



# DRAWING with circuits

Creating  
functional and beautiful  
PCBs together

Kliment  
and  
Morag

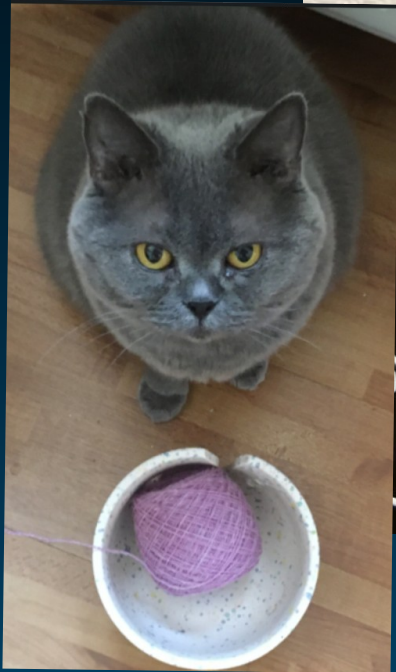
# Who we are

- Kliment

Electronics person

# Who we are

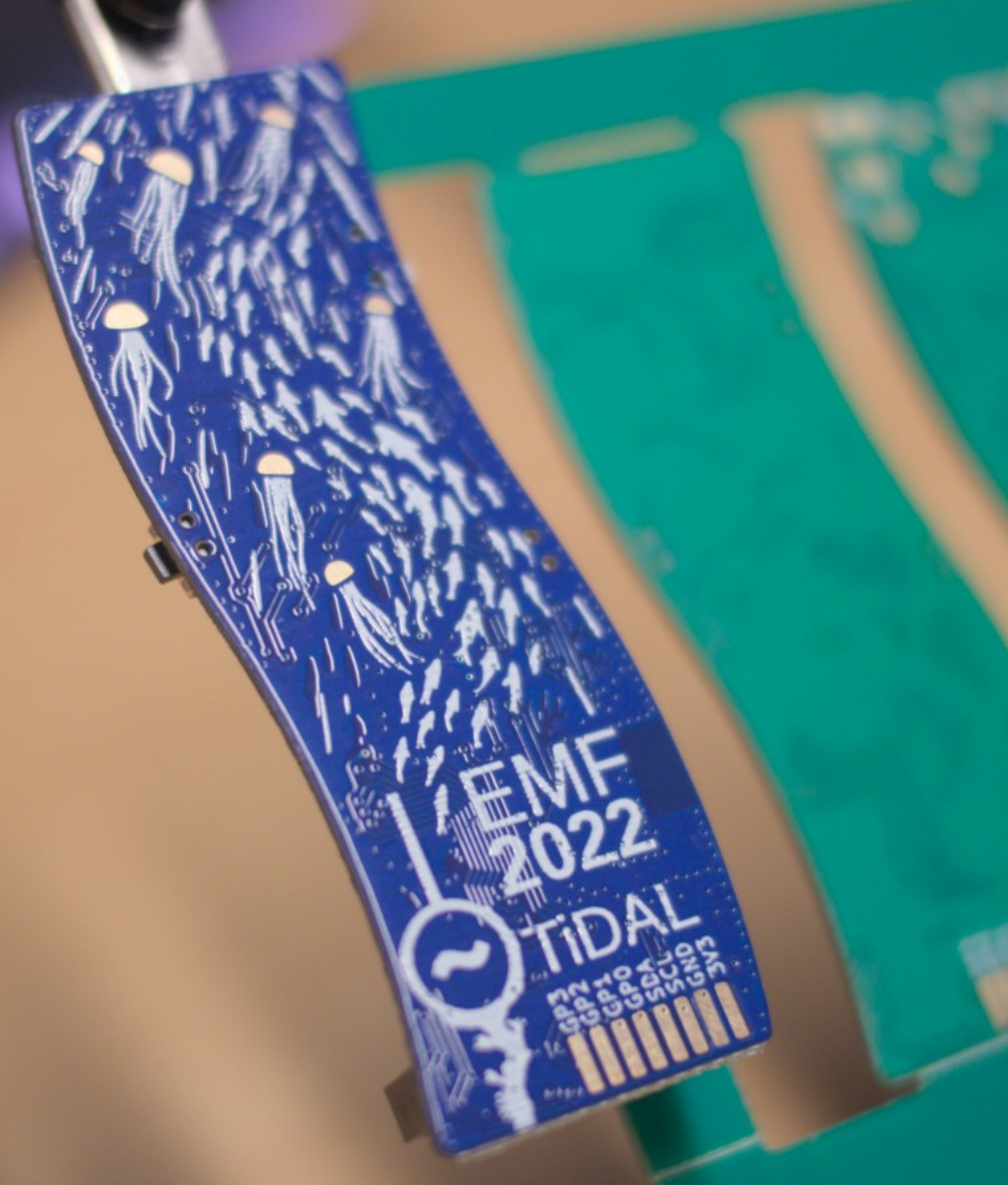
- Kliment



# Who we are

- Morag  
Art person





# Why bother with any of this?

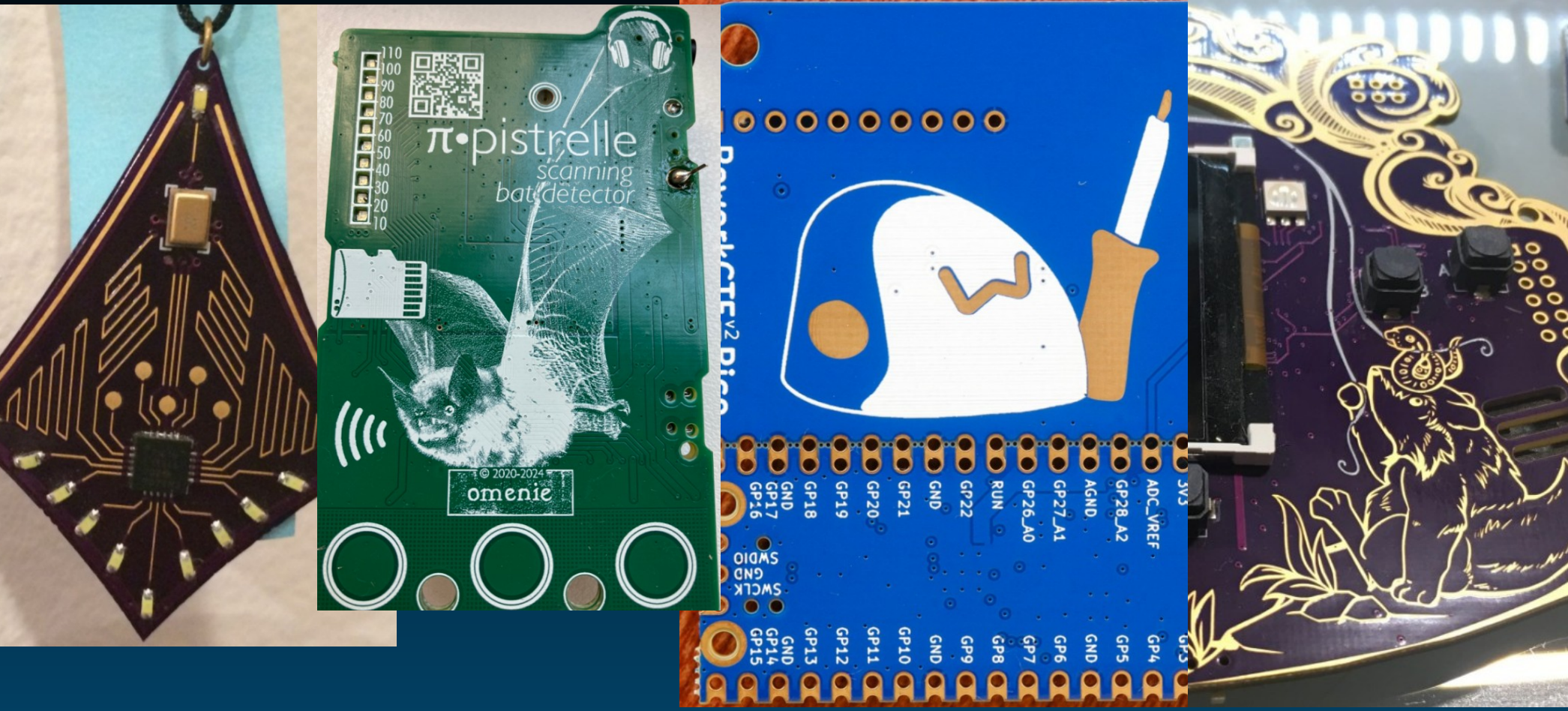
- Circuit boards are no longer hidden
- Beauty is nice!
- Pride in your work

