

## My Project

Generated by Doxygen 1.8.14



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# Chapter 1

## Namespace Index

### 1.1 Packages

Here are the packages with brief descriptions (if available):

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<a href="#">openbu.passport</a>	7
<a href="#">openbu.salameche.cram</a>	8
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<a href="#">openbu.utils.reactions_class</a>	9





## Chapter 2

# Design Unit Index

### 2.1 Design Unit Hierarchy

This inheritance list is sorted roughly, but not completely, alphabetically:

Exception	
Initial_nucl_not_in_Nucl_set . . . . .	16
Initial_nucl_not_set . . . . .	16
Nucl_set_not_in_Lib_nucl . . . . .	21
Nuclide_list_redundant . . . . .	22
Passlist_not_defined . . . . .	24
Initial_nuclides_not_in_nuclide_list . . . . .	16
STOP . . . . .	32
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Incorrect_nuc_id . . . . .	15
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Not_a_Fission_Product . . . . .	20
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Empty_argument . . . . .	14
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Couple_openmc . . . . .	13
Input . . . . .	17
Batch . . . . .	11
Passlist . . . . .	22
Passport . . . . .	25
Sequence . . . . .	30
Stand_alone . . . . .	31
System . . . . .	32
decay_lib . . . . .	14
fy_lib . . . . .	15
xs_lib . . . . .	33



## Chapter 3

# Design Unit Index

### 3.1 Design Unit List

Here is a list of all design unit members with links to the Entities they belong to:

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<a href="#">Cell</a>	11
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<a href="#">Couple_openmc</a>	13
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<a href="#">Input</a>	17
<a href="#">MidpointNormalize</a>	18
<a href="#">Neg_decay</a>	19
<a href="#">Neg_xs</a>	19
<a href="#">No_fission_XS</a>	20
<a href="#">Not_a_Fission_Product</a>	20
<a href="#">Nuc_xs_not_found</a>	21
<a href="#">Nuc_xs_not_found</a>	21
<a href="#">Nucl_set_not_in_Lib_nucl</a>	21
<a href="#">Nuclide_list_redundant</a>	22
<a href="#">Passlist</a>	22
<a href="#">Passlist_not_defined</a>	24
<a href="#">Passport</a>	25
<a href="#">Sequence</a>	30
<a href="#">Stand_alone</a>	31
<a href="#">Step_0</a>	32
<a href="#">STOP</a>	32
<a href="#">System</a>	32
<a href="#">xs_lib</a>	33
<a href="#">xs_name_not_found</a>	33
<a href="#">XS_not_yet_set</a>	34



## Chapter 4

# Namespace Documentation

### 4.1 openbu.passlist Namespace Reference

#### Classes

- class [Neg\\_decay](#)
- class [Neg\\_xs](#)
- class [Nuc\\_xs\\_not\\_found](#)
- class [Passlist](#)

#### 4.1.1 Detailed Description

Create list of passport, set mass, decay and xs

### 4.2 openbu.passport Namespace Reference

#### Classes

- class [Incorrect\\_nuc\\_id](#)
- class [No\\_fission\\_XS](#)
- class [Not\\_a\\_Fission\\_Product](#)
- class [Nuc\\_xs\\_not\\_found](#)
- class [Passport](#)
- class [XS\\_not\\_yet\\_set](#)

#### 4.2.1 Detailed Description

This module defines the Python class passport used in Open-Burnup

## 4.3 openbu.salameche.cram Namespace Reference

### Functions

#### 4.3.1 Detailed Description

Compute the solution of the matricial depletion equation using the CRAM method

#### 4.3.2 Function Documentation

##### 4.3.2.1 CRAM16()

```
def openbu.salameche.cram.CRAM16 (
    At,
    N_0 )
```

CRAM uses the Chebishev rational approximation method to compute the solution of the matricial depletion equation

