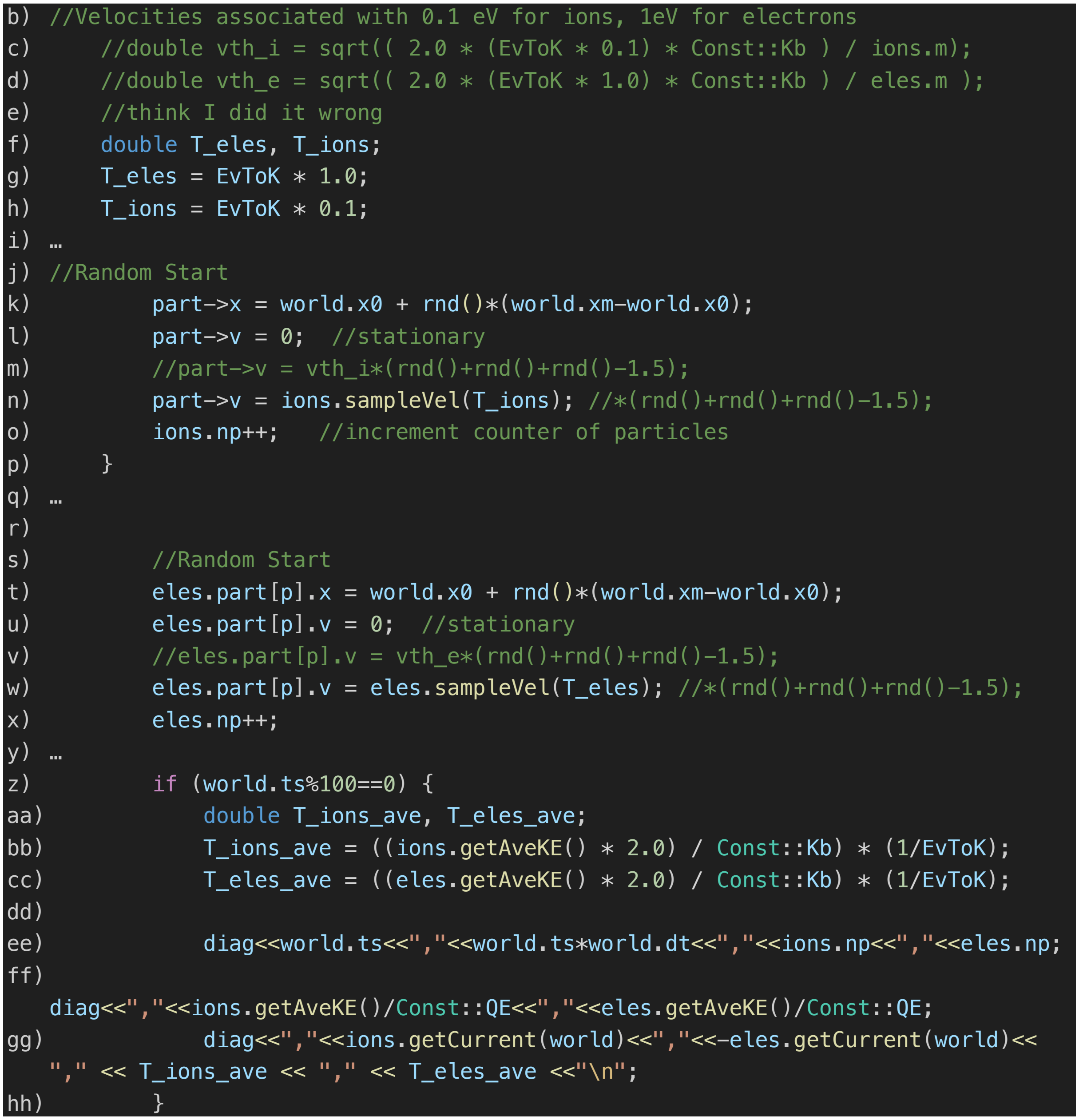
