



Digitally clone your best operators, in combination with engineering experience and real-time process data, to advise operators on how to best achieve refinery plans.

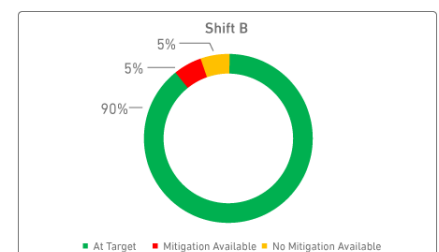
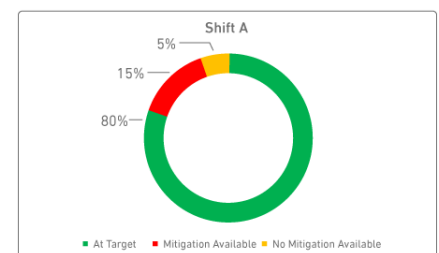
BEYOND LIMITS LUMINAI REFINERY ADVISOR

Beyond Limits LUMINAI Refinery Advisor is a cloud-based decision support tool that guides refinery operators to hit production planning targets and improves reliability in operations and start-ups. The application is designed to help optimize many different, often changing, constraints. Designed to “think” like an engineer and provide expert guidance to solve problems across the entire refinery, the advisor works with and goes beyond conventional automation-focused approaches to ensure process objectives are always met.

LUMINAI Refinery Advisor removes communication barriers between planning, engineering, and operations teams when it comes to determining how to best optimize your refinery to meet ever-changing commercial plans. Enable your teams the ability to consistently meet profitability plans using intuitive guidance and specific instructions, making every operator your best operator. Expand your crude selection options and enable operations teams to optimize across highly varying campaign feedstocks. This no-code tool delivers fast operator adoption and easy-to-use functionality that is less expensive than homegrown solutions and at a fraction of the typical cost of other refinery optimization software.

DRIVE CONSISTENCY IN OPERATIONS FROM SHIFT TO SHIFT AND ACROSS THE ENTERPRISE

- + Digitize your plans to capture more operating margin and provide crude changeover flexibility
- + Enable operators with expert optimization advice in real-time to improve employee capabilities and operations constancy
- + Drive operating standards to constantly meet your campaign profit plan closer to 100% of the time while remaining within safety and equipment capabilities
- + Enable safe, consistent and efficient plant startup and crude changeovers



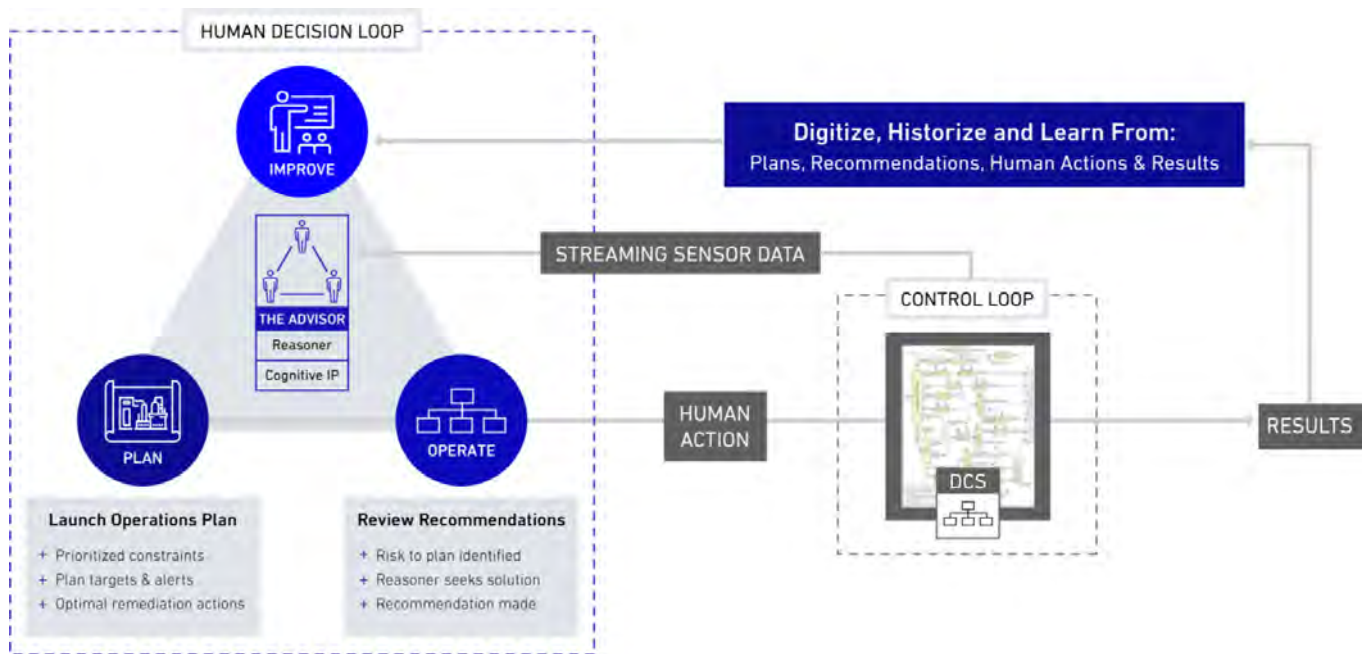
Unlike typical static guidance, the Refinery Advisor sees an operation’s constraints through real-time sensor values from plant historians and recommends actions to the operators to optimize up to the constraints to maximize profitability. It helps operators to prioritize which moves to make first, second, and third to hit desired targets. The Refinery Advisor provides a no-code environment to link engineer and operator workflows for communication and collaboration.

