Use of PI to increase refinery margin

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OSIsoft.

REGIONAL SEMINARS 2012

The Power of Data

Agenda

1. A few words about me
2. A few words about Nynas

3. Nynas PI system – General structure
4. How we use PI to enhance production
   - Monitoring of performance
   - Increased reliability
   - Operator support and plant optimization
   - Operator training
5. Summary

A few words about me – Tomas Montin

- Exam from Royal Institute of Technology Stockholm1979
- Employed by Nynas since 1984:
  - Project manager engineering
  - Planner Group Optimisation
  - Manger Process control systems
  - Plant manager crude distillation unit
  - Planning manager Nynäshamn refinery
  - Manger Corporate Planning and Optimization
  - Asset Manager NSP units
  - Production engineer and manger production engineers

A global business

- Nynas concentrate on specialised oil applications bitumen
- Nynas has over 850 employees with specialist knowledge

Our specialised oil applications

Specialty oils

- Tyre oils
- Base oils
- Process oils
- Transformer oils
- Insulating Oil Management

Bitumen applications

- Paving grades
- Performance asphalt
- Surface treatment
- Cold paving technology
- Industrial applications

Nynas operates three refineries in Europe:

- Nynäshamn (Sweden)
- Gothenburg (Sweden)
- Dundee (UK)

All three refineries have a common PI database running on a server in Nynäshamn

Nynas PI system in general

- All process displays from DCS has been duplicated in PI ProcessBook.
- We have developed many Excel applications which uses PI DataLink to retrieve data.
- We also use PI Batch
- Web-applications has been developed (Mainly using ASP code)
- PI ProcessBook run in a Citrix environment.
- The PI database contains about 10 000 tags and about 200 performance calculations.
- The system was implementation by Plant Soft and was up running 2007 in Nynäshamn

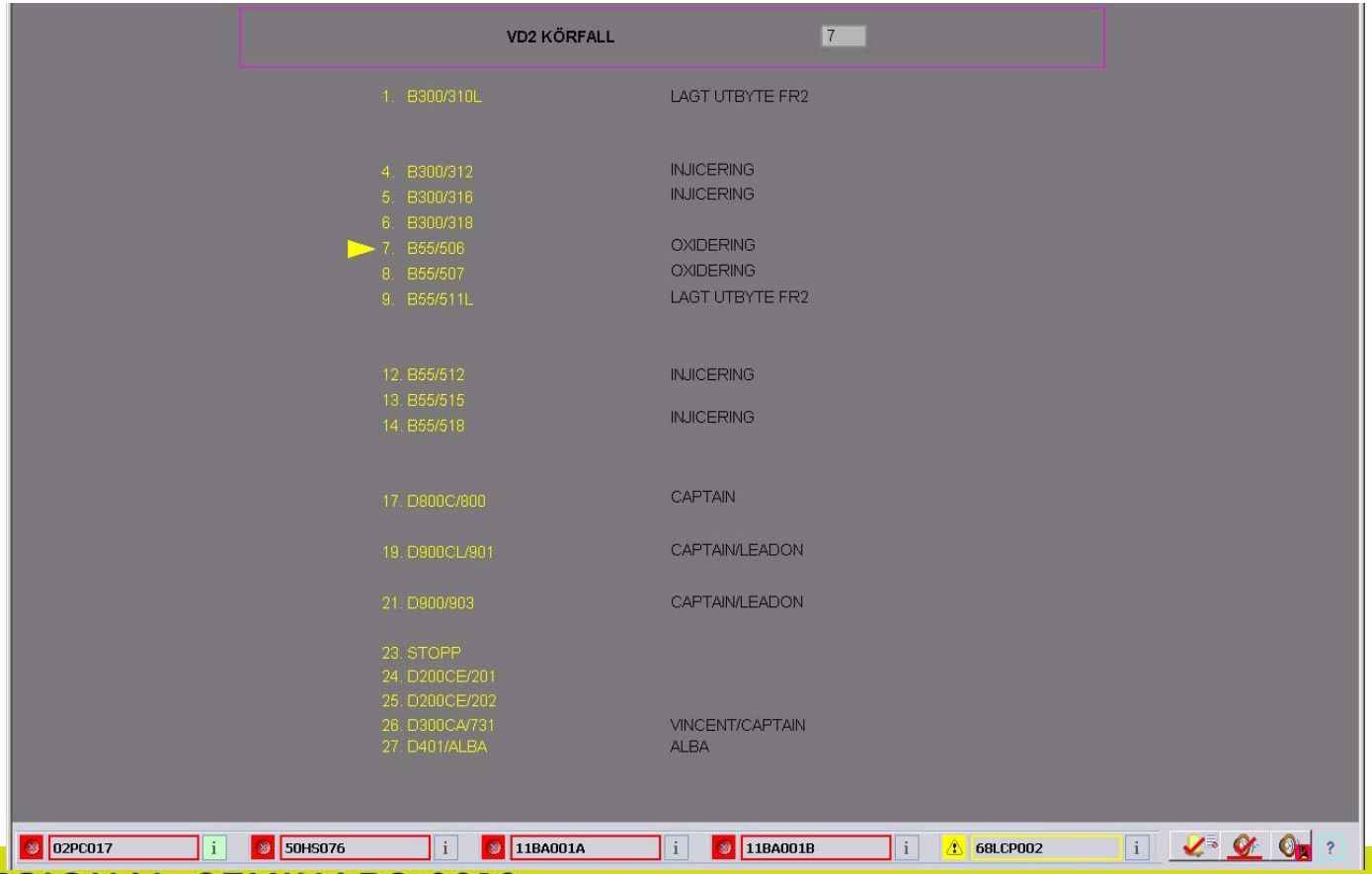
PI system components in use at Nynas

- ProcessBook
- DataLink
- PI Batch
- PI SQC Client (installed but not in active use)
- PI WebParts

Nynas PI system integrates data from different sources

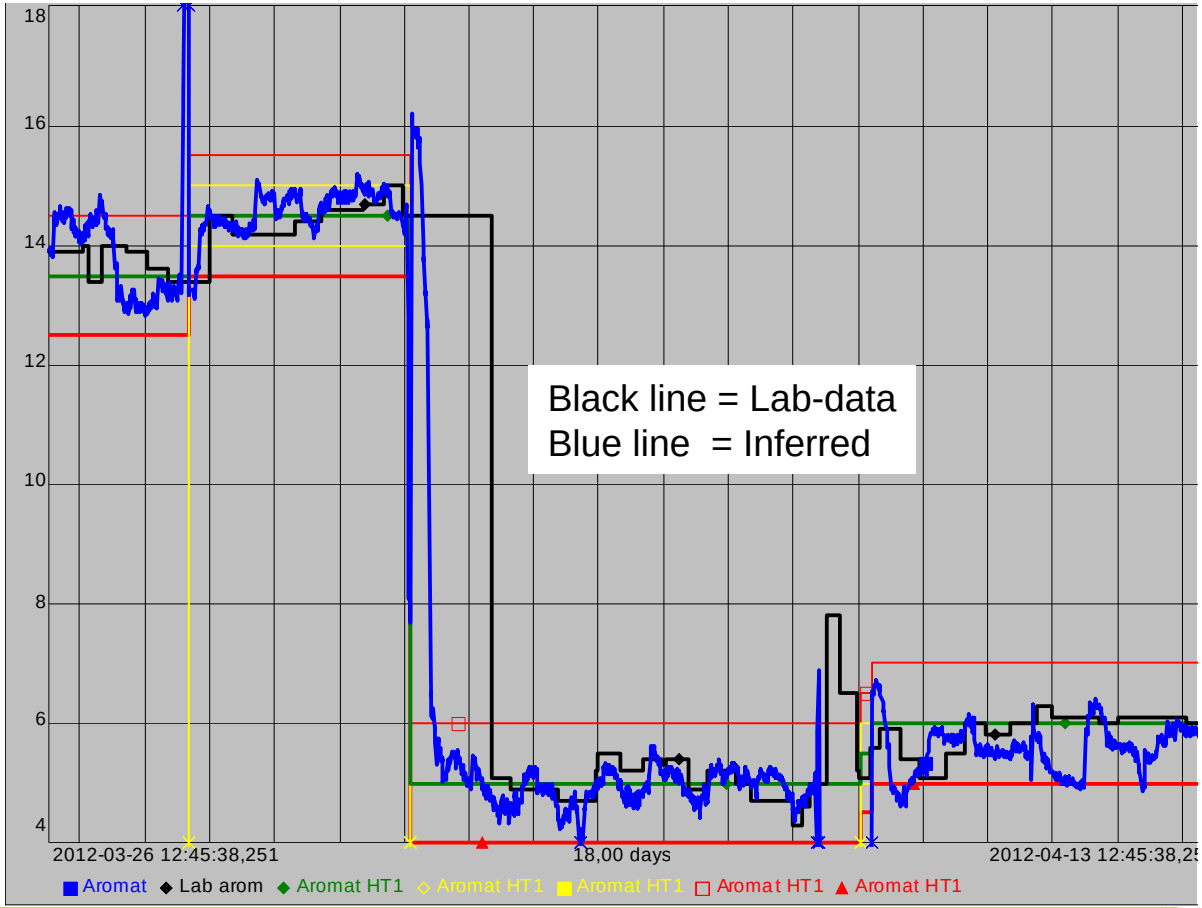
- Data from control system - all three Nynas refineries
- Tank-farm data (levels, mass and volume inventory, temperatures etc.)
- Lab-data for all product streams.
- Quality limits – target values, control limits and slop limits.
- Production value for each stream
- Planned flow rates for different feed and product streams.
- Product flow rates to approved tanks as well as to to slop tanks.

