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# **Application of Foxboro Invensys Magnetic Resonance Analyzer at Refinería Isla (Curacao) S.A**

By

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**COMPANY**

**Refineria Isla is a subsidiary of**

**P**etróleos  
**D**e  
**V**enezuela  
**S**ociedad  
**A**nónima

**Objectives**

Safety  
Productivity  
Refinery profitability  
Increase client satisfaction  
Improve implementation &  
Completion of projects  
Productivity  
People  
Total quality



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## **REFINING CAPACITY**

**335 MBD**

## **DISTILLATION UNITS:**

|                      |            |
|----------------------|------------|
| <b>3 Atmospheric</b> | <b>335</b> |
| <b>5 High Vacuum</b> | <b>186</b> |

## **CONVERSION UNITS:**

|                           |           |
|---------------------------|-----------|
| <b>1 Cat Cracker</b>      | <b>50</b> |
| <b>2 Thermal Crackers</b> | <b>80</b> |
| <b>1 Platformer</b>       | <b>18</b> |
| <b>1 Alkylation</b>       | <b>9</b>  |
| <b>Polymerization</b>     | <b>4</b>  |

## **SPECIALTIES UNITS:**

|  |                |
|--|----------------|
| <b>1 Naphthenic lubes</b>              | <b>2</b>       |
| <b>1 Paraffinic Lubes</b>              | <b>5</b>       |
| <b>Asphalts: Penetration / Roofers</b> | <b>15 - 20</b> |



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*COMPANY OBJECTIVES*

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## **KEY REFINERY OBJECTIVE**

### **Refinery Profitability**

Maximize opportunities in incremental crude processing.



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## **IMPLEMENTATION OF CRUDE MANAGEMENT PROJECT**

- **Maximize yields of more valuable products**
- **Maximum utilization of crude potential and minimize loss during crude switch**
- **Platformer operating condition are based on the naphtha specs at the Crude Distiller**



## *INSTALLATION & INIT. TARGETS*

# **EQUIPMENT TO BE INSTALLED** **ON A TRIAL BASIS**

### *Foxboro Invensys to supply:*

- **MRA Analyzer & required analyzer data**
- **Required sample conditioning system**
- **Initial models for prediction of all required parameters**

### *Isla to provide:*

- **Sample transport lines for the crude, kerosene & naphtha samples**
- **Utilities**
- **Power requirements**
- **Lab analysis for validation**



**CRUDE UNIT 3**

|                              |   |
|------------------------------|---|
| <b>Rate capacity</b>         | <b>30.000 tons/day</b>                                  |
| <b>Crude handled</b>         | <b>26 – 29 API</b>                                      |
| <b>Modes of operation</b>    | <b>Paraffinic crude</b><br><b>General Purpose crude</b> |
| <b>Mode switch frequency</b> | <b>Every 2-3 days</b>                                   |





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# ***INSTALLATION & INIT. TARGETS***



**MRA**  
**Multi Purpose Single**  
**Schedular**  
**Software version 3.0**  
**D- magnet**



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**INSTALLMENT MRA AT ATMOSPHERIC  
DISTILLING UNIT CD-3**

- Analyzer shelter with all required utilities available
- Sample take-off and return points for crude at a short distance (60 m) from the analyzer shelter.
- Crude sample can be transported at ambient condition
- Existing naphtha supply & return line available at analyzer shelter
- Kerosene take-off & return point at a distance of 150 m.



**SAMPLE CONDITIONING POINTS OF  
ATTENTION**

- **Thermal stress to ceramic part MRA sample probe:**  
Crude temperature @ 35  
Naphtha temperature @ 130  
Kerosene temperature @ 130
- **Cross contamination of sample in MRA probe**
- **Stream sequence: Kerosene – Naphtha - Crude**
- **Sample return during flushing through the probe**



## *INSTALLATION & INIT. TARGETS*

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### **TARGETS**

| <b>Measurement</b>      | <b>Achieved</b> |
|-------------------------|-----------------|
| <b>Crude analysis</b>   | <b>No</b>       |
| <b>Kero analysis</b>    | <b>Yes</b>      |
| <b>Naphtha analysis</b> | <b>Yes</b>      |



## ***INSTALLATION & INIT. TARGETS***

# **ISLA MRA PERFORMANCE vs LAB MEASUREMENT**

| <b><u>Stream Parameter</u></b> | <b><u>Kero Flash</u></b> | <b><u>Kero Freezing</u></b> | <b><u>Naphtha End Point</u></b> |
|--------------------------------|--------------------------|-----------------------------|---------------------------------|
| <b>Avg diff.</b>               | <b>-2</b>                | <b>-1</b>                   | <b>4</b>                        |
| <b>Avg diff.<br/>Std Dev</b>   | <b>2</b>                 | <b>2</b>                    | <b>3</b>                        |



**INITIAL MRA CRUDE ANALYSIS**  
**UNSUCCESSFULL**

- **Stability of the Crude sample temperature dependent**
- **Crude sample phase separate along the sample line**
- **Initial chosen stream sequence Kerosene – Naphtha - Crude**
- **Wax deposition within the MRA sample loop & probe while processing paraffinic crude**



## **RE-DESIGN MRA SAMPLE SYSTEM**

- **Bring crude sample temperature to minimum 60 C & maximum of 70 C at take-off through MRA probe**
- **While flushing through MRA probe kerosene & naphtha**
- **Sample must be brought to the same temperature of 60 C**
- **Flushing through SSC & MRA probe must be routed to sample return**
- **Prevent sample cross contamination in SSC & MRA probe**



