Implementation and evaluation of APC in the DDHT-3 unit

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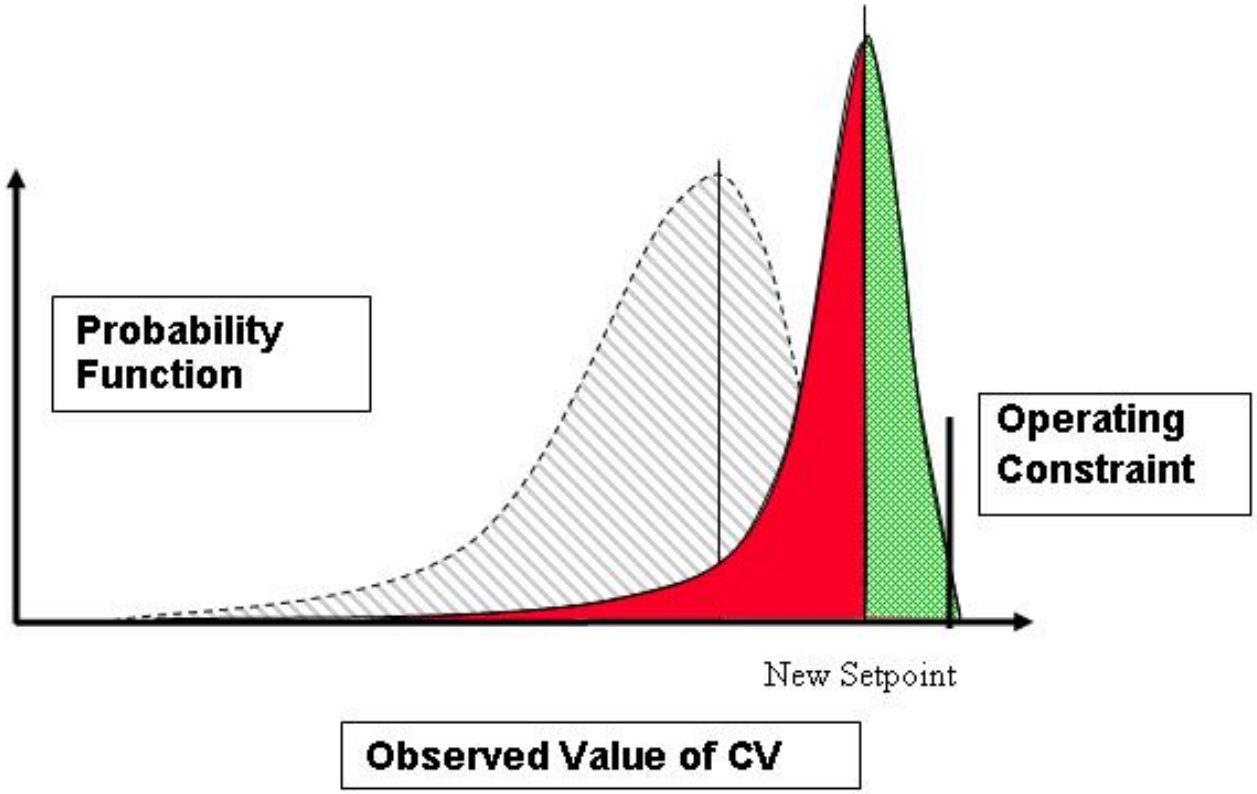
APS Forum, May 25-26th 2011

EMERSON Process Management

Agenda

1. **Introduction to APC**
2. **Overview of the DDHT-3 unit implementation**
3. **Operator interface**
4. **Evaluation of APC, benefit estimation**
5. **Possible developments of the system**

General APC target



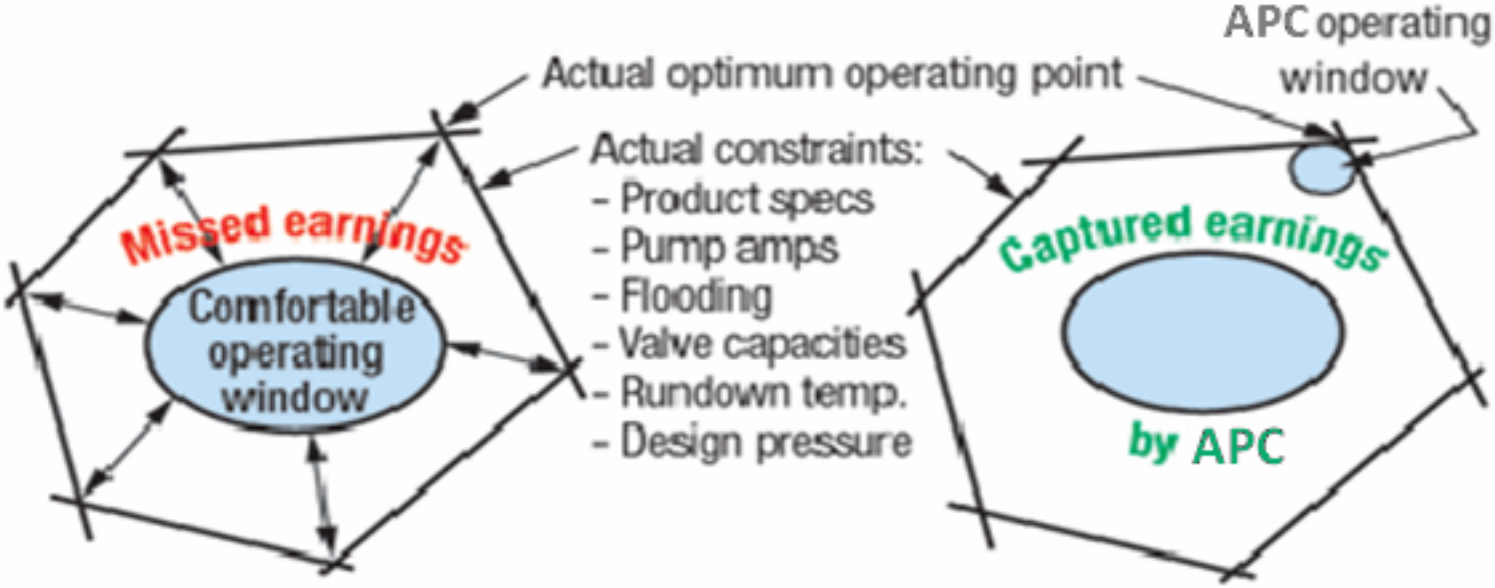
- *improve product yield*
- *improve product quality and consistency*
- *reduce product quality giveaway*
- *reduce energy consumption*

What is Advanced Process Control

INCREASED PRODUCTION EFFICIENCY

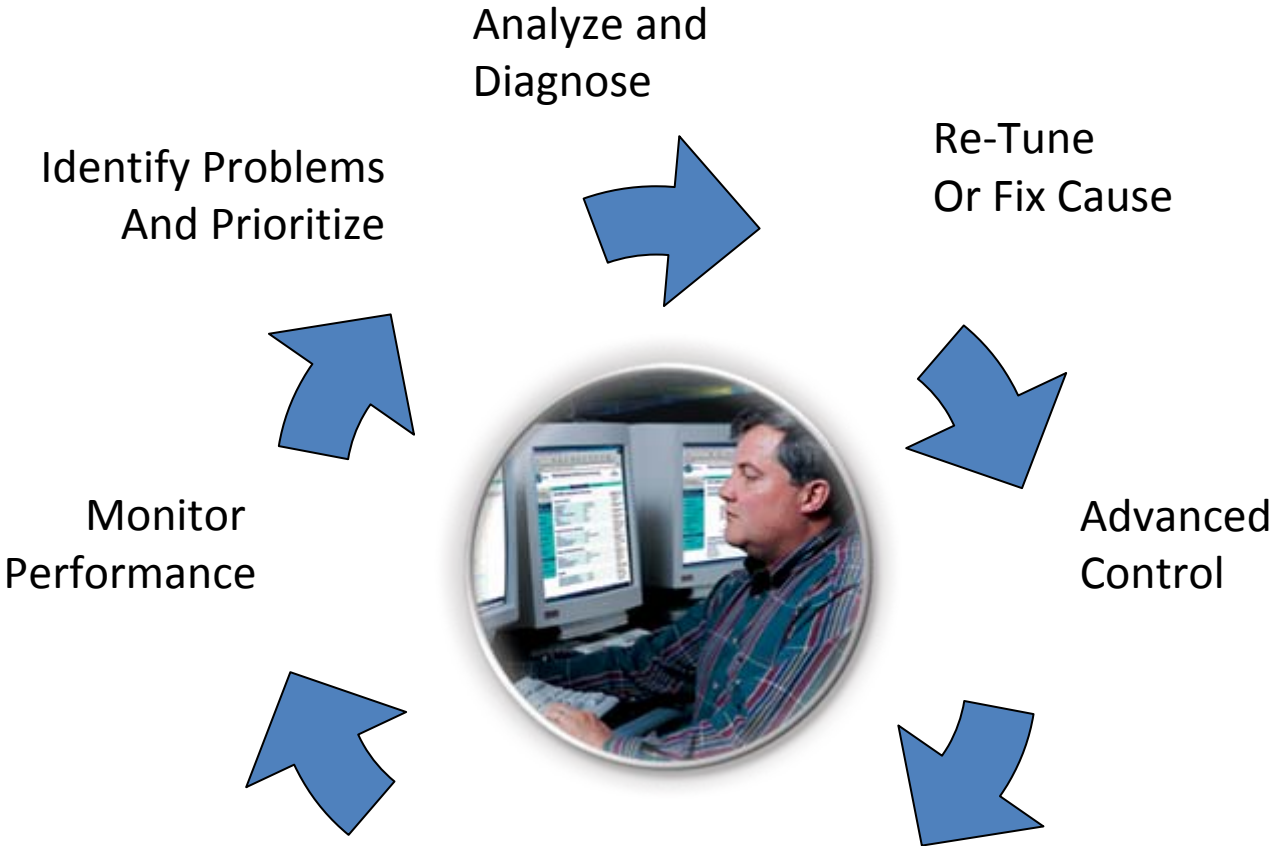
Without APC
Operation stays in a "comfort zone," away from constraints.