## 4.4 openbu.salameche.mat\_builder Namespace Reference

### Functions

#### 4.4.1 Detailed Description

Uses the passport list to build the transmutation matrix

#### 4.4.2 Function Documentation

##### 4.4.2.1 \_get\_decay\_mat()

```
def openbu.salameche.mat_builder._get_decay_mat (
    passlist ) [private]
```

Build the cross section matrix

#### 4.4.2.2 `_get_xs_mat()`

```
def openbu.salameche.mat_builder._get_xs_mat (
    passlist ) [private]
```

Build the cross section matrix

## 4.5 openbu.utils.reactions\_class Namespace Reference

### Classes

- class [decay\\_lib](#)
- class [Empty\\_data](#)
- class [fy\\_lib](#)
- class [xs\\_lib](#)

#### 4.5.1 Detailed Description

This module defines multiple Python class that are designed to be used by the user when using the Python environment to define and launch an OpenBU calculation



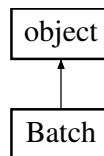


## Chapter 5

# Class Documentation

### 5.1 Batch Class Reference

Inheritance diagram for Batch:



#### Public Member Functions

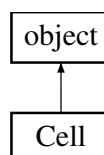
#### Private Attributes

The documentation for this class was generated from the following file:

- /Users/mouginot/work/app/OpenBU/openbu/nax/functions.py

### 5.2 Cell Class Reference

Inheritance diagram for Cell:



## Public Member Functions

## Public Attributes

## Static Public Attributes

## Private Member Functions

## Private Attributes

## Static Private Attributes

### 5.2.1 Member Function Documentation

#### 5.2.1.1 `bu_sec_conv_factor()`

```
def bu_sec_conv_factor (
    self )
```

Returns the absolute values of the decay constant of the nuclide

#### 5.2.1.2 `ihm()`

```
def ihm (
    self )
```

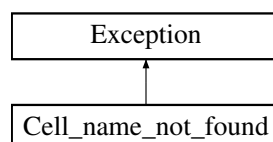
Returns the absolute values of the decay constant of the nuclide

The documentation for this class was generated from the following file:

- `/Users/mouginot/work/app/OpenBU/openbu/cell.py`

### 5.3 `Cell_name_not_found` Class Reference

Inheritance diagram for `Cell_name_not_found`:

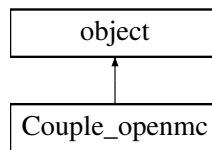


The documentation for this class was generated from the following file:

- `/Users/mouginot/work/app/OpenBU/openbu/system.py`

## 5.4 Couple\_openmc Class Reference

Inheritance diagram for Couple\_openmc:



### Public Member Functions

### Public Attributes

### Static Public Attributes

### Private Member Functions

### Private Attributes

#### 5.4.1 Member Data Documentation

##### 5.4.1.1 \_initial\_summary

```
_initial_summary [private]
```

OpenMC Summary src does not close the hdf5 file it opens When OpenBU tries to shutil.rmtree the pre\_run folder, it can't because a stream to summary.h5 is still open We therefore close it here !!!! This should be modified in OpenMC at some points #####.

!!!! This should be modified in OpenMC at some points #####

##### 5.4.1.2 \_updated\_summary

```
_updated_summary [private]
```

OpenMC Summary src does not close the hdf5 file it opens When OpenBU tries to shutil.rmtree the pre\_run folder, it can't because a stream to summary.h5 is still open We therefore close it here !!!! This should be modified in OpenMC at some points #####.

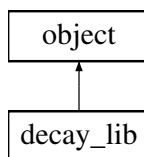
!!!! This should be modified in OpenMC at some points #####

The documentation for this class was generated from the following file:

- /Users/mouginot/work/app/OpenBU/openbu/couple/couple\_openmc.py

## 5.5 decay\_lib Class Reference

Inheritance diagram for decay\_lib:



### Public Member Functions

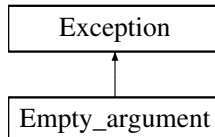
### Private Attributes

The documentation for this class was generated from the following file:

