Conditioning Data for Digital Transformation

Presented by:

PIMSOFT
INNOVATIVE SOLUTIONS

Agenda

- About Pimsoft & Sigmafine
- Data Quality Challenges
- About Data Conditioning
- Use Cases
- Pimsoft Solution
- Conclusion

About Pimsoft & Sigmafine

Company

Headquartered in Turin (IT) offices in Milan, Houston (TX), Cherry Hill (NJ)

OSIsoft Partner since 1995

- Tier: Select
- Type: OEM, System Integrator, Application Partner, Value-added Reseller

Product

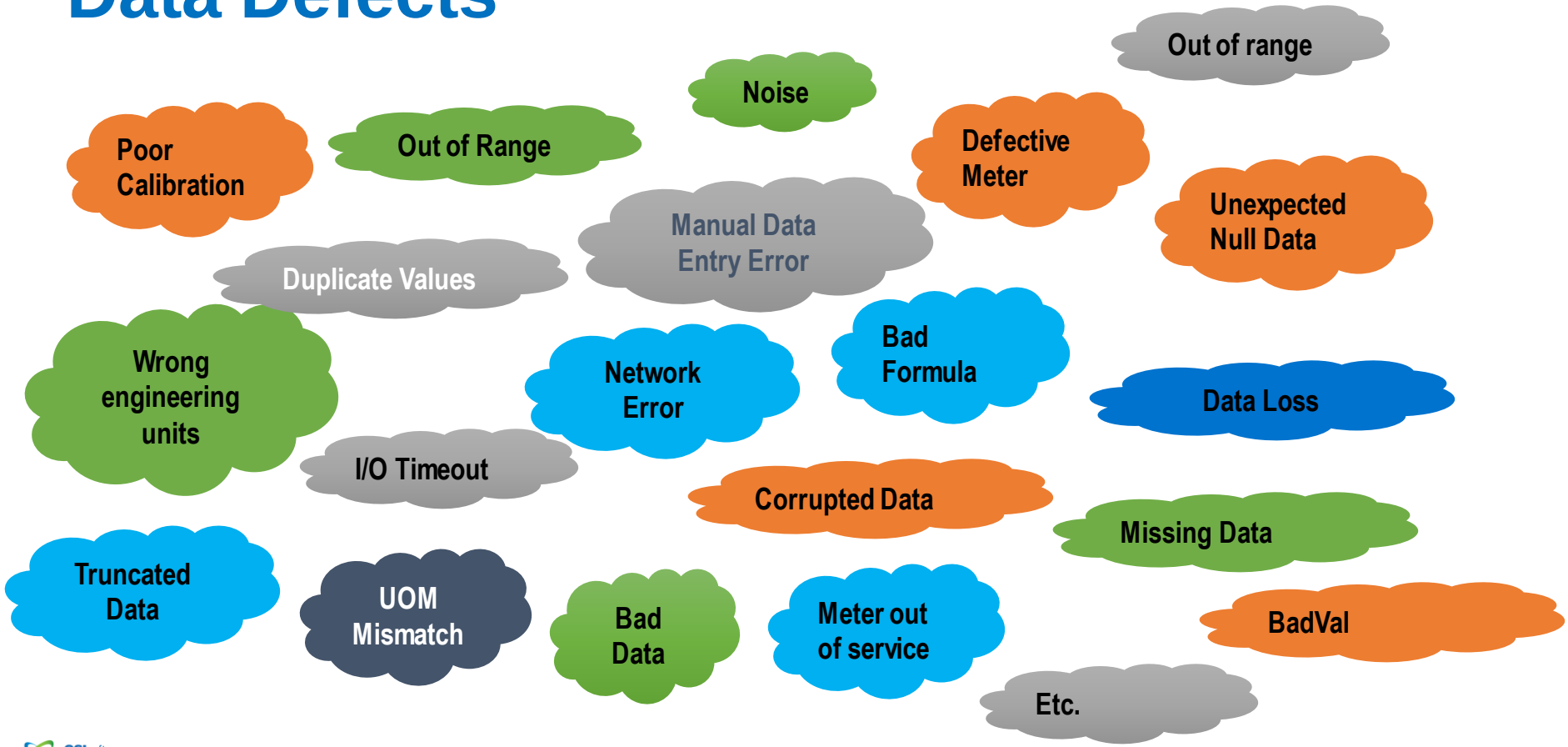
Sigmafine - AF Application & Extension (OEM)

