

Remote Process Analysis for Process Analysis and Optimization

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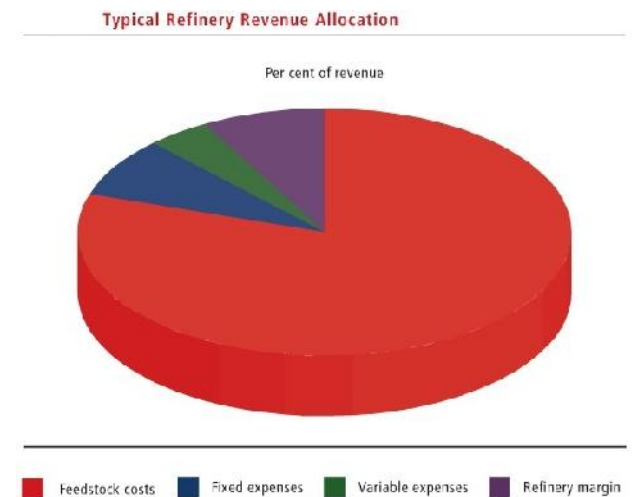


The Challenges Ahead

- The worldwide oil and gas industry has undergone a major transformation in the last decade due to changes in regulatory and market forces, such as fluctuating crude prices, tighter regulation on product quality and emissions, shifting crude quality and fundamental changes in fuel demands
- At present, refineries must be flexible enough to respond immediately to crude oil changes and deviations in product demands as a result of the changing global economy.
- The required flexibility in the management and the complexity of the different processes, crude oils and distillates can only be achieved by stringent quality monitoring and process optimization

