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Parallel reconstruction profiling on multiple Hygon GPUs for ptychography in HEPS

When we try to move the software named 'Hepsptycho', which is a ptychography reconstruction program originally based on multiple Nvidia GPU and MPI techs, to run on the Hygon DCU architectures, we found that the reconstructed object and probe encountered an error while the results running on Nvidia GPUs are correct. We profiled the ePIE algorithm using NVIDIA Nsight Systems and Hygon's HIP-compatible profiler (Hippfrof). Multiple GPUs will communicate and share with each other the object and probe information after the batch or iteration computation completes as slave GPUs send the reconstructed results back to GPU 0 using the Reduce or AllReduce function. Nvidia CUDA toolkit could successfully execute the communication. Hygon DCU 0 encounters a memory corruption error during synchronization, likely due to race conditions when updating the object/probe buffers. We show the profiling results here and how we repair this bug. Here we also show the computational speedup using other HPC techs to get a better reconstruction performance on multi GPUs. This work is implemented within Institute of High Energy Physics (IHEP) DAISY framework.

Significance

This is the distributed computing method for ptycho reconstruction running on China-made GPU.

References

Experiment context, if any

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