

```
In [1]: # import library
import numpy as np
import pandas as pd
import os
import matplotlib
import matplotlib.pyplot as plt
%matplotlib inline
```

Visualization

```
In [11]: ## Read data
# f = open("myFile.txt", "r")
# print(f.read())
```

```
In [5]: ## Import data to pandas dataframe
dataRad = pd.read_csv('myFile.txt', sep=",", header=None)
#dataRad[0]
dataRad
```

Out[5]:

| | 0 | 1 | 2 | 3 |
|-----|------|------|------|-------|
| 0 | 19.0 | 20.0 | 1.0 | 225.2 |
| 1 | 19.0 | 20.0 | 3.0 | 243.1 |
| 2 | 19.0 | 20.0 | 5.0 | 261.5 |
| 3 | 19.0 | 20.0 | 7.0 | 277.1 |
| 4 | 19.0 | 20.0 | 9.0 | 288.6 |
| 5 | 19.0 | 20.0 | 11.0 | 310.4 |
| 6 | 19.0 | 20.0 | 13.0 | 334.1 |
| 7 | 19.0 | 20.0 | 15.0 | 360.7 |
| 8 | 19.0 | 20.0 | 17.0 | 376.5 |
| 9 | 19.0 | 20.0 | 19.0 | 385.6 |
| 10 | 17.0 | 20.0 | 1.0 | 211.7 |
| 11 | 17.0 | 20.0 | 3.0 | 243.5 |
| 12 | 17.0 | 20.0 | 5.0 | 256.8 |
| 13 | 17.0 | 20.0 | 7.0 | 270.1 |
| 14 | 17.0 | 20.0 | 9.0 | 284.4 |
| 15 | 17.0 | 20.0 | 11.0 | 304.5 |
| 16 | 17.0 | 20.0 | 13.0 | 333.9 |
| 17 | 17.0 | 20.0 | 15.0 | 358.8 |
| 18 | 17.0 | 20.0 | 17.0 | 374.2 |
| 19 | 17.0 | 20.0 | 19.0 | 384.7 |
| 20 | 15.0 | 20.0 | 1.0 | 215.6 |
| 21 | 15.0 | 20.0 | 3.0 | 233.5 |
| 22 | 15.0 | 20.0 | 5.0 | 250.5 |
| 23 | 15.0 | 20.0 | 7.0 | 268.6 |
| 24 | 15.0 | 20.0 | 9.0 | 284.9 |
| 25 | 15.0 | 20.0 | 11.0 | 302.6 |
| 26 | 15.0 | 20.0 | 13.0 | 320.3 |
| 27 | 15.0 | 20.0 | 15.0 | 361.8 |
| 28 | 15.0 | 20.0 | 17.0 | 369.8 |
| 29 | 15.0 | 20.0 | 19.0 | 378.6 |
| ... | ... | ... | ... | ... |
| 730 | 15.0 | 6.0 | 11.0 | 115.0 |
| 731 | 17.0 | 6.0 | 11.0 | 140.8 |
| 732 | 19.0 | 6.0 | 11.0 | 181.1 |
| 733 | 15.0 | 6.0 | 13.0 | 79.5 |
| 734 | 17.0 | 6.0 | 13.0 | 98.9 |
| 735 | 19.0 | 6.0 | 13.0 | 143.3 |
| 736 | 19.0 | 7.0 | 14.0 | 89.1 |
| 737 | 19.0 | 9.0 | 14.0 | 106.3 |
| 738 | 19.0 | 11.0 | 14.0 | 112.4 |
| 739 | 19.0 | 13.0 | 14.0 | 106.5 |
| 740 | 17.0 | 7.0 | 14.0 | 71.0 |
| 741 | 17.0 | 9.0 | 14.0 | 88.1 |
| 742 | 17.0 | 11.0 | 14.0 | 92.3 |
| 743 | 17.0 | 13.0 | 14.0 | 78.6 |
| 744 | 15.0 | 7.0 | 14.0 | 68.9 |
| 745 | 15.0 | 9.0 | 14.0 | 78.7 |
| 746 | 15.0 | 11.0 | 14.0 | 78.4 |
| 747 | 15.0 | 13.0 | 14.0 | 64.4 |
| 748 | 5.0 | 13.0 | 14.0 | 44.0 |
| 749 | 3.0 | 13.0 | 14.0 | 46.9 |
| 750 | 1.0 | 13.0 | 14.0 | 58.6 |
| 751 | 5.0 | 11.0 | 14.0 | 52.7 |
| 752 | 3.0 | 11.0 | 14.0 | 54.7 |
| 753 | 1.0 | 11.0 | 14.0 | 65.5 |
| 754 | 5.0 | 9.0 | 14.0 | 52.0 |
| 755 | 3.0 | 9.0 | 14.0 | 51.0 |
| 756 | 1.0 | 9.0 | 14.0 | 63.3 |
| 757 | 5.0 | 7.0 | 14.0 | 43.2 |
| 758 | 3.0 | 7.0 | 14.0 | 39.8 |
| 759 | 1.0 | 7.0 | 14.0 | 50.6 |

