

SoilFluxProTM

The LI-8100A Data File Viewer (ver 4.0)

Nov 2015



4647 Superior St • P.O.Box 4425 • Lincoln, NE 68504 USA

North America: 800-447-3576 • International: 402-467-3576

Fax 402-467-2819

envsales@licor.com • www.licor.com

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1 Introduction

SoilFluxPro™ (SFP) software is a multi-platform application designed to view and analyze data files for both chamber and continuous measurements generated by the LI-COR LI-8100A Automated Soil CO₂ Flux System.

SFP offers a very convenient way to view selected quantities or summaries of these files, as well as quickly plot meaningful analyses that let you evaluate the measurements. Editing and recomputations are easily done.

SoilFluxPro ver 4.0

New Open Acquire Save Export Map

Cut Copy Paste Delete Recompute Transform Remove Import

Display Statistics Add Chart Show Details

Item#	#Msgs	Date_IV	#Raw	Obs#	Label
1	0	2011-11-09 15:18:21	104	1	survey_wit
2	0	2011-11-09 15:20:57	104	2	survey_wit
3	0	2011-11-09 15:23:56	104	3	survey_wit
4	0	2011-11-09 15:26:56	104	4	survey_wit
5	0	2011-11-09 15:29:56	104	5	survey_wit
6	0	2011-11-09 15:32:56	104	6	survey_wit
7	0	2011-11-09 15:35:57	105	7	survey_wit
8	0	2011-11-09 15:38:57	105	8	survey_wit
9	0	2011-11-09 15:41:57	105	9	survey_wit
10	0	2011-11-09 15:44:57	105	10	survey_wit

Created new view for file /Users/jon/Documents/SampleSurvey.81x
10 observations read into view SampleSurvey.81x
Created new view for file //Users/jon/Desktop/Soil/11-09-2011.81x

Exp Flux for Cdry = 1.120000

As Read Current Measurements Recompute Fit#1 Cdry

Revert Keep

$C(t) = C_0 + (C_1 - C_0) \exp(-a(t-t_0))$

$C_0 = 406.1$ $a = 6.1016e-03$ Exp
 $C_1 = 429.1$ $t_0 = 3.4$

dC/dt SE of dC/dt R² Flux Flux CV
Exponential: 0.140 0.001 0.9861 1.120000 1.500000
Linear: 0.103 0.002 0.9808 0.830 2.0

Regression Details Guidance

Manually set Co

Start time 20 Stop time 89 Max iter 10

Measured data
 Include t < 0
 Exp fit
 Linear fit

Compute

Group and plot data

Examine a curve fit

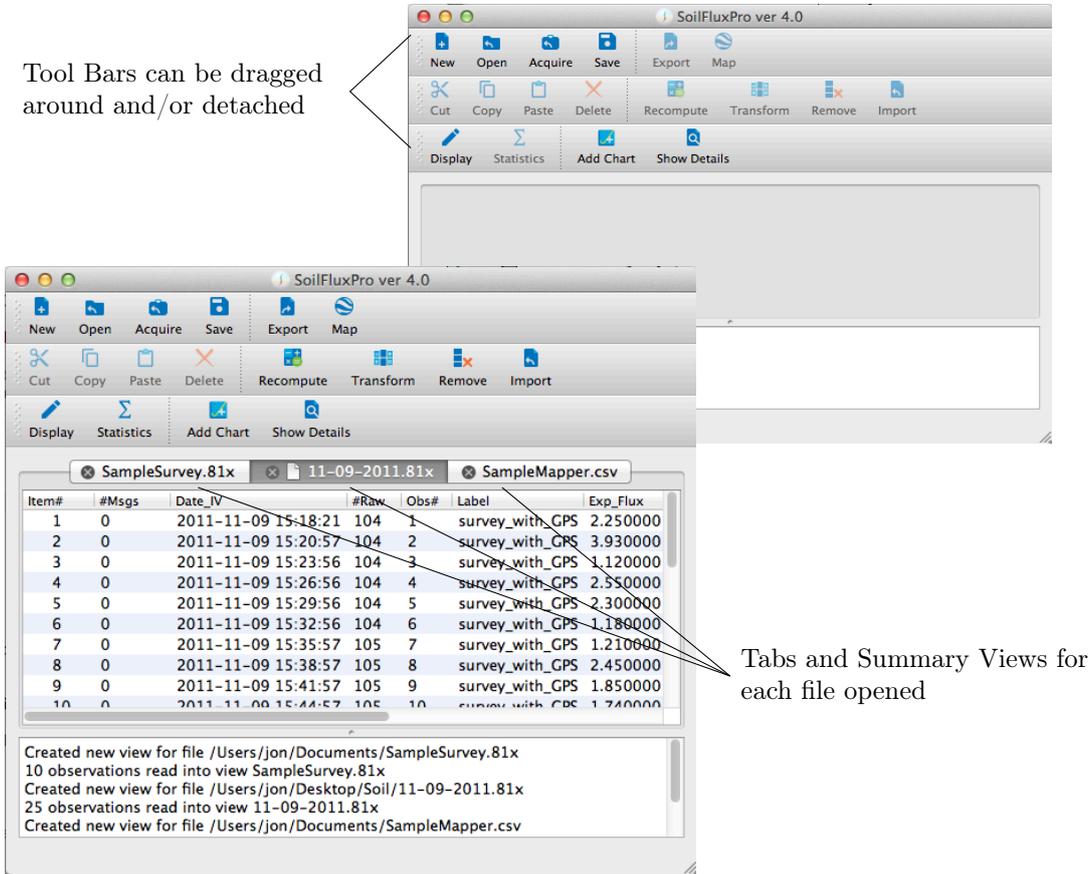
Surface analysis

Create .kml files

2 Introductory Tour

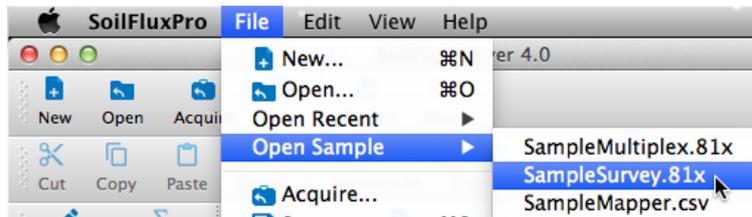
1. Launch SoilFluxPro™

When run, SFP presents you with an empty Main Window and three tool bars. For each LI-8100A data file you open, this view will create a tab sheet for that file, and display a [Summary View](#).



2. Open a Data File

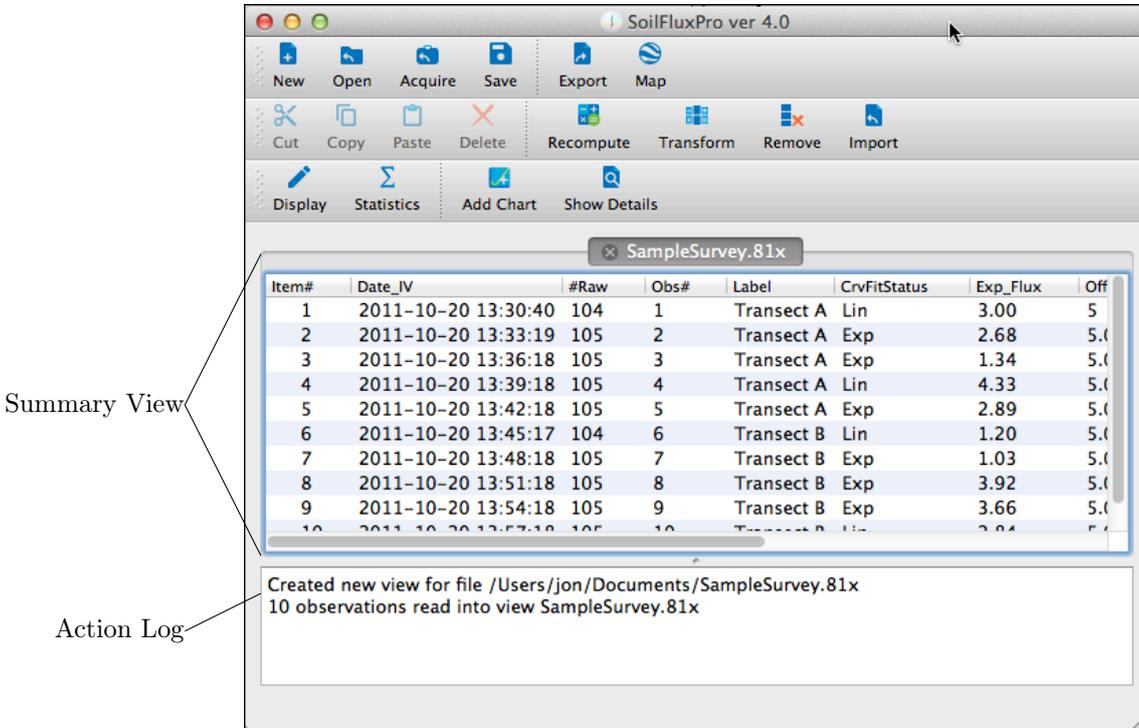
Normally, you would select **File** > **Open...** and pick an LI-8100A data file. Note that there are also several "built-in" sample files located under **File** > **Open Sample**; we'll select the one named **SampleSurvey.81x**.



2 Introductory Tour

3. The Summary View

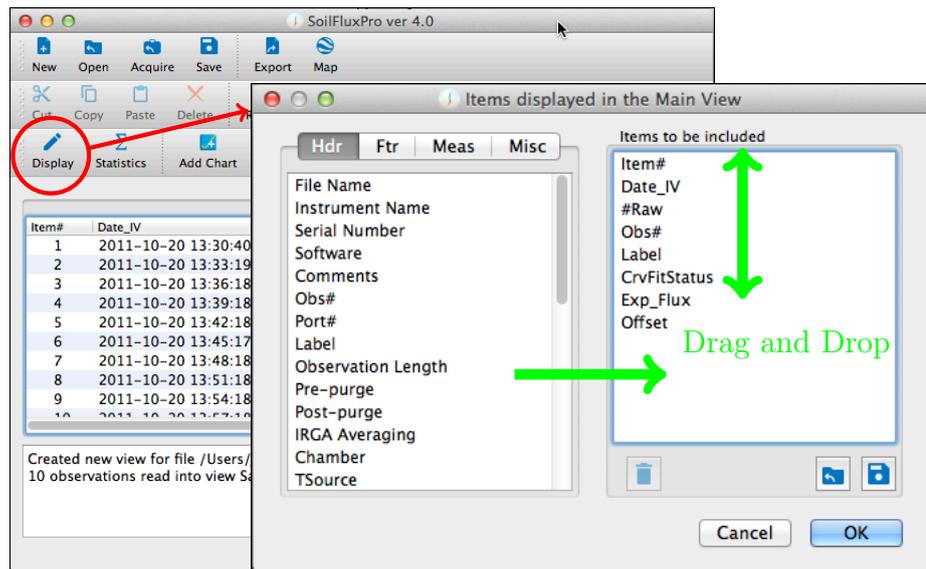
Each observation in the data file is shown on one line in the summary view. In the example here, 10 observations from an LI-8100A with a survey chamber were read. Each observation is represented by one line, showing selected variables (**Label**, **Obs#**, etc.) from that observation.



4. Setting the Displayed Variables

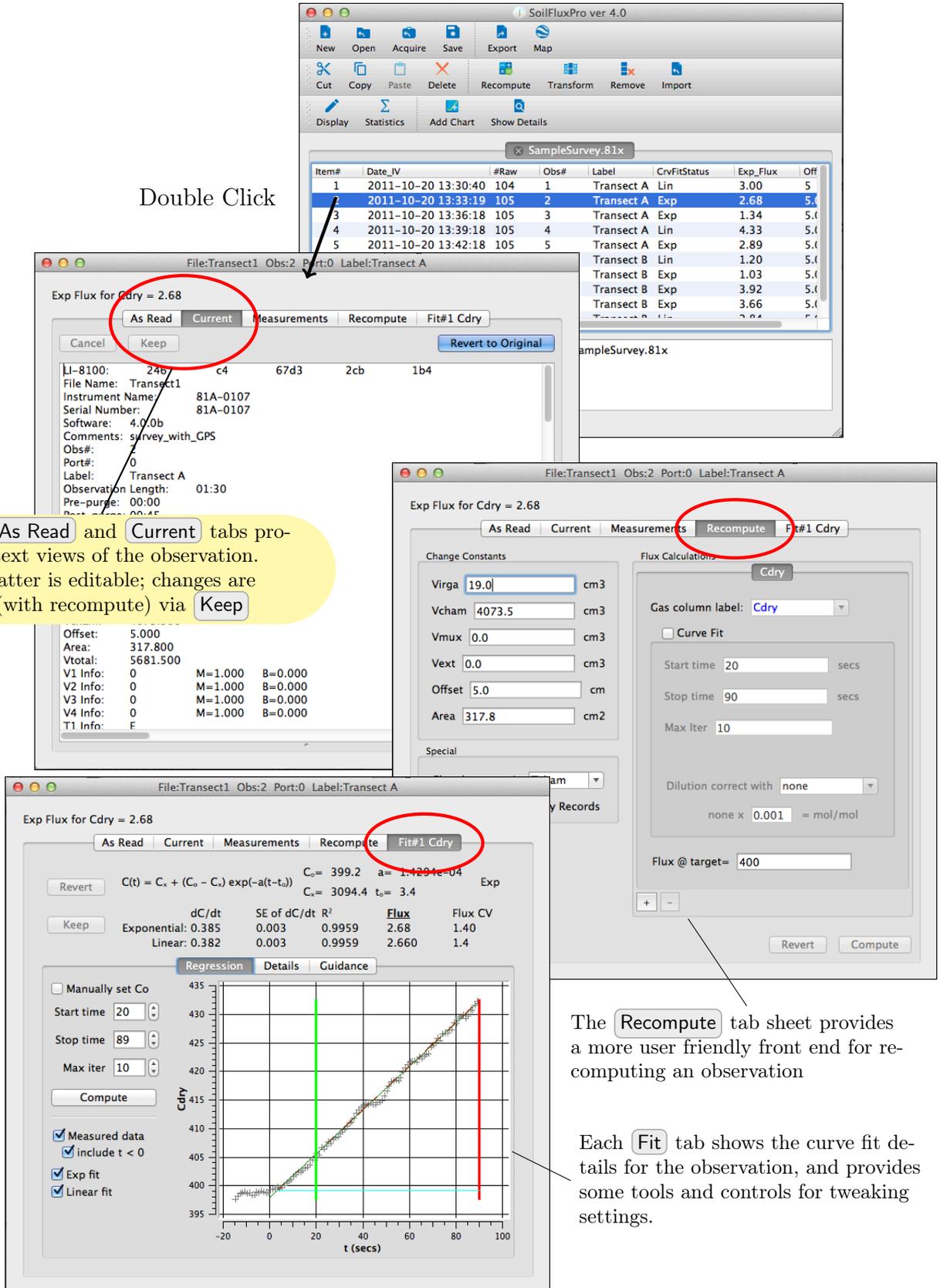
The variables that are displayed for each observation are editable. Select **View >> Display** (or click on **Display**), to bring up the dialog for changing them.

Click and drag to add items from the left list to the right list. Also, click and drag items in the right hand list to rearrange them. To delete items from the right hand list, highlight them and click the trash button. This dialog is discussed in more detail in [Change Displayed Variables](#).



5. Zoom in on one Observation (Method 1)

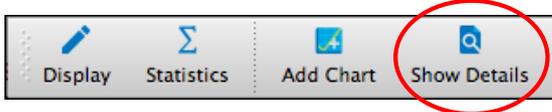
We now illustrate how to view the details of an observation. Double click one of the observations (lines) in the Summary View to open the **Observation Details**. In this view, we can see all the header, measured, and footer variables. The window opened by double clicking “belongs” to that observation; if you double click another observation, you get another window for that observation.



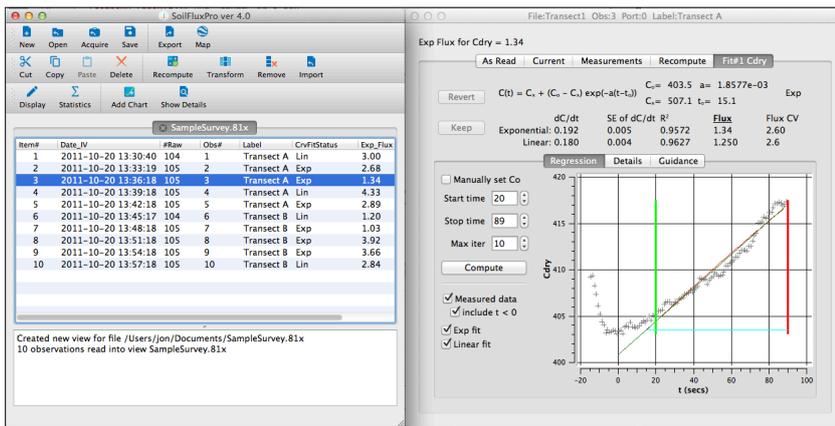
2 Introductory Tour

6. Zoom in on an Observation (Method 2)

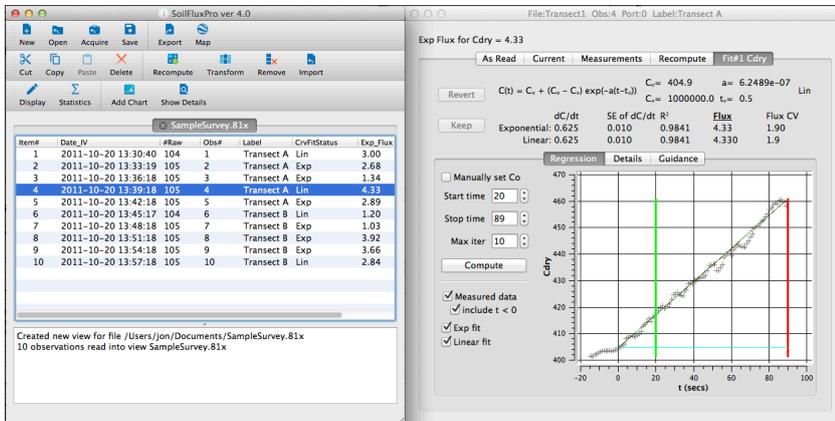
A second method for seeing details of an observation is to open the **Show Details** window. This window does not belong to any one observation, but rather shows the first highlighted observation, or (if there are none) the first observation in the active summary view. You can use this to quickly step through a series of observations viewing the curve fit, for example.



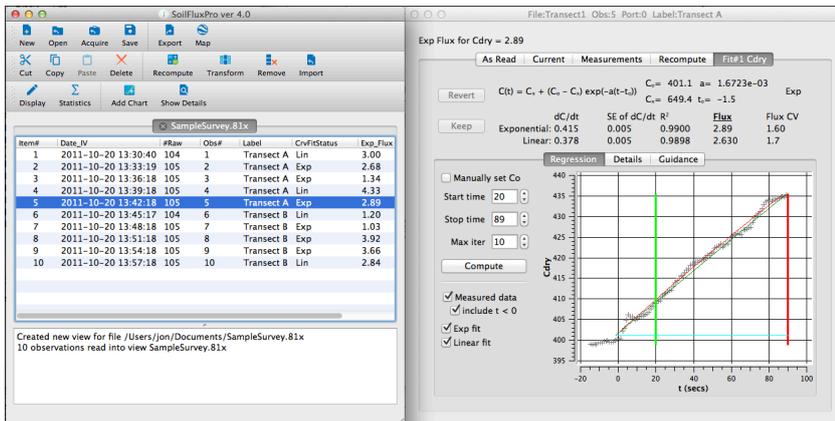
Always shows the first selected observation in the active view



Press ↓



Press ↓



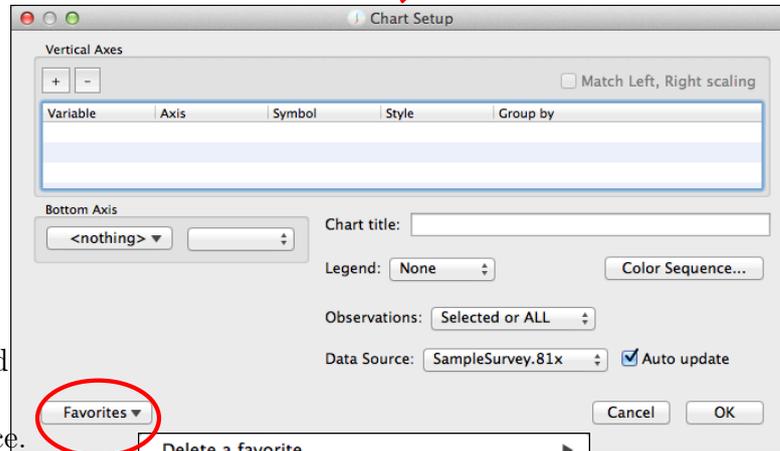
2 Introductory Tour

7. Make a Chart

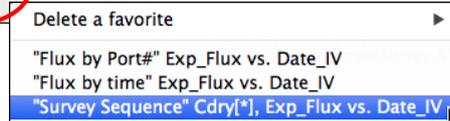
Next, we will demonstrate charts. Click **Add Chart**.



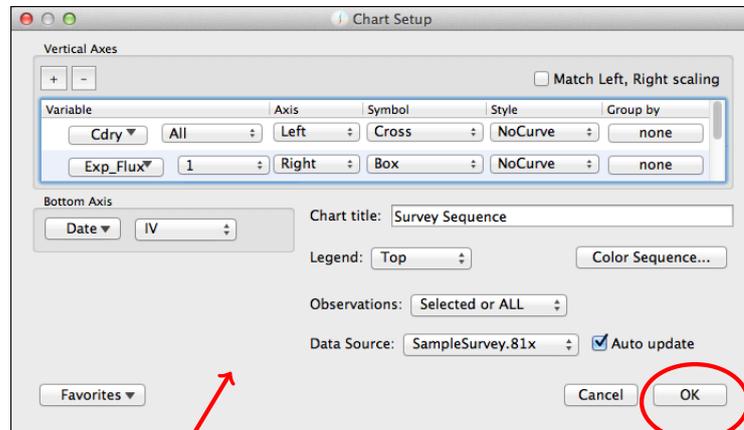
1. You are presented with an empty plot definition.



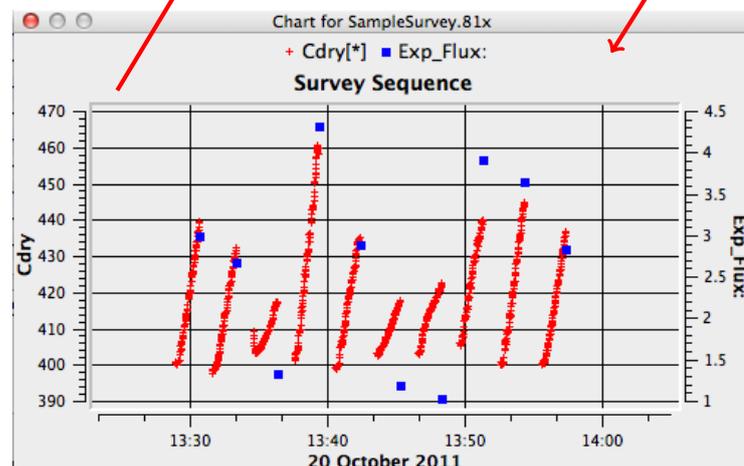
2. Click **Favorites** and select mykeySurvey Sequence. The dialog should change as shown below.



