Projection Users Guide

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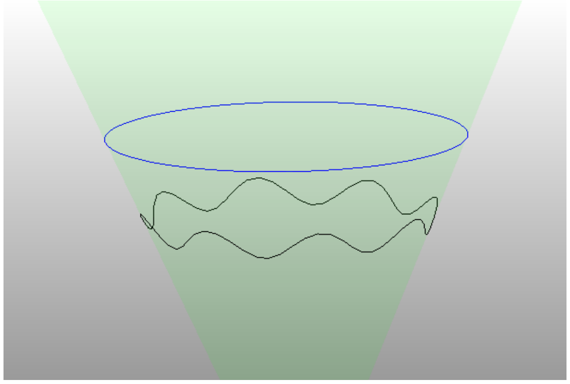
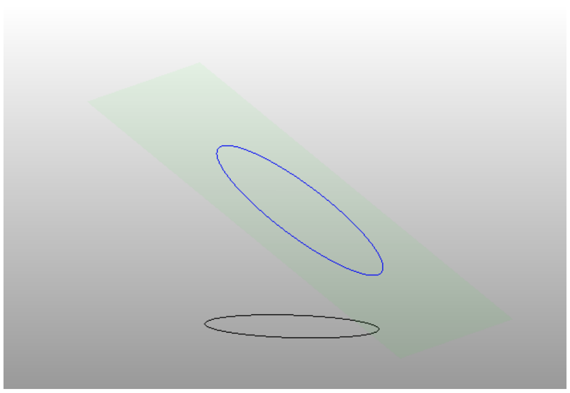
Overview

The purpose of the projection program is to move point data onto a specific plane tangent to the surface normal vectors of the input points. Unlike classical projection which simply moves the point data this program extrapolates what the intersection shape would look like at the intersecting surface. The following shows graphical examples of the function of this program.

Image	*Description*
	Projection is using data generated from the inside of a conical shape (green). The input scanning data (black) has variations in height which could be from various reasons. The output projected point data (blue) forms a circle on the target plane representing the intersection of the cone and the plane. *This projection was done using the default 2D option.*
	Projection of data in one plane onto a plane in another orientation (green). The input data (black) forms a circle. The output projected point data (blue) forms an ellipse on the target plane. The ellipse would be the same shape formed by punching a pin represented by the circle onto the target plane. *This projection was done using the 3D option.*

Compile Notes

The program is provided as source code or as a pre-compiled executable. To compile enter the command 'make' from a command prompt. A makefile is included based on the GNU GCC C++ compiler.

Compile Example:

```
C:\MinGW\MyProjects\projection>make clean
rm -rf *.o projection.exe

C:\MinGW\MyProjects\projection>make
g++ -c -Wall -c main.cpp
g++ -c -Wall -c vector3.cpp
g++ -c -Wall -c mat4.cpp
g++ -c -Wall -c refsys.cpp
g++ -c -Wall -c projection.cpp
g++ -c -Wall -c cmdline.cpp
g++ main.o vector3.o mat4.o refsys.o projection.o cmdline.o -o projection
```

Command Line Options

The projection program has the following command line options:

```
Command line options:
          -h Display argument help and exit
     -infile Name of input file
    -outfile Name of output file
       -path File path.  Add quotes around path with spaces
      -plane Projection plane [X Y Z I J K]
 -project_3d Perform projection in 3D
-project_ijk Flatten IJK values onto plane
      -quiet Suppress output
          -v Show version and exit
```

The projection program can be run without parameters. The input file name is 'infile.txt' and is expected to exist in the same directory as the program.

```
C:\MinGW\MyProjects\projection>projection
INFO:  Input file path: C:\MinGW\MyProjects\projection
INFO:  Processing data file 'infile.txt' ... Done
INFO:  InFile data size: 72
INFO:  Writing output file 'outfile.txt' ... Done
INFO:  Processing complete
```

The projection program can be run with command line parameters to override the default values used for calculations:

```
C:\MinGW\MyProjects\projection>projection -path "g:\data to send" -plane 0 0 60 0 0 1 -outfile output.csv
INFO:  Input file path: g:\data to send
INFO:  Processing data file 'infile.txt' ... Done
INFO:  InFile data size: 72
INFO:  Writing output file 'output.csv' ... Done
INFO:  Processing complete
```

Parameters

The following describes the parameters used by the projection program.

[infile]

The name and file extension of the input file.

[outfile]

The name and file extension of the output file.

[plane]

The plane parameter describes the projection plane that the input data will be projected to. The projection of the point data is done perpendicular to the point normal.

