Coker advanced control application at Petronas Melaka

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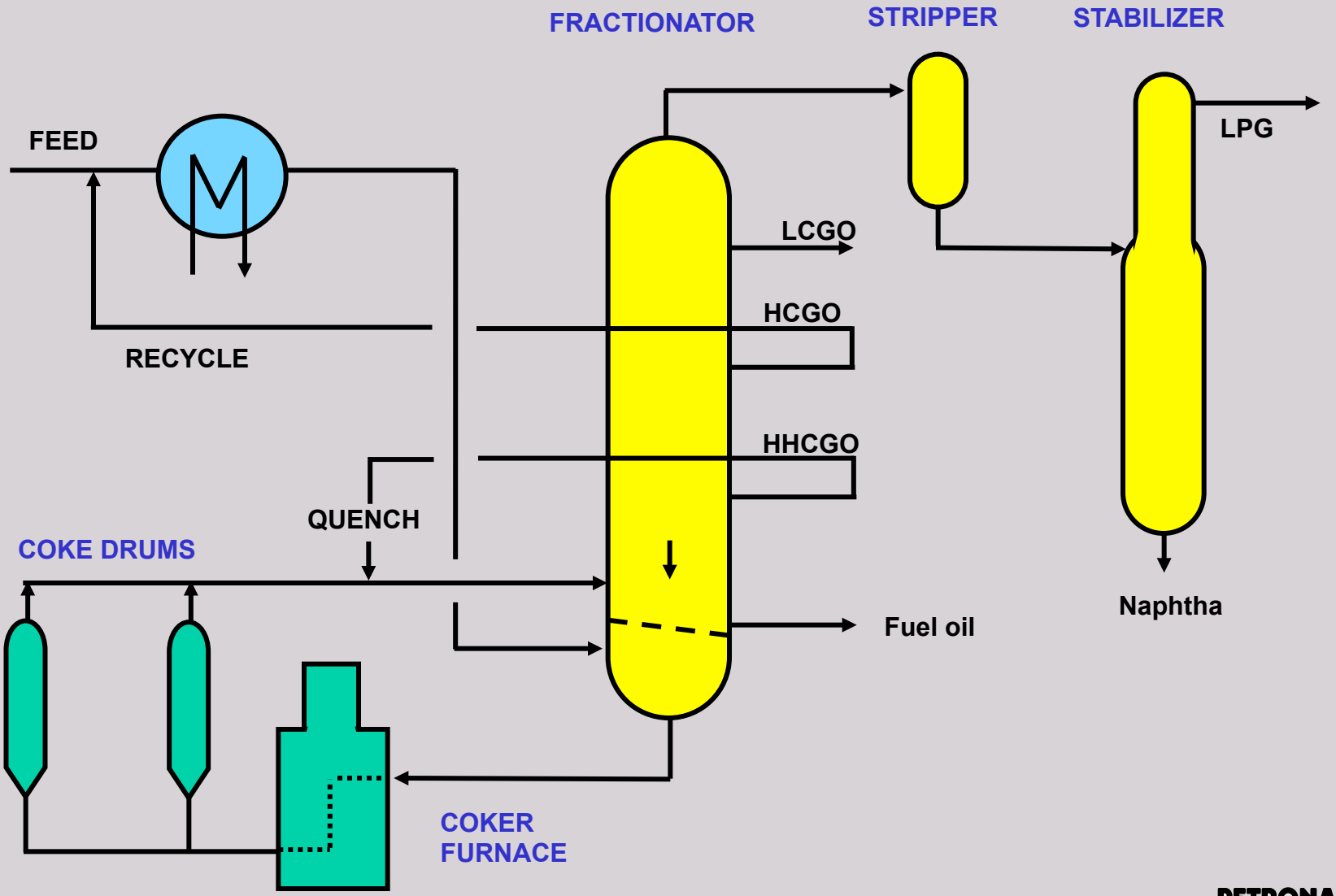
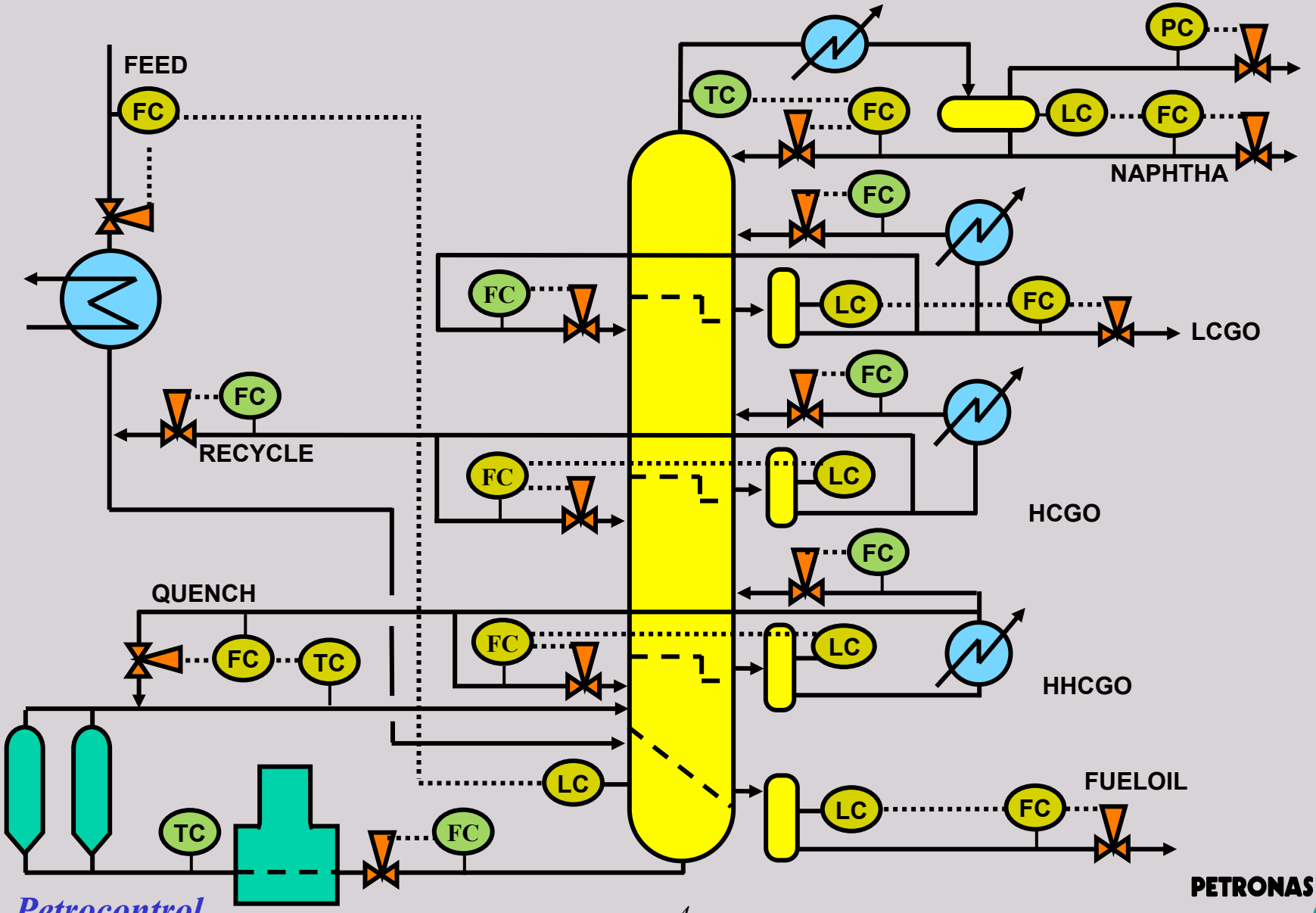
Why delayed coking unit is a good APC candidate?