Operators select mode of operation from DCS (DeltaV) display and this information is used in PI



Quality against limits – Process Book

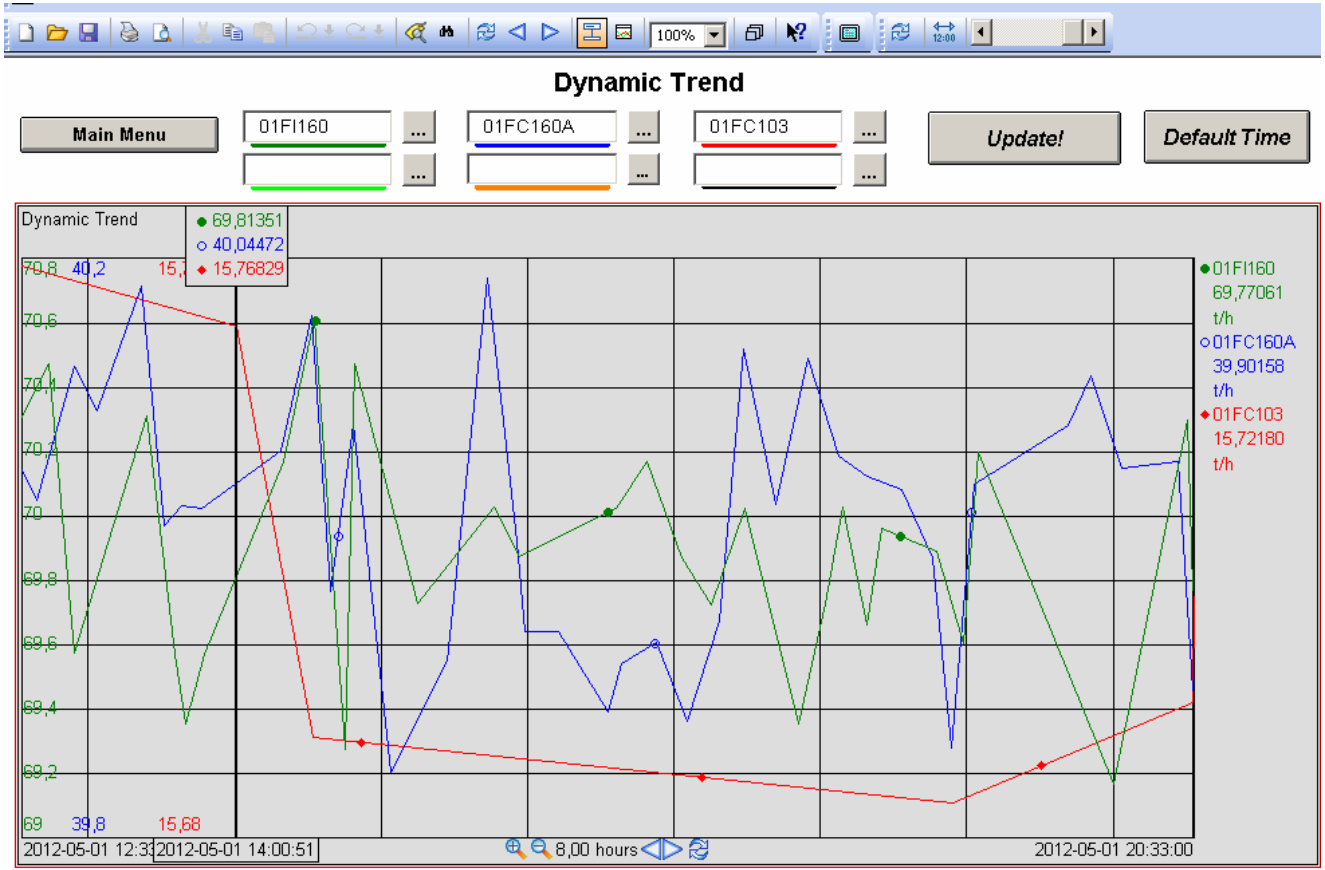
- Limits are retrieved from lab information system and is mode dependant.
- Most quality parameters are “inferred” – calculated – using model which is calibrated against lab-data.



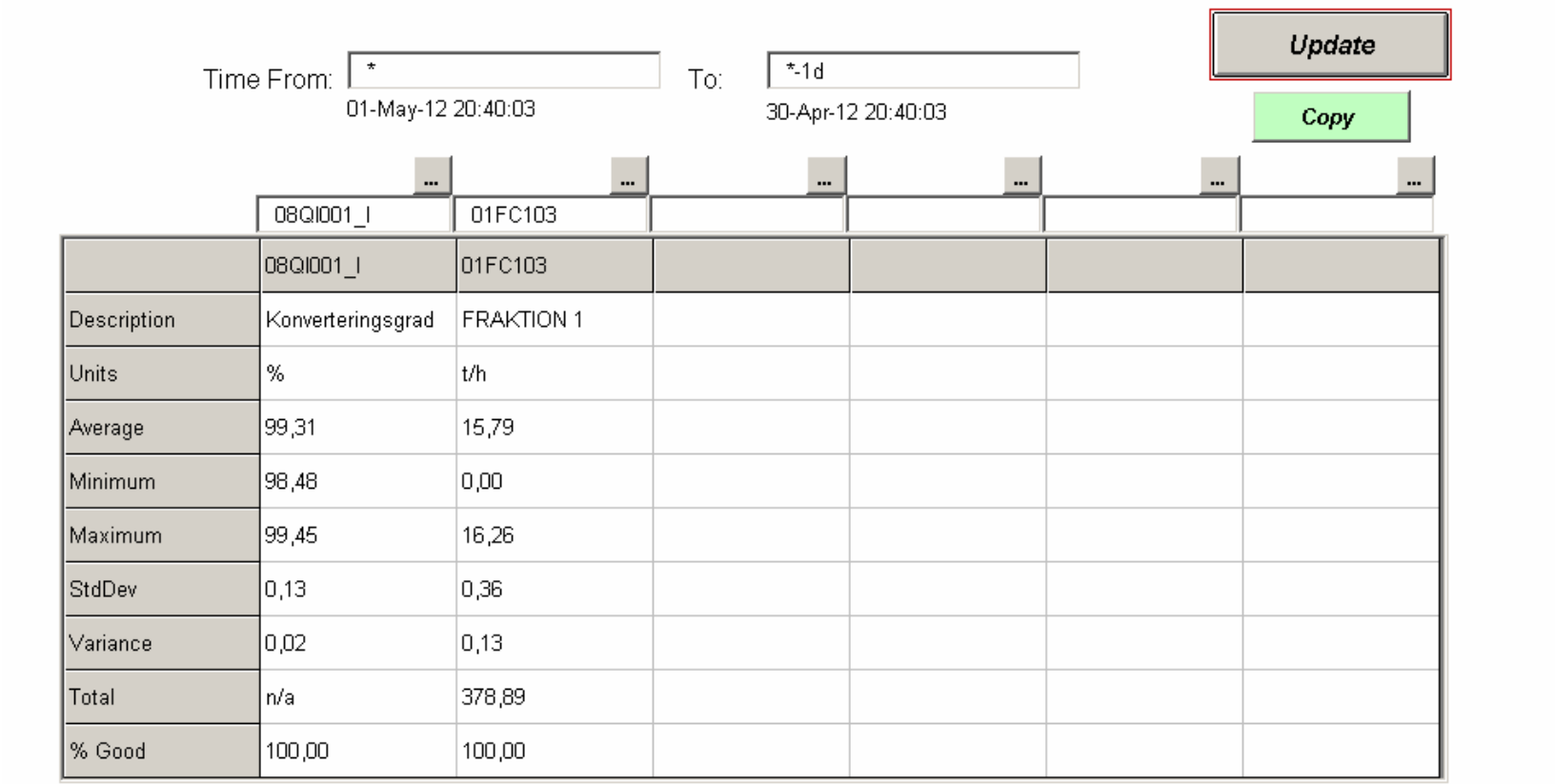
Plant Soft developed two useful data tools for us

