

EGS Brachy

Generated by Doxygen 1.8.11



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# Chapter 1

## Main Page

### 1.1 General Information

egs\_brachy is an egs++ application for rapid brachytherapy calculations for both photon and electron sources. The current documentation serves as a Technical Reference Manual to complement the egs\_brachy user manual ([https://clrp-code.github.io/egs\\_brachy/docs/egs\\_brachy\\_user\\_manual.pdf](https://clrp-code.github.io/egs_brachy/docs/egs_brachy_user_manual.pdf)) and our initial egs\_brachy paper ([https://clrp-code.github.io/egs\\_brachy/docs/egs\\_brachy\\_paper2016.pdf](https://clrp-code.github.io/egs_brachy/docs/egs_brachy_paper2016.pdf)): MJP Chamberland, REP Taylor, DWO Rogers, and RM Thomson, egs\_brachy: a versatile and fast Monte Carlo code for brachytherapy, Phys. Med. Biol. 61, 8214-8231 (2016). Please cite this paper when egs\_brachy is used in publications.

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### 1.2 License

The egs\_brachy code (all pieces of code associated with the egs\_brachy code system) is copyrighted Rowan Thomson, Dave Rogers, Randle Taylor, and Marc Chamberland. egs\_brachy is distributed in the hope that it will be useful, but without any warranty; without even the implied warranty of merchantability or fitness for a particular purpose. egs\_brachy is distributed as free software according to the terms of the GNU Affero General Public License as published by the Free Software Foundation, either version 3 of the License, or (at your option), any later version (<https://www.gnu.org/licenses/>). (See also section 2 of the User Manual for egs\_brachy ↵: [https://clrp-code.github.io/egs\\_brachy/docs/egs\\_brachy\\_user\\_manual.pdf](https://clrp-code.github.io/egs_brachy/docs/egs_brachy_user_manual.pdf))

## 1.3 Installation instructions (including EGSnrc installation)

For a more detailed version of the installation instructions, see section 3 of the User Manual for egs\_brachy ([https://clrp-code.github.io/egs\\_brachy/docs/egs\\_brachy\\_user\\_manual.pdf](https://clrp-code.github.io/egs_brachy/docs/egs_brachy_user_manual.pdf)). Clone the CLRP fork of the EGSnrc repository:

```
git clone git@github.com:clrp-code/EGSnrc_with_egs_brachy.git EGSnrc
cd EGSnrc
```

Checkout the most-up-to-date 'egs\_brachy' branch and download the egs\_brachy user code:

```
git checkout egs_brachy
git submodule update --init --recursive
```

Finally, configure EGSnrc by following the instructions for your OS (skip Step 2, which is already completed if you've been following these instructions):

- Linux: <https://github.com/nrc-cnrc/EGSnrc/wiki/Install-EGSnrc-on-Linux>
- Mac: <https://github.com/nrc-cnrc/EGSnrc/wiki/Install-EGSnrc-on-OS-X-El-Capitan>
- Windows: <https://github.com/nrc-cnrc/EGSnrc/wiki/Install-EGSnrc-on-Windows>

At this point you should have everything required to run egs\_brachy. If you did not choose to compile it when configuring EGSnrc, you should do so now:

```
cd $EGS_HOME/egs_brachy
make
```

## 1.4 Usage

### 1.4.1 Run Control

egs\_brachy uses the same run control block as other egs++ user codes with the addition of one extra input egsdat file format which you can use to tell egs\_brachy to output its egsdat file in gzip format. Using gzip format can result in significantly smaller egsdat file sizes for simulations with a large number of regions defined.

```
:start run control:
  ncase = 10000
  nbatch=1
  geometry error limit = 10
  egsdat file format = gzip # gzip or text
:stop run control:
```

## 1.4.2 Run Modes

There are currently three different run modes available in egs\_brachy:

1. 'normal' (default): a regular simulation. For an example see `tests/seeds_in_xyz/seeds_in_xyz.egsinp`.
2. 'superposition' : This type of simulation requires the used of an EGS\_ASwitchedEnvelope as the simulation geometry. At the start of every history only a single inscribed geometry will be activated. This allows you to explore the effects of intersource attenuation by performing TG-43 dose superposition type calculations. For an example see `tests/tg43mode/tg43mode.egsinp`.
3. 'volume correction only': Just run the volume correction routines, print the results and then quit. No actual dose calculations will be done. For an example see `tests/volume_correction/vc.egsinp`.

The run mode is set using a 'run mode' input block:

```
:start run mode:  
    run mode = normal # 'normal', 'superposition', or 'volume correction only'  
:stop run mode:
```

In simulations with more than a single source, egs\_brachy uses the first source as a particle generator. That is, all particles are initiated at the location of the first source and transported until they escape the source geometry. From there, the particle is moved to the location of the next source before transport continues (more accurately, a new particle is added to the top of the stack at the location of the chosen source and the original particle is killed).

This behaviour can be disabled by setting `single generator = no` in the run mode block (see `tests/single_generator/single_generator.egsinp`).

```
:start run mode:  
    run mode = normal  
    single generator = no  
:stop run mode:
```

Disabling the single generator (see `tests/single_generator/multiple_generator.egsinp`) mode may be slightly faster for some simulations (there is an extra call to `howfar` for every particle escaping the source geometry in single generator mode). Note that in some situations (particle recycling for example) single generator will always be enabled by egs\_brachy.

## 1.4.3 Geometry Specification

In general, arbitrary egs++ geometries can be included in a simulation although, for the sake of efficiency, it is expected that EGS\_AEnvelope geometries will be used for most simulations.

There are three egs\_brachy specific input keys that are required for the 'geometry definition' input block (in addition to the standard egs++ 'simulation geometry' key):

1. 'source geometries' : this key specifies which geometries define the actual brachytherapy source object. This may be a single geometry name (e.g. when using the `egs_glib` shim to load an externally defined geometry) or a list of all the sub-geometries used to compose a single source geometry when defining geometries inline.

2. 'phantom geometries': this tells egs\_brachy which geometries to score dose in (1 or more phantom geometries are required). Currently 3 geometry types are allowed to be used as phantoms:
  - (a) EGS\_XYZGeometry (library egs\_ndgeometry, see [tests/seeds\\_in\\_xyz/seeds\\_in\\_xyz.egsinp](#))
  - (b) EGS\_RZGeometry (library egs\_rz, see [tests/stepped\\_source/stepped.egsinp](#))
  - (c) EGS\_cSpheres (library egs\_spheres, see [tests/scatter/scatter.egsinp](#))
3. 'source envelope geometry': this input is only required for superposition run mode and must name the EG←S\_ASwitchedEnvelope geometry that contains the sources.

Other phantom geometry types could be added in future provided they implement the getBound, getNRegDir, and getMass methods of the EGS\_BaseGeometry class.

An (abbreviated) example geometry specification might look like:

```
:start geometry definition:

# all geometries that are a part of the source
source geometries = planes, end_cap_1, seed_middle, end_cap_2, seed

phantom geometries = phantom

simulation geometry = phantom_w_seeds

# only required for superposition run mode
source envelope geometry = phantom_w_seeds

:start geometry:

  name = phantom
  library = egs_ndgeometry
  type    = EGS_XYZGeometry

  # rest of geom definition

:stop geometry:

:start geometry:
  library = egs_planes
  name = planes
  # ...
:stop geometry:

:start geometry:
  name = end_cap_1
  #...
:stop geometry:

:start geometry:
  name = seed_middle
  #...
:stop geometry:

:start geometry:
  name = end_cap_2
  #...
:stop geometry:

:start geometry:

  library = egs_cdgeometry
  name = seed
  base geometry = planes
  set geometry = 0 end_cap_1
  set geometry = 1 seed_middle
  set geometry = 2 end_cap_2

:stop geometry:
```

```
:start geometry:
library = egs_autoenvelope
name = phantom_w_seeds
base geometry = phantom

:start inscribed geometry:
inscribed geometry name = seed
# rest of auto envelope inscribed geom definition

:stop inscribed geometry:

:stop geometry:
:stop geometry definition:
```

#### 1.4.3.1 Using CT data to create phantoms

Using the `egs_glib` geometry library you can construct an `EGS_XYZGeometry` using a `.egsphant` file like so:

```
:start geometry:
library = egs_glib
type = egsphant
name = my_egsphant_geom
egsphant file = /path/to/some/egsphant/file
density file = /path/to/density/file
:stop geometry:
```

The `egsphant` file may either be a typical `.egsphant` text file or gzipped `.egsphant.gz` file, and the latter compressed format is often advantageous in terms of memory) The density file indicates to `egs_brachy` the nominal density of each medium in the `egsphant` (voxel-by-voxel densities are defined in the `egsphant` file), and currently `egs_brachy` can read these data from a (a) material.dat file, (b) pgs4 data file, or (c) a simple text file of the format:

```
MEDIUM=WATER
RHO=1.000
MEDIUM=AIR
RHO=1.2E-3
```

*Note the `egs_glib` geometry library in the main EGSnrc repository does not currently contain support for `egsphant` files. The `egs_glib` contained in the `egs_brachy` git branch is customized to include support for `egsphant` files.*

It is also possible to use the `egs_ndgeometry` library to construct an `EGS_XYZGeometry` using a `.egsphant` file like so:

```
:start geometry:
library = egs_ndgeometry
type = EGS_XYZGeometry
name = my_egsphant_geom
egsphant file = /path/to/some/egsphant/file
ct ramp = /path/to/ramp/file.ramp

:stop geometry:
```

See the `egs_ndgeometry` documentation for details about the format of the `ct ramp` file. Note, however, that the `egs_ndgeometry` approach assumes that there is no overlap in voxel mass densities for different media in the `egsphant`, i.e., each medium has a distinct and non-overlapping range of mass densities. This is often *not* the case for brachytherapy phantoms, and so using the `egs_glib` geometry with `.egsphant` files (gzip format) is recommended.

### 1.4.3.2 The geometry library

The geometry library (see [The Geometry Library](#) below) consists of useful phantom geometries ([lib/geometry/phantoms](#)), source geometries and radioactivity distributions [lib/geometry/sources](#), eye plaques [lib/geometry/eye\\_plaques](#) and sets of transformations [lib/geometry/transformations/](#).

### 1.4.4 Scoring options

The 'scoring options' input block currently has the following keys:

- 'muen file': path to the file containing the muen data required for the simulation. See the MuenDataParser class for more information about the format of this file.
- 'muen for media': (Optional) a list of the materials that muen data is required for. Dose will be set to 0 for any phantom media that don't have muen data available. (Can be used instead of or in conjunction with `muen for medium`).
- 'muen for medium': (Optional) one or more input blocks which specify the muen dataset to be used for a given transport medium. (Can be used instead of or in conjunction with `muen for media`) This allows you to, for example, transport particles in tissue but score in water with notation  $D_{w,m}$  according to the conventions of TG-186.

```
:start muen for medium:
    transport medium = WATER
    scoring medium = TISSUE
:stop muen for medium:
```

- 'score tracklength dose' : (Optional) Controls whether dose using a tracklength estimator is scored in the phantom geometries. The choices are 'yes' (default) or 'no'.
- 'score energy deposition' : (Optional) Controls whether dose from particle interactions is scored in the phantom geometries. The choices are 'yes' or 'no' (default). See [tests/brem\\_cyl/brem\\_cyl.egsinp](#) for an example
- 'score scatter dose' : (Optional) Controls whether scatter dose (normalized to total radiant energy) is scored in the phantom geometries. The choices are 'yes' or 'no' (default). See [tests/scatter/scatter.egsinp](#) for an example.
- 'spectrum scoring': (Optional) zero or more input blocks specifying spectra to score (described below). See [tests/spec\\_absolute/spec\\_absolute.egsinp](#), [tests/spec\\_eflu/spec\\_eflu.egsinp](#), and [tests/spec\\_vox/spec\\_vox.egsinp](#) for examples.
- 'phsp scoring': (Optional) zero or one input block specifying whether to score a phase space on the surface of the source (described below). See [tests/phsp\\_scoring/phsp\\_score.egsinp](#) for an example.
- 'dose file format': (Optional) Controls whether 3ddose files are written as text or gzipped text files. Options are 'text' (default) and 'gzip'.
- 'output egsphant files': (Optional) Controls whether egsphant files are created for scoring phantoms. Options are 'no' (default) and 'yes'.
- 'egsphant file format': (Optional) Controls whether egsphant files are written as text or gzipped text files. Options are 'text' (default) and 'gzip'.
- 'output voxel info files': (Optional) Controls whether voxel info files are created for scoring phantoms. Options are 'no' (default) and 'yes'. See below for a description of these files. See [tests/volume\\_correction/vc.egsinp](#) for an example.

- 'voxel info file format': (Optional) Controls whether voxel info files are written in text (default) or gzip format
- 'output volume correction files for phantoms': (Optional) Controls which phantoms will have volume correction files created.
- 'volume correction file format': (Optional) Controls whether volume correction files are written in text (default) or gzip format
- 'record initial particle positions': (Optional) If this is set to a number N, where N > 0, then the first N initial particle positions will be written to a .pinit file. You can use this file to visualize the initial particle positions using gnuplot for example.
- 'current result phantom region': (Optional) Controls which phantom region is used for displaying results at the end of each batch and/or terminating the calculation if the required statistical uncertainty is reached. Defaults to region 0 of the first phantom object. Currently the result of the tracklength dose scoring is always used. See [tests/brem\\_cyl/brem\\_cyl.egsinp](#) for an example.
- 'dose scaling factor': (Optional) Allows you to scale all dose files output by egs\_brachy by a constant factor.

A sample 'scoring options' block looks like this:

```
:start scoring options:

score tracklength dose = yes # 'yes' (default) or 'no'
score energy deposition = no # 'no' (default) or 'yes'
score scatter dose = yes # 'no' (default) or 'yes'
muen file = /home/randlet/egs/HEN_HOUSE/muen_data/brachy_xcom_1.5MeV.muendat
muen for media = WATER_0.998, AIR_TG43

dose file format = gzip # text or gzip

output egsphant files = yes
egsphant file format = gzip

output voxel info files = no
voxel info file format = text # text or gzip

output volume correction files for phantoms = phantom1, phantom2
volume correction file format = gzip # text or gzip

current result phantom region = phantom 123 # phant name and reg number

dose scaling factor = 1

:start spectrum scoring:
    type = surface count
    particle type = photon
    minimum energy = 0.001
    maximum energy = 0.040
    number of bins = 100
    output format = xmgr
:stop spectrum scoring:

:start phsp scoring:
    phsp output directory = /home/randlet/egs/egsnrc/egs_brachy/
    access mode = write
    print header = no
    kill after scoring = yes
:stop phsp scoring:

:stop scoring options:
```

#### 1.4.4.1 Volume correction files

If one or more phantoms are specified in 'output volume correction files for phantoms' then egs\_brachy will output a file containing region numbers and the corrected volumes for any regions which has had its volume corrected.

File mode is specified with the 'volume correction file format' input and can either be 'text' or 'gzip'.

These volume correction files allow you to precompute volume corrections for a given geometry arrangement and can then be used in conjunction with the 'volume correction from file' volume correction option. This can be particularly useful when running a simulation in parallel. A single job in "volume correction only" mode can be run to initially calculate the volume corrections and then the parallel jobs can use the precomputed volume corrections values eliminating the redundant calculation of volume corrections by every job in your parallel run.

The input file `tests/volume_correction/vc.egsinp` demonstrates this feature.

#### 1.4.4.2 Spectrum Scoring Options

`egs_brachy` can currently score three different type of spectra:

1. Absolute counts of particles escaping the surface of the source (See `tests/spec_absolute/spec_absolute.egsinp`)
2. Energy weighted spectra of particles on the surface of the source (See `tests/spec_eflu/spec_eflu.egsinp`)
3. Photon energy fluence in a single geometry region (See `tests/spec_vox/spec_vox.egsinp`)

To score a spectrum, add one or more 'spectrum scoring' input blocks to the 'scoring options' block (you may add an arbitrary number of 'spectrum scoring' blocks.)

**Note that for the 'energy fluence in region' spectrum type, it is essential that the scoring region has no other overlapping geometries.**

Spectrum scoring input options are explained below.

```
:start scoring options:
...
:start spectrum scoring:
  type = surface count # surface count, energy weighted surface, energy fluence in region
  particle type = photon # photon, electron, positron
  minimum energy = 0.001 # defaults to 0.001MeV
  maximum energy = 1.00 # defaults to max energy of source
  number of bins = 1000 # defaults to 100
  output format = xmgr # xmgr (default), csv, egsnrc

  file extension = my_spectrum # (optional)

  # egsnrc 'output format' only
  egsnrc format mode = 0 # 0, 1, 2

  # 'energy fluence in region' mode only
  geometry = your_geom_name
  scoring region = 10 # region of specified geometry to score fluence in (defaults to 0 )

:stop spectrum scoring:
:stop scoring options:
```

#### 1.4.4.3 Phase Space Scoring Options

`egs_brachy` has the ability to score an IAEA format phase space file of all particles escaping the source geometry. This phase space can then be used as a particle source in future simulations with the `eb_iaeaphsp_source` source type (see Phase Space Source section below).

To enable this option you need to add a `phsp scoring` block to the `scoring options` input section. The `phsp scoring` block has the following inputs:

1. 'phsp output directory': (Optional) Controls where the `.IAEAheader` & `.IAEAphsp` files are written too. Defaults to the current working directory.
2. 'access mode': (Optional) Controls whether `egs_brachy` should write to a new file or append to an existing `phsp` file. Options are `write` and `append` (default).
3. 'kill after scoring': (Optional) Controls whether the weight of scored particles should be set to 0 which will increase the speed of phase space file generation. Options are `yes` and `no` (default).
4. 'boundary step': (Optional) Since `egs_brachy` scores `phsp` particles on the surface of a source, you may find that when you use a `phsp` source, particles get stuck at the geometry boundary when they are initialized. To combat this, before scoring a `phsp` particle `egs_brachy` propagates the particle a small distance forward along its current direction of travel before writing it to the phase space file. By default this value is `1E-4 cm` but you can make it smaller or larger if necessary.
5. 'print header': (Optional) Controls whether the `iaea_print_header` function is called during the `outputResults`. Options are `yes` and `no` (default).

A complete `phsp scoring` block looks like:

```
:start phsp scoring:
    phsp output directory = /home/randlet/egs/egsnrc/egs_brachy/
    access mode = write
    print header = no
    kill after scoring = yes
    boundary step = 1E-6
:stop phsp scoring:
```

See [tests/phsp\\_scoring/phsp\\_score.egsinp](#) for an example of scoring a phase space and [tests/phsp\\_run/phsp\\_run.egsinp](#) for an example of running a phase space source.

#### Limitations

Currently phase space generation using parallel runs is not supported.

#### 1.4.5 Source definition

The `source definition` block for `egs_brachy` consists of 3 parts:

1. a standard `egs++ source` block which defines what the base particle source and spectrum will be (typically for brachy calculations this will be an isotropic source).
2. a `transformations` input block which contains one or more `EGS_AffineTransform` input blocks to tell `egs_brachy` the location of all particle sources (this will usually be identical to the `inscribed geometry -> transformations` block for an `egs_autoenvelope` geometry and hence an external file and an `include` file directive should probably be used.)

3. a simulation source input item which is set to the name of the source defined in 1.
4. an optional source weights input item which is a list of relative statistical weights for each source. This input is described below in the Variable source weights section.

An example source definition block is shown below for a 6702 seed:

```
:start source definition:

:start source:

library = egs_isotropic_source
name = 6702_spheres
charge = 0

# three spherical shell sources for 6702 Source
:start shape:

library = egs_shape_collection

:start shape:
library = egs_spherical_shell
inner radius = 0.0299
outer radius = 0.03
midpoint = 0, 0, -0.11
:stop shape:

:start shape:
library = egs_spherical_shell
inner radius = 0.0299
outer radius = 0.03
midpoint = 0, 0, 0
:stop shape:

:start shape:
library = egs_spherical_shell
inner radius = 0.0299
outer radius = 0.03
midpoint = 0, 0, 0.11
:stop shape:

probabilities = 1 1 1

:stop shape:

:start spectrum:
type = tabulated spectrum
spectrum file = /home/randlet/egs/HEN_HOUSE/spectra/I125_TG43.spectrum
:stop spectrum:

:stop source:

:start transformations :
:start transformation:
translation = -2,-2,-2
:stop transformation:
:start transformation:
translation = -2,-2,-1
:stop transformation:

# more transformations...

:stop transformations:

simulation source = 6702_spheres

:stop source definition:
```

#### 1.4.5.1 Variable source weighting

In order to simulate sources with different activity levels you can add a `source weights` input to the `source definition` section. For example, if you have a simulation with two sources, the first of which has three times the activity of the second, you would set the following source input:

```
:start source definition:

:start source:

library = egs_point_source
name = pt_source
charge = 0
position = 0 0 0

:start spectrum:
type = tabulated spectrum
spectrum file = /home/randlet/egs/HEN_HOUSE/spectra/I125_TG43.spectrum
:stop spectrum:

:stop source:

:start transformations :
:start transformation:
translation = 0 0 -1
:stop transformation:
:start transformation:
translation = 0 0 1
:stop transformation:
:stop transformations:

simulation source = pt_source

source weights = 3 1 # give source at (0, 0, -1) three times the weight of source 2

:stop source definition:
```

`egs_brachy` uses these weights to assign the initial statistical weight of the particles originating in a source. If the `source weights` input is missing all sources are given equal weighting. If the number of inputs for `source weights` is less than the number of sources, the missing inputs will be assumed to be 1. See [tests/variable\\_activity/variable.egsinp](#) for an example.

When the superposition run mode is used, the `source weights` input represents relative dwell times (e.g. for a stepped Ir192 HDR source) rather than different activity levels. See [tests/stepped\\_source/stepped.egsinp](#) for an example of this feature.

#### 1.4.5.2 Phase Space Sources

Using an IAEA phase space source in `egs_brachy` is just a matter of setting the `source` input block to use the `eb_ieaphsp_source` type like so:

```
:start source definition:

:start source:
library = eb_ieaphsp_source
name = 6702
header file = /home/randlet/egs/egsnrc/egs_brachy/iaea.phsp.IAEAheader
:stop source:

:start transformations :
include file = lib/geometry/transformations/125seeds_1cm_grid
:stop transformations:

simulation source = 6702

:stop source definition:
```

See the eb\_iaeaphsp\_source documentation for more information on the inputs and [tests/phsp\\_run/phsp\\_run.egsinp](#) input file for an example of this feature.

It should be noted that phase space sources are treated slightly differently than other source types when particle recycling is enabled. This is discussed below in the particle recycling section.

## 1.4.6 Transport Parameters

egs\_brachy has a couple of extra optional transport parameters.

1. Fluorescent Photon Cutoff which will kill all fluorescent photons with energy less than or equal to the cutoff energy.

```
:start MC transport parameter:  
  
Global ECUT          = 1.512  
Global PCUT          = 0.001  
# ...  
Fluorescent Photon Cutoff = 0.005 # kill all flu. photons with E <= 5keV  
  
:stop MC transport parameter:
```

2. Source ECUT & Source PCUT these two transport parameters allow you to set ECUT and PCUT to different values within the source compared to elsewhere. This is required for x-ray source simulations (see e.g. [tests/brem\\_cyl/brem\\_cyl.egsinp](#)).

```
:start MC transport parameter:  
  
Global ECUT          = 1.512  
Global PCUT          = 0.001  
Source ECUT          = 0.512  
Source PCUT          = 0.001  
  
:stop MC transport parameter:
```

## 1.4.7 Variance Reduction

### 1.4.7.1 Particle Recycling

egs\_brachy has the ability to reuse particles which escape from the source geometry an arbitrary number of times. With particle recycling enabled, egs\_brachy detects (in ausgab) when a particle is escaping the source, and then adds Nrecycle new particles to the top of the stack at the location of each source in the simulation.

This can increase the efficiency of a simulation where only a fraction of particles are escaping the source geometry (since particles which don't escape the source geometry are 'wasted' because they don't contribute to dose in the phantom).

In order to enable source particle recycling you must include a `particle recycling` block in the variance reduction block.

```
:start variance reduction:  
:start particle recycling:  
  times to reuse recycled particles = 10  
  rotate recycled particles = yes  
:stop particle recycling:  
:stop variance reduction:
```

If `rotate recycled particles` is set to yes, each particle will be rotated by an arbitrary angle about the z-axis prior to being reused. (If `times to reuse recycled particles` is greater than 1, particle rotation is enforced).

Examples of particle recycling may be seen in the following test files: [tests/phsp\\_run/phsp\\_run.egsinp](#), [tests/recycling/recycling.egsinp](#), [tests/tg43mode\\_recycle/tg43mode\\_recycling.egsinp](#), [tests/variable\\_w\\_recycling/variable\\_w\\_recycling.egsinp](#).

### Particle Recycling with PHSP Sources

Phase space particles are scored once they've already escaped the source and therefore particles from a phsp source will be initiated outside of sources. Because of this phsp particles never escape the source and trigger the recycling routines in ausgab. Instead, at the beginning of each history a single particle is retrieved from the phase space file and then NRecycle copies of the particle are made and placed at the location of all the sources (so the history starts with NRecycle\*NSource particles on the stack rather than just a single particle).

### Particle Recycling and Superposition Mode

Currently when running in superposition mode recycled particles are only generated for the currently active source rather than all source locations ( i.e. when a particle escapes a source only Nrecycle particles are created rather than Nrecycle\*Nsource).

#### 1.4.7.2 Range Rejection

Range rejection is enabled outside of sources and disabled within sources by default in egs\_brachy. The default maximum range rejection energy is set to 2.511 MeV (including rest mass). In other words, by default range rejection is applied to electrons in the phantom with kinetic energy lower than 2 MeV. To enable or disable range rejection within sources, or outside of sources, use the source range rejection and global range rejection inputs, respectively.

The source range rejection max energy and global range rejection max energy inputs are used to set the maximum energy of electrons (in MeV, including rest mass) to use range rejection with.

```
:start variance reduction:  
    global range rejection = yes  
    global range rejection max energy = 0.611  
    source range rejection = yes  
    source range rejection max energy = 0.516  
:stop variance reduction:
```

#### 1.4.7.3 Bremsstrahlung Splitting

To enable brem splitting in egs\_brachy set the split brems photons input to something greater than 1 in the variance reduction block.

```
:start variance reduction:  
    split brem photons = 100  
:stop variance reduction:
```

See [tests/brem\\_cyl/brem\\_cyl.egsinp](#) for an input file that uses brem splitting.

#### 1.4.7.4 Bremsstrahlung Cross Section Enhancement

To enable bremsstrahlung cross section enhancement in egs\_brachy add a bcse medium input item in the variance reduction block. The format of the input is medium\_name enhancement\_factor.

```
:start variance reduction:  
    split brem photons = 100  
    bcse medium = Ti10W90 100  
:stop variance reduction:
```

## 1.4.8 Voxel volume correction details

egs\_brachy has three methods available for doing voxel volume correction calculations. There is a 'fast' method that uses the same technique described in the egs\_autoenvelope documentation and a more general purpose routine which can be used for larger volumes with multiple overlapping phantom geometries. In addition to those two methods, corrected voxel volumes can be precomputed (either manually or by egs\_brachy) and read from a file.

See [tests/volume\\_correction/vc.egsinp](#) for examples of the fast & general volume correction methods.

### 1.4.8.1 Fast voxel volume corrections for sources

The input block for this type of volume correction looks like:

```
:start volume correction:
:start source volume correction:
  correction type = correct # optional: none(default), correct, zero dose
  density of random points (cm^-3) = 1E7 # optional random point sampling density defaults to 1E8
  # shape which encompasses source
  :start shape:
    type = cylinder
    radius = 0.04
    height = 0.45
  :stop shape:
  # optional rng definition
  :start rng definition:
    type = sobol
    initial seed = 1234
  :stop rng definition:
  # -or-
  :start rng definition:
    type = ranmar
    initial seeds = two integers
  :stop rng definition:
:stop source volume correction:
:stop volume correction:
```

### 1.4.8.2 General purpose volume corrections

The general purpose algorithm is similar, except any geometry region within the bounding shape will have its region volume corrected. Currently the shape must be cylinder, sphere, or box type.

The input block for the general purpose volume corrections is shown below:

```
:start volume correction:
:start extra volume correction:
  correction type = correct # correct, none, zero dose
  density of random points (cm^-3) = 1E5
  # correct volume of region for all geometries within
  # x,y,z = +/- 2cm around origin
  :start shape:
```

```

type = box
box size = 4

:start transformation:
    translation = 0 0 0
:stop transformation:

:stop shape:

:stop extra volume correction:

:stop volume correction:

```

#### 1.4.8.3 Volume calculations from file

You can also use precomputed volume corrections by using a 'volume correction from file' input.

The input block specifies one or more 'phantom file' inputs with two strings. The first string is the name of the phantom to set the volumes for and the second string is the file to read the volumes from. egs\_brachy will automatically determine whether the file is in text or gzip mode.

```

:start volume correction:

:start volume correction from file:

phantom file = phantom1 your_precomputed_phantom1_volumes.volcor
phantom file = phantom2 your_precomputed_phantom2_volumes.volcor

:stop volume correction from file:

:stop volume correction:

```

To create your own volcor text files, create a text file in the format:

```

NRECORDS
REG_NUM_1 REG_1_VOLUME
REG_NUM_2 REG_2_VOLUME
...
REG_NUM_3 REG_3_VOLUME

```

for example the following file:

```

3
5 0.5
13 1.0
1000 2.5

```

would set regions 5, 13 and 1000 to volumes  $0.5 \text{ cm}^3$ ,  $1 \text{ cm}^3$ ,  $2.5 \text{ cm}^3$  of whichever phantom it was assigned to.

#### 1.4.8.4 Random Number Generator for volume corrections

If a `box` shape is used as the volume correction shape, volume corrections will use a Sobol Quasi Random Number Generator by default. For all other shapes the regular Ranmar RNG will be used (the Sobol generator only works for Cartesian coordinate systems). The RNG can be overridden as show in the example above.

## 1.4.9 Output files

### 1.4.9.1 3ddose files

A 3ddose file will be output for every phantom geometry named in the geometry definition -> phantom geometries input item. The filename format of these 3ddose files is {input\_file}\_{phantom\_name}.3ddose where {input\_file} is replaced with the name of the simulations input file and {phantom\_name} is replaced with the name of the phantom.

If score energy deposition = yes is set, a second 3ddose file with dose from interaction scoring will be output to {input\_file}\_{phantom\_name}.edep.3ddose as well.

If score scatter dose is enabled, egs\_brachy will score primary, single scattered and multiple scattered dose (normalized to total radiant energy) and output them to 3ddose files with the format {input\_file}\_{{phantom\_name}}.{pr,ss,ms,to}.3ddose

### 1.4.9.2 egsphant file

If the user sets output egsphant files to yes in the scoring options input block, an egsphant file will be output for each scoring phantom in the simulation.

```
:start scoring options:  
#...  
output egsphant files = yes  
:stop scoring options:
```

### 1.4.9.3 Voxel info files

If the user sets output voxel info files to yes in the scoring options input block, a file with a .voxels extension ({input\_file}\_{phantom\_name}.voxels) will be output that contains region by region information about every voxel in a phantom. The information currently includes, region #, corrected volume, uncorrected volume, mass, density, medium, dose and uncertainty.

```
:start scoring options:  
#...  
output voxel info files = yes  
:stop scoring options:
```

## 1.4.10 Running a simulation

egs\_brachy uses the standard egs++ run control input block to control the number of histories, batches, geometry error limits etc.. Likewise the standard methods of running EGSnrc user codes from the command line all apply to egs\_brachy (i.e. use ex, exb or egs\_brachy -i input\_file [-p pegs\_file] [-o output\_file] [-s] [-P n -j i])

## 1.5 Test Suite

egs\_brachy comes with a test suite that will allow you to confirm the code is still performing as expected after making modifications or updating the egsnrc version.

Geometries required for the tests are either defined within the .egsinp files or within `tests/test_geoms`.

### 1.5.1 Setup

In order to make accurate CPU time comparisons the test suite needs to know how fast your CPU is. If you are on a linux system that makes processor speed available in `/proc/cpuinfo` then the test suite can likely determine this information on its own. Otherwise you will need to set a `CPU_MHZ` environment variable with the value of your CPU speed in MHz (e.g. `CPU_MHZ=2400`).

### 1.5.2 Running the test suite

To run the test suite you need to be in the root egs\_brachy directory. To run the whole test suite type (tested with Python 2.7 & 3.4):

```
python run_tests.py
```

after which you should see output like:

```
~/egs/egsnrc/egs_brachy$ python run_tests.py
CPU speed read from /proc/cpuinfo as 3498.557000 MHz
Running test 'tests.volume_correction'...
PASS - tests.volume_correction - ran in 5.72E-05 s/MHz (0.2 s)
Running test 'tests.scatter'...
PASS - tests.scatter - ran in 0.0056 s/MHz (19.6 s)
Running test 'tests.seeds_in_xyz'...
...
Running test 'tests.spec_vox'...
PASS - tests.spec_vox - ran in 0.000829 s/MHz (2.9 s)
=====
Tests finished 17/17 passed
~/egs/egsnrc/egs_brachy$
```

You can also run a subset of the tests in the following way:

```
~/egs/egsnrc/egs_brachy$ python run_tests.py tests/seeds_in_xyz/
CPU speed read from /proc/cpuinfo as 3498.557000 MHz
Running test 'tests.seeds_in_xyz'...
PASS - tests.seeds_in_xyz - ran in 0.00269 s/MHz (9.4 s)
=====
Tests finished 1/1 passed
~/egs/egsnrc/egs_brachy$
```

or

```
~/egs/egsnrc/egs_brachy$ python run_tests.py "tests/spec*"
CPU speed read from /proc/cpuinfo as 3498.557000 MHz
Running test 'tests.spec_eflu'...
PASS - tests.spec_eflu - ran in 0.000629 s/MHz (2.2 s)
Running test 'tests.spec_absolute'...
PASS - tests.spec_absolute - ran in 0.000629 s/MHz (2.2 s)
Running test 'tests.spec_vox'...
PASS - tests.spec_vox - ran in 0.000743 s/MHz (2.6 s)
=====
Tests finished 3/3 passed
~/egs/egsnrc/egs_brachy$
```

### 1.5.3 A list of the current tests

A list of all the tests currently implemented can be found in the [egs\\_brachy tests page](#).

## 1.6 The egs\_brachy Library

### 1.6.1 The Geometry Library

For a list of the current geometry objects available in the egs\_brachy library, please see [the geometry library page](#).

### 1.6.2 Transport Parameters

For a list of the current default transport parameter files available in the egs\_brachy library, please see [the transport parameters page](#).

### 1.6.3 Spectra

For a list of the current spectra available in the egs\_brachy library, please see [the spectra page](#).

### 1.6.4 Media & Muen Data

egs\_brachy includes material files for peggless runs and muen data for scoring dose in different media using the tracklength estimator. For a list of the current media available see [here](#).

### 1.6.5 Example egsinp files

A suite of input files is distributed with egs\_brachy (found in lib/examples). These provide a good starting point for users new to egs\_brachy.

## 1.7 Documentation

This egs\_brachy Technical Reference Manual uses doxygen and Python to build its documentation. Documentation for the egs\_brachy library and test suite are generated by a number of Python scripts located in the \_docs directory. The Python scripts generate markdown documents based on the contents of the lib and tests directory. These markdown documents are then compiled to html by doxygen. A pdf of all the documentation will also be created and placed at docs/pdf/egs\_brachy\_manual.pdf.

This document ([egs\\_brachy.md](#)) and the scripts for generating the library and test documents are located in `_docs/` and the generated html is placed in `docs/` (the documents in the `docs/` directory should not be modified manually).

To update the documentation simply run `make docs` and then commit the changes:

```
1 make docs
2 git add _docs/
3 git commit -am 'your commit message'
```

# Chapter 2

## geom

### The egs\_brachy Geometry Library

#### 2.1 Source Library

The current list of sources available in the egs\_brachy geometry library.

##### 2.1.1 I125 LDR Sources

###### 2.1.1.1 OncoSeed\_6711

**Description** *No description available*

**Geometry Files** [OncoSeed\\_6711.geom](#)

**Shape Files** [OncoSeed\\_6711.shape](#), [boundary.shape](#)

**Images**

##### 2.1.2 Ir192 HDR Sources

###### 2.1.2.1 MBDCA-WG

**Description** *No description available*

**Geometry Files** [MBDCA-WG.geom](#)

**Shape Files** [MBDCA-WG.shape](#), [boundary.shape](#)

**Images**

### 2.1.2.2 microSelectron-v2

**Description** *No description available*

**Geometry Files** `microSelectron-v2.geom`

**Shape Files** `microSelectron-v2.shape, boundary.shape`

**Images**

### 2.1.3 Pd103 LDR Sources

#### 2.1.3.1 TheraSeed\_200

**Description** *No description available*

**Geometry Files** `TheraSeed_200.geom, TheraSeed_200_AIR_TG43_LD.geom`

**Shape Files** `TheraSeed_200.shape, boundary.shape`

**Images**

### 2.1.4 point source Sources

#### 2.1.4.1 sphere

**Description** *No description available*

**Geometry Files** `sphere.geom`

**Shape Files** `sphere.shape, boundary.shape`

**Images**

### 2.1.5 xray Sources

#### 2.1.5.1 eshell

**Description** *No description available*

**Geometry Files** `eshell.geom`

**Shape Files** `eshell.shape, boundary.shape`

**Images**

## 2.2 Phantom Library

The current list of phantoms available in the egs\_brachy geometry library.

**10.0cmx10.0cmx10.0cm\_2mm\_xyz\_water.geom****File Location:** lib/geometry/phantoms/10.0cmx10.0cmx10.0cm\_2mm\_xyz\_water.geom

-5.0cm <= X, Y, Z <= 5.0cm with 0.2cm voxels

**10.1cmx10.1cmx10.1cm\_1mm\_xyz\_water.geom****File Location:** lib/geometry/phantoms/10.1cmx10.1cmx10.1cm\_1mm\_xyz\_water.geom

-5.05cm <= X, Y, Z <= 5.05cm with 1mm voxels

**10cmx10cmx10cm\_box\_xyz\_water.geom****File Location:** lib/geometry/phantoms/10cmx10cmx10cm\_box\_xyz\_water.geom

A 10cm<sup>3</sup> water phantom with a single region

**15.0cmx19.1cmx13.5cm\_xyz\_breast.geom****File Location:** lib/geometry/phantoms/15.0cmx19.1cmx13.5cm\_xyz\_breast.geom

*No description available*

**2.0cmx2.0cmx2.0cm\_1mm\_xyz\_water.geom****File Location:** lib/geometry/phantoms/2.0cmx2.0cmx2.0cm\_1mm\_xyz\_water.geom

-1cm <= X, Y, Z <= 1cm with 1mm voxels

**2.0cmx2.0cmx2.0cm\_2mm\_xyz\_water.geom****File Location:** lib/geometry/phantoms/2.0cmx2.0cmx2.0cm\_2mm\_xyz\_water.geom

-1cm <= X, Y, Z <= 1cm with 0.2mm voxels

**20.1cmx20.1cmx20.1cm\_1mm\_xyz\_water.geom****File Location:** lib/geometry/phantoms/20.1cmx20.1cmx20.1cm\_1mm\_xyz\_water.geom

-10.05cm <= X, Y, Z <= 10.05cm with 1mm voxels

---

**20.1cmx20.1cmx20.1cm\_box\_xyz\_water.geom****File Location:** lib/geometry/phantoms/20.1cmx20.1cmx20.1cm\_box\_xyz\_water.geom*No description available***3.0cmx3.0cmx3.0cm\_0.5mm\_xyz\_water.geom****File Location:** lib/geometry/phantoms/3.0cmx3.0cmx3.0cm\_0.5mm\_xyz\_water.geom

-1.5cm <= X, Y, Z <= 1.5cm with 0.5cm voxels

**3.0cmx3.0cmx3.0cm\_1mm\_xyz\_water.geom****File Location:** lib/geometry/phantoms/3.0cmx3.0cmx3.0cm\_1mm\_xyz\_water.geom

-1.5cm <= X, Y, Z <= 1.5cm with 0.1cm voxels

**3.0cmx3.0cmx3.0cm\_2mm\_xyz\_water.geom****File Location:** lib/geometry/phantoms/3.0cmx3.0cmx3.0cm\_2mm\_xyz\_water.geom

-1.5cm <= X, Y, Z <= 1.5cm with 0.2cm voxels

**30.2cmx30.2cmx30.2cm\_2mm\_xyz\_water.geom****File Location:** lib/geometry/phantoms/30.2cmx30.2cmx30.2cm\_2mm\_xyz\_water.geom

-15.1cm <= X, Y, Z <= 15.1cm with 0.2mm voxels

**30cm\_0.1mm\_sph\_water.geom****File Location:** lib/geometry/phantoms/30cm\_0.1mm\_sph\_water.geom

0cm <= r <= 15cm with 0.1mm voxels for r <= 1.015cm

**30cm\_0.5mm\_sph\_water.geom****File Location:** lib/geometry/phantoms/30cm\_0.5mm\_sph\_water.geom

0cm <= r <= 15cm with 0.5mm voxels for r <= 5.075cm

**30cm\_1mm\_sph\_water.geom****File Location:** lib/geometry/phantoms/30cm\_1mm\_sph\_water.geom

0cm  $\leq r \leq$  15cm with 1mm voxels for  $r \leq 10\text{cm}$

**30cmx30cm\_r101xz203\_0.1mm\_rz\_water.geom****File Location:** lib/geometry/phantoms/30cmx30cm\_r101xz203\_0.1mm\_rz\_water.geom

0  $\leq r \leq$  30cm, -15.1cm  $\leq Z \leq$  15.1cm 0.01 cm voxels for 0  $\leq r \leq$  1.015cm and -1.015cm  $\leq z \leq$  1.015cm

**30cmx30cm\_r101xz203\_0.5mm\_rz\_water.geom****File Location:** lib/geometry/phantoms/30cmx30cm\_r101xz203\_0.5mm\_rz\_water.geom

0  $\leq r \leq$  30cm, -15.1cm  $\leq Z \leq$  15.1cm 0.05 cm voxels for 0  $\leq r \leq$  5.075cm and -5.075cm  $\leq z \leq$  5.075cm

**30cmx30cm\_r101xz203\_1.0mm\_rz\_water.geom****File Location:** lib/geometry/phantoms/30cmx30cm\_r101xz203\_1.0mm\_rz\_water.geom

0  $\leq r \leq$  30cm, -15.1cm  $\leq Z \leq$  15.1cm 1cm voxels for 0  $\leq r \leq$  10.15cm and -10.15cm  $\leq z \leq$  10.15cm

**30cmx30cmx30cm\_0.1mm\_xyz\_water.geom****File Location:** lib/geometry/phantoms/30cmx30cmx30cm\_0.1mm\_xyz\_water.geom

-15cm  $\leq X, Y, Z \leq$  15cm 0.01cm voxels for -1.015  $\leq X, Z \leq$  1.015cm, and a 0.01cm voxel from -0.005cm  $\leq Y \leq$  0.005cm

**30cmx30cmx30cm\_0.5mm\_xyz\_water.geom****File Location:** lib/geometry/phantoms/30cmx30cmx30cm\_0.5mm\_xyz\_water.geom

-15cm  $\leq X, Y, Z \leq$  15cm 0.05cm voxels for -5.075cm  $\leq X, Z \leq$  5.075cm, and a 0.05cm voxel from -0.025cm  $\leq Y \leq$  0.025cm

**30cmx30cmx30cm\_1.0mm\_xyz\_water.geom****File Location:** lib/geometry/phantoms/30cmx30cmx30cm\_1.0mm\_xyz\_water.geom

-15cm  $\leq X, Y, Z \leq$  15cm 0.1cm voxels for -10.15  $\leq X, Z \leq$  10.15cm, and a 0.1cm voxel from -0.05cm  $\leq Y \leq$  0.05cm

**30cmx30cmx30cm\_box\_xyz\_prostate.geom****File Location:** lib/geometry/phantoms/30cmx30cmx30cm\_box\_xyz\_prostate.geom*No description available***30cmx30cmx30cm\_box\_xyz\_water.geom****File Location:** lib/geometry/phantoms/30cmx30cmx30cm\_box\_xyz\_water.geom

single 30cm voxel filled with water

**5.0cmx5.0cmx5.0cm\_2mm\_xyz\_breast.geom****File Location:** lib/geometry/phantoms/5.0cmx5.0cmx5.0cm\_2mm\_xyz\_breast.geom*No description available***5.0cmx5.0cmx5.0cm\_2mm\_xyz\_water.geom****File Location:** lib/geometry/phantoms/5.0cmx5.0cmx5.0cm\_2mm\_xyz\_water.geom

-2.5cm &lt;= X, Y, Z &lt;= 2.5Cm with 0.2cm voxels

**50cmx50cmx50cm\_box\_xyz\_air.geom****File Location:** lib/geometry/phantoms/50cmx50cmx50cm\_box\_xyz\_air.geom*No description available***50cmx50cmx50cm\_box\_xyz\_water.geom****File Location:** lib/geometry/phantoms/50cmx50cmx50cm\_box\_xyz\_water.geom*No description available***80cmx80cm\_r101x0.1mm\_z203x0.1mm\_rz\_water.geom****File Location:** lib/geometry/phantoms/80cmx80cm\_r101x0.1mm\_z203x0.1mm\_rz\_water.geom

0 &lt;= r &lt;= 40cm, -40cm &lt;= Z &lt;= 40cm 0.01 cm voxels for 0 &lt;= r &lt;= 1.015cm and -1.015cm &lt;= z &lt;= 1.015cm

**80cmx80cm\_r101x0.5mm\_z203x0.5mm\_rz\_water.geom****File Location:** lib/geometry/phantoms/80cmx80cm\_r101x0.5mm\_z203x0.5mm\_rz\_water.geom

$0 \leq r \leq 40\text{cm}$ ,  $-40\text{cm} \leq Z \leq 40\text{cm}$  0.05 cm voxels for  $0 \leq r \leq 5.075\text{cm}$  and  $-5.075\text{cm} \leq z \leq 5.075\text{cm}$

**80cmx80cm\_r101x1.0mm\_z203x1.0mm\_rz\_water.geom****File Location:** lib/geometry/phantoms/80cmx80cm\_r101x1.0mm\_z203x1.0mm\_rz\_water.geom

$0 \leq r \leq 40\text{cm}$ ,  $-40\text{cm} \leq Z \leq 40\text{cm}$  0.1 cm voxels for  $0 \leq r \leq 10.15\text{cm}$  and  $-10.15\text{cm} \leq z \leq 10.15\text{cm}$

**80cmx80cm\_r101x2.0mm\_z203x2.0mm\_rz\_water.geom****File Location:** lib/geometry/phantoms/80cmx80cm\_r101x2.0mm\_z203x2.0mm\_rz\_water.geom

$0 \leq r \leq 40\text{cm}$ ,  $-40\text{cm} \leq Z \leq 40\text{cm}$  0.2 cm voxels for  $0 \leq r \leq 20.3\text{cm}$  and  $-20.3\text{cm} \leq z \leq 20.3\text{cm}$

**80cmx80cmx80cm\_203x0.1mm\_xyz\_water.geom****File Location:** lib/geometry/phantoms/80cmx80cmx80cm\_203x0.1mm\_xyz\_water.geom

$-40\text{cm} \leq X, Y, Z \leq 40\text{cm}$  0.01cm voxels for  $-1.015 \leq X, Z \leq 1.015\text{cm}$ , and a 0.01cm voxel from  $-0.005\text{cm} \leq Y \leq 0.005\text{cm}$

**80cmx80cmx80cm\_203x0.5mm\_xyz\_water.geom****File Location:** lib/geometry/phantoms/80cmx80cmx80cm\_203x0.5mm\_xyz\_water.geom

$-40\text{cm} \leq X, Y, Z \leq 40\text{cm}$  0.05cm voxels for  $-5.075 \leq X, Z \leq 5.075\text{cm}$ , and a 0.05cm voxel from  $-0.025\text{cm} \leq Y \leq 0.025\text{cm}$

**80cmx80cmx80cm\_203x1.0mm\_xyz\_water.geom****File Location:** lib/geometry/phantoms/80cmx80cmx80cm\_203x1.0mm\_xyz\_water.geom

$-40\text{cm} \leq X, Y, Z \leq 40\text{cm}$  0.1cm voxels for  $-10.15\text{cm} \leq X, Z \leq 10.15\text{cm}$ , and a 0.1cm voxel from  $-0.05\text{cm} \leq Y \leq 0.05\text{cm}$

**80cmx80cmx80cm\_203x2.0mm\_xyz\_water.geom****File Location:** lib/geometry/phantoms/80cmx80cmx80cm\_203x2.0mm\_xyz\_water.geom

$-40\text{cm} \leq X, Y, Z \leq 40\text{cm}$  0.2cm voxels for  $-20.3\text{cm} \leq X, Z \leq 20.3\text{cm}$ , and a 0.2cm voxel from  $-0.1\text{cm} \leq Y \leq 0.1\text{cm}$

**ptv\_3.4cmx2.8cmx3.8cm\_2mm\_xyz\_prostate.geom**

**File Location:** lib/geometry/phantoms/ptv\_3.4cmx2.8cmx3.8cm\_2mm\_xyz\_prostate.geom

*No description available*

**ptv\_3.4cmx2.8cmx3.8cm\_2mm\_xyz\_water.geom**

**File Location:** lib/geometry/phantoms/ptv\_3.4cmx2.8cmx3.8cm\_2mm\_xyz\_water.geom

*No description available*

**sk\_10cm\_0.1cm.geom**

**File Location:** lib/geometry/phantoms/sk\_10cm\_0.1cm.geom

0.05x0.1x0.1 cm voxel at 10cm away along transverse axis for scoring air kerma strength

**sk\_10cm\_2.66cm.geom**

**File Location:** lib/geometry/phantoms/sk\_10cm\_2.66cm.geom

0.05x2.66x2.66 cm voxel at 10cm away along transverse axis for scoring air kerma strength

## 2.3 Applicator Library

The current list of applicators available in the egs\_brachy geometry library.

**TG186\_applicator.geom**

**File Location:** lib/geometry/applicators/TG186/TG186\_applicator.geom

Generic shielded applicator from the AAPM Working Group on Model-Based Dose Calculation Algorithms (MBDCA)  
This is commonly referred to as the TG-186 applicator.

## 2.4 Eye Plaques Library

The current list of eye plaques available in the egs\_brachy geometry library.

## 2.5 Transformation Sets

The current list of predefined transformation sets available in the egs\_brachy geometry library.

**100seeds\_grid\_5x7mmx4x7mmx5x8mm\_0.5mm\_perturb\_in\_z****File Location:** lib/geometry/transformations/100seeds\_grid\_5x7mmx4x7mmx5x8mm\_0.5mm\_perturb\_in\_z*No description available***125seeds\_0.5cm\_grid****File Location:** lib/geometry/transformations/125seeds\_0.5cm\_grid

Seed locations at -1, -0.5, 0, 0.5, 1 in X, Y, Z

**125seeds\_1cm\_grid****File Location:** lib/geometry/transformations/125seeds\_1cm\_grid

125 seed locations at -2, -1, 0, 1, 2 in X, Y, Z

**5\_seeds\_along\_z****File Location:** lib/geometry/transformations/5\_seeds\_along\_z

Seeds located along the z axis at: (0, 0, -2), (0, 0, -1), (0, 0, 0), (0, 0, 1), (0, 0, 2)

**64seeds\_grid\_4x4x4\_1.55cm\_0.55cm****File Location:** lib/geometry/transformations/64seeds\_grid\_4x4x4\_1.55cm\_0.55cm*No description available***PeppaBreastHDR192lr\_MBDCA-WG\_srcPosnRotn****File Location:** lib/geometry/transformations/PeppaBreastHDR192lr\_MBDCA-WG\_srcPosnRotn*No description available***single\_seed\_at\_origin****File Location:** lib/geometry/transformations/single\_seed\_at\_origin

A null transformation

**single\_seed\_at\_x7cm****File Location:** lib/geometry/transformations/single\_seed\_at\_x7cm*No description available*



# **Chapter 3**

## **media**

### **egs\_brachy Media & Muen Data**

#### **3.1 Peggless run materials**

The current list of media available for peggless runs is as follows:

**25GLAND-75ADIPOSE** rho = 0.9675

elements = H, C, N, O, NA, P, S, CL

mass fractions = 0.112, 0.5215, 0.01275, 0.34025, 0.001, 0.00025, 0.00125, 0.001

bremssstrahlung correction = NRC

**50GLAND-50ADIPOSE** rho = 0.985

elements = H, C, N, O, NA, P, S, CL

mass fractions = 0.11, 0.465, 0.0185, 0.4025, 0.001, 0.0005, 0.0015, 0.001

bremssstrahlung correction = NRC

**75GLAND-25ADIPOSE** rho = 1.0025

elements = H, C, N, O, NA, P, S, CL

mass fractions = 0.108, 0.3985, 0.02425, 0.46475, 0.001, 0.00075, 0.00175, 0.001

bremssstrahlung correction = NRC

**ADIPOSE2\_WW86** bremssstrahlung correction = NRC

density correction file = adiposetissue\_icru\_1986

**ADIPOSE\_PHANT** rho = 0.95

elements = H, C, N, O, NA, S, CL

mass fractions = 11.4, 58.9, 0.7, 28.7, 0.1, 0.1, 0.1

bremssstrahlung correction = NRC

**ADV\_PD\_POLY** rho = 1.2

elements = H, C, N, CL, PD

mass fractions = 0.08, 0.9, 0.03, 0.07, 0.01

bremssstrahlung correction = NRC

**AIR\_0.0012** rho = 1.2000E-03

elements = N, O, AR

mass fractions = 7.55000E-01, 2.32000E-01, 1.30000E-02

bremssstrahlung correction = NRC

gas pressure = 1.0

**AIR\_PHANT** rho = 0.0012  
elements = H, C, N, O, AR,  
mass fractions = 0.0732, 0.0123, 75.0325, 23.6077, 1.2743  
bremsstrahlung correction = NRC

**AIR\_TG43** rho = 0.0012  
elements = H, C, N, O, AR  
mass fractions = 0.0732, 0.0123, 75.0325, 23.6077, 1.2743  
gas pressure = 1.0  
bremsstrahlung correction = NRC

**AIR\_TG43\_LD** rho = 1.20e-13  
elements = H, C, N, O, AR  
mass fractions = 0.0732, 0.0123, 75.0325, 23.6077, 1.2743  
gas pressure = 1.0  
bremsstrahlung correction = NRC

**AQUEOUS\_MAR** rho = 1.0035  
elements = H, C, O, NA, CL  
mass fractions = 0.111, 0.001, 0.881, 0.003, 0.004  
bremsstrahlung correction = NRC

**Ag** bremsstrahlung correction = NRC  
density correction file = silver

**AgBrAgI\_6.20** rho = 6.20  
elements = AG, BR, I  
mass fractions = 0.536, 0.284, 0.180  
bremsstrahlung correction = NRC

**AgI** bremsstrahlung correction = NRC  
density correction file = silveriodide

**AgI\_6.003** rho = 6.003  
elements = AG, I  
mass fractions = 0.459458, 0.540542  
bremsstrahlung correction = NRC

**Al2O3** rho = 3.97  
elements = O, AL  
mass fractions = 0.470749, 0.529251  
bremsstrahlung correction = NRC

**Al** bremsstrahlung correction = NRC  
density correction file = aluminum

**AlN\_Y2O3\_0.05\_3.26** rho = 3.26  
elements = AL, N, O, Y  
mass fractions = 0.642, 0.333, 0.0053, 0.0197  
bremsstrahlung correction = NRC

**AlSilicate** rho = 2.81  
elements = O, SI, AL, NA, AG  
mass fractions = 0.407, 0.214, 0.166, 0.113, 0.1  
bremsstrahlung correction = NRC

**AlSilicate** rho = 2.81  
elements = O, SI, AL, NA, AG  
mass fractions = 0.407, 0.214, 0.166, 0.113, 0.1  
bremsstrahlung correction = NRC

**Alumina\_2.88** rho = 2.88  
elements = O, AL  
number of atoms = 3, 2  
bremsstrahlung correction = NRC

**Ar** bremsstrahlung correction = NRC  
density correction file = argon

**Ar** bremsstrahlung correction = NRC  
density correction file = argon

**Au80Cu20** rho = 15.5  
elements = AU, CU  
mass fractions = 80, 20  
bremsstrahlung correction = NRC

**Au** bremsstrahlung correction = NRC  
density correction file = gold

**BRAIN\_PHANT** rho = 1.05  
elements = H, C, N, O, NA, MG, P, S, CL, K  
mass fractions = 10.7, 14.4, 2.2, 71.3, 0.2, 0, 0.4, 0.2, 0.3, 0.3  
bremsstrahlung correction = NRC

**BRAIN\_WMATTER\_WW1986** rho = 1.04  
elements = H, C, N, O, NA, P, S, CL, K  
mass fractions = 0.106, 0.194, 0.025, 0.661, 0.002, 0.004, 0.002, 0.003, 0.003  
bremsstrahlung correction = NRC

**C12H18NCl** rho = 1.2  
elements = H, C, N, CL  
number of atoms = 18, 12, 1, 1  
bremsstrahlung correction = NRC

**C85.7H14.3** rho = 1.0  
elements = C, H  
mass fractions = 85.7, 14.3  
bremsstrahlung correction = NRC

**CALCIFICATION\_ICRU46** rho = 3.06  
elements = H, C, N, O, P, CA  
mass fractions = 0.003, 0.016, 0.005, 0.407, 0.187, 0.382  
bremsstrahlung correction = NRC

**CARTILAGE\_PHANT** rho = 1.1  
elements = H, C, N, O, NA, P, S, CL  
mass fractions = 9.6, 9.9, 2.2, 74.4, 0.5, 2.2, 0.9, 0.3  
bremsstrahlung correction = NRC

**CORNEA\_COLLSTRUCMECH\_ZIE** rho = 1.05  
elements = H, C, N, O, S  
mass fractions = 0.1016, 0.1199, 0.0364, 0.7411, 0.0009  
bremsstrahlung correction = NRC

**CORTICAL\_BONE\_WW86** bremsstrahlung correction = NRC  
density correction file = bone\_cortical\_icru\_1986

**CRANIUM\_PHANT** rho = 1.245  
elements = H, C, N, O, NA, MG, P, S, CL, K  
mass fractions = 8.1, 31.7, 2.8, 45.1, 0.2, 0.1, 3.7, 0.3, 0.1, 0.1  
bremsstrahlung correction = NRC

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**CS10\_polymer** rho = 1.15  
elements = H, C, N, O  
mass fractions = 0.085, 0.648, 0.05, 0.217  
bremsstrahlung correction = NRC

**Co** bremsstrahlung correction = NRC  
density correction file = cobalt

**Cu** bremsstrahlung correction = NRC  
density correction file = copper

**DENSIMET\_D176** rho = 17.6  
elements = FE, NI, W  
mass fractions = 0.025, 0.05, 0.925  
bremsstrahlung correction = NRC

**EXTERNAL\_1.00** rho = 1.00  
elements = H, C, N, O, P, S, CL  
mass fractions = 1.08000E-01, 3.56000E-01, 2.20000E-02, 5.09000E-01, 1.00000E-03, 2.00000E-03, 2.00000E-03  
bremsstrahlung correction = NRC

**EYES\_PHANT** rho = 1.05  
elements = H, C, N, O, NA, MG, P, S, CL  
mass fractions = 9.7, 18.3, 5.4, 66, 0.1, 0, 0.1, 0.3, 0.1  
bremsstrahlung correction = NRC

**F\_SOFT\_TISSUE\_ICRU46** rho = 1.02  
elements = H, C, N, O, NA, P, S, CL, K  
mass fractions = 0.106, 0.315, 0.024, 0.547, 0.001, 0.002, 0.002, 0.001, 0.002  
bremsstrahlung correction = NRC

**GLAND2\_WW86** bremsstrahlung correction = NRC  
density correction file = breasttissue\_icru\_1986

**GLAND\_PHANT** rho = 1.03  
elements = H, C, N, O, NA, P, S, CL, K  
mass fractions = 10.5, 23.5, 2.8, 62.2, 0.1, 0.2, 0.3, 0.2, 0.2  
bremsstrahlung correction = NRC

**Graphite2.26** bremsstrahlung correction = NRC  
density correction file = carbon\_graphite\_2.265g\_cm3

**HEART\_1.05** rho = 1.05  
elements = H, C, N, O, NA, P, S, CL, K  
mass fractions = 9.85000E-02, 1.70500E-01, 4.60000E-02, 6.72500E-01, 4.00000E-03, 1.00000E-03, 4.00000E-03, 2.50000E-03, 1.00000E-03  
bremsstrahlung correction = NRC

**HEART\_BLOODFILLED\_WW86** bremsstrahlung correction = NRC  
density correction file = heart\_blood-filled\_icru\_1986

**I** bremsstrahlung correction = NRC  
density correction file = iodine

**IPPlant\_active** rho = 2.58  
elements = SI, XE, I, TE  
mass fractions = 0.976174, 0.023804, 1.6e-05, 6e-06  
bremsstrahlung correction = NRC

**Ir70Pt30** rho = 21.76  
elements = IR, PT  
mass fractions = 70, 30  
bremsstrahlung correction = NRC

**Ir** bremsstrahlung correction = NRC  
density correction file = iridium

**Ir** bremsstrahlung correction = NRC  
density correction file = iridium

**KOVAR** rho = 8.36  
elements = C, SI, MN, FE, CO, NI  
mass fractions = 0.0002, 0.002, 0.003, 0.5348, 0.17, 0.29  
bremsstrahlung correction = NRC

**LENS\_ICRU** rho = 1.07  
elements = H, C, N, O, NA, P, S, CL  
mass fractions = 0.096, 0.195, 0.057, 0.646, 0.001, 0.001, 0.003, 0.001  
bremsstrahlung correction = NRC

**LUNGS\_0.26** rho = 0.26  
elements = H, C, N, O, NA, P, S, CL, K  
mass fractions = 1.03000E-01, 1.05000E-01, 3.10000E-02, 7.49000E-01, 2.00000E-03, 2.00000E-03, 3.00000E-03, 3.00000E-03, 2.00000E-03  
bremsstrahlung correction = NRC

**LUNG\_BLOODFILLED\_WW86** bremsstrahlung correction = NRC  
density correction file = lung\_inflated\_icru\_1986

**MANDIBLE\_PHANT** rho = 1.189  
elements = H, C, N, O, NA, MG, P, S, CL, K  
mass fractions = 8.7, 35.7, 2.6, 42.9, 0.2, 0.1, 3, 0.3, 0.1, 0.1  
bremsstrahlung correction = NRC

**MINERALBONE\_PHANT** rho = 1.92  
elements = H, C, N, O, NA, MG, P, S  
mass fractions = 3.6, 15.9, 4.2, 44.8, 0.3, 0.2, 9.4, 0.3  
bremsstrahlung correction = NRC

**MODULAY** rho = 15.8  
elements = AU, AG, CU, PD  
mass fractions = 0.77, 0.14, 0.08, 0.01  
bremsstrahlung correction = NRC

**MUSCLE2\_WW86** bremsstrahlung correction = NRC  
density correction file = muscle\_skeletal\_icru\_1986

**MUSCLE\_PHANT** rho = 1.05  
elements = H, C, N, O, NA, P, S, CL, K  
mass fractions = 10.2, 14.2, 3.4, 71.1, 0.1, 0.2, 0.3, 0.1, 0.4  
bremsstrahlung correction = NRC

**M\_SOFT\_TISSUE\_ICRU46** rho = 1.03  
elements = H, C, N, O, NA, P, S, CL, K  
mass fractions = 0.105, 0.256, 0.027, 0.602, 0.001, 0.002, 0.003, 0.002, 0.002  
bremsstrahlung correction = NRC

**Mo** bremsstrahlung correction = NRC  
density correction file = molybdenum

**Ni** bremsstrahlung correction = NRC  
density correction file = nickel

**P50C50** rho = 1.5524  
elements = H, C, N, O, NA, P, S, K, CA  
mass fractions = 0.054, 0.0525, 0.015, 0.5905, 0.001, 0.094, 0.001, 0.001, 0.191  
bremsstrahlung correction = NRC

