

Reducing Methane Slip and Recycle Rates Through Advanced Packed Bed Design In A Demethanizer Column

Ian Buttridge, Vice President of Technology, GTI Solutions

David Lin, Head of Global Sales & Marketing, GTI Solutions

Luis Torres, Process Engineer, Braskem Idesa

Jorge Cabrera, Process Engineering Manager, Braskem Idesa

Leandro Ruiz, Process Engineering Superintendent, Braskem Idesa

TNChE Asia 2026:

Session: Process Excellence & Optimization; Efficiency Enhancement



Disclaimer

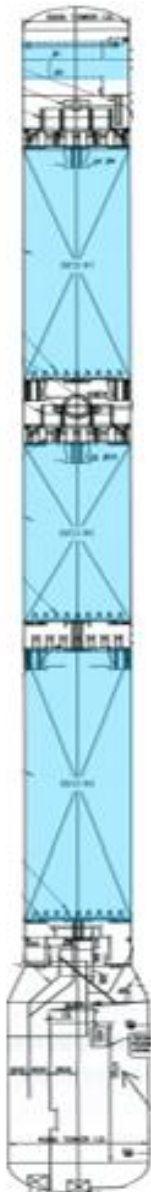
This presentation is provided for informational purposes only and is based on site-specific data, design and operating experience. It does not constitute engineering, design, or operational advice. Actual results may vary depending on equipment design, operating conditions, feed composition, and other factors. The content does not necessarily reflect the views of any affiliated companies or organizations.

Demethanizer column: Original design

- This column was originally designed with 48 trays
- Since startup in 2016, the column has been limited by hydraulic flooding and high pressure-drop, preventing operation at its 125 tph nameplate capacity

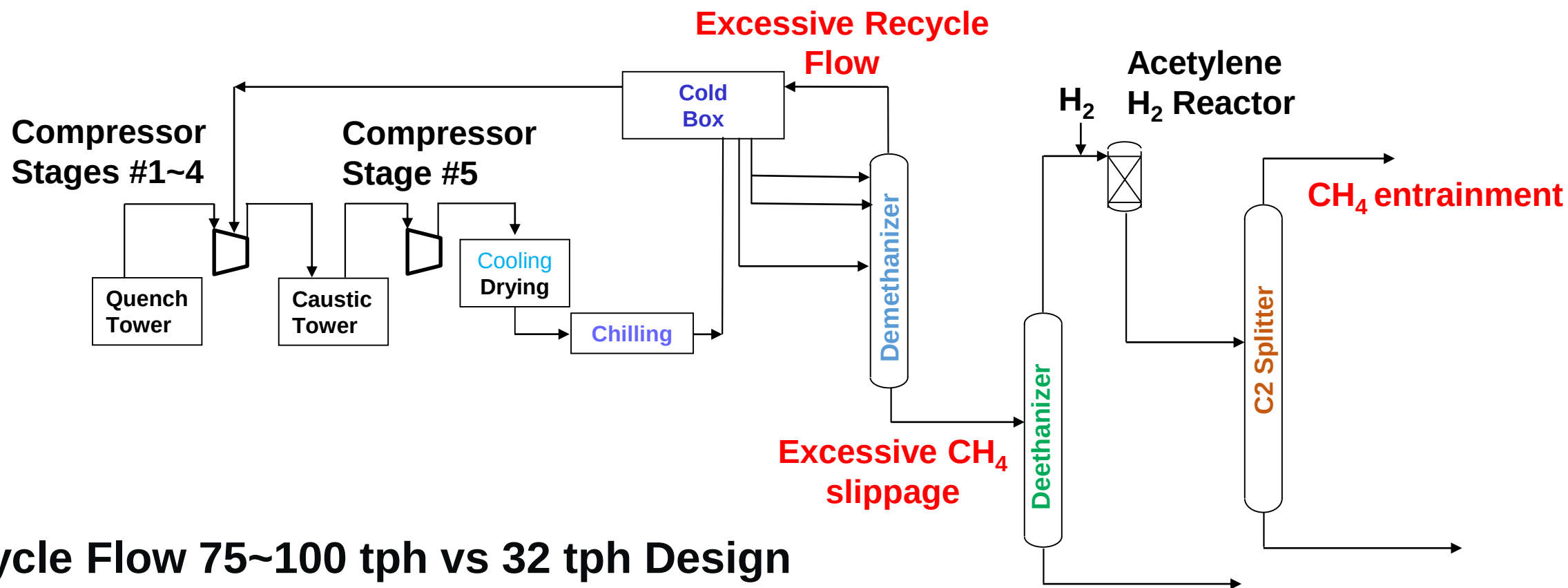


Demethanizer column: First troubleshooting



- In 2018, Demethanizer was revamped by replacing the original trays with three beds of high-capacity random packing and retaining two trays at the top.
- This modification effectively resolved the pressure drop issue, thereby enabling the production rate to reach its nameplate capacity of 125 tph. However...

Demethanizer column: Post troubleshooting operation results



- Recycle Flow 75~100 tph vs 32 tph Design
- 1,600~1,750ppm CH_4 slip vs. 200 ppm CH_4 Design
- Ethylene in the overhead 48.2mol% vs. 25.3mol% Design

Higher Recycle Rate

- Increased load on the Cracked Gas Compressor (CGC), resulting in higher energy consumption and operating costs.
- Potential compressor capacity constraints, limiting operating flexibility.