- **Unit with operational difficulties**
  - **Drum switch disturbances**
  - **High temperature coking environment**
  - **Many constraints**
- **APC can**
  - **Improve response to drum switch disturbances**
  - **Run the unit closer to constraints**
  - **Maximize middle distillates yield**

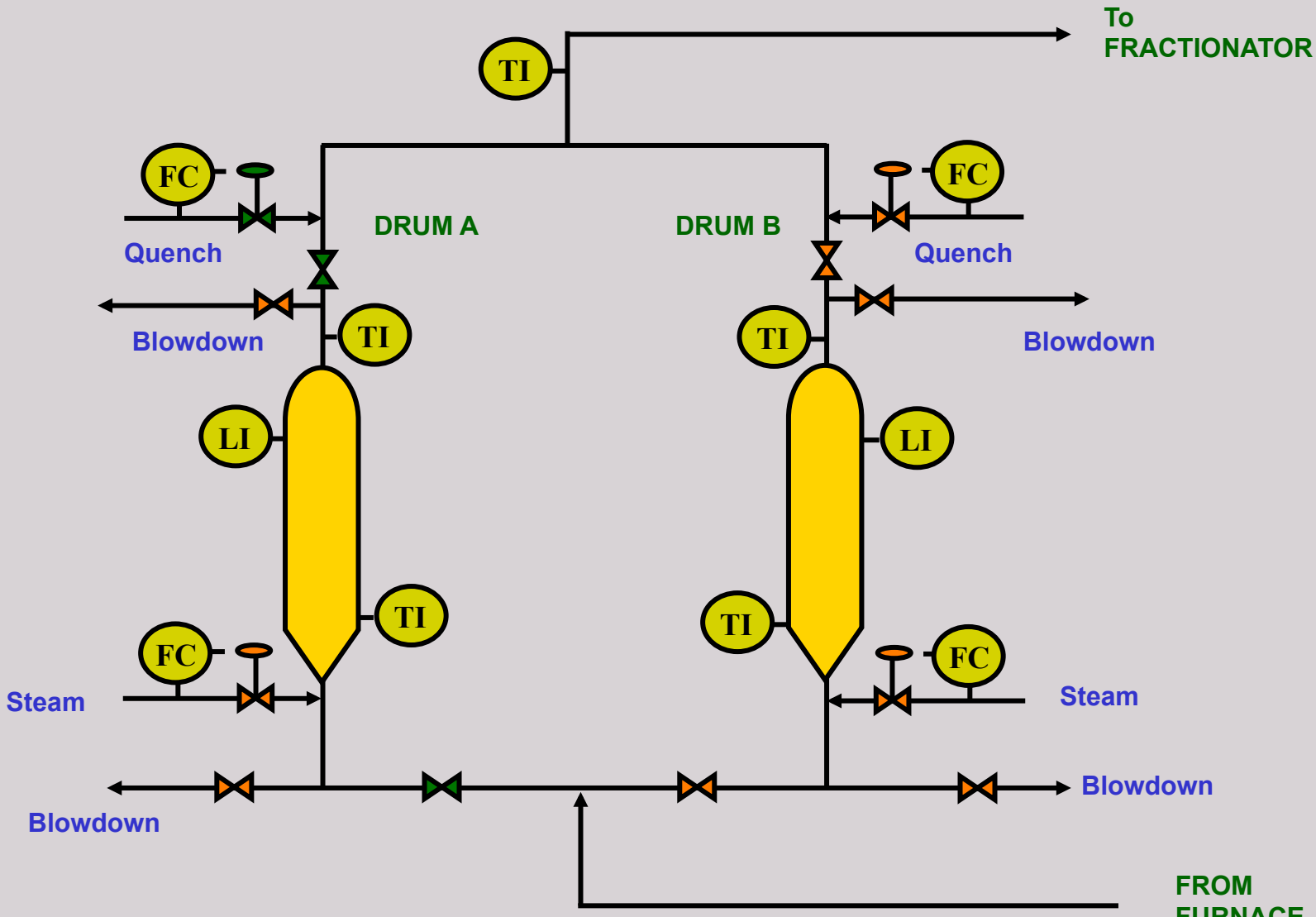
