
NoSeMaze

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CONTENTS:

1	NoSeMaze Controller	1
1.1	NoSeMazeControl Modules	1
1.1.1	NoSeMaze Controller	1
1.1.2	Analysis package	1
1.1.3	Controllers package	5
1.1.4	Designs package	7
1.1.5	HelperFunctions package	10
1.1.6	PyPulse package	13
1.1.7	TrialLogic package	15
1.1.8	Windows package	16
1.1.9	daqface package	19
1.1.10	main module	25
2	NoSeMaze Schedule	29
2.1	NoSeMazeSchedule Modules	29
2.1.1	Schedule Generator	29
2.1.2	Exceptions module	29
2.1.3	Generation package	29
2.1.4	ScheduleDesigns package	30
2.1.5	ScheduleModels package	34
2.1.6	SchedulePyPulse package	35
2.1.7	scheduleMain module	36
3	Indices and tables	39
	Python Module Index	41

NOSEMAZE CONTROLLER

1.1 NoSeMazeControl Modules

1.1.1 NoSeMaze Controller

This folder contains the UI of NoSeMaze Controller which control, save and load experiments in NoSeMaze setup.

1.1.2 Analysis package

Analysis

This package contains the modules used in analysis window. To implement new analysis, please change the analysis window implementation and designs accordingly.

Submodules

Analysis.Analysis module

This module contains methods used in analysis windows or in report in Email module.

Calculation of d' is left as commentar in `weighted_binned_performance` method.

Analysis.Analysis.binned_performance(*mouse: Models.Experiment.Mouse, bin_size: int, idx: int*) → list[float]

Calculate hit rate and correct rejection rate and returns them.

Parameters

- **mouse** (*Experiment.mouse class*) – Instance of Experiment.mouse class that is of interest.
- **bin_size** (*int*) – Size of bin.
It is the number of trials used to calculate hit rate or correct rejection rate.
- **idx** (*int*) – Index of tab window selected on analysis window.
It differentiate between left GNG or right GNG

Returns **binned_correct** – List of correct rate (hit and correct rejection altogether) to be shown in graphic view on analysis window.

Return type list of float

`Analysis.Analysis.n_trials_last_24(mouse: Models.Experiment.Mouse) → int`

Calculate number of trials in last 24h.

Parameters `mouse` (*Experiment.mouse class*) – Instance of mouse to calculate number of trials.

Returns `n_trials` – Number of trials since 1 day.

Return type `int`

`Analysis.Analysis.n_trials_performed(mouse: Models.Experiment.Mouse) → int`

Calculate number of trials performed by a mouse since the start of the experiment.

Parameters `mouse` (*Experiment.mouse class*) – Instance of mouse to calculate total trials performed.

Returns `total_trials` – Total trials performed since experiment start.

Return type `int`

`Analysis.Analysis.n_trials_since(mouse: Models.Experiment.Mouse, since: datetime.datetime) → int`

Calculate number of trials since a time.

Parameters

- `mouse` (*Experiment.mouse class*) – Instance of mouse to calculate number of trials of.
- `since` (*datetime.datetime*) – Instance of *datetime.datetime* as start point to calculate number of trials performed.

Returns `n_trials` – Number of trials since time given.

Return type `int`

`Analysis.Analysis.weighted_binned_performance(mouse: Models.Experiment.Mouse, bin_size: int, idx: int) → tuple[list[float], list[float]]`

In this function we examine performance by how many rewarded vs. unrewarded trials there were.

Parameters

- `mouse` (*Experiment.mouse class*) – Instance of *Experiment.mouse class* that is of interest.
- `bin_size` (*int*) – Size of bin.
It is the number of trials used to calculate hit rate or correct rejection rate.
- `idx` (*int*) – Index of tab window selected on analysis window.
It differentiate between left GNG or right GNG

Returns

- `binned_perf_p` (*list of float*) – List of hit rate in bin to be viewed in graphic view on analysis window.
- `binned_perf_m` (*list of float*) – List of correct rejection rate in bin to be viewed in graphic view on analysis window.

Analysis.Conversion module

This module contains methods used for converting experiment data into matlab data. It is not used and not supported in NoSeMaze but still saved here for archive purpose.

Analysis.Conversion.batch_convert(*paths: list[str], out_path: str, out_name: str, trial_parameter: int, verbose: bool = True, save_licks: bool = False*)

Convert files in batch.

Parameters

- **paths** (*list of str*) – List of paths to convert experiment data from.
- **out_path** (*str*) – Path to save the converted data.
- **out_name** (*str*) – Name of the saved file of the converted data.
- **trial_parameter** (*int*) – Parameter for output.
- **verbose** (*bool*) – Check if verbose mode should be used.
- **save_licks** (*bool*) – Check if licks should be saved.

Analysis.Conversion.convert()

Converting in a batch files with defined paths.

Analysis.Conversion.load_experiment(*path: str*) → tuple[Models.Experiment.Experiment, list[str], dict]

Read all experiment files in path and return the data.

Parameters **path** (*str*) – Path of the experiment files.

Returns

- **experiment** (*Experiment.Experiment*) – Last experiment loaded from .autmaus file.
- **data_files** (*list[str]*) – List of .mat files filename.
- **schedule_map** (*dict*) – Last schedule read from .csv file.

Analysis.Conversion.read_schedule_map(*path: str*) → dict

Read schedule map from csv file.

Parameters **path** (*str*) – Path of the csv file.

Returns **schedule_map** – Schedule map read from the csv file.

Return type dict

Analysis.Performance module

This module contains method to show risk taking performance of mouses.

Analysis.Performance.get_performance(*all_data: list[dict[str, list[list[float]]]], bins: int*) → list[list]

Get performance list in data.

Parameters

- **all_data** (*list of dict*) – Data is a list of data.
- **bins** (*int*) – Window to determine performance.

Returns performance – A list of performance with the length of data.

Return type 2d-list

`Analysis.Performance.load_data(filepath: str, start_date: datetime.datetime, stop_date: datetime.datetime)`
→ tuple[list[str], list[dict]]

Load experiment data.

Parameters

- **filepath** – Path to experiment file.
- **start_date** – Start date of time of interest.
- **stop_date** – Stop date of time of interest.

Returns

- **header** (*list*) – List of header
- **all_data** (*list of dict*) – List of dictionary of all data with headers as keys.

`Analysis.Performance.show_percent_correct(data: dict[str, list[list[float]]], mice: list[str], bins: int)`
Plot rate of correct hit or correct rejection.

Parameters

- **data** (*2d-list of float*) – Data to be plotted.
- **mouse** (*str*) – Id of the mouse.
- **bins** (*int*) – Bin size.

`Analysis.Performance.show_percent_left_right(data: dict[str, list[list[float]]], mice: list[str], bins: int)` → None

Plot rate of licks between left and right.

Parameters

- **data** (*2d-list of float*) – Data to be plotted.
- **mouse** (*str*) – Id of the mouse.
- **bins** (*int*) – Bin size.

`Analysis.Performance.show_risk_per_mouse(data: list[list[float]], mouse: str, bins: int)` → None
Plot rate of risk taken per mouse.

Parameters

- **data** (*2d-list of float*) – Data to be plotted.
- **mouse** (*str*) – Id of the mouse.
- **bins** (*int*) – Bin size.

`Analysis.Performance.show_risk_per_odor(data: dict[str, list[list[float]]], mice: list[str], bins: int)` → None

Plot rate of risk taken per odor.

Parameters

- **data** (*2d-list of float*) – Data to be plotted.
- **mouse** (*list of str*) – Id of the mice
- **bins** (*int*) – Bin size.

Analysis.Performance.**show_total_risk**(*data: dict[str, list[list[float]]], mice: list[str], bins: int*) → None
 Plot rate of risk taken.

Parameters

- **data** (*2d-list of float*) – Data to be plotted.
- **mouse** (*list of str*) – Id of the mouse.
- **bins** (*int*) – Bin size.

1.1.3 Controllers package

Controllers

This package contains the controller of measurement thread and its worker.

Submodules

Controllers.ExperimentControl module

This module contains thread controller and thread.

As this module was developed rapidly per changing demand, some actually unused code might still be saved as comments and there may be some codes that is actually obsolete, but still not removed, as it might be used later on, if demand changed.

class Controllers.ExperimentControl.**ExperimentController**(*parent: PyQt5.QtWidgets.QMainWindow*)

Bases: object

start()

Slot for starting the experiment.

stop()

Slot for stopping experiment

update_pref(*new_pref: dict[str, object]*)

Slot for updating hardware preferences while the experiment is running

Parameters **new_pref** (*dict*) – The new hardware preferences should be used.

class Controllers.ExperimentControl.**ExperimentWorker**(*parent: Optional[PyQt5.QtCore.QObject] = None*)

Bases: PyQt5.QtCore.QObject

Worker of experiment thread. Sequence of thread is in trial method.

animal_present()

Checks whether animal is present in the port.

check_licks()

Check if a mouse has not licked in a period of time, then send a warning e-mail. Currently, all e-mail will be saved as text notification in Dropbox.

check_status()

Check if deadman's switch has be sent or not. Message will be sent at 8 AM, 5 PM, and 10 PM.

finished

Signal sent if an experiment is finished.

Type pyqtSignal

get_present_animal()

Returns the animal in the port. 'Rfid.check_rfid' method differs between NoSeMaze 1 and NoSeMaze 2.

get_trial_daq(*t: Optional[list] = None, odor_pulses: Optional[Union[object, list[float]]] = None, current_trial: Optional[Union[list, float]] = None, fv_pulse: Optional[float] = None, pretraining: bool = False, odour_training: bool = False, concatenate: bool = False*) → *daqface.DAQ.ThreadSafeAnalogInput | daqface.DAQ.DoAiMultiTaskOdourTraining | daqface.DAQ.DoAiConcatenatedWaitTrainingMultiTask | daqface.DAQ.DoAiConcatenatedPretrainingMultiTask | daqface.DAQ.DoAiMultiTask*

Initialise daq instance then returns it. Daq instance is responsible for data acquisition and the sequences of the actual trial. E.g. sequence of pretraining trial or wait training trial.

Parameters

- **t** (*list*) – Time axis.
- **odor_pulses** (*obj or list of float*) – List of odor parameters to be given to DAQ
- **current_trial** (*list of float*) – Current trial parameters. Details, see schedule generator.
- **fv_pulse** (*float*) – Duration of delay before final valve is opened.
- **pretraining** (*bool*) – Indicator if schedule is for pretraining.
- **odour_training** (*bool*) – Indicator if schedule is for odour training.
- **concatenate** (*bool*) – Indicator if schedule is for concatenated trial.

Returns **trial_daq** – Instance of daq class that is responsible of executing the trial sequence.

Return type daqface.daq-class

reward(*animal: Models.Experiment.Mouse*)

Initialise DAQ and execute giving water.

Parameters **animal** (*instance of Mouse class from Experiment module*) – Instance of mouse to be given the reward. Reward is given according to the schedule (Only amount of water. Reward is always given or probability is always 1).

save_data(*animal_id: str, timestamp: datetime.datetime, rewarded: list, wait_response: list, response: list, correct: bool, timeout: bool, pulses: numpy.array, time_axis: numpy.array, file_timestamp: datetime.datetime, lick_time: list[list], licks: list[float], wait_time: list[list]*)

Save experiment data. New data will be appended in the existing file. If there is no existing file or date is changed, a new file will be made.

Parameters

- **animal_id** (*str*) – Id of animal
- **timestamp** (*datetime.datetime*) – Timestamp of trial started.
- **rewarded** (*list*) – List of reward parameters (Reward probability and amount of water).
- **wait_response** (*list*) – Response at wait window of left and right port. Currently, only left port is used.
- **response** (*list*) – Response at lick window of left and right port. Currently, only left port is used.

