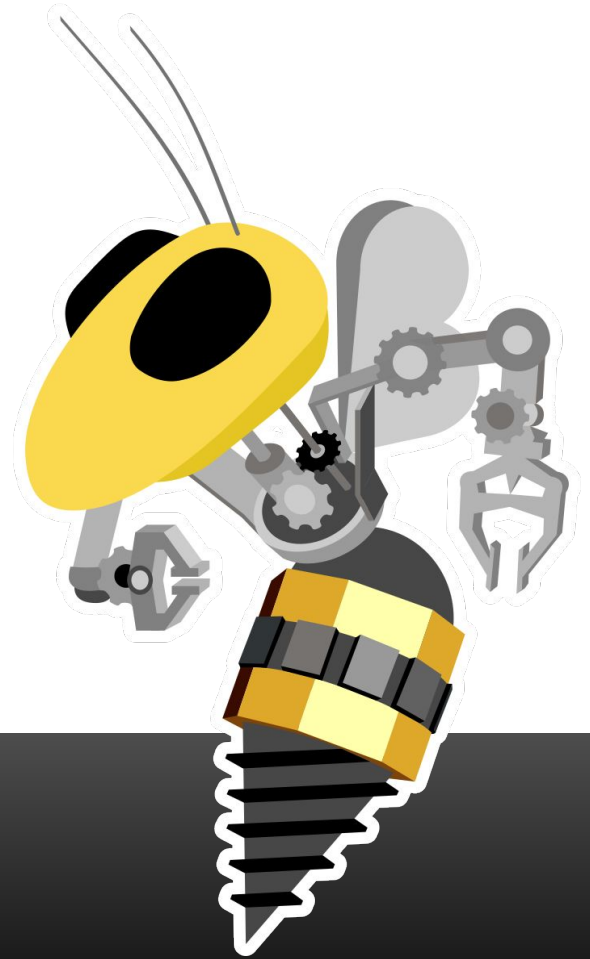


# Welcome!

Electrical Training  
Week 4

**ROBOJACKETS**  
COMPETITIVE ROBOTICS AT GEORGIA TECH

*[www.robojackets.org](http://www.robojackets.org)*



# Last Week!

- Communication Systems
- KiCAD Schematics

# This Week!

1. Recap
2. Board Layout
  - a. Layers
  - b. Arranging components
  - c. Routing
  - d. Polygons
  - e. Commands
  - f. Lab!

# Recap

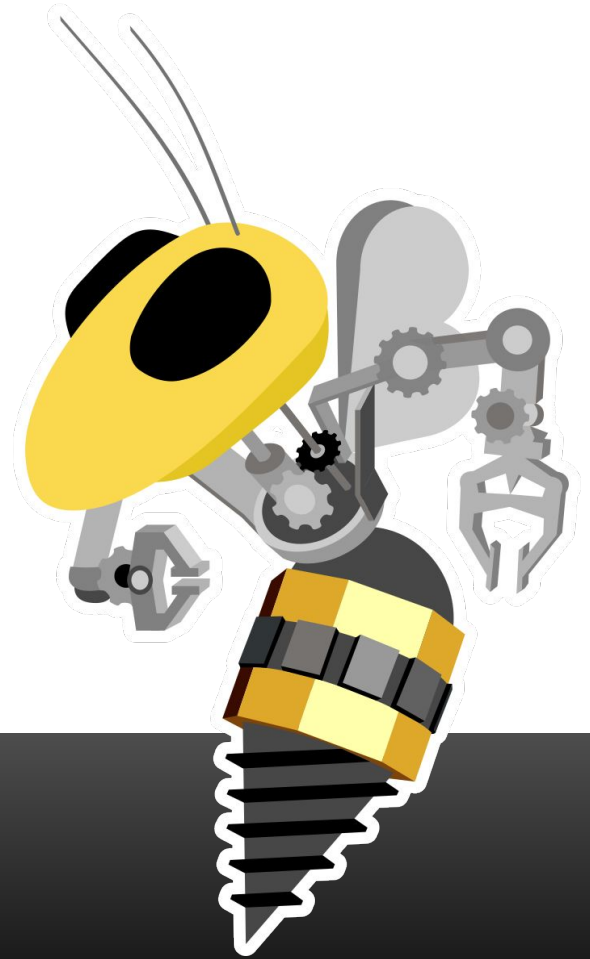
- Previously studied Parts/Libraries and Schematics
- There are separate **symbol** and **footprint** libraries
- In schematics, we use **nets** to link **pins** on a **symbol** together to represent a device's function