- /Users/mouginot/work/app/OpenBU/openbu/utils/reactions\_class.py

## 5.6 Empty\_argument Class Reference

Inheritance diagram for Empty\_argument:



### 5.6.1 Detailed Description

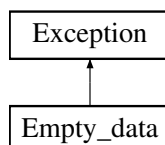
Raise when the user calls `decay_half-life_conv` without entering any argument

The documentation for this class was generated from the following file:

- /Users/mouginot/work/app/OpenBU/openbu/utils/functions.py

## 5.7 Empty\_data Class Reference

Inheritance diagram for Empty\_data:



### 5.7.1 Detailed Description

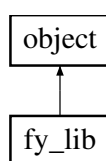
Raise when the user does not enter any data while add\_data has been called for a nuclide

The documentation for this class was generated from the following file:

- /Users/mouginot/work/app/OpenBU/openbu/utils/reactions\_class.py

## 5.8 fy\_lib Class Reference

Inheritance diagram for fy\_lib:



### Public Member Functions

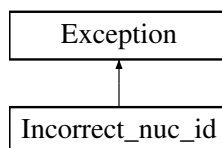
### Private Attributes

The documentation for this class was generated from the following file:

- /Users/mouginot/work/app/OpenBU/openbu/utils/reactions\_class.py

## 5.9 Incorrect\_nuc\_id Class Reference

Inheritance diagram for Incorrect\_nuc\_id:



### 5.9.1 Detailed Description

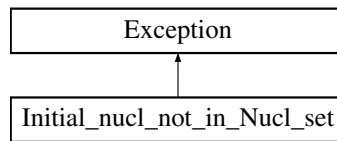
Raise when the id input format in passport instantiation is incorrect

The documentation for this class was generated from the following file:

- /Users/mouginot/work/app/OpenBU/openbu/passport.py

## 5.10 Initial\_nucl\_not\_in\_Nucl\_set Class Reference

Inheritance diagram for Initial\_nucl\_not\_in\_Nucl\_set:



### 5.10.1 Detailed Description

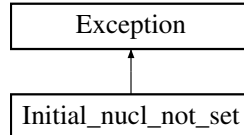
Raise when the user forgot to set the initial nuclide of the cell and tries to burn cell

The documentation for this class was generated from the following file:

- /Users/mouginot/work/app/OpenBU/openbu/cell.py

## 5.11 Initial\_nucl\_not\_set Class Reference

Inheritance diagram for Initial\_nucl\_not\_set:



### 5.11.1 Detailed Description

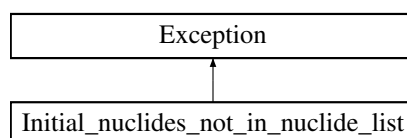
Raise when the user forgot to set the initial nuclide of the cell and tries to burn cell

The documentation for this class was generated from the following file:

- /Users/mouginot/work/app/OpenBU/openbu/cell.py

## 5.12 Initial\_nuclides\_not\_in\_nuclide\_list Class Reference

Inheritance diagram for Initial\_nuclides\_not\_in\_nuclide\_list:



### 5.12.1 Detailed Description

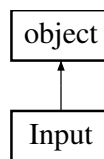
Raise when some initial nuclides are not included in `nucl_list`

The documentation for this class was generated from the following file:

- `/Users/mouginot/work/app/OpenBU/openbu/couple/couple_openmc.py`

## 5.13 Input Class Reference

Inheritance diagram for Input:



### Public Member Functions

### Public Attributes

### Private Member Functions

### Private Attributes

### Static Private Attributes

### 5.13.1 Detailed Description

`input` reads, stores and process the input data in the input file provided by the user

### 5.13.2 Member Function Documentation

#### 5.13.2.1 `cell_id_list()`

```
def cell_id_list (
    self )
```

Returns the absolute values of the decay constant of the nuclide

### 5.13.2.2 cells()

```
def cells (
    self )
```

Returns the absolute values of the decay constant of the nuclide

### 5.13.2.3 lib()

```
def lib (
    self )
```

Returns the absolute values of the decay constant of the nuclide

### 5.13.2.4 mode()

```
def mode (
    self )
```

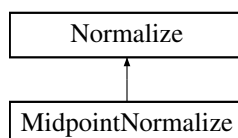
Returns the absolute values of the decay constant of the nuclide