# PCBs can be artworks/shitposts





# Or mix functional with pretty



# Why not just DIY?

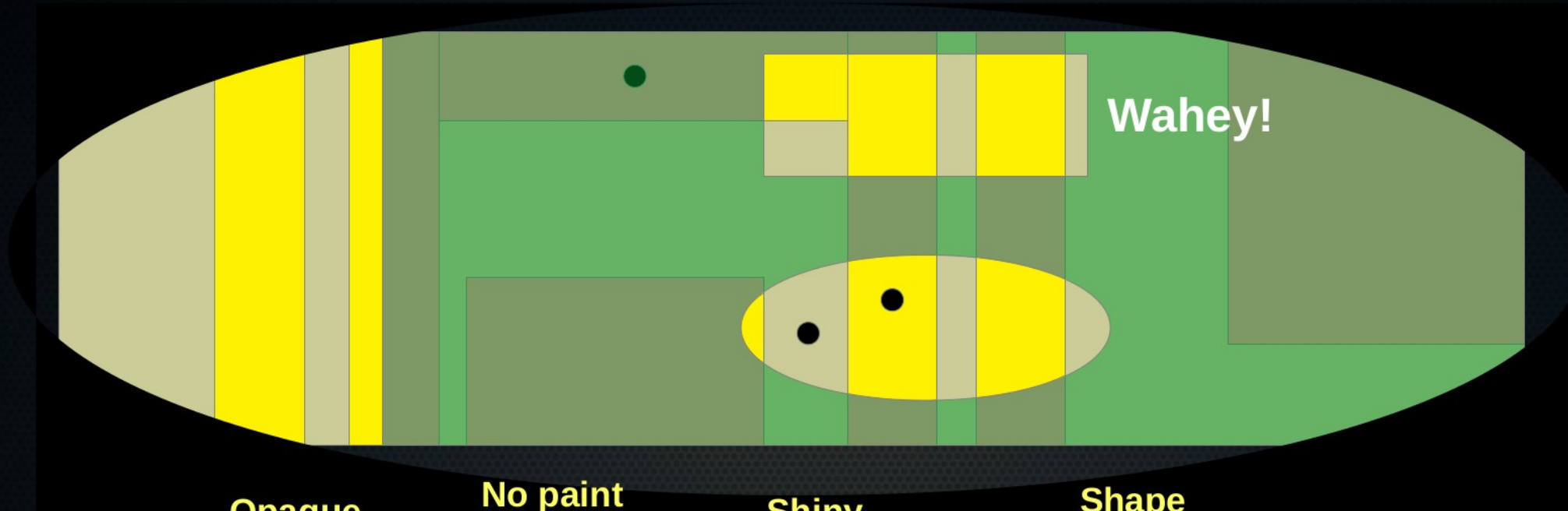
- Personal limits
- Collaboration enables better results
- But it's hard! You have to talk to people!
- Explain PCB processes to art person
- Explain art processes to PCB person

# What's a PCB anyway

- Conductive perforated lasagnes  
that connect thinky and zappy things

# What's a PCB anyway

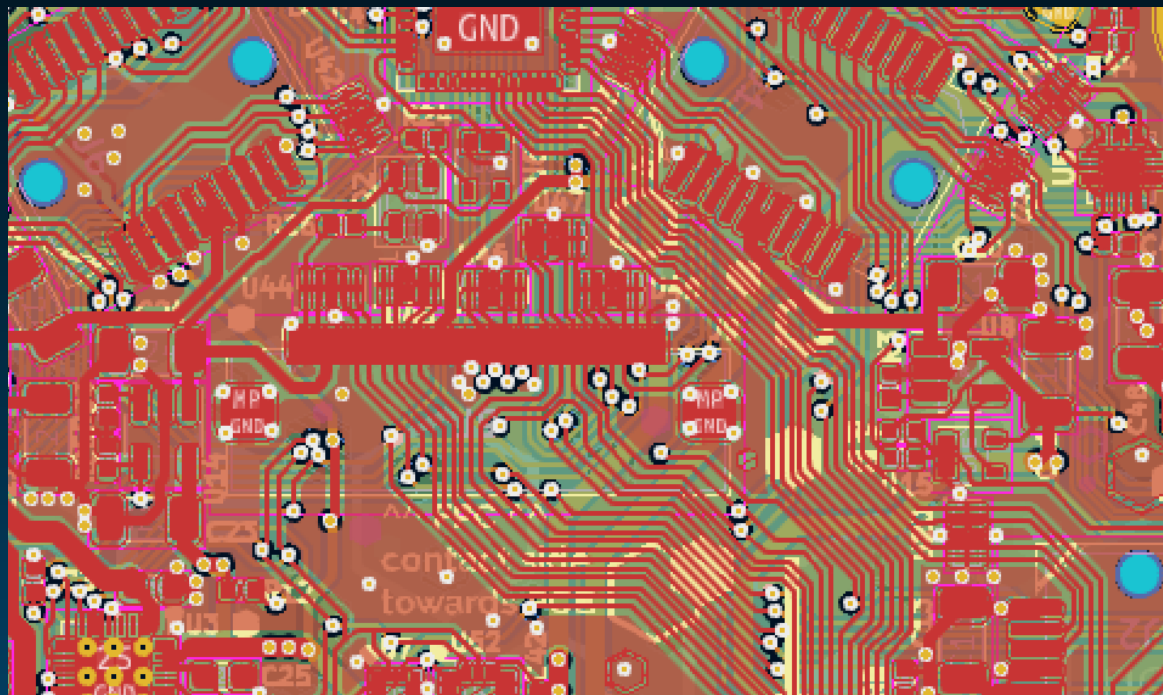
- ~~Conductive perforated lasagnes~~  
~~that connect thinky and zappy things~~
- Precision manufactured product for connecting small electronic parts together in a densely engineered pattern of conductive and insulating materials



