



AI Platform for Industrial Coordinated Operating Strategies™

The Next Generation of Operational Excellence



Edison Tan

Chartered Engineer (Ceng)
Chartered Chemical Engineer (MIChemE)

Imubit at a Glance: World-Class Expertise in both AI and Process

Process Expertise

- Process Engineering
- Control Integration
- Advanced Process Control
- Planning & Economics
- Operations
- Project Management



AI Expertise

- CEO and Co-Founder sold previous company to Nvidia
- CTO, President and Co-Founder is global 4th Google Doctoral Fellow in Deep Learning
- 13 Approved patents on core technology and process applications
- The only commercial solution that applies closed loop Reinforcement Learning in product environment

Safety, Security & Compliance



Main Investors



\$100MM

- ★ HQ – Houston, Texas
- 160+ FTEs world-wide
- ◆ Partner Network

Driving Value Across Energy, Chemicals & Beyond

Oil Refining



Fluid Catalytic Cracker (FCC)
Atmos / Vac Crude
Reformers
Cokers
Distillate Systems
Hydrocrackers
Other Refining Applications

250+

Applications Deployed

\$.25-.40/bbl

Range of Improvement
in Refining

Chemicals & Polymers



Reaction selectivity and distillation

7+

Years of Closed Loop
Model Engagement

15-30%

Reduced Energy
Consumption

Cement, Mining, Minerals & Solid Fuels



Rotary Kiln yield, energy, emissions



INVISTA

FULLER



ExxonMobil



Oxbow



moeve



HF Sinclair



Par Pacific



Execution of coordinated decisions is the barrier of Operational Excellence

Operational Excellence Goals



**Safety &
Environmental
Integrity**



**Reliability &
Asset
Integrity**



**Efficiency &
Margin
Optimization**



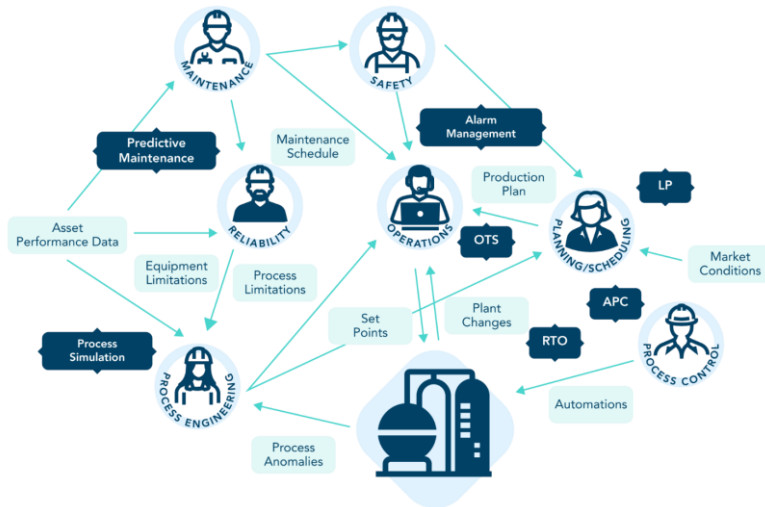
**Compliance &
Sustainability**



**Competency &
Collaboration**

Different teams execute decisions

- At different times
- Using different systems
- With different objectives
- With partial visibility of constraints and outcomes



Even when everyone does their job “correctly”, the plant behaves inconsistently and reactively



More data, AI, and workflows won't help.
A new approach is required

The new approach to Operational Excellence: Coordinated Operating Strategies

A framework that connects plant operational **handles** and observable **outcomes** to plant **objectives** and **constraints**.