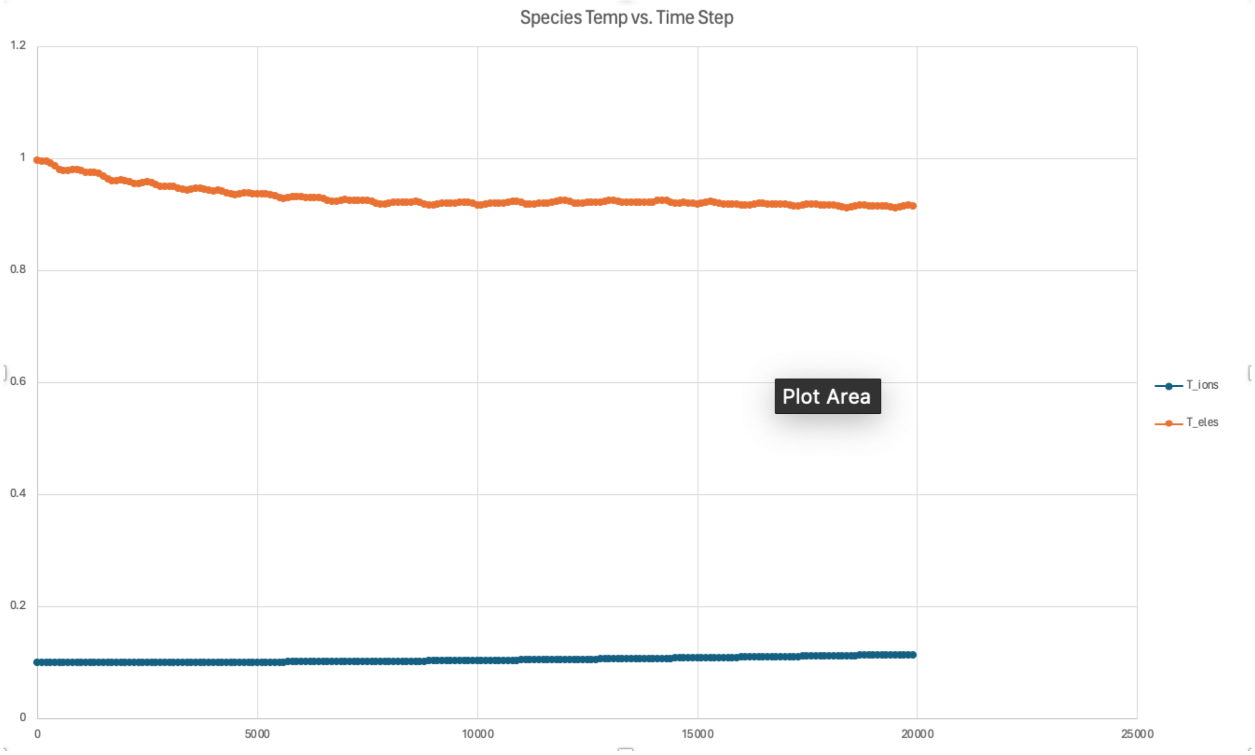
Karin Metzgar
HW 5