The documentation for this class was generated from the following file:

- /Users/mouginot/work/app/OpenBU/openbu/input.py

## 5.14 MidpointNormalize Class Reference

Inheritance diagram for MidpointNormalize:





## Public Member Functions

## Public Attributes

### 5.14.1 Detailed Description

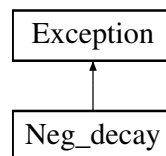
Normalise the colorbar so that diverging bars work there way either side from a prescribed midpoint value)  
e.g. `im=ax1.imshow(array, norm=MidpointNormalize(midpoint=0., vmin=-100, vmax=100))`

The documentation for this class was generated from the following file:

- `/Users/mouginot/work/app/OpenBU/openbu/utils/functions.py`

## 5.15 Neg\_decay Class Reference

Inheritance diagram for Neg\_decay:



### 5.15.1 Detailed Description

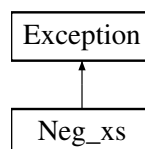
Raise when a negative decay constant is found

The documentation for this class was generated from the following file:

- `/Users/mouginot/work/app/OpenBU/openbu/passlist.py`

## 5.16 Neg\_xs Class Reference

Inheritance diagram for Neg\_xs:



### 5.16.1 Detailed Description

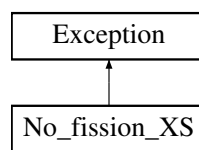
Raise when a negative cross-section is found

The documentation for this class was generated from the following file:

- /Users/mouginot/work/app/OpenBU/openbu/passlist.py

## 5.17 No\_fission\_XS Class Reference

Inheritance diagram for No\_fission\_XS:



### 5.17.1 Detailed Description

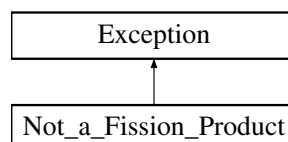
Raise when the user tries to access fission XS for a nuclide which fission XS have not been set yet

The documentation for this class was generated from the following file:

- /Users/mouginot/work/app/OpenBU/openbu/passport.py

## 5.18 Not\_a\_Fission\_Product Class Reference

Inheritance diagram for Not\_a\_Fission\_Product:



### 5.18.1 Detailed Description

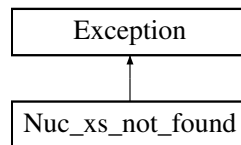
Raise when the user tries to set fission yields for a non fission product nuclide

The documentation for this class was generated from the following file:

- /Users/mouginot/work/app/OpenBU/openbu/passport.py

## 5.19 Nuc\_xs\_not\_found Class Reference

Inheritance diagram for Nuc\_xs\_not\_found:



### 5.19.1 Detailed Description

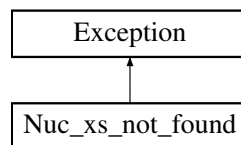
Raise when the user requests a cross-sections of a nuclide that is not in the nuclide set

The documentation for this class was generated from the following file:

- /Users/mouginot/work/app/OpenBU/openbu/passport.py

## 5.20 Nuc\_xs\_not\_found Class Reference

Inheritance diagram for Nuc\_xs\_not\_found:



### 5.20.1 Detailed Description

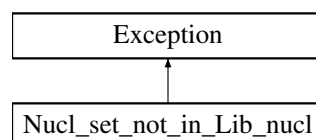
Raise when the user requests a cross-sections of a nuclide that is not in the nuclide set

The documentation for this class was generated from the following file:

- /Users/mouginot/work/app/OpenBU/openbu/passlist.py

## 5.21 Nucl\_set\_not\_in\_Lib\_nucl Class Reference

Inheritance diagram for Nucl\_set\_not\_in\_Lib\_nucl:



### 5.21.1 Detailed Description

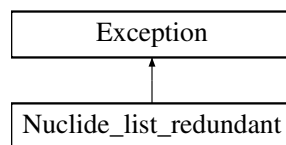
Raise when the user forgot to set the initial nuclide of the cell and tries to burn cell

The documentation for this class was generated from the following file:

- /Users/mouginot/work/app/OpenBU/openbu/cell.py

## 5.22 Nuclide\_list\_redundant Class Reference

Inheritance diagram for Nuclide\_list\_redundant:

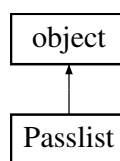


The documentation for this class was generated from the following file:

- /Users/mouginot/work/app/OpenBU/openbu/cell.py

## 5.23 Passlist Class Reference

Inheritance diagram for Passlist:



### Public Member Functions

### Private Member Functions

### Private Attributes

### 5.23.1 Member Function Documentation

#### 5.23.1.1 `_get_name_passport_dict()`

```
def _get_name_passport_dict (
    self ) [private]
```

Convert the list of passport into a dictionary of passports where entries are the zamid of the nuclides

#### 5.23.1.2 `_get_zamid_passport_dict()`

```
def _get_zamid_passport_dict (
    self ) [private]
```

Convert the list of passport into a dictionary of passports where entries are the zamid of the nuclides

#### 5.23.1.3 `_overwrite_xs()`

```
def _overwrite_xs (
    self,
    xs_dict ) [private]
```

Read and set the cross sections for each nuclide in the passports list

#### 5.23.1.4 `_set_decay()`

```
def _set_decay (
    self,
    decay_lib_b,
    decay_lib_a ) [private]
```

Read and set the decay constants for each nuclide in the passports list

#### 5.23.1.5 `_set_fy()`

```
def _set_fy (
    self,
    fy_dict ) [private]
```

Read and set the fission yields for fission products in the passports list

#### 5.23.1.6 `_set_mass()`

```
def _set_mass (
    self,
    passport_list ) [private]
```

Read and set the atomic mass for each nuclide in the passports list

#### 5.23.1.7 `_set_xs()`

```
def _set_xs (
    self,
    xs_dict ) [private]
```

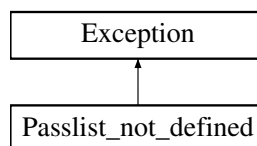
Read and set the cross sections for each nuclide in the passports list

The documentation for this class was generated from the following file:

- `/Users/mouginot/work/app/OpenBU/openbu/passlist.py`

## 5.24 `Passlist_not_defined` Class Reference

Inheritance diagram for `Passlist_not_defined`:



### 5.24.1 Detailed Description

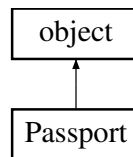
Raise when the user forgot to defined passlist for a cell

The documentation for this class was generated from the following file:

- `/Users/mouginot/work/app/OpenBU/openbu/cell.py`

## 5.25 Passport Class Reference

Inheritance diagram for Passport:



### Public Member Functions

### Public Attributes

### Private Member Functions

### Private Attributes

### Static Private Attributes

#### 5.25.1 Detailed Description

passport stores all the relevant data of individual nuclides and offers methods to extract information on them

The passport class is individually instantiated for each nuclide. It contains two types of information: constant data, such as the atomic mass, decay constant or the element's family (actinide, fission product) and variable data such as cross sections or fission yields that vary during a simulation and need thus to be updated. Some of the data are created at the time of the instantiation of the class for a nuclide such as the element's neutron reaction daughters. Other type of data, typically large in size such as cross sections and decay constants, are loaded from a data source. A setter method will enable any script that reads the data source to set this data for the passport of a specific nuclide. The code of Open-Burnup to set the data for a list of passports. The other way to explicitly set the data is to go to the data source itself, read the data and set it for the passport of a specific nuclide. This method offers a user-friendly way to get information on individual nuclides.