- Integrates natively with the OSIsoft PI System
- Adds connectivity and model building capabilities to AF

Data Quality challenges in the Process Industries

- ✓ Inherent precision limitations of measurement systems
- ✓ Unpredictable occurrence of data defects
- ✓ Detection of data defects with minimal human vigilance
- ✓ Create coherent & usable datasets with the lowest margin of error possible for Digital Transformation initiatives
- ✓ Manual entries vs. human errors
- ✓ Repurposing of data & events for different use cases
- ✓ Sustainability of data curation/validation

Data Defects

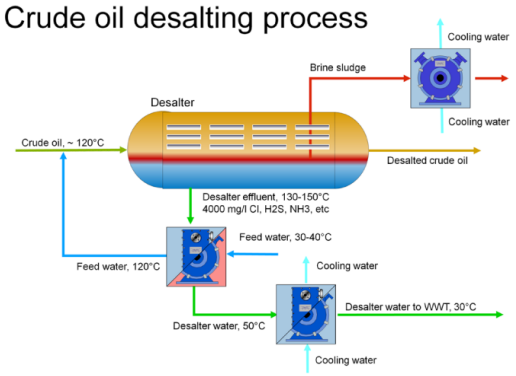


What “Data Conditioning”

Def.: -> Bring into the desired “state of use”

Air

Skin



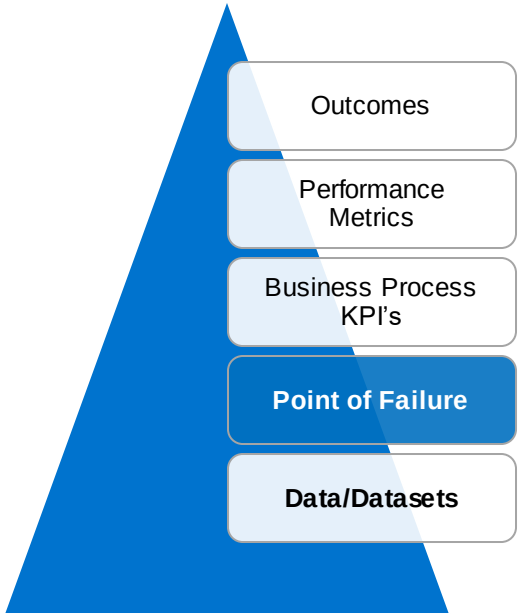
Crude oil

Data Conditioning by Sigmafine® brings “Process Data” into the desired “state of use”

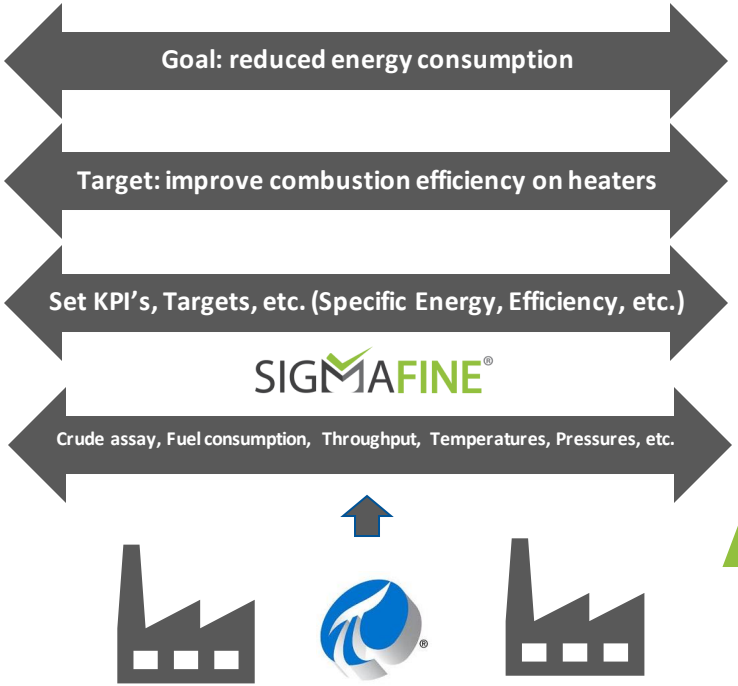
Why “Data Conditioning”