- A general trend package
- A tool which calculates average data

Trend tool to trend up to six signals



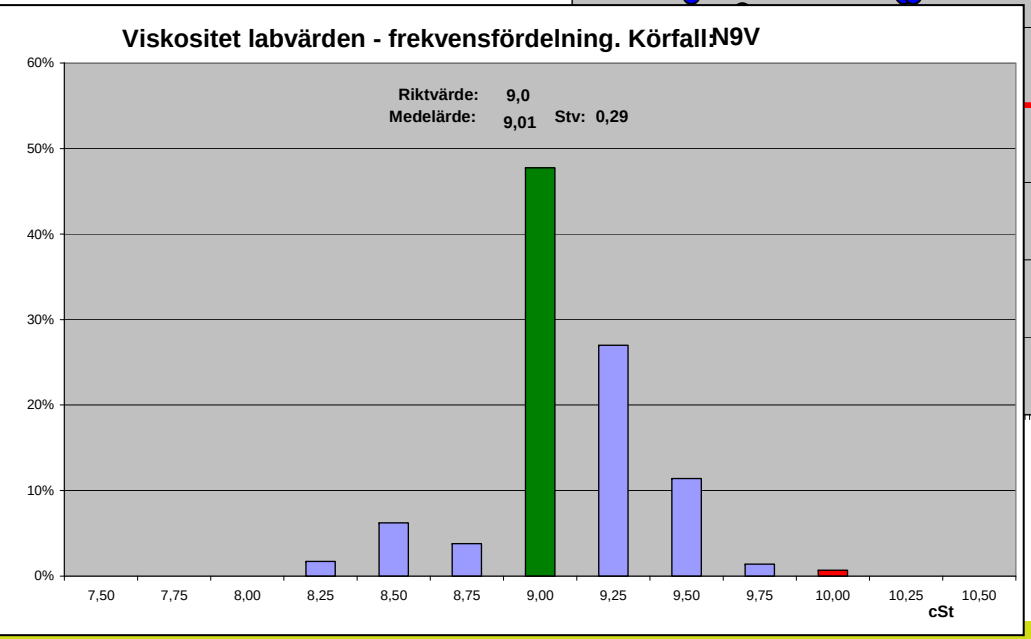
Calculates average and accumulated values

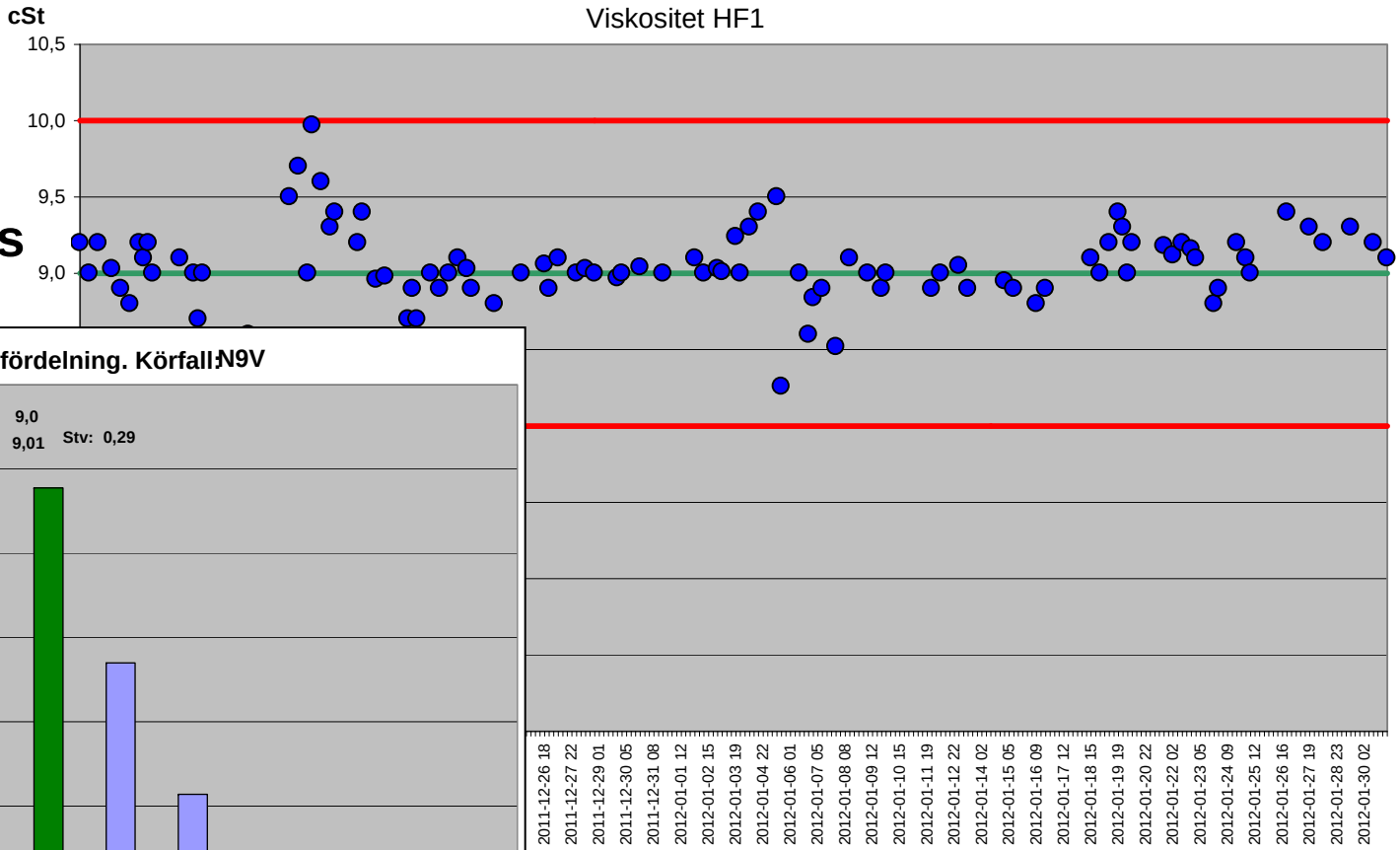


	08QI001_I	01FC103				
Description	Konverteringsgrad	FRAKTION 1				
Units	%	t/h				
Average	99,31	15,79				
Minimum	98,48	0,00				
Maximum	99,45	16,26				
StdDev	0,13	0,36				
Variance	0,02	0,13				
Total	n/a	378,89				
% Good	100,00	100,00				

PI used for monitoring of performance

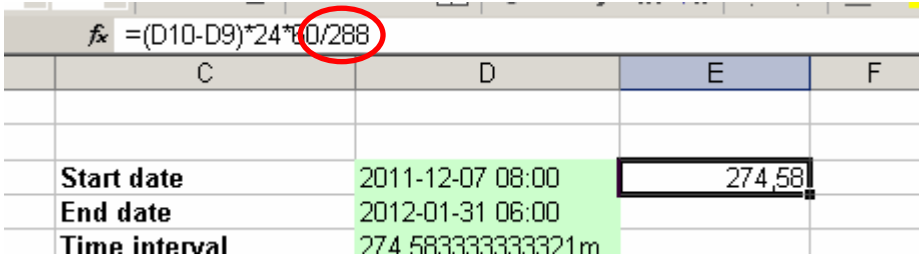
Nynas use Excel DataLink reports for monitoring of individual batches