Melaka coker design overview



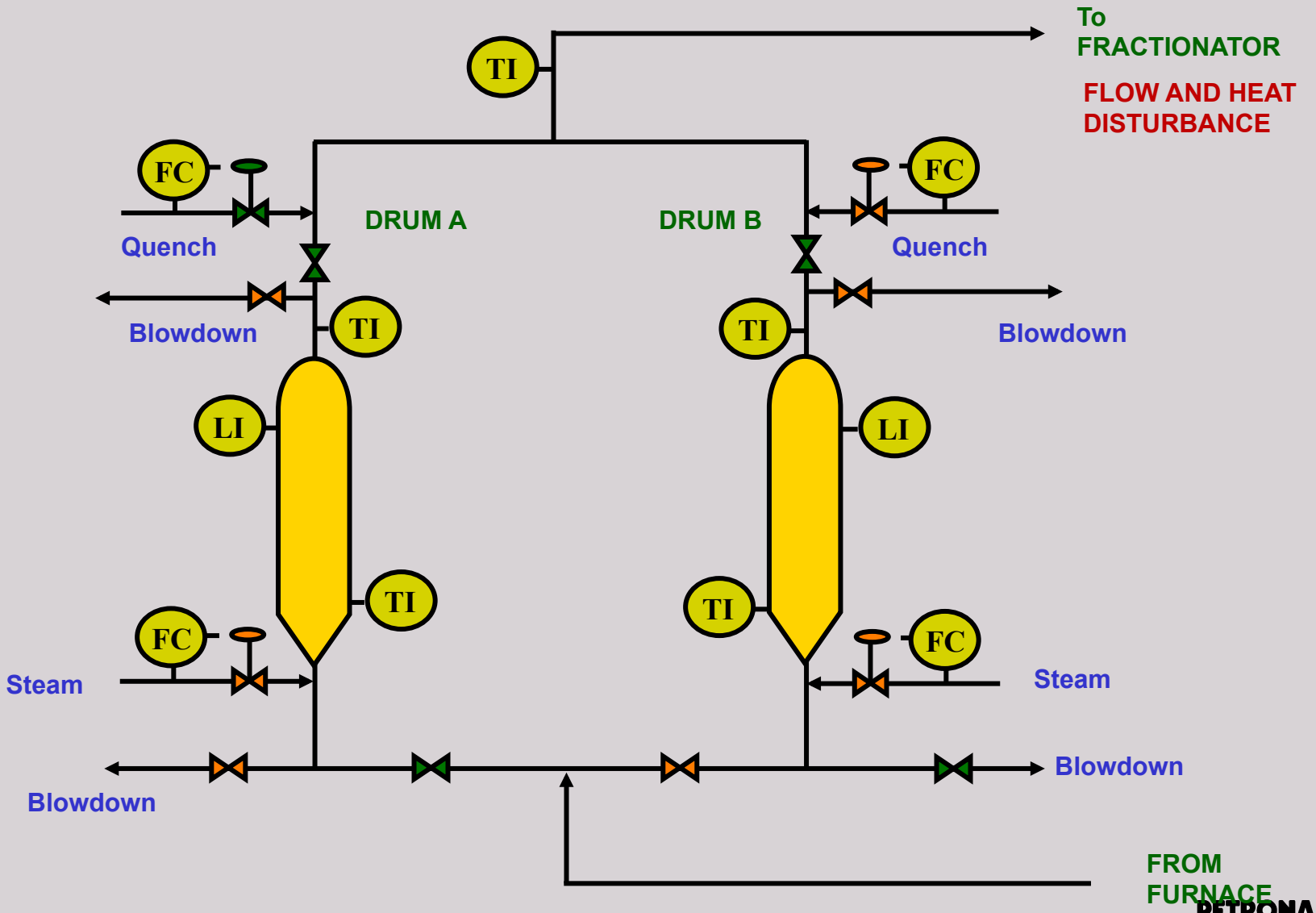
Coker fractionator configuration



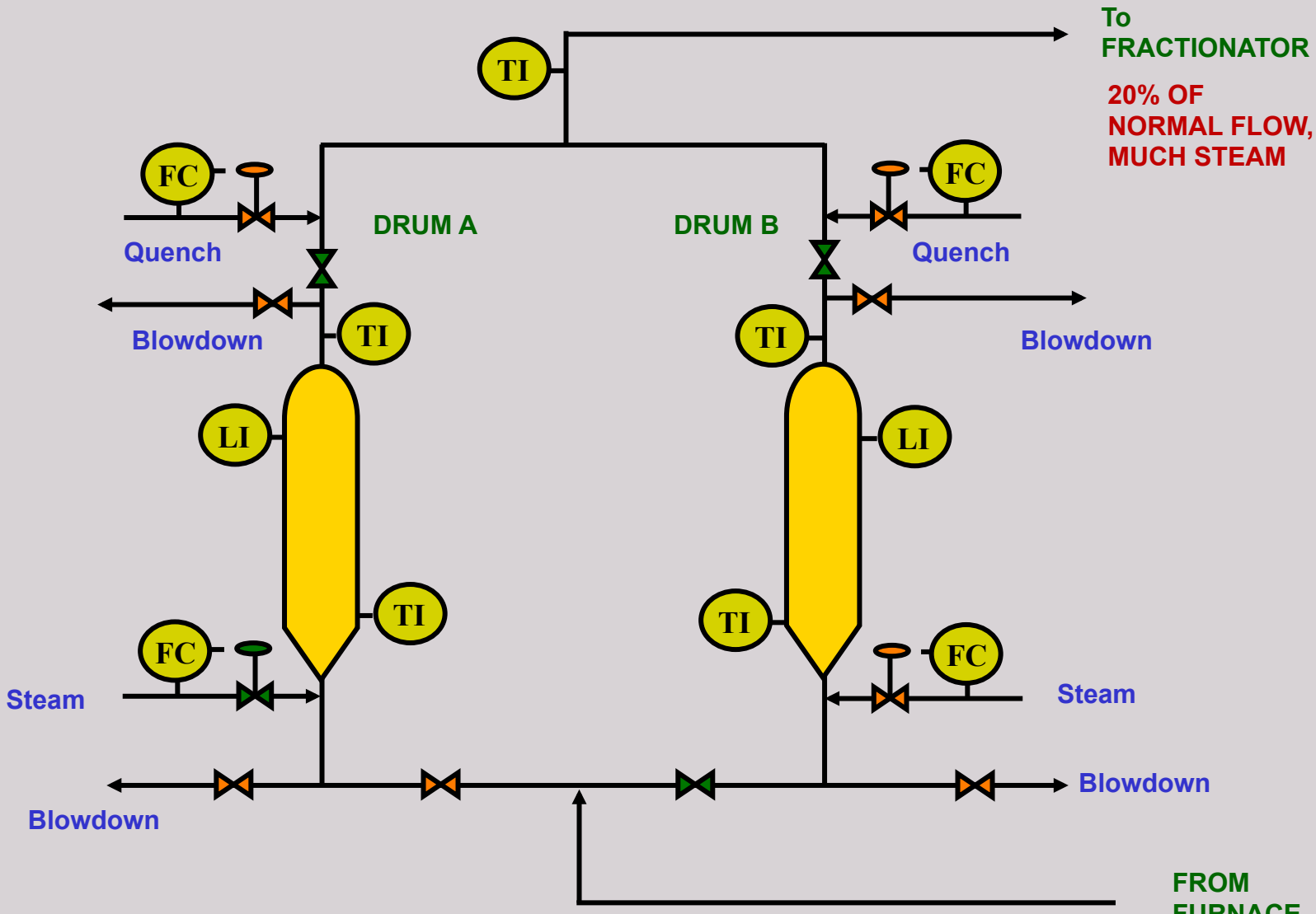
Coker drums, drum A working



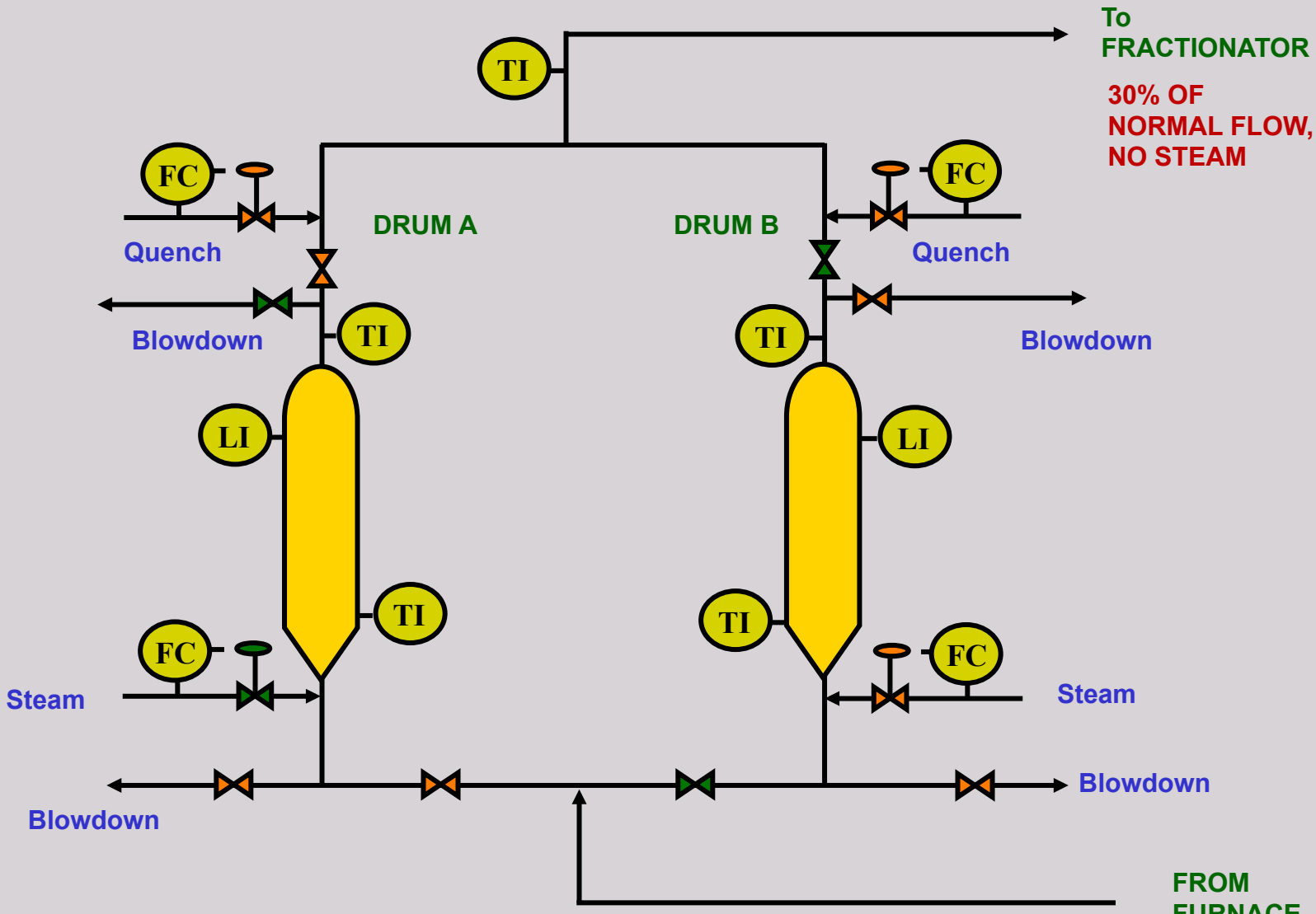
Drum B worming up



Drum B starting, drum A stripped



Drum B heating, no drum A steam

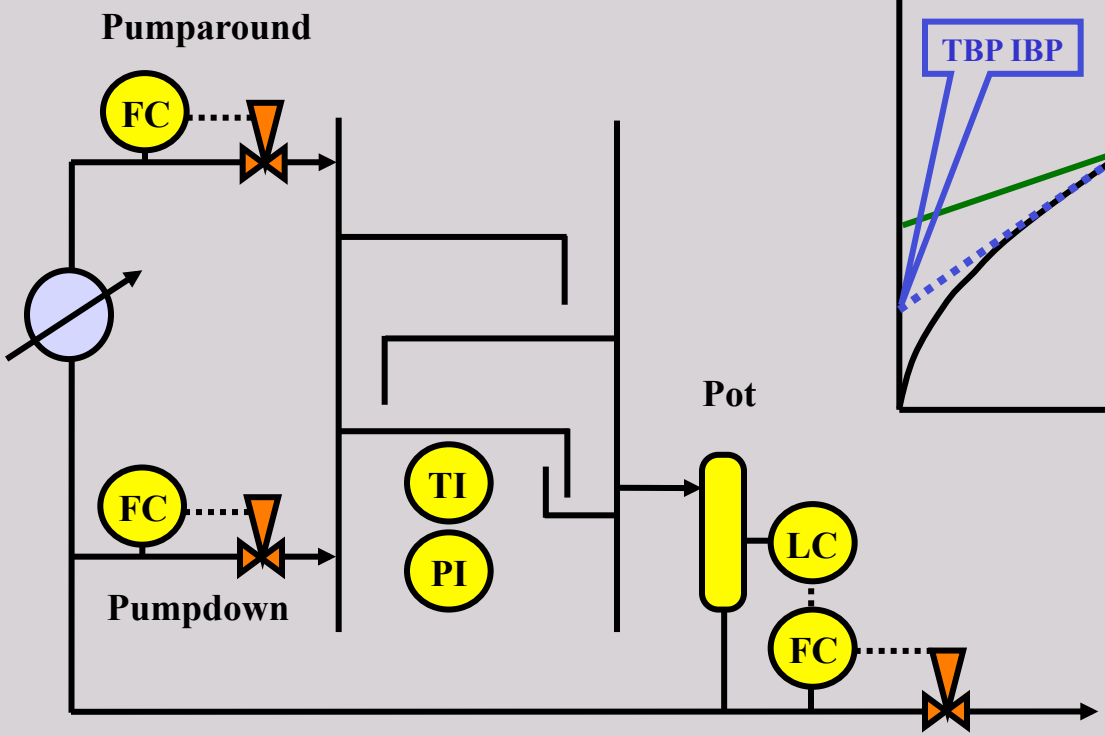


