# Weekly report

## 1 My *Accomplishments* this week

### 1.1 Project 1: *Massive Uniform Control*

- $Fe3O4$ powder stands up: lowered z axis coil and hence we got more magnetic magnitude of z axis in workspace. Powder is polarized along z axis, so gradient field in x-y plane can actuate the powder.

- Camera relocation: lifted up the platform and installed the camera on the bottom.

- Gradient field: programmed Arduino to create a uniform gradient magnetic field in x-y plane.

- Clear view: calibrate the 3 knobs of the camera and got a clear and suitable view of video.

- New arena: made new mazes including "Y" shape, a square and a circle maze.

- Linear relation: measurement along x axis with coil 3 showed that the magnetic field magnitude changes linearly with Arduino input from 0 to 9.

- Control GUI: created a MATLAB GUI for magnetic field orientation and magnitude control.

- Microscope view: made a screenshot of microscope view of $Fe3O4$ particles and clusters.

- Swarm manipulation: tried manipulating particles and observed their motion. Dominated by z axis magnetic field, these clusters do not get together easily. They repel each other when they get larger.

- Fluid environment: changed from detergent to vegetable oil from Kroger. Vegetable oil is clear, with density close to water, and less sticky than detergent. $Fe3O4$ powder works excellently in oil.

## 2 My *Goals* for next week

- Particles motion observation and manipulation

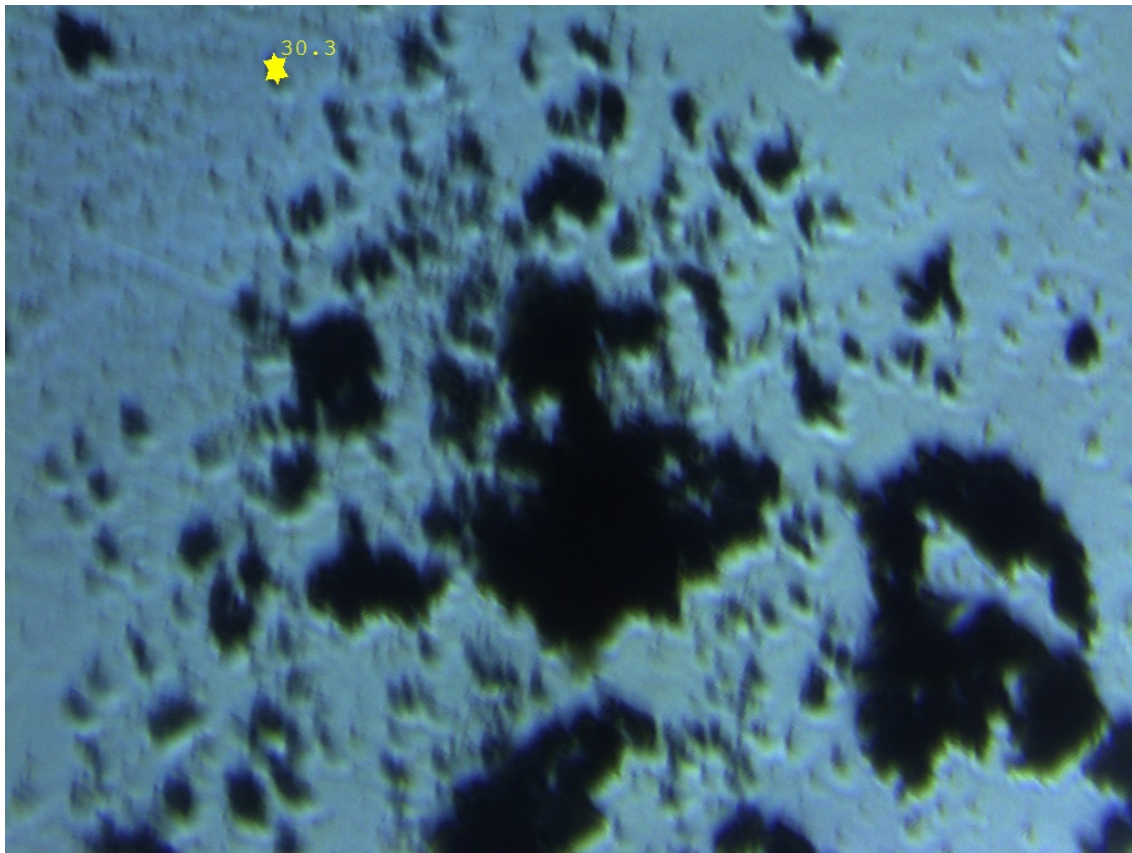- Make magnetic fields more flexible (all direction control)

