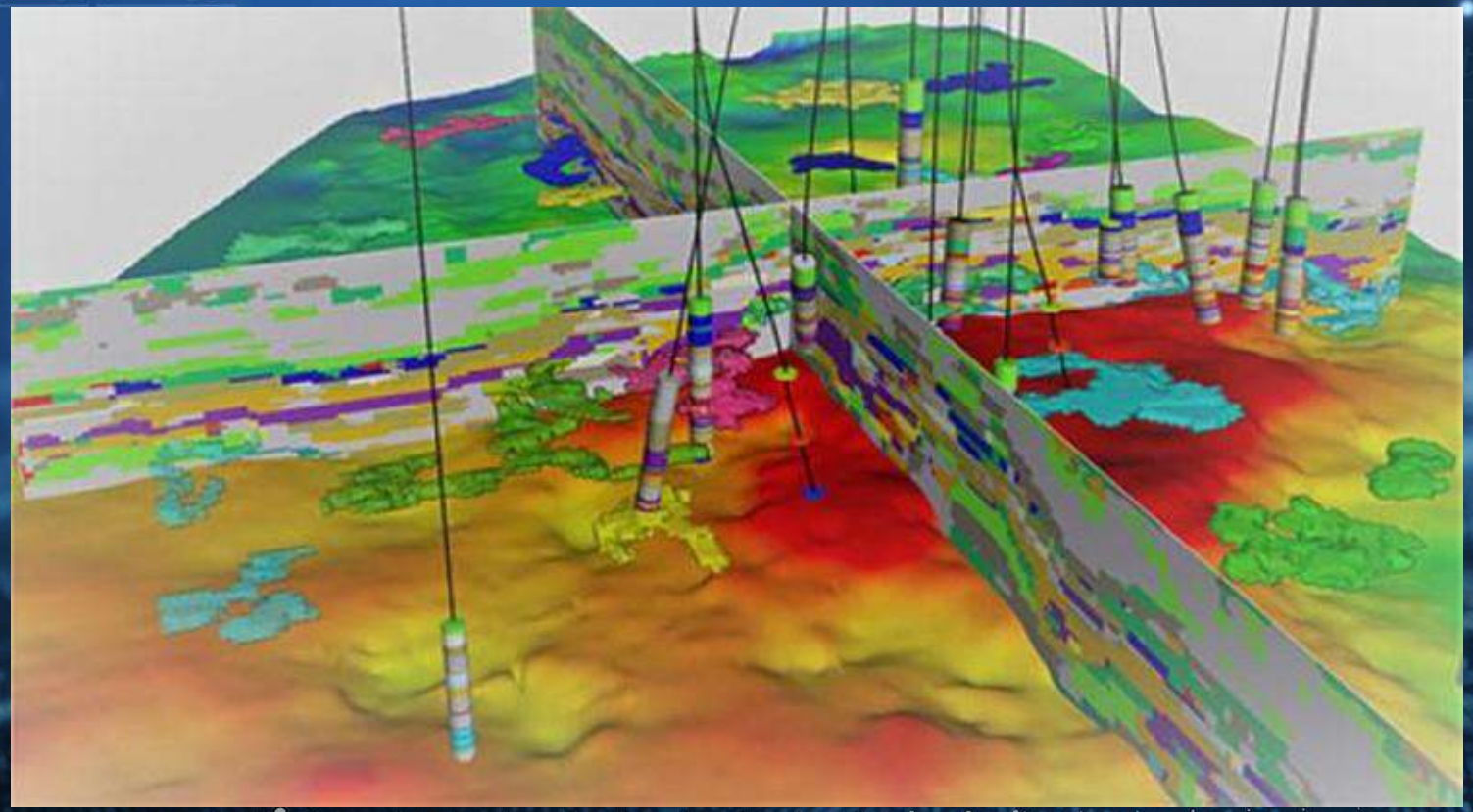
Subsurface Workflows



Aspen SeisEarth and Geolog

Before

- Manual Qualitative Analysis
- Increased Drilling Complexity
- Increased Risk of Emission

Benefits

- Improve Productivity
- Predict Rock Properties
- Accelerate CO2 Permitting
- Subsurface H2 Storage