# Board Layout

Place and route

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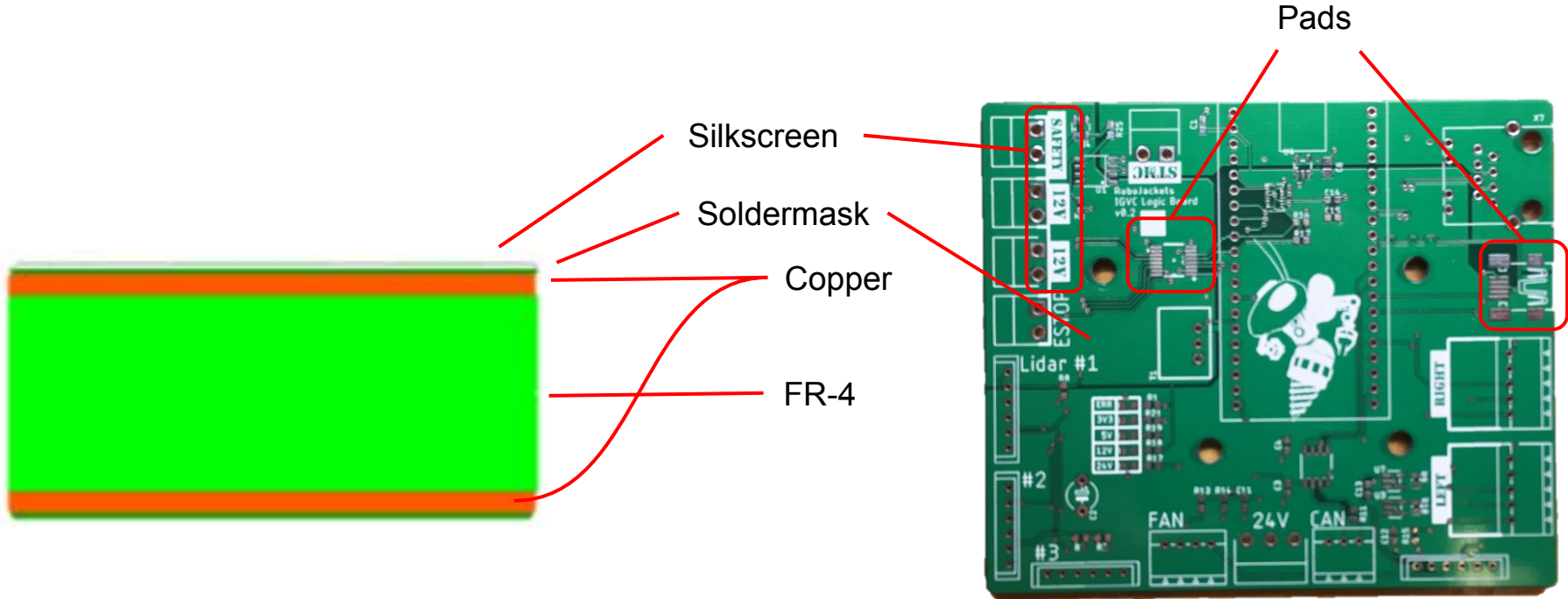
*[www.robojackets.org](http://www.robojackets.org)*



# Board Layout

- Physical placement of components on the PCB
- Replace the abstract **nets** from schematic with physical **traces**
- Access this feature by pressing the “Open PCB in board editor” button at the top of your schematic window or opening the PCB editor from the Project Manager window

