Gray Laser Manual

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1 Introduction

Basic guide for operating the GRAY laser.

2 Regular Use Steps

1. Turn on water chiller

2. Check vacuum pressure (Should be e-4)

3. Turn oscillator to 3.5watts

4. Modelock oscillator. Adjust screw so that the spectrum is split between two peaks at about 756nm and 790nm, and then repeatedly tap the button while moving the screw around to search. The modelocked spectrum will have a much smaller peak and be much wider. It can be subtle to notice. After modelocking, if any CW peaks remain, rotate the screwdriver to try to eliminate them.

5. Turn switch and key on pump

6. Activate timing computer

7. Run pump on external

8. Turn pockel cell on to 7kV

9. Check that all beam lines are unblocked

10. Check the output of the regen with a photodiode (DET210 Conrad thinks). You want the prepulse contrast to be 1:100 or better. If not, adjust the tip-tilt of the Pockel's cell and rotate the half waveplate slightly.
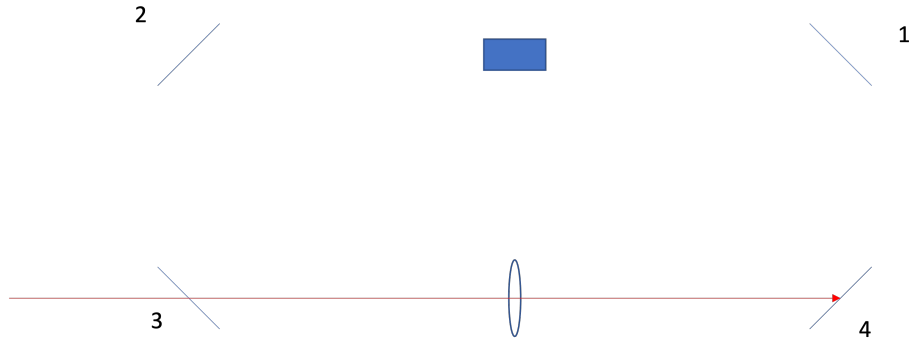
Figure 1: Setup for basic HeNe Alignment

3 Regen alignment

1. Align pump to center of crystal. Run at low power and use lens tissue to see crystal.

2. Send HeNe perpendicularly through lens and back mirrors.

3. Tweak mirror 1 and 4 to send hene through center of crystal back face and front face. Use lens tissue to see crystal shadow

4. Check overlap using lens tissue of forward and backward propagation between mirror 2 and crystal. Tweak mirror 3 until they are on top of each other.

5. check overlap of forward and backward propagation between mirror 2 and 3. Tweak mirror 2 to correct. Repeat previous step until perfect on both sides

6. Run pump at 24amps, check for lasing with IR viewer. Slightly tweak one of the four cavity mirrors while decreasing pump power to achieve lowest power with visible lasing.

7. Install polarizers. Align for perfect back reflection then rotate each stage antiparallel by 72 (Optimal angle for these polarizers) degrees

8. Install waveplate, set to zero rotation

9. Cross check step 3 and 4

10. Repeat step 6, additionally, tweak waveplate for best lasing.

11. Install pockel's cell. Align beam through center then tweak alignment using dot and cross method - Maltese Cross.
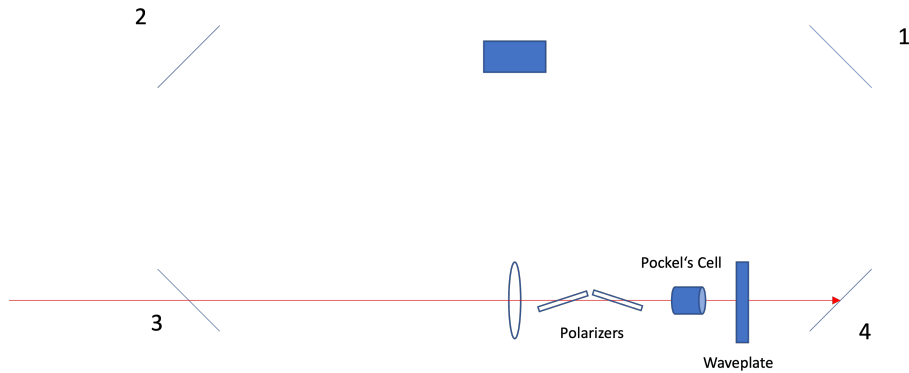
12. Repeat step 6

Figure 2: Caption

13. Place two irises in the lasing mode, one between mirror 2 and 3, and one between 1 and 4.

14. Align the seed pulse to bounce off the polarizer closest to the lens so it follows the lasing mode. Use the two irises from the previous step.

15. With waveplate at zero degree rotation, Pockel cell on maybe look at output on oscilliscope. Set pulse width to 0.6, delay around 3

16. Tweak optics until good seeded gaussian with pulses touching zero volts.

17. Set waveplate to 45 degrees past zero degree rotation mark

18. set pockel pulse window to greater than 1.4 microsecond

19. tweak wave plate

20. tweak pockel delay until most power

21. decrease pockel pulse window to dump on one pulse

22. tweak optics to optimize power

4 Regen Timing

Oscillator creates 76MHz pulse detected by a photodiode

5 Compressor Alignment

1. Align regen output to compressor telescope.

2. Install two tall irises and align the beam after the periscope to them.

3. run d-scan and auto-correlation. adjust as necessary

6 Fixing Oscillator

Over time, the oscillator cavity will tend to drift, such that CW power may drop from 400mW to something like 300mW or worse. In that case, the cavity mirrors add annotated picture need to be adjusted to maximize the CW power. When the CW power falls, modelocking will either become impossible, or if modelocking is achieved, it will be unstable and randomly drop out.

7 Troubleshooting dumb stuff

- When using oscilliscope, check BNC is connected.

- Make sure seed is unblocked