PROSIMPLUS APPLICATION EXAMPLE

LOAD & EXPORT OF DATA BETWEEN PROSIMPLUS AND EXCEL BY SCRIPTING

EXAMPLE PURPOSE
This example illustrates the possibility to link ProSimPlus to Excel: ProSimPlus loads parameters from an Excel file and exports simulation results to the same Excel file.

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

CORRESPONDING PROSIMPLUS FILE	*PSPS_EX_EN-Script-Load-&-Export-Excel.pmp3*
CORRESPONDING EXCEL FILE	*PSPS_EX_EN - data.xls*

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.

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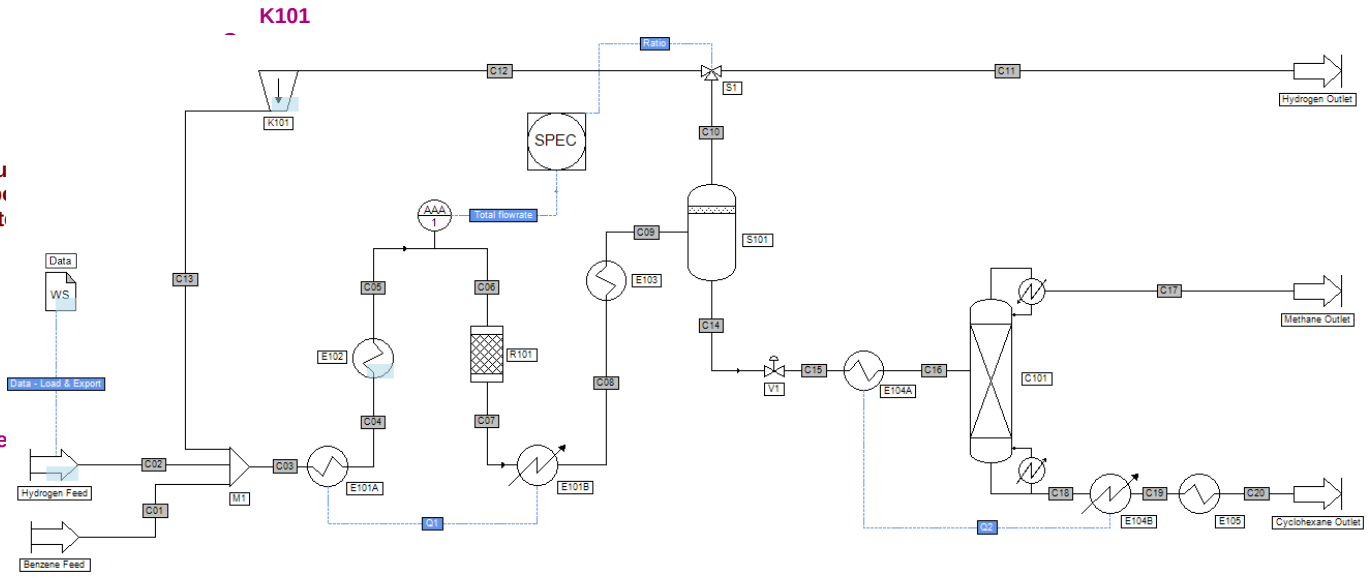
1. PROCESS FLOWSHEET

The process flowsheet is based on the Cyclohexane Plant flowsheet (refer to the ProSimPlus example "PSPS_EX_EN - Cyclohexane Plant.pmp3" for a complete description of the process).



