**lattice module**

The lattice module contains lattice elements, lattices and related classes.

**Python-only Classes**

*class* synergia.lattice.Mad8\_reader(*element\_adaptor\_map=None*)

Read lattice descriptions written in Mad8 format

|  |  |
| --- | --- |
| **Parameters:** | **element\_adaptor\_map** – The Element\_adaptor\_map class used to interpret the elements. If *None*, the Mad8\_adaptor\_map class is used. |

get\_element\_adaptor\_map()

Returns the Element\_adaptor\_map used by the reader.

get\_lattice(*line\_names*, *filename=None*, *enable\_cache\_write=True*, *enable\_cache\_read=True*)

Retrieve a lattice

|  |  |
| --- | --- |
| **Parameters:** | * **line\_name** – the name of the line to be used * **filename** – if given, parse *filename* first * **enable\_cache\_write** – if True, write cache to the lattice\_cache directory when appropriate. * **enable\_cache\_write** – if True, read cache from the lattice\_cache directory when appropriate. |

get\_lattice\_element(*label*, *filename=None*)

Return the parsed definition of a lattice element.

|  |  |
| --- | --- |
| **Parameters:** | * **label** – the lattice element’s label * **filename** – if not *None*, parse *filename* first |

get\_lines(*filename=None*)

Return a list of lines found in the last parse.

|  |  |
| --- | --- |
| **Parameters:** | **filename** – if not *None*, parse *filename* first |

parse(*filename*)

Parse a file containing a lattice description in Mad8 format.

parse\_string(*string*)

Parse a string containing a lattice description in Mad8 format.

**Classes**

*class* **Chef\_lattice**

*Public Functions*

**Chef\_lattice**([*Lattice\_sptr*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0lattice_8h_1aed3d29e01edf5749d82e95bcd935bd9b) lattice\_sptr)

double **get\_brho**()

**Chef\_lattice**()

[*Chef\_elements*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0chef__elements_8h_1a6d36608ae2352f888bcc26d07b266b5f) **get\_chef\_elements**([*Lattice\_element*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice__element) & lattice\_element)

[*Chef\_lattice\_section\_sptr*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0chef__lattice__section__fwd_8h_1a764c8616d58e5008caeac5d267927ff4) **get\_chef\_section\_sptr**([*Chef\_lattice\_sptr*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0chef__lattice_8h_1a22ad176949b22cf1f6e2a236134553df) this\_chef\_lattice\_sptr, [*Lattice\_element\_slice*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice__element__slice) & lattice\_element\_slice)

[*Lattice\_element*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice__element) & **get\_lattice\_element**(ElmPtr const & chef\_element)

[*Lattice\_element\_slice*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice__element__slice) & **get\_lattice\_element\_slice**(ElmPtr const & chef\_element)

bool **have\_sliced\_beamline**()

void **construct\_sliced\_beamline**([*Lattice\_element\_slices*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0lattice__element__slice_8h_1a7f51f027f9907f3a4e08f37304f858c4) const & slices)

BmlPtr **get\_beamline\_sptr**()

BmlPtr **get\_sliced\_beamline\_sptr**()

beamline::iterator **get\_sliced\_beamline\_iterator**(int index)

beamline::const\_iterator **get\_sliced\_beamline\_const\_iterator**(int index)

template < class Archive >

void **save**(Archive & ar, const unsigned int version)

template < class Archive >

void **load**(Archive & ar, const unsigned int version)

**~Chef\_lattice**()

*Public Static Attributes*

const char **internal\_marker\_name**[]

*class* **Begin\_end**

*Public Functions*

template < class Archive >

void **serialize**(Archive & ar, const unsigned int version)

*Public Members*

int **begin**

int **end**

*class* **Chef\_lattice\_section**

*Public Type*

typedef beamline::iterator **iterator**

typedef beamline::const\_iterator **const\_iterator**

*Public Functions*

**Chef\_lattice\_section**([*Chef\_lattice\_sptr*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0chef__lattice_8h_1a22ad176949b22cf1f6e2a236134553df) chef\_lattice\_sptr)

**Chef\_lattice\_section**([*Chef\_lattice\_sptr*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0chef__lattice_8h_1a22ad176949b22cf1f6e2a236134553df) chef\_lattice\_sptr, int begin\_index, int end\_index)

**Chef\_lattice\_section**()

Default constructor for serialization use only.

void **extend**([*Chef\_lattice\_section*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_chef__lattice__section) const & chef\_lattice\_section)

void **extend**(int begin\_index, int end\_index)

int **get\_begin\_index**()

int **get\_end\_index**()

[*iterator*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_chef__lattice__section_1ad26aa269591abd3e7bddf690529f29fa) **begin**()

[*iterator*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_chef__lattice__section_1ad26aa269591abd3e7bddf690529f29fa) **end**()

[*const\_iterator*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_chef__lattice__section_1a9349e1ea9941ba98f0512aa0d059ba36) **begin**()

[*const\_iterator*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_chef__lattice__section_1a9349e1ea9941ba98f0512aa0d059ba36) **end**()

bool **empty**()

void **clear**()

template < class Archive >

void **serialize**(Archive & ar, const unsigned int version)

*class* **Drift\_mad8\_adaptor**

*Public Functions*

**Drift\_mad8\_adaptor**()

[*Chef\_elements*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0chef__elements_8h_1a6d36608ae2352f888bcc26d07b266b5f) **get\_chef\_elements**([*Lattice\_element*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice__element) const & lattice\_element, double brho)

template < class Archive >

void **serialize**(Archive & ar, const unsigned int version)

**~Drift\_mad8\_adaptor**()

*class* **Drift\_madx\_adaptor**

*Public Functions*

**Drift\_madx\_adaptor**()

[*Chef\_elements*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0chef__elements_8h_1a6d36608ae2352f888bcc26d07b266b5f) **get\_chef\_elements**([*Lattice\_element*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice__element) const & lattice\_element, double brho)

template < class Archive >

void **serialize**(Archive & ar, const unsigned int version)

**~Drift\_madx\_adaptor**()

*class* **Ecollimator\_mad8\_adaptor**

*Public Functions*

**Ecollimator\_mad8\_adaptor**()

template < class Archive >

void **serialize**(Archive & ar, const unsigned int version)

**~Ecollimator\_mad8\_adaptor**()

*class* **Ecollimator\_madx\_adaptor**

*Public Functions*

**Ecollimator\_madx\_adaptor**()

template < class Archive >

void **serialize**(Archive & ar, const unsigned int version)

**~Ecollimator\_madx\_adaptor**()

*class* **Element\_adaptor**

*Public Functions*

**Element\_adaptor**()

[*Lattice\_element\_sptr*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0lattice__element_8h_1af69189c702f654fd34b2c22816a7e1b9) **get\_default\_element\_sptr**()

