

CLAIMS

We claim:

1. A system comprising;
a plurality of modular subassemblies and a precision mounting plate;
wherein each modular subassembly comprises an enclosure and a plurality of optical components aligned to the enclosure, and the enclosure comprises a plurality of precision mounting structures; and
each modular subassembly is mechanically coupled to the precision mounting plate, such that each precision mounting structure from a modular subassembly attaches directly to a corresponding precision mounting structure located on the precision mounting plate or an adjacent modular subassembly.
2. The system of claim 1, wherein the plurality of modular subassemblies comprises a line generation module, a focus tracking module, a camera module, or an emission optics module.
3. The system of claim 2, wherein the line generation module comprises a first light source operating at a first wavelength, a second light source operating at a second wavelength, and a beam shaping lens aligned at a predetermined angle to each light source.
4. The system of claim 3, wherein the first wavelength is a green wavelength or a blue wavelength, the second wavelength is a green wavelength or a red wavelength, and the beam shaping lens is a Powell lens.
5. The system of claim 2, wherein the emissions optics module comprises an objective lens optically coupled to a light generation module, and a tube lens optically coupled to the objective lens, the objective lens to focus light onto a flow cell positioned at a predetermined distance from the objective.
6. The system of claim 5, wherein the objective is to articulate along a longitudinal axis to move a focal point of the objective with respect to one or more surfaces of the flow cell.

7. The system of claim 5, wherein the flow cell comprises a translucent cover plate, a substrate, and a liquid sandwiched therebetween, and a biological sample is located at an inside surface of the translucent cover plate or an inside surface of the substrate.
8. The system of claim 7, wherein the biological sample comprises a DNA sample or an RNA sample.
9. The system of claim 2, wherein the focus tracking module comprises a focus tracking light source and a focus tracking sensor:
wherein the light source is to generate a light beam, transmit the light beam through the plurality of optical components such that the light beam terminates at the focus tracking sensor; and
the focus tracking sensor is communicatively coupled to a processor and a non-transitory computer readable medium with machine-readable instructions stored thereon, the machine-readable instructions, when executed, cause the processor to:
receive an output signal from the focus tracking sensor; and
analyze the output signal to determine a set of characteristics of the light beam.
10. The system of claim 9, wherein the machine-readable instructions, when executed, further cause the processor to generate a feedback signal indicating that one or more of the optical components should be reconfigured to optimize the set of characteristics of the light beam.
11. The system of claim 1, wherein at least one of the modular subassemblies is a field replaceable unit.
12. The system of claim 1, wherein the plurality of precision mounting structures comprises a slot, a datum, a tab, a pin, or a recessed cavity.
13. The system of claim 2, wherein the camera module comprises a plurality of optical sensors, and the light generation module comprises a plurality of light sources, wherein

each optical sensor is oriented to receive and detect a fluorescent light beam emitted from an optical target triggered in response to a light beam emitted from one of the light sources.

14. A method comprising:
 - disposing a plurality of light sources within a first enclosure;
 - disposing a tubular lens and an objective within a second enclosure;
 - disposing a plurality of optical sensors within a third enclosure;
 - disposing a focus tracking light source and a focus tracking optical sensor within fourth enclosure; and
 - mounting each of the first enclosure, the second enclosure, the third enclosure, and the fourth enclosure to a precision mounting plate.
15. The method of claim 14, further comprising disposing a beam shaping lens within the first enclosure.
16. The method of claim 15, further comprising testing and aligning the plurality of light sources and the beam shaping lens to the first enclosure before mounting the first enclosure to the precision mounting plate.
17. The method of claim 14, further comprising:
 - generating a light beam with the focus tracking light source;
 - transmitting the light beam through the objective such that the light beam reflects off a flow cell oriented and a predetermined distance from a distal end of the objective;
 - receiving a reflection of the light beam at the focus tracking sensor;
 - generating a feedback signal using the focus tracking sensor;
 - reorienting the tube lens, the objective, or the second enclosure, in response to the feedback signal.
18. The method of claim 17 further comprising articulating the objective along a longitudinal axis to move a focal point of the objective with respect to one or more surfaces of the flow cell.

19. The method of claim 17, further comprising fabricating the flow cell by sandwiching a liquid between a translucent cover plate and a substrate, and disposing a biological sample on the one or more surfaces of the flow cell.

20. The method of claim 19, further comprising locating the biological sample at a top surface and a bottom surface of the liquid, wherein the biological sample comprises a DNA sample or an RNA sample.