

# Overview of AspenTech's CAPE-OPEN Support

*Andrew McGough  
Michael Halloran*

*May 2005*





# Outline

- **AspenTech History with CAPE-OPEN**
- **aspenONE CAPE-OPEN Interfaces Available Today**
- **Demonstrations**
- **Future Developments**



# History Overview

- **Leading contributor to both EU-funded CAPE-OPEN projects:**
  - **CAPE-OPEN: Jan-1997 to Jun-1999**
  - **Global-CAPE-OPEN (GCO): Jul-1999 to Dec-2001**
- **Aspen Plus 10.2 and Aspen Properties 10.2 both with CAPE-OPEN version 0.93 support released in December 1999**
- **AES 12.1 with support for CAPE-OPEN version 1.0 Unit and Thermo interfaces released in November 2002**
- **aspenONE 2004 with improved support for CAPE-OPEN version 1.0 Unit and Thermo interfaces released in November 2004**
- **Record of continuous improvement to CAPE-OPEN features driven by customer feedback and interoperability testing**



# AspenTech and Co-LaN

- Officially joined as an associate member in May 2003
- Active participant in:
  - Thermo SIG
    - e.g. added prototype support for solid streams in Aspen Plus 12.1 and 2004 for SolidSim interoperability
  - Interoperability SIG
    - e.g. developed concept and prototype of a runtime logging and testing tool to help diagnose interoperability problems
- Reviewer for Unit SIG
- AspenTech is a Co-LaN approved consultant providing advice on achieving interoperability to 3<sup>rd</sup> parties sponsored by Co-LaN members
  - 5 interoperability projects undertaken to date
- Provide the Standard's type library build and installation kit to Co-LaN for distribution to all vendors



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# aspenONE is AspenTech's Approach for Helping Process Manufacturers Realize the Value of EOM



**ONE Vision**

**ONE Approach**

**ONE System**

*The aspenONE™ approach enables you to deliver on your strategic initiatives more quickly by using models to help you gain control of operations.*





# AspenTech's Open Simulation Environment Sits at the Core of aspenONE



- Open environment for modeling plant operations & business decision making
- Integrated model execution environment with common asset representation
- Simultaneous access to simulation, economic evaluation and financial analysis tools
- Support for offline and online model deployment
- Support of third-party models

***“If you can’t model your process, you don’t understand it.  
If you don’t understand it, you can’t improve it.  
And, if you can’t improve it, you won’t be competitive in the 21st century.”***

-- Jim Trainham, Former CTO Invista



# aspenONE Supports Key Industry Standards

**CO-LaN**

**CAPE-OPEN**

**ISA S95**

**ISA S88**

**SCOR**

**Chem eStandards**



# aspenONE – **Aspen Plus 2004**

## CAPE-OPEN v1.0 Unit Interfaces Support

- **CAPE-OPEN Unit Operation Socket – sequential modular**
  - Allows any CAPE-OPEN Unit to be used in an Aspen Plus simulation
  - MixNSplit example implementing 1.0 interfaces with full source code is installed with Aspen Plus
  - Supports both 0.93 and 1.0 versions of the standard.
  - CAPE-OPEN Reporting interfaces are not supported
- **CAPE-OPEN Reactions Interfaces**
  - A partial implementation to allow Unit Operations to access Reaction schemes
- **Prototype implementations:**
  - Equation-Oriented Unit Operation Socket, which allows any equation-oriented CAPE-OPEN Unit to run in Aspen Plus EO mode. The Aspen Plus MixNSplit CAPE-OPEN example demonstrates EO support



# aspenONE – **Aspen Plus 2004/Aspen Properties 2004** **CAPE-OPEN v1.0 Thermo Interfaces Support**

- **CAPE-OPEN Thermodynamics Socket**
  - **Allows CAPE-OPEN Property Packages to be used to provide property calculations in Aspen Plus simulations.**
  - **CAPE-OPEN flash calculations (CalcEquilibrium method) will be supported from 2004 Update 2**
- **CAPE-OPEN Thermodynamics Plug**
  - **Use Aspen Plus to create CAPE-OPEN Property Packages based on Aspen Plus Compounds and Property Methods.**
- **Prototype implementations:**
  - **Access to streams comprising one MIXED and one CISOLID substream via CAPE-OPEN interfaces to support solids processing Unit Operations.**
- **Standard chemical component mixtures are supported**
- **Electrolytes, petroleum assays, are currently excluded.**
- **Polymers are not covered by the standard.**