Example:

```
-plane 0 0 10 0 0 1
```

Projection Sample Data:

```
1) 0.000, 0.000, 10.125, 0.000, 1.000, 0.000
2) 0.000, 0.000, 10.125, 0.000, 0.866,-0.500
3) 0.000, 0.000, 10.000, 0.000, 0.866,-0.500
```

1) Point will be projected from position (0.000, 0.000, 10.125) to (0.000, 0.000, 10.000). The perpendicular vector of the surface normal is (0.000, 0.000, 1.000)

2) Point will be projected from position (0.000, 0.000, 10.125) to (0.000, -0.072, 10.000) along the perpendicular vector of (0,0.5.0.866).

3) Point will not be changed. The position of the point is already (0.000, 0.000, 10.000)

The estimated projection position from example 2 is based on a 30 degree projection vector to Z (tan(30) X 0.125 = 0.072169).

The perpendicular vector of the point surface normal relies on the direction of the input data. It cannot be calculated from a single point.

[project_3d]

This parameter will cause the projection of the input data to be done in 3D. If not specified the projection is 2D.

This option should not be used unless the input data is already flattened as any variations in height will affect the output.

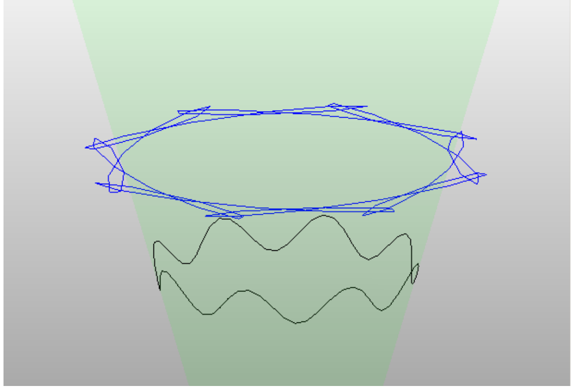


Illustration 1: Data that should not be projected with 3D option. Output influenced by variation in height causing the path to be erratic.

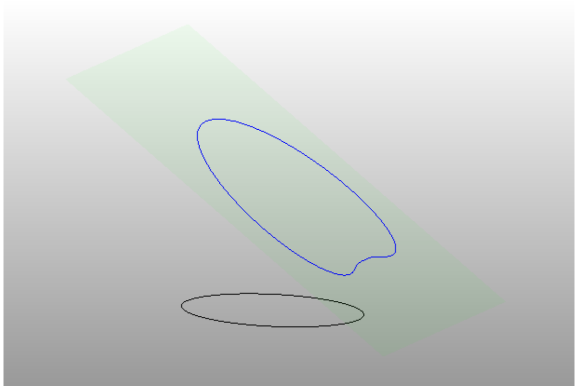


Illustration 2: Data that should be projected with 3D option. Input data appears elliptical from projection plane forming a 'surfboard' shape.

[project_ijk]

This option will cause the output IJK vector for each point to be projected into the projection plane.

[path]

The location of the input and output files. The default file location is the directory of the executable if the path is not specified.

[quiet, v, h]

These options are general purpose and do not affect the output. The option 'quiet' will suppress output messages other than warnings or errors. Option 'v' will report the version and option 'h' will display the list of supported command line options.

Default parameter values

All values used by the projection program are optional. The default values for the parameters are listed below:

```
projection plane vector = 0,0,1
projection plane position = <set to the first point of the input data>
path = <current directory>
project 3D = false
project IJK = false
input file name = infile.txt
output file name = outfile.txt
```

It is not necessary to provide values for all parameters if the default values are satisfactory.

Input File

The input file is expected to contain XYZIJK comma separated values. Lines not containing six values are ignored.

Example data file:

```
0.00000000,0.00000000,0.00000000,0.09950315,-0.99503725,0.00000000
0.36493325,0.03649323,0.00000000,0.09950315,-0.99503725,0.00000000
0.59945265,0.05994492,0.00000000,0.09950210,-0.99503735,0.00000000
0.83087753,0.08308689,0.00000000,0.09950072,-0.99503749,0.00000000
...
```

Output File

A single output file is created containing all projected input data. The output format is identical to that of the expected input file.

Example output file:

```
0.00000000,0.00000000,0.00000000,0.23224817,-0.97265656,0.00000000
2.52072000,0.60073200,0.00000000,0.23126869,-0.97288992,0.00000000
4.89888000,1.16452800,0.00000000,0.23005161,-0.97317843,0.00000000
7.13448000,1.69138800,0.00000000,0.22867289,-0.97350332,0.00000000
...
```