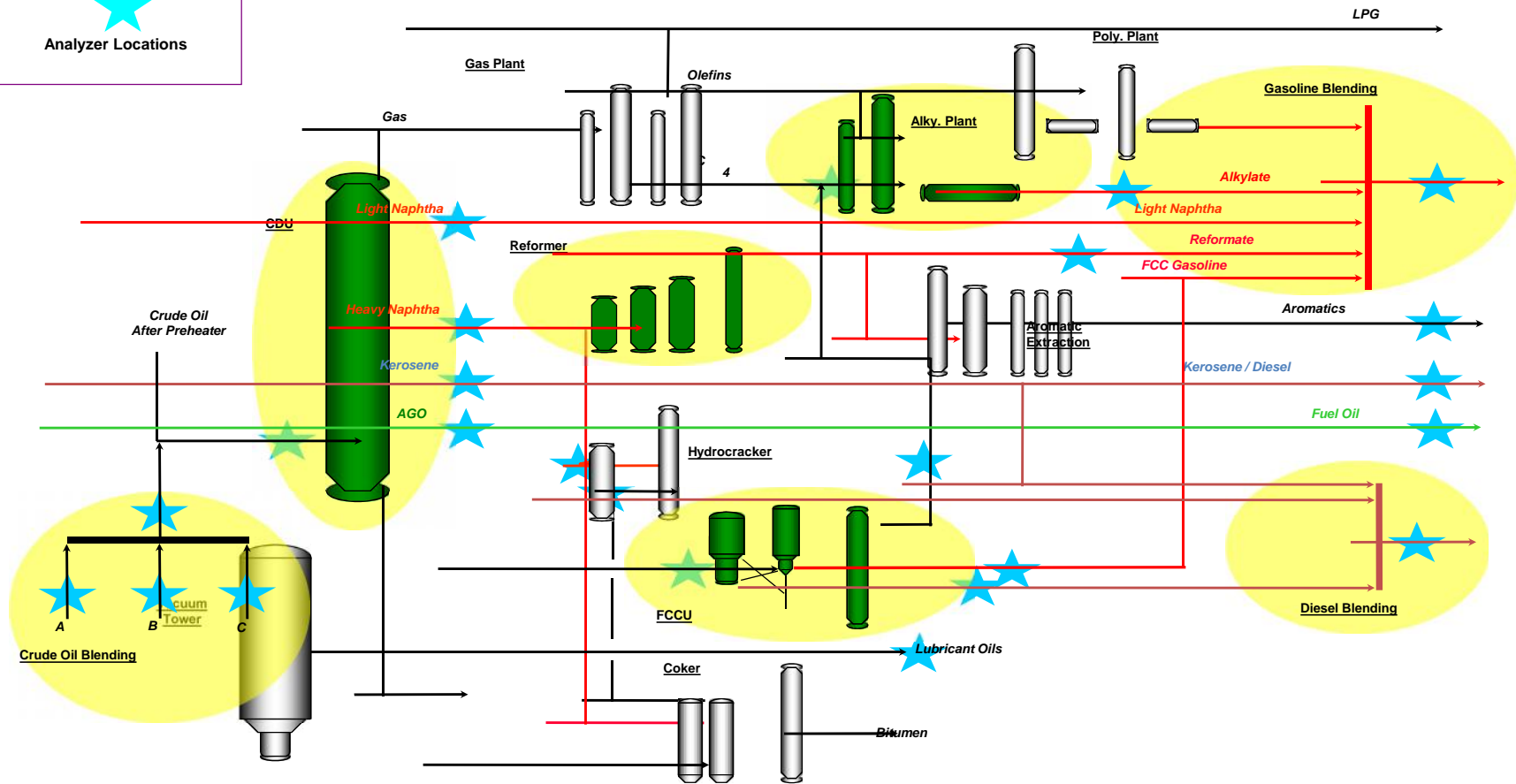
Refinery Industry Trends

- The modern refinery is a high-volume and generally low-margin enterprise. While revenue may be large, feedstock costs around 90% of the cash flow. After accounting for fixed and variable operating costs, the remaining margin is typically below 5% of revenues
- To increase the margin, the refiner must (1) reduce feedstock costs, (2) decrease operating expenses and (3) increase product revenue

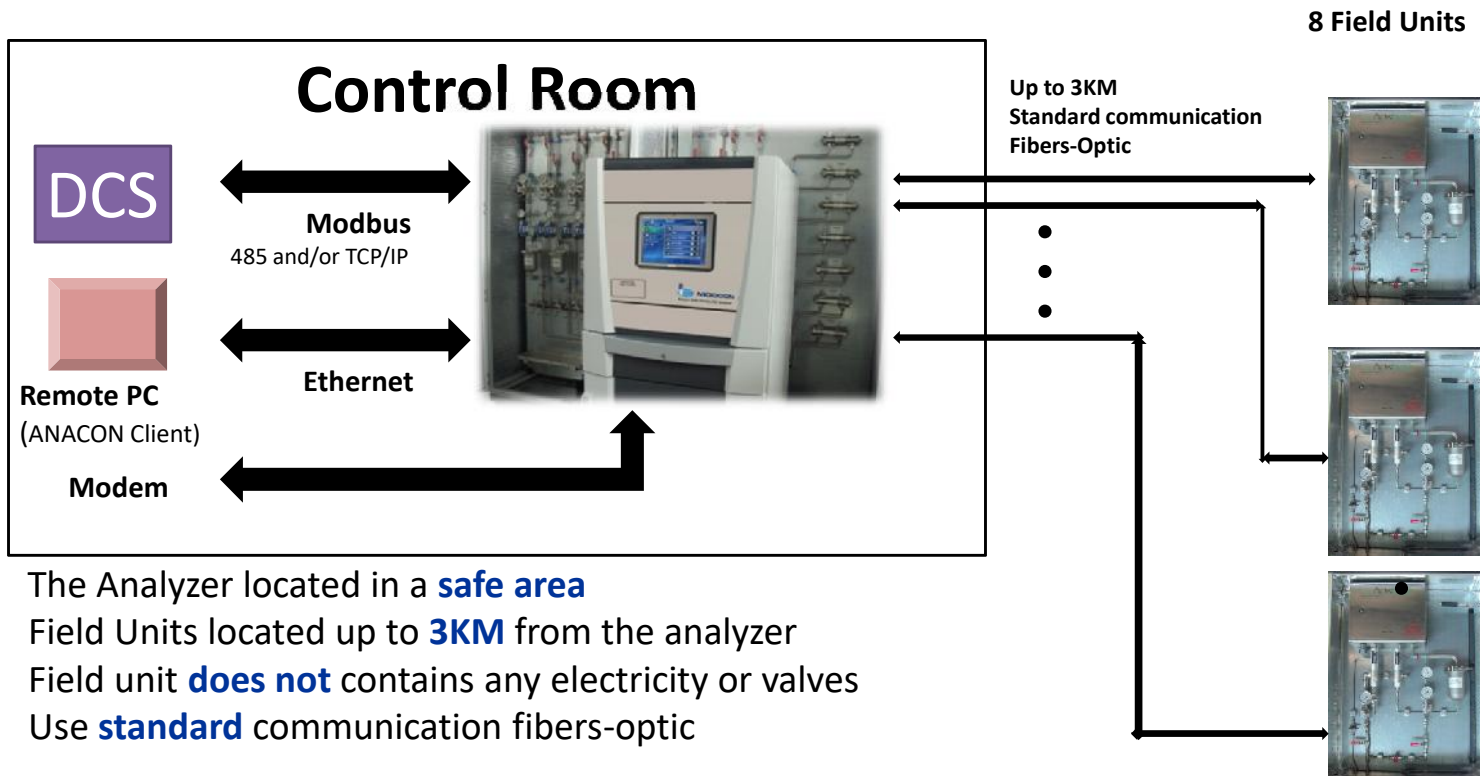


Remote Analysis Technologies

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Analyzer Locations



Remote Analysis Technologies



The Analyzer located in a **safe area**
Field Units located up to **3KM** from the analyzer
Field unit **does not** contains any electricity or valves
Use **standard** communication fibers-optic

