

NOVEMBER 16, 2022

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# Optimizing Refinery Operations

A Digital Transformation Journey

Presented by: Doug Raven, Saudi Aramco

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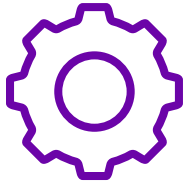
## Saudi Aramco

### Real-Time Operations Digital Transformation

- 1990's: Corporate-wide Real-Time Infrastructure  
[AVEVA PI System]
- 2000's: Advanced Process Control (APC) Deployment
- 2010's: Performance Monitoring and Benchmarking
- 2020's: Closed-Loop Real-Time Optimization (RTO) & Process Digital Twin (PDT) Deployment

# Optimizing Refinery Operations

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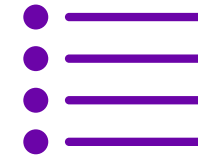
## Challenge

- Close the **Plan vs Actual** performance gap for a refinery providing transportation fuels for western Saudi Arabia
- Close the **Technology Gap** between the Refinery Planning System and APC System



## Solution

- Deployed a **refinery-wide** optimization solution utilizing **AVEVA Process Optimization** software on a **PI System** infrastructure to provide real-time optimum operating targets for all key process parameters.



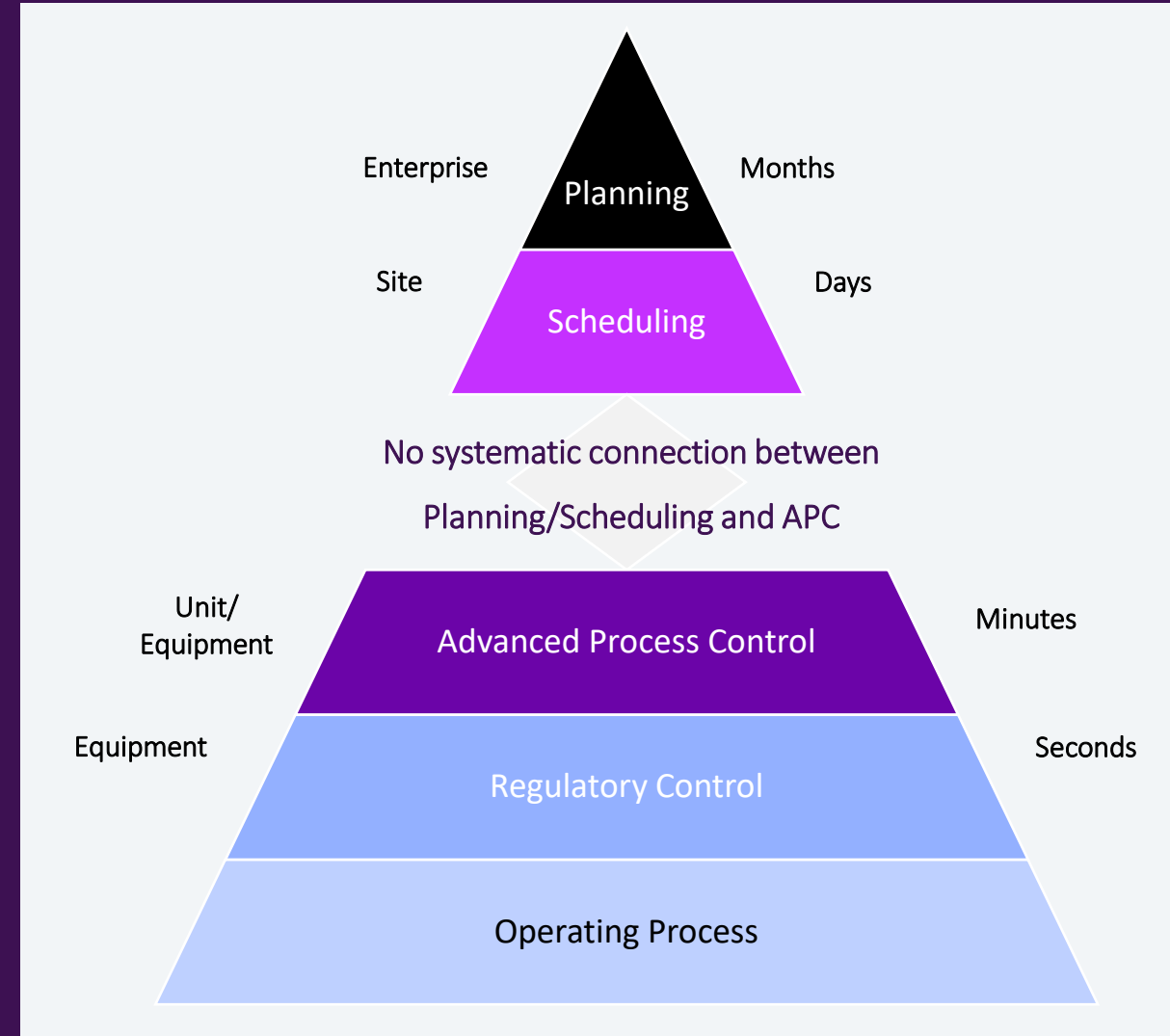
## Benefits

- **Continuously maximizes** most-valuable refinery products while maintaining product specifications and adhering to process constraints
- Payback time: **3-6 months**

