How to get started in Aspentech

Dll needs to be installed on the user's machine
Aspen Shell&Tube V7.21 should be installed.

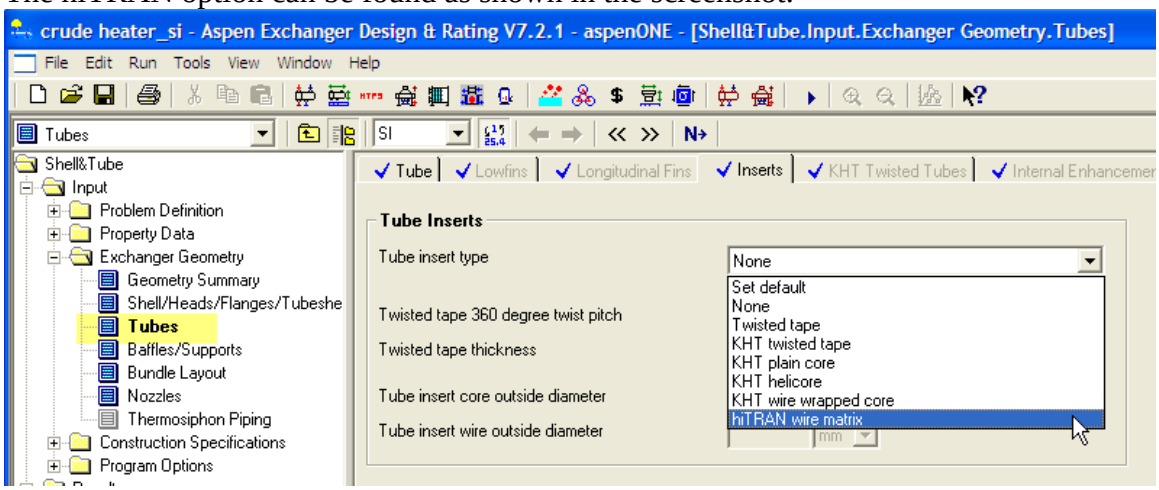
Release of V7.3 which was released beginning of January 2011 is not recommended since there are some minor inconsistencies which are not present in V7.21

If possible Calculations should be done with Version 7.21

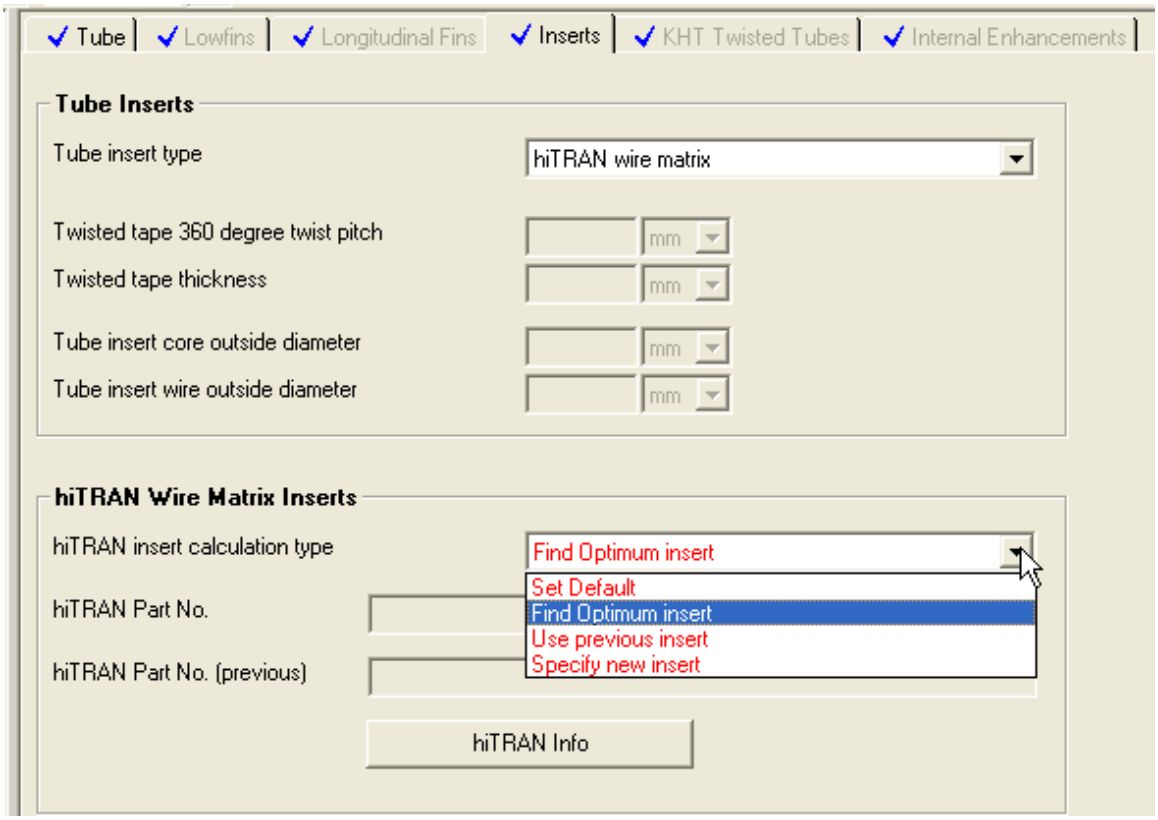
Limitations: Single Phase Flow only

Shell&Tube

The hiTRAN option can be found as shown in the screenshot:



Once the hiTRAN option is clicked the hiTRAN wire Matrix Frame is activated and the drop down list populated with the following options:
Find optimum Insert
Use previous Insert
Specify new Insert



Once selected the tube side heat transfer and pressure drop calculations are based on Cal Gavin data.

