

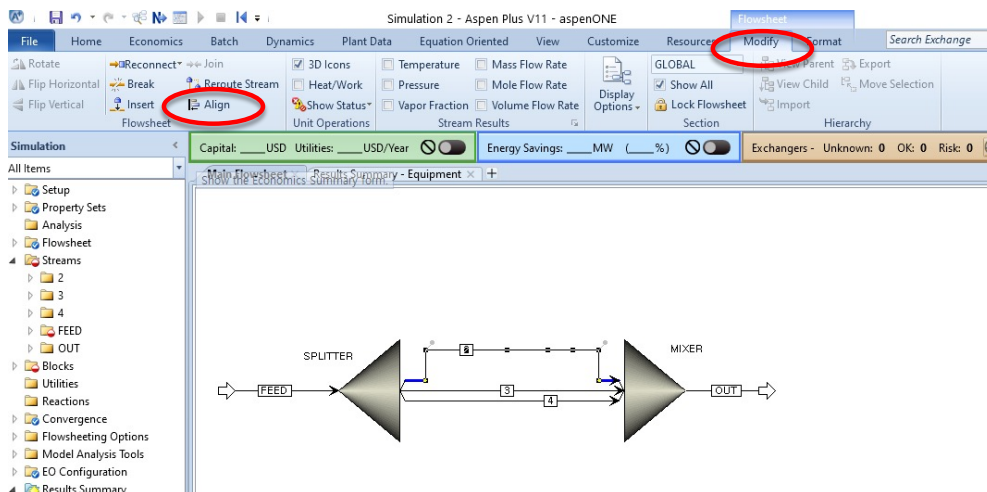
Tips for Aspen Plus & Help Session for HW

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Align Streams and Blocks

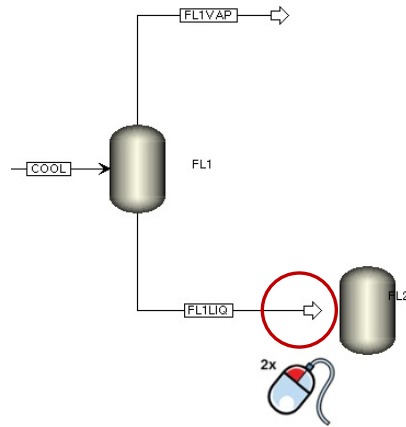
You can straighten your stream lines by clicking “Align” button that can be found on the tab of
Flowsheet→ Modify → Align



Or draw a large rectangle to select all of your icons on the flowsheet and then right click to activate a pop up menu. Select the Align Blocks entry from this pop up menu.

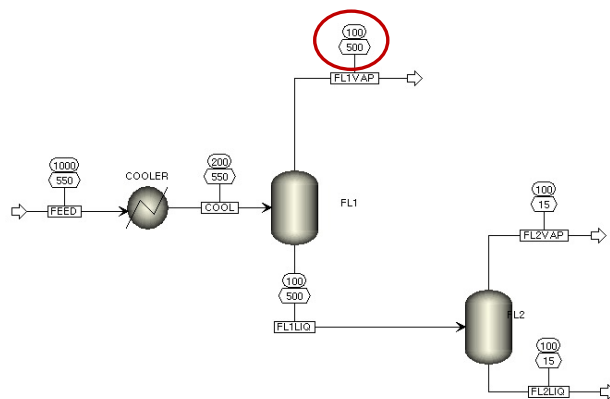
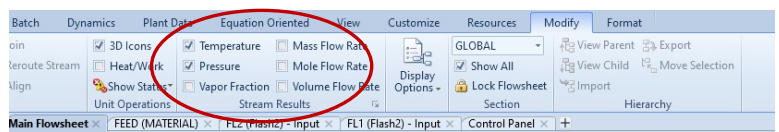
Connecting Streams to a Unit

- **Double click** on the end of the stream you wish to connect to the unit
- Your mouse will gain the control **the end of the stream**
- Now **move** the end of the stream **over** one of the **red** or **blue** arrows **on the unit**.
- **Red** arrows represent **required** streams that must be connected



Display T, P, and other information on the stream

Select the options of Temperature, Pressure, etc. on the “Modify” Tab



Missing Info. of Aspen Tutorial Videos

- Fractional conversion of ethanol should be specified in RSTOIC reactor. The explanation is missing.