# Refinery Operations Challenge

## Operations Technology Gap

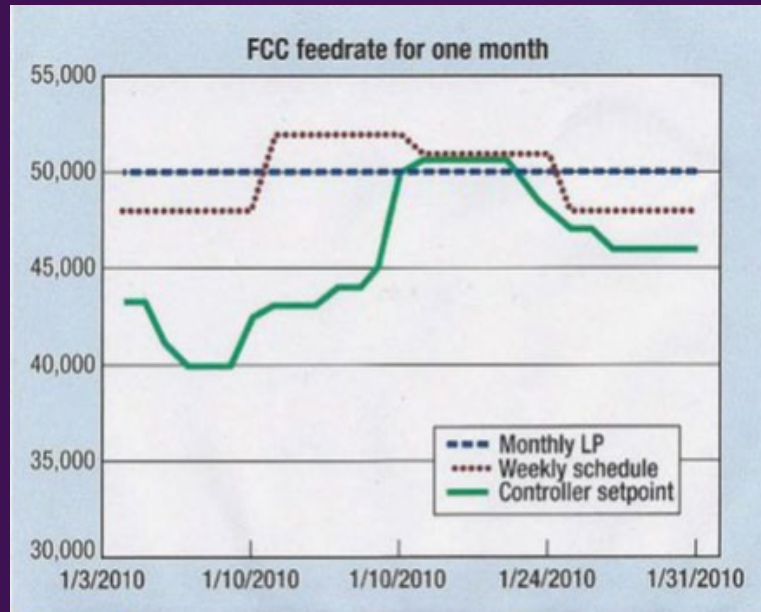
- No systematic connection between Planning/Scheduling and APC
- **Monthly Planning LP:** Provides monthly optimal, average operation plan for the enterprise
- **Daily/Weekly Schedule:** Provides operation orders for site based on plan
- **Advanced Process Control:** Stabilizes unit operation based on manually entered targets



# Refinery Operations Challenge

## Technology Gap Causes Performance Gap

- **Misalignment** between planning, scheduling and APC objectives, constraints and targets.
- **Simplification** in planning and scheduling models.
- **Infrequent** feedback from actual process conditions.
- Process constraints **unaccounted** for in real-time.
- **Manual communication** of coordinating information
- **Plan vs. Actual Gap: up to 10% of crude margin**

