FuLBLINKy
USER GUIDE

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ABSTRACT

This document provides general information about using the FuLBLINKy software. FuLBLINKy is a visualization tool, created specifically for Computational Fluid Dynamics simulations, with particular focus on Lattice Boltzmann methods.

1 PREPARING YOUR COMPUTER

1.1 Technical requirements

Before installing FuLBLINKy, please make sure that the following software is installed on your machine:

- GLFW3 (http://www.glfw.org/)

- GLM (http://glm.g-truc.net/0.9.6/index.html)

- CEGUI 0.8+ (http://cegui.org.uk/)

- GTK 3.0+

- A graphics driver compatible with OpenGL 3.3+

1.2 Installation of FuLBLINKy

If everything went well with the above steps, you should now have everything you need to build the project. Just make sure your `LD_LIBRARY_PATH` points to the location the GLFW and CEGUI libs were installed to (`/usr/local/lib` by default) and run `make` from the project directory.

Once all software is installed, run the following command from the terminal in corresponding folder: `./fluid-vis`. This should open the FuLBLINKy user interface.

2 GETTING STARTED WITH FULBLINKY

FuLBLINKy provides two main options:

- Flow visualization from a *.vtk* file;

- Live visualization of a fluid flow simulation on arbitrary geometries using the Lattice Boltzmann method.

For the visualization of the flow from a given *.vtk* file, press **"Load VTK"** button in the left upper corner of the screen (see fig. 1) and choose the appropriate input file. FuLBLINKy automatically detects files in the directory that are a part of the result sequence of the simulation. To navigate through the time steps use <| (previous timestep) and |> (next timestep) buttons. Use the » button for a continuous, forward-in-time visualization of a sequence of result files.
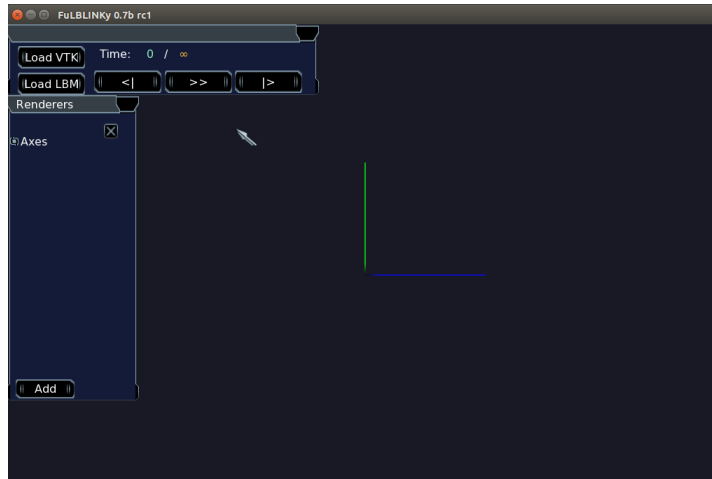
Figure 1: Main window

In order to run live LBM simulation, press **"Load LBM"** button in the left upper corner of the screen and choose an appropriate input file. Sample input files can be found here: */lb-sim/inputFiles*.

FuLBLINKy also supports standard camera features such as zoom in/zoom out and pan. Use mouse scroll to zoom in/out. For panning, press and hold the right mouse button and drag to adjust the image position.

3 DATA VISUALIZATION OPTIONS

FuLBLINKy provides several standard data visualization options: Point data, vector-glyphs, line-glyphs, streamlines. In addition, FuLBLINKy also allows visualization of probability density values for the live LBM solver - a handy feature for debugging nasty LBM errors.

3.1 Points

To enable grid points colored according to the velocity values or density values:

- Press the button **Add**

- Choose **Points** and press **Add** again (see fig. 2);

Figure 2: Add renderer window

- In the "Renderers" window under the appeared field **"Points"** choose the field you want to visualize from drop-down menu (see fig. 3).

3.2 Glyphs

To be able to see glyphs to the velocity (or other) values or density values:

- Press the button **Add**

- Choose **Glyphs** and press **Add** again.

- In the "Renderers" window under the appeared field **"Glyphs"** choose the field you want to visualize from drop-down menu (see fig. 4).

3.3 Lines

Analogical to Glyphs, but without specifying directions.

