ASPEN PLUS

Introduction to Aspen Plus Interface

What is Aspen Plus?

- Computer package/software provided by **AspenTech**
- **ASPEN: A**dvanced **S**ystem for **P**rocess **EN**gineering
- Market leading Chemical process optimization software
- Iconic flowsheet simulator to predict process behavior using basic engineering relationships

Aspen Plus in fields of Chemical Engineering:

Powerful tool that can be used in

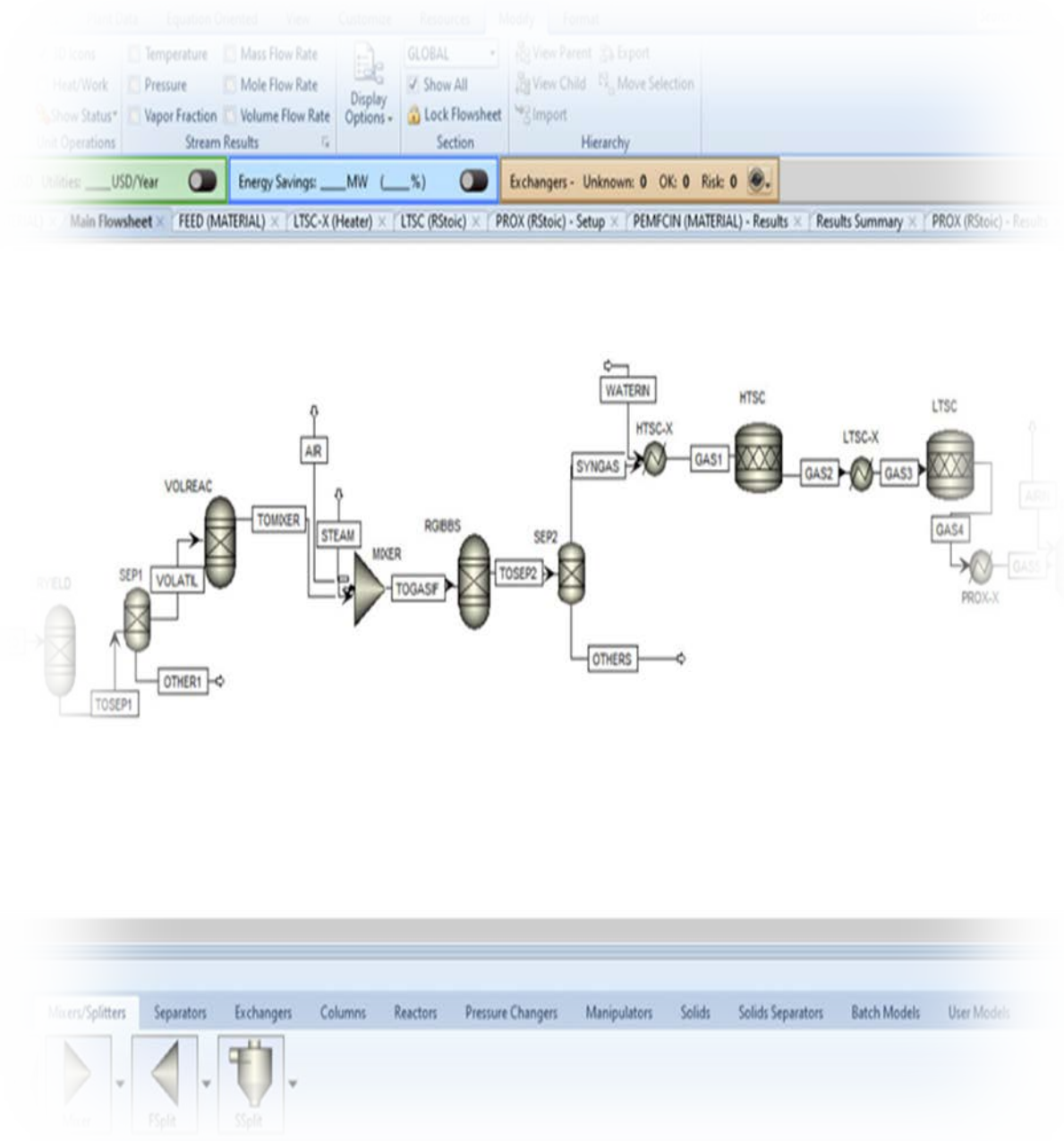
- Oil and gas production
- Refining
- Chemical Processing
- Environmental studies etc,.

Why Process Modelling/Simulation?

- Industrial process are often not solved by hand because of
  - Human error
  - Time constraints
- Using Process simulations:
  - Makes process easier and Faster
  - Multiple and simultaneous simulations

Aspen Plus flowsheet simulation enables us to run many tasks, such as :

- conduct “what if” tests;
- design specification (plant configuration) checks;
- carry out “de-bottlenecking of constricting parts of a process” studies;
- perform sensitivity analyses;
- run optimization investigations.