- **correct** (*bool*) – Indicator if trial is correctly performed (hit or correct rejection). Currently, correct is always True if water is given. That means, correct rejection will be falsely indicated as false.
- **timeout** (*bool*) – Indicator if a timeout is executed. Currently, there is no timeout.
- **pulses** (*ndarray*) – Array of pulses shown. Currently obsolete.
- **time_axis** (*ndarray*) – Array of indicator of time axis. Currently obsolete.
- **file_timestamp** (*datetime.datetime*) – Timestamp to be converted to file name.
- **lick_time** (*2d-list*) – List of timestamp of licks on left port and right port. Currently, only left port is used.
- **licks** (*list of float*) – List of number of licks on left port and right port. Currently, only left port is used.
- **wait_time** (*2d-list*) – List of timestamp of licks in wait window.

timeout()

Set the thread to sleep of a duration.

trial()

Sequence of trial. Contains pre-trial sequences, trial sequences in daq instance, and post-trial sequences.

trial_end

Signal sent if a trial has ended.

Type PyQtSignal

1.1.4 Designs package

Designs

This package contains the design classes of the windows used in the controller UI. It is recommended to separate the implementation of a window and the design of the window into two separate scripts, that the scripts have a better overview.

The modules are created using PyQt5 UI generator and modified as needed.

Submodules

Designs.HardwareWindowEdited module

class Designs.HardwareWindowEdited.Ui_MainWindow

Bases: object

retranslateUi(MainWindow)

setupUi(MainWindow)

Designs.addWindow module

```
class Designs.addWindow.Ui_MainWindow
    Bases: object
    retranslateUi (MainWindow)
    setupUi (MainWindow)
```

Designs.adjustmentWidget module

```
class Designs.adjustmentWidget.Ui_DockWidget
    Bases: object
    retranslateUi (DockWidget)
    setupUi (DockWidget)
```

Designs.analysisWindow module

```
class Designs.analysisWindow.GNGWidget
    Bases: PyQt5.QtWidgets.QWidget
class Designs.analysisWindow.RiskWidget
    Bases: PyQt5.QtWidgets.QWidget
class Designs.analysisWindow.Ui_MainWindow
    Bases: object
    retranslateUi (MainWindow)
    setupUi (MainWindow)
```

Designs.animalWindow module

```
class Designs.animalWindow.Ui_MainWindow
    Bases: object
    retranslateUi (MainWindow)
    setupUi (MainWindow)
```

Designs.controlWindow module

```
class Designs.controlWindow.Ui_MainWindow
    Bases: object
    retranslateUi (MainWindow)
    setupUi (MainWindow)
```

Designs.controlWindowGraphicsView module

```
class Designs.controlWindowGraphicsView.Ui_MainWindow
    Bases: object
    retranslateUi (MainWindow)
    setupUi (MainWindow)
```

Designs.hardwareWindow module

```
class Designs.hardwareWindow.Ui_MainWindow
    Bases: object
    retranslateUi (MainWindow)
    setupUi (MainWindow)
```

Designs.mailWindow module

```
class Designs.mailWindow.Ui_MainWindow
    Bases: object
    retranslateUi (MainWindow)
    setupUi (MainWindow)
```

Designs.mainWindow module

```
class Designs.mainWindow.Ui_MainWindow
    Bases: object
    retranslateUi(MainWindow)
    setupUi(MainWindow)
```

Designs.prefsWindow module

```
class Designs.prefsWindow.Ui_MainWindow
    Bases: object
    retranslateUi(MainWindow)
    setupUi(MainWindow)
```

Designs.settingWindow module

```
class Designs.settingWindow.Ui_MainWindow
    Bases: object
    retranslateUi(MainWindow)
    setupUi(MainWindow)
```

1.1.5 HelperFunctions package

HelperFunctions

This package contains useful methods used in the measurement thread.

Submodules

HelperFunctions.BeamCheck module

This module contains method to check if beam is broken, which signals the start of a trial.

HelperFunctions.BeamCheck.**check_beam**(*device*, *channels*, *beam_channel*)

Check if beam is broken. If beam is broken, TTL is high and data is measured at 5 V. If beam is not broken, TTL is low and data is measured at 0 V. If mean of data > 1, means that in 0.1 s there is a TTL high, ergo beam was broken.

Parameters

- **device** (*str*) – Name of device in NI-board where beam sensor is connected.
- **channels** (*int*) – Number of analog input channels read.
- **beam_channel** (*int*) – Index of beam channel.

Returns **broken** – Indicator if beam is broken or not.

Return type bool

HelperFunctions.Email module

This module contains methods used for e-mailing. Currently, is used to write notification message in Dropbox. Codes to send e-mail is in commentar.

HelperFunctions.Email.**crash_error**(*exctype, value, tb*)

Get traceback if software is crashed and send e-mail. Currently, a message will be written in Dropbox.

Parameters

- **exctype** (*Type of Exception*) – Type of exception
- **value** (*int*) – Error id.
- **tb** (*obj*) – Traceback object.

HelperFunctions.Email.**deadmans_switch**(*experiment*)

Notification every day to indicate if experiment is running.

Parameters **experiment** (*Experiment.experiment*) – Instance of Experiment.experiment class to take information from.

HelperFunctions.Email.**parse_list**(*string*)

Method used to parse string of a list into a list of float, then sum it.

Parameters **string** (*str*) – String of a list to be parsed.

Returns **result** – Sum of the parsed list.

Return type float

HelperFunctions.Email.**send**(*subject, content, attachment*)

Write a message with subject, content and attachment in Dropbox.

Parameters

- **subject** (*str*) – Subject of message
- **content** (*str*) – Content of message
- **attachement** (*list*) – List of attachment.

HelperFunctions.Email.**warning_licks**(*logs_path, namelist*)

Send warning e-mail if any mouse has not licked in a period of time. Currently, a message will be written in Dropbox.

Parameters

- **logs_path** (*str*) – Directory path to folder with all licks log of mouses.
- **namelist** (*list*) – List of mouse's ID which has not licked in a period of time.

HelperFunctions.Filter module

This module is used to filter analog data read from NI-Board.

HelperFunctions.Filter.**Gauss_Filter**(*data, k, fs, fcut*)

HelperFunctions.Filter.**Square_Filter**(*data, fs, fcut*)

HelperFunctions.RFID module

This module read the rfid tag of the mouse present at the port.

HelperFunctions.RFID.**check_rfid**(*port, n*)

Read the rfid from the rfid reader with a 2 seconds timeout. If no valid rfid read in 2 seconds, returns 'default'.

Parameters

- **port** (*str*) – COM-port of rfid reader.
- **n** (*int*) – Total number of ID. In this case, it is not used.

Returns out – ID of mouse present.

Return type str

HelperFunctions.Reward module

This module contains methods to deliver reward at different situations.

HelperFunctions.Reward.**deliver_reward**(*do_device, samp_rate, secs, sync_clock, ai_channels*)

Deliver reward to a device.

Parameters

- **do_device** (*str*) – Name of digital out device
- **samp_rate** (*int*) – Sample rate specified in hardware configuration.
- **secs** (*float*) – Duration that the ventil should be opened (water amount).
- **sync_clock** (*str*) – Clock preferred for synchronised reading.
- **ai_channels** (*int*) – Number of analog input channels read.

Returns out – Currently, there is no analog data read.

Return type None

`HelperFunctions.Reward.deliver_reward_static(do_device, secs)`

Deliver reward from a ventill.

Parameters

- **do_device** (*str*) – Name of device.
- **secs** (*float*) – Duration that the ventill should be opened (water amount).

Returns out – Currently no analog input is read.

Return type None

`HelperFunctions.Reward.deliver_reward_static_concatenate(device1, device2, secs, index)`

Deliver reward for concatenated training.

Parameters

- **device1** (*str*) – Name of device 1 (left port).
- **device2** (*str*) – Name of device 2 (right port).
- **secs** (*float*) – Duration that the ventill should be opened (water amount).
- **index** (*int*) – Index of odour actually presented.

Returns out – There is currently no analog input read.

Return type None

`HelperFunctions.Reward.deliver_reward_static_two(device1, device2, secs1, secs2)`

Deliver reward for concatenated training.

Parameters

- **device1** (*str*) – Name of device 1 (left port).
- **device2** (*str*) – Name of device 2 (right port).
- **secs1** (*float*) – Duration that left ventill should be opened (water amount).
- **secs2** (*float*) – Duration that right ventill should be opened (water amount).

Returns out – There is currently no analog input read.

Return type None

1.1.6 PyPulse package

PyPulse

A set of tools for generating complex pulse trains for digital inputs, largely for use in driving high speed valves / PWM.

This contains a slightly different methods than from PyPulse in schedule generator because of pulse parameters that is needed to be prepared for DAQ.

Submodules

PyPulse.PulseGeneration module

This module contains methods to generate pulse for use in DAQ.

PyPulse.PulseGeneration.**concatenated_pulse**(*sampling_rate, params, number, total*)

PyPulse.PulseGeneration.**dummy_noise_pulse**(*sampling_rate, params*)

PyPulse.PulseGeneration.**extended_square_pulse**(*sampling_rate, duration, frequency, duty*)

PyPulse.PulseGeneration.**fv_pulse**(*sampling_rate, params_list, length, fv_delay*)

PyPulse.PulseGeneration.**lick_pulse**(*sampling_rate, duration, frequency, duty*)

PyPulse.PulseGeneration.**multi_noise_pulse**(*sampling_rate, global_onset, global_offset, params_list*)

PyPulse.PulseGeneration.**multi_simple_pulse**(*sampling_rate, global_onset, global_offset, params_list*)

PyPulse.PulseGeneration.**noise_pulse**(*sampling_rate, params*)

PyPulse.PulseGeneration.**plume_pulse**(*sampling_rate, params*)

PyPulse.PulseGeneration.**random_shatter_pulse**(*sampling_rate, duration, frequency, duty,*
shatter_frequency, target_duty, amp_min, amp_max,
extend=False)

this function generates a shattered pulse based on major pulse frequency and duty, as well as shatter frequency. The function will generate standard pulse and then shatter it, with the duty of each shattered pulse randomised. The function will aim to keep the integral of the pulse at duty * target duty

PyPulse.PulseGeneration.**random_simple_pulse**(*sampling_rate, params*)

PyPulse.PulseGeneration.**shatter_pulse**(*sampling_rate, duration, frequency, duty, shatter_frequency,*
shatter_duty)

PyPulse.PulseGeneration.**simple_pulse**(*sampling_rate, params*)

PyPulse.PulseGeneration.**simple_pulse_static**(*sampling_rate, params*)

PyPulse.PulseGeneration.**spec_time_pulse**(*sampling_rate, params*)

PyPulse.PulseGeneration.**square_pulse**(*sampling_rate, duration, frequency, duty*)

PyPulse.PulseInterface module

This module contains method to input pulse parameters to get desired pulse.

PyPulse.PulseInterface.**make_pulse**(*sampling_rate, global_onset, global_offset, params_list*)

Parameters

- **sampling_rate** (*int*) – Sampling rate defined in hardware configuration
- **global_onset** (*float*) – Number of element set to be an onset.

- **global_offset** (*float*) – Number of element set to be an offset.
- **params_list** (*list*) – List of pulse parameters.

Returns

- **pulse_matrix** (*2d-list*) – List of pulse.
- **t** (*ndarray*) – Time axis.

1.1.7 TrialLogic package

TrialLogic

This package contains modules for deciding trial results.

Submodules

TrialLogic.TrialConditions module

This module contains methods to analyse read data.

class TrialLogic.TrialConditions.TrialResult(*value*)

Bases: `enum.Enum`

An enumeration.

correct_rejection = 2

correct_response = 1

false_alarm = 4

miss = 3

TrialLogic.TrialConditions.**lick_detect**(*lick_data*, *threshold*, *percent_accepted*)

Detect lick and analyse it if it is considered licked or not.

Parameters

- **lick_data** (*ndarray*) – Read data to be analysed.
- **threshold** (*int*) – Threshold if data is considered TTL high.
- **percent_accepted** (*float*) – Ratio of TTL high in data to be considered licked.

Returns **response** – Response is true, if number of licks is greater than 2 or if the ratio is greater than indicated.

Return type `bool`

TrialLogic.TrialConditions.**licks_number**(*lick_data*, *threshold*, *samp_rate*, *start_time*)

Get the number of licks from data.

Parameters

- **lick_data** (*ndarray*) – Read data to be analysed.
- **threshold** (*int*) – Threshold if data is considered TTL high.
- **samp_rate** (*int*) – Sample rate defined in hardware configuration.

