

rl_raylib
1.1.8

Generated by Doxygen 1.7.1

Wed Oct 3 2012 18:04:56

Contents

1	rl_RayLib User's Guide	1
1.1	Copyright and License	1
1.2	Purpose	1
1.2.1	Ray class	2
1.2.2	Reflectivity classes	2
2	Directory Hierarchy	2
2.1	Directories	2
3	Class Index	3
3.1	Class List	3
4	Directory Documentation	4
4.1	rl_raylib/ Directory Reference	4
5	Class Documentation	5
5.1	rl_DielectricData Class Reference	5
5.1.1	Detailed Description	6
5.1.2	Constructor & Destructor Documentation	6
5.1.3	Member Function Documentation	7
5.2	rl_DielectricData::rl_DielectricDataBinPOD Struct Reference	9
5.2.1	Detailed Description	10
5.2.2	Member Data Documentation	10
5.3	rl_DielectricLayer Class Reference	10
5.3.1	Detailed Description	12
5.3.2	Member Typedef Documentation	12
5.3.3	Constructor & Destructor Documentation	13
5.3.4	Member Function Documentation	14
5.4	rl_Traits::rl_DielectricPOD Struct Reference	21
5.4.1	Detailed Description	22
5.4.2	Member Data Documentation	22

5.5	rl_DielectricPODArray Class Reference	23
5.5.1	Detailed Description	24
5.5.2	Constructor & Destructor Documentation	24
5.5.3	Member Function Documentation	25
5.5.4	Member Data Documentation	27
5.6	rl_Exception Class Reference	28
5.6.1	Detailed Description	28
5.6.2	Constructor & Destructor Documentation	28
5.7	rl_Multilayer Class Reference	29
5.7.1	Detailed Description	30
5.7.2	Member Typedef Documentation	31
5.7.3	Constructor & Destructor Documentation	31
5.7.4	Member Function Documentation	31
5.7.5	Member Data Documentation	34
5.8	rl_MultilayerSurface Class Reference	35
5.8.1	Detailed Description	37
5.8.2	Constructor & Destructor Documentation	37
5.8.3	Member Function Documentation	37
5.9	rl_Polarization Class Reference	39
5.9.1	Detailed Description	40
5.9.2	Member Typedef Documentation	40
5.9.3	Constructor & Destructor Documentation	41
5.9.4	Member Function Documentation	42
5.10	rl_PolCSPOD Struct Reference	45
5.10.1	Detailed Description	46
5.10.2	Member Function Documentation	46
5.10.3	Member Data Documentation	48
5.11	rl_Ray Class Reference	48
5.11.1	Detailed Description	49
5.11.2	Constructor & Destructor Documentation	50
5.11.3	Member Function Documentation	50

5.12	rl_ReflectionCoefPOD Class Reference	54
5.12.1	Detailed Description	54
5.12.2	Member Function Documentation	54
5.13	rl_Traits Class Reference	57
5.13.1	Detailed Description	58
5.13.2	Member Typedef Documentation	58
5.13.3	Member Enumeration Documentation	58
5.14	rl_TransmissionCoefPOD Class Reference	59
5.14.1	Detailed Description	60
5.14.2	Member Function Documentation	60

1 rl_RayLib User's Guide

1.1 Copyright and License

Copyright (C) 2006 Smithsonian Astrophysical Observatory

This file is part of the rl_raylib package.

rl_raylib is free software; you can redistribute it and/or modify it under the terms of the GNU General Public License as published by the Free Software Foundation; either version 2 of the License, or (at your option) any later version.

tracefct 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. See the GNU General Public License for more details.

You should have received a copy of the GNU General Public License along with this program; if not, write to the Free Software Foundation, Inc. 51 Franklin Street, Fifth Floor Boston, MA 02110-1301, USA

Author

Terry Gaetz

1.2 Purpose

The rl_RayLib library consists of a set of C++ classes for manipulating rays, including the effects of multilayer reflectivity.

1.2.1 Ray class

The [rl_Ray](#) class generalizes the [rl_BasicRay](#) class (found in the [rl_basicray](#) package) to include polarization information to the [rl_BasicRay](#)'s position, direction, energy, and id number components. See the [rl_basicray](#) package documentation for further information on the [rl_BasicRay](#) and [rl_RayMath](#) classes.

The rays can be translated/rotated from a standard coordinate system (STD) to a “body center system” (BCS), and de-rotated/de-translated from the BCS system back to the STD system. Given a surface normal, the ray direction can be reflected to a new direction. This yields much of the transformation functionality needed for basic raytracing.

1.2.2 Reflectivity classes

The reflectivity classes include a number of components:

- [rl_DielectricData](#) encapsulates an array of energy bins providing the dielectric decrement information and methods to evaluate (interpolate) the decrements at a requested energy. The array is built on a helper “Plain Ol’ Data” (POD) struct [rl_DielectricPOD](#) which provides the dielectric decrement at a specific energy.
- [rl_DielectricLayer](#) encapsulates the information about the interaction of a photon with a single dielectric layer, including the layer thickness, dielectric decrements given the photon energy, the component of the photon wave vector perpendicular to the layer, and various reflection and transmission coefficients, and surface “roughness” information. The layer can be a “substrate” (in which case the layer is considered as semi-infinite), vacuum, or a dielectric layer. These are mediated by helper “Plain Ol’ Data” (POD) structs and classes: [rl_ReflectionCoefPOD](#), [rl_TransmissionCoefPOD](#), [rl_ReflectionCoefPOD](#).
- [rl_Multilayer](#) encapsulates a stack of [rl_DielectricLayer](#)'s. Given the energy, sine of the graze angle, the multilayer reflectivity can be evaluated.
- [rl_MultilayerSurface](#) adds surface normal information to an [rl_Multilayer](#). Given an [rl_Ray](#), [rl_MultilayerSurface](#) can evaluate the reflectivity for the surface. This is also where hooks for surface interception and scattering could be placed.

2 Directory Hierarchy

2.1 Directories

This directory hierarchy is sorted roughly, but not completely, alphabetically:

[rl_raylib](#)

4

3 Class Index

3.1 Class List


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

rl_DielectricData	5
rl_DielectricData::rl_DielectricDataBinPOD	9
rl_DielectricLayer	10
rl_Traits::rl_DielectricPOD	21
rl_DielectricPODArray	23
rl_Exception	28
rl_Multilayer	29
rl_MultilayerSurface	35
rl_Polarization	39
rl_PolCSPOD	45
rl_Ray	48
rl_ReflectionCoefPOD	54
rl_Traits	57
rl_TransmissionCoefPOD	59

4 Directory Documentation

4.1 rl_raylib/ Directory Reference

Directory dependency graph for rl_raylib/:



rl_raylib

Files

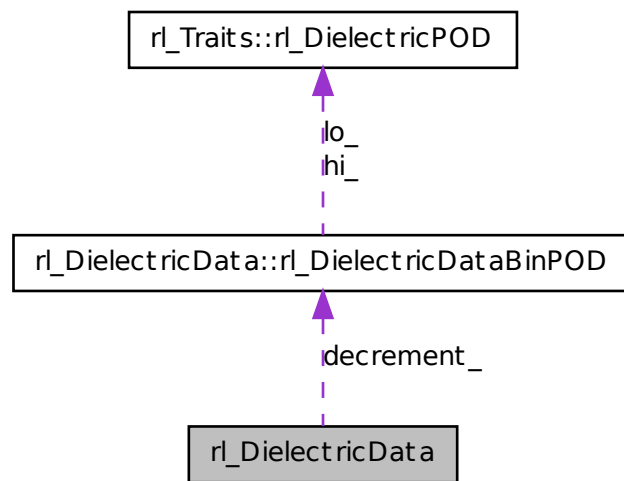
- file **rl_DielectricData.cc**
- file **rl_DielectricData.h**
- file **rl_DielectricLayer.cc**
- file **rl_DielectricLayer.h**
- file **rl_DielectricPODArray.cc**
- file **rl_DielectricPODArray.h**
- file **rl_Exception.cc**
- file **rl_Exception.h**
- file **rl_Multilayer.cc**
- file **rl_Multilayer.h**
- file **rl_MultilayerSurface.cc**
- file **rl_MultilayerSurface.h**
- file **rl_Polarization.cc**
- file **rl_Polarization.h**
- file **rl_Ray.cc**
- file **rl_Ray.h**
- file **rl_RayLib.h**
- file **rl_ReflectionCoefPOD.h**
- file **rl_Traits.h**
- file **rl_TransmissionCoefPOD.h**

5 Class Documentation

5.1 rl_DielectricData Class Reference

```
#include <rl_DielectricData.h>
```

Collaboration diagram for rl_DielectricData:



Classes

- struct [rl_DielectricDataBinPOD](#)

Public Member Functions

- [~rl_DielectricData\(\)](#)
- [rl_DielectricData\(\)](#)
- [rl_DielectricData\(rl_DielectricData const &other\) throw \(rl_Exception\)](#)
- [rl_DielectricData\(rl_Traits::rl_DielectricPOD const *diel, size_t num_pts, rl_Traits::EInterpMode interp_mode, double bulk_density=1.0\) throw \(rl_Exception\)](#)

- void `init` (`rl_Traits::rl_DielectricPOD` const *diel, `size_t` num_pts, `rl_Traits::EInterpMode` interp_mode, double bulk_density=1.0) throw (`rl_Exception`)
- int `alpha_gamma` (double energy, double &alpha, double &gamma)
- double `energy_min` () const
- double `energy_max` () const
- double `bulk_density_factor` () const
- `rl_Traits::Bool` `is_vacuum` () const

5.1.1 Detailed Description

A class encapsulating the dielectric data (alpha, gamma) as a function of energy.

Definition at line 64 of file `rl_DielectricData.h`.

5.1.2 Constructor & Destructor Documentation

5.1.2.1 `rl_DielectricData::~~rl_DielectricData` ()

Non-virtual destructor.

Definition at line 53 of file `rl_DielectricData.cc`.

5.1.2.2 `rl_DielectricData::rl_DielectricData` () [`inline`]

Default constructor. Constructs a vacuum `rl_DielectricData`. Use `init` to initialize the object to a state other than vacuum.

Definition at line 215 of file `rl_DielectricData.h`.

5.1.2.3 `rl_DielectricData::rl_DielectricData` (`rl_DielectricData` const & *other*) throw (`rl_Exception`)

Copy constructor

Parameters

other `rl_DielectricData` to be copied.

Definition at line 60 of file `rl_DielectricData.cc`.

5.1.2.4 rl_DielectricData::rl_DielectricData (rl_Traits::rl_DielectricPOD const * *diel*, size_t *num_pts*, rl_Traits::EInterpMode *interp_mode*, double *bulk_density* = 1.0) throw (rl_Exception)

Constructor. The data for the dielectric constants are obtained from a c-style array of const rl_DielectricPOD; the array contains num_pts points. The interpolation mode will be set to interp_mode. The optical constants will be scaled by bulk_density.

Parameters

diel an array of num_pts POD's containing the complex dielectric decrements.

num_pts number of elements in diel.

interp_mode type of interpolation to be used in interpolating the dielectric constants.

bulk_density relative bulk density factor to be used; 1.0 for full bulk density. The dielectric decrements will be scaled by bulk_density.

Definition at line 75 of file rl_DielectricData.cc.

5.1.3 Member Function Documentation

5.1.3.1 int rl_DielectricData::alpha_gamma (double *energy*, double & *alpha*, double & *gamma*)

Evaluate the dielectric decrements, alpha and gamma, at the given energy. The energy must be between the minimum and the maximum energies in the rl_DielectricPOD array used to initialize the rl_DielectricData. Returns: 0 on success; -1 if energy is below lower limit, +1 if energy is above upper limit.

Parameters

energy photon energy (in keV).

alpha real part of the complex dielectric decrement.

gamma imaginary part of the complex dielectric decrement.

Definition at line 176 of file rl_DielectricData.cc.

References rl_Traits::rl_DielectricPOD::alpha_, rl_Traits::ELinLin, rl_Traits::ELinLog, rl_Traits::ELogLin, rl_Traits::ELogLog, rl_Traits::rl_DielectricPOD::energy_, rl_Traits::rl_DielectricPOD::gamma_, rl_DielectricData::rl_DielectricDataBinPOD::hi_, and rl_DielectricData::rl_DielectricDataBinPOD::lo_.

Referenced by rl_DielectricLayer::setup_for().

