

CEMTREX, INC. MODCON SYSTEMS LTD

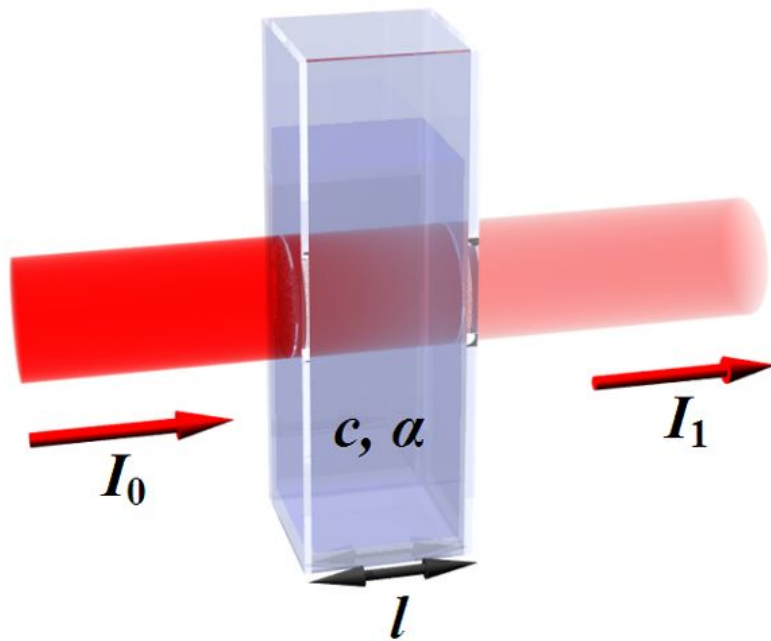
NIR Systems

July 2010



NIR Spectroscopy Principle

Beer–Lambert law

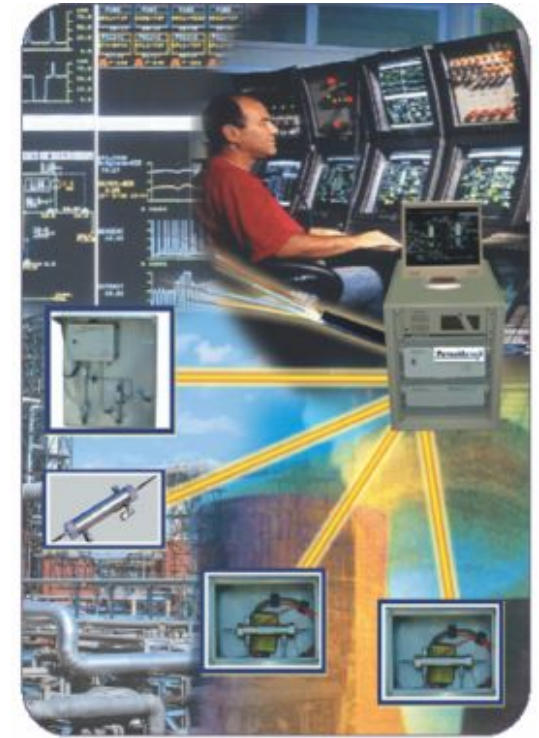


$$A = \epsilon lc = \alpha l$$

Logarithmic dependence between the transmission T , of light through a substance and the product of the absorption A coefficient of the substance, α , and the distance the light travels through the material (i.e. the path length), l .

NIR Analyzers Advantage

- Low Cost of Ownership
- Optimized production processes by real time monitoring
- Improved process knowledge
- Expensive and time consuming laboratory analyses are no longer necessary
- Improved quality assurance
- Minimal maintenance required
- Easy to calibrate - automatic calibration model updating
- Powerful communication system

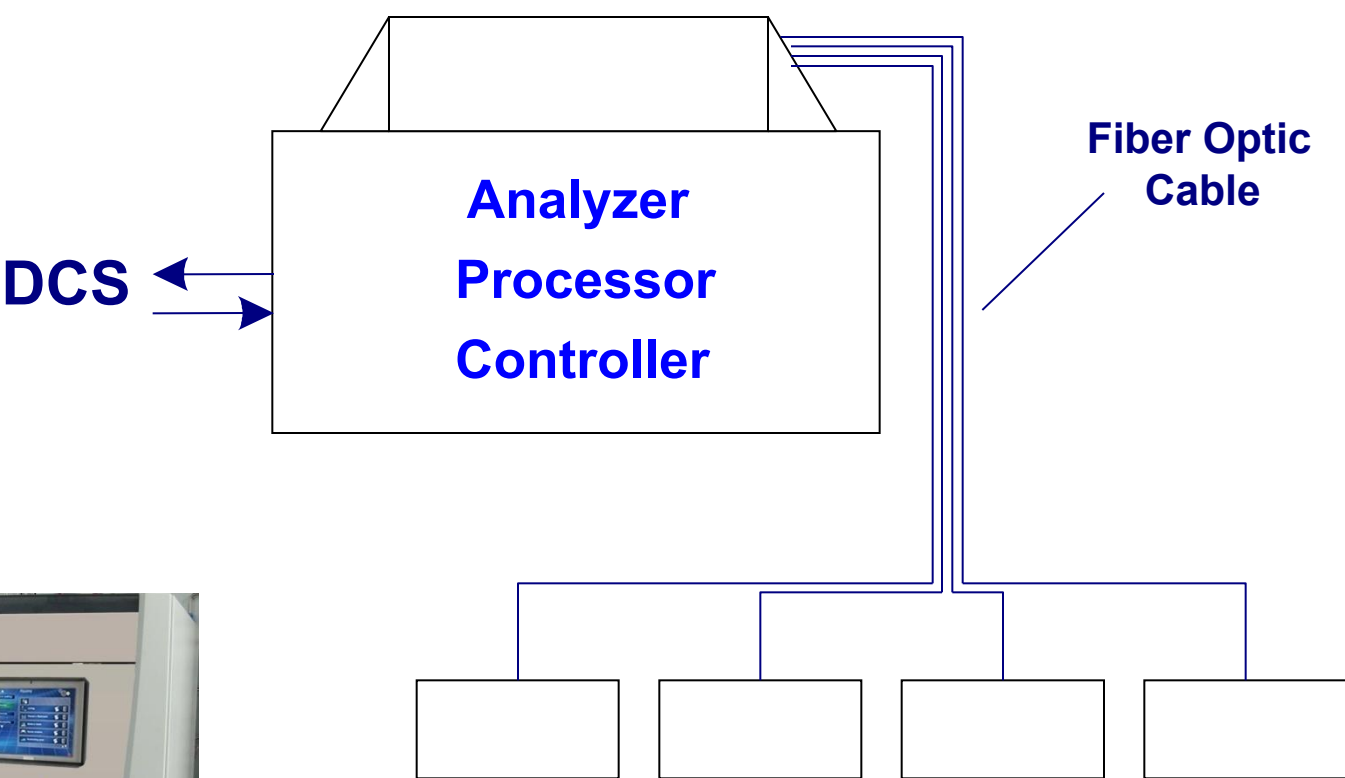


Beacon 3000 NIR Analyzer Advantage

- Connection to up to 8 process stream sensors
- No longer location-specific can be situated up to 2 miles (3,2km) away from main analyzer
- Use of standard telecommunication fiber optics
- Contains no moving parts
- No electricity required



Block Diagram



Field Units installed throughout the plant

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



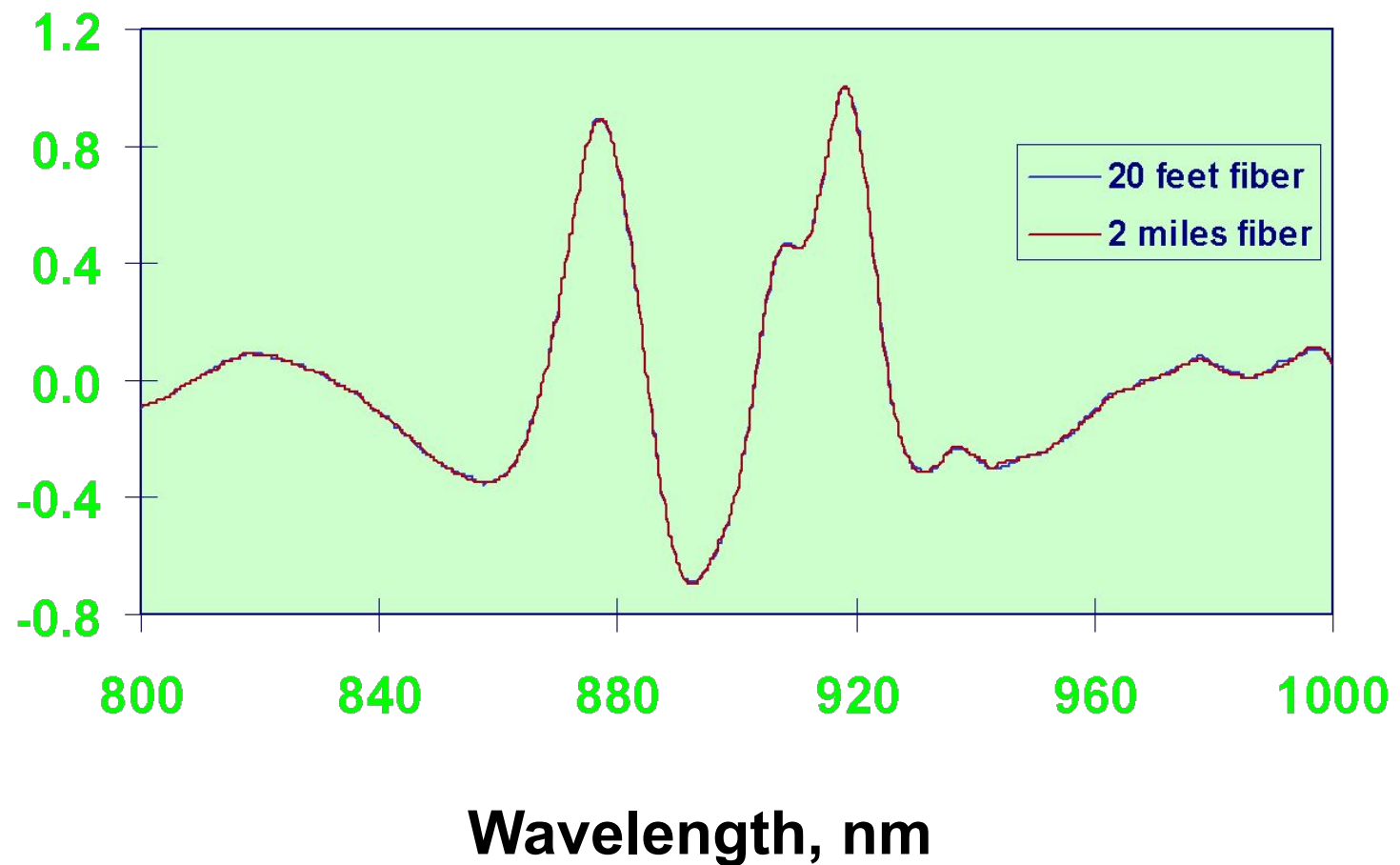
Sample Cell



Probe

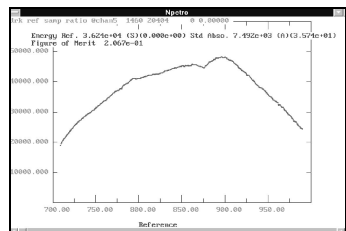


No Effect of Fiber Length

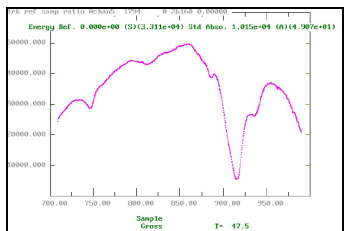


From Spectral Information to Electronic Data

Light Source



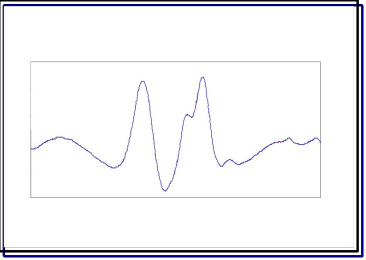
Field Unit



Detector Module

Processor

Measured Spectra



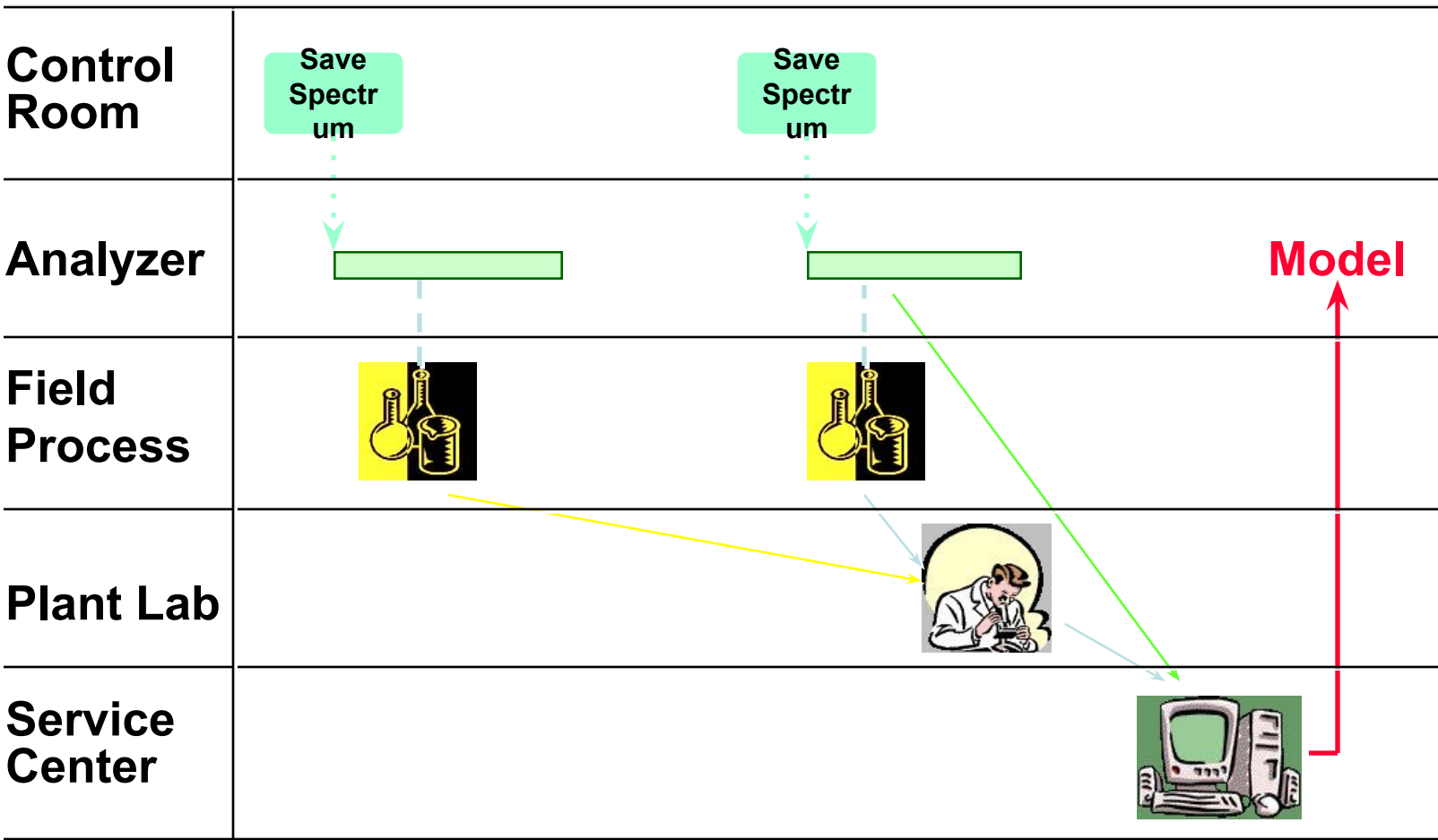
Measured Spectra

Reports



Properties Calculation

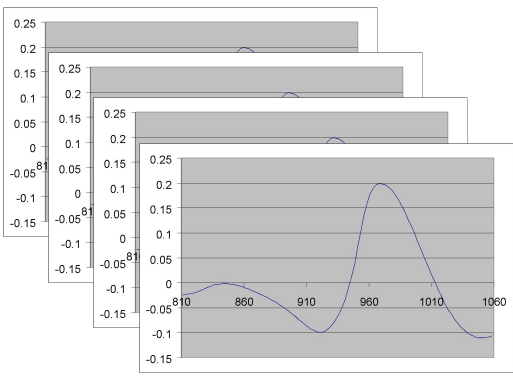
Online Sample Collection and Model Building



