Do current sources perform as simulated?

Hardware for evaluating simulator accuracy

(a work in progress)

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Talking to Hardware Designers

EIT/ERT Technology Survey 2018/2019

9. DESIGN PRIORITIES a priori

a. In your opinion, identify the relevance of the following list of priorities to your device(s), at the outset of the project, on a scale of 1 to 10. If your priorities changed across different devices, please add comments below your answers.
1: irrelevant … 5: necessary … 10: very important, 11: critical!

1. Size 1 .. 2 .. 3 .. 4 .. 5 .. 6 .. 7 .. 8 .. 9 .. 10 .. 11
2. Weight 1 .. 2 .. 3 .. 4 .. 5 .. 6 .. 7 .. 8 .. 9 .. 10 .. 11
3. Power 1 .. 2 .. 3 .. 4 .. 5 .. 6 .. 7 .. 8 .. 9 .. 10 .. 11
4. Time to Market (Development Time) 1 .. 2 .. 3 .. 4 .. 5 .. 6 .. 7 .. 8 .. 9 .. 10 .. 11
5. Development Cost 1 .. 2 .. 3 .. 4 .. 5 .. 6 .. 7 .. 8 .. 9 .. 10 .. 11
6. Production Cost 1 .. 2 .. 3 .. 4 .. 5 .. 6 .. 7 .. 8 .. 9 .. 10 .. 11
7. Compliance (to relevant standards; which standards?) 1 .. 2 .. 3 .. 4 .. 5 .. 6 .. 7 .. 8 .. 9 .. 10 .. 11
8. Safety (fail in safe ways, possibly under extreme conditions) 1 .. 2 .. 3 .. 4 .. 5 .. 6 .. 7 .. 8 .. 9 .. 10 .. 11
9. Longevity (maximize mean time between failure) 1 .. 2 .. 3 .. 4 .. 5 .. 6 .. 7 .. 8 .. 9 .. 10 .. 11
10. Resilience (surviving partial failures) 1 .. 2 .. 3 .. 4 .. 5 .. 6 .. 7 .. 8 .. 9 .. 10 .. 11
11. Simplicity (minimize part count/features) 1 .. 2 .. 3 .. 4 .. 5 .. 6 .. 7 .. 8 .. 9 .. 10 .. 11
12. Quality Assurance (self-test features) 1 .. 2 .. 3 .. 4 .. 5 .. 6 .. 7 .. 8 .. 9 .. 10 .. 11
13. Calibration (not required, intermittent/external or built-in) 1 .. 2 .. 3 .. 4 .. 5 .. 6 .. 7 .. 8 .. 9 .. 10 .. 11

10. DESIGN PRIORITIES a posteriori

a. For a "next" design, describe how your design priorities have evolved. What would you do differently?

For example: After the misadventures with Device A, I would never focus on simulations. For Device B, I'd contract the PCB layout to someone else.

11. REPORTING SPECIFICATIONS and PERFORMANCE

a. What design specifications do you view as the most informative when reported in the literature?

b. In your view, what additional information, if any, is most often lacking when these important specifications are reported?

c. What specifications do you find least useful when reported in the literature and why?

d. What specifications have you seen lead to the most confusion in their interpretation and implementation?

12. DESIGN WISHLIST

a. What single feature do you think should be available in every EIT/ERT device?

b. In your opinion, why is that feature not implemented?

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- EASY
  1. Design in simulator.
  2. Build it.
  3. Measure in the lab with **resistor** phantoms
     and often some healthy people.
  4. It correlates!

- CHALLENGING
  1. Design in simulator.
  2. Build it.
  3. Measure on a *variety* of **people** (or on the **ground** for ERT[1]).
  4. It does not correlate!