5.1.3.2 double rl_DielectricData::bulk_density_factor () const [inline]

Return the maximum energy covered by this dataset. Return the relative bulk density for this set of optical constants. 1.0 is nominal full bulk density

Definition at line 239 of file rl_DielectricData.h.

Referenced by rl_DielectricLayer::bulk_density_factor(), rl_DielectricLayer::cdump_on(), rl_DielectricLayer::cprint_constraints_on(), and rl_DielectricLayer::dump_on().

5.1.3.3 double rl_DielectricData::energy_max () const [inline]

Return the maximum energy covered by this dataset.

Definition at line 234 of file rl_DielectricData.h.

Referenced by rl_DielectricLayer::cdump_on(), rl_DielectricLayer::cprint_constraints_on(), rl_DielectricLayer::dump_on(), and rl_DielectricLayer::energy_max().

5.1.3.4 double rl_DielectricData::energy_min () const [inline]

Return the minimum energy covered by this dataset.

Definition at line 229 of file rl_DielectricData.h.

Referenced by rl_DielectricLayer::cdump_on(), rl_DielectricLayer::cprint_constraints_on(), rl_DielectricLayer::dump_on(), and rl_DielectricLayer::energy_min().

5.1.3.5 void rl_DielectricData::init (rl_Traits::rl_DielectricPOD const * *diel*, size_t *num_pts*, rl_Traits::EInterpMode *interp_mode*, double *bulk_density* = 1.0) throw (rl_Exception)

Initialization function. The data are obtained from a c-style array of const rl_DielectricPOD; the array contains num_pts points. The interpolation mode will be set to interp_mode. The optical constants will be scaled by bulk_density.

Parameters

diel an array of num_pts POD's containing the complex dielectric decrements.

num_pts number of elements in diel.

interp_mode type of interpolation to be used in interpolating the dielectric constants.

bulk_density relative bulk density factor to be used; 1.0 for full bulk density. The dielectric decrements will be scaled by bulk_density.

Definition at line 86 of file rl_DielectricData.cc.

References rl_Traits::ELinLin, rl_Traits::ELinLog, rl_Traits::ELogLin, and rl_Traits::ELogLog.

5.1.3.6 rl_Traits::Bool rl_DielectricData::is_vacuum () const [inline]

Returns True if the object is a vacuum state; False, otherwise.

Definition at line 244 of file rl_DielectricData.h.

Referenced by rl_DielectricLayer::is_vacuum().

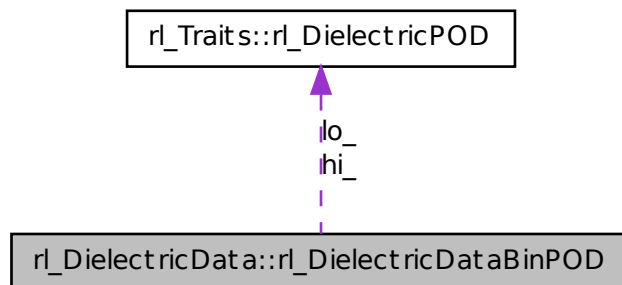
The documentation for this class was generated from the following files:

- rl_DielectricData.h
- rl_DielectricData.cc

5.2 rl_DielectricData::rl_DielectricDataBinPOD Struct Reference

```
#include <rl_DielectricData.h>
```

Collaboration diagram for rl_DielectricData::rl_DielectricDataBinPOD:



Public Attributes

- [rl_Traits::rl_DielectricPOD lo_](#)
lower edge of energy bin

- [rl_Traits::rl_DielectricPOD hi_](#)
upper edge of energy bin

5.2.1 Detailed Description

A POD describing the lower and upper edge of an energy bin.

Definition at line 73 of file rl_DielectricData.h.

5.2.2 Member Data Documentation

5.2.2.1 rl_Traits::rl_DielectricPOD rl_DielectricData::rl_DielectricDataBinPOD::hi_

upper edge of energy bin

Definition at line 78 of file rl_DielectricData.h.

Referenced by rl_DielectricData::alpha_gamma().

5.2.2.2 rl_Traits::rl_DielectricPOD rl_DielectricData::rl_DielectricDataBinPOD::lo_

lower edge of energy bin

Definition at line 76 of file rl_DielectricData.h.

Referenced by rl_DielectricData::alpha_gamma().

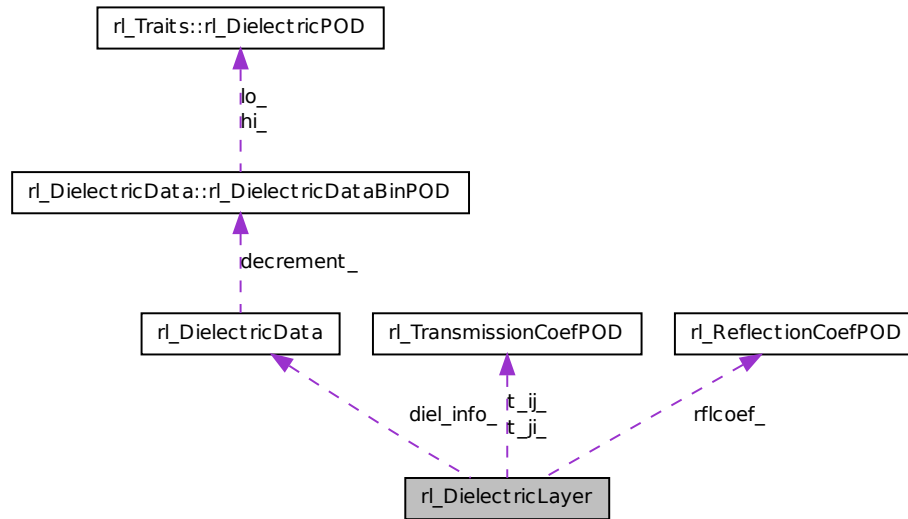
The documentation for this struct was generated from the following file:

- rl_DielectricData.h

5.3 rl_DielectricLayer Class Reference

```
#include <rl_DielectricLayer.h>
```

Collaboration diagram for rl_DielectricLayer:



Public Types

- typedef `rl_Traits::complex` `complex`
complex type
- typedef `rl_Traits::ERoughType` `ERoughType`
roughness type

Public Member Functions

- `~rl_DielectricLayer()`
- `rl_DielectricLayer(char const layer_name[]=0) throw (rl_Exception)`
- `rl_DielectricLayer(rl_DielectricLayer const &other) throw (rl_Exception)`
- `rl_DielectricLayer(rl_Traits::rl_DielectricPOD const *diel, std::size_t ndielpts, double layer_thickness, double roughness, rl_Traits::ERoughType roughness_type, rl_Traits::EInterpMode interp_mode, double bulkdensity, char const *layer_name, rl_Traits::Bool is_substrate=rl_Traits::False) throw (rl_Exception)`

- void `init` (rl_Traits::rl_DielectricPOD const *diel, std::size_t ndielpts, double layer_thickness, double roughness, rl_Traits::ERoughType roughness_type, rl_Traits::EInterpMode interp_mode, double bulkdensity, char const *layer_name, rl_Traits::Bool is_substrate=rl_Traits::False) throw (rl_Exception)
- int `setup_for` (double energy, double sinphi)
- void `reflect_nlayer` (rl_DielectricLayer layer[], int num)
- void `reflect_amp` (rl_DielectricLayer const &layer, double sinphi)
- `complex` const & `propagator` () const
- double `alpha` () const
- double `gamma` () const
- double `roughness` () const
- `ERoughType` `roughness_type` () const
- `rl_ReflectionCoefPOD` const & `reflection_coef` () const
- double `reflectivity` (double polarization_factor=0.0) const
- rl_Traits::Bool `is_substrate` () const
- rl_Traits::Bool `is_vacuum` () const
- char const * `layer_name` () const
- double `energy_min` () const
- double `energy_max` () const
- double `thickness` () const
- double `zcoat` () const
- double `bulk_density_factor` () const
- std::ostream & `dump_on` (std::ostream &os, char const pre[]="", char const pst[]="") const
- void `cdump_on` (std::FILE *of, char const pre[]="", char const pst[]="") const
- void `cprint_constraints_on` (std::FILE *of, char const pre[]="", char const pst[]="") const

5.3.1 Detailed Description

A class encapsulating the multilayer reflection of a ray. Given the energy and the sine of the graze angle, the reflection coefficient is evaluated.

Definition at line 60 of file rl_DielectricLayer.h.

5.3.2 Member Typedef Documentation

5.3.2.1 typedef rl_Traits::complex rl_DielectricLayer::complex

complex type

Definition at line 65 of file rl_DielectricLayer.h.

5.3.2.2 typedef rl_Traits::ERoughType rl_DielectricLayer::ERoughType

roughness type

Definition at line 68 of file rl_DielectricLayer.h.

5.3.3 Constructor & Destructor Documentation

5.3.3.1 rl_DielectricLayer::~~rl_DielectricLayer ()

Destructor

Definition at line 47 of file rl_DielectricLayer.cc.

5.3.3.2 rl_DielectricLayer::rl_DielectricLayer (char const *layer_name*[] = 0) throw (rl_Exception)

Constructor. By default, constructs a VACUUM layer. Use init method to initialize for conditions other than vacuum.

Parameters

layer_name optional string naming the layer.

Definition at line 56 of file rl_DielectricLayer.cc.

5.3.3.3 rl_DielectricLayer::rl_DielectricLayer (rl_DielectricLayer const & *other*) throw (rl_Exception)

DEEP Copy constructor

Parameters

other [rl_DielectricLayer](#) to be copied.

Definition at line 99 of file rl_DielectricLayer.cc.


```

5.3.3.4 rl_DielectricLayer::rl_DielectricLayer ( rl_Traits::rl_DielectricPOD
const * diel, std::size_t ndielpts, double layer_thickness,
double roughness, rl_Traits::ERoughType roughness_type,
rl_Traits::EInterpMode interp_mode, double bulkdensity, char const *
layer_name, rl_Traits::Bool is_substrate = rl_Traits::False )
throw ( rl_Exception )

```

Constructor.

Parameters

diel array of dielectric decrement information.
ndielpts number of points in diel array.
layer_thickness layer thickness (Angstroms).
roughness layer “roughness” (Angstroms).
roughness_type interlayer grading “roughness” type.
interp_mode type of optical constant interpolation to be done.
bulkdensity relative bulk density factor; 1 for full bulk density.
layer_name string describing the layer composition.
is_substrate boolean: True if this is the substrate layer.

Definition at line 142 of file rl_DielectricLayer.cc.

5.3.4 Member Function Documentation

```

5.3.4.1 double rl_DielectricLayer::alpha ( ) const [inline]

```

Returns this layer’s dielectric decrement (real part).

Returns

this layer’s dielectric decrement (real part).

Definition at line 528 of file rl_DielectricLayer.h.

```

5.3.4.2 double rl_DielectricLayer::bulk_density_factor ( ) const [inline]

```

Returns

the relative bulk density for this layer. 1.0 is nominal full bulk density

Definition at line 580 of file rl_DielectricLayer.h.

References rl_DielectricData::bulk_density_factor().

5.3.4.3 `void rl_DielectricLayer::cdump_on (std::FILE * of, char const pre[] = "", char const pst[] = "") const`

Dumps layer information to a C-style FILE* stream.

Parameters

of output file.

pre optional prefix string.

pst optional postfix string.

Definition at line 836 of file rl_DielectricLayer.cc.

References rl_DielectricData::bulk_density_factor(), rl_ReflectionCoefPOD::cprint_on(), rl_DielectricData::energy_max(), rl_DielectricData::energy_min(), and is_vacuum().

Referenced by rl_Multilayer::cdump_on().

5.3.4.4 `void rl_DielectricLayer::cprint_constraints_on (std::FILE * of, char const pre[] = "", char const pst[] = "") const`

Dumps layer information and constraints to a C-style FILE* stream.

Parameters

of output file.

pre optional prefix string.

pst optional postfix string.

Definition at line 880 of file rl_DielectricLayer.cc.

References rl_DielectricData::bulk_density_factor(), rl_DielectricData::energy_max(), rl_DielectricData::energy_min(), is_vacuum(), rl_ReflectionCoefPOD::para(), rl_TransmissionCoefPOD::para(), rl_ReflectionCoefPOD::perp(), and rl_TransmissionCoefPOD::perp().

Referenced by reflect_nlayer().

5.3.4.5 `std::ostream & rl_DielectricLayer::dump_on (std::ostream & os, char const pre[] = "", char const pst[] = "") const`

Dumps layer information to a stream.

