

SR Research PyLink

Version: 2.1.1197.0

Generated: September 27, 2024

Generated by Doxygen 1.9.1

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Chapter 1

Introduction

1.1 Introduction

Performing research with eye-tracking equipment typically requires carefully implemented software tools to collect, process, and analyze data. Much of these tools involve tracker calibration, real-time data collection, and so on.

The EyeLink® eye-tracking system is most powerful when used with the Ethernet link interface, which allows flexible control of data collection and real-time data transfer. The PyLink module implements all core EyeLink functions and classes for EyeLink connection and the EyeLink graphics, such as the display of the camera image, calibration, validation, and drift-check. The EyeLink graphics included in the EyeLink Developer's Kit are currently implemented using the SDL library (www.libsdl.org). However, users can implement custom EyeLink graphics with a library they prefer to use for stimulus presentation (see the PsychoPy and Pygame examples bundled in the EyeLink Developer's Kit).

1.1.1 Organization of This Document

[EyeLink Programming Conventions](#) of this document introduces the standard programming convention recommended for an EyeLink experiment, and the standard EyeLink messages that can be used to facilitate data analysis and visualization in Data Viewer. [Overview of PyLink module](#) documents the common functions and classes used in the PyLink module in detail. You will rarely need other functions or classes than those listed here.

1.1.2 Getting Started

Please refer to the EyeLink Installation Guide (<https://www.sr-support.com/forum-34.html>) for instructions on how to set up the stimulus presentation PC (hereby referred to as the "Display PC"). The PyLink library also comes with a Getting Started Guide for Python and PyLink, which clearly explains the installation of Python and PyLink, the example scripts provided by us, the typical structure of an EyeLink experiment, and some troubleshooting tips. For general knowledge about Python programming, you may refer to the tutorials available on the official Python website, <https://www.python.org/>.

1.2 EyeLink Programming Conventions

The PyLink library contains a set of classes and functions, which are used to program experiments on many different platforms, such as Windows, Linux (e.g., Ubuntu), and macOS. This chapter will outline the programming convention of a typical EyeLink experiment, and the standard messages that would allow seamless integration with analysis tools such as EDF2ASC converter or EyeLink Data Viewers.

1.2.1 Outline of a Typical Windows Experiment

To help programmers understand how to write experiment software, and how to port existing experiments to the EyeLink platform, this section outlines the standard operations involved in an EyeLink experiment. A typical experiment using the EyeLink eye-tracker involves some variation of the following sequence of operations:

- Open a link connection to the EyeLink Host PC.
- Set up an EDF file name, and open an EDF data file on the EyeLink Host PC.
- Send configuration commands to the EyeLink Host PC to prepare it for the experiment.
- Open a full-screen window and configure the calibration graphics routines.
- Record one or more blocks of trials. Each block typically begins with tracker setup (camera setup and calibration), and then several trials are run.
- Close the EDF data file. If desired, retrieve the file via the link to the Host PC.
- Close the link connection to the Host PC and terminate the task.

For each trial, the experiment will do these steps:

- Send a message ("TRIALID") to the Host PC to mark the start of a trial.
- Send a record status message to show on the Host PC screen (optional).
- Draw background graphics (image or landmarks) on the Host PC display (optional).
- Perform a drift-check (or drift-correction).
- Start data recording.
- Present experimental stimuli for the trial, and retrieve real-time eye movement data if needed.
- Stop data recording.
- Send a message ("TRIAL_RESULT") to the Host PC to mark the end of a trial.

This sequence of operations is the core of almost all experiments (see the accompanying "Getting Started with Python and PyLink" doc for an example illustrating the above concept). A real experiment would probably add practice trials, instruction screens, randomization, and so on.

During recording, all eye-tracking data and events are usually written into the EDF file, which is saved on the eye tracker's hard disk, and may be copied to the Display PC at the end of the experiment. Your experiment will also add messages to the EDF file to identify trial conditions and to timestamp important events (such as participant responses and display changes) for use in analysis. The EDF file may be processed directly using the EyeLink Data Viewer (<https://www.sr-support.com/forum-7.html>), or converted to an ASC file and processed by your own software.

1.2.2 Standard Messages

Experiments should place certain messages into the EDF file, to mark the start and end of trials. These messages will facilitate the SR Research viewing and analysis applications (e.g., Data Viewer) to process the EDF files.

Text messages can be sent to the EyeLink Host PC and added to the EDF file along with the eye movement data. These messages will be time stamped with an accuracy of 1 millisecond from the time sent, and can be used to mark important events such as display changes. Be careful not to send messages too quickly: the eye tracker can handle about 20 messages every 10 milliseconds. Above this rate, some messages may be lost before being written to the EDF file.

To facilitate data analysis in EyeLink Data Viewer, special messages can be added to the EDF file. Examples of these messages include those that specify the overlay image, the interest areas, and the trial variables. Detailed information about the various standard messages that Data Viewer recognizes can be found in the "EyeLink Data Viewer user manual" (<https://www.sr-support.com/thread-135.html>).

- The "TRIALID" message is sent at the beginning of a trial, before the start of data recording. It is not mandatory, but it is recommended to include a unique trial identifier in the message, for instance, "TRIALID 13".
- The "TRIAL_RESULT" message is sent after the recording ends. Importantly, the variables that would be used for analysis (i.e., the "TRIAL_VAR" messages) should be written in the EDF file before the "TRIAL_RESULT" message. Additional info can be included in the "TRAIL_RESULT" message, e.g., to indicate the result, for instance "TRIAL_RESULT 0".
- The other critical message that worth noting here is the "DISPLAY_COORDS" message. This message is used by Data Viewer to figure out the appropriate screen size (in pixels) for visualizing the eye movement data, e.g., "DISPLAY_COORDS 0 0 1023 767". The four integers in the message mark the left, top, right, and bottom of the screen.
- One or several "!V TRIAL_VAR" messages should be sent to report the experiment condition(s) of a recording trial. These messages should generally be sent at the end of each trial, allowing variables that may get updated during the recording, such as response time, accuracy, etc., to be included. These messages should be sent before the TRIAL_RESULT message, which marks the end of the trial.
- One of several "!V IAREA" messages can be written into the EDF files to allow Data Viewer to display interest areas during analysis.
- One or several "!V IMGLOAD" messages can be sent to the EDF file to specify the background images for fixation/saccade/heatmap data visualization.
- Other Data Viewer integration messages can be used to play back video stimuli, draw positions of target traces, or draw simple graphics such as boxes, lines, or circles to mark object locations on the screen. Please see section "Protocol for EyeLink Data to Viewer Integration" of the EyeLink Data Viewer User Manual.
- Users should also send messages to the EDF file to mark the critical events in a trial (e.g., onset/offset of a critical display, start/end of the audio playing, participant's keyboard/mouse/button responses. These messages can be used in Data Viewer to create interest period or reaction time definition for data filtering.

1.3 Overview of PyLink module

The interaction of the EyeLink tracker and your experiment is fairly sophisticated: for example, in the Setup menu it is possible to perform calibration or validation, display a camera image on the Display PC to aid in participant setup, and record data with the experiment following along by displaying proper graphics. Large files can be transferred over the link, and should the EyeLink tracker software terminate, the experiment application is automatically terminated as well. Keys pressed on the Display PC keyboard are transferred to the EyeLink PC and operate the tracker during setup, and buttons pressed on the tracker button box may be used to control the execution of the experiment on the Display PC.

PyLink, a Python wrapper for the EyeLink core API, implements all of the functions and classes for EyeLink connection and graphics, such as the display of camera image, calibration, validation, and drift correct. Each of the above operations required just one line of code in your program. Almost all of the source code you will need to write is for the experiment itself, e.g., the control of trials, the presentation and generation of visual and auditory stimuli, and error handling.

Please see a detailed description of all functions in the pyLink module and all classes in this module under Classes section.

Chapter 2

Module Index

2.1 Modules

Here is a list of all modules:

- Tracker Data Type Constants 7
- Event Type Flags 7
- Event Data Flags 7
- Special Key values for the tracker 7
- Tracker Mode values 8
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Chapter 3

Module Documentation

3.1 Tracker Data Type Constants

3.1.1 Detailed Description

3.2 Event Type Flags

The following specifies what types of events were written by tracker.

3.2.1 Detailed Description

The following specifies what types of events were written by tracker.

3.3 Event Data Flags

The following specifies what types of data were included in events by tracker.

3.3.1 Detailed Description

The following specifies what types of data were included in events by tracker.

3.4 Special Key values for the tracker

The following specifies special key values for the tracker.

3.4.1 Detailed Description

The following specifies special key values for the tracker.

3.5 Tracker Mode values

Set of bit flags that mark mode function:

3.5.1 Detailed Description

Set of bit flags that mark mode function:

3.6 EyeLink Graphics Functions

Functions

- def [openGraphicsEx](#) (eyeCustomDisplay)
Allow one to configure the graphics with [EyeLinkCustomDisplay](#).
- def [openGraphics](#) (*args)
Opens the graphics if the display mode is not set.
- def [setCalibrationColors](#) (*args)
Passes the colors of the display background and fixation target to the `eyelink_core_graphics` library.
- def [setTargetSize](#) (*args)
The standard calibration and drift correction target is a disk (for peripheral delectability) with a central "hole" target (for accurate fixation).
- def [setCalibrationSounds](#) (*args)
Selects the sounds to be played during `do_tracker_setup()`, including calibration, validation and drift correction.
- def [setDriftCorrectSounds](#) (*args)
Selects the sounds to be played during `doDriftCorrect()`.
- def [setCameraPosition](#) (*args)
Sets the camera position on the display computer.
- def [getDisplayInformation](#) (*args)
Returns the display configuration.
- def [closeGraphics](#) ()
Notifies the `eyelink_core_graphics` or the [EyeLinkCustomDisplay](#) to close or release the graphics.

3.6.1 Detailed Description

3.6.2 Function Documentation

3.6.2.1 openGraphicsEx()

```
def pylink.openGraphicsEx (
    eyeCustomDisplay )
```

Allow one to configure the graphics with [EyeLinkCustomDisplay](#).

See [EyeLinkCustomDisplay](#) for more details.

```
genv = EyeLinkCoreGraphicsPsychoPy(el_tracker, win)
pylink.openGraphicsEx(genv)
```

Parameters

<i>eyeCustomDisplay</i>	instance of EyeLinkCustomDisplay for the desired platform. This cannot be used with <code>eyelink_core_graphics</code> library or <code>openGraphics</code>
-------------------------	---

3.6.2.2 `openGraphics()`

```
def pylink.openGraphics (
    * args )
```

Opens the graphics if the display mode is not set.

If the display mode is already set, uses the existing display mode.

Remarks

This is equivalent to the SDL version C API

```
INT16 init_expt_graphics(SDL_Surface * s, DISPLAYINFO *info);
```

Parameters

<i>dimension</i>	Two-item tuple of display containing width and height information.
<i>bits</i>	Color bits.

Returns

None or run-time error.

Remarks

This function only works with SDL 1.2 in conjunction with `eyelink_core_graphics` library and cannot be used with [EyeLinkCustomDisplay](#)

3.6.2.3 `setCalibrationColors()`

```
def pylink.setCalibrationColors (
    * args )
```

Passes the colors of the display background and fixation target to the `eyelink_core_graphics` library.

During calibration, camera image display, and drift correction, the display background should match the brightness of the experimental stimuli as closely as possible, in order to maximize tracking accuracy. This function passes the colors of the display background and fixation target to the `eyelink_core_graphics` library. This also prevents flickering of the display at the beginning and end of drift correction.

Remarks

This is equivalent to the C API

```
void set_calibration_colors(SDL_Color *fg, SDL_Color *bg);
```

Parameters

<i>foreground_color</i>	Color for foreground calibration target.
<i>background_color</i>	Color for foreground calibration background.

Both colors must be a three-integer (from 0 to 255) tuple encoding the red, blue, and green color component.

Example:

```
setCalibrationColors((0, 0, 0), (255, 255, 255))
```

This sets the calibration target in black and calibration background in white.

Remarks

This function only works with SDL 1.2 in conjunction with `eyelink_core_graphics` library and cannot be used with [EyeLinkCustomDisplay](#)

3.6.2.4 setTargetSize()

```
def pylink.setTargetSize (
    * args )
```

The standard calibration and drift correction target is a disk (for peripheral delectability) with a central "hole" target (for accurate fixation).

The sizes of these features may be set with this function.

Remarks

This function is equivalent to the C API

```
void set_target_size(UINT16 diameter, UINT16 holesize);
```

Parameters

<i>diameter</i>	Size of outer disk, in pixels.
<i>holesize</i>	Size of central feature, in pixels. If holesize is 0, no central feature will be drawn. The disk is drawn in the calibration foreground color, and the hole is drawn in the calibration background color.

Remarks

This function only works with SDL 1.2 in conjunction with `eyelink_core_graphics` library and cannot be used with [EyeLinkCustomDisplay](#)

3.6.2.5 setCalibrationSounds()

```
def pylink.setCalibrationSounds (
    * args )
```

Selects the sounds to be played during `do_tracker_setup()`, including calibration, validation and drift correction.

These events are the display or movement of the target, successful conclusion of calibration or good validation, and failure or interruption of calibration or validation.

Remarks

If no sound card is installed, the sounds are produced as "beeps" from the PC speaker. Otherwise, sounds can be selected by passing a string. If the string is "" (empty), the default sounds are played. If the string is "off", no sound will be played for that event. Otherwise, the string should be the name of a .WAV file to play.

This function is equivalent to the C API

```
void set_cal_sounds(char *target, char *good, char *error);
```

Parameters

<i>target</i>	Sets sound to play when target moves.
<i>good</i>	Sets sound to play on successful operation.
<i>error</i>	Sets sound to play on failure or interruption.

Remarks

This function only works with SDL 1.2 in conjunction with `eyelink_core_graphics` library and cannot be used with [EyeLinkCustomDisplay](#)

3.6.2.6 setDriftCorrectSounds()

```
def pylink.setDriftCorrectSounds (
    * args )
```

Selects the sounds to be played during `doDriftCorrect()`.

These events are the display or movement of the target, successful conclusion of drift correction, and pressing the 'ESC' key to start the Setup menu.

Remarks

If no sound card is installed, the sounds are produced as "beeps" from the PC speaker. Otherwise, sounds can be selected by passing a string. If the string is "" (empty), the default sounds are played. If the string is "off", no sound will be played for that event. Otherwise, the string should be the name of a .WAV file to play.

This function is equivalent to the C API

```
void set_dcorr_sounds(char *target, char *good, char *setup);
```

Parameters

<i>target</i>	Sets sound to play when target moves.
<i>good</i>	Sets sound to play on successful operation.
<i>setup</i>	Sets sound to play on 'ESC' key pressed.

Remarks

This function only works with SDL 1.2 in conjunction with `eyelink_core_graphics` library and cannot be used with [EyeLinkCustomDisplay](#)

3.6.2.7 setCameraPosition()

```
def pylink.setCameraPosition (
    * args )
```

Sets the camera position on the display computer.

Moves the top left hand corner of the camera position to new location.

Parameters

<i>left</i>	X coordinate of upper-left corner of the camera image window.
<i>top</i>	Y coordinate of upper-left corner of the camera image window.
<i>right</i>	X coordinate of lower-right corner of the camera image window.
<i>bottom</i>	Y coordinate of lower-right corner of the camera image window.

Remarks

This function only works with SDL 1.2 in conjunction with `eyelink_core_graphics` library and cannot be used with [EyeLinkCustomDisplay](#)

3.6.2.8 getDisplayInformation()

```
def pylink.getDisplayInformation (
    * args )
```

Returns the display configuration.

Returns

Instance of [DisplayInfo](#) class. The width, height, bits, and refresh rate of the display can be accessed from the returned value.

Example:

```
display = getDisplayInformation()
print display.width, display.height, display.bits, display.refresh
```

3.7 EyeLink Utility Functions

Functions

- def `currentDoubleUsec ()`
- def `inRealTimeMode ()`
- def `endRealTimeMode ()`
- def `flushGetkeyQueue ()`
- def `getLastError ()`
- def `bitmapSave ()`
- def `getDisplayAPIVersion ()`
- def `closeMessageFile ()`
- def `currentUsec ()`
- def `alert ()`
- def `beginRealTimeMode ()`
- def `currentTime ()`
- def `msecDelay ()`
- def `openMessageFile ()`
- def `pumpDelay ()`
- def `getEYELINK ()`
 - <> Returns the [EyeLink](#) tracker object

3.7.1 Detailed Description

3.7.2 Function Documentation

3.7.2.1 `currentDoubleUsec()`

```
def currentDoubleUsec ( )
```

Returns the current microsecond time (as a double type) since the initialization of the [EyeLink](#) library.

Remarks

Same as `currentUsec ()` except, this function can return large microseconds. That is the `currentUsec ()` can return up to 2147483648 microseconds starting from initialization. The `currentDoubleUsec ()` can return up to 36028797018963968 microseconds. This is equivalent to the C API

```
double current_double_usec(void);
```

Returns

A float data for the current microsecond time since the initialization of the [EyeLink](#) library.

3.7.2.2 inRealTimeMode()

```
def inRealTimeMode ( )
```

returns whether the current mode is real-time.

Returns

1 if in realtime mode, else 0.

3.7.2.3 endRealTimeMode()

```
def endRealTimeMode ( )
```

Returns the application to a priority slightly above normal, to end realtime mode. This function should execute rapidly, but there is the possibility that Windows will allow other tasks to run after this call, causing delays of 1-20 milliseconds.

Remarks

This function is equivalent to the C API
`void end_realtime_mode(void);`

3.7.2.4 flushGetkeyQueue()

```
def flushGetkeyQueue ( )
```

Initializes the key queue used by `getKey()`. It may be called at any time to get rid any of old keys from the queue.

Remarks

This is equivalent to the C API
`void flush_getkey_queue(void);`

3.7.2.5 getLastError()

```
def getLastError ( )
```

Retrieves a tuple containing the error number and error message generated by last Pylink call to have failed

Remarks

This has no equivalence in C API. This can be used to help identify the Runtime Error last raised by a Pylink call

Returns

(*Error-Number, Error-Message*) tuple or (0, ' ') if no Runtime Error has been raised.

Example:

```
try:
    getEYELINK().waitForBlockStart(500,1,0)
except RuntimeError:
    if getLastError()[0] == 0: # wait time expired without link data
        print ("ERROR: No link samples received!")
        return TRIAL_ERROR
    else: # for any other status simply re-raise the exception
        raise
```

See also

commandResult()

3.7.2.6 bitmapSave()

```
def bitmapSave ( )
```

This function saves the entire bitmap or selected part of a bitmap in an image file (with an extension of .png, .bmp, .jpg, or .tif). It creates the specified file if this file does not exist.

Parameters

<i>iwidth</i>	Original image width.
<i>iheight</i>	Original image height.
<i>pixels</i>	Pixels of the image in one of two possible formats: pixel=[line1, line2, ... linen] line=[pix1,pix2,...,pixn],pix=(r,g,b). pixel=[line1, line2, ... linen] line=[pix1,pix2,...,pixn],pix=0xAARRGGBB.
<i>xs</i>	Crop x position.
<i>ys</i>	Crop y position.
<i>width</i>	Crop width.
<i>height</i>	Crop height.
<i>fname</i>	File name to save.
<i>path</i>	Path to save.
<i>svoptions</i>	Save options(SV_NOREPLACE, SV_MAKEPATH). If the file exists, it replaces the file unless SV_NOREPLACE is specified.

This function is equivalent to the C API `el_bitmap_save()`

3.7.2.7 `getDisplayAPIVersion()`

```
def getDisplayAPIVersion ( )
```

Returns text associated with last command response: may have error message.

Remarks

This is equivalent to the C API
`INT16 eyelink_dll_version(char *buf);`

Returns

Text associated with last command response or None.

3.7.2.8 `closeMessageFile()`

```
def closeMessageFile ( )
```

Flush and close message file, opened by [openMessageFile\(\)](#).

3.7.2.9 `currentUsec()`

```
def currentUsec ( )
```

Returns the current microsecond time since the initialization of the [EyeLink](#) library.

Remarks

This is equivalent to the C API
`UINT32 current_usec(void);`

Returns

Long integer for the current microsecond time since the initialization of the [EyeLink](#) library.

3.7.2.10 `alert()`

```
def alert ( )
```

This method is used to give a notification to the user when an error occurs.

Remarks

This function does not allow `printf` formatting as in c. However you can do a formatted string argument in python. This is equivalent to the C API
`void alert_printf(char *fmt, ...);`

Parameters

<i>message</i>	Text message to be displayed.
----------------	-------------------------------

3.7.2.11 beginRealTimeMode()

```
def beginRealTimeMode ( )
```

Sets the application priority and cleans up pending Windows activity to place the application in realtime mode. This could take up to 100 milliseconds, depending on the operation system, to set the application priority.

Remarks

This function is equivalent to the C API
`void begin_realtime_mode(UINT32 delay);`

Parameters

<i>delay</i>	An integer, used to set the minimum time this function takes, so that this function can act as a useful delay.
--------------	--

3.7.2.12 currentTime()

```
def currentTime ( )
```

Returns the current millisecond time since the initialization of the [EyeLink](#) library.

Remarks

This function is equivalent to the C API
`UINT32 current_time(void);`

Returns

Long integer for the current millisecond time since the initialization of the [EyeLink](#) library.

3.7.2.13 msecDelay()

```
def msecDelay ( )
```

Does a unblocked delay using [currentTime\(\)](#).

Remarks

This is equivalent to the C API
`void msec_delay(UINT32 n);`

Parameters

<i>delay</i>	An integer for number of milliseconds to delay.
--------------	---

3.7.2.14 openMessageFile()

```
def openMessageFile ( )
```

Creates message file, once open call to `sendMessageToFile()`, will not send messages to tracker. Messages are kept in a queue if the application is in realtime mode, and written to disk on non real-time mode except when `closeMessageFile()` is called while in real-time mode.

Parameters

<i>in</i>	<i>fname</i>	Message file name
-----------	--------------	-------------------

3.7.2.15 pumpDelay()

```
def pumpDelay ( )
```

During calls to `msecDelay()`, Windows is not able to handle messages. One result of this is that windows may not appear. This is the preferred delay function when accurate timing is not needed. It calls `pumpMessages()` until the last 20 milliseconds of the delay, allowing Windows to function properly. In rare cases, the delay may be longer than expected. It does not process modeless dialog box messages.

Remarks

This is equivalent to the C API

```
void pump_delay(UINT32 delay);
```

Parameters

<i>delay</i>	An integer, which sets number of milliseconds to delay.
--------------	---

3.7.2.16 getEYELINK()

```
def pylink.getEYELINK ( )
```

<> Returns the [EyeLink](#) tracker object

The returned instance had been created when calling `EyeLink()`.

Remarks

This function replaces the previous convention of using `EYELINK`. (`EYELINK` is no longer constant, it is now initialized with `None`)

Chapter 4

Class Documentation

4.1 ButtonEvent Class Reference

A [ButtonEvent](#) class, derived from the [IOEvent](#) class, is created to handle specifics of button events.

Inherits [IOEvent](#).

Public Member Functions

- def [getButtons](#) (self)
A list of buttons pressed or released.
- def [getStates](#) (self)
The button state (1 for pressed or 0 for released).

4.1.1 Detailed Description

A [ButtonEvent](#) class, derived from the [IOEvent](#) class, is created to handle specifics of button events.

For this class, in addition to the generic [IOEvent](#) class methods, two additional methods can be used for instances of the [ButtonEvent](#) class.