With APC
Process is controlled at the real optimum, capturing additional earnings.

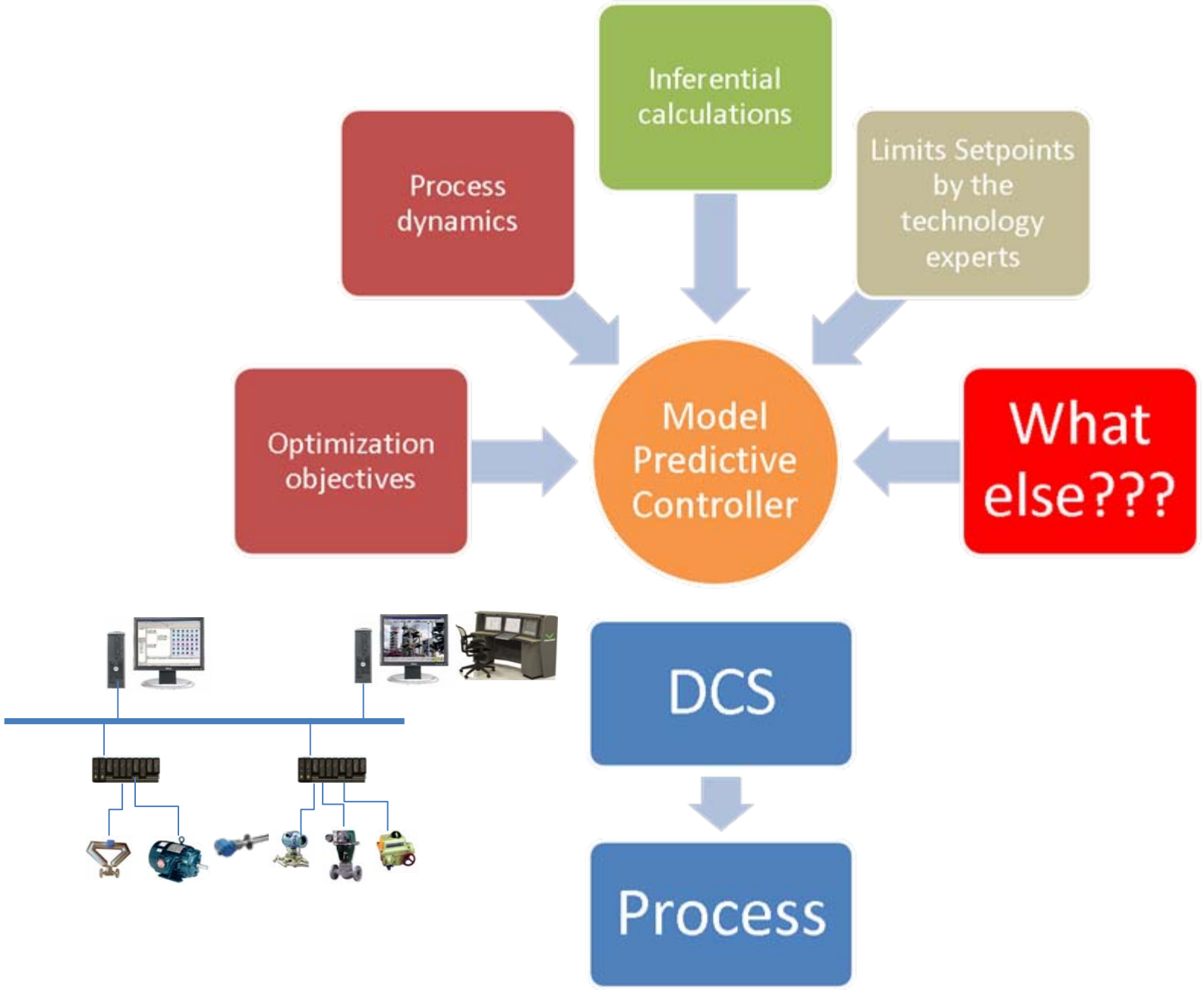


Advanced Control „lifecycle”

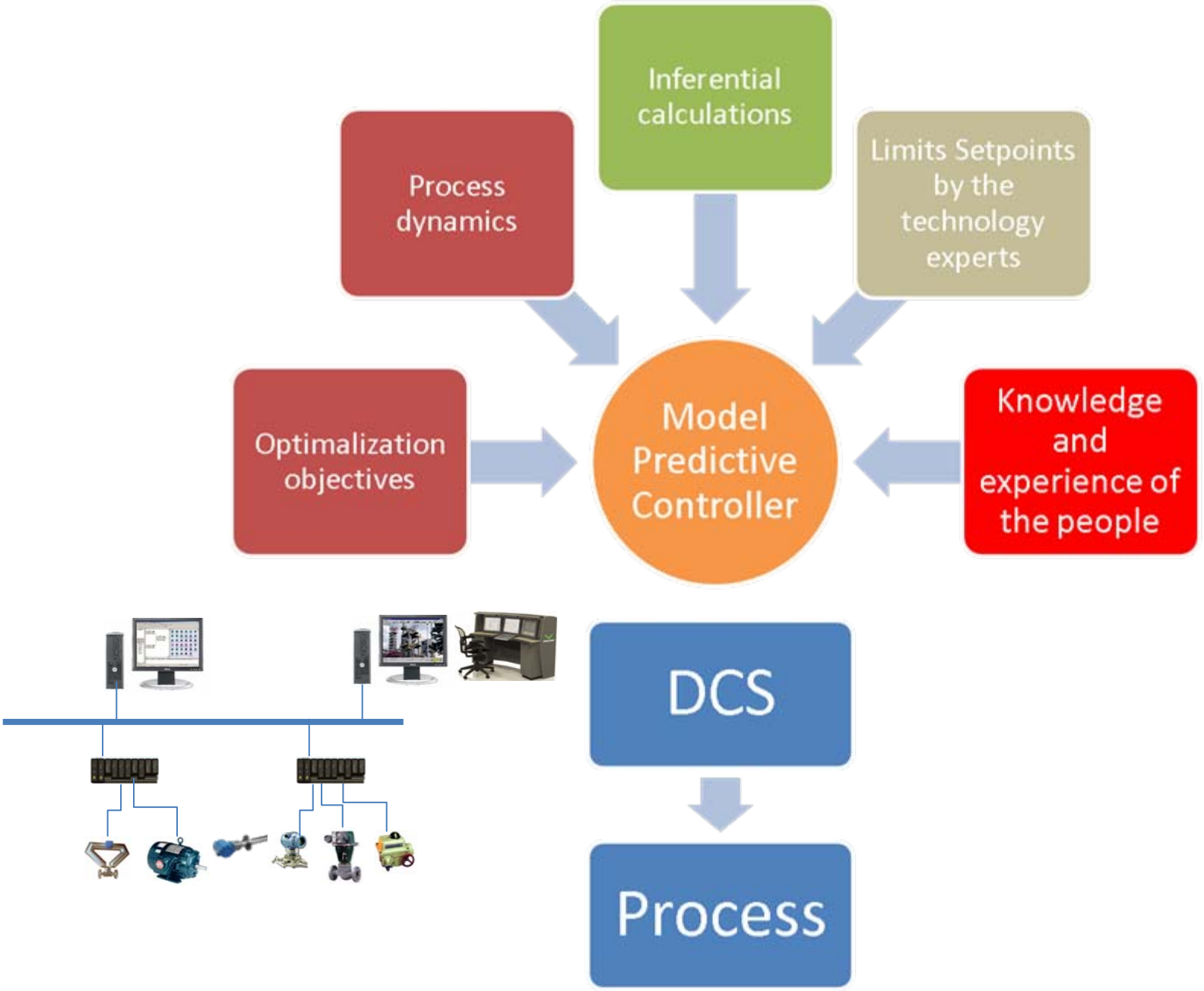
A Systematic Approach for Sustained Performance



Structure of APC



Structure of APC



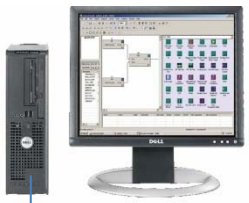
Traditional APC solution

- APC configuration
- communication with DCS (control and operation parameters)

APC workstation

-regulatory control modification
- communication with APC
- operator display modification