Objectives

- Minimize Slurry
- Max Opportunity
- Feedstock

Handles

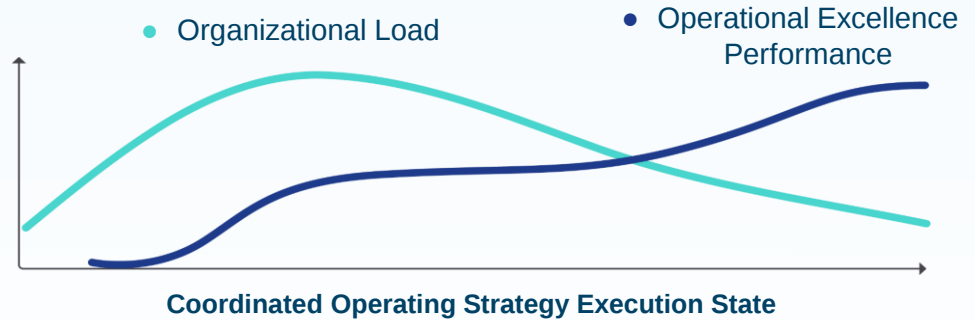
- Riser Temperature
- Feed Selection
- Catalyst Addition and Selection

Constraints

- Product Demand & Pool Qualities
- Pump Cavitation

Outcomes

- Product Yields and Qualities
- CO₂ Emissions
- Salt Deposition



Unidentified

Decisions based on opinions and tribal knowledge



Reactive

Informal definitions, reactive decisions (e.g. response to alarms)



Deliberate

Decisions driven by formal multi-functional alignment



Augmented

Operations executes the strategy at any time without the overhead of alignment



Automated

Strategy is execution 24/7 through supervised automation

Imubit Operations Studio: Patented Deep Learning Process Control® Technology

13 Approved US patents • 100+ Closed Loop Applications • 7+ Years of Closed Loop Engagement



Deep Learning Predictor

Nonlinear dynamic model of the process based on historical data with guiding 1st principles



Deep Learning Controller

Millions of simulations over thousands of simulated years



Deep Learning Process Control®

Automated minute-by-minute closed-loop optimization

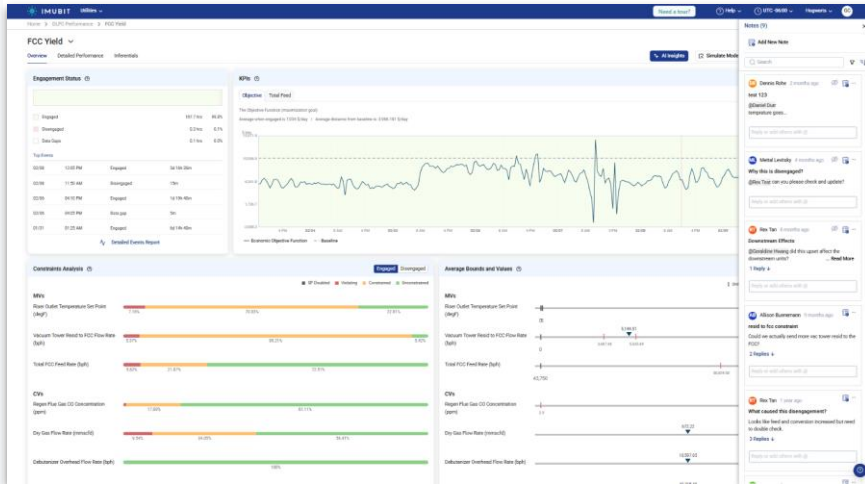
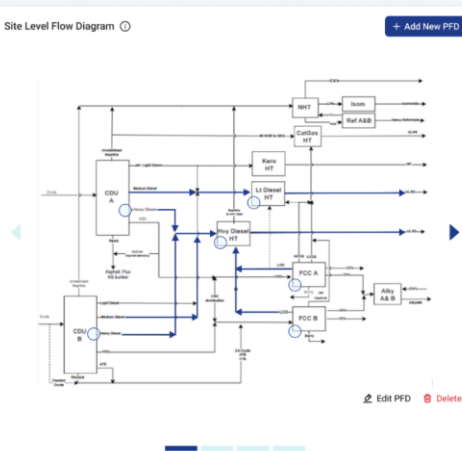
Nonintrusive Cloud Modeling

On-premise, integrated to DCS / APC

Map and Define Your Strategy, Visualize and Level Your Execution

Map your COS's across the plant to build a system of record for decision coordination

Define your COS's and visualize current execution in the context of the Handles, Outcomes, Constraints & Objectives



Streamlined and Intuitive Nonlinear Modeling to Augment Your Strategy

Empower your engineers with scalable, data-driven modeling of handles to outcomes for operational guidance and clarity