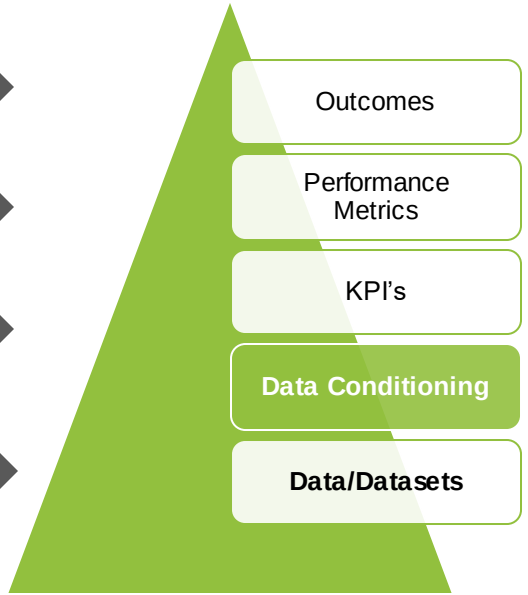
Reduce the Margin of Doubt

Data Quality ➔ Single Point of Failure



Source: "Gartner Business Value Model. Framework for measuring Performance"





Modified business value model to include data conditioning in the process

Data Lifecycle

Raw

- As measured
- Off the sensors

Cleansed

- Processed at or near acquisition time

Conditioned

- Post processed
- Model based

Data Quality Goal
➔ Zero Defects

Data Quality Goal
➔ Fitness for use

SIGMAFINE®

How Data Conditioning works

Model Based

- Digital Transformation Mandate
  - Plant, Process unit, Business Unit, Unit operations, Equipment, Process, etc
  - Connectivity, Direction, Modes

Apply Engineering Principles

- Automate basic calculations
  - PT Compensations/UOM/M to V conversions/Simple expressions
- Implement complex calculations
  - Eq. of state (e.g. Peng Robinson), Property estimation (e.g. Klosek McKinley)

Apply Constraint

- Σ In- Σ Out + Σ Generation + Σ Consumption- Σ Accumulation = 0
  - Analysis Rules: Mass, Energy, Composition

Solve

- Minimization of the SSR

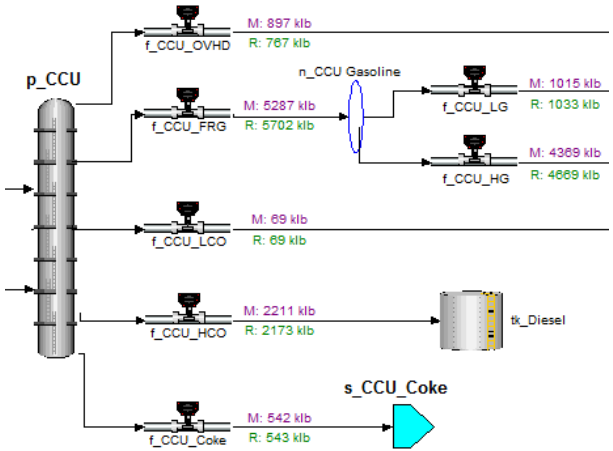
$$\text{Minimize} \sum_{i=1}^{N} \left(\frac{\text{Raw}_i - \text{Reconciled}_i}{\text{Absolute Tolerance}_i} \right)^2$$

How models are built

AF ELEMENTS

- Inputs & Outpouts
- Meters, Sensors, Scales, etc.
- Tanks, Reservoirs, etc.
- Analysers, LIMS
- Unit Operations
- Manifolds
- Design Data

MODEL



How Elements are related

- Connectivity
- Direction
- Mode

SCOPE/ENVELOPE

- Company wide, plantwide
- Unit, Unit Operations
- Utilities system & network
- Equipment
- Etc.

CALCULATONS

- Data References
- Extensions

ANALYSIS/CONSTRAINT

- Mass, Energy
- Mass & Energy
- Composition
- Properties

TIME RULES

- Near Real-Time
- Batch
- Hourly
- Daily
- Monthly

Case Studies

- NIS - Value Chain Optimization
  - Reconciling mass balance from production to retail in O&G
  - https://sigmafine.pimsoftinc.com/digitalizing-the-value-chain-mass-balance-for-an-integrated-energy-company-nis/
- IPLOM - Equipment Performance
  - Performance monitoring on a process heater
  - https://sigmafine.pimsoftinc.com/iplom-supporting-timely-business-decisions-in-an-agile-refinery-with-sigmafine/
- ENI - Product Quality
  - Estimating feedstock quality – Aromatics extraction
  - https://sigmafine.pimsoftinc.com/leveraging-sigmafine-and-the-pi-system-to-ensure-data-consistency-through-the-eni-versalis-mes-infrastructure/