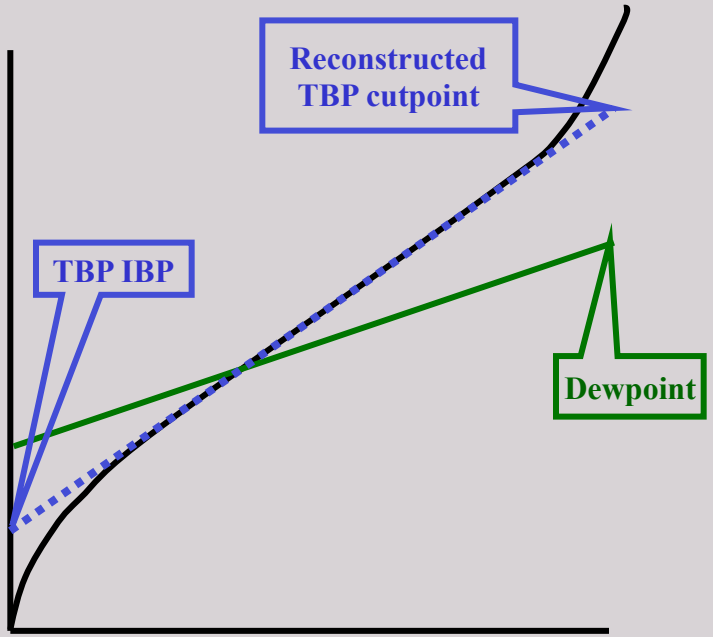
APC economics

- **Maximize coker distillate, subject to naphtha and distillate specifications**
- **Control coker recycle ratio at target**
- **Maximize fresh feed**
- **Maintain property control, fractionator inventory and heat balance control during drum switching**
- **Avoid excessive fractionator coking**

