



Petro-SIM Simulator and CAPE-OPEN: Experiences and Successes

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DRIVING EXCELLENCE

Agenda



- About KBC
- What is Petro-SIM?
- Implementing CAPE-OPEN support
- Case Study
- Where Next?



Leader in Refinery Simulation since 1982





KBC: Who we are

An Independent Consultancy



KBC Office Locations

2006

Acquires **TTS Performance Systems** for Human Performance improvement services and **Veritech** to extend Energy services

2004

Petro-SIM™ – Plant-Wide Flowsheet Simulation Software released

2002

Acquired **PEL** for Oil and Gas market analysis and **Linnhoff March** to enhance Energy services

2000

Created **Petrochemical, Gas Processing and Energy Industry** services

1996

Developed **Reliability, Availability & Maintenance** services

1995

Created **On-site Implementation Services**

1986

Developed **Petrofine** simulation software

1979

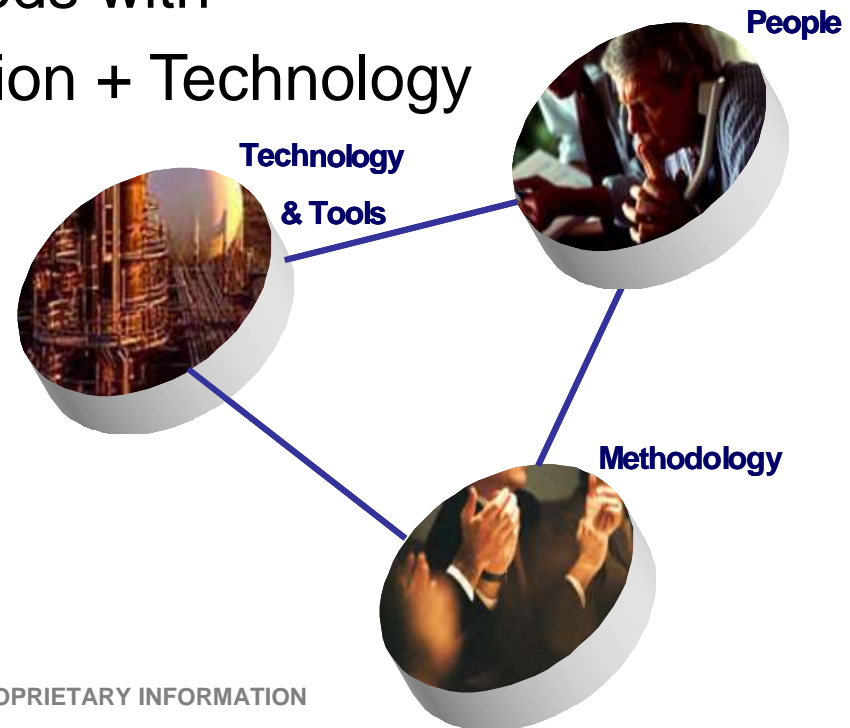
KBC founded as **independent consulting company**, specialising in energy improvement in refineries



What We Do



- Provide Independent, Objective Advice
- Enhance Capital & Asset Effectiveness
- Improve Operational Performance
- Increase Competitive Advantage
- Meet Individual Client Needs with Consulting + Implementation + Technology





What is Petro-SIM?

Petro-SIM



- Full-featured process simulator focussing on simulation needs of oil refineries and petrochemical complexes
- Used for refinery-wide simulation as well as smaller scale process areas
- Builds on KBC's extensive experience in refinery simulation
 - Over 130 refinery wide models built
- First release in 2005



Petro-SIM



- Has comprehensive library of hydrocarbon-specific features:
 - Assays and oil properties
 - Refinery reactors
 - FCC, Hydrocracking, Hydrotreating, Catalytic Reforming, Delayed Coking, Visbreaking, Alkylation, Isomerisation
 - Petrochemical reactors for aromatics and olefins handling