[*Lattice\_element*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice__element) & **get\_default\_element**()

void **set\_double\_default**([*Lattice\_element*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice__element) & lattice\_element, std::string const & name, double value)

void **set\_string\_default**([*Lattice\_element*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice__element) & lattice\_element, std::string const & name, std::string const & value)

void **set\_defaults**([*Lattice\_element*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice__element) & lattice\_element)

void **set\_derived\_attributes\_internal**([*Lattice\_element*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice__element) & lattice\_element)

void **set\_derived\_attributes\_external**([*Lattice\_element*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice__element) & lattice\_element, double lattice\_length, double beta)

[*Chef\_elements*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0chef__elements_8h_1a6d36608ae2352f888bcc26d07b266b5f) **get\_chef\_elements**([*Lattice\_element*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice__element) const & lattice\_element, double brho)

template < class Archive >

void **serialize**(Archive & ar, const unsigned int version)

**~Element\_adaptor**()

*class* **Element\_adaptor\_map**

*Public Functions*

**Element\_adaptor\_map**()

void **set\_adaptor**(std::string const & name, [*Element\_adaptor\_sptr*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0element__adaptor_8h_1aa0d826b5a930a8915bf0379a1a882561) element\_adaptor\_sptr)

bool **has\_adaptor**(std::string const & name)

[*Element\_adaptor\_sptr*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0element__adaptor_8h_1aa0d826b5a930a8915bf0379a1a882561) **get\_adaptor**(std::string const & name)

std::list< std::string > **get\_adaptor\_names**()

template < class Archive >

void **serialize**(Archive & ar, const unsigned int version)

**~Element\_adaptor\_map**()

*class* **Elseparator\_mad8\_adaptor**

*Public Functions*

**Elseparator\_mad8\_adaptor**()

template < class Archive >

void **serialize**(Archive & ar, const unsigned int version)

**~Elseparator\_mad8\_adaptor**()

*class* **Elseparator\_madx\_adaptor**

*Public Functions*

**Elseparator\_madx\_adaptor**()

template < class Archive >

void **serialize**(Archive & ar, const unsigned int version)

**~Elseparator\_madx\_adaptor**()

*class* **Hkicker\_mad8\_adaptor**

*Public Functions*

**Hkicker\_mad8\_adaptor**()

[*Chef\_elements*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0chef__elements_8h_1a6d36608ae2352f888bcc26d07b266b5f) **get\_chef\_elements**([*Lattice\_element*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice__element) const & lattice\_element, double brho)

template < class Archive >

void **serialize**(Archive & ar, const unsigned int version)

**~Hkicker\_mad8\_adaptor**()

*class* **Hkicker\_madx\_adaptor**

*Public Functions*

**Hkicker\_madx\_adaptor**()

[*Chef\_elements*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0chef__elements_8h_1a6d36608ae2352f888bcc26d07b266b5f) **get\_chef\_elements**([*Lattice\_element*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice__element) const & lattice\_element, double brho)

template < class Archive >

void **serialize**(Archive & ar, const unsigned int version)

**~Hkicker\_madx\_adaptor**()

*class* **Hmonitor\_mad8\_adaptor**

*Public Functions*

**Hmonitor\_mad8\_adaptor**()

[*Chef\_elements*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0chef__elements_8h_1a6d36608ae2352f888bcc26d07b266b5f) **get\_chef\_elements**([*Lattice\_element*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice__element) const & lattice\_element, double brho)

template < class Archive >

void **serialize**(Archive & ar, const unsigned int version)

**~Hmonitor\_mad8\_adaptor**()

*class* **Hmonitor\_madx\_adaptor**

*Public Functions*

**Hmonitor\_madx\_adaptor**()

[*Chef\_elements*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0chef__elements_8h_1a6d36608ae2352f888bcc26d07b266b5f) **get\_chef\_elements**([*Lattice\_element*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice__element) const & lattice\_element, double brho)

template < class Archive >

void **serialize**(Archive & ar, const unsigned int version)

**~Hmonitor\_madx\_adaptor**()

*class* **Instrument\_mad8\_adaptor**

*Public Functions*

**Instrument\_mad8\_adaptor**()

template < class Archive >

void **serialize**(Archive & ar, const unsigned int version)

**~Instrument\_mad8\_adaptor**()

*class* **Instrument\_madx\_adaptor**

*Public Functions*

**Instrument\_madx\_adaptor**()

[*Chef\_elements*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0chef__elements_8h_1a6d36608ae2352f888bcc26d07b266b5f) **get\_chef\_elements**([*Lattice\_element*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice__element) const & lattice\_element, double brho)

template < class Archive >

void **serialize**(Archive & ar, const unsigned int version)

**~Instrument\_madx\_adaptor**()

*class* **Kicker\_mad8\_adaptor**

*Public Functions*

**Kicker\_mad8\_adaptor**()

[*Chef\_elements*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0chef__elements_8h_1a6d36608ae2352f888bcc26d07b266b5f) **get\_chef\_elements**([*Lattice\_element*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice__element) const & lattice\_element, double brho)

template < class Archive >

void **serialize**(Archive & ar, const unsigned int version)

**~Kicker\_mad8\_adaptor**()

*class* **Kicker\_madx\_adaptor**

*Public Functions*

**Kicker\_madx\_adaptor**()

[*Chef\_elements*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0chef__elements_8h_1a6d36608ae2352f888bcc26d07b266b5f) **get\_chef\_elements**([*Lattice\_element*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice__element) const & lattice\_element, double brho)

template < class Archive >

void **serialize**(Archive & ar, const unsigned int version)

**~Kicker\_madx\_adaptor**()

*class* **Lambertson\_mad8\_adaptor**

*Public Functions*

**Lambertson\_mad8\_adaptor**()

[*Chef\_elements*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0chef__elements_8h_1a6d36608ae2352f888bcc26d07b266b5f) **get\_chef\_elements**([*Lattice\_element*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice__element) const & lattice\_element, double brho)

template < class Archive >

void **serialize**(Archive & ar, const unsigned int version)

**~Lambertson\_mad8\_adaptor**()

*class* **Lambertson\_madx\_adaptor**

*Public Functions*

**Lambertson\_madx\_adaptor**()

[*Chef\_elements*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0chef__elements_8h_1a6d36608ae2352f888bcc26d07b266b5f) **get\_chef\_elements**([*Lattice\_element*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice__element) const & lattice\_element, double brho)

template < class Archive >

void **serialize**(Archive & ar, const unsigned int version)

**~Lambertson\_madx\_adaptor**()

*class* **Lattice**

The [*Lattice*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice) class contains an abstract representation of an ordered set of objects of type [*Lattice\_element*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice__element).

