



## Model Gateway - AI Modeling infrastructure

### Spectra Modeling

#### The problem:

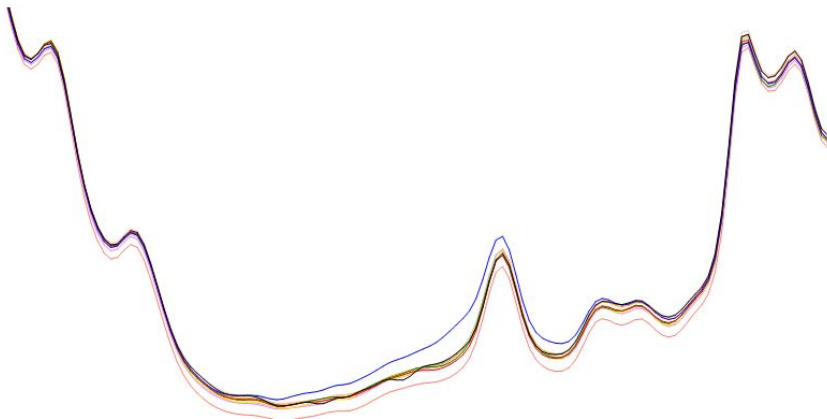
There is no straight forward way to define the relationship between the spectrum and the corresponding direct value (e.g. octane).

#### The solution:

Linear modeling is used based on known spectra and lab data in order to build a model that can predict unknown spectra.

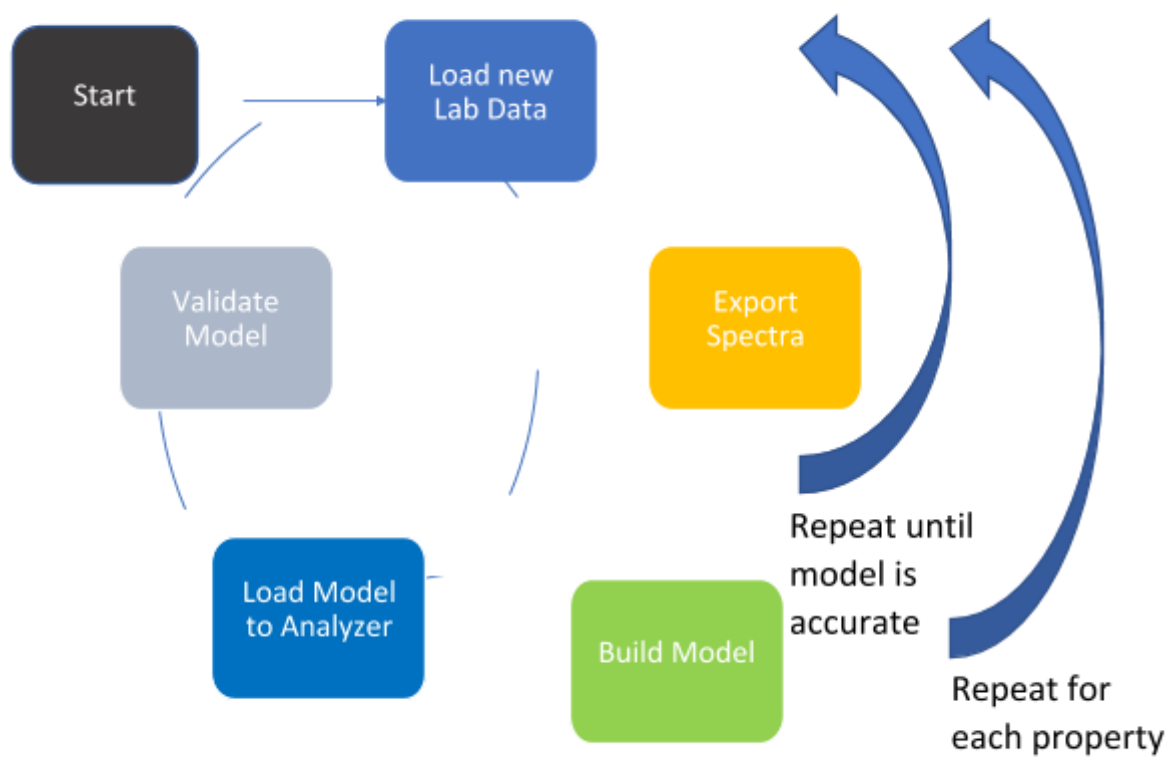
#### **Spectra of Polymer from FT-NIR analyzer**