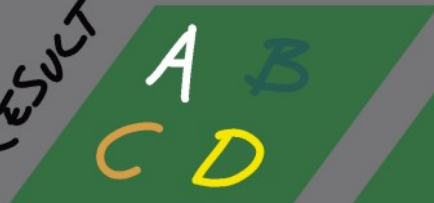
<b>Translucent</b>	<b>Opaque</b>	<b>No paint</b>	<b>Shiny</b>	<b>Shape</b>
Fiberglass	Copper pattern	Solder mask	Surface	Milling
		Paint (color)	Holes	Paint (white)
		Mask pattern	Holes Vias	Silkscreen



# What can an artist do with it?



RESULT



INK

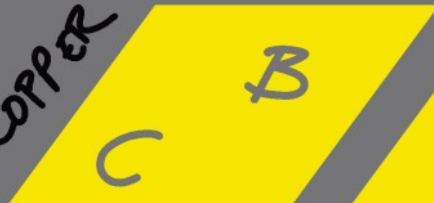
A

Now!

MASK

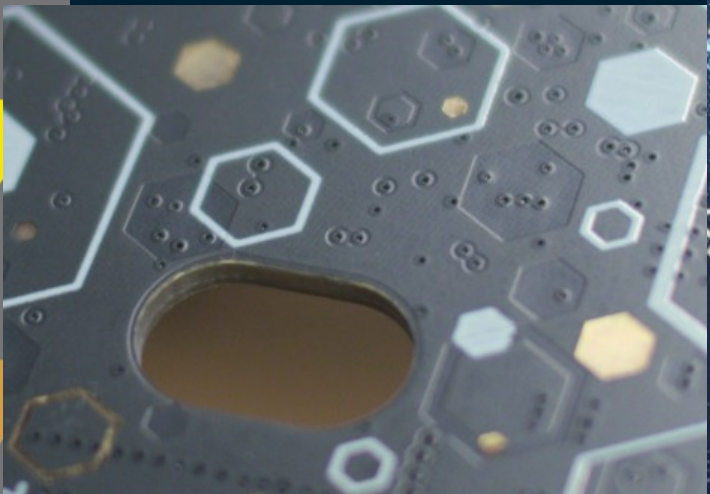


COPPER



BOARD







# Planning a collaboration

- Find a collaborator
- Make plans
- Make important decisions
- Discard stuff early
- Expect the plans to fall apart