# PCB Structure



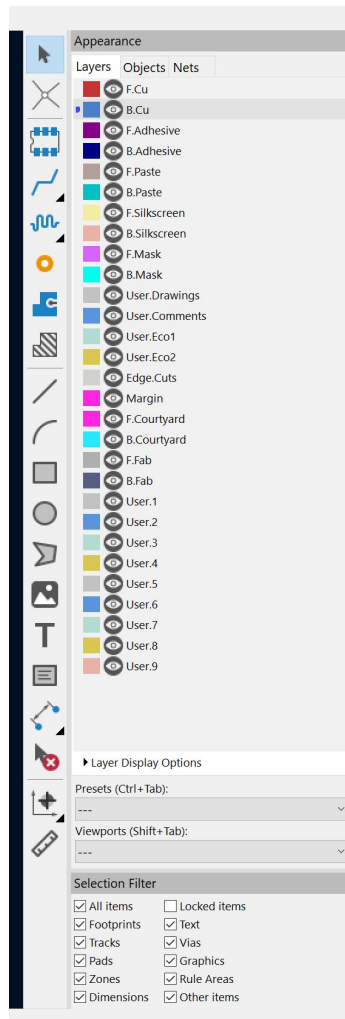
Color	Layer Name	Layer Purpose
	F.Cu	Top/front layer of copper
	B.Cu	Bottom/back layer of copper
	Edge.Cuts	Outline of the board
	F.Silkscreen	Silkscreen for top
	B.Silkscreen	Silkscreen for bottom
	F.Fab	Top/front documentation layer (just for reference)

NOTE: Pads (SMD and through-hole) are part of footprints and vias are not part of any layer