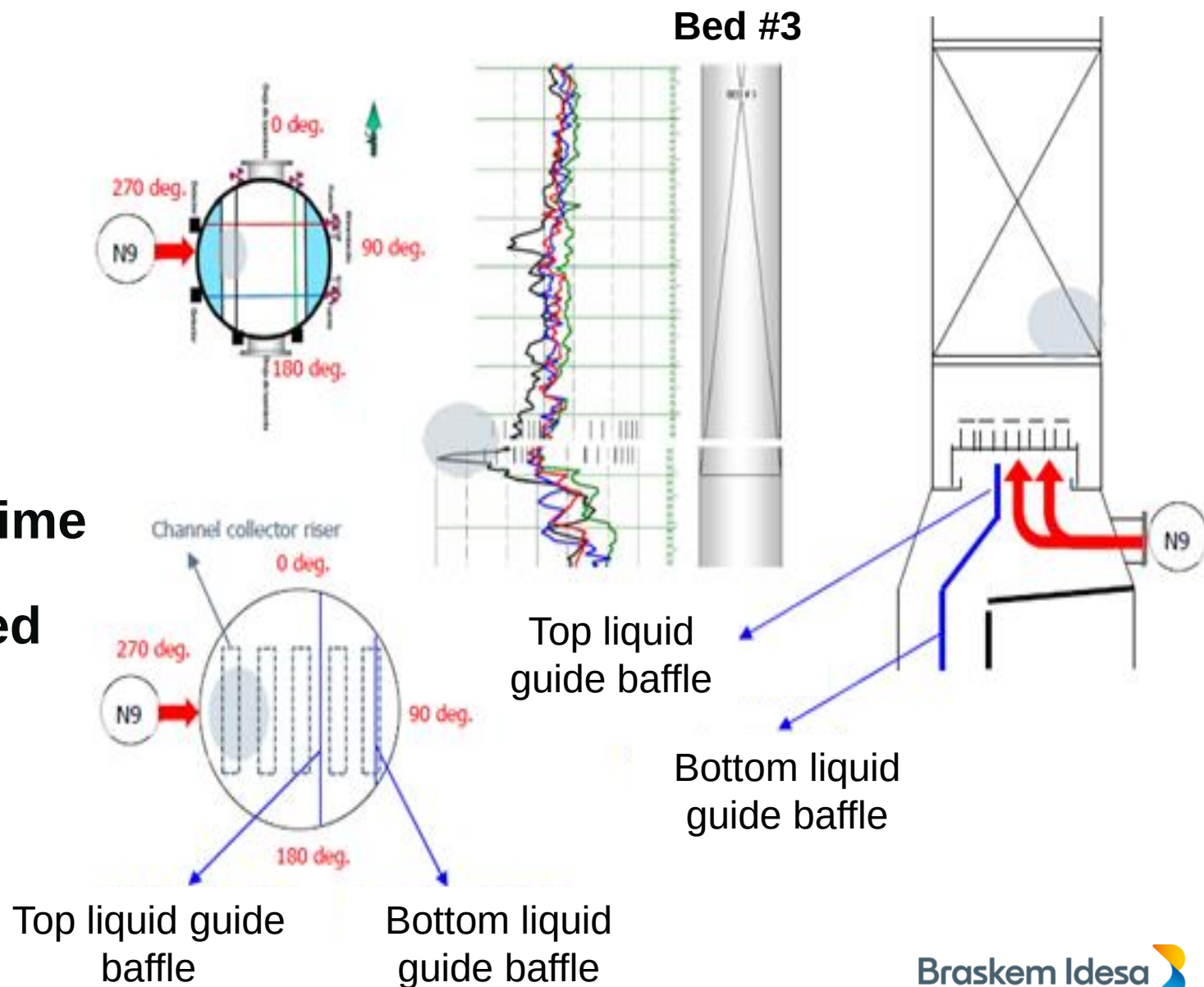
Elevated Methane in Bottoms Stream

- Increased risk of C₂ Splitter trips, impacting unit reliability.
- Higher C₂ Splitter vent rates, resulting in ethylene losses and reduced product recovery.
- Off-spec operation and increased flaring exposure.

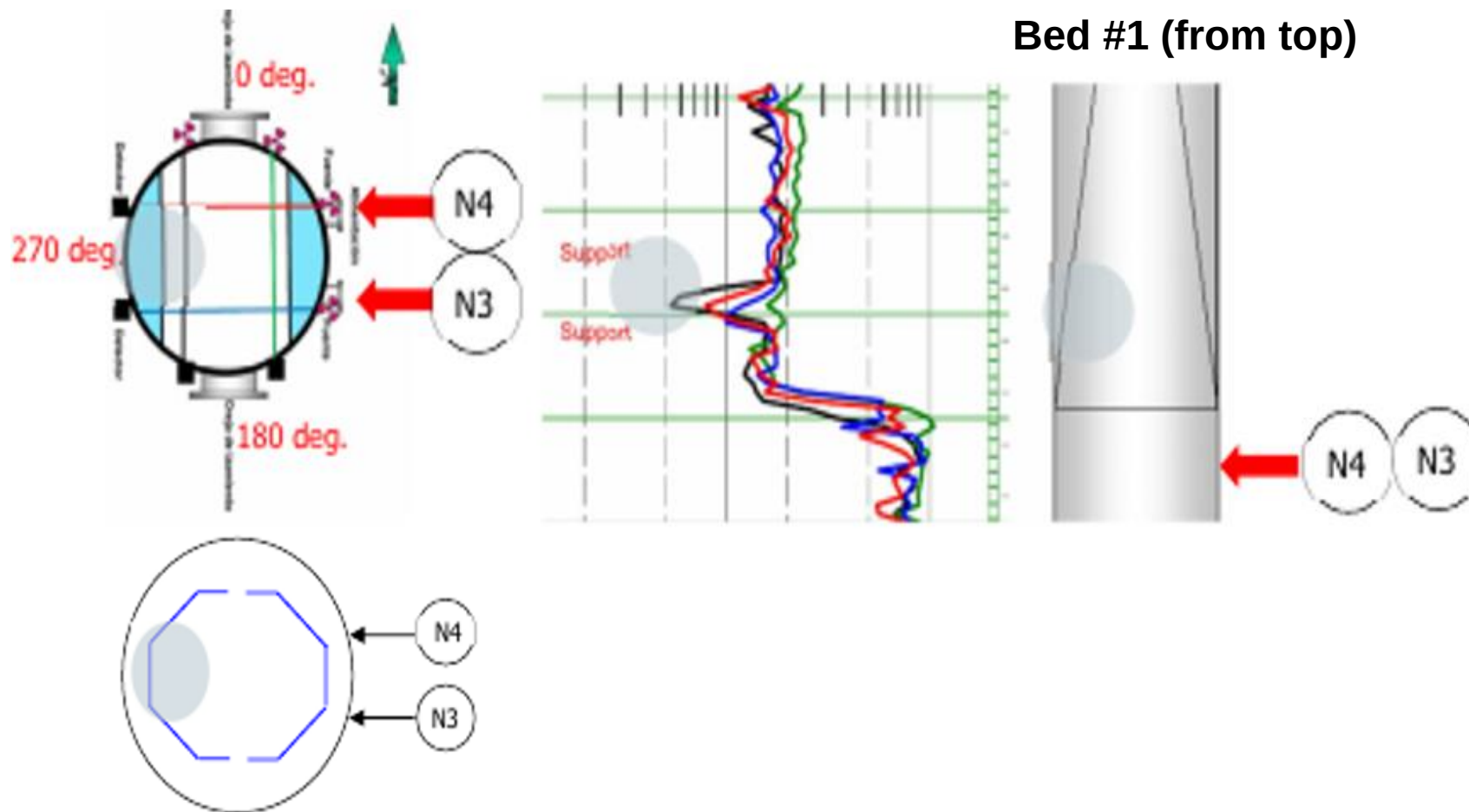
Low ΔT at the lowest bed (0.99 ~ 1°C)

