Rutherford Scattering Experiment: Handling Sample Specimens.

The samples used for the Rutherford scattering experiment are very thin; two-thousands of a millimeter thick (0.002mm) for the case of the gold sample. Both the aluminum and gold samples are very fragile and need to be handled slowly and carefully.

Extremely disruptive and dangerous air pressure fluctuations occur inside the chamber of the Rutherford scattering experiment when air is released into or withdrawn from the chamber with the vacuum pump. These pressure fluctuations can easily break the thin film by any one of several means:

(a) If the plane of the sample is perpendicular to the direction of the air port, then pressure gradients between the sides of the sample can break the film.
(b) Pockets of air trapped between the thin film and its black plastic support holder will expand when the air pressure is reduced; if this happens quickly, the sample will rip.
(c) Pockets of air between the thin film and an adjacent mask can expand and push against the film, breaking it.
(d) A stream of air entering the evacuated chamber has enough force to break the film directly.

Thus, utmost care is required to evacuate the chamber and to bring the chamber back up to room pressure. It is best to first experiment with evacuating an empty chamber (i.e. no sample inside), and first practice releasing air into the chamber. Close the chamber, checking that that there is no sample inside. Move the alpha particle detector opposite the particle source, and turn on the counter to measure the activity. This count rate will act as a sort of vacuum gauge. Attach the vacuum pump, open the valve, and pump down. After a few minutes, close the valve and disconnect the vacuum pump hose. The count rate should be high. Put your thumb over the opening to the chamber, and very slowly open the value, feeling with your thumb for the moment when the air enters the chamber. The moment you feel your thumb being sucked in, move the valve back towards the closed position, so that the air flow is reduced to a minimum. At this point you wait a few minutes, after which time you can open the value a tad bit more, always feeling with your thumb the airflow. After a few more minutes, you should see the count rate start to decrease, and it has halted, you can slowly open the value all the way, and then open the cover.

To evacuate the chamber with the sample inside, you start with the chamber and valve closed. Make sure the plane of the sample is perpendicular to the location of the valve. Recall the position of the valve when air first started entering the chamber, and slowly open the valve to that position. Stop there, and wait for the count rate to start up again.
After a few minutes, you can slowly open the value all the way, pump for a few minutes, and then close the value and turn off the pump for data acquisition.

The samples are expensive ($450 for the gold). If you still don't feel confident in manipulating the samples despite practicing (without the sample), please call upon your TA, Instructor, or the Lab Manager for assistance.