3.4 Streamlines

Streamlines are initiated as uniformly distributed points on a line source. To visualize streamlines (see fig. 5) from a line source:
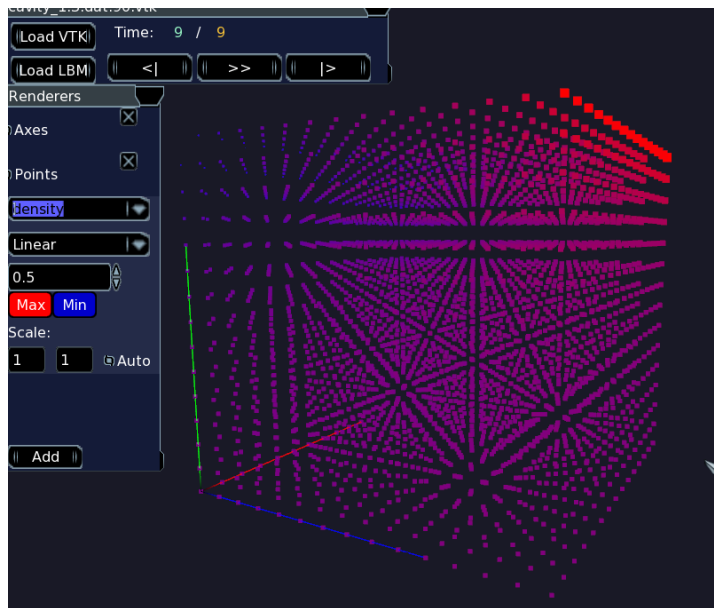
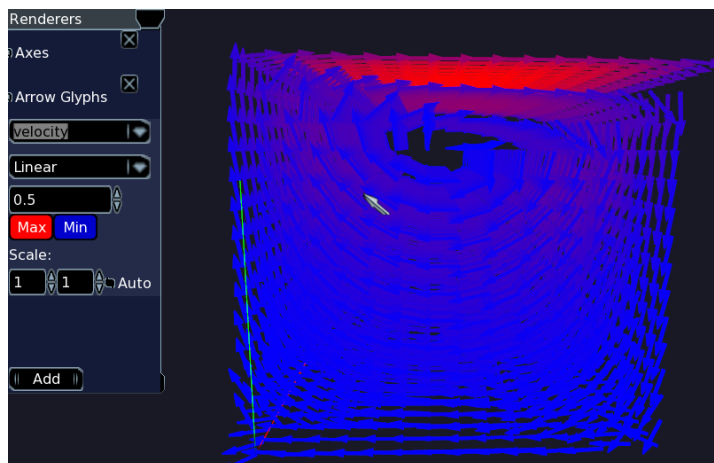- Press the button **Add**

Figure 3: Points renderer
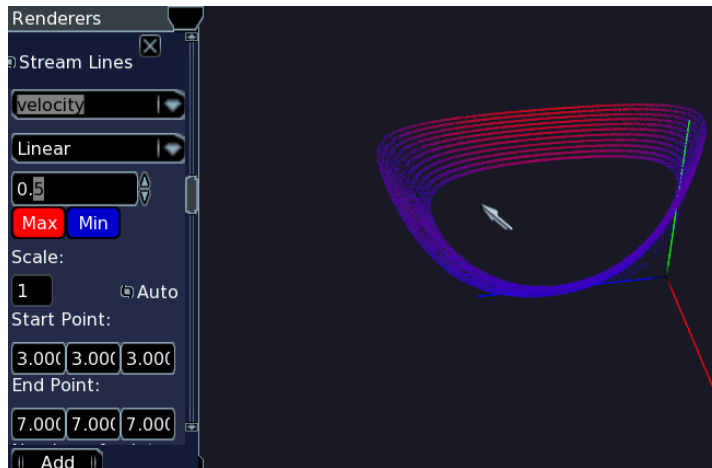

Figure 4: Glyphs renderer

Figure 5: Streamline renderer

- Choose **Streamlines** and press **Add** again.

- Enter the coordinates of start and end points of the line source in corresponding fields

- Enter number of points on a line, which are to be used as a starting points for streamline

- Enter maximum length of streamlines

To change thickness of streamlines uncheck **Auto** checkbox and enter the value in a field **Scale**.
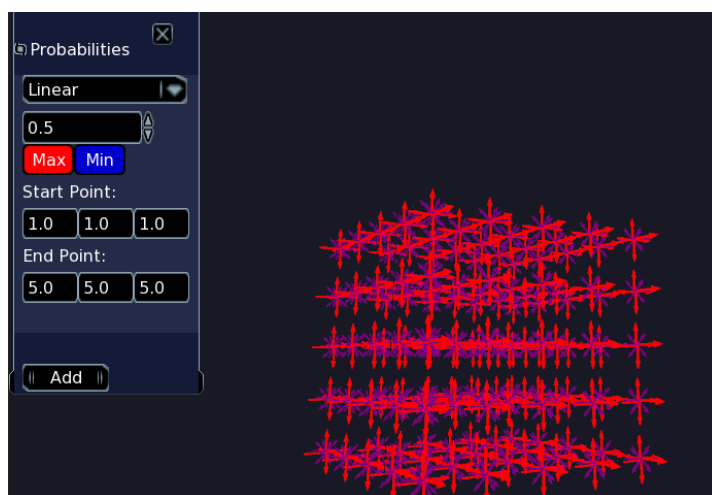
3.5 Probability distributions (LBM only)

Figure 6: Probability distributions in lattice directions

To visualize probability distributions in lattice directions (see fig. 6) (currently D3Q19 is used):

- Press the button **Add**.

- Choose **Probabilities** and press **Add** again.

- Enter the range for x,y and z coordinates points to be visualized.

Arrows are colored according to the relative probability magnitude.

4 DATA ANALYSIS FEATURES

In the current version of FuLBLINKy, several scaling options are provided to enable the user to highlight particular features of their flow results.

4.1 Color Scaling

The following scaling options are available for all visualization features:

- To change color scaling, pick one of the three options in the second drop-down menu:
    - Linear
    - Smooth
    - Exponential

- To set minimum and maximum values for color scaling use **min** and **max** color pickers.

4.2 Size Scaling

To change length scaling of the glyphs, uncheck **Auto** checkbox in the right lower corner of the *renderers -> Points* window and enter an appropriate range in corresponding fields.