3. Click **OK** to draw the chart.

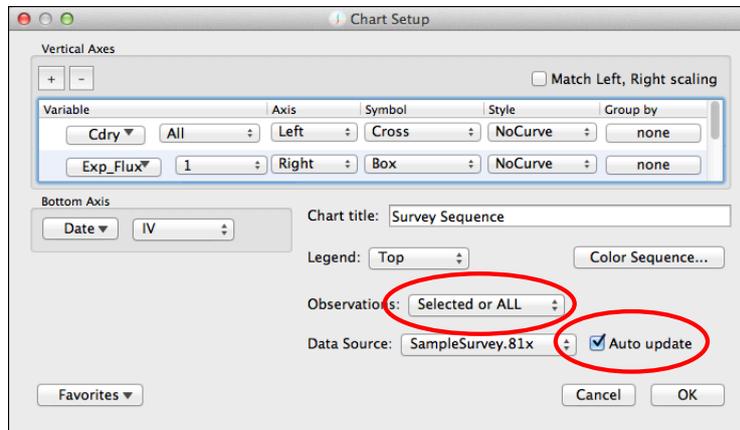


4. You can double click anywhere on the chart to bring back the Setup Dialog.



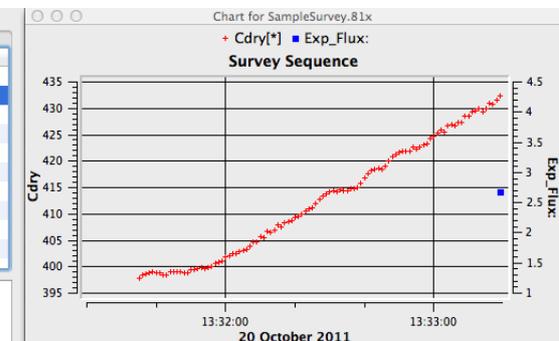
2 Introductory Tour

When the Observations setting in the setup dialog is **Selected or All**, and Auto update is checked, then the chart will update anytime a selection change is made in the summary view, as illustrated below



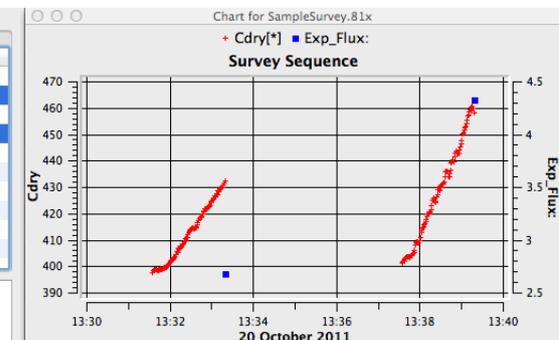
Item#	Date_IV	#Records	Obs#	Port#	Label	CrvFitStatus	Exp_Flux	CO2_IV
1	2011-10-20 13:30:40	104	1	0	Transect A Lin	3.00	399.19	
2	2011-10-20 13:33:19	105	2	0	Transect A Exp	2.68	396.4	
3	2011-10-20 13:36:18	105	3	0	Transect A Exp	1.34	400.66	
4	2011-10-20 13:39:18	105	4	0	Transect A Lin	4.33	401.88	
5	2011-10-20 13:42:18	105	5	0	Transect A Exp	2.89	398.52	
6	2011-10-20 13:45:17	104	6	0	Transect B Lin	1.20	401.84	
7	2011-10-20 13:48:18	105	7	0	Transect B Exp	1.03	404.08	
8	2011-10-20 13:51:18	105	8	0	Transect B Exp	3.92	404.92	
9	2011-10-20 13:54:18	105	9	0	Transect B Exp	3.66	401.61	
10	2011-10-20 13:57:18	105	10	0	Transect B Lin	2.84	398.92	

Created new view for file /Users/jon/Documents/SampleSurvey.81x
10 observations read into view SampleSurvey.81x



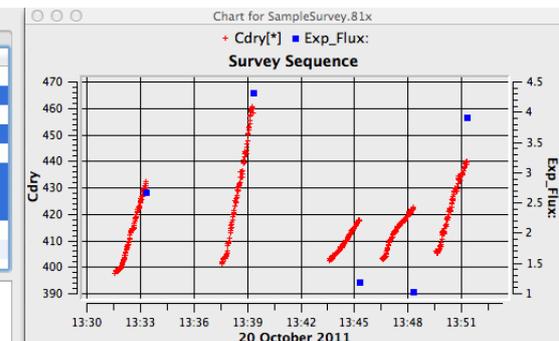
Item#	Date_IV	#Records	Obs#	Port#	Label	CrvFitStatus	Exp_Flux	CO2_IV
1	2011-10-20 13:30:40	104	1	0	Transect A Lin	3.00	399.19	
2	2011-10-20 13:33:19	105	2	0	Transect A Exp	2.68	396.4	
3	2011-10-20 13:36:18	105	3	0	Transect A Exp	1.34	400.66	
4	2011-10-20 13:39:18	105	4	0	Transect A Lin	4.33	401.88	
5	2011-10-20 13:42:18	105	5	0	Transect A Exp	2.89	398.52	
6	2011-10-20 13:45:17	104	6	0	Transect B Lin	1.20	401.84	
7	2011-10-20 13:48:18	105	7	0	Transect B Exp	1.03	404.08	
8	2011-10-20 13:51:18	105	8	0	Transect B Exp	3.92	404.92	
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Item#	Date_IV	#Records	Obs#	Port#	Label	CrvFitStatus	Exp_Flux	CO2_IV
1	2011-10-20 13:30:40	104	1	0	Transect A Lin	3.00	399.19	
2	2011-10-20 13:33:19	105	2	0	Transect A Exp	2.68	396.4	
3	2011-10-20 13:36:18	105	3	0	Transect A Exp	1.34	400.66	
4	2011-10-20 13:39:18	105	4	0	Transect A Lin	4.33	401.88	
5	2011-10-20 13:42:18	105	5	0	Transect A Exp	2.89	398.52	
6	2011-10-20 13:45:17	104	6	0	Transect B Lin	1.20	401.84	
7	2011-10-20 13:48:18	105	7	0	Transect B Exp	1.03	404.08	
8	2011-10-20 13:51:18	105	8	0	Transect B Exp	3.92	404.92	
9	2011-10-20 13:54:18	105	9	0	Transect B Exp	3.66	401.61	
10	2011-10-20 13:57:18	105	10	0	Transect B Lin	2.84	398.92	

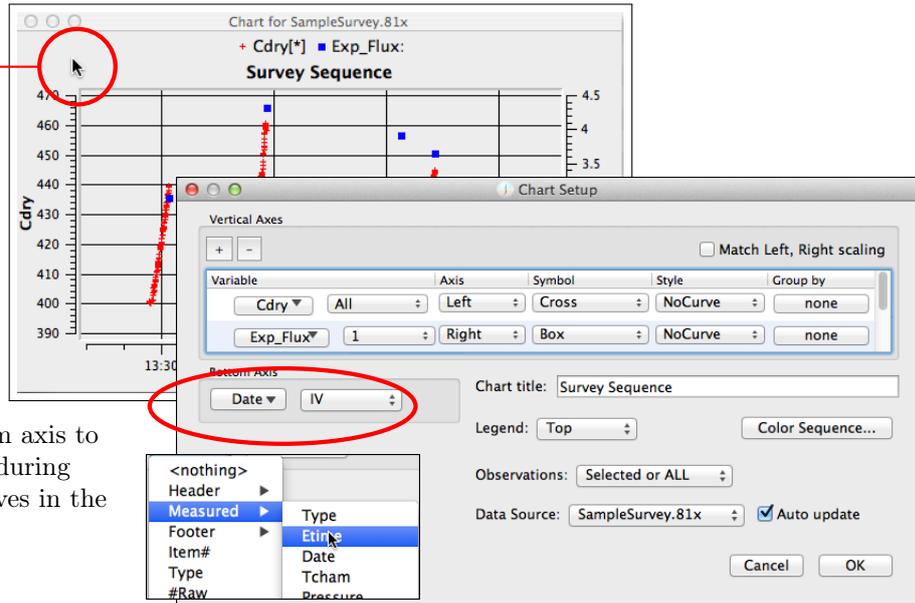
Created new view for file /Users/jon/Documents/SampleSurvey.81x
10 observations read into view SampleSurvey.81x



2 Introductory Tour

Suppose we want to superimpose the **Cdry** vs. time curves. Double click the chart to bring up the setup dialog for it, and modify it like this:

1. Double click the chart.



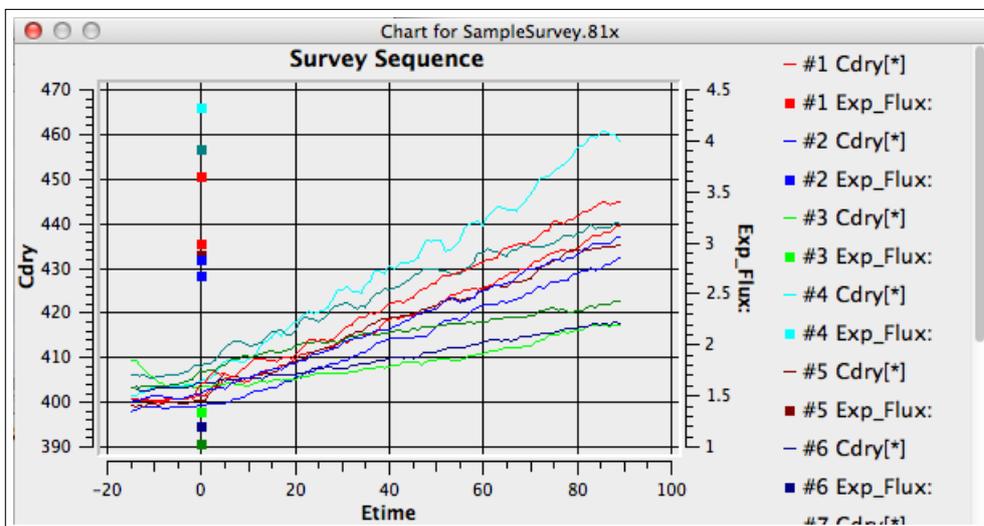
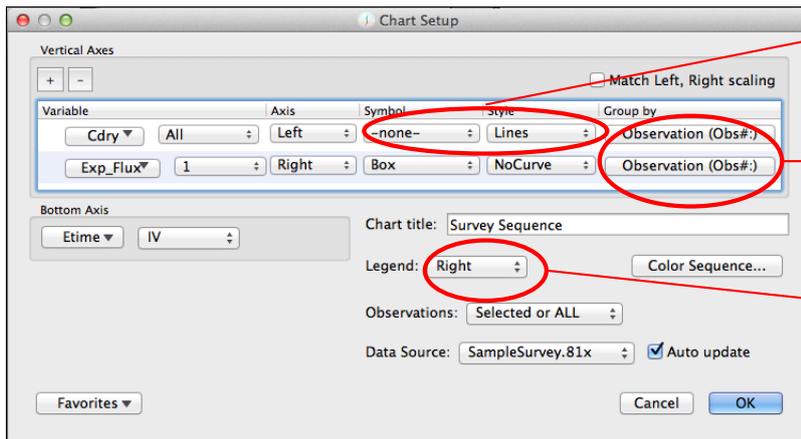
2. Change the bottom axis to **Etime** (elapsed time during the observation - it lives in the **Measured** submenu).

3. Change the **Cdry** symbol to **none**, and **Style** to **Lines**.

4. Set grouping for both variables to **Observation**.

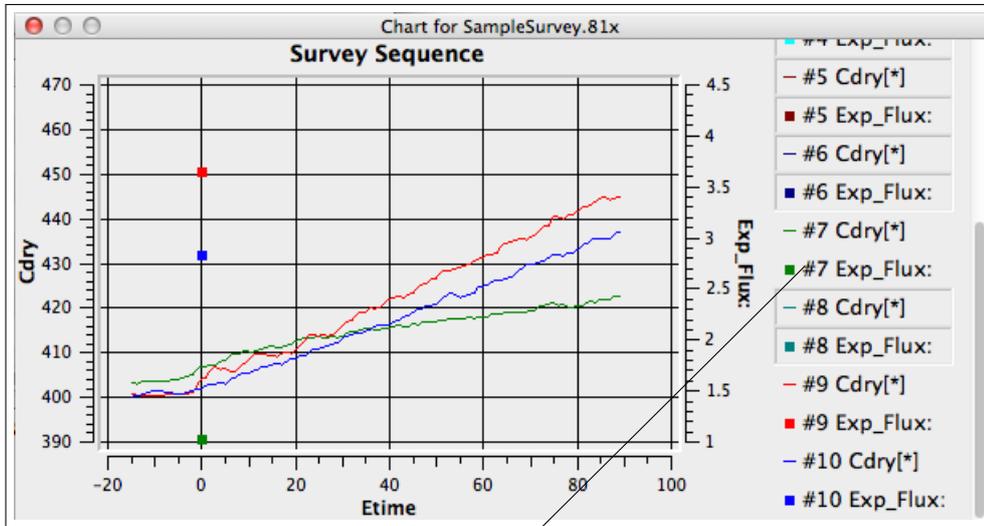
5. Move the legend to the right.

6. Click **OK**.



2 Introductory Tour

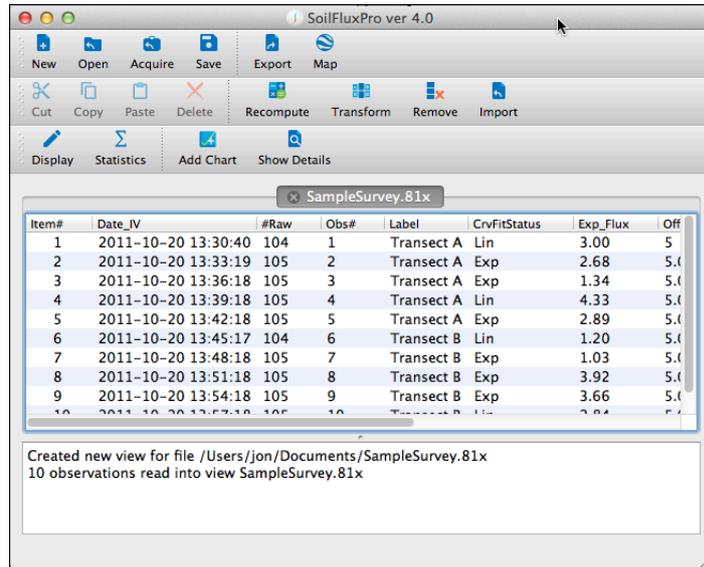
Note that legend entries are clickable buttons: Click to make that entry disappear from the graph, and click again to make it reappear.



Clickable buttons. Down = hidden, up = visible

3 Summary View

-  Create an Empty View
-  Open a File
-  Import from an LI-8100
-  Save a File
-  Export Data
-  Create a .kml file



-     Move Observations Between Views
-  Recompute Observations
-  Transform Columns
-  Remove Columns
-  Import Columns

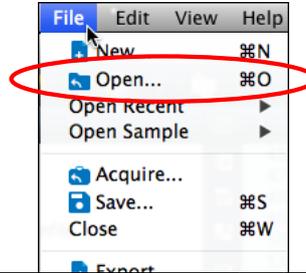
-  Change Displayed Variables
-  Compute Statistics
-  Add a Chart
-  Observation Details

3 Summary View

3.1 Open a File

SFP can read both Chamber and Continuous measurement types. Both measurement types can reside within the same file, regardless of the extension type (.81x, .csv).

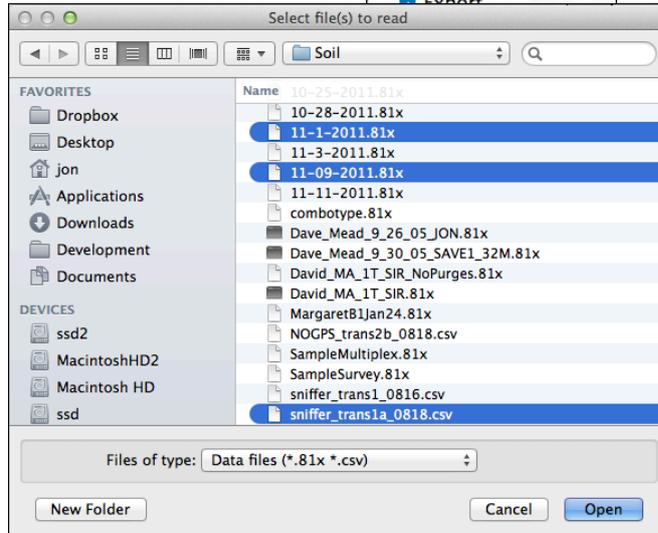
1. Click **Open** on the tool bar, or select it in the File Menu.



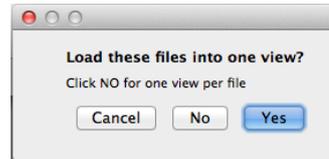
2. Use the Open file dialog box to navigate to the desired directory, and select the file(s) to be opened.

To select multiple files, use **ctrl** + click (⌘ + click on Mac) to select individual files, or **shift** + click to select a range.

Note that SFP can read both .csv and .81x file types.



3. If multiple files are selected when you click **Open**, you are given a choice of combining them all into one view or keeping them separate.

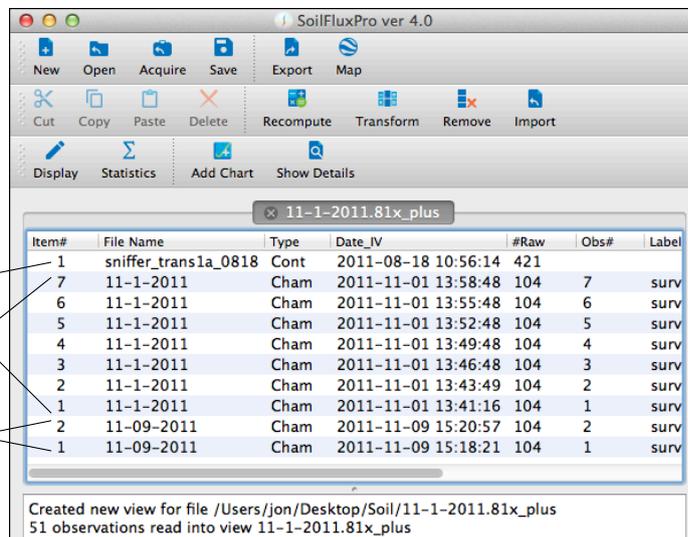


When multiple files are combined, each observation retains its original **File Name**.

Item# indicates the order of the observation as read from the file.
Type indicates the type of data, Chamber or Continuous.

The illustration to the right combines three files into one view.

1
2
3

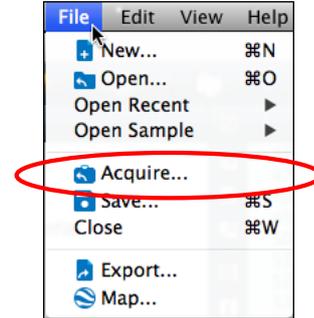


3 Summary View

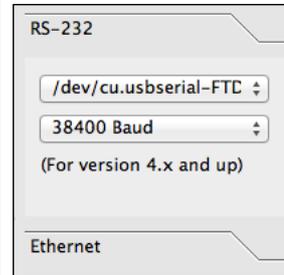
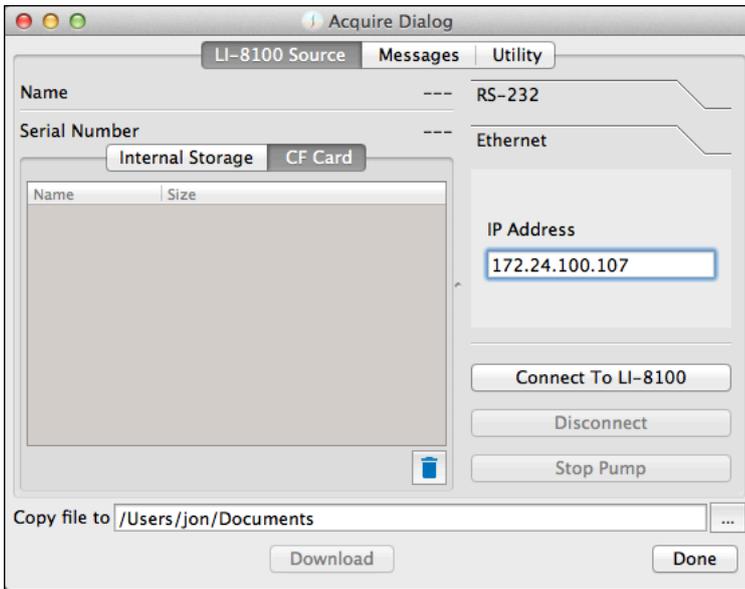
3.2 Import Data From an LI-8100A

SFP can read data files directly from an LI-8100A.

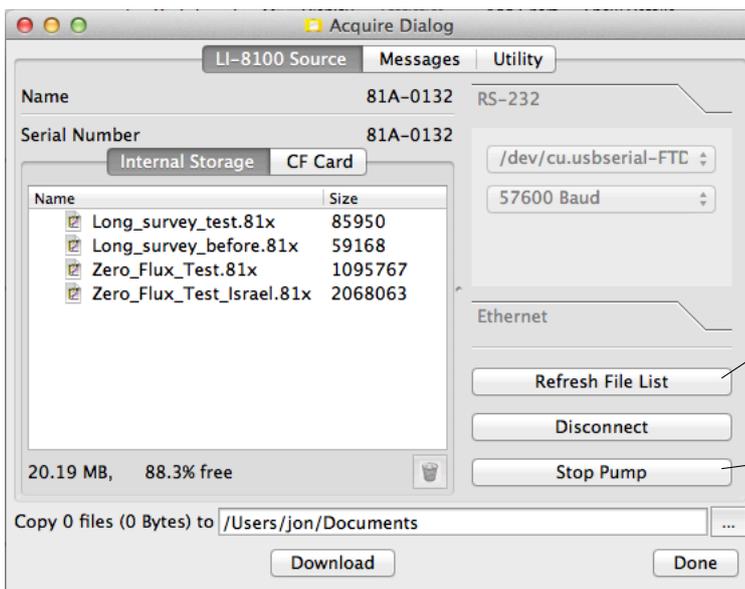
1. Click **Acquire** on the tool bar, or select it from the File menu.



2. Specify IP address if using Ethernet, or select the comm port if using RS-232.



3. Click **Connect to LI-8100A**. You should get a file list.



Try this if the list doesn't appear.

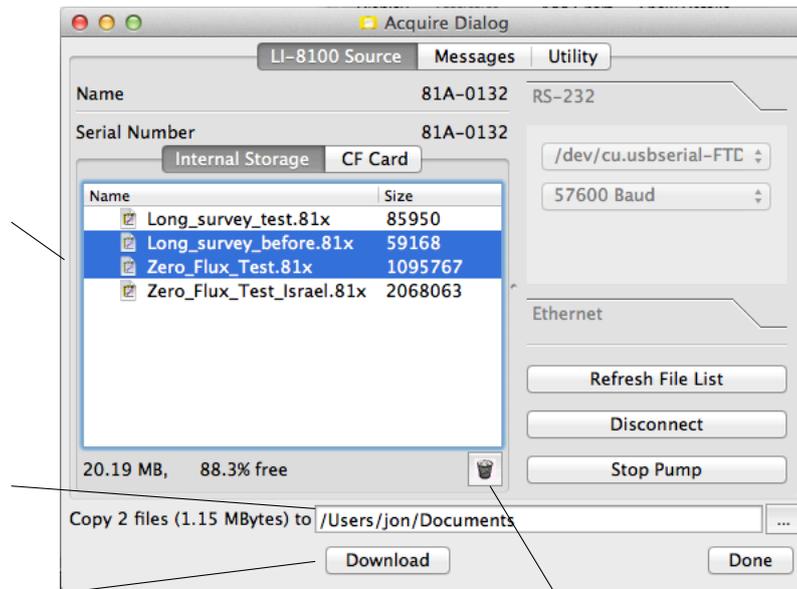
If the LI-8100A just powered up, the pump may be running. This will stop it.