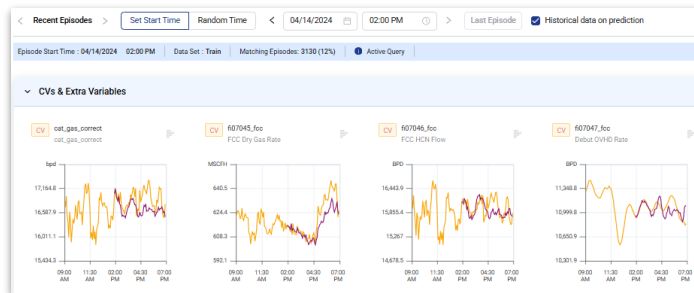
- Utilize historic data to learn all possible handle to outcome relationships, discover hidden interdependencies and benchmark current operations against it.



- Understand handle outcome relationship over time and bring clarity to long term decisions.

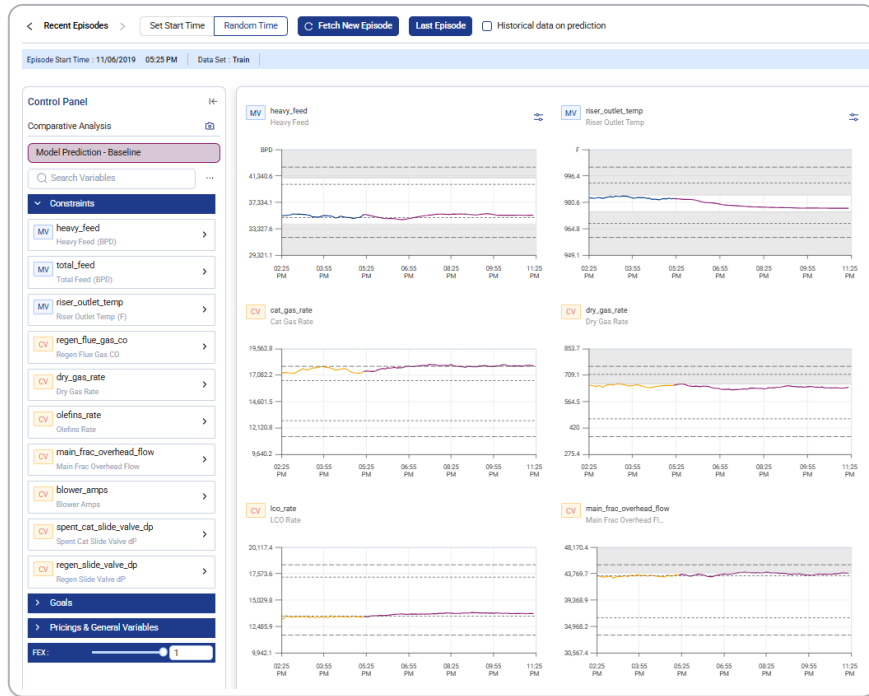


- Test different scenarios and handles to know what is best when you go to execution

