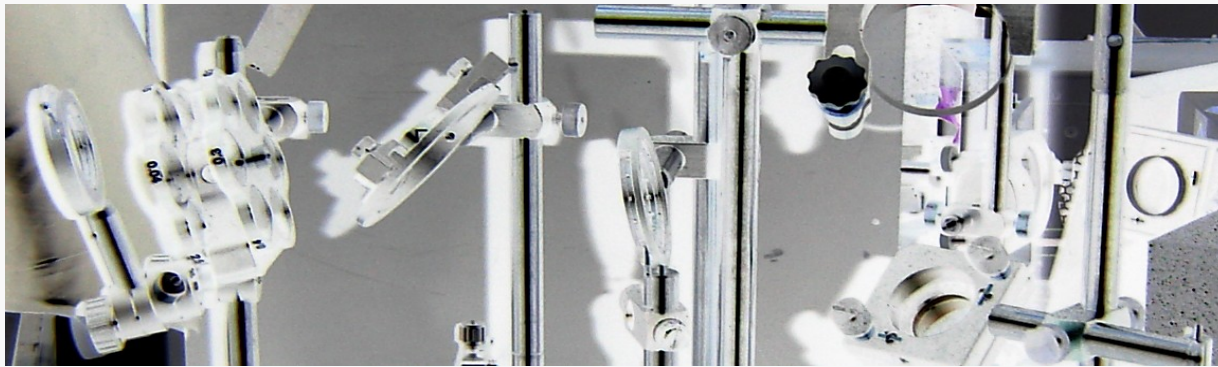


# **Laser safety in the PDY lab**



Anthony Fu  
Laser Safety Officer  
Nov. 11, 2013

# Why are we here?

- Lasers can be very dangerous:
  - UV lasers cause injuries in various components in the eye and skin
  - Visible and IR exposure burn retina – “Retinal Hazard Region” – 100,000 optical gain
  - Long-time UV exposure can cause skin cancer
- Laser accidents are always severe:
  - 93% laser-related accidents on campus result in eye injury, 72% cause permanent damage to the vision.
- Accidents can result in long investigations, lab shutdown or *university-wide* loss of DOE funding, including the LBNL.



# PDY Rules on Laser Lab (BG7)

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For most lab members, the necessary information:

- Rule #1 of Laser Lab: Don't go into Laser lab
- Rule #2 of Laser Lab: If you need help, ask a laser user.
  - BG7 – Anthony, Sarah, Yanwei (in the future)

# Wavelength and Injury Potential

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**200 to 400 nm** - Various components of the eye (excluding the retina) and the skin may be exposed under certain conditions. Photochemical and thermal effects are both possible at these wavelengths.

**400 to 1400 nm** - Called the “retinal hazard region,” these wavelengths can focus on the retina, causing severe retinal burns and trauma. The eye has an optical gain of about 100,000 (1 mW/cm<sup>2</sup> entering the eye effectively becomes 100 W/cm<sup>2</sup> at the retina).

**1400 nm to 1 mm** - Surface (cornea) of the eye and skin may be burned if the beam power is sufficient.

# Overview

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- Campus Laser Safety Administration
- How to become an authorized Laser user
- Preventing Laser Accidents

# Campus Laser Safety Program

<http://www.ehs.berkeley.edu/healthsafety/lasersafety.html>



Office of *Environment, Health & Safety*  
University of California, Berkeley

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Services

▀ Emergency Response

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▀ Hazardous Materials

▀ **Health & Safety**

▀ Radiation Safety

Laser Safety Program

Lead: Eddie Ciprazo  
Phone: 643-9243  
E-mail: [racerx@berkeley.edu](mailto:racerx@berkeley.edu)

Team: Health & Safety  
Associate Director: Brandon DeFrancisci

Description

The University of California at Berkeley Laser Safety Program is intended to provide staff, researchers, students and visitors with a safe laser use environment. All Class 3b and 4 lasers on the campus must be registered with the UC Berkeley Non-Ionizing Radiation Safety Program. The Office of Environment, Health & Safety administers this program for the UC Berkeley Non-Ionizing Radiation Safety Committee (NIRSC). The campus Laser Safety Officer (LSO) is responsible for implementation of the Non-Ionizing Radiation Safety program.

Please contact Eddie Ciprazo at (510) 643-9243 if you need additional information. Copies of training handouts, forms and manuals can be obtained by calling EH&S at (510) 642-3073.

Resources

[Laser Safety Program Fact Sheet](#)  
[Laser Safety Manual](#)  
[Laser Use Registration \(LUR\)](#)  
[Authorization Procedure for New Laser Users](#)  
[Laser Safety Training Supplement](#)  
[Laser Safety Forms](#)  
[Laser Safety Refresher Web Course](#)- A CalNet ID is required to access the online course through Berkeley's Learning Management System web site.  
[Non-Ionizing Radiation Safety \(non-laser\)](#) (Non-Laser)  
[Non-Ionizing Radiation Safety Committee \(NIRSC\)](#)

# Overview

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- Campus Laser Safety Administration
- **How to become an authorized Laser user**
- Preventing Laser Accidents

# Authorization Procedure for New Laser Users

Effective June 4, 2007

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<http://www.ehs.berkeley.edu/healthsafety/lasersafety/newuser.html>

All campus personnel whose work will involve unsupervised use of Class 3b or 4 lasers are required to complete the following steps prior to the operation of laser(s).