3 Summary View

4. Select the file(s) to download.

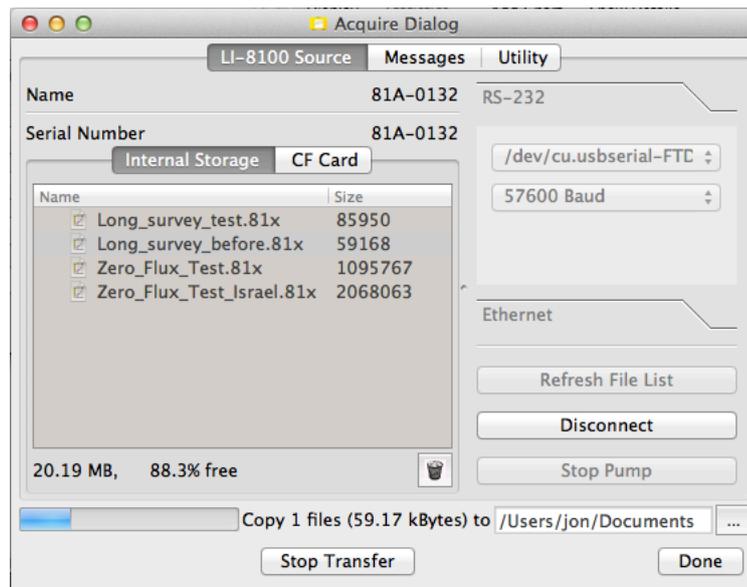
5. Specify the destination directory.

6. Click **Download**.



Deletes selected files on the instrument.

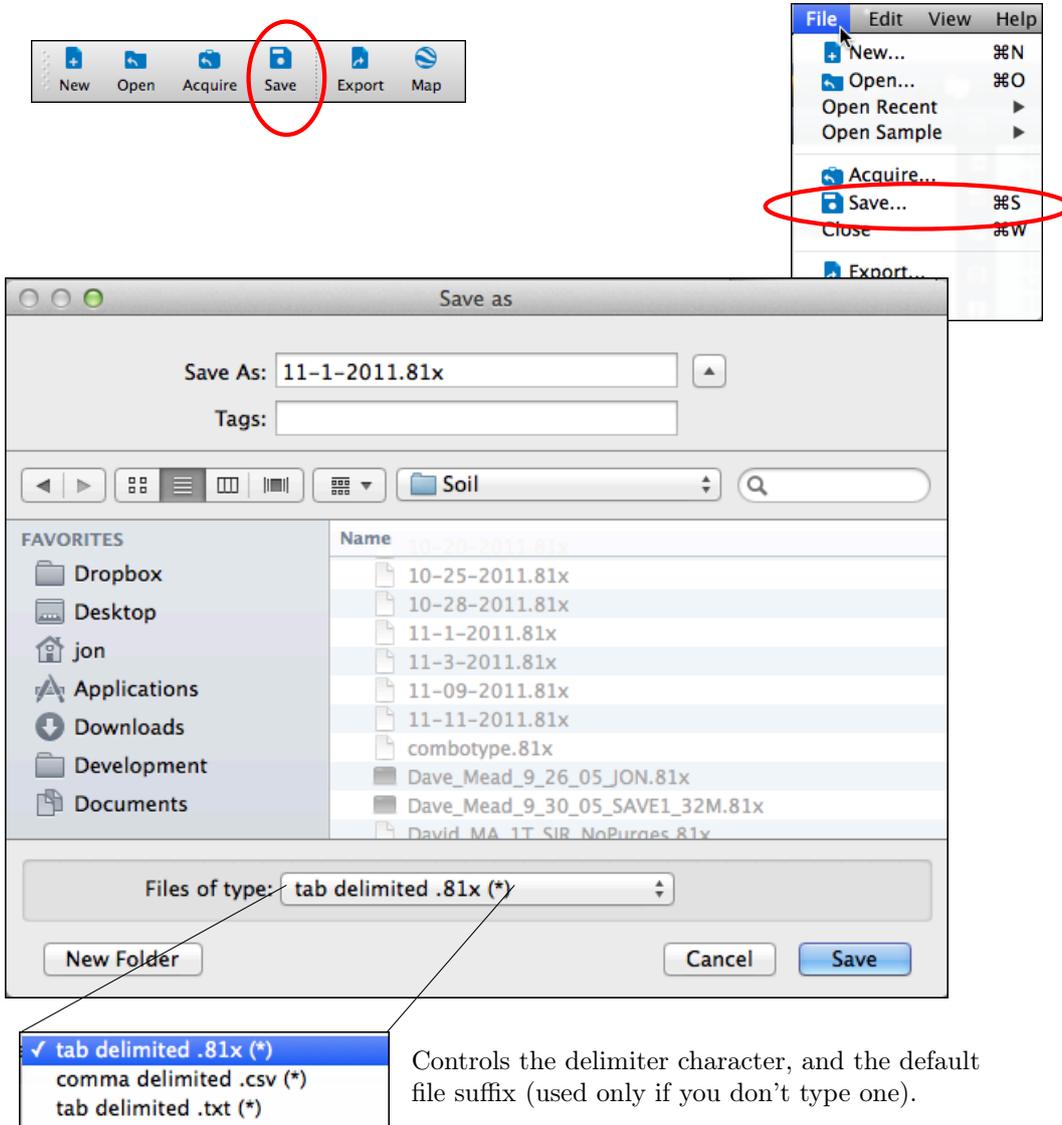
The download in progress.



3 Summary View

3.3 Save a File

Select **File** > **Save...**, or click **Save** on the tool bar.



3.3.1 File Suffixes

You can type any suffix (e.g. .81x, .txt, .junk, etc.) that you wish on the file name. If you leave a suffix off, the program will automatically append the one showing in the filter box. However, the *type* of file that is written is determined by the filter box setting.

3.3.2 File Delimiters

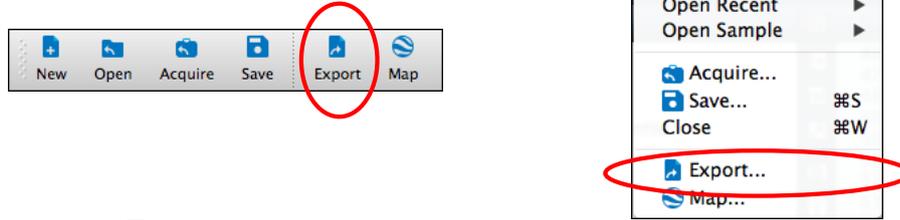
The save dialog filter box also determines what delimiter character is used when the observations are written. Note that SFP can read files with any combination of continuous or chamber measurements with any of these delimiters: tab, comma, or semi-colon. Delimiters must be consistent within an observation, but can be different from one observation to the next within a file. When SFP writes files, however, it will use a consistent delimiter throughout the file.

3 Summary View

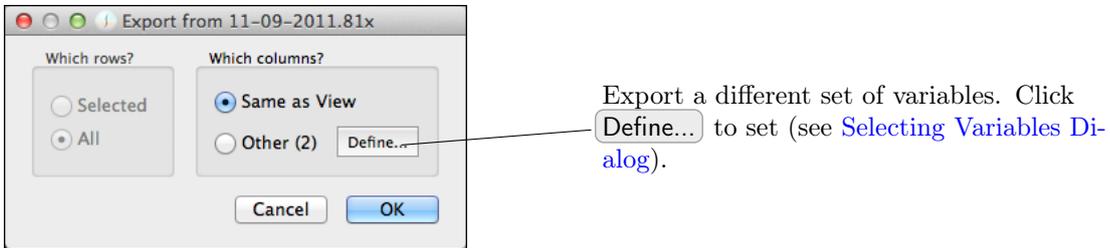
3.4 Export Data

Summary-style data (one observation per row) can be written to a text file, for input to spreadsheet or text editing applications.

1. Click **Export**, or select it from the File menu.



2. Select the fields to export. These can be the same as the Summary View, or you can define a different set.



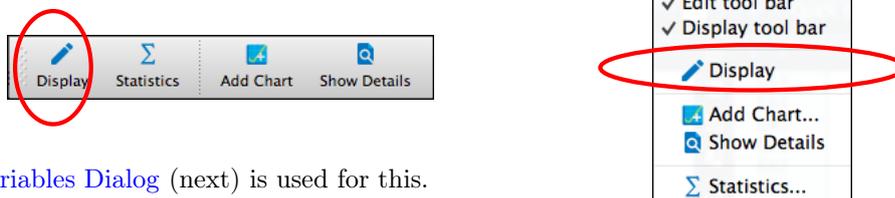
The 'Export from 11-09-2011.81x' dialog box shows a table of data with columns: Item#, Date_IV, #Raw, Obs#, Port#, Label, CrvFitStatus, Exp_Flux, and Offset. The table contains 10 rows of data.

Item#	Date_IV	#Raw	Obs#	Port#	Label	CrvFitStatus	Exp_Flux	Offset
25	2011-11-09 16:29:57	105	25	0	survey_with_GPS	Exp	2.760000	5.000
24	2011-11-09 16:26:57	105	24	0	survey_with_GPS	Exp	2.770000	5.000
23	2011-11-09 16:23:56	104	23	0	survey_with_GPS	Exp	2.610000	5.000
22	2011-11-09 16:20:56	104	22	0	survey_with_GPS	Lin	2.230000	5.000
21	2011-11-09 16:17:56	104	21	0	survey_with_GPS	Exp	2.990000	5.000
20	2011-11-09 16:14:57	105	20	0	survey_with_GPS	Exp	1.900000	5.000
19	2011-11-09 16:11:57	105	19	0	survey_with_GPS	Lin	1.300000	5.000
18	2011-11-09 16:08:57	105	18	0	survey_with_GPS	Lin	1.340000	5.000
17	2011-11-09 16:05:57	105	17	0	survey_with_GPS	Exp	7.460000	5.000
16	2011-11-09 16:02:57	105	16	0	survey_with_GPS	Exp	2.550000	5.000

3. The results can be saved to a file, or copied to the clipboard for pasting into other applications.

3.5 Change Displayed Variables

1. Click **Display**, or select it from the View menu.

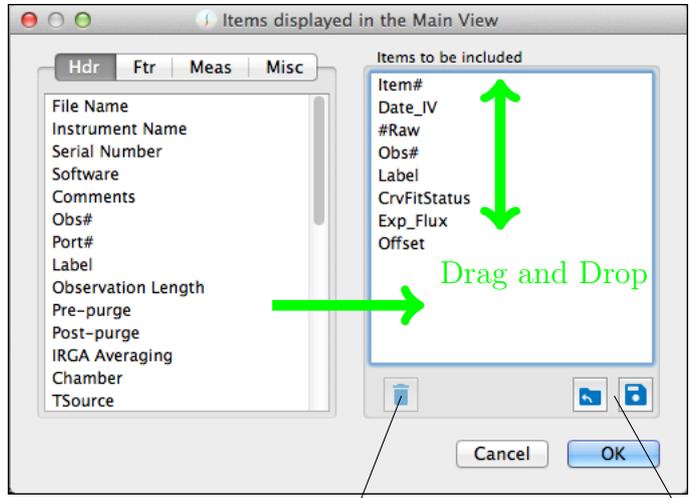


2. The [Selecting Variables Dialog](#) (next) is used for this.

3 Summary View

3.5.1 Selecting Variables Dialog

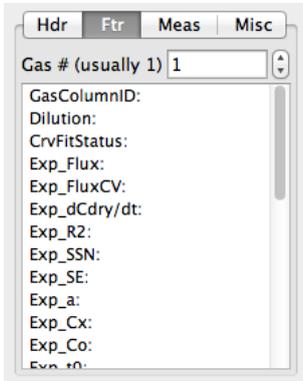
Any time a list of variables needs to be defined, such as when selecting variables to display in the Summary View, or selecting variables to print or export, the following dialog is used:



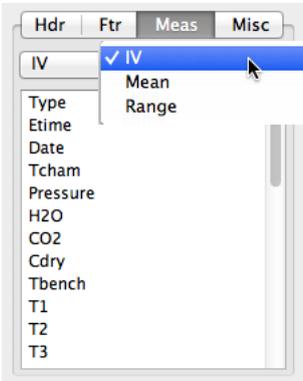
Remove selected items from list.

Read/write right-hand list from/to a file.

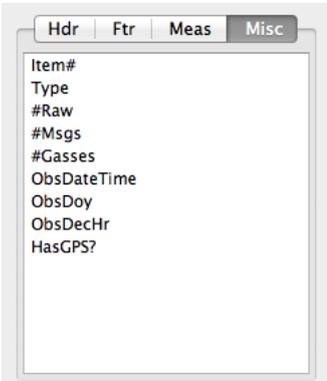
The list of potential variables is divided into 4 lists: Header (above), Footer, Measured, and Miscellaneous (below).



Footer Items. **Gas #** refers to which flux column to use. Usually this is 1. If you add flux computations, there will be more columns.



Measured Items. You can select IV (initial value), Mean or Range.



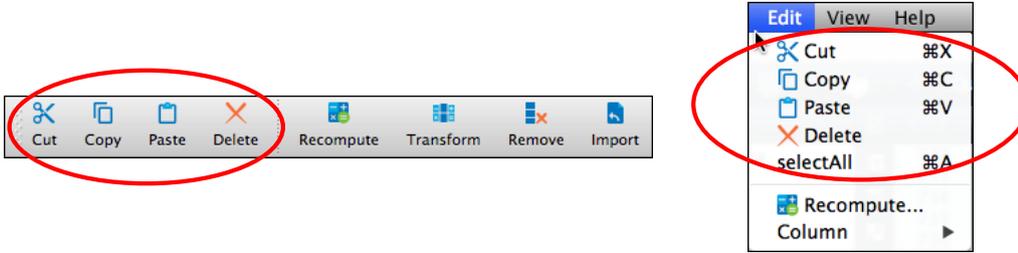
Miscellaneous items.

More information about the structure of LI-8100A files and what these variables are can be found in [SFP Definitions](#).

3 Summary View

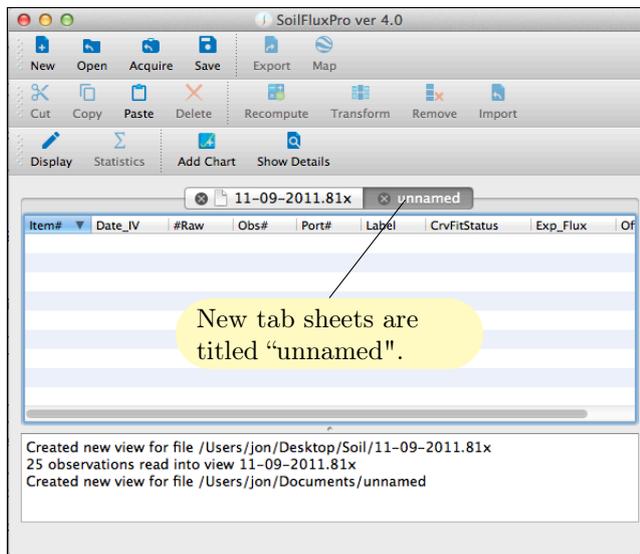
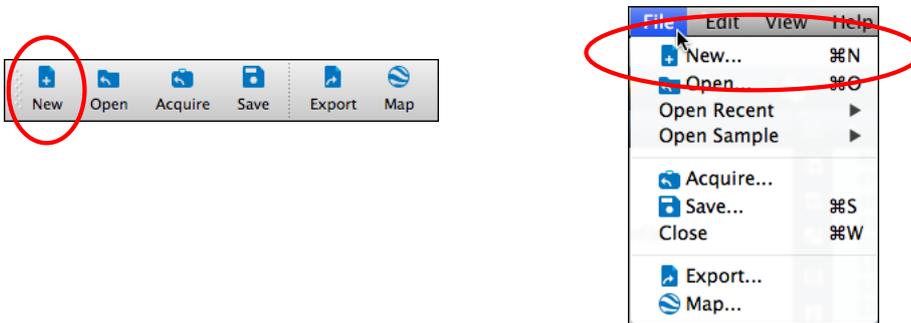
3.6 Move Observations Between Views

Selected observations in the Summary View can be Copied, Cut, and Pasted. Observations are selected by clicking on them. Note that **ctrl** + click (or **⌘** + click on Mac) selects multiple observations, and **ctrl** + click selects a range of observations. See also [Create an Empty View](#).



3.7 Create an Empty View

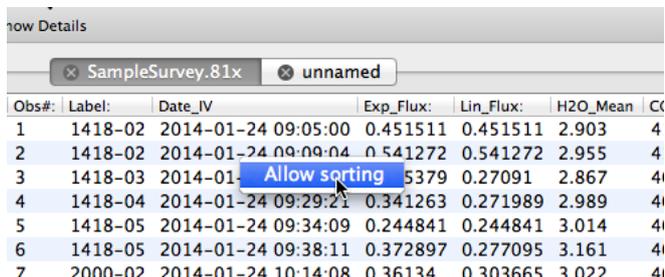
Sometimes it is useful to create an empty view, such as to create a destination for observations that you will paste in from other views ([Move Observations Between Views](#)). Creating an empty view is done by selecting **New** from the File menu or tool bar.



3 Summary View

3.8 Sort Observations

Click on the column header you wish to use for sorting. Click again to change sort direction.

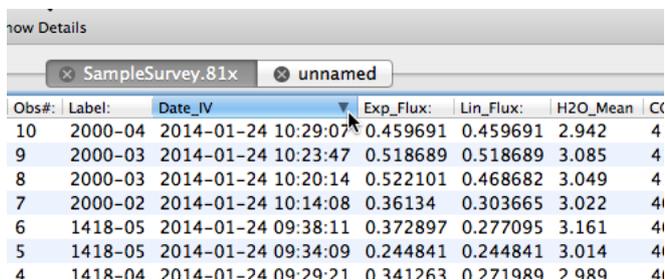


How Details

SampleSurvey.81x unnamed

Obs#:	Label:	Date_IV	Exp_Flux:	Lin_Flux:	H2O_Mean	CC
1	1418-02	2014-01-24 09:05:00	0.451511	0.451511	2.903	4
2	1418-02	2014-01-24 09:09:04	0.541272	0.541272	2.955	4
3	1418-03	2014-01-24 09:29:21	0.341263	0.27091	2.867	4
4	1418-04	2014-01-24 09:29:21	0.341263	0.271989	2.989	4
5	1418-05	2014-01-24 09:34:09	0.244841	0.244841	3.014	4
6	1418-05	2014-01-24 09:38:11	0.372897	0.277095	3.161	4
7	2000-02	2014-01-24 10:14:08	0.36134	0.303665	3.022	4

1. Enable sorting by right clicking in the content area of a Summary View.



How Details

SampleSurvey.81x unnamed

Obs#:	Label:	Date_IV	Exp_Flux:	Lin_Flux:	H2O_Mean	CC
10	2000-04	2014-01-24 10:29:07	0.459691	0.459691	2.942	4
9	2000-03	2014-01-24 10:23:47	0.518689	0.518689	3.085	4
8	2000-03	2014-01-24 10:20:14	0.522101	0.468682	3.049	4
7	2000-02	2014-01-24 10:14:08	0.36134	0.303665	3.022	4
6	1418-05	2014-01-24 09:38:11	0.372897	0.277095	3.161	4
5	1418-05	2014-01-24 09:34:09	0.244841	0.244841	3.014	4
4	1418-04	2014-01-24 09:29:21	0.341263	0.271989	2.989	4

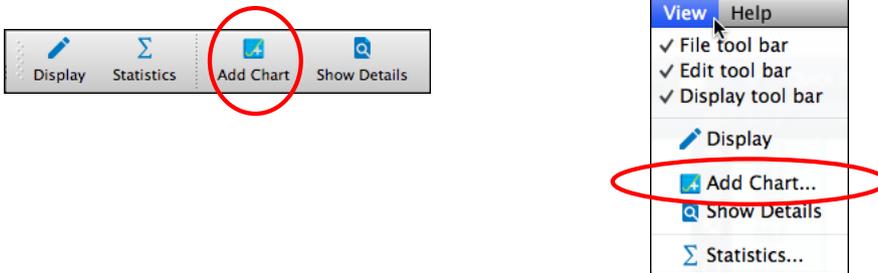
2. When sorting is enabled, you can sort by a column by clicking in that column's header.

To reverse the direction of sort, click again in the header.

3 Summary View

3.9 Add a Chart

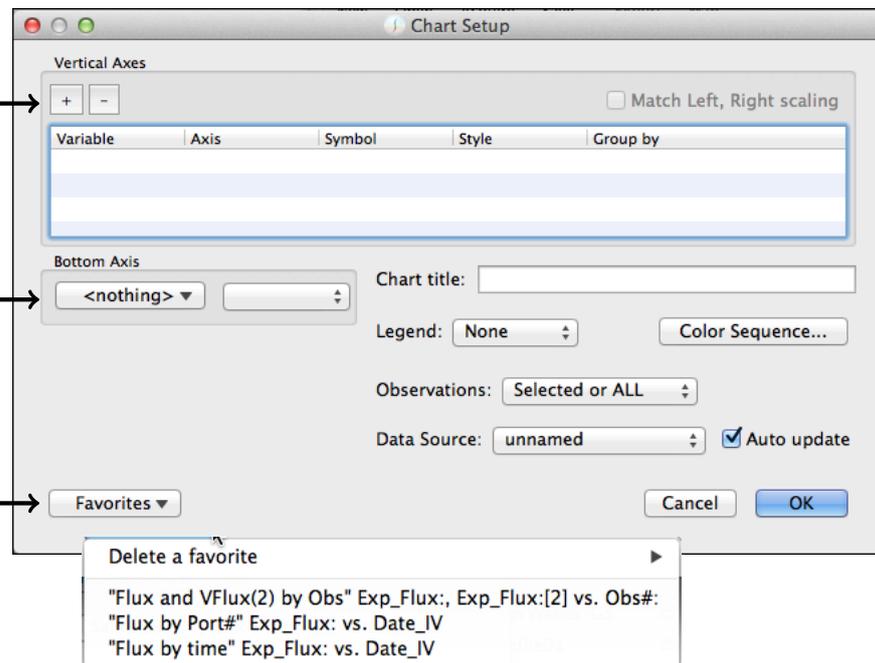
Click **Add Chart**, or select it from the View menu.



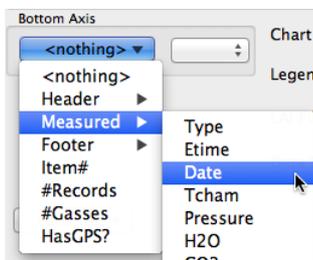
Click here to add a vertical axis...

... then here to define the horizontal axis...

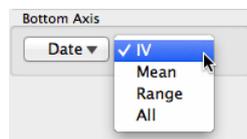
...or click here and select from a list of pre-defined graphs.



