CONDITIONING DATA FOR DIGITAL TRANSFORMATION

SUMMIT 2018

MILAN

Conditioning Data for Automated Business Processes Using Sigmafine

Marco Lanteri, Industry Principal, Refining & Petrochemicals

Pimsoft

Milan – 10th October 2018

PIMSOFT INNOVATIVE SOLUTIONS

Topics

Business Context

Use Cases

Data Validation Strategies and Automation

The Need for Business Process Automation

Automatically Manage Large Volumes of Information

Making Relevant and Timely Information Available

Maximization of Business Data Utilization

SUMMIT 2018

Business Process Automation Pillars

Large Volume of Data

- Standard asset representation
- Adequate data granularity
- Appropriate data analysis tools (BI, analytics,…)

Integration

- Aggregation rules
- Data requirements
- Data constraints
- Data availability

Data analysis

- Increase depth of analysis
- Automatic validation
- Use your past to improve your future

Empower Users

- Make Data Accessible
- Provide the Right Tools
- Training and Education
- More Satisfying User Experience

SUMMIT 2018

Benefits of Business Data Utilization

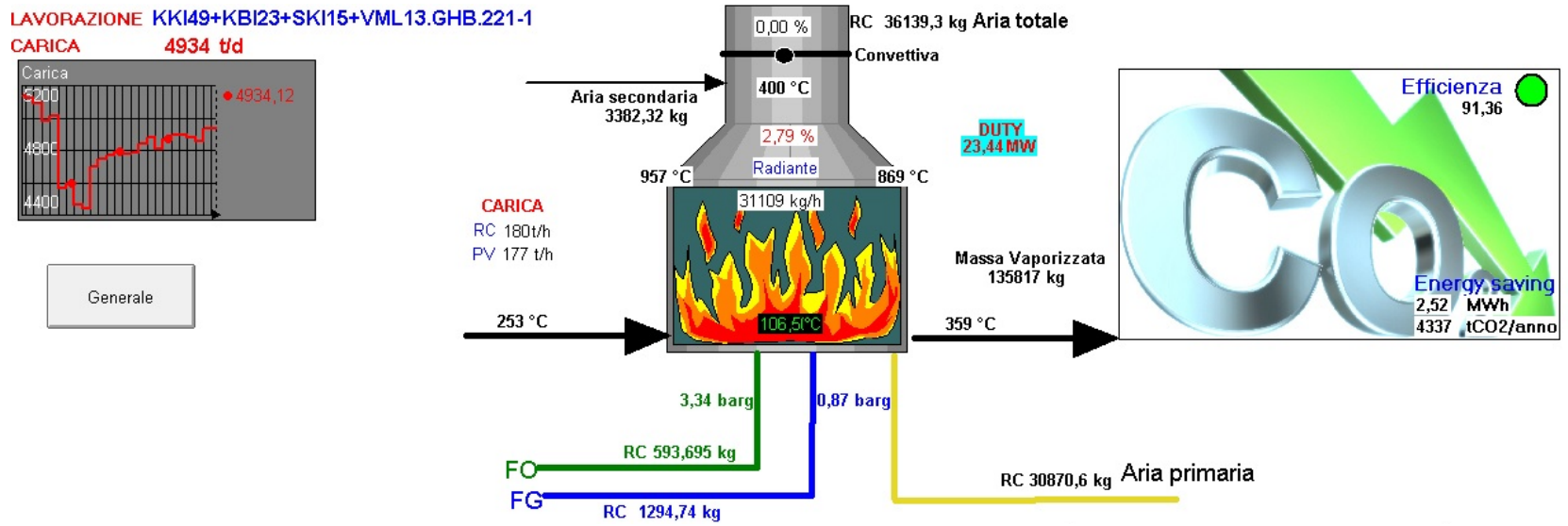
- Yield Optimization
- Support Energy Management
- Improved Supply Chain
- Better Insight of Business and Process KPIs