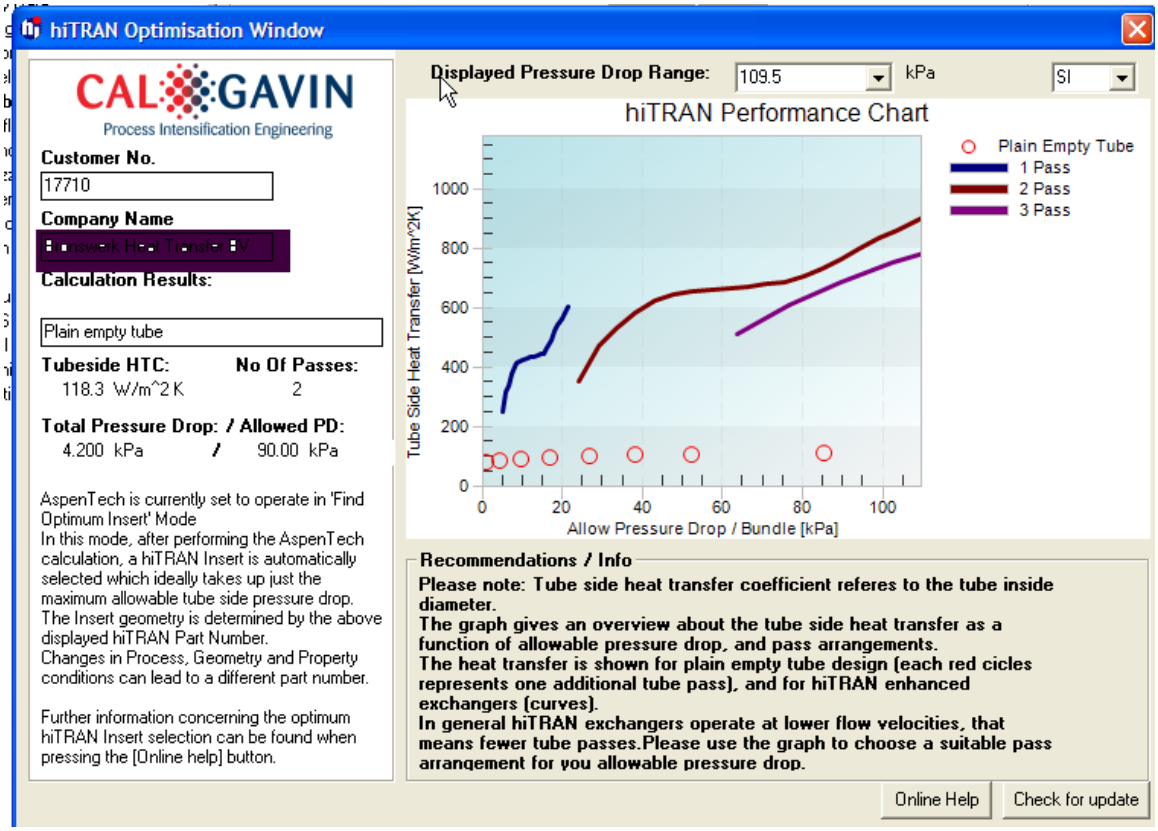
Depending on the selected Calculation Mode in Aspen
(Find optimum Insert ; Use previous Insert)
The plug in behavior differs as explained below:

Find optimum Insert / (rating / checking) mode

In order to run this mode in Aspen Shell&Tube under calculation option [rating / checking] has to be selected. The hiTRAN plug in will try to find a Insert geometry (Loopdensity) which just takes up all the allowable pressure drop in order to give the highest tube side heat transfer. Main parameters to influence the result are:

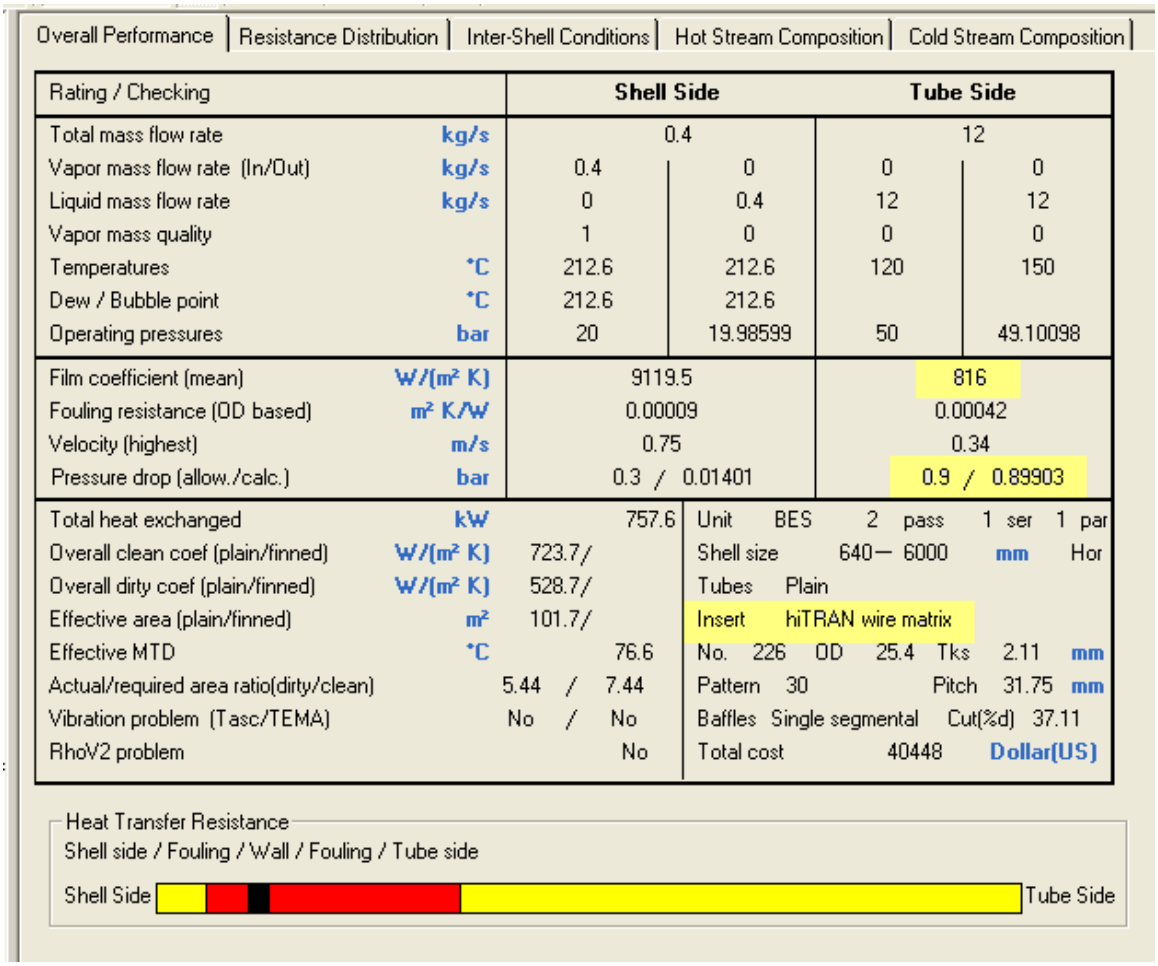
- Allowable tube side pressure drop
- Number of tube passes per bundle

In order to see what kind of combination is useful the hiTRAN Info button can be clicked.
!Prior of doing this, the case to be run once in Shell&Tube!
The following Info Graph will be shown:



This graph gives additional Information how to choose the pass arrangement with hiTRAN in order to stay within the allowable pressure drop. In an optimised design the allowable pressure drop should equal the calculated pressure drop

The case can be run and in the Output summary the hiTRAN pressure drop and heat transfer can be seen.



