EPIC MEMO #005

ARIZONA STATE UNIVERSITY
TEMPE, ARIZONA 85287

Implementation of Cross-Correlation Module and Modifications to Romein Gridding Kernel

Hariharan Krishnan
10, April, 2020

Implementation of the Cross-correlation Module :

The cross-correlation function of the gridded X- and Y- voltages is now implemented as an independent module as a CUDA C kernel. It replaces the usage of the bifrost map kernel which implemented a cross-pol correlation function. The current module runs twice as slower than the map kernel implementation (refer Figure 1), however we are now able to grid twice the number of pixels than before indicating a more efficient memory usage strategy. There is, however, still much scope for optimization and that is being worked on.

https://github.com/epic-astronomy/bifrost/blob/epic_optim/src/xCorr.cu

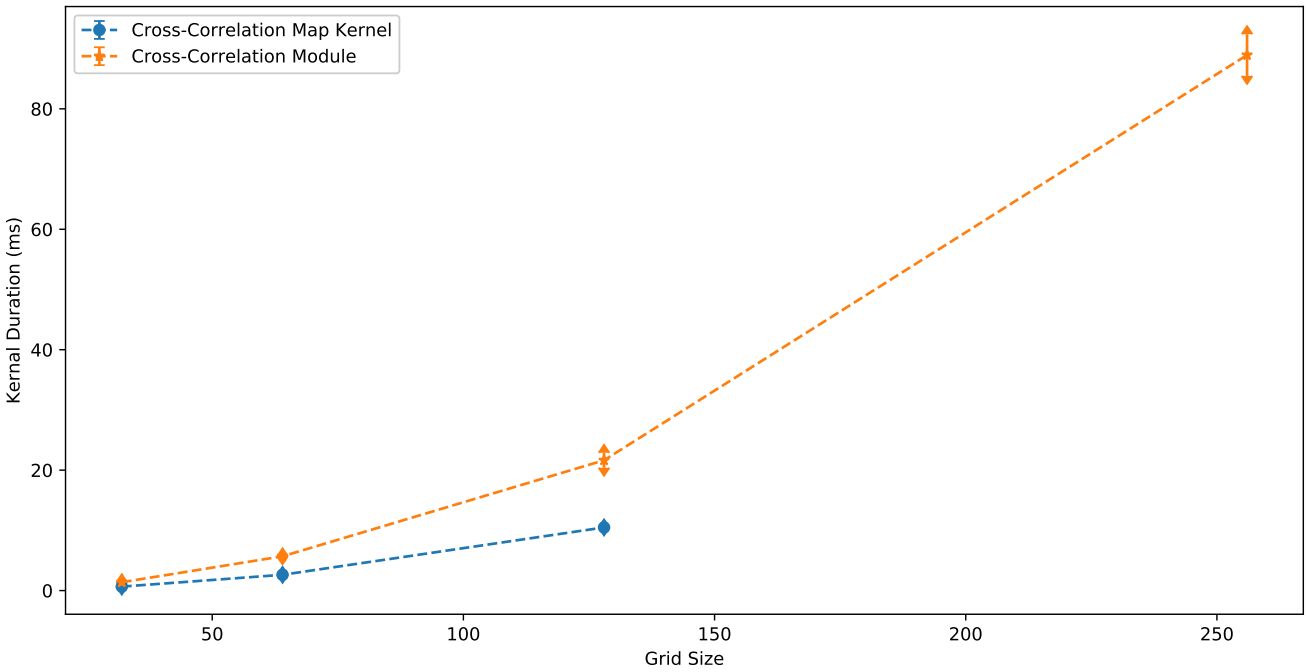

Figure 1: Comparison of run-time durations of the Cross-correlation functionality

Bug-fixing in the Modified Romein Gridding

The modified romein gridding kernel threw up memory errors for illumination pattern was a matrix and not a single value. This was fixed and the function call to “atomicadd” (CUDA API that takes care of memory associated race-conditions) was removed (refer Figure 2) that significantly improved the performance of the kernel in terms of run-time duration as seen in Figure 3. However the latter could potentially limit the use case to the current EPIC and this will have to be seriously re-examined or looked upon.

```
150  -                  atomicAdd(&d_out[grid_s + vi*gridsize*gridsize + gridsize*grid_point_v + grid_point_u].x, sum.x);
151  -                  atomicAdd(&d_out[grid_s + vi*gridsize*gridsize + gridsize*grid_point_v + grid_point_u].y, sum.y);
152  -              }
135  +                  d_out[grid_s + vi*gridsize*gridsize + gridsize*grid_point_v + grid_point_u].x+= sum.x;
136  +                    d_out[grid_s + vi*gridsize*gridsize + gridsize*grid_point_v + grid_point_u].y+= sum.y;    }
```

Figure 2: Modification in romein.cu

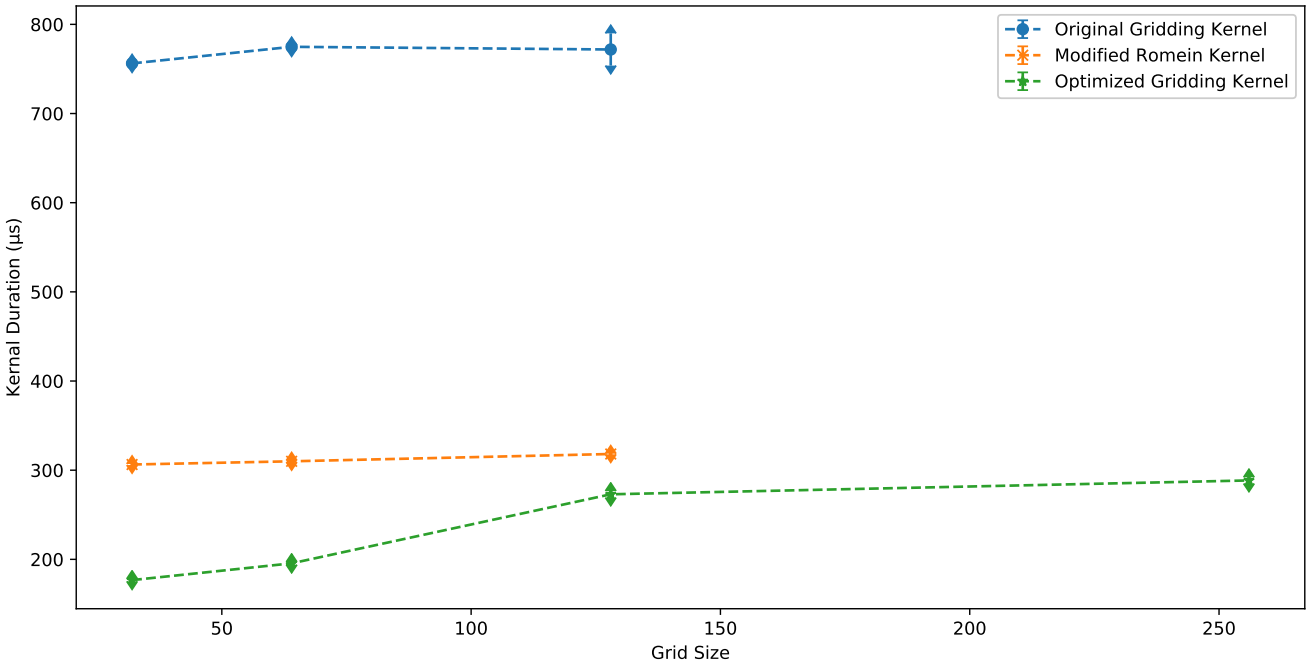

Figure 3: Comparison of Romein Gridding Kernel Duration