Softening point property ranges from 200 – 250 degrees Fahrenheit

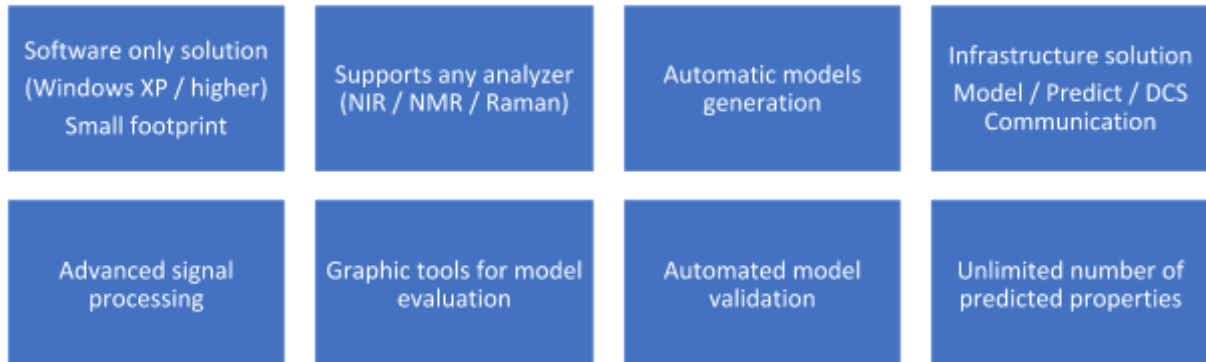


## Modeling process today

1. Expensive manual process.
2. Based on highly qualified personnel.
3. Slow response to changes.
4. Poor model maintenance forced by the complexity.
5. Compromise on low number of properties.
6. Manual model validation.
7. Operators need to work for the analyzers.



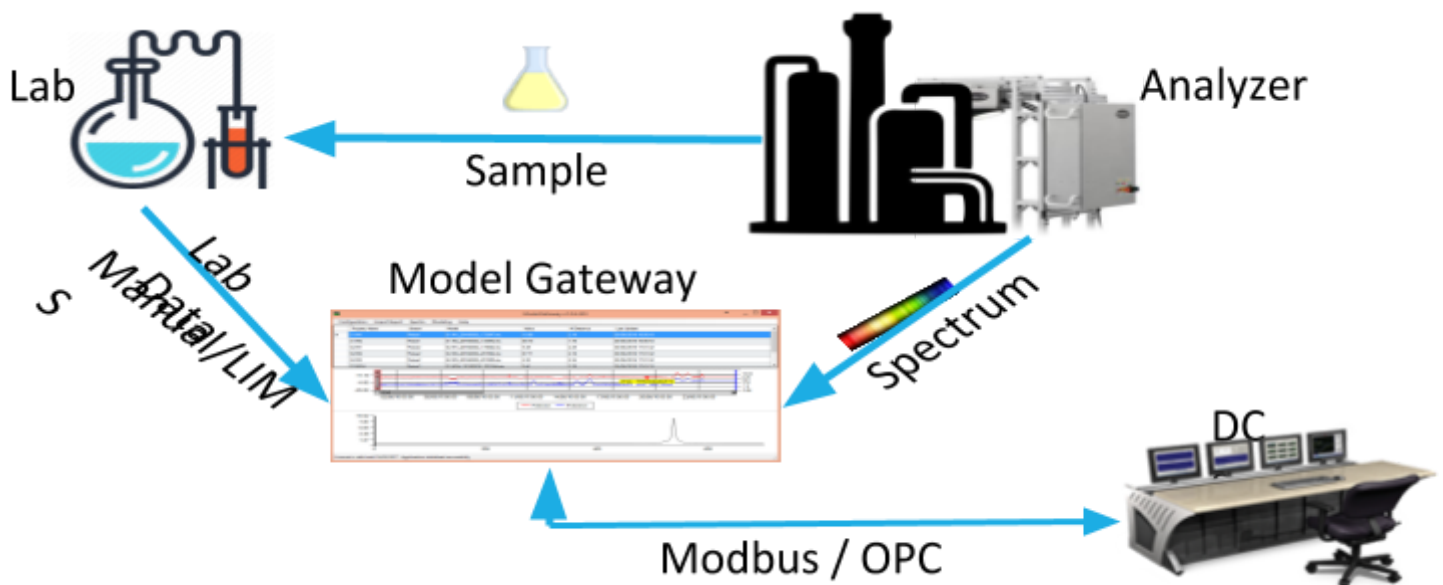
## ModelGateway - the iModel Solution



## Product Architecture

ModelGateway has 3 Interfaces: Analyzer, Lab and DCS

1. Spectra automatically loaded from analyzer. Lab data loaded by the operator
2. Models automatically built by Artificial Intelligence Algorithms
3. Each new spectrum is processed, predicted and reported to DCS