Value Chain Mass Balance

NIS GAZPROM NEFT
БУДУЋНОСТ НА ДЕЛУ

CHALLENGES

- Make sense of data belonging to different company LOB's
- Handle several systems with a lot of different data formats available in different times
- Manual entries causing poor quality and complex monthly reconciliation procedures

SOLUTION

- Create a data lake within the PI System
- Model the full logistic network in Sigmafine
- Automate data collection of all tank internal data, receipt, shipments, sales& purchases
- Automate notification of large discrepancies to operations and stakeholders

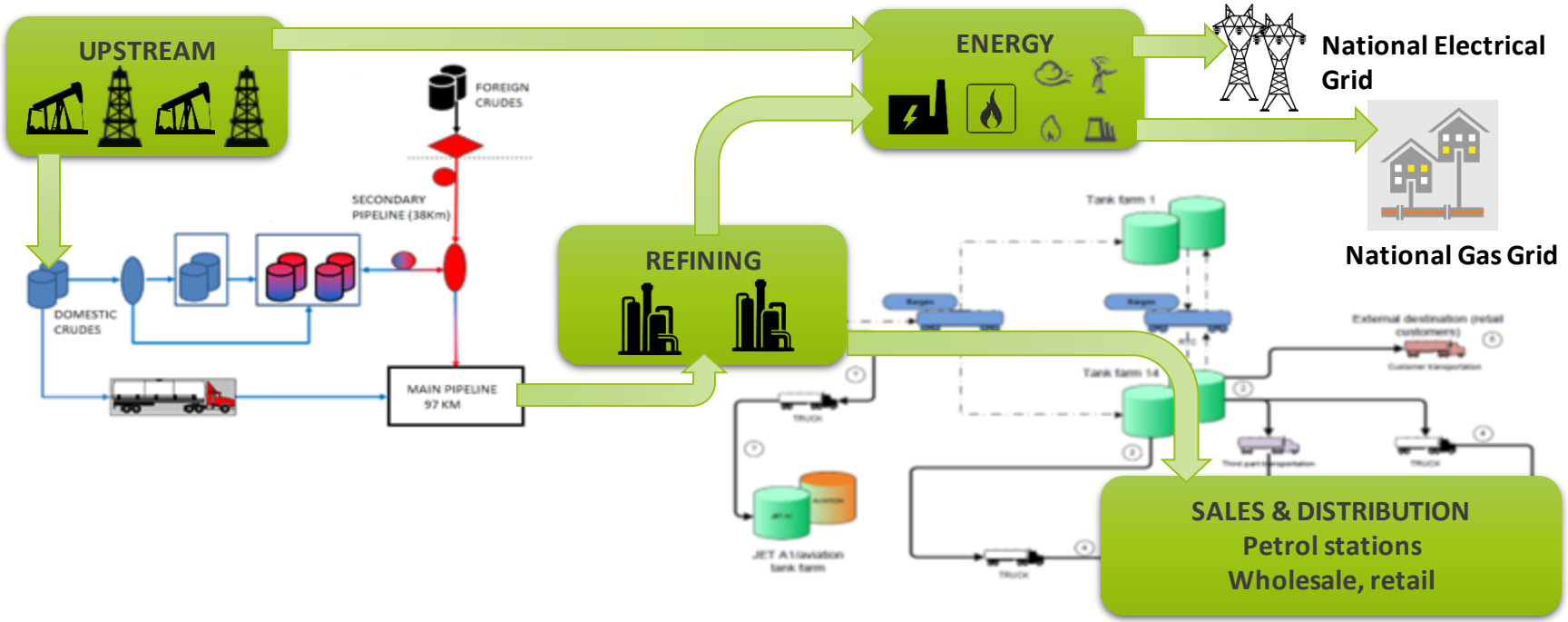
BENEFITS

- Accurate logistic data now available on daily basis
- Integrated view of validated data across the entire company
- Improve operations of distribution network and identification of losses and thefts
- Provided the backbone for the gas and energy trading platform

"Everybody now can do the quick analytics: previously it was necessary 4 days, now people make analytics in 15-20 minutes."

