Saudi Aramco TOTAL Refining & Petrochemical Company (SATORP)

Saudi Arabia's First Delayed Coker Unit

Maximizing DCU Liquid Yields from Arabian Heavy Feedstock

Presenter: Essam Al-Otaibi
Operation Engineer, SATORP

REFCOMM
BAHRAIN
8-12 NOVEMBER 2015

2 *Nations*

ساتورب
satorp

Complex Deep Conversion Refinery with high level of Automation.

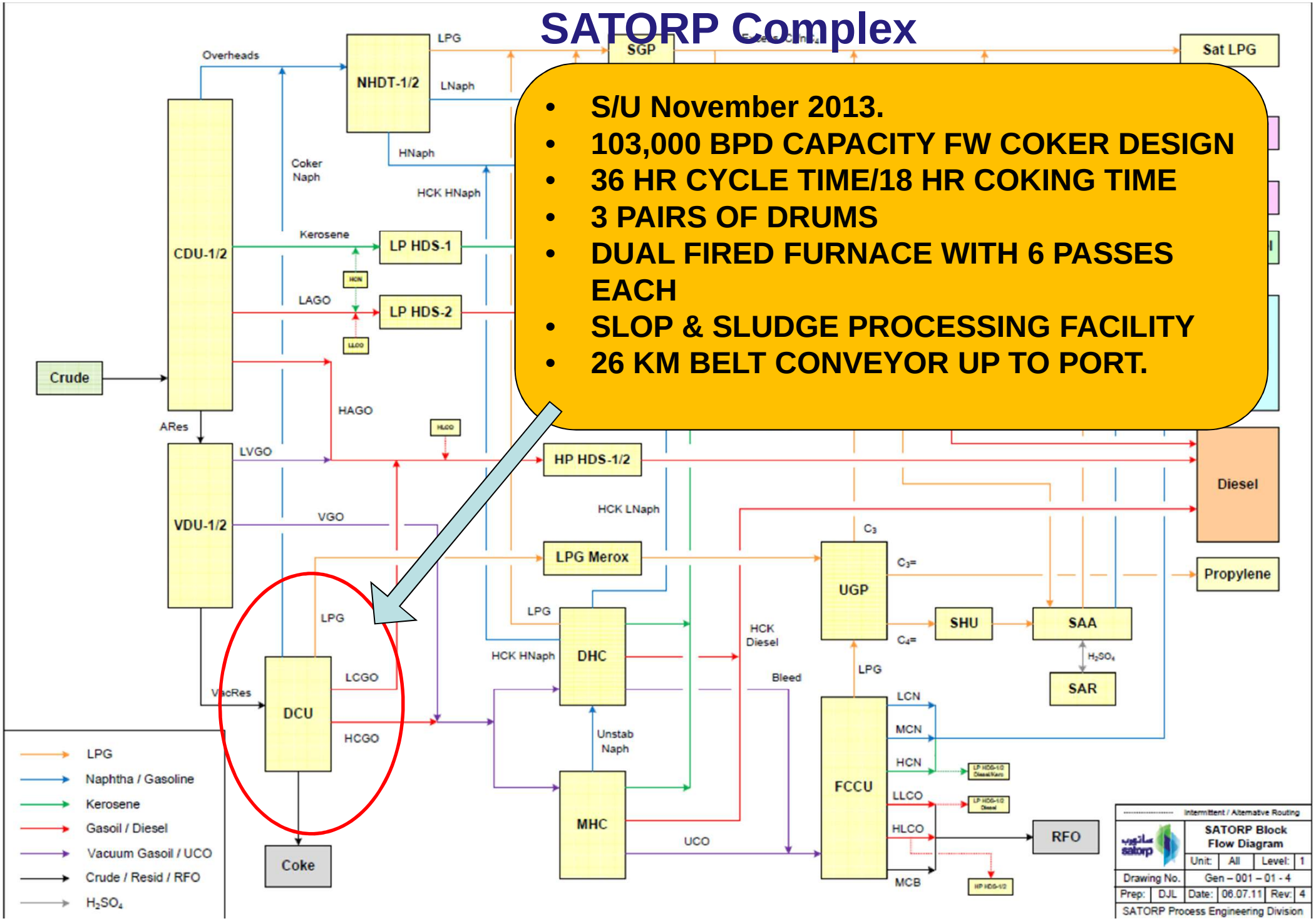
Equipments of a Complex & Sophisticated Refinery	
Pumps	1,260
Vessels	866
Analyzers	600
Columns	121
Compressors	80
Reactors	68
Boiler & Furnaces	43
Loops	120,000

- Refined High Value Product Complying with most Stringent International Specifications.
- 400 kbd of Arabian Heavy.
- Full Conversion; Integrated with Petrochemical.
- Solomon Benchmark Ranking #7 in complexity index among more than 300 Refineries worldwide.

