A4. SAXS Q-calibration procedure using Ag-Behenate

The working procedure for SAXS Q-calibration is described in the following.

A. Collect data

(a) Start the supersonic program for 2-D SAXS pattern

(b) In SAXS mode (" do saxs.do ↵ ") take background image.

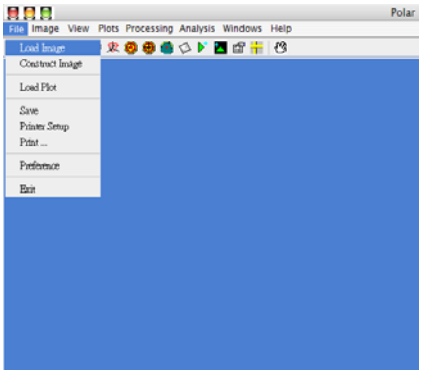
(c) Put Ag-behenate in beam and take the scattering pattern.

(d) measure the sample transmission (" do tm.do ↵ ") (see the data reduction procedure appended at the end for the transmission measurement).

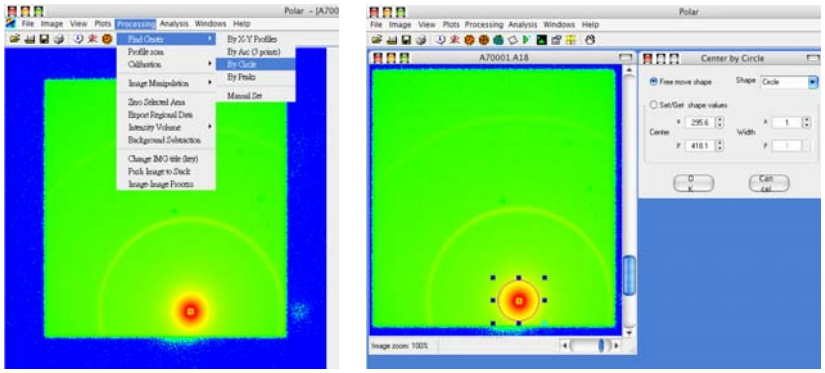
B. Data processing

(a) Open Polar program for image file processing.

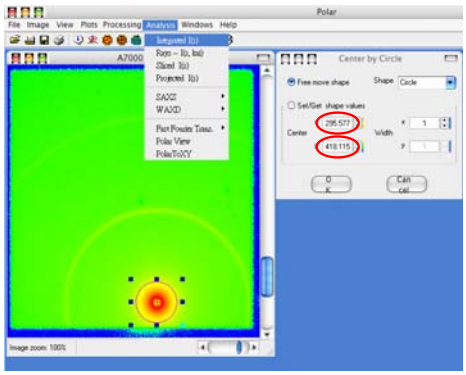
(b) Load the SAXS image file

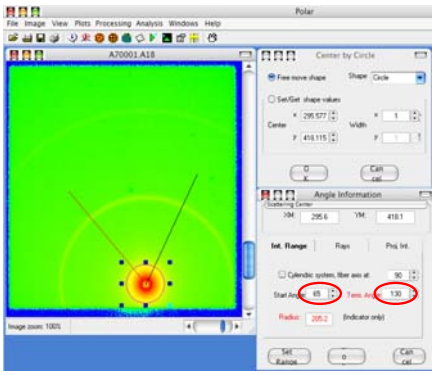


(c) Find the direct beam position (beam center): For the analysis of X-ray scattering data, it is required to know with good precision the position of the incident beam. In addition to manual settings, an automatic and accurate method to find center by several options (X-Y profiles, Arc, Circle, Peaks) has been implemented by the Polar program as shown in the following graphs.



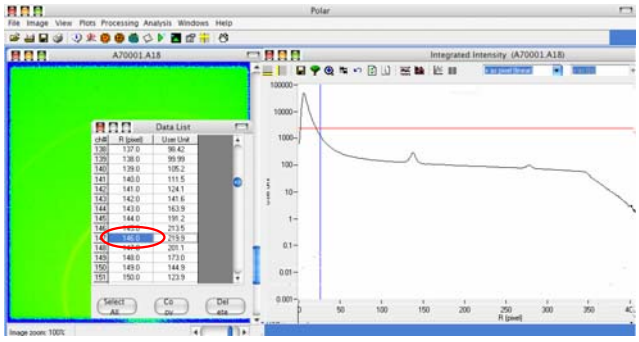
(d). Find peak position according to the following graphs. The scattering pattern can be integrated to obtain one-dimensional profile. In angle information window set the integrated range. Then click on "ok" button to get one dimensional profile.



