Conceptual Engineering Product™ 2004

Azeotropic Separation Guide

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1 Azeotropic Separation Manager

1.1 Introduction

The Azeotropic Separation Manager view is used to access, create, or delete the following operations:

- Azeotrope Analysis
- Residue Curves Maps
- Distillation Region Diagrams
- Column Designs
- Azeotropic Column Sequencing
- Split Generator

These are conceptual design tools that aid in understanding multi-component vapour liquid equilibria, as well as the design of mass transfer unit operations, such as distillation columns.

1.1.1 Azeotrope Analysis

The Azeotrope Analysis operation allows you to observe the influence of pressure on azeotrope composition and boiling temperatures.

General Procedure

To create an Azeotrope Analysis:

1. Create a fluid package containing the necessary components and property package.
2. Open the Azeotrope Analysis view.
3. On the **Setup** tab, specify the fluid package, components, and pressure(s) for the analysis.
4. Click the **Calculate** button to begin calculations.
5. Click the other tabs in the view to examine the results of the calculations.

1.1.2 Residue Curve Map (RCM)

The Residue Curve Map (RCM) operation gives you a broad view of the component space and provides insight into the nature of the mixture you are working with.

General Procedure

To create a Residue Curve Map:

1. Create a fluid package containing the necessary components and property package.
2. Open the Residue Curve Map view.
3. On the **Setup** tab, specify the fluid package, components, and pressure for the RCM plot. You can also indicate whether or not you want the azeotrope points calculated.
4. On the **Plots** tab, create an RCM plot.
5. Add the residue curve on the RCM plot by clicking in the plot area or by entering the composition of the components in the **Residue Curves** tab.

1.1.3 Distillation Region Diagram

The Distillation Region Diagram (DRD) operation allows you to construct distillation region diagrams without the use of pure component or thermodynamic data.

General Procedure

To create a Distillation Region Diagram:

1. Create a fluid package containing the necessary components and property package.
2. Open the DRD view.
3. On the DRD view, specify the boiling point temperature of the pure components, boiling point temperature of the azeotropes, and composition of the azeotropes at the boiling point.

4. DISTIL automatically constructs the DRD based on the specifications you provide.

1.1.4 Column Designs

Only two or three components can be active at any time. If you have more than three components, you will have to deselect the remaining components.

The Column Design operation is used to design distillation towers with either two or three components.

General Procedure

To design a distillation package using this operation:

1. Create a fluid package containing the necessary components and property package.
2. Open the Column Design view.
3. In the **Setup** tab, specify the fluid package, components, and pressure for the feed stream(s) entering the column.
4. In the **Configuration** tab, manipulate the column configuration. At this point, you can access the following:
   - Component Space or McCabe-Thiele plot.
   - Residue Curve Map Data view: this displays all the azeotrope points generated and creates residue curves based on your assumed feed.
     The plots and known azeotrope points can help you decide what type of column configuration would be best.
5. In the **Spec Entry** tab, enter the composition values for the streams entering and exiting the column, and a value for the reflux or reboil ratio.
6. Click the **Calculate** button.
7. Click the **Summary** and **Plots** tabs to observe the final calculated results of the column design.

Create Component Space Plot icon

Open Residue Curve Map icon

1.1.5 Azeotropic Column Sequencing

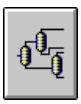
The Column Sequencing operation is used to identify feasible distillation sequences, which separate a specified feed stream into several selected products. The number of stages, the feed tray location and the reflux ratio for each of the feasible distillation column is also determined.

General Procedure

To use the column sequencing operation:

The Scenario and Design views display different information in both the Main (upper) pane and the Worksheet (lower) pane.

1. Create a fluid package containing the necessary components and property package.
2. Open the Azeotropic Column Sequence view.
3. In the Viewer group, select a Scenario name to enter the scenario level.
4. In the scenario level, you can specify the following information: fluid package, components, composition, pressure, calculation methods, and design assumptions/settings.



Generate Feasible Column Sequences icon

5. When you have entered all the values, click the **Generate Feasible Column Sequences** icon to begin calculations and generate feasible designs.
6. When the calculation is complete, the Viewer group will contain a list of feasible designs generated by DISTIL.
7. Select the design listed in the Viewer group to move to design level. The design level allows you to examine the selected design in more detail.

1.1.6 Split Generator

The Split Generator operation is used to determine a feasible separation split of a multi-component mixture using a simple distillation column with one feed and two products, a condenser, and a reboiler.

General Procedure

To determine a feasible separation split using the Split Generator operation:

1. Create a fluid package containing the necessary components and property package.
2. Open the Split Generator view.
3. In the **Setup** tab, specify the fluid package, components, pressure, feasible column calculation method, and column type.
4. In the **Products** tab, specify the feed stream composition.
5. Click the **Calculate** button to begin feasible column calculations. The results appear in the **Products** tab.

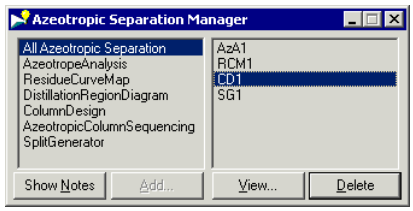
1.2 Azeotropic Separation Manager View

Azeotropic Separation Technology Manager icon

To access the Azeotropic Separation Manager view:

- Click on the **Azeotropic Separation Technology Manager** icon in the toolbar.
- From the **Managers** menu, select **Azeotropic Separation Manager**.

Figure 1.1



The Azeotropic Separation Manager view contains four buttons:

Button	Description
Show/Hide Notes	Allows you to access the notes associated with the operations.
Add	Allows you to add operations to the case.
View	Allows you to access existing operations in the case.
Delete	Allows you to delete existing operations in the case.

1.2.1 Adding an Operation

Azeotropic Separation Technology Manager icon

To add an operation:

1. Click the **Azeotropic Separation Technology Manager** icon. The Azeotropic Separation Manager view appears.
2. In the list on the left, select the type of operation you want to add.
3. Click the **Add** button. The selected operation property view appears.

1.2.2 Editing an Operation

Azeotropic Separation Technology Manager icon

To edit an existing operation:

1. Click the **Azeotropic Separation Technology Manager** icon. The Azeotropic Separation Manager view appears.
2. In the list on the left, select the type of operation you want to edit. To see all existing operations available, select **All Azeotropic Separation** from the list.
3. From the list on the right, select the specific instance of the operation you want to edit.
4. Click the **View** button, and the selected operation property view appears.

1.2.3 Deleting an Operation

Azeotropic Separation Technology Manager icon

To delete an existing operation:

1. Click the **Azeotropic Separation Technology Manager** icon. The Azeotropic Separation Manager view appears.
2. In the list on the left, select the type of operation you want to delete. To see all existing operations available, select **All Azeotropic Separation** from the left list.
3. From the list on the right, select the specific instance of the operation you want to delete.
4. Click the **Delete** button.
5. DISTIL will prompt you to confirm that you want to delete the selected operation.
   Click the **Yes** button to delete the selected operation, or click the **No** button to keep the selected operation.

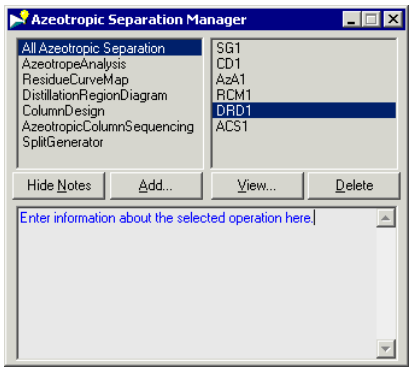
1.2.4 Editing Operation Notes

Azeotropic Separation Technology Manager icon

To edit the notes associated with the operation:

1. Click the **Azeotropic Separation Technology Manager** icon. The Azeotropic Separation Manager view appears.
2. In the list on the left, select the type of operation you want. To see all existing operations available, select **All Azeotropic Separation** from the left list.
3. From the list on the right, select the specific instance of the operation you want to edit.
4. Click the **Show Notes** button. A text editor appears at the bottom of the Azeotropic Separation Manager view.

Figure 1.2



5. Edit the notes associated with the selected operation in the text editor.
   If there have been no previous notes entered for the selected operation, the text editor will appear blank.

The notes text editor in this view is connected to the Notes tab of the selected operation. Any changes made to the information in this text editor of an operation will also appear in the Notes tab of the operation.

6. Once you have completed editing the notes, you can hide the text editor by clicking the **Hide Notes** button.

2 Azeotrope Analysis

2.1 Introduction

The Azeotrope Analysis operation allows you to observe the influence of pressure on azeotrope composition and boiling temperatures.

For more information about azeotropes refer to **Section 2.2 - Azeotropes** of the **Reference Guide**.

DISTIL calculates all of the azeotropes present in a multi-component mixture at fixed pressure using a homotopy continuation technique based on the work of Fidkowski et. al. (1993)[44].

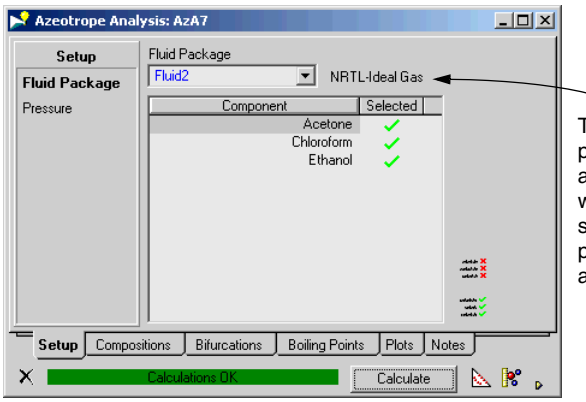
2.2 Azeotrope Analysis View

To access previously created Azeotrope Analysis operations, refer to **Section 1.2.2 - Editing an Operation**.

To create an Azeotrope Analysis operation, do one of the following:

- From the **Features** menu, select **Azeotrope Analysis**.
- From the **Managers** menu, select **Azeotropic Separation Manager**. The manager view appears. From the left list, select **AzeotropeAnalysis**, then click the **Add** button.

Figure 2.1



The tabs that appear depend on the number of components and the type of options selected.

The Azeotrope Analysis view contains four to six tabs, a status bar, and several objects at the bottom of the view. The following table lists and describes the objects in the Azeotrope Analysis view:

Object	Icon	Description
Delete icon		Allows you to delete the current Azeotrope Analysis operation
Status bar		Displays the status of the current Azeotrope Analysis operation.
View Ternary Composition Space icon		Allows you to open the Ternary Composition Space view based on the selected fluid package, three components, and pressure range.
Calculate button		Allows you to begin calculation of the azeotrope analysis for the specified fluid package and pressure.
() Fraction Basis icon		Allows you to access the Basis Selection view. See the **Basis Selection View** section for more information.
Opens Current Page in Separate Window icon		Allows you to open the active tab as a separate view.

For more information about the Ternary Composition Space view, see **Section 2.3 - Ternary Composition Space**.

Basis Selection View

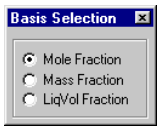
The Basis Selection view allows you to change the composition basis fraction type displayed in the Azeotrope Analysis view.

Molar Fraction Basis icon

Mass Fraction Basis icon

Liquid Volume Fraction Basis icon

Figure 2.2



To change the composition basis using the Basis Selection view:

1. Click on the **Molar/Mass/Volume Fraction Basis** icon to open the Basis Selection view.
   Depending on the current composition basis, one of three fraction basis icons will appear at the bottom of the Azeotrope Analysis view:
2. Use the radio buttons to select the composition basis you want to display in the Azeotrope Analysis view.
3. Click the **Close** icon when you are done.

Close icon

The following sections describe the tabs in the Azeotrope Analysis view in detail.

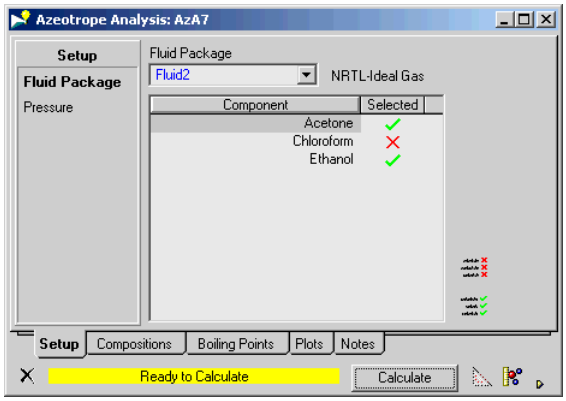
2.2.1 Setup Tab

The Setup tab is divided into two pages: Fluid Package and Pressure. The Setup tab allows you to enter the basic information required to perform azeotrope analysis.

Fluid Package Page

The Fluid Package page allows you to select fluid package and components for the azeotrope analysis.

Figure 2.3



The following table lists and describes the objects available in the Fluid Package page:

Object	Icon	Description
Fluid Package drop-down list		Allows you to select the fluid package for the azeotrope analysis.
Component column		Displays all the components in the selected fluid package.
Selected column	✓ ✗	Allows you to toggle the selection status of the components by clicking the on the icon in the column. • A green checkmark indicates that the component is selected. • A red cross indicates that the component is not selected.

You can select any number of components.

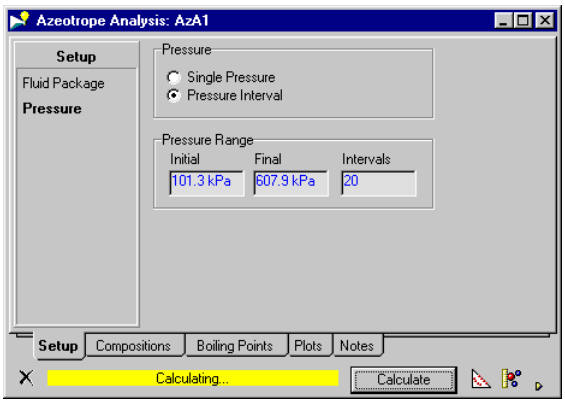
After you select three components, the View Ternary Composition Space icon becomes available.

Object	Icon	Description
Unselect All Components icon		Allows you to deselect all the components in the fluid package.
Select All Components icon		Allows you to select all the components in the fluid package.

Pressure Page

The Pressure page allows you to specify the pressure(s) for the azeotrope analysis and the composition basis displayed in the Azeotrope Analysis view.

Figure 2.4



The following table lists and describes the objects available in the Options page:

Object	Description
Single Pressure radio button	Allows you to specify only one pressure for the azeotrope analysis.
Single Pressure field	Allows you to enter the pressure value for the azeotrope analysis.
Pressure Interval radio button	Allows you to specify a pressure range for the azeotrope analysis.
Initial field	Allows you to enter the initial pressure value of the pressure range for the azeotrope analysis.

The Single Pressure field is available only if the Single Pressure radio button is selected.

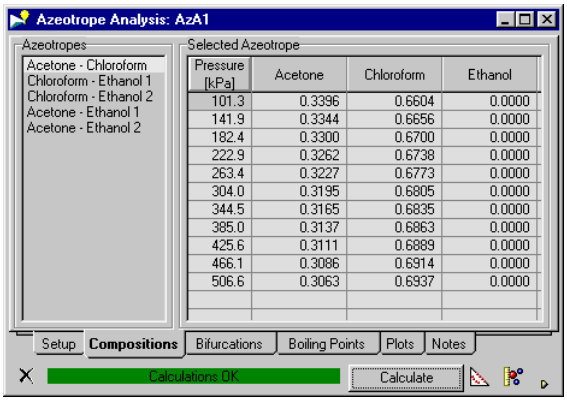
The Initial, Final, and Intervals fields are available only if the Pressure Interval radio button is selected.

Object	Description
Final field	Allows you to enter the final pressure value of the pressure range for the azeotrope analysis.
Intervals field	Allows you to enter the number of intervals in the pressure range.

2.2.2 Compositions Tab

The Compositions tab displays the azeotrope(s) found for the mixture in the Azeotropes list.

