



Exchanger Rating Using CAPE-OPEN in a Process Modeling Environment

Joseph W. Holmes, David L. Johnson,
Sunday Ogundiran, and Mark Lichtenauer



Topics

- What is CAPE-OPEN?
- Why do we need CAPE-OPEN?
- CAPE-OPEN in an end-user flowsheet
- CAPE-OPEN in alternative process simulator
- Flexible workflow
- Future work



What is CAPE-OPEN?

- Started in the mid 90's by CAPE-OPEN and Global CAPE-OPEN organizations
- The CAPE-OPEN standard is the de facto standard for interfacing process modeling software components
- It is based on universally recognized software technologies such as COM and CORBA
- The CO standard is open, multi-platform, uniform and available free of charge



Why Do We Need CAPE-OPEN?

- Interoperability
 - Convenience
 - Time
 - No transcription errors
 - No need for user written interfaces
- Process models that depend upon unit operation models
 - More accurate flowsheeting
 - No iteration
 - Pressure sensitivity



CAPE-OPEN in a “Real” Case

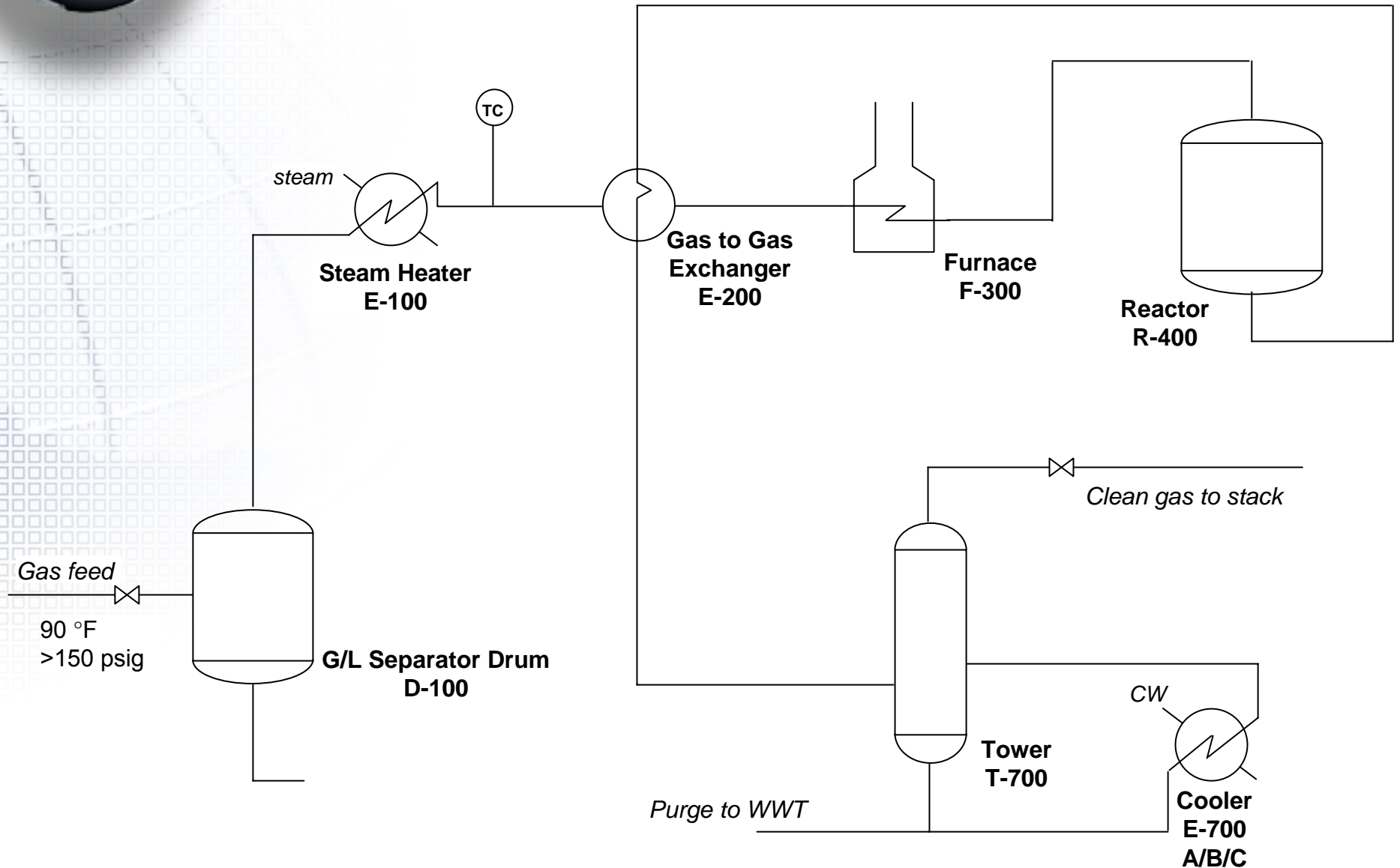
- User selected case based on existing flowsheet models
- Aspen Plus[®] 12.1.9
 - Standard in-house version
 - Not the most current version
- HTRI *Xchanger Suite*[®] 5.0
 - Current version