Implementing CAPE-OPEN Support

Extension methods in Petro-SIM



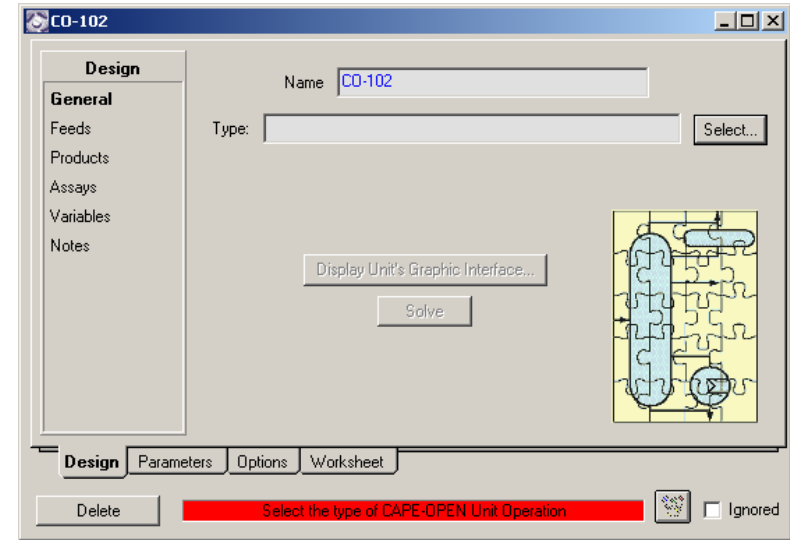
- Extension unit operation method
 - Works against Petro-SIM through COM interfaces
 - Extension data stored inside Petro-SIM case
 - Extension dll exists outside
 - Rich view
- User unit operation
 - Simpler mechanism useful for prototyping and where full op not justified
 - Container unit op in flowsheet
 - Uses Active Scripting interface to add methods
 - Simple view



CAPE-OPEN Unit Operation



- Added natively
 - CO unit operation class as host
- Existing interfaces enhanced to recognise CO
 - Fluid & Stream classes
- Simple internal view / rich component view
- First released Sept 2007



Comparing methods



- Extension op
 - Offers best user experience but unique to each simulator
- User unit op
 - Good for prototyping and in-house use
- CO unit op
 - Most flexible on paper
 - Dependant on what component provider exposes
 - No refinery reactor support yet





Case Study

Detailed Heat Exchanger Design



- SuperTarget/Petro-SIM is used to define preheat train heat balance
 - Temperatures and Duties
- Basic Engineering Design package requires TEMA type heat exchanger data sheets containing:
 - Shell ID
 - Number Tubes
 - Tube OD etc
- Require detailed heat exchanger design program to generate data sheets
- Petro-SIM links to HTRI