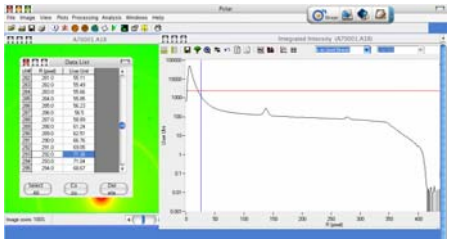


(e) Get the one-dimensional profile after click on “ok” button.

From the data column, locate the maximum channel number N_{max} (or even better to do the peak profile fitting for the central maximum using Table Curve or other program).



Please double check the second peak appears at the channel no. $2N_{max}$. If not, the beam center channels may be misplaced. Check the beam center and redo the procedure.

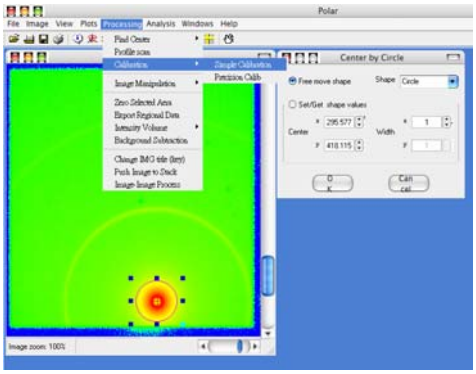


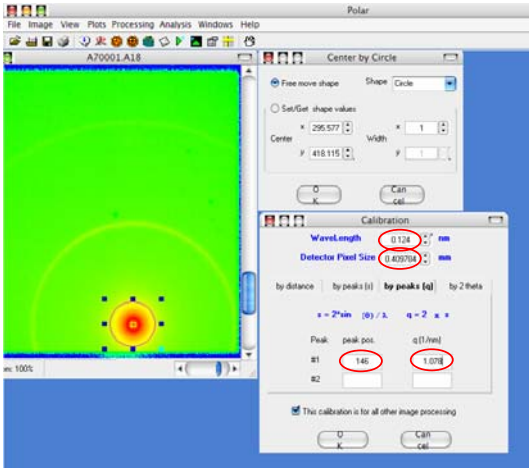
(f). Open the calibration dialog window and set the calibration parameters, including

(1) 1^{st} peak tabulated Q position = 1.078 nm^{-1} (Ag-behenate) with the corresponding observed peak channel position N_{max} =146

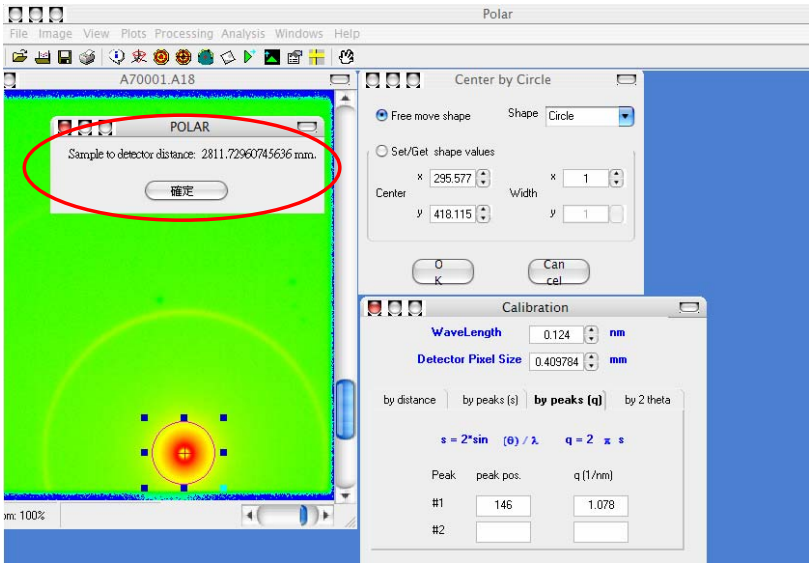
(2) Incident beam energy E (10 keV) = 0.124 nm

(3) Detector pixel size= 0.409784 mm (for detector set for 512×512 pixel array)





(g). After filling the parameters, the program calculates the sample-to-detector distance, S-D = 2811.7 mm, from sub-window. With the SD, E, and pixel size, the program can calculate the Q-value for the scattering pattern measured later.