SUMMIT 2018

Use Cases

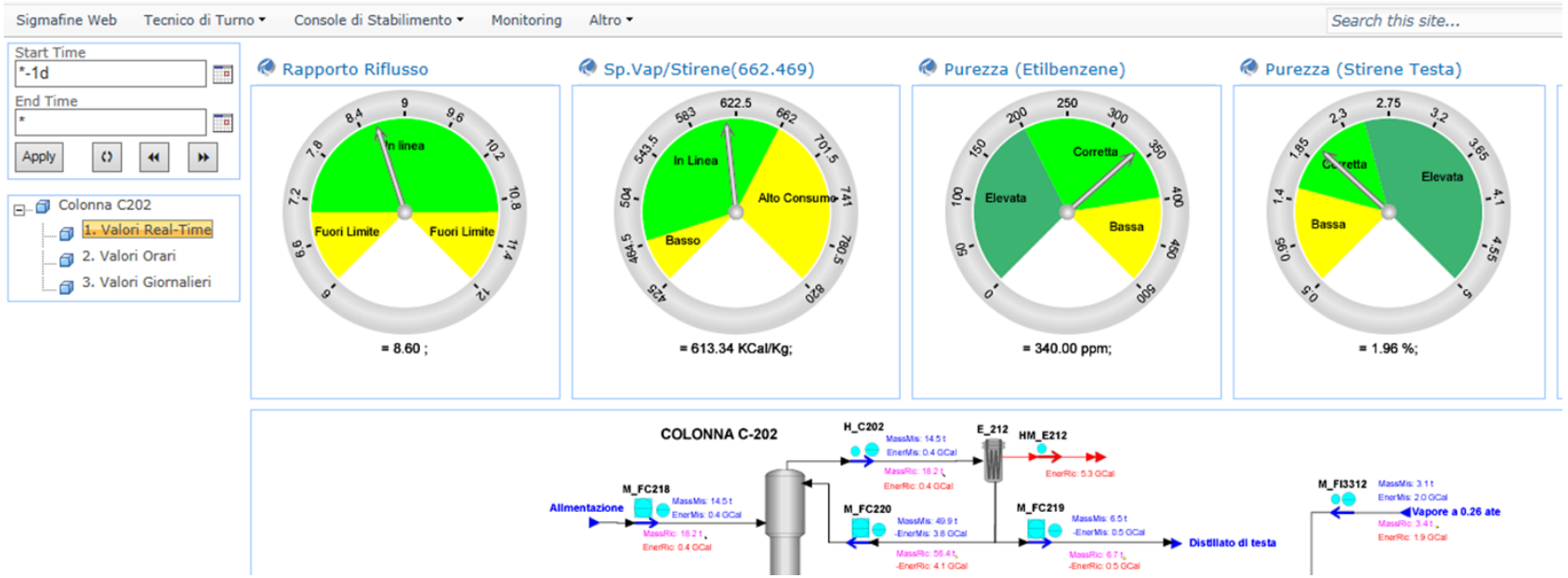
Crude Oil Furnace Monitoring to Support Operations in Near Real-Time

Sigmafine provides hourly reconciled duty, efficiency and oil vaporization to improve topping operations and support energy manager tasks



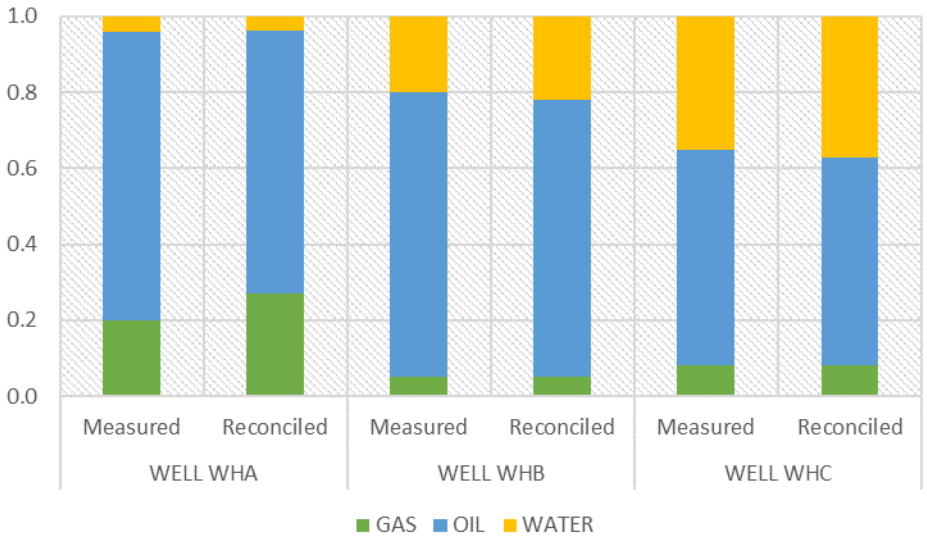
Ethylbenzene-Styrene Purification Column: Monitoring Heat Consumption vs Purity