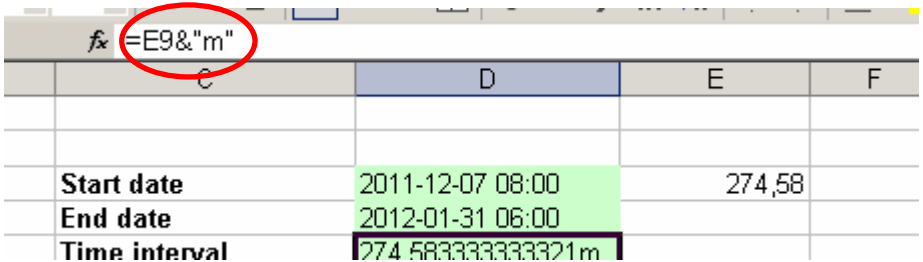


How to create Excel – DataLink – graphs with a variable time range

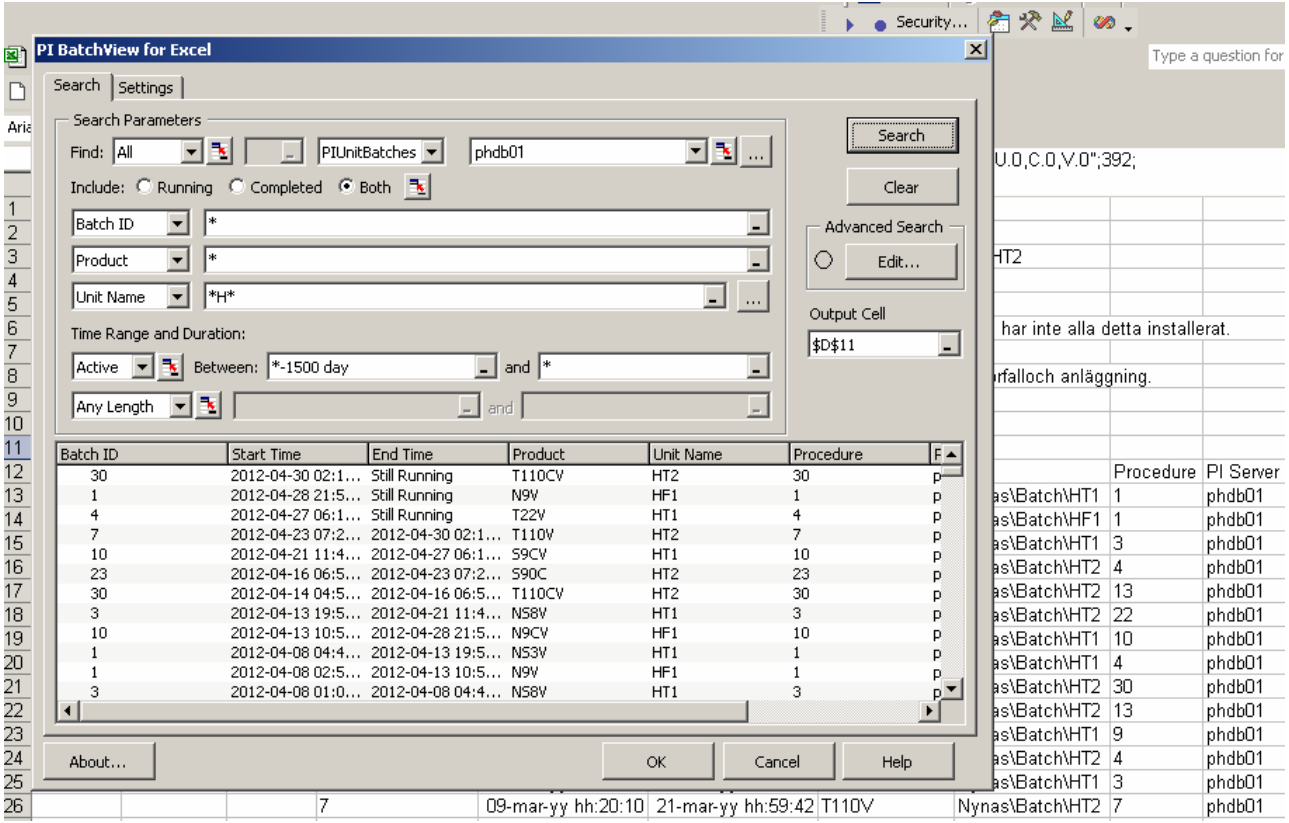
- Use the same number of data points (288 in this example) and calculate time interval



- Add an “m” for minutes



Batch search for Excel to retrieve start and end time for batches



Batch search is a powerful tool to compare individual batches

Anläggning	Produkt	Starttid	Sluttid	Körlängd		Flöde in			Flöde ut	
				Dagar	Verkligt	Planerat	Skillnad	Verkligt	Planerat	Skillnad
						t/h			t/h	
HT1	NS3V	2012-04-08 04:42	*	Pågår	24,4	25,0	-0,6	21,1	19,7	1,4
HF1	N9V	2012-04-08 02:54	*	Pågår	25,2	23,0	2,2	22,7	20,2	2,4
HT1	NS8V	2012-04-08 01:08	2012-04-08 04:42	0,1	24,1	7,4	16,7	20,7	7,3	13,4
HT2	T22V	2012-04-07 02:25	*	Pågår	27,9	30,0	-2,1	26,2	26,4	-0,2
HT2	T110C	2012-04-05 15:01	2012-04-07 02:25	1,5	27,5	28,0	-0,5	26,3	25,3	1,0
HT2	T400C	2012-04-02 16:05	2012-04-05 15:01	3,0	25,9	26,0	-0,1	25,3	23,9	1,4
HT1	S9CV	2012-04-01 02:30	2012-04-08 01:08	6,9	25,3	26,0	-0,7	23,8	23,0	0,7
HT1	T22V	2012-03-28 16:10	2012-04-01 02:30	3,4	24,1	25,0	-0,9	22,6	22,2	0,4
HT2	T110CV	2012-03-28 14:01	2012-04-02 16:05	5,1	25,3	26,0	-0,7	24,0	23,3	0,7
HT2	T110C	2012-03-26 01:53	2012-03-28 14:01	2,5	24,9	27,0	-2,1	24,3	24,4	-0,2
HT1	N9V	2012-03-22 11:46	2012-03-28 16:10	6,2	24,5	26,0	-1,5	22,9	22,8	0,2
HT2	T22V	2012-03-21 23:59	2012-03-26 01:53	4,1	24,3	24,0	0,3	22,9	21,4	1,6
HT1	NS8V	2012-03-10 11:18	2012-03-22 11:46	12,0	21,1	7,0	14,1	19,0	19,5	-0,5
HT2	T110V	2012-03-09 04:20	2012-03-21 23:59	12,8	25,0	27,0	-2,0	22,9	22,8	0,1
HT2	T110CV	2012-03-05 05:05	2012-03-09 04:20	4,0	22,3	26,0	-3,7	21,3	23,3	-2,0

Data has deliberately been changed for confidentiality reasons.

PI used to increase reliability

Running time for compressors and pumps are monitored

Compressor Running Time Analysis

Starttid:	2011-05-02 00:00	2012-04-30 00:00
Sluttid:	2012-05-01 00:00	2012-05-01 00:00

Tag	Beskrivning	Current	"ON" state	Formula	Gångtid Timmar	% ON
24XL204A	Makeup kopressor A	1	1	('24XL204A' = 1)	**6238,1**	71,2%
24XL204B	Makeup kopressor B	1	1	('24XL204B' = 1)	**4257,1**	48,6%
24XL304A	Cirk kompressor A	1	1	('24XL304A' = 1)	**6471,6**	73,9%
24XL304B	Cirk kompressor B	1	1	('24XL304B' = 1)	**5469,0**	62,4%
24XL304S	Cirk kompressor S	1	1	('24XL304S' = 1)	**5050,4**	57,7%
24XL714	PC2403	1	1	('24XL714' = 1)	**7017,0**	80,1%
02PC0201A	Make.up A i drift	1	1	('02PC0201A' = 1)	**5430,0**	62,0%
02PC0201B	Make.up B i drift	0	1	('02PC0201B' = 1)	**3721,5**	42,5%
02PC0202A	CIRK A i drift	0	1	('02PC0202A' = 1)	**3648,6**	41,7%
02PC0202B	CIRK B i drift	1	1	('02PC0202B' = 1)	**6040,6**	69,0%