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**PMMA** bremsstrahlung correction = NRC  
density correction file = polymethylmethacrylate\_lucite\_perspex\_plexiglas

**PROSTATE\_WW86** rho = 1.04  
elements = H, C, N, O, NA, P, S, CL  
mass fractions = 0.105, 0.089, 0.025, 0.774, 0.002, 0.001, 0.002, 0.002  
bremsstrahlung correction = NRC

**PTV\_1.02** rho = 1.02  
elements = H, C, N, O, P, S, CL  
mass fractions = 1.08000E-01, 3.56000E-01, 2.20000E-02, 5.09000E-01, 1.00000E-03, 2.00000E-03, 2.00000E-03  
bremsstrahlung correction = NRC

**Pb** bremsstrahlung correction = NRC  
density correction file = lead

**Pd** bremsstrahlung correction = NRC  
density correction file = palladium

**Pollucite** rho = 2.9  
elements = SI, TI, AL, B, MG, CA, NA, CS, O  
mass fractions = 0.2618, 0.03, 0.0159, 0.0373, 0.0121, 0.0286, 0.1261, 0.0094, 0.4789  
bremsstrahlung correction = NRC

**PolySty** rho = 1.06  
elements = H, C  
mass fractions = 0.077418, 0.922582  
bremsstrahlung correction = NRC

**PolySty** rho = 1.06  
elements = H, C  
mass fractions = 0.077418, 0.922582  
bremsstrahlung correction = NRC

**Poly\_Best2335\_0.5gpcm** rho = 0.5  
elements = H, C, O, N  
mass fractions = 7.85, 89.73, 1.68, 0.74  
bremsstrahlung correction = NRC

**Poly\_for\_BestPd103\_1gpcm** rho = 1.0  
elements = H, C, O, N  
mass fractions = 7.85, 89.73, 1.68, 0.74  
bremsstrahlung correction = NRC

**Poly\_for\_BestPd103\_1gpcm** rho = 1.0  
elements = H, C, O, N  
mass fractions = 7.85, 89.73, 1.68, 0.74  
bremsstrahlung correction = NRC

**Pt70Ir30** rho = 21.68  
elements = PT, IR  
mass fractions = 70, 30  
bremsstrahlung correction = NRC

**Pt75Ir25** rho = 21.68  
elements = PT, IR  
mass fractions = 70, 30  
bremsstrahlung correction = NRC

**Pt90Ir10** rho = 21.45  
elements = PT, IR  
mass fractions = 90, 10  
bremsstrahlung correction = NRC

**Pt90Ir10** rho = 21.45  
elements = PT, IR  
mass fractions = 90, 10  
bremsstrahlung correction = NRC

**Pt** bremsstrahlung correction = NRC  
density correction file = platinum

**Pyrex\_2.4** rho = 2.4  
elements = B, O, NA, AL, SI, K  
mass fractions = 0.040064, 0.539562, 0.028191, 0.011644, 0.37722, 0.003321  
bremsstrahlung correction = NRC

**Pyrex\_2.4** rho = 2.4  
elements = B, O, NA, AL, SI, K  
mass fractions = 0.040064, 0.539562, 0.028191, 0.011644, 0.37722, 0.003321  
bremsstrahlung correction = NRC

**Pyrex\_2.4\_Cs** rho = 2.4  
elements = B, O, NA, AL, SI, K, CS  
mass fractions = 0.0400632, 0.539551, 0.0281904, 0.0116438, 0.377213, 0.00332093, 2e-05  
bremsstrahlung correction = NRC

**Pyrex\_2.4\_Cs** rho = 2.4  
elements = B, O, NA, AL, SI, K, CS  
mass fractions = 0.0400632, 0.539551, 0.0281904, 0.0116438, 0.377213, 0.00332093, 2e-05  
bremsstrahlung correction = NRC

**RECTUM\_ICRP23** rho = 0.75  
elements = H, C, N, O, NA, P, CL, K  
mass fractions = 0.063, 0.121, 0.022, 0.788, 0.0001, 0.001, 0.001, 0.001  
bremsstrahlung correction = NRC

**RIBS\_1.92** rho = 1.92  
elements = H, C, N, O, NA, MG, P, S, CA  
mass fractions = 3.40000E-02, 1.55000E-01, 4.20000E-02, 4.35000E-01, 1.00000E-03, 2.00000E-03, 1.03000E-01, 3.00000E-03, 2.25000E-01  
bremsstrahlung correction = NRC

**SCLERA\_COLLSTRUCMECH\_ZIE** rho = 1.05  
elements = H, C, N, O, S  
mass fractions = 0.097, 0.1696, 0.0499, 0.6831, 0.0003  
bremsstrahlung correction = NRC

**SILASTIC** rho = 1.12  
elements = H, C, O, SI, PT  
mass fractions = 0.063, 0.249, 0.289, 0.399, 5e-05  
bremsstrahlung correction = NRC

**SKIN2\_WW86** bremsstrahlung correction = NRC  
density correction file = skin\_icru\_1986

**SKIN\_1.09** rho = 1.09  
elements = H, C, N, O, NA, P, S, CL, K, CA  
mass fractions = 9.50000E-02, 4.55000E-01, 2.50000E-02, 3.55000E-01, 1.00000E-03, 2.10000E-02, 1.00000E-03, 1.00000E-03, 1.00000E-03, 4.50000E-02  
bremsstrahlung correction = NRC

**SKIN\_PHANT** rho = 1.09  
elements = H, C, N, O, NA, MG, P, S, CL, K  
mass fractions = 10, 19.9, 4.2, 65, 0.2, 0, 0.1, 0.2, 0.3, 0.1  
bremsstrahlung correction = NRC

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**SS\_AISI301** rho = 8.0  
elements = C, SI, CR, P, MN, FE, S, NI  
mass fractions = 0.15, 1, 17, 0.045, 2, 71.77, 0.03, 7  
bremsstrahlung correction = NRC

**SS\_AISI301** rho = 8.0  
elements = C, SI, CR, P, MN, FE, S, NI  
mass fractions = 0.15, 1, 17, 0.045, 2, 71.77, 0.03, 7  
bremsstrahlung correction = NRC

**SS\_AISI304** rho = 8.02  
elements = NI, SI, CR, MN, FE  
mass fractions = 0.1, 0.01, 0.19, 0.02, 0.68  
bremsstrahlung correction = NRC

**SS\_AISI304\_p5.6** rho = 5.6  
elements = NI, SI, CR, MN, FE  
mass fractions = 0.1, 0.01, 0.19, 0.02, 0.68  
bremsstrahlung correction = NRC

**SS\_AISI316L** rho = 8.06  
elements = SI, CR, MN, FE, NI, MO  
mass fractions = 0.007, 0.17, 0.01, 0.668, 0.12, 0.025  
bremsstrahlung correction = NRC

**SS\_AISI316L** rho = 8.06  
elements = SI, CR, MN, FE, NI, MO  
mass fractions = 0.007, 0.17, 0.01, 0.668, 0.12, 0.025  
bremsstrahlung correction = NRC

**SS\_AISI316L\_p5.0** rho = 5.0  
elements = NI, FE, MN, CR, SI  
mass fractions = 0.12, 0.68, 0.02, 0.17, 0.01  
bremsstrahlung correction = NRC

**SS\_AISI316L\_p6.9** rho = 6.9  
elements = SI, CR, MN, FE, NI, MO  
mass fractions = 0.007, 0.17, 0.01, 0.668, 0.12, 0.025  
bremsstrahlung correction = NRC

**SS\_AISI316L\_p7.8** rho = 7.8  
elements = SI, CR, MN, FE, NI, MO  
mass fractions = 0.007, 0.17, 0.01, 0.668, 0.12, 0.025  
bremsstrahlung correction = NRC

**SS\_AISI316L\_p8.02** rho = 8.02  
elements = NI, FE, MN, CR, SI  
mass fractions = 0.12, 0.68, 0.02, 0.17, 0.01  
bremsstrahlung correction = NRC

**SS\_AISI316L\_rho4.81** rho = 4.81  
elements = SI, CR, MN, FE, NI, MO  
mass fractions = 0.007, 0.17, 0.01, 0.668, 0.12, 0.025  
bremsstrahlung correction = NRC

**SS\_AISI321** rho = 8.027  
elements = C, SI, CR, TI, FE, NI, W  
mass fractions = 0.11, 0.2, 18.2, 0.6, 72.04, 8.2, 0.6  
bremsstrahlung correction = NRC

**SS\_AISI321** rho = 8.027  
elements = C, SI, CR, TI, FE, NI, W  
mass fractions = 0.11, 0.2, 18.2, 0.6, 72.04, 8.2, 0.6  
bremsstrahlung correction = NRC

**SS\_PROBE\_RHO8.0** rho = 8.0  
elements = NI, FE, MN, CR, SI, C, P  
mass fractions = 0.095, 0.68375, 0.02, 0.19, 0.01, 0.0008, 0.00045  
bremsstrahlung correction = NRC

**SdVBC24H24** rho = 1.26  
elements = C, H  
mass fractions = 0.9167, 0.0833  
bremsstrahlung correction = NRC

**SiO2** rho = 2.32  
elements = O, SI  
mass fractions = 0.532565, 0.467435  
bremsstrahlung correction = NRC

**TEETH\_PHANT** rho = 2.75  
elements = H, C, N, O, MG, P  
mass fractions = 2.2, 9.5, 2.9, 42.1, 0.7, 13.7  
bremsstrahlung correction = NRC

**Ti10W90** rho = 17.824  
elements = W, TI  
mass fractions = 0.9, 0.1  
bremsstrahlung correction = NRC

**Ti10W90** rho = 17.824  
elements = W, TI  
mass fractions = 0.9, 0.1  
bremsstrahlung correction = NRC

**Ti44.4Ni55.6** rho = 6.5  
elements = NI, TI  
mass fractions = 55.6, 44.4  
bremsstrahlung correction = NRC

**Ti** bremsstrahlung correction = NRC  
density correction file = titanium

**Ti\_grade2** rho = 4.512  
elements = H, C, N, O, FE, TI  
mass fractions = 0.00015, 0.001, 0.0003, 0.0025, 0.002, 0.99405  
bremsstrahlung correction = NRC

**URETHRA\_WW86** rho = 1.04  
elements = H, C, N, O, NA, P, S, CL  
mass fractions = 0.105, 0.089, 0.025, 0.774, 0.002, 0.001, 0.002, 0.002  
bremsstrahlung correction = NRC

**URINARY\_BLADDER\_EMPTY** rho = 1.04  
elements = H, C, N, O, NA, P, S, CL, K  
mass fractions = 0.105, 0.096, 0.026, 0.761, 0.002, 0.002, 0.003, 0.003  
bremsstrahlung correction = NRC

**URINARY\_BLADDER\_FULL** rho = 1.03  
elements = H, C, N, O, NA, P, S, CL, K  
mass fractions = 0.108, 0.035, 0.015, 0.83, 0.003, 0.001, 0.001, 0.005, 0.002  
bremsstrahlung correction = NRC

**VITREOUS\_TUMRAM\_MAR** rho = 1.0071  
elements = H, O, NA, CL, K  
mass fractions = 0.1109, 0.8804, 0.0038, 0.0045, 0.0003  
bremsstrahlung correction = NRC

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**W** bremsstrahlung correction = NRC  
 density correction file = tungsten

**W** bremsstrahlung correction = NRC  
 density correction file = tungsten

**WATER\_0.998** rho = 0.998  
 elements = H, O  
 number of atoms = 2, 1  
 bremsstrahlung correction = NRC

**Yb169** bremsstrahlung correction = NRC  
 density correction file = ytterbium

**melanoma1\_maughan** rho = 1.05  
 elements = H, C, N, O, NA, P, S, CL, K  
 mass fractions = 0.094, 0.212, 0.056, 0.615, 0.00253, 0.00506, 0.00644, 0.00391, 0.00506  
 bremsstrahlung correction = NRC

**quartz\_2.21** rho = 2.21  
 elements = Si, O  
 number of atoms = 1, 2  
 bremsstrahlung correction = NRC

## 3.2 Materials with Muen data

The current list of media with muen data available for scoring dose with the tracklength estimator is as follows:

### 3.2.1 brachy\_xcom\_1.5MeV\_egsphant.muendat

**File Location:** ..//lib/muen/brachy\_xcom\_1.5MeV\_egsphant.muendat

**10GLAND-90ADIPOSE** Medium used is 10GLAND-90ADIPOSE found in brachy\_xcom\_1.5MeV\_nelson  
 Number of energy intervals is 2000

**25GLAND-75ADIPOSE** Medium used is 25GLAND-75ADIPOSE found in brachy\_xcom\_1.5MeV\_nelson  
 Number of energy intervals is 2000

**50GLAND-50ADIPOSE** Medium used is 50GLAND-50ADIPOSE found in brachy\_xcom\_1.5MeV\_nelson  
 Number of energy intervals is 2000

**75GLAND-25ADIPOSE** Medium used is 75GLAND-25ADIPOSE found in brachy\_xcom\_1.5MeV\_nelson  
 Number of energy intervals is 2000

**80ADIPOSE-20GLAND** Medium used is 80ADIPOSE-20GLAND found in brachy\_xcom\_1.5MeV\_nelson  
 Number of energy intervals is 2000

**80ADIPOSE-20GLAND\_M** Medium used is 80ADIPOSE-20GLAND\_M found in brachy\_xcom\_1.5MeV\_nelson  
 Number of energy intervals is 2000

**90GLAND-10ADIPOSE** Medium used is 90GLAND-10ADIPOSE found in brachy\_xcom\_1.5MeV\_nelson  
 Number of energy intervals is 2000

**A10C90** Medium used is A10C90 found in brachy\_xcom\_1.5MeV\_nelson  
 Number of energy intervals is 2000

**A15C85** Medium used is A15C85 found in brachy\_xcom\_1.5MeV\_nelson  
 Number of energy intervals is 2000

**A20C80** Medium used is A20C80 found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**A25C75** Medium used is A25C75 found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**A30C70** Medium used is A30C70 found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**A35C65** Medium used is A35C65 found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**A40C60** Medium used is A40C60 found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**A45C55** Medium used is A45C55 found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**A50C50** Medium used is A50C50 found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**A55C45** Medium used is A55C45 found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**A5C95** Medium used is A5C95 found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**A60C40** Medium used is A60C40 found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**A65C35** Medium used is A65C35 found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**A70C30** Medium used is A70C30 found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**A75C25** Medium used is A75C25 found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**A80C20** Medium used is A80C20 found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**A85C15** Medium used is A85C15 found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**A90C10** Medium used is A90C10 found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**A95C5** Medium used is A95C5 found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**ADIPOSE1\_WW86** Medium used is ADIPOSE1\_WW86 found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**ADIPOSE2\_WW86** Medium used is ADIPOSE2\_WW86 found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**ADIPOSE3\_WW86** Medium used is ADIPOSE3\_WW86 found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**ADIPOSE\_H79** Medium used is ADIPOSE\_H79 found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**AGAR** Medium used is AGAR found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

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**AIR\_TG43** Medium used is AIR\_TG43 found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**AIR\_TG43\_LD** Medium used is AIR\_TG43\_LD found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**CALCIFICATION\_AUS1\_HCO** Medium used is CALCIFICATION\_AUS1\_HCO found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**CALCIFICATION\_AUS1\_O** Medium used is CALCIFICATION\_AUS1\_O found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**CALCIFICATION\_AUS2\_HCO** Medium used is CALCIFICATION\_AUS2\_HCO found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**CALCIFICATION\_AUS2\_O** Medium used is CALCIFICATION\_AUS2\_O found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**CALCIFICATION\_AUS3\_HCO** Medium used is CALCIFICATION\_AUS3\_HCO found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**CALCIFICATION\_AUS3\_O** Medium used is CALCIFICATION\_AUS3\_O found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**CALCIFICATION\_AUS4\_HCO** Medium used is CALCIFICATION\_AUS4\_HCO found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**CALCIFICATION\_AUS4\_O** Medium used is CALCIFICATION\_AUS4\_O found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**CARTILAGE\_WW86** Medium used is CARTILAGE\_WW86 found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**CORTICAL\_BONE\_WW86** Medium used is CORTICAL\_BONE\_WW86 found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**EYELENS\_ICRU46** Medium used is EYELENS\_ICRU46 found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**F\_SOFT\_TISSUE\_ICRU46** Medium used is F\_SOFT\_TISSUE\_ICRU46 found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**GITRACT\_ICRU46** Medium used is GITRACT\_ICRU46 found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**GLAND1\_WW86** Medium used is GLAND1\_WW86 found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**GLAND2\_WW86** Medium used is GLAND2\_WW86 found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**GLAND2\_WW98** Medium used is GLAND2\_WW98 found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**GLAND3\_WW86** Medium used is GLAND3\_WW86 found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**GLAND\_H79** Medium used is GLAND\_H79 found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**HEART1\_WW86** Medium used is HEART1\_WW86 found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**HEART2\_WW86** Medium used is HEART2\_WW86 found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**HEART3\_WW86** Medium used is HEART3\_WW86 found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**HEART\_BLOODFILLED\_WW86** Medium used is HEART\_BLOODFILLED\_WW86 found in brachy\_xcom\_1.5←  
MeV\_nelson  
Number of energy intervals is 2000

**LUNG\_BLOODFILLED\_WW86** Medium used is LUNG\_BLOODFILLED\_WW86 found in brachy\_xcom\_1.5MeV←  
\_nelson  
Number of energy intervals is 2000

**LUNG\_UNITRHO** Medium used is LUNG\_UNITRHO found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**MUSCLE1\_WW86** Medium used is MUSCLE1\_WW86 found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**MUSCLE2\_WW86** Medium used is MUSCLE2\_WW86 found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**MUSCLE3\_WW86** Medium used is MUSCLE3\_WW86 found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**M\_SOFT\_TISSUE\_ICRU46** Medium used is M\_SOFT\_TISSUE\_ICRU46 found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**P10C90** Medium used is P10C90 found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**P15C85** Medium used is P15C85 found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**P20C80** Medium used is P20C80 found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**P25C75** Medium used is P25C75 found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**P30C70** Medium used is P30C70 found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**P35C65** Medium used is P35C65 found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**P40C60** Medium used is P40C60 found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**P45C55** Medium used is P45C55 found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**P50C50** Medium used is P50C50 found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**P55C45** Medium used is P55C45 found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**P5C95** Medium used is P5C95 found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

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**P60C40** Medium used is P60C40 found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**P65C35** Medium used is P65C35 found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**P70C30** Medium used is P70C30 found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**P75C25** Medium used is P75C25 found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**P80C20** Medium used is P80C20 found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**P85C15** Medium used is P85C15 found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**P90C10** Medium used is P90C10 found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**P95C5** Medium used is P95C5 found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**PROSTATE\_01PCALC** Medium used is PROSTATE\_01PCALC found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**PROSTATE\_05PCALC** Medium used is PROSTATE\_05PCALC found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**PROSTATE\_1PCALC** Medium used is PROSTATE\_1PCALC found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**PROSTATE\_1p5PCALC** Medium used is PROSTATE\_1p5PCALC found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**PROSTATE\_3PCALC** Medium used is PROSTATE\_3PCALC found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**PROSTATE\_4PCALC** Medium used is PROSTATE\_4PCALC found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**PROSTATE\_5PCALC** Medium used is PROSTATE\_5PCALC found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**PROSTATE\_ICRP23** Medium used is PROSTATE\_ICRP23 found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**PROSTATE\_WW86** Medium used is PROSTATE\_WW86 found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**RECTUM\_ICRP23** Medium used is RECTUM\_ICRP23 found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**RED\_MARROW\_WW86** Medium used is RED\_MARROW\_WW86 found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**RIBS\_10\_WH87** Medium used is RIBS\_10\_WH87 found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**RIBS\_2\_6\_WH87** Medium used is RIBS\_2\_6\_WH87 found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**SKIN1\_WW86** Medium used is SKIN1\_WW86 found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**SKIN2\_WW86** Medium used is SKIN2\_WW86 found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**SKIN3\_WW86** Medium used is SKIN3\_WW86 found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**SKIN\_H79** Medium used is SKIN\_H79 found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**SOFT\_BONE\_ICRU44** Medium used is SOFT\_BONE\_ICRU44 found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**SPONGIOSA\_WW86** Medium used is SPONGIOSA\_WW86 found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**TISSUE\_ICRU33** Medium used is TISSUE\_ICRU33 found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**URETHRA\_WW86** Medium used is URETHRA\_WW86 found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**URINARY\_BLADDER** Medium used is URINARY\_BLADDER found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**URINARY\_BLADDER\_EMPTY** Medium used is URINARY\_BLADDER\_EMPTY found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**URINARY\_BLADDER\_FULL** Medium used is URINARY\_BLADDER\_FULL found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**URINE** Medium used is URINE found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**WATER\_0.998** Medium used is WATER\_0.998 found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**WATER\_1.000** Medium used is WATER\_1.000 found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

**YELLOW\_MARROW\_WW86** Medium used is YELLOW\_MARROW\_WW86 found in brachy\_xcom\_1.5MeV\_nelson  
Number of energy intervals is 2000

### 3.2.2 PeppaBreastHDR192lr\_MBDCA-WG\_muen.muendat

**File Location:** ..//lib/muen/PeppaBreastHDR192lr\_MBDCA-WG\_muen.muendat

**AIR\_0.0012** Medium used is mediaName found in PeppaCompareCase3\_WGMBDCA.pegs4dat  
Number of energy intervals is 2000

**EXTERNAL\_1.00** Medium used is mediaName found in PeppaCompareCase3\_WGMBDCA.pegs4dat  
Number of energy intervals is 2000

**HEART\_1.05** Medium used is mediaName found in PeppaCompareCase3\_WGMBDCA.pegs4dat  
Number of energy intervals is 2000

**LUNGS\_0.26** Medium used is mediaName found in PeppaCompareCase3\_WGMBDCA.pegs4dat  
Number of energy intervals is 2000

**PTV\_1.02** Medium used is mediaName found in PeppaCompareCase3\_WGMBDCA.pegs4dat  
Number of energy intervals is 2000

**RIBS\_1.92** Medium used is mediaName found in PeppaCompareCase3\_WGMBDCA.pegs4dat  
Number of energy intervals is 2000

**SKIN\_1.09** Medium used is mediaName found in PeppaCompareCase3\_WGMBDCA.pegs4dat  
Number of energy intervals is 2000

### 3.2.3 brachy\_xcom\_1.5MeV.muendat

**File Location:** ..//lib/muen/brachy\_xcom\_1.5MeV.muendat

**10GLAND-90ADIPOSE** Medium used is 10GLAND-90ADIPOSE found in brachy\_xcom\_1500keV  
Number of energy intervals is 2000

**25GLAND-75ADIPOSE** Medium used is 25GLAND-75ADIPOSE found in brachy\_xcom\_1500keV  
Number of energy intervals is 2000

**50GLAND-50ADIPOSE** Medium used is 50GLAND-50ADIPOSE found in brachy\_xcom\_1500keV  
Number of energy intervals is 2000

**75GLAND-25ADIPOSE** Medium used is 75GLAND-25ADIPOSE found in brachy\_xcom\_1500keV  
Number of energy intervals is 2000

**90GLAND-10ADIPOSE** Medium used is 90GLAND-10ADIPOSE found in brachy\_xcom\_1500keV  
Number of energy intervals is 2000

**ADIPOSE1\_WW86** Medium used is ADIPOSE1\_WW86 found in brachy\_xcom\_1500keV  
Number of energy intervals is 2000

**ADIPOSE2\_WW86** Medium used is ADIPOSE2\_WW86 found in brachy\_xcom\_1500keV  
Number of energy intervals is 2000

**ADIPOSE3\_WW86** Medium used is ADIPOSE3\_WW86 found in brachy\_xcom\_1500keV  
Number of energy intervals is 2000

**AIR\_TG43** Medium used is AIR\_TG43 found in brachy\_xcom\_1500keV  
Number of energy intervals is 2000

**AIR\_TG43\_LD** Medium used is AIR\_TG43\_LD found in brachy\_xcom\_1500keV  
Number of energy intervals is 2000

**CALCIFICATION** Medium used is CALCIFICATION found in brachy\_xcom\_1500keV  
Number of energy intervals is 2000

**CARTILAGE\_WW86** Medium used is CARTILAGE\_WW86 found in brachy\_xcom\_1500keV  
Number of energy intervals is 2000

**CORTICAL\_BONE\_WW86** Medium used is CORTICAL\_BONE\_WW86 found in brachy\_xcom\_1500keV  
Number of energy intervals is 2000

**EYELENS\_ICRU46** Medium used is EYELENS\_ICRU46 found in brachy\_xcom\_1500keV  
Number of energy intervals is 2000

**F\_SOFT\_TISSUE\_ICRU46** Medium used is F\_SOFT\_TISSUE\_ICRU46 found in brachy\_xcom\_1500keV  
Number of energy intervals is 2000

**GLAND2\_WW86** Medium used is GLAND2\_WW86 found in brachy\_xcom\_1500keV  
Number of energy intervals is 2000

**HEART1\_WW86** Medium used is HEART1\_WW86 found in brachy\_xcom\_1500keV  
Number of energy intervals is 2000

**HEART2\_WW86** Medium used is HEART2\_WW86 found in brachy\_xcom\_1500keV  
Number of energy intervals is 2000

**HEART3\_WW86** Medium used is HEART3\_WW86 found in brachy\_xcom\_1500keV  
Number of energy intervals is 2000

**HEART\_BLOODFILLED\_WW86** Medium used is HEART\_BLOODFILLED\_WW86 found in brachy\_xcom\_1500keV  
Number of energy intervals is 2000

**LUNG\_BLOODFILLED\_WW86** Medium used is LUNG\_BLOODFILLED\_WW86 found in brachy\_xcom\_1500keV  
Number of energy intervals is 2000

**LUNG\_UNITRHO** Medium used is LUNG\_UNITRHO found in brachy\_xcom\_1500keV  
Number of energy intervals is 2000

**MUSCLE1\_WW86** Medium used is MUSCLE1\_WW86 found in brachy\_xcom\_1500keV  
Number of energy intervals is 2000

**MUSCLE2\_WW86** Medium used is MUSCLE2\_WW86 found in brachy\_xcom\_1500keV  
Number of energy intervals is 2000

**MUSCLE3\_WW86** Medium used is MUSCLE3\_WW86 found in brachy\_xcom\_1500keV  
Number of energy intervals is 2000

**M\_SOFT\_TISSUE\_ICRU46** Medium used is M\_SOFT\_TISSUE\_ICRU46 found in brachy\_xcom\_1500keV  
Number of energy intervals is 2000

**PROSTATE\_WW86** Medium used is PROSTATE\_WW86 found in brachy\_xcom\_1500keV  
Number of energy intervals is 2000

**RED\_MARROW\_WW86** Medium used is RED\_MARROW\_WW86 found in brachy\_xcom\_1500keV  
Number of energy intervals is 2000

**RIBS\_10\_WH87** Medium used is RIBS\_10\_WH87 found in brachy\_xcom\_1500keV  
Number of energy intervals is 2000

**RIBS\_2\_6\_WH87** Medium used is RIBS\_2\_6\_WH87 found in brachy\_xcom\_1500keV  
Number of energy intervals is 2000

**SKIN1\_WW86** Medium used is SKIN1\_WW86 found in brachy\_xcom\_1500keV  
Number of energy intervals is 2000

**SKIN2\_WW86** Medium used is SKIN2\_WW86 found in brachy\_xcom\_1500keV  
Number of energy intervals is 2000

**SKIN3\_WW86** Medium used is SKIN3\_WW86 found in brachy\_xcom\_1500keV  
Number of energy intervals is 2000

**SOFT\_BONE\_ICRU44** Medium used is SOFT\_BONE\_ICRU44 found in brachy\_xcom\_1500keV  
Number of energy intervals is 2000

**SPONGIOSA\_WW86** Medium used is SPONGIOSA\_WW86 found in brachy\_xcom\_1500keV  
Number of energy intervals is 2000

**TISSUE\_ICRU33** Medium used is TISSUE\_ICRU33 found in brachy\_xcom\_1500keV  
Number of energy intervals is 2000

**WATER\_0.998** Medium used is WATER\_0.998 found in brachy\_xcom\_1500keV  
Number of energy intervals is 2000

**WATER\_1.000** Medium used is WATER\_1.000 found in brachy\_xcom\_1500keV  
Number of energy intervals is 2000

**YELLOW\_MARROW\_WW86** Medium used is YELLOW\_MARROW\_WW86 found in brachy\_xcom\_1500keV  
Number of energy intervals is 2000

---



## Chapter 4

# spectra

### egs\_brachy Spectra

The current list of spectra available in the egs\_brachy geometry library.

#### Cs131\_NNDC\_2.6\_line.spectrum

**File Location:** lib/spectra/Cs131\_NNDC\_2.6\_line.spectrum

NuDat 2.6 NNDC Cs131 spectrum Khazov et al. (2006)

#### Cs137\_NNDC\_2.6\_line.spectrum

**File Location:** lib/spectra/Cs137\_NNDC\_2.6\_line.spectrum

NuDat 2.6 NNDC Cs137 spectrum Browne and Tuli, Nuclear Data Sheets 108,2173 (2007)

#### I125\_NCRP\_line.spectrum

**File Location:** lib/spectra/I125\_NCRP\_line.spectrum

NCRP No.58 spectrum

#### I125\_TG43.spectrum

**File Location:** lib/spectra/I125\_TG43.spectrum

TG43 I125 spectrum

**Ir192\_NNDC.spectrum**

**File Location:** lib/spectra/Ir192\_NNDC.spectrum

NuDat 2.6 NNDC Ir192 spectrum

**Ir192\_NNDC\_2.6\_line.spectrum**

**File Location:** lib/spectra/Ir192\_NNDC\_2.6\_line.spectrum

NuDat 2.6 NNDC Ir192 spectrum Baglin (2012) beta- and EC decays

**Ir192\_bare\_1993.spectrum**

**File Location:** lib/spectra/Ir192\_bare\_1993.spectrum

192-Ir spectrum; Duchemin and Coursol 1993

**Pd103\_NNDC\_2.6\_line.spectrum**

**File Location:** lib/spectra/Pd103\_NNDC\_2.6\_line.spectrum

NNDC 2.6 Pd 103 spectrum

**Pd103\_TG43.spectrum**

**File Location:** lib/spectra/Pd103\_TG43.spectrum

TG43 Pd 103 spectrum

**Rh106\_ICRU72\_line.spectrum**

**File Location:** lib/spectra/Rh106\_ICRU72\_line.spectrum

Rh-106 spectra extracted from ICRP72 containing beta emissions

**Yb169\_NNDC\_2.6\_line.spectrum**

**File Location:** lib/spectra/Yb169\_NNDC\_2.6\_line.spectrum

NuDat 2.6 NNDC Yb169 full spectrum Baglin (2008)

**bareco60\_line.spectrum**

**File Location:** lib/spectra/bareco60\_line.spectrum

Bare 60Co spectrum with 2 gamma ray lines of equal intensity

# Chapter 5

## tests

### egs\_brachy Test Suite

The current list of tests available in the egs\_brachy test suite

#### Brem Cyl

**Test Directory:** tests/brem\_cyl

A test for ensuring x-ray sources mode is working. The test consists of a  $1\text{cm}^2$  beam of electrons incident on a thin cylindrical disc with dose being calculated in cylindrical slabs behind the target. The egs\_brachy energy deposition doses are compared with values calculated by dosrznrc.

#### Flu Cutoff

**Test Directory:** tests/flu\_cutoff

A test for ensuring that the fluorescent photon cutoff works. A monoenergetic source of 0.015keV is placed within a thin Ti sphere and photon counts are scored on the outer surface of the sphere. Normally there would be a fluorescent peak at  $\sim 4.5\text{keV}$  so when the `fluorescent photon cutoff` setting is set to 0.005 MeV that peak should not be present.

Two energy bins from 0-10keV and 10-20keV are used. If fluorescent photon cutoff feature is working correctly 100% of photons should be in the 10-20keV range.

#### Phsp Run

**Test Directory:** tests/phsp\_run

A test to compare a dose calculation using a phsp source with the equivalent ab-initio simulation.

## Phsp Scoring

### **Test Directory:** tests/phsp\_scoring

A test that generates an IAEAphsp source with egs\_brachy and then checks the IAEA file to make sure it was created correctly.

## Recycling

### **Test Directory:** tests/recycling

A test for ensuring doses calculated with recycling turned on are the same as doses without recycling.

## Scatter

### **Test Directory:** tests/scatter

A test for comparing egs\_brachy scatter dose calculations for an Ir192 sources with previously calculated values when egs\_brachy was in a known good state.

## Seeds In Xyz

### **Test Directory:** tests/seeds\_in\_xyz

A test for comparing dose calculated by egs\_brachy in a simple rectilinear phantom containing multiple 6702 sources (some of which are rotated/translated). The calculated dose is compared with dose values calculated when egs←brachy was in a known good state.

## Seeds In Xyz Genvelope

### **Test Directory:** tests/seeds\_in\_xyz\_genvelope

Same as tests/seeds\_in\_xyz except using a regular egs\_genvelope instead of an autoenvelope.

## Simple Dose Sph

### **Test Directory:** tests/simple\_dose\_sph

A very simple dose calculation in a spherical phantom with multiple media. The simple geometry allows a fast calculation with high precision for comparing against a previously calculated dose.

## Single Generator

### **Test Directory:** tests/single\_generator

This test ensures the 'single generator=no' and 'single\_generator=yes' options give the same results.

Gold standard dose distribution was generated with egs\_brachy and multiple\_generator.egsinp

## Source Energies

**Test Directory:** tests/source\_energies

A test to ensure initialized/escaping source/escaping geometry energy tallies are consistent with previously calculated values.

## Spec Absolute

**Test Directory:** tests/spec\_absolute

A test for comparing the total absolute photon counts on the surface of a source with the expected value. A uniform spectrum between 15keV-25keV in a near-vaccum source is used so the expected spectrum can easily be calculated analytically.

## Spec Eflu

**Test Directory:** tests/spec\_eflu

A test for comparing the calculated energy fluence spectrum on the surface of a source with the expected value. A uniform spectrum between 15keV-25keV in a near-vaccum source is used so the expected spectrum can easily be calculated analytically.

## Spec Vox

**Test Directory:** tests/spec\_vox

A test for comparing the calculated energy fluence spectrum in a phantom region with the expected value. A uniform spectrum between 15keV-25keV in a near-vaccum geometry is used so the expected spectrum can easily be calculated analytically.

## Stepped Source

**Test Directory:** tests/stepped\_source

A test for comparing the dose from a "stepped source" (i.e. superposition mode with variable activity) with previous calculations made when egs\_brachy was in a known good state.

## Tg43Mode

**Test Directory:** tests/tg43mode

A test to ensure egs\_brachy superposition mode calculations match previous calculations when egs\_brachy was in a known good state.

## Tg43Mode Recycle

**Test Directory:** tests/tg43mode\_recycle

A test to ensure superposition mode calculations with recycling turned on result in the same dose as superposition mode calculations without recycling.

## Tg43Mode Zeroweight

**Test Directory:** tests/tg43mode\_zeroweight

A test to ensure superposition mode calculations work when a source has zero weighting.

Gold standard dose distribution was generated with egs\_brachy and gold\_standard.egsinp

## Variable Activity

**Test Directory:** tests/variable\_activity

A test for comparing the dose from sources with different source weighting with calculations from when egs\_brachy was in a known good state.

## Variable W Recycling

**Test Directory:** tests/variable\_w\_recycling

A test for comparing the dose from sources with different source weighting and recycling on with calculations from when egs\_brachy was in a known good state.

Gold standard dose distribution was generated with egs\_brachy and gold\_standard.egsinp

## Volume Correction

**Test Directory:** tests/volume\_correction

A test of the egs\_brachy Monte Carlo volume correction routines. The volume of phantom voxels overlapped by sources and other phantoms are calculated by egs\_brachy and compared with analytical values.

# Chapter 6

## transport

### egs\_brachy Sample Transport Parameters

Sample Monte Carlo transport parameters for various simulations.

#### electron\_transport\_10keV

**File Location:** lib/transport/electron\_transport\_10keV

Turns on electron transport in the source and in the phantom, with electron cutoff energy set to 10 keV; photon cutoff energy is 1 keV.

#### high\_energy\_default

**File Location:** lib/transport/high\_energy\_default

Default MC parameters for high energy sources; electron cutoff energy 1.5 MeV, photon cutoff energy 1 keV.

#### high\_energy\_sk\_calc

**File Location:** lib/transport/high\_energy\_sk\_calc

Recommended for air-kerma strength calculations of high energy sources; electron cutoff energy 1.5 MeV, photon cutoff energy 10 keV.

#### low\_energy\_default

**File Location:** lib/transport/low\_energy\_default

Default MC parameters for low energy sources; electron cutoff energy 1.5 MeV, photon cutoff energy 1 keV.

## low\_energy\_sk\_calc

**File Location:** lib/transport/low\_energy\_sk\_calc

Recommended for air-kerma strength calculations of low energy sources; electron cutoff energy 1 MeV, photon cutoff energy 5 keV.

## xray\_source

**File Location:** lib/transport/xray\_source

Recommended for x-ray source simulations; electron cutoff energy 1 keV in the source geometry only (1 MeV elsewhere), photon cutoff energy 1 keV.

## **Chapter 7**

# **CLRP egs++ brachytherapy source models**

Work in progress...



# Chapter 8

## Namespace Index

### 8.1 Namespace List

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# Chapter 10

## Class Index

### 10.1 Class List

Here are the classes, structs, unions and interfaces with brief descriptions:

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<a href="#">EB_Application</a>	The main egs_brachy application class. See the <a href="#">Main Page</a> for full documentation . . . . .	121
<a href="#">EB_IAEASource</a>	A phase space file source for egs_brachy . . . . .	142
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<a href="#">EnergyFluenceSpectrumInVoxel</a>	A class for scoring the energy weighted spectrum (normalized to total radiant energy) of particles on the surface of a source geometry . . . . .	163
<a href="#">EnergyScoringStats</a>	Class to use for scoring information about total energy initialized, escaping sources etc . . . . .	166
<a href="#">EnergyWeightedSurfaceSpectrum</a>	A class for scoring the energy weighted spectrum (normalized to total radiant energy) of particles on the surface of a source geometry . . . . .	170
<a href="#">ebvolcor::FileResults</a>	. . . . .	172
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<a href="#">Latch</a>	A class for handling latch bits relevant to egs_brachy. The <a href="#">Latch</a> class listens for particle events and sets/unsets latch bits on the particle based on the event type . . . . .	189
<a href="#">muen::MuenDataParser</a>	Class for parsing muen data from a file . . . . .	193
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/home/randlet/projects/egs/egs_brachy_release/egs_brachy/ <a href="#">eb_volcor.h</a>	
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/home/randlet/projects/egs/egs_brachy_release/egs_brachy/ <a href="#">egs_brachy.cpp</a>	
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# Chapter 12

## Namespace Documentation

### 12.1 doc\_utils Namespace Reference

#### Functions

- def [find\\_file\\_descriptions](#) (dir\_path, include\_key=None)

#### 12.1.1 Function Documentation

##### 12.1.1.1 def doc\_utils.find\_file\_descriptions ( dir\_path, include\_key = None )

Definition at line 3 of file doc\_utils.py.

### 12.2 ebvolcor Namespace Reference

#### Classes

- struct [FileResults](#)
- class [Options](#)

*Volume correction initialization helper class.*
- struct [Results](#)

*Struct used to collect and output results about a volume correction run.*
- class [VolumeCorrector](#)

*An object for controlling the volume correction routine.*

#### TypeDefs

- typedef pair< int, int > [PhantRegT](#)

*PhantRegT is a pair of the form (PhantomNumber, PhantomRegion) e.g. a pair of (2, 12) would represent region 12 (i.e. the 13th region) of phantom 2 (i.e. the 3rd phantom)*
- typedef pair< int, EGS\_Float > [RegVolume](#)

*RegVolumeT is a pair of the form (RegionNumber, Volume)*
- typedef std::map< [PhantRegT](#), EGS\_I64 > [HitCounterT](#)

*HitCounterT is used for counting how many random points land in a given phantoms region.*

## Enumerations

- enum `VolCorMode` { `NO_CORRECTION`, `ZERO_DOSE`, `CORRECT_VOLUME` }

## Functions

- bool `isGZip` (istream &vfile)
- EGS\_Float `getShapeVolume` (EGS\_Input \*shape\_inp)
- void `readVolumes` (istream &vfile, vector< `RegVolume` > &reg\_volumes)
- int `loadVolumes` (string fname, vector< `RegVolume` > &reg\_volumes)

### 12.2.1 Typedef Documentation

#### 12.2.1.1 `typedef std::map<PhantRegT, EGS_I64> ebvolcor::HitCounterT`

`HitCounterT` is used for counting how many random points land in a given phantoms region.

Definition at line 90 of file `eb_volcor.h`.

#### 12.2.1.2 `typedef pair<int, int> ebvolcor::PhantRegT`

`PhantRegT` is a pair of the form (PhantomNumber, PhantomRegion) e.g. a pair of (2, 12) would represent region 12 (i.e. the 13th region) of phantom 2 (i.e. the 3rd phantom)

Definition at line 83 of file `eb_volcor.h`.

#### 12.2.1.3 `typedef pair<int, EGS_Float> ebvolcor::RegVolume`

`RegVolumeT` is a pair of the form (RegionNumber, Volume)

Definition at line 86 of file `eb_volcor.h`.

### 12.2.2 Enumeration Type Documentation

#### 12.2.2.1 `enum ebvolcor::VolCorMode`

Enumerator

`NO_CORRECTION`  
`ZERO_DOSE`  
`CORRECT_VOLUME`

Definition at line 78 of file `eb_volcor.h`.

### 12.2.3 Function Documentation

#### 12.2.3.1 EGS\_Float ebvolcor::getShapeVolume ( EGS\_Input \* *shape\_inp* )

getShapeVolume takes an EGS\_Input for a shape and returns the volume of the shape. Currently the volume will be calculated automatically for cylinders, spheres and box shapes. Other shapes must specify a volume using the *shape volume* input key. For example:

```
:start shape:  
    type = my_new_shape  
    input key 1 = 1234  
    input key 2= 5678  
    shape volume = 123456  
:stop shape:
```

If *shape volume* is present for a cylinder, sphere or box shape that value will be used and the automatic calculation will be ignored

Definition at line 77 of file eb\_volcor.cpp.

#### 12.2.3.2 bool ebvolcor::isGZip ( istream & *vfile* )

looks at first two bytes of a stream and checks if they match the file type specifiers for gzip files

Definition at line 54 of file eb\_volcor.cpp.

#### 12.2.3.3 int ebvolcor::loadVolumes ( string *fname*, vector< RegVolume > & *reg\_volumes* )

Definition at line 396 of file eb\_volcor.cpp.

#### 12.2.3.4 void ebvolcor::readVolumes ( istream & *vfile*, vector< RegVolume > & *reg\_volumes* )

Definition at line 385 of file eb\_volcor.cpp.

## 12.3 gen\_docs Namespace Reference

### Functions

- def [gen\\_docs \(\)](#)

### Variables

- list [modules](#)

### 12.3.1 Function Documentation

#### 12.3.1.1 def gen\_docs.gen\_docs ( )

Definition at line 17 of file gen\_docs.py.

### 12.3.2 Variable Documentation

#### 12.3.2.1 list gen\_docs.modules

**Initial value:**

```
1 = [
2     (gen_geom, "geom.md"),
3     (gen_specs, "spectra.md"),
4     (gen_transport, "transport.md"),
5     (gen_media, "media.md"),
6     (gen_tests, "tests.md"),
7 ]
```

Definition at line 8 of file gen\_docs.py.

## 12.4 gen\_geom Namespace Reference

### Functions

- def [get\\_readme](#) (dir\_path)
- def [get\\_filetype\\_links](#) (dir\_path, extension)
- def [get\\_images](#) (dir\_path)
- def [gen\\_geom\\_docs](#) (droot, title, is\_sources=False)
- def [gen\\_docs](#) (fname)

### Variables

- `root = os.path.join(.., "lib")`
- `abs_root = os.path.abspath(root)`
- `geom = os.path.join(abs_root, "geometry")`
- string `outfile = "geom.md"`

### 12.4.1 Function Documentation

#### 12.4.1.1 def gen\_geom.gen\_docs ( fname )

Definition at line 76 of file gen\_geom.py.

#### 12.4.1.2 def gen\_geom.gen\_geom\_docs ( droot, title, is\_sources=False )

Definition at line 36 of file gen\_geom.py.

12.4.1.3 def gen\_geom.get\_filetype\_links ( *dir\_path, extension* )

Definition at line 22 of file gen\_geom.py.

12.4.1.4 def gen\_geom.get\_images ( *dir\_path* )

Definition at line 29 of file gen\_geom.py.

12.4.1.5 def gen\_geom.get\_readme ( *dir\_path* )

Look in directory *dir\_path* for a file called README.md and return it's contents if available

Definition at line 10 of file gen\_geom.py.

## 12.4.2 Variable Documentation

12.4.2.1 *gen\_geom.abs\_root = os.path.abspath(root)*

Definition at line 7 of file gen\_geom.py.

12.4.2.2 *gen\_geom.geom = os.path.join(abs\_root, "geometry")*

Definition at line 8 of file gen\_geom.py.

12.4.2.3 *string gen\_geom.outfile = "geom.md"*

Definition at line 134 of file gen\_geom.py.

12.4.2.4 *gen\_geom.root = os.path.join(.., "lib")*

Definition at line 6 of file gen\_geom.py.

## 12.5 gen\_media Namespace Reference

### Functions

- def [get\\_pegless\\_materials \(\)](#)
- def [get\\_muen \(\)](#)
- def [gen\\_docs \(fname\)](#)

## Variables

- `root = os.path.join(.., "lib")`
- `abs_root = os.path.abspath(root)`
- `media_file = os.path.join(abs_root, "media", "material.dat")`
- `muen_dir = os.path.join(abs_root, "muen")`
- string `outfile = "media.md"`

### 12.5.1 Function Documentation

12.5.1.1 `def gen_media.gen_docs ( fname )`

Definition at line 64 of file `gen_media.py`.

12.5.1.2 `def gen_media.get_muen ( )`

Definition at line 33 of file `gen_media.py`.

12.5.1.3 `def gen_media.get_pegless_materials ( )`

Definition at line 8 of file `gen_media.py`.

### 12.5.2 Variable Documentation

12.5.2.1 `gen_media.abs_root = os.path.abspath(root)`

Definition at line 4 of file `gen_media.py`.

12.5.2.2 `gen_media.media_file = os.path.join(abs_root, "media", "material.dat")`

Definition at line 5 of file `gen_media.py`.

12.5.2.3 `gen_media.muen_dir = os.path.join(abs_root, "muen")`

Definition at line 6 of file `gen_media.py`.

12.5.2.4 `string gen_media.outfile = "media.md"`

Definition at line 99 of file `gen_media.py`.

12.5.2.5 `gen_media.root = os.path.join(.., "lib")`

Definition at line 3 of file `gen_media.py`.

## 12.6 gen\_specs Namespace Reference

### Functions

- def [get\\_spectra \(\)](#)
- def [gen\\_docs \(fname\)](#)

### Variables

- [root = os.path.join\(".." , "lib"\)](#)
- [abs\\_root = os.path.abspath\(root\)](#)
- [specs = os.path.join\(abs\\_root, "spectra"\)](#)
- string [outfile = "spectra.md"](#)

#### 12.6.1 Function Documentation

##### 12.6.1.1 def [gen\\_specs.gen\\_docs \( fname \)](#)

Definition at line 26 of file [gen\\_specs.py](#).

##### 12.6.1.2 def [gen\\_specs.get\\_spectra \( \)](#)

Definition at line 8 of file [gen\\_specs.py](#).

#### 12.6.2 Variable Documentation

##### 12.6.2.1 [gen\\_specs.abs\\_root = os.path.abspath\(root\)](#)

Definition at line 4 of file [gen\\_specs.py](#).

##### 12.6.2.2 string [gen\\_specs.outfile = "spectra.md"](#)

Definition at line 46 of file [gen\\_specs.py](#).

##### 12.6.2.3 [gen\\_specs.root = os.path.join\(".." , "lib"\)](#)

Definition at line 3 of file [gen\\_specs.py](#).

##### 12.6.2.4 [gen\\_specs.specs = os.path.join\(abs\\_root, "spectra"\)](#)

Definition at line 5 of file [gen\\_specs.py](#).

## 12.7 gen\_tests Namespace Reference

### Functions

- def [get\\_tests \(\)](#)
- def [gen\\_docs \(fname\)](#)

### Variables

- `root_tests = os.path.join("..", "tests")`
- `globber = os.path.join(root_tests, "*", "test.py")`
- string `outfile = "tests.md"`

#### 12.7.1 Function Documentation

##### 12.7.1.1 def `gen_tests.gen_docs ( fname )`

Definition at line 30 of file `gen_tests.py`.

##### 12.7.1.2 def `gen_tests.get_tests ( )`

Definition at line 11 of file `gen_tests.py`.

#### 12.7.2 Variable Documentation

##### 12.7.2.1 `gen_tests.globber = os.path.join(root_tests, "*", "test.py")`

Definition at line 9 of file `gen_tests.py`.

##### 12.7.2.2 string `gen_tests.outfile = "tests.md"`

Definition at line 47 of file `gen_tests.py`.

##### 12.7.2.3 `gen_tests.root_tests = os.path.join("..", "tests")`

Definition at line 6 of file `gen_tests.py`.

## 12.8 gen\_transport Namespace Reference

### Functions

- def [gen\\_docs \(fname\)](#)

## Variables

- `root = os.path.join("../", "lib")`
- `abs_root = os.path.abspath(root)`
- `transport = os.path.join(abs_root, "transport")`
- string `outfile` = "transport.md"

### 12.8.1 Function Documentation

#### 12.8.1.1 def gen\_transport.gen\_docs ( `fname` )

Definition at line 9 of file gen\_transport.py.

### 12.8.2 Variable Documentation

#### 12.8.2.1 `gen_transport.abs_root = os.path.abspath(root)`

Definition at line 5 of file gen\_transport.py.

#### 12.8.2.2 string `gen_transport.outfile` = "transport.md"

Definition at line 26 of file gen\_transport.py.

#### 12.8.2.3 `gen_transport.root = os.path.join("../", "lib")`

Definition at line 4 of file gen\_transport.py.

#### 12.8.2.4 `gen_transport.transport = os.path.join(abs_root, "transport")`

Definition at line 6 of file gen\_transport.py.

## 12.9 muen Namespace Reference

### Classes

- class `MuenDataParser`  
*class for parsing muen data from a file.*

### TypeDefs

- typedef pair< double, double > `MuenAtET`  
*pair of form (energy, muen(energy))*
- typedef map< string, vector< `MuenAtET` > > `MuenMapT`  
*Map from medium name to vector of (e, muen(e)) data for that medium.*

## Functions

- std::vector< std::string > & **split** (const std::string &s, char delim, std::vector< std::string > &elems)  
*Split a string on input delimiter.*
- std::vector< std::string > **split** (const std::string &s, char delim)  
*Split a string on input delimiter.*

### 12.9.1 Typedef Documentation

#### 12.9.1.1 **typedef pair<double, double> muen::MuenAtET**

pair of form (energy, muen(energy))

Definition at line 104 of file muen.h.

#### 12.9.1.2 **typedef map<string, vector<MuenAtET>> muen::MuenMapT**

Map from medium name to vector of (e, muen(e)) data for that medium.

Definition at line 107 of file muen.h.

### 12.9.2 Function Documentation

#### 12.9.2.1 **std::vector<std::string>& muen::split ( const std::string & s, char delim, std::vector< std::string > & elems )**

Split a string on input delimiter.

Definition at line 68 of file muen.h.

#### 12.9.2.2 **std::vector<std::string> muen::split ( const std::string & s, char delim )**

Split a string on input delimiter.

Definition at line 79 of file muen.h.

## 12.10 run\_tests Namespace Reference

### Functions

- def **dyn\_import** (name)
- def **create\_egsinp** (test\_module)
- def **find\_cpu\_time** (egslist)
- def **run\_simulation** ()
- def **cleanup** ()
- def **find\_tests** ()
- def **run\_all\_tests** ()

## Variables

- bool `VERBOSE` = False
- string `timing_hard_fail` = "--timing-hard-fail"
- `EGS_HOME` = os.environ["EGS\_HOME"]
- `EGS_BRACHY` = os.path.join(EGS\_HOME, "egs\_brachy")
- string `USER_CODE` = "egs\_brachy"
- string `TEST_EGSINP_FILE` = "eb\_test\_run"
- `TEST_EGSINP_PATH_ROOT` = os.path.join(EGS\_BRACHY, TEST\_EGSINP\_FILE)
- string `TEST_EGSINP_PATH` = `TEST_EGSINP_PATH_ROOT`+.egsinp"
- string `PASS_FMT` = "%(pass\_fail)s - %(test)s - ran in %(actual\_time).3G s/MHz (%(real\_time).3G s)"
- string `TIMING_WARN_FMT`
- string `FAIL_FMT`
- string `cpu_speed_cmd` = """grep -i "cpu mhz" /proc/cpuinfo | tail -1 | awk -F ":" '{print \$2}'''
- `CPU_MHZ` = float(os.environ["CPU\_MHZ"])
- string `source` = "CPU\_MHZ env variable"
- `p`
- `stdin`
- `stdout`
- `stderr`
- float `TIMING_MARGIN` = 1.05

### 12.10.1 Function Documentation

12.10.1.1 `def run_tests.cleanup( )`

Definition at line 108 of file run\_tests.py.

12.10.1.2 `def run_tests.create_egsinp( test_module )`

Definition at line 78 of file run\_tests.py.

12.10.1.3 `def run_tests.dyn_import( name )`

Definition at line 70 of file run\_tests.py.

12.10.1.4 `def run_tests.find_cpu_time( egslst )`

Definition at line 85 of file run\_tests.py.

12.10.1.5 `def run_tests.find_tests( )`

Definition at line 117 of file run\_tests.py.

12.10.1.6 `def run_tests.run_all_tests( )`

Definition at line 126 of file run\_tests.py.

12.10.1.7 `def run_tests.run_simulation( )`

Definition at line 92 of file run\_tests.py.

## 12.10.2 Variable Documentation

12.10.2.1 `run_tests.CPU_MHZ = float(os.environ["CPU_MHZ"])`

Definition at line 48 of file run\_tests.py.

12.10.2.2 `string run_tests.cpu_speed_cmd = """grep -i "cpu mhz" /proc/cpuinfo | tail -1 | awk -F ":" '{print $2}"""`

Definition at line 43 of file run\_tests.py.

12.10.2.3 `run_tests.EGS_BRACHY = os.path.join(EGS_HOME, "egs_brachy")`

Definition at line 17 of file run\_tests.py.

12.10.2.4 `run_tests.EGS_HOME = os.environ["EGS_HOME"]`

Definition at line 16 of file run\_tests.py.

12.10.2.5 `string run_tests.FAIL_FMT`

**Initial value:**

```
1 = """%(pass_fail)s - %(test)s
2     Timing: %(timing_pass_fail)s
3         Limit: %(time_limit).3G s/MHz
4         Actual : %(actual_time).3G s/MHz
5     Results: %(results_pass_fail)s
6     Expected: %(expected_results)s
7     Actual   : %(actual_results)s
8 """
```

Definition at line 34 of file run\_tests.py.

12.10.2.6 `run_tests.p`

**Initial value:**

```
1 = Popen(cpu_speed_cmd, shell=True,
2         stdin=PIPE, stdout=PIPE, stderr=PIPE, close_fds=True)
```

Definition at line 53 of file run\_tests.py.

12.10.2.7 string `run_tests.PASS_FMT = "%(pass_fail)s - %(test)s - ran in %(actual_time).3G s/MHz (%(real_time).3G s)"`

Definition at line 25 of file `run_tests.py`.

12.10.2.8 string `run_tests.source = "CPU_MHZ env variable"`

Definition at line 49 of file `run_tests.py`.

12.10.2.9 `run_tests.stderr`

Definition at line 55 of file `run_tests.py`.

12.10.2.10 `run_tests.stdin`

Definition at line 55 of file `run_tests.py`.

12.10.2.11 `run_tests.stdout`

Definition at line 55 of file `run_tests.py`.

12.10.2.12 string `run_tests.TEST_EGSINP_FILE = "eb_test_run"`

Definition at line 20 of file `run_tests.py`.

12.10.2.13 string `run_tests.TEST_EGSINP_PATH = TEST_EGSINP_PATH_ROOT + ".egsinp"`

Definition at line 22 of file `run_tests.py`.

12.10.2.14 `run_tests.TEST_EGSINP_PATH_ROOT = os.path.join(EGS_BRACHY, TEST_EGSINP_FILE)`

Definition at line 21 of file `run_tests.py`.

12.10.2.15 string `run_tests.timing_hard_fail = "--timing-hard-fail"`

Definition at line 14 of file `run_tests.py`.

12.10.2.16 float `run_tests.TIMING_MARGIN = 1.05`

Definition at line 67 of file `run_tests.py`.

### 12.10.2.17 string run\_tests.TIMING\_WARN\_FMT

**Initial value:**

```

1 = """%(pass_fail)s - %(test)s
2     Timing: %(timing_pass_fail)s
3         Limit: %(time_limit).3G s/MHz
4         Actual : %(actual_time).3G s/MHz
5     Results: %(results_pass_fail)s
6 """

```

Definition at line 27 of file run\_tests.py.

### 12.10.2.18 string run\_tests.USER\_CODE = "egs\_brachy"

Definition at line 19 of file run\_tests.py.

### 12.10.2.19 bool run\_tests.VERBOSE = False

Definition at line 9 of file run\_tests.py.

## 12.11 tests Namespace Reference

### Namespaces

- [brem\\_cyl](#)
- [flu\\_cutoff](#)
- [iaea](#)
- [iaea\\_errors](#)
- [iaea\\_types](#)
- [phsp\\_run](#)
- [phsp\\_scoring](#)
- [recycling](#)
- [scatter](#)
- [seeds\\_in\\_xyz](#)
- [seeds\\_in\\_xyz\\_genvelope](#)
- [simple\\_dose\\_sph](#)
- [single\\_generator](#)
- [source\\_energies](#)
- [spec\\_absolute](#)
- [spec\\_eflu](#)
- [spec\\_vox](#)
- [stepped\\_source](#)
- [tg43mode](#)
- [tg43mode\\_recycle](#)
- [tg43mode\\_zeroweight](#)
- [utils](#)
- [variable\\_activity](#)
- [variable\\_w\\_recycling](#)
- [volume\\_correction](#)

## 12.12 tests.brem\_cyl Namespace Reference

### Namespaces

- [test](#)

## 12.13 tests.brem\_cyl.test Namespace Reference

### Functions

- def [compare\\_results](#) (egslist, inp\_name)

### Variables

- string [EGSINP](#) = "brem\_cyl.egsinp"
- int [TIME\\_LIMIT\\_S\\_PER\\_MHZ](#) = 20
- list [DOSRZ\\_NRC\\_DOSES](#)
- dictionary [expected\\_doses](#)

### 12.13.1 Detailed Description

A test for ensuring x-ray sources mode is working. The test consists of a 1cm^2 beam of electrons incident on a thin cylindrical disc with dose being calculated in cylindrical slabs behind the target. The egs\_brachy energy deposition doses are compared with values calculated by dosrznrc.

### 12.13.2 Function Documentation

#### 12.13.2.1 def tests.brem\_cyl.test.compare\_results ( *egslist, inp\_name* )

Definition at line 43 of file test.py.

### 12.13.3 Variable Documentation

#### 12.13.3.1 list tests.brem\_cyl.test.DOSRZ\_NRC\_DOSES

##### Initial value:

```
1 = [
2     (3.0107E-013, 0.0002),
3     (1.0088E-016, 0.0040),
4     (5.6843E-017, 0.0042),
5     (3.8797E-017, 0.0041),
6 ]
```

Definition at line 18 of file test.py.

### 12.13.3.2 string tests.brem\_cyl.test.EGSINP = "brem\_cyl.egsinp"

Definition at line 14 of file test.py.

### 12.13.3.3 dictionary tests.brem\_cyl.test.expected\_doses

#### Initial value:

```

1 = {
2     "tlen": [
3         (3.702E-16, 2.84),
4         (1.042E-16, 2.90),
5         (5.933E-17, 3.04),
6         (4.064E-17, 3.14),
7     ],
8     "edep": [
9         (3.002E-13, 0.41),
10        (1.073E-16, 3.15),
11        (5.943E-17, 3.66),
12        (3.912E-17, 4.20),
13    ]
14 }
```

Definition at line 26 of file test.py.

### 12.13.3.4 int tests.brem\_cyl.test.TIME\_LIMIT\_S\_PER\_MHZ = 20

Definition at line 15 of file test.py.

## 12.14 tests.flu\_cutoff Namespace Reference

### Namespaces

- [test](#)

## 12.15 tests.flu\_cutoff.test Namespace Reference

### Functions

- def [compare\\_results](#) (egslst, inp\_name)

### Variables

- string [EGSINP](#) = "flu\_cutoff.egsinp"
- int [TIME\\_LIMIT\\_S\\_PER\\_MHZ](#) = 2

### 12.15.1 Detailed Description

A test for ensuring that the fluorescent photon cutoff works. A monoenergetic source of 0.015keV is placed within a thin Ti sphere and photon counts are scored on the outer surface of the sphere. Normally there would be a fluorescent peak at ~4.5keV so when the 'fluorescent photon cutoff' setting is set to 0.005 MeV that peak should not be present.

Two energy bins from 0-10keV and 10-20keV are used. If fluorescent photon cutoff feature is working correctly 100% of photons should be in the 10-20keV range.

### 12.15.2 Function Documentation

#### 12.15.2.1 def tests.flu\_cutoff.test.compare\_results ( *egslist*, *inp\_name* )

Definition at line 23 of file test.py.

### 12.15.3 Variable Documentation

#### 12.15.3.1 string tests.flu\_cutoff.test.EGSINP = "flu\_cutoff.egsinp"

Definition at line 19 of file test.py.

#### 12.15.3.2 int tests.flu\_cutoff.test.TIME\_LIMIT\_S\_PER\_MHZ = 2

Definition at line 20 of file test.py.

## 12.16 tests.iaea Namespace Reference

### Classes

- class [IAEAPhaseSpace](#)

### Variables

- `HEN_HOUSE` = `os.getenv("HEN_HOUSE")`
- `IAEA_DLL` = `glob.glob(os.path.join(HEN_HOUSE,"egs++/dso/*/", "libiaea_phsp.so"))[0]`
- `iaeadll` = `ctypes.CDLL(IAEA_DLL)`

### 12.16.1 Variable Documentation

#### 12.16.1.1 tests.iaea.HEN\_HOUSE = `os.getenv("HEN_HOUSE")`

Definition at line 6 of file iaea.py.

---

12.16.1.2 tests.iae.IAEA\_DLL = glob.glob(os.path.join(HEN\_HOUSE,"egs++/dso/\*", "libiae\_phsp.so"))[0]

Definition at line 8 of file iaea.py.

12.16.1.3 tests.iae.iaeadll = ctypes.CDLL(IAEA\_DLL)

Definition at line 19 of file iaea.py.

## 12.17 tests.iae\_errors Namespace Reference

### Classes

- class [IAEAPhaseSpaceError](#)
- class [IAEAPhaseSpaceSetupError](#)

### Variables

- dictionary [error\\_messages](#) = {}
- tuple [new\\_source\\_errors](#)

#### 12.17.1 Variable Documentation

12.17.1.1 dictionary tests.iae\_errors.error\_messages = {}

Definition at line 1 of file iaea\_errors.py.