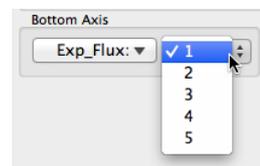
Defining the variable associated with a vertical or bottom axis is done as shown:



1. Use the drop down menu to select the variable. Most are grouped in submenus. Here, we are selecting **Date**.



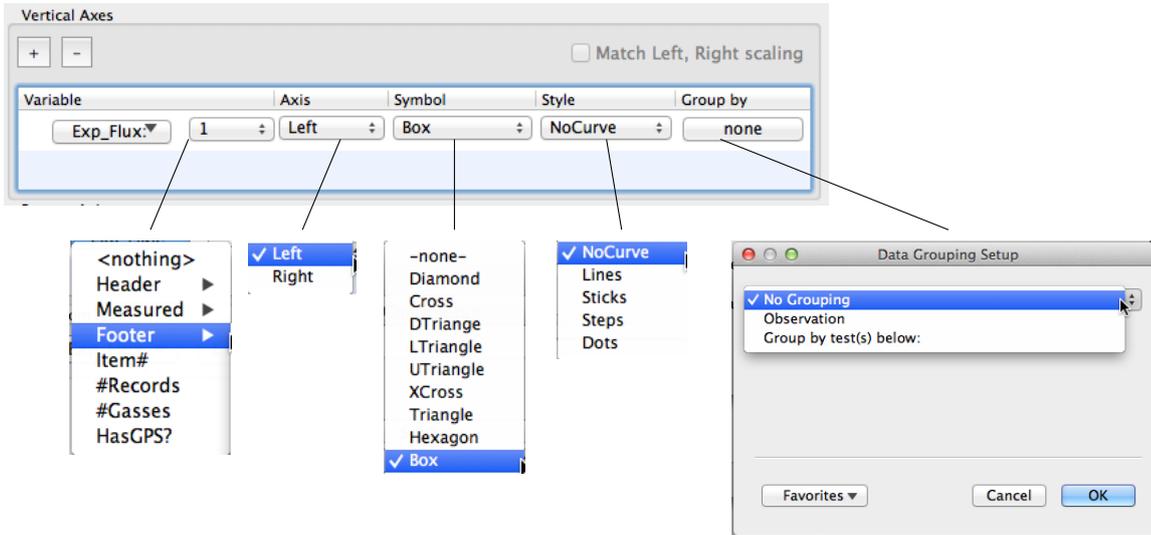
2. Items from the Measured menu have a secondary selection: **IV**, **Mean**, and **Range** have one value per observation, while the **All** selection refers to all of the **Type=1** values.



Footer items also have a secondary selection, although it is usually 1. If you have **added** more flux computations, then this is how you get to them.

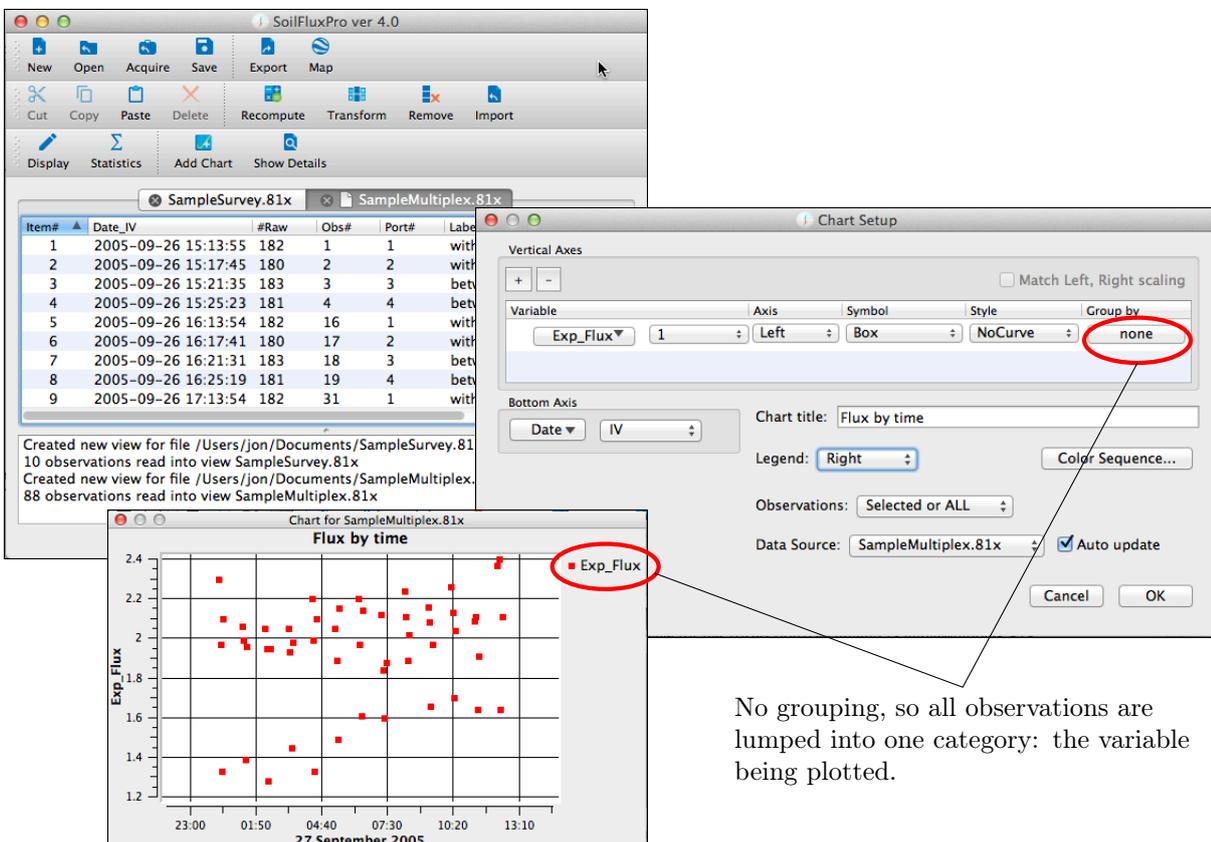
3 Summary View

The vertical axis definition includes which variable to plot, which axis, symbol, curve type, and grouping information.



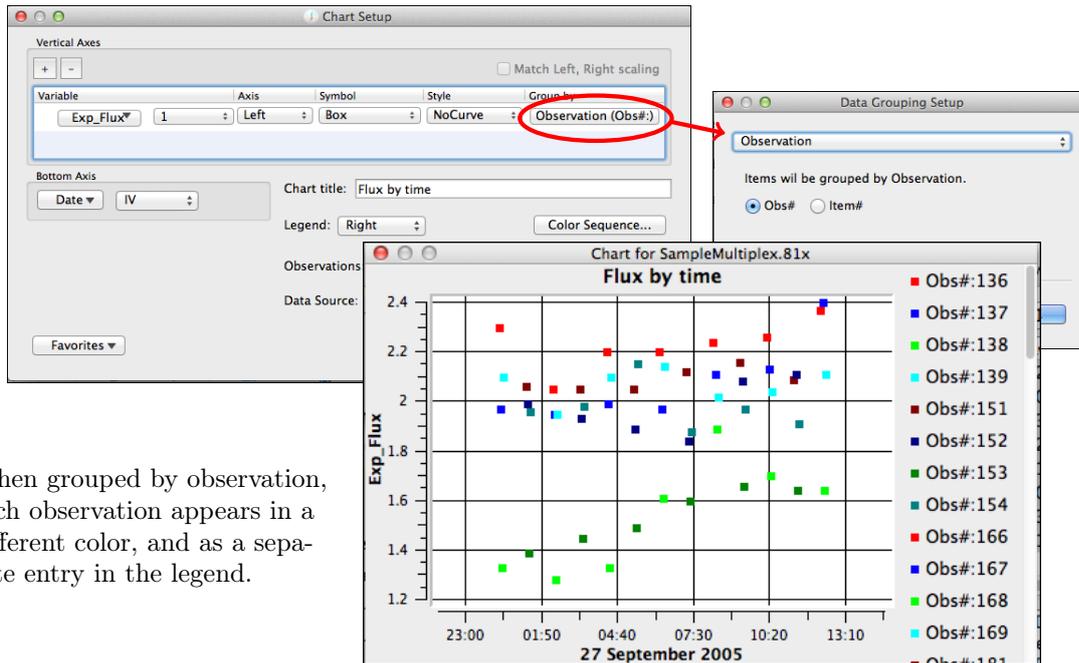
3.9.1 How to Group Plotted Data

To illustrate grouping, we will use a data file with four multiplexed ports. (If you wish to follow along, use `File >> Open Sample >> SampleMultiplex.81x`). The first graph shows flux as a function of time, with no grouping.



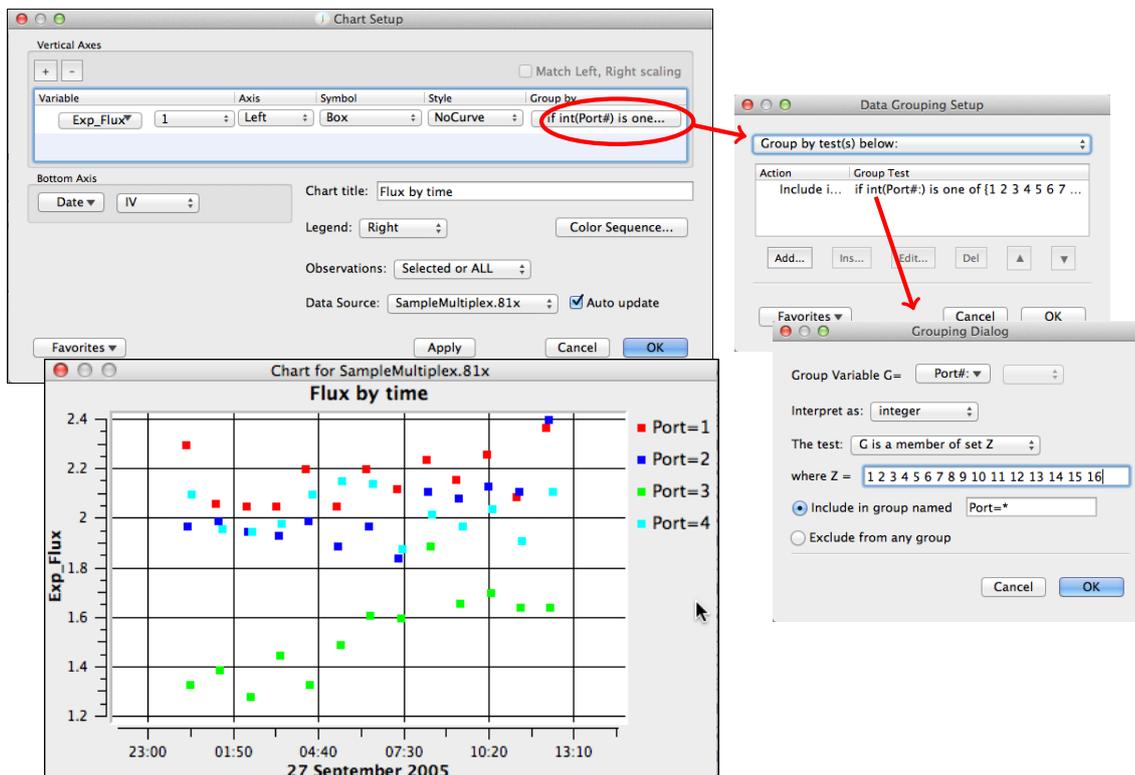
3 Summary View

Next, we do a simple grouping by observation.



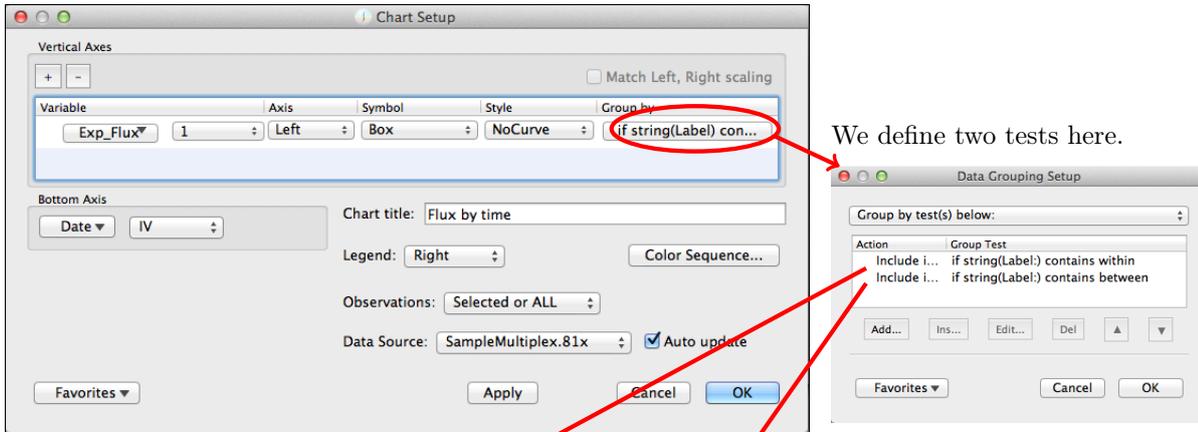
When grouped by observation, each observation appears in a different color, and as a separate entry in the legend.

Grouping can also occur via one or more tests. In this next example, we examine **Port#**, treat them as integers, and combine data sets with like port numbers together, naming them "Port=".

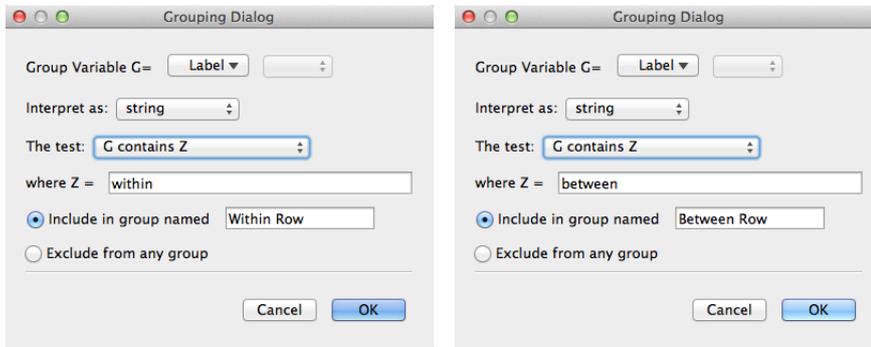


3 Summary View

Finally, we combine the data into two groups: between rows and within rows, based on the **Label** in each observation.

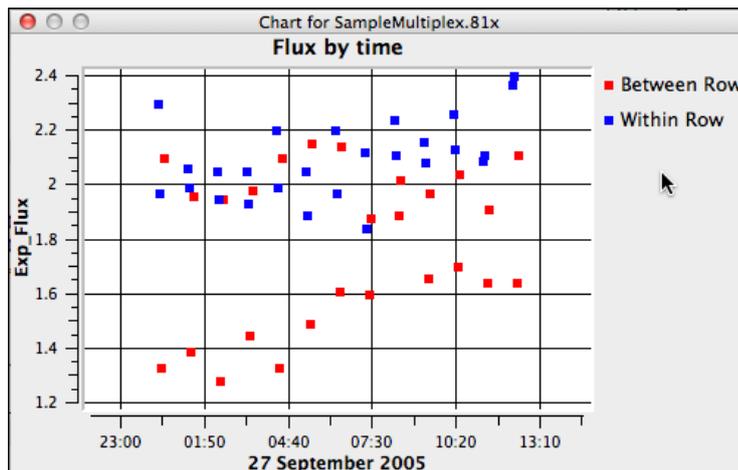


We define two tests here.



Test 1: If **Label** contains the word *within*, put it in this group.

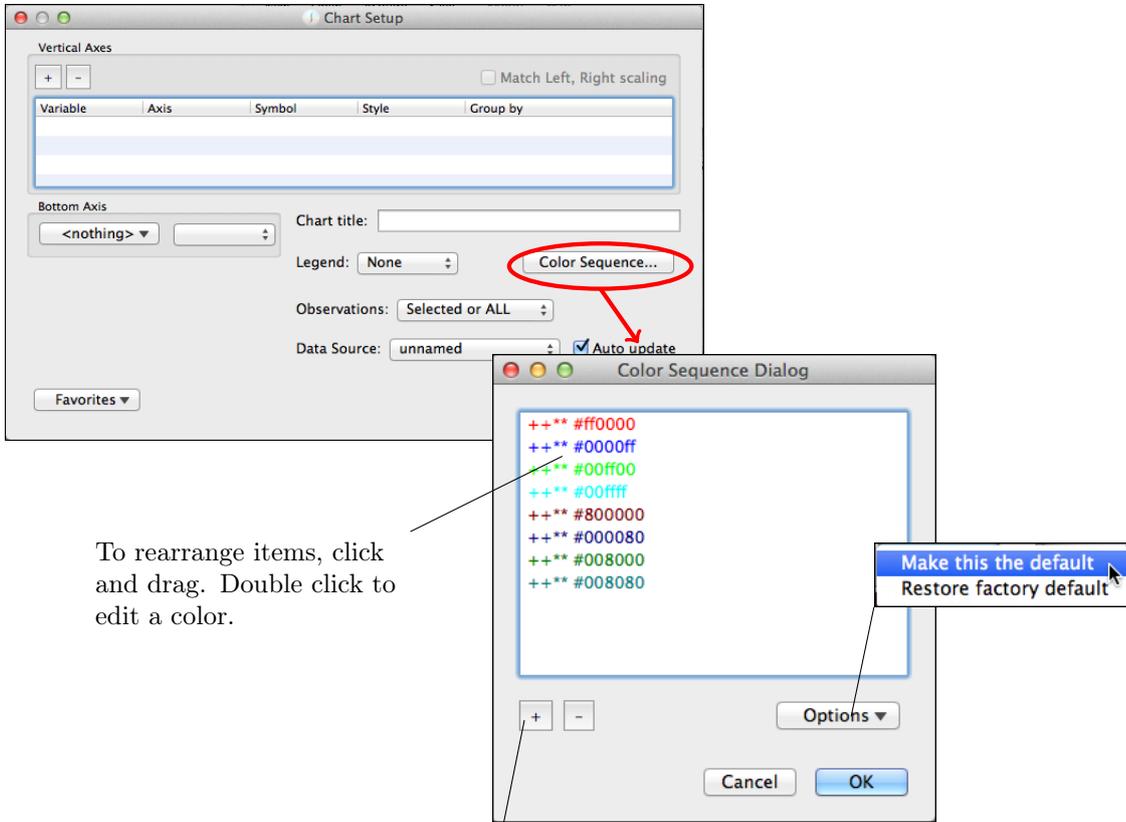
Test 2: If **Label** contains the word *between*, put it in this group.



3 Summary View

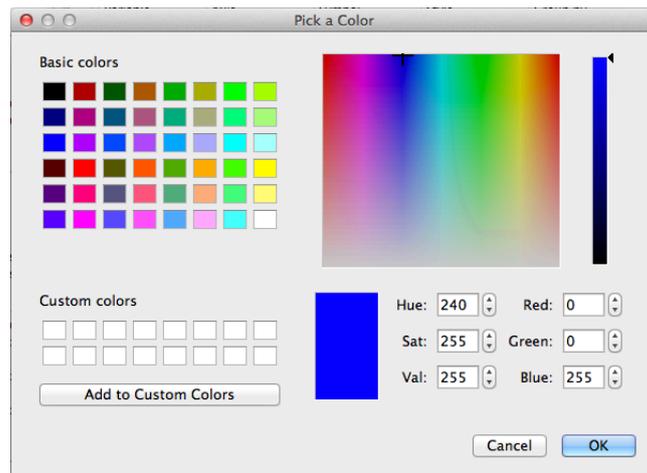
3.9.2 Setting the Color Sequence

The sequence of colors used in Charts is automatic, but you can modify that sequence with the Color Sequence Dialog.



To rearrange items, click and drag. Double click to edit a color.

Adding or editing an entry uses the system color picker dialog.

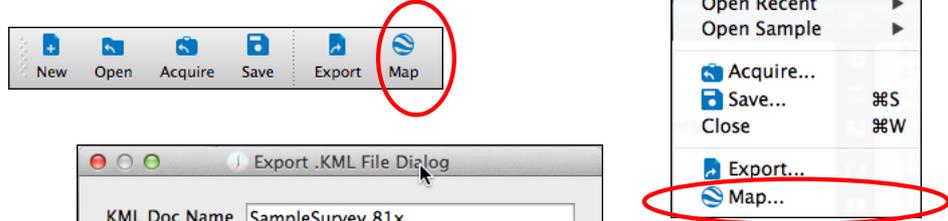


3 Summary View

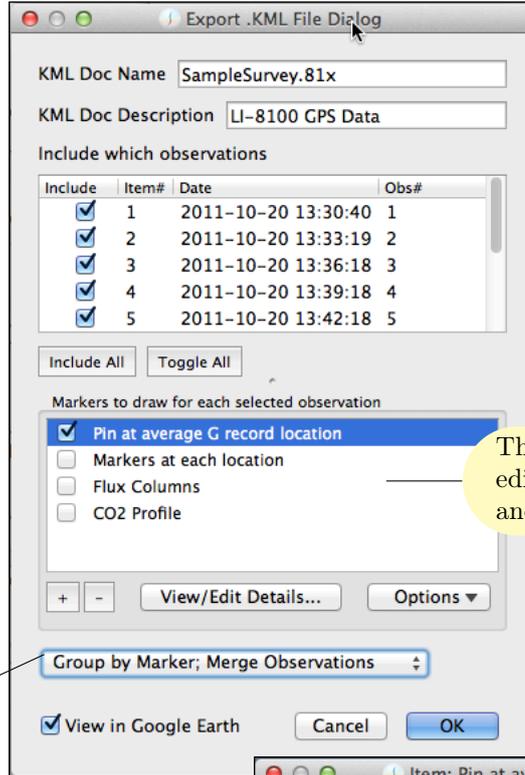
3.10 Create a .kml File for Google Earth

If GPS data is contained in the observation, then a .kml file can be created. The following example uses the file `File >> Open Sample >> SampleMultiplex.81x`.

1. Click `Map` on the tool bar, or select it from the File menu.



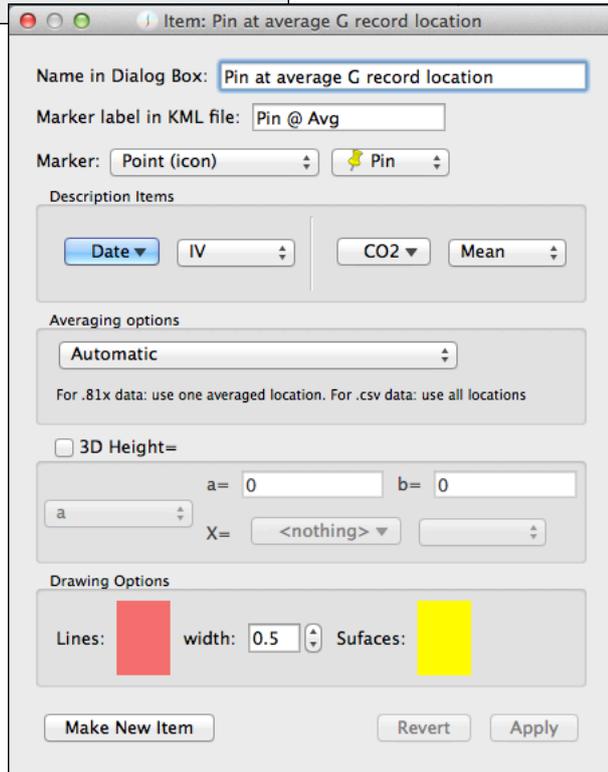
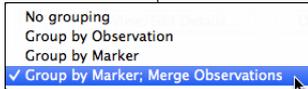
2. Check the observations to be included. This list will only show observations that have Latitude and Longitude data.



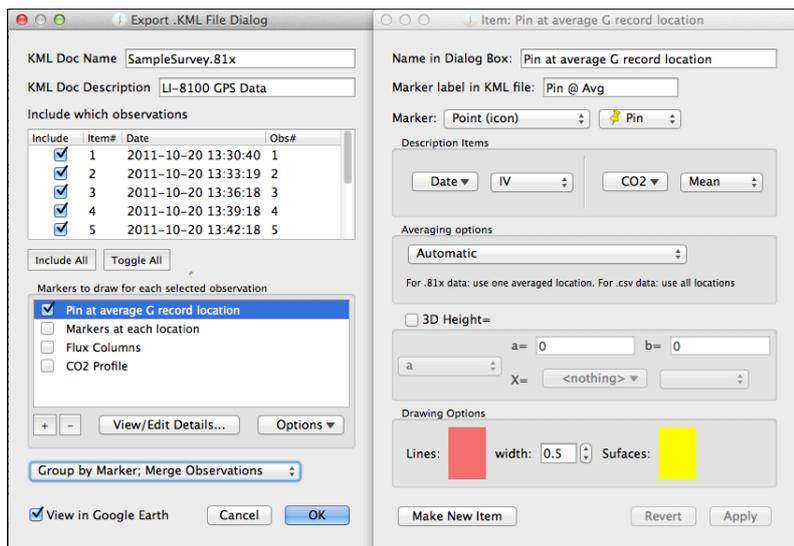
3. Select which sorts of markers you wish to have drawn.

