

**“The Flowsheet
Processor”**

LIMN USER WIZARD

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1. INTRODUCTION

When one is doing simulations with the same set of parameters it is easier to create a user-defined wizard. By editing the stream data sheets in the creation of the user wizard one does not have to edit the sheets once the wizard has run.

2. CREATING THE USER DEFINED WIZARD

2.1 Open a new Microsoft Excel workbook. Do not enter anything onto the sheets, make sure that they are all blank.

2.2 Click on the Limn: Wizards button. 

2.3 Select the 1D_Vertical Wizard. The 1_D Vertical Wizard will be used for this example however a user defined wizard can be created using any of the wizards.

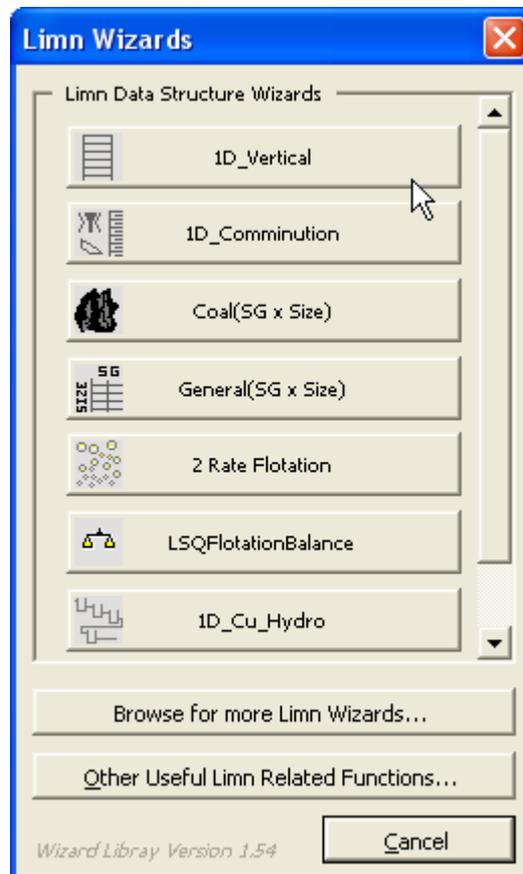


Figure 1: LIMN Wizards template

2.4 One will notice that the wizard only has 2 steps as opposed to the 6 steps when running the wizard with a complete flowsheet.