#### Attributes:

```

* **decay_a:** returns the absolute value of the decay constants of the nuclide
* **decay_b:** returns the percent fraction value of the decay constants of the nuclide
* **fy:** returns the value of fission yields in percent
* **mass:** returns the atomic mass of the nuclide
* **xs:** returns the absolute value of cross sections for the nuclide
* **FAM:** returns the family group name of the nuclide
* **xs_relatives:** returns neutron reaction's daughter nuclides' id
* **decay_relatives:** returns decay reaction's daughter nuclides' id

```

#### Methods:

```

* **set_mass:** set the atomic mass of the nuclide
* **set_decay:** set the decay constants (both absolute values and percent fractions) of the nuclide
* **set_xs:** set the cross sections of the nuclide
* **set_fy:** set the fission yields of the nuclide
* **load_mass:** load the atomic mass of the nuclide
* **load_decay:** load the decay constants (both absolute values and percent fractions) of the nuclide
* **load_xs:** load the cross sections of the nuclide
* **load_fy:** load the fission yields of the nuclide
* **get_zamid:** returns the zaaam id of the nuclide
* **get_nuc_name:** returns the name of the nuclide

```

## 5.25.2 Member Function Documentation

### 5.25.2.1 `_set_initial_dens()`

```
def _set_initial_dens (
    self,
    new_dens ) [private]
```

set new dens to current dens and append to dens\_segor

### 5.25.2.2 `_set_state()`

```
def _set_state (
    self ) [private]
```

Returns the state of the nuclide (excited or ground state)

### 5.25.2.3 `current_dens()` [1/2]

```
def current_dens (
    self )
```

Returns the density of the nuclide in atom per cm<sup>3</sup>

### 5.25.2.4 `current_dens()` [2/2]

```
def current_dens (
    self,
    new_dens )
```

set the density of the nuclide in atom per cm<sup>3</sup>



**5.25.2.5 current\_xs()**

```
def current_xs (
    self )
```

Returns the cross sections data of the nuclide

**5.25.2.6 decay\_a()**

```
def decay_a (
    self )
```

Returns the absolute values of the decay constant of the nuclide

**5.25.2.7 decay\_b()**

```
def decay_b (
    self )
```

Returns the fraction percent values of the decay constant of the nuclide

**5.25.2.8 decay\_child()**

```
def decay_child (
    self )
```

Returns the decay reactions' daughter products

**5.25.2.9 decay\_parent()**

```
def decay_parent (
    self )
```

Returns the decay reactions' daughter products

**5.25.2.10 fy()**

```
def fy (
    self )
```

Returns the fission yields data in percent

**5.25.2.11 get\_a()**

```
def get_a (
    self )
```

Returns the mass number of the nuclide

**5.25.2.12 get\_z()**

```
def get_z (
    self )
```

Returns the atomic number of the nuclide

**5.25.2.13 load\_decay()**

```
def load_decay (
    self )
```

Load the decay constant value of the nuclide

This method directly fetches the decay constant values from the source data and automatically set of the passport object

**5.25.2.14 load\_fy()**

```
def load_fy (
    self )
```

Load the fission yields data of the nuclide

This method directly fetches the fission yields data from the source data and automatically set of the passport object

If the nuclide for which the fission yields data are being loaded is not a fission product, the error `*Not_a_Fission_Product*` will be raised

**5.25.2.15 load\_mass()**

```
def load_mass (
    self )
```

Load the atomic mass of the nuclide in gram

This method directly fetches the atomic mass from the source data and automatically set of the passport object

**5.25.2.16 load\_xs()**

```
def load_xs (
    self )
```

Load the cross sections data of the nuclide

This method directly fetches the cross sections data from the source data and automatically set of the passport object