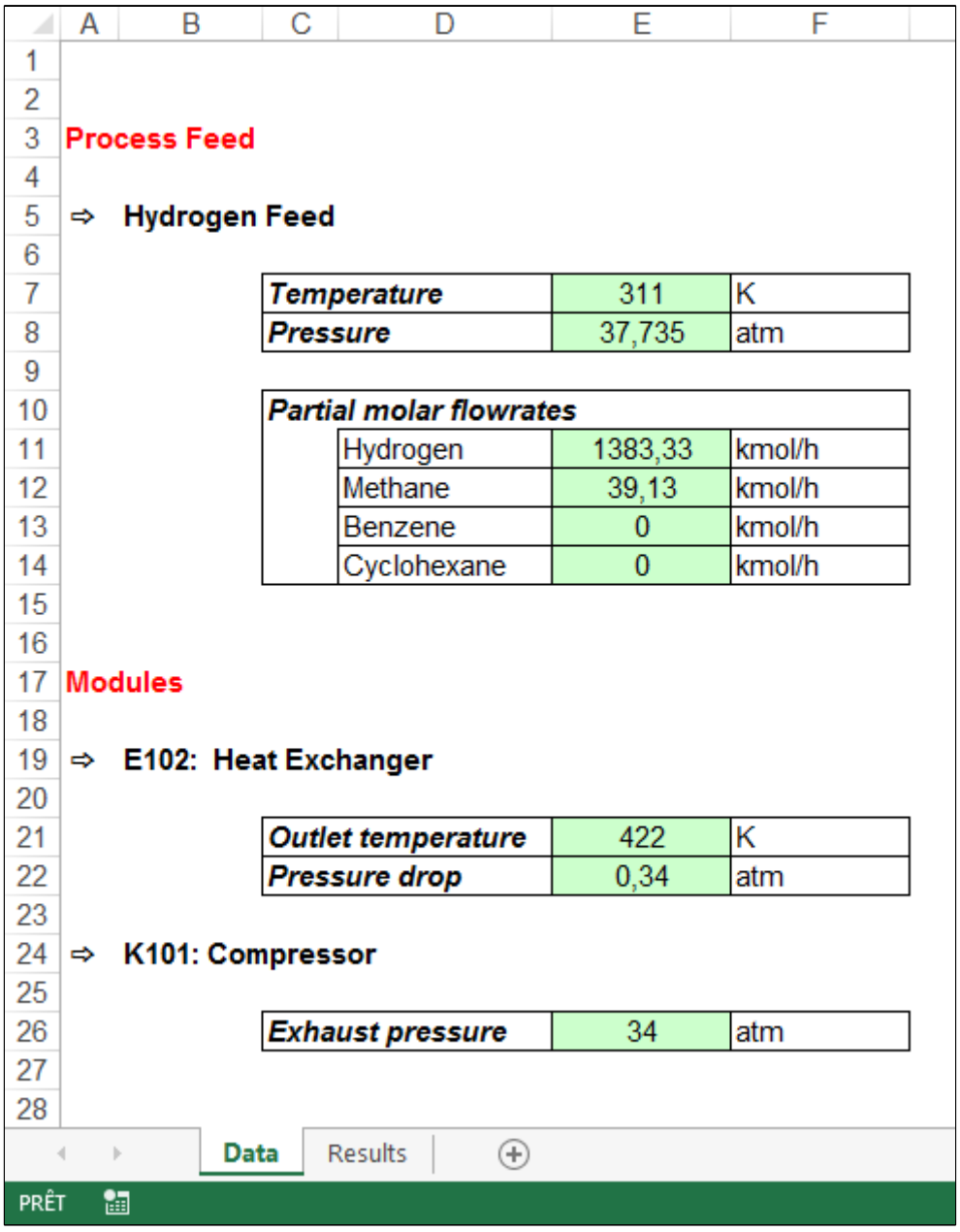
The parameters to be loaded and exported are presented hereafter.

To be loaded	To be exported
Hydrogen Feed: Temperature, pressure and partial molar flowrates	**E102 Heat Exchanger:** Heat duty required to reach the fixed outlet temperature
E102 Heat Exchanger: Outlet temperature and pressure drop	**E103 Heat Exchanger:** Heat duty required to reach the fixed outlet temperature
K101 Compressor: Exhaust pressure	**C101 Column:** Condenser and reboiler heat duties

2. LOAD & EXPORT

2.1. Excel file

The parameters used by the ProSimPlus simulation file are described in the sheet named “Data” and presented below.