Field Unit Operation Conditions

- Haze free
- Max. Pressure - 550 psi (40 bar)
- Flow rate - 1 l/min to 3 l/min
- Temperature- Above Cloud point to +160°C (300°F)

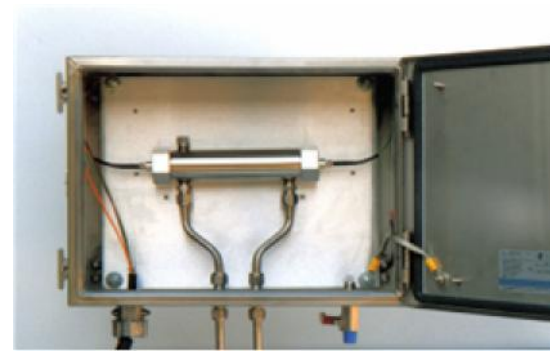
Field Unit



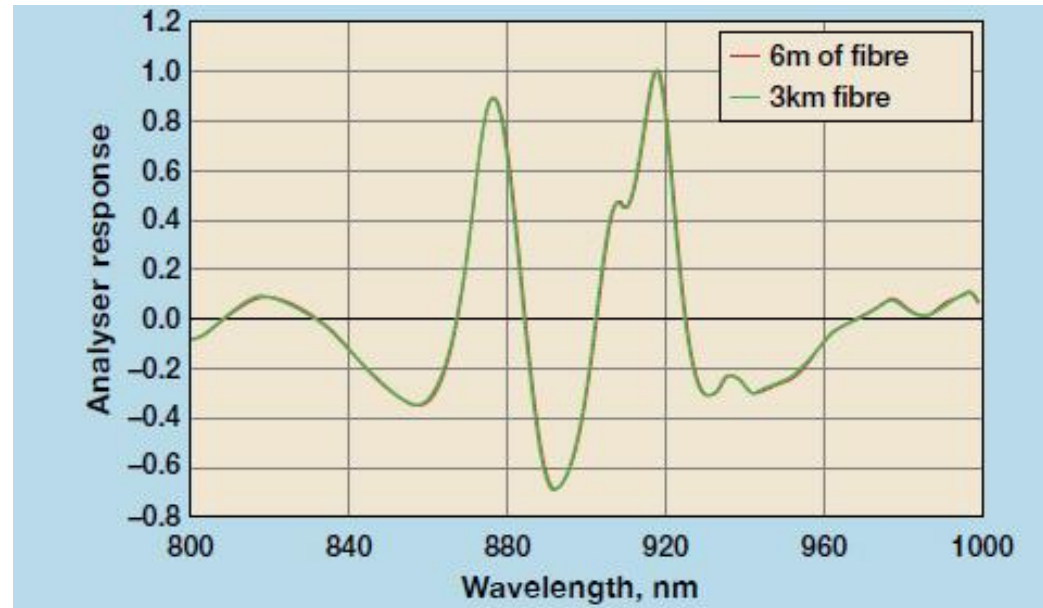
Sample Cell



Probe



Dependence Signal of Fiber Length



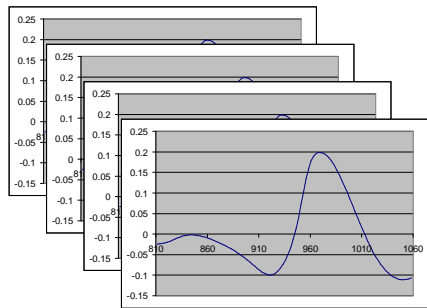
UP TO 3 km

NOT INFLUENCED BY FIBER LENGTH

Principles of Chemometrics

Calibration Phase

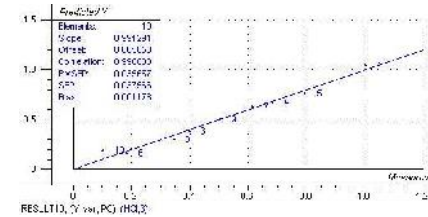
Reference Spectra



Reference Measurements

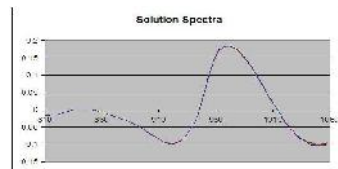
mix#	HCl	HF
0	0	0
1	1.178964	0.39912
2	0.790395	0.442637
3	1.090314	0.496751
4	1.06258	0.543865
5	0.852719	0.593886
6	0.99566	0.634382
7	0.873404	0.669103
8	0.988138	0.721126
9	0.849897	0.778561
10	1.000474	0.81478
11	1.102819	0.853354
12	1.135659	0.893109
13	0.799425	1.009638
14	0.950737	0.958367