Parameters

os stream.

pre optional prefix string.

pst optional postfix string.

Definition at line 791 of file rl_DielectricLayer.cc.

References rl_DielectricData::bulk_density_factor(), rl_DielectricData::energy_max(), rl_DielectricData::energy_min(), and is_vacuum().

Referenced by rl_Multilayer::dump_on().

5.3.4.6 double rl_DielectricLayer::energy_max () const [inline]

Returns

the maximum energy allowed for this layer.

Definition at line 576 of file rl_DielectricLayer.h.

References rl_DielectricData::energy_max().

5.3.4.7 double rl_DielectricLayer::energy_min () const [inline]

Returns

the minimum energy allowed for this layer.

Definition at line 572 of file rl_DielectricLayer.h.

References rl_DielectricData::energy_min().

5.3.4.8 double rl_DielectricLayer::gamma () const [inline]

Returns this layer's dielectric decrement (imag part).

Returns

this layer's dielectric decrement (imag part).

Definition at line 532 of file rl_DielectricLayer.h.

```

5.3.4.9 void rl_DielectricLayer::init ( rl_Traits::rl_DielectricPOD const *
    diel, std::size_t ndielpts, double layer_thickness, double roughness,
    rl_Traits::ERoughType roughness_type, rl_Traits::EInterpMode
    interp_mode, double bulkdensity, char const * layer_name,
    rl_Traits::Bool is_substrate = rl_Traits::False ) throw (
    rl_Exception )

```

Initializer

Parameters

diel array of dielectric decrement information.

ndielpts number of points in diel array.

layer_thickness layer thickness (Angstroms).

roughness interlayer grading "roughness" (Angstrom).

roughness_type interlayer grading "roughness" type.

interp_mode type of optical constant interpolation to be done.

bulkdensity relative bulk density factor; 1 for full bulk density.

layer_name string describing the layer composition.

is_substrate boolean: True if this is the substrate layer.

Definition at line 160 of file rl_DielectricLayer.cc.

References rl_Traits::ERoughDebyeWaller_CSAO, rl_Traits::ERoughDebyeWaller_RSAO, rl_Traits::ERoughDebyeWaller_Spiller, rl_Traits::ERoughModifiedDebyeWaller, rl_Traits::ERoughNevotCroce, and rl_Traits::ERoughNone.

```

5.3.4.10 rl_Traits::Bool rl_DielectricLayer::is_substrate ( ) const [inline]

```

Returns

rl_Traits::True if this layer is the substrate, rl_Traits::False otherwise.

Definition at line 560 of file rl_DielectricLayer.h.

Referenced by reflect_amp(), and setup_for().

```

5.3.4.11 rl_Traits::Bool rl_DielectricLayer::is_vacuum ( ) const [inline]

```

Returns

rl_Traits::True if this layer is the vacuum, rl_Traits::False otherwise.

Definition at line 564 of file rl_DielectricLayer.h.

References rl_DielectricData::is_vacuum().

Referenced by cdump_on(), cprint_constraints_on(), dump_on(), and setup_for().

5.3.4.12 char const * rl_DielectricLayer::layer_name () const [inline]**Returns**

the name of this layer as a character string.

Definition at line 568 of file rl_DielectricLayer.h.

5.3.4.13 rl_Traits::complex const & rl_DielectricLayer::propagator () const [inline]

The propagator for this layer.

Returns

propagator for this layer.

Definition at line 524 of file rl_DielectricLayer.h.

Referenced by reflect_nlayer().

5.3.4.14 void rl_DielectricLayer::reflect_amp (rl_DielectricLayer const & layer, double sinphi)

Compute reflection amplitude for the interface between this layer and the layer immediately above it. sinphi is the graze angle at the topmost layer (i.e., in vacuum). Layer "layer" is assumed to be adjacent to this layer, with "layer" nearer the vacuum and this layer nearer the substrate. The reflection coefficient for this layer is updated.

PRECONDITION: The layers must be pre-initialized with setup_for

Parameters

layer adjacent layer above this layer, where above means closer to the vacuum.

sinphi sine of the graze angle between the ray (in vacuum) and the top surface of the multilayer.

Definition at line 324 of file rl_DielectricLayer.cc.

References rl_Traits::ERoughDebyeWaller_CSAO, rl_Traits::ERoughDebyeWaller_RSAO, rl_Traits::ERoughDebyeWaller_Spiller, rl_Traits::ERoughModifiedDebyeWaller, rl_Traits::ERoughNevotCroce, rl_Traits::ERoughNone, is_substrate(), rl_TransmissionCoefPOD::para(), rl_TransmissionCoefPOD::perp(), and rl_TransmissionCoefPOD::perp().

Referenced by rl_Multilayer::multilayer_reflect_coef().

5.3.4.15 void rl_DielectricLayer::reflect_nlayer (rl_DielectricLayer layer[], int num)

Compute reflectivity for a stack of num layers.

PRECONDITION: The layers must be pre-initialized with setup_for and the reflection coefficients evaluated with reflect_amp.

Parameters

layer array of layers.

num number of layers in the array.

Definition at line 520 of file rl_DielectricLayer.cc.

References cprint_constraints_on(), rl_ReflectionCoefPOD::para(), rl_ReflectionCoefPOD::perp(), and propagator().

Referenced by rl_Multilayer::multilayer_reflect_coef().

5.3.4.16 rl_ReflectionCoefPOD const & rl_DielectricLayer::reflection_coef () const [inline]

Returns this layer's complex reflection coefficient.

Returns

this layer's complex reflection coefficient.

Definition at line 552 of file rl_DielectricLayer.h.

Referenced by rl_Multilayer::multilayer_reflect_coef().

5.3.4.17 `double rl_DielectricLayer::reflectivity (double polarization_factor = 0.0) const [inline]`

Returns: this layer's reflectivity.

Parameters

polarization_factor - polarization factor; it must be a value between -1 and 1.

The polarization factor is related to parallel (p) and perpendicular (s) polarization by: $\text{polarization_factor} = (I_{\text{perp}} - I_{\text{para}}) / (I_{\text{perp}} + I_{\text{para}})$ or $\text{polarization_factor} = (I_s - I_p) / (I_s + I_p)$ where I_{perp} and I_{para} are the perpendicular and parallel E-field intensities, respectively. Thus,

- -1: pure parallel (p) polarization.
- 0: completely unpolarized.
- +1: pure perpendicular (s) polarization.

Returns

this layer's reflectivity

Definition at line 556 of file rl_DielectricLayer.h.

References rl_ReflectionCoefPOD::reflectivity().

5.3.4.18 `double rl_DielectricLayer::roughness () const [inline]`

Returns the roughness parameter of the upper surface of this layer.

Returns

the roughness parameter of the upper surface of this layer.

Definition at line 548 of file rl_DielectricLayer.h.

5.3.4.19 `rl_Traits::ERoughType rl_DielectricLayer::roughness_type () const [inline]`

Returns the roughness type of the upper surface of this layer.

Returns

the roughness type of the upper surface of this layer.

Definition at line 544 of file rl_DielectricLayer.h.

5.3.4.20 int rl_DielectricLayer::setup_for (double *energy*, double *sinphi*)

Set up layer state for given energy and graze angle.

Parameters

energy energy (keV).

sinphi sine of the graze angle between the ray (in vacuum) and the top surface of the multilayer.

Definition at line 224 of file rl_DielectricLayer.cc.

References rl_DielectricData::alpha_gamma(), rl_Traits::ERoughNone, is_substrate(), and is_vacuum().

Referenced by rl_Multilayer::multilayer_reflect_coef().

5.3.4.21 double rl_DielectricLayer::thickness () const [inline]**Returns**

the layer thickness.

Definition at line 536 of file rl_DielectricLayer.h.

5.3.4.22 double rl_DielectricLayer::zcoat () const [inline]**Returns**

the layer dimensionless thickness.

Definition at line 540 of file rl_DielectricLayer.h.

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

- rl_DielectricLayer.h
- rl_DielectricLayer.cc

5.4 rl_Traits::rl_DielectricPOD Struct Reference

```
#include <rl_Traits.h>
```


Public Attributes

- double [energy_](#)
energy (keV)
- double [alpha_](#)
dielectric decrement, real part
- double [gamma_](#)
dielectric decrement, imag part

5.4.1 Detailed Description

Plain Ol' Data: dielectric data (alpha, gamma) as a function of energy.

Definition at line 93 of file rl_Traits.h.

5.4.2 Member Data Documentation

5.4.2.1 double rl_Traits::rl_DielectricPOD::alpha_

dielectric decrement, real part

Definition at line 98 of file rl_Traits.h.

Referenced by rl_DielectricData::alpha_gamma(), and rl_DielectricPODArray::init().

5.4.2.2 double rl_Traits::rl_DielectricPOD::energy_

energy (keV)

Definition at line 96 of file rl_Traits.h.

Referenced by rl_DielectricData::alpha_gamma(), and rl_DielectricPODArray::init().

5.4.2.3 double rl_Traits::rl_DielectricPOD::gamma_

dielectric decrement, imag part

Definition at line 100 of file rl_Traits.h.

Referenced by `rl_DielectricData::alpha_gamma()`, and `rl_DielectricPODArray::init()`.

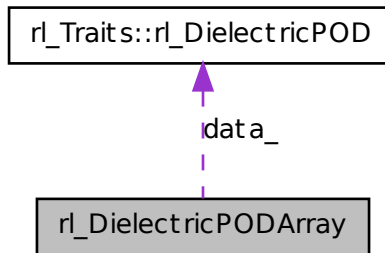
The documentation for this struct was generated from the following file:

- `rl_Traits.h`

5.5 rl_DielectricPODArray Class Reference

```
#include <rl_DielectricPODArray.h>
```

Collaboration diagram for `rl_DielectricPODArray`:



Public Member Functions

- `~rl_DielectricPODArray ()`
- `rl_DielectricPODArray ()`
- `rl_DielectricPODArray (size_t nelts, double const *energy, double const *alpha, double const *gamma) throw (rl_Exception)`
- `rl_DielectricPODArray (size_t nelts, rl_Traits::rl_DielectricPOD *diel) throw (rl_Exception)`
- `void init (size_t nelts, double const *energy, double const *alpha, double const *gamma)`
- `void init (size_t nelts, rl_Traits::rl_DielectricPOD *diel)`
- `size_t num_elts () const`
- `rl_Traits::rl_DielectricPOD const * const_data_ptr () const`
- `void cprint_on (std::FILE *of, char const pre[]="", char const pst[]="") const`

Protected Attributes

- `size_t nelts_`
number of dielectric decrements read in
- `rl_Traits::rl_DielectricPOD * data_`
pointer to the data

5.5.1 Detailed Description

A class encapsulating an array of `rl_DielectricPODs` storing the dielectric constants as a function of energy:

- energy (keV)
- alpha (real part of dielectric decrement)
- gamma (imaginary part of the dielectric decrement)

The complex dielectric constant has real part (1-alpha) and imaginary part (-gamma).

Definition at line 57 of file `rl_DielectricPODArray.h`.

5.5.2 Constructor & Destructor Documentation

5.5.2.1 `rl_DielectricPODArray::~~rl_DielectricPODArray ()`

Destructor

Definition at line 65 of file `rl_DielectricPODArray.cc`.

References `data_`.

5.5.2.2 `rl_DielectricPODArray::rl_DielectricPODArray ()`

Default constructor.

An empty uninitialized `rl_DielectricPODArray` is created and the `init` method must be called to initialize the object.

Definition at line 69 of file `rl_DielectricPODArray.cc`.

5.5.2.3 `rl_DielectricPODArray::rl_DielectricPODArray (size_t nelts, double const * energy, double const * alpha, double const * gamma) throw (rl_Exception)`

Constructor.

Parameters

nelts number of elements in the array
energy array of energies
alpha array of dielectric decrement real part (alpha)
gamma array of dielectric decrement imag part (gamma)

Definition at line 74 of file rl_DielectricPODArray.cc.

5.5.2.4 `rl_DielectricPODArray::rl_DielectricPODArray (size_t nelts, rl_Traits::rl_DielectricPOD * diel) throw (rl_Exception)`

Constructor.

Parameters

nelts number of elements in the array
diel array of dielectric decrement PODs

Definition at line 101 of file rl_DielectricPODArray.cc.

5.5.3 Member Function Documentation

5.5.3.1 `rl_Traits::rl_DielectricPOD const * rl_DielectricPODArray::const_data_ptr () const [inline]`

Accessor.