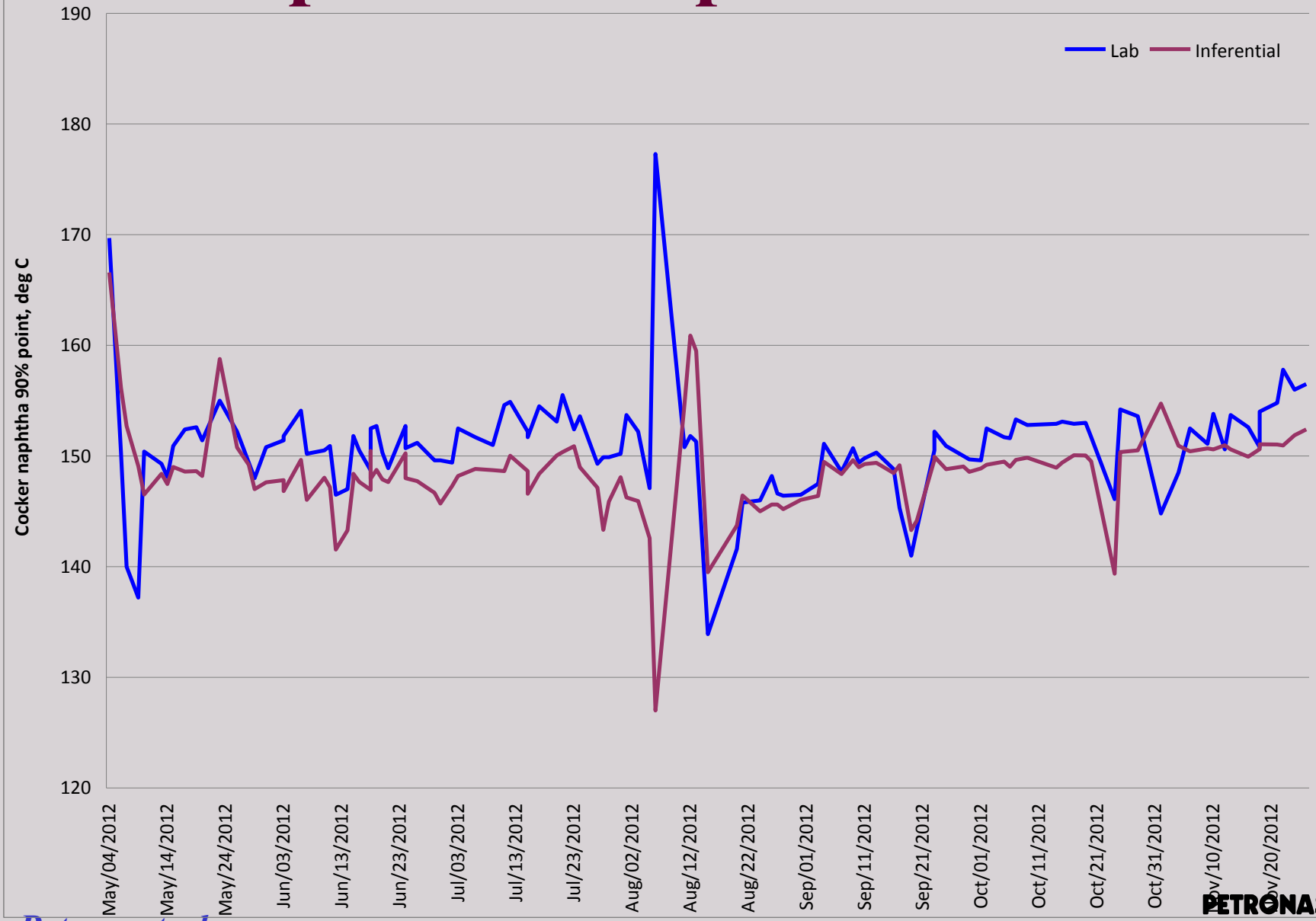
Robust inferential model

GCC inferential model

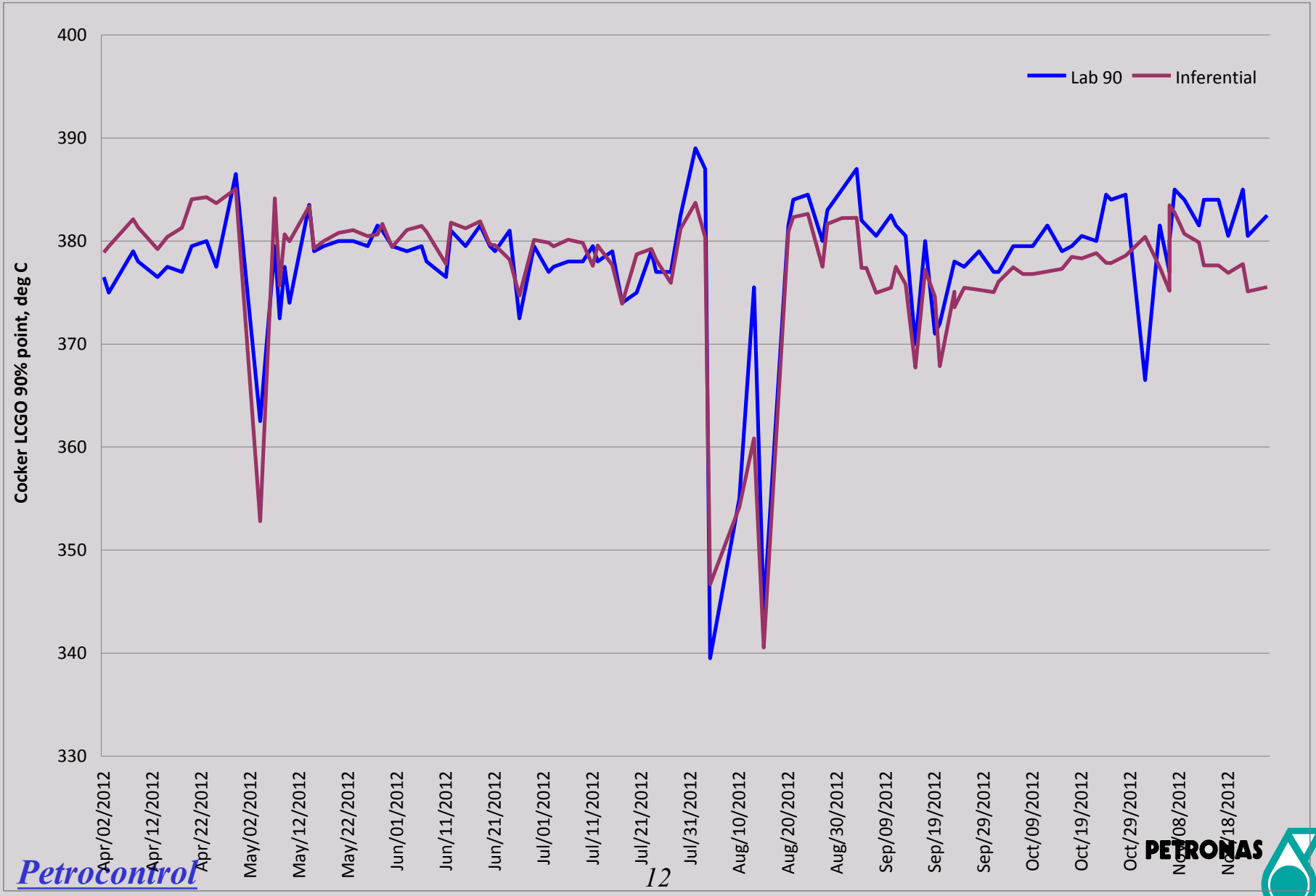




Naphtha 90% point inference



LCGO 90% point inference



Two RMPCT controllers

- **Furnace RMPCT**
  - **Maximize feed to furnace constraints**
  - **Balance furnace passes**
  - **Increase COT after drum switch to speed up the return to normal operation**
- **Column RMPCT**
  - **Control product specifications, heat balance, mass balance, column constraints**
  - **Accept the given feed, relax product specs if needed**

