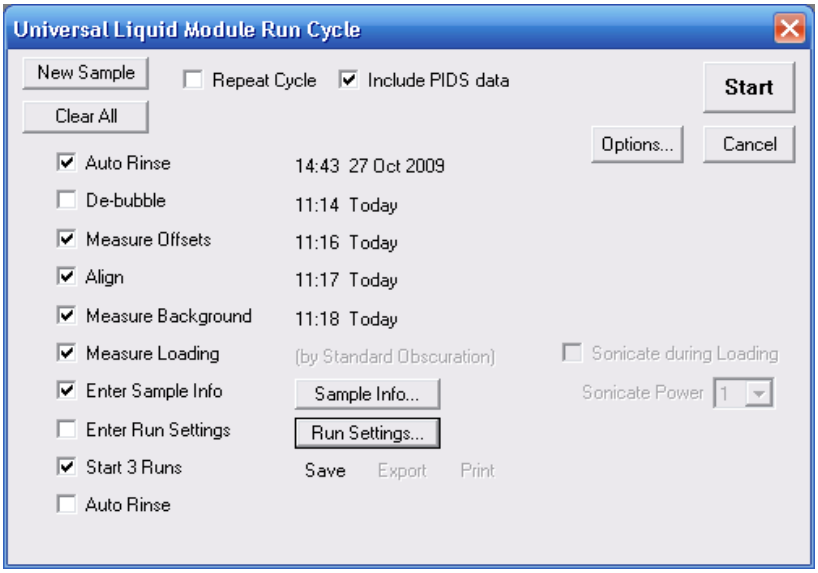
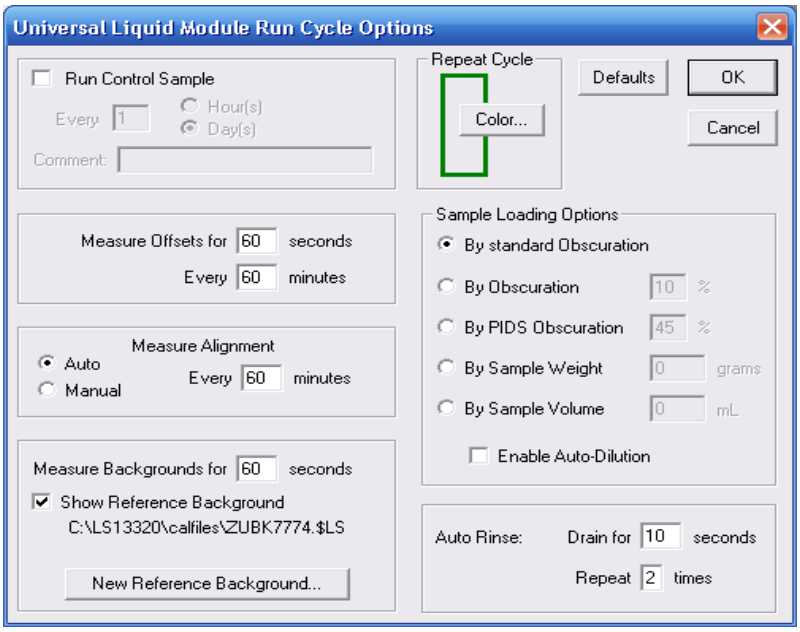
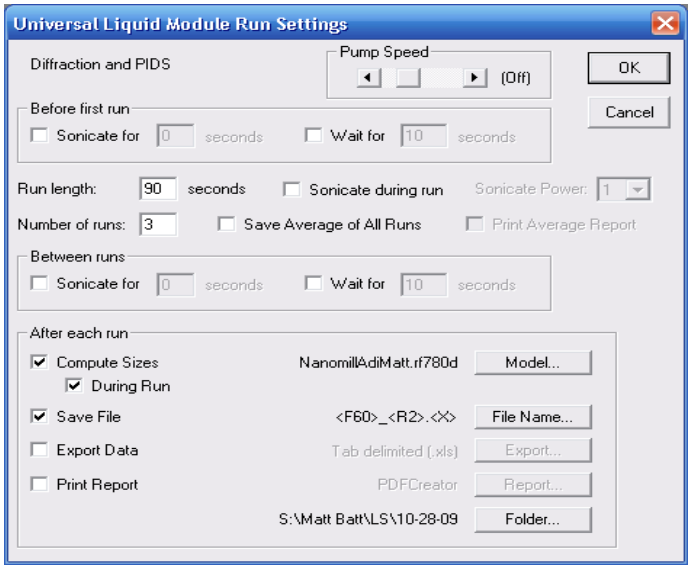
1. “Cycle” button and clicking “New Sample” button in the Run Cycle dialogue box gives



2. “Options” button gives: measure offsets, align laser, measure background time, show reference background, number of rinses, rinse time, load by standard obscuration. (Remember ~ rule of 60s for offsets, alignment, and background.)
   Try to rinse once with organic solvents to cut down on waste.
   Reference background vs. new background shows if instrument is clean enough.