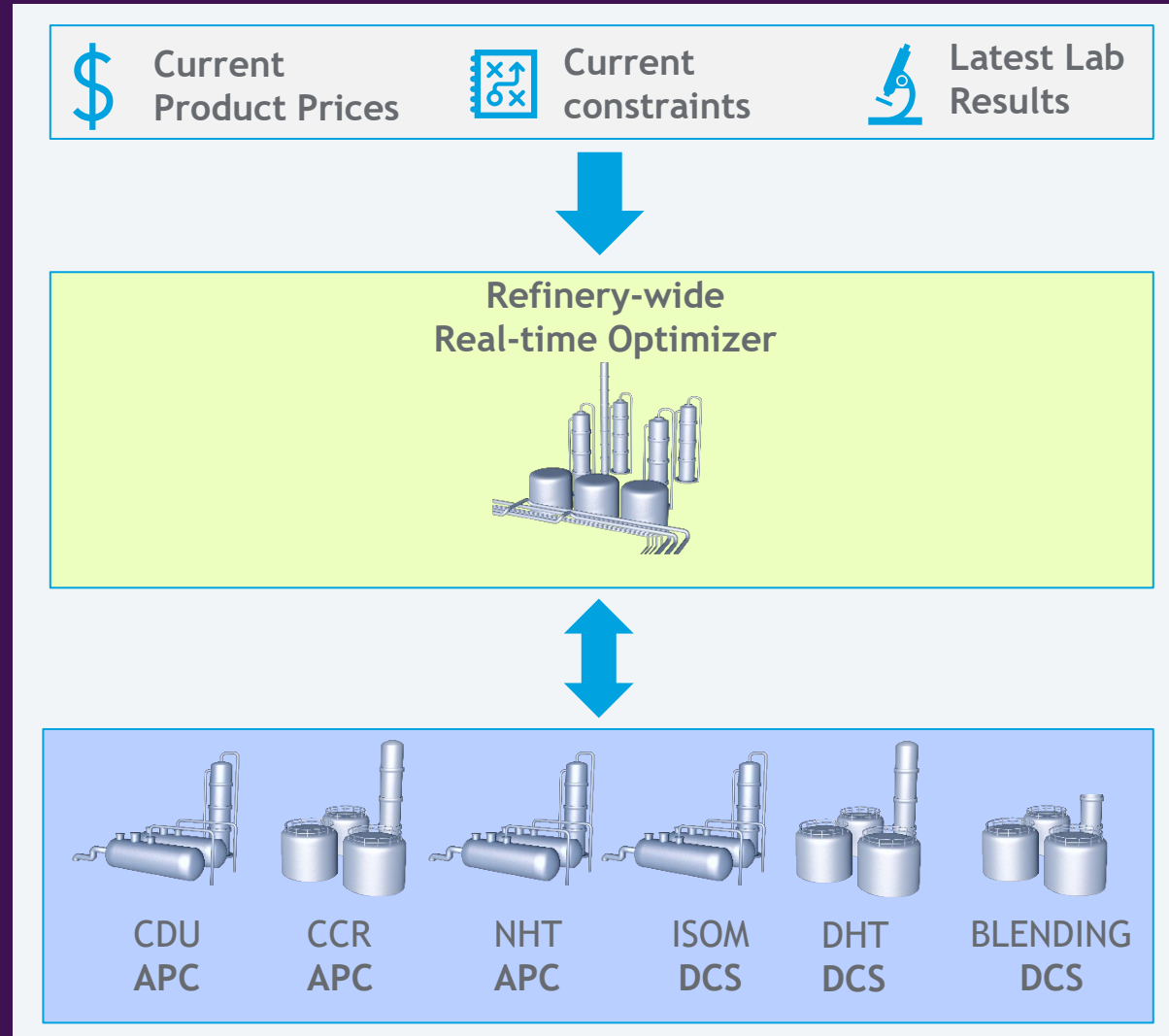


# Refinery-wide RTO Solution

## What is RTO?

*A scope-wide rigorous or semi-rigorous nonlinear process model utilized directly or through steady-state gain updates by a scope-wide economic optimization calculation implemented in a closed-loop manner.*