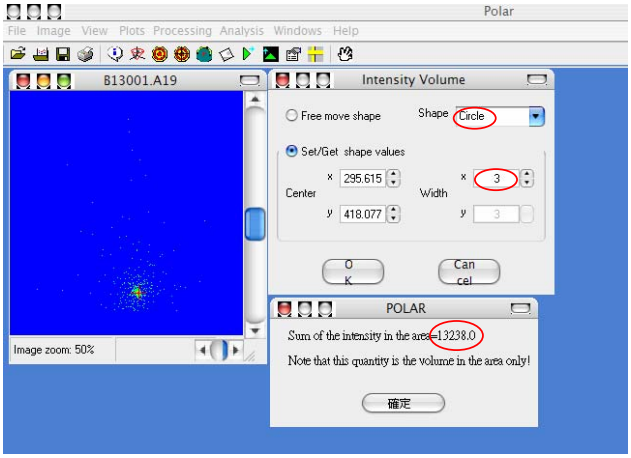


A5. Background subtraction and absolute intensity calibration for 2-D SAXS

- Transmission measurement:

The transmission could be measured by moving the beamstop away, and exposed the detector to the attenuated direct beam for the intensity ratio of the intensities collected with and without sample, respectively.

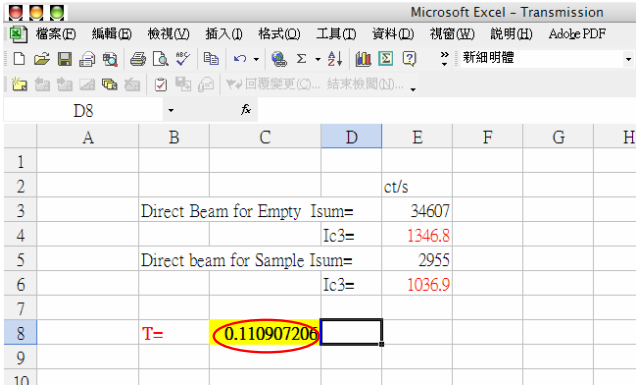
1. Put sample (ex. PE) in beam.
2. In transmission mode (type " do tm.do ↵ ") take a direct beam image and record the beam intensity (Ic3) in the meantime.
3. Open the image file with Polar.
4. Integrate the intensity of direct beam with a circle of 3 pixels in diameter.



5. Repeat steps f2~f3 with empty (sample cell).

Transmission calculation.

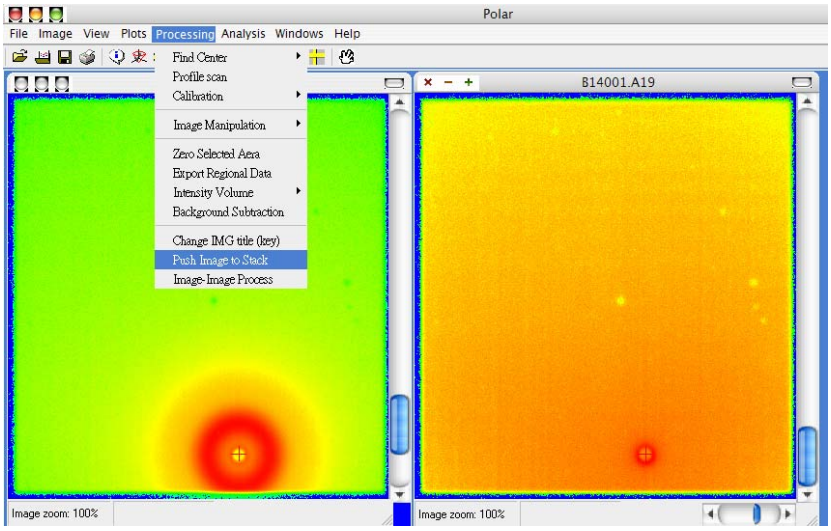
6. Key in Isum and Ic3 values into Excel spreadsheet for the transmission (T) calculation to get transmission of sample.



- **Data reduction for 2-D SAXS pattern from the gas-type area detector**

g1. Open PE and empty scattering images with Polar.

