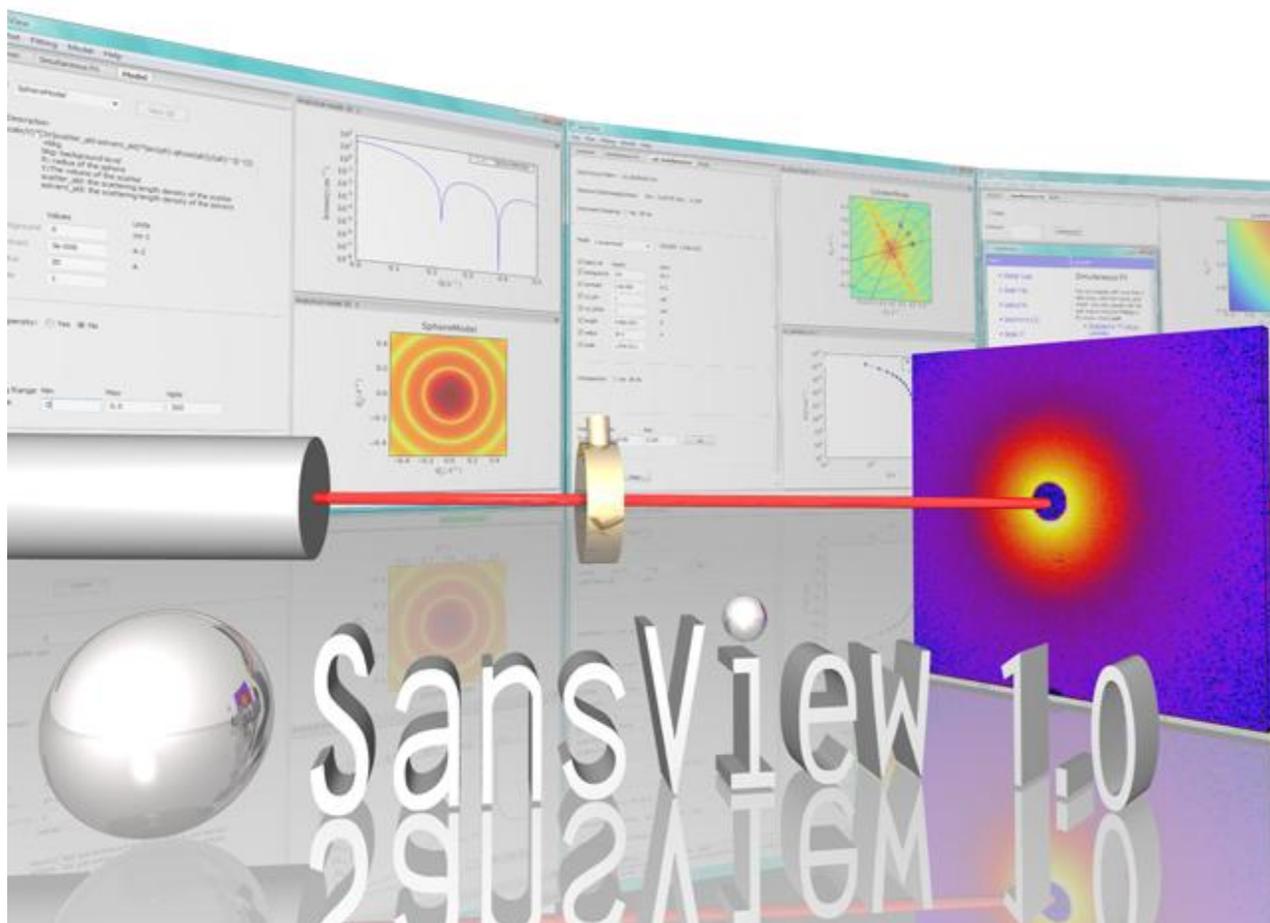




SansView 1.0



DANSE/SANS Group
University of Tennessee



This software was developed by the University of Tennessee as part of the Distributed Data Analysis of Neutron Scattering Experiments (DANSE) project funded by the US National Foundation.

SansView 1.0

Build: 1.0

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*If you use this program to do productive scientific research that leads to publication, we ask that you acknowledge use of the program by citing the following paper in your publication:

"This work benefited from DANSE software developed under NSF award DMR-0520547."

*G. Alina, P. Butler, J. Cho, M. Doucet, and P. Kienzle,
"SANS analysis software", to be published.*



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Introduction

New application for SANS oriented system modeling and data analysis.

Oct. 1, 2009: version 0.1 is released.

Roadmap:

SansView is a new application provided to the community to generate feedback. It is part of a broader effort to provide analysis tools to the SANS community. In providing this application, we hope to learn about the analysis needs of our users. We are interested in suggestions in two areas:

- Functionality: what functionality would you like to see in an analysis application for SANS
- Ease-of-use: how would you improve the user interface

The functionality provided by SansView will be incorporated in a more complete analysis application scheduled for late 2009. SansView will continue to be supported and updates will mostly focus on both feature adding and bug fixing. See our Mission page for more details on the plans for future developments.

Features:

- Simultaneous fit of a number of different sets of SANS data with/without the constraints.
- Loading and displaying 1D and 2D data in various formats.
- 1D and 2D data fitting using Scipy (L-M algorithm) or Park (a MC fitting optimizer) fitting engine.
- Support $P(r)$ inversion (via. indirect Fourier transform).
- Supporting polydispersity and /or orientational distribution for virtually all built-in model functions.
- Supporting pinhole or slit smearing for all the data with dQ (or dQ_I , dQ_w) data given.
- Supporting various 2D averaging methods : Circular, Sectorslicer, Annulus, Boxsum, BoxQx and BoxQy.
- Supporting a number of standard models and model-independent functions including form factor and structure factor functions and their multiplications.
- Plug-in mechanism for data readers.
- User sets Q_{range} (Q_{min} and Q_{max}) for both 1D and 2D data for fitting and modeling.
- The user can toggle between a number of different scales on all plots.

Installation and Usage:

Currently the installer is supported only on the Windows : Windows XP (PC), Vista (PC), and VMware (with Windows XP) on Mac were tested.

Contact us:

You can visit the SansView web page at: <http://danse.chem.utk.edu/sansview.html>

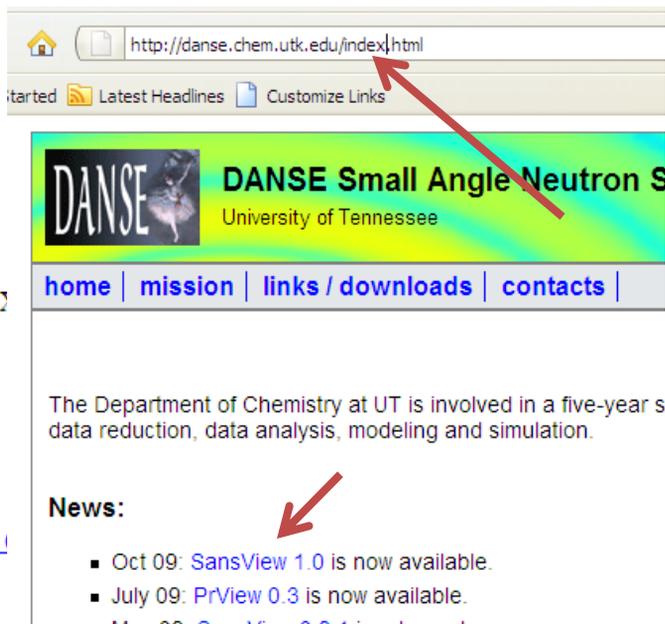
Comments? Bugs? Requests? Write to us at sansdanse@gmail.com



How to install

1. Go to our DANSE Small Angle Neutron Scattering Project web page, <http://danse.chem.utk.edu/index.html> and clicking on the “SansView 1.0” will point to the release page where the windows installer can be downloaded.

Also, SansView tutorial can be found at the same site.

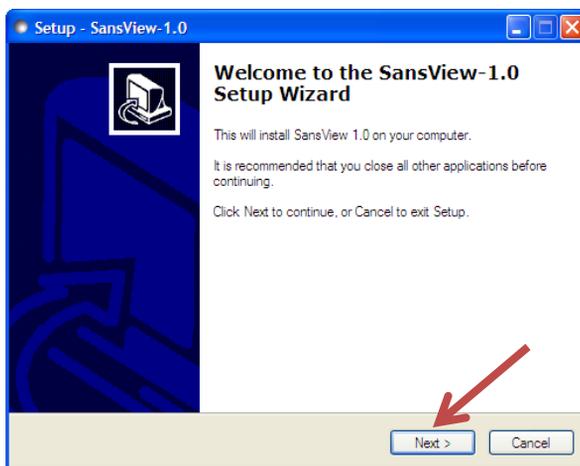


- Currently supported only on Windows : Windows 2 (Notes for Wine (Linux/Mac) users.)

Download links:

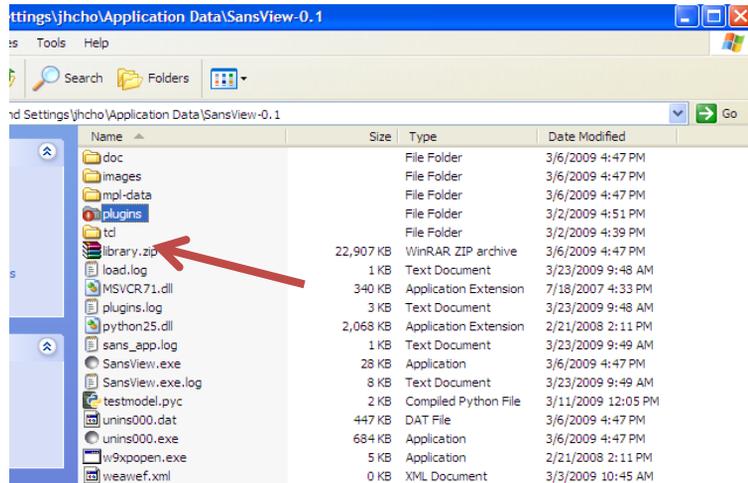
- [Windows installer SansView-1.0](#)
- Tutorial: [SansView 1.0 tutorial \(pdf format\)](#)
- Documentation: [Description of the model functions](#)
- Previous versions: [SansView-0.9.0](#)

2. Once “setupSansView-1.0.exe is downloaded, open the installer and follow the steps as directed.



How to install (continued)

- Once the SansView is installed, some sample 1D and 2D data can be found inside the “test” folder in the SansView-1.0 folder. This allows you to follow this tutorial session without having your own data set.



- The “plugins” folder also includes two example python files (testmodel_2.py and testmodel.py) for users to write their own model function. The file should be modified and saved as a different file name before running the SansView application in order for the functions to work. Modify the arrowed lines for your own functions. Each file can hold one model function and more than one functions can be added in this way. See Appendix (page 31) or the example files in the plugins folder of the SansView folder for more details.

```

1 1=""
2 2 """ Test plug-in model
3 3 """
4 4 from sans.models.pluginmodel import ModelIDPlugin
5 5
6 6 import math
7 7
8 8
9 9 # Your model HAS to be called Model
10 10 class Model(ModelIDPlugin):
11 11     """ Class that evaluates a cog(x) """
12 12     """
13 13
14 14     ## Name of the model
15 15     name = "A+Bcos(2X)+Csin(2X)"
16 16
17 17 def __init__(self):
18 18     """ Initialization """
19 19     ModelIDPlugin.__init__(self, name=self.name)
20 20
21 21     ## Parameters definition and defaults
22 22     self.params = {}
23 23     self.params['A'] = 0.0
24 24     self.params['B'] = 1.0
25 25     self.params['C'] = 0.0
26 26
27 27     ## Parameter details [units, min, max]
28 28     self.details = {}
29 29     self.details['A'] = ['', -1e16, 1e16]
30 30     self.details['B'] = ['', -1e16, 1e16]
31 31     self.details['C'] = ['', -1e16, 1e16]
32 32
33 33 def function(self, x = 0.0):
34 34     """ Evaluate the model
35 35     @param x: input x
36 36     @return: function value
37 37     """
38 38     return self.params['A']+self.params['B']*math.cos(2.0*x)+self.params['C']*math.sin(2.0*x)
39 39

```

I. Loading 1D and 2D data

I-1. Click on “Open” from the File menu (Fig. 1).

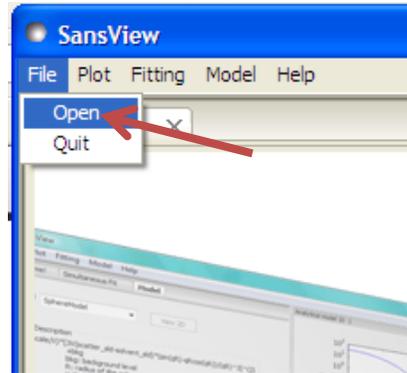


Fig. 1

I-2. Locate your data file and click on the “Open” button (Fig. 2)

(You can choose either 1D or 2D data in this way).
File extension types that can be loaded are ASCII (text), CANSASxml, ASC (2D), sans, pr files.