Engineering

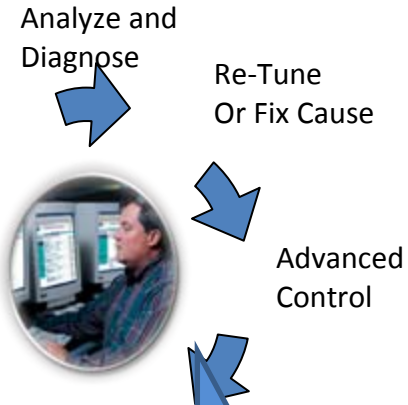


OPC

Operator

Regulatory Control

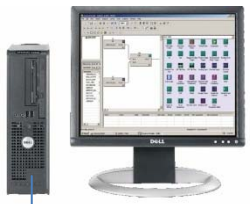
Embedded APC solution



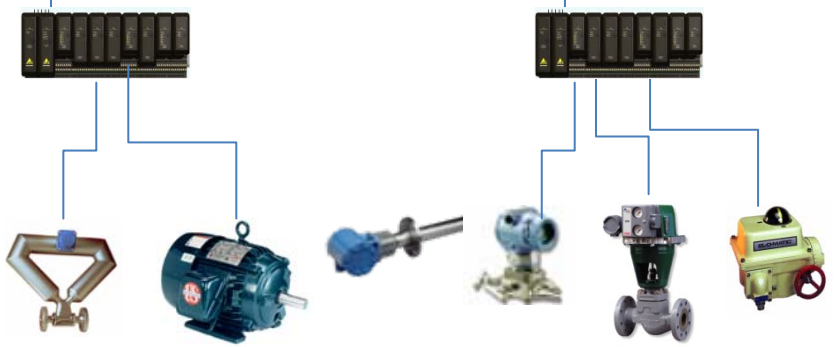
-regulatory control modification
-APC configuration
- operator display modification

Engineering

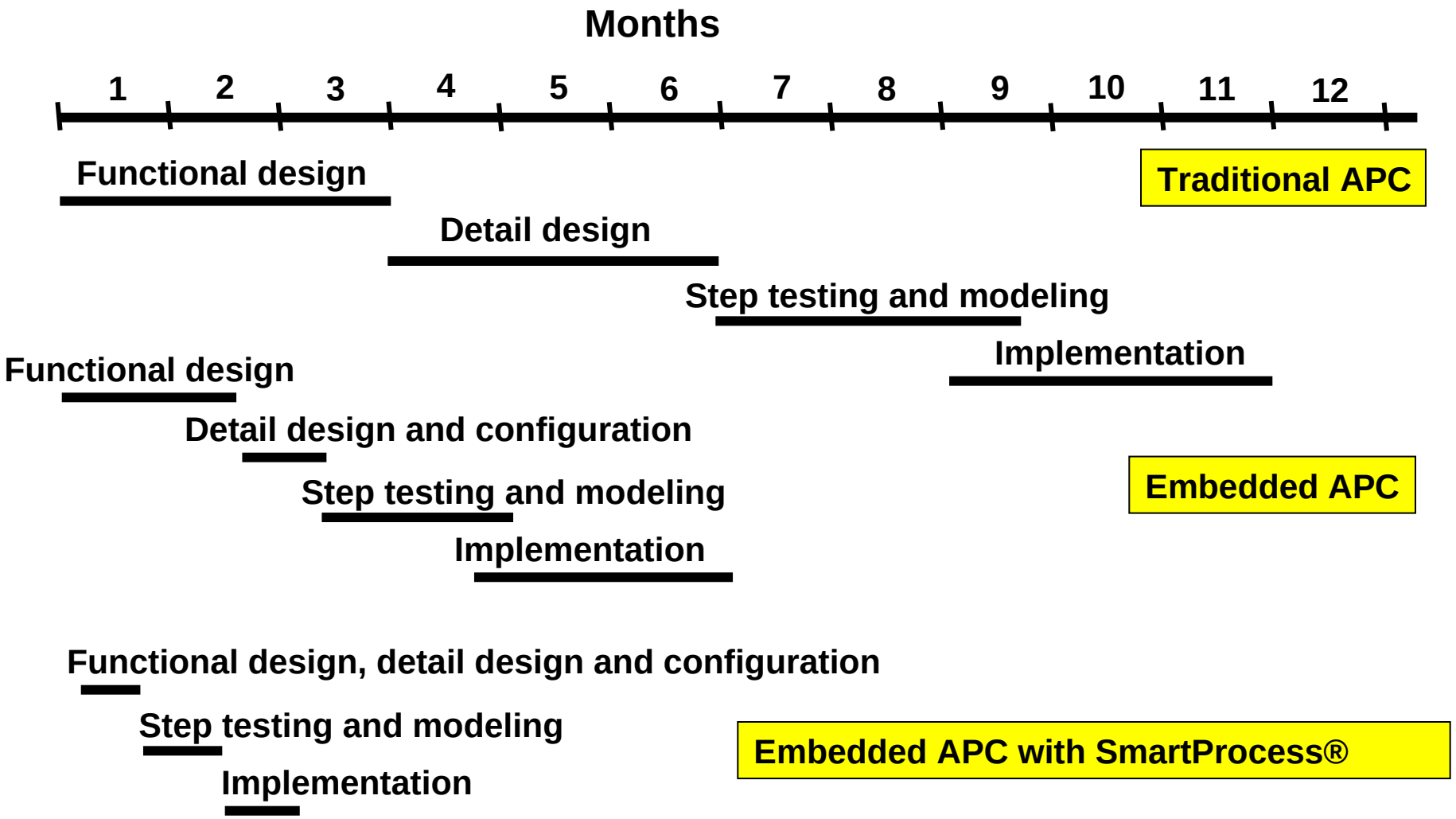
Operator



Regulatory Control
Advanced Control



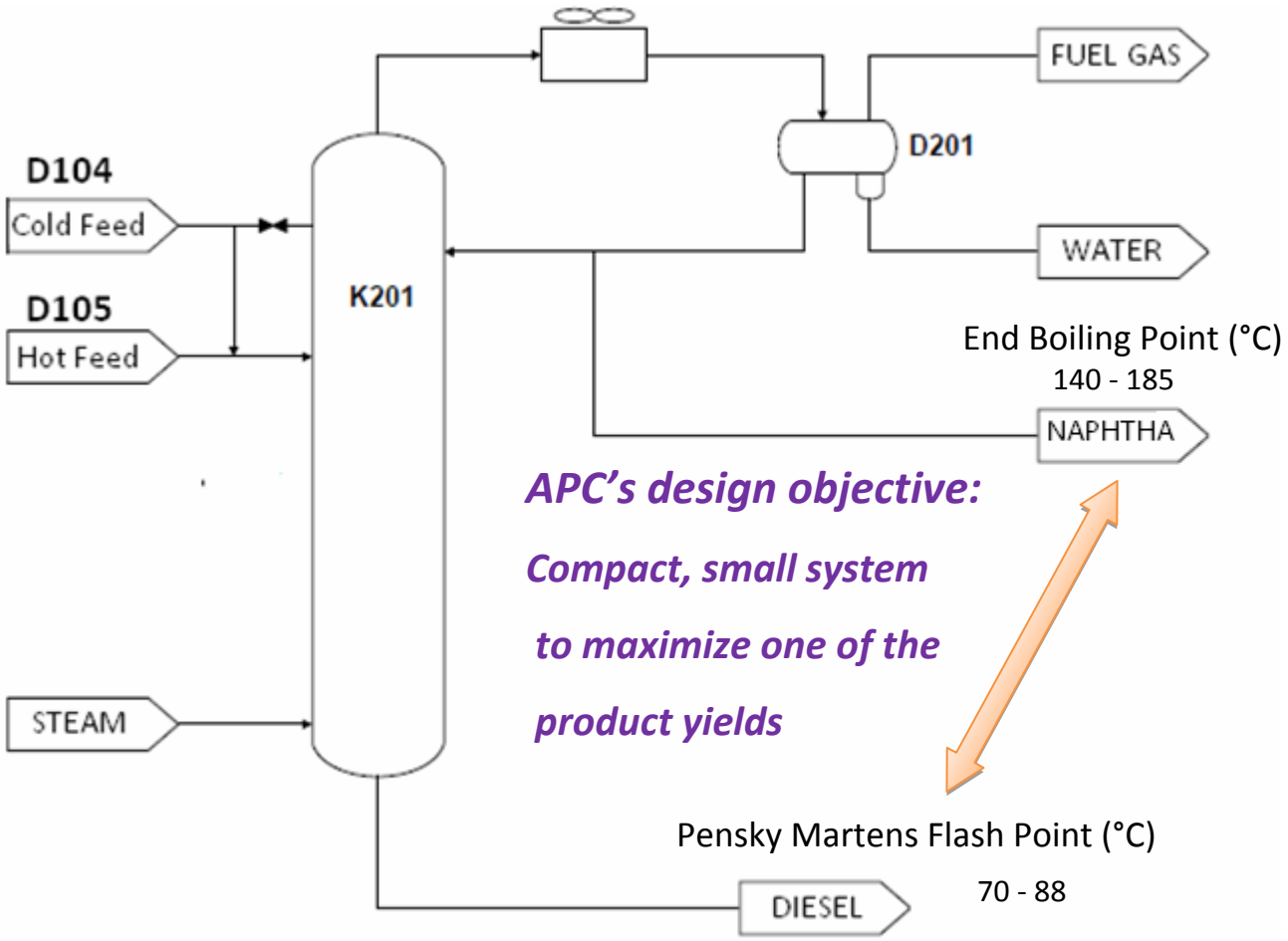
What is the difference?



