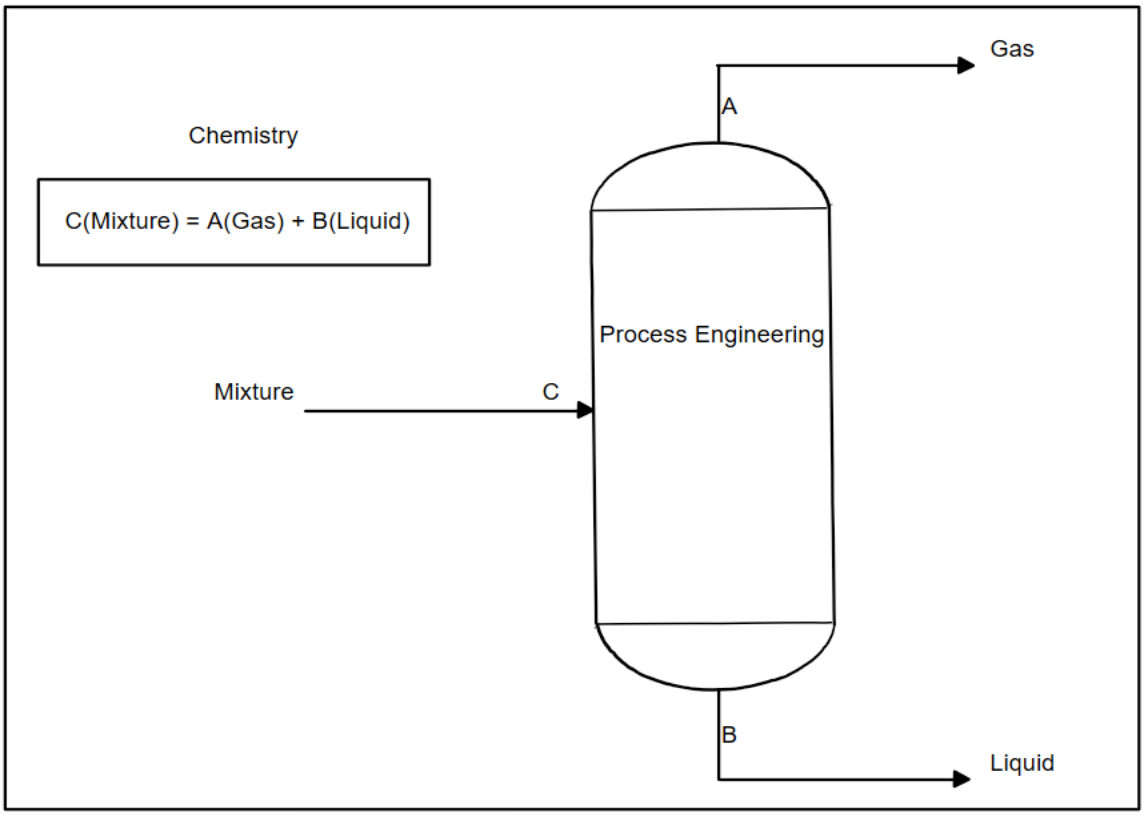
Separators Simulation

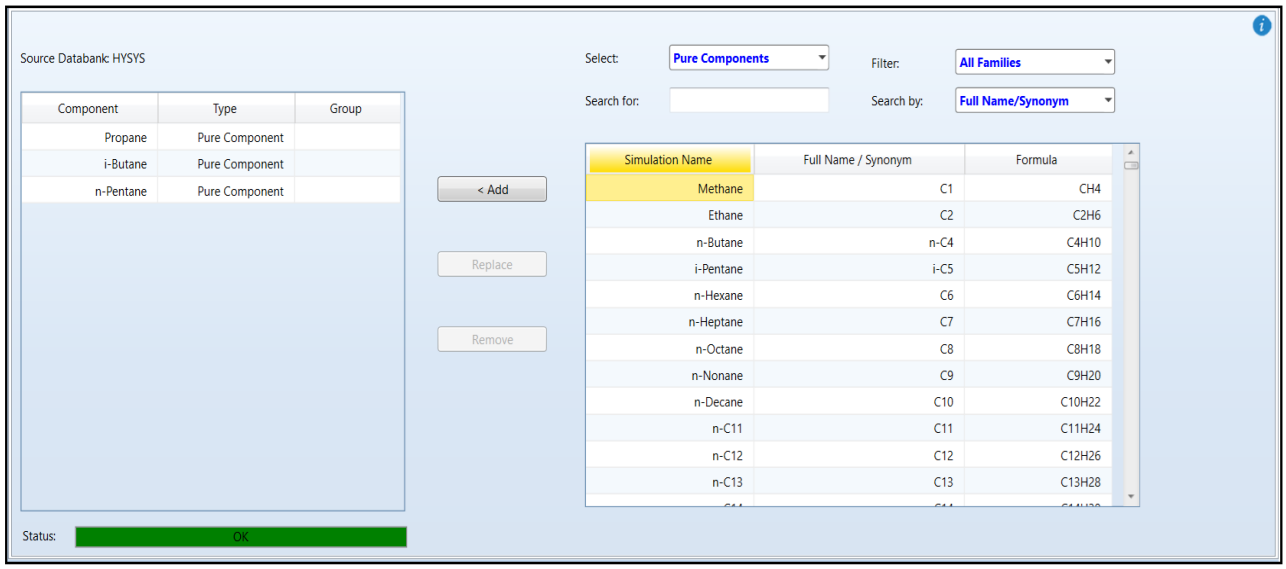
Example: Determine components' fraction in both liquid and gaseous phases for a mixture containing 15% propane, 35% iso-butane, 50% n-pentane. The percentages are molar fraction. The operating pressure is 150 kPa and the operating temperature is 25C.

Solution: In order to solve the problem, we are supposed to perform the tedious long flash calculation. Aspen Hysys can solve the problem in a minute. That is the reason we use software like Aspen Plus or Hysys.