- 1) Enroll in the Initial Laser Safety class
- 2) Arrange to obtain a baseline eye exam within 60 days of meeting the training requirement. Information on the eye exam policy and procedures can be found in AppendixD on the Laser Safety Manual.
- 3) After meeting the training requirement, the Laser Safety Officer (LSO) will add the new user to the PI's Laser Use Registration (LUR).
- 4) The new user reviews, receives (on the job) training on, and signs the applicable laser standard operating procedure (SOP). The PI will verify that the new user is authorized to use the laser(s) by initialing the SOP signature page.
- 5) During the next laser inspection, the LSO will verify that all users are listed and authorized.



# PDY Group Fast Track for New Laser Users

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- Take Laser Safety Class
- Have Laser Safety Eye-exam (Instruction)
- Get your name on the Laser Use Registration (LUR)
- Sign the Standard Operating Procedures (SOPs)
- Go through Lab Laser Training

# 1. Take Laser Safety Class

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1. Log in to [blu.berkeley.edu](http://blu.berkeley.edu) using your CalNet ID.
2. Click on the "UC Learning Center" link on the left to see the catalog.
3. Search "Laser Safety training" in the catalog.
4. Click the "Register" button on the option presented. A list of all the available classes, presented in chronological order, will appear.
5. Select the session you wish to attend, then click the "submit" button at the top of the list. An email will be sent to you confirming your registration.

# 1. Take Laser Safety Class

The screenshot shows the MyBlu Self Service portal for a user named Ruoxue. The interface includes a top navigation bar with links like 'My Blu', 'People', 'Buying', and 'Finance'. A sidebar on the left contains a 'Self Service' menu with various options. The main content area features 'Blu News' with updates on cell phone policy and CSAC membership. A right sidebar lists 'Campus Resources' such as the Directory of Administration Services and CalAgenda. A 'Useful Links' section at the bottom left highlights the 'UCB Learning Center' with a red box. A weather widget for Berkeley, CA, is visible in the bottom right corner.

**Self Service**

- Careers Home ?
- Direct Deposit ?
- ADP Total Paycard Enrollment
- Earnings Statements Online ?
- W2 Online ?
- Update Personal Information [-]**
  - Personal Information Summary ?
  - Home and Mailing Address ?
  - Phone Numbers ?
  - Email Addresses ?
  - Emergency Contacts ?
  - Name Change ?
  - Ethnic Groups ?
- At Your Service Online
- Gartner Research
- e-Learn ?
- WarnMe ?
- UCB Learning Center ?**

**Useful Links**

- Administration

**Blu News**

**Cell Phone Policy update *NEW!***  
The IRS has permitted University of California to suspend the new Cell Phone Policy implementation until January 31, 2010. UC may use the former Cell Phone Policy (G-46) commencing with October's earnings. Questions? Please contact [Payroll Office](#).

**Blu Spotlight - Cal Marketplace**  
Visit [Cal Marketplace](#)'s brand new site --Your Gateway to All Things Cal!

**Join CSAC**  
The Chancellor's Staff Advisory Committee is recruiting new members. Download and complete the [2009 CSAC Membership Application form](#). The deadline for submitting applications is October 26. See [details](#) about the scheduled informational sessions and application writing workshops.

**Online Earnings Statements**  
Electronic earnings statements are now located at Office of the President's At Your Service website, which you can access from [MyBlu Self Service - At Your Service Online](#). You will receive an e-mail each payday from the UC Berkeley Payroll Office when your statement is available to view or print. You are still able to print/view statements prior to July 31, 2009 at [MyBlu Self Service - Earnings Statements Online](#).

**BFS Version 9 site live**  
Read [information](#) about the BFS financial system reimplementation. Questions? Contact the [project](#).

**Campus Resources**

- Directory of Administration Services
- CalAgenda
- CalMail
- Administration Calendar
- Campus Institutional Membership
- Berkeley Job Builder ?
- Notaries
- UC Ready - Continuity Planning

**Yahoo Weather**

Condition for Berkeley, CA  
Mon, 19 Oct 2009 9:53 am PDT  
**Light Rain**  
Temperature 50F

# 1. Take Laser Safety Class

The screenshot displays the UC Learning Center web application. At the top, the UC Learning Center logo is on the left, and the user's name 'ANTHONY FU' with a 'log off' link is on the right. A navigation bar contains 'Assess', 'Plan', and 'Learn' tabs. Below this, a 'Search' bar is highlighted with a red rectangle, containing the text 'Laser Safety Training' and a 'Go' button. To the right of the search bar, there are links for 'Advanced Search' and 'Search Tips'. Below the search bar, there are sections for 'Quick Links' (Edit Preferences, Manage Training, Training Transcript, Training Schedule, Training Analysis), 'Favorites', 'Current Registration' (Academic Orientation), and 'Complete Registration'.