Principles of Chemo-metrics

Calibration Phase

Reference Spectra

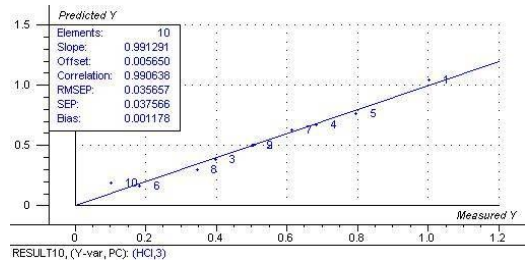


Reference Measurements

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

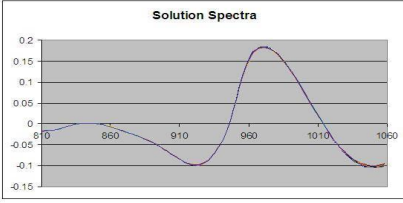


Calibration Model

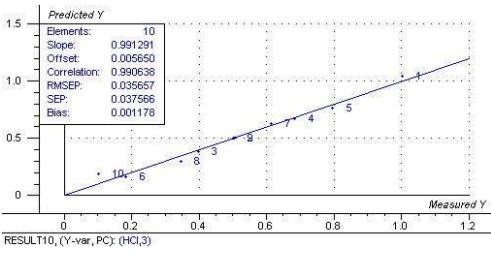


Measurement Phase

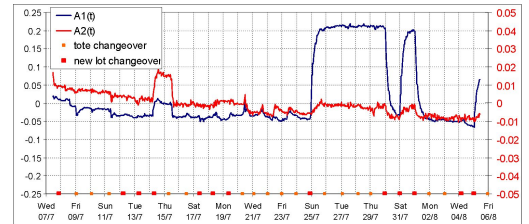
Unknown Spectra



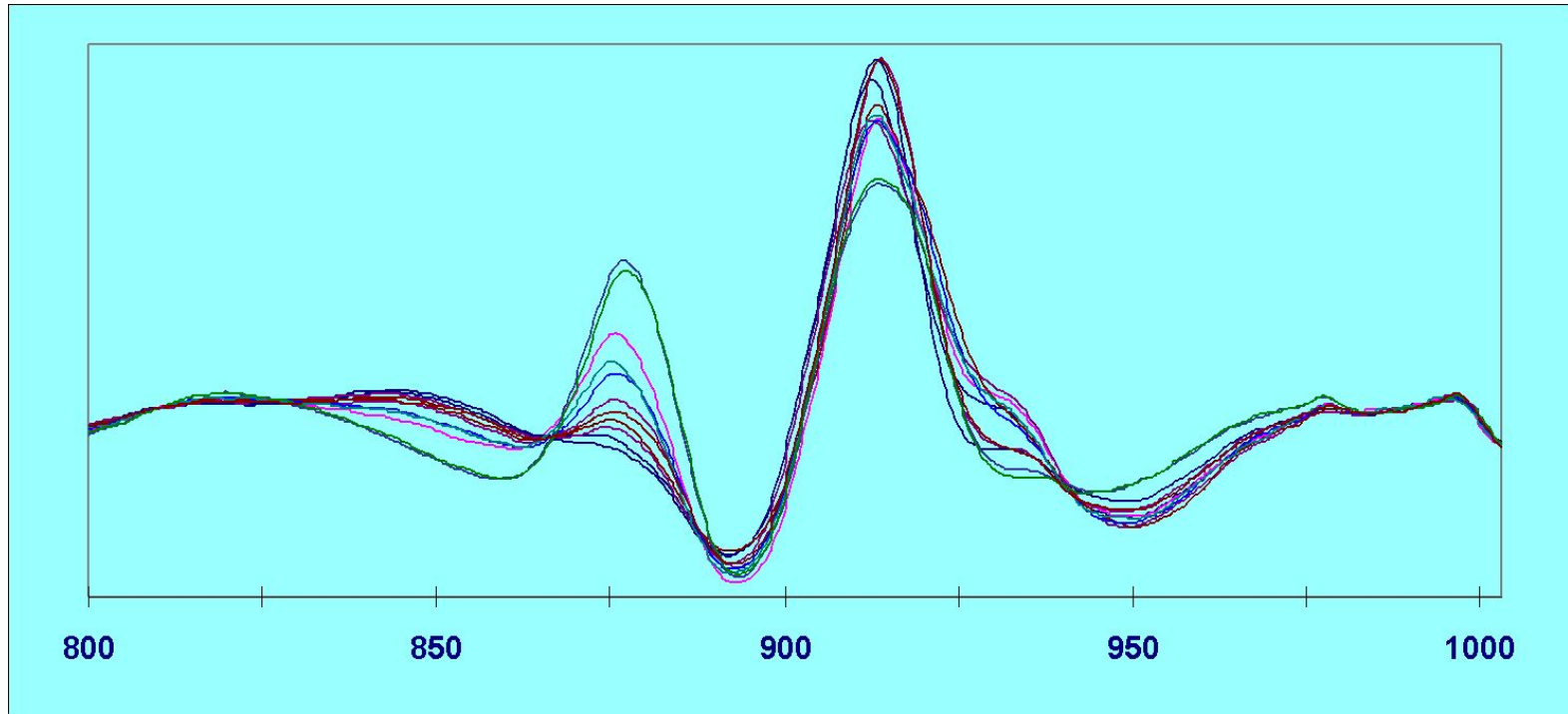
Calibration Model



Real Time Results

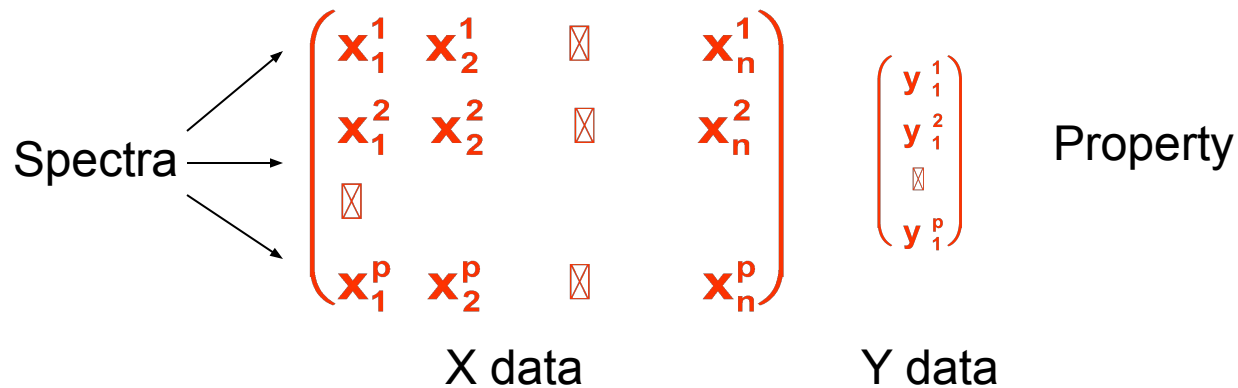
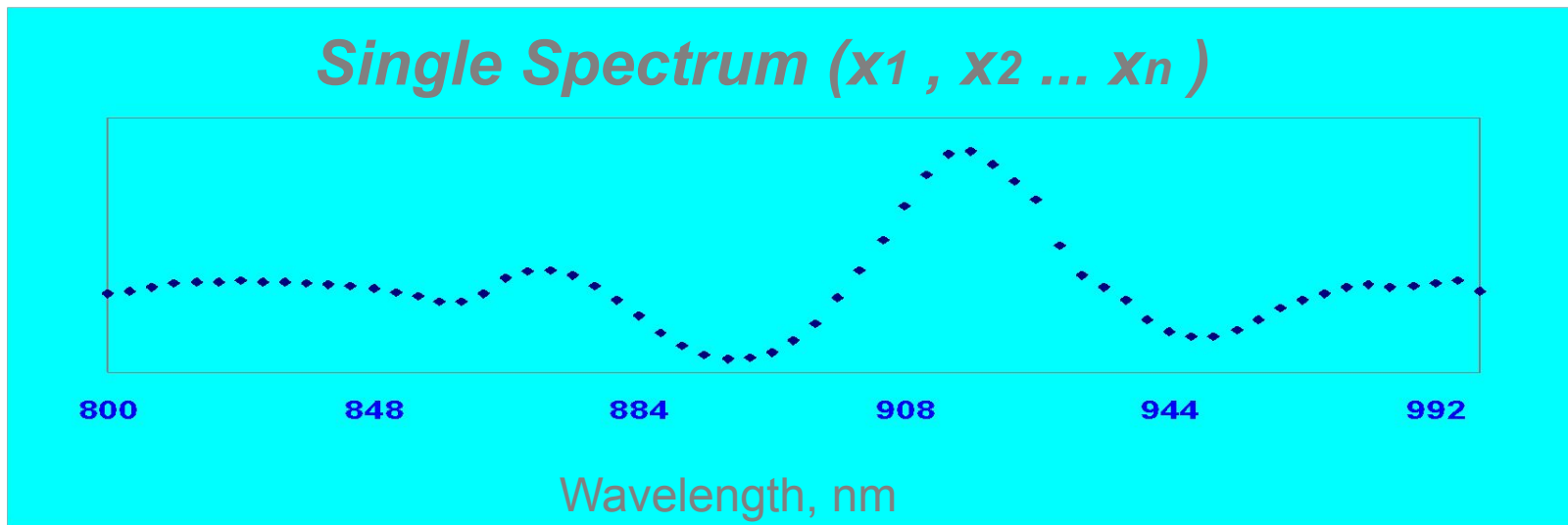


Typical Gasoline Spectra

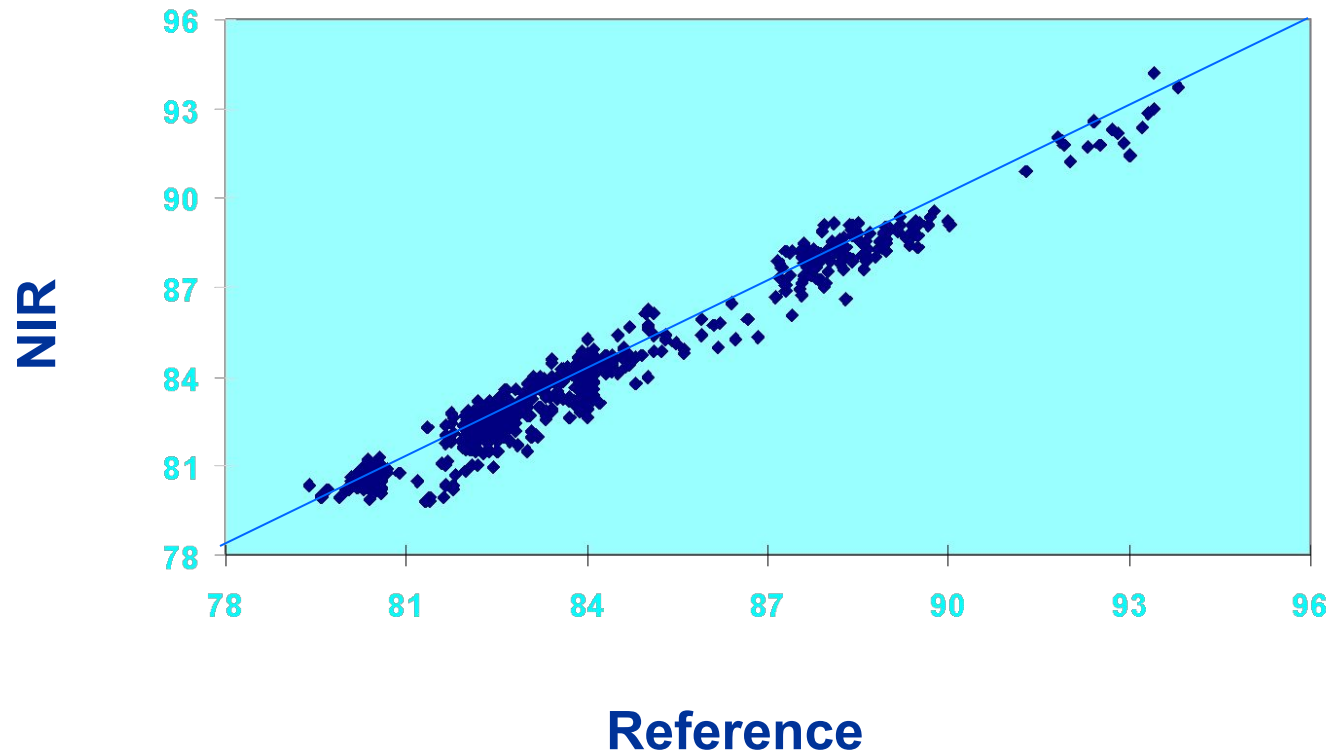


Wavelength, nm

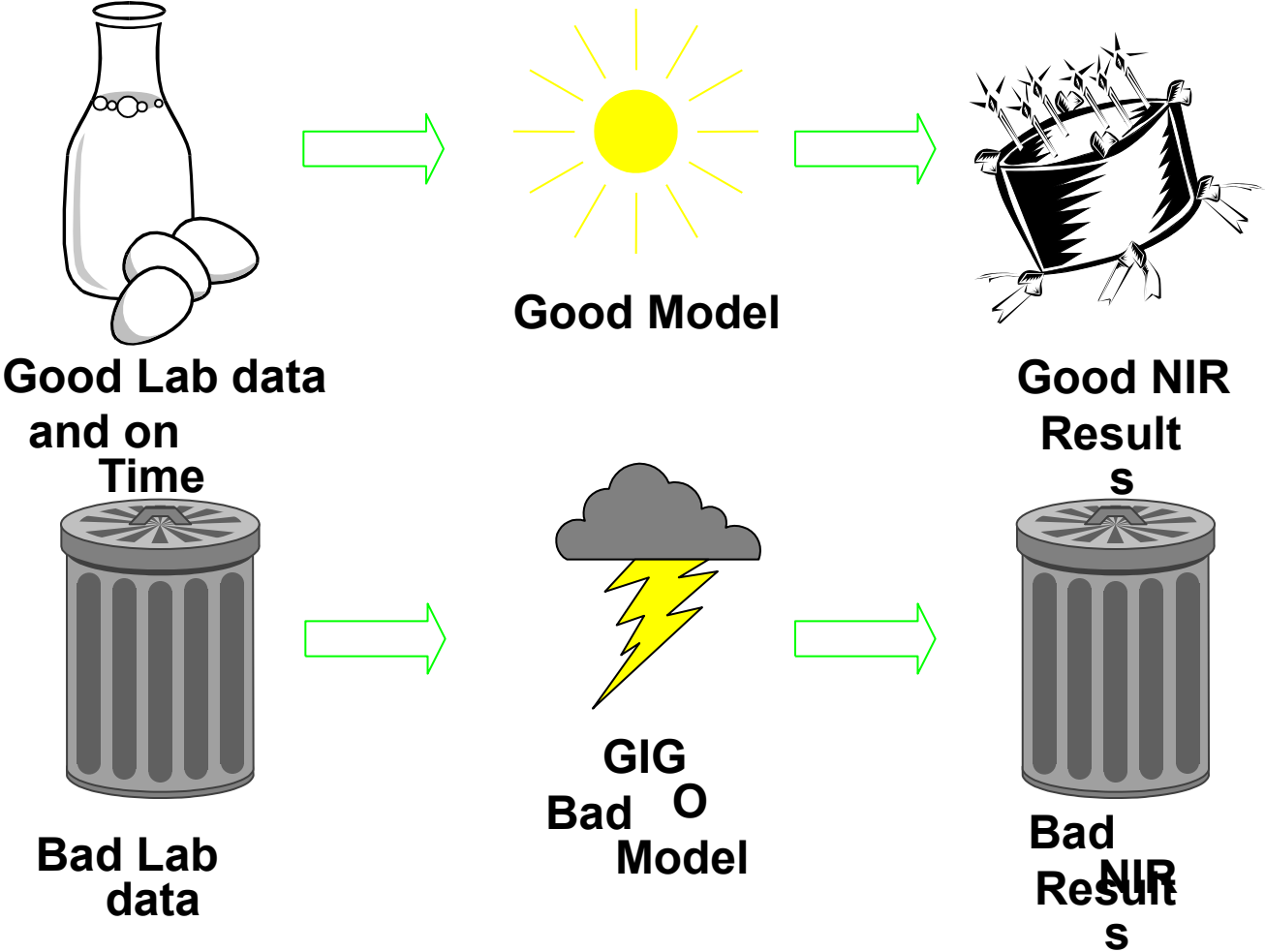
X and Y Data



MON of Gasoline - Universal Model



Note on Lab Results



Statistic Nomenclature

Root Mean Square Error of Prediction

$$\text{RMSEP} = \sqrt{\frac{\sum_{i=1}^n (\hat{y}_i - y_i)^2}{n}}$$

\hat{y} - laboratory reference

y - calculated value

Standard Error of Prediction

$$\text{SEP} = \sqrt{\frac{\sum_{i=1}^n (\hat{y}_i - y_i - \text{Bias})^2}{n-1}}$$