Igor Stanic, Mass Balance Manager, NIS

Value chain



Model based performance monitoring

IPLOM

CHALLENGES

- Direct measurement of vaporized crude not available
- Crude blends changing every 2-3 days
- Hard to get reliable EnPIs(1) data for the CDU furnace, the most energy intensive equipment

SOLUTION

- Model based performance monitoring of the furnace using Sigmafine mass & energy balance
- Sigmafine App for Thermodynamics enables crude properties estimation within PI AF

BENEFITS

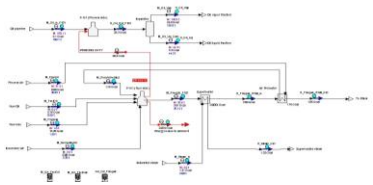
- Improved operational decision leading to savings of 300,000 €/y and 2,700 t CO_2/y
- Reliable EnPIs for the Energy Manager accessible anytime through PBI dashboard

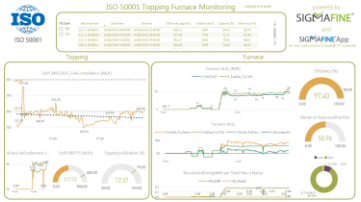
(1) EnPIs – Energy Performance Indicators (ISO-50001)

> Only trustable data, available at the right time to the right people which can take decisions are really useful to increase the company's income.
> Walter Mantelli, Technical Director, Iplom S.p.A.

Data Conditioning Lifecycle

From Raw to Cleansed Data	Data Conditioning	Data Consumption





Process data [real-time]

Crude analysis [per batch]

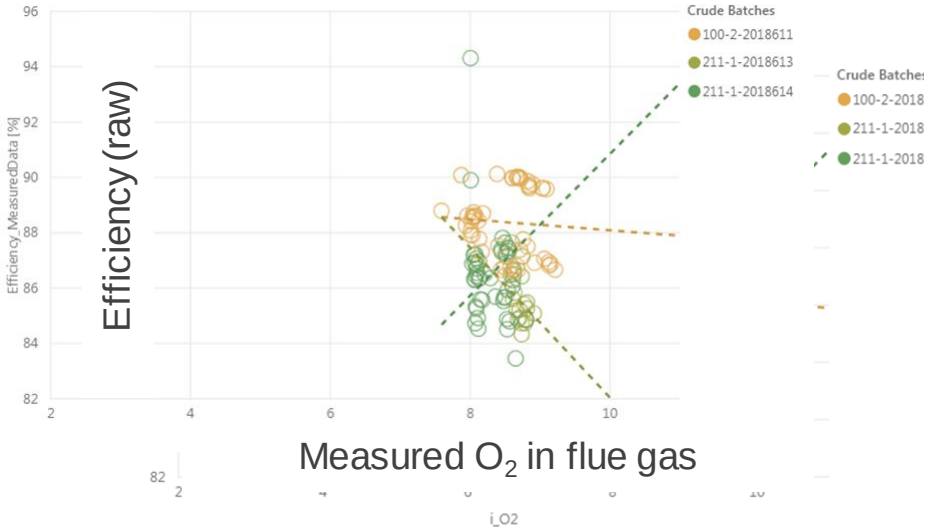
Sigmafine model Mass & Energy balance [hourly]

Thermodynamic App
- Crude properties
- V-L equilibrium
- Enthalpy

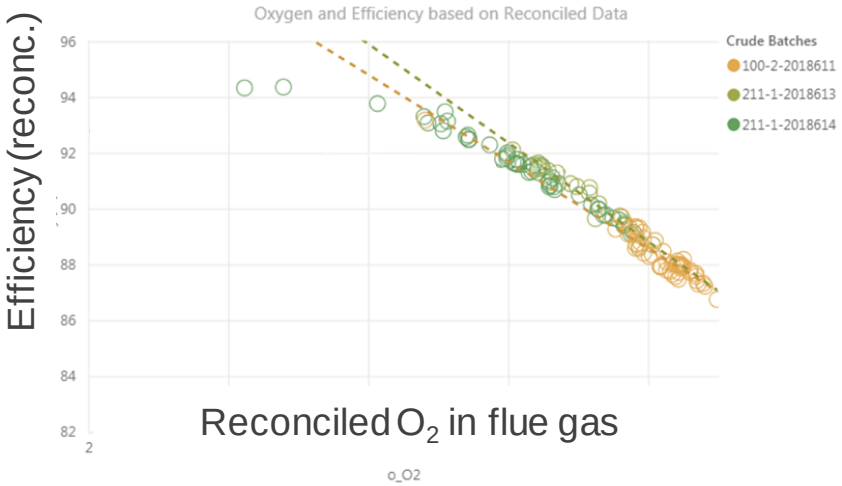
Energy manager

Control room

Measured vs. Conditioned Data



Before



After

Quality Tracking

CHALLENGES

- Data spread out among several repositories, even on paper
- Lack of visibility of plant performance against feedstocks
- Planning possible on monthly basis only due to lack of daily updates

