



DMC3 APPLIED TO C3 FRACTIONATORS

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Braskem 

A G E N D A

1. Corporate Presentation
2. Braskem APC Applications
3. Motivation and Objectives
4. Project Main Steps
5. Control Design
6. Results and Benefits

COMPETITIVE INTEGRATION**EXTRACTION**

Raw Materials

1st GENERATION

Basic Petrochemicals

2nd GENERATION

Thermoplastic Resins

3rd GENERATION

Plastic Converters

An offshore oil rig is shown in the background of the first stage. The rig is a complex structure of steel and concrete, situated in the middle of the ocean. In the distance, a coastline with hills and buildings is visible under a clear sky.

NAPHTA
NATURAL GAS
ETHANOL
SALT

A close-up view of large, white industrial pipes, likely part of a petrochemical processing plant. The pipes are curved and have a metallic sheen.

ETHYLENE
PROPYLENE
CHLOR-ALKALI

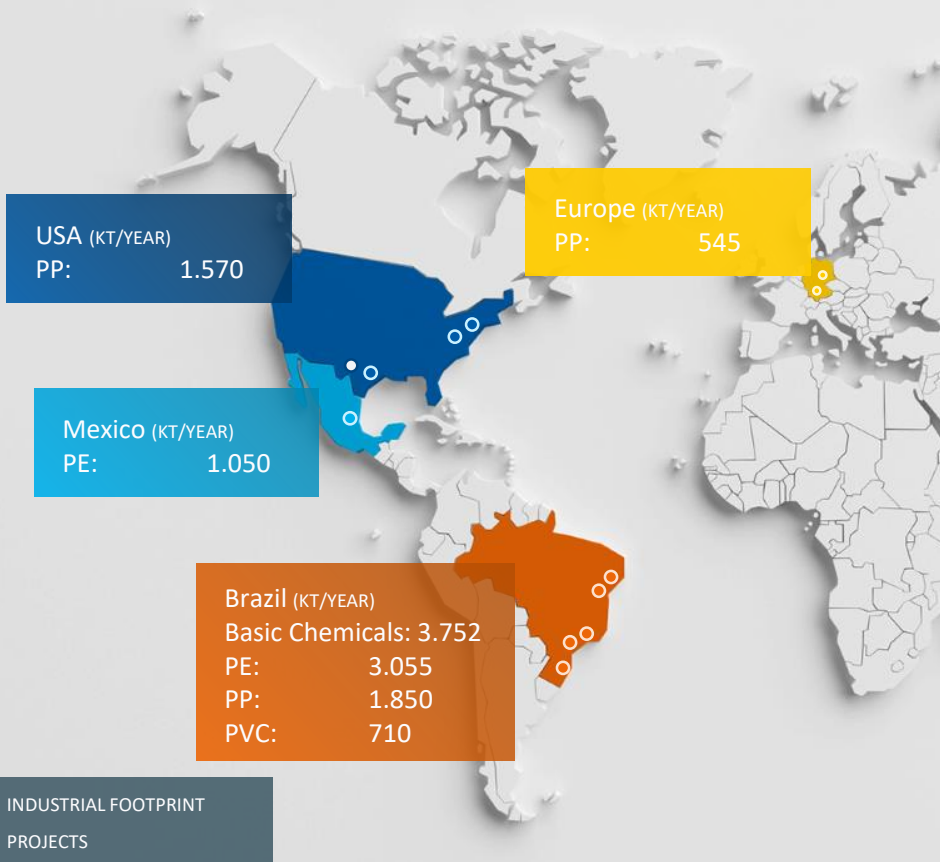
A close-up view of numerous small, blue, spherical plastic pellets, which are the raw material for many thermoplastic resins.

PE
PP
PVC

A collection of colorful plastic products, including a yellow and blue plastic cup, a red plastic container, and a red plastic bag with a white tag that says "I'm green".

