## PROSIMPLUS APPLICATION EXAMPLE

# SIMULATION OF A FCCU MAIN FRACTIONATOR

| EXAMPLE PURPOSE |
| --- |
| This example illustrates the simulation of a FCCU main fractionator with ProSimPlus. |

| ACCESS | ☑ Free-Internet | ☐ Restricted to clients | ☐ Restricted | ☐ Confidential |
| --- | --- | --- | --- | --- |

| CORRESPONDING PROSIMPLUS FILE | *PSPS_EX_EN-Fractionating-Column.pmp3* |
| --- | --- |

*Reader is reminded that this use case is only an example and should not be used for other purposes. Although this example is based on actual case it may not be considered as typical nor are the data used always the most accurate available. Fives ProSim shall have no responsibility or liability for damages arising out of or related to the use of the results of calculations based on this example.*

Energy

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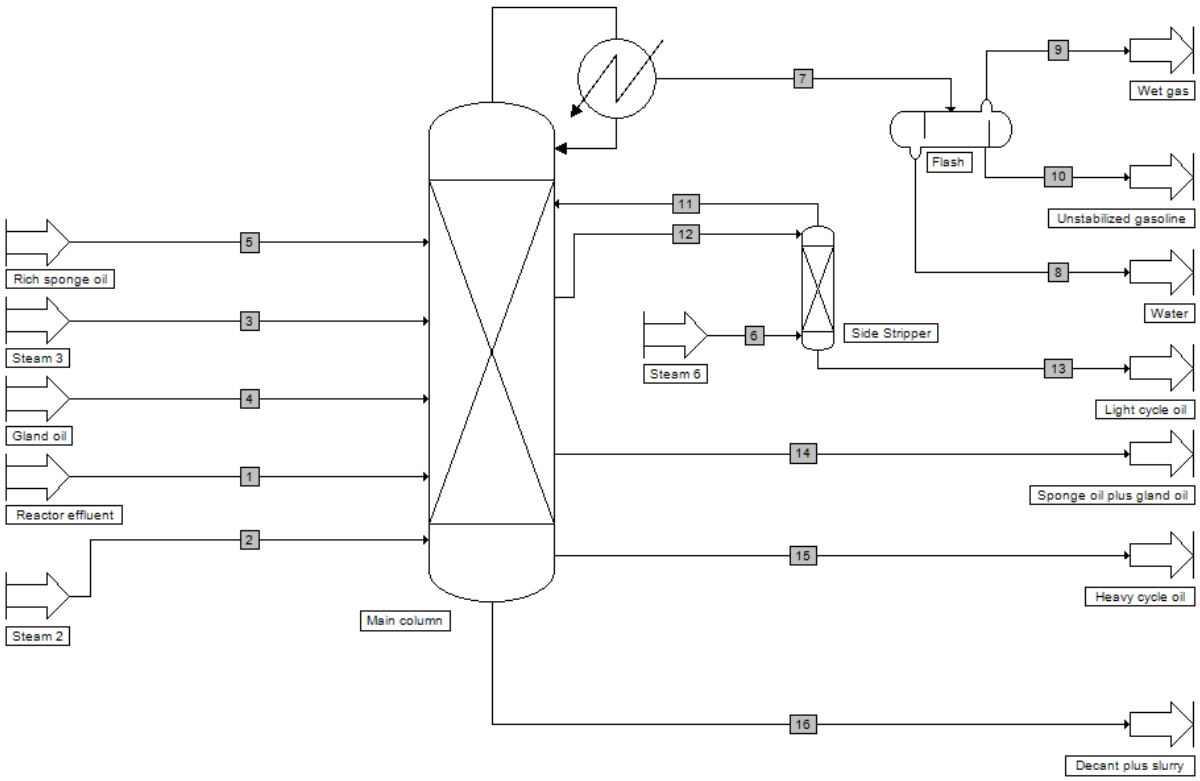
# 1. PROCESS MODELING

## 1.1. Process presentation

The distillation system consists of a main column coupled with a side stripper. This column is a stripping column with a partial condenser and a three-phase flash.

The input data of this problem is available in [SIM83].

## 1.2. Process flowsheet



## 1.3. Compounds

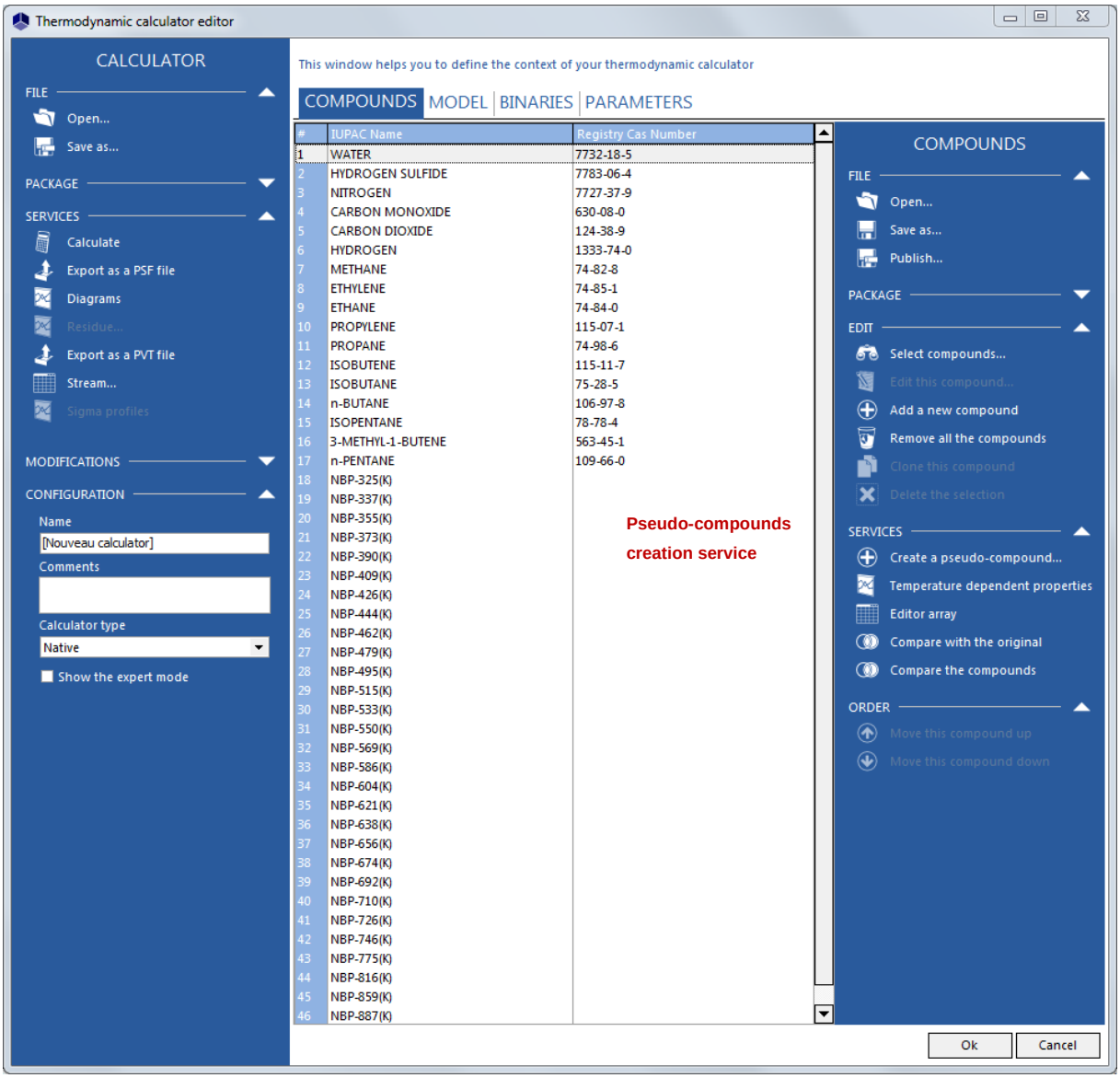
The fractionating column is fed by a hydrocarbon effluent coming from the cracking reactor, two products containing hydrocarbons and lights (gland oil, rich sponge oil), and steam.