Key Findings

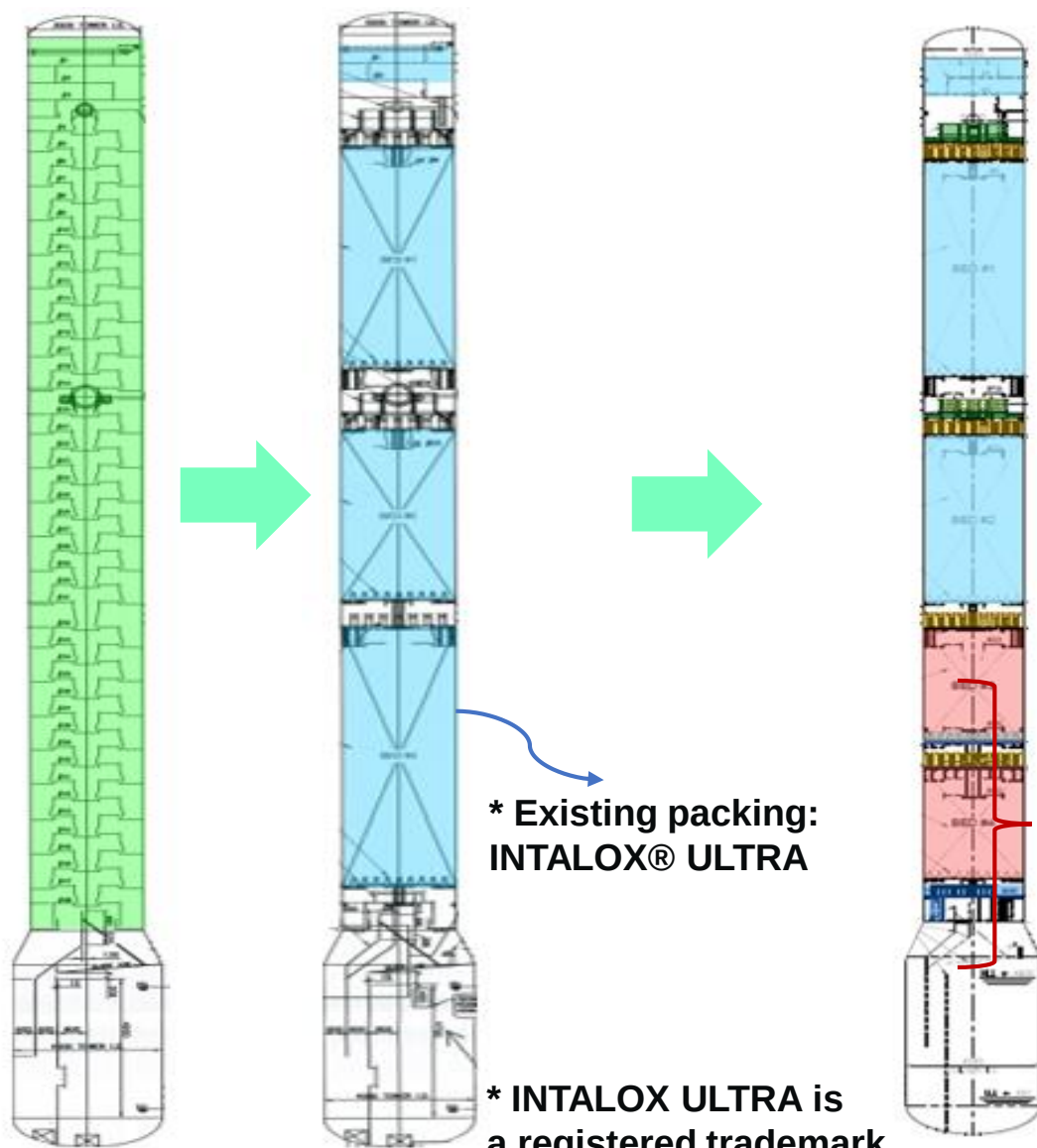
- 1) Excessive Bottom Bed Height
bed height >29 ft (8.9 m)
- 2) Liquid Distribution
Deck-Type w / Low Residence Time
- 3) Vapor Distribution to Bottom Bed



Flashing feeds from cold box carries high momentum



Demethanizer column: Equipment Design Focus



Proposed Solutions

Bed #1 - #2

- New liquid distributor
- New flash feed gallery

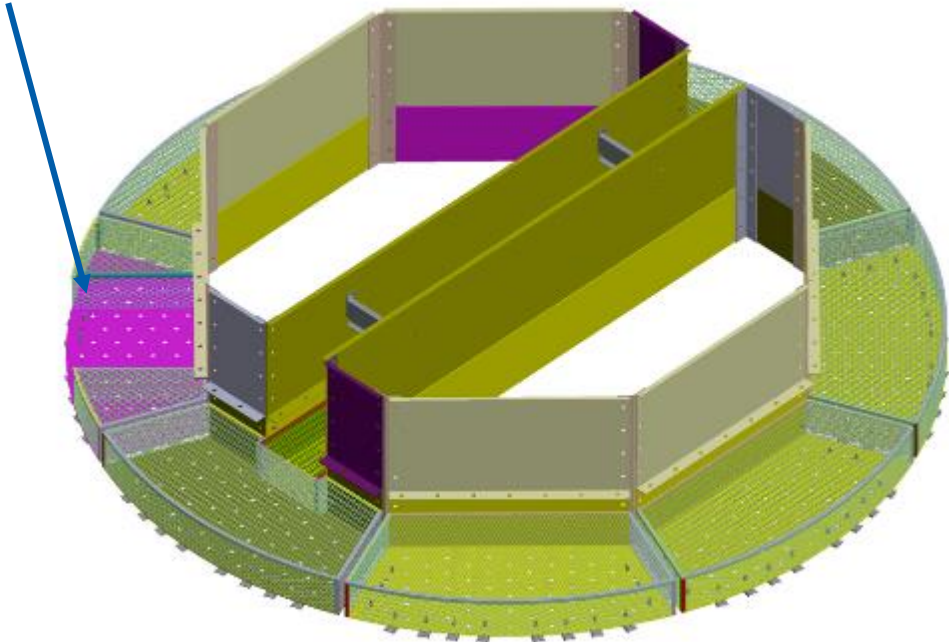
Bed #3 → Bed #3 & #4

- Upgraded liquid distributor
- New high performance random packing, G-SR™
- Vapor Distributor Integrated with Chimney Tray