Figure 2.5



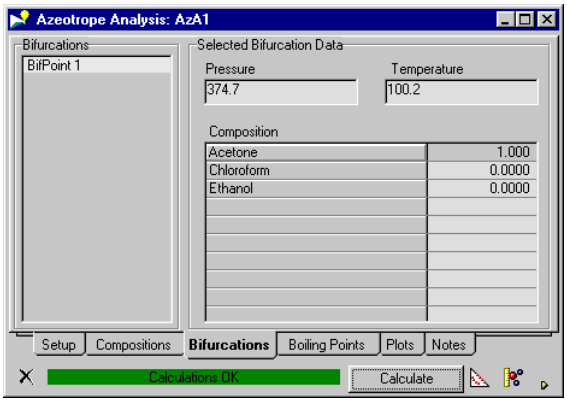
The Selected Azeotrope table displays the composition of the mixture and the pressure for the selected azeotrope from the Azeotropes list.

2.2.3 Bifurcations Tab

The Bifurcation tab is available only if any azeotrope is discovered for the mixture at the specified pressure(s).

The Bifurcations tab displays the bifurcation(s) found for the mixture in the Bifurcations list.

Figure 2.6



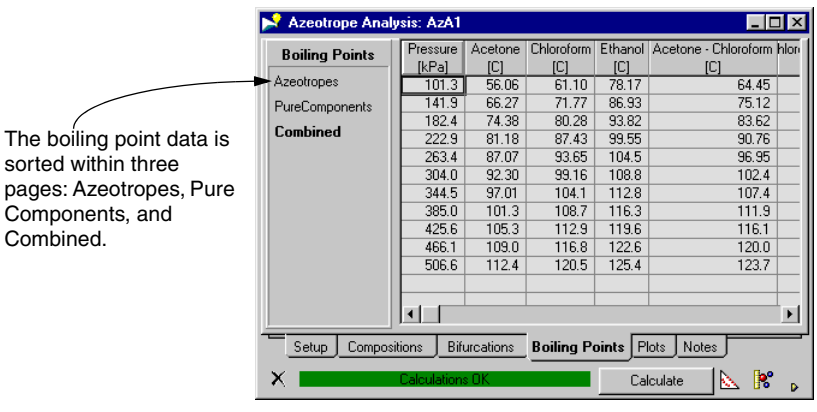
The Selected Bifurcation Data group displays the pressure, temperature, and composition of the selected bifurcation from the Bifurcations list.

2.2.4 Boiling Points Tab

The Boiling Points tab displays the pressures and temperatures of the boiling points in the mixture. If a single pressure is specified, only the temperature of the boiling points in the mixture appears.

Figure 2.7

The Azeotropes page contains the boiling point data for the azeotrope(s) found in the mixture. The Pure Components page contains the boiling point data for the pure components in the mixture. The Combined page contains boiling point data for both azeotrope(s) and pure components.



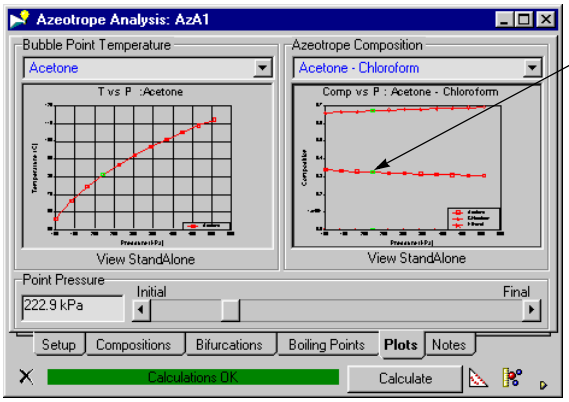
The boiling point data is sorted within three pages: Azeotropes, Pure Components, and Combined.

2.2.5 Plots Tab

The Plots tab is available only if you select three components from the fluid package and a pressure range on the Setup tab.

The Plots tab displays the boiling point temperatures, pressures, and azeotrope composition in a plot format.

Figure 2.8



The green squares on the plots indicate the value for the specified pressure.

The information displayed on the Plots tab is divided into three groups:

The View StandAlone buttons at the bottom of the plot allows you to open the plots as a separate view.

The pressure values for the plots are based on the pressure range specified in the Options page of the Setup tab.

- Bubble Point Temperature. This group displays the pressure and boiling point temperature plot line of the component or azeotrope selected from the Bubble Point Temperature drop-down list.
- Azeotrope Composition. This group displays the pressure and component composition plot line of the azeotrope selected from the Azeotrope Composition drop-down list.
- Point Pressure. This group contains a horizontal scroll bar that allows you to specify a pressure point on the plots. The specified pressure point is indicated by green squares.

2.2.6 Notes Tab

The Notes tab allows you to:

Any changes made to the information in the Notes text editor will appear in the text editor located at the bottom of the Azeotropic Separation Manager view when the Show Notes button has been clicked.

- Change the name of the Azeotrope Analysis operation by entering a new name in the **Name** field.
- Enter information regarding the Azeotrope Analysis operation in the **Notes** text editor.

2.3 Ternary Composition Space

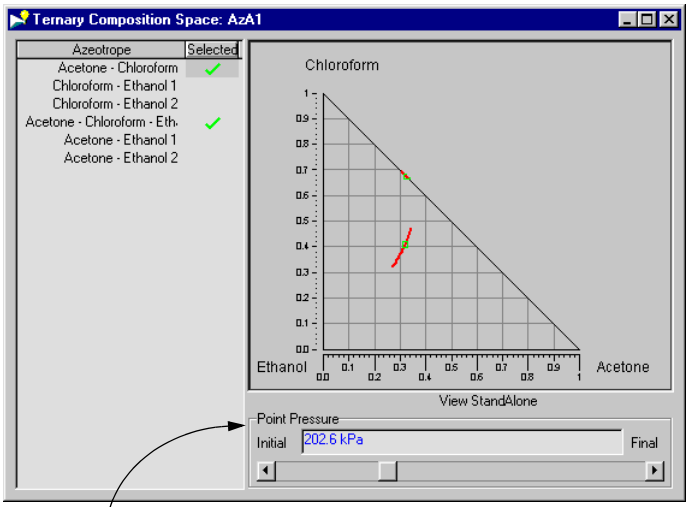
The Ternary Composition Space view contains a ternary plot of the selected components, a list of all the azeotropes found within the pressure range, and a horizontal scroll bar to manipulate the pressure point in the plot.

The Ternary Composition Space view is available only for a three component mixture with a specified pressure range.

View Ternary Component Space icon

To access the Ternary Composition Space, click the View Ternary Component Space icon located at the bottom of the Azeotrope Analysis view.

Figure 2.9



The options in the Point Pressure group allow you to observe the azeotrope composition at a specific pressure.

The following table lists and describes the objects available in the Ternary Composition Space view:

Object	Description
Azeotrope column	Displays the list of azeotropes found for the selected components in the specified temperature range.
Selected column	Allows you to toggle the selection status of the azeotropes by clicking in the column. When the azeotrope is selected, its composition appears on the plot.
Ternary Plot	Displays the azeotrope composition for the specified pressure range.
View StandAlone button	Allows you to open the ternary composition space plot as a separate view.
Point Pressure field	Allows you to enter a specific point pressure in the plot.
Point Pressure scroll bar	Allows you to select a specific point pressure in the plot.

A green checkmark ✓ in the Selected column indicates that the azeotrope is selected.

A blank area indicates that the azeotrope is not selected.

The point pressure is indicated by a green square on the plot.

3 Azeotropic Column Sequencing

3.1 Introduction

The Azeotropic Column Sequencing operation is used to identify feasible distillation sequences. The distillation sequences are used to separate a specified feed stream into several selected products. The number of stages, the feed tray location and the reflux ratio for each of the feasible distillation columns are also computed.

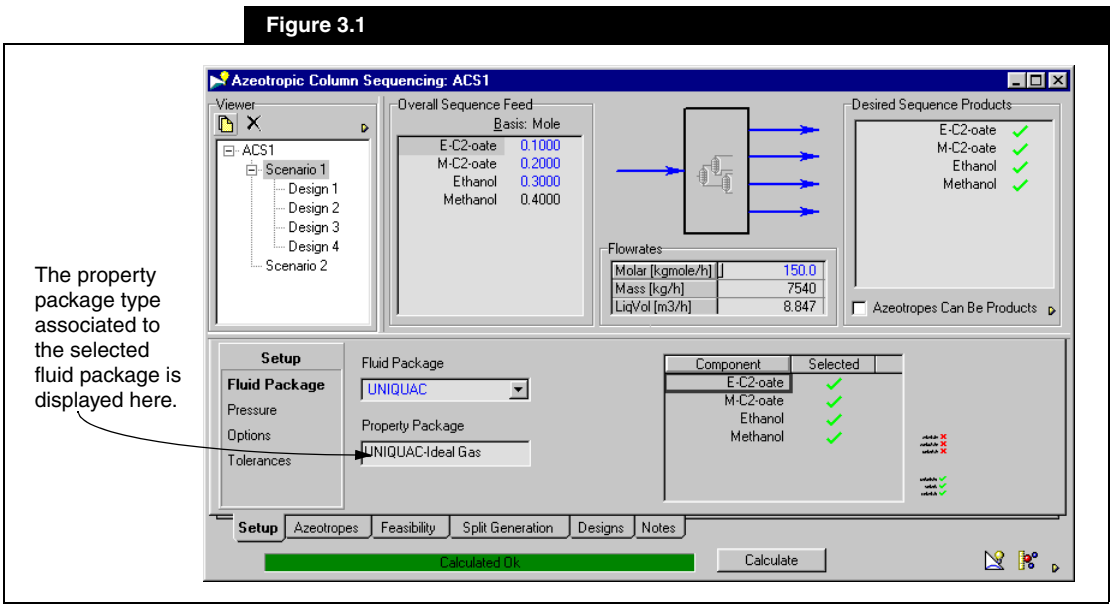
3.2 Column Sequencing View

To access previously created Column Sequencing operations, refer to **Section 1.2.2 - Editing an Operation**.

To create an Azeotropic Column Sequencing Analysis operation:

- From the **Features** menu, select the **Column Sequencing** command.
- From the **Managers** menu, select **Azeotropic Separation Manager**. The manager view appears. In the list on the left, select **AzeotropicColumnSequencing**, then click the **Add** button.

Figure 3.1



For more information about the Project view, refer to **Section 2.3.5 - Project View** of the **User Guide**.

The Azeotropic Column Sequencing view is a project view. All project views have three levels: Project, Scenario, and Design. Each level contains different objects, tabs, and groups. The only group/object in the project view that stays constant is the Viewer group. The Viewer group allows you to navigate from level to level.

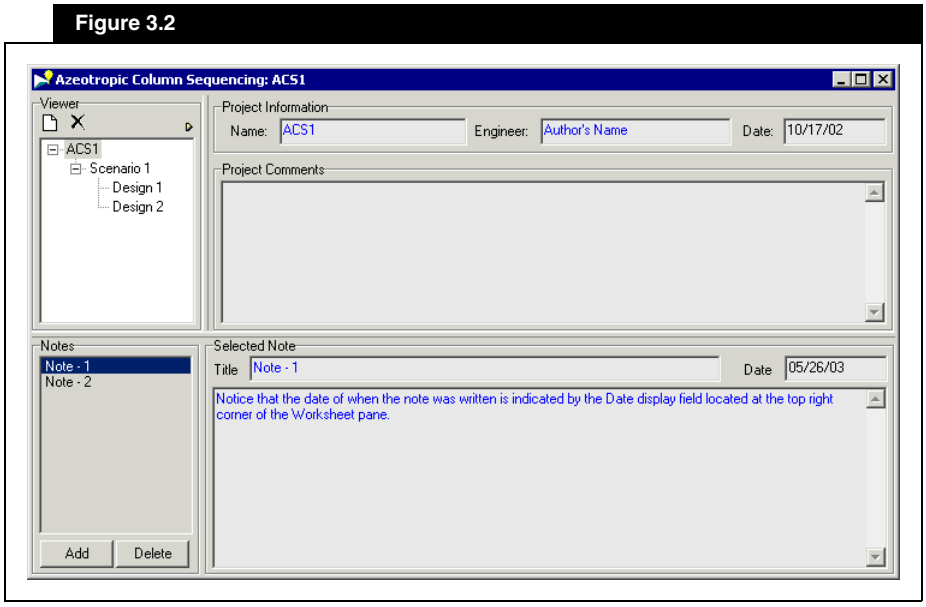
The following sections describe in detail what groups/objects each level contains.

3.3 Project Level

For more information about the options at Project level, refer to **Section 2.3.5 - Project View** of the **User Guide**.

At the Project level, the view is the same for all operations. The Project level contains the objects/groups that allow you to enter general information about the operation.

Figure 3.2



Multiple Scenarios and Designs can exist in the Column Sequencing operation, but only one Project can exist in the operation.

You cannot add/clone/delete the Project in the operation.

3.3.1 Viewer Group

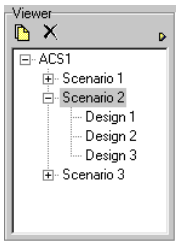
The objects in the Viewer group remain the same for all three levels of the project view.

The Viewer group allows you to navigate among levels in the project view and manipulate the levels. For more information, see **Section 7.5.1 - Viewer Pane** of the **User Guide**.

The following table describes the icons available in the Viewer group:

Name	Icon	Description
Add Scenario		Allows you to add a scenario to the project. Available only at the Project level.
Clone Scenario/ Design		Allows you to clone a selected scenario or design. Available at the Scenario and Design levels.
Delete Scenario/ Design		Allows you to delete the selected scenario or design.
Open Viewer as Separate Window		Allows you to open the Viewer group as a separate view.

3.4 Scenario Level



Viewer group

At the Scenario level:

- One of the Scenario names must be selected in the Viewer group, as shown in the figure on the left.
- The Main (upper) pane allows you to determine the composition and flow rate of the overall sequence feed stream.
- The Worksheet (lower) pane contains several tabs that allow you to manipulate the parameters of columns in the generated sequence.
- The column sequencing designs and calculations occur at this level. For more information, refer to the **Calculating Feasible Separation Sequences** section.

The following table lists and describes the common objects at the bottom of the Worksheet pane that are available for all tabs.

Object	Icon	Description
Status bar		Displays the status of the selected scenario.
Calculate button		Allows you to start calculations of azeotropes, distillation regions, and/or splits. See the **Calculating Feasible Splits** section for more information.

For more information about RCM, refer to **Chapter 6 - Residue Curve Map**.

Object	Icon	Description
Create Residue Curve Map icon		Allows you to generate a RCM plot based on the selected components. You need to specify the fluid package, components, and pressure of the feed stream, then click the Calculate button before DISTIL can generate an RCM plot.
() Fraction Basis icon		Allows you to access the Basis Selection view. See the **Basis Selection View** section for more information.
Opens Current Page in Separate Window icon		Allows you to open the active tab as a separate view.

Basis Selection View

The Basis Selection view allows you to change the composition basis fraction type displayed in the operation view.

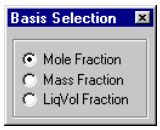

Molar Fraction Basis icon


Mass Fraction Basis icon


Liquid Volume Fraction Basis icon


Close icon

Figure 3.3



To change the composition basis using the Basis Selection view:

1. Click on the **Molar/Mass/Volume Fraction Basis** icon to open the Basis Selection view.
   Depending on the current composition basis, one of three fraction basis icons will appear at the bottom of the Azeotrope Analysis view:
2. Use the radio buttons to select the composition basis you want to display in the Azeotrope Analysis view.
3. Click the **Close** icon when you are done.

Calculating Feasible Splits

To calculate feasible splits, use the following procedure:

1. Open the Azeotropic Column Sequencing view.
2. From the Viewer group, select a Scenario name.
3. Click the **Setup** tab.
4. In the Setup group, select the **Fluid Package** page.

5. In the Fluid Package page, select the fluid package and components in the feed stream.
6. In the Setup group, select the **Pressure** page.
7. In the **Pressure** page, select how many pressure values will be available for the columns in the generated sequences, and enter the pressure value(s).
8. Click the **Split Generation** tab.
9. In the Feed group, specify the feed compositions.
10. Click the **Calculate** button to start the feasibility split calculation. The calculation can take a few minutes to complete.
11. Once the calculation is complete, you can do any of the following:
    - Click the **Azeotropes** tab, then select the **Combined** page to examine all the singular points that were calculated.
    - Click the **Feasibility** tab, then select the **Regions** page to examine all the regions that were found.
    - Click the **Split Generation** tab to examine the calculated splits in the Products group.