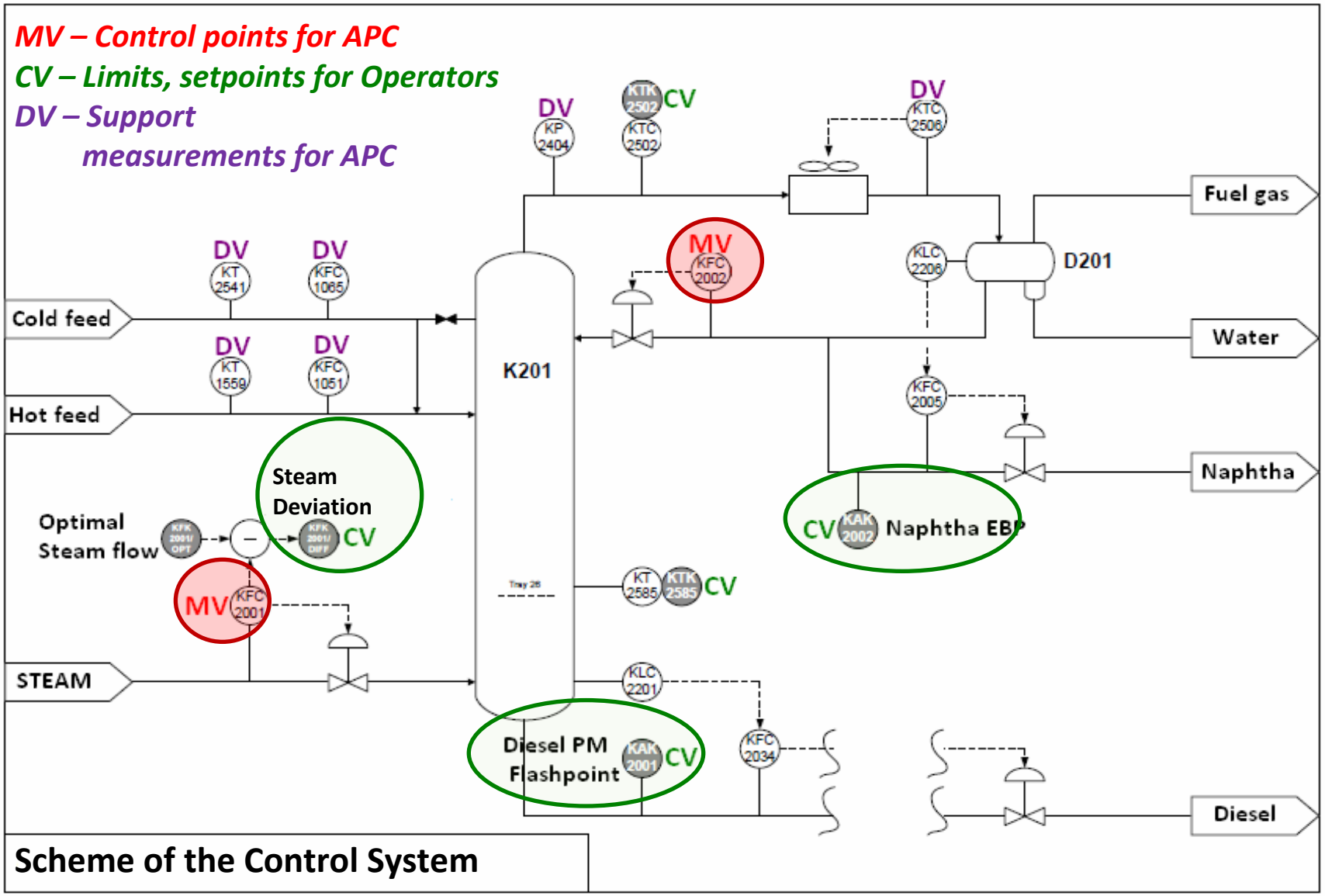
Steps of the implementation

FDS
Model building
Software installation
Step test
Validation
Performance test

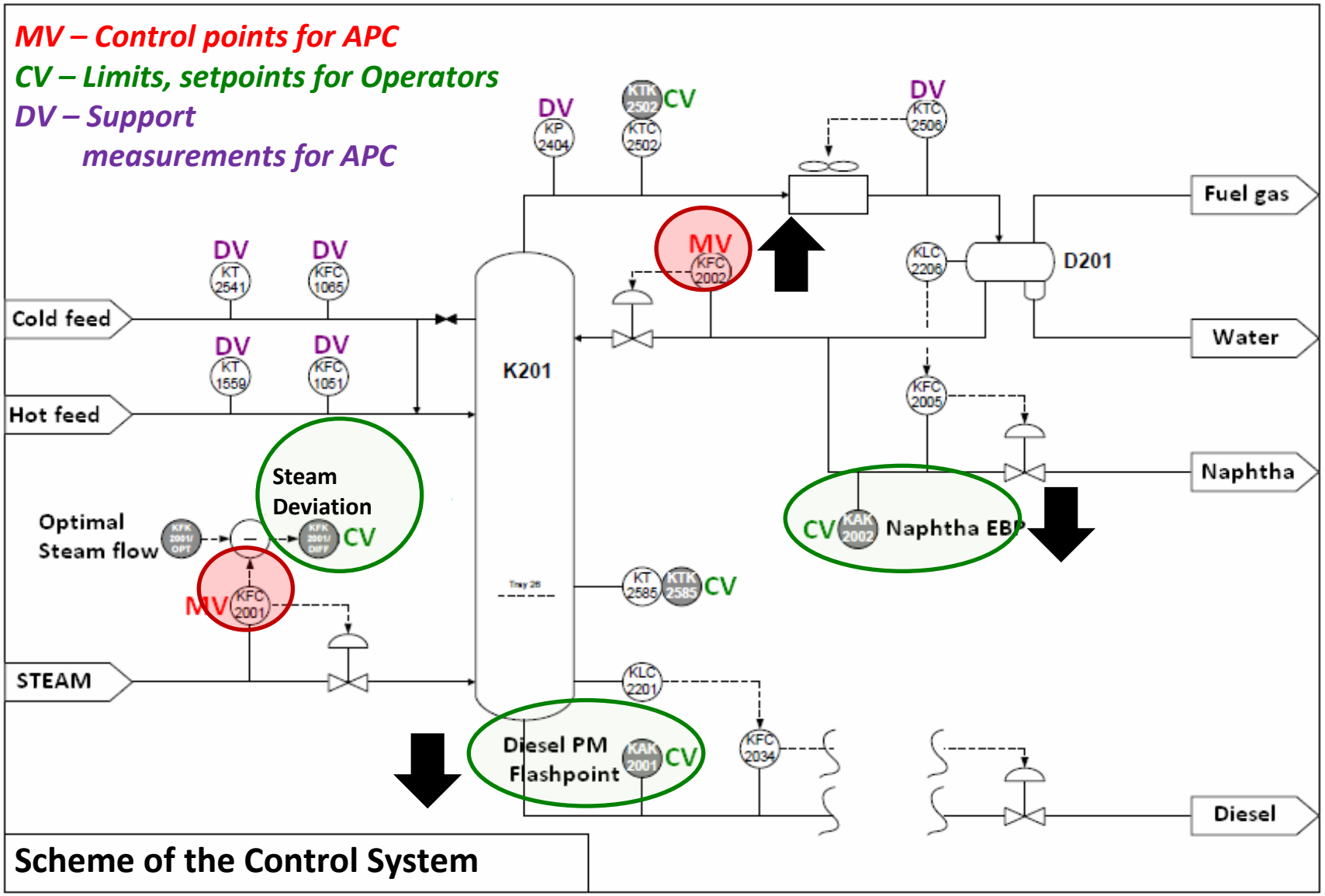
Implementation Base technology – K-201 stripper