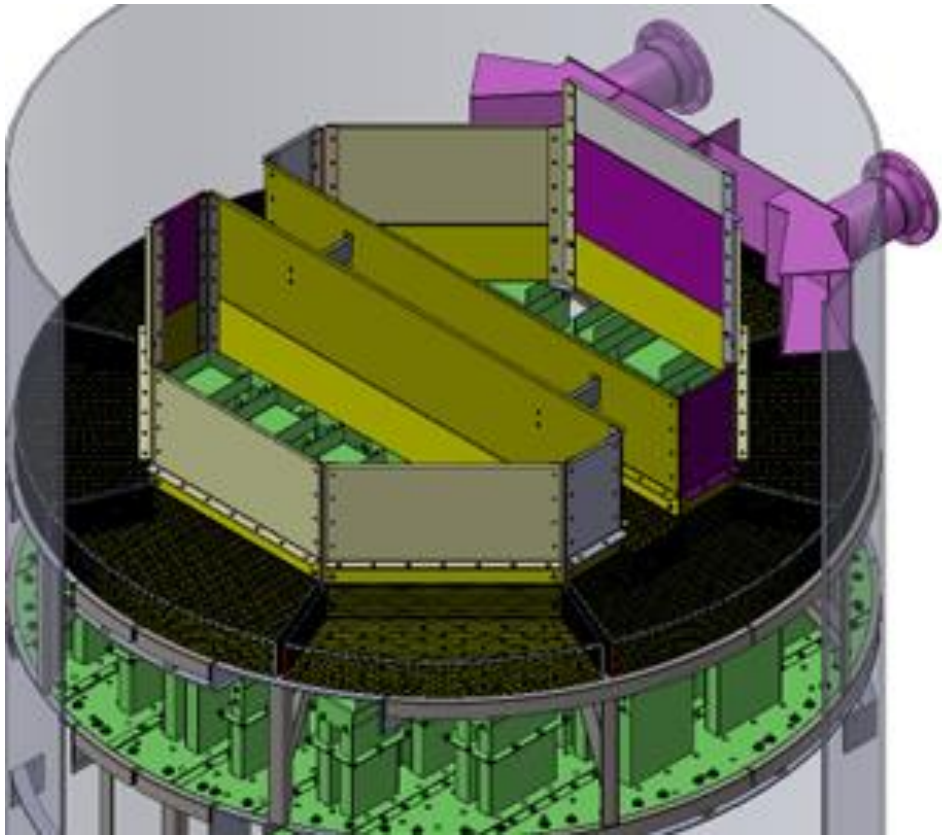


10 Feed Device Upgrade Enabling Two-Phase Disengagement Bed #1 and Bed #2

Diffuser added to gallery deck

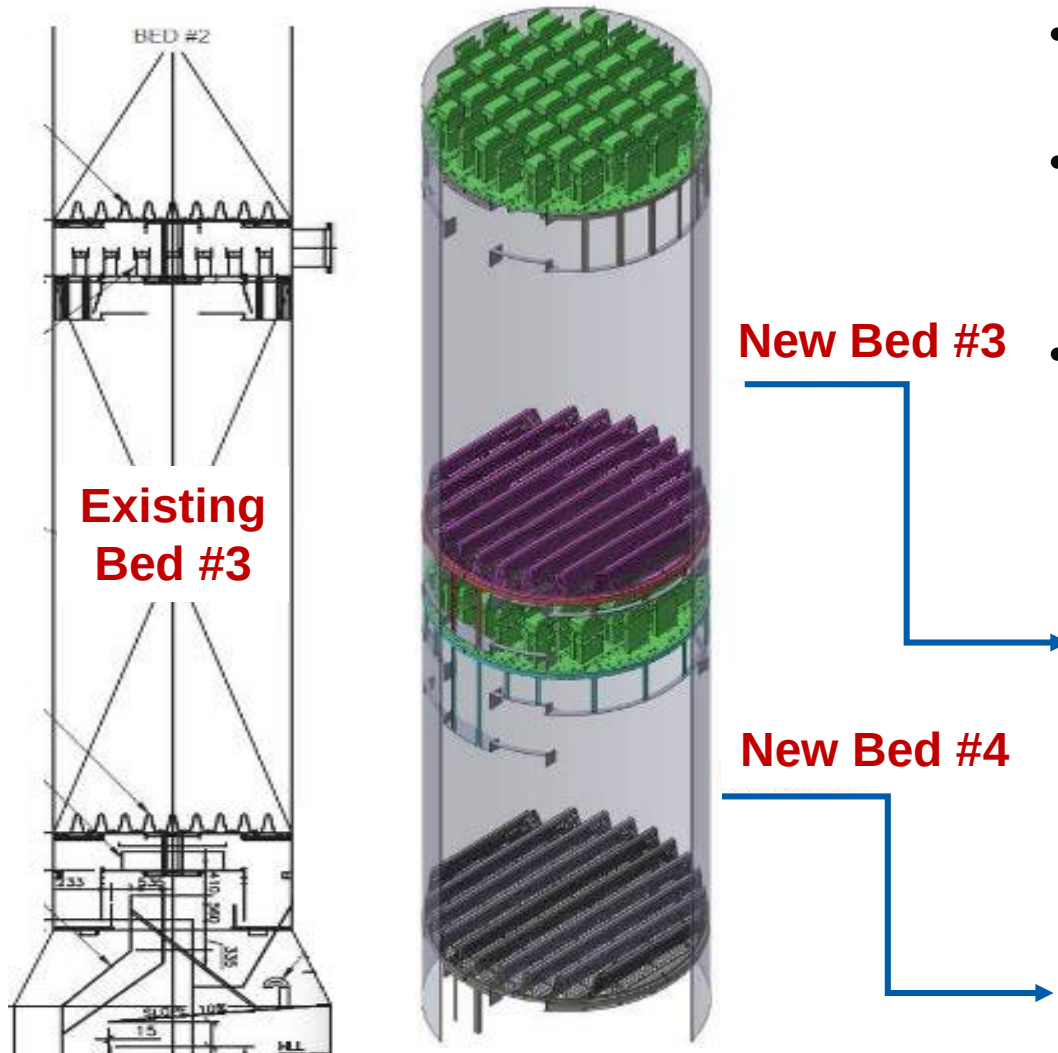


Modified Feed Inlets



Riser height Increased

11 Two-Bed Configuration Achieved Without Tower Shell Modifications



- Split Bed #3 into Two Beds
- Existing support rings reused from previous tray installation
- Rods tack-welded as needed to existing rings

