

To prevent injuries, **cryogenic gloves and goggles must be worn when operating the freezer mill.**
A lab coat is recommended. Reservations can be made on Idea ELAN.

Starting Freezer Mill and Preparing Sample Vessel into Chamber:

1. **Open liquid nitrogen (LN₂) valve, do not open completely** as it can freeze-lock the valve in place.
2. Assure sample is completely frozen.
3. Flick switch located on the rear-left part of mill.
4. Install one plug into sample vessel and lightly tap with hammer, transfer sample into vessel, then insert impactor. Close the other end of the vessel. Shake vessel to assure impactor can move to pulverize the sample. Always use the appropriate plug for the vessel size.
5. Release freezer mill latch and open lid completely.
6. On the vessel grinding chambers closest to the user, prop and rotate handle **towards** user to unlock the chamber door, open chamber and carefully insert vessel.
If using only the chamber closest to the user (Chamber 1), then select "mono" on touchscreen panel; if using both chambers, select "dual" (Chambers 1 and 2).
7. Close chamber door and turn handle **away** from user to lock chamber door. Apply latch.

Setting Run:

1. On the touch panel showing the home screen, click the **control panel**.
2. Select the appropriate grinding mode – **mono**: chamber 1 ; **dual**: chamber 1 and 2.
3. Press **auto-fill** to begin LN₂ filling in freezer mill.
4. **Pre-cool time (mins)**: samples must be pre-cooled before grinding, suggested: 5-10 mins.
5. **Run time (mins)**: to grind samples, suggested: 1 min.
6. **Cool time (mins)**: time to settle down post grinding, suggested: 1 min.
7. **Cycles**: quantity to execute grind run time plus cool time.
 - One run = Precool + [Cycles • (run time + cool time)]
 - One run is suggested to be less than 30 mins
8. **Rate**: number of back-and-forth cycles per second (CPS), minimum: 5 CPS; maximum: 15 CPS.
9. **Run**: will start grinding process with set parameters.

Retrieve Sample Vessels Post Run:

1. Firmly hold lid down with one hand, open latch with other hand and open lid completely.
2. Open the chamber and retrieve sample vessel.

Cleaning Sample Vessels and Closing LN₂ Valve:

1. Close LN₂ valve completely.
2. Wipe down the vessel interior and exterior using soap and water. **Do not use any solvents.**



Considerations:

1. **Cracks in polycarbonate capsule:** During runs, LN2 can enter the capsule through cracks and once the capsule resumes to ambient temperatures, internal capsule pressures can increase causing sample loss. Always check for cracks on capsules.
2. **Cleaning steel parts:** the magnetic stainless steel impactor and capsule plugs are corrosion-resistant but not rust-resistant. If cleaning with water, dry immediately to prevent rust formation. Steel parts can be cleaned with water and soap, or autoclaved. Do not wash with bleach or chemical cleaners. Store metal parts in sealed boxes/bags.
3. **If filling LN2 manually:** the unit will sound a series of “beeps” when the proper operating LN level is reached – which is approximately 2 inches (5.1 cm) below the rim of the tub. Always close the lid slowly to avoid LN2 splashing. If beeping occurs after lid has been closed, this indicated enough LN2 has been added, if not, then more LN2 is required.
4. **If LN2 is depleted during run:** If the LN2 runs low during a grinding program, the program will stop. Add LN2 manually if LN2 tank is depleted.
5. **LN2 consumption rate:** for initial cool-down, 15-19 liters then 4-6 liters per hour for use – is typical.
6. It is recommended to open the vials immediately after removing them from the unit as internal capsule pressure will increase which could cause a plug to pop off.
7. **Recovering samples:** Once capsules are opened, it is recommended to transfer samples out of the capsule as quickly as possible as cold temperatures will attract moisture. If condensation is not acceptable for your sample, wait until the capsule warms before opening and emptying it. Alternatively, capsules can be opened in a box filled with nitrogen gas to prevent moisture attraction.
8. Do not drain LN2 by tipping over the unit as this can damage the unit, to remove LN2 open the lid and allow for LN2 evaporation.
9. Only use a low-pressure LN2 supply with delivery pressure of 20-22 psi.
10. **DANGEROUS:** operating without LN2 even for one minute will cause the electromagnetic coils to overheat and may sustain permanent damage. The unit warranty does not cover damage to the coils caused by operating the mill with little or no liquid nitrogen.
11. **If sample does not grind as anticipated, try the following:**
 - Reduce the overall weight of the sample: some fibers and thin films may grind best in the small vial with a sample weight of 1-2 g
 - Reduce the size of the individual pieces to 1/4 or 1/8 inches (3 to 6 mm)
 - Increase the precool time: 20 mins is the maximum necessary for most samples to reach LN2 temperatures.
 - Grind longer: in manual fill mode, 30 minutes of actual grinding time is the maximum recommended for one run, due to the liquid nitrogen capacity of the tub, but you can top off the LN2 and repeat the run if needed.

Table 1. Typical Sample Sizes

Sample	Large Vial 6801, 6803	Mid-Size Vial 6881, 6883, 6885	Small Vial 6751, 6761, 6771, 6781S	Microvial 6757
Plant tissue, bone, muscle, etc.	20-50 g	5-20 g	2-5 g	100-300 mg
Polymer pellet	10-20 g	2-10 g	1-2 g	NA