COMPACT LIGHT SHEET MICROSCOPE CONTROL SYSTEM

Joe Li[1], Kiley Smith[1,2], Brittany Glaeser[1,2], Jan Huisken[1,3]

[1] Dept. of Medical Engineering, Morgridge Institute for Research, Madison, WI, USA;
[2] University of Wisconsin, Madison, USA;
[3] Dept. of Integrative Biology, University of Wisconsin, Madison, USA.
E-mail: jli@morgridge.org

Light sheet microscope control is a challenge for scientists and researchers who are interested in developing repeatable, precise and flexible experiment workflows. The lack of integration and synchronization of the many microscope components have produced less than optimal experiment results. The Huisken Lab's solution is to develop an effective smart light sheet microscope control system to meet the experiment needs of the biologists, researchers, scientists and light sheet microscope enthusiasts.

We utilize low-cost, off-the-shelf, small micro-computers and micro-controllers to interface with the microscope components and provide an integrated control system. Custom hardware and firmware are used to synchronize microscope operations and control. Each hardware subsystem component is independently modularized to permit many variations of components that may be used to build the microscope without any modifications to the control system. For example, selecting a Toptica MLE over the CLE for more power. Additionally, the control system is capable of supporting the multiple configurations of the Flamingo portable and shareable microscope. The microscope may have one or two cameras, different laser engines or stage configurations; the control system is able operate all of the microscope's configurations.

Microscope control is accomplished with a user interface application that connects to the instrument over a network wired or wireless connection. The user interface is built as a drag and drop application that encapsulates all its dependencies and is able to run without any additional software installs. The user interface application and one settings file are all that are required to operate the microscope. The control system also accepts multiple connections and allows non-co-located users to operate the scope simultaneously in a collaborative venture.

We streamline common workflows in to a few simple mouse clicks to allow ease of operation while providing a rich set of options for experiment flexibility and customizability. The blend of software, firmware and hardware provide the scientific community a systematic way of precision data collection, workflow automation, results collaboration and a high degree of experiment configuration.
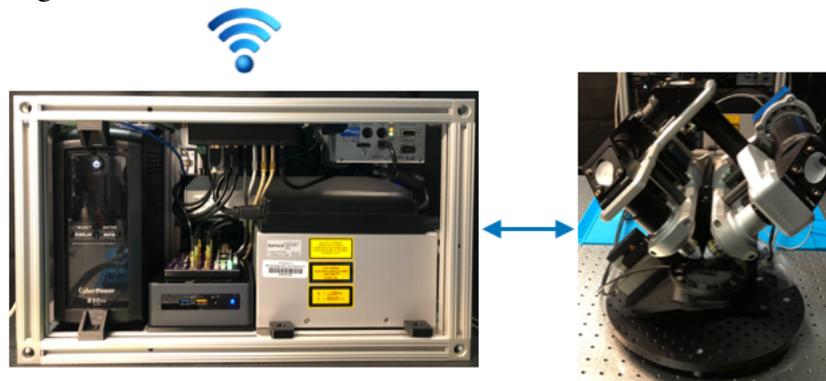

Figure 1: Control system with Flamingo in V-SPIM configuration.