760 rows x 4 columns

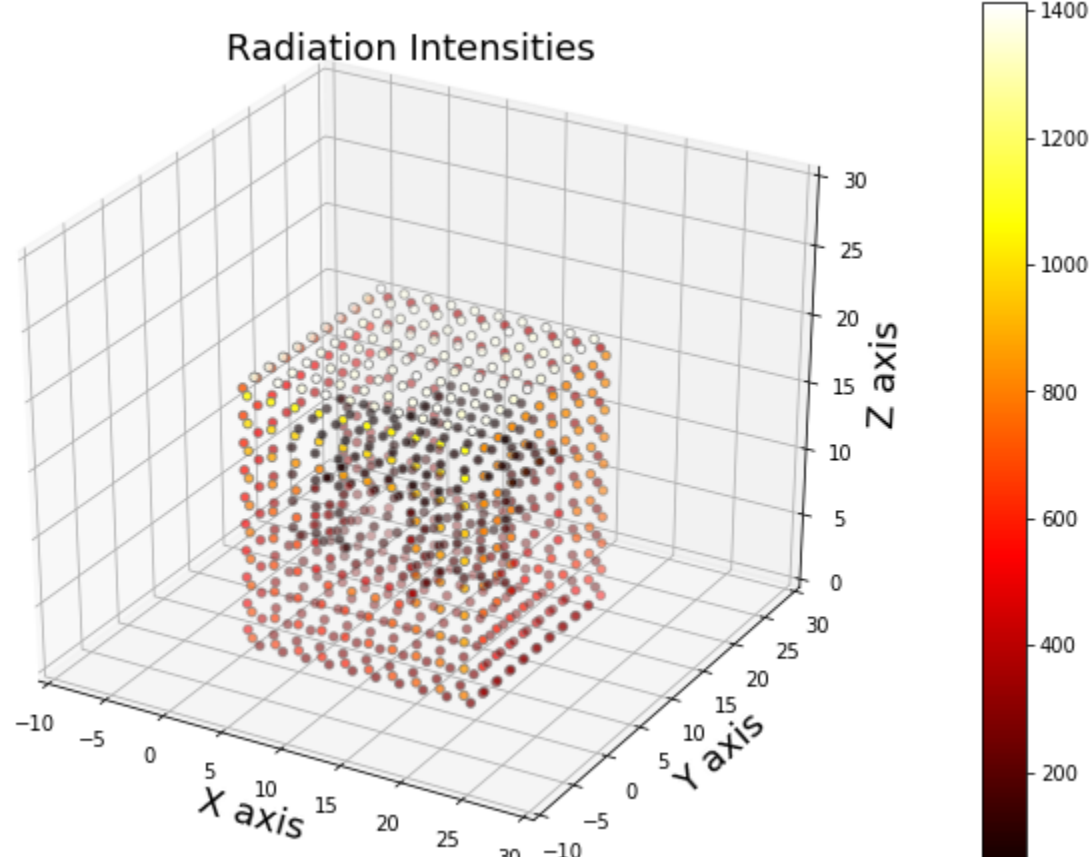
Visualize exported data

```
In [10]: my_cmap = plt.cm.hot
from mpl_toolkits.mplot3d import Axes3D # <-- This is important for 3d plotting

fig = plt.figure(figsize=(25,8))
ax1 = fig.add_subplot(122, projection='3d')
im = ax1.scatter(dataRad[0], dataRad[1], dataRad[2],
                s=20, c=dataRad[3], cmap=my_cmap, edgecolors='grey')

ax1.set_xlabel('X axis', fontsize =18)
ax1.set_ylabel('Y axis', fontsize =18)
ax1.set_zlabel('Z axis', fontsize =18)
ax1.set_xlim(-10, 30)
ax1.set_ylim(-10, 30)
ax1.set_zlim(0, 30)
ax1.set_title('Radiation Intensities', fontsize =18)
plt.colorbar(im)

plt.show()
```