Roundtrip early & often



**KRITA**



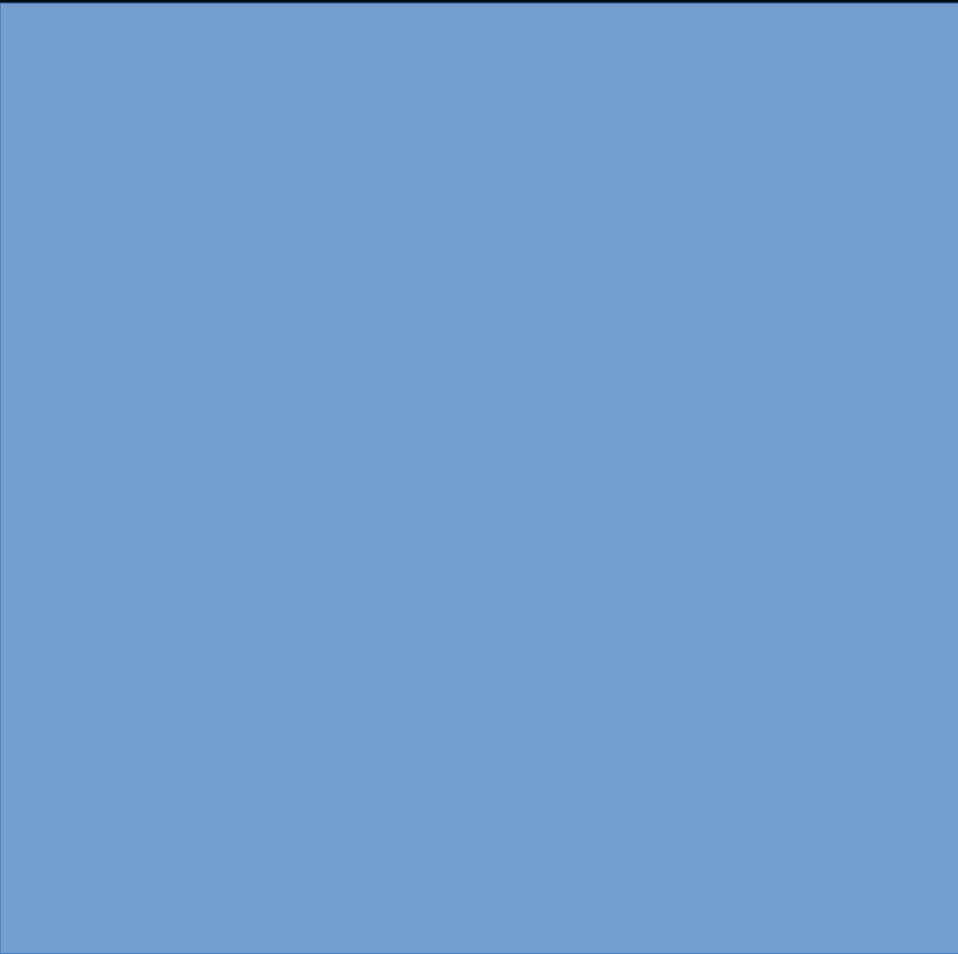
**INKSCAPE**

# Roundtrip HOWTO

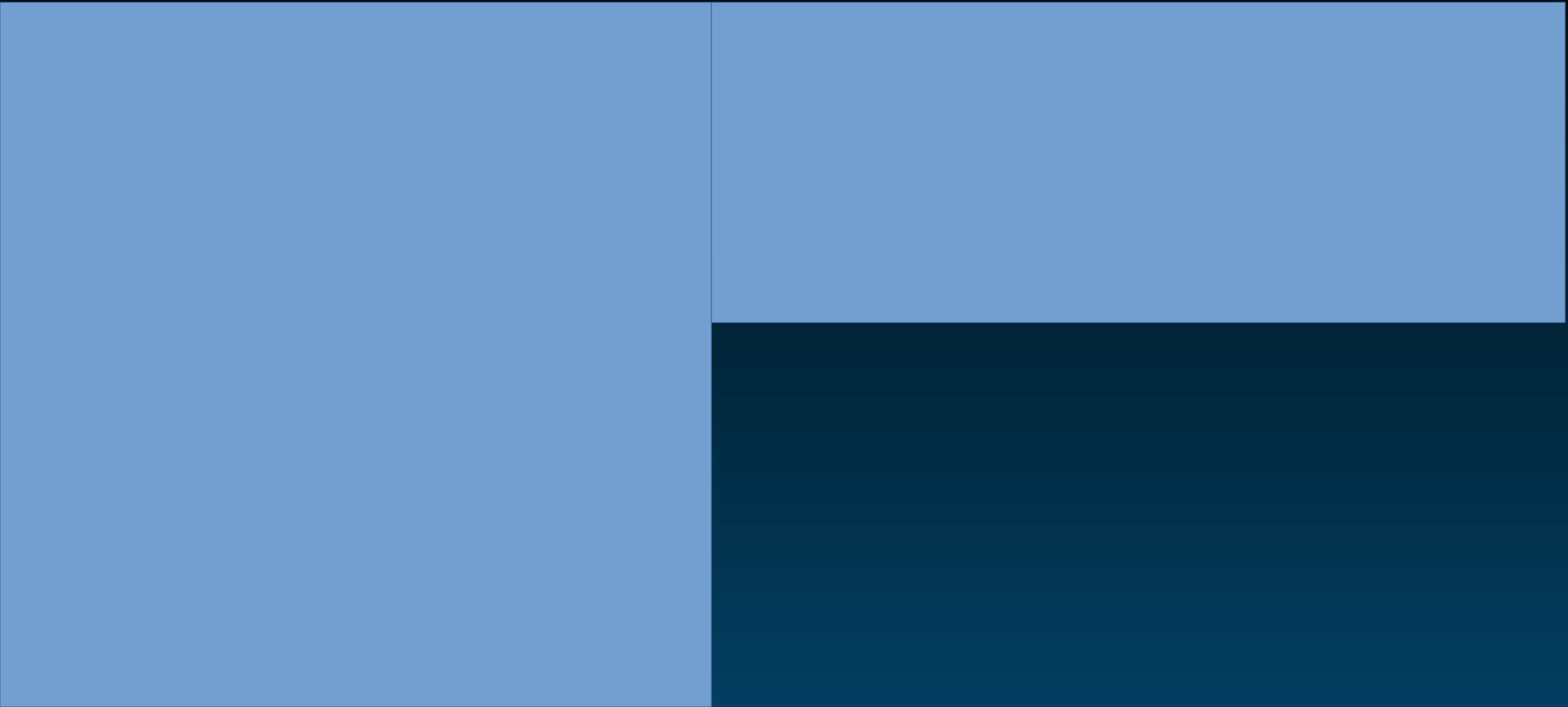
- Make some sort of board and export it
- Import into art tool and add some quick awful art
- Export from art tool and import into PCB tool
- See what breaks and what's difficult
- Repeat until you get what you expect