I'm
green

41 INDUSTRIAL UNITS WORLDWIDE



UNITED STATES

Pennsylvania	1 PP
West Virginia	1 PP
Texas	3 PP 1 UTEC

MEXICO

Veracruz	1 CRACKER 3 PE
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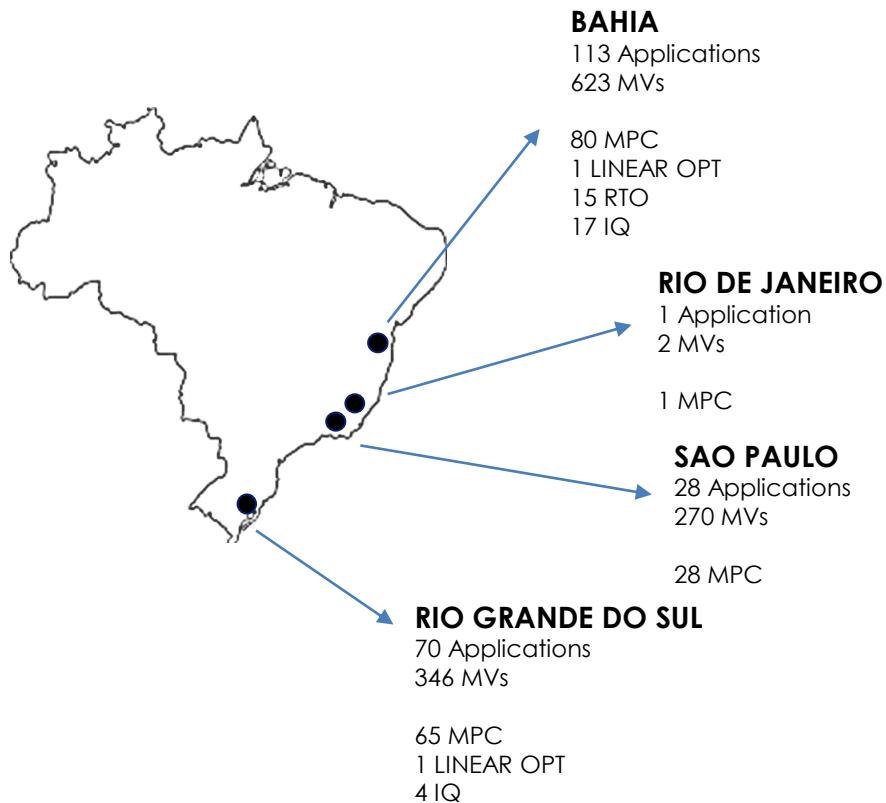
GERMANY

North Rhine	1 PP
Saxony-Anhalt	1 PP

BRAZIL

Bahia	1 CRACKER 4 PE 1 PP 1 PVC CHLOR-ALKALI
Alagoas	2 PVC 1 CHLOR-ALKALI
São Paulo	2 PE 2PP 1 CRACKER 1 SPECIALTIES
Rio de Janeiro	1 CRACKER 1 PE 1 PP
Rio Grande do Sul	2 CRACKER 5 PE 2PP

210 DMC Controllers



Recent autonomous projects had allowed new investments on APC developments and revamps.

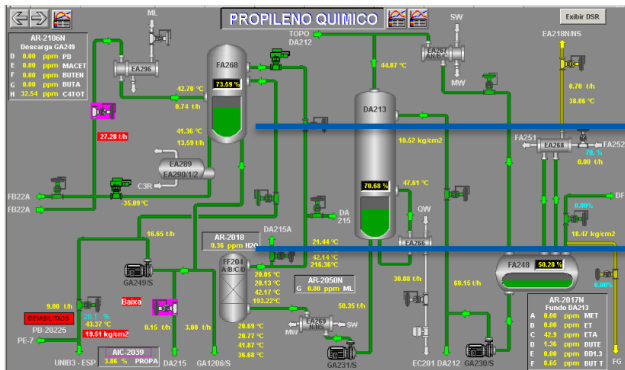


Braskem 2018 APC Program:

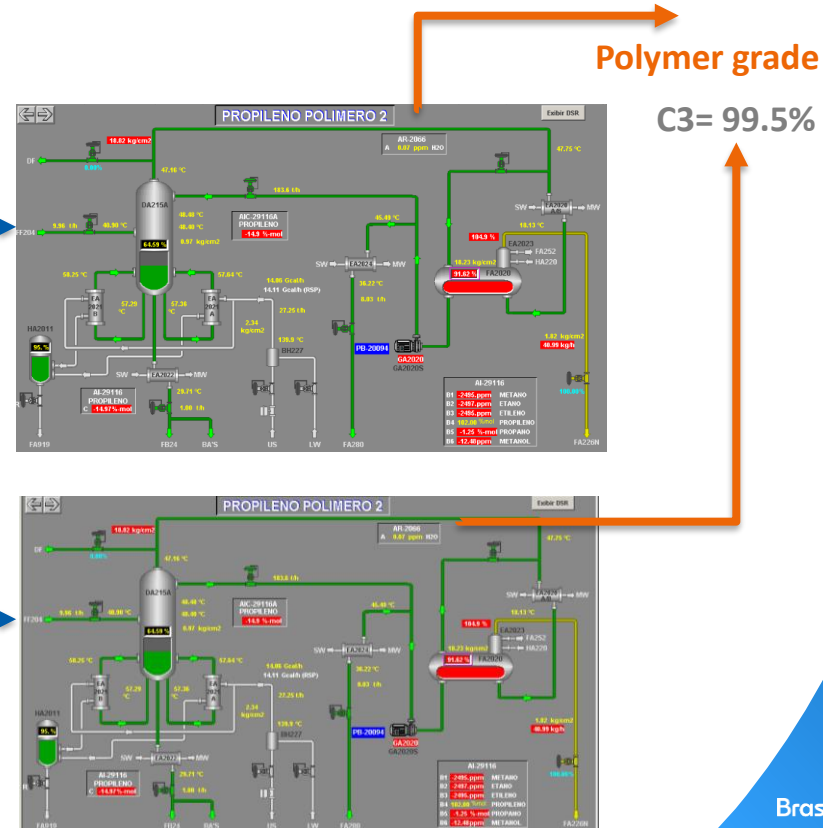
8 simultaneous projects among Brazilian sites

Motivation and objectives

- **SCOPE:** Apply DMC3 strategy in both C3 fractionators columns - they operate in parallel, receiving feed from the same vessel.
- **CHALLENGES:**
 - High losses of propylene on bottoms flow.
 - Columns with high time constants (~15h), regulatory PIDs were not able to deal with it.
 - Hard quality control.
 - Feed flow changes a lot.



C3= 90%



OBJECTIVE: Propylene losses reduction on columns bottom flow

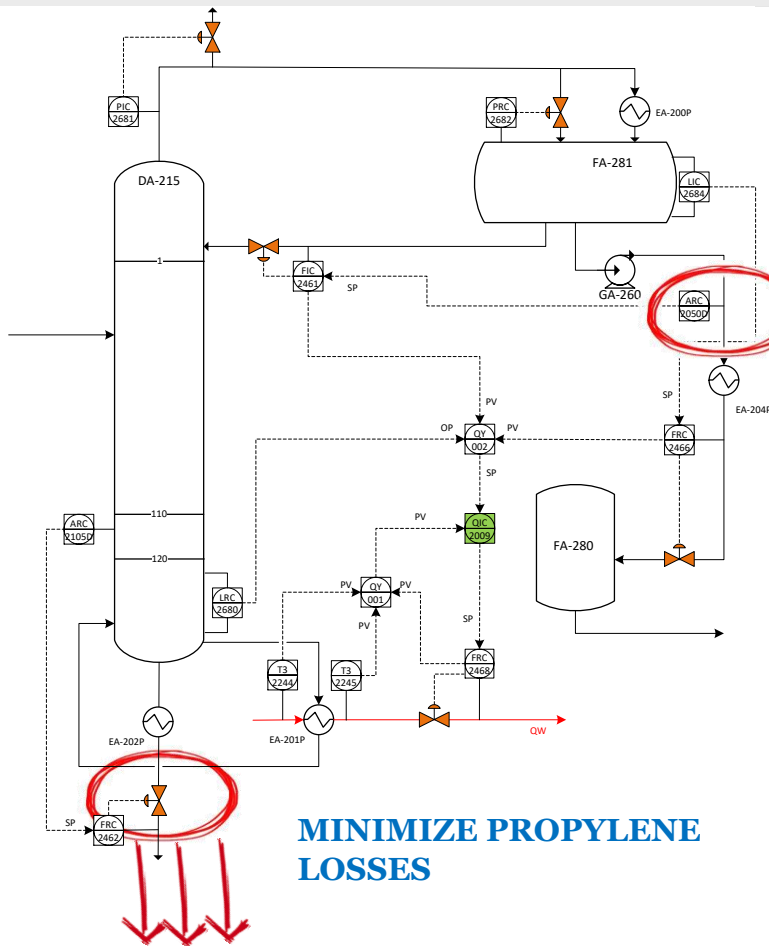
Bottoms are sold as LPG or used as monomer to (smaller price)