2.5 Click Next.

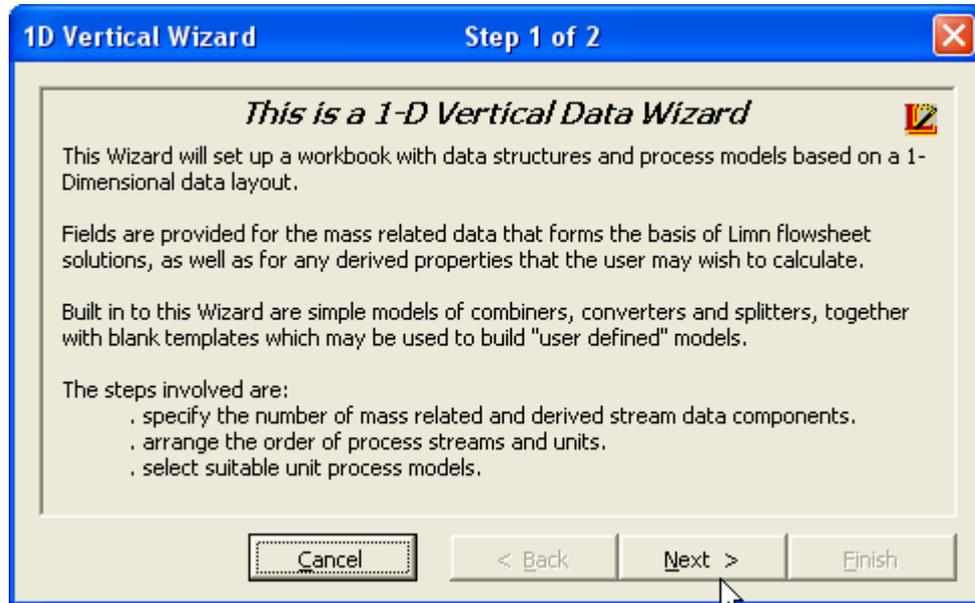


Figure 2: Step 1 of 2

2.6 Change the number of mass related components to 6 and the number of derived components to 3.

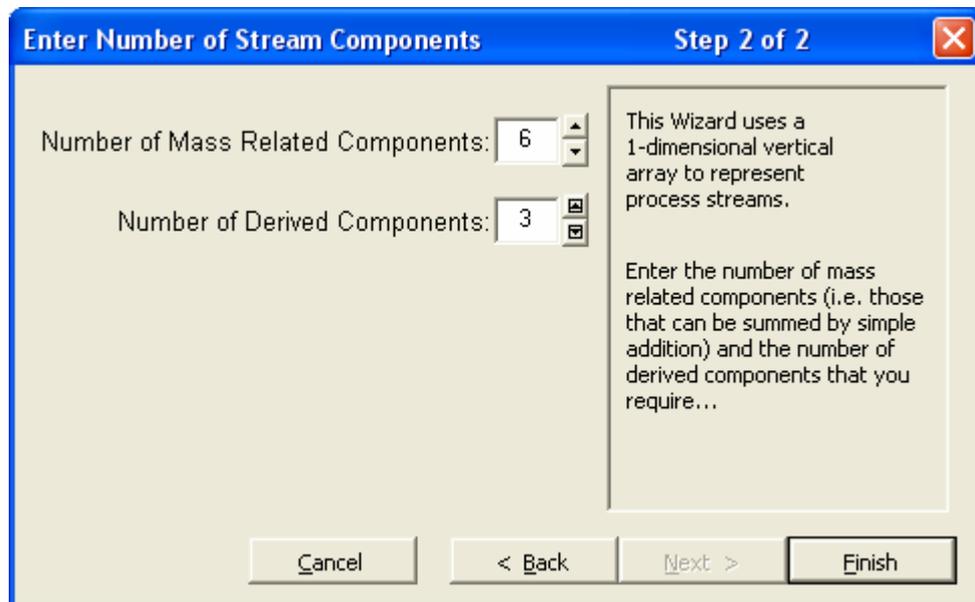


Figure 3: Step 2 of 2

2.7 Click on Finish.

2.8 The wizard will then prompt the user to save the wizard template. Click Yes.



Figure 4: Save Wizard prompt

2.9 Save the wizard as Wizard_1_My_1D_Wizard.xls. Make sure that the name is correct.

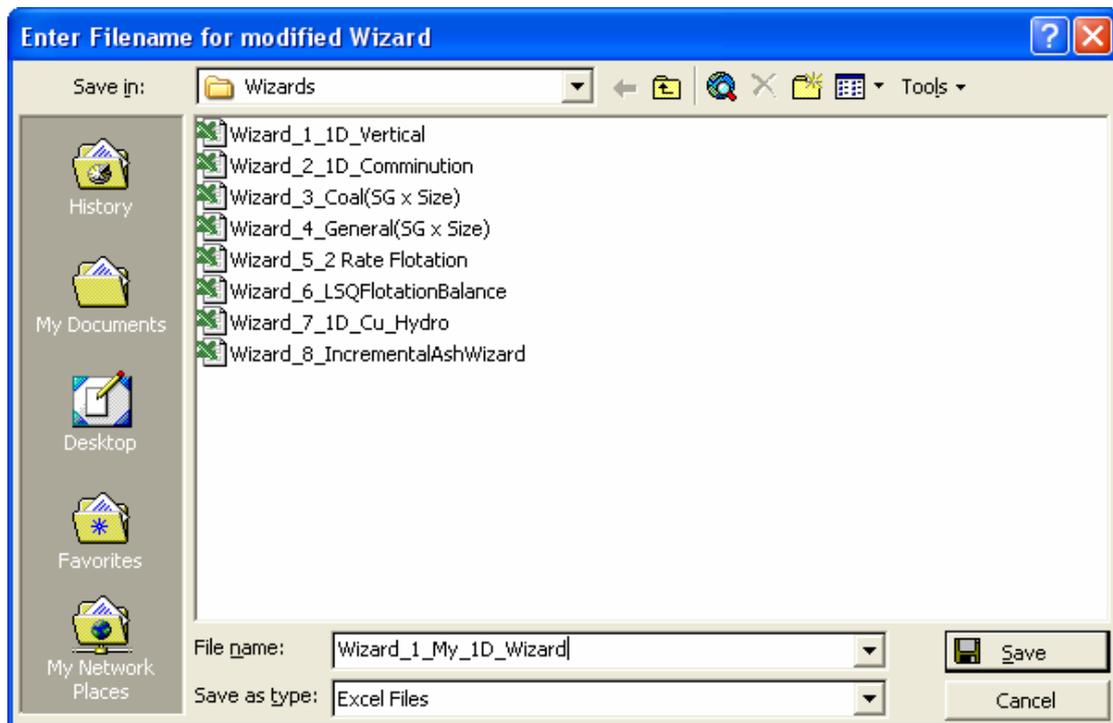


Figure 5: Save wizard

2.10 Close the Excel workbook.

3. CREATING AN ICON PICTURE FOR USER WIZARDS

Once a new user defined wizard has been created one can create an icon picture for the wizard.



3.1 Open Microsoft Paint.

3.2 To ensure that the icon picture is the right size one must specify the pixels. Click on the Image menu in Paint, select Attributes. Set the Width to 24 and the Height to 24. Make sure that Pixels and Colors are selected.



3.3 Use the paint drawing toolbar to reproduce the image in figure 6. Use the Large Size option for Zoom in the View toolbar.

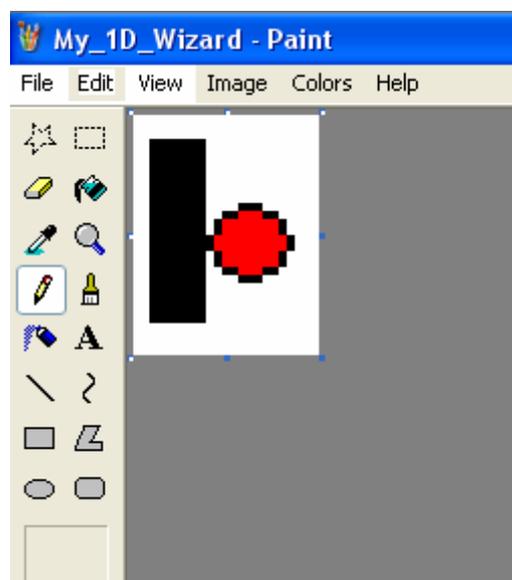


Figure 6: Wizard Icon Picture

- 3.4 Save the picture as a bitmap in the same folder as the LIMN user wizard, ie c:\LIMN Wizards. The icon picture name must be the same as the associated wizard file without the "Wizard_n_" prefix.
- 3.5 Save the bitmap as My_1D_Wizard.bmp. The icon picture file must have the same format as the wizard file or else LIMN will not assign the picture to the wizard.
- 3.6 Check the icon picture by clicking the Limn: Wizards button in Excel. 