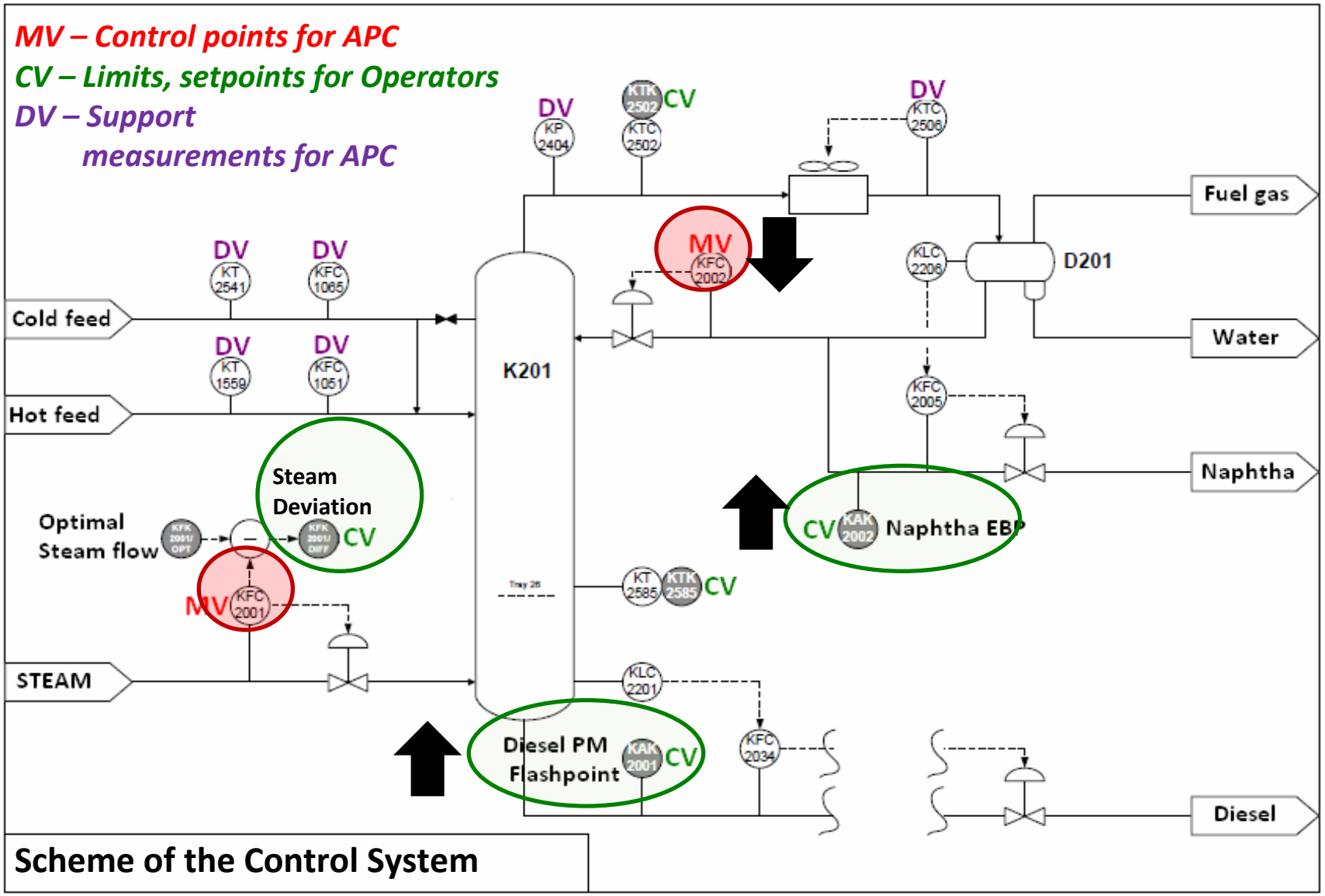
Implementation of APC - Overview



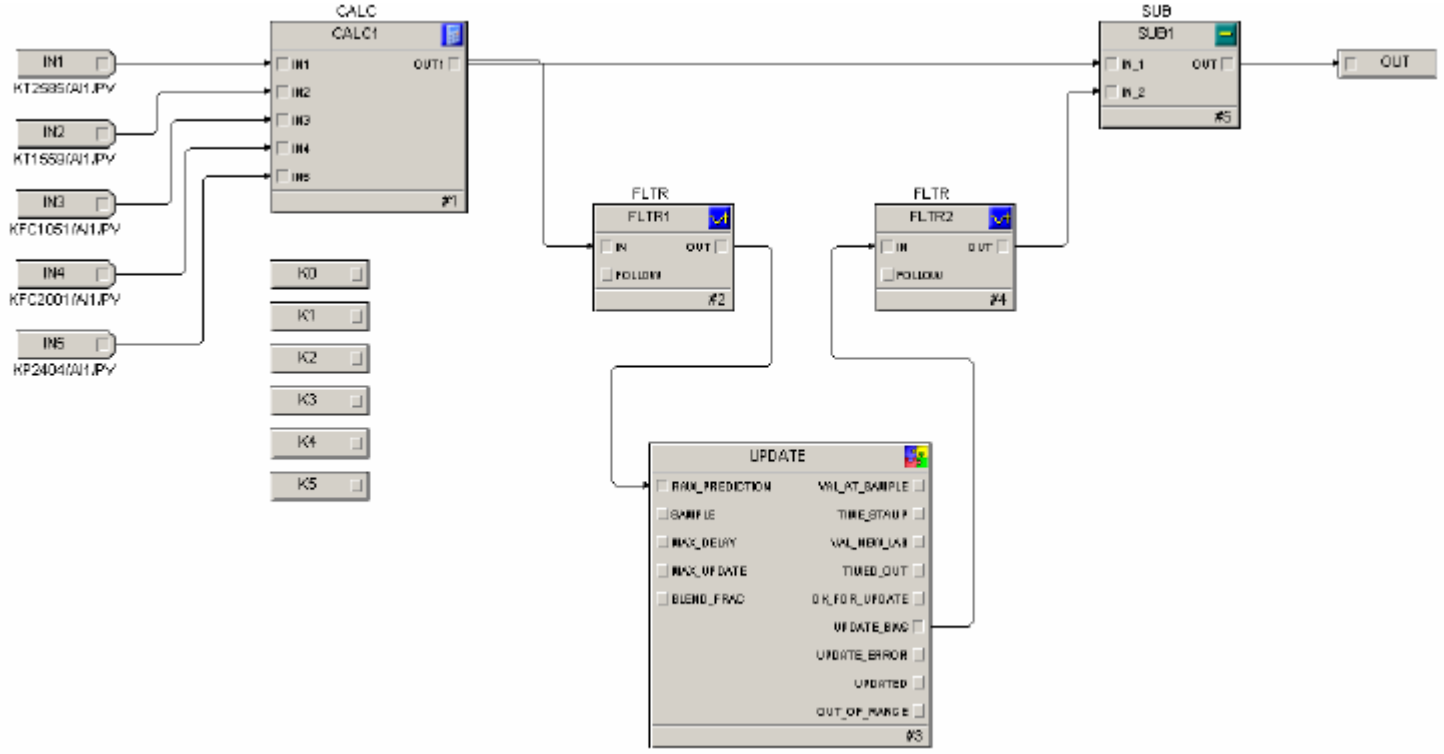
Implementation of APC – Diesel Maximalization



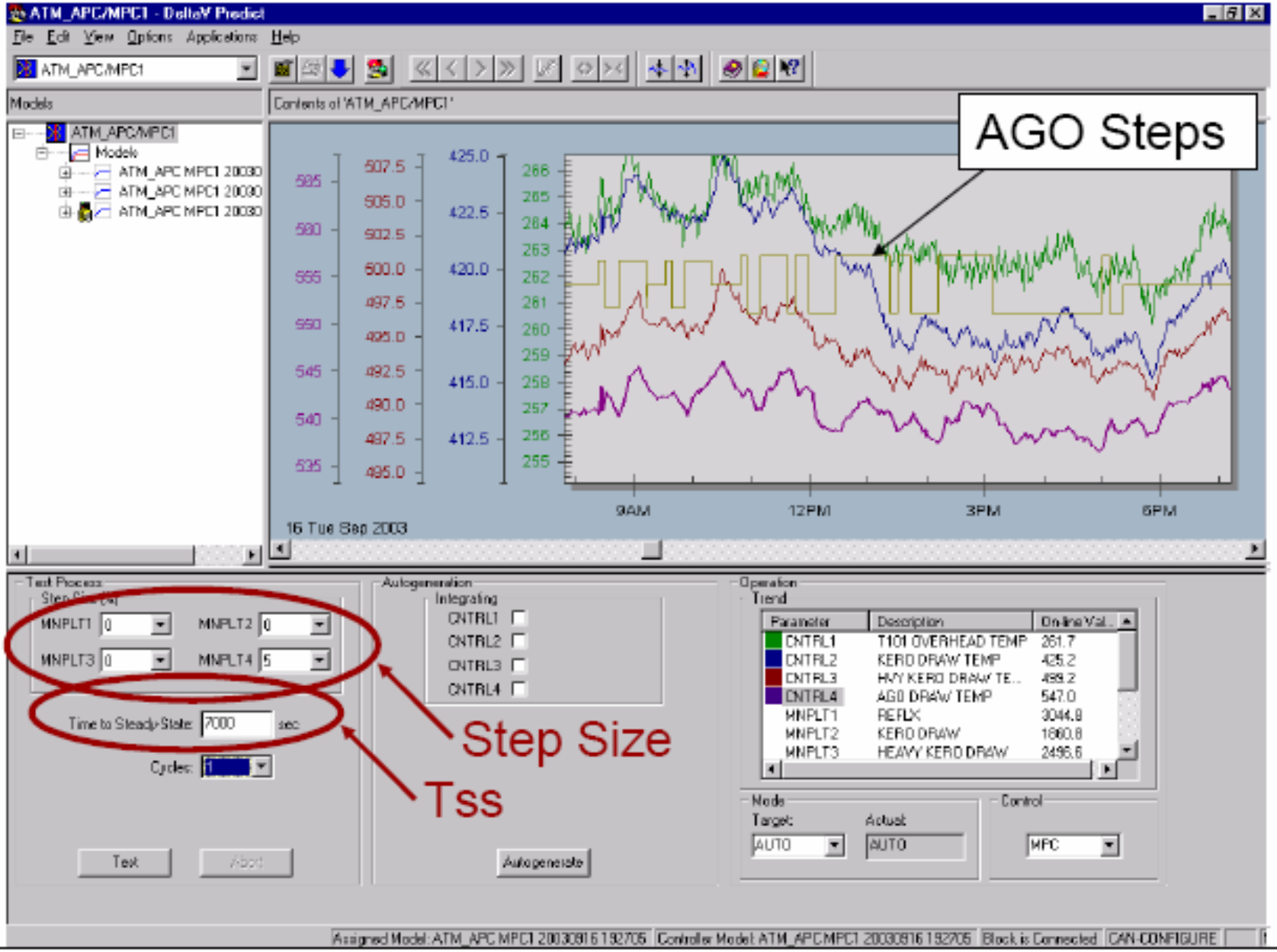
Implementation of APC – Naphtha Maximalization