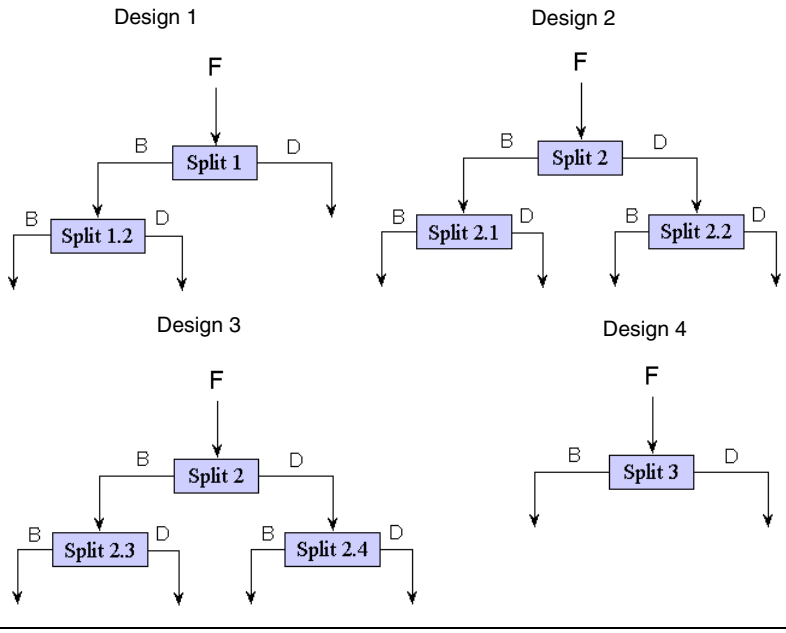
Calculating Feasible Separation Sequences

The Sequence Synthesis calculation that DISTIL performs uses the same Split Generation calculation described in the previous **Calculating Feasible Splits** section, however, the Split Generation generates feasible splits for a single feed only and does not deal with multiple column sequences.

First, the Sequence Synthesis generates feasible splits for a specified overall sequence feed. Then, the non-pure products of the first simple distillation are treated as feeds to a set of secondary distillation columns for which the split calculations are repeated. This calculation continues until either all products are pure components, azeotropes, or reside on a distillation boundary.

The figure below displays the four different sequences of splits for the equimolar mixture of methyl acetate, ethyl acetate, methanol and ethanol. These sequences will result in four different designs.

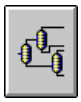
Figure 3.4



To generate feasible column sequences:

1. Open the Azeotropic Column Sequencing view.
2. From the Viewer group, select a Scenario name.
3. Click the **Setup** tab.
4. In the Setup group, select the **Fluid Package** page. Select the fluid package and components in the feed stream.
5. In the Setup group, select the **Pressure** page. Select how many pressure values will be available for the columns in the generated sequences, and enter the pressure value(s).

Refer to the **Desired Sequence Products Group** section in the **Section 3.4.1 - Main Pane** for more information



Generate Feasible Column Sequences icon

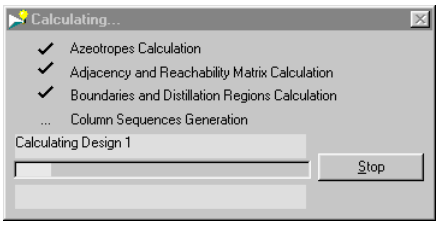
6. In the Setup group, select the **Options** page. Specify the column design options/setting.
7. In the Main (upper) pane, specify the composition of the feed in the Overall Sequence Feed group, the feed flow rate in the Flow Rate field, and the products in the Desired Sequence Products group.
8. Click the **Generate Feasible Column Sequences** icon.

DISTIL will calculate the feasible column sequences (designs) that can be used to separate the feed into selected products.

Calculating View

DISTIL may take some time to generate a set of feasible process configurations for your system. During the design calculations the Calculating view appears to show which calculations are taking place.

Figure 3.5



The Stop button allows you to stop the calculations after DISTIL finishes calculating the current sequence. For example, if you click the Stop button in a middle of the sequence calculation for design #3, DISTIL will stop the calculation after finishing the calculation for design #3.

For more information regarding the generated column sequences, refer to **Section 3.5 - Design Level**.

Once DISTIL has finished the calculation, you can view any of the generated column sequences by selecting a Design name in the Viewer group. A process flow-sheet diagram displaying stream and column sequence information appears in the Main pane for the selected design.

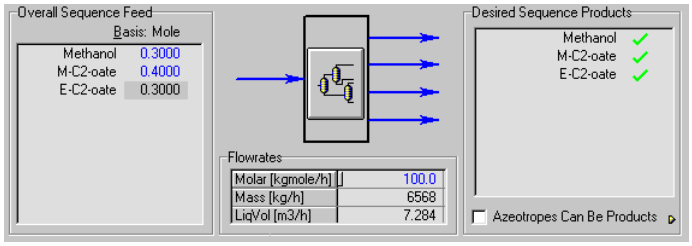
The following sections describe the Main (upper) pane and each tab in the Worksheet (lower) pane for the Scenario level in more detail.

3.4.1 Main Pane

The Main pane will appear blank until you select a fluid package and components in the Worksheet pane. Refer to **Section 3.4.2 - Setup Tab** for more information.

The Main pane (located at the top of the Azeotropic Column Sequencing view) allows you to specify the feed composition, the feed flow rate, and the desired products.

Figure 3.6



The following table lists and describes the objects available in the Main pane:

Object	Icon	Description
Overall Sequence Feed table		Allows you to specify the feed composition entering the column sequence. If all but one component's fraction value has been specified, DISTIL will automatically calculate the missing value for that component.
Flowrates group		Displays the three types of flow rate for the feed stream and allows you to enter the molar flow rate of the feed stream in the *Molar* cell.
Generate Feasible Column Sequences icon		Allows you to generate feasible column sequences to separate the feed into the selected products.
Desired Sequence Product table	 	Allows you to select the products of the column sequences. • A green checkmark indicates that the component is selected. • A red cross indicates that the component is not selected.
Azeotropes Can Be Products checkbox		Allows you to select azeotropes as products of the column sequences.
Open Page Tab in Separate Window icon		Allows you to open the Main pane into a separate view.

Refer to the following **Desired Sequence Products Group** section for more information.

Desired Sequence Products Group

The Desired Sequence Products group allows you to select the kind of product streams you will allow in the sequence.

A stream from a newly added separator to the sequence is marked as a desired sequence product if:

- It is a pure component within the user-specified tolerance. You can only influence this criteria by changing the tolerance.
- There are no desired pure components in the stream, therefore, do not separate it further. By deselecting a pure component in the Desired Sequence Products group, you indicate that you do not require the full recovery of this component. The deselected component will exit from the sequence as a mixture with other deselected components.
- It is a selected azeotrope within the user-specified tolerance. The **Azeotropes Can Be Products** checkbox must be checked to see all azeotropes in the mixture at any of the selected pressures.

Refer to **Section 3.4.2 - Setup Tab** for more information about changing the tolerance settings.

3.4.2 Setup Tab

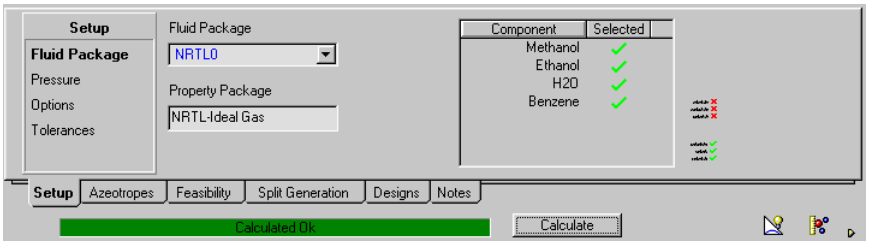
The Setup tab is located in the Worksheet pane (at the bottom of the ACS view).

The Setup tab is divided into four pages: Fluid Package, Pressure, Options, and Tolerances.

Fluid Package Page

The Fluid Package page allows you to select the fluid package and the components in the feed.

Figure 3.7



The following table lists and describes the objects available in the Fluid Package page:

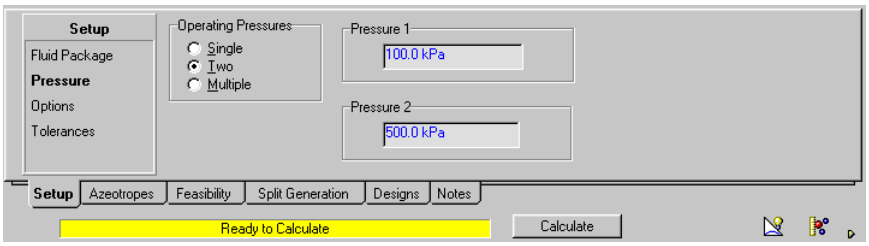
Object	Icon	Description
Fluid Package drop-down list		Allows you to select the fluid package for the Column Sequencing operation.
Property Package field		Displays the property package associated with the selected fluid package.
Select All Components icon		Allows you to select all the components in the selected fluid package. The selected components will be added into the feed stream.
Unselect All Components icon		Allows you to deselect all the components, removing them from the feed stream.
Setup table	 	Allows you to select and deselect which components to include in the feed stream. • A green checkmark indicates that the component is selected. • A red cross indicates that the component is not selected.

The default setting is to select all the components in the selected fluid package.

Pressure Page

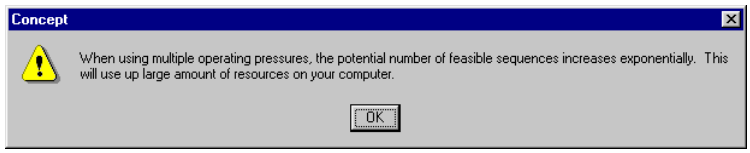
The Pressure page allows you to specify how many different pressure values will be available for the columns in the generated sequence, and allows you to specify the pressure value(s) in the field(s) provided.

Figure 3.8



The objects that become available depend on which radio button is selected in the Operating Pressures group.

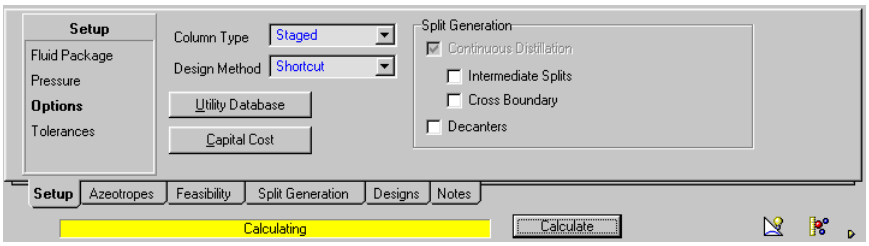
The following table lists and describes the objects available in the Pressure page:

Object	Description
Operating Pressures group	Allows you to select how many pressure values are made available for the columns. There are three selections: • **Single**. Select this radio button to specify only one pressure for all the columns in the generated sequences. • **Two**. Select this radio button to specify two pressures for all the columns in the generated sequences. • **Multiple**. Select this radio button to specify three or more pressures for all the columns in the generated sequences. If you select this radio button the following warning view appears:
	
Single Pressure group	Contains the Single Pressure field, which allows you to specify one pressure value for all column sequence designs. Available only if the Single radio button is selected.
Pressure 1 & Pressure 2 groups	Contains the Pressure 1 and Pressure 2 fields, which allow you to specify two pressure values for all column sequence designs. Available only if the Two radio button is selected.
Multiple Pressures group	Contains the Multiple Pressure table, which allows you to specify multiple pressure values for all column sequence designs. Available only if the Multiple radio button is selected.

Options Page

The Options page allows you to select the column type and design method for generating sequences, manipulate capital and operating cost calculations, and select the Split Generation type.

Figure 3.9



The following table lists and describes the objects available in the Options page:

Object	Description
Column Type drop-down list	Allows you to select the type of column for all the columns in the designs. There are two options: Packed or Staged
Design Method drop-down list	Allows you to select the design method used to generate the column sequences. There are three options: • **None**. • **Shortcut**. For more information, refer to **Section 4.4.1 - Shortcut Method** in the **Reference Guide**. • **Geometric**. For more information, refer to **Section 4.4.2 - Geometric Method** in the **Reference Guide**.
Utility Database button	Allows you access to the Utility Database view. This view allows you to manipulate the operating cost of the designs.
Capital Cost button	Allows you access to the Capital Cost view. This view allows you to manipulate the capital cost of the designs.
Continuous Distillation checkbox	When checked, a continuous distillation split will be used in column sequencing.
Intermediate Splits checkbox	When checked, allows for intermediate splits in a simple distillation column.
Cross Boundary checkbox	Allows DISTIL to cross curved boundaries if possible.
Decanters checkbox	Allows DISTIL to automatically place decanters on the columns in the designs whenever necessary.

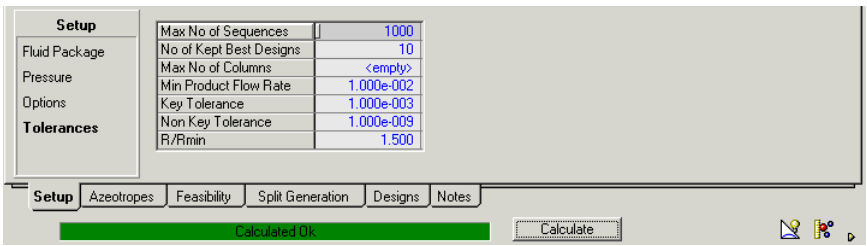
Refer to **Chapter 10 - Sizing and Costing** of the **User Guide** for more information about the Utility Database view and the Capital Cost view.

Refer to **Section 3.4.2 - Designs with Decanter** from the **Reference Guide** for more information.

Tolerances Page

The Tolerances page allows you to manipulate the parameters of the column design calculations.

Figure 3.10



The following table lists and describes the objects available in the Tolerances tab:

To have an unlimited number of sequences, kept best designs, and/or columns, click on the appropriate cell and press the **DELETE** key so that the cell displays <empty>.

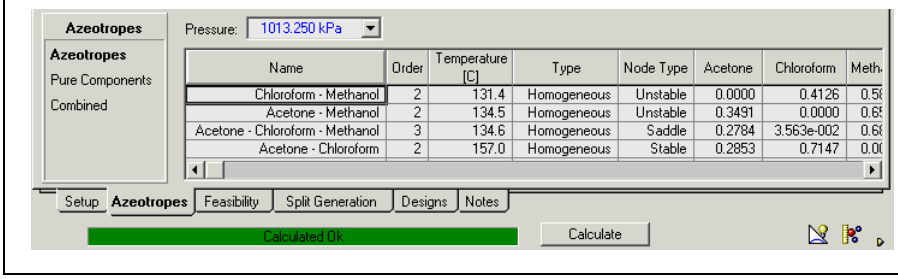
Object	Description
Max No of Sequences cell	Allows you to specify the maximum number of column sequences to be generated.
No of Kept Best Designs cell	Allows you to specify how many of the best designs generated by DISTIL will be kept.
Max No of Columns cell	Allows you to specify the maximum number of columns allowed in each design.
Min Product Flow Rate cell	Allows you to specify the minimum product flow rate (fraction of the overall sequences feed flow rate) from any of the columns in the designs.
Key Tolerance cell	Allows you to specify the purity of the end products. The lower the value the purer the end products.
Non Key Tolerance cell	Allows you to specify the purity of the non-key components in the end products. The lower the value, the purer the end products.
R/Rmin cell	Allows you to specify the ratio between the reflux and minimum reflux for the columns in the designs.

3.4.3 Azeotropes Tab

The Azeotropes tab is located in the Worksheet pane (at the bottom of the ACS view).

The Azeotropes tab displays information about all pure components and azeotropes for the selected mixture and pressures.

Figure 3.11



The Pressure drop-down list displays the selected pressures.

If you specify more than one pressure, you can use the drop-down list to select the other pressures and view the different calculated values.

The information in the Azeotropes tab is divided into three pages:

- **Azeotropes page**. Displays the name, order, temperature, azeotrope type, node type, and composition of the azeotropes.
- **Pure Components page**. Displays the name, temperature, and node type of the pure components.
- **Combined page**. Displays the name, order, temperature, and node type of the azeotropes and pure components.

All singular points displayed in the Combined page are sorted in order of increasing boiling point temperatures. The number beside each singular point's name indicates the order of increasing temperature.

3.4.4 Feasibility Tab

The Feasibility tab is located in the Worksheet pane (at the bottom of the ACS view).