Figure 7: My_1D_Wizard button

4. CONFIGURING THE WIZARD

4.1 Open the wizard Wizard_1_My_1D_Wizard.xls in the folder C: LIMN \ Wizards.

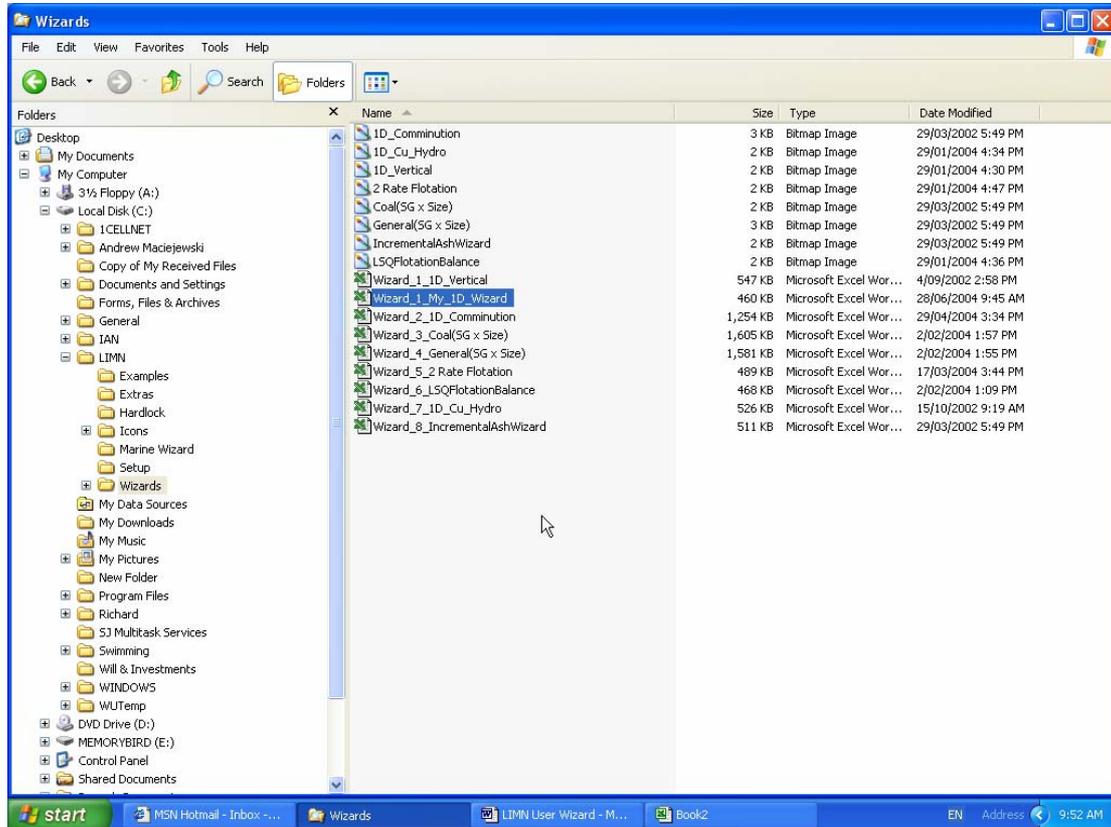


Figure 8: LIMN folder

4.2 Click on the Configuration Sheet. Enter the size fractions and Water in the Simulated Components column. Enter Total Solids, Total Flow and % solids in the Derived Components column, refer to figure 7 below.

	A	B	C	D	E	F
1						
2		Configuration Data				Created with Wizard : 1D_Generic
3						
4		<u>Property Definition</u>				
5						
6			Simulation Components			
7			20 mm			
8			15 mm			
9			10 mm			
10			5 mm			
11			0 mm			
12			Water			
13						
14			Derived Components			
15			Total Solids			
16			Total Flow			
17			% solids			
18						

Figure 9: Configuration Sheet

4.3 Click on the Stream_Data(Input) sheet. Enter the formula into the derived cells as per figure 8 below.

	A	B	C	D	E	F	G
1	Feed Stream Data Input						
2							
3				Stream Name			
4			20 mm				
5			15 mm				
6			10 mm				
7			5 mm				
8			0 mm				
9			Water				
10							
11			Total Solids	0.00			=sum(D4:D8)
12			Total Flow	0.00			=D9+D11
13			% solids	#DIV/0!			=D11/D12
14							
15							
16							
17							
18							

Figure 10: Stream_Data(Input) Sheet

4.4 Click on the Stream_Data sheet. Enter the formula into the derived cells as per figure 9 below.

	A	B	C	D	E	F	G
1	Stream Summary						
2							
3				Stream Name			
4			20 mm				
5			15 mm				
6			10 mm				
7			5 mm				
8			0 mm				
9			Water				
10							
11			Total Solids	0.00			=sum(D4:D8)
12			Total Flow	0.00			=D9+D11
13			% solids	#DIV/0!			=D11/D12
14							
15							
16							
17							
18							