Control propane on final product (column top)

\$\$\$ Economic and quality benefits: losses are minimized and final product is under specification

Less valuable stream:

- GLP
- Nonene
- Tetramer



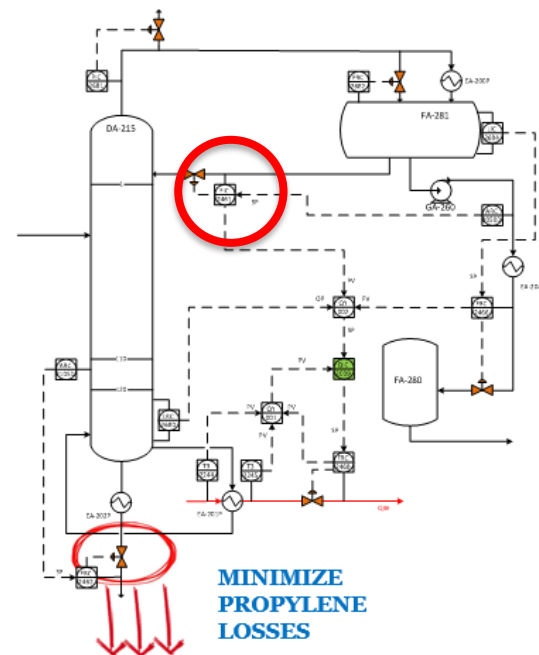
COMPOSITION CONTROL

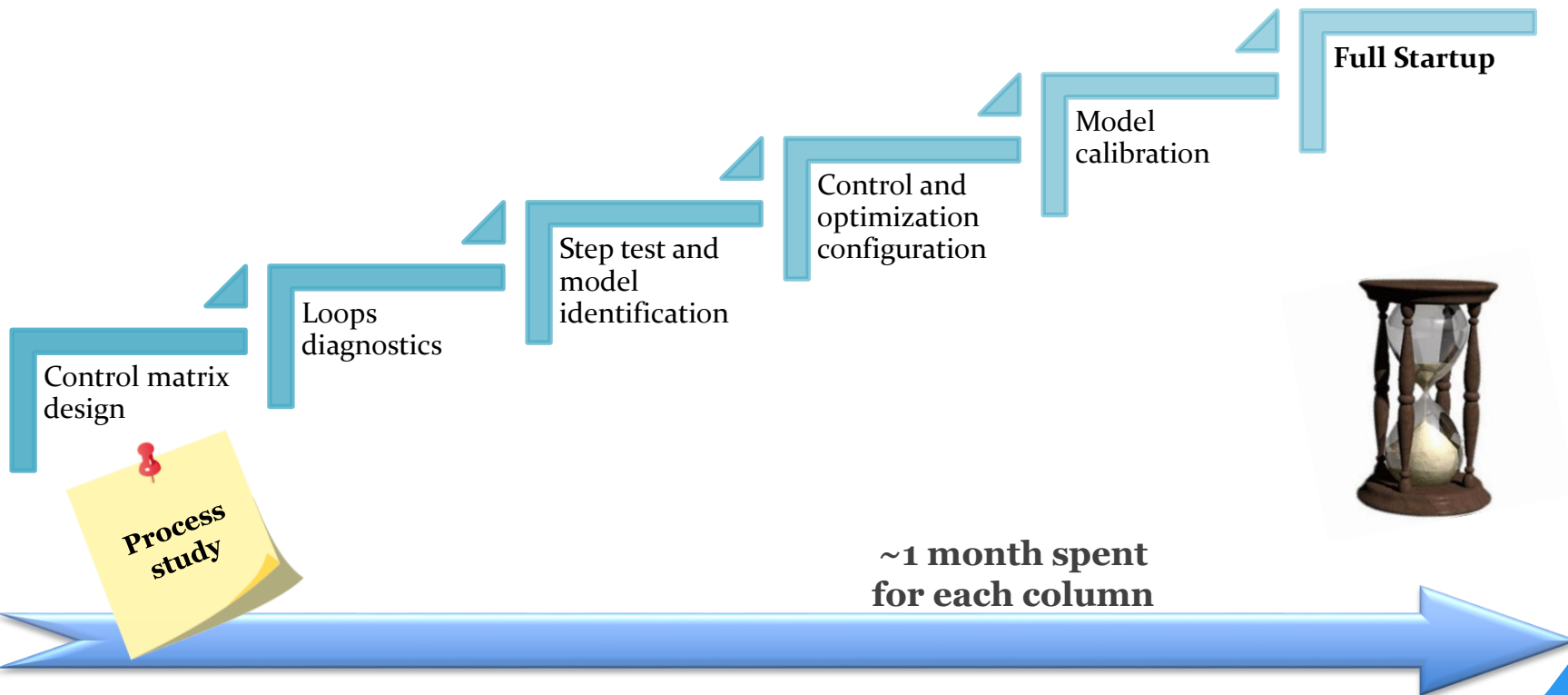
MINIMIZE PROPYLENE LOSSES



C3 frac Control Philosophy

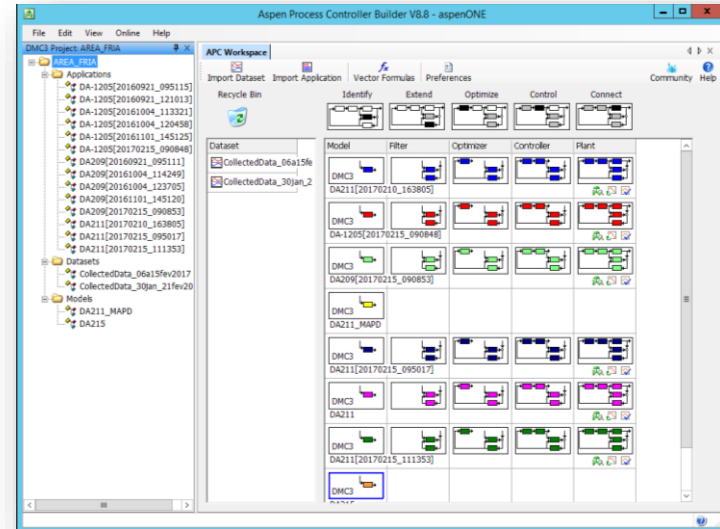
- ❑ Drive bottoms composition (losses) to the minimum desired
- ❑ Drive top composition on spec limits
- ❑ Manipulate reflux flow setpoint
- ❑ Manipulate bottoms flow (**minimize**)
- ❑ Constraints:
 - ❑ **Total pressure drop in columns**
- ❑ Measured disturbances:
 - ❑ Feeds flow and composition
 - ❑ Columns pressure
- ❑ Do not manipulate any utilities, only mass flows.

