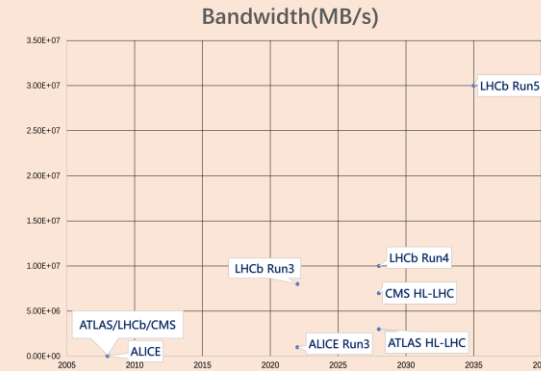
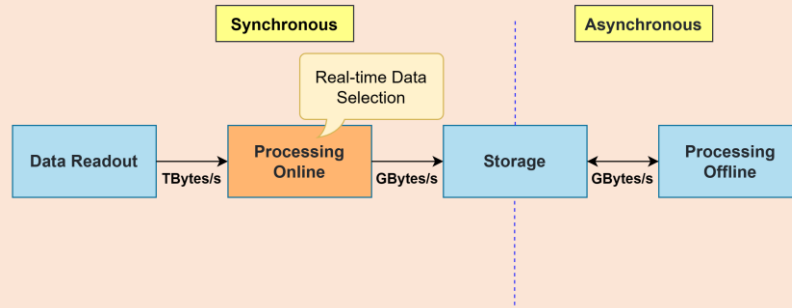
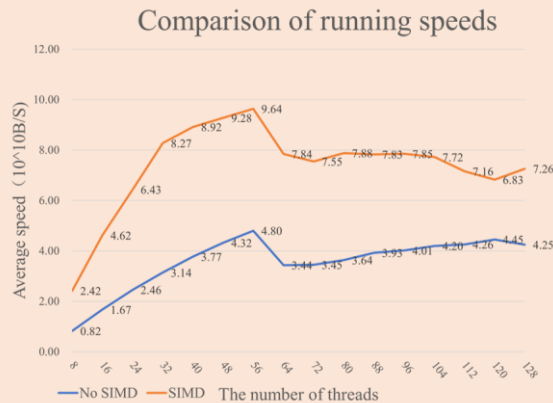
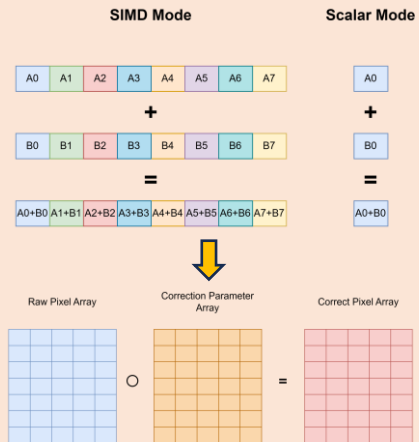