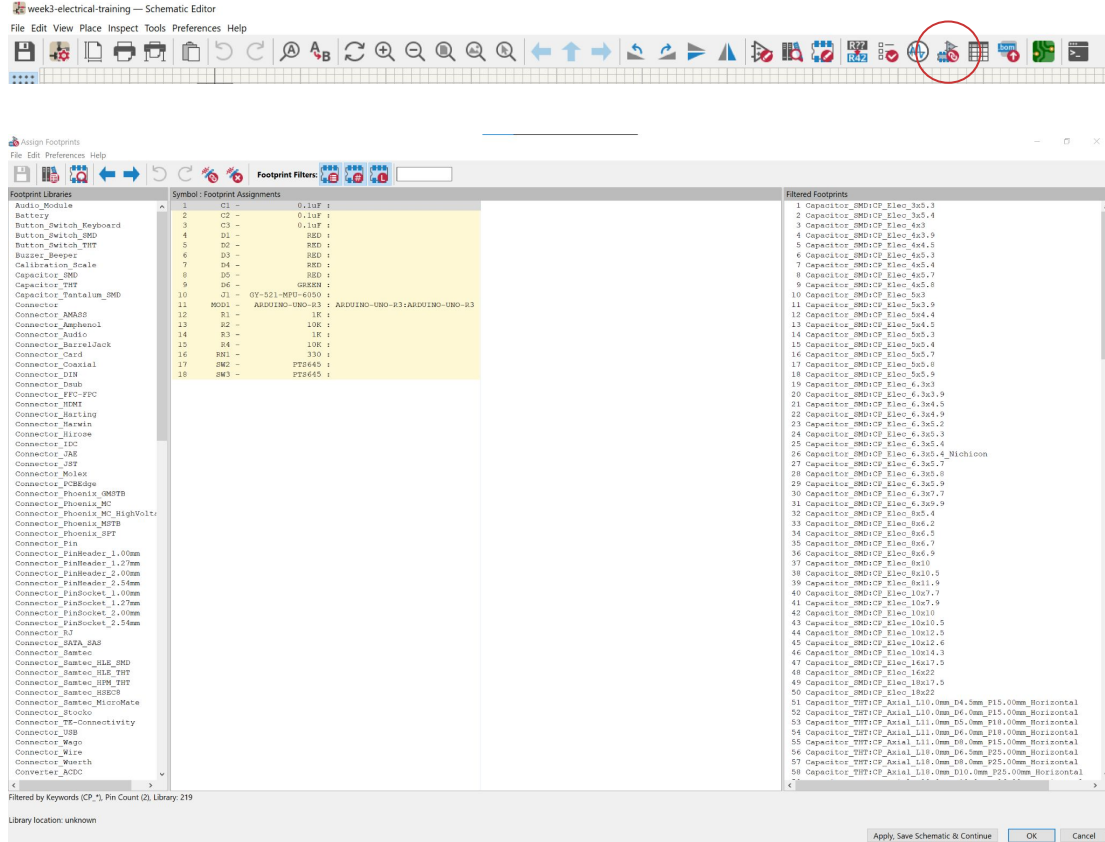
# Changing Layers

*Select the  
layer you want  
to edit*



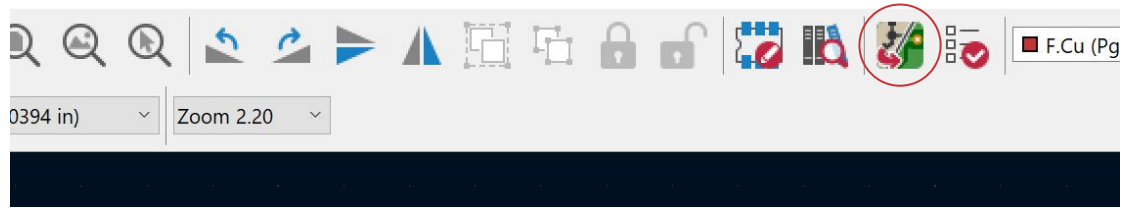
# Assign Footprints to Symbols

*This must be  
done from the  
Schematic  
Editor*



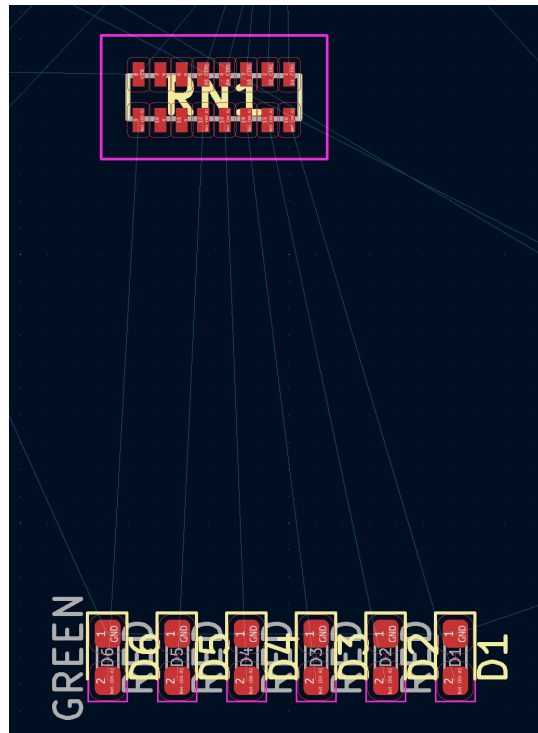
# Board Generation

*This is in the  
PCB Editor*



# Arranging Components

- Click on part and drag to move parts around
- Press 'R' to rotate
- Position components on the board area

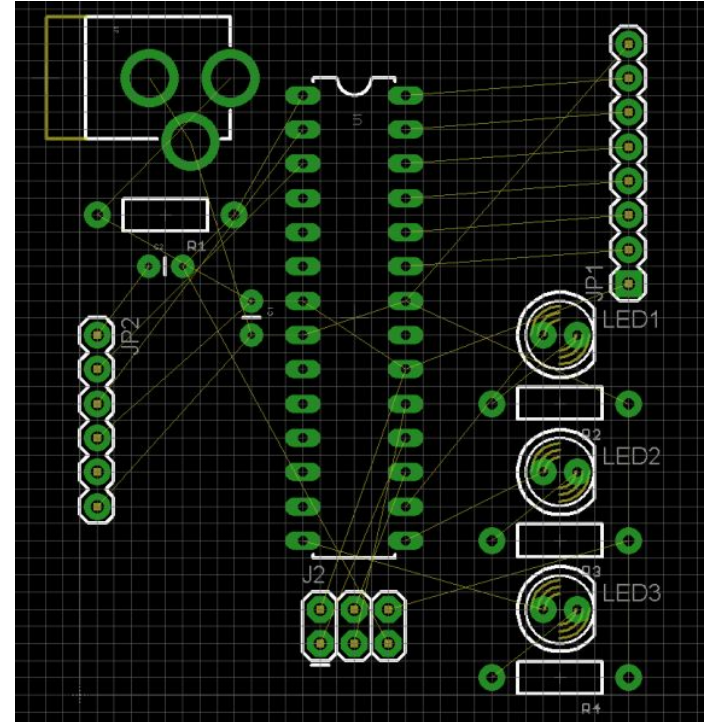


# Arrangement Considerations

- Minimize airwires (the unrouted wires)
  - Collection of all airwires is ratsnest
- Maximum size of board
- Clearance between mounting holes and components
- Location of specific components
  - Connectors on board edge
  - Decoupling capacitors near decoupled pins
  - Communicating/related components near one another