Calibration Model

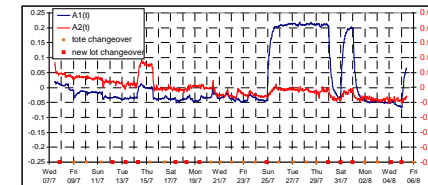
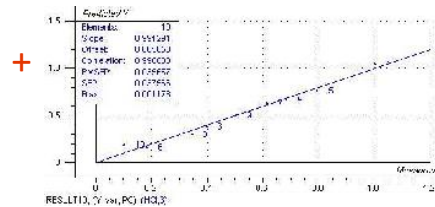


Measurement Phase

Unknown Spectra



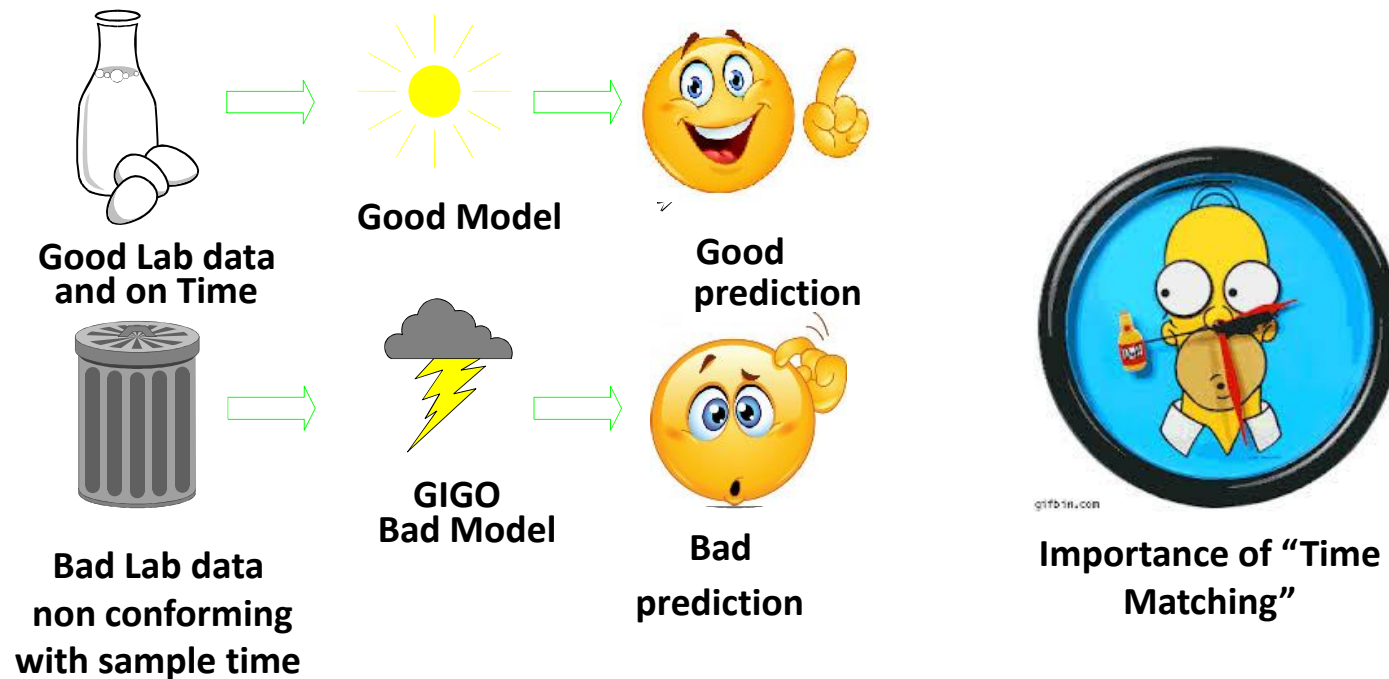
Calibration Model



The Bottleneck in NIR/FTIR Analytics

- The main drawback not related to the hardware but to finding the resources (time and money) to build the models and maintaining the model robustness.
- For the most economical incentive applications, such as CDU and blending, a successful implementation of NIR/FTIR can last up to 12 months.
- The bottleneck is not the NIR/FTIR spectrometry accuracy or the limits on laboratory resources, it is the fact that the model has to be robust. For this to happen the model has to cover all possible variations of the product composition, which is constantly changing over time. Therefore, although very powerful, current NIR systems are not “plug and play” devices.
- If changing crude influences the analyzer's behavior, the refinery operators will lose their confidence in the analyzer.

