

Project proposal

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1 Selection

For this project, we have selected to investigate the effects of reduced precision data types in the sputniPIC code. The idea is that using a selected precision type brings forth a trade-off when moving, processing, and outputting code. The aim of this project is to evaluate the impact of using a reduced precision type and discuss if it is appropriate for the purposes of the sputniPIC particle simulations.

2 Initial Design

We intend to test the effect of using fp8, fp16 and integers inplace of the currently used floats in the `interpP2G` function. To profile the effect on performance we intend to use `nvprof` and `nvsight`.

3 Evaluation Plan

We will evaluate the performance on a varied range of GPUs, mainly GTX 1080, GTX 980 and Google Colab. We have not yet decided on whether we use the 2D or 3D input. If possible, we will run the simulation with high precision and use the output to run only one step of the low-precision variant. This ensures that accumulating deviations due to the instability of the system does not affect our results. To measure the impact on the accuracy we evaluate the mean-square error for the thermal and drift velocity of each particle when compared to the double precision simulation.

4 Time Plan

parts of the project and planned completion dates, and specify who are responsible for each part.

For the majority of the following tasks, we plan on working together simultaneously. If the distribution of tasks is required we will indicate this in the final report.

1. 7.12: Ensure assignment 3 is complete in order to build on top of the GPU implementation of exercise 4.
2. 7.12: Setup repository in such a way that it can be easily run locally and on Google Colab
3. 14.12: Examine input and output format. Investigate if the output can be used as input in the next step.
4. 14.12: Implement lower precision interpolation
5. 1.1: Run short tests to ensure functionality.
6. 1.1: Evaluate implementation and write scripts to evaluate performance over many different simulations
7. 12.1: Submit Report and Present