Returned by `getFloatData()` whenever there is a Button Event.

4.1.2 Member Function Documentation

4.1.2.1 `getButtons()`

```
def getButtons (  
    self )
```

A list of buttons pressed or released.

Returns

List of integers.

4.1.2.2 getStates()

```
def getStates (
    self )
```

The button state (1 for pressed or 0 for released).

Returns

List of integers.

4.2 DisplayInfo Class Reference

The [DisplayInfo](#) class is used to contain information on display configurations, including width, height, color bits, and refresh rate.

Public Attributes

- [width](#)
Display width in screen pixels.
- [height](#)
Display height in screen pixels.
- [bits](#)
Color resolution, in bits per pixel, of the display device (for example: 4 bits for 16 colors, 8 bits for 256 colors, or 16 bits for 65,536 colors).
- [refresh](#)
Refresh rate.

4.2.1 Detailed Description

The [DisplayInfo](#) class is used to contain information on display configurations, including width, height, color bits, and refresh rate.

The current display configuration can be retrieved by the [getDisplayInformation\(\)](#) function of the `pylink` module.

For example:

```
from pylink import *
// Code to open the display
currentDisplay = getDisplayInformation();
    print("Current display settings: ", currentDisplay.width, currentDisplay.height, \
print "Current display settings: ", currentDisplay.width, currentDisplay.height, \
    currentDisplay.bits, currentDisplay.refresh
```

4.2.2 Member Data Documentation

4.2.2.1 refresh

`refresh`

Refresh rate.

4.3 EndBlinkEvent Class Reference

Class to represent End Blink event.

Inherits [EyeEvent](#).

Public Member Functions

- def [getEndTime](#) (self)
Timestamp of the last sample of the blink.

4.3.1 Detailed Description

Class to represent End Blink event.

This also contains the Start Blink data. This also inherits all properties from [EyeEvent](#).

4.3.2 Member Function Documentation

4.3.2.1 getEndTime()

```
def getEndTime (  
    self )
```

Timestamp of the last sample of the blink.

Returns

Long integer.

4.4 EndFixationEvent Class Reference

Class to represent End Fixation event.

Inherits [StartFixationEvent](#), and [EndNonBlinkEvent](#).

Public Member Functions

- def [getAverageGaze](#) (self)
The average gaze position during the fixation period (in pixel coordinates set by the `screen_pixel_coords` command).
- def [getAverageHREF](#) (self)
Average HEADREF position during the fixation period.
- def [getAveragePupilSize](#) (self)
Average pupil size (in arbitrary units, area or diameter as selected) during a fixation.
- def [getEndPupilSize](#) (self)
Pupil size (in arbitrary units, area or diameter as selected) at the end of a fixation interval.

4.4.1 Detailed Description

Class to represent End Fixation event.

This also contains the Start Fixation data. This also inherits all properties from [StartFixationEvent](#) and [EndNonBlinkEvent](#).

4.4.2 Member Function Documentation

4.4.2.1 [getAverageGaze\(\)](#)

```
def getAverageGaze (  
    self )
```

The average gaze position during the fixation period (in pixel coordinates set by the `screen_pixel_coords` command).

Returns

Two-item tuple in the format of (float, float).

4.4.2.2 [getAverageHREF\(\)](#)

```
def getAverageHREF (  
    self )
```

Average HEADREF position during the fixation period.

Returns

Two-item tuple in the format of (float, float).

4.4.2.3 getAveragePupilSize()

```
def getAveragePupilSize (
    self )
```

Average pupil size (in arbitrary units, area or diameter as selected) during a fixation.

Returns

Float.

4.4.2.4 getEndPupilSize()

```
def getEndPupilSize (
    self )
```

Pupil size (in arbitrary units, area or diameter as selected) at the end of a fixation interval.

Returns

Float.

4.5 EndNonBlinkEvent Class Reference

This interface is never used as is.

Inherited by [EndFixationEvent](#), [EndSaccadeEvent](#), and [FixUpdateEvent](#).

Public Member Functions

- def [getEndTime](#) (self)
Timestamp of the last sample of the event.
- def [getEndGaze](#) (self)
Gaze position at the end of the event (in pixel coordinates set by the `screen_pixel_coords` command).
- def [getEndHREF](#) (self)
HEADREF position at the end of the event.
- def [getEndVelocity](#) (self)
Gaze velocity at the end of the event (in visual degrees per second).
- def [getAverageVelocity](#) (self)
Average gaze velocity during event (in visual degrees per second).
- def [getPeakVelocity](#) (self)
Peak gaze velocity during event (in visual degrees per second).
- def [getEndPPD](#) (self)
Angular resolution at the end of the event (in screen pixels per visual degree).

4.5.1 Detailed Description

This interface is never used as is.

[EndFixationEvent](#), [EndSaccadeEvent](#) and [FixUpdateEvent](#) types inherit this.

Please note that the `getStartTime()` and `getEndTime()` methods of the event class are the timestamps of the first and last samples in the event. To compute duration, subtract these two values and add 4 msec (even in 500 Hz tracking modes, the internal parser of [EyeLink II](#) quantizes event times to 4 milliseconds).

Peak velocity returned by `getPeakVelocity()` for fixations is usually corrupted by terminal segments of the preceding and following saccades.

The `getStartPPD()` and `getEndPPD()` methods contain the angular resolution at the start and end of the saccade or fixation. The average of the start and end angular resolution can be used to compute the size of saccades in degrees. This Python code would compute the true magnitude of a saccade from an `ENDSACC` event in the following way:

```
newEvent = getEYELINK().getFloatData()
if isinstance(newEvent, EndFixationEvent):
    Start_Gaze = newEvent.getStartGaze()
    Start_PPD = newEvent.getStartPPD()
    End_Gaze = newEvent.getEndGaze()
    End_PPD = newEvent.getEndPPD()
dx = (End_Gaze[0] - Start_Gaze[0]) / ((End_PPD[0] + Start_PPD[0])/2.0);
dy = (End_Gaze[1] - Start_Gaze[1]) / ((End_PPD[1] + Start_PPD[1])/2.0);
dist = math.sqrt(dx*dx + dy*dy);
```

Please note that the average velocity for saccades may be larger than the saccade magnitude divided by its duration because of overshoots and returns.

4.5.2 Member Function Documentation

4.5.2.1 `getEndTime()`

```
def getEndTime (
    self )
```

Timestamp of the last sample of the event.

Returns

Long integer.

4.5.2.2 `getEndGaze()`

```
def getEndGaze (
    self )
```

Gaze position at the end of the event (in pixel coordinates set by the `screen_pixel_coords` command).

The first and second items of the returned tuple store the x- and y- gaze position respectively.

Returns

Two-item tuple in the format of (float, float).

4.5.2.3 getEndHREF()

```
def getEndHREF (
    self )
```

HEADREF position at the end of the event.

The first and second items of the returned tuple store the x- and y- coordinate HREF data respectively.

Returns

Two-item tuple in the format of (float, float).

4.5.2.4 getEndVelocity()

```
def getEndVelocity (
    self )
```

Gaze velocity at the end of the event (in visual degrees per second).

Returns

Float.

4.5.2.5 getAverageVelocity()

```
def getAverageVelocity (
    self )
```

Average gaze velocity during event (in visual degrees per second).

Returns

Float.

4.5.2.6 getPeakVelocity()

```
def getPeakVelocity (
    self )
```

Peak gaze velocity during event (in visual degrees per second).

Returns

Float.

4.5.2.7 getEndPPD()

```
def getEndPPD (
    self )
```

Angular resolution at the end of the event (in screen pixels per visual degree).

Returns

Two-item tuple in the format of (float, float).

4.6 EndSaccadeEvent Class Reference

Class to represent End Saccade event.

Inherits [StartSaccadeEvent](#), and [EndNonBlinkEvent](#).

Public Member Functions

- def [getAmplitude](#) (self)
Returns the amplitude between the start and end of the event.
- def [getAngle](#) (self)
Returns the angle between the start and end of the event.

4.6.1 Detailed Description

Class to represent End Saccade event.

This also contains the Start Saccade data. This also inherits all properties from [StartSaccadeEvent](#) and [EndNonBlinkEvent](#).

4.6.2 Member Function Documentation

4.6.2.1 getAmplitude()

```
def getAmplitude (
    self )
```

Returns the amplitude between the start and end of the event.

Returns

Amplitude between the start and end of the event.

4.6.2.2 getAngle()

```
def getAngle (
    self )
```

Returns the angle between the start and end of the event.

Returns

Angle between the start and end of the event.

4.7 EyeEvent Class Reference

The [EyeLink](#) tracker simplifies data analysis by detecting important changes in the sample data and placing corresponding events into the data stream.

Inherited by [EndBlinkEvent](#), [StartBlinkEvent](#), and [StartNonBlinkEvent](#).

Public Member Functions

- def [getTime](#) (self)
Timestamp of the sample causing event (in milliseconds since [EyeLink](#) tracker was activated).
- def [getType](#) (self)
The event code.
- def [getEye](#) (self)
Which eye produced the event: 0 (LEFT_EYE) or 1 (RIGHT_EYE).
- def [getRead](#) (self)
Bits indicating which data fields contain valid data (see `eye_data.h` file for details of the bits information).
- def [getStartTime](#) (self)
Timestamp of the first sample of the event.
- def [getStatus](#) (self)
Errors and warnings of the event.

4.7.1 Detailed Description

The [EyeLink](#) tracker simplifies data analysis by detecting important changes in the sample data and placing corresponding events into the data stream.

These include eye-data events (blinks, saccades, and fixations), button events, input-port events, and messages. Several classes have been created to hold eye event data (start/end of fixation, start/end of saccade, start/end of blink, fixation update) information. Start events contain only the start time, and optionally the start eye or gaze position.

End events contain the start and end time, plus summary data on saccades and fixations.

It is important to remember that data sent over the link does not arrive in strict time sequence.

Typically, eye events (such as `STARTSACC` and `ENDFIX`) arrive up to 32 milliseconds after the corresponding samples, and messages and buttons may arrive before a sample with the same time code. This differs from the order seen in an ASC file, where the events and samples have been sorted into a consistent order by their timestamps.

The `LOST_DATA_EVENT` is a new event, introduced for [EyeLink](#) tracker version 2.1 and later, and produced within the DLL to mark the location of lost data. It is possible that data may be lost, either during recording with real-time data enabled, or during playback. This might happen because of a lost link packet or because data was not read fast enough (data is stored in a large queue that can hold 2 to 10 seconds of data, and once it is full the oldest data is discarded to make room for new data). This event has no data or time associated with it.

Event data returned by the `getFloatData()` method of the [EyeLink](#) class.

For example,

```
newEvent = getEYELINK().getFloatData()
```

Right now, the [EyeLink](#) Core implements the following eye events:

Constant Name	Value	Description
STARTBLINK	3	Pupil disappeared (time only)
ENDBLINK	4	Pupil reappeared (duration data)
STARTSACC	5	Start of saccade (with time only)
ENDSACC	6	End of saccade (with summary data)
STARTFIX	7	Start of fixation (with time only)
ENDFIX	8	End of fixation (with summary data)
FIXUPDATE	9	Update within fixation (summary data for interval)
MESSAGEEVENT	24	User-definable text (IMESSAGE structure)
BUTTONEVENT	25	Button state change (IOEVENT structure)
INPUTEVENT	28	Change of input port (IOEVENT structure)
SAMPLE_TYPE	200	Event flags gap in data stream

Please note that due to the tracker configuration, some of the property information returned may be a missing value `MISSING_DATA` (or 0, depending on the field). So make sure you check for the validity of the data before trying to use them. To do the tracker configuration, the user can use the `setLinkEventFilter()` and `setLinkEventData()` methods of the [EyeLink](#) class to send commands at the start of the experiment or modify the `DATA.INI` file on the tracker PC.

When both eyes are being tracked, left and right eye events are produced. The eye from which data was produced can be retrieved by the `getEye()` method.

4.7.2 Member Function Documentation

4.7.2.1 getTime()

```
def getTime (
    self )
```

Timestamp of the sample causing event (in milliseconds since [EyeLink](#) tracker was activated).

Returns

Long integer.

4.7.2.2 getType()

```
def getType (
    self )
```

The event code.

Returns

Integer.

4.7.2.3 getEye()

```
def getEye (
    self )
```

Which eye produced the event: 0 (LEFT_EYE) or 1 (RIGHT_EYE).

Returns

Integer.

4.7.2.4 getRead()

```
def getRead (
    self )
```

Bits indicating which data fields contain valid data (see `eye_data.h` file for details of the bits information).

Returns

Integer.

4.7.2.5 getStartTime()

```
def getStartTime (
    self )
```

Timestamp of the first sample of the event.

Returns

Long integer.

4.8 EyeLink Class Reference

The [EyeLink](#) class is an extension of the [EyeLinkListener](#) class with additional utility functions.

Inherits [EyeLinkListener](#).

Public Member Functions

- def [__init__](#) (self, trackeraddress="100.1.1.1")
Constructor.
- def [progressUpdate](#) (self, size, received)
prints out the file transfer progress to the console.
- def [progressSendDataUpdate](#) (self, size, sent)
prints out the sending file progress to the console.
- def [setSampleSizeForVelAndAcceleration](#) (self, sm)
Sets the sample model to be used for velocity and acceleration calculation.
- def [getSampleSizeForVelAndAcceleration](#) (self)
Returns the sample model used for velocity and acceleration calculation.
- def [setVelocityAccelerationModel](#) (self, sm)
Sets the sample model to be used for velocity and acceleration calculation.
- def [getVelocityAccelerationModel](#) (self)
Returns the sample model used for velocity and acceleration calculation in text form.
- def [getTrackerAddress](#) (self)
Returns the tracker address.
- def [getDummyMode](#) (self)
Returns whether in dummy mode or not.
- def [doTrackerSetup](#) (self, width=None, height=None)
Switches the [EyeLink](#) tracker to the Setup menu, from which camera setup, calibration, validation, drift correction, and configuration may be performed.
- def [setAcceptTargetFixationButton](#) (self, button)
This programs a specific button for use in drift correction.
- def [setCalibrationType](#) (self, type)
This command sets the calibration type, and recomputed the calibration targets after a display resolution change.
- def [setXGazeConstraint](#) (self, x_position="AUTO")
Locks the x part of gaze position data.
- def [setYGazeConstraint](#) (self, y_position="AUTO")
Locks the y part of gaze position data.
- def [enableAutoCalibration](#) (self)

- Enables the auto calibration mechanism.*

 - def `disableAutoCalibration` (self)
- Disables the auto calibration mechanism.*

 - def `setAutoCalibrationPacing` (self, pace)
- Sets automatic calibration pacing.*

 - def `readIOPort` (self, ioport)
- Sends a command to the tracker to read the specified io port.*

 - def `writelOPort` (self, ioport, data)
- Sends a command to the tracker to write the specified io port.*

 - def `setHeuristicLinkAndFileFilter` (self, linkfilter, filefilter=-1)

EyeLink II only: Can be used to set level of filtering on the link and analog output, and on file data.
- EyeLink 1 Only: Can be used to enable filtering, increases system delay by 4 msec if the filter was originally off.*

 - def `setHeuristicFilterOn` (self)
- EyeLink 1 Only: Can be used to disable filtering, reduces system delay by 4 msec.*

 - def `setHeuristicFilterOff` (self)
- Can be used to determine pupil size information to be recorded.*

 - def `setPupilSizeDiameter` (self, value)
- Can be used to turn off head tracking if not used.*

 - def `setSimulationMode` (self, value)
- Used to compute correct visual angles and velocities when head tracking not used.*

 - def `setScreenSimulationDistance` (self, distance)
- Marks the location in the data file from which playback will begin at the next call to `EYELINK.startPlayBack()`.*

 - def `markPlayBackStart` (self)
- Selects what types of events can be sent over the link while not recording (e.g between trials).*

 - def `setNoRecordEvents` (self, message=False, button=False, inpuvent=False)
- Sets data in samples written to EDF file.*

 - def `setFileSampleFilter` (self, list)
- Sets data in events written to EDF file.*

 - def `setFileEventData` (self, list)
- Sets which types of events will be written to EDF file.*

 - def `setFileEventFilter` (self, list)
- Sets data in samples sent through link.*

 - def `setLinkSampleFilter` (self, list)
- Sets data in events sent through link.*

 - def `setLinkEventData` (self, list)
- Sets which types of events will be sent through link.*

 - def `setLinkEventFilter` (self, list)
- Sets velocity threshold of saccade detector: usually 30 for cognitive research, 22 for pursuit and neurological work.*

 - def `setSaccadeVelocityThreshold` (self, vel)
- Sets acceleration threshold of saccade detector: usually 9500 for cognitive research, 5000 for pursuit and neurological work.*

 - def `setAccelerationThreshold` (self, accel)
- Sets a spatial threshold to shorten saccades.*

 - def `setMotionThreshold` (self, deg)
- Sets the maximum pursuit velocity accommodation by the saccade detector.*

 - def `setPursuitFixup` (self, maxvel)
- Normally set to 0 to disable fixation update events.*

 - def `setUpdateInterval` (self, time)
- Normally set to 0 to disable fixation update events.*

 - def `setFixationUpdateAccumulate` (self, time)

- def [setRecordingParseType](#) (self, rtype="GAZE")
Sets how velocity information for saccade detection is computed.
- def [drawText](#) (self, text, pos=(-1,-1))
Draws text, coordinates are gaze-position display coordinates.
- def [clearScreen](#) (self, color)
Clear tracker screen for drawing background graphics or messages.
- def [drawLine](#) (self, firstPoint, secondPoint, color)
Draws line, coordinates are gaze-position display coordinates.
- def [drawBox](#) (self, x, y, width, height, color)
Draws an empty box, coordinates are gaze-position display coordinates.
- def [drawFilledBox](#) (self, x, y, width, height, color)
Draws a solid block of color, coordinates are gaze-position display coordinates.
- def [getFixationUpdateInterval](#) (self)
Returns the fixation update interval value.
- def [getFixationUpdateAccumulate](#) (self)
Returns the fixation update accumulate value.
- def [setFixationUpdateInterval](#) (self, interval)
Sends a command to the tracker to update the FixationUpdateInterval.
- def [setFixationUpdateAccumulate](#) (self, accumulate)
Sends a command to the tracker to update the FixationUpdateAccumulate.
- def [echo](#) (self, text, pos=(-1,-1))
Prints text at current print position to tracker screen, gray on black only.
- def [drawCross](#) (self, x, y, color)
Draws a small "+" to mark a target point.

4.8.1 Detailed Description

The [EyeLink](#) class is an extension of the [EyeLinkListener](#) class with additional utility functions.

Most of these functions are used to perform tracker setups (For current information on the [EyeLink](#) tracker configuration, examine the *.INI files in the EYELINK2\EXE\ or ELCL\EXE\ directory of the eye tracker computer). An instance of the [EyeLink](#) class can be created by using the class constructor function. For example,

```
try:
    EYELINK = EyeLink()
except:
    EYELINK = None
```

An instance of [EyeLink](#) class can directly use all of the [EyeLinkListener](#) methods. In addition, it has its own methods as listed in the following. All of the methods should be called in the format of: EYELINK.functionName(parameters), where EYELINK is an instance of [EyeLink](#) class.

4.8.2 Constructor & Destructor Documentation

4.8.2.1 __init__()

```
def __init__ (
    self,
    trackeraddress = "100.1.1.1" )
```

Constructor.

Parameters

<i>trackeraddress</i>	optional tracker address. If no parameters passed in, default address of 100.1.1.1 is used. If None is passed as the address, the connection is opened in dummy mode.
-----------------------	---

4.8.3 Member Function Documentation

4.8.3.1 progressUpdate()

```
def progressUpdate (
    self,
    size,
    received )
```

prints out the file transfer progress to the console.

This is called after the call to receiveDataFile

Parameters

<i>size</i>	Size of the file.
<i>received</i>	Size received so far.

4.8.3.2 progressSendDataUpdate()

```
def progressSendDataUpdate (
    self,
    size,
    sent )
```

prints out the sending file progress to the console.

This is called after the call to sendDataFile

Parameters

<i>size</i>	Size of the file.
<i>sent</i>	Size sent so far.

4.8.3.3 setSampleSizeForVelAndAcceleration()

```
def setSampleSizeForVelAndAcceleration (
```

```

        self,
        sm )

```

Sets the sample model to be used for velocity and acceleration calculation.

Parameters

<i>sm</i>	sample model to be used. Valid values are FIVE_SAMPLE_MODEL, NINE_SAMPLE_MODEL, SEVENTEEN_SAMPLE_MODEL, and EL1000_TRACKER_MODEL
-----------	--

4.8.3.4 setVelocityAccelerationModel()

```

def setVelocityAccelerationModel (
    self,
    sm )

```

Sets the sample model to be used for velocity and acceleration calculation.

Same as setSampleSizeForVelAndAcceleration excepts this interprets string message.

Parameters

<i>sm</i>	sample model to be used. Valid values are 5-sample Model, 9-sample Model, 17-sample Model, and EL1000 Tracker Model
-----------	---

4.8.3.5 doTrackerSetup()

```

def doTrackerSetup (
    self,
    width = None,
    height = None )

```

Switches the [EyeLink](#) tracker to the Setup menu, from which camera setup, calibration, validation, drift correction, and configuration may be performed.

Pressing the 'Esc' key on the tracker keyboard will exit the Setup menu and return from this function. Calling [exitCalibration\(\)](#) from an event handler will cause any call to `do_tracker_setup()` in progress to return immediately.

Parameters

<i>width</i>	Width of the screen.
<i>height</i>	Height of the screen.

4.8.3.6 setAcceptTargetFixationButton()

```
def setAcceptTargetFixationButton (
    self,
    button )
```

This programs a specific button for use in drift correction.

Remarks

This function is equivalent to

```
getEYELINK().sendCommand("button_function %d 'accept_target_fixation'"%button);
```

Parameters

<i>button</i>	Id of the button that is used to accept target fixation.
---------------	--

4.8.3.7 setCalibrationType()

```
def setCalibrationType (
    self,
    type )
```

This command sets the calibration type, and recomputed the calibration targets after a display resolution change.

Remarks

This function is equivalent to

```
getEYELINK().sendCommand("calibration_type=%s"%caltype);
```

Parameters

<i>type</i>	One of these calibration type codes listed below:	
	H3	horizontal 3-point calibration
	HV3	3-point calibration, poor linearization
	HV5	5-point calibration, poor at corners
	HV9	9-point grid calibration, best overall
	HV13	13-point calibration for large calibration region (EyeLink II version 2.0 or later; EyeLink 1000)

4.8.3.8 setXGazeConstraint()

```
def setXGazeConstraint (
```

```

    self,
    x_position = "AUTO" )

```

Locks the x part of gaze position data.

Usually set to `AUTO`: this will use the last drift-correction target position when in H3 mode.

Remarks

This function is equivalent to

```

getEYELINK().sendCommand("x_gaze_constraint=%s"%(str(value)));

```

Parameters

<code>x_position</code>	x gaze coordinate, or <code>AUTO</code> .
-------------------------	---

4.8.3.9 setYGazeConstraint()

```

def setYGazeConstraint (
    self,
    y_position = "AUTO" )

```

Locks the y part of gaze position data.

Usually set to `AUTO`: this will use the last drift-correction target position when in H3 mode.