Operating window measure process-parameters against limits

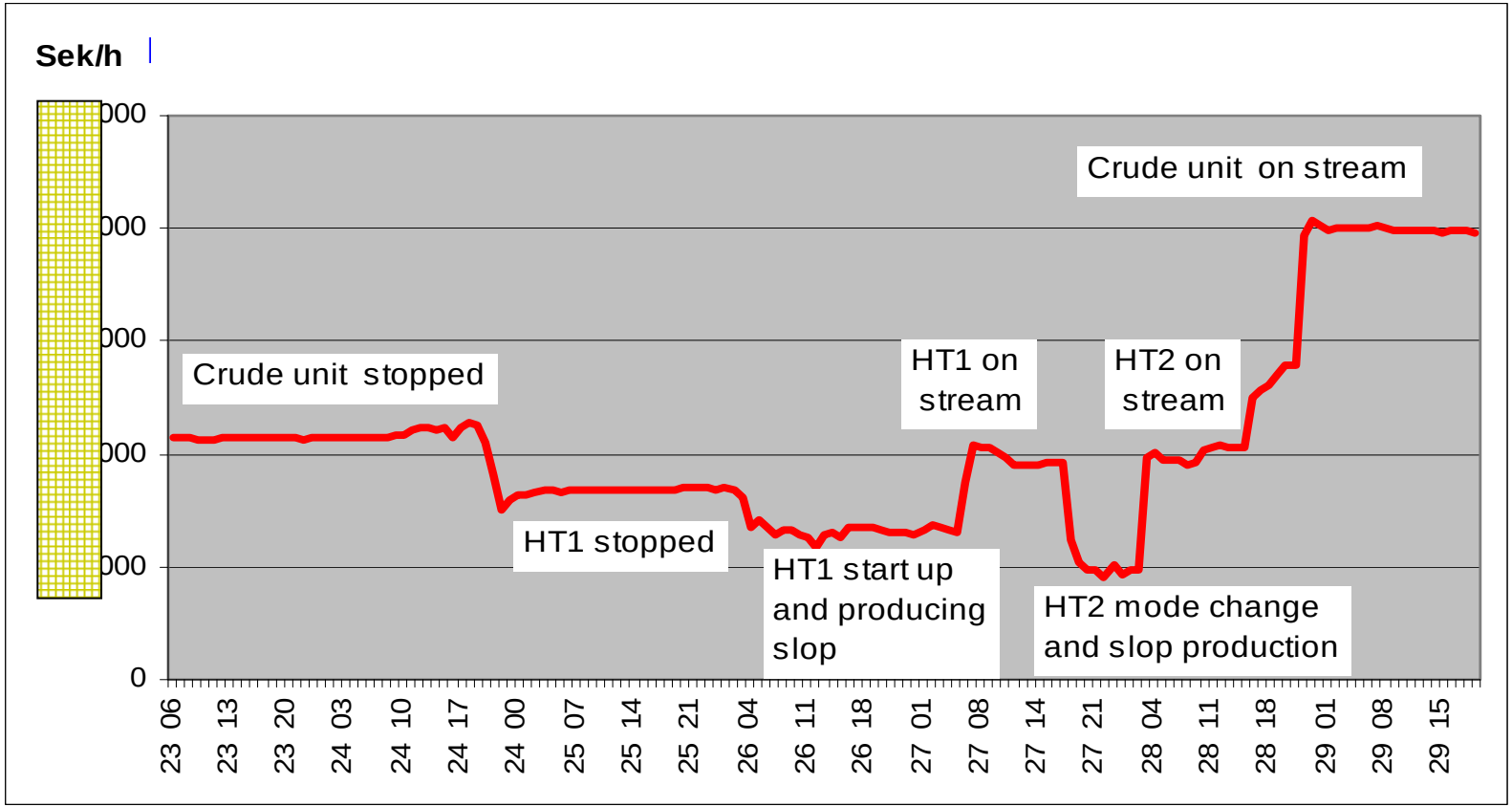
Operating window analysis HF1

From: 2012-01-22 17:18
To: 2012-05-01 17:18

Green fields to be updated

Tag	Descriptor	Current	Limit	Formula	Time above limit [h]	Time above limit [%]
	Design temperatures					
12TI102	Matning 1202 A/B	92	343	('12TI102' > 343)	**0,0**	0,0%
12TI104	Högtr. gas	51	177	('12TI104' > 177)	**0,0**	0,0%
12TI105	Lågtrycksavskiljare	242	270	('12TI105' > 270)	**0,0**	0,0%
12TI106	Torrkolonn	175	250	('12TI106' > 250)	**0,0**	0,0%
12TI109	Vätskelås	29	100	('12TI109' > 100)	**0,0**	0,0%
12TI110	Före ugn	276	371	('12TI110' > 371)	**0,0**	0,0%
12TI129	Produkt 1205	107	300	('12TI129' > 300)	**0,0**	0,0%
12TI132	Efter TT1210	138	250	('12TI132' > 250)	**0,0**	0,0%
12TI133	GAS FÖRE TA1207	197	250	('12TI133' > 250)	**0,0**	0,0%
12TI140	Flashzon	195	270	('12TI140' > 270)	**0,0**	0,0%
12TR212	Olja efter ugn	380	371	('12TR212' > 371)	**79,6**	3,3%
	Design pressures					

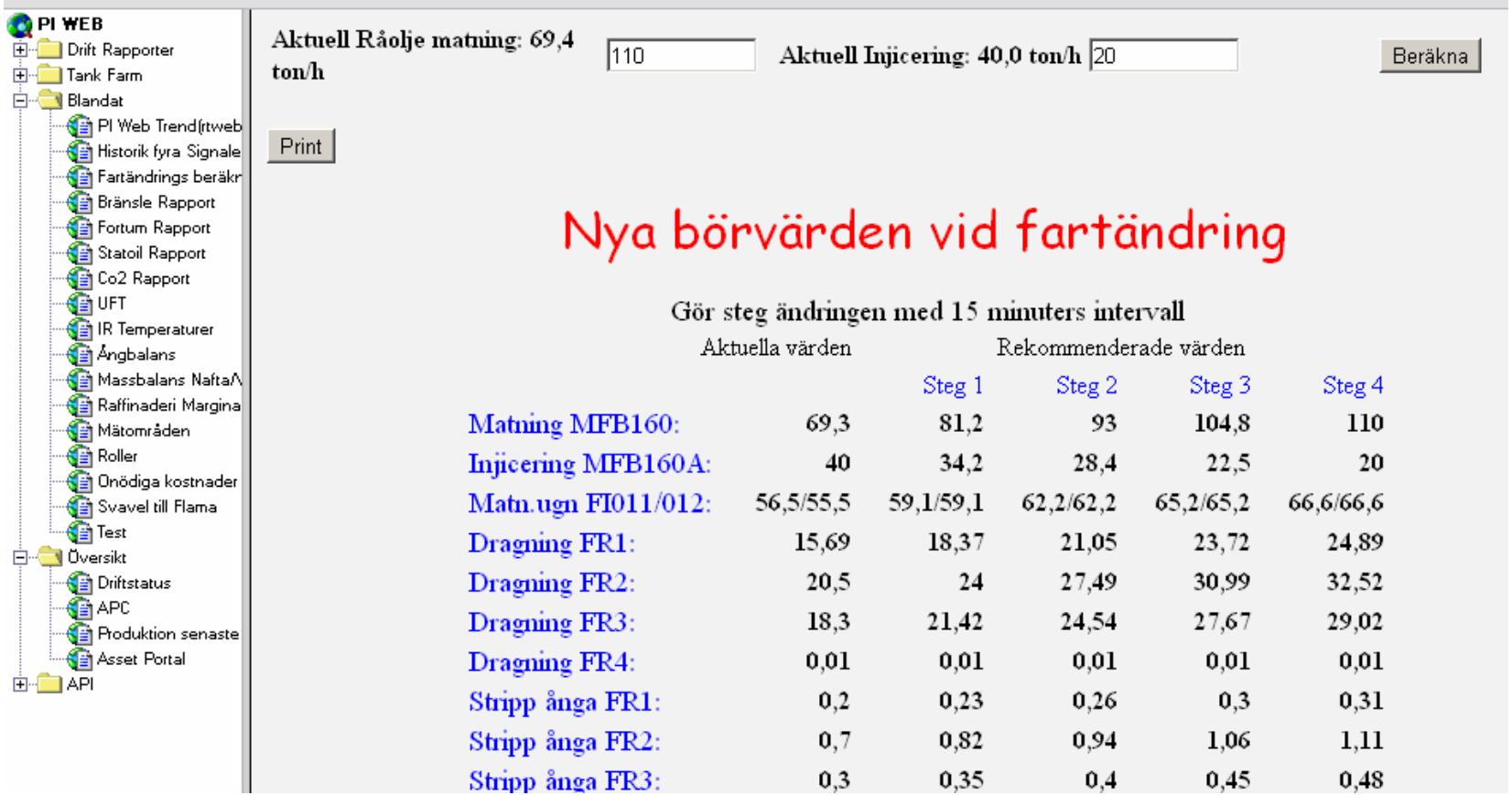
Refinery margin is calculated and is e.g. used to estimate production loss costs