KAK2001 Module Structure (top level)



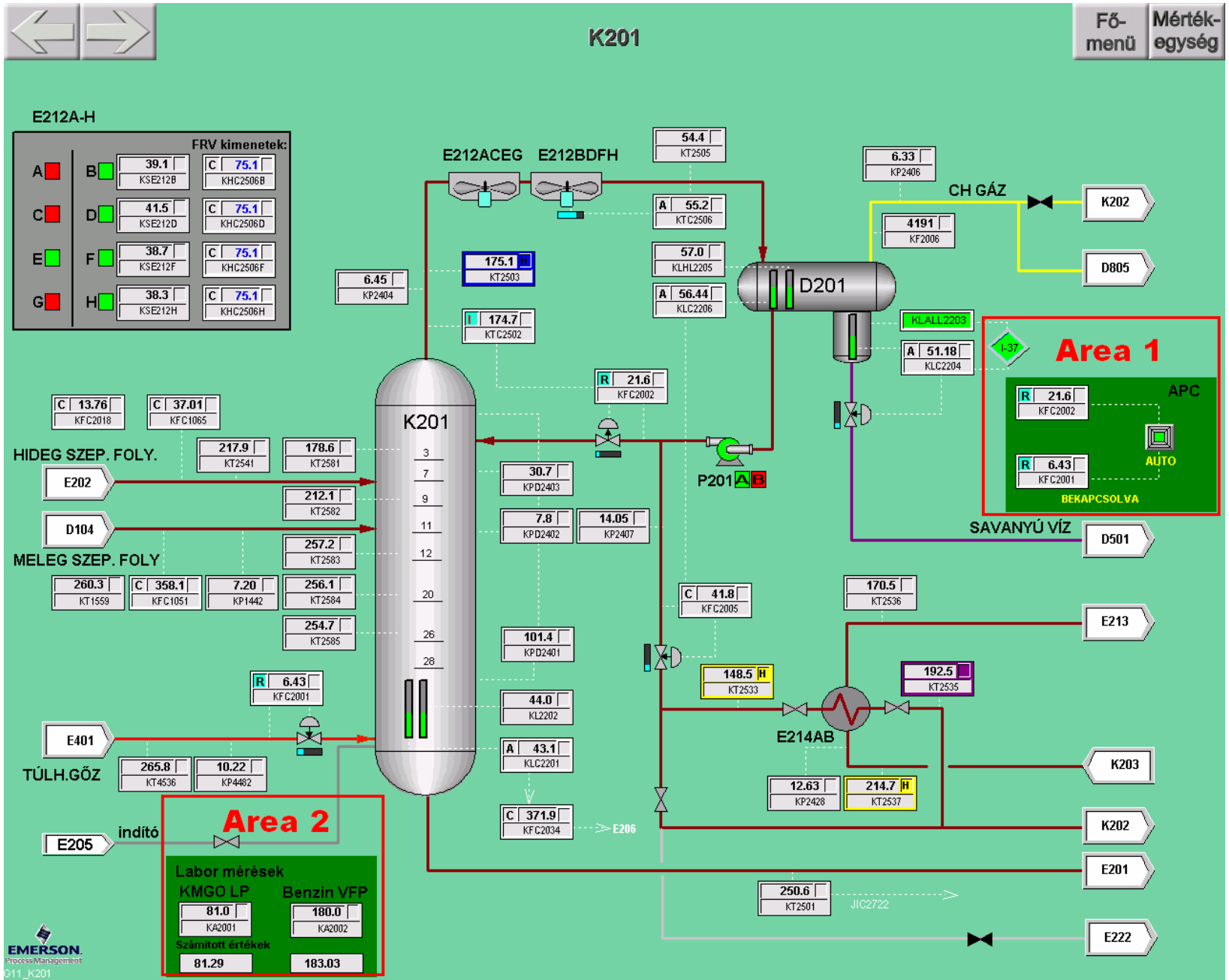
Automated Step Testing



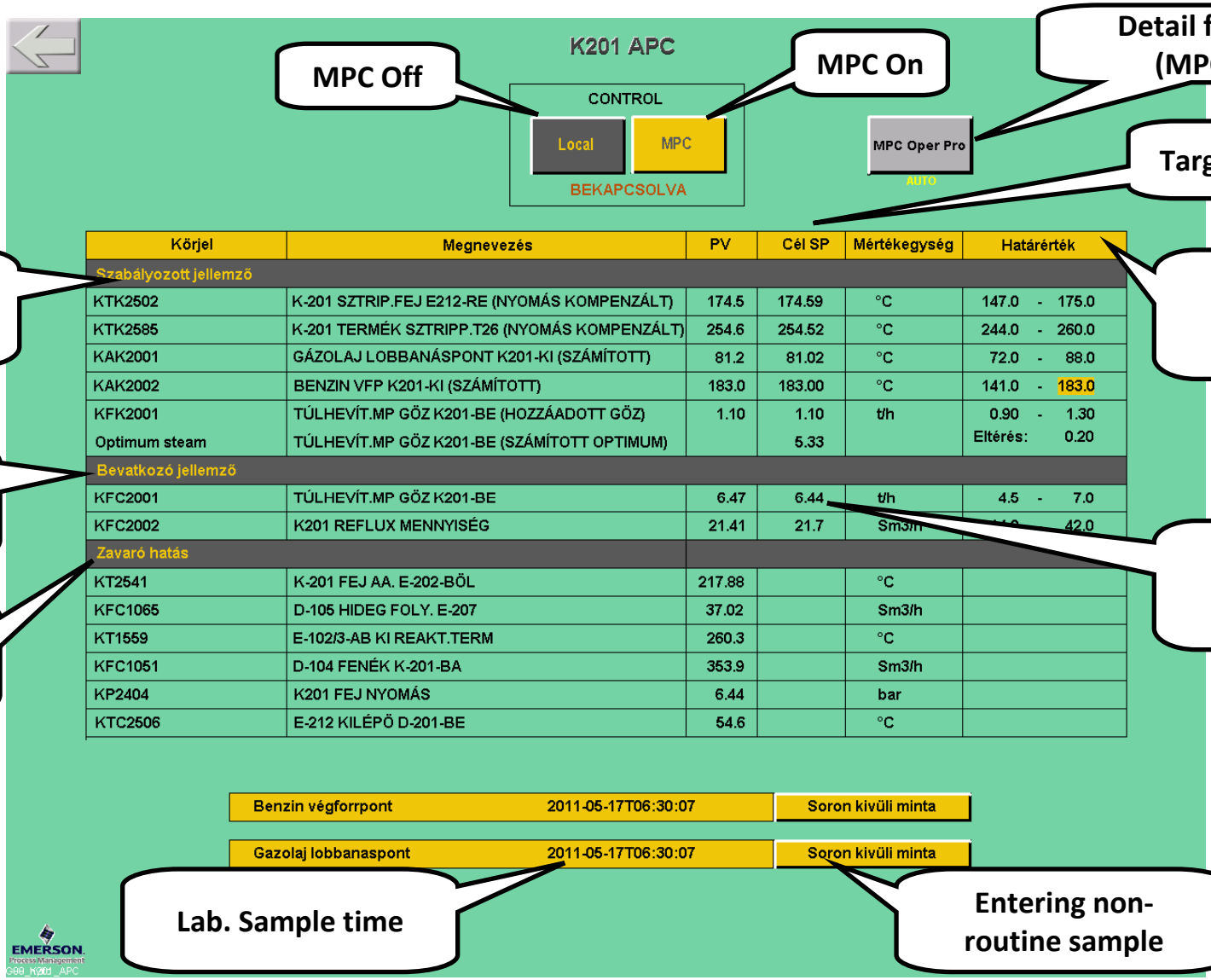
Model Matrix

	Reflux mennyiség KFC2002	E-212 kilépő hőmérséklet D201-be KTC2506	Strip gőz mennyiség KFC2001	Hideg betáp hőmérséklet KT2541	Hideg betáp mennyiség KFC1065	Meleg betáp hőmérséklet KT1559	Meleg betáp mennyiség KFC1051	K201 fej nyomás KP2404
Opt. gőz mennyiség KFK2001	Gain = 0 D Time = 0 Tau = 0	Gain = 0 D Time = 0 Tau = 0	Gain = 0.725 D Time = 60 Tau = 125	Gain = 0 D Time = 0 Tau = 0	D Time = 0 Tau = 0	Gain = 0 D Time = 0 Tau = 0	Gain = 0 D Time = 0 Tau = 0	Gain = 0 D Time = 0 Tau = 0
Nyomás komp. Fej KTK2502	Gain = -0.898 D Time = 60 Tau = 300	Gain = 0 D Time = 0 Tau = 0	Gain = 0 D Time = 0 Tau = 0	Gain = 0.2 D Time = 60 Tau = 498	Gain = 0 D Time = 0 Tau = 0	Gain = 1 D Time = 60 Tau = 332	Gain = 0 D Time = 0 Tau = 0	Gain = 5.17 D Time = 60 Tau = 1661
Ny. K 26. tányér hőfok KTK2585	Gain = -0.29 D Time = 60 Tau = 581	Gain = 0 D Time = 0 Tau = 0	Gain = 0 D Time = 0 Tau = 0	Gain = 0.25 D Time = 1500 Tau = 200	Gain = 0 D Time = 0 Tau = 0	Gain = 0.25 D Time = 450 Tau = 400	Gain = 0 D Time = 0 Tau = 0	Gain = -0.6 D Time = 0 Tau = 60
Gázolaj lobbanáspont KAK2001	Gain = -0.51 D Time = 60 Tau = 581	Gain = 0 D Time = 0 Tau = 0	Gain = 0 D Time = 0 Tau = 0	Gain = 0.6 D Time = 1500 Tau = 200	Gain = 0 D Time = 0 Tau = 0	Gain = 0.425 D Time = 450 Tau = 400	Gain = 0 D Time = 0 Tau = 0	Gain = -0.6 D Time = 0 Tau = 60