ساتورب
satorp

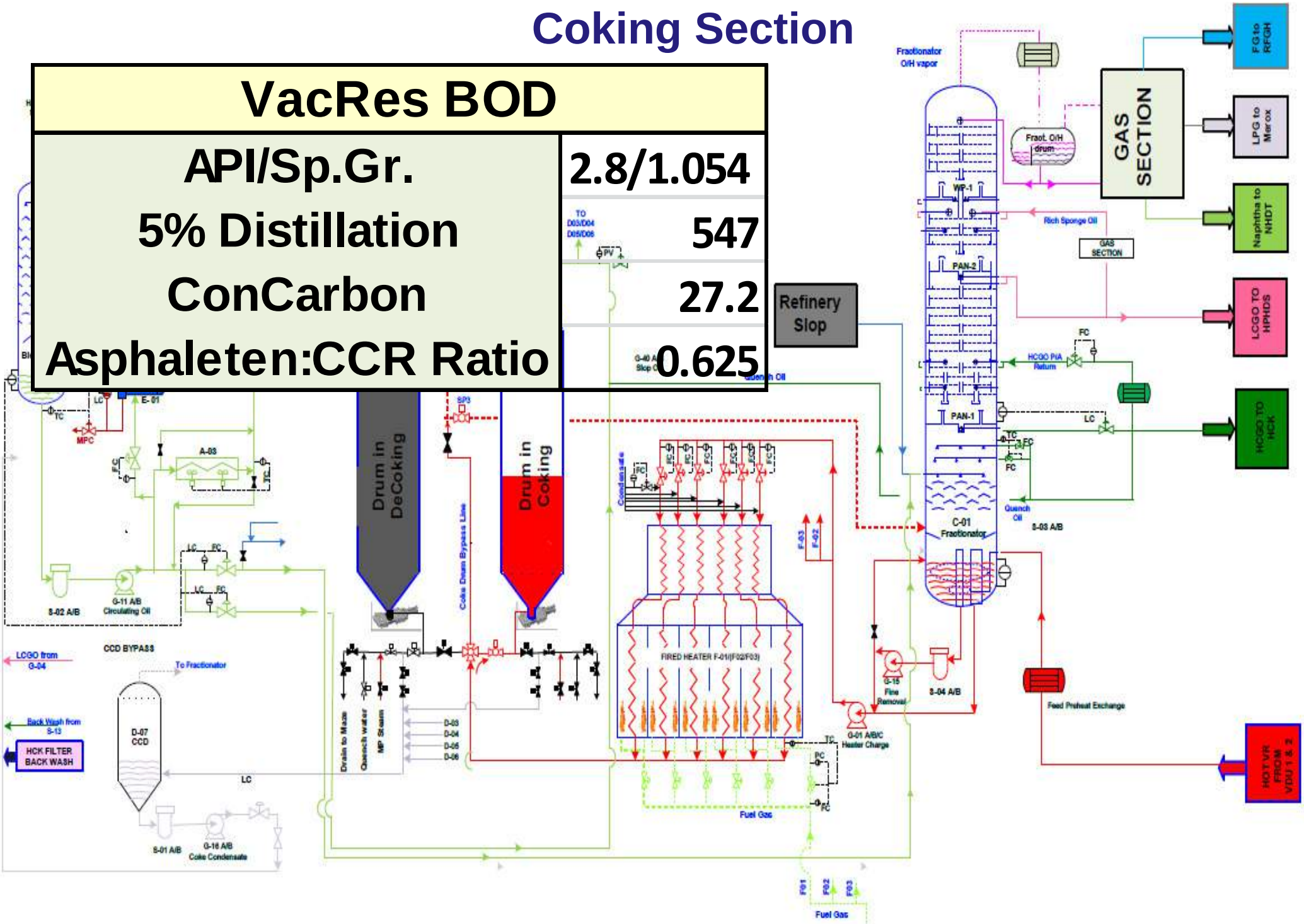
SATORP Complex

- S/U November 2013.
- 103,000 BPD CAPACITY FW COKER DESIGN
- 36 HR CYCLE TIME/18 HR COKING TIME
- 3 PAIRS OF DRUMS
- DUAL FIRED FURNACE WITH 6 PASSES EACH
- SLOP & SLUDGE PROCESSING FACILITY
- 26 KM BELT CONVEYOR UP TO PORT.