# aspenONE – **HYSYS 2004**

## CAPE-OPEN v1.0 Unit Interfaces Support

- **CAPE-OPEN Unit Operation Socket – sequential modular**
  - **Allows any CAPE-OPEN Unit to be used in a HYSYS Simulation**
  - **Supports both 0.93 and 1.0 versions of the standard.**



# aspenONE – **COMThermo 2004** CAPE-OPEN v1.0 Interfaces Support

- **CAPE-OPEN Thermodynamics Socket - via COMThermo**
  - **Allows CAPE-OPEN Property Packages to be used to provide property calculations in HYSYS simulations**
- **CAPE-OPEN Thermodynamics Plug – via COMThermo**
  - **Use HYSYS (or any COMThermo client) to create CAPE-OPEN Property Packages based on COMThermo Compounds and Property Methods**
- **CAPE-OPEN is accessible in DISTIL via COMThermo**
- **HTFS uses COMThermo but does not expose CAPE-OPEN functionality**
- **Standard chemical component mixtures are supported**
- **Electrolytes, petroleum assays, solids are excluded**



## aspenONE **Aspen Plus 2004** – Compatibility Testing CAPE-OPEN v1.0 Interfaces Support

- **Unit Operation interoperability has been tested against:**
  - **FLUENT**
  - **PSE**
  - **CHEMSEP**
  - **HTRI**
  - **AixCAPE**
  - **Heritage Hyprotech**
- **Thermo interoperability tested against:**
  - **COMThermo – as provider of COMThermo packages to Aspen Plus**
  - **MULTIFLASH**
  - **Simulis**
  - **In-house packages**
  - **PSE – Aspen Packages used in gPROMS**



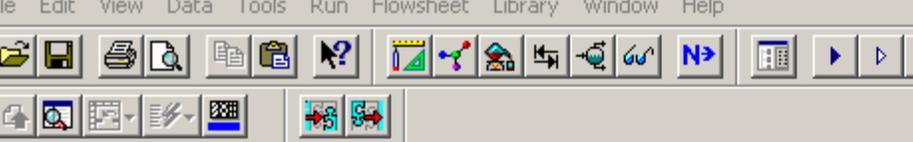
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  - **FLUENT**
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  - **CHEMSEP**
  - **HTRI**
  - **AixCAPE**
  - **Heritage AspenTech**
- **Thermo interoperability tested against:**
  - **Aspen Properties – as provider of Property Packages to HYSYS via COMThermo**
  - **MULTIFLASH**
  - **Simulis**
  - **In-house packages**



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aspenONE

Aspen Plus®  
Version 2004 (13.1.0.2961)  
Built: Oct 22 2004 17:22:05

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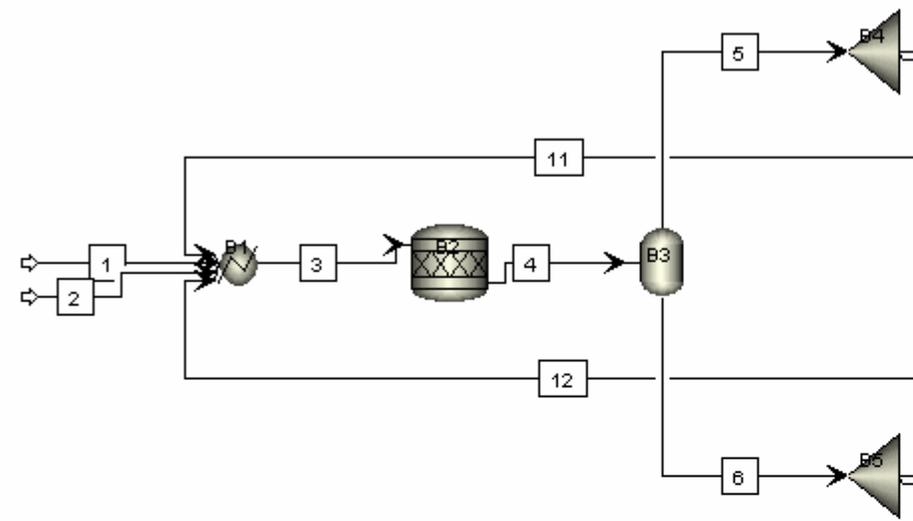
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OK



Process Flo...