Returns

pointer-to-const to rl_DielectricPOD array.

Definition at line 174 of file rl_DielectricPODArray.h.

References `data_`.

5.5.3.2 void rl_DielectricPODArray::cprint_on (std::FILE * *of*, char const *pre*[] = "", char const *pst*[] = "") const

Accessor.

Returns

pointer-to-const to rl_DielectricPOD array. Print reflectivity information to output FILE* stream.

Parameters

of output FILE* stream.
pre optional prefix (char*) string.
pst optional postfix (char*) string.

Definition at line 156 of file rl_DielectricPODArray.cc.

References data_, and nelts_.

5.5.3.3 void rl_DielectricPODArray::init (size_t *nelts*, rl_Traits::rl_DielectricPOD * *diel*)

Initializer.

Parameters

nelts number of elements in the array
diel array of dielectric decrement PODs

initialize this [rl_DielectricPODArray](#) from the input array of rl_DielectricPODs. The [rl_DielectricPODArray](#) is sorted on the energy field.

Definition at line 140 of file rl_DielectricPODArray.cc.

References rl_Traits::rl_DielectricPOD::alpha_, data_, rl_Traits::rl_DielectricPOD::energy_, rl_Traits::rl_DielectricPOD::gamma_, and nelts_.

5.5.3.4 void rl_DielectricPODArray::init (size_t *nelts*, double const * *energy*, double const * *alpha*, double const * *gamma*)

Initializer.

Parameters

nelts number of elements in the array
energy array of energies

alpha array of dielectric decrement real part (alpha)

gamma array of dielectric decrement imag part (gamma)

initialize this [rl_DielectricPODArray](#) from the energy, alpha, and gamma arrays. The [rl_DielectricPODArray](#) is sorted on the energy field.

Definition at line 122 of file rl_DielectricPODArray.cc.

References [rl_Traits::rl_DielectricPOD::alpha_](#), [data_](#), [rl_Traits::rl_DielectricPOD::energy_](#), [rl_Traits::rl_DielectricPOD::gamma_](#), and [nelts_](#).

5.5.3.5 `size_t rl_DielectricPODArray::num_elts () const [inline]`

Accessor.

Returns

number of elements in the rl_DielectricPOD array.

Definition at line 170 of file rl_DielectricPODArray.h.

References [nelts_](#).

5.5.4 Member Data Documentation

5.5.4.1 `rl_Traits::rl_DielectricPOD* rl_DielectricPODArray::data_ [protected]`

pointer to the data

Definition at line 64 of file rl_DielectricPODArray.h.

Referenced by [const_data_ptr\(\)](#), [cprint_on\(\)](#), [init\(\)](#), and [~rl_DielectricPODArray\(\)](#).

5.5.4.2 `size_t rl_DielectricPODArray::nelts_ [protected]`

number of dielectric decrements read in

Definition at line 62 of file rl_DielectricPODArray.h.

Referenced by [cprint_on\(\)](#), [init\(\)](#), and [num_elts\(\)](#).

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

- [rl_DielectricPODArray.h](#)
- [rl_DielectricPODArray.cc](#)

5.6 rl_Exception Class Reference

```
#include <rl_Exception.h>
```

Public Member Functions

- [~rl_Exception](#) () throw ()
Destructor.
- [rl_Exception](#) (const string &msg)
Include a string describing the exception.
- [rl_Exception](#) (const char *format,...)
Format a string describing the exception.

5.6.1 Detailed Description

The exception thrown by the rl_RayLib and rl_RaySupLib libraries.

Definition at line 35 of file rl_Exception.h.

5.6.2 Constructor & Destructor Documentation

5.6.2.1 rl_Exception::~~rl_Exception () throw ()

Destructor.

Definition at line 27 of file rl_Exception.cc.

5.6.2.2 rl_Exception::rl_Exception (const string & msg)

Include a string describing the exception.

Definition at line 29 of file rl_Exception.cc.

5.6.2.3 rl_Exception::rl_Exception (const char * format, ...)

Format a string describing the exception.

Definition at line 32 of file rl_Exception.cc.

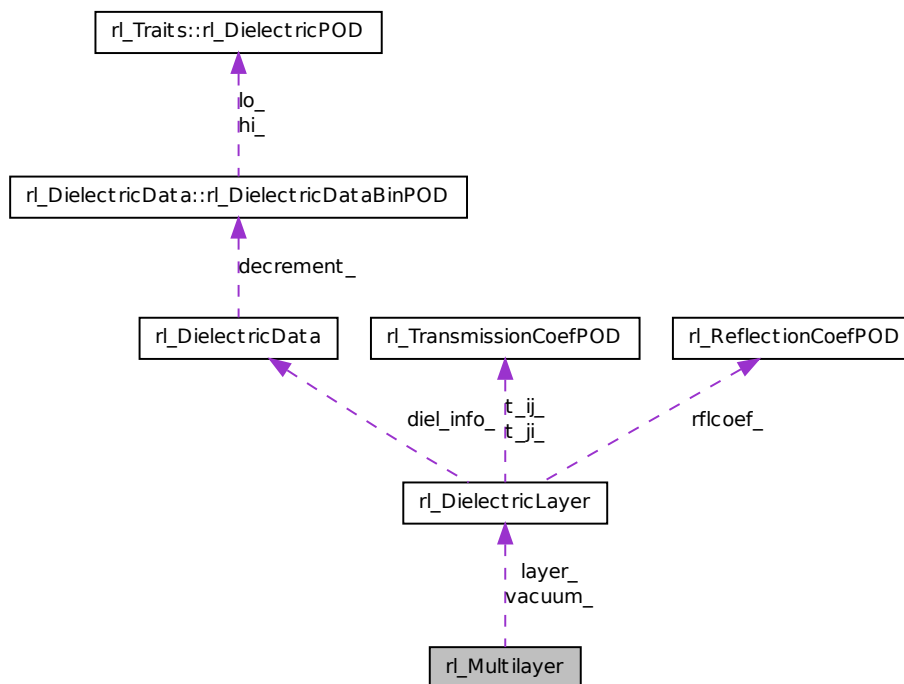
The documentation for this class was generated from the following files:

- rl_Exception.h
- rl_Exception.cc

5.7 rl_Multilayer Class Reference

```
#include <rl_Multilayer.h>
```

Collaboration diagram for rl_Multilayer:



Public Types

- typedef `rl_Traits::EInterpMode` `EInterpMode`
interpolation mode for dielectric data

Public Member Functions

- virtual [~rl_Multilayer](#) ()
- [rl_Multilayer](#) (int num_layers, [rl_DielectricLayer](#) *layers, [rl_Traits::Bool](#) adopt_data=[rl_Traits::True](#))
- void [init](#) (int num_layers, [rl_DielectricLayer](#) *layers, [rl_Traits::Bool](#) adopt_data=[rl_Traits::True](#))
- int [multilayer_reflect_coef](#) ([rl_ReflectionCoefPOD](#) &rfl, double energy, double sg)
- int [multilayer_reflectivity](#) (double &rfl, double energy, double sg, double polarization_factor=0.0)
- [rl_DielectricLayer](#) const & [layer](#) (int layer_no) const
- int [num_layers](#) () const
- std::ostream & [dump_on](#) (std::ostream &os, int layer_no, char const pre[]="", char const pst[]="") const
- void [cdump_on](#) (std::FILE *of, int layer_no, char const pre[]="", char const pst[]="") const

Protected Attributes

- int [num_layers_](#)
number of multilayers
- [rl_DielectricLayer](#) [vacuum_](#)
the top (vacuum) layer
- [rl_DielectricLayer](#) * [layer_](#)
array of dielectric layers
- [rl_Traits::Bool](#) [own_data_](#)
do we own the [rl_DielectricLayer](#) array?

5.7.1 Detailed Description

A class encapsulating reflection of a ray from a multilayer surface. Given the energy and the sine of the graze angle, reflection coefficient can be evaluated.

Definition at line 60 of file [rl_Multilayer.h](#).

5.7.2 Member Typedef Documentation

5.7.2.1 typedef rl_Traits::EInterpMode rl_Multilayer::EInterpMode

interpolation mode for dielectric data

Definition at line 85 of file rl_Multilayer.h.

5.7.3 Constructor & Destructor Documentation

5.7.3.1 rl_Multilayer::~~rl_Multilayer () [virtual]

Destructor.

Frees up [rl_DielectricLayer](#) array if own_data_ is rl_Traits::True.

Definition at line 46 of file rl_Multilayer.cc.

References [layer_](#), and [own_data_](#).

5.7.3.2 rl_Multilayer::rl_Multilayer (int num_layers, rl_DielectricLayer * layers, rl_Traits::Bool adopt_data = rl_Traits::True)

Construct multilayer from num_layers individual layers.

Parameters

num_layers number of layers to construct.

layers pointer to array of layer data

adopt_data boolean flag

- if rl_Traits::True, [rl_Multilayer](#) assumes responsibility for deleting the [rl_DielectricLayer](#) array;
- if rl_Traits::False, it is the caller's responsibility.

Definition at line 53 of file rl_Multilayer.cc.

5.7.4 Member Function Documentation

5.7.4.1 void rl_Multilayer::cdump_on (std::FILE * of, int layer_no, char const pre[] = "", char const pst[] = "") const

Dump information about layer layer_no to output FILE*.

Parameters

of output FILE*
layer_no layer number to be dumped
pre optional prefix string
pst optional postfix string

Definition at line 181 of file rl_Multilayer.cc.

References rl_DielectricLayer::cdump_on(), and layer_.

5.7.4.2 std::ostream & rl_Multilayer::dump_on (std::ostream & os, int layer_no, char const pre[] = "", char const pst[] = "") const

Dump information about layer layer_no to stream os.

Returns

reference to stream os.

Parameters

os output stream
layer_no layer number to be dumped
pre optional prefix string
pst optional postfix string

Definition at line 164 of file rl_Multilayer.cc.

References rl_DielectricLayer::dump_on(), and layer_.

Referenced by rl_MultilayerSurface::dump_on().

5.7.4.3 void rl_Multilayer::init (int num_layers, rl_DielectricLayer * layers, rl_Traits::Bool adopt_data = rl_Traits::True)

Initialize multilayer from num_layers individual layers.

Parameters

num_layers number of layers to construct.
layers pointer to array of layer data
adopt_data boolean flag

- if rl_Traits::True, [rl_Multilayer](#) assumes responsibility for deleting the [rl_DielectricLayer](#) array;

- if rl_Traits::False, it is the caller's responsibility.

Definition at line 64 of file rl_Multilayer.cc.

References layer_, num_layers_, and own_data_.

5.7.4.4 rl_DielectricLayer const & rl_Multilayer::layer (int layer_no) const

Returns

const reference to layer layer_no

Definition at line 156 of file rl_Multilayer.cc.

References layer_.

Referenced by rl_MultilayerSurface::layer().

5.7.4.5 int rl_Multilayer::multilayer_reflect_coef (rl_ReflectionCoefPOD & rfl, double energy, double sg)

Evaluate the multilayer reflection coefficients

Returns

0 if successful, the number of the invalid layer if not.

Parameters

rfl the computed reflection coefficient.

energy ray energy.

sg sine of the graze angle between the ray and the surface.

Definition at line 90 of file rl_Multilayer.cc.

References layer_, num_layers_, rl_DielectricLayer::reflect_amp(), rl_DielectricLayer::reflect_nlayer(), rl_DielectricLayer::reflection_coef(), rl_DielectricLayer::setup_for(), and vacuum_.

Referenced by multilayer_reflectivity(), and rl_MultilayerSurface::reflect().

5.7.4.6 int rl_Multilayer::multilayer_reflectivity (double & rfl, double energy, double sg, double polarization_factor = 0.0)

Evaluate the multilayer reflectivity (assuming unpolarized rays)

Returns

0 if successful, the number of the invalid layer if not.

Parameters

rfl multilayer reflectivity.

energy ray energy.

sg sine of the graze angle between the ray and the surface.

polarization_factor polarization factor; it must be a value between -1 and 1. The polarization factor is related to parallel (p) and perpendicular (s) polarization by:

$$\text{polarization_factor} = \frac{(I_{\perp} - I_{\parallel})}{(I_{\perp} + I_{\parallel})}$$

or

$$\text{polarization_factor} = \frac{(I_s - I_p)}{(I_s + I_p)}$$

where I_{\perp} and I_{\parallel} are the perpendicular and parallel E-field *intensities*, respectively. Thus,

- -1: pure parallel (p) polarization.
- 0: completely unpolarized.
- +1: pure perpendicular (s) polarization.