12.17.1.2 tuple tests.iae\_errors.new\_source\_errors

#### Initial value:

```

1 = (
2
3     #errors returned in iaea_new_source
4
5     (105,'Header file not set'),
6
7     (-1,'Unable to initialize phase space'),
8     (-91,'Failed to get record contents'),
9     (-93,'Failed to read header'),
10    (-94,'Null file pointer to phase space file'),
11    (-95,'Failed to set record for new phase space file'),
12    (-96,'Phase space file failed to open'),
13    (-98,'Maximum number of sources exceeded or invalid source id'),
14    (-99,'Invalid access mode'),
15    (-100,'Path to phase space file is too long'),
16    (-101,'Path to phase space file is too short')
17
18 )

```

Definition at line 4 of file iaea\_errors.py.

## 12.18 tests.iaea\_types Namespace Reference

## Variables

- `IAEA_Float` = `ctypes.c_float`
  - `PIAEA_Float` = `ctypes.POINTER(IAEA_Float)`
  - `IAEA_I16` = `ctypes.c_short`
  - `PIAEA_I16` = `ctypes.POINTER(IAEA_I16)`
  - `IAEA_I32` = `ctypes.c_int`
  - `PIAEA_I32` = `ctypes.POINTER(IAEA_I32)`
  - `IAEA_I64` = `ctypes.c_longlong`
  - `PIAEA_I64` = `ctypes.POINTER(IAEA_I64)`
  - dictionary `iaea_file_modes`
  - int `all_particles` = -1
  - int `photons` = 1
  - int `electrons` = 2
  - int `positrons` = 3
  - int `neutrons` = 4
  - int `protons` = 5
  - dictionary `particle_types`
  - int `max_sources` = 30

### **12.18.1 Variable Documentation**

### 12.18.1.1 int tests.iaeatypes.all\_particles = -1

Definition at line 20 of file iaea\_types.py.

#### 12.18.1.2 int tests.iaeatypes.electrons = 2

Definition at line 22 of file iaea\_types.py.

### 12.18.1.3 dictionary tests.iaeatypes.iaeafilmodes

### Initial value:

```
1 = {  
2   'r': IAEA_I32(1),  
3   'w': IAEA_I32(2),  
4   'a': IAEA_I32(3)  
5 }
```

Definition at line 14 of file iaea\_types.py.

#### 12.18.1.4 tests.iaeatypes.IAEA\_Float = ctypes.c\_float

Definition at line 3 of file iaea\_types.py.

12.18.1.5 tests.iaeatypes.IAEA\_I16 = ctypes.c\_short

Definition at line 7 of file iaea\_types.py.

12.18.1.6 tests.iaeatypes.IAEA\_I32 = ctypes.c\_int

Definition at line 9 of file iaea\_types.py.

12.18.1.7 tests.iaeatypes.IAEA\_I64 = ctypes.c\_longlong

Definition at line 11 of file iaea\_types.py.

12.18.1.8 int tests.iaeatypes.max\_sources = 30

Definition at line 39 of file iaea\_types.py.

12.18.1.9 int tests.iaeatypes.neutrons = 4

Definition at line 24 of file iaea\_types.py.

12.18.1.10 dictionary tests.iaeatypes.particle\_types

**Initial value:**

```
1 = {
2     'all'      : all_particles,
3     'photon'   : photons,
4     'electron' : electrons,
5     'positron' : positrons,
6     'neutron'   : neutrons,
7     'proton'    : protons,
8     'charged'   : (electrons,positrons,protons),
9     'neutral'   : (photons,neutrons)
10 }
```

Definition at line 27 of file iaea\_types.py.

12.18.1.11 int tests.iaeatypes.photons = 1

Definition at line 21 of file iaea\_types.py.

12.18.1.12 tests.iaeatypes.PIAEA\_Float = ctypes.POINTER(IAEA\_Float)

Definition at line 5 of file iaea\_types.py.

12.18.1.13 `tests.iaeatypes.PIAEA_I16 = ctypes.POINTER(IAEA_I16)`

Definition at line 8 of file iaea\_types.py.

12.18.1.14 `tests.iaeatypes.PIAEA_I32 = ctypes.POINTER(IAEA_I32)`

Definition at line 10 of file iaea\_types.py.

12.18.1.15 `tests.iaeatypes.PIAEA_I64 = ctypes.POINTER(IAEA_I64)`

Definition at line 12 of file iaea\_types.py.

12.18.1.16 `int tests.iaeatypes.positrons = 3`

Definition at line 23 of file iaea\_types.py.

12.18.1.17 `int tests.iaeatypes.protons = 5`

Definition at line 25 of file iaea\_types.py.

## 12.19 tests.phsp\_run Namespace Reference

### Namespaces

- `test`

## 12.20 tests.phsp\_run.test Namespace Reference

### Functions

- def `compare_results` (egslist, inp\_name)

### Variables

- string `EGSINP` = "phsp\_run.egsinp"
- int `TIME_LIMIT_S_PER_MHZ` = 80

### 12.20.1 Detailed Description

A test to compare a dose calculation using a phsp source with the equivalent ab-initio simulation.

## 12.20.2 Function Documentation

12.20.2.1 def tests.phsp\_run.test.compare\_results ( *egslist*, *inp\_name* )

Definition at line 18 of file test.py.

## 12.20.3 Variable Documentation

12.20.3.1 string tests.phsp\_run.test.EGSINP = "phsp\_run.egsinp"

Definition at line 14 of file test.py.

12.20.3.2 int tests.phsp\_run.test.TIME\_LIMIT\_S\_PER\_MHZ = 80

Definition at line 15 of file test.py.

# 12.21 tests.phsp\_scoring Namespace Reference

## Namespaces

- [test](#)

# 12.22 tests.phsp\_scoring.test Namespace Reference

## Functions

- def [compare\\_results](#) (*egslist*, *inp\_name*)

## Variables

- string [EGSINP](#) = "phsp\_score.egsinp"
- int [TIME\\_LIMIT\\_S\\_PER\\_MHZ](#) = 10
- tuple [SOURCE\\_WEIGHTS](#) = (1., 9.)
- tuple [MAX\\_E](#) = (0.05, 0.025,)
- int [NHIST](#) = 1000
- float [RM](#) = 0.511
- dictionary [EXPECTED](#)

## 12.22.1 Detailed Description

A test that generates an IAEApshp source with egs\_brachy and then checks the IAEA file to make sure it was created correctly.

## 12.22.2 Function Documentation

12.22.2.1 def tests.phsp\_scoring.test.compare\_results ( *egslist*, *inp\_name* )

Definition at line 29 of file test.py.

## 12.22.3 Variable Documentation

12.22.3.1 string tests.phsp\_scoring.test.EGSINP = "phsp\_score.egsinp"

Definition at line 13 of file test.py.

12.22.3.2 dictionary tests.phsp\_scoring.test.EXPECTED

**Initial value:**

```
1 = {
2     'num_e': NHIST*SOURCE_WEIGHTS[0]/sum(SOURCE_WEIGHTS),
3     'num_p': NHIST*SOURCE_WEIGHTS[1]/sum(SOURCE_WEIGHTS),
4     'max_energy': 0.05,
5     'num_orig': NHIST,
6 }
```

Definition at line 21 of file test.py.

12.22.3.3 tuple tests.phsp\_scoring.test.MAX\_E = (0.05, 0.025,)

Definition at line 17 of file test.py.

12.22.3.4 int tests.phsp\_scoring.test.NHIST = 1000

Definition at line 18 of file test.py.

12.22.3.5 float tests.phsp\_scoring.test.RM = 0.511

Definition at line 19 of file test.py.

12.22.3.6 tuple tests.phsp\_scoring.test.SOURCE\_WEIGHTS = (1., 9.)

Definition at line 16 of file test.py.

12.22.3.7 int tests.phsp\_scoring.test.TIME\_LIMIT\_S\_PER\_MHZ = 10

Definition at line 14 of file test.py.

## 12.23 tests.recycling Namespace Reference

### Namespaces

- [test](#)

## 12.24 tests.recycling.test Namespace Reference

### Functions

- def [compare\\_results](#) (*egslist*, *inp\_name*)

### Variables

- string [EGSINP](#) = "recycling.egsinp"
- int [TIME\\_LIMIT\\_S\\_PER\\_MHZ](#) = 16

### 12.24.1 Detailed Description

A test for ensuring doses calculated with recycling turned on are the same as doses without recycling.

### 12.24.2 Function Documentation

#### 12.24.2.1 def [tests.recycling.test.compare\\_results](#) ( *egslist*, *inp\_name* )

Definition at line 18 of file [test.py](#).

### 12.24.3 Variable Documentation

#### 12.24.3.1 string [tests.recycling.test.EGSINP](#) = "recycling.egsinp"

Definition at line 14 of file [test.py](#).

#### 12.24.3.2 int [tests.recycling.test.TIME\\_LIMIT\\_S\\_PER\\_MHZ](#) = 16

Definition at line 15 of file [test.py](#).

## 12.25 tests.scatter Namespace Reference

### Namespaces

- [test](#)

## 12.26 tests.scatter.test Namespace Reference

### Functions

- def `get_n_highest_doses` (`doses, uncs, n=NCOMPARE`)
- def `compare_results` (`egslist, inp_name`)

### Variables

- string `EGSINP` = "scatter.egsinp"
- int `TIME_LIMIT_S_PER_MHZ` = 65
- int `NCOMPARE` = 10

#### 12.26.1 Detailed Description

A test for comparing egs\_brachy scatter dose calculations for an Ir192 sources with previously calculated values when egs\_brachy was in a known good state.

#### 12.26.2 Function Documentation

##### 12.26.2.1 def tests.scatter.test.compare\_results ( `egslist, inp_name` )

Definition at line 23 of file test.py.

##### 12.26.2.2 def tests.scatter.test.get\_n\_highest\_doses ( `doses, uncs, n=NCOMPARE` )

Definition at line 19 of file test.py.

#### 12.26.3 Variable Documentation

##### 12.26.3.1 string tests.scatter.test.EGSINP = "scatter.egsinp"

Definition at line 14 of file test.py.

##### 12.26.3.2 int tests.scatter.test.NCOMPARE = 10

Definition at line 16 of file test.py.

##### 12.26.3.3 int tests.scatter.test.TIME\_LIMIT\_S\_PER\_MHZ = 65

Definition at line 15 of file test.py.

## 12.27 tests.seeds\_in\_xyz Namespace Reference

### Namespaces

- [test](#)

## 12.28 tests.seeds\_in\_xyz.test Namespace Reference

### Functions

- def [compare\\_results](#) (egslist, inp\_name)

### Variables

- string [EGSINP](#) = "seeds\_in\_xyz.egsinp"
- int [TIME\\_LIMIT\\_S\\_PER\\_MHZ](#) = 25

### 12.28.1 Detailed Description

A test for comparing dose calculated by egs\_brachy in a simple rectilinear phantom containing multiple 6702 sources (some of which are rotated/translated). The calculated dose is compared with dose values calculated when egs\_brachy was in a known good state.

### 12.28.2 Function Documentation

#### 12.28.2.1 def tests.seeds\_in\_xyz.test.compare\_results ( *egslist, inp\_name* )

Definition at line 22 of file test.py.

### 12.28.3 Variable Documentation

#### 12.28.3.1 string tests.seeds\_in\_xyz.test.EGSINP = "seeds\_in\_xyz.egsinp"

Definition at line 18 of file test.py.

#### 12.28.3.2 int tests.seeds\_in\_xyz.test.TIME\_LIMIT\_S\_PER\_MHZ = 25

Definition at line 19 of file test.py.

## 12.29 tests.seeds\_in\_xyz\_genvelope Namespace Reference

### Namespaces

- [test](#)

## 12.30 tests.seeds\_in\_xyz\_genvelope.test Namespace Reference

### Functions

- def [compare\\_results](#) (egslst, inp\_name)

### Variables

- string [EGSINP](#) = "seeds\_in\_xyz\_genvelope.egsinp"
- int [TIME\\_LIMIT\\_S\\_PER\\_MHZ](#) = 25

#### 12.30.1 Detailed Description

Same as tests/seeds\_in\_xyz except using a regular egs\_genvelope instead of an autoenvelope.

#### 12.30.2 Function Documentation

##### 12.30.2.1 def tests.seeds\_in\_xyz\_genvelope.test.compare\_results ( *egslst, inp\_name* )

Definition at line 18 of file test.py.

#### 12.30.3 Variable Documentation

##### 12.30.3.1 string tests.seeds\_in\_xyz\_genvelope.test.EGSINP = "seeds\_in\_xyz\_genvelope.egsinp"

Definition at line 14 of file test.py.

##### 12.30.3.2 int tests.seeds\_in\_xyz\_genvelope.test.TIME\_LIMIT\_S\_PER\_MHZ = 25

Definition at line 15 of file test.py.

## 12.31 tests.simple\_dose\_sph Namespace Reference

### Namespaces

- [test](#)

## 12.32 tests.simple\_dose\_sph.test Namespace Reference

### Functions

- def [compare\\_results](#) (egslst, inp\_name)

## Variables

- string `EGSINP` = "simple\_dose\_sph.egsinp"
- int `TIME_LIMIT_S_PER_MHZ` = 22
- dictionary `expected_doses`

### 12.32.1 Detailed Description

A very simple dose calculation in a spherical phantom with multiple media. The simple geometry allows a fast calculation with high precision for comparing against a previously calculated dose.

### 12.32.2 Function Documentation

#### 12.32.2.1 def tests.simple\_dose\_sph.test.compare\_results ( `egslist, inp_name` )

Definition at line 35 of file test.py.

### 12.32.3 Variable Documentation

#### 12.32.3.1 string tests.simple\_dose\_sph.test.EGSINP = "simple\_dose\_sph.egsinp"

Definition at line 14 of file test.py.

#### 12.32.3.2 dictionary tests.simple\_dose\_sph.test.expected\_doses

**Initial value:**

```

1 = {
2     "tlen": [
3         (5.219E-12, 0.0004),
4         (1.117E-12, 0.0002),
5         (4.292E-13, 0.0002),
6         (2.126E-13, 0.0002),
7         (1.332E-13, 0.0001),
8     ],
9     "edep": [
10        (5.212E-12, 0.0073),
11    ]
12 }
```

Definition at line 20 of file test.py.

#### 12.32.3.3 int tests.simple\_dose\_sph.test.TIME\_LIMIT\_S\_PER\_MHZ = 22

Definition at line 15 of file test.py.

## 12.33 tests.single\_generator Namespace Reference

### Namespaces

- [test](#)

## 12.34 tests.single\_generator.test Namespace Reference

### Functions

- def [compare\\_results](#) (egslist, inp\_name)

### Variables

- string [EGSINP](#) = "single\_generator.egsinp"
- int [TIME\\_LIMIT\\_S\\_PER\\_MHZ](#) = 25

### 12.34.1 Detailed Description

This test ensures the 'single generator=no' and 'single\_generator=yes' options give the same results.

Gold standard dose distribution was generated with egs\_brachy and multiple\_generator.egsinp

### 12.34.2 Function Documentation

#### 12.34.2.1 def tests.single\_generator.test.compare\_results ( *egslist, inp\_name* )

Definition at line 20 of file test.py.

### 12.34.3 Variable Documentation

#### 12.34.3.1 string tests.single\_generator.test.EGSINP = "single\_generator.egsinp"

Definition at line 16 of file test.py.

#### 12.34.3.2 int tests.single\_generator.test.TIME\_LIMIT\_S\_PER\_MHZ = 25

Definition at line 17 of file test.py.

## 12.35 tests.source\_energies Namespace Reference

### Namespaces

- [test](#)

## 12.36 tests.source\_energies.test Namespace Reference

### Functions

- def [compare\\_results](#) (egslst, inp\_name)

### Variables

- string [EGSINP](#) = "source\_energies.egsinp"
- int [TIME\\_LIMIT\\_S\\_PER\\_MHZ](#) = 2
- dictionary [expected\\_results](#)

#### 12.36.1 Detailed Description

A test to ensure initialized/escaping source/escaping geometry energy tallies are consistent with previously calculated values.

#### 12.36.2 Function Documentation

##### 12.36.2.1 def [tests.source\\_energies.test.compare\\_results](#) ( egslst, inp\_name )

Definition at line 24 of file test.py.

#### 12.36.3 Variable Documentation

##### 12.36.3.1 string [tests.source\\_energies.test.EGSINP](#) = "source\_energies.egsinp"

Definition at line 14 of file test.py.

##### 12.36.3.2 dictionary [tests.source\\_energies.test.expected\\_results](#)

#### Initial value:

```
1 = {
2     'initialized': 1135.1,
3     'escaping_source': 898.8,
4     'escaping_geom': 702.01,
5 }
```

Definition at line 17 of file test.py.

##### 12.36.3.3 int [tests.source\\_energies.test.TIME\\_LIMIT\\_S\\_PER\\_MHZ](#) = 2

Definition at line 15 of file test.py.

## 12.37 tests.spec\_absolute Namespace Reference

### Namespaces

- [test](#)

## 12.38 tests.spec\_absolute.test Namespace Reference

### Functions

- def [expected](#) (*e*)
- def [compare\\_results](#) (*egslist*, *inp\_name*)

### Variables

- string [EGSINP](#) = "spec\_absolute.egsinp"
- int [TIME\\_LIMIT\\_S\\_PER\\_MHZ](#) = 6
- [EMIN](#)
- [EMAX](#)

### 12.38.1 Detailed Description

A test for comparing the total absolute photon counts on the surface of a source with the expected value. A uniform spectrum between 15keV–25keV in a near-vaccum source is used so the expected spectrum can easily be calculated analytically.

### 12.38.2 Function Documentation

#### 12.38.2.1 def tests.spec\_absolute.test.compare\_results ( *egslist*, *inp\_name* )

Definition at line 25 of file test.py.

#### 12.38.2.2 def tests.spec\_absolute.test.expected ( *e* )

Definition at line 20 of file test.py.

### 12.38.3 Variable Documentation

#### 12.38.3.1 string tests.spec\_absolute.test.EGSINP = "spec\_absolute.egsinp"

Definition at line 15 of file test.py.

### 12.38.3.2 tests.spec\_absolute.test.EMAX

Definition at line 18 of file test.py.

### 12.38.3.3 tests.spec\_absolute.test.EMIN

Definition at line 18 of file test.py.

### 12.38.3.4 int tests.spec\_absolute.test.TIME\_LIMIT\_S\_PER\_MHZ = 6

Definition at line 16 of file test.py.

## 12.39 tests.spec\_eflu Namespace Reference

### Namespaces

- [test](#)

## 12.40 tests.spec\_eflu.test Namespace Reference

### Functions

- def [expected](#) (e)
- def [compare\\_results](#) (egslst, inp\_name)

### Variables

- string [EGSINP](#) = "spec\_eflu.egsinp"
- int [TIME\\_LIMIT\\_S\\_PER\\_MHZ](#) = 6
- [EMIN](#)
- [EMAX](#)
- int [NHIST](#) = 1
- float [BIN\\_WIDTH](#) = 0.001
- int [AVG\\_E](#) = ([EMAX](#)+[EMIN](#))/2
- [TOTAL\\_E](#) = [AVG\\_E](#)\*[NHIST](#)
- tuple [N\\_BINS\\_IN\\_RANGE](#) = ([EMAX](#)-[EMIN](#))/[BIN\\_WIDTH](#)
- [SCORED\\_IN\\_BIN](#) = [NHIST](#)/[N\\_BINS\\_IN\\_RANGE](#)
- [SCORED\\_IN\\_BIN\\_PER\\_MEV](#) = [SCORED\\_IN\\_BIN](#)/[BIN\\_WIDTH](#)

### 12.40.1 Detailed Description

A test for comparing the calculated energy fluence spectrum on the surface of a source with the expected value. A uniform spectrum between 15keV-25keV in a near-vaccum source is used so the expected spectrum can easily be calculated analytically.

## 12.40.2 Function Documentation

12.40.2.1 `def tests.spec_eflu.test.compare_results ( egslst, inp_name )`

Definition at line 35 of file test.py.

12.40.2.2 `def tests.spec_eflu.test.expected ( e )`

Definition at line 30 of file test.py.

## 12.40.3 Variable Documentation

12.40.3.1 `int tests.spec_eflu.test.AVG_E = (EMAX+EMIN)/2`

Definition at line 23 of file test.py.

12.40.3.2 `float tests.spec_eflu.test.BIN_WIDTH = 0.001`

Definition at line 22 of file test.py.

12.40.3.3 `string tests.spec_eflu.test.EGSINP = "spec_eflu.egsinp"`

Definition at line 15 of file test.py.

12.40.3.4 `tests.spec_eflu.test.EMAX`

Definition at line 18 of file test.py.

12.40.3.5 `tests.spec_eflu.test.EMIN`

Definition at line 18 of file test.py.

12.40.3.6 `tuple tests.spec_eflu.test.N_BINS_IN_RANGE = (EMAX-EMIN)/BIN_WIDTH`

Definition at line 25 of file test.py.

12.40.3.7 `int tests.spec_eflu.test.NHIST = 1`

Definition at line 20 of file test.py.

---

12.40.3.8 `tests.spec_eflu.test.SCORED_IN_BIN = NHIST/N_BINS_IN_RANGE`

Definition at line 27 of file test.py.

12.40.3.9 `tests.spec_eflu.test.SCORED_IN_BIN_PER_MEV = SCORED_IN_BIN/BIN_WIDTH`

Definition at line 28 of file test.py.

12.40.3.10 `int tests.spec_eflu.test.TIME_LIMIT_S_PER_MHZ = 6`

Definition at line 16 of file test.py.

12.40.3.11 `tests.spec_eflu.test.TOTAL_E = AVG_E*NHIST`

Definition at line 24 of file test.py.

## 12.41 tests.spec\_vox Namespace Reference

### Namespaces

- `test`

## 12.42 tests.spec\_vox.test Namespace Reference

### Functions

- def `expected` (`e`)
- def `compare_results` (`egslist, inp_name`)

### Variables

- string `EGSINP` = "spec\_vox.egsinp"
- int `TIME_LIMIT_S_PER_MHZ` = 7
- float `BIN_WIDTH` = 0.001
- `EMIN`
- `EMAX`
- `R1`
- `R2`
- `TRACK_LENGTH = R2-R1`
- tuple `N_BINS_IN_RANGE` = (`EMAX-EMIN`)/`BIN_WIDTH`
- `SCORED_IN_BIN = TRACK_LENGTH/N_BINS_IN_RANGE`
- int `VOLUME` = 4

### 12.42.1 Detailed Description

A test for comparing the calculated energy fluence spectrum in a phantom region with the expected value. A uniform spectrum between 15keV-25keV in a near-vaccum geometry is used so the expected spectrum can easily be calculated analytically.

### 12.42.2 Function Documentation

#### 12.42.2.1 def tests.spec\_vox.test.compare\_results ( *egslist*, *inp\_name* )

Definition at line 35 of file test.py.

#### 12.42.2.2 def tests.spec\_vox.test.expected ( *e* )

Definition at line 30 of file test.py.

### 12.42.3 Variable Documentation

#### 12.42.3.1 float tests.spec\_vox.test.BIN\_WIDTH = 0.001

Definition at line 17 of file test.py.

#### 12.42.3.2 string tests.spec\_vox.test.EGSINP = "spec\_vox.egsinp"

Definition at line 14 of file test.py.

#### 12.42.3.3 tests.spec\_vox.test.EMAX

Definition at line 18 of file test.py.

#### 12.42.3.4 tests.spec\_vox.test.EMIN

Definition at line 18 of file test.py.

#### 12.42.3.5 tuple tests.spec\_vox.test.N\_BINS\_IN\_RANGE = (EMAX-EMIN)/BIN\_WIDTH

Definition at line 24 of file test.py.

#### 12.42.3.6 tests.spec\_vox.test.R1

Definition at line 19 of file test.py.

12.42.3.7 `tests.spec_vox.test.R2`

Definition at line 19 of file test.py.

12.42.3.8 `tests.spec_vox.test.SCORED_IN_BIN = TRACK_LENGTH/N_BINS_IN_RANGE`

Definition at line 26 of file test.py.

12.42.3.9 `int tests.spec_vox.test.TIME_LIMIT_S_PER_MHZ = 7`

Definition at line 15 of file test.py.

12.42.3.10 `tests.spec_vox.test.TRACK_LENGTH = R2-R1`

Definition at line 22 of file test.py.

12.42.3.11 `int tests.spec_vox.test.VOLUME = 4`

Definition at line 28 of file test.py.

## 12.43 `tests.steped_source` Namespace Reference

### Namespaces

- `test`

## 12.44 `tests.steped_source.test` Namespace Reference

### Functions

- def `get_n_highest_dose_pairs`(dose1, dose2, n=`NCOMPARE`)
- def `compare_results`(egslist, inp\_name)

### Variables

- string `EGSINP` = "stepped.egsinp"
- int `TIME_LIMIT_S_PER_MHZ` = 1000
- int `NCOMPARE` = 20

### 12.44.1 Detailed Description

A test for comparing the dose from a "stepped source" (i.e. superposition mode with variable activity) with previous calculations made when egs\_brachy was in a known good state.

### 12.44.2 Function Documentation

12.44.2.1 `def tests.steped_source.test.compare_results ( egslst, inp_name )`

Definition at line 21 of file test.py.

12.44.2.2 `def tests.steped_source.test.get_n_highest_dose_pairs ( dose1, dose2, n=NCOMPARE )`

Definition at line 18 of file test.py.

### 12.44.3 Variable Documentation

12.44.3.1 `string tests.steped_source.test.EGSINP = "stepped.egsinp"`

Definition at line 14 of file test.py.

12.44.3.2 `int tests.steped_source.test.NCOMPARE = 20`

Definition at line 16 of file test.py.

12.44.3.3 `int tests.steped_source.test.TIME_LIMIT_S_PER_MHZ = 1000`

Definition at line 15 of file test.py.

## 12.45 tests.tg43mode Namespace Reference

### Namespaces

- [test](#)

## 12.46 tests.tg43mode.test Namespace Reference

### Functions

- def [`get\_n\_highest\_dose\_pairs`](#) (*dose1*, *dose2*, *n*=NCOMPARE)
- def [`compare\_results`](#) (*egslst*, *inp\_name*)

## Variables

- string `EGSINP` = "tg43mode.egsinp"
- int `TIME_LIMIT_S_PER_MHZ` = 2000
- int `NCOMPARE` = 100

### 12.46.1 Detailed Description

A test to ensure egs\_brachy superposition mode calculations match previous calculations when egs\_brachy was in a known good state.

### 12.46.2 Function Documentation

#### 12.46.2.1 def tests.tg43mode.test.compare\_results ( `egslist`, `inp_name` )

Definition at line 20 of file test.py.

#### 12.46.2.2 def tests.tg43mode.test.get\_n\_highest\_dose\_pairs ( `dose1`, `dose2`, `n=NCOMPARE` )

Definition at line 17 of file test.py.

### 12.46.3 Variable Documentation

#### 12.46.3.1 string tests.tg43mode.test.EGSINP = "tg43mode.egsinp"

Definition at line 13 of file test.py.

#### 12.46.3.2 int tests.tg43mode.test.NCOMPARE = 100

Definition at line 15 of file test.py.

#### 12.46.3.3 int tests.tg43mode.test.TIME\_LIMIT\_S\_PER\_MHZ = 2000

Definition at line 14 of file test.py.

## 12.47 tests.tg43mode\_recycle Namespace Reference

### Namespaces

- `test`

## 12.48 tests.tg43mode\_recycle.test Namespace Reference

### Functions

- def `get_n_highest_dose_pairs` (`dose1, dose2, n=NCOMPARE`)
- def `compare_results` (`egslist, inp_name`)

### Variables

- string `EGSINP` = "tg43mode\_recycling.egsinp"
- int `TIME_LIMIT_S_PER_MHZ` = 1000
- int `NCOMPARE` = 50

#### 12.48.1 Detailed Description

A test to ensure superposition mode calculations with recycling turned on result in the same dose as superposition mode calculations without recycling.

#### 12.48.2 Function Documentation

##### 12.48.2.1 def tests.tg43mode\_recycle.test.compare\_results ( `egslist, inp_name` )

Definition at line 20 of file test.py.

##### 12.48.2.2 def tests.tg43mode\_recycle.test.get\_n\_highest\_dose\_pairs ( `dose1, dose2, n=NCOMPARE` )

Definition at line 17 of file test.py.

#### 12.48.3 Variable Documentation

##### 12.48.3.1 string tests.tg43mode\_recycle.test.EGSINP = "tg43mode\_recycling.egsinp"

Definition at line 13 of file test.py.

##### 12.48.3.2 int tests.tg43mode\_recycle.test.NCOMPARE = 50

Definition at line 15 of file test.py.

##### 12.48.3.3 int tests.tg43mode\_recycle.test.TIME\_LIMIT\_S\_PER\_MHZ = 1000

Definition at line 14 of file test.py.

## 12.49 tests.tg43mode\_zeroweight Namespace Reference

### Namespaces

- [test](#)

## 12.50 tests.tg43mode\_zeroweight.test Namespace Reference

### Functions

- def [get\\_n\\_highest\\_dose\\_pairs](#) (dose1, dose2, n=NCOMPARE)
- def [compare\\_results](#) (egslst, inp\_name)

### Variables

- string [EGSINP](#) = "tg43mode\_zeroweight.egsinp"
- int [TIME\\_LIMIT\\_S\\_PER\\_MHZ](#) = 2000
- int [NCOMPARE](#) = 10

### 12.50.1 Detailed Description

A test to ensure superposition mode calculations work when a source has zero weighting.

Gold standard dose distribution was generated with egs\_brachy and gold\_standard.egsinp

### 12.50.2 Function Documentation

#### 12.50.2.1 def tests.tg43mode\_zeroweight.test.compare\_results ( egslst, inp\_name )

Definition at line 23 of file test.py.

#### 12.50.2.2 def tests.tg43mode\_zeroweight.test.get\_n\_highest\_dose\_pairs ( dose1, dose2, n=NCOMPARE )

Definition at line 20 of file test.py.

### 12.50.3 Variable Documentation

#### 12.50.3.1 string tests.tg43mode\_zeroweight.test.EGSINP = "tg43mode\_zeroweight.egsinp"

Definition at line 16 of file test.py.

12.50.3.2 int tests.tg43mode\_zeroweight.test.NCOMPARE = 10

Definition at line 18 of file test.py.

12.50.3.3 int tests.tg43mode\_zeroweight.test.TIME\_LIMIT\_S\_PER\_MHZ = 2000

Definition at line 17 of file test.py.

## 12.51 tests.utils Namespace Reference

### Functions

- def [extract\\_all\\_doses](#) (egslst)
- def [values\\_close](#) (a, b, max\_percent\_diff=0.001)
- def [values\\_close\\_abs](#) (a, b, max\_diff=0.001)
- def [read\\_csv\\_spectrum](#) (fname)
- def [doses\\_approx\\_equal](#) (d1, d1\_unc, d2, d2\_unc, max\_percent\_diff=None, compare\_unc=True, max\_unc\_per cent\_diff=None)
- def [read3ddose](#) (fname)
- def [compare\\_3ddose\\_files](#) (f1, f2, max\_percent\_diff=None)

### Variables

- string [REG\\_DOSE\\_UNC\\_RE](#) = "\s+(\d)+\s+\d+\s+\d+.\*?\s+(.\*?)\s+\+/-\s+(.\*?)%\s+(.\*?)\s+\+/-\s+(.\*?)%"

#### 12.51.1 Function Documentation

12.51.1.1 def tests.utils.compare\_3ddose\_files ( *f1*, *f2*, *max\_percent\_diff*=None )

Definition at line 77 of file utils.py.

12.51.1.2 def tests.utils.doses\_approx\_equal ( *d1*, *d1\_unc*, *d2*, *d2\_unc*, *max\_percent\_diff*=None, *compare\_unc*=True, *max\_unc\_percent\_diff*=None )

Definition at line 37 of file utils.py.

12.51.1.3 def tests.utils.extract\_all\_doses ( *egslst* )

return all regionss and doses from egslst file. This may include doses from more than one phantom

Definition at line 7 of file utils.py.

---

12.51.1.4 def tests.utils.read3ddose ( *fname* )

Definition at line 53 of file utils.py.

12.51.1.5 def tests.utils.read\_csv\_spectrum ( *fname* )

Definition at line 21 of file utils.py.

12.51.1.6 def tests.utils.values\_close ( *a*, *b*, *max\_percent\_diff* = 0.001 )

Definition at line 12 of file utils.py.

12.51.1.7 def tests.utils.values\_close\_abs ( *a*, *b*, *max\_diff* = 0.001 )

Definition at line 18 of file utils.py.

## 12.51.2 Variable Documentation

12.51.2.1 string tests.utils.REG\_DOSE\_UNC\_RE = "\s+(\d)+\s+\d+\s+\d+.\*?\s+(.\*?)\s+/-|\s+(.\*?)%|\s+(.\*?)\s+/-|\s+(.\*?)%"

Definition at line 4 of file utils.py.

## 12.52 tests.variable\_activity Namespace Reference

### Namespaces

- [test](#)

## 12.53 tests.variable\_activity.test Namespace Reference

### Functions

- def [compare\\_results](#) (egslist, inp\_name)

### Variables

- string [EGSINP](#) = "variable.egsinp"
- int [TIME\\_LIMIT\\_S\\_PER\\_MHZ](#) = 100

### 12.53.1 Detailed Description

A test for comparing the dose from sources with different source weighting with calculations from when egs\_brachy was in a known good state.

### 12.53.2 Function Documentation

12.53.2.1 def `tests.variable_activity.test.compare_results ( egslst, inp_name )`

Definition at line 18 of file test.py.

### 12.53.3 Variable Documentation

12.53.3.1 string `tests.variable_activity.test.EGSINP = "variable.egsinp"`

Definition at line 14 of file test.py.

12.53.3.2 int `tests.variable_activity.test.TIME_LIMIT_S_PER_MHZ = 100`

Definition at line 15 of file test.py.

## 12.54 tests.variable\_w\_recycling Namespace Reference

### Namespaces

- [test](#)

## 12.55 tests.variable\_w\_recycling.test Namespace Reference

### Functions

- def [compare\\_results](#) (egslst, inp\_name)

### Variables

- string `EGSINP = "variable_w_recycling.egsinp"`
- int `TIME_LIMIT_S_PER_MHZ = 15`
- list `BENCHMARK_DOSES = [(1.061E-13, 0.0001), (1.644E-13, 0.0001)]`

### 12.55.1 Detailed Description

A test for comparing the dose from sources with different source weighting and recycling on with calculations from when egs\_brachy was in a known good state.

Gold standard dose distribution was generated with egs\_brachy and gold\_standard.egsinp

## 12.55.2 Function Documentation

12.55.2.1 def tests.variable\_w\_recycling.test.compare\_results ( *egslist, inp\_name* )

Definition at line 24 of file test.py.

## 12.55.3 Variable Documentation

12.55.3.1 list tests.variable\_w\_recycling.test.BENCHMARK\_DOSES = [(1.061E-13, 0.0001), (1.644E-13, 0.0001)]

Definition at line 21 of file test.py.

12.55.3.2 string tests.variable\_w\_recycling.test.EGSINP = "variable\_w\_recycling.egsinp"

Definition at line 17 of file test.py.

12.55.3.3 int tests.variable\_w\_recycling.test.TIME\_LIMIT\_S\_PER\_MHZ = 15

Definition at line 18 of file test.py.

## 12.56 tests.volume\_correction Namespace Reference

### Namespaces

- [test](#)

## 12.57 tests.volume\_correction.test Namespace Reference

### Functions

- def [approx\\_equal](#) (*a, b, eps=0.001*)
- def [read\\_vols](#) (*phant, inp\_name*)
- def [compare\\_results](#) (*egslist, inp\_name*)

### Variables

- string [EGSINP](#) = "vc.egsinp"
- int [TIME\\_LIMIT\\_S\\_PER\\_MHZ](#) = 1
- dictionary [expected\\_volumes](#)

### 12.57.1 Detailed Description

A test of the egs\_brachy Monte Carlo volume correction routines. The volume of phantom voxels overlapped by sources and other phantoms are calculated by egs\_brachy and compared with analytical values.

### 12.57.2 Function Documentation

**12.57.2.1 def tests.volume\_correction.test.approx\_equal ( a, b, eps = 0.001 )**

Definition at line 28 of file test.py.

**12.57.2.2 def tests.volume\_correction.test.compare\_results ( egslst, inp\_name )**

Definition at line 50 of file test.py.

**12.57.2.3 def tests.volume\_correction.test.read\_vols ( phant, inp\_name )**

Read voxel values for the phantom named 'phant' and return the region volumes for that phantom

Definition at line 33 of file test.py.

### 12.57.3 Variable Documentation

**12.57.3.1 string tests.volume\_correction.test.EGSINP = "vc.egsinp"**

Definition at line 13 of file test.py.

**12.57.3.2 dictionary tests.volume\_correction.test.expected\_volumes**

**Initial value:**

```

1 = {
2   "source_volume": 4/3.*math.pi*0.1**3,
3   "bounding_shape_volume": 4/3.*math.pi*0.11**3,
4   "extra_bounding_shape_vol": 8**3,
5   "box_reg_0": 10**3 - 6**3,
6   "phantom_reg_0": 6*6*3 - 0.5*(4./3*math.pi*1**3),
7   "phantom_reg_1": 6*6*3 - 0.5*(4./3*math.pi*1**3),
8   "sph_phantom_reg_0": 4/3.*math.pi*(0.3**3 - 0.1**3),
9   "sph_phantom_reg_1": 4./3*math.pi*(1**3 - 0.3**3)
10 }
```

Definition at line 16 of file test.py.

**12.57.3.3 int tests.volume\_correction.test.TIME\_LIMIT\_S\_PER\_MHZ = 1**

Definition at line 14 of file test.py.



# Chapter 13

## Class Documentation

### 13.1 BaseSpectrumScorer Class Reference

abstract base class for scoring spectrum information

```
#include <spec_scoring.h>
```

Inheritance diagram for BaseSpectrumScorer:

Collaboration diagram for BaseSpectrumScorer:

#### Public Member Functions

- `BaseSpectrumScorer (EGS_Input *input, EGS_BaseSource *src, GeomInfo *ginfo, Publisher *publisher)`
- `virtual ~BaseSpectrumScorer ()`
- `EGS_Float getBinWidth () const`
- `double getParticleEnergy (const EGS_Particle *p) const`
- `virtual void update (EB_Message message, void *data=0)`

*Receives messages from application. This method handles NEW\_HISTORY messages but delegates all other messages to the score methods of the derived classes.*

- `virtual void score (EB_Message message, void *data=0)=0`
- `void setEffectiveHistories (EGS_Float effective_histories)`
- `int outputResults (string root_name)`  
*, write the scored spectrum to file with filename. Returns 0 on success, all other values indicate a failure*
- `virtual string getInfo () const`
- `bool isValid () const`
- `int outputData (ostream *ofile)`
- `int readData (istream *ifile)`
- `void resetCounter ()`
- `int addState (istream &data)`

#### Static Public Member Functions

- `static BaseSpectrumScorer * getSpectrumScorer (EGS_Input *inp, EGS_BaseSource *source, GeomInfo *ginfo, Publisher *publisher)`  
*factory method for creating one of the derived spectrum scoring classes*

## Public Attributes

- int `nbins`  
*number of bins to score spectrum in*
- EGS\_ScoringArray \* `bins`  
*spectrum scoring array*
- EGS\_Float `e_min`  
*minimum spectrum energy to score*
- EGS\_Float `e_max`  
*maximum spectrum energy to score*

## Static Public Attributes

- static const int `DEFAULT_NBINS` = 100

## Protected Member Functions

- string `outputCSV` (string filename)  
*output results to csv file*
- string `outputXMGR` (string filename)  
*output results to xmgrace file*
- string `outputEGSnrc` (string filename)  
*output results to EGSnrc tabulated spectrum format*
- int `getBin` (EGS\_Float E) const  
*get index of bin that that E falls in*
- virtual string `getTitle` () const
- virtual string `getSubTitle` () const
- virtual string `getYAxisLabel` () const
- virtual string `getXAxisLabel` () const
- string `getFileName` (string root) const
- virtual string `getFileExtension` () const
- virtual void `getResult` (int bin, EGS\_Float &r, EGS\_Float &dr)  
*set r & dr to result/uncertainty for given bin. Normalization can be done in this routine*
- string `getParticleName` () const  
*Return name of particle we are scoring.*
- virtual void `outputTotal` ()

## Protected Attributes

- string `format`
- int `egsnrc_mode`
- int `particle_type`
- EGS\_I64 `cur_history`
- EGS\_I64 `eff_history`
- EGS\_Float `bin_width`
- EGS\_Float `total_scored`
- EGS\_BaseSource \* `source`
- bool `valid`
- string `fextension`

### 13.1.1 Detailed Description

abstract base class for scoring spectrum information

Inputs:

```

type           - determines which derived class to initialize ('surface count',
                  'energy weighted surface', 'energy fluence in region')
particle type - which kind of particle to score
minimum energy - don't score any particles below this energy (defaults to 0.001 MeV)
maximum energy - don't score any particles above this energy (defaults to source->getEmax())
number of bins - number of scoring bins to use (bin width = (E_max - E_min) / nbins
output format - xmgr, csv, or egsnrc (defaults to xmgr)
egsnrc format mode - if egsnrc output format is chosen, which mode to use (see egs++ docs)

geometry       - for 'energy fluence in region' mode used in conjunction with 'scoring region'
scoring region - input for determining which geometry region to score the spectrum in
scoring region - for 'energy fluence in region' mode used in conjunction with 'geometry'
file extension - input for determining which geometry region to score the spectrum in
file extension - if provided the output will be written to
                  sim_input_file.{file extension}.{output format} otherwise the output
                  file will be given a name like sim_input_file.surfcount.agr

```

Sample input:

```

:start spectrum scoring:
  type = surface count # surface count, energy weighted surface, energy fluence in region
  particle type = photon # photon, electron, positron
  minimum energy = 0.001
  maximum energy = 1.00
  number of bins = 1000
  output format = xmgr # xmgr (default), csv, egsnrc
  file extension = my_spectrum # (optional)
:stop spectrum scoring:

```

Definition at line 260 of file spec\_scoring.h.

### 13.1.2 Constructor & Destructor Documentation

**13.1.2.1 BaseSpectrumScorer::BaseSpectrumScorer ( *EGS\_Input \* input, EGS\_BaseSource \* src, GeomInfo \* ginfo, Publisher \* publisher* )**

Definition at line 112 of file spec\_scoring.cpp.

**13.1.2.2 BaseSpectrumScorer::~BaseSpectrumScorer ( ) [virtual]**

Definition at line 185 of file spec\_scoring.cpp.

### 13.1.3 Member Function Documentation

**13.1.3.1 int BaseSpectrumScorer::addState ( *istream & data* )**

Definition at line 413 of file spec\_scoring.cpp.

13.1.3.2 `int BaseSpectrumScorer::getBin ( EGS_Float E ) const` [protected]

get index of bin that that *E* falls in

Definition at line 195 of file spec\_scoring.cpp.

13.1.3.3 `EGS_Float BaseSpectrumScorer::getBinWidth ( ) const`

Definition at line 200 of file spec\_scoring.cpp.

13.1.3.4 `virtual string BaseSpectrumScorer::getFileExtension ( ) const` [inline], [protected], [virtual]

Reimplemented in [EnergyFluenceSpectrumInVoxel](#), [EnergyWeightedSurfaceSpectrum](#), and [SurfaceCountSpectrum](#).

Definition at line 312 of file spec\_scoring.h.

13.1.3.5 `string BaseSpectrumScorer::getFileName ( string root ) const` [inline], [protected]

Definition at line 308 of file spec\_scoring.h.

13.1.3.6 `virtual string BaseSpectrumScorer:: getInfo ( ) const` [inline], [virtual]

Definition at line 376 of file spec\_scoring.h.

13.1.3.7 `double BaseSpectrumScorer::getParticleEnergy ( const EGS_Particle * p ) const`

Definition at line 204 of file spec\_scoring.cpp.

13.1.3.8 `string BaseSpectrumScorer::getParticleName ( ) const` [inline], [protected]

Return name of particle we are scoring.

Definition at line 321 of file spec\_scoring.h.

13.1.3.9 `void BaseSpectrumScorer::getResult ( int bin, EGS_Float & r, EGS_Float & dr )` [protected], [virtual]

set *r* & *dr* to result/uncertainty for given bin. Normalization can be done in this routine

Reimplemented in [EnergyFluenceSpectrumInVoxel](#), [EnergyWeightedSurfaceSpectrum](#), and [SurfaceCountSpectrum](#).

Definition at line 374 of file spec\_scoring.cpp.

13.1.3.10 **BaseSpectrumScorer \* BaseSpectrumScorer::getSpectrumScorer ( EGS\_Input \* *inp*, EGS\_BaseSource \* *source*, GeomInfo \* *ginfo*, Publisher \* *publisher* ) [static]**

factory method for creating one of the derived spectrum scoring classes

Definition at line 85 of file spec\_scoring.cpp.

13.1.3.11 **virtual string BaseSpectrumScorer::getSubTitle ( ) const [inline], [protected], [virtual]**

Reimplemented in [EnergyWeightedSurfaceSpectrum](#), and [SurfaceCountSpectrum](#).

Definition at line 296 of file spec\_scoring.h.

13.1.3.12 **virtual string BaseSpectrumScorer::getTitle ( ) const [inline], [protected], [virtual]**

Reimplemented in [EnergyFluenceSpectrumInVoxel](#), [EnergyWeightedSurfaceSpectrum](#), and [SurfaceCountSpectrum](#).

Definition at line 292 of file spec\_scoring.h.

13.1.3.13 **virtual string BaseSpectrumScorer::getXAxisLabel ( ) const [inline], [protected], [virtual]**

Definition at line 304 of file spec\_scoring.h.

13.1.3.14 **virtual string BaseSpectrumScorer::getYAxisLabel ( ) const [inline], [protected], [virtual]**

Reimplemented in [EnergyFluenceSpectrumInVoxel](#), [EnergyWeightedSurfaceSpectrum](#), and [SurfaceCountSpectrum](#).

Definition at line 300 of file spec\_scoring.h.

13.1.3.15 **bool BaseSpectrumScorer::isValid ( ) const [inline]**

returns true if scorer was initialized correctly, otherwise false

Definition at line 381 of file spec\_scoring.h.

13.1.3.16 **string BaseSpectrumScorer::outputCSV ( string *filename* ) [protected]**

output results to csv file

Definition at line 237 of file spec\_scoring.cpp.

13.1.3.17 **int BaseSpectrumScorer::outputData ( ostream \* *ofile* )**

Definition at line 378 of file spec\_scoring.cpp.

13.1.3.18 `string BaseSpectrumScorer::outputEGSnrc ( string filename ) [protected]`

output results to EGSnrc tabulated spectrum format

Definition at line 253 of file spec\_scoring.cpp.

13.1.3.19 `int BaseSpectrumScorer::outputResults ( string root_name )`

, write the scored spectrum to file with filename. Returns 0 on success, all other values indicate a failure

Definition at line 209 of file spec\_scoring.cpp.

13.1.3.20 `virtual void BaseSpectrumScorer::outputTotal ( ) [inline], [protected], [virtual]`

Reimplemented in [EnergyFluenceSpectrumInVoxel](#), [EnergyWeightedSurfaceSpectrum](#), and [SurfaceCountSpectrum](#).

Definition at line 334 of file spec\_scoring.h.

13.1.3.21 `string BaseSpectrumScorer::outputXMGR ( string filename ) [protected]`

output results to xmgrace file

Definition at line 306 of file spec\_scoring.cpp.

13.1.3.22 `int BaseSpectrumScorer::readData ( istream * ifile )`

Definition at line 391 of file spec\_scoring.cpp.

13.1.3.23 `void BaseSpectrumScorer::resetCounter ( )`

Definition at line 404 of file spec\_scoring.cpp.

13.1.3.24 `virtual void BaseSpectrumScorer::score ( EB_Message message, void * data = 0 ) [pure virtual]`

override in derived classes to do scoring

Implemented in [EnergyFluenceSpectrumInVoxel](#), [EnergyWeightedSurfaceSpectrum](#), and [SurfaceCountSpectrum](#).

13.1.3.25 `void BaseSpectrumScorer::setEffectiveHistories ( EGS_Float effective_histories )`

Definition at line 191 of file spec\_scoring.cpp.

13.1.3.26 `void BaseSpectrumScorer::update ( EB_Message message, void * data = 0 ) [virtual]`

Receives messages from application. This method handles NEW\_HISTORY messages but delegates all other messages to the `score` methods of the derived classes.

Implements [Subscriber](#).

Definition at line 363 of file `spec_scoring.cpp`.

#### 13.1.4 Member Data Documentation

13.1.4.1 `EGS_Float BaseSpectrumScorer::bin_width [protected]`

Definition at line 270 of file `spec_scoring.h`.

13.1.4.2 `EGS_ScoringArray* BaseSpectrumScorer::bins`

spectrum scoring array

Definition at line 345 of file `spec_scoring.h`.

13.1.4.3 `EGS_I64 BaseSpectrumScorer::cur_history [protected]`

keep track of the current history we are on

Definition at line 267 of file `spec_scoring.h`.

13.1.4.4 `const int BaseSpectrumScorer::DEFAULT_NBINS = 100 [static]`

Definition at line 341 of file `spec_scoring.h`.

13.1.4.5 `EGS_Float BaseSpectrumScorer::e_max`

maximum spectrum energy to score

Definition at line 347 of file `spec_scoring.h`.

13.1.4.6 `EGS_Float BaseSpectrumScorer::e_min`

minimum spectrum energy to score

Definition at line 346 of file `spec_scoring.h`.

13.1.4.7 `EGS_I64 BaseSpectrumScorer::eff_history` [protected]

effective histories (for normalization)

Definition at line 268 of file spec\_scoring.h.

13.1.4.8 `int BaseSpectrumScorer::egsnrc_mode` [protected]

egsnrc spectrum output format mode

Definition at line 265 of file spec\_scoring.h.

13.1.4.9 `string BaseSpectrumScorer::fextension` [protected]

file extension to use

Definition at line 277 of file spec\_scoring.h.

13.1.4.10 `string BaseSpectrumScorer::format` [protected]

format to output results in

Definition at line 264 of file spec\_scoring.h.

13.1.4.11 `int BaseSpectrumScorer::nbins`

number of bins to score spectrum in

Definition at line 344 of file spec\_scoring.h.

13.1.4.12 `int BaseSpectrumScorer::particle_type` [protected]

What kind of particle are we interested in

Definition at line 266 of file spec\_scoring.h.

13.1.4.13 `EGS_BaseSource* BaseSpectrumScorer::source` [protected]

simulation source, used for limits on energy, normalization etc

Definition at line 273 of file spec\_scoring.h.

13.1.4.14 `EGS_Float BaseSpectrumScorer::total_scored` [protected]

Definition at line 271 of file spec\_scoring.h.

13.1.4.15 bool BaseSpectrumScorer::valid [protected]

Definition at line 275 of file spec\_scoring.h.

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

- /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/spec\_scoring.h
- /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/spec\_scoring.cpp

## 13.2 EB\_Application Class Reference

The main egs\_brachy application class. See the [Main Page](#) for full documentation.

```
#include <egs_brachy.h>
```

Inheritance diagram for EB\_Application:

Collaboration diagram for EB\_Application:

### Public Member Functions

- **EB\_Application** (int argc, char \*\*argv)  
*egs\_brachy constructor*
- **~EB\_Application** ()  
*egs\_brachy destructor*
- **void describeUserCode** () const  
*Print information about the egs\_brachy user code.*
- **void describeSimulation** ()  
*Describe the simulation.*
- **void printIncludedFiles** ()
- **int initSimulation** ()  
*set the run mode and then call EGS\_AdvancedApplication::initSimulation*
- **int initRunControl** ()  
*egs\_brachy specific run control initialization*
- **int initRunMode** ()  
*Get run mode from the input file.*
- **int initScoring** ()  
*initialize all scoring and variance reduction parameters*
- **int initVarianceReduction** ()  
*initialize all variance reduction parameters*
- **int initRussianRoulette** (EGS\_Input \*)  
*Initialize Russian roulette variance reduction if requested.*
- **int initBCSE** (EGS\_Input \*)  
*Initialize BCSE variance reduction if requested.*
- **int ausgab** (int iarg)  
*user scoring of dose, spectra etc*
- **int outputData** ()

*Output intermediate results. The egs\_brachy version outputs the standard egs++ data along with egs\_brachy specific information such as phantom and spectrum scoring information. egs\_brachy also allows you to output data in gzip format.*

- int `outputDataHelper` (ostream \*)
 

*helper function for outputData*
- int `egsApplicationOutputData` (ostream \*)
 

*helper function for outputData*
- int `egsAdvApplicationOutputData` (ostream \*)
 

*helper function for outputData*
- int `egsBrachyOutputData` (ostream \*)
 

*helper function for outputData*
- int `readData` ()
 

*Read data required for restarting simulations.*
- int `readDataHelper` (istream \*)
 

*helper function for outputData*
- int `egsApplicationReadData` (istream \*)
 

*helper function for outputData*
- int `egsAdvApplicationReadData` (istream \*)
 

*helper function for outputData*
- int `egsBrachyReadData` (istream \*)
 

*helper function for outputData*
- int `combineResults` ()
 

*Reset the application to a 'pristine' state. Adapted from egs\_application.cpp to allow combining in text or gzip format.*
- int `addState` (istream &data)
 

*Add data from a parallel job. Add standard egs++ data as well as egs\_brachy specific scoring information.*
- void `outputResults` ()
 

*Reports the current results for this batch of the simulation.*
- virtual void `startNewParticle` ()
 

*Set source ecut/pcut if different from global ecut/pcut.*
- virtual void `enterNewRegion` ()
- virtual int `runSimulation` ()
- string `getOutputVolcorFormat` ()

## Public Attributes

- int `nsources`

*total number of particle sources in current simulation*
- EGS\_Float `effective_histories`
- Latch `latch_control`

## Protected Member Functions

- void `addRecycledParticlesToStack` (EGS\_Particle \*p, bool new\_hist=false)
- void `copyParticleToSourceLoc` (EGS\_Particle \*p, int source, bool kill\_orig, bool rotate, EGS\_Float new\_wt)
- void `doPhotonSplitting` (int)
- int `simulateSingleShower` ()
- int `startNewShower` ()
- int `initGeometry` ()
 

*override default initGeometry so we can manually create our own geometry.*
- int `initSource` ()
- int `initSourceTransforms` ()
 

*read in the location of all particle sources*
- vector<EGS\_AffineTransform \*> `createTransforms` (EGS\_Input \*input)

## Private Types

- enum `RunMode { RM_NORMAL, RM_SUPERPOSITION, RM_VC_ONLY }`

## Private Member Functions

- int `createPhantoms ()`  
*set up Phantom objects for any geometries that user has requested scoring for*
- int `correctVolumes ()`  
*run the volume correction routines*
- void `initTrackLengthScoring (EGS_Input *)`  
*track length scoring initialization*
- void `initMuenData (EGS_Input *)`  
*load muen data for requested media*
- void `initOutputFiles (EGS_Input *)`  
*set up whether to output extra info files*
- void `initPHSPScoring (EGS_Input *)`  
*set up phsp scoring*
- void `initEDepScoring (EGS_Input *)`  
*energy deposition scoring initialization*
- void `initScatScoring (EGS_Input *)`  
*energy deposition scoring initialization*
- void `clearAusbabCalls ()`  
*disable all ausbab calls*
- void `enableAusbabCalls (int ncalls, AusbabCall calls[ ])`  
*enable an array of ausbab calls*
- void `initGCRScoring (EGS_Input *)`  
*setup which phantom/region will be used for getCurrentResult*
- void `initAusbabCalls ()`  
*setup any required ausbab calls*
- void `initDoseScaling (EGS_Input *)`  
*Initialize dose scaling factor if requested.*
- void `initXCCScaling (EGS_Input *)`  
*Initialize cross section scaling if requested.*
- void `initSpectrumScoring (EGS_Input *)`  
*Initialize all spectrum scoring objects.*
- int `initCrossSections ()`
- void `discardTopParticle (int idisc=1)`
- void `calcEffectiveHistories ()`
- bool `isStuck ()`

## Private Attributes

- `RunMode run_mode`  
*Which run mode are we using (RM\_NORMAL, RM\_SUPERPOSITION or RM\_VC\_ONLY \*/.*
- string `run_mode_name`
- `EnergyScoringStats * escoring`  
*Energy related scoring/stats.*
- `vector< BaseSpectrumScorer * > spectrum_scorers`
- `RecycleOpts * recycle_opts`

- bool `single_generator`
- bool `is_phsp_source`
- vector< EGS\_Float > `source_weights`
- int `active_source`
- PHSPControl \* `phsp`
- bool `score_tlen`  
*true when tracklength estimator is enabled*
- bool `score_edep`  
*true when energy deposition is enabled*
- bool `score_scat`  
*true when scatter scoring is enabled*
- string `output_egsdat_format`  
*text or gzip*
- bool `output_3ddose_files`  
*false if run mode is 'volume correction only'*
- string `output_dose_format`  
*text or gzip*
- bool `output_egsphant`  
*true if user requests egsphant output*
- string `output_egsphant_format`  
*text or gzip*
- bool `output_voxinfo`  
*true if user requests voxel info file*
- string `output_voxinfo_format`  
*text or gzip*
- vector< string > `output_volcor_phantoms`  
*vector of phantom names to output volume correction files for*
- string `output_volcor_format`  
*text or gzip*
- int `record_n_init`  
*if > 0 write initial pos of record\_n\_init particles to {input\_file}.pinit*
- vector< EGS\_Vector > `p_init_locs`
- EGS\_Vector `last_position`
- EGS\_Float `last_R`
- EGS\_Float `cur_R`
- int `steps_at_same_loc`
- EGS\_I64 `n_stuck`
- EGS\_BaseGeometry \* `source_envelope_geom`  
*geometry that the sources are embedded in*
- EGS\_ASwitchedEnvelope \* `superpos_geom`  
*an ASwitchedEnv cast of simulation geometry.*
- vector< EB\_Phantom \* > `phantom_geoms`  
*pointers to all of the phantom objects*
- vector< EGS\_AffineTransform \* > `source_transforms`  
*transforms to locations of all sources*
- EGS\_AffineTransform \* `base_transform`  
*same as source\_transforms[0]*
- EGS\_AffineTransform \* `base_transform_inv`  
*same as source\_transforms[0].inverse()*
- map< int, EGS\_Interpolator \* > `media_muen`  
*Map from medium index to muen interpolator for that medium.*

- map< string, string > [media\\_muen\\_names](#)
- bool [do\\_brem\\_split](#)
- int [nbr\\_split](#)

*Number of times to split bremsstrahlung photons.*
- bool [do\\_bcse](#)
- int [bcse\\_med\\_num](#)
- EGS\_Float [bcse\\_factor](#)
- EGS\_Float [flu\\_cutoff](#)

*fluorescent photon cutoff energy*
- EGS\_Float [source\\_ecut](#)

*ecut for source objects*
- EGS\_Float [source\\_pcut](#)

*pcut for source objects*
- EGS\_Float [global\\_ecut](#)

*ecut for source objects*
- EGS\_Float [global\\_pcut](#)

*pcut for source objects*
- bool [global\\_i\\_do\\_rr](#)

*enable range rejection outside of sources*
- EGS\_Float [global\\_e\\_max\\_rr](#)

*max range rejection energy globally*
- bool [source\\_i\\_do\\_rr](#)

*enable range rejection in sources*
- EGS\_Float [source\\_e\\_max\\_rr](#)

*max range rejection energy for source objects*
- [GeomInfo ginfo](#)

*meta data about the geometries*
- [EB\\_Phantom \\* gcr\\_phantom](#)

*phantom object to use in getCurrentResult (defaults to 1st phantom)*
- int [gcr\\_phantom\\_reg](#)

*region of phantom to use for getCurrentResult (default to 0)*
- [ebvolcor::Results source\\_vc\\_results](#)

*results from source volume correction box phantom*
- [ebvolcor::Results gen\\_vc\\_results](#)

*results from general volume correction*
- [ebvolcor::FileResults file\\_vc\\_results](#)

*results from precomputed volume correction*
- [Publisher pevent\\_pub](#)

*Particle event publisher.*
- [EB\\_TimingTree timing\\_blocks](#)

*Track CPU times of various functions.*
- map< int, EGS\_I64 > [steps\\_in\\_sources](#)
- map< int, EGS\_I64 > [steps\\_in\\_phantoms](#)
- map< int, EGS\_I64 > [steps\\_in\\_other](#)
- [ogzstream \\* gz\\_data\\_out](#)

*GZip file for outputing egsdat.*
- [igzstream \\* gz\\_data\\_in](#)

*GZip file for outputing egsdat.*

## Static Private Attributes

- static const EGS\_Float **DEFAULT\_BCSE\_FACTOR** = 100
- static string **revision** = "\$Revision: 0.9.1 \$"  
*the usercode revision number*

### 13.2.1 Detailed Description

The main egs\_brachy application class. See the [Main Page](#) for full documentation.

Definition at line 90 of file egs\_brachy.h.

### 13.2.2 Member Enumeration Documentation

#### 13.2.2.1 enum **EB\_Application::RunMode** [private]

Enumerator

- RM\_NORMAL** Standard running mode.
- RM\_SUPERPOSITION** Superposition mode for intersource effects.
- RM\_VC\_ONLY** Run volume correction routines then quit.

Definition at line 92 of file egs\_brachy.h.

### 13.2.3 Constructor & Destructor Documentation

#### 13.2.3.1 **EB\_Application::EB\_Application ( int argc, char \*\* argv )** [inline]

egs\_brachy constructor

Definition at line 260 of file egs\_brachy.h.

#### 13.2.3.2 **EB\_Application::~EB\_Application ( )** [inline]

egs\_brachy destructor

Definition at line 297 of file egs\_brachy.h.

### 13.2.4 Member Function Documentation

#### 13.2.4.1 **void EB\_Application::addRecycledParticlesToStack ( EGS\_Particle \* p, bool new\_hist = false )** [protected]

Definition at line 1355 of file egs\_brachy.cpp.

13.2.4.2 `int EB_Application::addState ( istream & data )`

Add data from a parallel job. Add standard egs++ data as well as egs\_brachy specific scoring information.

Definition at line 2253 of file egs\_brachy.cpp.

13.2.4.3 `int EB_Application::ausgab ( int iarg )`

user scoring of dose, spectra etc

Definition at line 1417 of file egs\_brachy.cpp.

13.2.4.4 `void EB_Application::calcEffectiveHistories ( ) [private]`

Definition at line 1633 of file egs\_brachy.cpp.

13.2.4.5 `void EB_Application::clearAusgabCalls ( ) [private]`

disable all ausgab calls

Definition at line 1022 of file egs\_brachy.cpp.

13.2.4.6 `int EB_Application::combineResults ( )`

Definition at line 2170 of file egs\_brachy.cpp.

13.2.4.7 `void EB_Application::copyParticleToSourceLoc ( EGS_Particle * p, int source, bool kill_orig, bool rotate, EGS_Float new_wt ) [protected]`

Definition at line 1254 of file egs\_brachy.cpp.

13.2.4.8 `int EB_Application::correctVolumes ( ) [private]`

run the volume correction routines

Definition at line 444 of file egs\_brachy.cpp.

13.2.4.9 `int EB_Application::createPhantoms ( ) [private]`

set up Phantom objects for any geometries that user has requested scoring for

Definition at line 476 of file egs\_brachy.cpp.

---

13.2.4.10 `vector< EGS_AffineTransform * > EB_Application::createTransforms ( EGS_Input * input ) [protected]`

Definition at line 390 of file egs\_brachy.cpp.

13.2.4.11 `void EB_Application::describeSimulation ( )`

Describe the simulation.

Add extra information to egs\_applications describeSimulation

Definition at line 127 of file egs\_brachy.cpp.

13.2.4.12 `void EB_Application::describeUserCode ( ) const`

Print information about the egs\_brachy user code.

Definition at line 113 of file egs\_brachy.cpp.

13.2.4.13 `void EB_Application::discardTopParticle ( int idisc = 1 ) [private]`

Definition at line 1347 of file egs\_brachy.cpp.

13.2.4.14 `void EB_Application::doPhotonSplitting ( int iarg ) [protected]`

Definition at line 1581 of file egs\_brachy.cpp.