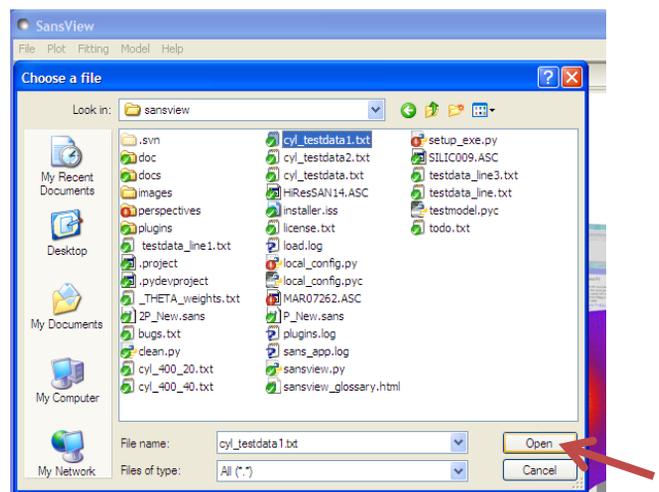


Fig. 2

The format of ASCII files should consist of 2 to 4 columns of Q, Intensity, (dl, dQ) in order where dQ is the instrumental uncertainty of Q and assumed to be originated by pinhole geometry.

I-3. Fig. 3 shows an example of 1 D and 2D plots of the loaded data.

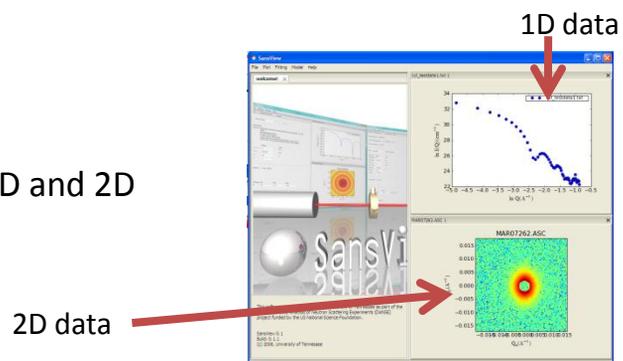


Fig. 3

II. Data fitting: 1D and 2D data; Single fit

II-1. Highlight the data in the plot by locating your mouse pointer to the plot symbols (Fig. 4). (For 2D, right click on 2D data image plot.)

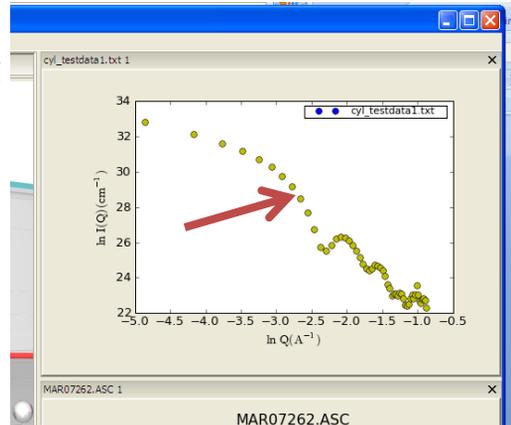


Fig. 4

II-2. After right clicking on the highlighted data, you select “Select data for fitting” (Fig. 5).
 *Same for 2D from now.

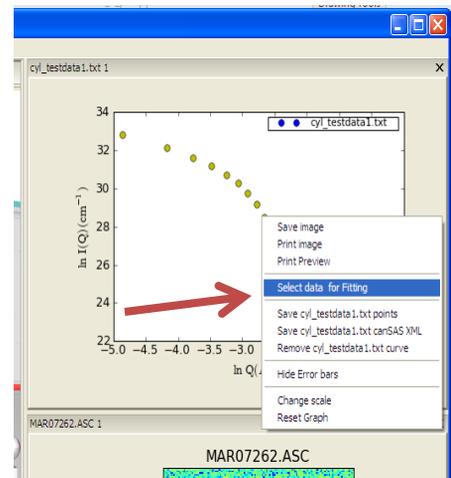


Fig. 5

II-3. Then, you have a fitting panel for the data you have chosen, on the left side (Fig. 6).

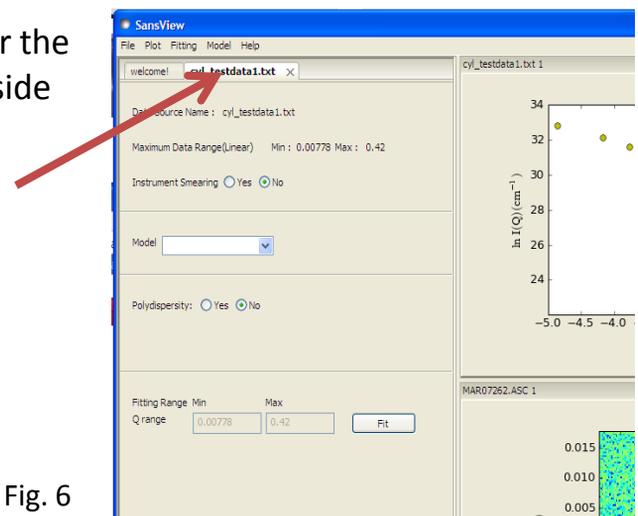


Fig. 6

II. Data fitting : 1D and 2D data; Single fit (continued)

7

II-4. Select a model type of interest.

Right click on the arrow of the model drop box, and choose the model function to fit(Fig. 7)

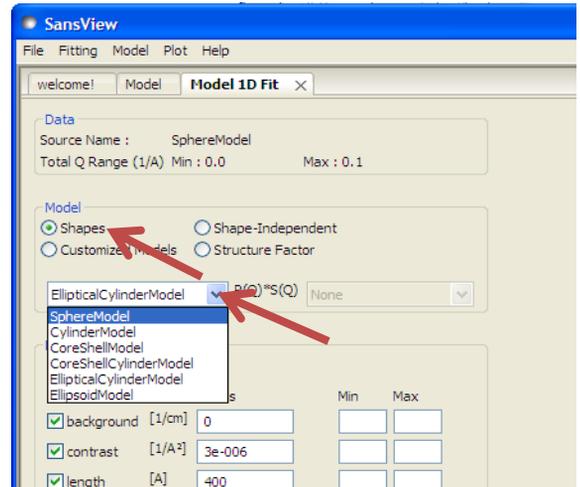


Fig. 7

II-5. Play with the parameter values so that you have a model calculated (green) curve as closed to the data as possible (Fig. 8).

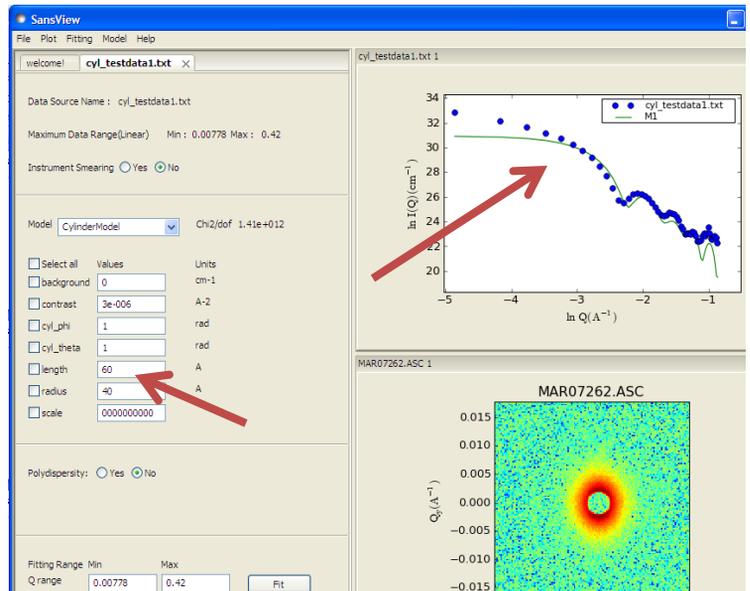


Fig. 8

II. Data fitting : 1D and 2D data; Single fit (continued)

8

II-6. Select parameters to fit by clicking on the check box. (Fig. 9).

II-7. Adjust Q range of data for fitting (optional) (Fig. 9).

II-8. Q range can be reset to the default values by clicking the reset button (Fig. 9).

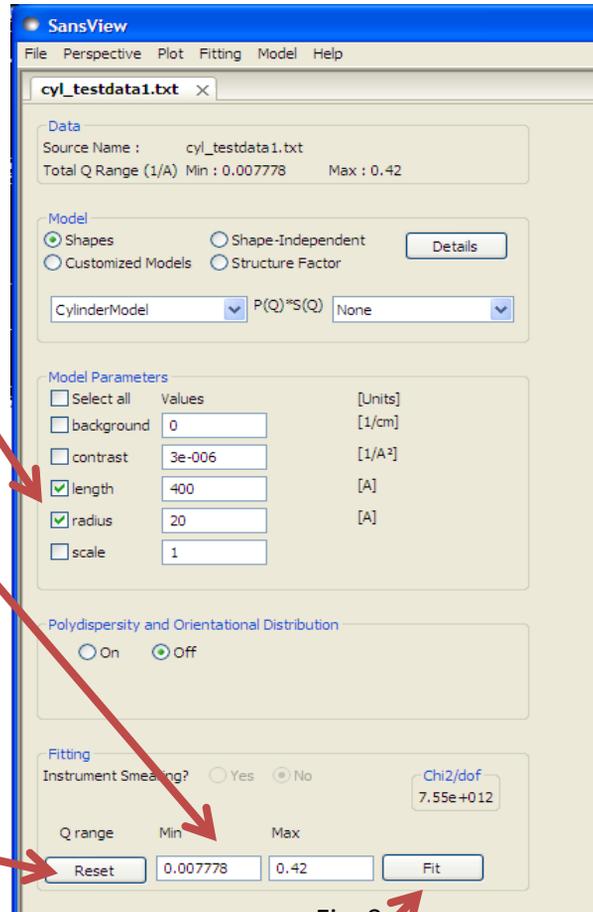


Fig. 9

II-9. (Optional) You can switch Simple Fit (Scipy) or Complex Fit (Park) fitting engine by selecting or deselecting "Park" in the Fitting menu (Fig. 10).

*Note that the simple fit uses Levenberg–Marquardt algorithm, while the complex fit employs MC to find a global minimum in chi2 space (longer run time).

II-10. Click on the "Fit" button (Fig. 9).

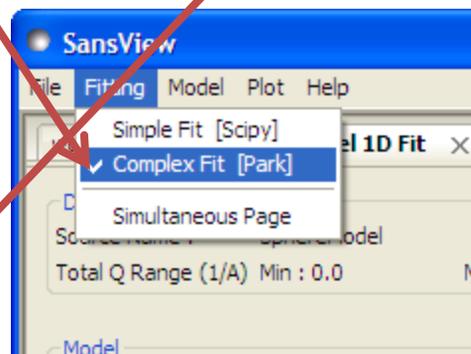


Fig. 10

II. Data fitting : 1D and 2D data; Single fit (continued)

9

II-10. If the fitting is successful, the fitting errors and chi2 will show up in the panel, and there will be nice consistency between the fitted curve and your data. ((Fig. 11).