The streams “Reactor effluent”, “Gland oil” and “Rich sponge oil” are petroleum cuts mixtures defined by distillation curves and lights composition data. The pseudo-compounds are generated using their normal boiling point, molar weight and density (available in [SIM81]) and given below.

| Compound | $T_b$ (°F) | Mw (g/mol) | Density |
|---|---|---|---|
| NBP-325(K) | 126 | 75.95 | 0.7009 |
| NBP-337(K) | 147 | 81.98 | 0.70585 |
| NBP-355(K) | 179 | 91.34 | 0.71433 |
| NBP-373(K) | 212 | 202.27 | 0.72256 |
| NBP-390(K) | 243 | 111.23 | 0.73137 |
| NBP-409(K) | 276 | 121.62 | 0.74029 |
| NBP-426(K) | 307 | 131.49 | 0.74916 |
| NBP-444(K) | 340 | 139.56 | 0.77576 |
| NBP-462(K) | 372 | 149.12 | 0.80681 |
| NBP-479(K) | 402 | 155.84 | 0.84471 |
| NBP-495(K) | 432 | 162.68 | 0.88078 |
| NBP-515(K) | 468 | 177.16 | 0.8936 |
| NBP-533(K) | 499 | 190.45 | 0.90216 |
| NBP-550(K) | 531 | 203.4 | 0.92054 |
| NBP-569(K) | 564 | 216.46 | 0.93825 |
| NBP-586(K) | 596 | 229.09 | 0.95501 |
| NBP-604(K) | 627 | 240.57 | 0.98194 |
| NBP-621(K) | 659 | 255.59 | 0.99173 |
| NBP-638(K) | 688 | 268.61 | 1.0036 |
| NBP-656(K) | 721 | 285.17 | 1.01404 |
| NBP-674(K) | 754 | 301.9 | 1.02194 |
| NBP-692(K) | 786 | 319.42 | 1.02817 |
| NBP-710(K) | 818 | 337.01 | 1.03323 |
| NBP-726(K) | 848 | 355 | 1.03597 |
| NBP-746(K) | 883 | 377.44 | 1.03642 |
| NBP-775(K) | 935 | 406.2 | 1.04928 |
| NBP-816(K) | 1010 | 449.13 | 1.06699 |
| NBP-859(K) | 1086 | 493.56 | 1.08271 |
| NBP-887(K) | 1137 | 524.42 | 1.09248 |

The pseudo-compounds creation service is available in the thermodynamic calculator editor as illustrated below.




In addition to pseudo-compounds, the compounds of the process are: water, $H_2S$, $N_2$, CO, $CO_2$, $H_2$, methane, ethylene, ethane, propylene, propane, isobutene, isobutane, n-butane, isopentane, 3-methyl-1-butene, n-pentane.

## 1.4. Thermodynamic model

The studied process deals with mixtures of water and hydrocarbons. Thus, the Peng-Robinson (PR) equation of state with the “Water-Hydrocarbons” option has been chosen. The liquid molar volume calculation uses the “Ideal mixture” model.

## 1.5. Operating conditions

### 1.5.1. Feeds

The feed properties are given in the following table.

| | Partial molar flowrates (lbmol/h) | | | Partial mass flowrates (lb/h) | | |
|---|---|---|---|---|---|---|
| | Reactor effluent | Gland Oil | Rich Sponge oil | Steam 2 | Steam 3 | Steam 6 |
| WATER | 571.7455 | 0.0000 | 0.0000 | 1000 | 1000 | 2350 |
| HYDROGEN SULFIDE | 119.1349 | 0.0000 | 11.3847 | 0 | 0 | 0 |
| NITROGEN | 71.7524 | 0.0000 | 1.4636 | 0 | 0 | 0 |
| CARBON MONOXIDE | 6.0690 | 0.0000 | 0.0000 | 0 | 0 | 0 |
| CARBON DIOXIDE | 13.6333 | 0.0000 | 0.0000 | 0 | 0 | 0 |
| HYDROGEN | 292.6588 | 0.0000 | 0.4961 | 0 | 0 | 0 |
| METHANE | 257.4331 | 0.0000 | 4.5504 | 0 | 0 | 0 |
| ETHYLENE | 42.0617 | 0.0000 | 2.2814 | 0 | 0 | 0 |
| ETHANE | 77.3196 | 0.0000 | 17.8257 | 0 | 0 | 0 |
| PROPYLENE | 312.5401 | 0.0000 | 10.3375 | 0 | 0 | 0 |
| PROPANE | 140.0775 | 0.0000 | 7.6878 | 0 | 0 | 0 |
| ISOBUTENE | 351.9283 | 0.0000 | 12.0307 | 0 | 0 | 0 |
| ISOBUTANE | 125.4043 | 0.0000 | 4.4733 | 0 | 0 | 0 |
| n-BUTANE | 47.1750 | 0.0000 | 3.0109 | 0 | 0 | 0 |
| ISOPENTANE | 178.5146 | 0.0000 | 12.5574 | 0 | 0 | 0 |
| 3-METHYL-1-BUTENE | 226.4206 | 0.0000 | 9.9953 | 0 | 0 | 0 |
| n-PENTANE | 30.9767 | 0.0000 | 2.7720 | 0 | 0 | 0 |
| NBP-325(K) | 75.1235 | 0.0000 | 0.0000 | 0 | 0 | 0 |
| NBP-337(K) | 194.3412 | 0.0000 | 0.0000 | 0 | 0 | 0 |
| NBP-355(K) | 173.5292 | 0.0000 | 0.0000 | 0 | 0 | 0 |
| NBP-373(K) | 146.1561 | 0.0000 | 0.0000 | 0 | 0 | 0 |
| NBP-390(K) | 137.3204 | 0.0000 | 0.0000 | 0 | 0 | 0 |
| NBP-409(K) | 116.2538 | 0.0000 | 0.0000 | 0 | 0 | 0 |
| NBP-426(K) | 109.4752 | 0.0000 | 0.0000 | 0 | 0 | 0 |
| NBP-444(K) | 106.5823 | 0.5961 | 5.8067 | 0 | 0 | 0 |
| NBP-462(K) | 108.2828 | 1.0388 | 10.1191 | 0 | 0 | 0 |
| NBP-479(K) | 124.8481 | 1.3964 | 13.6025 | 0 | 0 | 0 |
| NBP-495(K) | 71.3718 | 2.7966 | 27.2421 | 0 | 0 | 0 |
| NBP-515(K) | 53.5058 | 4.6527 | 45.3226 | 0 | 0 | 0 |
| NBP-533(K) | 59.2491 | 4.9738 | 48.4505 | 0 | 0 | 0 |
| NBP-550(K) | 61.0015 | 4.1917 | 40.8319 | 0 | 0 | 0 |
| NBP-569(K) | 63.8801 | 3.5796 | 34.8694 | 0 | 0 | 0 |
| NBP-586(K) | 79.0126 | 3.4629 | 33.7326 | 0 | 0 | 0 |
| NBP-604(K) | 165.7175 | 3.0199 | 29.4173 | 0 | 0 | 0 |
| NBP-621(K) | 167.1575 | 2.0422 | 19.8933 | 0 | 0 | 0 |
| NBP-638(K) | 129.4807 | 0.3775 | 3.6773 | 0 | 0 | 0 |
| NBP-656(K) | 60.4776 | 0.0000 | 0.0000 | 0 | 0 | 0 |
| NBP-674(K) | 35.9724 | 0.0000 | 0.0000 | 0 | 0 | 0 |
| NBP-692(K) | 22.9229 | 0.0000 | 0.0000 | 0 | 0 | 0 |
| NBP-710(K) | 15.8420 | 0.0000 | 0.0000 | 0 | 0 | 0 |
| NBP-726(K) | 8.1898 | 0.0000 | 0.0000 | 0 | 0 | 0 |
| NBP-746(K) | 2.1190 | 0.0000 | 0.0000 | 0 | 0 | 0 |
| NBP-775(K) | 3.9871 | 0.0000 | 0.0000 | 0 | 0 | 0 |
| NBP-816(K) | 2.8048 | 0.0000 | 0.0000 | 0 | 0 | 0 |
| NBP-859(K) | 2.0608 | 0.0000 | 0.0000 | 0 | 0 | 0 |
| NBP-887(K) | 0.5742 | 0.0000 | 0.0000 | 0 | 0 | 0 |
| **Temperature (°F)** | 927.939 | 200.000 | 118.710 | 314.946 | 312.160 | 312.160 |
| **Pressure (psig)** | 15.000 | 13.846 | 205.000 | 15.000 | 13.462 | 13.000 |