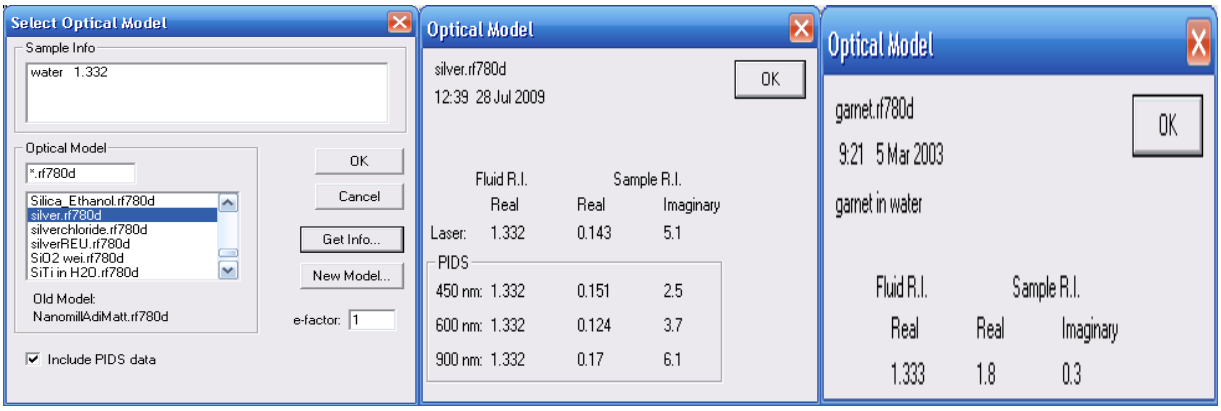


3. "Run Settings" pulls up the run settings dialogue box.



a. **Pump Speed: sets stir speed from ~ 270 rpm to 2700 rpm. Keep pump speed low to prevent bubble formation.**
b. **Sonicate: No sonicator so leave Sonicate boxes empty.**
c. **Wait For: Time to wait before collecting data.**
d. **Run Length = data collection time; 60 seconds minimum for PIDS.**
e. **Number of Runs: Number of times sample analyzed**
f. **Compute Sizes, Save File.**
g. **Folder: select data path in LS Data folder or elsewhere.**
h. **Model: Select optical model. "Model" is a set of refractive indices, real and complex, ideally at all four wavelengths of the LS, used to calculate the scattering intensity of a single particle, for a set of diameters, and scattering angles. (See below)**

Below are the Select Optical Model dialogue box, an "extended" optical model including the PIDS wave lengths, and a simple optical model for the laser wavelength of 780 nm. The web site of Filmetrics, http://www.filmetrics.com/refractive-index-database, has real and complex indices for a large number of materials, measured as thin films.



When the refractive indices, $n(\lambda_k)_{Re}, n(\lambda_k)_{Im}$ are entered, the scattering intensities,

$$i(\theta_m, d_a, n(\lambda_k)_{Re}, n(\lambda_k)_{Im})$$

of a single particle of diameter d_a at scattering angle θ_m, and wavelength λ_k
are ***calculated for a fixed set of diameters, scattering angles, and wavelengths***.
There are 115 diameters, 136 angles, and 4 wavelengths used.

********** The ***LS DOES NOT*** !! measure diameter!! **********

The total scattering intensity at each detector at scattering angle θ is the
scattering intensity of a single particle, $i(\theta_m, d_a, n(\lambda_k)_{Re}, n(\lambda_k)_{Im})$,
times the number of particles $N(d_a)$ summed over all diameters and wavelengths:

$$I(\theta_m) = \sum_{a=1}^{A} \sum_{k=1}^{4} i(\theta_m, d_a, n(\lambda_k)_{Re}, n(\lambda_k)_{Im}) * N(d_a) = \sum_{d} i(\theta_n, d) n(d).$$