Sampling data- from urban scale

```
In [12]: ## Import data to pandas dataframe
dataRad = pd.read_csv('myContextFile.txt', sep=",", header=None)
#dataRad[0]
dataRad
```

Out[12]:

| | 0 | 1 | 2 | 3 |
|------|------------|------------|-----------|--------|
| 0 | -57.868183 | -15.000000 | 2.100000 | 409.4 |
| 1 | -57.868183 | -15.000000 | 6.300000 | 415.7 |
| 2 | -57.868183 | -15.000000 | 10.500000 | 452.2 |
| 3 | -57.868183 | -15.000000 | 14.700000 | 481.0 |
| 4 | -57.868183 | -15.000000 | 18.900000 | 500.1 |
| 5 | -57.868183 | -15.000000 | 23.100000 | 496.2 |
| 6 | -57.868183 | -15.000000 | 27.299999 | 527.6 |
| 7 | -57.868183 | -15.000000 | 31.500000 | 532.8 |
| 8 | -57.868183 | -15.000000 | 35.699997 | 546.2 |
| 9 | -57.868183 | -15.000000 | 39.899998 | 552.2 |
| 10 | -53.710331 | -15.000000 | 2.100000 | 371.1 |
| 11 | -53.710331 | -15.000000 | 6.300000 | 378.6 |
| 12 | -53.710331 | -15.000000 | 10.500000 | 389.9 |
| 13 | -53.710331 | -15.000000 | 14.700000 | 446.9 |
| 14 | -53.710331 | -15.000000 | 18.900000 | 443.0 |
| 15 | -53.710331 | -15.000000 | 23.100000 | 461.7 |
| 16 | -53.710331 | -15.000000 | 27.299999 | 459.7 |
| 17 | -53.710331 | -15.000000 | 31.500000 | 507.8 |
| 18 | -53.710331 | -15.000000 | 35.699997 | 527.9 |
| 19 | -53.710331 | -15.000000 | 39.899998 | 534.2 |
| 20 | -49.552479 | -15.000000 | 2.100000 | 362.7 |
| 21 | -49.552479 | -15.000000 | 6.300000 | 362.7 |
| 22 | -49.552479 | -15.000000 | 10.500000 | 378.4 |
| 23 | -49.552479 | -15.000000 | 14.700000 | 405.7 |
| 24 | -49.552479 | -15.000000 | 18.900000 | 416.3 |
| 25 | -49.552479 | -15.000000 | 23.100000 | 429.7 |
| 26 | -49.552479 | -15.000000 | 27.299999 | 475.0 |
| 27 | -49.552479 | -15.000000 | 31.500000 | 477.2 |
| 28 | -49.552479 | -15.000000 | 35.699997 | 514.3 |
| 29 | -49.552479 | -15.000000 | 39.899998 | 538.3 |
| ... | ... | ... | ... | ... |
| 8058 | 7.000000 | 66.916672 | 30.000000 | 1344.9 |
| 8059 | 7.000000 | 70.750000 | 30.000000 | 1339.2 |
| 8060 | 7.000000 | 74.583328 | 30.000000 | 1320.5 |
| 8061 | 7.000000 | 78.416672 | 30.000000 | 1355.3 |
| 8062 | 7.000000 | 82.250000 | 30.000000 | 1346.4 |
| 8063 | 7.000000 | 86.083328 | 30.000000 | 1335.2 |
| 8064 | 11.000000 | 66.916672 | 30.000000 | 1339.2 |
| 8065 | 11.000000 | 70.750000 | 30.000000 | 1343.2 |
| 8066 | 11.000000 | 74.583328 | 30.000000 | 1311.7 |
| 8067 | 11.000000 | 78.416672 | 30.000000 | 1323.0 |
| 8068 | 11.000000 | 82.250000 | 30.000000 | 1303.5 |
| 8069 | 11.000000 | 86.083328 | 30.000000 | 1294.6 |
| 8070 | 15.000000 | 66.916672 | 30.000000 | 1342.0 |
| 8071 | 15.000000 | 70.750000 | 30.000000 | 1336.5 |
| 8072 | 15.000000 | 74.583328 | 30.000000 | 1312.5 |
| 8073 | 15.000000 | 78.416672 | 30.000000 | 1314.4 |
| 8074 | 15.000000 | 82.250000 | 30.000000 | 1289.2 |
| 8075 | 15.000000 | 86.083328 | 30.000000 | 1304.5 |
| 8076 | 19.000000 | 66.916672 | 30.000000 | 1325.8 |
| 8077 | 19.000000 | 70.750000 | 30.000000 | 1328.1 |
| 8078 | 19.000000 | 74.583328 | 30.000000 | 1313.4 |
| 8079 | 19.000000 | 78.416672 | 30.000000 | 1308.7 |
| 8080 | 19.000000 | 82.250000 | 30.000000 | 1296.8 |
| 8081 | 19.000000 | 86.083328 | 30.000000 | 1265.6 |
| 8082 | 23.000000 | 66.916672 | 30.000000 | 1324.5 |
| 8083 | 23.000000 | 70.750000 | 30.000000 | 1315.3 |
| 8084 | 23.000000 | 74.583328 | 30.000000 | 1317.3 |
| 8085 | 23.000000 | 78.416672 | 30.000000 | 1306.2 |
| 8086 | 23.000000 | 82.250000 | 30.000000 | 1287.4 |
| 8087 | 23.000000 | 86.083328 | 30.000000 | 1274.6 |

