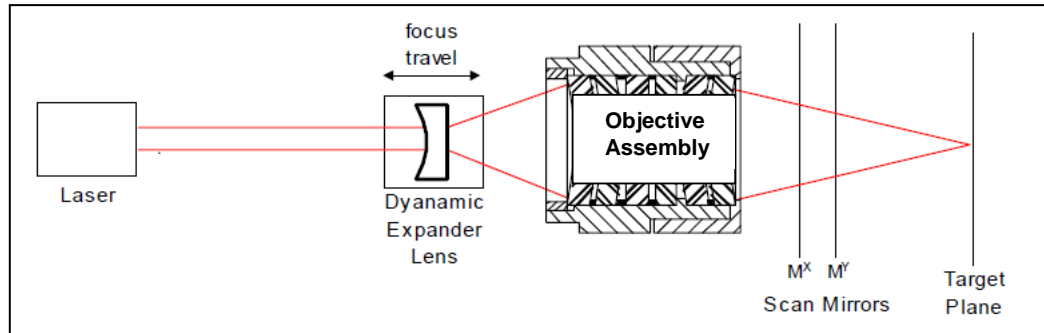


Theory of Operation

System Overview



Unfolded optical path of a standard 3-Axis System

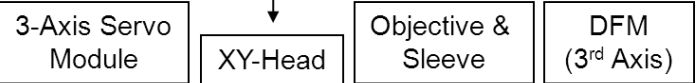
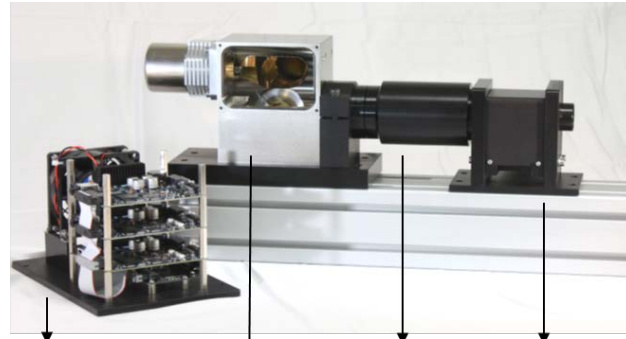
Cambridge Technology 3-Axis Scanning System's working mechanism is commonly referred to as "Post-objective scanning" or "Pre-scanning objective". The raw laser beam enters the optical system either directly or by using turning mirrors for optical alignment. The dynamic expander lens causes the beam to diverge strongly, thereby expanding quickly on its way to the imaging objective. The Objective lens re-images the beam waist formed by the dynamic expander lens onto the target plane. Motion of the dynamic expansion lens via the linear translator varies the target plane where the image is located; hence dynamic focus. The mirrors (M^x and M^y) located in the XY-head fold the beam and direct it by angular deflection to scan on the target plane. Orchestrated by a Cambridge Technology Controller, each XY coordinate at the work plane will also have its own Z value which adjusts dynamically throughout the whole job. The adjustment of focus is applied according to the programmed scanning geometry through a software look-up table on the fly. Using this technique, Cambridge Technology 3-Axis Scanning Systems can be used for:

- Correcting geometrical distortions in large field 2-Axis scanning applications
- Shifting the focus between different work planes

Together, they allow the Cambridge Technology 3-Axis System to enable true 3-dimensional scanning.

Components of a 3-Axis System

All 3-Axis Systems utilize the post-objective scanning technology. The scanning element (XY scan head) is positioned in the optical path after (post) the imaging element (objective lens). Post-objective scanning permits both fixed focus and dynamic focus laser beam configurations. The 3-Axis Scanning System employs a dynamic focus module in all standard variations.



XY-Head Module

The XY scan head module is an OEM unit with a laser-safe enclosure. The enclosure optically seals the input beam aperture and provides an output aperture that limits exposure to radiation outside the intended scan field. The XY Scanning Module deflects the laser beam in the X and Y axes under the control of the X and Y galvanometers that are attached to the mirrors. These galvanometers are closed loop, limited rotation, servomotors.

DFM Module

The Dynamic Focus Module (DFM) is a unique Z-axis scanning element that adjusts focus on the fly via a previously generated look-up table. The Dynamic Focus Module contains a lens cell (the dynamic expansion lens) that translates along its optical axis under precise motion control. The Dynamic Focus Module, like the X and Y scanners, is a galvanometer-driven device, a closed-loop, limited rotation, servomotor. It receives its control signal and power from the D-to-A Card.

Objective Lens

The Objective Lens couples the beam from the dynamic expansion element through the XY scan head and onto the target field as a focused spot. Its focal length, the distance from the dynamic expansion lens, and the focal length of the dynamic expansion lens determine the working distance of the target as well as the leverage ratio between the translator motion and the motion of the focused spot.

Servo Module

The Servo Electronics are tuned individually for each scanning system. The Module comes with standard XY2-100 Digital Communication and Power interfaces. The power requirement for each model may vary depending on the family and the configuration.

Controller Electronics – Optional

Cambridge Technology Inc. provides a variety of controller products for each application. Please contact CTI to choose the most suitable controller for your application.

Protection Window Kits – Optional

Cambridge Technology Inc. offers additional options such as protection window kits for CO₂ and Nd: YAG lasers to prevent the scan head mirrors from being contaminated by nearby sources. Check with a CTI technical sales representative for the latest version and compatibility.