Remarks

This function is equivalent to

```

getEYELINK().sendCommand("y_gaze_constraint=%s"%(str(value)));

```

Parameters

<code>y_position</code>	y gaze coordinate, or <code>AUTO</code> .
-------------------------	---

4.8.3.10 enableAutoCalibration()

```

def enableAutoCalibration (
    self )

```

Enables the auto calibration mechanism.

By default, this mechanism is turned off.

Remarks

This function is equivalent to

```

if(getEYELINK().isConnected()):
    getEYELINK().sendCommand("enable_automatic_calibration=YES")

```

4.8.3.11 disableAutoCalibration()

```
def disableAutoCalibration (
    self )
```

Disables the auto calibration mechanism.

By default, this mechanism is turned off.

Remarks

This function is equivalent to

```
if(getEYELINK().isConnected()):
    getEYELINK().sendCommand("enable_automatic_calibration=NO")
```

4.8.3.12 setAutoCalibrationPacing()

```
def setAutoCalibrationPacing (
    self,
    pace )
```

Sets automatic calibration pacing.

1000 is a good value for most subjects, 1500 for slow subjects and when interocular data is required.

Remarks

This function is equivalent to

```
getEYELINK().sendCommand("automatic_calibration_pacing=%d"%(time))
```

Parameters

<i>pace</i>	shortest delay.
-------------	-----------------

4.8.3.13 readIOPort()

```
def readIOPort (
    self,
    ioport )
```

Sends a command to the tracker to read the specified io port.

Parameters

<i>ioport</i>	port id of the io port.
---------------	-------------------------

4.8.3.14 writeIOPort()

```
def writeIOPort (
    self,
    ioport,
    data )
```

Sends a command to the tracker to write the specified io port.

Parameters

<i>ioport</i>	byte hardware I/O port address. The port address for the C and D ports on the EyeLink analog output card are 4 and 5, respectively; the print port address will typically be 0x378 (please see the buttons.ini settings).
<i>data</i>	data to write

4.8.3.15 setHeuristicLinkAndFileFilter()

```
def setHeuristicLinkAndFileFilter (
    self,
    linkfilter,
    filefilter = -1 )
```

[EyeLink II](#) only: Can be used to set level of filtering on the link and analog output, and on file data.

An additional delay of 1 sample is added to link or analog data for each filter level.
 If an argument of <on> is used, link filter level is set to 1 to match [EyeLink I](#) delays.
 The file filter level is not changed unless two arguments are supplied.
 The default file filter level is 2.

Remarks

This function is equivalent to

```
if(getEYELINK().getTrackerVersion() >=2):
    if(filefilter == -1):
        getEYELINK().sendCommand("heuristic_filter %d"%(linkfilter))
    else:
        getEYELINK().sendCommand(" %d %d"%(linkfilter, filefilter));
```

Parameters

<i>linkfilter</i>	Filter level of the link data. 0 or OFF disables link filter. 1 or ON sets filter to 1 (moderate filtering, 1 sample delay). 2 applies an extra level of filtering (2 sample delay).
<i>filefilter</i>	Filter level of the data written to EDF file. 0 or OFF disables link filter. 1 or ON sets filter to 1 (moderate filtering, 1 sample delay). 2 applies an extra level of filtering (2 sample delay).

4.8.3.16 setHeuristicFilterOn()

```
def setHeuristicFilterOn (
    self )
```

[EyeLink 1](#) Only: Can be used to enable filtering, increases system delay by 4 msec if the filter was originally off.

NEVER TURN OFF THE FILTER WHEN ANTIREFLECTION IS TURNED ON.

For [EyeLink II](#) and newer eye tracker models, you should use the `setHuristicFileAndLinkFilter()` method instead.

Remarks

This function is equivalent to
`getEYELINK().sendCommand("heuristic_filter=ON");`

4.8.3.17 setHeuristicFilterOff()

```
def setHeuristicFilterOff (
    self )
```

[EyeLink 1](#) Only: Can be used to disable filtering, reduces system delay by 4 msec.

NEVER TURN OFF THE FILTER WHEN ANTIREFLECTION IS TURNED ON. For [EyeLink II](#) and newer eye tracker models, you should use the following `setHuristicFileAndLinkFilter()` method instead.

Remarks

This function is equivalent to
`getEYELINK().sendCommand("heuristic_filter = OFF");`

4.8.3.18 setPupilSizeDiameter()

```
def setPupilSizeDiameter (
    self,
    value )
```

Can be used to determine pupil size information to be recorded.

Remarks

This function is equivalent to
`getEYELINK().sendCommand("pupil_size_diameter = %s"%(value));`

Parameters

<i>value</i>	YES to convert pupil area to diameter; NO to output pupil area data.
--------------	--

4.8.3.19 setSimulationMode()

```
def setSimulationMode (
    self,
    value )
```

Can be used to turn off head tracking if not used.

Do this before calibration.

Remarks

This function is equivalent to

```
getEYELINK().sendCommand("simulate_head_camera = %s"%(value));
```

Parameters

<i>value</i>	YES to disable head tracking; NO to enable head tracking.
--------------	---

4.8.3.20 setScreenSimulationDistance()

```
def setScreenSimulationDistance (
    self,
    distance )
```

Used to compute correct visual angles and velocities when head tracking not used.

Remarks

This function is equivalent to

```
getEYELINK().sendCommand("simulation_screen_distance = %s"%(distance));
```

Parameters

<i>distance</i>	simulated distance from display to subject in millimeters.
-----------------	--

4.8.3.21 markPlayBackStart()

```
def markPlayBackStart (
    self )
```

Marks the location in the data file from which playback will begin at the next call to `EYELINK.startPlayBack()`.

When this command is not used (or on older tracker versions), playback starts from the beginning of the previous recording block. This default behavior is suppressed after this command is used, until the tracker application is shut down.

Remarks

This function is equivalent to

```
getEYELINK().sendCommand("mark_playback_start");
```

4.8.3.22 setNoRecordEvents()

```
def setNoRecordEvents (
    self,
    message = False,
    button = False,
    inpuvent = False )
```

Selects what types of events can be sent over the link while not recording (e.g between trials).

This command has no effect for [EyeLink II](#), and messages cannot be enabled for versions of [EyeLink I](#) before v2.1.

Remarks

This function is equivalent to

```
re = []
if(message):
    re.append("MESSAGE ")
if(button):
    re.append("BUTTON ")
if(inpuvent):
    re.append("INPUT ")
getEYELINK().sendCommand("link_nonrecord_events = %s"%".join(re));
```

Parameters

<i>message</i>	1 to enable the recording of EyeLink messages.
<i>button</i>	1 to enable recording of buttons (1..8 press or release).
<i>inpuvent</i>	1 to enable recording of changes in input port lines.

4.8.3.23 setFileSampleFilter()

```
def setFileSampleFilter (
    self,
    list )
```

Sets data in samples written to EDF file.

See tracker file "DATA.INI" for types.

Remarks

This function is equivalent to

```
getEYELINK().sendCommand("file_sample_data = %s"%list)
```

Parameters

<i>list</i>	list of the following data types, separated by spaces or commas.	
	GAZE	screen x/y (gaze) position
	GAZERES	units-per-degree screen resolution
	HREF	head-referenced gaze
	PUPIL	raw eye camera pupil coordinates
	AREA	pupil area
	STATUS	warning and error flags
	BUTTON	button state and change flags
	INPUT	input port data lines

4.8.3.24 setFileEventData()

```
def setFileEventData (
    self,
    list )
```

Sets data in events written to EDF file.

See tracker file "DATA.INI" for types.

Remarks

This function is equivalent to

```
getEYELINK().sendCommand("file_event_data = %s"%list);
```

Parameters

<i>list</i>	list of the following event data types, separated by spaces or commas.	
	GAZE	screen xy (gaze) position
	GAZERES	units-per-degree angular resolution
	HREF	HREF gaze position
	AREA	pupil area or diameter
	VELOCITY	velocity of eye motion (avg, peak)
	STATUS	warning and error flags for event
	FIXAVG	include ONLY average data in ENDFIX events
	NOSTART	start events have no data, just time stamp

4.8.3.25 setFileEventFilter()

```
def setFileEventFilter (
    self,
    list )
```

Sets which types of events will be written to EDF file.

See tracker file "DATA.INI" for types.

Remarks

This function is equivalent to

```
getEYELINK().sendCommand("file_event_filter = %s"%list);
```

Parameters

<i>list</i>	list of the following event types, separated by spaces or commas.	
	LEFT, RIGHT	events for one or both eyes
	FIXATION	fixation start and end events
	FIXUPDATE	fixation (pursuit) state updates
	SACCADE	saccade start and end
	BLINK	blink start an end
	MESSAGE	messages (user notes in file)
	BUTTON	button 1..8 press or release
	INPUT	changes in input port lines;

4.8.3.26 setLinkSampleFilter()

```
def setLinkSampleFilter (
    self,
    list )
```

Sets data in samples sent through link.

See tracker file "DATA.INI" for types.

Remarks

This function is equivalent to

```
getEYELINK().sendCommand("link_sample_data = %s"%list)
```

Parameters

<i>list</i>	list of data types, separated by spaces or commas.	
	GAZE	screen xy (gaze) position
	GAZERES	units-per-degree screen resolution
	HREF	head-referenced gaze
	PUPIL	raw eye camera pupil coordinates
	AREA	pupil area
	STATUS	warning and error flags
	BUTTON	button state and change flags
	INPUT	input port data lines

4.8.3.27 setLinkEventData()

```
def setLinkEventData (
    self,
    list )
```

Sets data in events sent through link.

See tracker file "DATA.INI" for types.

Remarks

This function is equivalent to

```
getEYELINK().sendCommand("link_event_data = %s"%list);
```

Parameters

<i>list</i>	list of data types, separated by spaces or commas.	
	GAZE	screen xy (gaze) position
	GAZERES	units-per-degree angular resolution
	HREF	HREF gaze position
	AREA	pupil area or diameter
	VELOCITY	velocity of eye motion (avg, peak)
	STATUS	warning and error flags for event
	FIXAVG	include ONLY average data in ENDFIX events
	NOSTART	start events have no data, just time stamp

4.8.3.28 setLinkEventFilter()

```
def setLinkEventFilter (
    self,
    list )
```

Sets which types of events will be sent through link.

See tracker file "DATA.INI" for types.

Remarks

This function is equivalent to

```
getEYELINK().sendCommand("link_event_filter = %s"%list);
```

Parameters

<i>list</i>	list of event types.
-------------	----------------------

LEFT, RIGHT

events for one or both eyes

FIXATION

fixation start and end events

FIXUPDATE

fixation (pursuit) state updates

SACCADE

saccade start and end

BLINK

blink start an end

MESSAGE

messages (user notes in file)

BUTTON

button 1-8 press or release

INPUT

changes in input port lines;

4.8.3.29 setSaccadeVelocityThreshold()

```
def setSaccadeVelocityThreshold (
    self,
    vel )
```

Sets velocity threshold of saccade detector: usually 30 for cognitive research, 22 for pursuit and neurological work.

Remarks

This function is equivalent to

```
getEYELINK().sendCommand("saccade_velocity_threshold =%d"%(vel));
```

Parameters

<i>vel</i>	minimum velocity (%/sec) for saccades.
------------	--

4.8.3.30 setAccelerationThreshold()

```
def setAccelerationThreshold (
    self,
    accel )
```

Sets acceleration threshold of saccade detector: usually 9500 for cognitive research, 5000 for pursuit and neurological work.

Remarks

This function is equivalent to

```
getEYELINK().sendCommand("saccade_acceleration_threshold =%d"%(accl));
```

Parameters

<i>accel</i>	minimum acceleration (%sec/sec) for saccades.
--------------	---

4.8.3.31 setMotionThreshold()

```
def setMotionThreshold (
    self,
    deg )
```

Sets a spatial threshold to shorten saccades.

Usually 0.15 for cognitive research, 0 for pursuit and neurological work.

Remarks

This function is equivalent to

```
getEYELINK().sendCommand("saccade_motion_threshold =%d"%(deg));
```

Parameters

<i>deg</i>	minimum motion (degrees) out of fixation before saccade onset allowed.
------------	--

4.8.3.32 setPursuitFixup()

```
def setPursuitFixup (
    self,
    maxvel )
```

Sets the maximum pursuit velocity accommodation by the saccade detector.

Usually set to 60.

Remarks

This function is equivalent to

```
getEYELINK().sendCommand("saccade_pursuit_fixup = %d"%(v));
```

Parameters

<i>maxvel</i>	maximum pursuit velocity fixup (%sec).
---------------	--

4.8.3.33 setUpdateInterval()

```
def setUpdateInterval (
    self,
    time )
```

Normally set to 0 to disable fixation update events.

Set to 50 or 100 milliseconds to produce updates for gaze-controlled interface applications.

Remarks

This function is equivalent to

```
getEYELINK().sendCommand("fixation_update_interval = %d"%(time));
```

Parameters

<i>time</i>	milliseconds between fixation updates, 0 turns off.
-------------	---

4.8.3.34 setFixationUpdateAccumulate() [1/2]

```
def setFixationUpdateAccumulate (
    self,
    time )
```

Normally set to 0 to disable fixation update events.

Set to 50 or 100 milliseconds to produce updates for gaze-controlled interface applications. Set to 4 to collect single sample rather than average position.

Remarks

This function is equivalent to

```
getEYELINK().sendCommand("fixation_update_accumulate = %d"%(time));
```

Parameters

<i>time</i>	milliseconds to collect data before fixation update for average gaze position.
-------------	--

4.8.3.35 setRecordingParseType()

```
def setRecordingParseType (
    self,
    rtype = "GAZE" )
```

Sets how velocity information for saccade detection is computed.

Remarks

This function is equivalent to

```
getEYELINK().sendCommand("recording_parse_type %s"%(rtype));
```

Parameters

<i>rtype</i>	GAZE or HREF; Almost always left to GAZE.
--------------	---

4.8.3.36 drawText()

```
def drawText (
    self,
    text,
    pos = (-1, -1) )
```

Draws text, coordinates are gaze-position display coordinates.

Remarks

This function is equivalent to

```
getEYELINK().sendCommand("print_position= %d %d"%pos)
getEYELINK().sendCommand("echo %s"%(text))
```

Parameters

<i>text</i>	text to print in quotes.
<i>pos</i>	Center point of text; Default position is (-1, -1).

4.8.3.37 clearScreen()

```
def clearScreen (
    self,
    color )
```

Clear tracker screen for drawing background graphics or messages.

Remarks

This function is equivalent to
`getEYELINK().sendCommand("clear_screen %d"%(color));`

Parameters

<i>color</i>	0 to 15.
--------------	----------

4.8.3.38 drawLine()

```
def drawLine (
    self,
    firstPoint,
    secondPoint,
    color )
```

Draws line, coordinates are gaze-position display coordinates.

Remarks

This function is equivalent to
`getEYELINK().sendCommand("draw_line %d %d %d %d %d"%
 (firstPoint[0], firstPoint[1], secondPoint[0], secondPoint[1], color));`

Parameters

<i>firstPoint</i>	a two-item tuple, containing the x, y coordinates of the start point.
<i>secondPoint</i>	a two-item tuple, containing the x, y coordinates of the end point.
<i>color</i>	0 to 15.

4.8.3.39 drawBox()

```
def drawBox (
    self,
    x,
    y,
    width,
```

```

    height,
    color )

```

Draws an empty box, coordinates are gaze-position display coordinates.

Remarks

This function is equivalent to

```
getEYELINK().sendCommand("draw_box %d %d %d %d %d"%(x,y,x+width,y+height,color));
```

Parameters

<i>x</i>	x coordinates for the top-left corner of the rectangle.
<i>y</i>	y coordinates for the top-left corner of the rectangle.
<i>width</i>	width of the filled rectangle.
<i>height</i>	height of the filled rectangle.
<i>color</i>	0 to 15.

4.8.3.40 drawFilledBox()

```

def drawFilledBox (
    self,
    x,
    y,
    width,
    height,
    color )

```

Draws a solid block of color, coordinates are gaze-position display coordinates.

Remarks

This function is equivalent to

```
getEYELINK().sendCommand("draw_filled_box %d %d %d %d %d"%(x,y,x+width,y+height,color));
```

Parameters

<i>x</i>	x coordinates for the top-left corner of the rectangle.
<i>y</i>	y coordinates for the top-left corner of the rectangle.
<i>width</i>	width of the filled rectangle.
<i>height</i>	height of the filled rectangle.
<i>color</i>	0 to 15.

4.8.3.41 getFixationUpdateInterval()

```

def getFixationUpdateInterval (
    self )

```

Returns the fixation update interval value.

This does not query the tracker, only valid if `setFixationUpdateInterval` is called prior to calling this function.

4.8.3.42 `getFixationUpdateAccumulate()`

```
def getFixationUpdateAccumulate (
    self )
```

Returns the fixation update accumulate value.

This does not query the tracker, only valid if `setFixationUpdateAccumulate` is called prior to calling this function.

4.8.3.43 `setFixationUpdateInterval()`

```
def setFixationUpdateInterval (
    self,
    interval )
```

Sends a command to the tracker to update the `FixationUpdateInterval`.

Parameters

<i>interval</i>	value for fixation update interval
-----------------	------------------------------------

4.8.3.44 `setFixationUpdateAccumulate()` [2/2]

```
def setFixationUpdateAccumulate (
    self,
    accumulate )
```

Sends a command to the tracker to update the `FixationUpdateAccumulate`.

Parameters

<i>accumulate</i>	value for fixation update accumulate
-------------------	--------------------------------------

4.8.3.45 `echo()`

```
def echo (
    self,
    text,
    pos = (-1, -1) )
```

Prints text at current print position to tracker screen, gray on black only.

Parameters

<i>text</i>	text to print in quotes.
<i>pos</i>	position of the text to display

Remarks

This function is equivalent to

```
getEYELINK().sendCommand("echo %s"%text)
```

4.8.3.46 drawCross()

```
def drawCross (
    self,
    x,
    y,
    color )
```

Draws a small "+" to mark a target point.

Remarks

This function is equivalent to

```
getEYELINK().sendCommand("draw_cross %d %d %d"%(x,y, color));
```

Parameters

<i>x</i>	x coordinates for the center point of cross.
<i>y</i>	y coordinates for the center point of cross.
<i>color</i>	0 to 15 (0 for black; 1 for blue; 2 for green; 3 for cyan; 4 for red; 5 for magenta; 6 for brown; 7 for light gray; 8 for dark gray; 9 for light blue; 10 for light green; 11 for light cyan; 12 for light red; 13 for bright magenta; 14 for yellow; 15 for bright white).

4.9 EyeLinkAddress Class Reference

The [EyeLinkAddress](#) class is used to hold addresses to [EyeLink](#) nodes.

Inherited by [EyelinkMessage](#).

Public Member Functions

- def `__init__` (self, ip=(100, 1, 1, 1), port=4000)
Constructor.
- def `getIP` (self)
Returns the IP address of the [EyeLink](#) node.
- def `getPort` (self)
Returns the port number of the [EyeLink](#) node.

4.9.1 Detailed Description

The [EyeLinkAddress](#) class is used to hold addresses to [EyeLink](#) nodes.

An instance of [EyeLinkAddress](#) class can be initialized with the class constructor:

```
EyeLinkAddress(ip = (100,1,1,1), port = 4000)
```

where *ip* is a four-item tuple containing the IP address of the [EyeLink](#) node and *port* is the port number of the connection.

For example,

```
myAddress = EyeLinkAddress((100, 1, 1, 1), 4000)
```

4.9.2 Constructor & Destructor Documentation

4.9.2.1 __init__()

```
def __init__ (
    self,
    ip = (100,1,1,1),
    port = 4000 )
```

Constructor.

Parameters

<i>ip</i>	optional ipaddress in tuple form. eg. if the ip address is 192.168.25.48, the tuple form is (192,168,25,48) The default ip address is 100.1.1.1
<i>port</i>	optional port value as integer. The default value is 4000.

4.9.3 Member Function Documentation

4.9.3.1 getIP()

```
def getIP (
    self )
```

Returns the IP address of the [EyeLink](#) node.

Returns

A four-item tuple (integer) containing the IP address of the [EyeLink](#) node.

4.9.3.2 getPort()

```
def getPort (
    self )
```

Returns the port number of the [EyeLink](#) node.

Returns

An integer for the port number of the connection.

4.10 EyeLinkCBind Class Reference

Inherited by [EyeLinkListener](#).

Public Member Functions

- def [calculateOverallVelocityAndAcceleration](#) ()
- def [getTrackerVersion](#) ()
- def [nodeSendMessage](#) ()
- def [getkey](#) ()
- def [trackerTimeUsecOffset](#) ()
- def [startPlayBack](#) ()
- def [doTrackerSetup](#) ()
- def [inSetup](#) ()
- def [stopData](#) ()
- def [receiveDataFile](#) ()
- def [readKeyQueue](#) ()
- def [sendCommand](#) ()
- def [reset](#) ()
- def [openDataFile](#) ()
- def [sendTimedCommandEx](#) ()
- def [eyeAvailable](#) ()
- def [userMenuSelection](#) ()
- def [dummy_open](#) ()
- def [calculateVelocityXY](#) ()
- def [imageModeDisplay](#) ()
- def [requestTime](#) ()
- def [calculateVelocity](#) ()
- def [waitForBlockStart](#) ()
- def [echo_key](#) ()
- def [sendMessage](#) ()
- def [getNode](#) ()
- def [readKeyButton](#) ()
- def [bitmapBackdrop](#) ()
- def [pollTrackers](#) ()
- def [close](#) ()
- def [key_message_pump](#) ()
- def [closeDataFile](#) ()
- def [getNextData](#) ()
- def [acceptTrigger](#) ()

- def [startRecording](#) ()
- def [getLastMessage](#) ()
- def [readReply](#) ()
- def [trackerTimeUsec](#) ()
- def [getEventDataFlags](#) ()
- def [dataSwitch](#) ()
- def [isRecording](#) ()
- def [readRequest](#) ()
- def [getTrackerMode](#) ()
- def [sendKeybutton](#) ()
- def [startSetup](#) ()
- def [quietMode](#) ()
- def [getModeData](#) ()
- def [nodeSend](#) ()
- def [terminalBreak](#) ()
- def [startData](#) ()
- def [pollResponses](#) ()
- def [getLastButtonStates](#) ()
- def [isConnected](#) ()
- def [waitForData](#) ()
- def [broadcastOpen](#) ()
- def [getRecordingStatus](#) ()
- def [open](#) ()
- def [targetModeDisplay](#) ()
- def [getCalibrationResult](#) ()
- def [nodeReceive](#) ()
- def [getDataCount](#) ()
- def [getLastData](#) ()
- def [getSample](#) ()
- def [doDriftCorrect](#) ()
- def [setOfflineMode](#) ()
- def [getNewestSample](#) ()
- def [breakPressed](#) ()
- def [setName](#) ()
- def [getCurrentMode](#) ()
- def [resetData](#) ()
- def [getCalibrationMessage](#) ()
- def [pollRemotes](#) ()
- def [sendDataFile](#) ()
- def [getTrackerVersionString](#) ()
- def [escapePressed](#) ()
- def [pumpMessages](#) ()
- def [getSampleDataFlags](#) ()
- def [stopRecording](#) ()
- def [getButtonStates](#) ()
- def [abort](#) ()
- def [stopPlayBack](#) ()
- def [sendTimedCommand](#) ()
- def [getLastButtonPress](#) ()
- def [getKeyEx](#) ()
- def [isInDataBlock](#) ()
- def [nodeRequestTime](#) ()
- def [applyDriftCorrect](#) ()
- def [setAddress](#) ()
- def [readTime](#) ()

- def [getImageCrossHairData](#) ()
- def [bitmapSaveAndBackdrop](#) ()
- def [getEventTypeFlags](#) ()
- def [trackerTimeOffset](#) ()
- def [getPositionScalar](#) ()
- def [waitForModeReady](#) ()
- def [exitCalibration](#) ()
- def [openNode](#) ()
- def [flushKeybuttons](#) ()
- def [commandResult](#) ()
- def [getFloatData](#) ()
- def [getTargetPositionAndState](#) ()
- def [startDriftCorrect](#) ()
- def [trackerTime](#) ()

4.10.1 Detailed Description

C Implementation of [EyeLinkListener](#).

