

# TiSa operation

## Optical Lattice TiSa/SHG system

1. Turn on VERDI V12 and set it to max power (~12.5 W)
2. Adjust the pump beam for the TiSa instantly after turning on the pump laser to maximize the TiSa power.
3. Wait 30 min. Realign the pump

**Note:** Do not forget to instantly adjust the pump after turning on the TiSa. In the worst case, you will lose lasing operation during warmup and it might be tricky to find the sweet spot again concerning power.

## Locking the TiSa

The TiSa is locked to a transfer cavity. The PID for this lock works in series mode where the output of the "current" part of the PID is used as input for the "piezo" part of the PID. The PID scheme has been modified as well. Since the fast output of PID goes to the high voltage amplifier (which only takes in 0-10 volts input) which then drives the fast piezo in TiSa, we have added an offset 5 Volts on this output. The high voltage amplifier is based on the Apex PA98 op-amp. This has roughly an amplification factor of 15 and can go from -15 V to 250 V. There is a low pass filter of 50 kHz placed within the amplifier to limit the bandwidth. Also the maximum current of the amplifier is also limited. The TiSa fast piezo can be operated in +- 300 V range. The first resonance of the piezo is at around

77 kHz

. Therefore the PID bandwidth is limited to around 33 kHz.

The whole PID modified scheme is attached here:

tisa\_lockpid.pdf

## Aligning the TiSa

Alignment for the TiSa has to be done from time to time. **Some important notes:**

- Be careful when taking off the cover. The alignment knobs can get stuck. If this happens, the TiSa might need to be aligned from scratch or the TiSa-Crystal can be damaged, if the pump hits it on the wrong place.
- Same is true for putting the cover back on to the TiSa. Here, make sure not to apply force. Don't make the cover fall down, since some elements can misalign pretty easily.

## Power optimization

To optimize the power, the main knobs are the Input-Mirror and the two cavity mirrors on the other side of the TiSa (one is the outcoupling mirror).

1. Optimize the pump-beam position
2. Adjust the two rear end mirrors for maximum power
3. Repeat the process

It also sometimes helps, to align the thick etalon using the knobs.

## Aligning the TiSa from scratch

DONT DO IT :D But if you have to, use the manual. Tip: If you don't have to, dont move the curved mirrors around the crystal.

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