PINNACLE

Quantitative Reliability Optimization (QRO)

The Next Evolution in Reliability Modeling

DATA-DRIVEN RELIABILITY

Quantitative Reliability Optimization empowers better reliability decisions for industrial facilities.

READ THE QRO BRIEF →

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What is Quantitative Reliability Optimization (QRO)?

Watch Ryan Myers, Product Manager, introduce QRO

Quantitative Reliability Optimization (QRO) is a dynamic reliability analysis model that synthesizes and expands upon the best elements of other existing reliability models while introducing new data science and analytical concepts to drive improved and strategically balanced availability, process safety, and spending performance.

LEARN MORE ABOUT QRO →

What Quantitative Reliability Optimization Empowers You to Do

Economically Justify All Reliability Plans
Understand the economic value of every maintenance, inspection, or reliability focused redesign at your facility

Model Complex Reliability Scenarios
Optimize your reliability plans based on new design, different feedstock, pushed turnarounds, or market shifts

Drive Facility Sustainability
Understand the spend and planning required to sustain a reliable, safe, and environmentally friendly facility

More Clearly Drive Digital Transformation
Understand the data that is truly valuable to reliability and process safety and tap into and model off of that data

Provide a Common Reliability Language
Empower your team to collaborate with safety, operations, finance, and management to create value-driven reliability plans

Better Leverage Expertise
Use data to drive reliability decisions while focusing expertise on model refinement or reducing data uncertainty

