KBC Petro-SIM Design Tools
Integrated Equipment Operations

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Petro-SIM Design Tools

- KBC has completed 100+ CDU/VDU projects using Petro-SIM
  - 40 “grassroots” and revamp process designs with Petro-SIM
- Petro-SIM process modeling tools upgraded in every version
  - Version 4.1 equipment sizing modules are in the Petro-SIM Flowsheet
- Benefits of fully integrated CDU-VDU equipment models
  - Allows simulation of the entire process and integrated units
  - Optimization and design of Distillation Columns and equipment
  - KBC proprietary Fired Heater models upgraded in 4.1
  - Heat Exchange Networks (HX Monitor Utility)
  - Shell and Tube Heat Exchangers (STHE)
  - Towers, Vessels, Drums and Receivers
  - Rotating Equipment
    - Centrifugal & Positive Displacement Pumps
    - Compressors & Expanders
Petro-SIM Design Tools

- Petro-SIM Excel Interface to KBC Design Tools
  - Facilitates direct generation of:
    - Process Unit Reports
      - Flowsheet Heat and Material Balances (HMB)
    - Equipment performance summaries and datasheets:
      - Unit, Column and Sub-flowsheet HMB
      - Stream Summaries with extensive physical properties
      - Column stage-by-stage loadings, stage properties, packing and tray sizing interfaces
    - Equipment datasheets updated for changes in operating conditions, product specs and feedstocks
- Fired Heater tube-by-tube & Transfer Line performance
  ◆ Cracking and coking curves
  ◆ Tube-by-tube pressure drop, fluid temperature, density, viscosity, heat flux, percent vaporization, oil film and tube metal temperatures, residence time, fluid velocity, sonic and critical velocities
  ◆ Excel link to API 560 Process Datasheets

- Equipment design and rating reports and datasheets
  ◆ TEMA datasheets embedded in Petro-SIM
  ◆ Excel Interfaces to API datasheets
    ▶ Centrifugal and Positive Displacement Pumps
    ▶ Compressors and Expanders
  ◆ Excel Interface to KBC datasheets
    ▶ Towers, Columns and Vessels
    ▶ Drums and Receivers
Heat Exchange Networks

SuperTarget Interface
New version 4.1 HX Monitor Utility
Embedded TEMA Datasheets
Heat Exchange Networks

• KBC Pinch Technology and heat exchange network SuperTarget optimization software ensure optimal energy performance
• Petro-SIM flowsheets interface to SuperTarget with updated data
  ▪ Pinch analysis carried out using SuperTarget
    - Analyzes the complex interaction of heat sources and sinks
    - Efficiently evaluates how changes in equipment or operation affect energy costs
  ▪ KBC SuperTarget program can be used:
    - On existing exchanger networks to analyze how well available temperature driving forces are being used
    - Evaluate exchanger network revamps and develop optimum grassroots designs
      ◆ KBC crude preheat designs achieve 600-610°F Crude Heater inlet temperatures
  ▪ SuperTarget link to Petro-SIM facilitates analysis of heat exchange networks, process and facility flowsheets
  ▪ Stream properties and conditions linked allowing case study comparisons
    - SuperTarget is updated with changes in operating conditions, feeds and products
  ▪ Process and Energy Optimization conducted on the same basis
KBC STHE Heat Exchanger Operation

Steady State Rating Mode
New upgraded STHE model in 4.1
STHE Heat Exchanger Operation

- Petro-SIM STHE Heat Exchanger Operation
  - Upgraded with Bell Delaware and proprietary KBC correlations
- The new KBC STHE model in 4.1
  - Produces results consistent with third party programs
  - STHE geometry and TEMA specifications
    - Entered only once in Petro-SIM for all exchanger operating modes
    - Geometry changes transfer to all KBC STHE operating modes
    - Geometry changes also transfer to third party programs including HTRI
      - HTRI and STX can be viewed in Petro-SIM
  - Ratings are evaluated with identical stream properties
  - KBC Rate Mode, tube and shell side duties, heat transfer coefficients, UA, ΔP and excess surface area match HTRI and STX
  - In the evaluation mode, predicted fouling factors also match results from third party STHE programs
STHE Heat Exchanger Operation

- Petro-SIM 4.1 allows integration of STHE networks in one simulation
- Entire crude preheat network can be built into one Petro-SIM model
  - Changes in column operating conditions, pumparound and product streams result in an integrated, simultaneous solution of individual heat exchanger performance
- Petro-SIM also allows inter-unit heat exchange with multiple process units in one Refinery Flowsheet
  - Crude preheat train can be integrated with the Crude Column, Vacuum Unit and Delayed Coker in a single flowsheet
- The upgraded Petro-SIM STHE Heat Exchanger Operation improves convergence times compared to third-party programs
- Fully integrated models convergence in a fraction of the run time
  - KBC demonstration of integrated Petro-SIM CDU-VDU Design Model
  - Grassroots design for South American client
  - 150000 BPD CDU / 90000 BPD VDU design basis
  - 165000 BPD CDU / 100000 BPD VDU equipment rating
KBC Fired Heater Models

ver 4.1 predicts coke laydown over time
Proprietary Fired Heater Models

- Furnace model analyzes the performance of Fired Heater Coils, Transfer Lines and Column Internals
  - Includes convection and radiant sections
  - New option provides flux profile on a tube-by-tube basis
  - Enhanced 4.1 reporting for vapor and liquid
- Essential technology in identifying heater tubes and column zones subject to potential coking
  - Function of temperature, residence time & flow regime
  - Valuable when designing Vacuum Columns, internals, Fired Heaters and ancillary equipment to avoid coking
  - 4.1 kinetic model predicts and tracks coke laydown
Stream Physical Properties

106 Component Refinery Assays
Stream Physical Properties

• Petro-SIM can represent new and existing operations
• Accurately predicts product yields and qualities due to crude assay handling system
  - 106 component Refinery Fluid Package
  - Refinery streams represented by an assay comprised of 75 pseudo-components and 31 pure components
  - Each pseudo-component stores up to 77 physical properties
    - Assay Properties include all refinery product qualities
  - Predicts critical physical properties for VDU Deep Cut projects
    - Concarbon, C_7 Insoluble (Asphaltenes)
    - Sulfur, Nitrogen and Metals (Ni + Va)