第13讲 Aspen软件中的换热器模型

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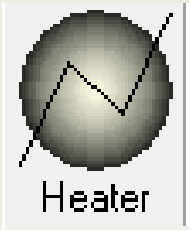
本节主要内容

- Heater和HeatX的比较
- 操作Heater
- 操作HeatX
- 热曲线
- 换热器的设计
- 模拟实例

Heater和HeatX的比较

❖**Heater**：



加热器或冷却器，单物流。用途：确定热和相态条件

❖**HeatX**：

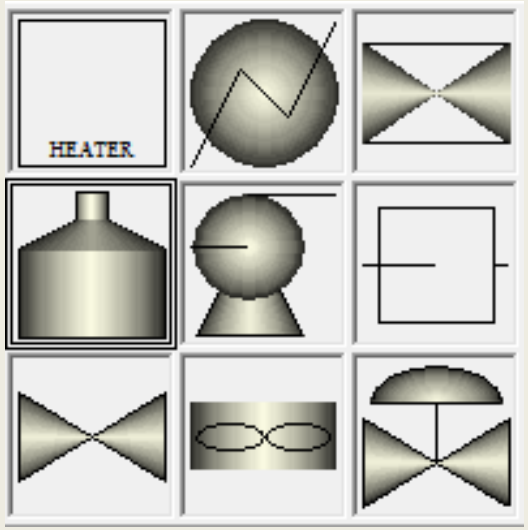
两物流换热器。用途：两股物流的换热器

操作Heater

❖Heater模块在规定热力学状态下把多股入口物流混合生成单股出口物流。

❖Heater模块包括：

- Heaters（加热器）
- Coolers（冷却器）
- Valves（阀门）
- Pumps（泵）
- Compressors（压缩机）

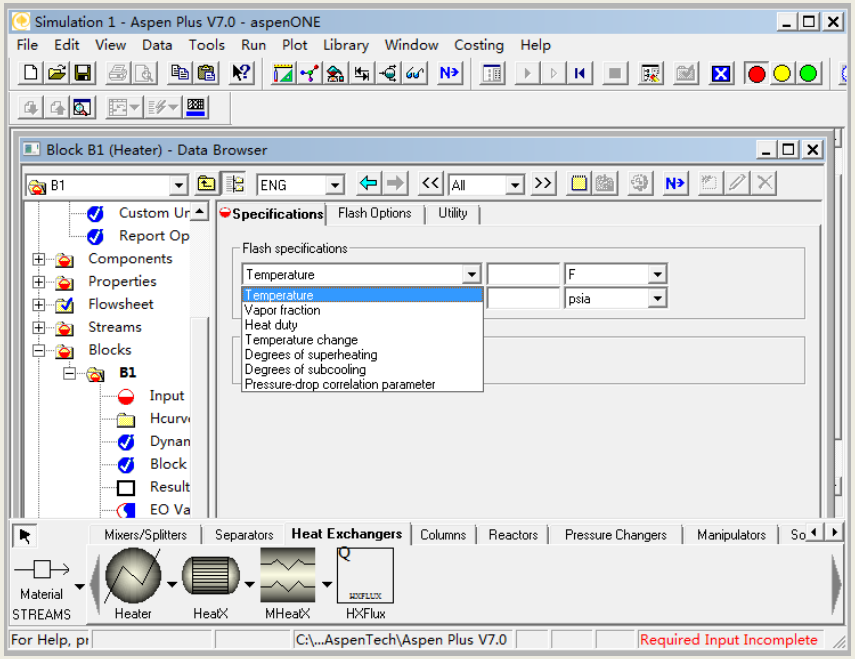


Heater输入规定（1）

❖允许组合：

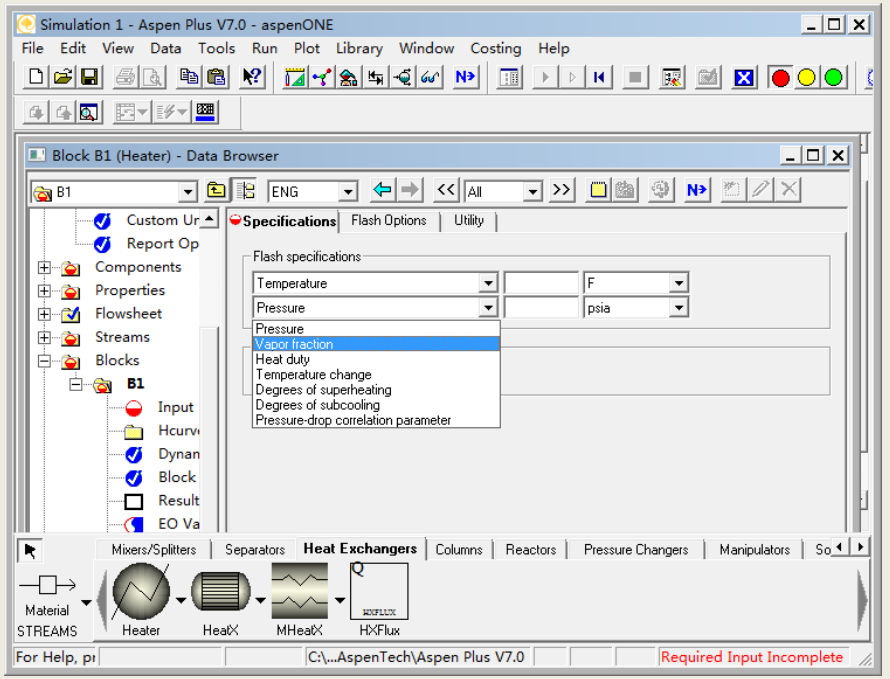
●压力（或压降）和下列之一：

- 出口温度
- 热负荷或入口热流股
- 气化分率（1是露点，0是泡点）
- 温度变化
- 过冷或过热度数



Heater输入规定（2）

- 出口温度或温度变化和下列之一：
  - 压力
  - 热负荷
  - 气化分率
- 对于单相用压力（压降）和下列之一：
  - 出口温度
  - 热负荷或入口热流股
  - 温度变化

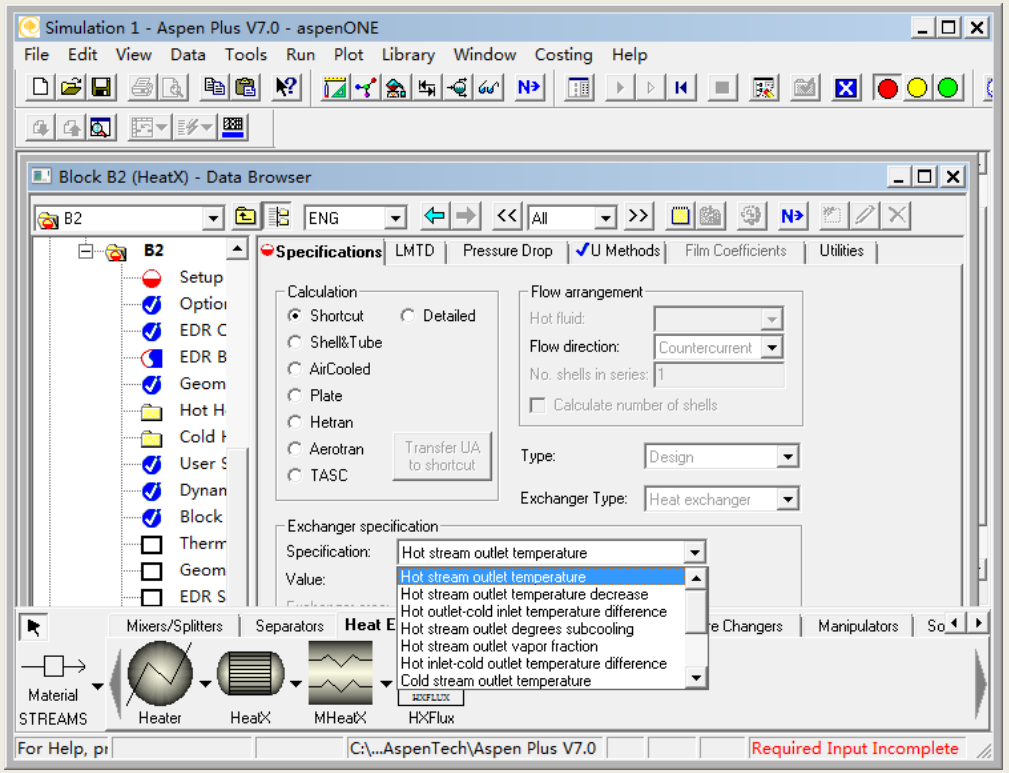


操作HeatX

- HeatX能模拟如下管壳换热器类型：
  - 逆流和并流
  - 弓形隔板TEMA E, F, G, H, J和X壳
  - 圆形隔板TEMA E和F壳
  - 裸管和翅片管
- HeatX执行：
  - 全区域分析
  - 传热和压降计算
  - 显热、气泡状气化、凝结膜系数计算
  - 内置的或用户定义的关联式

HeatX输入规定

- 选择如下规定之一：
  - 传热面积和几何尺寸
  - 换热负荷
  - 热端或冷端出口物流：
    - 温度
    - 温度变化
    - 接近温度
    - 过热/过冷度数
    - 气化分率



热曲线

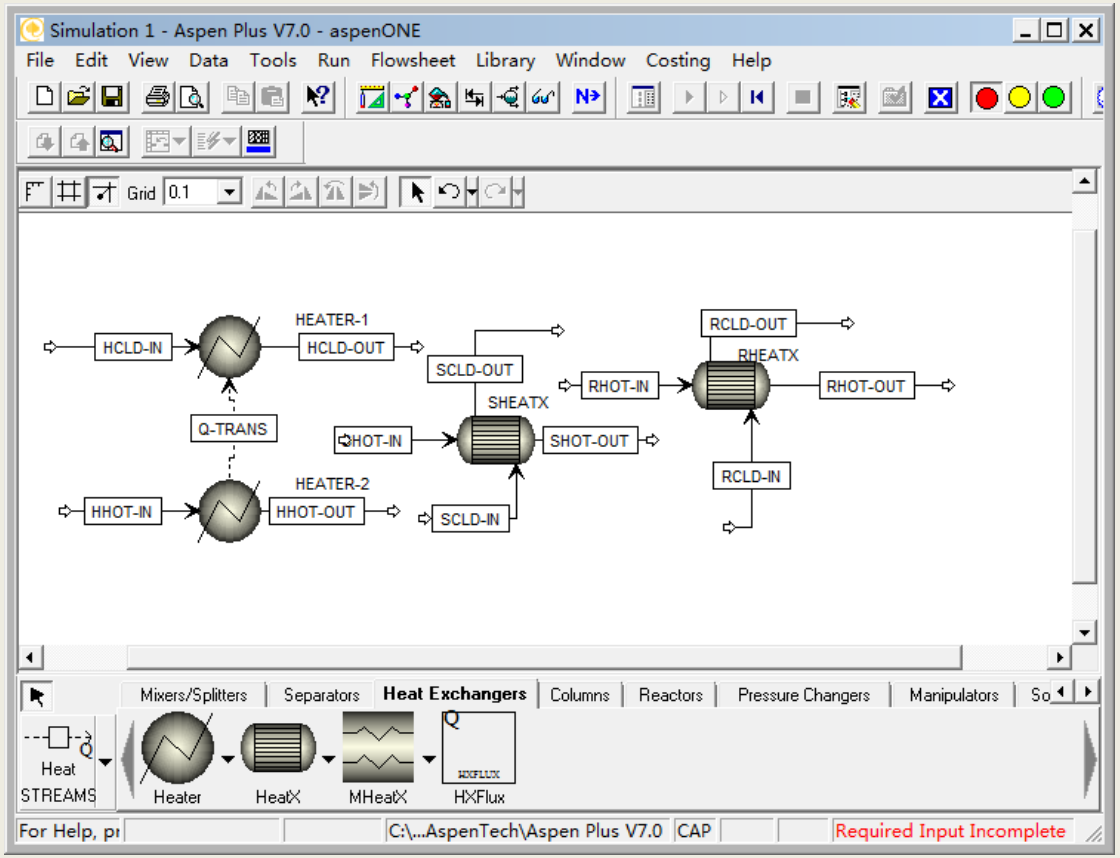
- HeatX和Heater能计算热曲线（Hcurves）
- 对于Aspen Plus能生成的任何性质的各种独立变量（通常负荷和温度）能够创建表格
- 这些表格能打印、绘制曲线或输出与其它换热器设计软件一起使用

模拟实例

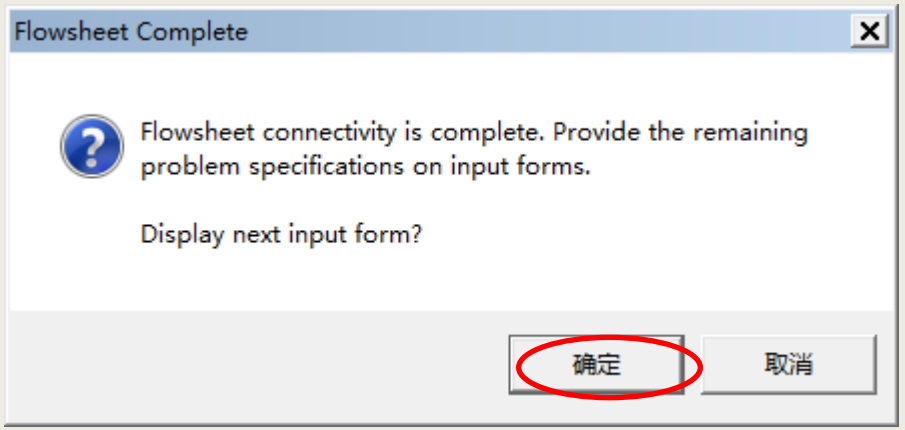
- 【例1】比较用三种方法模拟用水冷却混合烃：
  - 一个是简捷HeatX
  - 一个是严格HeatX
  - 一个是连接一个热流股的两个Heater

画流程图

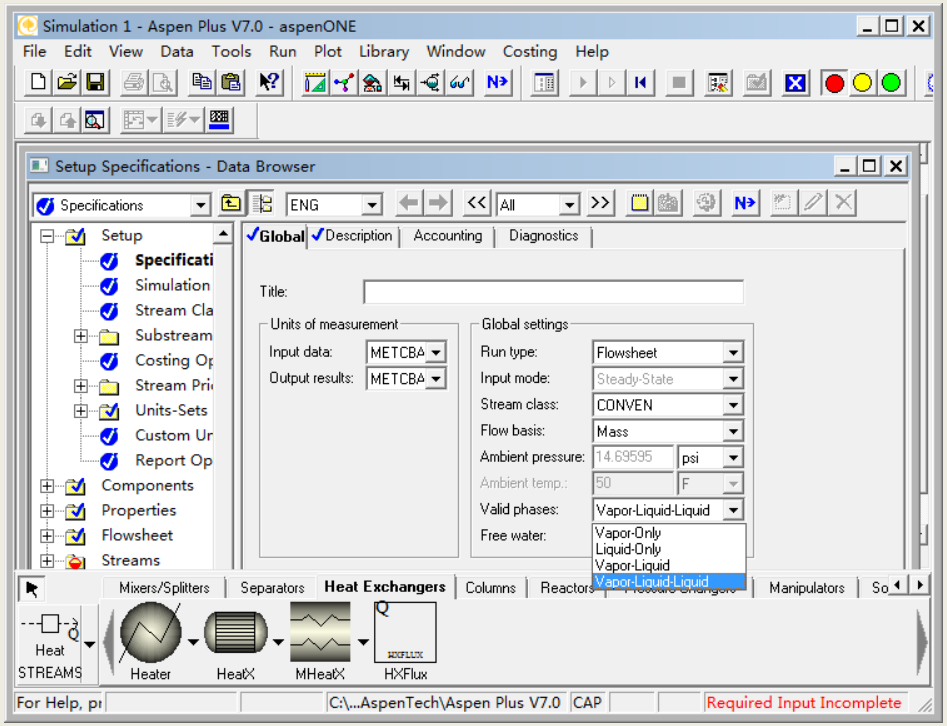
※ 画出三个流程图：连接一个热流股的两个Heater、简捷HeatX和严格HeatX



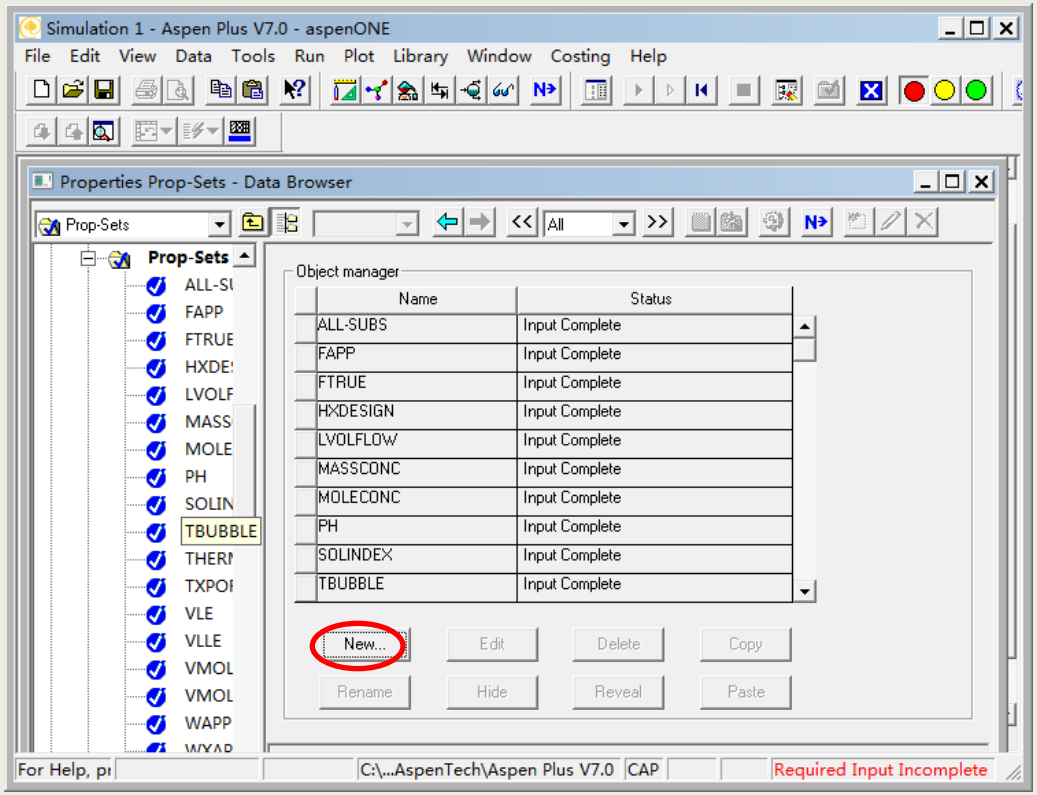
※ 单击NEXT，出现下图对话框，单击确定



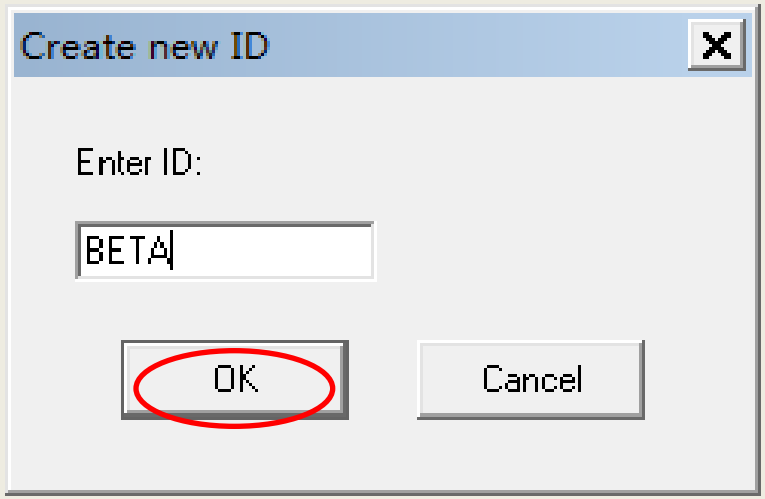
※ 设置Setup选项。Valid phases（有效相）选Vapor-Liquid-Liquid（水和烃类两个液相）