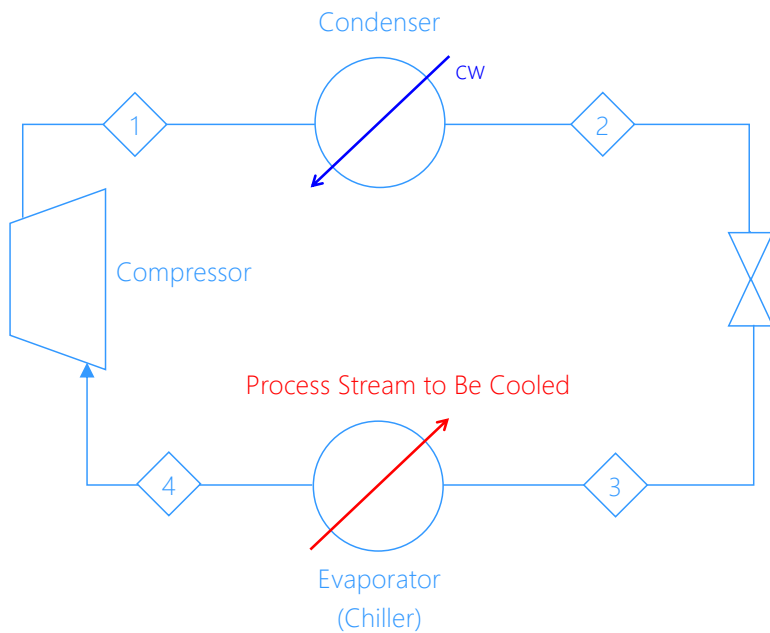
PFR and CSTR

- You need to define a reaction set for the simulation.

Table 1 Summary of reactor models in Aspen Plus™

Model	Stoichiometry	Kinetics	Rigorous	Feed
RSTOIC	Yes	No	No	Any
RYIELD	No	No	No	Any
REQUIL	No	No	No	Any
RGIBBS	No	No	No	Any
RBATCH	Yes	Yes	Yes	1
RCSTR	Yes	Yes	Yes	Any
RPLUG	Yes	Yes	Yes	1

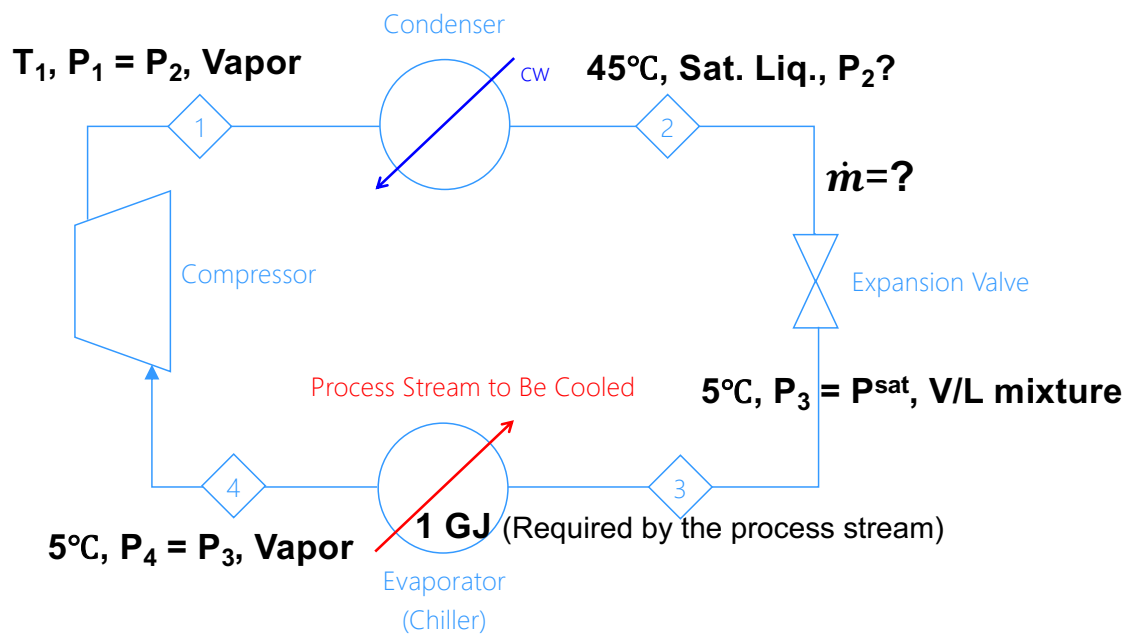
Example 8.5



Refrigerated cooling utility at 5 °C

Refrigerant: R-152a (1,1-difluoroethane)

Determine the amount of R-152a to circulate in the loop in order to extract 1GJ of heat in the evaporator.