## **MRA SAMPLE TEMPERATURE** **CONTROL**

- **Crude Fast Loop heater at sample take-off**
- **Sample Heater with PID control at MRA for temperature control sample through MRA probe**





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## *RE-DESIGN & ACH. RESULTS*



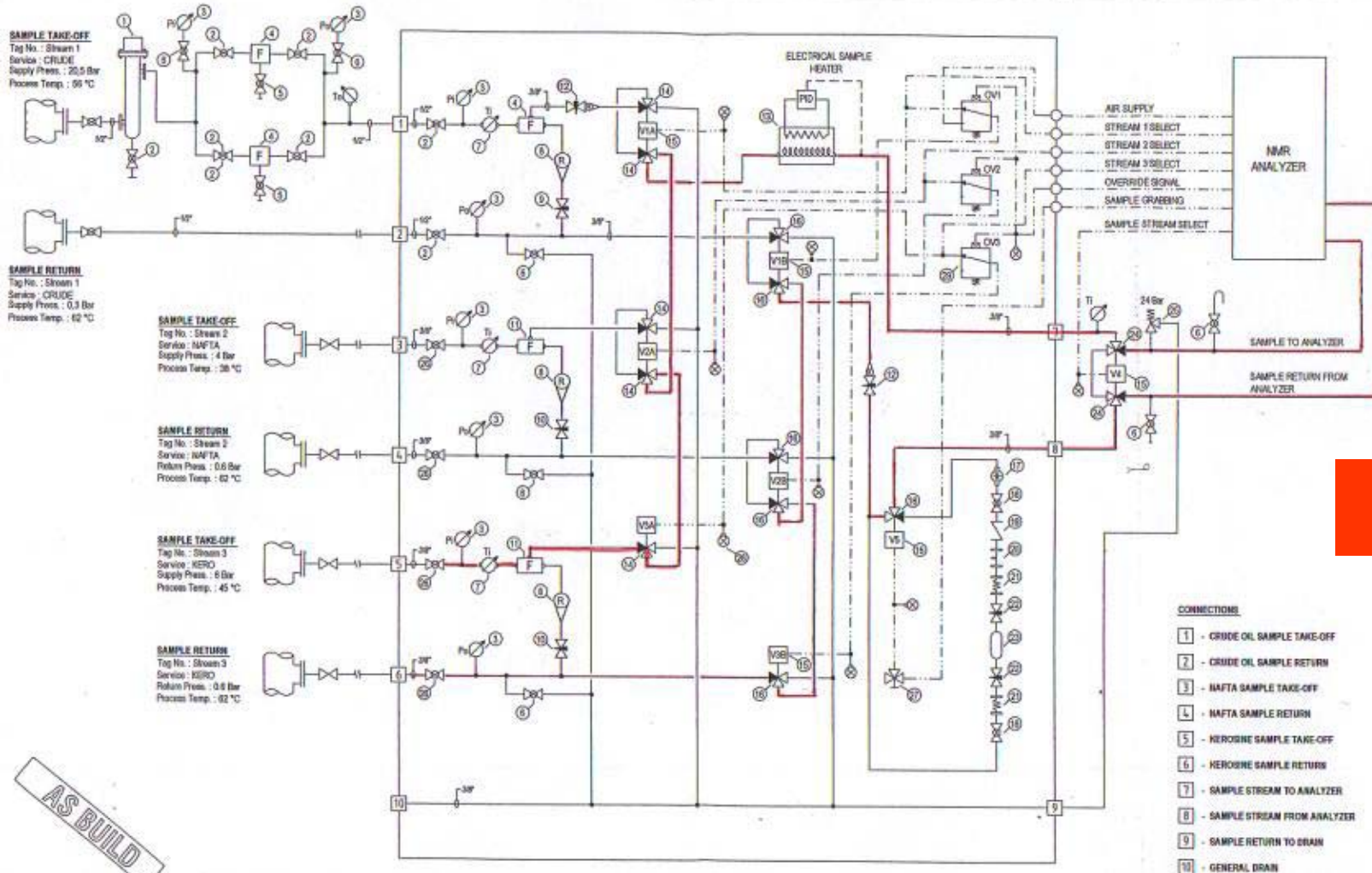
**Crude Fast Loop Heater**



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# RE-DESIGN & ACH. RESULTS



SSC dwg

AS BUILT





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## *RE-DESIGN & ACH. RESULTS*



**SSC inside**



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## *RE-DESIGN & ACH. RESULTS*