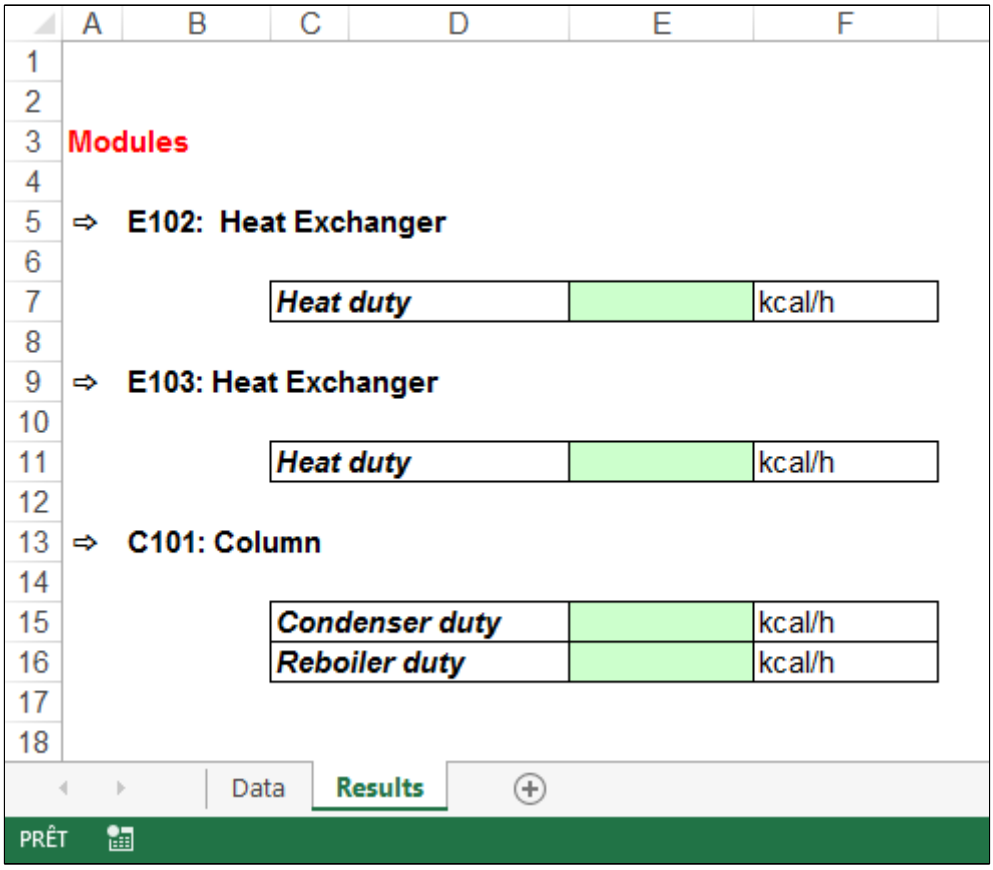
Process Feed			
⇨ **Hydrogen Feed**			
	Temperature	311	K
	Pressure	37,735	atm
	Partial molar flowrates		
	Hydrogen	1383,33	kmol/h
	Methane	39,13	kmol/h
	Benzene	0	kmol/h
	Cyclohexane	0	kmol/h
Modules			
⇨ **E102: Heat Exchanger**			
	Outlet temperature	422	K
	Pressure drop	0,34	atm
⇨ **K101: Compressor**			
	Exhaust pressure	34	atm

Data Results

PRÊT

Remark: the data to be loaded must be in ProSim Units. The full ProSim unit system can be found in ProSimPlus in the “Unit sytem” menu : 

The simulation results are exported to the following sheet, named “Results”:



2.2. Scripts

A Windows Script Module named “Data” is used to load the data of operating parameters from Excel. Other modules (Hydrogen Feed, E101 and E102 Heat Exchangers…) use then these parameters during calculations.

At the end of the simulation, the Windows Script Module is able to export results to Excel.

2.2.1. "Data" Windows Script Module

The script (used to load and export parameters) is presented below.

```
' Return the path of the folder containing the specified file (without the "\" delimiter)
Function ExtractFilePath(Filename)

  Set fileSystem = CreateObject("Scripting.FileSystemObject")
  Set file = fileSystem.GetFile(Filename)
  ExtractFilePath = fileSystem.GetParentFoldername(file) & "\"
  Set file = Nothing
  Set fileSystem = Nothing

End Function
```

File path extraction

```
Dim Excel, Workbook

Sub OnSimulationStart()

  ' Excel: Application creation
  Set Excel = CreateObject("Excel.Application")

  ' Data file: Opening
  Set Workbook = Excel.Workbooks.Open(ExtractFilePath(Project.Filename) & _
    "PSPS_EX_EN - data.xls")

End Sub
```

Start of simulation:

- Excel Object creation
- Excel File opening

```
' Data load
Function OnCalculation()

  With Module

    ' --> Hydrogen Feed
    .parameter(1) = WorkBook.WorkSheets("Data").Range("E7") ' Temperature
    .parameter(2) = WorkBook.WorkSheets("Data").Range("E8") ' Pressure

    For i = 1 to Project.Compounds.Count
      .parameter(2+i) = WorkBook.WorkSheets("Data").Range("E"& 10+i)  ' Partial Flowrates
    Next

    ' --> E102: Heat Exchanger
    Project.UserValues("E102_T") = WorkBook.WorkSheets("Data").Range("E21")    ' Temperature
    Project.UserValues("E102_DP") = WorkBook.WorkSheets("Data").Range("E22")   ' Pressure drop

    '  --> K101: Compressor
    .parameter(12) = WorkBook.WorkSheets("Data").Range("E26")   ' Exhaust Pressure

  End With
  Oncalculation = True

End Function
```

Module Calculation:

- Data loading

```
' Data export
Sub OnSimulationEnd()

  ' --> E102: Heat duty
  WorkBook.WorkSheets("Results").Range("E7") = Project.modules("E102").HeatDuty

  ' --> E103: Heat duty
  WorkBook.WorkSheets("Results").Range("E11") = Project.modules("E103").HeatDuty

  ' --> C101: Condenser (Qc) and reboiler (Qb) duties
  WorkBook.WorkSheets("Results").Range("E15") = Project.modules("C101").Qc
  WorkBook.WorkSheets("Results").Range("E16") = Project.modules("C101").Qb

  '  Data File: Save and close
  WorkBook.Save
  WorkBook.Close
  Set Workbook = Nothing

  ' Excel: Exit
  Excel.quit

  ' Excel: Application release
  Set Excel = Nothing

End Sub
```

End of simulation:

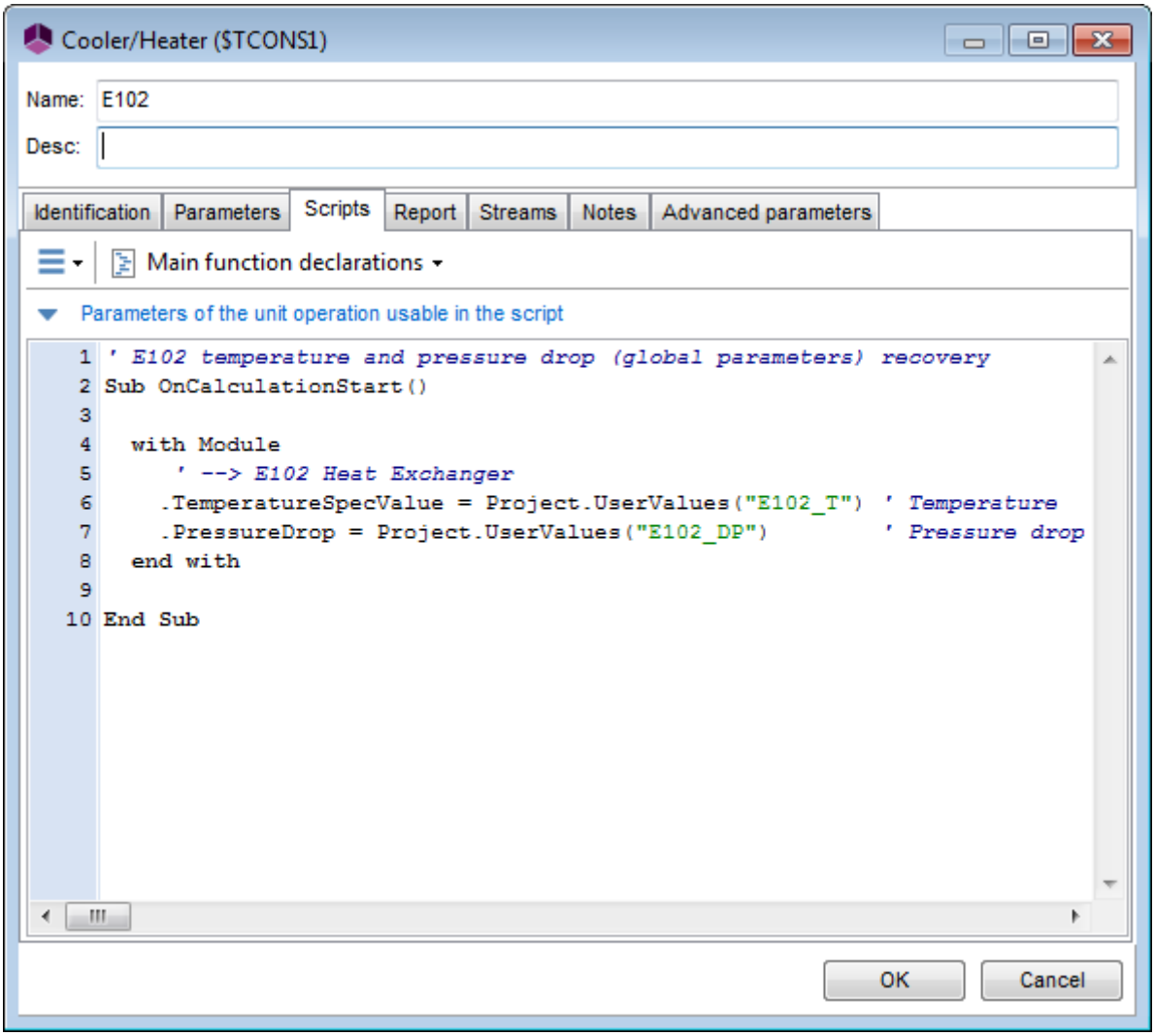
- Data exporting
- Excel file: Save and close
- Excel Object: Release

Remark: ProSimPlus user must specify the right Excel File location.

In this example: “ExtractFilePath(Project.Filename) & "PSPS_EX_EN - data.xls"” means that the Excel file "PSPS_EX_EN - data.xls" is in the same directory as the simulation file. Of course, this location can be modified.