Part 1: Quiet Start

a) Changing the velocity to represent 0.1eV ions and 1eV electrons, not sure why it took me so many tries to figure out but got it :

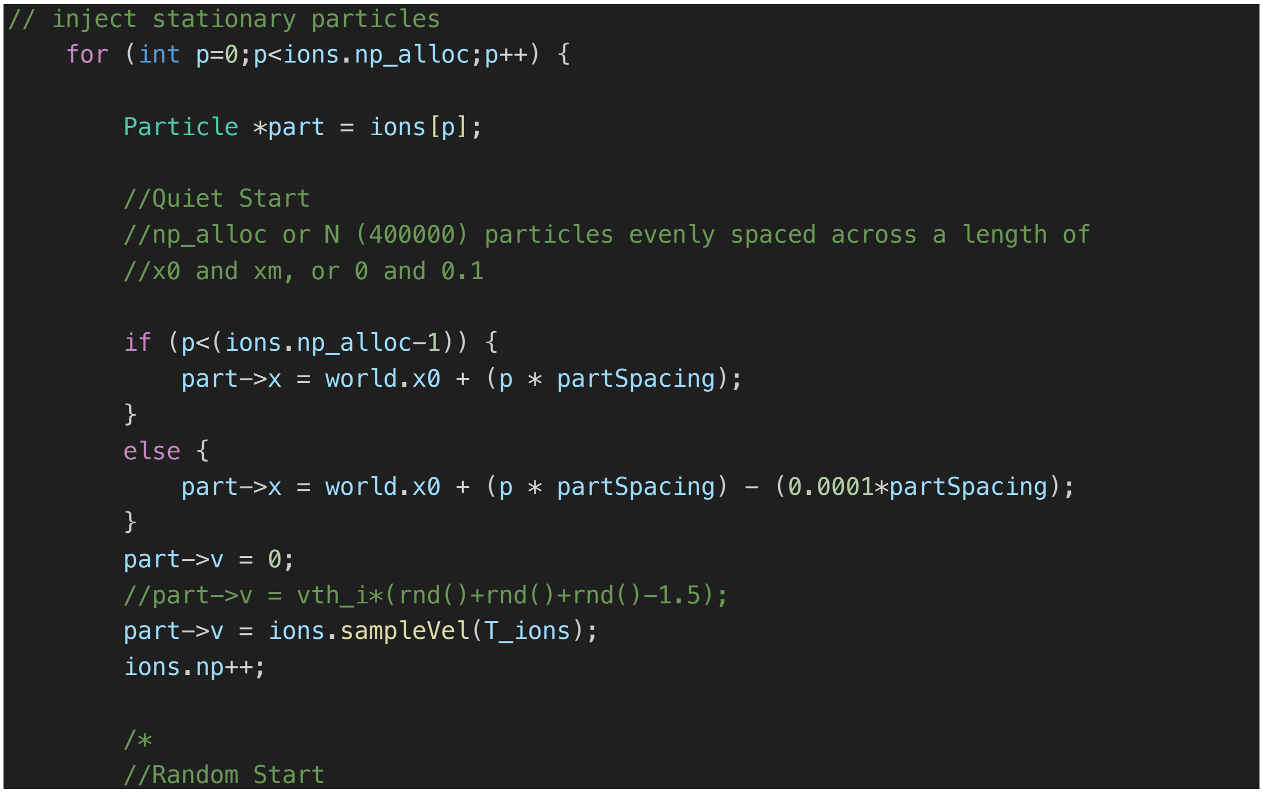


```
//Velocities associated with 0.1 eV for ions, 1eV for electrons
    //double vth_i = sqrt(( 2.0 * (EvToK * 0.1) * Const::Kb ) / ions.m);
    //double vth_e = sqrt(( 2.0 * (EvToK * 1.0) * Const::Kb ) / eles.m );
    //think I did it wrong
    double T_eles, T_ions;
    T_eles = EvToK * 1.0;
    T_ions = EvToK * 0.1;
…
//Random Start
        part->x = world.x0 + rnd()*(world.xm-world.x0);
        part->v = 0;  //stationary
        //part->v = vth_i*(rnd()+rnd()+rnd()-1.5);
        part->v = ions.sampleVel(T_ions); //*(rnd()+rnd()+rnd()-1.5);
        ions.np++;   //increment counter of particles
    }
…

        //Random Start
        eles.part[p].x = world.x0 + rnd()*(world.xm-world.x0);
        eles.part[p].v = 0;  //stationary
        //eles.part[p].v = vth_e*(rnd()+rnd()+rnd()-1.5);
        eles.part[p].v = eles.sampleVel(T_eles); //*(rnd()+rnd()+rnd()-1.5);
        eles.np++;
…
        if (world.ts%100==0) {
            double T_ions_ave, T_eles_ave;
            T_ions_ave = ((ions.getAveKE() * 2.0) / Const::Kb) * (1/EvToK);
            T_eles_ave = ((eles.getAveKE() * 2.0) / Const::Kb) * (1/EvToK);

            diag<<world.ts<<","<<world.ts*world.dt<<","<<ions.np<<","<<eles.np;
diag<<","<<ions.getAveKE()/Const::QE<<","<<eles.getAveKE()/Const::QE;
            diag<<","<<ions.getCurrent(world)<<","<<-eles.getCurrent(world)<<"," << T_ions_ave << "," << T_eles_ave <<"\n";
        }
```