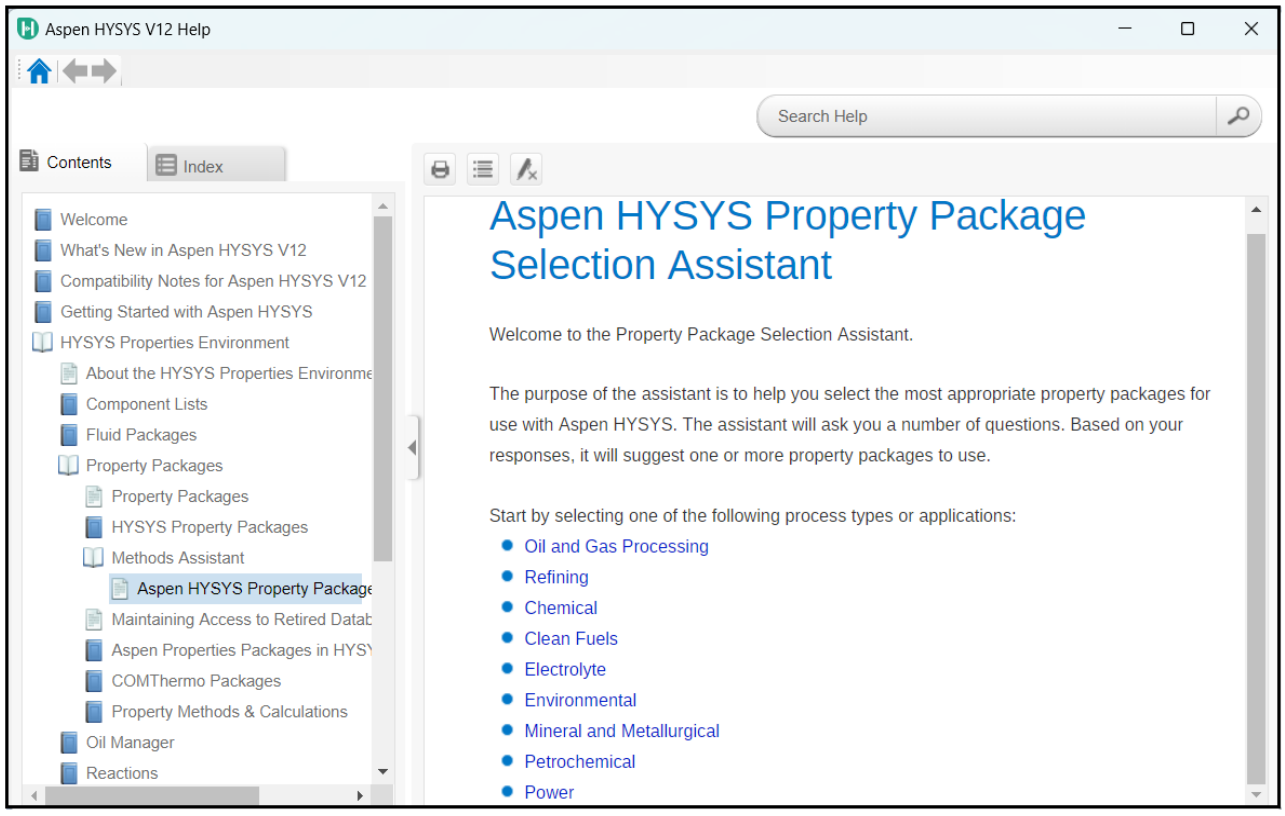
We assume that we have a mixture with aforementioned operating conditions which is introduced to a separator. The function of the separator is to separate the gaseous phase/stream from liquid phase/stream. Aspen Hysys can easily simulate the separator and provide us with both stream thermodynamic and physical properties result. Isn't it what we want?