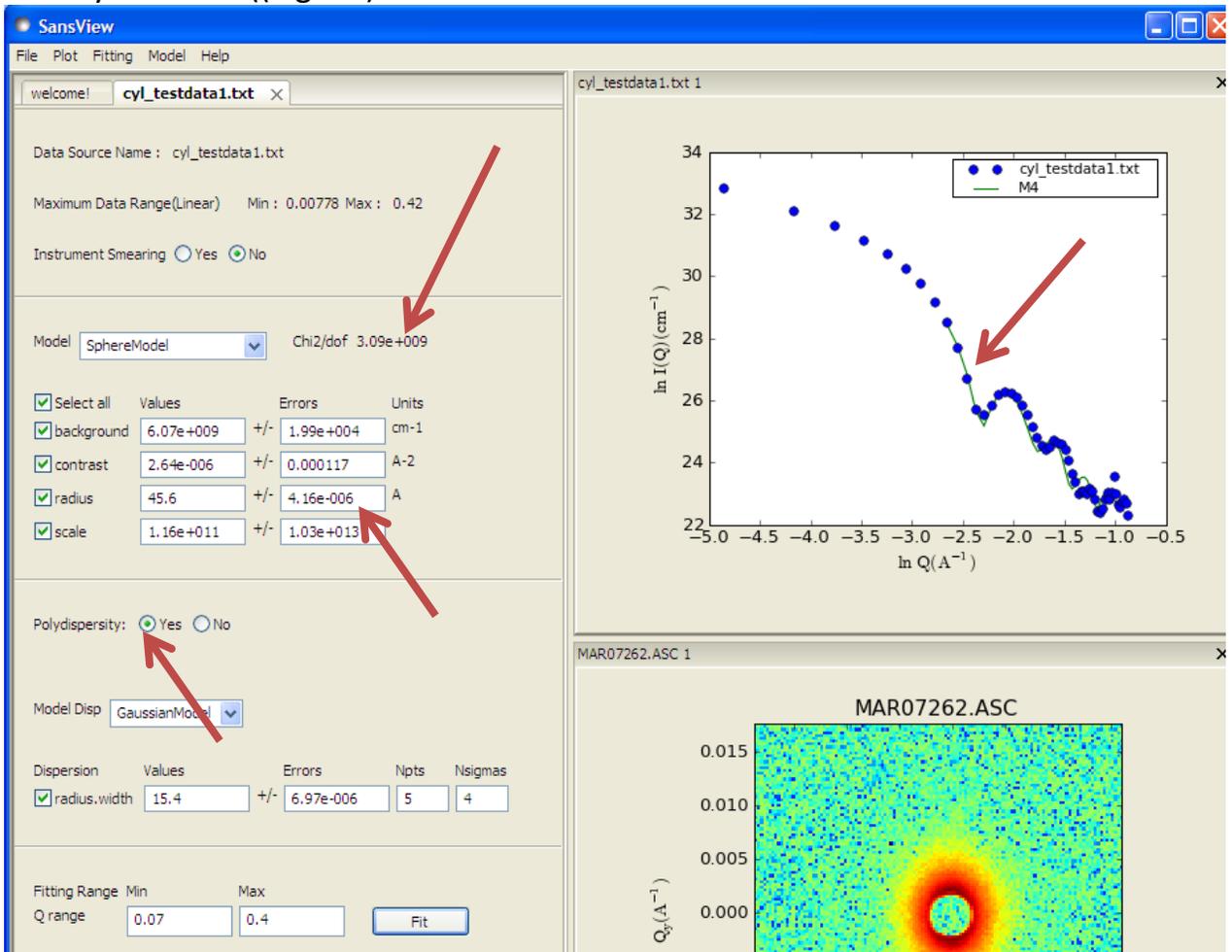


Fig. 11

II-11. If the fitting is not successful, you can play more with other model functions by choosing another model function (see Step II-4), or polydispersity parameters which will show up by clicking on “polydispersity” “yes” check box . (Fig. 11): For polydispersity parameters, good values of Nsigmas are between 3 and 5, where Nsigma refers to x-distance of Gaussian distribution to be considered in the unit of sigma (See VII-10 for more details).

II. Data fitting : 1D and 2D data; Single fit (continued)

10

II-12. The fitting panel (and model panel) can be bookmarked by right-clicking on the panel and choosing bookmark in the popup menu. Once the panel is bookmarked, it can be recalled later by right-clicking on the panel and choosing the model name in the popup menu (Fig. 12). (Note that once the bookmark is recalled, you may lose the previous panel that you were working on unless it was already bookmarked.)

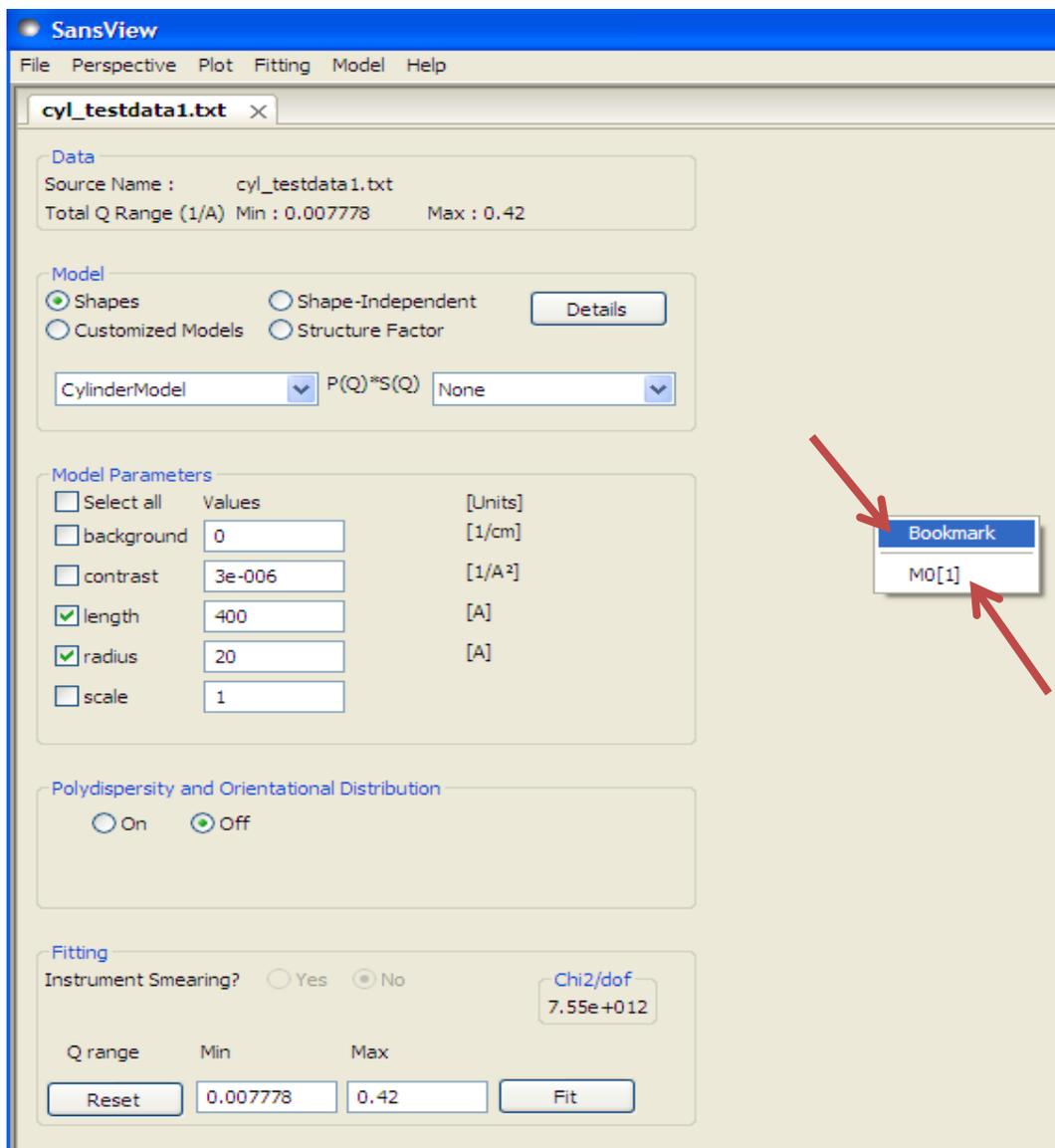


Fig. 12

II. Data fitting : 1D and 2D data; Single fit (continued)

11

II-12. You can also try instrumental smearing by clicking on “On” button only if users provide dQ (, dQ_I , or dQ_w) in the forth column of their data (Fig. 13).

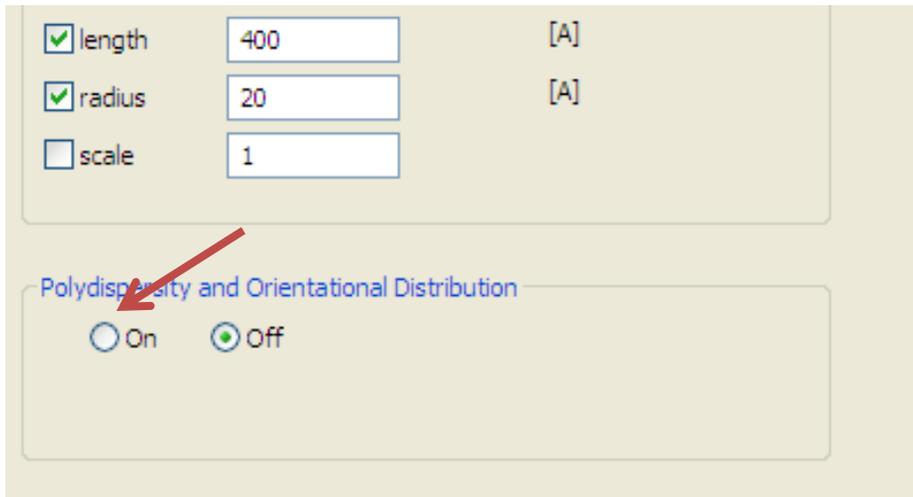


Fig. 13

II-13. It is possible that the fitting results return with an error, especially when the model does not work with your data. This case, some functionalities of the panel may not work. You can delete the fitting panel by clicking on the “x” mark beside of the panel title, and always open a new fitting panel by (Step II-2) (Fig. 14).

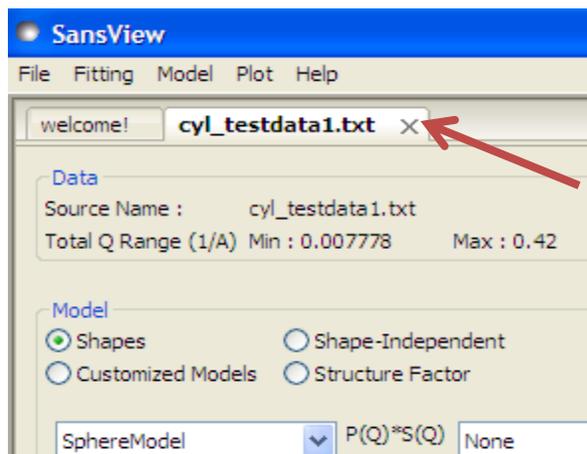
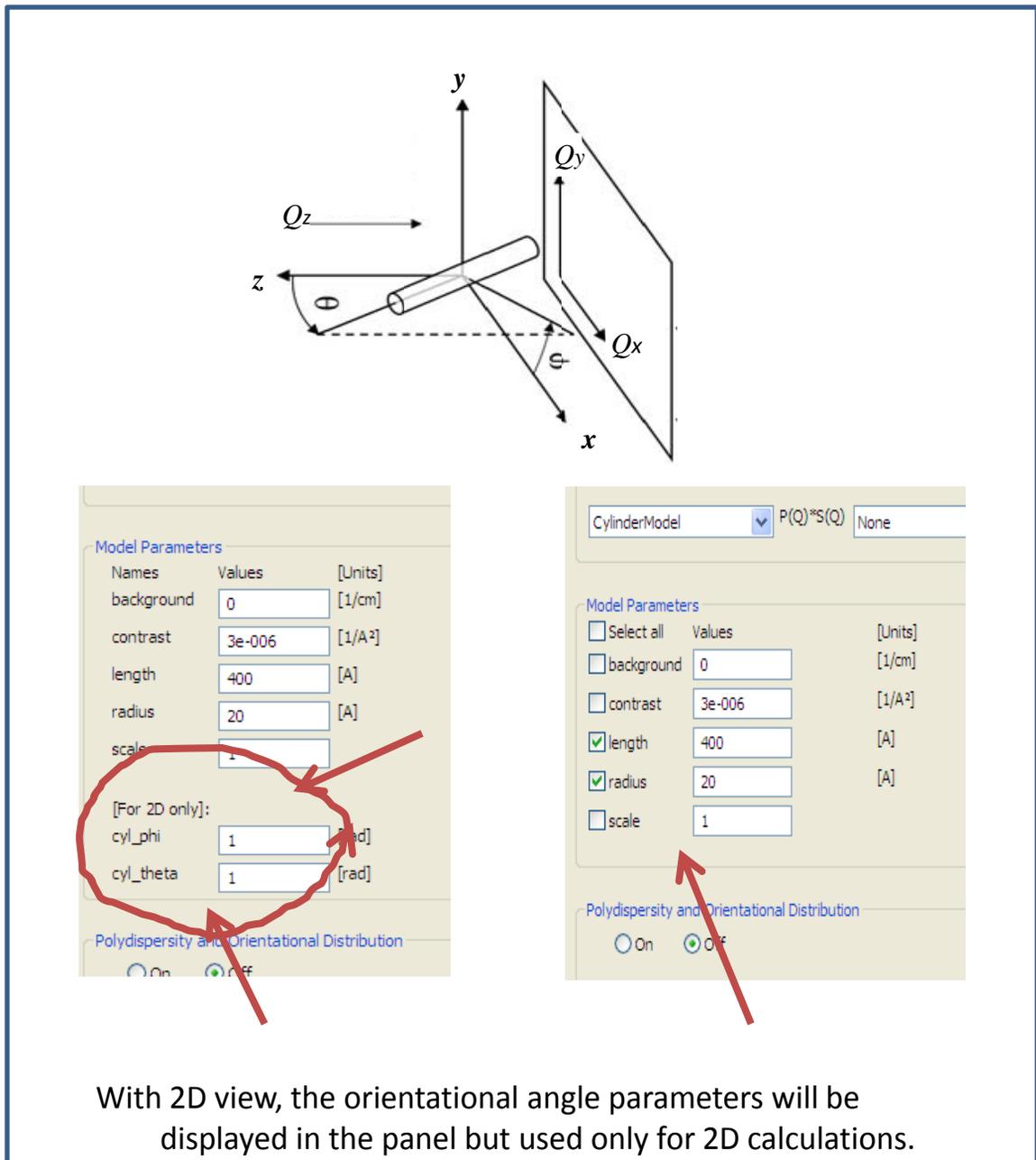


Fig. 14

II. Data fitting : 1D and 2D data; Single fit (continued)

12

II-14 A geometry of the cylinder model (2D) is shown in (Fig. 15). See model functions in the Help menu (of the SansView Application) for other models.