[1] Electrical Resistivity Tomography (geophysics)

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Talking to Hardware Designers

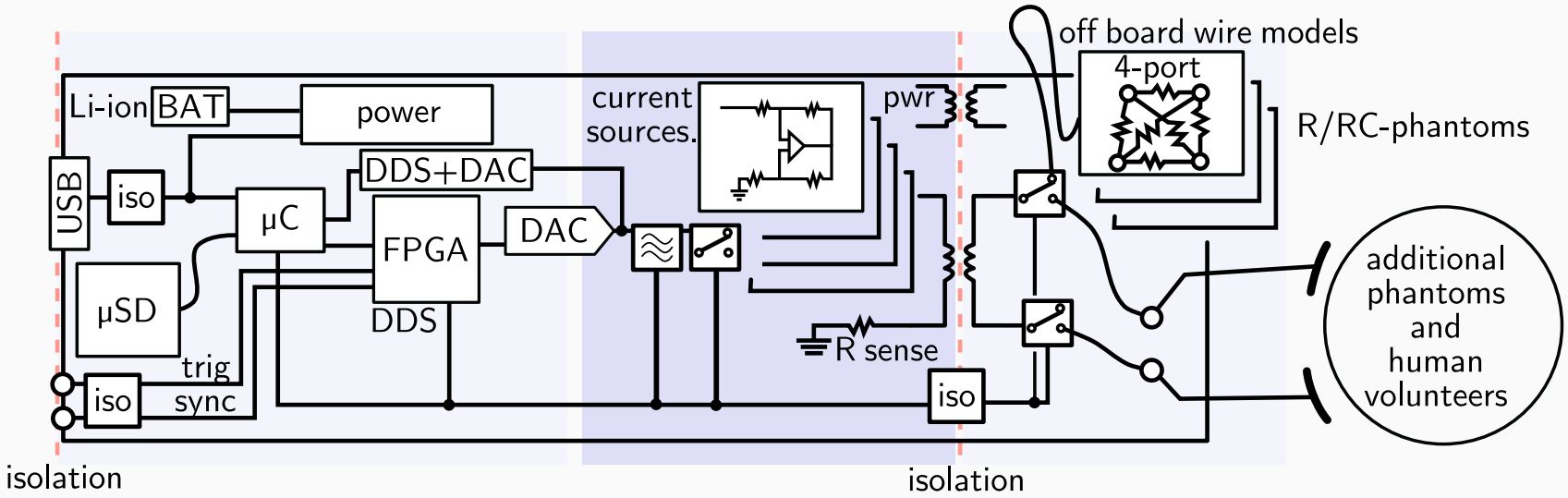
Do current sources behave according to “spec?”

Sometimes.