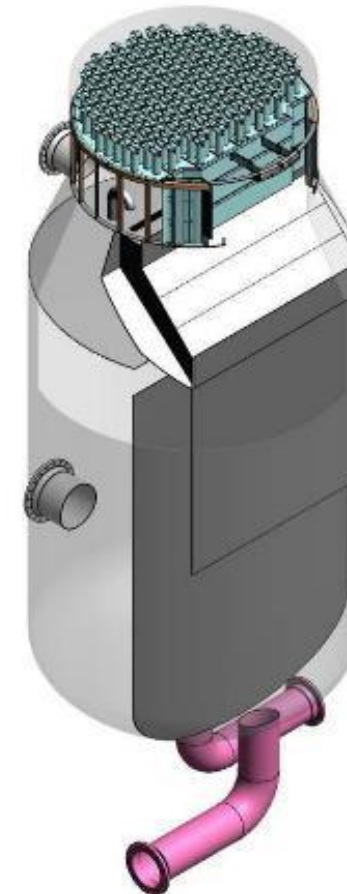


12 Key Findings and Solutions - Tower Bottom

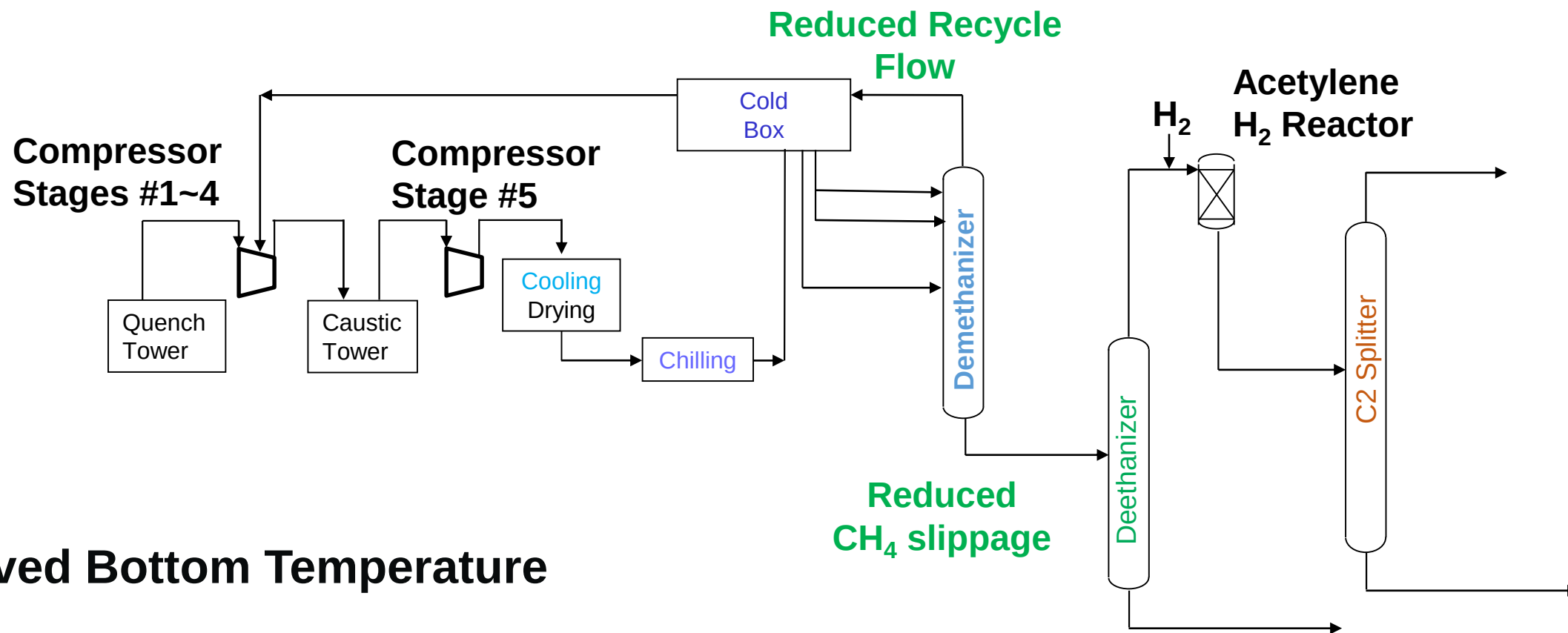
Existing vapor distributor occupied a small portion of the column diameter, limiting effective vapor flow



Solution: Replaced with round risers incorporating restriction plates to improve vapor distribution