Average Difference between \hat{y} and y in Prediction Set

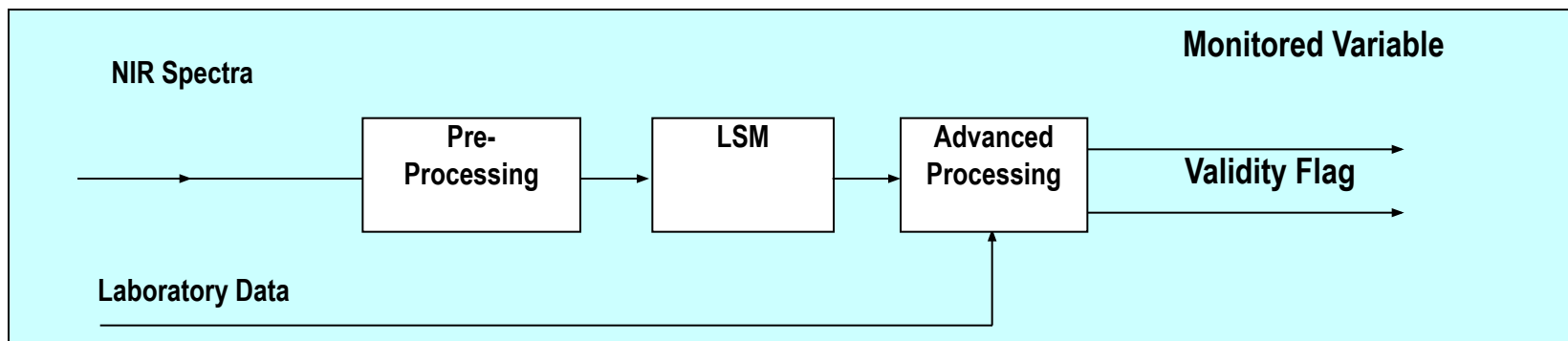
$$\text{Bias} = \sum_{i=1}^n \frac{(\hat{y}_i - y_i)}{n}$$

Modcon Solution

Free-tune Software

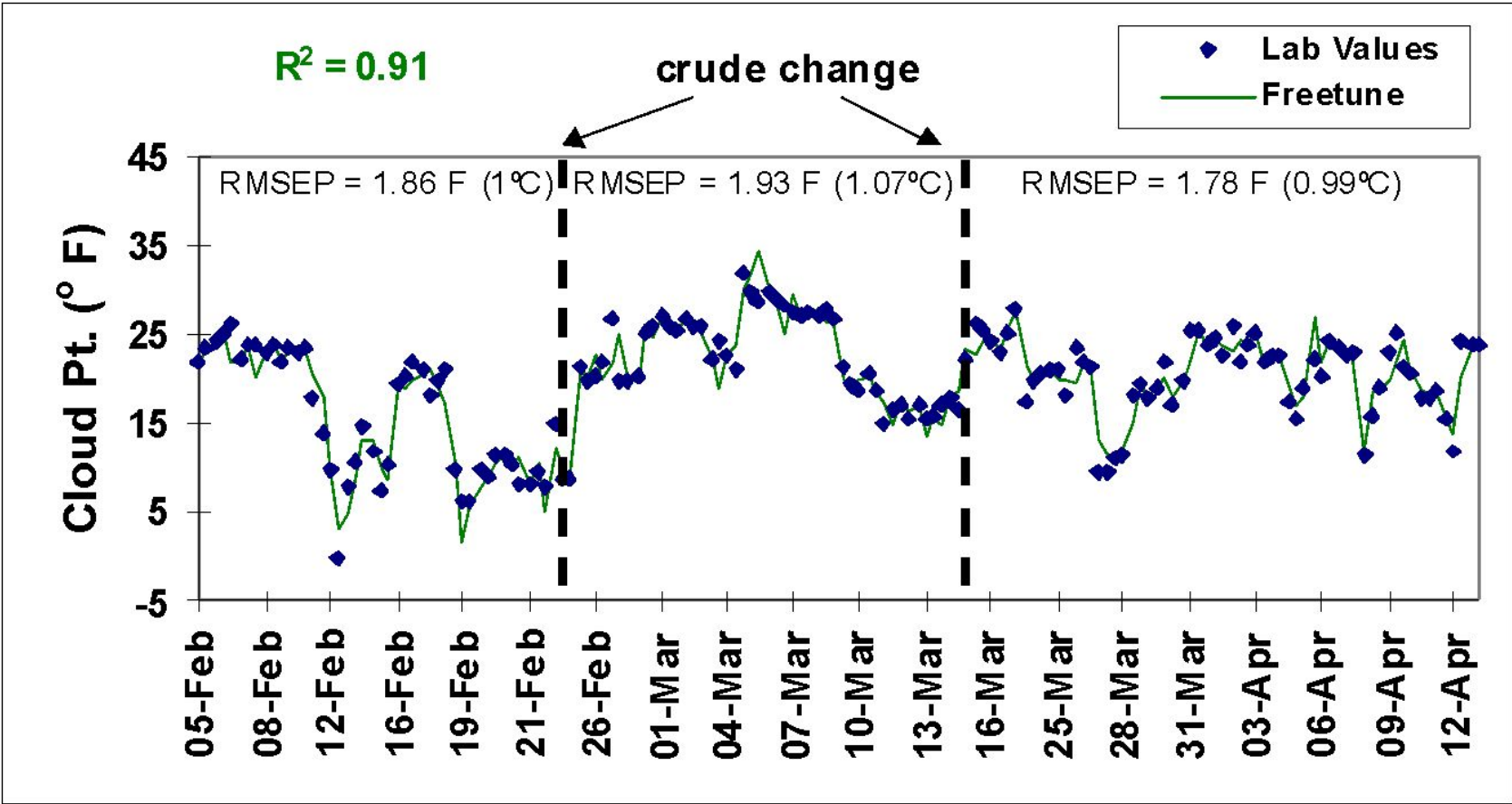
This software program is composed of two sequential blocks:

- I. 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.
- II. A proprietary software program processes the model, together with the specified plant data, to accurately quantify the properties. This part deals with predicting the long-term product variability.

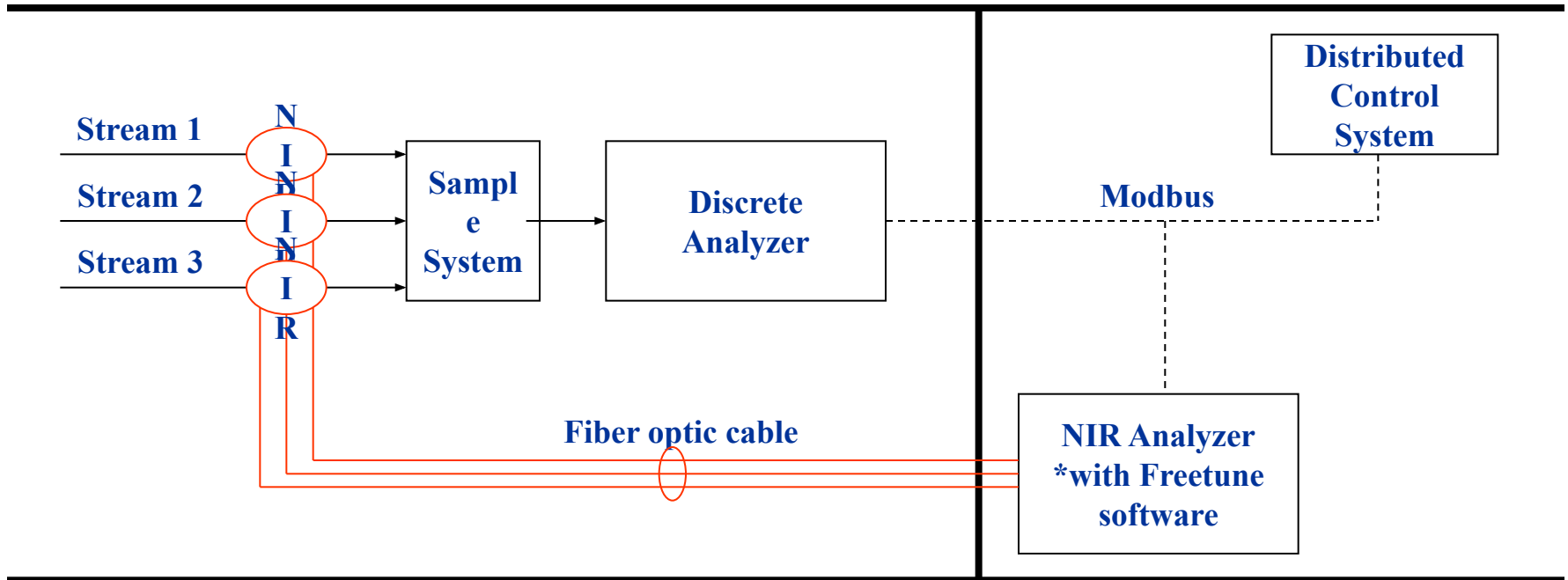


Model Updating

Model updating during the crude switching



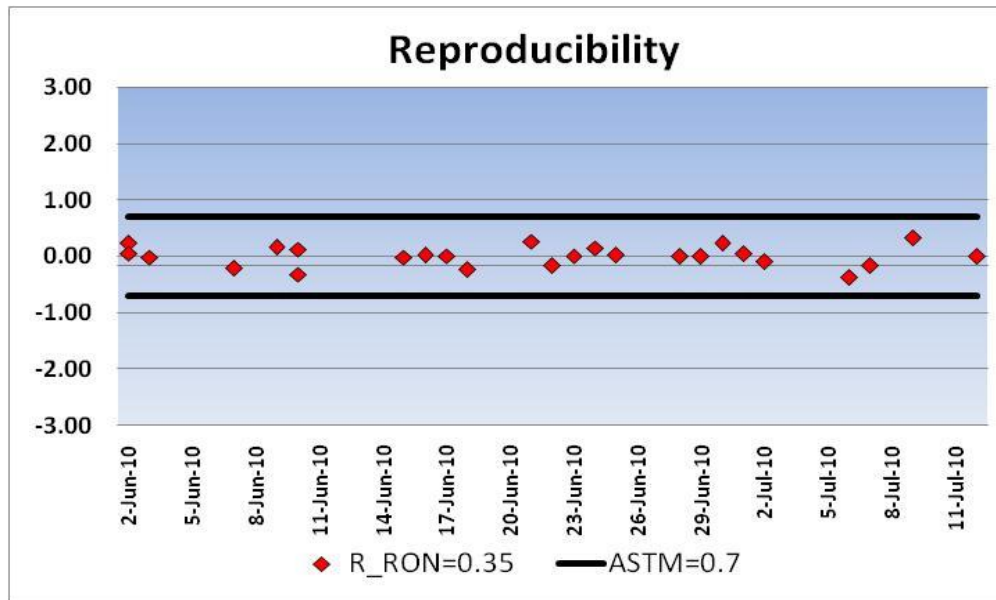
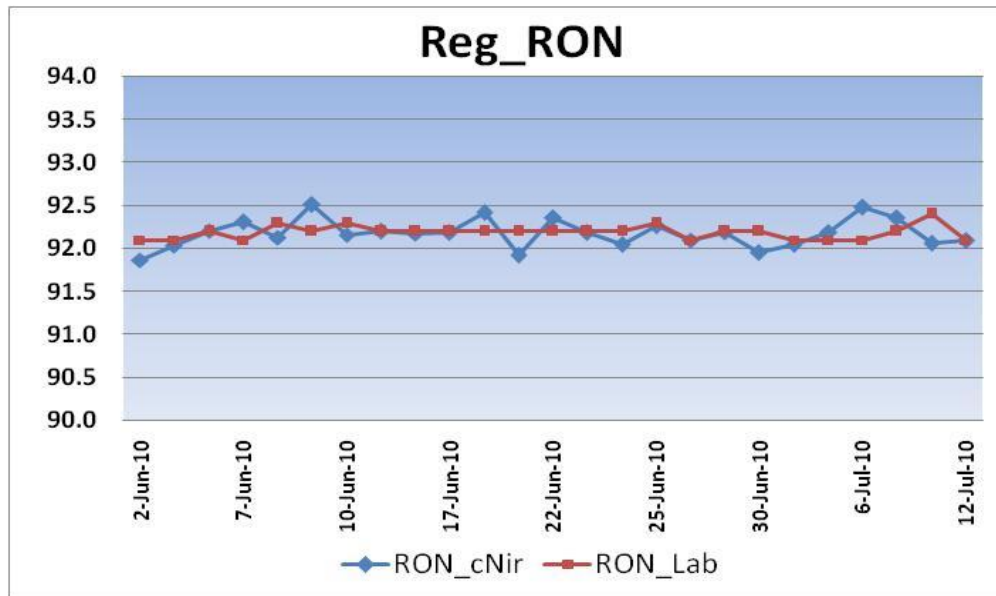
Fusion Solutions