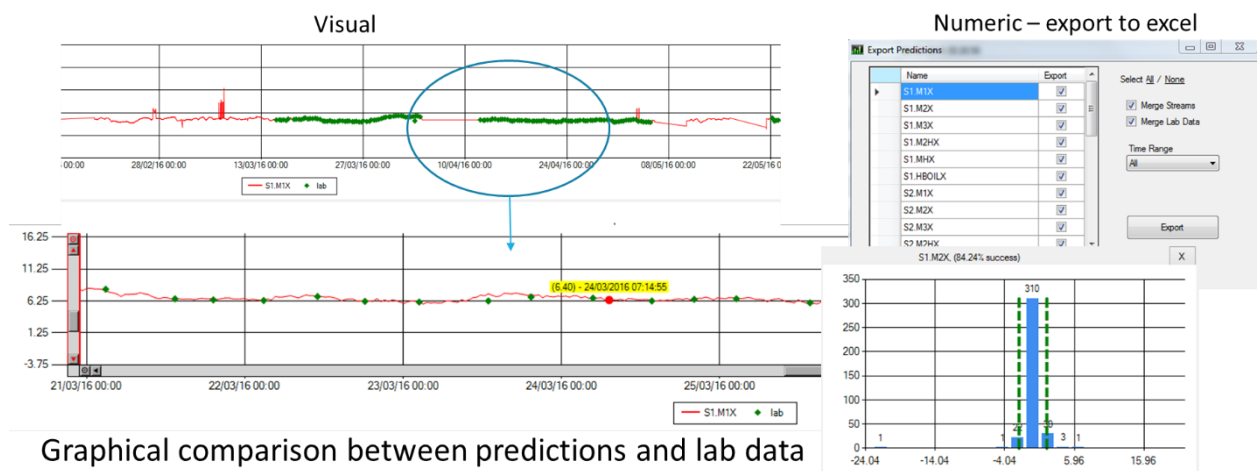


## Advantages

- No user intervention required, Full modeling automation
- Fast Response to changes (analyzer / sample / temperature)
- Integrated validation based on lab data feedback
- No compromise on the number of predicted properties
- Infrastructure solution – Modeling / Prediction / Communication / Reports
- Free evaluation – until reaching good results and full automation

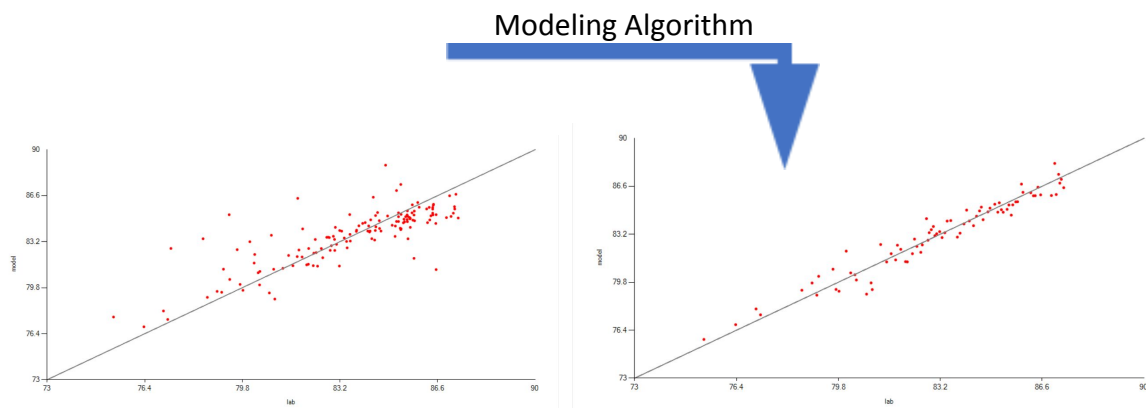
Just feed the system with lab data, the rest is automatic!

