Petro-SIM Process Simulation Fundamentals Training Course

10 – 14 October 2027
Amman (Jordan)

UK Traininig
PARTNER



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Introduction:

Petro-SIM process simulation fundamentals encompass the core engineering principles of thermodynamic property prediction, flowsheet convergence, and unit operation modelling used to design and optimise hydrocarbon facilities. This one-week course prepares process and facilities engineers to build a verified Petro-SIM steady-state process simulation dossier. Delivered at practitioner depth through a hands-on modelling build practical mode, the course applies the Computer Aided Process Engineering open architecture interface standard, known as CAPE-OPEN, alongside established industrial design methods. Professionals master Petro-SIM process simulation fundamentals with Blackbird Training Centre to deliver reliable digital models for facility operations.

Course Objectives:

- Select appropriate thermodynamic property packages and fluid assay characterization methods for hydrocarbon and chemical processing systems.
- Compare equation-of-state models against activity coefficient frameworks to evaluate phase equilibria and flash calculations accurately.
- Apply unit operation algorithms within Petro-SIM 7.7 to model fractionation columns, heat exchangers, compressors, and pipeline hydraulics.
- Distinguish between first-principles process simulation and empirical hybrid machine-learning models when predicting equipment performance and energy consumption.
- Interpret process modeling submittal criteria under engineering procedure design standards to ensure documentation compliance for plant engineering deliverables.
- Justify relief scenario design assumptions and safety system blowdown rates against ANSI/ASME piping and process safety standards.

Target Audience:

- Process engineers responsible for facility flowsheeting who must select thermodynamic fluid packages and converging algorithms for complex hydrocarbons.
- Operations technologists responsible for plant performance monitoring who must decide between first-principles calculations and hybrid digital twin models.
- Facilities engineers responsible for piping networks and equipment sizing who must evaluate pressure drop constraints and relief capacity requirements.
- Simulation model support specialists responsible for corporate governance who must determine alignment with corporate engineering documentation standards.



Course Outline:

Day 1: Thermodynamic Foundations and Hydrocarbon Characterisation

- Equation-of-State vs Activity Coefficient Models: Selecting Thermodynamic Methods for Hydrocarbon Processing
- Petro-SIM Flowsheet Navigation: Configuring Fluid Packages and Simulation Property Databases
- Crude Oil Assay Characterisation: Defining Pseudo-Components and Boiling Point Cut Curves
- Flash Calculation Algorithms: Determining Multi-Phase Vapour-Liquid Equilibrium Across Vessel Streams
- Physical Property Estimation: Predicting Stream Densities, Viscosities, and Critical Properties

Day 2: Modelling Frameworks and Engineering Governance Standards

- First-Principles vs Hybrid Machine Learning Models: Evaluating Petro-SIM 7.7 Predictive Methods
- CAPE-OPEN Standard Compliance: Integrating External Unit Operations and Thermodynamic Modules
- Corporate Procedure Alignment: Establishing Quality Standards for Process Simulation Deliverables
- Multi-Stage Directives: Mapping Process Safety Data to Regulatory Design Milestones
- Distributed Recursive Linear Programming: Linking Petro-SIM Models with Planning Workflows

Day 3: Core Unit Operation Modelling and Fractionation

- Equilibrium Trays vs Rate-Based Mass Transfer: Specifying Hydrocarbon Fractionation Columns
- Column Internals: Sizing Distillation Trays and Packing Under Operating Constraints
- Heat Exchanger Train Rating: Modelling Shell-and-Tube Geometries and Thermal Duties
- Rotating Equipment Simulation: Evaluating Centrifugal Compressor Curves and Pump Hydraulics
- Separator Vessel Sizing: Applying Design Criteria for Multi-Phase Separation

Day 4: Hydraulic Networks, Relief Sizing, and System Dynamics

- Steady-State Modelling vs Dynamic Surge Analysis: Comparing Flow Regime Responses
- Network Simulation: Evaluating Gathering Piping Hydraulics and Pressure Drops
- Surge Assessment: Sizing Pipeline Overpressure Mitigations Under ANSI/ASME B31.3
- Depressuring Utility Calculations: Modelling Rapid Blowdown and Low-Temperature Metal Limits
- Recycle Loop Convergence: Resolving Flowsheet Tear Streams and Numerical Instability

Day 5: Modelling Build: Industrial Plant Simulation and Dossier Finalisation

- Process Units vs Utility Headers: Modelling Steam Boilers and Turbines
- Feedstock Fluctuation Case Studies: Assessing Plant Flexibility Across Variable Assays
- Equipment Rating Verification: Auditing Simulated Heat Duties Against Installed Capacities
- Procedural Quality Checks: Validating Mass and Energy Balances for Governance
- Simulation Dossier Finalisation: Completing the Verified Petro-SIM Steady-State Process Deliverable



Skills You Will Gain:

- Fluid Property Package Selection
- Petroleum Assay Characterisation
- Column Convergence Troubleshooting
- Petro-SIM Flowsheet Architecture
- Pipeline Network Hydraulics Analysis
- Hybrid Machine Learning Modelling
- Utility System Energy Balancing
- Simulation Quality Assurance Auditing

Why Attend This Course:

- From relying on generic physical property defaults to methodically selecting calibrated thermodynamic packages and detailed crude assays.
- From treating process simulation as isolated manual flowsheets to leveraging hybrid machine-learning models integrated with corporate planning tools.
- From struggling with flowsheet tear-stream recycle divergence to applying structured numerical convergence and column troubleshooting protocols.
- From producing unverified model files to assembling a complete Verified Petro-SIM Steady-State Process Simulation Dossier that aligns with rigorous engineering governance.

Conclusion:

Petro-SIM process simulation fundamentals provide the engineering rigor needed to model, evaluate, and debottleneck complex refining and petrochemical assets. The course clarifies foundational distinctions between equation-of-state and activity coefficient thermodynamics, steady-state flowsheet mass balancing and dynamic pressure-relief transients, and first-principles simulation versus artificial intelligence hybrid models. Designed for operational process engineers and facility specialists seeking practitioner competence, this course equips participants to develop stable, reliable process flowsheets that satisfy exacting engineering standards and support optimal facility operations.

Frequently Asked Questions FAQ:

What is Petro-SIM process simulation?

Petro-SIM process simulation is an engineering software platform developed by KBC that combines first-principles chemical engineering calculations with empirical modelling to simulate steady-state and dynamic hydrocarbon refining, gas processing, and petrochemical facility operations.



What is the difference between steady-state and dynamic process simulation in Petro-SIM?

Steady-state process simulation models continuous plant operations under constant equilibrium conditions to evaluate mass and energy balances, whereas dynamic process simulation models time-dependent behavior to analyse transient disturbances, pipeline hydraulic surges, startup sequences, and emergency depressuring events.

Which engineering standards govern Petro-SIM process simulation model development?

Model development commonly follows open architectural frameworks like CAPE-OPEN alongside proprietary engineering governance procedures, standard operating guidelines, and design criteria including ANSI/ASME B31 piping codes.

Is this Petro-SIM process simulation fundamentals course suitable for operational process engineers?

Yes, operational process engineers gain direct practitioner capabilities to configure thermodynamic fluid packages, build unit operation flowsheets, resolve complex recycle loop convergences, and compile auditable engineering simulation documentation for operating plant facilities.