SSC  
&  
MRA



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*RE-DESIGN & ACH. RESULTS*

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**ISLA MRA MEASURING RESULTS**  
**POST RE-DESIGN OF SSC**

**MRA Parameters with Corresponding Lab Data**

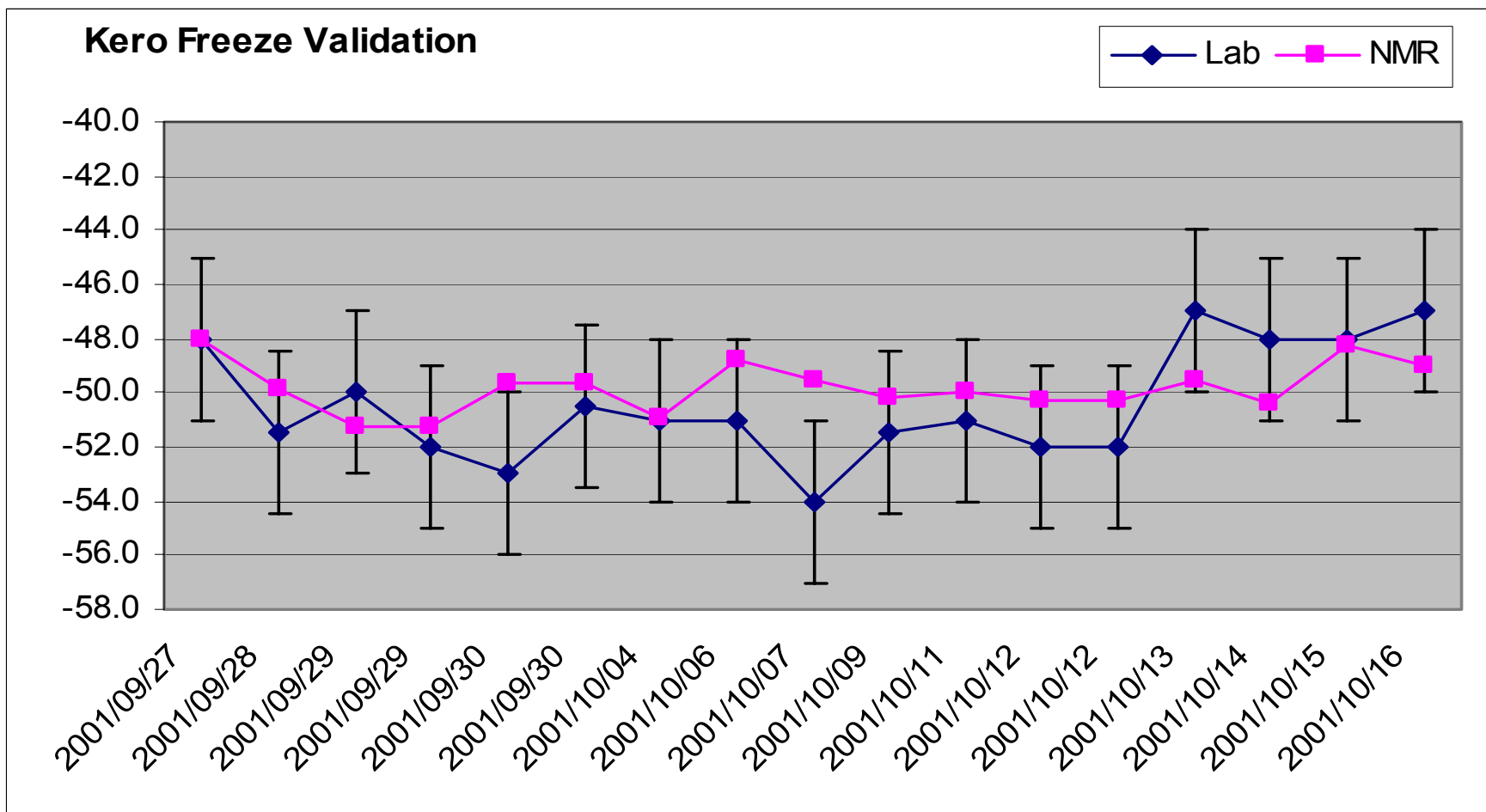
Kero Freeze & Flash

Naphtha T10, T50, T90, FBP





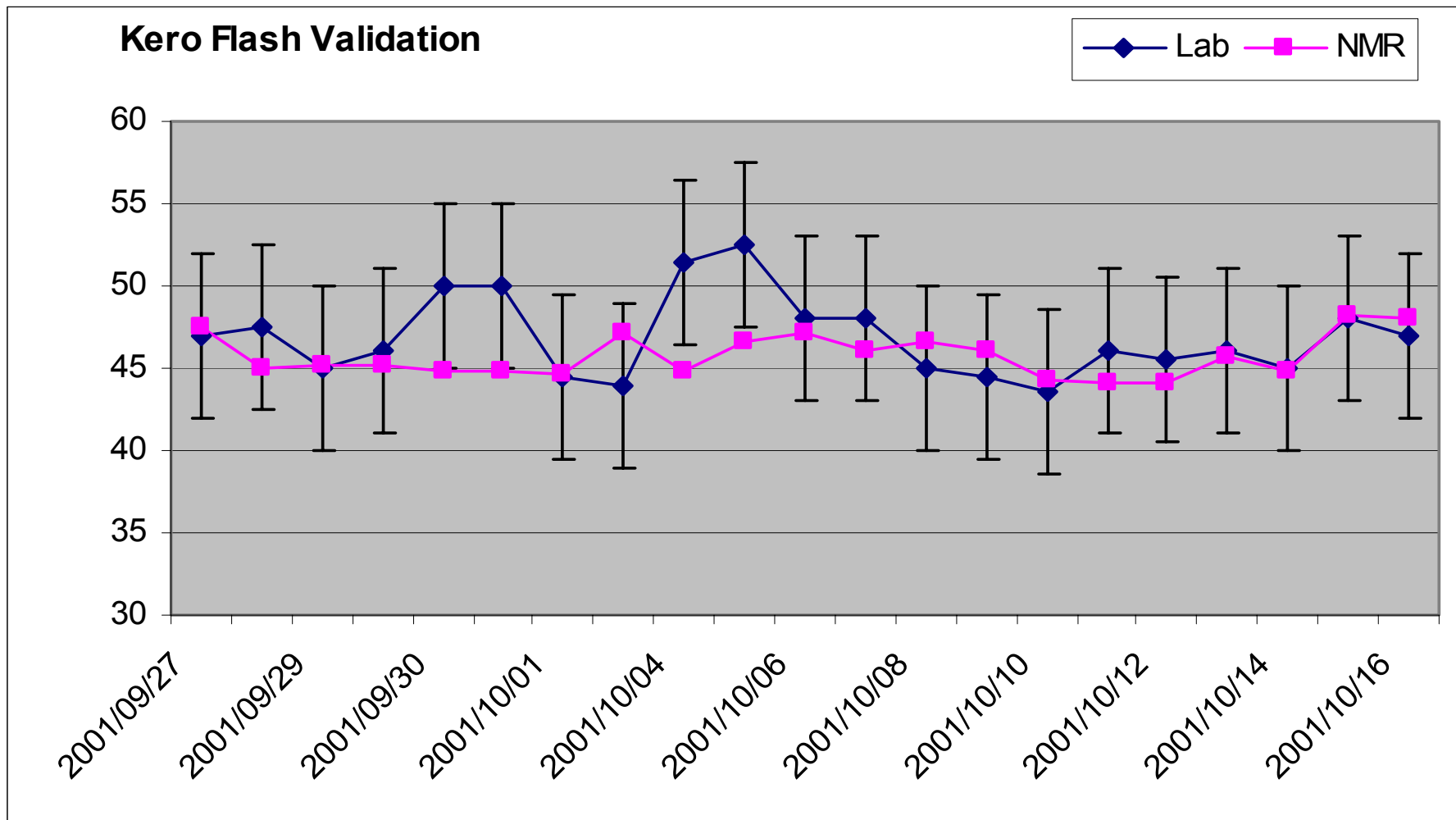
# RE-DESIGN & ACH. RESULTS



**Kero Frz. val.**



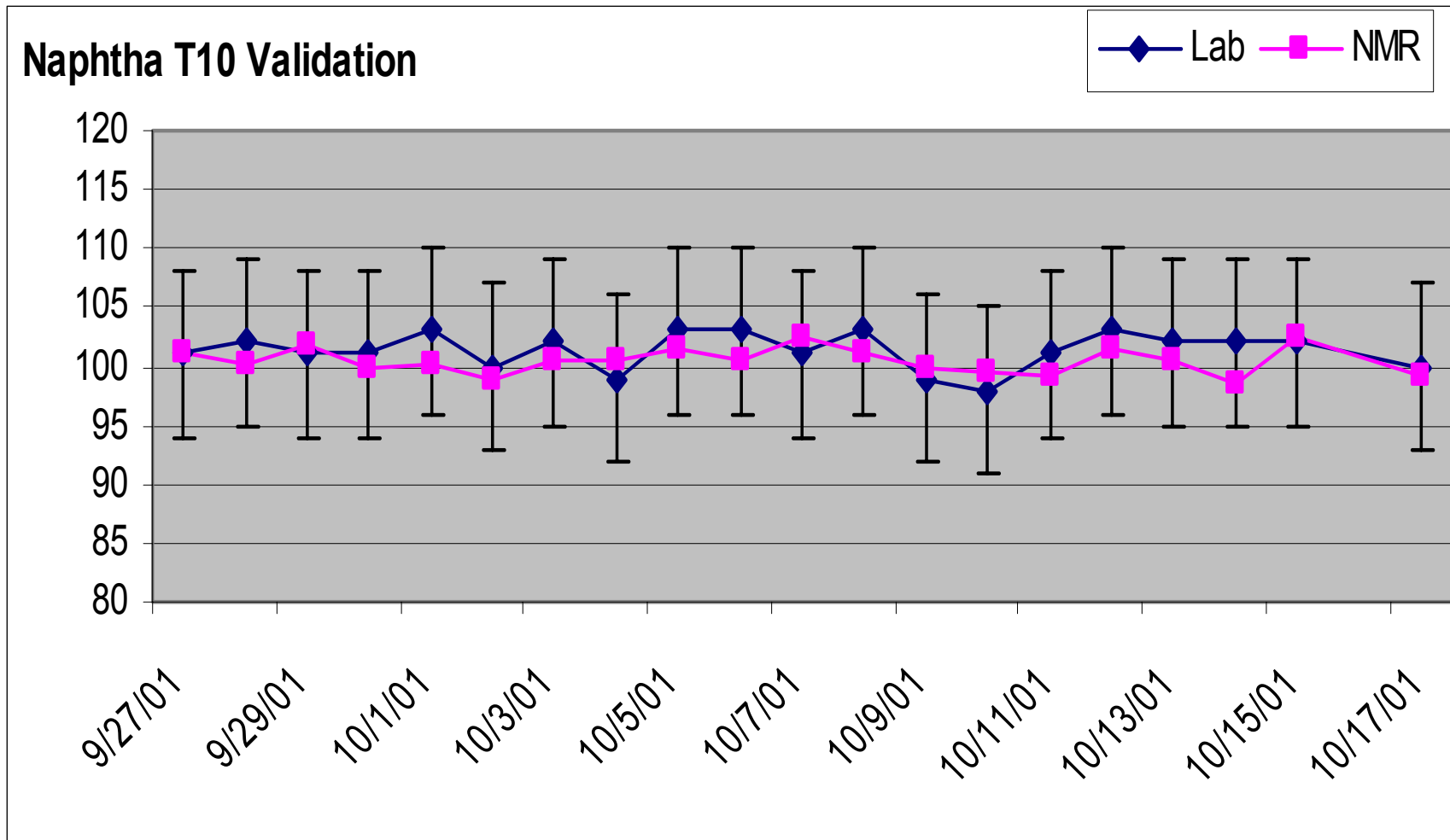
