*Ministry of Higher Education and Scientific Research*

*Al – Zahraa University for Women*

*College of Medical and Health Technologies*

**Practical**

**Lecture 3**

# Visualization of Laser Setup and Beam Alignment

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## Visualization of Laser Setup and Beam Alignment

### 1. Learning Objectives

- **Identify the main components of a basic laser optical setup.**
- **Explain the purpose of beam alignment and the role of mirrors and a target screen.**
- **Observe the beam path using an approved, low-risk teaching setup.**
- **Apply essential laser laboratory safety rules before, during, and after the demonstration.**

### 2. Background and Key Concepts

**Laser setup:** **an arrangement of a laser source and optical components mounted in a stable line or optical path.Depending on the experiment, components may include mirrors, lenses or a beam expander, apertures, and a target screen or beam profiler.**

**Beam alignment:** **the process of positioning optical components so the beam follows the intended path and reaches the designated target. Good alignment reduces clipping and unwanted reflections and improves the repeatability of measurements.**

**Beam profile:** **the shape and intensity distribution of the beam spot observed**

on an appropriate screen or detector. Acentered, stable spot can indicate alignment, but does not by itself prove that every component is correctly aligned.

## 3. Equipment

| Equipment | Purpose |
|---|---|
| Enclosed or instructor-approved low-power laser | Provides the light beam for demonstration. |
| Optical bench / stable mounts | Keeps components fixed and at a consistent height. |
| Adjustable mirrors (if required) | Redirect the beam along the intended optical path. |
| Beam expander or lens (optional) | Changes beam diameter or focuses/reshapes the beam, as specified bythe experiment. |
| Target screen or suitable beam viewer | Shows the beam position without looking into the beam. |
| Beam stop / beam dump | Safely terminates the beam at the end of the path. |
| Laser safety eyewear rated for the laser wavelength and power | Provides wavelength- and hazard-appropriate eye protection. |

## 4. Laboratory Safety — Must Be Completed First

- Never look directly into a laser beam or at specular reflections, even when the beam appears faint.
- Only the instructor or an authorized, trained person should operate and align the laser.
- Use a low-power, enclosed, or otherwise institution-approved teaching system. Do not perform open-beam alignment with an unknown or high-power laser.
- Wear laser eyewear specifically rated for the laser wavelength and

**optical density required by the local risk assessment; ordinary glasses are not protective eyewear.**

**• Keep the beam below eye level where practicable, remove reflective jewellery/tools from the beam area, and secure**
**a beam stop at the end of the path.**
**• Keep access controlled, post the required warning sign, and follow the institution's laser safety procedures.**

## 5. Experimental Procedure (Instructor-Led Demonstration)

### Step 1 — Inspect the setup

**Confirm that the optical bench and mounts are stable, the beam path is clear, the target is in place, and the beam stop is secure. Keep the laser off during initial inspection.**

### Step 2 — Identify the optical path

**Locate the laser source, any optional optical element, each mirror, the target screen, and the beam stop. Trace the intended path without energizing the laser.**

### Step 3 — Establish the beam

**The instructor turns on the approved laser using the laboratory's procedure. Observe the spot only on the target or approved viewer; never place eyes or reflective objects in the beam path.**

### Step 4 — Observe alignment

**Check whether the spot reaches the designated target area and whether the beam is clipped by mounts or apertures.Make only small adjustments under instructor supervision and according to the equipment manual.**

### Step 5 — Check the full path

**Verify the beam reaches the target through the intended components and that no unintended beam exits or reflections are present. Use approved viewers or detectors rather than looking along the beam.**

### Step 6 — Secure and shut down

**Once the demonstration is complete, turn off the laser, secure or cover the source as instructed, and leave the bench in a safe condition.**

## 6. Observation Table

| Observation | Result / Notes |
|---|---|
| Laser source and wavelength (if known) | _____ _____ |
| Target screen position | _____ _____ |
| Spot appearance (round, distorted, unstable) | _____ _____ |
| Any clipping or unintended reflections observed? | _____ _____ |
| Was the beam stop in place? | Yes / No |
| Safety precautions followed | _____ _ |