13.2.4.15 `int EB_Application::egsAdvApplicationOutputData ( ostream * out )`

helper function for outputData

Definition at line 1917 of file egs\_brachy.cpp.

13.2.4.16 `int EB_Application::egsAdvApplicationReadData ( istream * in )`

helper function for outputData

Definition at line 2056 of file egs\_brachy.cpp.

13.2.4.17 `int EB_Application::egsApplicationOutputData ( ostream * out )`

helper function for outputData

Definition at line 1893 of file egs\_brachy.cpp.

13.2.4.18 `int EB_Application::egsApplicationReadData ( istream * in )`

helper function for outputData

Definition at line 2033 of file egs\_brachy.cpp.

13.2.4.19 `int EB_Application::egsBrachyOutputData ( ostream * out )`

helper function for outputData

Definition at line 1944 of file egs\_brachy.cpp.

13.2.4.20 `int EB_Application::egsBrachyReadData ( istream * in )`

helper function for outputData

Definition at line 2084 of file egs\_brachy.cpp.

13.2.4.21 `void EB_Application::enableAusgabCalls ( int ncalls, AusgabCall calls[] ) [private]`

enable an array of ausgab calls

Definition at line 1150 of file egs\_brachy.cpp.

13.2.4.22 `void EB_Application::enterNewRegion ( ) [virtual]`

Definition at line 1328 of file egs\_brachy.cpp.

13.2.4.23 `void EB_Application::getCurrentResult ( double & sum, double & sum2, double & norm, double & count )`

Reports the current results for this batch of the simulation.

Definition at line 1771 of file egs\_brachy.cpp.

13.2.4.24 `string EB_Application::getOutputVolcorFormat ( ) [inline]`

Definition at line 455 of file egs\_brachy.h.

13.2.4.25 `void EB_Application::initAusgabCalls ( ) [private]`

setup any required ausgab calls

For efficiency, only those ausgab calls which are strictly neccessary should be enabled

Definition at line 1029 of file egs\_brachy.cpp.

---

13.2.4.26 `int EB_Application::initBCSE ( EGS_Input * inp )`

Initialize BCSE variance reduction if requested.

Definition at line 964 of file egs\_brachy.cpp.

13.2.4.27 `int EB_Application::initCrossSections ( ) [private]`

Definition at line 628 of file egs\_brachy.cpp.

13.2.4.28 `void EB_Application::initDoseScaling ( EGS_Input * scoring_options ) [private]`

Initialize dose scaling factor if requested.

Definition at line 1205 of file egs\_brachy.cpp.

13.2.4.29 `void EB_Application::initEDepScoring ( EGS_Input * scoring_options ) [private]`

energy deposition scoring initialization

Definition at line 1157 of file egs\_brachy.cpp.

13.2.4.30 `void EB_Application::initGCRScoring ( EGS_Input * inp ) [private]`

setup which phantom/region will be used for getCurrentResult

Definition at line 704 of file egs\_brachy.cpp.

13.2.4.31 `int EB_Application::initGeometry ( ) [protected]`

override default initGeometry so we can manually create our own geometry.

This allows us to track region numbers for each geometry object individually

Definition at line 310 of file egs\_brachy.cpp.

13.2.4.32 `void EB_Application::initMuenData ( EGS_Input * scoring_options ) [private]`

load muen data for requested media

Definition at line 1093 of file egs\_brachy.cpp.

13.2.4.33 `void EB_Application::initOutputFiles ( EGS_Input * inp ) [private]`

set up whether to output extra info files

Definition at line 748 of file egs\_brachy.cpp.

13.2.4.34 void EB\_Application::initPHSPScoring ( EGS\_Input \* *inp* ) [private]

set up phsp scoring

Definition at line 777 of file egs\_brachy.cpp.

13.2.4.35 int EB\_Application::initRunControl ( )

egs\_brachy specific run control initialization

Definition at line 582 of file egs\_brachy.cpp.

13.2.4.36 int EB\_Application::initRunMode ( )

Get run mode from the input file.

Definition at line 595 of file egs\_brachy.cpp.

13.2.4.37 int EB\_Application::initRussianRoulette ( EGS\_Input \* *scoring\_options* )

Initialize Russian roulette variance reduction if requested.

Definition at line 938 of file egs\_brachy.cpp.

13.2.4.38 void EB\_Application::initScatScoring ( EGS\_Input \* *scoring\_options* ) [private]

energy deposition scoring initialization

Definition at line 1176 of file egs\_brachy.cpp.

13.2.4.39 int EB\_Application::initScoring ( )

initialize all scoring and variance reduction parameters

Definition at line 670 of file egs\_brachy.cpp.

13.2.4.40 int EB\_Application::initSimulation ( )

set the run mode and then call EGS\_AdvancedApplication::initSimulation

Definition at line 562 of file egs\_brachy.cpp.

13.2.4.41 int EB\_Application::initSource ( ) [protected]

Definition at line 519 of file egs\_brachy.cpp.

13.2.4.42 `int EB_Application::initSourceTransforms( )` [protected]

read in the location of all particle sources

Definition at line 412 of file egs\_brachy.cpp.

13.2.4.43 `void EB_Application::initSpectrumScoring( EGS_Input * scoring_input )` [private]

Initialize all spectrum scoring objects.

Definition at line 1001 of file egs\_brachy.cpp.

13.2.4.44 `void EB_Application::initTrackLengthScoring( EGS_Input * scoring_options )` [private]

track length scoring initialization

Definition at line 1041 of file egs\_brachy.cpp.

13.2.4.45 `int EB_Application::initVarianceReduction( )`

initialize all variance reduction parameters

Definition at line 788 of file egs\_brachy.cpp.

13.2.4.46 `void EB_Application::initXCCScaling( EGS_Input * scoring_options )` [private]

Initialize cross section scaling if requested.

Definition at line 1218 of file egs\_brachy.cpp.

13.2.4.47 `bool EB_Application::isStuck( )` [private]

Definition at line 1387 of file egs\_brachy.cpp.

13.2.4.48 `int EB_Application::outputData( )`

Output intermediate results. The egs\_brachy version outputs the standard egs++ data along with egs\_brachy specific information such as phantom and spectrum scoring information. egs\_brachy also allows you to output data in gzip format.

Definition at line 1991 of file egs\_brachy.cpp.

13.2.4.49 `int EB_Application::outputDataHelper( ostream * out )`

helper function for outputData

Definition at line 1977 of file egs\_brachy.cpp.

13.2.4.50 void EB\_Application::outputResults( )

Definition at line 1652 of file egs\_brachy.cpp.

13.2.4.51 void EB\_Application::printIncludedFiles( )

Definition at line 290 of file egs\_brachy.cpp.

13.2.4.52 int EB\_Application::readData( )

Read data required for restarting simulations.

Definition at line 2128 of file egs\_brachy.cpp.

13.2.4.53 int EB\_Application::readDataHelper( istream \* in )

helper function for outputData

Definition at line 2113 of file egs\_brachy.cpp.

13.2.4.54 void EB\_Application::resetCounter( )

Reset the application to a 'pristine' state. Adapted from egs\_application.cpp to allow combining in text or gzip format.

Definition at line 2232 of file egs\_brachy.cpp.

13.2.4.55 int EB\_Application::runSimulation( ) [virtual]

Definition at line 1781 of file egs\_brachy.cpp.

13.2.4.56 int EB\_Application::simulateSingleShower( ) [protected]

Definition at line 1789 of file egs\_brachy.cpp.

13.2.4.57 void EB\_Application::startNewParticle( ) [virtual]

Set source ecut/pcut if different from global ecut/pcut.

Definition at line 1313 of file egs\_brachy.cpp.

13.2.4.58 int EB\_Application::startNewShower( ) [protected]

Definition at line 1867 of file egs\_brachy.cpp.

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### 13.2.5 Member Data Documentation

13.2.5.1 `int EB_Application::active_source [private]`

Definition at line 111 of file egs\_brachy.h.

13.2.5.2 `EGS_AffineTransform* EB_Application::base_transform [private]`

same as `source_transforms[0]`

Definition at line 147 of file egs\_brachy.h.

13.2.5.3 `EGS_AffineTransform* EB_Application::base_transform_inv [private]`

same as `source_transforms[0].inverse()`

Definition at line 148 of file egs\_brachy.h.

13.2.5.4 `EGS_Float EB_Application::bcse_factor [private]`

Definition at line 159 of file egs\_brachy.h.

13.2.5.5 `int EB_Application::bcse_med_num [private]`

Definition at line 158 of file egs\_brachy.h.

13.2.5.6 `EGS_Float EB_Application::cur_R [private]`

Definition at line 137 of file egs\_brachy.h.

13.2.5.7 `const EGS_Float EB_Application::DEFAULT_BCSE_FACTOR = 100 [static], [private]`

Definition at line 160 of file egs\_brachy.h.

13.2.5.8 `bool EB_Application::do_bcse [private]`

Definition at line 157 of file egs\_brachy.h.

13.2.5.9 `bool EB_Application::do_brem_split [private]`

Definition at line 154 of file egs\_brachy.h.

**13.2.5.10 EGS\_Float EB\_Application::effective\_histories**

Definition at line 350 of file egs\_brachy.h.

**13.2.5.11 EnergyScoringStats\* EB\_Application::escoring [private]**

Energy related scoring/stats.

Definition at line 102 of file egs\_brachy.h.

**13.2.5.12 ebvolcor::FileResults EB\_Application::file\_vc\_results [private]**

results from precomputed volume correction

Definition at line 181 of file egs\_brachy.h.

**13.2.5.13 EGS\_Float EB\_Application::flu\_cutoff [private]**

fluorescent photon cutoff energy

Definition at line 162 of file egs\_brachy.h.

**13.2.5.14 EB\_Phantom\* EB\_Application::gcr\_phantom [private]**

phantom object to use in getCurrentResult (defaults to 1st phantom)

Definition at line 176 of file egs\_brachy.h.

**13.2.5.15 int EB\_Application::gcr\_phantom\_reg [private]**

region of phantom to use for getCurrentResult (default to 0)

Definition at line 177 of file egs\_brachy.h.

**13.2.5.16 ebvolcor::Results EB\_Application::gen\_vc\_results [private]**

results from general volume correction

Definition at line 180 of file egs\_brachy.h.

**13.2.5.17 GeomInfo EB\_Application::ginfo [private]**

meta data about the geometries

Definition at line 174 of file egs\_brachy.h.

13.2.5.18 **EGS\_Float EB\_Application::global\_e\_max\_rr** [private]

max range rejection energy globally

Definition at line 169 of file egs\_brachy.h.

13.2.5.19 **EGS\_Float EB\_Application::global\_ecut** [private]

ecut for source objects

Definition at line 165 of file egs\_brachy.h.

13.2.5.20 **bool EB\_Application::global\_i\_do\_rr** [private]

enable range rejection outside of sources

Definition at line 168 of file egs\_brachy.h.

13.2.5.21 **EGS\_Float EB\_Application::global\_pcut** [private]

pcut for source objects

Definition at line 166 of file egs\_brachy.h.

13.2.5.22 **igzstream\* EB\_Application::gz\_data\_in** [private]

GZip file for outputing egsdat.

Definition at line 192 of file egs\_brachy.h.

13.2.5.23 **ogzstream\* EB\_Application::gz\_data\_out** [private]

GZip file for outputing egsdat.

Definition at line 191 of file egs\_brachy.h.

13.2.5.24 **bool EB\_Application::is\_phsp\_source** [private]

Definition at line 108 of file egs\_brachy.h.

13.2.5.25 **EGS\_Vector EB\_Application::last\_position** [private]

Definition at line 135 of file egs\_brachy.h.

13.2.5.26 `EGS_Float EB_Application::last_R` [private]

Definition at line 136 of file egs\_brachy.h.

13.2.5.27 `Latch EB_Application::latch_control`

Definition at line 352 of file egs\_brachy.h.

13.2.5.28 `map<int, EGS_Interpolator *> EB_Application::media_muen` [private]

Map from medium index to muen interpolator for that medium.

Definition at line 150 of file egs\_brachy.h.

13.2.5.29 `map<string, string> EB_Application::media_muen_names` [private]

Definition at line 151 of file egs\_brachy.h.

13.2.5.30 `EGS_I64 EB_Application::n_stuck` [private]

Definition at line 139 of file egs\_brachy.h.

13.2.5.31 `int EB_Application::nbr_split` [private]

Number of times to split bremsstrahlung photons.

Definition at line 155 of file egs\_brachy.h.

13.2.5.32 `int EB_Application::nsources`

total number of particle sources in current simulation

Definition at line 346 of file egs\_brachy.h.

13.2.5.33 `bool EB_Application::output_3ddose_files` [private]

false if run mode is 'volume correction only'

Definition at line 121 of file egs\_brachy.h.

13.2.5.34 `string EB_Application::output_dose_format` [private]

text or gzip

Definition at line 122 of file egs\_brachy.h.

13.2.5.35 `string EB_Application::output_egsdat_format` [private]

text or gzip

Definition at line 119 of file egs\_brachy.h.

13.2.5.36 `bool EB_Application::output_egsphant` [private]

true if user requests egsphant output

Definition at line 123 of file egs\_brachy.h.

13.2.5.37 `string EB_Application::output_egsphant_format` [private]

text or gzip

Definition at line 124 of file egs\_brachy.h.

13.2.5.38 `string EB_Application::output_volcor_format` [private]

text or gzip

Definition at line 130 of file egs\_brachy.h.

13.2.5.39 `vector<string> EB_Application::output_volcor_phantoms` [private]

vector of phantom names to output volume correction files for

Definition at line 129 of file egs\_brachy.h.

13.2.5.40 `bool EB_Application::output_voxinfo` [private]

true if user requests voxel info file

Definition at line 126 of file egs\_brachy.h.

13.2.5.41 `string EB_Application::output_voxinfo_format` [private]

text or gzip

Definition at line 127 of file egs\_brachy.h.

13.2.5.42 `vector<EGS_Vector> EB_Application::p_init_locs` [private]

Definition at line 133 of file egs\_brachy.h.

13.2.5.43 **Publisher** `EB_Application::pevent_pub` [private]

Particle event publisher.

Definition at line 183 of file egs\_brachy.h.

13.2.5.44 `vector<EB_Phantom *> EB_Application::phantom_geoms` [private]

pointers to all of the phantom objects

Definition at line 144 of file egs\_brachy.h.

13.2.5.45 `PHSPControl* EB_Application::phsp` [private]

Definition at line 113 of file egs\_brachy.h.

13.2.5.46 `int EB_Application::record_n_init` [private]

if > 0 write initial pos of record\_n\_init particles to {input\_file}.pinit

Definition at line 132 of file egs\_brachy.h.

13.2.5.47 `RecycleOpts* EB_Application::recycle_opts` [private]

Definition at line 106 of file egs\_brachy.h.

13.2.5.48 `string EB_Application::revision = "$Revision: 0.9.1 $"` [static], [private]

the usercode revision number

Definition at line 194 of file egs\_brachy.h.

13.2.5.49 `RunMode EB_Application::run_mode` [private]

Which run mode are we using (RM\_NORMAL, RM\_SUPERPOSITION or RM\_VC\_ONLY \*/.

Definition at line 99 of file egs\_brachy.h.

13.2.5.50 `string EB_Application::run_mode_name` [private]

Definition at line 100 of file egs\_brachy.h.

13.2.5.51 `bool EB_Application::score_edep [private]`

true when energy deposition is enabled

Definition at line 116 of file egs\_brachy.h.

13.2.5.52 `bool EB_Application::score_scat [private]`

true when scatter scoring is enabled

Definition at line 117 of file egs\_brachy.h.

13.2.5.53 `bool EB_Application::score_tlen [private]`

true when tracklength estimator is enabled

Definition at line 115 of file egs\_brachy.h.

13.2.5.54 `bool EB_Application::single_generator [private]`

Definition at line 107 of file egs\_brachy.h.

13.2.5.55 `EGS_Float EB_Application::source_e_max_rr [private]`

max range rejection energy for source objects

Definition at line 172 of file egs\_brachy.h.

13.2.5.56 `EGS_Float EB_Application::source_ecut [private]`

ecut for source objects

Definition at line 163 of file egs\_brachy.h.

13.2.5.57 `EGS_BaseGeometry* EB_Application::source_envelope_geom [private]`

geometry that the sources are embedded in

Definition at line 141 of file egs\_brachy.h.

13.2.5.58 `bool EB_Application::source_i_do_rr [private]`

enable range rejection in sources

Definition at line 171 of file egs\_brachy.h.

13.2.5.59 `EGS_Float EB_Application::source_pcut [private]`

pcut for source objects

Definition at line 164 of file egs\_brachy.h.

13.2.5.60 `vector<EGS_AffineTransform *> EB_Application::source_transforms [private]`

transforms to locations of all sources

Definition at line 146 of file egs\_brachy.h.

13.2.5.61 `ebvolcor::Results EB_Application::source_vc_results [private]`

results from source volume correctio box phantom

Definition at line 179 of file egs\_brachy.h.

13.2.5.62 `vector<EGS_Float> EB_Application::source_weights [private]`

Definition at line 110 of file egs\_brachy.h.

13.2.5.63 `vector<BaseSpectrumScorer *> EB_Application::spectrum_scorers [private]`

Definition at line 103 of file egs\_brachy.h.

13.2.5.64 `int EB_Application::steps_at_same_loc [private]`

Definition at line 138 of file egs\_brachy.h.

13.2.5.65 `map<int, EGS_I64> EB_Application::steps_in_other [private]`

Definition at line 189 of file egs\_brachy.h.

13.2.5.66 `map<int, EGS_I64> EB_Application::steps_in_phantoms [private]`

Definition at line 188 of file egs\_brachy.h.

13.2.5.67 `map<int, EGS_I64> EB_Application::steps_in_sources [private]`

Definition at line 187 of file egs\_brachy.h.

13.2.5.68 **EGS\_ASwitchedEnvelope\*** **EB\_Application::superpos\_geom** [private]

an ASwitchedEnv cast of simulation geometry.

Definition at line 142 of file egs\_brachy.h.

13.2.5.69 **EB\_TimingTree** **EB\_Application::timing\_blocks** [private]

Track CPU times of various functions.

Definition at line 185 of file egs\_brachy.h.

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

- /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/[egs\\_brachy.h](#)
- /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/[egs\\_brachy.cpp](#)

### 13.3 EB\_IAEASource Class Reference

A phase space file source for egs\_brachy.

```
#include <eb_iaeaphsp_source.h>
```

Inheritance diagram for EB\_IAEASource:

Collaboration diagram for EB\_IAEASource:

#### Public Member Functions

- [EB\\_IAEASource](#) (EGS\_Input \*, EGS\_ObjectFactory \*f=0)  
*Constructor.*
- [~EB\\_IAEASource](#) ()
- EGS\_I64 [getNextParticle](#) (EGS\_RandomGenerator \*rndm, int &q, int &latch, EGS\_Float &E, EGS\_Float &wt, EGS\_Vector &x, EGS\_Vector &u)
- EGS\_Float [getEmax](#) () const
- EGS\_Float [getFluence](#) () const
- void [setSimulationChunk](#) (EGS\_I64 nstart, EGS\_I64 nrun)
- bool [storeState](#) (ostream &data) const
- bool [setState](#) (istream &data)
- bool [addState](#) (istream &data)
- void [resetCounter](#) ()
- bool [isValid](#) () const

#### Protected Member Functions

- void [openPHSPFile](#) ()
- void [initSourceParams](#) ()

## Protected Attributes

- bool `is_valid`
- string `phsp_file_name`  
*The phase space file name.*
- ifstream `phsp_file`  
*Phase space data stream.*
- IAEA\_I32 `source_id`
- IAEA\_I32 \* `p_source_id`
- EGS\_Float `Emax`  
*Maximum energy (obtained from the phsp file)*
- EGS\_Float `Emin`  
*Minimum energy (obtained from the phsp file)*
- EGS\_Float `Nincident`  
*Number of incident particles that created the file.*
- IAEA\_I64 `Nparticle`  
*Number of particles in the file.*
- IAEA\_I64 `Nphoton`  
*Number of photons in the file.*
- IAEA\_I64 `Nused`  
*Number of particles used so far.*
- IAEA\_I64 `Npos`  
*Next record to be read.*
- IAEA\_I64 `Nfirst`  
*first record this source can use*
- IAEA\_I64 `Nlast`  
*Last record this source can use.*
- IAEA\_I64 `Nread`  
*Number of particles read from file so far.*
- IAEA\_I64 `count`  
*Particles delivered so far.*
- IAEA\_I32 `n_parallel`
- IAEA\_I32 `i_parallel`

## Static Protected Attributes

- static IAEA\_I32 `next_source_id` = 0
- static const string `iae_header_ext` = ".IAEHeader"

### 13.3.1 Detailed Description

A phase space file source for egs\_brachy.

A phase space file source reads and delivers particles from a an IAEA phase space file. Note this source is an incomplete implementation and may only be suitable for use with egs\_brachy.

A phase space file source is defined as follows:

```
:start source:
    library = eb_iaeaphsp_source
    name = some_name
    header file = path to the phase space header file
    particle type = one of photons, electrons, positrons, all, or charged
:stop source:
```

Definition at line 101 of file eb\_iaeaphsp\_source.h.

### 13.3.2 Constructor & Destructor Documentation

13.3.2.1 `EB_IAEASource::EB_IAEASource ( EGS_Input * input, EGS_ObjectFactory * f = 0 )`

Constructor.

Construct a phase space file source from the information pointed to by *inp*.

Definition at line 53 of file eb\_ieaphsp\_source.cpp.

13.3.2.2 `EB_IAEASource::~EB_IAEASource ( )`

Definition at line 107 of file eb\_ieaphsp\_source.cpp.

### 13.3.3 Member Function Documentation

13.3.3.1 `bool EB_IAEASource::addState ( istream & data )`

Definition at line 319 of file eb\_ieaphsp\_source.cpp.

13.3.3.2 `EGS_Float EB_IAEASource::getEmax ( ) const`

Definition at line 232 of file eb\_ieaphsp\_source.cpp.

13.3.3.3 `EGS_Float EB_IAEASource::getFluence ( ) const`

Definition at line 240 of file eb\_ieaphsp\_source.cpp.

13.3.3.4 `IAEA_I64 EB_IAEASource::getNextParticle ( EGS_RandomGenerator * rndm, int & q, int & latch, EGS_Float & E, EGS_Float & wt, EGS_Vector & x, EGS_Vector & u )`

Definition at line 157 of file eb\_ieaphsp\_source.cpp.

13.3.3.5 `void EB_IAEASource::initSourceParams ( ) [protected]`

Definition at line 131 of file eb\_ieaphsp\_source.cpp.

13.3.3.6 `bool EB_IAEASource::isValid ( ) const`

Definition at line 236 of file eb\_ieaphsp\_source.cpp.

13.3.3.7 `void EB_IAEASource::openPHSPFile( )` [protected]

Definition at line 116 of file eb\_iaeaphsp\_source.cpp.

13.3.3.8 `void EB_IAEASource::resetCounter( )`

Definition at line 330 of file eb\_iaeaphsp\_source.cpp.

13.3.3.9 `void EB_IAEASource::setSimulationChunk( EGS_I64 nstart, EGS_I64 nrun )`

Definition at line 208 of file eb\_iaeaphsp\_source.cpp.

13.3.3.10 `bool EB_IAEASource::setState( istream & data )`

Definition at line 282 of file eb\_iaeaphsp\_source.cpp.

13.3.3.11 `bool EB_IAEASource::storeState( ostream & data ) const`

Definition at line 245 of file eb\_iaeaphsp\_source.cpp.

### 13.3.4 Member Data Documentation

13.3.4.1 `IAEA_I64 EB_IAEASource::count` [protected]

Particles delivered so far.

Definition at line 142 of file eb\_iaeaphsp\_source.h.

13.3.4.2 `EGS_Float EB_IAEASource::Emax` [protected]

Maximum energy (obtained from the phsp file)

Definition at line 138 of file eb\_iaeaphsp\_source.h.

13.3.4.3 `EGS_Float EB_IAEASource::Emin` [protected]

Minimum energy (obtained from the phsp file)

Definition at line 138 of file eb\_iaeaphsp\_source.h.

13.3.4.4 `IAEA_I32 EB_IAEASource::i_parallel` [protected]

Definition at line 151 of file eb\_iaeaphsp\_source.h.

13.3.4.5 `const string EB_IAEASource::iaea_header_ext = ".IAEAheader" [static], [protected]`

Definition at line 159 of file eb\_iaeaphsp\_source.h.

13.3.4.6 `bool EB_IAEASource::is_valid [protected]`

Definition at line 131 of file eb\_iaeaphsp\_source.h.

13.3.4.7 `IAEA_I32 EB_IAEASource::n_parallel [protected]`

Definition at line 151 of file eb\_iaeaphsp\_source.h.

13.3.4.8 `IAEA_I32 EB_IAEASource::next_source_id = 0 [static], [protected]`

Definition at line 157 of file eb\_iaeaphsp\_source.h.

13.3.4.9 `IAEA_I64 EB_IAEASource::Nfirst [protected]`

first record this source can use

Definition at line 142 of file eb\_iaeaphsp\_source.h.

13.3.4.10 `EGS_Float EB_IAEASource::Nincident [protected]`

Number of incident particles that created the file.

Definition at line 138 of file eb\_iaeaphsp\_source.h.

13.3.4.11 `IAEA_I64 EB_IAEASource::Nlast [protected]`

Last record this source can use.

Definition at line 142 of file eb\_iaeaphsp\_source.h.

13.3.4.12 `IAEA_I64 EB_IAEASource::Nparticle [protected]`

Number of particles in the file.

Definition at line 142 of file eb\_iaeaphsp\_source.h.

13.3.4.13 `IAEA_I64 EB_IAEASource::Nphoton [protected]`

Number of photons in the file.

Definition at line 142 of file eb\_iaeaphsp\_source.h.

13.3.4.14 IAEA\_I64 EB\_IAEASource::Npos [protected]

Next record to be read.

Definition at line 142 of file eb\_iaeaphsp\_source.h.

13.3.4.15 IAEA\_I64 EB\_IAEASource::Nread [protected]

Number of particles read from file so far.

Definition at line 142 of file eb\_iaeaphsp\_source.h.

13.3.4.16 IAEA\_I64 EB\_IAEASource::Nused [protected]

Number of particles used so far.

Definition at line 142 of file eb\_iaeaphsp\_source.h.

13.3.4.17 IAEA\_I32\* EB\_IAEASource::p\_source\_id [protected]

Definition at line 136 of file eb\_iaeaphsp\_source.h.

13.3.4.18 ifstream EB\_IAEASource::phsp\_file [protected]

Phase space data stream.

Definition at line 133 of file eb\_iaeaphsp\_source.h.

13.3.4.19 string EB\_IAEASource::phsp\_file\_name [protected]

The phase space file name.

Definition at line 132 of file eb\_iaeaphsp\_source.h.

13.3.4.20 IAEA\_I32 EB\_IAEASource::source\_id [protected]

Definition at line 135 of file eb\_iaeaphsp\_source.h.

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

- /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/eb\_iaeaphsp\_source/[eb\\_iaeaphsp\\_source.h](#)
- /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/eb\_iaeaphsp\_source/[eb\\_iaeaphsp\\_source.cpp](#)

## 13.4 EB\_Phantom Class Reference

A class to represent a single phantom for scoring dose in egs\_brachy.

```
#include <phantom.h>
```

Inheritance diagram for EB\_Phantom:

Collaboration diagram for EB\_Phantom:

### Public Types

- enum `GeomDirections { XDIR, YDIR, ZDIR }`

### Public Member Functions

- `EB_Phantom (EGS_Application *, EGS_BaseGeometry *, set< int > global_regions, int nsources, Publisher *publisher)`  
*EB\_Phantom constructor.*
- `~EB_Phantom ()`  
*EB\_Phantom destructor.*
- `void scoreTlen (int ir, EGS_Float dose, EGS_Particle *p)`  
*add tracklength dose to region ir*
- `void scoreEdep (int ir, EGS_Float dose)`  
*add energy deposition dose to region ir*
- `void getCurrentScore (int ireg, double &sum, double &sum2)`  
*get current tlen score for region*
- `double getTlenNorm (int ireg)`
- `void setDoseScale (EGS_Float)`  
*set dose scaling factor for output*
- `void update (EB_Message message, void *data)`
- `EGS_Float getCorrectedVolume (int ireg)`  
*get uncorrected volume for a given region*
- `EGS_Float getUncorrectedVolume (int ireg)`  
*get corrected volume for a given region*
- `vector< int > getRegionsWithCorrections ()`  
*return a vector of all regions which were corrected*
- `void setCorrectedVolume (int ir, double fraction)`  
*Allow user to tell phantom what the actual volume of a region is.*
- `void enableTLenScoring ()`  
*enableTLenScoring must be called before simulation begins if you want to score dose with tracklength estimator in addition to tracklength scoring*
- `void enableInteractionScoring ()`  
*enableInteractionScoring must be called before simulation begins if you want to score dose with interaction scoring in addition to tracklength scoring*
- `void enableScatterScoring ()`  
*enableInteractionScoring must be called before simulation begins if you want to score dose with interaction scoring in addition to tracklength scoring*
- `void setHistory (EGS_I64 current_case)`  
*set current history on scoring arrays for proper statistics*
- `void setEffectiveHistories (EGS_Float current_case)`

- **EGS\_Float avgVoxelVol ()**  
*return average voxel volume*
- **void outputVoxelInfo (string format)**  
*write voxel volumes, mass, desnity etc*
- **void writeVoxelInfo (ostream &)**  
*write voxel info file*
- **void outputVolumeCorrection (string format)**  
*initialize and output write voxel volumes to file*
- **void writeVolumeCorrection (ostream &)**  
*write voxel volumes to file*
- **void outputResults (int top\_n=20, string output\_3ddose="text", string output\_egsphant="text", string output\_voxinfo="text", string output\_volcor="text")**  
*tell phantom to output its results.*
- **bool globalRegIsInPhant (int global\_reg)**  
*check whether a global region falls within this phantom*
- **int globalToLocal (int global\_reg)**  
*convert global region to local phantom region*
- **int outputData (ostream \*ofile)**
- **int readData (istream \*ifile)**
- **void resetCounter ()**
- **int addState (istream &ifile)**
- **EGS\_Float getRealRho (int ireg)**  
*return actual density for region*
- **EGS\_Float getRealMass (int ireg)**  
*return (corrected) real mass for region*
- **EGS\_Float getUncorrectedMass (int ireg)**  
*return uncorrected for region*

## Static Public Member Functions

- **static bool allowedPhantomGeom (const string &geom\_type)**  
*function for checking whether a given geometry type is allowed to be used as a phantom*

## Public Attributes

- **EGS\_BaseGeometry \* geometry**  
*the phantom geometry object*
- **set< int > global\_regions**  
*the set of all global regions contained in this phantom*
- **int global\_reg\_start**  
*starting global region index for this phantom*
- **int global\_reg\_stop**  
*ending global region index for this phantom*

## Private Member Functions

- `void outputDoseStats (EGS_ScoringArray *score, string type)`  
`write some stats about dose arrays`
- `void outputTopDoses (int top_n, vector< RegionResult > region_results)`  
`write the top_n doses to console`
- `void output3ddoseResults (string)`  
`write the phantom boundaries, doses and uncertainties to 3ddose file`
- `void output3DDoses (ostream &out, EGS_ScoringArray *score, string type)`  
`write input scoring array to 3ddose file`
- `void output3DBounds (ostream &out)`  
`write the phantom bounds to 3ddose file`
- `void outputEGSPphant (string)`  
`initialize and write an egsphant file for this phantom`
- `void writeEGSPphant (ostream &)`  
`write actual egsphant data to file for this phantom`
- `vector< RegionResult > getRegionResults ()`  
`create a vector of RegionResult structs which can then be sorted by dose value. used for output routines`
- `void getResult (EGS_ScoringArray *, int ireg, string type, EGS_Float &r, EGS_Float &dr)`  
`get result for region from scoring array and normalize based on the type requested.`
- `void getScoringArrays (vector< EGS_ScoringArray * > &scores, vector< string > &types, vector< string > &descriptions)`  
`get all active scoring arrays, their types and descriptions`
- `void getEGSdatScoringArrays (vector< EGS_ScoringArray * > &scores)`  
`get all active scoring arrays for writing to egsdat file`

## Private Attributes

- `EGS_Application * app`  
`Parent application instance. Required for constructing filenames.`
- `EGS_ScoringArray * tlen_score`  
`Tracklength dose scoring array.`
- `EGS_ScoringArray * edep_score`  
`Interaction scored dose scoring array.`
- `EGS_ScoringArray * prim_score`  
`Tracklenth scored dose from primary particles.`
- `EGS_ScoringArray * sscat_score`  
`Tracklenth scored dose from single scattered particles.`
- `EGS_ScoringArray * mscat_score`  
`Tracklenth scored dose from multiple scattered particles.`
- `int nsources`
- `EGS_Float dose_scale`
- `EGS_Float total_radiant_e`
- `EGS_I64 cur_history`
- `EGS_Float effective_histories`
- `Publisher * publisher`
- `std::map< int, double > corrected_volumes`  
`Corrected volume in a given region.`

## Static Private Attributes

- static const string `allowed_phantom_geom_types` [ ] = {"EGS\_cSpheres", "EGS\_cSphericalShell", "EGS\_cXYZGeometry", "EGS\_RZ"}

### 13.4.1 Detailed Description

A class to represent a single phantom for scoring dose in egs\_brachy.

A simulation may have an arbitrary number of these phantoms. This class handles scoring both tracklength and interaction scoring, outputting the top N doses to the console and output to 3ddose files.

Region numbers are all 'local' region numbers. That is the phantom does not know anything about its global region number. egs\_brachy should convert to local region number before calling any method taking a region number as input.

Definition at line 71 of file phantom.h.

### 13.4.2 Member Enumeration Documentation

#### 13.4.2.1 enum EB\_Phantom::GeomDirections

Enumerator

**XDIR** XDIR=0 x dir for rectilinear, r dir for spherical, z dir for cylindrical.

**YDIR** YDIR=1 y dir for rectilinear, r dir for cylindrical.

**ZDIR** ZDIR=2 z dir for rectilinear.

Definition at line 135 of file phantom.h.

### 13.4.3 Constructor & Destructor Documentation

#### 13.4.3.1 EB\_Phantom::EB\_Phantom ( *EGS\_Application \*parent, EGS\_BaseGeometry \*geom, set< int > global\_regions, int nsource, Publisher \*publisher* )

[EB\\_Phantom](#) constructor.

Definition at line 97 of file phantom.cpp.

#### 13.4.3.2 EB\_Phantom::~EB\_Phantom ( ) [inline]

[EB\\_Phantom](#) destructor.

Definition at line 145 of file phantom.h.

### 13.4.4 Member Function Documentation

13.4.4.1 `int EB_Phantom::addState ( istream & ifile )`

Definition at line 789 of file phantom.cpp.

13.4.4.2 `bool EB_Phantom::allowedPhantomGeom ( const string & geom_type ) [static]`

function for checking whether a given geometry type is allowed to be used as a phantom

Definition at line 157 of file phantom.cpp.

13.4.4.3 `EGS_Float EB_Phantom::avgVoxelVol ( )`

return average voxel volume

Definition at line 661 of file phantom.cpp.

13.4.4.4 `void EB_Phantom::enableInteractionScoring ( )`

enableInteractionScoring must be called before simulation begins if you want to score dose with interaction scoring in addition to tracklength scoring

Definition at line 191 of file phantom.cpp.

13.4.4.5 `void EB_Phantom::enableScatterScoring ( )`

enableInteractionScoring must be called before simulation begins if you want to score dose with interaction scoring in addition to tracklength scoring

Definition at line 198 of file phantom.cpp.

13.4.4.6 `void EB_Phantom::enableTLenScoring ( )`

enableTLenScoring must be called before simulation begins if you want to score dose with tracklength estimator in addition to tracklength scoring

Definition at line 184 of file phantom.cpp.

13.4.4.7 `EGS_Float EB_Phantom::getCorrectedVolume ( int ireg )`

get uncorrected volume for a given region

Definition at line 281 of file phantom.cpp.

13.4.4.8 `void EB_Phantom::getCurrentScore ( int ireg, double & sum, double & sum2 )`

get current tlen score for region

Definition at line 287 of file phantom.cpp.

13.4.4.9 `void EB_Phantom::getEGSdatScoringArrays ( vector< EGS_ScoringArray * > & scores ) [private]`

get all active scoring arrays for writing to egsdat file

Definition at line 487 of file phantom.cpp.

13.4.4.10 `EGS_Float EB_Phantom::getRealMass ( int ireg )`

return (corrected) real mass for region

Definition at line 267 of file phantom.cpp.

13.4.4.11 `EGS_Float EB_Phantom::getRealRho ( int ireg )`

return actual density for region

Definition at line 261 of file phantom.cpp.

13.4.4.12 `vector< RegionResult > EB_Phantom::getRegionResults ( ) [private]`

create a vector of [RegionResult](#) structs which can then be sorted by dose value. used for output routines

Definition at line 332 of file phantom.cpp.

13.4.4.13 `vector< int > EB_Phantom::getRegionsWithCorrections ( )`

return a vector of all regions which were corrected

Definition at line 171 of file phantom.cpp.

13.4.4.14 `void EB_Phantom::getResult ( EGS_ScoringArray * score, int ireg, string type, EGS_Float & r, EGS_Float & dr ) [private]`

get result for region from scoring array and normalize based on the type requested.

Definition at line 304 of file phantom.cpp.

```
13.4.4.15 void EB_Phantom::getScoringArrays ( vector< EGS_ScoringArray * > & scores, vector< string > & types,
                                             vector< string > & descriptions ) [private]
```

get all active scoring arrays, their types and descriptions

Definition at line 455 of file phantom.cpp.

```
13.4.4.16 double EB_Phantom::getTlenNorm ( int ireg )
```

Definition at line 299 of file phantom.cpp.

```
13.4.4.17 EGS_Float EB_Phantom::getUncorrectedMass ( int ireg )
```

return uncorrected for region

Definition at line 271 of file phantom.cpp.

```
13.4.4.18 EGS_Float EB_Phantom::getUncorrectedVolume ( int ireg )
```

get corrected volume for a given region

Definition at line 275 of file phantom.cpp.

```
13.4.4.19 bool EB_Phantom::globalRegIsInPhant ( int global_reg ) [inline]
```

check whether a global region falls within this phantom

Definition at line 240 of file phantom.h.

```
13.4.4.20 int EB_Phantom::globalToLocal ( int global_reg ) [inline]
```

convert global region to local phantom region

Definition at line 245 of file phantom.h.

```
13.4.4.21 void EB_Phantom::output3DBounds ( ostream & out ) [private]
```

write the phantom bounds to 3ddose file

Definition at line 554 of file phantom.cpp.

```
13.4.4.22 void EB_Phantom::output3ddoseResults ( string format ) [private]
```

write the phantom boundaries, doses and uncertainties to 3ddose file

Definition at line 507 of file phantom.cpp.

13.4.4.23 void EB\_Phantom::output3DDoses ( ostream & *out*, EGS\_ScoringArray \* *score*, string *type* ) [private]

write input scoring array to 3ddose file

Definition at line 577 of file phantom.cpp.

13.4.4.24 int EB\_Phantom::outputData ( ostream \* *ofile* )

Definition at line 751 of file phantom.cpp.

13.4.4.25 void EB\_Phantom::outputDoseStats ( EGS\_ScoringArray \* *score*, string *type* ) [private]

write some stats about dose arrays

Definition at line 362 of file phantom.cpp.

13.4.4.26 void EB\_Phantom::outputEGSPhant ( string *format* ) [private]

initialize and write an egsphant file for this phantom

Definition at line 639 of file phantom.cpp.

13.4.4.27 void EB\_Phantom::outputResults ( int *top\_n* = 20, string *output\_3ddose* = "text", string *output\_egsphant* = "text", string *output\_voxinfo* = "text", string *output\_volcor* = "text" )

tell phantom to output its results.

Definition at line 235 of file phantom.cpp.

13.4.4.28 void EB\_Phantom::outputTopDoses ( int *top\_n*, vector< RegionResult > *region\_results* ) [private]

write the top\_n doses to console

Definition at line 405 of file phantom.cpp.

13.4.4.29 void EB\_Phantom::outputVolumeCorrection ( string *format* )

intialize and output write voxel volumes to file

Definition at line 727 of file phantom.cpp.

13.4.4.30 void EB\_Phantom::outputVoxellInfo ( string *format* )

write voxel volumes, mass, desnity etc

Definition at line 689 of file phantom.cpp.

---

13.4.4.31 `int EB_Phantom::readData ( istream * ifile )`

Definition at line 770 of file phantom.cpp.

13.4.4.32 `void EB_Phantom::resetCounter ( )`

Definition at line 815 of file phantom.cpp.

13.4.4.33 `void EB_Phantom::scoreEdep ( int ir, EGS_Float dose )`

add energy deposition dose to region ir

Definition at line 146 of file phantom.cpp.

13.4.4.34 `void EB_Phantom::scoreTlen ( int ir, EGS_Float dose, EGS_Particle * p )`

add tracklength dose to region ir

Definition at line 124 of file phantom.cpp.

13.4.4.35 `void EB_Phantom::setCorrectedVolume ( int ir, double fraction )`

Allow user to tell phantom what the actual volume of a region is.

Definition at line 179 of file phantom.cpp.

13.4.4.36 `void EB_Phantom::setDoseScale ( EGS_Float scale )`

set dose scaling factor for output

add energy deposition dose to region ir

Definition at line 153 of file phantom.cpp.

13.4.4.37 `void EB_Phantom::setEffectiveHistories ( EGS_Float current_case )`

set number of effective histories for normalizing scoring arrays

Definition at line 229 of file phantom.cpp.

13.4.4.38 `void EB_Phantom::setHistory ( EGS_I64 current_case )`

set current history on scoring arrays for proper statistics

Definition at line 210 of file phantom.cpp.

```
13.4.4.39 void EB_Phantom::update ( EB_Message message, void * data ) [virtual]
```

Implements [Subscriber](#).

Definition at line 115 of file phantom.cpp.

```
13.4.4.40 void EB_Phantom::writeEGSPhant ( ostream & out ) [private]
```

write actual egsphant data to file for this phantom

Definition at line 599 of file phantom.cpp.

```
13.4.4.41 void EB_Phantom::writeVolumeCorrection ( ostream & out )
```

write voxel volumes to file

Definition at line 714 of file phantom.cpp.

```
13.4.4.42 void EB_Phantom::writeVoxelInfo ( ostream & out )
```

write voxel info file

Definition at line 671 of file phantom.cpp.

## 13.4.5 Member Data Documentation

```
13.4.5.1 const string EB_Phantom::allowed_phantom_geom_types = {"EGS_cSpheres", "EGS_cSphericalShell",
    "EGS_XYZGeometry", "EGS_RZ"} [static], [private]
```

Definition at line 75 of file phantom.h.

```
13.4.5.2 EGS_Application* EB_Phantom::app [private]
```

Parent application instance. Required for constructing filenames.

Definition at line 77 of file phantom.h.

```
13.4.5.3 std::map<int, double> EB_Phantom::corrected_volumes [private]
```

Corrected volume in a given region.

Definition at line 94 of file phantom.h.

13.4.5.4 **EGS\_I64 EB\_Phantom::cur\_history** [private]

Definition at line 89 of file phantom.h.

13.4.5.5 **EGS\_Float EB\_Phantom::dose\_scale** [private]

Definition at line 86 of file phantom.h.

13.4.5.6 **EGS\_ScoringArray\* EB\_Phantom::edep\_score** [private]

Interaction scored dose scoring array.

Definition at line 79 of file phantom.h.

13.4.5.7 **EGS\_Float EB\_Phantom::effective\_histories** [private]

Definition at line 90 of file phantom.h.

13.4.5.8 **EGS\_BaseGeometry\* EB\_Phantom::geometry**

the phantom geometry object

Definition at line 271 of file phantom.h.

13.4.5.9 **int EB\_Phantom::global\_reg\_start**

starting global region index for this phantom

Definition at line 280 of file phantom.h.

13.4.5.10 **int EB\_Phantom::global\_reg\_stop**

ending global region index for this phantom

Definition at line 281 of file phantom.h.

13.4.5.11 **set<int> EB\_Phantom::global\_regions**

the set of all global regions contained in this phantom

Definition at line 278 of file phantom.h.

13.4.5.12 EGS\_ScoringArray\* EB\_Phantom::mscat\_score [private]

Tracklength scored dose from multiple scattered particles.

Definition at line 83 of file phantom.h.

13.4.5.13 int EB\_Phantom::nsources [private]

Definition at line 85 of file phantom.h.

13.4.5.14 EGS\_ScoringArray\* EB\_Phantom::prim\_score [private]

Tracklength scored dose from primary particles.

Definition at line 80 of file phantom.h.

13.4.5.15 Publisher\* EB\_Phantom::publisher [private]

Definition at line 92 of file phantom.h.

13.4.5.16 EGS\_ScoringArray\* EB\_Phantom::sscat\_score [private]

Tracklength scored dose from single scattered particles.

Definition at line 81 of file phantom.h.

13.4.5.17 EGS\_ScoringArray\* EB\_Phantom::tlen\_score [private]

Tracklength dose scoring array.

Definition at line 78 of file phantom.h.

13.4.5.18 EGS\_Float EB\_Phantom::total\_radiant\_e [private]

Definition at line 88 of file phantom.h.

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

- /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/[phantom.h](#)
- /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/[phantom.cpp](#)

## 13.5 EB\_Timer Class Reference

```
#include <timing.h>
```

## Public Member Functions

- `EB_Timer (string tname, int level)`
- `void start ()`
- `void stop ()`
- `EGS_Float getElapsedTime ()`
- `EGS_Float getStartTime ()`
- `EGS_Float getStop ()`
- `EGS_Float getDuration ()`
- `string getName ()`
- `bool isStopped ()`
- `bool isRunning ()`
- `int getLevel ()`

## Private Attributes

- `string name`
- `EGS_Timer timer`
- `EGS_Float start_time`
- `EGS_Float stop_time`
- `int nested_level`

### 13.5.1 Detailed Description

Definition at line 47 of file timing.h.

### 13.5.2 Constructor & Destructor Documentation

#### 13.5.2.1 `EB_Timer::EB_Timer ( string tname, int level ) [inline]`

Definition at line 56 of file timing.h.

### 13.5.3 Member Function Documentation

#### 13.5.3.1 `EGS_Float EB_Timer::getDuration ( ) [inline]`

Definition at line 84 of file timing.h.

#### 13.5.3.2 `EGS_Float EB_Timer::getElapsedTime ( ) [inline]`

Definition at line 72 of file timing.h.

#### 13.5.3.3 `int EB_Timer::getLevel ( ) [inline]`

Definition at line 103 of file timing.h.

13.5.3.4 `string EB_Timer::getName( ) [inline]`

Definition at line 91 of file timing.h.

13.5.3.5 `EGS_Float EB_Timer::getStartTime( ) [inline]`

Definition at line 76 of file timing.h.

13.5.3.6 `EGS_Float EB_Timer::getStop( ) [inline]`

Definition at line 80 of file timing.h.

13.5.3.7 `bool EB_Timer::isRunning( ) [inline]`

Definition at line 99 of file timing.h.

13.5.3.8 `bool EB_Timer::isStopped( ) [inline]`

Definition at line 95 of file timing.h.

13.5.3.9 `void EB_Timer::start( ) [inline]`

Definition at line 63 of file timing.h.

13.5.3.10 `void EB_Timer::stop( ) [inline]`

Definition at line 68 of file timing.h.

## 13.5.4 Member Data Documentation

13.5.4.1 `string EB_Timer::name [private]`

Definition at line 49 of file timing.h.

13.5.4.2 `int EB_Timer::nested_level [private]`

Definition at line 53 of file timing.h.

13.5.4.3 `EGS_Float EB_Timer::start_time [private]`

Definition at line 51 of file timing.h.

**13.5.4.4 EGS\_Float EB\_Timer::stop\_time [private]**

Definition at line 52 of file timing.h.

**13.5.4.5 EGS\_Timer EB\_Timer::timer [private]**

Definition at line 50 of file timing.h.

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

- /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/timing.h

## 13.6 EB\_TimingTree Class Reference

```
#include <timing.h>
```

### Public Member Functions

- [EB\\_TimingTree \(\)](#)
- [~EB\\_TimingTree \(\)](#)
- [void addTimer \(string name\)](#)
- [void stopTimer \(\)](#)
- [void outputInfo \(\)](#)

### Private Attributes

- [vector< EB\\_Timer \\* > running\\_blocks](#)
- [vector< EB\\_Timer \\* > stopped\\_blocks](#)
- [int level](#)

### 13.6.1 Detailed Description

Definition at line 110 of file timing.h.

### 13.6.2 Constructor & Destructor Documentation

**13.6.2.1 EB\_TimingTree::EB\_TimingTree( ) [inline]**

Definition at line 118 of file timing.h.

**13.6.2.2 EB\_TimingTree::~EB\_TimingTree( ) [inline]**

Definition at line 120 of file timing.h.

### 13.6.3 Member Function Documentation

13.6.3.1 `void EB_TimingTree::addTimer ( string name ) [inline]`

Definition at line 132 of file timing.h.

13.6.3.2 `void EB_TimingTree::outputInfo ( ) [inline]`

Definition at line 159 of file timing.h.

13.6.3.3 `void EB_TimingTree::stopTimer ( ) [inline]`

Definition at line 139 of file timing.h.

### 13.6.4 Member Data Documentation

13.6.4.1 `int EB_TimingTree::level [private]`

Definition at line 115 of file timing.h.

13.6.4.2 `vector<EB_Timer *> EB_TimingTree::running_blocks [private]`

Definition at line 112 of file timing.h.

13.6.4.3 `vector<EB_Timer *> EB_TimingTree::stopped_blocks [private]`

Definition at line 113 of file timing.h.

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

- /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/timing.h

## 13.7 EnergyFluenceSpectrumInVoxel Class Reference

A class for scoring the energy weighted spectrum (normalized to total radiant energy) of particles on the surface of a source geometry.

```
#include <spec_scoring.h>
```

Inheritance diagram for EnergyFluenceSpectrumInVoxel:

Collaboration diagram for EnergyFluenceSpectrumInVoxel:

## Public Member Functions

- `EnergyFluenceSpectrumInVoxel` (`EGS_Input *input, EGS_BaseSource *src, GeomInfo *ginfo, Publisher *publisher`)
- virtual `void score` (`EB_Message message, void *data=0`)

## Private Member Functions

- `void getResult` (`int bin, EGS_Float &r, EGS_Float &dr`)
   
*set r & dr to result/uncertainty for given bin. Normalization can be done in this routine*
- `string getTitle () const`
- `string getYAxisLabel () const`
- `void outputTotal ()`
- `string getFileExtension () const`

## Private Attributes

- `EGS_BaseGeometry * geometry`
- `EGS_Float region_volume`
- `int local_scoring_region`
- `int scoring_region`

## Additional Inherited Members

### 13.7.1 Detailed Description

A class for scoring the energy weighted spectrum (normalized to total radiant energy) of particles on the surface of a source geometry.

Note: this currently only works if there are no other geometries overlapping the scoring region. If there is, you will get incorrect results!

Sample input:

```
:start spectrum scoring:
  type = energy weighted surface
  particle type = photon
  minimum energy = 0.001
  maximum energy = 1.00
  number of bins = 1000
  output format = xmgr
  geometry = your_phantom_geom_name
  scoring region = 1 # which region of 'your_phantom_geom' to score in (defaults to 0)
:stop spectrum scoring:
```

Definition at line 528 of file spec\_scoring.h.

### 13.7.2 Constructor & Destructor Documentation

#### 13.7.2.1 EnergyFluenceSpectrumInVoxel::EnergyFluenceSpectrumInVoxel ( `EGS_Input *input, EGS_BaseSource *src, GeomInfo *ginfo, Publisher *publisher` ) [inline]

Definition at line 558 of file spec\_scoring.h.

### 13.7.3 Member Function Documentation

13.7.3.1 `string EnergyFluenceSpectrumInVoxel::getFileExtension( ) const` [inline], [private], [virtual]

Reimplemented from [BaseSpectrumScorer](#).

Definition at line 551 of file spec\_scoring.h.

13.7.3.2 `void EnergyFluenceSpectrumInVoxel::getResult( int bin, EGS_Float & r, EGS_Float & dr )` [private], [virtual]

set r & dr to result/uncertainty for given bin. Normalization can be done in this routine

Reimplemented from [BaseSpectrumScorer](#).

Definition at line 527 of file spec\_scoring.cpp.

13.7.3.3 `string EnergyFluenceSpectrumInVoxel::getTitle( ) const` [inline], [private], [virtual]

Reimplemented from [BaseSpectrumScorer](#).

Definition at line 538 of file spec\_scoring.h.

13.7.3.4 `string EnergyFluenceSpectrumInVoxel::getYAxisLabel( ) const` [inline], [private], [virtual]

Reimplemented from [BaseSpectrumScorer](#).

Definition at line 545 of file spec\_scoring.h.

13.7.3.5 `void EnergyFluenceSpectrumInVoxel::outputTotal( )` [private], [virtual]

Reimplemented from [BaseSpectrumScorer](#).

Definition at line 537 of file spec\_scoring.cpp.

13.7.3.6 `void EnergyFluenceSpectrumInVoxel::score( EB_Message message, void * data = 0 )` [virtual]

override in derived classes to do scoring

Implements [BaseSpectrumScorer](#).

Definition at line 509 of file spec\_scoring.cpp.

### 13.7.4 Member Data Documentation

13.7.4.1 `EGS_BaseGeometry* EnergyFluenceSpectrumInVoxel::geometry` [private]

Definition at line 530 of file spec\_scoring.h.

13.7.4.2 int EnergyFluenceSpectrumInVoxel::local\_scoring\_region [private]

Definition at line 532 of file spec\_scoring.h.

13.7.4.3 EGS\_Float EnergyFluenceSpectrumInVoxel::region\_volume [private]

Definition at line 531 of file spec\_scoring.h.

13.7.4.4 int EnergyFluenceSpectrumInVoxel::scoring\_region [private]

Definition at line 533 of file spec\_scoring.h.

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

- /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/spec\_scoring.h
- /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/spec\_scoring.cpp

## 13.8 EnergyScoringStats Class Reference

a class to use for scoring information about total energy initialized, escaping sources etc

```
#include <spec_scoring.h>
```

Inheritance diagram for EnergyScoringStats:

Collaboration diagram for EnergyScoringStats:

### Public Member Functions

- [EnergyScoringStats \(Publisher \\*publisher\)](#)  
 Needed for loading data from egsdat file.
- [void scoreEnergyInitialized \(EGS\\_Float E\)](#)  
 return the ratio of energy escaping the source to total energy initialized
- [EGS\\_Float escapingSourcesRatio \(\)](#)  
 return the ratio of energy escaping the simulation geometry to total energy initialized
- [EGS\\_Float escapingGeomRatio \(\)](#)  
 return the ratio of energy escaping the simulation geometry to total energy initialized
- [EGS\\_Float totalEnergyInitialized \(\)](#)  
 returns the total energy initialized
- [EGS\\_Float energyEscapingSources \(\)](#)  
 returns the total particle energy escaping source geometry
- [EGS\\_Float energyEscapingGeom \(\)](#)  
 returns the total energy of particles escaping simulation geometry
- [void update \(EB\\_Message message, void \\*particle\)](#)  
 delegate messages to appropriate scoring functions
- [void outputResults \(\)](#)  
 write results to console
- [int outputData \(ostream \\*ofile\)](#)
- [int readData \(istream \\*ifile\)](#)
- [void resetCounter \(\)](#)
- [int addState \(istream &data\)](#)

## Private Member Functions

- EGS\_Float [getParticleEnergy](#) (const EGS\_Particle \**p*, bool subtractRM=true)
- void [scoreParticleInitialized](#) (EGS\_Particle \**p*)  
*add energy from initial particle to total*
- void [scoreParticleEscapingSource](#) (EGS\_Particle \**p*)  
*add energy from a particle escaping a source to the total*
- void [scoreParticleEscapingGeom](#) (EGS\_Particle \**p*)  
*add energy from a escaping simulation geometry to the total*

## Private Attributes

- EGS\_Float [total\\_energy\\_initialized](#)  
*total energy of particles initialized so far*
- EGS\_Float [energy\\_escaping\\_sources](#)  
*total energy of particles escaping the source geometry note: doesn't currently exclude particles reentering the source geometry and then escaping again*
- EGS\_Float [energy\\_escaping\\_geom](#)  
*total energy of particles escaping the simulation geometry*

### 13.8.1 Detailed Description

a class to use for scoring information about total energy initialized, escaping sources etc

Definition at line 57 of file spec\_scoring.h.

### 13.8.2 Constructor & Destructor Documentation

#### 13.8.2.1 EnergyScoringStats::EnergyScoringStats ( Publisher \* *publisher* ) [inline]

Definition at line 94 of file spec\_scoring.h.

### 13.8.3 Member Function Documentation

#### 13.8.3.1 int EnergyScoringStats::addState ( istream & *data* ) [inline]

Definition at line 205 of file spec\_scoring.h.

#### 13.8.3.2 EGS\_Float EnergyScoringStats::energyEscapingGeom ( ) [inline]

returns the total energy of particles escaping simulation geometry

Definition at line 141 of file spec\_scoring.h.

13.8.3.3 **EGS\_Float EnergyScoringStats::energyEscapingSources ( ) [inline]**

returns the total particle energy escaping source geometry

Definition at line 136 of file spec\_scoring.h.

13.8.3.4 **EGS\_Float EnergyScoringStats::escapingGeomRatio ( ) [inline]**

return the ratio of energy escaping the simulation geometry to total energy initialized

Definition at line 122 of file spec\_scoring.h.

13.8.3.5 **EGS\_Float EnergyScoringStats::escapingSourcesRatio ( ) [inline]**

return the ratio of energy escaping the source to total energy initialized

Definition at line 112 of file spec\_scoring.h.

13.8.3.6 **EGS\_Float EnergyScoringStats::getParticleEnergy ( const EGS\_Particle \* p, bool subtractRM = true ) [inline], [private]**

Definition at line 66 of file spec\_scoring.h.

13.8.3.7 **int EnergyScoringStats::outputData ( ostream \* ofile ) [inline]**

Definition at line 185 of file spec\_scoring.h.

13.8.3.8 **void EnergyScoringStats::outputResults ( ) [inline]**

write results to console

Definition at line 165 of file spec\_scoring.h.

13.8.3.9 **int EnergyScoringStats::readData ( istream \* ifile ) [inline]**

Definition at line 192 of file spec\_scoring.h.

13.8.3.10 **void EnergyScoringStats::resetCounter ( ) [inline]**

Definition at line 199 of file spec\_scoring.h.

13.8.3.11 void EnergyScoringStats::scoreEnergyInitialized ( EGS\_Float *E* ) [inline]

Needed for loading data from egsdat file.

Definition at line 107 of file spec\_scoring.h.

13.8.3.12 void EnergyScoringStats::scoreParticleEscapingGeom ( EGS\_Particle \* *p* ) [inline], [private]

add energy from a escaping simulation geometry to the total

Definition at line 88 of file spec\_scoring.h.

13.8.3.13 void EnergyScoringStats::scoreParticleEscapingSource ( EGS\_Particle \* *p* ) [inline], [private]

add energy from a particle escaping a source to the total

Definition at line 83 of file spec\_scoring.h.

13.8.3.14 void EnergyScoringStats::scoreParticleInitialized ( EGS\_Particle \* *p* ) [inline], [private]

add energy from initial particle to total

Definition at line 75 of file spec\_scoring.h.

13.8.3.15 EGS\_Float EnergyScoringStats::totalEnergyInitialized ( ) [inline]

returns the total energy initialized

Definition at line 131 of file spec\_scoring.h.

13.8.3.16 void EnergyScoringStats::update ( EB\_Message *message*, void \* *particle* ) [inline], [virtual]

delegate messages to appropriate scoring functions

Implements [Subscriber](#).

Definition at line 147 of file spec\_scoring.h.

## 13.8.4 Member Data Documentation

13.8.4.1 EGS\_Float EnergyScoringStats::energy\_escaping\_geom [private]

total energy of particles escaping the simulation geometry

Definition at line 64 of file spec\_scoring.h.

### 13.8.4.2 EGS\_Float EnergyScoringStats::energy\_escaping\_sources [private]

total energy of particles escaping the source geometry note: doesn't currently exclude particles reentering the source geometry and then escaping again

Definition at line 60 of file spec\_scoring.h.

### 13.8.4.3 EGS\_Float EnergyScoringStats::total\_energy\_initialized [private]

total energy of particles initialized so far

Definition at line 59 of file spec\_scoring.h.

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

- /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/spec\_scoring.h

## 13.9 EnergyWeightedSurfaceSpectrum Class Reference

A class for scoring the energy weighted spectrum (normalized to total radiant energy) of particles on the surface of a source geometry.

```
#include <spec_scoring.h>
```

Inheritance diagram for EnergyWeightedSurfaceSpectrum:

Collaboration diagram for EnergyWeightedSurfaceSpectrum:

### Public Member Functions

- [EnergyWeightedSurfaceSpectrum](#) (EGS\_Input \*input, EGS\_BaseSource \*src, GeomInfo \*ginfo, Publisher \*publisher)
- virtual [void score](#) ([EB\\_Message](#) message, [void](#) \*data=0)

### Private Member Functions

- [void getResult](#) (int bin, EGS\_Float &r, EGS\_Float &dr)  
*set r & dr to result/uncertainty for given bin. Normalization can be done in this routine*
- string [getTitle](#) () const
- string [getSubTitle](#) () const
- string [getYAxisLabel](#) () const
- [void outputTotal](#) ()
- string [getFileExtension](#) () const

## Additional Inherited Members

### 13.9.1 Detailed Description

A class for scoring the energy weighted spectrum (normalized to total radiant energy) of particles on the surface of a source geometry.

See Taylor & Rogers, Med. Phys., 35 , 4933 – 4944, 2008

Sample input:

```
:start spectrum scoring:  
    type = energy weighted surface  
    particle type = photon  
    minimum energy = 0.001  
    maximum energy = 1.00  
    number of bins = 1000  
    output format = xmgr  
:stop spectrum scoring:
```

Definition at line 471 of file spec\_scoring.h.

### 13.9.2 Constructor & Destructor Documentation

13.9.2.1 **EnergyWeightedSurfaceSpectrum::EnergyWeightedSurfaceSpectrum ( EGS\_Input \* *input*, EGS\_BaseSource \* *src*, GeomInfo \* *ginfo*, Publisher \* *publisher* ) [inline]**

Definition at line 495 of file spec\_scoring.h.

### 13.9.3 Member Function Documentation

13.9.3.1 **string EnergyWeightedSurfaceSpectrum::getFileExtension ( ) const [inline], [private], [virtual]**

Reimplemented from [BaseSpectrumScorer](#).

Definition at line 489 of file spec\_scoring.h.

13.9.3.2 **void EnergyWeightedSurfaceSpectrum::getResult ( int *bin*, EGS\_Float & *r*, EGS\_Float & *dr* ) [private], [virtual]**

set r & dr to result/uncertainty for given bin. Normalization can be done in this routine

Reimplemented from [BaseSpectrumScorer](#).

Definition at line 488 of file spec\_scoring.cpp.

13.9.3.3 **string EnergyWeightedSurfaceSpectrum::getSubTitle ( ) const [inline], [private], [virtual]**

Reimplemented from [BaseSpectrumScorer](#).

Definition at line 479 of file spec\_scoring.h.

13.9.3.4 `string EnergyWeightedSurfaceSpectrum::getTitle ( ) const [inline], [private], [virtual]`

Reimplemented from [BaseSpectrumScorer](#).

Definition at line 475 of file `spec_scoring.h`.

13.9.3.5 `string EnergyWeightedSurfaceSpectrum::getYAxisLabel ( ) const [inline], [private], [virtual]`

Reimplemented from [BaseSpectrumScorer](#).

Definition at line 483 of file `spec_scoring.h`.