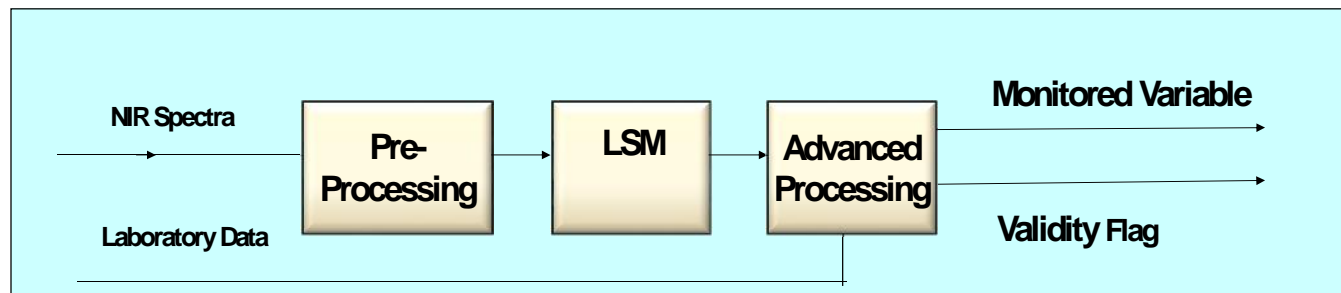
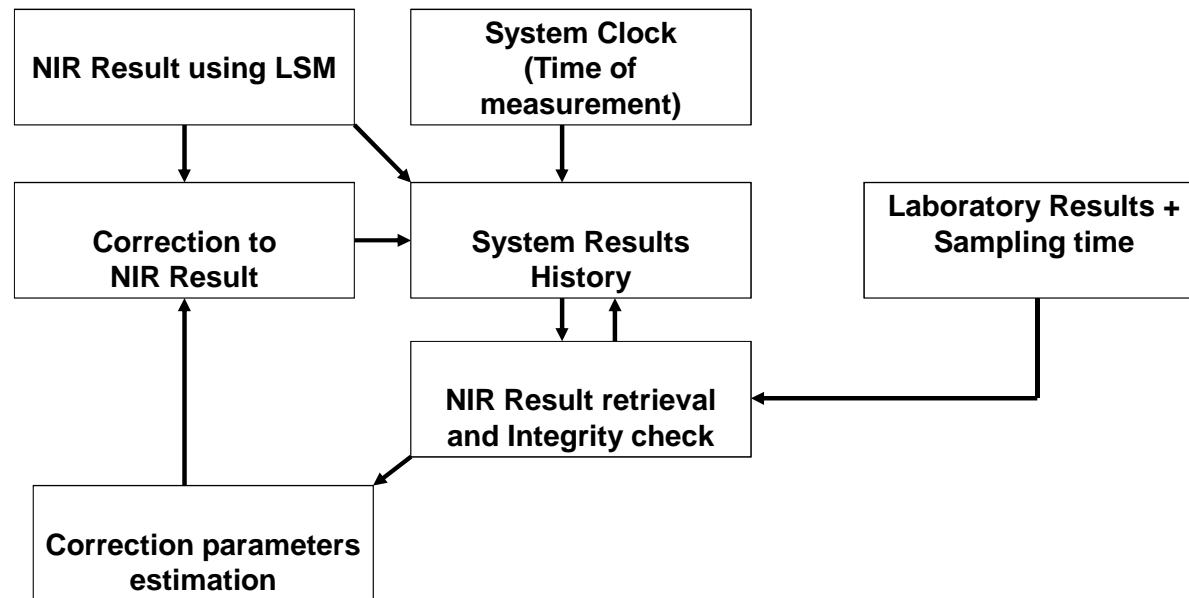
Successful Model Building



