

EXAMPLE PURPOSE		
This example illustrates the simulation of a crude oil atmospheric distillation unit with a preflash ProSimPlus.	column	with

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CORRESPONDING PROSIMPLUS FILE	PSPS_EX_EN-Atmospheric-Distillation-with-Preflash.pmp3
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Il est rappelé au lecteur que ce cas d'utilisation est un exemple et ne doit pas être utilisé à d'autres fins. Bien que cet exemple soit basé sur un cas réel il ne doit pas être considéré comme un modèle de ce type de procédé et les données utilisées ne sont pas toujours les plus exactes disponibles. Fives ProSim ne pourra en aucun cas être tenu pour responsable de l'application qui pourra être faite des calculs basés sur cet exemple.

Energy

Fives ProSim

Siège social : Immeuble Stratège A - 51 rue Ampère - 31670 Labège - FRANCE Tél. : +33 (0)5 62 88 24 30 S.A.S. au capital de 147 800 € - 350 476 487 R.C.S. Toulouse - Siret 350 476 487 00037 - APE 5829C - N° TVA FR 10 350 476 487 www.fivesgroup.com / <u>www.fives-prosim.com</u>

TABLE OF CONTENTS

1. Pro	DCESS MODELING	3
1.1.	Process presentation	3
1.2.	Process flowsheet	3
1.3.	Compounds	4
1.4.	Thermodynamic model	9
1.5.	Operating conditions	9
1.5.	1. Feeds	9
1.5.2	2. Preflash column C1	10
1.5.3	3. Side stripper C2	11
1.5.4	4. Main column C3	11
1.5.	5. Side stripper C4	12
1.5.0	6. Side stripper C5	13
1.5.7	7. Numerical parameters	13
2. Res	SULTS	13
2.1.	Mass and energy balances	13
2.2.	Process Performances	15
2.3.	Column profiles	18
Referei	NCES	25

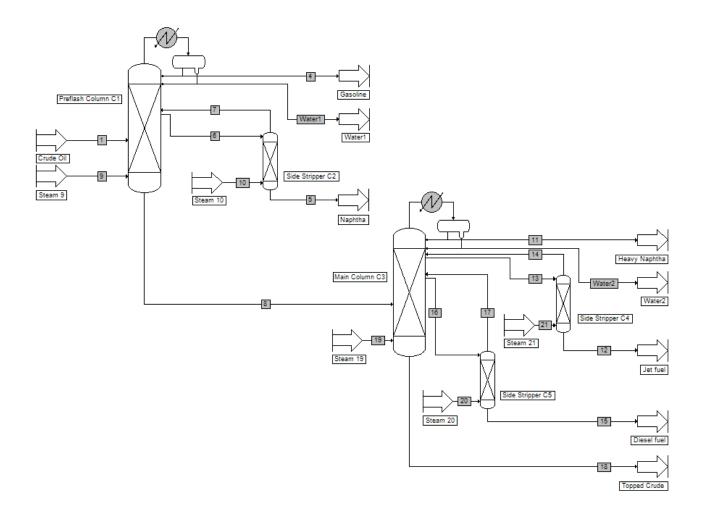
1. PROCESS MODELING

1.1. Process presentation

The distillation system consists of a preflash column coupled with a side stripper and of a main column coupled with two side strippers. These columns have got a decanter and a total condenser. The liquid streams that feed this two main columns are pre-heated with furnaces: these furnaces are simulated by a heating on the column feed stages.

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

1.2. <u>Process flowsheet</u>



1.3. Compounds

The crude oil to be processed is made of 32 compounds: 3 light-ends (propane, isobutane, n-butane) and 29 pseudo-compounds. Water is also used for the stripping vapor in this process.

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

CALCULATOR	This	window helps you to define	the context of your thermodynamic calculator		
TLE			BINARIES PARAMETERS		
i Open					
Save as	#	IUPAC Name	Registry Cas Number		COMPOUNDS
u a	1	WATER	7732-18-5		
ACKAGE	- 🛨 📫	PROPANE	74-98-6		FILE A
	5	ISOBUTANE n-BUTANE	75-28-5 106-97-8		i Open
SERVICES	- 🔶 📳	NBP-276(K)	106-97-8		Save as
📓 Calculate	5	NBP-304(K)			
Export as a PSF file	7	NBP-318(K)			Publish
2		NBP-333(K)			
🗠 Diagrams	9	NBP-346(K)			РАСКАБЕ ———— 🔻
🔀 Residue	10	NBP-360(K)			ЕДП ———— 🔺
	11	NBP-373(K)			
🕹 Export as a PVT file	12	NBP-387(K)			Select compounds
Stream	13	NBP-401(K)	Pseudo-compounds		📓 Edit this compound
🔀 Sigma profiles	14	NBP-415(K)	creation service		Add a new compound
Sigma promes	15	NBP-429(K)	creation service		
	16	NBP-443(K)			🐨 Remove all the compounds
MODIFICATIONS	- 🛨 17	NBP-457(K)			Clone this compound
	18	NBP-471(K)			
CONFIGURATION	- 🔺 19	NBP-485(K)			X Delete the selection
Name	20	NBP-498(K)			
[New calculator]	21	NBP-512(K)			SERVICES — A
Comments	22	NBP-526(K)			Create a pseudo-compound
	23	NBP-540(K)			 Temperature dependent propertie
·	24	NBP-554(K)			
Calculator type	25	NBP-575(K)			Editor array
	26	NBP-603(K)			Compare with the original
Native	▼ 27	NBP-629(K)			
Show the expert mode	28	NBP-658(K)			Compare the compounds
	29	NBP-699(K)			
	30	NBP-754(K)			ORDER A
	31	NBP-810(K)			Move this compound up
	32	NBP-865(K)			Maya this compound days

The pseudo-compounds are generated using the following crude oil properties:

- the mean API gravity,
- the TPB at 760 mmHg,
- the API gravity curve,
- the lights volume composition.