Figure 11: Stream_Data sheet

4.5 Save the wizard workbook.

4.6 Close the workbook.

5. RUNNING THE USER WIZARD

5.1 Open the workbook with the example from the LIMN Data Wizard manual.

5.2 Clone the flowsheet as detailed in the 1_D Vertical manual.

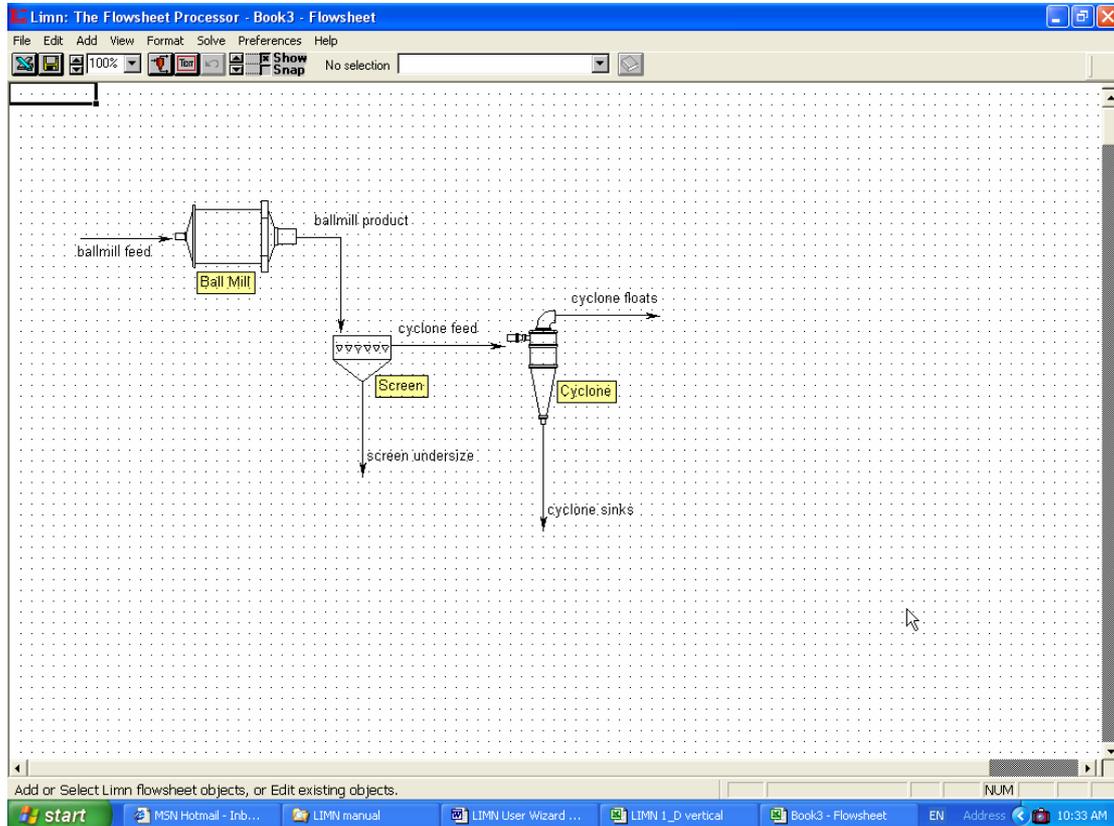


Figure 12: Limn Data wizard flowsheet

5.3 Save the workbook as LIMN User Wizard example.xls.

5.4 Click on the Limn: Wizards icon. 

5.5 Select the wizard that we have just created, i.e. My_1D_Wizard.



Figure 13: User Defined Wizard

- 5.6 One will notice that Step 2 of 6 has the mass related components and derived components as per the user defined wizard. We do not need to enter anything so click Next.

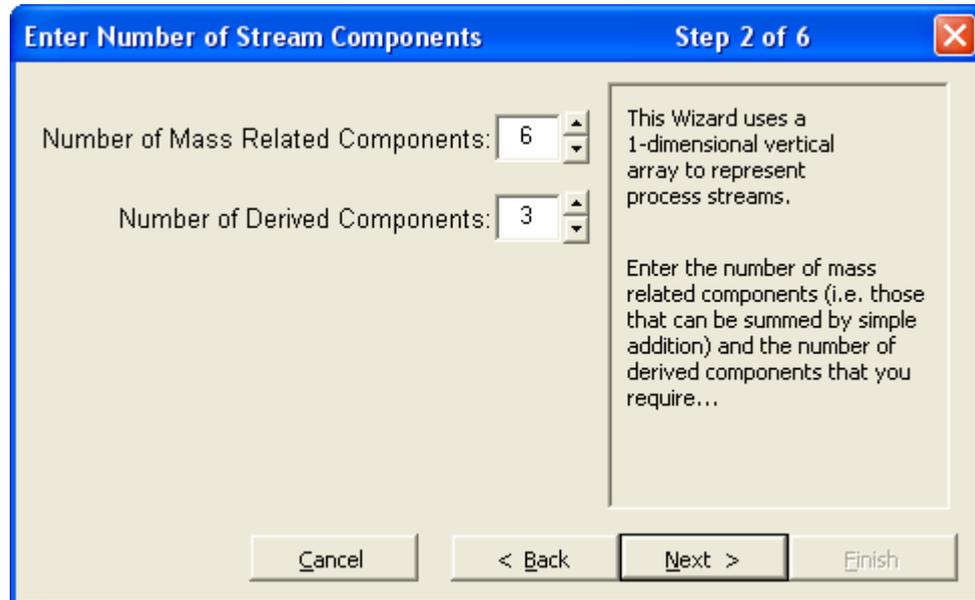


Figure 14: Step 2 of 6

- 5.7 Complete Step 3 of 6 and Step 4 of 6.

- 5.8 Select the models for the different unit operations as per figure 13 below.