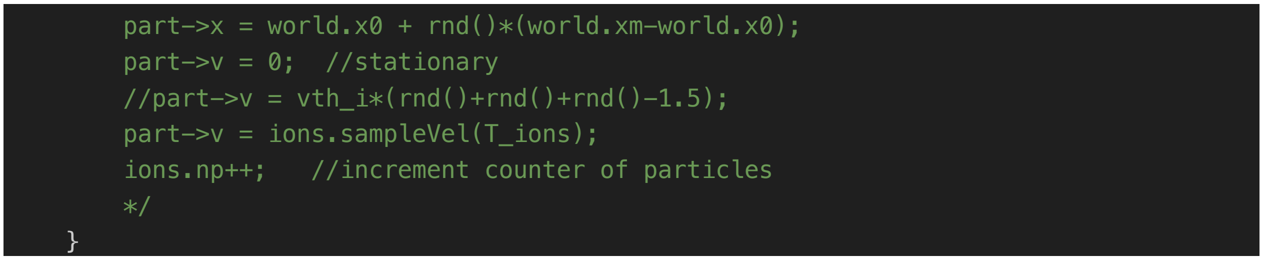


For random start I am getting -27 to 3.5 instead of 0 to 3.5 range

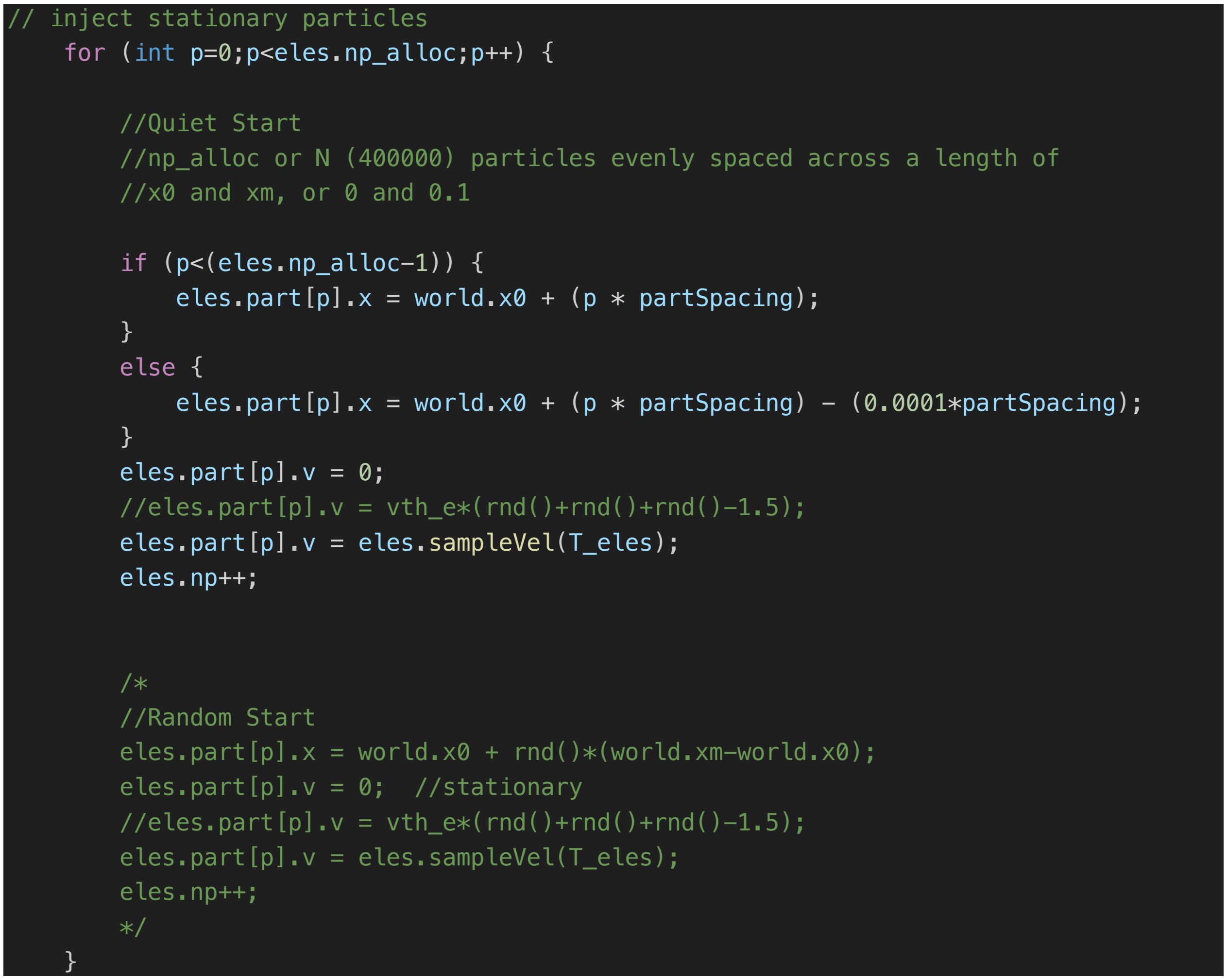
Silent Start:



```
// inject stationary particles
    for (int p=0;p<ions.np_alloc;p++) {

        Particle *part = ions[p];

        //Quiet Start
        //np_alloc or N (400000) particles evenly spaced across a length of
        //x0 and xm, or 0 and 0.1

        if (p<(ions.np_alloc-1)) {
            part->x = world.x0 + (p * partSpacing);
        }
        else {
            part->x = world.x0 + (p * partSpacing) - (0.0001*partSpacing);
        }
        part->v = 0;
        //part->v = vth_i*(rnd()+rnd()+rnd()-1.5);
        part->v = ions.sampleVel(T_ions);
        ions.np++;

        /*
        //Random Start
```