The main content area is titled 'Welcome to UCB Learning Center!'. Below this, a 'To Do' section shows a table of training activities. The table has columns for Activity Name, Action, Assignment Type, Start Date, Due Date, and Status. The first row shows '2010 Compliance Briefing...' with a 'Start' button, 'Required' assignment type, and a due date of '12/31/2010'. Below the table, there is a section for '2010 Compliance Briefing: UC Ethica...' with a 'View Details' button and 'Other Actions'.

The bottom section is titled 'Catalog' and lists various training categories and topics, including Academic Policy and Practices, Business and Operations, Environment, Safety, and Emergency Management, Health Care Education, Occupation-Specific Skills, Organizational Effectiveness, Professional Skills and Career Development, Supervision, Management and Leadership, Technology, Systems and Software, UC Essentials, and Work Life and Wellness.

# 1. Take Laser Safety Class

The screenshot shows the UC Learning Center interface. At the top, there's a navigation bar with 'Assess', 'Plan', and 'Learn' tabs. A user profile for 'ANTHONY FU' is visible in the top right. Below the navigation bar, a search bar contains the text 'Laser Safety Training'. To the left of the search results, there's a sidebar with filters for 'Learning activities(2)', 'Categories (6)', 'Activity Type (2)', and 'Skillssoft Referenceware (199)'. The main content area displays '2 search results found' and a table with the following data:

Activity Name	Activity Type	Code	Start Date	End Date
Laser Safety	ILT Course	BEEHS003		
Laser Safety	ILT Class	BEEHS_LaserSaf...	10/6/2010	10/6/2010
Laser Safety	ILT Class	BEEHS_LaserSaf...	11/4/2010	11/4/2010
Laser Safety	ILT Class	BEEHS_LaserSaf...	12/8/2010	12/8/2010
Laser Safety	ILT Class	BEEHS_LaserSaf...	1/13/2011	1/13/2011
Laser Safety Refresher Online Tra...	eCourse	BEEHS_LaserSaf...		

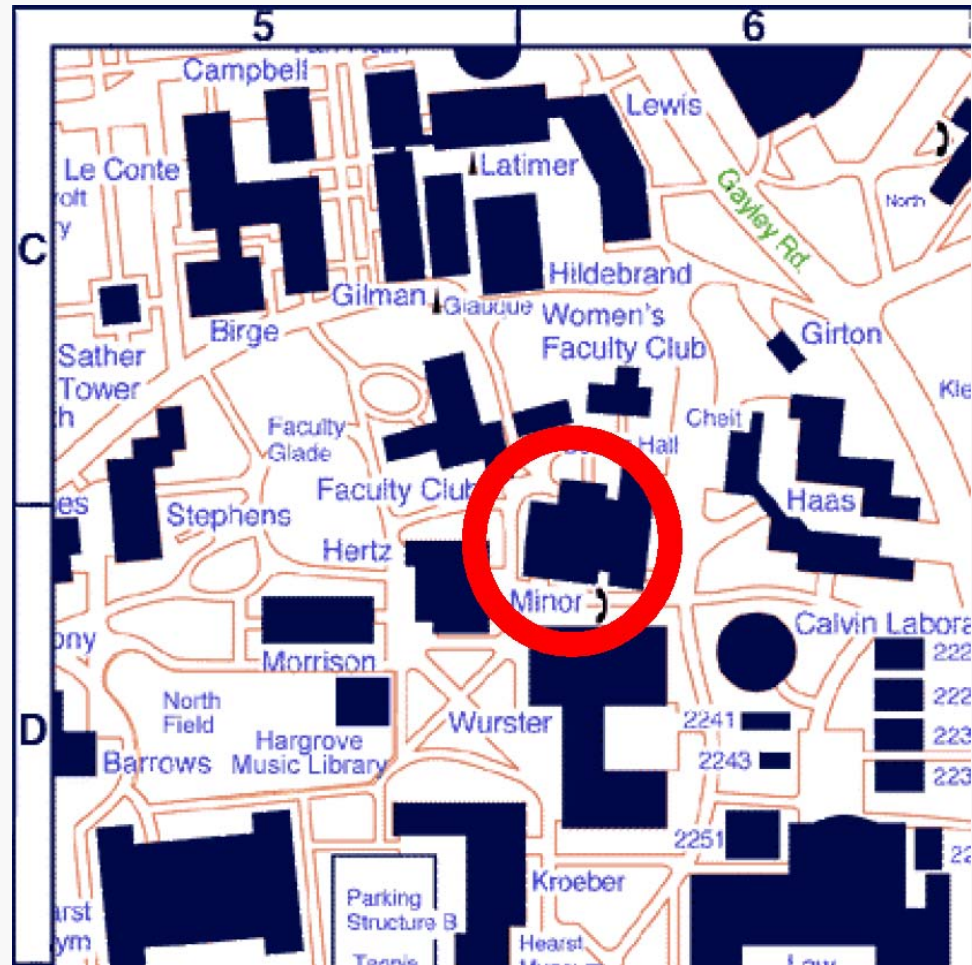
Below the table, the details for the 'Laser Safety' activity are shown. A red box highlights the 'Register' button. The description states: 'Click "Register" for a list of dates. After selecting a date, click "Submit." Classroom. Laser Safety Training is required for personnel whose work involves using a Class 3b or Class 4 laser system.' Other details include categories, locations, instructor, training organization, content type, and publish date.

