Internal column design Radfrac

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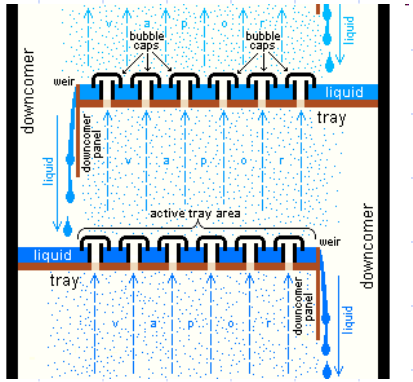


Example: staged column design with Radfrac

- Separation of a mixture of hydrocarbons by distillation
  - The feed is 0.100 mol fraction ethane, 0.300 mole fraction propane, 0.500 mole fraction n-butane and 0.100 mole fraction n-pentane.
  - The feed is 1.0 kmol/s at 25°C and 15.0 atm.
  - The column has N (Aspen notation) = 35 equilibrium stages and the feed is on stage 16.
  - The column operates at 15.0 atm, has a partial condenser and produces a vapor distillate with D = 0.400 kmol/s (D/F=0.4).
  - The column has a kettle type reboiler.
  - Reflux ratio is L/D = 2.5.
  - Use the Peng-Robinson VLE correlation with standard binary interaction parameters.

Example: staged column design with Radfrac

- Separation of a mixture of hydrocarbons by distillation
- Using Radfrac perform the following calculations:
  1. With a base case obtain the column profiles: T, Kij, L/V, compositions. Verify that:
     1. Max. n-C4 mole fraction in the vapor distillate of $y_{D,C4,max} = 0.001$
     2. Max. C3 mole fraction in the liquid bottoms of $x_{Bot,C3,max} = 0.0$
  2. Create a new column internal section for a sieve tray column internal using the following specifications:
     1. Create an auto section and verify that two sections are created (2-15 and 16-34 stage)
     2. Specify Sieve trays with 2 pass (sec.1) and 4 pass (sec.2).
     3. Verify and understand the Design parameters (in the Geometry section).
     4. Estimate D and tray spacing.
     5. Verify hydraulic plots and adjust the geometry, until you have no warnings / errors.
  3. Change the tray type to BubbleCup
     1. Adjust the geometry until you have no warnings / errors.

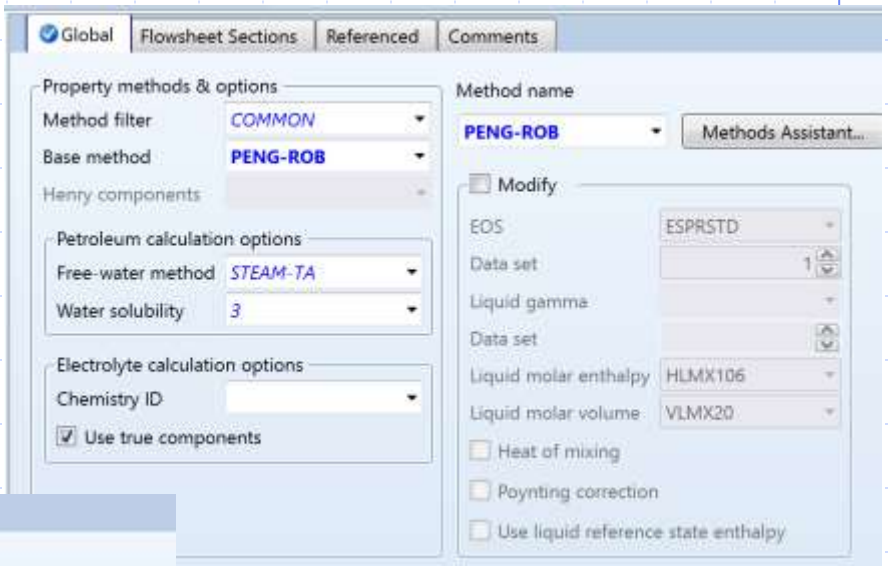
Example: staged column design with Radfrac

