The Monte Carlo Tracer

Sebastian Achim Mueller[a,b]

[a] *Institute for Particle Physics, ETH, Otto-Stern-Weg 5, 8093 Zuerich, Switzerland*
[b] *Experimental Physics 5b, TU Dortmund, Otto-Hahn-Strasse 4, 44227 Dortmund, Germany*

Abstract

In γ ray and cosmic ray astronomy it needs dedicated simulations of detectors to develope and run the instruments which observe particle interactions far beyond any energy accessable in the lab. The Monte Carlo Tracer exists since we do what we must, because we can.

Keywords: ray tracing, photon propagation

1. The scenery tree

1.1. The root of the scenery tree

The frame at the root of the tree structure represents the whole scenery. Before ray tracing is performed on the scenery tree, all frames in the tree estimate threir position and orientation w.r.t. the root frame. This way rays can easily and fast be transformed back and forth from the root tree to an individual object frame.

2. How to set up a scenery in source code

First we define the main frame of our scenery. This frame, often called world, will be the root of the scenery 1.1.

```
28  Frame world;
29  world.set_name_pos_rot("World", Vector3D::null, Rotation3D::null);
```

examples/set_up_scenery.cpp

Second we define frames that will hold individual structures like a tree which will be composed from several objects. The tree will be placed in $x = 5\,\mathrm{m}$ w.r.t. its later mother frame, i.e. the wolrd.

*Sebastian Achim Mueller
Email address: sebmuell@phys.ethz.ch (Sebastian Achim Mueller)

```
31  Vector3D tree_pos(5.0, 0.0, 0.0);
32  Frame tree;
33  tree.set_name_pos_rot("My_Tree", tree_pos, Rotation3D::null);
```

examples/set_up_scenery.cpp

Also part of the tree is the wooden pole.

```
35  Color leaf_green(0, 128, 0);
36  Sphere leaf_ball;
37  leaf_ball.set_name_pos_rot("leaf_ball", Vector3D(0.0, 0.0, 2.0), Rotation3D::null);
38  leaf_ball.set_outer_color(&leaf_green);
39  leaf_ball.set_sphere_radius(1.0);
```

examples/set_up_scenery.cpp