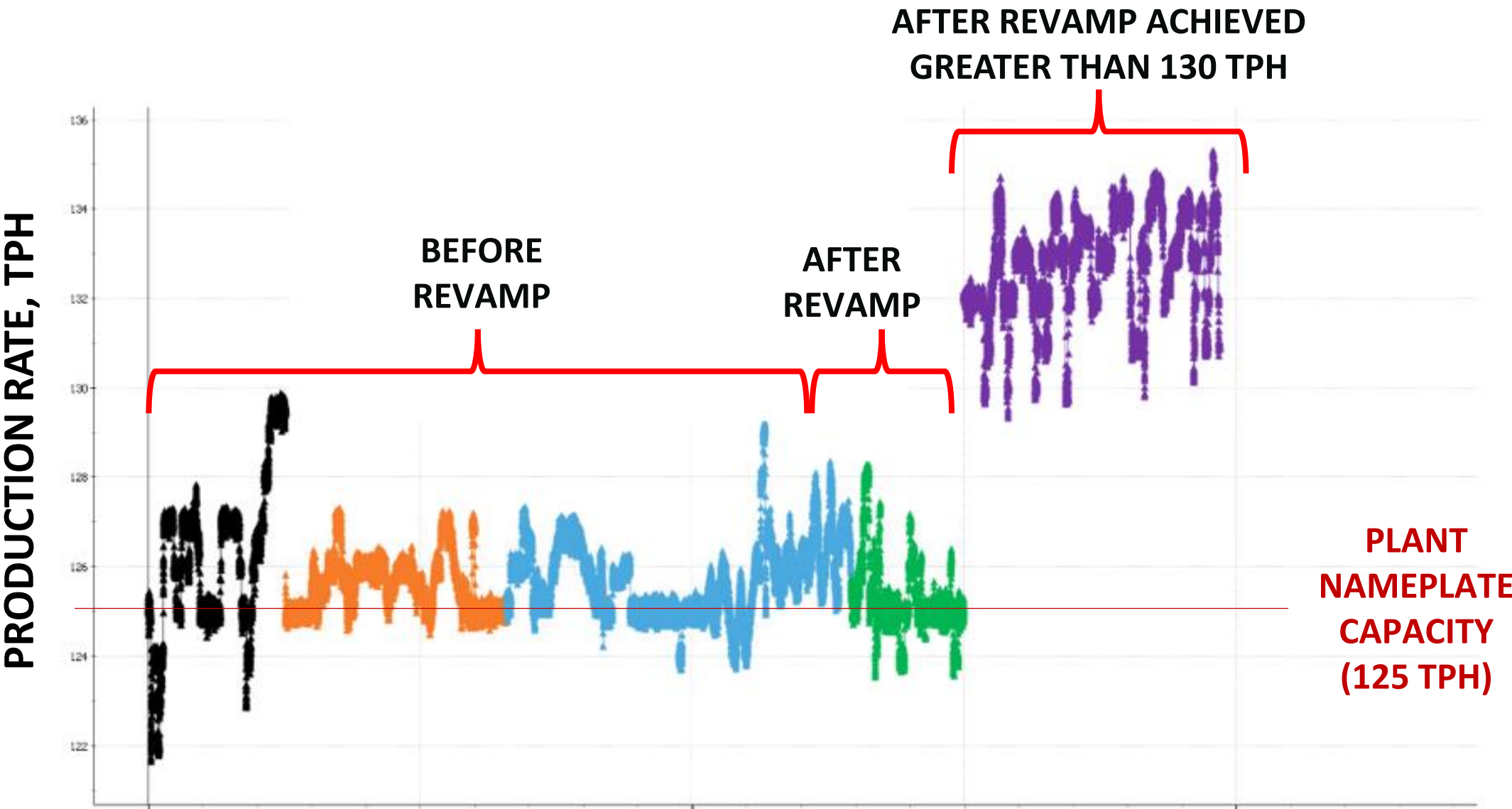


Demethanizer column: Post troubleshooting operation results

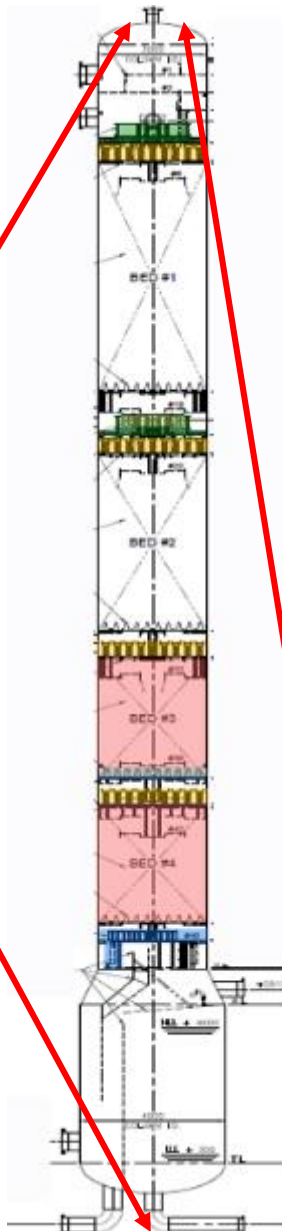