This list is user definable. To edit a definition, highlight it and click `View/Edit Details...`

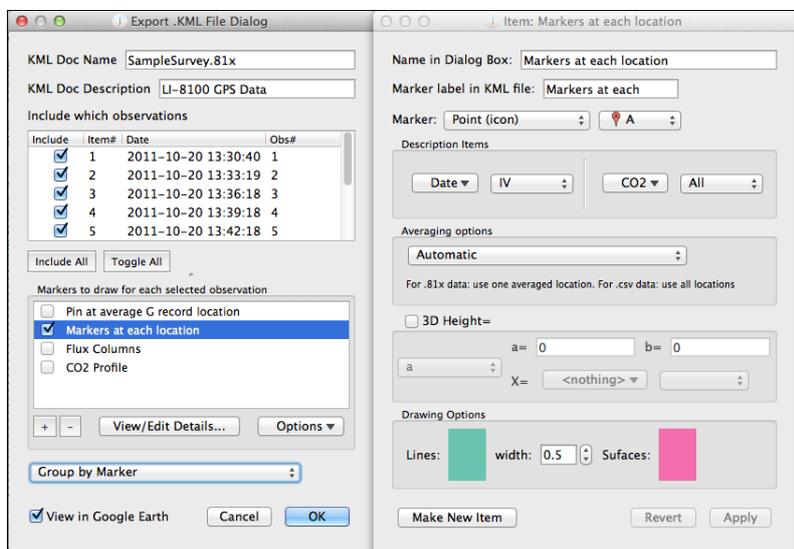
3. Select how the data should be grouped.



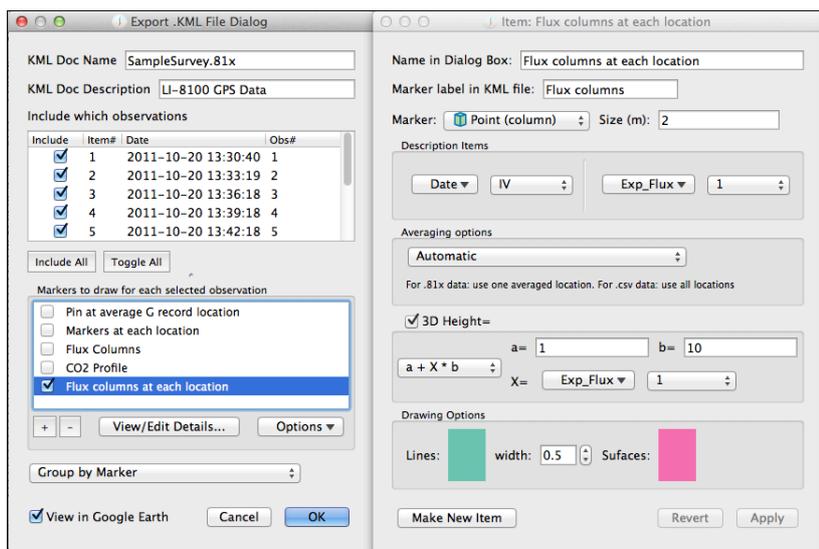
3 Summary View



a) Single marker (merged observations) showing average location of all 10 observations.



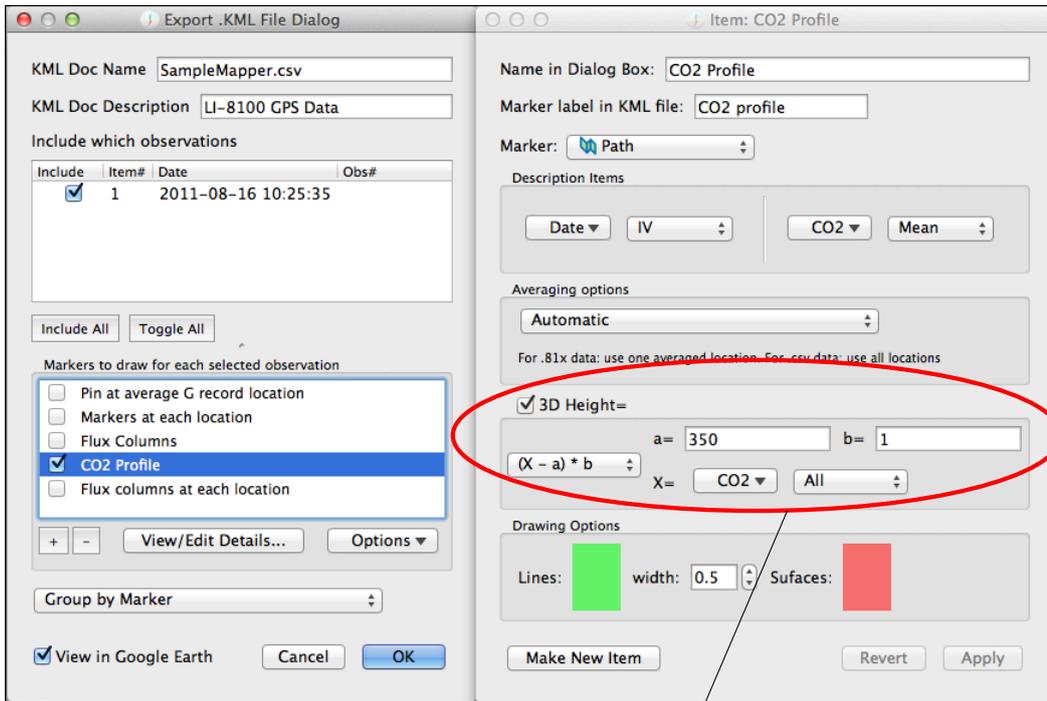
b) To put a marker at each observation, do not merge them.



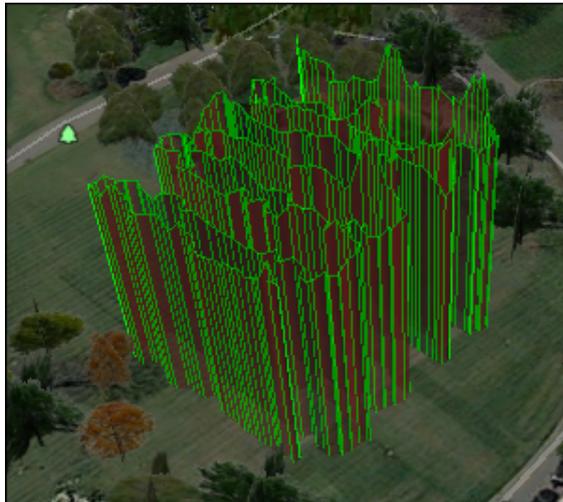
c. Each obs location marked with a 3D column, height proportional to flux.

3 Summary View

With continuous measurement (for example, `File > Open Sample > SampleMapper.csv`), the **Path** marker is probably the most interesting to use.



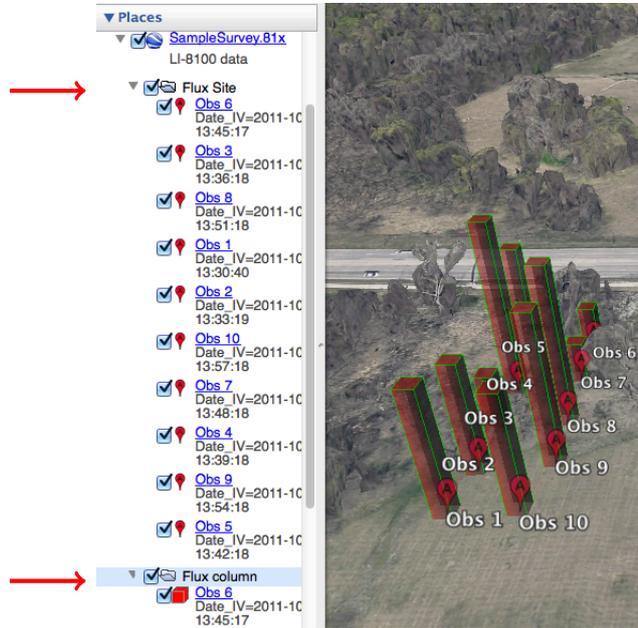
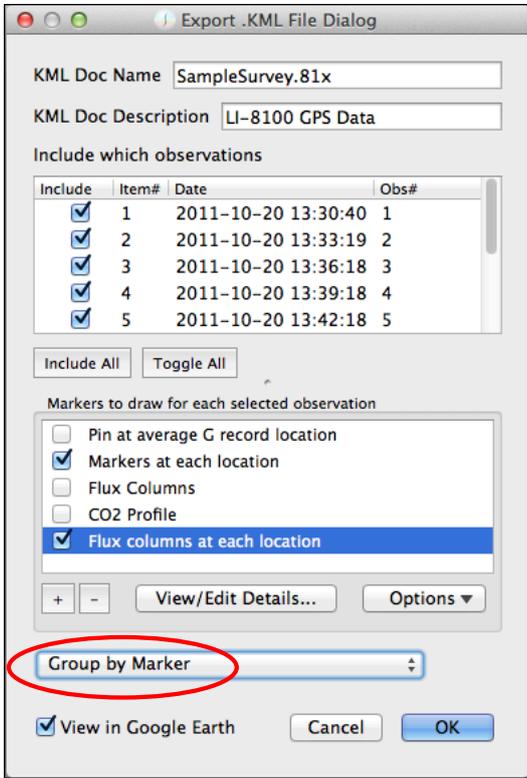
The 3D path has a height (m) that is computed from the CO₂ concentration at each point minus 350.



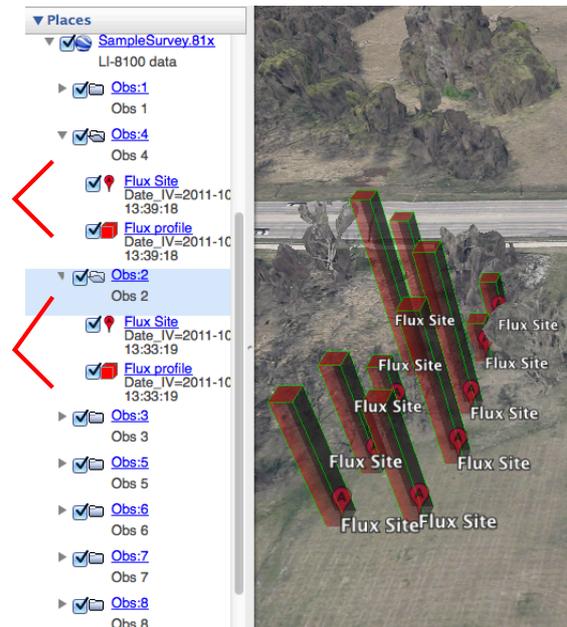
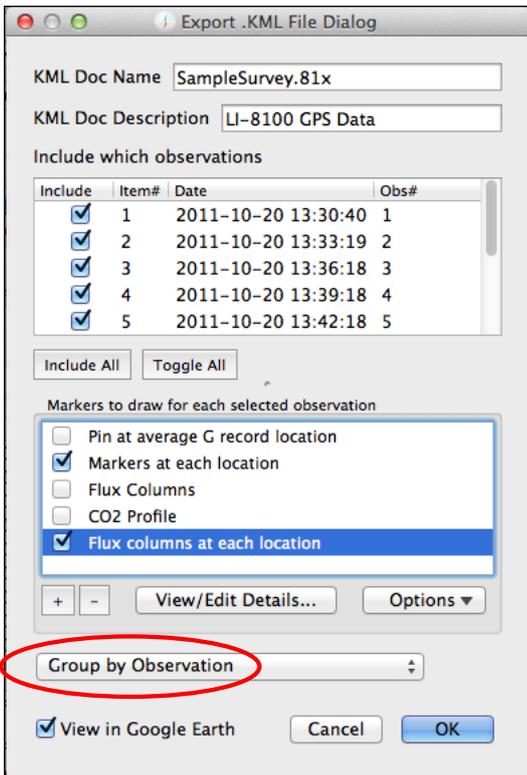
3 Summary View

3.10.1 Group by Observation or Marker

The following illustrates the difference between the option to group by observation, and group by marker.



There's a column check box, and a marker check box. Under each are 10 check boxes for each observation location.

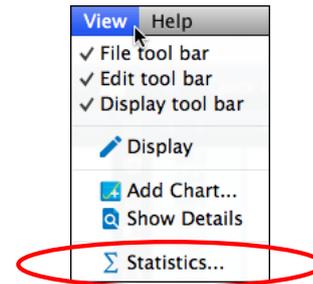


Each of the 10 observations has a check box, and under each is a check box for the column and one for the marker.

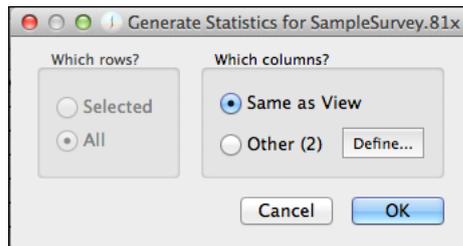
3 Summary View

3.11 Compute Statistics

1. Click **Statistics**, or select it from the View menu.



2. Pick the list of variables on which to compute statistics. It can be the same as the Summary View list, or you can pick a different set ([Selecting Variables Dialog](#)).



3. Click **OK**, and the results will be shown in a window. This summary table can be saved as a text file, or printed.

	Item#	Date_IV	#Raw	Obs#	Port#	Label	CrvFitStatus	Exp_Flux	Offset
Sample N	10	10	10	10	10	10	10	10	10
Mean	5.5	1.31914e+09	104.8	5.5	0	0	0	2.689	5
Minimum	1	1.31914e+09	104	1	0	0	0	1.03	5
Maximum	10	1.31914e+09	105	10	0	0	0	4.33	5
StdDev	2.87228	513.455	0.4	2.87228	0	0	0	1.10001	0

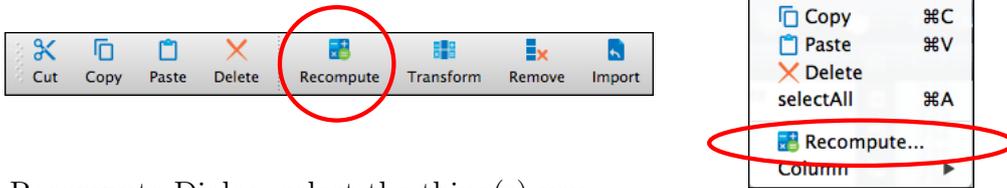
Copy to clipboard puts this content into the system's clipboard, allowing you to paste it into other applications, such as spreadsheets.

Save allows you to write the contents with tab delimiters to a text file.

3 Summary View

3.12 Recompute Observations

1. Click **Recompute**, or select it from the Edit menu.



2. In the Recompute Dialog, select the thing(s) you wish to change. In the example below, we are changing the **Offset** (collar height parameter), which will change the total volume, and thus the flux.

The 'Recompute Dialog' window is shown. On the left, under 'Change Constants', the 'Offset' checkbox is checked and its value is set to 7 cm. On the right, under 'Flux Calculations', the 'Gas column label' is set to 'Cdry'. A yellow callout box points to the 'Flux Calculations' area with the text: 'If you wish to redo the curve fit, or set all the start/stop times the same, you can check the appropriate boxes in the Flux Calculations area.'

3. Click **OK**, and the observation(s) will be recomputed, and the results displayed in a summary window.

The 'Recompute Results for SampleSurvey.81x' window displays a table with the following data:

Item#	Old Offset	New Offset	Old Vtotal	New Vtotal	Old Flux	New Flux
1	5	7	5682	6317	3.00	3.33669
2	5	7	5682	6317	2.68	2.97485
3	5	7	5682	6317	1.34	1.48496
4	5	7	5682	6317	4.33	4.81454
5	5	7	5682	6317	2.89	3.21193
6	5	7	5682	6317	1.20	1.32888
7	5	7	5682	6317	1.03	1.14158
8	5	7	5682	6317	3.92	4.35952
9	5	7	5682	6317	3.66	4.06724
10	5	7	5682	6317	2.84	3.15255

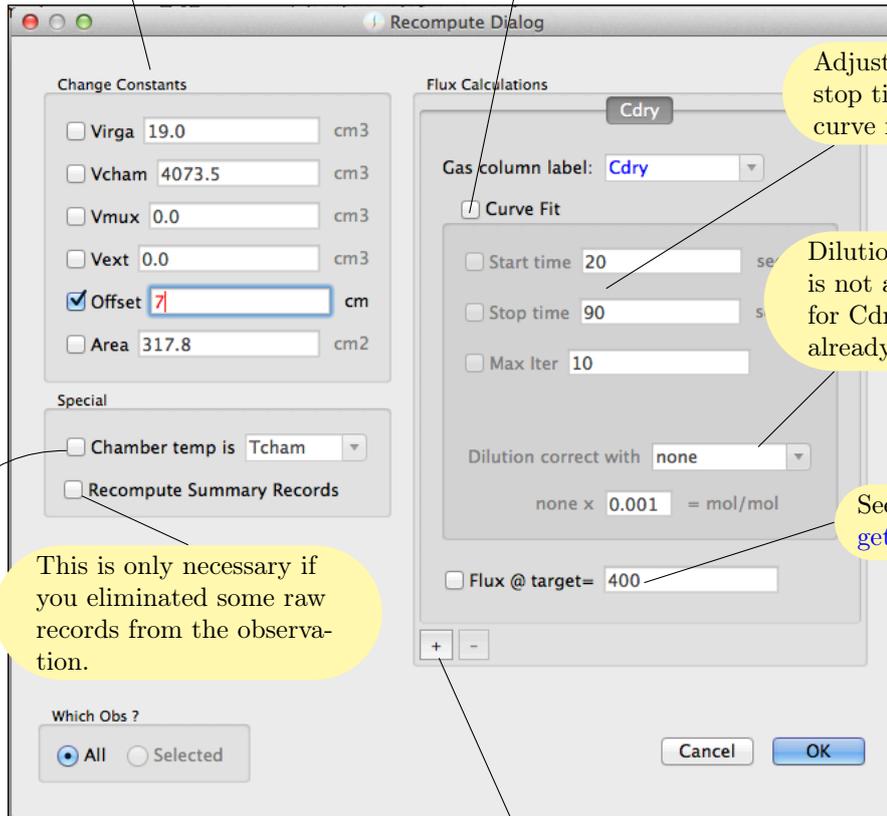
3 Summary View

3.12.1 Recompute Options

The figure below indicates the various options available when recomputing.

Changing any of these constants will change the total volume, and thus the flux.

Redo the **Cdry** vs. **Etime** curve fit.



Adjust start and stop times for the curve fit.

Dilution correction is not an option for Cdry, since it is already corrected.

See Compute Targeted Flux

This is only necessary if you eliminated some raw records from the observation.

You can specify the column to use for chamber air temperature.

Fluxes of additional Gasses.

3.12.2 Compute Targeted Flux

The LI-8100A computes flux at the concentration present when the chamber closed. SFP supports additional flux computations at other targets based on the slope of the exponential fit of **Cdry** vs. **Etime**. To compute the rate of change of **Cdry** at a particular target concentration C_t , we first solve the [Exponential Fit](#) expression for time t_t such that $C(t_t) = C_t$. Since

$$C_t = C_\infty + (C_0 - C_\infty)e^{-a(t_t - t_0)} \quad (1)$$

3 Summary View

$$t_t = \frac{1}{a} \ln \frac{C_0 - C_\infty}{C_t - C_\infty} + t_0 \quad (2)$$

The rate of change of Cdry at time t_t is then

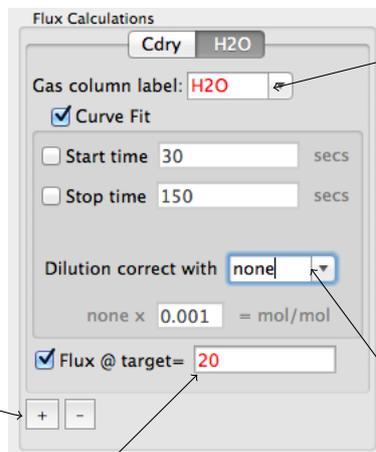
$$\frac{\delta}{\delta t} C(t_t) = a(C_0 - C_\infty) e^{-a(t_t - t_0)} \quad (3)$$

Targeted flux is computed using this slope. The target can be a user entered value (**Target**), and the flux at this value is **Flux@Target**. SFP also computes the minimum Cdry value during chamber closing (**MinCO2**), and the flux at that target value (**Flux@Min**). Target can be specified in the [Recompute Observations](#) dialog.

3.12.3 Fluxes of Additional Gasses

The LI-8100A computes flux for **Cdry**, the water corrected CO₂ concentration. You can add additional fluxes for other gasses that are recorded during the measurement (e.g. use **H2O** or use signals from an external gas analyzer that were recorded by the LI-8100A in a spare channel). See [Footer](#) for where the results reside.

1. To add a flux computation, click **+**.



2. Specify the column label for the data to be used for this gas. If you had methane data logged in **V2**, then you would use that. In this figure, we are using the **H2O** column to compute a water flux.

4. If you want a targeted flux value, specify the target here.

3. If the data needs to be corrected for water vapor, specify the column to use for water vapor (typically **H2O**). Also, specify how to convert the water data in that column to units of mol/mol. (If you used **H2O**, which is in mmol/mol, then the multiplier is 0.001.)