OPTIMIZATION, OPERATIONS & PROFITABILITY CHALLENGES

Although closed-loop control systems have been effective tools for the implementation and achievement of refinery optimization goals, a gap between plan objectives and actual performance remains. To close this gap and reclaim lost profits, LUMINAL Refinery Advisor is employed to accelerate how humans in the loop identify off-plan behavior and make fast, accurate, consistent, and confident remediation decisions when control systems cannot.

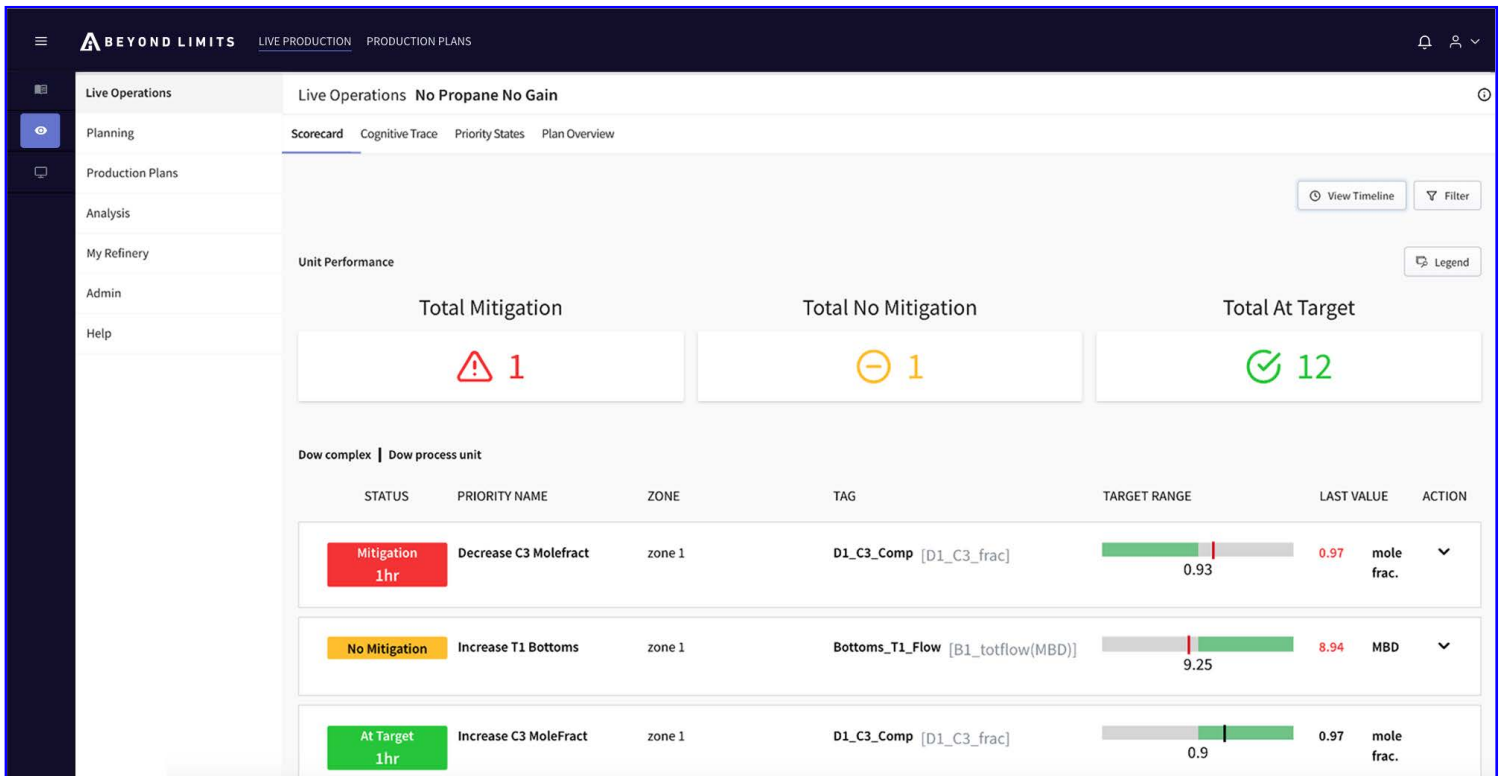
AN EXPERT ADVISOR FOR NEWER OPERATORS

The Refinery Advisor allows users to digitize how they plan, operate, and improve process operations. The system, configurable and extensible by engineering and operations staff, requires minimal to no input from data specialists to maintain. Primary components are illustrated and described below:



PLAN: The purpose of the “Plan” component is to enable optimization engineers to create, analyze, launch, manage, and record Digital Operations Plans. Each plan guides operators and control room personnel to manage process units and associated sub-systems to the objectives in the production plan. Production planning or process engineers can explain what each objective is trying to accomplish and give guidance for each of the objectives