Installation & Dependencies

- Python 3.8+
- PySide6 (Qt bindings for Python)
    - pip install PySide6
- pyserial (serial communication)
    - pip install pyserial
- Matplotlib (live plotting)
    - pip install matplotlib
- Numpy (live plotting)
    - pip install numpy

Note: pip install commands should be done in the Windows/Linux terminal and not the python interpreter.

File Descriptions

- main.py
    - Entry point of the GUI. Creates a Qt application and instantiates the GUILogic window and starts the event loop.
- plasma_control_GUI.py
    - Defines the GUI layout and integrates Matplotlib canvas for live data plotting. Contains: Ui_MainWindow class sets up widgets and their arrangement. MplCanvas wrapper around matpotlib.figure.
- GUI_Logic.py
    - Connects signals and handlers to GUI widgets, Power on/off etc. Maintains state flags, system_on, manual_voltage_allowed, etc. Initializes PlasmaSerialInterface('/dev/ttyACM0'). Provides pop-up warnings via QMessageBox.
- PlasmaSerialInterface.py
    - Encapsulates low-level serial communication. Opens serial port and implements _send to transmit command character-by-character with 10ms delay. Provides methods for query/toggle power supplies, set/query frequency, etc.
- PlasmaException.py
    - Subclass of Exception used by PlasmaSerialInterface to report errors.

Note: the serial port used will be determined by OS. Use "COM3" on Windows or "/dev/ttyACM0" on Linux. See line 28 in GUI_Logic.py.

Interaction Flow

- Launch
    - User runs python main.py and the GUI launches.
        - If you receive the following error, "Error initializing plasma interface: module 'serial' has no attribute 'Serial'." Ensure the serial port selected in GUI_Logic.py (see note in File Descriptions) is correct and that the microcontroller is otherwise connected.

- Power Control
    - Located in Q1 (see Fig 1.) Power On/Off buttons toggle power supply startup routine. Press “Power On” to turn on the system.
        - An on state is indicated by both the system status text and a green LED style indicator, off is indicated in red.
        - System must be powered on before striking a plasma.
- Striking Plasma
    - Located in Q1 (see Fig 1.) Strike/Stop plasma buttons toggle the signal sent to the driver board (H-bridge). Press “Strike Plasma” to begin exciting the array.
        - An on state is indicated by both the system status text and a green LED style indicator, off is indicated in red.
- Manual and Auto Control
    - Located in Q3 (see Fig 1.)
        - Checkboxes indicate whether or not the auto control is active.
        - The corresponding text fields allow manual voltage/frequency entry.
- Data Logging
    - Located in Q3 (see Fig 1.) Press “Enter Log Save Location” to open file explorer and select or create a .csv file to capture the data from the run.
        - Ensure the checkbox is selected to enable datalogging.
        - Text field displays the current save location.
        - Saves: time, frequency, deadtime, bridge current, bridge voltage, plasma voltage, control B status, frequency adjustment points
        - ~60 ms interval between sampled periods
- Live Data Plotting
    - Located in Q2 (see Fig 1.) Displays bridge current, plasma voltage and the points used in determining the frequency correction.
        - Updates ~5 times a second
- Supply Voltage Readouts
    - Located in Q4 (see Fig 1.) Displays supply voltages as seen by the control board.
        - Includes 3.3 V, 15 V and high voltage supplies.
- Other Settings and Temperature Readouts
    - Located in Q3 and Q4 respectively (see Fig 1.). Currently there are no features implemented that require these sections. These sections are reserved space for the future development of additional features.

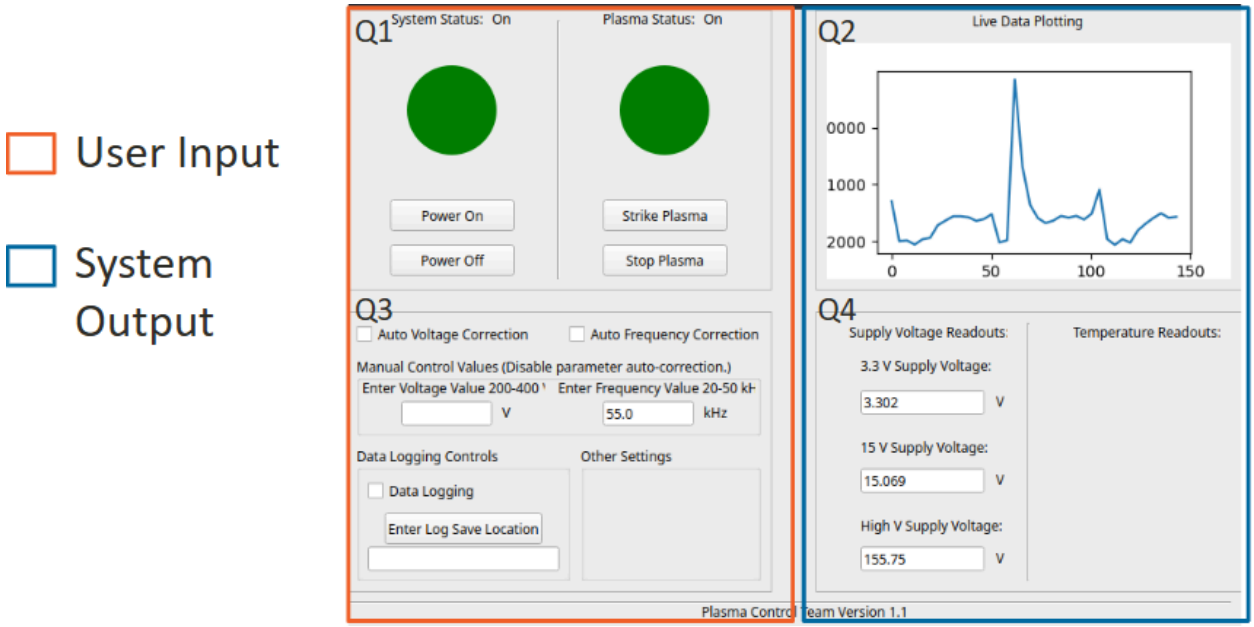

Figure 1. A screenshot of the plasma control GUI delineated by quadrant and user input/system output.

Scaling The GUI

- It may become necessary to scale the GUI, especially if using a high DPI monitor. This is most easily done by setting the QT_SCALE_FACTOR environment variable.
    - For Linux edit ~/.bashrc or ~/.bash_profile using “export QT_SCALE_FACTOR=x.x”
    - For Windows: 1. Press Win + R, 2. Search SystemPropertiesAdvanced, 3. Select “Environment Variables,” 4. Under User variables or System variables, 4. Click “New,” enter QT_SCALE_FACTOR as a variable name and desired value, 5. Click OK on all windows

Known Issues

- The frequency range is improperly displayed as 20-50 kHz, should be displayed as 20-65 kHz.
- Occasionally when stopping the plasma, the entire GUI program terminates.