Definition at line 136 of file rl_Multilayer.cc.

References rl_ReflectionCoefPOD::init(), multilayer_reflect_coef(), and rl_ReflectionCoefPOD::reflectivity().

5.7.4.7 int rl_Multilayer::num_layers () const [inline]**Returns**

number of layers

Definition at line 231 of file rl_Multilayer.h.

References num_layers_.

5.7.5 Member Data Documentation**5.7.5.1 rl_DielectricLayer* rl_Multilayer::layer_ [protected]**

array of dielectric layers

Definition at line 78 of file rl_Multilayer.h.

Referenced by `cdump_on()`, `dump_on()`, `init()`, `layer()`, `multilayer_reflect_coef()`, and `~rl_Multilayer()`.

5.7.5.2 int rl_Multilayer::num_layers_ [protected]

number of multilayers

Definition at line 74 of file rl_Multilayer.h.

Referenced by `init()`, `multilayer_reflect_coef()`, and `num_layers()`.

5.7.5.3 rl_Traits::Bool rl_Multilayer::own_data_ [protected]

do we own the [rl_DielectricLayer](#) array?

Definition at line 80 of file rl_Multilayer.h.

Referenced by `init()`, and `~rl_Multilayer()`.

5.7.5.4 rl_DielectricLayer rl_Multilayer::vacuum_ [protected]

the top (vacuum) layer

Definition at line 76 of file rl_Multilayer.h.

Referenced by `multilayer_reflect_coef()`.

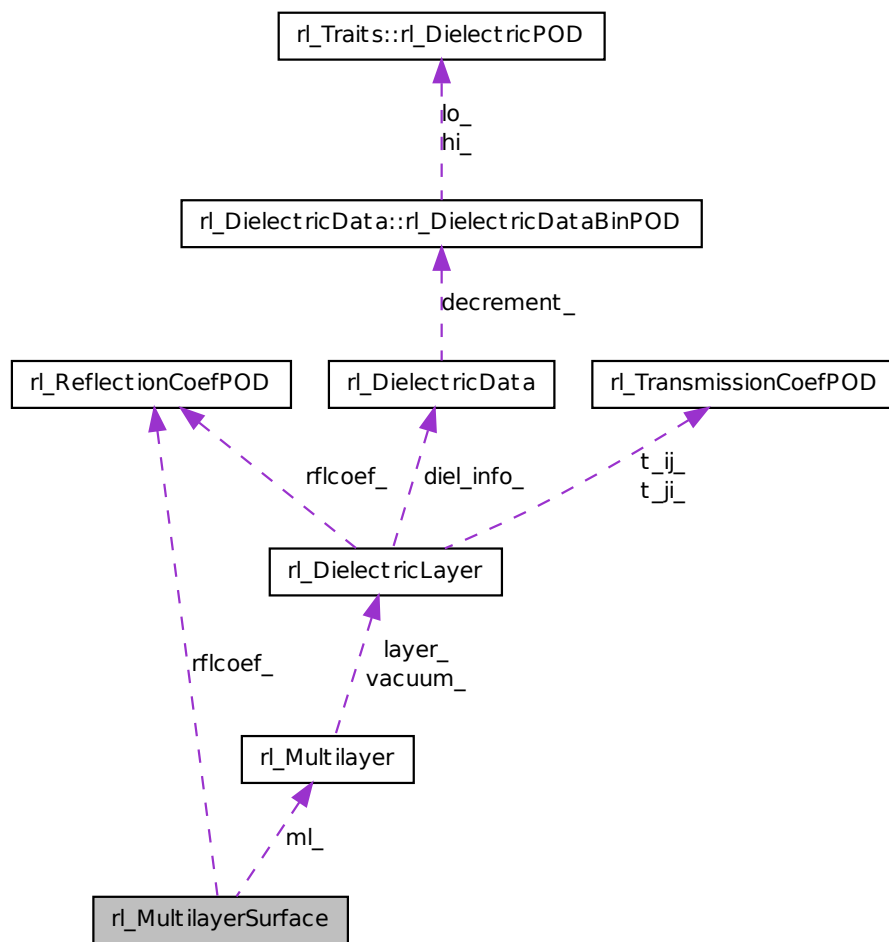
The documentation for this class was generated from the following files:

- rl_Multilayer.h
- rl_Multilayer.cc

5.8 rl_MultilayerSurface Class Reference

```
#include <rl_MultilayerSurface.h>
```

Collaboration diagram for rl_MultilayerSurface:



Public Member Functions

- virtual `~rl_MultilayerSurface()`
- `rl_MultilayerSurface(rl_Multilayer &ml, dvm3_Vector &norm)`
- `dvm3_Vector const &normal_vector() const`
- void `set_normal(dvm3_Vector const &norm)`

- int [reflect](#) ([rl_Ray](#) &ray)
- [rl_ReflectionCoefPOD](#) const & [reflection_coefs](#) () const
- [rl_DielectricLayer](#) const & [layer](#) (int layer_no) const
- std::ostream & [dump_on](#) (std::ostream &os, int layer_no, char const pre[]="", char const pst[]="") const

5.8.1 Detailed Description

A class encapsulating a multilayer surface, including surface normal. This class contains the multilayer data and surface normal *by reference*. That is, the [rl_Multilayer](#) and [dvm3_Vector](#) objects must already exist.

Definition at line 51 of file [rl_MultilayerSurface.h](#).

5.8.2 Constructor & Destructor Documentation

5.8.2.1 [rl_MultilayerSurface::~~rl_MultilayerSurface](#) () [[virtual](#)]

Destructor.

Definition at line 35 of file [rl_MultilayerSurface.cc](#).

5.8.2.2 [rl_MultilayerSurface::rl_MultilayerSurface](#) ([rl_Multilayer](#) & *ml*, [dvm3_Vector](#) & *norm*) [[inline](#)]

Constructor. Constructs multilayer surface information from the provided [rl_Multilayer](#) object and normal vector.

Parameters

- ml* the [rl_Multilayer](#) object to be used (must already exist)
- norm* the surface normal [dvm3_Vector](#) to be used (must already exist)

Definition at line 181 of file [rl_MultilayerSurface.h](#).

5.8.3 Member Function Documentation

5.8.3.1 [std::ostream & rl_MultilayerSurface::dump_on](#) ([std::ostream](#) & *os*, int *layer_no*, char const *pre*[]=" ", char const *pst*[]=" ") const [[inline](#)]

Dump information about a layer.

Parameters

os output stream
layer_no layer number for which the information is requested.
pre optional char* prefix string.
pst optional char* postfix string.

Definition at line 231 of file rl_MultilayerSurface.h.

References rl_Multilayer::dump_on().

5.8.3.2 rl_DielectricLayer const & rl_MultilayerSurface::layer (int *layer_no*) const [inline]

Accessor.

Parameters

layer_no layer number for which the information is requested.

Returns

const reference to the [rl_DielectricLayer](#) for layer *layer_no*.

Definition at line 226 of file rl_MultilayerSurface.h.

References rl_Multilayer::layer().

5.8.3.3 dvm3_Vector const & rl_MultilayerSurface::normal_vector () const [inline]

Accessor.

Returns

the surface normal vector at the ray intercept

Definition at line 190 of file rl_MultilayerSurface.h.

5.8.3.4 int rl_MultilayerSurface::reflect (rl_Ray & *ray*) [inline]

Mutator. Reflect ray direction vector at this surface

Parameters

ray to be reflected. The ray is assumed to be already at a valid surface intercept point. The ray direction vector and polarization state are updated.

Returns

0 if successful.

Definition at line 213 of file rl_MultilayerSurface.h.

References `rl_Multilayer::multilayer_reflect_coef()`, and `rl_Ray::reflect()`.

5.8.3.5 `rl_ReflectionCoefPOD` const & `rl_MultilayerSurface::reflection_coefs ()` const [inline]

Accessor.

Returns

`rl_ReflectionCoefPOD` holding the complex perpendicular and parallel reflection coefficients.

Definition at line 195 of file rl_MultilayerSurface.h.

5.8.3.6 `void rl_MultilayerSurface::set_normal (dvm3_Vector const & norm)` [inline]

Mutator. Set the surface normal at the ray/surface intercept. Until the full surface intercept apparatus is available, applications need to set the surface normal at the intercept.

Parameters

norm the surface normal vector at the ray intercept

Definition at line 203 of file rl_MultilayerSurface.h.

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

- `rl_MultilayerSurface.h`
- `rl_MultilayerSurface.cc`

5.9 rl_Polarization Class Reference

```
#include <rl_Polarization.h>
```

Public Types

- typedef `rl_Traits::complex` `complex`
complex type

Public Member Functions

- [~rl_Polarization](#) ()
- [rl_Polarization](#) ()
- [rl_Polarization](#) ([rl_Polarization](#) const &rhs)
- [rl_Polarization](#) ([rl_PolCSPD](#) const &cs, [dvm3_Vector](#) const &dir)
- void [init](#) ([rl_PolCSPD](#) const &cs, [dvm3_Vector](#) const &dir)
- void [get_PolCSPD](#) ([rl_PolCSPD](#) &cs, [dvm3_Vector](#) const &dir) const
- double [intensity](#) () const
- void [rotate](#) ([rl_Polarization](#) &rotated, [dvm3_RotMat](#) const &rot_mtx)
- void [derotate](#) ([rl_Polarization](#) &derotated, [dvm3_RotMat](#) const &rot_mtx)
- void [attenuate](#) (double factor)
- void [reflect](#) ([dvm3_Vector](#) const &normal, [dvm3_Vector](#) const &dir_in, [dvm3_Vector](#) const &dir_out, [rl_ReflectionCoefPOD](#) const &rflcoef)
- [dvm3_Vector](#) const & [C_r](#) () const
return the real “cosine” polarization vector
- [dvm3_Vector](#) const & [C_i](#) () const
return the imaginary “cosine” polarization vector
- [dvm3_Vector](#) const & [S_r](#) () const
return the real “sine” polarization vector
- [dvm3_Vector](#) const & [S_i](#) () const
return the imaginary “sine” polarization vector
- std::ostream & [print_on](#) (std::ostream &os) const
- void [cprint_on](#) (std::FILE *of) const

5.9.1 Detailed Description

Encapsulates the polarization state of a ray. The class is a simple class to handle the ray polarization state resolved onto a specific coordinate system. The polarization axes are constructed from a direction vector and the coordinate axes. A coordinate triple is constructed in which one axis is the direction vector.

Definition at line 186 of file [rl_Polarization.h](#).

5.9.2 Member Typedef Documentation

5.9.2.1 typedef [rl_Traits::complex](#) [rl_Polarization::complex](#)

complex type

Definition at line 191 of file rl_Polarization.h.

5.9.3 Constructor & Destructor Documentation

5.9.3.1 rl_Polarization::~~rl_Polarization () [inline]

Destructor (NON-VIRTUAL)

Definition at line 343 of file rl_Polarization.h.

5.9.3.2 rl_Polarization::rl_Polarization () [inline]

Default constructor; constructs [rl_Polarization](#) with INVALID fields.

Definition at line 349 of file rl_Polarization.h.

5.9.3.3 rl_Polarization::rl_Polarization (rl_Polarization const & rhs) [inline]

Copy constructor; constructs [rl_Polarization](#) with INVALID fields.

Parameters

rhs - [rl_Polarization](#) object to be copied.

Definition at line 359 of file rl_Polarization.h.

5.9.3.4 rl_Polarization::rl_Polarization (rl_PolCSPOD const & cs, dvm3_Vector const & dir) [inline]

Conversion constructor. Convert OSAC-style polarization amplitudes into polarization vector set.

Parameters

cs OSAC-style polarization amplitude

dir ray direction vector

Definition at line 354 of file rl_Polarization.h.

References [init\(\)](#).

5.9.4 Member Function Documentation

5.9.4.1 void rl_Polarization::attenuate (double *factor*)

Attenuate reflectivity by a factor.

Parameters

factor attenuation factor. (NOTE: this multiplies the polarization components by sqrt(factor).)

Definition at line 243 of file rl_Polarization.cc.

Referenced by rl_Ray::attenuate().

5.9.4.2 dvm3_Vector const & rl_Polarization::C_i () const [inline]

return the imaginary “cosine” polarization vector

Definition at line 395 of file rl_Polarization.h.