that appear within a graphic scorecard. Generic optimization templates are also included for optimizing across a specific refinery process technology, depending upon your commercial objectives. For example, a Crude Unit, Vacuum Unit, HCC, FCC, etc.

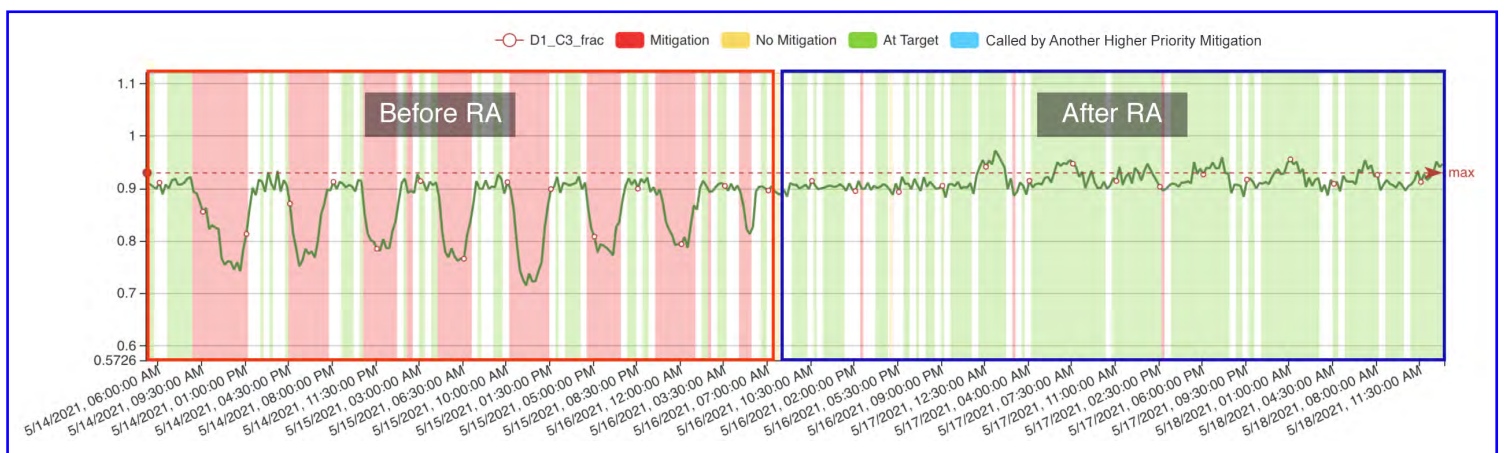
OPERATE: The “Operate” component runs 24/7/365 to assist board operators, shift supervisors, engineers, and managers in identifying and remediating risks to plan objectives. The Advisor automatically compares actual performance, based on streaming data from historians, lab systems, as well as APC and DCS control systems, with the digital operations plan to identify off-plan behavior. The Advisor then uses its prescriptive reasoning capability to perform a global search for a solution to the problem within and across the monitored sensors. Next, it automatically recommends globally consistent remediation actions, where and when possible, and provides a full audit trail, or “cognitive trace” for the reasoning behind each recommended action. Operators can trust the system’s recommendations because they have more transparent visibility into how it arrived at those conclusions. With the advisor’s guidance, operators can provide feedback directly to engineers and commercial experts to improve future plans.