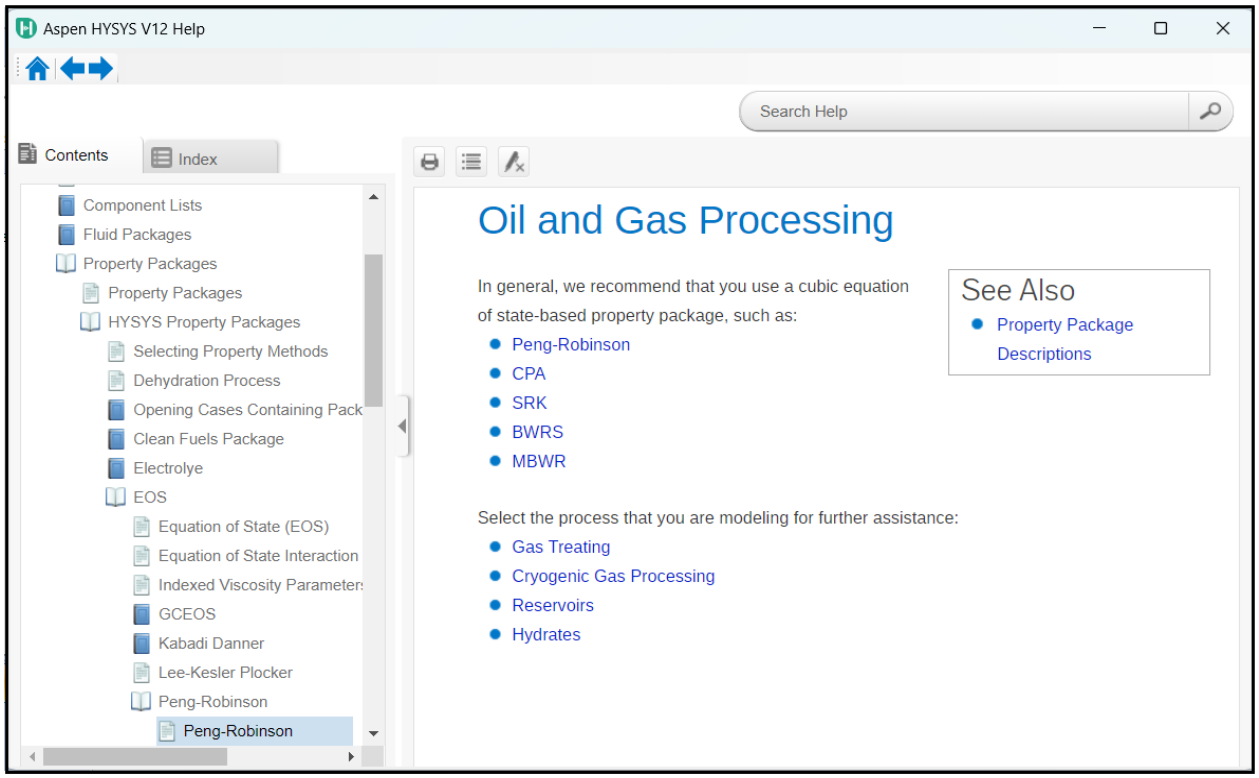


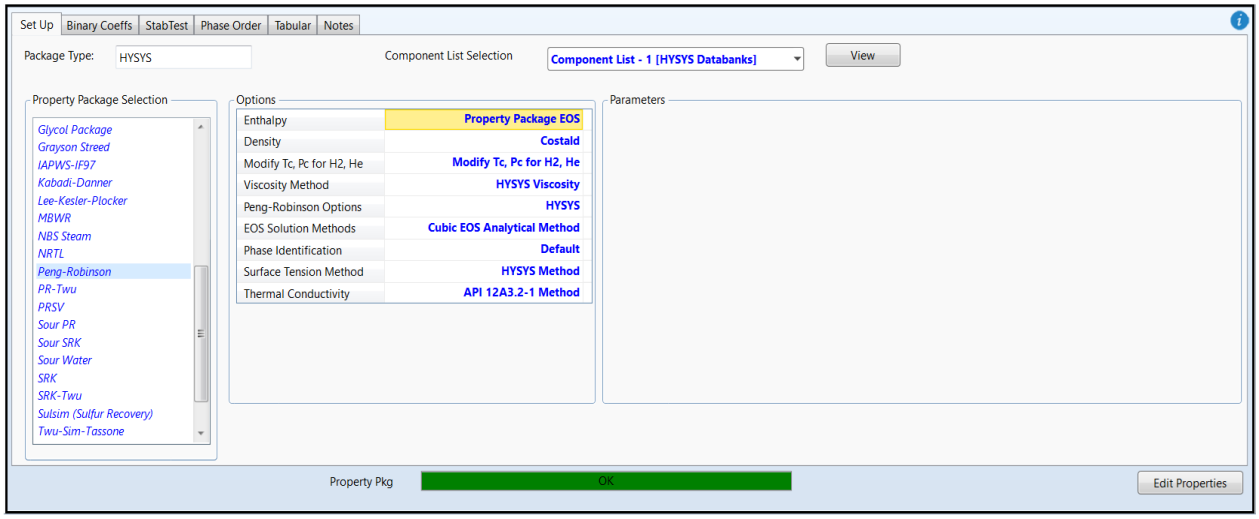
1.Define the components



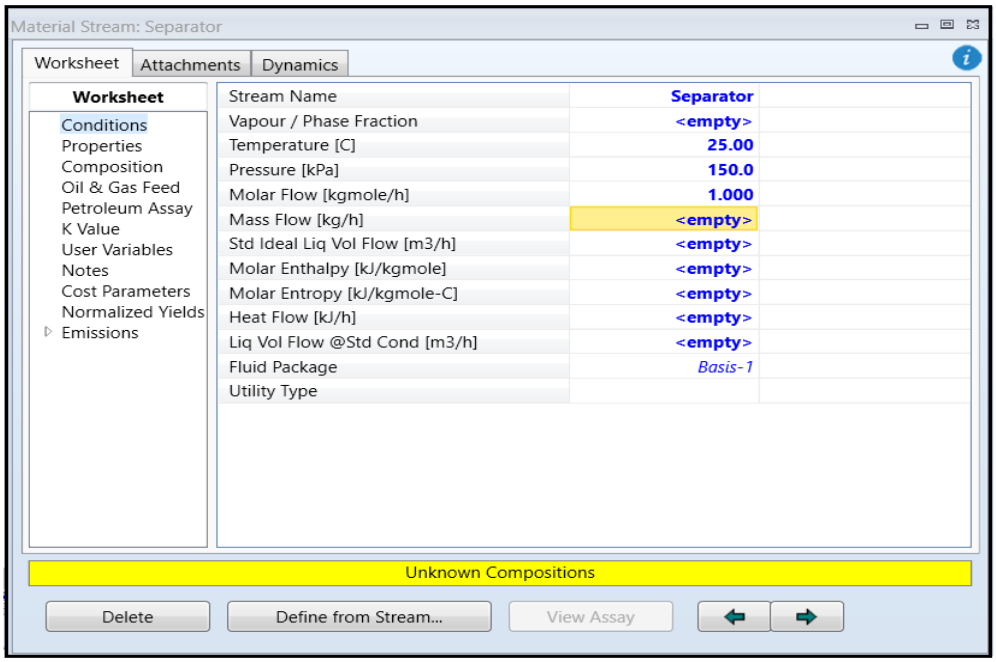
2.For fluid package selection, this time we will use Methods Assistance under Home.



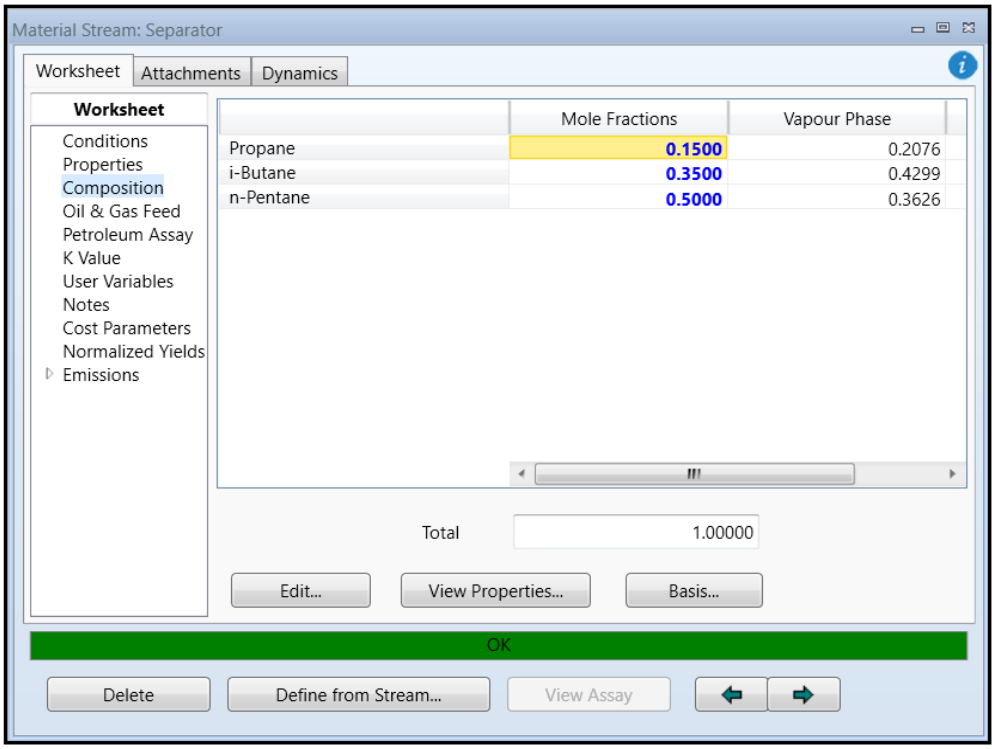

Aspen HYSYS V12 Help
Search Help
Contents
Index
Component Lists
Fluid Packages
Property Packages
Property Packages
HYSYS Property Packages
Selecting Property Methods
Dehydration Process
Opening Cases Containing Pack
Clean Fuels Package
Electrolye
EOS
Equation of State (EOS)
Equation of State Interaction
Indexed Viscosity Parameter
GCEOS
Kabadi Danner
Lee-Kesler Plocker
Peng-Robinson
Peng-Robinson
Oil and Gas Processing
In general, we recommend that you use a cubic equation of state-based property package, such as:
Peng-Robinson
CPA
SRK
BWRS
MBWR
See Also
Property Package Descriptions
Select the process that you are modeling for further assistance:
Gas Treating
Cryogenic Gas Processing
Reservoirs
Hydrates


Set Up
Binary Coeffs
StabTest
Phase Order
Tabular
Notes
Package Type:
HYSYS
Component List Selection
Component List - 1 [HYSYS Databanks]
View
Property Package Selection
Glycol Package
Grayson Streed
IAPWS-IF97
Kabadi-Danner
Lee-Kesler-Plocker
MBWR
NBS Steam
NRTL
Peng-Robinson
PR-Twu
PRSV
Sour PR
Sour SRK
Sour Water
SRK
SRK-Twu
Sulsim (Sulfur Recovery)
Twu-Sim-Tassone
Options
Enthalpy
Property Package EOS
Density
Costald
Modify Tc, Pc for H2, He
Modify Tc, Pc for H2, He
Viscosity Method
HYSYS Viscosity
Peng-Robinson Options
HYSYS
EOS Solution Methods
Cubic EOS Analytical Method
Phase Identification
Default
Surface Tension Method
HYSYS Method
Thermal Conductivity
API 12A3.2-1 Method
Parameters
Property Pkg
OK
Edit Properties

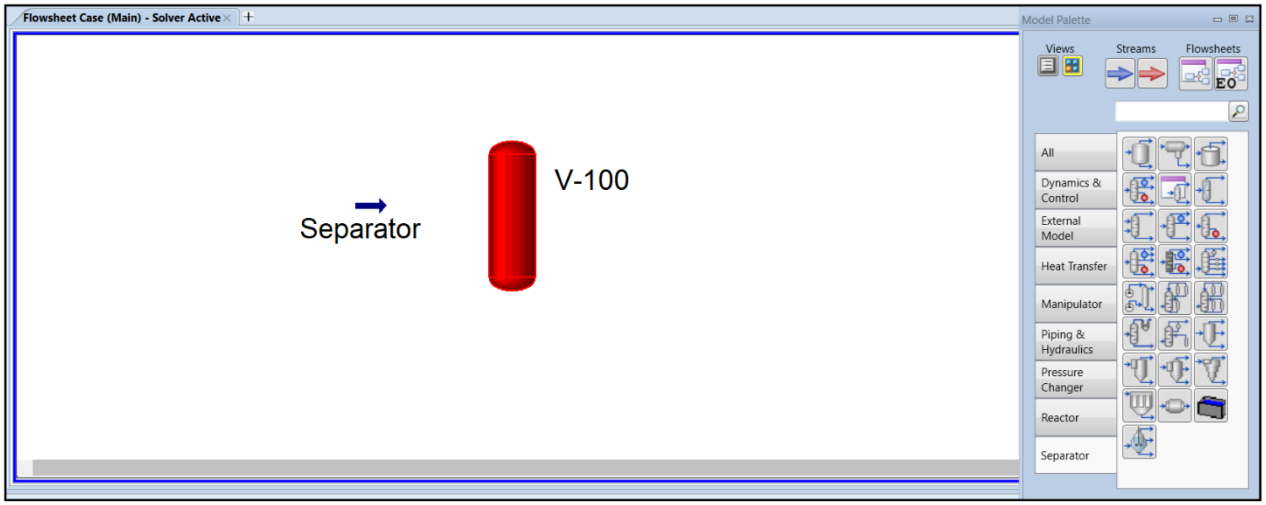
4.Enter Simulation Environment and define a mixture with mentioned operating conditions. Notice since the flowrate is not mentioned, the flowrate is set to 1 kmole/hr.