Click "Register" for a list of dates. After selecting a date, click "Submit."



## 2. Laser Safety Eye Exam

- ***UCB Employer***  
University Eye Center  
642-2020  
Schedule laser safety  
eye exam asap
- ***LBNL Employer***  
Health Services  
Department  
486-6266



Meredith W. Morgan University Eye  
center (Minor Hall)

### 3. Get your name on the Laser Use Registration (**LUR**)

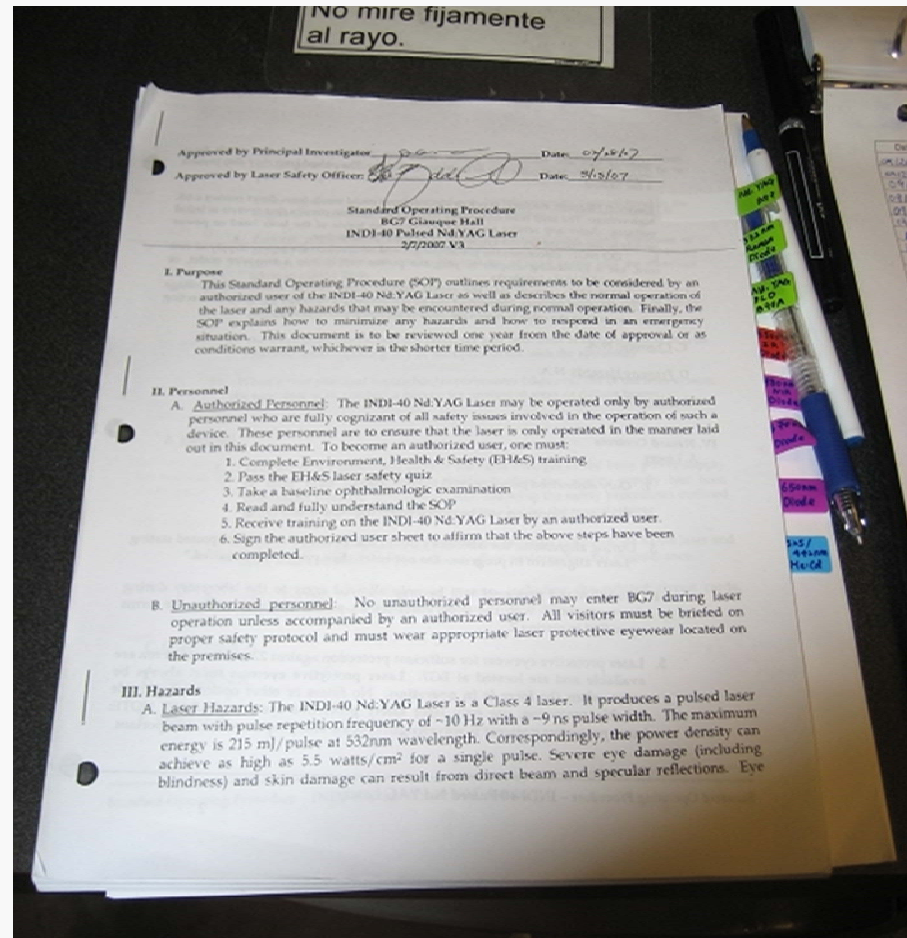
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- No class 3b or 4 lasers are allowed to operate without a LUR.
- Contains important laser specifications
- Ensures safe operation of lasers
- Used to track lasers on campus
- *After the eye-exam & safety class, ask Campus LSO to put your name on the LURs of the lasers you need to use*

racerox@berkeley.edu

## 4. Read and Sign the Standard Operating Procedure (SOP)

- Contains guidelines for the operation of each laser
- Updated regularly for new instruments
- Available in Lab:
  - ***Original copy-in Peidong's office-Authorized User Signatures***
  - Two Lab copies: File cabinet in B34, Front table in BG7





## 5. Group Laser User Training

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- Read and understand the SOP of the laser you need to use
- Schedule a training session with an authorized user (Listed on the SOPs)
- For the first 3 months, make sure at least one frequent user of the corresponding laser is around when you are operating

# Who can train you?

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## Main Optics Room

- 1) Anthony Fu
- 2) Sarah Brittman
- 3) Yanwei (future)