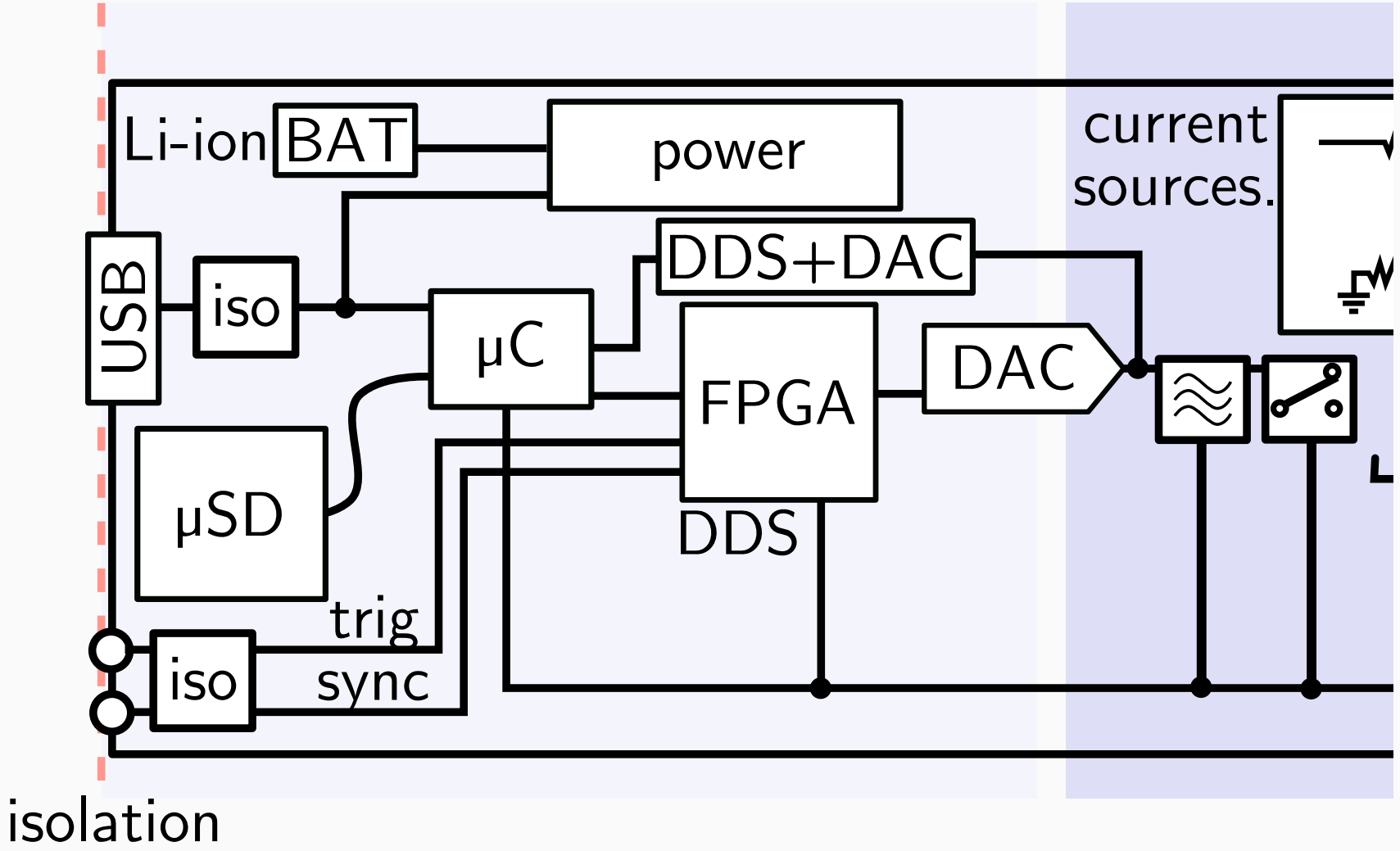
Reproduce these Challenges

Lets reproduce this issue.
We need a hardware platform.