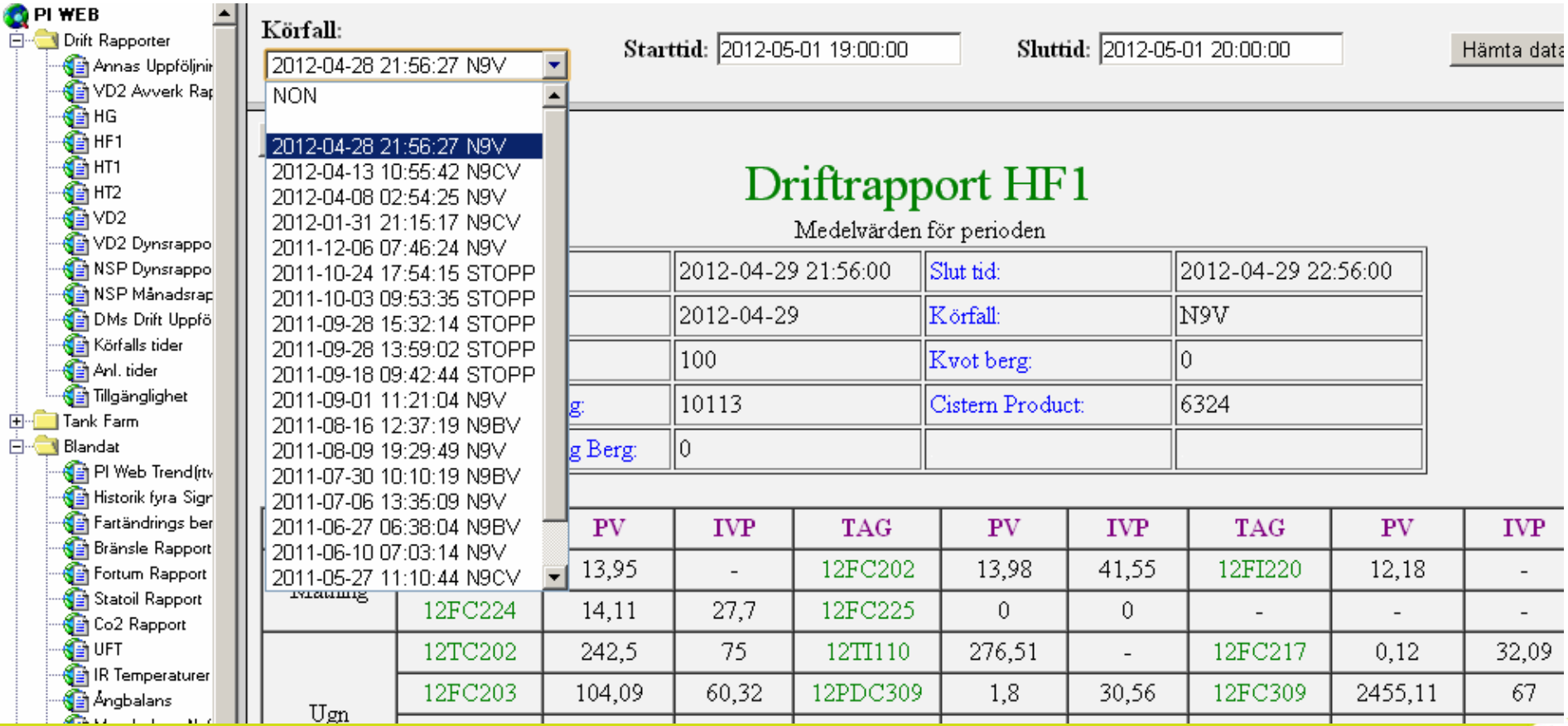
Data has deliberately been hidden for confidentiality reasons.

PI used for operator support and plant optimization

Program which calculates new set-points for controllers at feed rate change



Tool to find set points from previous runs



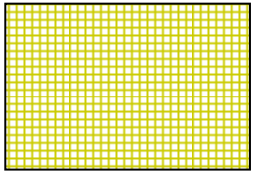
Application which identifies overall unit constrain and calculates the cost for not running at the constrain

Production against constrains

Start time 2012-04-27 16:09
End time 2012-04-27 17:09
Period 0.04 days

NSP units

Unit	Mode	Feed t/h	Constrain	Max feed t/h	Diff ag max t/h	Lost prod ton	Lost revenu SEK/h	Lost revenu SEK in total *During 0,04 days*
HT1	T22V	25.7	Feed pumps	26.5	0.8	0.8		
HT2	T110V	28.5	Furnace	28.9	0.4	0.4		
HF1	N9CV	22.6	Reac. temp	28.6	0.9	0.9		
Totalt		**76.8**		**84.0**	**2.1**	**2.1**		



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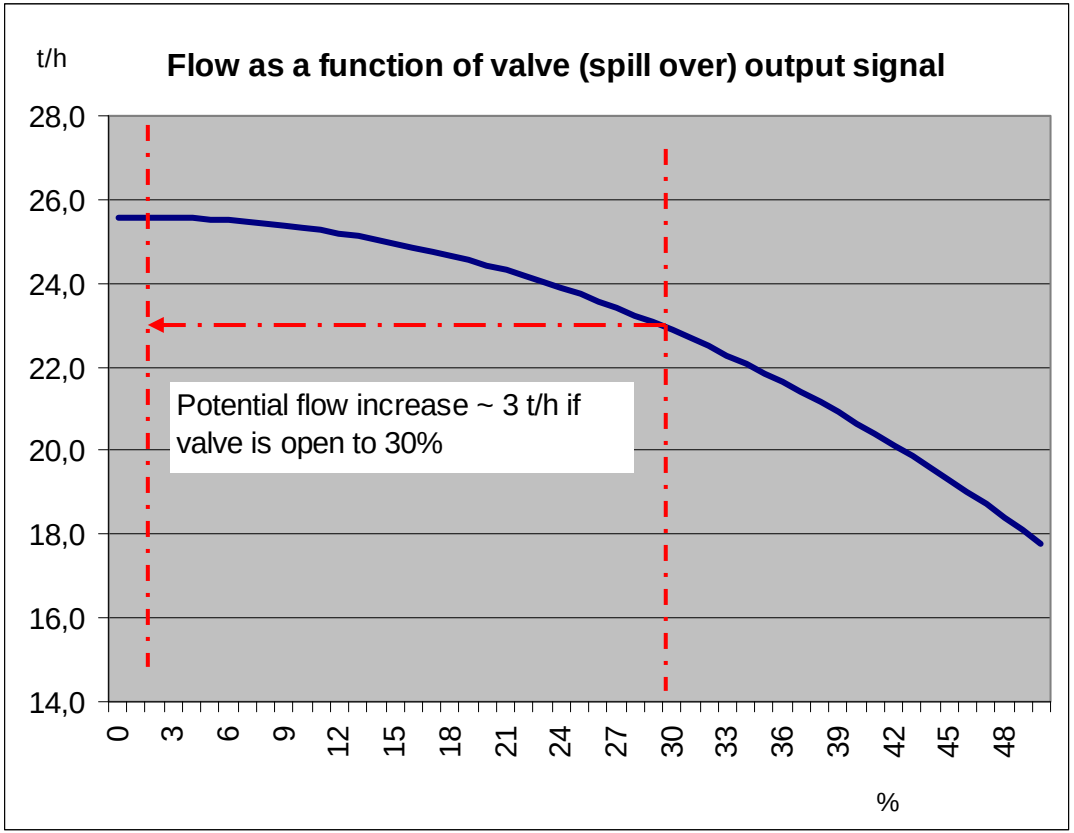
Constrains evaluated in Feed Max application