Live Scorecard & Live Flowsheet views communicate objectives, within a strategy and market context, that may require optimization of multiple process parameters and links units showing dependencies between units, then communicates how to achieve refinery-wide objectives and prioritizes order of actions.

IMPROVE: The “Improve” component leverages a variety of techniques to analyze, visualize, and deliver timely operational insights to correct off-plan performance. Here, both retrospective and predictive analysis are automatically performed to explore, understand, and identify what drives profit and production gaps within a continuous learning loop.

Longer-term retrospectives also allow a deeper understanding of performance for the the optimization team to prescribe further remedies to a constraint. A clearer understanding of the relevant constraints could justify investment in capital changes. Relevant investment examples could include on-line analyzers, process modifications, automation, or better training.



The image above shows a performance improvement by reducing off-plan operating time resulting in the increased achievement of commercial objectives for one client (Red: Off-plan, Green: On-plan time).



The Refinery advisor is to the human decision loop what automated control systems are to the machine control loop.

- bp Refinery Engineer

ENGINEERS CAN ACT IMMEDIATELY

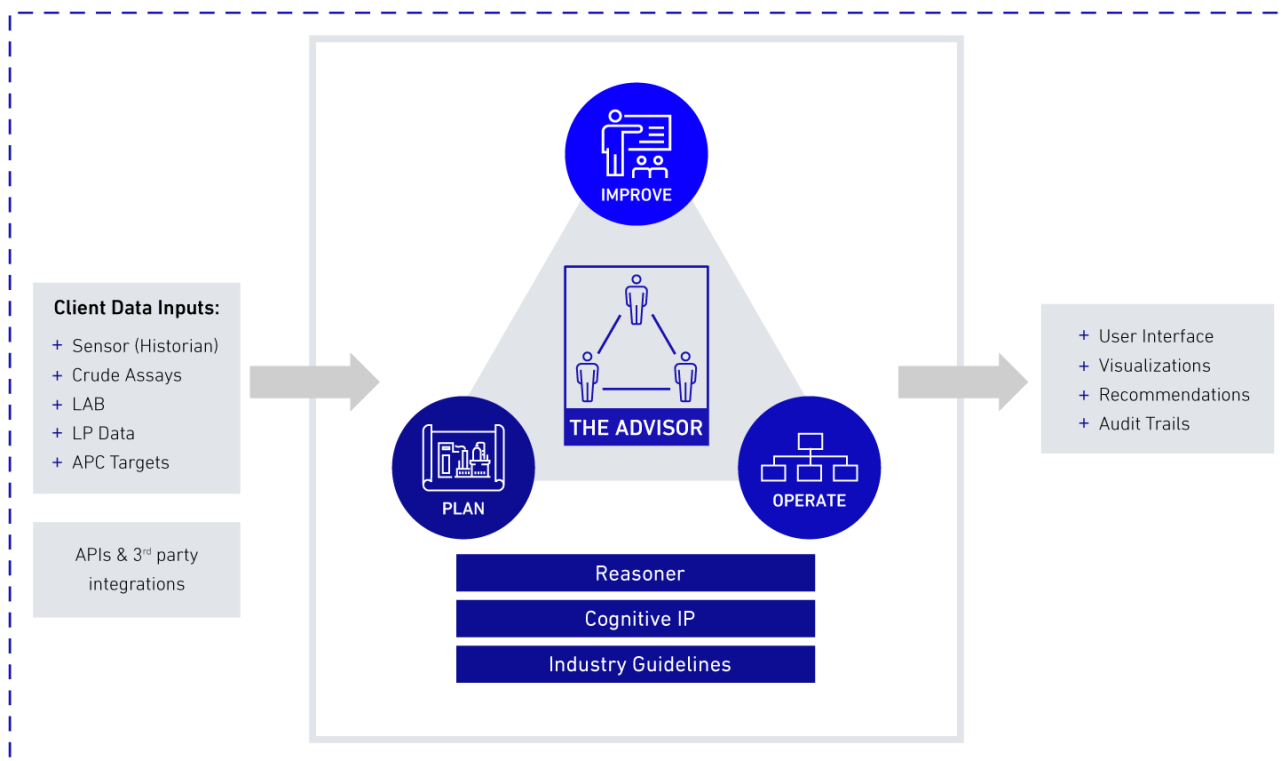
If the Digital Operations Plan cannot achieve an objective with the priorities, operating envelopes, and mitigation options specified by the operations engineer in the plan, the system highlights the scenario and provides a trace of all failed mitigation steps and constraining conditions. This enables an engineer to rapidly determine the cause of failure to meet the operations plan such as remediation action taken, not taken, not available, or invalid assumptions that can be traced to the LP model itself. This rapid feedback enables engineers to take immediate action. Furthermore, this information, and the factors that hinder process performance and profitability, are captured within the improve component and can be made available to Planning & Scheduling teams.

API DATA EXPORT