### 1.5.2. Main column

#### 1.5.2.1. Parameters

- Characteristics:
  - Stripper with partial condenser
  - Number of theoretical stages: 15
  - Operating mode specifications: condenser duty to be withdraw
  - Condenser duty to be withdraw: 0 Btu/h
  - Liquid distillate flowrate: 0 lbmol/h
  - Pressure profile: 10 psig at the condenser, 10 psig at stage 2 and 15 psig at the bottom
- Feeds:
  - Stream 1 at stage 14 (Reactor effluent)
  - Stream 4 at stage 12 (Gland oil)
  - Stream 3 at stage 11 (Steam 3)
  - Stream 5 at stage 7 (Rich sponge oil)
  - Stream 11 at stage 7 (Side stripper head stream)
- Sidestreams:
  - Stream 12 at stage 8 (Side stripper feed stream)
  - Stream 14 at stage 9 (Sponge oil)
  - Stream 15 at stage 11 (Heavy cycle)
- Pumparound 1:
  - From stage 4 to stage 2 (liquid phase)
  - Flowrate calculated for a duty of -1 MBtu/h
  - Temperature difference: -100 °F
- Pumparound 2:
  - From stage 11 to stage 10 (liquid phase)
  - Flowrate calculated for a duty of -10 MBtu/h
  - Temperature difference: -100 °F

- Pumparound 3:
    - From stage 15 to stage 13 (liquid phase)
    - Flowrate calculated for a duty of -10 MBtu/h
    - Temperature difference: -75 °F

#### 1.5.2.2. Objectives

- Flowrate (volume standard liquid) at stage 12: 150 bbl/h

  Adjusted variable: duty at pumparound 1
- Flowrate (volume standard liquid) of the liquid sidestream 14: 215 bbl/h

  Adjusted variable: sidestream flowrate 14
- Flowrate (volume standard liquid) of the liquid sidestream 15: 433.33 bbl/h

  Adjusted variable: sidestream flowrate 15
- Bottom liquid product flowrate: 46.83 bbl/h (volume standard liquid)

  Adjusted variable: duty at pumparound 3

#### 1.5.2.3. Initialization

- Liquid sidestream flowrate at stage 8: 400 lbmol/h (this flowrate is adjusted by a specification on the side stripper)
- Liquid sidestream flowrate at stage 9: 300 lbmol/h (this flowrate is adjusted by a specification)
- Liquid sidestream flowrate at stage 11: 500 lbmol/h (this flowrate is adjusted by a specification)
- Pumparound 1 reboiler duty: -1 MBtu/h (cooling)
- Pumparounds 2 and 3 reboiler duty: -10 MBtu/h (cooling)

### 1.5.3. Side-stripper

#### 1.5.3.1. Parameters

- Characteristics:
  - Absorber
  - Number of theoretical stages: 2
  - Pressure: 13 psig

#### 1.5.3.2. Objectives

- Bottom liquid product flowrate: 230 bbl/h in volume standard liquid

  Adjusted variable: feed flowrate (Stream 12)

### 1.5.4. General 3-phase flash

#### 1.5.4.1. Parameters

- Characteristics:
  - Temperature: 100 °F
  - Pressure: 5 psig

### 1.5.5. Numerical parameters

The default numerical parameters are used for all the unit operations expected for the main column: the maximum damping factor has been set to 0.3 and the maximum number of iterations to 100.

# 2. RESULTS

## 2.1. Mass and energy balances

This document only presents the most relevant stream results. In ProSimPlus, mass and energy balances are provided for every stream. Results are also available at the unit operation level (result tab in the configuration window).

Inlet streams:

| Streams | | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|
| From | | Reactor effluent | Steam 2 | Steam 3 | Gland oil | Rich sponge oil | Steam 6 |
| To | | Main column | Main column | Main column | Main column | Main column | Side Stripper |
| Total flow | lbmol/h | 5162.1 | 55.5 | 55.5 | 32.1 | 413.8 | 130.4 |
| Mole fractions | | | | | | | |
| WATER | | 0.11076 | 1 | 1 | 0 | 0 | 1 |
| HYDROGEN SULFIDE | | 0.02308 | 0 | 0 | 0 | 0.02751 | 0 |
| NITROGEN | | 0.01390 | 0 | 0 | 0 | 0.00354 | 0 |
| CARBON MONOXIDE | | 0.00118 | 0 | 0 | 0 | 0.00000 | 0 |
| CARBON DIOXIDE | | 0.00264 | 0 | 0 | 0 | 0.00000 | 0 |
| HYDROGEN | | 0.05669 | 0 | 0 | 0 | 0.00120 | 0 |
| METHANE | | 0.04987 | 0 | 0 | 0 | 0.01100 | 0 |
| ETHYLENE | | 0.00815 | 0 | 0 | 0 | 0.00551 | 0 |
| ETHANE | | 0.01498 | 0 | 0 | 0 | 0.04307 | 0 |
| PROPYLENE | | 0.06055 | 0 | 0 | 0 | 0.02498 | 0 |
| PROPANE | | 0.02714 | 0 | 0 | 0 | 0.01858 | 0 |
| ISOBUTENE | | 0.06818 | 0 | 0 | 0 | 0.02907 | 0 |
| ISOBUTANE | | 0.02429 | 0 | 0 | 0 | 0.01081 | 0 |
| n-BUTANE | | 0.00914 | 0 | 0 | 0 | 0.00728 | 0 |
| ISOPENTANE | | 0.03458 | 0 | 0 | 0 | 0.03034 | 0 |
| 3-METHYL-1-BUTENE | | 0.04386 | 0 | 0 | 0 | 0.02415 | 0 |
| n-PENTANE | | 0.00600 | 0 | 0 | 0 | 0.00670 | 0 |
| NBP-325(K) | | 0.01455 | 0 | 0 | 0 | 0 | 0 |
| NBP-337(K) | | 0.03765 | 0 | 0 | 0 | 0 | 0 |
| NBP-355(K) | | 0.03362 | 0 | 0 | 0 | 0 | 0 |
| NBP-373(K) | | 0.02831 | 0 | 0 | 0 | 0 | 0 |
| NBP-390(K) | | 0.02660 | 0 | 0 | 0 | 0 | 0 |
| NBP-409(K) | | 0.02252 | 0 | 0 | 0 | 0 | 0 |
| NBP-426(K) | | 0.02121 | 0 | 0 | 0 | 0 | 0 |
| NBP-444(K) | | 0.02065 | 0 | 0 | 0.01855 | 0.01403 | 0 |
| NBP-462(K) | | 0.02098 | 0 | 0 | 0.03233 | 0.02445 | 0 |
| NBP-479(K) | | 0.02419 | 0 | 0 | 0.04346 | 0.03287 | 0 |
| NBP-495(K) | | 0.01383 | 0 | 0 | 0.08705 | 0.06583 | 0 |
| NBP-515(K) | | 0.01037 | 0 | 0 | 0.14482 | 0.10952 | 0 |
| NBP-533(K) | | 0.01148 | 0 | 0 | 0.15481 | 0.11708 | 0 |
| NBP-550(K) | | 0.01182 | 0 | 0 | 0.13047 | 0.09867 | 0 |
| NBP-569(K) | | 0.01237 | 0 | 0 | 0.11142 | 0.08426 | 0 |
| NBP-586(K) | | 0.01531 | 0 | 0 | 0.10778 | 0.08151 | 0 |
| NBP-604(K) | | 0.03210 | 0 | 0 | 0.09400 | 0.07109 | 0 |
| NBP-621(K) | | 0.03238 | 0 | 0 | 0.06356 | 0.04807 | 0 |
| NBP-638(K) | | 0.02508 | 0 | 0 | 0.01175 | 0.00889 | 0 |
| NBP-656(K) | | 0.01172 | 0 | 0 | 0 | 0 | 0 |
| NBP-674(K) | | 0.00697 | 0 | 0 | 0 | 0 | 0 |
| NBP-692(K) | | 0.00444 | 0 | 0 | 0 | 0 | 0 |
| NBP-710(K) | | 0.00307 | 0 | 0 | 0 | 0 | 0 |
| NBP-726(K) | | 0.00159 | 0 | 0 | 0 | 0 | 0 |
| NBP-746(K) | | 0.00041 | 0 | 0 | 0 | 0 | 0 |
| NBP-775(K) | | 0.00077 | 0 | 0 | 0 | 0 | 0 |
| NBP-816(K) | | 0.00054 | 0 | 0 | 0 | 0 | 0 |
| NBP-859(K) | | 0.00040 | 0 | 0 | 0 | 0 | 0 |
| NBP-887(K) | | 0.00011 | 0 | 0 | 0 | 0 | 0 |
| Physical state | | Vapor | Vapor | Vapor | Liquid | Liquid | Vapor |
| Temperature | °F | 927.9 | 314.9 | 312.2 | 200.0 | 118.7 | 312.2 |
| Pressure | psig | 15.0 | 15.0 | 13.5 | 13.8 | 205.0 | 13.0 |
| Molar weight | g/mol | 98.7 | 18.0 | 18.0 | 200.8 | 163.5 | 18.0 |

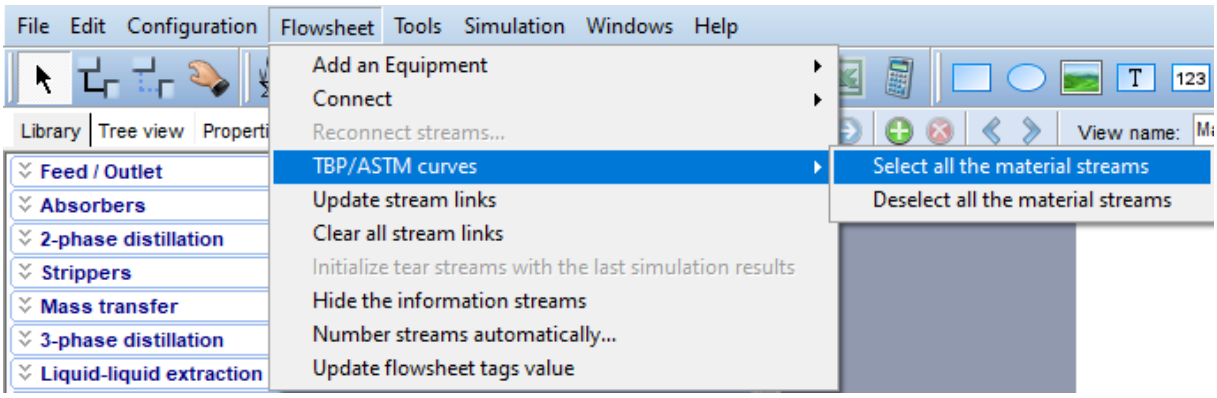
## Outlet streams:

| Streams | | 8 | 9 | 10 | 13 | 14 | 15 | 16 |
|---|---|---|---|---|---|---|---|---|
| From | | Flash | Flash | Flash | Side Stripper | Main column | Main column | Main column |
| To | | Water | Wet gas | Unstabilized gasoline | Light cycle oil | Sponge oil plus gland oil | Heavy cycle oil | Decant plus slurry |
| Total flow | lbmol/h | 690.3 | 2404.5 | 1397.4 | 380.4 | 330.1 | 593.5 | 53.2 |
| Mole fractions | | | | | | | | |
| WATER | | 1 | 0.04827 | 0.00128 | 0.00962 | 0.00126 | 0.00128 | 0.00380 |
| HYDROGEN SULFIDE | | 0 | 0.05239 | 0.00310 | 3E-07 | 0.00024 | 0.00022 | 0.00008 |
| NITROGEN | | 0 | 0.03039 | 0.00007 | 1E-09 | 0.00003 | 0.00003 | 0.00001 |
| CARBON MONOXIDE | | 0 | 0.00252 | 0.00001 | 1E-10 | 0.00000 | 0.00000 | 0.00000 |
| CARBON DIOXIDE | | 0 | 0.00558 | 0.00014 | 6E-09 | 0.00002 | 0.00002 | 0.00000 |
| HYDROGEN | | 0 | 0.12177 | 0.00017 | 4E-09 | 0.00012 | 0.00014 | 0.00003 |
| METHANE | | 0 | 0.10845 | 0.00074 | 2E-08 | 0.00019 | 0.00020 | 0.00005 |
| ETHYLENE | | 0 | 0.01816 | 0.00044 | 2E-08 | 0.00005 | 0.00005 | 0.00002 |
| ETHANE | | 0 | 0.03872 | 0.00138 | 8E-08 | 0.00012 | 0.00011 | 0.00003 |
| PROPYLENE | | 0 | 0.12642 | 0.01305 | 1E-06 | 0.00075 | 0.00066 | 0.00024 |
| PROPANE | | 0 | 0.05735 | 0.00684 | 7E-07 | 0.00035 | 0.00031 | 0.00011 |
| ISOBUTENE | | 0 | 0.12673 | 0.04158 | 0.00001 | 0.00135 | 0.00113 | 0.00046 |
| ISOBUTANE | | 0 | 0.04629 | 0.01302 | 0.00000 | 0.00045 | 0.00038 | 0.00015 |
| n-BUTANE | | 0 | 0.01690 | 0.00671 | 0.00000 | 0.00020 | 0.00016 | 0.00007 |
| ISOPENTANE | | 0 | 0.05097 | 0.04839 | 0.00002 | 0.00107 | 0.00085 | 0.00038 |
| 3-METHYL-1-BUTENE | | 0 | 0.06815 | 0.05117 | 0.00002 | 0.00126 | 0.00101 | 0.00045 |
| n-PENTANE | | 0 | 0.00819 | 0.00995 | 0.00000 | 0.00020 | 0.00016 | 0.00007 |
| NBP-325(K) | | 0 | 0.01374 | 0.02972 | 0.00002 | 0.00069 | 0.00053 | 0.00026 |
| NBP-337(K) | | 0 | 0.02799 | 0.08970 | 0.00010 | 0.00208 | 0.00155 | 0.00076 |
| NBP-355(K) | | 0 | 0.01601 | 0.09527 | 0.00019 | 0.00237 | 0.00169 | 0.00084 |
| NBP-373(K) | | 0 | 0.00776 | 0.08976 | 0.00035 | 0.00258 | 0.00177 | 0.00089 |
| NBP-390(K) | | 0 | 0.00404 | 0.08948 | 0.00067 | 0.00314 | 0.00205 | 0.00104 |
| NBP-409(K) | | 0 | 0.00172 | 0.07809 | 0.00121 | 0.00354 | 0.00220 | 0.00111 |
| NBP-426(K) | | 0 | 0.00081 | 0.07410 | 0.00230 | 0.00446 | 0.00261 | 0.00132 |
| NBP-444(K) | | 0 | 0.00039 | 0.07561 | 0.00539 | 0.00652 | 0.00351 | 0.00176 |
| NBP-462(K) | | 0 | 0.00019 | 0.07621 | 0.01515 | 0.01098 | 0.00500 | 0.00249 |
| NBP-479(K) | | 0 | 0.00009 | 0.07379 | 0.05928 | 0.02688 | 0.00822 | 0.00400 |
| NBP-495(K) | | 0 | 0.00002 | 0.02616 | 0.11948 | 0.04522 | 0.00720 | 0.00316 |
| NBP-515(K) | | 0 | 8E-07 | 0.00361 | 0.17547 | 0.07827 | 0.00955 | 0.00335 |
| NBP-533(K) | | 0 | 4E-08 | 0.00042 | 0.17806 | 0.10421 | 0.01632 | 0.00506 |
| NBP-550(K) | | 0 | 1E-09 | 0.00003 | 0.13880 | 0.11262 | 0.02630 | 0.00743 |
| NBP-569(K) | | 0 | 3E-11 | 2E-06 | 0.10052 | 0.11517 | 0.04290 | 0.01142 |
| NBP-586(K) | | 0 | 1E-12 | 2E-07 | 0.07732 | 0.12312 | 0.07589 | 0.02089 |
| NBP-604(K) | | 0 | 5E-14 | 2E-08 | 0.07043 | 0.16755 | 0.18966 | 0.06571 |
| NBP-621(K) | | 0 | 0 | 1E-09 | 0.03487 | 0.11351 | 0.22404 | 0.10138 |
| NBP-638(K) | | 0 | 0 | 0 | 0.00926 | 0.05050 | 0.18043 | 0.11759 |
| NBP-656(K) | | 0 | 0 | 0 | 0.00116 | 0.01275 | 0.08609 | 0.08890 |
| NBP-674(K) | | 0 | 0 | 0 | 0.00023 | 0.00416 | 0.05030 | 0.08741 |
| NBP-692(K) | | 0 | 0 | 0 | 0.00005 | 0.00141 | 0.02962 | 0.09134 |
| NBP-710(K) | | 0 | 0 | 0 | 0.00001 | 0.00048 | 0.01732 | 0.10143 |
| NBP-726(K) | | 0 | 0 | 0 | 1E-06 | 0.00011 | 0.00681 | 0.07726 |
| NBP-746(K) | | 0 | 0 | 0 | 7E-08 | 0.00001 | 0.00106 | 0.02794 |
| NBP-775(K) | | 0 | 0 | 0 | 6E-09 | 2E-06 | 0.00064 | 0.06775 |
| NBP-816(K) | | 0 | 0 | 0 | 0 | 5E-08 | 0.00005 | 0.05210 |
| NBP-859(K) | | 0 | 0 | 0 | 0 | 8E-10 | 3E-06 | 0.03867 |
| NBP-887(K) | | 0 | 0 | 0 | 0 | 0 | 2E-07 | 0.01078 |
| Physical state | | Liquid | Vapor | Liquid | Liquid | Liquid | Liquid | Liquid |
| Temperature | °F | 100.0 | 100.0 | 100.0 | 414.2 | 489.8 | 563.5 | 656.1 |
| Pressure | psig | 5.0 | 5.0 | 5.0 | 13.0 | 12.7 | 13.5 | 15.0 |
| Molar weight | g/mol | 18.0 | 42.4 | 116.4 | 194.0 | 215.0 | 251.8 | 315.1 |