Overall Performance | Resistance Distribution | Inter-Shell Conditions | Hot Stream Composition | Cold Stream Composition

Rating / Checking		Shell Side		Tube Side	
Total mass flow rate	kg/s	0.4		12	
Vapor mass flow rate (In/Out)	kg/s	0.4	0	0	0
Liquid mass flow rate	kg/s	0	0.4	12	12
Vapor mass quality		1	0	0	0
Temperatures	°C	212.6	212.6	120	150
Dew / Bubble point	°C	212.6	212.6		
Operating pressures	bar	20	19.98599	50	49.10098
Film coefficient (mean)	W/(m² K)	9119.5		816	
Fouling resistance (OD based)	m² K/W	0.00009		0.00042	
Velocity (highest)	m/s	0.75		0.34	
Pressure drop (allow./calc.)	bar	0.3 / 0.01401		0.9 / 0.89903	

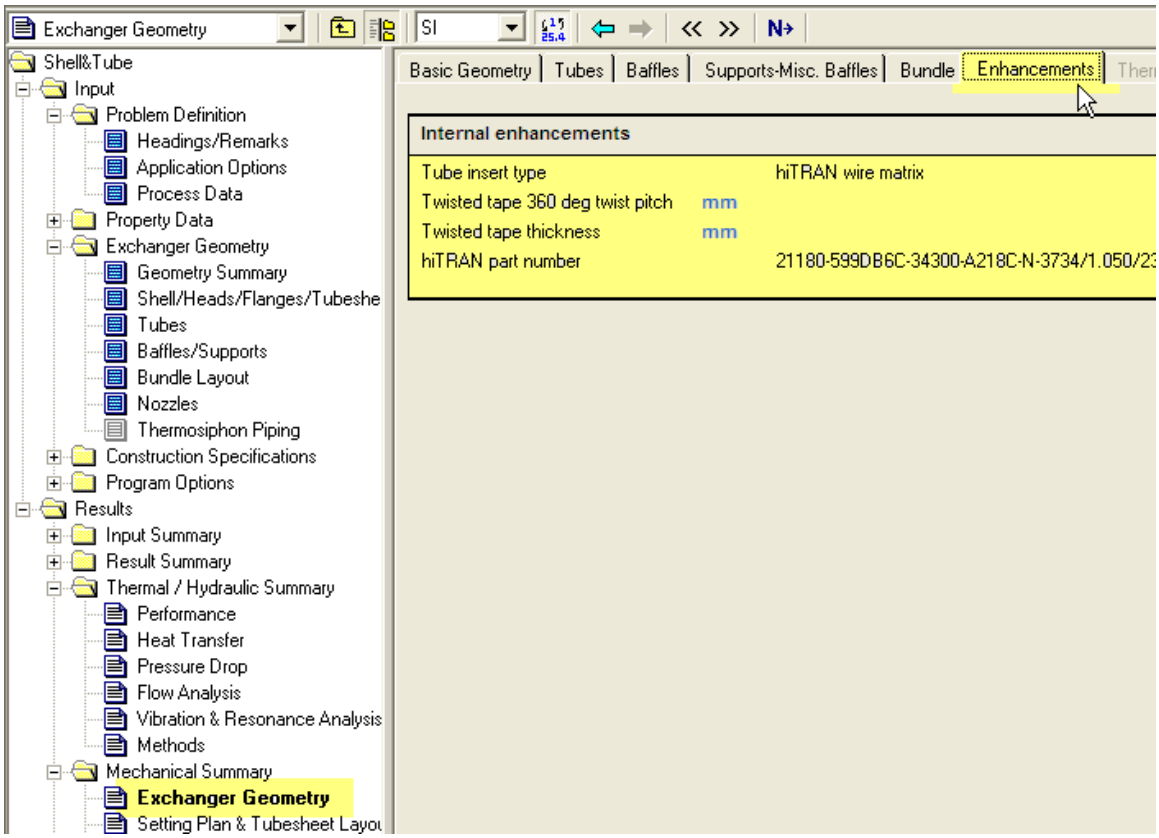
Total heat exchanged	kW	757.6	Unit BES 2 pass 1 ser 1 par	
Overall clean coef (plain/finned)	W/(m² K)	723.7/	Shell size 640— 6000 mm Hor	
Overall dirty coef (plain/finned)	W/(m² K)	528.7/	Tubes Plain	
Effective area (plain/finned)	m²	101.7/	Insert hiTRAN wire matrix	
Effective MTD	°C	76.6	No. 226 OD 25.4 Tks 2.11 mm	
Actual/required area ratio(dirty/clean)		5.44 / 7.44	Pattern 30 Pitch 31.75 mm	
Vibration problem (Tasc/TEMA)		No / No	Baffles Single segmental Cut(%d) 37.11	
RhoV2 problem		No	Total cost 40448 Dollar(US)	

Heat Transfer Resistance

Shell side / Fouling / Wall / Fouling / Tube side

Shell Side Tube Side

It can be seen that the Insert Geometry is chosen to take up all the allowable pressure drop.
The Insert Part Number which describes the Geometry can be found under

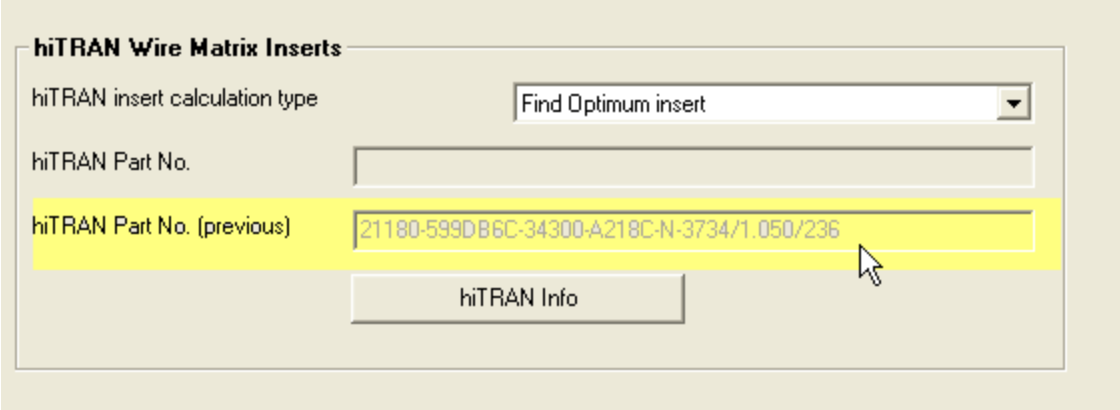


The Part Number can also be found in the TEMA specification sheet.