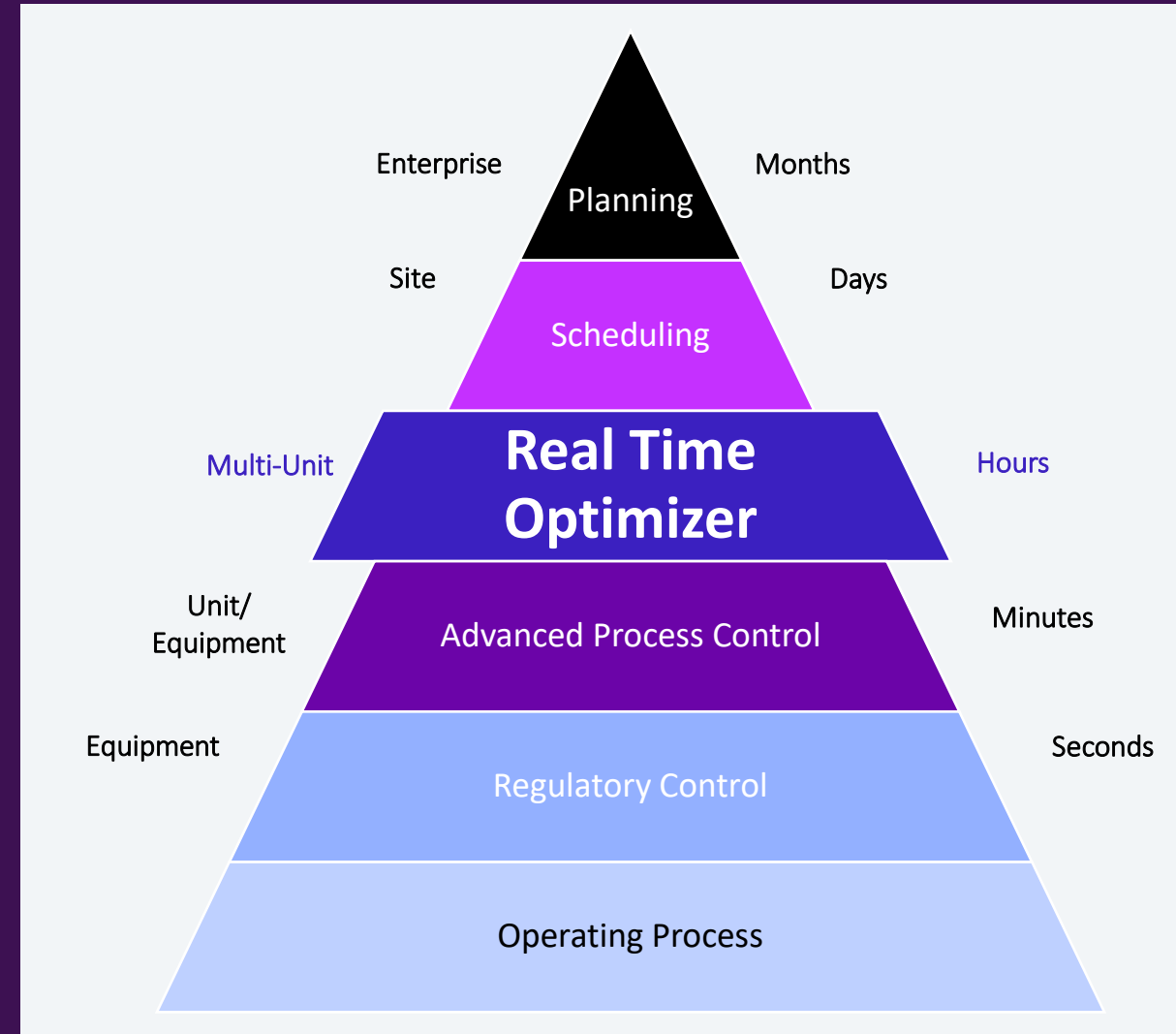
- Economics, current operating constraints (APC/DCS), Operating Plan, and Lab Results are fed to RTO
- RTO calculates optimum operating scenario using rigorous process models updated with real-time data
- RTO automatically adjusts refinery parameters using existing APC and DCS infrastructure