Benzin végforrpont KAK2002	Gain = -1 D Time = 60 Tau = 208	Gain = 0 D Time = 0 Tau = 0	Gain = 0 D Time = 0 Tau = 0	Gain = 0.2674 D Time = 60 Tau = 500	Gain = 0 D Time = 0 Tau = 0	Gain = 1.337 D Time = 60 Tau = 332	Gain = 0 D Time = 0 Tau = 0	Gain = 4.95 D Time = 60 Tau = 1600

Operator interface / Summary Screen



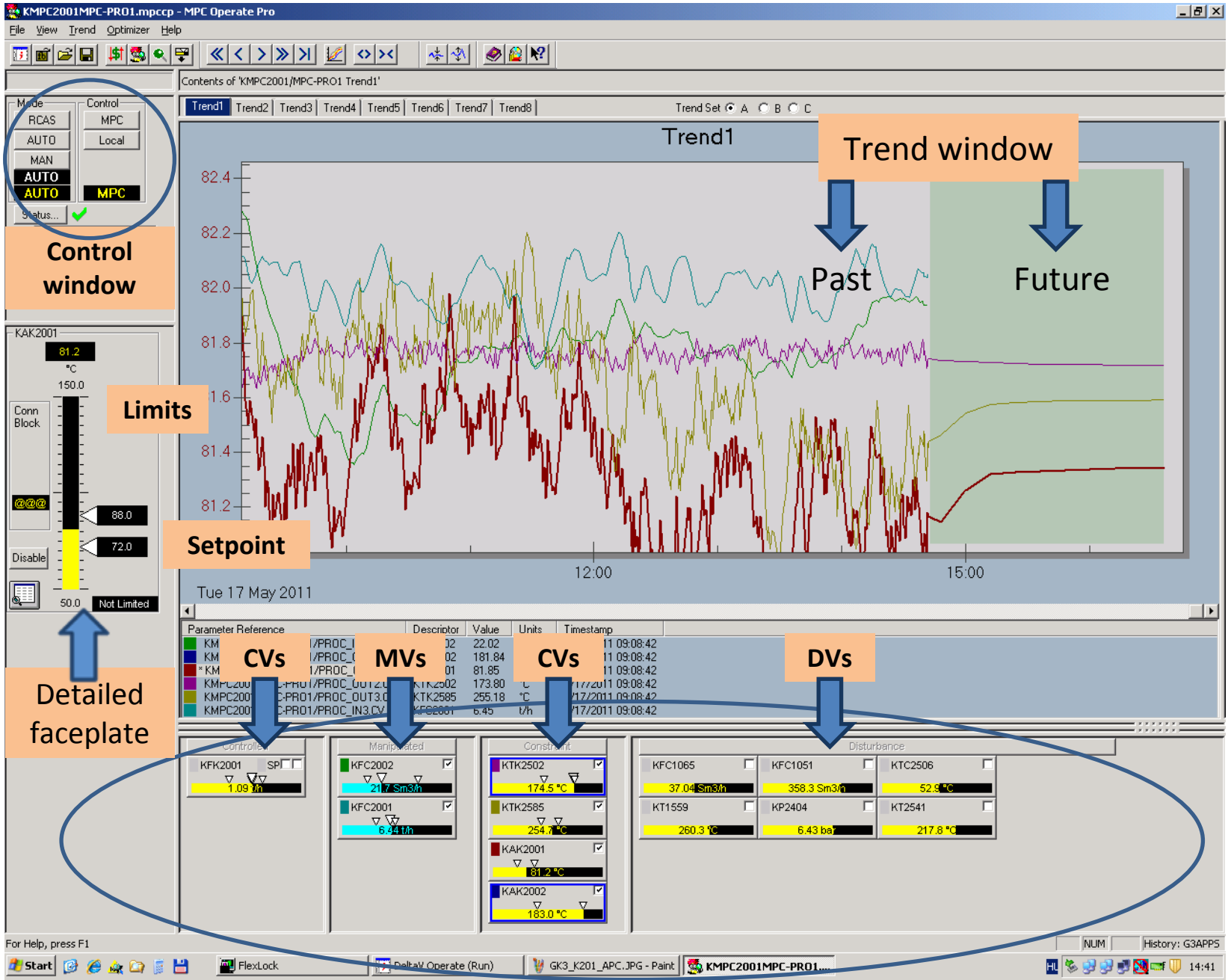
APC Summary Screen



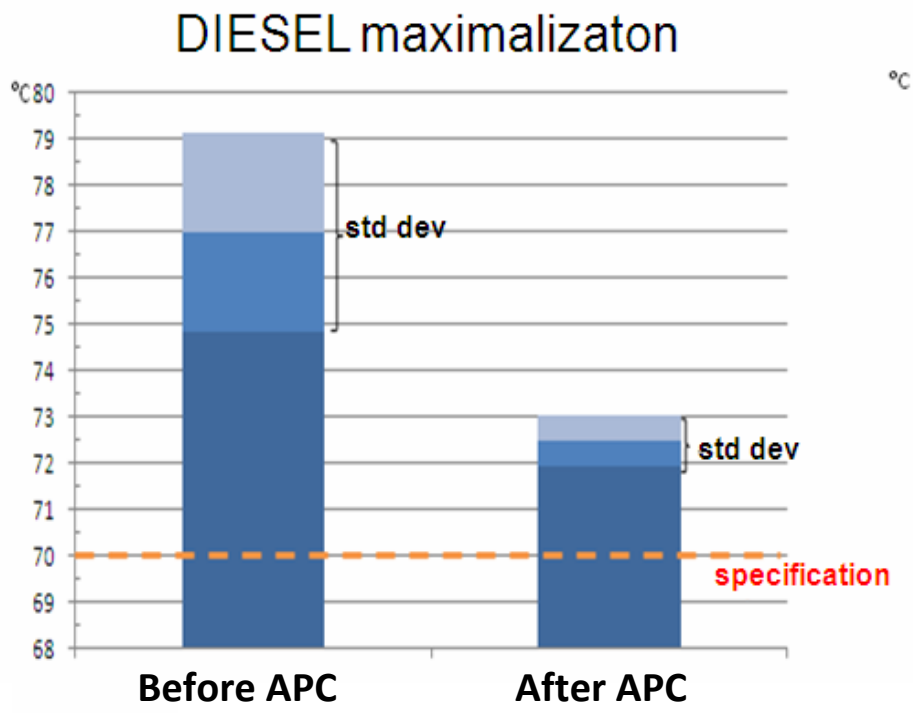
Körjel	Megnevezés	PV	Cél SP	Mértékegység	Határérték
Szabályozott jellemző					
KTK2502	K-201 SZTRIP.FEJ E212-RE (NYOMÁS KOMPENZÁLT)	174.5	174.59	°C	147.0 - 175.0
KTK2585	K-201 TERMÉK SZTRIPP.T26 (NYOMÁS KOMPENZÁLT)	254.6	254.52	°C	244.0 - 260.0
KAK2001	GÁZOLAJ LOBBANÁSPONT K201-KI (SZÁMÍTOTT)	81.2	81.02	°C	72.0 - 88.0
KAK2002	BENZIN VFP K201-KI (SZÁMÍTOTT)	183.0	183.00	°C	141.0 - 183.0
KFK2001	TÚLHEVÍT.MP GÖZ K201-BE (HOZZÁADOTT GÖZ)	1.10	1.10	t/h	0.90 - 1.30
Optimum steam	TÚLHEVÍT.MP GÖZ K201-BE (SZÁMÍTOTT OPTIMUM)		5.33		Eltérés: 0.20
Bevatkozó jellemző					
KFC2001	TÚLHEVÍT.MP GÖZ K201-BE	6.47	6.44	t/h	4.5 - 7.0
KFC2002	K201 REFLUX MENNYISÉG	21.41	21.7	Sm3/h	42.0
Zavaró hatás					
KT2541	K-201 FEJ AA. E-202-BÖL	217.88		°C	
KFC1065	D-105 HIDEG FOLY. E-207	37.02		Sm3/h	
KT1559	E-102/3-AB KI REAKT.TERM	260.3		°C	
KFC1051	D-104 FENÉK K-201-BA	353.9		Sm3/h	
KP2404	K201 FEJ NYOMÁS	6.44		bar	
KTC2506	E-212 KILÉPÖ D-201-BE	54.6		°C	

