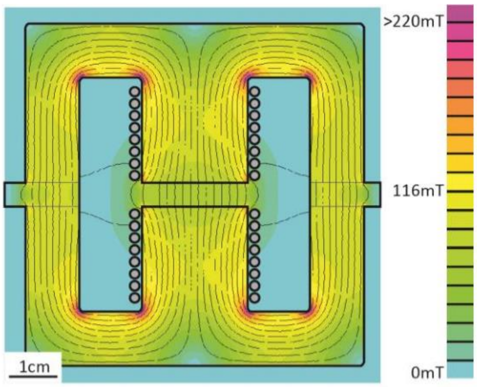
Equipment and materials you will need

Component	Sub-component	Comments/Link
Amplifier		The one we used was the 2100L, found here: https://www.eandiltd.com/products/rf-power-amplifiers/ These E&I amplifiers are fantastic—they have a lot of built in protection so the only way you can hurt them is by putting in more than 1V. Some places sell these amplifiers used and if you get a lower power, it might be affordable: https://www.bellnw.com/manufacturer/Electronics-and-Innovation/240L-Refurb.htm Also, some places offer a monthly rental https://www.theemcshop.com/dc-220-mhz-rf-amplifiers/649-monthly-rental-ei-eni-2200l-200w-rf-power-amplifier-10-khz-12-mhz.html I think you might be able to make due with 40W, such as the E&I 240L, and anything more than 100W would be wasteful.
Oscilloscope and function generator		One option is to borrow good equipment from your friends in the electrical engineering department.
		Another is to play around with Bitscopes as waveform generators and scopes: https://bitscope.com/
		If you're fans of MATLAB, you might like https://www.digikey.com/product-detail/en/digilent-inc/410-321/1286-1117-ND/5810115
Electromagnet	Core	Rather than a gapped toroid, I now recommend a different geometry with E cores: https://www.digikey.com/product-detail/en/tdk-electronics-inc/B66375G0000X187/495-5493-ND/3914860 (Other geometries are available in TDK N87 material if you want, especially smaller E cores like this one https://www.digikey.com/product-detail/en/tdk-electronics-inc/B66335G0000X187/495-5441-ND/3914763 a smaller one would require less power and dissipate heat a little more efficently) Then you stack little pieces like these on either side to the thickness you want https://www.digikey.com/product-detail/en/tdk-electronics-inc/B66483P0000X187/495-75529-ND/3915025 You might need to 3D print or laser cut a frame to hold it together

		
	Wire	We used Litz wire custom made for us from MWS, but I do not think this is really necessary because at high amplitudes, the losses are dominated by the core. Moreover, it can be a bit difficult to solder properly and the technique is different from soldering almost anything else—not a great way to learn if it is new for you. I would recommend something around 12 AWG and try something cheap first: https://www.digikey.com/product-detail/en/nte-electronics-inc/WH612-06-25/2368-WH612-06-25-ND/11655551 Consider getting silicone tubing as an extra outer layer precaution for the wires going between the coil and the capacitor https://www.mcmaster.com/silicone-rubber-tubing
Capacitors		Capacitor selection is pretty important for making this work properly, but there is some wiggle room. Essentially, you ideally want capacitors that are “High Q” or “Low loss” RF capacitors. It is usually cheapest to make an array of these capacitors to handle the current and the voltage. I wrote a lot about designing the array in the tutorial, so look there and don’t be afraid to run a selection by me if you want to check. My two favorite options are the following: • Surface mount mica capacitors (excellent stability, very high Q) Here is an example: https://www.digikey.ch/product-detail/en/cornell-dubilier-electronics-cde/MC22FF152J-TF/338-4455-2-ND/1921772 • Surface mount ceramic capacitors with X7R dielectric material or C0G, NP0 dielectric typically work well if you make an array with a lot of them in parallel. They drift a little bit more than the mica ones during operation, but with a field probe or shunt you can characterize your field vs time and make sure you’re getting what you want.
	Vector board (for laying out array)	https://www.digikey.com/products/en?keywords=169P44WEC1 Basically you have to cut out a shape with shears and then scrape away the copper, e.g. with a Deremel tool where you don’t need it.