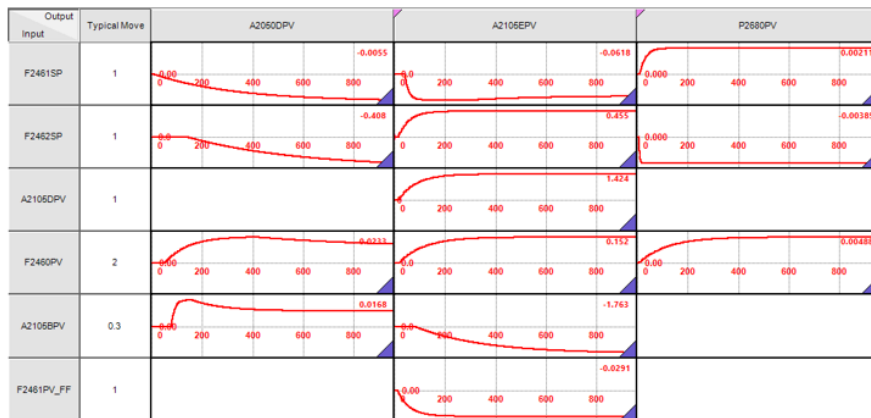




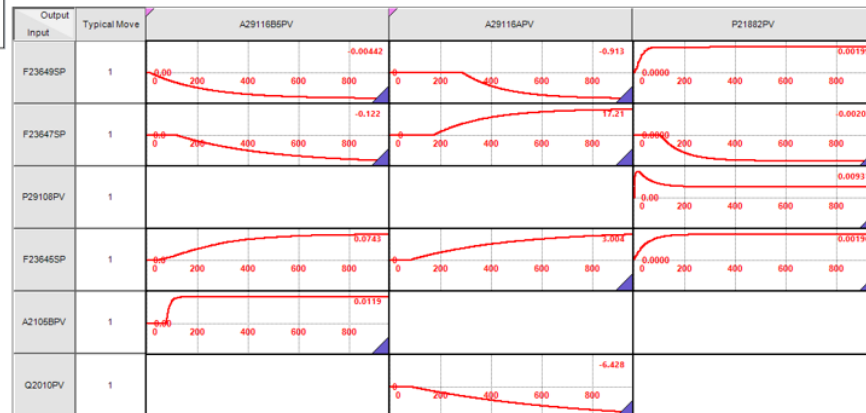


- Collect data
- Build seed model
- Configure controller and optimizer (Smart Tune)
- Deploy applications





Control
Matrix



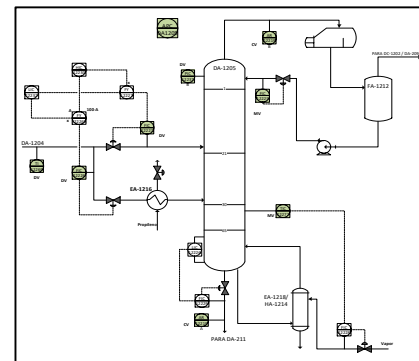
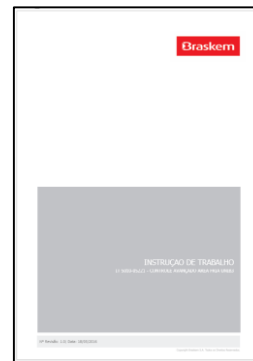
Controller Commissioning

