Hi Professor

This week I am still working on the laser measurement. Here is some most important results I found this week:

1. the most important thing is the formic acid laser output power actually is higher than we previous measured. because the shielding foam using for blocking the IR also attenuate the FIR power, the attenuation is about half of the original power. So 24 mW we measured previous actually is nearly 50 mW (Experiment log11/13/2024), which the detector is covered by shielding foam. So the output power should be no problem.
2. The formic acid laser cavity length will expand 45um in 1 hour with intensity drop to nearly zero if we don’t adjust the cavity . The intensity fluctuation along the cavity shift is quit high, which cause quick adjust method unavailable at here. So I am going to using the step scanning around the peak region to find the optimal position for auto-adjusting.( Laser Experiment Log - 11/12/2024).
3. The beam profile without lens in front of the windows always look like donut, but when put lens in front of the output window ,the beam profile would much more like gaussian beam .so I measured the beam profile with the lens in front of the window.

The new problem temporally is I didn’t get very robust results. the measurement results for beam waist radius and waist position seems change with time, sometime the results show that it is definitely not Gaussian beam structure (Laser Experiment Log - 11/14/2024). Maybe the error is causing by thermal expanding and intensity fluctuation. I will continue check the beam waist after it reach the thermal stability, maybe 1 hour later. If the problem still exists, I will try to using camera to measure the beam profile, which could provide us the quick image ,avoiding time disturb.Here is the link of Experiment log: https://app.box.com/s/acwhfafxxkfukanvzksrxs4kctwmj1sp.

This week, I continued working on the laser measurement, and here are the key findings:

1. **Laser Output Power**: The formic acid laser output power is actually higher than previously measured. The shielding foam used to block IR also attenuates the FIR power by about half. Thus, the 24 mW we measured before (with the detector covered by shielding foam, Laser Experiment Log - 11/13/2024) is closer to 50 mW, indicating no issue with the output power.
2. **Cavity Expansion**: The formic acid laser cavity length expands by 45 µm in one hour, causing the intensity to drop nearly to zero if we don’t adjust the cavity. Intensity fluctuations along the cavity shift are high, making quick adjustment methods ineffective. I plan to use step scanning around the peak region to find the optimal position for auto-adjustment (Laser Experiment Log - 11/12/2024).
3. **Beam Profile**: Without a lens in front of the window, the beam profile resembles a donut shape. However, with a lens, it takes on a more Gaussian profile. I’ve been measuring the beam profile with the lens in front of the window.

The current issue is a lack of robust results. Measurements of the beam waist radius and position appear to change over time; sometimes the results indicate a non-Gaussian beam structure (Laser Experiment Log - 11/14/2024). This variability may be due to thermal expansion and intensity fluctuations. I’ll continue monitoring the beam waist after it reaches thermal stability, which may take around an hour. If the issue persists, I’ll try using a camera to measure the beam profile, as this could provide a quick image and help avoid disturbances over time. Here is the link of Experiment log: <https://app.box.com/s/acwhfafxxkfukanvzksrxs4kctwmj1sp>.

Have a good weekend!

Best regards

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