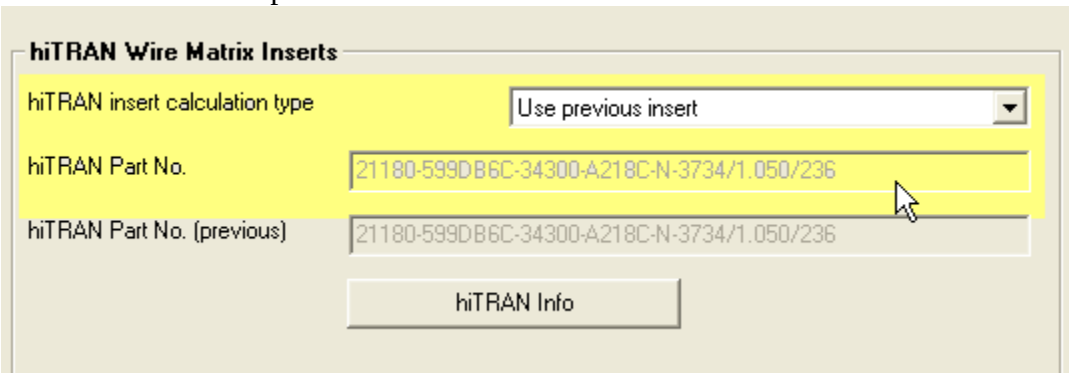
Use previous Insert / (simulation) mode

In Simulation Mode the Insert is fixed. This means different process conditions can be simulated with a fixed Insert Geometry. To do this the following steps needs to be undertaken:

1.
Prior to simulation the case has to be run in Rating checking mode in order to find an optimized Insert.



In this mode a part number is calculated and displayed under ***hiTRAN Part No. (previous)***
When in the drop down list ***Use previous Insert*** is clicked. The part number is copied into this box and the part number fixed.

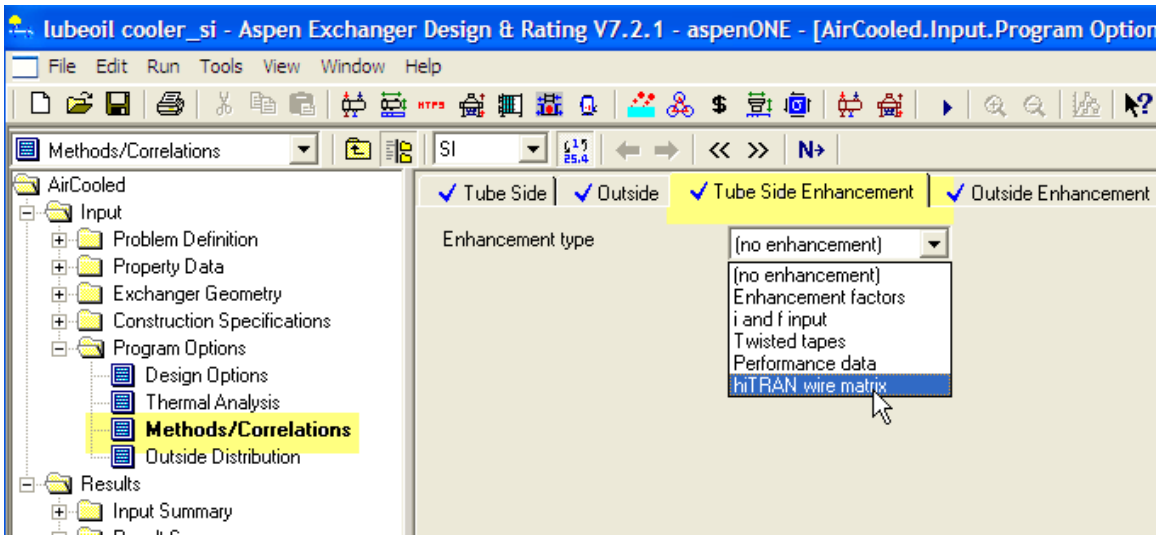


Now the Calculation mode in Shell&Tube can be changed to simulation and the Insert Geometry will be fixed for all calculations.

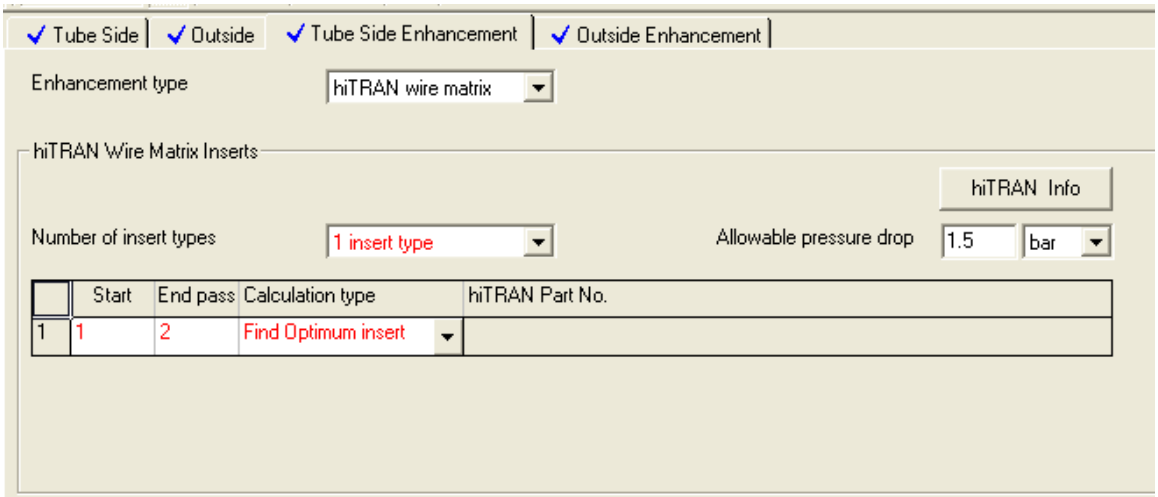
In General now the calculated pressure drop will differ from allowable pressure drop.

AirCooled

In AirCooled the hiTRAN option can be found as shown in the screenshot:



Once selected the tube side heat transfer and pressure drop calculations are based on Cal Gavin data and the following frame appears.:



Default setting is:
Number of insert types [**1 insert type**] this means. This means for the Start Pass number until the End Pass Number an Insert Geometry is selected which should take up just the maximum Allowable pressure drop. In the case above, in a two pass exchanger the 1

Insert type is specified to be installed in each pass. This would be the normal first default choice.