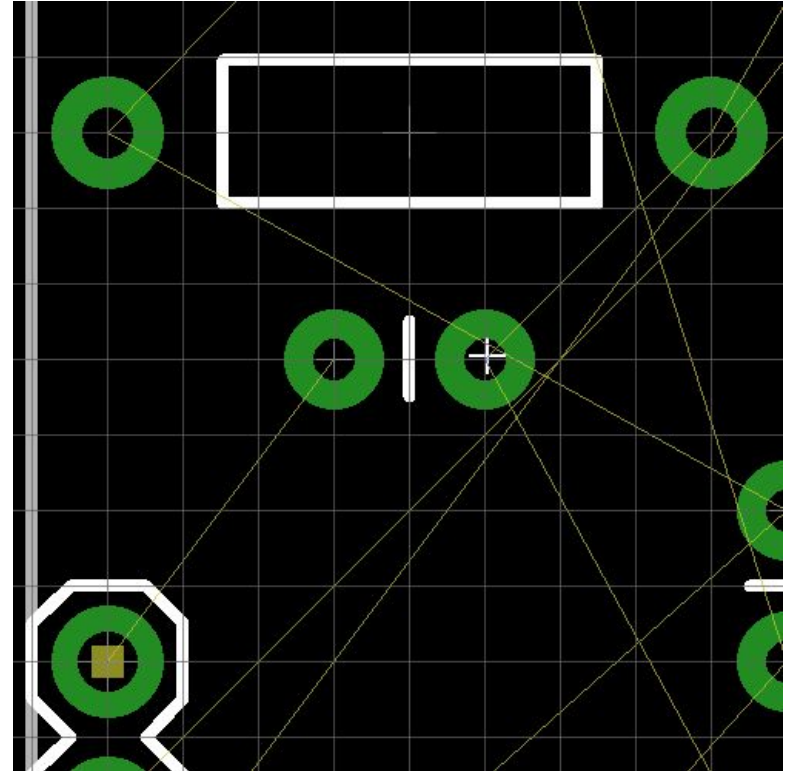
# Arranging Components

- Leave some space
  - Room for traces
  - Room to solder
- Minimize the number of intersecting airwires
  - Easier to route traces



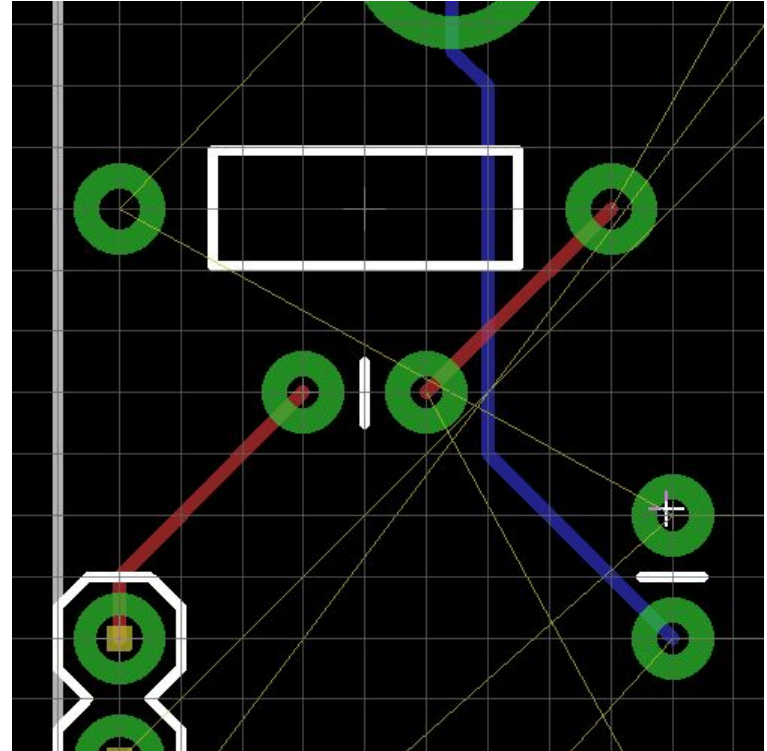
# Drawing Traces

- Use the Route tracks command in the right bar
  - Left click on starting point and left click on end point
- Follow start and end of airwire
- Routing angle of 45 degrees