- **start_time** (*datetime.datetime*) – Start time of a trial.

Returns

- **lick_times** (*list*) – Timestamps of licks.
- **licks** (*int*) – Number of licks.

`TrialLogic.TrialConditions.trial_result(_rewarded, _response_l, _response_r)`

Analyse trial, if it is correct.

Parameters

- **_rewarded** (*list*) – List of reward parameteres (reward probability and amount of reward).
- **_response_l** (*bool*) – Indicator if left port is licked.
- **_response_r** (*bool*) – Indicator if right port is licked.

Returns

- **TrialResult_enum** (*TrialResult*) – Enum of trial result.
4 indicators - correct response, correct rejection, miss, and false alarm.
- **correct** (*bool*) – Indicator if correct response or correct rejection.
- **timeout** (*bool*) – Indicator if timeout is executed.

1.1.8 Windows package

This module contains all implementation of windows in UI. There are adjustment window, hardware window, control window, animal window, e-mail window and analysis window.

Submodules

Windows.AppWindows module

This module contains all implementation of windows in UI. There are adjustment window, hardware window, control window, animal window, e-mail window and analysis window.

class `Windows.AppWindows.AdjustmentWidget`(*cam, settings, parent=None*)

Bases: `PyQt5.QtWidgets.QDockWidget`, `Designs.adjustmentWidget.Ui_DockWidget`

set_brightness(*value*)

set_contrast(*value*)

set_saturation(*value*)

class `Windows.AppWindows.AnalysisWindow`(*experiment, parent=None*)

Bases: `PyQt5.QtWidgets.QMainWindow`, `Designs.analysisWindow.Ui_MainWindow`

current_animal()

display_animal_performance()

display_group_performance()

```

    on_animal_selected()

    on_tab_selected(index)

    populate_stats_table()

class Windows.AppWindows.AnimalWindow(parent=None)
    Bases: PyQt5.QtWidgets.QMainWindow, Designs.animalWindow.Ui_MainWindow

    add_row()

    add_schedule()

    animal_selected()

    change_false()

    change_true()

    changed
        int = ..., arguments: Sequence = ...) -> PYQT_SIGNAL

        types is normally a sequence of individual types. Each type is either a type object or a string that is the
        name of a C++ type. Alternatively each type could itself be a sequence of types each describing a different
        overloaded signal. name is the optional C++ name of the signal. If it is not specified then the name of
        the class attribute that is bound to the signal is used. revision is the optional revision of the signal that is
        exported to QML. If it is not specified then 0 is used. arguments is the optional sequence of the names of
        the signal's arguments.

        Type pyqtSignal(*types, name
        Type str = ..., revision

    closeEvent(self, QCloseEvent)

    current_animal()

    current_sched_index()

    populate_animal_table(animals_list)

    remove_row()

    remove_schedule()

    saved
        int = ..., arguments: Sequence = ...) -> PYQT_SIGNAL

        types is normally a sequence of individual types. Each type is either a type object or a string that is the
        name of a C++ type. Alternatively each type could itself be a sequence of types each describing a different
        overloaded signal. name is the optional C++ name of the signal. If it is not specified then the name of
        the class attribute that is bound to the signal is used. revision is the optional revision of the signal that is
        exported to QML. If it is not specified then 0 is used. arguments is the optional sequence of the names of
        the signal's arguments.

        Type pyqtSignal(*types, name
        Type str = ..., revision

    schedule_selected()

```

```
    update_animals()

class Windows.AppWindows.ControlWindow(experiment, parent=None)
    Bases: PyQt5.QtWidgets.QMainWindow, Designs.controlWindow.Ui_MainWindow
    adjust_cam1()
    adjust_cam2()
    closeEvent(self, QCloseEvent)
    configure_settings(settings)
    get_cam1()
    get_cam2()
    get_res_cam1()
    get_res_cam2()
    on_animal_selected()
    populate_table()
    qsize_to_string(qsize)
    set_cam1(cam)
    set_cam2(cam)
    set_res_cam1(x, y)
    set_res_cam2(x, y)
    update_ticks_view(animal)

class Windows.AppWindows.HardwareWindow(parent=None)
    Bases: PyQt5.QtWidgets.QMainWindow, Designs.hardwareWindow.Ui_MainWindow
    change()
    closeEvent(self, QCloseEvent)

    new_pref
        int = ..., arguments: Sequence = ...) -> PYQT_SIGNAL

        types is normally a sequence of individual types. Each type is either a type object or a string that is the
        name of a C++ type. Alternatively each type could itself be a sequence of types each describing a different
        overloaded signal. name is the optional C++ name of the signal. If it is not specified then the name of
        the class attribute that is bound to the signal is used. revision is the optional revision of the signal that is
        exported to QML. If it is not specified then 0 is used. arguments is the optional sequence of the names of
        the signal's arguments.

        Type pyqtSignal(*types, name
        Type str = ..., revision

    save_preferences()
```

saved

int = ..., arguments: Sequence = ...) -> PYQT_SIGNAL

types is normally a sequence of individual types. Each type is either a type object or a string that is the name of a C++ type. Alternatively each type could itself be a sequence of types each describing a different overloaded signal. name is the optional C++ name of the signal. If it is not specified then the name of the class attribute that is bound to the signal is used. revision is the optional revision of the signal that is exported to QML. If it is not specified then 0 is used. arguments is the optional sequence of the names of the signal's arguments.

Type pyqtSignal(*types, name

Type str = ..., revision

saved_status()

set_preferences(prefs)

zero_edit()

class Windows.AppWindows.**MailWindow**(parent=None)

Bases: PyQt5.QtWidgets.QMainWindow, *Designs.mailWindow.Ui_MainWindow*

add_address(new_addrs)

get_address()

populate_mailing_list(mlist)

remove_address()

save(mlist)

class Windows.AppWindows.**PreferencesWindow**(parent=None)

Bases: PyQt5.QtWidgets.QMainWindow, *Designs.prefsWindow.Ui_MainWindow*

save_preferences()

select_save_path()

set_preferences(prefs)

1.1.9 daqface package

daqface

A high-level python interface for a number of common NI DAQmx hardware tasks. Some unused classes are removed from the original version as to maintain overview and avoid confusion.

Submodules

daqface.DAQ module

```
class daqface.DAQ.DoAiConcatenatedPretrainingMultiTask(ai_device: str, ai_channels: str, do_device:  
str, fv_device: str, reward_device_l: str,  
reward_device_r: str, samp_rate: int, secs:  
float, odor_write: float, fv_write: float,  
sync_clock: str, static: bool, lick_channel_l:  
int, lick_channel_r: int, beam_channel: int,  
rewarded: list[object])
```

Bases: object

DAQ for concatenated pretraining schedule. Not used in current implementation.

CheckLicks(*analogData: numpy.ndarray, idx: int*)

Check if reward should be given. In this case, reward is always given regardless of performance.

Parameters

- **analogData** (*ndarray*) – Measured data of time window of interest.
- **idx** (*int*) – Index of odour that is actually presented. E.g., for 1st odour is idx = 0.

Returns **water_given** – List of indicator when water is given between 3 odours at left port and right port.

Return type 2d-list

ClearTasks()

Stop task and clear it

DoTask()

Start task and execute sequences.

Returns

- **analogData** (*ndarray*) – All measured data read during the trial
- **waitData** (*ndarray*) – Measured data read during the wait window
- **shouldLickData** (*ndarray*) – Measured data read during the lick window
- **timestamp1** (*datetime.datetime*) – Timestamp of the start of odour presentation
- **timestamp2** (*datetime.datetime*) – Timestamp of the start of trial.
- **water_given** (*list*) – List of indicator if water are given on left port or right port.

```
class daqface.DAQ.DoAiConcatenatedWaitTrainingMultiTask(ai_device: str, ai_channels: int, do_device:  
str, fv_device: str, reward_device_l: str,  
reward_device_r: str, samp_rate: int, secs:  
float, odor_write: float, fv_write: float,  
sync_clock: str, static: bool,  
lick_channel_l: int, lick_channel_r: int,  
beam_channel: int, rewarded: list[object])
```

Bases: object

DAQ for concatenated wait training schedule. Not used in current implementation.

CheckLicks(*analogData: numpy.ndarray, idx: int*)

Check if reward should be given.

Parameters

- **analogData** (*ndarray*) – Measured data of time window of interest.
- **idx** (*int*) – Index of odour that is actually presented. E.g., for 1st odour is idx = 0.

Returns **water_given** – List of indicator when water is given between 3 odours at left port and/or right port.

Return type 2d-list

ClearTasks()

Stop task and clear it

DoTask()

Start task and execute sequences.

Returns

- **analogData** (*ndarray*) – All measured data read during the trial
- **waitData** (*ndarray*) – Measured data read during the wait window
- **shouldLickData** (*ndarray*) – Measured data read during the lick window
- **timestamp1** (*datetime.datetime*) – Timestamp of the start of odour presentation
- **timestamp2** (*datetime.datetime*) – Timestamp of the start of trial.
- **water_given** (*list*) – List of indicator if water are given on left port or right port.

```
class daqface.DAQ.DoAiMultiTask(ai_device: str, ai_channels: int, do_device: str, fv_device: str,
                                reward_device_l: str, reward_device_r: str, samp_rate: int, secs: float,
                                odor_write: list[object], fv_write: numpy.ndarray, sync_clock: str, static:
                                bool, wait_delay: float, lick_delay: float, lick_channel_l: int,
                                lick_channel_r: int, beam_channel: int, rewarded: list[float])
```

Bases: object

DAQ for normal GNG or risk trial

CheckLicks()

Check if reward should be given.

Returns **water_given** – List of indicator if water is given at left port and/or right port.

Return type list

ClearTasks()

Stop task and clear it.

DoTask()

Start task and execute sequences.

Returns

- **analogData** (*ndarray*) – All measured data read during the trial
- **waitData** (*ndarray*) – Measured data read during the wait window
- **shouldLickData** (*ndarray*) – Measured data read during the lick window
- **timestamp1** (*datetime.datetime*) – Timestamp of the start of odour presentation

- **timestamp2** (*datetime.datetime*) – Timestamp of the start of trial.
- **water_given** (*list*) – List of indicator if water are given on left port or right port.

```
class daqface.DAQ.DoAiMultiTaskOdourTraining(ai_device, ai_channels, do_device, fv_device,  
                                             reward_device_l, reward_device_r, samp_rate, secs,  
                                             odor_write, fv_write, sync_clock, static, thorax_delay,  
                                             lick_delay, lick_channel_l, lick_channel_r,  
                                             beam_channel, rewarded)
```

Bases: object

DAQ for normal GNG odor association training. That is reward is always given after odor presentation regardless of performance.

CheckLicks()

Check how reward should be presented. Reward is always given after odor presentation regardless of performance.

Returns

- **licks_l** (*int*) – Number of licks in lick window at left port during trial.
- **licks_r** (*int*) – Number of licks in lick window at right port during trial.
- **timestamps_l** (*list*) – Timestamps of licks in lick window.
- **timestamps_r** (*list*) – Timestamps of licks in lick window.
- **water_given** (*list*) – List of indicator if water is given at left port and/or right port.

ClearTasks()

Stop task then clear it

DoTask()

Start task and execute sequences.

Returns

- **analogData** (*ndarray*) – All measured data read during the trial
- **waitData** (*ndarray*) – Measured data read during the wait window
- **shouldLickData** (*ndarray*) – Measured data read durign the lick window
- **timestamp_1** (*datetime.datetime*) – Timestamp of the start of odour presentation
- **water_given** (*list*) – List of indicator if water are given on left port or right port.
- **licks** (*list of int*) – List of number of licks at left port and right port.
- **timestamps** (*2d-list*) – List of timestamps of licks at left port and right port.
- **timestamp_2** (*datetime.datetime*) – Timestamp of the start of trial.

```
class daqface.DAQ.DoAiMultiTaskWaitTraining(ai_device, ai_channels, do_device, fv_device,  
                                             reward_device_l, reward_device_r, samp_rate, secs,  
                                             odor_write, fv_write, sync_clock, static, thorax_delay,  
                                             lick_delay, lick_channel_l, lick_channel_r, beam_channel,  
                                             rewarded)
```

Bases: object

DAQ for strict GNG wait training. That means, reward will not be given if mouse does not wait. Not used in current implementation.