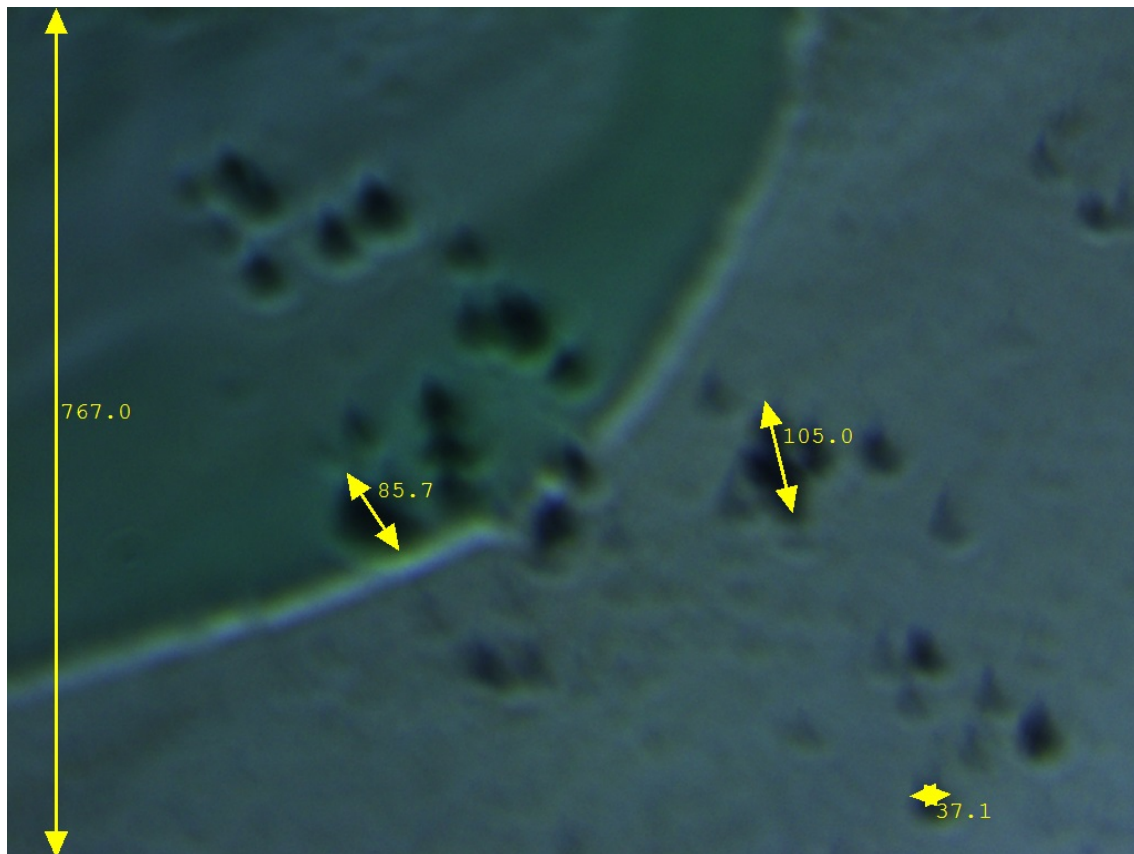**Figure 1:** *40 times magnification of $Fe3O4$ powder in microscope view*

**Figure 2:** *40 times magnification of $Fe3O4$ powder in microscope view, and 10 pixels stands for about 4.5 microns in real scale*
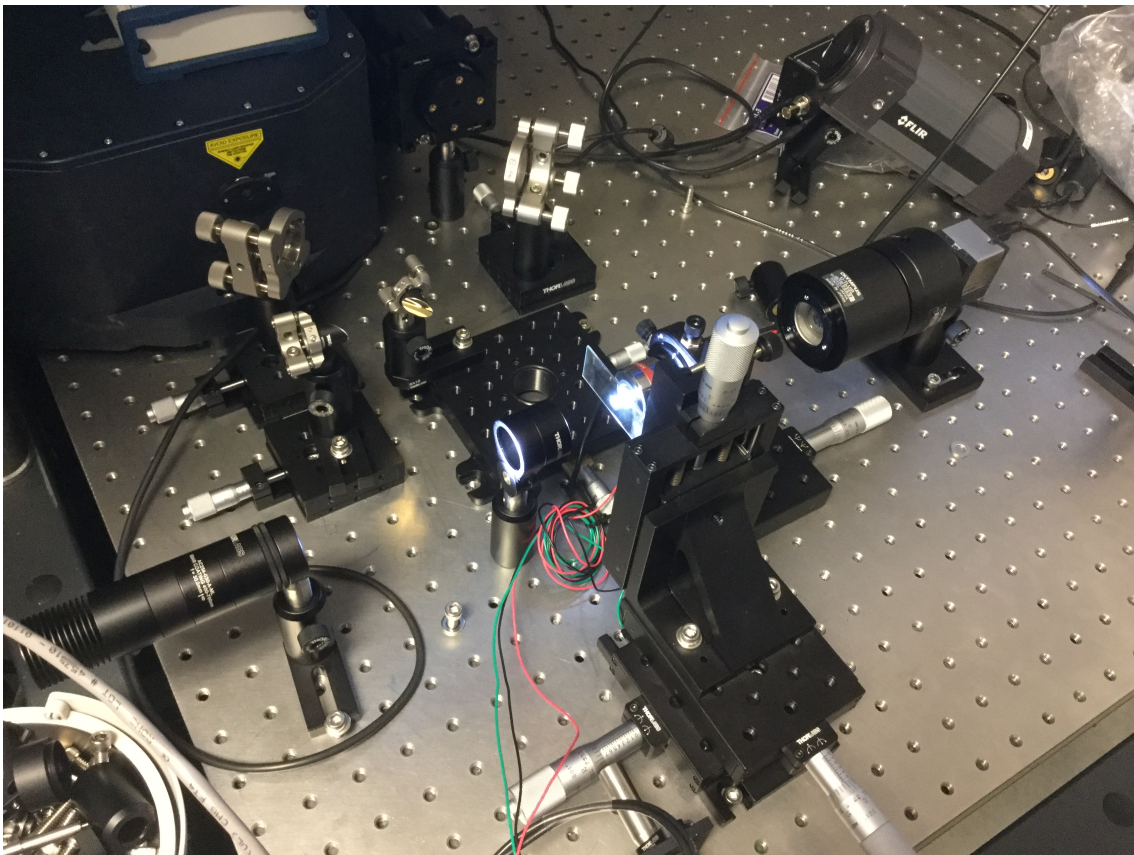
**Figure 3:** *Microscope setup*