※ 添加新的物性集。点击New进入下一步

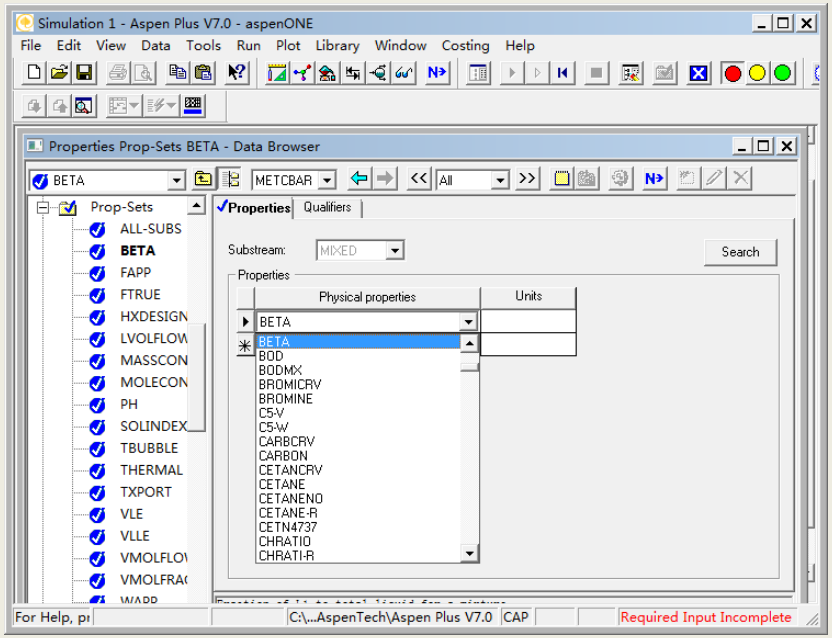


※输入新物性集的ID。此处输入**BETA**，代表第一液相占总液相的分率

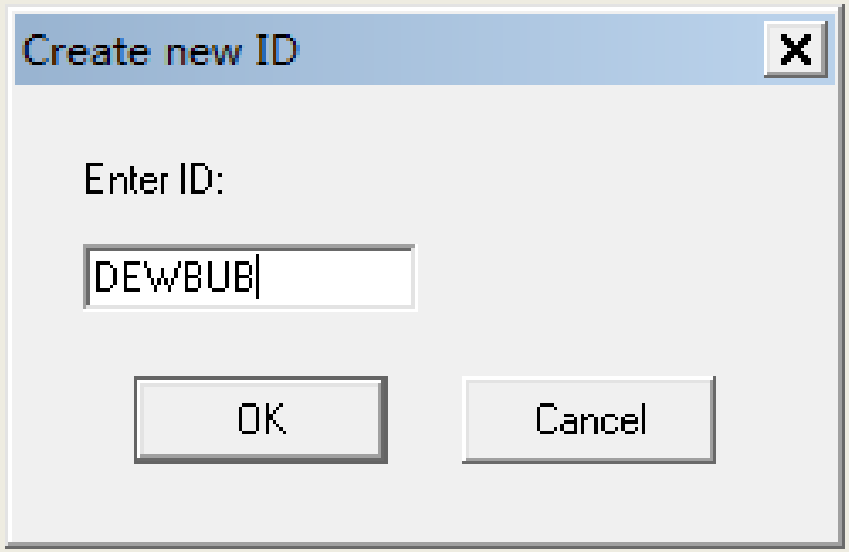


※ 单击上图OK，出现下图窗口

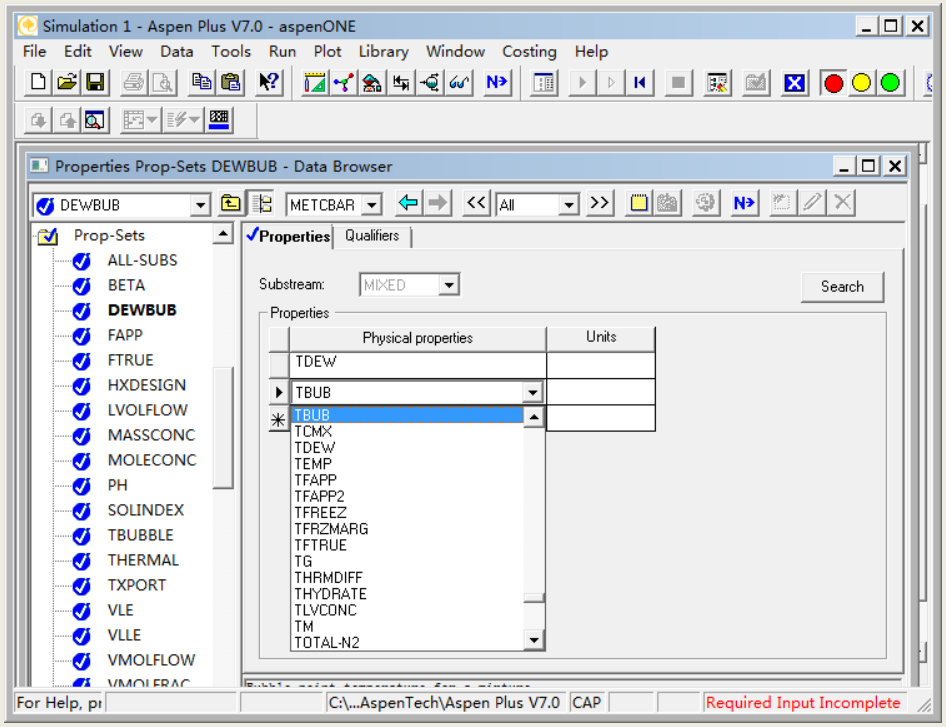
➢ **Physical properties选BETA**



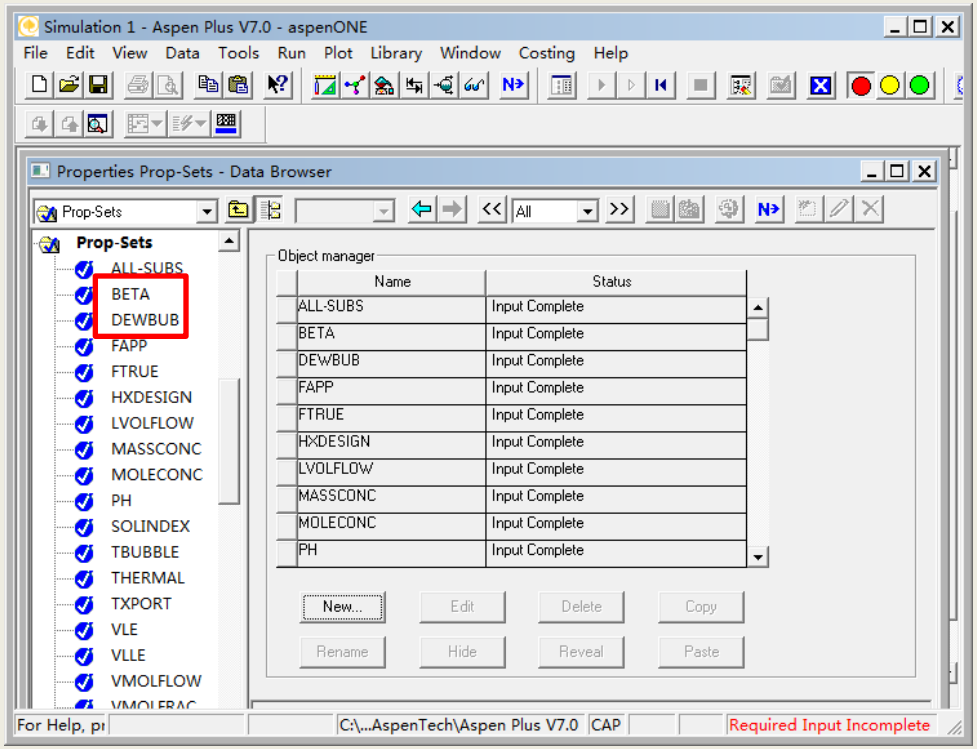
※ 创建第二个物性集，输入ID为**DEWBUB**，代表混合物的露点和泡点



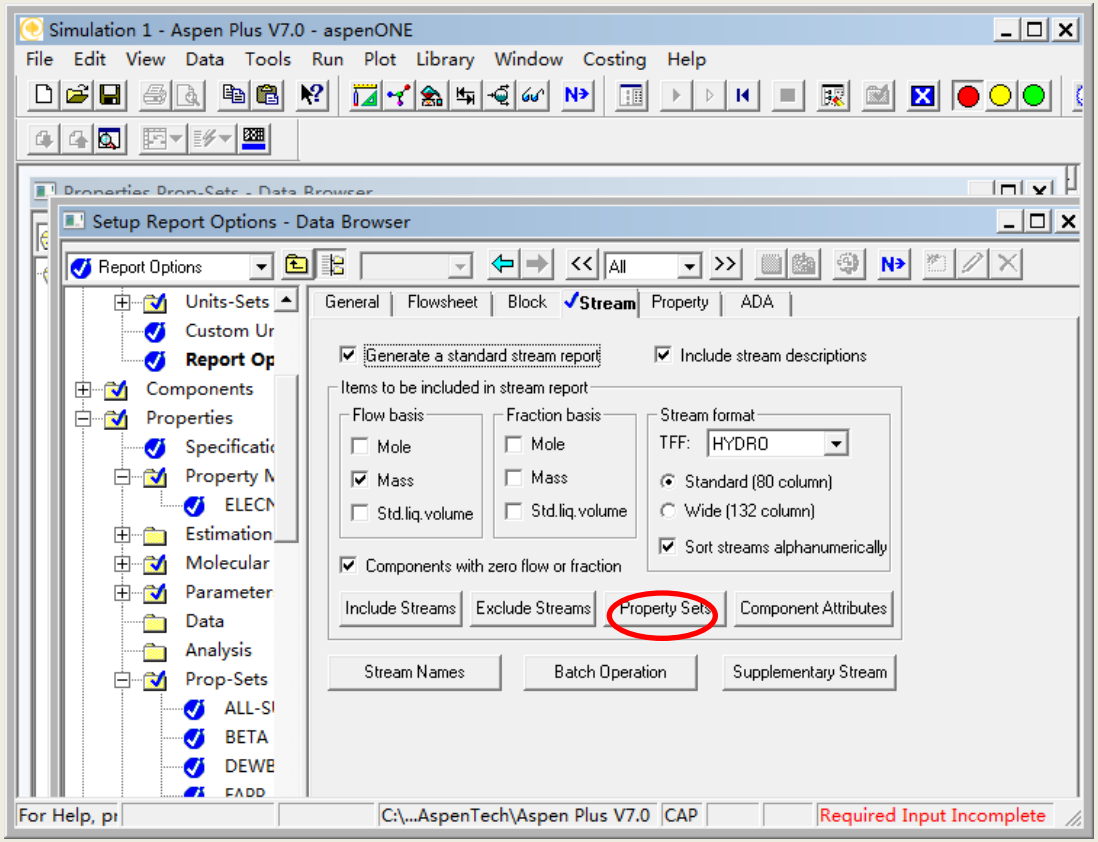
※ Physical properties选TDEW和TBUB，分别代表混合物的露点和泡点



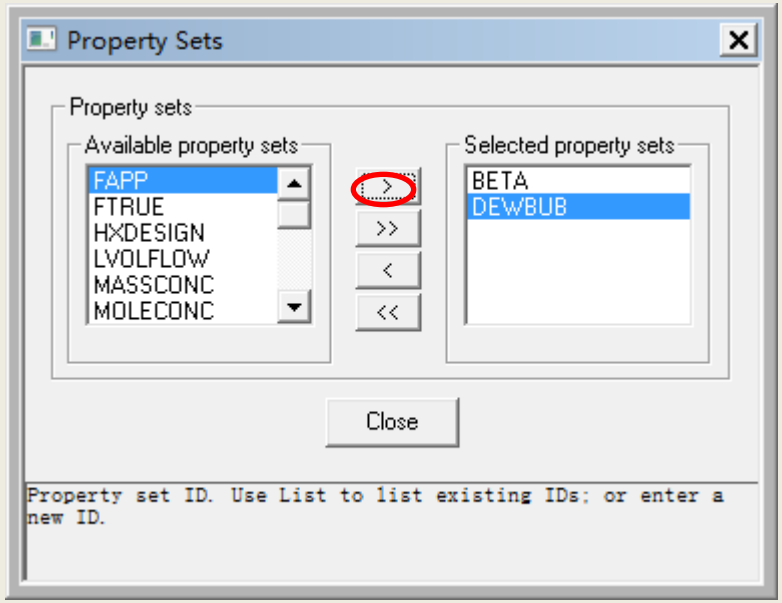
物性集添加完毕


Simulation 1 - Aspen Plus V7.0 - aspenONE
File Edit View Data Tools Run Plot Library Window Costing Help
Properties Prop-Sets - Data Browser
Prop-Sets
Prop-Sets
ALL-SUBS
BETA
DEWBUB
FAPP
FTRUE
HXDESIGN
LVOLFLOW
MASSCONC
MOLECONC
PH
SOLINDEX
TBUBBLE
THERMAL
TXPORT
VLE
VLLE
VMOLFLOW
Object manager
Name
Status
ALL-SUBS Input Complete
BETA Input Complete
DEWBUB Input Complete
FAPP Input Complete
FTRUE Input Complete
HXDESIGN Input Complete
LVOLFLOW Input Complete
MASSCONC Input Complete
MOLECONC Input Complete
PH Input Complete
New...
Edit
Delete
Copy
Rename
Hide
Reveal
Paste
For Help, pr
C:\...AspenTech\Aspen Plus V7.0
CAP
Required Input Incomplete

※ **Setup/Report Options**，点击**Property Sets**按扭添加物性集，这样结果报告中会包括选择物性集的内容

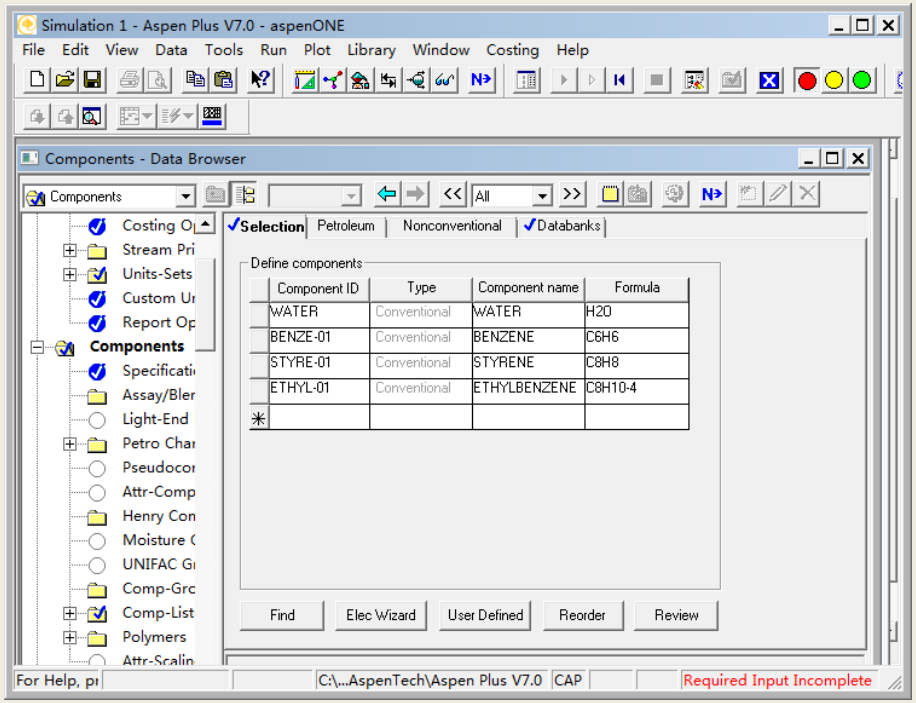


※ 添加新创建的两个物性集BETA和DEWBUB



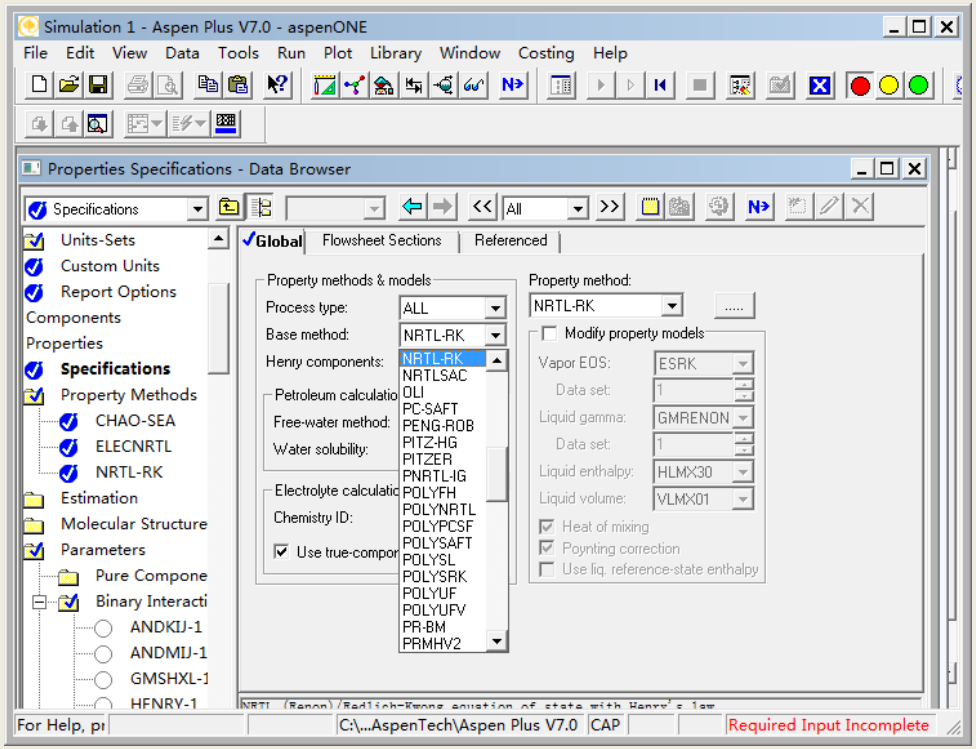
指定组分

- 输入WATER（水）、BENZENE（苯）、STYRENE（苯乙烯）和EB（乙苯）

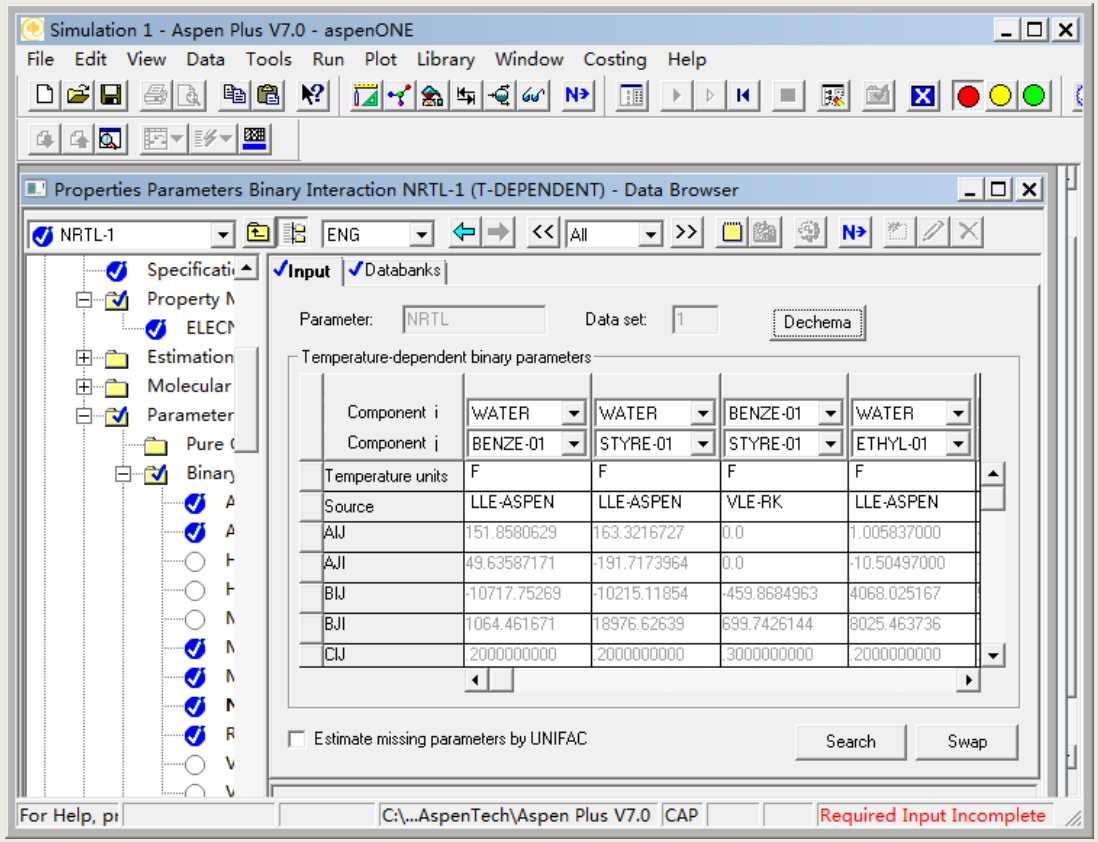


指定物性方法

- 采用**NRTL-RK**物性方法

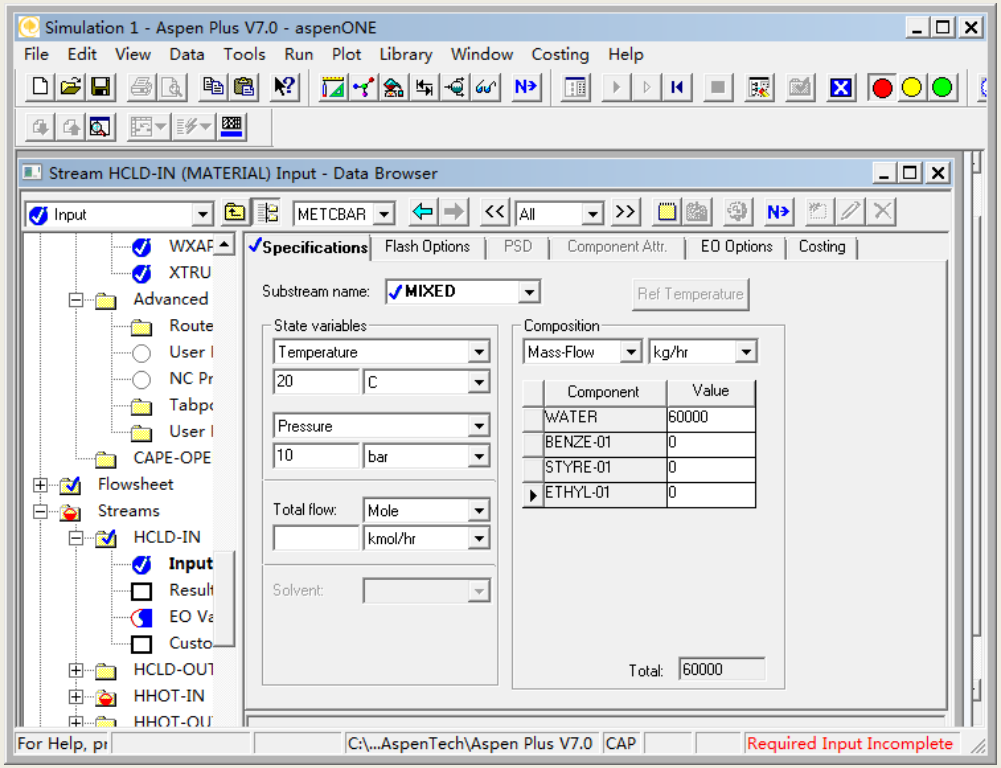


查看二元交互参数


Simulation 1 - Aspen Plus V7.0 - aspenONE
File Edit View Data Tools Run Plot Library Window Costing Help
Properties Parameters Binary Interaction NRTL-1 (T-DEPENDENT) - Data Browser
NRTL-1
ENG
All
Input
Databanks
Parameter: NRTL
Data set: 1
Dechema
Temperature-dependent binary parameters
Component i
Component j
WATER BENZE-01
WATER STYRE-01
BENZE-01 STYRE-01
WATER ETHYL-01
Temperature units F F F F
Source LLE-ASPEN LLE-ASPEN VLE-RK LLE-ASPEN
AIJ 151.8580629 163.3216727 0.0 1.005837000
AJI 49.63587171 -191.7173964 0.0 -10.50497000
BIJ -10717.75269 -10215.11854 -459.8684963 4068.025167
BJI 1064.461671 18976.62639 699.7426144 8025.463736
CIJ .2000000000 .2000000000 .3000000000 .2000000000
Estimate missing parameters by UNIFAC
Search
Swap
For Help, pr
C:\...AspenTech\Aspen Plus V7.0
CAP
Required Input Incomplete