CheckLicks()

Check if reward should be given. If mouse does not wait and licked in wait window, no reward will be given.

Returns

- **licks_l** (*int*) – Number of licks in lick window at left port during trial.
- **licks_r** (*int*) – Number of licks in lick window at right port during trial.
- **timestamps_l** (*list*) – Timestamps of licks in lick window.
- **timestamps_r** (*list*) – Timestamps of licks in lick window.
- **water_given** (*list*) – List of indicator if water is given at left port and/or right port.

ClearTasks()**DoTask()**

Start task and execute sequences.

Returns

- **analogData** (*ndarray*) – All measured data read during the trial
- **waitData** (*ndarray*) – Measured data read during the wait window
- **shouldLickData** (*ndarray*) – Measured data read during the lick window
- **timestamp_1** (*datetime.datetime*) – Timestamp of the start of odour presentation
- **water_given** (*list*) – List of indicator if water are given on left port or right port.
- **licks** (*list of int*) – List of number of licks at left port and right port.
- **timestamps** (*2d-list*) – List of timestamps of licks at left port and right port.
- **timestamp_2** (*datetime.datetime*) – Timestamp of the start of trial.

```
class daqface.DAQ.NiUsbDigitalOut(device: str, secs: float, on: int)
```

Bases: object

Send digital signal out to one device.

ClearTasks()

Stop task and clear it

DoTask()

Start task and execute sequence

```
class daqface.DAQ.NiUsbDigitalOutTwoDevices(device1: str, device2: str, secs1: float, secs2: float, on1:
int, on2: int)
```

Bases: object

Send digital signals out to two devices simultaneously. For giving reward.

ClearTask()

Stop task and clear it.

DoTask()

```
class daqface.DAQ.NiUsbDigitalOutTwoDevicesC(device1: str, device2: str, secs: float, on1: int, on2: int)
```

Bases: object

Send digital signal out to two channels simultaneously for concatenated training. It is currently not used

ClearTask()

Stop and clear all tasks.

DoTask()

Start task and execute sequences

```
class daqface.DAQ.ThreadSafeAnalogInput(ai_device: str, channels: int, samp_rate: int, secs: float, clock:  
                                         str = "")
```

Bases: object

Read thread safe analog input.

ClearTasks()

Stop task and clear it

DoTask()

Start task and read input.

Returns **analogData** – Data measured.

Return type ndarray

```
class daqface.DAQ.ThreadSafeDigitalOut(device: str, samprate: int, secs: float, write: numpy.ndarray,  
                                       clock: str, ai_channels: int)
```

Bases: object

Send thread safe digital signal out to a device.

ClearTasks()

Stop task and clear it

DoTask()

Start task and execute sequence

daqface.Uutils module

```
daqface.Uutils.binary_to_digital_map(bin_buffer: numpy.ndarray) → numpy.ndarray
```

If we have a sequence of 1s and 0s corresponding to digital ON and OFF times, we want to map this to digital commands that the digital ports can read and implement.

Input should be mapped as a 2d numpy array (dtype=numpy.uint32), rows are individual lines, columns are continuous time points. Ignores sampling rate until we tell NIDAQmx what it is.

Parameters **bin_buffer** (ndarray) – An integer array of zeros and ones to be converted.

Returns **digital** – Mapped digital commands.

Return type ndarray

1.1.10 main module

class main.MainApp

Bases: PyQt5.QtWidgets.QMainWindow, *Designs.mainWindow.Ui_MainWindow*

The main window class of the UI.

Inherits QMainWindow from QtWidgest and uses UI design from mainWindow.py.

saved_status

Status if experiments already saved. Checked while closing the windows and changed if any trials are executed or experiment is saved.

Type bool

config_path

Path to the config files.

Type str

hardware_prefs

Hardware preferences.

Type dict

dropbox_path

Path to dropbox to save deadman-switch, warning and error messages.

Type str

hardware_window

Hardware window to configure hardware preferences.

Type instance of AppWindows.HardwareWindow class

animal_window

Animal window to input animals in the experiment and their schedules.

Type instance of AppWindows.AnimalWindow class

analysis_window

Analysis window that shows the performance curve of the experiment and of each mouses respectively.

Type instance of AppWindows.AnalysisWindow class

mail_window

Mail window to input the mailing list.

Type instance of AppWindows.MailWindow class

control_window

Control window which shows video feed of usb cameras connected. Currently not maintained.

Type instance of AppWindows.ControlWindow class

Note: E-Mailing functionality is deprecated as messages are now saved in a cloud folder.

closeEvent(event)

Things to be executed if closeEvent occurred (x in main window is clicked).

Parameters **event** (*instance of QCloseEvent*) – Events with close event information sent to the window.

experiment_saved()

Changing status and name of window if experiment is saved.

load_config_data()

Load hardware configuration data. Load files from path defined in config_path.

Returns **hardware_configs** – Hardware configurations saved in hardware.config

Return type dict

load_dropbox_path()

Load dropbox path saved in dropbox.txt to dropbox_path_file variable.

Returns **dropbox_path_file** – Path to dropbox file for messages to be written.

Return type str

load_experiment()

Load experiment.

loaded

pyqtSignal sent if experiment is loaded.

Type QtCore.pyqtSignal

on_trial_selected()

Update trial if trial is selected.

open_analysis_window()

Open analysis window.

open_animal_window()

Open animal window.

open_control_window()

Open control window.

open_hardware_window()

Open hardware window.

open_mail_window()

Open mail window.

open_user_guide()

Open User Guide. If user guide is not locally available, open user guide in Github

save_experiment()

Save experiment.

saved

pyqtSignal sent if experiment is saved.

Type QtCore.pyqtSignal

set_dropbox_path()

Set dropbox path in which the deadman-switch, warning and error messages to be saved.

setup_experiment_bindings(*experiment*)

Set up experiment in the GUI and populate the experiment table in the GUI.

experiment [instance of Experiment.Experiment class] Experiment to be set up.

show_about()

Show the *about* message.

status_changed()

Changing status and name of window if a trial is executed.

thread_control()

Stop experiment control thread.

update_data_view()

Update data view of the trial.

update_experiment_info()

Update experiment labels in the GUI.

update_graphics_view(*trial*)

Update graph view to the odour signal of the selected trial.

Parameters **trial** (*int*) – Trial index to be viewed.

update_trial_view()

Update graph view of the trial if a trial is executed.

windows_control()

Check if any window is opened, then close it.

main.main()

Main method to be called.

main.my_exception_hook(*exctype, value, traceback*)

Custom exception hook.

Parameters

- **exctype** (*type of BaseException*) – Type of exception.
- **value** (*BaseException*) – Exception occurred.
- **traceback** (*TracebackType*) – Traceback up to the exception.

NOSEMAZE SCHEDULE

2.1 NoSeMazeSchedule Modules

2.1.1 Schedule Generator

A GUI tool for generating schedules - sequences of trials that run in NoSeMaze

Python 3.10+ (on Windows, WinPython is recommended). GUI is PyQt5/pyqtgraph based. Requires pypulse to run.

2.1.2 Exceptions module

Custom Exceptions Used In Autonomouse Schedule

exception Exceptions.**RewardMapError**
Bases: Exception

2.1.3 Generation package

Generation

This package contains the Gen module. The module is used to generate randomize sequence of trials.

Submodules

Generation.Gen module

This module contains methods to generate randomise sequence of trials.

Generation.Gen.**odor_sequence**(*odour_choice*, *n_trials*)
Randomized sequence after odour.

Parameters

- **odour_choice** (*list*) – List of odours to be randomised from.
- **n_trials** (*int*) – Number of trials in a schedule defined in UI.

Generation.Gen.**reward_sequence**(*n_trials*)
Generate sequence after reward.

n_trials [int] Number of trials in a schedule defined in UI.

2.1.4 ScheduleDesigns package

ScheduleDesigns

This package contains the UI designs for the schedule widgets and some other widgets. It is recommended to separate implementation script and design script and put the design script here.

The modules are created using PyQt5 UI generator and modified as needed.

Submodules

ScheduleDesigns.NoSeMazeConcatenatedScheduleDesign module

```
class ScheduleDesigns.NoSeMazeConcatenatedScheduleDesign.Ui_Form
    Bases: object
    retranslateUi(Form)
    setupUi(Form)
```

ScheduleDesigns.NoSeMazeScheduleDesign module

```
class ScheduleDesigns.NoSeMazeScheduleDesign.Ui_Form
    Bases: object
    retranslateUi(Form)
    setupUi(Form)
```

ScheduleDesigns.concGNGDesign module

```
class ScheduleDesigns.concGNGDesign.Ui_Form
    Bases: object
    retranslateUi(Form)
    setupUi(Form)
```

ScheduleDesigns.contCorrDesign module

```
class ScheduleDesigns.contCorrDesign.Ui_Form
    Bases: object
    retranslateUi(Form)
    setupUi(Form)
```

ScheduleDesigns.corrDesign module

```
class ScheduleDesigns.corrDesign.Ui_Form
    Bases: object
    retranslateUi(Form)
    setupUi(Form)
```

ScheduleDesigns.corrDifficultySwitchCameraTriggerDesign module

```
class ScheduleDesigns.corrDifficultySwitchCameraTriggerDesign.Ui_Form
    Bases: object
    retranslateUi(Form)
    setupUi(Form)
```

ScheduleDesigns.corrDifficultySwitchDesign module

```
class ScheduleDesigns.corrDifficultySwitchDesign.Ui_Form
    Bases: object
    retranslateUi(Form)
    setupUi(Form)
```

ScheduleDesigns.corrOnsetDisruptDesign module

```
class ScheduleDesigns.corrOnsetDisruptDesign.Ui_Form
    Bases: object
    retranslateUi(Form)
    setupUi(Form)
```

ScheduleDesigns.corrRandomFrequency2Design module

```
class ScheduleDesigns.corrRandomFrequency2Design.Ui_Form
    Bases: object
    retranslateUi(Form)
    setupUi(Form)
```

ScheduleDesigns.corrRandomFrequencyDesign module

```
class ScheduleDesigns.corrRandomFrequencyDesign.Ui_Form
    Bases: object
    retranslateUi(Form)
    setupUi(Form)
```

ScheduleDesigns.mainDesign module

```
class ScheduleDesigns.mainDesign.Ui_MainWindow
    Bases: object
    retranslateUi(MainWindow)
    setupUi(MainWindow)
```

ScheduleDesigns.pretrainDesign module

```
class ScheduleDesigns.pretrainDesign.Ui_Form
    Bases: object
    retranslateUi(Form)
    setupUi(Form)
```

ScheduleDesigns.scheduleBeastDesign module**ScheduleDesigns.shatterValveTestDesign module**

```
class ScheduleDesigns.shatterValveTestDesign.Ui_Form
    Bases: object
    retranslateUi(Form)
    setupUi(Form)
```

ScheduleDesigns.simpleCorrDesign module

```
class ScheduleDesigns.simpleCorrDesign.Ui_Form
    Bases: object
    retranslateUi(Form)
    setupUi(Form)
```

ScheduleDesigns.simpleGNGDesign module

```
class ScheduleDesigns.simpleGNGDesign.Ui_Form
    Bases: object
    retranslateUi(Form)
    setupUi(Form)
```

ScheduleDesigns.valveMapDesign module

```
class ScheduleDesigns.valveMapDesign.Ui_Form
    Bases: object
    retranslateUi(Form)
    setupUi(Form)
```

2.1.5 ScheduleModels package

ScheduleModels

Implementation of the actual schedule generation can be found in *ScheduleWidgets.py*. To add another trial sequence, implement a new schedule widgets in *ScheduleWidgets.py*. It will be automatically listed in the drop down list. It is recommended to separate the implementation script and the design script and put the implementation script in the module *ScheduleWidgets.py*

Submodules

ScheduleModels.ScheduleView module

This module contains the model of the table in Schedule Generator UI.

```
class ScheduleModels.ScheduleView.ScheduleModel(headerdata, arraydata, parent=None, *args)
    Bases: PyQt5.QtCore.QAbstractTableModel
    columnCount(self, parent: QModelIndex = QModelIndex()) → int
    data(self, QModelIndex, role: int = Qt.ItemDataRole.DisplayRole) → Any
    headerData(self, int, Qt.Orientation, role: int = Qt.ItemDataRole.DisplayRole) → Any
    rowCount(self, parent: QModelIndex = QModelIndex()) → int
```

ScheduleModels.ScheduleWidgets module

This module contains the implementation of the schedule widgets. If a new trial sequence is needed, then a new schedule widget is also needed.