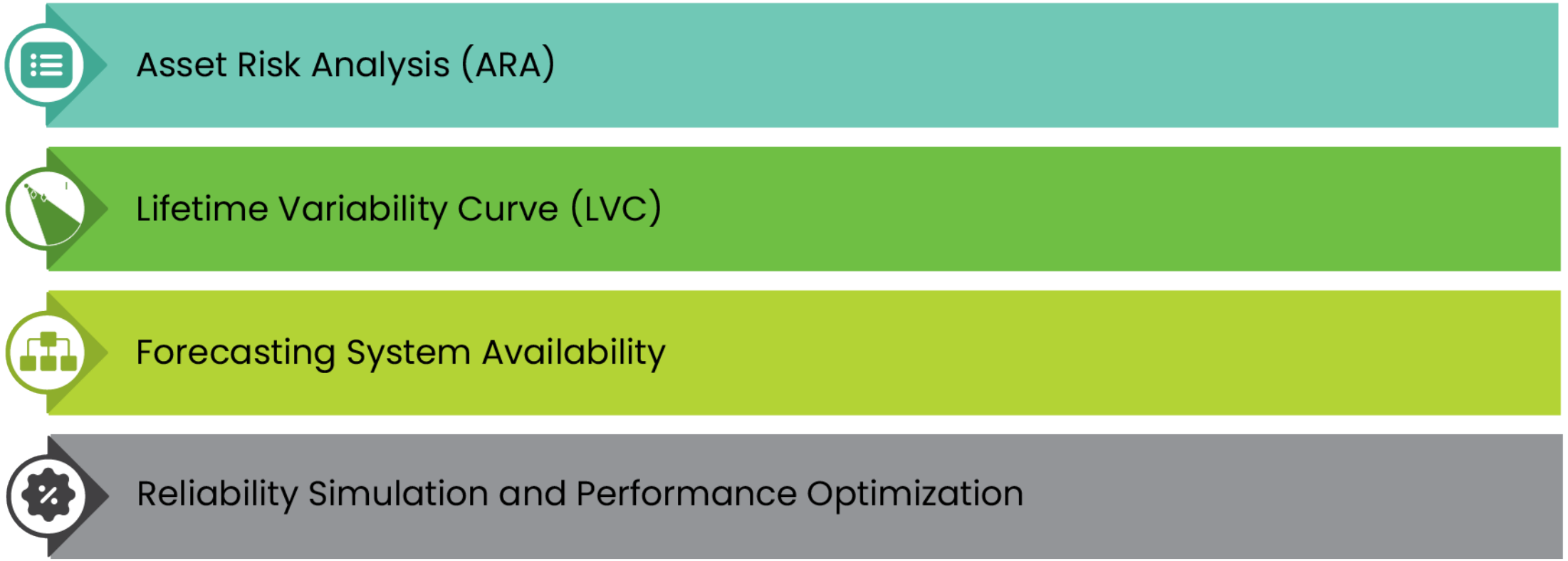
Reliability Model Comparison

QRO represents an evolution in modeling that brings the best of Risk-Based Inspection, Reliability Centered Maintenance, Reliability Availability Maintainability, and Multi-Variate Machine Learning into one model.

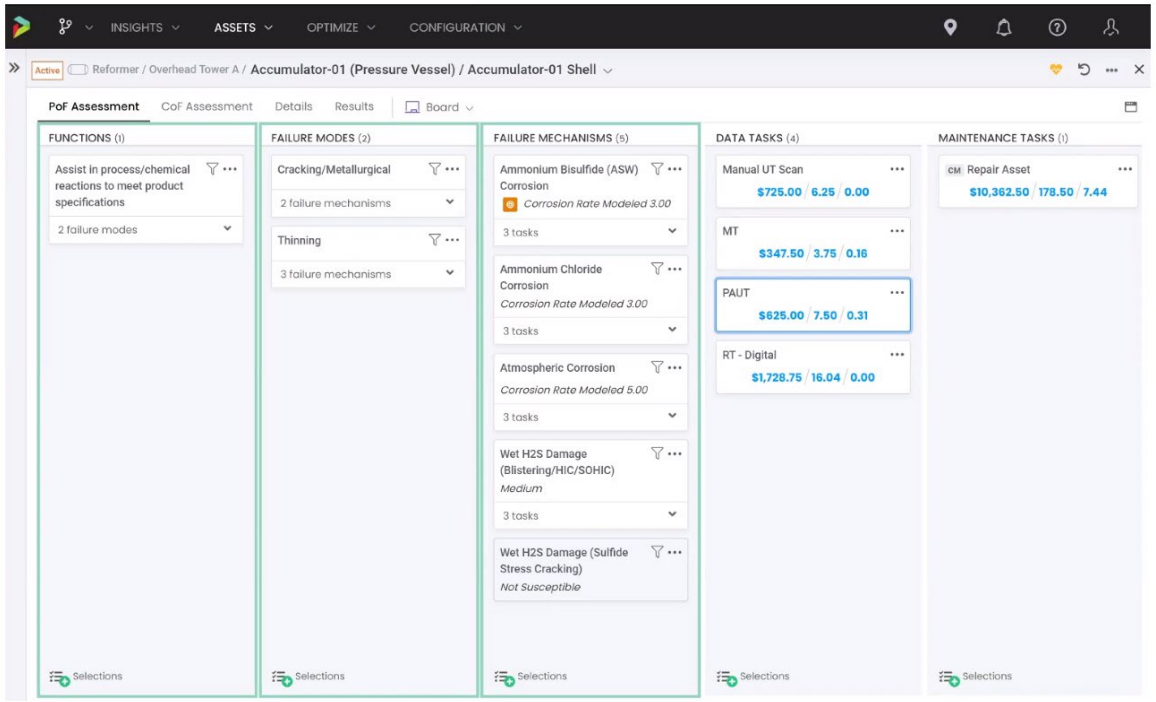
Capabilities:	Failure Modes and Effects	Reliability Centered Maintenance	Risk-Based Inspection	Multi-Variate Machine Learning	Process Hazard Analysis	Reliability Availability Maintainability	Quantitative Reliability Optimization
Loss of Containment Relative Risk Mitigation	✗	✗	✓	✗	✓	✗	✓
Functional Failure Relative Risk Mitigation	✓	✓	✗	✗	✗	✗	✓
Critical Equipment Early Failure Detection	✗	✗	✗	✓	✗	✗	✓
Quantitative Approach	✗	✗	✓	✓	✗	✓*	✓
Reliability-Based Design Optimization	✗	✗	✗	✗	✗	✓	✓
Facility-Wide Optimization of Spend Versus Impact	✗	✗	✗	✗	✗	✗	✓
Complex Reliability Simulations Based on Data	✗	✗	✗	✗	✗	✓*	✓