13.9.3.6 `void EnergyWeightedSurfaceSpectrum::outputTotal ( ) [private], [virtual]`

Reimplemented from [BaseSpectrumScorer](#).

Definition at line 497 of file `spec_scoring.cpp`.

13.9.3.7 `void EnergyWeightedSurfaceSpectrum::score ( EB_Message message, void * data = 0 ) [virtual]`

override in derived classes to do scoring

Implements [BaseSpectrumScorer](#).

Definition at line 473 of file `spec_scoring.cpp`.

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

- /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/[spec\\_scoring.h](#)
- /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/[spec\\_scoring.cpp](#)

## 13.10 ebvolcor::FileResults Struct Reference

```
#include <eb_volcor.h>
```

### Public Member Functions

- [FileResults \(\)](#)
- [FileResults \(map< string, string > phant\\_files\)](#)
- [void outputResults \(\)](#)

### Public Attributes

- bool [success](#)
- EGS\_Float [time](#)
- map< string, string > [phantom\\_files](#)
- map< string, int > [nreg](#)

### 13.10.1 Detailed Description

Definition at line 244 of file eb\_volcor.h.

### 13.10.2 Constructor & Destructor Documentation

#### 13.10.2.1 ebvolcor::FileResults::FileResults ( ) [inline]

Definition at line 251 of file eb\_volcor.h.

#### 13.10.2.2 ebvolcor::FileResults::FileResults ( map< string, string > *phant\_files* ) [inline]

Definition at line 255 of file eb\_volcor.h.

### 13.10.3 Member Function Documentation

#### 13.10.3.1 void ebvolcor::FileResults::outputResults ( ) [inline]

Definition at line 260 of file eb\_volcor.h.

### 13.10.4 Member Data Documentation

#### 13.10.4.1 map<string, int> ebvolcor::FileResults::nreg

Definition at line 249 of file eb\_volcor.h.

#### 13.10.4.2 map<string, string> ebvolcor::FileResults::phantom\_files

Definition at line 248 of file eb\_volcor.h.

#### 13.10.4.3 bool ebvolcor::FileResults::success

did the volume correction succeed?

Definition at line 246 of file eb\_volcor.h.

#### 13.10.4.4 EGS\_Float ebvolcor::FileResults::time

how long (s) did the volume correction take

Definition at line 247 of file eb\_volcor.h.

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

- /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/eb\_volcor.h

## 13.11 GeomInfo Class Reference

a container for organizing meta data about the geometries

```
#include <ginfo.h>
```

Collaboration diagram for GeomInfo:

### Public Member Functions

- `GeomInfo ()`
- `~GeomInfo ()`
- int `initializeFromInput (EGS_Input *input)`

*Initialize the `GeomInfo` structure (ginfo) This function reads the geometry input block, ensures all the required keys are present and pulls out information like which geometries are phantoms and sources.*
- void `setGeometryIndexes (EGS_BaseGeometry *sim_geom)`

*Setup all arrays required to decide which geometry/phantom a region is in and whether or not we are scoring dose in it.*
- int `phantomFromRegion (int ir)`

*return the phantom index for this region number or -1 if region is not in a phantom*
- `GeomRegT globalToLocal (int ir)`

*convert global region number to (EGS\_BaseGeometry, local\_reg\_num) pair*
- int `globalToLocalReg (int ir)`

*convert global region number to local\_reg\_num*
- int `localToGlobal (GeomRegT)`
- bool `isPhantom (int ir)`
- bool `isSource (int ir)`
- void `printInfo ()`

### Public Attributes

- string `sim_geom_name`
- string `source_envelope_name`
- vector< string > `phantom_names`
- vector< string > `source_names`
- `Node * geom_tree`
- int `ngeom`

*total number of geometries created*
- int `nreg_total`

*total number of regions in the simulation geometry*
- vector< `GeomRegionInfo` > `ordered_geom_data`
- map< `EGS_BaseGeometry` \*, `GeomRegionInfo` > `geom_to_regioninfo`
- vector< `EB_Phantom` \* > `phantom_geoms`

*pointers to all of the phantom objects*

### Private Member Functions

- vector< string > `getChildren (string name, EGS_Input *inp)`
- void `getGeomRegs (Node, vector< GeomRegionInfo > &, int)`
- void `setGeomMap ()`
- `Node build_tree (string root, vector< Node > &children)`

## Private Attributes

- vector< int > [global\\_ir\\_to\\_phant](#)  
*array of size nreg mapping global region number to*
- vector< int > [global\\_ir\\_to\\_source](#)  
*the phantoms geometry index or -1 if not a phantom*
- vector< EGS\_BaseGeometry \* > [global\\_ir\\_to\\_geom](#)  
*the source geometry index or -1 if not a source*
- vector< int > [global\\_ir\\_to\\_local\\_ir](#)  
*pointer for the geometry it belongs to*
- [GeomRegionInfoMapT gmap](#)

### 13.11.1 Detailed Description

a container for organizing meta data about the geometries

Definition at line 99 of file ginfo.h.

### 13.11.2 Constructor & Destructor Documentation

#### 13.11.2.1 GeomInfo::GeomInfo ( ) [inline]

Definition at line 142 of file ginfo.h.

#### 13.11.2.2 GeomInfo::~GeomInfo ( ) [inline]

Definition at line 143 of file ginfo.h.

### 13.11.3 Member Function Documentation

#### 13.11.3.1 Node GeomInfo::build\_tree ( string root, vector< Node > & children ) [private]

Definition at line 71 of file ginfo.cpp.

#### 13.11.3.2 vector< string > GeomInfo::getChildren ( string name, EGS\_Input \* inp ) [private]

Definition at line 316 of file ginfo.cpp.

#### 13.11.3.3 void GeomInfo::getGeomRegs ( Node root, vector< GeomRegionInfo > & ordered, int start ) [private]

Definition at line 399 of file ginfo.cpp.

**13.11.3.4 GeomRegT GeomInfo::globalToLocal ( int *ir* )**

convert global region number to (EGS\_BaseGeometry, local\_reg\_num) pair

Definition at line 461 of file ginfo.cpp.

**13.11.3.5 int GeomInfo::globalToLocalReg ( int *ir* )**

convert global region number to local\_reg\_num

Definition at line 469 of file ginfo.cpp.

**13.11.3.6 int GeomInfo::initializeFromInput ( EGS\_Input \* *input* )**

Initialize the **GeomInfo** structure (ginfo) This function reads the geometry input block, ensures all the required keys are present and pulls out information like which geometries are phantoms and sources.

Note since we can't do a deep copy of the input we have to take all the geometry input items and then re-write them to the ginput

Definition at line 85 of file ginfo.cpp.

**13.11.3.7 bool GeomInfo::isPhantom ( int *ir* )**

Definition at line 480 of file ginfo.cpp.

**13.11.3.8 bool GeomInfo::isSource ( int *ir* )**

Definition at line 485 of file ginfo.cpp.

**13.11.3.9 int GeomInfo::localToGlobal ( GeomRegT *local* )**

Definition at line 474 of file ginfo.cpp.

**13.11.3.10 int GeomInfo::phantomFromRegion ( int *ir* )**

return the phantom index for this region number or -1 if region is not in a phantom

Definition at line 490 of file ginfo.cpp.

**13.11.3.11 void GeomInfo::printInfo ( )**

Definition at line 495 of file ginfo.cpp.

**13.11.3.12 void GeomInfo::setGeometryIndexes ( EGS\_BaseGeometry \* *sim\_geom* )**

Setup all arrays required to decide which geometry/phantom a region is in and whether or not we are scoring dose in it.

To setup the arrays we loop through all geometries, decide whether it is a phantom or not, then loop through each region in the geometry and set the local region number phantom index etc

Definition at line 423 of file ginfo.cpp.

**13.11.3.13 void GeomInfo::setGeomMap ( ) [private]****13.11.4 Member Data Documentation****13.11.4.1 map<EGS\_BaseGeometry \*, GeomRegionInfo> GeomInfo::geom\_to\_regioninfo**

mapping from geometry to info about that geometry

Definition at line 151 of file ginfo.h.

**13.11.4.2 Node\* GeomInfo::geom\_tree**

a tree representing the parent/child relationships of the geometry

Definition at line 136 of file ginfo.h.

**13.11.4.3 vector<EGS\_BaseGeometry \*> GeomInfo::global\_ir\_to\_geom [private]**

the source geometry index or -1 if not a source

array of size nreg mapping global region number to

Definition at line 108 of file ginfo.h.

**13.11.4.4 vector<int> GeomInfo::global\_ir\_to\_local\_ir [private]**

pointer for the geometry it belongs to

array of size nreg mapping global region number to

Definition at line 111 of file ginfo.h.

**13.11.4.5 vector<int> GeomInfo::global\_ir\_to\_phant [private]**

array of size nreg mapping global region number to

Definition at line 101 of file ginfo.h.

13.11.4.6 `vector<int> GeomInfo::global_ir_to_source [private]`

the phantoms geometry index or -1 if not a phantom

array of size nreg mapping global region number to

Definition at line 104 of file ginfo.h.

13.11.4.7 `GeomRegionInfoMapT GeomInfo::gmap [private]`

the local region number of the geometry it belongs to. e.g. it would look like: global\_ir\_to\_local\_ir = [0, 1, 2, 3, 0, 1, 2, 3, 5] for a geometry consisting of two objects, the first with 4 regions and the second with 5 regions

Definition at line 118 of file ginfo.h.

13.11.4.8 `int GeomInfo::ngeom`

total number of geometries created

Definition at line 138 of file ginfo.h.

13.11.4.9 `int GeomInfo::nreg_total`

total number of regions in the simulation geometry

Definition at line 139 of file ginfo.h.

13.11.4.10 `vector<GeomRegionInfo> GeomInfo::ordered_geom_data`

All geometries in their constructed order

Definition at line 149 of file ginfo.h.

13.11.4.11 `vector<EB_Phantom *> GeomInfo::phantom_geoms`

pointers to all of the phantom objects

Definition at line 153 of file ginfo.h.

13.11.4.12 `vector<string> GeomInfo::phantom_names`

A list of all geometries to create scoring phantom objects for (arbitrary ordering)

Definition at line 132 of file ginfo.h.

## 13.11.4.13 string GeomInfo::sim\_geom\_name

name of the simulation geometry

Definition at line 130 of file ginfo.h.

## 13.11.4.14 string GeomInfo::source\_envelope\_name

name of the geometry that embeds the sources (required for superposition mode)

Definition at line 131 of file ginfo.h.

## 13.11.4.15 vector&lt;string&gt; GeomInfo::source\_names

Names of geometries the user has specified as being source geoms

Definition at line 134 of file ginfo.h.

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

- /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/ginfo.h
- /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/ginfo.cpp

## 13.12 GeomRegionInfo Struct Reference

a struct to contain elementary information about a geometry

```
#include <ginfo.h>
```

### Public Attributes

- string `name`
- string `type`
- vector< string > `children`
- int `nreg`
- int `start`
- int `end`

### 13.12.1 Detailed Description

a struct to contain elementary information about a geometry

Definition at line 83 of file ginfo.h.

### 13.12.2 Member Data Documentation

#### 13.12.2.1 `vector<string> GeomRegionInfo::children`

list of children contained by this geometry (if any)

Definition at line 87 of file ginfo.h.

#### 13.12.2.2 `int GeomRegionInfo::end`

global end region number

Definition at line 90 of file ginfo.h.

#### 13.12.2.3 `string GeomRegionInfo::name`

the name given to the geometry by the user

Definition at line 85 of file ginfo.h.

#### 13.12.2.4 `int GeomRegionInfo::nreg`

total number of regions in this geometry

Definition at line 88 of file ginfo.h.

#### 13.12.2.5 `int GeomRegionInfo::start`

global start region number

Definition at line 89 of file ginfo.h.

#### 13.12.2.6 `string GeomRegionInfo::type`

egs++ geometry type

Definition at line 86 of file ginfo.h.

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

- /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/[ginfo.h](#)

## 13.13 gzstreambase Class Reference

```
#include <gzstream.h>
```

Inheritance diagram for gzstreambase:

Collaboration diagram for gzstreambase:

### Public Member Functions

- [gzstreambase \(\)](#)
- [gzstreambase \(const char \\*name, int open\\_mode\)](#)
- [~gzstreambase \(\)](#)
- [void open \(const char \\*name, int open\\_mode\)](#)
- [void close \(\)](#)
- [gzstreambuf \\* rdbuf \(\)](#)

### Protected Attributes

- [gzstreambuf buf](#)

#### 13.13.1 Detailed Description

Definition at line 78 of file gzstream.h.

#### 13.13.2 Constructor & Destructor Documentation

##### 13.13.2.1 [gzstreambase::gzstreambase \( \) \[inline\]](#)

Definition at line 82 of file gzstream.h.

##### 13.13.2.2 [gzstreambase::gzstreambase \( const char \\* name, int open\\_mode \)](#)

Definition at line 140 of file gzstream.C.

##### 13.13.2.3 [gzstreambase::~gzstreambase \( \)](#)

Definition at line 145 of file gzstream.C.

#### 13.13.3 Member Function Documentation

##### 13.13.3.1 [void gzstreambase::close \( \)](#)

Definition at line 154 of file gzstream.C.

13.13.3.2 `void gzstreambase::open ( const char * name, int open_mode )`

Definition at line 149 of file gzstream.C.

13.13.3.3 `gzstreambuf* gzstreambase::rdbuf ( ) [inline]`

Definition at line 89 of file gzstream.h.

#### 13.13.4 Member Data Documentation

13.13.4.1 `gzstreambuf gzstreambase::buf [protected]`

Definition at line 80 of file gzstream.h.

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

- /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/gzstream/gzstream.h
- /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/gzstream/gzstream.C

### 13.14 `gzstreambuf` Class Reference

```
#include <gzstream.h>
```

Inheritance diagram for `gzstreambuf`:

Collaboration diagram for `gzstreambuf`:

#### Public Member Functions

- `gzstreambuf ()`
- `int is_open ()`
- `gzstreambuf * open (const char *name, int open_mode)`
- `gzstreambuf * close ()`
- `~gzstreambuf ()`
- `virtual int overflow (int c=EOF)`
- `virtual int underflow ()`
- `virtual int sync ()`

#### Private Member Functions

- `int flush_buffer ()`

## Private Attributes

- `gzFile file`
- `char buffer [bufferSize]`
- `char opened`
- `int mode`

## Static Private Attributes

- `static const int bufferSize = 47+256`

### 13.14.1 Detailed Description

Definition at line 45 of file `gzstream.h`.

### 13.14.2 Constructor & Destructor Documentation

#### 13.14.2.1 `gzstreambuf::gzstreambuf ( )` [inline]

Definition at line 57 of file `gzstream.h`.

#### 13.14.2.2 `gzstreambuf::~gzstreambuf ( )` [inline]

Definition at line 69 of file `gzstream.h`.

### 13.14.3 Member Function Documentation

#### 13.14.3.1 `gzstreambuf * gzstreambuf::close ( )`

Definition at line 68 of file `gzstream.C`.

#### 13.14.3.2 `int gzstreambuf::flush_buffer ( )` [private]

Definition at line 103 of file `gzstream.C`.

#### 13.14.3.3 `int gzstreambuf::is_open ( )` [inline]

Definition at line 64 of file `gzstream.h`.

#### 13.14.3.4 `gzstreambuf * gzstreambuf::open ( const char * name, int open_mode )`

Definition at line 45 of file `gzstream.C`.

13.14.3.5 `int gzstreambuf::overflow ( int c = EOF ) [virtual]`

Definition at line 113 of file `gzstream.C`.

13.14.3.6 `int gzstreambuf::sync ( ) [virtual]`

Definition at line 125 of file `gzstream.C`.

13.14.3.7 `int gzstreambuf::underflow ( ) [virtual]`

Definition at line 78 of file `gzstream.C`.

#### 13.14.4 Member Data Documentation

13.14.4.1 `char gzstreambuf::buffer[bufferSize] [private]`

Definition at line 51 of file `gzstream.h`.

13.14.4.2 `const int gzstreambuf::bufferSize = 47+256 [static], [private]`

Definition at line 47 of file `gzstream.h`.

13.14.4.3 `gzFile gzstreambuf::file [private]`

Definition at line 50 of file `gzstream.h`.

13.14.4.4 `int gzstreambuf::mode [private]`

Definition at line 53 of file `gzstream.h`.

13.14.4.5 `char gzstreambuf::opened [private]`

Definition at line 52 of file `gzstream.h`.

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

- [/home/randlet/projects/egs/egs\\_brachy\\_release/egs\\_brachy/gzstream/gzstream.h](#)
- [/home/randlet/projects/egs/egs\\_brachy\\_release/egs\\_brachy/gzstream/gzstream.C](#)

## 13.15 tests.iaeа.IAEAPhaseSpace Class Reference

Inheritance diagram for tests.iaeа.IAEAPhaseSpace:

Collaboration diagram for tests.iaeа.IAEAPhaseSpace:

### Public Member Functions

- def `__init__` (self, path, mode='r')
- def `num_particles` (self, particle\_type='all')
- def `num_orig_particles` (self)
- def `maximum_energy` (self)
- def `source_id` (self)

### Public Attributes

- `access`
- `path`

### Static Public Attributes

- string `header_ext` = '.IAEAheader'
- string `phsp_ext` = '.IAEApchsp'

### Private Member Functions

- def `_create_source` (self)
- def `_set_path` (self, path)

### Private Attributes

- `_source_id`

#### 13.15.1 Detailed Description

Definition at line 22 of file iaea.py.

#### 13.15.2 Constructor & Destructor Documentation

##### 13.15.2.1 def tests.iaeа.IAEAPhaseSpace.`__init__` ( self, path, mode = 'r' )

Set up access to an IAEA phase space file

Arguments:

path -- The path to the iaea phase space file

Keyword arguments:

mode -- 'r' for read, 'w' for read/write or 'a' for 'append' (default 'r')

Definition at line 28 of file iaea.py.

### 13.15.3 Member Function Documentation

13.15.3.1 `def tests.iaea.IAEAPhaseSpace._create_source ( self ) [private]`

Definition at line 49 of file iaea.py.

13.15.3.2 `def tests.iaea.IAEAPhaseSpace._set_path ( self, path ) [private]`

Definition at line 119 of file iaea.py.

13.15.3.3 `def tests.iaea.IAEAPhaseSpace.maximum_energy ( self )`

Return maximum energy in this source in (MeV)

Definition at line 105 of file iaea.py.

13.15.3.4 `def tests.iaea.IAEAPhaseSpace.num_orig_particles ( self )`

Return max number of particles of type particle\_type

Keyword arguments:  
`particle_type` -- type or category of particle to check (default 'all')

Definition at line 85 of file iaea.py.

13.15.3.5 `def tests.iaea.IAEAPhaseSpace.num_particles ( self, particle_type = 'all' )`

Return max number of particles of type particle\_type

Keyword arguments:  
`particle_type` -- type or category of particle to check (default 'all')

Definition at line 58 of file iaea.py.

13.15.3.6 `def tests.iaea.IAEAPhaseSpace.source_id ( self )`

Definition at line 116 of file iaea.py.

### 13.15.4 Member Data Documentation

13.15.4.1 `tests.iaea.IAEAPhaseSpace._source_id [private]`

Definition at line 39 of file iaea.py.

#### 13.15.4.2 tests.iaeas.IAEAPhaseSpace.access

Definition at line 42 of file iaea.py.

#### 13.15.4.3 string tests.iaeas.IAEAPhaseSpace.header\_ext = '.IAEAheader' [static]

Definition at line 24 of file iaea.py.

#### 13.15.4.4 tests.iaeas.IAEAPhaseSpace.path

Definition at line 120 of file iaea.py.

#### 13.15.4.5 string tests.iaeas.IAEAPhaseSpace.phsp\_ext = '.IAEApmsp' [static]

Definition at line 25 of file iaea.py.

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

- /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/tests/[iaeas.py](#)

## 13.16 tests.iaeas\_errors.IAEAPhaseSpaceError Class Reference

Inheritance diagram for tests.iaeas\_errors.IAEAPhaseSpaceError:

Collaboration diagram for tests.iaeas\_errors.IAEAPhaseSpaceError:

### Public Member Functions

- def [\\_\\_init\\_\\_](#) (self, err\_id=None, [message](#)= "")

### Public Attributes

- [message](#)

#### 13.16.1 Detailed Description

Definition at line 28 of file iaea\_errors.py.

#### 13.16.2 Constructor & Destructor Documentation

##### 13.16.2.1 def tests.iaeas\_errors.IAEAPhaseSpaceError.[\\_\\_init\\_\\_](#) ( self, err\_id=None, message = " " )

Definition at line 29 of file iaea\_errors.py.

### 13.16.3 Member Data Documentation

#### 13.16.3.1 tests.iaea\_errors.IAEAPhaseSpaceError.message

Definition at line 32 of file iaea\_errors.py.

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

- /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/tests/[iaea\\_errors.py](#)

## 13.17 tests.iaea\_errors.IAEAPhaseSpaceSetupError Class Reference

Inheritance diagram for tests.iaea\_errors.IAEAPhaseSpaceSetupError:

Collaboration diagram for tests.iaea\_errors.IAEAPhaseSpaceSetupError:

### 13.17.1 Detailed Description

Definition at line 25 of file iaea\_errors.py.

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

- /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/tests/[iaea\\_errors.py](#)

## 13.18 igzstream Class Reference

```
#include <gzstream.h>
```

Inheritance diagram for igzstream:

Collaboration diagram for igzstream:

### Public Member Functions

- [igzstream \(\)](#)
- [igzstream \(const char \\*name, int open\\_mode=std::ios::in\)](#)
- [gzstreambuf \\* rdbuf \(\)](#)
- [void open \(const char \\*name, int open\\_mode=std::ios::in\)](#)

### Additional Inherited Members

#### 13.18.1 Detailed Description

Definition at line 100 of file gzstream.h.

### 13.18.2 Constructor & Destructor Documentation

13.18.2.1 `igzstream::igzstream( ) [inline]`

Definition at line 102 of file gzstream.h.

13.18.2.2 `igzstream::igzstream( const char * name, int open_mode = std::ios::in ) [inline]`

Definition at line 103 of file gzstream.h.

### 13.18.3 Member Function Documentation

13.18.3.1 `void igzstream::open( const char * name, int open_mode = std::ios::in ) [inline]`

Definition at line 108 of file gzstream.h.

13.18.3.2 `gzstreambuf* igzstream::rdbuf( ) [inline]`

Definition at line 105 of file gzstream.h.

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

- /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/gzstream/gzstream.h

## 13.19 Latch Class Reference

A class for handling latch bits relevant to egs\_brachy. The [Latch](#) class listens for particle events and sets/unsets latch bits on the particle based on the event type.

```
#include <latch.h>
```

Inheritance diagram for Latch:

Collaboration diagram for Latch:

### Public Member Functions

- `void update (EB_Message message, void *particle)`  
*listen to events and delegate to appropriate handler*

## Static Public Member Functions

- static bool `hasEscaped` (EGS\_Particle \**p*)  
*True if particle is currently in a source.*
- static void `setFlag` (Flag *flag*, EGS\_Particle \**p*)  
*Set flag on input particle *p*.*
- static void `setFlag` (Flag *flag*, int &*latch*)  
*Set flag on input latch.*
- static void `unsetFlag` (Flag *flag*, EGS\_Particle \**p*)  
*Unset flag on input particle *p*.*
- static void `unsetFlag` (Flag *flag*, int &*latch*)  
*Unset flag on input latch *p*.*
- static bool `checkFlag` (Flag *flag*, EGS\_Particle \**p*)  
*Check whether flag is set on particle *p*.*
- static bool `checkFlag` (Flag *flag*, int *latch*)  
*Check whether flag is set on latch.*
- static void `addScatter` (EGS\_Particle \**p*)
- static void `addScatter` (int &*latch*)
- static void `setPrimary` (int &*latch*)
- static void `setPrimary` (EGS\_Particle \**p*)
- static bool `isPrimary` (int *latch*)
- static bool `isPrimary` (EGS\_Particle \**p*)
- static bool `isSingleScat` (int *latch*)
- static bool `isSingleScat` (EGS\_Particle \**p*)
- static bool `isMultScat` (int *latch*)
- static bool `isMultScat` (EGS\_Particle \**p*)

## Private Types

- enum Flag {  
 IN\_SOURCE, ESCAPED\_SOURCE, PRIM\_PARTICLE, SSCAT\_PARTICLE,  
 MSCAT\_PARTICLE }

### 13.19.1 Detailed Description

A class for handling latch bits relevant to egs\_brachy. The `Latch` class listens for particle events and sets/unsets latch bits on the particle based on the event type.

Definition at line 51 of file `latch.h`.

### 13.19.2 Member Enumeration Documentation

#### 13.19.2.1 enum Latch::Flag [private]

##### Enumerator

- IN\_SOURCE** a particle is in the source (either hasn't escaped yet, or has re-entered)
- ESCAPED\_SOURCE** an initial particle has escaped the source (this bit will still be set on particles which ave re-entered a source geometry)
- PRIM\_PARTICLE**
- SSCAT\_PARTICLE**
- MSCAT\_PARTICLE**

Definition at line 53 of file `latch.h`.

### 13.19.3 Member Function Documentation

13.19.3.1 **void Latch::addScatter ( EGS\_Particle \* *p* ) [static]**

Definition at line 80 of file latch.cpp.

13.19.3.2 **void Latch::addScatter ( int & *latch* ) [static]**

Definition at line 92 of file latch.cpp.

13.19.3.3 **bool Latch::checkFlag ( Flag *flag*, EGS\_Particle \* *p* ) [static]**

Check whether flag is set on particle p.

Definition at line 62 of file latch.cpp.

13.19.3.4 **bool Latch::checkFlag ( Flag *flag*, int *latch* ) [static]**

Check whether flag is set on latch.

Definition at line 66 of file latch.cpp.

13.19.3.5 **bool Latch::hasEscaped ( EGS\_Particle \* *p* ) [static]**

True if particle is currently in a source.

True if particle has escaped a source

Definition at line 134 of file latch.cpp.

13.19.3.6 **bool Latch::isMultScat ( int *latch* ) [static]**

Definition at line 121 of file latch.cpp.

13.19.3.7 **bool Latch::isMultScat ( EGS\_Particle \* *p* ) [static]**

Definition at line 125 of file latch.cpp.

13.19.3.8 **bool Latch::isPrimary ( int *latch* ) [static]**

Definition at line 105 of file latch.cpp.

13.19.3.9 **bool Latch::isPrimary ( EGS\_Particle \* *p* ) [static]**

Definition at line 109 of file latch.cpp.

13.19.3.10 **bool Latch::isSingleScat ( int *latch* ) [static]**

Definition at line 113 of file latch.cpp.

13.19.3.11 **bool Latch::isSingleScat ( EGS\_Particle \* *p* ) [static]**

Definition at line 117 of file latch.cpp.

13.19.3.12 **void Latch::setFlag ( Flag *flag*, EGS\_Particle \* *p* ) [static]**

Set flag on input particle p.

Definition at line 46 of file latch.cpp.

13.19.3.13 **void Latch::setFlag ( Flag *flag*, int & *latch* ) [static]**

Set flag on input latch.

Definition at line 50 of file latch.cpp.

13.19.3.14 **void Latch::setPrimary ( int & *latch* ) [static]**

Definition at line 88 of file latch.cpp.

13.19.3.15 **void Latch::setPrimary ( EGS\_Particle \* *p* ) [static]**

Definition at line 84 of file latch.cpp.

13.19.3.16 **void Latch::unsetFlag ( Flag *flag*, EGS\_Particle \* *p* ) [static]**

Unset flag on input particle p.

Definition at line 54 of file latch.cpp.

13.19.3.17 **void Latch::unsetFlag ( Flag *flag*, int & *latch* ) [static]**

Unset flag on input latch p.

Definition at line 58 of file latch.cpp.

13.19.3.18 void Latch::update ( EB\_Message message, void \* particle ) [virtual]

listen to events and delegate to appropriate handler

Implements [Subscriber](#).

Definition at line 70 of file `latch.cpp`.

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

- [/home/randlet/projects/egs/egs\\_brachy\\_release/egs\\_brachy/latch.h](#)
- [/home/randlet/projects/egs/egs\\_brachy\\_release/egs\\_brachy/latch.cpp](#)

## 13.20 muen::MuenDataParser Class Reference

class for parsing muen data from a file.

```
#include <muen.h>
```

### Public Member Functions

- [MuenDataParser \(\)](#)  
*construct class by parsing the data file. Note the actual EGS\_Interpolator classes are only created when user calls getMuenInterpolator. User is responsible for deleting the interpolator when they are done with it.*
- int [setMuenFile \(string filename\)](#)
- EGS\_Interpolator \* [getMuenInterpolator \(string med\\_name\)](#)  
*Create a new EGS\_Interpolator of muen data for the requested medium and return pointer to it. Ownership of the object belongs to the caller.*

### Static Public Attributes

- static const string [MUEN\\_START](#) = "Muen values for medium MEDIUM ="

### Private Member Functions

- [MuenMapT splitFileByMed \(ifstream &in\)](#)  
*does the actual parsing of data from the muen file*

### Private Attributes

- [MuenMapT med\\_data](#)

### Static Private Attributes

- static const int [NSKIP](#) = 3

### 13.20.1 Detailed Description

class for parsing muen data from a file.

The muen data must be in the format generated by the egsnrc usercode g:

```
Muen values for medium MEDIUM = MED_NAME_1
Medium used is MED_NAME_1 found in your_pegs_data_set
Number of energy intervals is 2000
Energy      Muen
0.001000 MeV 4075.692785 cm^2/g
0.001004 MeV 4036.185761 cm^2/g
0.001007 MeV 3997.307705 cm^2/g
(# 1997 more lines)
Muen values for medium MEDIUM = MED_NAME_2
Medium used is MED_NAME_2 found in your_pegs_data_set
Number of energy intervals is 500
0.001000 MeV 4075.692785 cm^2/g
0.001004 MeV 4036.185761 cm^2/g
0.001007 MeV 3997.307705 cm^2/g
(# 497 more lines)
```

Definition at line 131 of file muen.h.

### 13.20.2 Constructor & Destructor Documentation

#### 13.20.2.1 muen::MuenDataParser::MuenDataParser( ) [inline]

construct class by parsing the data file. Note the actual EGS\_Interpolator classes are only created when user calls getMuenInterpolator. User is responsible for deleting the interpolator when they are done with it.

##### Note

Rather than just calling egsFatal on failure we should probably set a success flag and then let the users check the flag and decide what they want to do.

Definition at line 205 of file muen.h.

### 13.20.3 Member Function Documentation

#### 13.20.3.1 EGS\_Interpolator\* muen::MuenDataParser::getMuenInterpolator( string med\_name ) [inline]

Create a new EGS\_Interpolator of muen data for the requested medium and return pointer to it. Ownership of the object belongs to the caller.

##### Note

currently calling repeatedly with the same med\_name will create a new instance of EGS\_Interpolator for every call. We could change this to return a cached copy if it had already been created in the past.

Definition at line 228 of file muen.h.

13.20.3.2 int muen::MuenDataParser::setMuenFile ( string *filename* ) [inline]

Definition at line 207 of file muen.h.

13.20.3.3 MuenMapT muen::MuenDataParser::splitFileByMed ( ifstream & *in* ) [inline], [private]

does the actual parsing of data from the muen file

Definition at line 141 of file muen.h.

#### 13.20.4 Member Data Documentation

13.20.4.1 MuenMapT muen::MuenDataParser::med\_data [private]

holds all muen data from file.

Definition at line 133 of file muen.h.

13.20.4.2 const string muen::MuenDataParser::MUEN\_START = "Muen values for medium MEDIUM =" [static]

string indicating start of a new medium

Definition at line 193 of file muen.h.

13.20.4.3 const int muen::MuenDataParser::NSKIP = 3 [static], [private]

number of lines in muen data for a medium to skip between first line for a medium and the start of the data

Definition at line 135 of file muen.h.

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

- /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/muen.h

## 13.21 Node Class Reference

```
#include <ginfo.h>
```

### Public Member Functions

- [Node \(string n, vector< Node > children\)](#)
- [void addNode \(Node node\)](#)

## Public Attributes

- string `name`
- vector<`Node`> `children`

### 13.21.1 Detailed Description

Definition at line 58 of file ginfo.h.

### 13.21.2 Constructor & Destructor Documentation

#### 13.21.2.1 `Node::Node ( string n, vector< Node > children ) [inline]`

Definition at line 63 of file ginfo.h.

### 13.21.3 Member Function Documentation

#### 13.21.3.1 `void Node::addNode ( Node node ) [inline]`

Definition at line 71 of file ginfo.h.

### 13.21.4 Member Data Documentation

#### 13.21.4.1 `vector<Node> Node::children`

Definition at line 61 of file ginfo.h.

#### 13.21.4.2 `string Node::name`

Definition at line 60 of file ginfo.h.

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

- /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/ginfo.h

## 13.22 ogzstream Class Reference

```
#include <gzstream.h>
```

Inheritance diagram for ogzstream:

Collaboration diagram for ogzstream:

## Public Member Functions

- [ogzstream \(\)](#)
- [ogzstream \(const char \\*name, int mode=std::ios::out\)](#)
- [gzstreambuf \\* rdbuf \(\)](#)
- [void open \(const char \\*name, int open\\_mode=std::ios::out\)](#)

## Additional Inherited Members

### 13.22.1 Detailed Description

Definition at line 113 of file gzstream.h.

### 13.22.2 Constructor & Destructor Documentation

#### 13.22.2.1 [ogzstream::ogzstream \( \) \[inline\]](#)

Definition at line 115 of file gzstream.h.

#### 13.22.2.2 [ogzstream::ogzstream \( const char \\* name, int mode = std::ios::out \) \[inline\]](#)

Definition at line 116 of file gzstream.h.

### 13.22.3 Member Function Documentation

#### 13.22.3.1 [void ogzstream::open \( const char \\* name, int open\\_mode = std::ios::out \) \[inline\]](#)

Definition at line 121 of file gzstream.h.

#### 13.22.3.2 [gzstreambuf\\* ogzstream::rdbuf \( \) \[inline\]](#)

Definition at line 118 of file gzstream.h.

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

- [/home/randlet/projects/egs/egs\\_brachy\\_release/egs\\_brachy/gzstream/gzstream.h](#)

## 13.23 ebvolcor::Options Class Reference

Volume correction initialization helper class.

```
#include <eb_volcor.h>
```

## Public Member Functions

- [Options \(EGS\\_Input \\*inp\)](#)
- [~Options \(\)](#)
- [EGS\\_Vector getRandomPoint \(\)](#)

## Public Attributes

- [bool valid](#)
- [EGS\\_Float bounds\\_volume](#)
- [EGS\\_Float density](#)
- [EGS\\_Float npoints](#)
- [VolCorMode mode](#)

## Private Member Functions

- [void setMode \(\)](#)  
*read mode from input*
- [int setBoundsShape \(\)](#)  
*create bounding shape from the shape input and calculate its volume*
- [void setDensity \(\)](#)
- [void setRNG \(\)](#)

## Private Attributes

- [EGS\\_Input \\* input](#)
- [EGS\\_BaseShape \\* bounds](#)
- [bool sobolAllowed](#)
- [EGS\\_RandomGenerator \\* rng](#)

## Static Private Attributes

- [static const double DEFAULT RAND POINT DENSITY = 1E8](#)

### 13.23.1 Detailed Description

Volume correction initialization helper class.

[Options](#) is a small helper class for parsing a volume correction input item A sample input including both a source specific correction and a general purpose correction would look like this:

```

:start volume correction:

:start source volume correction:
    correction type = correct # correct, none, zero dose
    density of random points (cm^-3) = 1E8

:start shape:

    type = sphere
    radius = 0.11
    midpoint = 0 0 0

:stop shape:

:stop source volume correction:

:start extra volume correction:

    correction type = correct # correct, none, zero dose
    density of random points (cm^-3) = 1E5

:start shape:

    type = box
    box size = 8
    midpoint = 0 0 0

:stop shape:

:stop extra volume correction:

:stop volume correction:

```

An EGS\_RNG input can also optionally be included in either of the volume correction inputs to use something other than the EGSnrc default RNG.

Definition at line 138 of file eb\_volcor.h.

### 13.23.2 Constructor & Destructor Documentation

#### 13.23.2.1 ebvolcor::Options::Options ( EGS\_Input \* *inp* ) [inline]

Definition at line 157 of file eb\_volcor.h.

#### 13.23.2.2 ebvolcor::Options::~Options ( ) [inline]

Definition at line 181 of file eb\_volcor.h.

### 13.23.3 Member Function Documentation

#### 13.23.3.1 EGS\_Vector ebvolcor::Options::getRandomPoint ( )

Definition at line 232 of file eb\_volcor.cpp.

13.23.3.2 `int ebvolcor::Options::setBoundsShape( ) [private]`

create bounding shape from the shape input and calculate its volume

Definition at line 159 of file eb\_volcor.cpp.

13.23.3.3 `void ebvolcor::Options::setDensity( ) [private]`

set user requested density or default to DEFAULT RAND POINT DENSITY

Definition at line 189 of file eb\_volcor.cpp.

13.23.3.4 `void ebvolcor::Options::setMode( ) [private]`

read mode from input

Definition at line 149 of file eb\_volcor.cpp.

13.23.3.5 `void ebvolcor::Options::setRNG( ) [private]`

set user requested RNG or default to EGS\_RandomGenerator::defaultRNG

Definition at line 201 of file eb\_volcor.cpp.

#### 13.23.4 Member Data Documentation

13.23.4.1 `EGS_BaseShape* ebvolcor::Options::bounds [private]`

Definition at line 145 of file eb\_volcor.h.

13.23.4.2 `EGS_Float ebvolcor::Options::bounds_volume`

Definition at line 192 of file eb\_volcor.h.

13.23.4.3 `const double ebvolcor::Options::DEFAULT RAND POINT DENSITY = 1E8 [static], [private]`

Definition at line 140 of file eb\_volcor.h.

13.23.4.4 `EGS_Float ebvolcor::Options::density`

Definition at line 193 of file eb\_volcor.h.

13.23.4.5 `EGS_Input* ebvolcor::Options::input` [private]

Definition at line 142 of file eb\_volcor.h.

13.23.4.6 `VolCorMode ebvolcor::Options::mode`

Definition at line 195 of file eb\_volcor.h.

13.23.4.7 `EGS_Float ebvolcor::Options::npoints`

Definition at line 194 of file eb\_volcor.h.

13.23.4.8 `EGS_RandomGenerator* ebvolcor::Options::rng` [private]

Definition at line 149 of file eb\_volcor.h.

13.23.4.9 `bool ebvolcor::Options::sobolAllowed` [private]

Definition at line 146 of file eb\_volcor.h.

13.23.4.10 `bool ebvolcor::Options::valid`

Definition at line 190 of file eb\_volcor.h.

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

- /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/[eb\\_volcor.h](#)
- /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/[eb\\_volcor.cpp](#)

## 13.24 PHSPControl Class Reference

```
#include <phsp.h>
```

Inheritance diagram for PHSPControl:

Collaboration diagram for PHSPControl:

## Public Member Functions

- **PHSPControl** (EGS\_Input \*inp, EGS\_AffineTransform \*trans, EGS\_AdvancedApplication \*app, Publisher \*pub)  
*PHSP Control constructor.*
- **void finish** (EGS\_I64 n\_orig\_particles)  
*set final number of particles written and destroy source*
- **void destroySource ()**  
*destroy the source*
- **void outputResults ()**  
*output file name and number of particles written*
- **void update (EB\_Message message, void \*particle)**  
*receive PARTICLE\_ESCAPED\_SOURCE message*

## Private Types

- enum **ACCESS** { **READ** = 1, **WRITE** = 2, **APPEND** = 3 }
- enum **PARTICLE\_TYPE** {  
**ALL\_TYPES** = -1, **PHOTON** = 1, **ELECTRON** = 2, **POSITRON** = 3,  
**NEUTRON** = 4, **PROTON** = 5 }

## Private Member Functions

- **void initSource ()**  
*create/open new source and set extra numbers*
- **void writeParticle (EGS\_Particle \*p)**  
*write a single particle to the phsp*
- short **getIAEAParticleType (const EGS\_Particle \*p)**  
*convert a particle to its IAEA Particle type*

## Private Attributes

- IAEA\_I32 **mode**  
*Access mode.*
- string **fname**  
*root name of phsp header*
- IAEA\_I32 **id**  
*IAEA Source ID (just set to 1 currently)*
- IAEA\_I64 **num\_written**  
*Number of particles written to phsp file.*
- EGS\_AffineTransform \* **transform**
- EGS\_Float **boundary\_step**
- bool **kill\_after\_scoring**  
*Set wt = 0 for particle after scoring if true.*
- bool **print\_header**  
*User has requested the phsp header gets printed after run.*

### 13.24.1 Detailed Description

Definition at line 51 of file phsp.h.

### 13.24.2 Member Enumeration Documentation

#### 13.24.2.1 enum PHSPControl::ACCESS [private]

Enumerator

**READ** IAEA Read mode.

**WRITE** IAEA Write mode.

**APPEND** IAEA Append mode.

Definition at line 53 of file phsp.h.

#### 13.24.2.2 enum PHSPControl::PARTICLE\_TYPE [private]

Enumerator

**ALL\_TYPES**

**PHOTON**

**ELECTRON**

**POSITRON**

**NEUTRON**

**PROTON**

Definition at line 59 of file phsp.h.

### 13.24.3 Constructor & Destructor Documentation

#### 13.24.3.1 PHSPControl::PHSPControl ( EGS\_Input \* *inp*, EGS\_AffineTransform \* *trans*, EGS\_AdvancedApplication \* *app*, Publisher \* *pub* )

PHSP Control constructor.

Definition at line 59 of file phsp.cpp.

### 13.24.4 Member Function Documentation

#### 13.24.4.1 void PHSPControl::destroySource ( )

destroy the source

Definition at line 221 of file phsp.cpp.

#### 13.24.4.2 void PHSPControl::finish ( EGS\_J64 *n\_orig\_particles* )

set final number of particles written and destroy source

Definition at line 193 of file phsp.cpp.

13.24.4.3 `short PHSPControl::getIAEAParticleType ( const EGS_Particle * p ) [private]`

convert a particle to its IAEA Particle type

Definition at line 103 of file phsp.cpp.

13.24.4.4 `void PHSPControl::initSource ( ) [private]`

create/open new source and set extra numbers

Definition at line 163 of file phsp.cpp.

13.24.4.5 `void PHSPControl::outputResults ( )`

output file name and number of particles written

Definition at line 199 of file phsp.cpp.

13.24.4.6 `void PHSPControl::update ( EB_Message message, void * particle ) [virtual]`

receive PARTICLE\_ESCAPED\_SOURCE message

Implements [Subscriber](#).

Definition at line 185 of file phsp.cpp.

13.24.4.7 `void PHSPControl::writeParticle ( EGS_Particle * p ) [private]`

write a single particle to the phsp

Definition at line 117 of file phsp.cpp.

## 13.24.5 Member Data Documentation

13.24.5.1 `EGS_Float PHSPControl::boundary_step [private]`

transform used to return particle to origin before writing to phsp

Definition at line 78 of file phsp.h.

13.24.5.2 `string PHSPControl::fname [private]`

root name of phsp header

Definition at line 69 of file phsp.h.

13.24.5.3 **IAEA\_I32 PHSPControl::id** [private]

IAEA Source ID (just set to 1 currently)

Definition at line 70 of file phsp.h.

13.24.5.4 **bool PHSPControl::kill\_after\_scoring** [private]

Set wt = 0 for particle after scoring if true.

Distance to push particle past source boundary before writing to phase space. Defaults to 1E-4 cm

Definition at line 82 of file phsp.h.

13.24.5.5 **IAEA\_I32 PHSPControl::mode** [private]

Access mode.

Definition at line 68 of file phsp.h.

13.24.5.6 **IAEA\_I64 PHSPControl::num\_written** [private]

Number of particles written to phsp file.

Definition at line 72 of file phsp.h.

13.24.5.7 **bool PHSPControl::print\_header** [private]

User has requested the phsp header gets printed after run.

Definition at line 84 of file phsp.h.

13.24.5.8 **EGS\_AffineTransform\* PHSPControl::transform** [private]

Definition at line 75 of file phsp.h.

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

- /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/phsp.h
- /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/phsp.cpp

## 13.25 Publisher Class Reference

---

```
#include <pubsub.h>
```

## Public Member Functions

- `Publisher ()`
- `virtual ~Publisher ()`
- `void subscribe (Subscriber *s, EB_Message message)`
- `void unsubscribe (Subscriber *s, EB_Message message)`
- `void notify (EB_Message message, void *what=0, Subscriber *s=0)`
- `void setNotifyEnabled (bool flag)`
- `bool getNotifyEnabled () const`

## Private Attributes

- `map< EB_Message, list< Subscriber * > > subscribers`
- `bool notifyEnabled`

### 13.25.1 Detailed Description

Definition at line 77 of file pubsub.h.

### 13.25.2 Constructor & Destructor Documentation

#### 13.25.2.1 Publisher::Publisher ( ) [inline]

Definition at line 79 of file pubsub.h.

#### 13.25.2.2 virtual Publisher::~Publisher ( ) [inline], [virtual]

Definition at line 82 of file pubsub.h.

### 13.25.3 Member Function Documentation

#### 13.25.3.1 bool Publisher::getNotifyEnabled ( ) const [inline]

Definition at line 93 of file pubsub.h.

#### 13.25.3.2 void Publisher::notify ( EB\_Message message, void \* what = 0, Subscriber \* s = 0 )

Definition at line 46 of file pubsub.cpp.

#### 13.25.3.3 void Publisher::setNotifyEnabled ( bool flag ) [inline]

Definition at line 90 of file pubsub.h.

13.25.3.4 void Publisher::subscribe ( **Subscriber** \* *s*, **EB\_Message** *message* ) [inline]

Definition at line 83 of file pubsub.h.

13.25.3.5 void Publisher::unsubscribe ( **Subscriber** \* *s*, **EB\_Message** *message* ) [inline]

Definition at line 86 of file pubsub.h.

#### 13.25.4 Member Data Documentation

13.25.4.1 bool Publisher::notifyEnabled [private]

Definition at line 98 of file pubsub.h.

13.25.4.2 map<**EB\_Message**,list<**Subscriber**\*>> Publisher::subscribers [private]

Definition at line 97 of file pubsub.h.

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

- /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/pubsub.h
- /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/pubsub.cpp

## 13.26 RecycleOpts Class Reference

```
#include <recycle.h>
```

### Public Member Functions

- [RecycleOpts](#) (EGS\_Input \*inp)
- [void printInfo \(\)](#)

### Public Attributes

- int [nrecycle](#)
- bool [rotate](#)

#### 13.26.1 Detailed Description

Definition at line 64 of file recycle.h.

### 13.26.2 Constructor & Destructor Documentation

#### 13.26.2.1 `RecycleOpts::RecycleOpts ( EGS_Input * inp )`

Definition at line 45 of file recycle.cpp.

### 13.26.3 Member Function Documentation

#### 13.26.3.1 `void RecycleOpts::printInfo ( )`

Definition at line 68 of file recycle.cpp.

### 13.26.4 Member Data Documentation

#### 13.26.4.1 `int RecycleOpts::nrecycle`

Definition at line 71 of file recycle.h.

#### 13.26.4.2 `bool RecycleOpts::rotate`

Definition at line 72 of file recycle.h.

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

- /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/recycle.h
- /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/recycle.cpp

## 13.27 RegionResult Struct Reference

### Public Attributes

- int `reg`
- double `volume`
- double `tlen`
- double `tlen_err`
- double `edep`
- double `edep_err`

### 13.27.1 Detailed Description

Definition at line 57 of file phantom.cpp.

### 13.27.2 Member Data Documentation

#### 13.27.2.1 double RegionResult::edep

Definition at line 65 of file phantom.cpp.

#### 13.27.2.2 double RegionResult::edep\_err

Definition at line 66 of file phantom.cpp.

#### 13.27.2.3 int RegionResult::reg

Definition at line 59 of file phantom.cpp.

#### 13.27.2.4 double RegionResult::tlen

Definition at line 62 of file phantom.cpp.

#### 13.27.2.5 double RegionResult::tlen\_err

Definition at line 63 of file phantom.cpp.

#### 13.27.2.6 double RegionResult::volume

Definition at line 60 of file phantom.cpp.

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

- [/home/randlet/projects/egs/egs\\_brachy\\_release/egs\\_brachy/phantom.cpp](#)

## 13.28 ebvolcor::Results Struct Reference

Struct used to collect and output results about a volume correction run.

```
#include <eb_volcor.h>
```

### Public Member Functions

- [Results \(\)](#)
- [Results \(Options \\*opts\)](#)
- [void outputResults \(string extra=""\)](#)

## Public Attributes

- bool `success`
- EGS\_Float `time`
- double `density`
- double `npoints`
- EGS\_Float `bounds_volume`
- EGS\_Float `other_volume`
- map< int, vector< int > > `regions_corrected`

### 13.28.1 Detailed Description

Struct used to collect and output results about a volume correction run.

Definition at line 202 of file eb\_volcor.h.

### 13.28.2 Constructor & Destructor Documentation

#### 13.28.2.1 ebvolcor::Results::Results ( ) [inline]

Definition at line 213 of file eb\_volcor.h.

#### 13.28.2.2 ebvolcor::Results::Results ( Options \* *opts* ) [inline]

Definition at line 221 of file eb\_volcor.h.

### 13.28.3 Member Function Documentation

#### 13.28.3.1 void ebvolcor::Results::outputResults ( string *extra* = " " ) [inline]

Definition at line 230 of file eb\_volcor.h.

### 13.28.4 Member Data Documentation

#### 13.28.4.1 EGS\_Float ebvolcor::Results::bounds\_volume

what was the volume of the bounding shape

Definition at line 208 of file eb\_volcor.h.

#### 13.28.4.2 double ebvolcor::Results::density

what was the density of points used for the VC

Definition at line 206 of file eb\_volcor.h.

**13.28.4.3 double ebvolcor::Results::npoints**

what was the total number of points used for the VC

Definition at line 207 of file eb\_volcor.h.

**13.28.4.4 EGS\_Float ebvolcor::Results::other\_volume**

what was the estimated volume of the inscribed geometry

Definition at line 209 of file eb\_volcor.h.

**13.28.4.5 map<int, vector<int> > ebvolcor::Results::regions\_corrected**

Definition at line 211 of file eb\_volcor.h.

**13.28.4.6 bool ebvolcor::Results::success**

did the volume correction succeed?

Definition at line 204 of file eb\_volcor.h.

**13.28.4.7 EGS\_Float ebvolcor::Results::time**

how long (s) did the volume correction take

Definition at line 205 of file eb\_volcor.h.

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

- /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/[eb\\_volcor.h](#)

## 13.29 Subscriber Class Reference

```
#include <pubsub.h>
```

Inheritance diagram for Subscriber:

### Public Member Functions

- virtual [~Subscriber \(\)](#)
- virtual [void update \(EB\\_Message message, void \\*what=0\)=0](#)

### 13.29.1 Detailed Description

Definition at line 71 of file pubsub.h.

### 13.29.2 Constructor & Destructor Documentation

#### 13.29.2.1 virtual Subscriber::~Subscriber( ) [inline], [virtual]

Definition at line 73 of file pubsub.h.

### 13.29.3 Member Function Documentation

#### 13.29.3.1 virtual void Subscriber::update ( EB\_Message message, void \* what = 0 ) [pure virtual]

Implemented in [BaseSpectrumScorer](#), [EB\\_Phantom](#), [EnergyScoringStats](#), [PHSPControl](#), and [Latch](#).

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

- /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/pubsub.h

## 13.30 SurfaceCountSpectrum Class Reference

A class for scoring a histogram of the number of particles escaping a source geometry.

```
#include <spec_scoring.h>
```

Inheritance diagram for SurfaceCountSpectrum:

Collaboration diagram for SurfaceCountSpectrum:

### Public Member Functions

- [SurfaceCountSpectrum](#) (EGS\_Input \*input, EGS\_BaseSource \*src, GeomInfo \*ginfo, Publisher \*publisher)
- virtual void [score](#) (EB\_Message message, void \*data=0)

### Private Member Functions

- void [getResult](#) (int bin, EGS\_Float &r, EGS\_Float &dr)  
*set r & dr to result/uncertainty for given bin. Normalization can be done in this routine*
- string [getTitle](#) () const
- string [getSubTitle](#) () const
- string [getYAxisLabel](#) () const
- void [outputTotal](#) ()
- string [getFileExtension](#) () const

## Additional Inherited Members

### 13.30.1 Detailed Description

A class for scoring a histogram of the number of particles escaping a source geometry.

Sample input:

```
:start spectrum scoring:  
    type = surface count  
    particle type = photon  
    minimum energy = 0.001  
    maximum energy = 1.00  
    number of bins = 1000  
    output format = xmgr  
:stop spectrum scoring:
```

Definition at line 414 of file spec\_scoring.h.

### 13.30.2 Constructor & Destructor Documentation

13.30.2.1 **SurfaceCountSpectrum::SurfaceCountSpectrum ( EGS\_Input \* *input*, EGS\_BaseSource \* *src*, GeomInfo \* *ginfo*, Publisher \* *publisher* ) [inline]**

Definition at line 440 of file spec\_scoring.h.

### 13.30.3 Member Function Documentation

13.30.3.1 **string SurfaceCountSpectrum::getFileExtension ( ) const [inline], [private], [virtual]**

Reimplemented from [BaseSpectrumScorer](#).

Definition at line 433 of file spec\_scoring.h.

13.30.3.2 **void SurfaceCountSpectrum::getResult ( int *bin*, EGS\_Float & *r*, EGS\_Float & *dr* ) [private], [virtual]**

set r & dr to result/uncertainty for given bin. Normalization can be done in this routine

Reimplemented from [BaseSpectrumScorer](#).

Definition at line 453 of file spec\_scoring.cpp.

13.30.3.3 **string SurfaceCountSpectrum::getSubTitle ( ) const [inline], [private], [virtual]**

Reimplemented from [BaseSpectrumScorer](#).

Definition at line 423 of file spec\_scoring.h.

13.30.3.4 `string SurfaceCountSpectrum::getTitle ( ) const` [inline], [private], [virtual]

Reimplemented from [BaseSpectrumScorer](#).

Definition at line 419 of file `spec_scoring.h`.

13.30.3.5 `string SurfaceCountSpectrum::getYAxisLabel ( ) const` [inline], [private], [virtual]

Reimplemented from [BaseSpectrumScorer](#).

Definition at line 427 of file `spec_scoring.h`.

13.30.3.6 `void SurfaceCountSpectrum::outputTotal ( )` [private], [virtual]

Reimplemented from [BaseSpectrumScorer](#).

Definition at line 462 of file `spec_scoring.cpp`.

13.30.3.7 `void SurfaceCountSpectrum::score ( EB_Message message, void * data = 0 )` [virtual]

override in derived classes to do scoring

Implements [BaseSpectrumScorer](#).

Definition at line 438 of file `spec_scoring.cpp`.

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

- /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/[spec\\_scoring.h](#)
- /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/[spec\\_scoring.cpp](#)

## 13.31 ebvolcor::VolumeCorrector Class Reference

An object for controlling the volume correction routine.

```
#include <eb_volcor.h>
```

Collaboration diagram for ebvolcor::VolumeCorrector:

### Public Member Functions

- `VolumeCorrector (EGS_Input *volcor_input, vector< EB_Phantom * > phantoms, EGS_BaseGeometry *base_geom, GeomInfo *geom_info, vector< EGS_AffineTransform * > transforms=vector< EGS_AffineTransform * >())`
- `~VolumeCorrector ()`
- `Results runSourceCorrection (EB_TimingTree &timer)`
- `Results runGeneralCorrection (EB_TimingTree &timer)`
- `FileResults runFileCorrection (EB_TimingTree &timer)`

## Private Member Functions

- `void setupOptions ()`
- `double correctPhantomVolumesForSources ()`
- `double correctGeneralVolumes ()`
- `void applyVolumeCorrections (Options *options, HitCounterT hit_counter)`
- `map< string, int > loadFileVolumeCorrections ()`

## Private Attributes

- `EGS_Input * input`
- `Options * source_opts`
- `Options * gen_opts`
- `map< string, string > phantom_files`
- `vector< EB_Phantom * > phantoms`
- `EGS_BaseGeometry * base_geom`
- `GeomInfo * ginfo`
- `vector< EGS_AffineTransform * > transforms`
- `EGS_AffineTransform * base_transform`
- `EGS_AffineTransform * base_transform_inv`

### 13.31.1 Detailed Description

An object for controlling the volume correction routine.

See [EB\\_Application::correctVolumes](#) for usage.

Definition at line 280 of file eb\_volcor.h.

### 13.31.2 Constructor & Destructor Documentation

13.31.2.1 `ebvolcor::VolumeCorrector::VolumeCorrector ( EGS_Input * volcor_input, vector< EB_Phantom * > phantoms, EGS_BaseGeometry * base_geom, GeomInfo * geom_info, vector< EGS_AffineTransform * > transforms = vector<EGS_AffineTransform *>() ) [inline]`

Definition at line 302 of file eb\_volcor.h.

13.31.2.2 `ebvolcor::VolumeCorrector::~VolumeCorrector ( ) [inline]`

Definition at line 322 of file eb\_volcor.h.

### 13.31.3 Member Function Documentation

13.31.3.1 `void ebvolcor::VolumeCorrector::applyVolumeCorrections ( Options * options, HitCounterT hit_counter ) [private]`

Definition at line 364 of file eb\_volcor.cpp.

13.31.3.2 `double ebvolcor::VolumeCorrector::correctGeneralVolumes( )` [private]

Definition at line 277 of file eb\_volcor.cpp.

13.31.3.3 `double ebvolcor::VolumeCorrector::correctPhantomVolumesForSources( )` [private]

Definition at line 317 of file eb\_volcor.cpp.

13.31.3.4 `map< string, int > ebvolcor::VolumeCorrector::loadFileVolumeCorrections( )` [private]

Definition at line 415 of file eb\_volcor.cpp.

13.31.3.5 `FileResults ebvolcor::VolumeCorrector::runFileCorrection( EB_TimingTree & timer )` [inline]

Definition at line 376 of file eb\_volcor.h.

13.31.3.6 `Results ebvolcor::VolumeCorrector::runGeneralCorrection( EB_TimingTree & timer )` [inline]

Definition at line 356 of file eb\_volcor.h.

13.31.3.7 `Results ebvolcor::VolumeCorrector::runSourceCorrection( EB_TimingTree & timer )` [inline]

Definition at line 335 of file eb\_volcor.h.

13.31.3.8 `void ebvolcor::VolumeCorrector::setupOptions( )` [private]

Definition at line 236 of file eb\_volcor.cpp.

## 13.31.4 Member Data Documentation

13.31.4.1 `EGS_BaseGeometry* ebvolcor::VolumeCorrector::base_geom` [private]

Definition at line 287 of file eb\_volcor.h.

13.31.4.2 `EGS_AffineTransform* ebvolcor::VolumeCorrector::base_transform` [private]

Definition at line 291 of file eb\_volcor.h.

13.31.4.3 `EGS_AffineTransform* ebvolcor::VolumeCorrector::base_transform_inv` [private]

Definition at line 292 of file eb\_volcor.h.

13.31.4.4 **Options\*** `ebvolcor::VolumeCorrector::gen_opts` [private]

Definition at line 284 of file eb\_volcor.h.

13.31.4.5 **GeomInfo\*** `ebvolcor::VolumeCorrector::ginfo` [private]

Definition at line 289 of file eb\_volcor.h.

13.31.4.6 **EGS\_Input\*** `ebvolcor::VolumeCorrector::input` [private]

Definition at line 282 of file eb\_volcor.h.

13.31.4.7 **map<string, string>** `ebvolcor::VolumeCorrector::phantom_files` [private]

Definition at line 285 of file eb\_volcor.h.

13.31.4.8 **vector<EB\_Phantom \*>** `ebvolcor::VolumeCorrector::phantoms` [private]

Definition at line 286 of file eb\_volcor.h.

13.31.4.9 **Options\*** `ebvolcor::VolumeCorrector::source_opts` [private]

Definition at line 283 of file eb\_volcor.h.

13.31.4.10 **vector<EGS\_AffineTransform \*>** `ebvolcor::VolumeCorrector::transforms` [private]

Definition at line 290 of file eb\_volcor.h.

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

- /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/eb\_volcor.h
- /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/eb\_volcor.cpp



# Chapter 14

## File Documentation

### 14.1 doc\_utils.py File Reference

#### Namespaces

- [doc\\_utils](#)

#### Functions

- def [doc\\_utils.find\\_file\\_descriptions](#) (dir\_path, include\_key=None)

### 14.2 egs\_brachy.dox File Reference

### 14.3 egs\_brachy.md File Reference

### 14.4 gen\_docs.py File Reference

#### Namespaces

- [gen\\_docs](#)

#### Functions

- def [gen\\_docs.gen\\_docs](#) ()

#### Variables

- list [gen\\_docs.modules](#)

## 14.5 gen\_geom.py File Reference

### Namespaces

- `gen_geom`

### Functions

- def `gen_geom.get_readme` (`dir_path`)
- def `gen_geom.get_filetype_links` (`dir_path, extension`)
- def `gen_geom.get_images` (`dir_path`)
- def `gen_geom.gen_geom_docs` (`droot, title, is_sources=False`)
- def `gen_geom.gen_docs` (`fname`)

### Variables

- `gen_geom.root = os.path.join(.., "lib")`
- `gen_geom.abs_root = os.path.abspath(root)`
- `gen_geom.geom = os.path.join(abs_root, "geometry")`
- string `gen_geom.outfile = "geom.md"`

## 14.6 gen\_media.py File Reference

### Namespaces

- `gen_media`

### Functions

- def `gen_media.get_pegless_materials` ()
- def `gen_media.get_muen` ()
- def `gen_media.gen_docs` (`fname`)

### Variables

- `gen_media.root = os.path.join(.., "lib")`
- `gen_media.abs_root = os.path.abspath(root)`
- `gen_media.media_file = os.path.join(abs_root, "media", "material.dat")`
- `gen_media.muen_dir = os.path.join(abs_root, "muen")`
- string `gen_media.outfile = "media.md"`

## 14.7 gen\_specs.py File Reference

### Namespaces

- `gen_specs`

## Functions

- def `gen_specs.get_spectra ()`
- def `gen_specs.gen_docs (fname)`

## Variables

- `gen_specs.root = os.path.join(.., "lib")`
- `gen_specs.abs_root = os.path.abspath(root)`
- `gen_specs.specs = os.path.join(abs_root, "spectra")`
- string `gen_specs.outfile = "spectra.md"`

# 14.8 gen\_tests.py File Reference

## Namespaces

- `gen_tests`

## Functions

- def `gen_tests.get_tests ()`
- def `gen_tests.gen_docs (fname)`

## Variables

- `gen_tests.root_tests = os.path.join(.., "tests")`
- `gen_tests.globber = os.path.join(root_tests, "*", "test.py")`
- string `gen_tests.outfile = "tests.md"`

# 14.9 gen\_transport.py File Reference

## Namespaces

- `gen_transport`

## Functions

- def `gen_transport.gen_docs (fname)`

## Variables

- `gen_transport.root = os.path.join(.., "lib")`
- `gen_transport.abs_root = os.path.abspath(root)`
- `gen_transport.transport = os.path.join(abs_root, "transport")`
- string `gen_transport.outfile = "transport.md"`

## 14.10 geom.md File Reference

### 14.11 media.md File Reference

### 14.12 spectra.md File Reference

### 14.13 tests.md File Reference

### 14.14 transport.md File Reference

## 14.15 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/array\_sizes.h File Reference

### Macros

- `#define MXMED 50`
- `#define MXSTACK 200000`

#### 14.15.1 Macro Definition Documentation

##### 14.15.1.1 `#define MXMED 50`

Definition at line 57 of file array\_sizes.h.

##### 14.15.1.2 `#define MXSTACK 200000`

Definition at line 58 of file array\_sizes.h.