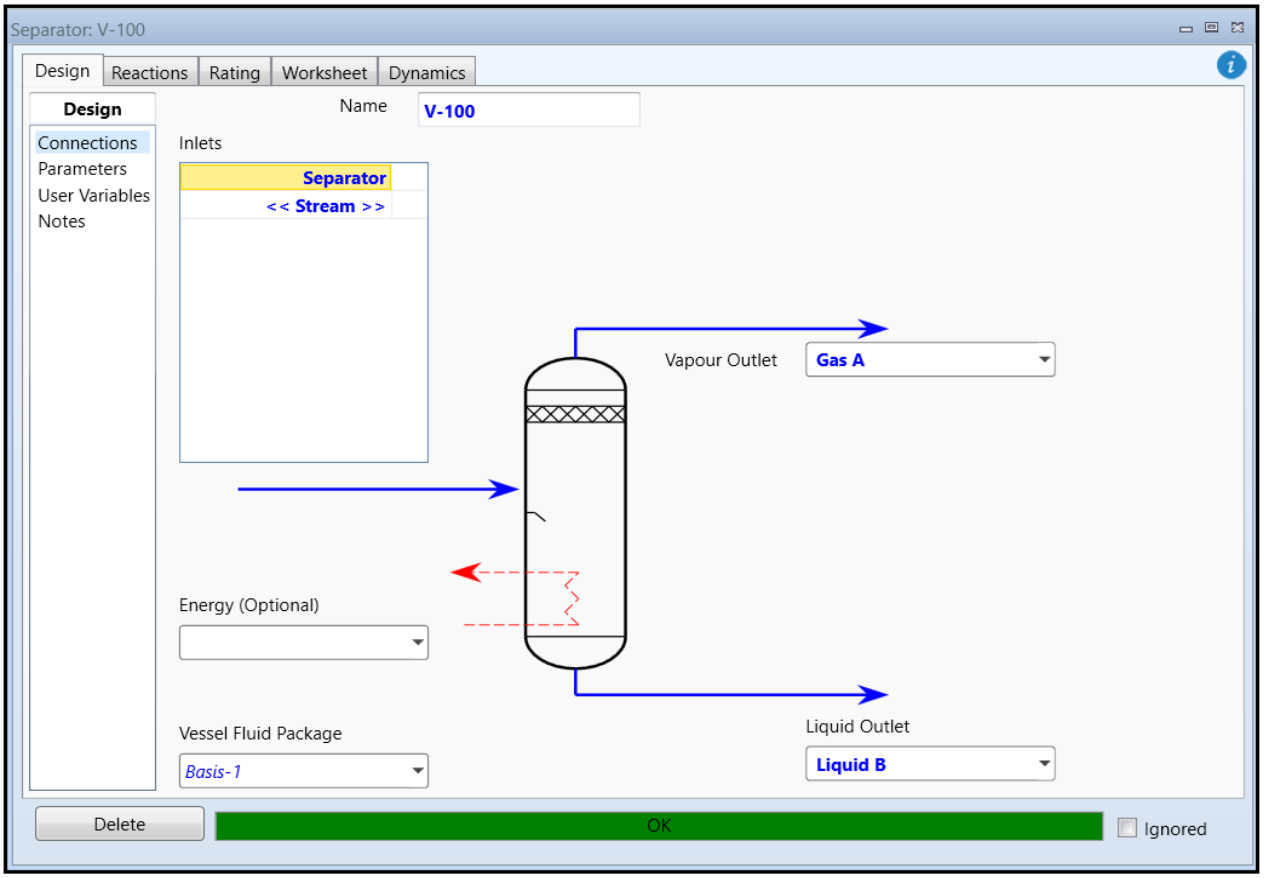
5. Now enter the composition. Click Composition/Edit and provide the composition.



6.From the Model Pallete, select separators and click on first icon which is two-phase separator.