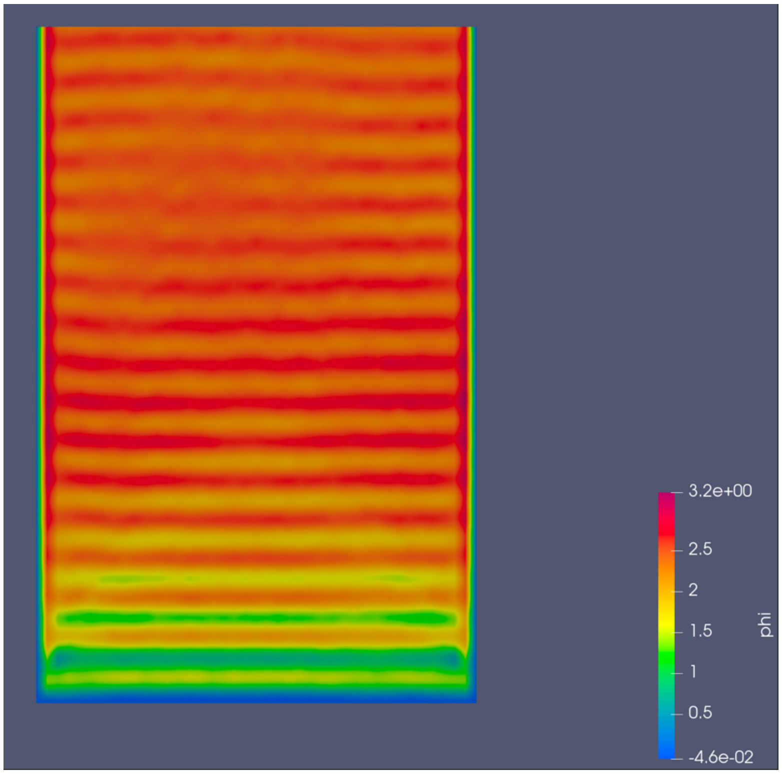
```
        part->x = world.x0 + rnd()*(world.xm-world.x0);
        part->v = 0;  //stationary
        //part->v = vth_i*(rnd()+rnd()+rnd()-1.5);
        part->v = ions.sampleVel(T_ions);
        ions.np++;   //increment counter of particles
        */
    }
```



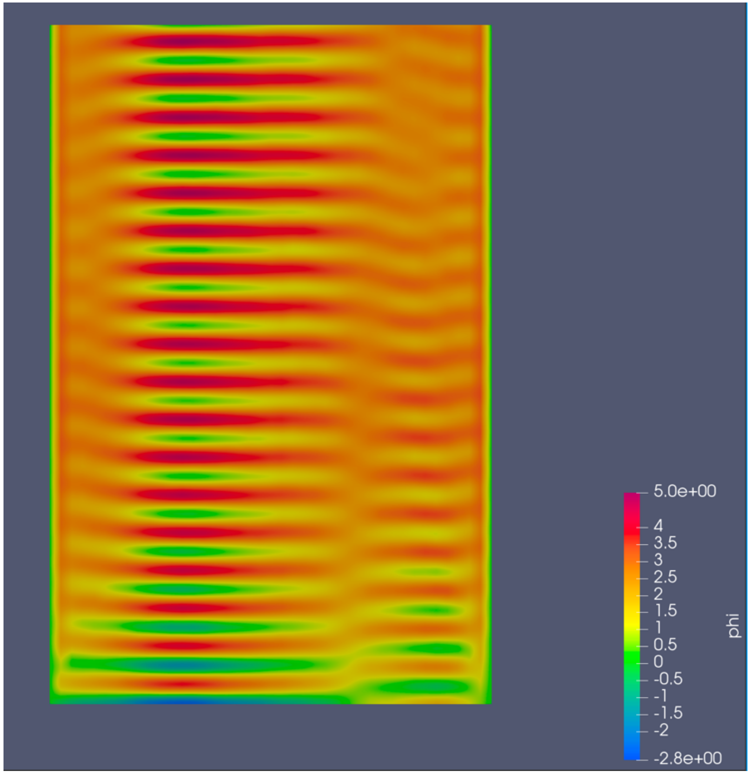
```
// inject stationary particles
    for (int p=0;p<eles.np_alloc;p++) {

        //Quiet Start
        //np_alloc or N (400000) particles evenly spaced across a length of
        //x0 and xm, or 0 and 0.1

        if (p<(eles.np_alloc-1)) {
            eles.part[p].x = world.x0 + (p * partSpacing);
        }
        else {
            eles.part[p].x = world.x0 + (p * partSpacing) - (0.0001*partSpacing);
        }
        eles.part[p].v = 0;
        //eles.part[p].v = vth_e*(rnd()+rnd()+rnd()-1.5);
        eles.part[p].v = eles.sampleVel(T_eles);
        eles.np++;


        /*
        //Random Start
        eles.part[p].x = world.x0 + rnd()*(world.xm-world.x0);
        eles.part[p].v = 0;  //stationary
        //eles.part[p].v = vth_e*(rnd()+rnd()+rnd()-1.5);
        eles.part[p].v = eles.sampleVel(T_eles);
        eles.np++;
        */
    }
```