Methods needed in a class implementation of a schedule widget is: `generate_schedule()` and `pulse_parameters()`.

```
class ScheduleModels.ScheduleWidgets.NoSeMazeScheduleWidget(parentUi=None)
    Bases: PyQt5.QtWidgets.QWidget, ScheduleDesigns.NoSeMazeScheduleDesign.Ui_Form
    change_reward_map()
    flatten_value(value)
    generate_schedule(valence_map)
```

`pulse_parameters(trial)`

ScheduleModels.Widgets module

This module contains the ValveMapWidget, that is used in the UI.

```
class ScheduleModels.Widgets.ValveMapWidget(parentUi=None)
    Bases: PyQt5.QtWidgets.QWidget, ScheduleDesigns.valveMapDesign.Ui_Form

    change_valve_map()

    flatten_value(value)

    get_valence_map()
```

2.1.6 SchedulePyPulse package

SchedulePyPulse

A set of tools for generating complex pulse trains for digital inputs, largely for use in driving high speed valves / PWM. PyPulse in NoSeMazeController contains some modification from this PyPulse.

Submodules

SchedulePyPulse.PulseGeneration module

This module contains methods used to make pulses after PulseInterface decide, which pulse is to be made.

```
SchedulePyPulse.PulseGeneration.concatenated_pulse(sampling_rate, params, number, total)

SchedulePyPulse.PulseGeneration.dummy_noise_pulse(sampling_rate, params)

SchedulePyPulse.PulseGeneration.extended_square_pulse(sampling_rate, duration, frequency, duty)

SchedulePyPulse.PulseGeneration.multi_noise_pulse(sampling_rate, global_onset, global_offset,
                                                    params_list)

SchedulePyPulse.PulseGeneration.multi_simple_pulse(sampling_rate, global_onset, global_offset,
                                                    params_list)

SchedulePyPulse.PulseGeneration.noise_pulse(sampling_rate, params)

SchedulePyPulse.PulseGeneration.plume_pulse(sampling_rate, params)

SchedulePyPulse.PulseGeneration.random_shatter_pulse(sampling_rate, duration, frequency, duty,
                                                    shatter_frequency, target_duty, amp_min,
                                                    amp_max, extend=False)
```

This function generates a shattered pulse based on major pulse frequency and duty, as well as shatter frequency. The function will generate standard pulse and then shatter it, with the duty of each shattered pulse randomised. The function will aim to keep the integral of the pulse at $\text{duty} * \text{target duty}$

`SchedulePyPulse.PulseGeneration.random_simple_pulse(sampling_rate, params)`

`SchedulePyPulse.PulseGeneration.shatter_pulse(sampling_rate, duration, frequency, duty, shatter_frequency, shatter_duty)`

`SchedulePyPulse.PulseGeneration.simple_pulse(sampling_rate, params)`

`SchedulePyPulse.PulseGeneration.spec_time_pulse(sampling_rate, params)`

`SchedulePyPulse.PulseGeneration.square_pulse(sampling_rate, duration, frequency, duty)`

SchedulePyPulse.PulseInterface module

This module contains method to make pulse according to parameter inputed.

`SchedulePyPulse.PulseInterface.make_pulse(sampling_rate, global_onset, global_offset, params_list)`

2.1.7 scheduleMain module

class `scheduleMain.MainApp`(*parent=None*)

Bases: `PyQt5.QtWidgets.QMainWindow`, `ScheduleDesigns.mainDesign.Ui_MainWindow`

The MainApp of schedule generator UI. Inherits QMainWindow and uses design from mainDesign.

parent

Parent of the main window.

Type `QtWidgets`

current_schedule_type

Type widget from ScheduleWidgets

draw_pulse()

Slot for drawing or redrawing pulse in UI if a new trial is selected.

generate()

Slot for generating schedule if generate button is clicked.

open_user_guide()

Open User Guide. If there is no user guide locally available, open the user guide in Github.

save_schedule()

Slot for saving schedule as .schedule

select_schedule_type()

Slot for updating schedule view if a schedule type is selected.

show_about()

Show the *about* message.

`scheduleMain.main()`

The main method to be runned.

`scheduleMain.my_exception_hook(exctype: Type[BaseException], value: BaseException, traceback: types.TracebackType)`

Custom exception hook.

Parameters

- **exctype** (*type of exception*) – Type of exception catch.
- **value** (*BaseException*) – Exception caught.
- **traceback** (*TracebackType*) – Traceback associated with the exception.

INDICES AND TABLES

- `genindex`
- `modindex`
- `search`

PYTHON MODULE INDEX

a

Analysis.Analysis, 1
Analysis.Conversion, 3
Analysis.Performance, 3

C

Controllers.ExperimentControl, 5

d

daqface.DAQ, 20
daqface.Utills, 24
Designs.addWindow, 8
Designs.adjustmentWidget, 8
Designs.analysisWindow, 8
Designs.animalWindow, 8
Designs.controlWindow, 9
Designs.controlWindowGraphicsView, 9
Designs.hardwareWindow, 9
Designs.HardwareWindowEdited, 7
Designs.mailWindow, 9
Designs.mainWindow, 10
Designs.prefsWindow, 10
Designs.settingWindow, 10

e

Exceptions, 29

g

Generation.Gen, 29

h

HelperFunctions.BeamCheck, 10
HelperFunctions.Email, 11
HelperFunctions.Filter, 12
HelperFunctions.Reward, 12
HelperFunctions.RFID, 12

m

main, 25

p

PyPulse.PulseGeneration, 14

PyPulse.PulseInterface, 14

S

ScheduleDesigns.concGNGDesign, 30
ScheduleDesigns.contCorrDesign, 31
ScheduleDesigns.corrDesign, 31
ScheduleDesigns.corrDifficultySwitchCameraTriggerDesign, 31
ScheduleDesigns.corrDifficultySwitchDesign, 31
ScheduleDesigns.corrOnsetDisruptDesign, 32
ScheduleDesigns.corrRandomFrequency2Design, 32
ScheduleDesigns.corrRandomFrequencyDesign, 32
ScheduleDesigns.mainDesign, 32
ScheduleDesigns.NoSeMazeConcatenatedScheduleDesign, 30
ScheduleDesigns.NoSeMazeScheduleDesign, 30
ScheduleDesigns.pretrainDesign, 33
ScheduleDesigns.scheduleBeastDesign, 33
ScheduleDesigns.shatterValveTestDesign, 33
ScheduleDesigns.simpleCorrDesign, 33
ScheduleDesigns.simpleGNGDesign, 33
ScheduleDesigns.valveMapDesign, 34
scheduleMain, 36
ScheduleModels.ScheduleView, 34
ScheduleModels.ScheduleWidgets, 34
ScheduleModels.Widgets, 35
SchedulePyPulse.PulseGeneration, 35
SchedulePyPulse.PulseInterface, 36

t

TrialLogic.TrialConditions, 15

W

Windows.AppWindows, 16

INDEX

\spxentryadd_address()\spxextraWindows.AppWindows.MainWindow
 method, 19

\spxentryadd_row()\spxextraWindows.AppWindows.AnimalWindow
 method, 17

\spxentryadd_schedule()\spxextraWindows.AppWindows.AnimalWindow
 method, 17

\spxentryadjust_cam1()\spxextraWindows.AppWindows.ComputerWindow
 method, 18

\spxentryadjust_cam2()\spxextraWindows.AppWindows.ComputerWindow
 method, 18

\spxentryAdjustmentWidget\spxextraclass in Windows.AppWindows, 16

\spxentryAnalysis.Analysis
 \spxentrymodule, 1

\spxentryAnalysis.Conversion
 \spxentrymodule, 3

\spxentryAnalysis.Performance
 \spxentrymodule, 3

\spxentryanalysis_window\spxextramain.MainApp
 attribute, 25

\spxentryAnalysisWindow\spxextraclass in Windows.AppWindows, 16

\spxentryanimal_present()\spxextraControllers.ExperimentControl.ExperimentControl
 method, 5

\spxentryanimal_selected()\spxextraWindows.AppWindows.AnimalWindow
 method, 17

\spxentryanimal_window\spxextramain.MainApp
 attribute, 25

\spxentryAnimalWindow\spxextraclass in Windows.AppWindows, 17

\spxentrybatch_convert()\spxextrain module Analysis.Conversion, 3

\spxentrybinary_to_digital_map()\spxextrain module daqface.Utils, 24

\spxentrybinned_performance()\spxextrain module Analysis.Analysis, 1

\spxentrychange()\spxextraWindows.AppWindows.HardwareWindow
 method, 18

\spxentrychange_false()\spxextraWindows.AppWindows.AnimalWindow
 method, 17

\spxentrychange_reward_map()\spxextraScheduleModels.ScheduleWidgets.
 method, 34

\spxentrychange_true()\spxextraWindows.AppWindows.AnimalWindow
 method, 17

\spxentrychange_valve_map()\spxextraScheduleModels.Widgets.ValveMap
 method, 35

\spxentrychanged\spxextraWindows.AppWindows.AnimalWindow
 attribute, 17

\spxentrycheck_beam()\spxextrain module HelperFunc-
 tions.BeamCheck, 10

\spxentrycheck_licks()\spxextraControllers.ExperimentControl.ExperimentControl
 method, 5

\spxentrycheck_rfid()\spxextrain module HelperFunc-
 tions.RFID, 12

\spxentrycheck_status()\spxextraControllers.ExperimentControl.ExperimentControl
 method, 5

\spxentryCheckLicks()\spxextradaqface.DAQ.DoAiConcatenatedPretraining
 method, 20

\spxentryCheckLicks()\spxextradaqface.DAQ.DoAiConcatenatedWaitTraining
 method, 20

\spxentryCheckLicks()\spxextradaqface.DAQ.DoAiMultiTask
 method, 21

\spxentryCheckLicks()\spxextradaqface.DAQ.DoAiMultiTaskOdourTraining
 method, 22

\spxentryCheckLicks()\spxextradaqface.DAQ.DoAiMultiTaskWaitTraining
 method, 22

\spxentryClearTask()\spxextradaqface.DAQ.NiUsbDigitalOutTwoDevices
 method, 23

\spxentryClearTask()\spxextradaqface.DAQ.NiUsbDigitalOutTwoDevicesC
 method, 23

\spxentryClearTasks()\spxextradaqface.DAQ.DoAiConcatenatedPretraining
 method, 20

\spxentryClearTasks()\spxextradaqface.DAQ.DoAiConcatenatedWaitTraining
 method, 21