The required data are provided in the following screen shot:

elect the source curve type: TBP at 7	60 mmHg						•
			Mea	n API gravity			
DATA	35,0000						
Copy data to clipboard							
Paste data from clipboard				1			
-	Volume percent distil		tures	Volume percent di	istillated	-	vity data cur
Insert a new line	3,83000	98 °F		12,0000		66,7000	
🛐 Delete the current line	5,00000	125 °F		19,0000		55,3000	
🔀 Draw graph	10,0000 20,0000	167 °F 227 °F		40,0000 62,0000		37,6000 27,0000	
- · · ·	30,0000	291 °F		82,0000		19,0000	
OPTIONS	40,0000	370 °F		02,0000		10,0000	
Mean API gravity 🔻	50,0000	460 °F					
and the second	60,0000	552 °F					
API gravity data curve 🔻	70,0000	643 °F					
INITS	80,0000	799 °F]			
	90,0000	1023 °F					
Temperature °F 🛛 🔻	100,000	1440 °F					
Light ends							
		Bubble temp. (K)		cular weight (g/mol)		/ (g/cm3)	Volume %
Data 🔺	WATER	373,15	18,015	53	0,998997	/ (g/cm3)	Volume %
pata 🔺	WATER PROPANE	373,15 231,11	18,015 44,095	53	0,998997 0,5057	r (g/cm3)	Volume 9 0 0,18
lata 🔺	WATER : PROPANE : ISOBUTANE :	373,15 231,11 261,43	18,015 44,095 58,122	53 56 22	0,998997 0,5057 0,563246	r (g/cm3) 7	Volume % 0 0,18 0,3
Pata Copy data to clipboard	WATER : PROPANE : ISOBUTANE :	373,15 231,11	18,015 44,095	53 56 22	0,998997 0,5057	r (g/cm3) 7	Volume % 0 0,18
Data A	WATER : PROPANE : ISOBUTANE :	373,15 231,11 261,43	18,015 44,095 58,122	53 56 22	0,998997 0,5057 0,563246	r (g/cm3) 7	Volume % 0 0,18 0,3
Data Copy data to clipboard	WATER : PROPANE : ISOBUTANE :	373,15 231,11 261,43	18,015 44,095 58,122	53 56 22	0,998997 0,5057 0,563246	r (g/cm3) 7	Volume % 0 0,18 0,3
ata A for a clipboard fo	WATER : PROPANE : ISOBUTANE :	373,15 231,11 261,43	18,015 44,095 58,122	53 56 22	0,998997 0,5057 0,563246	r (g/cm3) 7	Volume % 0 0,18 0,3
Pata	WATER : PROPANE : ISOBUTANE :	373,15 231,11 261,43	18,015 44,095 58,122	53 56 22	0,998997 0,5057 0,563246	r (g/cm3) 7	Volume % 0 0,18 0,3
ata Copy data to clipboard Paste data from clipboard omposition type Volume	WATER : PROPANE : ISOBUTANE :	373,15 231,11 261,43	18,015 44,095 58,122	53 56 22	0,998997 0,5057 0,563246	r (g/cm3) 7	Volume % 0 0,18 0,3
ata Copy data to clipboard Paste data from clipboard omposition type Volume	WATER : PROPANE : ISOBUTANE :	373,15 231,11 261,43	18,015 44,095 58,122	53 56 22	0,998997 0,5057 0,563246	r (g/cm3) 7	Volume % 0 0,18 0,3
ata Copy data to clipboard Paste data from clipboard omposition type Volume	WATER : PROPANE : ISOBUTANE :	373,15 231,11 261,43	18,015 44,095 58,122	53 56 22	0,998997 0,5057 0,563246	r (g/cm3) 7	Volume % 0 0,18 0,3
ata Copy data to clipboard Paste data from clipboard omposition type Volume	WATER : PROPANE : ISOBUTANE :	373,15 231,11 261,43	18,015 44,095 58,122	53 56 22	0,998997 0,5057 0,563246	r (g/cm3) 7	Volume 9 0 0,18 0,3
Pata	WATER : PROPANE : ISOBUTANE :	373,15 231,11 261,43	18,015 44,095 58,122	53 56 22	0,998997 0,5057 0,563246	r (g/cm3) 7	Volume % 0 0,18 0,3
Pata	WATER : PROPANE : ISOBUTANE :	373,15 231,11 261,43	18,015 44,095 58,122	53 56 22	0,998997 0,5057 0,563246	r (g/cm3) 7	Volume % 0 0,18 0,3
Pata	WATER : PROPANE : ISOBUTANE :	373,15 231,11 261,43	18,015 44,095 58,122	53 56 22	0,998997 0,5057 0,563246	r (g/cm3) 7	Volume % 0 0,18 0,3
Pata	WATER : PROPANE : ISOBUTANE :	373,15 231,11 261,43	18,015 44,095 58,122	53 56 22	0,998997 0,5057 0,563246	r (g/cm3) 7	Volume % 0 0,18 0,3
Pata	WATER : PROPANE : ISOBUTANE :	373,15 231,11 261,43	18,015 44,095 58,122	53 56 22	0,998997 0,5057 0,563246	r (g/cm3) 7	Volume % 0 0,18 0,3
Pata	WATER : PROPANE : ISOBUTANE :	373,15 231,11 261,43	18,015 44,095 58,122	53 56 22	0,998997 0,5057 0,563246	r (g/cm3) 7	Volume % 0 0,18 0,3
Pata	WATER : PROPANE : ISOBUTANE :	373,15 231,11 261,43	18,015 44,095 58,122	53 56 22	0,998997 0,5057 0,563246	r (g/cm3) 7	Volume % 0 0,18 0,3
Pata	WATER : PROPANE : ISOBUTANE :	373,15 231,11 261,43	18,015 44,095 58,122	53 56 22	0,998997 0,5057 0,563246	r (g/cm3) 7	Volume % 0 0,18 0,3
Pata	WATER : PROPANE : ISOBUTANE :	373,15 231,11 261,43	18,015 44,095 58,122	53 56 22	0,998997 0,5057 0,563246	r (g/cm3) 7	Volume % 0 0,18 0,3
Paste data from clipboard Composition type Volume	WATER : PROPANE : ISOBUTANE :	373,15 231,11 261,43	18,015 44,095 58,122	53 56 22	0,998997 0,5057 0,563246	γ (g/cm3)	Volume % 0 0,18 0,3 0,69