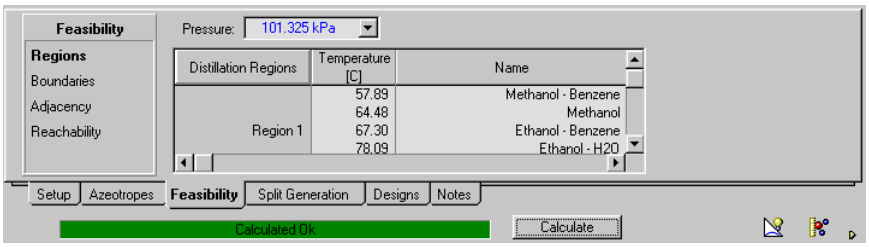
The Feasibility tab displays regions and boundaries present in the mixture, and the Adjacency and Reachability matrixes.

The information in the Feasibility tab is divided into four pages: Regions, Boundaries, Adjacency, and Reachability.

Regions Page

The Regions page displays the regions present in the mixture.

Figure 3.12



The following table lists and describes the objects available on the Regions page:

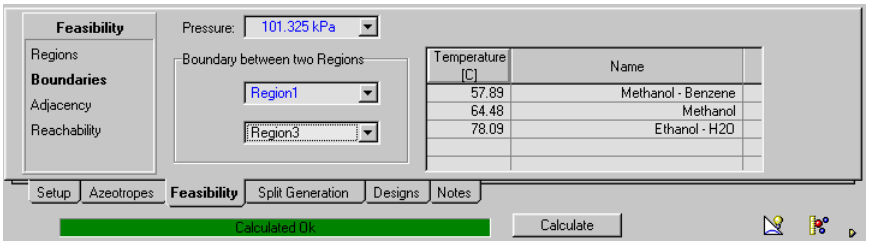
If you specify more than one pressure, you can use the drop-down list to select the other pressures and view the different calculated values.

Object	Description
Pressure drop-down list	Displays the pressure on which the calculated values are based.
Regions table	Displays the distillation regions, temperatures, and names of the singular points that define a particular region.

Boundaries Page

The Boundaries page displays the boundaries between selected distillation regions.

Figure 3.13



The following table lists and describes the objects available on the Boundaries page:

Object	Description
Pressure drop-down list	Displays the pressure value on which the calculated values are based.
Boundary between two Regions group	Allows you to specify the boundary you want to observe based on the selected two regions. The two drop-down lists in this group allow you to select the two regions between which is boundary you want to see.
Boundaries table	Displays the temperatures and names of the singular points found in the selected boundary.

If you specify more than one pressure, you can use the drop-down list to select the other pressures and view the different calculated values.

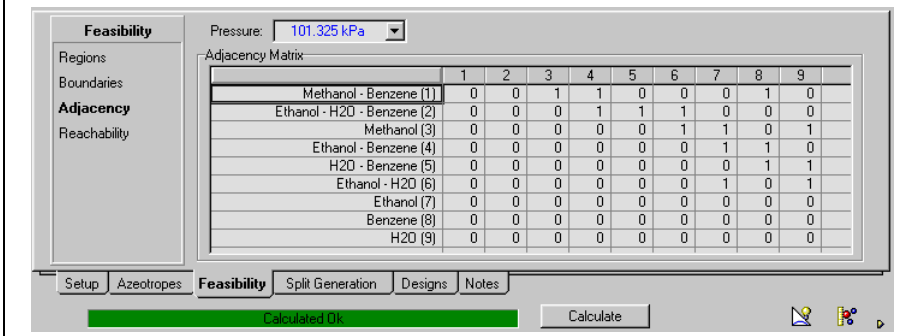
Adjacency Page

The Pressure drop-down list displays the selected pressures.

If you specify more than one pressure, you can use the drop-down list to select the other pressures and view the different calculated values.

The Adjacency page displays the Adjacency matrix. Refer to **Section 3.2.1 - Adjacency Matrix** of the **Reference Guide** for more information.

Figure 3.14



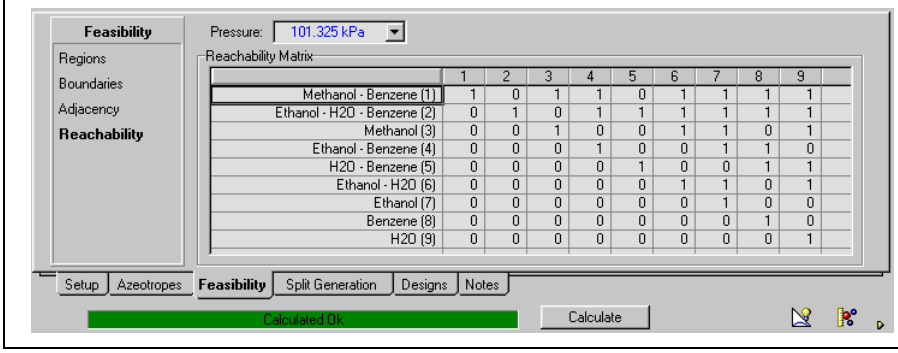
Reachability Page

The Pressure drop-down list displays the pressure of the calculated values.

If you specify more than one pressure, you can use the drop-down list to select the other pressure and view the different calculated values.

The Reachability page displays the Reachability matrix. Refer to **Section 3.2.2 - Reachability Matrix** of the **Reference Guide** for more information.

Figure 3.15

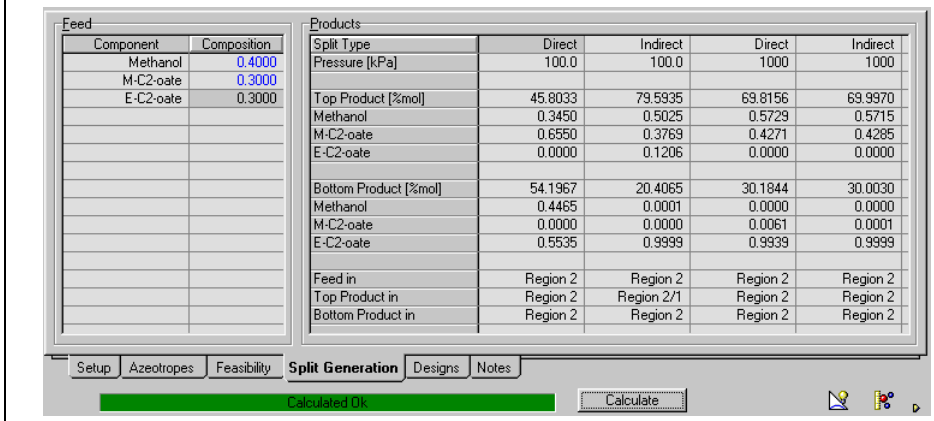


3.4.5 Split Generation Tab

The Split Generation tab is located in the Worksheet pane (at the bottom of the ACS view).

The Split Generation tab allows you to specify the composition of a stream and observe the splits DISTIL generates values for all selected pressures and all active options.

Figure 3.16



The Split Generation tab contains two groups:

- **Feed group**. Allows you to specify the feed composition. The components available are based on the components selected in the **Setup** tab.
- **Products group**. Displays the split type, top product (molar, mass, or volume) % of the feed & composition, bottom product (molar, mass, or volume) % of the feed & composition, and the regions of the feed, top product, and bottom product of the generated splits.

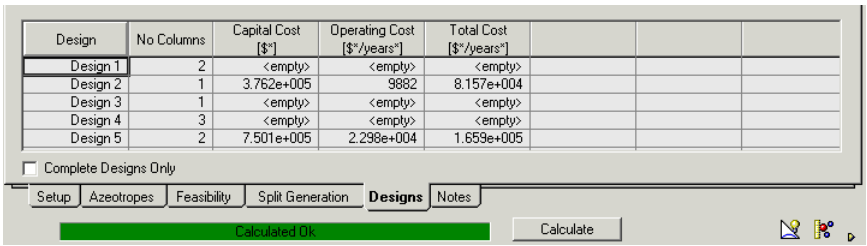
If the composition of the feed stream is not specified and/or the Calculate button has not been clicked since the last option change, the Product table will appear blank.

3.4.6 Designs Tab

The Designs tab is located in the Worksheet pane (at the bottom of the ACS view).

The Designs tab displays the list of possible column sequences generated by DISTIL.

Figure 3.17



Refer to **Chapter 10 - Sizing and Costing** in the **User Guide** for more information on calculating the capital and operating cost.

The Designs table displays the name, number of columns, capital cost, operating cost, and total cost of each design.

If the Shortcut or Geometric method (Setup tab, Options page, Design Method drop-down list) was not selected when generating the designs, then the capital, operating, and total cost fields will appear blank.

Refer to **Section 3.4.2 - Setup Tab** for more information on the kept best designs.

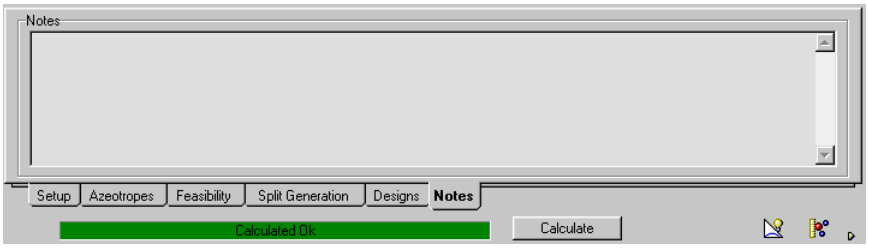
The Complete Designs Only checkbox allows you to display only the generated designs that are complete (meet all the requirements) when checked. When unchecked, the Designs table displays all the kept best designs.

3.4.7 Notes Tab

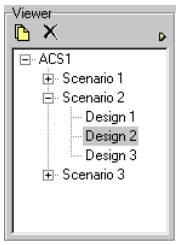
The Notes tab is located in the Worksheet pane (at the bottom of the ACS view).

The Notes tab allows you to enter general information about the selected scenario in the Notes text editor.

Figure 3.18



3.5 Design Level



Viewer group

Open Page Tab in Separate Window icon

At the Design level:

- One of the **Design** names must be selected in the Viewer group, as shown in the figure on the left.
- The Main (upper) pane displays the Process Flow Diagram (PFD) of the column sequence in the selected design.
- The Worksheet (lower) pane contains several tabs that display the information about the streams and columns in the process flow diagram.

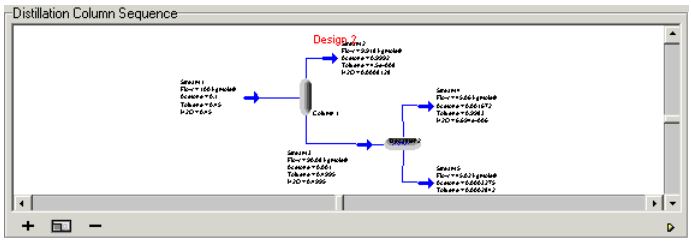
The Open Page Tab in Separate Window icon is available for all tabs.

The following sections describe the Main pane and each tab in the Worksheet pane for the Design level in more detail.

3.5.1 Main Pane

The Main pane (located at the top of the Azeotropic Column Sequencing view) displays the Process Flow Diagram of the selected design as well as the flow rate and composition of each stream in the PFD.

Figure 3.19



The following table lists and describes the objects available in the Main pane:

Object	Icon	Description
PFD		Displays the objects in the separation sequence.
Zoom In icon		Increases the viewing size of the PFD so you can view objects in detail.
Reset Flowsheet Size icon		Allows you to reset the focus on the PFD to the DISTIL default setting.
Zoom Out icon		Decreases the viewing size of the PFD so you can see an overview of the sequence.
Open Current Page in Separate Window icon		Allows you to open the Main pane as a separate view.

You can double click on any object in the PFD except the streams to open a property view of the selected object.

For more information refer to the **PFD Object View** section.

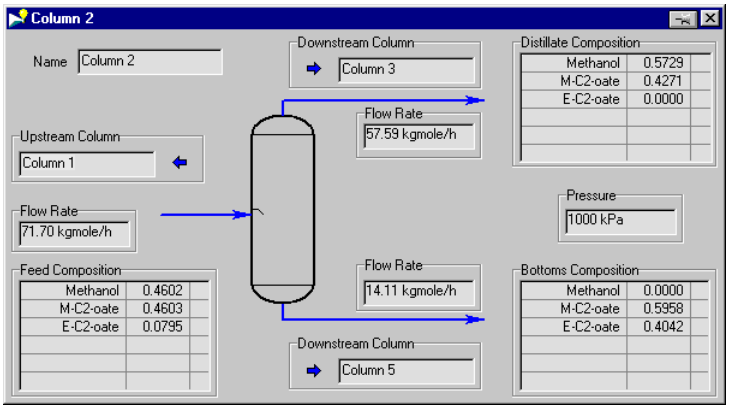
PFD Object View

Each PFD object in the Main pane, except for the streams, has its own property view, which contains information about the pressure within the object, the flow rate, and the composition of the streams entering and exiting the object. To access the object's property view, double-click the object in the PFD.

The Column Sequencing operation contains the following PFD objects:

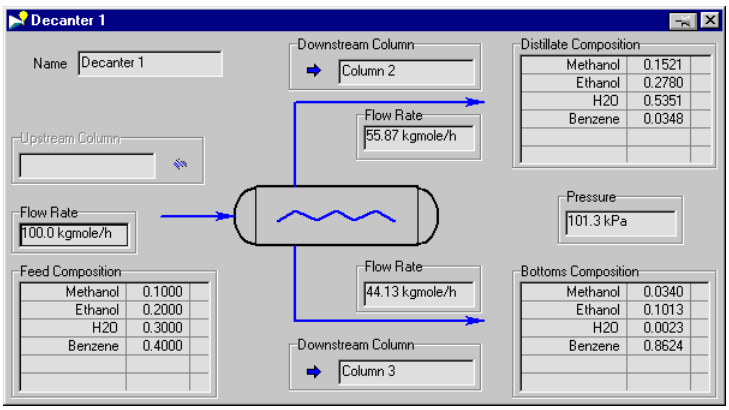
- Column

Figure 3.20



- Decanter

Figure 3.21



You can view the previous or next object in the sequence by doing one of the following:

Right-arrow icon

Left-arrow icon

- On the **Main** pane of the Column Sequencing view, double-click on the previous or next object in the sequence.
- In the current object property view, click the Right arrow icon in the **Downstream Column** group to open the next object view.
- In the current object property view, click the Left arrow icon in the **Upstream Column** group to open the previous object view.

3.5.2 Streams Tab

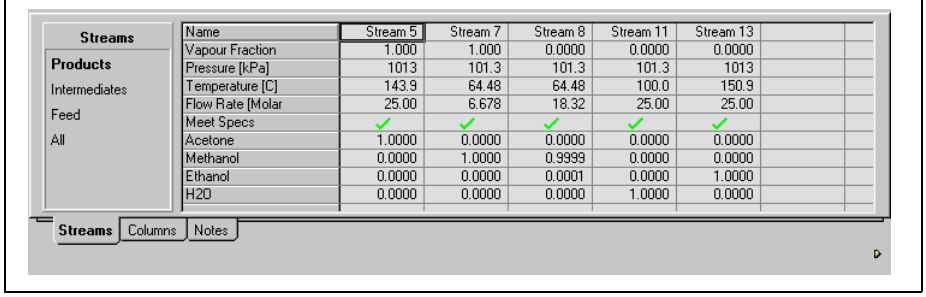
The Streams tab is located in the Worksheet pane (at the bottom of the ACS view).

The Streams tab contains information about all the streams in the column sequence design. The information is divided into four pages: Products page, Intermediates page, Feed page, and All page.

Products Page

The Products page displays information about all the product streams.

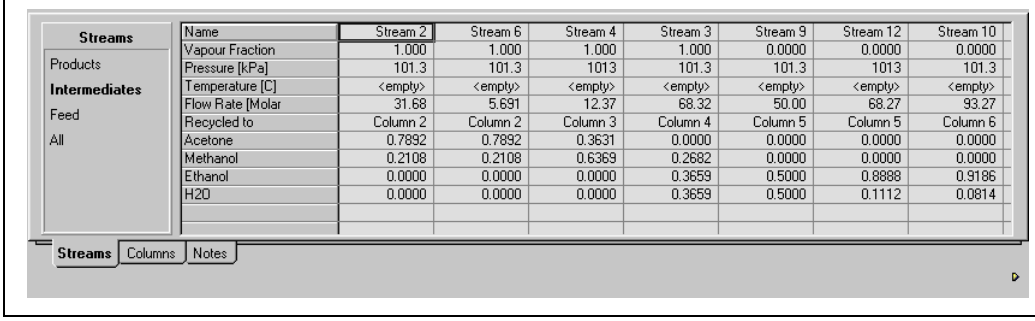
Figure 3.22



Intermediates Page

The Intermediates page displays information about all the streams internal to the flowsheet.