The figure illustrates the geometry of a cylinder model in a 2D view. A cylinder is shown in a 3D coordinate system with axes x , y , and z . The scattering vector Q is decomposed into components Q_x , Q_y , and Q_z . The angle θ is the angle between the z -axis and the Q vector, and ϕ is the angle between the x -axis and the projection of Q onto the xz -plane.

Below the diagram are two screenshots of the software interface. The left screenshot shows the 'Model Parameters' panel for a cylinder model. The parameters are:

Names	Values	[Units]
background	0	[1/cm]
contrast	3e-006	[1/A ²]
length	400	[Å]
radius	20	[Å]
scale	1	
[For 2D only]:		
cyl_phi	1	[rad]
cyl_theta	1	[rad]

The right screenshot shows the 'Model Parameters' panel for a cylinder model. The parameters are:

Names	Values	[Units]
background	0	[1/cm]
contrast	3e-006	[1/A ²]
length	400	[Å]
radius	20	[Å]
scale	1	

Red arrows point from the 'cyl_phi' and 'cyl_theta' parameters in the left screenshot to the 'length' and 'radius' parameters in the right screenshot, indicating that these parameters are used for 2D calculations.

With 2D view, the orientational angle parameters will be displayed in the panel but used only for 2D calculations.

Fig. 15

III. Data fitting; Simultaneous fit

III-1. The simultaneous fit uses the complex fit engine (Park).

III-2. Repeat Step II-1 to II-6 to load at least two data set. Make sure that all adjustable parameters were checked including the parameters you want to constrain for the simultaneous fitting.

III-3. Open the simultaneous fit panel by clicking on “Simultaneous” in the Fitting menu (Fig. 16). The complex fitting engine will be set automatically.

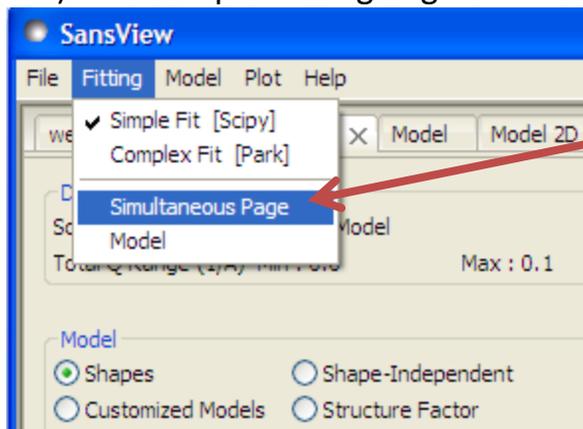


Fig. 16

III-4. Make sure that you know the model fitting function name labeled in your data plot (green curve): It is automatically named as M0, M1, M2,...

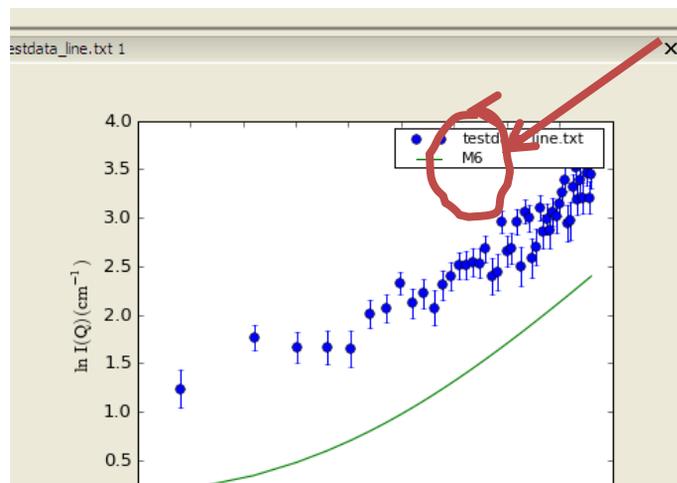


Fig. 17

III. Data fitting; Simultaneous fit (continued)

III-5. Assuming your model describes your data well, in the Simultaneous Fit panel, click on the check box on your models corresponding to your data to fit or click on the Models check box to select all of them (Fig. 18).

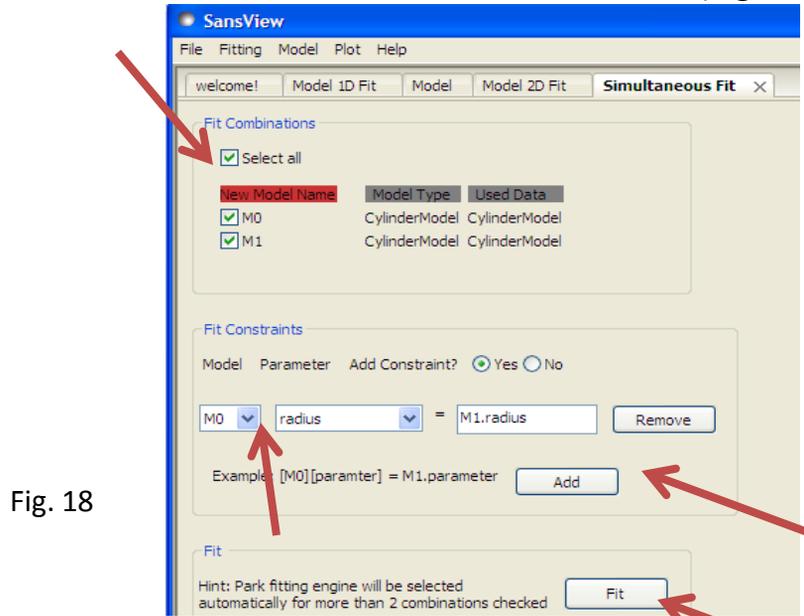


Fig. 18

III-6. Click on “Yes” to “Add constraints”.

Select and type the constraints between two sets of fitting parameters (Fig. 18); eg., $[M0][radius] = M1.radius$, or $[M0][radius] = 2 * M1.radius + M1.length$. For more constraint box, click on Add button. Or click on Remove button when it is not applicable.

III-7 Once all constraint setups are done, click on the Fit button to perform fit.

III-8. When the fitting is finished, the progress bar at the bottom of window will disappear (Fig.19).

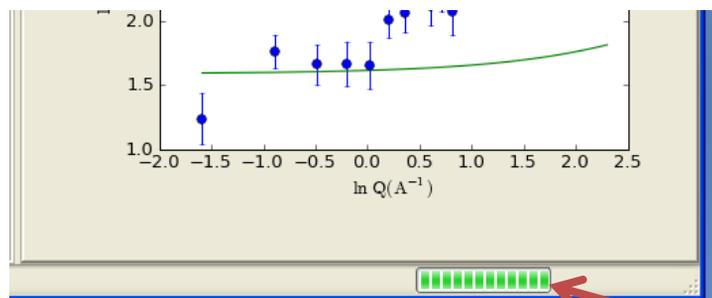


Fig. 19

III. Data fitting; Simultaneous fit (continued)

III-9. Then, go back to the Fit panels of the data, and inspect the results (Fig. 20). Note: Currently the errors of constrained parameters will not be displayed well, but can be calculated by applying the equation of your constraints.

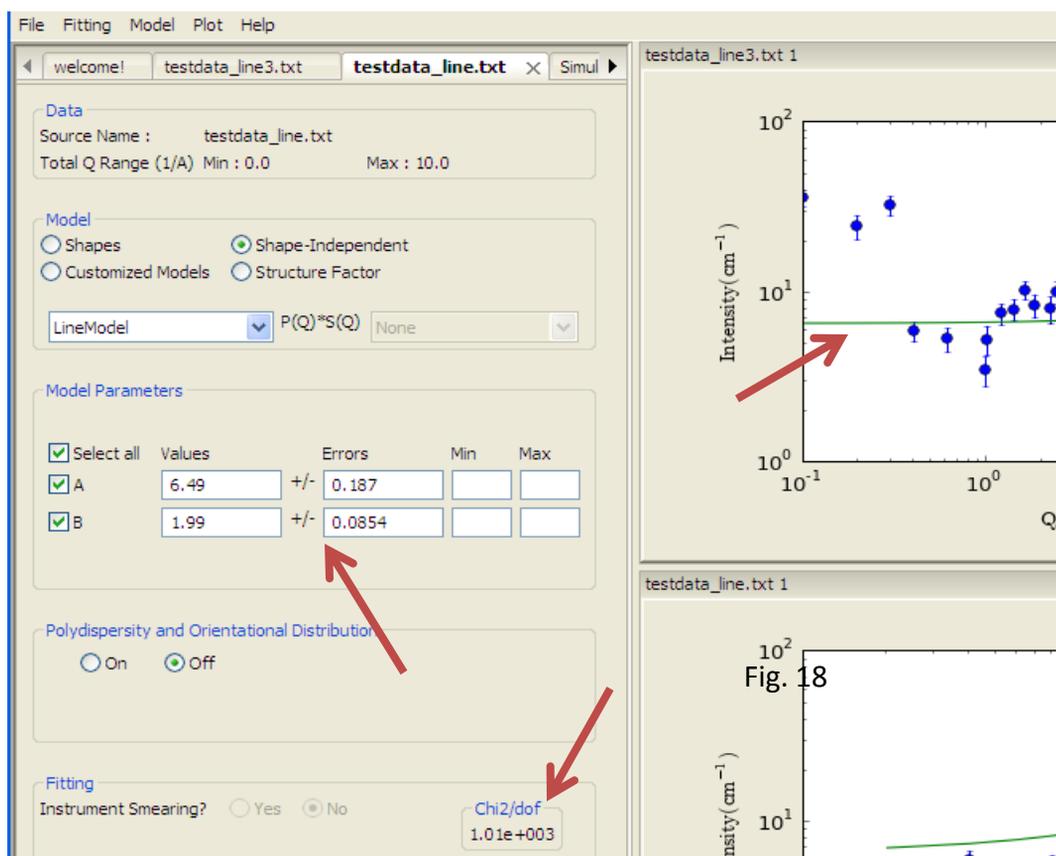


Fig. 20

III-10. If the fitting results return with an error at the bottom of the SansView window, close the Simultaneous Fit panel (in the same way shown in Step II-3), and repeat it again with different initial values of your parameters.

IV. Model calculation

IV-1. Click on the model in the “Model” menu bar (Fig. 21). It will open a model panel as well as a plot panel (Fig. 22).

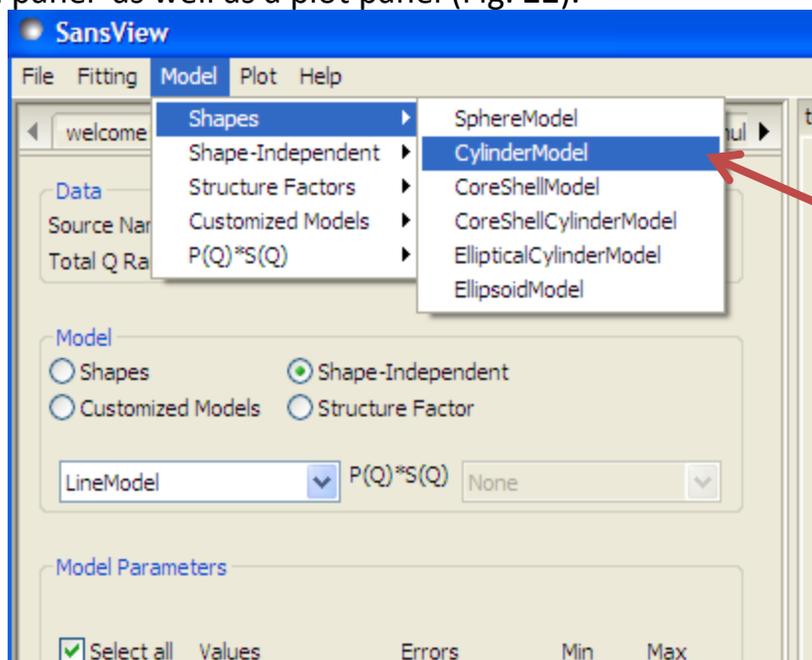


Fig. 21

IV-2. In the model panel, the model description and parameter inputs are provided. User can also change model function by selecting another from “Model” combo-box. Also, Q range and the number of points of the calculation can be adjusted by users (Fig.22).