# RE-DESIGN & ACH. RESULTS



**Kero Frz. val.**



# RE-DESIGN & ACH. RESULTS

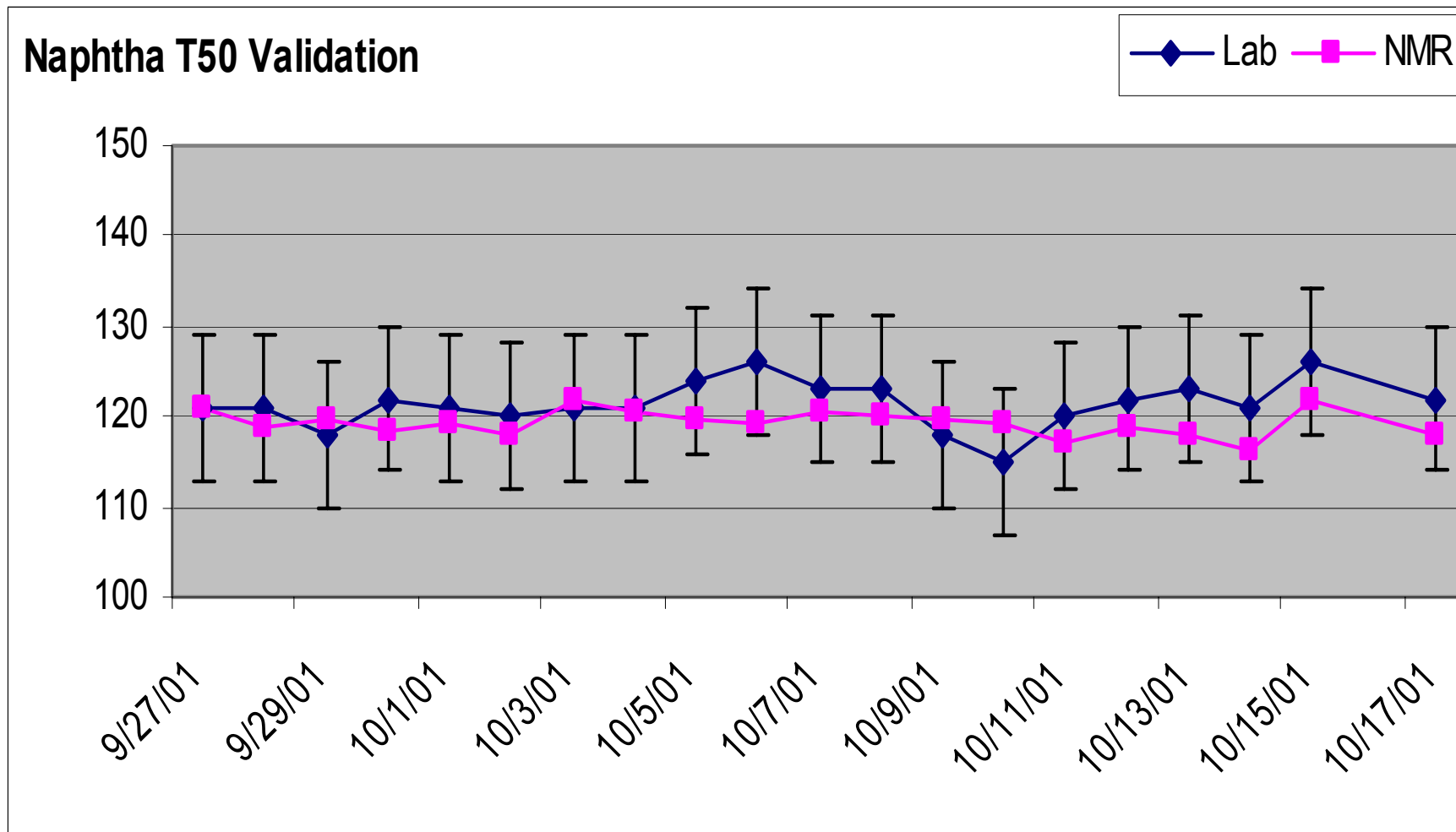


**Naphtha T10 val.**





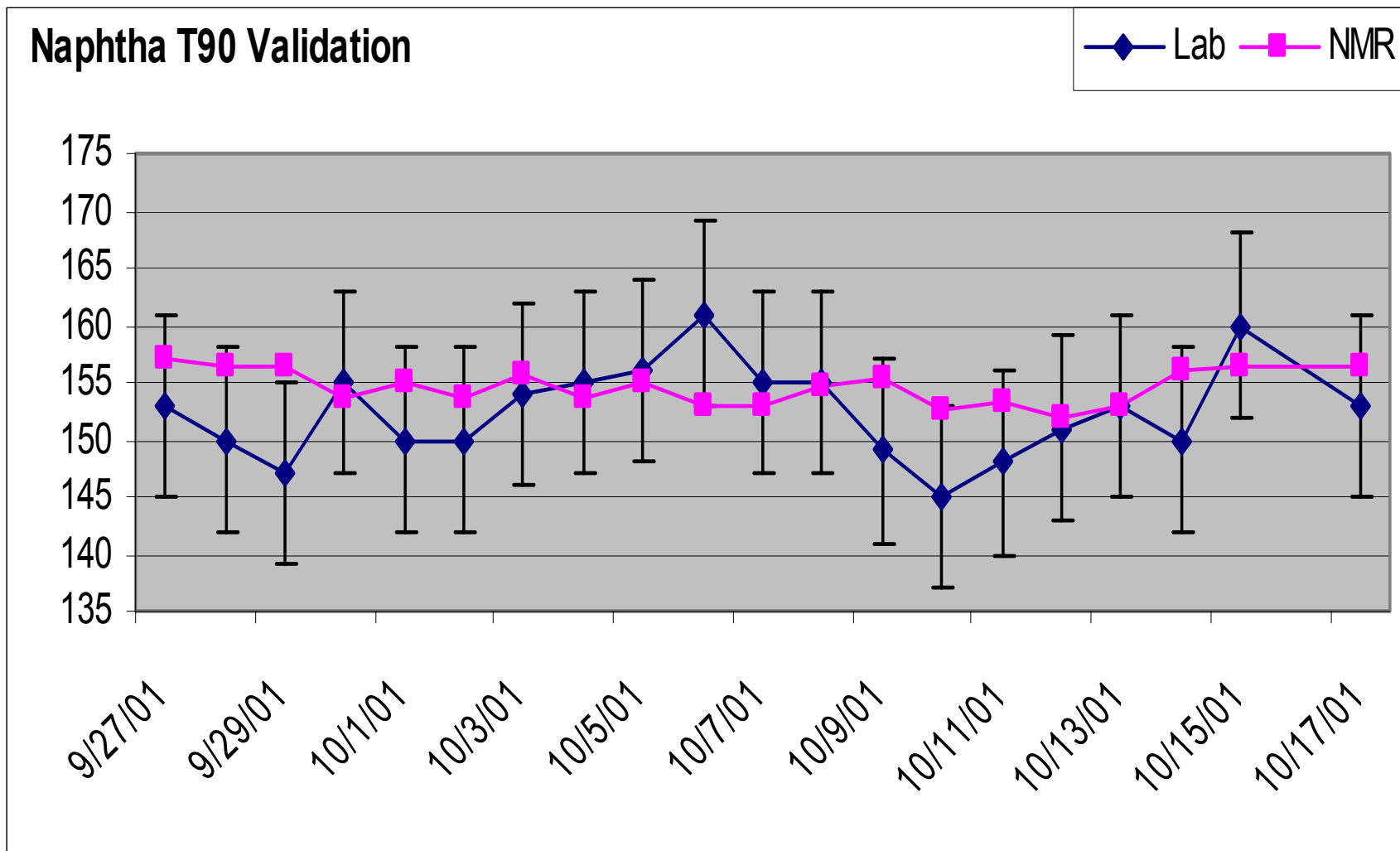