4.10.2 Member Function Documentation

4.10.2.1 calculateOverallVelocityAndAcceleration()

```
def calculateOverallVelocityAndAcceleration ( )
```

Calculates overall velocity and acceleration for left and right eyes separately.

Parameters

<i>in</i>	<i>slen</i>	Sample model to use for velocity calculation. Acceptable models are FIVE_SAMPLE_MODEL, NINE_SAMPLE_MODEL, SEVENTEEN_SAMPLE_MODEL and EL1000_TRACKER_MODEL.
-----------	-------------	--

Returns

A list with 3 elements

- The first element of the list:
 - overall velocity for left and right eye. Upon return of this function, vel[0] will contain overall velocity for left eye and vel[1] will contain overall velocity for right eye. If velocity cannot be calculated for any reason(eg. insufficient samples, no data) MISSING_DATA is filled for the given velocity.
- The second element of the list:
 - overall acceleration for left and right eye. Upon return of this function, acc[0] will contain overall acceleration for left eye and acc[1] will contain overall acceleration for right eye. If acceleration cannot be calculated for any reason(eg. insufficient samples, no data) MISSING_DATA is filled for the given acceleration.
- The third element of the list:
 - vel_sample Velocity for sample.

4.10.2.2 getTrackerVersion()

```
def getTrackerVersion ( )
```

After connection, determines if the connected tracker is an [EyeLink I](#) or II. Use [getTrackerVersionString\(\)](#) to get the string value.

Remarks

This is equivalent to the C API

```
INT16 eyelink_get_tracker_version(char *c);
```

Returns

The returned value is a number (0 if not connected, 1 for [EyeLink I](#), 2 for [EyeLink II](#)).

4.10.2.3 nodeSendMessage()

```
def nodeSendMessage ( )
```

Sends a text message the connected eye tracker. The text will be added to the EDF file.

Remarks

If the link is initialized but not connected to a tracker, the message will be sent to the tracker set by [setAddress\(\)](#) of the pylink module. This function is equivalent to the C API

```
INT16 eyelink_node_send_message(ELINKADDR node, char *msg);
```

Parameters

<i>address</i>	Address of a specific tracker.
<i>message</i>	Text to send to the tracker.

Returns

0 if no error, else link error code.

4.10.2.4 getkey()

```
def getkey ( )
```

Returns the key pressed.

Remarks

Warning: This function processes and dispatches any waiting messages. This will allow Windows to perform disk access and negates the purpose of realtime mode. Usually these delays will be only a few milliseconds, but delays over 20 milliseconds have been observed. You may wish to call `escapePressed()` or `breakPressed()` in recording loops instead of `getKey()` if timing is critical, for example in a gaze-contingent display. Under Windows XP, these calls will not work in realtime mode at all (although these do work under Windows 2000). Under Windows 95/98/Me, realtime performance is impossible even with this strategy. Some useful keys are:

- CURS_UP
- CURS_DOWN
- CURS_LEFT
- CURS_RIGHT
- ESC_KEY
- ENTER_KEY
- TERMINATE_KEY
- JUNK_KEY

This function is equivalent to the C API

```
unsigned getKey(void);
```

Returns

0 if no key pressed, else key code. `TERMINATE_KEY` if CTRL-C held down or program has been terminated.

4.10.2.5 trackerTimeUsecOffset()

```
def trackerTimeUsecOffset ( )
```

Returns the time difference between the tracker time and display pc time.

Remarks

This is equivalent to the C API

```
double eyelink_time_usec_offset();
```

Returns

A double precision data for the time difference (in microseconds) between the tracker time and display pc time.

4.10.2.6 startPlayBack()

```
def startPlayBack ( )
```

Flushes data from queue and starts data playback. An EDF file must be open and have at least one recorded trial. Use `waitForData()` method to wait for data: this will time out if the playback failed. Playback begins from start of file or from just after the end of the next-but-last recording block. Link data is determined by file contents, not by link sample and event settings.

Remarks

This function is equivalent to the C API
`INT16 eyelink_playback_start(void);`

Returns

0 if command sent fine, else link error.

4.10.2.7 doTrackerSetup()

```
def doTrackerSetup ( )
```

Switches the [EyeLink](#) tracker to the Setup menu, from which camera setup, calibration, validation, drift correction, and configuration may be performed. Pressing the 'ESC' key on the tracker keyboard will exit the Setup menu and return from this function. Calling `exitCalibration()` from an event handler will cause any call to `do_tracker_setup()` in progress to return immediately.

Parameters

<i>width</i>	Width of the screen.
<i>height</i>	Height of he screen.

4.10.2.8 inSetup()

```
def inSetup ( )
```

Checks if tracker is still in a Setup menu activity (includes camera image view, calibration, and validation). Used to terminate the subject setup loop.

Remarks

This function is equivalent to the C API
`INT16 eyelink_in_setup(void);`

Returns

0 if no longer in setup mode.

4.10.2.9 stopData()

```
def stopData ( )
```

Places tracker in idle (off-line) mode, does not flush data from queue.

Remarks

Should be followed by a call to [waitForModeReady\(\)](#) method. This function is equivalent to the C API
`INT16 eyelink_data_stop(void);`

Returns

0 if command sent fine, else link error.

4.10.2.10 receiveDataFile()

```
def receiveDataFile ( )
```

This receives a data file from the [EyeLink](#) tracker PC. Source file name and destination file name should be given.

Remarks

This function is equivalent to the C API
`int receive_data_file(char *src, char *dest, int is_path=0);`

Parameters

<i>src</i>	Name of eye tracker file (including extension).
<i>dest</i>	Name of local file to write to (including extension).

Returns

Size of file if successful, Otherwise Runtime Exception is raised.

4.10.2.11 readKeyQueue()

```
def readKeyQueue ( )
```

Read keys from the key queue. It is similar to [getKey\(\)](#), but does not process Windows messages. This can be used to build key-message handlers in languages other than C.

Remarks

This function is equivalent to the C API
`UINT16 read_getkey_queue(void);`

Returns

0 if no key pressed.
JUNK_KEY (1) if untranslatable key.
TERMINATE_KEY (0x7FFF) if CTRL-C is pressed, `terminal_break()` was called, or the program has been terminated with ALT-F4.
or code of key if any key pressed.

4.10.2.12 sendCommand()

```
def sendCommand ( )
```

Sends the given command to connected eyelink tracker and returns the command result.

Remarks

This is equivalent to the C API
`int eyecmd_printf(char *fmt, ...); // without any formatting.`

Parameters

<i>command_text</i>	Text command to be sent. It does not support <code>printf()</code> kind of formatting.
---------------------	--

Returns

Command result. If there is any problem sending the command, a runtime exception is raised.

4.10.2.13 reset()

```
def reset ( )
```

Sends a reset message to the [EyeLink](#) tracker.

Remarks

This function is equivalent to the C API
`INT16 eyelink_close(int send_msg); // with send_msg parameter 0.`

Returns

0 if successful, otherwise link error.

4.10.2.14 openDataFile()

```
def openDataFile ( )
```

Opens a new EDF file on the [EyeLink](#) tracker computer's hard disk. By calling this function will close any currently opened file. This may take several seconds to complete. The file name should be formatted for MS-DOS, usually 8 or less characters with only 0-9, A-Z, and '_' allowed.

Remarks

This function is equivalent to the C API
`int open_data_file(char *name);`

Parameters

<i>name</i>	Name of eye tracker file, 8 characters or less.
-------------	---

Returns

0 if file was opened successfully else error code.

4.10.2.15 sendTimedCommandEx()

```
def sendTimedCommandEx ( )
```

Sends a command to the connected eye tracker, wait for reply.

Returns

List of 2 items. The first item contains the return value of `eyelink_timed_command()`. The second item contains a string description of the error message.

Remarks

If there is an error, no exception is raised.

See also

[sendTimedCommand\(\)](#)

4.10.2.16 eyeAvailable()

```
def eyeAvailable ( )
```

After calling the [waitForBlockStart\(\)](#) method, or after at least one sample or eye event has been read, this function can be used to check which eyes data is available for.

Remarks

This is equivalent to the C API
`INT16 eyelink_eye_available(void);`

Returns

LEFT_EYE (0) if left eye data.
RIGHT_EYE (1) if right eye data.
BINOCULAR (2) if both left and right eye data.
-1 if no eye data is available.

4.10.2.17 userMenuSelection()

```
def userMenuSelection ( )
```

Checks for a user-menu selection, clears response for next call.

Remarks

This function is equivalent to the C API
`INT16 eyelink_user_menu_selection(void);`

Returns

0 if no selection made since last call, else code of selection.

4.10.2.18 dummy_open()

```
def dummy_open ( )
```

Sets the [EyeLink](#) library to simulate an eyetracker connection. Functions will return plausible values, but no data.

Remarks

The function [isConnected\(\)](#) will return -1 to indicate a simulated connection.

4.10.2.19 calculateVelocityXY()

```
def calculateVelocityXY ( )
```

Calculates left x velocity, left y velocity, right x velocity and right y velocity from queue of samples.

Parameters

<i>in</i>	<i>slen</i>	Sample model to use for velocity calculation. Acceptable models are FIVE_SAMPLE_MODEL, NINE_SAMPLE_MODEL, SEVENTEEN_SAMPLE_MODEL and EL1000_TRACKER_MODEL.
-----------	-------------	--

Returns

A list with 3 elements

- The first element of the list:
 - leftvel x and y velocity for left eye. The float tuple of 2 filled with x and y velocity values. Upon return of this function leftvel[0] contains the left x velocity data and leftvel[1] contains left y velocity data. If velocity cannot be calculated for any reason (eg. insufficient samples, no data) MISSING_DATA is filled for the given velocity.
- The second element of the list:
 - rightvel x and y velocity for right eye. The float tuple of 2 filled with x and y velocity values. Upon return of this function rightvel[0] contains the right x velocity data and rightvel[1] contains right y velocity data. If velocity cannot be calculated for any reason (eg. insufficient samples, no data) MISSING_DATA is filled for the given velocity.
- The third element of the list:
 - vel_sample Velocity for sample.

4.10.2.20 imageModeDisplay()

```
def imageModeDisplay ( )
```

This handles display of the [EyeLink](#) camera images. While in imaging mode, it continuously requests and displays the current camera image. It also displays the camera name and threshold setting. Keys on the subject PC keyboard are sent to the tracker, so the experimenter can use it during setup. It will exit when the tracker leaves imaging mode or disconnects.

Returns

0 if OK, TERMINATE_KEY if pressed, -1 if disconnect.

Remarks

This function not normally used externally. If you need camera setup use [doTrackerSetup\(\)](#) or if you need drift correction use [doDriftCorrect\(\)](#)

4.10.2.21 requestTime()

```
def requestTime ( )
```

Sends a request the connected eye tracker to return its current time.

Remarks

The time reply can be read with `readTime()`.

Returns

0 if no error, else link error code.

See also

`rackerTime()`

4.10.2.22 calculateVelocity()

```
def calculateVelocity ( )
```

Calculates overall velocity for left and right eyes separately.

Parameters

<i>in</i>	<i>slen</i>	Sample model to use for velocity calculation. Acceptable models are FIVE_SAMPLE_MODEL, NINE_SAMPLE_MODEL, SEVENTEEN_SAMPLE_MODEL and EL1000_TRACKER_MODEL.
-----------	-------------	---

Returns

A list with 3 elements:

- First two elements of the list:
 - Upon return of this function, `vel[0]` will contain overall velocity for left eye and `vel[1]` will contain overall velocity for right eye. If velocity cannot be calculated for any reason(eg. insufficient samples, no data) MISSING_DATA is filled for the given velocity.
- Third element of the list:
 - `vel_sample` Velocity for sample.

4.10.2.23 waitForBlockStart()

```
def waitForBlockStart ( )
```

Reads and discards events in data queue until in a recording block. Waits for up to `<timeout>` milliseconds for a block containing samples, events, or both to be opened. Items in the queue are discarded until the block start events are found and processed. This function will fail if both samples and events are selected but only one of link samples and events were enabled by `startRecording()`.

Remarks

This function did not work in versions previous to 2.0. This function is equivalent to the C API
`INT16 eyelink_wait_for_block_start(UINT32 maxwait,INT16 samples, INT16 events);`

Parameters

<i>timeout</i>	Time in milliseconds to wait.
<i>samples</i>	If non-zero, check if in a block with samples.
<i>events</i>	If non-zero, check if in a block with events.

Exceptions

<i>Runtime</i>	exception is raised if time expires and no data of masked types is available. handling: <code>getLastError() [0]==0</code>
----------------	--

Returns

`true` if data is available

4.10.2.24 echo_key()

```
def echo_key ( )
```

Checks for Windows keystroke events and dispatches messages; similar to `getKey()`, but also sends keystroke to tracker.

Remarks

Warning: Under Windows XP, this call will not work in realtime mode at all, and will take several seconds to respond if graphics are being drawn continuously. This function works well in realtime mode under Windows 2000. This function is equivalent to the C API
`unsigned echo_key(void);`

Returns

0 if no key pressed, else key code `TERMINATE_KEY` if CTRL-C held down or program has been terminated.

4.10.2.25 sendMessage()

```
def sendMessage ( )
```

Sends the given message to the connected eyelink tracker. The message will be written to the eyelink tracker.

Remarks

This is equivalent to the C API
`int eyemsg_printf(char *fmt, ...);`

Parameters

<i>message_text</i>	Text message to be sent. It does not support <code>printf()</code> kind of formatting.
---------------------	--

Returns

If there is any problem sending the message, a runtime exception is raised.

4.10.2.26 getNode()

```
def getNode ( )
```

Reads the responses returned by other trackers or remotes in response to `pollTrackers()` or `pollRemotes()`. It can also read the tracker broadcast address and remote broadcast addresses.

Remarks

This function is equivalent to the C API

```
INT16 eyelink_get_node(INT16 resp, void *data);
```

Parameters

<i>resp</i>	Number of responses to read: 0 gets our data, 1 get first response, 2 gets the second response, etc. -1 to read the tracker broadcast address. -2 to read remote broadcast addresses.
-------------	---

Returns

If successful, an instance of EyeLinkMessage class returned.

4.10.2.27 readKeyButton()

```
def readKeyButton ( )
```

Reads any queued key or button events from tracker.

Remarks

This function is equivalent to the C API

```
UINT16 eyelink_read_keybutton(INT16 *mods, INT16 *state, UINT16 *kcode, UINT32 *time);
```

Returns

A five-item tuple, recording (in the following order):

- Key character if key press/release/repeat, `KB_BUTTON (0xFF00)` if button press or release,
- Button number or key modifier (Shift, Alt and Ctrl key states),
- Key or button change (`KB_PRESS`, `KB_RELEASE`, or `KB_REPEAT`),
- Key scan code,
- Tracker time of the key or button change.

4.10.2.28 bitmapBackdrop()

```
def bitmapBackdrop ( )
```

This function transfers the bitmap to the tracker PC as backdrop for gaze cursors.

Parameters

<i>iwidth</i>	Original image width.
<i>iheight</i>	Original image height.
<i>pixels</i>	Pixels of the image in one of two possible formats: pixel=[line1, line2, ... linen] line=[pix1,pix2,...,pixn],pix=(r,g,b). pixel=[line1, line2, ... linen] line=[pix1,pix2,...,pixn],pix=0xAARRGGBB.
<i>xs</i>	Crop x position.
<i>ys</i>	Crop y position.
<i>width</i>	Crop width.
<i>height</i>	Crop height.
<i>xd</i>	X position - transfer.
<i>yd</i>	Y position - transfer.
<i>xferoptions</i>	Transfer options(BX_AVERAGE, BX_DARKEN, BX_LIGHTEN, BX_MAXCONTRAST, BX_↔ NODITHER, BX_GRAYSCALE). Transfer options set with bitwise OR of the following constants, determines how bitmap is processed: <ul style="list-style-type: none"> • BX_AVERAGE Averaging combined pixels • BX_DARKEN Choosing darkest and keep thin dark lines. • BX_LIGHTEN Choosing darkest and keep thin white lines and control how bitmap size is reduced to fit tracker display. • BX_MAXCONTRAST Maximizes contrast for clearest image. • BX_NODITHER Disables the dithering of the image. • BX_GRAYSCALE Converts the image to grayscale (grayscale works best for EyeLink I, text, etc.).

Remarks

This function should not be called when timing is critical, as this might take very long to return.

4.10.2.29 pollTrackers()

```
def pollTrackers ( )
```

Asks all trackers (with [EyeLink](#) software running) on the network to send their names and node address.

Remarks

This function is equivalent to the C API

```
INT16 eyelink_poll_trackers(void);
```

Returns

0 if successful, otherwise link error.

4.10.2.30 close()

```
def close ( )
```

Sends a disconnect message to the [EyeLink](#) tracker.

Remarks

This function is equivalent to the C API
`INT16 eyelink_close(int send_msg); // with send_msg parameter 1.`

Returns

0 if successful, otherwise link error.

4.10.2.31 key_message_pump()

```
def key_message_pump ( )
```

Similar to [pumpMessages\(\)](#), but only processes keypresses. This may help reduce latency.

4.10.2.32 closeDataFile()

```
def closeDataFile ( )
```

Closes any currently opened EDF file on the [EyeLink](#) tracker computer's hard disk. This may take several seconds to complete.

Remarks

This function is equivalent to the C API
`int close_data_file(void);`

Returns

0 if command executed successfully else error code.

4.10.2.33 getNextData()

```
def getNextData ( )
```

Fetches next data item from link buffer and returns the data item type. If the item is not wanted, simply ignore it. Otherwise, call [getFloatData\(\)](#) to read it into a buffer.

Returns

0 if no data, `SAMPLE_TYPE` if sample, else event type.

4.10.2.34 acceptTrigger()

```
def acceptTrigger ( )
```

Triggers the [EyeLink](#) tracker to accept a fixation on a target, similar to the 'Enter' key or spacebar on the tracker.

Remarks

This function is equivalent to the C API
`INT16 eyelink_accept_trigger(void);`

Returns

NO_REPLY if drift correction not completed yet.
 OK_RESULT (0) if success.
 ABORT_REPLY (27) if 'ESC' key aborted operation.
 -1 if operation failed.
 1 if poor calibration or excessive validation error.

4.10.2.35 startRecording()

```
def startRecording ( )
```

Starts the [EyeLink](#) tracker recording, sets up link for data reception if enabled.

Remarks

Recording may take 10 to 30 milliseconds to begin from this command. The function also waits until at least one of all requested link data types have been received. If the return value is not zero, return the result as the trial result code. This is equivalent to the C API

```
INT16 start_recording(INT16 file_samples, INT16 file_events, INT16 link_samples, INT16 link_events);
```

Parameters

<i>file_samples</i>	If 1, writes samples to EDF file. If 0, disables sample recording.
<i>file_events</i>	If 1, writes events to EDF file. If 0, disables event recording.
<i>link_samples</i>	If 1, sends samples through link. If 0, disables link sample access.
<i>link_events</i>	If 1, sends events through link. If 0, disables link event access.

Returns

0 if successful, else trial return code.

4.10.2.36 getLastMessage()

```
def getLastMessage ( )
```

Returns text associated with last command response: may have error message.

Remarks

This is equivalent to the C API
`INT16 eyelink_last_message(char *buf);`

Returns

Text associated with last command response or None.

4.10.2.37 readReply()

```
def readReply ( )
```

Returns text with reply to last read request.

Remarks

This is equivalent to the C API
`INT16 eyelink_read_reply(char *buf);`

Returns

String to contain text or None.

4.10.2.38 trackerTimeUsec()

```
def trackerTimeUsec ( )
```

Returns the current tracker time (in microseconds) since the tracker application started.

Remarks

This is equivalent to the C API
`UINT32 eyelink_tracker_time();`

Returns

A double precision data for the current tracker time (in microseconds) since tracker initialization.

4.10.2.39 getEventDataFlags()

```
def getEventDataFlags ( )
```

Returns the event data content flags.

Remarks

This is equivalent to the C API
`UINT16 eyelink_event_data_flags(void);`

Returns

Possible return values are a set of the following bit flags:

Constant Name	Value	Description
EVENT_VELOCITY	0x8000	Has velocity data
EVENT_PUPLISIZE	0x4000	Has pupil size data
EVENT_GAZERES	0x2000	Has gaze resolution
EVENT_STATUS	0x1000	Has status flags
EVENT_GAZEXY	0x0400	Has gaze x, y position
EVENT_HREFXY	0x0200	Has head-ref x, y position
EVENT_PUPILXY	0x0100	Has pupil x, y position
FIX_AVG_ONLY	0x0008	Only average data to fixation events
START_TIME_ONLY	0x0004	Only start-time in start events
PARSED_BY_GAZE	0x00C0	Events were generated by GAZE data
PARSED_BY_HREF	0x0080	Events were generated by HREF data
PARSED_BY_PUPIL	0x0040	Events were generated by PUPIL data

4.10.2.40 dataSwitch()

```
def dataSwitch ( )
```

Sets what data from tracker will be accepted and placed in queue.

Remarks

This does not start the tracker recording, and so can be used with `broadcastOpen()`. It also does not clear old data from the queue. This function is equivalent to the C API

```
INT16 eyelink_data_switch(UINT16 flags);
```

Parameters

<i>flags</i>	Bitwise OR of the following flags: <ul style="list-style-type: none"> • RECORD_LINK_SAMPLES - send samples on link. • RECORD_LINK_EVENTS - send events on link.
--------------	---

Returns

0 if no error, else link error code.

4.10.2.41 isRecording()

```
def isRecording ( )
```

Check if we are recording: if not, report an error. Call this function while recording. It will return true if recording is still in progress, otherwise it will throw an exception. It will also handle the [EyeLink Abort](#) menu. Any errors returned by this function should be returned by the trial function. On error, this will disable realtime mode and restore the heuristic.

Remarks

This function is equivalent to the C API
`int check_recording(void);`

Returns

TRIAL_OK (0) if no error.
REPEAT_TRIAL, SKIP_TRIAL, ABORT_EXPT, TRIAL_ERROR if recording aborted.

4.10.2.42 readRequest()

```
def readRequest ( )
```

Sends a text variable name whose value is read and returned by the tracker as a text string.

Remarks

If the link is initialized but not connected to a tracker, the message will be sent to the tracker set by `setAddress()`. However, these requests will be ignored by tracker versions older than [EyeLink I v2.1](#) and [EyeLink II v1.1](#). This is equivalent to the C API
`INT16 eyelink_read_request(char *text);`

Parameters

<i>text</i>	String with message to send.
-------------	------------------------------

Returns

0 if success, otherwise link error code.

4.10.2.43 getTrackerMode()

```
def getTrackerMode ( )
```

Returns raw [EyeLink](#) mode numbers.

Remarks

This function is equivalent to the C API
`INT16 eyelink_tracker_mode(void);`

Returns

Raw [EyeLink](#) mode, -1 if link disconnected.