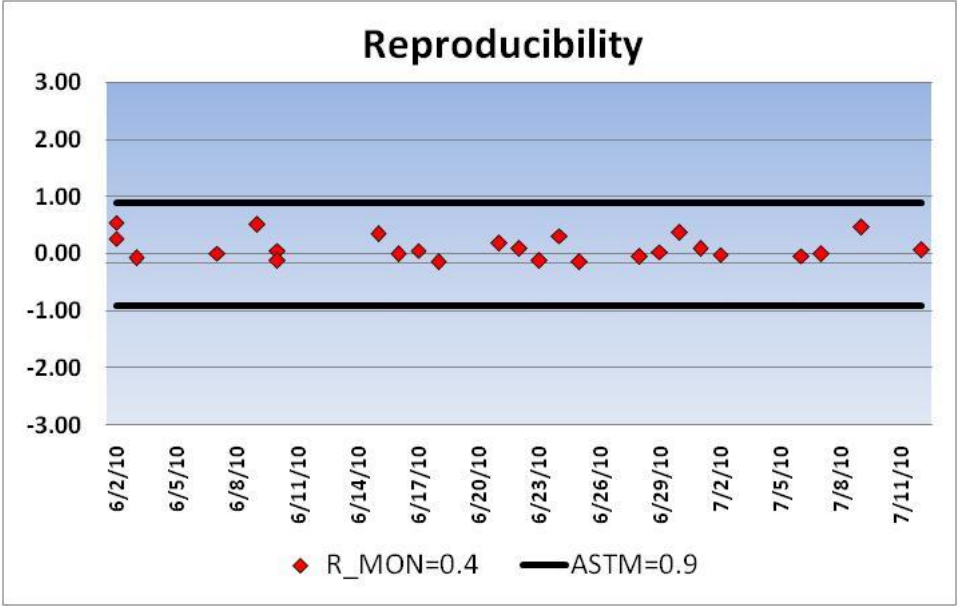
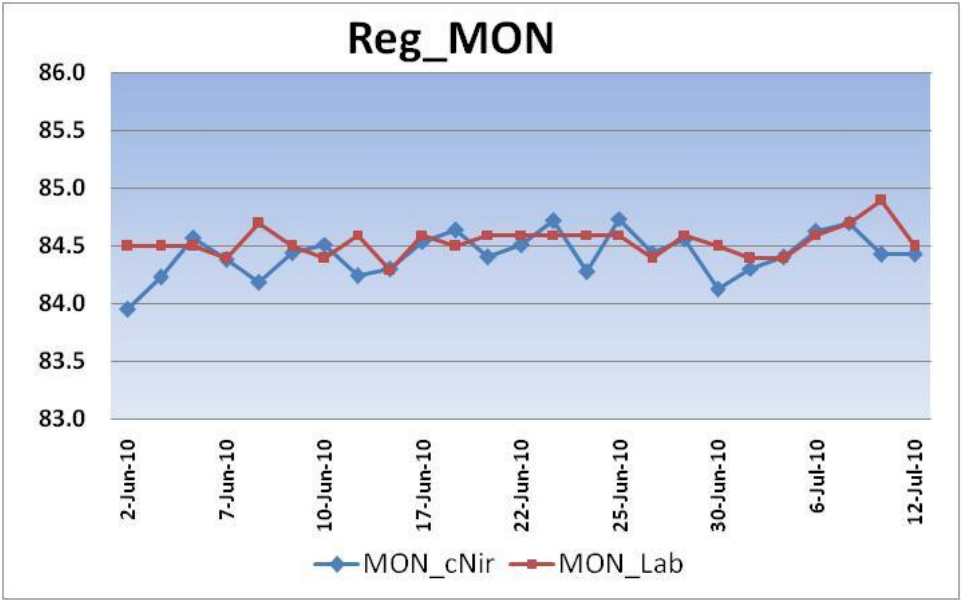


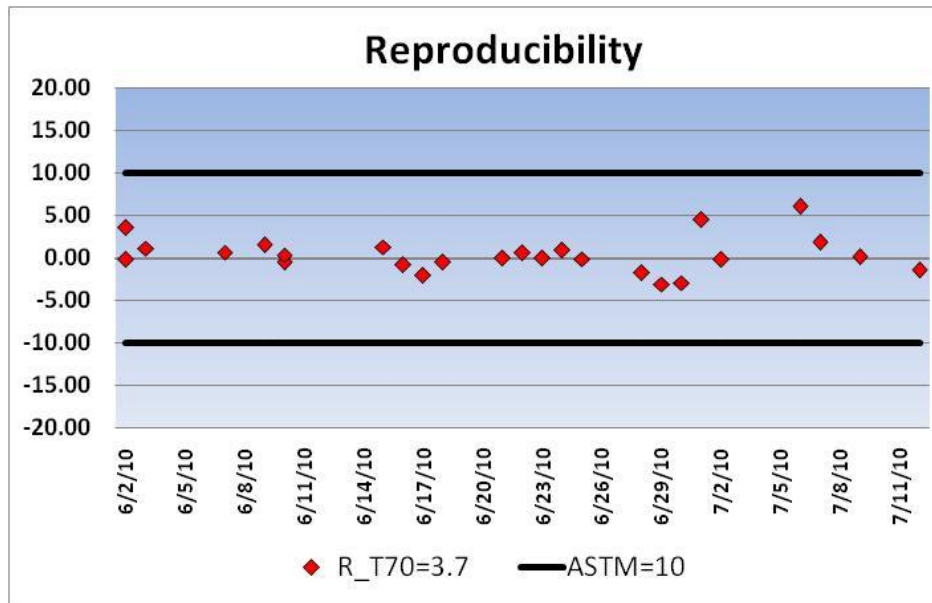
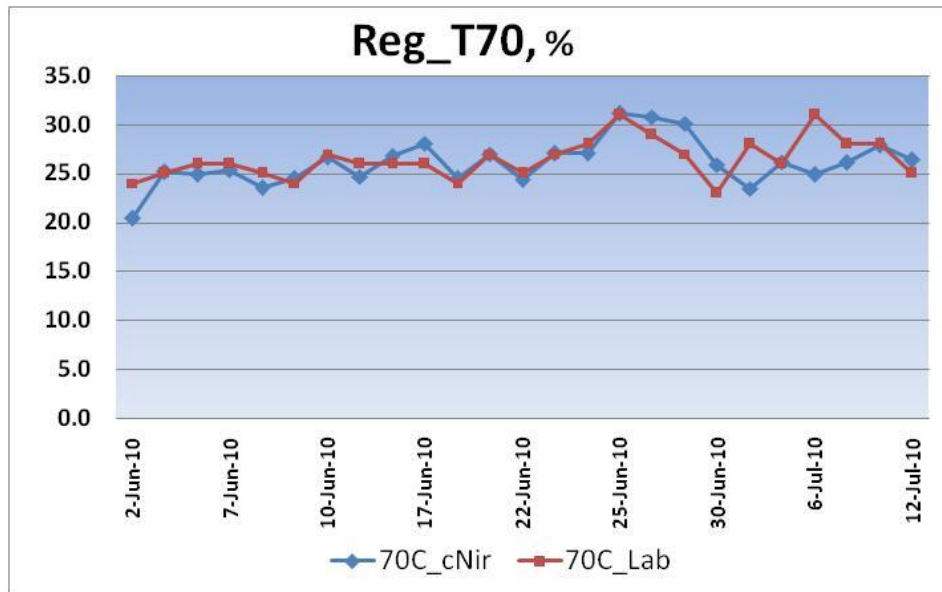
Response time: 5-10 min

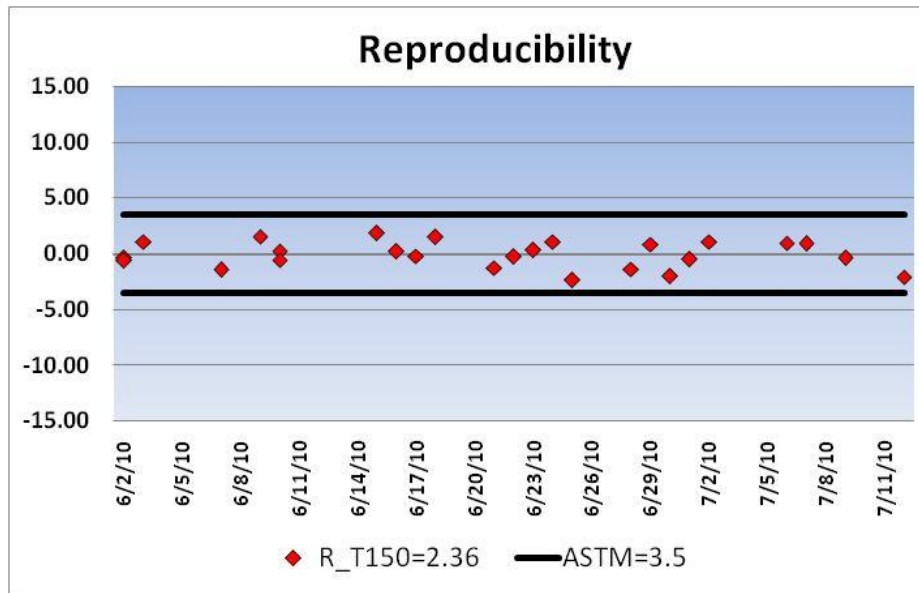
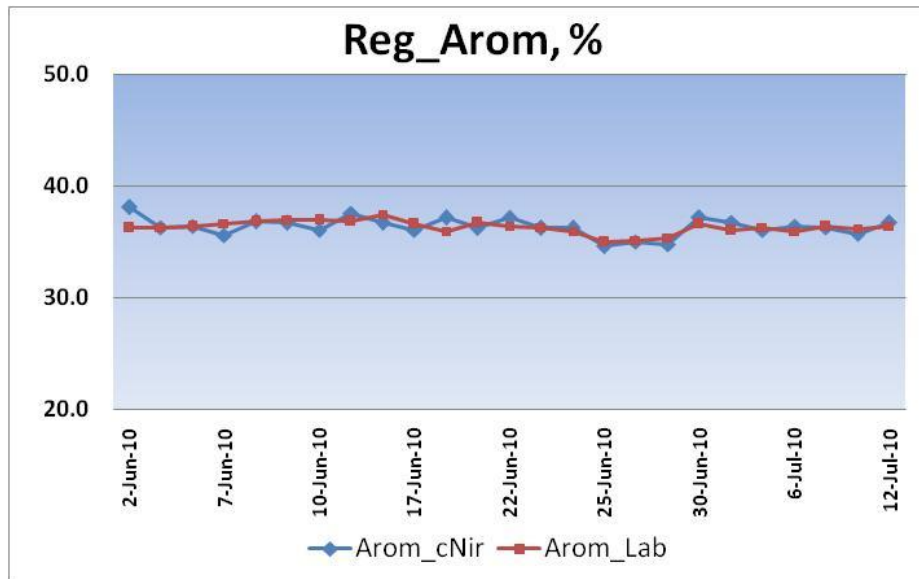
Accuracy: according to ASTM

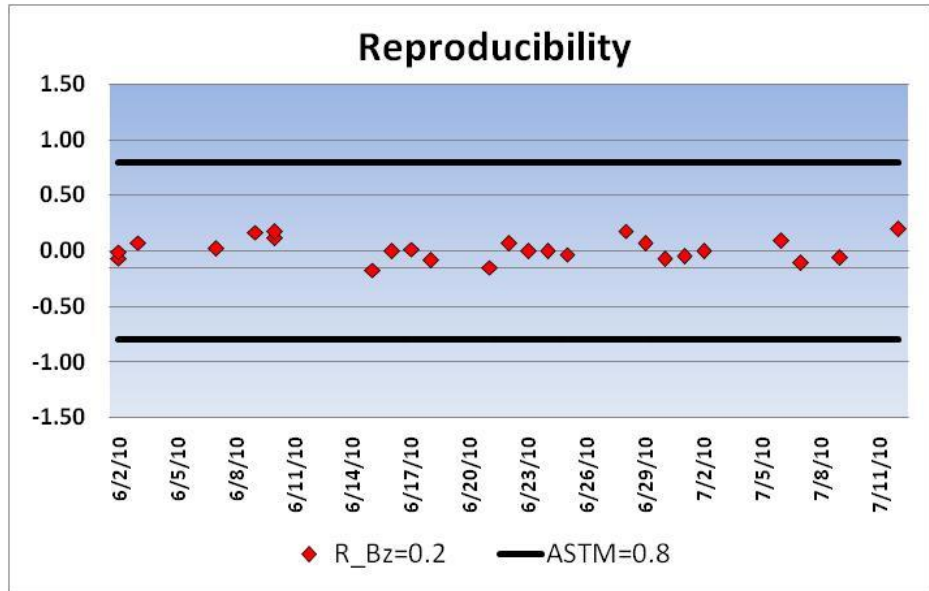
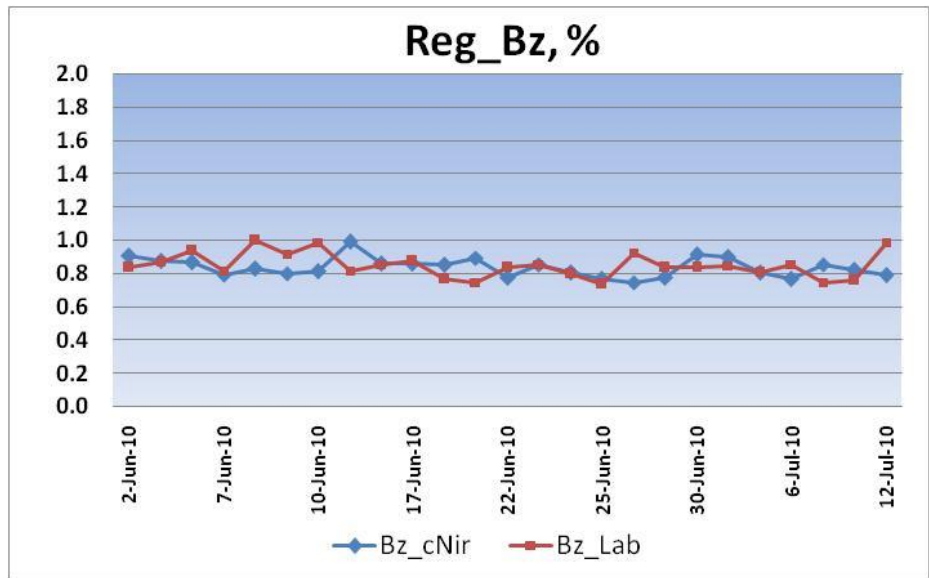
Availability: above 98% (full-redundant system)

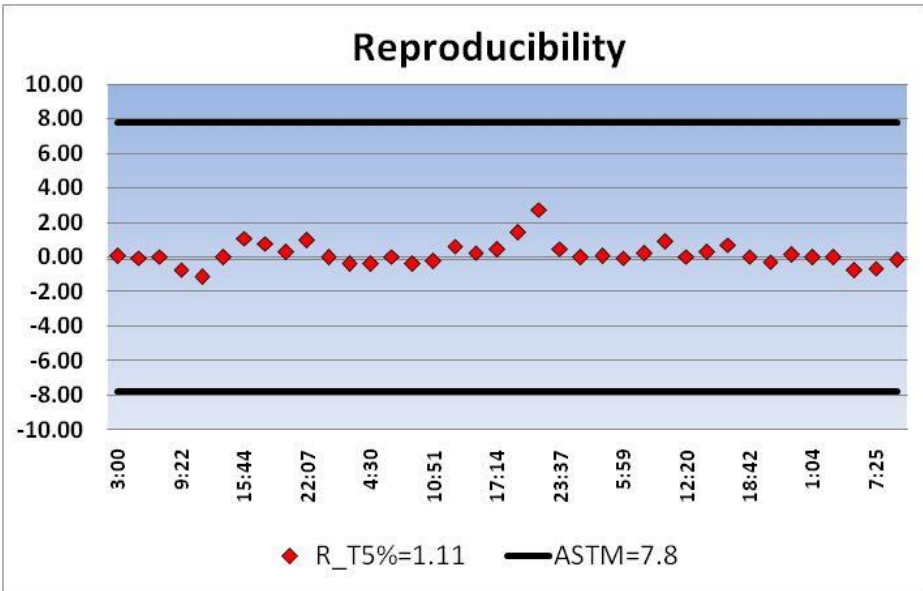
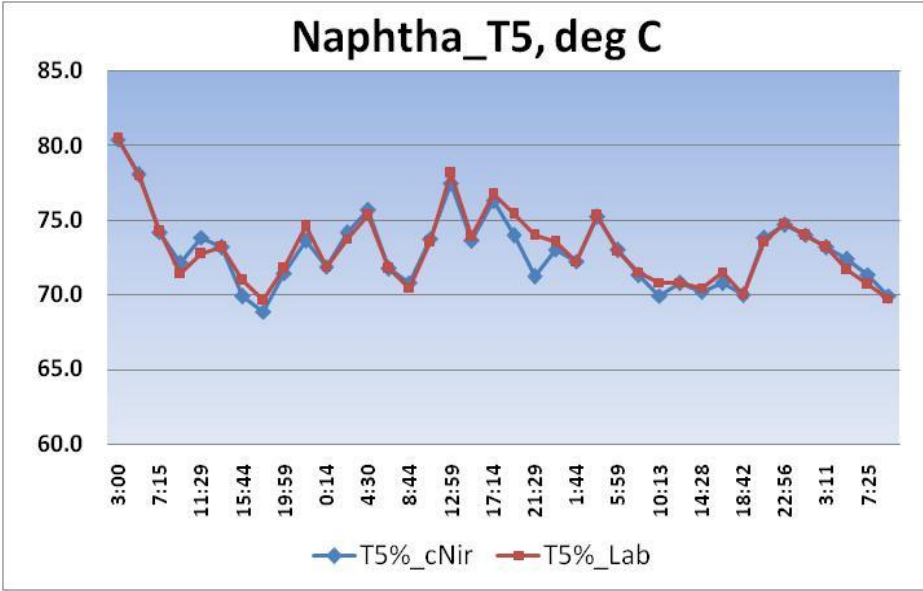


