(1) Why do some particles get trapped and some particles do not?

Some particles may have a really high initial velocity that allows them to escape the saddle point.

There may also be an imbalance of mass which does not result in an equilibrium, or a charge force on the particles that does not perfectly cancel their weight.

(2) If each particle trapped has equal mass, how does a lower particle’s charge compare to that

of a higher particle in the trap?

A particle that is located at any of the poles will experience the greatest force and thus will have the greatest charge. Therefore, charges that are located higher in the trap have lower masses.

 (3) If each particle trapped has an equal charge, how does a lower particle’s mass compare to that of a higher particle in the trap?

If each particle has the same charge, then the particles that are higher in the trap will experience a greater force and therefore have larger masses (assuming they are in equilibrium).

a. What is the effect of particle number on the 1D crystal?

If there are too many particles, the 1D crystal becomes a zig zag pattern, or worse, the crystal will not fall into a 1D line.

b. What is the effect of end cap voltage?

The end cap Voltage alters the horizontal spacing between the particles. Increasing the endcap voltage condenses the particles horizontally.

c. What is the effect of the variac voltage?

Increasing the variac voltage raises (vertically) all particles into a horizontal line (if there arent too many particles). Decreasing the variac voltage causes some particles to droop and eventually fall out. If the variac is decreased enough, all particles will drop out which is something we have to watch out for when trying to eliminate the zig zag pattern.