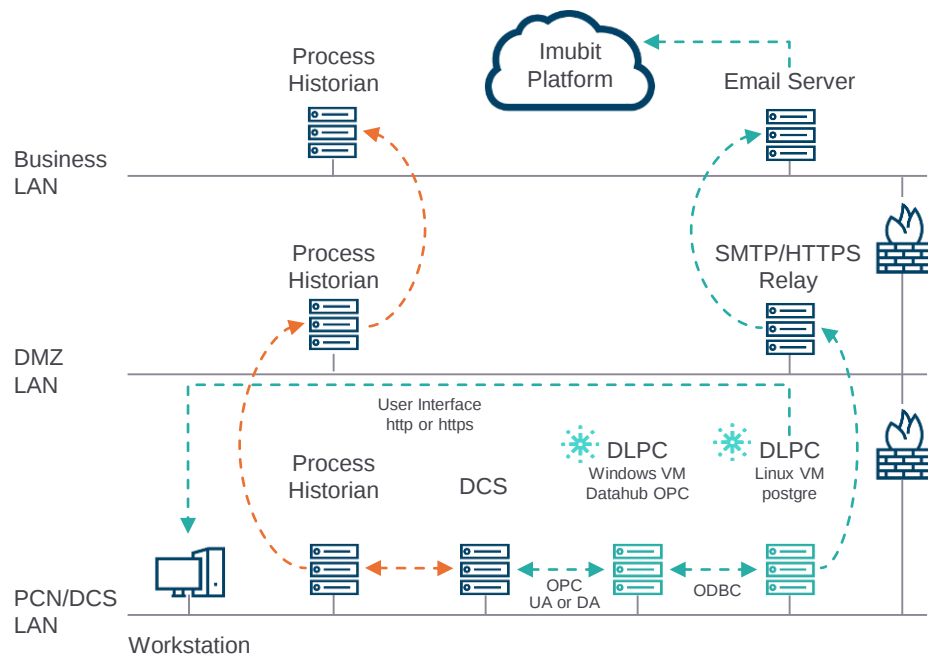


Safe Closed-Loop Optimization to Automate Your Strategy

- Automate the coordinated execution via closed-loop data-driven optimization
- of various process areas



Imubit Process Control Network / DMZ (On-Prem) Architecture

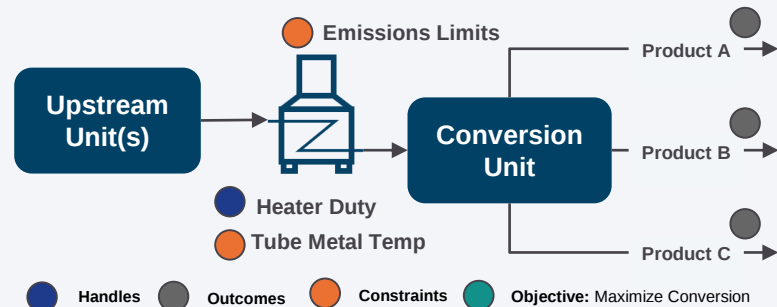


Map and Define Your Strategy, Visualize and Coordinate Your Execution

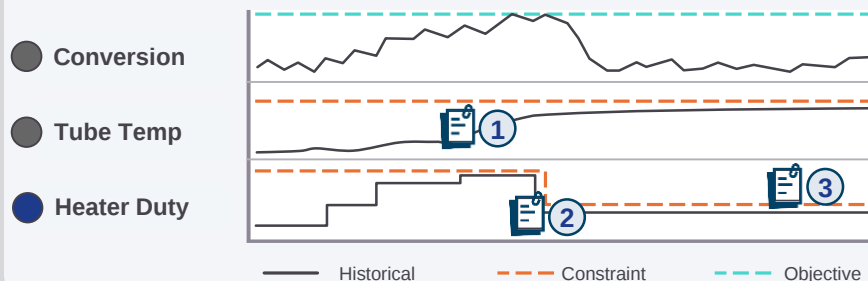
Process Unit Example



Process Mapping



Scenario & Context



① Operator observes increase of Tube Metal Temperature and logs observation. On the next day Process Engineer communicates this event to maintenance along with context like feed quality.



@jane
@george see tube metal temperature

② As a result the cross functional team agrees on lower max Heater Duty and based on the current situation agree to move planned tube replacement forward



@sharon
@james @jane - we are replacing the tube earlier.

③ Process Engineering informs Operations that a new feedstock will be introduced, links properties and updated run plan.



@james
@laura - we introduced a new feedstock

Streamlined and Intuitive Nonlinear Modeling to Augment Your Strategy



Process Unit Example

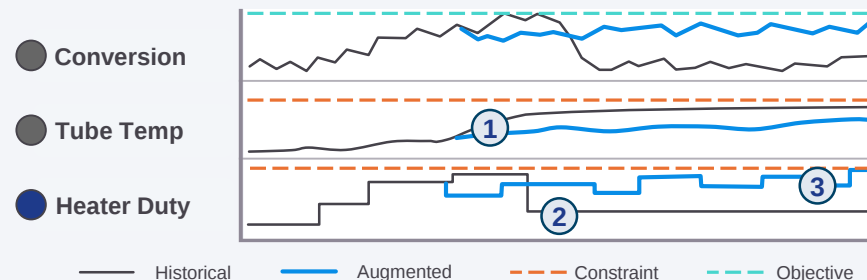
Result of Augmented Execution

Moves and decisions are made through shared knowledge and evidence. Changing relationships and long term behaviour becomes actionable.