# Design constraints

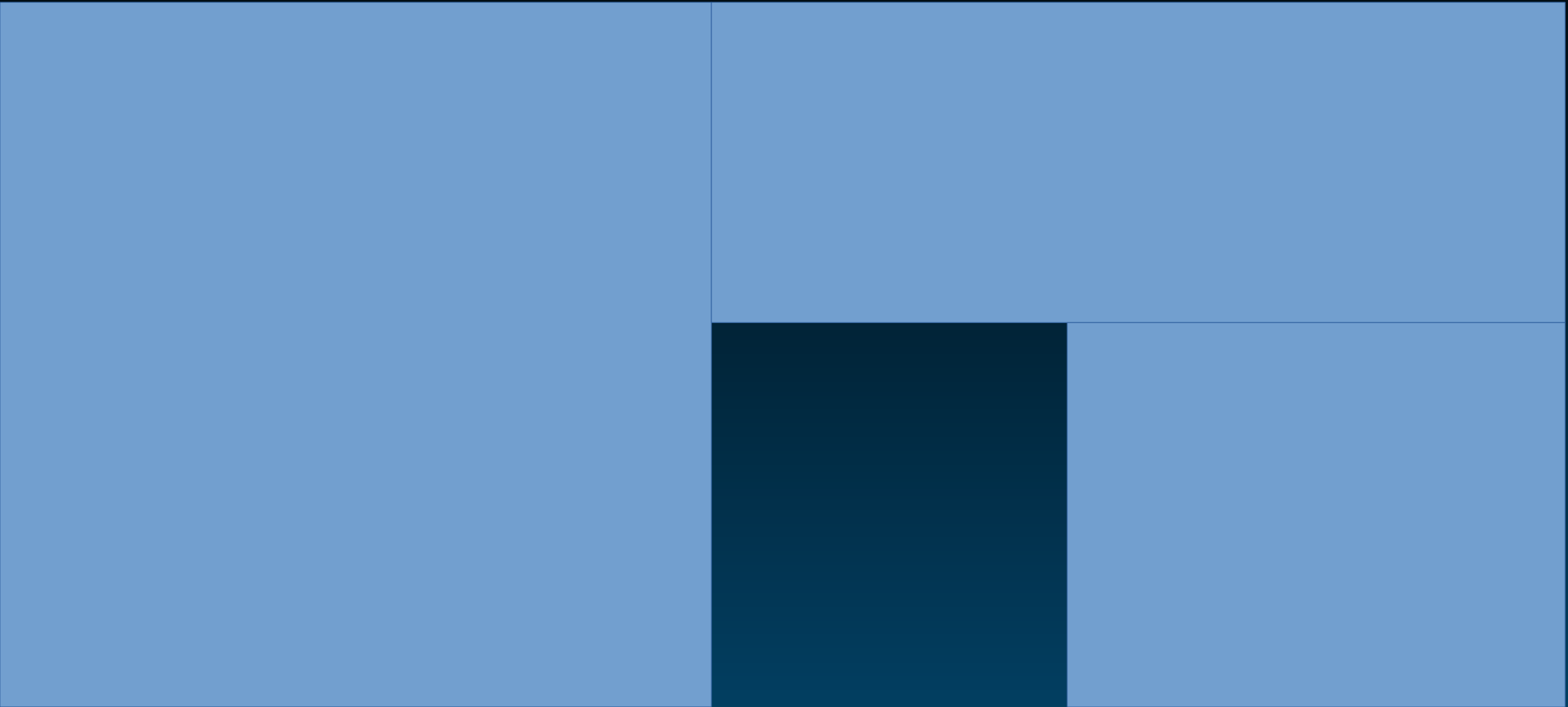
# Design constraints



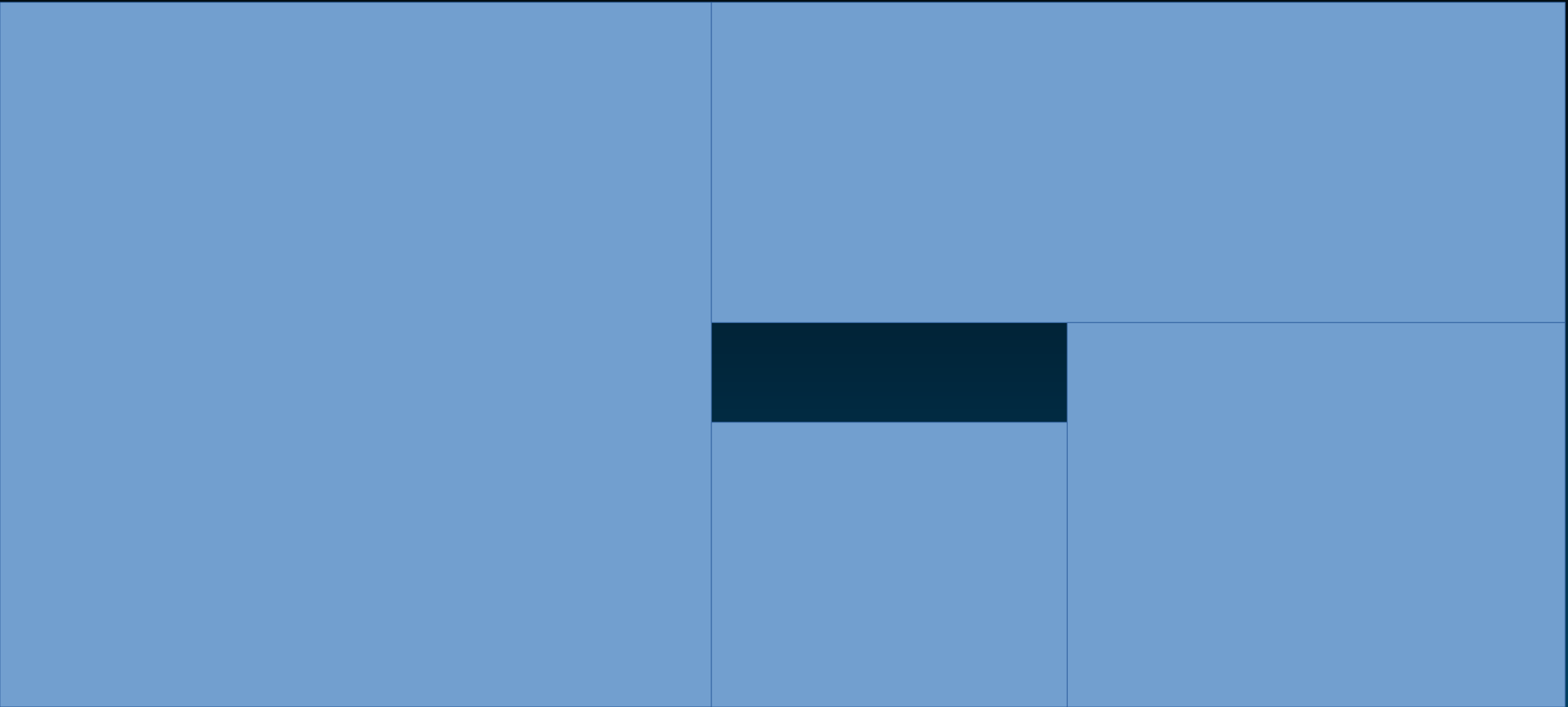
# Design constraints



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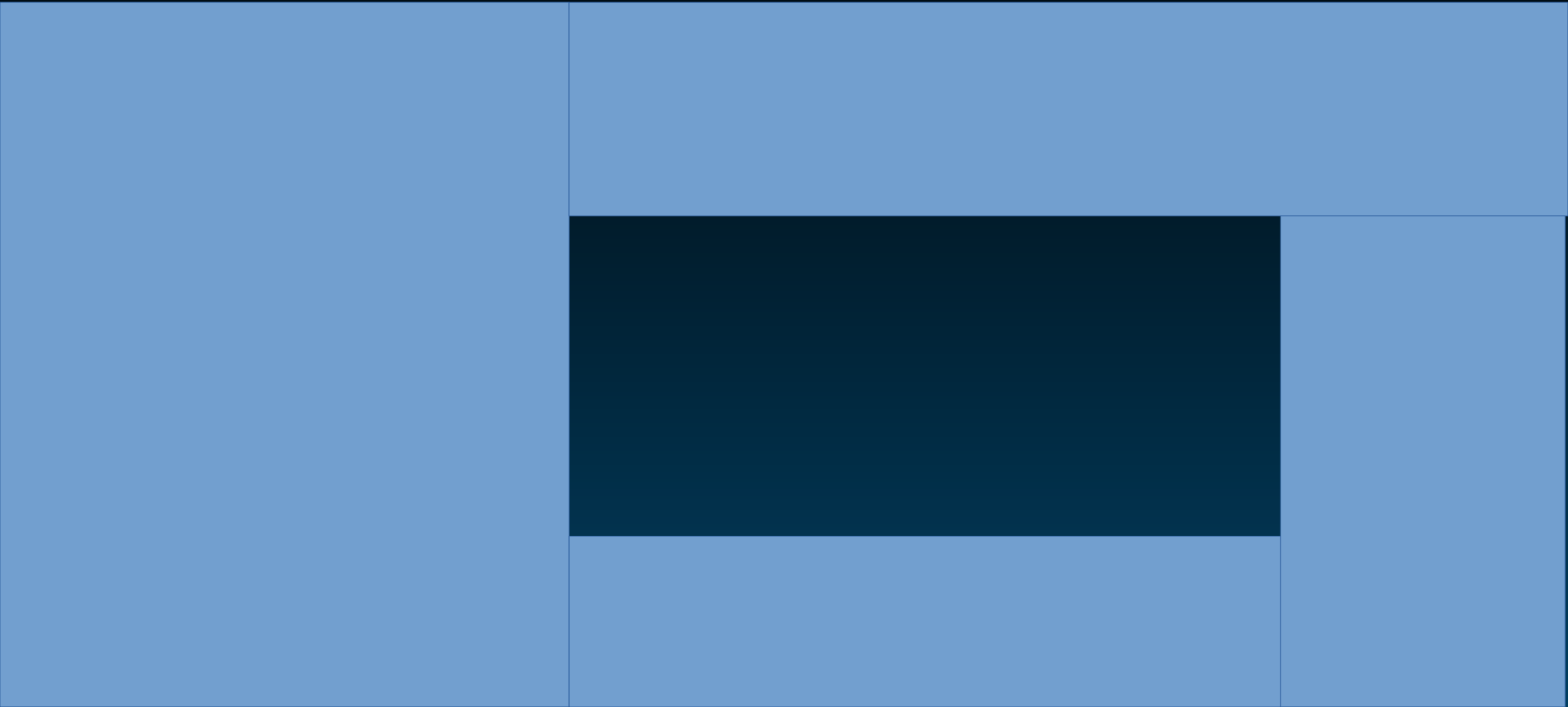