45°C, Sat. Pressure is P2

Property package: **Peng-Robinson**

(or one can use REFPROP – refrigerant property developed by NIST)

Estimation of vapor pressure

Analysis → Pure

Thermodynamic → PL

Property method: PENG-ROB
Property type: Thermodynamic
Property: PL
Units: C
Phase: ☒ Liquid
Temperature: 45
Start point: 5
End point: 45
Number of intervals: 1
Pressure: 1.01325 bar
Run Analysis

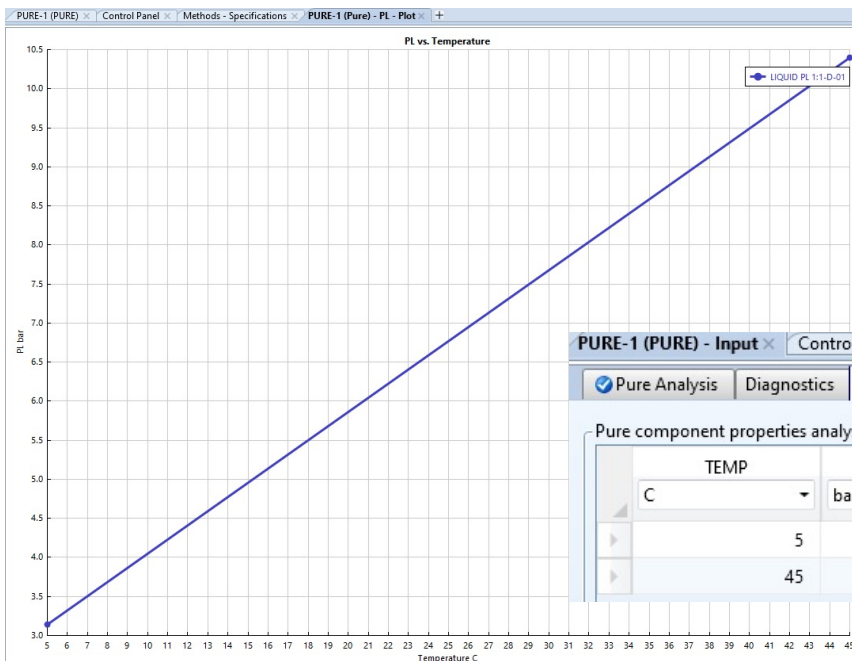


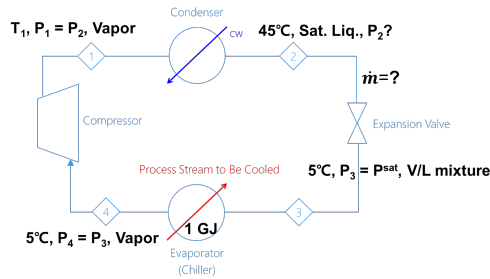
Table E8.5 Stream Conditions for Figure E8.5

Condition	Stream Number			
	1	2	3	4
Pressure (bar)	10.41	10.41	3.19	3.19
Temperature (°C)	74.2	45.0	5.0	5.0
Vapor Fraction	1.0	0.0	0.2237	1.0

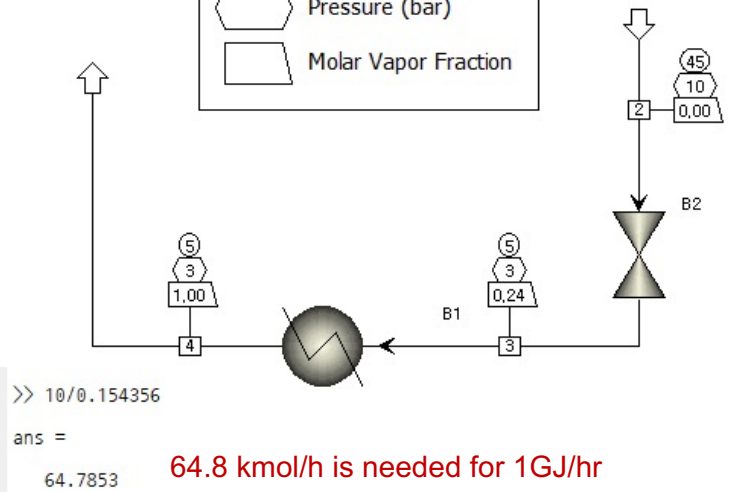
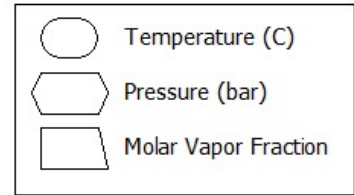
Pure component properties analysis results		
TEMP	PRES	LIQUID PL 1:1-D-01
C	bar	bar
5	1.01325	3.13945
45	1.01325	10.4019