Translate a process into an Aspen Plus process simulation model

1. **Specify the chemical components in the process.** We can fetch these components from Aspen Plus databanks, or we can introduce them to Aspen Plus platform.
2. **Specify thermodynamic models to represent the physical properties of the components and mixtures in the process.** These models are built into Aspen Plus.
3. **Define the process flowsheet**:

• Define the unit operations in the process.

• Define the process streams that flow into and out of the unit operations.

• Select models from Aspen Plus Model Library to describe each unit operation or chemical synthesis and place them onto the process flowsheet.

• Label each unit operation model (i.e., block) as part of the process flowsheet and connect the blocks via process streams.

4. Specify the component flow rates and the thermodynamic conditions (temperature, pressure, and composition) of all feed streams.

5. Specify the operating conditions for the unit operation models (i.e., blocks).

Launch ASPEN PLUS

Knowing the interface

- Product updates Training, Examples and Resources
- New and Open icons, Template windows
- Quick Access Toolbar and Ribbons
- Navigation Pane and Environments: Properties, Simulation, Safety Analysis, Energy Analysis
- Status Bar, Zoom Bar
- Help icon

This Symbol	On a(n)	Means
	Input form or sheet	Required input complete, or visited and no data required *
	Input form or sheet	Required input incomplete
	Input form	No data entered
	Mixed form	Input and results
	Results form	No results present (calculations have not been run)
	Results form	Results available without Errors or Warnings (OK) **
	Results form or flowsheet	Results available with Warnings **
	Results form or flowsheet	Results available with Errors **
	Results form	Results inconsistent with current input (input changed)
	Input folder	No data entered
	Input folder	Required input incomplete
	Input folder	Required input complete, or visited and no data required *
	Results folder	No results present
	Results folder	Results available – OK **
	Results folder	Results available with Warnings **
	Results folder	Results available with Errors **
	Results folder	Results inconsistent with current input (input changed)
	Folder or form	Object deactivated

Databanks for Component Selection

- A **component can be either picked up from one of Aspen Plus built-in component databanks**, or **can be defined by the user** and in the latter case it is considered as a non-databank member.
- The database is provided under an agreement with the **N**ational **I**nstitute of **S**tandards and **T**echnology's (**NIST**) **S**tandard **R**eference **D**ata **P**rogram (**SRDP**).
- The property parameters and the experimental data used were collected and evaluated by the **T**hermodynamics **R**esearch **C**enter (**TRC**) using the NIST **T**hermo**D**ata **E**ngine (**TDE**) and the NIST-TRC source data archival system for experimental thermophysical and thermochemical property data.
- ***The "NIST-TRC" source data is one of the world's most comprehensive collections of such data.***

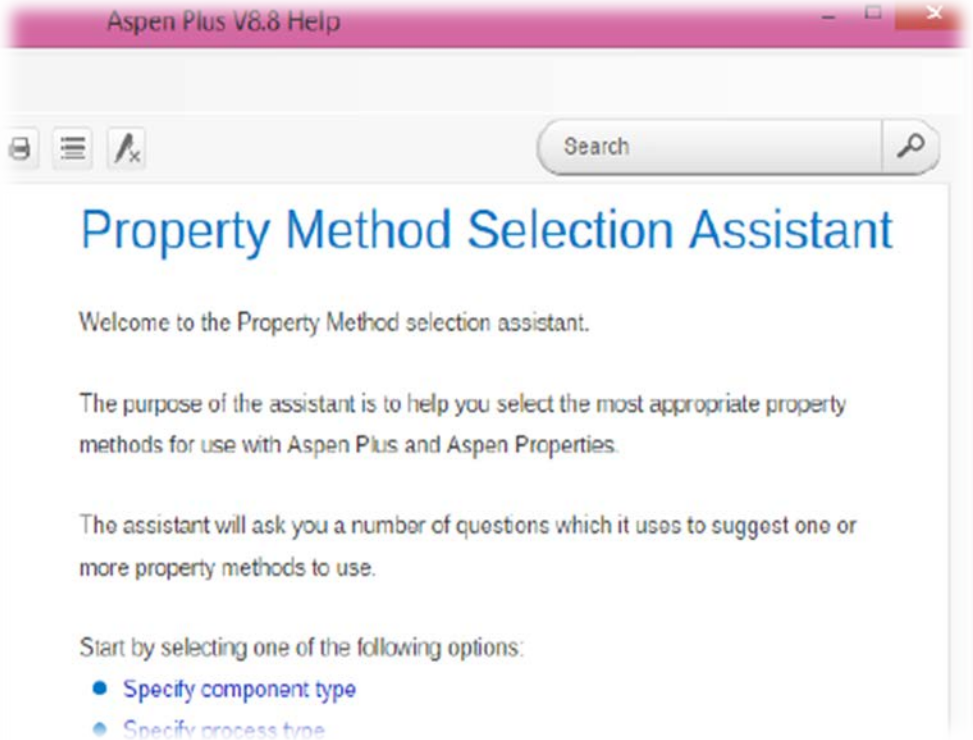
Try it yourself:
Add the following components from the databank - water, acetone, methane

