# README
## [Assignment 1 - CSCI 2240]
# Path Tracer

## Description

This project contains code to perform Monte Carlo Path Tracing written in C++ and was built on top of the Stencil code provided to us.

## Requirements

Qt ( > 5.9.0)
Qt Creator ( > 4.5.0)
OpenMP

## Usage

Build :

- Using Qt Creator.
- Using CLI:

```
 cd Path_Tracer_2240
mkdir build
cd build
qmake -makefile ../path-stencil.pro
make -j4
```

Run :

- Using Qt Creator

  Set the following arguments in Qt Creator.

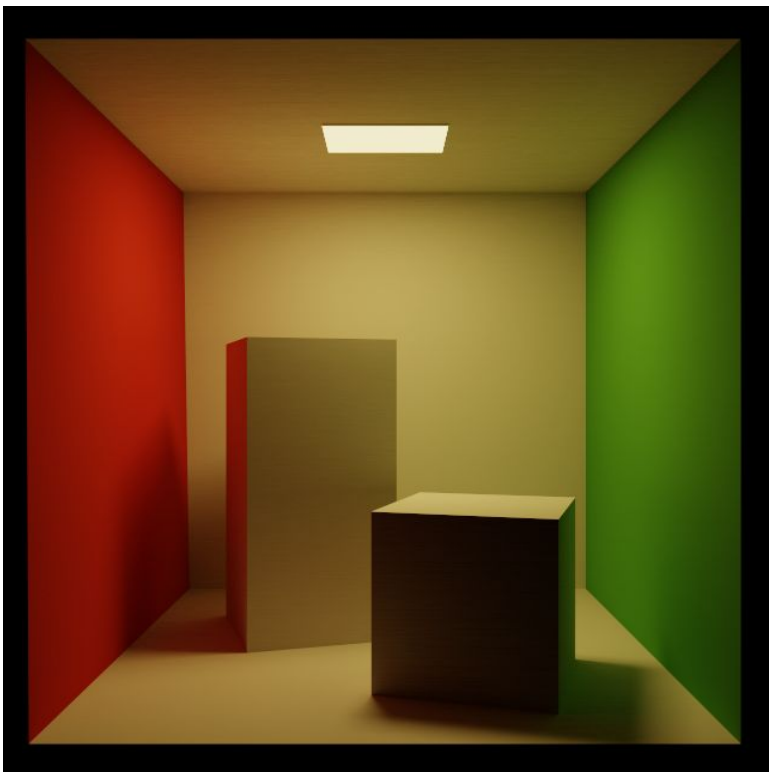
  *# <path to xml file>  <rendered image path>  <number of samples>  <image height> <image width>*
  `../Path_Tracer_2240/example-scenes/CornellBox-Sphere.xml ./output.png 100 256 256`

- Using CLI :

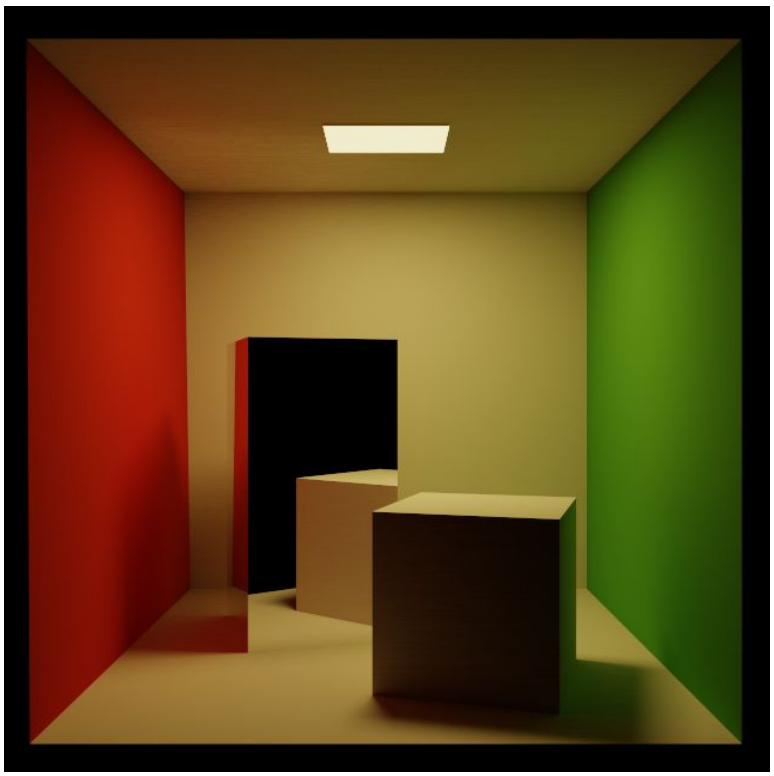
  ```
  ./path-stencil ../Path_Tracer_2240/example-scenes/CornellBox-Sphere.xml ./output.png 100 256 256
  ```