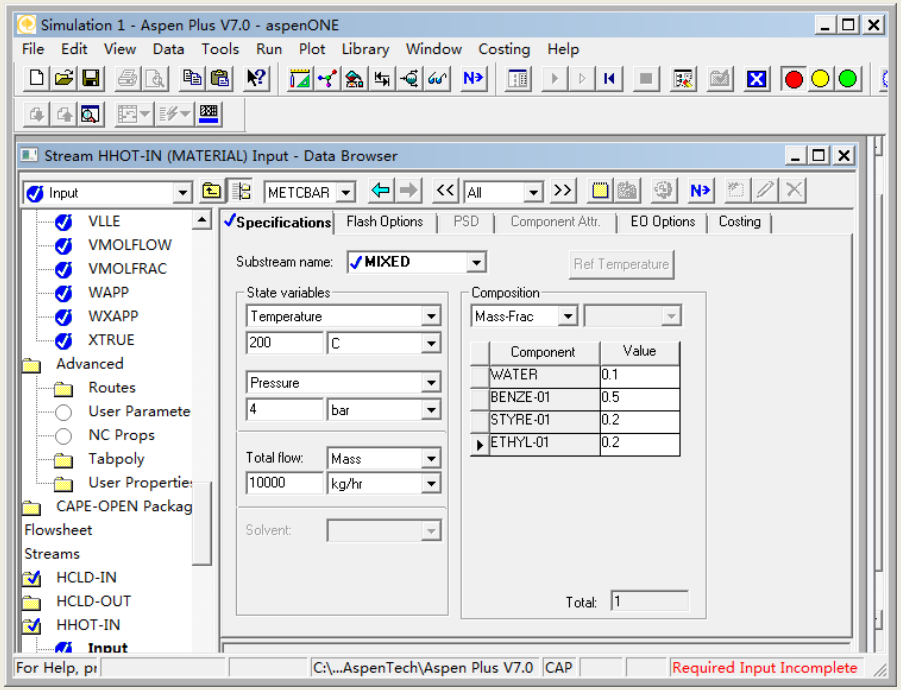
指定HCLD-IN物流

- 温度20℃、压力10 bar、流量60000 kg/h水



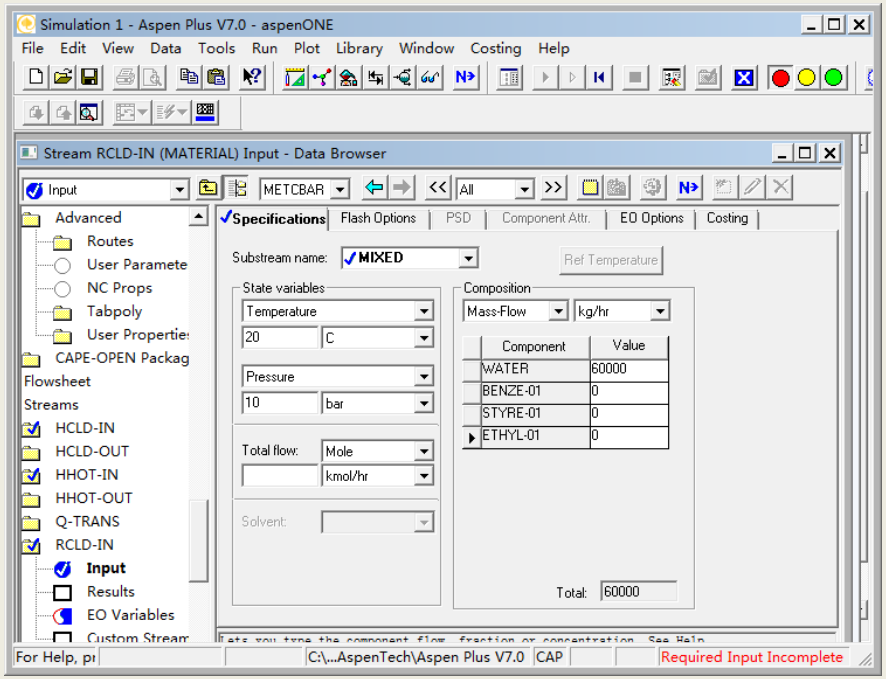
指定HHOT-IN物流

- 温度200℃、压力4 bar、流量10000 kg/h、质量百分组成：50 wt%苯、20%苯乙烯、20%乙苯和10%水



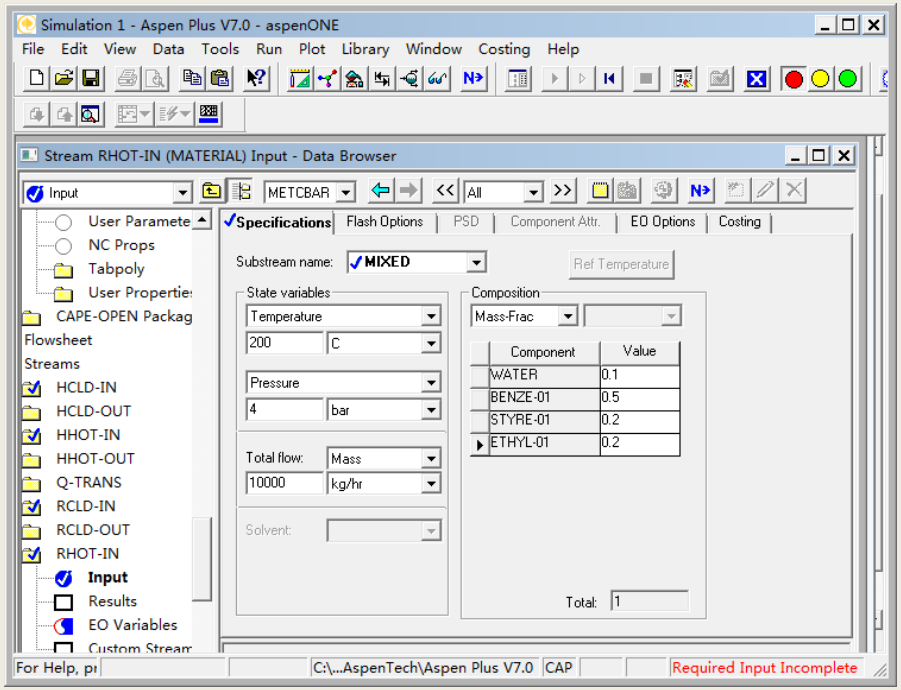
指定RCLD-IN物流

- 温度20℃、压力10 bar、流量60000 kg/hr水



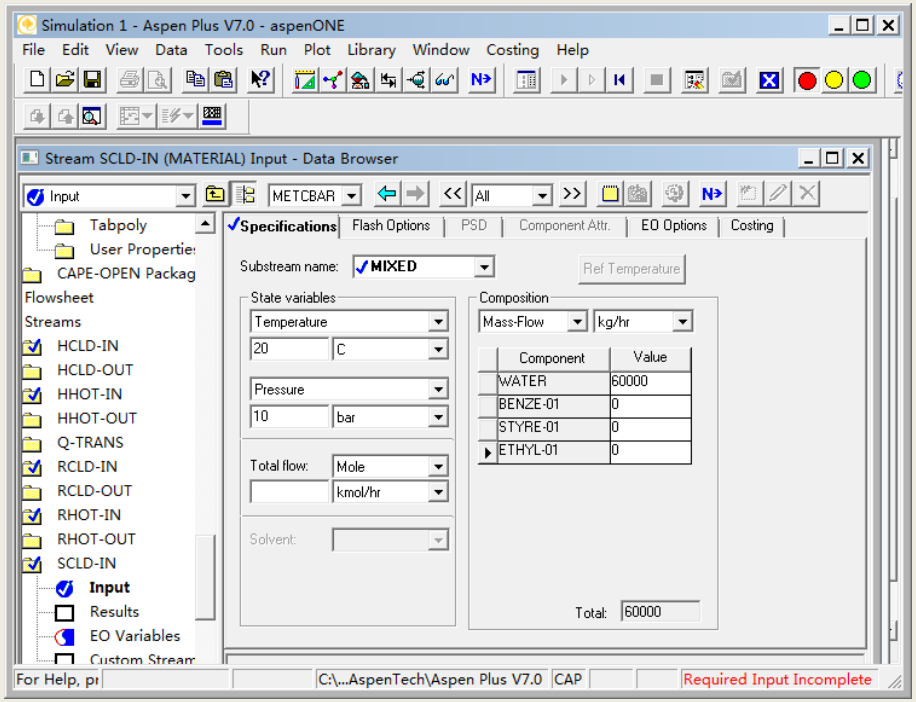
指定RHOT-IN物流

- 温度200℃、压力4 bar、流量10000 kg/hr、质量百分组成：50 wt%苯、20%苯乙烯、20%乙苯和10%水



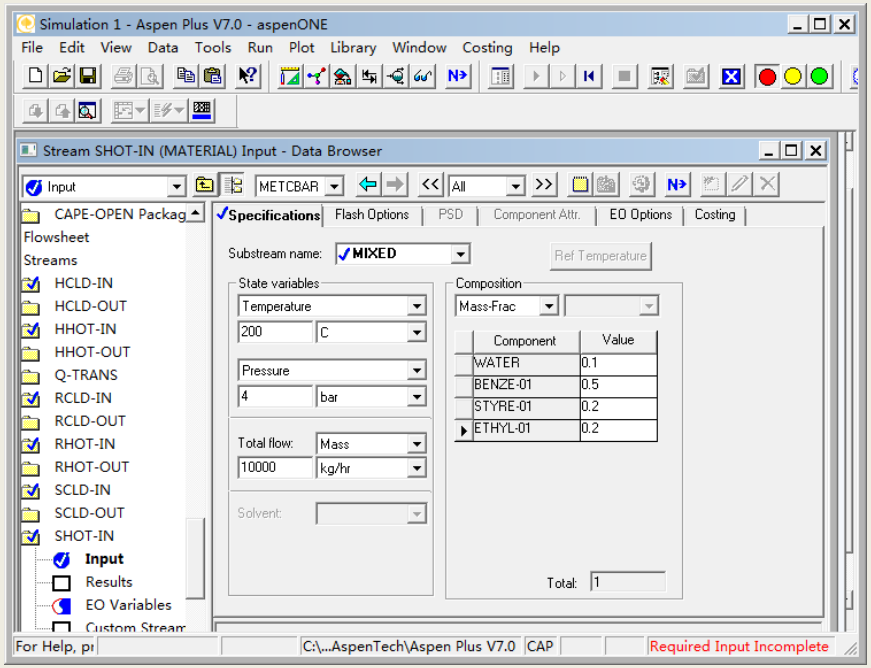
指定SCLD-IN物流

- 温度20℃、压力10 bar、流量60000 kg/h水



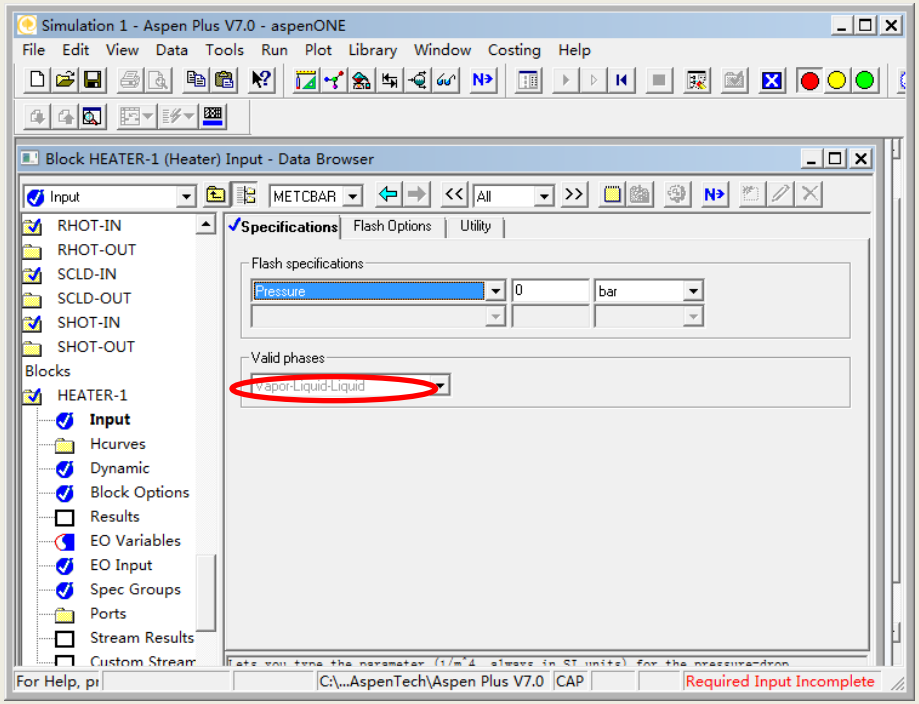
指定SHOT-IN物流

- 温度200℃、压力4 bar、流量10000 kg/h、百分组成：50 wt%苯、20%苯乙烯、20%乙苯和10%水



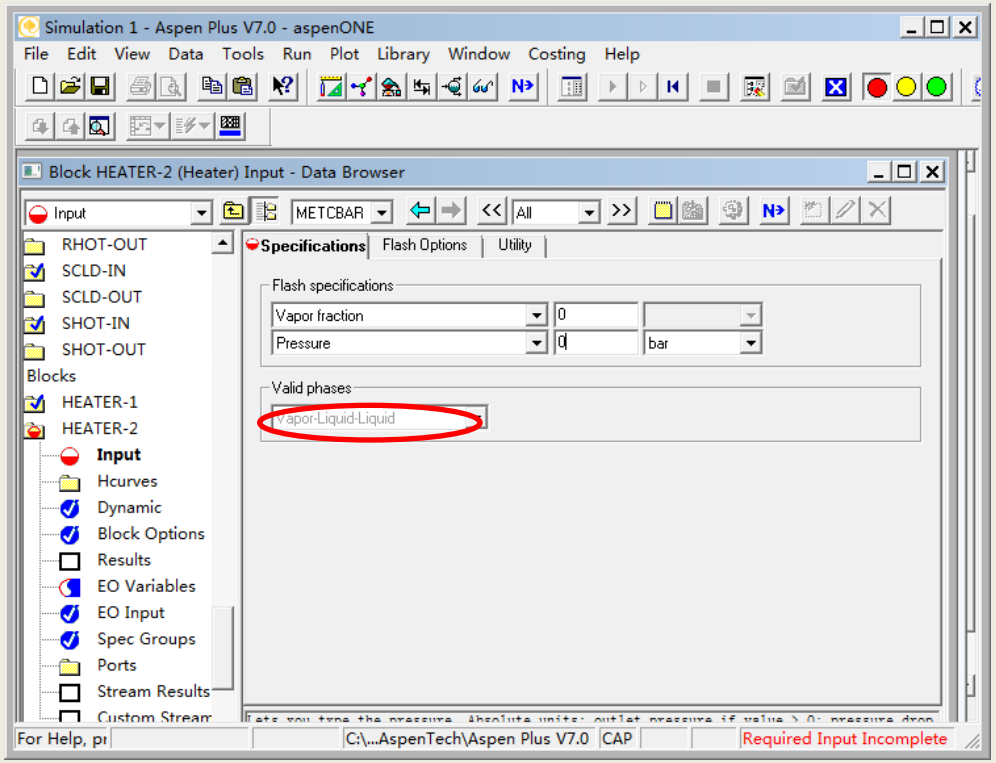
指定HEATER-1模块

- 压降0，注意有效相为Vapor-Liquid-Liquid



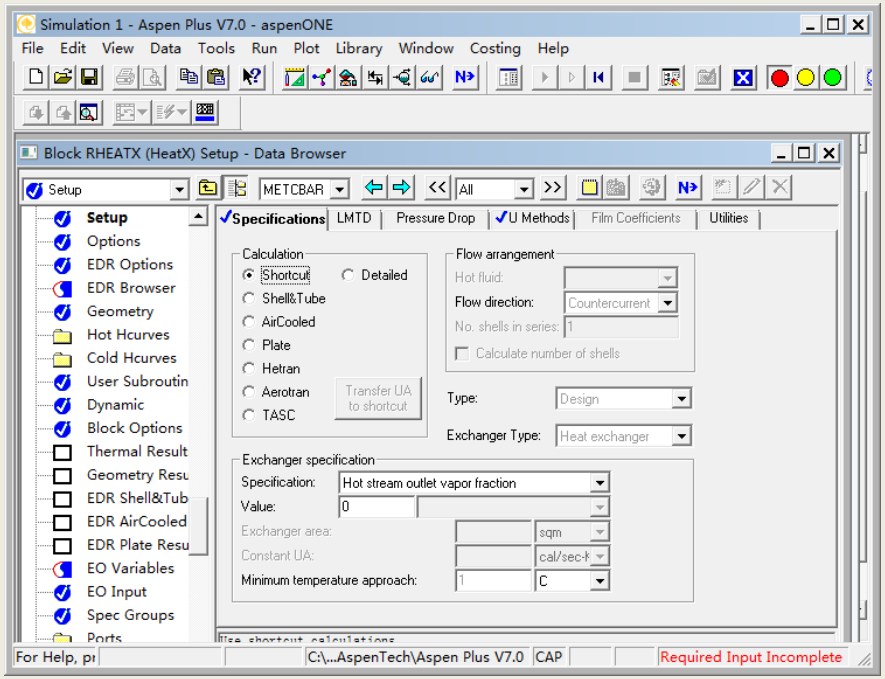
指定HEATER-2模块

- 压降0、烃出口气化分率0，有效相为Vapor-Liquid-Liquid



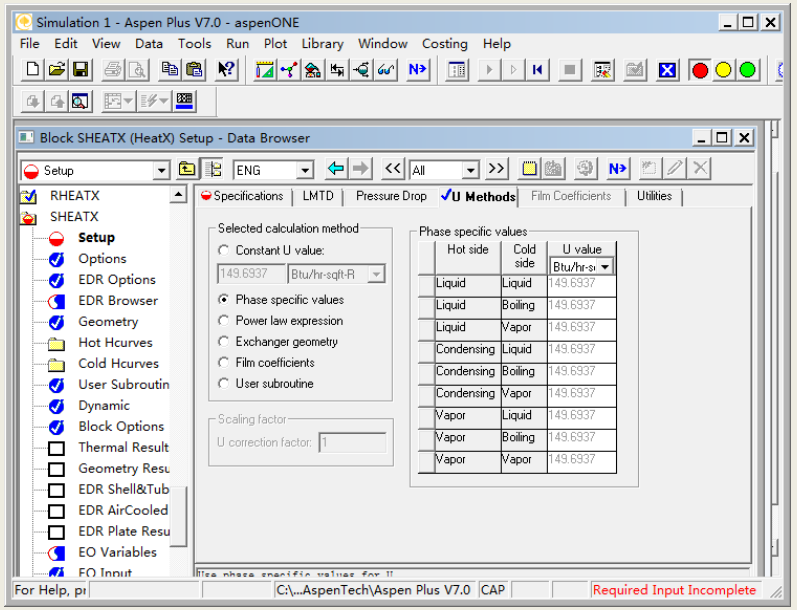
指定RHEATX模块（1）

- 选Shortcut（简捷法）、Countcurrent（逆流）、指定Hot stream outlet vapor fraction（热物流出口气化分率）为0



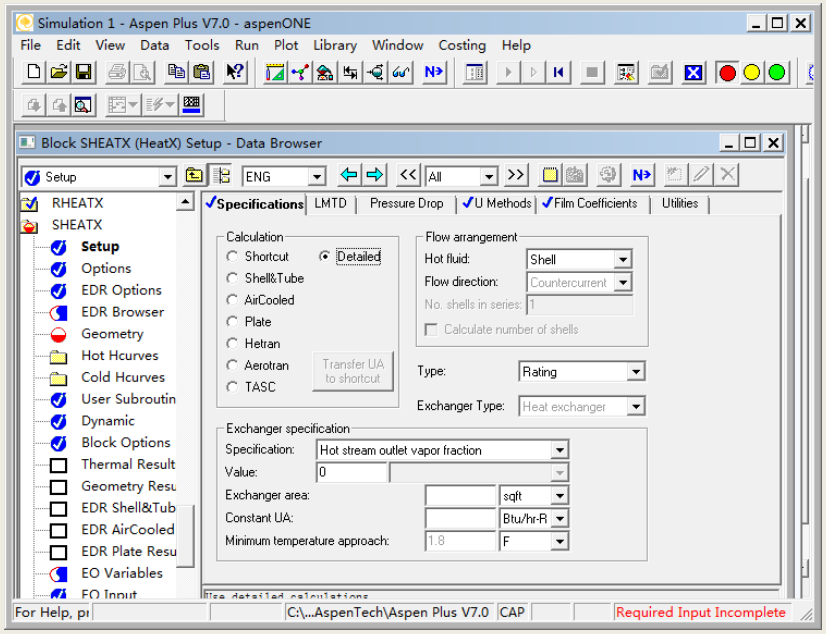
指定RHEATX模块（2）

- **U Methods**（Calculation method for the overall heat transfer coefficient）采用默认值**Phase specfic values**



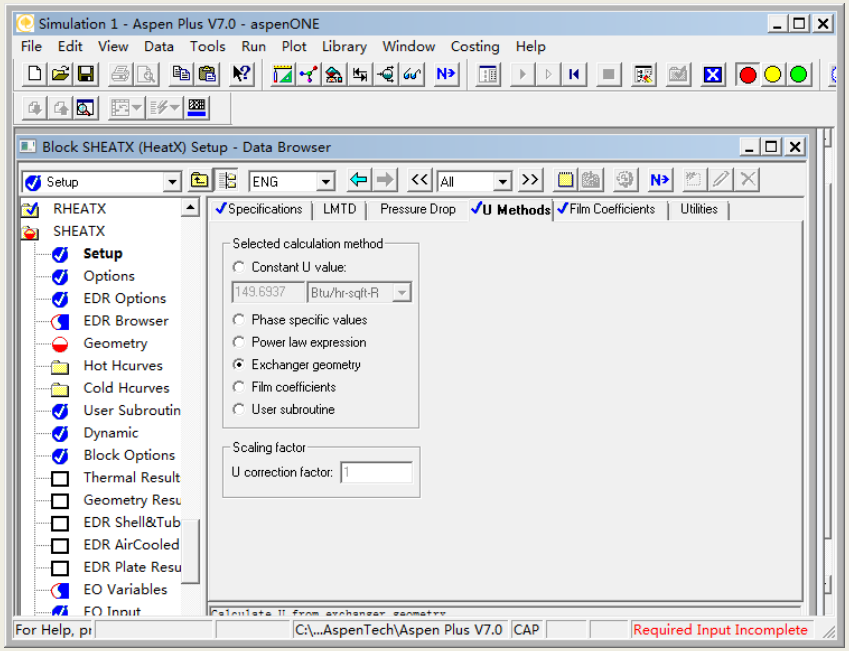
指定SHEATX模块（1）

- 选Detailed（严格法）、热端Shell（壳程）、冷端Tube（管程）、Countcurrent（逆流）、指定Hot stream outlet vapor fraction（热物流出口气化分率）为0



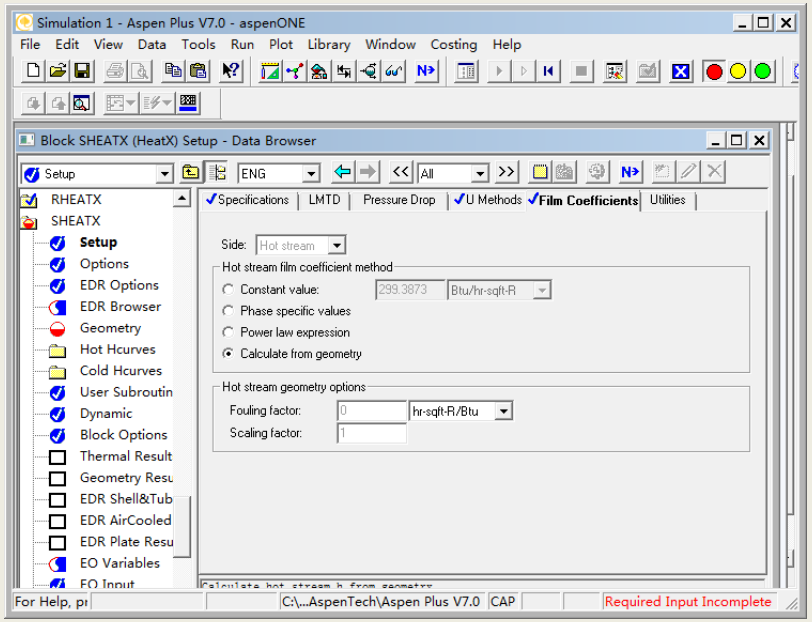
指定SHEATX模块（2）

- U Methods采用默认值Exchanger geometry



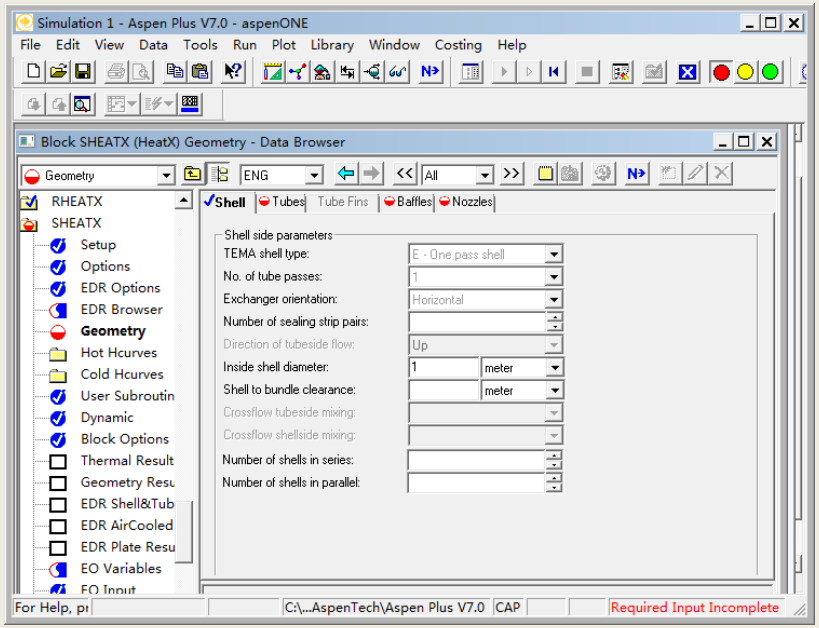
指定SHEATX模块（3）

- **Film Coefficients**（Calculation method for the hot and cold stream film coefficients）采用默认值