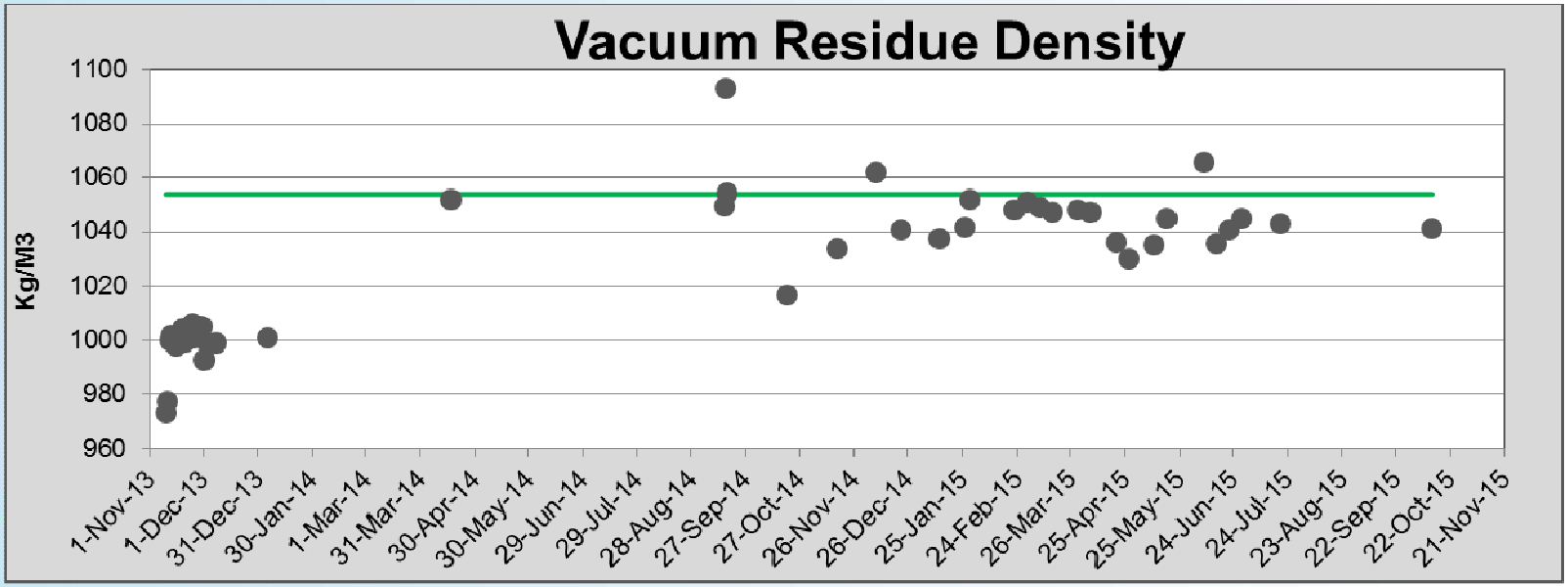


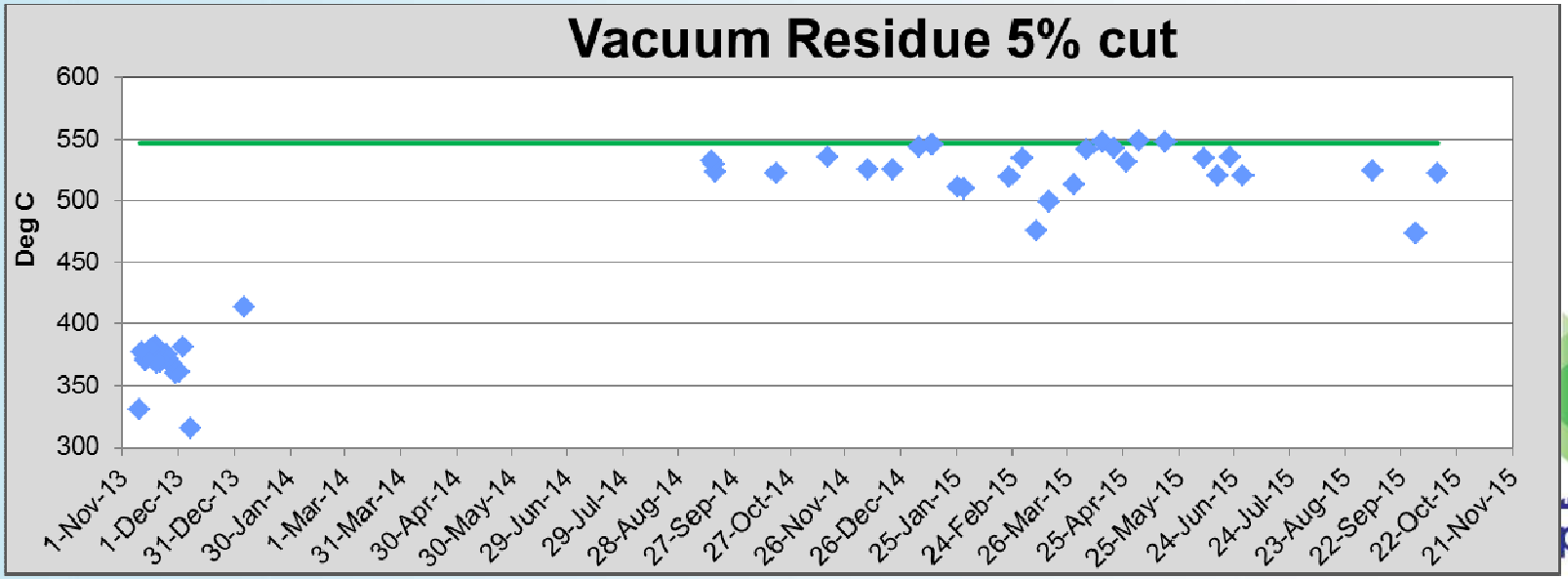
Coking Section

VacRes BOD	
API/Sp.Gr.	2.8/1.054
5% Distillation	547
ConCarbon	27.2
Asphaleten:CCR Ratio	0.625