- Components

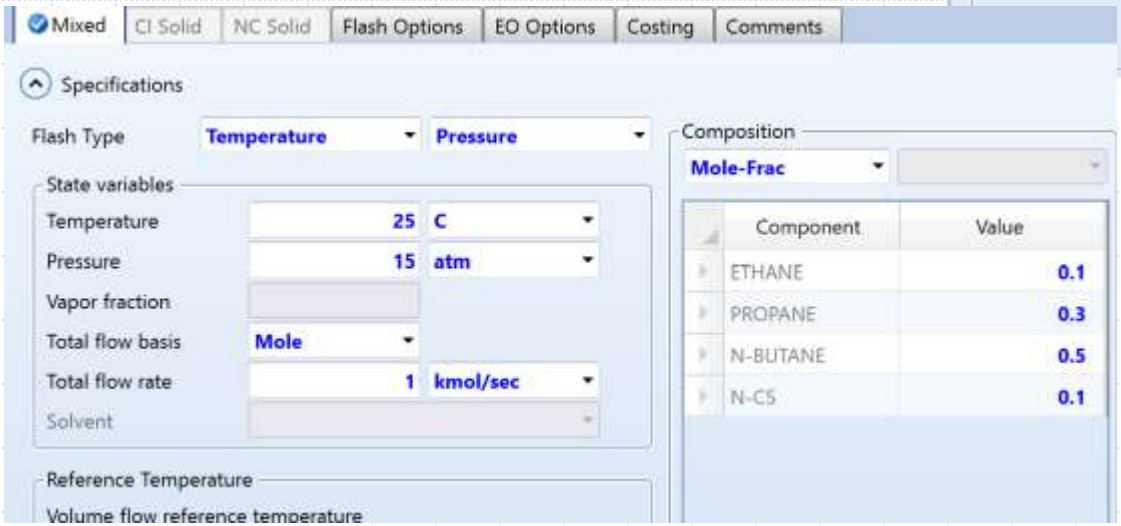
Select components

Component ID	Type	Component name	Alias
ETHANE	Conventional	ETHANE	C2H6
PROPANE	Conventional	PROPANE	C3H8
N-BUTANE	Conventional	N-BUTANE	C4H10-1
N-C5	Conventional	N-PENTANE	C5H12-1