EXX (XX between 7 and 26 in this example) are the Excel cell addresses of the working parameters (for importation or exportation).

To access the “Script” tab of a module, open the corresponding module definition window and select the “Script” tab as presented below for the “E102” module:

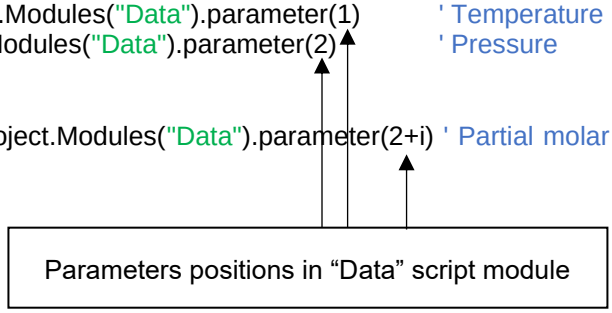


For further information about scripting in ProSimPlus, please refer to the “Windows script” help accessible by pressing “F1” in the script module definition window.

2.2.2. Hydrogen Feed

The script used in the “Hydrogen Feed” module is presented hereafter.

```
‘ Temperature, pressure and partial molar flowrates recovery from the "Data" script module
Sub OnCalculationStart()

  With Module
    ' --> Hydrogen Feed
    .OutputStreamTemperatureSpecValue = Project.Modules("Data").parameter(1)        ' Temperature
    .OutputStreamPressureSpecValue    = Project.Modules("Data").parameter(2)        ' Pressure

    For i = 1 to Project.Compounds.Count
      .OutputStreamCompositionSpecValues(i) = Project.Modules("Data").parameter(2+i) ' Partial molar
flowrates
    Next

  End With

End Sub
```



2.2.3. K101 Compressor

The script used in the “K101” module is presented hereafter.

```
' Exhaust pressure recovery from the "Data" script module
Sub OnCalculationStart()

  ' --> K101 Compressor
  Module.SpecificationValue = Project.Modules("Data").parameter(12) ' Exhaust pressure

End Sub
```

2.2.4. E102 Heat Exchanger

The script used in the “E102” module is presented hereafter.

```
' E102 temperature and pressure drop (global parameters) recovery
Sub OnCalculationStart()

  With Module
    ' --> E102 Heat Exchanger
    .TemperatureSpecValue = Project.UserValues("E102_T") ' Temperature
    .PressureDrop = Project.UserValues("E102_DP")        ' Pressure drop
  End With

End Sub
```

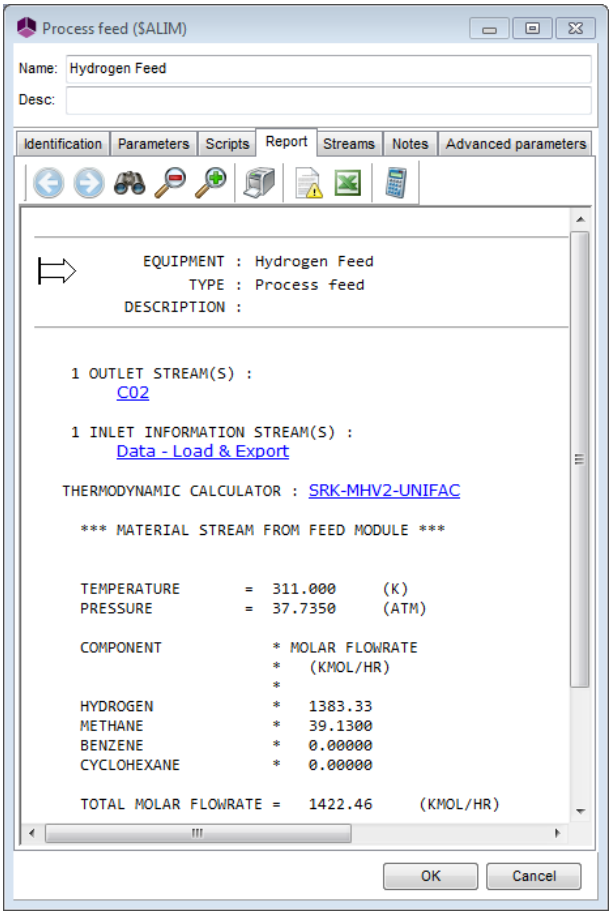
Remark: global parameters (Project.UserValues) can be defined (in this case, they are defined in the “Data” module) and then used in all of the modules (like here in the “E102” module).