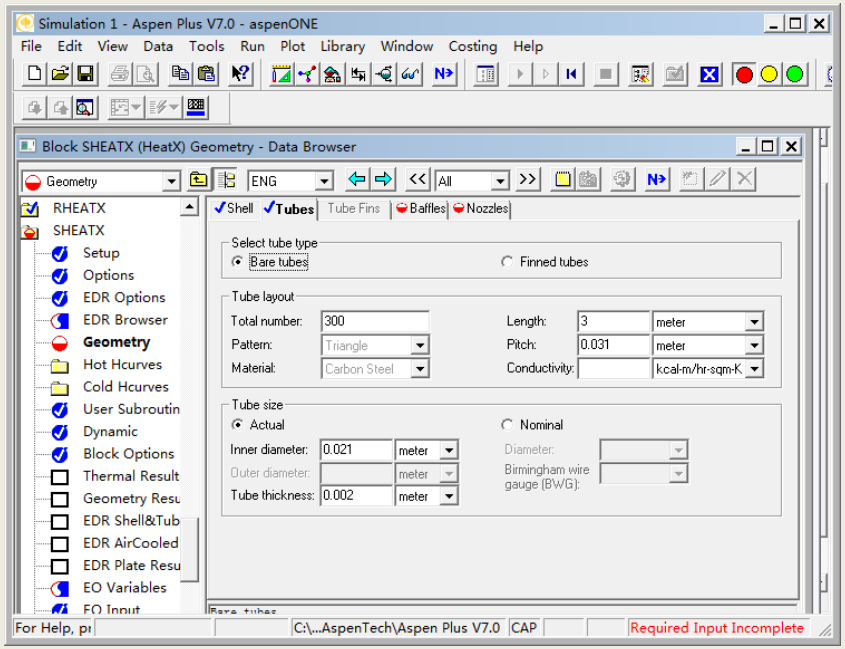
设定Blocks/ SHEATX /geometry选项

- 右边的Shell页面中壳程直径1 m，管程数为1



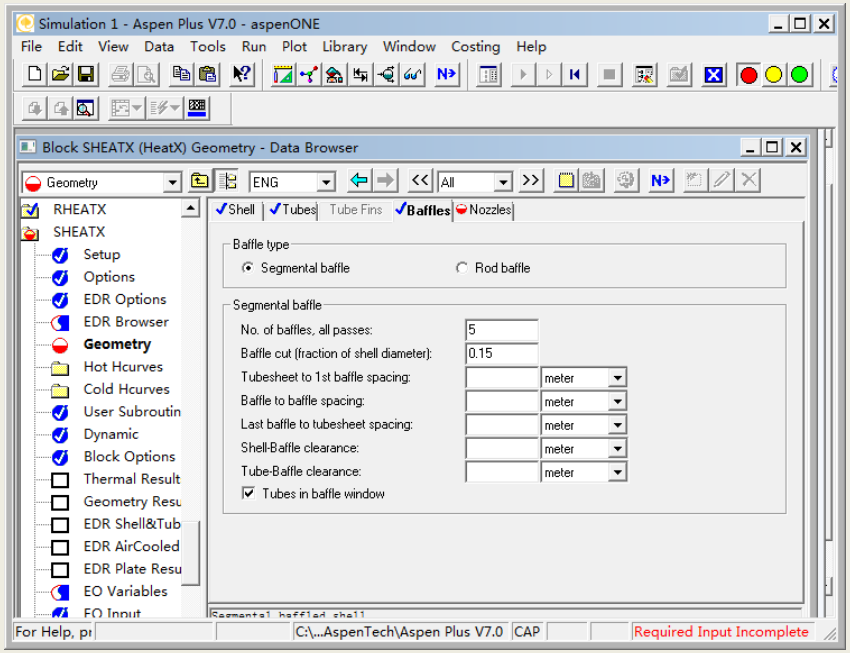
设定Tubes页面

- 裸管300根，3 m长、管心距31 mm、内径21 mm、外径25 mm



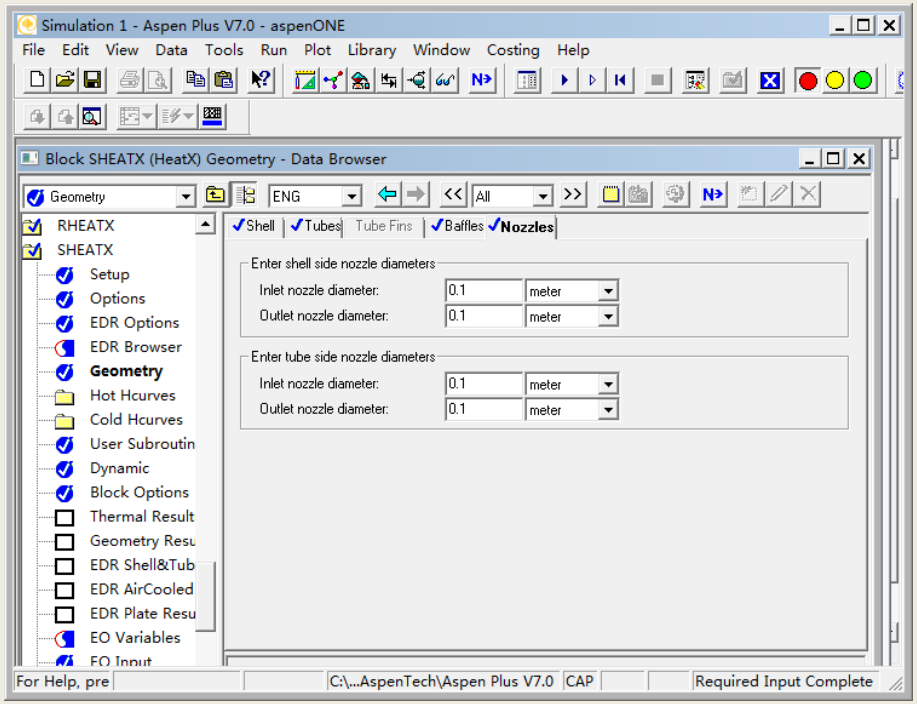
设定Baffles页面

- 折流板5个、切削15%

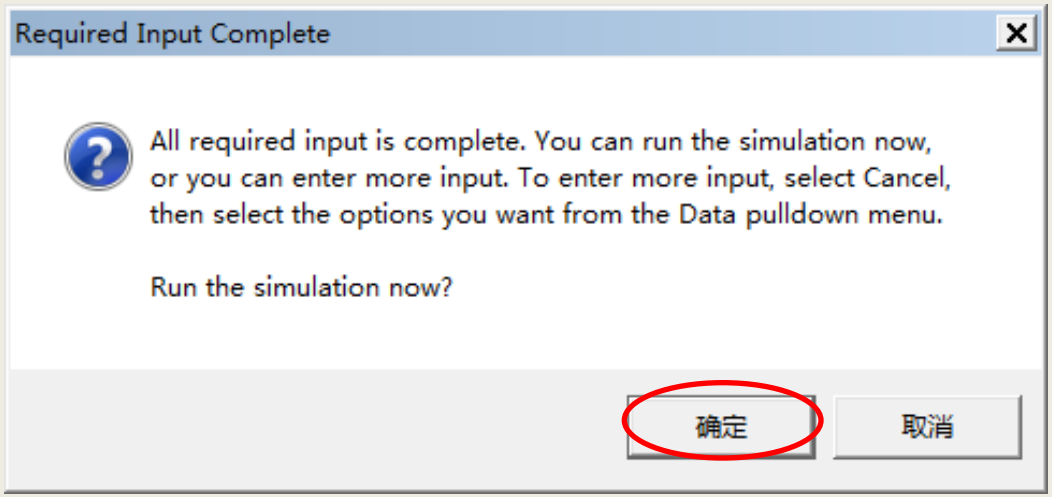


设定Nozzles页面

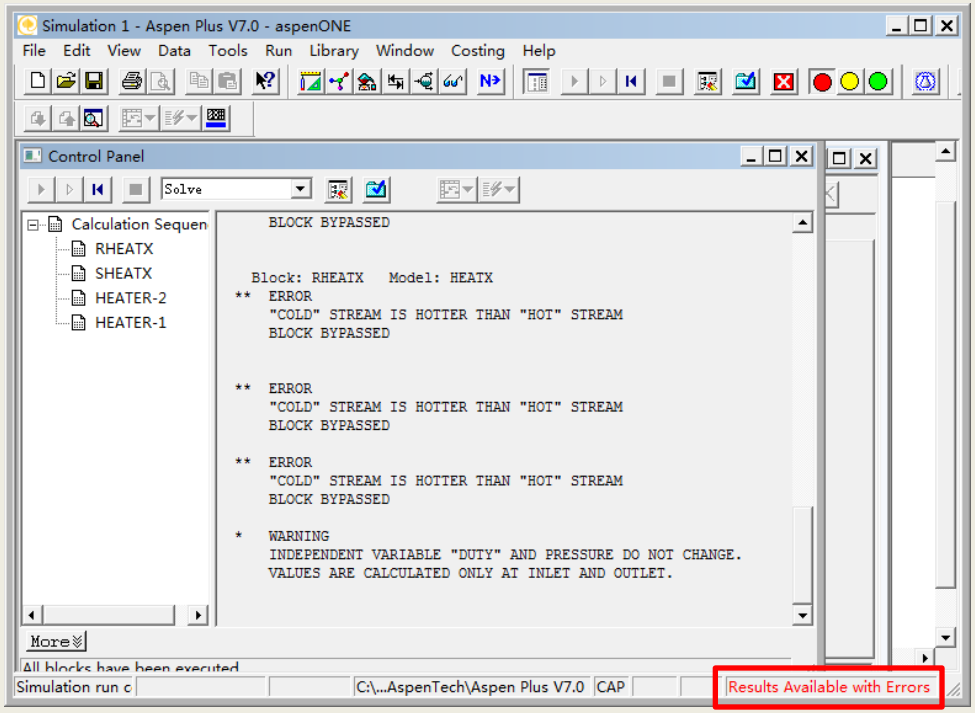
- 所有管嘴100 mm



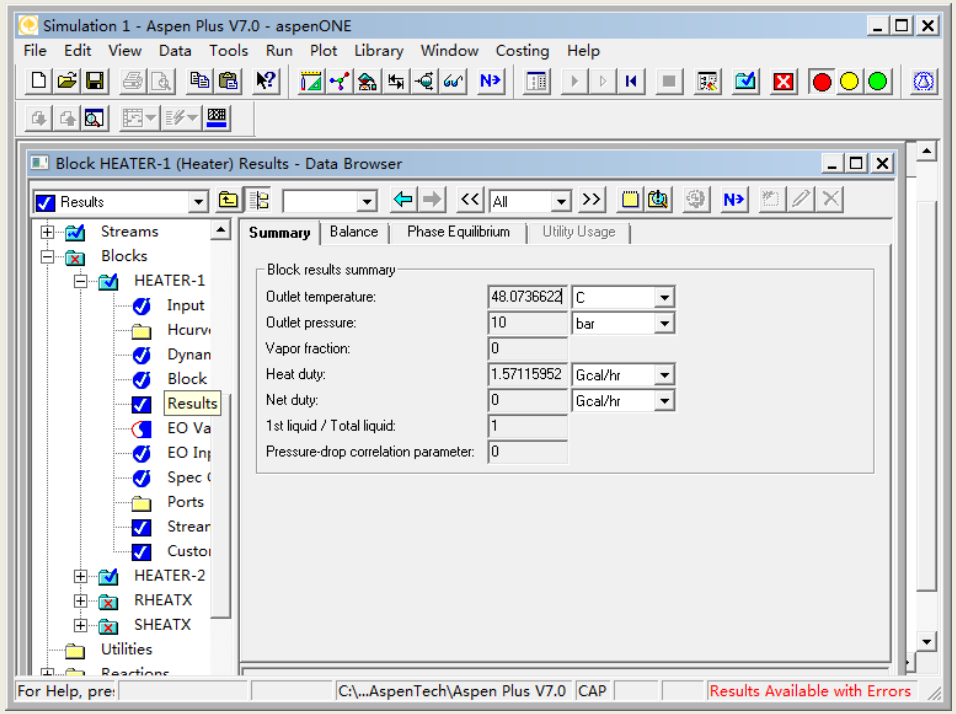
单击NEXT，出现下图对话框，点击确定



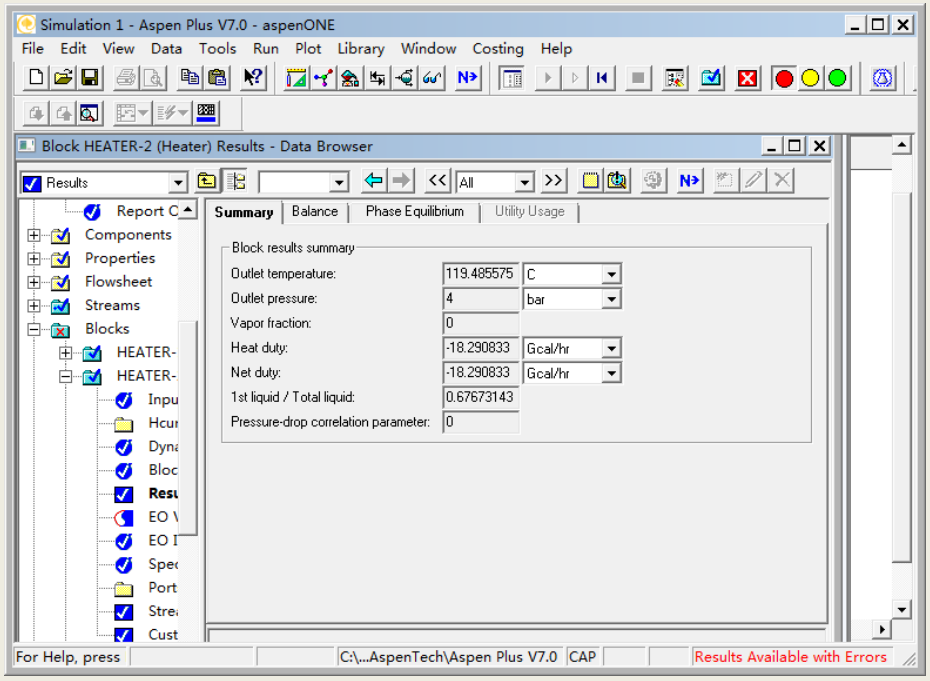
打开控制面板，运行如下


Simulation 1 - Aspen Plus V7.0 - aspenONE
File Edit View Data Tools Run Library Window Costing Help
Control Panel
Solve
Calculation Sequen
RHEATX
SHEATX
HEATER-2
HEATER-1
BLOCK BYPASSED
Block: RHEATX Model: HEATX
** ERROR
"COLD" STREAM IS HOTTER THAN "HOT" STREAM
BLOCK BYPASSED
** ERROR
"COLD" STREAM IS HOTTER THAN "HOT" STREAM
BLOCK BYPASSED
** ERROR
"COLD" STREAM IS HOTTER THAN "HOT" STREAM
BLOCK BYPASSED
* WARNING
INDEPENDENT VARIABLE "DUTY" AND PRESSURE DO NOT CHANGE.
VALUES ARE CALCULATED ONLY AT INLET AND OUTLET.
More
All blocks have been executed
Simulation run c
C:\...AspenTech\Aspen Plus V7.0
CAP
Results Available with Errors

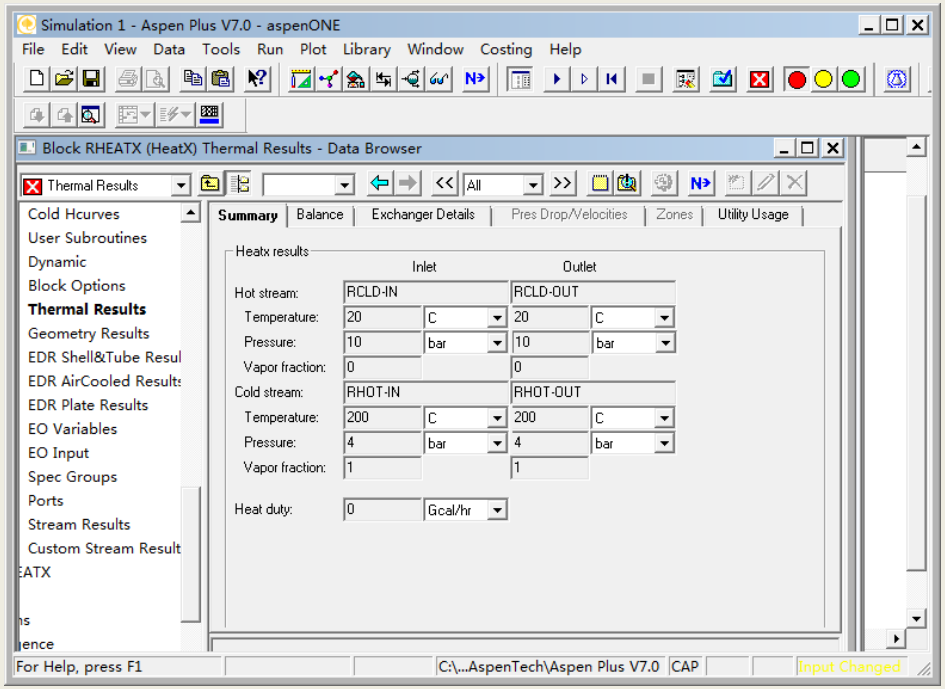
HEATER-1的结果


Simulation 1 - Aspen Plus V7.0 - aspenONE
File Edit View Data Tools Run Plot Library Window Costing Help
Block HEATER-1 (Heater) Results - Data Browser
Results
Streams
Blocks
HEATER-1
Input
Block
Results
HEATER-2
RHEATX
SHEATX
Utilities
Summary
Balance
Phase Equilibrium
Utility Usage
Block results summary
Outlet temperature: 48.0736622 C
Outlet pressure: 10 bar
Vapor fraction: 0
Heat duty: 1.57115952 Gcal/hr
Net duty: 0 Gcal/hr
1st liquid / Total liquid: 1
Pressure-drop correlation parameter: 0
C:\...AspenTech\Aspen Plus V7.0
CAP
Results Available with Errors

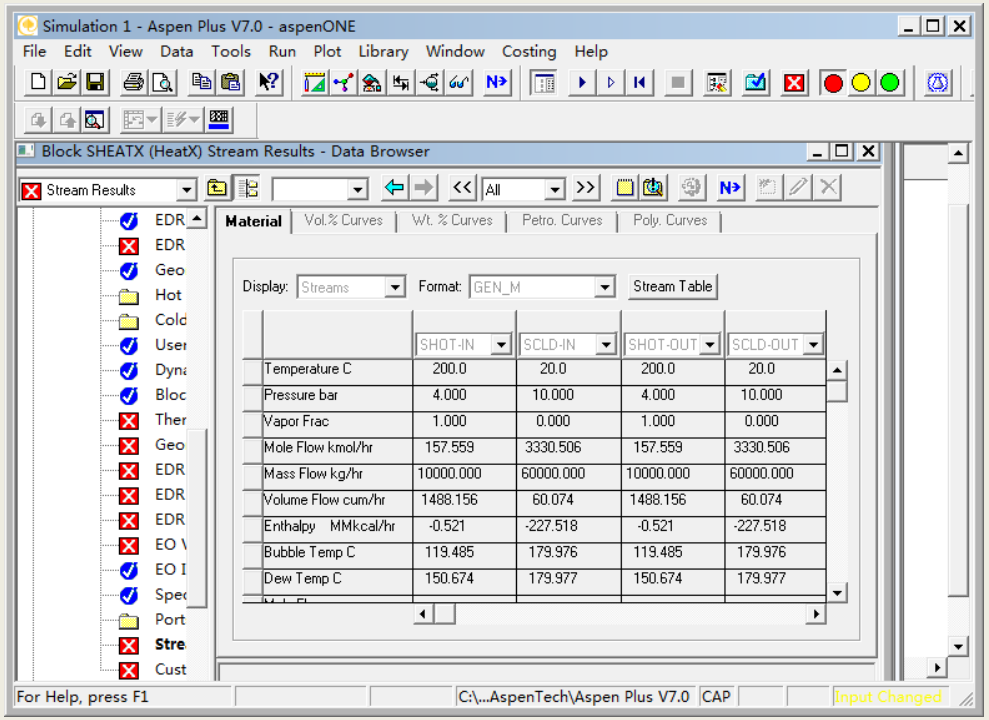
HEATER-2的结果


Simulation 1 - Aspen Plus V7.0 - aspenONE
File Edit View Data Tools Run Plot Library Window Costing Help
Block HEATER-2 (Heater) Results - Data Browser
Results
All
Report C
Components
Properties
Flowsheet
Streams
Blocks
HEATER-
HEATER-
Summary Balance Phase Equilibrium Utility Usage
Block results summary
Outlet temperature: 119.485575 C
Outlet pressure: 4 bar
Vapor fraction: 0
Heat duty: -18.290833 Gcal/hr
Net duty: -18.290833 Gcal/hr
1st liquid / Total liquid: 0.67673143
Pressure-drop correlation parameter: 0
For Help, press
C:\...AspenTech\Aspen Plus V7.0
CAP
Results Available with Errors

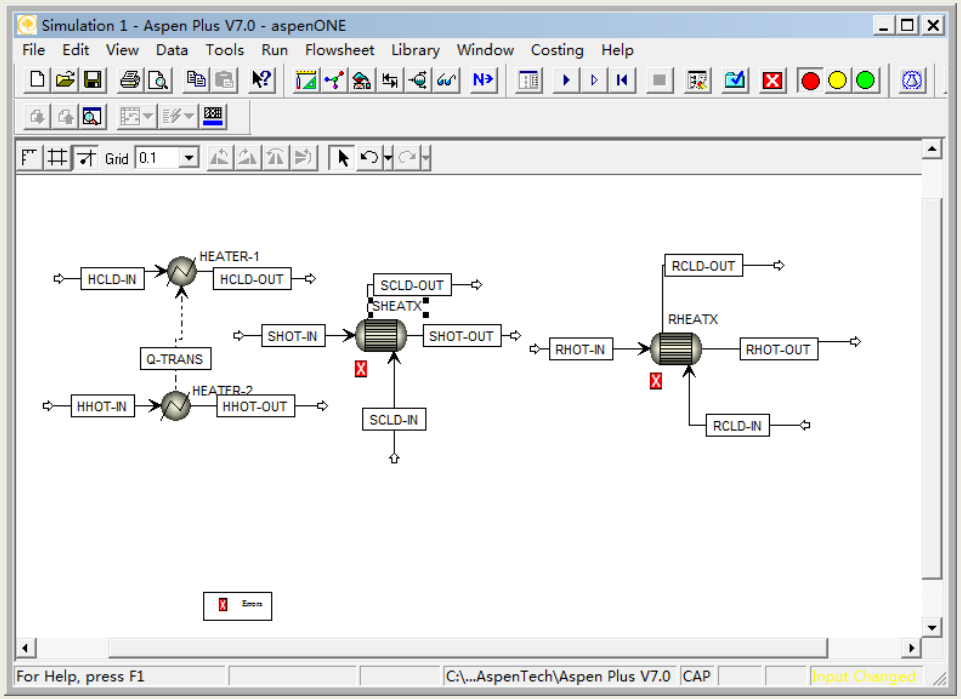
RHEATX的结果


Simulation 1 - Aspen Plus V7.0 - aspenONE
File Edit View Data Tools Run Plot Library Window Costing Help
Block RHEATX (HeatX) Thermal Results - Data Browser
Thermal Results
Cold Hcurves
User Subroutines
Dynamic
Block Options
Thermal Results
Geometry Results
EDR Shell&Tube Resul
EDR AirCooled Results
EDR Plate Results
EO Variables
EO Input
Spec Groups
Ports
Stream Results
Custom Stream Result
Summary Balance Exchanger Details Pres Drop/Velocities Zones Utility Usage
Heatx results
Inlet Outlet
Hot stream: RCLD-IN RCLD-OUT
Temperature: 20 C 20 C
Pressure: 10 bar 10 bar
Vapor fraction: 0 0
Cold stream: RHOT-IN RHOT-OUT
Temperature: 200 C 200 C
Pressure: 4 bar 4 bar
Vapor fraction: 1 1
Heat duty: 0 Gcal/hr
For Help, press F1
C:\...AspenTech\Aspen Plus V7.0
CAP
Input Changed

SHEATX的结果


Simulation 1 - Aspen Plus V7.0 - aspenONE
File Edit View Data Tools Run Plot Library Window Costing Help
Block SHEATX (HeatX) Stream Results - Data Browser
Stream Results
Material
Vol.% Curves
Wt. % Curves
Petro. Curves
Poly. Curves
Display: Streams
Format: GEN_M
Stream Table
SHOT-IN
SCLD-IN
SHOT-OUT
SCLD-OUT
Temperature C 200.0 20.0 200.0 20.0
Pressure bar 4.000 10.000 4.000 10.000
Vapor Frac 1.000 0.000 1.000 0.000
Mole Flow kmol/hr 157.559 3330.506 157.559 3330.506
Mass Flow kg/hr 10000.000 60000.000 10000.000 60000.000
Volume Flow cum/hr 1488.156 60.074 1488.156 60.074
Enthalpy MMkcal/hr -0.521 -227.518 -0.521 -227.518
Bubble Temp C 119.485 179.976 119.485 179.976
Dew Temp C 150.674 179.977 150.674 179.977
For Help, press F1
C:\...AspenTech\Aspen Plus V7.0
CAP
Input Changed

流程图显示错误

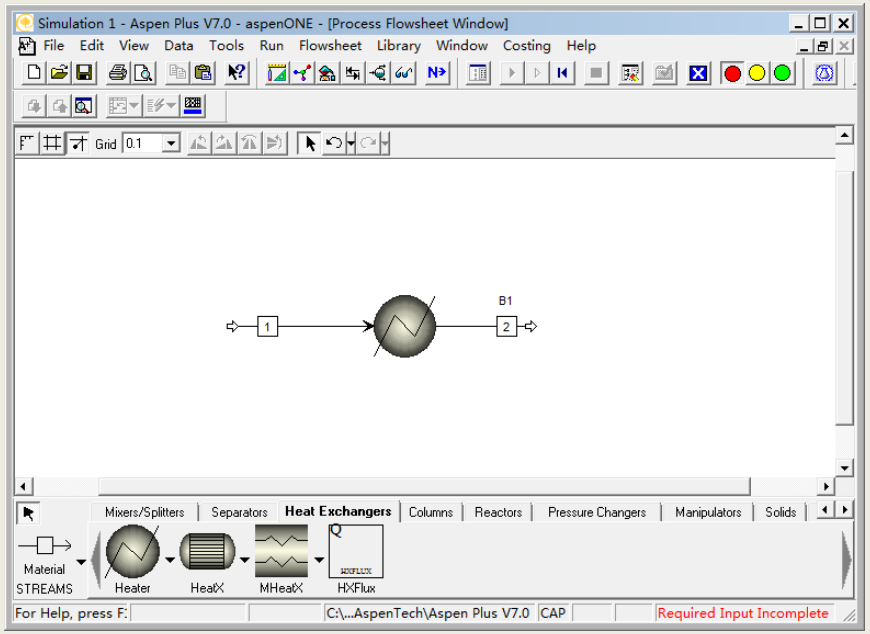

Simulation 1 - Aspen Plus V7.0 - aspenONE
File Edit View Data Tools Run Flowsheet Library Window Costing Help
Grid 0.1
HEATER-1
HCLD-IN
HCLD-OUT
SCLD-OUT
SHEATX
SHOT-IN
SHOT-OUT
Q-TRANS
HEATER-2
HHOT-IN
HHOT-OUT
SCLD-IN
RCLD-OUT
RHEATX
RHOT-IN
RHOT-OUT
RCLD-IN
For Help, press F1
C:\...AspenTech\Aspen Plus V7.0
CAP
Input Changed

换热器的设计

※ 换热器是化学工业及其他过程工业的通用设备，其设备投资占设备总投资的0.3-0.4。换热器类型多种多样，但以管壳式换热器应用最广。此类换热器通过管壁进行传热，结构简单，换热负荷大，下面以管壳式换热器为例，说明利用Aspen进行换热器设计的基本过程。