Each element of the [*Lattice*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice) is unique.

*Public Functions*

**Lattice**()

Construct a [*Lattice*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice) object without a name.

Defaults to interpreting elements as Mad8 elements

**Lattice**(std::string const & name)

Construct a [*Lattice*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice) object with a name Defaults to interpreting elements as Mad8 elements.

**Parameters**

* name -

an arbitrary name

**Lattice**(std::string const & name, [*Element\_adaptor\_map\_sptr*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0element__adaptor__map_8h_1af8118442a0e910e72e993f8adf68ca02) element\_adaptor\_map\_sptr)

Construct a [*Lattice*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice) object with a name.

**Parameters**

* name -

an arbitrary name

* element\_adaptor\_map\_sptr -

an [*Element\_adaptor\_map*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_element__adaptor__map) for interpreting elements

**Lattice**([*Lattice*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice) const & lattice)

Copies of Lattices contain copies of elements.

std::string const & **get\_name**()

Get the [*Lattice*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice) name.

void **set\_reference\_particle**([*Reference\_particle*](http://compacc.fnal.gov/~amundson/html/foundation.html#project0class_reference__particle) const & reference\_particle)

Set the [*Lattice*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice) reference particle.

**Parameters**

* reference\_particle -

a [*Reference\_particle*](http://compacc.fnal.gov/~amundson/html/foundation.html#project0class_reference__particle)

bool **has\_reference\_particle**()

Determine whether the [*Lattice*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice) has a reference particle.

[*Reference\_particle*](http://compacc.fnal.gov/~amundson/html/foundation.html#project0class_reference__particle) const & **get\_reference\_particle**()

Get the [*Lattice*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice) reference particle.

void **append**([*Lattice\_element*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice__element) const & element)

Append a copy of a [*Lattice\_element*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice__element).

**Parameters**

* element -

a [*Lattice\_element*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice__element)

void **set\_defaults**()

Set the defaults in elements of the [*Lattice*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice).

void **derive\_internal\_attributes**()

Derive internal attributes where necessary.

void **derive\_external\_attributes**()

Derive external attributes where necessary.

void **complete\_attributes**()

Complete all attribute updates. Includes defaults and derivations.

void **set\_all\_double\_attribute**(std::string const & name, double value, bool increment\_revision = true)

Set the value of the named double attribute on all elements.

**Parameters**

* name -

attribute name

* value -

attribute value

* increment\_revision -

can be set to false for attributes that do not affect dynamics

void **set\_all\_string\_attribute**(std::string const & name, std::string const & value, bool increment\_revision = true)

Set the value of the named string attribute on all elements.

**Parameters**

* name -

attribute name

* value -

attribute value

* increment\_revision -

can be set to false for attributes that do not affect dynamics

[*Lattice\_elements*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0lattice__element_8h_1ae81b6b4f394d59398056cc93bdb2c56c) & **get\_elements**()

Get the list of elements in the [*Lattice*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice).

[*Element\_adaptor\_map*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_element__adaptor__map) & **get\_element\_adaptor\_map**()

Get the [*Element\_adaptor\_map*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_element__adaptor__map).

double **get\_length**()

Get the combined length of all the elements in the [*Lattice*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice).

double **get\_total\_angle**()

Get the total angle in radians subtended by all the elements in the [*Lattice*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice).

std::string **as\_string**()

Return a human-readable summary of the elements in the [*Lattice*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice).

void **print**()

Print a human-readable summary of the elements in the [*Lattice*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice).

The Python version of this function is named “print\_”.

template < class Archive >

void **serialize**(Archive & ar, const unsigned int version)

**~Lattice**()

*class* **Lattice\_diagnostics**

*Public Functions*

**Lattice\_diagnostics**([*Lattice\_sptr*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0lattice_8h_1aed3d29e01edf5749d82e95bcd935bd9b) lattice\_sptr, std::string const & filename, std::string const & attribute, std::string const & local\_dir = “”)

void **set\_default\_value**(double value)

double **get\_default\_value**()

void **set\_reduce**(bool reduce)

bool **get\_reduce**()

void **set\_reduce\_op**(MPI\_Op op)

MPI\_Op **get\_reduce\_op**()

bool **is\_serial**()

Multiple serial diagnostics can be written to a single file.

void **update**()

Update the diagnostics.

void **write**()

Write the diagnostics to the file.

void **update\_and\_write**()

Update the diagnostics and write to file.

**~Lattice\_diagnostics**()

*class* **Lattice\_element**

The [*Lattice\_element*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice__element) class contains the description of a single lattice element.

Each element has a name, a (string) type and dictionaries of named double and string attributes. [*Lattice*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice) structure is described by a list of ancestors stored in an element.

*Public Functions*

**Lattice\_element**()

Construct a [*Lattice\_element*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice__element) with an empty name and type.

**Lattice\_element**(std::string const & type, std::string const & name)

Construct a [*Lattice\_element*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice__element).

**Parameters**

* name -

name

* type -

type

**Lattice\_element**([*Lattice\_element*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice__element) const & lattice\_element)

Copy constructor.

std::string const & **get\_type**()

Get the type.

std::string const & **get\_name**()

Get the name.

void **set\_default\_element**([*Lattice\_element\_sptr*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0lattice__element_8h_1af69189c702f654fd34b2c22816a7e1b9) default\_element\_sptr)

Set the defaults for this element.

void **add\_ancestor**(std::string const & ancestor)

Add an ancestor to the list of ancestors.

**Parameters**

* ancestor -

ancestor name

std::list< std::string > const & **get\_ancestors**()

Get the list of ancestors.

void **set\_double\_attribute**(std::string const & name, double value, bool increment\_revision = true)

Set the value of the named double attribute.

**Parameters**

* name -

attribute name

* value -

attribute value

* increment\_revision -

can be set to false for attributes that do not affect dynamics

bool **has\_double\_attribute**(std::string const & name, bool include\_default = true)

Check for the existence of the named double attribute.

**Parameters**

* name -

attribute name

double **get\_double\_attribute**(std::string const & name)

Get the value of the named double attribute.

**Parameters**

* name -

attribute name

std::map< std::string, double > const & **get\_double\_attributes**()

Get the entire dictionary of double attributes.

void **set\_string\_attribute**(std::string const & name, std::string const & value, bool increment\_revision = true)

Set the value of the named string attribute.

**Parameters**

* name -

attribute name

* value -

attribute value

* increment\_revision -

can be set to false for attributes that do not affect dynamics

bool **has\_string\_attribute**(std::string const & name, bool include\_default = true)

Check for the existence of the named string attribute.

**Parameters**

* name -

attribute name

std::string const & **get\_string\_attribute**(std::string const & name)

Get the value of the named string attribute.