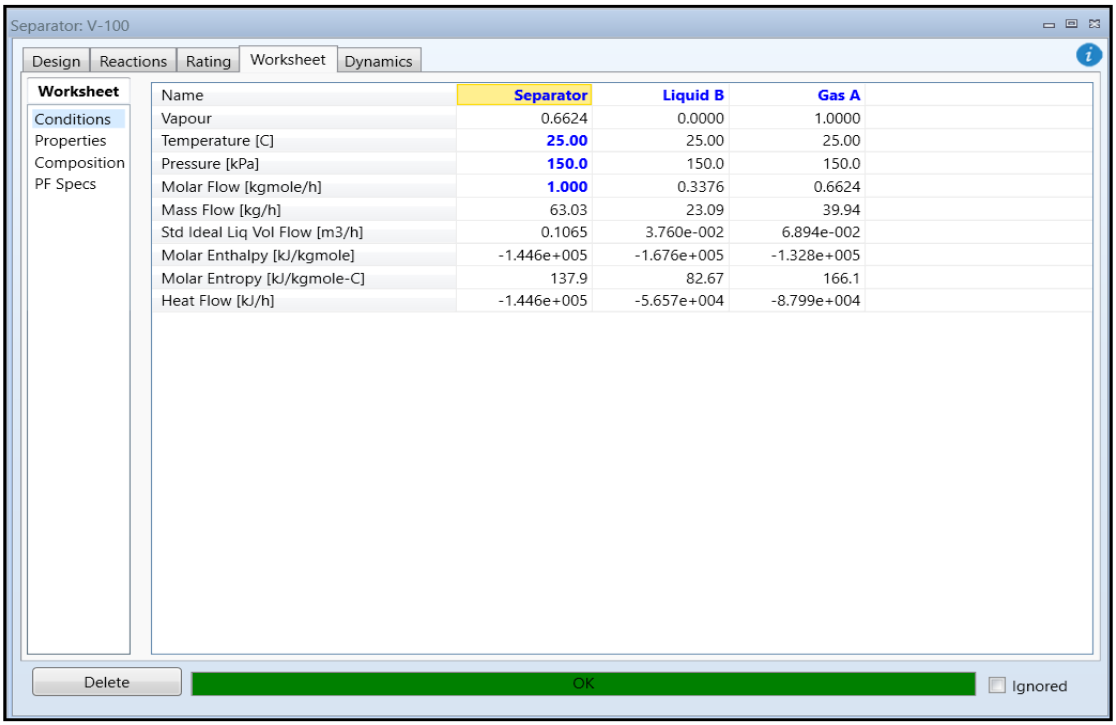


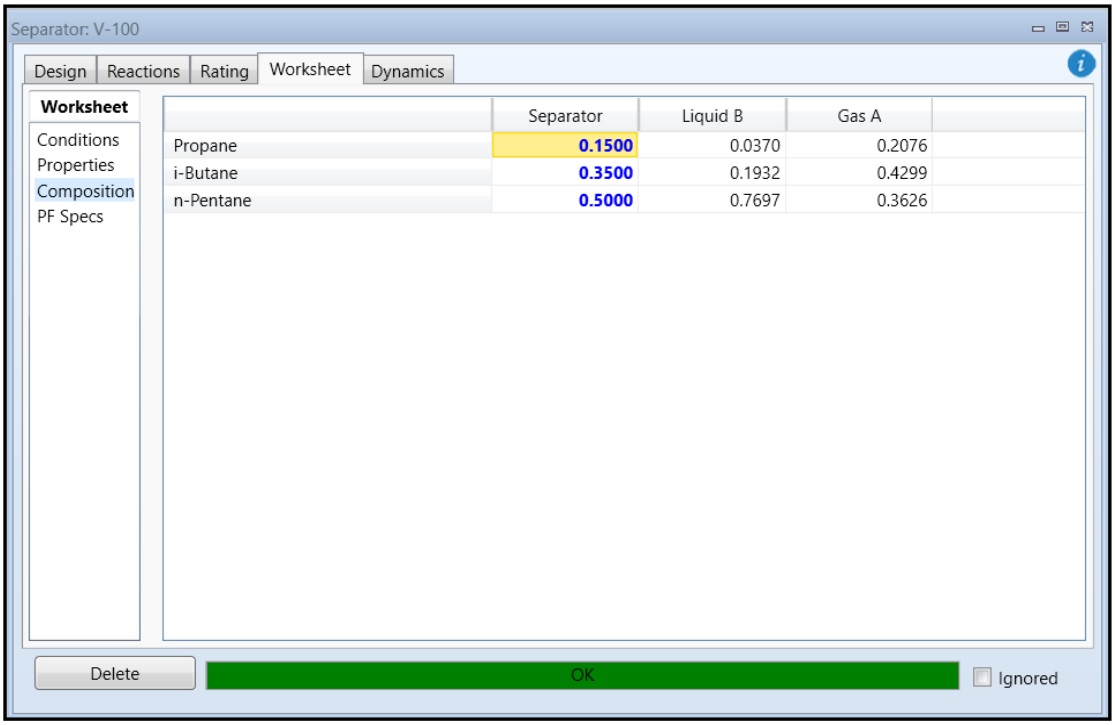
7.Double-click on the separator and define streams like below:



8.The moment you define the streams, the problem is solved and you see the green indication on the separator window.

9.Click on the Worksheet and then Composition tab.





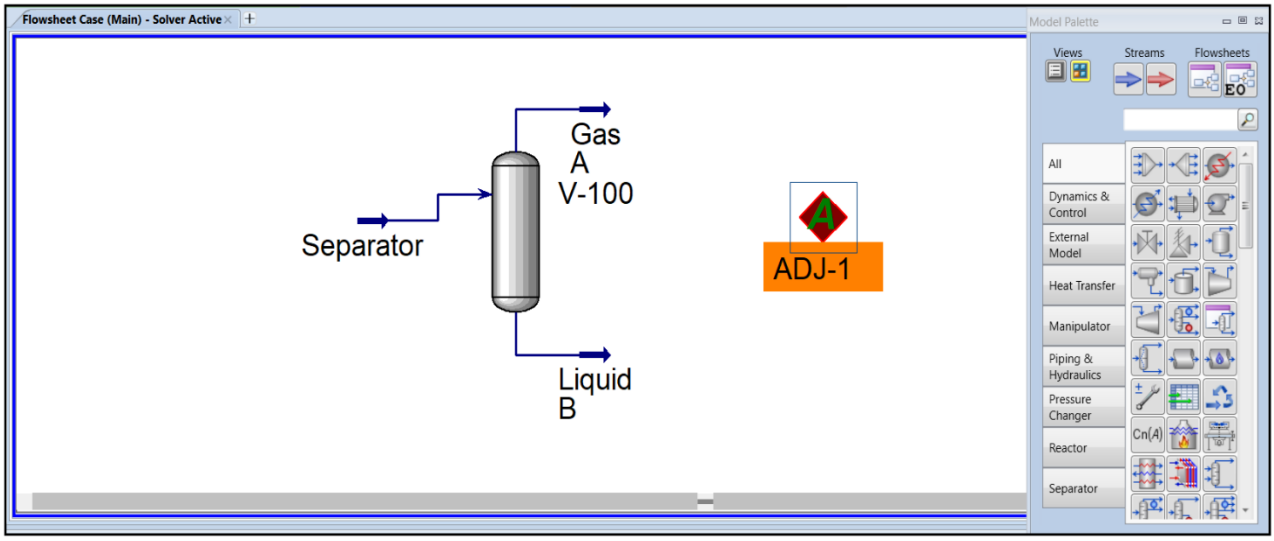
There is nothing to explain; each component fraction in each phase is provided.

Example 2: For the mixture in last example, determine the inlet mixture temperature in a way that at 150kPa the propane mole fraction is 0.07.

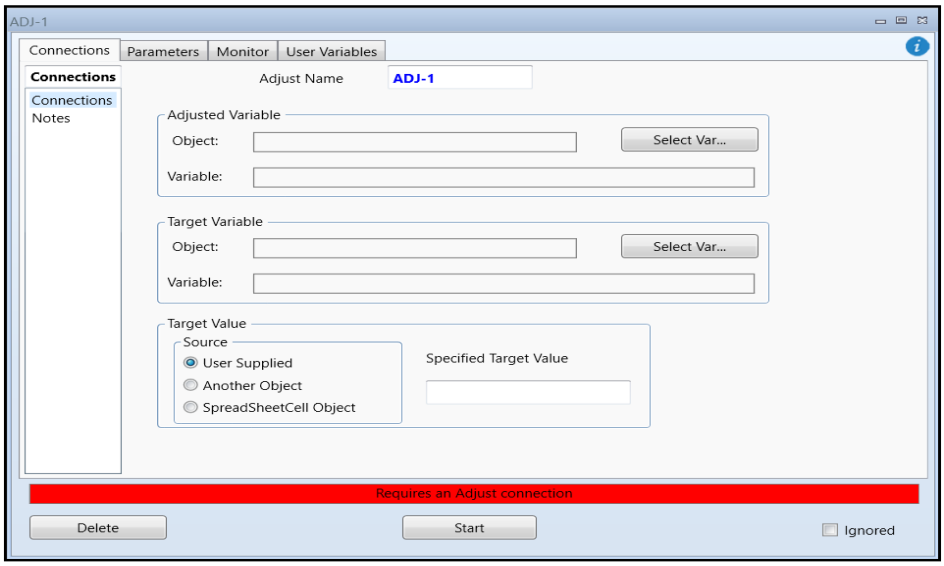
Solution:

Just for your notice, as shown in previous pages, the propane mole fraction in liquid stream was 0.037.