Constant	Value
EL_IDLE_MODE	1
EL_IMAGE_MODE	2
EL_SETUP_MENU_MODE	3
EL_USER_MENU_1	5
EL_USER_MENU_2	6
EL_USER_MENU_3	7
EL_OPTIONS_MENU_MODE	8
EL_OUTPUT_MENU_MODE	9
EL_DEMO_MENU_MODE	10
EL_CALIBRATE_MODE	11
EL_VALIDATE_MODE	12
EL_DRIFT_CORR_MODE	13
EL_RECORD_MODE	14

USER_MENU_NUMBER(mode) ((mode) - 4)

4.10.2.44 sendKeybutton()

```
def sendKeybutton ( )
```

Sends a key or button event to tracker. Only key events are handled for remote control.

Remarks

This function is equivalent to the C API

```
INT16 eyelink_send_keybutton(UINT16 code, UINT16 mods, INT16 state);
```

Parameters

<i>code</i>	Key character, or KB_BUTTON (0xFF00) if sending button event.
<i>mods</i>	Button number, or key modifier (Shift, Alt and Ctrl key states).
<i>state</i>	Key or button change (KB_PRESS or KB_RELEASE).

Returns

0 if OK, else send link error.

4.10.2.45 startSetup()

```
def startSetup ( )
```

Switches the [EyeLink](#) tracker to the setup menu, for calibration, validation, and camera setup. Should be followed by a call to [waitForModeReady\(\)](#).

Remarks

This is equivalent to the C API
`INT16 eyelink_start_setup(void);`

Returns

0 if command send fine.

4.10.2.46 quietMode()

```
def quietMode ( )
```

Controls the level of control an application has over the tracker.

Remarks

This function is equivalent to the C API
`INT16 eyelink_quiet_mode(INT16 mode);`

Parameters

<i>mode</i>	0 to allow all communication; 1 to block commands (allows only key presses, messages, and time or variable read requests); 2 to disable all commands, requests and messages; -1 to just return current setting.
-------------	--

Returns

Returns the previous mode settings.

4.10.2.47 getModeData()

```
def getModeData ( )
```

After calling `waitForBlockStart()`, or after at least one sample or eye event has been read, returns [EyeLink II](#) extended mode data.

Remarks

This function is equivalent to the C API
`INT16 eyelink2_mode_data(INT16 *sample_rate, INT16 *crmode, INT16 *file_filter, INT16 *link_filter);`

Returns

A five-item tuple holding (in the following order):

- success value of call to `eyelink2_mode_data()`. 0 if link state data available, -1 otherwise.
- sampling rate (samples per second),
- CR mode flag (0 if pupil-only mode, else pupil-CR mode),
- filter level applied to file samples (0 = off, 1 = std, 2 = extra),
- filter level applied to link and analog output samples (0 = off, 1 = std, 2 = extra).

4.10.2.48 nodeSend()

```
def nodeSend ( )
```

Sends a given data to the given node.

Remarks

This function is equivalent to the C API

```
INT16 eyelink_node_send(ELINKADDR node, void *data, UINT16 dsize);
```

Parameters

<i>addr</i>	the address of the node.
<i>data</i>	Pointer to buffer containing data to send.
<i>length</i>	Number of bytes of data.

Returns

0 if successful, otherwise link error.

4.10.2.49 terminalBreak()

```
def terminalBreak ( )
```

This function can be called in an event handler to signal that the program is terminating. Calling this function with an argument of 1 will cause `breakPressed()` to return 1, and `getKey()` to return `TERMINATE_KEY`. These functions can be re-enabled by calling `terminalBreak()` with an argument of 0.

Remarks

This function is equivalent to the C API

```
void terminal_break(INT16 assert);
```

Parameters

<i>assert</i>	1 to signal a program break, 0 to reset break.
---------------	--

4.10.2.50 startData()

```
def startData ( )
```

Switches tracker to Record mode, enables data types for recording to EDF file or sending to link. These types are set with a bit wise OR of these flags:

Constant Name	Value	Description
RECORD_FILE_SAMPLES	1	Enables sample recording to EDF file
RECORD_FILE_EVENTS	2	Enables event recording to EDF file
RECORD_LINK_SAMPLES	4	Enables sending samples to the link
RECORD_LINK_EVENTS	8	Enables sending events to the link

Remarks

If <lock> is nonzero, the recording may only be terminated through [stopRecording\(\)](#) or [stopData\(\)](#) method of the [EyeLinkListener](#) class, or by the Abort menu ('Ctrl' 'Alt' 'A' keys on the eye tracker). If zero, the tracker 'ESC' key may be used to halt recording. This function is equivalent to the C API `INT16 eyelink_data_start(UINT16 flags, INT16 lock);`

Parameters

<i>flags</i>	Bitwise OR of flags to control what data is recorded. If 0, recording will be stopped.
<i>lock</i>	If nonzero, prevents 'ESC' key from ending recording.

Returns

0 if command sent fine, else link error.

4.10.2.51 pollResponses()

```
def pollResponses ( )
```

Returns the count of node addresses received so far following the call of [pollRemotes\(\)](#) or [pollTrackers\(\)](#).

Remarks

You should allow about 100 milliseconds for all nodes to respond. Up to 4 node responses are saved. This function is equivalent to the C API `INT16 eyelink_poll_responses(void);`

Returns

Number of nodes responded. 0 if no responses.

4.10.2.52 getLastButtonStates()

```
def getLastButtonStates ( )
```

Returns a flag word with bits set to indicate which tracker buttons are currently pressed. This is button 1 for the LSB, up to button 16 for the MSB. Same as [getButtonStates\(\)](#) except, the time is also returned.

Returns

a list of with values time and states of 7 buttons. Example:

```
v = eyelink.getLastButtonStates()
print "time of last button states ", v[0]
print "Button states"
button_states = v[1:]
button =0
for x in button_states:
    button = button +1
    if x!=0:
        print "Button ",button," Pressed "
```

See also

[eyelink_send_keybutton\(\)](#)

4.10.2.53 isConnected()

```
def isConnected ( )
```

Checks whether the connection to the tracker is alive.

Remarks

This is equivalent to the C API
`INT16 eyelink_is_connected(void);`

Returns

0 if link closed.
-1 if simulating connection.
1 for normal connection.
2 for broadcast connection.

4.10.2.54 waitForData()

```
def waitForData ( )
```

Waits for data to be received from the eye tracker. Can wait for an event, a sample, or either. Typically used after record start to check if data is being sent.

Remarks

This function is equivalent to the C API
`INT16 eyelink_wait_for_data (UINT32 maxwait, INT16 samples, INT16 events);`

Parameters

<i>maxwait</i>	Time in milliseconds to wait for data.
<i>samples</i>	If 1, return when first sample available.
<i>events</i>	If 1, return when first event available.

Exceptions

<i>RuntimeError</i>	if time expires and no data of masked types is available. handling: <code>getLastError()[0] == 0</code>
---------------------	--

Returns

1 if data is available.

4.10.2.55 broadcastOpen()

```
def broadcastOpen ( )
```

Allows a third computer to listen in on a session between the eye tracker and a controlling remote machine. This allows it to receive data during recording and playback, and to monitor the eye tracker mode. The local computer will not be able to send commands to the eye tracker, but may be able to send messages or request the tracker time.

Remarks

This may not function properly, if there are more than one Ethernet cards installed. This function is equivalent to the C API

```
INT16 eyelink_broadcast_open(void);
```

Returns

0 if successful.

LINK_INITIALIZE_FAILED if link could not be established.

CONNECT_TIMEOUT_FAILED if tracker did not respond.

WRONG_LINK_VERSION if the versions of the [EyeLink](#) library and tracker are incompatible.

4.10.2.56 getRecordingStatus()

```
def getRecordingStatus ( )
```

Checks if we are in Abort menu after recording stopped and returns trial exit code. Call this function on leaving a trial. It checks if the [EyeLink](#) tracker is displaying the Abort menu, and handles it if required. The return value from this function should be returned as the trial result code.

Remarks

This function is equivalent to the C API

```
INT16 check_record_exit(void);
```

Returns

TRIAL_OK if no error.

REPEAT_TRIAL, SKIP_TRIAL, ABORT_EXPT if Abort menu activated.

4.10.2.57 open()

```
def open ( )
```

Opens connection to single tracker. If no parameters are given, it tries to open connection to the default host (100.1.1.1).

Remarks

This is equivalent to the C API

```
INT16 eyelink_open_node(ELINKADDR node, INT16 busytest);
```

Parameters

<i>eyelink_address</i>	Optional argument. Text IP address of the host PC (the default value is, "100.1.1.1").
<i>busytest</i>	Optional argument. If non-zero the call to <code>eyelink_open_node()</code> will not disconnect an existing connection.

Returns

Throws Runtime error exception if it cannot open the connection.

4.10.2.58 targetModeDisplay()

```
def targetModeDisplay ( )
```

This function needs some "helper" graphics to clear the screen and draw the fixation targets. Since C graphics are compiler-dependent, these are found in other C source files.

While tracker is in any mode with fixation targets... Reproduce targets tracker needs. (if `local_trigger`) Local Spacebar acts as trigger. (if `local_control`) Local keys echoes to tracker.

Returns

0 if OK, 27 if aborted, `TERMINATE_KEY` if pressed..

4.10.2.59 getCalibrationResult()

```
def getCalibrationResult ( )
```

Checks for a numeric result code returned by calibration, validation, or drift correction.

Remarks

This function is equivalent to the C API

```
INT16 eyelink_cal_result(void);
```

Returns

`NO_REPLY` if drift correction not completed yet.

`OK_RESULT` (0) if success.

`ABORT_REPLY` (27) if 'ESC' key aborted operation.

-1 if operation failed.

1 if poor calibration or excessive validation error.

4.10.2.60 nodeReceive()

```
def nodeReceive ( )
```

Checks for and gets the last packet received, stores the data and the node address sent from.

Remarks

Data can only be read once, and is overwritten if a new packet arrives before the last packet has been read.

This function is equivalent to the C API

```
INT16 eyelink_node_receive(ELINKADDR node, void *data);
```

Returns

An instance of EyeLinkMessage class is returned, if successful.

4.10.2.61 getDataCount()

```
def getDataCount ( )
```

Counts total items in queue: samples, events, or both.

Remarks

This function is equivalent to the C API

```
INT16 eyelink_data_count(INT16 samples, INT16 events);
```

Parameters

<i>samples</i>	if non-zero count the samples.
<i>events</i>	if non-zero count the events.

Returns

Total number of samples and events is in the queue.

4.10.2.62 getLastData()

```
def getLastData ( )
```

Gets an integer (unconverted) copy of the last/newest link data (sample or event) seen by [getNextData\(\)](#).

Remarks

This function is equivalent to the C API

```
INT16 eyelink_get_last_data(void *buf);
```

Returns

Object of type [Sample](#) or Event.

4.10.2.63 getSample()

```
def getSample ( )
```

Gets an integer (unconverted) sample from end of queue, discards any events encountered.

Remarks

This is equivalent to the C API
`INT16 eyelink_get_sample(void *sample);`

Returns

Object of type [Sample](#).

4.10.2.64 doDriftCorrect()

```
def doDriftCorrect ( )
```

Performs a drift correction before a trial.

Remarks

This is equivalent to the C API
`int do_drift_correct(int x, int y, int draw, int allow_setup);`

Parameters

<i>x</i>	X Position (in pixels) of drift correction target.
<i>y</i>	Y Position (in pixels) of drift correction target.
<i>draw</i>	If 1, the drift correction will clear the screen to the target background color, draw the target, and clear the screen again when the drift correction is done. If 0, the fixation target must be drawn by the user.
<i>allow_setup</i>	If 1, accesses Setup menu before returning, else aborts drift correction.

Returns

0 if successful, 27 if 'ESC' key was pressed to enter Setup menu or abort.

4.10.2.65 setOfflineMode()

```
def setOfflineMode ( )
```

Places [EyeLink](#) tracker in off-line (idle) mode. Wait till the tracker has finished the mode transition.

Remarks

This is equivalent to the C API
`INT16 set_offline_mode(void);`

4.10.2.66 getNewestSample()

```
def getNewestSample ( )
```

Check if a new sample has arrived from the link. This is the latest sample, not the oldest sample that is read by [getNextData\(\)](#), and is intended to drive gaze cursors and gaze-contingent displays.

Remarks

This function is equivalent to the C API
`INT16 CALLTYPE eyelink_newest_float_sample(void FARTYPE *buf);`

Returns

None if there is no sample, instance of [Sample](#) type otherwise.

4.10.2.67 breakPressed()

```
def breakPressed ( )
```

Tests if the program is being interrupted. You should break out of loops immediately if this function does not return 0, if [getKey\(\)](#) return `TERMINATE_KEY`, or if [isConnected\(\)](#) method of the class returns 0.

Remarks

Under Windows XP, this call will not work in realtime mode at all, and will take several seconds to respond if graphics are being drawn continuously. This function works well in realtime mode under Windows 2000. This function is equivalent to the C API

```
INT16 break_pressed(void);
```

Returns

1 if CTRL-C is pressed, [terminalBreak\(\)](#) was called, or the program has been terminated with ALT-F4;
0 otherwise

4.10.2.68 setName()

```
def setName ( )
```

Sets the node name of this computer (up to 35 characters).

Remarks

This function is equivalent to the C API
`INT16 eyelink_set_name(char *name);`

Parameters

<i>name</i>	String to become new name.
-------------	----------------------------

4.10.2.69 getCurrentMode()

```
def getCurrentMode ( )
```

This function tests the current tracker mode, and returns a set of flags based of what the mode is doing. The most useful flag using the [EyeLink](#) experiment toolkit is `IN_USER_MENU` to test if the [EyeLink](#) Abort menu has been activated.

Remarks

This is equivalent to the C API
`INT16 eyelink_current_mode(void);`

Returns

Set of bit flags that mark mode function:

<code>IN_DISCONNECT_MODE</code>	if disconnected
<code>IN_IDLE_MODE</code>	if off-line (Idle mode)
<code>IN_SETUP_MODE</code>	if in Setup-menu related mode
<code>IN_RECORD_MODE</code>	if tracking is in progress
<code>IN_PLAYBACK_MODE</code>	if currently playing back data
<code>IN_TARGET_MODE</code>	if in mode that requires a fixation target
<code>IN_DRIFTCORR_MODE</code>	if in drift-correction
<code>IN_IMAGE_MODE</code>	if displaying grayscale camera image
<code>IN_USER_MENU</code>	if displaying Abort or user-defined menu

4.10.2.70 resetData()

```
def resetData ( )
```

Prepares link buffers to receive new data and removes old data from buffer.

4.10.2.71 getCalibrationMessage()

```
def getCalibrationMessage ( )
```

Returns text associated with result of last calibration, validation, or drift correction. This usually specifies errors or other statistics.

Remarks

This function is equivalent to the C API
`INT16 eyelink_cal_message(char *msg);`

Returns

Message string associated with result of last calibration, validation, or drift correction.

4.10.2.72 pollRemotes()

```
def pollRemotes ( )
```

Asks all non-tracker computers (with [EyeLink](#) software running) on the network to send their names and node address.

Remarks

This function is equivalent to the C API
`INT16 eyelink_poll_remotes(void);`

Returns

0 if successful, otherwise link error.

4.10.2.73 sendDataFile()

```
def sendDataFile ( )
```

This sends a file to the [EyeLink](#) tracker PC. Source file name and destination file name should be given. Using this function, an image or video can be uploaded from the Display PC to the Tracker PC. The image can later be used as a Gaze Cursor Backdrop via a call to `SendCommand("draw_image imagename.ext")`

Remarks

This function is equivalent to the C API
`int send_data_file(char *src, char *dest, int is_path=0)`

Parameters

<i>src</i>	Name of local file (including extension).
<i>dest</i>	Short Name of eye tracker file to write to (including extension).

Returns

Size of file if successful, Otherwise Runtime Exception is raised.

Example:

```

getEYELINK().sendDataFile("ur.jpg", "ur.jpg")           # transfer images as files
getEYELINK().sendDataFile("small.wmv", "small.wmv")    # transfer images as files
getEYELINK().sendCommand("draw_image ur.jpg")          # draw_image <name>
getEYELINK().sendCommand("draw_video small.wmv")       # draw_video <name> <-- webui only command

```

See also

[bitmapSaveAndBackdrop\(\)](#), [bitmapSave\(\)](#), [bitmapBackdrop\(\)](#), [sendCommand\(\)](#)

4.10.2.74 getTrackerVersionString()

```
def getTrackerVersionString ( )
```

After connection, determines if the connected tracker is an [EyeLink I](#) or [II](#) (use [getTrackerVersion](#)) to get number value.

Remarks

This is equivalent to the C API

```
INT16 eyelink_get_tracker_version(char *c);
```

Returns

A string indicating [EyeLink](#) tracker version.

4.10.2.75 escapePressed()

```
def escapePressed ( )
```

This function tests if the 'ESC' key is held down, and is usually used to break out of nested loops.

Remarks

Under Windows XP, this call will not work in realtime mode at all, and will take several seconds to respond if graphics are being drawn continuously. This function works well in realtime mode under Windows 2000. This function is equivalent to the C API

```
INT16 escape_pressed(void);
```

Returns

1 if 'ESC' key held down 0 if not.

4.10.2.76 pumpMessages()

```
def pumpMessages ( )
```

Forces the graphical environment to process any pending key or mouse events.

Remarks

This function is equivalent to the C API
`INT16 message_pump(HWND dialog_hook);`

4.10.2.77 getSampleDataFlags()

```
def getSampleDataFlags ( )
```

After calling `waitForBlockStart()`, or after at least one sample or eye event has been read, returns sample data content flag (0 if not in sample block).

Remarks

This function is equivalent to the C API
`INT16 eyelink_sample_data_flags(void);`

Returns

Possible return values are a set of the following bit flags:

Constant Name	Value	Description
SAMPLE_LEFT	0x8000	Data for left eye
SAMPLE_RIGHT	0x4000	Data for right eye
SAMPLE_TIMESTAMP	0x2000	always for link, used to compress files
SAMPLE_PUPILXY	0x1000	pupil x,y pair
SAMPLE_HREFXY	0x0800	head-referenced x,y pair
SAMPLE_GAZEXY	0x0400	gaze x,y pair
SAMPLE_GAZERES	0x0200	gaze res (x,y pixels per degree) pair
SAMPLE_PUPILSIZE	0x0100	pupil size
SAMPLE_STATUS	0x0080	error flags
SAMPLE_INPUTS	0x0040	input data port
SAMPLE_BUTTONS	0x0020	button state: LSBY state, MSBY changes
SAMPLE_HEADPOS	0x0010	head-position: byte tells # words
SAMPLE_TAGGED	0x0008	reserved variable-length tagged
SAMPLE_UTAGGED	0x0004	user-definable variable-length tagged

4.10.2.78 stopRecording()

```
def stopRecording ( )
```

Stops recording, resets [EyeLink](#) data mode. Call 50 to 100 msec after an event occurs that ends the trial. This function waits for mode switch before returning.

Remarks

This is equivalent to the C API
`void stop_recording(void);`

4.10.2.79 getButtonStates()

```
def getButtonStates ( )
```

Returns a flag word with bits set to indicate which tracker buttons are currently pressed. This is button 1 for the LSB, up to button 16 for the MSB. Buttons above 8 are not realized on the [EyeLink](#) tracker.

Remarks

This function is equivalent to the C API
`UINT16 eyelink_button_states(void);`

Returns

Flag bits for buttons currently pressed.

4.10.2.80 abort()

```
def abort ( )
```

Places [EyeLink](#) tracker in off-line (idle) mode.

Remarks

Use before attempting to draw graphics on the tracker display, transferring files, or closing link. Always call [waitForModeReady\(\)](#) afterwards to ensure tracker has finished the mode transition. This function pair is implemented by the [EyeLink](#) toolkit library function [setOfflineMode\(\)](#). This function is equivalent to the C API

```
INT16 eyelink_abort(void);
```

Returns

0 if mode switch begun, else link error.

4.10.2.81 stopPlayBack()

```
def stopPlayBack ( )
```

Stops playback if in progress. Flushes any data in queue.

Remarks

This function is equivalent to the C API
`INT16 eyelink_playback_stop(void);`

4.10.2.82 sendTimedCommand()

```
def sendTimedCommand ( )
```

Sends a command to the connected eye tracker, wait for reply.

Exceptions

<i>If</i>	there is an error, Runtime exception is raised.
-----------	---

See also

[sendTimedCommandEx\(\)](#)

4.10.2.83 getLastButtonPress()

```
def getLastButtonPress ( )
```

Reads the number of the last button detected by the [EyeLink](#) tracker. This is 0 if no buttons were pressed since the last call, or since the buttons were flushed. If a pointer to a variable is supplied the eye-tracker timestamp of the button may be read. This could be used to see if a new button has been pressed since the last read. If multiple buttons were pressed since the last call, only the last button is reported.

Remarks

This function is equivalent to the C API
`UINT16 eyelink_last_button_press(UINT32 *time);`

Returns

Two-item tuple, recording the button last pressed (0 if no button pressed since last read) and the time of the button press.

4.10.2.84 getKeyEx()

```
def getKeyEx ( )
```

Returns the key pressed. Same as [getKey\(\)](#) except, this returns a tuple with the first value contains the key and the second contains value contains the modifier.

Remarks

Warning: This function processes and dispatches any waiting messages. This will allow Windows to perform disk access and negates the purpose of realtime mode. Usually these delays will be only a few milliseconds, but delays over 20 milliseconds have been observed. You may wish to call [escapePressed\(\)](#) or [breakPressed\(\)](#) in recording loops instead of [getKey\(\)](#) if timing is critical, for example in a gaze-contingent display. Under Windows XP, these calls will not work in realtime mode at all (although these do work under Windows 2000). Under Windows 95/98/Me, realtime performance is impossible even with this strategy. Some useful keys are:

- CURS_UP
- CURS_DOWN
- CURS_LEFT
- CURS_RIGHT
- ESC_KEY
- ENTER_KEY
- TERMINATE_KEY
- JUNK_KEY

This function is equivalent to the C API
`unsigned getKey(void);`

Returns

0 if no key pressed, else key code. `TERMINATE_KEY` if CTRL-C held down or program has been terminated.

4.10.2.85 isInDataBlock()

```
def isInDataBlock ( )
```

Checks to see if framing events read from queue indicate that the data is in a block containing samples, events, or both.

Remarks

The first item in queue may not be a block start even, so this should be used in a loop while discarding items using `eyelink_get_next_data(NULL)`. NOTE: this function did not work reliably in versions of the DLL before v2.0 (did not detect end of blocks). This function is equivalent to the C API `INT16 eyelink_in_data_block(INT16 samples, INT16 events);`

Parameters

<i>samples</i>	if non-zero, check if in a block with samples.
<i>events</i>	if non-zero, check if in a block with events.

Returns

0 if no data of either masked type is being sent.

4.10.2.86 nodeRequestTime()

```
def nodeRequestTime ( )
```

Sends a request the connected eye tracker to return its current time.

Remarks

The time reply can be read with `getTrackerTime()`. This function is equivalent to the C API `UINT32 eyelink_node_request_time(ELINKADDR node);`

Parameters

<i>address</i>	Text IP address (for example, "100.1.1.1") for a specific tracker.
----------------	--

Returns

0 if no error, else link error code.

4.10.2.87 applyDriftCorrect()

```
def applyDriftCorrect ( )
```

Applies the results of the last drift correction. This is not done automatically after a drift correction, allowing the message returned by [getCalibrationMessage\(\)](#) to be examined first.