## 14.16 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/eb\_ieaphsp\_source/docs/eb\_ieaphsp\_source.dox File Reference

## 14.17 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/eb\_ieaphsp\_source/docs/output/ht File Reference

### Functions

- function `toggleVisibility` (`linkObj`)
- function `updateStripes` ()
- function `toggleLevel` (`level`)
- function `toggleFolder` (`id`)
- function `toggleInherit` (`id`)

## 14.17.1 Function Documentation

### 14.17.1.1 function toggleFolder ( *id* )

Definition at line 49 of file dynsections.js.

### 14.17.1.2 function toggleInherit ( *id* )

Definition at line 84 of file dynsections.js.

### 14.17.1.3 function toggleLevel ( *level* )

Definition at line 28 of file dynsections.js.

### 14.17.1.4 function toggleVisibility ( *linkObj* )

Definition at line 1 of file dynsections.js.

### 14.17.1.5 function updateStripes ( )

Definition at line 22 of file dynsections.js.

## 14.18 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/eb\_ieaphsp\_source/docs/output/html/jquery.js File Reference

### Functions

- **b extend** ({cssHooks:{opacity:{get:function(bw, bv){**if**(bv){var e=**Z**(bw,"opacity","opacity");return e===""??"1":e}**else**{return bw.style.opacity}}}}, cssNumber:{fillOpacity:true, fontWeight:true, lineHeight:true, opacity:true, orphans:true, widows:true, zIndex:true, zoom:true}, cssProps:{"float":b.support.cssFloat?"cssFloat":"styleFloat"}, style:function(bx, bw, bD, by){**if**(!bx||bx.nodeType==3||bx.nodeType==8||!bx.style){return}var bb, bC, bz=b.camelCase(bw), bv=bx.style, bE=b.cssHooks[bz];bw=b.cssProps[bz]||bz;**if**(b**D**!=**L**){bC=typeof bD;**if**(bC=="string"&&(bB=l.exec(bD))){bD=(+**(bB[1]+1)\*+bB[2])+parseFloat(**b.css**(bx, bw));bC="number"}**if**(bD==null||bC=="number"&&isNaN(bD)){return}**if**(bC=="number"&&!b.cssNumber[bz]){bD+="px"}**if**(!bE||bE||(bD=bE.set(bx, bD))!=**L**){try{bv[bw]=bD}catch(bA){}}**else**{**if**(bE &&"get"in bE &&(bB=bE.get(bx, false, bv))!=**L**){return bB}return bv[bw]}}, css:function(by, bx, bv){var bw, e;bx=b.camelCase(bx);e=b.cssHooks[bx];bx=b.cssProps[bx]||bx;**if**(bx=="cssFloat"){bx="float"}**if**(e &&"get"in e &&(bw=e.get(by, true, bv))!=**L**){return bw}**else**{**if**(Z){return Z(by, bx)}}, swap:function(bx, bw, by){var e={};for(var bv in bw){e[bv]=bx.style[bv];bx.style[bv]=bw[bv];by.call(bx);for(bv in bw){bx.style[bv]=e[bv]}}}}**
- **b each** (["height", "width"], function(bv, e){b.cssHooks[e]={get:function(by, bx, bw){var bz;**if**(bx){**if**(by.offsetWidth!=0){return p(by, e, bw)}**else**{b.swap(by, a7, function(){bz=p(by, e, bw)});return bz}}, set:function(bw, bx){**if**(bc.test(bx)){bx=parseFloat(bx);**if**(bx>=0){return bx+"px"}**else**{return bx}}}}})
- **if** (!b.support.opacity)
- **b** (function(){**if**(!b.support.reliableMarginRight){b.cssHooks.marginRight={get:function(bw, bv){var e;b.swap(bw,{display:"inline-block"}, function(){**if**(bv){e=**Z**(bw,"margin-right","marginRight")}**else**{e=bw.style.marginRight}});return e}}}))
- **if** (av.defaultView &&av.defaultView.getComputedStyle)

- **if** (av.documentElement.currentStyle)
- function **p** (by, bw, bv)
- **if** (b.expr && b.expr.filters)
- function **bh** ()
- function **at** ()
- function **a0** (bv, e)
- **b each** ({slideDown:a0("show", 1), slideUp:a0("hide", 1), slideToggle:a0("toggle", 1), fadeIn:{opacity:"show"}, fadeOut:{opacity:"hide"}, fadeToggle:{opacity:"toggle"}}, function(e, bv){b.fn[e]=function(bw, by, bx){return this.animate(bv, bw, by, bx)}})
- **b extend** (b.fx,{tick:function(){var bw, bv=b.timers, e=0;for(;e< bv.length;e++){bw=bv[e];**if**(!bw()&&bv[e]===bw){bv.splice(e--, 1)}**if**(!bv.length){b.fx.stop()}}, interval:13, stop:function(){clearInterval(a3);a3=null}, speeds:{slow:600, fast:200, \_default:400}, step:{opacity:function(e){b.style(e.elem,"opacity", e.now)}, \_default:**function**(e){**if**(e.elem.style &&e.elem.style[e.prop]!=null){e.elem.style[e.prop]=e.now+e.unit}**else**{e.elem[e.prop]=e.now}}}}})
- function **x** (bx)
- **if** ("getBoundingClientRect" in av.documentElement)
- function **aK** (e)
- **if** (typeof define==="function"&&define.amd &&**define.amd.jQuery**)

## Variables

- function **bb**
- function **L** {var av=bb.document,bu=bb.navigator,bl=bb.location
- var **b**
- var **au** =/opacity=([^"]\*)/,z=/([A-Z]|^ms)/g,bc=/^-?\d+(?:px)?\$/i,bn=/^-?\d/,l=/^([^-]+)([^-.\de]+)/,a7={position :"absolute",visibility:"hidden",display:"block"},an=["Left","Right"],a1=["Top","Bottom"],Z,al,aX
- **b fn css** =function(e,bv){**if**(arguments.length==2&&bv===**L**){return this}return b.access(this,e,bv,true,function(bx,bw,by){return by!==**L**?b.style(bx,bw,by):b.css(bx,bw)})}
- **b curCSS** =**b.css**
- **Z** =al||aX
- var **k** =/%20/g
- var **ap** =/\n\$/
- var **bs** =/\r?\n/g
- var **bq** =/#.\*\$/
- var **aD** =/^(.\*):[\t]\*([^\r\n]\*)\r?\$/mg
- var **aZ** =/^(:color|date|datetime|datetime-local|email|hidden|month|**number**|password|range|search|tel|text|time|url|week)\$/**i**
- var **aM** =/^(:about|app|app\storage|.+extension|file|res|widget)\$/**i**
- var **aQ** =/^(:GET|HEAD)\$/**i**
- var **c**
- **b fx prototype** ={update:function(){**if**(this.options.step){this.options.step.call(this.elem,this.now,this)}(b.fx.**step**[this.prop]||b.fx.step.\_default)(this)},cur:function(){**if**(this.elem[this.prop]!=null&&(!this.elem.style||this.elem.style[this.prop]==null)){return this.elem[this.prop]}var e,bv=**b.css**(this.elem,this.prop);return isNaN(e=parseFloat(bv))?!bv||bv=="auto"?0:bv:e,custom:function(bz,bw,bx){var e=this,bw=b.fx>this.startTime=a4||bh();this.end=by;this.now=this.start=bz;this.pos=this.state=0;this.unit=bx||this.unit||(b.cssthis.prop)?"":"px");function bv(bA){return e.step(bA)}bv.queue=this.options.queue;bv.elem=this.elem;bv.saveState=function(){**if**(e.options.hide&&b.\_data(e.elem,"fxshow"+e.prop)===**L**){b.\_data(e.elem,"fxshow"+e.prop,e.start)}**if**(bv()&&b.timers.push(bv)&&!a3){a3=setInterval(bw.tick,bw.interval)}},show:function(){var e=b.\_data(this.elem,"fxshow"+this.prop);this.options.orig[this.prop]=e||b.style(this.elem,this.prop);this.options.show=true;**if**(e!==**L**){this.custom(this.cur(),e)}**else**{this.custom(this.prop=="width"||this.prop=="height"?1:0,this.cur())}**if**(this.elem.show(),hide:function(){this.options.orig[this.prop]=b.\_data(this.elem,"fxshow"+this.prop)||b.style(this.elem,this.prop);this.options.hide=true;this.custom(this.cur(),0)},step:function(by){var

Reference

```
bA,bB,bv,bx=a4||bh(),e=true,bz=this.elem,bw=this.options;if(by||bx>=bw.duration+this.startTime){this.←
now=this.end;this.pos=this.state=1;this.update();bw.animatedProperties[this.prop]=true;for(bA in bw.←
animatedProperties){if(bw.animatedProperties[bA]!==true){e=false}}if(e){if(bw.overflow!=null&&!b.support.←
shrinkWrapBlocks){b.each(["","X","Y"],function(bC,bD){bz.style["overflow"+bD]=bw.overflow[bC]});if(bw.←
hide){bz.hide()}if(bw.hide||bw.show){for(bA in bw.animatedProperties){b.style(bz,bA,bw.orig[bA]);b.←
removeData(bz,"fxshow"+bA,true);b.removeData(bz,"toggle"+bA,true)}};bw.complete;if(bw){bw.complete=false;bv.←
call(bz)};return false}else{if(bw.duration==Infinity){this.now=bx}else{bB=bx-this.startTime;this.state=bB/bw.←
duration;this.pos=b.easing[bw.animatedProperties[this.prop]](this.state,bB,0,1,bw.duration);this.now=this.←
start+((this.end-this.start)*this.pos)};this.update();}return true}}
```

- var **V** =/^t(?:able|d|h)\$/*i*
- var **ad** =/^(:body|html)\$/*i*
- **else** {b.fn.offset=function(bF){var bz=this[0];if(bF){return this.each(function(bG){b.offset.setOffset(this,bF,bG))});if(!bz||!bz.←
ownerDocument){return null}if(bz==bz.ownerDocument.body){return b.offset.bodyOffset(bz)}var bC,bw=bz.←
offsetParent,bv=bz,bE=bz.ownerDocument,bx=bE.documentElement,bA=bE.body,bB=bE.defaultView,e=bB?b.←
B.getComputedStyle(bz,null):bz.currentStyle,bD=bz.offsetTop,by=bz.offsetLeft;while((bz=bz.parentNode)&&bz!=bA&&bz!=b.←
support.fixedPosition&&e.position==="fixed"){break}bC=bB?bB.getComputedStyle(bz,null):bz.current←
Style;bD=bz.scrollTop;by-=bz.scrollLeft;if(bz==bw){bD+=bz.offsetTop;by+=bz.offsetLeft;if(b.support.←
doesNotAddBorder&&!(b.support.doesAddBorderForTableAndCells&&V.test(bz.nodeName))){bD+=parse←
Float(bC.borderTopWidth)||0;by+=parseFloat(bC.borderLeftWidth)||0}bv=bw;bw=bz.offsetParent;if(b.←
support.subtractsBorderForOverflowNotVisible&&bC.overflow!="visible"){bD+=parseFloat(bC.borderTop←
Width)||0;by+=parseFloat(bC.borderLeftWidth)||0}e=bC;if(e.position==="relative"||e.position==="static"){bD+=b.←
A.offsetTop;by+=bA.offsetLeft}if(b.support.fixedPosition&&e.position==="fixed"){bD+=Math.max(bx.scroll←
Top,bA.scrollTop);by+=Math.max(bx.scrollLeft,bA.scrollLeft))}return{top:bD,left:by}}};b.offset={bodyOffset←
:function(e){var bw=e.offsetTop,bv=e.offsetLeft;if(b.support.doesNotIncludeMarginInBodyOffset){bw+=parse←
Float(b.css(e,"marginTop"))||0;bv+=parseFloat(b.css(e,"marginLeft"))||0}return{top:bw,left:bv}},setOffset←
:function(bx,bG,bA){var bB=b.css(bx,"position");if(bB==="static"){bx.style.position="relative"}var bz=b(bx),bv=bz.←
offset(),e=b.css(bx,"top"),bE=b.css(bx,"left"),bF=(bB==="absolute"||bB==="fixed")&&b.inArray("auto",[e,bE])>-1,bD={},bC={},bw,by;if(bF){bC=bz.position();bw=bC.top;by=bC.left}else{bw=parseFloat(e)||0;by=parse←
Float(bE)||0}if(bisFunction(bG)){bG=bG.call(bx,bA,bv)}if(bG.top!=null){bD.top=(bG.top-bv.top)+bw}if(bG.←
left!=null){bD.left=(bG.left-bv.left)+by}if("using" in bG){bG.using.call(bx,bD)}else{bz.css(bD))}}
- **bb** jQuery =bb.\$=b
- **window**

### 14.18.1 Function Documentation

#### 14.18.1.1 function a0 ( *bv*, *e* )

Definition at line 30 of file jquery.js.

#### 14.18.1.2 function aK ( *e* )

Definition at line 30 of file jquery.js.

#### 14.18.1.3 function at ( )

Definition at line 30 of file jquery.js.

#### 14.18.1.4 b ( *function(){if(!b.support.reliableMarginRight){b.cssHooks.marginRight={get:function(bw, bv){var* *e;b.swap(bw,{display:"inline-block"}, function(){if(bv){e=Z(bw,"margin-right","marginRight")}else{e=bw.style.←* *marginRight});return e}}}} } )*

#### 14.18.1.5 function bh ( )

Definition at line 30 of file jquery.js.

```

14.18.1.6 b each ( function(bv, e){b.cssHooks[e]={get:function(by, bx, bw){var bz;if(bx){if(by.offsetWidth!==0){return p(by, e, bw)}else{b.swap(by, a7, function(){bz=p(by, e, bw)});return bz}}, set:function(bw, bx){if(bc.test(bx)){bx=parseFloat(bx);if(bx >=0){return bx+"px"}else{return bx}}}}) }

14.18.1.7 b each ( {slideDown:a0("show", 1), slideUp:a0("hide", 1), slideToggle:a0("toggle", 1), fadeIn:{opacity:"show"}, fadeOut:{opacity:"hide"}, fadeToggle:{opacity:"toggle"}}, function(e, bv){b.fn[e]=function(bw, by, bx){return this.animate(bv, bw, by, bx)}} )

14.18.1.8 b fn extend ( {cssHooks:{opacity:{get:function(bw, bv){var e=Z(bw,"opacity","opacity");return e=="?":e:else{return bw.style.opacity}}}}, cssNumber:{fillOpacity:true, fontWeight:true, lineHeight:true, opacity:true, orphans:true, widows:true, zIndex:true, zoom:true}, cssProps:{"float":b.support.cssFloat?"cssFloat":styleFloat, style:function(bx, bw, bD, by){if(!bx||bx.nodeType==3||bx.nodeType==8||!bx.style){return}var bB, bC, bz=b.camelCase(bw), bv=bx.style, bE=b.cssHooks[bz];bw=b.cssProps[bz]||bz;if(bD!=L){bC=typeof bD;if(bC=="string"&&(bB=l.exec(bD))){bD=(+bB[1]+1)*+bB[2])+parseFloat(b.css(bx, bw));bC="number"}if(bD=null||bC=="number"&&isNaN(bD)){return}if(bC=="number"&&!b.css:Number[bz]){{bD+="px"}if(!bE||!("set"in bE)||((bD=bE.set(bx, bD))!=L)){try{bv[bw]=bD}catch(bA){}}else{if(bE&&"get"in bE &&(bB=bE.get(bx, false, by))!=L){return bB}return bv[bw]}}, css:function(by, bx, bv){var bw, e;bx=b.camelCase(bx);e=b.cssHooks[bx];bx=b.cssProps[bx]||bx;if(bx=="cssFloat"){bx="float"}if(e && "get"in e &&(bw=e.get(by, true, bv))!=L){return bw}else{if(Z){return Z(by, bx)}}, swap:function(bx, bw, by){var e={};for(var bv in bw){e[bv]=bx.style[bv];bx.style[bv]=bw[bv]}by.call(bx);for(bv in bw){bx.style[bv]=e[bv]}}) }

14.18.1.9 b extend ( b, fx, {tick:function(){var bw, bv=b.timers, e=0;for(;e< bv.length;e++){bw=bv[e];if(!bw()&&bv[e]==bw){bv.splice(e--, 1)}if(!bv.length){b.fx.stop()}}, interval:13, stop:function(){clearInterval(a3);a3=null}, speeds:{slow:600, fast:200, _default:400}, step:{opacity:function(e){b.style(e.elem,"opacity", e.now)}, _default:function(e){if(e.elem.style&&e.elem.style[e.prop]!=null){e.elem.style[e.prop]=e.now+e.unit}else{e.elem[e.prop]=e.now}}}} ) 
```

14.18.1.10 if ( !b.support.opacity )

Definition at line 28 of file jquery.js.

14.18.1.11 if ( av.defaultView &&av.defaultView.getComputedStyle )

Definition at line 28 of file jquery.js.

14.18.1.12 if ( av.documentElement.currentStyle )

Definition at line 28 of file jquery.js.

14.18.1.13 if ( b.expr &&b.expr.filters )

Definition at line 29 of file jquery.js.

14.18.1.14 if ( typeof define == "function" &&define.amd &&define.amd.jQuery )

Definition at line 30 of file jquery.js.

Reference

14.18.1.15 if ( "getBoundingClientRect" in av. documentElement )

Definition at line 30 of file jquery.js.

14.18.1.16 function p ( by, bw, bv )

Definition at line 28 of file jquery.js.

14.18.1.17 function x ( bx )

Definition at line 30 of file jquery.js.

## 14.18.2 Variable Documentation

14.18.2.1 var aD =/^(.\*):[\t]\*([^\r\n]\*)\r?\$/mg

Definition at line 29 of file jquery.js.

14.18.2.2 var ad =/^(?:body|html)\$/i

Definition at line 30 of file jquery.js.

14.18.2.3 var aM =/^(?:about|app|app-storage|.+extension|file|res|widget):\$/

Definition at line 29 of file jquery.js.

14.18.2.4 var ap =^[\]\$

Definition at line 29 of file jquery.js.

14.18.2.5 var aQ =/^(?:GET|HEAD)\$/

Definition at line 29 of file jquery.js.

14.18.2.6 var au =/opacity=([^\r\n]+),z=([A-Z][^\r\n]+)g,bc=/^-\d+(?:px)?\$/i,bn=/^-\d/,l=/^([^\r\n-]+)=([^\r\n-]+),a7={position:"absolute",visibility:"hidden",display:"block"},an=["Left","Right"],a1=["Top","Bottom"],Z,al,aX

Definition at line 28 of file jquery.js.

**14.18.2.7 var aZ =/<sup>^</sup>(?:color|date|datetime|datetime-  
local|email|hidden|month|number|password|range|search|tel|text|time|url|week)\$/i**

Definition at line 29 of file jquery.js.

**14.18.2.8 var b**

**Initial value:**

```
= (function() {var bF=function(b0,b1){return new bF.fn.init(b0,b1,bD)},bU=bb.jQuery,bH=
  bb.$,bD,bY=/^(?:[^#<]*(<[\w\W]+>)[^>]*$|#([\w\W]+*))$/i,bM=/S/,bI=/^s+/,bE=/\s+/,bA=/^<(\w+)\s*/>(?:</\w+>)?$/i,bN=/^[\s\S]*$/i,bW=/\\((?:["\\\bf{fn}rt"]|u[0-9a-fA-F]{4})/g,bP=/^["\\\n\r]*["true|false|null|-?]\d+(?:\.\d*)?(?:[eE][+\-]?d+)/g,bJ=/^(?:\s*[:]|\s*+/g,by=/(webkit)[ \/\](\[\w\.\+]//,bR=/^(opera)(?:.*version)?[ \/\](\[\w\.\+]//,bQ=/(msie)([\.\w\.\+]//,bS=/(mozilla)(?:.*rv:(\[\w\.\+]//)?,bB=-([a-z|[0-9])//,bZ=/^-\ms/-,bT=function(b0,b1){return(b1+"").toUpperCase()},bX=bu.userAgent,bV,bC,e,bL=Object.prototype.toString,
  bG=Object.prototype.hasOwnProperty,bz=Array.prototype.push,bk=Array.prototype.slice,bO=String.prototype.trim,
  bv=Array.prototype.indexOf,bx={};bF.fn=bF.prototype={constructor:bF,init:function(b0,b4,b3){var b2,b5,b1,b6,
  if(!b0){return this}if(b0.nodeType){this.context=this[0]=b0;this.length=1;return this}if(b0==="body"&&!b4&&av.body){this.context=av;this[0]=av.body;this.selector=b0;this.length=1;return this}if(typeof b0==="string"){
  if(b0.charCodeAt(0)==<"&b0.charCodeAt(b0.length-1)==>"&b0.length>=3){b2=[null,b0,null]}else{b2=bY.exec(b0)}if(
  b2&&(b2[1]||!b4)){if(b2[1])}{b4=b4 instanceof bF?b4[0]:b4;b6=(b4?b4.ownerDocument||b4:b4);bI=bA.exec(b0);if(
  b1){if(bF.isPlainObject(b4)){b0=[av.createElement(b1[1])];bF.fn.attr.call(b0,b4,true)}else{b0=[b6.
  createElement(b1[1])]}else{b1=bF.buildFragment([b2[1]],b6)];b0=(b1.cacheable?bF.clone(b1.fragment):b1.fragment).
  childNodes}return bF.merge(this,b0)}else{b5=av.getElementById(b2[2]);if(b5&&b5.parentNode){if(b5.id!==b2[2]){
  return b3.find(b0)}this.length=1;this[0]=b5}this.context=av;this.selector=b0;return this}else{if(!b4||b4.jquery
  ){return(b4||b3).find(b0)}else{return this.constructor(b4).find(b0)}}}else{if(bF.isFunction(b0)){return b3.
  ready(b0)}if(b0.selector!=L){this.selector=b0.selector;this.context=b0.context}return bF.makeArray(b0,this),
  selector:"",jquery:"1.7.1",length:0,size:function(){return this.length},toArray:function(){return bK.call(
  this,0),get:function(b0){return b0==null?this.toArray():(b0>0?this.slice(b0+b0):this[b0])},pushStack:
  function(b1,b3,b0){var b2=this.constructor();if(bF.isArray(b1)){bZ.apply(b2,b1)}else{bF.merge(b2,b1)}b2.
  prevObject=this;b2.context=this.context;if(b3==="find"){b2.selector=this.selector+this.selector?" ":"")+
  b0}else{if((b3){b2.selector=this.selector+"."+b3+"("+b0+")"}return b2},each:function(b1,b0){return bF.each(this,b1,b0)
  },ready:function(b0){bF.bindReady();bC.add(b0);return this},eq:function(b0){b0+=b0;return b0===-1?this.slice(
  b0):this.slice(b0,b0+1)},first:function(){return this.eq(0)},last:function(){return this.eq(-1)},slice:
  function(){return this.pushStack(bK.apply(this,arguments),"slice",bK.call(arguments).join(","))),map:function(b0){
  return this.pushStack(bF.map(this,function(b2,b1){return b0.call(b2,b1,b2)})),end:function(){return this.
  prevObject||this.constructor(null)},push:bZ,sort:[].sort.splice:[].splice},bF.fn.init.prototype=bF.fn.bF.
  extend=bF.fn.extend=function(){var b9,b2,b0,b1,b6,b7,b5=arguments[0]||{},b4=1,b3=arguments.length,b8=false;if(
  typeof b5==="boolean"){b8=b5;b5=arguments[1]||{};b4=2}if(typeof b5!="object"&&!bF.isFunction(b5)){b5={}}if(
  b3==b4){b5=this;--b4}for(;b4<b3;b4++){if((b9=arguments[b4])!=null){for(b2 in b9){b0=b5[b2];b1=b9[b2];if(b5==
  b1){continue}if(b8&&b1&&(bF.isPlainObject(b1)||b6=bF.isArray(b1))){if(b6){b6=false;b7=b0&&bF.isArray(b0)?
  b0:[ ]}else{b7=b0&&bF.isPlainObject(b0)}b0:[ ]}b5[b2]=bF.extend(b8,b7,b1)}else{if(b1!=-
  L){b5[b2]=b1}}}}}return b5};bF.extend({noConflict:function(b0){if(bb.$==bF){bb.$=bH}if(b0&&
  bb.jQuery==bF){bb.jQuery=bU}return bF},isReady:false,readyWait:1,holdReady:function(b0){if(b0){bF.
  readyWait++}else{bF.ready(true)}},ready:function(b0){if((b0==true&&!--bF.readyWait)||!(b0==true&&!
  bF.isReady)){if(av.body){return setTimeout(bF.ready,1)}bF.isReady=true;if(b0==true&&!--bF.readyWait>0){return
  bC.fireWith(av,[bF]);if(bF.fn.trigger("bf").off("ready")){bindReady:function(){if(bC){return}bC=bF.
  Callbacks("once memory");if(av.readyState==="complete"){return setTimeout(bF.ready,1)}if(av.addEventListener){av.
  addEventListener("DOMContentLoaded",e,false);bb.addEventListener("load",bF.ready,false)}else{if(av.
  attachEvent){av.attachEvent("onreadystatechange",e);bb.attachEvent("onload",bF.ready);var b0=false;try{b0=
  bb.frameElement==null?catch(b1){if(av.documentElement.scrollTop&&b0){bW()}}:isFunction(function(b0{
  return bF.type(b0)=="function"},isArray.isArray||function(b0){return bF.type(b0)=="array"},isWindow:
  function(b0){return b0&&typeof b0==="object"&&!setInterval" in b0},isNumeric:function(b0){return !isNaN(
  parseFloat(b0))},type:function(b0){return b0==null?String(b0):bx[bL.call(b0)]||"object"},isPlainObject:
  function(b2){if(!b2||bF.type(b2)!="object"||b2.nodeType||bF.isWindow(b2)){return false}try{if(b2.
  constructor&&!bG.call(b2,"constructor")&&!bG.call(b2.constructor.prototype,"isPrototypeOf")){return
  false}}catch(b1){return false}var b0;for(b0 in b2){return b0==L||bG.call(b2,b0)},isEmptyObject:function(b1){for(var b0 in b1
  ){return false}return true},error:function(b0){throw new Error(b0)},parseJSON:function(b0){if(typeof b0!="
  string"||!b0){return null}b0=bF.trim(b0);if(bb.JSON&&bb.JSON.parse){return bb.JSON.parse(b0)}if(bN.test(b0.
  replace(bW,"@").replace(bP,""))){return(new Function("return "+b0))()}bF.error("Invalid JSON:
  "+b0)},parseXML:function(b2){var b0,b1;try{if(bb.DOMParser){bL=new DOMParser();b0=bL.parseFromString(b2,
  "text/xml")}else{b0=new ActiveXObject("Microsoft.XMLDOM");b0.async="false";b0.loadXML(b2)}}catch(b3){b0=
  L}if(!b0||!b0.documentElement||b0.getElementsByTagName("parsererror").length){bF.error("Invalid XML: "+b2)}
  return b0},noop:function(){},globalEval:function(b0){if(b0){if(b0&&BM.test(b0)){(bb.execScript||function(bb{
  bb["eval"].call(bb,b1)})(b0))}},camelCase:function(b0){return b0.replace(bZ,"ms-").replace(bB,bT)},nodeName:
  function(b1,b0){return b1.nodeName&&b1.nodeName.toUpperCase()==b1.toUpperCase()},each:function(b3,b6,b2){var b1,b4=0,b5=b3.length,b0=b5==L||bF.isFunction(b3);if(b2){if(b0){for(b1 in b3){
  if(b6.apply(b3[b1],b2)==false){break}}else{for(b4<b5){if(b6.apply(b3[b4+1],b2)==false){break}}}}else{if(
  b0){for(b1 in b3){if(b6.call(b3[b1],b1,b3[b1])==false){break}}else{for(b4<b5){if(b6.call(b3[b4],b4,b3[b4
  ++])==false){break}}}}}return b3},trim:b0?function(b0){return b0==null?"":b0.call(b0)}:function(b0){return
  b0==null?"":b0.toString().replace(bI,"").replace(bE,"")},makeArray:function(b3,b1){var b0=b1||[];if(b3!=null){
  var b2=bF.type(b3);if(b3.length==null||b2=="string"||b2=="function"||b2=="regexp"||bF.isWindow(b3)){bZ.
  call(b0,b3)}else{bF.merge(b0,b3)}}return b0},inArray:function(b2,b3,b1){var b0;if(b3){if(bV){return
  bV.call(b3,b2,b1)}b0=b3.length;b1=b1>1?0?Math.max(0,b0+b1):b1:0;for(;b1<0;b1++){if(b1 in b3&&b3[b1]==b2){return
  b1}}}-1},merge:function(b4,b2){var b3=b4.length,b1=0;if(typeof b2.length=="number"){for(var b0=b2.
  length;b1<0;b1++){b4[b3++]=b2[b1+1]}}b4.length=b3;return b4},grep:
  function(b1,b6,b0){var b2=[],b5=b0=!b0;for(var b3=0,b4=b1.length;b3<b4;b3++){b5!=!b6(b1[b3],b3);if(b0==b5){b2.
  push(b1[b3])}}return b2},map:function(b0,b7,b8){var b5,b6,b4=[],b2=0,b1=b0.length,b3=b0 instanceof bF||b1==
  L&&typeof b1=="number"&&(b1>0&&b0[0]&&b0[b1-1])||b1==0||bF.isArray(b0));if(b3){for(;b2<b1;b2++){b5=b7(b0
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[b2],b2,b8);if(b5!=null){b4[b4.length]=b5}}}else{for(b6 in b0){b5=b7(b0[b6],b6,b8);if(b5!=null){b4[b4.length]=b5}}}return b4.concat.apply([],b4)},guid:1,proxy:function(b4,b3){if(typeof b3==="string"){var b2=b4[b3];b3=b4;b4=b2;if(!bFisFunction(b4)){return L}var b0=bK.call(arguments,2),b1=function(){return b4.apply(b3,b0).concat(bK.call(arguments))};b1.guid=b4.guid||b1.guid||bF.guid++;return b1},access:function(b0,b8,b6,b2,b5,b7){var b1=b0.length;if(typeof b8==="object"){for(var b3 in b8){bF.access(b0,b3,b8[b3],b2,b5,b6)}}return b0}if(b6==L){b2=b7&&b2&&bFisFunction(b6);for(var b4=0;b4<1;b4++){b5(b0[b4],b8,b2)b6.call(b0[b4],b4,b5(b0[b4],b8),b6,b7)}return b0}return b1?b5(b0[0],b8):L},now:function(){return(new Date()).getTime()},uaMatch:function(b1){b1=b1.toLowerCase();var b0=by.exec(b1)||brQ.exec(b1)||b1.indexOf("compatible")<0&&bS.exec(b1)||[];return{browser:b0[1]||'',version:b0[2]||''}},sub:function(){function b0(b3,b4){return new b0.fn.init(b3,b4)}b0.fn=b0.prototype=this();b0.fn.constructor=b0;b0.sub=this.sub;b0.fn.init=function b2(b3,b4){if(b4&&b4 instanceof bF&&(b4 instanceof b0)){b4=b0(b4)}return bF.fn.init.call(this,b3,b4,b1)};b0.fn.init.prototype=b0.fn;var b1=b0(av);return b0,browser:{}}};bF.each("Boolean Number String Function Array Date RegExp Object".split(" "),function(b1,b0){bx["[object "+b0+"]"] = b0.toLowerCase()});bv=bF.uaMatch(bX);if(bV.browser){bF.browser[bV.browser]=true;bF.browser.version=bV.version;if(bF.browser.webkit){bF.browser.safari=true}if(bM.test("\x0A")){bI=/[\s\xA0]+/;bE=/[\s\xA0]+$/;bD=bF(av);if(av.addEventListener){e=function(){av.removeEventListener("DOMContentLoaded",e,false);bF.ready()}else{if(av.attachEvent){e=function(){if(av.readyState==="complete"){av.detachEvent("onreadystatechange",e);bF.ready()}}}}function bw(){if(bF.isReady){return}try{av.documentElement.doScroll("left")}{catch(b0){setTimeout(bw,1);return}}bF.ready()}else{return bF()}});var a2={};function X(e){var bv=a2[e]={},bw,bx;e=e.split(/\s+/);for(bw=0,bx=e.length;bw<bx;bw++) {bv[e[bw]]=true}return bv}b.Callbacks=function(bw){bw=bW?(a2[bw]||{})(bx):{};var bB=[],bC=[],bx,by,bv,bz,bA,bE=function(bF){var bG,bJ,bI,bH,bK;for(bG=0,bJ=bF.length;bG<bJ;bG++) {bI=bF[bG];bH=b.type(bI);if(bH==="array"){bE(bI)}else{if(bH==="function"){if(!bw.unique||!bD.has(bI)){bB.push(bI)}}}}},e=function(bG,bF){bF=bF||[];bx=!!bG.memory||[bG,bF];by=true;bA=bV||{};bz=bB.length;for(bB&&bA<bZ;bA++) {if(bB[bA].apply(bG,bF)==false&&bW.stopOnFalse){bx=true;break}}by=false;if(bB){if(bW.once){if(bC&&bC.length){bx=bC.shift();bD.fireWith(bx[0],bx[1])}}else{if(bx==true){bD.disable()}else{bB=[]}}},bD={add:function(){if(bB){var bF=bB.length;bE(arguments);if(by){bz=bB.length}else{if(bx&&bx==true){bv=bF;e(bx[0],bx[1])}}return this},remove:function(){if(bB){var bF=arguments,bH=0,bI=bF.length;for(;bH<bI;bH++){for(var bG=0,bH<bD.length;bG++) {if(bF[bH]===bB[bG]){if(by){if(bG==bz){bz=-1;if(bG<bA){bA.splice(bG,-1);if(bw.unique){break}}}}}}return this},has:function(bG){if(bB){var bv=0,bH=bB.length;for(;bF<bH;bF++){if(bG==bB[bF]){return true}}}}return false},empty:function(){bB=[];return this},disable:function(){bB=bC=bx=L;return this},disabled:function(){return !bB},lock:function(){bC=L;if(!bx||bx==true){bD.disable()}return this},locked:function(){return !bC},fireWith:function(bG,bF){if(bC){if(by){if(!bW.once){bC.push([bG,bF])}}else{if(!!(bW.once&&bx)){e(bG,bF)}}}return this},fire:function(){bD.fireWith(this,arguments);return this},fired:function(){return !bx}}};return bD};var aJ=[].slice;b.extend({Deferred:function(by){var bx=b.Callbacks("once memory"),bw=b.Callbacks("once memory"),bv=b.Callbacks("memory"),e="pending",bA={resolve:bx,reject:bw,notify:bw},bC={done:bx,add:fail:bw,progress:bw,add,state:function(){return e},isResolved:bx,fired,isRejected:bw,fired,then:function(bE,bb,bF){bB.done(bE).fail(bD).progress(bF);return this},always:function(){bB.done.apply(bB,arguments).fail.apply(bB,arguments);return this},pipe:function(bF,bE,bD){return b.Deferred(function(bG){b.each({done:[bF,"resolve"],fail:[bE,"reject"],progress:[bD,"notify"]},{bH=bL[0],bK=bL[1],bJ;if(b.isFunction(bH)){bH[bI].function(){bJ=bH.apply(this,arguments);if(bJ&&bJ.isFunction(bJ.promise)){bJ.promise().then(bG.resolve,bG.reject,bG.notify)}else{bG[bK+"With"]((this==bB?bG:this,[bJ]))}}else{bB[bI](bG[bK])}}).promise(),promise:function(bE){if(bE==null){bE=bC}else{for(var bD in bC){bE[bD]=bC[bD]}}return bE}},bB=bC.promise({},bz);for(bz in bA){bB[bz]=bA[bz].fire;bB[bz+"With"]=(bA[bz].fireWith)bB.done(function(){e="resolved"},bw.disable,bv.lock).fail(function(){e="rejected"},bx.disable,bv.lock);if(by){by.call(bB,bB)}}return bB},when:function(bA){var bx=aJ.call(arguments,0),bv=0,e=bx.length,bB=new Array(e),bw=e,by=e,bC=e<=1&&bA&&bA.isFunction(bA.promise)?bA:b.A.Deferred(),bE=bC.promise();function bD(bF){return function(bG){bx[bF]=arguments.length>1?aJ.call(arguments,0):bG;if(!(--bw)){bC.resolveWith(bC,bx)}}}function bz(bF){return function(bG){bB[bF]=arguments.length>1?aJ.call(arguments,0):bG;bC.notifyWith(bE,bG)}if(e>1){for(;bv<e;bv++) {if(bx[bv]&&bx[bv].promise&&bA.isFunction(bx[bv].promise)){bx[bv].promise().then(bD(bv),bC.reject,bz(bv))}}else{--bw}if(!bw){bC.resolveWith(bC,bx)}}else{if(bC==bA){bC.resolveWith(bC,e?[bA]:[])}return bE}}};b.support=(function(){var bJ,bI,bF,bG,bx,bE,bA,bD,bz,bK,bB,by,bw,bv=av.createElement("div"),bH=av.documentElement;bw.setAttribute("className","t");bw.innerHTML=" <link/><table><a href='/'>";bI=bv.getElementsByTagName("*");bF=bv.getElementsByTagName("a")[0];if(!bI||!bI.length||!bF){return}bG=av.createElement("select");bx=bG.appendChild(av.createElement("option"));bE=bv.getElementsByTagName("input")[0];bJ=leadingWhitespace:(bv.firstChild.nodeType==3),tbody:!bv.getElementsByTagName("tbody").length,htmlSerialize:!bv.getElementsByTagName("link").length,style:/top/.test(bF.getAttribute("style")),hrefNormalized:(bF.getAttribute("href")==="/a"),opacity:/^0.55/.test(bF.style.opacity),cssFloat:!bf.style.cssFloat,checkOn:(bE.value=="on"),optSelected:bx.selected,getAttribute:bv.className!="t",enctype:!av.createElement("form").enctype,html5Clone:av.createElement("nav").cloneNode(true).outerHTML=="#navs</nav>",submitBubbles:true,changeBubbles:true,focusinBubbles:false,deleteExpando:true,noCloneEvent:true,inlineBlockNeedsLayout:false,shrinkWrapBlocks:false,reliableMarginRight:true};bE.checked=true;bJ.noCloneChecked=bE.cloneNode(true).checked;bG.disabled=true;bJ.optDisabled=bx.disabled;try{delete bv.test}catch(bC){bJ.deleteExpando=false}if(!bv.addEventListener&&bv.attachEvent&&bv.fireEvent){bv.attachEvent("onclick",function(){bJ.noCloneEvent=false});bv.cloneNode(true).fireEvent("onclick")}bE=av.createElement("input");bE.value="t";bE.setAttribute("type","radio");bJ.radioValue=bE.value=="t";bE.setAttribute("checked","checked");bv.appendChild(bE);bD=av.createDocumentFragment();bD.appendChild(bv.lastChild);bJ.checkClone=bD.cloneNode(true).cloneNode(true).lastChild.checked;bJ.appendChecked=bE.checked;bD.removeChild(bE);bD.appendChild(bv);bv.innerHTML="#"if(bb.getComputedStyle){bA=av.createElement("div");bA.style.width="0";bA.style.marginRight="0";bv.style.width="2px";bv.appendChild(bA);bJ.reliableMarginRight=(parseInt(bb.getComputedStyle(bA,null)||{marginRight:0}).marginRight,10)||0==0}if(bv.attachEvent){for(by in {submit:1,change:1,focusin:1})(bB="on"+by;bw=(bB in bv);if(!bw){bv.setAttribute(bB,"return");bw=(typeof bv[bB]==="function")}bJ[by+"Bubbles"]=bw)}bD.removeChild(bv);bD=bG=bx=bA=bv=bE=null;bF(function(){var bM,bU,bV,bT,bN,bO,bL,bS,bR,e,bP,bQ=av.createElement("body")[0];if(!bQ){return}bL=1;bS="position:absolute;top:0;left:0;width:1px;height:1px;margin:0;"%;bR="visibility:hidden;border:0;";e="style='"+bS+"'border:#000;padding:0"';bP=<div "+e"><div></div></div><table "+e+" cellpadding='0' cellspacing='0'><tr><td></td></tr></table>";bM=av.createElement("div");bM.style.cssText=bk+"width:0;height:0;position:px";bQ.insertBefore(bM,bQ.firstChild);bv=av.createElement("div");bM.appendChild(bv);bv.innerHTML="<table><tr><td style='padding:0;border:0;display:none'></td><td></td></tr></table>";bz=bv.getElementsByTagName("td");bw=(bz[0].offsetHeight==0);bz[0].style.display="";bz[1].style.display="none";bJ.reliableHiddenOffsets=bw&&(bz[0].offsetHeight==0);bv.innerHTML="#"bv.style.width=bv.style.paddingLeft="1px";b.boxModel=bJ.boxModel=bv.offsetWidth==2;if(typeof bv.style.zoom!="undefined")bv.style.display="inline";bv.style.zoom=1;bJ.inlineBlockNeedsLayout=(bv.offsetWidth==2);bv.style.display="";bv.innerHTML=<div style='width:4px;'></div>;bJ.shrinkWrapBlocks=(bv.offsetWidth!=2);bv.style.cssText=bS+bR;bv.innerHTML=bP;bU=bv.firstChild;bv=bU.firstChild;bN=bU.nextSibling.firstChild.firstChild;bO={doesNotAddBorder:(bV.offsetTop==5),doesAddBorderForTableAndCells:(bN.offsetTop==5)},bv.style.position="fixed";bV.style.top="20px";bO.fixedPosition=(bV.offsetTop==20||bV.offsetTop==15);bv.style.position=bV.style.top;"bv.style.overflow="hidden";bU.style.position="relative";bO.subtractsBorderForOverflowNotVisible=(bV.offsetTop==5);bO.
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doesNotIncludeMarginInBodyOffset=(bQ.offsetTop!==bL);bQ.removeChild(bM);bv=bM=null;b.extend(bJ,bO});return bJ))();var
{.*})|\[.*\])$/i,aa=/([A-Z])/gi;b.extend({cache:{},uuid:0,expando:"jQuery"+(b.fn.jquery+Math.random()),replace
(/D/g,""),noData:{embed:true,object:"clsid:D27CDB6E-AE6D-11cf-96B8-44453540000",apple:true},hasData:
function(e){e==.nodeType?b.cache[e[b].expandable]:e[b].expandable;return !!e&&!S(e)},data:function(bx,bv,bz,by){if(!
b.acceptData(bx)){return var bG,bA,bD,bE=b.expandable,bC=typeof bv=="string",bF=bx.nodeType,e=bF?
b.cache:bx,bw=bF?bx[bE]:bx[bE]&&e.bE,bB=bv==="events";if((!bw||!e[bw]||(bB&&!bBy&&e[bw].data))&&bC&&bz===
L){return if(!bw){if(bF){bx[bE]->b.uuid}else(bw=bE)}if((!e[bw])if(e[bw]={});if(!bF){e[bw].toJSON-
b.noop};if(typeof bv=="object"||typeof bv=="function"){if(by){e[bw]=b.extend(e[bw],bv)}elsee[bw].data=
b.extend(e[bw].data,bv)}bG=bA=e[bw];if(!by){if(!bA.data){bA.data={}}bA=bA.data}bif(bz!=
L){ba[b.camelCase(bv)]=bZ;if(bB&&!ba[bv])return bG.events;if(bC){bD=ba[bv];if(bD==null){bD=bA[
b.camelCase(bv)}}else{bD=bA}return bD},removeData:function(bx,bv,by){if(!b.acceptData(bx)){return var bb,
ba,bz,bC=b.expandable,e=bD?bx[bC]:bc;if((!e[bw])return if(bv){bB=by?e[bw]:e[bw].
data;if(bB){if(!b.isArray(bv)){if(bv in bB){bv=[bv]}elseb.camelCase(bv);if(bv in bB){bv=[bv]}else{bv=bv.
split(" ")}}for(ba=0,bz=bv.length;bA<bz;bA++)delete bB[bv[ba]];if((!by)?S(b.isEmptyObject)(bB)){return}if
(!by){delete e[bw].data;if((!S(e[bw]))return)if(b.support.deleteExpando||!e.setInterval)delete e[bw]else{
e[bw]=null};if(bD){if(b.support.deleteExpando)delete bx[bC];elseif(bx.removeAttribute){bx.removeAttribute(
bC)}else{bx[bC]=null}}},_data:function(bv,e,bw){return b.data(bv,e,bw,true)},acceptData:function(bv){if(bv.
nodeName){var e=b.noData[bv.nodeName.toLowerCase()];if(e){return !(====true||bv.getAttribute("classid")!==e)}
return true)},b.fn.extend({data:function(by,ba){var bB,e,bw,bz=null;if(typeof by==="undefined")if(this.
length){bz=b.data(this[0]);if(this[0].nodeType==!=1&&b._data(this[0],"parsedAttrs"))e=this[0].attributes;for(
var bx=0,bv=e.length;bx<bv;bx++)bw=e[bx].name;if(bw.indexOf("data-")===0){bw=b.camelCase(bw.substring(5));
a5(this[0],bw,bz[bw])}}b._data(this[0],"parsedAttrs",true)return bz}elseif(typeof by=="object")return
this.each(function(){b.data(this,by)});bB=by.split(".");bB[1]=bB[1]?"."+bB[1]:"";if(bA===
L){bz=this.triggerHandler("getData"+bB[1]+!"!",[bB[0]]);if(bz==!=L&&this.length){bz=
b.data(this[0],by);bz=a5(this[0],by,bz)}return bz==!=L&&bB[1]?this.data(bB[0]):bz}
elsereturn this.each(function(){var bC=b(this),bd=[bB[0],bA];bC.triggerHandler("setData"+bB[1]+!"!",bD);
b.data(this,by,ba);bC.triggerHandler("changeData"+bB[1]+!"!",bD)}),removeData:function(e){return this.
each(function(){b.removeData(this,e)});functiona5(bx,bw,by){if(by==!=L&&bx.nodeType==!=1){var bv="data-"+
bw.replace(aA,"-$1").toLowerCase();by=bx.getAttribute(bv);if(typeof bv=="string"){try(by==true?true:
by==false?false:by==null?null:b.isNumeric(by)?parseFloat(by):aS.test(by)?b.parseJSON(by):by) catch(bz){}
b.data(bx,bw,by);elseif(by==L)return b.function(S(bv){for(var e in bv){if(e==="data"&&
b.isEmptyObject(bv[e]))continueif(e!="toJSON")return false};return true});functionbi(by,bx,bA){var bw=bx
+"defer",bx=bx+"queue",e=bx+"mark",bz=b._data(by,bw);if(bz&&(bA==="queue"||!b._data(by,bv))&&(bA==="mark"||!
b._data(by,e)))setTimeOut(function(){if(!b._data(by,bv)&&!b._data(by,e)){b.removeData(by,bw,true);bz.fire(
)}},0)}elseif(bD==!=string){bz=bD;bD=L;bD=bx+"fx";var e=b.Deferred(),bv=this,by=bv.length,bB=1,bz=bD+"defer"
,bA=bD+"queue",bC=bD+"mark",bx;functionbE(){if((!(-bB)){e.resolveWith(bv,[bv]))}while(by--){if(bx=
b.data(bv[by],bz,L,true))||if(b.data(bv[by],bA,L,true))||b.data(bv[by],bC,L,true))&&
b.data(bv[by],bz,b.callbacks("once memory"),true));bB++;bx.add(bE)}bE();return e.promise();});var aP=/
\n|\t|r)/g,aU=/\r/g,g=/^(?:button|input)|$|i,D=/^(?:button|input|object|select|textarea)$|i,l/^a(?:rea
)?$/i,ao=/^(?: autofocus|autoplay|async|checked|controls|defer|disabled|hidden|loop|multiple|open|readonly|
required|scoped|selected)$|i,F=b.support.getSetAttribute,be,aY,aF;b.fn.extend({attr:function(e,bv){return b.ac
cess(this,e,bv,true,b.attr)},removeAttr:function(e){return this.each(function(){b.removeAttr(this,e)}),prop
:function(e,bv){return b.access(this,e,bv,true,b.prop)},removeProp:function(e){e=
b.propFix[e]||e;return this.each(function(){try(this[e]=L;delete this[e])catch(bv{})});addClass:function
(by){var bA,bw,bv,bx,bz,bE,e;if(bisFunction(by)){return this.each(function(bC){b(this).addClass(by.call(this,
bC,this.className))});if(by&&typeof by=="string"){bA=by.split(af);for(bw=0,bv=this.length;bw<bv;bw++)bx=
this[bw];if(bx.nodeType==!=1){if(!bx.className&&ba.length==!=1){bx.className=bz;}else{bz=" "+bx.className+
";"for(bB=0,e=bA.length;bB<e;bB++){if(~bz.indexOf(" "+ba[Bb]+")){bz+=ba[Bb]+"}");bx.className=
b.trim(bz)}return this};removeClass:function(bz){var bA,bw,bv,by,bx,bz;if(bisFunction(bz)){return
this.each(function(bC){b(this).removeClass(bz.call(this,bc,this.className))});if((bz&&typeof bz==="string")||bz
==!=L){ba=(bz||"").split(af);for(bw=0,bv=bz.length;bw<bv;bw++)by=this[bw];if(by.nodeType==!=1&&by.className
){if(bz){bx=( " "+by.className+" ").replace(aP," ");for(bB=0,e=bA.length;bB<e;bB++){bx=bx.replace(" "+ba[Bb]+
" ", "")};by.className=b.trim(bx);else{by.className=""}}}return this};toggleClass:function(bx,bv){var bw=
typeof bx,e=typeof bv=="boolean";if(bisFunction(bx)){return this.each(function(){if(bv==="string"){
var bA,bz=0,by=b(this),bw=bv,bC=bx.split(af);while((ba=B[bz++]))ba=e?bB:by.hasClass(bA);by[bB?"+addClass":-
removeClass"](ba)elseif(bw==="undefined"||bw=="boolean")if(this.className){
b._data(this,"__className__",this.className)}this.className=b.className||bx==="false"?":
b._data(this,"__className__")+"");},hasClass:function(e){var bx=" "+e+" ",bw=0,bv=this.length;for(;bw<bv
;bw++)if(this[bw].nodeType==!=1&&(" "+this[bw].className+" ").replace(aP," ").indexOf(bx)>-1){return true}
return false};val:function(bx){var e=bx.value,bv=this[0];if(!arguments.length){if(bw){e=
b.valHooks[bw.nodeName.toLowerCase()]]||b.valHooks[bw.type];if(e&&"get" in e&&(bv=e.get(bw,"value"))!=
L){return bv}bv=bw.value;return typeof bv=="string"?bv.replace(aU,""):if(bv==null?"":bv)}return bv;
bisFunction(bx);return this.each(function(bA){var bz=b(this),bB;if((this.nodeType==!=1){return if(by){bB=bx.
call(this,bA,bz.val())}else{bB=bz}if(bB==null){bz=""}elseif(typeof bz=="number")ba=bzelseif(
b.isArray(bB)){bB=b.map(bB,function(bC){return bC==null?"":bC+""});elseb=B.valHooks[b(this.nodeName.toLowerCase()
)]||b.valHooks[this.type];if(!e||!"set" in e){if(e){e.set(this,bB,"value")==!=L){this.value=bB}}});else
b.extend({valHooks:{option:{get:function(e){var bv=e.attributes.value;return !bv||bv.specified?value:e.
text}},select:{get:function(e){var bA,bv,bz,bx,by=e.selectedIndex,bB=[],bC=e.options,bw=e.type=="select-one";
if(by<0){return null};bv=bw?by:0,bz=bw?by+1:bx.length;for(;bv<bx;bv++)bx=bC[bv];if(bx.selected&&
b.support.optDisabled){!bx.disabled;b.x.getAttribute("disabled")==!=null)}&&(!bx.parentNode.disabled||!
b.nodeName(bx.parentNode,"optgroup"))}{bA=b(bx).val();if(bx){return bA.b.push(bA)}if(bw&&bB.length&&bC.
length){return b(bC[bv]).val()}elseb.set:function(bv,bw){var e=b.makeArray(bw);
b(bv).find("option").each(function(){if(this.selected=b.inArray(b(this).val(),e)>=0);if(!e.length){bv.

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## Reference

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selectedIndex=-1{return e}}},attrFn:{val:true,css:true,html:true,text:true,data:true,width:true,height:true,offset: true},attr:function(bA,bx,bB,bz){var bw,e,by,bv=bA.nodeType;if(!bA||bx==3||bx==8||bx==2){return}if(bz&&bx in b.attrFn){return b(bA)[bx](bB)}if(typeof bA.getAttribute=="undefined"){return b.prop(bA,bx,bz)}by=bv==1||!b.isXMLDoc(bA);if(by){bx=bx.toLowerCase();e=b.attrHooks[bx]||(ao.test(bx)?aY:be)}if(bB==null){b.removeAttribute(bA,bx);return}else{if(e&&"set" in e&&by&&(bw=e.set(bA,bB,bx))!=!L){return bw}else{bA.setAttribute(bx,""+bB);return bB}}else{if(e&&"get" in e&&by&&(bw=e.get(bA,bx))!=!null){return bw}else{bw=bA.getAttribute(bx);return bw==null?L:bw}},removeAttr:function(bx,bz){var by,bA,bv,be,bw=0;if(bz&&bx.nodeType==1){bA=bx.toLowerCase().split(af);e=bA.length;for(;bw<e;bw++){bv=bA[bw];if(by){bv=b.propFix[bv]||bx;b.attr(bx,bv,"");bx.removeAttribute(F?bv:by);if(ao.test(bv)&&by in bx){bx[bv]=false}}}},attrHooks:{type:{set:function(e,bv){if(g.test(e.nodeName)&&e.parentNode){b.error("type property can't be changed")}}else{if(!b.support.radioValue&&bv=="radio"&&b.nodeName(e,"input")){var bw=e.value;e.setAttribute("type",bv);if(bw){e.value=bw}return bv}}},value:{get: function(bv,e){if(be&&b.nodeName(bv,"button")){return be.get(bv,e)}}return e in bv?bv.value:null},set: function(bv,bw,e){if(be&&b.nodeName(bv,"button")){return be.set(bv,bw,e)}}bv.value=bw},propFix:{tabIndex:"tabIndex",readonly:"readOnly",for:"htmlFor",class:"className",maxLength:"maxLength",cellspacing:"cellSpacing",cellpadding:"cellPadding",rowspan:"rowSpan",colspan:"colSpan",usemap:"useMap",frameborder:"frameBorder",contenteditable:"contentEditable"},prop:function(bz,bx,bA){var bw,e,by,bv=bz.nodeType;if(bA!=L){if(e&&"set" in e&&(bw=e.set(bz,bA,bx))!=!L){return bw}else{return(bz[bx]=bA)}}else{if(e&&"get" in e&&(bw=e.get(bz,bx))!=!null){return bw}else{return(bz[bx])}}},propHooks:{tabIndex:{get:function(bv){var e=bv.getAttributeNode("tabindex");return e.e&&e.specified?parseInt(e.value,10):D.test(bv.nodeName)||L.test(bv.nodeName)&&bv.href?0:L}}},b.attrHooks.tabIndex=b.propHooks.tabIndex;aY={get:function(bv,e){var bx,bw=b.prop(bv,e);return bw==true||typeof bw=="boolean"&&(bx=bv.getAttributeNode(e))&&bx.nodeValue!=false?e.toLowerCase():L},set:function(bv,bx,e){var bw;if(bx==false){b.removeAttribute(e.toLowerCase());return e}}},if(!F){aF={name:true,id:true};be=b.valHooks.button={get:function(bw,bv){var e;e=bw.getAttributeNode(bv);return e&&(aF[bv]?e.nodeValue=="":e.specified)?e.nodeValue:L},set:function(bw,bx,bv){var e=bw.getAttributeNode(bv);if(!e){e=av.createAttribute(bv);bw.setAttributeNode(e)}return(e.nodeValue=bx+"")}},b.attrHooks.tabIndex.set=be.set; b.each(["width","height"],function(bv,e){b.attrHooks[e]=b.extend(b.attrHooks[e],{set:function(bw,bx){if(bx==""){bw.setAttribute(e,"auto");return bx}}});b.attrHooks.contenteditable={get:be.get,set:function(bv,bw,e){if(bw==""){bw=false}be.set(bv,bw,e)}}},if(!b.support.hrefNormalized){b.each(["href","src","width","height"],function(bv,e){b.attrHooks[e]=b.extend(b.attrHooks[e],{get:function(bx){var bw=bx.getAttribute(e,2);return bw==null?L:bw}})}),if(!b.support.style){b.attrHooks.style={get:function(e){return e.style.cssText.toLowerCase()||L},set:function(e,bv){return(e.style.cssText)+"+bv}}},if(!b.support.optSelected){b.propHooks.selected=b.extend(b.propHooks.selected,{get:function(bv){var e=bv.parentNode;if(e){e.selectedIndex;if(e.parentNode){e.parentNode.selectedIndex}return null}}})},if(!b.support.enctype){b.propFix.enctype="encoding"},if(!b.support.checkOn){b.each(["radio","checkbox"],function(){b.valHooks[this]={get:function(e){return e.getAttribute("value")==null?"on":e.value}}}),b.each(["radio","checkbox"],function(){b.valHooks[this]=b.extend(b.valHooks[this],{set:function(e,bv){if(b.isArray(bv)){return(e.checked=b.inArray(b(e).val(),bv)>0)}}}),var bd=/^(?:textareainput|select)$|i,n=/^(?:\.\.)*?(?:\.\.)*$|J=/bhover(\.\.)*$?|a=/?key|bf=/^:(?:mousecontextmenu)|click|T=/^:(?:focusin|focusout|blur)$|U=/^:(?:w*)|(?:#(?:\[\w\]-+))|(?:\.(?:\[\w\]-+))|?$/|Y=function(e){var bv=U.exec(e);if(bv){bv[1]=(bv[1]||"").toLowerCase();bv[3]=bv[3]&&\new RegExp("(?:^|\s)"+bv[3]+"(?:\s|$)")return bv},j=function(bw,e){var bv=bw.attributes||{};return((!e[1]||bw.nodeName.toLowerCase()==e[1])&&(!e[2]||bv.id||{}).value==e[2])&&(!e[3]||e[3].test((bv["class"]||{}).value))),bt=function(e){return b.event.special.hover?e:e.replace(J,"mouseenter$1 mouseleave$1")};b.event={add:function(bx,bC,bJ,bA,by){var bD,bB,bK,bI,bH,e,bG,bv,bz,bw,bE;if(bx.nodeType==3||bx.nodeType==8||!bC||!bJ||(bd=b._data(bx))) {return}if(bJ.handler){bv=bJ;bJ=bv.handler}if(!bJ.guid){bJ.guid++;bK=bD.events;if(!bK){bD.events=bK=1}bB=bD.handle;if(!bB){bD.handle=bB=function(bL){return typeof b!="undefined"&&(bL||b.event.triggered==bL.type)?b.event.dispatch.apply(bB.elem,arguments):L};bB.elem=bx;bC=b.trim(bt(bC)).split(" ");for(bl=0;bl<bC.length;bl++){bH=n.exec(bC[bl])||[];bF=bH[1];e=(bH[2]||"").split(".").sort();bE=b.event.special[bF]||{};bF=(by?bE.delegateType:bE.bindType)||bF;bE=b.event.special[bF]||{};bG=b.extend({type:bf,origType:bH[1],data:bA,handler:bJ,guid:bJ.guid,selector:by,quick:Y(bY,namespace:e.join(".")),bv},bw=bK[bF];if(!bw){bw=bK[bF]=[]};bw.delegateCount=0;if(!bE.setup){call(bx,bA,e,bB)==false}{if(bx.addEventListener){bx.addEventListener(bF,bB,false)}else{if(bx.attachEvent){bx.attachEvent("on"+bF,bB)}}}if(bE.add){bE.add.call(bx,bG);if(!bG.handler.guid){bG.handler.guid=bJ.guid}}if(by){bw.splice(bw.delegateCount++,0,bG)}else{bw.push(bG)}b.event.global[bF]=true;bx=null},global:{}},remove:function(bJ,bE,bv,bz,bw,bB){var bI=b.hasData(bJ)&&b._data(bJ,bF,bx,bz,bL,bC,bA,bG,bw,by,bK,bD,e;if(!bI||(bw=bI.events)){return}bE=b.trim(bt(bE||"")).split(" ");for(bF=0;bF<bE.length;bF++){bx=n.exec(bE[bF])||[];bz=bL=bx[1];bC=bx[2];if(!bz){for(bz in bw){b.event.remove(bJ,bz+bE[bF],bv,bH,true)}}continue}by=b.event.special[bz]||{};bz=(bH?bH.delegateType:by.bindType)||bz;bd=bw[bz]||[];ba=bD.length;bC=bC?new RegExp("(^|\.\.)*"+bC.split(".").sort().join("\.\.(?:\.*\.\.)?")+"(\.\.|\$)"):null;for(bG=0;bG<bD.length;bG++){e=bD[bG];if((bB||bl)==e.origType){(!bv||bv.guid==e.guid)&&(!bC||bC.test(e.namespace))&&(!bH||bH==e.selector||bH=="**"&&e.selector)){bD.splice(bG--,1);if(e.selector){bD.delegateCount--}if(by.remove){by.remove.call(bJ,e)}}}if(bd.length==0&&ba==bd.length){if(!by.teardown){by.teardown.call(bJ,bC)==false}{b.removeEvent(bJ,bz,bI.handle){delete bw[bz]}if(b.isEmptyObject(bw)){bK=b.I.handle;if(bK){bK.elem=null}}b.removeData(bJ,[{"events":"handle"},true]),customEvent:{getData:true,setData:true,changeData:true},trigger :function(bv,bD,bA,bJ){if(bA&&(bA.nodeType==3||bA.nodeType==8)){return}var bG=bv.type||bv,bx=[],e,bw,bC,bH,bz,by,bF,bE,bB,bI;if(T.test(bG+b.event.triggered)){return}if(bG.indexOf('!"')>0){bG=bG.slice(0,-1);bw=true}if(bG.indexOf('."')>0){bx=bG.split(".");bG=bx.shift();bx.sort()}if(!bA){b.event.customEvent[bG]}}&& b.event.global[BG]{return}bv.type==="object"?bv:[b.expand(bv):new b.Event(bG,bv):new b.Event(bG,bv):new b.Event(bG);bv.type=bG;bv.isTrigger=true;bv.exclusive=bw;bv.namespace=bx.join(".");bv.namespace_re=bv.namespace?new RegExp("(^|\.\.)*"+bx.join("\.\.(?:\.*\.\.)?")+"(\.\.|\$)"):null;by=bG.indexOf('!"')<0?"on"+bG:"";if(!bA){e=b.cache;for(bC in e){if(e[bC].events&&e[bC].events[bG]){b.event.trigger(bv,bD,e[bC].handle.elem,true)}}return}bv.result=L;if(!bv.target){bv.target=Ba}bd=bD=null?b.makeArray(bD):[];bd.unshift(bv);bF=b.event.special[bG]||{};if(bF.trigger&&bF.trigger.apply(bA,bD)==false){return}bB=[bA,bF.bindType||bG]];if(!bJ&&!bF.noBubble&&!b.isWindow(bA)){bI=bF.delegateType||bG;bH=T.test(bI+bG)?bA:bA.parentNode;bz=null;for(bH;bH=bH.parentNode){bB.push([bH.defaultView||bz]);parentWindow||bH,bI])}for(bC=0;bC<bD.length&&!bv.isPropagationStopped();bC++){bH=bB[bC][0];bv.type=bz=bC[1];bE=(b._data(bH,"events")||{})[bv.type]&&b._data(bH,"handle");if(bE){bE.apply(bH,bD);bE=bE&&bH[b];if(bE&&b.acceptData(bH)&&B.apply(bH,bD)==false){bv.preventDefault()}bv.type=bG;if(!bJ&&bv.isDefaultPrevented()){if(!bF._default){b.default.apply(bA.ownerDocument,bD)==false}}&&(!bG==="click")&& b.nodeName(bA,"a"))&&b.acceptData(bA){if(by&&bA[BG]&&(bG==="focus"||bG==="blur"))||bv.target.offsetWidth!=0}&& !b.isWindow(bA){bz=bA[b];if(bz){bA[b]=null}b.event.triggered=bG;bA[bG]();b.event.triggered=L;if(bz){bA[b]=bz}}},return bv.result,dispatch:function(e){e=b.event.fix(e||bb.event);var bz=(b._data(this,"events")||{})[e.type]||[],bA=bz.delegateCount,bG=[];slice.call(arguments,0),by!=e.exclusive&&e.namespace,bH=[,bC,bB,bK,bx,bF,bv,bD,bI,bw,bJ,bG[0]=e;e.delegateTarget=this;if(bA&&e.target.disabled&&(e.button&&e.type=="click")){bx=b(this);bx.context=this.ownerDocument
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|this;for(bK=e.target;bK!=this;bK=bK.parentNode||this){bE={};bD=[];bx[0]=bK;for(bC=0;bC<bA;bC++){bI=bx[bC];bw=bI.selector;if(bE[bw]===L){bE[bw]=(bI.quick?j(bk,bI.quick):bx.is(bw))}if(bE[bw]){\bB.push(bI)}}if(bD.length){bH.push({elem:bK,matches:bD})}}if(bz.length>bA){bH.push({elem:this,matches:bx.slice(bA)})}for(bC=0;bC<bH.length&&!e.isPropagationStopped();bC++){bV=bH[bC];e.currentTarget=bv.elem;for(bB=0;bB<bV.matches.length&&!e.isImmediatePropagationStopped();bB++){bI=bV.matches[bB];if(by||(!e.namespace&&!bI.namespace)||e.namespace_re&&e.namespace_re.test(bI.namespace)){e.data=bI.data;e.handleObj=bI;bF=((b.event.special[bI.origType]||{}).handle||bI.handler).apply(bv.elem,bG);if(bF==L){e.result=bF;if(bF==false){e.preventDefault();}e.stopPropagation();}}}return e.result},props:"attrChange attrName relatedNode srcElement altKey bubbles cancelable ctrlKey currentTarget eventPhase metaKey relatedTarget shiftKey target timeStamp view which".split(" "),fixHooks:{},keyHooks:{props:"char charCode key keyCode".split(" "),filter:function(bv,e){if(bv.which==null){bv.which=e.charCodeAt!=null?e.charCodeAt:e.keyCode}return bv}},mouseHooks:{props:"button buttons clientX clientY fromElement offsetX offsetY pageX pageY screenX screenY toElement".split(" "),filter:function(bx,bw){var by,bz,e,bv=bw.button,bA=bw.fromElement;if(bx.pageX==null&&bw.clientX!=null){by=bx.target.ownerDocument||av;bz=by.documentElement;e=by.body;bx.pageX=bw.clientX+(bz&&bz.scrollLeft||e&&e.scrollLeft||0)-(bz&&bz.clientXLeft||e&&e.clientXLeft||0);bx.pageY=bw.clientY+(bZ&&bZ.scrollTop||e&&e.scrollTopTop||0)-(bZ&&bZ.clientHeightTop||e&&e.clientHeightTop||0)}if(!bx.relatedTarget&&bA){bx.relatedTarget=bA==bx.target?bw.toElement:bA}if(!bx.which&&bV==L){bx.which=(bv&1?1:(bv&2?3:(bv&4?2:0)))return bx},fix:function(bw){if(bw[b.expand])return bw}var bv,bz,e=bw,bx=b.event.fixHooks[bw.type]||{},by=bx.props.concat(bx.props):this.props;bw=b.Event(e);for(bv=by.length;bv){bz=by[-bv];bw[bz]=e[bz]if(!bw.target){bw.target=e.srcElement||av}if(bw.target.nodeType==3){bw.target=bw.target.parentNode}if(bw.metaKey==L){bw.metaKey=bw.ctrlKey}return bx.filter?bx.filter(bw,e):bw},special:{ready:{setup:b.bindReady},load:{noBubble:true},focus:{delegateType:"focusin"},blur:{delegateType:"focusout"},beforeunload:{setup:function(bw,bv,e){if(bv.isWindow(this)){this.onerror=onbeforeunload=e},teardown:function(bv,e){if(this.onerror!=e){this.onerror=null}}},simulate:function(by,bx,bv){var bz=b.extend(new b.Event(),bx,{type:bw,isSimulated:true,originalEvent:{}}),if(bv){b.event.trigger(bz,null,bv)}else{b.event.dispatch.call(by,bz)}if(bz.isDefaultPrevented()){bx.preventDefault()}},b.event.handle=b.event.dispatch;b.removeEvent=av.removeEventListener?function(bv,e,bw){if(bv.removeEventListener){bv.removeEventListener(e,bw,false)}}:function(bv,e,bw){if(bv.detachEvent){bv.detachEvent("on"+e,bw)}};b.Event=function(bv,e){if(!(this instanceof b.Event)){return new b.Event(bv,e)}if(bv&&bv.type){this.originalEvent=bv;this.type=bv.type;this.isDefaultPrevented=(bv.defaultPrevented||bv.returnValue==false)||bv.getPreventDefault&&bv.getPreventDefault()?bk:else{this.type=bv;if(e){b.extend(this,e)}this.timeStamp=bv&&bv.timeStamp||b.now();this[b.expand]=true};function bk(){return false}function i(){return true}b.Event.prototype={preventDefault:function(){this.isDefaultPrevented=i;var bv=this.originalEvent;if(!bv){return}if(bv.preventDefault){bv.preventDefault()}else{bv.returnValue=false}},stopPropagation:function(){this.stopPropagation=i;var bv=this.originalEvent;if(!bv){return}if(bv.stopPropagation){bv.stopPropagation()}else{bv.cancelBubble=true},stopImmediatePropagation:function(){this.isImmediatePropagationStopped=i;this.stopPropagation();isDefaultPrevented=bk,isPropagationStopped=bk,isImmediatePropagationStopped=bk},b.each({mouseenter:"mouseover",mouseleave:"mouseout"},function(bv,e){b.event.special[bv]={delegateType:e,bindType:e,handle:function(bz){var bB=this,bA=bz.relatedTarget,by=bz.handleObj,bw=bz.selector,bx;if(!bA||!(bA==bB&&!b.contains(bB,bA))){bz.type=by.origType;bx=by.handler.apply(this,arguments);bz.type=e}return bx}});if(!b.support.submitBubbles){b.event.special.submit={setup:function(){if(b.nodeName(this,"form")){return false}}};b.event.add(this,"click._submit keypress._submit",function(bx){var bw=bx.target,bv=bw.nodeName,"input")||b.nodeName(bw,"button")?bw.form:L;if(bv&&!bv._submit_attached){b.event.add(bv,"submit._submit",function(e){if(this.parentNode&&!e.isTrigger){b.event.simulate("submit",this.parentNode,e,true)}},bv._submit_attached=true)}},teardown:function(){if(b.nodeName(this,"form")){return false}b.event.remove(this,"_submit")});if(!b.support.changeBubbles){b.event.special.change={setup:function(){if(bd.test(this.nodeName)){if(this.type=="checkbox"||this.type=="radio"){b.event.add(this,"propertychange._change",function(e){if(e.originalEvent.propertyName=="checked"){this._just_changed=true}});b.event.add(this,"click._change",function(e){if(this._just_changed&&!e.isTrigger){this._just_changed=false};b.event.simulate("change",this,e,true)}))}return false}b.event.add(this,"beforeactivate._change",function(bw){var bv=bw.target;if(bd.test(bv.nodeName)&&!bv._change_attached){b.event.add(bv,"change._change",function(e){if(this.parentNode&&e.isSimulated&&!e.isTrigger){b.event.simulate("change",this.parentNode,e,true)}});bv._change_attached=true}}),handle:function(bv){var e=bv.target;if(this!==e||bv.isSimulated||bv.isTrigger||(e.type=="radio"&&e.type=="checkbox")){return bv.handleObj.handler.apply(this,arguments)}},teardown:function(){b.event.remove(this,"_change");return bd.test(this.nodeName)});if(!b.support.focusinBubbles){b.each({focus:"focusin",blur:"focusout"},function(bx,e){var bv=0,bw=function(by){b.event.simulate(e,by.target,b.event.fix(by),true)},b.event.special[e]={setup:function(){if(bv++==0){av.addEventListener(bx,bw,true)}},teardown:function(){if(--bv==0){av.removeEventListener(bx,bw,true)}}});b.fn.extend({on:function(bw,e,bz,by,bv){var bA,bx;if(typeof bw=="object"){if(typeof e=="string"){bZ=e;e=L}for(bx in bw){this.on(bx,e,bz,bw[bx],bv)}return this}if(bz==null&&by==null){by=e;bZ==L}else{if(by==null){if(typeof e=="string"){by=bZ;bZ=L}else{by=bZ;bZ=e;e=L}}if(by==false){by=bk}else{if(iby){return this}}if(bv==L){ba=by;by=function(bB){b.B.off(bB);return bA.apply(this,arguments)};by.guid=bA.guid||(bA.guid+=1)}return this.each(function(){b.event.add(this,bw,by,bz,e)}),one:function(bv,e,bx,bw){return this.on.call(this,bv,e,bx,bw,1)},off:function(bw,e,by){if(bw&&bw.preventDefault&&bw.handleObj){var bv=bw.handleObj;b(bw.delegateTarget).off(bv.namespace?bv.type+"."+bv.namespace:bv.type,bv.selector,bv.handler);return this}if(typeof bw=="object"){for(var bx in bw){this.off(bx,e,bw[bx])}return this}if(e==false||typeof e=="function"){by=e;e=L}if(by==bk){return this.each(function(){b.event.remove(this,bw,by,e)}),bind:function(e,bw,bv){return this.on(e,null,bw,bv)},unbind:function(e,bv){return this.off(e,null,bv)},live:function(e,bw,bv){b(this.context).on(e,this.selector,bw,bv);return this},die:function(e,bv){b(this.context).off(e,this.selector)||"**",bv);return this},delegate:function(e,bv,bx,bw){return this.on(bv,e,bx,bw)},undelegate:function(e,bv,bw){return arguments.length==1?this.off(e,"**"):this.off(bv,e,bw)},trigger:triggerFunction(e,bv){return this}},each(function(){b.event.trigger(e,bv,this)}),triggerHandler:triggerHandlerFunction(e,bv){if(this[0]){return b.event.trigger(e,bv,this[0],true)}},toggle:toggleFunction(bx){var bv=arguments,e=bx.guid||b.guid++,bw=0,by=function(bz){var bA=b._data(this,"lastToggle"+bx.guid)||0%bw;b._data(this,"lastToggle"+bx.guid,bA+1);bz.preventDefault();return bv[bA].apply(this,arguments)||false};by.guid=e;while(bw<bv.length){bv[bw++].guid=e}return this.click(by)},hover:hoverFunction(e,bv){return this.mouseenter(e).mouseleave(bv||e)}},b.each({"blur focus focusout load resize scroll unload click dblclick mouseover mousemove mouseout mouseleave change select submit keydown keypress keyup error contextmenu":split(" "),function(bv,e){b.fn[e]=function(bw,bv){if(bw==null){bw=bx;bX=null}return arguments.length>0?this.on(e,null,bw,bv):this.trigger(e);if(b.attrFn){b.attrFn[e]=true}if(a0.test(e)){b.event.fixHooks[e]=b.event.keyHooks}if(bf.test(e)){b.event.fixHooks[e]=b.event.mouseHooks}}},(function(){var bH=/((?:\((?:\((?:\[(^()\]+)\)|[^()]+)\)+\))|\[(?:\[[^\[\]]*\]\]|[""]*[""]*[^\[\]]+\]|\\.|[^>+,(\[\]\]+)|[>+~])(\s*,\s*)?((?:\..|\r|\n)*)/g,bC="sizcache"+(Math.random()+"").replace(".","");
bI=0,bL=Object.prototype.toString,bB=false,bA=true,bK=/\//g,bO=0});var by=function(bV,e,bY,bZ){bY=bY||[];e=e||av;var bL=e.nodeType==1&&e.nodeType==9?return[]:if(!bV||typeof bV=="string"){return bY}var bS,b3,b6,bR,b2,b5,b4,bX,bU=true,bT=bX.isXML(e),bW=[],b0=bV;do{bH.exec("")};

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bS=bH.exec(b0);if(bS){b0=bS[3];bW.push(bS[1]);if(bS[2]) {bR=bS[3];break}};while(bS);if(bW.length>1&&bD.exec(bV)) {(if(bW.length==2&&e.relative[bW[0]]){b3=bM(bW[0]+bW[1],e,bZ)}else{b3=bE.relative[bW[0]]?e:by(bW.shift(),e);while(bW.length){bV=bW.shift();if(bE.relative[bV]) {bW+=bV.shift();b3=bM(bV,b3,bZ)}}}else{if(!bZ&&bW.length>1&&e.nodeType==9&&bt&&bE.match.ID.test(bW[0])&&!bE.match.ID.test(bW[bW.length-1])}{b2=by.find(bW.shift(),e,bT);e=b2.expr?by.filter(b2.expr,b2.set[0]):b2.set[0] if(e){b2=bZ?{expr:bW.pop(),set:bF(bZ)}:by.find(bW.pop()),bW.length==1&&(bW[0]==="#"||bW[0]=="+")&&e.parentNode?e.parentNode:e,bT};b3=b2.expr?by.filter(b2.expr,b2.set):b2.set;if(bW.length>0){b6=bF(b3)}else{bU=false};while(bW.length){b5=bW.pop();b4=b5;if(!bE.relative[b5]) {b5=""}else{b4=bW.pop()}if(b4==null){b4=e}bE.relative[b5](b6,b4,bT)}else{b6=bW[]}if(!b6){b6=b3}if(!b6){by.error("Array")}}if(!bU){bY.push.apply(bY,b6)}else{if(e&&e.nodeType==1){for(bX=0;b6[bX]!=null;bX++){if(b6[bX]&&(b6[bX]==true||b6[bX].nodeType==1&&by.contains(e,b6[bX]))){bY.push(b3[bX])}}}else{for(bX=0;b6[bX]!=null;bX++){if(b6[bX]&&b6[bX].nodeType==1){bY.push(b3[bX])}}}}else{bf(b6,bY)}if(br,bY);by.uniqueSort=function(br){if(bJ){(bB=bA;br.sort(br));if(bB){for(var e=1;e<bR.length;e++){if(br[e]==bR[e-1]){bR.splice(e,1)}}}}br.matches=function(e,br){return by(e,null,null,br)};by.matchesSelector=function(e,br){return by(br,null,null,[e]).length>0};by.find=function(bX,e,bY){var bW,bs,bu,bT,bV,bR;if(!bX){return[]}}for(bS=0,bU=bE.order.length;bS<bu;bS++){bV=bE.order[bS];if((bT=bE.leftMatch[bV]).exec(bT[1])=(bT[1]||"").replace(bK,""));bW=bE.find[bV](bT,e,bY);if(bW!=null){(bX=bX.replace(bE.match[bV],""));break}}}}if(!bW){bW=typ.e.getElementsByTagName!="undefined"?e.getElementsByTagName("*"):[]};return{set:bW,expr:bX}};by.filter=function(b1,b0,bW,e,bZ,b6,b3,bR,bV,b2,bS,b1,b5=[],bY=b0,bX=b0&&b0[0]&&bY.isXML(b0[0]);while(b1&&b0.length){for(bZ in bE.filter){if((bW=bE.leftMatch[bZ]).exec(b1))!=null&&bW[2]) {bR=bE.filter[bZ];bT=bW[1];e=false;bW.splice(1,1);if(bT.substring(0,1)){continue}}if(bY==b5){b5=[]}if(bE.preFilter[bZ]{bW=bE.preFilter[bZ](bW,bY,b4,b5,bU,bX);if(!bW){e=b6=true}else{if(bW==true){continue}}}}if(bW){for(bV=0;(b3=bY[bV])!=null;bV++){if(b3){b6=bR(b3,bW,bV,bY);b2=bU^b6;if(b4&&b6!=null){if(b2){e=true}else{bY[bV]=false}}}}else{if(b2){b5.push(b3);e=true}}}}if(b6==L){if(!b4){bY=b5}b1=b1.replace(bE.match[bZ],"");if(!e){return[]}}break}}}}if(Error){"Syntax error, unrecognized expression: "+e)};var bw=by.getText=function(bU){var bS,bT,e=bU.nodeType,bR="";if(e){if(e==1||e==9){if(typeof bU.textContent=="string"){return bU.textContent}else{if(typeof bU.innerText=="string"){return bU.innerText}}}}else{for(bU=bU.firstChild;bU;bU=bU.nextSibling){bR+=bw(bU)}}}else{if(e==3||e==4){return bU.nodeValue}}}}else{for(bS=0;(bT=bU[bS]);bS++){if(bT.nodeType!=8){bR+=bw(bT)}}}return bR};var bE=by.selectors={order:0},CLASS:/\.\.((?:[\w\u00c0-\uFFFF\-\]|\.))+/,NAME:/\[name='((?:[\w\u00c0-\uFFFF\-\]|\.))+)\'|\"]*,ATTR:/\[s*((?:[\w\u00c0-\uFFFF\-\]|\.))+\]/,TAG:/^((?:[\w\u00c0-\uFFFF\-\]|\.))+)/,CHILD:/\:(only|nth|last|first)-child?:\((?:\s*(even|odd|?:[+-]?d+|?:[+-]?d+)?n\|(?:(?:[+-]\s*)\$*\|d+)?))/,PSEUDO:/\:(?:[\w\u00c0-\uFFFF\-\]|\.))+\:(?:\((?:[^"]?)((?:\[(^\])+\]|^\(\)))+)\)\2\)\}/,leftMatch:{},attrMap:{"class":"className","for":"htmlFor"},attrHandle:{href:function(e){return e.getAttribute("href")}},type:function(e){return e.getAttribute("type")}},relative:{"+":function(bW,bR){var bT=typeof bR=="string",bV=bT&&!bQ.test(bR),bX=bT&&!bV;if(bV){(bR=bR.toLowerCase())}for(var bS=0,e=bW.length,bU;bS<e;bS++){if((bU=bW[bS])){while((bU=bU.previousSibling)&&U.nodeType==1){bW[bS]=bX||bU&&bU.nodeName.toLowerCase()===bR?bU||false:bU==bR}}if(bX){(by,f,bS=0,e=bW.length;if(bU&&!bQ.test(bR)){(bR=bR.toLowerCase());for(;bS<e;bS++){(bV=bW[bS]);if(bV){(var bT=bV.parentNode;bW[bS]=bT.nodeName.toLowercase())}}}else{for(;bS<e;bS++){(bV=bW[bS]);if(bV){(bR=bT:false)}}}else{for(;bS<e;bS++){(bV=bW[bS]);if(bV){(bW[bS]=bU?bV.parentNode:bV.parentNode==bR)?if(bU){(by,&&!bQ.test(bR)){(bR=bR.toLowerCase());bU=bR;e=bV}e("parentNode",bR,bS,bT,bU,bV),"\~":function(bT,bR,bV){(var bU,bS=bI++,e=bN;if(typeof br=="string"&&!bQ.test(br)){(bR=bR.toLowerCase());bU=bR;e=bV}e("previousSibling",bR,bS,bT,bU)},find:{ID:function(bR,bS,bT){if(typeof bs.getelementByIdId=="undefined"&&!bT){(var e=bS.getElementById(bR[1]);return e&&e.parentNode:[e:[],NAME:function(bS,bV){if(typeof bV.getelementsByName!="undefined",bR=[],bU=bV.getelementsByName(bS[1]);for(var bT=0,e=bU.length;bT<e;bT++){if(bU[bT].getAttribute("name")=="bS[1]"){(bR.push(bU[bT]))}return bR.length==0?null:bR}},TAG:function(e,bR){if(typeof br.getelementsByTagName!="undefined"){(return br.getelementsByTagName(e[1]))}},preFilter:{CLASS:function(bT,bR,bS,e,bW,bX){bT=" "+bT[1].replace(bK,"")+"";if(bX){(return true)}bT for(var bU=0,bV=bU.length;bU<bV;bU++){(bV[bU]==bR[bU])!=null;bU++)}}if(bV){(if(bW^bV.className&&"+"+bV.className+"").replace(/\t\|n\|r/g," ")}.indexof(bT)>0){(if(!bS){e.push(bV)})}else{(if(bS){bR[bU]=false})}}return false}},ID:function(e){return e[1].replace(bK,toLowerCase()),CHILD:function(e){if(e[1]==="nth"){(if(!e[2])?(by.error(e[0])):e[2]==e[2].replace(/\+|\s*/g," ")};var bR=(-?)(\d*)(?:n\|+\-?\d*))?/.exec(e[2]==="even"?"2n":e[2]==="odd"?"2n+1":!/\D/.test(e[2])&"On+"+e[2]||e[2];e[2]=(bR[1]+(bR[2]-1))-0;e[3]=bR[3]-0}else{if(e[2])?(by.error(e[0])):e[0]=bI++;return e},ATTR:function(bU,bR,bS,e,bV){var bT=bU[1].replace(bK,"");if(bU[2]==="~="){(bU[4]==" "+bU[4]-bU),PSEUDO:function(bU,bR,bS,e,bV){(if(bU[1]==="not")||(bH.exec(bU[3]))||"").length>1||/^\\w/.test(bU[3])}(bU[3]=by(bU[3],null,null,bR))else{(var bT=by.filter(bU[3],bR,bS,true^bV);if(!bS){e.push.apply(e,bT)}}return false}}else{if(bE.match.POS.test(bU[0])||bE.match.CHILD.test(bU[0])){(return true)}return bU},POS:function(e){e.unshift e},filters:{enabled:function(e){(return e.disabled==false&&e.type!="hidden"},disabled:function(e){(return e.disabled==true)},checked:function(e){(return e.checked==true)},selected:function(e){(if(e.parentNode){e.parentNode.selectedIndex})return e.selected==true},parent:func e.firstChild,has:function(bS,bR,e){(return !by(e[3],bS).length)},header:function(e){(return (/h\d/i).test(e.nodeName)},text:function(bS){var e=bS.getAttribute("type"),bR=bS.type;return bS.nodeName.toLowerCase()==="intext"=="br&&(e==br||e==null)},radio:function(e){(return e.nodeName.toLowerCase()==="input"&&"radio"==e.type)},checkbox:function(e){(return e.nodeName.toLowerCase()==="input"&&"checkbox"==e.type)},file:function(e){(return e.nodeName.toLowerCase()==="input"&&"file"==e.type)},password:function(e){(return e.nodeName.toLowerCase()==="input"&&"password"==e.type)},submit:function(bR){(var e=bR.nodeName.toLowerCase());return (e=="button"||e=="submit"||e==br.type)},image:function(e){(return e.nodeName.toLowerCase()==="input"&&"image"==e.type)},reset:function(bR){(var e=bR.nodeName.toLowerCase());return (e=="input"||e=="button")&&"reset"==e.type)},button:function(bR){(var e=bR.nodeName.toLowerCase());return e=="input"&&"button"==br.type||e=="button"},input:function(e){(return (/input|select|textarea|button/i).test(e.nodeName))},focus:function(e){(return e==e.ownerDocument.activeElement)},setFilters:{first:function(bR,e){(return e==0)},last:function(bS,bR,e,bT){(return bR==bT.length-1)},even:function(bR,e){(return e%2==0)},odd:function(bR,e){(return e%2==1)},lt:function(bS,bR,e){(return bR<e[3]-0)},gt:function(bS,bR,e){(return bR>e[3]-0)},nth:function(bS,bR,e){(return e[3]-0==bR)},eq:function(bS,bR,e){(return e[3]-0==bR)},filter:{PSEUDO:function e=bX[1],br=bE.filters[e];if(br){(return br(bS,bW,bX,bY))}else{if(e=="contains"){(return(bS.textContent||bS.innerText||bw([bS])||"").indexof(bX[1])>0)}else{if(e=="not"){(var bT=bX[1];for(var bV=0,bU=bT.length;bV<bU;bV++){(if(bT[bV]==bS){(return false)}return true)}else{by.error(e))}}},CHILD:function(bS,bU){(var bT,b0,bW,bZ,e,bV,bX=bU[1],bR=bS;switch(bX){case"only":case"first":while((bR=bR.previousSibling)){(if(bR.nodeType==false)}return true;case"nth":bT=bU[2];b0=bU[3];if(bT==1&&b0==0){(return true)bW=bU[0];bZ=bS.parentNode;if(bZ&&(bZ[bC]!#=bW)||!bS.nodeIndex)){bV=0;for(bR=bZ.firstChild;bR;bR=bR.nextSibling){(if(bR.nodeType==1){(bR.nodeIndex++&#bV);bZ[bC]=bW,y==0){(return(bYbT==0&&bYbT>0))}},ID:function(bR,e){(return bR.nodeType==1&&bR.getAttribute("id")==e)},TAG:func &#bR.nodeType==1)!!!(br.nodeName&&bR.nodeName.toLowerCase()==e),CLASS:function(bR,e){(return (" "+(bR.className||br.get

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"class"))+"").indexOf(e)>-1},ATTR:function(bV,bT){var
bS=bT[1],e=by.attr?by.attr(bV,bS):bE.getAttributeHandle[bS](bV):bV[bS]!=null?bV[bS]:bV.getAttribute(bS),bW=e
!="!:bU&&by.attr?e!=null:bU=="?"bW==bR:bU=="?"bW.indexOf(bR)>0:bU=="?"(" "+bW+" "
).indexOf(bR)>0:!bR2bW&&e!=="false":bU=="!"|"?"bW==bR|bW.substr(0,bR.length+1)=="bR+"-":false},POS:function(bU,bR,bs,
e=bR[2],bT=bE.setFilters[e];if(bT){return bT(bU,bs,bR,bV)}},var bD=bE.match.POS,bx=function(bR,e){return"\\"+
+(e+0)};for(var bz in bE.match){bE.match[bz]=new RegExp(bE.match[bz].source+(/\?![^\[]*\])/)?![^\[]*)+
)/.source});bE.leftMatch[bz]=new RegExp(/(^?:|\[\|\n)*?)/.source+bE.match[bz].source.replace(/\((\d+)/g,bx))}var
bF=function(bR,e){bR=Array.prototype.slice.call(bR,0);if(e){e.push.apply(e,bR);return e}return
bR};try{Array.prototype.slice.call(av.documentElement.childNodes,0)[0].nodeType}catch(bP){bF=function(bU,bT){var
bS=0,br=bT||[];if(bL.call(bU)===[object Array])Array.prototype.push.apply(br,bU);else{if(typeof br.bU.length==="number"){(for(var e=bU.length;bs<e;bs++)br.push(bU[bs]))}else{for(var bU[bs];bs++)(br.push(bU[bs]))}}}return
br}}var bJ,bG;if(av.documentElement.compareDocumentPosition){bJ=function(bR,e){if(br==e){bB=true;return
0}if(!bR.compareDocumentPosition||!e.compareDocumentPosition){return bR.compareDocumentPosition?-1:1}return
bR.compareDocumentPosition(e)&4?-1:1}else{bJ=function(bY,bX){if(bY==bX){bB=true;return
0}else{if(bY.sourceIndex&&bX.sourceIndex){return bY.sourceIndex-bX.sourceIndex}}var
bV,bR,bS=[],e[],bU=bY.parentNode,bW=bX.parentNode,bZ=bU;if(bU==bW){return bG(bY,bX)}else{if(!bU){return -1}else{if(!b
1)}while(bZ){bS.unshift(bZ);bZ=bZ.parentNode}bZ=bW;while(bZ){e.unshift(bZ);bZ=bZ.parentNode}bV=bS.length;bR=e.length;
bT=0;bt<bV&&bt<bR;bT++}{if(bS[bT]===e[bT]){return bG(bS[bT],e[bT])}}return
bT==bV?bG(bY,e[bT]-1):bG(bS[bT],bX,1);bG=function(bR,e,bS){if(br==e){return bS}var bT=bR.nextSibling;while(bT){if(-1)bT=bT.nextSibling}return 1}}(function(){var br=av.createElement("div"),bS="script"+(new
Date()).getTime(),e=av.documentElement;bR.innerHTML=<a name='"+bS+"' />"}
;e.insertBefore(br,e.firstChild);if(av.getElementById(bS)){bE.find.ID=function(bU,bV,bW){if(typeof bV.getElementById!==
bt?bT.id==bU[1]||typeof bt.getAttributeNode!="undefined"&&bT.getAttributeNode("id"
).nodeValue==bU[1]?[bT]:L:[]);bE.filter.ID=function(bV,bT){var bU=typeof bV.getAttributeNode!="undefined"&&!bV.getAttribute
};return bV.nodeType==1&&bU&&bU.nodeType==bT}e.removeChild(bR);e=bR=null}});(function(){var
e=av.createElement("div");e.appendChild(av.createComment(""));if(e.getElementsByTagName("*"
).length>0){bE.find.TAG=function(bR,bV){var bU=bV.getElementsByTagName(bR[1]);if(bR[1]==="#"){var bT=[];for(var
bS=0;bu[bS];bS++){if(bU[bS].nodeType==1){bT.push(bU[bS])}}bU=bT}return bU}e.innerHTML=<a href="#">/</a>;if(e.firstChild
e.firstChild.getAttribute!="undefined"&&!e.firstChild.getAttribute("href")!=""
){bE.getAttribute.href=function(bR){return bR.getAttribute("href",2)};e=null}});if(av.querySelectorAll){(function(){var
e=by,bT=av.createElement("div"),bS="__sizzle__";bT.innerHTML=<p class='TEST'>/</p>
;if(bT.querySelectorAll&&bT.querySelectorAll(".TEST").length==0){return}by=function(b4,bV,bZ,b3){bV=bV||av;if(!b3&&by
([\w-]+$)|^#([\w-]+$)/.exec(b4);if(b2&&(bV.nodeType==1||bV.nodeType==9)){if(b2[1]){return
bF(bV.getElementsByTagName(b4),bZ)}else{if(b2[2]&&bE.find.CLASS&&bV.getElementsByClassName){return
bF(bV.getElementsByClassName(b2[2]),bZ)}}if(bV.nodeType==9){if(b4=="body"&&!bV.body){return
bF([bV.body],bZ)}else{if(b2&&b2[3]){var bY=bV.getElementById(b2[3]);if(bY&&bY.parentNode){if(bY.id==b2[3]){return bF(
bF([],bZ)}}}try{return
bF(bV.querySelectorAll(b4),bZ)}catch(b0){}else{if(bV.nodeType==1&&bV.nodeName.toLowerCase()!=="object"){var bW=bV,bX
*+[+]/.test(b4);if(!bX){bV.setAttribute("id",bU);else{bU=bU.replace('/"/g,"\\$&");if(b5&&b6){bV=bV.parentNode}try{if(!b5
bF(bV.querySelectorAll("[" id=" "+bU+"] "+b4),bZ)}catch(b1){}finally{if(!bX){bW.removeAttribute("id"
)}}}}}}return e(b4,bV,bZ,b3)};for(var bR in e){by[bR]=e[bR];bT=null}}})(function(){var
e=av.documentElement,bS=e.matchesSelector||e.webkitMatchesSelector||e.msMatchesSelector;if(bS){v
bU=!bS.call(av.createElement("div","div"),bR=false);try{bS.call(av.documentElement,[test:='']:sizzle"
})catch(bT){bR=true}by.matchesSelector=function(bW,bY){bY=bY.replace(/\=\s*([\^\"]+)\*\s*\|\g,="$'\")";if(!bY.isXML(bW)
||!bE.match.PSEUDO.test(bY)&&!/.test(bY)){var bV=bS.call(bW,bY);if(bV||!bU||bW.document&&bW.document.
nodeType==11){return bV}};catch(bX){}}return by(bY,null,null,[bW]).length>0}}));(function(){var e=av.
createElement("div");e.innerHTML=<div class='test e'>/</div><div class='test'>/</div>;if(!e.getElementsByClassName||e
.getElementsByClassName("e").length==0){return}e.lastChild.className="e";if(e.getElementsByClassName("e").
length==1){return}bE.order.splice(1,0,"CLASS");bE.find.CLASS=function(bR,bS,bT){if(typeof bS.
getElementsByClassName!="undefined"&&!bT){return bS.getElementsByClassName(bR[1])};e=null}});function bv(bR,bW,bV,
bY){for(var bT=0,bs=bZ.length;bT<bS;bT++){var e=bZ[bT];if(e){var bu=false;e=e[bR];while(e){if(e[bC]==bV){bU
=bZ[e.sizset];break}if(e.nodeType==1&&e[bC]==bV){e.sizset=bT}if(e.nodeName.toLowerCase()===bW){bU=e;
break}e=e[bR];bZ[bT]=bU}}}}function bN(bR,bW,bV,bZ,bX,bY){for(var bT=0,bs=bZ.length;bT<bS;bT++){var e=bZ[bT];if(e
){var bu=false;e=e[bR];while(e){if(e[bC]==bV){bU=bZ[e.sizset];break}if(e.nodeType==1){if(!bY){e[bC]=bV;e.
sizset=bT}if(typeof bW=="string"){if(e==bW){bu=true;break}else{if(by.filter(bW,[e]).length>0){bu=true;break}}
}e=e[bR];bZ[bT]=bU}}}}if(av.documentElement.contains){by.contains=function(bR,e){return bR==e&&(bR.contains?
bR.contains(e):true)};else{if(av.documentElement.compareDocumentPosition){by.contains=function(bR,e){return
!-(bR.compareDocumentPosition(e)&16)};else{by.contains=function(){return false}}}}by.isXML=function(e){var br
=(e?e.ownerDocument||e:0).documentElement;return br?br.nodeName!=="HTML":false};var bM=function(bS,e,bW){var
bV,bX[],bY=e.nodeType?e:e;while((bV=bE.match.PSEUDO.exec(bS))[bU=bV[0]];bS=bS.replace(bE.match.
PSEUDO,""));bS=bE.relative[bS]?bS+"*":bS;for(var bT=0;br=bY.length;bt<bR;bT++){by(bS,bY[bT],bX,bW)}return by.
filter(bU,bX);by.attr=b.attr;by.selectors.attrMap={};b.find=by;b.expr=by.selectors;
b.expr+":="=b.expr.filters;b.unique=by.uniqueDoc;b.text=by.getText;b.isXMLDoc=by.isXML;
b.contains=by.contains();var ab=/Until/,aq=/^(?:parents|prevUntil|prevAll)/,a9=/_,/bp=/^[:#:\.\,\]*$/,P
=Array.prototype.slice,H=b.expr.match.POS,ay=[children:true,contents:true,next:true,prev:true];
b.fn.extend({find:function(e){var bw=this,by,bV;if(typeof e!=="string"){return b(e).filter(function(){for
by=0,bv=bw.length;by<bV;by++)if(b.contains(bw[bv],this)){return true}})}var bx=this.pushStack("",find,e),
bA,bB,bz;for(by=0,bv=this.length;by<bV;by++)bA=bx.length;bx.find(e,this[bv],bx);if(by>0){for(bB=bA;bB<bx.
length;bb++)for(bz=0;bz<bA;bz++)if(bx[bz]===bx[bb])bx.splice(bb--,-1);break}});return bx},has:function(bv){
var e=b(bv);return this.filter(function(){for(var bx=0,bw=e.length;bx<bw;bx++){if(b.contains(this,e[bx])){ret
urn true}}}),not:function(e){return this.pushStack(aG(this,e,false),"not",e)},filter:function(e){return
this.pushStack(aG(this,e,true),"filter",e),is:function(e){return !e&(typeof e=="string"?H.test(e):b(e,
this.context).index(this[0])>0:b.filter(e,this).length>0):this.filter(e).length>0},closest:function(by
,bx){var bv=[],bw,e,bz=this[0];if(b.isArray(by)){var bb=1;while(bz&&bz.ownerDocument&&bz==bx){for(bw=0;bw<
by.length;bw++)if(b(bz).is(by[bw])){bv.push({selector:by[bw],elem:bz,level:bb});bz=bz.parentNode;bB++}
return bv}var bA=H.test(by)||typeof by=="string"?b(by,bx||this.context):0;for(bw=0,e=this.length;bw<e;bw++)bz=
this[bw];while(bz){if(bA.index(bz)>-1:b.find.matchesSelector(bz,by)){bv.push(bz);break}else{bz=bz.
parentNode;if(!bz||!bz.ownerDocument||bz==bx||bz.nodeType==11){break}}}}bv.length>1?
b.unique(bv);return this.pushStack(bv,"closest",by)},index:function(e){if(!e){return(this[0]&&this[0].
parentNode)?this.prevAll().length:-1;if(typeof e=="string"){return b.inArray(this[0],
b(e))}return b.inArray(e.jquery?e[0]:e,this)},add:function(e,bV){var bx=typeof e=="string"?
b(e,bV):b.makeArray(e&&e.nodeType?e:e),bw=b.merge(this.get(),bx);return this.pushStack(C(bx[0])||C(bw[0])
?bw:bw.unique(bw)),andSelf:function(){return this.add(this.prevObject)}},function C(e){return !e||!e.
parentNode||e.parentNode.nodeType==11}b.each({parent:function(bv){var e=bv.parentNode;return e&&e.nodeType!=11?e:
null},parents:function(e){return b.dir(e,"parentNode")},parentsUntil:function(bv,e,bW){return
b.dir(bv,"parentNode",bW)},next:function(e){return b.nth(e,2,"nextSibling")},prev:function(e){return