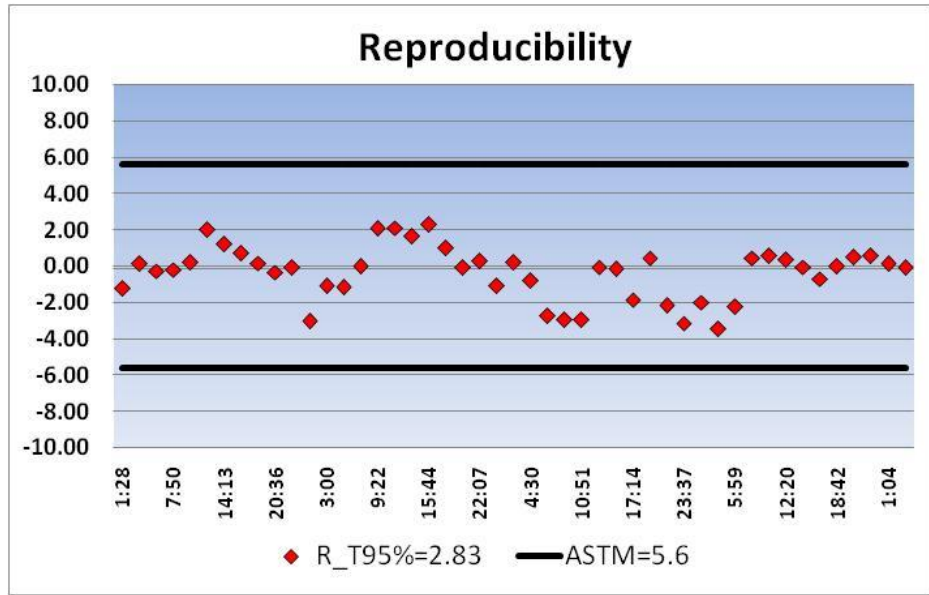
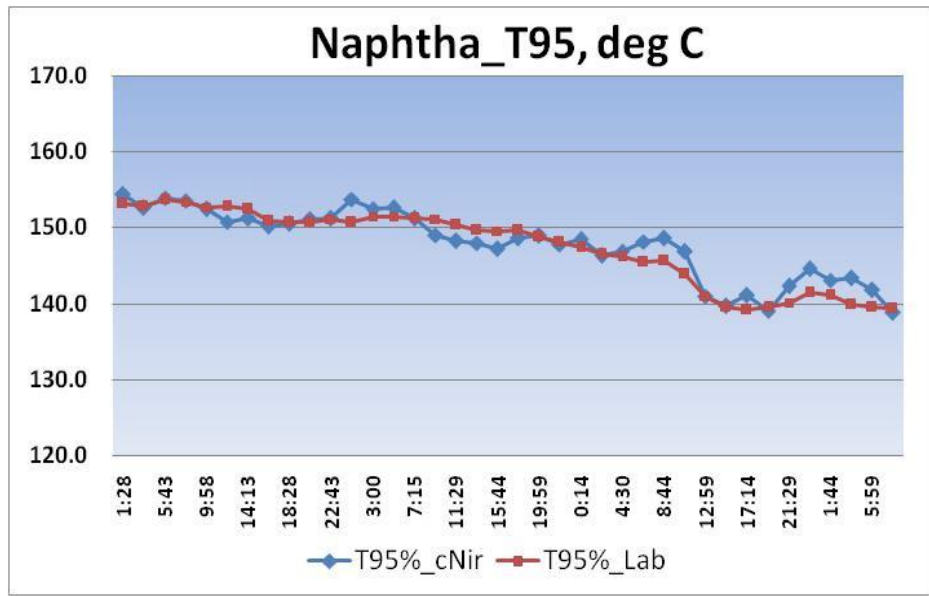


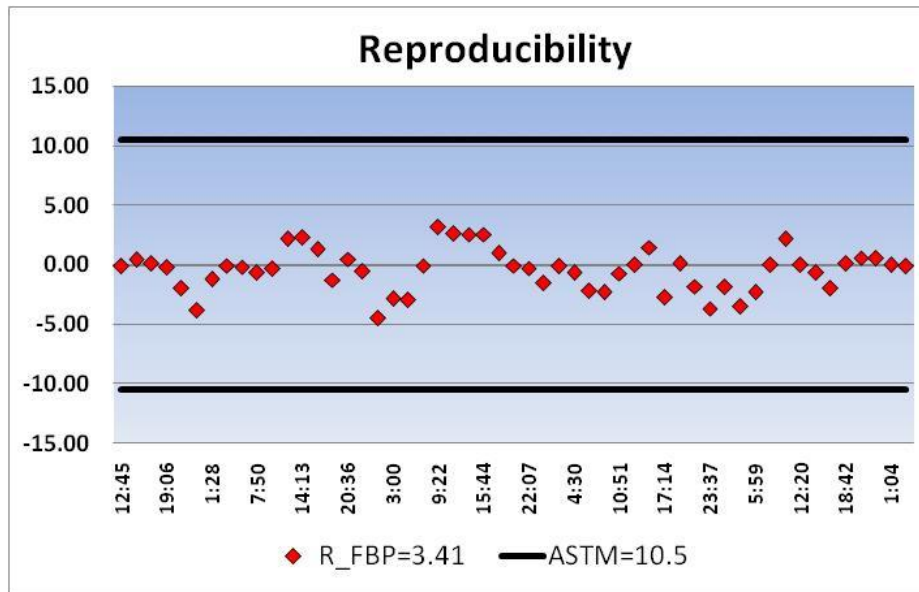
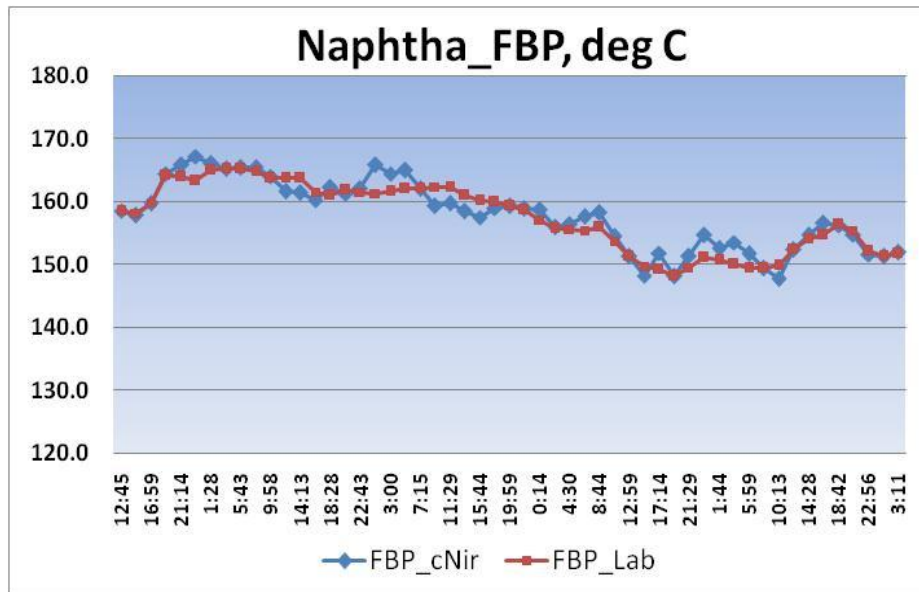


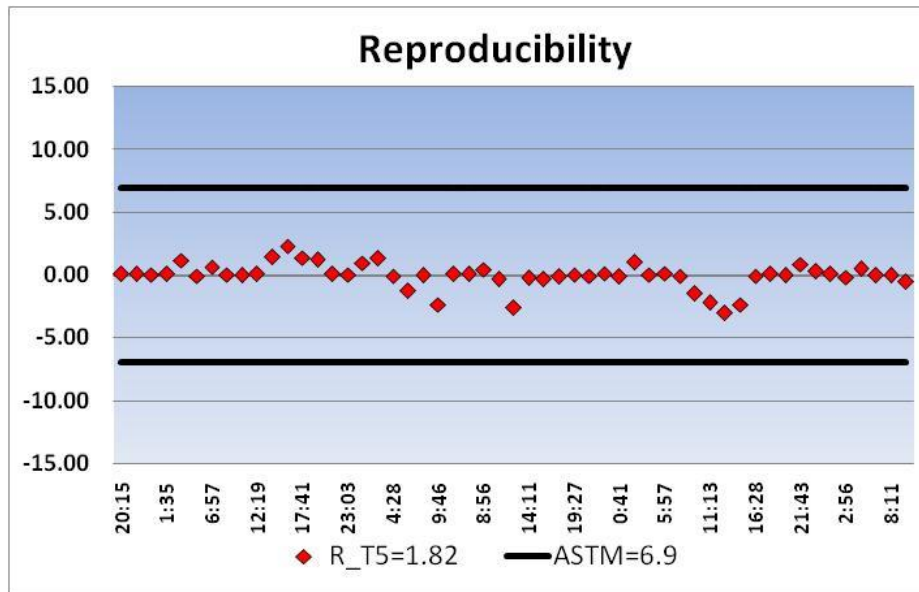
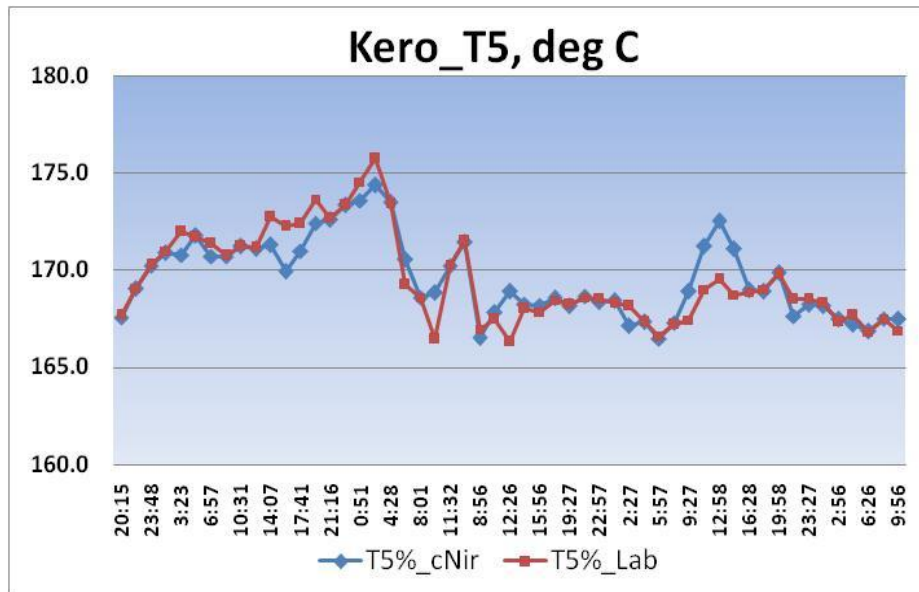


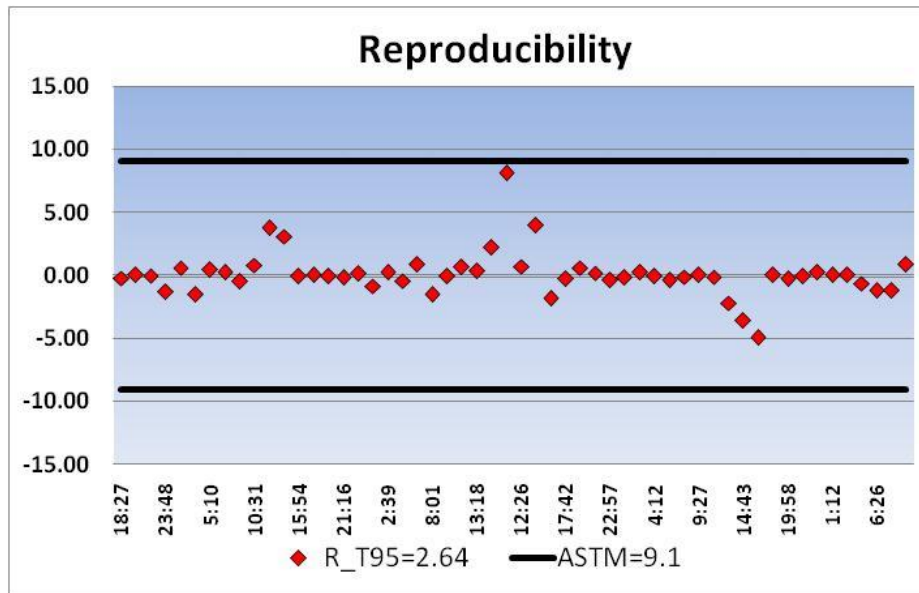
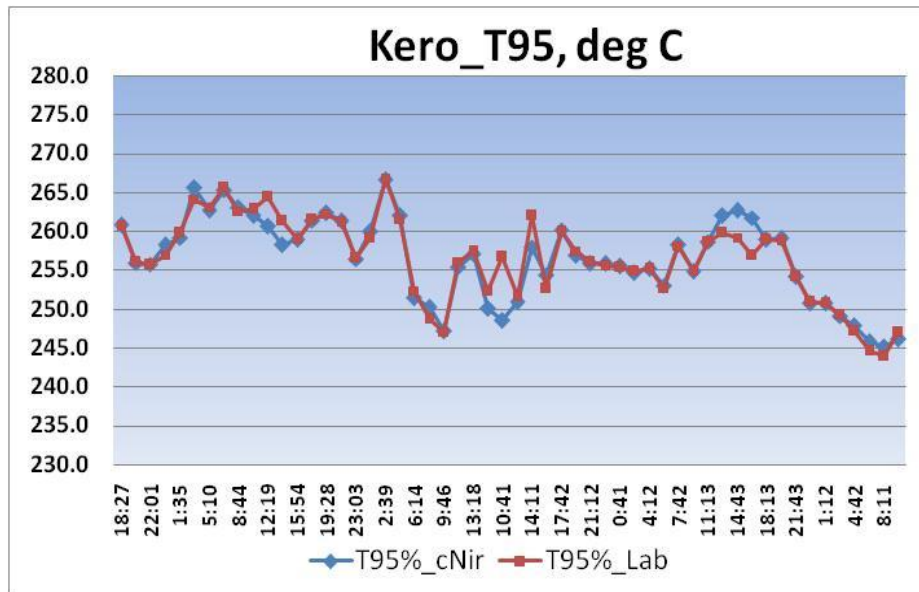