# RE-DESIGN & ACH. RESULTS



**Naphtha T50 val**



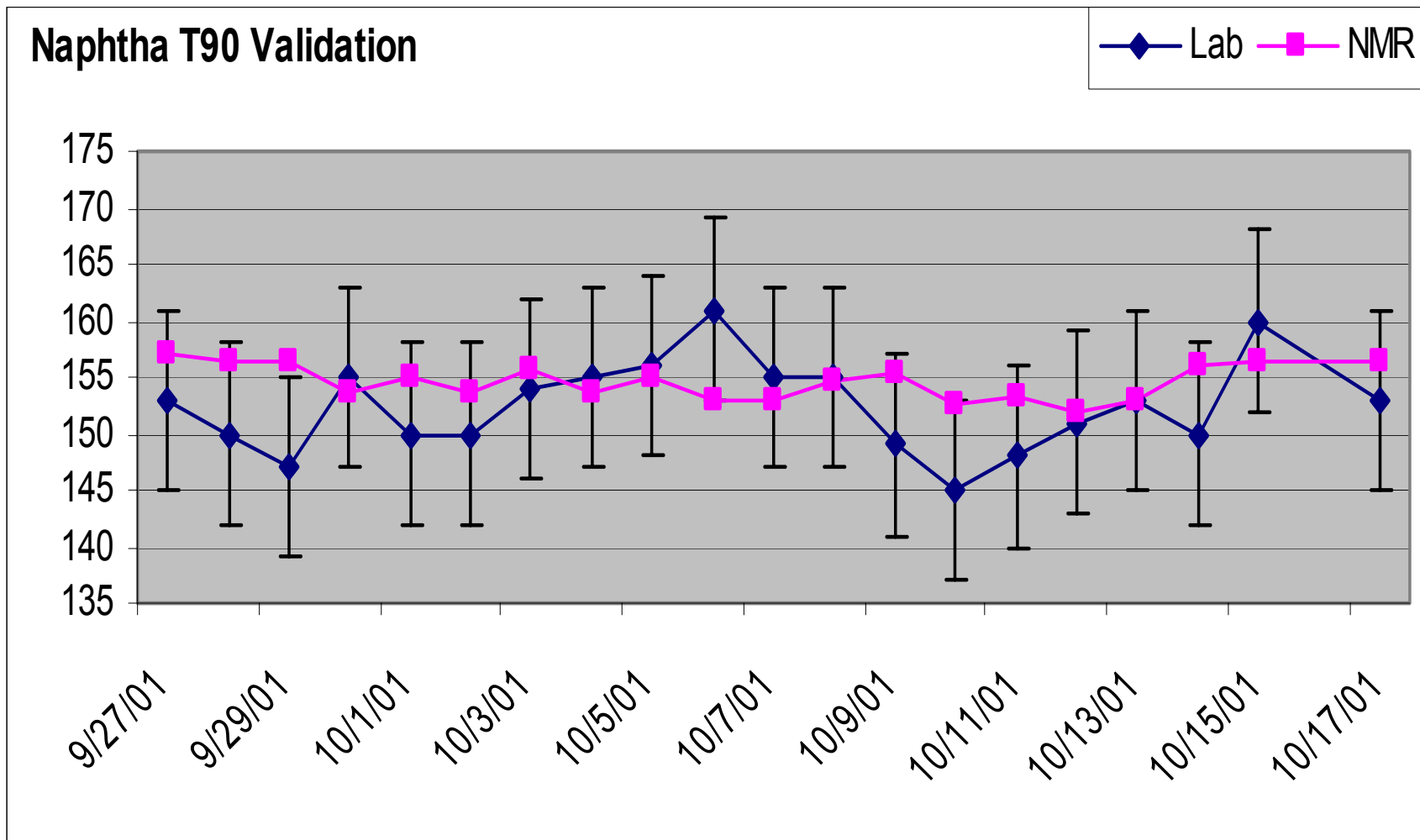
# RE-DESIGN & ACH. RESULTS



**Naphtha Endpoint**



# RE-DESIGN & ACH. RESULTS



**Naphtha T90**



**MRA PARAMETERS WITHOUT  
CORRESPONDING LAB DATA**