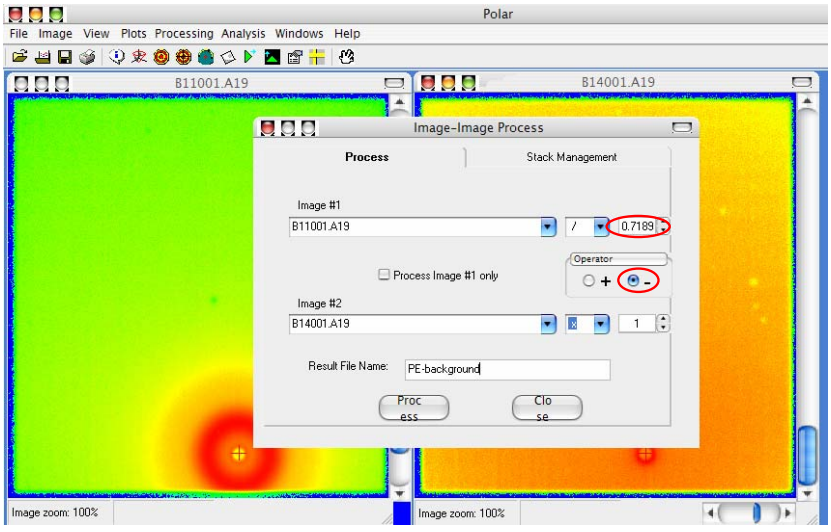
g2. Push images to stock

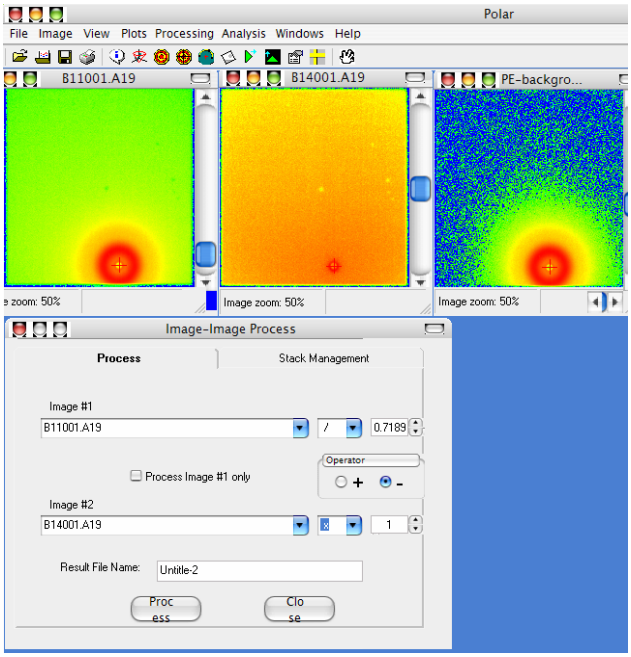


g3. Open image-image process.

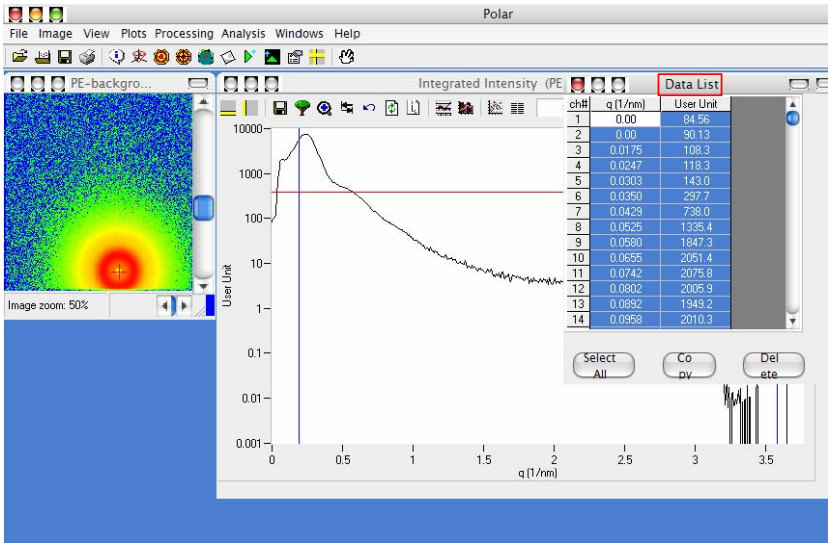
g4. Normalize scattering intensity with sample thickness, sample transmission and photon flux (Ic3).

g5. Subtract background from PE scattering image





g6. Integrate the new image to obtain data list (q and intensity).



g7. Analyze the data and plot it with graphing software as shown in Figure A5.

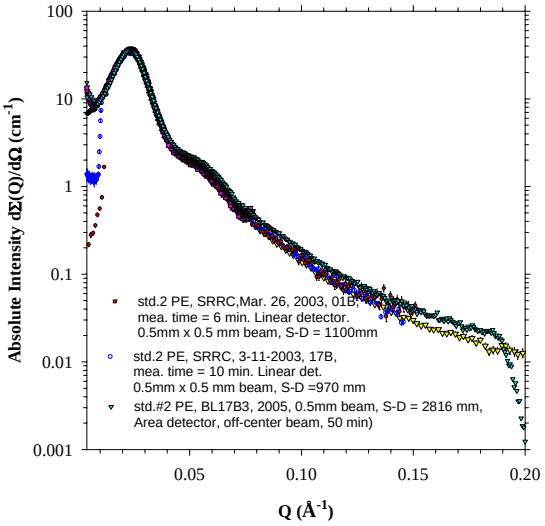


Figure A5. Intensity profiles of PE obtained following the procedure mentioned above. Without the correction of dark current and pixel sensitivity, the profile deviates from the well-calibrated PE profile measured at the SAXS setup at BL01B previously.

Note: the data reduction procedure mentioned above didn't consider the effect of detector sensitivity and dark current.