5.9.4.3 dvm3_Vector const & rl_Polarization::C_r () const [inline]

return the real “cosine” polarization vector

Definition at line 388 of file rl_Polarization.h.

5.9.4.4 void rl_Polarization::cprint_on (std::FILE * *of*) const

Write the polarization amplitude to FILE* of. The state is written as "[x y z][x y z][x y z][x y z]".

Parameters

of output FILE*.

5.9.4.5 void rl_Polarization::derotate (rl_Polarization & *derotated*, dvm3_RotMat const & *rot_mtx*) [inline]

Rotate polarization state back from frame described by rot_mtx

Parameters

derotated output derotated polarization state. The state is now back in the original frame.

rot_mtx rotation matrix.

Definition at line 378 of file rl_Polarization.h.

Referenced by rl_Ray::derotate_detranslate().

5.9.4.6 void rl_Polarization::get_PolCSPOD (rl_PolCSPOD & cs, dvm3_Vector const & dir) const

Evaluate [rl_PolCSPOD](#) corresponding to this polarization state.

Parameters

cs OSAC-style polarization amplitude

dir ray direction vector

Definition at line 217 of file rl_Polarization.cc.

References [rl_PolCSPOD::c2_](#), and [rl_PolCSPOD::s2_](#).

Referenced by rl_Ray::get_PolCSPOD().

5.9.4.7 void rl_Polarization::init (rl_PolCSPOD const & cs, dvm3_Vector const & dir)

Initialize the polarization state.

Parameters

cs OSAC-style polarization amplitude

dir ray direction vector

Definition at line 171 of file rl_Polarization.cc.

References [rl_PolCSPOD::c2_](#), and [rl_PolCSPOD::s2_](#).

Referenced by rl_Ray::init_ray(), rl_Polarization(), and rl_Ray::set_polarization().

5.9.4.8 double rl_Polarization::intensity () const

Evaluate intensity.

Returns

intensity (i.e., Stoke's s_0).

Definition at line 208 of file rl_Polarization.cc.

Referenced by rl_Ray::intensity().

5.9.4.9 std::ostream & rl_Polarization::print_on (std::ostream & *os*) const

Write the polarization vectors to stream *os*. The state is written as "[x y z][x y z][x y z][x y z]".

Parameters

os output stream.

Definition at line 339 of file rl_Polarization.cc.

Referenced by rl_Ray::print_on().

5.9.4.10 void rl_Polarization::reflect (dvm3_Vector const & *normal*, dvm3_Vector const & *dir_in*, dvm3_Vector const & *dir_out*, rl_ReflectionCoefPOD const & *rflcoef*)

Evaluate the reflected polarization vectors. Given a surface normal, incident and reflected ray direction vectors, and the parallel and perpendicular reflection coefficients, evaluate the reflected polarization vectors.

Parameters

normal surface normal vector.

dir_in direction vector for incoming ray.

dir_out direction vector for reflected ray.

rflcoef complex reflection coefficients for surface.

Definition at line 262 of file rl_Polarization.cc.

References rl_ReflectionCoefPOD::para(), and rl_ReflectionCoefPOD::perp().

Referenced by rl_Ray::reflect().

5.9.4.11 void rl_Polarization::rotate (rl_Polarization & *rotated*, dvm3_RotMat const & *rot_mtx*) [inline]

Rotate polarization state to frame described by *rot_mtx*

Parameters

rotated output rotated polarization state. The state is now in the frame obtained by applying *rot_mtx*.

rot_mtx rotation matrix.

Definition at line 368 of file rl_Polarization.h.

Referenced by rl_Ray::translate_rotate().

5.9.4.12 dvm3_Vector const & rl_Polarization::S_i () const [inline]

return the imaginary “sine” polarization vector

Definition at line 409 of file rl_Polarization.h.

5.9.4.13 dvm3_Vector const & rl_Polarization::S_r () const [inline]

return the real “sine” polarization vector

Definition at line 402 of file rl_Polarization.h.

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

- rl_Polarization.h
- rl_Polarization.cc

5.10 rl_PolCSPOD Struct Reference

```
#include <rl_Polarization.h>
```

Public Member Functions

- void [init](#) (double b_over_a=1.0, double psi=0.0)
- void [attenuate](#) (double factor)
- double [intensity](#) () const
- std::ostream & [print_on](#) (std::ostream &os) const
- void [cprint_on](#) (FILE *of) const

Public Attributes

- [rl_Traits::complex c2_ \[2\]](#)
polarization amplitude (cosine component)
- [rl_Traits::complex s2_ \[2\]](#)
polarization amplitude (sine component)

5.10.1 Detailed Description

A Plain Ol' Data struct (POD) encapsulating the OSAC-style complex polarization amplitudes. This is a utility POD to simplify communication with BPipe.

Relation to OSAC polarization amplitudes:

$$\begin{aligned} c2_q1 &\iff c2comp(1), & c2_q2 &\iff c2comp(2) & s2_q1 &\iff \\ s2comp(1), & & s2_q2 &\iff s2comp(2) \end{aligned}$$

For random polarization:

$$wt = c2_q1.r^2 + c2_q2.r^2 + c2_q1.i^2 + c2_q2.i^2 + s2_q1.r^2 + s2_q2.r^2 + s2_q1.i^2 + s2_q2.i^2$$

or

$$wt = |c2[0]|^2 + |s2[0]|^2$$

For discrete polarization:

$$wt = c2_q1.r^2 + c2_q2.r^2 + c2_q1.i^2 + c2_q2.i^2 + s2_q1.r^2 + s2_q2.r^2 + s2_q1.i^2 + s2_q2.i^2 + 2(c2_q1.i s2_q1.r + c2_q2.i s2_q2.r)$$

or

$$wt = |c2[0]|^2 + |s2[0]|^2 + 2(c2[0]s2*[0] + c2[1]s2*[1])$$

where the * superscript denotes a complex conjugate.

Definition at line 106 of file rl_Polarization.h.

5.10.2 Member Function Documentation**5.10.2.1 void rl_PolCSPD::attenuate (double *factor*)**

Attenuate intensity by a factor.

Parameters

factor the attenuation factor; the ray intensity is multiplied by factor.

Definition at line 121 of file rl_Polarization.cc.

References [c2_](#), and [s2_](#).

5.10.2.2 void rl_PolCSPOD::cprint_on (FILE * *of*) const

Write the polarization amplitude to FILE* of. The state is written out as "[$(r,i)(r,i)$]\n[$(r,i)(r,i)$]".

Parameters

of output FILE*.

Definition at line 149 of file rl_Polarization.cc.

References c2_, intensity(), and s2_.

5.10.2.3 void rl_PolCSPOD::init (double *b_over_a* = 1.0, double *psi* = 0.0)

Initialization method.

Parameters

b_over_a ratio of semiminor axis to semi-major axis.

psi angle of the major axis from the +X axis, with psi increasing towards +Y

Definition at line 76 of file rl_Polarization.cc.

References c2_, and s2_.

5.10.2.4 double rl_PolCSPOD::intensity () const

Evaluate the intensity.

Returns

the intensity (i.e., Stoke's s_0).

Definition at line 99 of file rl_Polarization.cc.

References c2_, and s2_.

Referenced by cprint_on().

5.10.2.5 std::ostream & rl_PolCSPOD::print_on (std::ostream & *os*) const

Write the polarization amplitude to stream os. The state is written out as "[$(r,i)(r,i)$][$(r,i)(r,i)$]".

Parameters

os output stream.

Definition at line 135 of file rl_Polarization.cc.

References c2_, and s2_.

5.10.3 Member Data Documentation

5.10.3.1 rl_Traits::complex rl_PolCSPOD::c2_[2]

polarization amplitude (cosine component)

Definition at line 109 of file rl_Polarization.h.

Referenced by attenuate(), cprint_on(), rl_Polarization::get_PolCSPOD(), rl_Polarization::init(), init(), intensity(), and print_on().

5.10.3.2 rl_Traits::complex rl_PolCSPOD::s2_[2]

polarization amplitude (sine component)

Definition at line 111 of file rl_Polarization.h.

Referenced by attenuate(), cprint_on(), rl_Polarization::get_PolCSPOD(), rl_Polarization::init(), init(), intensity(), and print_on().

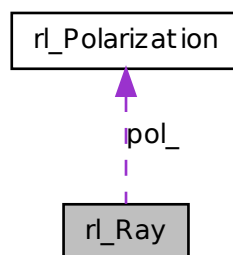
The documentation for this struct was generated from the following files:

- rl_Polarization.h
- rl_Polarization.cc

5.11 rl_Ray Class Reference

```
#include <rl_Ray.h>
```

Collaboration diagram for rl_Ray:



Public Member Functions

- virtual `~rl_Ray()`
- `rl_Ray()`
- `rl_Ray` (`rl_BasicRay` const &ray, `rl_PolCSPOD` const &cspol)
- `rl_Ray` (`dvm3_Vector` const &pos, `dvm3_Vector` const &dir, double energy, long int id, `rl_PolCSPOD` const &cspol)
- void `init_ray` (`dvm3_Vector` const &pos, `dvm3_Vector` const &dir, double energy, long int id, `rl_PolCSPOD` const &cspol)
- `rl_Polarization` const & `polarization()` const
- void `set_polarization` (`rl_PolCSPOD` const &cspol)
- void `get_PolCSPOD` (`rl_PolCSPOD` &cs) const
- double `intensity()` const
- void `attenuate` (double by_how_much)
- void `reflect` (`dvm3_Vector` const &normal, `rl_ReflectionCoefPOD` const &rflcoef)
- void `translate_rotate` (`dvm3_Vector` const &trans, `dvm3_RotMat` const &rotmat)
- void `derotate_detranslate` (`dvm3_Vector` const &trans, `dvm3_RotMat` const &rotmat)
- `std::ostream & print_on` (`std::ostream &os`, char const pre[]="", char const pst[]="") const

5.11.1 Detailed Description

An `rl_BasicRay` with added polarization information.

Definition at line 45 of file `rl_Ray.h`.

5.11.2 Constructor & Destructor Documentation

5.11.2.1 rl_Ray::~~rl_Ray () [virtual]

Destructor

Definition at line 41 of file rl_Ray.cc.

5.11.2.2 rl_Ray::rl_Ray () [inline]

Default constructor. Constructs a ray in an INVALID state; use init_ray to initialize the fields.

Definition at line 193 of file rl_Ray.h.

5.11.2.3 rl_Ray::rl_Ray (rl_BasicRay const & ray, rl_PolCSPOD const & cspol) [inline]

Constructor. Construct a ray given an rl_BasicRay and a polarization state.

Definition at line 198 of file rl_Ray.h.

5.11.2.4 rl_Ray::rl_Ray (dvm3_Vector const & pos, dvm3_Vector const & dir, double energy, long int id, rl_PolCSPOD const & cspol) [inline]

Constructor. Construct a ray.

Parameters

pos ray position vector.

dir ray direction unit vector.

energy ray energy (keV).

id a numeric ray identifier.

cspol an OSAC-style complex polarization amplitude vector.

Definition at line 203 of file rl_Ray.h.

5.11.3 Member Function Documentation

5.11.3.1 void rl_Ray::attenuate (double by_how_much) [inline]

Attenuate this ray by by_how_much

Parameters

by_how_much how much to attenuate this ray.

Definition at line 247 of file rl_Ray.h.

References rl_Polarization::attenuate().

5.11.3.2 void rl_Ray::derotate_detranslate (dvm3_Vector const & *trans*, dvm3_RotMat const & *rotmat*)

Derotate back to std coordinates; detranslate back to std origin

Parameters

trans translation vector.

rotmat rotation matrix to be applied. rotmat specifies a rotation from std to bcs; the inverse of rotmat is applied to the ray.

Definition at line 75 of file rl_Ray.cc.

References rl_Polarization::derotate().

5.11.3.3 void rl_Ray::get_PolCSPOD (rl_PolCSPOD & *cs*) const [inline]

Evaluate [rl_PolCSPOD](#) corresponding to this ray's polarization state.

Parameters

cs return an OSAC-style complex polarization amplitude vector.

Definition at line 229 of file rl_Ray.h.

References rl_Polarization::get_PolCSPOD().

5.11.3.4 void rl_Ray::init_ray (dvm3_Vector const & *pos*, dvm3_Vector const & *dir*, double *energy*, long int *id*, rl_PolCSPOD const & *cspol*) [inline]

Initialize a ray.

Parameters

pos ray position vector.

dir ray direction unit vector.

energy ray energy (keV).

id a numeric ray identifier.

cspol an OSAC-style complex polarization amplitude vector.