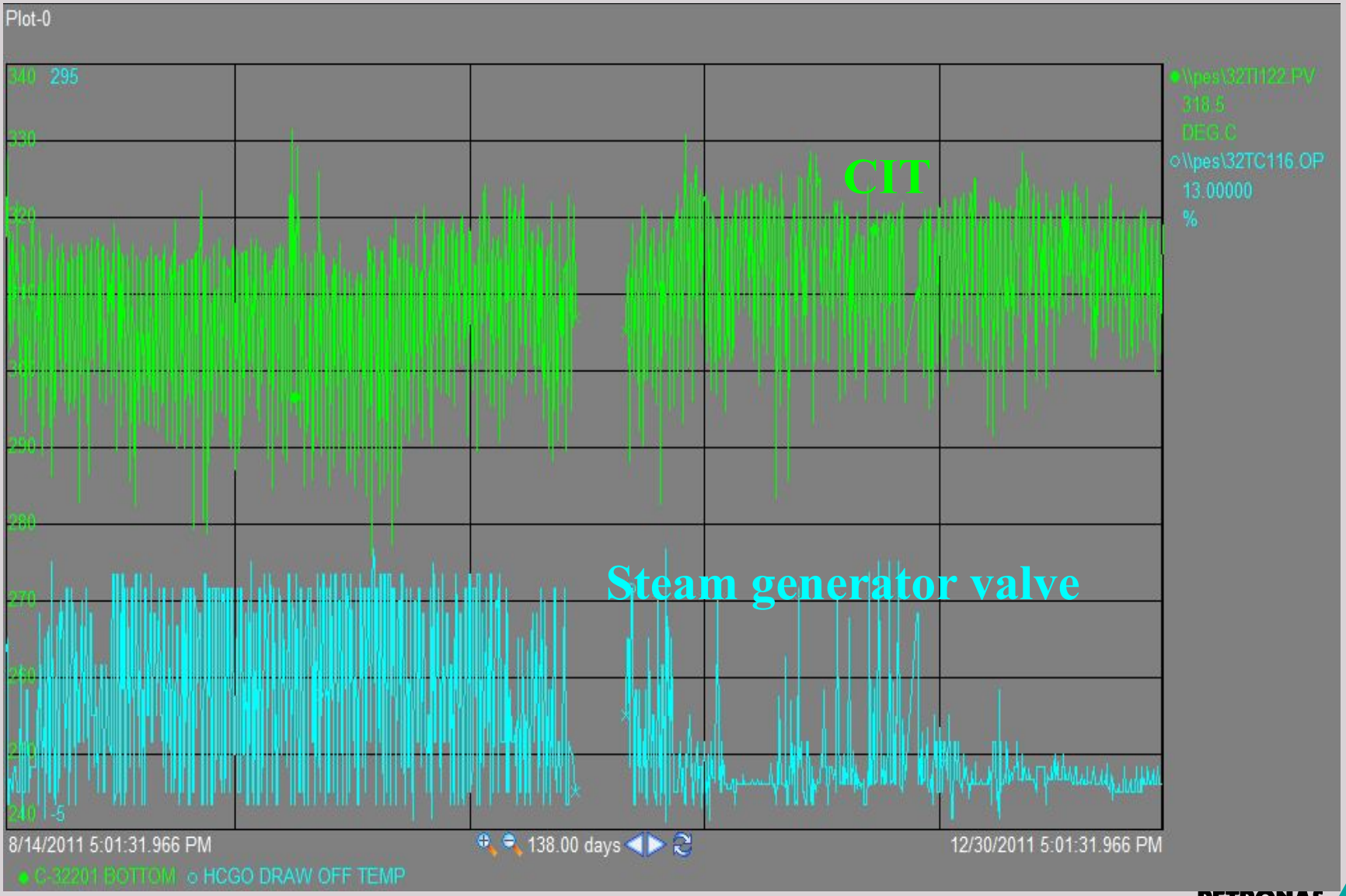
Main column control variables

- Product inferential calculations
  - Naphtha and LCGO draw 90% points
- Column inventory constraints that become active during drum switches
  - Draw pans and overhead drum levels
- Temperature constraints in the lower section of the column
- Coker recycle ratio
- Hydraulic constraints
  - Maximum valve positions, flows or sometimes pump currents
- Coking furnace constraints
  - Most active are skin temperatures

