

Engineering Physics / C.E.D.T. Research Hazards Safety Report

Project: Laser bone drilling; the laser system used in the experiments is Tsunami laser system.

System description: Ti: Sapphire solid state laser medium operates in a mode-locked operation over a broad range of near IR wavelengths (690 to 1080nm) and produces a pulse durations in the range of (few ps to 10fs) with ~10nJ maximum pulse energy and frequency of 70-90 MHz; pumped by solid state Nd: YVO4 continuous wave laser with a wavelength of 532nm, then pulses are amplified to 170fs pulses with maximum power of 500mW and 1kHz repetition rate.

Lasers hazards: American National Standards Institute (ANSI) classified lasers hazards depending on the laser output power or energy, the higher classification number the larger the risk. Tsunami and its pump laser are classified as a class IV high power lasers, since their beams are safety and fire hazards; reflections cause severe skin or eye damage.

Lasers with high power even they are CW or pulsed classified in the class IV and include the following hazards: diffuse reflection ocular hazards, direct reflection ocular hazards, skin damage hazards, and fire hazards.

Tsunami produces continuous and pulsed IR waves which can pass through cornea to the retina and cause permanent damage. Vision damage can occur even from the diffuse reflection of Tsunami laser due to its high power, and this type of accident is the most popular. Focused beam or beams with a very high intensity can cause skin burn, and cause explosion for the inflammable objects.

Precautions for safe operation of this class of lasers:

-Protective eyewear should be worn and selected depending on the wavelength and the intensity of the radiation; safety glasses are only for the diffuse light viewing; direct reflection should be avoided.

-The protective cover should be kept on the laser all the time.

-Avoid looking at the output beam, and avoid blocking it with any part of your body.

-Make sure that the laser beam is off before working in front of the laser, by using infrared detector. Also, use the powermeter to measure the beam intensity.

-Use the lowest possible beam intensity which gives the requirements of the application.