**5.25.2.17 mass()**

```
def mass (
    self )
```

Return the atomic mass of the nuclide in gram

**5.25.2.18 set\_decay()**

```
def set_decay (
    self,
    decay_a,
    decay_b )
```

Set the absolute and fractional values of the decay constant of the nuclide

#### 5.25.2.19 `xs_child()`

```
def xs_child (
    self )
```

Returns the neutron reactions' daughter products

#### 5.25.2.20 `xs_parent()`

```
def xs_parent (
    self )
```

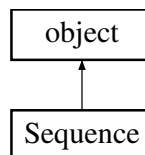
Returns the neutron reactions' daughter products

The documentation for this class was generated from the following file:

- `/Users/mouginot/work/app/OpenBU/openbu/passport.py`

## 5.26 Sequence Class Reference

Inheritance diagram for Sequence:



### Public Member Functions

### Public Attributes

### Private Member Functions

### Private Attributes

#### 5.26.1 Member Function Documentation

#### 5.26.1.1 `_set_initial_flux()`

```
def _set_initial_flux (
    self,
    new_flux ) [private]
```

set new new\_flux to current flux and append to flux sequence

#### 5.26.1.2 `_set_initial_pow_dens()`

```
def _set_initial_pow_dens (
    self,
    new_pow_dens ) [private]
```

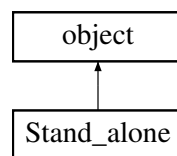
set new new\_pow\_dens to current pow\_dens and append to pow\_dens sequence

The documentation for this class was generated from the following file:

- `/Users/mouginot/work/app/OpenBU/openbu/sequence.py`

## 5.27 Stand\_alone Class Reference

Inheritance diagram for Stand\_alone:



### Public Member Functions

### Public Attributes

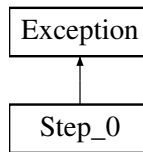
### Private Attributes

The documentation for this class was generated from the following file:

- `/Users/mouginot/work/app/OpenBU/openbu/standalone.py`

## 5.28 Step\_0 Class Reference

Inheritance diagram for Step\_0:



### 5.28.1 Detailed Description

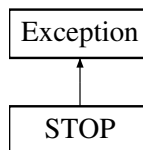
Raise when the user try to access subinterval for the first step

The documentation for this class was generated from the following file:

- /Users/mouginot/work/app/OpenBU/openbu/sequence.py

## 5.29 STOP Class Reference

Inheritance diagram for STOP:



### 5.29.1 Detailed Description

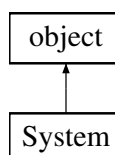
Just a way to stop the code

The documentation for this class was generated from the following file:

- /Users/mouginot/work/app/OpenBU/openbu/couple/couple\_openmc.py

## 5.30 System Class Reference

Inheritance diagram for System:



### Public Member Functions

### Public Attributes

### Private Member Functions

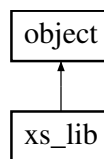
### Private Attributes

The documentation for this class was generated from the following file:

- /Users/mouginot/work/app/OpenBU/openbu/system.py

## 5.31 xs\_lib Class Reference

Inheritance diagram for xs\_lib:



### Public Member Functions

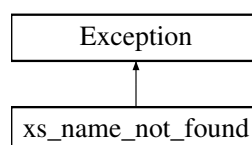
### Private Attributes

The documentation for this class was generated from the following file:

- /Users/mouginot/work/app/OpenBU/openbu/utls/reactions\_class.py

## 5.32 xs\_name\_not\_found Class Reference

Inheritance diagram for xs\_name\_not\_found:



### 5.32.1 Detailed Description

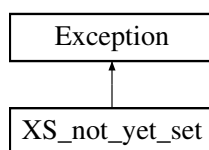
Raise when the user tries to access fission XS for a nuclide which fission XS have not been set yet

The documentation for this class was generated from the following file:

- /Users/mouginot/work/app/OpenBU/openbu/utis/data\_processor.py

## 5.33 XS\_not\_yet\_set Class Reference

Inheritance diagram for XS\_not\_yet\_set:



### 5.33.1 Detailed Description

Raise when the user tries to access XS for a nuclide which XS have not been set yet

The documentation for this class was generated from the following file:

- /Users/mouginot/work/app/OpenBU/openbu/passport.py



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