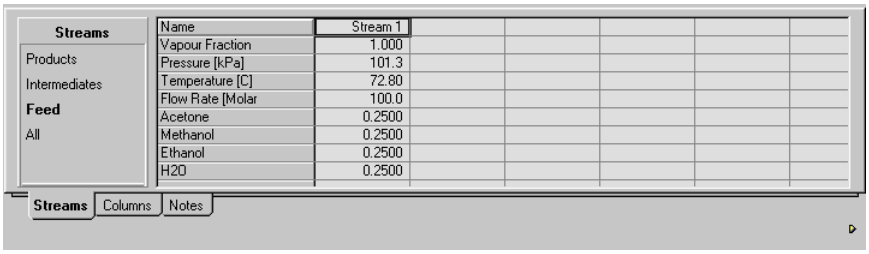
Figure 3.23



Feed Page

The Feed page displays information about the feed stream.

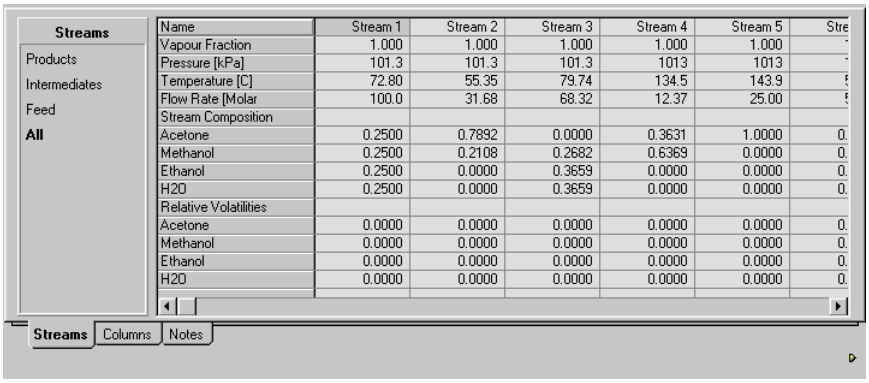
Figure 3.24



All Page

The All page displays information about all the streams in the column sequence.

Figure 3.25

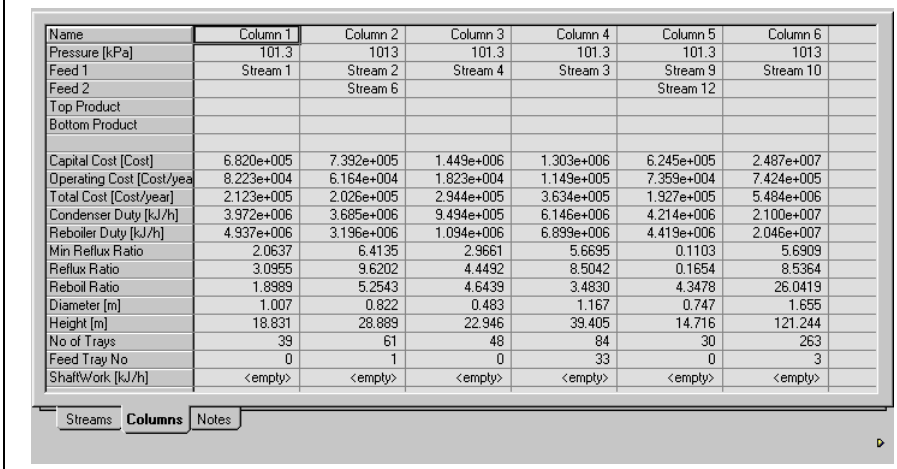


3.5.3 Columns Tab

The Columns tab is located in the Worksheet pane (at the bottom of the ACS view).

The Columns tab displays information about all the columns in the column sequence.

Figure 3.26



Name	Column 1	Column 2	Column 3	Column 4	Column 5	Column 6
Pressure [kPa]	101.3	1013	101.3	101.3	101.3	1013
Feed 1	Stream 1	Stream 2	Stream 4	Stream 3	Stream 9	Stream 10
Feed 2		Stream 6			Stream 12	
Top Product						
Bottom Product						
Capital Cost [Cost]	6.820e+005	7.392e+005	1.449e+006	1.303e+006	6.245e+005	2.487e+007
Operating Cost [Cost/yea	8.223e+004	6.164e+004	1.823e+004	1.149e+005	7.359e+004	7.424e+005
Total Cost [Cost/year]	2.123e+005	2.026e+005	2.944e+005	3.634e+005	1.927e+005	5.484e+006
Condenser Duty [kJ/h]	3.972e+006	3.685e+006	9.494e+005	6.146e+006	4.214e+006	2.100e+007
Reboiler Duty [kJ/h]	4.937e+006	3.196e+006	1.094e+006	6.899e+006	4.419e+006	2.046e+007
Min Reflux Ratio	2.0637	6.4135	2.9661	5.6695	0.1103	5.6909
Reflux Ratio	3.0955	9.6202	4.4492	8.5042	0.1654	8.5364
Reboil Ratio	1.8989	5.2543	4.6439	3.4830	4.3478	26.0419
Diameter [m]	1.007	0.822	0.483	1.167	0.747	1.655
Height [m]	18.831	28.889	22.946	39.405	14.716	121.244
No of Trays	39	61	48	84	30	263
Feed Tray No	0	1	0	33	0	3
ShaftWork [kJ/h]	<empty>	<empty>	<empty>	<empty>	<empty>	<empty>

3.5.4 Notes Tab

The Notes tab is located in the Worksheet pane (at the bottom of the ACS view).

The Notes tab allows you to enter general information about the selected column sequence design in the Design Notes text editor.

Figure 3.27

4 Column Design

4.1 Introduction

The Column Design operation is used to design distillation towers with either two or three components. The Column Design operation allows you to specify various column operating parameters and observe the changes in McCabe-Thiele or Component Space plots.

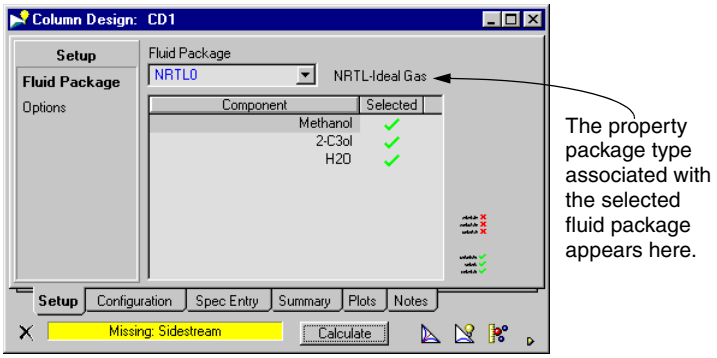
4.2 Column Design View

To access previously created Azeotrope Analysis operations, refer to **Section 1.2.2 - Editing an Operation**.

To create a Column Design operation:

- From the **Features** menu, select **Graphical Column Design**.
- From the **Managers** menu, select Azeotropic Separation Manager. The manager view appears. In the list on the left side, select **ColumnDesign**, then click the **Add** button.

Figure 4.1



The Advanced tab appears if you check the Advanced Output checkbox on the Options page of the Setup tab.

The Column Design view contains six or seven tabs and seven objects located at the bottom of the view. The following table lists and describes the objects available in the Column Design view:

Object	Icon	Description
Delete icon		Allows you to delete the current Column Design operation
Status bar		Displays the status of the current Column Design operation.

For more information about the TCS view, see **Section 2.3 - Ternary Composition Space**.

Refer to the **Basis Selection View** section for more information.

Object	Icon	Description
Calculate button		Allows you to calculate the column design for the specified fluid package, components, pressure, and column type.
Open Composition Space icon		Allows you to create a Ternary Composition Space (TCS) view based on the specified fluid package, three components, and pressure. Available only when three components are selected.
Open McCabe-Thiele Plot icon		Allows you to create a McCabe-Thiele Plot view based on the specified fluid package, two components, and pressure. Available only when two components are selected.
Open Residue Curve Map icon		Allows you access to the Residue Curve Map Data (RCMD) view. Refer to the **Residue Curve Map Data View** section for more information.
() Fraction Basis icon		Allows you to access the Basis Selection view.
Opens Current Page in Separate Window icon		Allows you to open the active tab as a separate view.

Residue Curve Map Data View

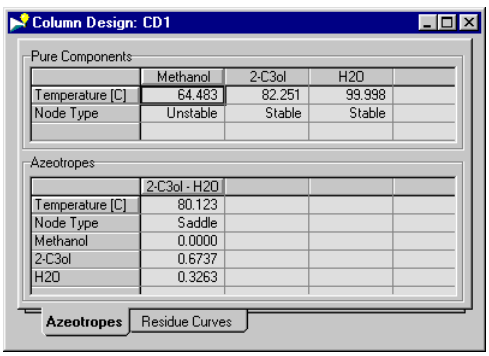
Open Residue Curve Map icon

To access the Residue Curve Map Data (RCMD) view, click the Open Residue Curve Map icon.

The RCMD view is divided into two tabs:

- **Azeotropes tab**. This tab displays the temperature, node type, and composition of the calculated singular points (azeotropes and pure components) based on the specified fluid package, components, and pressure.

Figure 4.2

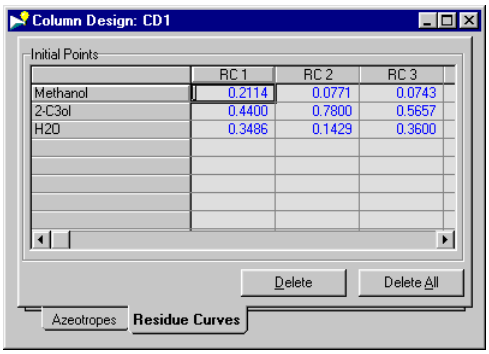


- **Residue Curves tab**. This tab allows you to enter the composition of the mixture to generate a residue curve on the TCS view. This tab is available only if you select three components for the feed stream.

The Delete button allows you to remove the selected residue curve from the TCS plot.

The Delete All button allows you to remove all the residue curves from the TCS plot.

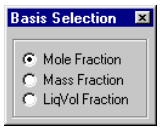
Figure 4.3



Basis Selection View

The Basis Selection view allows you to change the composition basis fraction type displayed in the Column Design view and the Residue Curve Map Data view.

Figure 4.4



To change the composition basis using the Basis Selection view:

1. Click on the **Molar/Mass/Volume Fraction Basis** icon to open the Basis Selection view.
   Depending on the current basis selection, one of the three icon which associates to the current basis setting will be visible.
2. Use the radio buttons to select the composition basis you want to display in the Column Design view.
3. Click the **Close** icon ☒ when you are done.

Molar Fraction Basis icon

Mass Fraction Basis icon

Volume Faction Basis icon

4.2.1 Setup Tab

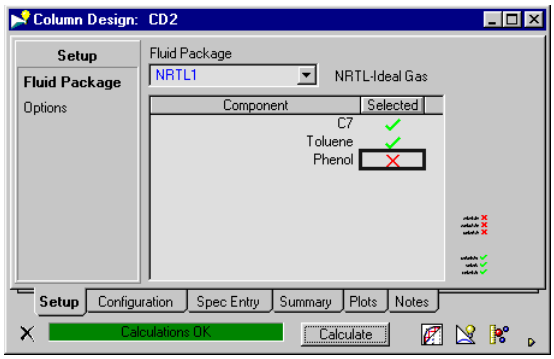
The Setup tab is divided into two pages: Fluid Package and Options.

Fluid Package Page

The Fluid Package page allows you to select the fluid package and the components of the feed stream entering the column.

Only two or three components can be in the feed stream at any time. If you have more than three components in the fluid package, you will have to deselect the remaining components.

Figure 4.5



The following table lists and describes the objects available in the Fluid Package page:

Object	Icon	Description
Fluid Package drop-down list		Allows you to select the fluid package for the feed stream.
Component column		Displays all the components in the selected fluid package.
Selected column	✓ ✗	Allows you to toggle the selection status of the components by clicking the icon in the column. • A green checkmark indicates that the component is selected. • A red cross indicates that the component is not selected.

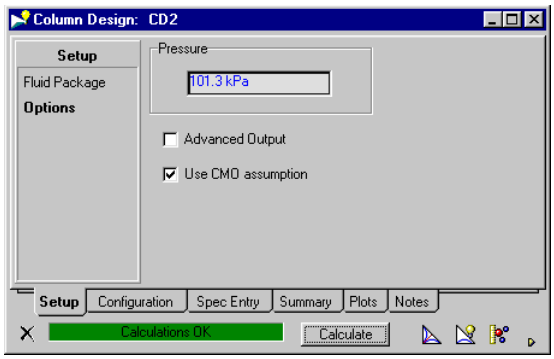
You can only select up to three components.

Object	Icon	Description
Unselect All Components icon		Allows you to deselect all the components in the fluid package.
Select All Components icon		Allows you to select all the components in the fluid package.

Options Page

The Options page allows you to specify the pressure of the column, composition basis type, and calculation assumptions.

Figure 4.6



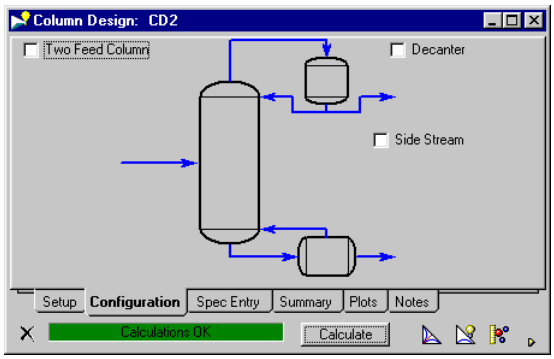
The following table lists and describes the objects available in the Options page:

Object	Description
Pressure field	Allows you to specify the pressure for the column.
Advanced Output checkbox	When you check this checkbox, the Advanced tab appears between the Plots and Notes tabs.
Use CMO assumption checkbox	When you check this checkbox, all profile calculations will assume Constant Molar Flow (no energy balances on stages). When unchecked, the flows on each stage will be calculated from the energy balance. This is more rigorous but also more time-consuming, and requires very accurate enthalpy and heat of mixing calculations.

4.2.2 Configuration Tab

The Configuration tab allows you to manipulate the configuration of the column.

Figure 4.7



You can change the design of the column by checking or unchecking the three checkboxes in the Configuration tab:

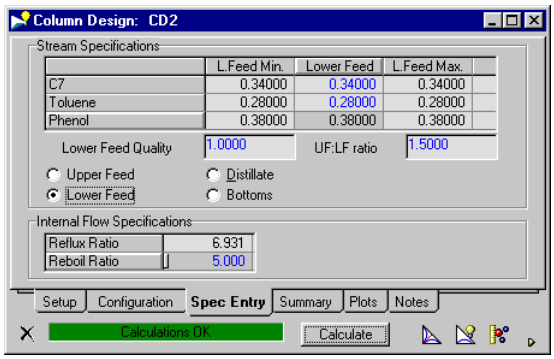
- **Two Feed Column**. Checking this checkbox changes the column from a single feed to a two feed column.
- **Decanter**. Checking this checkbox changes the condenser at the top of the column to a decanter.
- **Side Stream**. Checking this checkbox adds a side stream to the column. You can also place the side stream above or below the feed tray by using the radio buttons that appear when the Side Stream checkbox is checked.

Depending on which checkbox is checked, the column design figure in the Configuration tab will change to match the checked checkbox(es).

4.2.3 Spec Entry Tab

The Spec Entry tab allows you to specify the composition of the feed stream(s), product streams, and reflux ratio or reboil ratio.

Figure 4.8



The objects in the Stream Specifications group vary depending on the settings on the Configuration tab.