Remarks

This function is equivalent to the C API

```
INT16 eyelink_apply_driftcorr(void);
```

Returns

0 if command sent fine, else link error.

4.10.2.88 setAddress()

```
def setAddress ( )
```

Sets the IP address used for connection to the [EyeLink](#) tracker. This is set to "100.1.1.1" in the DLL, but may need to be changed for some network configurations. This must be set before attempting to open a connection to the tracker.

A "broadcast" address ("255.255.255.255") may be used if the tracker address is not known - this will work only if a single Ethernet card is installed, or if DLL version 2.1 or higher, and the latest tracker software versions ([EyeLink I](#) v2.1 or higher, and [EyeLink II](#) v1.1 or higher) are installed.

Remarks

This is equivalent to the C API

```
INT16 set_eyelink_address(char *addr);
```

Parameters

<i>text_IP_address</i>	Pointer to a string containing a "dotted" 4-digit IP address;
------------------------	---

Returns

0 if success, -1 if could not parse address string.

4.10.2.89 readTime()

```
def readTime ( )
```

Returns the tracker time requested by [eyelink_request_time\(\)](#) or [eyelink_node_request_time\(\)](#).

Returns

0 if no response yet, else timestamp in millisecond.

See also

`trackerTime()`

4.10.2.90 getImageCrossHairData()

```
def getImageCrossHairData ( )
```

4.10.2.91 bitmapSaveAndBackdrop()

```
def bitmapSaveAndBackdrop ( )
```

This function saves the entire bitmap as a .BMP, .JPG, .PNG, or .TIF file, and transfers the image to tracker as backdrop for gaze cursors.

Parameters

<i>iwidth</i>	Original image width.
<i>iheight</i>	Original image height.
<i>pixels</i>	Pixels of the image in one of two possible formats: pixel=[line1, line2, ... linen] line=[pix1,pix2,...,pixn],pix=(r,g,b). pixel=[line1, line2, ... linen] line=[pix1,pix2,...,pixn],pix=0xAARRGGBB.
<i>xs</i>	Crop x position.
<i>ys</i>	Crop y position.
<i>width</i>	Crop width.
<i>height</i>	Crop height.
<i>fname</i>	File name to save.
<i>path</i>	Path to save.
<i>svoptions</i>	Save options(SV_NOREPLACE, SV_MAKEPATH). If the file exists, it replaces the file unless SV_NOREPLACE is specified.
<i>xd</i>	X position - transfer.
<i>yd</i>	Y position - transfer.
<i>xferoptions</i>	Transfer options(BX_AVERAGE, BX_DARKEN, BX_LIGHTEN, BX_MAXCONTRAST, BX_↔ NODITHER, BX_GRAYSCALE). Transfer options set with bitwise OR of the following constants, determines how bitmap is processed: <ul style="list-style-type: none"> • BX_AVERAGE Averaging combined pixels • BX_DARKEN Choosing darkest and keep thin dark lines. • BX_LIGHTEN Choosing darkest and keep thin white lines and control how bitmap size is reduced to fit tracker display. • BX_MAXCONTRAST Maximizes contrast for clearest image. • BX_NODITHER Disables the dithering of the image.
	<ul style="list-style-type: none"> • BX_GRAYSCALE Converts the image to grayscale (grayscale works best for EyeLink 1, text, etc.).

See also

[bitmapBackdrop\(\)](#),[bitmapSave\(\)](#)

4.10.2.92 getEventTypeFlags()

```
def getEventTypeFlags ( )
```

After at least one button or eye event has been read, can be used to check what type of events will be available.

Remarks

This is equivalent to the C API
 UINT16 eyelink_event_type_flags(void);

Returns

Possible return values are a set of the following bit flags:

Constant Name	Value	Description
LEFTEYE_EVENTS	0x8000	Has left eye events
RIGHTEYE_EVENTS	0x4000	Has right eye events
BLINK_EVENTS	0x2000	Has blink events
FIXATION_EVENTS	0x1000	Has fixation events
FIXUPDATE_EVENTS	0x0800	Has fixation updates
SACCADE_EVENTS	0x0400	Has saccade events
MESSAGE_EVENTS	0x0200	Has message events
BUTTON_EVENTS	0x0040	Has button events
INPUT_EVENTS	0x0020	Has input port events

4.10.2.93 trackerTimeOffset()

```
def trackerTimeOffset ( )
```

Returns the time difference between the tracker time and display pc time.

Remarks

This is equivalent to the C API
 UINT32 eyelink_time_offset();

Returns

An integer data for the time difference (in milliseconds) between the tracker time and display pc time.

4.10.2.94 getPositionScalar()

```
def getPositionScalar ( )
```

Returns the divisor used to convert integer eye data to floating point data.

Remarks

This function is equivalent to the C API
`INT16 eyelink_position_prescaler(void);`

Returns

Integer for the divisor (usually 10).

4.10.2.95 waitForModeReady()

```
def waitForModeReady ( )
```

After a mode-change command is given to the [EyeLink](#) tracker, an additional 5 to 30 milliseconds may be needed to complete mode setup. Call this function after mode change functions.

Remarks

If it does not return 0, assume a tracker error has occurred. This function is equivalent to the C API
`INT16 eyelink_wait_for_mode_ready(UINT32 maxwait);`

Parameters

<i>maxwait</i>	Maximum milliseconds to wait for the mode to change.
----------------	--

Returns

0 if mode switching is done, else still waiting.

4.10.2.96 exitCalibration()

```
def exitCalibration ( )
```

This function should be called from a message or event handler if an ongoing call to [doDriftCorrect\(\)](#) or [doTrackerSetup\(\)](#) should return immediately.

Remarks

This function is equivalent to the C API
`void exit_calibration(void);`

4.10.2.97 openNode()

```
def openNode ( )
```

Allows the computer to connect to tracker, where the tracker is on the same network.

Remarks

This is equivalent to the C API

```
INT16 eyelink_open_node(ELINKADDR node, INT16 busytest);
```

with node parameter converted from text to ELINKADDR.

Parameters

<i>eyelink_address</i>	Text IP address of the host PC (the default value is, "100.1.1.1").
<i>busytest</i>	If non-zero the call to openNode () will not disconnect an existing connection.

Returns

Throws Runtime Exception if it connects to the remote host.

4.10.2.98 flushKeybuttons()

```
def flushKeybuttons ( )
```

Causes the [EyeLink](#) tracker and the [EyeLink](#) library to flush any stored button or key events. This should be used before a trial to get rid of old button responses. The `<enable_buttons>` argument controls whether the [EyeLink](#) library will store button press and release events. It always stores tracker key events. Even if disabled, the last button pressed and button flag bits are updated.

Remarks

This is equivalent to the C API

```
INT16 eyelink_flush_keybuttons(INT16 enable_buttons);
```

Parameters

<i>enable_buttons</i>	Sets to 0 to monitor last button press only, 1 to queue button events.
-----------------------	--

Returns

Always 0.

4.10.2.99 commandResult()

```
def commandResult ( )
```

Check for and retrieves the numeric result code sent by the tracker from the last command.

Remarks

This function is equivalent to the C API
`INT16 eyelink_command_result(void);`

Returns

`NO_REPLY` if no reply to last command.
`OK_RESULT (0)` if OK.
Other error codes represent tracker execution error.

4.10.2.100 `getFloatData()`

```
def getFloatData ( )
```

Reads data of a specific type returned by `getNextData()`. If this function called multiple times without calling `getNextData()`, the same data is returned.

Remarks

This function is equivalent to the C API
`INT16 eyelink_get_next_data(void *buf);`

Returns

None if no data available. Otherwise, a valid data is returned. The returned data type can be:

- [Sample](#)
- [StartBlinkEvent](#)
- [EndBlinkEvent](#)
- [StartSaccadeEvent](#)
- [EndSaccadeEvent](#)
- [StartFixationEvent](#)
- [EndFixationEvent](#)
- [FixUpdateEvent](#)
- [IOEvent](#)
- [MessageEvent](#)

4.10.2.101 `getTargetPositionAndState()`

```
def getTargetPositionAndState ( )
```

Returns the current target position and state.

Remarks

This function is equivalent to the C API
`INT16 eyelink_target_check(INT16 *x, INT16 *y);`

Returns

A three-item tuple holding (in the following order):

- the target visibility (1 if visible, 0 if not),
- x position of the target,
- and y position of the target.

4.10.2.102 `startDriftCorrect()`

```
def startDriftCorrect ( )
```

Sets the position of the drift correction target, and switches the tracker to drift-correction mode. Should be followed by a call to `waitForModeReady()` method.

Remarks

This function is equivalent to the C API
`INT16 eyelink_driftcorr_start(INT16 x, INT16 y);`

Parameters

<code>x</code>	x position of the target.
<code>y</code>	y position of the target.

Returns

0 if command sent fine, else link error.

4.10.2.103 `trackerTime()`

```
def trackerTime ( )
```

Returns the current tracker time (in milliseconds) since the tracker application started.

Remarks

This is equivalent to the C API
`UINT32 eyelink_tracker_time();`

Returns

An integer data for the current tracker time (in milliseconds) since tracker initialization.

4.11 EyeLinkCustomDisplay Class Reference

[EyeLinkCustomDisplay](#) is an abstract class, that one would implement to present calibration/validation/drift correction targets and camera images.

Public Member Functions

- def `__init__` (self)
Constructor takes no parameters.
- def `__updateimgsize__` (self, width, height)
Internal function to update the mage size.
- def `setup_cal_display` (self)
This function is called to setup calibration/validation display.
- def `exit_cal_display` (self)
This function is called just before exiting calibration/validation display.
- def `record_abort_hide` (self)
This function is called if abort of record.
- def `setup_image_display` (self, width, height)
This function is used to setup image display.
- def `image_title` (self, title)
This function displays the camera image title.
- def `draw_image_line` (self, width, line, totlines, buff)
This function is used to display an image line.
- def `set_image_palette` (self, red, green, blue)
This function is called to setup the image palettes.
- def `exit_image_display` (self)
Called to end the image display.
- def `clear_cal_display` (self)
Called to clear the calibration display.
- def `erase_cal_target` (self)
Called to erase the calibration or validation target.
- def `draw_cal_target` (self, x, y)
Called to draw the calibration or validation target.
- def `play_beep` (self, beepid)
Called to play target beeps.
- def `get_input_key` (self)
This function should return list of [KeyInput](#).
- def `alert_printf` (self, msg)
Called to notify any error message to display or print.
- def `draw_line` (self, x1, y1, x2, y2, colorindex)
Called to draw the cross hair, in response to the call to [draw_cross_hair\(\)](#).

- def `draw_lozenge` (self, x, y, width, height, colorindex)
Called to draw the cross hair, in response to the call to `draw_cross_hair()`.
- def `get_mouse_state` (self)
Called to get the mouse location.
- def `draw_cross_hair` (self)
User call this function to request draw cross hair.

4.11.1 Detailed Description

`EyeLinkCustomDisplay` is an abstract class, that one would implement to present calibration/validation/drift correction targets and camera images.

In addition, `EyeLinkCustomDisplay` can also play target beeps and display error messages.

To use custom display do the following.

1. Implement `EyeLinkCustomDisplay`
2. Create an instance of the custom display object
3. Use `pylink.openGraphicsEx` to let `pylink` know to use the custom display object

Example:

```
genv = EyeLinkCoreGraphicsPyGame(800,600,eyelinktracker)
openGraphicsEx(genv)
```

Example implementation of `EyeLinkCustomDisplay` Code to implement `EyeLinkCustomDisplay` using `pygame`.

4.11.2 Member Function Documentation

4.11.2.1 `__updateimgsize__()`

```
def __updateimgsize__ (
    self,
    width,
    height )
```

Internal function to update the mage size.

The size set by this function is used to draw cross hair when `draw_cross_hair()` is called This function should **not** be overridden and should **not** be called other than the display mechanism.

Parameters

<code>width</code>	Width of the image.
<code>height</code>	Height of the image.

4.11.2.2 `setup_cal_display()`

```
def setup_cal_display (
    self )
```

This function is called to setup calibration/validation display.

This will be called just before we enter into the calibration or validation or drift correction mode. Any allocation per calibration or validation drift correction can be done here. Also, it is normal to clear the display in this call.

4.11.2.3 `exit_cal_display()`

```
def exit_cal_display (
    self )
```

This function is called just before exiting calibration/validation display.

Any resource allocation done in `setup_cal_display()` can be cleared.

4.11.2.4 `record_abort_hide()`

```
def record_abort_hide (
    self )
```

This function is called if abort of record.

It is used to hide display from subject.

4.11.2.5 `setup_image_display()`

```
def setup_image_display (
    self,
    width,
    height )
```

This function is used to setup image display.

It takes expected image size of the source image. This may be called repeatedly for same display. If this fails, It should return 1 if success and 0 otherwise.

Parameters

<i>width</i>	Width of the incoming image.
<i>height</i>	Height of the incoming image.

Returns

1 if success, 0 otherwise.

4.11.2.6 image_title()

```
def image_title (
    self,
    title )
```

This function displays the camera image title.

This is called whenever the title changes

Parameters

<i>title</i>	title change
--------------	--------------

4.11.2.7 draw_image_line()

```
def draw_image_line (
    self,
    width,
    line,
    totlines,
    buff )
```

This function is used to display an image line.

This function is called with an array of bytes containing picture colors. The byte on pixels are just palette indexes. This index should be used against the palette created on the call to `set_image_palette_hook()`. The image is given line by line from top to bottom. It may be efficient to collect one full image and do a full blit of the entire image.

```
i = 0
imline = self.imagebuffer[line-1]
while i < width:
    imline[i] = self.pal[buff[i]]
i = i+1
```

4.11.2.8 set_image_palette()

```
def set_image_palette (
    self,
    red,
    green,
    blue )
```

This function is called to setup the image palettes.

The function is called with a set of RGB colors to set up for next image.

```
self.pal = []
while i < sz:
    rf = int(b[i])
    gf = int(g[i])
    bf = int(r[i])
    self.pal.append((rf<<16) | (gf<<8) | (bf))
    i = i+1
```

4.11.2.9 erase_cal_target()

```
def erase_cal_target (
    self )
```

Called to erase the calibration or validation target.

Erase the target drawn by the previous call to [draw_cal_target \(\)](#).

4.11.2.10 draw_cal_target()

```
def draw_cal_target (
    self,
    x,
    y )
```

Called to draw the calibration or validation target.

Draw a target at x,y and display it.

Remarks

x and y values are relative to the active `screen_pixel_coords` command.

Parameters

x	X location to draw the target.
y	Y location to draw the target.

4.11.2.11 play_beep()

```
def play_beep (
    self,
    beepid )
```

Called to play target beeps.

Parameters

<i>beepid</i>	<p>Id of the beep to be played. Possible values for beepid are:</p> <ul style="list-style-type: none"> • CAL_ERR_BEEP = -1 • DC_ERR_BEEP = -2 • CAL_GOOD_BEEP = 0 • CAL_TARG_BEEP = 1 • DC_GOOD_BEEP = 2 • DC_TARG_BEEP = 3
---------------	---

4.11.2.12 `get_input_key()`

```
def get_input_key (
    self )
```

This function should return list of [KeyInput](#).

If there are not keys, return an empty list or None.

4.11.2.13 `draw_line()`

```
def draw_line (
    self,
    x1,
    y1,
    x2,
    y2,
    colorindex )
```

Called to draw the cross hair, in response to the call to [draw_cross_hair\(\)](#).

This function should draw a line from (x1,y1) to (x2,y2). The x and y values are relative to the width and height of the image, given at [setup_image_display\(\)](#).

Parameters

<i>x1</i>	Starting x position.
<i>y1</i>	Starting y position.
<i>x2</i>	Ending x position.
<i>y2</i>	Ending y position.
<i>colorindex</i>	<p>Color id of the line. Possible value for colorindex are:</p> <ul style="list-style-type: none"> • CR_HAIR_COLOR=1 • PUPIL_HAIR_COLOR=2 • PUPIL_BOX_COLOR=3 • SEARCH_LIMIT_BOX_COLOR=4 • MOUSE_CURSOR_COLOR=5

4.11.2.14 draw_lozenge()

```
def draw_lozenge (
    self,
    x,
    y,
    width,
    height,
    colorindex )
```

Called to draw the cross hair, in response to the call to `draw_cross_hair()`.

This function should draw an lozenge bounded by the box (x,y),(width,height). The x and y values are relative to the width and height of the image, given at `setup_image_display()`.

Remarks

This function is not used at the moment.

Parameters

<i>x</i>	Starting x position.
<i>y</i>	Starting y position.
<i>width</i>	bounding width
<i>height</i>	bounding height
<i>colorindex</i>	Color id of the ellipse. Possible value for colorindex are: <ul style="list-style-type: none"> • CR_HAIR_COLOR=1 • PUPIL_HAIR_COLOR=2 • PUPIL_BOX_COLOR=3 • SEARCH_LIMIT_BOX_COLOR=4 • MOUSE_CURSOR_COLOR=5

4.11.2.15 get_mouse_state()

```
def get_mouse_state (
    self )
```

Called to get the mouse location.

This function should return the mouse location and the state at the time of call. ((x,y),state). At the moment we only care if the mouse is clicked or not. So, if clicked the state = 1, 0 otherwise. This function is only useful for EyeLink1000.

4.11.2.16 draw_cross_hair()

```
def draw_cross_hair (
    self )
```

User call this function to request draw cross hair.

After completion of filling in the camera image, call this function to draw the cross hair on the camera image.

4.12 EyeLinkListener Class Reference

[EyeLinkListener](#) class implements most of the core [EyeLink](#) interface.

Inherits [EyeLinkCBind](#).

Inherited by [EyeLink](#).

Public Member Functions

- def [getTrackerInfo](#) (self)
Returns the current tracker information.
- def [drawCalTarget](#) (self, position)
Allow the normal calibration target drawing to proceed at different locations.
- def [getCurrentTime](#) (self)
returns the current tracker time.
- def [getSampleRate](#) (self)
returns the current sample rate.
- def [getCRMode](#) (self)
returns the current mode data, either PUPIL_ONLY or PUPIL_CR.
- def [getLinkFilter](#) (self)
returns the Link Filter Level.
- def [getFileFilter](#) (self)
returns the File Filter Level.
- def [getEyeUsed](#) (self)
returns the eye used.
- def [sendMessage](#) (self, message_text, offset=0)
Sends the given message to the connected [EyeLink](#) tracker.
- def [imageBackdrop](#) (self, filename, Xs, Ys, width, height, Xd, Yd, xferoptions)
Sends the given image file backdrop to the connected [EyeLink](#) tracker.

4.12.1 Detailed Description

[EyeLinkListener](#) class implements most of the core [EyeLink](#) interface.

This includes the simple connection to the eye tracker, sending commands and messages to the tracker, opening and saving a recording file, performing calibration and drift correction, real-time access to tracker data and eye movement events (such as fixations, blinks, and saccades), as well as other important operations.

An instance of the [EyeLinkListener](#) class can be created by using the class constructor function. For example,

```
try:
    EYELINK = EyeLinkListener ()
except:
    EYELINK = None
```

All of the methods should be called in the format of: EYELINK.functionName(parameters), where EYELINK is an instance of the [EyeLinkListener](#) class.

4.12.2 Member Function Documentation

4.12.2.1 getTrackerInfo()

```
def getTrackerInfo (
    self )
```

Returns the current tracker information.

Returns

An instance of the [ILinkData](#) class.

4.12.2.2 drawCalTarget()

```
def drawCalTarget (
    self,
    position )
```

Allow the normal calibration target drawing to proceed at different locations.

This is equivalent to the C API

```
INT16 CALLTYPE set_draw_cal_target_hook(INT16 (CALLBACK * erase_cal_target_hook)(HDC hdc), INT16 options);
```

Parameters

<i>position</i>	A tuple in the format of (x, y), passing along the position of drift correction target. X and y are in screen pixels.
-----------------	---

4.12.2.3 sendMessage()

```
def sendMessage (
    self,
    message_text,
    offset = 0 )
```

Sends the given message to the connected [EyeLink](#) tracker.

The message will be written to the [EyeLink](#) tracker.

Remarks

This is equivalent to the C API

```
int eyecmd_printf(char *fmt, ...);
```

The maximum text length is 130 characters. If the given string has more than 130 characters, the first 130 characters will be sent and if the send passes this function will return 1. If the text is not truncated, 0 will be returned on a successful message send.

Parameters

<i>message_text</i>	text message to be sent. It does not support printf() kind of formatting.
<i>offset</i>	time offset in millisencond for the message.

Returns

If there is any problem sending the message, a runtime exception is raised.

4.12.2.4 imageBackdrop()

```
def imageBackdrop (
    self,
    filename,
    Xs,
    Ys,
    width,
    height,
    Xd,
    Yd,
    xferoptions )
```

Sends the given image file backdrop to the connected [EyeLink](#) tracker.

Remarks

This will open the image file, convert to bitmap using PIL.Image and call bitmapBackdrop to send the image to host

Parameters

<i>filename</i>	- full or relative path of the image file name
<i>Xs</i>	- crop x position
<i>Ys</i>	- crop y position
<i>width</i>	- crop width
<i>height</i>	- crop height
<i>Xd</i>	- xposition - transfer
<i>Yd</i>	- yposition - transfer
<i>xferoptions</i>	- transfer options(BX_AVERAGE,BX_DARKEN,BX_LIGHTEN,BX_MAXCONTRAST,BX_↔ NODITHER,BX_GRAYSCALE)

Returns

if PIL couldn't load, it will return None, otherwise return value of bitmapBackdrop

4.13 EyelinkMessage Class Reference

[EyelinkMessage](#) class, derived from [EyeLinkAddress](#) class, is used to send and receive messages between [EyeLink](#) nodes.

Inherits [EyeLinkAddress](#).

Public Member Functions

- def `__init__` (self, ip=(100, 1, 1, 1), port=4000, msg="")
Constructor.
- def `getText` ()
Returns the message to be sent to or received from the node.

4.13.1 Detailed Description

[EyelinkMessage](#) class, derived from [EyeLinkAddress](#) class, is used to send and receive messages between [EyeLink](#) nodes.

Instances of this class are commonly used as the return values of the `nodeReceive()` and `getNode()` methods of the [EyeLinkListener](#) or [EyeLink](#) class. An instance of [EyelinkMessage](#) class can be initialized with the class constructor:

```
EyelinkMessage(ip = (100,1,1,1), port = 4000, msg = "")
```

where *ip* is a four-item tuple containing the IP address of the [EyeLink](#) node, *port* is the port number of the connection, *msg* is the message to be sent to or received from the node.

For example,

```
myMessage = EyelinkMessage((100, 1, 1, 1), 4000, "test")
```

4.13.2 Constructor & Destructor Documentation

4.13.2.1 `__init__()`

```
def __init__ (  
    self,  
    ip = (100,1,1,1),  
    port = 4000,  
    msg = "" )
```

Constructor.

Parameters

<i>ip</i>	optional ipaddress in tuple form. eg. if the ip address is 192.168.25.48, the tuple form is (192,168,25,48) The default ip address is 100.1.1.1
<i>port</i>	optional port value as integer. The default value is 4000.
<i>msg</i>	text message.

4.13.3 Member Function Documentation

4.13.3.1 getText()

```
def getText ( )
```

Returns the message to be sent to or received from the node.

Returns

Text message.

4.14 FixUpdateEvent Class Reference

Class to represent the Fix Update event.

