

# Physics 3D Manual

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## Getting Started

### *Installation*

To install the program double click the "Setup Physics3D.exe" file. The following screen will appear:



Follow the on screen instructions to complete the installation.

### **Notes**

In order for Physics3D to work correctly the Java Runtime and Java3D runtime must be installed. To download these follow the following links. If you have the CD-Installation version you the JRE and Java 3D RE are included in the install package:

Java Runtime (Click the Download link under JRE and Windows)

<http://java.sun.com/j2se/1.4.1/download.html>

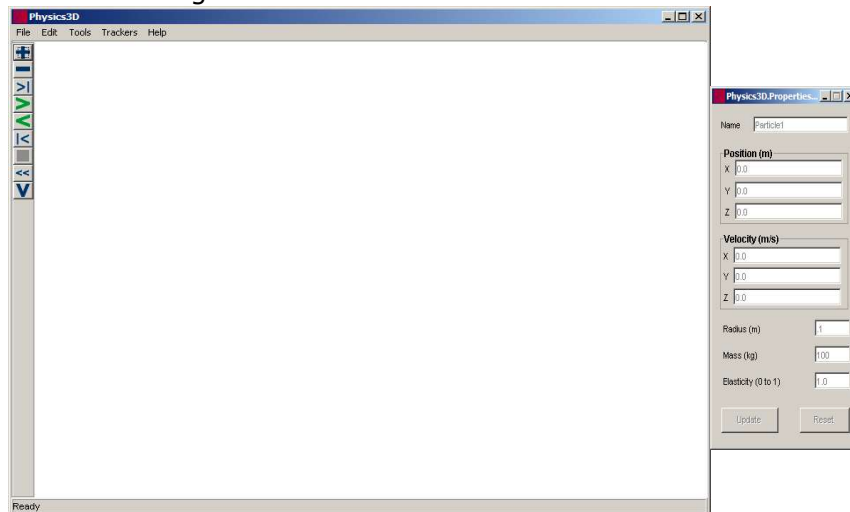
Java3D Runtime (Select Java3D for Windows (Open GL Version) from

the drop-down box.








<http://java.sun.com/products/java-media/3D/download.html>

## Starting up for the First Time

After a successful installation, the program should appear in your "Start Menu." To start it navigate to the Physics3D folder and click on the Physics3D icon. If all goes well a loading screen should be displayed and finally the main window should be displayed. It should look something like this:



## The Tool-bar Buttons

-  This button is the "Add Particle" button. Upon clicking it a new particle will be added to the system which can then be edited using the properties frame to the left.
-  This button is the "Remove Particle" button. To use it first click a particle in the system and then click this button.
-  This button is the "Step Forward" button. When the button is clicked the Physics3D Simulation engine will step forward one frame
-  This button is the "Start Animation" button. When this button is clicked, the Physics3D Simulation engine will start up simulating collisions and gravitational attraction.
-  This button is the "Start Animation in Reverse" button. When this button is clicked, the Physics3D Simulation will simulate the world in reverse.
-  This button is the "Step Back" button. When the button is clicked the Physics3D Simulation engine will step backward one frame
-  This button is the "Stop Animation" button. It will be initially disabled but is used to stop/pause the animation in mid stream. Upon stopping the animation it can be started from the same point by pressing the play button again.



This button is the “Reset Particles” button. It will reset all the particles back to their initial positions.



This button is the “Reset View” button. When clicked a dialog box will come up asking for the viewing distance. Upon clicking “OK” the view will be reset a view looking down the z-axis some distance away from the origin.

## The Properties Windows

To the right is the Properties window. This window will be visible while the Physics3D Simulation engine is inactive. It is an interface to the particles that are in the system. Either by clicking the particle in the main screen or clicking the Prev and Next buttons it is possible to select any particle in the system. Below is a brief explanation of each of the fields.

**Name** – In this field is the name of the particle. When creating many particles it is useful to give the particles a name other than the default (“Unnamed Particle”).

**Position (m)** – In the three fields in this box the position of the particle is specified in meters.

**Velocity (m/s)** – In the three fields in this box the velocity of the particle is specified in meters.

**Radius (m)** – This field displays the radius of the particle.

**Mass (kg)** – This field displays the mass of the particle.

**Elasticity (0 to 1)** – This field displays the elasticity of the particle.

Once changed to satisfaction, the particle can be updated by pressing the [Update] button. If any of the fields contain illegal values the whole frame will be reset.

Upon clicking the [Reset] button, the Properties window will reset the values of the fields to those of the current particle.

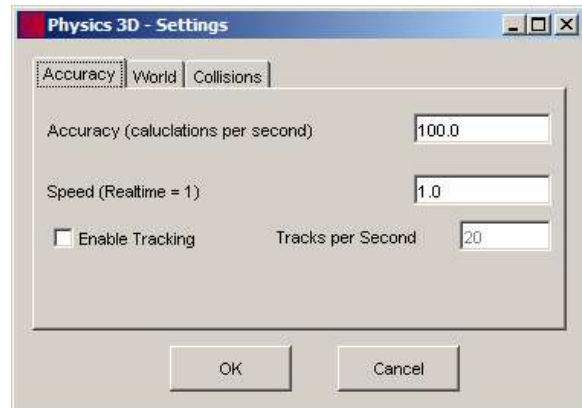
### NOTE

All number fields can use scientific notation in the form  $nEx$  where  $n$  is the base and  $x$  is the power of 10 multiply by. Notation in the form  $x*10^x$  is not accepted.