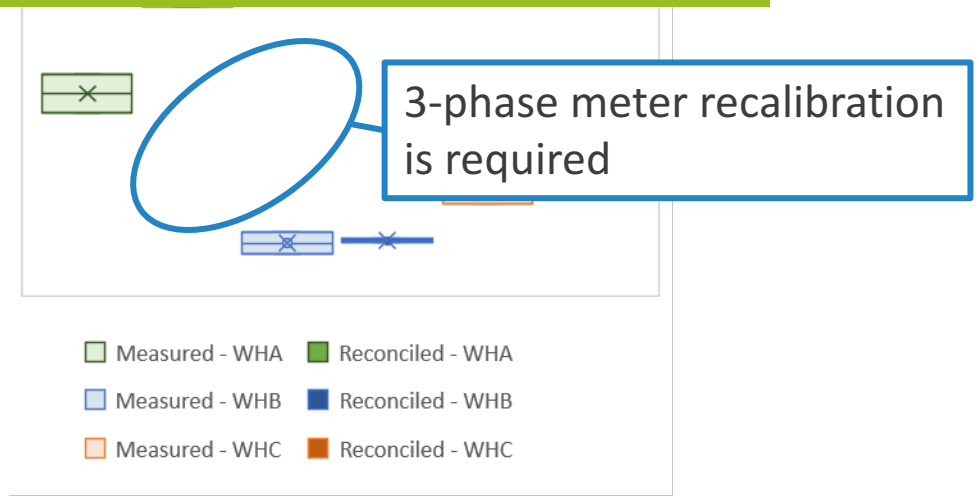
Sigmafine validates heat consumption every 10 minutes and data are provided in control room through a web dashboard



Meter Validation, Wells Production Monitoring and Allocation in Upstream

Sigmafine tracks automatically production of each well and provides accurate estimation for Gas-Oil Ratio