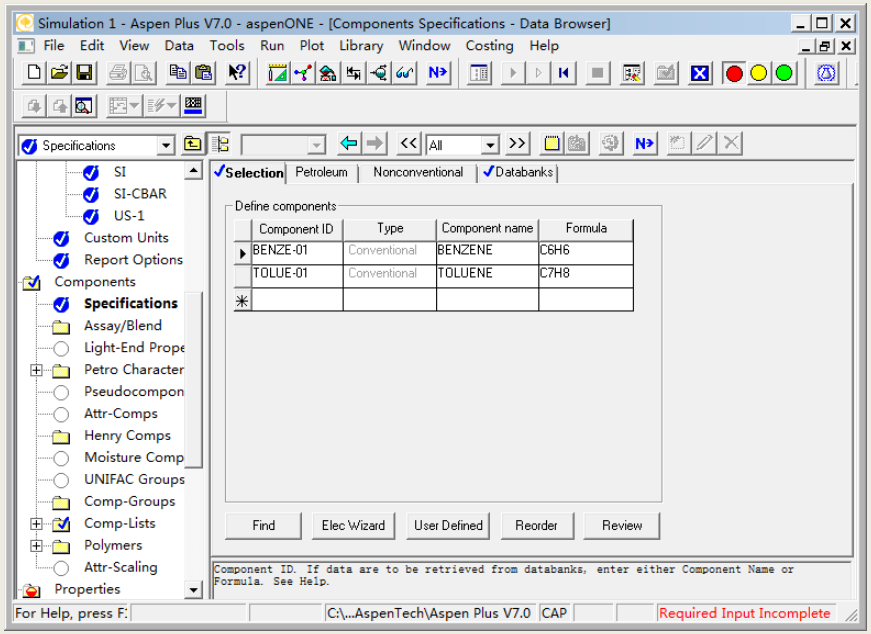
模拟实例

※ 将5t/h常温常压下的苯（0.44，质量分数）的甲苯混合液加热到泡点，求热负荷及泡点温度，如图搭建流程图：



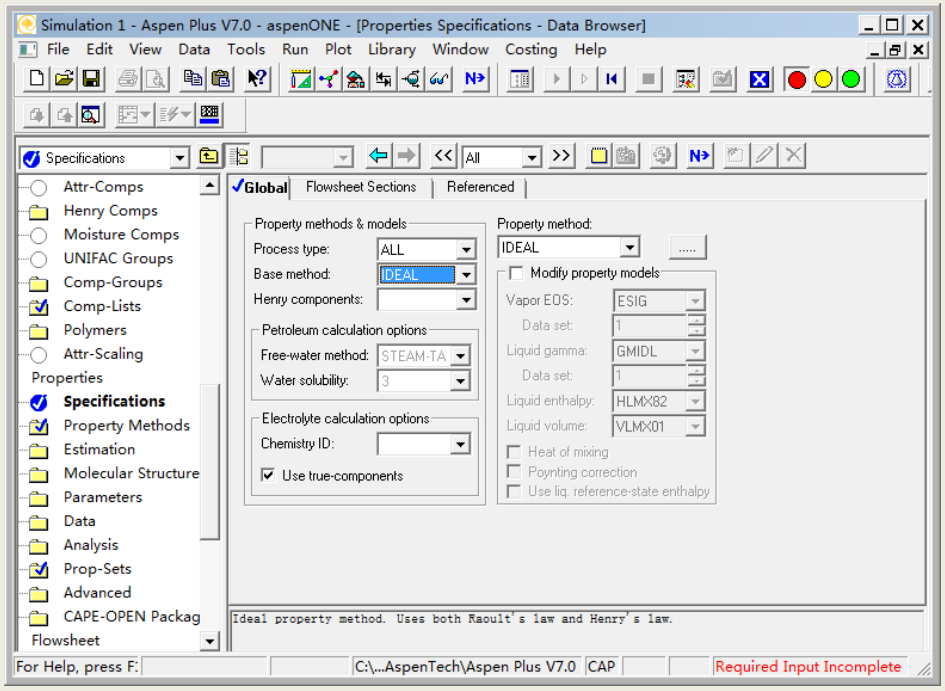
指定组分

※输入组分苯与甲苯，如图：



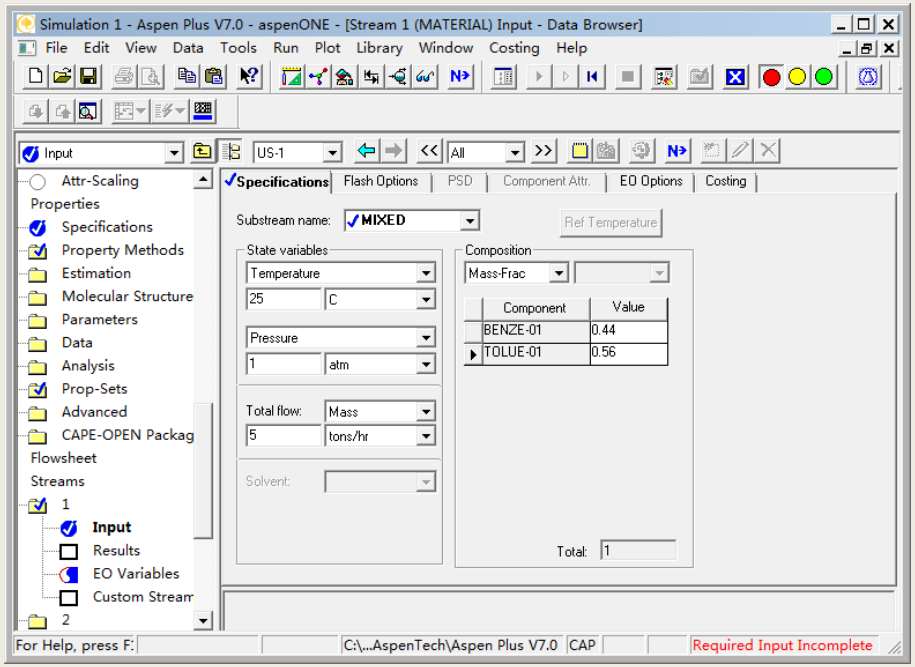
指定热力学方法

※选择IDEAL热力学方法，如图：



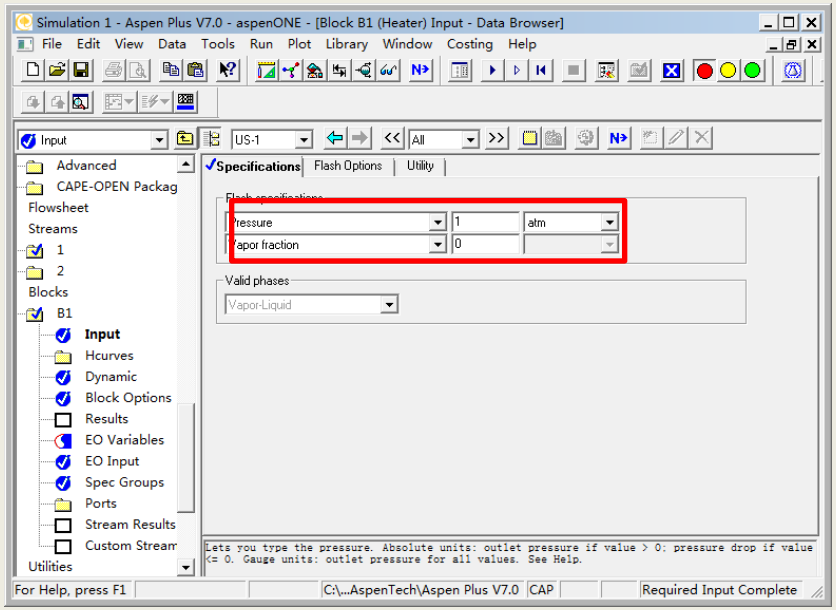
输入进料物流参数

※输入进料物流1的参数，如图：

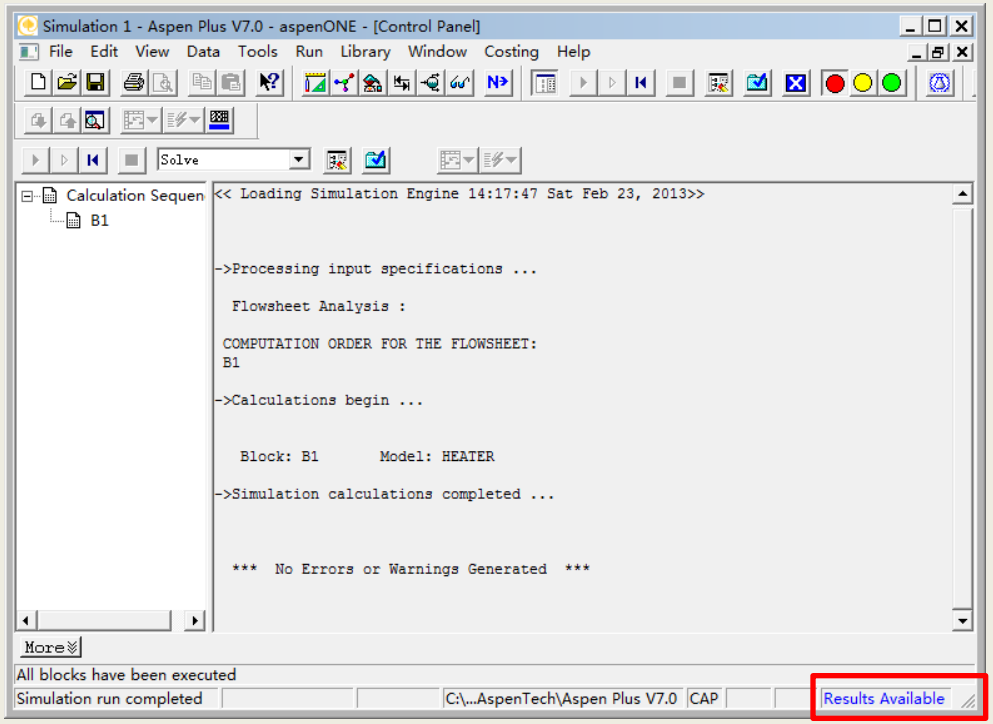


指定B1的参数

※在加热器模块对话框中选择压力及汽化分率，如图：

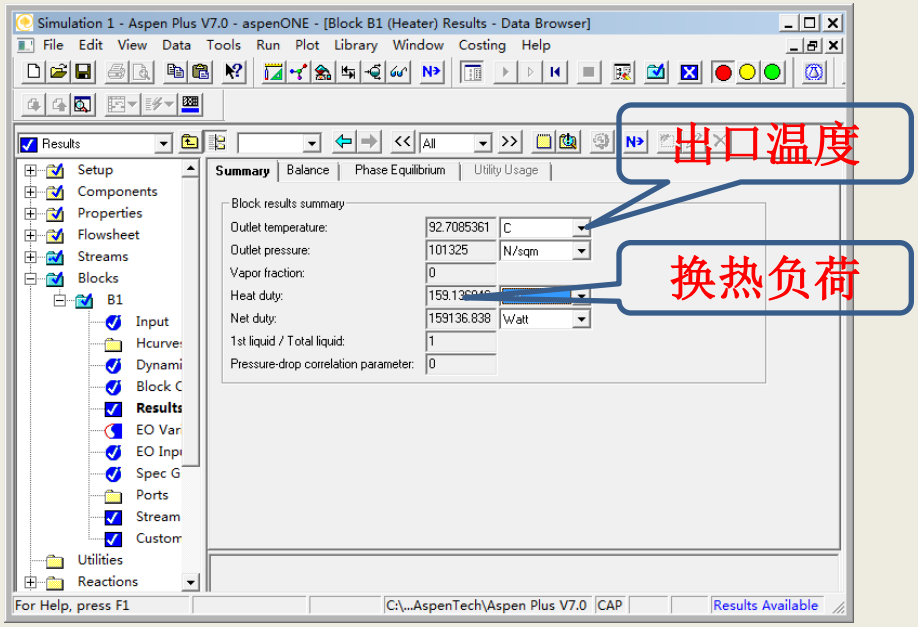


运行模拟


Simulation 1 - Aspen Plus V7.0 - aspenONE - [Control Panel]
File Edit View Data Tools Run Library Window Costing Help
Solve
Calculation Sequen
B1
<< Loading Simulation Engine 14:17:47 Sat Feb 23, 2013>>
->Processing input specifications ...
Flowsheet Analysis :
COMPUTATION ORDER FOR THE FLOWSHEET:
B1
->Calculations begin ...
Block: B1 Model: HEATER
->Simulation calculations completed ...
*** No Errors or Warnings Generated ***
More
All blocks have been executed
Simulation run completed
C:\...AspenTech\Aspen Plus V7.0
CAP
Results Available

