PLD instructions

# 1. To begin with...

1. As you do the various tasks, run through the check list and sign in.
2. Check the Air and Nitrogen cylinders, as well as any gasses you may be using.
3. Check the coolant level and the dials behind the chamber.
4. Turn on the interlock by turning it on at the mains turning the key to on and pressing reset, you should then hear a click.

# 2. Turning on Laser

1. Turn both keys and open the shutter on the board. Emission and shutter should then illuminate on Vitesse
2. Open Vitesse in Coherent folder
3. Open Evolution, set current to LESS THAN 22A. Click and hold on ‘RUN’ until illuminated.
4. Open SDG, make sure the interlock light is on, on the SDG window. Then click start.
5. You then need to make sure the shutter is open on the coherent board, if the light is on, it is open, if not, you need to press it.
6. At this point, a pulse will be visible on the Oscilloscope. You need to adjust out 1 delay and out 2 delay to make the two highest peaks relatively the same, whilst at the same time, minimising the other peaks. This is more of a ‘best effort’ kind of adjustment.
7. Also check that the trigger frequency is set to 1.
8. Make sure the shutter is closed on the Libra panel, so light can get out yet.

# 3. Putting target in

1. On the laptop by the chamber, select to load a target of a particular number, the chamber will rotate so you can put you target in. Once it is in, click OK.
2. This will then put the target in place.

# 4. Checking Rastering

1. Firstly, you need to put the laser into a low power mode. This is done by pressing the ENABLE button for out 2 delay on the coherent board. The laser is now at a safe power. You can also open the shutter so the laser can get through.
2. Hoist up the chamber so you can see the inside clearly
3. Using something like a white business card (with a coarse surface to deflect the light in multiple directions) put it over where the target is and the laser spot should be visible.
4. Load a rastering recipe and begin the rastering process, this will enable you to see where the laser is moving. Try and keep the card as close to the target as possible to get an accurate picture of where it is.
5. The rastering details can be changed in the rastering tab on the laptop near the chamber. Do this by changing the numbers (+ve for one direction, -ve for the opposite) by keeping them in proportion and the same for the forward and backward directions of each respective step.
6. Try and find a raster which will traverse the middle quickly, and go all the way to the edges.

# 5. Putting the Substrate in

1. Firstly, clean the substrate firstly by running it under deionized water then a more thorough clean using acetone on the lens cleaners with clamped tweezers.
2. I have found that the best way of getting the substrate into the chamber and avoiding dropping the sample or sample holder is to hoist up the lid of the chamber and it can then be inserted with the little inward notch going to the back of the holder. Make sure this is done using plastic tweezers.
3. Once the sample is in, the substrate-target distance needs to be established.
4. On motion controls, raise the heater and substrate by clicking on UP. Do this before lowering the chamber lid.
5. Then, with the chamber lid down, take a plastic ruler, and measure the distance between the very top of where the target is (it may be better to use an empty target holder at this point) and the substrate. Ensure the substrate is fully up when this is done.
6. Adjustments can be made by lowering the heater, either by clicking DOWN and STOP when it is at a required distance or, to be more precise, JOG DOWN by a specific amount. Obviously don’t do this with the ruler still in there! On the little Ruler on the chamber, I found that a height of 60mm (target to substrate) was found at around 55mm. This may have been a miss calculation so CHECK THIS!!!

# 7. Checking the Laser Power

1. It is important to see how the power of the laser power varies as it makes its way into the chamber. It can vary quite dramatically.
2. To begin with, there are three separate measurements which need to be made, one just before the mirror, one just after the mirror and one inside the chamber. This is done using the laser power meter.
3. The meter should be plugged in, so all you need to do is turn the power on. Once this is done, you need to set the units to be in mJ.
4. With this done, take the cap off the power meter and remove the shielding on the laser pathway. Take the measurements at each segment and note them down.

# 8. Getting down to Vacuum

1. Firstly, make sure the turbo pump is on and warmed up to approximately 833 Hz before starting.
2. Once this is done, on the chamber controls, you can implement a CHAMBER PUMP DOWN on the pull down menu.
3. The dry pump will start first, taking the pressure in the chamber down to a certain level. This will then be over-taken by the turbo pump and the ion-gauge pressure sensor will be initiated. Remember teh ion-gauge must never be used at any pressure above 10-4.
4. Under vacuum, it is very important not to adjust the substrate/heater height as this can cause problems.

# 9. Pre Baking

1. This process is done to further clean the surface of the substrate. A recipe for this has already been made and can be loaded up using the software.
2. Once it has been loaded, remember to click on UPLOAD to confirm the heating regime.
3. Go to main, then on the eurotherm section, change reset to RUN to initiate it.
4. Once the process is done, it will take some time for the substrate to cool down, but once it has finished, change the drop down menu to reset.

# 10. Creating the right atmosphere and Running a deposition

1. Firstly, the correct gas cylinder must be connected. If a change is needed, turn the valve on the connected cylinder and with a monkey wrench, undo the screw on the connection to the cylinder and remove it.
2. Swap the cylinders over, tie them to the wall, connect the correct cylinder and turn it on. Only turn it on just enough so the gauges show a reading.
3. It is very important the ion gauge is turned off before raising the pressure, so not to damage it.
4. Then, on the main page, begin the rastering for both the substrate and target.
5. Next, set the required pressure, e.g. 75 mTorr and then put it into the chamber, by clicking on the Ar icon (provided the gas you want is on the Ar line). Then on the drop down menu, select setpoint and it will be pumped into the chamber.
6. The pressure can be checked more accurately on the Manometer to the left of the main tabs. This is more accurate than the other pressure gauges.
7. Once the pressure is stable, a second pre-baking must be carried out. This will be identical to the previous one, but should hopefully remove even more oxygen from the chamber and clean the substrate further.
8. Next, to clean the target of any ‘gunk’ it is a good idea to let the laser run for a few seconds on it. This can be done by closing the substrate shutter, blocking any ablated material. To close the shutter, go to chamber control and when the light is on next to substrate, the substrate is exposed, when it is off, the substrate is blocked. Before starting the laser, make sure the rastering for the target is on.
9. So with the substrate shutter closed and the rastering on, open the laser shutter on the main screen for about 30 seconds, then close it again. This should clean the target well enough of anything on its surface.

# 11. Getting a Sample Out

1. Make sure the shutter is closed on the laptop by the chamber
2. Make sure the rastering/rotation of the target and substrate has stopped.
3. Stop the gasses (e.g. Ar or H/Ar)
4. Close the VAT
5. Vent the chamber in the chamber controls
6. Go to motion control, move the heater up, then the substrate down.
7. Once done, the samples will be ready to be removed from the chamber

# 12. After taking out a sample

1. Once a sample has to be taken out, the chamber needs to be kept under pressure. So, firstly, under chamber controls, select pump down.
2. Once the chamber is at a sufficiently low pressure, change ‘pump down’ to manual. This will not stop the chamber from pumping down altogether however.
3. To stop the pump down completely, you need to click to turn off the....

# 13. Shutting the laser down

1. Press stop on the Libra screen
2. Press stop on the SDG screen
3. Press stop on the evolution screen
4. Press stop on the Vitesse screen
5. Turn both keys off.
6. The laser is now powered down and is safe, you can therefore turn off the interlock. Simply turn the key and turn off the mains switch