## Raman

1. Dohyung Kim

# Overview

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- Campus Laser Safety Administration
- How to become an authorized Laser user
- Preventing Laser Accidents

# Preventing Laser Accidents

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## **Safety is the first priority!**

Laser accidents are most common when the laser user:

- 1. Wears improper eyewear for the wavelength being used.**
- 2. Manipulates or aligns the laser without protective eyewear**
3. Gets hit by stray reflections in unknown or unexpected places
4. Fails to confine beams
5. Is distracted or rushing

# Laser Safety Eyewears for BG7 Lasers

- **UV lasers** (He:Cd 325nm, Nd:YAG 266nm)
  - Clear Plastic, **Dark Brown**, **Blue**
- **Blue/Green Lasers** (He:Cd —442nm, Nd:YAG 532nm)
  - **Dark Brown**
- **Red Lasers** (Diode 650/670nm)
  - **Blue**
- **IR Lasers** (Diode 980nm, Nd:YAG 1064nm)
  - **Dark Brown**



Clear Plastic (3 Pairs); LOTG-YAG/KTP (2 Pairs); Thorlabs Blue (3 Pairs)

# Preventing Laser Accidents

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## **Safety is the first priority**

Laser accidents are most common when the laser user:

1. Wears improper eyewear for the wavelength being used.
2. Manipulates or aligns the laser without protective eyewear
- 3. Gets hit by stray reflections in unknown or unexpected places**
4. Fails to confine beams
5. Is distracted or rushing

# Be a responsible laser user

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**If you add/removed optics, realigned the beam path, or altered the beam path in any way, make sure you:**

1. Check for **Specular Reflection**(stray beams), especially off-table reflections from the mirrors, filters, and lenses.
2. Confine stray beams, and if using high power lasers, confine diffuse reflections
3. Document any **modification to the beam path, the stray beam check and other safety notes** on ***BG7 Signup book***

Reminder: Do not wear watches, jewelries, badges or anything that reflects laser beams during operation.

# Anticipate potential hazards

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**Before going beyond the safety curtains in BG7**, please always be aware of:

Who is working in BG7 right now?

Which lasers are in use?

Which goggles to use?

Check **Online schedule** ([BG7time@gmail.com](mailto:BG7time@gmail.com)), **Door signs**, **BG7 Signup book (notes on stray beams)**, and **check with** the person(s) working in the room: 1. if it's safe to enter, 2. which safety eyewear to use.



# BG7 Door Signs



**"Danger"** Warning sign on means **Class IV YAG** is on!

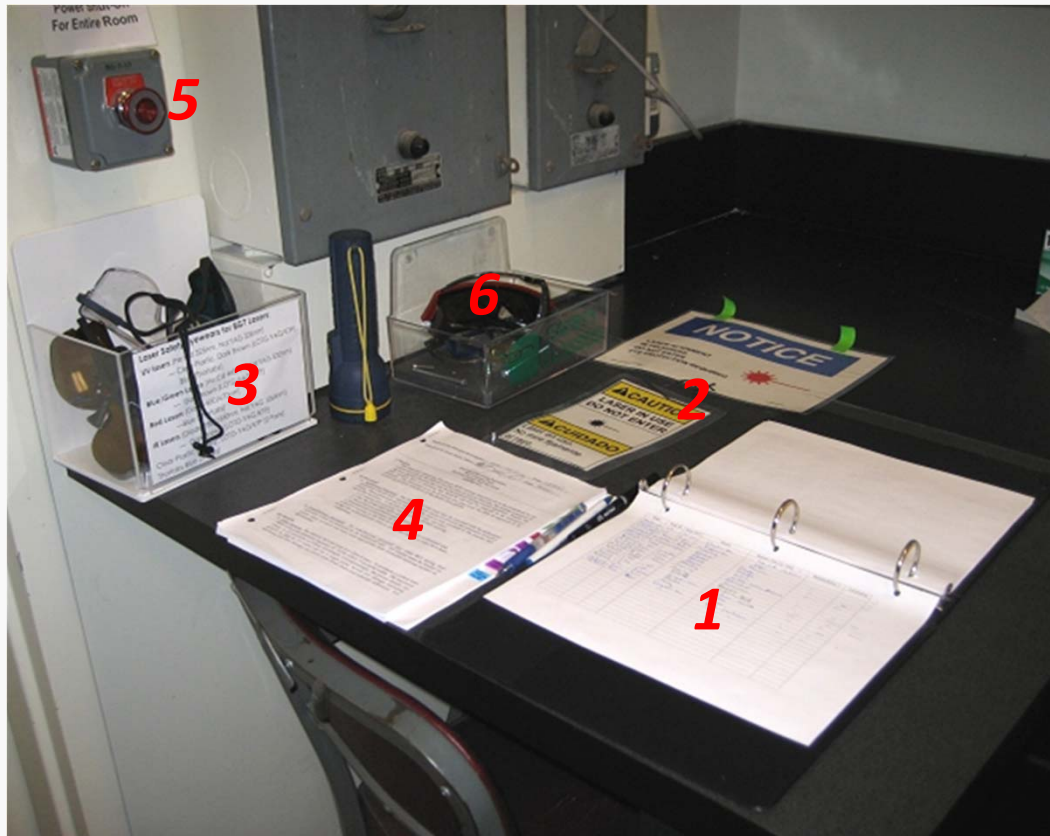
**Do not enter unless absolutely necessary!**



**"Laser Alignment in progress"** sign on the door:  
**Dangerous!** Lasers Not Confined, may have stray beams pointing to any direction!