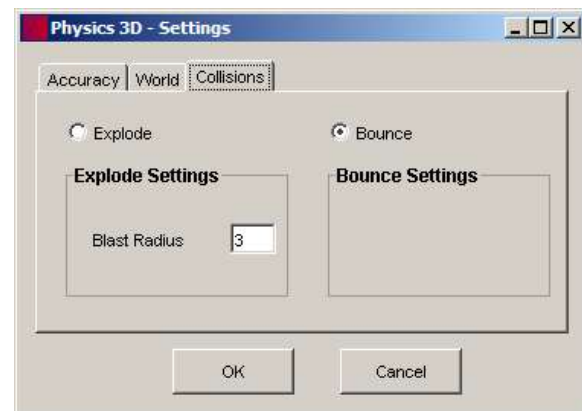
## Settings Window

In order to access the Settings window, click the edit menu then settings. Once clicked, the following window with three different tabs will show up:

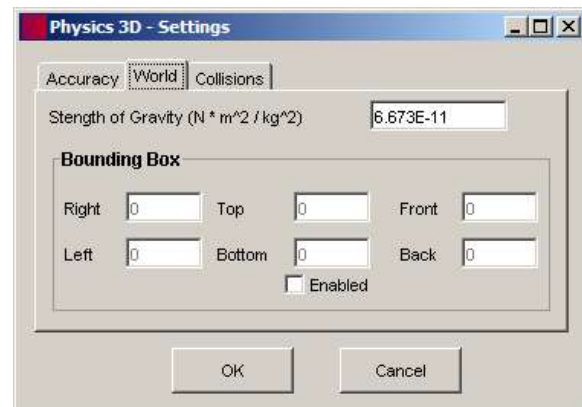
In the first tab, **Accuracy**, there are three basic settings. The Accuracy of the system, this is any number from 1 to 1000, it represents the number of calculations per second. The second setting is the speed of the system. This can be used to effectively increase accuracy (by slowing down the system) or increasing speed (useful for large to-scale systems where orbits are very large and long).



The second tab, **World**, contains basic settings for the world. The first, Strength of Gravity, holds the gravitational constant to be used in the simulation. The default is  $6.673 \times 10^{-11}$  which is the real world constant. The second part of the World tab allows a Bounding Box for the world to be specified. Any particles that hit the walls of this invisible box will bounce off.



The last tab, **Collisions**, defines the collision handling for the system. The default is bounce, optionally explode behavior can be activated which makes colliding particles explode rather than bounce off each other. The bottom half of this tab has not yet been implemented but will eventually contain additional settings for each collision mode.

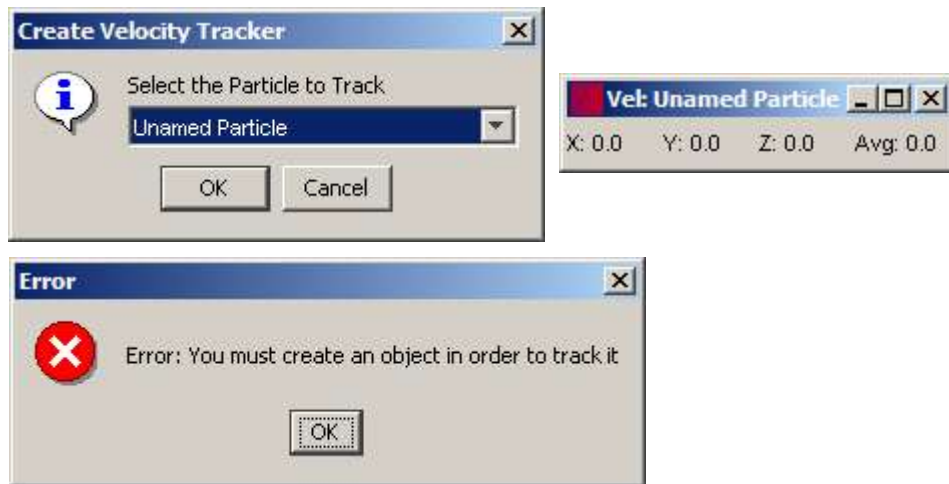


## Trackers

Perhaps one of the most important features of Physics3D is the ability to track particles within the system. In order to create a tracker first click the tools menu, then click the trackers item. At this point a popup menu will appear with a number of trackers to choose from. All of the trackers but the time tracker require specification of one or more particles to track. When such specification is needed, a dialog box will appear with a selection of particles to choose from by their names. Upon selecting all the particles for the tracker a small window will appear with the requested tracker. If there are no particles in the system when a tracker is requested, an error dialog will appear.

### NOTE

It is recommended that all particles in the system be named in order to use the tracking feature.



## Menu Options

### File Menu

- New – Erase entire system and start over. **WARNING:** This does not yet prompt to save, so make sure you save any work before clicking this.
- Save / Save As – Save current system to a file.
- Open – Load a system from a file. The default open directory for this is in the Examples directory where there are some examples to try out.
- Print – Prints the current state. One page with the current 3D view, and another page with any active trackers.
- Exit – Exit Physics3D

### Edit Menu

- Settings – See "Settings Window" section.

**Tools Menu**

- Trackers – See “Trackers” section.
- Create Random Particle Grid – Creates an X by X by X grid of particles with random x, y and z velocities between -1 and 1.