**Parameters**

* name -

attribute name

std::map< std::string, std::string > const & **get\_string\_attributes**()

Get the entire dictionary of string attributes.

void **set\_vector\_attribute**(std::string const & name, std::vector< double > const & value, bool increment\_revision = true)

Set the value of the named vector attribute.

**Parameters**

* name -

attribute name

* value -

attribute value

* increment\_revision -

can be set to false for attributes that do not affect dynamics

bool **has\_vector\_attribute**(std::string const & name, bool include\_default = true)

Check for the existence of the named vector attribute.

**Parameters**

* name -

attribute name

std::vector< double > const & **get\_vector\_attribute**(std::string const & name)

Get the value of the named vector attribute.

**Parameters**

* name -

attribute name

std::map< std::string, std::vector< double > > const & **get\_vector\_attributes**()

Get the entire dictionary of vector attributes.

void **set\_length\_attribute\_name**(std::string const & attribute\_name)

Set the attribute name to be used to determine the length of the [*Lattice\_element*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice__element).

**Parameters**

* attribute\_name -

attribute name

void **set\_bend\_angle\_attribute\_name**(std::string const & attribute\_name)

Set the attribute name to be used to determine the bend\_angle of the [*Lattice\_element*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice__element).

**Parameters**

* attribute\_name -

attribute name

void **set\_needs\_internal\_derive**(bool value)

Set whether the element needs to determine some of its parameters from its other parameters.

bool **get\_needs\_internal\_derive**()

Get whether the element needs to determine some of its parameters from its other parameters.

void **set\_needs\_external\_derive**(bool value)

Set whether the element needs to determine some of its parameters from the lattice length and/or reference particle.

bool **get\_needs\_external\_derive**()

Get whether the element needs to determine some of its parameters from the lattice length and/or reference particle.

double **get\_length**()

Get the [*Lattice\_element*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice__element)‘s length.

double **get\_bend\_angle**()

Get the [*Lattice\_element*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice__element)‘s bend angle.

long int **get\_revision**()

Get the [*Lattice\_element*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice__element)‘s revision number.

std::string **as\_string**()

Return a human-readable description of the [*Lattice\_element*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice__element).

void **print**()

Print a human-readable description of the [*Lattice\_element*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice__element) The Python version of the function is named “print\_”.

template < class Archive >

void **serialize**(Archive & ar, const unsigned int version)

*class* **Lattice\_element\_slice**

*Public Functions*

**Lattice\_element\_slice**([*Lattice\_element\_sptr*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0lattice__element_8h_1af69189c702f654fd34b2c22816a7e1b9) lattice\_element\_sptr)

**Lattice\_element\_slice**([*Lattice\_element\_sptr*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0lattice__element_8h_1af69189c702f654fd34b2c22816a7e1b9) lattice\_element\_sptr, double left, double right)

**Lattice\_element\_slice**()

bool **is\_whole**()

bool **has\_left\_edge**()

bool **has\_right\_edge**()

double **get\_left**()

double **get\_right**()

[*Lattice\_element*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice__element) const & **get\_lattice\_element**()

[*Lattice\_element*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice__element) & **get\_lattice\_element**()

std::string **as\_string**()

void **print**()

template < class Archive >

void **serialize**(Archive & ar, const unsigned int version)

*class* **Mad8\_adaptor\_map**

*Public Functions*

**Mad8\_adaptor\_map**()

template < class Archive >

void **serialize**(Archive & ar, const unsigned int version)

*class* **MadX\_adaptor\_map**

*Public Functions*

**MadX\_adaptor\_map**()

template < class Archive >

void **serialize**(Archive & ar, const unsigned int version)

*class* **MadX\_reader**

*Public Functions*

**MadX\_reader**()

**MadX\_reader**([*Element\_adaptor\_map\_sptr*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0element__adaptor__map_8h_1af8118442a0e910e72e993f8adf68ca02) element\_adaptor\_map\_sptr)

void **parse**(std::string const & string)

void **parse\_file**(std::string const & filename)

std::vector< std::string > **get\_line\_names**()

std::vector< std::string > **get\_sequence\_names**()

std::vector< std::string > **get\_all\_names**()

double **get\_double\_variable**(std::string const & name)

std::string **get\_string\_variable**(std::string const & name)

[*Lattice\_sptr*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0lattice_8h_1aed3d29e01edf5749d82e95bcd935bd9b) **get\_lattice\_sptr**(std::string const & line\_name)

[*Lattice\_sptr*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0lattice_8h_1aed3d29e01edf5749d82e95bcd935bd9b) **get\_lattice\_sptr**(std::string const & line\_name, std::string const & filename)

**~MadX\_reader**()

*class* **Marker\_mad8\_adaptor**

*Public Functions*

**Marker\_mad8\_adaptor**()

[*Chef\_elements*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0chef__elements_8h_1a6d36608ae2352f888bcc26d07b266b5f) **get\_chef\_elements**([*Lattice\_element*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice__element) const & lattice\_element, double brho)

template < class Archive >

void **serialize**(Archive & ar, const unsigned int version)

**~Marker\_mad8\_adaptor**()

*class* **Marker\_madx\_adaptor**

*Public Functions*

**Marker\_madx\_adaptor**()

[*Chef\_elements*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0chef__elements_8h_1a6d36608ae2352f888bcc26d07b266b5f) **get\_chef\_elements**([*Lattice\_element*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice__element) const & lattice\_element, double brho)

template < class Archive >

void **serialize**(Archive & ar, const unsigned int version)

**~Marker\_madx\_adaptor**()

*class* **Monitor\_mad8\_adaptor**

*Public Functions*

**Monitor\_mad8\_adaptor**()

[*Chef\_elements*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0chef__elements_8h_1a6d36608ae2352f888bcc26d07b266b5f) **get\_chef\_elements**([*Lattice\_element*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice__element) const & lattice\_element, double brho)

template < class Archive >

void **serialize**(Archive & ar, const unsigned int version)

**~Monitor\_mad8\_adaptor**()

*class* **Monitor\_madx\_adaptor**

*Public Functions*

**Monitor\_madx\_adaptor**()

[*Chef\_elements*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0chef__elements_8h_1a6d36608ae2352f888bcc26d07b266b5f) **get\_chef\_elements**([*Lattice\_element*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice__element) const & lattice\_element, double brho)

template < class Archive >

void **serialize**(Archive & ar, const unsigned int version)

**~Monitor\_madx\_adaptor**()

*class* **Multipole\_mad8\_adaptor**

*Public Functions*

**Multipole\_mad8\_adaptor**()

[*Chef\_elements*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0chef__elements_8h_1a6d36608ae2352f888bcc26d07b266b5f) **get\_chef\_elements**([*Lattice\_element*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice__element) const & lattice\_element, double brho)

template < class Archive >

void **serialize**(Archive & ar, const unsigned int version)

