General information

The overall setup of the microscope is shown in Figure 1 with laser been represented by blue and fluorescent light been represented by green. The overall setup is further divided into 4 subsections for details of alignment procedures and equipment used for assembling will be listed at the end of each section. It should be noticed that all optics were setup on a secondary breadboard that was elevated around 5inch higher than the optical table. The illumination laser was setup on a separate breadboard that is elevated around 1.5inch higher than the first one. This is done so that it provides enough space in z-direction for the alignment of optics and electronics could also been housed under elevated breadboard to save space. In addition, a bright-field imaging system was added in section 1 by using a removable turning mirror 2, S3, T4 and camera 2. This is done so that it provides the system a much easier way to locate the sample and the region of interest prior to the 3D scanning.

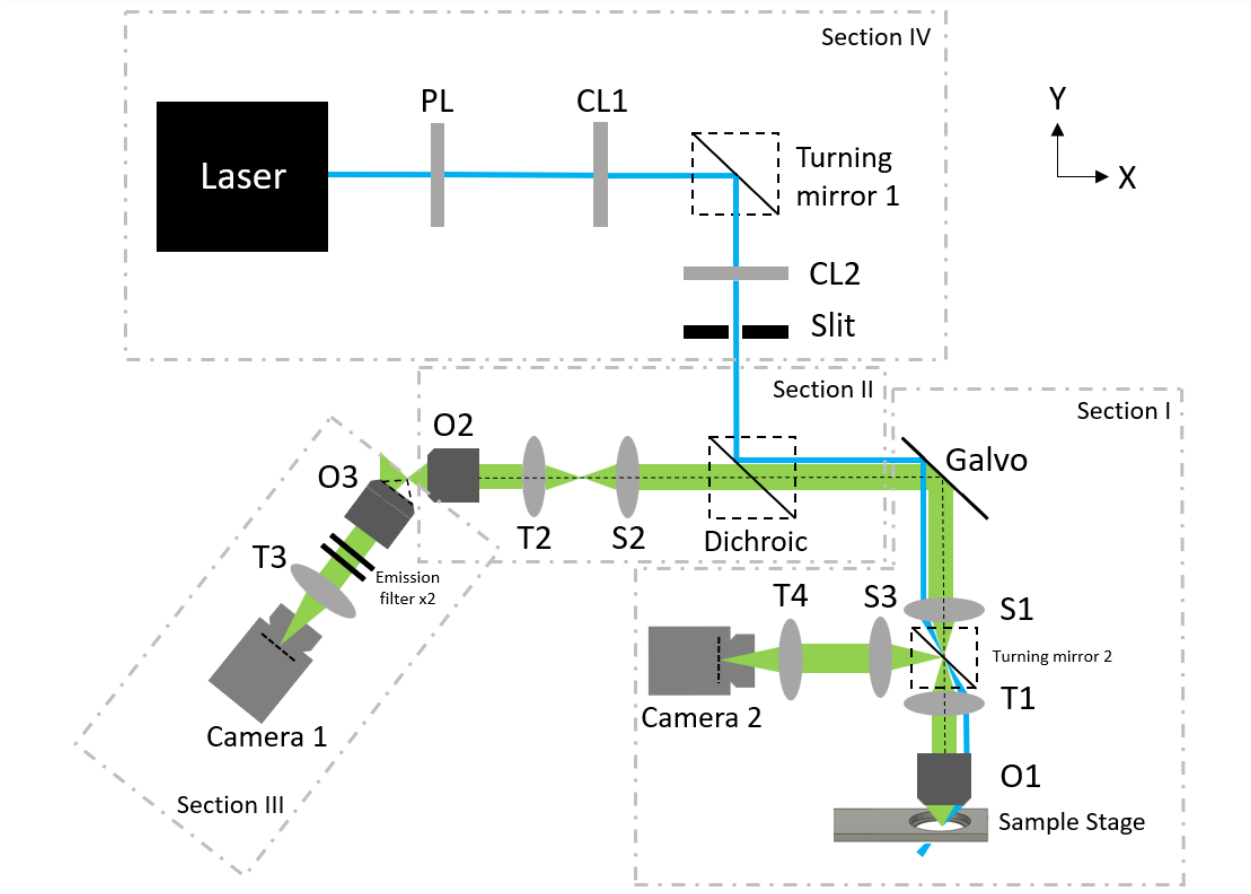

Figure 1 Overall setup of the microscope with subsections

Apart from the equipment and tools used in individual sections, several other equipment was used throughout the entire process for the calibration and mounting purpose. Cage system is widely used within the system to facilitate easier mounting and alignment. Both 30mm and 60mm cage system are used due to the need of lens in different size. As a result, generic naming will be used regarding cage system in subsections and the amount used will be detailed in tables. For calibration purpose, a shear plate compatible with beam size from 1-3mm (Thorlabs, SI035) were used to test collimation of beams. Another 4.5mW collimated laser module at 532nm with 3.5mm round beam size (Thorlabs, CPS532) were used to assist the alignment. The collimated laser module was fitted into the 30mm cage system by a SM1-threaded adaptor (Thorlabs, AD11F) and mounted onto a quick-release cage plate (Thorlabs, CP44F). In addition, both post-mountable and cage system iris diaphragms (Thorlabs, ID25 and CP20D) were used for lens positioning. Finally, laser viewing cards (Thorlabs, VRC1 and VRC2) were used to visualize the laser beam while minimizing its potential harm to eyes.

Before any part of the microscope was assembled, a 30×48inch optical table with 4inch thick breadboard (Newport, VIS3048-PG4-325A) was inflated using compressed nitrogen. The flatness of the surface was first checked by making sure the bubble leveler on each stand of the optical table was centered. After that, illumination laser (HUBNER Photonics) was used, and the height of the laser beam was measured over a long distance for verification. It is important to use the minimal laser power available (~1mW) during the flatness verification and a laser safety glass (ex. Thorlabs, LG14) should be used based on the wavelength of the laser used.

Table 1 General items used throughout all alignment processes

Item description	**Part number (Vendor)**
Shear plate (1-3mm beam diameter)	SI035(Thorlabs)
Collimated laser module, 532nm	CPS532(Thorlabs)
SM1-threaded adaptor	AD11F(Thorlabs)
Quick-release cage plate	CP44F(Thorlabs)
Post-mountable Iris diaphragms	ID25(Thorlabs)
30mm cage system Iris diaphragms	CP20D(Thorlabs)

Laser viewing cards (UV/Vis and Vis/NIR)	VRC1, VRC2(Thorlabs)
Laser safety glass	LG14(Thorlabs)
Illumination laser, 488nm	C-flex Series(HUBNER Photonics)
30×48inch optical table	VIS3048-PG4-325A(Newport)