



UC IRVINE LASER SAFETY NEWSLETTER

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The purpose of this newsletter is to keep laser operators on this campus informed regarding laser safety news, bargains on laser safety equipment (including protective eyewear), novel/inexpensive methods for controlling laser hazards, lessons learned from laser accidents, and other tips to improve safety. These newsletters are distributed approximately every 6 months or whenever a laser safety issue with significant urgency arises. For past issues of this newsletter, please visit the UC Irvine Environmental Health & Safety website (www.ehs.uci.edu) and look under "Radiation & Laser Safety".

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ULTRAFAST PULSE RATED PROTECTIVE EYEWEAR

Some laser safety eyewear vendors are now inserting disclaimers into their advertising and on their websites regarding doubts about whether their standard protective eyewear is capable of adequately absorbing femtosecond-pulse radiation emitted by Ti:Sapphire regenerative amplifiers and other ultrafast lasers (*normally mode-locked lasers*) with pulse durations of less than one nanosecond. For example, Rockwell Laser Institute (RLI) currently includes the following disclaimer on its website:

"Note that some filters may exhibit saturated absorption when exposed to femtosecond laser pulses and may not afford adequate laser eyewear protection for those laser types."

It therefore appears that even though eyewear has sufficient optical density (OD) as determined using LAZAN[®], the computer program most frequently employed by laser eyewear vendors and laser safety professionals (*the pulse duration is an input parameter in that calculation*), **the eyewear might not be able to adequately protect against a direct hit by a high-power ultrafast-pulse laser beam.**



The standard eyewear will likely work well for diffusely-scattered ultrafast-pulse laser radiation and for greatly reduced power beams such as those ideally used during beam alignments.

Saturated absorption is not a problem when operating nanosecond-pulse Q-switched Nd:YAG lasers; it becomes a concern when the pulse duration is considerably less than one nanosecond -- on the order of picoseconds and faster. It is also not a problem for continuous wave lasers. But since ultrafast lasers are becoming more commonplace these days, including uses in research, industrial and medical/dental applications, sufficient care needs to be exercised to avoid eyewear failure and subsequent eye injuries.

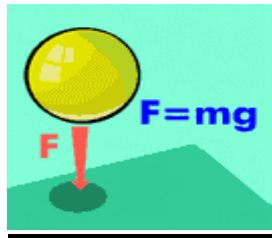
I have contacted many laser eyewear vendors and thus far have only identified one pair of reasonably priced polymer eyewear that the vendor certifies for use with ultrafast pulse lasers. All of the other **M-rated** (*ultrafast pulse-rated*) eyewear I identified is constructed of glass and costs \$430 or more per pair! Ordering information regarding the polymer eyewear is below:

California Safety & Supply Co.
44340 Osgood Road
Fremont, CA 94539
U.S.A.
www.calsafety.com

Email: contactus@calsafety.com
Phone: 408-969-5066 (Tom Nicholson)
Fax: 408-988-6623

GPT-Glendale Part Number LGF 31-30300
\$199 each (LGF frame fits over prescription glasses; other frames available -- see www.calsafety.com)

As always, make sure that sound engineering and administrative laser safety controls are in place in your laboratories. Those are your first lines of defense against laser hazards. Protective eyewear is essential for all open-beam laser operations but in reality it is your final line of defense!



MEMORABLE QUOTE

"Science may be described as the art of systematic over-simplification."

Karl Popper (1902–1994), Austrian-born British philosopher



INDIRECT VIEWING OF LASER RADIATION

One of the most common causes of laser accidents involves laser operators who do not use protective eyewear when aligning their lasers because they claim they need to “see the beam”. Unfortunately, in some cases these individuals end up seeing a lot more of the beam than is good for them and eye damage occurs.