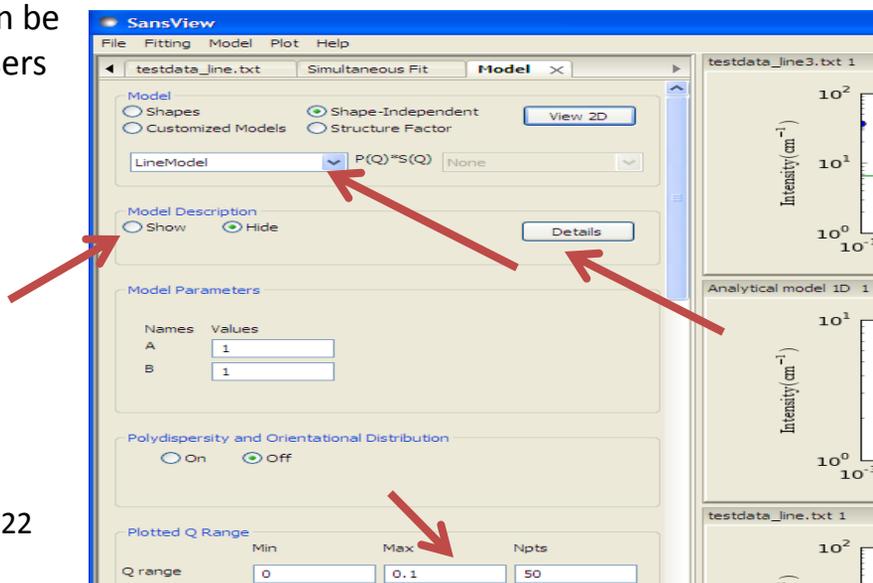


Fig. 22

IV. Model calculation (continued)

17

IV-3. 2D model plot panel can be open by clicking on the “View 2D” button, and it will automatically updated afterward together with 1D plot as the input values are changed (Fig. 23).

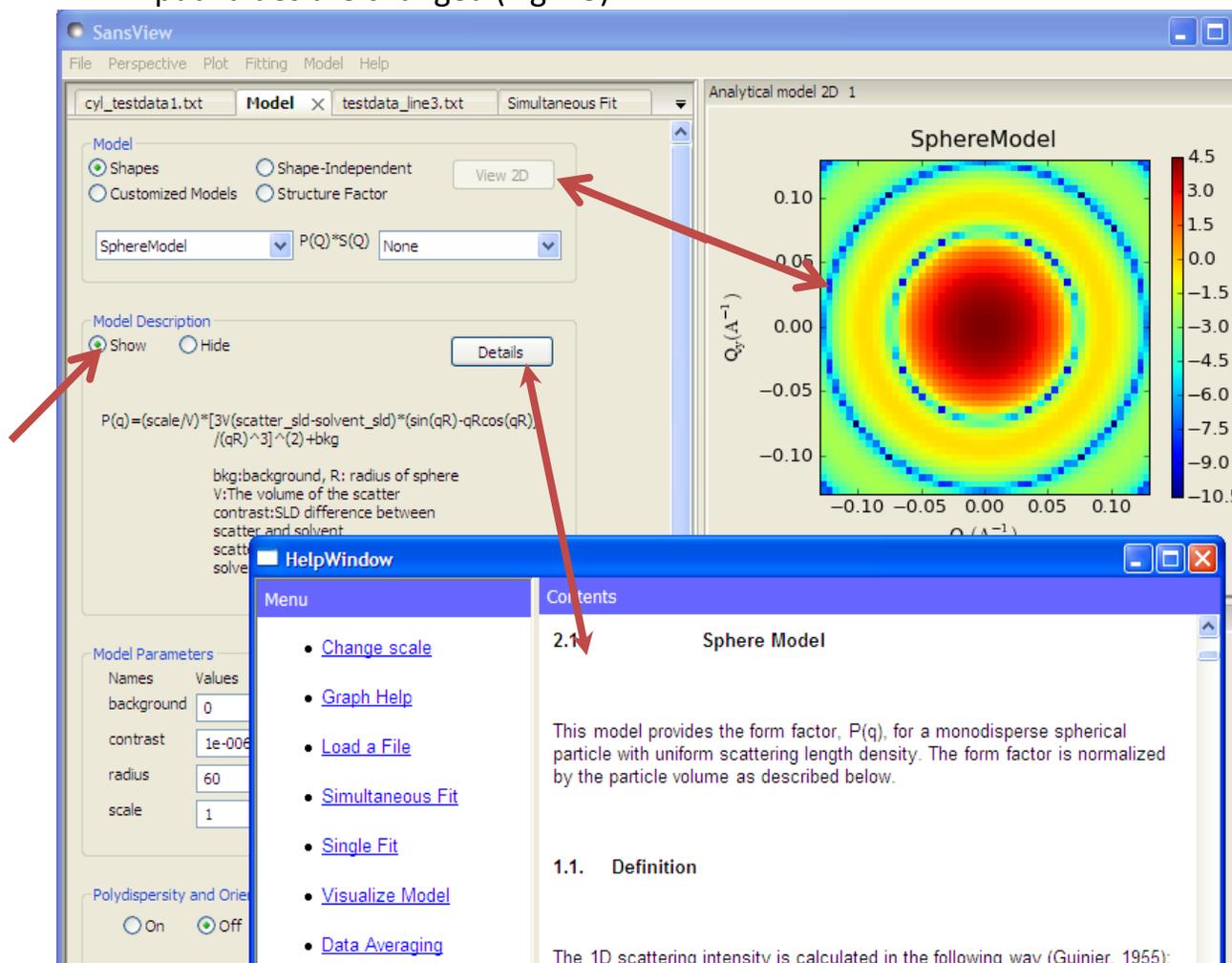


Fig. 23

IV-4. User can reset the model panel by selecting a new model from the “Model” menu, and also can delete any control panel by clicking on “x” mark beside of the panel name at the top right side corner. By clicking the Save button, the panel also can be saved and open later from the Fitting menu in the menu bar or by right-clicking and selecting it from the panel.

V. 2D averaging

V-1. Once user loaded a 2D data or 2D model plot panel, 2D averaging is ready to go.

V-2. Locate the mouse pointer anywhere in the 2D image, and select one of averaging methods (Sector, Annulus, Boxsum or Box average) by right-click-holding the mouse and by locating the pointer.

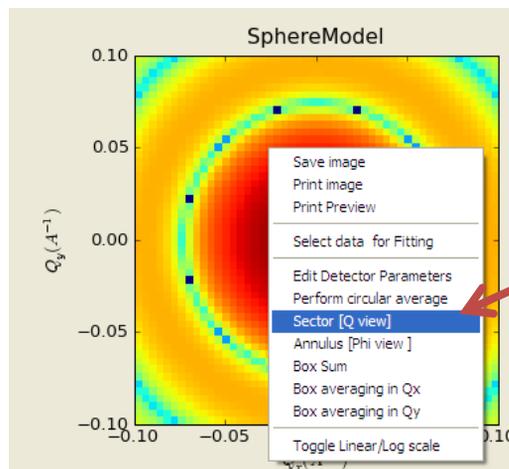


Fig. 24

V-3. Use your mouse to hold and to drag the small cursor in the line to perform an average the area between lines or inside lines (except the circular average). Depending on the kinds of averaging features, the cursor movement is restricted to fit the geometry of the area to perform the averaging.

V-4. In some case, the error may interrupt to see the pattern of the averaged 1D plot. Right-click on the highlighted 1D plot and choose “hide error bars”.

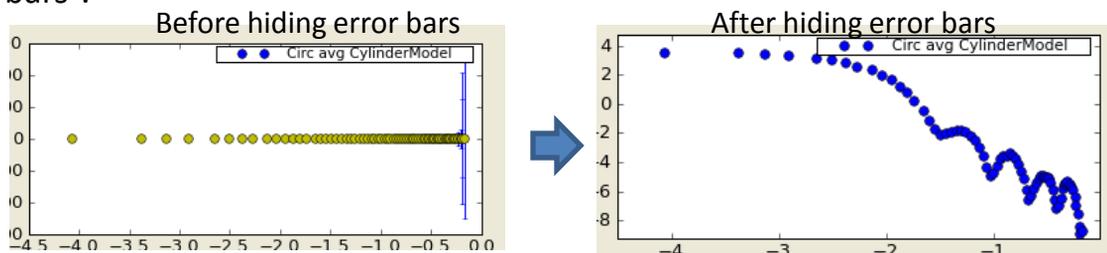


Fig. 25

V. 2D average (continued)

V-5. Some screen shots below show the shape of averaging area that we support.

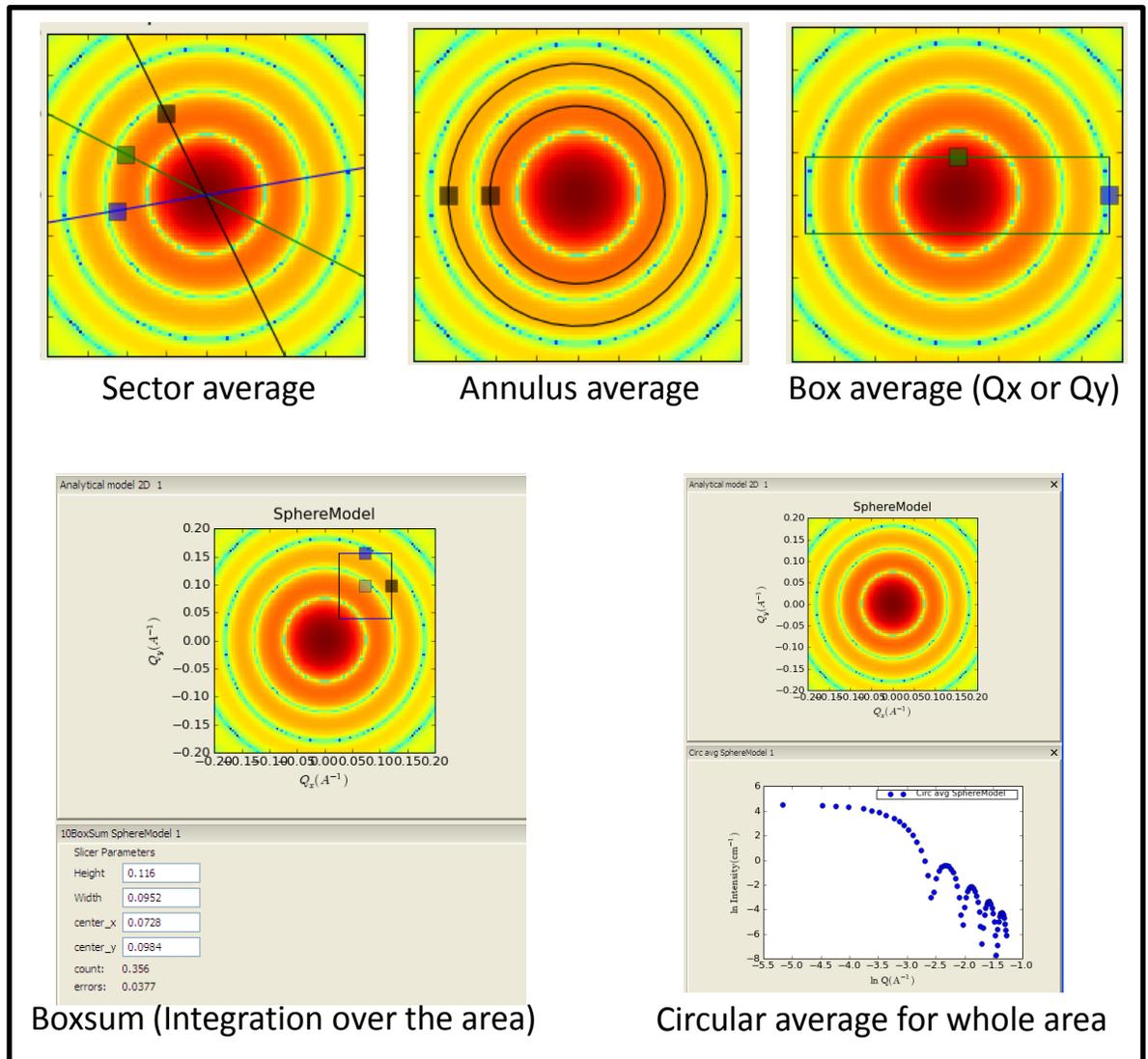


Fig. 26

VI. Save data and print images and plots

VI-1. Currently saving an image or a plot panel is supported in png format. Right-clicking on anywhere inside 1D and 2D plot will bring the context menu box. Select “Save image”, “Print image”, or “Print Preview” of interest (Fig. 27).