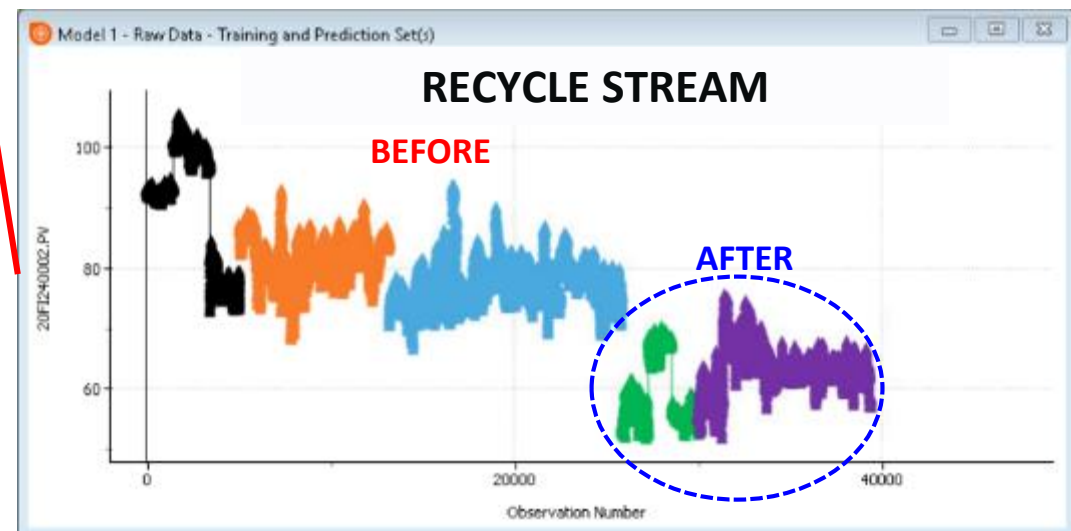
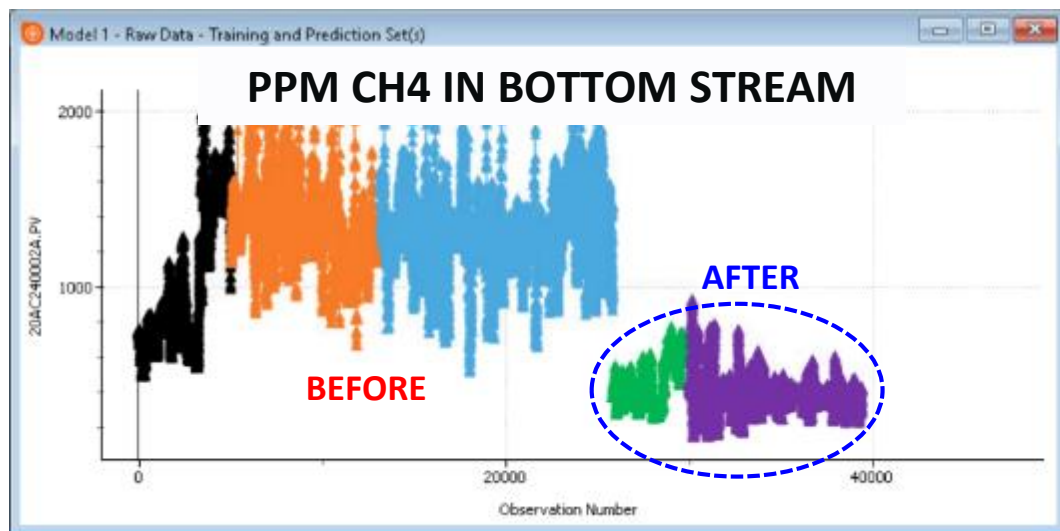
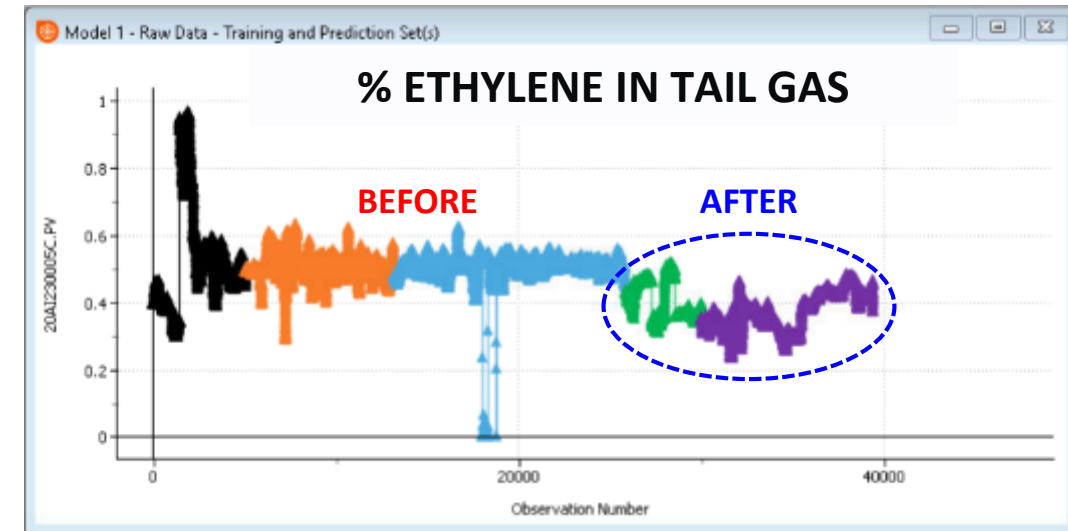
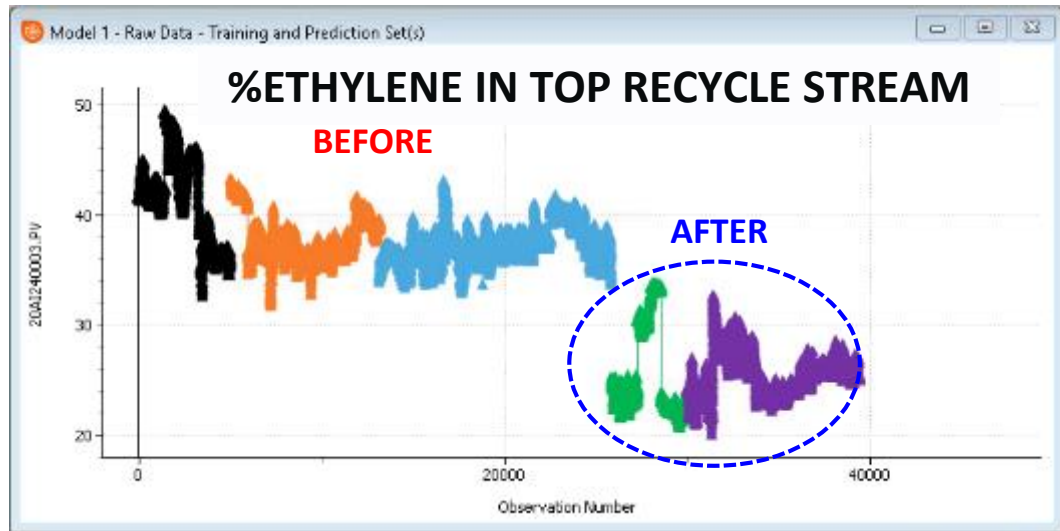