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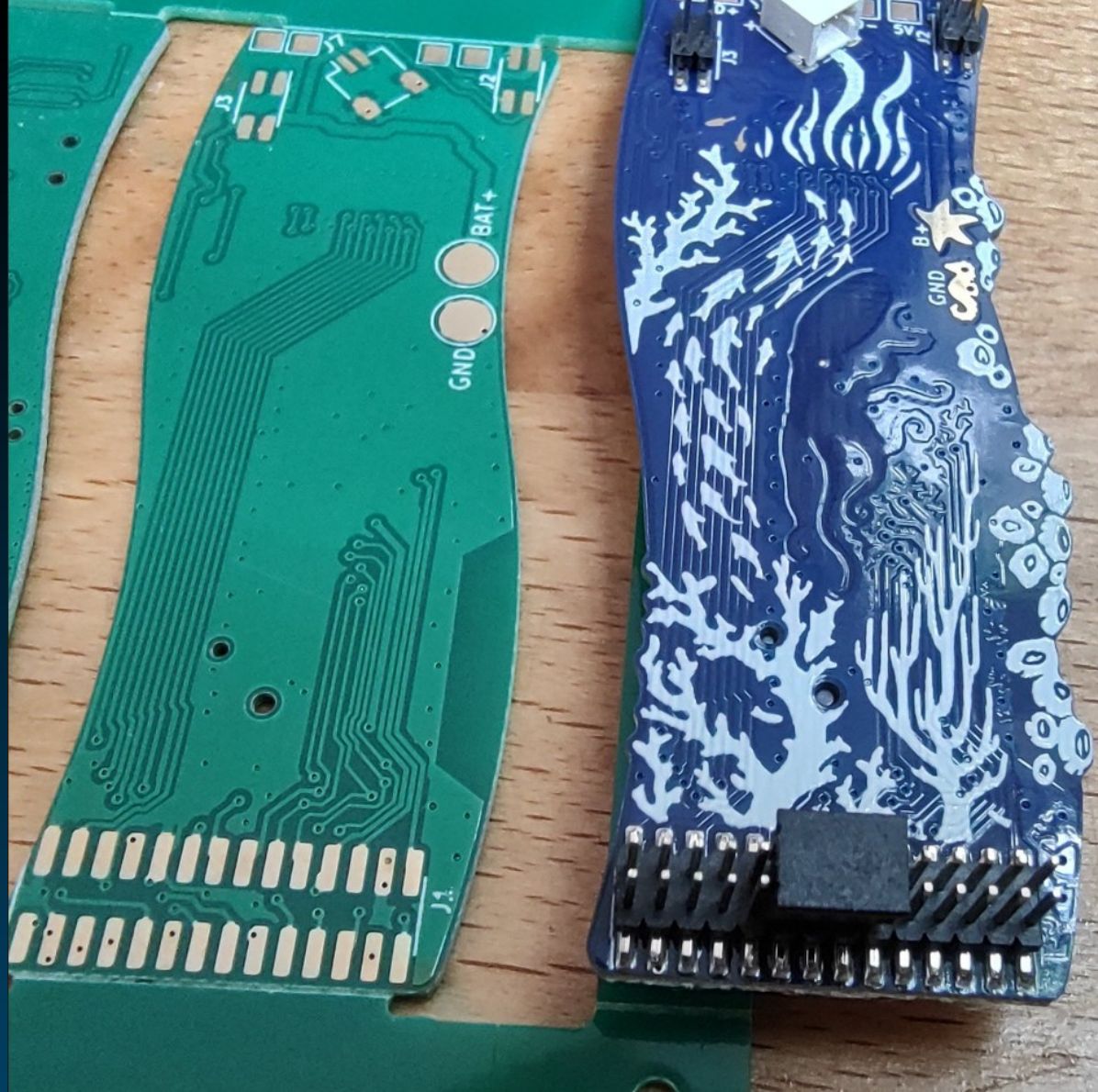




# Design constraints







# Export PCB

- Screenshots, as realistic as reasonable (bitmaps)
  - These are for sketching onto, template, discussion
- Technical layers (SVG to scale)
  - Copper, mask, silk – each side each PCB
  - Outline

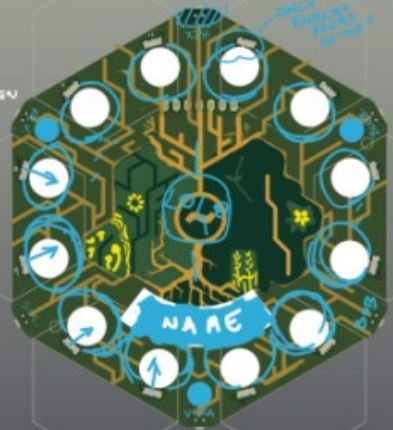
# Sit down and scribble on it

- Annotate the design
- Communicate constraints
- Sketch where the design space is

TF

- 2024
- BEWARE SCRUB HEADS
- NB: BESIDE LEDS VERY BRIGHT + COLOURFUL
- SIDE-LIGHTING → TEXTURE
- NAME AREA NOT UNDER SCREEN
- DESIGN BEHIND SCREEN = LOOP-VIS
- LABEL BUTTONS
- BUSY NEAR TOP
- MID AREA VERY FLEXIBLE
- LEDS → split colour
- GRID NOT BRIGHT BY LEDS
- LABEL LEDs 1-12

99%



GOLD AVOID H-FLES

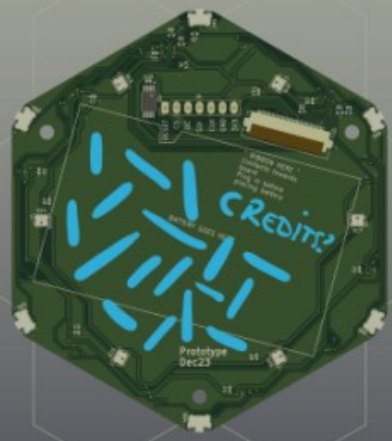
standoffs soldered on!



SILK/INK  
BARE BOARD  
MAKE ON BOARD  
MAKE COMPLETE  
BARE METAL

TB

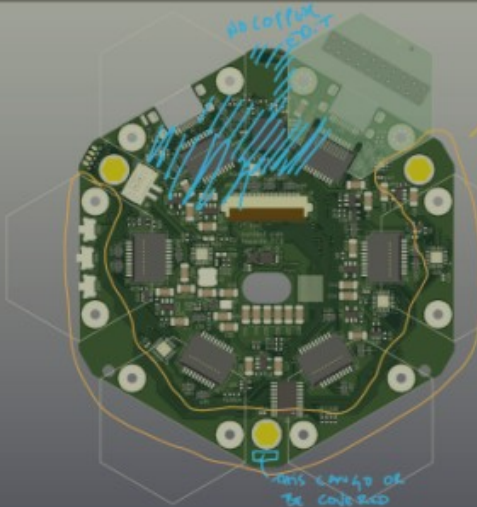
- LOWER PRIORITY
- CREDITS - TEXT OR SIGNATURE



BRAILLE?

