Developing microscope software with Python

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We have created Microscope and Cockpit, two Python packages to dramatically reduce effort required for bespoke microscope development. Scientists that would rather be building microscopes are instead spending their time in low-level software development and GUI toolkits to control the microscopes. This software ends up being tied to the specifics of the devices, impossible to maintain, or incur ongoing licensing costs. Effort is wasted as scientists in different labs, and even in the same lab, keep independently implementing solutions to the same problems.

Microscope is a Python package that provides remote control of microscope devices, abstract base classes of different type of devices, and concrete implementations for a wide range of devices. Remote control enables us to control arbitrarily complex microscopes by distributing devices across multiple machines, while the common interface enables us to swap devices from different vendors without changes to the underlying code.

On top of Microscope we have created Cockpit, a graphical interface for microscope control and running both simple and complex experiments. The Cockpit interface adjusts to the available devices, providing device independent access to a wide range of hardware. Experiments are written in Python and provide generic experiment types such as time lapse or Z-stacks, as well as much more complex experiments, independent of the actual device details.

We have successfully deployed Cockpit on a number of bespoke microscope systems, and used Microscope in student projects and for the development of microscope tools.