

Aspen RefSYS™

A multi-unit refinery simulation and optimization modeling application for optimizing refinery performance and making more accurate operational decisions with integrated models

Aspen RefSYS is a multi-unit simulation and optimization modeling application that helps refiners improve operational decision making and achieve a more accurate view of the overall potential for refinery profitability. By building multi-unit refinery models in a single flowsheet, refiners can understand the complex interactions among multiple refinery units.

Best-in-Class First-Principle Refinery Reactor Models

Aspen RefSYS combines AspenTech's industry-proven Aspen HYSYS® process simulation flowsheet technology with best-in-class first-principle refinery reactor models, including AspenTech's FCC, reformer, hydrocracker and hydrotreater reactor models. These reactor models can be used to support flowsheet simulation, case study analysis and optimization. Each reactor model can also be run in a standalone mode with a simple flowsheet, or run inside an expanded flowsheet that contains upstream and downstream units.

The reactor models available with Aspen RefSYS feature rigorous kinetics and utilize AspenTech's unique "Equation Oriented" technology, which allows rapid and accurate solution of recycle streams. The open architecture on which Aspen RefSYS is built also enables the integration of third-party reactor models.

Benefits of Integrated Multi-Unit Refinery Models

Refining companies will be able to use integrated refinery models to evaluate potential operating strategies quickly and accurately, support better planning decisions to optimize operational performance and improve overall plant reliability and safety. Other benefits include:

- **Understanding unit interdependencies.** Refiners can evaluate the impact of changes in unit operations, find the "best" set of operating conditions and quickly assess the change in value of final products. These capabilities lead to reductions in the gap between actions and plans, enabling changes to happen at the refinery level and ultimately providing confident identification of the most profitable crude purchasing and refinery operating strategy.
- **Generating accurate LP models.** Aspen RefSYS helps refinery planners to generate process unit sub-models and incorporate crude assays that can be applied within the refinery planning LP model, and is easily integrated with AspenTech's Aspen PIMS™ petroleum industry planning application. They can also use the rigorous modeling capabilities of Aspen RefSYS to quickly test and update their planning & scheduling models in order to make operating decisions based on more accurate economic information.
- **Understanding the "true operating window."** Models with higher accuracy allow refiners to identify the true process constraints and reduce operational bottlenecks, and lets them manage the impact of unplanned events and quickly respond to operational upsets. Utilization of accurate models ensures decision making consistency across multiple groups in the refinery.
- **Planning for new regulations/operations.** Aspen RefSYS enables refiners to maximize the efficiency of existing equipment and assess its potential. Refiners are able to quickly evaluate numerous configurations and process schemes when planning for new regulations and operating plan changes.



"Multi-unit modeling will allow us to analyze the complex interactions among the process units in our refineries, using consistent and accurate models. This understanding will help us to identify the most profitable crude purchasing strategies, and will enable refinery managers to maximize throughput without compromising the safety and reliability of our operations."

Ángel Morales Morales
Planning & Simulation Advisor
CEPSA Gibraltar Refinery



- **Maximizing investment through integration with other AspenTech solutions.** Aspen RefSYS is tightly integrated with other AspenTech applications, giving refiners greater decision making capabilities and maximizing the value of their investments in other AspenTech offerings. Value is especially significant for Aspen HYSYS customers, who can now use their existing Aspen HYSYS models in Aspen RefSYS.

Aspen RefSYS is scalable, allowing users to build refinery models in a series of stages. It also provides an intuitive user interface with access to a sophisticated set of modeling tools, including refinery properties and mixing rules, distillation column technology, first principle refinery reactor models, and a crude assay management system.

Aspen RefSYS is a part of the aspenONE™ Simulation & Optimization for Petroleum solution.

Features

Leading Edge Refining Technology

Access to CrudeManager from Spiral Software, Ltd.