The distillation curve is cut as follows: 4 compounds between 50 and 150 °F, 16 compounds between 150 and 550 °F, 4 compounds between 550 and 750 °F and 5 compounds between 750 and 1250 °F.

Options			
Intervals Co	nversions		
	Temperature i	ntervals for distillation (cuts
Values are	expressed in:	°F ▼	
📄 Сору	Paste	💱 Reset	
T Min.	T Max.	Number of compou	Delta T 🔺
50	150	4	25
150	550	16	25
550	750	4	50
750	1250	5	100
		Ok	Cancel

The normal boiling points of the compounds generated with Simulis are gathered in the following table. The minimal temperature of the first interval is taken equal to the heaviest light normal boiling point (here 31 °F for the n-butane).

Compound	Normal boiling point (°F)
NBP-276(K)	37
NBP-304(K)	88
NBP-318(K)	114
NBP-333(K)	139
NBP-346(K)	163
NBP-360(K)	187
NBP-373(K)	212
NBP-387(K)	237
NBP-401(K)	262
NBP-415(K)	287
NBP-429(K)	312
NBP-443(K)	337
NBP-457(K)	362
NBP-471(K)	387
NBP-485(K)	412
NBP-498(K)	437
NBP-512(K)	462
NBP-526(K)	487
NBP-540(K)	513
NBP-554(K)	538
NBP-575(K)	575
NBP-603(K)	625
NBP-629(K)	673
NBP-658(K)	725
NBP-699(K)	799
NBP-754(K)	898
NBP-810(K)	999
NBP-865(K)	1098
NBP-969(K)	1284

The obtained molar composition of the crude oil is presented in the table below. The molar mass calculated is equal to 163.42 g/mol.

1	Compound	Molar composition
	WATER	0
	PROPANE	0.00397
	ISOBUTANE	0.00560
	n-BUTANE	0.01335
	NBP-276(K)	0.03596
	NBP-304(K)	0.01465
	NBP-318(K)	0.01788
	NBP-333(K)	0.04094
	NBP-346(K)	0.05631
	NBP-360(K)	0.06382
	NBP-373(K)	0.06105
	NBP-387(K)	0.05699
	NBP-401(K)	0.05380
	NBP-415(K)	0.04910
	NBP-429(K)	0.04272
	NBP-443(K)	0.03763
	NBP-457(K)	0.03378
	NBP-471(K)	0.03159
	NBP-485(K)	0.03000
	NBP-498(K)	0.02840
	NBP-512(K)	0.02679
	NBP-526(K)	0.02583
	NBP-540(K)	0.02479
	NBP-554(K)	0.02383
	NBP-575(K)	0.04544
	NBP-603(K)	0.04160
	NBP-629(K)	0.02584
	NBP-658(K)	0.01881
	NBP-699(K)	0.03108
	NBP-754(K)	0.02114
	NBP-810(K)	0.01463
	NBP-865(K)	0.00962
	NBP-969(K)	0.01282

1.4. Thermodynamic model

The studied process deals with mixtures of water (with molar ratio less than 50% when not pure) and hydrocarbons. Thus, a Peng-Robinson (PR) equation of state with the Water-Hydrocarbons model has been chosen. The liquid molar volume calculation uses the "Ideal mixture" model.

1.5. Operating conditions

1.5.1. Feeds

The aim is to process 25 000 bbl/d of crude oil at standard conditions (60 °F and 1 bar). This corresponds to 28 510 bbld/d (1 187.9 bbl/h) in the process operating conditions. The crude oil is at 300 °F and 54.636 psi.