LUMINAL Refinery Advisor provides a UI to track KPI's. If the user wishes to integrate LUMINAL data into other applications, or to build their own dashboard to track KPIs based on specific needs, an export capability is provided.

DATA PRIVACY AND SECURITY

Beyond Limits understands that data inputs to the Refinery Advisor, including sensitive information such as operating plans, crude assays, lab test results, APC setpoints, process readings from historians and other data sets, are amongst its clients' most valuable business assets.



We protect and secure our clients' data against unauthorized or unwanted use and adhere to state-of-the-art data privacy, security standards and uptime across all storage and deployment scenarios, including cloud or private cloud.

SECURE DATA ACROSS MULTIPLE SCENARIOS INCLUDING:

- + Authentication and Role Authorization enforced on application end users
- + Enforcement of strong credentials and (optional) 2-factor authentication
- + Protection of all cloud endpoints by a Web Application Firewall
- + Encryption of all data, at rest and in motion
- + Stringent Cloud access that follows the principle of least privilege - Limited User Access, Network Access with VPC/Security Groups
- + Prudent Application and System logging via CloudWatch and CloudTrail, with threat detection monitoring in place
- + Inability to access backend APIs externally
- + Dynamic Cloud Services leveraged in a dedicated manner by being actively patched and updated
- + Assurance that all data access from the application is tenant specific
- + Rigorous restriction policies in place to handle client data, with protocols restricting access to data and approval through centralized identity management
- + Safeguards that best practices are followed in user training (e.g. to avoid social engineering)

Contact us today to see how the Beyond Limits LUMINAI Refinery Advisor can help your organization be more competitive.

About Beyond Limits

Beyond Limits is an industrial-grade AI company built for demanding sectors, including energy and utilities. Beyond Limits' pioneering Cognitive AI technology combines machine learning techniques with knowledge-based reasoning to provide decision-makers with actionable intelligence, boosting operational insights, improving operating conditions, enhancing performance, and ultimately increasing profits as a result. www.beyond.ai