Stream 3 → Heat Duty w/ Basis of 10 kmol/h

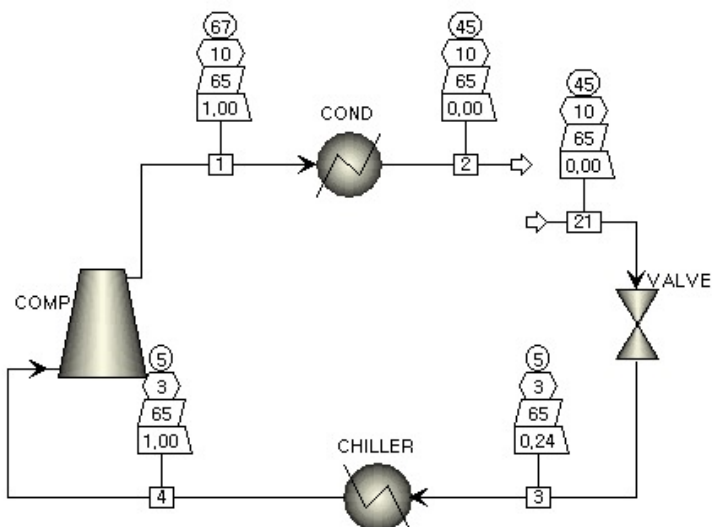
Assume $m = 10 \text{ kmol/h}$



B1 (Heater) - Results	
Main Flowsheet × 4 (MATERIAL) × Control Panel × Se	
Summary Balance Phase Equilibrium Utility Usage Status	
Outlet temperature	5 C
Outlet pressure	3.13945 bar
Vapor fraction	1
Heat duty	0.154356 GJ/hr
Net duty	0.154356 GJ/hr
1st liquid / Total liquid	
Pressure-drop correlation parameter	
Pressure drop	0.0505489 bar



Ex 8.5) Method II: Using Design Specification



I split the stream 2 into 2 and 21 for better convergence, but closed-loop simulation may work.

Ex 8.5) Method II: Using Design Specification

Capital: ___USD Utilities: ___USD/Year Energy Savings: ___MW (___%) Exchangers - Unknown: 0 OK: 0 Risk: 0

Main Flowsheet × DS-1 - Input × DS-1 - Results × +

Define Spec Vary Fortran Declarations EO Options Comments

☒ Active

Sampled variables (drag and drop variables from form to the grid below)

Variable	Definition
CHILDUTY	Block-Var Block=CHILLER Variable=NET-DUTY Sentence=RESULTS Units=GJ/hr

New Delete Copy Paste Move Up Move Down View Variables

Edit selected variable

Variable: **CHILDUTY**

Category:

- ☐ All
- ☒ Blocks
- ☐ Streams
- ☐ Model Utility
- ☐ Property Parameters
- ☐ Reactions

EO input

Open variable

Description

Reference

Type: **Block-Var**

Block: **CHILLER**

Variable: **NET-DUTY**

Sentence: **RESULTS**

Units: **GJ/hr**

Reference

Type: **Block-Var**

Block: **CHILLER**

Variable: **DUTY**

Sentence: **PARAM**

Units: **GJ/hr**

Since the duty is the dependent variable, we should select **NET-DUTY (Results)**, not **DUTY (Param)**. If you choose DUTY, nothing will be calculated because DUTY is a specification, not a calculated variable.

Main Flowsheet × DS-1 - Input × DS-1 - Results × +

Results Status

Variable	Initial value	Final value	Units
MANIPULATED	50	64.7854	KMOL/HR
CHILDUTY	0.771779	1	GJ/HR

- Flowsheeting Options
 - Design Specs
 - DS-1
 - ☒ Input
 - Results
 - EO Variables
 - EO Input
 - Summary

Main Flowsheet × DS-1 - Input × DS-1 - Results × +

Define Spec Vary Fortran Declarations EO Options Comments

Manipulated variable

Type: **Mole-Flow**

Stream: **21**

Substream: **MIXED**

Component: **1:1-D-01**

Units: **kmol/hr**

Manipulated variable limits

Lower: **50**

Upper: **100**

Step size: **1**

Maximum step size:

Report labels

Line 1: Line 2: Line 3: Line 4:

EO input

Open variable

Description

Copy Paste Clear

A third method will be using Sensitivity Analysis, which I am not showing here.