SUMMIT 2018

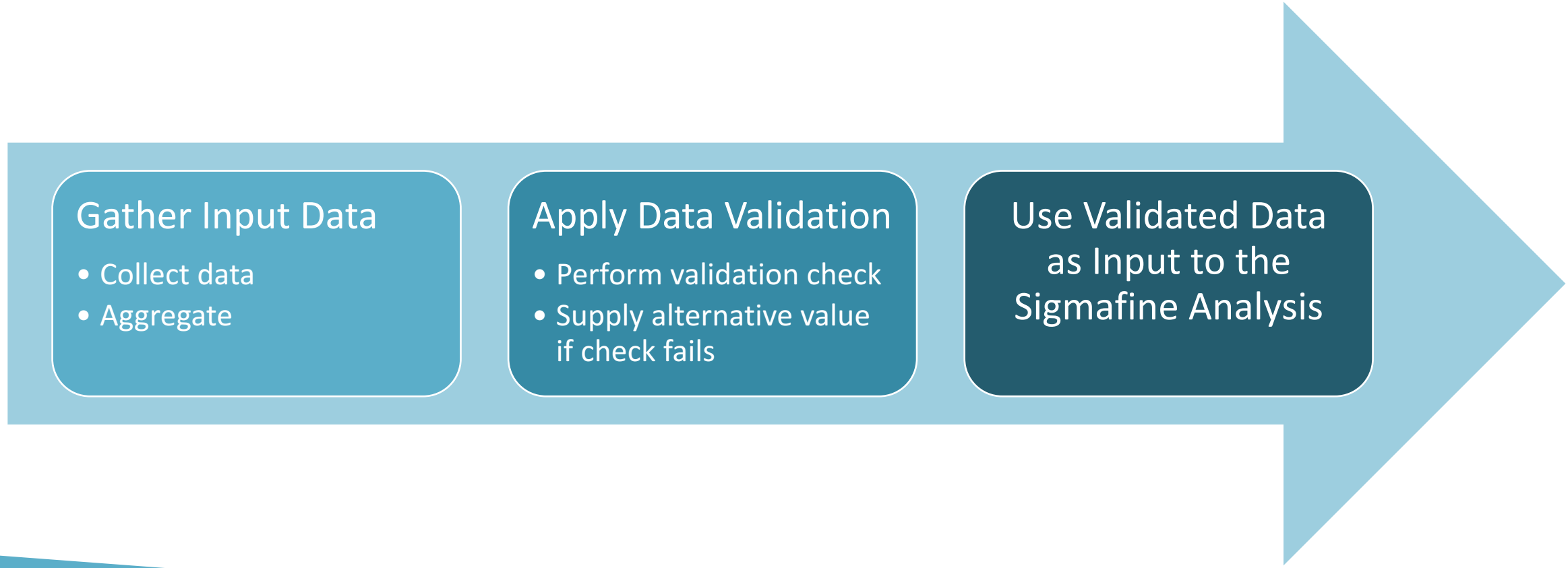
Managing Data Uncertainties

Data Validation Strategies

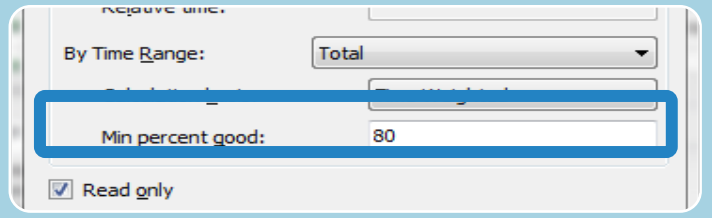
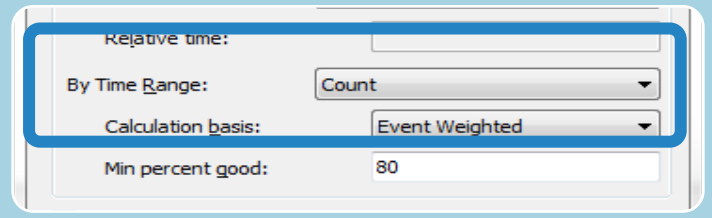
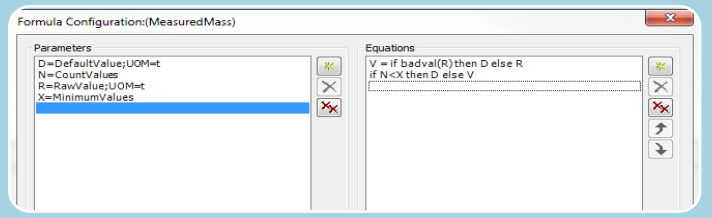
Data Validation to Support Unattended Data Reconciliation

Bad / Missing Data	Out of Range	Spikes	Data Freeze / Unsteady Process	Non-Solvability
Data Aggregation	Data Clip	Data Aggregation	Statistical Detection	Increase Redundancy
Data Replacement		Data Filtering	Data Replacement	Estimate Unmeasured Flows

Validation Process for Sigmafine Analysis



Avoiding Bad Data or Missing Data

Raw Value	Counter	Validated Value
		
Threshold of sensitivity to bad data	Number of historicized data in the case	Use *badval()* function and *if* statements

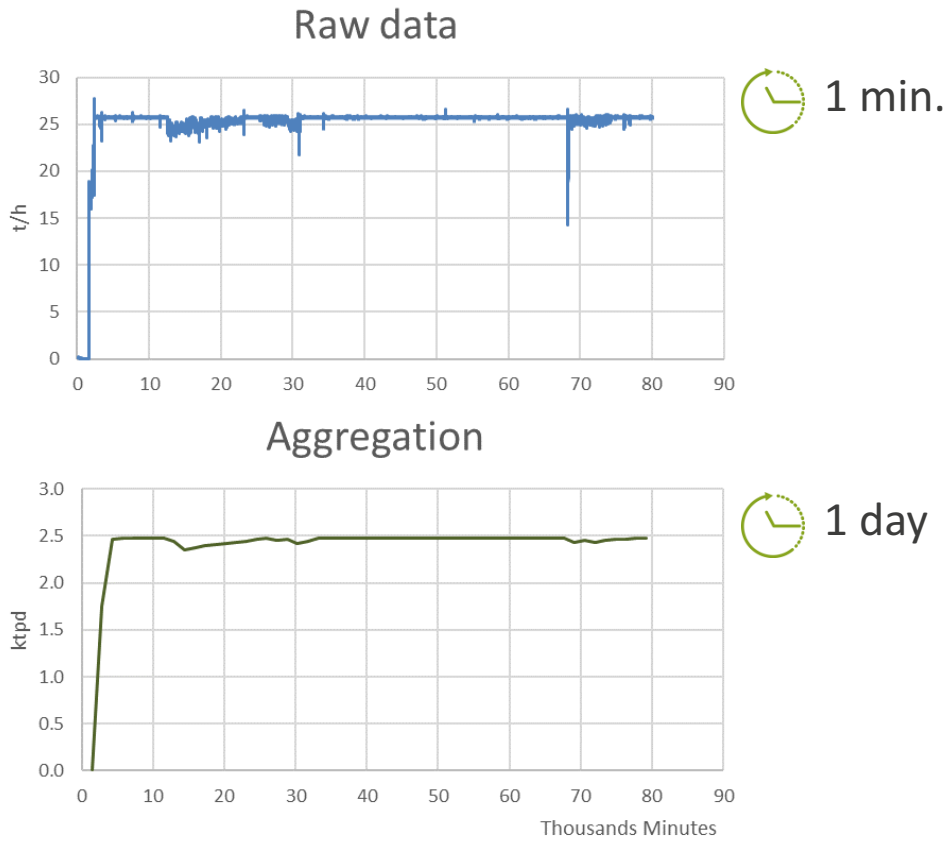
Conditioning Out of Range Data to Avoid Large Deviations