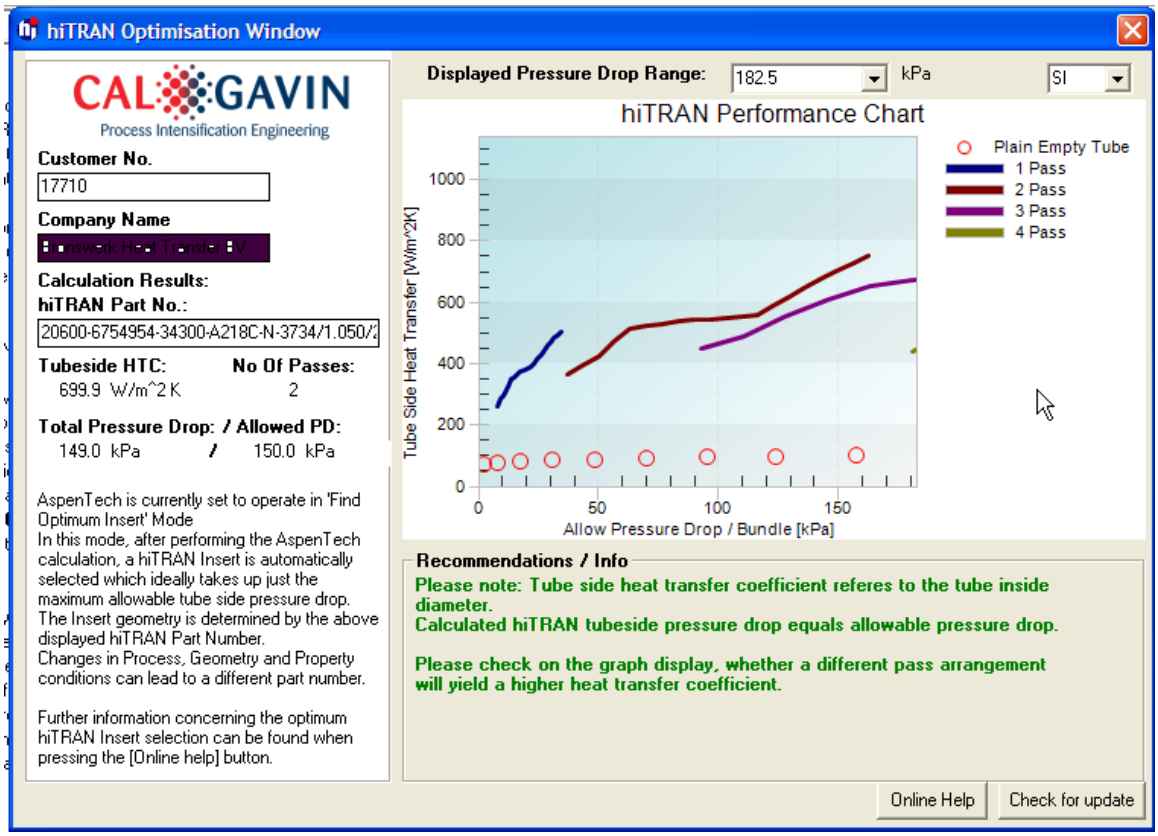
Depending on the selected Calculation type in Aspen
(Find optimum Insert ; Use previous Insert)
The plug in behavior differs as explained below:

Find optimum Insert / (rating / checking) mode

In order to run this mode in Aspen AirCooled under Program calculation mode [rating / checking] has to be selected. The hiTRAN plug in will try to find a Insert geometry (Loopdensity) which just takes up all the allowable pressure drop in order to give the highest tube side heat transfer. Main parameters to influence the result are:

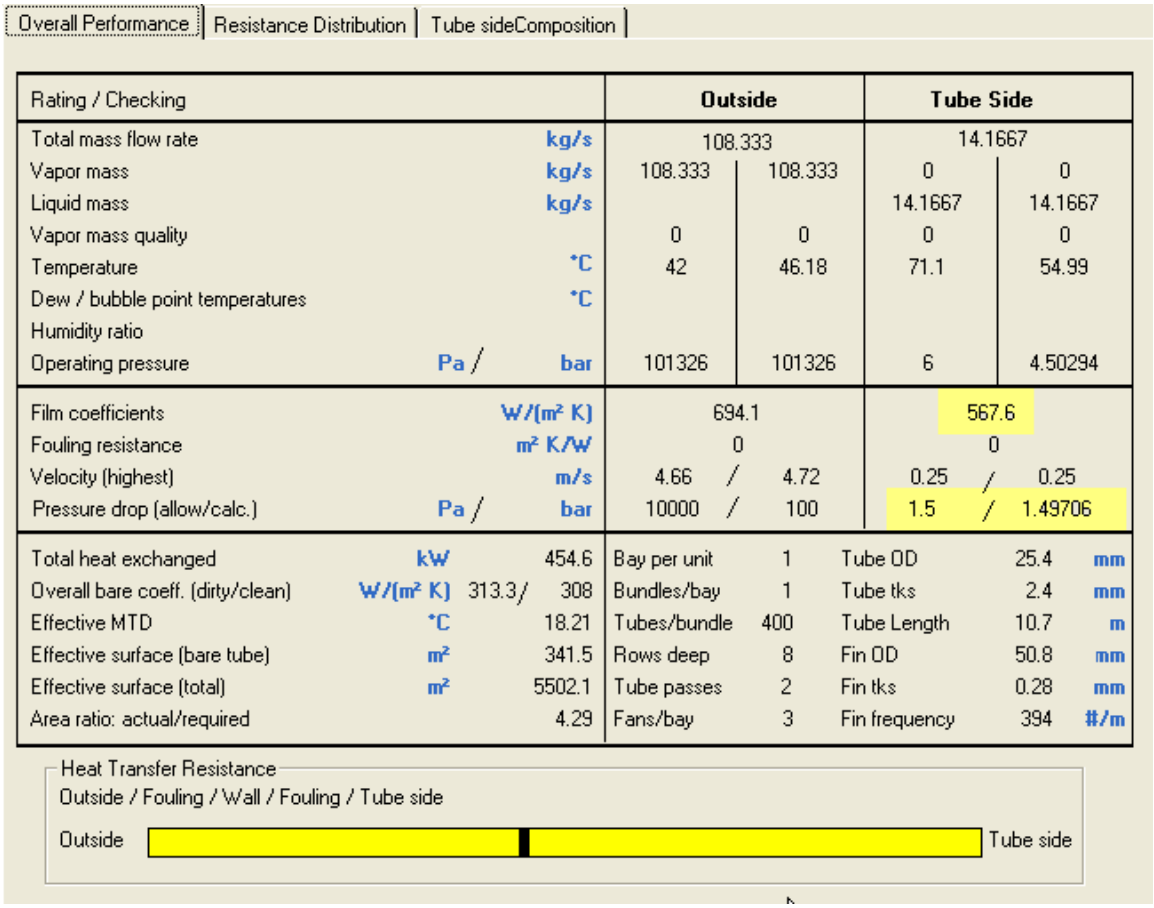
- Allowable tube side pressure drop
- Number of tube passes per bundle