Definition at line 211 of file rl_Ray.h.

References rl_Polarization::init().

5.11.3.5 double rl_Ray::intensity () const [inline]

Returns this ray's normalized intensity (i.e., "weight")

Returns

this ray's normalized intensity (i.e., "weight")

Definition at line 234 of file rl_Ray.h.

References rl_Polarization::intensity().

5.11.3.6 rl_Polarization const & rl_Ray::polarization () const [inline]

Return the polarization state.

Returns

polarization state

Definition at line 224 of file rl_Ray.h.

5.11.3.7 std::ostream & rl_Ray::print_on (std::ostream & os, char const pre[] = "", char const pst[] = "") const

Write the ray contents with optional pre and post comment strings.

Parameters

os output stream.

pre optional prefix c-string.

pst optional postfix c-string.

Definition at line 86 of file rl_Ray.cc.

References rl_Polarization::print_on().

5.11.3.8 void rl_Ray::reflect (dvm3_Vector const & *normal*, rl_ReflectionCoefPOD const & *rflcoef*)

Reflect this ray's direction vector and polarization state.

Parameters

normal surface normal unit vector.

rflcoef complex reflectances for the surface.

Definition at line 51 of file rl_Ray.cc.

References rl_Polarization::reflect().

Referenced by rl_MultilayerSurface::reflect().

5.11.3.9 void rl_Ray::set_polarization (rl_PolCSPOD const & *cspol*) [inline]

Set the polarization state.

Parameters

cspol an OSAC-style complex polarization amplitude vector.

Definition at line 242 of file rl_Ray.h.

References rl_Polarization::init().

5.11.3.10 void rl_Ray::translate_rotate (dvm3_Vector const & *trans*, dvm3_RotMat const & *rotmat*)

Translate to BCS origin and rotate from STD to BCS coordinates.

Parameters

trans translation vector

rotmat rotation matrix to be applied. rotmat specifies a rotation from std to bcs.

Definition at line 63 of file rl_Ray.cc.

References rl_Polarization::rotate().

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

- rl_Ray.h
- rl_Ray.cc

5.12 rl_ReflectionCoefPOD Class Reference

```
#include <rl_ReflectionCoefPOD.h>
```

Public Member Functions

- double [reflectivity](#) (double polarization_factor=0.0) const
- void [init](#) ()
- void [init](#) (rl_Traits::complex ¶, rl_Traits::complex &perp)
- [rl_Traits::complex](#) para () const
- [rl_Traits::complex](#) & para ()
- [rl_Traits::complex](#) perp () const
- [rl_Traits::complex](#) & perp ()
- std::ostream & [print_on](#) (std::ostream &os, char const pre[]="", char const pst[]="") const
- void [cprint_on](#) (std::FILE *of, char const pre[]="", char const pst[]="") const

5.12.1 Detailed Description

A Plain Ol' Data class representing complex reflection coefficients.

Definition at line 76 of file rl_ReflectionCoefPOD.h.

5.12.2 Member Function Documentation

5.12.2.1 void [rl_ReflectionCoefPOD::cprint_on](#) (std::FILE * *of*, char const *pre*[] = "", char const *pst*[] = "") const [\[inline\]](#)

Print reflectivity information to output FILE* stream.

Parameters

- of* output FILE* stream.
- pre* optional prefix (char*) string.
- pst* optional postfix (char*) string.

Definition at line 219 of file rl_ReflectionCoefPOD.h.

References [para\(\)](#), and [perp\(\)](#).

Referenced by [rl_DielectricLayer::cdump_on\(\)](#).

5.12.2.2 void rl_ReflectionCoefPOD::init () [inline]

initialize perpendicular (s) and parallel (p) reflection coefficients to zero.

Definition at line 172 of file rl_ReflectionCoefPOD.h.

Referenced by rl_Multilayer::multilayer_reflectivity().

**5.12.2.3 void rl_ReflectionCoefPOD::init (rl_Traits::complex & *para*,
rl_Traits::complex & *perp*) [inline]**

initialize perpendicular (s) and parallel (p) reflection coefficients. to zero.

Parameters

para parallel reflection coefficient.

perp perpendicular reflection coefficient.

Definition at line 179 of file rl_ReflectionCoefPOD.h.

**5.12.2.4 rl_Traits::complex rl_ReflectionCoefPOD::para () const
[inline]****Returns**

parallel (p) reflection coefficient.

Definition at line 187 of file rl_ReflectionCoefPOD.h.

Referenced by rl_DielectricLayer::cprint_constraints_on(), cprint_on(),
rl_Polarization::reflect(), rl_DielectricLayer::reflect_amp(), and rl_
DielectricLayer::reflect_nlayer().

5.12.2.5 rl_Traits::complex & rl_ReflectionCoefPOD::para () [inline]**Returns**

parallel (p) reflection coefficient (read/write access).

Definition at line 195 of file rl_ReflectionCoefPOD.h.

5.12.2.6 rl_Traits::complex & rl_ReflectionCoefPOD::perp () [inline]

Returns

perpendicular (p) reflection coefficient (read/write access).

Definition at line 199 of file rl_ReflectionCoefPOD.h.

5.12.2.7 rl_Traits::complex rl_ReflectionCoefPOD::perp () const [inline]

Returns

perpendicular (p) reflection coefficient.

Definition at line 191 of file rl_ReflectionCoefPOD.h.

Referenced by rl_DielectricLayer::cprint_constraints_on(), cprint_on(), rl_Polarization::reflect(), rl_DielectricLayer::reflect_amp(), and rl_DielectricLayer::reflect_nlayer().

5.12.2.8 std::ostream & rl_ReflectionCoefPOD::print_on (std::ostream & os, char const *pre*[] = "", char const *pst*[] = "") const [inline]

Print reflectivity information to output stream.

Parameters

os output stream.

pre optional prefix (char*) string.

pst optional postfix (char*) string.

Definition at line 210 of file rl_ReflectionCoefPOD.h.

5.12.2.9 double rl_ReflectionCoefPOD::reflectivity (double *polarization_factor* = 0.0) const [inline]

evaluate the reflectivity.

Parameters

polarization_factor polarization factor; it must be a value between -1 and 1. The polarization factor is related to parallel (p) and perpendicular (s) polarization by:

$$\text{polarization_factor} = \frac{(I_{\perp} - I_{\parallel})}{(I_{\perp} + I_{\parallel})}$$

or

$$\text{polarization_factor} = \frac{(I_s - I_p)}{(I_s + I_p)}$$

where I_{\perp} and I_{\parallel} are the perpendicular and parallel E-field *intensities*, respectively. Thus,

- -1: pure parallel (p) polarization.
- 0: completely unpolarized.
- +1: pure perpendicular (s) polarization.

Returns

const reference to layer layer_no

Definition at line 203 of file rl_ReflectionCoefPOD.h.

Referenced by rl_Multilayer::multilayer_reflectivity(), and rl_DielectricLayer::reflectivity().

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

- rl_ReflectionCoefPOD.h

5.13 rl_Traits Class Reference

```
#include <rl_Traits.h>
```

Classes

- struct [rl_DielectricPOD](#)

Public Types

- enum [Bool](#) { **False**, **True** }
Typedef for the Boolean type.
- enum [EInterpMode](#) { [ELinLin](#), [ELinLog](#), [ELogLin](#), [ELogLog](#) }

- enum [ERoughType](#) {
 [ERoughNone](#), [ERoughDebyeWaller_RSAO](#), [ERoughDebyeWaller_CSAO](#),
 [ERoughDebyeWaller_Spiller](#),
 [ERoughModifiedDebyeWaller](#), [ERoughNevotCroce](#) }
• typedef std::complex< double > [complex](#)
 Typedef for the complex type.

5.13.1 Detailed Description

[rl_Traits](#) is a “traits” class for the [rl_RayLib](#) library. It defines typedefs (e.g., abstracting out the complex class) and enums used in the library. It also declares a Plain Old Data (POD) struct to encapsulate the dielectric constant data.

Definition at line 55 of file [rl_Traits.h](#).

5.13.2 Member Typedef Documentation

5.13.2.1 typedef std::complex<double> rl_Traits::complex

Typedef for the complex type.

Definition at line 61 of file [rl_Traits.h](#).

5.13.3 Member Enumeration Documentation

5.13.3.1 enum rl_Traits::Bool

Typedef for the Boolean type.

Definition at line 64 of file [rl_Traits.h](#).

5.13.3.2 enum rl_Traits::EInterpMode

Enumeration specifying the interpolation of the optical constants.

Enumerator:

ELinLin linear in energy, linear in optical constants.

ELinLog log in energy, linear in optical constants.

ELogLin linear in energy, log in optical constants.

ELogLog log in energy, log in optical constants.

Definition at line 69 of file rl_Traits.h.

5.13.3.3 enum rl_Traits::ERoughType

Enumeration specifying the type of interlayer diffusion treatment

Enumerator:

ERoughNone no interlayer diffusion

ERoughDebyeWaller_RSAO Debye-Waller factor

ERoughDebyeWaller_CSAO Debye-Waller factor

ERoughDebyeWaller_Spiller Debye-Waller factor

ERoughModifiedDebyeWaller Modified Debye-Waller factor

ERoughNevotCroce Nevot-Croce factor

Definition at line 80 of file rl_Traits.h.

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

- rl_Traits.h

5.14 rl_TransmissionCoefPOD Class Reference

```
#include <rl_TransmissionCoefPOD.h>
```

Public Member Functions

- void [init](#) ()
- void [init](#) (rl_Traits::complex ¶, rl_Traits::complex &perp)
- double [transmission](#) (double polarization_factor=0.0) const
- rl_Traits::complex [para](#) () const
- rl_Traits::complex & [para](#) ()
- rl_Traits::complex [perp](#) () const
- rl_Traits::complex & [perp](#) ()
- std::ostream & [print_on](#) (std::ostream &os, char const pre[]="", char const pst[]="") const
- void [cprint_on](#) (std::FILE *of, char const pre[]="", char const pst[]="") const

5.14.1 Detailed Description

A Plain Ol' Data class representing complex reflection coefficients.

Definition at line 75 of file rl_TransmissionCoefPOD.h.

5.14.2 Member Function Documentation

5.14.2.1 void rl_TransmissionCoefPOD::cprint_on (std::FILE * *of*, char const *pre*[] = "", char const *pst*[] = "") const [inline]

Print reflectivity information to output FILE* stream.

Parameters

of output FILE* stream.

pre optional prefix (char*) string.

pst optional postfix (char*) string.

Definition at line 218 of file rl_TransmissionCoefPOD.h.

5.14.2.2 void rl_TransmissionCoefPOD::init () [inline]

Initialize perpendicular (s) and parallel (p) transmission coefficients to zero.

Definition at line 171 of file rl_TransmissionCoefPOD.h.

5.14.2.3 void rl_TransmissionCoefPOD::init (rl_Traits::complex & *para*, rl_Traits::complex & *perp*) [inline]

Initialize perpendicular (s) and parallel (p) transmission coefficients.

Parameters

para parallel transmission coefficient

perp perpendicular transmission coefficient

Definition at line 178 of file rl_TransmissionCoefPOD.h.

5.14.2.4 rl_Traits::complex rl_TransmissionCoefPOD::para () const [inline]

Returns

parallel (p) transmission coefficient.

Definition at line 186 of file rl_TransmissionCoefPOD.h.

Referenced by rl_DielectricLayer::cprint_constraints_on(), and rl_DielectricLayer::reflect_amp().

**5.14.2.5 rl_Traits::complex & rl_TransmissionCoefPOD::para ()
[inline]****Returns**

parallel (p) transmission coefficient (read/write access).

Definition at line 194 of file rl_TransmissionCoefPOD.h.

**5.14.2.6 rl_Traits::complex & rl_TransmissionCoefPOD::perp ()
[inline]****Returns**

perpendicular (s) transmission coefficient (read/write access).

Definition at line 198 of file rl_TransmissionCoefPOD.h.

**5.14.2.7 rl_Traits::complex rl_TransmissionCoefPOD::perp () const
[inline]****Returns**

perpendicular (s) transmission coefficient.

Definition at line 190 of file rl_TransmissionCoefPOD.h.

Referenced by rl_DielectricLayer::cprint_constraints_on(), and rl_DielectricLayer::reflect_amp().

5.14.2.8 `std::ostream & rl_TransmissionCoefPOD::print_on (std::ostream & os, char const pre[] = "", char const pst[] = "") const [inline]`

Print reflectivity information to output stream.