The following table lists and describes all possible objects available in the Spec Entry tab:

Object	Description
Stream Specifications table	Allows you to specify the selected stream composition. The selected stream values are related to the selected radio button.
(Upper/Lower) Feed Quality field	Allows you to specify the quality of the selected feed stream.
UF:LF ratio field	Allows you to specify the feed ratio between the upper and lower feed. Available only for two feed column configurations.
Feed radio button	Allows you to select the feed stream for specification. Available only for single feed column configurations.
Upper Feed radio button	Allows you to select the upper feed stream for specification. Available only for two feed column configurations.
Lower Feed radio button	Allows you to select the lower feed stream for specification. Available only for two feed column configurations.
Distillate radio button	Allows you to select the distillate product stream for specification. Available only for condensers.
Top Vapour radio button	Allows you to select the top vapour product stream for specification. Available only for decanters.
Bottoms radio button	Allows you to select the bottom product stream for specification.
Side Stream radio button	Allows you to select the side stream for specification. Available only for side stream column configurations.

There are two ways to select a tray for the side stream:

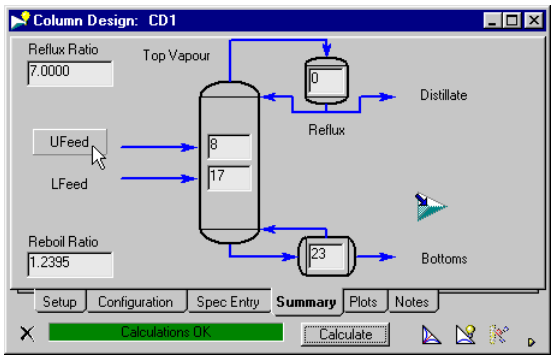
- Double-click the tray number you want from the Feasible Side Stream list.
- Enter the tray number in the Selected Side Stage field.

Object	Description
Selected Side Stage field	Displays the selected tray number for the side stream.
Feasible Side Streams list	Displays all the possible trays for the side stream. The side streams are feasible only from a mass balance perspective.
Reflux Ratio field	Allows you to specify the reflux ratio of the column, if you have not specified the reboil ratio.
Reboil Ratio field	Allows you to specify the reboil ratio of the column, if you have not specified the reflux ratio.

4.2.4 Summary Tab

The Summary tab displays the reflux ratio, reboil ratio, total number of trays in the column, tray number where the streams enter and exit the column, and summary information for all the streams.

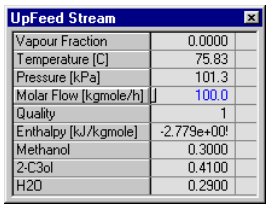
Figure 4.9



To view summary information for the streams:

1. Move the mouse cursor over the text/name of the stream. The text/name of the stream becomes a button (see the above figure).
2. Click the button. The information summary view of the selected stream appears.

For example, the figure below is the summary view of the UpFeed stream.



Most of the values displayed in the information summary view of the streams cannot be modified. Non-modifiable values are indicated by black text.

The text in the Molar Flow cell of the feed streams is usually blue. This indicates that you can specify the flow rate of the feed streams.

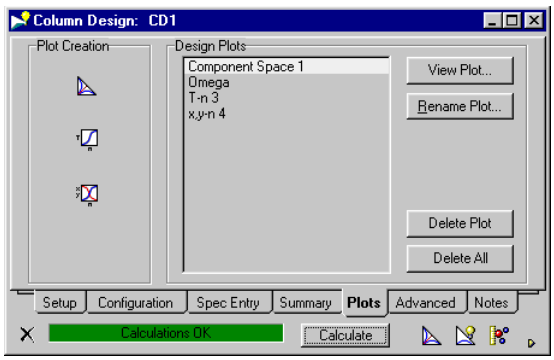
Simulate icon

Once the status bar in the Column Design view displays Calculations OK, the Summary tab will contain the Simulate icon. The Simulate icon allows you to take the entire Column Design operation from DISTIL to HYSYS to perform a more rigorous simulation of the separation. Refer to **Section 4.3 - Simulating in HYSYS** for more information.

4.2.5 Plots Tab

The Plots tab allows you to access all the plots available in the Column Design operation.

Figure 4.10



The following table lists and describes the objects available in the Plots tab:

For more information about the TCS view, see **Section 2.3 - Ternary Composition Space**.

Object	Icon	Description
Create Component Space Plot icon		Allows you to create a Ternary Composition Space view, which is based on the specified fluid package, three components, and pressure. Available only when three components are selected.
Create McCabe-Thiele Plot icon		Allows you to create a McCabe-Thiele Plot view based on the specified fluid package, two components, and pressure. Available only when two components are selected.

The Temperature vs. Stage and Component vs. Stage plots appear empty if the status bar of the Column Design does not display Calculations Ok.

Object	Icon	Description
Create Temperature vs. Stage Plot icon		Allows you to create a temperature vs. stage plot of the column.
Create Component vs. Stage Plot icon		Allows you to create a component vs. stage plot of the column.
Design Plots list		Displays all the plots that have been created in the current Column Design operation.
View Plot button		Allows you to open the plot selected in the Design Plots list.
Rename Plot button		Allows you to rename the selected plot view. To rename a plot view, select the plot you want to rename from the Design Plots list, click the Rename Plot button, and enter the new name in the New Name field.
Delete Plot button		Allows you to delete the selected plot view. To delete a plot view, select the plot you want to delete from the Design Plots list, and click the Delete Plot button or press the **DELETE** key.
Delete All button		Allows you to delete all the plots in the Design Plots list.

Delete icon

If the Column Design operation cannot find a feasible column, DISTIL recommends you check the column separation profiles on the composition plot of the TCS view:

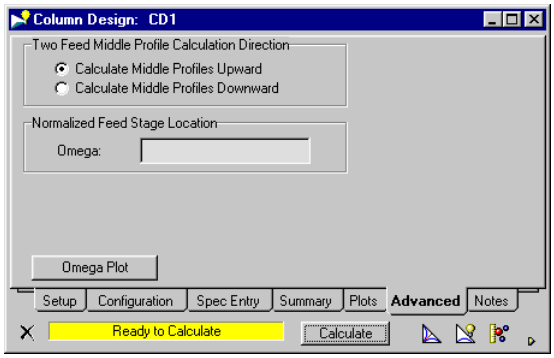
- Examine the product composition points. If the points are not all in the same distillation region, the profiles will never cross. Re-specify the compositions so that the Distillate and Bottoms are in the same distillation region.
- The Reflux and Reboil ratios affect the column profiles significantly. Generally, a higher reflux ratio will expand the rectifying curve; a higher reboil ratio will expand the stripping curve.
- You can usually expand the rectifying or stripping profiles by moving the distillate or bottoms point closer to a boundary on the composition diagram.
- If you have specified a feed that is very close to a boundary on the composition diagram, it may be very difficult to obtain a solution, as the triangle formed by joining the distillate, bottoms and side stream composition points must enclose the feed point.
- Selecting a different side stream composition will move one corner of the triangle that joins the distillate, bottoms and side stream composition points. You could expand the triangle (possibly resulting in a feasible column) by making a more feasible choice for the sidestream stage.

4.2.6 Advanced Tab

The Advanced tab is available only if the Advanced Output checkbox (Setup tab, Options page) is checked.

The Advanced tab allows you to manipulate the calculations in the Omega method. For more information, refer to the **Omega Method** section in **Section 4.3.1 - Background** of the **Reference Guide**.

Figure 4.11



The following table lists and describes the objects available in the Advanced tab:

DISTIL determines the optimum feed position automatically, however, you can change the feed position by entering the new feed tray number in the Omega field.

Object	Description
Calculate Middle Profiles Upward/Downward radio buttons	Allows you to calculate the middle profile upwards or downwards for a two-feed column to adjust for sensitivities within this profile that can make it more difficult to find a feasible solution.
Omega field	Displays the optimal or user-specified omega value, which corresponds to the feed tray number where the feed stream(s) enter the column.
Omega Plot button	Allows you access to the Omega Composition Space view. This view contains the number of stages at each section and total as a function of omega.

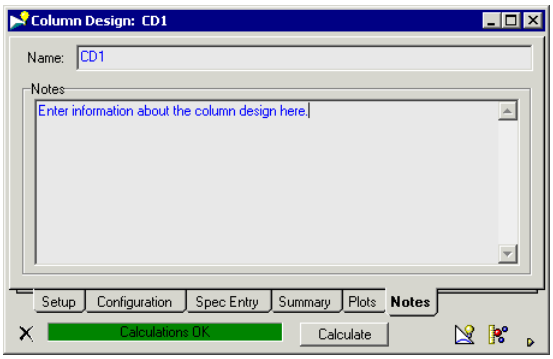
4.2.7 Notes Tab

The Notes tab allows you to:

- Change the name of the Column Design operation by entering a new name in the **Name** field.
- Enter information regarding the Column Design operation in the **Notes** text editor.

Any changes made to the information in the Notes text editor, will appear in the text editor located at the bottom of the Azeotropic Separation Manager view when the Show Notes button has been clicked.

Figure 4.12



4.3 Simulating in HYSYS

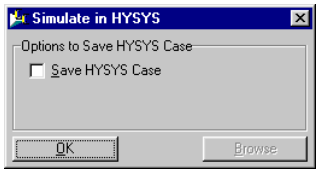
Once a column has been designed (the status bar displays Calculations OK with a green background), it can be rigorously simulated in HYSYS.

To simulate a column in HYSYS:

1. Open the Column Design property view of an operation instance with a complete column design.
2. Click the **Summary** tab.
3. Click the **Simulate** icon.
4. The Simulate in HYSYS view will appear.

Simulate icon

Figure 4.13

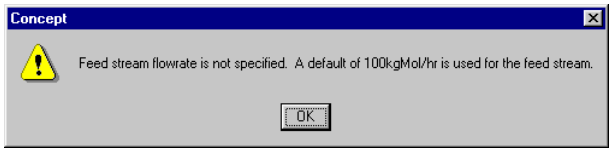


5. Do one of the following:
   - Check the **Save HYSYS Case** checkbox, then click the **OK** button to simulate and automatically save the column design in HYSYS.
   - Click the **OK** button to simulate the column in HYSYS without automatically saving the design.

The Simulate in HYSYS view will appear only after you click the OK button in the warning view.

If the Feed stream flow rate has not been specified, a warning message will appear after you click the Simulate icon. This message notifies you of the default feed stream flow rate value that will be used in HYSYS. Click the OK button. The Simulate in HYSYS view appears.

Figure 4.14

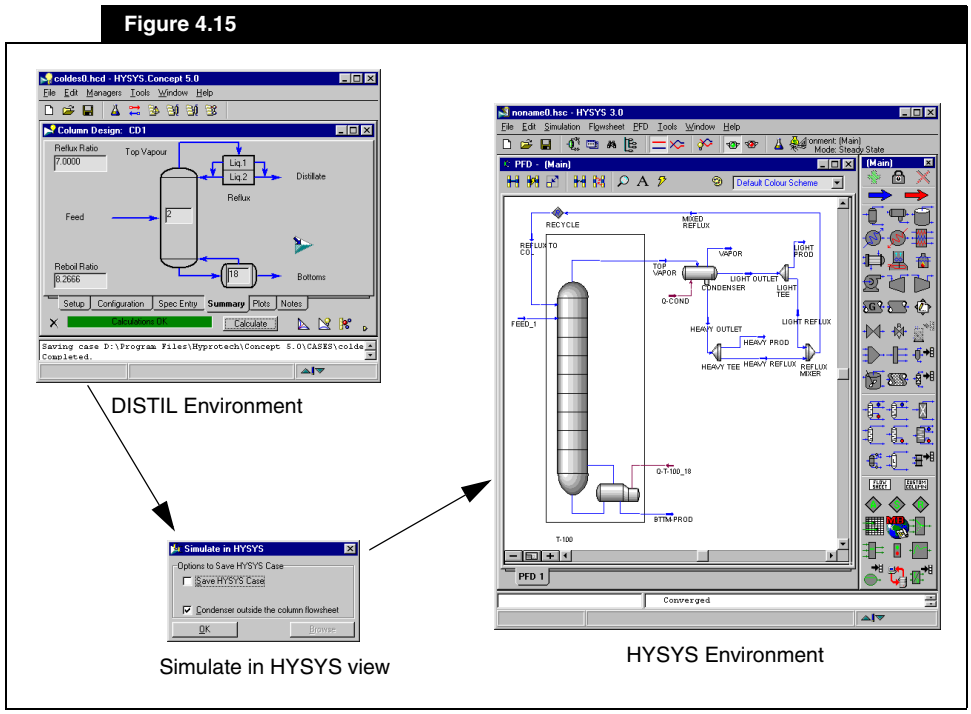


The Simulate in HYSYS view contains two options, which are explained in the following sections.

4.3.1 Simulate in HYSYS & Manually Save the Case

On the Simulate in HYSYS view, if you click the OK button without checking the Save HYSYS Case checkbox, DISTIL will simply simulate the column in HYSYS. This means that HYSYS will start, if not already running, and the column will then be simulated. The case name in HYSYS will be [noname0.hsc] until you save it under another name. The general process appears in the figure below.

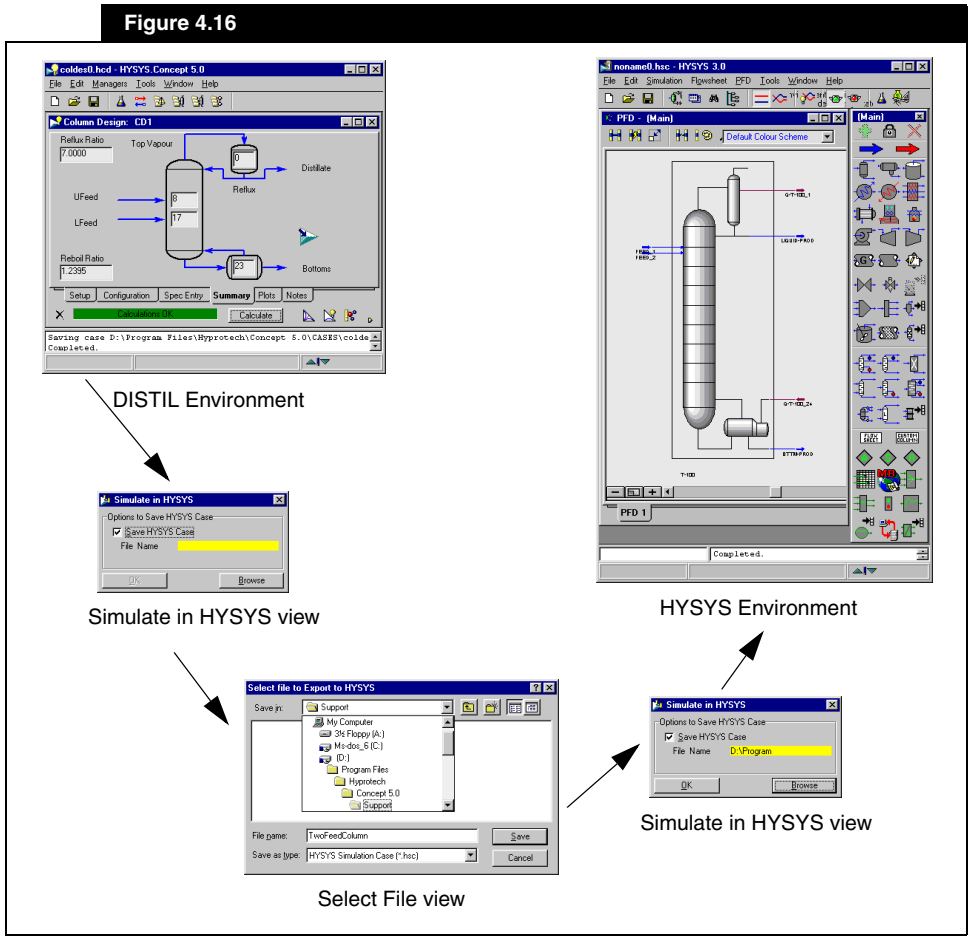
Figure 4.15



4.3.2 Simulate in HYSYS & Automatically Save the Case

If you checked the Save HYSYS Case checkbox on the Simulate in HYSYS view, DISTIL will allow you to specify the HYSYS case name along with its file path before entering the HYSYS environment. Once the case name and the file path are specified, clicking the OK button will start HYSYS, if it is not already running, and the column will be simulated. The case name in HYSYS and the file path will be the same as the ones you specified in the Select File view. The general process appears in the figure below.