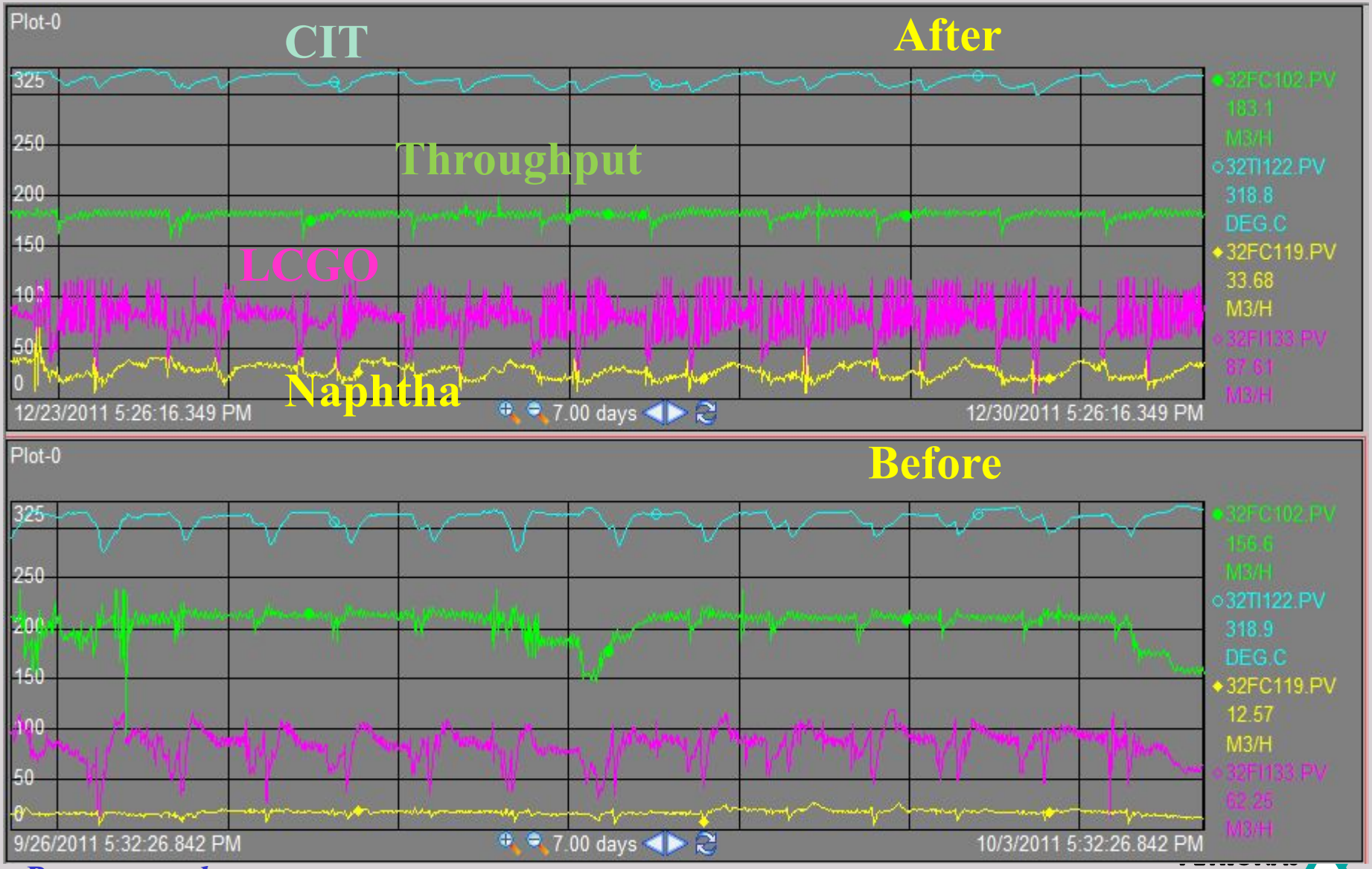
Main column manipulated variables

- Column top temperature
  - Controls naphtha 90% point
- Pump-down flows
  - Control side draw 90% points
  - HCGO pump-down controls coker recycle ratio
- Other secondary MVs