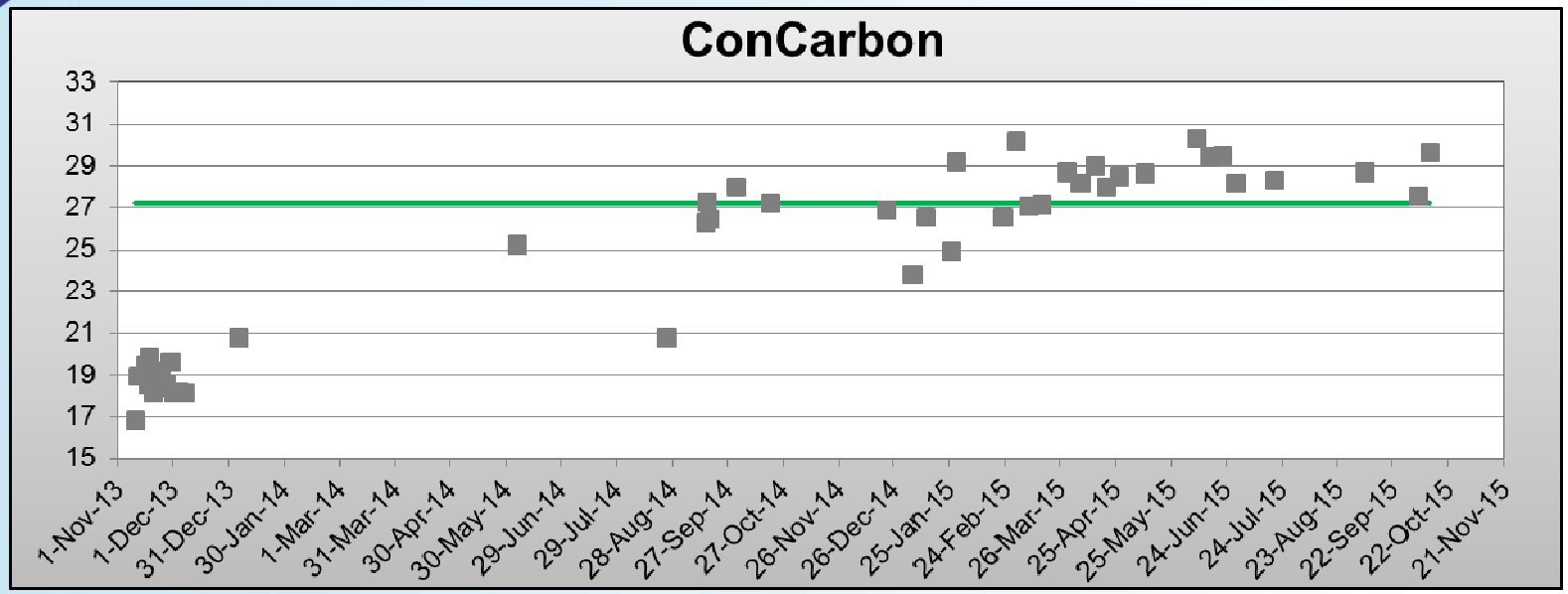


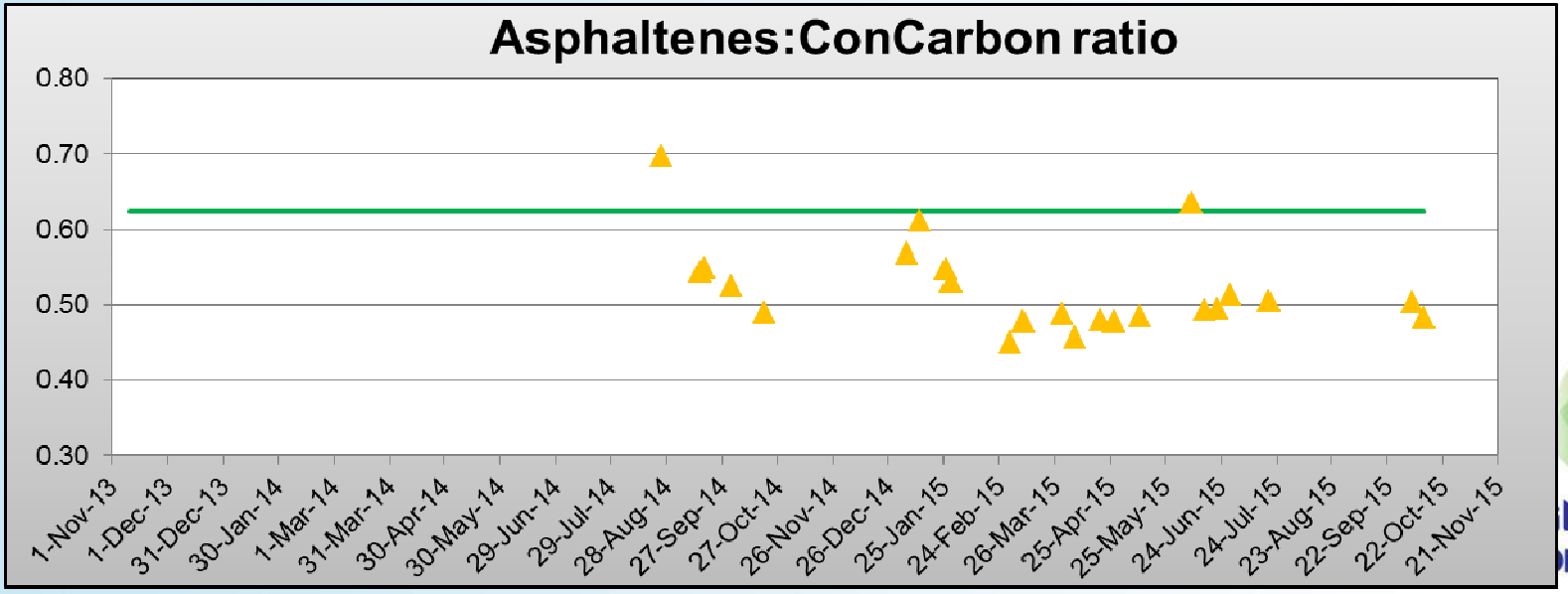
Feed Quality





Feed Quality





Basis of Design

Design Operating Conditions	
Coil Outlet Temperature	496 ºC
Drum Pressure	1.03 Bar
Recycle Ratio - Normal /Flexibility	17% (5% - 20%)
Quenched Vapor Temperature	425 - 433 ºC

Liquids & Coke Yields	
Liquids (C5+)	56 – 58 wt%
Coke	32.9 – 34.6 wt%

ساتورب
satorp

Key Parameters to Improve Liquid Yield

- **Improving liquid yield by 1% results in 8% additional margin per ton of VR processed.**
- **Below are the parameters that we have manipulated to increase the liquid yield:**

Temperature:

- Drum Inlet
- Vapor Outlet
- COT

Recycle Ratio:

- Wash Oil
- Vapor Line Quench
- Wash Zone Design

Pressure:

- Coke Drum Pressure

Additives:

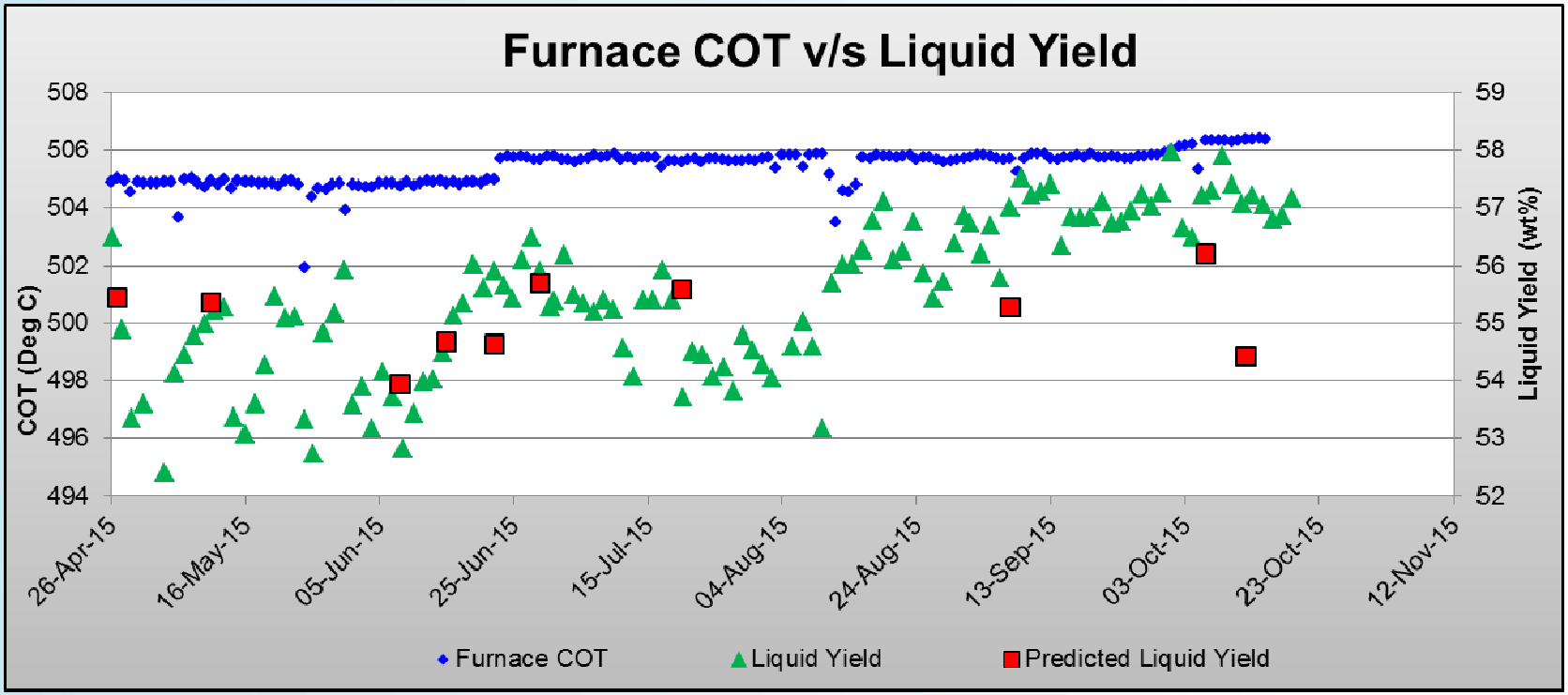
- Additives to Boost Liquid Yield

ساتورب
satorp

Temperature Improvement Plan

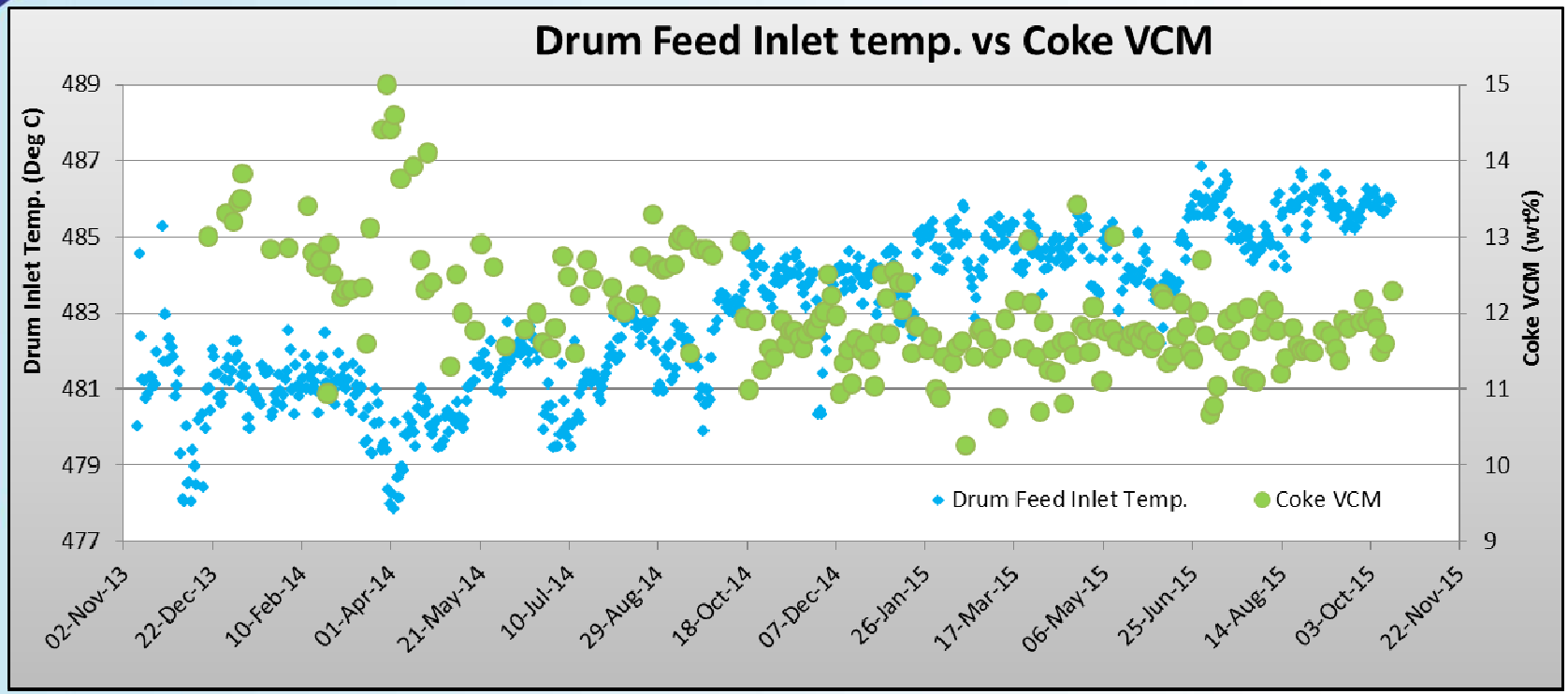
	Current Position	Forseen
Temperature	COT – increased to 506 º C (10 º C higher than design)	Further 2 – 4 º C
	Drum Inlet Temperature increase by 5 – 6 º C (current 486 º C)	Up to 490 º C - Further COT. - Ongoing Insulation improving project.