\spxentryClearTasks()\spxextradaqface.DAQ.DoAiMultiTask
 method, 21

\spxentryClearTasks()\spxextradaqface.DAQ.DoAiMultiTaskOdourTraining
 method, 22

\spxentryClearTasks()\spxextradaqface.DAQ.DoAiMultiTaskWaitTraining
 method, 23

\spxentryClearTasks()\spxextradaqface.DAQ.NiUsbDigitalOut
 method, 23

\spxentryClearTasks()\spxextradaqface.DAQ.ThreadSafeAnalysisEntry deliver_reward()\spxextrain module Helper-
 method, 24 Functions.Reward, 12
 \spxentryClearTasks()\spxextradaqface.DAQ.ThreadSafeDigitalEntry deliver_reward_static()\spxextrain module
 method, 24 HelperFunctions.Reward, 12
 \spxentrycloseEvent()\spxextramain.MainApp method, \spxentrydeliver_reward_static_concatenate()\spxextrain
 25 module HelperFunctions.Reward, 13
 \spxentrycloseEvent()\spxextraWindows.AppWindows.AnimationWindow deliver_reward_static_two()\spxextrain module
 method, 17 HelperFunctions.Reward, 13
 \spxentrycloseEvent()\spxextraWindows.AppWindows.ControllWindow Designs.addWindow
 method, 18 \spxentrymodule, 8
 \spxentrycloseEvent()\spxextraWindows.AppWindows.HardwareWindow Designs.adjustmentWidget
 method, 18 \spxentrymodule, 8
 \spxentrycolumnCount()\spxextraScheduleModels.ScheduleView.ScheduleModel AnalysisWindow
 method, 34 \spxentrymodule, 8
 \spxentryconcatenated_pulse()\spxextrain module Py- \spxentryDesigns.animalWindow
 Pulse.PulseGeneration, 14 \spxentrymodule, 8
 \spxentryconcatenated_pulse()\spxextrain module Sched- \spxentryDesigns.controlWindow
 ulePyPulse.PulseGeneration, 35 \spxentrymodule, 9
 \spxentryconfig_path\spxextramain.MainApp attribute, \spxentryDesigns.controlWindowGraphicsView
 25 \spxentrymodule, 9
 \spxentryconfigure_settings()\spxextraWindows.AppWindows.CenterWindow hardwareWindow
 method, 18 \spxentrymodule, 9
 \spxentrycontrol_window\spxextramain.MainApp at- \spxentryDesigns.HardwareWindowEdited
 tribute, 25 \spxentrymodule, 7
 \spxentryControllers.ExperimentControl \spxentryDesigns.mailWindow
 \spxentrymodule, 5 \spxentrymodule, 9
 \spxentryControlWindow\spxextraclass in Win- \spxentryDesigns.mainWindow
 dows.AppWindows, 18 \spxentrymodule, 10
 \spxentryconvert()\spxextrain module Analy- \spxentryDesigns.prefsWindow
 sis.Conversion, 3 \spxentrymodule, 10
 \spxentrycorrect_rejection\spxextraTrialLogic.TrialConditionsEntry Designs.settingWindow
 attribute, 15 \spxentrymodule, 10
 \spxentrycorrect_response\spxextraTrialLogic.TrialConditionsEntry display_animal_performance()\spxextraWindows.AppWindows.An-
 attribute, 15 \spxentrymodule, 16
 \spxentrycrash_error()\spxextrain module HelperFunc- \spxentrydisplay_group_performance()\spxextraWindows.AppWindows.An-
 tions.Email, 11 \spxentrymodule, 16
 \spxentrycurrent_animal()\spxextraWindows.AppWindows.AnalysisWindow ConcatenatedPretrainingMultiTask\spxextraclass
 method, 16 in daqface.DAQ, 20
 \spxentrycurrent_animal()\spxextraWindows.AppWindows.AnimationWindow ConcatenatedWaitTrainingMultiTask\spxextraclass
 method, 17 in daqface.DAQ, 20
 \spxentrycurrent_sched_index()\spxextraWindows.AppWindows.AnimationWindow ConcatenatedWaitTrainingMultiTask\spxextraclass in daqface.DAQ,
 method, 17 21
 \spxentrycurrent_schedule_type\spxextrascheduleMain.MainApp \spxentryDoAiMultiTaskOdourTraining\spxextraclass in
 attribute, 36 daqface.DAQ, 22
 \spxentrydaqface.DAQ \spxentryDoAiMultiTaskWaitTraining\spxextraclass in
 \spxentrymodule, 20 daqface.DAQ, 22
 \spxentrydaqface.Utils \spxentryDoTask()\spxextradaqface.DAQ.DoAiConcatenatedPretrainingMul-
 \spxentrymodule, 24 \spxentrymodule, 20
 \spxentrydata()\spxextraScheduleModels.ScheduleView.ScheduleModel \spxentryDoTask()\spxextradaqface.DAQ.DoAiConcatenatedWaitTrainingMul-
 method, 34 \spxentrymodule, 21
 \spxentrydeadmans_switch()\spxextrain module Helper- \spxentryDoTask()\spxextradaqface.DAQ.DoAiMultiTask
 Functions.Email, 11 \spxentrymodule, 21
 \spxentryDoTask()\spxextradaqface.DAQ.DoAiMultiTaskOdourTraining
 method, 22

\spxentryDoTask()\spxextradaqface.DAQ.DoAiMultiTaskWaitTraining method, 23
 \spxentryDoTask()\spxextradaqface.DAQ.NiUsbDigitalOut \spxentryget_cam1()\spxextraWindows.AppWindows.ControlWindow method, 23 method, 18
 \spxentryDoTask()\spxextradaqface.DAQ.NiUsbDigitalOut \spxentryget_cam2()\spxextraWindows.AppWindows.ControlWindow method, 23 method, 18
 \spxentryDoTask()\spxextradaqface.DAQ.NiUsbDigitalOut \spxentryget_performance()\spxextrain module Analysis.Performance, 3
 \spxentryDoTask()\spxextradaqface.DAQ.NiUsbDigitalOut \spxentryget_present_animal()\spxextraControllers.ExperimentControl.ExperimentWorker method, 24 method, 6
 \spxentryDoTask()\spxextradaqface.DAQ.ThreadSafeAnalogOutput \spxentryget_res_cam1()\spxextraWindows.AppWindows.ControlWindow method, 24 method, 18
 \spxentryDoTask()\spxextradaqface.DAQ.ThreadSafeDigitalOutput \spxentryget_res_cam2()\spxextraWindows.AppWindows.ControlWindow method, 24 method, 18
 \spxentrydraw_pulse()\spxextrascheduleMain.MainApp \spxentryget_trial_daq()\spxextraControllers.ExperimentControl.ExperimentWorker method, 36 method, 6
 \spxentrydropbox_path\spxextramain.MainApp attribute, 25 \spxentryget_valence_map()\spxextraScheduleModels.Widgets.ValveMapView method, 35
 \spxentrydummy_noise_pulse()\spxextrain module \spxentryGNGWidget\spxextraclass in Designs.analysisWindow, 8
 PyPulse.PulseGeneration, 14
 \spxentrydummy_noise_pulse()\spxextrain module \spxentryhardware_prefs\spxextramain.MainApp attribute, 25
 SchedulePyPulse.PulseGeneration, 35
 \spxentryExceptions \spxentryhardware_window\spxextramain.MainApp attribute, 25
 \spxentrymodule, 29
 \spxentryexperiment_saved()\spxextramain.MainApp \spxentryHardwareWindow\spxextraclass in Windows.AppWindows, 18
 method, 26
 \spxentryExperimentController\spxextraclass in Controllers.ExperimentControl, 5 \spxentryheaderData()\spxextraScheduleModels.ScheduleView.ScheduleModel method, 34
 \spxentryExperimentWorker\spxextraclass in Controllers.ExperimentControl, 5 \spxentryHelperFunctions.BeamCheck
 \spxentryextended_square_pulse()\spxextrain module Py- \spxentrymodule, 10
 Pulse.PulseGeneration, 14 \spxentryHelperFunctions.Email
 \spxentryextended_square_pulse()\spxextrain module \spxentrymodule, 11
 SchedulePyPulse.PulseGeneration, 35 \spxentryHelperFunctions.Filter
 \spxentrymodule, 12
 \spxentryfalse_alarm\spxextraTrialLogic.TrialConditions.TrialResult \spxentryHelperFunctions.Reward
 attribute, 15 \spxentrymodule, 12
 \spxentryfinished\spxextraControllers.ExperimentControl.ExperimentWorker \spxentryHelperFunctions.RFID
 attribute, 5 \spxentrymodule, 12
 \spxentryflatten_value()\spxextraScheduleModels.ScheduleWidgets.NoSeMazeScheduleWidget module Trial-
 method, 34 Logic.TrialConditions, 15
 \spxentryflatten_value()\spxextraScheduleModels.Widgets.ValveMapView \spxentryget_pulse()\spxextrain module Py-
 method, 35 Pulse.PulseGeneration, 14
 \spxentryfv_pulse()\spxextrain module Py- \spxentrylicks_number()\spxextrain module Trial-
 Pulse.PulseGeneration, 14 Logic.TrialConditions, 15
 \spxentryGauss_Filter()\spxextrain module HelperFunc- \spxentryload_config_data()\spxextramain.MainApp
 tions.Filter, 12 method, 26
 \spxentrygenerate()\spxextrascheduleMain.MainApp \spxentryload_data()\spxextrain module Analysis.Performance, 4
 method, 36
 \spxentrygenerate_schedule()\spxextraScheduleModels.ScheduleWidgets.NoSeMazeScheduleWidget method, 34
 \spxentryGeneration.Gen \spxentryload_dropbox_path()\spxextramain.MainApp
 \spxentrymodule, 29 method, 26
 \spxentryget_address()\spxextraWindows.AppWindows.MailWindow \spxentryload_experiment()\spxextrain module Analysis.Conversion, 3
 method, 19 \spxentryload_experiment()\spxextramain.MainApp
 method, 26

- \spxentryloaded\spxextramain.MainApp attribute, 26
- \spxentrymail_window\spxextramain.MainApp attribute, 25
- \spxentryMailWindow\spxextraclass in Windows.AppWindows, 19
- \spxentrymain
 - \spxentrymodule, 25
 - \spxentrymain()\spxextrain module main, 27
 - \spxentrymain()\spxextrain module scheduleMain, 36
 - \spxentryMainApp\spxextraclass in main, 25
 - \spxentryMainApp\spxextraclass in scheduleMain, 36
 - \spxentrymake_pulse()\spxextrain module PyPulse.PulseInterface, 14
 - \spxentrymake_pulse()\spxextrain module SchedulePyPulse.PulseInterface, 36
 - \spxentrymiss\spxextraTrialLogic.TrialConditions.TrialResult attribute, 15
- \spxentrymodule
 - \spxentryAnalysis.Analysis, 1
 - \spxentryAnalysis.Conversion, 3
 - \spxentryAnalysis.Performance, 3
 - \spxentryControllers.ExperimentControl, 5
 - \spxentrydaqface.DAQ, 20
 - \spxentrydaqface.Utils, 24
 - \spxentryDesigns.addWindow, 8
 - \spxentryDesigns.adjustmentWidget, 8
 - \spxentryDesigns.analysisWindow, 8
 - \spxentryDesigns.animalWindow, 8
 - \spxentryDesigns.controlWindow, 9
 - \spxentryDesigns.controlWindowGraphicsView, 9
 - \spxentryDesigns.hardwareWindow, 9
 - \spxentryDesigns.HardwareWindowEdited, 7
 - \spxentryDesigns.mailWindow, 9
 - \spxentryDesigns.mainWindow, 10
 - \spxentryDesigns.prefsWindow, 10
 - \spxentryDesigns.settingWindow, 10
 - \spxentryExceptions, 29
 - \spxentryGeneration.Gen, 29
 - \spxentryHelperFunctions.BeamCheck, 10
 - \spxentryHelperFunctions.Email, 11
 - \spxentryHelperFunctions.Filter, 12
 - \spxentryHelperFunctions.Reward, 12
 - \spxentryHelperFunctions.RFID, 12
 - \spxentrymain, 25
 - \spxentryPyPulse.PulseGeneration, 14
 - \spxentryPyPulse.PulseInterface, 14
 - \spxentryScheduleDesigns.concGNGDesign, 30
 - \spxentryScheduleDesigns.contCorrDesign, 31
 - \spxentryScheduleDesigns.corrDesign, 31
 - \spxentryScheduleDesigns.corrDifficultySwitchCameraTriggerDesign, 31
 - \spxentryScheduleDesigns.corrDifficultySwitchDesign, 31
 - \spxentryScheduleDesigns.corrOnsetDisruptDesign, 32
 - \spxentryScheduleDesigns.corrRandomFrequency2Design, 32
 - \spxentryScheduleDesigns.corrRandomFrequencyDesign, 32
 - \spxentryScheduleDesigns.mainDesign, 32
 - \spxentryScheduleDesigns.NoSeMazeConcatenatedScheduleDesign, 30
 - \spxentryScheduleDesigns.NoSeMazeScheduleDesign, 30
 - \spxentryScheduleDesigns.pretrainDesign, 33
 - \spxentryScheduleDesigns.scheduleBeastDesign, 33
 - \spxentryScheduleDesigns.shatterValveTestDesign, 33
 - \spxentryScheduleDesigns.simpleCorrDesign, 33
 - \spxentryScheduleDesigns.simpleGNGDesign, 33
 - \spxentryScheduleDesigns.valveMapDesign, 34
 - \spxentryscheduleMain, 36
 - \spxentryScheduleModels.ScheduleView, 34
 - \spxentryScheduleModels.ScheduleWidgets, 34
 - \spxentryScheduleModels.Widgets, 35
 - \spxentrySchedulePyPulse.PulseGeneration, 35
 - \spxentrySchedulePyPulse.PulseInterface, 36
 - \spxentryTrialLogic.TrialConditions, 15
 - \spxentryWindows.AppWindows, 16
- \spxentrymulti_noise_pulse()\spxextrain module PyPulse.PulseGeneration, 14
- \spxentrymulti_noise_pulse()\spxextrain module SchedulePyPulse.PulseGeneration, 35
- \spxentrymulti_simple_pulse()\spxextrain module PyPulse.PulseGeneration, 14
- \spxentrymulti_simple_pulse()\spxextrain module SchedulePyPulse.PulseGeneration, 35
- \spxentrymy_exception_hook()\spxextrain module main, 27
- \spxentrymy_exception_hook()\spxextrain module scheduleMain, 36
- \spxentryn_trials_last_24()\spxextrain module Analysis.Analysis, 1
- \spxentryn_trials_performed()\spxextrain module Analysis.Analysis, 2
- \spxentryn_trials_since()\spxextrain module Analysis.Analysis, 2
- \spxentrynew_pref\spxextraWindows.AppWindows.HardwareWindow attribute, 18
- \spxentryNiUsbDigitalOut\spxextraclass in daqface.DAQ, 23
- \spxentryNiUsbDigitalOutTwoDevices\spxextraclass in daqface.DAQ, 23
- \spxentryNiUsbDigitalOutTwoDevicesC\spxextraclass in daqface.DAQ, 23