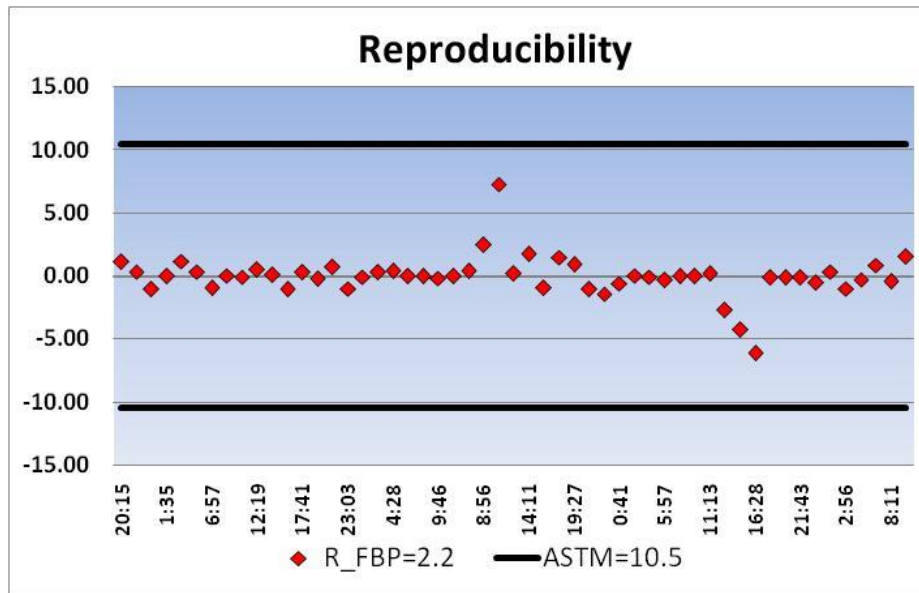
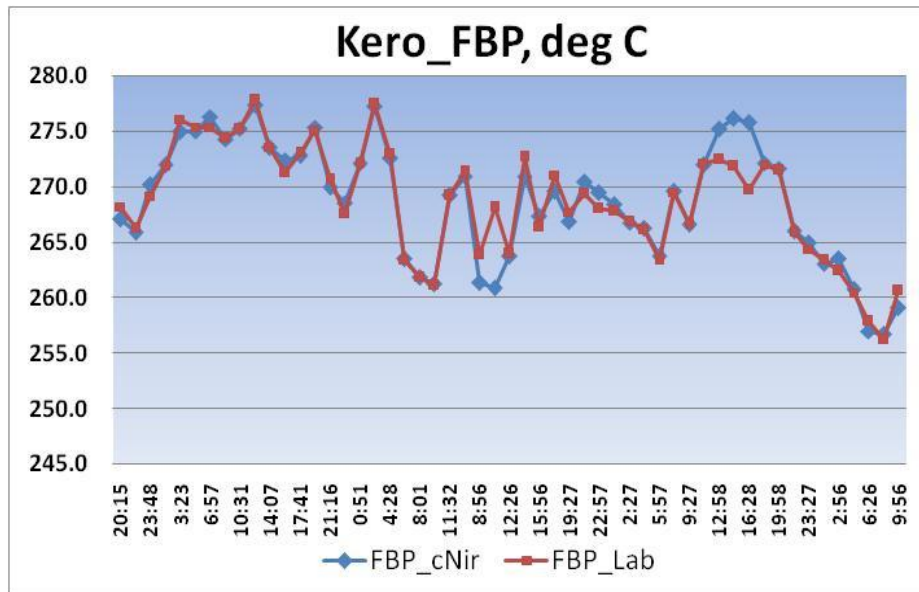


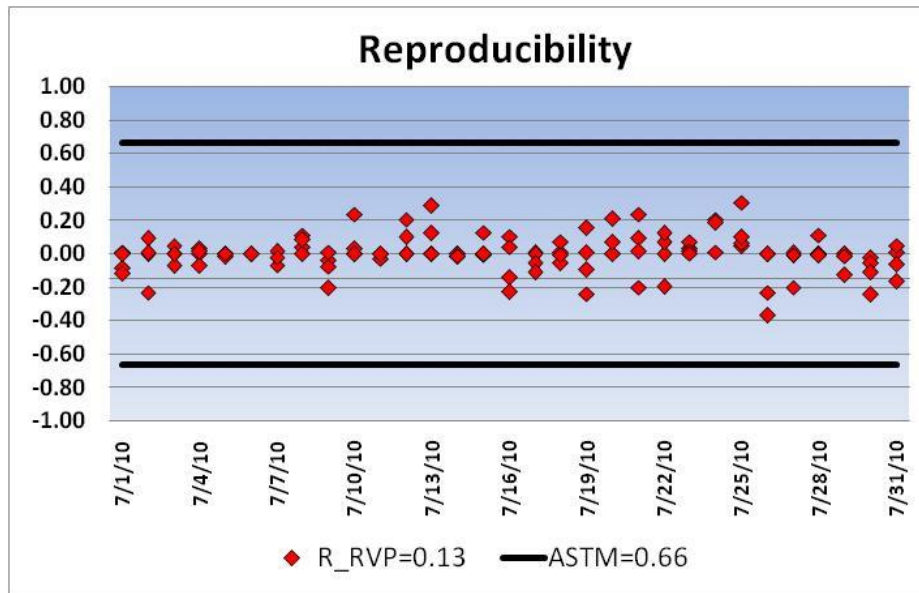
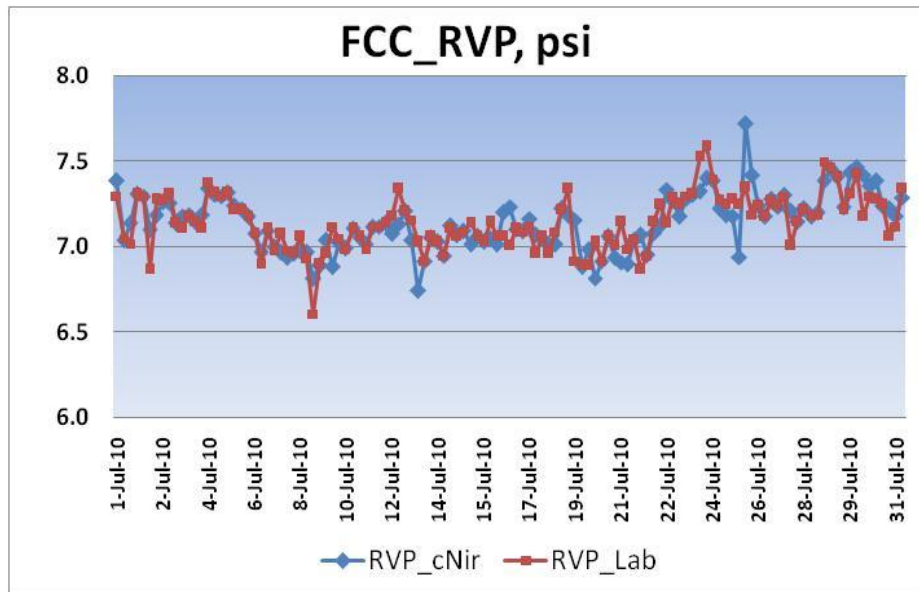




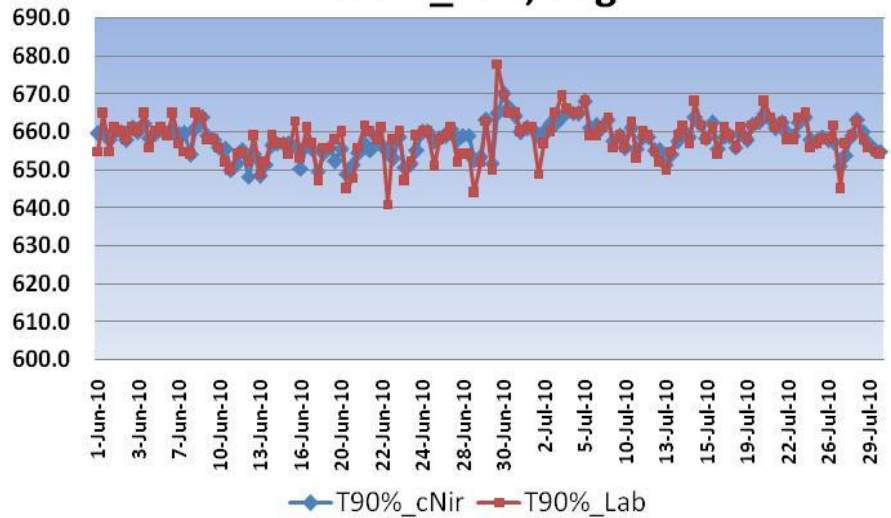




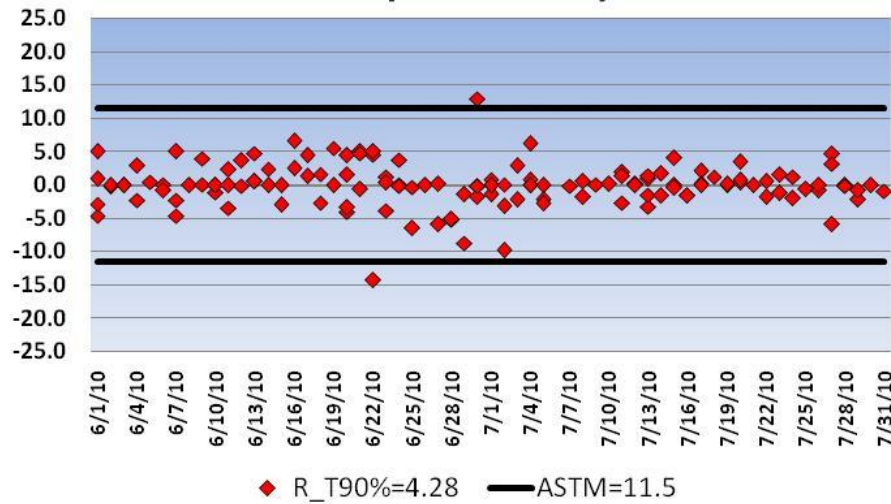


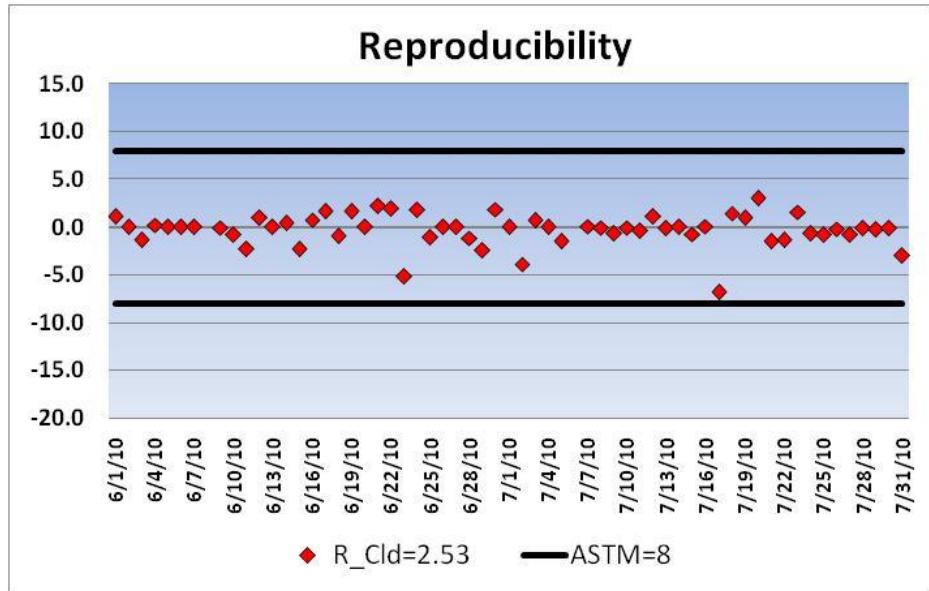
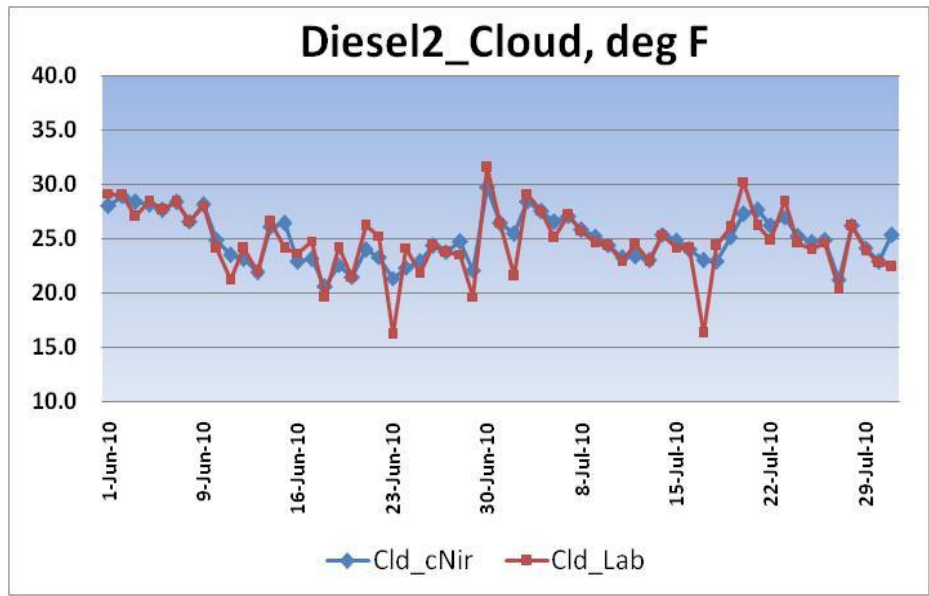


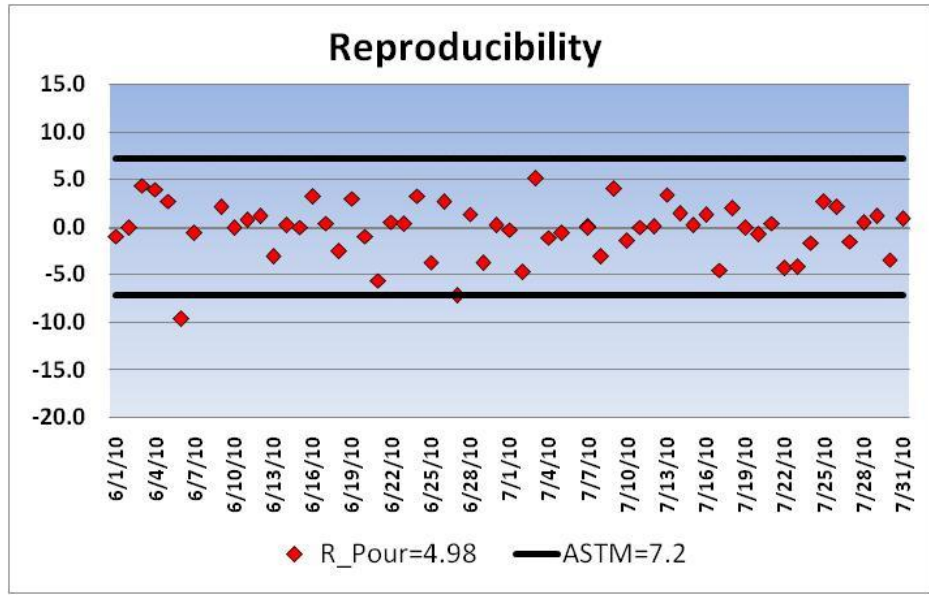
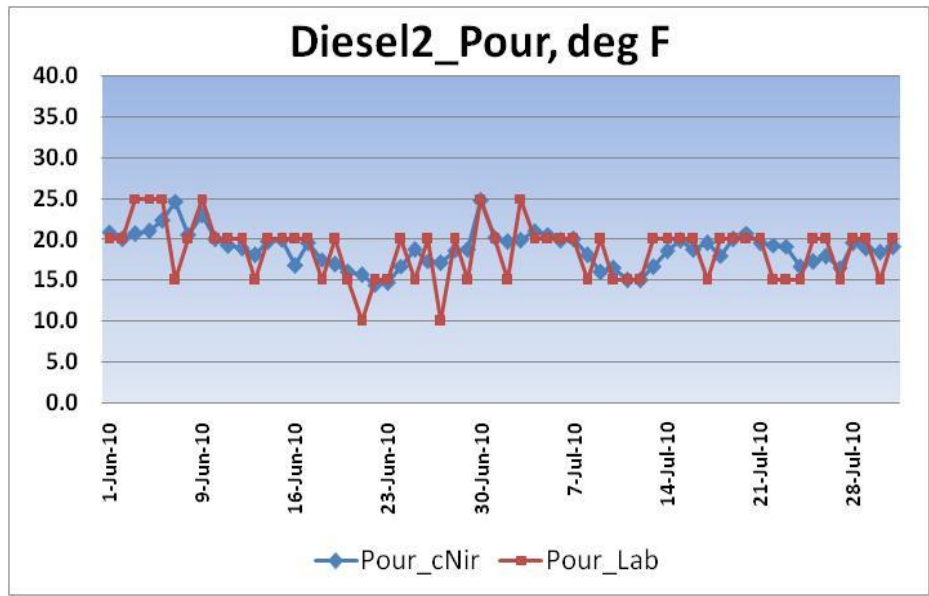
Diesel2_T90, deg F