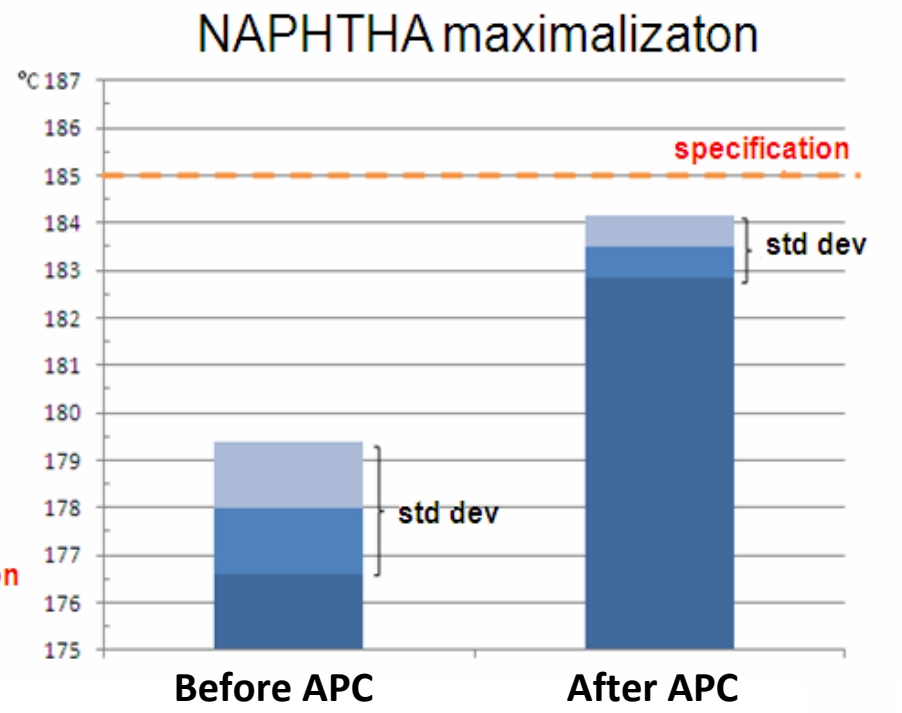
Benzin végforrpont	2011-05-17T06:30:07	Soron kivüli minta
Gazolaj lobbanaspont	2011-05-17T06:30:07	Soron kivüli minta

MPC PRO screen



Evaluation – Product yield maximalisation





Is based on 2010 historical data

With the quality ~ product yield correlation, the estimated product yield increase:

DIESEL: 2,5%

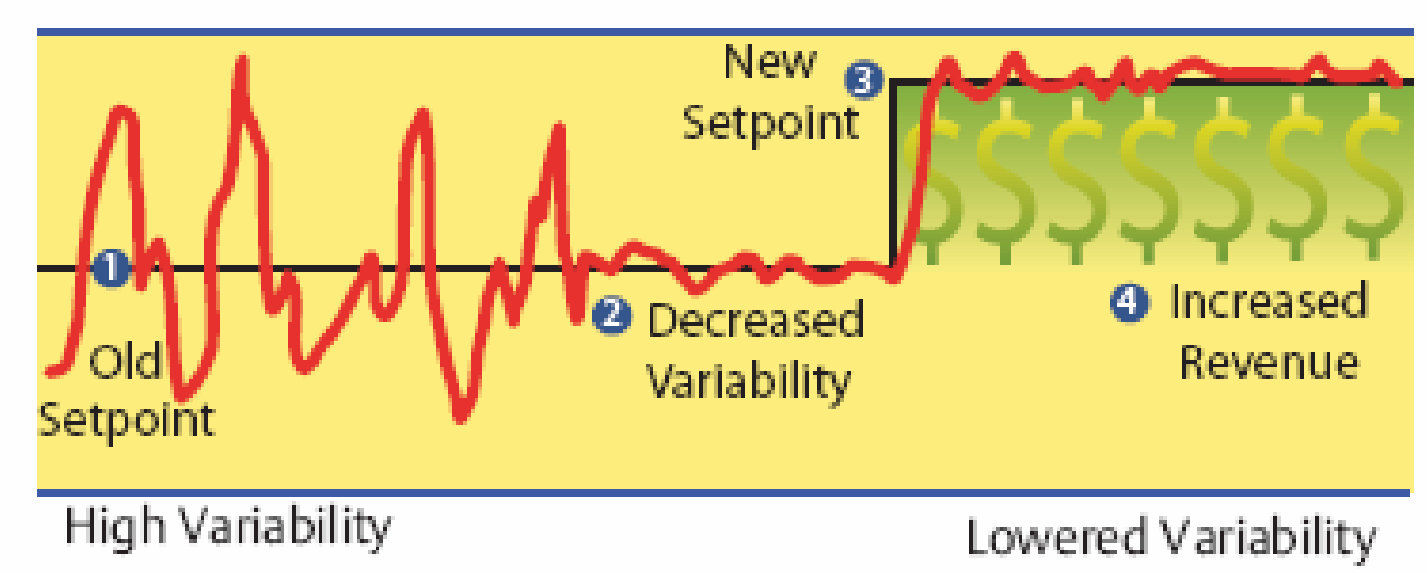
NAPHTHA: 1,6 %

Evaluation – Inferential validation

	EBP calculation (°C)	Flash point calculation (°C)
Average absolute Error inferential -laboratory	***1,6***	***0,8***
Acceptable Error	***2,5***	***1,5***
Standard deviation of Absolute Error	0,9	0,68
Acceptable Error	2,0	1,0

The APC is as good as it's inferential calculations

GOK-3 APC benefits



In January, 2011 the crackspread difference was 10 $/t in favour of diesel

Benefits: 120.000.000 HUF / year

Additional benefit: Steam reduction ~ 20 M HUF

Capital cost: 30.000.000 HUF

Payback time: 3 months

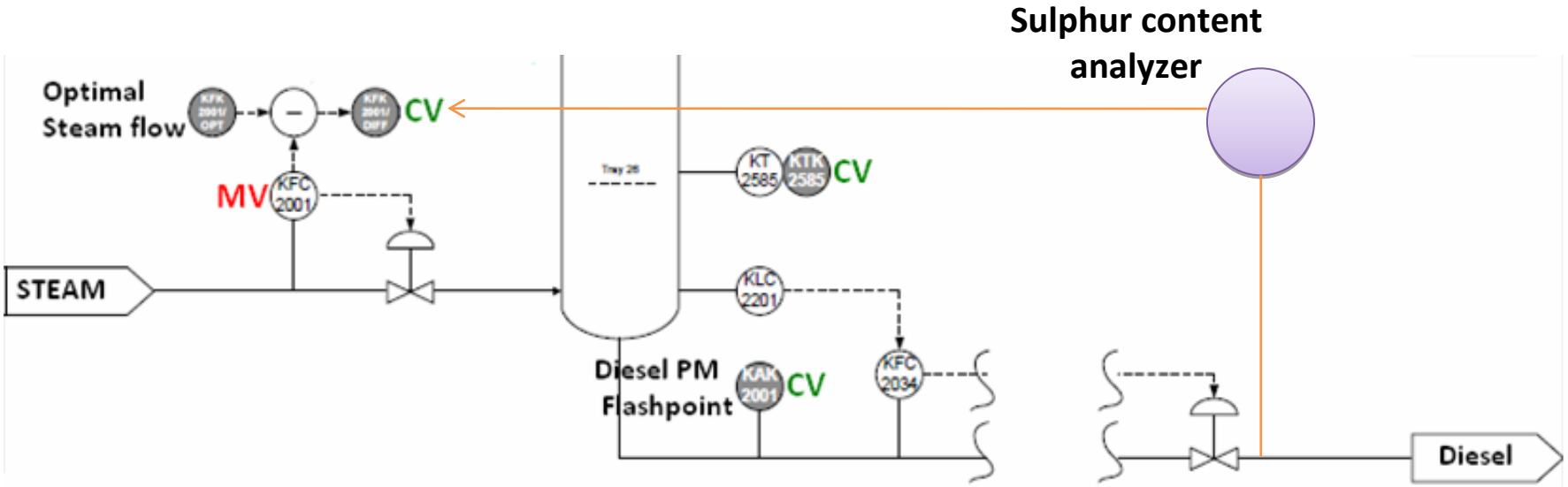
Challenges of the project

Staff behaviour
Communication between the contractor and customer
Detailed design was not available during the contractual phase

Strength of the project

Short implementation duration less than 3 months.
The staff accepted to work with APC under shorten period.
Control room implementation without working on site

Possible development of the system



Connect a sulphur content analyzer

Ability to calculate the optimal steam consumption inside the sulphur content limit

Continuous Validation , availability, reliability

MESSAGES

For managers:
APC project promotion
Quick capex roi
Decreasing the load of the operators
Utilize the capabilities of the built in automation devices

For operators:
Using the knowledge of operators and the opportunity of APC systems achieve the best quality and maximum product yields.