\spxentrynoise_pulse()\spxextrain module Py-Pulse.PulseGeneration, 14	\spxentryPyPulse.PulseInterface \spxentrymodule, 14
\spxentrynoise_pulse()\spxextrain module SchedulePy-Pulse.PulseGeneration, 35	\spxentryqsize_to_string()\spxextraWindows.AppWindows.ControlWindow method, 18
\spxentryNoSeMazeScheduleWidget\spxextraclass in ScheduleModels.ScheduleWidgets, 34	\spxentryrandom_shatter_pulse()\spxextrain module Py-Pulse.PulseGeneration, 14
\spxentryodor_sequence()\spxextrain module Generation.Gen, 29	\spxentryrandom_shatter_pulse()\spxextrain module SchedulePy-Pulse.PulseGeneration, 35
\spxentryon_animal_selected()\spxextraWindows.AppWindows.AnalysisWindow method, 16	\spxentryrandom_simple_pulse()\spxextrain module Py-Pulse.PulseGeneration, 14
\spxentryon_animal_selected()\spxextraWindows.AppWindows.ControlWindow method, 18	\spxentryrandom_simple_pulse()\spxextrain module SchedulePy-Pulse.PulseGeneration, 35
\spxentryon_tab_selected()\spxextraWindows.AppWindows.AnalysisWindow method, 17	\spxentryread_schedule_map()\spxextrain module Analysis.Conversion, 3
\spxentryon_trial_selected()\spxextramain.MainApp method, 26	\spxentryremove_address()\spxextraWindows.AppWindows.MailWindow method, 19
\spxentryopen_analysis_window()\spxextramain.MainApp method, 26	\spxentryremove_row()\spxextraWindows.AppWindows.AnimalWindow method, 17
\spxentryopen_animal_window()\spxextramain.MainApp method, 26	\spxentryremove_schedule()\spxextraWindows.AppWindows.AnimalWindow method, 17
\spxentryopen_control_window()\spxextramain.MainApp method, 26	\spxentryretranslateUi()\spxextraDesigns.addWindow.Ui_MainWindow method, 8
\spxentryopen_hardware_window()\spxextramain.MainApp method, 26	\spxentryretranslateUi()\spxextraDesigns.adjustmentWidget.Ui_DockWidget method, 8
\spxentryopen_mail_window()\spxextramain.MainApp method, 26	\spxentryretranslateUi()\spxextraDesigns.analysisWindow.Ui_MainWindow method, 8
\spxentryopen_user_guide()\spxextramain.MainApp method, 26	\spxentryretranslateUi()\spxextraDesigns.animalWindow.Ui_MainWindow method, 8
\spxentryopen_user_guide()\spxextrascheduleMain.MainApp method, 36	\spxentryretranslateUi()\spxextraDesigns.controlWindow.Ui_MainWindow method, 9
\spxentryparent\spxextrascheduleMain.MainApp attribute, 36	\spxentryretranslateUi()\spxextraDesigns.controlWindowGraphicsView.Ui_MainWindow method, 9
\spxentryparse_list()\spxextrain module HelperFunctions.Email, 11	\spxentryretranslateUi()\spxextraDesigns.hardwareWindow.Ui_MainWindow method, 9
\spxentryplume_pulse()\spxextrain module Py-Pulse.PulseGeneration, 14	\spxentryretranslateUi()\spxextraDesigns.HardwareWindowEdited.Ui_MainWindow method, 7
\spxentryplume_pulse()\spxextrain module SchedulePy-Pulse.PulseGeneration, 35	\spxentryretranslateUi()\spxextraDesigns.mailWindow.Ui_MainWindow method, 9
\spxentrypopulate_animal_table()\spxextraWindows.AppWindows.AnimalWindow method, 17	\spxentryretranslateUi()\spxextraDesigns.mainWindow.Ui_MainWindow method, 10
\spxentrypopulate_mailing_list()\spxextraWindows.AppWindows.MailWindow method, 19	\spxentryretranslateUi()\spxextraDesigns.prefsWindow.Ui_MainWindow method, 10
\spxentrypopulate_stats_table()\spxextraWindows.AppWindows.AnalysisWindow method, 17	\spxentryretranslateUi()\spxextraDesigns.settingWindow.Ui_MainWindow method, 10
\spxentrypopulate_table()\spxextraWindows.AppWindows.ControlWindow method, 18	\spxentryretranslateUi()\spxextraScheduleDesigns.concGNGDesign.Ui_Form method, 30
\spxentryPreferencesWindow\spxextraclass in Windows.AppWindows, 19	\spxentryretranslateUi()\spxextraScheduleDesigns.contCorrDesign.Ui_Form method, 31
\spxentrypulse_parameters()\spxextraScheduleModels.ScheduleWidgets.NoSeMazeScheduleWidget method, 34	\spxentryretranslateUi()\spxextraScheduleDesigns.corrDesign.Ui_Form method, 31
\spxentryPyPulse.PulseGeneration \spxentrymodule, 14	\spxentryretranslateUi()\spxextraScheduleDesigns.corrDifficultySwitchCam method, 31

\spxentryretranslateUi()\spxextraScheduleDesigns.corrDifficultySwitchDesignUi(FopreextraWindows.AppWindows.HardwareWindow
 method, 31 \spxentryScheduleDesignUi(FopreextraWindows.AppWindows.HardwareWindow
 method, 19
 \spxentryretranslateUi()\spxextraScheduleDesigns.corrOnsetDisruptDesignUi(FopreextraWindows.AppWindows.AnimalWind
 method, 32 \spxentryScheduleDesignUi(FopreextraWindows.AppWindows.AnimalWind
 method, 17
 \spxentryretranslateUi()\spxextraScheduleDesigns.corrRandomFrequency2DesignUi(FopreextraWindows.AppWindows.GNGDesign
 method, 32 \spxentryScheduleDesignUi(FopreextraWindows.AppWindows.GNGDesign
 \spxentrymodule, 30
 \spxentryretranslateUi()\spxextraScheduleDesigns.corrRandomFrequencyDesignUi(FopreextraWindows.AppWindows.CorrDesign
 method, 32 \spxentryScheduleDesignUi(FopreextraWindows.AppWindows.CorrDesign
 \spxentrymodule, 31
 \spxentryretranslateUi()\spxextraScheduleDesigns.mainDesignUi(FopreextraWindows.AppWindows.MainDesign
 method, 32 \spxentryScheduleDesignUi(FopreextraWindows.AppWindows.MainDesign
 \spxentrymodule, 31
 \spxentryretranslateUi()\spxextraScheduleDesigns.NoSeMazeConcatenatedScheduleDesignUi(FopreextraWindows.AppWindows.NoSeMazeConcatenatedScheduleDesign
 method, 30 \spxentryScheduleDesignUi(FopreextraWindows.AppWindows.NoSeMazeConcatenatedScheduleDesign
 \spxentrymodule, 31
 \spxentryretranslateUi()\spxextraScheduleDesigns.NoSeMazeConcatenatedScheduleDesignUi(FopreextraWindows.AppWindows.NoSeMazeConcatenatedScheduleDesign
 method, 30 \spxentryScheduleDesignUi(FopreextraWindows.AppWindows.NoSeMazeConcatenatedScheduleDesign
 \spxentrymodule, 31
 \spxentryretranslateUi()\spxextraScheduleDesigns.pretrainDesignUi(FopreextraWindows.AppWindows.PretrainDesign
 method, 33 \spxentryScheduleDesignUi(FopreextraWindows.AppWindows.PretrainDesign
 \spxentrymodule, 32
 \spxentryretranslateUi()\spxextraScheduleDesigns.shatterValveTestDesignUi(FopreextraWindows.AppWindows.ShatterValveTestDesign
 method, 33 \spxentryScheduleDesignUi(FopreextraWindows.AppWindows.ShatterValveTestDesign
 \spxentrymodule, 32
 \spxentryretranslateUi()\spxextraScheduleDesigns.simpleCorrDesignUi(FopreextraWindows.AppWindows.SimpleCorrDesign
 method, 33 \spxentryScheduleDesignUi(FopreextraWindows.AppWindows.SimpleCorrDesign
 \spxentrymodule, 32
 \spxentryretranslateUi()\spxextraScheduleDesigns.simpleGNGDesignUi(FopreextraWindows.AppWindows.SimpleGNGDesign
 method, 33 \spxentryScheduleDesignUi(FopreextraWindows.AppWindows.SimpleGNGDesign
 \spxentrymodule, 32
 \spxentryretranslateUi()\spxextraScheduleDesigns.valveMapDesignUi(FopreextraWindows.AppWindows.ValveMapDesign
 method, 34 \spxentryScheduleDesignUi(FopreextraWindows.AppWindows.ValveMapDesign
 \spxentrymodule, 30
 \spxentryreward()\spxextraControllers.ExperimentControl.ExperimentWorker\spxentryScheduleDesigns.NoSeMazeScheduleDesign
 method, 6 \spxentryScheduleDesigns.NoSeMazeScheduleDesign
 \spxentrymodule, 30
 \spxentryreward_sequence()\spxextrain module Generation.Gen, 29 \spxentryScheduleDesigns.pretrainDesign
 \spxentrymodule, 33
 \spxentryRewardMapError, 29 \spxentryScheduleDesigns.scheduleBeastDesign
 \spxentrymodule, 33
 \spxentryRiskWidget\spxextraclass in Design.analysisWindow, 8 \spxentryScheduleDesigns.shatterValveTestDesign
 \spxentrymodule, 33
 \spxentryrowCount()\spxextraScheduleModels.ScheduleView.ScheduleModel, 34 \spxentryScheduleDesigns.simpleCorrDesign
 method, 34 \spxentryScheduleDesigns.simpleCorrDesign
 \spxentrymodule, 33
 \spxentrysave()\spxextraWindows.AppWindows.MailWindow\spxentryScheduleDesigns.simpleGNGDesign
 method, 19 \spxentryScheduleDesigns.simpleGNGDesign
 \spxentrymodule, 33
 \spxentrysave_data()\spxextraControllers.ExperimentControl.ExperimentWorker\spxentryScheduleDesigns.valveMapDesign
 method, 6 \spxentryScheduleDesigns.valveMapDesign
 \spxentrymodule, 34
 \spxentrysave_experiment()\spxextramain.MainApp\spxentryscheduleMain
 method, 26 \spxentrymodule, 36
 \spxentrysave_preferences()\spxextraWindows.AppWindows.HardwareWindow\spxentryScheduleModel\spxextraclass in ScheduleMod-
 method, 18 els.ScheduleView, 34
 \spxentrysave_preferences()\spxextraWindows.AppWindows.PreferencesWindow\spxentryScheduleModels.ScheduleView
 method, 19 \spxentrymodule, 34
 \spxentrysave_schedule()\spxextrascheduleMain.MainApp\spxentryScheduleModels.ScheduleWidgets
 method, 36 \spxentrymodule, 34
 \spxentrysaved\spxextramain.MainApp attribute, 26 \spxentryScheduleModels.Widgets
 \spxentrymodule, 35
 \spxentrysaved\spxextraWindows.AppWindows.AnimalWindow\spxentrySchedulePyPulse.PulseGeneration
 attribute, 17 \spxentrymodule, 35
 \spxentrysaved\spxextraWindows.AppWindows.HardwareWindow\spxentrySchedulePyPulse.PulseInterface
 attribute, 18 \spxentrymodule, 36
 \spxentrysaved_status\spxextramain.MainApp attribute, 25 \spxentryselect_save_path()\spxextraWindows.AppWindows.PreferencesWi
 method, 19