**Naphtha**

**PIONA**

**Kero**

**FBP**

**Crude**

**API, sulfur, n-parafins, cumulative  
cutpoints & yields**



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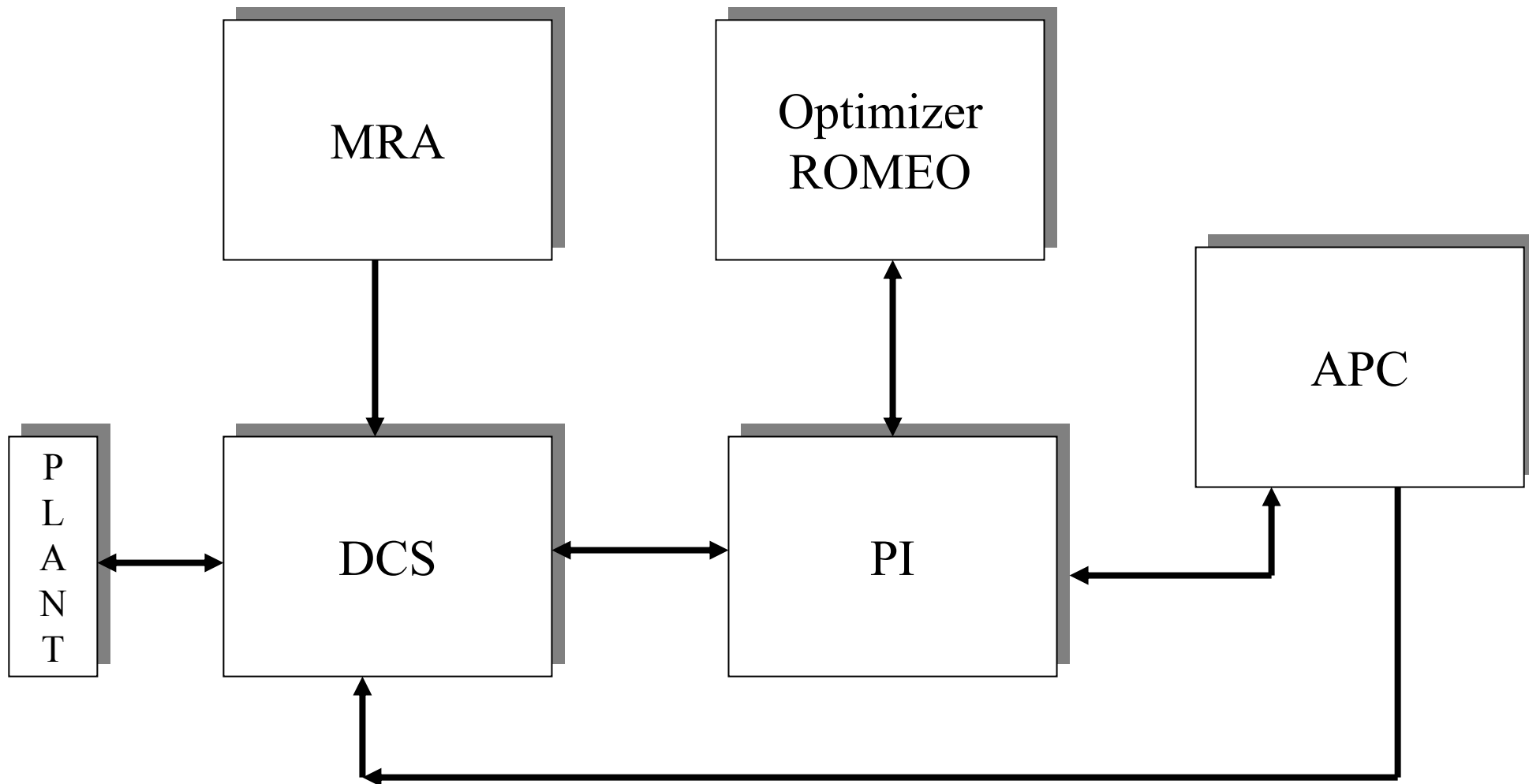
## ***RE-DESIGN & ACH. RESULTS***