# Refinery-wide RTO Solution

## AVEVA Process Optimization on PI System Infrastructure

- Aligns and coordinates planning, scheduling and APC systems
- Utilizes rigorous process models
- Continuously fits models to actual process conditions

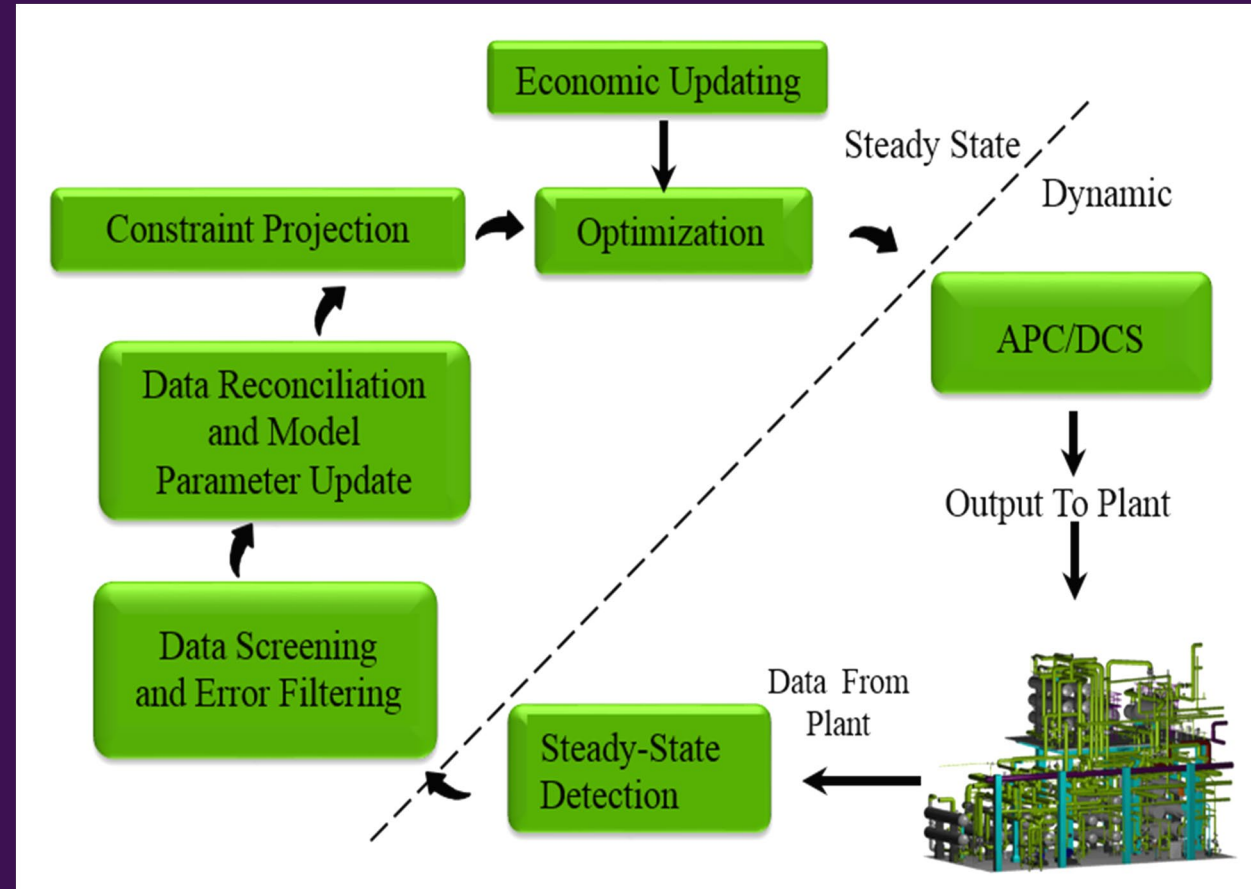




# Refinery-wide RTO Solution

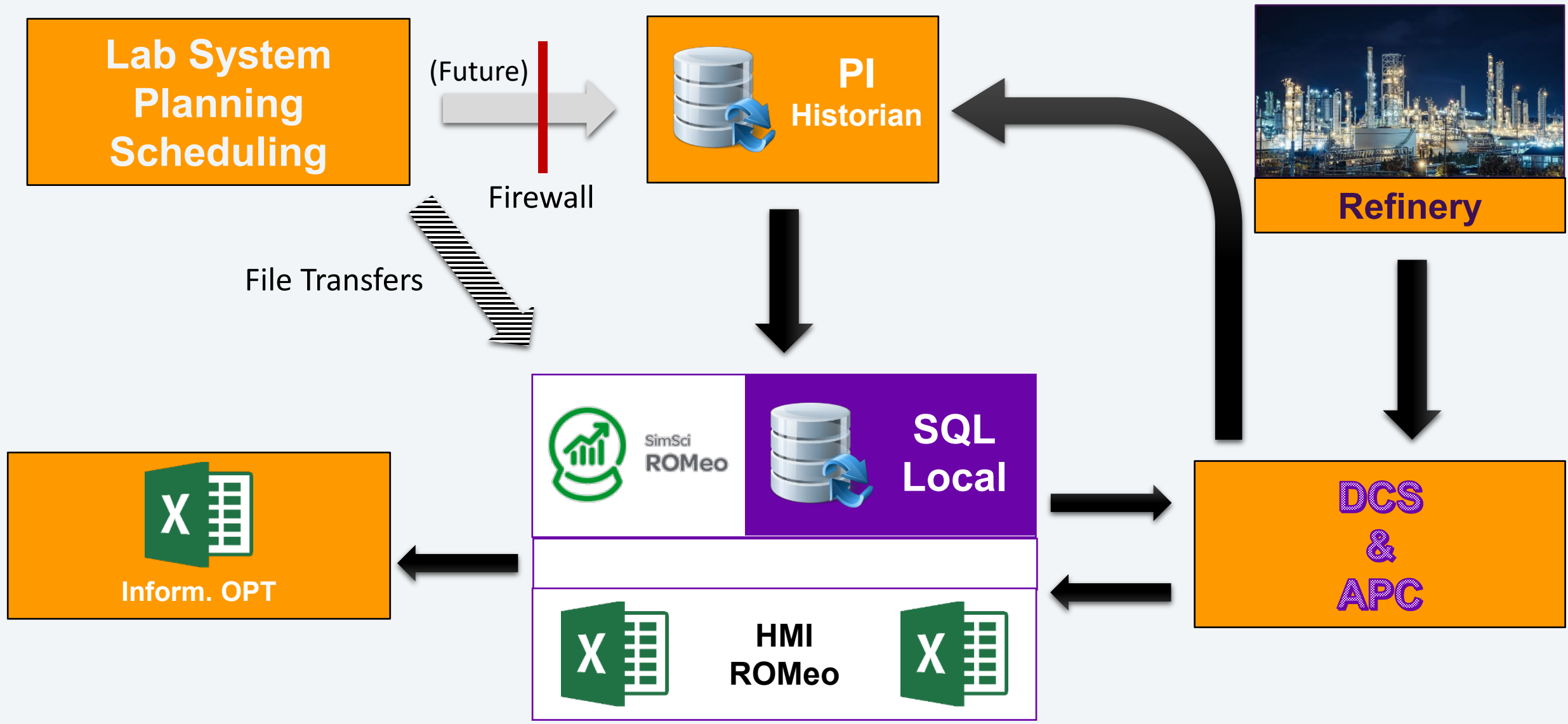
## AVEVA Process Optimization on PI System Infrastructure

- Accounts for real-time **process constraints**
- Optimizes APC targets while achieving schedule and plan objectives
- **Closes Plan vs. Actual Gap**
- Also finds **new paths** to achieve plan in better ways