Process

- Typical gas clean-up process
- Three CAPE-OPEN embedded exchangers
 - Steam heater
 - Cold water cooler
 - Gas-gas exchanger

Process Flowsheet





Results

- Accuracy
 - CAPE-OPEN generated properties identical to native property generation
 - Embedded exchanger models identical to standalone simulation
- Workflow
 - Specify CAPE-OPEN unit instead of native exchanger unit operation
 - Requires specification of exchanger geometry
 - Longer runtimes (1 minute versus a few seconds)
 - No manual iteration with unit operation models required



Portability

- Run same flowsheet with same unit operation models in alternate process simulators
- “Write once, use everywhere” interfaces



Simulator Results

Exchanger	Overdesign (%)	ΔP (shell) (kPa)	ΔP (tube) (kPa)
E-100 (Aspen Plus)	8.39	16.7	16.9
E-100 (UniSim Design)	8.73	16.9	16.9
E-200 (Aspen Plus)	7.83	19.6	12.3
E-200 (UniSim Design)	-0.99	19.5	12.2
E-700 (Aspen Plus)	6.99	54.6	47.0
E-700 (UniSim Design)	8.93	54.3	46.8

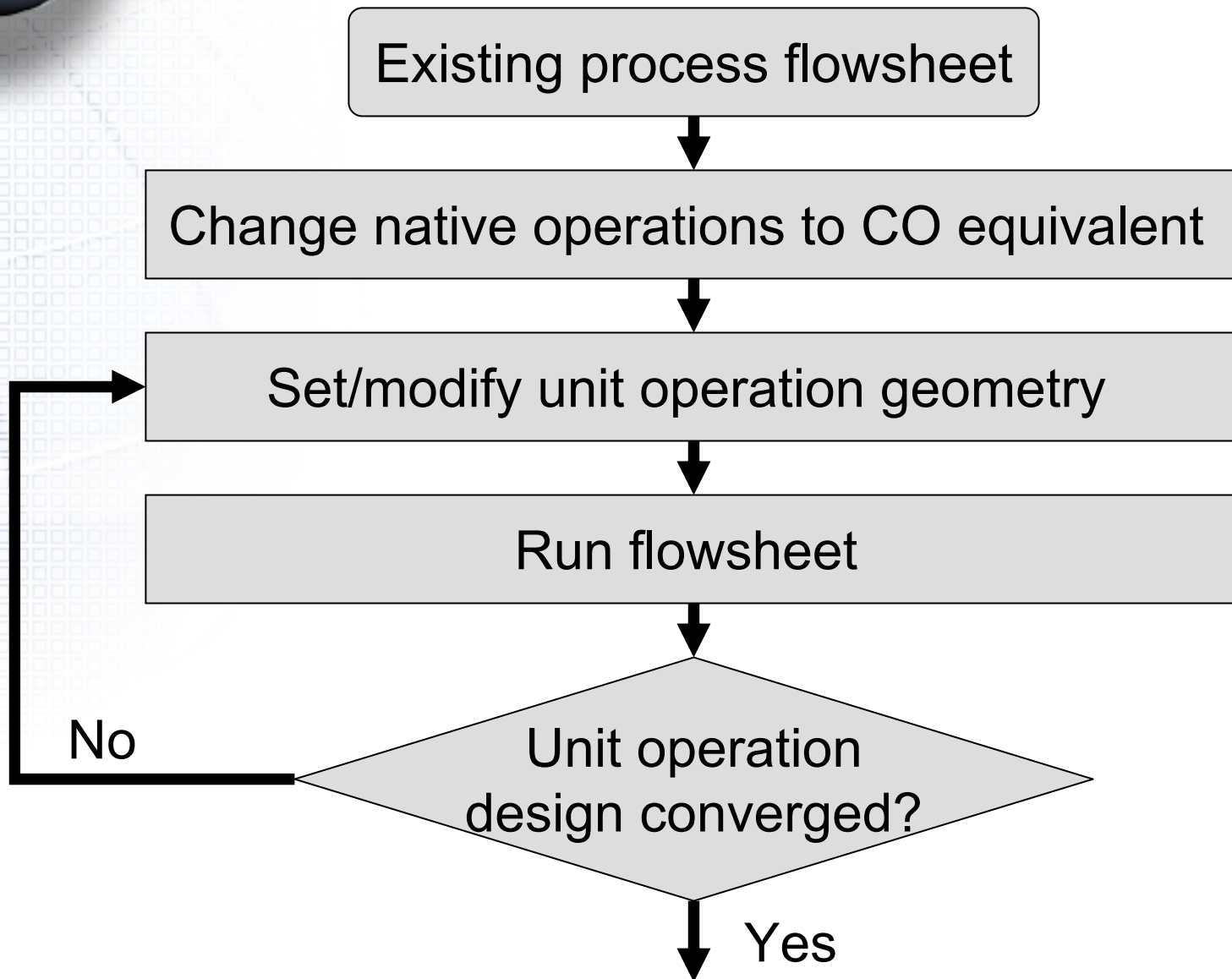


Sample Workflows

- Embedded design/rating
- Offline design/rating
- Process simulator as interface
- Standalone design/rating