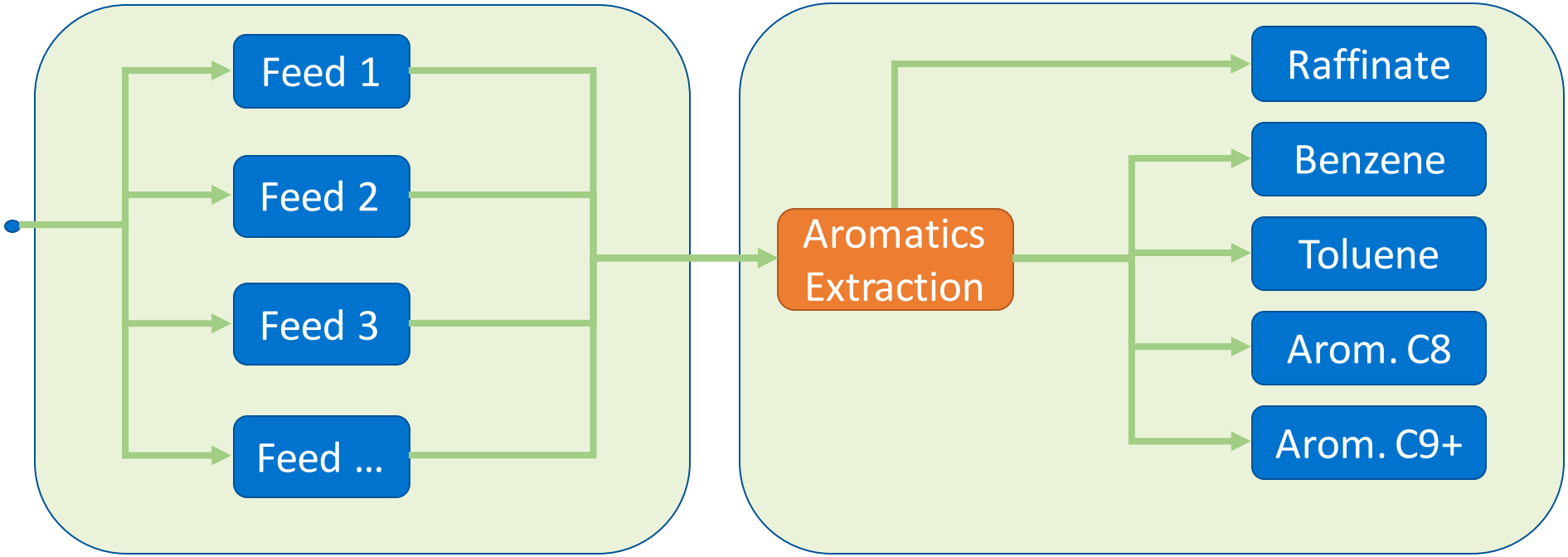
SOLUTION

- Data have been aggregated in a MES system powered by PI System
- Sigmafine quality tracking provided daily estimation of stocks and plant feed composition and related physical properties

BENEFITS

- Daily plant yields and daily material stocks
- Improvement of supply chain operations and reduction of operating costs
- Identification of plant inefficiencies to enable on-time action

Quality Tracking



Reconciled Feed-in + **Quality Tracking** → **Expected Yield** → **Reduced Uncertainty** → **Reconciled Yield** ← **Reconciled Production**

Conclusion

Direct Benefits of Data Conditioning

- Lowers the margin of doubt ➔ $
- Achieve “Fitness for use” ➔ $
- Creates a repeatable, reliable & sustainable process

Indirect Benefits of Data Conditioning

- Models ➔ Digitalizes operational intelligence & enable its reuse at low marginal cost
- Data Reconciliation ➔ Generates Data Quality KPI’s to drive continuous improvement & data defects detection

For more information

www.sigmafine.pimsoftinc.com

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