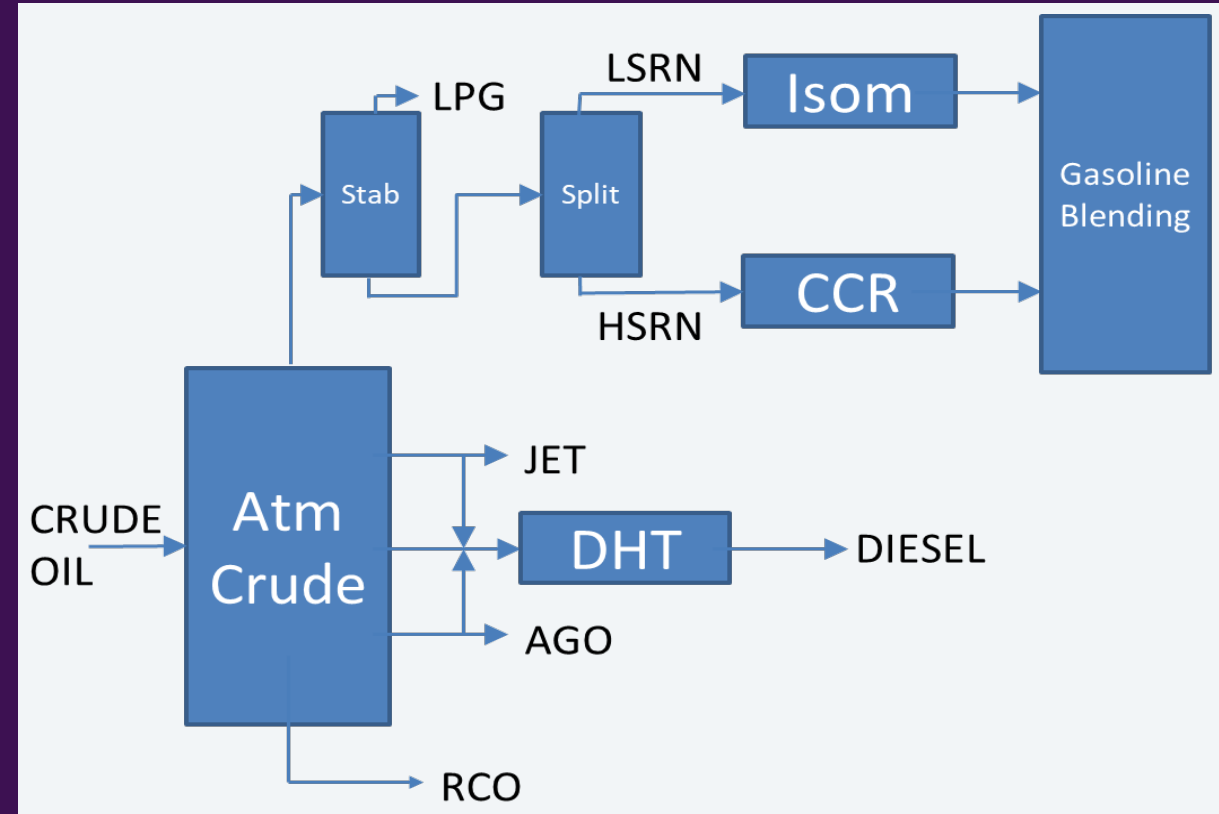


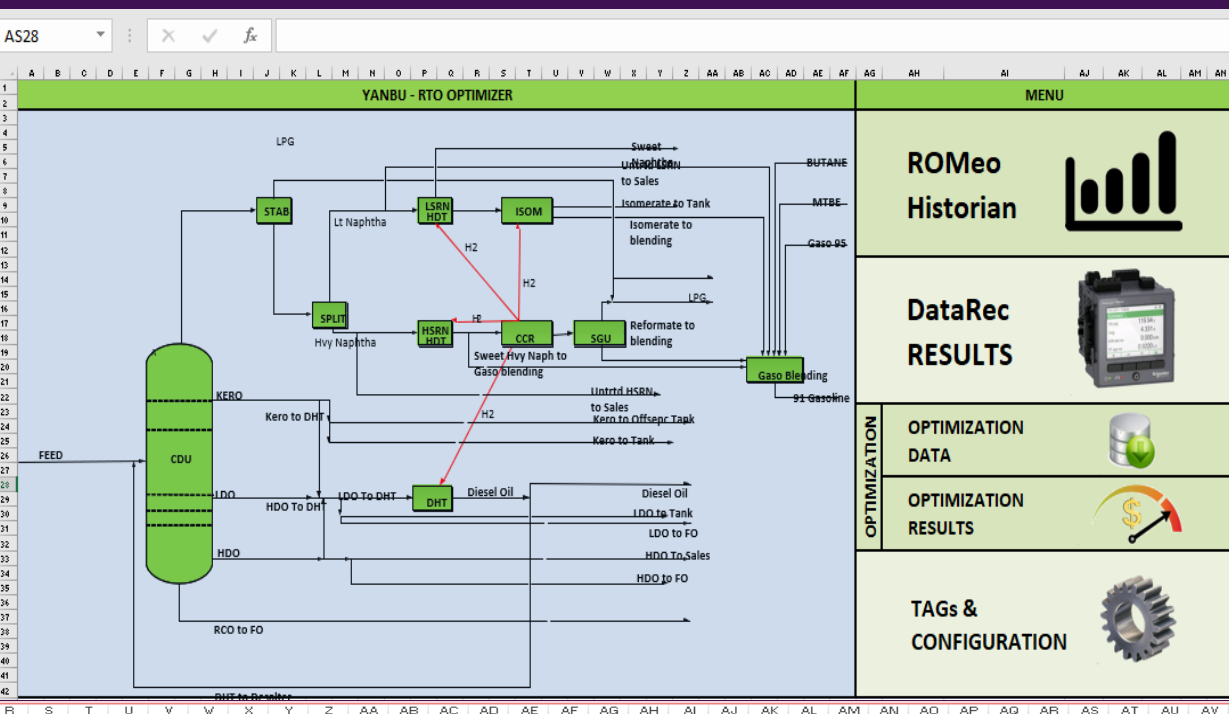
# AVEVA Process Optimization on PI System Infrastructure