**~Multipole\_mad8\_adaptor**()

*class* **Multipole\_madx\_adaptor**

*Public Functions*

**Multipole\_madx\_adaptor**()

[*Chef\_elements*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0chef__elements_8h_1a6d36608ae2352f888bcc26d07b266b5f) **get\_chef\_elements**([*Lattice\_element*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice__element) const & lattice\_element, double brho)

template < class Archive >

void **serialize**(Archive & ar, const unsigned int version)

**~Multipole\_madx\_adaptor**()

*class* **Octupole\_mad8\_adaptor**

*Public Functions*

**Octupole\_mad8\_adaptor**()

[*Chef\_elements*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0chef__elements_8h_1a6d36608ae2352f888bcc26d07b266b5f) **get\_chef\_elements**([*Lattice\_element*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice__element) const & lattice\_element, double brho)

template < class Archive >

void **serialize**(Archive & ar, const unsigned int version)

**~Octupole\_mad8\_adaptor**()

*class* **Octupole\_madx\_adaptor**

*Public Functions*

**Octupole\_madx\_adaptor**()

[*Chef\_elements*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0chef__elements_8h_1a6d36608ae2352f888bcc26d07b266b5f) **get\_chef\_elements**([*Lattice\_element*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice__element) const & lattice\_element, double brho)

template < class Archive >

void **serialize**(Archive & ar, const unsigned int version)

**~Octupole\_madx\_adaptor**()

*class* **Quadrupole\_mad8\_adaptor**

*Public Functions*

**Quadrupole\_mad8\_adaptor**()

[*Chef\_elements*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0chef__elements_8h_1a6d36608ae2352f888bcc26d07b266b5f) **get\_chef\_elements**([*Lattice\_element*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice__element) const & lattice\_element, double brho)

template < class Archive >

void **serialize**(Archive & ar, const unsigned int version)

**~Quadrupole\_mad8\_adaptor**()

*class* **Quadrupole\_madx\_adaptor**

*Public Functions*

**Quadrupole\_madx\_adaptor**()

[*Chef\_elements*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0chef__elements_8h_1a6d36608ae2352f888bcc26d07b266b5f) **get\_chef\_elements**([*Lattice\_element*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice__element) const & lattice\_element, double brho)

template < class Archive >

void **serialize**(Archive & ar, const unsigned int version)

**~Quadrupole\_madx\_adaptor**()

*class* **Rbend\_mad8\_adaptor**

*Public Functions*

**Rbend\_mad8\_adaptor**()

void **set\_defaults**([*Lattice\_element*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice__element) & lattice\_element)

void **set\_derived\_attributes\_internal**([*Lattice\_element*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice__element) & lattice\_element)

[*Chef\_elements*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0chef__elements_8h_1a6d36608ae2352f888bcc26d07b266b5f) **get\_chef\_elements**([*Lattice\_element*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice__element) const & lattice\_element, double brho)

template < class Archive >

void **serialize**(Archive & ar, const unsigned int version)

**~Rbend\_mad8\_adaptor**()

*class* **Rbend\_madx\_adaptor**

*Public Functions*

**Rbend\_madx\_adaptor**()

void **set\_defaults**([*Lattice\_element*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice__element) & lattice\_element)

void **set\_derived\_attributes\_internal**([*Lattice\_element*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice__element) & lattice\_element)

[*Chef\_elements*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0chef__elements_8h_1a6d36608ae2352f888bcc26d07b266b5f) **get\_chef\_elements**([*Lattice\_element*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice__element) const & lattice\_element, double brho)

template < class Archive >

void **serialize**(Archive & ar, const unsigned int version)

**~Rbend\_madx\_adaptor**()

*class* **Rcollimator\_mad8\_adaptor**

*Public Functions*

**Rcollimator\_mad8\_adaptor**()

template < class Archive >

void **serialize**(Archive & ar, const unsigned int version)

**~Rcollimator\_mad8\_adaptor**()

*class* **Rcollimator\_madx\_adaptor**

*Public Functions*

**Rcollimator\_madx\_adaptor**()

template < class Archive >

void **serialize**(Archive & ar, const unsigned int version)

**~Rcollimator\_madx\_adaptor**()

*class* **Rfcavity\_mad8\_adaptor**

*Public Functions*

**Rfcavity\_mad8\_adaptor**()

[*Chef\_elements*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0chef__elements_8h_1a6d36608ae2352f888bcc26d07b266b5f) **get\_chef\_elements**([*Lattice\_element*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice__element) const & lattice\_element, double brho)

template < class Archive >

void **serialize**(Archive & ar, const unsigned int version)

**~Rfcavity\_mad8\_adaptor**()

*class* **Rfcavity\_madx\_adaptor**

*Public Functions*

**Rfcavity\_madx\_adaptor**()

[*Chef\_elements*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0chef__elements_8h_1a6d36608ae2352f888bcc26d07b266b5f) **get\_chef\_elements**([*Lattice\_element*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice__element) const & lattice\_element, double brho)

void **set\_derived\_attributes\_external**([*Lattice\_element*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice__element) & lattice\_element, double lattice\_length, double beta)

template < class Archive >

void **serialize**(Archive & ar, const unsigned int version)

**~Rfcavity\_madx\_adaptor**()

*class* **Sbend\_mad8\_adaptor**

*Public Functions*

**Sbend\_mad8\_adaptor**()

[*Chef\_elements*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0chef__elements_8h_1a6d36608ae2352f888bcc26d07b266b5f) **get\_chef\_elements**([*Lattice\_element*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice__element) const & lattice\_element, double brho)

template < class Archive >

void **serialize**(Archive & ar, const unsigned int version)

**~Sbend\_mad8\_adaptor**()

*class* **Sbend\_madx\_adaptor**

*Public Functions*

**Sbend\_madx\_adaptor**()

[*Chef\_elements*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0chef__elements_8h_1a6d36608ae2352f888bcc26d07b266b5f) **get\_chef\_elements**([*Lattice\_element*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice__element) const & lattice\_element, double brho)

template < class Archive >

void **serialize**(Archive & ar, const unsigned int version)

**~Sbend\_madx\_adaptor**()

*class* **Septum\_mad8\_adaptor**

*Public Functions*

**Septum\_mad8\_adaptor**()

[*Chef\_elements*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0chef__elements_8h_1a6d36608ae2352f888bcc26d07b266b5f) **get\_chef\_elements**([*Lattice\_element*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice__element) const & lattice\_element, double brho)

template < class Archive >

void **serialize**(Archive & ar, const unsigned int version)