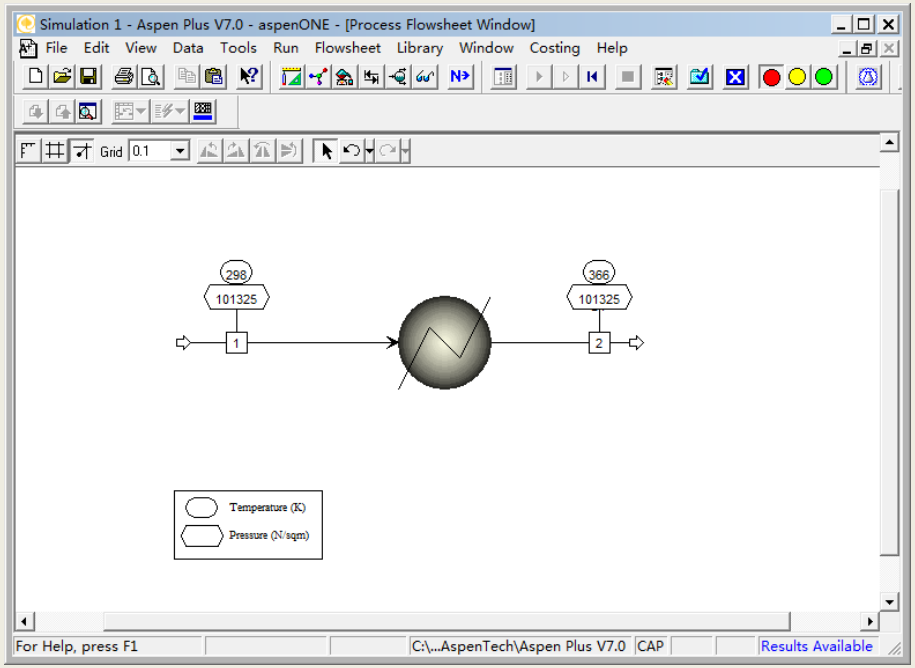
查看模拟运行结果

※加热器计算结果，如图：



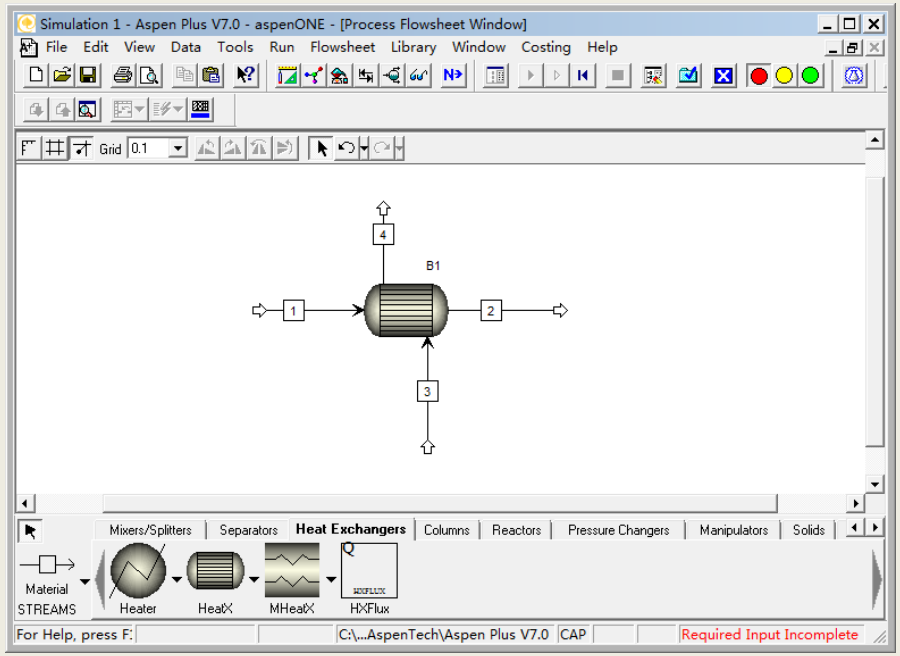
模拟运行后的流程图

※物流的温度、压力已显示，如图：



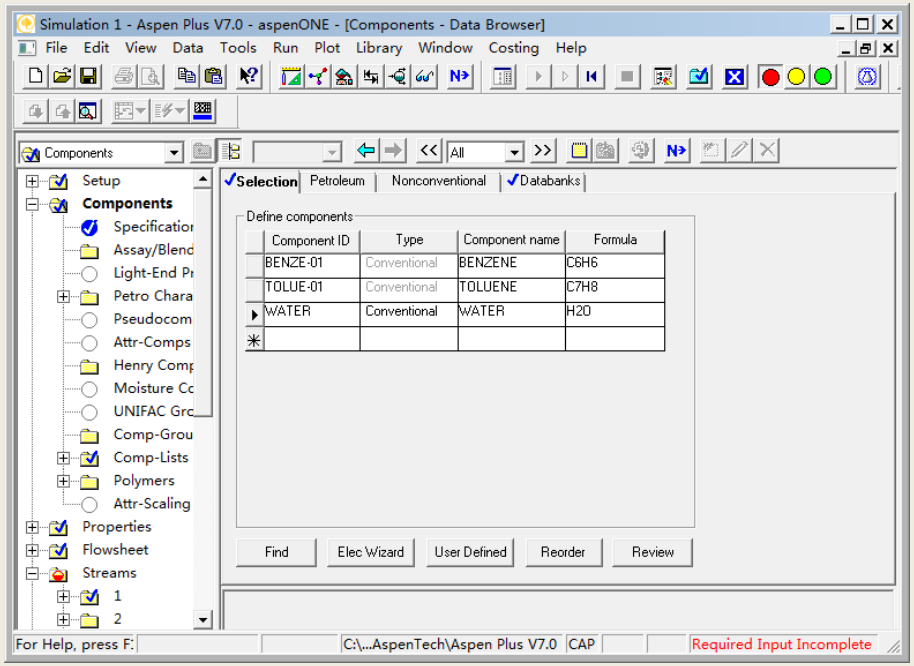
两股物流换热负荷的确定

※搭建流程图，如图：



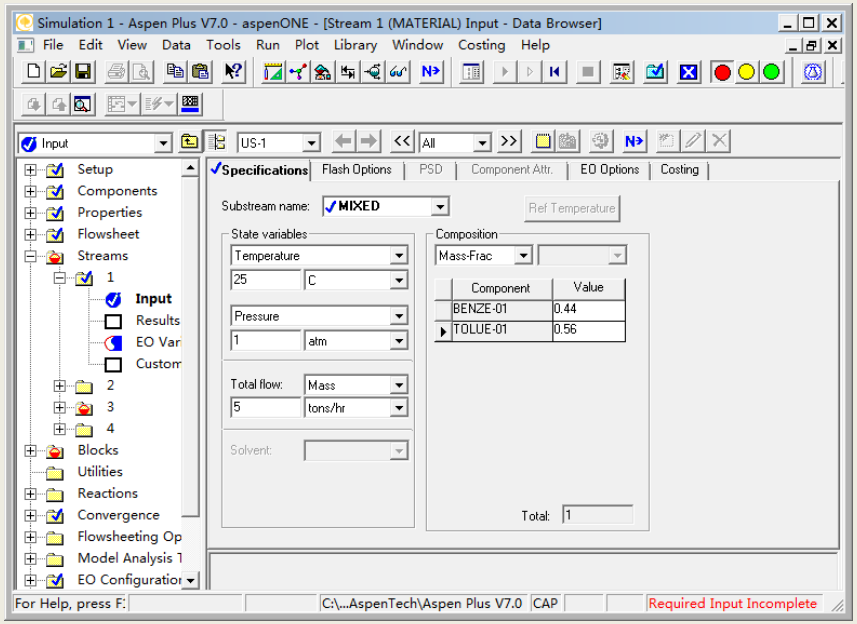
指定组分

※输入组分苯、甲苯、水，如图：



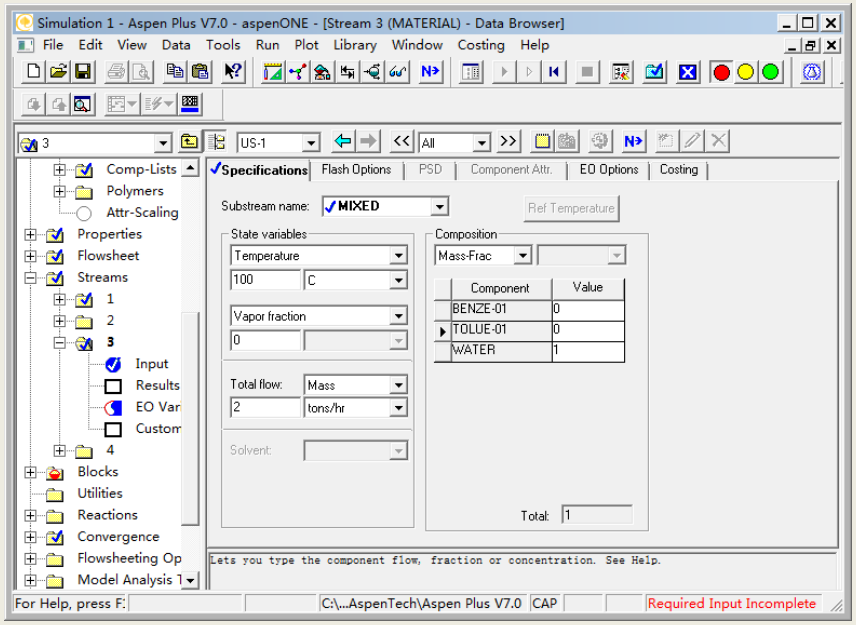
指定进料物流参数（1）

※输入进料物流1的参数，如图：



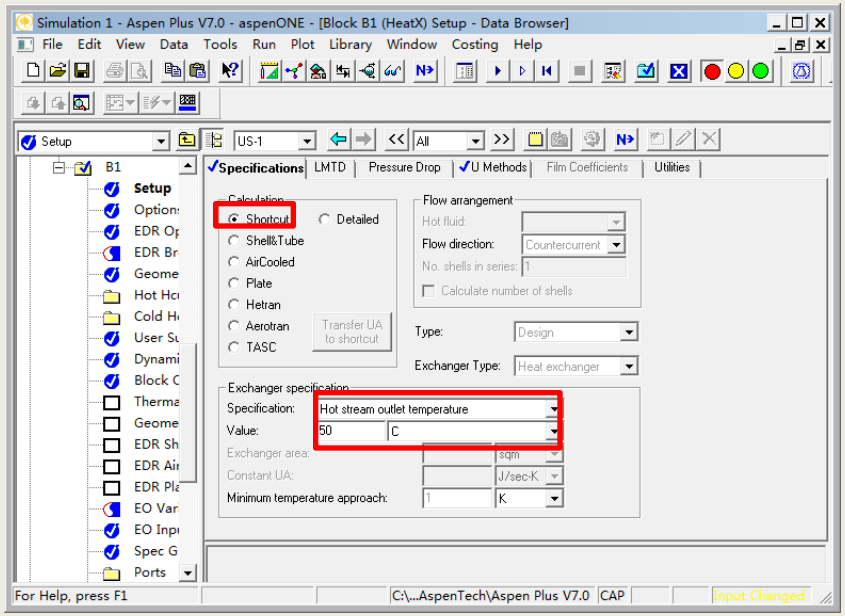
指定进料物流参数（2）

※输入进料物流3的参数，如图：



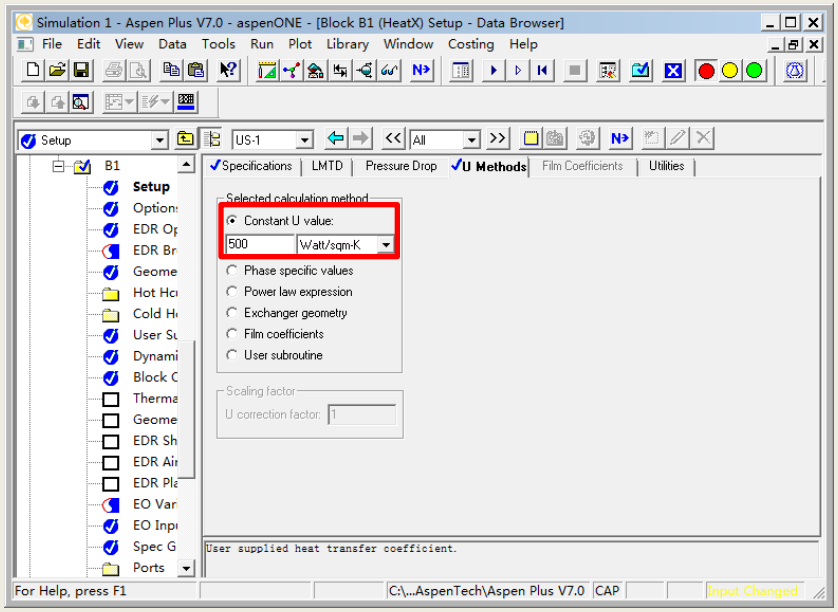
指定B1参数（1）

※ 选择简捷计算和设计选项，并在换热器规定中指定物流出口温度为50℃, 如图：

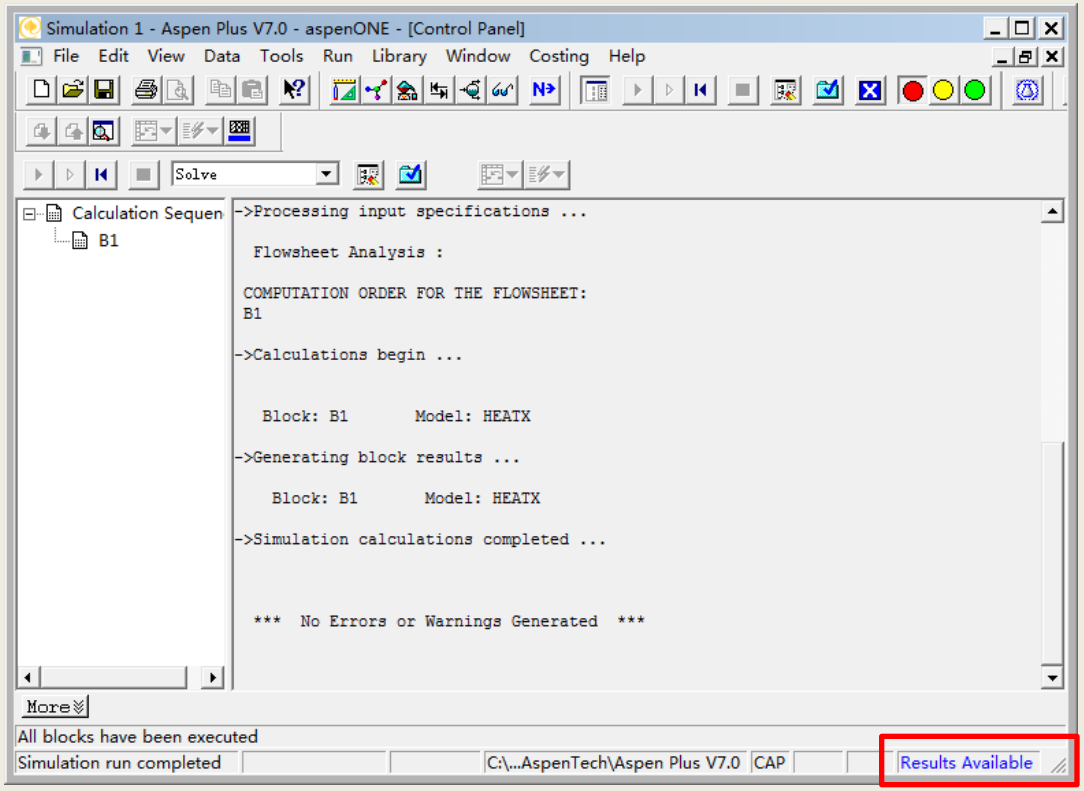


指定B1参数（2）

※ 在此标签中指定总传热系数为定值，并输入其值为500W/(M²k)，如图：

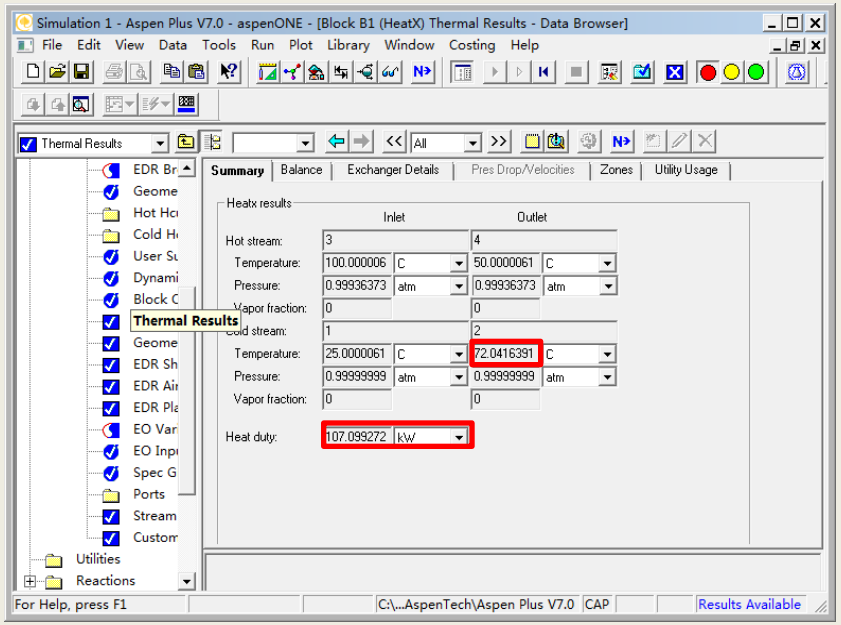


运行模拟


Simulation 1 - Aspen Plus V7.0 - aspenONE - [Control Panel]
File Edit View Data Tools Run Library Window Costing Help
Solve
Calculation Sequen
B1
->Processing input specifications ...
Flowsheet Analysis :
COMPUTATION ORDER FOR THE FLOWSHEET:
B1
->Calculations begin ...
Block: B1 Model: HEATX
->Generating block results ...
Block: B1 Model: HEATX
->Simulation calculations completed ...
*** No Errors or Warnings Generated ***
More
All blocks have been executed
Simulation run completed
C:\...AspenTech\Aspen Plus V7.0
CAP
Results Available

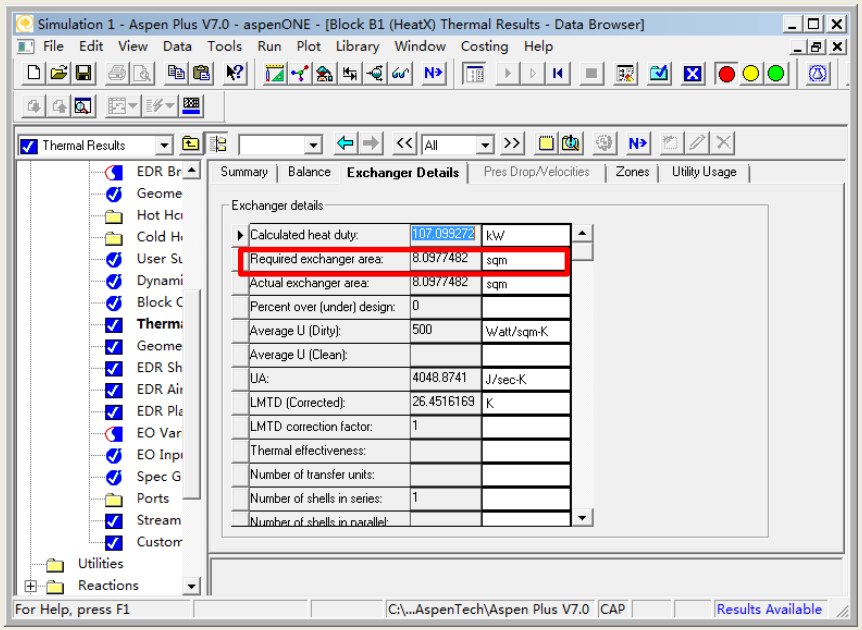
查看模拟结果（1）

※ 点击B1模块中的Thermal Results来查看热负荷，混合液的出口温度，如图：



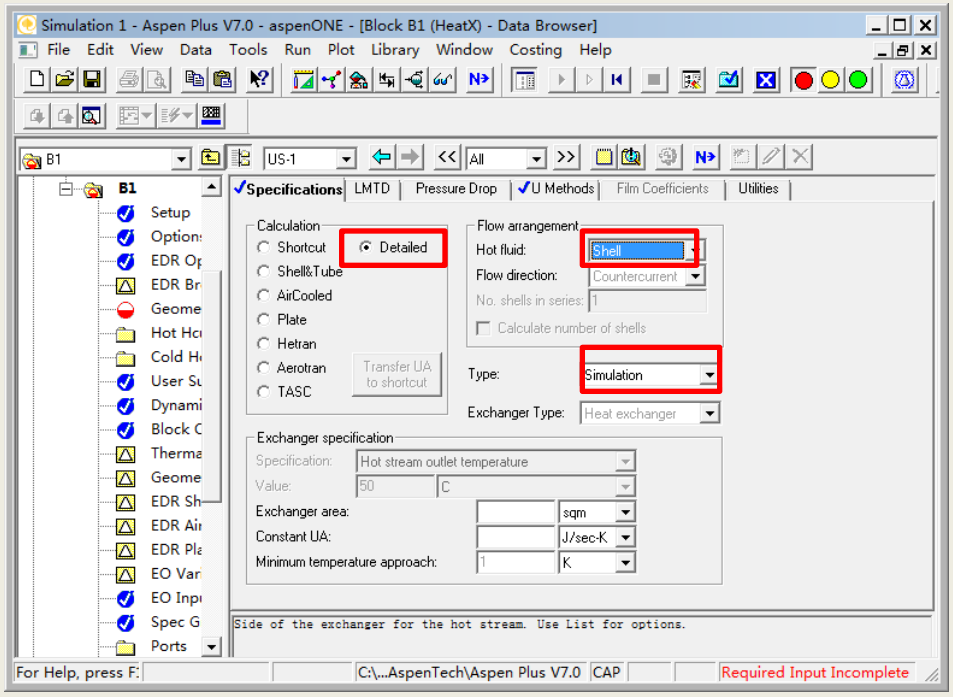
查看模拟结果（2）

※ 点击Exchanger Details看到所需的换热器面积为8.0m^2，如图：



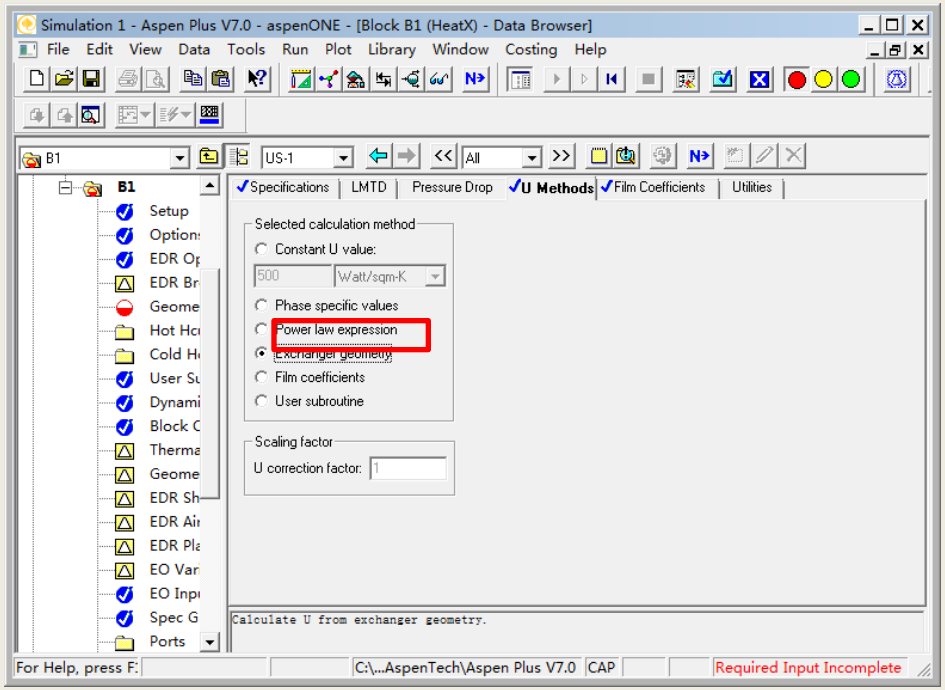
更改换热器的计算方式（1）

※ 计算方式改为严格计算，并指定热物流在壳程流动，计算选项为模拟，如图：



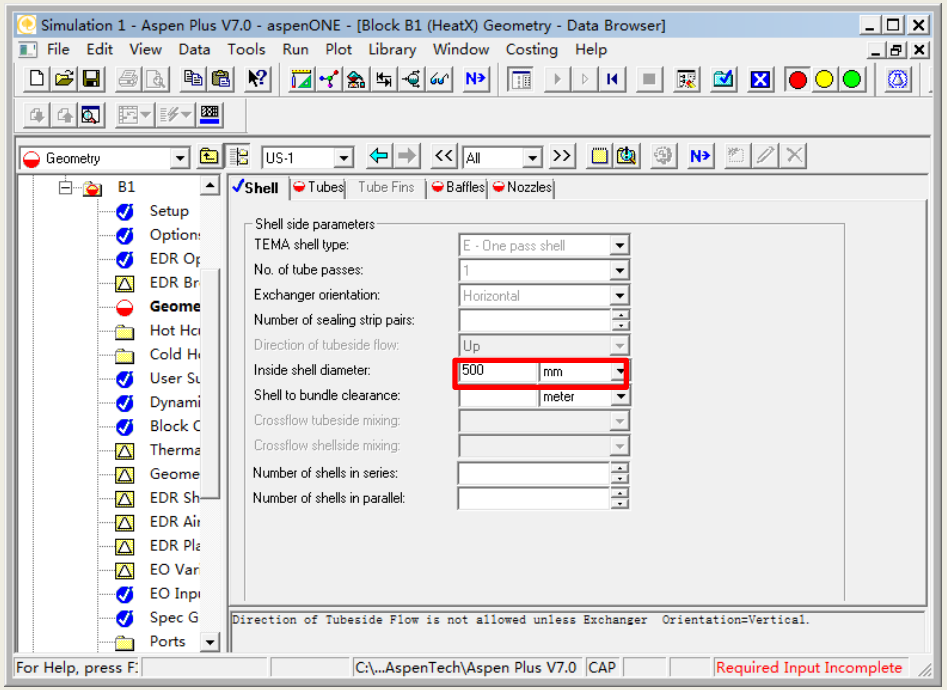
更改换热器的计算方式（2）

※ 在此标签中指定总传热系数的计算方式为通过换热器结构进行计算，如图：



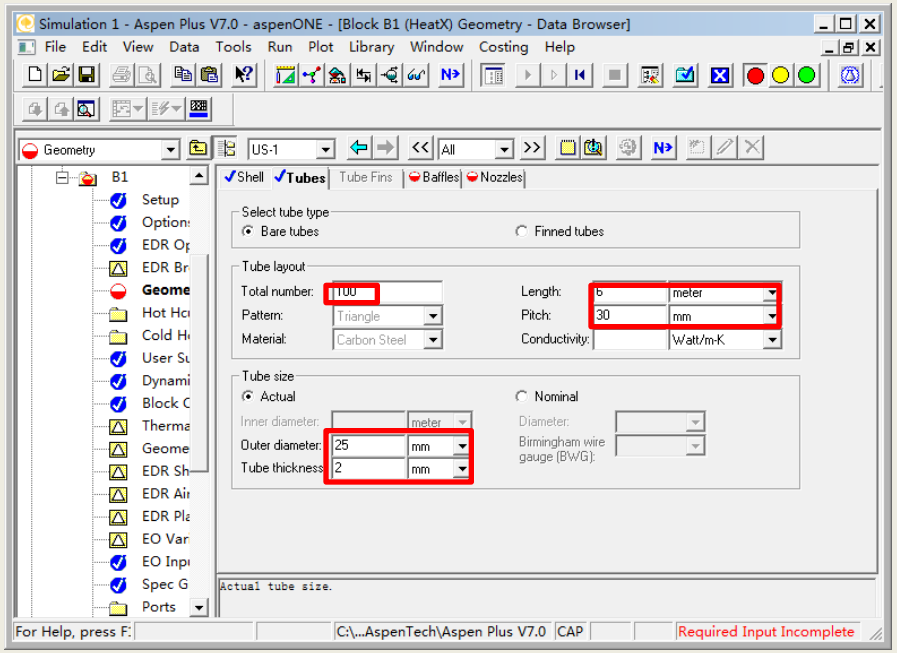
设置换热器结构尺寸（1）

※在壳程标签下，在壳内径中输入500mm，如图：



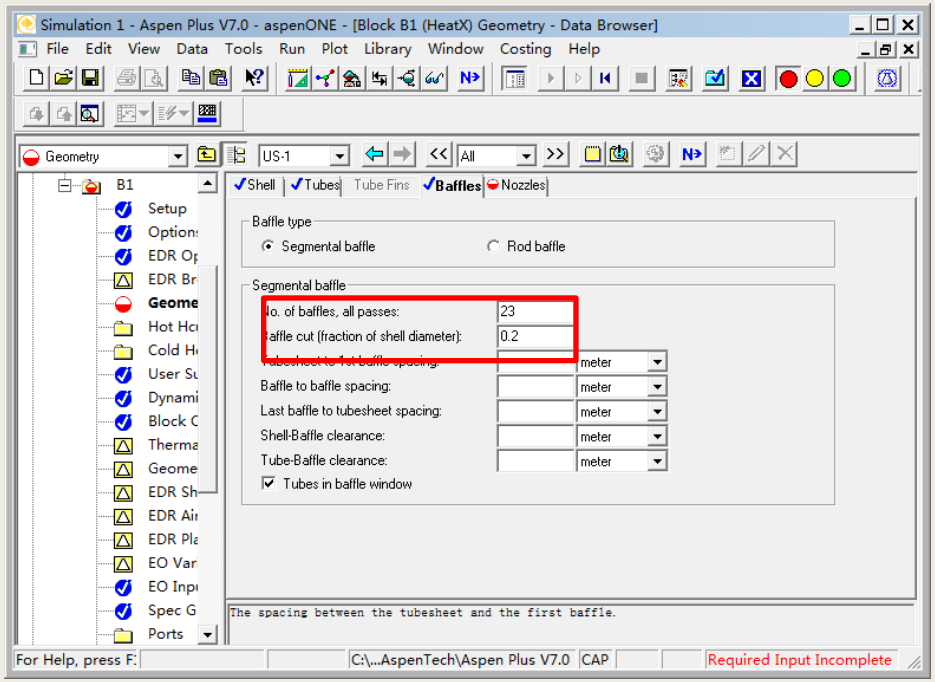
设置换热器结构尺寸（2）

※在管程标签下，输入管数100，管长6m，相邻管的中心距30mm，管外径25mm，管壁厚2mm，如图：



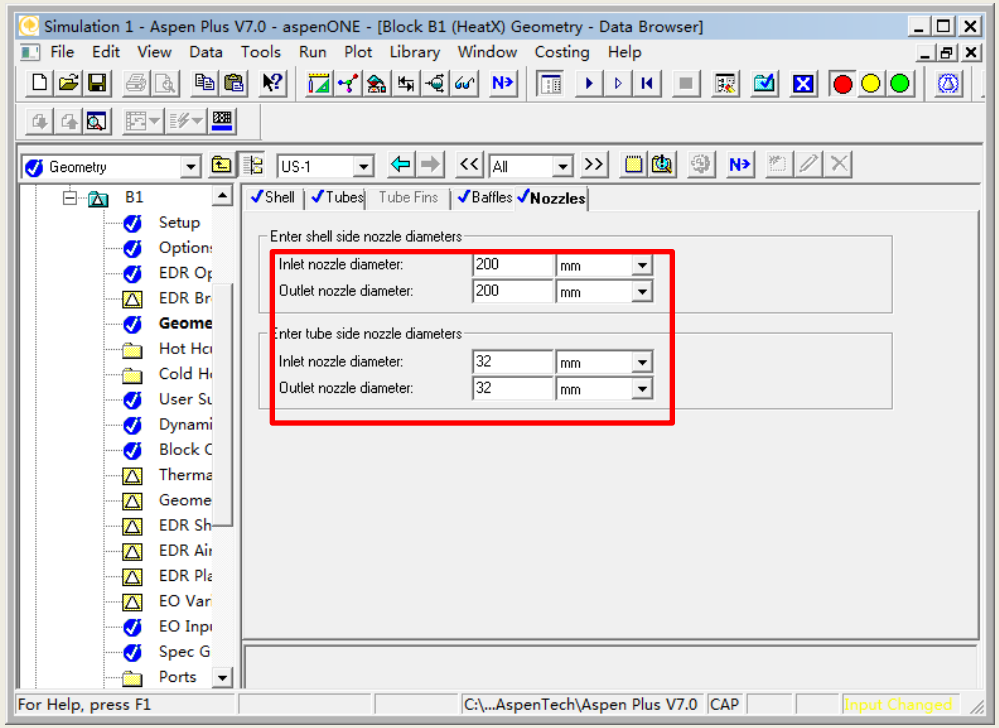
设置换热器结构尺寸（3）

※在折流板标签下，输入折流板数23，折流板切割分率0.2，如图：

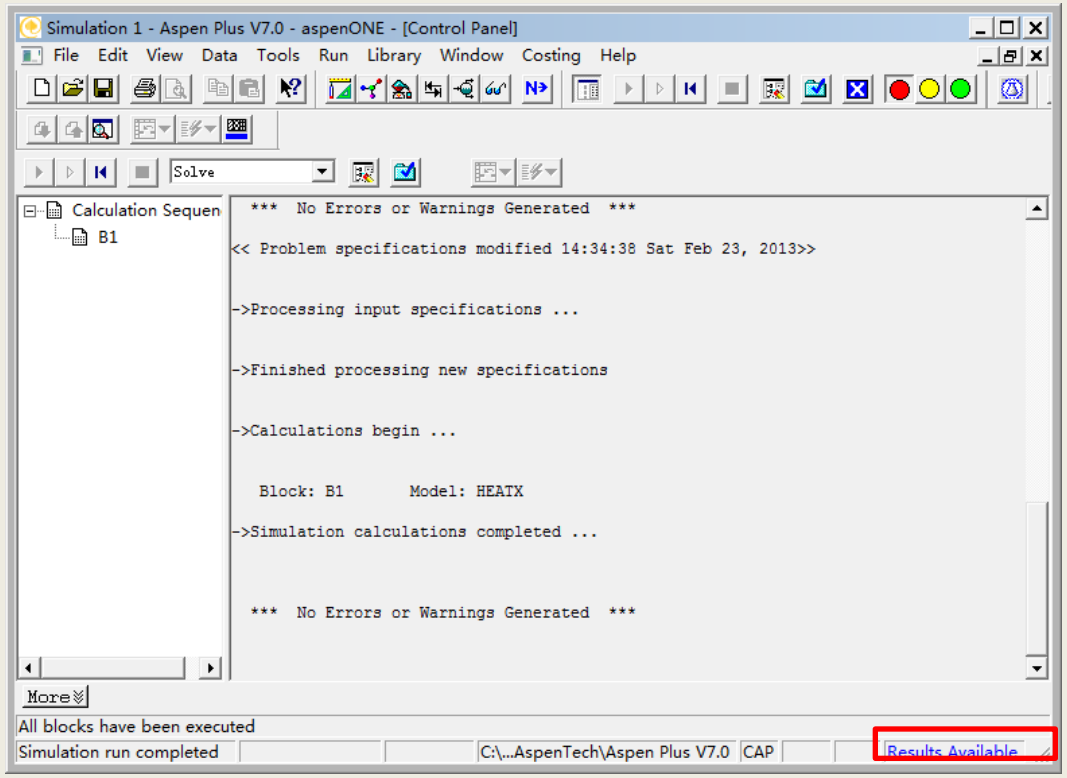


设置换热器结构尺寸（4）

※ 在管嘴标签下，输入壳程管嘴直径及管程管嘴直径，如图：

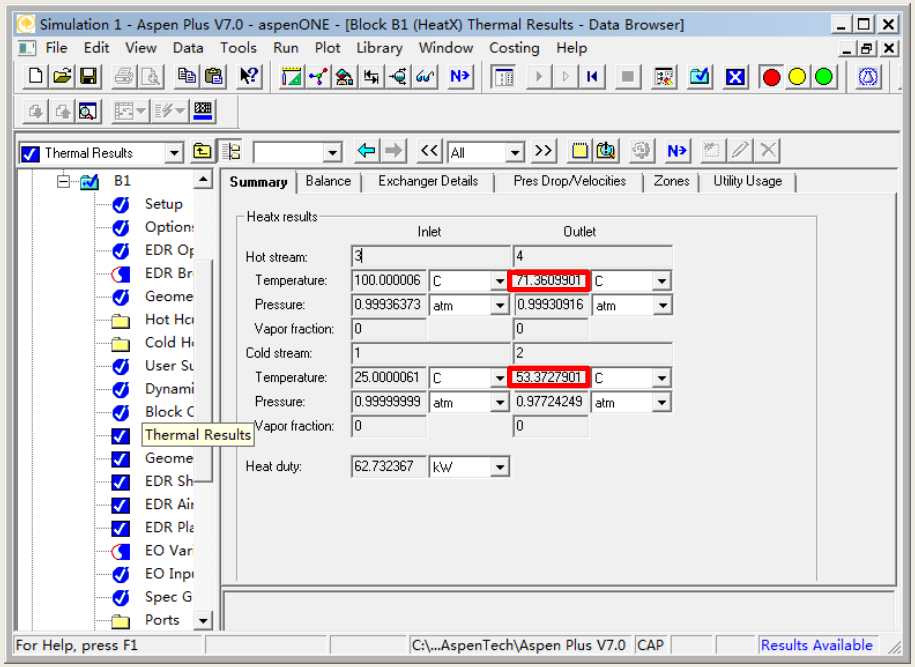


运行模拟


Simulation 1 - Aspen Plus V7.0 - aspenONE - [Control Panel]
File Edit View Data Tools Run Library Window Costing Help
Solve
Calculation Sequen
B1
*** No Errors or Warnings Generated ***
<< Problem specifications modified 14:34:38 Sat Feb 23, 2013>>
->Processing input specifications ...
->Finished processing new specifications
->Calculations begin ...
Block: B1 Model: HEATX
->Simulation calculations completed ...
*** No Errors or Warnings Generated ***
More
All blocks have been executed
Simulation run completed
C:\...AspenTech\Aspen Plus V7.0
CAP
Results Available