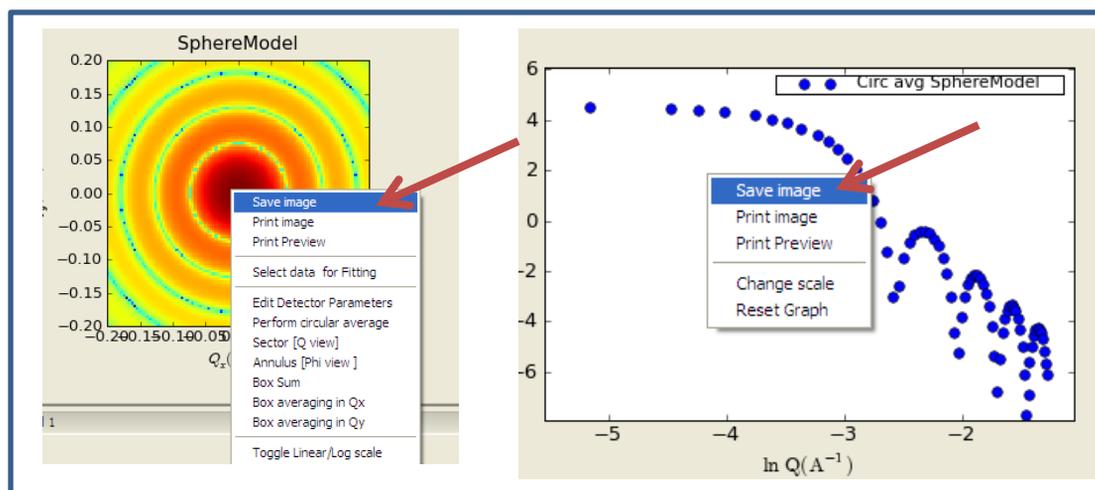


Fig. 27

VI-2. 1 D data in the plot can be saved in the formats of txt and CanSAS xml. Move mouse to the data points to highlight the symbols. Then, right-click on the highlighted data points. In the context menu, select “save points” (Fig. 28).

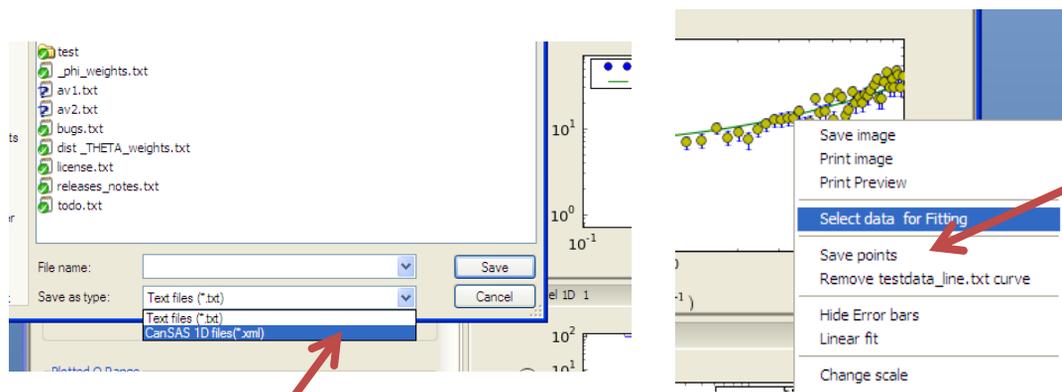


Fig. 28

VII. Pr inversion

Pr inversion is based on P. Moore, *J. Appl. Cryst.* (1980) 13, 168-175. This calculation method is available in a stand alone application (PrView). Please see details at http://danse.chem.utk.edu/downloads/PrView0.2_tutorial.pdf or <http://danse.chem.utk.edu/prview.html>.

In this tutorial, we show how to switch between Fitting (or model calculations) and Pr inversion.

VII-1. Choose 'Pr inversion' from 'Perspective' in the menu bar (cf., choose 'Fitting' to go back to model fitting panels).

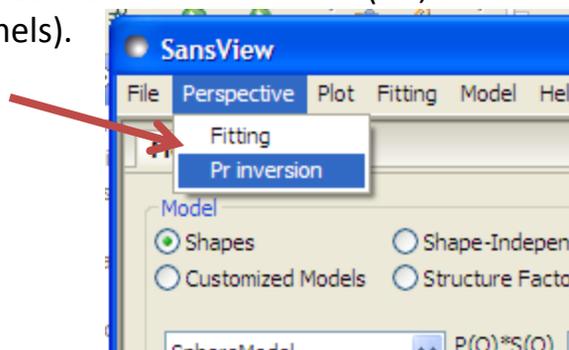


Fig. 29

VII-2. If you have a data plot open, locate your mouse to the plot to highlight (yellow). On right-clicking, choose 'compute P(r)' to load the data for Pr inversion. Once the data loaded for Pr inversion, the data file name will be displayed in the text box named 'Data'. If you don't have data open, follow the steps in page 5 (Chapter I) to open your data first.

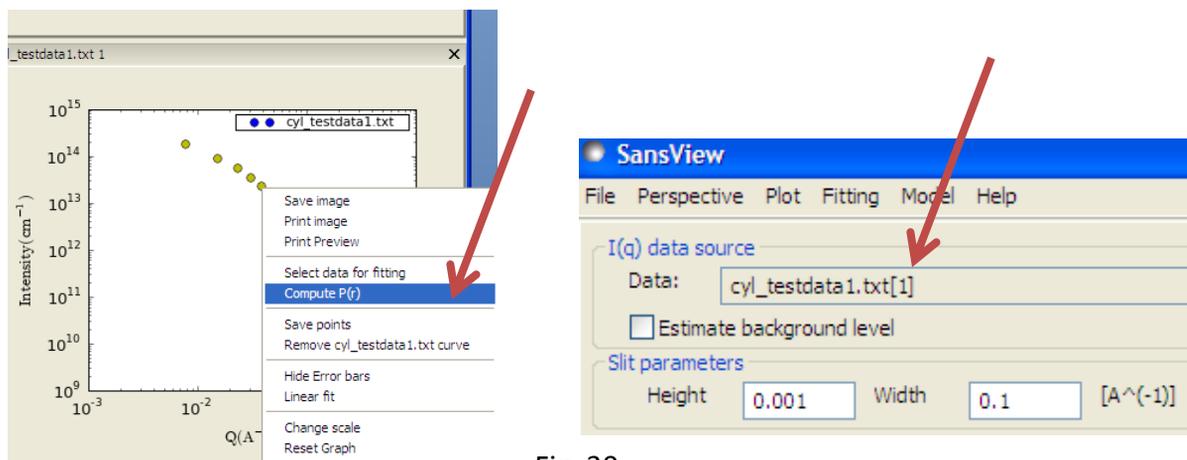


Fig. 30

VII. Pr inversion (continued)

VII-3. **Background estimate:** By checking the background estimate box, you can let the application fit a constant background value for your $I(q)$ data.

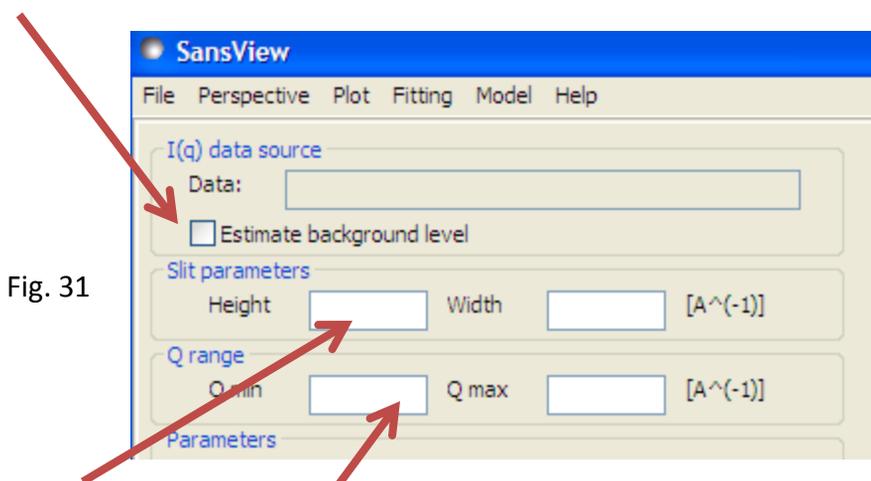


Fig. 31

VII-4. **Slit smearing:** By typing slit height and/or width (in $1/A$), you can include the smearing effect to the calculations. When smearing included, both of the results with and without the smearing effect will be displayed.

VII-5. **Q range:** Q range for the $I(q)$ may be specify in the Q min and Q max text boxes.

VII-6. **Suggested values:** Estimates for the number of terms and the regularization constant are computed when the maximum distance or Q range is changed. When an estimate is available, a button with the value will be enabled. Click the button to accept the value.

VII-7. Input parameters:

- 1) number of terms: number of terms in the expansion.
- 2) Regularization constant: α parameter of the regularization term.
- 3) Max distance: maximum distance in the any two points in the system.

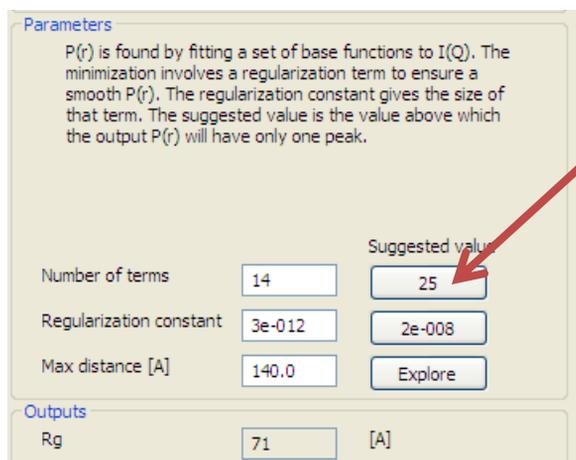


Fig. 32

VII. Pr inversion (continued)

23

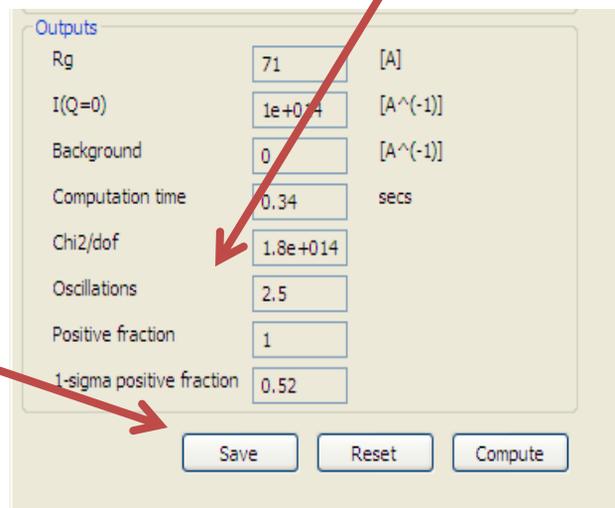
VII-8. Output parameters: Several output parameters are provided as figures of merit of the inversion process.

- 1) Rg and I(Q=0) are computed from the P(r) distribution.
- 2) Positive fraction: The fraction of the integral of the absolute value of p(r) that is positive.
- 3) 1-sigma positive fraction: The fraction of the integral of the absolute value of p(r) that is least one standard deviation above zero.
- 4) Oscillations: The oscillation parameter is defined as

$$\frac{\int (dp(r)/dp)^2 dr}{\int (p(r))^2 dr}$$
 Its value is 1.1 for a spherical system.

VII-9. Buttons:

- 1) Save: To save the information and results in the panel into a file so that later it can be reloaded.
- 2) Reset: To reset the panel to the default.
- 3) Compute: To perform the Pr calculations.



Outputs		
Rg	71	[A]
I(Q=0)	1e+014	[A ⁻¹]
Background	0	[A ⁻¹]
Computation time	0.34	secs
Chi2/dof	1.8e+014	
Oscillations	2.5	
Positive fraction	1	
1-sigma positive fraction	0.52	

Buttons: Save, Reset, Compute

Fig. 33

VII-10. P(r) plot: Right clicking on the highlighted data points by locating mouse pointer to the data points in the P(r) plot panel, will provides a popup (context) menu. Then,

- 1) another set of P(r) data can be added into the plot by selecting 'Add P(r) data' from the menu
- 2) the number of the calculation points can be changed by selecting 'Change number of P(r) points' from the menu
- 3) scaling and normalization can be also done by choosing a proper menu in the same way.