		If you want operation at a fixed frequency, I don't think you need to make complicated connectors. Instead you can just solder directly to the array
	Box	See instructions and drawings for making a box in the tutorial if you want https://www.mcmaster.com/acrylic-plastic Otherwise there are lots of commercially available plastic enclosures https://www.digikey.com/products/en/boxes-enclosures-racks/boxes/594
Transformer	Core	These are easy to make for this kind of application. https://www.digikey.com/product-detail/en/tdk-electronics-inc/B64290L0082X087/495-3872-ND/1830202
	Wire	Again litz wire would be ideal, but you should try first with the same 12 AWG wire you use for the coil
	BNC connector	https://www.digikey.ch/product-detail/en/adam-tech/RF1-08-D-00-50-HDW/2057-RF1-08-D-00-50-HDW-ND/9830966
Shunt resistor	Enclosure	See above for capacitor
	Resistor	The value depends on where you choose to put it in the circuit. If it's going to handle a lot of current, you want to keep its resistance small, but you do want a measurable voltage Here's a 0.1 Ohm option https://www.digikey.ch/product-detail/en/ohmite/TGHDXR100JE/273-TGHDXR100JE-ND/10441427 And a 1 Ohm option https://www.digikey.ch/product-detail/en/ohmite/TGHDX1R00JE/273-TGHDX1R00JE-ND/10441444 I think a heat sink is not needed for these above, since you should be dissipating <<100 watts in them if designed properly
Field probe	Wire	This needs to be very small wire. If you use thick wire, eddy currents will probably cause it to catch fire, or so was my experience. https://www.digikey.ch/product-detail/en/belden-inc/8055/BEL1983-ND/7389416 Small magnet wire is unfortunately a bit expensive, but I think you can shop around for a cheaper source than this above. If you're really having trouble, I can put a little bit of small Litz wire in an envelope and send it to you
	Form	I suggest you 3D print a suitable design

Process I would follow to make a suitable setup

1) Wind the turns on your inductor, make a frame to hold it together, including the spacers on each side.
2) Measure the inductance of your electromagnet. (Some multimeters have an inductance measurement function, your friends in the EE department might have access to a proper LCR

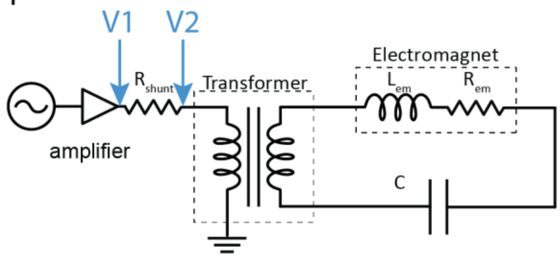
meter, or you can test resonance using some known capacitances with your fn generator/scope combo)

3) Design your capacitor to resonate appropriately with the inductor and lay out the rest of the circuit:
    a. Make your transformer, remembering that in this case the secondary has fewer turns than the primary so that you can step up current. Maybe start with a 5:1 ratio, a good guess for these circuits in my experience
    b. You might consider incorporating your shunt resistor right into the transformer box if there is space
4) Test resonance of your coil, monitoring the supplied current with the shunt resistor
5) Make adjustments as needed. This includes:
    a. Modifying the capacitor array to get the right resonance
    b. Changing the winding ratio on the transformer to optimize power transfer. (The amplifiers I recommended indicate values for power that is “reflected” and delivered. You want to adjust the transformer ratio to make the delivered power as large as possible and the reflected power as small as possible.
6) Use a field probe designed to sit in the same spot as your sample to study performance under the conditions you are interested in.

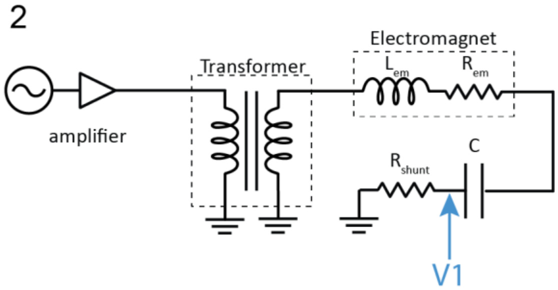
Misc

- I would recommend 500 kHz operation rather than 100 kHz since this is near where the H*f product of the material peaks
- There are lots of ways to incorporate a shunt. I recommend keeping ti out of the high current part of the circuit if you can

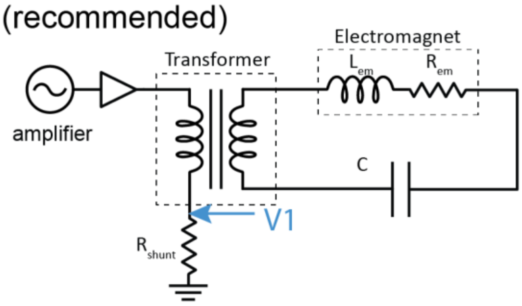
Option 1



Option 2



Option 3 (recommended)



- Here is a photo of a setup a student worked on recently in Zürich that might give you some inspiration for cooling. (The electronics driving this one are a bit different)