**~Septum\_mad8\_adaptor**()

*class* **Septum\_madx\_adaptor**

*Public Functions*

**Septum\_madx\_adaptor**()

[*Chef\_elements*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0chef__elements_8h_1a6d36608ae2352f888bcc26d07b266b5f) **get\_chef\_elements**([*Lattice\_element*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice__element) const & lattice\_element, double brho)

template < class Archive >

void **serialize**(Archive & ar, const unsigned int version)

**~Septum\_madx\_adaptor**()

*class* **Sextupole\_mad8\_adaptor**

*Public Functions*

**Sextupole\_mad8\_adaptor**()

[*Chef\_elements*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0chef__elements_8h_1a6d36608ae2352f888bcc26d07b266b5f) **get\_chef\_elements**([*Lattice\_element*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice__element) const & lattice\_element, double brho)

template < class Archive >

void **serialize**(Archive & ar, const unsigned int version)

**~Sextupole\_mad8\_adaptor**()

*class* **Sextupole\_madx\_adaptor**

*Public Functions*

**Sextupole\_madx\_adaptor**()

[*Chef\_elements*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0chef__elements_8h_1a6d36608ae2352f888bcc26d07b266b5f) **get\_chef\_elements**([*Lattice\_element*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice__element) const & lattice\_element, double brho)

template < class Archive >

void **serialize**(Archive & ar, const unsigned int version)

**~Sextupole\_madx\_adaptor**()

*class* **Solenoid\_mad8\_adaptor**

*Public Functions*

**Solenoid\_mad8\_adaptor**()

template < class Archive >

void **serialize**(Archive & ar, const unsigned int version)

**~Solenoid\_mad8\_adaptor**()

*class* **Solenoid\_madx\_adaptor**

*Public Functions*

**Solenoid\_madx\_adaptor**()

template < class Archive >

void **serialize**(Archive & ar, const unsigned int version)

**~Solenoid\_madx\_adaptor**()

*class* **Srot\_mad8\_adaptor**

*Public Functions*

**Srot\_mad8\_adaptor**()

[*Chef\_elements*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0chef__elements_8h_1a6d36608ae2352f888bcc26d07b266b5f) **get\_chef\_elements**([*Lattice\_element*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice__element) const & lattice\_element, double brho)

template < class Archive >

void **serialize**(Archive & ar, const unsigned int version)

**~Srot\_mad8\_adaptor**()

*class* **Srot\_madx\_adaptor**

*Public Functions*

**Srot\_madx\_adaptor**()

[*Chef\_elements*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0chef__elements_8h_1a6d36608ae2352f888bcc26d07b266b5f) **get\_chef\_elements**([*Lattice\_element*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice__element) const & lattice\_element, double brho)

template < class Archive >

void **serialize**(Archive & ar, const unsigned int version)

**~Srot\_madx\_adaptor**()

*class* **Thinpole\_mad8\_adaptor**

*Public Functions*

**Thinpole\_mad8\_adaptor**()

[*Chef\_elements*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0chef__elements_8h_1a6d36608ae2352f888bcc26d07b266b5f) **get\_chef\_elements**([*Lattice\_element*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice__element) const & lattice\_element, double brho)

template < class Archive >

void **serialize**(Archive & ar, const unsigned int version)

**~Thinpole\_mad8\_adaptor**()

*class* **Thinpole\_madx\_adaptor**

*Public Functions*

**Thinpole\_madx\_adaptor**()

[*Chef\_elements*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0chef__elements_8h_1a6d36608ae2352f888bcc26d07b266b5f) **get\_chef\_elements**([*Lattice\_element*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice__element) const & lattice\_element, double brho)

template < class Archive >

void **serialize**(Archive & ar, const unsigned int version)

**~Thinpole\_madx\_adaptor**()

*class* **Vkicker\_mad8\_adaptor**

*Public Functions*

**Vkicker\_mad8\_adaptor**()

[*Chef\_elements*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0chef__elements_8h_1a6d36608ae2352f888bcc26d07b266b5f) **get\_chef\_elements**([*Lattice\_element*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice__element) const & lattice\_element, double brho)

template < class Archive >

void **serialize**(Archive & ar, const unsigned int version)

**~Vkicker\_mad8\_adaptor**()

*class* **Vkicker\_madx\_adaptor**

*Public Functions*

**Vkicker\_madx\_adaptor**()

[*Chef\_elements*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0chef__elements_8h_1a6d36608ae2352f888bcc26d07b266b5f) **get\_chef\_elements**([*Lattice\_element*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice__element) const & lattice\_element, double brho)

template < class Archive >

void **serialize**(Archive & ar, const unsigned int version)

**~Vkicker\_madx\_adaptor**()

*class* **Vmonitor\_mad8\_adaptor**

*Public Functions*

**Vmonitor\_mad8\_adaptor**()

[*Chef\_elements*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0chef__elements_8h_1a6d36608ae2352f888bcc26d07b266b5f) **get\_chef\_elements**([*Lattice\_element*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice__element) const & lattice\_element, double brho)

template < class Archive >

void **serialize**(Archive & ar, const unsigned int version)

**~Vmonitor\_mad8\_adaptor**()

*class* **Vmonitor\_madx\_adaptor**

*Public Functions*

**Vmonitor\_madx\_adaptor**()

[*Chef\_elements*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0chef__elements_8h_1a6d36608ae2352f888bcc26d07b266b5f) **get\_chef\_elements**([*Lattice\_element*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice__element) const & lattice\_element, double brho)

template < class Archive >

void **serialize**(Archive & ar, const unsigned int version)

**~Vmonitor\_madx\_adaptor**()

*class* **synergia::Mad8**

*Public Functions*

**Mad8**()

string\_t **variable\_as\_string**(string\_t const & name)

double **variable\_as\_number**(string\_t const & name)

size\_t **command\_count**()

[*Mad8\_command*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0classsynergia_1_1_mad8__command) const & **command**(size\_t idx)

size\_t **label\_count**()

[*Mad8\_command*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0classsynergia_1_1_mad8__command) const & **label**(string\_t const & l)

size\_t **line\_count**()

[*Mad8\_line*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0classsynergia_1_1_mad8__line) const & **line**(string\_t const & l)

void **insert\_variable**(string\_t const & name, double value)

void **insert\_variable**(string\_t const & name, string\_t const & value)

void **insert\_label**(string\_t const & name, [*Mad8\_command*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0classsynergia_1_1_mad8__command) const & cmd)

void **insert\_line**(string\_t const & name, [*Mad8\_line*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0classsynergia_1_1_mad8__line) const & line)

void **insert\_command**([*Mad8\_command*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0classsynergia_1_1_mad8__command) const & cmd)