VII-11. Results: Once the p(r) distribution has be computed, the I(Q) corresponding to the Fourier transform of that distribution is shown and compared to the input data.

VII. Pr inversion (continued)

VII-12. **Explore Dmax:** Maximum distance (Dmax) can be examined by clicking the 'Explore' button next to the Max distance input box. New popup window will be open displaying χ^2 vs. Dmax as defaults. Exploring Dmax with other parameter spaces can be done by choosing the parameter in the combobox named 'Select a dependent variable' at the top of the window.

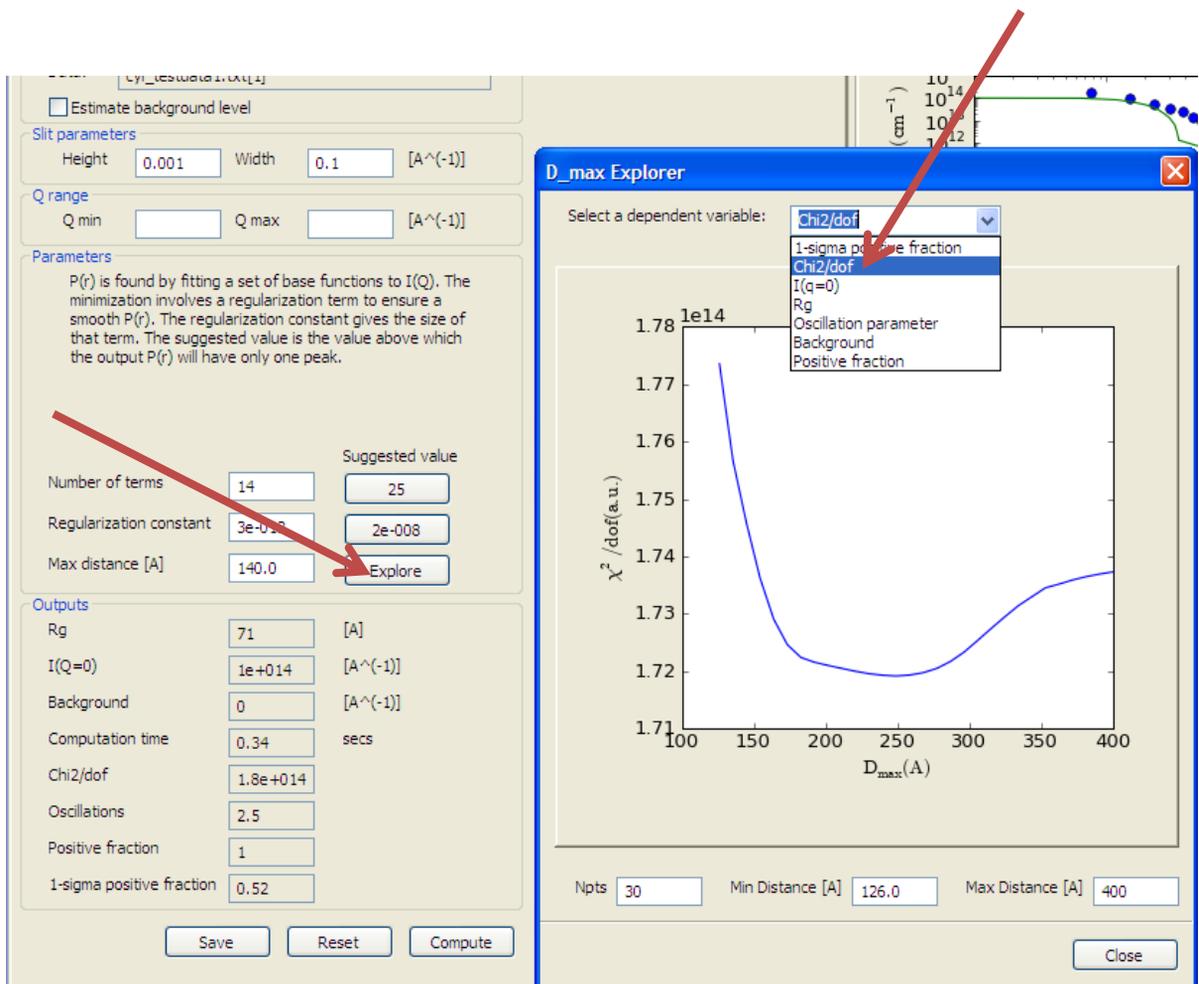


Fig. 34

VIII. Miscellaneous

VII-1. Change scales or toggle Linear/ Log.

Right-click on 1D, 2D plot. Select “Change scale” or “Toggle Linear/Log scale” (Fig. 35).

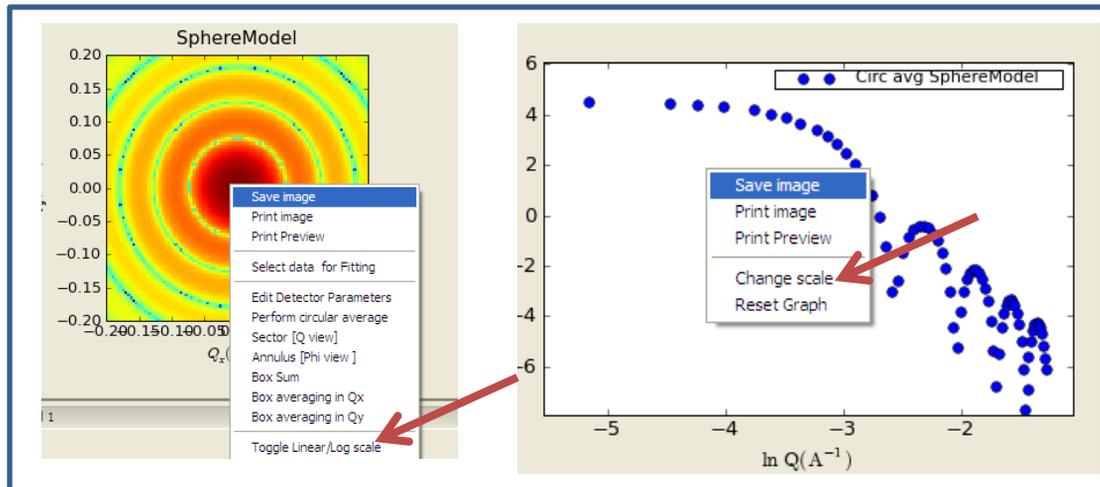


Fig. 35

VII-2. Close an open plot panels: All plot panels can be closed by clicking on the “x” mark at the top of window. In order to bring that panel back, go to the menu bar and select the panel to open under “Plot” menu (Fig. 36).

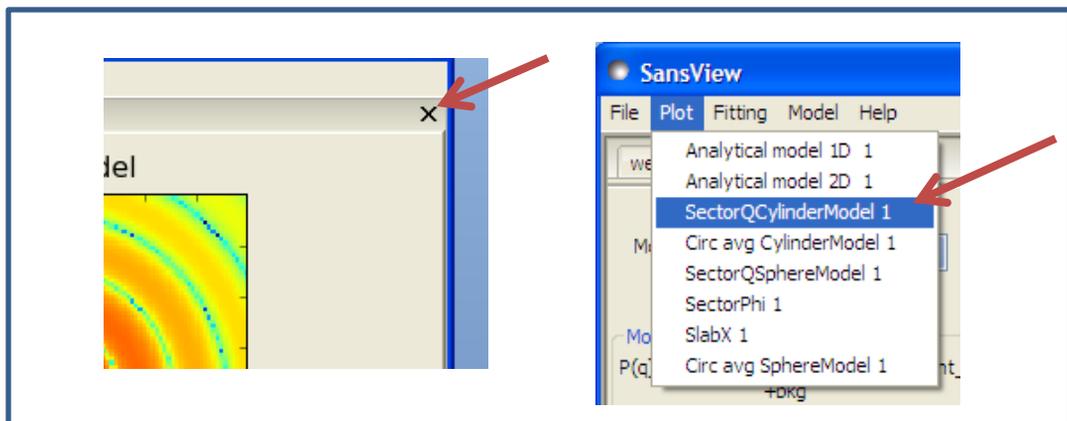


Fig. 36

VIII. Miscellaneous (Continued)

VII-3. Your workspace can be **re-arranged** by clicking on and dragging the title bar outside or back to inside of the SansView interface (Fig. 37).

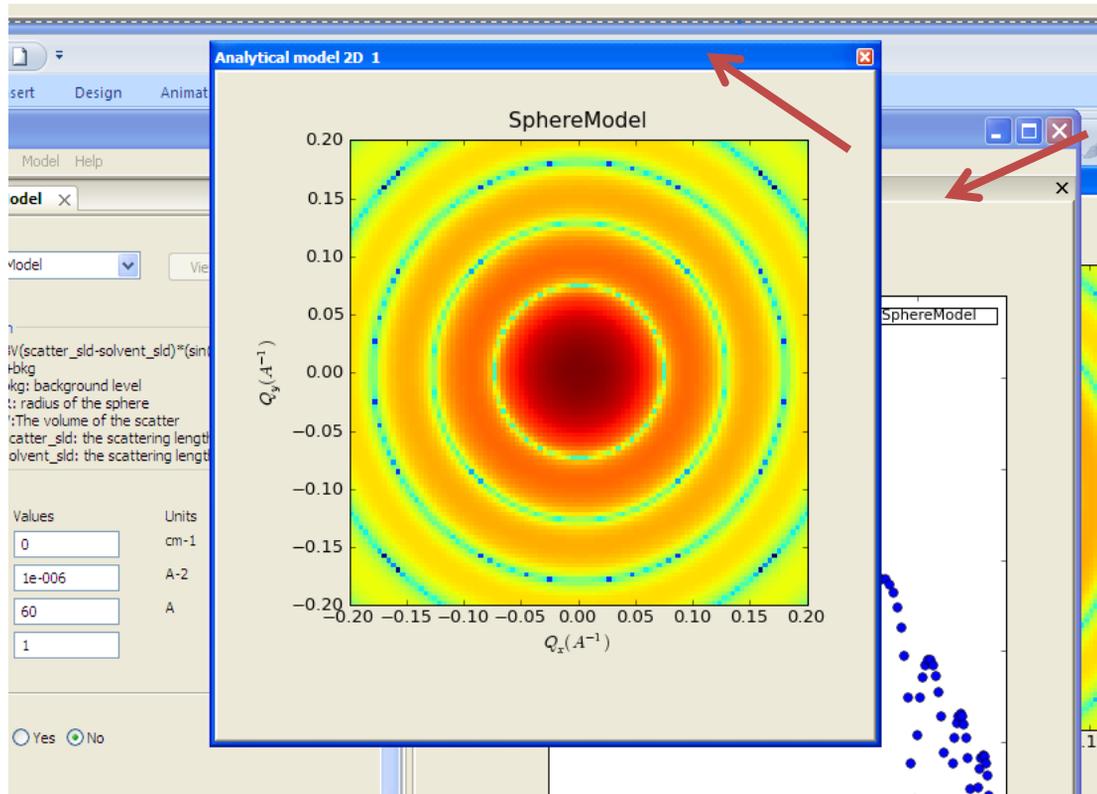


Fig.37

VII-4. **Changing color map** of a 2D image (Fig. 38);
Open the context menu by right-clicking on the image plot. Select “Edit detector parameters “. Type integer numbers (not zero”) in the box. If no number (no space) is entered, the image will be displayed in the default color depth. A different color map can be selected by choosing one from the combobox named Cmap. This feature is one time feature, which means it will not be updated when updating or change the image plot. Note: This feature is still under construction, so use it with care. (Fig. 38).

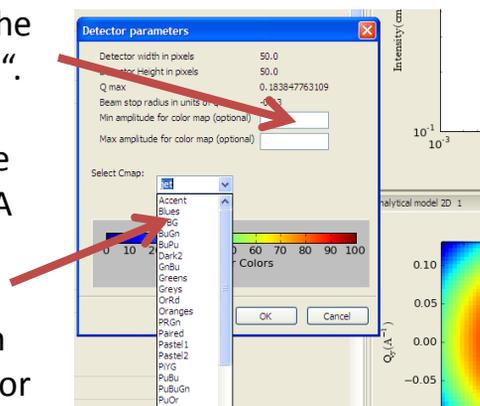


Fig.38

VIII. Miscellaneous (Continued)

VII-5. **Zooming:** 1D data plot can be zoomed out and in:

A) for both x- and y-axis; one-click in the plot panel, locate your pointer inside the axes then rotate the roller at the center of your mouse to zoom in and out (Fig. 39).