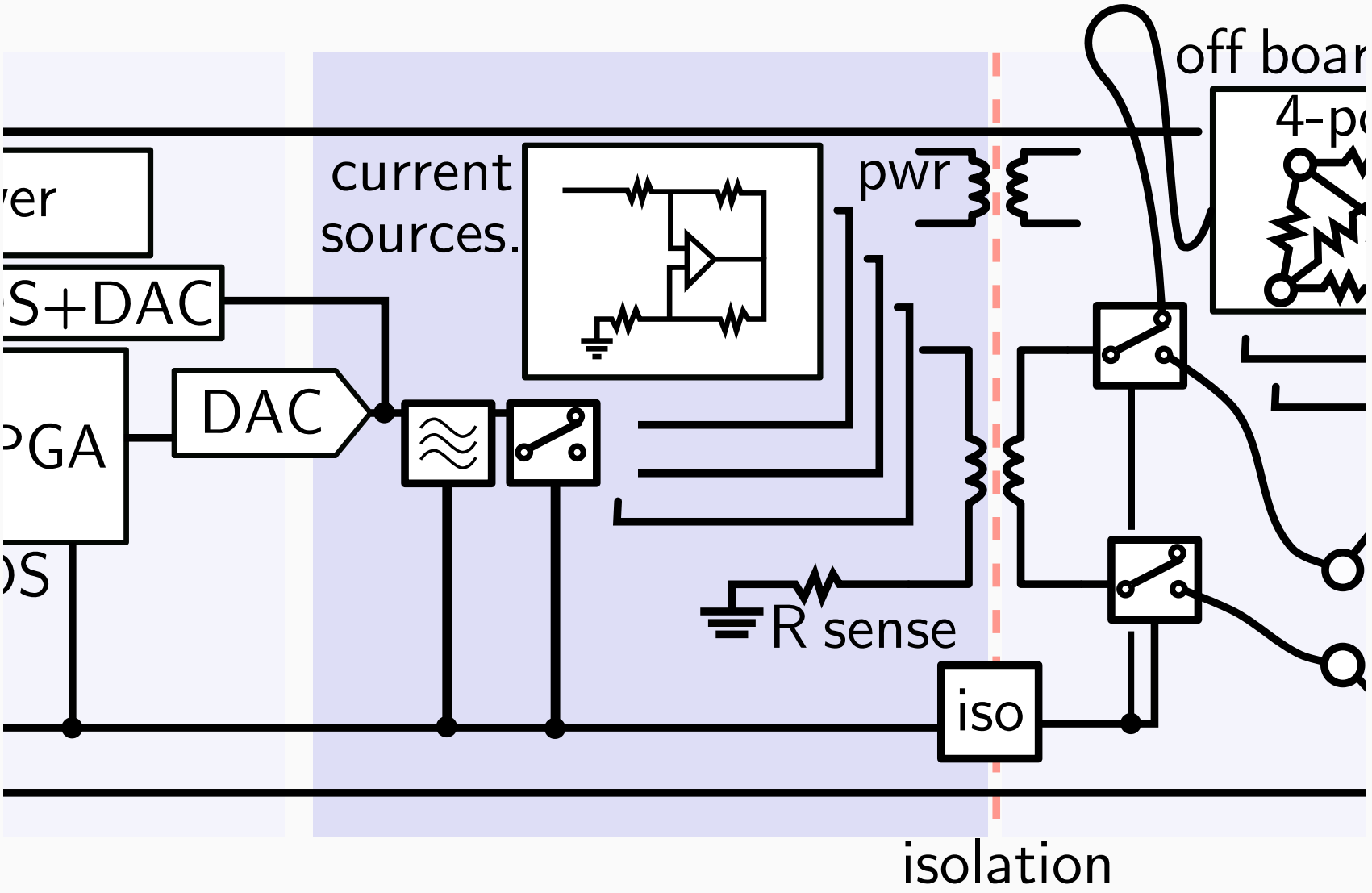
Reproduce these Challenges



Reproduce these Challenges



Reproduce these Challenges