*class* **synergia::Mad8\_command**

*Public Functions*

**Mad8\_command**()

string\_t **name**()

size\_t **attribute\_count**()

string\_t **attribute\_as\_string**(string\_t const & name)

double **attribute\_as\_number**(string\_t const & name)

void **set\_name**(string\_t const & name)

void **insert\_attribute**(string\_t const & name, double val)

void **insert\_attribute**(string\_t const & name, string\_t const & val)

*class* **synergia::Mad8\_line**

*Public Functions*

**Mad8\_line**()

size\_t **element\_count**()

ele\_t **element\_type**(size\_t idx)

string\_t **element\_as\_string**(size\_t idx)

[*Mad8\_line*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0classsynergia_1_1_mad8__line) **element\_as\_line**(size\_t idx)

void **insert\_operator**(string\_t const & op)

void **insert\_element**(string\_t const & ele)

void **insert\_subline**([*Mad8\_line*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0classsynergia_1_1_mad8__line) const & line)

*class* **synergia::MadX**

*Public Functions*

**MadX**()

string\_t **variable\_as\_string**(string\_t const & name)

string\_t **variable\_as\_string**(string\_t const & name, string\_t const & def)

double **variable\_as\_number**(string\_t const & name)

double **variable\_as\_number**(string\_t const & name, double def)

bool **variable\_as\_boolean**(string\_t const & name)

std::vector< double > **variable\_as\_number\_seq**(string\_t const & name)

std::vector< double > **variable\_as\_number\_seq**(string\_t const & name, double def)

size\_t **command\_count**()

std::vector< string\_t > **commands**()

[*MadX\_command*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0classsynergia_1_1_mad_x__command) **command**(size\_t idx, bool resolve = true)

size\_t **label\_count**()

std::vector< string\_t > **command\_labels**()

[*MadX\_command*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0classsynergia_1_1_mad_x__command) **command**(string\_t const & l, bool resolve = true)

size\_t **line\_count**()

std::vector< string\_t > **line\_labels**()

[*MadX\_line*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0classsynergia_1_1_mad_x__line) const & **line**(string\_t const & l)

size\_t **sequence\_count**()

std::vector< string\_t > **sequence\_labels**()

[*MadX\_sequence*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0classsynergia_1_1_mad_x__sequence) const & **sequence**(string\_t const & s)

[*MadX\_sequence*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0classsynergia_1_1_mad_x__sequence) const & **current\_sequence**()

[*MadX\_sequence*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0classsynergia_1_1_mad_x__sequence) & **current\_sequence**()

MadX\_entry\_type **entry\_type**(string\_t const & entry)

void **print**()

void **insert\_variable**(string\_t const & name, string\_t const & value)

void **insert\_variable**(string\_t const & name, mx\_expr const & value)

void **insert\_variable**(string\_t const & name, mx\_exprs const & value)

void **insert\_label**(string\_t const & name, [*MadX\_command*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0classsynergia_1_1_mad_x__command) const & cmd)

void **insert\_line**(string\_t const & name, [*MadX\_line*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0classsynergia_1_1_mad_x__line) const & line)

void **insert\_command**([*MadX\_command*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0classsynergia_1_1_mad_x__command) const & cmd)

void **start\_sequence**()

void **end\_sequence**()

void **insert\_attribute**(string\_t const & name, string\_t const & value)

void **insert\_attribute**(string\_t const & name, mx\_expr const & value)

void **insert\_attribute**(string\_t const & name, mx\_exprs const & value)

*Public Static Attributes*

double **nan**

string\_t **nst**

*class* **synergia::MadX\_command**

*Public Functions*

**MadX\_command**([*MadX*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0classsynergia_1_1_mad_x) \* parent = NULL)

string\_t **name**()

string\_t **label**()

size\_t **attribute\_count**()

std::vector< string\_t > **attribute\_names**()

MadX\_value\_type **attribute\_type**(string\_t const & name)

string\_t **attribute\_as\_string**(string\_t const & name)

string\_t **attribute\_as\_string**(string\_t const & name, string\_t const & def)

double **attribute\_as\_number**(string\_t const & name)

double **attribute\_as\_number**(string\_t const & name, double def)

bool **attribute\_as\_boolean**(string\_t const & name)

std::vector< double > **attribute\_as\_number\_seq**(string\_t const & name)

std::vector< double > **attribute\_as\_number\_seq**(string\_t const & name, double def)

MadX\_command\_type **type**()

bool **is\_element**()

bool **is\_reference**()

bool **is\_command**()

void **set\_parent**([*MadX*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0classsynergia_1_1_mad_x) const & parent)

void **set\_name**(string\_t const & name, MadX\_command\_type cmd\_type)

void **set\_label**(string\_t const & label)

void **insert\_attribute**(string\_t const & name, string\_t const & val)

void **insert\_attribute**(string\_t const & name, mx\_expr const & val)

void **insert\_attribute**(string\_t const & name, mx\_exprs const & val)

void **merge\_with\_overwrite**([*MadX\_command*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0classsynergia_1_1_mad_x__command) const & other)

void **merge**([*MadX\_command*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0classsynergia_1_1_mad_x__command) const & other)

*class* **synergia::MadX\_line**

*Public Functions*

**MadX\_line**([*MadX*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0classsynergia_1_1_mad_x) const & parent)

size\_t **element\_count**()

string\_t **element\_name**(size\_t idx)

[*MadX\_command*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0classsynergia_1_1_mad_x__command) **element**(size\_t idx, bool resolve = true)

void **insert\_element**(string\_t const & ele)

void **print**()

*class* **synergia::MadX\_sequence**

*Public Functions*

**MadX\_sequence**([*MadX*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0classsynergia_1_1_mad_x) const & parent)

string\_t **label**()

double **length**()

size\_t **element\_count**()

[*MadX\_command*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0classsynergia_1_1_mad_x__command) **element**(size\_t idx, bool resolve = true)

MadX\_entry\_type **element\_type**(size\_t idx)

MadX\_sequence\_refer **refer**()

void **set\_label**(string\_t const & label)

void **set\_length**(double length)

void **set\_refer**(MadX\_sequence\_refer ref)

void **add\_element**([*MadX\_command*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0classsynergia_1_1_mad_x__command) const & cmd)

void **reset**()

void **print**()

*class* **synergia::mx\_attr**

*Public Functions*

**mx\_attr**()

void **set\_attr**(std::string const & name, boost::any const & val)

void **set\_lazy\_attr**(std::string const & name, boost::any const & val)

mx\_attr\_type **type**()

std::string **name**()

boost::any **value**()

*class* **synergia::mx\_calculator**

*Public Functions*

**mx\_calculator**()

**mx\_calculator**(double def)

**mx\_calculator**([*MadX*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0classsynergia_1_1_mad_x) const & mx)

**mx\_calculator**([*MadX*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0classsynergia_1_1_mad_x) const & mx, double def)

double **operator()**(double val)

double **operator()**(std::string const & ref)

double **operator()**(string\_pair\_t const & ref)

double **operator()**(nop\_t const & n)

double **operator()**(uop\_t const & u)

double **operator()**(bop\_t const & b)