3. RESULTS

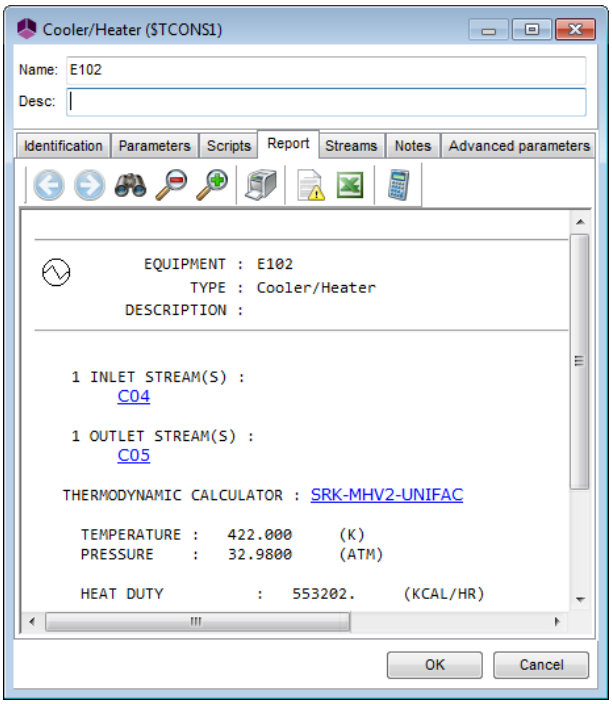
3.1. ProSimPlus simulation file

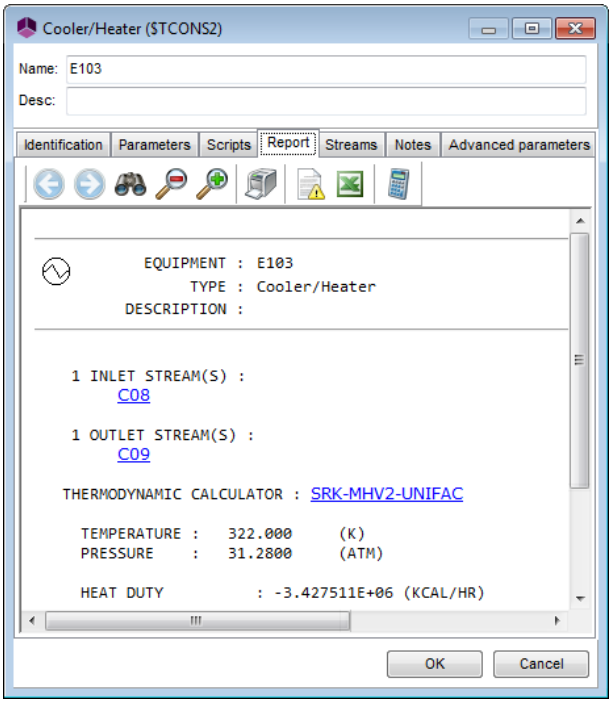
At the end of the simulation, the user can see in the “Report” tab of the different modules the imported data (boxed in green in this document) and the results (boxed in orange in this document) that have been exported to the Excel file.