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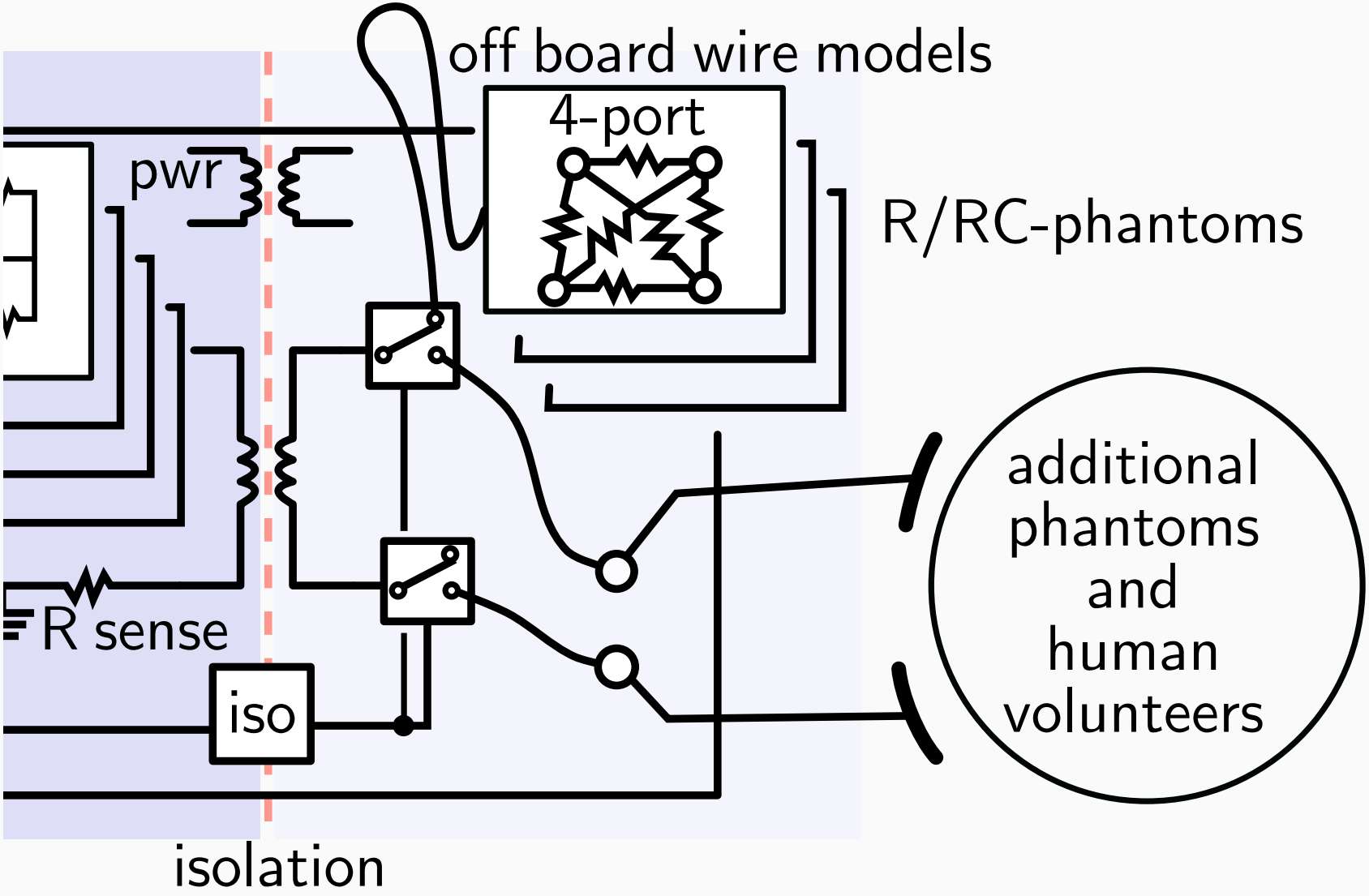
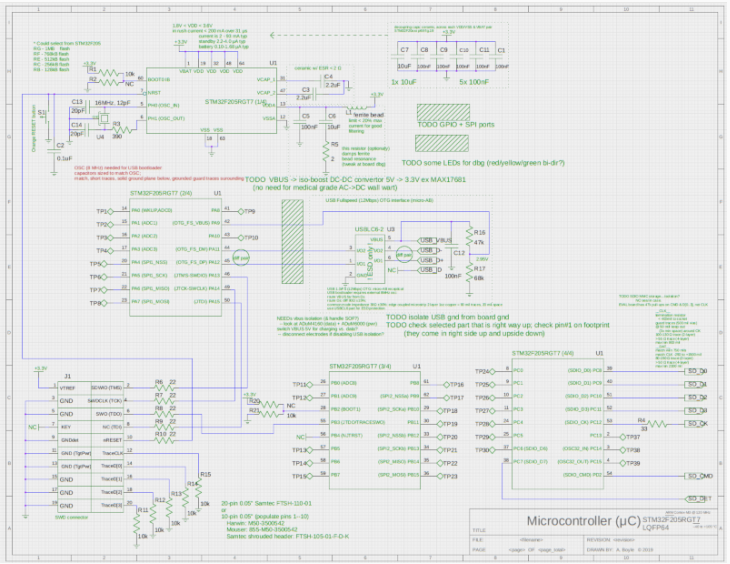
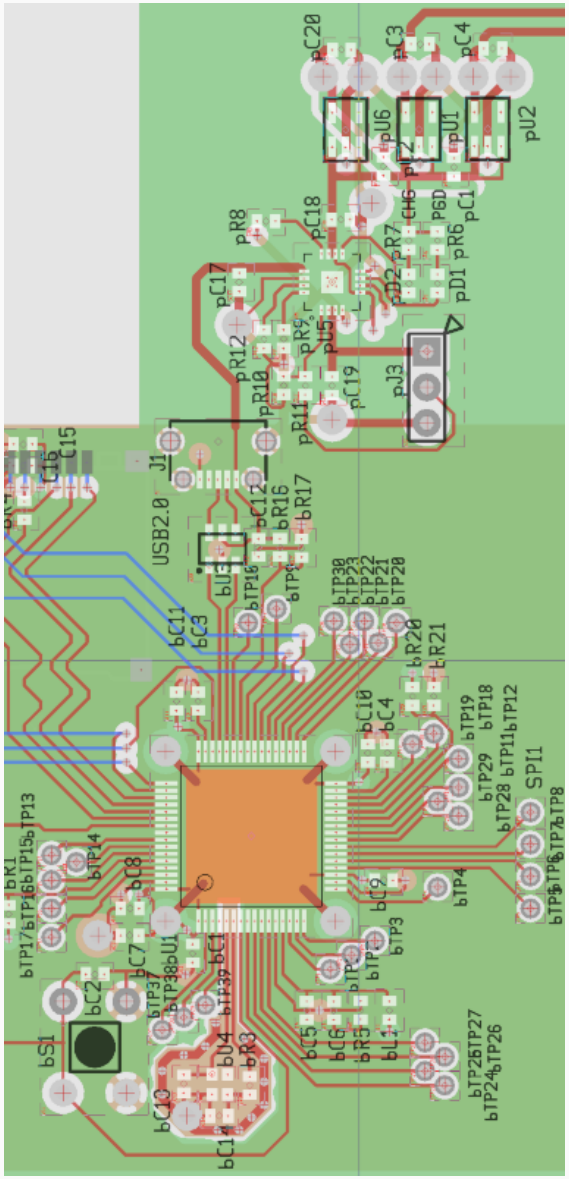