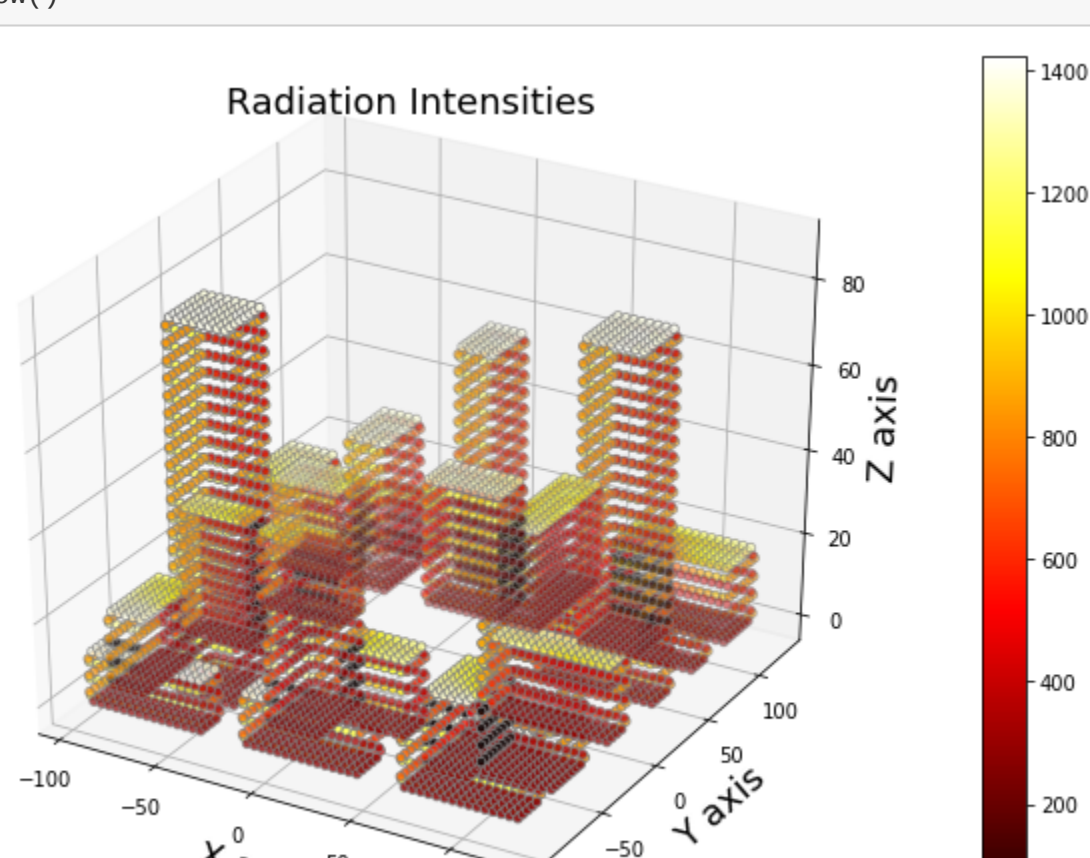
8088 rows x 4 columns

```
In [18]: fig = plt.figure(figsize=(25,8))
ax1 = fig.add_subplot(122, projection='3d')
im = ax1.scatter(dataRad[0], dataRad[1], dataRad[2],
                s=20, c=dataRad[3], cmap=my_cmap, edgecolors='grey')

ax1.set_xlabel('X axis', fontsize =18)
ax1.set_ylabel('Y axis', fontsize =18)
ax1.set_zlabel('Z axis', fontsize =18)

ax1.set_title('Radiation Intensities', fontsize =18)
plt.colorbar(im)

plt.show()
```