3.1.1. Hydrogen Feed

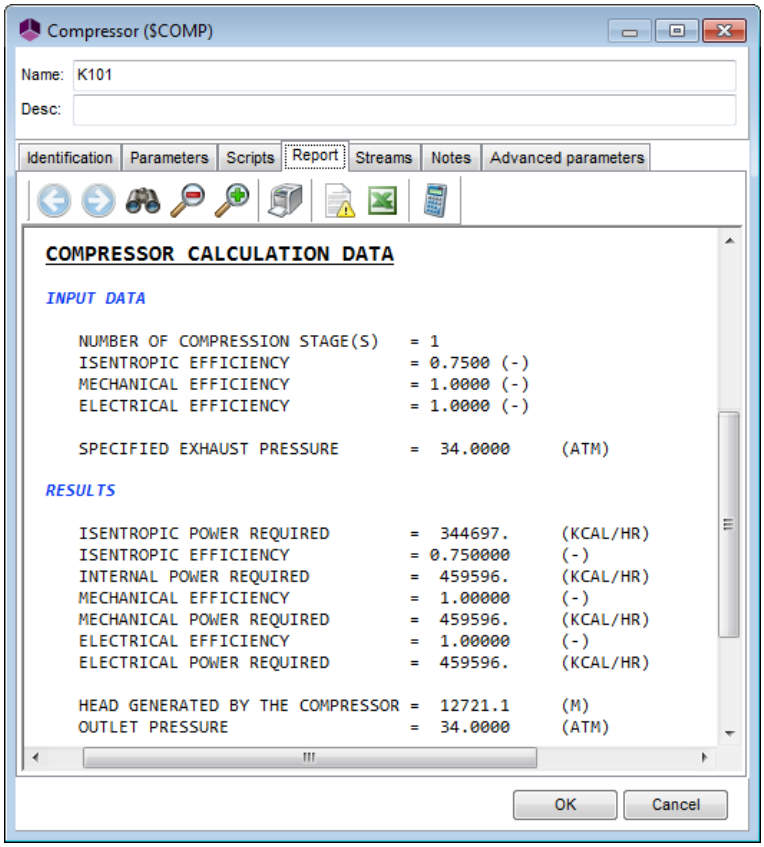


3.1.2. E102 and E103 Heat Exchangers

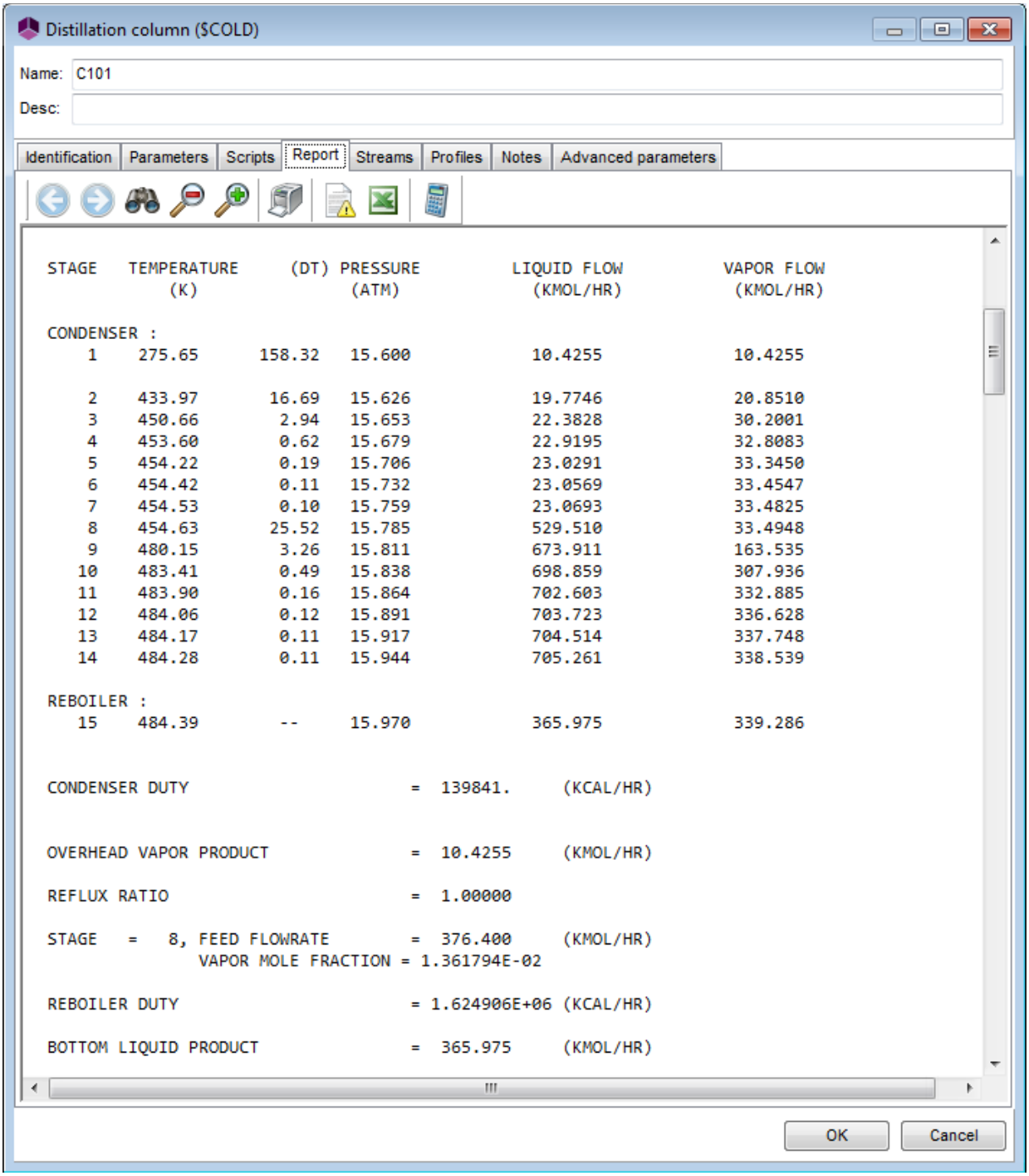




3.1.3. K101 Compressor



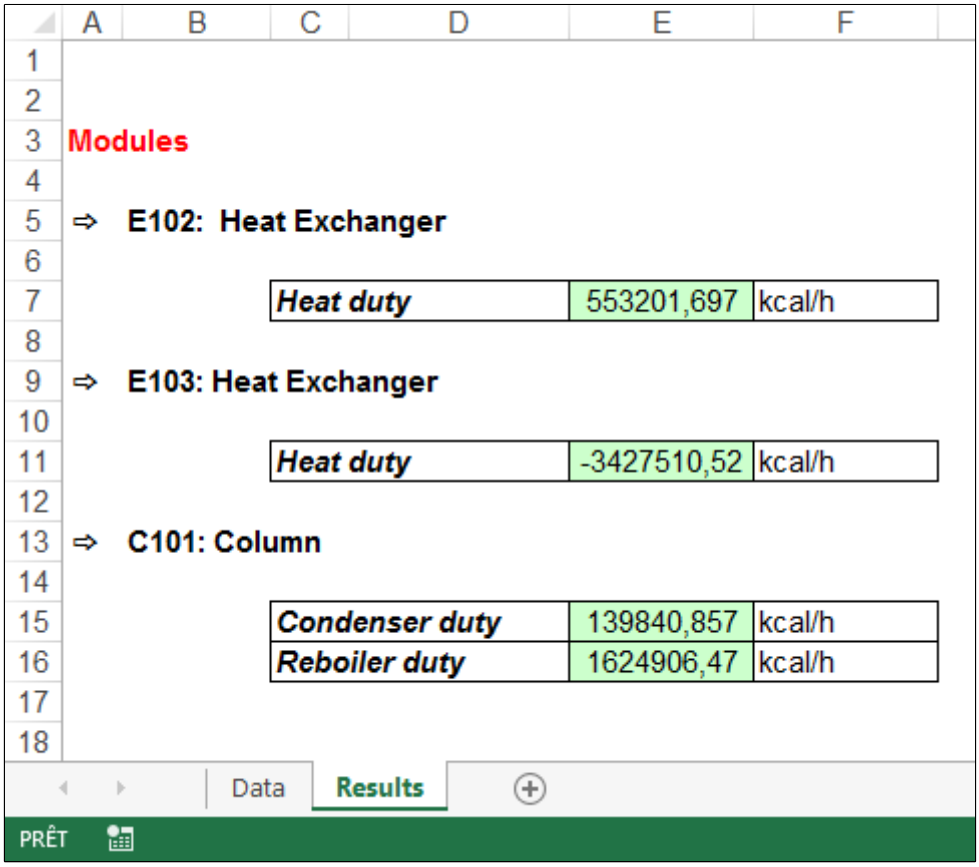
3.1.4. C101 Column




```
STAGE   TEMPERATURE     (DT) PRESSURE         LIQUID FLOW          VAPOR FLOW
            (K)                (ATM)            (KMOL/HR)            (KMOL/HR)

CONDENSER :
    1    275.65      158.32   15.600            10.4255              10.4255

    2    433.97       16.69   15.626            19.7746              20.8510
    3    450.66        2.94   15.653            22.3828              30.2001
    4    453.60        0.62   15.679            22.9195              32.8083
    5    454.22        0.19   15.706            23.0291              33.3450
    6    454.42        0.11   15.732            23.0569              33.4547
    7    454.53        0.10   15.759            23.0693              33.4825
    8    454.63       25.52   15.785            529.510              33.4948
    9    480.15        3.26   15.811            673.911              163.535
   10    483.41        0.49   15.838            698.859              307.936
   11    483.90        0.16   15.864            702.603              332.885