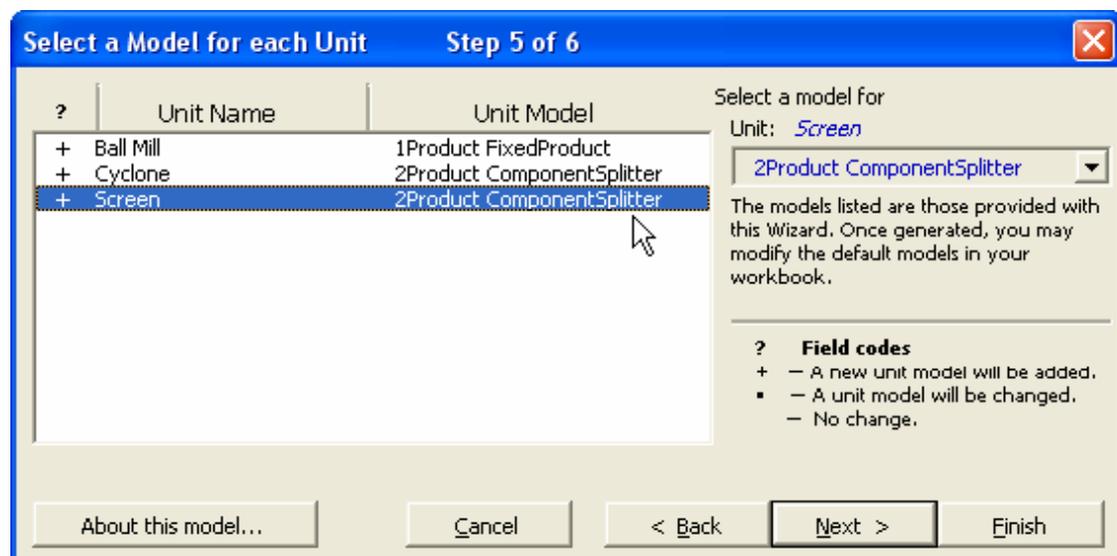


Figure 15: Step 5 of 6

- 5.9 Click Next.

- 5.10 For step 6 of 6 click Finish to complete the running of the wizard.

- 5.11 Save the workbook.

6. POPULATING THE WORKSHEETS

6.1 If one clicks on the Configuration sheet one will notice that the sheet has already been completed.

6.2 Click on the Stream_Data(Input) sheet. Input the % PSD of the ballmill feed stream, the total mass of ballmill feed and the total amount of water in the ballmill feed.

	A	B	C	E	F	G	H	I
1	Feed Stream Data Input							
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								

ballmill feed		%PSD	
20 mm	200.00	20 mm	40.00
15 mm	125.00	15 mm	25.00
10 mm	100.00	10 mm	20.00
5 mm	50.00	5 mm	10.00
0 mm	25.00	0 mm	5.00
Water	2,000.00	Water	
Total Solids	500.00	Total Solids	500.00
Total Flow	2,500.00		
% solids	20%		

Figure 16: Stream_Data(Input) sheet

6.3 If one clicks on the Stream_Data sheet one will notice that the formula for the Total Solids, Total Flow and % solids have been entered for the different streams.

6.4 Click on the Unit_Ball Mill sheet. Enter the required % PSD of the ballmill product as per figure 15 below. Make sure that the water passes straight through the ballmill by changing the formula in the ballmill product column.

	A	B	C	D	E	F	G
1	Model for Unit: Ball Mill						
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							

Model Parameters	
	Required % Product Component
20 mm	5.00
15 mm	10.00
10 mm	15.00
5 mm	20.00
0 mm	50.00
Water	

	Feed	ballmill product
20 mm	200.00	25.00
15 mm	125.00	50.00
10 mm	100.00	75.00
5 mm	50.00	100.00
0 mm	25.00	250.00
Water	2,000.00	2,000.00

Figure 17: Unit_Ball Mill sheet

6.5 Click on the Unit_Cyclone sheet. Enter the partition fractions for the split to the cyclone floats as per figure 16 below.

	A	B	C	D	E	F	G	
1								
2		Model for Unit: Cyclone						
3								
4				Partition Fractions				
5					Split to cyclone floats			
6				20 mm	0.95			
7				15 mm	0.95			
8				10 mm	0.95			
9				5 mm	0.95			
10				0 mm	0.95			
11				Water	0.70			
12								
13								
14			Feed		cyclone floats	cyclone sinks		
15		20 mm	25.00		23.75	1.25		
16		15 mm	50.00		47.50	2.50		
17		10 mm	75.00		71.25	3.75		
18		5 mm	100.00		95.00	5.00		
19		0 mm	50.00		47.50	2.50		
20		Water	200.00		140.00	60.00		
21								
22								

Figure 18: Unit_Cyclone sheet

6.6 Click on the Unit_Screen sheet. Enter the partition fractions for the split to cyclone feed as per figure 17 below.

	A	B	C	D	E	F	G	
1								
2		Model for Unit: Screen						
3								
4				Partition Fractions				
5					Split to cyclone feed			
6				20 mm	1.00			
7				15 mm	1.00			
8				10 mm	1.00			
9				5 mm	1.00			
10				0 mm	0.20			
11				Water	0.10			
12								
13								
14			Feed		cyclone feed	screen undersize		
15		20 mm	25.00		25.00	0.00		
16		15 mm	50.00		50.00	0.00		
17		10 mm	75.00		75.00	0.00		
18		5 mm	100.00		100.00	0.00		
19		0 mm	250.00		50.00	200.00		
20		Water	2,000.00		200.00	1,800.00		
21								
22								
23								