Property Method

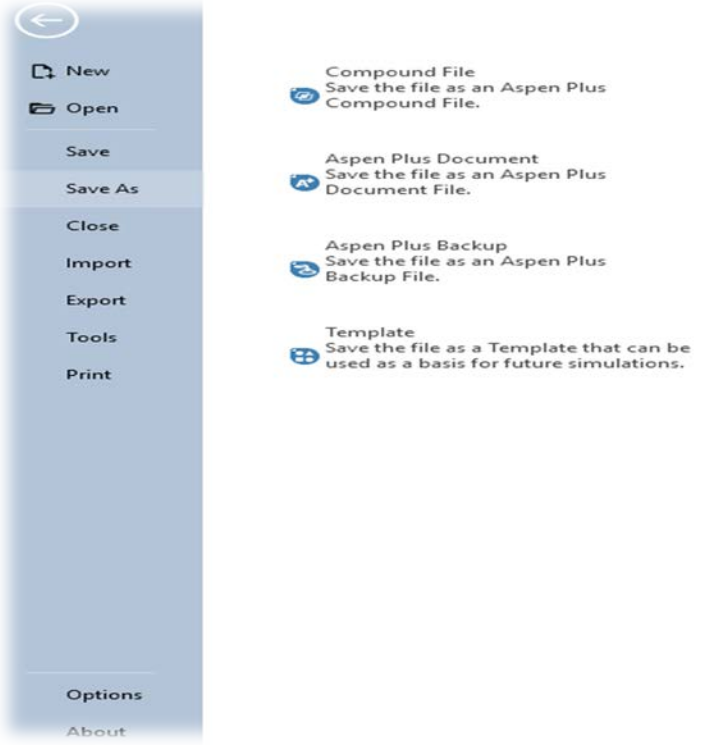
- A property method is a set of models used to calculate thermodynamic, kinetic, and transport properties.
- Aspen Plus provides what is called the property method selection assistant (or wizard) that can be reached via clicking on the “Methods Assistant…” button found in **“Methods” | “Specifications” | “Global”** tab window.

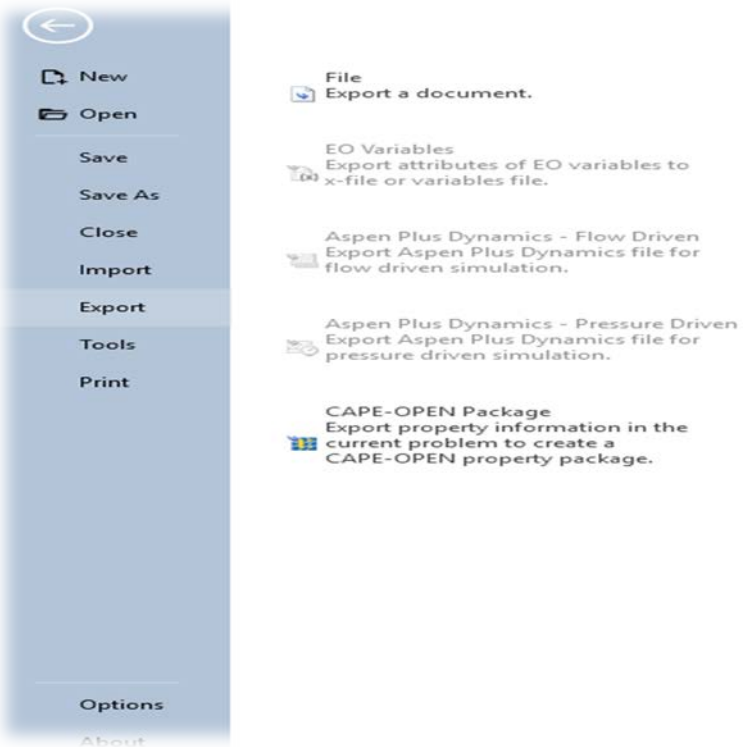
Property Models in Apsen Plus:

- ❖ Equations of State
- ❖ Activity Coefficient Models (non-ideal systems at low pressures)
  - NRTL (Non-Random-Two-Liquid)
  - UNIFAC (Universal Functional Activity Coefficient)
  - UNIQUAC (Universal Quasichemical Activity Coefficient)
  - Wilson
  - Van Laar



Saving Aspen Plus Simulations





File formats: .bkp, .rep, .aprbkp, .aprrep

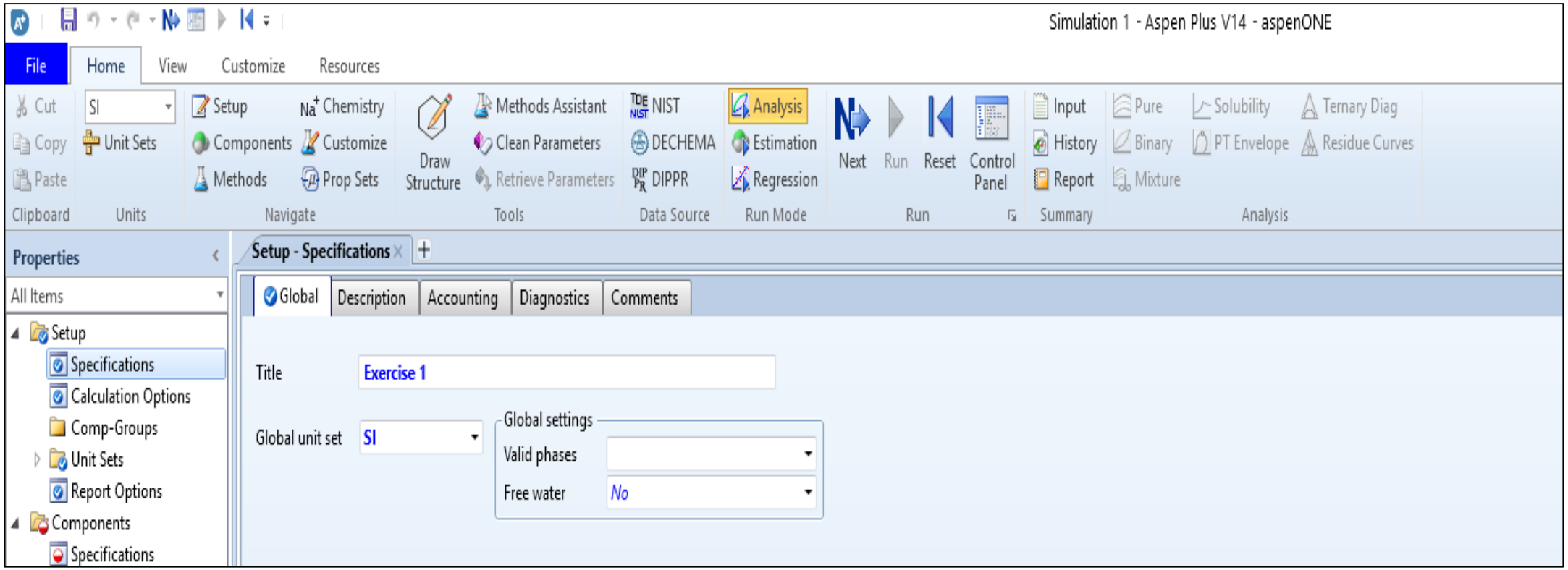
Practice Exercises

Exercise 1: Component Property Analysis

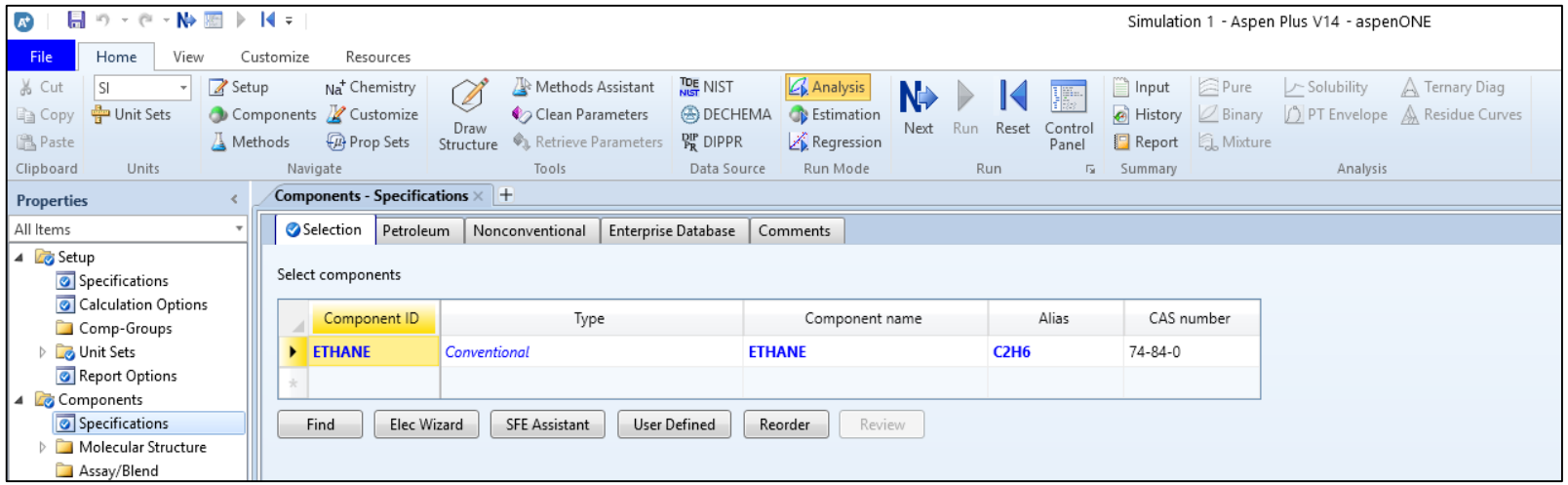
Determine the vapour pressure of ethane at 25°C using Aspen Plus properties database.