Figure 4.16



4.3.3 HYSYS and DISTIL Column Parameters

In order to start a column simulation in the HYSYS environment, DISTIL first transmits fluid package, column, tray and stream parameters to HYSYS, as listed in the following table:

Fluid Package	Column	Trays	Streams
Components	**Reflux** Ratio (if specified)	Temperature	**Feed** Temperature
Property Package	**Reboil** Ratio (if specified)	Vapour Composition	**Feed** Composition
	Total Number of Stage	Liquid Composition	**Feed** Pressure
	Feed(s) tray location		**Draw** flowrate if no Decanter
	Side Stream tray location		Decanter **Top Vapour** flowrate
			Decanter **Bottom** flowrate
			Side Stream flowrate

Because the profiles calculated in DISTIL are used as the initial estimates, convergence of the rigorous simulation will occur over very few iterations. This is especially important for azeotropic and extraction designs, and columns with a decanter. For other parameters needed for the simulation, HYSYS default values are used.

If the binary parameters have been modified in the property package used in DISTIL, these parameters will not be transmitted to the HYSYS simulation. Only the default binary coefficients of the property package will be used to simulate the column.

The Sparse Continuation solving method is automatically selected when simulating a column in HYSYS. This is an equation based solver. It supports two liquid phases on the trays and its main use is for solving highly non-ideal chemical systems such as azeotropic mixtures.

5 Distillation Region Diagram

5.1 Introduction

Distillation Region Diagrams (DRD) are semi-qualitative sketches of distillation boundaries, based only on pure component, azeotrope boiling-point data and approximate azeotrope compositions, without the use of a thermodynamic model.

The true utility of the DRD operation is in identifying the number of distillation regions, and the likely products that can be taken from a column when thermodynamic data is nonexistent or unreliable.

DRD operation allows you to enter the boiling temperatures for three pure components, as well as up to three binary azeotropes and one ternary azeotrope. Each of the three binary azeotropes is between a different pair of components.

In order to sketch a DRD, it requires that you input the following:

- Pure component boiling temperatures
- Ternary azeotropic compositions and boiling temperatures

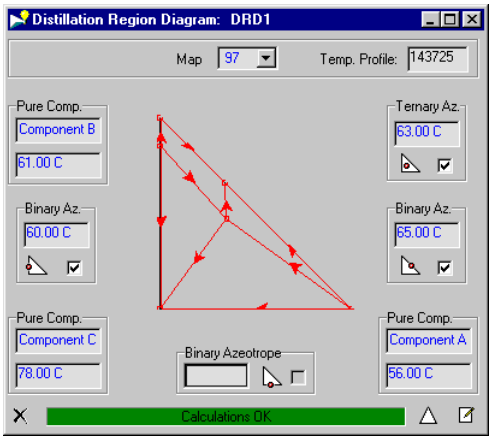
5.2 Distillation Region Diagram View

To access previously created Azeotrope Analysis operation, refer to **Section 1.2.2 - Editing an Operation**.

To create a Distillation Region Diagram operation view, do one of the following:

- From the **Features** menu, select **Distillation Region Diagram**.
- From the **Managers** menu, select **Azeotropic Separation Manager**. The manager view appears. In the left list, select **Distillation Region Diagram**, then click the **Add** button.

Figure 5.1



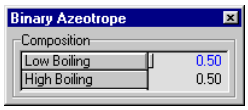
The following table lists and describes all the objects available in the DRD view:

For more information, refer to **Section 2.4.1 - Temperature Profile** of the **Reference Guide**.

Object	Description
Map drop-down list	Displays a map number used as a quick reference number to the type of distillation region diagram that has been constructed. The map number correspond to the number found in pages 13-59 to 13-64 of the Perry's Chemical Engineers' Handbook (7th edition)[108].
Temp. Profile field	Displays the temperature profile sequence of the constructed DRD.
Pure Comp. fields (top left)	The first field allows you to specify the name of the pure component that has the intermediate boiling point (bp) temperature, which is the bp temperature between the highest bp temperature and the lowest bp temperature for all three pure components. The second field allows you to specify the intermediate bp temperature value.

Edit Binary Azeotrope Composition icon (left)

Edit Binary Azeotrope Composition icon (bottom)

Object	Description
Binary Az. field (left)	Allows you to enter the bp temperature of the binary azeotrope occurring between the intermediate bp pure component and highest bp pure component.
Edit Binary Azeotrope Composition icon (left)	Allows you to access the Binary Azeotrope view.  This view allows you to specify the binary azeotrope's composition. After you specify the value for one component, the other value is automatically calculated so the sum equals 1.
Use Binary Azeotrope checkbox (left)	Allows you to toggle between adding and removing the binary azeotrope to the distillation region diagram.
Pure Comp. field (bottom left)	The first field allows you to specify the name of the pure component that has the highest boiling point (bp) temperature of all three pure components. The second field allows you to specify the highest bp temperature value.
Binary Az. field (bottom)	Allows you to enter the bp temperature of the binary azeotrope occurring between the highest bp pure component and the lowest bp pure component.
Edit Binary Azeotrope Composition icon (bottom)	Allows you to access the Binary Azeotrope view.  This view allows you to specify the binary azeotrope's composition. After you specify the value for one component, the other value is automatically calculated to equal 1.
Use Binary Azeotrope checkbox (bottom)	Allows you to toggle between adding and removing the binary azeotrope to the distillation region diagram.
Pure Comp. fields (bottom right)	The first field allows you to specify the name of the pure component that has the lowest boiling point (bp) temperature of all three pure components. The second field allows you to specify the lowest bp temperature value.
Binary Az. field (right)	Allows you to enter the bp temperature of the binary azeotrope occurring between the intermediate bp pure component and the lowest bp pure component.

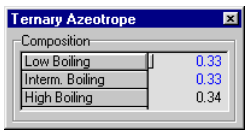
Edit Binary Azeotrope Composition icon (right)

Edit Ternary Azeotrope Composition icon

Delete icon

Changes to Equilateral/Right Angled Triangle icon

View DRD Notes icon

Object	Description
Edit Binary Azeotrope Composition icon (right)	Allows you to access the Binary Azeotrope view.  This view allows you to specify the binary azeotrope's composition. When you specify the value for one component, the other value is automatically calculated so the sum equals 1.
Use Binary Azeotrope checkbox (right)	Allows you to toggle between adding and removing the binary azeotrope on the distillation region diagram.
Ternary Az. field	Allows you to enter the bp temperature of the ternary azeotrope.
Edit Ternary Azeotrope Composition icon	Allows you to access the Ternary Azeotrope view.  This view allows you to specify the ternary azeotrope's composition. After you specify the value for two components, the third component's composition value is automatically calculated so the sum equals 1.
Use Ternary Azeotrope checkbox	Allows you to toggle between adding and removing the ternary azeotrope to the distillation region diagram.
Delete icon	Allows you to delete the current DRD operation.
Status bar	Displays the status of the current DRD operation.
Changes to (Right-Angled/Equilateral) Triangle icon	Allows you to toggle the distillation region diagram appearance between a right-angled triangle plot or an equilateral triangle plot.
View DRD Notes icon	Allows you to access the Notes for Distillation Region Diagram view. Refer to **Section 5.2.1 - View Notes for Distillation Region Diagram**for more information.

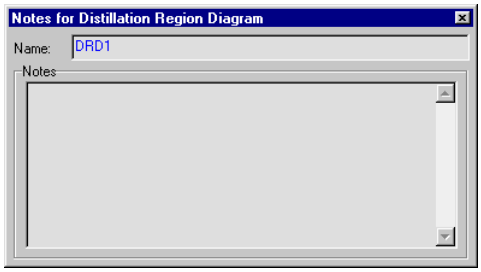
5.2.1 View Notes for Distillation Region Diagram

The Notes for Distillation Region Diagram view allows you to:

- Change the name of the DRD operation by entering a new name in the **Name** field.
- Enter information regarding the DRD operation in the **Notes** text editor.

Any changes made to the information in the Notes text editor will appear in the text editor located at the bottom of the Azeotropic Separation Manager view when the Show Notes button has been clicked.

Figure 5.2



6 Residue Curve Map

6.1 Introduction

The Residue Curve Map (RCM) gives you a broad view of the component space, which provides insight into the nature of the mixture you are manipulating.

DISTIL has a rigorous algorithm that can accurately calculate all of the azeotropes in a multi-component system (predicted by the property package and interaction parameters), so you can interpret these results and make general conclusions regarding the behaviour of the system.

The fundamental functions of the RCM operation include calculations of azeotropes, residue curves, and distillation boundaries. The results of these calculations can help identify trends, potential problems, and assist you in forming a strategy for solving your design task. The ability to predict azeotropes and view the component space can also enhance experimental programs by suggesting critical regions in the composition space for measuring data.

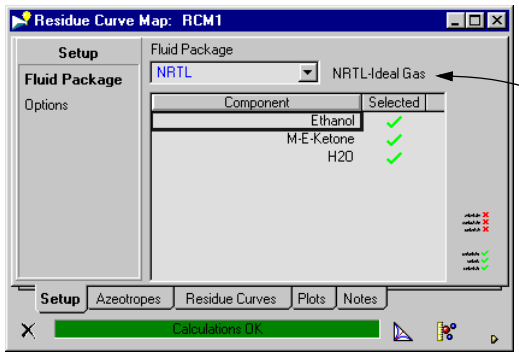
6.2 Residue Curve Map View

To access previously created RCM operation, refer to **Section 1.2.2 - Editing an Operation**.

To create a Residue Curve Map operation:

- From the **Features** menu, select **Residue Curve Map**.
- From the **Managers** menu, select **Azeotropic Separation Manager**. The manager view appears. From the left list, select **ResidueCurveMap**, then click the **Add** button.

Figure 6.1



The tabs that appear depend on how many components you select on the Fluid Package page, and whether or not you check the Calculate Azeotropes checkbox on the Options page.

The RCM view contains three to five tabs, a status bar, and several objects at the bottom of the view. The following table lists and describes the objects in the RCM view:


Delete icon


Creates RCM Plot icon


View RCM Plot icon

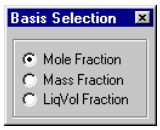

Opens Current Page in Separate Window icon

Object	Description
Delete icon	Allows you to delete the current RCM operation
Status bar	Displays the status of the current RCM operation.
Creates RCM Plot icon	Allows you to create an RCM plot based on the selected fluid package and three components. Appears only when you select three components on the Setup tab. For more information, see **Section 6.2.4 - Plots Tab**.
View RCM Plot icon	Allows you to create an RCM plot based on the selected fluid package and four components. Appears only when you select four components on the Setup tab.
Molar/Mass/Volume Fraction Basis icon	Allows you to access the Basis Selection view. See the **Basis Selection View** section for more information. Depending on the current composition basis selected, one of three fraction basis icons will appear at the bottom of the operation view.
Opens Current Page in Separate Window icon	Allows you to open the active tab as a separate view.

Basis Selection View

The Basis Selection view allows you to change the composition basis type displayed in the RCM view.

Figure 6.2




Molar Fraction Basis icon


Mass Fraction Basis icon


Volume Faction Basis icon

To change the composition basis using the Basis Selection view:

1. Click on the **Molar/Mass/Volume Fraction Basis** icon to open the Basis Selection view.
2. Use the radio buttons to select the composition basis you want to display in the RCM view.
3. Click the **Close** icon when you are done.

The following sections describe each tab in the Residue Curve Map view in detail.

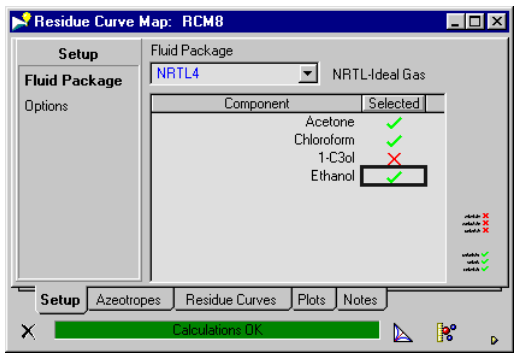
6.2.1 Setup Tab

The Setup tab is divided into two pages: Fluid Package and Options. The Setup tab allows you to manipulate the basic information required to generate an Residue Curve Map plot.

Fluid Package Page

The Fluid Package page allows you to select the fluid package and components you want to analyze.

Figure 6.3



The following table lists and describes the objects available in the Fluid Package page:

Object	Icon	Description
Fluid Package drop-down list		Allows you to select the fluid package you want for the RCM plot.
Component column		Displays all the components in the selected fluid package.
Selected column	✓ ✗	Allows you to toggle the selection status of the components by clicking the on icon in the column. • A green checkmark indicates that the component is selected. • A red cross indicates that the component is not selected.

You can select up to four components.

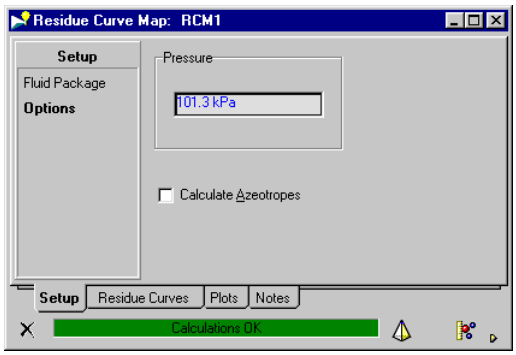
After you select three or four components, the Plots tab appears.

Object	Icon	Description
Unselect All Components icon		Allows you to deselect all the components in the fluid package.
Select All Components icon		Allows you to select all the components in the fluid package.

Options Page

The Options page allows you to specify the pressure value for the Residue Curve Map plot and the composition basis displayed in the RCM view. You can also indicate whether or not you want to calculate the azeotropes of the mixture.

Figure 6.4



The following table lists and describes the objects available in the Options page:

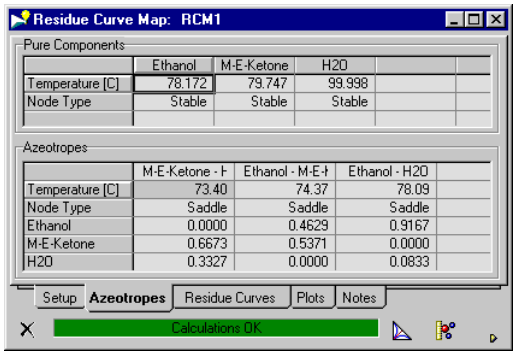
Object	Description
Pressure field	Allows you to specify the pressure for the RCM plot.
Calculate Azeotropes checkbox	Allows you to toggle between calculating or not calculating azeotropes for the selected components. • Check the **Calculate Azeotropes** checkbox to calculate azeotropes. • Uncheck the **Calculate Azeotropes** checkbox to skip calculation of azeotropes.

6.2.2 Azeotropes Tab

The Azeotropes tab is only available if the Calculate Azeotropes checkbox is checked (Setup tab, Options page).

The Azeotropes tab displays azeotropes and pure components found in the selected components mixture in a table format.

Figure 6.5



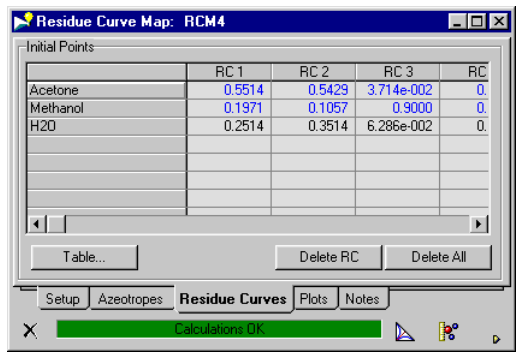
The text in the tables are black, indicating that the values in the tables are calculated and cannot be changed.

The calculated azeotropic compositions and temperatures depend on the selected thermodynamic model and its interaction parameters.

6.2.3 Residue Curves Tab

The Residue Curves tab allows you to enter the composition of the mixture to generate a residue curve on the RCM plot.

Figure 6.6



The following table lists and describes the objects available in the Residue Curves tab:

Object	Description
Initial Points table	Allows you to specify the initial point of the residue curve you want to calculate and plot on the RCM plot. Plot functionality is available only for three and four component mixtures.
Table button	Allows you to open the Residue Curve Points view for the residue curve selected in the Initial Points table.
Delete RC button	Allows you to remove the selected residue curve from the RCM plot.
Delete All button	Allows you to remove all the residue curves from the RCM plot.

See the **Residue Curve Points View** section for more information.