3 Summary View

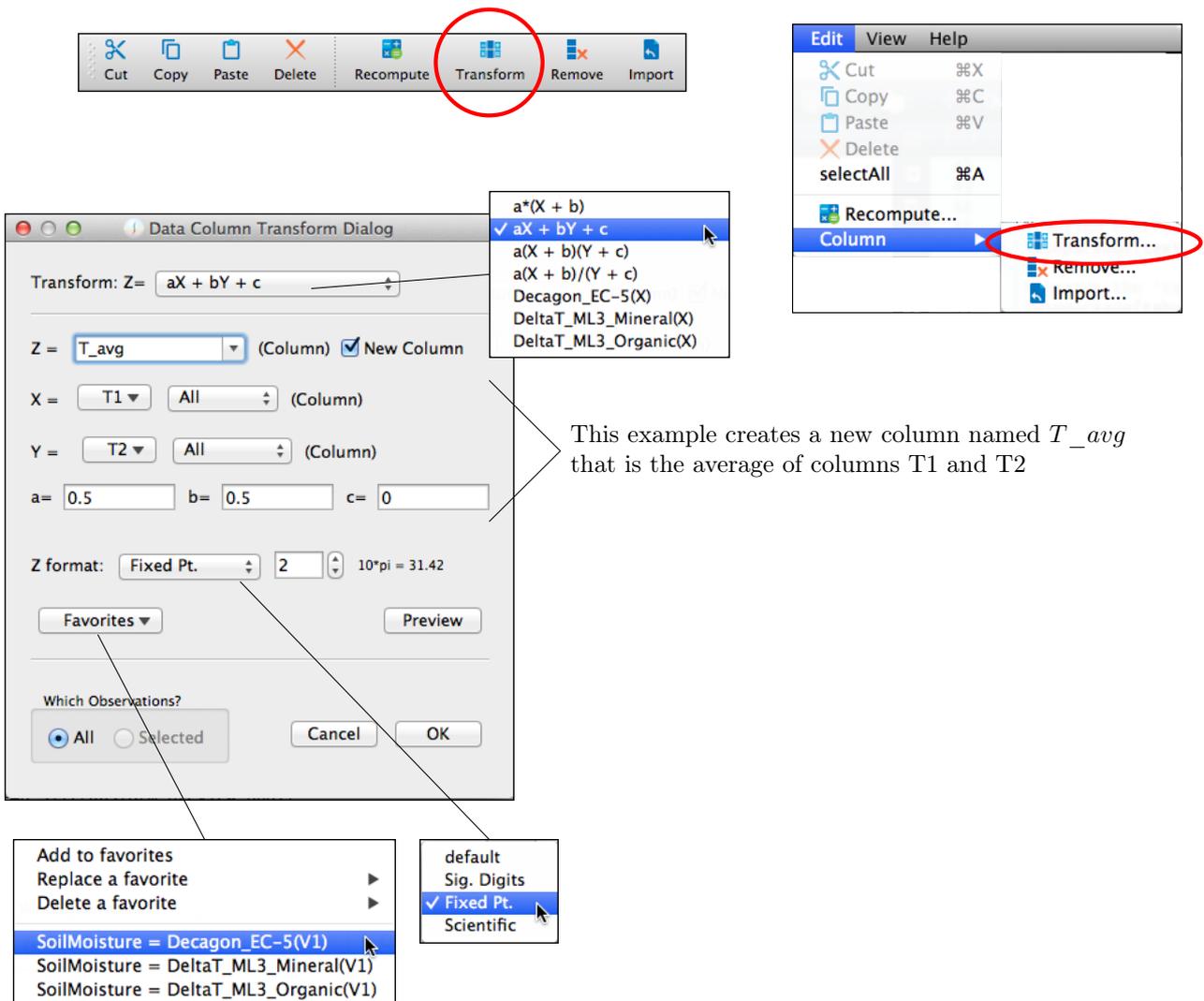
3.13 Transforming Columns

The measured data columns can be can be mathematically transformed, using one of the following:

$$\begin{aligned}
 Z &= a(X + b) \\
 Z &= aX + bY + c \\
 Z &= a(X + b)(Y + c) \\
 Z &= a \frac{X + b}{Y + c} \\
 Z &= a + bX + cX^2 \\
 Z &= a + bX + cX^2 + dX^3 + eX^5 + fX^5 + gX^6
 \end{aligned}
 \tag{4}$$

where Z are the values in the column to be transformed, $a, b \dots g$ are user entered constants, and X and Y are also column values (can be same as Z), but can also be any other value in the observation.

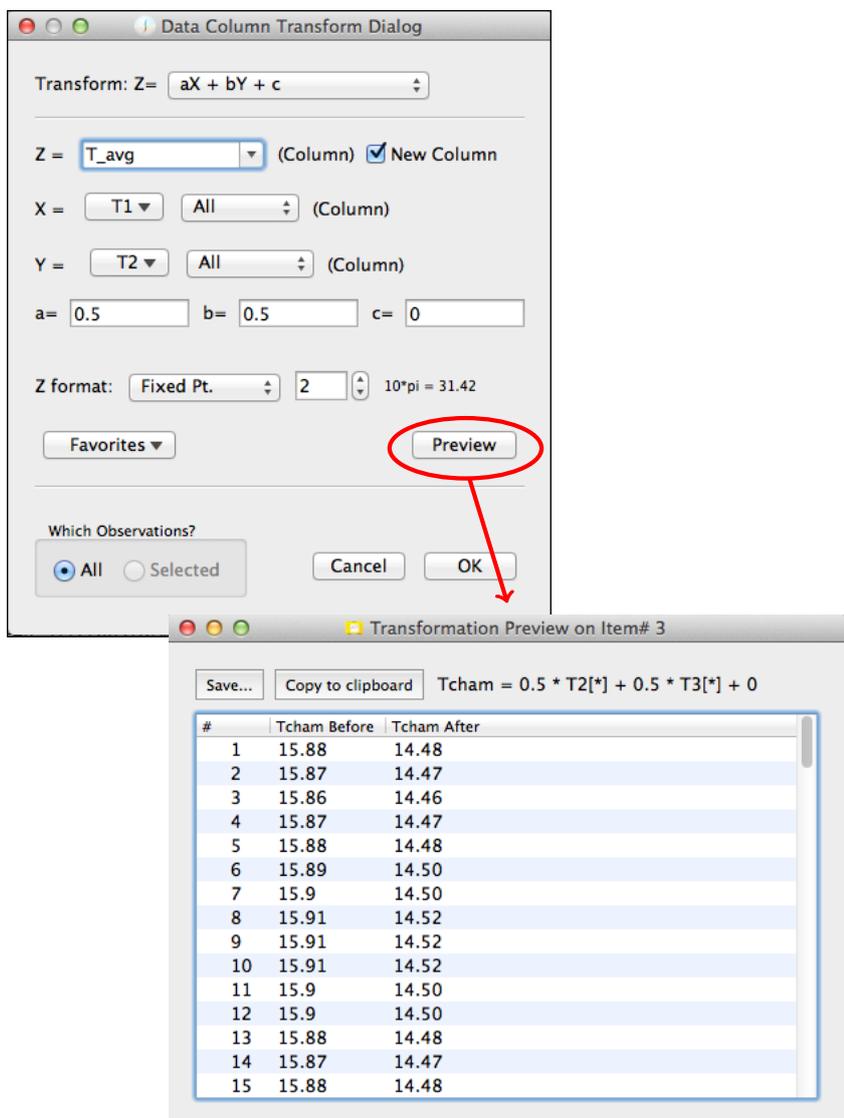
To do a column transform, click **Transform** on the tool bar or **Edit >> Column >> Transform...**.



This example creates a new column named T_avg that is the average of columns T1 and T2

3 Summary View

The **Preview** button applies the transform to the first file in the potential list and shows the results in a view; it does not change the observational data.



3.13.1 Soil Moisture

There are three "built-in" soil moisture transformations. Decagon_EC-5 uses a 3rd order polynomial, and the two DeltaT_ML3 transforms use a 6th order polynomial. Coefficients shown below.

Name	a	b	c	d	e	f	g
Decagon EC-5	-0.612	1.16	-0.314	-	-	-	-
DeltaT ML3 (Mineral)	-0.071	0.735	0.75	-8.759	21.838	21.998	8.097
DeltaT ML3 (Organic)	-0.039	0.802	0.819	-9.556	23.823	23.997	8.833

3 Summary View

3.14 Importing Columns

Data collected and stored in a separate file by another gas analyzer running in parallel with the LI-8100A can be imported into the LI-8100A data file, and fluxes computed from it. The methodology is to scan the external file(s) for the observations needed based on the time stamps in the LI-8100A file. The figure below illustrates the process.

Consider the first observation in an LI-8100A data file.

Item#	Type	Obs#	Tcham_IV	Port#	#Msgs	ObsDateTime	#Raw	Label	CO2_IV	Exp_Flux
1	Cham 1	23.26	2	0	0	2014-09-26 09:31:24	164		616.21	4.380000
2	Cham 2	23.43	2	0	0	2014-09-26 09:36:14	164		623.89	4.400000
3	Cham 3	23.41	2	0	0	2014-09-26 09:41:14	164		638.3	4.450000
4	Cham 4	23.44	2	0	0	2014-09-26 09:46:14	164		644.78	4.390000
5	Cham 5	23.42	2	0	0	2014-09-26 09:51:14	164		616.85	4.470000
6	Cham 6	23.39	2	0	0	2014-09-26 09:56:14	164		602.38	4.490000
7	Cham 7	23.4	2	0	0	2014-09-26 10:01:14	164		644.03	4.510000
8	Cham 8	23.38	2	0	0	2014-09-26 10:06:14	164		665.17	4.520000

For each reading in the observation, we look in source file(s) for corresponding readings to get the appropriate value to import for that reading.

For example, the LI-8100A record at 09:28:55 would import selected columns from the external file from a Los Gatos Research instrument, interpolated from its 09:28:54.003 and 09:28:55.039 records

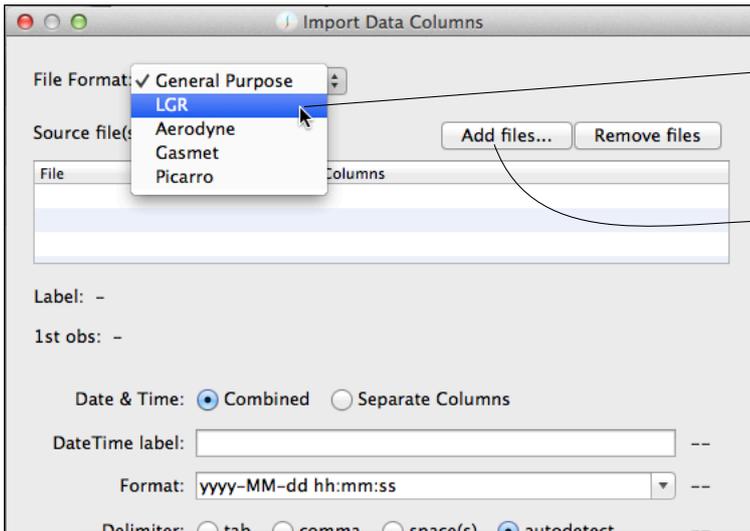
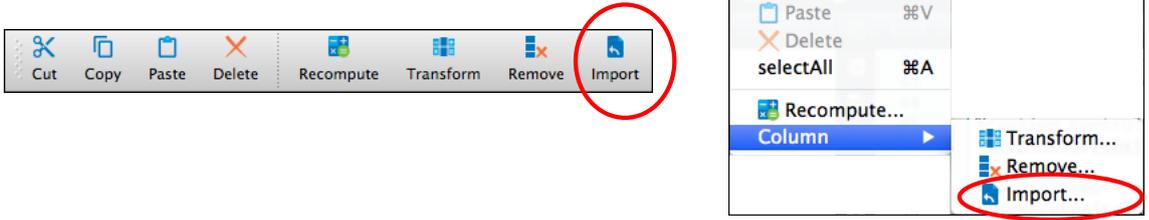
Type	Etime	Date	Tcham	Pressure	H2O	CO2	Cdry	Tber
1	-14	2014-09-26 09:28:41	26	96.87	12.384	610.15	617.8	50.6
1	-13	2014-09-26 09:28:42	24.18	96.87	12.378	610.2	617.85	50.5
1	-12	2014-09-26 09:28:43	23.25	96.85	12.378	610.69	618.35	50.5
1	-11	2014-09-26 09:28:44	23.25	96.85	12.38	610.74	618.4	50.5
1	-10	2014-09-26 09:28:45	23.25	96.84	12.377	610.47	618.12	50.5
1	-9	2014-09-26 09:28:46	23.25	96.85	12.368	611.02	618.67	50.5
1	-8	2014-09-26 09:28:47	23.26	96.85	12.366	611.51	619.17	50.5
1	-7	2014-09-26 09:28:48	23.25	96.86	12.366	611.17	618.82	50.6
1	-6	2014-09-26 09:28:49	23.25	96.87	12.367	613.43	621.11	50.6
1	-5	2014-09-26 09:28:50	23.25	96.87	12.372	613.19	620.87	50.5
1	-4	2014-09-26 09:28:51	23.25	96.86	12.383	614.02	621.72	50.5
1	-3	2014-09-26 09:28:52	23.26	96.85	12.385	616.03	623.76	50.5
1	-2	2014-09-26 09:28:53	23.26	96.85	12.388	614.75	622.46	50.5
1	-1	2014-09-26 09:28:54	23.27	96.85	12.397	616.87	624.62	50.5
1	0	2014-09-26 09:28:55	23.26	96.85	12.397	616.67	624.41	50.5
1	1	2014-09-26 09:28:56	23.26	96.86	12.411	616.99	624.74	50.5
1	2	2014-09-26 09:28:57	23.26	96.86	12.427	618.24	626.02	50.5
1	3	2014-09-26 09:28:58	23.27	96.86	12.436	617.94	625.72	50.5

Import

VC:904M BD:May 23 2013 SN:LGR-0201	Time,	[CH4]_ppm,	[CH4]_ppm_sd,	[H2O]_ppm,	[H2O]_ppm_sd,	[CO2]_ppm,	[CO2]_ppm_sd,	...
09/26/2014 08:50:30.336,	2.18974e+00,	0.00000e+00,	9.78762e+03,	0.00000e+00,	5.98649e+02,	0.00000e+00,	...	
09/26/2014 08:50:31.371,	2.17942e+00,	0.00000e+00,	9.66532e+03,	0.00000e+00,	5.95608e+02,	0.00000e+00,	...	
09/26/2014 08:50:32.394,	2.18086e+00,	0.00000e+00,	9.94430e+03,	0.00000e+00,	5.95132e+02,	0.00000e+00,	...	
09/26/2014 08:50:33.422,	2.17720e+00,	0.00000e+00,	9.88543e+03,	0.00000e+00,	5.94218e+02,	0.00000e+00,	...	
09/26/2014 08:50:35.414,	2.17283e+00,	0.00000e+00,	9.70276e+03,	0.00000e+00,	5.94465e+02,	0.00000e+00,	...	
09/26/2014 08:50:36.210,	2.17157e+00,	0.00000e+00,	9.51253e+03,	0.00000e+00,	5.95595e+02,	0.00000e+00,	...	
:	:	:	:	:	:	:	...	
09/26/2014 09:28:52.083,	2.28837e+00,	0.00000e+00,	1.28470e+04,	0.00000e+00,	6.26606e+02,	0.00000e+00,	...	
09/26/2014 09:28:52.975,	2.29001e+00,	0.00000e+00,	1.28893e+04,	0.00000e+00,	6.26771e+02,	0.00000e+00,	...	
09/26/2014 09:28:54.003,	2.29046e+00,	0.00000e+00,	1.28838e+04,	0.00000e+00,	6.27504e+02,	0.00000e+00,	...	
09/26/2014 09:28:55.039,	2.28834e+00,	0.00000e+00,	1.27897e+04,	0.00000e+00,	6.28009e+02,	0.00000e+00,	...	
09/26/2014 09:28:56.066,	2.28681e+00,	0.00000e+00,	1.29832e+04,	0.00000e+00,	6.28034e+02,	0.00000e+00,	...	
09/26/2014 09:28:57.091,	2.28848e+00,	0.00000e+00,	1.28487e+04,	0.00000e+00,	6.28989e+02,	0.00000e+00,	...	
09/26/2014 09:28:58.119,	2.28867e+00,	0.00000e+00,	1.28695e+04,	0.00000e+00,	6.29385e+02,	0.00000e+00,	...	
:	:	:	:	:	:	:	...	

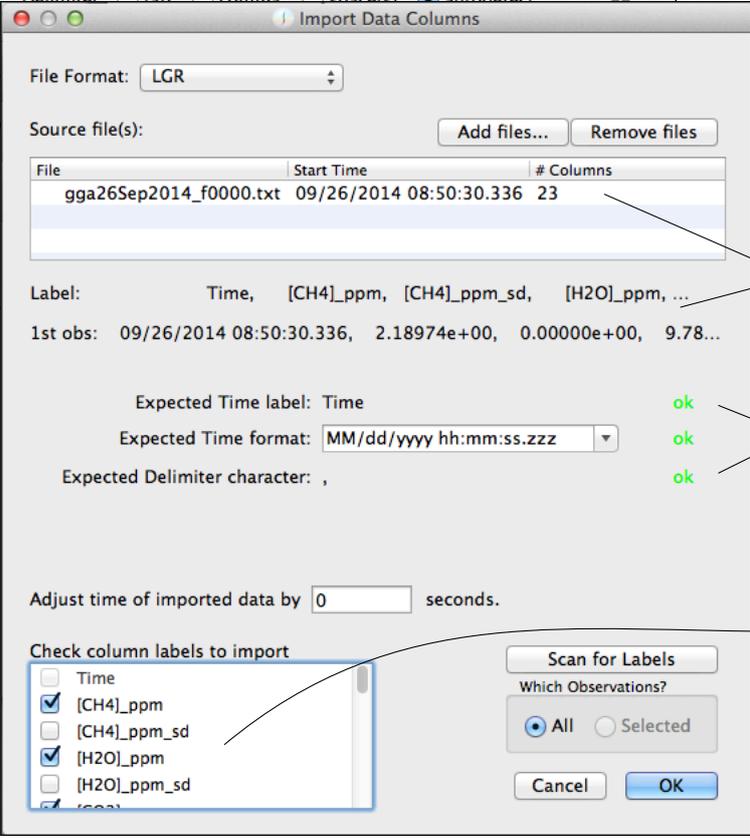
3 Summary View

To import columns of externally collected data, click the **Column Import** tool bar button.



Step 1. Select the file format of the source file(s).

Step 2. Add the source file(s) to the list.



The label line and first observation from the first file in the source list.

The expected format for an LGR file. **ok** means that format was successful, while **Error** means that format was not successful.

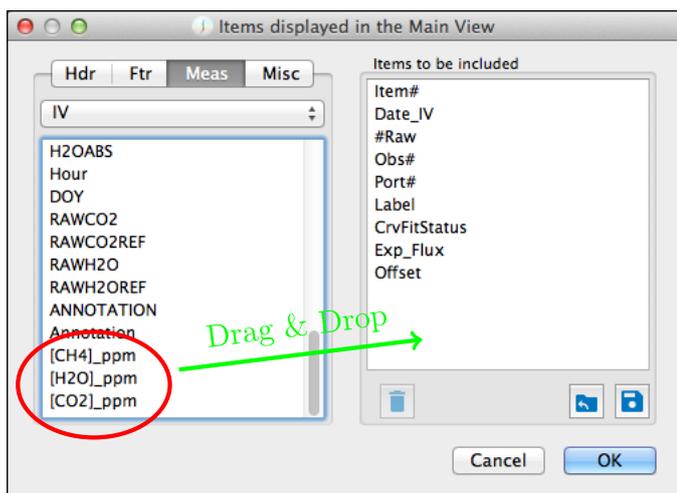
The list of data columns found in the first source file, when parsed according to the above expected formats.

Step 3. Check the columns you wish to import. Note that column(s) used for time and date are shown here, but are not checkable.

3 Summary View

Once the columns are imported, you can view them in the summary view, plot them, or use them to compute fluxes.

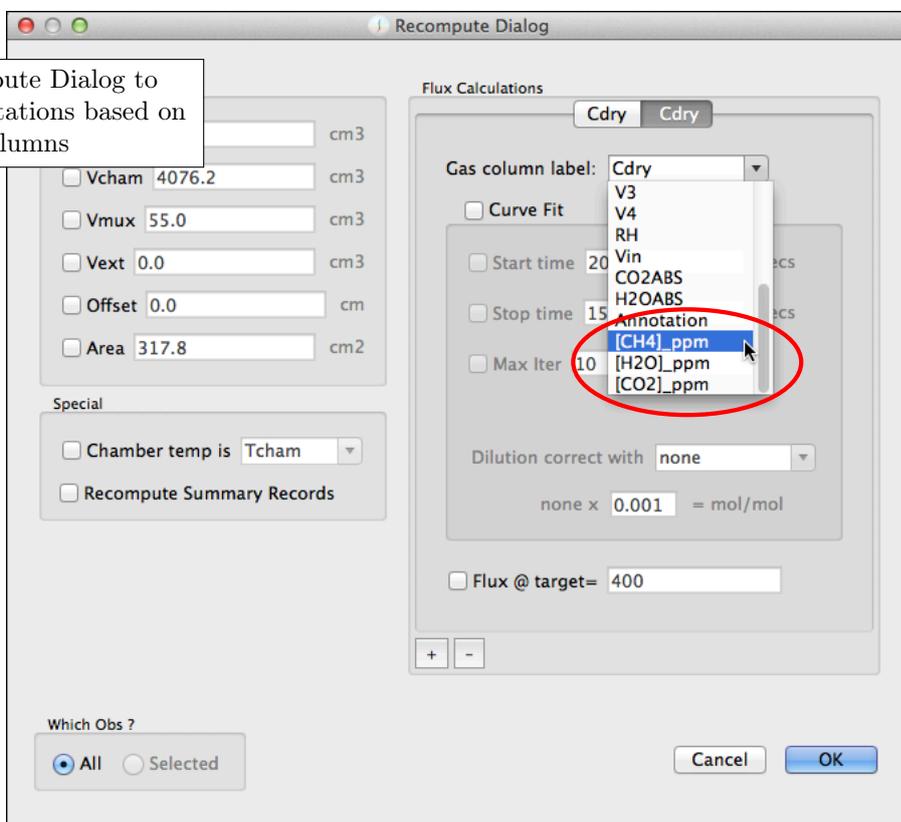
Imported columns in the Display Editor. Drag to add them...



...to the Summary View.

Item#	Date_IV	#Raw	Obs#	Port#	Label	CrvFitStatus	Exp_Flux	Offset	[CH4]_ppm_IV	[H2O]_ppm_IV	[CO2]_ppm_IV
* 8	2014-09-26 10:06:14	164	8	2	Lin	4.520000	0.000	2.25044	12950.4	676.795	
* 7	2014-09-26 10:01:14	164	7	2	Lin	4.510000	0.000	2.24899	13043.7	654.875	
* 6	2014-09-26 09:56:14	164	6	2	Lin	4.490000	0.000	2.23122	12972.5	615.903	
* 5	2014-09-26 09:51:14	164	5	2	Lin	4.470000	0.000	2.24414	13190.8	629.157	
* 4	2014-09-26 09:46:14	164	4	2	Lin	4.390000	0.000	2.28207	12984.2	661.324	
* 3	2014-09-26 09:41:14	164	3	2	Exp	4.450000	0.000	2.27784	13301.4	648.267	
* 2	2014-09-26 09:36:14	164	2	2	Lin	4.400000	0.000	2.2794	13049.1	637.205	
* 1	2014-09-26 09:31:24	164	1	2	Lin	4.380000	0	2.28844	12852.3	627.734	

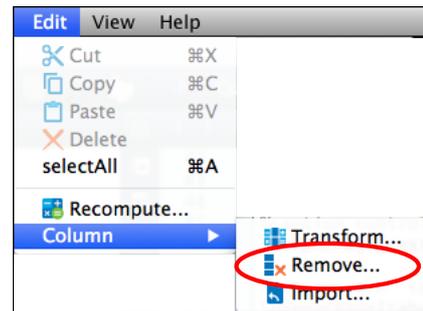
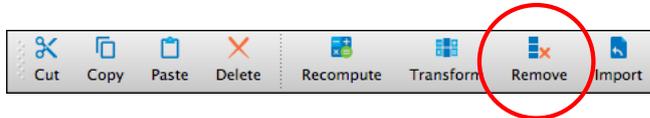
Use the Recompute Dialog to add flux computations based on the imported columns



3 Summary View

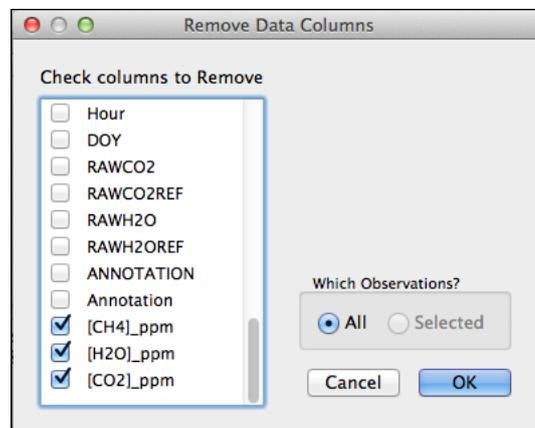
3.15 Removing Columns

To remove columns from observations, click on **Remove**, or else select it from **Edit > Column > Remove...**.



Check the names of the columns you wish to remove from the observations, and click **OK**.

Note: There is no “undo” for this.



4 Observation Details

To see Details for an observation, double click on that observation in [Summary View](#). This opens a view that “belongs” to that observation, updating automatically whenever something changes in that observation (e.g. recompute). Alternatively, click [Detail View](#), and see the detail view of whatever observation happens to be highlighted in the active Summary View. Confused? See [Zoom in on one Observation \(Method 1\)](#) and [Zoom in on an Observation \(Method 2\)](#).