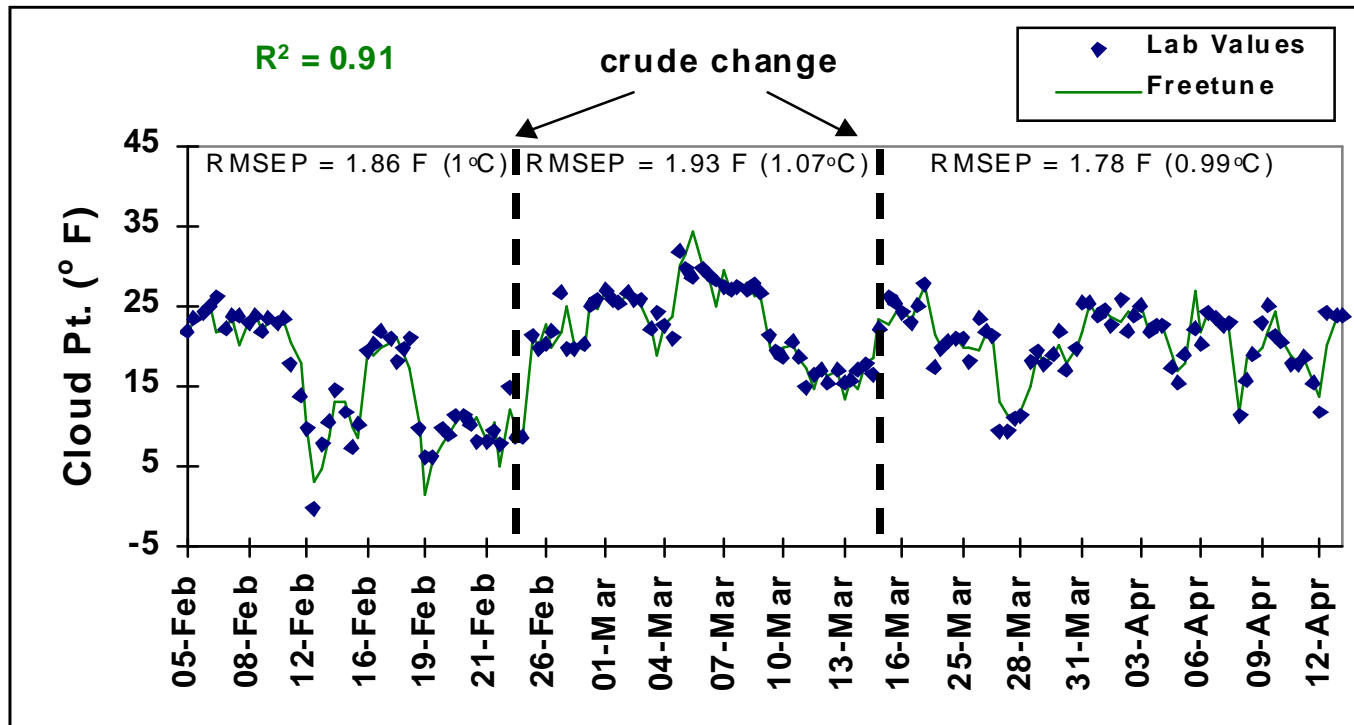
Freetune Software Solution

- Freetune™ is a software program composed of two sequential blocks.
- First, PLS regression is used to build a localized sensitive model (LSM), based on just a small number of samples. One of the characteristics of this model is its sensitivity to short term (hours) process variations. Since it is localized, the model can be quickly built and validated. This procedure takes up to one week and can be performed prior to startup.
- Second, a proprietary software program processes the model, together with the specified plant data, to accurately quantify the properties. This second part deals with predicting the long-term product variability.