## Implementation

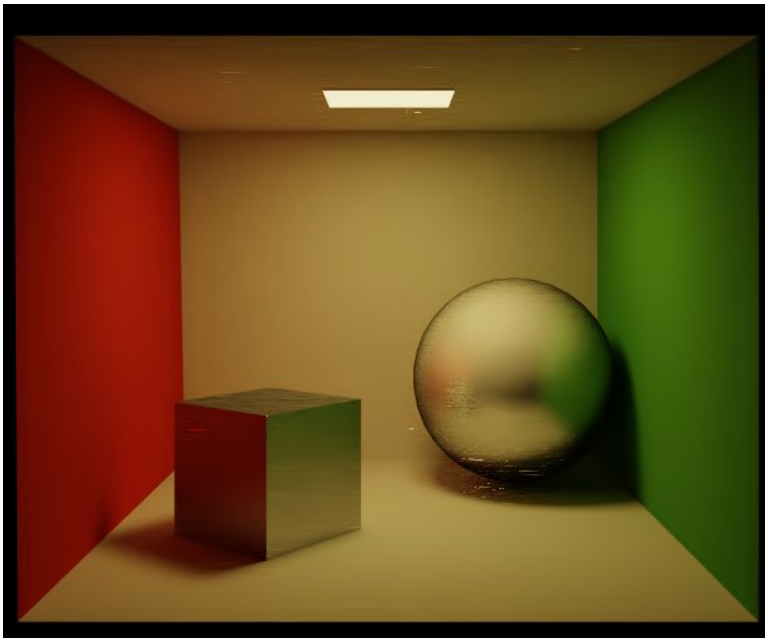
- Four basic types of BRDFs ✔



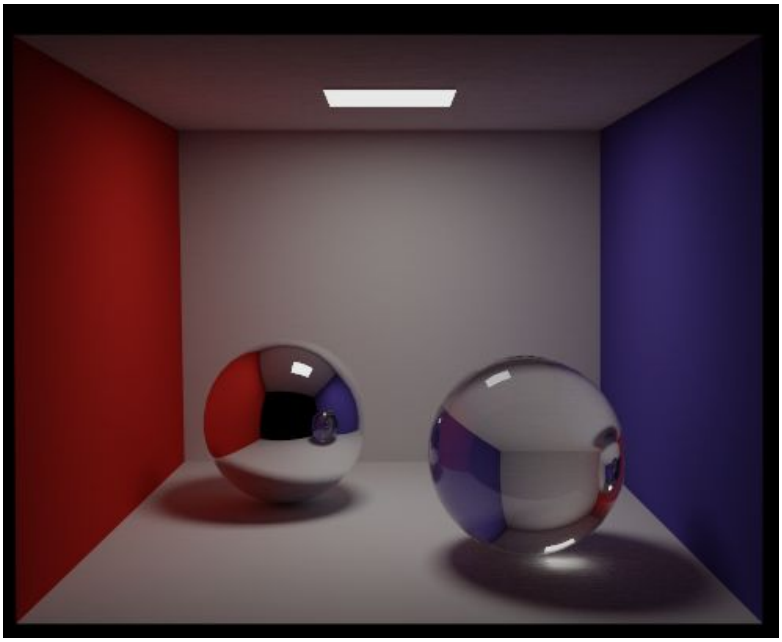
Diffuse [640 x 640] [2000 Samples]



Mirror [640 x 640] [2000 Samples]