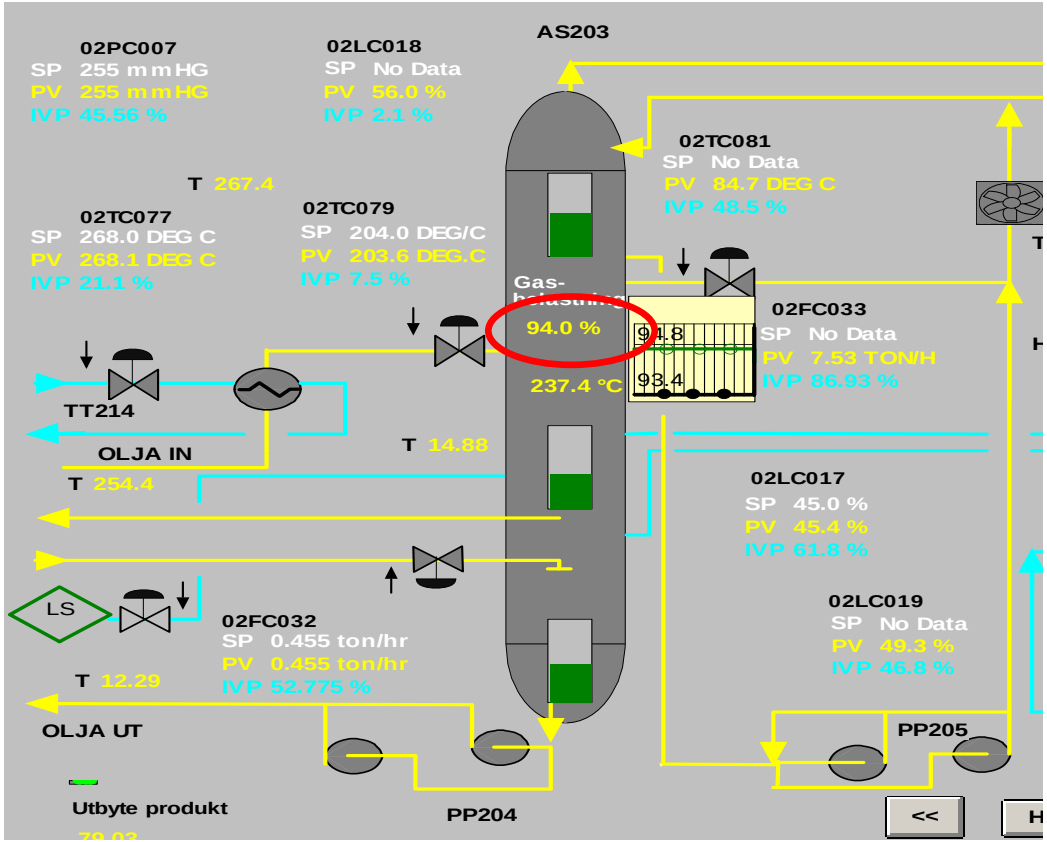
- Pump capacity
- Maximum reactor temperatures
- Column flooding
- Furnace duty
- Product quality

Evaluation of constrains – Pump capacity



Data has deliberately been changed for confidentiality reasons.

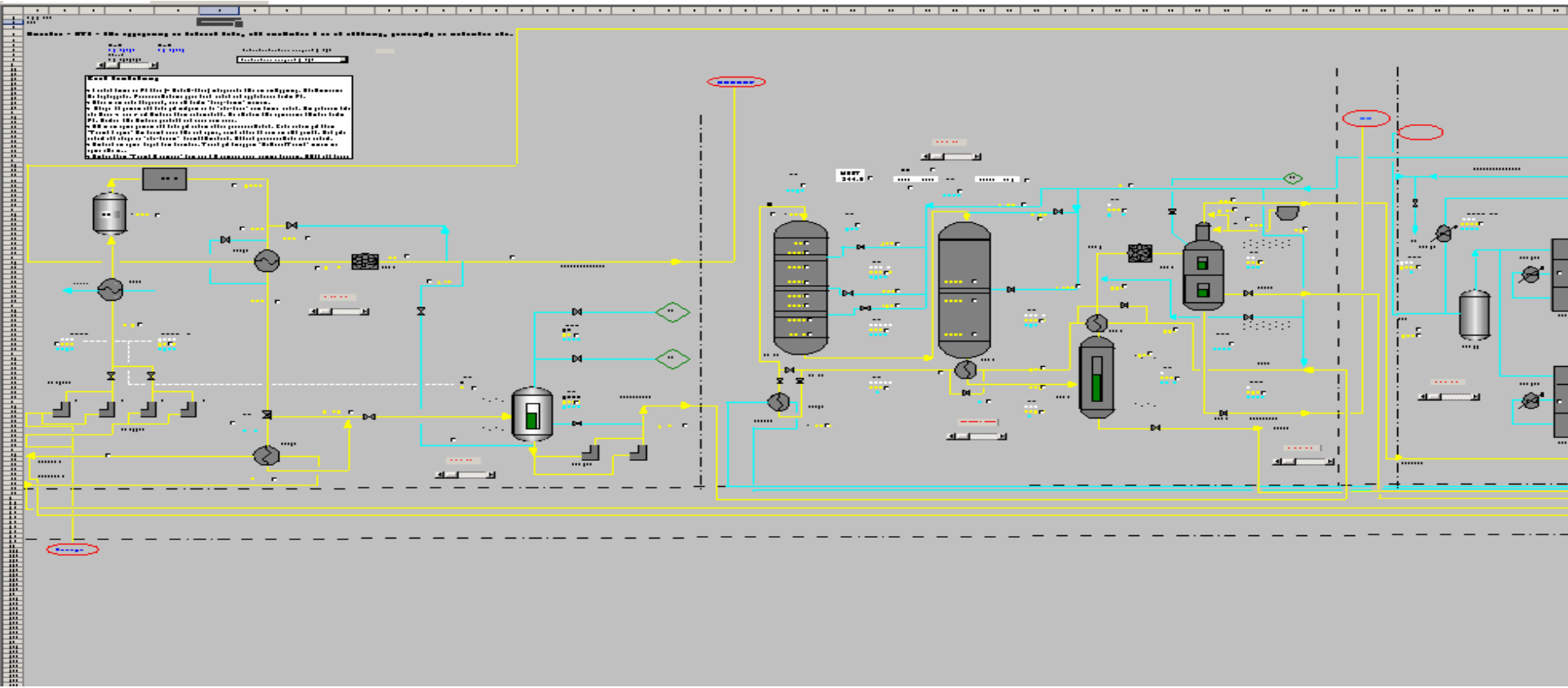
One constrain to be evaluated is the load in vapor load in columns



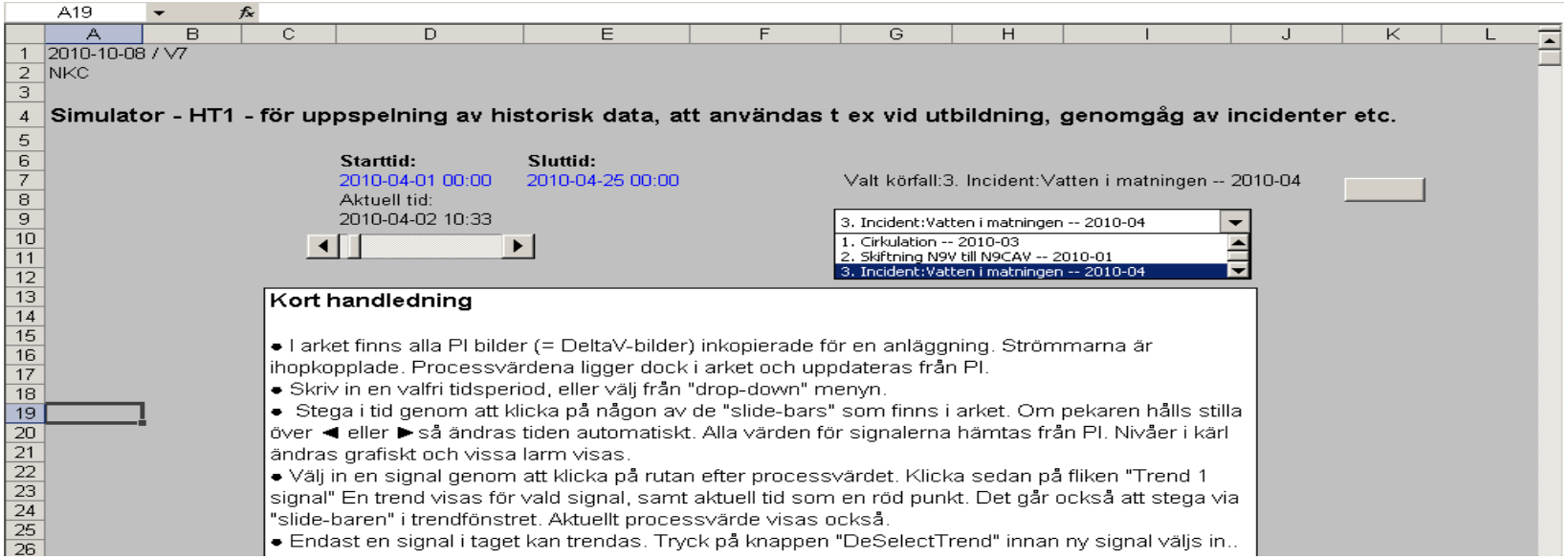
PI used for operator training

- An Excel application has been developed which makes it possible to “play back” events for a certain process unit.
- The graphical background from the ProcessBooks displays have been copied into to Excel and streams have been connected.
- Process values for different TAGs has been located in the cells in the sheet. (about 200 TAGs)
- Time can be changed within a selected time interval and all data in the sheet will update. Different occurrences (e.g. incidents) can be pre-defined and selected from a drop down list.
- All TAGs can be trended and the selected is marked with a red dot in the diagram