Freetune Software Solution

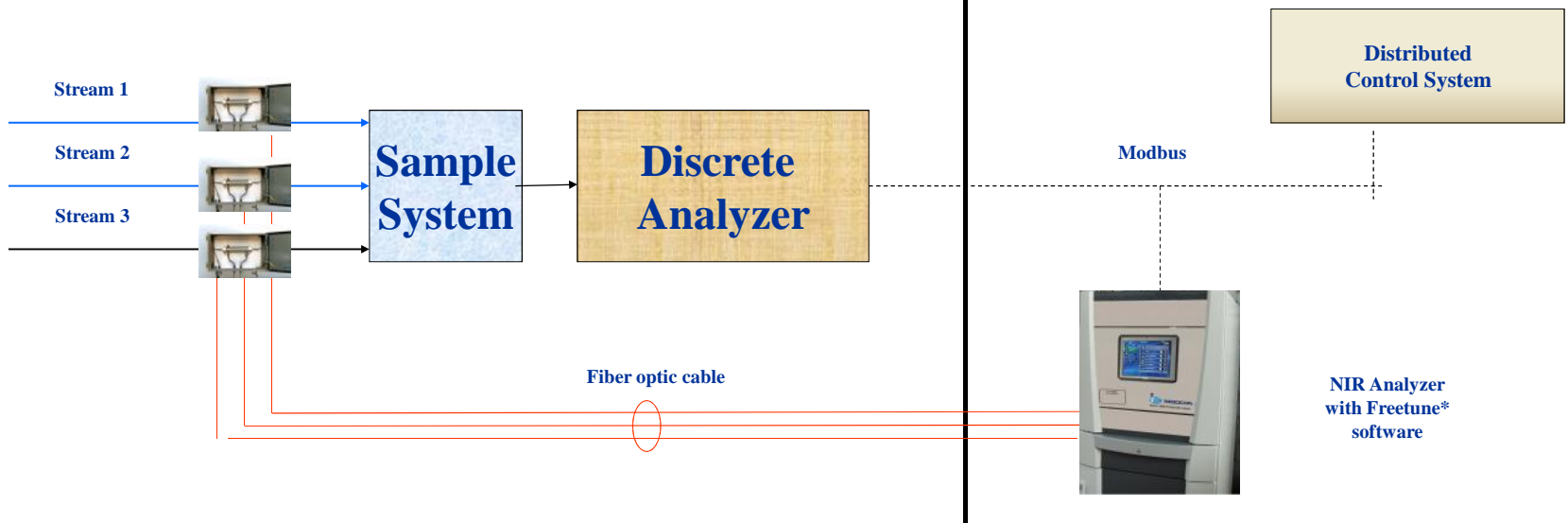


Crude Switching Problem Solving



Cloud Point of Diesel Fuel

The Fusion Solutions



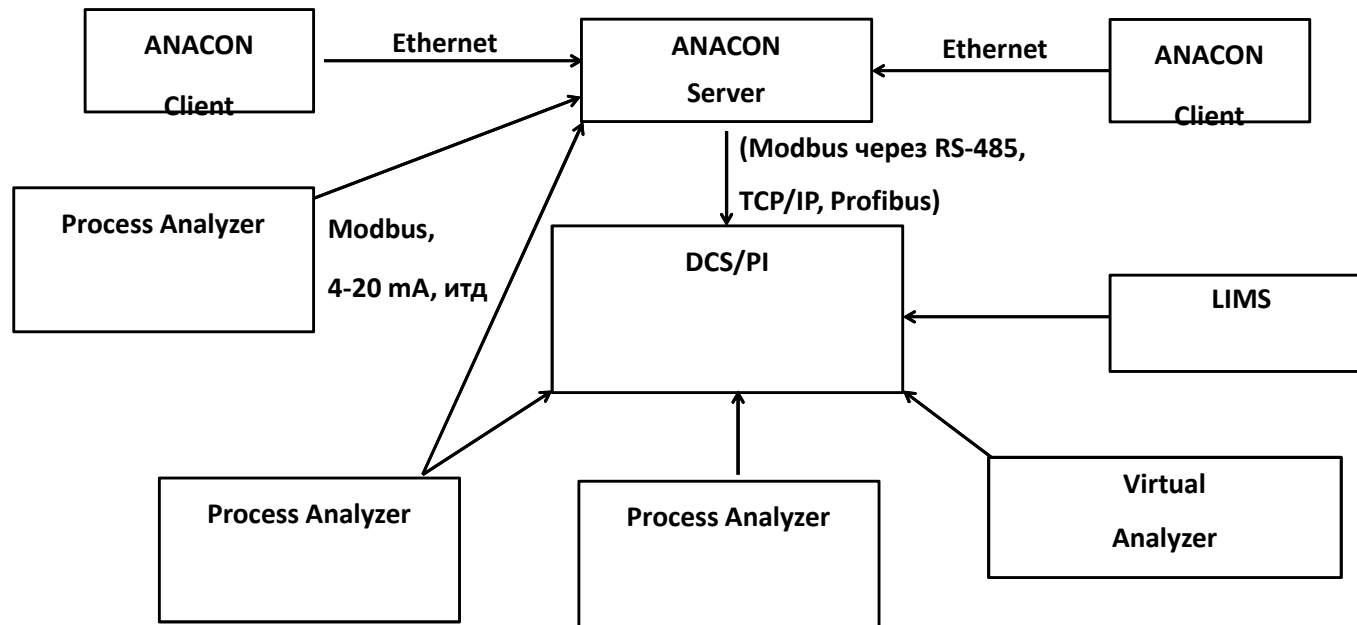
Response time: 5-10 min

Accuracy: according to ASTM

Availability: above 99% (full-redundant system)