In order to see what kind of combination is useful the hiTRAN Info button can be clicked.
!Prior of doing this, the case to be run once in Shell&Tube!
The following Info Graph will be shown:

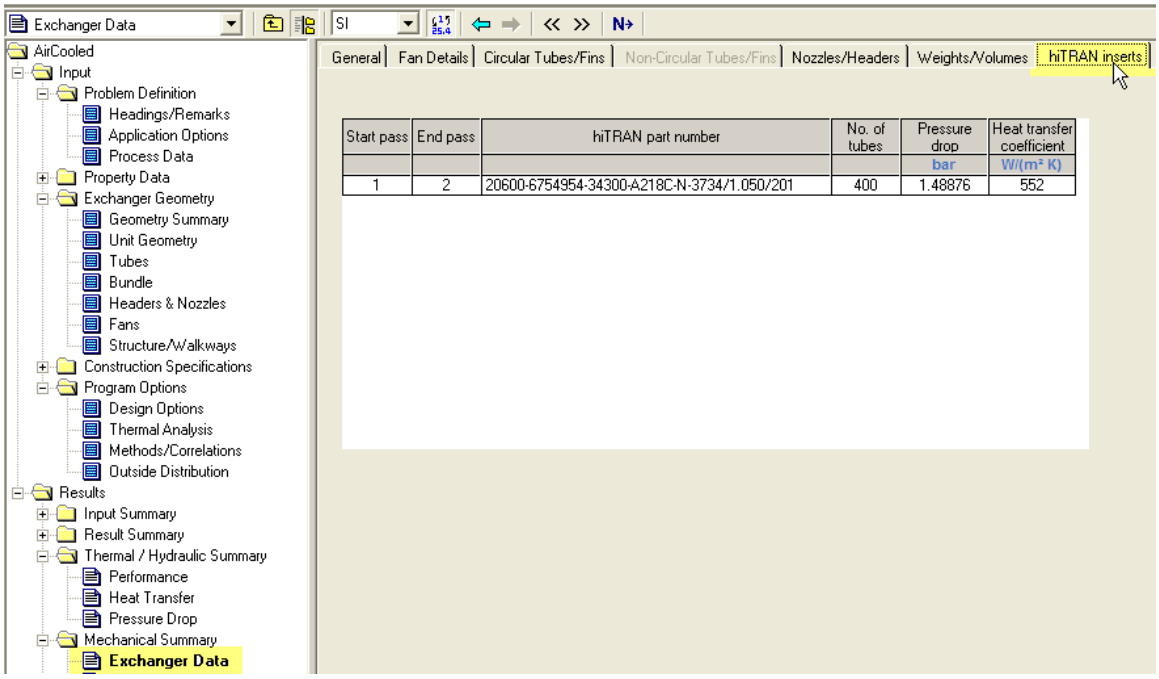


This graph gives additional Information how to choose the pass arrangement with hiTRAN in order to stay within the allowable pressure drop. In an optimised design the allowable pressure drop should equal the calculated pressure drop

The case can be run and under Results / Performance the hiTRAN pressure drop and heat transfer can be seen.



It can be seen that the Insert Geometry is chosen to take up all the allowable pressure drop.
The Insert Part Number which describes the Geometry can be found under

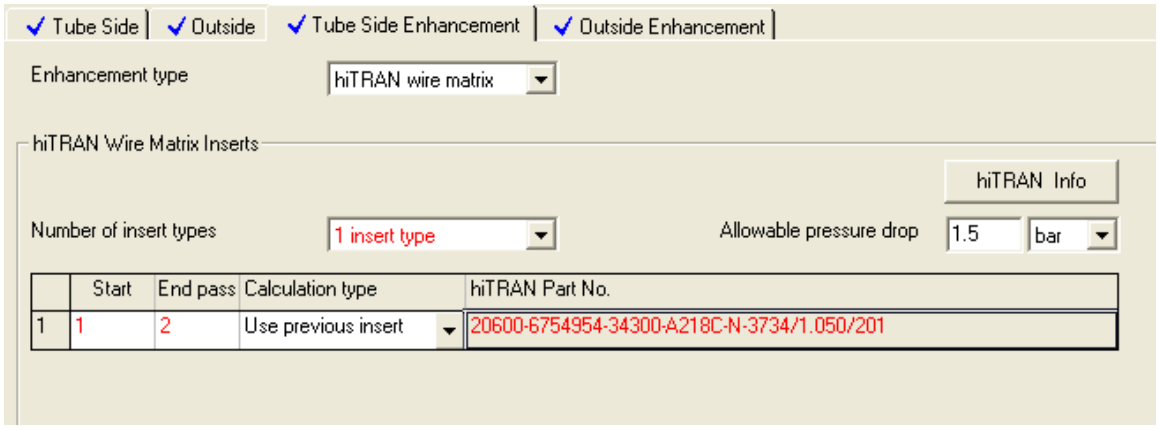


Use previous Insert / (simulation) mode

In AirCooled Simulation Mode the Insert is fixed. This means different process conditions can be simulated with a fixed Insert Geometry. To do this the following steps needs to be undertaken:

Prior to simulation the case has to be run in Rating checking mode in order to find an optimized Insert!