<b>Mixers/Splitters</b>	Separators	Heat Exchangers	Columns	Reactors	Pressure Changers	Manipulators	Solids	User Models
Mixer	FSplit	SSplit						



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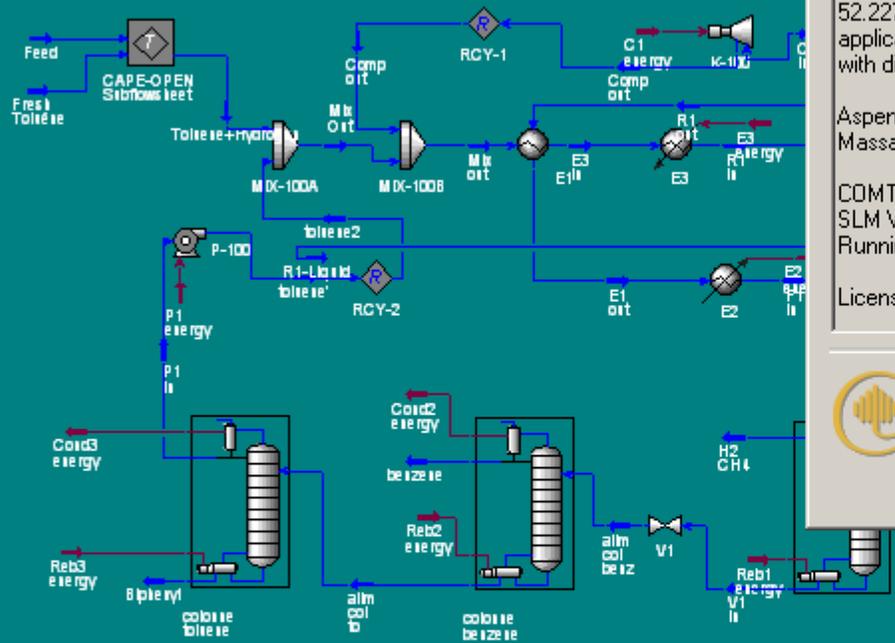
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COMThermo: 2004(13.1 Build 13.1.2)  
SLM Version: 2004.0.0.226 Release  
Running on: Windows NT 5.1

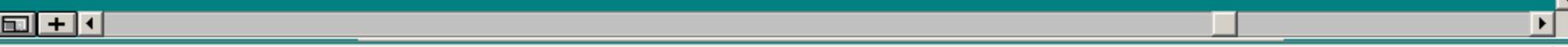
Licensed to: ASPENTECH



OK  
Licensing In



*Support are going to create an Aspen Plus Viewlet as soon as I can get a license for the software- should be today or tomorrow.*



FD 1

```
0.000005      Step Size: 1.0000
      Column Flowsheet colonne toluene      Converged
Recycle: RCY-1      Iteration      0
      Converged
Recycle: RCY-2      Iteration      0
      Converged
```