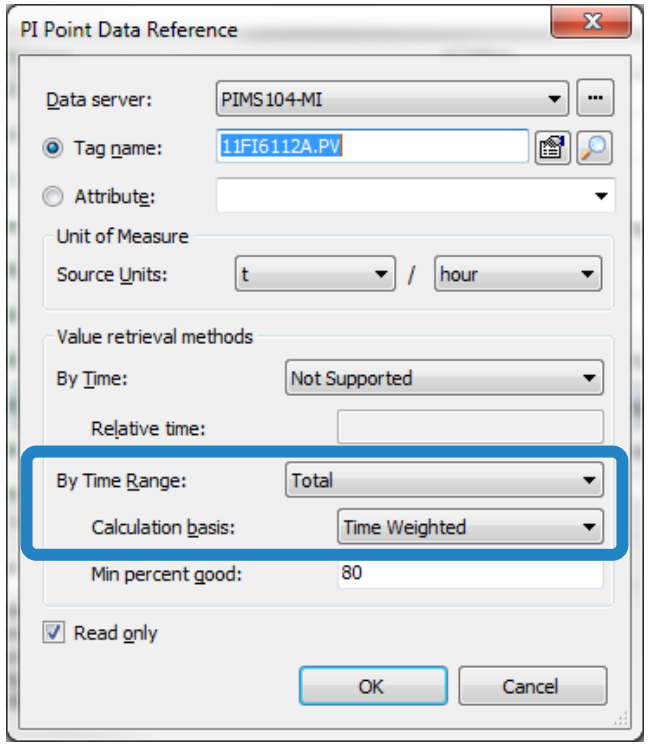
Avoid very large deviations from typical range
(e.g. valve opening with negative value when fully closed)

Define attributes for minimum and maximum value
For streams consider the minimum/maximum flowrate

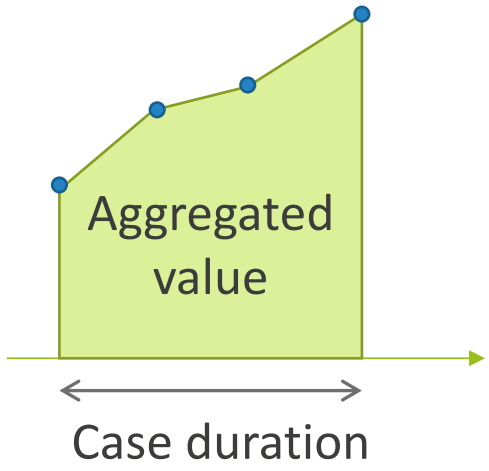
Filter input value through Formula Data Reference:
e.g. min(max(*raw_value, min_value*), *max_value*)

Time weighted data aggregation natively reduces spikes





- Historicized data

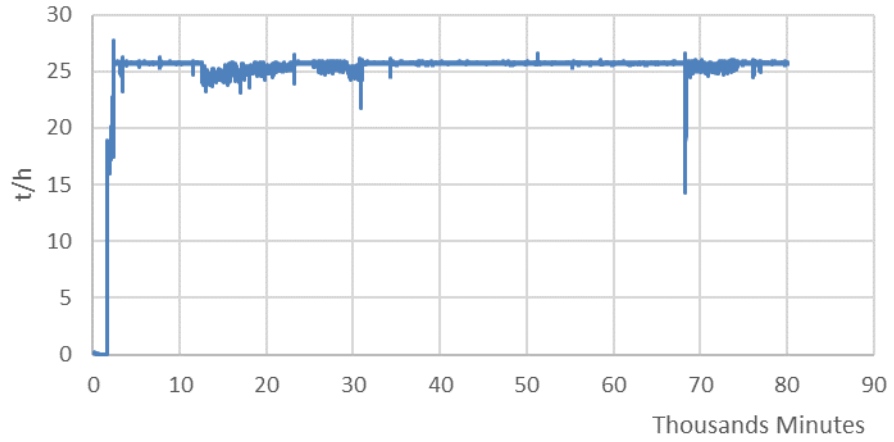


Data Filtering to Reduce Spikes

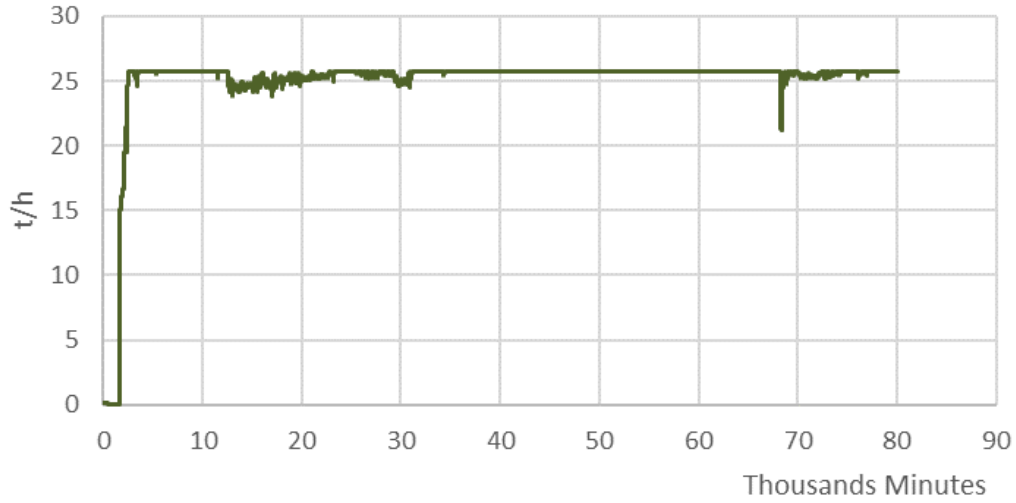
- A low pass filter can be applied at historian level to reduce spikes:

$$y_t = y_{t-1} + \alpha(x_t - y_{t-1}) \qquad 0 < \alpha \leq 1$$

Raw data

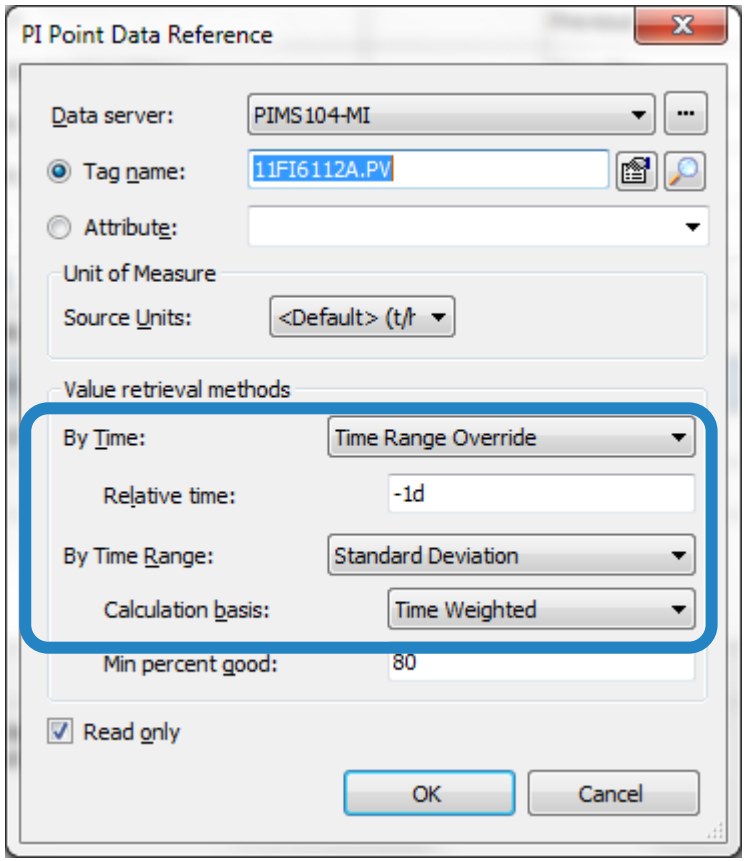


Low-Pass Filter



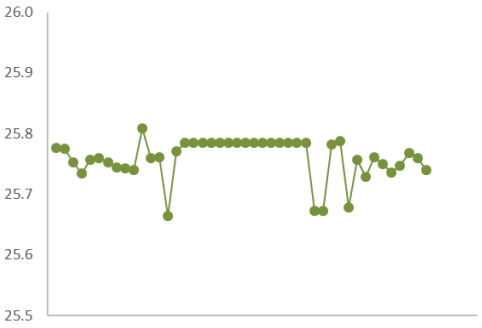
x: raw value; y: filtered value; t: time step; α: coefficient