```

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b.nth(e,2,"previousSibling")),nextAll:function(e){return b.dir(e,"nextSibling")},prevAll:function(e){return
b.dir(e,"previousSibling")},nextUntil:function(bv,e,bw){return b.dir(bv,"nextSibling",bw)},prevUntil:
function(bv,e,bw){return b.dir(bv,"previousSibling",bw)},siblings:function(e){return b.sibling(e.parentNode,
firstChild,e)},children:function(e){return b.sibling(e.firstChild)},contents:function(e){return
b.nodeName(e,"iframe")?e.contentDocument||e.contentWindow.document:b.makeArray(e.childNodes)},function(e,
bv){b.fn[e]=function(by,bw){var bx=b.map(this,bv,by);if(!ab.test(e)){bw=by}if(bw&typeof bw=="string"){bx=
b.filter(bw,bx)}bx=this.length>1&&!ay[e]?b.unique(bx):bx;if((this.length>1||a9.test(bw))&&aq.test(e)){bx=bx
.reverse()}return this.pushStack(bx,e,P.call(arguments).join(""))}};b.extend({filter:function(bw,e,bv){if(
bw){bw!="not("+bw+")"}return e.length==1?b.find.matchesSelector(e[0],bw)?[e[0]]:[];
b.find.matches(bw,e)},dir:function(bw,bv,by){var e=[],bx=bw[bv];while(bx&&bx.nodeType!=9&&(by===
L||bx.nodeType!=1||!bx.is(by)))if(bx.nodeType==1){e.push(bx)}bx=bw[bv]};nth:function(by,e,bw,
bx){e=e||1;var bv=0;for(;by;by=bw[bv+1])if(by.nodeType==1&&bv==e){break}};return by},sibling:function(bw,
bv){var e=[];for(;bw;bw=bw.nextSibling){if(bw.nodeType==1&&bw!=bv){e.push(bw)}}return e});function aG(bx,
bw,e){bw=bw[0];if(b.isFunction(bw)){return b.grep(bx,function(bz,by){var ba!=!bw.call(bz,by,bz);return ba==
e})}else{if(bw.nodeType){return b.grep(bx,function(bz,by){return(bz==bw)==e})}else{if(typeof bw=="string"
){var bv=b.grep(bx,function(bz,by){return bv.nodeType==1});if(bp.test(bw)){return b.filter(bw,bv,!e)}else{bw=
b.filter(bw,bv)}}}return b.grep(bx,function(bz,by){return(b.inArray(bz,bw)>0)==e})}}function a(e){var bw=
aR.split(" "),bv=e.createDocumentFragment();if(bv.createElement){while(bw.length){bv.createElement(bw.pop())}}
}return bv}var ar="";
abbr|article|aside|audio|canvas|datalist|details|figcaption|figure|footer|header|hgroup|mark|meter|nav|output|progress|
area|br|col|embed|hr|img|input|link|meta|param)(([w:]+[^>]*))/>/ig,d=/<([w:]+)/,w=<tbody/i,W=</&#?w+/,
ae=/^(?:script|style)/i,O=<(?:script|object|embed|option|style)/i,ah=new RegExp("<(?:"+aR+" )","i"),o=/
checked\s(?:[^=|=|=s*.checked)/i,bm=/\/(java|ecma)script/i,an="\`s*!?:(\?:(?:[CDATA\[|\|-\\|),ax=[option:[1,
<select multiple="multiple">,"</select>"],legend:[1,<fieldset>,"</fieldset>"],thead:[1,<table>,"</table>"],tr
:[2,<table><tbody>,"</tbody></table>"],td:[3,<table><tbody><tr>,"</tr></tbody></table>"],col:[2,
<table><tbody></tbody><colgroup>,"</colgroup></table>"],area:[1,<map>,"</map>"],_default:[0,""],ac=a(av);
ax.optgroup=ax.option;ax.tbody=ax.tfoot=ax.colgroup=ax.caption=ax.thead;ax.th=ax.td;if(
b.support.htmlSerialize)(ax._default=[1,"div<div>","</div>"]);b.fn.extend({text:function(e){if(
b.isFunction(e)){return this.each(function(bw){var bv=b(this);bv.text(e.call(this,bw,bv.text()))})}if(
typeof e=="object"&&!e==L){return this.empty().append(this[0]&&this[0].ownerDocument||av).createTextNode(e)}}
return b.text(this)),wrapAll:function(e){if(b.isFunction(e)){return this.each(function(bw){
b(this).wrapAll(e.call(this,bw)))}if(this[0]){var bv=b(e,this[0].ownerDocument).eq(0).clone(true);if(this[0].parentNode
){bv.insertBefore(this[0])}bv.map(function(){var bw=bv;while(bw.firstChild&&bw.firstChild.nodeType==1){bw=bw.firstChild}return bw}).append(this)}},wrapInner:function(e){if(
b.isFunction(e)){return this.each(function(bv){b(v).wrapInner(e.call(this,bv)))}return this.
each(function(){var bv=b(this),bw=bv.contents();if(bw.length){bw.wrapAll(e)}else{bv.append(e)}}),wrap:
function(e){var bv=b.isFunction(e);return this.each(function(bw){b(w).wrapAll(bv?e.call(this,bw):e)}),unwrap
:function(){return this.parent().each(function(){if(!b.nodeName(this,"body")){b(this).replaceWith(this.
childNodes)}}).end()},append:function(){return this.domManip(arguments,true,function(e){if(this.nodeType==1){this.appendChild(e)}},prepend:function(){return this.domManip(arguments,true,function(e){if(this.nodeType==1){this.insertBefore(e,this.firstChild)}},before:function(){if(this[0]&&this[0].parentNode){return this.
domManip(arguments,false,function(bv){this.parentNode.insertBefore(bv,this))}else{if(arguments.length){var e=
b.clean(arguments);e.push.apply(e,this.toArray());return this.pushStack(e,"before",arguments)}},after:
function(){if(this[0]&&this[0].parentNode){return this.domManip(arguments,false,function(bv){this.parentNode.
insertBefore(bv,this.nextSibling))}else{if(arguments.length){var e=this.pushStack(this,"after",arguments);e.
push.apply(e,b.clean(arguments));return e}}},remove:function(e,bx){for(var bv=0,bw;(bw=this[bv])!=null;bv++){if(!e||b.filter(e,[bw]).length){if((bx&&bw.nodeType==1){b.cleanData(bw.getElementsByTagName("*"));
b.cleanData([bw])}if((bw.parentNode){bw.parentNode.removeChild(bw))}return this},empty:function(){for(var e
=0,bv;(bv==this[e])!=null;e++)if(bv.nodeType==1){b.cleanData(bv.getElementsByTagName("*"))}while(bv.
firstChild){bv.removeChild(bv.firstChild)}return this},clone:function(bv,e){bv=bv==null?false: bv;e=e==null?bv:e;
return this.map(function(){return b.clone(this,bv,e)}),html:function(bx){if(bx==L){return this[0]&&this[0].
nodeType==1?this[0].innerHTML.replace(ag,""):null}else{if(typeof bx=="string"&&!ae.test(bx)&&
b.support.leadingWhitespace||!ar.test(bx))&&!ax[(d.exec(bx)[1][0].toLowerCase())][1].replace(R,"
<$1></$2>");try{for(var bw=0,bv=this.length;bw<bv;bw++){if(this[bw].nodeType==1){
b.cleanData(this[bw].getElementsByTagName("*"));this[bw].innerHTML=bx}}catch(by){this.empty().append(bx)}}
else{if(b.isFunction(bx)){this.each(function(bz){var e=b(this);e.html(bx.call(this,bz,e.html()))})}else{
this.empty().append(bx)}}return this},replaceWith:function(e){if(this[0]&&this[0].parentNode){if(
b.isFunction(e)){return this.each(function(bx){var bw=b(this),bv=bw.html();bw.replaceWith(e.call(this,bx,bv))
}))}if(typeof e!="string"){e=b(e).detach();return this.each(function(){var bw=this.nextSibling,bv=this.
parentNode;b(this).remove();if(bw){b(bw).before(e)}else{b(bw).append(e))}else{return this.length?this.
pushStack(b(b.isFunction(e)?e:"replaceWith",e):this),detach:function(e){return this.remove(e,true)},domManip:
function(bb,bF,bE){var bx,by,bA,bC=b[0],bv=[];if(!b.support.checkClone&&arguments.length==3&&typeof bC
=="string"&&!o.test(bC)){return this.each(function(){b(this).domManip(bB,bF,bE,true)})}if(
b.isFunction(bC)){return this.each(function(bH){var bG=b(this);bB[0]=bC.call(this,bH,bF?bG.html():
L);bG.domManip(bB,bF,BE))}if(this[0]){bD=bC&&C.parentNode;if(b.support.parentNode&&bD.parentNode.nodeType==11&&
bD.childNodes.length==this.length){bx=[fragment:bD]}else{bx=b.buildFragment(bb,this,bv)}bA=bx.fragment;if(
bA.childNodes.length==1){by=bA.firstChild}else{by=bA.firstChild;if(by){bF=bF&&
b.nodeName(by,"tr");for(var bw=0,e=this.length,bz=-1;bw<e;bw++){bE.call(bF?ba(this[bw],by):this[bw],bx.
cacheable||(e>1&&bw>2)?b.clone(bA,true,true):b)}if(bv.length){bE.each(bv,bo)}return this}};function ba(e,bv)
{return b.nodeName(e,"table")?(e.getElementsByTagName("tbody"))[0]|e.appendChild(e.ownerDocument).
createElement("tbody")):e}function t(bb,bv){if(bb.nodeType==1||!b.hasData(bb)){return}var by,bx,e,bA=
b._data(bb),bz=b._data(bb,bA),bw=bA.events;if(bw){delete bz.handle;bw.events={};for(by in bw){for(bx=0,e=bb
[by].length;bx<e;bx++){b.event.add(bb,by+(bw[by][bx]).namespace?"."+":")"+bw[by][bx].namespace,bw[by][bx],bw[j][bx].
data)}}}if(bb.data){bb.data=b.extend({},bb.data))}function ai(bv,e){var bw;if(e.nodeType!=1){return
if(e.clearAttributes){e.clearAttributes()}if(e.mergeAttributes){e.mergeAttributes(bv)}bw=e.nodeName.
toLowerCase();if(bw=="object"){e.outerHTML=bv.outerHTML}else{if(bw=="input"||bv.type=="checkbox"||bv.type=="radio")
{if(bv.checked){e.defaultChecked=e.checked}if(e.value!=bv.value){e.value=bv.value}else{if(
bw=="option"){e.selected=bv.defaultSelected}else{if(bw=="input"||bw=="textarea"){e.defaultValue=bv.
defaultValue}}}}e.removeAttribute(b.expandable)}b.buildFragment=function(bz,bx,bv){var by,e,bw,bA=b[0];if(bx&&bx[0])
{bA=bx[0].ownerDocument||bx[0]}if(!bA.createDocumentFragment){bA=av}if(bz.length==1&&typeof bB=="string"
&&bb.length<512&&bA==av&&bb.charAt(0)==="<"||!0.test(bb)&&(b.support.checkClone||!o.test(bb))&&
b.support.html5Clone||!ah.test(bb)){e=true;bw=b.fragments[b];if(bw&&bw!=1){by=bw}if(!by){by=bA.
createDocumentFragment();b.clean(bb,by,bv)}if(e){b.fragments[bB]=bw?by:1}return{fragment:by,cacheable:e}};
b.fragments={};b.each({appendTo:"append",prependTo:"prepend",insertBefore:"before",insertAfter:"after",
replaceAll:"replaceWith"},function(e,bv){b.fn[e]=function(bw){var bz[],bC=b(bb),bw=b[0],bz=bw.length==1&&this[0].
parentNode;if(bB&&bB.nodeType==11&&bB.childNodes.length==1&&bC.length==1){bC[bv](this[0]);return this}else{
for(var bA=0,bx=bC.length;bA<bx;bA++){var by=(bA>0?this.clone(true):this).get();b(bC[bA])[bv](by);bz=bz.
}}}
```

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concat(by) }return this.pushStack(bz,e,bC.selector))});function bg(e){if(typeof e.getElementsByTagName!=="undefined") {return e.
querySelectorAll("*") }else{if(typeof e.querySelectorAll!=="undefined") {return e.
checked}}function E(e){var bv=(e.nodeName||"").toLowerCase();if(bv==="input") {az(e)}else{if(bv==="script"&&
typeof e.getElementsByTagName!=="undefined") {b.grep(e.getElementsByTagName("input"),az)}}}function al(e){var bv=
av.createElement("div");ac.appendChild(bv);bv.innerHTML=e.outerHTML;return bv.firstChild}
b.extend({clone:function(by,ba,bw){var e,bv,bx,bz=b.support.html5Clone||!ah.test("< "+by.nodeName)?by.
cloneNode(true):al(by);if(!b.support.noCloneEvent||!b.support.noCloneChecked)&&(by.nodeType==!=1||by.nodeType==!=11
)&&!b.isXMLDoc(by)){ai(by,bz);e=bg(by);bv=bg(bz);for(bx=0;e[bx];++bx){if(bv[bx]) {ai(e[bx],bv[bx])}}if(bA){t
(by,bz);if(bw){e=bg(by);bv=bg(bz);for(bx=0;e[bx];++bx){t(e[bx],bv[bx])}}e=null;return bz},clean:function
(bw,bz,bA){var bF;by=by||av;if(typeof by.createElement=="undefined") {by=by.ownerDocument||by[0]&&by[0].
ownerDocument||av}var bI=[],bB;for(var bE=0,bz;(bz=bw[bE])!=null;bE++){if(typeof bz=="number"){bz+=""}if(!bz
){continue}if(typeof bz=="string"){if(!W.test(bz)){bz=by.createTextNode(bz)}else{bz=bz.replace(R,"<$1>/<$2>
");}}var bK=(d.exec(bz)||["","",""])[1].toLowerCase(),bx=ax[bK]||ax._default,bD=bx[0],bv=by.createElement("div");
if(by==av){ac.appendChild(bv)}else{a(by).appendChild(bv)}bv.innerHTML=bx[1]+bz+bx[2];while(bD--) {bv=bv.
lastChild}if(!b.support.tbody){var e=w.test(bz),bc=bK==="table"&&!e?bv.firstChild&&bv.firstChild.childNodes:bx[1]
===<table>"&&!e?bv.childNodes:[];for(bB=bC.length-1;bB>0;--bB){if(b.nodeName(bC[bB],"tbody")&&!bC[bB].
childNodes.length){bC[bB].parentNode.removeChild(bC[bB])}}}if(!b.support.leadingWhitespace&&ar.test(bz)){bv.
insertBefore(by.createTextNode(ar.exec(bz)[0]),bv.firstChild)}bz=bv.childNodes}var bG;if(!
b.support.appendChecked){if(bz[0]&&typeof(bG=bz.length)==="number"){for(bB=0;bB<bG;bB++){E(bz[bB])}}else{E(
bz)}}if(bz.nodeType){bI.push(bz)}else{bI=b.merge(bI,bz)}}if(bH){bF=function(bL){return !bL.type||bm.test(bL.
type)};for(bE=0;bI[bE];bE++){if(bA&&b.nodeName(bI[bE],"script")&&(!bI[bE].type||bI[bE].type.toLowerCase()===
"text/javascript")){bA.push(bI[bE].parentNode?bI[bE].parentNode.removeChild(bI[bE]):bI[bE])}else{if(bI[bE].
nodeType==!=1){var bJ=b.grep(bI[bE].getElementsByTagName("script"),bF);bI.splice.apply(bI,[bE+1,0].concat(bJ))
}bH.appendChild(bI[bE])}}}return bI},cleanData:function(bv){var by,bw,e=b.cache,bB=
b.event.special,bA=b.support.deleteExpando;for(var bz=0,bx;(bx=bv[bz])!=null;bz++){if(bx.nodeName&&
b.noData[bx.nodeName.toLowerCase()]) {continue}bw=bx[b.expando];if(bw){by=e[bw];if(by&&by.events){for(var bC
in by.events){if(bB[bC]){b.event.remove(bx,bC)}else{b.removeEvent(bx,bC,by.handle)}}}if(by.handle){by.handle
.elem=null}}if(bA){delete bx[b.expando]}else{if(bx.removeAttribute){bx.removeAttribute(
b.expando)}}}delete e[bw]}));function bo(e,bv){if(bv.src){b.ajax({url:bv.src,async:false,dataType:"script"
})}else{b.globalEval((bv.text||bv.textContent||bv.innerHTML||"").replace(aN,"/*$0*/"))}if(bv.parentNode){bv.
parentNode.removeChild(bv)}var ak=/alpha\(([^)]*)\)/i

```

Definition at line 16 of file jquery.js.

#### 14.18.2.9 function bb

Definition at line 16 of file jquery.js.

#### 14.18.2.10 var bq =/#.\*\$/

Definition at line 29 of file jquery.js.

#### 14.18.2.11 var bs =/\r?\n/g

Definition at line 29 of file jquery.js.

#### 14.18.2.12 var c

##### Initial value:

```

=/^\/\
{}))}var Q={},a8,m,aB=/^(?:toggle|show|hide)$/,aT=/^([+\-]=)?([\d+\.\-]+)([a-z%]*$)/i,a3,aH=[["height",
"marginTop","marginBottom","paddingTop","paddingBottom"],["width","marginLeft","marginRight","paddingLeft",
"paddingRight"],["opacity"]],a4

```

Definition at line 29 of file jquery.js.

Reference

14.18.2.13 b fn css =function(e,bv){if(arguments.length==2&&bv==L){return this}return  
b.access(this,e,bv,true,function(bx,bw,by){return by!=L?b.style(bx,bw,by):b.css(bx,bw)}))}

Definition at line 28 of file jquery.js.

14.18.2.14 b curCSS =b.css

Definition at line 28 of file jquery.js.

14.18.2.15 else {b.fn.offset=function(bF){var bz=this[0];if(bF){return this.each(function(bG){b.offset.set←  
Offset(this,bF,bG))}};if(!bz||!bz.ownerDocument){return null};if(bz==bz.ownerDocument.body){return  
b.offset.bodyOffset(bz)};var bC,bw=bz.offsetTop,bv=bz,bE=bz.ownerDocument,bx=bE.documentElement←  
Element,bA=bE.body,bB=bE.defaultView,e=bB?bB.getComputedStyle(bz,null):bz.currentStyle,bD=bz.offset←  
Top,by=bz.offsetTop;while((bz=bz.parentNode)&&bz!=bA&&bz!=bx){if(b.support.fixedPosition&&e.←  
position=="fixed"){break};bC=bB?bB.getComputedStyle(bz,null):bz.currentStyle;bD-=bz.scrollTop;by-  
=bz.scrollLeft;if(bz==bw){bD+=bz.offsetTop;by+=bz.offsetTop;if(b.support.doesNotAddBorder&&(b.←  
support.doesAddBorderForTableAndCells&&V.test(bz.nodeName))){bD+=parseFloat(bC.borderTop←  
Width)||0;by+=parseFloat(bC.borderLeftWidth)||0};bv=bw;bw=bz.offsetTop;if(b.support.subtractsBorderFor←  
OverflowNotVisible&&bC.overflow!="visible"){bD+=parseFloat(bC.borderTopWidth)||0;by+=parseFloat(b←  
C.borderLeftWidth)||0};e=bC;if(e.position=="relative"||e.position=="static"){bD+=bA.offsetTop;by+=b←  
A.offsetTop;if(b.support.fixedPosition&&e.position=="fixed"){bD+=Math.max(bx.scrollTop,bA.scrollTop←  
Top);by+=Math.max(bx.scrollLeft,bA.scrollLeft)}};return{top:bD,left:by}}};b.offset={bodyOffset:function(e){var  
bw=e.offsetTop,bv=e.offsetTop;if(b.support.doesNotIncludeMarginInBodyOffset){bw+=parseFloat(b.←  
css(e,"marginTop"))||0;bv+=parseFloat(b.css(e,"marginLeft"))||0};return{top:bw,left: bv}},setOffset←  
:function(bx,bG,bA){var bB=b.css(bx,"position");if(bB=="static"){bx.style.position="relative"};var  
bz=b(bx),bv=bz.offsetTop,e=b.css(bx,"top"),bE=b.css(bx,"left"),bF=(bB=="absolute"||bB=="fixed")&&b.←  
inArray("auto",[e,bE])>-1,bD={},bC={},bw,bv;if(bF){bC=bz.position();bw=bC.top;by=bC.←  
left};else{bw=parseFloat(e)||0;by=parseFloat(bE)||0};if(b.isFunction(bG)){bG=bG.call(bx,bA,bv)};if(b.←  
G.top!=null){bD.top=(bG.top-bv.top)+bw};if(bG.left!=null){bD.left=(bG.left-bv.left)+by};if("using" in  
bG){bG.using.call(bx,bD)};else{bz.css(bD)}}}}

Definition at line 30 of file jquery.js.

14.18.2.16 bb jQuery =bb.\$=b

Definition at line 30 of file jquery.js.

14.18.2.17 var k =/%20/g

Definition at line 29 of file jquery.js.

14.18.2.18 function L {var av=bb.document,bu=bb.navigator,bl=bb.location

Definition at line 16 of file jquery.js.

```
14.18.2.19 b fx prototype ={update:function(){if(this.options.step){this.options.step.call(this.elem,this.now,this)}(b.←
fx.step[this.prop]||b.fx.step._default)(this)},cur:function(){if(this.elem[this.prop]!=null&&(!this.elem.←
style||this.elem.style[this.prop]==null)){return this.elem[this.prop]}var e,bv=b.css(this.elem,this.prop);return
isNaN(e=parseFloat(bv))?!bv||bv==="auto"?0:bv:e},custom:function(bz,by,bx){var
e=this,bw=b.fx;this.startTime=a4||bh();this.end=by;this.now=this.start=bz;this.pos=this.←
state=0;this.unit=bx||this.unit||(b.cssNumber[this.prop]?"" :"px");function bv(bA){return
e.step(bA)}bv.queue=this.options.queue;bv.elem=this.elem;bv.saveState=function(){if(e.←
options.hide&&b._data(e.elem,"fxshow"+e.prop)===L){b._data(e.elem,"fxshow"+e.prop,e.←
start)}};if(bv()&&b.timers.push(bv)&&!a3){a3=setInterval(bw.tick,bw.interval)}},show:function(){var
e=b._data(this.elem,"fxshow"+this.prop);this.options.orig[this.prop]=e||b.style(this.elem,this.prop);this.options.←
show=true;if(e==L){this.custom(this.cur(),e)}else{this.custom(this.prop==="width"||this.prop==="height"?1←
:0,this.cur())}b(this.elem).show(),hide:function(){this.options.orig[this.prop]=b._data(this.elem,"fxshow"+this.←
prop)||b.style(this.elem,this.prop);this.options.hide=true;this.custom(this.cur(),0)},step:function(by){var
bA,bB,bv,bx=a4||bh(),e=true,bz=this.elem,bw=this.options;if(by||bx>=bw.duration+this.start←
Time){this.now=this.end;this.pos=this.state=1;this.update();bw.animatedProperties[this.prop]=true;for(bA
in bw.animatedProperties){if(bw.animatedProperties[bA]!==true){e=false}}if(e){if(bw.←
overflow!=null&&!b.support.shrinkWrapBlocks){b.each(["","X","Y"],function(bC,bD){bz.←
style["overflow"+bD]=bw.overflow[bC])}if(bw.hide){b(bz).hide()}if(bw.hide||bw.show){for(bA
in bw.animatedProperties){b.style(bz,bA,bw.orig[bA]);b.removeData(bz,"fxshow"+bA,true);b.←
removeData(bz,"toggle"+bA,true)}}}bv=bw.complete;if(bv){bw.complete=false;bv.call(bz)}return
false}else{if(bw.duration==Infinity){this.now=bx}else{bB=bx-this.startTime;this.state=bB/bw.duration;this.pos=b.←
easing[bw.animatedProperties[this.prop]](this.state,bB,0,1,bw.duration);this.now=this.start+((this.end-this.←
start)*this.pos)}this.update()}return true}}
```

Definition at line 30 of file jquery.js.

```
14.18.2.20 var V =/^t(?:able|d|h)$/i
```

Definition at line 30 of file jquery.js.

```
14.18.2.21 window
```

Definition at line 31 of file jquery.js.

```
14.18.2.22 Z =aI|aX
```

Definition at line 28 of file jquery.js.

## 14.19 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/eb\_ieaphsp\_source/docs/output/ht \_0.js File Reference

### Variables

- var [searchData](#)

14.19.1.1 var searchData

**Initial value:**

```
=  
[  
  ['count', ['count', ['../classEB__IAEASource.html#a59b8aff93bc2a44c9332251a39e03b2d', 1, 'EB_IAEASource']]  
]
```

Definition at line 1 of file all\_0.js.

## 14.20 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/eb\_ieaphsp\_source/docs/output/html/search/all\_1.js File Reference

### Variables

- var [searchData](#)

#### 14.20.1 Variable Documentation

14.20.1.1 var searchData

**Initial value:**

```
=  
[  
  ['eb_5fiaeaphsp_5fsource_2eh', ['eb_ieaphsp_source.h', ['../eb_ieaphsp_source_8h.html', 1, '' ]],  
  ['eb_5fiaeasource', ['EB_IAEASource', ['../classEB__IAEASource.html', 1, 'EB_IAEASource']],  
   ['../classEB__IAEASource.html#a5bf2bf03f93fc7087cd4f8d70f5510f2', 1, 'EB_IAEASource::EB_IAEASource()' ]],  
  ['emax', ['Emax', ['../classEB__IAEASource.html#a085ddd3e29afb1705532e4d7f98f5e6d', 1, 'EB_IAEASource']]],  
  ['emin', ['Emin', ['../classEB__IAEASource.html#acc52ee4da87b7a324436a5b400d6d635', 1, 'EB_IAEASource']]]  
]
```

Definition at line 1 of file all\_1.js.

## 14.21 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/eb\_ieaphsp\_source/docs/output/html/search/all\_2.js File Reference

### Variables

- var [searchData](#)

### 14.21.1 Variable Documentation

#### 14.21.1.1 var searchData

**Initial value:**

```
=
[
  ['nfirst', ['Nfirst', ['../classEB__IAEASource.html#a1e8b0e2d9508a824b64cf5760c5bbe9', 1, 'EB__IAEASource']]],
  ['nincident', ['Nincident', ['../classEB__IAEASource.html#a481aba1172d6618b31c7bbb7079f27f0', 1, 'EB__IAEASource']]],
  ['nlast', ['Nlast', ['../classEB__IAEASource.html#a5622aaa2e72c01a870c3368233db7d22', 1, 'EB__IAEASource']]],
  ['nparticle', ['Nparticle', ['../classEB__IAEASource.html#a5d88acc7dde735592b5fd4838f924485', 1, 'EB__IAEASource']]],
  ['nphoton', ['Nphoton', ['../classEB__IAEASource.html#a23605d1c842fa0b0c74214e78913f512', 1, 'EB__IAEASource']]],
  ['npos', ['Npos', ['../classEB__IAEASource.html#a5f4212bfae2ec3a680cf45733077f7d9', 1, 'EB__IAEASource']]],
  ['nread', ['Nread', ['../classEB__IAEASource.html#aa8775c096863828b09f3c3f177597786', 1, 'EB__IAEASource']]],
  ['nused', ['Nused', ['../classEB__IAEASource.html#abd7f7c192839e8af9b4cd69617f528e8', 1, 'EB__IAEASource']]]
]
```

Definition at line 1 of file all\_2.js.