Management of change

Documents Review

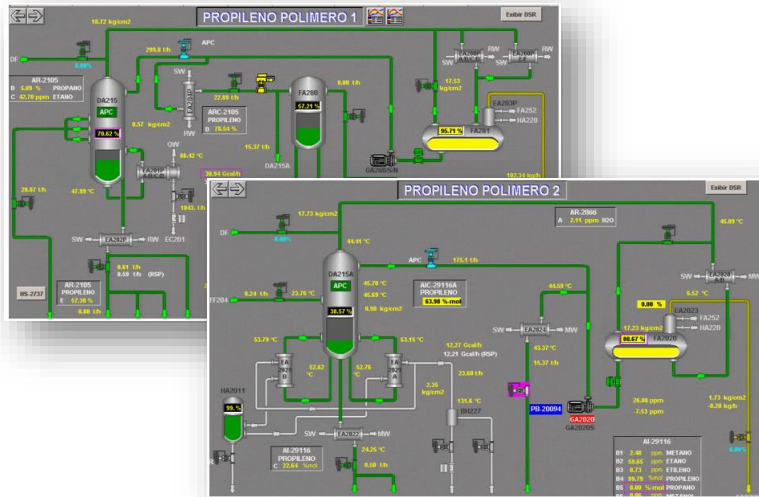
Operational Instruction

Training

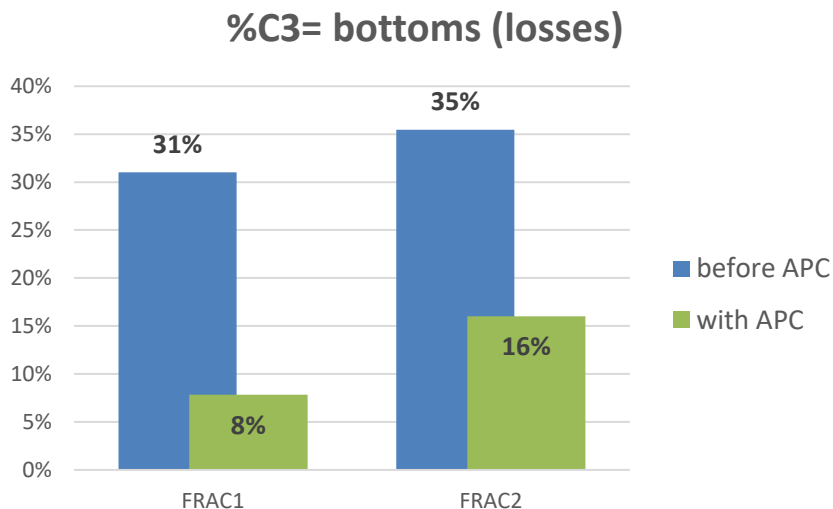


Controller Commissioning

- ✓ Servers already available
- ✓ Virtual servers environment
- ✓ APC/DCS: OPC communication
- ✓ DCS display configuration
- ✓ Web interface



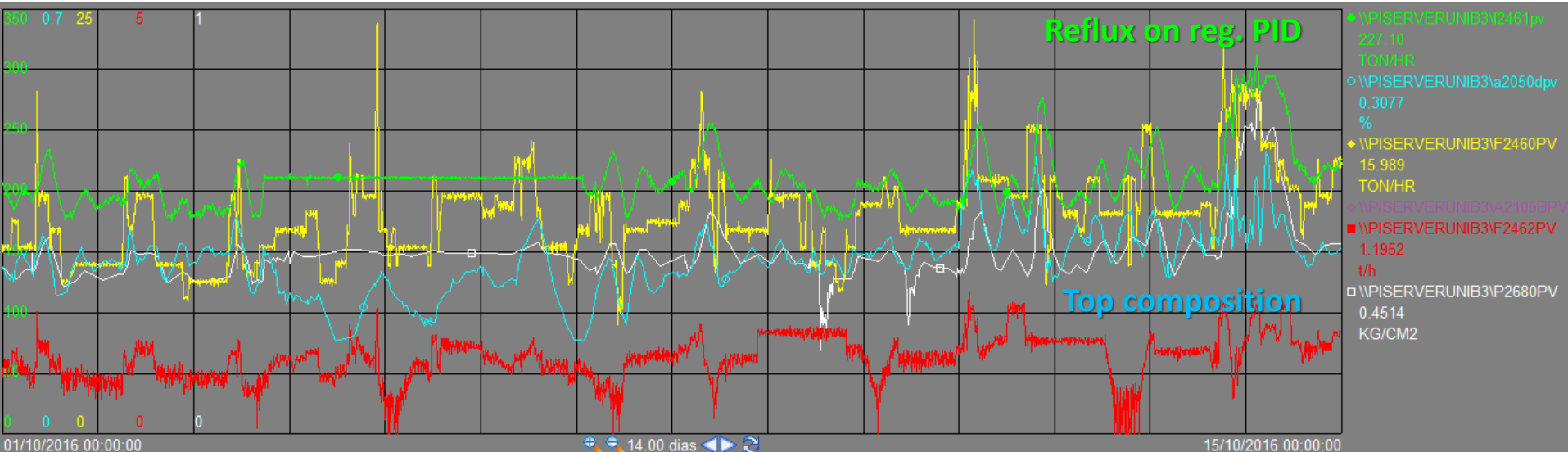
Simple strategies can be used to achieve great results.