# Changing Layers

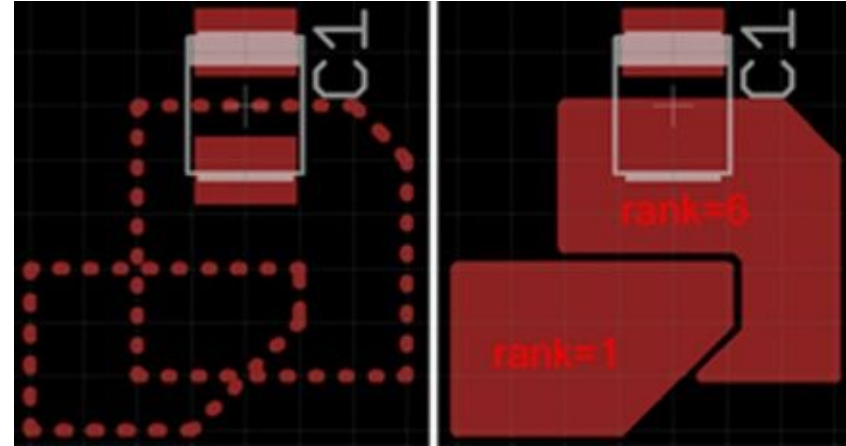
- Press “v” to change the layer and put a via
  - You can also right click, then click on “Place a via”





# Filled Zone

- Allows you to fill a drawn area with copper connected to a specific net
- Useful to make “ground planes”
- Click on “Add a filled zone”
  - Then draw a shape such as a rectangle or polygon
- Fill the polygon with Edit > Fill All Zones



# Design Rules and DRC

## Design Rules

Predefined rules that your board layout should follow to be correctly manufactured.

## DRC (Design Rules Checker)

This tool will check if your board layout is attending to all of the design rules and notify you accordingly.

Note: Load Design Rules early on your design.

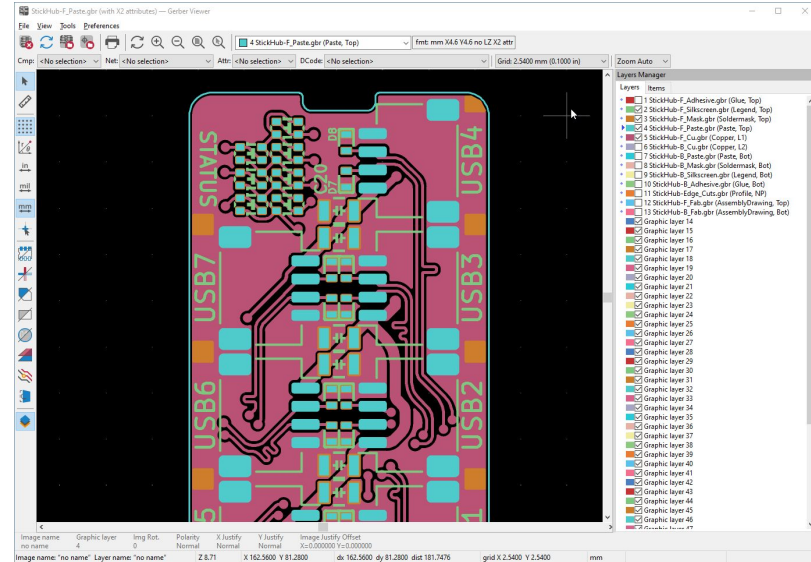
# Gerber Viewer

## Preview

- Make sure the silkscreen looks good (Both top and bottom side)

## Board

- Shows board properties: height, width, area, layers, board thickness, etc



# Lab Summary

- Start a new board layout
- Set up the dimensions
- Arrange the components
- Connect the traces
- Touch-up the silkscreen
- Check your design with DRC

For more information, access the LAB Document on GitHub.

# Resources

KiCad Getting Started:

[https://docs.kicad.org/7.0/en/getting\\_started\\_in\\_kicad/getting\\_started\\_in\\_kicad.html#tutorial\\_part\\_3\\_circuit\\_board](https://docs.kicad.org/7.0/en/getting_started_in_kicad/getting_started_in_kicad.html#tutorial_part_3_circuit_board)

How to branch on GIT:

<https://github.com/RoboJackets/robocup-firmware/blob/master/doc/Git.md>