Parameters

- os* output stream.
- pre* optional prefix (char*) string.
- pst* optional postfix (char*) string.

Definition at line 209 of file rl_TransmissionCoefPOD.h.

5.14.2.9 `double rl_TransmissionCoefPOD::transmission (double polarization_factor = 0.0) const [inline]`

Transmission factor.

Parameters

- polarization_factor* polarization factor; it must be a value between -1 and 1. The polarization factor is related to parallel (p) and perpendicular (s) polarization by:

$$\text{polarization_factor} = \frac{(I_{\perp} - I_{\parallel})}{(I_{\perp} + I_{\parallel})}$$

or

$$\text{polarization_factor} = \frac{(I_s - I_p)}{(I_s + I_p)}$$

where I_{\perp} and I_{\parallel} are the perpendicular and parallel E-field *intensities*, respectively. Thus,

- -1: pure parallel (p) polarization.
- 0: completely unpolarized.
- +1: pure perpendicular (s) polarization.

Returns

transmission factor

Definition at line 202 of file rl_TransmissionCoefPOD.h.

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

- rl_TransmissionCoefPOD.h

Index

- ~rl_DielectricData
 - rl_DielectricData, [6](#)
- ~rl_DielectricLayer
 - rl_DielectricLayer, [13](#)
- ~rl_DielectricPODArray
 - rl_DielectricPODArray, [24](#)
- ~rl_Exception
 - rl_Exception, [28](#)
- ~rl_Multilayer
 - rl_Multilayer, [31](#)
- ~rl_MultilayerSurface
 - rl_MultilayerSurface, [37](#)
- ~rl_Polarization
 - rl_Polarization, [41](#)
- ~rl_Ray
 - rl_Ray, [50](#)
- alpha
 - rl_DielectricLayer, [14](#)
- alpha_
 - rl_Traits::rl_DielectricPOD, [22](#)
- alpha_gamma
 - rl_DielectricData, [7](#)
- attenuate
 - rl_Polarization, [42](#)
 - rl_PolCSPOD, [46](#)
 - rl_Ray, [50](#)
- Bool
 - rl_Traits, [58](#)
- bulk_density_factor
 - rl_DielectricData, [7](#)
 - rl_DielectricLayer, [14](#)
- c2_
 - rl_PolCSPOD, [48](#)
- C_i
 - rl_Polarization, [42](#)
- C_r
 - rl_Polarization, [42](#)
- cdump_on
 - rl_DielectricLayer, [14](#)
 - rl_Multilayer, [31](#)
- complex
 - rl_DielectricLayer, [12](#)
 - rl_Polarization, [40](#)
 - rl_Traits, [58](#)
- const_data_ptr
 - rl_DielectricPODArray, [25](#)
- cprint_constraints_on
 - rl_DielectricLayer, [15](#)
- cprint_on
 - rl_DielectricPODArray, [25](#)
 - rl_Polarization, [42](#)
 - rl_PolCSPOD, [46](#)
 - rl_ReflectionCoefPOD, [54](#)
 - rl_TransmissionCoefPOD, [60](#)
- data_
 - rl_DielectricPODArray, [27](#)
- derotate
 - rl_Polarization, [42](#)
- derotate_detranslate
 - rl_Ray, [51](#)
- dump_on
 - rl_DielectricLayer, [15](#)
 - rl_Multilayer, [32](#)
 - rl_MultilayerSurface, [37](#)
- EInterpMode
 - rl_Multilayer, [31](#)
 - rl_Traits, [58](#)
- ELinLin
 - rl_Traits, [58](#)
- ELinLog
 - rl_Traits, [58](#)
- ELogLin
 - rl_Traits, [58](#)
- ELogLog
 - rl_Traits, [59](#)
- energy_
 - rl_Traits::rl_DielectricPOD, [22](#)
- energy_max
 - rl_DielectricData, [7](#)
 - rl_DielectricLayer, [16](#)
- energy_min

- rl_DielectricData, 8
 - rl_DielectricLayer, 16
- ERoughDebyeWaller_CSAO
 - rl_Traits, 59
- ERoughDebyeWaller_RSAO
 - rl_Traits, 59
- ERoughDebyeWaller_Spiller
 - rl_Traits, 59
- ERoughModifiedDebyeWaller
 - rl_Traits, 59
- ERoughNevotCroce
 - rl_Traits, 59
- ERoughNone
 - rl_Traits, 59
- ERoughType
 - rl_DielectricLayer, 12
 - rl_Traits, 59
- gamma
 - rl_DielectricLayer, 16
- gamma_
 - rl_Traits::rl_DielectricPOD, 22
- get_PolCSPOD
 - rl_Polarization, 43
 - rl_Ray, 51
- hi_
 - rl_DielectricData::rl_DielectricDataBinPOD, 10
- init
 - rl_DielectricData, 8
 - rl_DielectricLayer, 16
 - rl_DielectricPODArray, 26
 - rl_Multilayer, 32
 - rl_Polarization, 43
 - rl_PolCSPOD, 47
 - rl_ReflectionCoefPOD, 54, 55
 - rl_TransmissionCoefPOD, 60
- init_ray
 - rl_Ray, 51
- intensity
 - rl_Polarization, 43
 - rl_PolCSPOD, 47
 - rl_Ray, 52
- is_substrate
 - rl_DielectricLayer, 17
- is_vacuum
 - rl_DielectricData, 8
 - rl_DielectricLayer, 17
- layer
 - rl_Multilayer, 33
 - rl_MultilayerSurface, 38
- layer_
 - rl_Multilayer, 34
- layer_name
 - rl_DielectricLayer, 18
- lo_
 - rl_DielectricData::rl_DielectricDataBinPOD, 10
- multilayer_reflect_coef
 - rl_Multilayer, 33
- multilayer_reflectivity
 - rl_Multilayer, 33
- nelts_
 - rl_DielectricPODArray, 27
- normal_vector
 - rl_MultilayerSurface, 38
- num_elts
 - rl_DielectricPODArray, 27
- num_layers
 - rl_Multilayer, 34
- num_layers_
 - rl_Multilayer, 35
- own_data_
 - rl_Multilayer, 35
- para
 - rl_ReflectionCoefPOD, 55
 - rl_TransmissionCoefPOD, 60, 61
- perp
 - rl_ReflectionCoefPOD, 55, 56
 - rl_TransmissionCoefPOD, 61
- polarization
 - rl_Ray, 52
- print_on
 - rl_Polarization, 44
 - rl_PolCSPOD, 47
 - rl_Ray, 52

- rl_ReflectionCoefPOD, 56
 - rl_TransmissionCoefPOD, 61
- propagator
 - rl_DielectricLayer, 18
- reflect
 - rl_MultilayerSurface, 38
 - rl_Polarization, 44
 - rl_Ray, 52
- reflect_amp
 - rl_DielectricLayer, 18
- reflect_nlayer
 - rl_DielectricLayer, 19
- reflection_coef
 - rl_DielectricLayer, 19
- reflection_coefs
 - rl_MultilayerSurface, 39
- reflectivity
 - rl_DielectricLayer, 19
 - rl_ReflectionCoefPOD, 56
- rl_Traits
 - ELinLin, 58
 - ELinLog, 58
 - ELogLin, 58
 - ELogLog, 59
 - ERoughDebyeWaller_CSAO, 59
 - ERoughDebyeWaller_RSAO, 59
 - ERoughDebyeWaller_Spiller, 59
 - ERoughModifiedDebyeWaller, 59
 - ERoughNevotCroce, 59
 - ERoughNone, 59
- rl_DielectricData, 4
 - ~rl_DielectricData, 6
 - alpha_gamma, 7
 - bulk_density_factor, 7
 - energy_max, 7
 - energy_min, 8
 - init, 8
 - is_vacuum, 8
 - rl_DielectricData, 6
 - rl_DielectricData, 6
- rl_DielectricData::rl_-
 - DielectricDataBinPOD, 9
 - hi_, 10
 - lo_, 10
- rl_DielectricLayer, 10
 - ~rl_DielectricLayer, 13
 - alpha, 14
 - bulk_density_factor, 14
 - cdump_on, 14
 - complex, 12
 - cprint_constraints_on, 15
 - dump_on, 15
 - energy_max, 16
 - energy_min, 16
 - ERoughType, 12
 - gamma, 16
 - init, 16
 - is_substrate, 17
 - is_vacuum, 17
 - layer_name, 18
 - propagator, 18
 - reflect_amp, 18
 - reflect_nlayer, 19
 - reflection_coef, 19
 - reflectivity, 19
 - rl_DielectricLayer, 13
 - rl_DielectricLayer, 13
 - roughness, 20
 - roughness_type, 20
 - setup_for, 20
 - thickness, 21
 - zcoat, 21
- rl_DielectricPODArray, 23
 - ~rl_DielectricPODArray, 24
 - const_data_ptr, 25
 - cprint_on, 25
 - data_, 27
 - init, 26
 - nelts_, 27
 - num_elts, 27
 - rl_DielectricPODArray, 24, 25
 - rl_DielectricPODArray, 24, 25
- rl_Exception, 28
 - ~rl_Exception, 28
 - rl_Exception, 28
 - rl_Exception, 28
- rl_Multilayer, 29
 - ~rl_Multilayer, 31
 - cdump_on, 31
 - dump_on, 32
 - EInterpMode, 31

- init, 32
- layer, 33
- layer_, 34
- multilayer_reflect_coef, 33
- multilayer_reflectivity, 33
- num_layers, 34
- num_layers_, 35
- own_data_, 35
- rl_Multilayer, 31
- rl_Multilayer, 31
- vacuum_, 35
- rl_MultilayerSurface, 35
 - ~rl_MultilayerSurface, 37
 - dump_on, 37
 - layer, 38
 - normal_vector, 38
 - reflect, 38
 - reflection_coefs, 39
 - rl_MultilayerSurface, 37
 - rl_MultilayerSurface, 37
 - set_normal, 39
- rl_Polarization, 39
 - ~rl_Polarization, 41
 - attenuate, 42
 - C_i, 42
 - C_r, 42
 - complex, 40
 - cprint_on, 42
 - derotate, 42
 - get_PolCSPOD, 43
 - init, 43
 - intensity, 43
 - print_on, 44
 - reflect, 44
 - rl_Polarization, 41
 - rl_Polarization, 41
 - rotate, 44
 - S_i, 45
 - S_r, 45
- rl_PolCSPOD, 45
 - attenuate, 46
 - c2_, 48
 - cprint_on, 46
 - init, 47
 - intensity, 47
 - print_on, 47
 - s2_, 48
- rl_Ray, 48
 - ~rl_Ray, 50
 - attenuate, 50
 - derotate_detranslate, 51
 - get_PolCSPOD, 51
 - init_ray, 51
 - intensity, 52
 - polarization, 52
 - print_on, 52
 - reflect, 52
 - rl_Ray, 50
 - rl_Ray, 50
 - set_polarization, 53
 - translate_rotate, 53
- rl_raylib/ Directory Reference, 3
- rl_ReflectionCoefPOD, 54
 - cprint_on, 54
 - init, 54, 55
 - para, 55
 - perp, 55, 56
 - print_on, 56
 - reflectivity, 56
- rl_Traits, 57
 - Bool, 58
 - complex, 58
 - EInterpMode, 58
 - ERoughType, 59
- rl_Traits::rl_DielectricPOD, 21
 - alpha_, 22
 - energy_, 22
 - gamma_, 22
- rl_TransmissionCoefPOD, 59
 - cprint_on, 60
 - init, 60
 - para, 60, 61
 - perp, 61
 - print_on, 61
 - transmission, 62
- rotate
 - rl_Polarization, 44
- roughness
 - rl_DielectricLayer, 20
- roughness_type
 - rl_DielectricLayer, 20

- s2_
 - rl_PolCSPD, [48](#)
- S_i
 - rl_Polarization, [45](#)
- S_r
 - rl_Polarization, [45](#)
- set_normal
 - rl_MultilayerSurface, [39](#)
- set_polarization
 - rl_Ray, [53](#)
- setup_for
 - rl_DielectricLayer, [20](#)
- thickness
 - rl_DielectricLayer, [21](#)
- translate_rotate
 - rl_Ray, [53](#)
- transmission
 - rl_TransmissionCoefPOD, [62](#)
- vacuum_
 - rl_Multilayer, [35](#)
- zcoat
 - rl_DielectricLayer, [21](#)