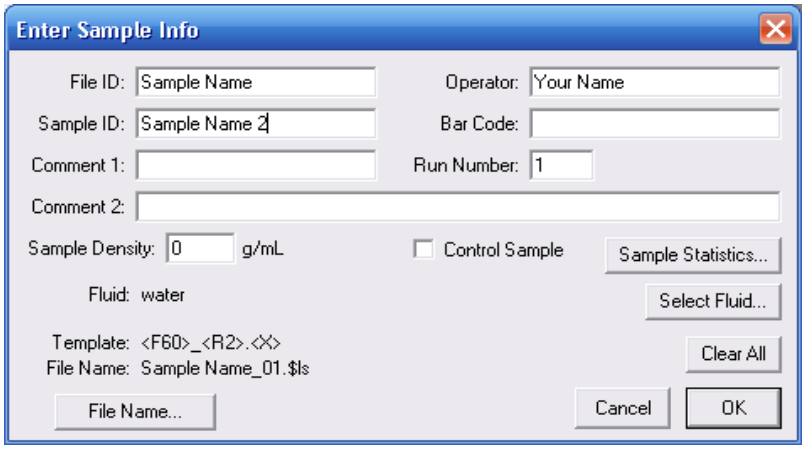
This can be written in matrix form

$$\begin{bmatrix} I(\theta_1) \\ \vdots \\ I(\theta_n) \end{bmatrix} = \begin{bmatrix} i(\theta_1, d_1) & \dots & i(\theta_1, d_A) \\ \vdots & \dots & \vdots \\ i(\theta_M, d_1) & \dots & i(\theta_M, d_A) \end{bmatrix} \begin{bmatrix} N(d_1) \\ \vdots \\ N(d_A) \end{bmatrix} \Rightarrow$$

Simply, $I = iN \Rightarrow N = i^{-1}I \Rightarrow N \sim I / i$.
Therefore, if i is too large $\sim \Rightarrow N$ too small, i small$\sim \Rightarrow N$ large.

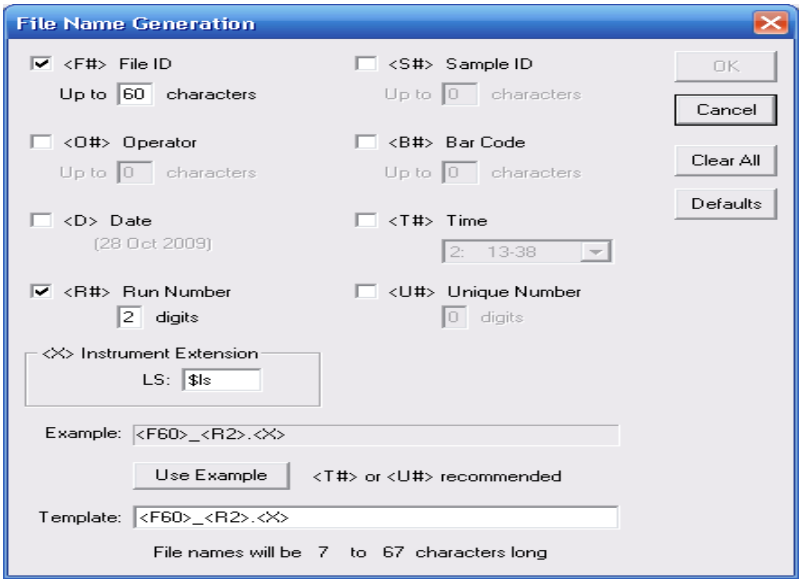
The indvidual scattering intensities, $i(\theta_m, d_a, n(\lambda_k)_{Re}, n(\lambda_k)_{Im})$ are calculated from
the Mie solution to Maxwell's equations for the interaction of electromagnetic plane waves
with a spherical object. It is too difficult to calculate if the diameter is too much larger than the
wavelength, so the intensities are calculated from Fraunhofer diffraction theory.
Fraunhofer does not depend on optical properties. If your particles are greater than **10 μm**,
the results of your measurement will not be too sensitive to changes in optical model.
Below **1μm**, the results can be very sensitive to the correct, extended optical model, so beware
in your interpretation of the results, if you do not have a reliable set of refractive indices.
The interpretation of scattering intensities as a function of angle also assumes particles are,
homogeneous in material, and isotropic in refractive response. The software does not know
how to interpret scattering patterns from complex particles in terms of particle size distribution.
Only simple spherical particles conform to the assumptions of the Mie solution.

4. **Sample Info: This is where your file names will be created.**



Fields in the sample info box to be used as file names are selected from the File Name Generation dialogue check box.

Run number increases by **1** after every run.



5. **Press “Start” in the run cycle dialogue box.**
6. **Measure Loading: When software gets to “measure loading”, add particles until the value for “Obscuration” is between 8 and 12 % and the PIDS is between 40 to 55%. Keep both to the high end of their range, without obscuration going over 12%, or PIDS over 55%.**

7. **Repeat the cycle, new sample, sample info, OK, Start for each new sample.**
8. **Change run settings for new sample types as needed.**