- Improved Bottom Temperature
- Reduced CH₄ Slip downstream
- Reduced Recycle Flow

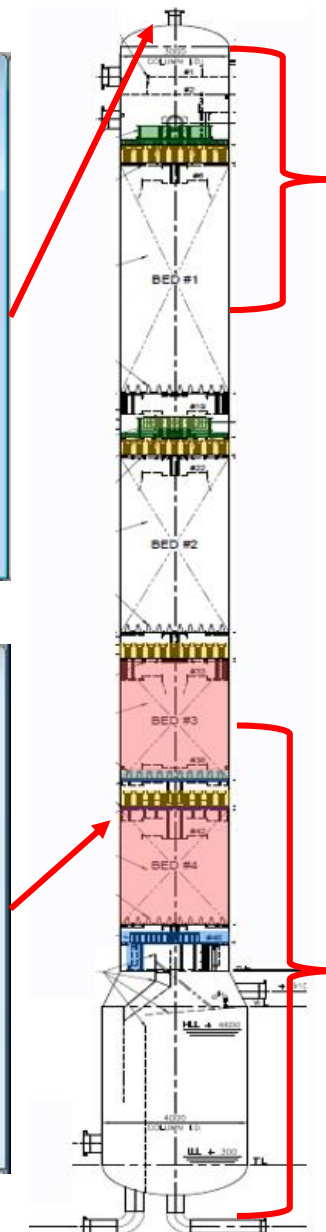
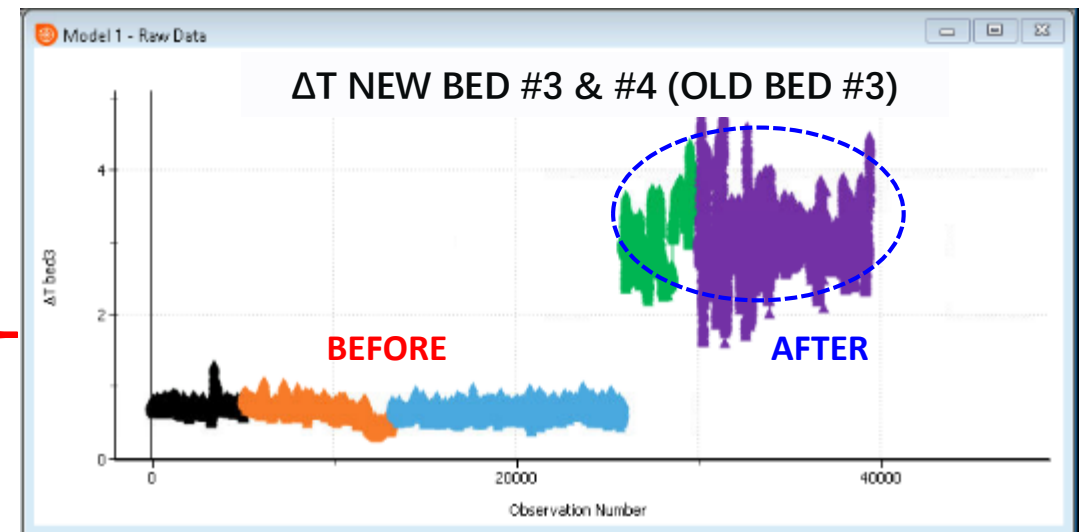
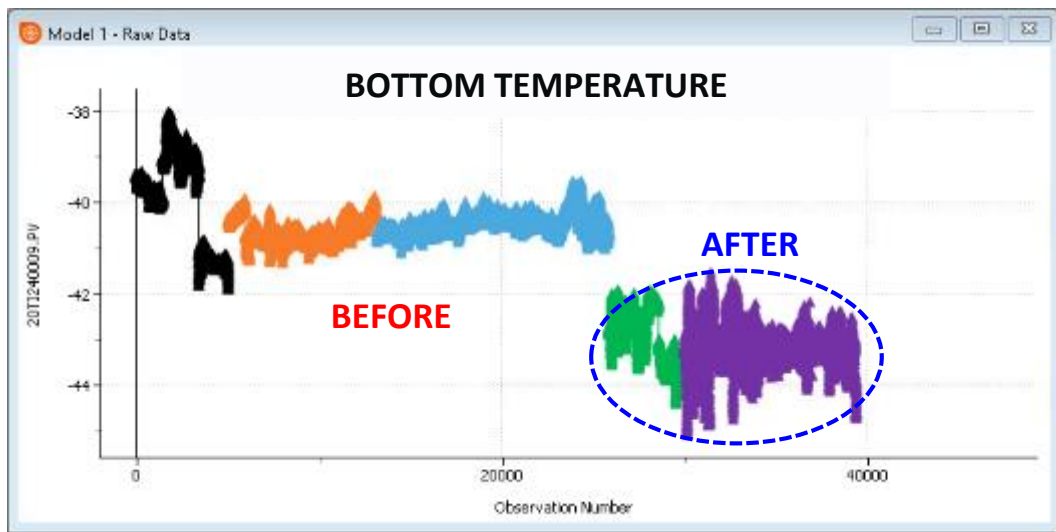
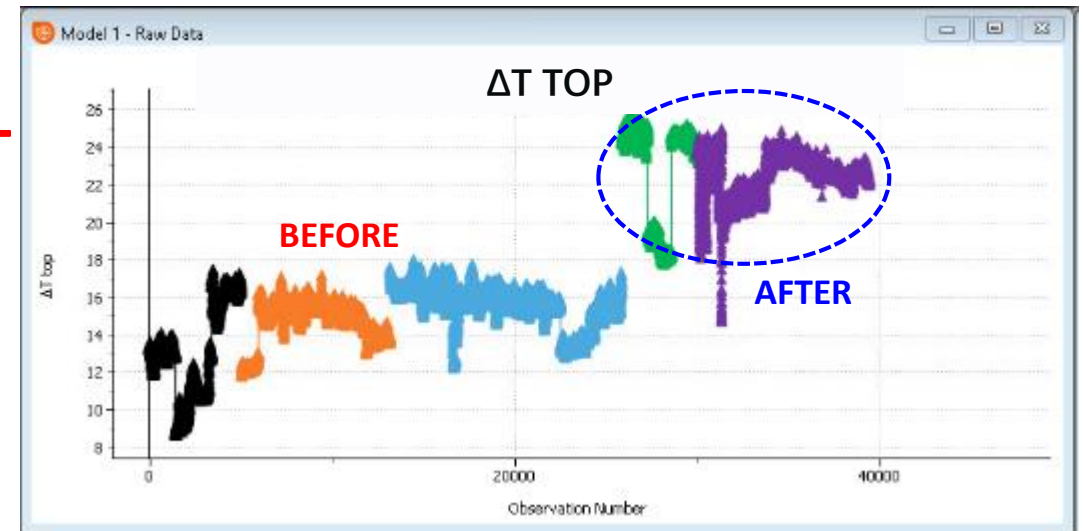
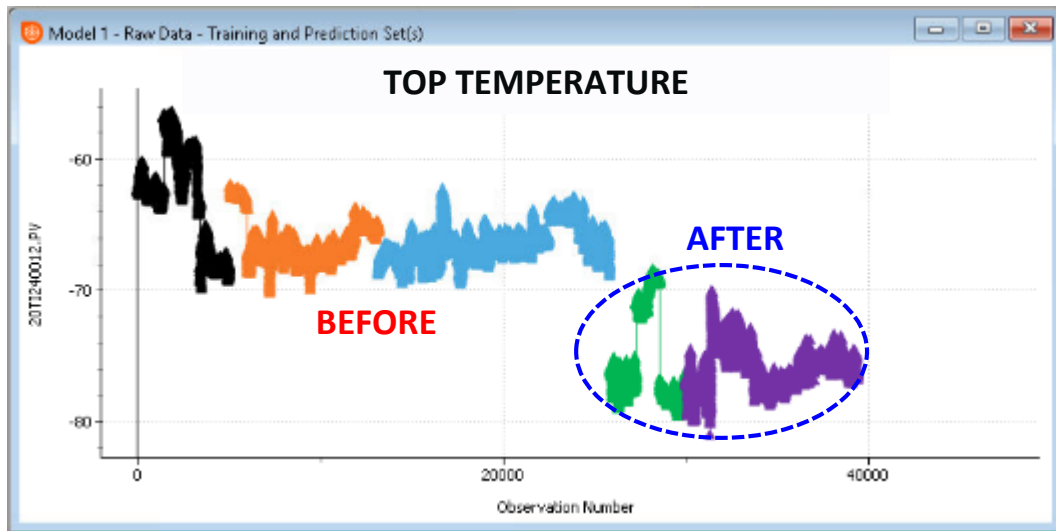
Column Capacity Evaluation Through Revamp Implementation



15 Post revamp column performance evaluation



16 Post revamp column performance evaluation



- The column temperature profile improved
- The top temperature reached the design value (-75°C)
- The top ΔT increased from 16°C to 25°C
- The bottom ΔT of bed #3 increased from 0.9°C to 4°C
- The percentage of ethylene in the recycle stream decreased by 38%
- Bottom impurities decreased by 65%
- The recycle rate decreased by at least 33%

- **Eliminating hydraulic limits does not guarantee good separation**
- **Packing bed height is critical in “fractionation” applications**
- **Feed momentum and flashing behavior must be explicitly managed**
- **Liquid and vapor distribution are equally important**
- **Plant data (temperature profile, ΔP , etc.) are powerful diagnostic tools**

Thank you!