BF

- NEED PART IDS
- OUTER RIM MOST VISIBLE ∴ NEEDS ART



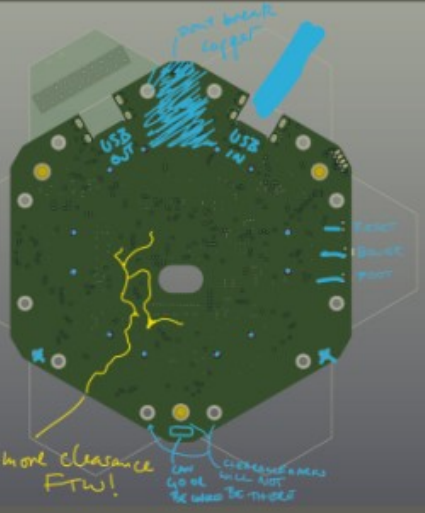
no coffee left

ART ME!

more clearance or be covered

BB

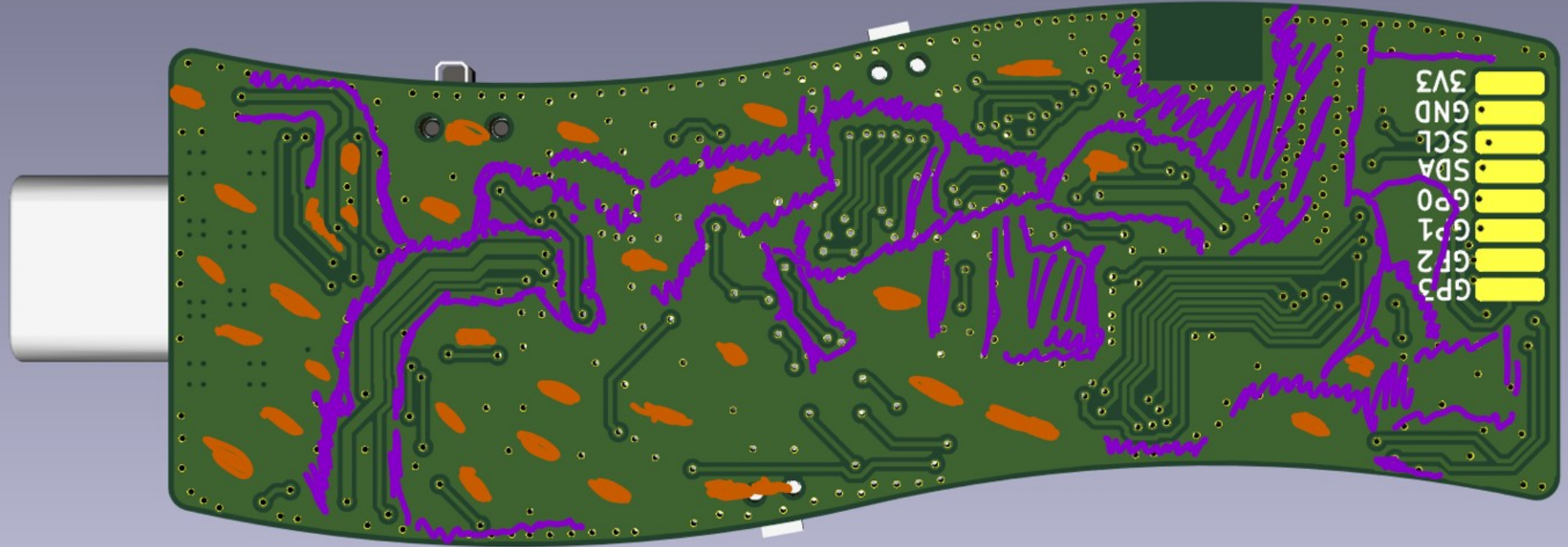
- No ground wires (around in sandwich)
- Go nuts!
- USB in/out
- Buttons



more break copper

more clearance FTW!

clearance will NOT be used bc there are 40 of them



3V3  
GND  
SCL  
SDA  
GP0  
GP1  
GP2  
GP3

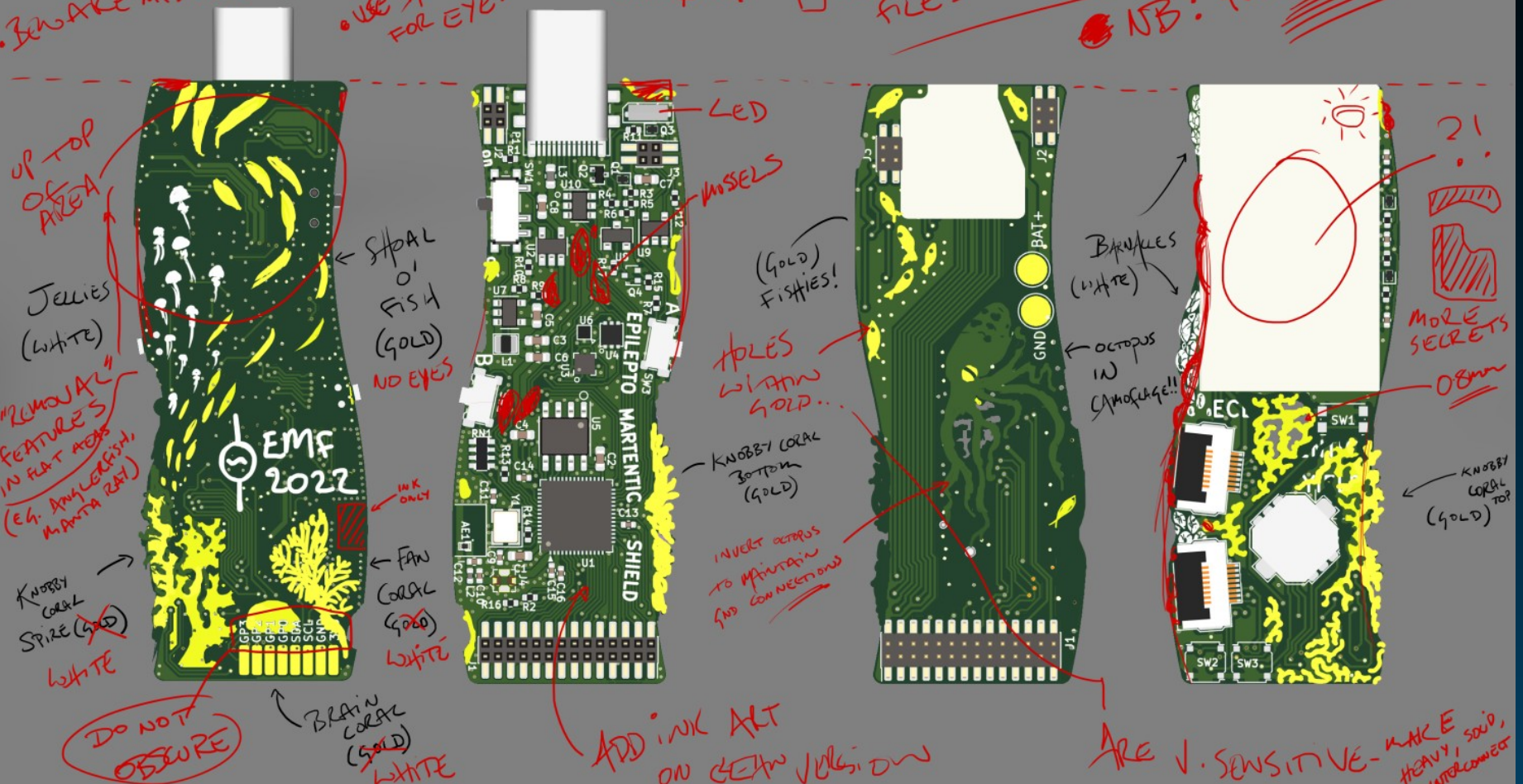
# FAVOUR SCREENPRINT OVER METAL

THIN GOLD LINES → -VE SPACE WITHIN GOLD  
Beware MISALIGNMENT  
• USE HOLES FOR EYES.