There are several means available for indirect viewing of laser radiation:

1) “Infrared” Viewing Scopes

These are self-contained hand-held viewers that are sensitive to radiation ranging from the near ultraviolet through the near infrared, with peak sensitivity occurring in the near infrared. A high resolution image converter tube and high voltage power supply combine with precision optics to permit a clear view of objects or images which could not otherwise be seen by the naked eye – or, at least, shouldn't be attempted to be seen with the naked eye. These have a wide variety of applications, including aligning laser systems. Information on various types of these viewing scopes can be found on the website below:

<http://cascadelaser.com/ir-viewer.htm>

2) Beam Detector/Sensor Cards

These are cards that can be inserted into near infrared beams to indirectly visualize the radiation due to visible luminescence (due to “photon up conversion” or another process). They emit visible light when the sensitive region of the card intercepts the beam. Several types are described on the websites below:

http://www.eoc-inc.com/ir_sensor_cards.htm

http://www.lasercomponents.de/pdf/lc/ldt-008_e.pdf

http://www.ilxlightwave.com/propgs/accessories_infrared_sensor_cards.html

3) ZAP-IT® Paper

This is similar to photographic paper and it is sensitive over a broad range of laser wavelengths ranging from the ultraviolet to the far infrared. It is relatively inexpensive and can be used to determine beam shape, mode, intensity, energy distribution and divergence. More information is available at the website below. A holder is also available from this vendor so that it is not necessary to insert the ZAP-IT® Paper into the beam by hand:

<http://www.kentek-laser.com/accessor/zapit.htm>

The examples below are from this website. The first photo is for a misaligned laser system and the second photo is for an aligned laser system. In each case, a 3 msec pulse produced the image:



☞ *Note: Regular paper, such as that used to make standard business cards, can also be used to visualize ultraviolet radiation due to fluorescence.*



MEMORABLE QUOTE

" Science is organized knowledge. Wisdom is organized life."

Immanuel Kant (1724–1804), German philosopher



ONLINE LASER SAFETY TRAINING

At present, laser safety training at UC Irvine is conducted via classroom-type Laser Safety Seminars. However, two separate online laser safety training programs will be available within several months to UC Irvine laser operators:

1) A program assembled by the University of California Laser Safety Officers

This will be an in-depth laser safety training program that includes modules on all relevant topics including engineering safety controls, administrative controls, protective eyewear, laser safety tools, non-beam hazards, etc. This program is very high-tech and has a considerable amount of Flash animation and other enhanced visual imagery including some interactive slides. Each module has a short quiz at the end to ensure adequate comprehension of the material presented. There is also a final exam after all of the modules have been successfully completed. This program, which should be available within a few months, may take as long as 4 hours for the student to complete. That is the only disadvantage of this program. *(It has been adapted from an excellent laser safety training program produced by Lawrence Livermore National Laboratory.)*



2) A UC Irvine-produced program

This is a training program that I am putting together with the assistance of our EH&S Training Specialist, Jessica Drew de Paz. It will include all of the necessary safety information required to operate the lasers used on campus. It will cover the same topics as the UC Laser Safety Officers' training program but in a much shorter format, and without some of the "bells and whistles". There will also be a competency assessment in this program. It is expected that this course will take about 90 minutes for the student to complete. It will hopefully be available on the EH&S website sometime this summer.

☛ *Successful completion of either of the above online programs will fulfill the laser safety training requirement for UC Irvine laser users.*

For persons who prefer the classroom setting, Laser Safety Seminars will still be presented periodically. However, the principal advantage of the online programs is that they can be taken at any time from any computer that is connected to the internet. The longer UC Laser Safety Officers' training program is designed such that it can be completed one module at a time, if desired; the program retains a memory of which modules have been completed. The shorter UC Irvine training program is still in development, but it will likely also include several modules that can be completed one at a time in different sessions, if that is preferred by the student.

If you have any questions concerned with laser safety, please contact Rick Mannix from EH&S (949-824-6098; rcmannix@uci.edu).

☝ BE SAFE!