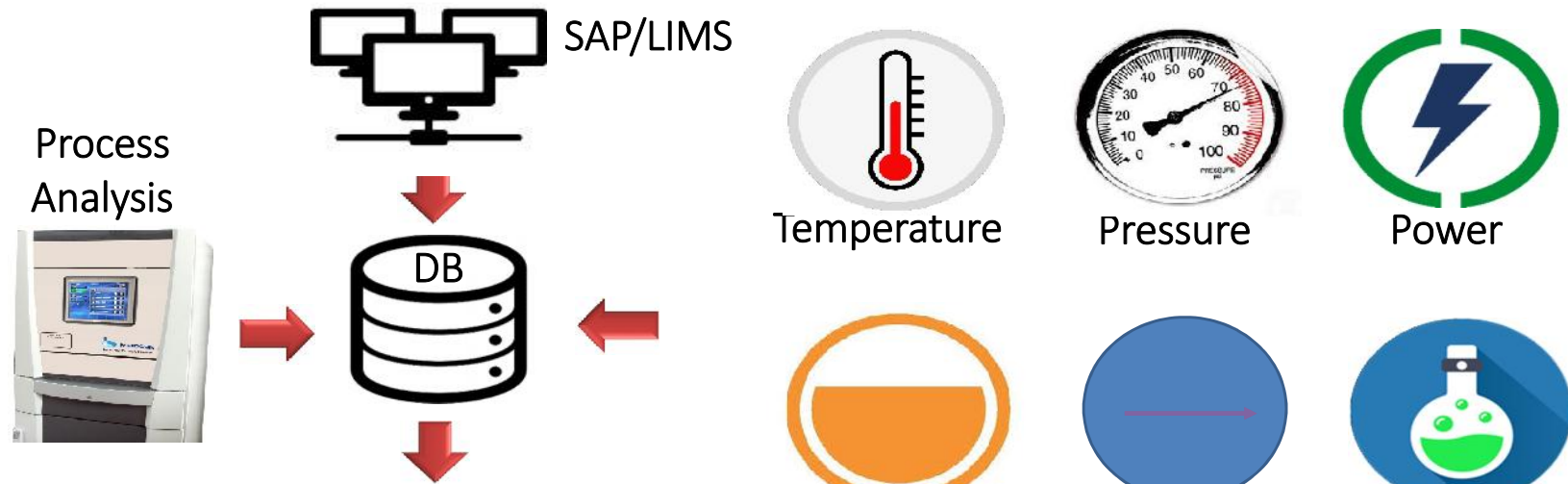
* Patent pending

ANACON Big Data Functionality



- Validation
- HMI
- Trends
- Reports
- Technical Support and Maintenance

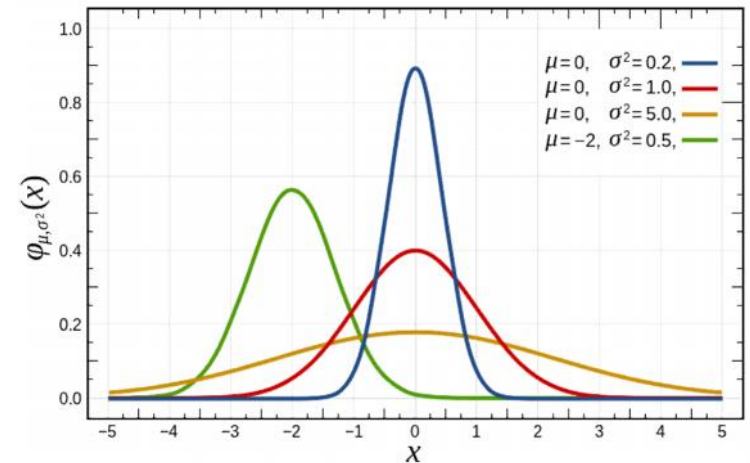
ANACON Big Data Functionality



- Process monitoring
- Anomalies detection
- Operators training
- Equipment diagnostics
- Preventive actions
- Quality control
- Optimization

ANACON Big Data Functionality

- Multidimensional fusion of incoming data
- Multidimensional distribution of proper data
- Abnormality of novel events detection
- Clustering, decision trees, linear, polynomial, logistic regression, SVM
- Escalation of novelty real-time analysis, etc.



$$s = \sqrt{\frac{1}{n-1} \sum (X - m)^2}$$

Conclusions

- Modern remote analysis technologies offers effective and proven solution for process quality control and optimization
- Analyzer management software enables data collection, verification, cross-validation and multidimensional fusion of incoming data for more effective process analysis and control
- The latest system release includes predictive data analysis, safety considerations, emission sources localization and equipment maintenance improvement, using linear programming and multidimensional distribution techniques
- Combination of remote process analysis with big data IIoT technology in oil and gas industries improves process monitoring, quality control, optimization and profitability



MODCON