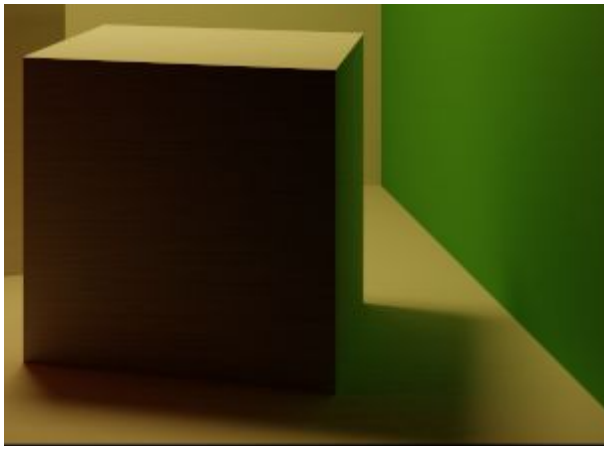


Glossy [640 x 640] [3000 Samples]

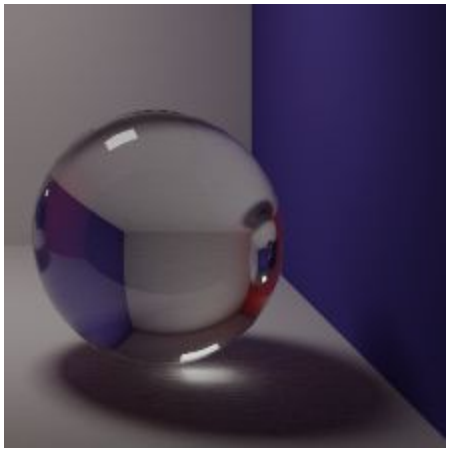


Refraction [640 x 640] [1500 Samples]