The vapor flowrates that feed the main columns and side strippers are the following:

- Stream "Steam 9": 3 000 lb/h (T = 314.3074 °F ; P = 55 psi)
- Stream "Steam 10": 900 lb/h (T = 313.8679 °F ; P = 54 psi)
- Stream "Steam 19": 1 500 lb/h (T = 300.5648 °F ; P = 25 psi)
- Stream "Steam 20": 650 lb/h (T = 300.0882 °F ; P = 24 psi)
- Stream "Steam 21": 600 lb/h (T = 300.0879 °F ; P = 24 psi)

1.5.2. Preflash column C1

1.5.2.1.Parameters

- Characteristics:
 - Stripper with decanter and total condenser subcooled to 100 °F
 - Number of theoretical stages: 13
 - o Operating mode specification: reflux flowrate, initial value: 3 000 lbmol/h
 - Intermediate reboiler at stage 11 (in order to simulate the feed heating in the furnace), initial value: 30 MBtu/h
 - Pressure profile: 48 psi at the condenser, 53 psi at stage 2, 55 psi at the bottom
- Feeds:
 - "Crude oil" at stage 11
 - Stream 7 at stage 7 (C2 side stripper head stream)
- Sidestream:
 - Stream 6 at stage 8 (stream feeding the side stripper C2) , initial value: 100 lbmol/h
- Pumparound:
 - From stage 8 to stage 6 (liquid phase)
 - Flowrate: 5 200 bbl/d (216.667 bbl/h, standard conditions)
 - Power: 5 MBtu/h (cooling)
 - 1.5.2.2. Objectives / Constraints
- Bottom liquid product flowrate: 16 800 bbl/d (700 bbl/h, standard conditions)

Adjusted variable: reflux flowrate

- Overflash: 400 bbl/d (16.667 bbl/h, standard conditions)

In ProSimPlus, the overflash is not specified in flowrate but in flowrate ratio (the liquid flowrate arriving at the feed stage divided by the flashed feed flowrate at the column pressure) at the feed stage. The fixed constraint in the simulation is here the liquid flowrate at stage 10 and is equal to 16.667 bbl/h (standard conditions).

Adjusted variable: stage 11 intermediate heat duty

1.5.2.3. Initializations

- Head composition in molar fraction: 0.1 for the 10 lightest hydrocarbons
- Bottom composition in molar fraction: 0.05 for the 20 heaviest hydrocarbons

1.5.3. Side stripper C2

1.5.3.1.Parameters

- Characteristics:
 - o Absorber
 - Number of theoretical stages: 2
 - Pressure: 54 psi

1.5.3.2. Objectives / Constraints

Bottom liquid product flowrate (Naphtha): 5 420 bbl/d (225.833 bbl/h, standard conditions)
 Adjusted variable: feed flowrate (stream 6)

1.5.4. Main column C3

1.5.4.1.Parameters

- Characteristics:
 - Stripper with decanter and total condenser subcooled to 100 °F
 - Number of theoretical stages: 16
 - Operating mode specification: reflux flowrate
 - Stage 14 intermediate reboiler (to simulate the heating of the feed in the furnace)
 - Pressure profile: 20 psi at the condenser, 23 psi at stage 2, 25 psi at the bottom

Feeds:

- Stream 8 at stage 14 (bottom liquid product stream of the preflash column)
- Stream 14 at stage 7 (head stream of the side stripper C4)
- Stream 17 at stage 11 (head stream of the side stripper C5)

- Sidestreams:
 - Stream 13 at stage 8 (stream feeding the side stripper C4)
 - Stream 16 at stage 12 (stream feeding the side stripper C5)
- Pumparound:
 - From stage 12 to stage 10 (liquid phase)
 - Flowrate: 4 700 bbl/d (195.833 bbl/h, standard conditions)
 - Power: 5 MBtu/h (cooling)

1.5.4.2. Objectives / Constraints

- Bottom liquid product flowrate: 7 335 bbl/d (305.625 bbl/h, standard conditions)

Adjusted variable: reflux flowrate

- Overflash of 0.05 (standard conditions)

Adjusted variable: stage 4 intermediate heating

The overflash in volume is defined as the liquid volume flowrate entering the feed stage divided by the feed volume flowrate (standard conditions).

- Stage 9 liquid flowrate: 200.2 bbl/h (standard conditions)

Adjusted variable: pumparound reboiler heat duty

1.5.4.3. Initializations

- Stage 8 sidestream liquid flowrate: 100 lbmol/h (this flowrate is adjusted by a specification of the side stripper C4).
- Stage 12 sidestream liquid flowrate: 100 lbmol/h (this flowrate is adjusted by a specification of the side stripper C5).
- Reflux flowrate: 1 000 lbmol/h
- Stage 14 intermediate reboiler heat duty: 40 MBtu/h (this heat duty is adjusted by the overflash specification)
- Head composition in molar fraction: 0.1 for the 11th to the 20th lightest hydrocarbons
- Bottom composition in molar fraction: 0.1 for the heaviest 10 hydrocarbons

1.5.5. Side stripper C4

1.5.5.1.Parameters

- Characteristics:

- o Absorber
- o Number of theoretical stages: 2
- o Pressure: 24 psi

1.5.5.2. Objectives / Constraints

Bottom liquid product flowrate (Jet fuel): 3 780 bbl/d (157.5 bbl/h, standard conditions)
 Adjusted variable: feed flowrate (stream 13)

1.5.6. Side stripper C5

1.5.6.1.Parameters

- Characteristics:
 - o Absorber
 - Number of theoretical stages: 2
 - Pressure: 24 psi

1.5.6.2. Objectives / Constraints

- Bottom liquid product flowrate (Diesel fuel): 3 765 bbl/d (156.875 bbl/h, standard conditions

Adjusted variable: feed flowrate (stream 16)

1.5.7. Numerical parameters

The default numerical parameters are used for all the unit operations.