- Flexible component slate to model user components
- Crude assay database

Aspen HYSYS flowsheet environment

- Commercially proven engineering tool

Petroleum-specific properties and mixing rules

- 100+ properties

Continuous petroleum property propagation

- Unique software architecture allowing efficient refinery-wide modeling
- Petroleum properties that are dynamically updated across reactors in the flowsheet

Petroleum-Specific Operations

Manipulation of assay properties

- Ability to adjust assay properties to match plant data

Feed and product blender

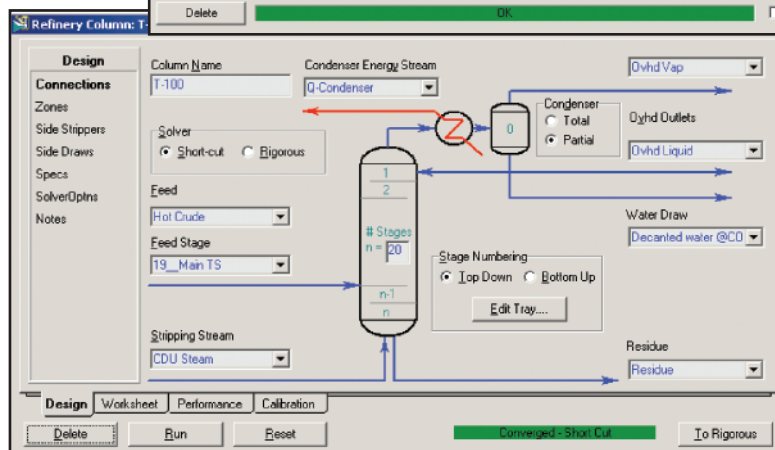
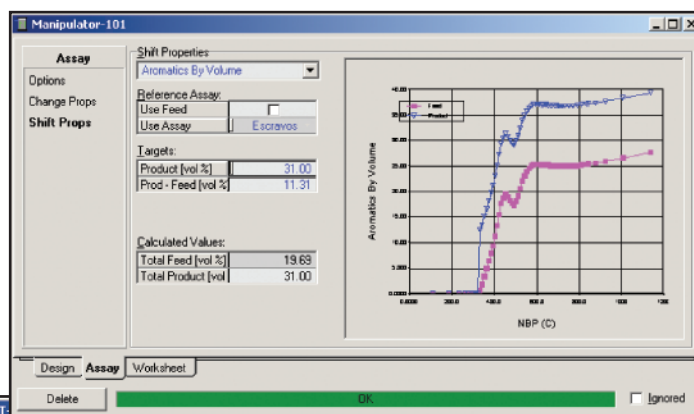
- Product feedstocks are blended to maximize profit and meet product specifications
- Simulation of mixed feeds and spiked feeds

Petroleum zone-by-zone distillation

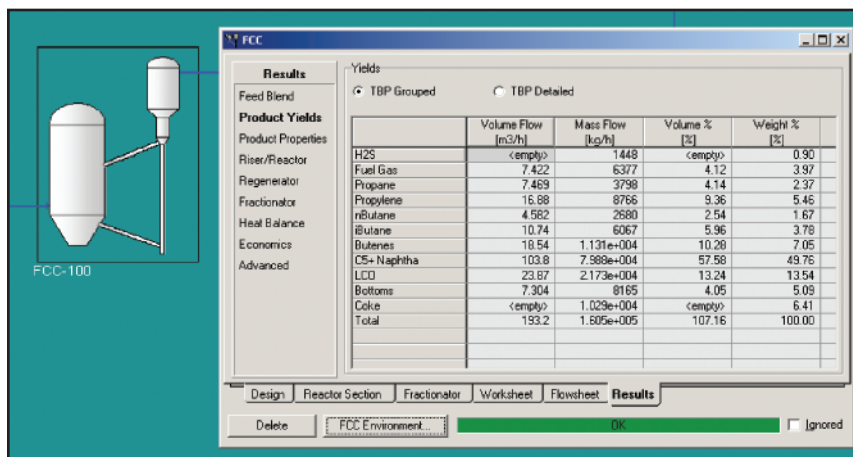
- Robust model that tunes to match plant data
- Support of crude, vacuum and FCC main fractionation columns in both zone-by-zone and rigorous tray-by-tray modes

Optimization technology

- Industry-proven Sequential Quadratic Programming (SQP)



Aspen RefSYS offers unique tools for refinery modeling



Flexible and robust reactor models are fully integrated to the flowsheet

Reactor Models

FCC Model

- Flexible topology supporting multiple licensors
- Catalyst database
- Unique feed fingerprinting capabilities

Reformer Model

- CCR and Semi-Regen configurations
- Advanced tuning capabilities
- Catalyst deactivation rates based on catalyst metals loadings and historical catalyst performance

