Hi Professor

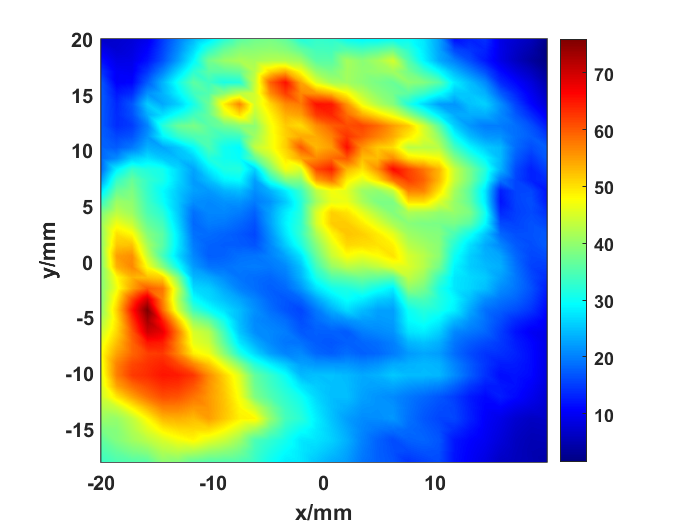
This week we keep on measuring and adjusting the laser after swap the old CO2 system with the new CO2 system duo to power supply malfunction. Now the main question is how to get good gauss beam profile and how to improve the formic acid laser output power.

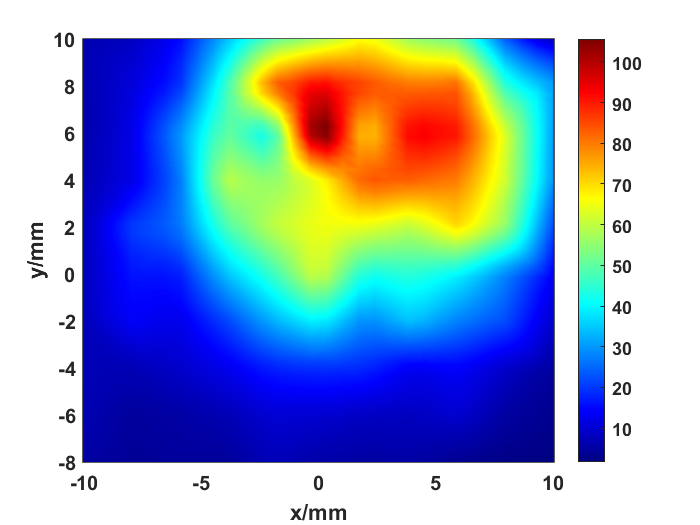
Measurement improvement:

First of all, with the help of Calvin and Jon, I improve the measurement setup to suppress 60Hz interfering signal which will cause serious fake fluctuation of formic acid laser power measurement. One interesting phenomenon is when I turn on the gentec power detector ,sometimes there will have 60Hz signal interfering signal ,as we know the gentec power detector is driven by 9V battery , it can’t generate 60Hz signal itself . When I use a wire connect the detector mental box to the ground (optical table) ,the interfering signal immediately disappear.it seems like the mental box working as antenna ,receiving the 60 Hz signal from the environment .It remind me how important the equipment ground is for shielding interference .

Main challenge:

1.The formic acid laser output power is not satisfied with us ,since the max power can only reach to 15 mW ,and the beam profile sometimes looks like MHD mode, not ideal gauss beam, sometimes looks like gauss beam ,the shape is not stable and the best position of cavity adjustment stepper motor also change as time elapse.





2. the CO2 consumption is very high ,we are considering if we can save the CO2 gas by limiting the pump gas speed .If we keep the system on for 6 hours every day ,one bottle of gas can only support about 1 week.

Next Plan:

To figure out the question why the output power is so lower, Jon gone to Check the CO₂ laser beam position at the formic acid output window to check if it is coaxial with the formic acid laser tube. I also have assembled 3D measurement stage to measure more detail beam structure as propagation and calculate the beam waist position and size.

GPT

Hi Professor,

This week, we have continued measuring and adjusting the laser after replacing the old CO₂ system with a new one due to a power supply malfunction. The main focus now is on achieving a good Gaussian beam profile and improving the formic acid laser output power.

**Measurement Improvement:**

With the help of Calvin and Jon, I improved the measurement setup to suppress the 60 Hz interference signal, which was causing significant fluctuations in the formic acid laser power readings. Interestingly, when I turned on the Gentec power detector, we sometimes observed a 60 Hz interference signal. Since the Gentec detector is powered by a 9V battery, it shouldn’t generate a 60 Hz signal by itself. However, connecting the detector’s metal casing to the ground (optical table) immediately eliminated the interference. It appears the metal casing was acting as an antenna, picking up the 60 Hz environmental signal. This experience reminded me of the importance of proper equipment grounding for shielding against interference.

**Main Challenges:**

1. The formic acid laser output power is lower than expected, reaching a maximum of only 15 mW. Additionally, the beam profile is inconsistent: at first it looks like gauss beam, after a while it became “MHD mode”. The optimal position for the cavity adjustment stepper motor also shifts over time.
2. CO₂ consumption is quite high. We are considering whether limiting the pump gas flow rate could reduce gas usage. Currently, if we run the system for 6 hours daily, one gas bottle lasts about a week.

**Next Steps:**

To address the low output power, Jon and I going to check the CO₂ laser beam alignment at the formic acid laser output window to ensure it’s coaxial with the formic acid laser tube. I have also assembled a 3D measurement stage to obtain more detailed measurements of the beam structure along the propagation axis, allowing us to calculate the beam waist position and size.