**While RAM uses Monte Carlo simulation, it is driven at the asset level by underlying qualitative Mean Time Between Failure (MTBF) assumptions.*

Elements of Quantitative Reliability Optimization (QRO)



Asset Risk Analysis (ARA)

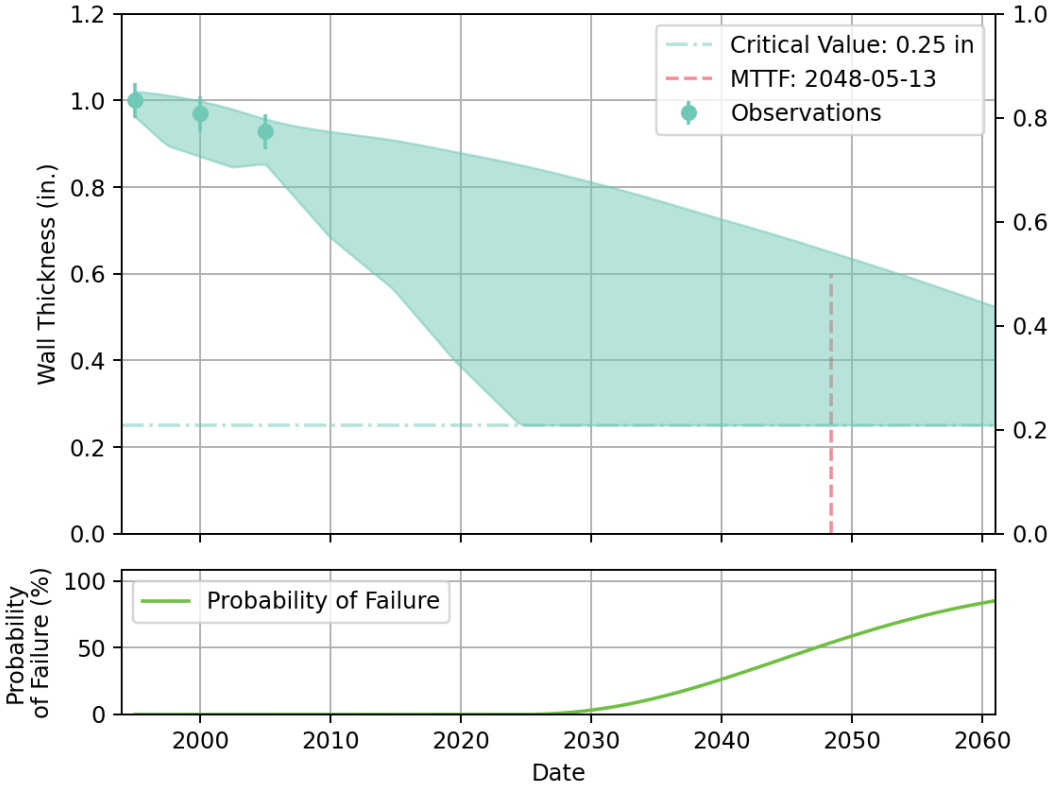


Example of an ARA of a Pressure Vessel in Newton™

An Asset Risk Analysis, or an ARA, integrates first principles engineering analysis and asset data with field execution limitations and operational constraints to build the foundation or our reliability operating basis.