Inherits [StartNonBlinkEvent](#), and [EndNonBlinkEvent](#).

Public Member Functions

- def [getStartPupilSize](#) (self)
Pupil size (in arbitrary units, area or diameter as selected) at the start of a fixation interval.
- def [getAverageGaze](#) (self)
The average gaze position during the fixation period (in pixel coordinates set by the `screen_pixel_coords` command).
- def [getAverageHREF](#) (self)
Average HEADREF position during the fixation period.
- def [getAveragePupilSize](#) (self)
Average pupil size (in arbitrary units, area or diameter as selected) during a fixation.
- def [getEndPupilSize](#) (self)
Pupil size (in arbitrary units, area or diameter as selected) at the end of a fixation interval.

4.14.1 Detailed Description

Class to represent the Fix Update event.

This also inherits all properties from [StartNonBlinkEvent](#) and [EndNonBlinkEvent](#).

4.14.2 Member Function Documentation

4.14.2.1 `getStartPupilSize()`

```
def getStartPupilSize (
    self )
```

Pupil size (in arbitrary units, area or diameter as selected) at the start of a fixation interval.

Returns

Float.

4.14.2.2 `getAverageGaze()`

```
def getAverageGaze (
    self )
```

The average gaze position during the fixation period (in pixel coordinates set by the `screen_pixel_coords` command).

Returns

Two-item tuple in the format of (float, float).

4.14.2.3 `getAverageHREF()`

```
def getAverageHREF (
    self )
```

Average HEADREF position during the fixation period.

Returns

Two-item tuple in the format of (float, float).

4.14.2.4 getAveragePupilSize()

```
def getAveragePupilSize (
    self )
```

Average pupil size (in arbitrary units, area or diameter as selected) during a fixation.

Returns

Float.

4.14.2.5 getEndPupilSize()

```
def getEndPupilSize (
    self )
```

Pupil size (in arbitrary units, area or diameter as selected) at the end of a fixation interval.

Returns

Float.

4.15 ILinkData Class Reference

Class to represent tracker status information such as time stamps, flags, tracker addresses and so on.

Public Member Functions

- def [getTime](#) (self)
Time of last control event.
- def [getSampleRate](#) (self)
*10*sample rate (0 if no samples, 1 if nonconstant).*
- def [getSampleDivisor](#) (self)
Sample "divisor" (min msec between samples).
- def [getPrescaler](#) (self)
Amount to divide gaze x,y,res by.
- def [getVelocityPrescaler](#) (self)
Amount to divide velocity by.
- def [getPupilPrescaler](#) (self)
Pupil prescale (1 if area, greater if diameter).
- def [getHeadDistancePrescaler](#) (self)
Head-distance prescale (to mm).
- def [getSampleDataFlags](#) (self)
0 if off, else all flags.
- def [getEventDataFlags](#) (self)
0 if off, else all flags.
- def [getEventTypeFlags](#) (self)

- 0 if off, else event-type flags.*
- def [isInBlockWithSamples](#) (self)
Set if in block with samples.
- def [isInBlockWithEvents](#) (self)
Set if in block with events.
- def [haveLeftEye](#) (self)
Set if any left-eye data expected.
- def [haveRightEye](#) (self)
Set if any right-eye data expected.
- def [getLostDataTypes](#) (self)
Flags what we lost before last item.
- def [getLastBufferType](#) (self)
Buffer-type code.
- def [getLastBufferSize](#) (self)
Buffer size of last item.
- def [isControlEvents](#) (self)
Set if control event read with last data.
- def [isNewBlock](#) (self)
Set if control event started new block.
- def [getLastItemTimeStamp](#) (self)
Time field of item.
- def [getLastItemType](#) (self)
Type: 100 = sample, 0 = none, else event type.
- def [getLastItemContent](#) (self)
Content: <read> (IEVENT), <flags> (ISAMPLE).
- def [getBlockNumber](#) (self)
Block in file.
- def [getSamplesInBlock](#) (self)
Samples read in block so far.
- def [getEventsInBlock](#) (self)
Events (excl.
- def [getLastResX](#) (self)
Updated by samples only.
- def [getLastResY](#) (self)
Updated by samples only.
- def [getLastPupil](#) (self)
Updated by samples only.
- def [getLastItemStatus](#) (self)
Updated by samples, events.
- def [getSampleQueueLength](#) (self)
Number of items in queue.
- def [getEventQueueLength](#) (self)
Includes control events.
- def [getQueueSize](#) (self)
Total queue buffer size.
- def [getFreeQueueLength](#) (self)
Unused bytes in queue.
- def [getLastReceiveTime](#) (self)
Time tracker last sent packet.
- def [isSamplesEnabled](#) (self)
Data type rcve enable (switch).

- def [isEventsEnabled](#) (self)
Data type rcve enable (switch).
- def [getPacketFlags](#) (self)
Status flags from data packet.
- def [getLinkFlags](#) (self)
Status flags from link packet header.
- def [getStateFlags](#) (self)
Tracker error state flags.
- def [getTrackerDataOutputState](#) (self)
Tracker data output state.
- def [getPendingCommands](#) (self)
Tracker commands pending.
- def [isPoolingRemote](#) (self)
1 if polling remotes, else polling trackers.
- def [getPoolResponse](#) (self)
Total nodes responding to polling.
- def [getReserved](#) (self)
0 for EyeLink I or original EyeLink API DLL.
- def [getName](#) (self)
A name for our machine.
- def [getTrackerName](#) (self)
Name of tracker connected to.
- def [getNodes](#) (self)
Data on nodes.
- def [getLastItem](#) (self)
Buffer containing last item.
- def [getAddress](#) (self)
Address of our machine.
- def [getTrackerAddress](#) (self)
Address of the connected tracker.
- def [getTrackerBroadcastAddress](#) (self)
Broadcast address for eye trackers.
- def [getRemoteBroadcastAddress](#) (self)
Broadcast address for remotes Equivalent field in ILINKDATA "C": rbroadcast_address.

4.15.1 Detailed Description

Class to represent tracker status information such as time stamps, flags, tracker addresses and so on.

A valid reference to this object can be obtained by calling the function [getEYELINK \(\)](#) .getTrackerInfo().

4.15.2 Member Function Documentation

4.15.2.1 getTime()

```
def getTime (
    self )
```

Time of last control event.

Equivalent field in ILINKDATA "C": Time.

4.15.2.2 getSampleRate()

```
def getSampleRate (
    self )
```

10*sample rate (0 if no samples, 1 if nonconstant).

Equivalent field in ILINKDATA "C": samrate.

4.15.2.3 getSampleDivisor()

```
def getSampleDivisor (
    self )
```

Sample "divisor" (min msec between samples).

Equivalent field in ILINKDATA "C": samdiv.

4.15.2.4 getPrescaler()

```
def getPrescaler (
    self )
```

Amount to divide gaze x,y,res by.

Equivalent field in ILINKDATA "C": prescaler.

4.15.2.5 getVelocityPrescaler()

```
def getVelocityPrescaler (
    self )
```

Amount to divide velocity by.

Equivalent field in ILINKDATA "C": vprescaler.

4.15.2.6 getPupilPrescaler()

```
def getPupilPrescaler (
    self )
```

Pupil prescale (1 if area, greater if diameter).

Equivalent field in ILINKDATA "C": pprescaler.

4.15.2.7 getHeadDistancePrescaler()

```
def getHeadDistancePrescaler (
    self )
```

Head-distance prescale (to mm).

Equivalent field in ILINKDATA "C": hprescaler.

4.15.2.8 getSampleDataFlags()

```
def getSampleDataFlags (
    self )
```

0 if off, else all flags.

Equivalent field in ILINKDATA "C": sample_data.

4.15.2.9 getEventDataFlags()

```
def getEventDataFlags (
    self )
```

0 if off, else all flags.

Equivalent field in ILINKDATA "C": event_data.

4.15.2.10 getEventTypeFlags()

```
def getEventTypeFlags (
    self )
```

0 if off, else event-type flags.

Equivalent field in ILINKDATA "C": event_types.

4.15.2.11 isInBlockWithSamples()

```
def isInBlockWithSamples (
    self )
```

Set if in block with samples.

Equivalent field in ILINKDATA "C": in_sample_block.

4.15.2.12 isInBlockWithEvents()

```
def isInBlockWithEvents (
    self )
```

Set if in block with events.

Equivalent field in ILINKDATA "C": in_event_block.

4.15.2.13 haveLeftEye()

```
def haveLeftEye (
    self )
```

Set if any left-eye data expected.

Equivalent field in ILINKDATA "C": have_left_eye.

4.15.2.14 haveRightEye()

```
def haveRightEye (
    self )
```

Set if any right-eye data expected.

Equivalent field in ILINKDATA "C": have_right_eye.

4.15.2.15 getLostDataTypes()

```
def getLostDataTypes (
    self )
```

Flags what we lost before last item.

Equivalent field in ILINKDATA "C": last_data_gap_types.

4.15.2.16 getLastBufferType()

```
def getLastBufferType (
    self )
```

Buffer-type code.

Equivalent field in ILINKDATA "C": last_data_buffer_type.

4.15.2.17 getLastBufferSize()

```
def getLastBufferSize (
    self )
```

Buffer size of last item.

Equivalent field in ILINKDATA "C": last_data_buffer_size.

4.15.2.18 isControlEvent()

```
def isControlEvent (
    self )
```

Set if control event read with last data.

Equivalent field in ILINKDATA "C": control_read.

4.15.2.19 isNewBlock()

```
def isNewBlock (
    self )
```

Set if control event started new block.

Equivalent field in ILINKDATA "C": first_in_block.

4.15.2.20 getLastItemTimeStamp()

```
def getLastItemTimeStamp (
    self )
```

Time field of item.

Equivalent field in ILINKDATA "C": last_data_item_time.

4.15.2.21 getLastItemType()

```
def getLastItemType (
    self )
```

Type: 100 = sample, 0 = none, else event type.

Equivalent field in ILINKDATA "C": last_data_item_type.

4.15.2.22 getLastItemContent()

```
def getLastItemContent (
    self )
```

Content: <read> (IEVENT), <flags> (ISAMPLE).

Equivalent field in ILINKDATA "C": last_data_item_contents.

4.15.2.23 getBlockNumber()

```
def getBlockNumber (
    self )
```

Block in file.

Equivalent field in ILINKDATA "C": block_number.

4.15.2.24 getSamplesInBlock()

```
def getSamplesInBlock (
    self )
```

Samples read in block so far.

Equivalent field in ILINKDATA "C": block_sample.

4.15.2.25 `getEventsInBlock()`

```
def getEventsInBlock (  
    self )
```

Events (excl. control read in block). Equivalent field in ILINKDATA "C": `block_event`.

4.15.2.26 `getLastResX()`

```
def getLastResX (  
    self )
```

Updated by samples only.
Equivalent field in ILINKDATA "C": `last_resx`.

4.15.2.27 `getLastResY()`

```
def getLastResY (  
    self )
```

Updated by samples only.
Equivalent field in ILINKDATA "C": `last_resy`.

4.15.2.28 `getLastPupil()`

```
def getLastPupil (  
    self )
```

Updated by samples only.
Equivalent field in ILINKDATA "C": `last_pupil`.

4.15.2.29 `getLastItemStatus()`

```
def getLastItemStatus (  
    self )
```

Updated by samples, events.
Equivalent field in ILINKDATA "C": `last_status`.

4.15.2.30 `getSampleQueueLength()`

```
def getSampleQueueLength (  
    self )
```

Number of items in queue.
Equivalent field in ILINKDATA "C": `queued_samples`.

4.15.2.31 getEventQueueLength()

```
def getEventQueueLength (
    self )
```

Includes control events.

Equivalent field in ILINKDATA "C": `queued_events`.

4.15.2.32 getQueueSize()

```
def getQueueSize (
    self )
```

Total queue buffer size.

Equivalent field in ILINKDATA "C": `queue_size`.

4.15.2.33 getFreeQueueLength()

```
def getFreeQueueLength (
    self )
```

Unused bytes in queue.

Equivalent field in ILINKDATA "C": `queue_free`.

4.15.2.34 getLastReceiveTime()

```
def getLastReceiveTime (
    self )
```

Time tracker last sent packet.

Equivalent field in ILINKDATA "C": `last_rcve_time`.

4.15.2.35 isSamplesEnabled()

```
def isSamplesEnabled (
    self )
```

Data type rcve enable (switch).

Equivalent field in ILINKDATA "C": `samples_on`.

4.15.2.36 isEventsEnabled()

```
def isEventsEnabled (
    self )
```

Data type rcve enable (switch).

Equivalent field in ILINKDATA "C": `events_on`.

4.15.2.37 **getPacketFlags()**

```
def getPacketFlags (
    self )
```

Status flags from data packet.

Equivalent field in ILINKDATA "C": packet_flags.

4.15.2.38 **getLinkFlags()**

```
def getLinkFlags (
    self )
```

Status flags from link packet header.

Equivalent field in ILINKDATA "C": link_flags.

4.15.2.39 **getStateFlags()**

```
def getStateFlags (
    self )
```

Tracker error state flags.

Equivalent field in ILINKDATA "C": state_flags.

4.15.2.40 **getTrackerDataOutputState()**

```
def getTrackerDataOutputState (
    self )
```

Tracker data output state.

Equivalent field in ILINKDATA "C": link_dstatus.

4.15.2.41 **getPendingCommands()**

```
def getPendingCommands (
    self )
```

Tracker commands pending.

Equivalent field in ILINKDATA "C": link_pendcmd.

4.15.2.42 **isPoolingRemote()**

```
def isPoolingRemote (
    self )
```

1 if polling remotes, else polling trackers.

Equivalent field in ILINKDATA "C": polling_remotes.

4.15.2.43 getPoolResponse()

```
def getPoolResponse (
    self )
```

Total nodes responding to polling.

Equivalent field in ILINKDATA "C": poll_responses.

4.15.2.44 getReserved()

```
def getReserved (
    self )
```

0 for [EyeLink I](#) or original [EyeLink API DLL](#).

Equivalent field in ILINKDATA "C": reserved.

4.15.2.45 getName()

```
def getName (
    self )
```

A name for our machine.

Equivalent field in ILINKDATA "C": our_name.

4.15.2.46 getTrackerName()

```
def getTrackerName (
    self )
```

Name of tracker connected to.

Equivalent field in ILINKDATA "C": eye_name.

4.15.2.47 getNodes()

```
def getNodes (
    self )
```

Data on nodes.

Equivalent field in ILINKDATA "C": nodes.

4.15.2.48 getLastItem()

```
def getLastItem (
    self )
```

Buffer containing last item.

Equivalent field in ILINKDATA "C": last_data_item.

4.15.2.49 getAddress()

```
def getAddress (
    self )
```

Address of our machine.

Equivalent field in ILINKDATA "C": our_address.

4.15.2.50 getTrackerAddress()

```
def getTrackerAddress (
    self )
```

Address of the connected tracker.

Equivalent field in ILINKDATA "C": eye_address.

4.15.2.51 getTrackerBroadcastAddress()

```
def getTrackerBroadcastAddress (
    self )
```

Broadcast address for eye trackers.

Equivalent field in ILINKDATA "C": ebroadcast_address.

4.16 IOEvent Class Reference

[IOEvent](#) class is used to handle `BUTTONEVENT` and `INPUTEVENT` types, which report changes in button status or in the input port data.

Inherited by [ButtonEvent](#).

Public Member Functions

- def [getTime](#) (self)
Timestamp of the sample causing event (in milliseconds since [EyeLink](#) tracker was activated).
- def [getType](#) (self)
The event code.
- def [getData](#) (self)
Coded event data.

4.16.1 Detailed Description

[IOEvent](#) class is used to handle `BUTTONEVENT` and `INPUTEVENT` types, which report changes in button status or in the input port data.

The `getTime()` method records the timestamp of the eye-data sample where the change occurred, although the event itself is usually sent before that sample. Button events from the link are rarely used; monitoring buttons with one of `readKeybutton()`, `lastButtonPress()`, or `buttonStates()` of the [EyeLink](#) class methods is preferable, since these can report button states at any time, not just during recording.

Returned by `getFloatData()` whenever there is an [IOEvent](#).

4.16.2 Member Function Documentation

4.16.2.1 `getTime()`

```
def getTime (
    self )
```

Timestamp of the sample causing event (in milliseconds since [EyeLink](#) tracker was activated).

Returns

Long integer.

4.16.2.2 `getType()`

```
def getType (
    self )
```

The event code.

This should be `BUTTONEVENT` (i.e., 25) or `INPUTEVENT` (i.e., 28).

Returns

Integer.

4.16.2.3 `getData()`

```
def getData (
    self )
```

Coded event data.

Returns

Long integer.

4.17 KeyInput Class Reference

This represents a key input.

4.17.1 Detailed Description

This represents a key input.

This is used with [EyeLinkCustomDisplay](#) to notify the `eyelink_core.dll` that a key input is available.

4.18 MessageEvent Class Reference

A message event is created by your experiment program and placed in the EDF file.

Public Member Functions

- def [getTime](#) (self)
Timestamp of the sample causing event (when camera imaged eye, in milliseconds since [EyeLink](#) tracker was activated).
- def [getType](#) (self)
The event code.
- def [getText](#) (self)
Message contents (max length 255 characters).

4.18.1 Detailed Description

A message event is created by your experiment program and placed in the EDF file.

It is possible to enable the sending of these messages back through the link, although there is rarely a reason to do this. The [MessageEvent](#) class is designed to hold information on [EyeLink](#) message events retrieved from the link. Please note that all methods for the [MessageEvent](#) class do not take a parameter.

Returned by `getFloatData()` whenever there is a Message Event.

4.18.2 Member Function Documentation

4.18.2.1 getTime()

```
def getTime (
    self )
```

Timestamp of the sample causing event (when camera imaged eye, in milliseconds since [EyeLink](#) tracker was activated).

Returns

Long integer.

4.18.2.2 getType()

```
def getType (
    self )
```

The event code.

This should be MESSAGEEVENT (i.e., 24).

Returns

Integer.

4.18.2.3 getText()

```
def getText (
    self )
```

Message contents (max length 255 characters).

Returns

String.

4.19 Sample Class Reference

The [EyeLink](#) toolkit library defines special data classes that allow the same programming calls to be used on different platforms such as Windows, Linux and macOS.

Public Member Functions

- def [initFromSample](#) (self, sample)
Convenient method to clone a sample.
- def [isLeftSample](#) (self)
1 if the sample contains the left eye data; 0 if not.
- def [isRightSample](#) (self)
1 if the sample contains the right eye data; 0 if not.
- def [isBinocular](#) (self)
1 if the sample contains data from both eyes; 0 if not.
- def [getTime](#) (self)
Timestamp when camera imaged eye (in milliseconds since [EyeLink](#) tracker was activated).
- def [getType](#) (self)
Always `SAMPLE_TYPE`.
- def [getPPD](#) (self)
Angular resolution at current gaze position in screen pixels per visual degree.
- def [getStatus](#) (self)
Error and status flags (only useful for [EyeLink II](#) and newer hardware, report CR status and tracking error).
- def [getInput](#) (self)
Data from input port(s).
- def [getFlags](#) (self)
Bits indicating what types of data are present, and for which eye(s).
- def [getButtons](#) (self)
Button input data: high 8 bits indicate changes from last sample, low 8 bits indicate current state of buttons 8 (MSB) to 1 (LSB).
- def [getRightEye](#) (self)
Returns the sample data information from the desired eye.
- def [getLeftEye](#) (self)
Returns the sample data information from the desired eye.
- def [getHData](#) (self)
Returns the href data.
- def [getEye](#) (self)
Returns Eye data status.
- def [getTargetDistance](#) (self)
Target Distance.
- def [getTargetX](#) (self)
Target X.
- def [getTargetY](#) (self)
Target Y.
- def [getTargetFlags](#) (self)
Target Flags.

4.19.1 Detailed Description

The [EyeLink](#) toolkit library defines special data classes that allow the same programming calls to be used on different platforms such as Windows, Linux and macOS.

You will need to know these classes to read the examples and to write your own experiments. In this documentation, the common data classes are: [Sample](#) class, Eye Event Classes, [MessageEvent](#) Class, and [IOEvent](#) Class. You only need to read this section if you are planning to use real-time link data for gaze-contingent displays or gaze-controlled interfaces, or to use data playback.

The [EyeLink](#) tracker measures eye position 250 or 2000 times per second depending on the tracking hardware and the tracker mode you are working with, and computes true gaze position on the display using the head camera data. This data is stored in the EDF file, and made available through the link in as little as 3 milliseconds after a physical eye movement.

Samples can be read from the link by `getFloatData()` or `getNewestSample()` method of the `EyeLink/↔EyeLinkLisenter` class. These functions can return instances of [Sample](#) class. For example, `newSample = getEYELINK().getFloatData()`

The following methods can be used to retrieve properties of a [Sample](#) class instance. For example, the timestamp of the sample can be retrieved as `newSample.getTime()`. Please note that all methods for the [Sample](#) class do not take a parameter whereas the return values are noted.

4.19.2 Member Function Documentation

4.19.2.1 isLeftSample()

```
def isLeftSample (
    self )
```

1 if the sample contains the left eye data; 0 if not.

Returns

Integer.

4.19.2.2 isRightSample()

```
def isRightSample (
    self )
```

1 if the sample contains the right eye data; 0 if not.

Returns

Integer.

4.19.2.3 isBinocular()

```
def isBinocular (
    self )
```

1 if the sample contains data from both eyes; 0 if not.

Returns

Integer.

4.19.2.4 getTime()

```
def getTime (
    self )
```

Timestamp when camera imaged eye (in milliseconds since [EyeLink](#) tracker was activated).

Returns

Long integer.

4.19.2.5 getType()

```
def getType (
    self )
```

Always `SAMPLE_TYPE`.

Returns

Integer.

4.19.2.6 getPPD()

```
def getPPD (
    self )
```

Angular resolution at current gaze position in screen pixels per visual degree.

The first item of the tuple stores the x-coordinate resolution and the second item of the tuple stores the y-coordinate resolution.

Returns

Two-item tuple in the format of (float, float).

4.19.2.7 getStatus()

```
def getStatus (
    self )
```

Error and status flags (only useful for [EyeLink](#) II and newer hardware, report CR status and tracking error).

See `eye_data.h` for useful bits.

Returns

Integer.

4.19.2.8 getInput()

```
def getInput (
    self )
```

Data from input port(s).

Returns

Integer.

4.19.2.9 getFlags()

```
def getFlags (
    self )
```

Bits indicating what types of data are present, and for which eye(s).

See eye_data.h for useful bits.

Returns

Integer.

4.19.2.10 getButtons()

```
def getButtons (
    self )
```

Button input data: high 8 bits indicate changes from last sample, low 8 bits indicate current state of buttons 8 (MSB) to 1 (LSB).

Returns

Integer.

4.19.2.11 getRightEye()

```
def getRightEye (
    self )
```

Returns the sample data information from the desired eye.

Returns

Instance of sample data class.

4.19.2.12 getLeftEye()

```
def getLeftEye (
    self )
```

Returns the sample data information from the desired eye.

Returns

Instance of sample data class.

4.19.2.13 getEye()

```
def getEye (
    self )
```

Returns Eye data status.

Returns

- 2 if both left and right eye data are present
- 1 if right eye data present
- 0 if left eye data present

4.19.2.14 getTargetDistance()

```
def getTargetDistance (
    self )
```

Target Distance.

Returns

Float.

4.19.2.15 getTargetX()

```
def getTargetX (
    self )
```

Target X.