**Laser(s) on!** Should be on the door whenever lasers are turned on

# BG7 Front Desk



1. **BG7 Signup book** (who's using lasers, **modification to beam paths**)
2. **Laser signs**
3. **Laser Safety Goggles** (User's instructions on the box)
4. BG7 copy of laser **SOPs**
5. **Emergency shut off button** (for all power supply in BG7)
6. **Normal lab goggles**, for handling chemicals, **NOT for laser protection**

**Layout of BG7 front desk  
(outside the safety curtain)**

# Emergency Procedures for laser accidents

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- 1) Shut down the laser system.
- 2) Provide for the safety of personnel (first aid, evacuation, etc.) as needed.
- 3) Obtain medical assistance for anyone who may be injured.

*Optometry Clinic (Normal Hours)* 2-2020

*Optometry Clinic (24 Hour Emergency)* 2-0992

*University Health Service (Emergency)* 2-3188

*Ambulance (Urgent Medical Care)* 9-911

- 4) If there is a fire, leave the area, pull the fire alarm, and contact the fire department (9-911).

# Emergency Procedures for laser accidents:

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- 5) Inform the Office of Radiation Safety (ORS) as soon as possible.

During normal working hours:

*ORS Office number* 3-8414

*Laser Safety Officer* 3-9566

*Radiation Safety Officer* 3-7976

After normal working hours, call 2-6760 to contact the UC Police Department (they have an ORS emergency call list).

- 6) Inform the Principal Investigator (Peidong) as soon as possible. If there is an injury, the PI must submit a report of injury to Risk Management.
- 7) After an accident, do not resume use of the laser system until the Laser Safety Committee has reviewed the incident.

# Laser Classes

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**Class 3a** - From 1 milliWatt to 5 mW - Unlikely to cause eye injury unless viewed with collecting optics or for prolonged periods (greater than the 0.25 sec. aversion response time).

**Class 3b** - From 5 mW to 500 mW - Can easily cause eye injury from intrabeam or specular reflection viewing.

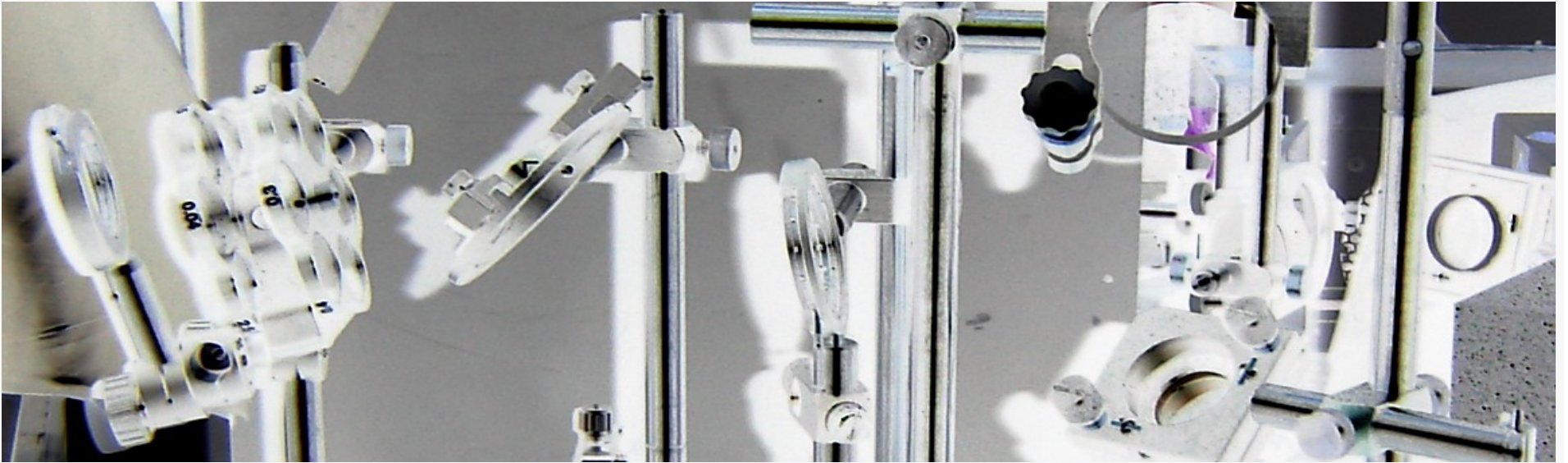
**Class 4** - Above 500 mW - Depending on beam power, can cause eye injury from viewing diffuse reflections. Can also cause skin injuries and ignite combustible materials in the beam path

<http://ehs.berkeley.edu/hs/133-laser-safety/laser-safety-manual/357.html>

All Class 3a and 3b (and 4) lasers require LURs.