Temperature vs. Liquid Yield



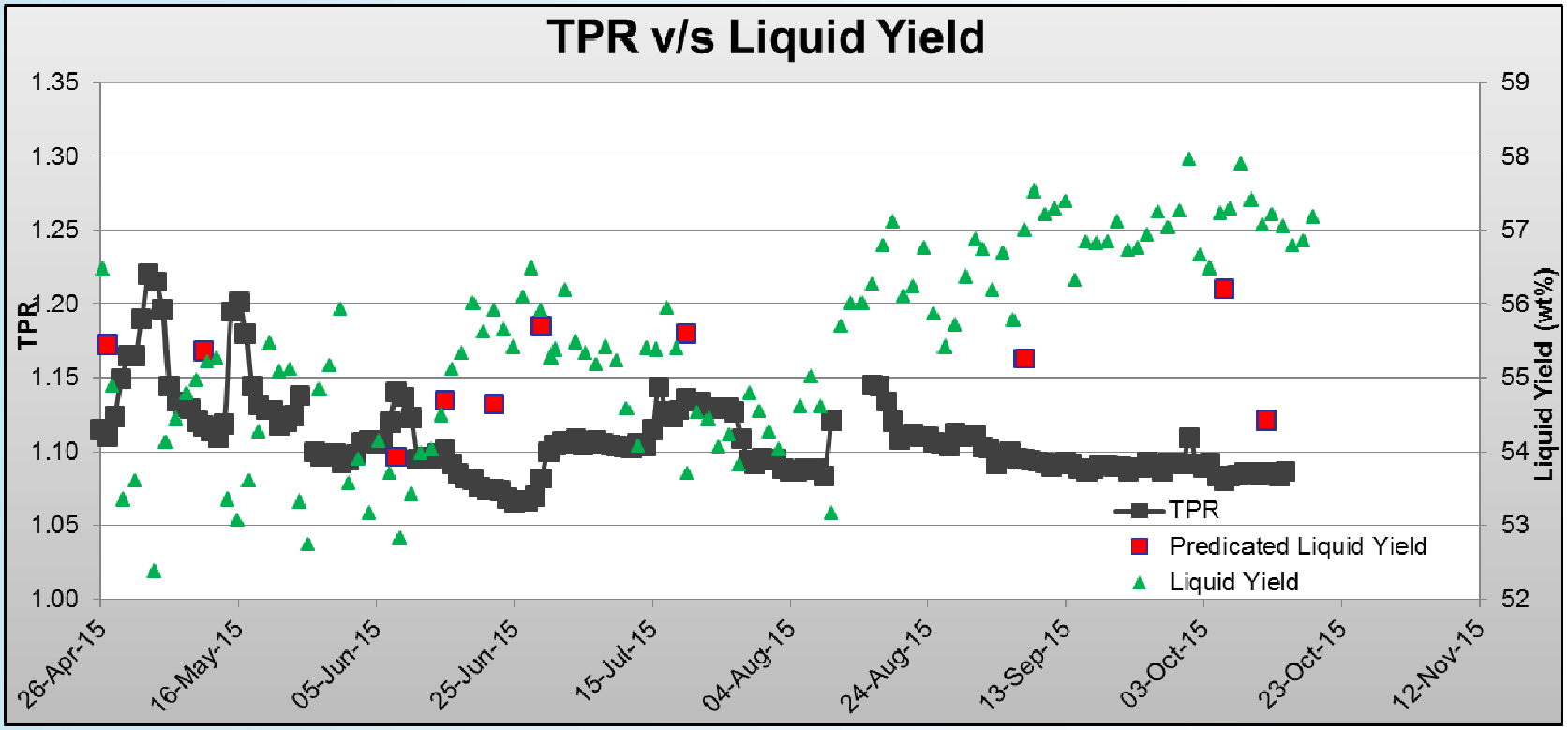
- Predicted Yield based on CCR.
- COT increase.

