A DUAL CAMERA LIVEVIEW ADDON TO FACILITATE SAMPLE POSITIONNING IN OPENSPIM SETUPS

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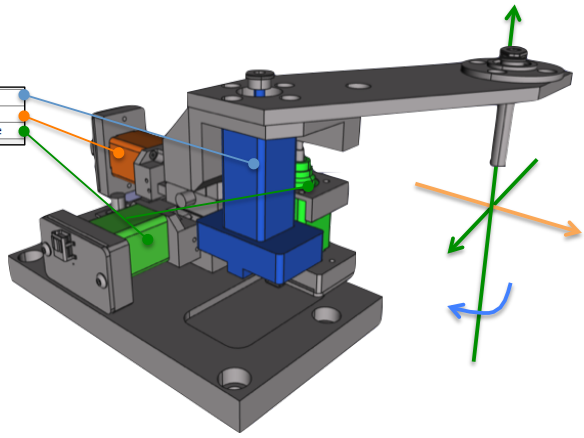
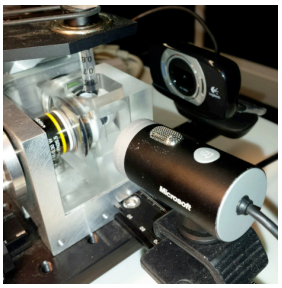
We have designed a Micro-Manager add-on that can help positioning the sample in the observation axis. It is based on the Webcam Capture Java library, and made available as a Micromanager plugin. The "Stage Cam Control" plugin allows to simultaneously present live image feeds from USB web cameras in a single image panel. Used in combination with e.g. the Picard Industries USB-4D-STAGE it allows easy alignment of the specimen while not needing to look at the specimen chamber directly, or in case where the entire light sheet setup needs to be kept in a dark enclosure for ambient light isolation.

4D Picard Stage

The Picard Industries 4D stage device used in Openspim setups is a precision motion control system made of three linear actuators for X,Y, and Z axis motion, and an additional stepper motor for the rotation axis. All are controlled over USB. Windows drivers are available to control the four axis from a dedicated software from Picard Industries, and a matching device adapter is available for Micromanager. The XY motor pair is seen from Micromanager as a supported XY stage. The Z axis will move the sample along the focal axis and is recognized as a Z stage. The theta axis, or "Picard Twister" device, controls the rotation of the sample holder, which Micromanager sees as a separate Z stage.

Picard Twister	Picard Twister/Pica…	Twister
Picard Z Stage	Picard Z Stage/Pica…	Z stage
Picard XY Stage	Picard XY Stage/Pic…	XY stage



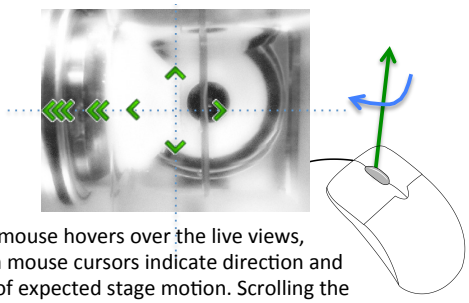


Webcam capture library

The Webcam Capture library by Bartosz Firyn allows to use a variety of webcam-like devices from Java. It's been designed to abstract common camera features and cameras themselves. Device abstraction hides the details of talking to a specific class of device and allows to write short and reusable code, as in:

```
webcam = Webcam.getDefault();
webcam.open();
image = webcam.getImage();
```

Intuitive user interactions

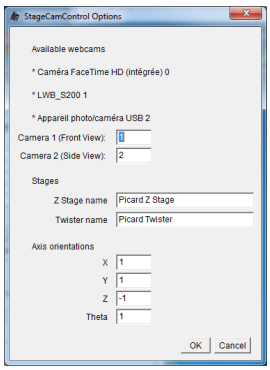


As the mouse hovers over the live views, custom mouse cursors indicate direction and speed of expected stage motion. Scrolling the mouse wheel rotates the Twister stage (*alt*-scroll for *FINE* step size)

Dual Camera Stage Control plugin

Micro-Manager has an open framework the accepts plugins written in Java. Plugins should implement the MMPlugin interface, and gain access to MM GUI, core acquisition and device control through MM API.

The Stage Cam Control options dialog

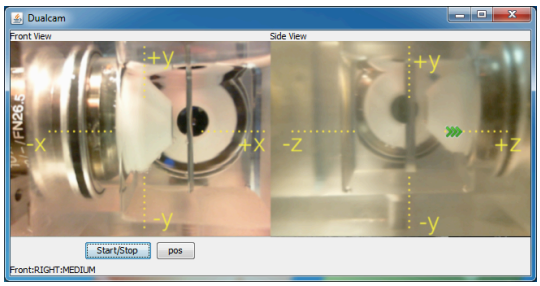


Choose from a list
Of connected webcams

In MM, devices are known by their given names

Axis orientations can be flipped (or scaled)

Graphical user interface



Users are presented with the "Front" and "Side" live views, with labelled axis overlaid. Currently provided additional functions include buttons for stopping and restarting the live feeds, and a "pos" button that dumps the current stage coordinates.
Future versions might include a 4D positions manager.

OpenSpim: http://openspim.org
Micro-Manager: https://www.micro-manager.org
Picard Industries: http://www.picard-industries.com
Webcam Capture documentation: http://webcam-capture.sarxos.pl
Stage Cam Control source code: https://github.com/mutterer/StageCamControl