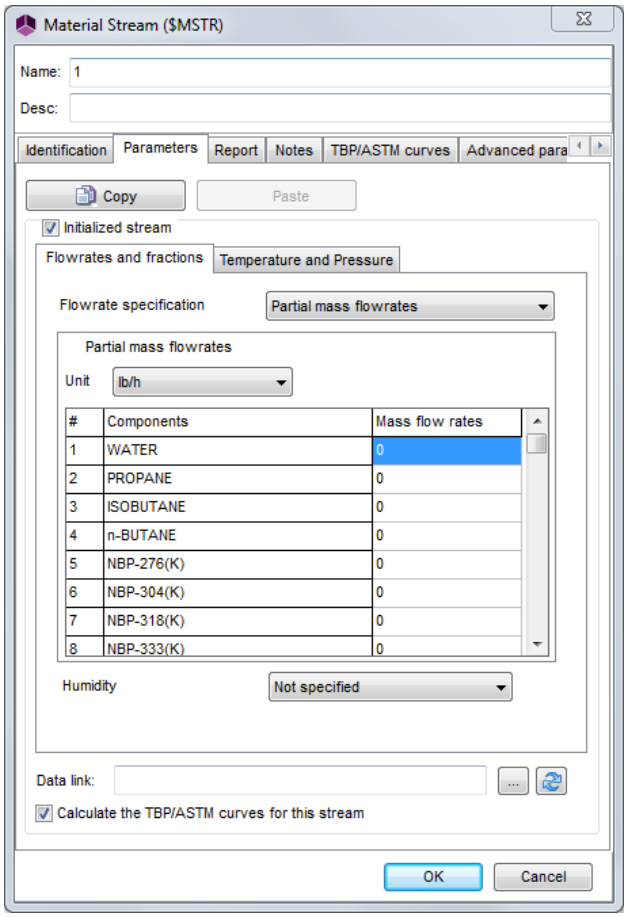
## 2.2. Process Performances

With ProSimPlus, it is possible to generate the TBP/ASTM curves of material streams. To do so, two ways are available:

- Select the option to plot the TBP/ASTM curves of all the material streams of the process during the next simulation in the tab “Flowsheet” as shown in the following figure:



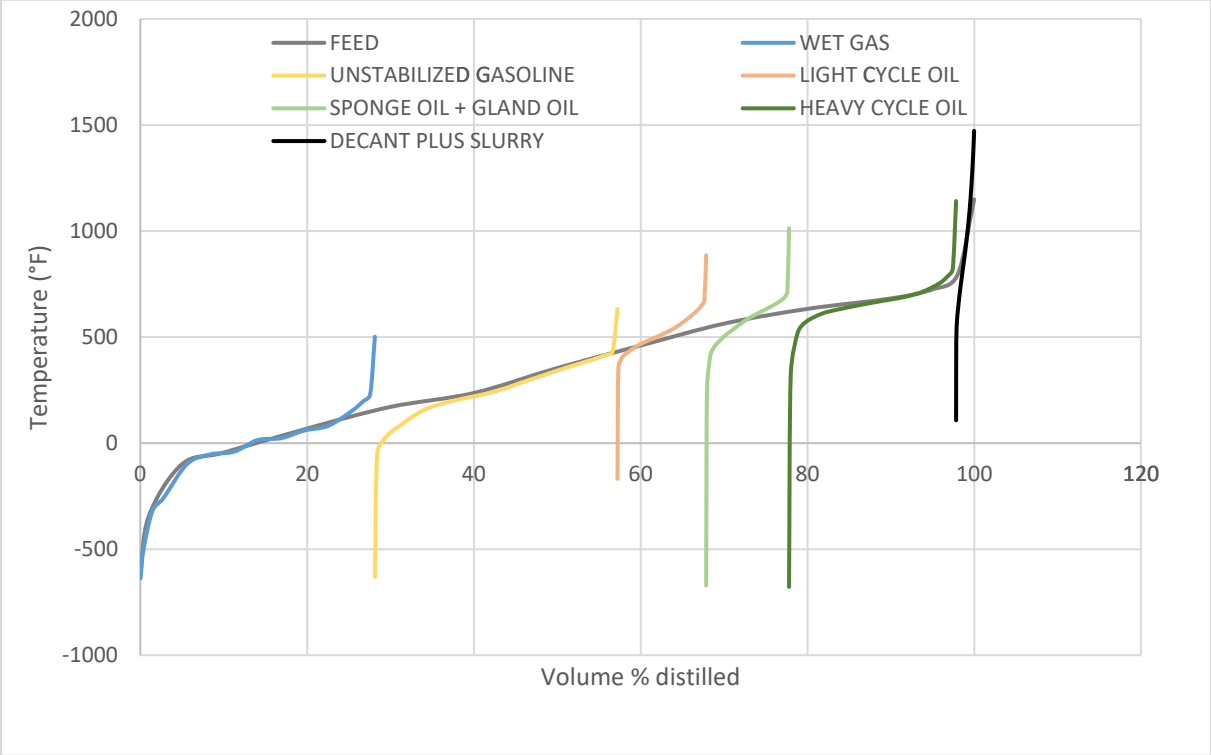

- Tick the “Calculate the TBP/ASTM curves for this stream” box in the configuration window of the material stream which TBP/ASTM curves have to be plotted during the next simulation as illustrated below:



To reach this option the “Initialized stream” box has to be ticked and then unticked once the “Calculate the TBP/ASTM curves for this stream” box has been ticked.

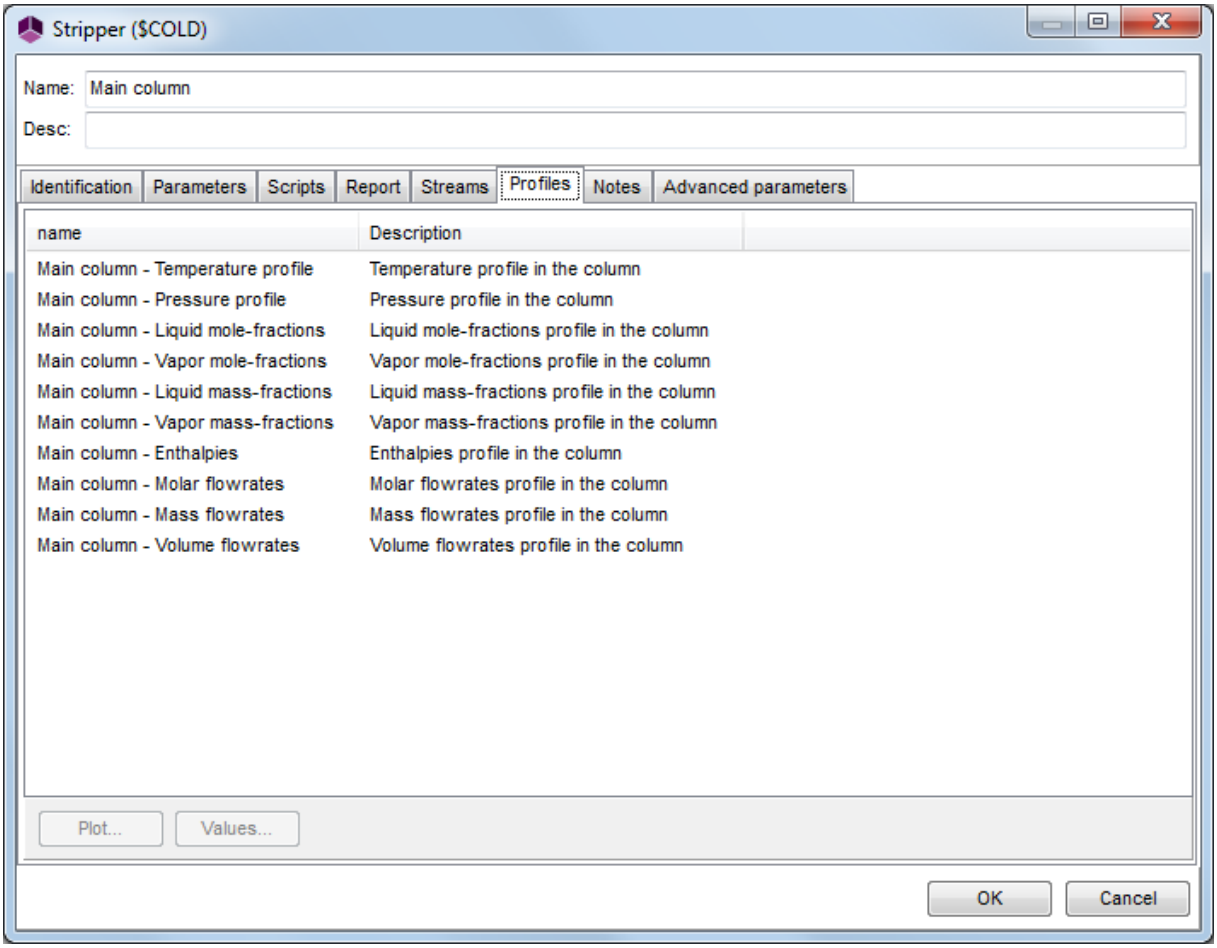
The following figure shows on a same graph the TBP at 760 mmHg curve of the mixture of the feeds (excepted the water vapor streams) entering the main column and the ones of the obtained cuts:



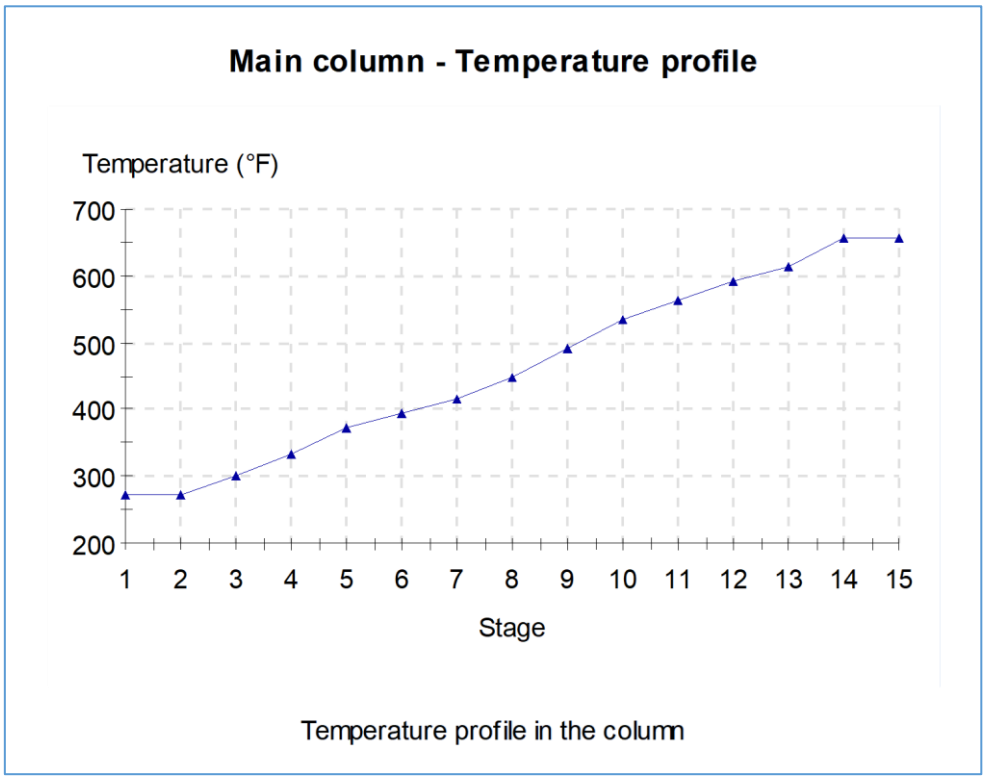
## 2.3. Column profiles

Profiles can be accessed after the simulation in each column configuration window, in the “Profiles” tab. Double clicking on the profile will generate the corresponding graph. It is important to note that, in ProSimPlus, the first stage corresponds to the top stage and the last stage to the bottom stage (respectively the condenser and the reboiler in the case of a distillation column).