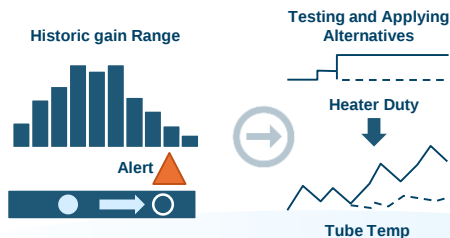
Impact

- Downtime as planned (+4% unit Reliability)
- Operation closer to objective target ⇒ \$1MM.
- Maintenance stays in budget

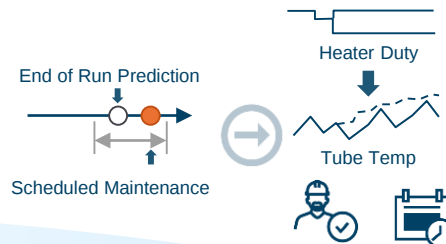
Augmented Execution Level



- ① Asset team anticipates Tube Temp spike of 5 degrees through increased gain from Heater Duty to Tube Temp, and backs off before Conversion target is reached.



- ② Long term fouling is predicted, influence and potential handle adjustments are understood, maintenance is confidently planned.



- ③ New feedstock or equipment are quickly being modeled through actual data, influence becomes visible and informs long term decision making



Safe Closed-Loop Optimization to Automate Your Strategy

Process Unit Example

Result of Automated Execution

Target can be approached automatically, quickly and safely and is sustained whenever possible.

Utilizing optimization potential even if situation not explicitly modeled.

Impact

- Operation closer to objective target $\Rightarrow$ \$2MM above Augment state.
- Reduction of manual testing and adjustment by 50% reducing weekly asset team workload by 40hrs.

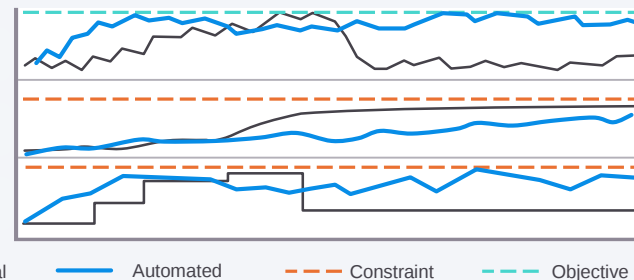


Automated Execution Level

● Conversion

● Tube Temp

● Heater Duty



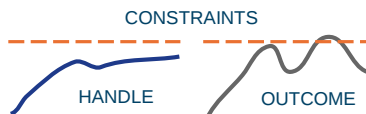
The nonlinear process model is used to build a closed loop controller which is able to control and optimize safely and stably as well as predict risks from measured and unmeasured disturbances.

Controller

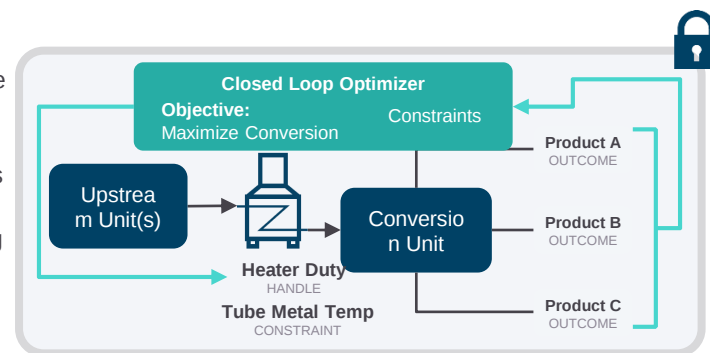


State: description of environment's status
Action: operation made by controller
Reward: goodness of environment's status

Environment



The closed-loop optimizer writes minute by minute 24/7 setpoints or external targets for the Handles while observing the Outcomes, maximizing the Objective and respecting the Constraints.



Customer Testimonials





Embracing AI Optimization to Transform the Workforce