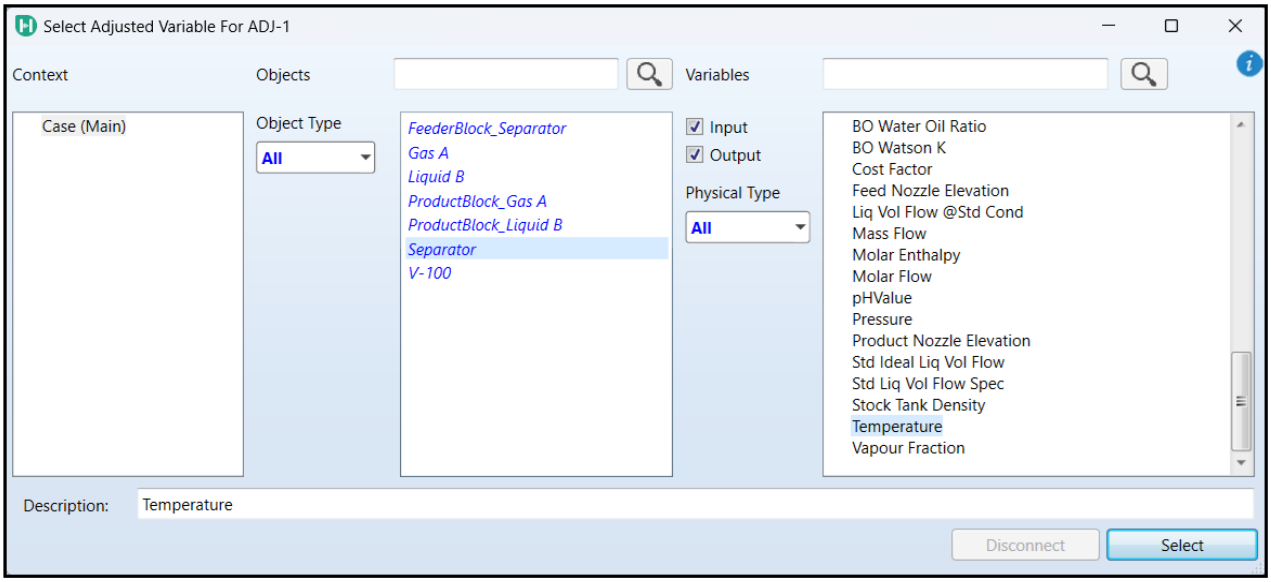
For this problem, we can reach a solution via trial and error but when we have such an amazing software, we can reach our target in a much faster way. In order to exploit the software and solve our problem, we can use Adjust tool under Model Pallete.



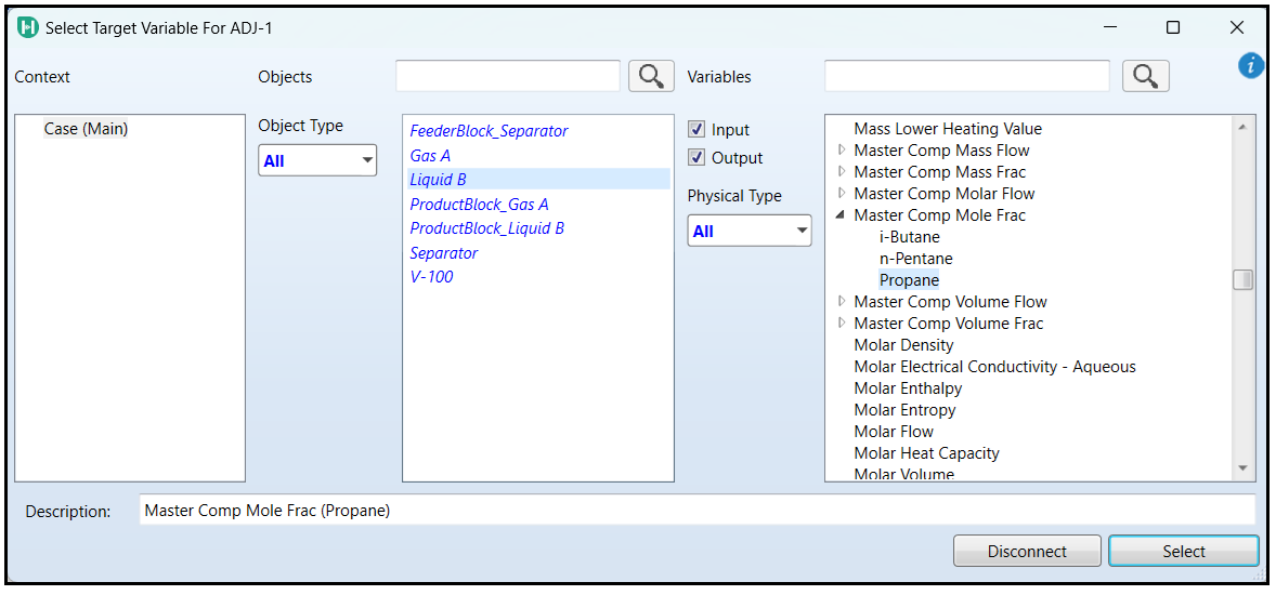
2.Open Adjust tool window



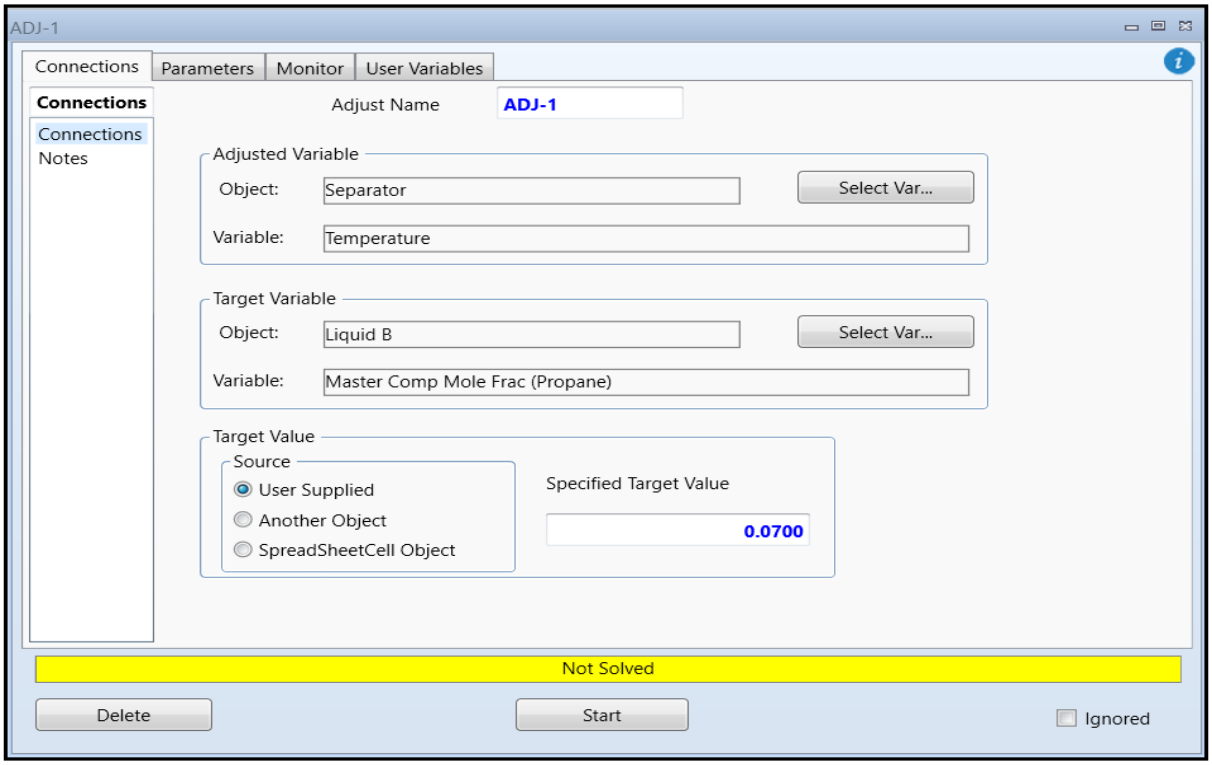
3. The adjusted variable is a variable which shall be changed to meet the specification. Here the temperature shall be changed until the propane fraction becomes 0.07. Select Variable, select Separator stream as the object, and select temperature as the variable.