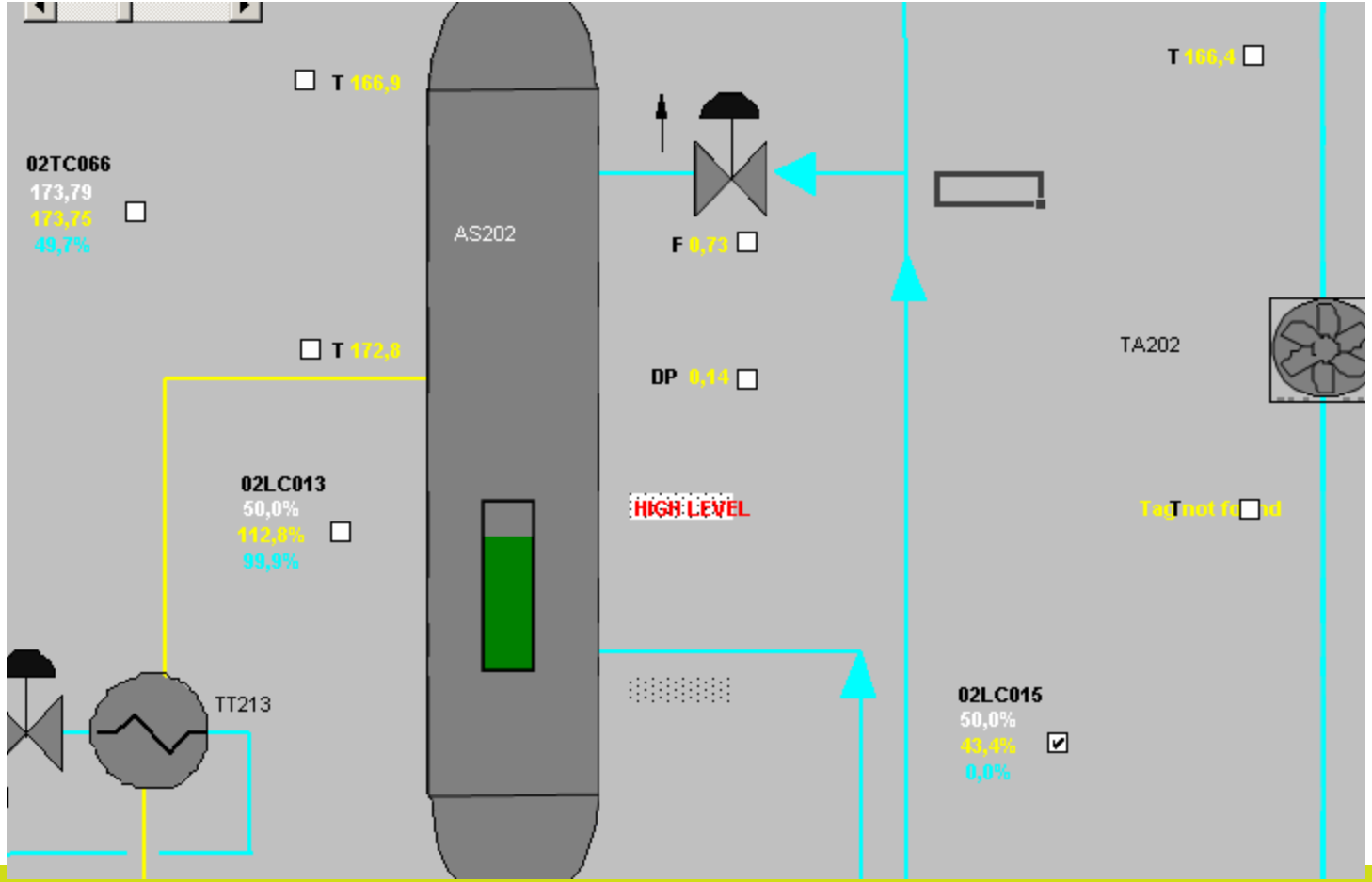
Operator training tool for “play-back of process events – e.g. incidents



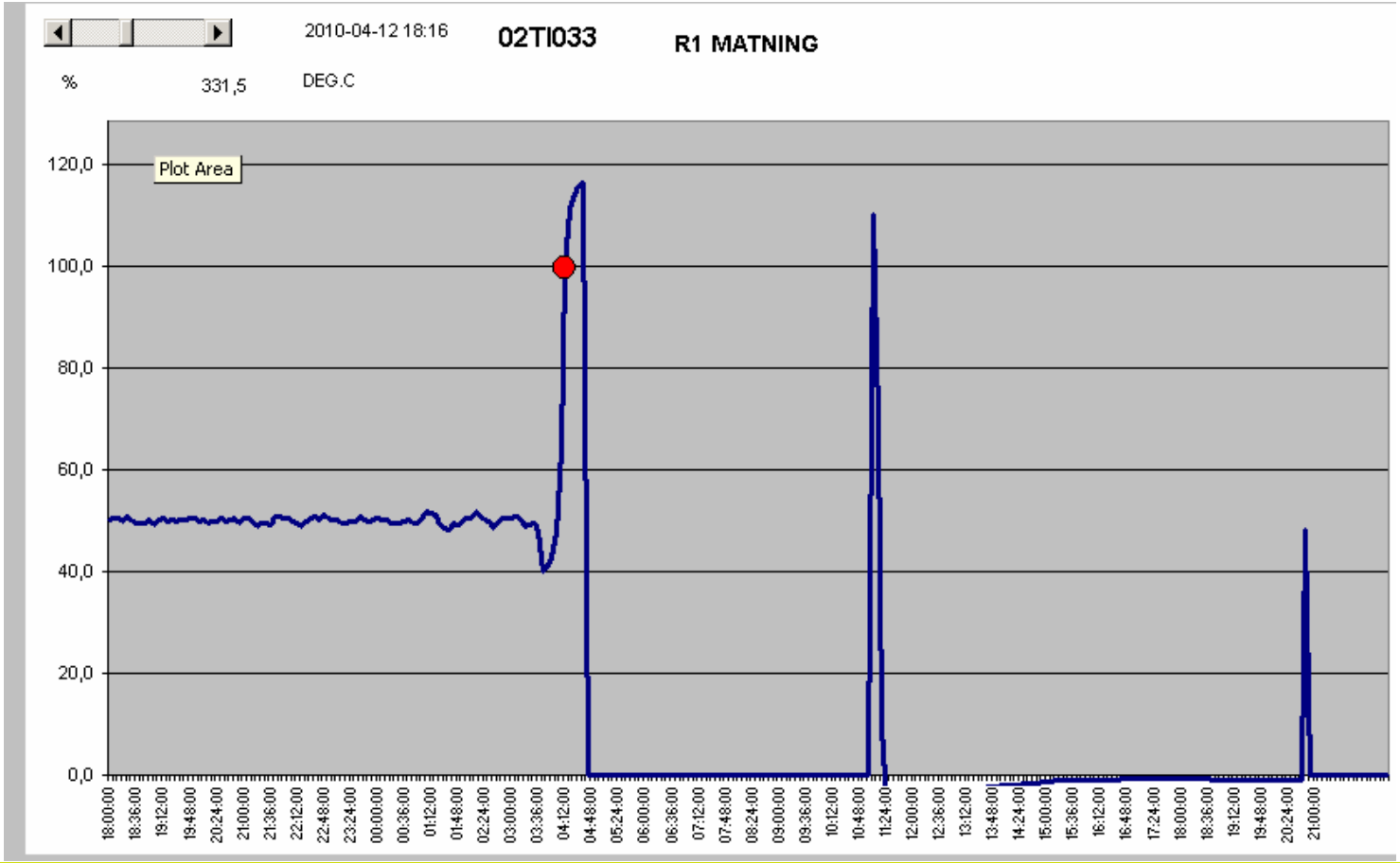
Historical events from disturbances can be chosen from a drop down list



Data for all TAGs will update as well as level indicators and some alarms



All TAGs can be trended



PI used for operator training is used for

- To review and discuss incidents with the operators
- Operator training

In summary – PI used at Nynas

- PI is highly integrated with other systems
- PI is an indispensable tool for i.e. operators and process engineers to monitor and optimize production
- PI supply information to many other business critical systems e.g. planning system and accounting systems.

THANK YOU

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