

Ref: NTU/EEE/NOVITAS/SWP/090.00	Date of issue: 01 Aug 2015	Next review date: 01 Aug 2018
Title : Usage of the PPR system in CINTRA Photonics Lab		
Audience : Faculty, Staff and students using the PPR system in School of Electrical and Electronics Engineering (EEE)		

### 1. Aim

This document outlines the safety requirements for usage of the PPR system.

### 2. Scope

This SWP covers the usage of the PPR system.

### 3. Definitions

EEE – refers to the School of Electrical and Electronic Engineering

PPR – refers to Pulsed Photo-thermal Reflectance

### 4. Responsibilities

4.1 Lab Safety Representative (LSR) – Appointed by the Safety Chairman to be the person to:

- a) communicate the safe work practices to the laboratory users
- b) follow up with assigned safety matters in his/her laboratory.
- c) Advise the lab users regarding the established safe work practices established by EEE.

4.2 Responsible Person (RP) – is the Principal Investigator / Supervisor / Cluster Manager of the project, students or laboratory respectively.

4.3 Laser users:

- a) to comply with established requirements stated in this document.
- b) ask their RP or LSR when in doubt.

### 5. General Rules

- Safe practices in laboratory are of high priority.
- Be vigilant and take precaution at all times. When in doubt, seek advice.
- No eating, drinking and smoking in the laboratory.
- Do not play or run in the laboratory.
- Lab users must familiarize themselves with the Emergency Exit Location(s) and Telephone Numbers.
- Lab users must familiar with the Emergency Response Plan & Emergency Contact Number.

- Access to Emergency EXIT, emergency equipment, controls should NEVER be blocked.
- Students are not allowed to work alone in the laboratory under whatever circumstances. At least one other student or staff must be present.
- Final Year Project Students and Attachment Students are not allowed to work unsupervised in the laboratory
- Staff or students must ensure that any windows/doors opened by them are closed and the respective equipment is shut down before leaving the laboratory.

Those wanting to work in the laboratory after office hour must seek prior approval from their Principal Investigator and Cluster Manager.

Staff or students will be held responsible for any unwarranted events that occur in the laboratory after office hours.

## **6. Procedure of using the PPR system**

**The PPR system comprises two lasers (HeNe laser and NdYAG Laser), which can expose you to hazardous laser radiation during normal operation.**

Using a laser processing workstation can be hazardous in several ways:

1. UV laser light can damage your eyes and skin and generate dangerous radiation.
2. Airborne contaminants generated by laser processing can injure or poison you.
3. Laser gases used by excimer laser can poison or asphyxiate you.
4. High voltages can burn or electrocute you.

### **Whenever you use laser equipment:**

- Use eyewear suitable for the light wavelength and your exposure to it.
- Remember that laser beams can be hazardous even at a distance.
- Remember that objects and surfaces can reflect and scatter laser light.

#### 6.1 Personal Protective Equipment (PPE) used:

- a. Goggles
- b. Gloves

#### 6.2 Pre-requisite for Operation of the system:

- a. Must have been trained on the operation of the system with laser license.
- b. Must have fully understood the safety procedures and risk assessment.

#### 6.3 Procedure of operation for the PPR system:

- a. Start the green pulsed laser with shutter off and let it warm up
- b. Turn on photo sensor, oscilloscope and multimeter
- c. Put sample on stage
- d. Start the red laser and Align the laser beam so that the red laser dot is in the middle of the green laser
- e. Output Connect to multimeter,
- f. Adjust stage Z and photodetector position to maximum value (valid range is below 3.3 V), with sample, adjust red laser intensity or detector aperture so that value is at range of 1.6 – 1.9.
- g. Output connect to oscilloscope

- h. Adjust laser intensity, clear sweep, adjust voltage scale until the suitable curve shown in oscilloscope
- i. Data save and export
- j. Change sample position and repeat from f to h for another data collection
- k. Data can be exported using thumb drive from oscilloscope
- l. Off the system by switch off lasers first
- m. Shut down oscilloscope, off photodetector and multimeter

## Version History

This Table below reflects the summary of changes made to the document. The full change information is indicated with yellow highlight in the document content.

<b>Revision</b>	<b>Section</b>	<b>Details of Change</b>	<b>Document Author</b>	<b>Effective Date</b>	<b>Approved By</b>
1	-	Initial Release	Liang Kun / Kong Qinyu	1 Aug 2015	Dr. Tan Yew Heng

Ref: NTU/EEE/NOVITAS/SWP/087.00	Date of issue: 01 Aug 2015	Next review date: 01 Aug 2018
Title : Standard Work Procedure of Femtosecond Laser Setup		
Audience : All trained Staff and Students allowed to operate the laser		

## 1. Aim

1.1 This document is to provide the safe working procedures to operate the femtosecond laser setup

1.2 The detailed information of the laser are as follows :

Wavelength range : 680 to 1080 nm

Power specifications:

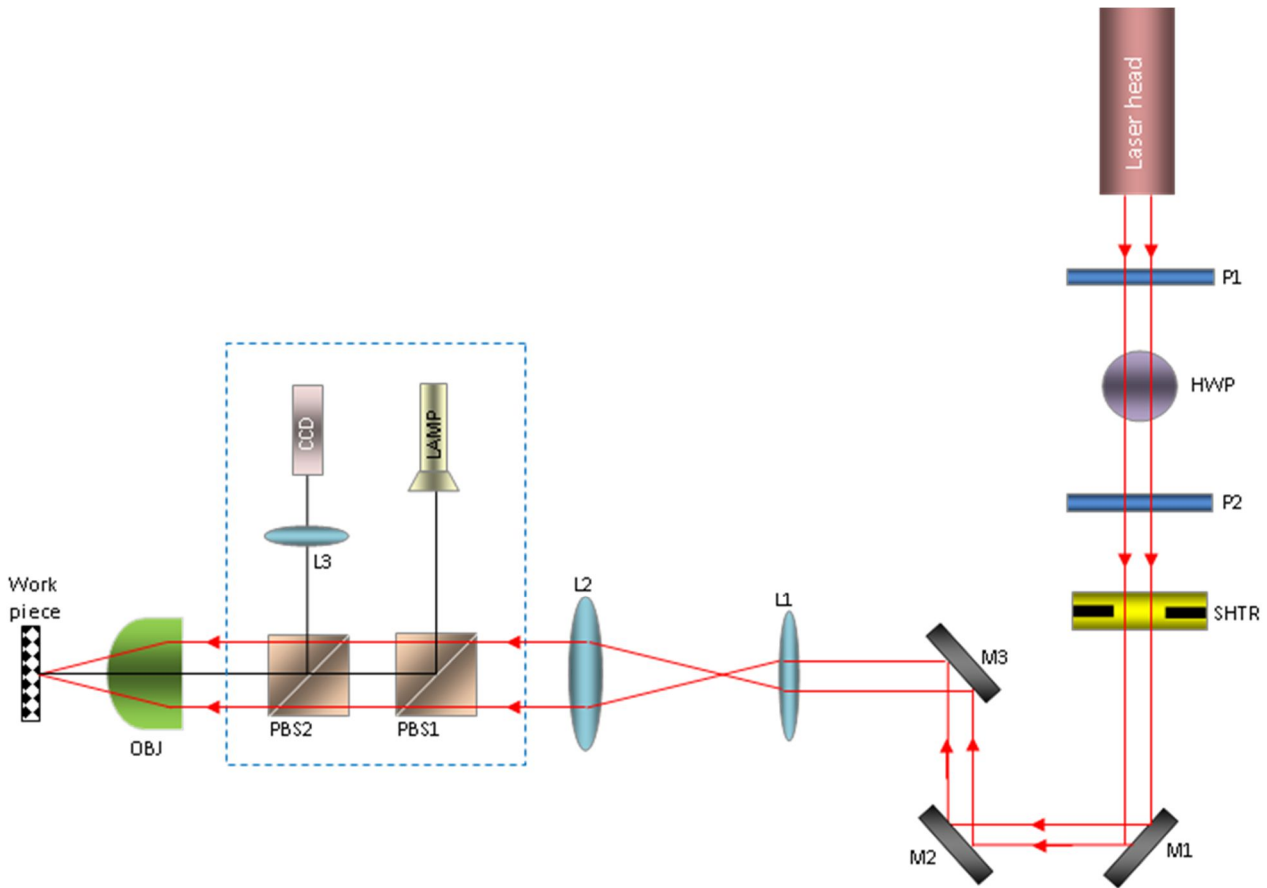
- 650mW at 680nm
- 1.6W at 700nm
- 4W at 800nm
- 1.6W at 920nm
- 550mW at 1020nm
- 200mW at 1080nm

Pulse width : 140 fs

Repetition rate : 80 MHz, nominal

Beam diameter: 1.2 mm

A sketch of the laser setup is shown below :



## 2. Scope

The procedure is applicable to those who might need to perform laser annealing.  
 Note: Only authorized and trained persons are allowed to perform the task under N3 laser licence

## 3. Standard work procedure

1. Safety glasses must be worn at all time
2. The laser is switched ON by turning the key switch located on the front panel
3. The power will ramp up for about 60 seconds until the front panel displays "OK"
4. The output power is first controlled by changing the angle of the half-wave plate. The calibration data sheet gives which power corresponds to which angle. It is set to minimum (10mW) to use with the imaging system. For safety reasons, it must always be set to minimum.
5. An imaging system along with a CCD camera allows the user to display the surface of the sample and to locate the required area.
  - Switch ON the lamp
  - Start Thorcam software and display the image
  - Adjust the Z screw of the 3D stage to focus the image
  - Open the shutter of the laser

- Aim the laser spot
  - Close the shutter of the laser
6. When the required area to anneal is chosen, the imaging system is removed by flipping the two beam splitters downward
  7. The shutter is closed and the output power is changed to its chosen value (annealing power).
  8. The annealing is carried out by opening all shutters for a chosen period of time. The time is varied with the shutter controller. A typical exposure time is 1s.
  9. Once the annealing is finished, the output power must be set to minimum and all shutters must be closed.
  10. The laser is turned OFF by turning the key switch located on the front panel.

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1	-	Initial Release	Hasman	1 Aug 2015	Dr. Tan Yew Heng