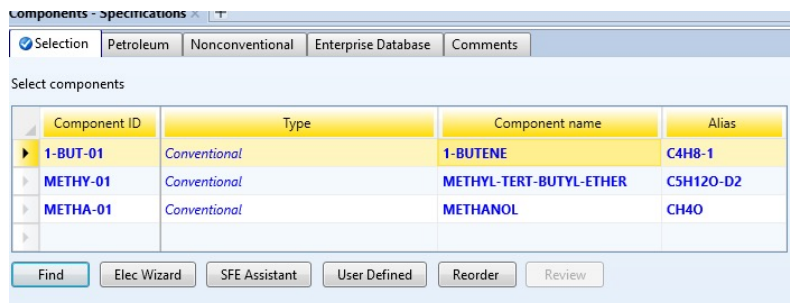
Main Flowsheet × DS-1 - Input × DS-1 - Results × +

Results Status

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MANIPULATED	50	64.7854	KMOL/HR
CHILDUTY	0.771779	1	GJ/HR

Azeotrope and Residue-Curve Maps @ 1 atm

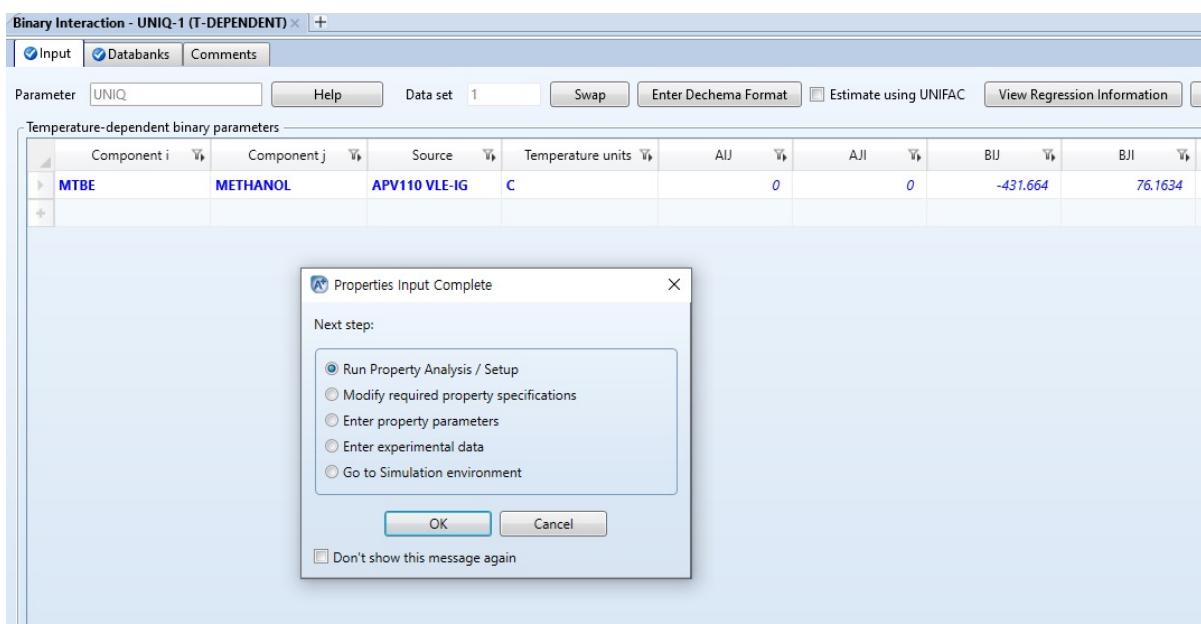
1-butene/ Methyl Tert-Butyl Ether (MTBE) / Methanol



You can change Component ID for your convenience.