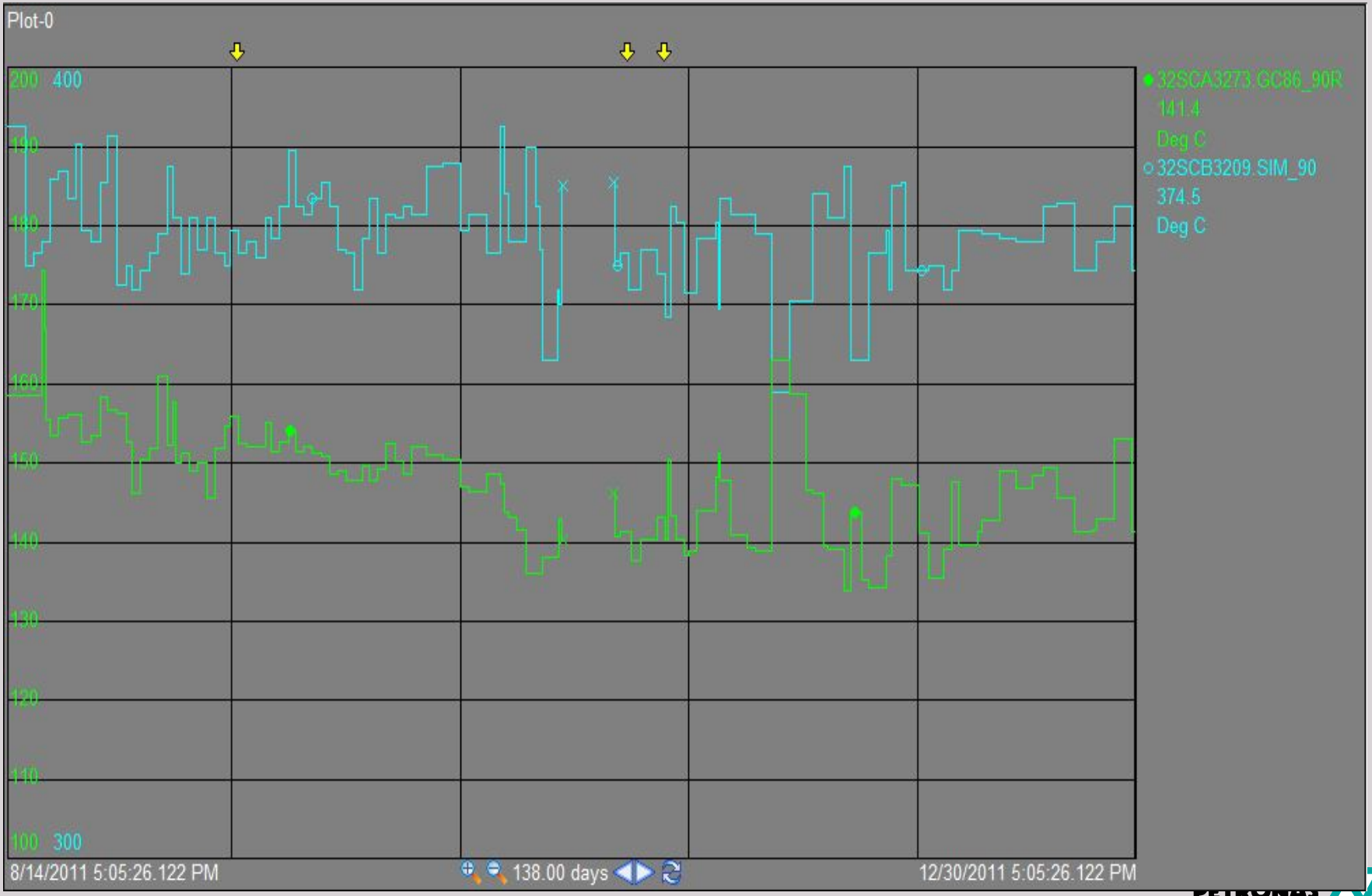
Evidence of CIT increase



No throughput maximization currently



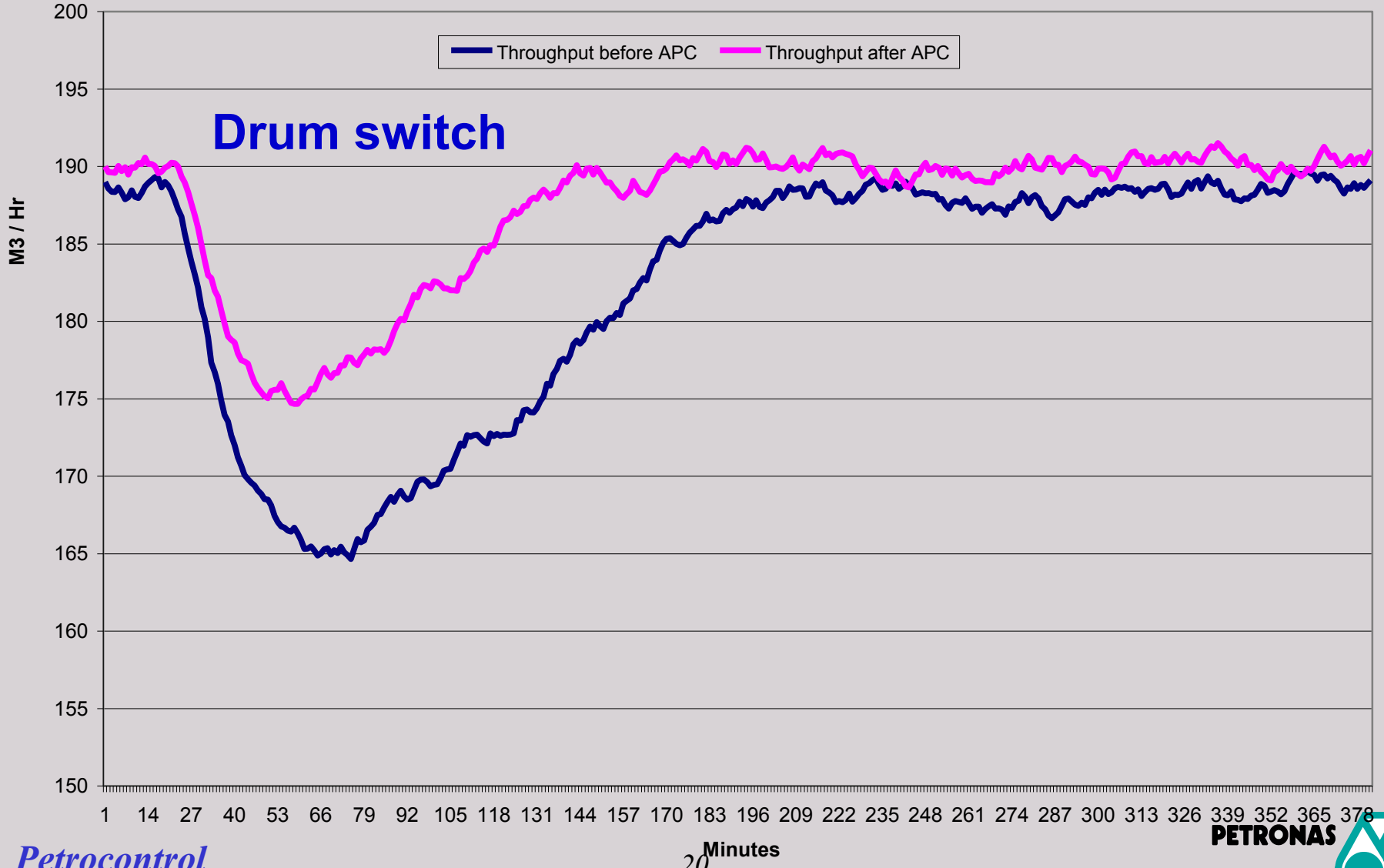
Evidence of naphtha shift to LCGO



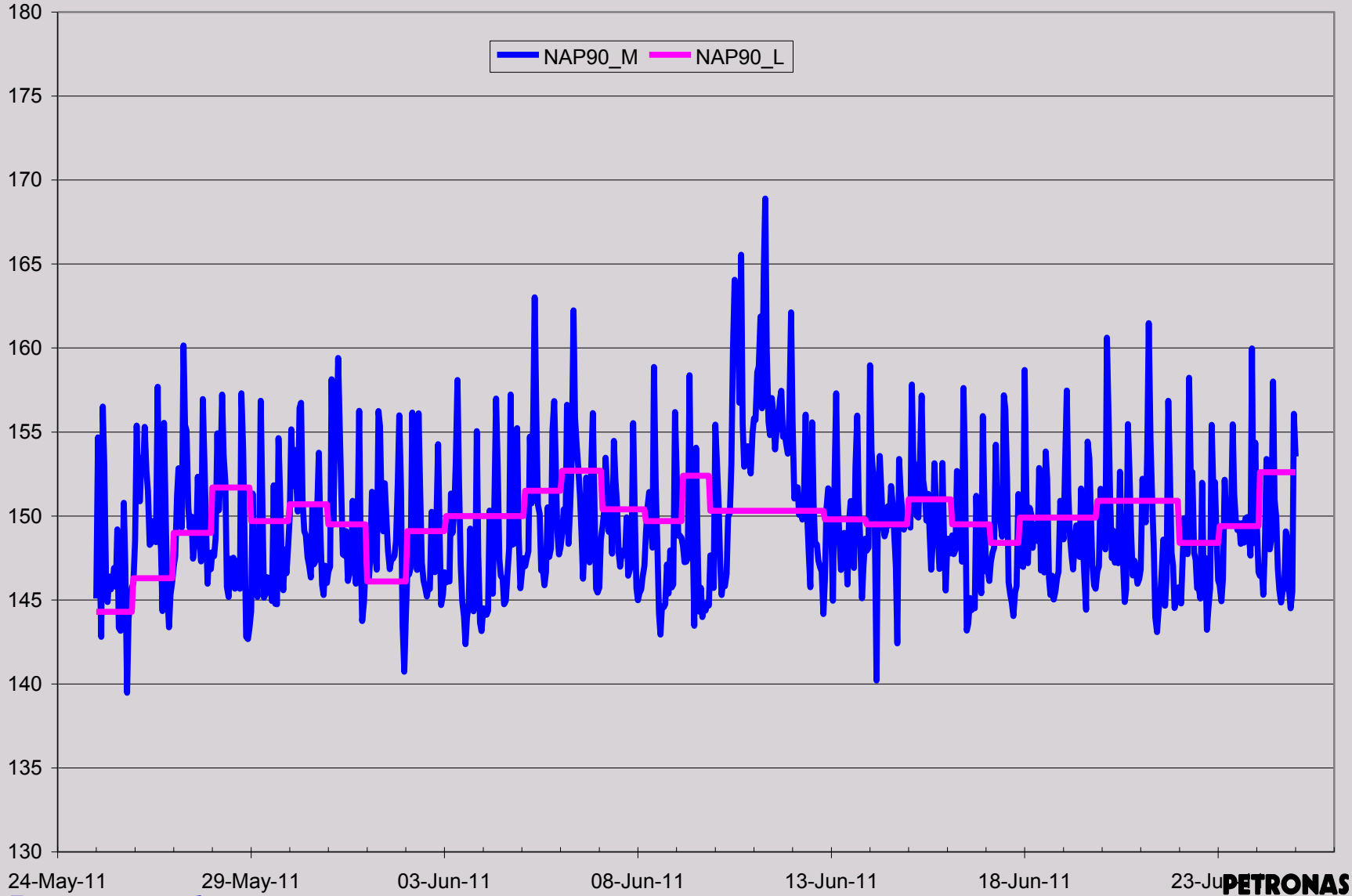
Conclusion: delayed coking unit is a good APC candidate

- **Conditions of successful implementation**
  - **Knowledge of the process and economics**
  - **Good quality inferential models**
  - **Much attention to detail**
  - **Operator and process engineer participation at the design stage**

Example of throughput increase



Naphtha 90% point inference



LCGO 90% point inference