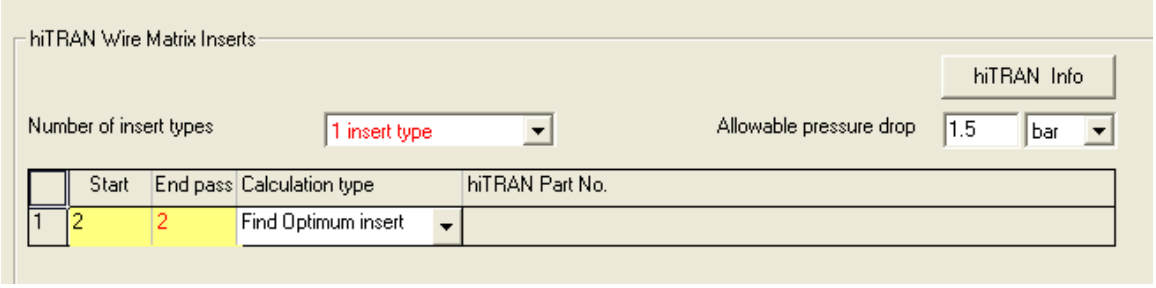
In Calculation type the dropdown list has to be set to [***previous insert***]



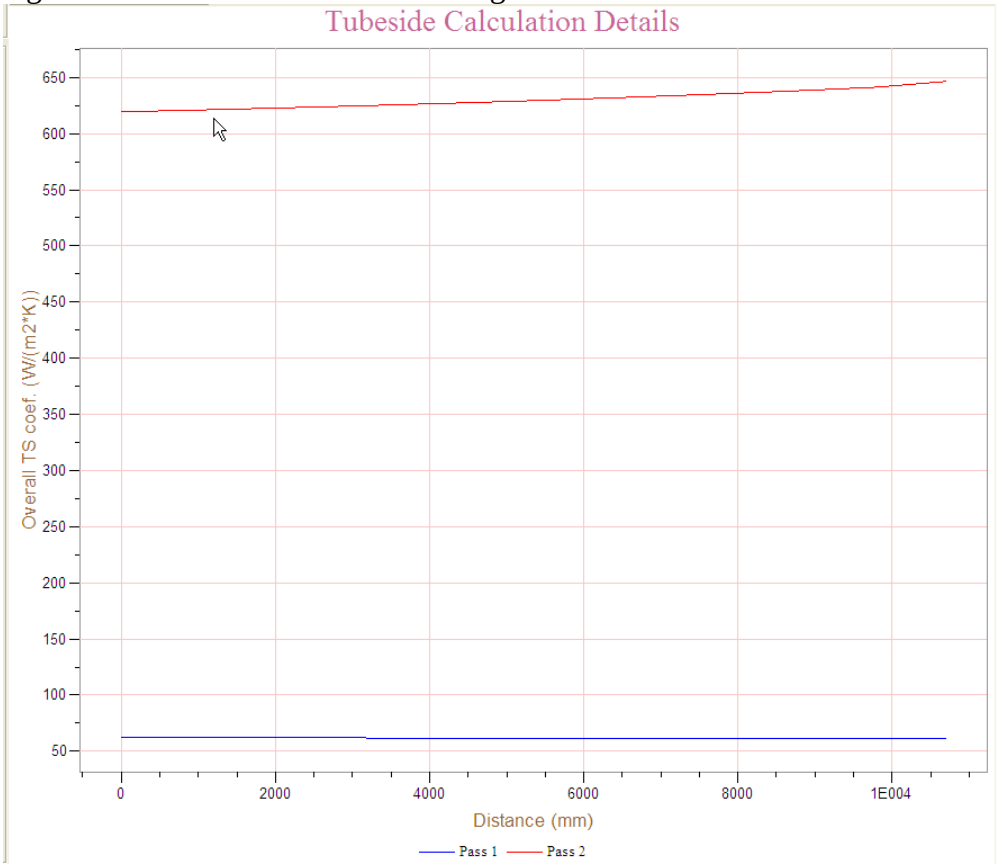
! Note: When you change the dropdown list the hiTRAN Part number field will stay blank, please click once with the mouse into the part number field to show the part number (unresolved bug)!

Assigning one Insert type only for certain tube passes in AirCooled

In AirCooled it is possible to assign hiTRAN Inserts to certain tubes only.
In our example we could assign the 1 insert type only to the second pass in the air Cooler:



Again there would be a dramatic change in heat transfer from the first to the second pass:



The Simulation option is here also available.

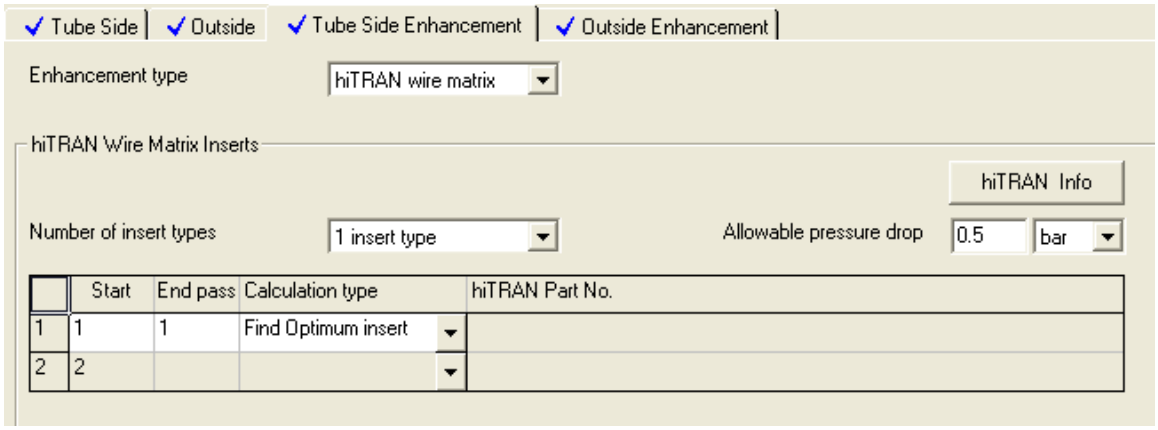
Assigning different Insert types for certain tube passes in AirCooled

In AirCooled it is possible to use up to 3 different Insert types in one bundle.

Example
Target pressure drop for the whole exchanger 1.2 bar

1. For the first set of Insert from pass 1 to pass 2 a estimate pressure drop has to be chosen:
   Chosen 0.5 bar

   Calculation with screenshots:

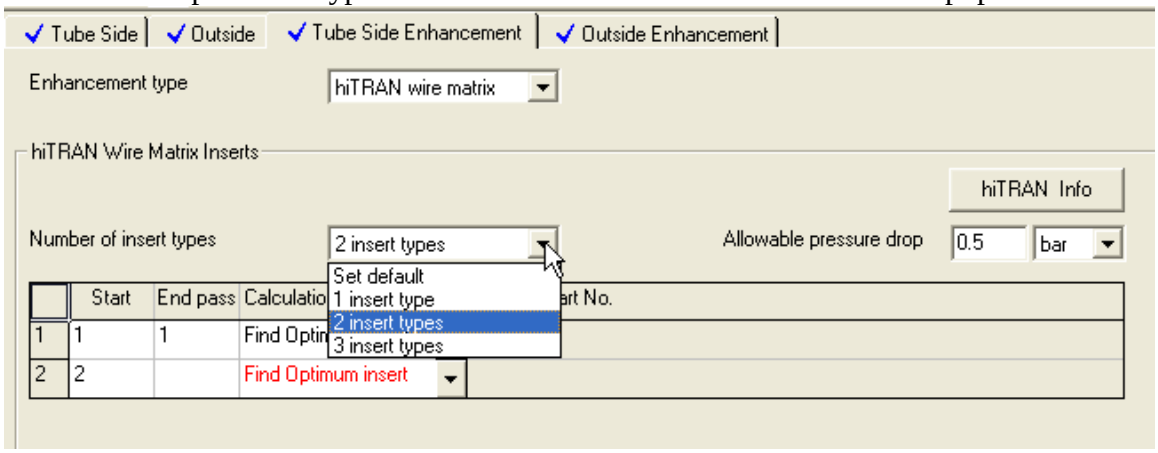


Rating / Checking			Outside		Tube Side	
Total mass flow rate		kg/s	108.333		14.1667	
Vapor mass		kg/s	108.333	108.333	0	0
Liquid mass		kg/s			14.1667	14.1667
Vapor mass quality			0	0	0	0
Temperature		°C	42	46.17	71.1	55.01
Dew / bubble point temperatures		°C				
Humidity ratio						
Operating pressure	Pa /	bar	101326	101326	6	5.49818
Film coefficients		W/(m² K)	694.2		209.5	
Fouling resistance		m² K/W	0		0	
Velocity (highest)		m/s	4.66 /	4.72	0.25 /	0.25
Pressure drop (allow/calc.)	Pa /	bar	10000 /	100	0.5 /	0.50182

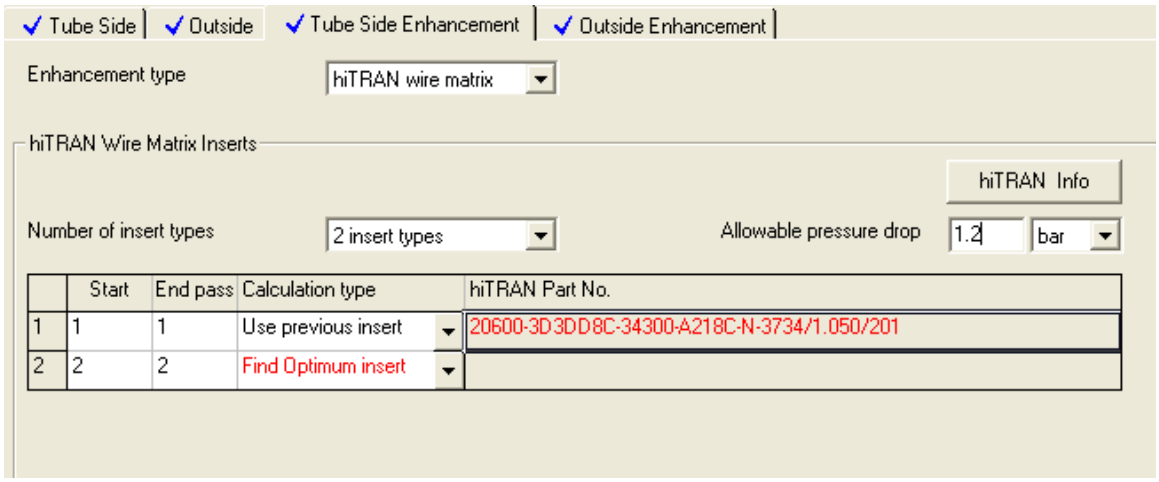
Total heat exchanged	kW	454	Bay per unit	1	Tube OD	25.4	mm
Overall bare coeff. (dirty/clean)	W/(m² K)	159.8/ 159.8	Bundles/bay	1	Tube tks	2.4	mm
Effective MTD	°C	18.08	Tubes/bundle	400	Tube Length	10.7	m
Effective surface (bare tube)	m²	341.5	Rows deep	8	Fin OD	50.8	mm
Effective surface (total)	m²	5502.1	Tube passes	2	Fin tks	0.28	mm
Area ratio: actual/required		2.17	Fans/bay	3	Fin frequency	394	#/m

The calculation result will be an bundle 1 Pass equipped with hiTRAN second pass empty plain. Overall pressure drop 0.5 bar.

2. In a next step 2 Insert types are selected. This means a second Insert is populated



Now the first Insert type has to be kept fixed with Calculation Mode use previous Insert. And the second Insert type has to work in find optimum Insert Mode.
In addition the allowable pressure drop has to be increased in this case to the desired 1.2 bar



The results are shown below:

Overall Performance | Resistance Distribution | Tube sideComposition

Rating / Checking		Outside		Tube Side	
Total mass flow rate	kg/s	108.333		14.1667	
Vapor mass	kg/s	108.333	108.333	0	0
Liquid mass	kg/s			14.1667	14.1667
Vapor mass quality		0	0	0	0
Temperature	°C	42	46.15	71.1	55.01
Dew / bubble point temperatures	°C				
Humidity ratio					
Operating pressure	Pa / bar	101326	101326	6	4.78513
Film coefficients	W/(m² K)	694.1		499.6	
Fouling resistance	m² K/W	0		0	
Velocity (highest)	m/s	4.66 /	4.72	0.25 /	0.25
Pressure drop (allow/calc.)	Pa / bar	10000 /	100	1.2 /	1.21487

Total heat exchanged	kW	453.9	Bay per unit	1	Tube OD	25.4	mm
Overall bare coeff. (dirty/clean)	W/(m² K)	289.4 / 286.8	Bundles/bay	1	Tube tks	2.4	mm
Effective MTD	°C	18.24	Tubes/bundle	400	Tube Length	10.7	m
Effective surface (bare tube)	m²	341.5	Rows deep	8	Fin OD	50.8	mm
Effective surface (total)	m²	5502.1	Tube passes	2	Fin tks	0.28	mm
Area ratio: actual/required		3.97	Fans/bay	3	Fin frequency	394	#/m

The Total Pressure drop is 1.2bar as required and two different Insert types are used.

Under Exchanger data the detailed Information about hiTRAN Geometry and pressure drop can be found:

General | Fan Details | Circular Tubes/Fins | Non-Circular Tubes/Fins | Nozzles/Headers | Weights/Volumes | hiTRAN inserts

Start pass	End pass	hiTRAN part number	No. of tubes	Pressure drop	Heat transfer coefficient
				bar	W/(m² K)
1	1	20600-3D3DD8C-34300-A218C-N-3734/1.050/201	200	0.43321	445.3
2	2	20600-67180D0-34300-A218C-N-3734/1.050/201	200	0.77335	587.6