- Method

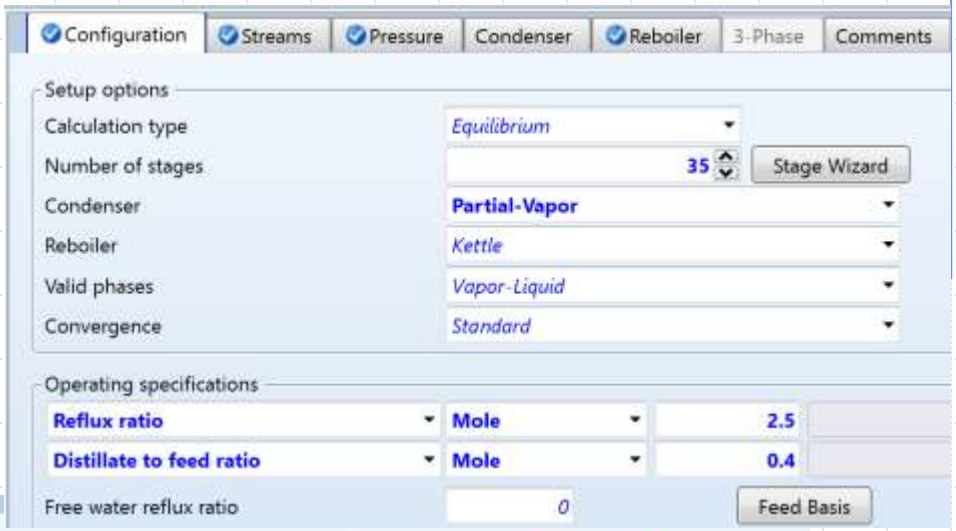


- Feed

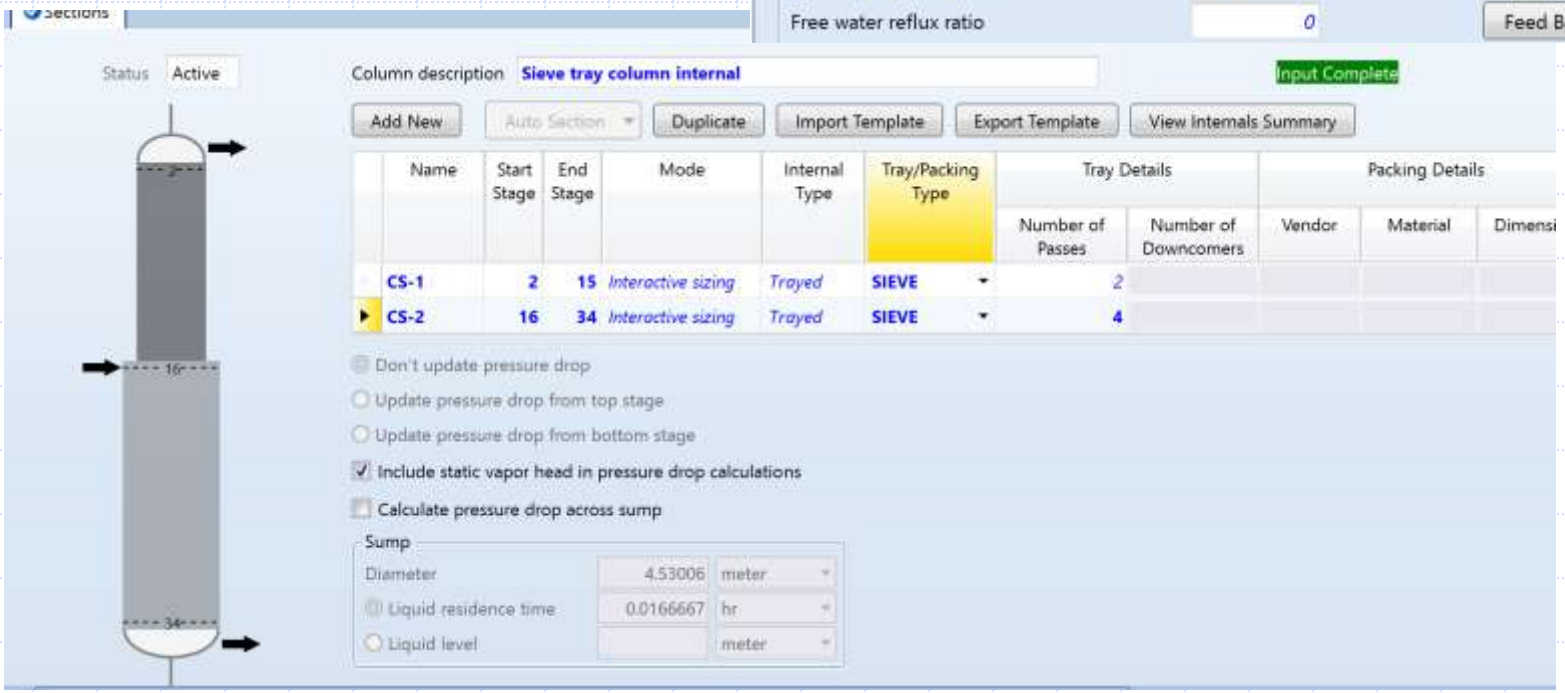


Example: staged column design with Radfrac

Setup



Internals



Example: packed column design with Radfrac

- Separation of a mixture of hydrocarbons by distillation
  - The feed is 0.100 mol fraction ethane, 0.300 mole fraction propane, 0.500 mole fraction n-butane and 0.100 mole fraction n-pentane.
  - The feed is 1.0 kmol/s at 25°C and 15.0 atm.
  - The column has N (Aspen notation) = 35 equilibrium stages and the feed is on stage 16.
  - The column operates at 15.0 atm, has a partial condenser and produces a vapor distillate with D = 0.400 kmol/s (D/F=0.4).
  - The column has a kettle type reboiler.
  - Reflux ratio is L/D = 2.5.
  - Use the Peng-Robinson VLE correlation with standard binary interaction parameters.
- Data are the same as for the example done for staged column

Example: packed column design with Radfrac

- Separation of a mixture of hydrocarbons by distillation
- Using Radfrac open the file used for staged column design and perform the following calculations:
  1. Verify the base case reported in the old file, and in particular that:
     1. Max. n-C4 mole fraction in the vapor distillate of $y_{D,C4,max}$ = 0.001
     2. Max. C3 mole fraction in the liquid bottoms of $x_{Bot,C3,max}$ = 0.001
  2. Create a new column internal section (INT-2) for a packed column internal (leave the INT-1 internal section of the tray design), using the following specifications:
     1. Create an auto section and verify that two sections are created (2-15 and 16-34 stage)
     2. Specify packed column – interactive sizing with pall rings.
     3. Verify and understand the Design parameters (in the Geometry section) and specify packed height per stage (HETP) in geometry section (.5 m for pall rings)
     4. Estimate D and tray spacing.
     5. Verify hydraulic plots and adjust the geometry, until you have no warnings / errors.
  3. Change the packing to Mellapack
     1. Verify and understand the Design parameters (in the Geometry section) and specify packed height per stage (HETP) in geometry section (.2 m for mellapack)
     2. Adjust the geometry until you have no warnings / errors.
  4. Add design specifications to obtain the desired purities:
     1. Max. n-C4 mole fraction in the vapor distillate of $y_{D,C4,max}$ = 0.001
     2. Max. C3 mole fraction in the liquid bottoms of $x_{Bot,C3,max}$ = 0.001

