

SLStudio User Manual

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Required Software

- QT Creator 5.9.5
- Point Cloud Library (PCL) 1.8
- OpenCV OpenCV 3.2.0
- ROS with the following packages
 - Versavis (devel/sl_sensor branch from [forked repo](#))
 - flir_camera_driver (devel/sl_sensor branch from [forked repo](#))

Running SLStudio

- Start Versavis to begin image acquisition
 - If using hardware trigger:
 - In `versavis_configuration.h`, change the camera trigger frequency based on the type of pattern used (PSP+TPU or 2P1 with TPU). Header file has comments to indicate with lines of code to comment/uncomment
 - Upload `versavis.ino` onto the board
 - In a terminal, run the code
 - `roslaunch versavis sls_run_versavis.launch`
- Launch SLStudio
 - In a separate terminal (need to be launch for a terminal to run properly with ROS), run
 - `qtcreator`
 - Open the SLStudio project in qtcreator
 - Press Run (Large green triangle)

Main Menu

SLStudio → Preferences

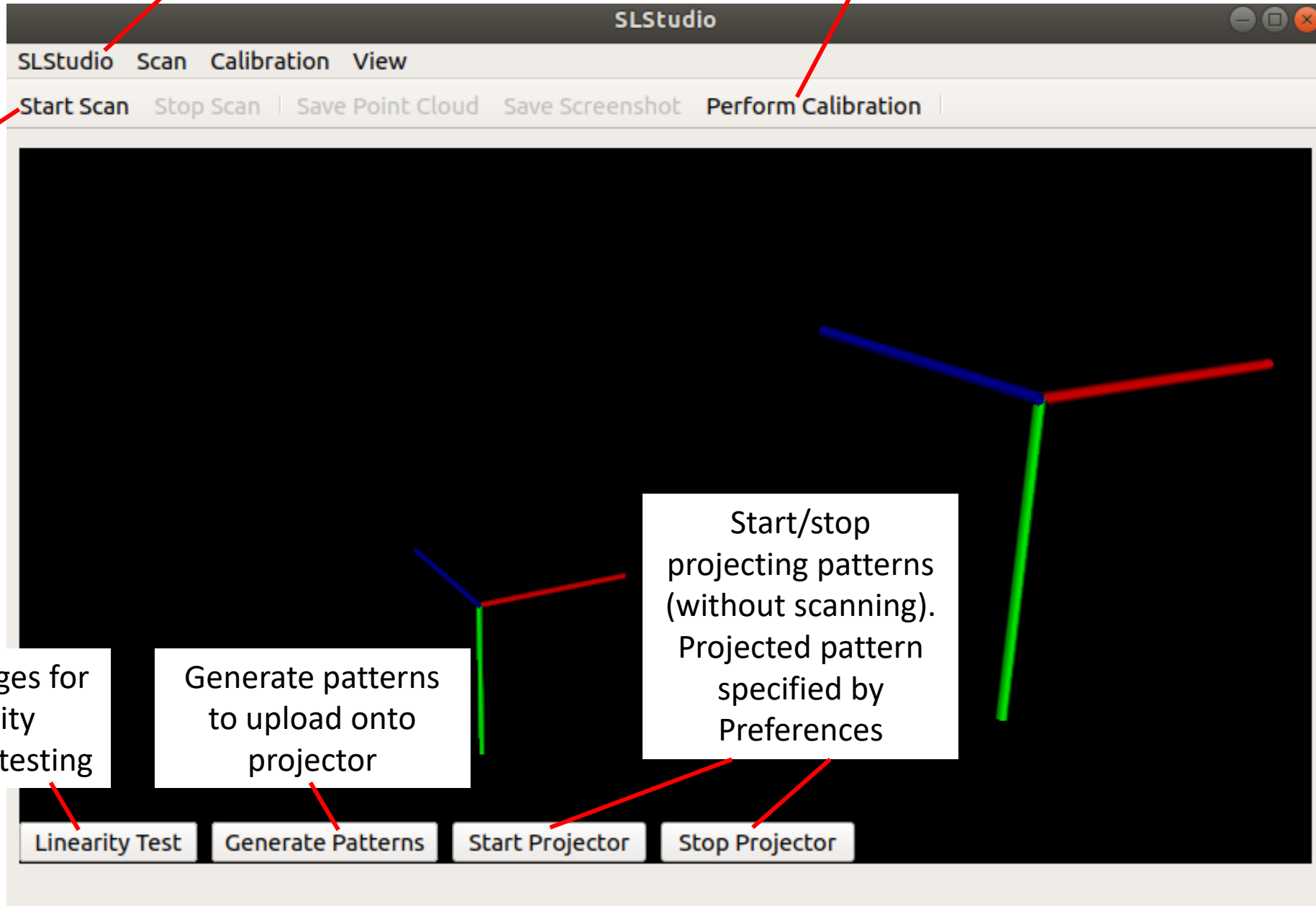
Go to calibration screen

Start
scanning

Grab images for
linearity
response testing

Generate patterns
to upload onto
projector

Start/stop
projecting patterns
(without scanning).
Projected pattern
specified by
Preferences



Preferences

Pattern to be projected.

Currently only supports:

- 2x3 Pattern Phase Shift
- 2+1 Pattern with TPU

Project vertical and/or horizontal patterns. Note 2+1 TPU only supports vertical or horizontal, but not both together

Check this because Lightcrafter has a diamond pixel arrangement

Shutter option is currently not in use, exposure time is managed by flir_camera_driver ROS package and is set to 16.667ms

The image shows a 'Preferences' dialog box with the following sections and settings:

- Aquisition:** Radio buttons for 'Continuous' and 'Single Point Cloud'. 'Single Point Cloud' is selected.
- Pattern Mode:** A dropdown menu showing '2x3 Pattern Phase Shift'.
- Horizontal/Vertical:** Checkboxes for 'Horizontal' and 'Vertical', both of which are checked.
- Projector:** A dropdown menu showing 'LC4500 Versavis API'.
- Diamond Pixel Pattern:** A checked checkbox.
- Camera:** A dropdown menu showing 'ROS: Grasshopper3 over ROS Driver'.
- Shutter:** A numeric input field set to '16.667' with a unit of 'ms'.
- Trigger Mode:** Radio buttons for 'Hardware' and 'Software'. 'Software' is selected.