## Reporting and analysis tools

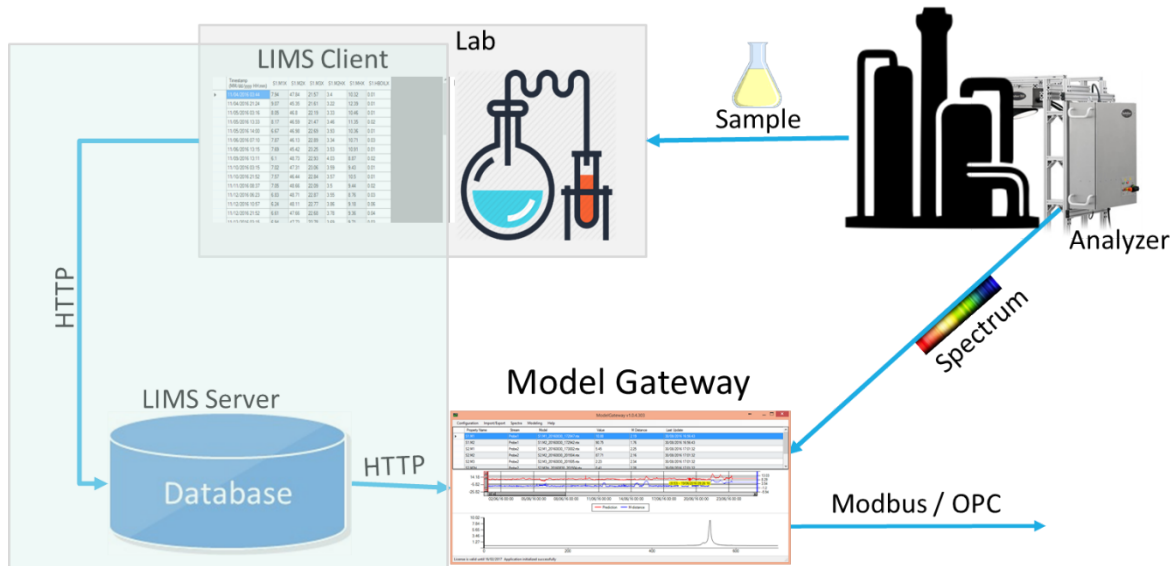


Graphical comparison between predictions and lab data

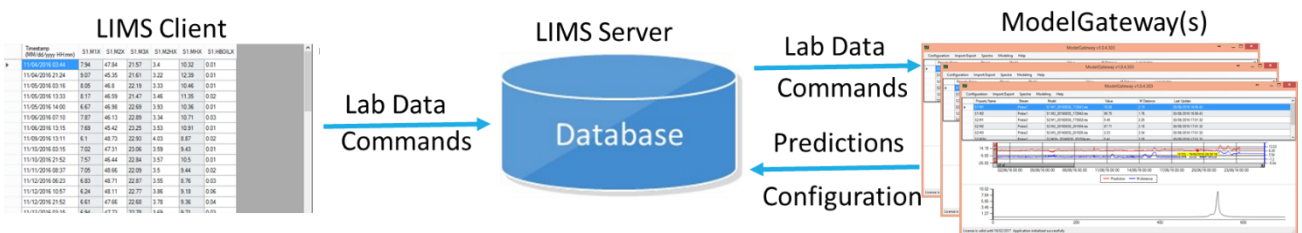
## Model Search Algorithm (visual)



# ModelGateway LIMS Architecture



- Centralized Dashboard for multiple analyzers
- Lab Data, Predictions and configuration are stored in a centralized LIMS database
- Prediction and configuration changes are uploaded from ModelGateway(s)
- Lab Data and commands propagate to ModelGateway(s) for modeling
- Full automation from the LIMS Client dashboard



## Manual / Automatic model comparison

Modeling Properties	Manual	ModelGateway
Model Quality: Accuracy/Robustness	Depends on the skills and experience of the developer. Model stops being robust when the process is changing	Large amount of training-set combinations are evaluated to produce an accurate model
Response to changes	A long manual process is required for each model maintenance iteration (takes days)	Load fresh lab data and click "Remodel" (takes hours)
Infrastructure	Advanced database / IT infrastructure is required to manage data from Lab, DCS and Analyzers	Simple analyzer infrastructure manages data, models and communication
Validation	Offline model development process requires user to manually validate the quality of the model and analyzer	Lab data feedback enables automatic validation. System can notify user on anomalies
Cost	Labor / outsourcing costs are added on every iteration of model maintenance. Skilled personnel is required	Software – perpetual license, infinite number of modeling iterations. No skills required