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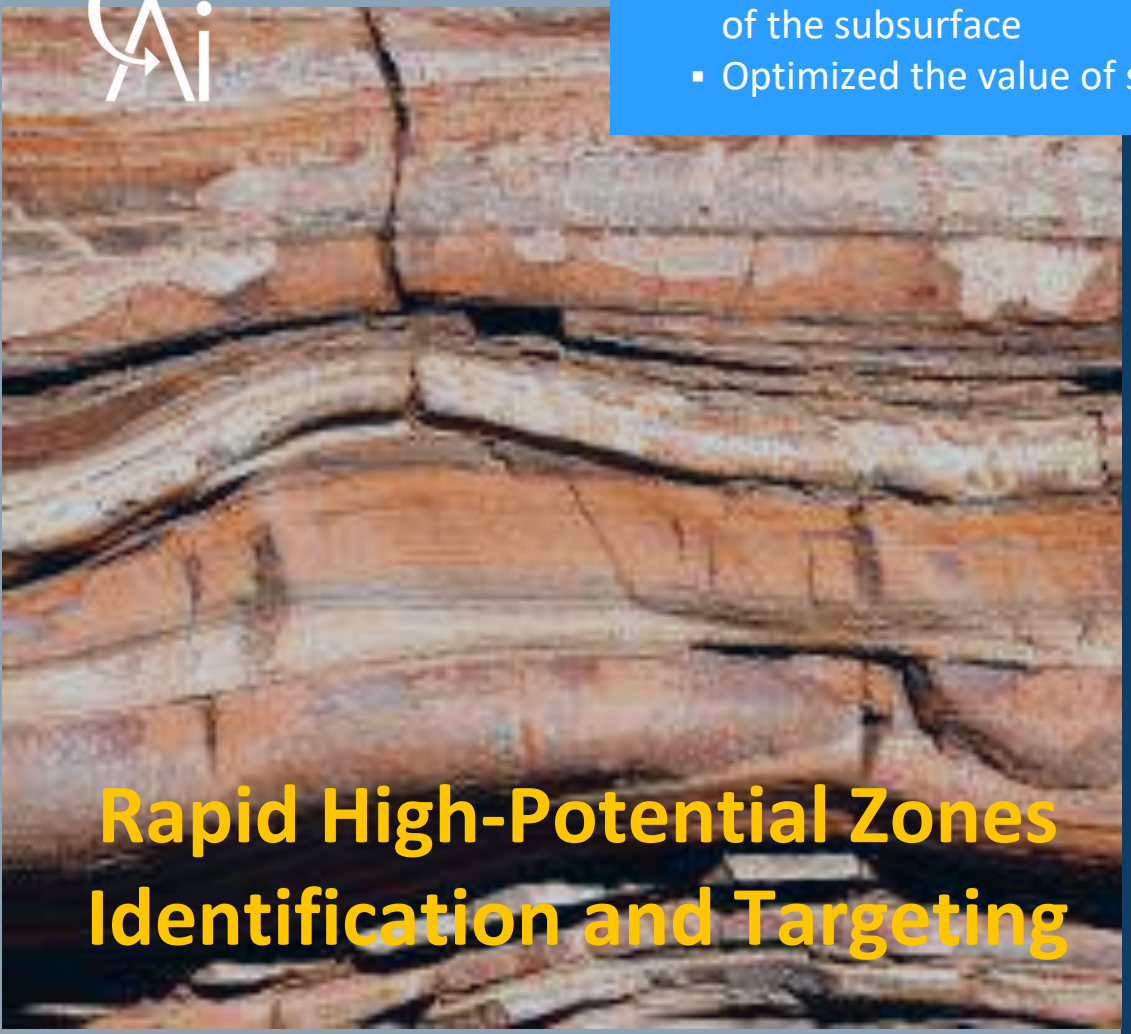
Industry: Upstream

Facies and Rock Type Prediction in Heterogeneous Zones

- Enhanced the decision-making process for determining drilling locations by delivering accurate images of the subsurface
- Optimized the value of seismic data for predicting reservoir facies away from wells



Rapid High-Potential Zones Identification and Targeting

CHALLENGE

- Highly heterogeneous play
- Understand the geological settings to optimize well placement
- Extract maximum information from seismic data
- Prediction of rock types distribution throughout the reservoir

SOLUTION

- Ensemble of neural networks for identifying connections between rock type at wells and seismic
- Volumes of lithology and probability were obtained
- Integration of geological & geophysical interpretation info
- Detailed prediction of target areas in 3D

Product(s):

Aspen SeisEarth, Aspen Geolog

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The Self-Optimizing Asset

The Path to Greater Operational Excellence

Safer Operation

More Sustainable

Higher Margins

Improved Reliability

SELF-LEARNING **SELF-ADAPTING** **SELF-SUSTAINING**

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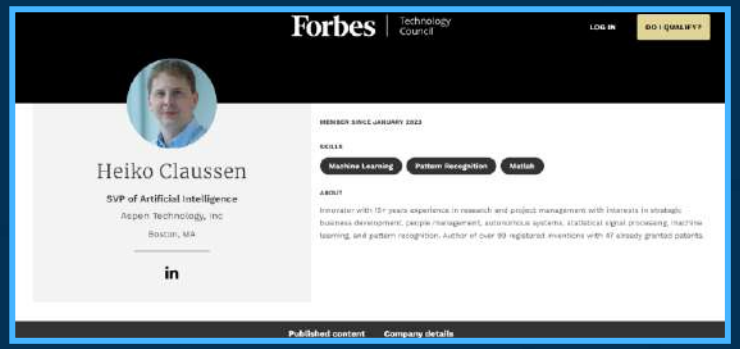
AspenTech Leadership in Industrial AI

Thought Leadership



Forbes Technology Council

Emerson Exchange Europe

Economist Sustainability Week

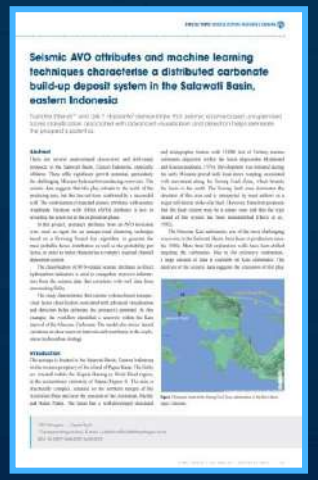
Technical Innovation

Sparse dimension reduction based on energy and ball statistics

Data Science Methods; Sven Serneels

Statistics

Elegant robustification of sparse partial least squares by robustness-inducing transformations



Seismic AVO attributes and machine learning techniques characterise a distributed carbonate build-up deposit system in the Salawati Basin, eastern Indonesia

Reservoir Characterization; RH Petrogas & AspenTech

Hybrid Models Point of View Paper

Hybrid Models HP Magazine Award

Mtell Multiple Industry Awards

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Our Mission

Accelerate the digital transformation of the industries we serve by optimizing their assets to run safer, greener, longer and faster

Thank You!