Solution:

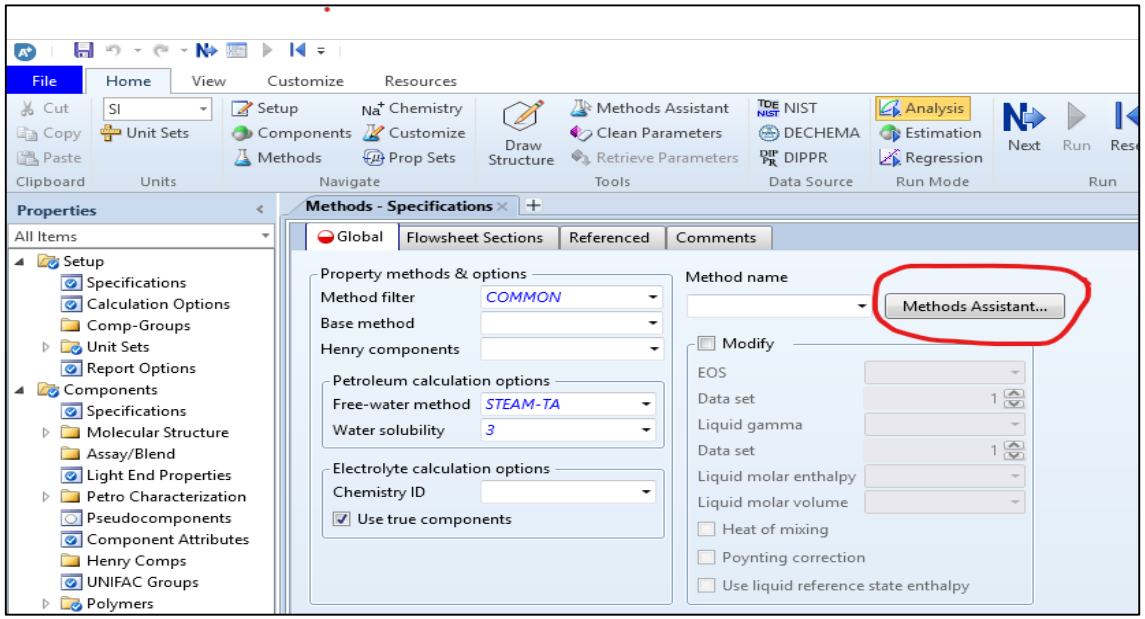
1. First, open up a New Simulation on the Aspen Plus Interface and put a suitable title and description. Set the **Global Unit Set** as **SI** and **Free Water Method** as **No**.



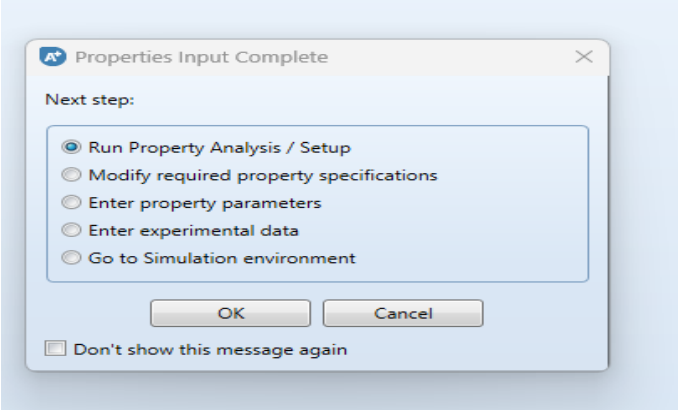
2. Click **Next** on the Home Ribbon and you will be directed to component selection. Choose ETHANE as your component from the databank using **FIND** option.



