

Applying Sigmafine in Petrochemicals

A model based solution for data quality driven decisions

Petrochemical industry produces most of the commodities required by large market sectors such as agriculture, packaging, construction, automotive, etc. Production is currently growing driven by global GDP and population growth. Although an overall positive outlook, several factors (political changes, oil price fluctuations, changes in feedstocks availability, environmental laws require more careful decisions both in planning and in operations. Availability is not enough for data driven decisions: consistency and accuracy are imperative requirements to achieve better sensitivity and judgment: data quality matters!!

Solution Area

- Improve data quality for better business decision
- Apply first principles to achieve consistent data
- Process monitoring and energy calculations to improve daily operations
- Model based KPIs you can rely upon to make decisions

Sigmafine improves the quality of real-time data

Sigmafine, the state-of-the-art data validation and reconciliation software, puts in relation raw process data, material transactions and business data in one model constrained by first principles equations, to get a refined set of consistent and more accurate information to support your decisional process. Sigmafine is currently used in major petrochemicals sites to drive the daily business of integrated refinery and petrochemicals, LNG, olefins and polyolefins, methanol and derivatives.

Modeling flexibility and a wide range of data analyses make Sigmafine the ideal solution to target:

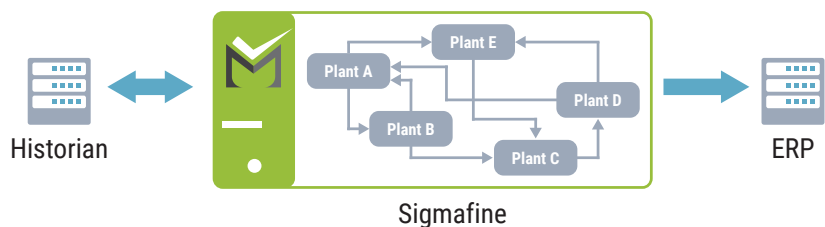
- Production accounting even in complex business arrangements such as joint-ventures and multi-affiliates sites
- Performance monitoring at both plant and equipment level
- Energy management and emission monitoring
- Composition and quality tracking of materials

Production accounting

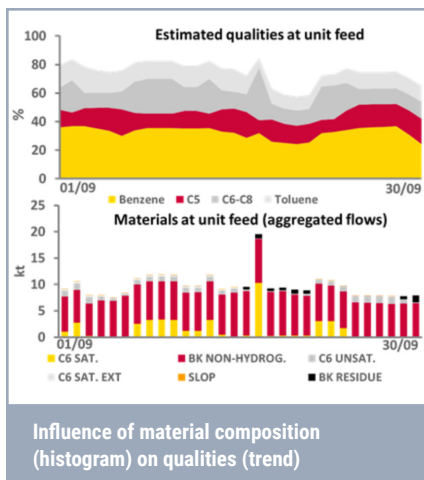
Sigmafine supports daily job of accountants in large petrochemical facilities, even in combination with refinery. Validated and reconciled data are combined with material information to provide reports of productions and consumptions, inventory stocks, site balance by material or plant / process units' yield.

Harmonize inter-company material exchanges

In large sites with many companies or complex joint ventures when many materials are produced and consumed among the plants, it is hard to achieve a set of productions and consumption figures agreed among all the parties.



Sigmafine modeling of all the intra and inter-company transfers of material combined with flow meter data and accuracy and inventory measurements provides to the ERP system a consistent daily balance of all productions and consumptions: no more misalignments at the end of the month and a traceable and auditable source of data for complete transparency in material balance.



Composition and Quality Tracking

Sigmafine Composition and Quality Tracking analyses increase plant knowledge by calculating composition and qualities (e.g. density, viscosity, Sulphur content, etc.) of materials stocked in the inventories or fed to the process units providing up-to-date estimates.

Monitoring can be done on daily or even hourly rate, enabling operations to take actions and timely fix production inefficiencies.

Planning can be updated along the month to optimize overall logistics and reduce related costs; furthermore an assessment of raw material and production costs based on unit feed qualities can be performed.

Model based performance monitoring

Being it a distillation column, a cracking furnace, a multi-stage compressor or a full ethylene production plant, Sigmafine can provide detailed modeling of your facility together with performance KPIs such as efficiencies, process duty, energy consumption, heat losses, flaring, etc..

For such applications, Sigmafine is typically configured with mass and energy balance supported by a thermodynamic package with an extensive database of chemical components.

Sigmafine can run unattended and provide operators validated performance indicators on a regular time basis (hourly or even less) to act at proper time, improving process operation (e.g. keep product in spec by better operating looking at the reconciled fuel consumption).

Sigmafine equipment KPIs are used both by process department for plant analysis and by maintenance to know in advance how performance of equipment is changing over time and take action accordingly.

CRACKING	Material	Quantity (t)	%
IN	ETHANE	119,7	3,1
	GASOIL	419,1	10,9
	VIRGIN NAPHTHA	3.300,2	86,0
	Total IN	3.839,1	100,0
OUT	C4	2.027,6	52,8
	ETHANE	119,7	3,1
	ETHYLENE	1.093,4	28,5
	LOSSES	36,3	0,9
	PROPYLENE	562,1	14,6
Total OUT	3.839,1	100,0	

Material balance report

Category: SF_Compressor	Value	Description
Compression_Ratio	6,6392	Compression ratio of the compressor
Efficiency	71,28 %	Compressor polytropic efficiency
Efficiency_Isoentropic	65,91 %	Compressor isentropic efficiency
Inlet_Pressure	0,263 bar(g)	Pressure at the inlet of the compr...
Inlet_Temperature	-53,37 °C	Temperature at the inlet of the co...
k_average	1,239	Average specific heat ratio
Outlet_Pressure	7,46 bar(g)	Pressure at the outlet of the comp...
Outlet_Temperature	93,6 °C	Temperature at the outlet of the c...
Polytropic_exp	1,371	Polytropic exponent
Work	2,12 mega wat...	Compressor work

Monitor asset properties

SAP integration

Sigmafine comes with an Integration Framework component allowing data exposing to external systems and facilitating integration with most common ERP systems, including SAP. Most common SAP modules integrated with Sigmafine are:

- **PPPI:** post reconciled figures of Productions, Consumptions & Losses and compare with Planned/Business figures
- **SD:** download from SAP inbound raw material receipts and outbound final product shipments
- **WM/MM:** align physical or logical SAP inventories with Sigmafine ones.

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