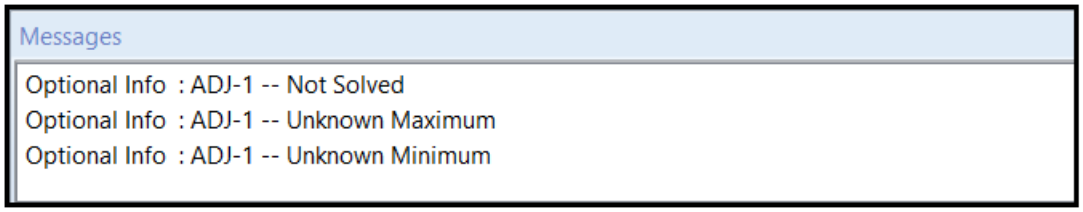
4. Select Variable, select Separator stream as the object, and select temperature as the variable.



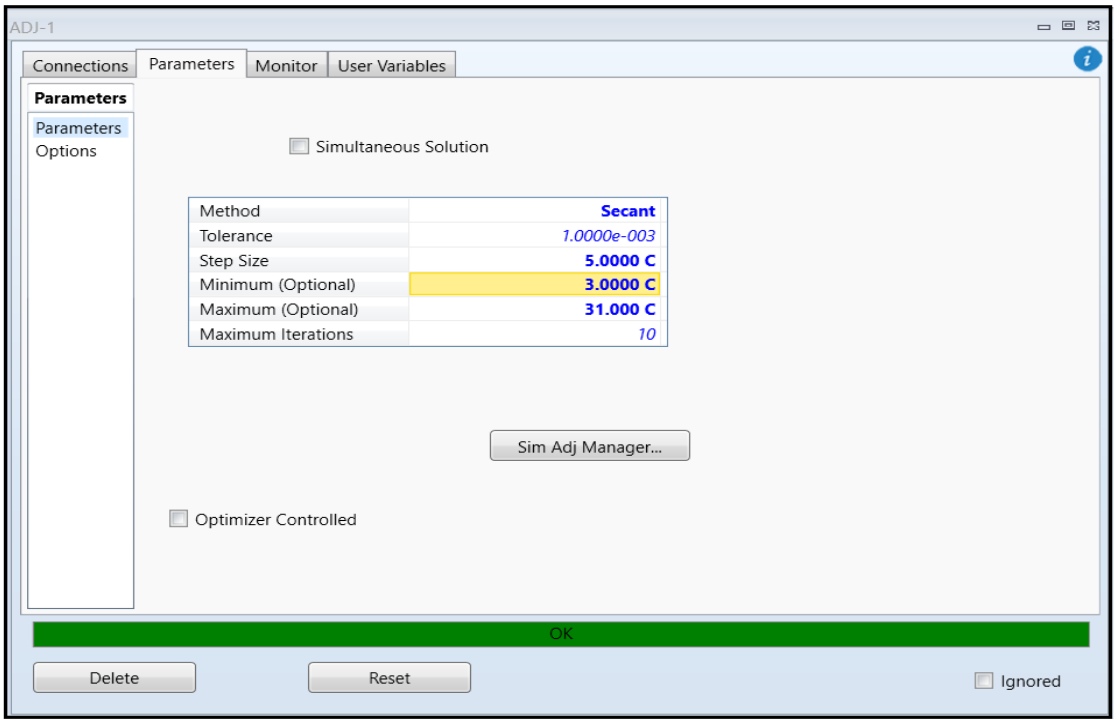
5.Under Specified Target Value, write 0.07.



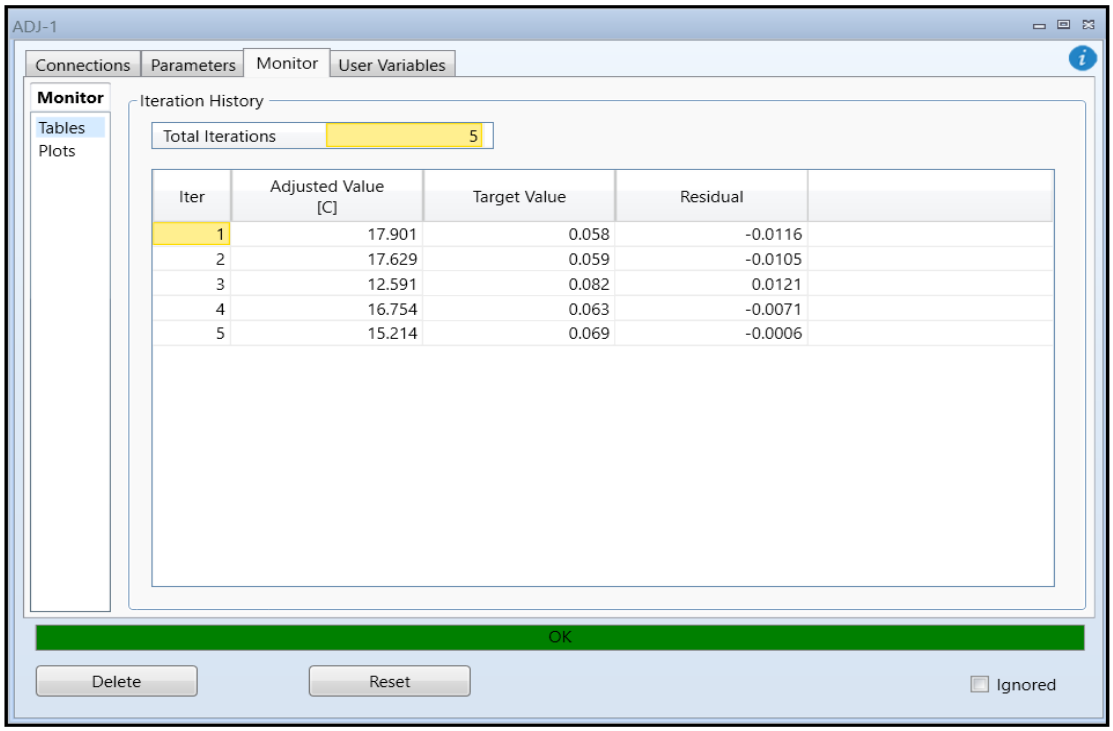
It is not solved but if look at the message box we can understand why it has not solved.



6.In this step we go to Parameter tab and specify the maximum temperature, minimum temperature, and step size. We set minimum temperature to bubbling point while maximum temperature to dew point. The step size changed to 5C.