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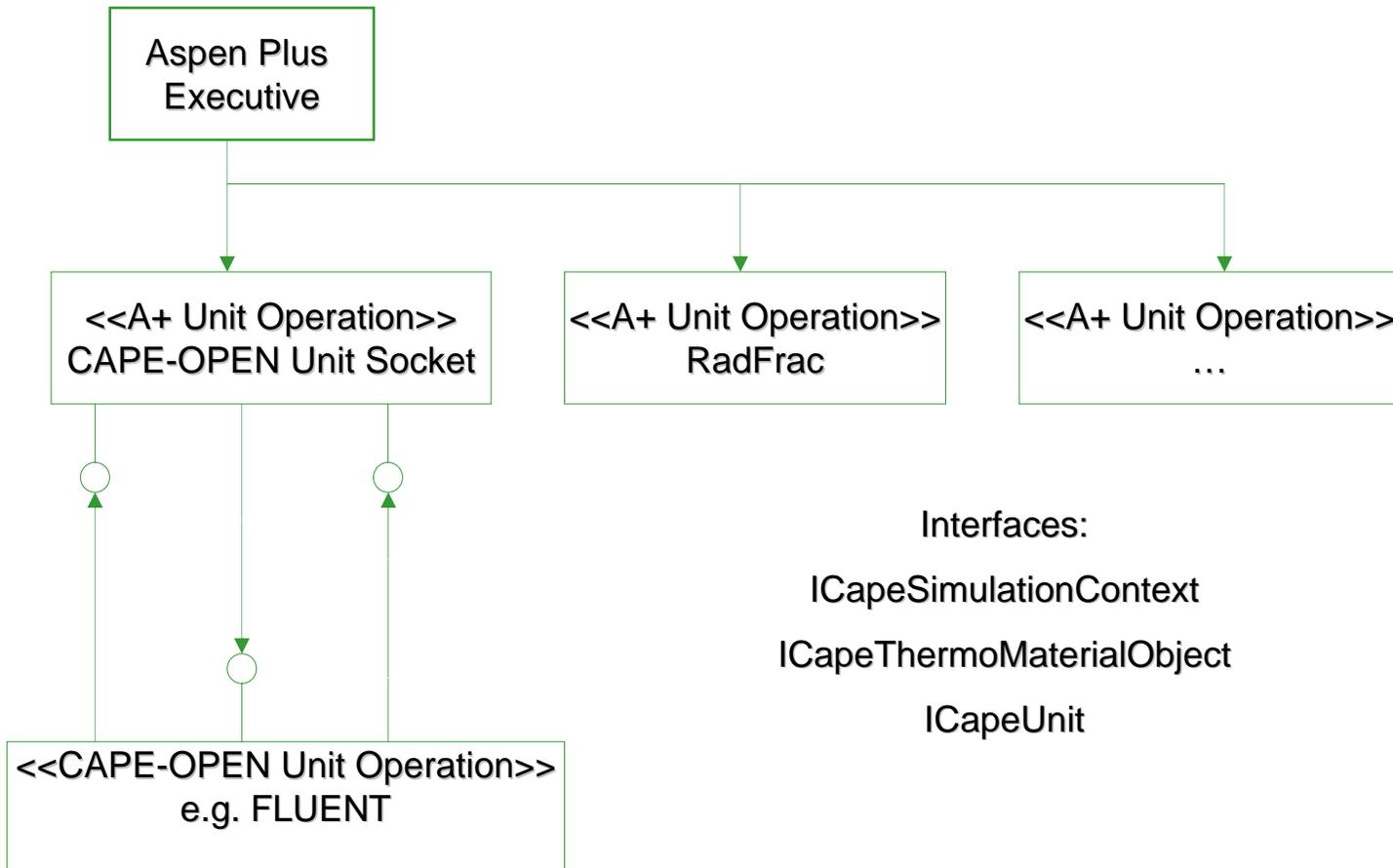
## aspenONE 2006 plans

- **Meet FTC settlement obligations:**
  - **Support for Thermo 1.1 in HYSYS/COMThermo for 2006 release**
    - **A significant task affecting thermo and Unit implementations**
  - **On-going fixes available via Cumulative Patches e.g. support for CalcEquilibrium call...**
- **CAPE-OPEN accessible in Aspen OSE through the simulators that are integrated with Aspen OSE – e.g. use a single CAPE-OPEN Property Package in a compound simulation**
- **CAPE-OPEN fully supported as an extension interface for customers and 3rd parties**