LEARN MORE ABOUT ARAs →

Lifetime Variability Curve (LVC)

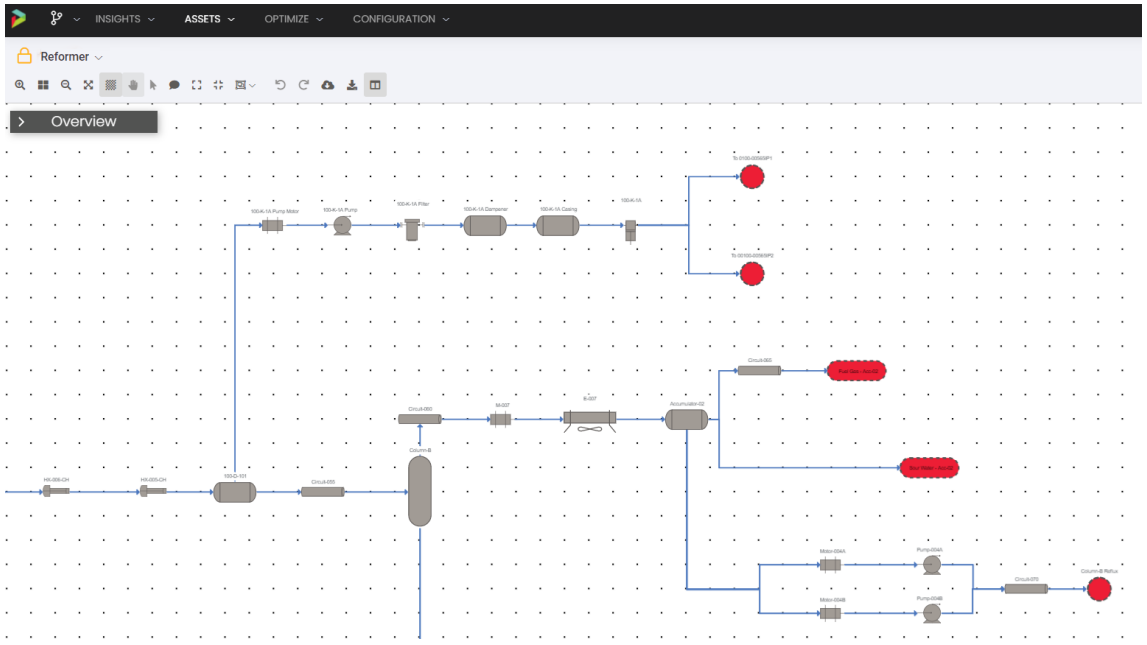


*Example LVC of asset thinning**

A Lifetime Variability Curve, or an LVC, quantifies predicted failure using data science principles, leverages historical information or no data, and updates dynamically as new data enters the system, resulting in a more realistic and dynamic end of life prediction.