I’m not sure why the range is not from 0 – 3.5 for these, like in the example images.

Silent Start

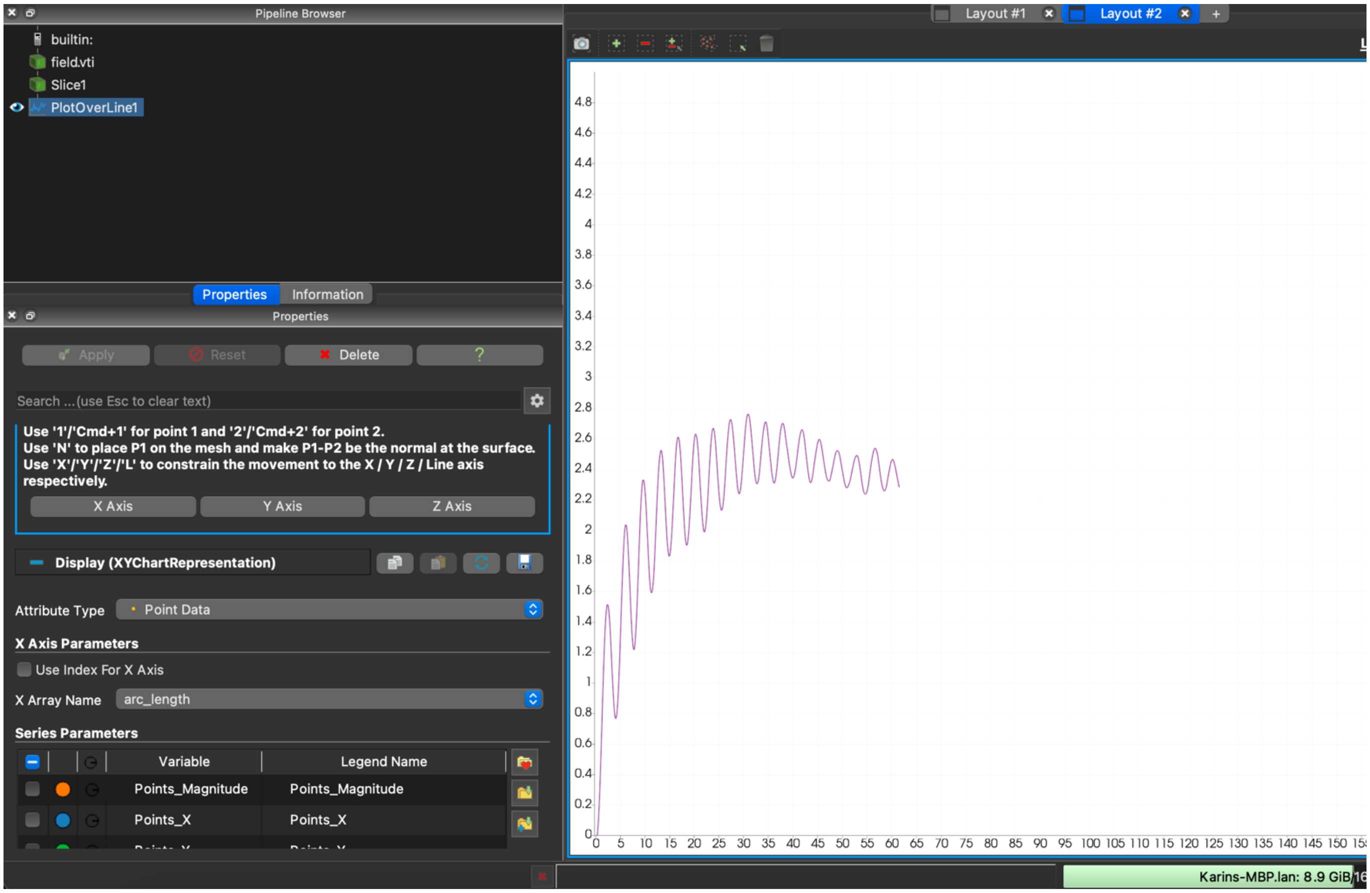


Random Start position



Also not sure why it won’t plot the whole graph, but the maximums are 4 counts apart, which is 4E-11 seconds

///



Pipeline Browser

- builtin:
- field.vti
- Slice1
- PlotOverLine1

Properties | Information

Use '1'/'Cmd+1' for point 1 and '2'/'Cmd+2' for point 2.
Use 'N' to place P1 on the mesh and make P1-P2 be the normal at the surface.
Use 'X'/'Y'/'Z'/'L' to constrain the movement to the X / Y / Z / Line axis respectively.