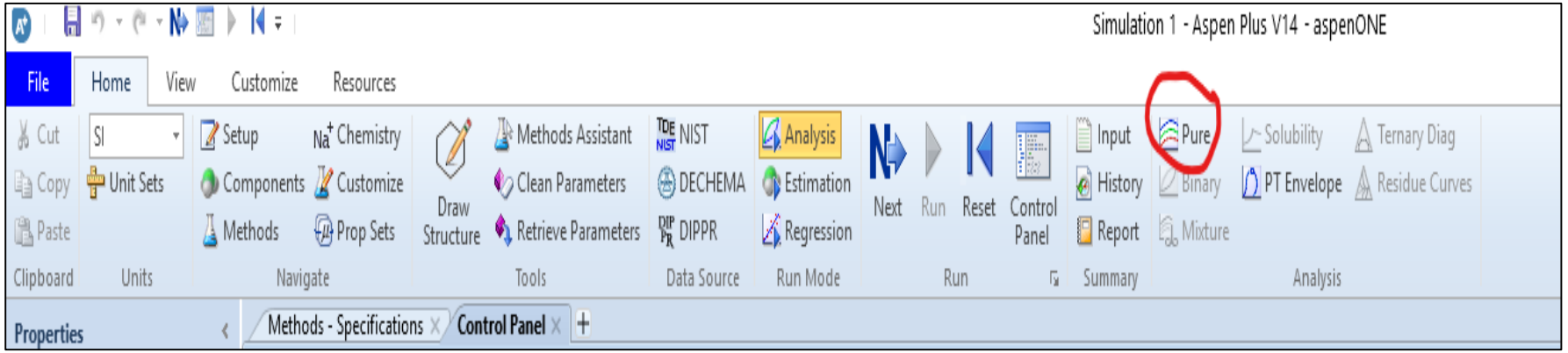
3. Click **Next** again and move to the **Method→ Specifications** tab. Use **Method Assistant** to choose a suitable method by selecting *Specify Component Type* followed by *Chemical System* component type.



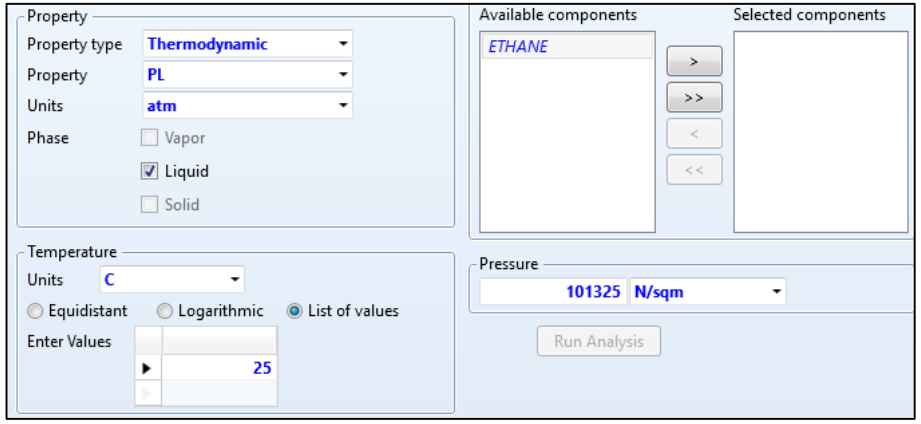
4. Click **Next** after selecting a property method. Check the Status Bar at the bottom left corner for the message **Required Properties Input Complete**. A dialog box appears on the screen with the radio button checked for **Run Property Analysis/Setup**. Click **OK**. The control panel will open up showing no error logs. If error logs persist, repeat the previous steps afresh.



5. Now, on the Home Ribbon's **Analysis** pane click on **Pure**. Since you are dealing with a single component, this is the appropriate Analysis option.



6. The Pure Analysis input interface opens up with your chosen property method. On the **Property** section, select **Property Type** from the dropdown menu as **PL.** This option corresponds to liquid vapor pressure. You may explore the other options on the dropdown menu for knowledge. Choose the suitable unit for the result.
On the **Temperature** section, choose the required temperature value with correct units as stated in the question. On the **Components** section, select Ethane from the *Available Components* list and move it to the *Selected Components* list using the arrows.



7. On successful input, the **Run Analysis** button gets activated. Click on it. A plot of Vapor pressure vs. Temperature opens up with a marker on the query point. Report this value.