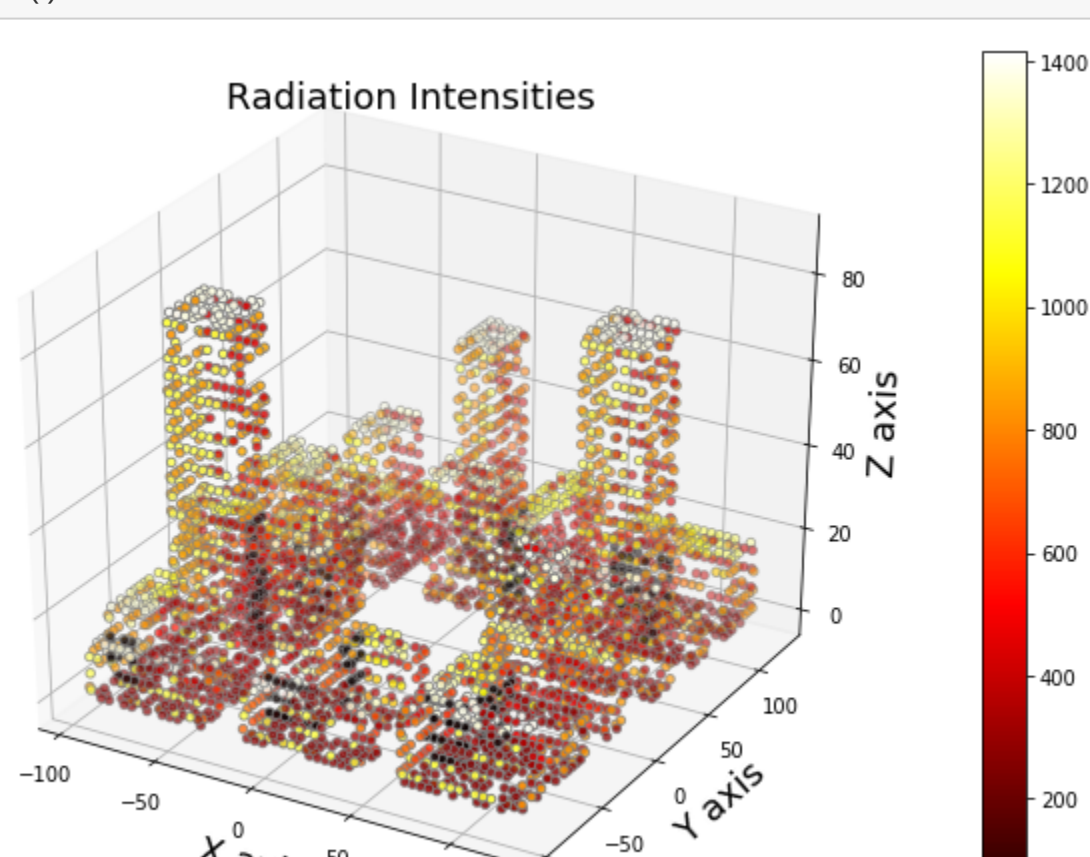
```
In [22]: ## Sampling pandas dataframe
SampledRad = dataRad.sample(n=5000, random_state=1) # reduce the number of 8088 rows for r
esampling
```

```
In [24]: fig = plt.figure(figsize=(25,8))
ax1 = fig.add_subplot(122, projection='3d')
im = ax1.scatter(SampledRad[0], SampledRad[1], SampledRad[2],
                s=20, c=SampledRad[3], cmap=my_cmap, edgecolors='grey')

ax1.set_xlabel('X axis', fontsize =18)
ax1.set_ylabel('Y axis', fontsize =18)
ax1.set_zlabel('Z axis', fontsize =18)

ax1.set_title('Radiation Intensities', fontsize =18)
plt.colorbar(im)

plt.show()
```



```
In [25]: SampledRad.to_csv('sampledContextRad.csv', index=False)
```

```
In [ ]:
```