Display (XYChartRepresentation)

Attribute Type: Point Data

X Axis Parameters

□ Use Index For X Axis

X Array Name: arc_length

Series Parameters

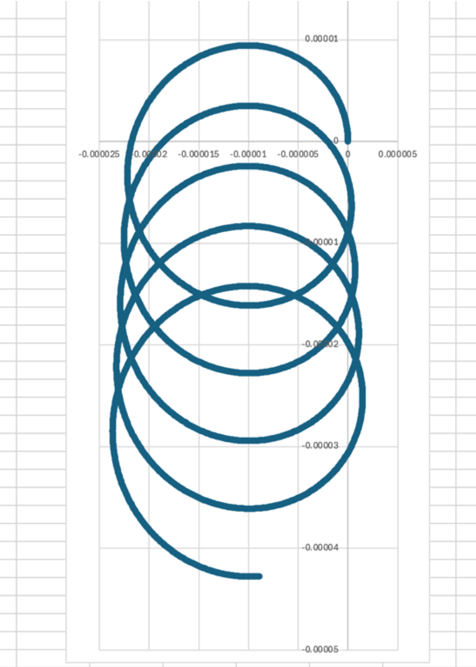
		Variable	Legend Name
□	●	Points_Magnitude	Points_Magnitude
□	●	Points_X	Points_X

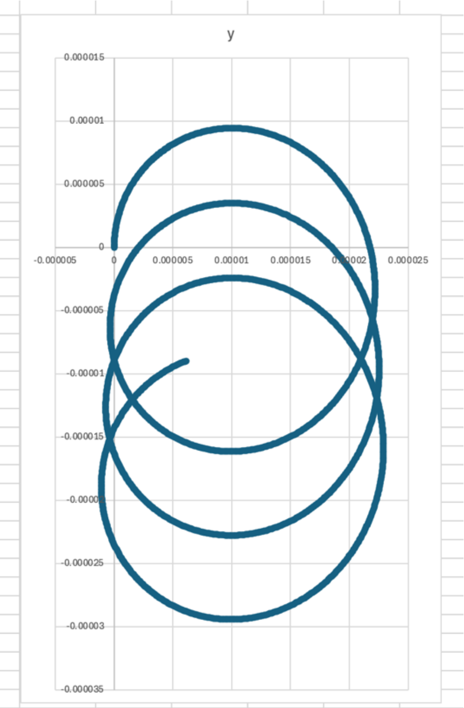
Karins-MBP.lan: 8.9 GiB/16

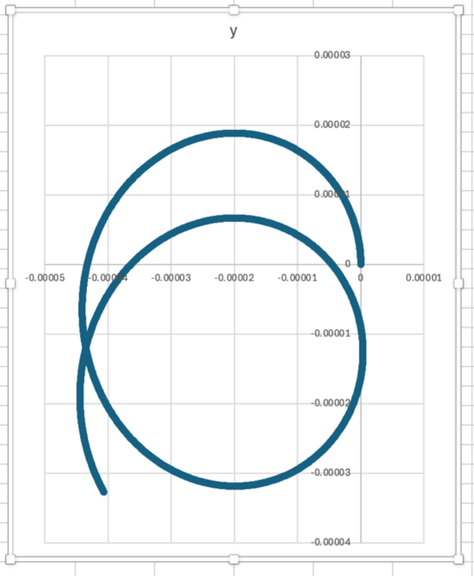
Part 2: Boris Push

The particle trajectory seems to increase in radius over time, I'm not sure if this is a result of some numerical instability going on or if my code is incorrect.