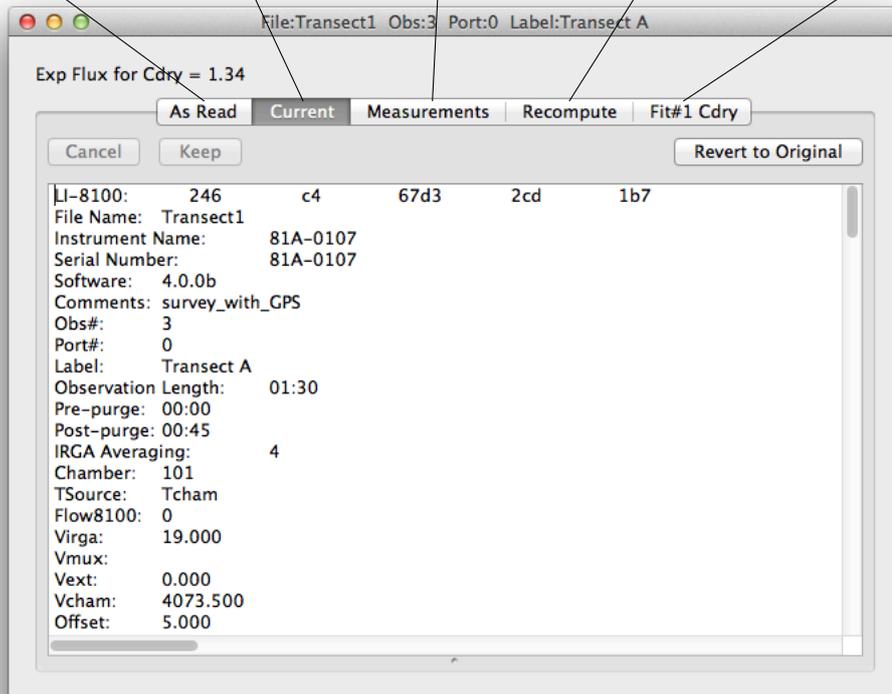
As Read is a read-only text view of the observation as it was last read from a file.

Current is an editable view of the observation in its current state.

Measurements shows raw and summary records in a table.

Recompute this observation.

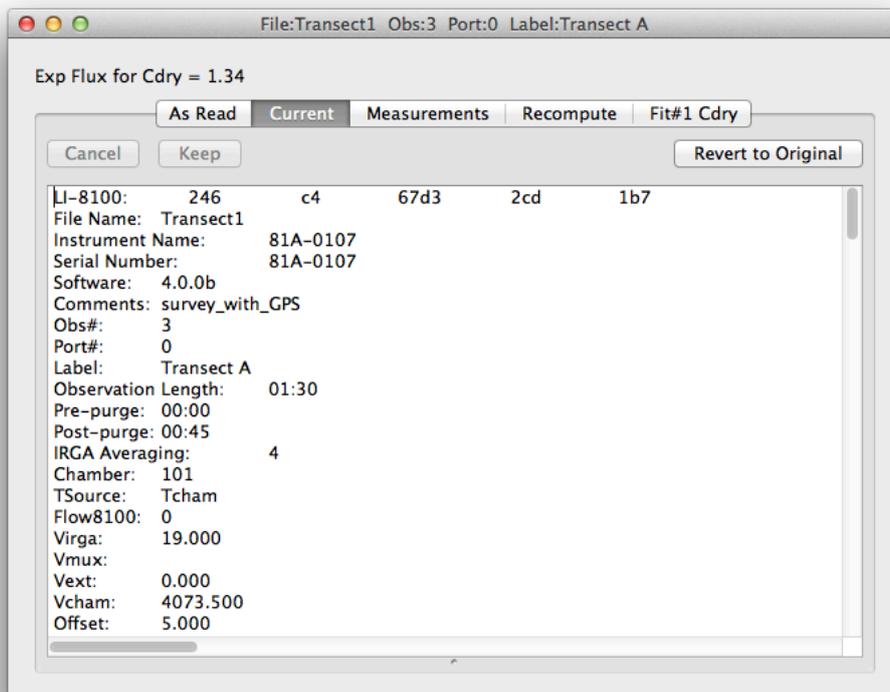
Fit #1 Cdry shows curve fitting details.



4 Observation Details

4.1 Current

The **Current** tab shows the observation in text form in its present form, including any changes due to recomputations, column transformations, etc. This view is editable, so any sort of editing is possible. **Keep** will rescan the text, just as if it were reading from a file. This does not change the original view, so any changes you make (as well as any recomputations, etc.) can always be undone by clicking **Revert to Original**.

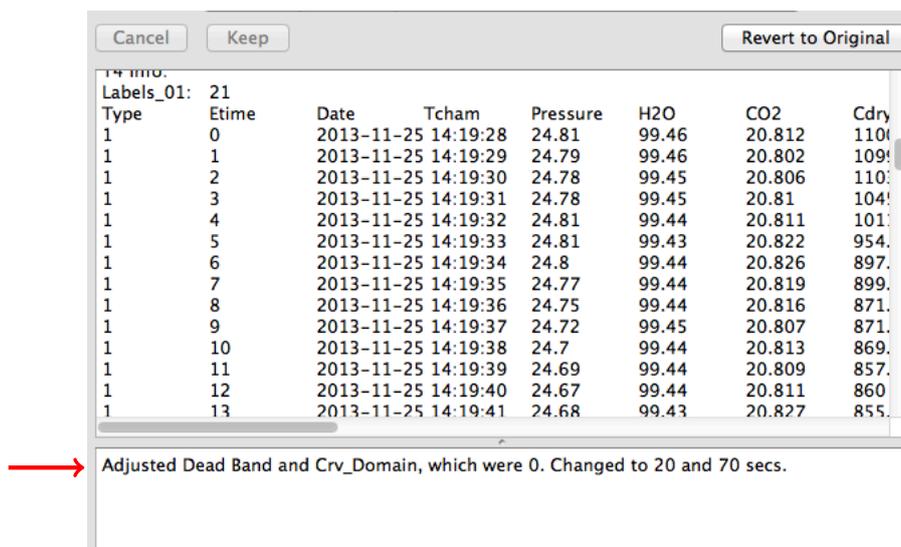


To change Area, Volume, and/or Label for multiple observations all at once, see [Recompute Observations](#).

4 Observation Details

4.1.1 Warnings and Messages

Warnings can be generated by the LI-8100A during the measurement; these are stored in records whose **Type** is -1. They were put into the file at the time measurements were taken, and typically say something about a measurement condition, such as high humidity, or the measurement was restarted, etc. In addition, SFP itself can generate messages at the time an observation is read, and the list of SFP's messages are shown below.



SFP Message	Explanation
File Name: missing from header	The label File Name was not found, but subsequent records were.
ERROR: Failed to find measured data labels	The line that identifies measured columns Type Etime Date... was missing.
Old version. Updating format	The original file is an older version format.
Adjusting dead band and Crv_Domain...	This would typically be caused by all or part of the observations footer missing.
Warning: Chamber never closed?	Elapsed times never reached values >0.
Summary Records and Footer not found	The file ended without any summary records or footer.
Footer not found	No footer was found in the file.

4 Observation Details

4.2 Measurements

4.2.1 Text

The Measurement tab sheet shows all of the raw records for this observation under the Text tab.

Type	Etime	Date	Tcham	Pressure	H2O	CO2	Cdry	Tbench
1	-15	2011-10-20 13:34:34	15.88	93.94	6.9	406.43	409.25	51.92
1	-14	2011-10-20 13:34:35	15.87	93.95	6.956	406.55	409.4	51.97
1	-13	2011-10-20 13:34:36	15.86	93.96	6.994	405.53	408.38	51.97
1	-12	2011-10-20 13:34:37	15.87	93.95	6.966	404.55	407.39	51.95
1	-11	2011-10-20 13:34:38	15.88	93.95	7.032	403.35	406.21	51.92
1	-10	2011-10-20 13:34:39	15.89	93.94	7.034	402.41	405.26	51.95
1	-9	2011-10-20 13:34:40	15.9	93.94	7.049	401.58	404.43	51.92
1	-8	2011-10-20 13:34:41	15.91	93.95	7.116	401.22	404.1	51.92
1	-7	2011-10-20 13:34:42	15.91	93.95	7.161	400.36	403.25	51.95
1	-6	2011-10-20 13:34:43	15.91	93.96	7.183	400.72	403.62	51.97
1	-5	2011-10-20 13:34:44	15.9	93.95	7.192	400.38	403.28	51.95
1	-4	2011-10-20 13:34:45	15.9	93.95	7.18	400.45	403.35	51.95
1	-3	2011-10-20 13:34:46	15.88	93.94	7.128	400.65	403.53	51.95
1	-2	2011-10-20 13:34:47	15.87	93.93	7.072	400.58	403.43	51.95
1	-1	2011-10-20 13:34:48	15.88	93.94	7.034	400.35	403.18	51.95
1	0	2011-10-20 13:34:49	15.89	93.95	7.057	400.57	403.42	51.95
1	1	2011-10-20 13:34:50	15.9	93.95	7.091	400.7	403.56	51.97
1	2	2011-10-20 13:34:51	15.92	93.94	7.151	400.26	403.14	51.95
1	3	2011-10-20 13:34:52	15.92	93.94	7.239	400.99	403.91	51.95
1	4	2011-10-20 13:34:53	15.93	93.94	7.302	401.05	404	51.92
1	5	2011-10-20 13:34:54	15.94	93.94	7.395	400.92	403.9	51.95
1	6	2011-10-20 13:34:55	15.97	93.94	7.478	401.35	404.37	51.92
1	7	2011-10-20 13:34:56	15.97	93.94	7.54	400.87	403.92	51.92
1	8	2011-10-20 13:34:57	15.99	93.95	7.608	400.79	403.86	51.97
1	9	2011-10-20 13:34:58	16	93.95	7.672	400.68	403.78	51.97

The IV, Mean, and Range records are at the bottom.

1	86	2011-10-20 13:36:15	16.97	93.94	10.106	413.03	417.23	51.95
1	87	2011-10-20 13:36:16	16.98	93.94	10.103	412.75	416.96	51.92
1	88	2011-10-20 13:36:17	16.99	93.94	10.115	412.93	417.15	51.92
1	89	2011-10-20 13:36:18	17	93.95	10.108	413.18	417.4	51.95
IV	0	2011-10-20 13:36:18	15.89	93.94	7.029	400.66	403.5	51.95
Mean	44.5	2011-10-20 13:36:18	16.5	93.94	8.847	405.66	409.29	51.94
Range	89	2011-10-20 13:36:18	1.11	0.04	3.058	12.92	14.26	0.05

4 Observation Details

4.2.2 Surface

For Continuous measurements that have GPS data, the Surface tab allows spectrographs and contours to be plotted on the surface of your choice.

The screenshot shows the 'Continuous measurement' window with the 'Surface' tab selected. The 'Z' dropdown is set to 'CO2'. The 'Min' is 378.3 and 'Max' is 395.09. The 'Grid #' is 70. The 'Contours' checkbox is checked with a value of 5, and the 'Spectrogram' checkbox is also checked. The 'Relative Meters' dropdown is set to 'Relative Meters'. The plot area shows a CO2 surface plot with axes 'Meters N' (0-30) and 'Meters E' (0-30). A color scale on the right ranges from 380 to 395.

Annotations and callouts:

- Which data column to plot.** Points to the 'Z: CO2' dropdown.
- Min and Max of intensity scale.** Points to the 'Min: 378.3' and 'Max: 395.09' input fields.
- # Grid lines used each dimension.** Points to the 'Grid # 70' input field.
- Determines color map transition points.** Points to the 'Contours 5' and 'Spectrogram' checkboxes.

Three resulting plot styles are shown below the main interface:

- Top plot:** A spectrogram plot with 'Contours' checked and 'Spectrogram' checked. The plot shows a color map with a vertical color bar on the right.
- Middle plot:** A contour plot with 'Contours' checked and 'Spectrogram' unchecked. The plot shows contour lines overlaid on a color map.
- Bottom plot:** A combined plot with 'Contours' checked and 'Spectrogram' checked. The plot shows both contour lines and a color map.

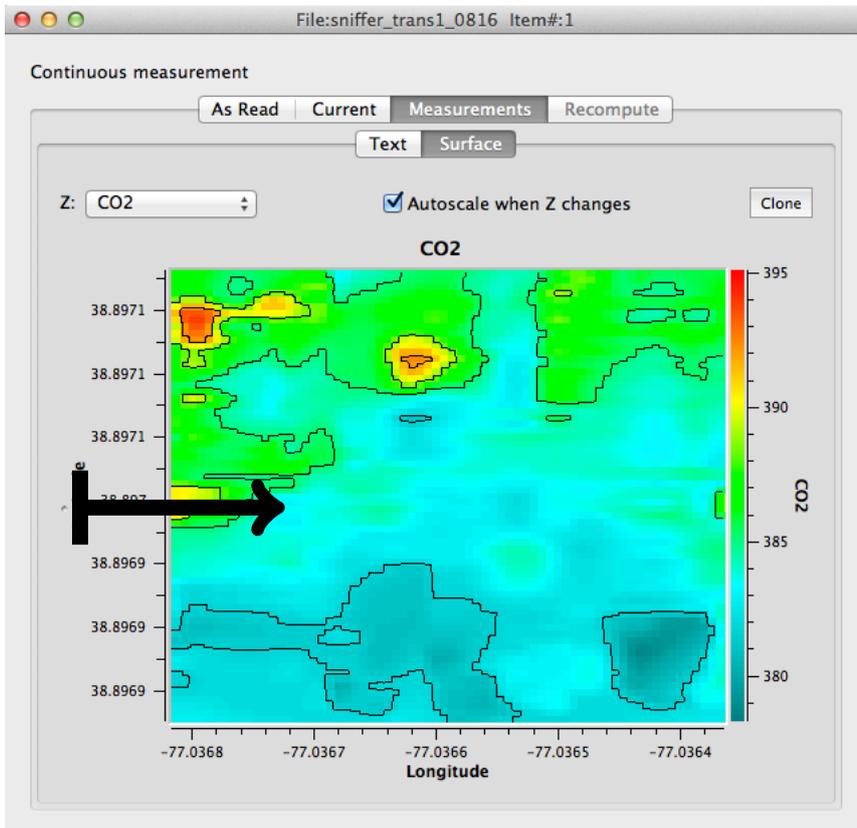
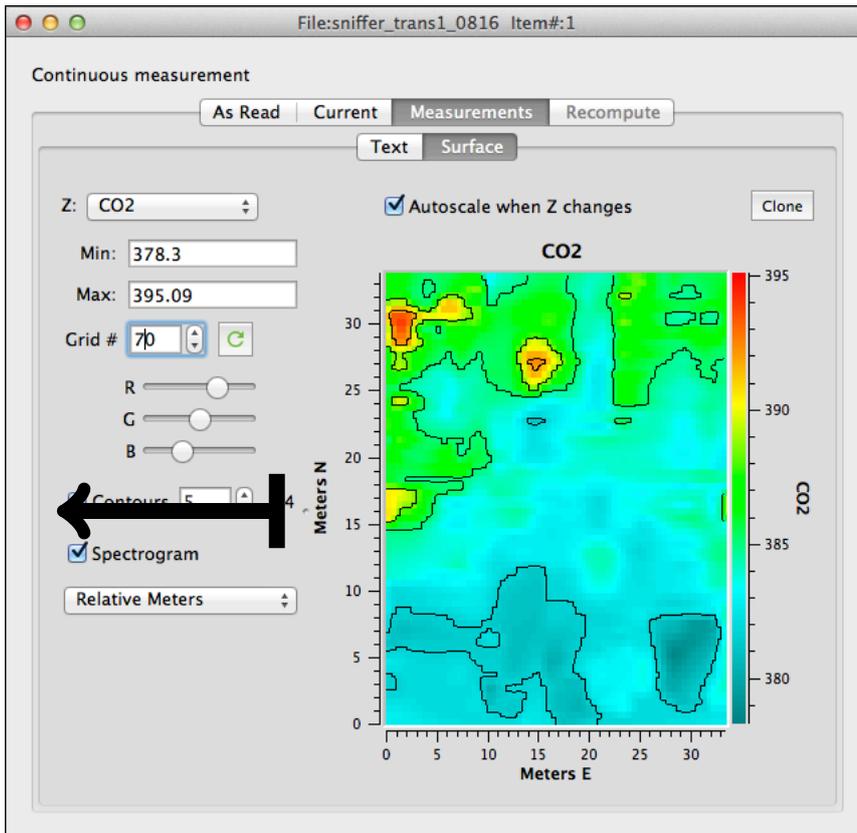
Additional callouts for the contour settings:

- # contour intervals between Min and Max.** Points to the 'Contours 5' input field.
- Resulting contour spacing in units of plotted variable.** Points to the '3.4' value next to the 'Contours' field.

A color map legend is shown on the left, with 'R' (Red) at 395, 'G' (Green) at 390, and 'B' (Blue) at 380. A small inset shows the 'Contours' and 'Spectrogram' checkboxes with their respective values.

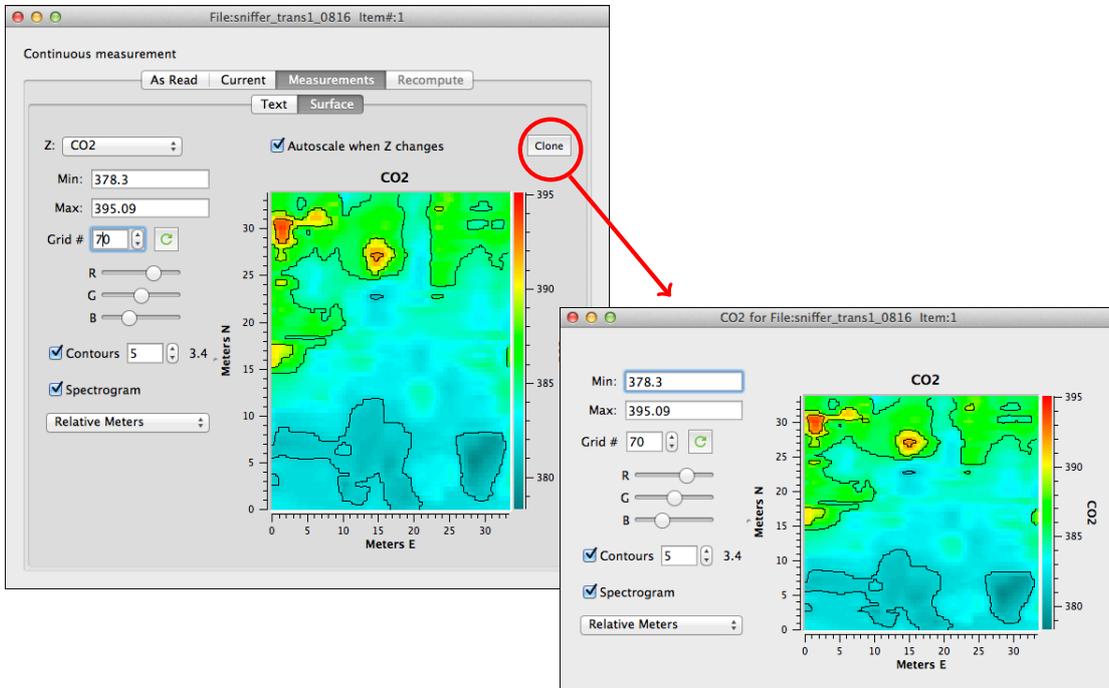
4 Observation Details

Note the partition control below: sliding it to the left will cover the setup controls.

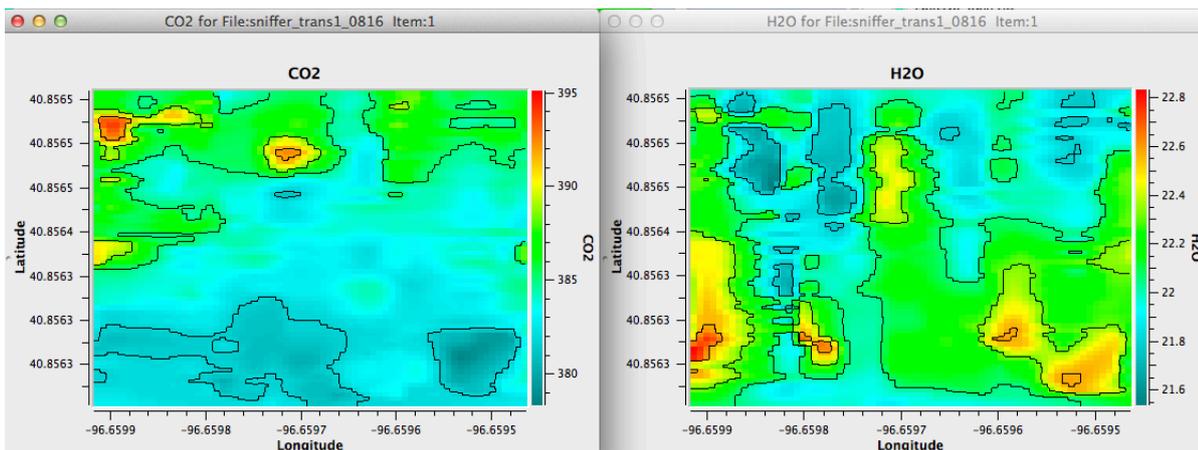


4 Observation Details

The **Clone** button will make a standalone window out of the surface graph and controls. The cloned window retains all the controls except being able to change the variable that is plotted. The window is also autonomous from the observation or its detail window that created it. If you delete the source observation from a view, the detail window also goes away, but not this cloned view.



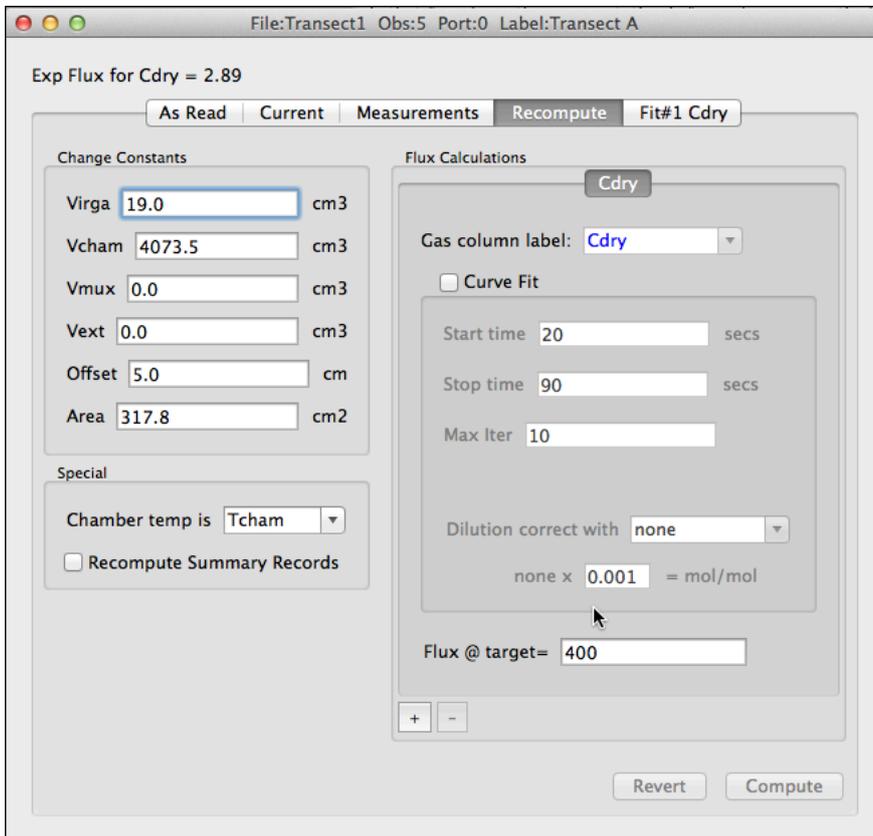
Using clones can let you compare multiple variables from the same observation.