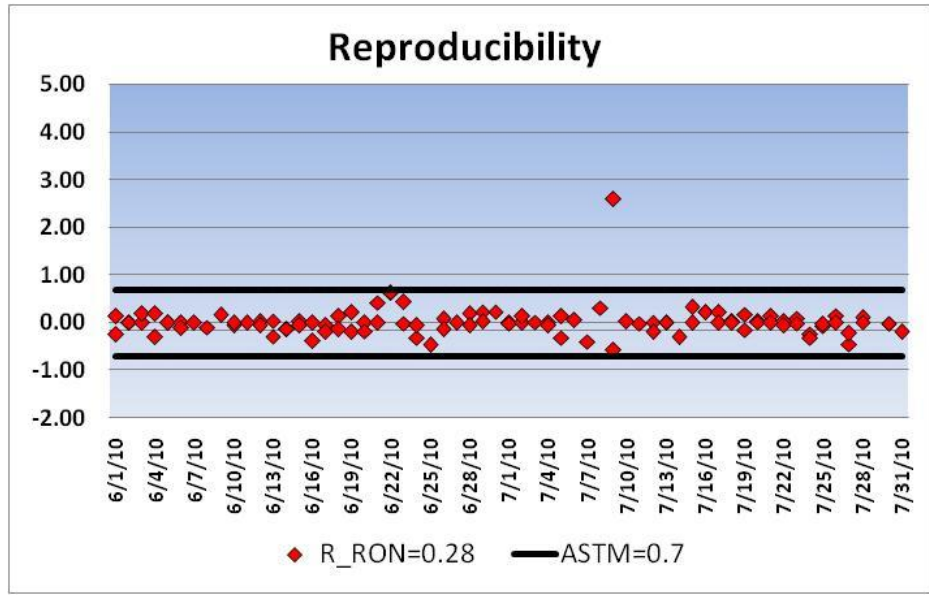
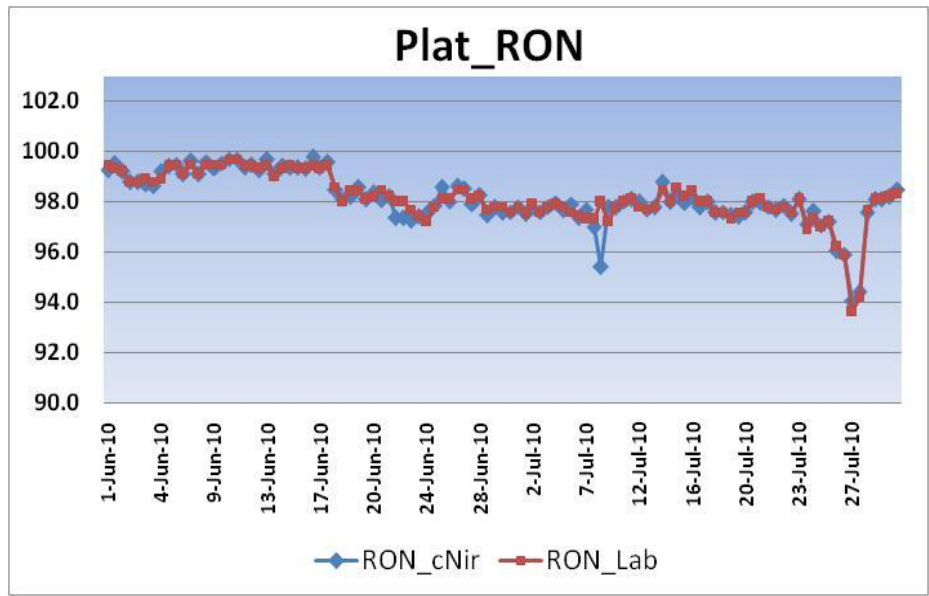


Reproducibility

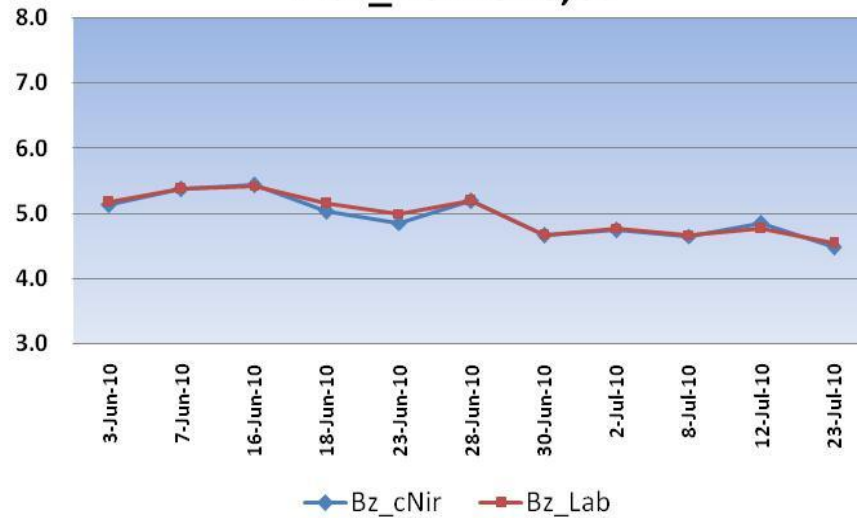




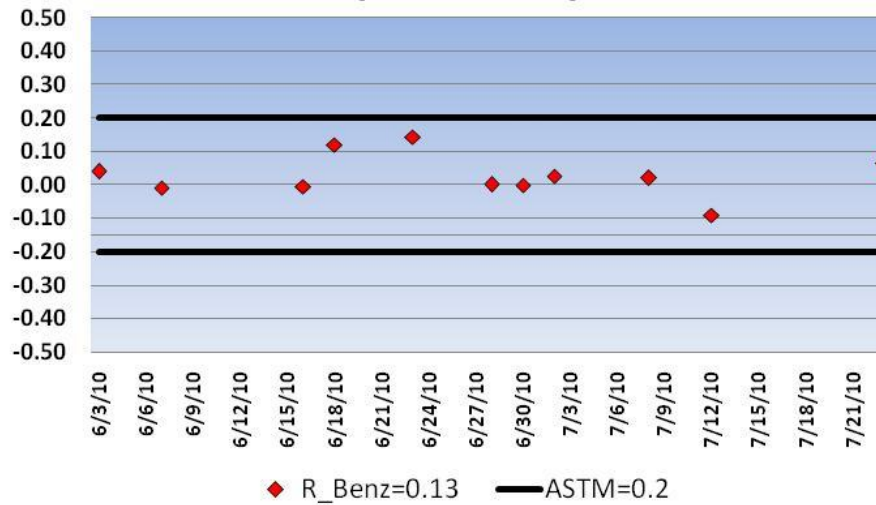


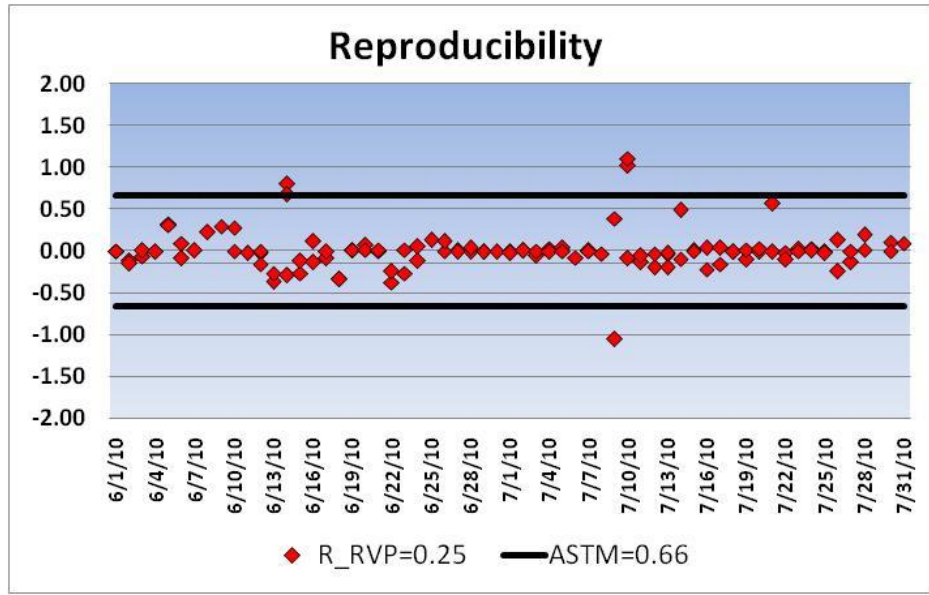
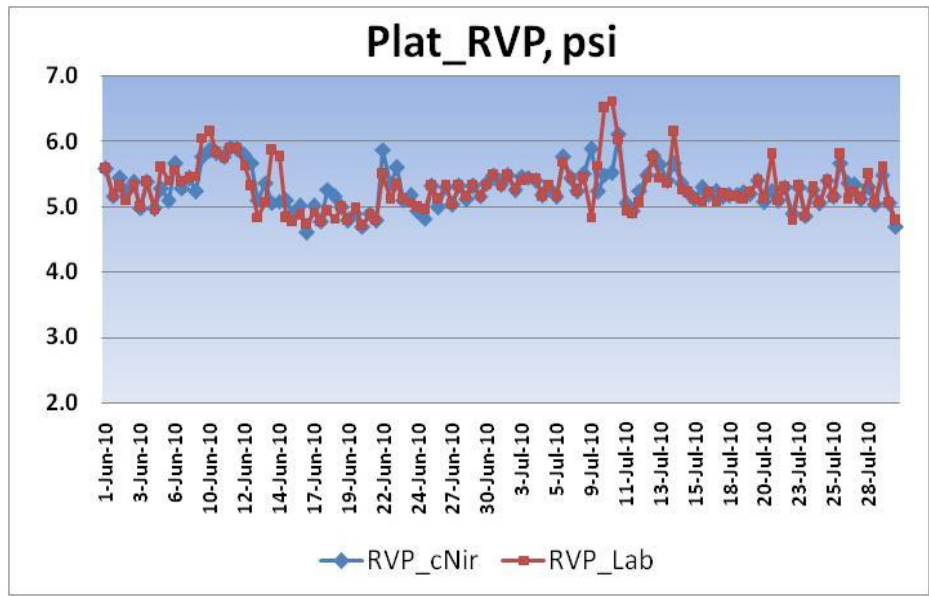


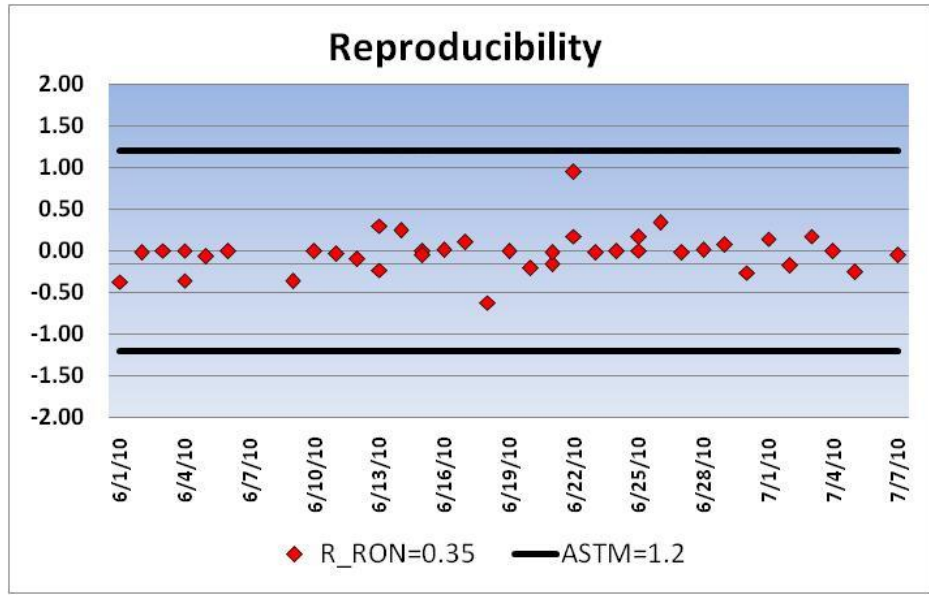
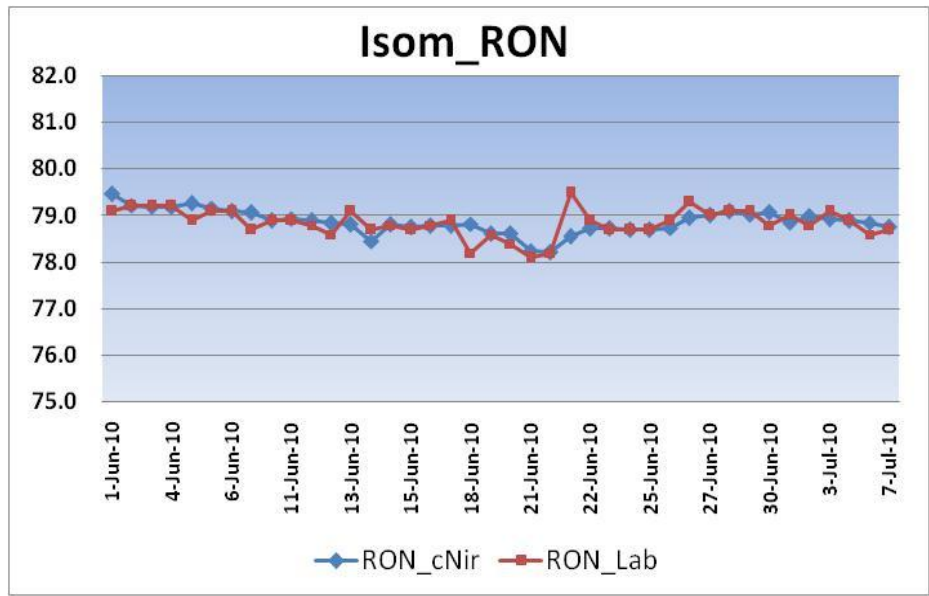
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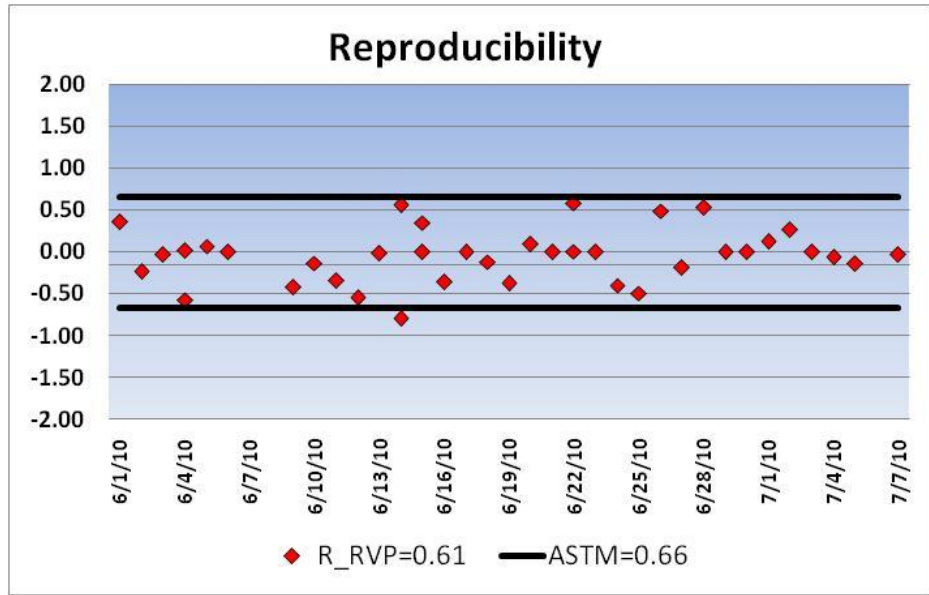
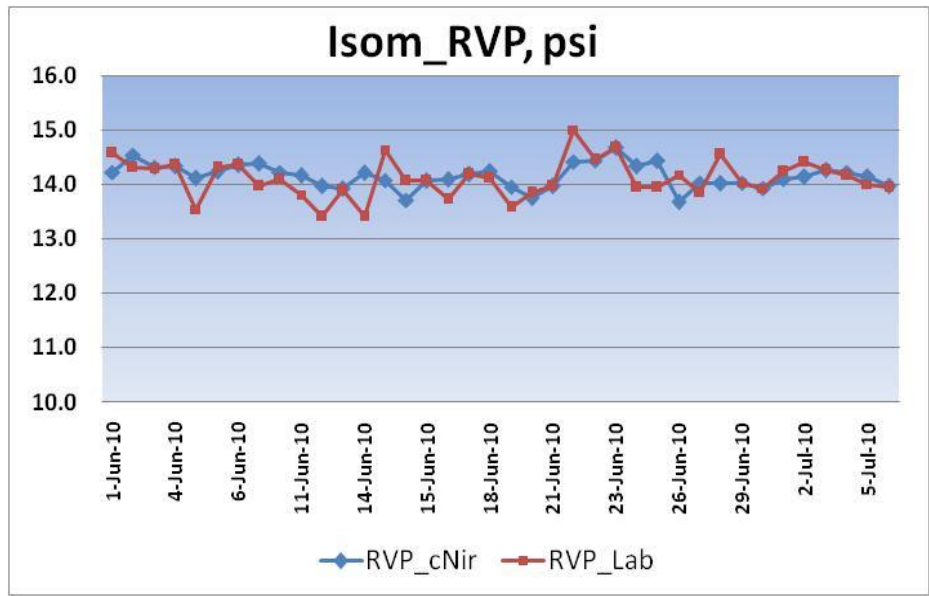


