

# Behavior Rig Overview

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**Project:** Behavior Rig Overview

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## System Specs

- Computer Specs
  - **Model:** Dell Optiplex 7060
  - **Processor:** Intel Core i7-8700 @ 3.20 GHz
  - **RAM:** 32.0 GB
  - **OS:** Windows 10 Pro (64-bit)
  - **GPU:** Intel UHD Graphics 630 (integrated) + NVIDIA GeForce GT 730 (installed)
  - **Screen Resolution:** 1680x1050
- Camera Specs
  - **Model:** Hamamatsu Electron Multiplier CCD Digital Camera C9100-50
  - **FPS:** 28.1 (1000x1000 resolution, no binning; decreasing size and/or binning allows for higher FPS at the cost of resolution)
- Projector Specs
  - **Model:** 3M MPro110
  - **Screen Resolution:** 800x600

## Computer Setup

- Installations
  - Matlab 2014b
    - Image Acquisition Toolbox + Image Processing Toolbox (from Matworks website)
      - Hamamatsu adaptor for Image Acquisition Toolbox (from Matlab "Get Hardware Support Packages" under "Add-Ons")
    - Psychtoolbox-3.0.15 (from [www.psychtoolbox.org](http://www.psychtoolbox.org))
      - NOTE: Psychtoolbox support for Windows 10 is incomplete, and Psychtoolbox runs with multiple warnings regarding stimulus timing; these are suppressed by the command `Screen('Preference', 'SkipSyncTests', 1)`
  - DCAM-API Firebird Phoenix driver (driver support for the CameraLink card, available on the Hamamatsu website)
- Display Settings
  - Dual display, 1680x1050 main monitor + 800x600 projector extended display
  - NVIDIA controls the projector display, Intel controls the main display (select from each GPU control panel as a single display, NOT a multiple display)
    - NOTE: The monitor should physically connect to the Intel GPU while the projector should physically connect to the installed card (adaptors may be necessary)
  - Set up multiple display in the Windows settings menu, with the larger display as the main display

## Matlab Settings

- Image Acquisition Settings
  - Use the default camera configuration (MONO16\_1000x1000)

- Other options are various forms of binning, which all result in lower resolution in exchange for higher framerate
- Frames to Capture: 2250 frames
  - Want to capture 60s of usable footage, so 60s + 20s startup = 80s -> 80s \* 28.1 FPS = 2248 frames, rounded to 2250 frames
  - Leave writing speed as the default (ie: same as the recording speed, such that 28.1 frames are written to each second of video and video playback is the same as the realtime recording)
- Exposure Time: 0.009
  - Leave all other camera settings (Contrast Offset, Offset, Sensitivity) at default, though they can be adjusted to fine-tune the output
- ROI: x-offset=96, y-offset=344, x-res=800, y-res=600
  - Default resolution is 1000x1000, so some cropping is necessary to achieve 800x600 (NOTE: this does not zoom in on/magnify the recording, so the quality of the video itself is unchanged)

## Troubleshooting

- Camera not recognized by Matlab, or is recognized briefly but then rejected
  - Re-install DCAM-API driver and ensure it is the appropriate version (Firebird Phoenix, the others are intended for different connection types)
  - Check that the adaptor PCI card is installed properly, with the correct drivers, and works with other devices (may be a compatibility issue between the card and the computer)
- Camera is recognized, but recording is either incredibly slow or frame rate lags significantly
  - Disable the C-state setting in the computer's BIOS
- Streaks of light run through or form solid lines on the recording
  - Symptom of excess light flooding a region of the camera; reduce sources of direct light as well as glares or reflection in the camera's field of view
    - NOTE: The outputted video is cropped to 800x600, but the camera records in a 1000x1000 field of view, so the source of excess light may not be visible from the outputted recording; use imaqttool() to diagnose the light source
    - NOTE: The camera is particularly sensitive to IR lighting and may streak from the reflection off of other parts of the rig