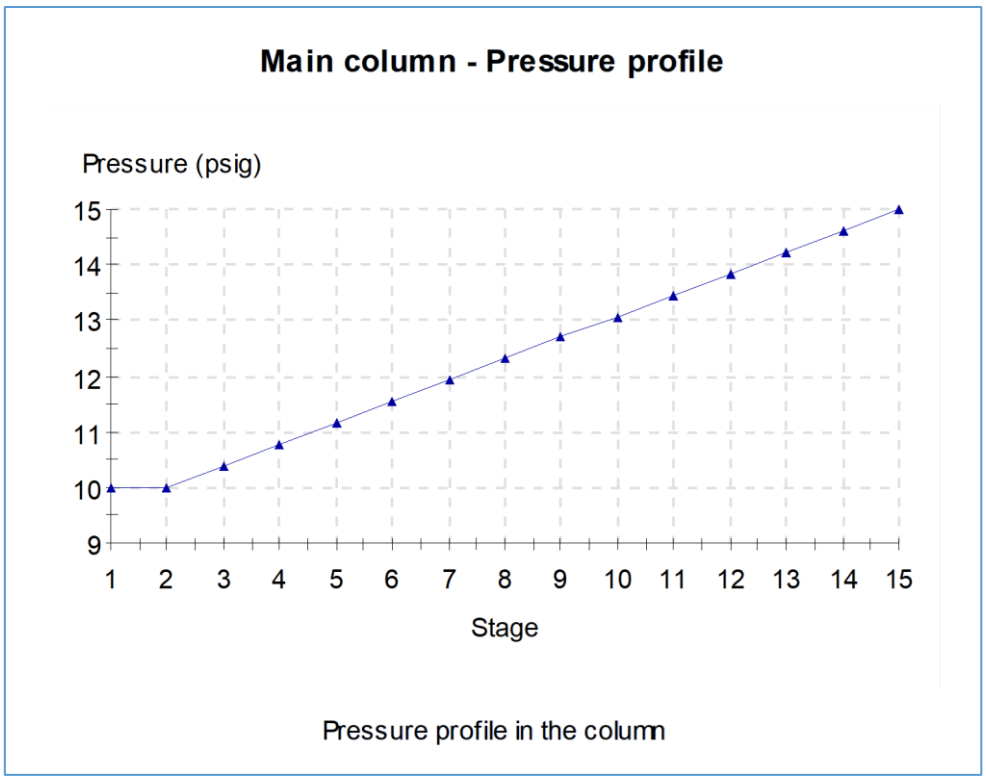


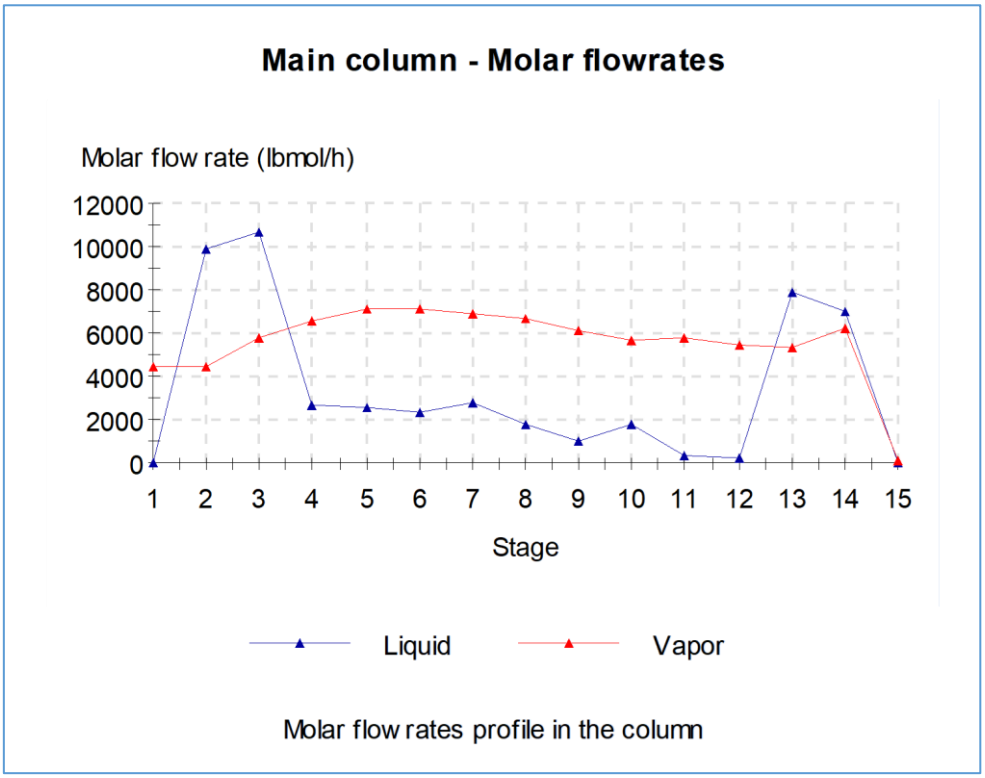
Main column:




Temperature profile in the column

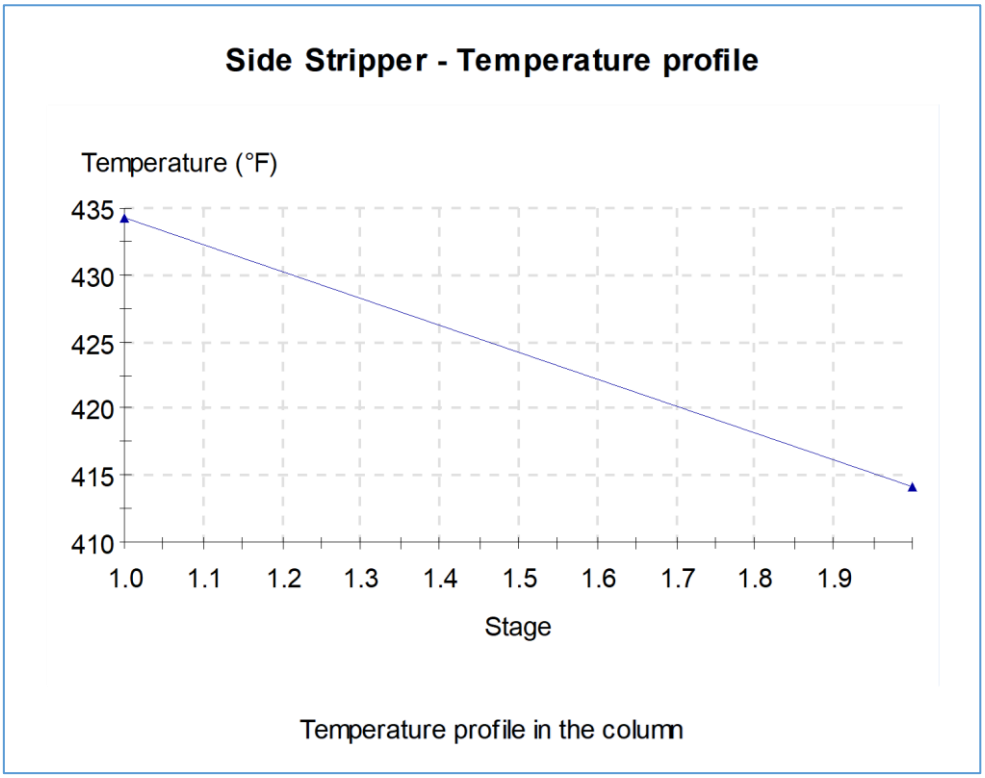



Pressure profile in the column

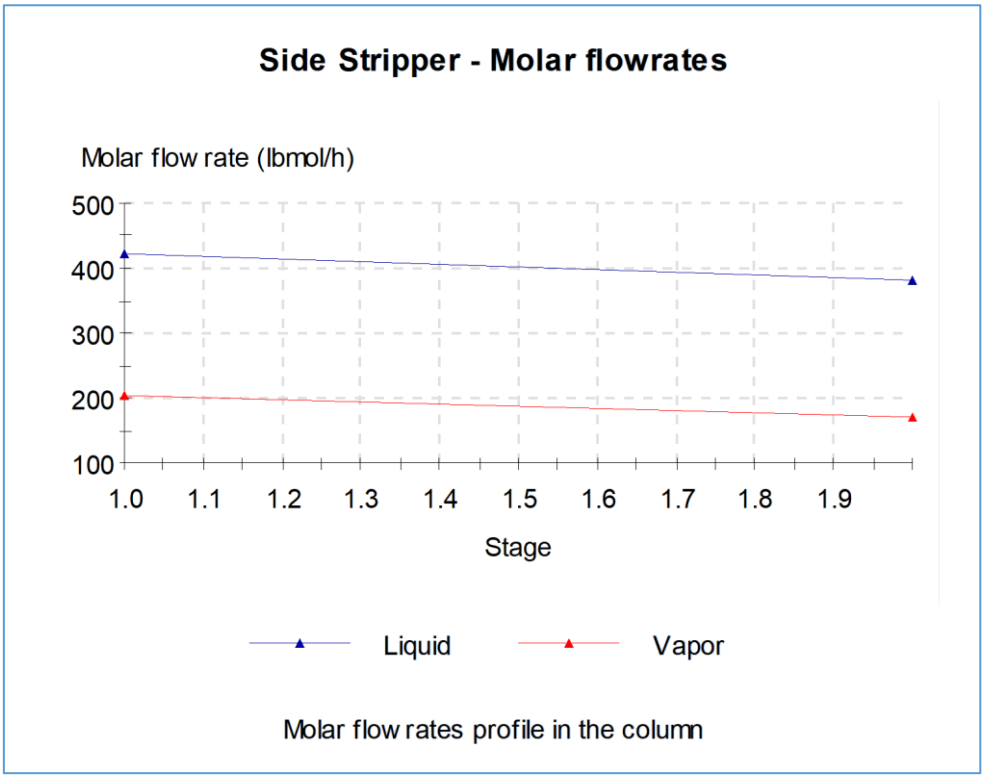



Molar flow rates profile in the column

Side stripper:




Temperature profile in the column




Molar flow rates profile in the column

# REFERENCES

[SIM83] Simulation Sciences Inc., SimSci Manual, Revision 1 (1983)

[SIM81] Simulation Sciences Inc., Troubleshooting the FCCU main fractionators on the timesharing terminal, SimSci Process – Technical Bulletin #23 (1981)