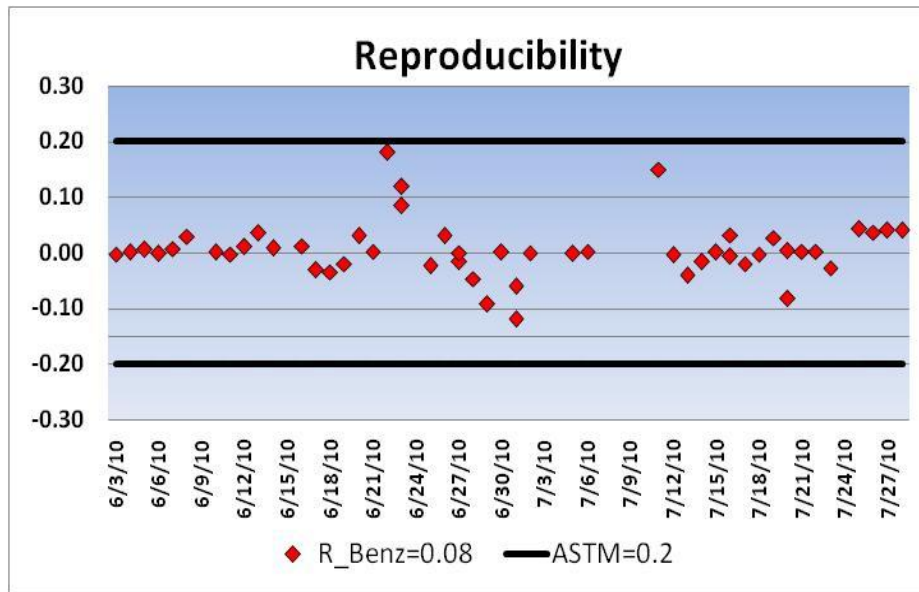
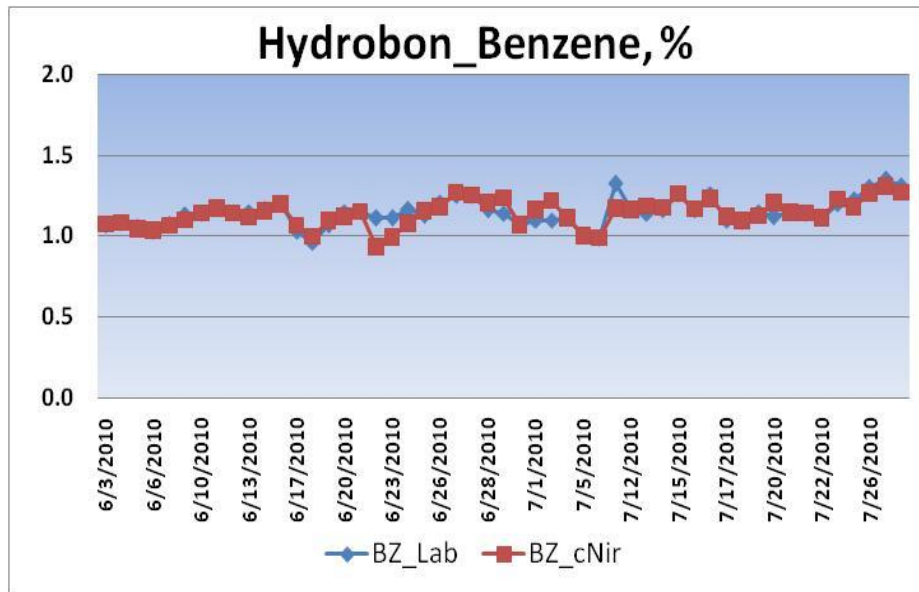
Reproducibility



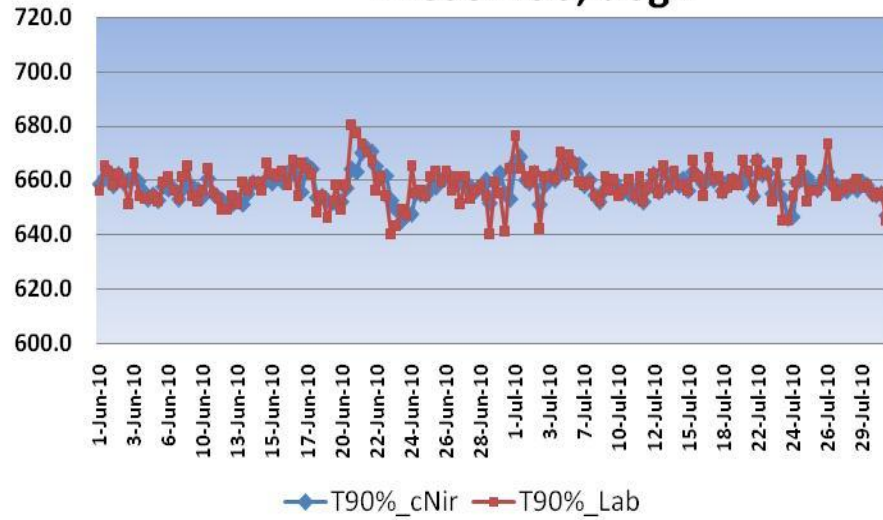




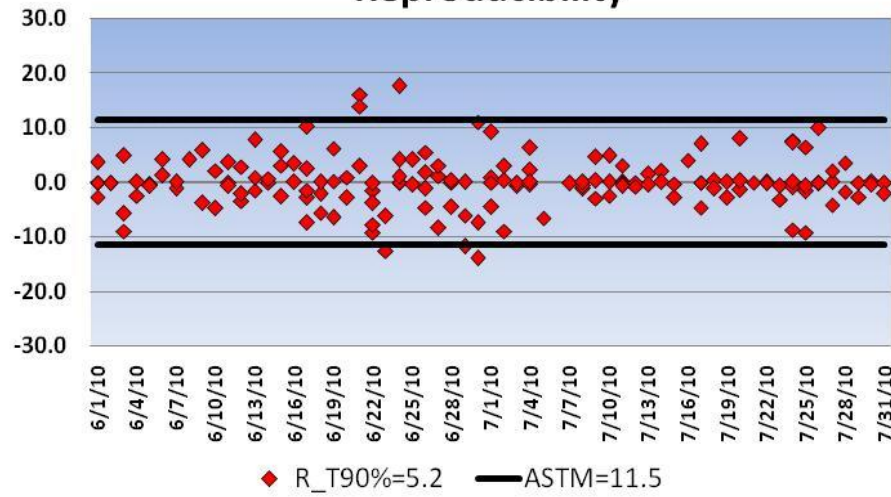


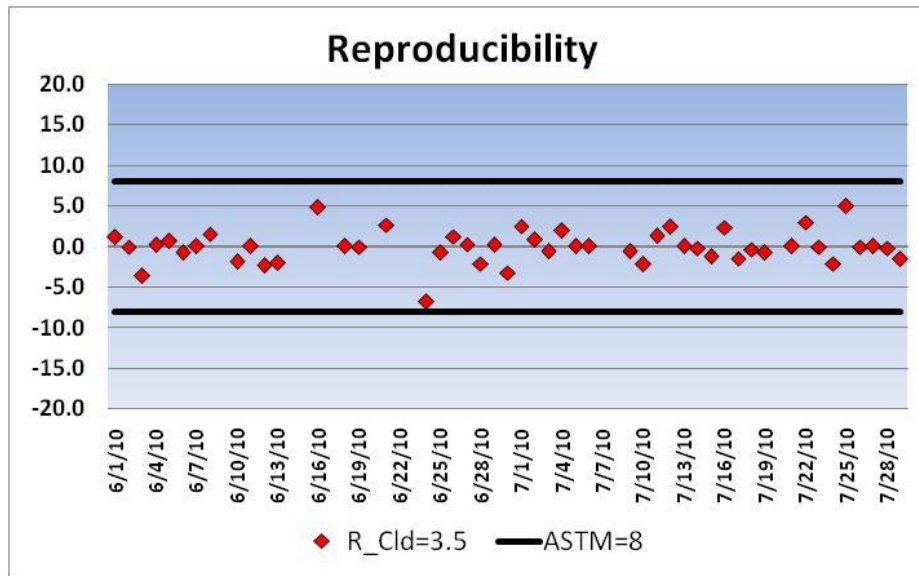
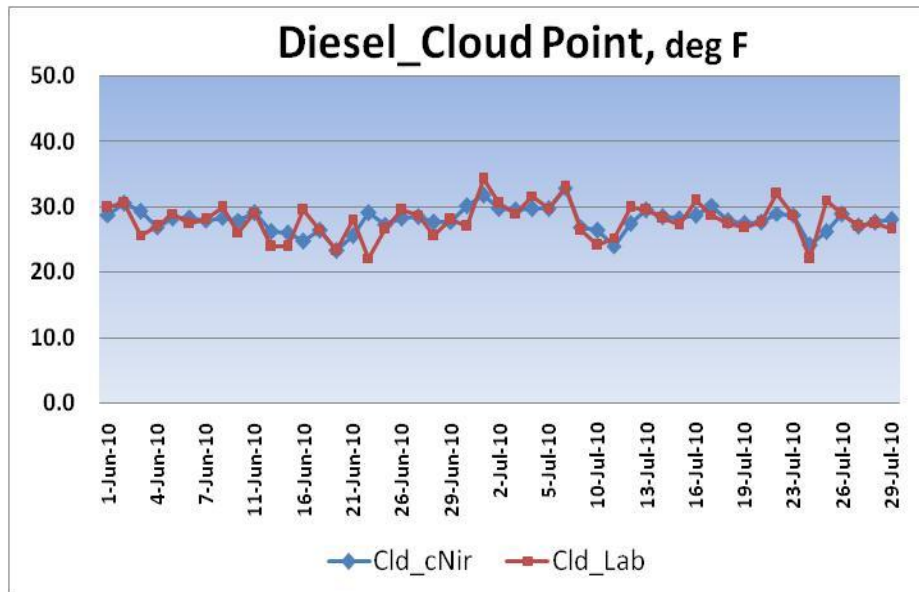


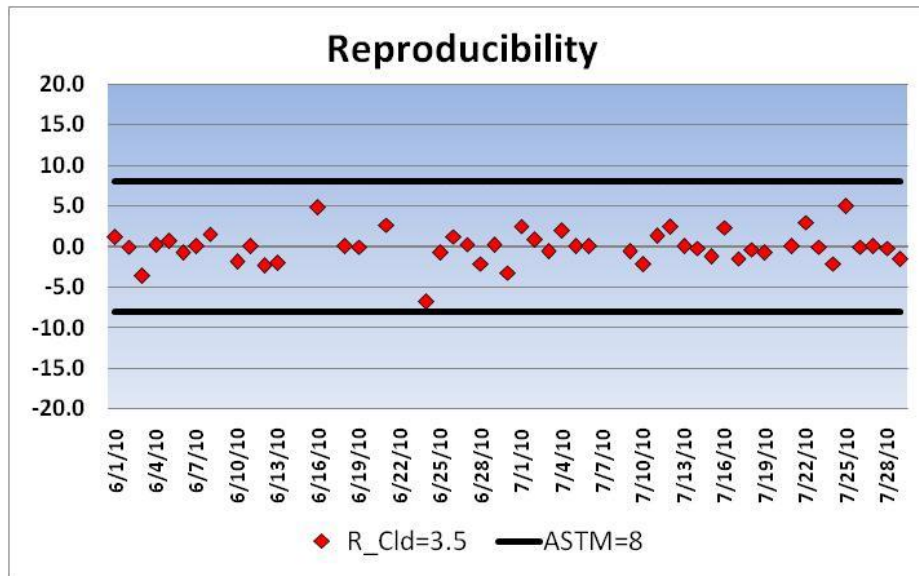
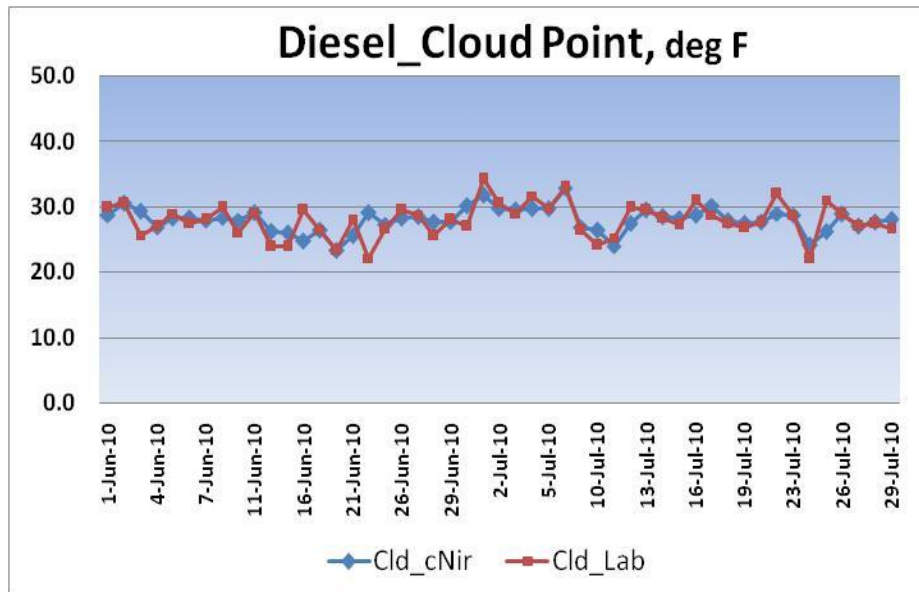
Diesel T90, deg F



Reproducibility









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