Figure 19: Unit_Screen sheet

6.7 Click on the Datablocks sheet. Click on the add datablocks adjacent to stream segment button.

6.8 Click on the flowsheet sheet.

6.9 Click on the Limn: Solve button. 

6.10 Click on Limn: Draw and position the datablocks as required. Go back to Excel mode and save the workbook.

6.11 Use the drop down dialogue boxes to show the Total Solids, Water, Total Flow and % solids as per figure 19 below.

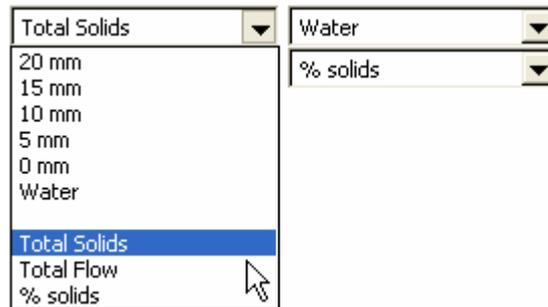


Figure 20: Datablock Drop Down List

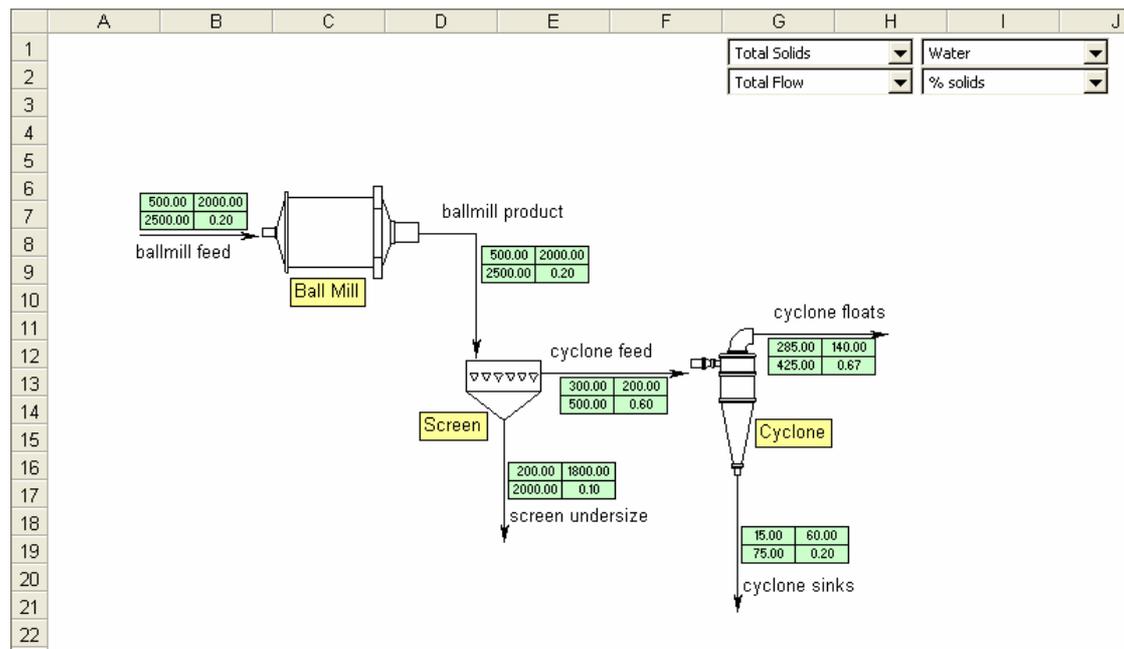


Figure 21: Flowsheet with dialogue boxes

6.12 Save the workbook.

7. CREATING A USER DEFINED UNIT MODEL

One can create a user defined model in LIMN for a unit operation which can be selected when running the wizard, thus saving time and hassle. We will create a cyclone model in this example.

7.1 Open the user-defined wizard that we have just created: Wizard_1_My_1D_Wizard.xls.

7.2 As we used the 2Product_ComponentSplitter model for the cyclone select the Unit_2_ComponentSplitter sheet in the wizard workbook.

Partition Fractions		Split to Product 1
20 mm		0.50
15 mm		0.50
10 mm		0.50
5 mm		0.50
0 mm		0.50
Water		0.50

	Feed	Product 1	Product 2
20 mm		0.00	0.00
15 mm		0.00	0.00
10 mm		0.00	0.00
5 mm		0.00	0.00
0 mm		0.00	0.00
Water		0.00	0.00

Figure 22: Component Splitter sheet

7.3 Click on the Limn: Wizards icon. 

7.4 Click the other useful functions button.

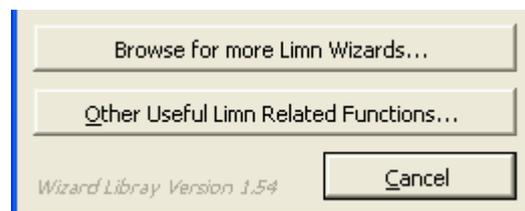


Figure 23: Limn wizards menu

7.5 Click the Create a copy of a Limn Wizard Worksheet button.

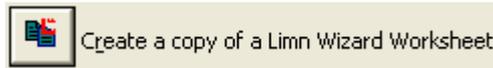


Figure 24: Create a copy icon

7.6 Enter the name Unit_2_Cyclone in the New Model Name box. Click OK.



Figure 25: New Model Name

7.7 Click on the Unit_2_Cyclone sheet and enter the partition numbers for the split to Product 1 as per figure below.

	A	B	C	D	E	F
1						
2		Model for Unit: this Unit				
3						
4				Partition Fractions		
5					Split to Product 1	
6				20 mm	0.95	
7				15 mm	0.95	
8				10 mm	0.95	
9				5 mm	0.95	
10				0 mm	0.95	
11				Water	0.70	
12						
13						
14			Feed		Product 1	Product 2
15			20 mm		0.00	0.00
16			15 mm		0.00	0.00
17			10 mm		0.00	0.00
18			5 mm		0.00	0.00
19			0 mm		0.00	0.00
20			Water		0.00	0.00
21						
22						

Figure 26: Cyclone Model

7.8 Save the wizard workbook.

7.9 If one reruns the user defined wizard (My_1D_Wizard) then the new model 2_Product Cyclone appears as a model option in Step 5 of 6.