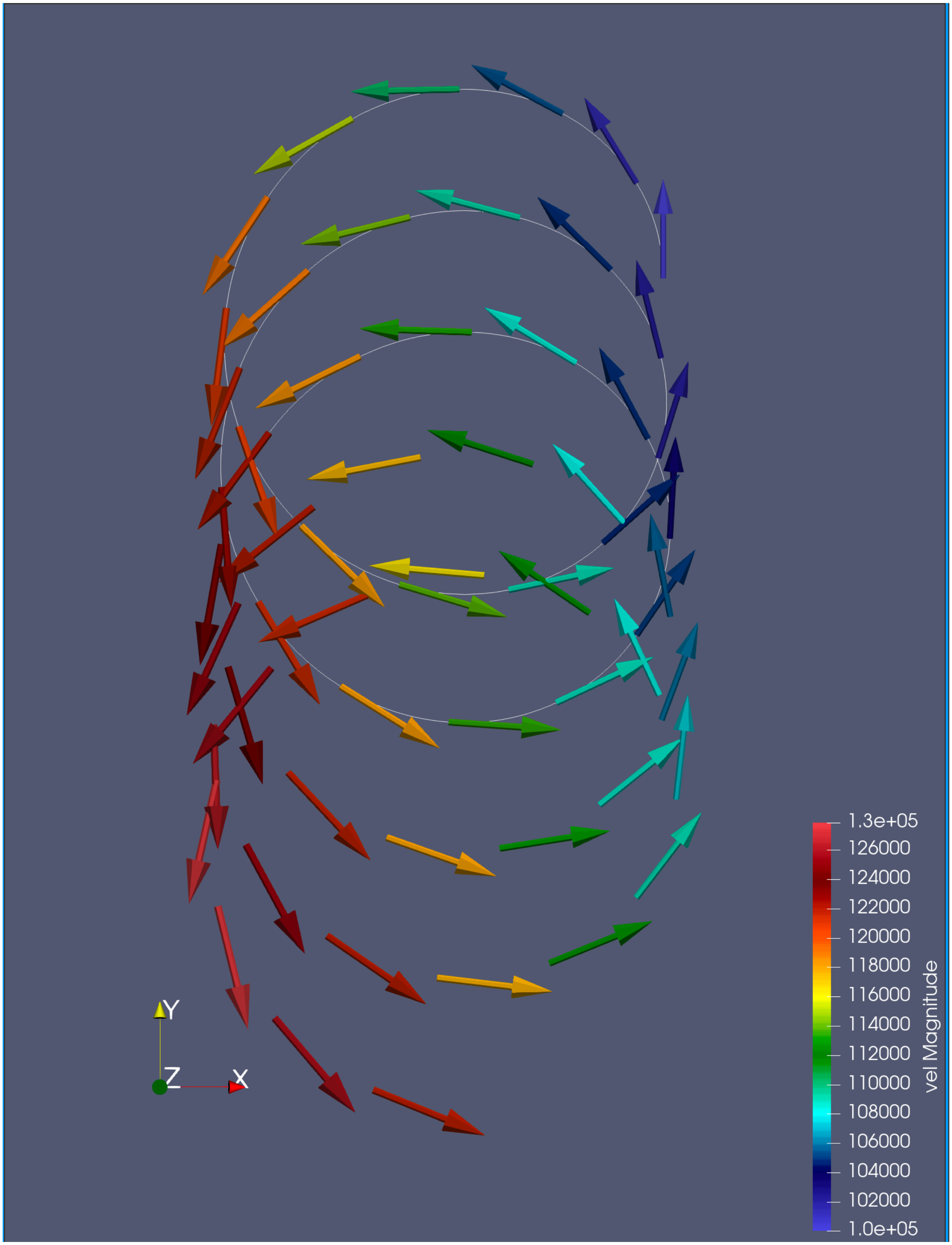
Particle 1 on the left, particle 2 on the right, particle 1 with twice the mass on the bottom.







Visualize the data in Paraview


Y
Z
X
1.3e+05
126000
124000
122000
120000
118000
116000
114000
112000
110000
108000
106000
104000
102000
1.0e+05
vel Magnitude