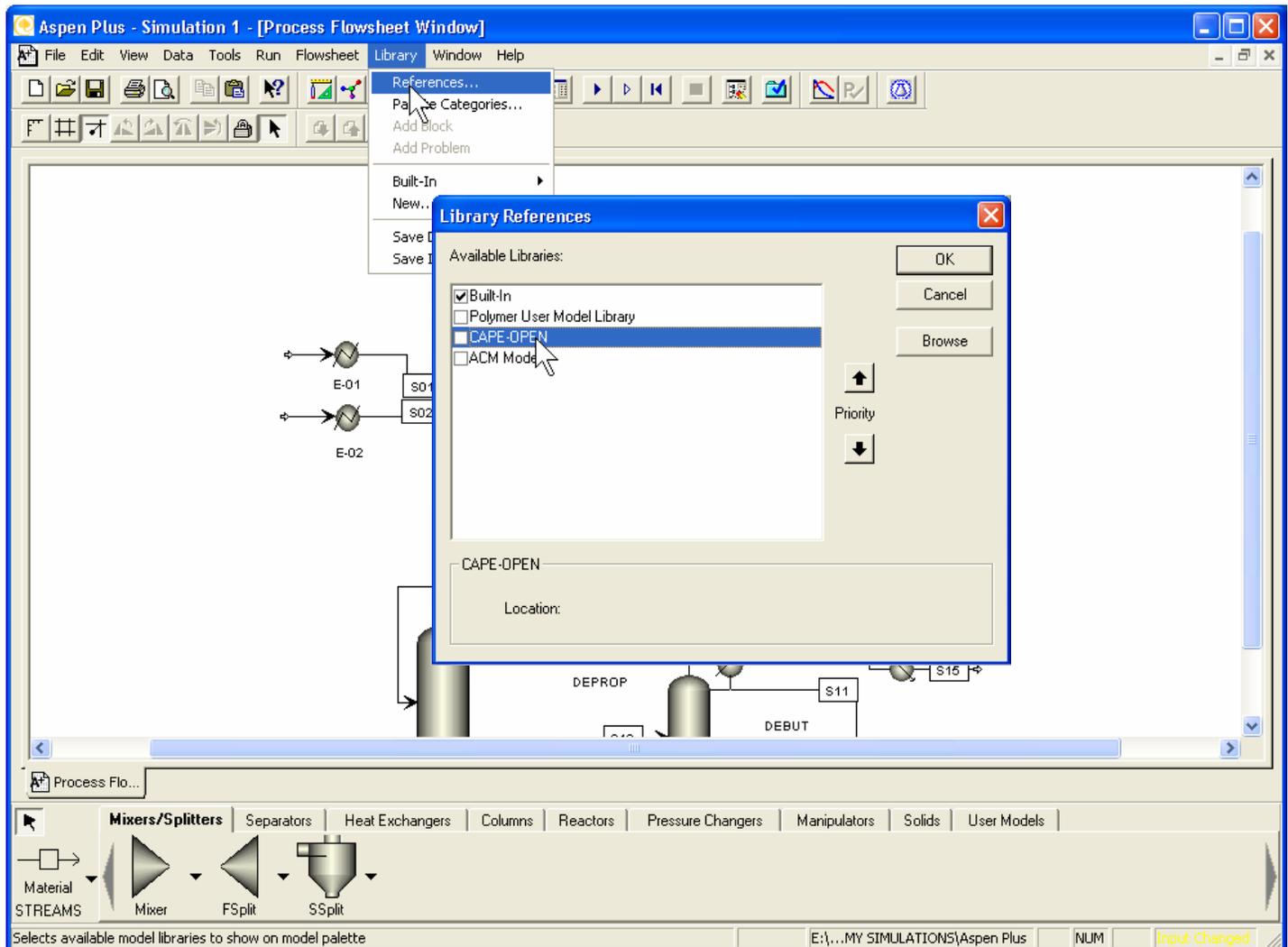


# CAPE-OPEN Architecture: Unit Operations in Aspen Plus





# Unit Interface in Aspen Plus



Aspen Plus - Simulation 1 - [Process Flowsheet Window]

File Edit View Data Tools Run Flowsheet Library Window Help

References...  
 Palette Categories...  
 Add Block  
 Add Problem

Built-In  
 New...  
 Save I...  
 Save I...

**Library References**

Available Libraries:

- Built-In
- Polymer User Model Library
- CAPE-OPEN
- ACM Model

Priority  
 ↑  
 ↓

OK  
 Cancel  
 Browse

CAPE-OPEN  
 Location:

Process Flo...

Mixers/Splitters Separators Heat Exchangers Columns Reactors Pressure Changers Manipulators Solids User Models