Statistical Detection for Data Freeze or Unsteady State Conditions



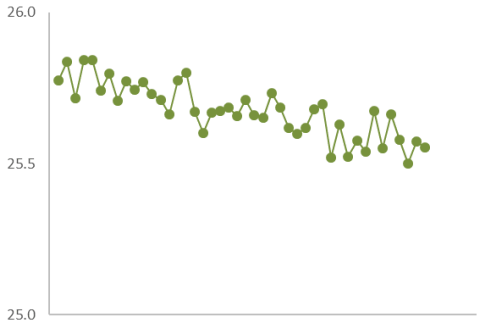
Data Freeze

$|\sigma| < \varepsilon$ → Use previous available data and set flag



Data Drift

$|\mu_{1h} - \mu_{1d}| > 3|\sigma|$ → Set flag for drift



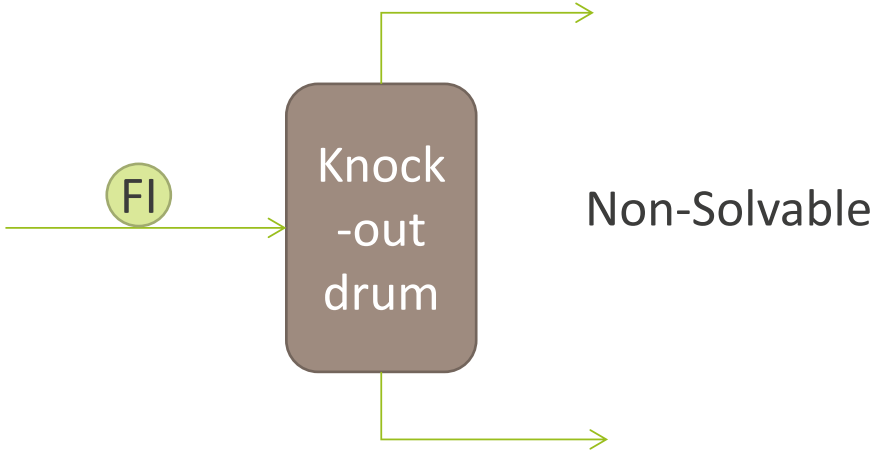
μ: mean value; σ: standard deviation; ε: small, positive number

Improve Robustness with Virtual Meters

- Use rule-of-thumb based values
- Use correlations:
  - Valve opening vs pressure difference, including valve characteristic and fluid properties
  - For heat exchangers use both sides (hot and cold) when feasible.
- Estimate heat losses using thermal properties

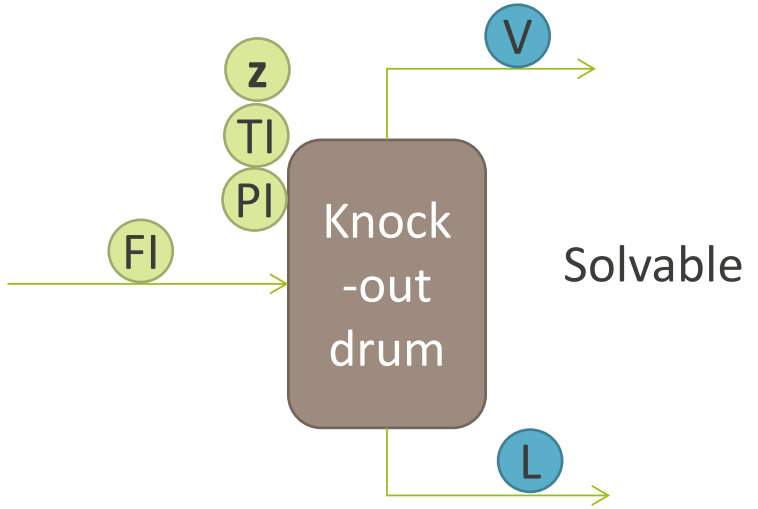
Increase Redundancy with Thermodynamic Relationships

Typical Mass Balance



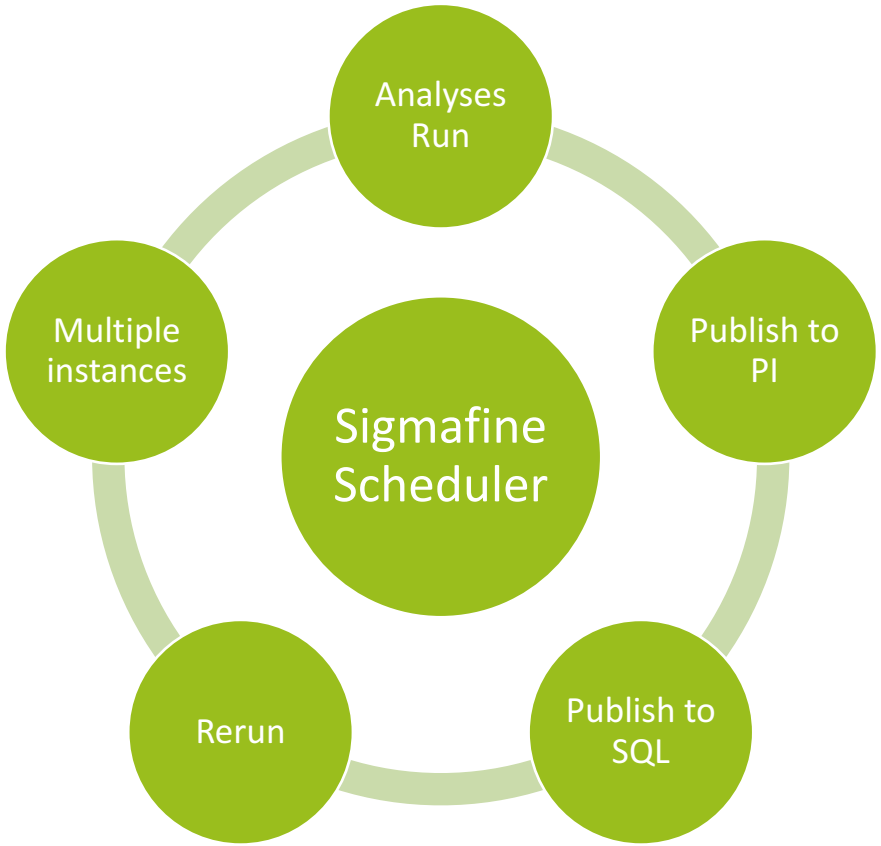
Not enough measurements around the unit: the network is not solvable