Generating a Residue Curve

To generate a residue curve:

See **Section 6.2.1 - Setup Tab** for details about the required basic information.

1. Open the RCM view and enter the basic information on the Setup tab.
2. Click the **Residue Curves** tab.
3. Specify the initial point for the residue curve by entering the composition of the mixture at the initial point.
   DISTIL automatically names the residue curve ***RC n***, where ***n*** is an integer number that starts at **1** and increases with every residue curve added.
4. Repeat step #3 until you have entered all initial points for the residue curves required.
5. To see how the composition fraction and temperature varies along a residue curve, select the residue curve (by clicking on any cell under the residue curve column), then click the **Table** button.

For three-component mixtures, you can also generate residue curves by clicking anywhere in the RCM plot. See Section 6.2.4 - Plots Tab for more information.

Deleting a Residue Curve

To delete a residue curve:

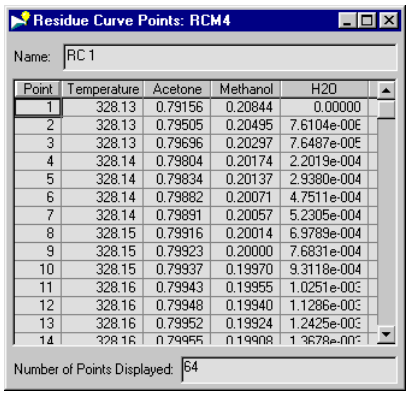
1. Open the Residue Curve Map view.
2. Click the **Residue Curves** tab.
3. Select the residue curve you want to delete by clicking on any cell in the residue curve column.
4. Click the **Delete** button.
   DISTIL will prompt you to confirm that you want to delete the selected residue curve.
5. Click the **Yes** button to delete the selected residue curve, or click the **No** button to keep the selected residue curve.

Residue Curve Points View

The text in the table are black, indicating that the values in the table are calculated and cannot be changed.

The Residue Curve Points view contains a table that displays compositions and temperatures of all points that constitute the residue curve.

Figure 6.7

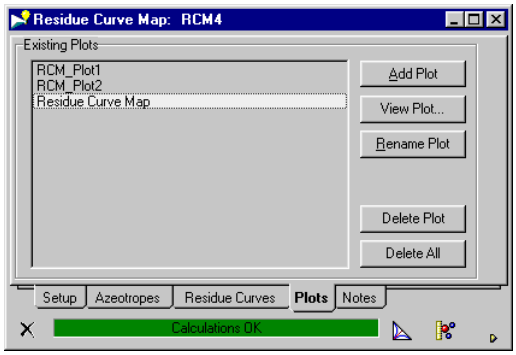


6.2.4 Plots Tab

The Plots tab is available only if you selected three or four components from the fluid package on the Setup tab.

The Plots tab allows you to create, delete, rename, and observe any of the Residue Curve Map plots you have created.

Figure 6.8



The following table lists and describes the objects available in the Plots tab:

You can also create an RCM plot by clicking the Create RCM Plot icon.

Object	Description
Existing Plots list	Displays all the RCM plots available in the current operation.
Add Plot button	Allows you to create an RCM plot. Refer to the **Adding an Residue Curve Map Plot** section for more information.
View Plot button	Allows you to access the RCM plot selected in the Existing Plots list. Refer to the **Editing the Residue Curve Map Plot** section for more information.
Rename Plot button	Allows you to rename the RCM plot selected in the Existing Plots list. Refer to the **Renaming the Residue Curve Map Plot** section for more information.
Delete Plot button	Allows you to delete the RCM plot selected in the Existing Plots list. Refer to the **Deleting the Residue Curve Map Plot** section for more information.
Delete All button	Allows you to delete all the existing RCM plots in the Existing Plots list.

Adding an Residue Curve Map Plot

To add an RCM plot:

See **Section 6.2.1 - Setup Tab** for details about the required basic information.

1. Open the RCM view and enter the basic information on the Setup tab.
2. Do one of the following:
   - Click the **Plots** tab, click the **Add Plot** button, and the RCM Plot view appears.
   - Click the **Create RCM Plot** icon, and the RCM Plot view appears.

Create RCM Plot icons

3. To add residue curve to the RCM plot, enter the initial composition point of the residue curve in the **Residue Curves** tab. Refer to **Section 6.2.3 - Residue Curves Tab** for more information.
   To manipulate the RCM plot refer to **Section 7.4 - Plot Area** and **Chapter 8 - Plot Properties** from the **User Guide**.
4. To close the RCM Plot view, click the **Close** icon  .

Editing the Residue Curve Map Plot

To edit an existing RCM plot:

1. Open the RCM view, then click the **Plots** tab.
2. From the Existing Plots list, select the RCM plot you want to edit.
3. Click the **View** button. The RCM Plot view appears.
4. Maximize the view.
5. To close the RCM Plot view after editing, click the **Close** icon.

Renaming the Residue Curve Map Plot

The RCM plot title will be the same as the name of the RCM plot unless specified otherwise on the Graph Control view.

To rename an existing RCM plot:

1. Open the RCM view, and go to the **Plots** tab.
2. Select the RCM plot you want from the Existing Plots list.
3. Click the **Rename Plot** button, the New Name view appears.
4. Enter the new name for the RCM plot in the New Name field, and press ENTER.
5. The New Name view automatically close, and the Existing Plots list displays the new name for the selected RCM plot.
   To exit the New Name view without changing the plot name, click the **Close** icon.

Close icon

Deleting the Residue Curve Map Plot

You can also delete the RCM plot by clicking the Delete icon on the RCM plot view.

Delete icon

To delete an existing RCM plot:

1. Open the RCM view, then click the **Plots** tab.
2. From the Existing Plots list, select the RCM plot you want to delete.
3. Do one of the following:
   - Click the **Delete** button.
   - Press the **DELETE** key.
     DISTIL will prompt you to confirm that you want to delete the selected RCM plot.
4. Click the **Yes** button to delete the selected plot, or click the **No** button to keep the selected plot.

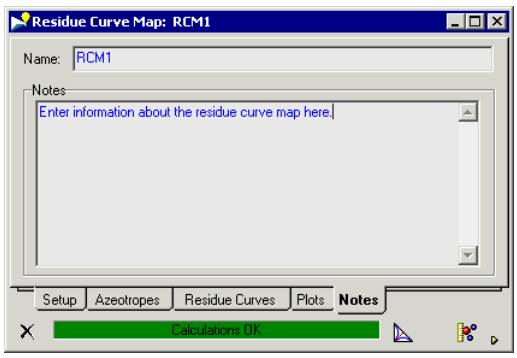
6.2.5 Notes Tab

The Notes tab allows you to:

- Change the name of the Residue Curve Map view by entering a new name in the **Name** field.
- Enter information regarding the Residue Curve Map operation in the **Notes** text editor.

Any changes made to the information in the Notes text editor will appear in the text editor located at the bottom of the Azeotropic Separation Manager view when the Show Notes button has been clicked.

Figure 6.9



7 Split Generator

7.1 Introduction

The Split Generator operation is used to recommend a feasible separation split for a multi-component mixture using a simple distillation column with one feed and two products, a condenser, and a reboiler. While this is a fairly straight forward exercise for a relatively ideal mixture, the information obtained using this feature can be very useful for highly non-ideal and azeotropic mixtures.

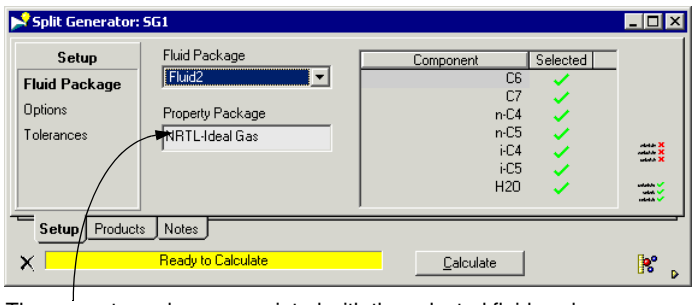
7.2 Split Generator View

To access previously created Azeotrope Analysis operation, refer to **Section 1.2.2 - Editing an Operation**.

There are two ways to create a Split Generator operation:

- From the **Features** menu, select **Split**.
- From the **Managers** menu, select **Azeotropic Separation Manager**. The manager view appears. In the list on the left, select **SplitGenerator**, then click the **Add** button.

Figure 7.1



The property package associated with the selected fluid package appears here.

The Split Generator view contains three tabs and six objects at the bottom of the view. The following table lists and describes the objects available in the Split Generator view:

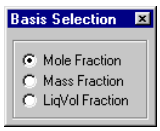
Object	Icon	Description
Delete icon		Allows you to delete the current Split Generator operation.
Status bar		Displays the status of the current Split Generator operation.
Calculate button		Allows you to activate the feasible split calculations.
() Fraction Basis icon		Allows you to access the Basis Selection view. Refer to the **Basis Selection View** section for more information.
Opens Current Page in Separate Window icon		Allows you to open the active tab as a separate view.

The Calculate button is available only after you have specified the fluid package, components, pressure, and feed stream composition.

Basis Selection View

The Basis Selection view allows you to change the composition basis fraction type displayed in the Split Generator view.

Figure 7.2



Molar Fraction Basis icon

Mass Fraction Basis icon

Volume Faction Basis icon

To change the composition basis using the Basis Selection view:

1. Click on the **Molar/Mass/Volume Fraction Basis** icon to open the Basis Selection view.
2. Use the radio button to select the composition basis you want to display in the Split Generator view.
   The fraction basis icon on the operation view changes according to your selection.
3. Click the **Close** icon  when you are done.

The following sections describe each tab in the Split Generator view in detail.

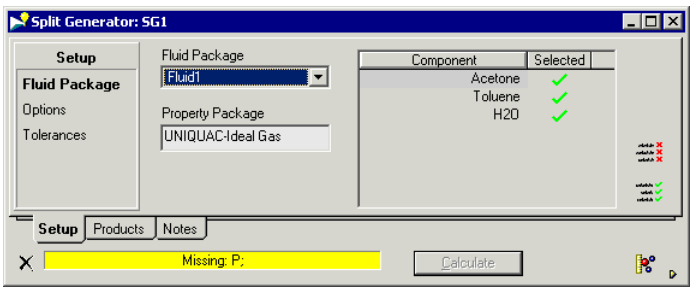
7.2.1 Setup Tab

The Setup tab is divided into three pages: Fluid Package, Options, and Tolerances.

Fluid Package Page

The Fluid Package page allows you to specify the fluid package and components in the feed stream.

Figure 7.3



The following table lists and describes the objects available in the Fluid Package page:

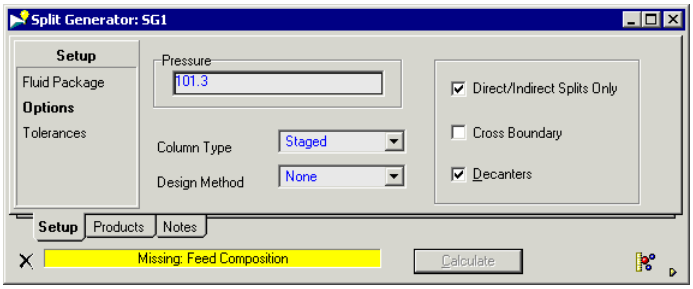
Object	Icon	Description
Fluid Package drop-down list		Allows you to select the fluid package you want to for the feed stream.
Property Package field		Displays the property package associated with the selected fluid package.
Component column		Displays all the components in the selected fluid package.
Selected column	✓ ✗	Allows you to toggle the selection status of the components by clicking the icon in the column. • A green checkmark indicates that the component is selected. • A red cross indicates that the component is not selected.

Object	Icon	Description
Unselect All Components icon		Allows you to deselect all the components in the fluid package.
Select All Components icon		Allows you to select all the components in the fluid package.

Options Page

The Options page allows you to specify the pressure for the column(s), column type, calculation method, and type of splits.

Figure 7.4



The following table lists and describes the objects available in the Options page:

Object	Description
Pressure field	Allows you to specify the pressure of the feed stream and feasible column(s).
Column Type drop-down list	Allows you to select which column type. There are two options available: Packed and Staged.
Design Method drop-down list	Allows you to select the feasible column calculation method. There are three methods to choose from: • **None**. When selected, DISTIL does not perform any feasible column calculations. • **Shortcut**. Refer to **Section 4.4.1 - Shortcut Method** of the **Reference Guide** for a description of this method. • **Geometric**. Refer to **Section 4.4.2 - Geometric Method** of the **Reference Guide** for a description of this method.
Direct/Indirect Split Only checkbox	Allows you to toggle between limiting the feasible columns to a direct/indirect split and allowing any possible feasible columns.

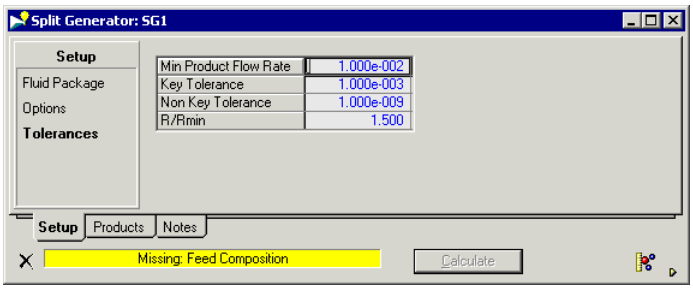
The Direct/Indirect Splits Only checkbox is automatically checked when the Geometric option is selected.

Object	Description
Cross Boundary checkbox	Allows you to toggle between attempting to cross curved boundaries and not in the feasible column calculations.
Decanters checkbox	Allows you to toggle between allowing and forbidding decanters in the feasible column(s).

Tolerances Page

The Tolerances page allows you to specify the tolerances in the feasible column calculations.

Figure 7.5



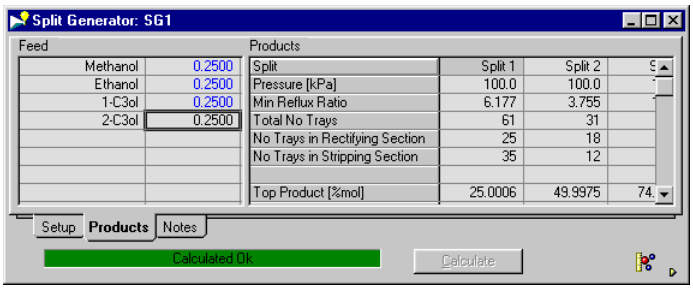
The following table lists and describes each tolerance variable you can manipulate in the Tolerances page:

Tolerance	Description
Min Product Flow Rate field	Allows you to specify the minimum amount of product flowing out of the column for all product streams.
Key Tolerance field	Allows you to specify the purity of the end products. The lower the value the purer the end products.
Non Key Tolerance field	Allows you to specify the purity of the non-key components in the end products. The lower the value, the purer the end products.
R/Rmin field	Allows you to specify the ratio between the operating reflux ratio and the minimum reflux ratio.

7.2.2 Products Tab

The Products tab allows you to specify the composition of the feed stream and observe the calculated feasible split results.

Figure 7.6



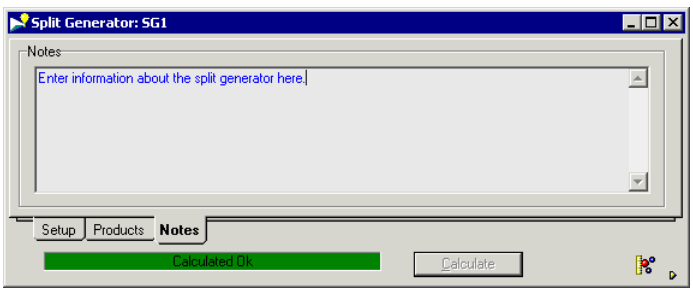
1. Enter the feed composition values in the **Feed** table.
   If you specify all the component fraction values except one, the fraction value for the remaining component will be automatically calculated so that the sum equals 1.
2. Click the **Calculate** button. The results appear in the **Products** table. The Products table appears empty if no feasible splits were found or if you have not clicked the **Calculate** button.

7.2.3 Notes Tab

Any changes made to the information in the Notes text editor will appear in the text editor located at the bottom of the Azeotropic Separation Manager view when the Show Notes button has been clicked.

The Notes tab allows you to store information regarding the Split Generator operation in the Notes text editor.

Figure 7.7



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