

# Lab 2: Electric Field

---

## 1 Assignment

In this lab, your team will be investigating the relationship between electric potential ( $V$ ) and electric field ( $\vec{E}$ ). At your lab station, there are several conductive metal shapes. You can apply a charge to these shapes with a DC power supply and measure the resulting electric potential with a probe that has been attached to the CNC.

Your team has been tasked with determining the electric field produced for each of the configurations listed in Section 4.3 when a voltage is applied to the configuration. To complete this task, your team will scan every configuration (see Section 4.1) and then calculate the field from the scan output.

## 2 Deliverables

For your lab report, 10% of the grade will be for following the guidelines in the lab report template. Another 10% will be allocated for the Abstract and Introduction of your report. The remaining percentage will be based on your inclusion of the following:

- [10%] a description of the process your team used to calculate electric field from the electric potential data
- [60% total, 15% for each configuration] for each configuration scanned:
  - [5%] a plot showing the electric potential
  - [5%] a plot showing the electric field
  - [5%] the value of the largest electric field magnitude observed in the scan
- [10%] your team's conclusion of how electric field lines interact with the surface of a conductor. This conclusion should be supported by data that *your team collected* during the lab.

## 3 Hazard Assessment

- Your team will be using a DC power supply in this lab. Always ensure the supply is **off** when plugging into or unplugging from the supply. The current output from the supply should not be over **0.1 A** during this lab.
- The conductive metal shapes have very sharp edges. Wear the provided cut gloves when handling these shapes.

## 4 Technical Information

### 4.1 Performing a scan

To use the voltage probe attached to the CNC to measure the electric potential, there is a script in the `examples/scanning` directory called `run_voltage_scan.py` that you may run. This script will record voltage readings in a grid of scan locations and write the resulting data out to a `.csv` file. Before running the script, you will need to set the parameters in the code for:

- `x_center`: the x value specifying the center of the region you wish to scan, in *mm*
- `y_center`: the y value specifying the center of the region you wish to scan, in *mm*
- `x_steps`: the number of scanning steps to take in the x direction
- `y_steps`: the number of scanning steps to take in the y direction
- `step_size`: the size (in *mm*) of each scan step