## 7.ResultsandDiscussion

**A beam is considered to follow the intended path when it reaches the designated target without being obstructed by mounts or apertures and when unintended reflections are controlled. The target spot's position and stability should be recorded. Spot shape and brightness can be affected by the laser, optical elements, target surface, and detector, so they should not be used as the sole measure of alignment.**

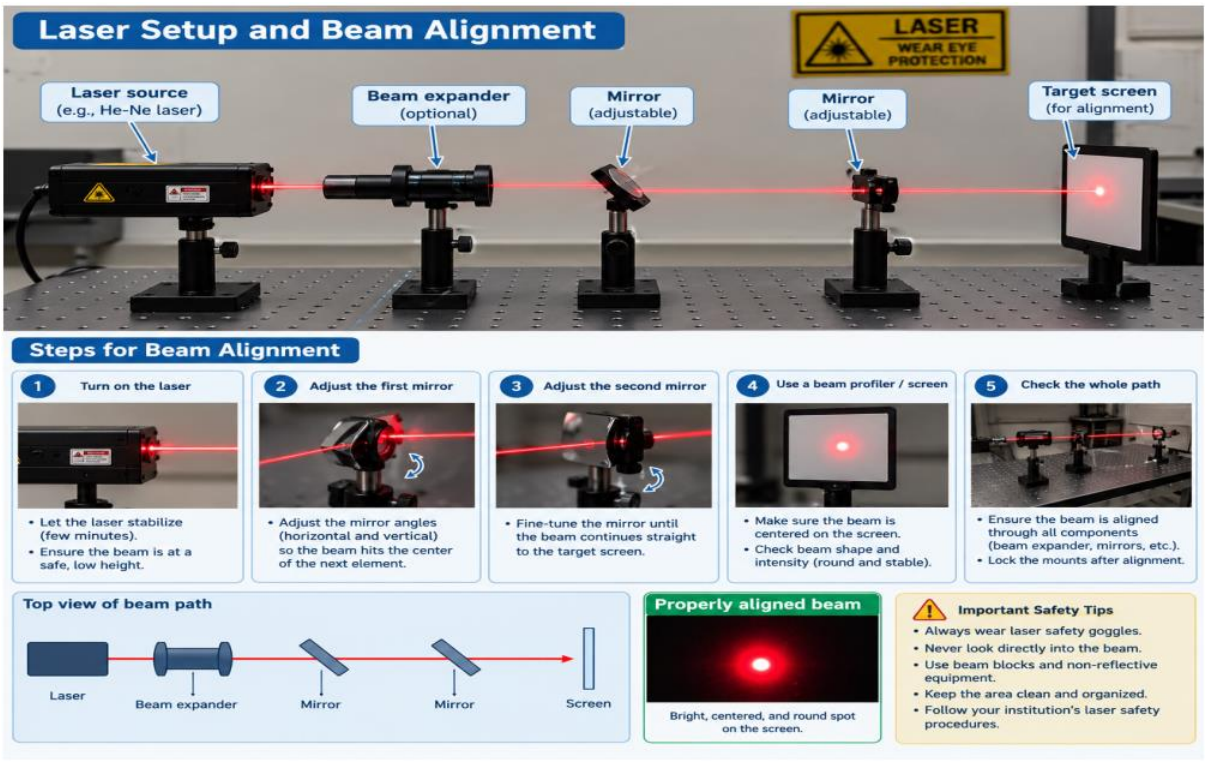
## 8.Conclusion

**This practical demonstrates the main parts of a laser optical setup and introduces the purpose of beam alignment .Stable mounts, careful observation of the target, a controlled optical path, and strict safety procedures are essential for reliable laboratory work.**

## 9. Review Questions

- **What is meant by laser beam alignment?**
- **What is the purpose of an adjustable mirror?**
- **Why is a beam stop or beam dump necessary?**
- **Why should the beam be observed on a suitable screen or detector rather than directly?**
- **Why must laser safety eyewear match the wavelength and hazard of the laser?**

## Suggested setup visualization




Illustrative diagram only. Actual equipment arrangement and procedures must follow the laboratory manual and the laser safety assessment.