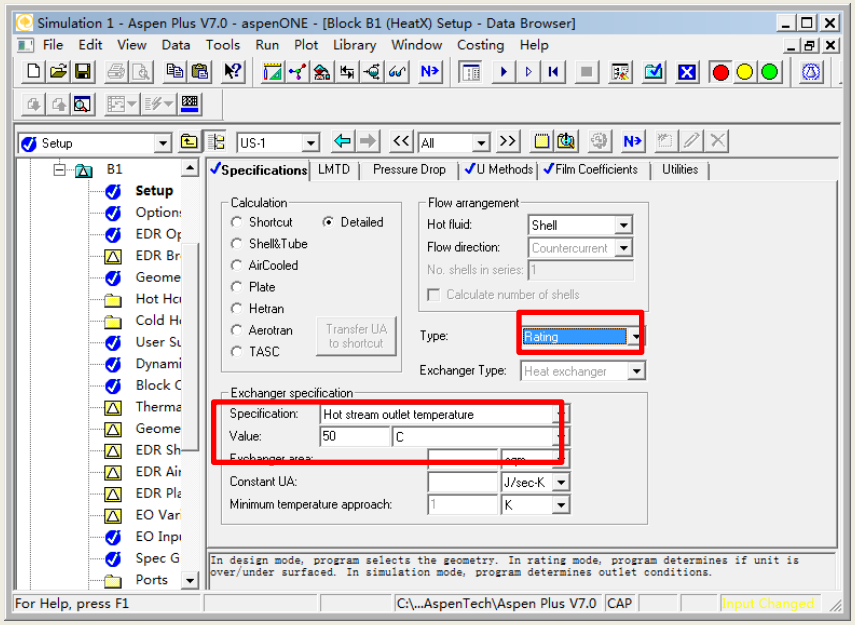
查看模拟结果

※ 热物流出口温度为71.3℃，冷物流出口温度为53.3 ℃，如图：

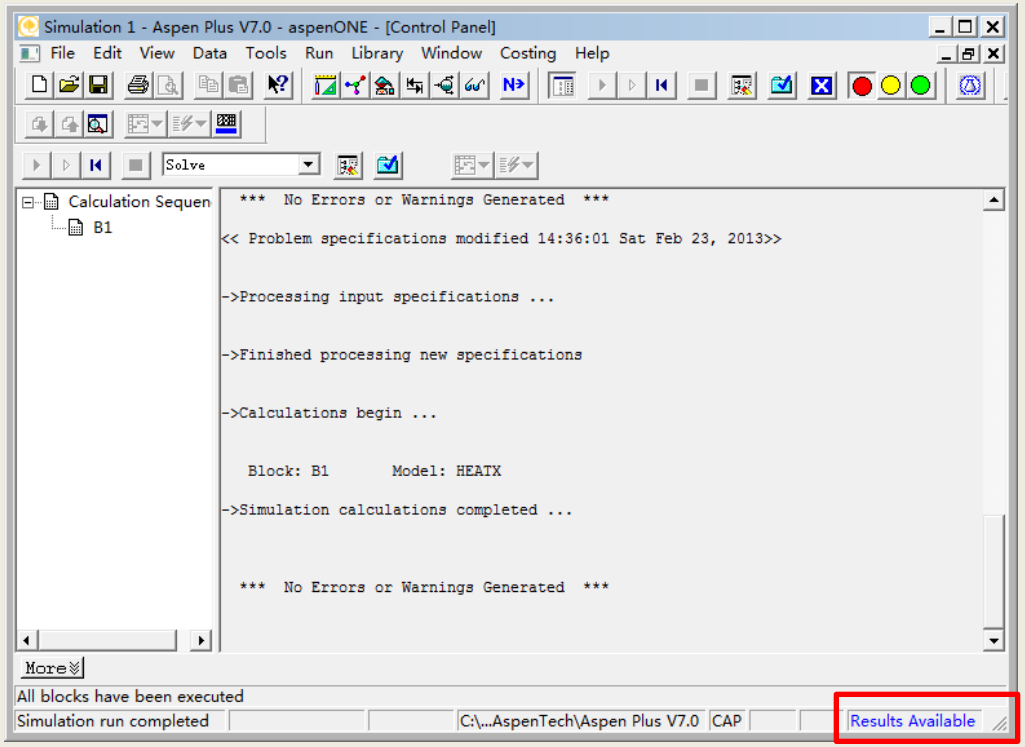


计算选项为核算Rating

※ 计算选项为核算Rating，并规定热物流的出口温度为50℃，如图：

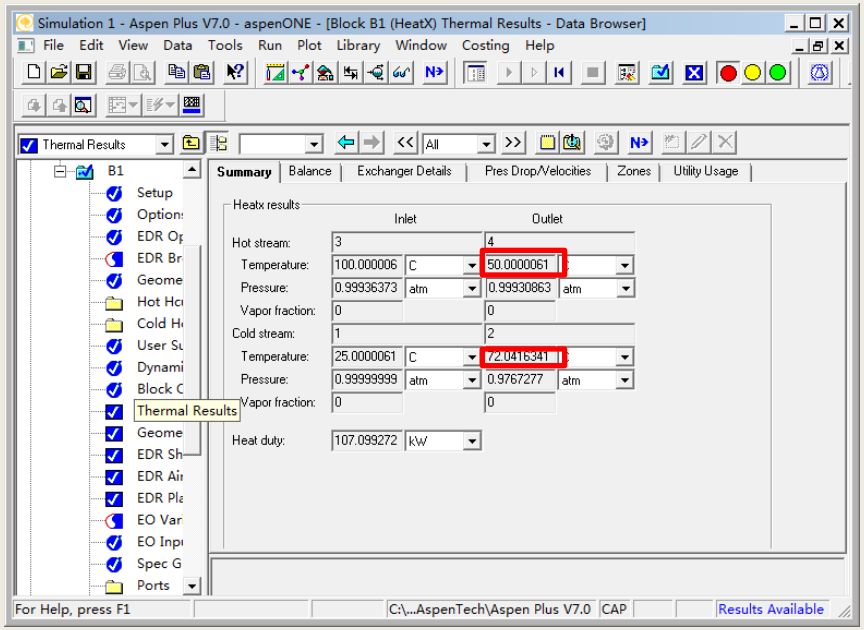


重新模拟


Simulation 1 - Aspen Plus V7.0 - aspenONE - [Control Panel]
File Edit View Data Tools Run Library Window Costing Help
Solve
Calculation Sequen
B1
*** No Errors or Warnings Generated ***
<< Problem specifications modified 14:36:01 Sat Feb 23, 2013>>
->Processing input specifications ...
->Finished processing new specifications
->Calculations begin ...
Block: B1 Model: HEATX
->Simulation calculations completed ...
*** No Errors or Warnings Generated ***
More
All blocks have been executed
Simulation run completed
C:\...AspenTech\Aspen Plus V7.0
CAP
Results Available

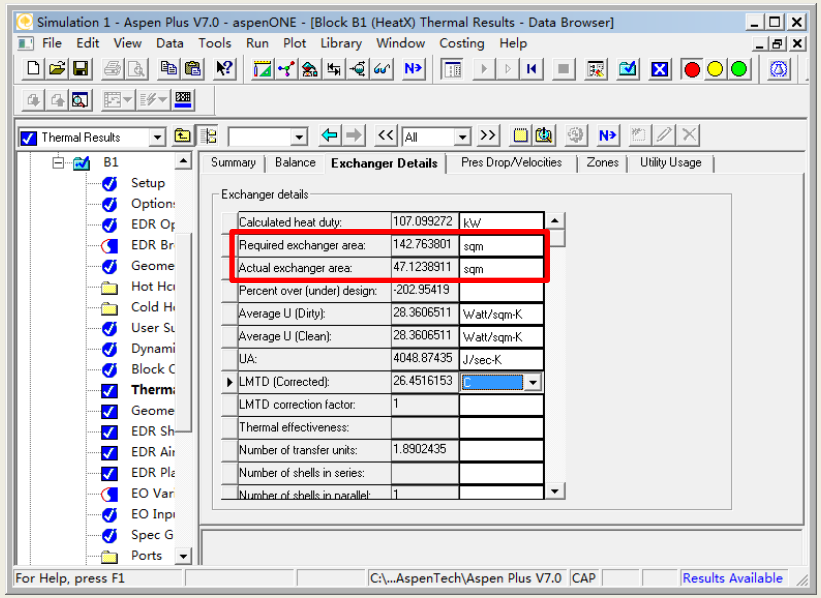
查看模拟结果（1）

※ 热物流出口温度为50℃，冷物流出口温度为72 ℃，如图：



查看模拟结果（2）

※ 换热所需面积为142m^2，大于实际面积47.1m^2，所以该换热器不能使热水出口温度为50 ℃，如图：

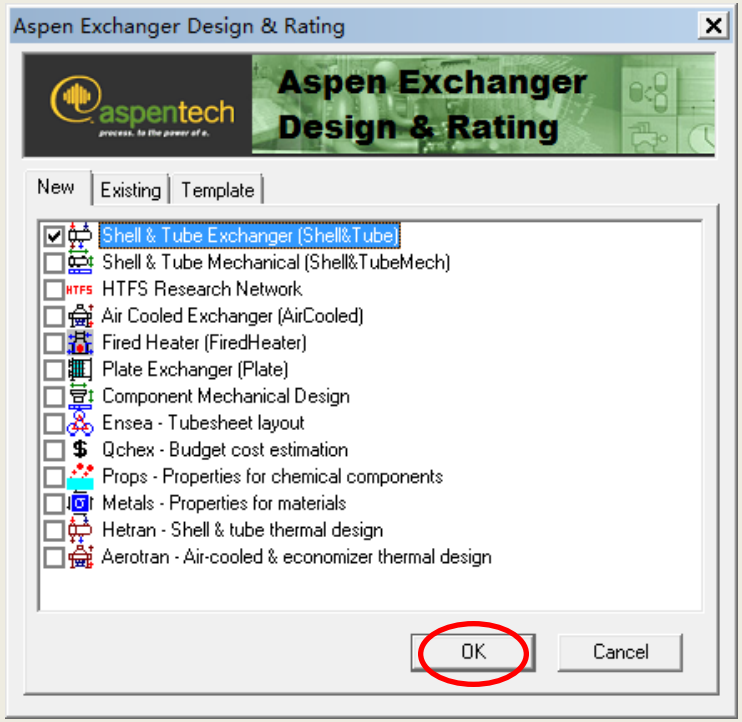


换热器结构设计

※ 管壳式换热器的设计过程是一个需要反复迭代的过程。因此传热系数和压降取决于许多几何因数，包括壳体和管子的直径、管子的长度、管子的排列方式、挡板形式和板间距、管程数及壳程数等，所有这些最初都是未知的，所以整个的设计过程将是一个试差过程。