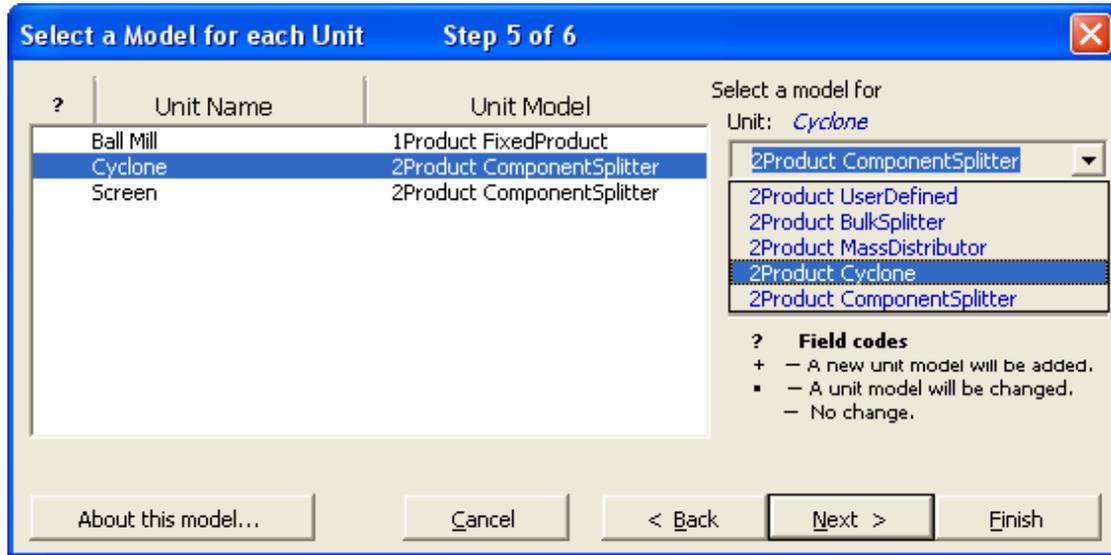


Figure 27: Step 5 of 6

8. CREATING ADVANCED UNIT MODELS

The separation within a cyclone is normally best modelled using a separation curve such as the Whiten efficiency curve equation. Cyclones are normally used to separate material according to size or according to density, therefore separation model curves can be used for either application. We will use the Whiten equation to separate the material according to size.

8.1 Open the wizard workbook that we created called Wizard_1_My_1D_Wizard.xls in the C:\LIMN\Wizards folder.

8.2 Click on the Unit_2_UserDefined sheet.

8.3 Click on the Limn: Wizards icon. 

8.4 Click on the Other Useful Limn Related Functions button.

8.5 Click on the Create a copy of a Limn Wizard Worksheet button.



Figure 28: Copy of Wizard Worksheet button

8.6 Label the model Unit_2_Cyclone(Whiten).

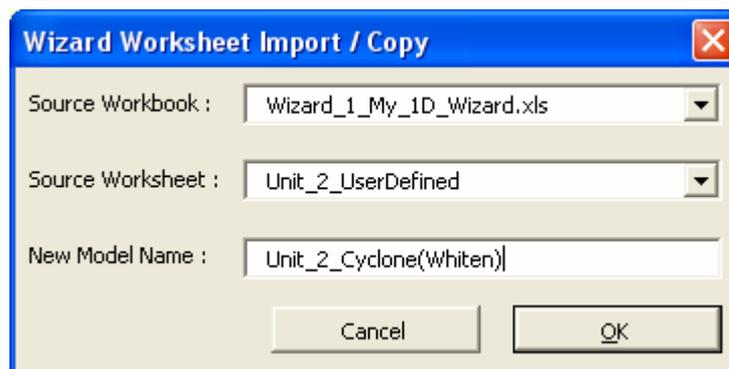


Figure 29: Naming Wizard

8.7 The basic format of the Whiten efficiency curve equation is:

$$pf = 1 - (1 - R_f) \times \left[\frac{\exp(\alpha - 1)}{\exp\left(\alpha \cdot \frac{D_i}{D_{50}}\right) + \exp(\alpha) - 2} \right]$$

Where pf is the partition fraction, R_f is the bypass fraction to coarse, α is the sharpness of cut, D_i is the current mean size and D_{50} is the cut point size.

8.8 Select the model worksheet that we have just created, Unit_2_Cyclone(Whiten).

	A	B	C	D	E	F
1						
2		Model for Unit: this Unit				
3						
4		Model Parameters				
5				Sharpness of cut - Alpha		5.00
6				Nominal cut size - d50c		5.00
7				Bypass fraction to coarse - Rf		0.10
8						
9				Size	Mean	Split Fraction to Coarse
10				20 mm	28.00	1.000
11				10 mm	14.00	1.000
12				5 mm	7.00	0.893
13				2.5 mm	3.50	0.261
14				0 mm	1.25	0.115
15						
16				Water		0.30
17						
18						
19			Feed		Product 1	Product 2
20			20 mm		-	-
21			15 mm		-	-
22			10 mm		-	-
23			5 mm		-	-
24			0 mm		-	-
25			Water		-	-
26						

Figure 30: Unit_2_Cylone(Whiten) sheet

8.9 Reproduce the model in figure 30 by doing the following:

- Insert the required number of rows above the stream table (15 rows).
- Create the model parameter table as per figure 30, shade the input cells blue.
- Create the model table with the Size, Mean and Split Fraction to Coarse columns.
- Enter the Whiten efficiency curve equation into the Split Fraction to Coarse column.
- Enter the required split of water to the coarse (sinks) product.

8.10 In the Product 2 column, multiply the Feed column by the Split Fraction to Coarse column. Make sure to multiply the water in the feed by the required split to coarse.