# Implementation Challenges

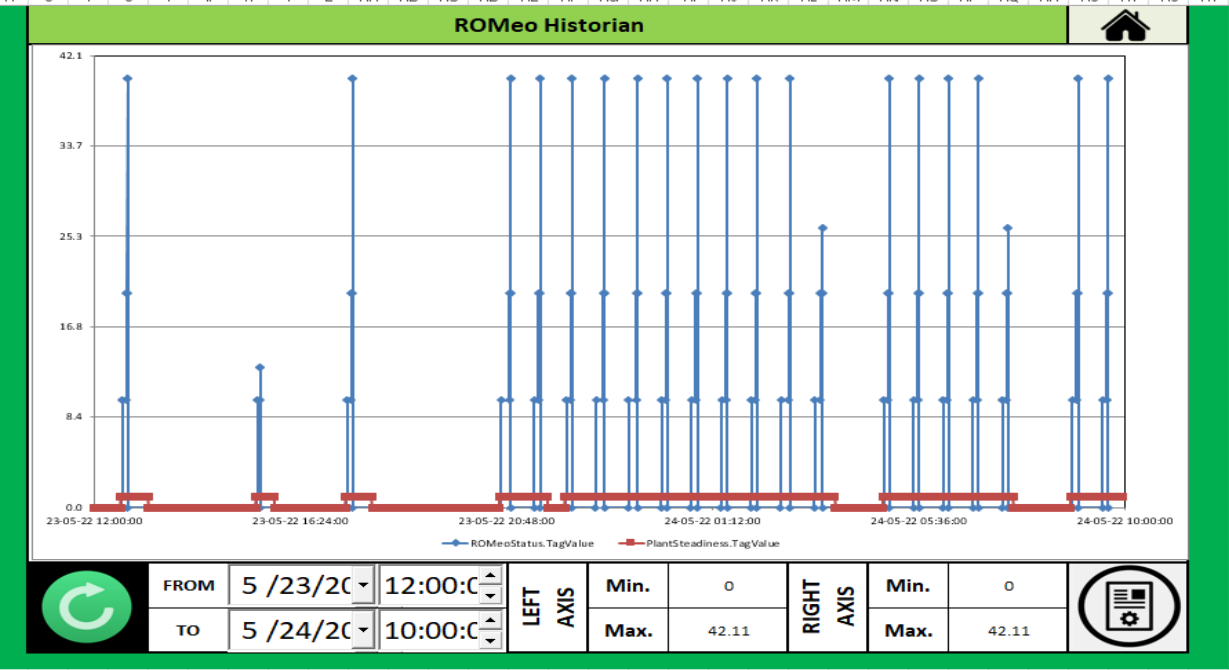
- Very aggressive **7-month** project schedule
- **Refinery-wide** scope of solution
- Changing refinery operation modes
- Delays in computing infrastructure
- **Cyber-security** restrictions
- Pandemic travel restrictions





**MENU**

- ROMeo Historian
- DataRec RESULTS
- OPTIMIZATION DATA
- OPTIMIZATION RESULTS
- TAGs & CONFIGURATION