Drum Inlet Vs. Coke VCM



- Temperature drop across the transfer line.
- Foreseen inlet temperature.

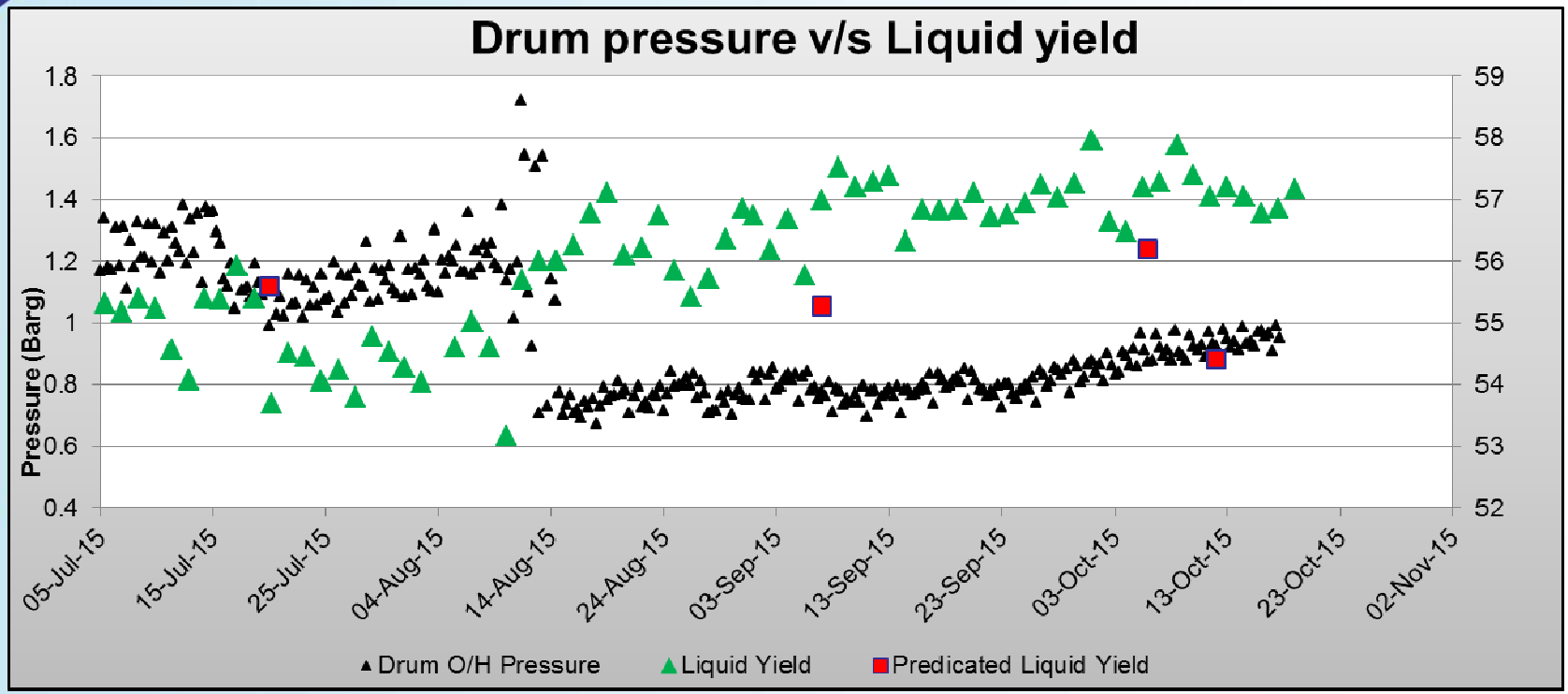
TPR – Liquid Yield



- Stopping Hydrocarbon to flash zone (BD,CCD).
- Routing fractionator bottom fine removal pump to heater charge pump.
- Optimizing Heavy service seal oil (plan-32).

ساتورب
satorp

Pressure



- Recovery of liquid yield is higher after overhead line cleaning.
- Vapor line cleaning frequency.
- Upstream unit VGO slippage recovery.

Further Improvement

- Chemical Additives.
- Reducing partial pressure of hydrocarbon by increasing condensate rate (velocity medium).
- Improvement of flash zone.

Conclusion

Although we have improved yields, and are operating in what is outside of accepted rule of thumb and even design conditions, we will continue to push further for the maximum DCU liquid yield.

THANK YOU.

Q & A

ساتورب
satorp