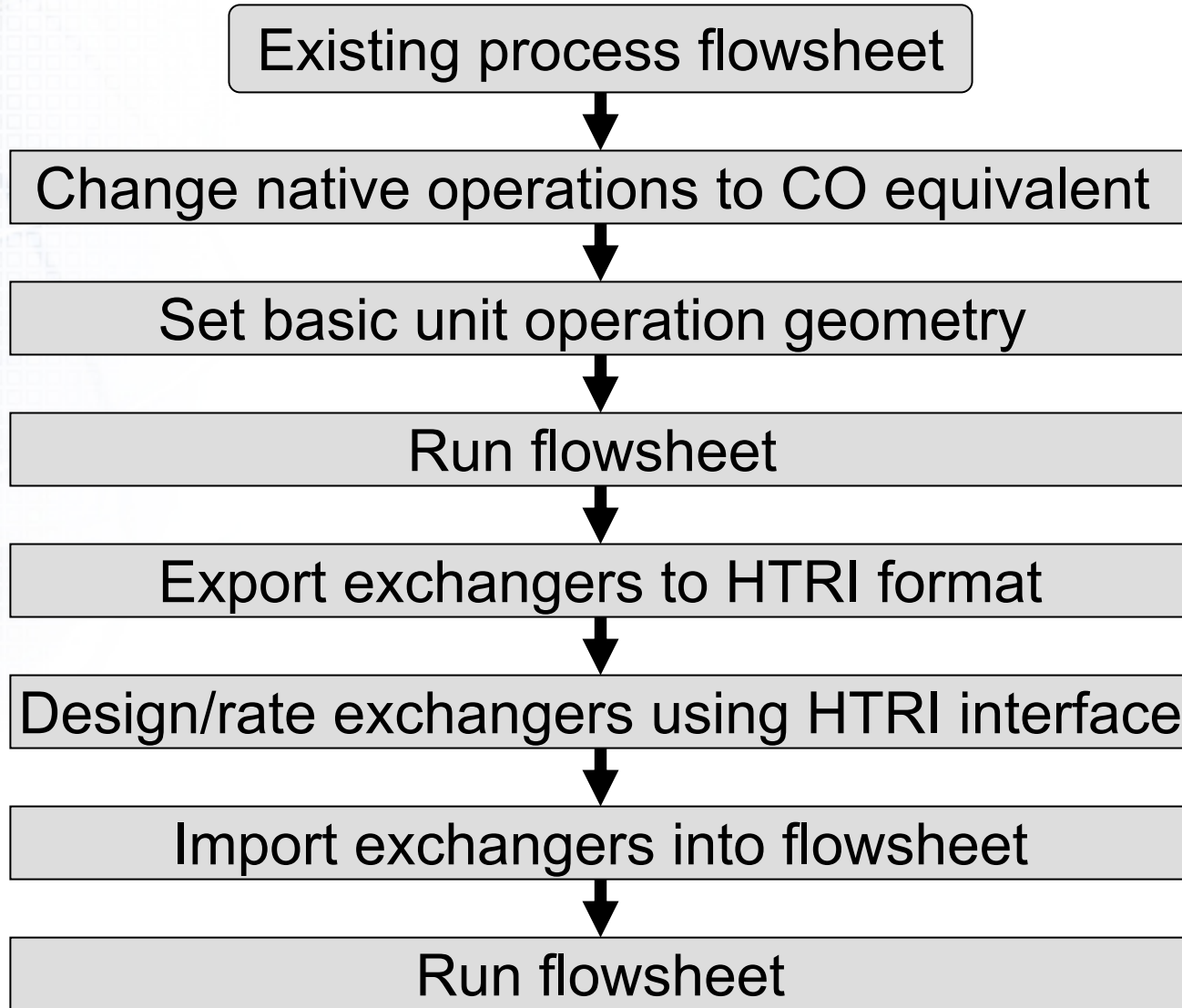


Embedded Design/Rating Usage Scenario 1





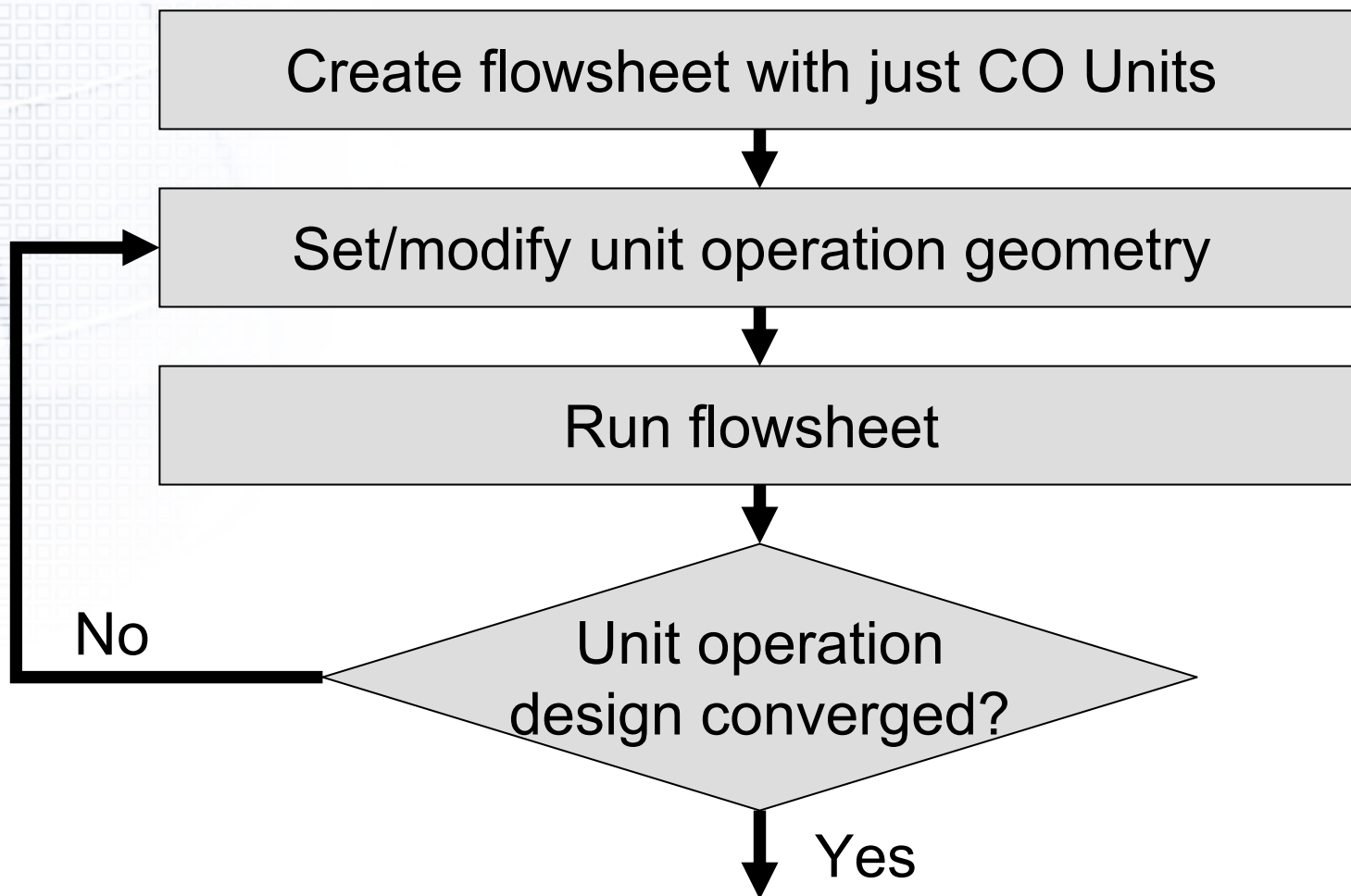
Offline Design/Rating Usage Scenario 2





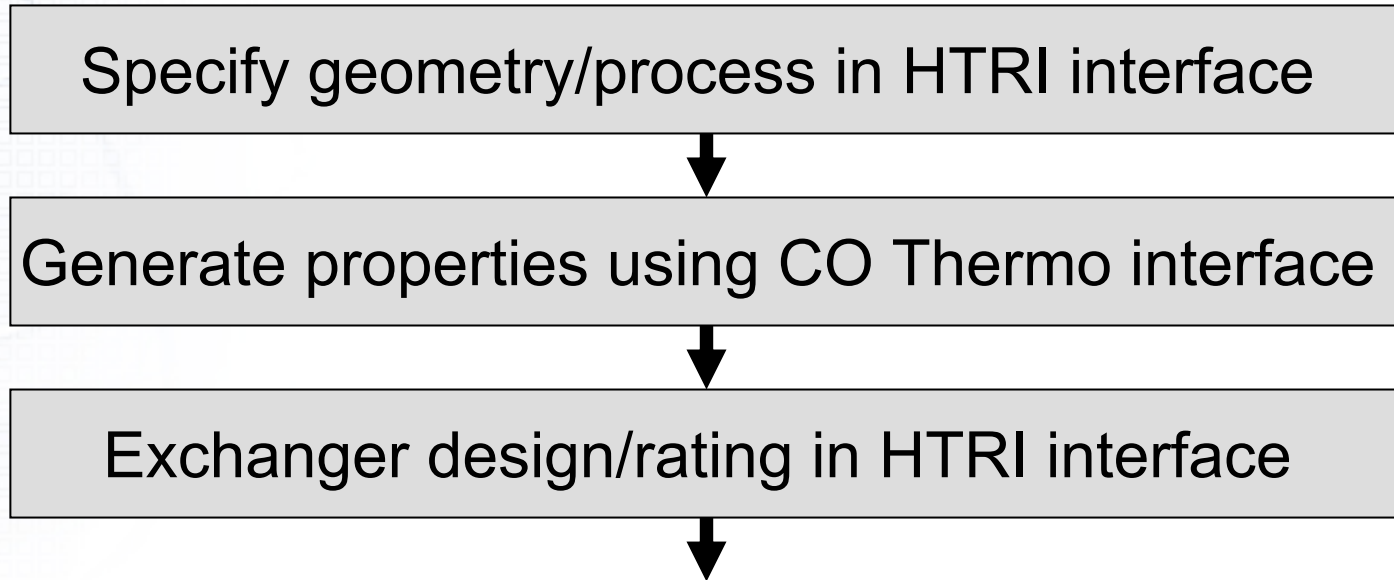
Process Simulator as Interface

Usage Scenario 3





Standalone Design/Rating Usage Scenario 4





Benefits/Tradeoffs

- Simultaneous process simulation and unit operation rating
- Rigorous unit operation models
- Transparent transfer of property/process information
- Need to know both interfaces
- Reports
 - No single integrated report
 - Full unit operation reports
- Runtimes
 - Increased flowsheet runtimes
 - Faster overall (no iteration required)



Future Work

- Native unit emulation
 - Debottlenecking/troubleshooting
- Run rigorous model from converged flowsheet
 - New designs