8.11 In the Product 1 column, subtract the Product 2 column from the Feed column.

8.12 Save the Wizard workbook and close the workbook.

8.13 Open the Excel workbook with the User Wizard example.

8.14 Click on the flowsheet sheet.

8.15 Click on the Limn: Wizards icon. 

8.16 Click on the Other Useful Limn Related Functions button.

8.17 Click on the Change a Limn: Wizard generated unit model button.



Figure 31: Change a model button

8.18 Click on the Cyclone unit and select the 2Product Cyclone(Whiten) model from the drop down list.

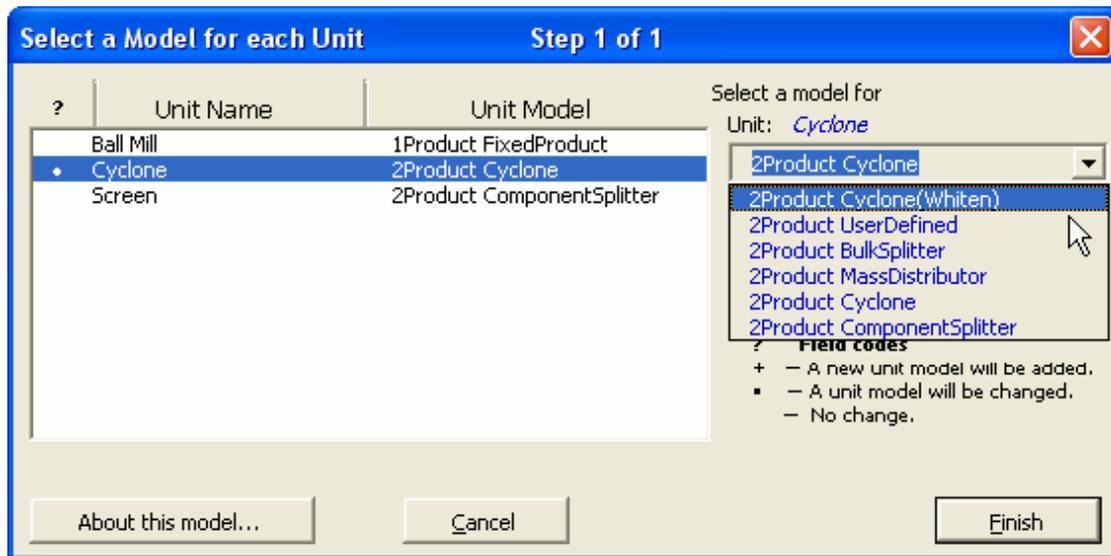


Figure 32: Select a model

8.19 Click on the Unit_Cyclone Sheet.

8.20 Click on the Limn: Solver icon. 

8.21 Once the solver has run the Unit_Cyclone sheet should be the same as figure 33.

	A	B	C	D	E	F
1	Model for Unit: Cyclone					
2						
3						
4	Model Parameters					
5	Sharpness of cut - Alpha				5.00	
6	Nominal cut size - d50c				5.00	
7	Bypass fraction to coarse - Rf				0.10	
8						
9		Size	Mean	Split Fraction to Coarse		
10		20 mm	28.00	1.000		
11		10 mm	14.00	1.000		
12		5 mm	7.00	0.893		
13		2.5 mm	3.50	0.261		
14		0 mm	1.25	0.115		
15						
16		Water		0.30		
17						
18		Feed		cyclone floats	cyclone sinks	
19		20 mm	25.00	0.00	25.00	
20		15 mm	50.00	0.01	49.99	
21		10 mm	75.00	8.00	67.00	
22		5 mm	100.00	73.90	26.10	
23		0 mm	50.00	44.25	5.75	
24		Water	200.00	140.00	60.00	
25						
26						
27						

Figure 33: Unit_Cyclone sheet

8.22 Save the workbook.

APPENDIX A: USER WIZARD WORKED EXAMPLE

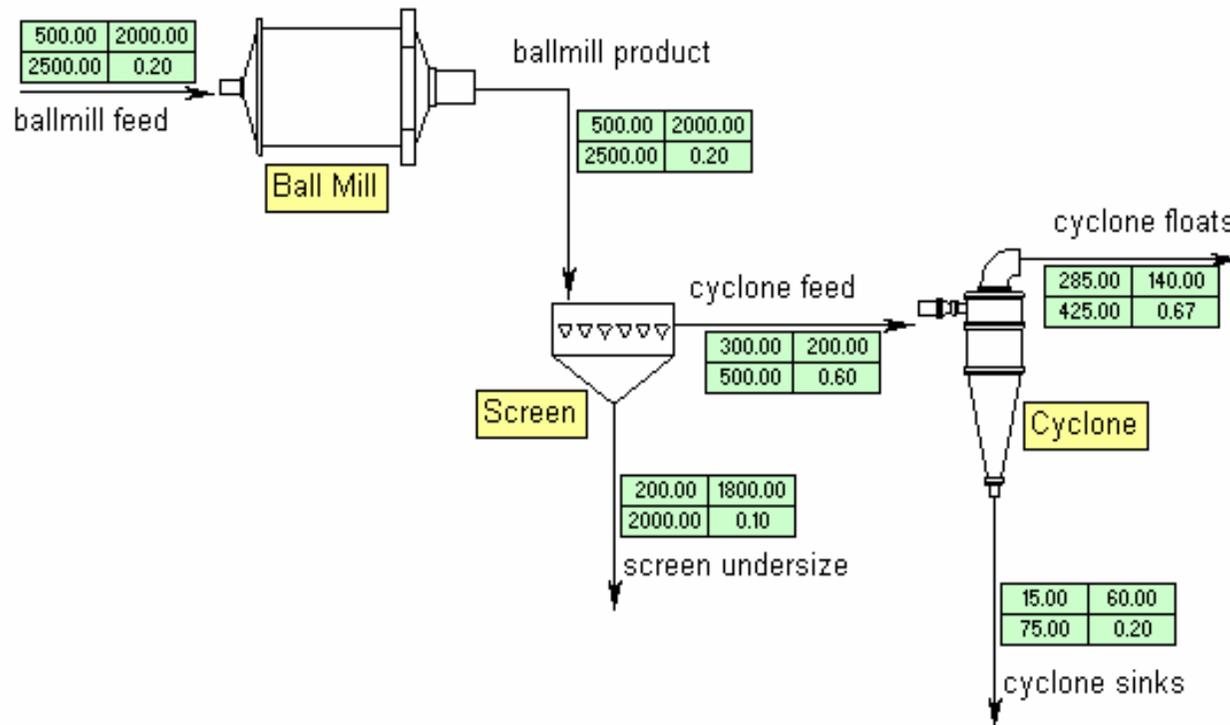


Figure 34: User Wizard worked example