Returns

Float.

4.19.2.16 getTargetY()

```
def getTargetY (
    self )
```

Target Y.

Returns

Float.

4.19.2.17 getTargetFlags()

```
def getTargetFlags (
    self )
```

Target Flags.

Returns

Float.

4.20 SampleData Class Reference

[Sample](#) data for left and right eye.

Public Member Functions

- def [getGaze](#) (self)
Display gaze position (in pixel coordinates set by the `screen_pixel_coords` command).
- def [getHREF](#) (self)
HREF angular coordinates.
- def [getRawPupil](#) (self)
Camera x, y of pupil center.
- def [getPupilSize](#) (self)
Pupil size (in arbitrary units, area or diameter as selected).

4.20.1 Detailed Description

[Sample](#) data for left and right eye.

The `getRightEye()` or `getLeftEye()` functions returns an instance of [SampleData](#) class, which contains the current sample position (raw, HREF, or gaze) and pupil size information of the desired eye. The following methods can be used to retrieve the attributes of an instance of the [SampleData](#) class.

For example, the x gaze position of the left eye for a given sample can be retrieved as:

```
newSample = getEYELINK().getFloatData()
gaze = newSample.getLeftEye().getGaze()
left_eye_gaze_x = gaze[0]
```

If certain property information not sent for this sample, the value `MISSING_DATA` (or 0, depending on the field) will be returned, and the corresponding bit in the flags field will be zero (see `eye_data.h` for a list of bits).

Data may be missing because of the tracker configuration (set by commands sent at the start of the experiment, from the Set Options screen of the [EyeLink II](#) tracker and newer eye tracker models, or from the default configuration set by the `DATA.INI` file for the [EyeLink I](#) tracker). Eye position data may also be set to `MISSING_VALUE` during a blink.

4.20.2 Member Function Documentation

4.20.2.1 `getGaze()`

```
def getGaze (
    self )
```

Display gaze position (in pixel coordinates set by the `screen_pixel_coords` command).

The first and second item of the tuple store the x- and y- coordinate gaze position respectively.

Returns

Two-item tuple in the format of (float, float).

4.20.2.2 `getHREF()`

```
def getHREF (
    self )
```

HREF angular coordinates.

The first and second items of the tuple are for the x and y coordinates, respectively.

Returns

Two-item tuple in the format of (float, float).

4.20.2.3 getRawPupil()

```
def getRawPupil (
    self )
```

Camera x, y of pupil center.

The first and second items of the tuple store pupil center in the x- and y- coordinate respectively.

Returns

Two-item tuple in the format of (float, float).

4.20.2.4 getPupilSize()

```
def getPupilSize (
    self )
```

Pupil size (in arbitrary units, area or diameter as selected).

Returns

Float.

4.21 StartBlinkEvent Class Reference

Class to represent Start Blink event.

Inherits [EyeEvent](#).

Additional Inherited Members

4.21.1 Detailed Description

Class to represent Start Blink event.

There are no direct properties for this interface. All properties are inherited from [EyeEvent](#).

4.22 StartFixationEvent Class Reference

Class to represent Start Fixation event.

Inherits [StartNonBlinkEvent](#).

Inherited by [EndFixationEvent](#).

Public Member Functions

- def [getStartPupilSize](#) (self)
Pupil size (in arbitrary units, area or diameter as selected) at the start of a fixation interval.

4.22.1 Detailed Description

Class to represent Start Fixation event.

This also inherits all properties from [StartNonBlinkEvent](#).

4.22.2 Member Function Documentation

4.22.2.1 [getStartPupilSize\(\)](#)

```
def getStartPupilSize (  
    self )
```

Pupil size (in arbitrary units, area or diameter as selected) at the start of a fixation interval.

Returns

Float.

4.23 StartNonBlinkEvent Class Reference

This interface is never used as is.

Inherits [EyeEvent](#).

Inherited by [FixUpdateEvent](#), [StartFixationEvent](#), and [StartSaccadeEvent](#).

Public Member Functions

- def [getStartGaze](#) (self)
Gaze position at the start of the event (in pixel coordinates set by the `screen_pixel_coords` command).
- def [getStartHREF](#) (self)
HEADREF position at the start of the event.
- def [getStartVelocity](#) (self)
Gaze velocity at the start of the event (in visual degrees per second).
- def [getStartPPD](#) (self)
Angular resolution at the start of the event (in screen pixels per visual degree, PPD).

4.23.1 Detailed Description

This interface is never used as is.

[FixUpdateEvent](#), [StartFixationEvent](#) and [StartSaccadeEvent](#) types inherit this. This also inherits all properties from [EyeEvent](#).

4.23.2 Member Function Documentation

4.23.2.1 `getStartGaze()`

```
def getStartGaze (
    self )
```

Gaze position at the start of the event (in pixel coordinates set by the `screen_pixel_coords` command).

The first and second items of the tuple store the x- and y- gaze position respectively.

Returns

Two-item tuple in the format of (float, float).

4.23.2.2 `getStartHREF()`

```
def getStartHREF (
    self )
```

HEADREF position at the start of the event.

The first and second items of the tuple store the x- and y- HREF data respectively.

Returns

Two-item tuple in the format of (float, float).

4.23.2.3 `getStartVelocity()`

```
def getStartVelocity (
    self )
```

Gaze velocity at the start of the event (in visual degrees per second).

Returns

Float.

4.23.2.4 `getStartPPD()`

```
def getStartPPD (
    self )
```

Angular resolution at the start of the event (in screen pixels per visual degree, PPD).

The first item of the tuple stores the x-coordinate PPD resolution and the second item of the tuple stores the y-coordinate PPD resolution.

Returns

Two-item tuple in the format of (float, float).

4.24 StartSaccadeEvent Class Reference

Class to represent Start Saccade event.

Inherits [StartNonBlinkEvent](#).

Inherited by [EndSaccadeEvent](#).

Additional Inherited Members

4.24.1 Detailed Description

Class to represent Start Saccade event.

There are no direct properties for this interface. All properties are inherited from [StartNonBlinkEvent](#).

Chapter 5

Example implementation of EyeLinkCustomDisplay

```
#
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#
# Last updated on 3/18/2021
import pygame
from pygame.locals import *
from math import pi
import array
import pylink
import platform
import sys
import os
#allow to disable sound, or if we failed to initialize pygame.mixer or failed to load audio file
#continue experiment without sound.
DISABLE_AUDIO=False
class PygameEyeLinkCustomDisplay(pylink.EyeLinkCustomDisplay):
    def __init__(self, tracker, win):
        global DISABLE_AUDIO
        pylink.EyeLinkCustomDisplay.__init__(self)
        self._disp = win # screen to use for calibration
        self._tracker = tracker # connection to the tracker
        self._version = '2021.3.16'
        self._last_updated = '3/16/2021'
        pygame.mouse.set_visible(False) # hide mouse cursor
        self._bgColor = (128, 128, 128) # target color (foreground)
        self._fgColor = (0, 0, 0) # target color (background)
        self._targetSize = 32 # diameter of the target
        self._targetType = 'circle' # could be 'circle' or 'picture'
        self._pictureTarget = None # picture target
        self._target_beep = None
        self._done_beep = None
        self._error_beep = None
        if not DISABLE_AUDIO:
            try:
                self._target_beep = pygame.mixer.Sound("type.wav")
                self._done_beep = pygame.mixer.Sound("qbeep.wav")
                self._error_beep = pygame.mixer.Sound("error.wav")
            except Exception as e:
                print ('Failed to load audio: '+ str(e))
                #we failed to load audio, so disable it
                #if the experiment is run with sudo/root user in Ubuntu, then audio will
                #fail. The work around is either allow audio playback permission
                #for root user or, run the experiment with non root user.
                DISABLE_AUDIO=True
        self._size = (384, 320) # size of the camera image
```

```

self._imagebuffer = array.array('I') # buffer to store camera image
self._resizedImg = None
self.surf = pygame.display.get_surface()
# image palette; its indices are used to reconstruct the camera image
self._pal = []
# we will use this for text messages
self._fnt = pygame.font.SysFont('Arial', 26)
self._w, self._h = self._disp.get_size()
self._cam_region = pygame.Rect((0, 0), (0, 0))
# cache the camera title
self._title = ""
# keep track of mouse states
self.mouse_pos = (self._w/2, self._h/2)
self.last_mouse_state = -1
def __str__(self):
    """ overwrite __str__ to show some information about the
    CoreGraphicsPsychoPy library
    """
    return "Using the CalibrationGraphicsPygame library, " + \
        "version %s, " % self._version + \
        "last updated on %s" % self._last_updated
def getForegroundColor(self):
    """ get the foreground color """
    return self._fgColor
def getBackgroundColor(self):
    """ get the foreground color """
    return self._bgColor
def setCalibrationColors(self, foreground_color, background_color):
    """ Set calibration background and foreground colors
    Parameters:
        foreground_color--foreground color for the calibration target
        background_color--calibration background.
    """
    self._fgColor = foreground_color
    self._bgColor = background_color
def setTargetType(self, type):
    """ Set calibration target size in pixels
    Parameters:
        type: "circle" (default) or "picture"
    """
    self._targetType = type
def setTargetSize(self, size):
    """ Set calibration target size in pixels"""
    self._targetSize = size
def setPictureTarget(self, picture_target):
    """ set the movie file to use as the calibration target """
    self._pictureTarget = picture_target
def setCalibrationSounds(self, target_beep, done_beep, error_beep):
    """ Provide three wav files as the warning beeps
    Parameters:
        target_beep -- sound to play when the target comes up
        done_beep -- calibration is done successfully
        error_beep -- calibration/drift-correction error.
    """
    # target beep
    if target_beep == "":
        self._target_beep = pygame.mixer.Sound("type.wav")
    elif target_beep == 'off':
        self._target_beep = None
    else:
        self._target_beep = pygame.mixer.Sound(target_beep)
    # done beep
    if done_beep == "":
        self._done_beep = pygame.mixer.Sound("qbeep.wav")
    elif done_beep == 'off':
        self._done_beep = None
    else:
        self._done_beep = pygame.mixer.Sound(done_beep)
    # error beep
    if error_beep == "":
        self._error_beep = pygame.mixer.Sound("error.wav")
    elif error_beep == 'off':
        self._error_beep = None
    else:
        self._error_beep = pygame.mixer.Sound(error_beep)
def setup_cal_display(self):
    """ setup calibration/validation display"""
    self.clear_cal_display()
def exit_cal_display(self):
    """ exit calibration/validation display"""
    self.clear_cal_display()
def record_abort_hide(self):
    pass
def clear_cal_display(self):
    self._disp.fill(self._bgColor)
    pygame.display.flip()
    self._disp.fill(self._bgColor)

```

```

def erase_cal_target(self):
    self.clear_cal_display()
def draw_cal_target(self, x, y):
    """ draw the calibration target, i.e., a bull's eye"""
    if self._targetType == 'picture':
        if self._pictureTarget is None:
            print('ERROR: Provide a picture as the calibration target')
            pygame.quit()
            sys.exit()
        elif not os.path.exists(self._pictureTarget):
            print('ERROR: Picture %s not found' % self._pictureTarget)
            pygame.quit()
            sys.exit()
        else:
            cal_pic = pygame.image.load(self._pictureTarget)
            w, h = cal_pic.get_size()
            self._disp.blit(cal_pic, (x - int(w/2.0), y - int(h/2.0)))
    else:
        pygame.draw.circle(self._disp, self._fgColor, (x, y),
            int(self._targetSize / 2.))
        pygame.draw.circle(self._disp, self._bgColor, (x, y),
            int(self._targetSize / 4.))
    pygame.display.flip()
def play_beep(self, beepid):
    """ play warning beeps if being requested"""
    global DISABLE_AUDIO
    # if sound is disabled, don't play
    if DISABLE_AUDIO:
        pass
    else:
        if beepid in [pylink.DC_TARG_BEEP, pylink.CAL_TARG_BEEP]:
            if self._target_beep is not None:
                self._target_beep.play()
                pygame.time.wait(50)
        if beepid in [pylink.CAL_ERR_BEEP, pylink.DC_ERR_BEEP]:
            if self._error_beep is not None:
                self._error_beep.play()
                pygame.time.wait(300)
        if beepid in [pylink.CAL_GOOD_BEEP, pylink.DC_GOOD_BEEP]:
            if self._done_beep is not None:
                self._done_beep.play()
                pygame.time.wait(100)
def getColorFromIndex(self, colorindex):
    """ color scheme for different elements """
    if colorindex == pylink.CR_HAIR_COLOR:
        return (255, 255, 255, 255)
    elif colorindex == pylink.PUPIL_HAIR_COLOR:
        return (255, 255, 255, 255)
    elif colorindex == pylink.PUPIL_BOX_COLOR:
        return (0, 255, 0, 255)
    elif colorindex == pylink.SEARCH_LIMIT_BOX_COLOR:
        return (255, 0, 0, 255)
    elif colorindex == pylink.MOUSE_CURSOR_COLOR:
        return (255, 0, 0, 255)
    else:
        return (0, 0, 0, 0)
def draw_line(self, x1, y1, x2, y2, colorindex):
    """ draw lines"""
    color = self.getColorFromIndex(colorindex)
    # get the camera image rect, then scale
    if self._size[0] > 192:
        imr = self._img.get_rect()
        x1 = int((float(x1) / 192) * imr.w)
        x2 = int((float(x2) / 192) * imr.w)
        y1 = int((float(y1) / 160) * imr.h)
        y2 = int((float(y2) / 160) * imr.h)
    # draw the line
    if True not in [x < 0 for x in [x1, x2, y1, y2]]:
        pygame.draw.line(self._img, color, (x1, y1), (x2, y2))
def draw_lozenge(self, x, y, width, height, colorindex):
    """ draw the search limits with two lines and two arcs"""
    color = self.getColorFromIndex(colorindex)
    if self._size[0] > 192:
        imr = self._img.get_rect()
        x = int((float(x) / 192) * imr.w)
        y = int((float(y) / 160) * imr.h)
        width = int((float(width) / 192) * imr.w)
        height = int((float(height) / 160) * imr.h)
    if width > height:
        rad = int(height / 2.)
        if rad == 0:
            return
        else:
            pygame.draw.line(self._img,
                color,
                (x + rad, y),
                (x + width - rad, y))

```

```

pygame.draw.line(self._img,
                 color,
                 (x + rad, y + height),
                 (x + width - rad, y + height))
pygame.draw.arc(self._img,
                color,
                [x, y, rad*2, rad*2],
                pi/2, pi*3/2, 1)
pygame.draw.arc(self._img,
                color,
                [x+width-rad*2, y, rad*2, height],
                pi*3/2, pi/2 + 2*pi, 1)
else:
    rad = int(width / 2.)
    if rad == 0:
        return
    else:
        pygame.draw.line(self._img,
                         color,
                         (x, y + rad),
                         (x, y + height - rad))
        pygame.draw.line(self._img,
                         color,
                         (x + width, y + rad),
                         (x + width, y + height - rad))
        pygame.draw.arc(self._img,
                        color,
                        [x, y, rad*2, rad*2],
                        0, pi, 1)
        pygame.draw.arc(self._img,
                        color,
                        [x, y+height-rad*2, rad*2, rad*2],
                        pi, 2*pi, 1)
def get_mouse_state(self):
    """ get mouse position and states"""
    x, y = pygame.mouse.get_pos()
    state = pygame.mouse.get_pressed()
    x = x * self._size[0]/self._w/2.0
    y = y * self._size[1]/self._h/2.0
    return ((x, y), state[0])
def get_input_key(self):
    """ handle key input and send it over to the tracker"""
    ky = []
    for ev in pygame.event.get():
        # check keyboard events
        if ev.type == KEYDOWN:
            keycode = ev.key
            if keycode == K_F1:
                keycode = pylink.F1_KEY
            elif keycode == K_F2:
                keycode = pylink.F2_KEY
            elif keycode == K_F3:
                keycode = pylink.F3_KEY
            elif keycode == K_F4:
                keycode = pylink.F4_KEY
            elif keycode == K_F5:
                keycode = pylink.F5_KEY
            elif keycode == K_F6:
                keycode = pylink.F6_KEY
            elif keycode == K_F7:
                keycode = pylink.F7_KEY
            elif keycode == K_F8:
                keycode = pylink.F8_KEY
            elif keycode == K_F9:
                keycode = pylink.F9_KEY
            elif keycode == K_F10:
                keycode = pylink.F10_KEY
            elif keycode == K_PAGEUP:
                keycode = pylink.PAGE_UP
            elif keycode == K_PAGEDOWN:
                keycode = pylink.PAGE_DOWN
            elif keycode == K_UP:
                keycode = pylink.CURS_UP
            elif keycode == K_DOWN:
                keycode = pylink.CURS_DOWN
            elif keycode == K_LEFT:
                keycode = pylink.CURS_LEFT
            elif keycode == K_RIGHT:
                keycode = pylink.CURS_RIGHT
            elif keycode == K_BACKSPACE:
                keycode = ord('\b')
            elif keycode == K_RETURN:
                keycode = pylink.ENTER_KEY
            # probe the tracker to see if it's "simulating gaze
            # with mouse". if so, show a warning instead of a blank
            # screen to experimenter do so, only when the tracker
            # is in Camera Setup screen

```

```

if self._tracker.getCurrentMode() == pylink.IN_SETUP_MODE:
    self._tracker.readRequest('aux_mouse_simulation')
    pylink.pumpDelay(50)
    if self._tracker.readReply() == '1':
        # draw a rectangle to mark the camera image
        rec_x = int((self._w - 192*2) / 2.0)
        rec_y = int((self._h - 160*2) / 2.0)
        rct = pygame.Rect((rec_x, rec_y, 192*2, 160*2))
        pygame.draw.rect(self._disp, self._fgColor, rct, 2)
        # show some message
        msg = 'Simulating gaze with the mouse'
        msg_w, msg_h = self._fnt.size(msg)
        t_surf = self._fnt.render(msg, True, self._fgColor)
        txt_x = int((self._w - msg_w)/2.0)
        txt_y = int((self._h - msg_h)/2.0)
        self._disp.blit(t_surf, (txt_x, txt_y))
        pygame.display.flip()
    elif keycode == K_SPACE:
        keycode = ord(' ')
    elif keycode == K_ESCAPE:
        keycode = pylink.ESC_KEY
    elif keycode == K_TAB:
        keycode = ord('\t')
    elif (keycode == pylink.JUNK_KEY):
        keycode = 0
    ky.append(pylink.KeyInput(keycode, ev.mod))
return ky
def exit_image_display(self):
    """ exit the camera image display"""
    self.clear_cal_display()
def alert_printf(self, msg):
    print(msg)
def setup_image_display(self, width, height):
    """ set up the camera image display
    return 1 to request high-resolution camera image"""
    self._size = (width, height)
    self.clear_cal_display()
    self.last_mouse_state = -1
    return 1
def image_title(self, text):
    """ show the camera image title
    target distance, and pupil/CR thresholds below the image. To prevent
    drawing glitches, we cache the image title and draw it with the camera
    image in the draw_image_line function instead"""
    self._title = text
def draw_image_line(self, width, line, tolines, buff):
    """ draw the camera image"""
    for i in range(width):
        try:
            self._imagebuffer.append(self._pal[buff[i]])
        except:
            pass
    if line == tolines:
        try:
            # construct the camera image from the buffer
            try:
                tmp_buffer = self._imagebuffer.tobytes()
            except:
                tmp_buffer = self._imagebuffer.tostring()
            cam = pygame.image.frombuffer(tmp_buffer,
                                         (width, tolines), 'RGBX')

            self._img = cam
            self.draw_cross_hair()
            # prepare the camera image
            img_w, img_h = (width*2, tolines*2)
            self._resizedImg = pygame.transform.scale(cam, (img_w, img_h))
            cam_img_pos = ((self._w/2-img_w/2),
                          (self._h/2-img_h/2))

            # prepare the camera image caption
            txt_w, txt_h = self._fnt.size(self._title)
            txt_surf = self._fnt.render(self._title, True, self._fgColor)
            txt_pos = (int(self._w/2 - txt_w/2),
                      int(self._h/2 + img_h/2 + txt_h/2))

            # draw the camera image and the caption
            surf = pygame.display.get_surface()
            surf.fill(self._bgColor)
            surf.blit(self._resizedImg, cam_img_pos)
            surf.blit(txt_surf, txt_pos)
            pygame.display.flip()
        except:
            pass
        self._imagebuffer = array.array('I')
def set_image_palette(self, r, g, b):
    """ get the color palette for the camera image"""
    self._imagebuffer = array.array('I')
    sz = len(r)
    i = 0

```

```

        self._pal = []
        while i < sz:
            rf = int(b[i])
            gf = int(g[i])
            bf = int(r[i])
            self._pal.append((rf << 16) | (gf << 8) | (bf))
            i = i + 1
# A short testing script showing the basic usage of this library
# We first instantiate a connection to the tracker (el_tracker), then we open
# a Pygame window (win). We then pass the tracker connection and the Pygame
# window to the graphics environment constructor (CalibrationGraphics).
# The graphics environment, once instantiated, can be configured to customize
# the calibration foreground and background color, the calibration target
# type, the calibration target size, and the beeps we would like to
# play during calibration and validation.
#
# IMPORTANT: Once the graphics environment is properly configured, call the
# pylink.openGraphicsEx() function to request PyLink to use the custom graphics
# environment for calibration instead.
def main():
    """ A short script showing how to use this library.
    We connect to the tracker, open a Pygame window, and then configure the
    graphics environment for calibration. Then, perform a calibration and
    disconnect from the tracker.
    The doTrackerSetup() command will bring up a gray calibration screen.
    When the gray screen comes up, press Enter to show the camera image,
    press C to calibrate, V to validate, and O to quit calibration"""
    # initialize Pygame
    pygame.init()
    # get the screen resolution natively supported by the monitor
    disp = pylink.getDisplayInformation()
    scn_w = disp.width
    scn_h = disp.height
    # connect to the tracker
    el_tracker = pylink.EyeLink("100.1.1.1")
    # open an EDF data file on the Host PC
    el_tracker.openDataFile('test.edf')
    # open a Pygame window
    win = pygame.display.set_mode((scn_w, scn_h), FULLSCREEN | DOUBLEBUF)
    # send over a command to let the tracker know the correct screen resolution
    scn_coords = "screen_pixel_coords = 0 0 %d %d" % (scn_w - 1, scn_h - 1)
    el_tracker.sendCommand(scn_coords)
    # Instantiate a graphics environment (genv) for calibration
    genv = CalibrationGraphics(el_tracker, win)
    # Set background and foreground colors for calibration
    foreground_color = (0, 0, 0)
    background_color = (128, 128, 128)
    genv.setCalibrationColors(foreground_color, background_color)
    # The calibration target could be a "circle" (default) or a "picture",
    genv.setTargetType('circle')
    # Configure the size of the calibration target (in pixels)
    genv.setTargetSize(24)
    # Beeps to play during calibration, validation, and drift correction
    # parameters: target, good, error
    # Each parameter could be "--default sound, 'off'--no sound, or a wav file
    genv.setCalibrationSounds("", "", "")
    # Request PyLink to use the graphics environment (genv) we customized above
    pylink.openGraphicsEx(genv)
    # calibrate the tracker
    el_tracker.doTrackerSetup()
    # close the data file
    el_tracker.closeDataFile()
    # disconnect from the tracker
    el_tracker.close()
    # quit pygame
    pygame.quit()
    sys.exit()
if __name__ == '__main__':
    main()

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