- Soft Shadows and Indirect Illumination ✔



Soft Shadows and Colour Bleeding

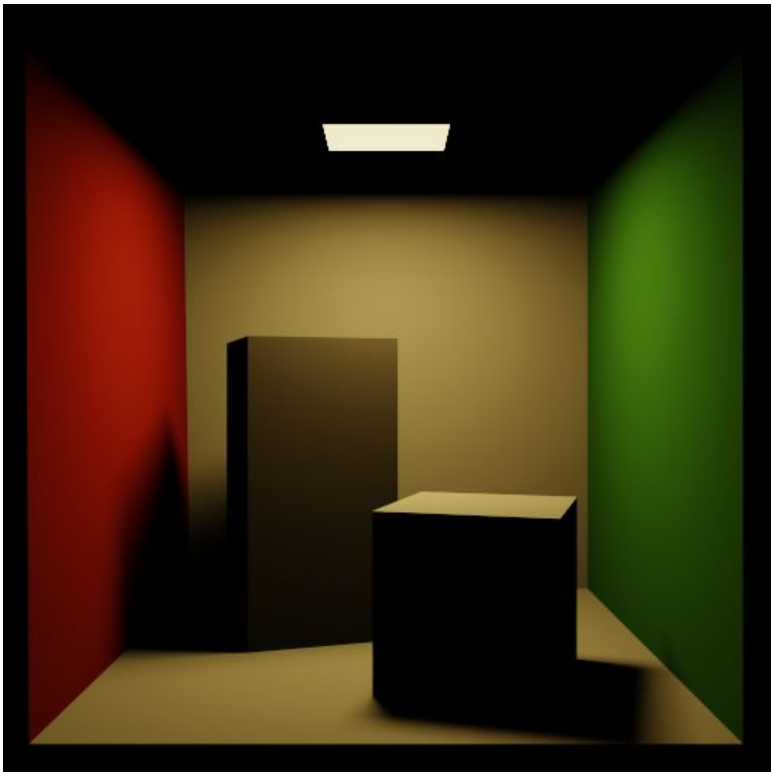


Caustics

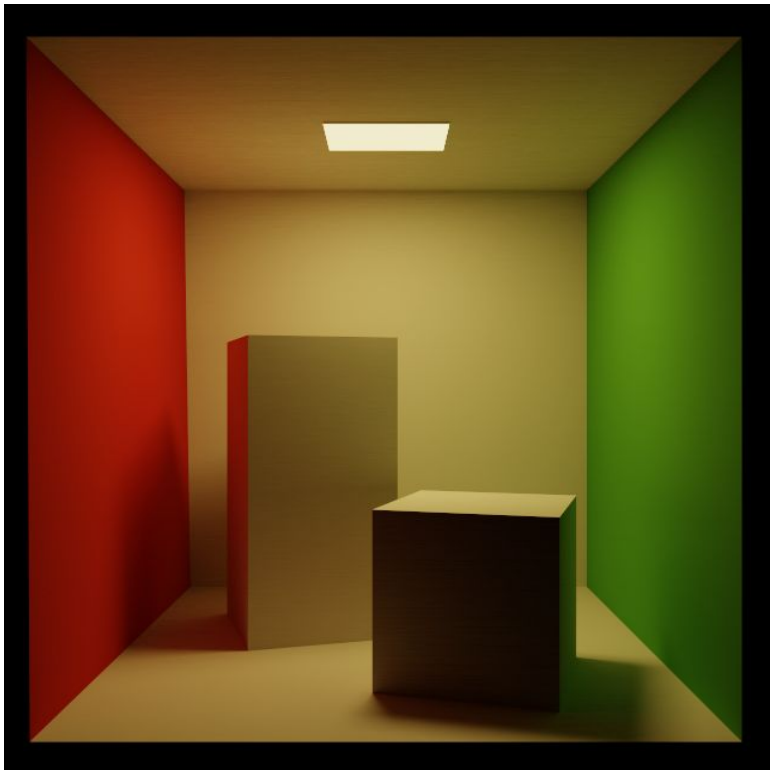
- Russian Roulette path termination ✔

- Tone Mapping ✔

- Event splitting ✔



Only Direct Lighting [640 x 640] [400 Samples]

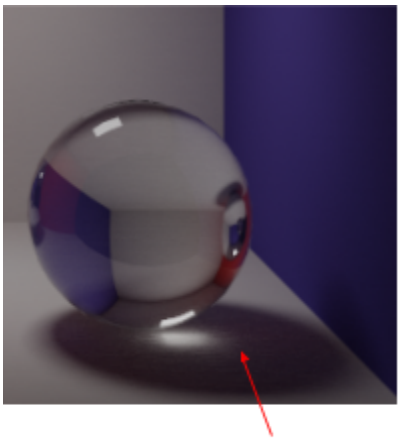


Full Global Illumination [640 x 640] [2000 Samples]

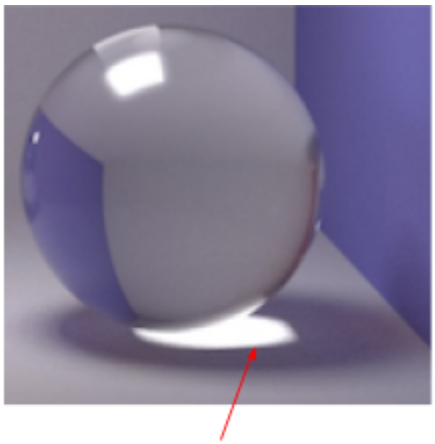
## Extra Features

- Attenuate refracted paths ✔

  Inspiration : https://www.scratchapixel.com/lessons/3d-basic-rendering/global-illumination-path-tracing