4 Observation Details

4.3 Recompute

The Recompute tab in the Detailed View provides a mechanism to recompute just the target observation. The interface is very similar to that provided in [Recompute Observations](#); the only difference is that from here, the recomputation is focused on one particular observation.



4 Observation Details

4.4 Curve Fit Details

The Fit tab in the Observation Details view provides a close look at the exponential and linear fits for an observation.

4.4.1 Changing Start/Stop Times

Click and drag the green Start (left vertical) line, or the red Stop (right vertical) line. When you release the mouse button, the data between the lines are linearly and exponentially fit, and the results shown in the grid above the chart. This doesn't actually change the observation, unless you click **Keep**.

Undo changes you have made here, since the last **Keep**.

Save changes you have made here.

You can also set Start and Stop with these controls, then click **Compute**.

	dC/dt	SE of dC/dt	R ²	Flux	Flux CV
Exponential:	0.385	0.003	0.9959	2.68	1.40
Linear:	0.382	0.003	0.9959	2.660	1.4

Regression Details Guidance

Manually set Co

Start time

Stop time

Compute

Measured data
 include t < 0

Exp fit
 Linear fit

Revert

Keep

As Read Current Measurements Recompute Fit#1 Cdry

Exp Flux for Cdry = 2.68

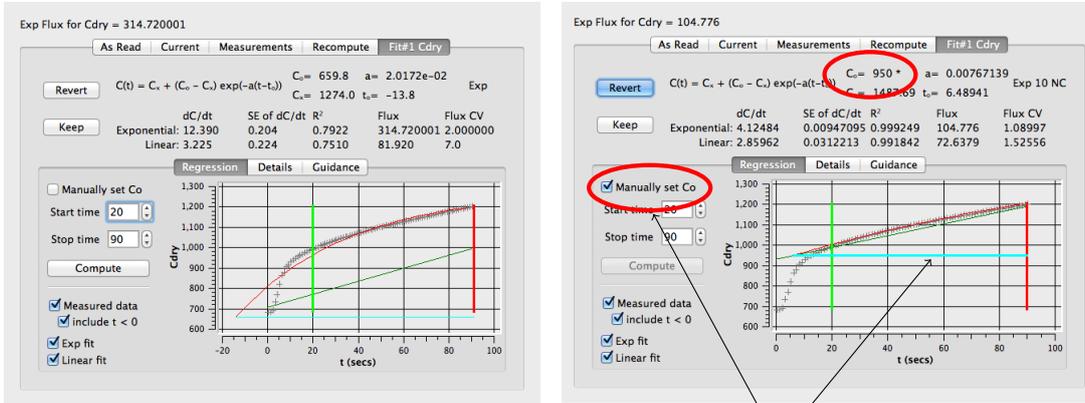
$C(t) = C_x + (C_0 - C_x) \exp(-a(t-t_0))$ $C_0 = 399.2$ $a = 1.4294e-04$ Exp
 $C_x = 3094.4$ $t_0 = 3.4$

Start Stop

4 Observation Details

4.4.2 Manually Set C_0

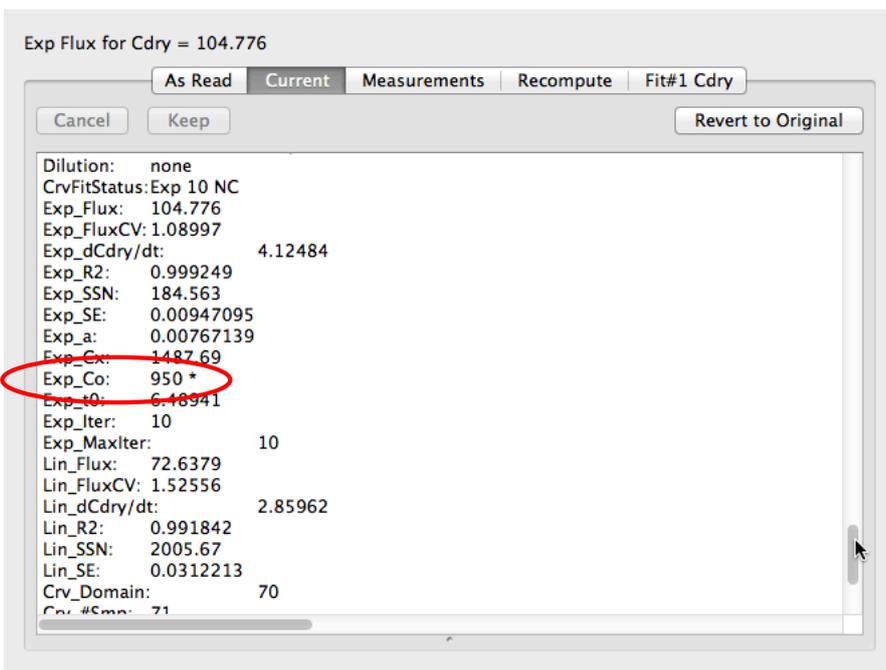
C_0 , the starting value of **Cdry**, is usually determined from the **IV** value of **Cdry**. You can manually override this by checking the **Manually Set C_0** check box, and clicking and dragging the blue horizontal line to the desired value. This normally is not necessary, but is available for strange data sets such as is shown below.



Check the box, then click and drag the blue line.

The figure is typical of non-standard chambers that do not close, so sampling begins immediately, resulting in a “catch up” period. The software picked a value for C_0 of 659.8 (the blue line, left figure). The right hand figure has the **Manually Set C_0** box checked, and the blue line has been dragged up to a more reasonable-looking value of 950.

Manually set C_0 values are marked with an asterisk, as seen above and in the Footer.

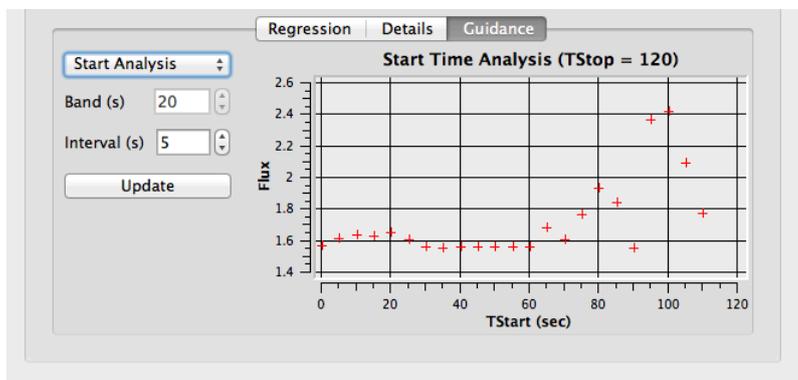


4 Observation Details

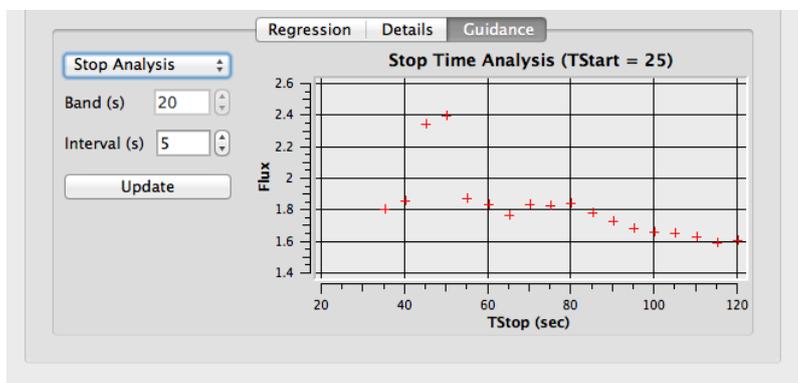
4.4.3 Start/Stop Guidance

The Guidance tab provides some automated tools for assessing start and stop times.

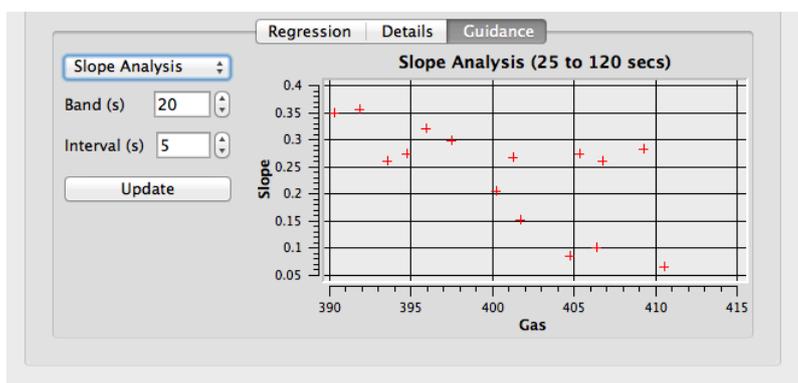
The **Start Analysis** plot shows Flux as a function of Start time (given the current Stop time).



The **Stop Analysis** plot shows Flux as a function of Stop time, given the current Start time.



The **Slope Analysis** shows the slope of an exponential fit of data in a moving band between the current Start and Stop times. In general, you try to work in the region where this changes linearly with CO₂.



5 Miscellaneous Topics

5.1 LI-8100A Data File Format

5.1.1 Chamber Measurements

LI-8100A chamber measurement files consist of lines of tab-delimited text that constitute one or more Observations. One observation is illustrated below:

	LI-8100:	246	c4	66e4	2c4	1b4	
Header	File Name:	Transect1					
	Instrument Name:	81A-0107					
	Serial Number:	81A-0107					
	Software:	4.0.0b					
	Comments:	survey_with_GPS					
	Obs#:	5					
	:						
	V4 Info:	0	M=1.000	B=0.000			
	T1 Info:	E					
	T2 Info:	E					
T3 Info:	E						
T4 Info:	E						
Labels_01:	34						
Raw Records	Type	Etime	Date	Tcham	Pressure	H2O	CO2
	1	-15	2011-10-20 13:40:34		15.6	93.97	6.444
	1	-14	2011-10-20 13:40:35		15.6	93.97	6.416
	:						
	1	0	2011-10-20 13:40:49		15.4	93.97	6.472
	:						
	1	89	2011-10-20 13:42:18		16.04	93.96	10.029
	2	0	2011-10-20 13:42:18		15.39	93.96	6.495
	3	44.5	2011-10-20 13:42:18		15.72	93.96	8.854
	4	89	2011-10-20 13:42:18		0.65	0.03	3.557
Summary Records	GasColumnID:	Cdry					
	Dilution:	none					
	CrvFitStatus:	Exp					
	Exp_Flux:	2.89					
	Exp_FluxCV:	1.60					
	Exp_dCdry/dt:	0.415					
	Exp_R2:	0.9900					
	:						
	Flux@Target:						
	MinCO2:						
Flux@Min:							
Footer							

Header. The lines from LI-8100A: through Labels_01:.

Raw Records. A record of **Type** = 1. These represent measured data from the time the chamber starts to close, to the when it starts to open.

Type	Description
-1	Warning Record
1	Raw Record
2	Initial Value (Regressed from first 10 seconds of ETime >= 0 data)
3	Mean Value (of ETime >= 0 data)
4	Range Value (of ETime >= 0 data)

Summary Records. A record of Type 2, 3, or 4. An Observation has one of each.

5 Miscellaneous Topics

Footer. The results of the analysis, including flux values. The footer won't be present for files logged with the **Compute Flux** option off, or for Version 1 files (below). However, SFP will regenerate the footer.

5 Miscellaneous Topics

5.1.2 Footer

The footer contains the calculations for an observation. SFP adds multiple flux capability, and these computations add some items to the columns found in the footer. In the example below, there is one extra column **[CH4]_ppm** and two extra rows (**GasColumnID** and **Dilution**). This indicates that an [extra flux computation](#) was done, using an [imported column](#), and it used the LI-8100A's water measurement **H2O** for the dilution correction.

GasColumnID:	Cdry	[CH4]_ppm
Dilution:	none	H2O 0.001
CrvFitStatus:	Exp 2	Lin
Exp_Flux:	4.45074	6.54166e-05
Exp_FluxCV:	1.09471	30.5448
Exp_dCdry/dt:	0.878935	1.29185e-05
Exp_R2:	0.999895	0.0773575
Exp_SSN:	14.8426	0.0003644
Exp_SE:	0.0007953	3.94342e-06
Exp_a:	2.6594e-05	1.29185e-11
Exp_Cx:	33,696	1e+06
Exp_Co:	646.609	2.3074
Exp_t0:	1.115	-351.287
Exp_Iter:	2	10
Exp_MaxIter:	10	10
Lin_Flux:	4.44089	6.54166e-05
Lin_FluxCV:	1.09473	30.5448
Lin_dCdry/dt:	0.87699	1.29185e-05
Lin_R2:	0.999894	0.0773575
Lin_SSN:	14.8707	0.0003644
Lin_SE:	0.0007967	3.94342e-06
Crv_Domain:	130	130
Crv_#Smp:	130	130
Dead Band:	00:20	00:20
TimeClosing:	14	14
Target:	400	400
Flux@Target:	4.48395	6.53906e-05
MinCO2:	638.27	2.30123
Flux@Min:	4.45187	6.54166e-05

5 Miscellaneous Topics

5.1.3 Continuous Measurements

LI-8100A Continuous Measurement data files consist of lines of comma-delimited text, as is illustrated below:

```
File Name:sniffer_trans1_0816
Instrument Name:Sniffer
Serial Number:81A-0107
Software:4.0.0b
Comments:
DATAH,Date,Pressure,H2O,CO2,Cdry,Tbench,T1,T2,T3,T4,V1,V2,V3,V4,LATITUDE,LONGITUDE,STATUS,SPEED,COURSE,RH,Tbo ...
DATA,2011-08-16 10:18:53,93.34,22.1,382.91,391.56,51.95,183.23,183.2,183.2,183.16,0.534,21.59,0.015,2.14748e+06 ...
DATA,2011-08-16 10:18:54,93.33,22.099,383.27,391.93,51.92,183.22,183.18,183.22,183.2,0.534,21.586,0.015,2.14748e+06 ...
DATA,2011-08-16 10:18:55,93.34,22.1,383.5,392.17,51.95,183.25,183.2,183.2,183.2,0.534,21.59,0.015,2.14748e+06,38 ...
DATA,2011-08-16 10:18:56,93.35,22.113,383.42,392.09,51.97,183.23,183.2,183.23,183.18,0.534,21.59,0.015,2.14748e+06 ...
DATA,2011-08-16 10:18:57,93.35,22.117,383.58,392.26,51.97,183.27,183.2,183.2,183.2,0.534,21.59,0.015,2.14748e+0 ...
DATA,2011-08-16 10:18:58,93.36,22.115,383.81,392.49,51.97,183.24,183.22,183.2,183.2,0.534,21.586,0.015,2.14748e+0 ...
DATA,2011-08-16 10:18:59,93.34,22.1,384.01,392.69,51.97,183.24,183.2,183.2,183.22,0.534,21.599,0.015,2.14748e+0 ...
```

5.2 SFP Definitions

SFP classifies the variables in LI-8100A files into three types: Header, Measured, and Footer, and adds a fourth type, Miscellaneous.

5.2.1 Miscellaneous Variables

Miscellaneous variables are not produced by the LI-8100A, but are added by SFP.

Label	Description
Item#	When a file is read, observations are assigned values starting with 1. They retain this number throughout their life loaded in SFP, even if observations are sorted, copy-pasted, etc. This value is not retained when a view is written to a file; when that file is read, Item# values are again assigned based on the order observations are read.
Type	Cham if a chamber measurement, or Cont if a continuous measurement.
#Msgs	The number of Warnings and Messages. Warnings are -1 TYPE records found in the data. Messages may be generated when SFP reads the file.
#Raw	Number of Type 1 records in the observation.
#Gasses	Number of gasses for which flux computations have been done. That is, the number of data columns in the footer. See Version 3.2 Footer.
ObsDateTime	Equivalent to the Date value of the record having ETime = 0.
ObsDateTime	Day of the Year (fractional) of ObsDateTime.
ObsDecHr	Decimal hour of the day of ObsDateTime.
HasGPS?	Yes if there are GPS columns (at least Latitude and Longitude) in the raw and summary data.

5 Miscellaneous Topics

5.2.2 Header Variables

Header variables are in the header of files produced by the LI-8100A.

Label	Description
LI-8100	5 hexadecimal values giving the size of the header, label, raw data, summary data, and footer. This is not used by SFP.
File Name	The original file name (as stored on the LI-8100A) is preserved by SFP, regardless of how you may rename the Windows files that contain this data, or cut and paste observations.
Instrument Name	
Serial Number	
Software	Version of the embedded code in the instrument. If the file has been stored by SFP, this field will also contain the SFP version.
Comment	User entered at time of data collection.
Obs#	Observation number.
Port#	Multiplexer port number. (0 if not using a multiplexer.)
Label	User entered at time of data collection.
Observation Length	The original observation length.
Observation Delay	Wait time between observations. (Renamed in version 3 to Prepurge.)
Pre-purge	Wait time before observations (named Observation Delay in v.2).
Post-purge	Wait time after observations (new in version 3).
IRGA Averaging	Averaging time for the gas analyzer.
Chamber	Model identifier for the chamber used.
TSource	Which channel to use for temperature for flux computations.
Flow8100	Pump setting in the LI-8100A box.
FlowMux	Pump setting in the multiplexer box.
Tmux	Multiplexer temperature at start of observation
Virga	Volume of the IRGA (cm ³)
Vmux	Volume of the multiplexer (if used) (cm ³)
Vext	Volume of extension tubing (cm ³)
<i>Continued on next page</i>	

Header Variables, Cont'd

Label	Description
Vcham	Volume of the chamber (cm ³)
Offset	Offset (cm) used in volume calculation
Area	Exposed soil area (cm ²)
Vtotal	Total volume (cm ³)
V1..V4 Info	Information on how the voltage channel is configured: Multiplexer channel, slope, offset, etc.
T1...T4 Info	Thermocouple type information.
Labels_01	Number of columns in the raw data section

5.2.3 Measured Variables

Summary statistics of measured variables are identified by the column label, and a prefix of **IV**, **Mean**, or **Range**. Thus, for example **IVCdry** means the Type 2 value of the **Cdry** column, and **Range Etime** means the Type 4 value of the **Etime** column.

5.2.4 Footer Variables

The table below describes the Footer variables.

Label	Description
CrvFitStatus	Curve fit solution. Exp means the exponential fit was better than the linear fit ($\text{Exp_SSN} < \text{Lin_SSN}$). Lin means the linear fit was still better after the maximum number of iterations, and the nonlinear coefficients have therefore been derived from linear fit.
Exp_Flux	Flux computed from Exponential Fit .
Exp_FluxCV	Coefficient of variance (%) of Exp Flux.
Exp_dCdry/dt	Slope of the Exponential Fit at time t_0 .
Exp_R2	Correlation coefficient for Exponential Fit .
Exp_SSN	Normalized sum of squares of residuals for Exponential Fit .
Exp_SE	Standard error (%) of the Exponential Fit .
Exp_a	The a term in the Exponential Fit .
Exp_Cx	The C_∞ term in the Exponential Fit .

Continued on next page

Header Variables, Cont'd

Label	Description
Exp_Co	The C_0 term in the Exponential Fit . Usually the IV value of Cdry, but if followed by * , indicates it has been manually set. See Manually Set Co .
Exp_t0	The t_0 term in the Exponential Fit .
Exp_Iter	Number of iterations used in the Exponential Fit .
Exp_MaxIter	Maximum number of iterations allowed for the Exponential Fit . This is fixed to 10 in the LI-8100A, but can be adjusted in SFP.
Lin Flux	Flux computed from Linear Fit .
Lin_FluxCV	Coefficient of variable (%) of Lin Flux
Lin dCdry/dt	Slope of the Linear Fit .
Lin_R2	Correlation coefficient for the Linear Fit .
Lin_SSN	Normalized sum of squares of residuals for Linear Fit .
Lin_SE	Standard error (%) of the Linear Fit .
Crv_Domain	Time span (s) used in the curve fit.
Crv_#Smp	Number of data points used for curve fitting.
Dead Band	Time (s) after the chamber closes that are skipped by the analysis, in the latest (re-)computation
TimeClosing	Time (s) it took the chamber to close.

The values below are not part of an LI-8100A data file as output by the instrument. They are, however, added to the footer of files saved by SFP.

GasColumnID	The column label for which flux is computed. The first one will always be Cdry.
Dilution	The column label used for the H2O measurements if a dilution correction is applied to the GasColumnID flux computation. When computing flux for Cdry, this is none, since dilution is already accounted for in Cdry. If a column label is specified, it will be followed by a decimal value, that represents what was used to convert the value in the water column to units of mol/mol.
Target	See Compute Targeted Flux .
Flux@Target	Flux at Target (Compute Targeted Flux).
MinCO2	Minimum CO ₂ during chamber closing.
Flux@Min	Flux computed at the Minimum CO ₂ value.

5.3 Curve Fitting Details

The LI-8100A (and SFP) fit measured variables **Cdry** vs. **Etime** in two ways: the traditional linear fit, and the theoretically more correct exponential fit.

Linear Fit. Dilution corrected CO₂ (C) is plotted against time in seconds (t) and fit by linear regression.

$$C(t) = mt + b \quad (5)$$

where slope m is reported as **Lin dCdry/dt**. Offset b is not reported. The correlation coefficient of this fit is reported as **Lin_R2**. The CO₂ flux based on this rate is reported as **Lin Flux**.

Exponential Fit. Dilution corrected CO₂ (C) is plotted against time in seconds (t) and fit by a nonlinear regression.

$$C(t) = C_{\infty} + (C_0 - C_{\infty})e^{-a(t-t_0)} \quad (6)$$

C_0 is the starting concentration, and is known (**Type 2** value of **Cdry**). It is also the theoretical concentration when $t = t_0$. The nonlinear regression solves for C_{∞} , t_0 , and a , which are reported as **Exp_Cx**, **Exp_a**, and **Exp_t0** respectively. The correlation coefficient of the fit is **Exp_R2**, the slope at $t = t_0$ is **Exp_dCdry/dt**, the standard error of this slope is **Exp_SE**, the CO₂ flux based on this slope is **Exp_Flux**, and the coefficient of variation of this flux (in %) is **Exp_FluxCV**.

The data sets are the same for both fits, and is some subset of the Raw Records. There is a dead band (**Dead Band**) of user-defined length to allow for complete mixing in the just closed chamber (SFP labels this value to as **Start time**). The LI-8100A uses all of the raw records after the start time slash deadband, but SFP allows you to shorten this by specifying a **Stoptime**. How much data was fit (number of seconds) is available as **Crv_Domain**, and **Crv_# Smp** is the number of data points.

Exp_Iter reports the number of iterations that the nonlinear regression took, which typically is less than 5. If the regression takes the maximum number of iterations (**Exp_MaxIter** - set via **Recompute**) and still hasn't converged, then the normalized sums of the squares of the residuals are compared (**Lin_SSN** and **Exp_SSN**) to see which gave the better fit. **CrvFitStatus** reports the result as **Lin** or **Exp**. **Exp** means the nonlinear fit had lower residuals than the linear fit, and **Lin** means the linear fit was better. Whenever **Lin** is reported, note that the nonlinear coefficients are set as follows, based on the linear fit:

$$\begin{aligned} C_{\infty} &= 1 \times 10^6 \\ t_0 &= \frac{C_0 - b}{m} \\ a &= \frac{m}{C_{\infty} - C_0} \end{aligned} \quad (7)$$

Lin usually indicates something strange with the data, caused by gusty conditions, a poor chamber seal with surface, excessive **DeadBand**, etc..

5 Miscellaneous Topics

5.4 Preferences

The Preferences Dialog allows you to modify the tool bar appearance.