Use thermodynamic model of **UNIQUAC** (one of the activity coefficient models)

Binary Interaction Parameters of UNIQUAC



Residue Curves → Find Azeotropes

Binary Interaction - UNIQU-1 (T-DEPENDENT) × Control Panel × Azeotrope Search × +

Azeotrope Search

- Input
- Output
 - Pure Components
 - Azeotropes
 - Singular Points
 - Report

Component List

Name	Description
BUTENE	1-BUTENE
MTBE	METHYL-TERT-BI
METHANO	METHANOL

Pressure: 1 ATM

Property Model

Model: UNIQUAC

Phases: VAP-LIQ

AZEOTROPE SEARCH REPORT

Physical Property Model: UNIQUAC Valid Phase: VAP-LIQ

Mixture Investigated For Azeotropes At A Pressure Of 1 ATM

Comp ID	Component Name	Classification	Temperature
BUTENE	1-BUTENE	Unstable node	-6.25 C
MTBE	METHYL-TERT-BUTYL-ETHER	Stable node	55.04 C
METHANOL	METHANOL	Stable node	64.53 C

The Azeotrope

Number Of Components: 2		Temperature 51.45 C	
Homogeneous		Classification: Saddle	
		MOLE BASIS	MASS BASIS
01	MTBE	0.6801	0.8540
	METHANOL	0.3199	0.1460

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MeOH = 0.3199

MTBE = 0.6801



Binary Interaction - UNIQU-1 (T-DEPENDENT) × Control Panel × Azeotrope Search × RESID-1 (RESIDUE) - Input × RESID-1 Residue Curve

Residue Curve Diagnostics Results Comments Status

Ternary system

Component 1: MTBE

Component 2: BUTENE

Component 3: METHANOL

Pressure: 1.01325 bar

Valid phases: Vapor-Liquid-Liquid

Number of curves: 3 - 5 curves 10 - 15 curves 15 - 20 curves

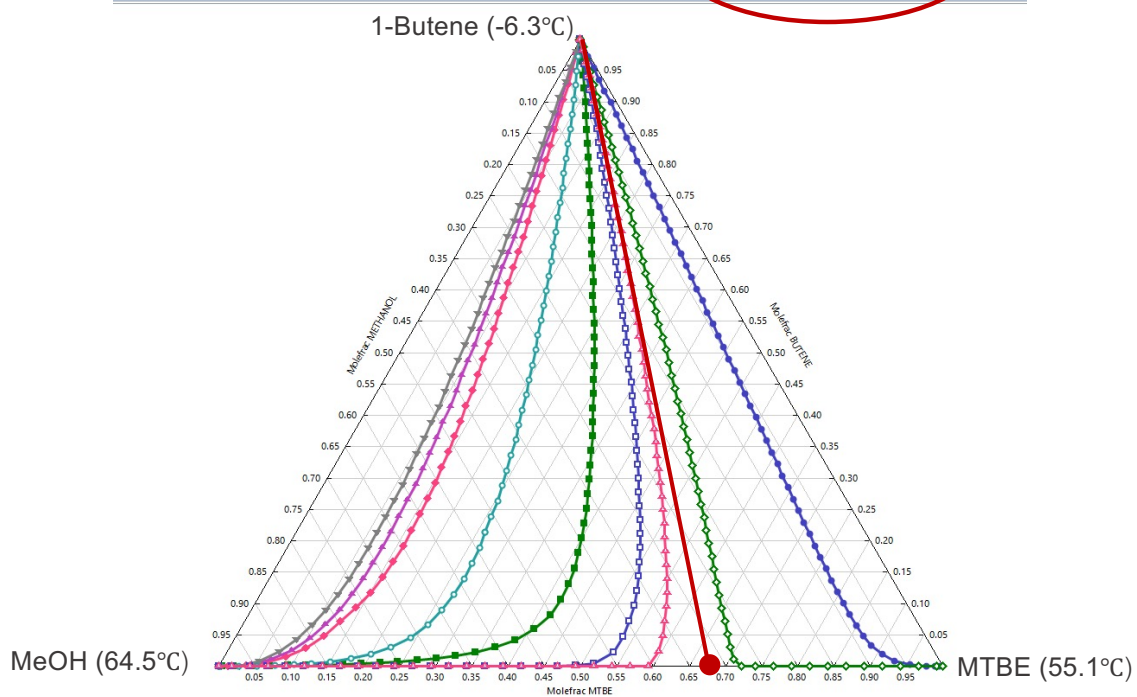
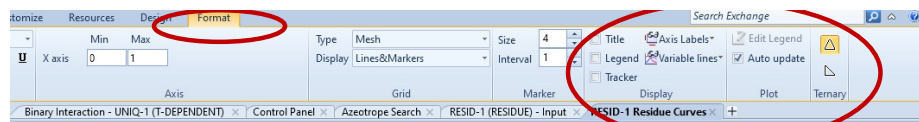
Property options

Property method: UNIQUAC

Henry components:

Chemistry ID:

Run Analysis



How to Setup RadFrac

- Pressure drop?
- Condenser pressure? Where do they come from? How do I get?