➤ What is the challenge to online data processing? — So Much Data To Handle

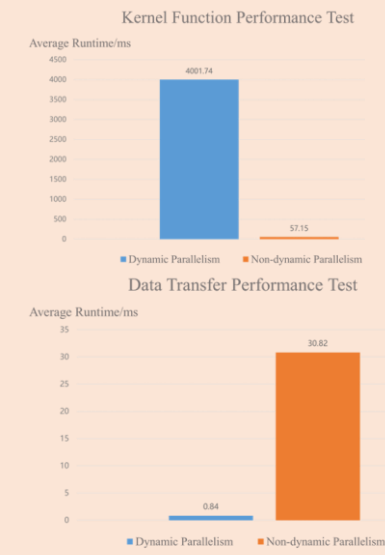
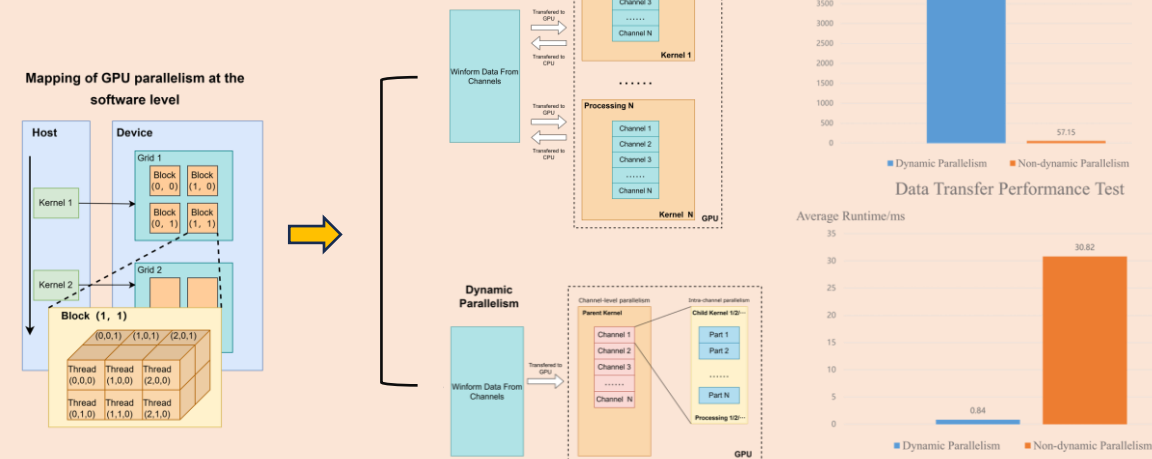


➤ How to make online data processing faster? — Try Using SIMD (Single Instruction Multiple Data)

On CPU



On GPU



What drives us do this

What's the SIMD like on CPU and GPU

MOTIVATION
 Online Data Processing Challenge
 Synchronous vs Asynchronous
 Data Readout → Processing Online → Storage → Processing Offline
 Bandwidth(MB/s)
 • The rapid growth of the data bandwidth has brought unprecedented challenges to online data processing.
 • The large volume of data necessitates a rapid method for handling them.

RESEARCH
 (OS:Linux, CentOS 8 CPU:Intel Xeon Platinum 8462Y+ GPU:Nvidia A100)
Research On CPU SIMD Applied In Image Coefficient Correction
 Comparison of running speed
 Running With Different Compilation Optimization Options
 • Image coefficient correction involves dense-independent multiplication calculations, suitable for SIMD processing.
 • The tested pixel array size is 256×576.
 • In a single-threaded scenario, the performance improvement reaches a maximum of 219.57%.
 Running on different numbers of threads
 • The tested pixel array size is 1000×1000, tested with-O0 compilation optimization options.
 • The performance improvement is affected by the number of threads, with the highest improvement reaching 203.00%.

Research On GPU SIMD Applied In Waveform Point Processing
 Waveform Point Processing parallelized on GPU
 Inspired by RDNA3 CUBE, the implementation of parallelized waveform point processing on GPU is conducted.

Research On Dynamic Parallelism Applied In Waveform Point Processing
 To try to fully utilize the computational resources of the GPU, the research on dynamic parallelism is conducted.

IMPLEMENTATION
 SIMD Technology Implemented In Silicon Pixel Detector DAQ
 • Combined with the O2 compilation optimization option, the performance of the field correction processing for 256×576 silicon pixels is improved to 706.09%.

SUMMARY
 • The SIMD (Single Instruction Multiple Data) acceleration technology based on CPU and GPU can effectively accelerate various online data processing scenarios in high-energy physics experiments, and has great potential for practical application.
 • The subsequent plan is to further explore the potential application of SIMD acceleration in online data processing, in order to improve the real-time performance and throughput of online data processing, and provide effective solutions for future large-scale high-energy physics experiments.

Related research and test

Current implementation

To sum up

Welcome to discuss with me if you are interested!

Find me at Poster B (#108)