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	9	10	19	20	21
From		Crude Oil	Steam 9	Steam 10	Steam 19	Steam 20	Steam 21
То		Preflash Column C1	Preflash Column C1	Side Stripper C2	Main Column C3	Side Stripper C5	Side Stripper C4
Total flow	lbmol/h	1850.8	166.5	50.0	83.3	36.1	33.3
Mole fractions		0	0	0	0	0	0
WATER		0	1	1	1	1	1
PROPANE		0.00397	0	0	0	0	0
ISOBUTANE		0.00560	0	0	0	0	0
n-BUTANE		0.01335	0	0	0	0	0
NBP-276(K)		0.03596	0	0	0	0	0
NBP-304(K)		0.01465	0	0	0	0	0
NBP-318(K)		0.01788	0	0	0	0	0
NBP-333(K)		0.04094	0	0	0	0	0
NBP-346(K)		0.05631	0	0	0	0	0
NBP-360(K)		0.06382	0	0	0	0	0
NBP-373(K)		0.06105	0	0	0	0	0
NBP-387(K)		0.05699	0	0	0	0	0
NBP-401(K)		0.05380	0	0	0	0	0
NBP-415(K)		0.04910	0	0	0	0	0
NBP-429(K)		0.04272	0	0	0	0	0
NBP-443(K)		0.03763	0	0	0	0	0
NBP-457(K)		0.03378	0	0	0	0	0
NBP-471(K)		0.03159	0	0	0	0	0
NBP-485(K)		0.03000	0	0	0	0	0
NBP-498(K)		0.02844	0	0	0	0	0
NBP-512(K)		0.02698	0	0	0	0	0
NBP-526(K)		0.02583	0	0	0	0	0
NBP-540(K)		0.02479	0	0	0	0	0
NBP-554(K)		0.02383	0	0	0	0	0
NBP-575(K)		0.04544	0	0	0	0	0
NBP-603(K)		0.04160	0	0	0	0	0
NBP-629(K)		0.02584	0	0	0	0	0
NBP-658(K)		0.01881	0	0	0	0	0
NBP-699(K)		0.03108	0	0	0	0	0
NBP-754(K)		0.02114	0	0	0	0	0
NBP-810(K)		0.01463	0	0	0	0	0
NBP-865(K)		0.00962	0	0	0	0	0
NBP-969(K)		0.01282	0	0	0	0	0
Physical state		Liquid	Vapor	Vapor	Vapor	Vapor	Vapor
Temperature	°F	300.0	314.3	313.9	300.6	300.1	300.1
Pressure	psi	54.6	55.0	54.0	25.0	24.0	24.0
Molar weight	g/mol	163.42	18.02	18.02	18.02	18.02	18.02

Outlet streams:

Streams		4	5	11	12	15	18	Water1	Water2
From		Preflash Column C1	Side Stripper C2	Main Column C3	Side Stripper C4	Side Stripper C5	Main Column C3	Preflash Column C1	Main Column C3
То		Gasoline	Naphtha	Heavy Naphtha	Jet fuel	Diesel fuel	Topped Crude	Water1	Water2
Total flow	lbmol/h	300.0	568.2	196.3	300.3	231.9	268.2	191.1	163.9
Mole fractions		0	0	0	0	0	0	0	0
WATER		0.00128	0.01533	0.00128	0.00589	0.00545	0.00659	1	1
PROPANE		0.02440	0.00004	0.00004	1E-09	3E-10	2E-10	0	0
ISOBUTANE		0.03398	0.00022	0.00020	2E-08	4E-09	2E-09	0	0
n-BUTANE		0.08034	0.00082	0.00071	9E-08	2E-08	7E-09	0	0
NBP-276(K)		0.21554	0.00257	0.00218	3E-07	7E-08	3E-08	0	0
NBP-304(K)		0.08339	0.00291	0.00229	1E-06	2E-07	5E-08	0	0
NBP-318(K)		0.09572	0.00610	0.00463	4E-06	5E-07	2E-07	0	0
NBP-333(K)		0.19101	0.02614	0.01838	0.00003	4E-06	1E-06	0	0
NBP-346(K)		0.18266	0.07227	0.04234	0.00013	0.00002	4E-06	0	0
NBP-360(K)		0.07692	0.14117	0.07471	0.00044	0.00005	0.00001	0	0
NBP-373(K)		0.01301	0.15560	0.10339	0.00110	0.00012	0.00003	0	0
NBP-387(K)		0.00155	0.13800	0.13130	0.00244	0.00026	0.00006	0	0
NBP-401(K)		0.00017	0.11704	0.15934	0.00524	0.00054	0.00012	0	0
NBP-415(K)		0.00002	0.09322	0.17475	0.01097	0.00103	0.00021	0	0
NBP-429(K)		0.00000	0.06887	0.16138	0.02575	0.00179	0.00036	0	0
NBP-443(K)		2E-07	0.05006	0.09774	0.07045	0.00301	0.00060	0	0
NBP-457(K)		1E-08	0.03597	0.02237	0.12076	0.00500	0.00098	0	0
NBP-471(K)		1E-09	0.02607	0.00268	0.13570	0.00836	0.00163	0	0
NBP-485(K)		1E-10	0.01847	0.00026	0.13666	0.01389	0.00266	0	0
NBP-498(K)		0	0.01246	0.00002	0.13036	0.02277	0.00421	0	0
NBP-512(K)		0	0.00788	2E-06	0.11702	0.03700	0.00648	0	0
NBP-526(K)		0	0.00461	1E-07	0.09631	0.05888	0.00973	0	0
NBP-540(K)		0	0.00243	6E-09	0.06854	0.08683	0.01413	0	0
NBP-554(K)		0	0.00113	2E-10	0.04042	0.11221	0.01981	0	0
NBP-575(K)		0	0.00057	0	0.02683	0.25482	0.06205	0	0
NBP-603(K)		0	0.00006	0	0.00444	0.21349	0.09741	0	0
NBP-629(K)		0	4E-06	0	0.00047	0.10096	0.09053	0	0
NBP-658(K)		0	2E-07	0	0.00004	0.04556	0.09037	0	0
NBP-699(K)		0	6E-09	0	2E-06	0.02576	0.19221	0	0
NBP-754(K)		0	0	0	6E-09	0.00209	0.14412	0	0
NBP-810(K)		0	0	0	0	0.00009	0.10088	0	0
NBP-865(K)		0	0	0	0	3E-06	0.06639	0	0
NBP-969(K)		0	0	0	0	1E-08	0.08846	0	0
Physical state		Liquid	Liquid	Liquid	Liquid	Liquid	Liquid	Liquid	Liquid
Temperature	°F	100.0	268.7	100.0	382.3	509.4	601.3	100.0	100.0
Pressure	psi	48.0	54.0	20.0	24.0	24.0	25.0	48.0	20.0
Molar weight	g/mol	73.88	107.82	110.97	156.96	212.48	376.96	18.02	18.02