Hydrocracker Model

- Flexible topology supporting multiple licensors
- Modeling of all key reactions – HDS, HDN, metals removal, saturation of olefins and aromatics, ring opening, ring dealkylation, paraffin cracking, paraffin isomerization
- Catalyst deactivation model

Hydrotreater Model

- Flexible topology supporting multiple licensors
- Specific models to distillate, VGO and residue feeds
- Clean fuels applications

LP Model Update

LP Delta-base Vectors Generator

- Direct generation of delta-base vectors from Aspen RefSYS
- User-supplied manipulated and observable variables
- User-defined model perturbations

Case Study Tool

- Generation of data over a large range
- User-specified manipulated and observable variables
- Regression of data outside of Aspen RefSYS to create an LP table

Assay Tables Generator

- Inclusion of imperfect fractionation effects by selecting existing columns on the flowsheet
- Definition of heart and swing cuts
- Use of Aspen PIMS tags for products and properties
- Export of Aspen PIMS assay tables

Services

Model commissioning services

- Configuration and tuning of reactor/separation models to plant conditions
- Detailed analysis of refinery operations
- LP model update projects
- Online performance monitoring and model update



"Refiners must go beyond unit optimization to achieve refinery-wide optimization by taking into account complex interactions among processing units that affect the overall profitability of a facility. Refinery-wide optimization has the potential to provide refiners with greater visibility to evaluate and make more informed decisions about higher value opportunities that will improve the bottom line."

Tom Fiske, Senior Analyst
ARC Advisory Group

About aspenONE for Petroleum

aspenONE for Petroleum is an integrated, comprehensive set of software solutions, professional services, and partnerships designed to help the downstream petroleum industry achieve operational excellence.

By using aspenONE for Petroleum in the plant, petroleum companies can enhance safety and reliability, improve throughput and product yields, reduce energy costs, improve crude acquisition and selection processes, make more profitable refinery plans and schedule process units and blends more effectively. It also provides solutions for the real-time performance management of the refinery.

aspenONE for Petroleum also allows petroleum companies to integrate the refinery with the supply chain, enabling integrated plant operations with optimal distribution planning, improved trading margins, real-time inventory visibility with reduced risk exposure and optimal positions, reduced supply shocks such as stock-outs and demurrage, and lower overall distribution costs in both primary and secondary distribution.

Based on AspenTech's Aspen Operations Manager integration infrastructure, aspenONE for Petroleum provides the key capabilities refiners and petrochemical manufacturers need for real-time performance management:

- A unified view of manufacturing and supply chain information and KPIs
- An ability to synchronize manufacturing plans with supply chain processes based on accurate insight into plant capabilities
- An ability to detect and respond to unanticipated manufacturing and supply chain problems and opportunities
- An ability to monitor and analyze operational KPIs, perform root cause analysis and leverage models to facilitate optimal decision making



Its combination of applications and services addresses challenges associated with the five major business areas of the petroleum industry:

- **Engineering & Innovation.** Improvement of plant performance through such techniques as benchmarking analysis and continuous process enhancements.
- **Plant Operations.** Safe and reliable plant operation with minimal energy costs and improvements in yields and throughput; an ability to meet the demands of activities such as refinery planning, scheduling and blending.
- **Regional Planning.** Development of operating plans, taking into consideration multiple periods, plants, commodities, markets, and transportation modes across a given geographical region.
- **Supply, Distribution & Trading.** Optimization, scheduling and managing “front line” decision making and operational execution.
- **Fuels Marketing.** Achieve fully automated and optimized supply chain management in secondary petroleum and petrochemical distribution.

About AspenTech

Aspen Technology, Inc. provides industry-leading software and professional services that help process companies improve the efficiency of their business processes, optimize their operational performance and enhance their financial results. The new generation of integrated aspenONE solutions gives manufacturers the capabilities they need to model, manage and control their operations, enabling real-time decision making and synchronization of the plant and supply chain.

For nearly a quarter century, AspenTech has established a track record of partnering with customers to deliver sustainable value. Our large installed base of satisfied customers includes 23 of the top 25 oil companies, 47 of the top 50 chemical companies, and all of the top five engineering, procurement and construction firms.



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