\spxentryselect_schedule_type()\spxextrascheduleMain.MainApp	\spxentrysetupUi()\spxextraScheduleDesigns.corrDesign.Ui_Form
method, 36	method, 31
\spxentrysend()\spxextrain module HelperFunc-	\spxentrysetupUi()\spxextraScheduleDesigns.corrDifficultySwitchCameraT
tions.Email, 11	method, 31
\spxentryset_brightness()\spxextraWindows.AppWindows.AdjustmentWidget	\spxentrysetupUi()\spxextraScheduleDesigns.corrDifficultySwitchDesign.Ui
method, 16	method, 31
\spxentryset_cam1()\spxextraWindows.AppWindows.ControlWindow	\spxentrysetupUi()\spxextraScheduleDesigns.corrOnsetDisruptDesign.Ui_F
method, 18	method, 32
\spxentryset_cam2()\spxextraWindows.AppWindows.ControlWindow	\spxentrysetupUi()\spxextraScheduleDesigns.corrRandomFrequency2Design
method, 18	method, 32
\spxentryset_contrast()\spxextraWindows.AppWindows.AdjustmentWidget	\spxentrysetupUi()\spxextraScheduleDesigns.corrRandomFrequencyDesign
method, 16	method, 32
\spxentryset_dropbox_path()\spxextramain.MainApp	\spxentrysetupUi()\spxextraScheduleDesigns.mainDesign.Ui_MainWindow
method, 26	method, 32
\spxentryset_preferences()\spxextraWindows.AppWindows.HardwareWindow	\spxentrysetupUi()\spxextraScheduleDesigns.NoSeMazeConcatenatedSched
method, 19	method, 30
\spxentryset_preferences()\spxextraWindows.AppWindows.PreferenceWidget	\spxentrysetupUi()\spxextraScheduleDesigns.NoSeMazeScheduleDesign.Ui
method, 19	method, 30
\spxentryset_res_cam1()\spxextraWindows.AppWindows.ControlWindow	\spxentrysetupUi()\spxextraScheduleDesigns.pretrainDesign.Ui_Form
method, 18	method, 33
\spxentryset_res_cam2()\spxextraWindows.AppWindows.ControlWindow	\spxentrysetupUi()\spxextraScheduleDesigns.shatterValveTestDesign.Ui_Fo
method, 18	method, 33
\spxentryset_saturation()\spxextraWindows.AppWindows.AdjustmentWidget	\spxentrysetupUi()\spxextraScheduleDesigns.simpleCorrDesign.Ui_Form
method, 16	method, 33
\spxentrysetup_experiment_bindings()\spxextramain.MainApp	\spxentrysetupUi()\spxextraScheduleDesigns.simpleGNGDesign.Ui_Form
method, 27	method, 33
\spxentrysetupUi()\spxextraDesigns.addWindow.Ui_MainWindow	\spxentrysetupUi()\spxextraScheduleDesigns.valveMapDesign.Ui_Form
method, 8	method, 34
\spxentrysetupUi()\spxextraDesigns.adjustmentWidget.Ui_DockWidget	\spxentryshatter_pulse()\spxextrain module Py-
method, 8	Pulse.PulseGeneration, 14
\spxentrysetupUi()\spxextraDesigns.analysisWindow.Ui_MainWindow	\spxentryshatter_pulse()\spxextrain module SchedulePy-
method, 8	Pulse.PulseGeneration, 36
\spxentrysetupUi()\spxextraDesigns.animalWindow.Ui_MainWindow	\spxentryshow_about()\spxextramain.MainApp
method, 8	method, 27
\spxentrysetupUi()\spxextraDesigns.controlWindow.Ui_MainWindow	\spxentryshow_about()\spxextrascheduleMain.MainApp
method, 9	method, 36
\spxentrysetupUi()\spxextraDesigns.controlWindowGraphicsSpkentryMainWindow	\spxentrysimple_pulse()\spxextrain module
method, 9	Analysis.Performance, 4
\spxentrysetupUi()\spxextraDesigns.hardwareWindow.Ui_MainWindow	\spxentryshow_percent_left_right()\spxextrain module
method, 9	Analysis.Performance, 4
\spxentrysetupUi()\spxextraDesigns.HardwareWindowEditSpkentryMainWindow	\spxentryshow_risk_per_mouse()\spxextrain module
method, 7	Analysis.Performance, 4
\spxentrysetupUi()\spxextraDesigns.mailWindow.Ui_MainWindow	\spxentryshow_risk_per_odour()\spxextrain module
method, 9	Analysis.Performance, 4
\spxentrysetupUi()\spxextraDesigns.mainWindow.Ui_MainWindow	\spxentryshow_total_risk()\spxextrain module Analy-
method, 10	sis.Performance, 4
\spxentrysetupUi()\spxextraDesigns.prefsWindow.Ui_MainWindow	\spxentrysimple_pulse()\spxextrain module Py-
method, 10	Pulse.PulseGeneration, 14
\spxentrysetupUi()\spxextraDesigns.settingWindow.Ui_MainWindow	\spxentrysimple_pulse()\spxextrain module SchedulePy-
method, 10	Pulse.PulseGeneration, 36
\spxentrysetupUi()\spxextraScheduleDesigns.concGNGDesign.Ui_Form	\spxentrysimple_pulse_static()\spxextrain module Py-
method, 30	Pulse.PulseGeneration, 14
\spxentrysetupUi()\spxextraScheduleDesigns.contCorrDesign.Ui_Form	\spxentryspec_time_pulse()\spxextrain module Py-
method, 31	Pulse.PulseGeneration, 14

\spxentryspec_time_pulse()\spxextrain module Sched- ulePyPulse.PulseGeneration, 36	\spxentryUi_Form\spxextraclass in Sched- uleDesigns.corrRandomFrequencyDesign, 32
\spxentrySquare_Filter()\spxextrain module HelperFunc- tions.Filter, 12	\spxentryUi_Form\spxextraclass in Sched- uleDesigns.NoSeMazeConcatenatedScheduleDesign, 30
\spxentrysquare_pulse()\spxextrain module Py- Pulse.PulseGeneration, 14	\spxentryUi_Form\spxextraclass in Sched- uleDesigns.NoSeMazeScheduleDesign, 30
\spxentrysquare_pulse()\spxextrain module SchedulePy- Pulse.PulseGeneration, 36	\spxentryUi_Form\spxextraclass in Sched- uleDesigns.pretrainDesign, 33
\spxentrystart()\spxextraControllers.ExperimentControl.ExperimentControl, 5	\spxentryUi_Form\spxextraclass in Sched- uleDesigns.shatterValveTestDesign, 33
\spxentrystatus_changed()\spxextramain.MainApp method, 27	\spxentryUi_Form\spxextraclass in Sched- uleDesigns.simpleCorrDesign, 33
\spxentrystop()\spxextraControllers.ExperimentControl.ExperimentControl, 5	\spxentryUi_Form\spxextraclass in Sched- uleDesigns.simpleGNGDesign, 33
\spxentrythread_control()\spxextramain.MainApp method, 27	\spxentryUi_Form\spxextraclass in Sched- uleDesigns.valveMapDesign, 34
\spxentryThreadSafeAnalogInput\spxextraclass in daq- face.DAQ, 24	\spxentryUi_MainWindow\spxextraclass in De- signs.addWindow, 8
\spxentryThreadSafeDigitalOut\spxextraclass in daq- face.DAQ, 24	\spxentryUi_MainWindow\spxextraclass in De- signs.analysisWindow, 8
\spxentrytimeout()\spxextraControllers.ExperimentControl.ExperimentControl, 7	\spxentryUi_MainWindow\spxextraclass in De- signs.animalWindow, 8
\spxentrytrial()\spxextraControllers.ExperimentControl.ExperimentControl, 7	\spxentryUi_MainWindow\spxextraclass in De- signs.controlWindow, 9
\spxentrytrial_end\spxextraControllers.ExperimentControl.ExperimentControl, 7	\spxentryUi_MainWindow\spxextraclass in De- signs.controlWindowGraphicsView, 9
\spxentrytrial_result()\spxextrain module Trial- Logic.TrialConditions, 16	\spxentryUi_MainWindow\spxextraclass in De- signs.hardwareWindow, 9
\spxentryTrialLogic.TrialConditions \spxentrymodule, 15	\spxentryUi_MainWindow\spxextraclass in De- signs.HardwareWindowEdited, 7
\spxentryTrialResult\spxextraclass in Trial- Logic.TrialConditions, 15	\spxentryUi_MainWindow\spxextraclass in De- signs.mailWindow, 9
\spxentryUi_DockWidget\spxextraclass in De- signs.adjustmentWidget, 8	\spxentryUi_MainWindow\spxextraclass in De- signs.mainWindow, 10
\spxentryUi_Form\spxextraclass in Sched- uleDesigns.concGNGDesign, 30	\spxentryUi_MainWindow\spxextraclass in De- signs.prefsWindow, 10
\spxentryUi_Form\spxextraclass in Sched- uleDesigns.contCorrDesign, 31	\spxentryUi_MainWindow\spxextraclass in De- signs.settingWindow, 10
\spxentryUi_Form\spxextraclass in Sched- uleDesigns.corrDesign, 31	\spxentryUi_MainWindow\spxextraclass in Sched- uleDesigns.mainDesign, 32
\spxentryUi_Form\spxextraclass in Sched- uleDesigns.corrDifficultySwitchCameraTriggerDesign, 31	\spxentryupdate_animals()\spxextraWindows.AppWindows.AnimalWindow method, 17
\spxentryUi_Form\spxextraclass in Sched- uleDesigns.corrDifficultySwitchDesign, 31	\spxentryupdate_data_view()\spxextramain.MainApp method, 27
\spxentryUi_Form\spxextraclass in Sched- uleDesigns.corrOnsetDisruptDesign, 32	\spxentryupdate_experiment_info()\spxextramain.MainApp method, 27
\spxentryUi_Form\spxextraclass in Sched- uleDesigns.corrRandomFrequency2Design, 32	\spxentryupdate_graphics_view()\spxextramain.MainApp method, 27
	\spxentryupdate_licks_view()\spxextraWindows.AppWindows.ControlWin method, 18
	\spxentryupdate_pref()\spxextraControllers.ExperimentControl.Experiment method, 5

\spxentryupdate_trial_view()\spxextramain.MainApp
method, [27](#)

\spxentryValveMapWidget\spxextraclass in Schedule-
Models.Widgets, [35](#)

\spxentrywarning_ticks()\spxextrain module HelperFunc-
tions.Email, [11](#)

\spxentryweighted_binned_performance()\spxextrain
module Analysis.Analysis, [2](#)

\spxentryWindows.AppWindows
\spxentrymodule, [16](#)

\spxentrywindows_control()\spxextramain.MainApp
method, [27](#)

\spxentryzero_edit()\spxextraWindows.AppWindows.HardwareWindow
method, [19](#)