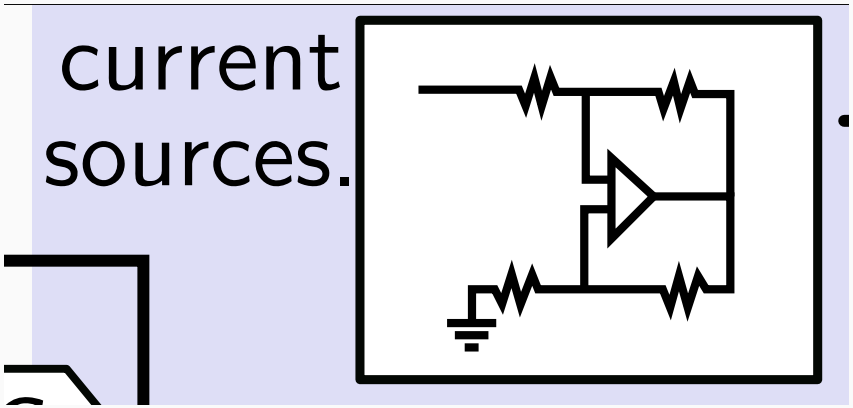
Whats Left?

Layout:



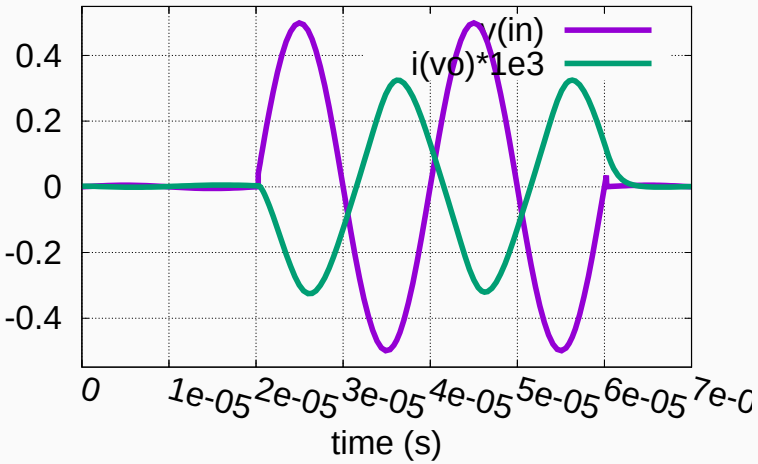


Compare to Simulation

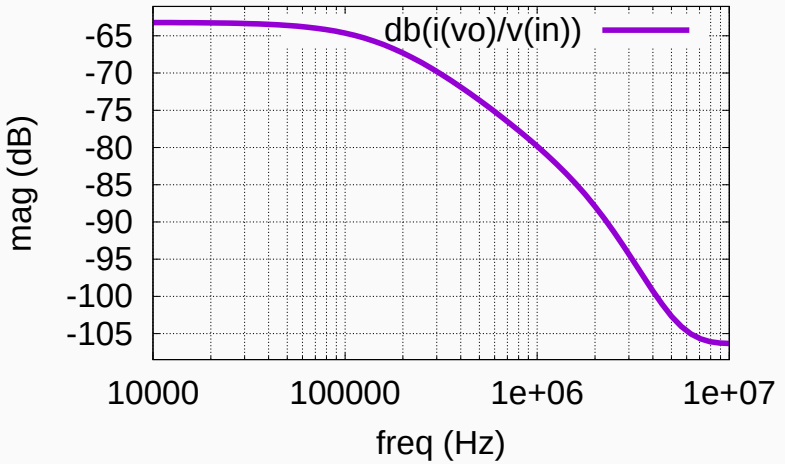


SPICE Simulation

tran 50us 500us



ac dec 20 10kHz 10MEGHz



Compare to Simulation

Does the simulation match measurements?

No? Build a better simulator.