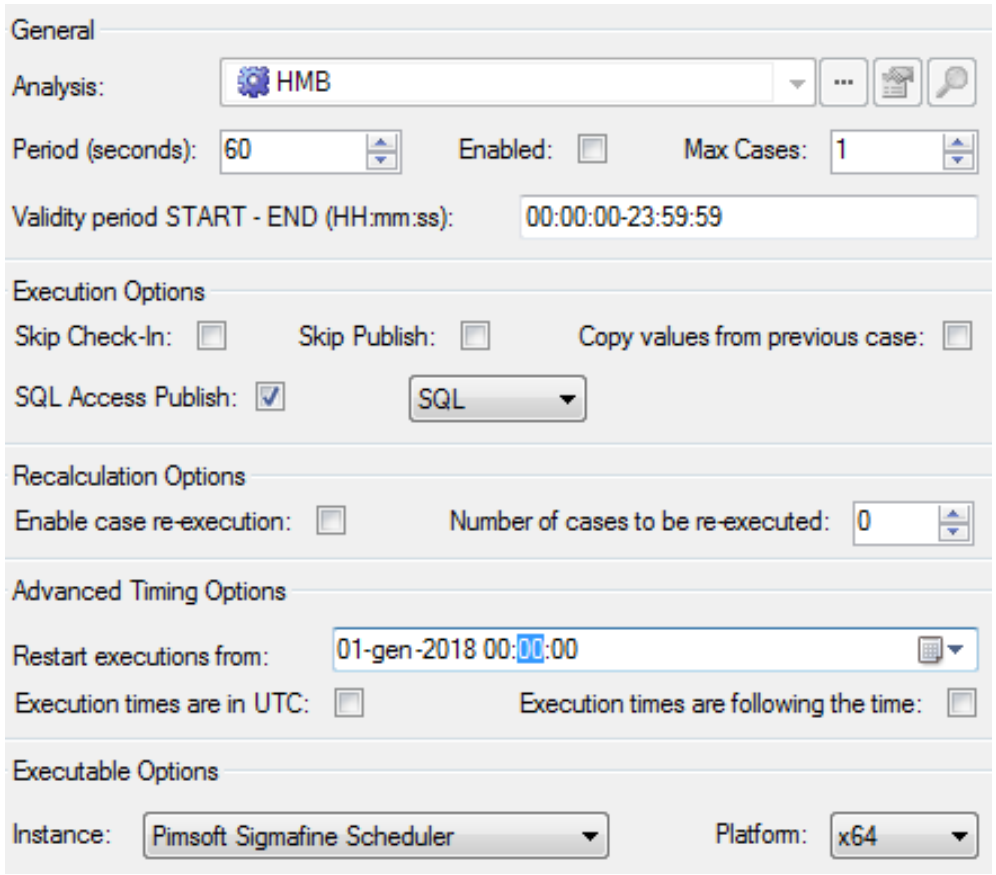
Balance Enhanced by the Thermodynamic Extension



Additional measurements (temperature, pressure and composition) and VLE relationships allow estimating unmeasured streams

Sigmafine Scheduler Provides the Automated Workflow Execution





Focus on Sigmafine Results

Automated execution, unattended

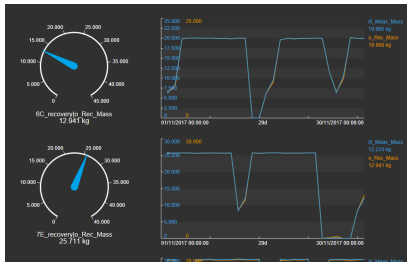
User interface

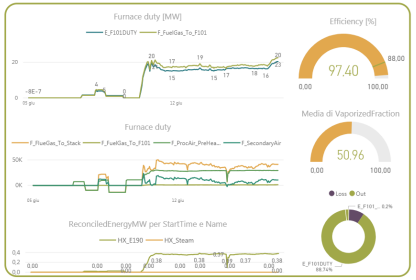
Process Historian

Other data sources

Interfaces

Scheduled models & analyses





Web dashboards, BI tools

Conclusions

Sigmafine increases the value of information, transforming the data for business and operational contexts:

- Meter validation and conditioning
- Bill of material verification
- Asset Monitoring
- Support of Energy Management

Presenter

Marco Lanteri

Industry Principal, Refining & Petrochemicals

Pimsoft S.p.A.

Marco.lanteri@pimsoftinc.com

thank you!

SUMMIT 2018

PIMSOFT INNOVATIVE SOLUTIONS