Optimization Analysis

Name :Xiaofo Luo

In order to optimize this project, I first browsed the composition of the project.

There are two folder in the project: Math, which has two classes called Matrix and Vect4D.The Vector consist of the Matrix, and Vector has 4 double value x,y,z and another one is Source files. Which is draw the graph and create the window and timer.

In the project , there are double value in every file, to **save the memory I plan to change it to float because it 4bytes.** I also found there are more implicit convert occurred in many function when call it, so I plan to **modify all double value to float by adding f after value.**

- In Vect4D, There are some functions which overloading the operator and normalize Vect. There is no copy operator in it.

To optimize it, I plan **add copy operator to manual it rather than compiler set it** , using **initialization list in constructor to save some steps** and **use RVO** in overloading operator function. I also found that the calculate 4 float value can **modify to SIMD** to calculate 4 values in one time. In norm function, there call a **sqrt function to calculate sqrt root, I plan to create new one to calculate it by using bisection ,which use shift and times method to avoid divide method.**

- In Matrix, the set and get function can get and set value in Matrix. There are also some functions which set the special Matrix to draw the graph. There are more functions to calculate Matrix value.

To optimize it, I plan **use SIMD to replace all normal method calculation.** The destructor is nothing to delete so I plan to **set it to default.**There is a Determinant function, I plan to do all multiplication by hand to save more calculation step in one function.

In Source Files, the main function creates window and timer to show graph and record update and draw time.

- The Particle function consist of Vect and Matrix ,and also set the position ,velocity ,scale which are used in draw graph.

To optimize it, I plan to use **initialization list in constructor,** and **overload += operator to calculate equation** in Update function. I also found that more unused code in Update(),I plan to delete it.The Particle should be 16 bytes alignment,so I plan **to create a align class as based class to malloc 16 bytes memory to save**,and change Particle class to a derived class. **The prev_Row0 , diff_Row0 and curr_Row0 actually do nothing in draw and update graph,so I plan to delete it.**

- The ParticleEmitter file to set color and scale of graph. There are update() and draw() to update and draw graph.

To optimize it, I plan to **delete STL list to save memory space**, because I found the particle_list do nothing in program, and drawBuffer just save the pointer of Particle object, which **can be replaced to pointer.** In update function, there are two while loops to go though linked list, so I **plan to merge it to one loop to save some steps.** In draw function, there are a lot of object in for loop, I plan to move it out of the loop, these Matrix and Vect4D can be created without each loop. For Exercute function, the y – variance and z – variance have the same code ,I plan **to create new function to difference x and y,z in two condition can save more casting time and analyzing conditions time.**

For all program, I found that there are many switch statements in many functions, I plan **to change it to if else and put the condition which call many times in the outer, and less times in inner loop, which can reduce number of judgments to save time.**