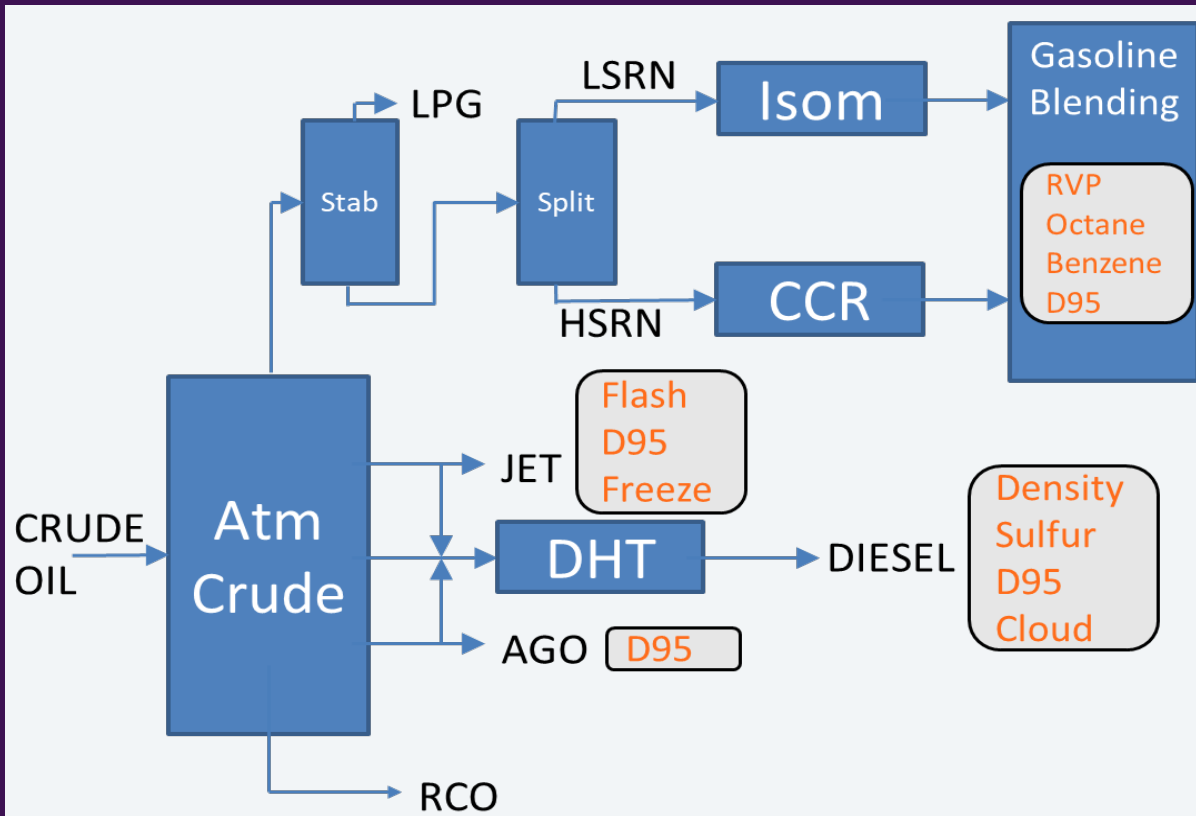


# Achievements & Innovations

## 1<sup>st</sup> Refinery-wide RTO in Middle East

- Hourly implementation frequency
- 10-minute computation time
- Rigorous process modelling throughout
- Model trained APC soft sensors
- RTO acts as “Soft Lab Update” for APC soft sensors
- Remote online development

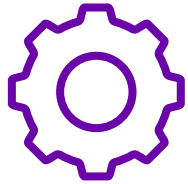
## RTO System Actions



- Naphtha, Jet, Diesel and AGO product flows and characteristics continuously optimized subject to plan
- Stabilizer targets adjusted depending on gasoline product RVP
- Naphtha Splitter separation based on ISOM and CCR conditions and gasoline blending needs
- Conversion unit targets optimize gasoline blend components

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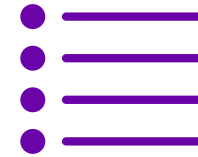
## Solution

- Deployed a **refinery-wide** optimization solution utilizing **AVEVA Process Optimization** software on a **PI System** infrastructure to provide real-time optimum operating targets for all key process parameters.



## Results

- **Project Payback: 3-6 Months**
- **On-Budget & On-Schedule Execution**
- High User Acceptance
- Reduced Operator Interventions
- Enhanced APC Utilization & Performance
- Enables Advanced Engineering Tools



## Path Forward

- RTO results into business network **AVEVA PI System**
- Develop RTO KPI and Benchmarking displays utilizing **AVEVA PI AF & PI Vision**
- Extend refinery-wide process model into **Process Digital Twin**



## Doug Raven

### Engineering Specialist

- Saudi Aramco
- douglas.raven@aramco.com



## Project Team

### Saudi Aramco

- Khalid Alahmadi, Abdullah Bahamdan, Ammar Bakhurji, Othman Shamrani

### AVEVA

- Jesus Palacin, Longinos Velasco, Jaidev Parmar, Prasad Patgaonkar



# Questions?

Please wait for the microphone.  
State your name and company.



# Please remember to...

Navigate to this session in the mobile app to complete the survey.





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