- Shift/Delay:** A numeric input field set to '0' for 'Shift' and a numeric input field set to '50' for 'Delay', both with a unit of 'ms'.
- Write to disk:** Checkboxes for 'Captured Frames', 'Point Clouds', and 'Tracking Data'. All three are unchecked.

At the bottom of the dialog are 'Cancel' and 'OK' buttons.

When Start Scan is pressed:

- 1) Continuous: Whether to keep scanning until Stop Scan is pressed
- 2) Single Point Cloud: just scan once

Currently only supports the combination
Projector: LC4500 Versavis API
Camera: ROS driver

Hardware or software triggered
(Camera is always hardware triggered, but projector is software triggered)

For software trigger, amount of delay between grabbing of next image

Whether to save the captured images/point cloud. Tracking data is currently not used

Calibration

The screenshot shows the 'SL Calibration' window. On the left is a large 'Live View / Processed Calibration images' area. At the bottom left is a 'Snap' button. On the right is a control panel with a list of sequences (8-24), a 'Size (mm)' dropdown set to 8, and 'Rows' and 'Cols' spinners both set to 10. Below these are 'Calibrate', 'Cancel', 'Save', and 'Re-Calibrate' buttons. Red arrows point from text annotations to these specific UI elements.

Screen showing Live View / Processed Calibration images

Snap to take a sequence of calibration images

All captured sequences, untick low quality sequences to remove them from the calibration process

Calibration board grid size

Row and columns of calibration board (# of grid intersections)

Press Calibrate to estimate sensor intrinsics/extrinsics

Press Save once you are satisfied with the results. Results will be saved in the file calibration.xml

Post-Calibration Steps

1. Once calibration has been done, press 'Generate Patterns' in the main menu
2. Upload the generated patterns onto the Lightcrafter projector using the steps in [pattern upload instructions.pdf](#)

Linearity Testing

1. Upload the DLPR350PROM_v4.1.0_with_cali_linearity_test.bin firmware onto the projector using the [lightcrafter 4500 gui](#)
2. Press 'Linearity Test' in the main menu
3. Projector will project fully illuminated images of increasing intensity and the camera will take pictures of them
4. Use the 'utiliy/linearity_test.m' script in [phase shifting profilometry matlab](#) to evaluate the captured images