Material  
 STREAMS Mixer FSplit SSplit

Selects available model libraries to show on model palette

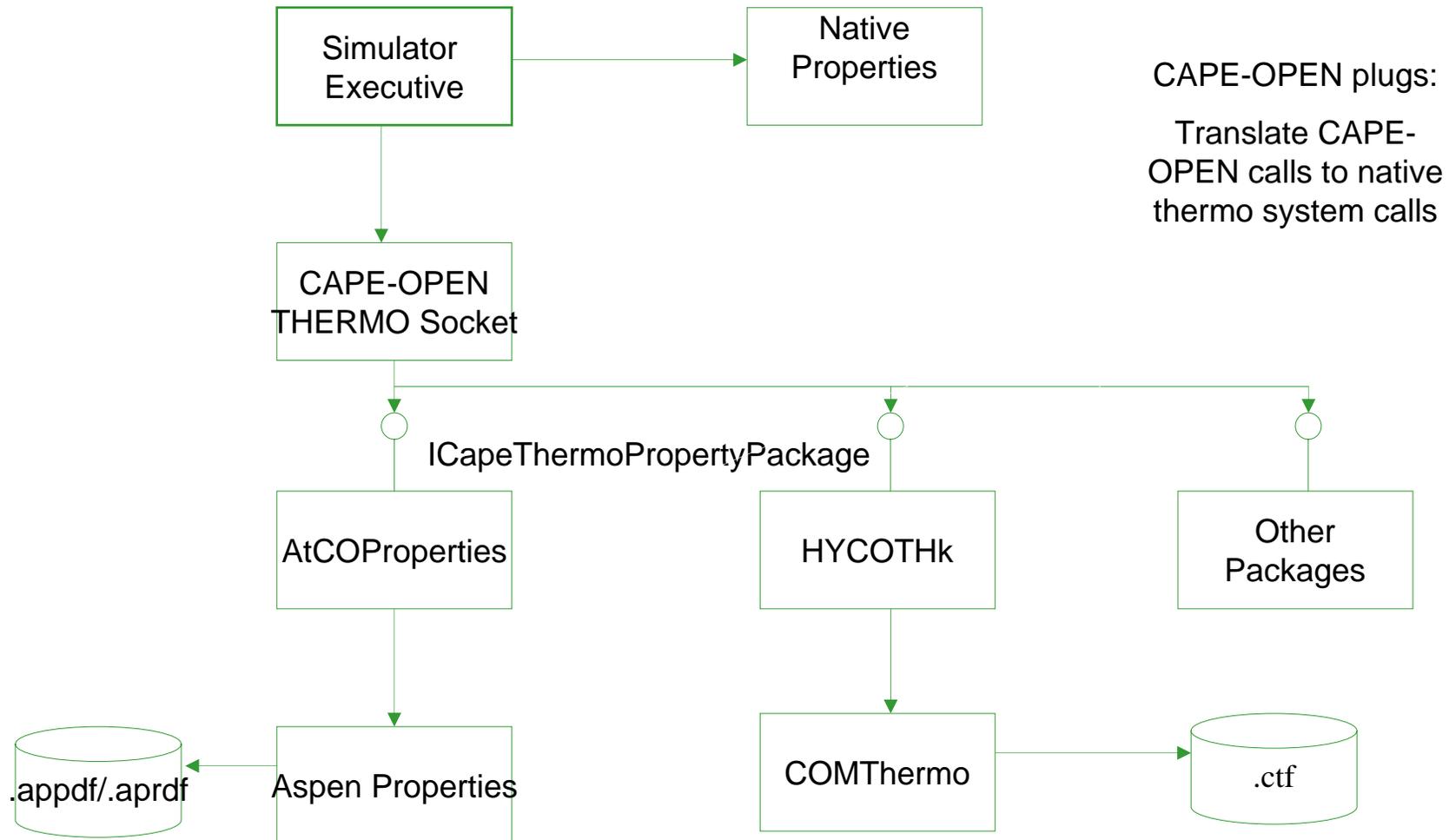
E:\...MY SIMULATIONS\Aspen Plus NUM Input Changed



# Unit Interface in Aspen Plus



# CAPE-OPEN Architecture: Thermo





# Thermo Interface in Aspen Properties

CAPE-OPEN toolbar:  
Import/Export Property Packages

The screenshot shows the Aspen Plus software interface. The main window is titled "Aspen Plus - Simulation 1 - [Properties Specifications - Data Browser]". The menu bar includes File, Edit, View, Data, Tools, Run, Plot, Library, Window, and Help. The toolbar contains various icons, with two icons (one with a plus sign and one with a minus sign) circled in red, corresponding to the text in the callout box. Below the toolbar, the "Specifications" section is active, showing "Global" as the selected tab. The "Property methods & models" section includes dropdowns for "Process type" (set to ALL), "Base method" (set to SRK), and "Henry components". There are also checkboxes for "Use true-components" and "Modify properties".

An "Available Property Packages" dialog box is open in the foreground. It has a tree view on the left showing "Property Packages" with sub-items: "Aspen.PropSystem.12.1" (expanded), "Aspen Properties" (selected), "Default", "Hogas", "Simple", and "Standalone Property Packages". On the right, the "Name" is "Aspen Properties", the "Description" is "AspenTech CAPE-OPEN Thermo System", and the "Vendor" is "http://www.aspentech.com". There are also fields for "CAPE-OPEN version" (1.0.0), "Component version", and "Component help" (Help).

At the bottom of the main window, the status bar shows "Input Complete" and "Process Flo... Properties S...". The system tray at the very bottom includes the text "©2005 AspenTech. All Rights Reserved. For Help, press F1" on the left, and "E:\...MY SIMULATIONS\Aspen Plus NUM Required Input Incomplete" on the right.