## 14.22 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/eb\_ieaphsp\_source/docs/output/ht \_3.js File Reference

### Variables

- var [searchData](#)

#### 14.22.1 Variable Documentation

##### 14.22.1.1 var searchData

**Initial value:**

```
=
[
  ['phsp_5ffile', ['phsp_file', ['../classEB__IAEASource.html#af46258bcd9e3d0cf7a9962212f04c84f', 1, 'EB__IAEASource']]],
  ['phsp_5ffile_5fname', ['phsp_file_name', ['../classEB__IAEASource.html#a14c4912c7ce7ce4bc716f713b541acab', 1, 'EB__IAEASource']]]
]
```

Definition at line 1 of file all\_3.js.

## 14.23 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/eb\_ieaphsp\_source/docs/output/ht \_0.js File Reference

### Variables

- var [searchData](#)

14.23.1.1 var searchData

**Initial value:**

```
=  
[  
  ['eb_5fiaeasource', ['EB_IAEASource', ['../classEB__IAEASource.html', 1, '' ]]]  
]
```

Definition at line 1 of file classes\_0.js.

14.24 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/eb\_ieaphsp\_source/docs/output/html/search/files\_0.js File Reference

Variables

- var [searchData](#)

14.24.1 Variable Documentation

14.24.1.1 var searchData

**Initial value:**

```
=  
[  
  ['eb_5fiaeaphsp_5fsource_2eh', ['eb_ieaphsp_source.h', ['../eb_ieaphsp_source_8h.html', 1, '' ]]]  
]
```

Definition at line 1 of file files\_0.js.

14.25 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/eb\_ieaphsp\_source/docs/output/html/search/files\_0.js File Reference

Variables

- var [searchData](#)

## 14.25.1 Variable Documentation

### 14.25.1.1 var searchData

#### Initial value:

```
=  
[  
  ['eb_5fiaeasource', ['EB_IAEASource', ['.../classEB__IAEASource.html#a5bf2bf03f93fc7087cd4f8d70f5510f2', 1,  
    'EB_IAEASource']]  
]
```

Definition at line 1 of file functions\_0.js.

## 14.26 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/eb\_ieaphsp\_source/docs/output/ht File Reference

### Functions

- function `convertTold` (`search`)
- function `getXPos` (`item`)
- function `getYPos` (`item`)
- function `SearchBox` (`name, resultsPath, inFrame, label`)
- function `SearchResults` (`name`)
- function `setKeyActions` (`elem, action`)
- function `setClassAttr` (`elem, attr`)
- function `createResults` ()

### Variables

- var `indexSectionsWithContent`
- var `indexSectionNames`

## 14.26.1 Function Documentation

### 14.26.1.1 function convertTold ( `search` )

Definition at line 26 of file search.js.

### 14.26.1.2 function createResults ( )

Definition at line 747 of file search.js.

### 14.26.1.3 function getXPos ( `item` )

Definition at line 49 of file search.js.

**Reference**

14.26.1.4 `function getYPos ( item )`

Definition at line 63 of file search.js.

14.26.1.5 `function SearchBox ( name, resultsPath, inFrame, label )`

Definition at line 84 of file search.js.

14.26.1.6 `function SearchResults ( name )`

Definition at line 429 of file search.js.

14.26.1.7 `function setClassAttr ( elem, attr )`

Definition at line 741 of file search.js.

14.26.1.8 `function setKeyActions ( elem, action )`

Definition at line 734 of file search.js.

## 14.26.2 Variable Documentation

14.26.2.1 `var indexSectionNames`

**Initial value:**

```
=  
{  
  0: "all",  
  1: "classes",  
  2: "files",  
  3: "functions",  
  4: "variables"  
}
```

Definition at line 17 of file search.js.

14.26.2.2 `var indexSectionsWithContent`

**Initial value:**

```
=  
{  
  0: "cencp",  
  1: "e",  
  2: "e",  
  3: "e",  
  4: "cencp"  
}
```

Definition at line 8 of file search.js.

## 14.27 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/eb\_ieaphsp\_source/docs/output/ht \_0.js File Reference

### Variables

- var `searchData`

#### 14.27.1 Variable Documentation

##### 14.27.1.1 var searchData

###### Initial value:

```
=  
[  
  ['count', ['count', ['.../classEB__IAEASource.html#a59b8aff93bc2a44c9332251a39e03b2d', 1, 'EB__IAEASource']]  
]
```

Definition at line 1 of file variables\_0.js.

## 14.28 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/eb\_ieaphsp\_source/docs/output/ht \_1.js File Reference

### Variables

- var `searchData`

#### 14.28.1 Variable Documentation

##### 14.28.1.1 var searchData

###### Initial value:

```
=  
[  
  ['emax', ['Emax', ['.../classEB__IAEASource.html#a085ddd3e29afb1705532e4d7f98f5e6d', 1, 'EB__IAEASource']]],  
  ['emin', ['Emin', ['.../classEB__IAEASource.html#acc52ee4da87b7a324436a5b400d6d635', 1, 'EB__IAEASource']]]  
]
```

Definition at line 1 of file variables\_1.js.

## 14.29 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/eb\_ieaphsp\_source/docs/output/ht \_2.js File Reference

### Variables

- var `searchData`

#### 14.29.1.1 var searchData

**Initial value:**

```
=  
[  
  ['nfirst', ['Nfirst', ['../classEB__IAEASource.html#a1e8b0e2d9508a824b64cf5760c5bbe9', 1, 'EB_IAEASource']]],  
  ['nincident', ['Nincident', ['../classEB__IAEASource.html#a481aba1172d6618b31c7bbb7079f27f0', 1, 'EB_IAEASource']]],  
  ['nlast', ['Nlast', ['../classEB__IAEASource.html#a5622aaa2e72c01a870c3368233db7d22', 1, 'EB_IAEASource']]],  
  ['nparticle', ['Nparticle', ['../classEB__IAEASource.html#a5d88acc7dde735592b5fd4838f924485', 1, 'EB_IAEASource']]],  
  ['nphoton', ['Nphoton', ['../classEB__IAEASource.html#a23605d1c842fa0b0c74214e78913f512', 1, 'EB_IAEASource']]],  
  ['npos', ['Npos', ['../classEB__IAEASource.html#a5f4212bfae2ec3a680cf45733077f7d9', 1, 'EB_IAEASource']]],  
  ['nread', ['Nread', ['../classEB__IAEASource.html#aa8775c096863828b09f3c3f177597786', 1, 'EB_IAEASource']]],  
  ['nused', ['Nused', ['../classEB__IAEASource.html#abd7f7c192839e8af9b4cd69617f528e8', 1, 'EB_IAEASource']]]]
```

Definition at line 1 of file variables\_2.js.

### 14.30 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/eb\_ieaphsp\_source/docs/output/html/search/variables\_3.js File Reference

#### Variables

- var searchData

#### 14.30.1 Variable Documentation

##### 14.30.1.1 var searchData

**Initial value:**

```
=  
[  
  ['phsp_5ffile', ['phsp_file', ['../classEB__IAEASource.html#af46258bcd9e3d0cf7a9962212f04c84f', 1, 'EB_IAEASource']]],  
  ['phsp_5ffile_5fname', ['phsp_file_name', ['../classEB__IAEASource.html#a14c4912c7ce7ce4bc716f713b541acab', 1, 'EB_IAEASource']]]]
```

Definition at line 1 of file variables\_3.js.

### 14.31 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/eb\_ieaphsp\_source/eb\_ieaphsp\_source.cpp File Reference

```
#include <sstream>  
#include "eb_ieaphsp_source.h"  
#include "egs_application.h"  
#include "egs_input.h"  
#include "egs_functions.h"  
Include dependency graph for eb_ieaphsp_source.cpp:
```

## 14.32 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/eb\_ieaphsp\_source/eb\_ieaphsp\_source.h File Reference

a minimal IAEA phase space source for egs\_brachy

```
#include "egs_config1.h"
#include "egs_vector.h"
#include "egs_base_source.h"
#include "egs_rndm.h"
#include "egs_alias_table.h"
#include "../iaea_phsp/iaea_phsp.h"
#include <fstream>
```

Include dependency graph for eb\_ieaphsp\_source.h: This graph shows which files directly or indirectly include this file:

### Classes

- class [EB\\_IAEASource](#)  
*A phase space file source for egs\_brachy.*

### Macros

- `#define EB_IAEA_SOURCE_EXPORT`
- `#define EB_IAEA_SOURCE_LOCAL`

#### 14.32.1 Detailed Description

a minimal IAEA phase space source for egs\_brachy

A minimal IAEA phsp source for use with egs\_brachy.

See the [EB\\_IAEASource](#) page for input details.

#### 14.32.2 Macro Definition Documentation

##### 14.32.2.1 #define EB\_IAEA\_SOURCE\_EXPORT

Definition at line 75 of file eb\_ieaphsp\_source.h.

##### 14.32.2.2 #define EB\_IAEA\_SOURCE\_LOCAL

Definition at line 76 of file eb\_ieaphsp\_source.h.

## 14.33 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/eb\_volcor.cpp File Reference

Main implementation of volume correction routines.

```
#include <eb_volcor.h>
#include <iostream>
#include <fstream>
#include "gzstream.h"
Include dependency graph for eb_volcor.cpp:
```

### Namespaces

- [ebvolcor](#)

### Functions

- [bool ebvolcor::isGZip \(istream &vfile\)](#)
- [EGS\\_Float ebvolcor::getShapeVolume \(EGS\\_Input \\*shape\\_inp\)](#)
- [void ebvolcor::readVolumes \(istream &vfile, vector< RegVolume > &reg\\_volumes\)](#)
- [int ebvolcor::loadVolumes \(string fname, vector< RegVolume > &reg\\_volumes\)](#)

#### 14.33.1 Detailed Description

Main implementation of volume correction routines.

#### Author

Randle Taylor ([randle.taylor@gmail.com](mailto:randle.taylor@gmail.com))

## 14.34 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/eb\_volcor.h File Reference

Volume correction routines for egs\_brachy.

```
#include <map>
#include <set>
#include <cstdlib>
#include "egs_functions.h"
#include "egs_input.h"
#include "egs_rndm.h"
#include "egs_shapes.h"
#include "phantom.h"
#include "ginfo.h"
#include "timing.h"
#include "egs_autoenvelope/egs_sobol.h"
```

Include dependency graph for eb\_volcor.h: This graph shows which files directly or indirectly include this file:

## Classes

- class `ebvolcor::Options`  
*Volume correction initialization helper class.*
- struct `ebvolcor::Results`  
*Struct used to collect and output results about a volume correction run.*
- struct `ebvolcor::FileResults`
- class `ebvolcor::VolumeCorrector`  
*An object for controlling the volume correction routine.*

## Namespaces

- `ebvolcor`

## Typedefs

- typedef pair< int, int > `ebvolcor::PhantRegT`  
*PhantRegT is a pair of the form (PhantomNumber, PhantomRegion) e.g. a pair of (2, 12) would represent region 12 (i.e. the 13th region) of phantom 2 (i.e. the 3rd phantom)*
- typedef pair< int, EGS\_Float > `ebvolcor::RegVolume`  
*RegVolumeT is a pair of the form (RegionNumber, Volume)*
- typedef std::map< PhantRegT, EGS\_I64 > `ebvolcor::HitCounterT`  
*HitCounterT is used for counting how many random points land in a given phantoms region.*

## Enumerations

- enum `ebvolcor::VolCorMode` { `ebvolcor::NO_CORRECTION`, `ebvolcor::ZERO_DOSE`, `ebvolcor::CORRECT_VOLUME` }

### 14.34.1 Detailed Description

Volume correction routines for egs\_brachy.

#### Author

Randle Taylor ([randle.taylor@gmail.com](mailto:randle.taylor@gmail.com))

#### Version

0.1

The source specific volume correction here is identical to the one used by the egs\_autoenvelope geometry. There is also an additional general purpose volume correction routine to allow for correcting volumes of multiple overlapping phantoms.

egs\_brachy uses its own volume correction routines to allow for correction of arbitrary phantom types (rather than just auto\_envelopes). In practice this may not be required and the autoenvelope volume corrections and the egs←\_brachy volume correction routines(eb\_volcor) can be factored out and combined into a single general purpose MC volume correction library.

## 14.35 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/egs\_brachy.cpp File Reference

the main egs\_brachy application implementation file

```
#include <algorithm>
#include <fstream>
#include <string>
#include <iomanip>
#include <assert.h>
#include "gzstream.h"
#include "zlib.h"
#include "egs_brachy.h"
#include "egs_ausgab_object.h"
#include "egs_rndm.h"
#include "egs_run_control.h"
Include dependency graph for egs_brachy.cpp:
```

### Macros

- #define egsGetRNGPointers F77\_OBJ\_(egs\_get\_rng\_pointers,EGS\_GET\_RNG\_POINTERS)
- #define egsGetRNGArray F77\_OBJ\_(egs\_get\_rng\_array,EGS\_GET\_RNG\_ARRAY)
- #define egsSetRNGState F77\_OBJ\_(egs\_set\_rng\_state,EGS\_SET\_RNG\_STATE)
- #define egsGetSteps F77\_OBJ\_(egs\_get\_steps,EGS\_GET\_STEPS)
- #define egsSetSteps F77\_OBJ\_(egs\_set\_steps,EGS\_SET\_STEPS)
- #define egsOpenUnits F77\_OBJ\_(egs\_open\_units,EGS\_OPEN\_UNITS)
- #define egsGetElectronData F77\_OBJ\_(egs\_get\_electron\_data,EGS\_GET\_ELECTRON\_DATA)
- #define egsGetPhotonData F77\_OBJ\_(egs\_get\_photon\_data,EGS\_GET\_PHOTON\_DATA)

### Functions

- \_\_extc\_\_ void egsGetRNGPointers (EGS\_I32 \*, EGS\_I32 \*)
- \_\_extc\_\_ void egsGetRNGArray (EGS\_Float \*)
- \_\_extc\_\_ void egsSetRNGState (const EGS\_I32 \*, const EGS\_Float \*)
- \_\_extc\_\_ void egsGetSteps (double \*, double \*)
- \_\_extc\_\_ void egsSetSteps (const double \*, const double \*)
- \_\_extc\_\_ void egsOpenUnits (const EGS\_I32 \*)
- \_\_extc\_\_ void egsGetElectronData (void(\*func)(EGS\_I32 \*, EGS\_Float \*, EGS\_Float \*, EGS\_Float \*, EGS\_Float \*), const EGS\_I32 \*, const EGS\_I32 \*)
- \_\_extc\_\_ void egsGetPhotonData (void(\*func)(EGS\_I32 \*, EGS\_Float \*, EGS\_Float \*, EGS\_Float \*, EGS\_Float \*, EGS\_Float \*), const EGS\_I32 \*, const EGS\_I32 \*)
- void F77\_OBJ\_ (egs\_scale\_xcc, EGS\_SCALE\_XCC)(const int \*)
- void const EGS\_Float \*void F77\_OBJ\_ (egs\_scale\_bc, EGS\_SCALE\_BC)(const int \*)
- void const EGS\_Float \*void const EGS\_Float \*void F77\_OBJ\_ (egs\_bcse, EGS\_BCSE)(const int \*)
- void const EGS\_Float \*void const EGS\_Float \*void const EGS\_Float \*void F77\_OBJ\_ (egs\_uniform\_photons, EGS\_UNIFORM\_PHOTONS)(const int \*)
- void const EGS\_Float \*void const EGS\_Float \*void const EGS\_Float \*void const EGS\_Float \*void printParticleWithSpherical (EGS\_Particle p)
- bool containsInclude (string str)
- map< string, string > getMuenForMedia (EGS\_Input \*scoring\_options)
- APP\_MAIN (EB\_Application)

### 14.35.1 Detailed Description

the main egs\_brachy application implementation file

#### Author

Randle Taylor ([randle.taylor@gmail.com](mailto:randle.taylor@gmail.com))

### 14.35.2 Macro Definition Documentation

14.35.2.1 `#define egsGetElectronData F77_OBJ_(egs_get_electron_data,EGS_GET_ELECTRON_DATA)`

Definition at line 73 of file egs\_brachy.cpp.

14.35.2.2 `#define egsGetPhotonData F77_OBJ_(egs_get_photon_data,EGS_GET_PHOTON_DATA)`

Definition at line 76 of file egs\_brachy.cpp.

14.35.2.3 `#define egsGetRNGArray F77_OBJ_(egs_get_rng_array,EGS_GET_RNG_ARRAY)`

Definition at line 63 of file egs\_brachy.cpp.

14.35.2.4 `#define egsGetRNGPointers F77_OBJ_(egs_get_rng_pointers,EGS_GET_RNG_POINTERS)`

Definition at line 61 of file egs\_brachy.cpp.

14.35.2.5 `#define egsGetSteps F77_OBJ_(egs_get_steps,EGS_GET_STEPS)`

Definition at line 67 of file egs\_brachy.cpp.

14.35.2.6 `#define egsOpenUnits F77_OBJ_(egs_open_units,EGS_OPEN_UNITS)`

Definition at line 71 of file egs\_brachy.cpp.

14.35.2.7 `#define egsSetRNGState F77_OBJ_(egs_set_rng_state,EGS_SET_RNG_STATE)`

Definition at line 65 of file egs\_brachy.cpp.

14.35.2.8 `#define egsSetSteps F77_OBJ_(egs_set_steps,EGS_SET_STEPS)`

Definition at line 69 of file egs\_brachy.cpp.

### 14.35.3 Function Documentation

14.35.3.1 `APP_MAIN( EB_Application )`

14.35.3.2 `bool containsInclude( string str )`

Definition at line 283 of file egs\_brachy.cpp.

14.35.3.3 `__extc__ void egsGetElectronData( void(*)(EGS_I32 *, EGS_Float *, EGS_Float *, EGS_Float *, EGS_Float *) func, const EGS_I32 * , const EGS_I32 * )`

14.35.3.4 `__extc__ void egsGetPhotonData( void(*)(EGS_I32 *, EGS_Float *, EGS_Float *, EGS_Float *, EGS_Float *) func, const EGS_I32 * , const EGS_I32 * )`

14.35.3.5 `__extc__ void egsGetRNGArray( EGS_Float * )`

14.35.3.6 `__extc__ void egsGetRNGPointers( EGS_I32 * , EGS_I32 * )`

14.35.3.7 `__extc__ void egsGetSteps( double * , double * )`

14.35.3.8 `__extc__ void egsOpenUnits( const EGS_I32 * )`

14.35.3.9 `__extc__ void egsSetRNGState( const EGS_I32 * , const EGS_Float * )`

14.35.3.10 `__extc__ void egsSetSteps( const double * , const double * )`

14.35.3.11 `void F77_OBJ_( egs_scale_xcc , EGS_SCALE_XCC ) const`

14.35.3.12 `void const EGS_Float* void F77_OBJ_( egs_scale_bc , EGS_SCALE_BC ) const`

14.35.3.13 `void const EGS_Float* void const EGS_Float* void F77_OBJ_( egs_bcse , EGS_BCSE ) const`

14.35.3.14 `void const EGS_Float* void const EGS_Float* void const EGS_Float* void F77_OBJ_( egs_uniform_photons , EGS_UNIFORM_PHOTONS ) const`

14.35.3.15 `map<string, string> getMuenForMedia( EGS_Input * scoring_options )`

Definition at line 1058 of file egs\_brachy.cpp.

14.35.3.16 `void const EGS_Float* void const EGS_Float* void const EGS_Float* void const EGS_Float* void printParticleWithSpherical( EGS_Particle p )`

Definition at line 86 of file egs\_brachy.cpp.

## 14.36 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/egs\_brachy.h File Reference

the main egs\_brachy application header file

```
#include <map>
#include <set>
#include <stack>
#include <cstdlib>
#include "egs_advanced_application.h"
#include "egs_functions.h"
#include "egs_input.h"
#include "egs_interface2.h"
#include "egs_interpolator.h"
#include "egs_alias_table.h"
#include "egs_rndm.h"
#include "egs_scoring.h"
#include "egs_transformations.h"
#include "egs_autoenvelope/egs_autoenvelope.h"
#include "egs_rz/egs_rz.h"
#include "egs_spheres/egs_spheres.h"
#include "pubsub.h"
#include "ginfo.h"
#include "muen.h"
#include "phantom.h"
#include "eb_volcor.h"
#include "spec_scoring.h"
#include "recycle.h"
#include "latch.h"
#include "phsp.h"
#include "timing.h"
```

Include dependency graph for egs\_brachy.h: This graph shows which files directly or indirectly include this file:

### Classes

- class [EB\\_Application](#)

*The main egs\_brachy application class. See the [Main Page](#) for full documentation.*

### Macros

- #define [PRINT\\_PARTICLE\(P\)](#) cout << "\nParticle in reg "<<P.ir << " at "<<P.x.x << " <<P.x.y <<
 " <<P.x.z << " wt "<<P.wt<< " E "<<P.E << " q "<<P.q << " latch "<<P.latch<<endl;
- #define [PRINT\\_PARTICLE\\_WITH\\_DIR\(P\)](#) cout << "\nParticle in reg "<<P.ir << " at "<<P.x.x <<
 " <<P.x.y << " <<P.x.z << " dir "<<P.u.x << " <<P.u.y << " <<P.u.z << " wt "<<P.wt << " E "<<P.E
 << " q "<<P.q << " latch "<<P.latch<<endl;
- #define [NUM\\_STUCK\\_STEPS](#) 1000
- #define [SAME\\_POSITION\\_TOLERANCE](#) 1E-10
- #define [EB\\_EPSILON](#) 1E-10

### 14.36.1 Detailed Description

the main egs\_brachy application header file

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## 14.36.2 Macro Definition Documentation

14.36.2.1 `#define EB_EPSILON 1E-10`

Definition at line 84 of file egs\_brachy.h.

14.36.2.2 `#define NUM_STUCK_STEPS 1000`

Definition at line 82 of file egs\_brachy.h.

14.36.2.3 `#define PRINT_PARTICLE( P ) cout << "\nParticle in reg "<<P.ir << " at "<<P.x.x << " "<<P.x.y << " "<<P.x.z << " wt "<<P.wt<< " E "<<P.E << " q "<<P.q << " latch "<<P.latch<<endl;`

Definition at line 80 of file egs\_brachy.h.

14.36.2.4 `#define PRINT_PARTICLE_WITH_DIR( P ) cout << "\nParticle in reg "<<P.ir << " at "<<P.x.x << " "<<P.x.y << " "<<P.x.z << " dir "<<P.u.x << " "<<P.u.y << " "<<P.u.z << " wt "<<P.wt<< " E "<<P.E << " q "<<P.q << " latch "<<P.latch<<endl;`

Definition at line 81 of file egs\_brachy.h.

14.36.2.5 `#define SAME_POSITION_TOLERANCE 1E-10`

Definition at line 83 of file egs\_brachy.h.

## 14.37 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/ginfo.cpp File Reference

implementation of Geometry Info class.

```
#include "ginfo.h"
#include <limits>
#include <algorithm>
#include <iostream>
Include dependency graph for ginfo.cpp:
```

### Typedefs

- `typedef pair< string, vector< int > > CDGeomRegType`

## Functions

- bool `pairCompare` (const **CDGeomRegType** &firstElem, const **CDGeomRegType** &secondElem)
- string `join` (const vector< string > &v, string delim)
- size\_t `countAutoEnvelopeInscribed` (EGS\_Input \*input)
- string `getGeomBaseName` (EGS\_Input \*input)
- vector< string > `getAutoEnvelopeChildren` (EGS\_Input \*input)
- vector< string > `getGEnvelopeChildren` (EGS\_Input \*input)
- vector< string > `getCDChildren` (EGS\_Input \*input)
- vector< string > `getNDChildren` (EGS\_Input \*input)
- vector< string > `getUnionChildren` (EGS\_Input \*input)
- vector< string > `getGStackChildren` (EGS\_Input \*input)
- int `findGeomInVec` (EGS\_BaseGeometry \*geom, vector< string > geoms)
- int `maxNRegOfGeoms` (vector< string > gnames, int start)
- int `nregForSubDiv` (**GeomRegionInfo** gri, int idx)

### 14.37.1 Detailed Description

implementation of Geometry Info class.

### 14.37.2 Typedef Documentation

#### 14.37.2.1 `typedef pair<string, vector<int>> CDGeomRegType`

Definition at line 48 of file ginfo.cpp.

### 14.37.3 Function Documentation

#### 14.37.3.1 `size_t countAutoEnvelopeInscribed ( EGS_Input * input )`

Definition at line 150 of file ginfo.cpp.

#### 14.37.3.2 `int findGeomInVec ( EGS_BaseGeometry * geom, vector< string > geoms )`

Definition at line 345 of file ginfo.cpp.

#### 14.37.3.3 `vector<string> getAutoEnvelopeChildren ( EGS_Input * input )`

Definition at line 190 of file ginfo.cpp.

#### 14.37.3.4 `vector<string> getCDChildren ( EGS_Input * input )`

Definition at line 222 of file ginfo.cpp.

14.37.3.5 `vector<string> getGEnvelopeChildren ( EGS_Input * input )`

Definition at line 213 of file ginfo.cpp.

14.37.3.6 `string getGeomBaseName ( EGS_Input * input )`

Definition at line 182 of file ginfo.cpp.

14.37.3.7 `vector<string> getGStackChildren ( EGS_Input * input )`

Definition at line 306 of file ginfo.cpp.

14.37.3.8 `vector<string> getNDChildren ( EGS_Input * input )`

Definition at line 281 of file ginfo.cpp.

14.37.3.9 `vector<string> getUnionChildren ( EGS_Input * input )`

Definition at line 298 of file ginfo.cpp.

14.37.3.10 `string join ( const vector< string > & v, string delim )`

Definition at line 56 of file ginfo.cpp.

14.37.3.11 `int maxNRegOfGeoms ( vector< string > gnames, int start )`

Definition at line 357 of file ginfo.cpp.

14.37.3.12 `int nregForSubDiv ( GeomRegionInfo gri, int idx )`

Definition at line 368 of file ginfo.cpp.

14.37.3.13 `bool pairCompare ( const CDGeomRegType & firstElem, const CDGeomRegType & secondElem )`

Definition at line 51 of file ginfo.cpp.

## 14.38 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/ginfo.h File Reference

ginfo contains classes for organizing information about the geometries present in an egs\_brachy simulation.

```
#include <map>
#include <set>
#include <cstdlib>
#include <algorithm>
#include "egs_functions.h"
#include "egs_input.h"
#include "phantom.h"
```

Include dependency graph for ginfo.h: This graph shows which files directly or indirectly include this file:

### Classes

- class [Node](#)
- struct [GeomRegionInfo](#)  
*a struct to contain elementary information aboud a geometry*
- class [GeomInfo](#)  
*a container for organizing meta data about the geometries*

### TypeDefs

- typedef pair< EGS\_BaseGeometry \*, int > [GeomRegT](#)  
*pair of geometry and local region number*
- typedef map< string, [GeomRegionInfo](#) > [GeomRegionInfoMapT](#)  
*a mapping from geometry name to information about that geometry*

#### 14.38.1 Detailed Description

ginfo contains classes for organizing information about the geometries present in an egs\_brachy simulation.

#### 14.38.2 Typedef Documentation

##### 14.38.2.1 `typedef map<string, GeomRegionInfo> GeomRegionInfoMapT`

a mapping from geometry name to information about that geometry

Definition at line 95 of file ginfo.h.

##### 14.38.2.2 `typedef pair<EGS_BaseGeometry *, int> GeomRegT`

pair of geometry and local region number

Definition at line 79 of file ginfo.h.

## 14.39 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/gzstream/gzstream.C File Reference

```
#include <gzstream.h>
#include <iostream>
#include <string.h>
Include dependency graph for gzstream.C:
```

## 14.40 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/gzstream/gzstream.h File Reference

```
#include <iostream>
#include <fstream>
#include <zlib.h>
```

Include dependency graph for gzstream.h: This graph shows which files directly or indirectly include this file:

### Classes

- class [gzstreambuf](#)
- class [gzstreambase](#)
- class [igzstream](#)
- class [ogzstream](#)

## 14.41 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/gzstream/LICENSE.txt File Reference

### Functions

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## Variables

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In mere aggregation of another **work not based on the Library with the you** must alter all the notices that refer to this **so that they** refer to the ordinary GNU General Public instead of to this **it** is irreversible for **that so** the ordinary GNU General Public **License** applies to all subsequent **copies and** derivative works made from **that copy** This option is useful when **you** wish to **copy** part of the **code** of the **Library** into a program **that is not a library** You may **copy and distribute** the which must be **distributed** under the **terms of Sections and above** on a medium customarily used for **software** interchange **If** distribution of object **code** is made by offering access to **copy** from a designated then offering equivalent access to **copy** the source **code** from the same **place** satisfies the requirement to **distribute** the source even though third parties are **not** compelled to **copy** the source along **with** the object **code** A program **that** contains no derivative of **any** portion of the **but** is designed to **work with** the **Library** by being compiled **or linked with** is called a **work that uses the Library** Such a **in** is **not** a derivative **work** of the **and** therefore falls outside the scope of this **License** linking a **work that uses the Library with the Library** creates an **executable that** is a derivative of the **rather than a work that uses the library** The **executable** is therefore covered by this **License Section** states **terms** for distribution of such **executables** When a **work that uses the Library** uses material from a header file **that** is part of the **the object code** for the **work** may be a derivative **work** of the **Library** even though the source **code** is **not** Whether this is true is especially significant if the **work** can be linked without the **or if the work is itself a library** The threshold for this to be true is **not** precisely defined by law **If** such an object file uses only numerical data structure layouts **and and** small macros **and small** then the **use** of the object file is **unrestricted**

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  - **and**
  - if the **work** is an executable linked **with the with** the complete machine readable **work that uses the as object code and or source so that** the user can **modify** the **Library and** then relink to produce a modified executable containing the modified **rather than copying library functions** into the **executable**
  - if the **work** is an executable linked **with the with** the complete machine readable **work that uses the as object code and or source so that** the user can **modify** the **Library and** then relink to produce a modified **executable** containing the modified **rather than copying library functions** into the **if the user installs one**
  - if the **work** is an executable linked **with the with** the complete machine readable **work that uses the as object code and or source so that** the user can **modify** the **Library and** then relink to produce a modified **executable** containing the modified **rather than copying library functions** into the **if the user installs as long as the modified version is interface compatible with the version that the work was made with c Accompany the work with a written offer**
  - if the **work** is an executable linked **with the with** the complete machine readable **work that uses the as object code and or source so that** the user can **modify** the **Library and** then relink to produce a modified **executable** containing the modified **rather than copying library functions** into the **if the user installs as long as the modified version is interface compatible with the version that the work was made with c Accompany the work with a written valid for at least three years**
  - if the **work** is an executable linked **with the with** the complete machine readable **work that uses the as object code and or source so that** the user can **modify** the **Library and** then relink to produce a modified **executable**

containing the modified rather than copying library functions into the if the user installs as long as the modified version is interface compatible with the version that the work was made with c Accompany the work with a written valid for at least three to give the same user the materials specified in Subsection

- if the work is an executable linked with the with the complete machine readable work that uses the as object code and or source so that the user can modify the Library and then relink to produce a modified executable containing the modified rather than copying library functions into the if the user installs as long as the modified version is interface compatible with the version that the work was made with c Accompany the work with a written valid for at least three to give the same user the materials specified in for a charge no more than the cost of performing this distribution d If distribution of the work is made by offering access to copy from a designated offer equivalent access to copy the above specified materials from the same place e Verify that the user has already received a copy of these materials or that you have already sent this user a copy For an the required form of the work that uses the Library must include any data and utility programs needed for reproducing the executable from it as a special exception
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the user has already received a **copy** of **these** materials or that you have already sent this user a **copy** For an the required form of the **work** that uses the **Library** must include **any** data and utility programs needed for reproducing the **executable** from it as a special the materials to be distributed need **not** include anything that is normally and so on of the operating **system** on which the **executable** unless that component itself accompanies the **executable** It may happen that this requirement contradicts the **license** restrictions of other proprietary **libraries** that do **not** normally accompany the operating **system** Such a contradiction means **you** cannot **use** both them and the **Library** together in an **executable** that you **distribute** You may **place** library facilities that are a **work** based on the **Library** side by side in a single **library** together with other **library** facilities **not** covered by this and **distribute** such a combined provided that the separate distribution of the **work** based on the **Library** and of the other **library** facilities is otherwise and provided that you do these two uncombined with **any other library** facilities This must be **distributed** under the **terms** of the Sections above b Give prominent notice with the combined **library** of the fact that part of it is a **work** based on the and explaining where to find the accompanying uncombined form of the same **work** You may not link with

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## 14.42 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/latch.cpp File Reference

methods for setting/checking latch bits for egs\_brachy

```
#include "latch.h"
Include dependency graph for latch.cpp:
```

#### 14.42.1 Detailed Description

methods for setting/checking latch bits for egs\_brachy

### 14.43 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/latch.h File Reference

handle particles latch bits for egs\_brachy

```
#include "egs_advanced_application.h"
#include "pubsub.h"
```

Include dependency graph for latch.h: This graph shows which files directly or indirectly include this file:

#### Classes

- class [Latch](#)

*A class for handling latch bits relevant to egs\_brachy. The [Latch](#) class listens for particle events and sets/unsets latch bits on the particle based on the event type.*

#### 14.43.1 Detailed Description

handle particles latch bits for egs\_brachy

### 14.44 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/lib/geometry/sources/← README.md File Reference

### 14.45 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/muen.h File Reference

Functions for loading muen data from a file.

```
#include <algorithm>
#include <fstream>
#include <string>
#include <iostream>
#include <iostream>
#include <sstream>
#include <map>
#include <cstdlib>
#include <vector>
#include "egs_functions.h"
#include "egs_input.h"
#include "egs_interpolator.h"
```

Include dependency graph for muen.h: This graph shows which files directly or indirectly include this file:

## Classes

- class [muen::MuenDataParser](#)  
*class for parsing muen data from a file.*

## Namespaces

- [muen](#)

## Typedefs

- typedef pair< double, double > [muen::MuenAtET](#)  
*pair of form (energy, muen(energy))*
- typedef map< string, vector< MuenAtET > > [muen::MuenMapT](#)  
*Map from medium name to vector of (e, muen(e)) data for that medium.*

## Functions

- std::vector< std::string > & [muen::split](#) (const std::string &s, char delim, std::vector< std::string > &elems)  
*Split a string on input delimiter.*
- std::vector< std::string > [muen::split](#) (const std::string &s, char delim)  
*Split a string on input delimiter.*

### 14.45.1 Detailed Description

Functions for loading muen data from a file.

#### Author

Randle Taylor ([randle.taylor@gmail.com](mailto:randle.taylor@gmail.com))

## 14.46 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/phantom.cpp File Reference

Implementation of phantom objects.

```
#include <algorithm>
#include <vector>
#include <fstream>
#include "phantom.h"
#include <iomanip>
#include "gzstream.h"
#include "latch.h"
#include "egs_run_control.h"
Include dependency graph for phantom.cpp:
```

## Classes

- struct [RegionResult](#)

## Functions

- bool [tlenRegTopResultCompare](#) (const [RegionResult](#) &firstElem, const [RegionResult](#) &secondElem)
- bool [edepRegTopResultCompare](#) (const [RegionResult](#) &firstElem, const [RegionResult](#) &secondElem)
- string [space2underscore](#) (std::string text)

### 14.46.1 Detailed Description

Implementation of phantom objects.

#### Author

Randle Taylor ([randle.taylor@gmail.com](mailto:randle.taylor@gmail.com))

### 14.46.2 Function Documentation

#### 14.46.2.1 bool [edepRegTopResultCompare](#) ( const [RegionResult](#) & *firstElem*, const [RegionResult](#) & *secondElem* )

Definition at line 76 of file phantom.cpp.

#### 14.46.2.2 string [space2underscore](#) ( std::string *text* )

Definition at line 83 of file phantom.cpp.

#### 14.46.2.3 bool [tlenRegTopResultCompare](#) ( const [RegionResult](#) & *firstElem*, const [RegionResult](#) & *secondElem* )

Definition at line 72 of file phantom.cpp.

## 14.47 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/phantom.h File Reference

Header file for phantom objects.

```
#include <map>
#include <set>
#include "egs_scoring.h"
#include "egs_application.h"
#include "egs_interface2.h"
#include "pubsub.h"
```

Include dependency graph for phantom.h: This graph shows which files directly or indirectly include this file:

## Classes

- class [EB\\_Phantom](#)

*A class to represent a single phantom for scoring dose in egs\_brachy.*

### 14.47.1 Detailed Description

Header file for phantom objects.

#### Author

Randle Taylor ([randle.taylor@gmail.com](mailto:randle.taylor@gmail.com))

## 14.48 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/phsp.cpp File Reference

Implementation of the [PHSPControl](#) object.

```
#include "phsp.h"
#include <sys/types.h>
#include <sys/stat.h>
#include "egs_interface2.h"
#include "iaea_header.h"
Include dependency graph for phsp.cpp:
```

## Functions

- bool [dirExists](#) (string path)  
*return true if input path is an existing directory*

### 14.48.1 Detailed Description

Implementation of the [PHSPControl](#) object.

### 14.48.2 Function Documentation

#### 14.48.2.1 bool [dirExists](#) ( string path )

return true if input path is an existing directory

Definition at line 51 of file phsp.cpp.

## 14.49 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/phsp.h File Reference

Definition of the [PHSPControl](#) object.

```
#include "egs_functions.h"
#include "egs_input.h"
#include "egs_advanced_application.h"
#include "egs_transformations.h"
#include "pubsub.h"
#include "iaea_phsp.h"
```

Include dependency graph for phsp.h: This graph shows which files directly or indirectly include this file:

### Classes

- class [PHSPControl](#)

#### 14.49.1 Detailed Description

Definition of the [PHSPControl](#) object.

## 14.50 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/pubsub.cpp File Reference

```
#include "pubsub.h"
```

Include dependency graph for pubsub.cpp:

## 14.51 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/pubsub.h File Reference

A simple pub/sub module to allow various egs\_brachy classes to subscribe to particle events.

```
#include <list>
#include <string>
#include <map>
```

Include dependency graph for pubsub.h: This graph shows which files directly or indirectly include this file:

### Classes

- class [Subscriber](#)
- class [Publisher](#)

### TypeDefs

- typedef pair< bool, [EB\\_Message](#) > [SendMessage](#)

## Enumerations

- enum `EB_Message` {
 `NEW_HISTORY, PARTICLE_INITIALIZED, PARTICLE_TAKING_STEP, PARTICLE_TOOK_STEP,`
`PARTICLE_ESCAPING_SOURCE, PARTICLE_ESCAPED_SOURCE, PARTICLE_ESCAPING_GEOM,`
`PARTICLE_ESCAPED_GEOM,`
`PHOTON_SCATTER_EVENT, NON_SOURCE_PHOTON_SCATTER_EVENT` }

### 14.51.1 Detailed Description

A simple pub/sub module to allow various egs\_brachy classes to subscribe to particle events.

Adapted from <http://www.cs.sjsu.edu/~pearce/modules/patterns/events/pubsubimp.htm>

### 14.51.2 Typedef Documentation

#### 14.51.2.1 `typedef pair<bool, EB_Message> SendMessage`

Definition at line 69 of file pubsub.h.

### 14.51.3 Enumeration Type Documentation

#### 14.51.3.1 `enum EB_Message`

Enumerator

`NEW_HISTORY`  
`PARTICLE_INITIALIZED`  
`PARTICLE_TAKING_STEP`  
`PARTICLE_TOOK_STEP`  
`PARTICLE_ESCAPING_SOURCE`  
`PARTICLE_ESCAPED_SOURCE`  
`PARTICLE_ESCAPING_GEOM`  
`PARTICLE_ESCAPED_GEOM`  
`PHOTON_SCATTER_EVENT`  
`NON_SOURCE_PHOTON_SCATTER_EVENT`

Definition at line 54 of file pubsub.h.

## 14.52 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/recycle.cpp File Reference

class implementations for recycling

```
#include "recycle.h"
Include dependency graph for recycle.cpp:
```

### 14.52.1 Detailed Description

class imlementations for recycling

## 14.53 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/recycle.h File Reference

class definitions for recycling

```
#include <map>
#include <set>
#include <stack>
#include <cstdlib>
#include "egs_functions.h"
#include "egs_input.h"
#include "egs_rndm.h"
#include "egs_transformations.h"
#include "pubsub.h"
#include "ginfo.h"
#include "latch.h"
```

Include dependency graph for recycle.h: This graph shows which files directly or indirectly include this file:

### Classes

- class [RecycleOpts](#)

### 14.53.1 Detailed Description

class definitions for recycling

## 14.54 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/run\_tests.py File Reference

### Namespaces

- [run\\_tests](#)

### Functions

- def [run\\_tests.dyn\\_import](#) (name)
- def [run\\_tests.create\\_egsinp](#) (test\_module)
- def [run\\_tests.find\\_cpu\\_time](#) (egslist)
- def [run\\_tests.run\\_simulation](#) ()
- def [run\\_tests.cleanup](#) ()
- def [run\\_tests.find\\_tests](#) ()
- def [run\\_tests.run\\_all\\_tests](#) ()

## Variables

- bool `run_tests.VERBOSE` = False
- string `run_tests.timing_hard_fail` = "--timing-hard-fail"
- `run_tests.EGS_HOME` = os.environ["EGS\_HOME"]
- `run_tests.EGS_BRACHY` = os.path.join(EGS\_HOME, "egs\_brachy")
- string `run_tests.USER_CODE` = "egs\_brachy"
- string `run_tests.TEST_EGSINP_FILE` = "eb\_test\_run"
- `run_tests.TEST_EGSINP_PATH_ROOT` = os.path.join(EGS\_BRACHY, TEST\_EGSINP\_FILE)
- string `run_tests.TEST_EGSINP_PATH` = TEST\_EGSINP\_PATH\_ROOT+.egsinp"
- string `run_tests.PASS_FMT` = "%(pass\_fail)s - %(test)s - ran in %(actual\_time).3G s/MHz (%(real\_time).3G s)"
- string `run_tests.TIMING_WARN_FMT`
- string `run_tests.FAIL_FMT`
- string `run_tests.cpu_speed_cmd` = """grep -i "cpu mhz" /proc/cpuinfo | tail -1 | awk -F ":" '{print \$2}"""
- `run_tests.CPU_MHZ` = float(os.environ["CPU\_MHZ"])
- string `run_tests.source` = "CPU\_MHZ env variable"
- `run_tests.p`
- `run_tests.stdin`
- `run_tests.stdout`
- `run_tests.stderr`
- float `run_tests.TIMING_MARGIN` = 1.05

## 14.55 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/spec\_scoring.cpp File Reference

implementation of spectrum scoring classes.

```
#include "spec_scoring.h"
#include <fstream>
#include <stdarg.h>
Include dependency graph for spec_scoring.cpp:
```

## Functions

- std::string `string_format` (const std::string fmt,...)
- string `getFileNameFromPath` (const string &s)

### 14.55.1 Detailed Description

implementation of spectrum scoring classes.

### 14.55.2 Function Documentation

#### 14.55.2.1 string `getFileNameFromPath` ( const string & s )

Definition at line 69 of file spec\_scoring.cpp.

14.55.2.2 `std::string string_format ( const std::string fmt, ... )`

Definition at line 47 of file spec\_scoring.cpp.

## 14.56 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/spec\_scoring.h File Reference

Definition of spectrum scoring classes.

```
#include <sstream>
#include "egs_advanced_application.h"
#include "egs_functions.h"
#include "egs_input.h"
#include "egs_interface2.h"
#include "egs_scoring.h"
#include "ginfo.h"
#include "pubsub.h"
```

Include dependency graph for spec\_scoring.h: This graph shows which files directly or indirectly include this file:

### Classes

- class [EnergyScoringStats](#)  
*a class to use for scoring information about total energy initialized, escaping sources etc*
- class [BaseSpectrumScorer](#)  
*abstract base class for scoring spectrum information*
- class [SurfaceCountSpectrum](#)  
*A class for scoring a histogram of the number of particles escaping a source geometry.*
- class [EnergyWeightedSurfaceSpectrum](#)  
*A class for scoring the energy weighted spectrum (normalized to total radiant energy) of particles on the surface of a source geometry.*
- class [EnergyFluenceSpectrumInVoxel](#)  
*A class for scoring the energy weighted spectrum (normalized to total radiant energy) of particles on the surface of a source geometry.*

### 14.56.1 Detailed Description

Definition of spectrum scoring classes.

## 14.57 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/tests/\_\_init\_\_.py File Reference

### Namespaces

- [tests](#)

14.58 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/tests/brem\_cyl/\_  
init\_\_.py File Reference

#### Namespaces

- [tests.brem\\_cyl](#)

14.59 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/tests/flu\_cutoff/\_  
init\_\_.py File Reference

#### Namespaces

- [tests.flu\\_cutoff](#)

14.60 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/tests/phsp\_run/\_  
init\_\_.py File Reference

#### Namespaces

- [tests.phsp\\_run](#)

14.61 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/tests/phsp\_scoring/\_  
\_init\_\_.py File Reference

#### Namespaces

- [tests.phsp\\_scoring](#)

14.62 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/tests/recycling/\_  
init\_\_.py File Reference

#### Namespaces

- [tests.recycling](#)

14.63 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/tests/scatter/\_init\_  
.py File Reference

#### Namespaces

- [tests.scatter](#)

## 14.64 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/tests/seeds\_in\_xyz/\_\_init\_\_.py File Reference

### Namespaces

- [tests.seeds\\_in\\_xyz](#)

## 14.65 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/tests/seeds\_in\_xyz\_genvelope/\_\_init\_\_.py File Reference

### Namespaces

- [tests.seeds\\_in\\_xyz\\_genvelope](#)

## 14.66 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/tests/simple\_dose\_sph/\_\_init\_\_.py File Reference

### Namespaces

- [tests.simple\\_dose\\_sph](#)

## 14.67 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/tests/single\_generator/\_\_init\_\_.py File Reference

### Namespaces

- [tests.single\\_generator](#)

## 14.68 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/tests/source\_energies/\_\_init\_\_.py File Reference

### Namespaces

- [tests.source\\_energies](#)

## 14.69 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/tests/spec\_absolute/\_\_init\_\_.py File Reference

### Namespaces

- [tests.spec\\_absolute](#)

14.70 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/tests/spec\_eflu/\_  
init\_\_.py File Reference

#### Namespaces

- [tests.spec\\_eflu](#)

14.71 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/tests/spec\_vox/\_  
init\_\_.py File Reference

#### Namespaces

- [tests.spec\\_vox](#)

14.72 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/tests/stepped\_←  
source/\_init\_\_.py File Reference

#### Namespaces

- [tests.stepped\\_source](#)

14.73 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/tests/tg43mode/\_  
init\_\_.py File Reference

#### Namespaces

- [tests.tg43mode](#)

14.74 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/tests/tg43mode\_←  
recycle/\_init\_\_.py File Reference

#### Namespaces

- [tests.tg43mode\\_recycle](#)

14.75 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/tests/tg43mode\_←  
zeroweight/\_init\_\_.py File Reference

#### Namespaces

- [tests.tg43mode\\_zeroweight](#)

## 14.76 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/tests/variable\_activity/\_\_init\_\_.py File Reference

### Namespaces

- [tests.variable\\_activity](#)

## 14.77 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/tests/variable\_w\_recycling/\_\_init\_\_.py File Reference

### Namespaces

- [tests.variable\\_w\\_recycling](#)

## 14.78 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/tests/volume\_correction/\_\_init\_\_.py File Reference

### Namespaces

- [tests.volume\\_correction](#)

## 14.79 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/tests/brem\_cyl/test.py File Reference

### Namespaces

- [tests.brem\\_cyl.test](#)

### Functions

- def [tests.brem\\_cyl.test.compare\\_results](#)(egslst, inp\_name)

### Variables

- string [tests.brem\\_cyl.test.EGSINP](#) = "brem\_cyl.egsinp"
- int [tests.brem\\_cyl.test.TIME\\_LIMIT\\_S\\_PER\\_MHZ](#) = 20
- list [tests.brem\\_cyl.test.DOSRZ\\_NRC\\_DOSES](#)
- dictionary [tests.brem\\_cyl.test.expected\\_doses](#)

## 14.80 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/tests/flu\_cutoff/test.py

### File Reference

#### Namespaces

- [tests.flu\\_cutoff.test](#)

#### Functions

- def [tests.flu\\_cutoff.test.compare\\_results](#) (egslst, inp\_name)

#### Variables

- string [tests.flu\\_cutoff.test.EGSINP](#) = "flu\_cutoff.egsinp"
- int [tests.flu\\_cutoff.test.TIME\\_LIMIT\\_S\\_PER\\_MHZ](#) = 2

## 14.81 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/tests/phsp\_run/test.py

### File Reference

#### Namespaces

- [tests.phsp\\_run.test](#)

#### Functions

- def [tests.phsp\\_run.test.compare\\_results](#) (egslst, inp\_name)

#### Variables

- string [tests.phsp\\_run.test.EGSINP](#) = "phsp\_run.egsinp"
- int [tests.phsp\\_run.test.TIME\\_LIMIT\\_S\\_PER\\_MHZ](#) = 80

## 14.82 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/tests/phsp\_scoring/test.py

### File Reference

#### Namespaces

- [tests.phsp\\_scoring.test](#)

#### Functions

- def [tests.phsp\\_scoring.test.compare\\_results](#) (egslst, inp\_name)

## Variables

- string `tests.phsp_scoring.test.EGSINP` = "phsp\_score.egsinp"
- int `tests.phsp_scoring.test.TIME_LIMIT_S_PER_MHZ` = 10
- tuple `tests.phsp_scoring.test.SOURCE_WEIGHTS` = (1., 9.)
- tuple `tests.phsp_scoring.test.MAX_E` = (0.05, 0.025,)
- int `tests.phsp_scoring.test.NHIST` = 1000
- float `tests.phsp_scoring.test.RM` = 0.511
- dictionary `tests.phsp_scoring.test.EXPECTED`

## 14.83 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/tests/recycling/test.py

### File Reference

## Namespaces

- `tests.recycling.test`

## Functions

- def `tests.recycling.test.compare_results` (`egslst`, `inp_name`)

## Variables

- string `tests.recycling.test.EGSINP` = "recycling.egsinp"
- int `tests.recycling.test.TIME_LIMIT_S_PER_MHZ` = 16

## 14.84 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/tests/scatter/test.py

### File Reference

## Namespaces

- `tests.scatter.test`

## Functions

- def `tests.scatter.test.get_n_highest_doses` (`doses`, `uncs`, `n=NCOMPARE`)
- def `tests.scatter.test.compare_results` (`egslst`, `inp_name`)

## Variables

- string `tests.scatter.test.EGSINP` = "scatter.egsinp"
- int `tests.scatter.test.TIME_LIMIT_S_PER_MHZ` = 65
- int `tests.scatter.test.NCOMPARE` = 10

## 14.85 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/tests/seeds\_in\_xy/test.py File Reference

### Namespaces

- [tests.seeds\\_in\\_xy.test](#)

### Functions

- def [tests.seeds\\_in\\_xy.test.compare\\_results](#) (egslst, inp\_name)

### Variables

- string [tests.seeds\\_in\\_xy.test.EGSINP](#) = "seeds\_in\_xy.egsinp"
- int [tests.seeds\\_in\\_xy.test.TIME\\_LIMIT\\_S\\_PER\\_MHZ](#) = 25

## 14.86 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/tests/seeds\_in\_xy\_genvelope/test.py File Reference

### Namespaces

- [tests.seeds\\_in\\_xy\\_genvelope.test](#)

### Functions

- def [tests.seeds\\_in\\_xy\\_genvelope.test.compare\\_results](#) (egslst, inp\_name)

### Variables

- string [tests.seeds\\_in\\_xy\\_genvelope.test.EGSINP](#) = "seeds\_in\_xy\_genvelope.egsinp"
- int [tests.seeds\\_in\\_xy\\_genvelope.test.TIME\\_LIMIT\\_S\\_PER\\_MHZ](#) = 25

## 14.87 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/tests/simple\_dose\_sph/test.py File Reference

### Namespaces

- [tests.simple\\_dose\\_sph.test](#)

### Functions

- def [tests.simple\\_dose\\_sph.test.compare\\_results](#) (egslst, inp\_name)

## Variables

- string `tests.simple_dose_sph.test.EGSINP` = "simple\_dose\_sph.egsinp"
- int `tests.simple_dose_sph.test.TIME_LIMIT_S_PER_MHZ` = 22
- dictionary `tests.simple_dose_sph.test.expected_doses`

# 14.88 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/tests/single\_generator/test.py

## File Reference

## Namespaces

- `tests.single_generator.test`

## Functions

- def `tests.single_generator.test.compare_results` (`egslst, inp_name`)

## Variables

- string `tests.single_generator.test.EGSINP` = "single\_generator.egsinp"
- int `tests.single_generator.test.TIME_LIMIT_S_PER_MHZ` = 25

# 14.89 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/tests/source\_energies/test.py

## File Reference

## Namespaces

- `tests.source_energies.test`

## Functions

- def `tests.source_energies.test.compare_results` (`egslst, inp_name`)

## Variables

- string `tests.source_energies.test.EGSINP` = "source\_energies.egsinp"
- int `tests.source_energies.test.TIME_LIMIT_S_PER_MHZ` = 2
- dictionary `tests.source_energies.test.expected_results`

# 14.90 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/tests/spec\_absolute/test.py

## File Reference

## Namespaces

- `tests.spec_absolute.test`

## Functions

- def `tests.spec_absolute.test.expected` (e)
- def `tests.spec_absolute.test.compare_results` (egslst, inp\_name)

## Variables

- string `tests.spec_absolute.test.EGSINP` = "spec\_absolute.egsinp"
- int `tests.spec_absolute.test.TIME_LIMIT_S_PER_MHZ` = 6
- `tests.spec_absolute.test.EMIN`
- `tests.spec_absolute.test.EMAX`

## 14.91 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/tests/spec\_eflu/test.py File Reference

### Namespaces

- `tests.spec_eflu.test`

## Functions

- def `tests.spec_eflu.test.expected` (e)
- def `tests.spec_eflu.test.compare_results` (egslst, inp\_name)

## Variables

- string `tests.spec_eflu.test.EGSINP` = "spec\_eflu.egsinp"
- int `tests.spec_eflu.test.TIME_LIMIT_S_PER_MHZ` = 6
- `tests.spec_eflu.test.EMIN`
- `tests.spec_eflu.test.EMAX`
- int `tests.spec_eflu.test.NHIST` = 1
- float `tests.spec_eflu.test.BIN_WIDTH` = 0.001
- int `tests.spec_eflu.test.AVG_E` = (EMAX+EMIN)/2
- `tests.spec_eflu.test.TOTAL_E` = AVG\_E\*NHIST
- tuple `tests.spec_eflu.test.N_BINS_IN_RANGE` = (EMAX-EMIN)/BIN\_WIDTH
- `tests.spec_eflu.test.SCORED_IN_BIN` = NHIST/N\_BINS\_IN\_RANGE
- `tests.spec_eflu.test.SCORED_IN_BIN_PER_MEV` = SCORED\_IN\_BIN/BIN\_WIDTH

## 14.92 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/tests/spec\_vox/test.py File Reference

### Namespaces

- `tests.spec_vox.test`

## Functions

- def `tests.spec_vox.test.expected` (e)
- def `tests.spec_vox.test.compare_results` (egslist, inp\_name)

## Variables

- string `tests.spec_vox.test.EGSINP` = "spec\_vox.egsinp"
- int `tests.spec_vox.test.TIME_LIMIT_S_PER_MHZ` = 7
- float `tests.spec_vox.test.BIN_WIDTH` = 0.001
- `tests.spec_vox.test.EMIN`
- `tests.spec_vox.test.EMAX`
- `tests.spec_vox.test.R1`
- `tests.spec_vox.test.R2`
- `tests.spec_vox.test.TRACK_LENGTH` = R2-R1
- tuple `tests.spec_vox.test.N_BINS_IN_RANGE` = (EMAX-EMIN)/BIN\_WIDTH
- `tests.spec_vox.test.SCORED_IN_BIN` = TRACK\_LENGTH/N\_BINS\_IN\_RANGE
- int `tests.spec_vox.test.VOLUME` = 4

## 14.93 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/tests/stepped\_source/test.py File Reference

### Namespaces

- `tests.steped_source.test`

### Functions

- def `tests.steped_source.test.get_n_highest_dose_pairs` (dose1, dose2, n=NCOMPARE)
- def `tests.steped_source.test.compare_results` (egslist, inp\_name)

### Variables

- string `tests.steped_source.test.EGSINP` = "stepped.egsinp"
- int `tests.steped_source.test.TIME_LIMIT_S_PER_MHZ` = 1000
- int `tests.steped_source.test.NCOMPARE` = 20

## 14.94 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/tests/tg43mode/test.py File Reference

### Namespaces

- `tests.tg43mode.test`

## Functions

- def `tests.tg43mode.test.get_n_highest_dose_pairs`(dose1, dose2, n=NCOMPARE)
- def `tests.tg43mode.test.compare_results`(egslst, inp\_name)

## Variables

- string `tests.tg43mode.test.EGSINP` = "tg43mode.egsinp"
- int `tests.tg43mode.test.TIME_LIMIT_S_PER_MHZ` = 2000
- int `tests.tg43mode.test.NCOMPARE` = 100

## 14.95 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/tests/tg43mode\_recycle/test.py File Reference

### Namespaces

- `tests.tg43mode_recycle.test`

## Functions

- def `tests.tg43mode_recycle.test.get_n_highest_dose_pairs`(dose1, dose2, n=NCOMPARE)
- def `tests.tg43mode_recycle.test.compare_results`(egslst, inp\_name)

## Variables

- string `tests.tg43mode_recycle.test.EGSINP` = "tg43mode\_recycling.egsinp"
- int `tests.tg43mode_recycle.test.TIME_LIMIT_S_PER_MHZ` = 1000
- int `tests.tg43mode_recycle.test.NCOMPARE` = 50

## 14.96 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/tests/tg43mode\_zeroweight/test.py File Reference

### Namespaces

- `tests.tg43mode_zeroweight.test`

## Functions

- def `tests.tg43mode_zeroweight.test.get_n_highest_dose_pairs`(dose1, dose2, n=NCOMPARE)
- def `tests.tg43mode_zeroweight.test.compare_results`(egslst, inp\_name)

## Variables

- string `tests.tg43mode_zeroweight.test.EGSINP` = "tg43mode\_zeroweight.egsinp"
- int `tests.tg43mode_zeroweight.test.TIME_LIMIT_S_PER_MHZ` = 2000
- int `tests.tg43mode_zeroweight.test.NCOMPARE` = 10

## 14.97 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/tests/variable\_activity/test.py File Reference

### Namespaces

- [tests.variable\\_activity.test](#)

### Functions

- def [tests.variable\\_activity.test.compare\\_results](#) (egslst, inp\_name)

### Variables

- string [tests.variable\\_activity.test.EGSINP](#) = "variable.egsinp"
- int [tests.variable\\_activity.test.TIME\\_LIMIT\\_S\\_PER\\_MHZ](#) = 100

## 14.98 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/tests/variable\_w\_recycling/test.py File Reference

### Namespaces

- [tests.variable\\_w\\_recycling.test](#)

### Functions

- def [tests.variable\\_w\\_recycling.test.compare\\_results](#) (egslst, inp\_name)

### Variables

- string [tests.variable\\_w\\_recycling.test.EGSINP](#) = "variable\_w\_recycling.egsinp"
- int [tests.variable\\_w\\_recycling.test.TIME\\_LIMIT\\_S\\_PER\\_MHZ](#) = 15
- list [tests.variable\\_w\\_recycling.test.BENCHMARK\\_DOSES](#) = [(1.061E-13, 0.0001), (1.644E-13, 0.0001)]

## 14.99 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/tests/volume\_correction/test.py File Reference

### Namespaces

- [tests.volume\\_correction.test](#)

### Functions

- def [tests.volume\\_correction.test.approx\\_equal](#) (a, b, eps=0.001)
- def [tests.volume\\_correction.test.read\\_vols](#) (phant, inp\_name)
- def [tests.volume\\_correction.test.compare\\_results](#) (egslst, inp\_name)

## Variables

- string `tests.volume_correction.test.EGSINP` = "vc.egsinp"
- int `tests.volume_correction.test.TIME_LIMIT_S_PER_MHZ` = 1
- dictionary `tests.volume_correction.test.expected_volumes`

### 14.100 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/tests/iaea.py File Reference

## Classes

- class `tests.iaea.IAEAPhaseSpace`

## Namespaces

- `tests.iaea`

## Variables

- `tests.iaea.HEN_HOUSE` = os.getenv("HEN\_HOUSE")
- `tests.iaea.IAEA_DLL` = glob.glob(os.path.join(HEN\_HOUSE,"egs++/dso/\*/", "libiaea\_phsp.so"))[0]
- `tests.iaea.iaeadll` = ctypes.CDLL(IAEA\_DLL)

### 14.101 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/tests/iaea\_errors.py File Reference

## Classes

- class `tests.iaea_errors.IAEAPhaseSpaceSetupError`
- class `tests.iaea_errors.IAEAPhaseSpaceError`

## Namespaces

- `tests.iaea_errors`

## Variables

- dictionary `tests.iaea_errors.error_messages` = {}
- tuple `tests.iaea_errors.new_source_errors`

### 14.102 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/tests/iaea\_types.py File Reference

## Namespaces

- `tests.iaea_types`

## Variables

- tests.iaea\_types.IAEA\_Float = ctypes.c\_float
- tests.iaea\_types.PIAEA\_Float = ctypes.POINTER(IAEA\_Float)
- tests.iaea\_types.IAEA\_I16 = ctypes.c\_short
- tests.iaea\_types.PIAEA\_I16 = ctypes.POINTER(IAEA\_I16)
- tests.iaea\_types.IAEA\_I32 = ctypes.c\_int
- tests.iaea\_types.PIAEA\_I32 = ctypes.POINTER(IAEA\_I32)
- tests.iaea\_types.IAEA\_I64 = ctypes.c\_longlong
- tests.iaea\_types.PIAEA\_I64 = ctypes.POINTER(IAEA\_I64)
- dictionary tests.iaea\_types.iaea\_file\_modes
- int tests.iaea\_types.all\_particles = -1
- int tests.iaea\_types.photons = 1
- int tests.iaea\_types.electrons = 2
- int tests.iaea\_types.positrons = 3
- int tests.iaea\_types.neutrons = 4
- int tests.iaea\_types.protons = 5
- dictionary tests.iaea\_types.particle\_types
- int tests.iaea\_types.max\_sources = 30

## 14.103 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/tests/utils.py File Reference

### Namespaces

- tests.utils

### Functions

- def tests.utils.extract\_all\_doses (egslist)
- def tests.utils.values\_close (a, b, max\_percent\_diff=0.001)
- def tests.utils.values\_close\_abs (a, b, max\_diff=0.001)
- def tests.utils.read\_csv\_spectrum (fname)
- def tests.utils.doses\_approx\_equal (d1, d1\_unc, d2, d2\_unc, max\_percent\_diff=None, compare\_unc=True, max\_unc\_percent\_diff=None)
- def tests.utils.read3ddose (fname)
- def tests.utils.compare\_3ddose\_files (f1, f2, max\_percent\_diff=None)

### Variables

- string tests.utils.REG\_DOSE\_UNC\_RE = "\s+(\d)+\s+\d+\s+\d+..\*\?\s+(.\*?)\s+\+/-\s+(.\*?)%\s+(.\*?)\s+\+/-\s+(.\*?)"

## 14.104 /home/randlet/projects/egs/egs\_brachy\_release/egs\_brachy/timing.h File Reference

```
#include <sstream>
#include <iomanip>
#include "egs_timer.h"
```

Include dependency graph for timing.h: This graph shows which files directly or indirectly include this file:

### Classes

- class EB\_Timer
- class EB\_TimingTree



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