*Public Static Attributes*

double **nan**

*class* **synergia::mx\_command**

*Public Functions*

**mx\_command**()

void **set\_label**(std::string const & label)

void **set\_keyword**(mx\_keyword const & keyword)

void **set\_keyword**(std::string const & keyword, mx\_cmd\_type tag)

void **ins\_attr**([*mx\_attr*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0classsynergia_1_1mx__attr) const & attr)

bool **has\_label**()

void **interpret**([*MadX*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0classsynergia_1_1_mad_x) & mx)

void **execute**([*MadX*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0classsynergia_1_1_mad_x) & mx)

void **print**()

*class* **synergia::mx\_if**

*Public Functions*

**mx\_if**()

void **assign\_if**([*mx\_logic*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0classsynergia_1_1mx__logic) const & logic, [*mx\_tree*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0classsynergia_1_1mx__tree) const & block)

void **assign\_elseif**([*mx\_logic*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0classsynergia_1_1mx__logic) const & logic, [*mx\_tree*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0classsynergia_1_1mx__tree) const & block)

void **assign\_else**([*mx\_tree*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0classsynergia_1_1mx__tree) const & block)

void **interpret**([*MadX*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0classsynergia_1_1_mad_x) & mx)

void **print**()

*class* **synergia::mx\_if\_block**

*Public Functions*

**mx\_if\_block**()

**mx\_if\_block**([*mx\_logic*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0classsynergia_1_1mx__logic) const & logic, [*mx\_tree*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0classsynergia_1_1mx__tree) const & block)

bool **valid**()

bool **evaluate\_logic**([*MadX*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0classsynergia_1_1_mad_x) const & mx)

void **interpret\_block**([*MadX*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0classsynergia_1_1_mad_x) & mx)

void **print\_logic**()

void **print\_block**()

*class* **synergia::mx\_line**

*Public Functions*

**mx\_line**()

**mx\_line**(string\_t const & name, [*mx\_line\_seq*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0classsynergia_1_1mx__line__seq) const & seq)

void **interpret**([*MadX*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0classsynergia_1_1_mad_x) & mx)

*class* **synergia::mx\_line\_member**

*Public Functions*

**mx\_line\_member**()

**mx\_line\_member**(string\_t const & name)

**mx\_line\_member**([*mx\_line\_seq*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0classsynergia_1_1mx__line__seq) const & seq)

void **interpret**([*MadX*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0classsynergia_1_1_mad_x) const & mx, [*MadX\_line*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0classsynergia_1_1_mad_x__line) & line, int op = 1)

*class* **synergia::mx\_line\_seq**

*Public Functions*

**mx\_line\_seq**()

void **insert\_member**(int op, [*mx\_line\_member*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0classsynergia_1_1mx__line__member) const & member)

void **interpret**([*MadX*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0classsynergia_1_1_mad_x) const & mx, [*MadX\_line*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0classsynergia_1_1_mad_x__line) & line, int op = 1)

*class* **synergia::mx\_logic**

*Public Functions*

**mx\_logic**(bool p = true)

**mx\_logic**(mx\_expr const & l, mx\_expr const & r, logic\_op\_t o)

void **set**(mx\_expr const & l, logic\_op\_t o, mx\_expr const & r)

bool **evaluate**([*MadX*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0classsynergia_1_1_mad_x) const & mx)

*class* **synergia::mx\_statement**

*Public Functions*

**mx\_statement**()

**mx\_statement**([*mx\_command*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0classsynergia_1_1mx__command) const & st)

**mx\_statement**([*mx\_if*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0classsynergia_1_1mx__if) const & st)

**mx\_statement**([*mx\_while*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0classsynergia_1_1mx__while) const & st)

**mx\_statement**([*mx\_line*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0classsynergia_1_1mx__line) const & st)

void **assign**([*mx\_command*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0classsynergia_1_1mx__command) const & st)

void **assign**([*mx\_if*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0classsynergia_1_1mx__if) const & st)

void **assign**([*mx\_while*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0classsynergia_1_1mx__while) const & st)

void **assign**([*mx\_line*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0classsynergia_1_1mx__line) const & st)

void **interpret**([*MadX*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0classsynergia_1_1_mad_x) & mx)

void **print**()

*class* **synergia::mx\_tree**

*Public Functions*

**mx\_tree**()

**mx\_tree**(mx\_statements\_t const & sts)

void **push**([*mx\_statement*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0classsynergia_1_1mx__statement) const & st)

void **interpret**([*MadX*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0classsynergia_1_1_mad_x) & mx)

void **print**()

*class* **synergia::mx\_while**

*Public Functions*

**mx\_while**()

void **assign**([*mx\_logic*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0classsynergia_1_1mx__logic) const & logic, [*mx\_tree*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0classsynergia_1_1mx__tree) const & block)

void **interpret**([*MadX*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0classsynergia_1_1_mad_x) & mx)

void **print**()

**Typedefs**

typedef std::list< ElmPtr > **Chef\_elements**

typedef boost::shared\_ptr< [*Chef\_lattice\_section*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_chef__lattice__section) > **Chef\_lattice\_section\_sptr**

typedef boost::shared\_ptr< [*Chef\_lattice*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_chef__lattice) > **Chef\_lattice\_sptr**

typedef boost::shared\_ptr< [*Element\_adaptor\_map*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_element__adaptor__map) > **Element\_adaptor\_map\_sptr**

typedef boost::shared\_ptr< [*Element\_adaptor*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_element__adaptor) > **Element\_adaptor\_sptr**

typedef boost::shared\_ptr< [*Lattice\_diagnostics*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice__diagnostics) > **Lattice\_diagnostics\_sptr**

typedef boost::shared\_ptr< [*Lattice\_element\_slice*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice__element__slice) > **Lattice\_element\_slice\_sptr**

typedef std::list< [*Lattice\_element\_slice\_sptr*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0lattice__element__slice_8h_1ab0bb2db459044dd329c1245604313030) > **Lattice\_element\_slices**

typedef boost::shared\_ptr< [*Lattice\_element*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice__element) > **Lattice\_element\_sptr**

typedef std::list< [*Lattice\_element\_sptr*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0lattice__element_8h_1af69189c702f654fd34b2c22816a7e1b9) > **Lattice\_elements**

typedef boost::shared\_ptr< [*Lattice*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_lattice) > **Lattice\_sptr**

typedef boost::shared\_ptr< [*Mad8\_adaptor\_map*](http://compacc.fnal.gov/~amundson/html/lattice.html#project0class_mad8__adaptor__map) > **Mad8\_adaptor\_map\_sptr**