□ RE-WATCH VIDEO

□ RE-SCALE NEW FILES TO OLD

● NB: F~~UCK~~ PHOTOSHOP.





# Art design

- Feature scale
- Use existing features as reference
- Don't get stuck in the details

# Layer setup

- Additive/subtractive layers
- Silk is additive
- Mask is subtractive
- Copper can be either

CIRCUIT DESIGN



CIRCUIT LAYERS

ADD

SUBTRACT

INK

+  
MAKE PCB ART!

MASK



COPPER



BOARD



ARTED CIRCUIT DESIGN



# EXAMPLE RASTER SETUP

---

- INK LAYER (BLENDING MODE = NORMAL)
  - ▶ MASK GROUP (75% OPACITY)
    - MASK SUBTRACTION LAYER (BLENDING MODE = ERASE)
    - MASK ADDITION LAYER (BLENDING MODE = NORMAL)
    - CIRCUIT DESIGN MASK .SVG (LOCKED)
  - ▶ COPPER GROUP ( % OPACITY)
    - COPPER SUBTRACTION LAYER (BLENDING MODE = ERASE)
    - COPPER ADDITION LAYER (BLENDING MODE = NORMAL)
    - CIRCUIT DESIGN COPPER .SVG (LOCKED)
- CIRCUIT DESIGN BOARD .SVG (LOCKED)

# Work in parallel

- Go away and do your thing
- Check in with each other
- Ask for changes
- Re-export things as needed

# Art export

- Board outline (possibly with holes)
  - Single-line SVG
- Technical layers as individual SVGs if possible
  - If not, use Inkscape to vectorize
  - Positive copper
  - Negative copper (holes in copper)
  - Positive silk
  - Negative mask (holes in mask)
- For each side of each board!
- Add an alignment feature in each file

# Integration

- Art and circuit come together
- Disasters happen
- You'll be real glad you know how to roundtrip

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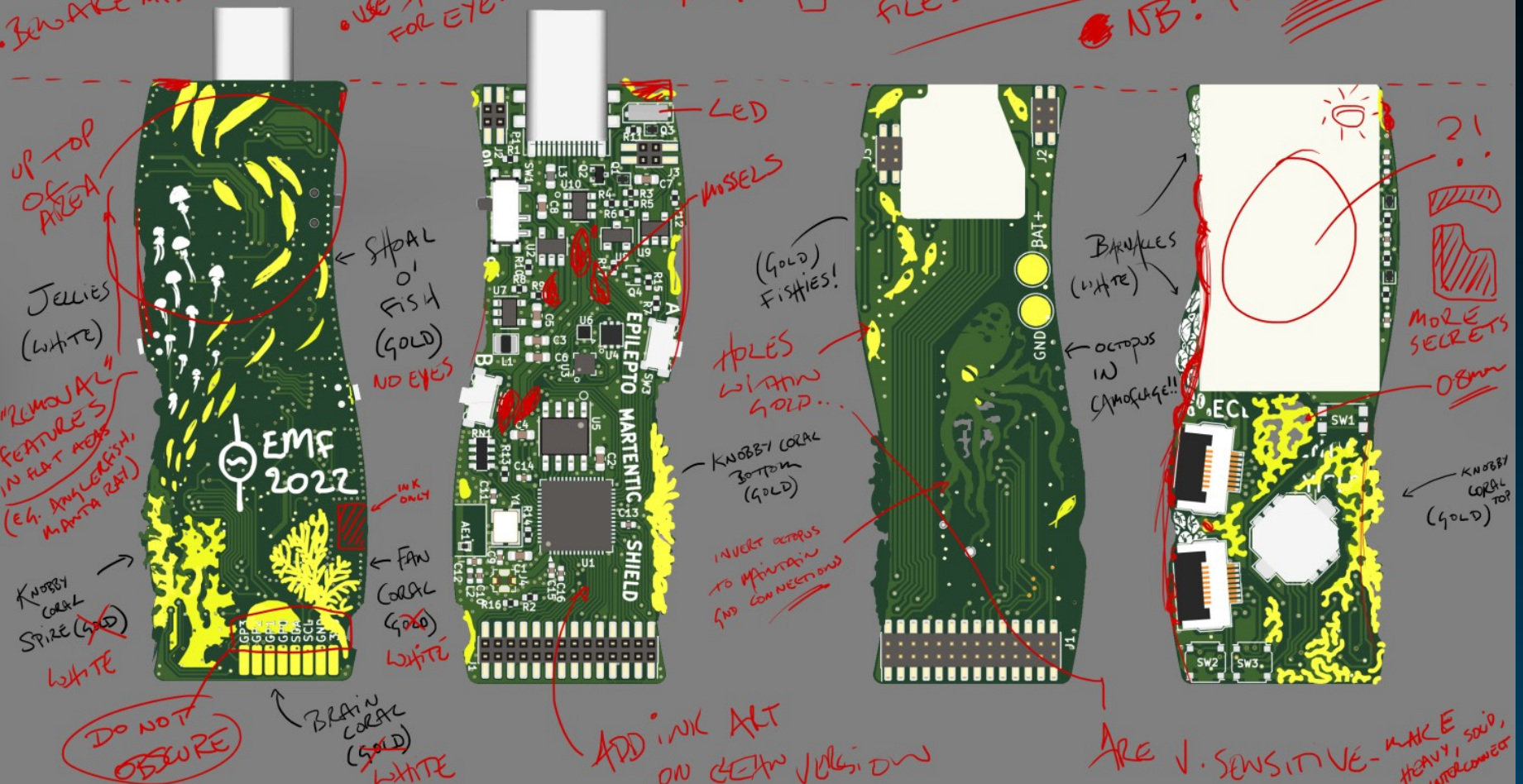
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DO NOT OBSCURE

BRAIN CORAL (GOLD) WHITE

ADD INK ART ON GETAW VERSION

ARE V. SENSITIVE - MAKE HEAVY, SOLID, INTERCONNECT



# Manufacturing

- PCB manufacturers expect normal boards
- You need to not ambush them
- Sometimes their tools get confused
- Crashes happen
- Give them permission to try to make things

# Summary

- Make plans but don't let them get in the way
- Round-trip
- Communicate among each other
- Communicate with your board vendor
- Make beautiful things



# THANK YOU

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Questions?