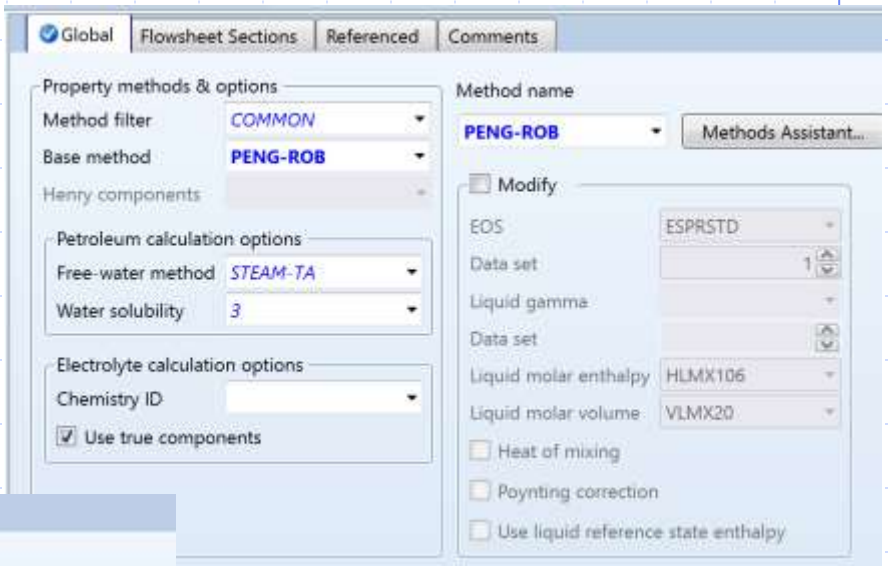
Example: packed column design with Radfrac

- Components

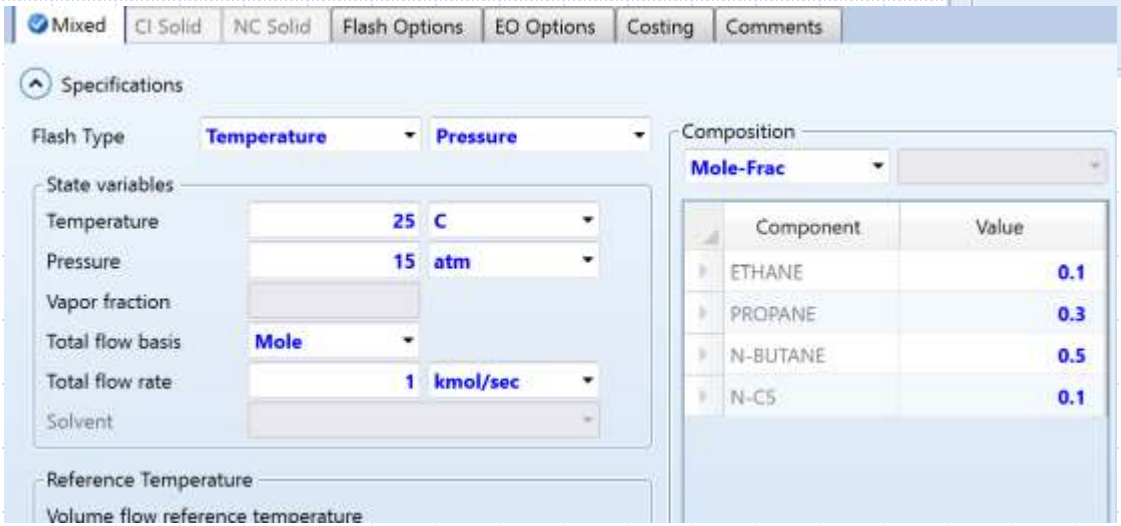
Select components

Component ID	Type	Component name	Alias
ETHANE	Conventional	ETHANE	C2H6
PROPANE	Conventional	PROPANE	C3H8
N-BUTANE	Conventional	N-BUTANE	C4H10-1
N-C5	Conventional	N-PENTANE	C5H12-1