LEARN MORE ABOUT LVCs →

Forecasting System Availability

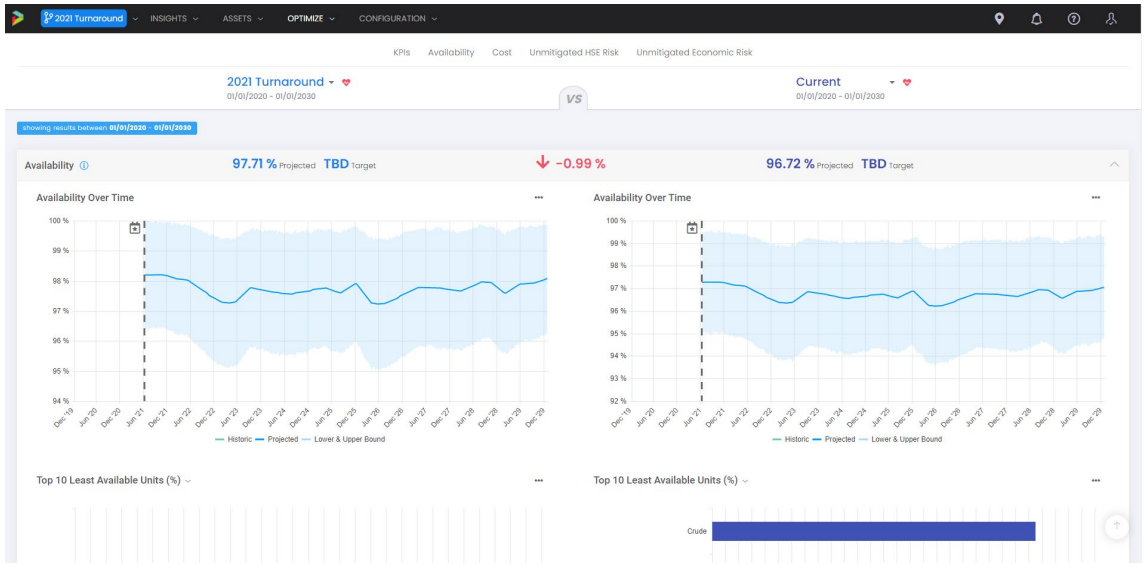


Example of a system model in Newton™

Forecasting System Availability creates a dynamic cause and effect link between every data point and the facility, allowing operators to model how each asset, component, or data point impacts facility performance.

LEARN MORE ABOUT FORECASTING SYSTEM AVALIABILITY →

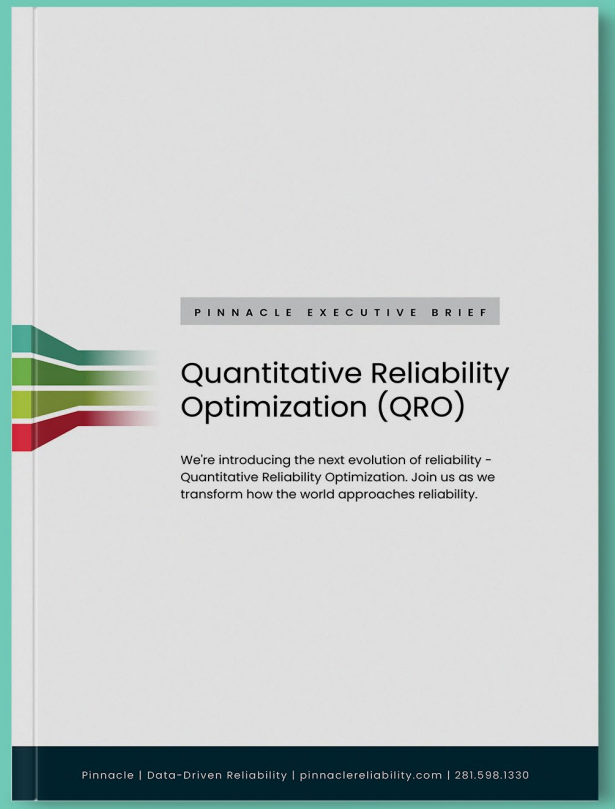
Reliability Simulation and Performance Optimization



Example of availability Newton™

Reliability Simulation and Performance Optimization uses the causal links created, to simulate events and identify optimized plans to drive the highest performance at the lowest cost, while ensuring operational safety.

LEARN MORE ABOUT SIMULATION AND PERFORMANCE OPTIMIZATION →



Quantitative Reliability Optimization is the next evolution in reliability modeling. Join us as we transform how the world approaches reliability.

Read the brief to learn more →

READ THE QRO BRIEF →

Making the World Reliable, One Customer at a Time

Pinnacle is the largest reliability analytics firm in the world, leveraging data from past experiences to accelerate reliability improvements every day for every customer

- Research and Development and Venture Fund dedicated to advancing industrial reliability
- 1MM+ assets implemented into reliability and maintenance programs
- 700+ employees with over 50% embedded in customer sites
- Driving reliability in 30+ countries with 5 offices around the world

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