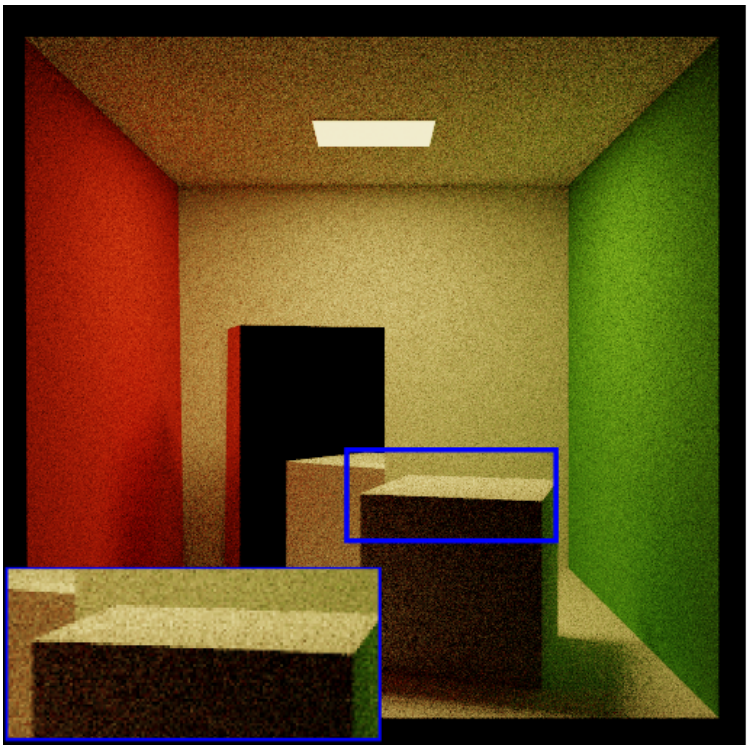


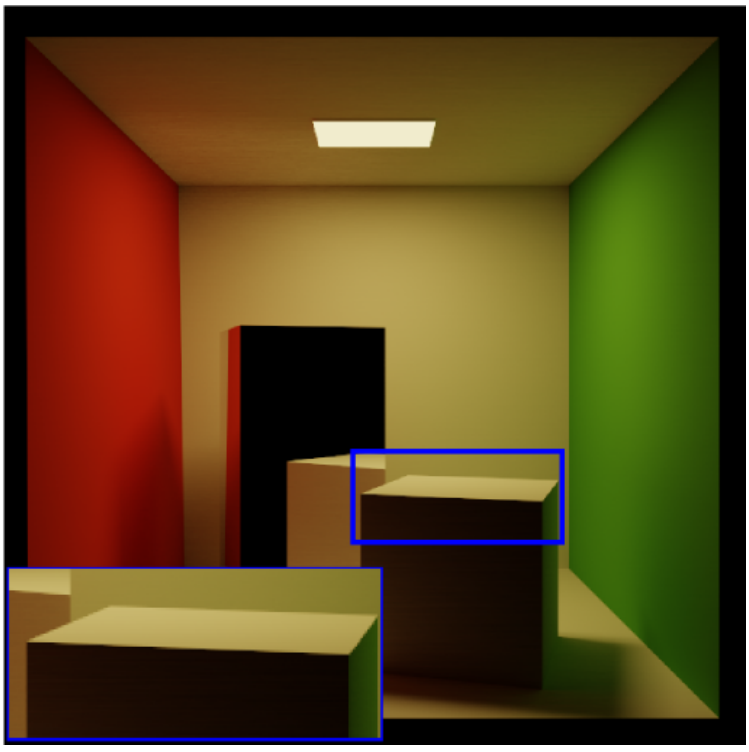
With Attenuation: Refracted rays lose their intensity.
[2000 spp] [*This is my render*]



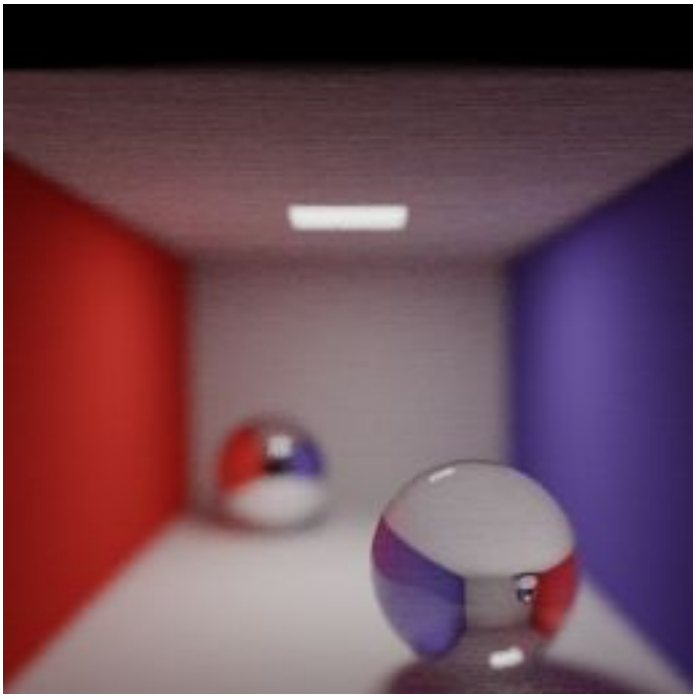
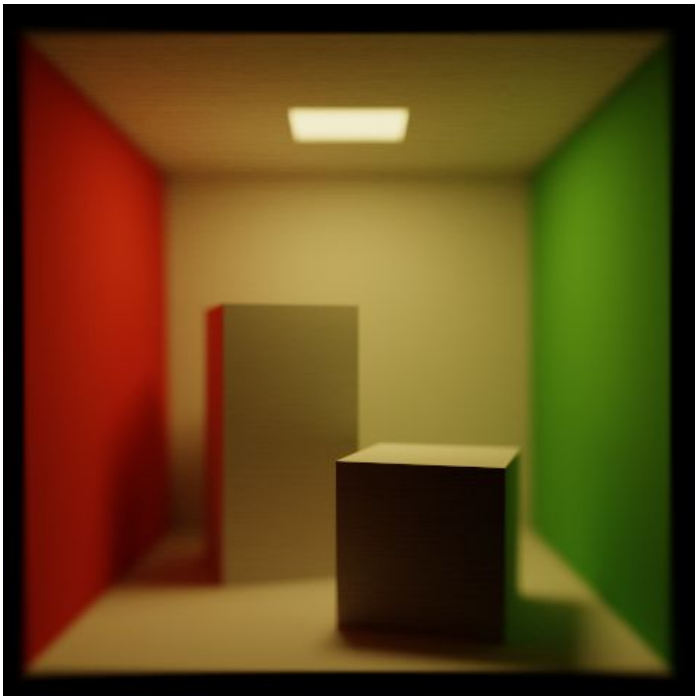
No Attenuation.
Source: Henrik W Jensen
[*This is NOT my render*]