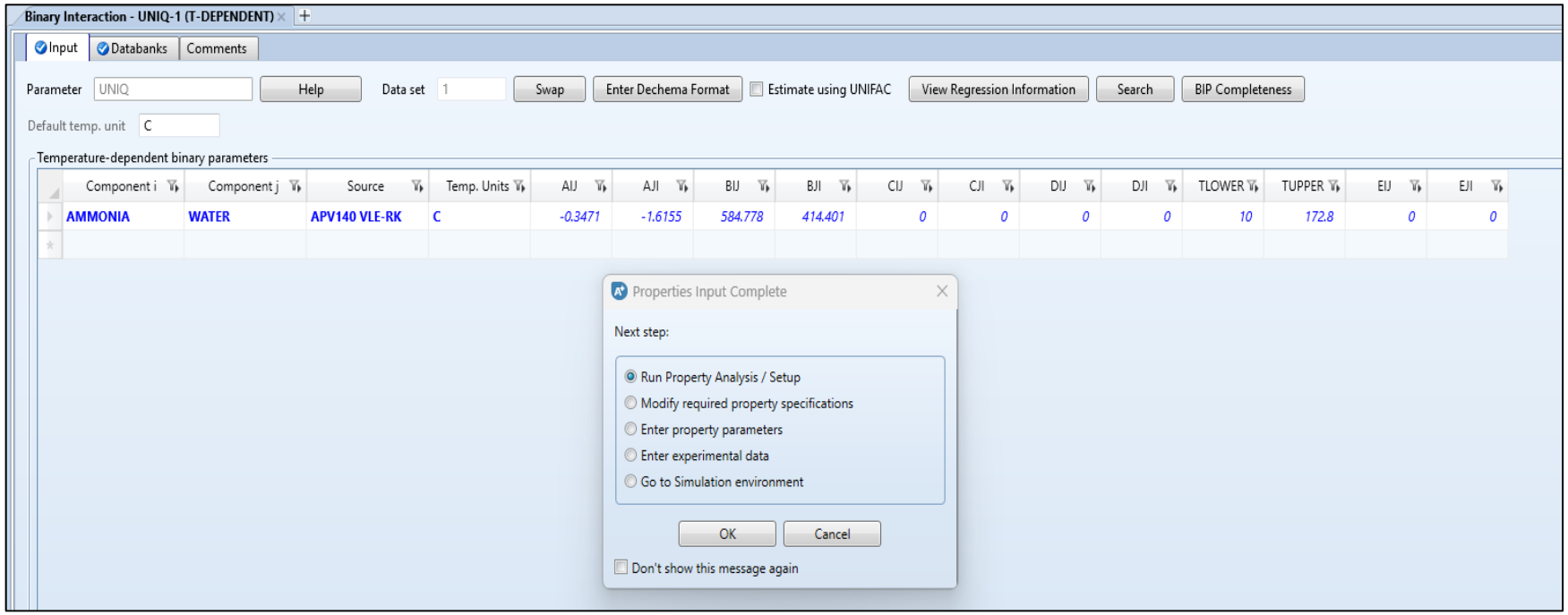
8. You can save your entire simulation as a .bkp or .aprbkp file and generate a report of your analysis by exporting the simulation as .aprrep file. These options are available from the File Menu.

Exercise 2: Component Property Analysis

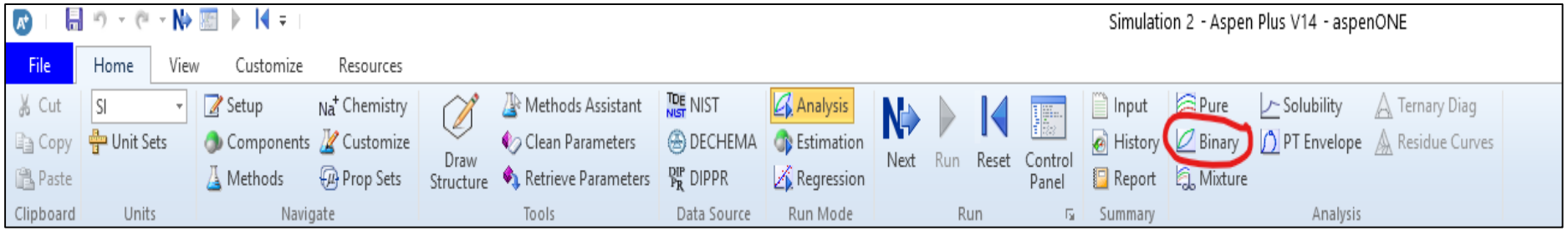
Generate the T-xy diagram for ammonia-water binary system and determine their separation mode. Save the relevant file, appropriately. *Use Property Method: UNIQ-RK*

Solution:

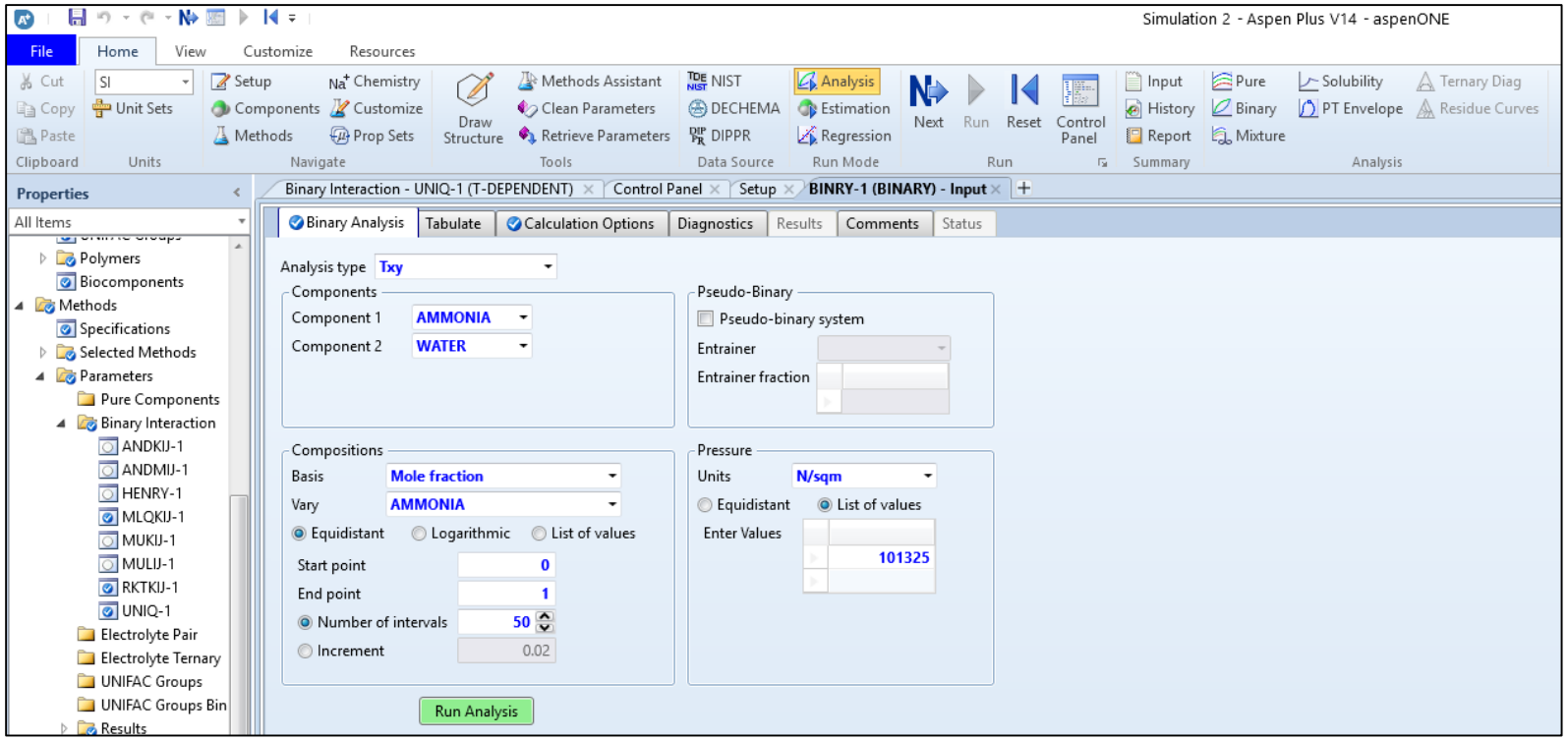
1. Like Exercise 1, open up a New Simulation on the Aspen Plus Interface and put a suitable title and description. Set the **Global Unit Set** as **SI** and **Free Water Method** as **No**.
2. Click **Next** on the Home Ribbon and choose AMMONIA and WATER as your components from the databank using **FIND** option.
3. Select the property method as mentioned in question. Click **Next**, and a Binary Interaction window opens up. Click **Next** again and **Run Property Analysis/Setup**. The *Control Panel* opens up without error logs, after this.



4. Click on **Binary** tab of the **Analysis** Section in the Home Ribbon



5. Choose Analysis type as **Txy** on the Binary Input Interface. Vary the mole fraction of Ammonia from 0 to 1 with the 50 equidistant plot points. Click **Run Analysis** when the input is complete. The Txy plot will be generated. You may explore other plots like y-x for the Binary Analysis. Save the simulation and report files appropriately as taught in Exercise 1.



Continue to Tutorial 1 of Aspen Plus