   12    484.06        0.12   15.891            703.723              336.628
   13    484.17        0.11   15.917            704.514              337.748
   14    484.28        0.11   15.944            705.261              338.539

REBOILER :
   15    484.39         --    15.970            365.975              339.286


CONDENSER DUTY                      =  139841.     (KCAL/HR)


OVERHEAD VAPOR PRODUCT              =  10.4255     (KMOL/HR)

REFLUX RATIO                        =  1.00000

STAGE   =   8, FEED FLOWRATE        =  376.400     (KMOL/HR)
               VAPOR MOLE FRACTION = 1.361794E-02

REBOILER DUTY                       = 1.624906E+06 (KCAL/HR)

BOTTOM LIQUID PRODUCT               =  365.975     (KMOL/HR)
```


3.2. Excel file

The results exported to the Excel file can be seen below.



	A	B	C	D	E	F
1						
2						
3	**Modules**					
4						
5	⇨	**E102: Heat Exchanger**				
6						
7			***Heat duty***		553201,697	kcal/h
8						
9	⇨	**E103: Heat Exchanger**				
10						
11			***Heat duty***		-3427510,52	kcal/h
12						
13	⇨	**C101: Column**				
14						
15			***Condenser duty***		139840,857	kcal/h
16			***Reboiler duty***		1624906,47	kcal/h
17						
18						

Data Results

PRÊT