- Importance Sampling ✔

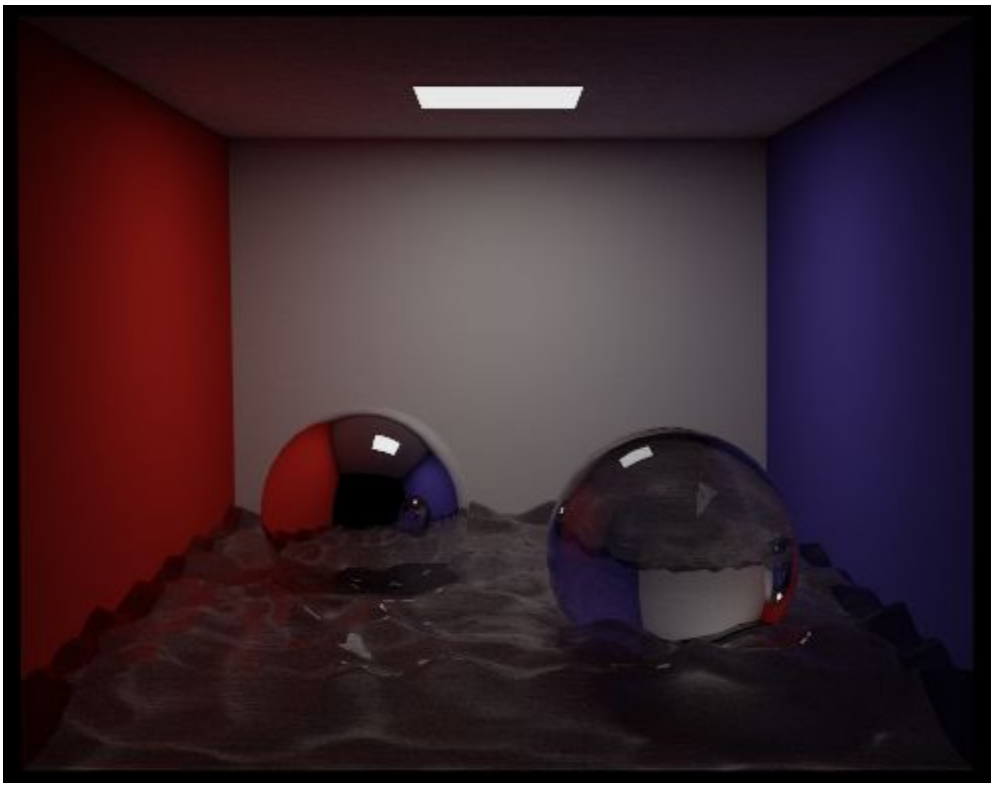




- Depth of field ✔

## Other Scenes



## Bloopers