- Method

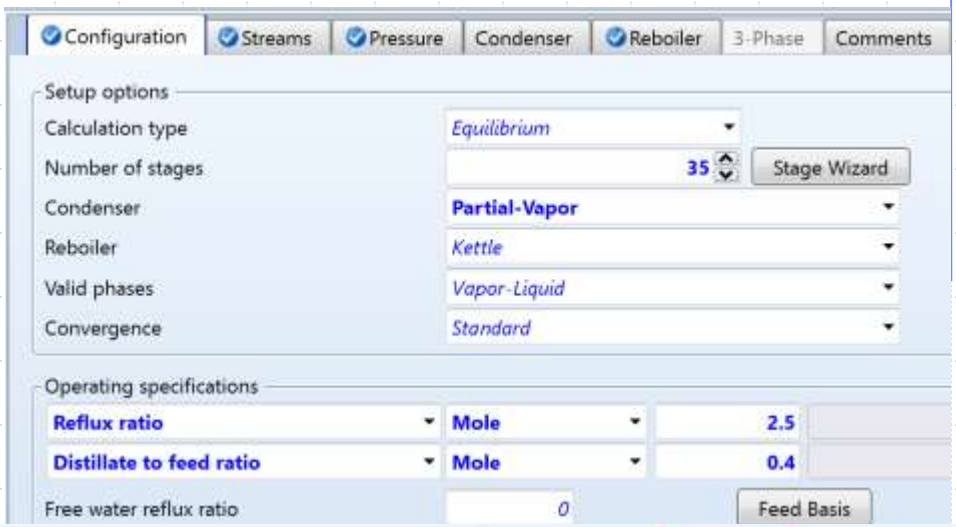


- Feed

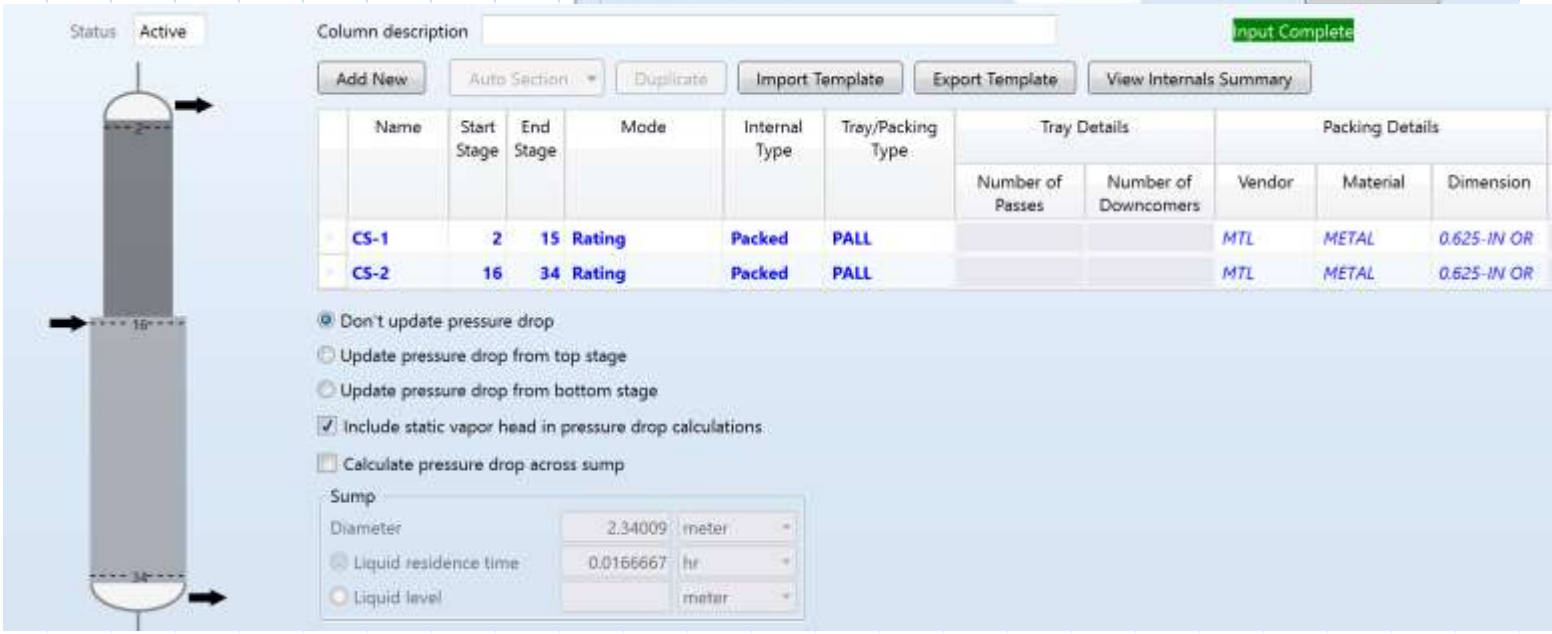


Example: packed column design with Radfrac

- Setup



- Internals



Example: packed column design with Radfrac

- Hydraulic plots