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:

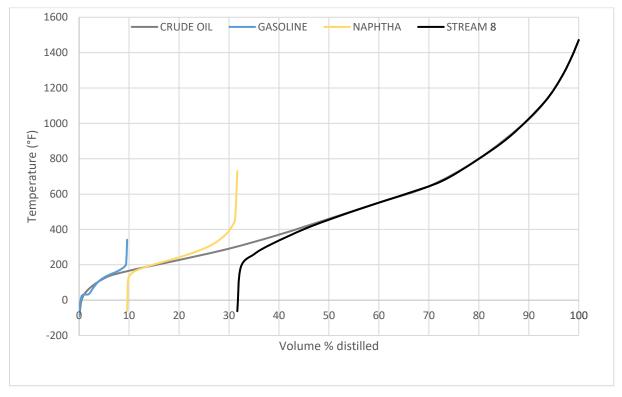
- Select the option to plot the TBP/ASTM curves of all the material streams of the process during the next simulation in the tab "Flowsheet" as shown in the following figure:

File Edit Configuration	Flowsheet Tools Simulation Windows Help		
▶ ┬_ ┬_ ≫ ↓	Add an Equipment	۲	📓 📄 🔵 🔙 T 123
.	Connect	•	
Library Tree view Properti	Reconnect streams		[🔁 🔯 🔍 🔪 View name: 🕅
🌣 Feed / Outlet	TBP/ASTM curves	•	Select all the material streams
× Absorbers	Update stream links		Deselect all the material streams
🔆 2-phase distillation	Clear all stream links		
× Strippers	Initialize tear streams with the last simulation results		
	Hide the information streams		
🔆 3-phase distillation	Number streams automatically		
Liquid-liquid extraction	Update flowsheet tags value		

- 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:

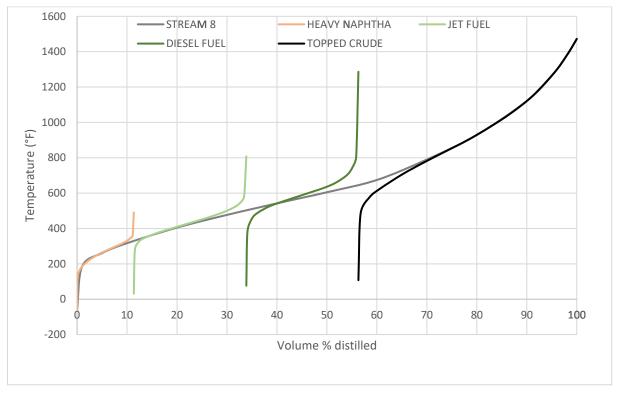
lame:)esc:	· [
ldenti	ificatio	Parameters	Report	Notes	TBP/A	STM curves	Advance	ed para 👎	•	
	6	Сору		Paste						
☑ Initialized stream										
Flowrates and fractions Temperature and Pressure										
	Flowrs	ate specification		Partial n	nace flo	wrates		_		
		ne apecinication		Faitial II	1055 110	Widles		•		
Partial mass flowrates										
	Unit	lb/h		-						
	#	Components				Mass flow ra	ites			
	1	WATER			0					
	2	PROPANE				0				
	3	ISOBUTANE				0				
	4	n-BUTANE			0					
	5	5 NBP-276(K)				0				
	6 NBP-304(K)					0				
	7	NBP-318(K)				0				
	8	NBP-333(K)				0				
Humidity Not specified -										
Dat	a link:									
		te the TBP/AST	Mieuryce	for this :	etreem					
V	Calcula	ite the TBP/AST	m curves	for this :	stream					

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 crude oil entering the preflash C1 column and the ones of the cuts obtained at the outlet of this column:

The following figure shows on a same graph the TBP at 760 mmHg curve of the stream 8 entering the main column C3 and the ones of the cuts obtained at the outlet of this column:

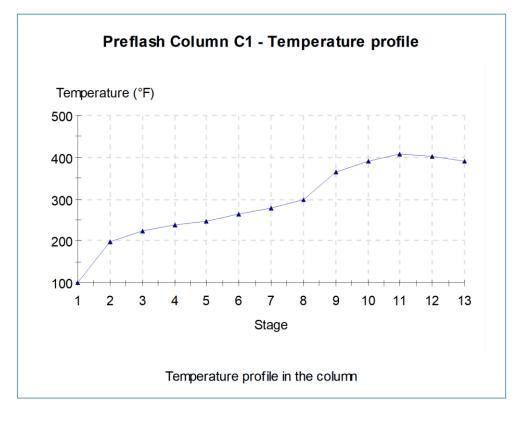


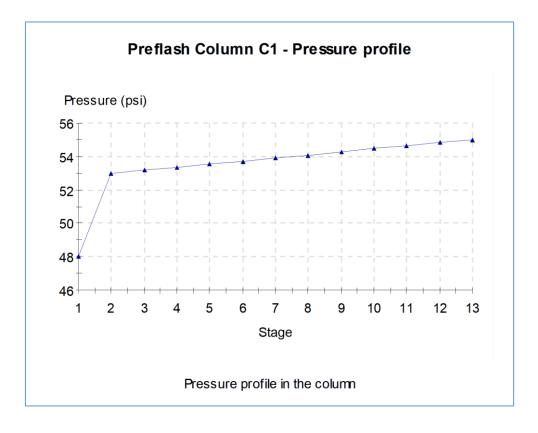
2.3. Column profiles

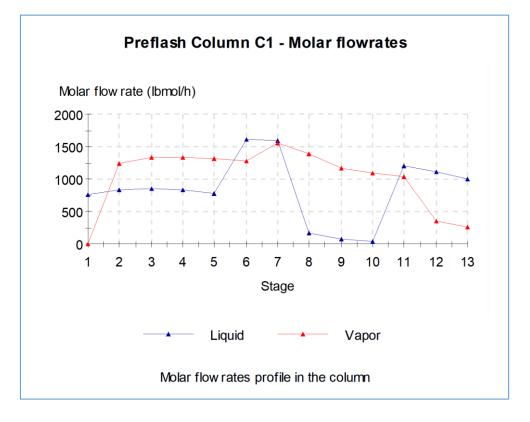
Profiles can be accessed after the simulation in each column configuration window, in the "Profiles" tab. Double clicking on the profile will generate the corresponding graph. It is important to note that, in ProSimPlus, the first stage corresponds to the top stage and the last stage to the bottom stage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

Stripper with decanter (total condenser)) (\$COLD)							
Name: Preflash Column C1 Desc:								
Identification Parameters Scripts Report	Streams Profiles Notes Advanced parameters							
name	Description							
Preflash Column C1 - Temperature profile Temperature profile in the column Preflash Column C1 - Pressure profile Pressure profile in the column								
Preflash Column C1 - Liquid mole-fractions	Liquid mole-fractions profile in the column							
Preflash Column C1 - Vapor mole-fractions	Vapor mole-fractions profile in the column							
Preflash Column C1 - Liquid mass-fractions Preflash Column C1 - Vapor mass-fractions	Liquid mass-fractions profile in the column Vapor mass-fractions profile in the column							
Preflash Column C1 - Enthalpies	Enthalpies profile in the column							
Preflash Column C1 - Molar flowrates	Molar flowrates profile in the column							
Preflash Column C1 - Mass flowrates	Mass flowrates profile in the column							
Preflash Column C1 - Volume flowrates	Volume flowrates profile in the column							
Plot Values								
		OK Cancel						

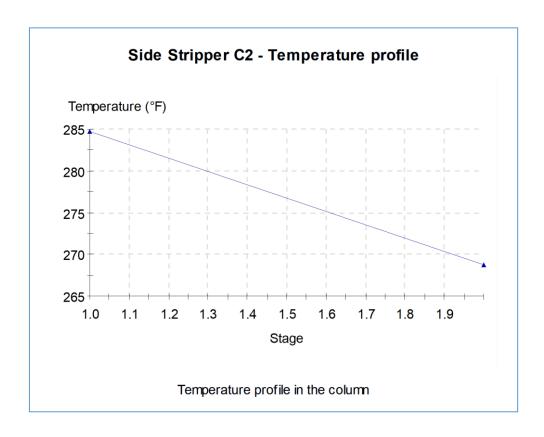
Preflash column C1:

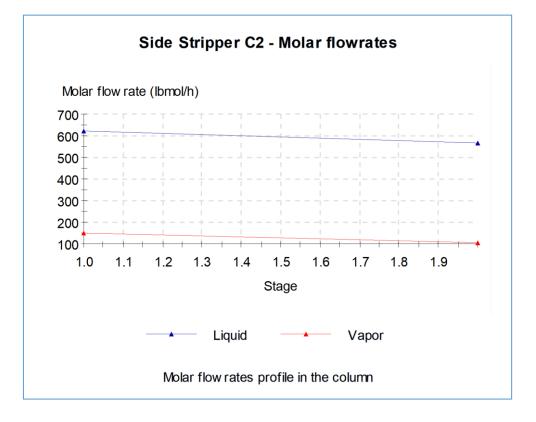




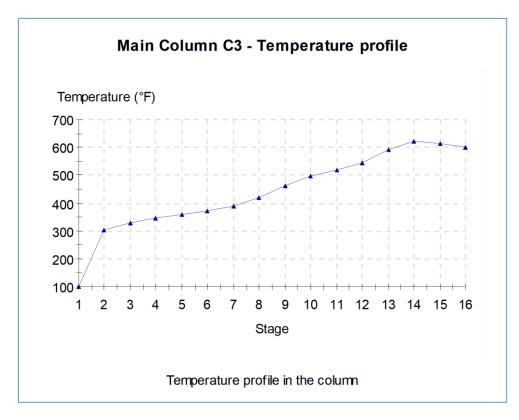


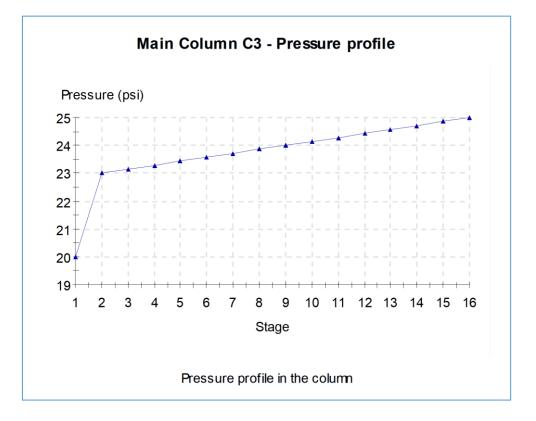
Side stripper C2:

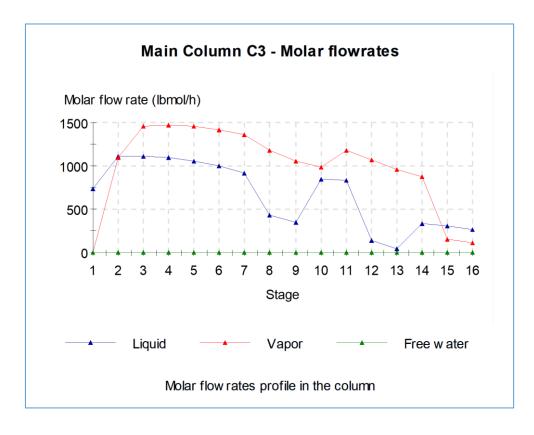




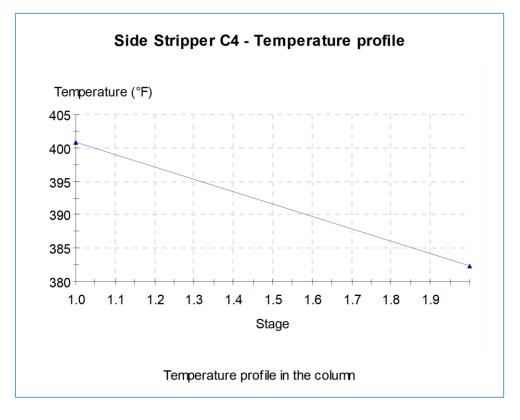
Main column C3:

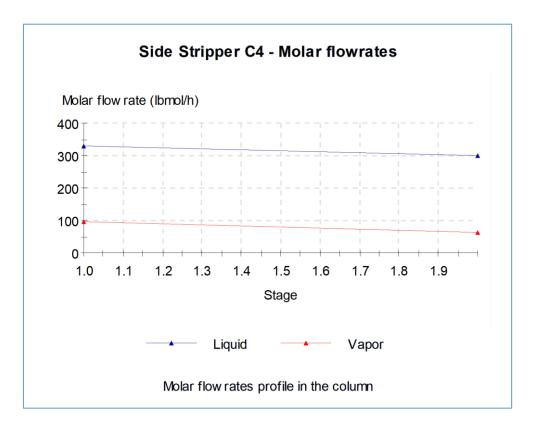




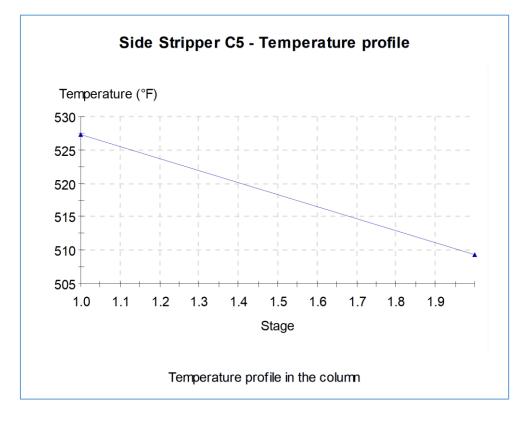


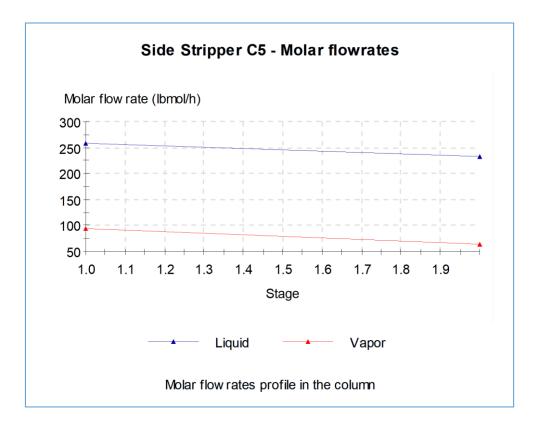
Side stripper C4:





Side stripper C5:





REFERENCES

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