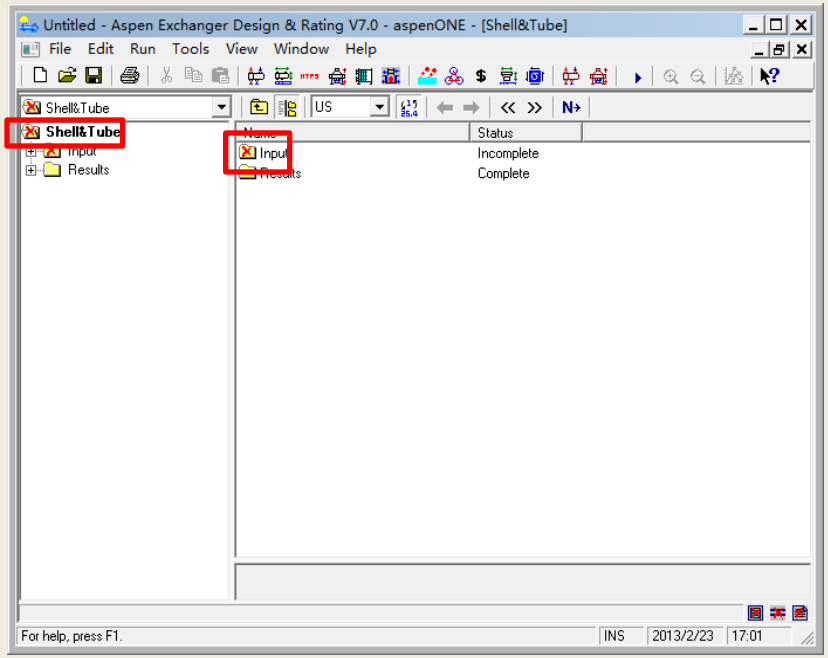
设计换热器结构（1）

※ 运行Aspen Exchanger Design &Rating软件，新建一个管壳式换热器设计案例，如图：



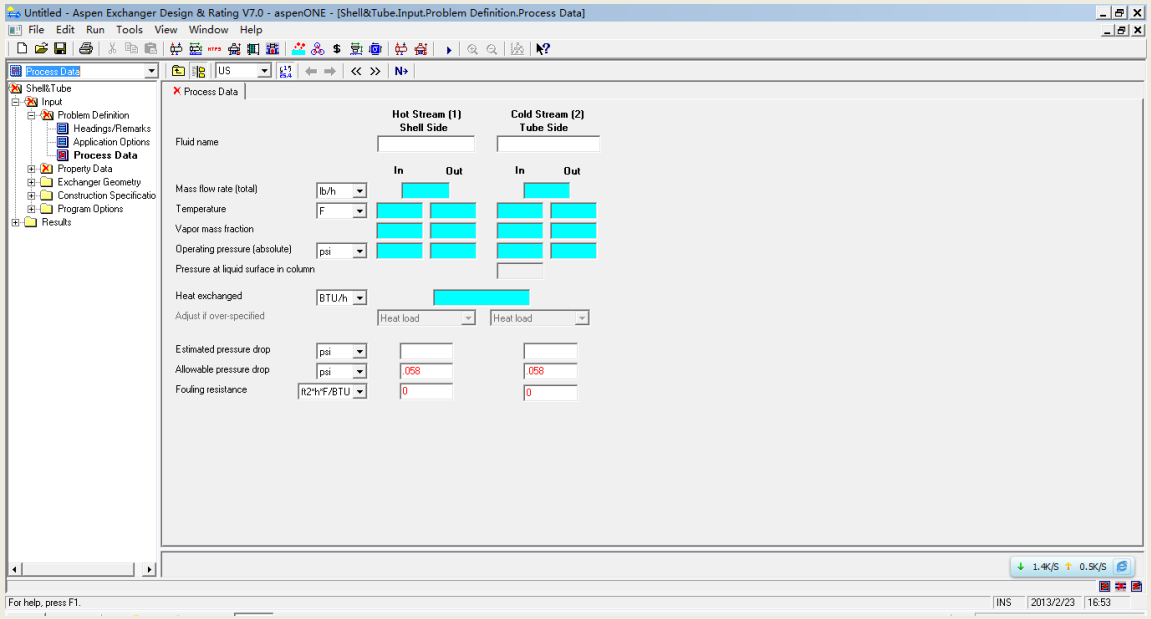
设计换热器结构（2）

※ 点击上图的**Ok**，出现下图窗口并点击**Shell&Tube**，如图：



设计换热器结构（3）

※ 点击上图的Input/Problem Definition/Process Data出现下图窗口，如图：

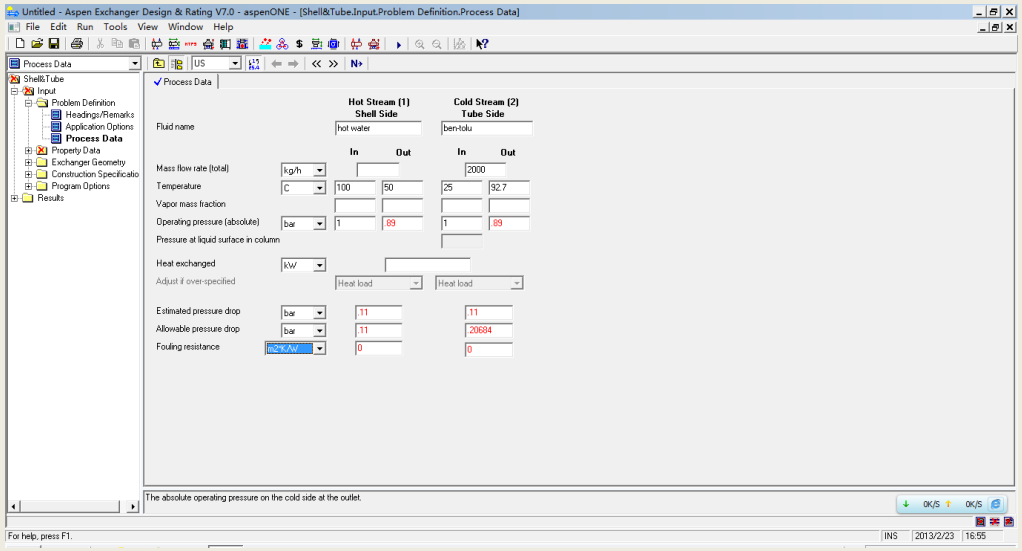


设计换热器结构（4）

※对话框中的数据未输入时，底色为蓝色；输入数据后，底色变为白色。红色字体数据代表系统默认值或自动计算出来的值。

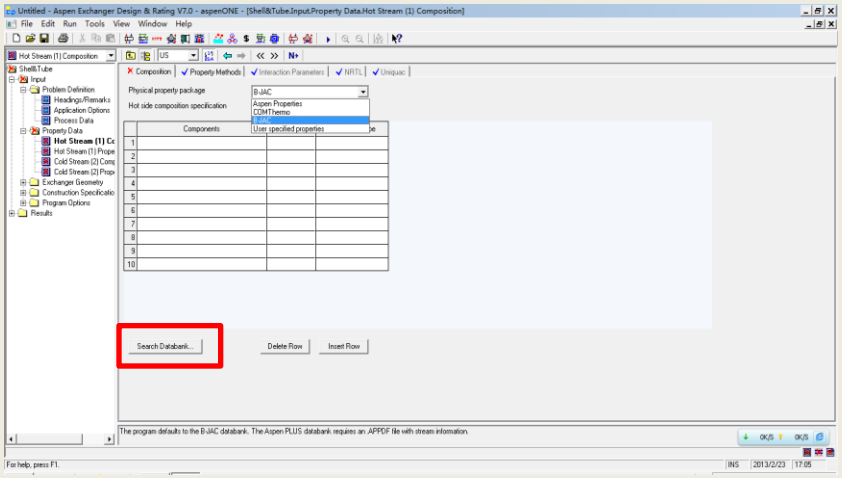
设计换热器结构（5）

※ 输入热物流的名称为hot water，进口温度、出口温度、操作压力；输入冷物流的名称为ben-tolu及质量流量、进口温度、出口温度、操作压力，如图：



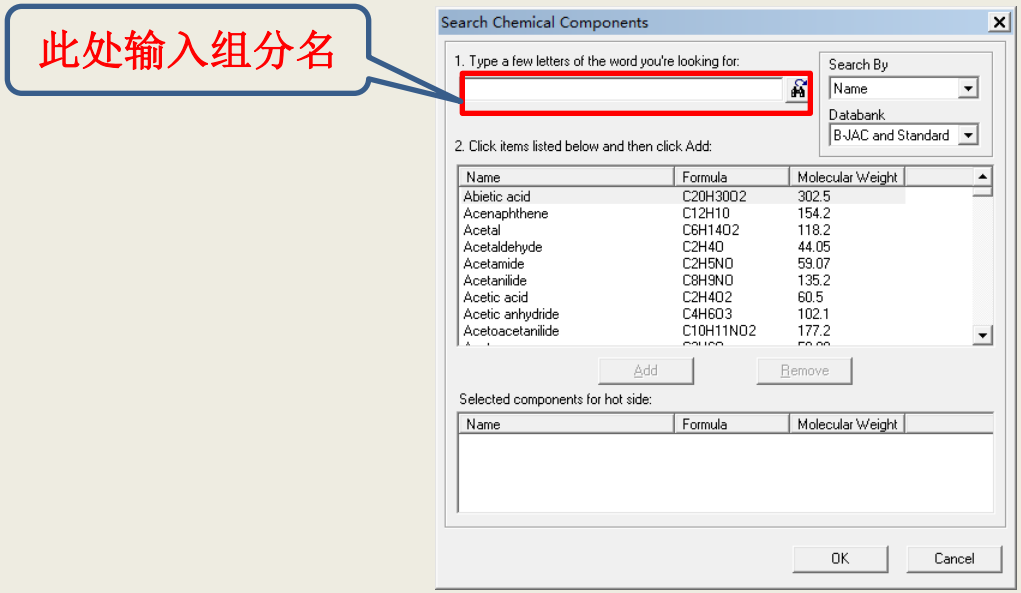
设计换热器结构（6）

※ 点击**Shell&Tube/Input/property Data/Hot Stream Compositions**，出现下图对话框如图：



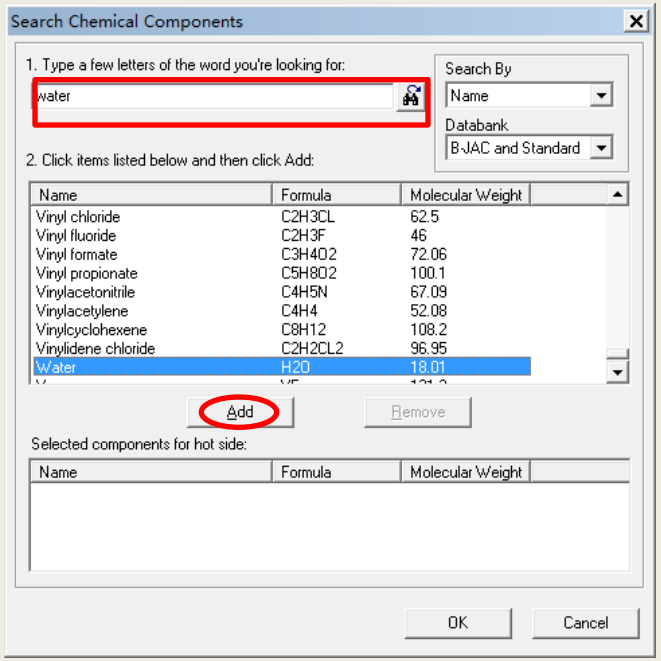
设计换热器结构（7）

※ 点击上图的Search Databank按钮，弹出下图对话框，在此对话框中查找所需组分，如图：



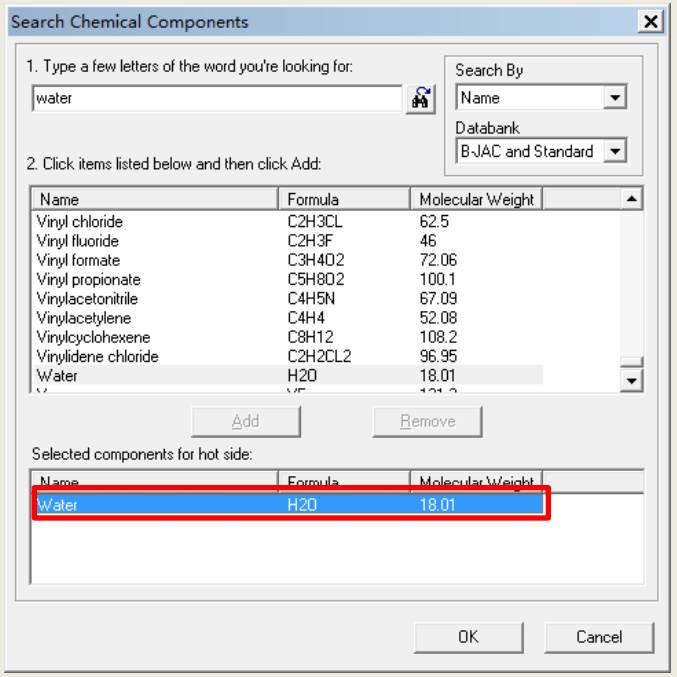
设计换热器结构（8）

※指定物质水，如图：



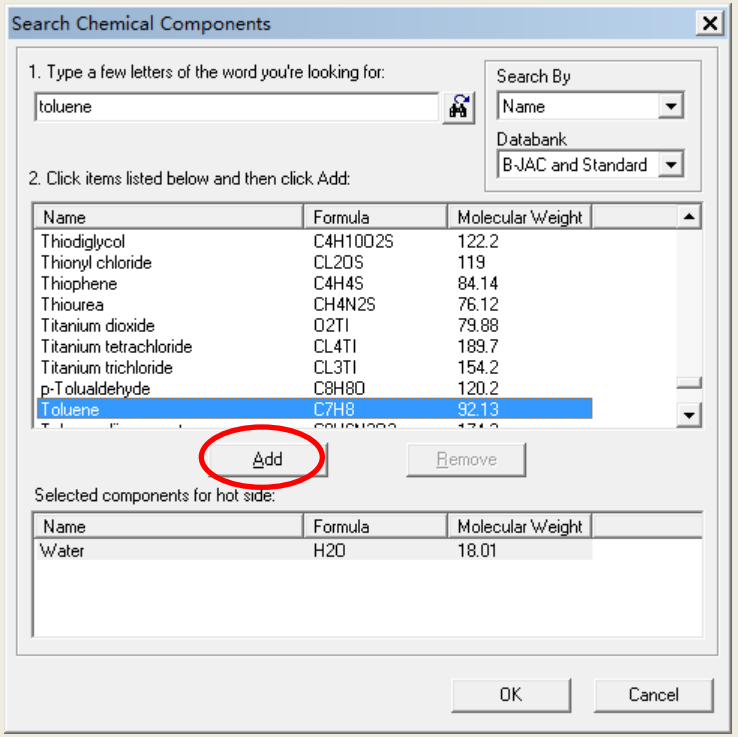
设计换热器结构（9）

※ 点击上图的**Add**，指定给组分已被添加，如图：



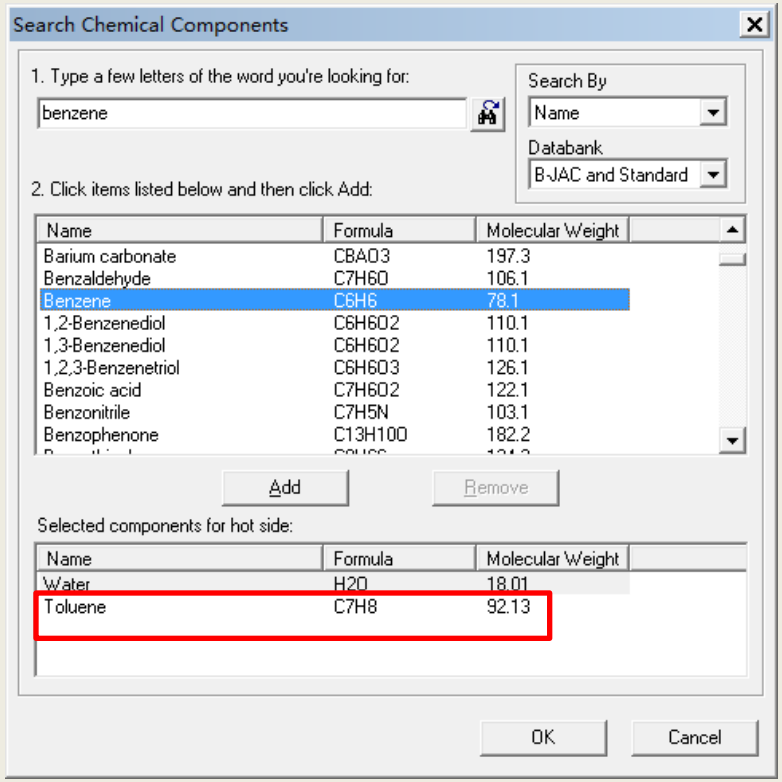
设计换热器结构（10）

※同理指定物质甲苯，如图：



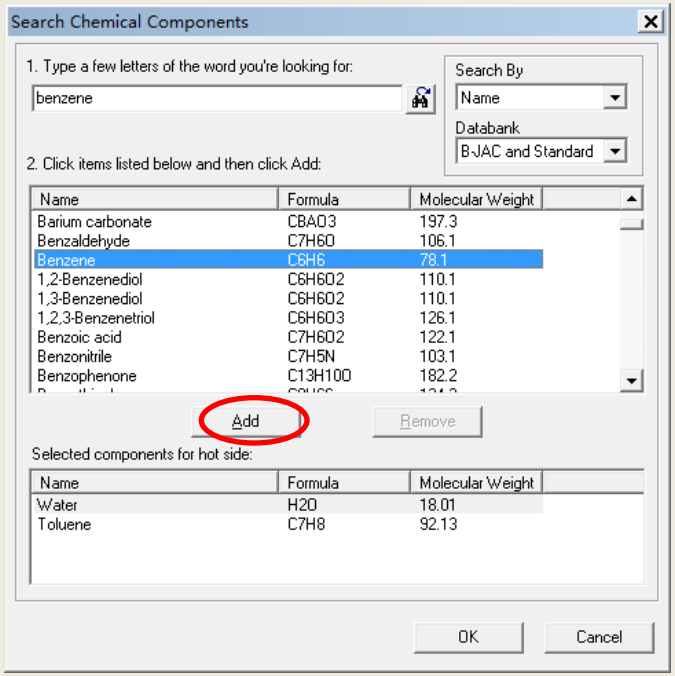
设计换热器结构（11）

※ 点击上图的**Add**，指定给组分已被添加，如图：



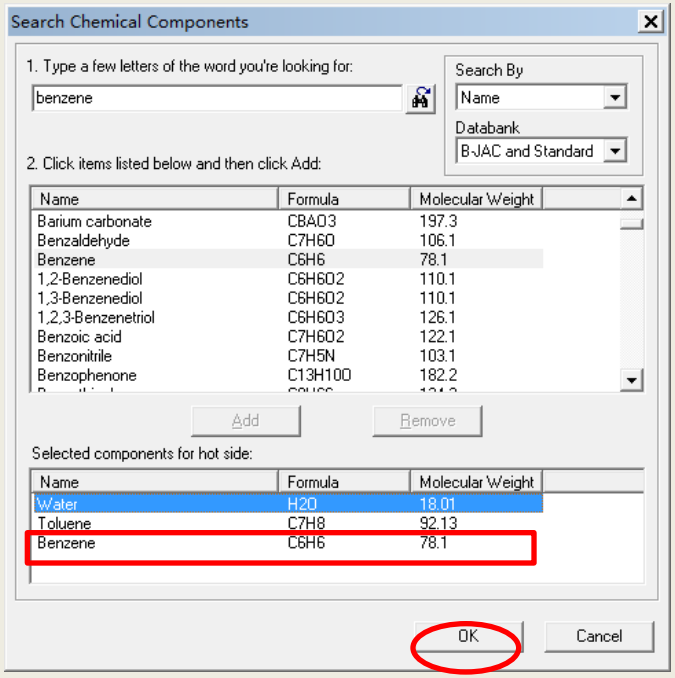
设计换热器结构（12）

※同理指定物质苯，如图：



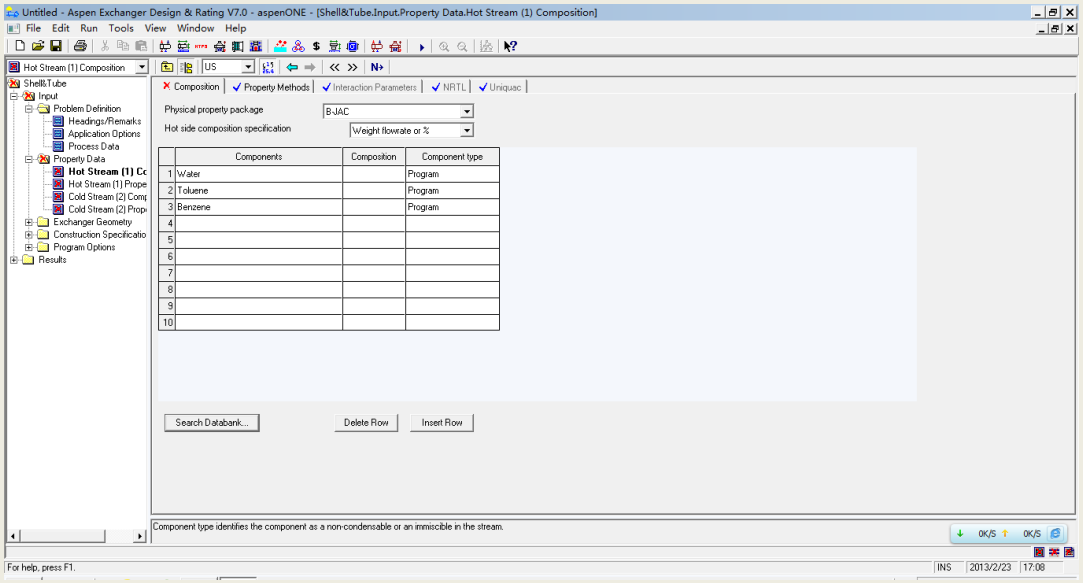
设计换热器结构（13）

※ 点击上图的**Add**，指定给组分已被添加，如图：



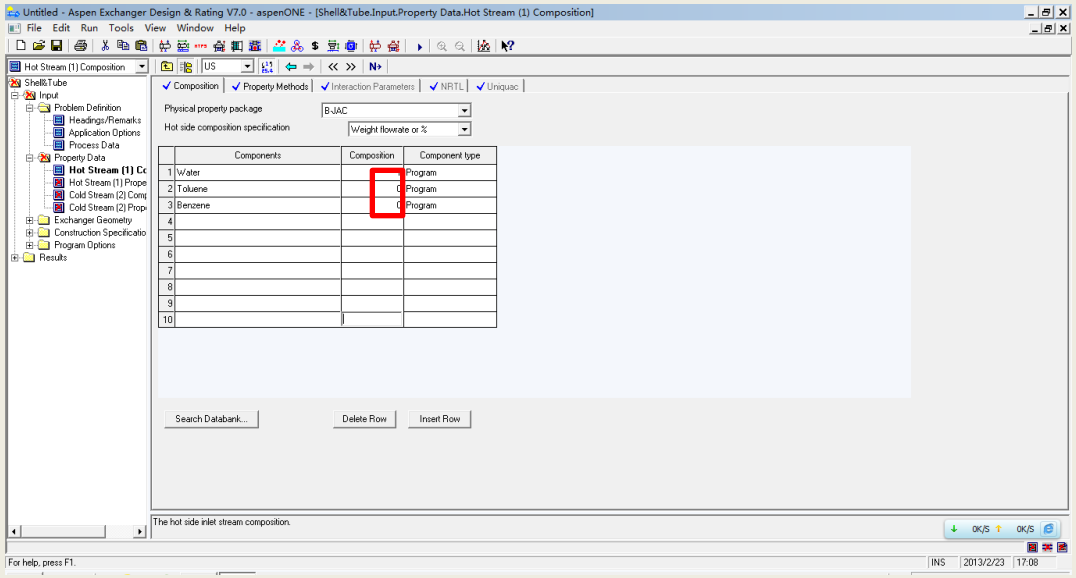
设计换热器结构（14）

※ 点击上图的**OK**，出现下图窗口，如图：



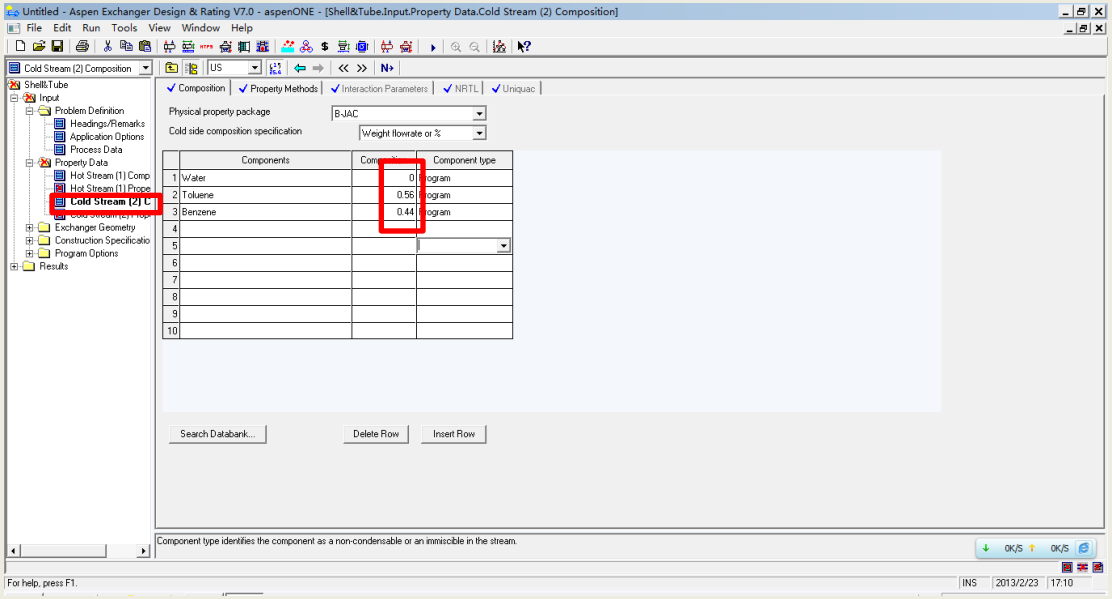
设计换热器结构（15）

※输入热物流各组分的质量浓度，如图：



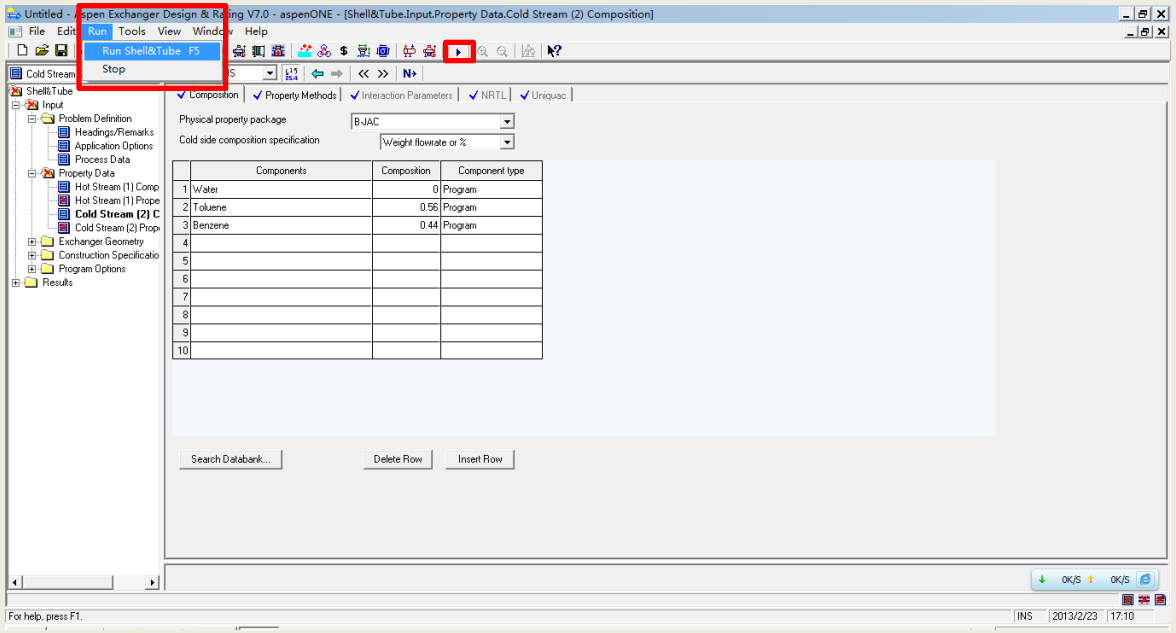
设计换热器结构（16）

※ 同理输入冷物流各组分的质量浓度，如图：

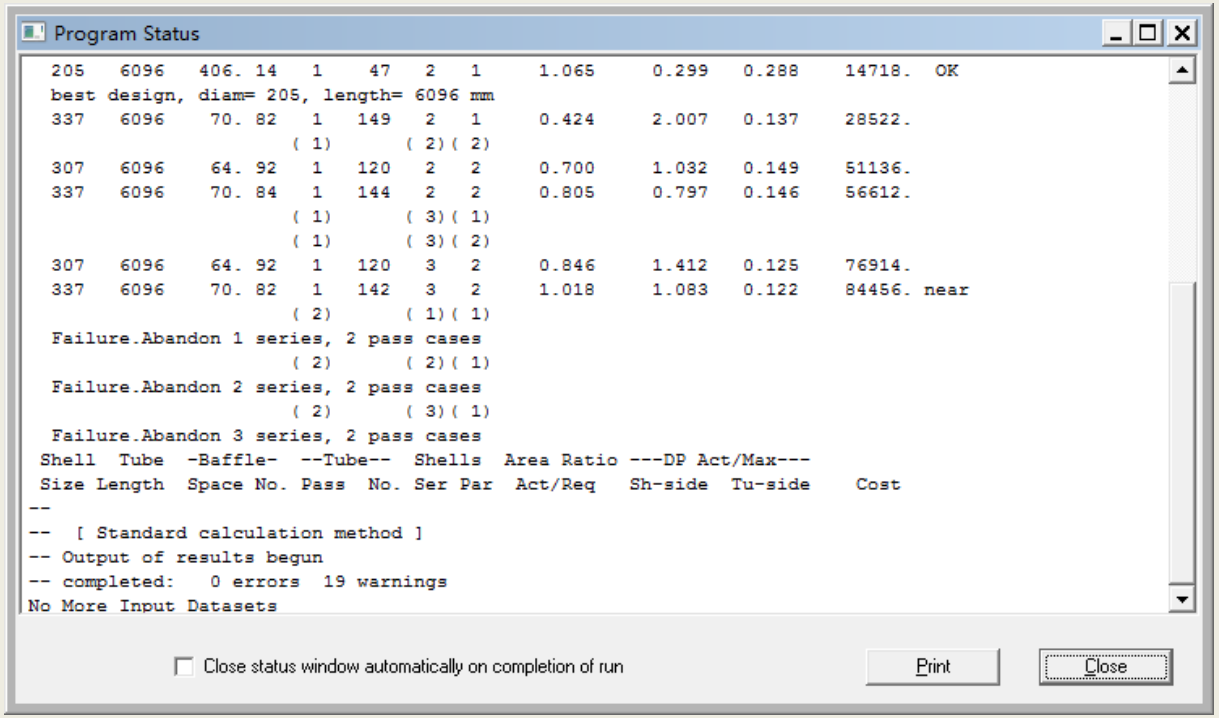


运行模拟（1）

※点击图中按钮，运行模拟运算，如图：

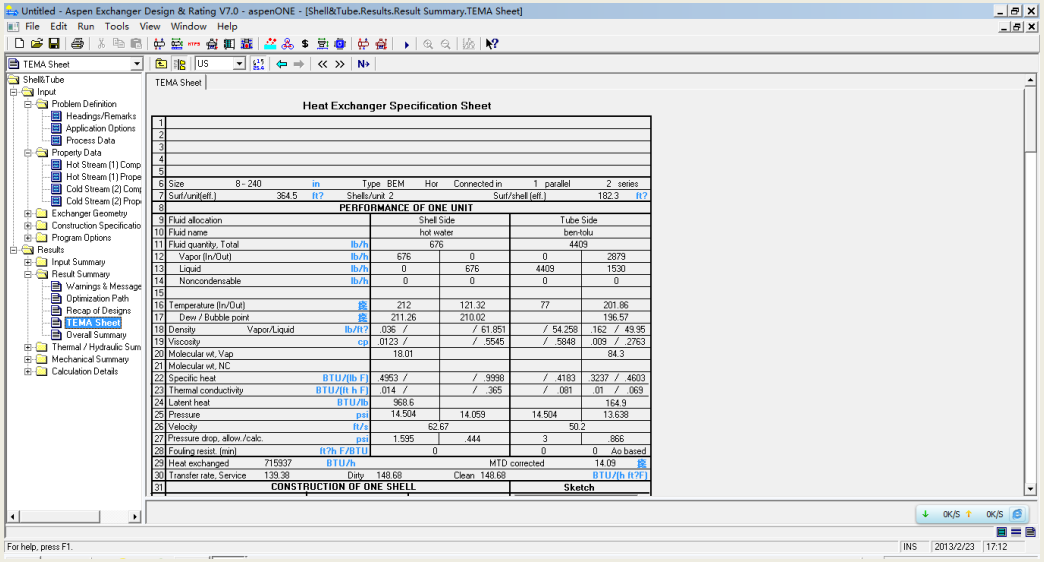


运行模拟（2）


Program Status
205 6096 406. 14 1 47 2 1 1.065 0.299 0.288 14718. OK
best design, diam= 205, length= 6096 mm
337 6096 70. 82 1 149 2 1 0.424 2.007 0.137 28522.
(1) (2)(2)
307 6096 64. 92 1 120 2 2 0.700 1.032 0.149 51136.
337 6096 70. 84 1 144 2 2 0.805 0.797 0.146 56612.
(1) (3)(1)
(1) (3)(2)
307 6096 64. 92 1 120 3 2 0.846 1.412 0.125 76914.
337 6096 70. 82 1 142 3 2 1.018 1.083 0.122 84456. near
(2) (1)(1)
Failure.Abandon 1 series, 2 pass cases
(2) (2)(1)
Failure.Abandon 2 series, 2 pass cases
(2) (3)(1)
Failure.Abandon 3 series, 2 pass cases
Shell Tube -Baffle- --Tube-- Shells Area Ratio ---DP Act/Max---
Size Length Space No. Pass No. Ser Par Act/Req Sh-side Tu-side Cost
--
-- [Standard calculation method]
-- Output of results begun
-- completed: 0 errors 19 warnings
No More Input Datasets
Close status window automatically on completion of run
Print
Close

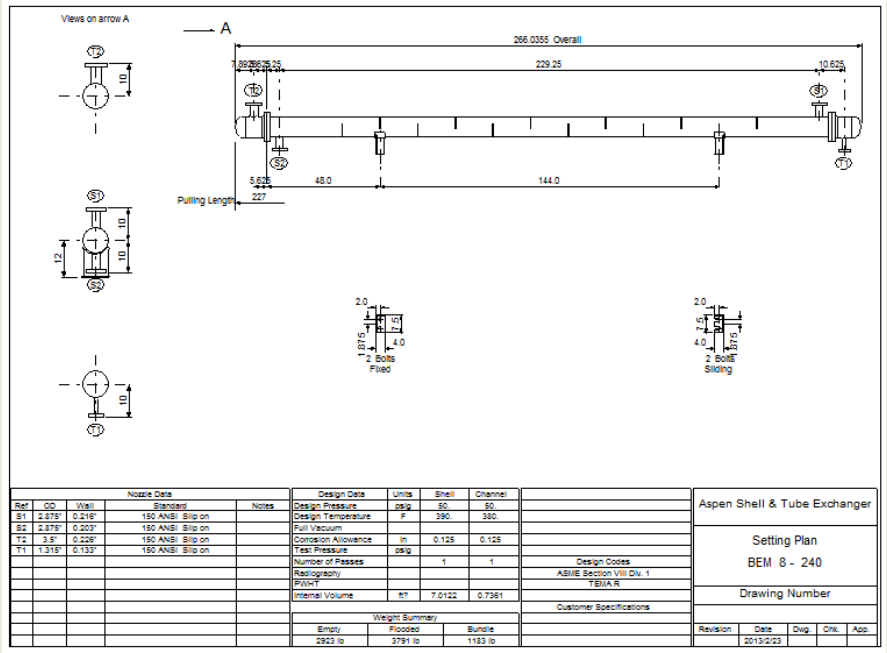
查看结果（1）

※ 点击**Shell&Tube/Results/Result Summary/TEMA Sheet**，查看所得换热器的设计说明书，如图：



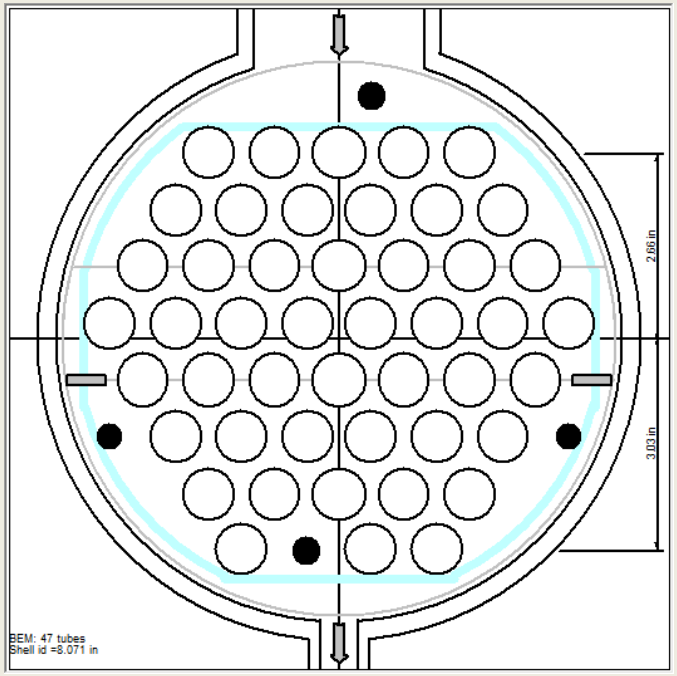
查看结果（2）

※ 点击Shell&Tube/Results/Mechanical Summary/Sheeting Plan&Tubesheet Layout，查看所得换热器的平面布置图，如图：



查看结果（3）

※ 点击Tubesheet Layout 标签下可以查看所得换热器的管子排列图，如图：



结束

下节内容：Aspen中的物质分离模型