# **AVAILABILITY & UTILIZATION**

|                    | <b>Availability</b> | <b>Utilization</b> |
|--------------------|---------------------|--------------------|
| <b>January 02</b>  | <b>98%</b>          | <b>98%</b>         |
| <b>February 02</b> | <b>64%</b>          | <b>64%</b>         |
| <b>March 02</b>    | <b>98%</b>          | <b>98%</b>         |

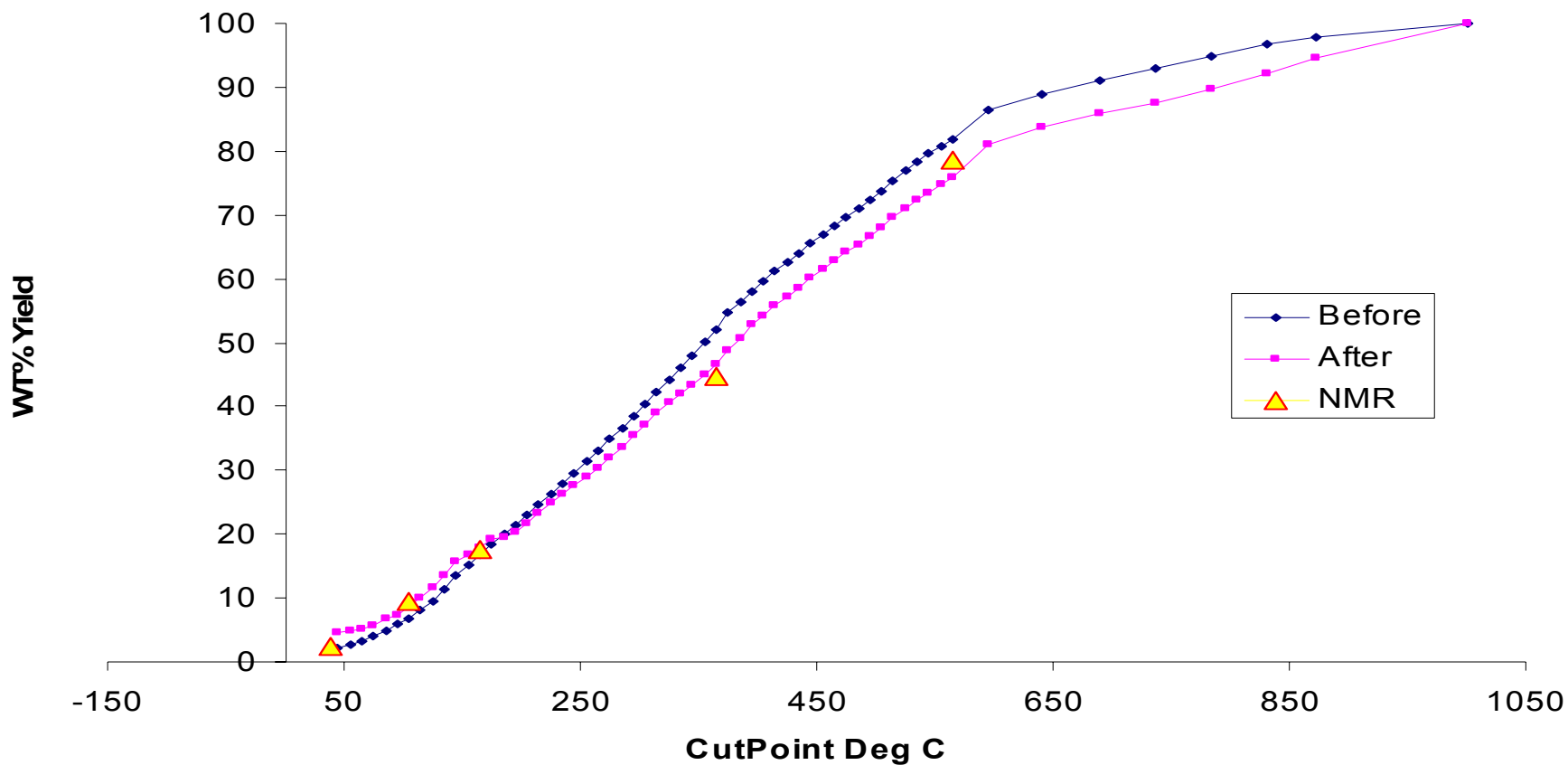


## ***RE-DESIGN & ACH. RESULTS***





## Crude Adjustment



Crude Reconciliation



## **PREVENTIVE MAINTENANCE MRA**

- Cleaning sample loop filters
- Cleaning air conditioning filters
- Checking gas detector magnet compartment
- Replace switching valves





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*MAINT. PERSP.*

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# **CORRECTIVE MAINTENANCE**

**August '01 – March '02**

**Still waiting for the first one**