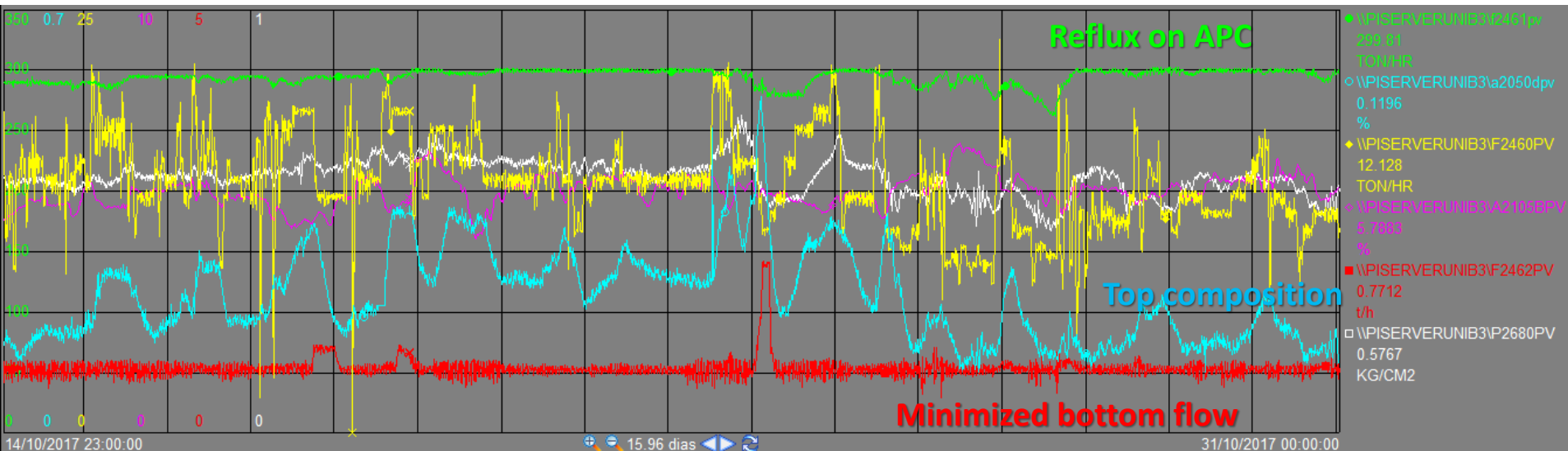
Mean composition reduction = 63%

Additionally:

- ✓ Standard deviation reduction on top composition
- ✓ Better usage of hot and cold utilities
- ✓ Total mass flow reduction on bottoms
- ✓ Great acceptance from operators
- ✓ 95% of service factor



- ◆ D215 - Reflux from FRC-2461
- D215 - % mol C3H8 Propylene Prod (ARC-205D)
- ◆ D215 - Feed from FRC-2460
- D215 - Bttm Flow from FRC-2462
- D215 - Twr DP from PDR-2680



- D215 - Reflux from FRC-2461
- D215 - % mol C3H8 Propylene Prod (ARC-205D)
- ◆ D215 - Feed from FRC-2460
- ◇ D215 - % mol Propane in Feed from AR-2105B
- D215 - Bttm Flow from FRC-2462
- D215 - Twr DP from PDR-2680

Thank you!
Obrigada!

Houston, June 01st 2018

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