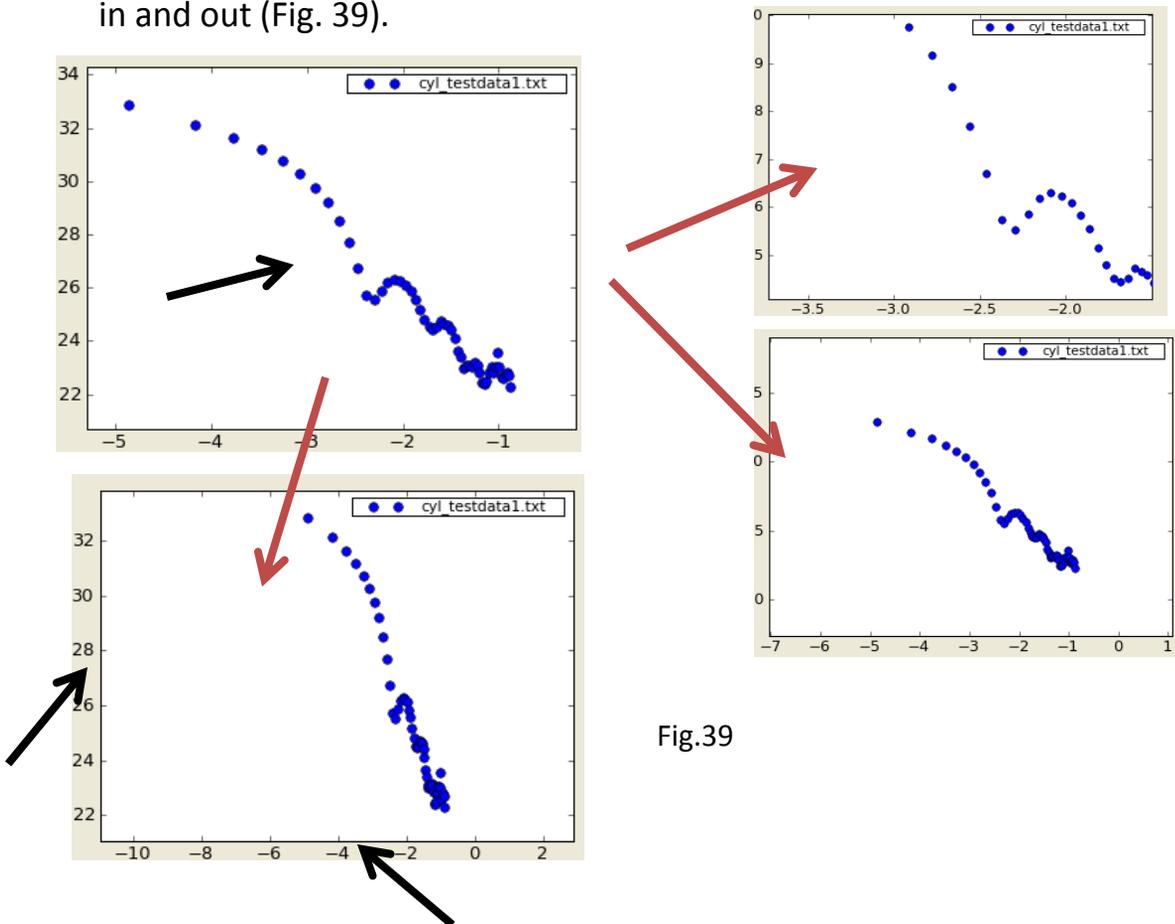


Fig.39

B) x- or y- axis separately; one-click in the plot panel, locate your pointer (black arrows in Fig. 39) somewhere between the axis line and label, and use the mouse roller to zoom in and out the axis as desired.

VII-7. The data points or curve can also be dragged around by click-and-holding within the plot range.

VIII. Miscellaneous (Continued)

VII-5. Some **Helps** and tips are available within the SansView application. Select “Fitting help” or others in the “Help” menu. This will provide you instant help (Fig. 40).

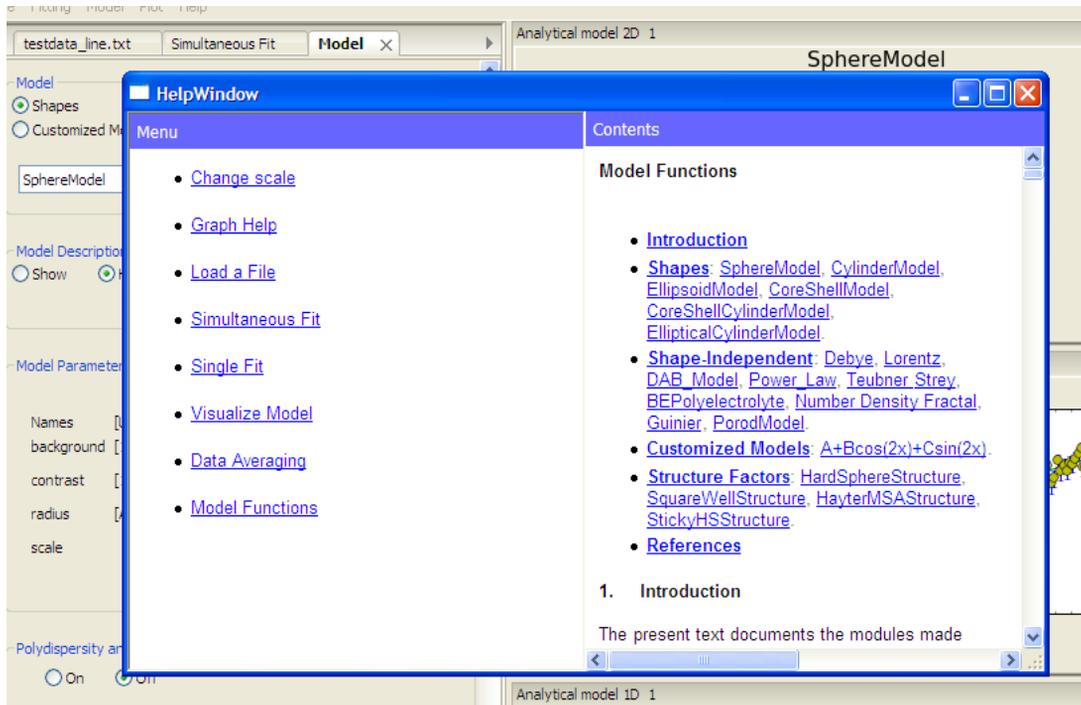


Fig.40

VII-6. Simple tips and information will be displayed at the bottom line of the application whenever it is necessary (Fig. 41).

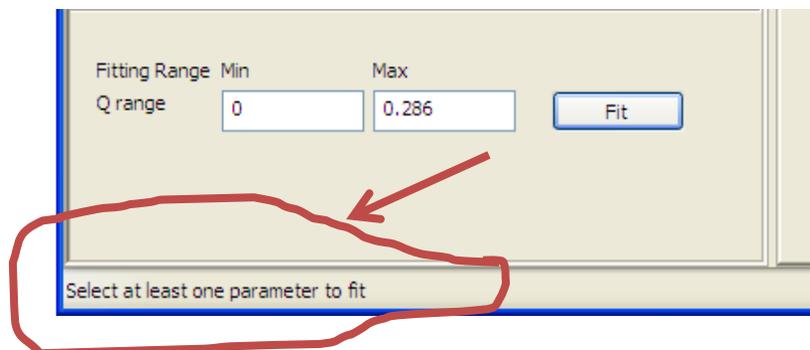


Fig.41



VIII. Miscellaneous (Continued)

VII-7. Loadable data formats:

A) 1D data:

- a) File extensions that can be loaded: .txt, .dat, .abs, .xml, or w/o extension.
- b) 2 to 4 columns of data are required in order of Q, I, (dI, dQ).
- c) The meta data (header) will be ignored unless in a standard xml format.

B) 2D data:

- a) File extensions that can be loaded: .ASC, .sans
 - b) 2D ASCII file should be from NIST IgorPro SANS reduction package and saved to the detector coordinates.
- C) Examples of data files are available in “test” folder inside the SansView-1.0 folder (See page 4 and Appendix: User model documentation on page 27 -29).

VII-8. Supporting model functions: The descriptions are available in the help menu.

A) Shape models (form factors): sphere, cylinder, coreshell cylinder, coreshell sphere, ellipsoid, elliptical cylinder, and many more.

B) Shape independent models: DAB, BEPolyelectrolyte, Guinier, Debye, Porod, line, number density fractal, Lorentz, power law, Teubner Strey.

C) Structure factors: square well, hardsphere, stickyHS, HayterMSA.

D) Customized models: Users can define their own model functions by modifying an example python file in the “plugins” folder inside of the SansView-1.0 folder. See Appendix or the example files in the plugins folder.

E) $P(Q)*S(Q)$: Form factor times structure factor supports for some shape based models (with 4 structure factors above). For cylinder and ellipsoid based models, the 2nd virial coefficient will be calculated automatically and applied to the structure factors.

VII-9. Instrumental smearing is supported in fitting when your data includes dQ in its forth column.



VIII. Miscellaneous (Continued)

VII-10. **Polydispersity (1D and 2D) and orientational distribution (2D only)** can be taken account for modeling and fitting.

A) We use the *Gaussian* distribution function (where width =Sigma (STD), Npts = number of points over the distribution, Nsigma = number * sigma (distance from the center to be covered)). Good values for Npts and Nsigma may be 7 to 21 and 2.5 to 3, respectively.

B) Using a customized model:

Users can make two columns of a distribution function, and open the functional data file from a fitting panel with polydispersity ON. The file should includes two columns of data where the first column is consistent with the values of the parameter and the 2nd column is for weighting factors. (Note that this user data will override the corresponding parameter value (eg., radius) so that the parameter will become no longer fittable.)

An example of the user function is;

radian	weight
0.707	0.4
1.14	1
1.414	0.1

VII-11. **Customized models:** Users can define their own model function in the plugin folder of the sansview folder. Take a look and modify the sample file in the folder, or create a new one. Then the model function will be show up under “Customized model” menu in the menu bar. See Appendix (page 31) or the example files in the plugins folder of SansView folder for more details.



IX. Appendix

User Model Documentation

SansView has a plug-in mechanism that allows users to write their own models in python. Each user model is placed in the *plugins* folder of the SansView installation. For instance, on the default Windows installation, the user model files will be placed in

`C:\Program Files\SansView-[version]\plugins`

Note that the user may thus define any number of such special models. The content of each model plugin is the following:

```
"""
    Test plug-in model
"""
from sans.models.pluginmodel import Model1DPlugin

import math

# ALL Your models MUST HAVE the class name Model as listed below (i.e.
# DO NOT MODIFY this next line).
# The unique name that appears in the menu for each of your models comes
# next (Name of the model)
class Model(Model1DPlugin):
    """ Class that evaluates a user model.
    """
```



VIII. Appendix (Continued)

```
## Name of the model -- this is where you put the unique name
##for the model that will appear in the menu
name = "A+Bcos(2x)+Csin(2x)"

def __init__(self):
    """ Initialization """
    Model1DPlugin.__init__(self, name= self.name)

    ## Parameters definition and defaults
    self.params = {}
    self.params['A'] = 1.0
    self.params['B'] = 1.0
    self.params['C'] = 10.0

    ## Parameter details [units, minimum value, maximum value]
    self.details = {}
    self.details['A'] = ["", -1e16, 1e16]
    self.details['B'] = ["", -1e16, 1e16]
    self.details['C'] = ["", -1e16, 1e16]
    self.description = "F(x)=A+Bcos(2x)+Csin(2x) "

def function(self, x = 0.0):
    """ Evaluate the model
        @param x: input x
        @return: function value
    """
    # For convenience, use local variables for the parameters
    A = self.params['A']
    B = self.params['B']
    C = self.params['C']

    return A+B*math.cos(2.0*x)+C*math.sin(2.0*x)
```



VIII. Appendix (Continued)

Notice the use of the *math* module in the function definition. The functions available through python's *math* module are documented on the [python web site](#). Any number of user models can be defined at one time. They will automatically appear in SansView in the Model menu, under "Customized Models".

The user models in the current version of SansView have a number of limitations:

- 1) SansView has to be restarted in order to see a new model appear in the Model menu. Similarly, any change in the model will require restarting SansView to be effective. Work is currently planned to allow live changes of the models.
- 2) Polydispersity is not currently available for user models. This feature is currently under development.
- 3) Since they are coded in python, user models can be slower to use. Contact the DANSE team if you would like to incorporate your model in the DANSE framework. The DANSE team will be able to port your model to a faster implementation.