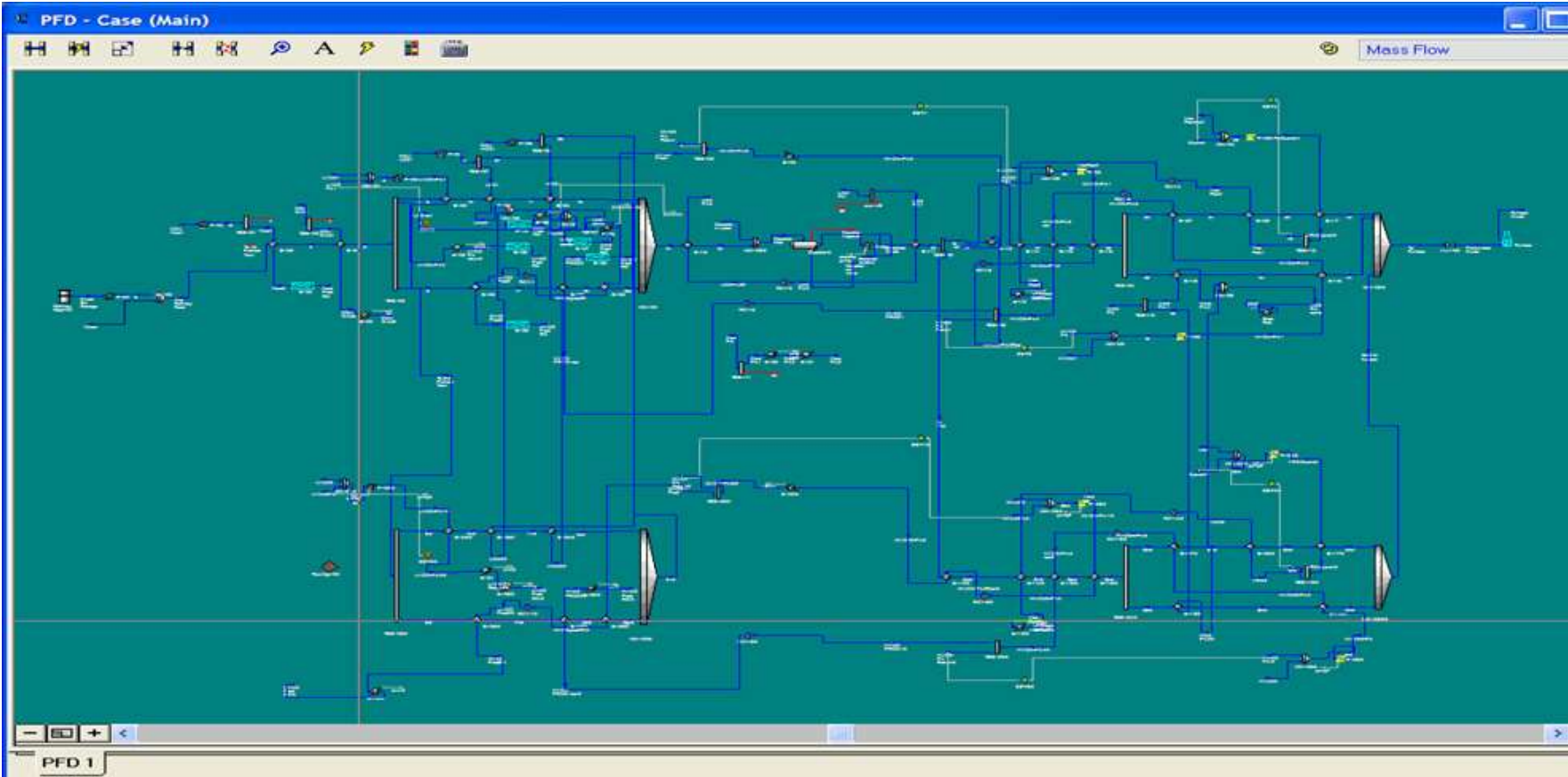
Heat Transfer Research, Inc



- HTRI founded in 1962
 - More than 850 corporate members
 - Standalone heat exchanger design software
 - Links to Petro-SIM through CAPE-OPEN link



Typical preheat train



HTRI Exchanger in Petro-SIM



- Multiple CO exchanger objects in the Petro-SIM flowsheet
- Solved when triggered by changes in flowsheet conditions
- Detailed design cases run using HTRI graphic interface
- Rating cases run from Petro-SIM

Parameters	Input shell inside diameter	0.653 ft	0.0040	m
Input duty	0.0000 hp	0.0000	W (m2 kg s-3)	
Run type	<empty>	<empty>		
Shell inside diameter	2.835 ft	0.8640	m	
Baffle spacing	0.5906 ft	0.1800	m	
Tube passes	2.000	2.000		
Tube diameter	0.1250 ft	3.810e-002	m	
Tube pitch ratio	1.249	1.249		
Tube length	20.00 ft	6.096	m	
Tube wall thickness	1.117e-002 ft	3.404e-003	m	
Shellside pressure drop	4.830 psi	3.330e+004	Pa (m-1 kg s-2)	
Tubeside pressure drop	5.112 psi	3.525e+004	Pa (m-1 kg s-2)	
Shellside coefficient	263.6 Btu/hr-f	1497	W/(m2 K) (kg	
Tubeside coefficient	269.9 Btu/hr-f	1532	W/(m2 K) (kg	
Area	1361 ft2	126.5	m2	
U	80.52 Btu/hr-f	457.2	W/(m2 K) (kg	

User Feedback



- CO mechanism to link to HTRI Xchanger Suite has been positively received
- Link being extensively used throughout company





Where Next?

Improving the user experience



- Split between simple view offered inside simulator and rich component view seen as issue
 - Constructing CO unit operations of complex operations involves making choices
 - Not practical to expose all parameters to CO Parameter list
- Should we enhance standard to support richer view?
 - Propose using an XML definition that each simulator can render in style that is consistent with its native objects
 - Makes all variables available to simulator