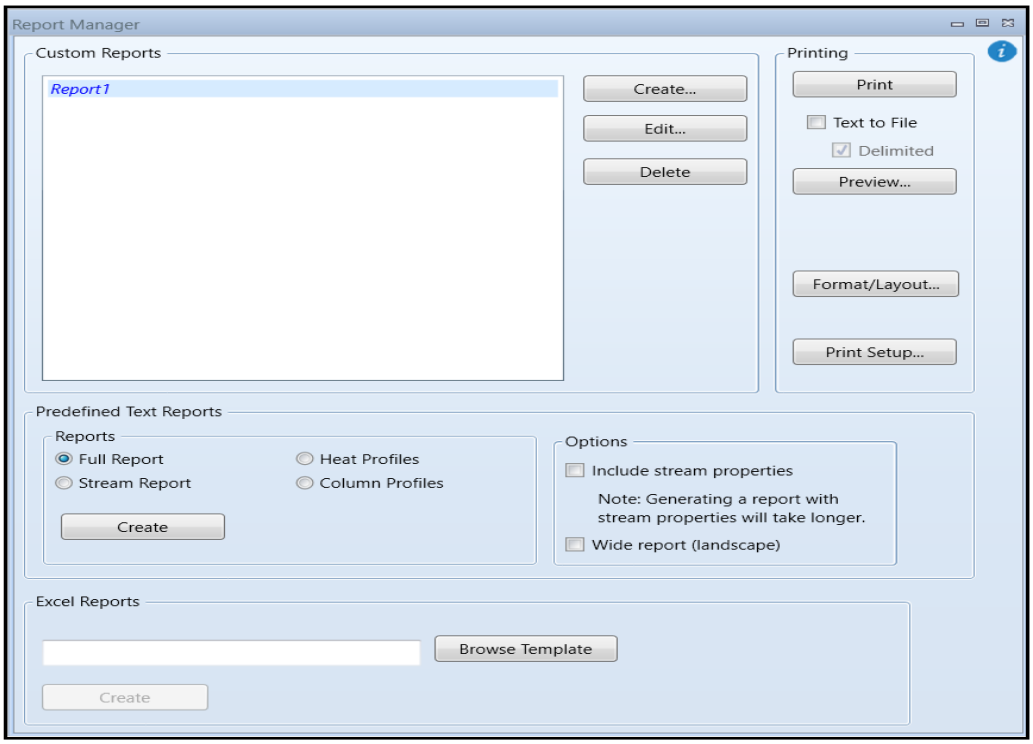
7. As the last step, check the Monitor tab to see the history of what Aspen Hysys has done.



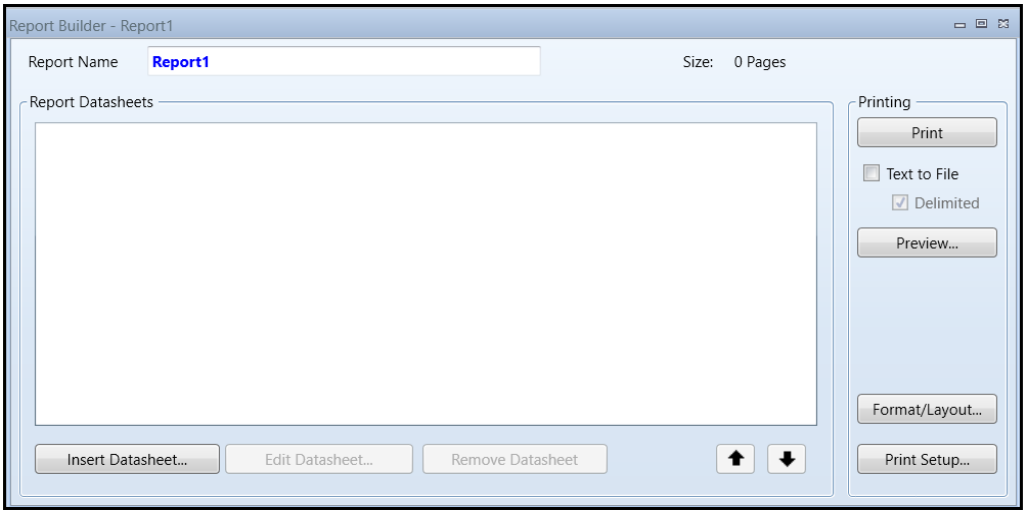
8.Based on the result, if the temperature of inlet mixture were about 15 C, then the propane fraction in liquid stream would be 0.07.

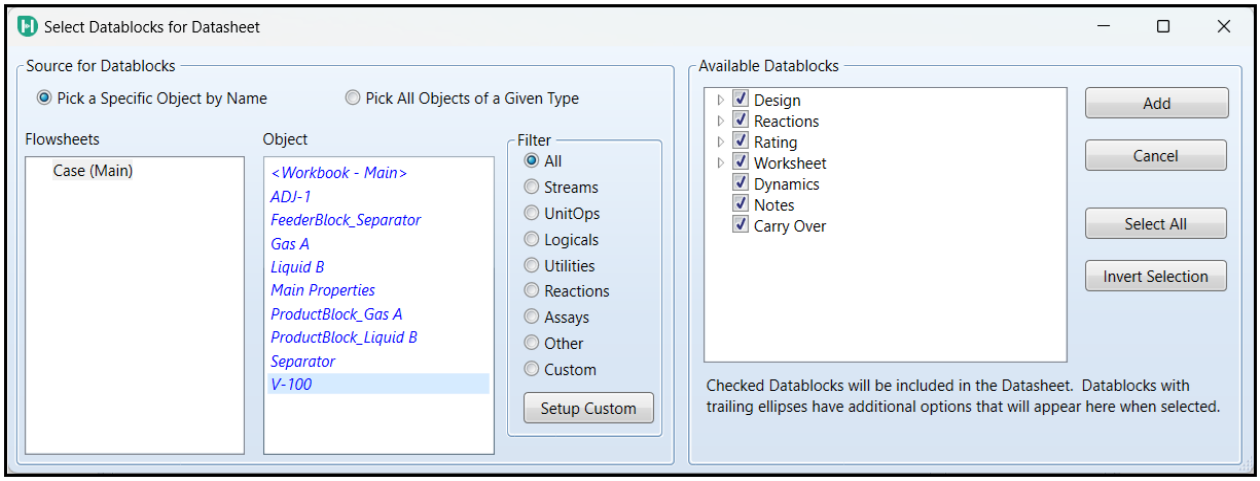
Before ending the session, let's learn how to print a report like a vessel datasheet.

9.Press CTRL+R to see the Report Manager window:



10. Click Create and then Insert Datasheet. Select V-100 and click Add.





11. Click Preview before printing.

32	**Sizing**					
33						
34	Cylinder		Vertical		Separator has a Boot: No	
35	Volume:	---	Diameter:	---	Height:	---
36						
37	**Nozzles**					
38	Base Elevation Relative to Ground Level		0.0000 m *	Diameter	---	Height ---
39			Separator		Gas A	Liquid B
40	Diameter	(m)	5.000e-002 *		5.000e-002 *	5.000e-002 *
41	Elevation (Base)	(m)	0.0000 *		0.0000 *	0.0000 *
42	Elevation (Ground)	(m)	0.0000 *		0.0000 *	0.0000 *
43	Elevation (% of Height)	(%)	---		---	---
44						
45	**Level Taps: Level Tap Specification**					
46	Level Tap	PV High	PV Low		OP High	OP Low
47						
48	**Level Taps: Calculated Level Tap Values**					
49	Level Tap		Liquid Level		Aqueous Level	
50						
51	**Options**					
52	PV Work Term Contribution	(%)	100.00 *			
53						
54	**CONDITIONS**					
55	Name		Separator		Liquid B	Gas A
56	Vapour		0.3371		0.0000	1.0000
57	Temperature	(C)	15.2140 *		15.2140	15.2140
58	Pressure	(kPa)	150.0000 *		150.0000	150.0000
59	Molar Flow	(kgmole/h)	1.0000 *		0.6629	0.3371
60	Mass Flow	(kg/h)	63.0335		43.8954	19.1381
61	Std Ideal Liq Vol Flow	(m3/h)	0.1065		0.0726	0.0340
62	Molar Enthalpy	(kJ/kgmole)	-1.533e+005		-1.657e+005	-1.288e+005