# Questions?

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# Non-Beam Hazards

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## 1. Electrical Hazards

1. HV power supplies and capacitor banks. All known laser deaths have been from electrical sources

## 2. Toxic Lasing Media

1. Laser dyes can be mutagenic and carcinogenic.  
Halogen gases are toxic too.

## 3. Compressed gas / Cryogenics

## 4. Fire and Explosions

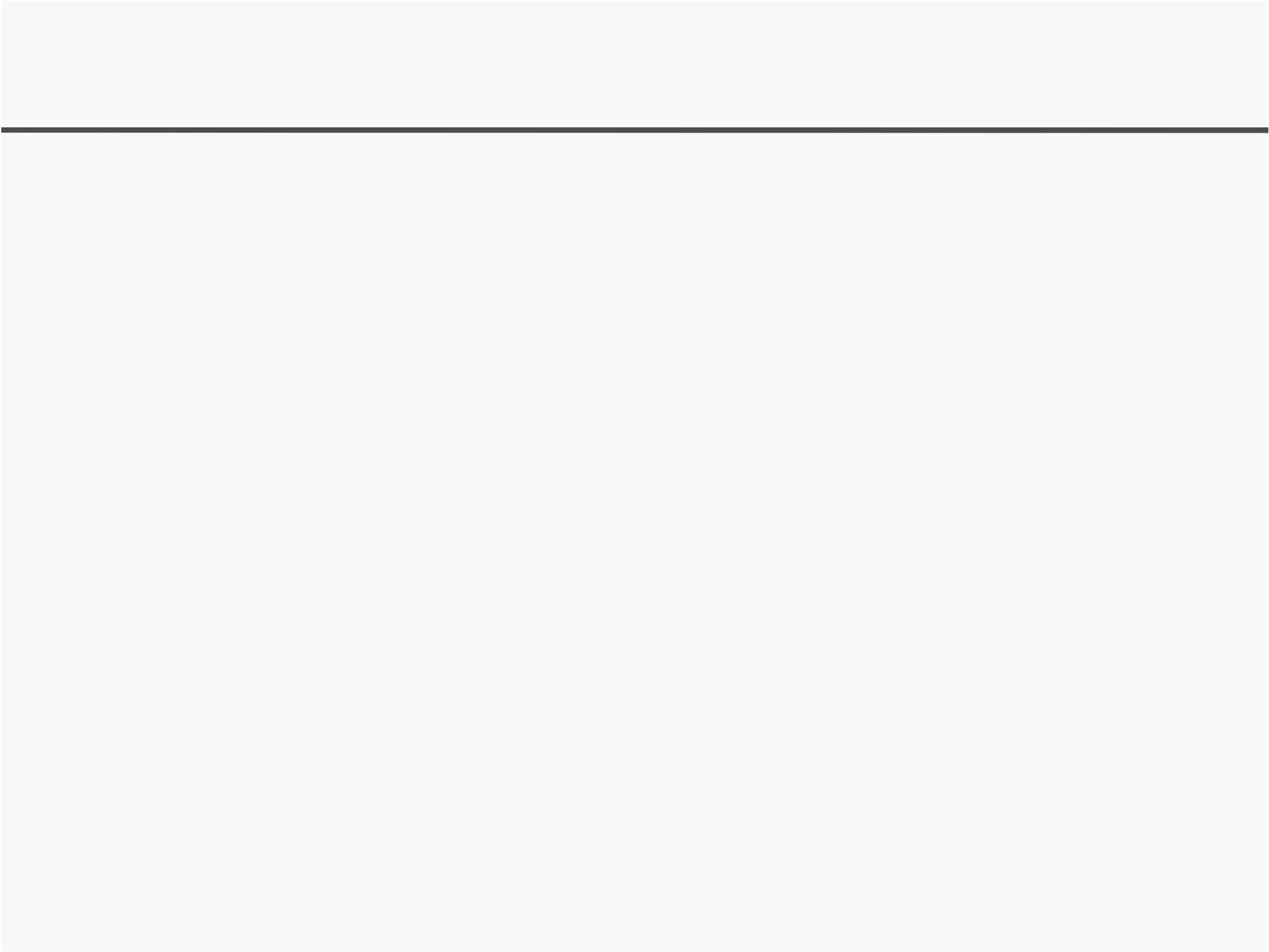
1. Class 4 lasers can start fires

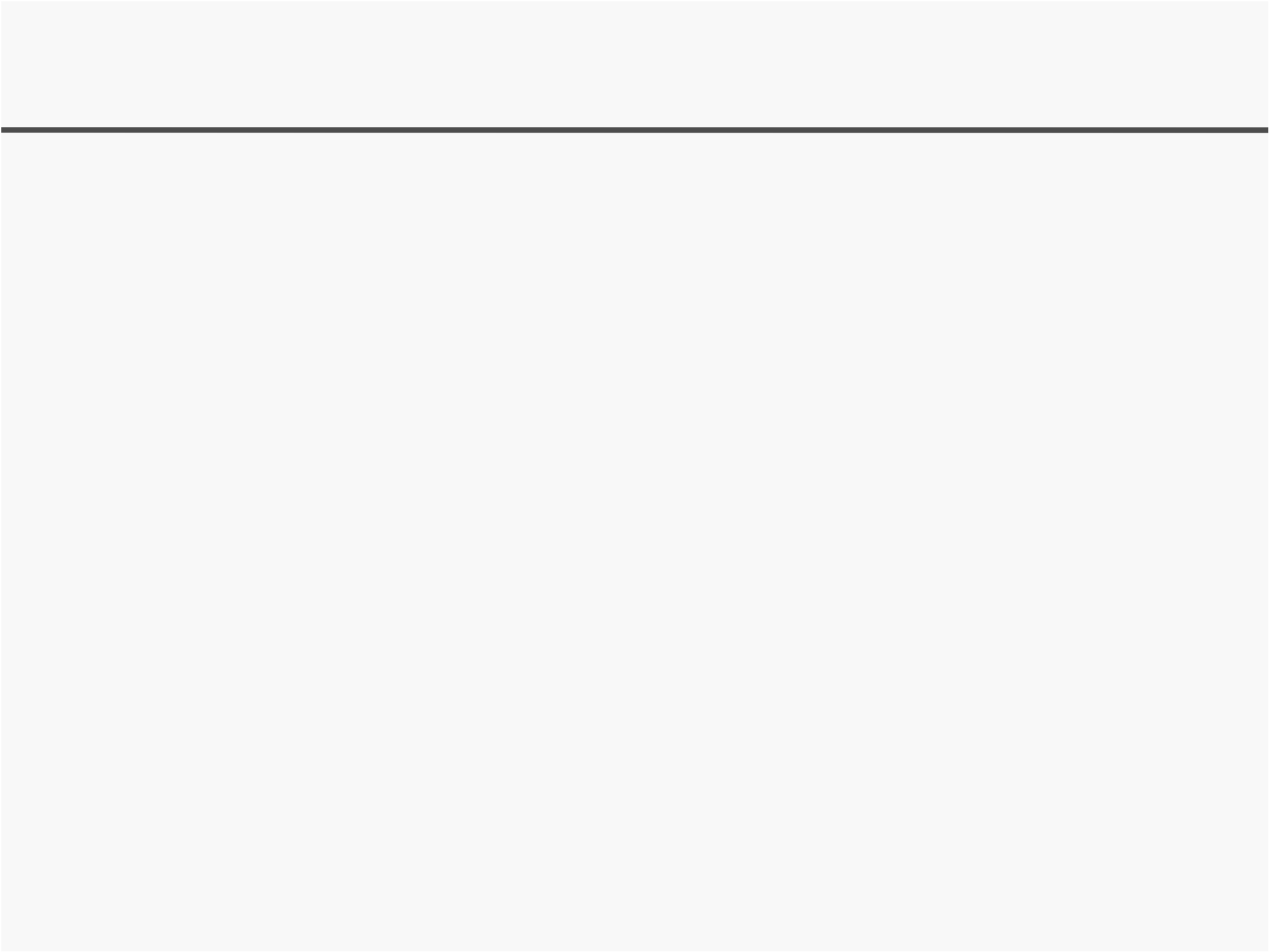
# Factors to Consider

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- 1.Laser Wavelength
- 2.Beam Power
- 3.Continuous vs. Pulsed
- 4.Pupil Size
- 5.Beam diameter







# BG7 Online Schedule

**BG7 time signup calendar:**

- “BG7 schedule” – Nikon, UV confocal and the integrating sphere, and HeCd, YAG and the diode lasers.
- “Raman” – Raman confocal microscope and the 3 Raman lasers (532, 633 and 785nm)

**Specify:** Name of User, Time span, optical systems/lasers, special notes (if any).

Day	Time Slot	User	System/Notes
Sun 10/18	8am - 10am	zhaoyu	HeCd
Mon 10/19	8 - 10	zhaoyu	Nikon
Mon 10/19	10p	Elaine	HeCd, Nikon
Mon 10/19	2p - 4p	jiongwoo	manipulator
Mon 10/19	4p - 12	Joe	Nikon HeCd
Tue 10/20	8 - 10	zhaoyu	HeCd
Wed 10/21	8 - 10	zhaoyu	HeCd
Thu 10/22	8 - 10	zhaoyu	HeCd
Fri 10/23	8 - 10	zhaoyu	HeCd
Fri 10/23	10 - 10:30p	Ruoxue	Nikon HeCd
Sat 10/24	5p - 12	Joe	Nikon HeCd