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KOKKOS KERNELS: STATE ON EXASCALE ARCHITECTURES

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KOKKOS KERNELS AND EXASCALE

- Portable math kernels for Kokkos
  - "native" implementations
  - compatibility wrappers for "TPLs", a.k.a third-party libraries (e.g cuSparse, MAGMA)
- No distributed-memory implementations

Exascale System*	Processor	KOKKOS_ARCH_
Frontier	AMD MI250X GPU	…AMD_GFX90A
El Capitan	AMD MI300A APU	…AMD_GFX942
Aurora	Intel Data Center Max GPU	…INTEL_PVC
Aurora	Intel Sapphire Rapids CPU	…SPR
N/A	Nvidia H100 GPU	…HOPPER90
N/A	Nvidia A100 GPU	…AMPERE80

**current or anticipated*

MI250X (AND MI300A)

- MI300A not available yet
  - AMD contributing early ROCm 6.0 adjustments
- TPLs
  - Broad coverage from rocSPARSE, rocBLAS,
  - Support from rocSOLVER in progress
- Known Issues
  - None (ROCm 5.6.0)
- PR tests on MI210

INTEL PONTE VECCHIO

- Recent access to Aurora: Intel Data Center Max GPU 1550
- TPLs
  - spotty oneMKL coverage, more in progress
- Known Issues
  - native SpGEMM
  - native COO -> CRS matrix conversion
  - oneMKL gemv NaN handling (reported to Intel, may already be fixed on Aurora)
  - investigating potential SpMV performance regression / misuse in oneMKL 2024 vs 2023
- Nightly SYCL tests in place on Data Center GPU Max 1100
  - working on promoting to PR tests
  - Much smaller: 1/2 cores, 1/3 HBM

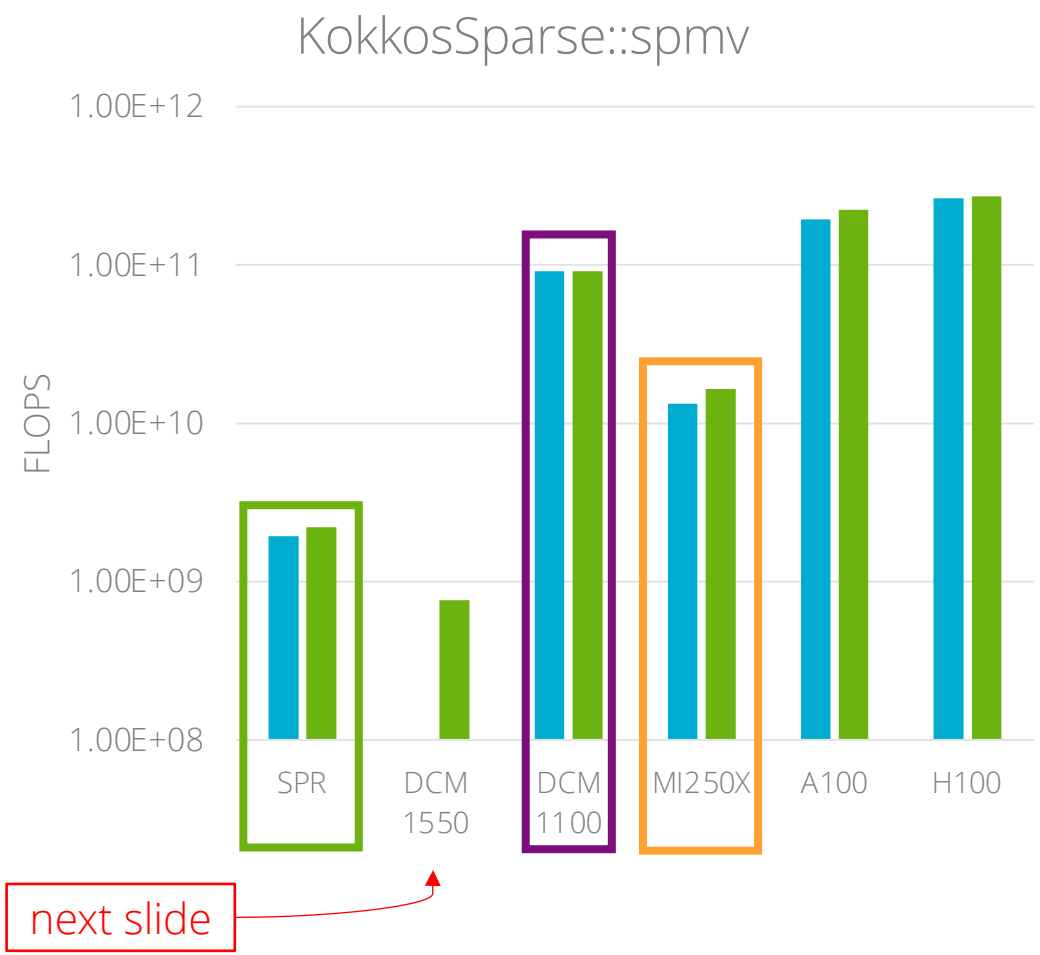
INTEL SAPPHIRE RAPIDS

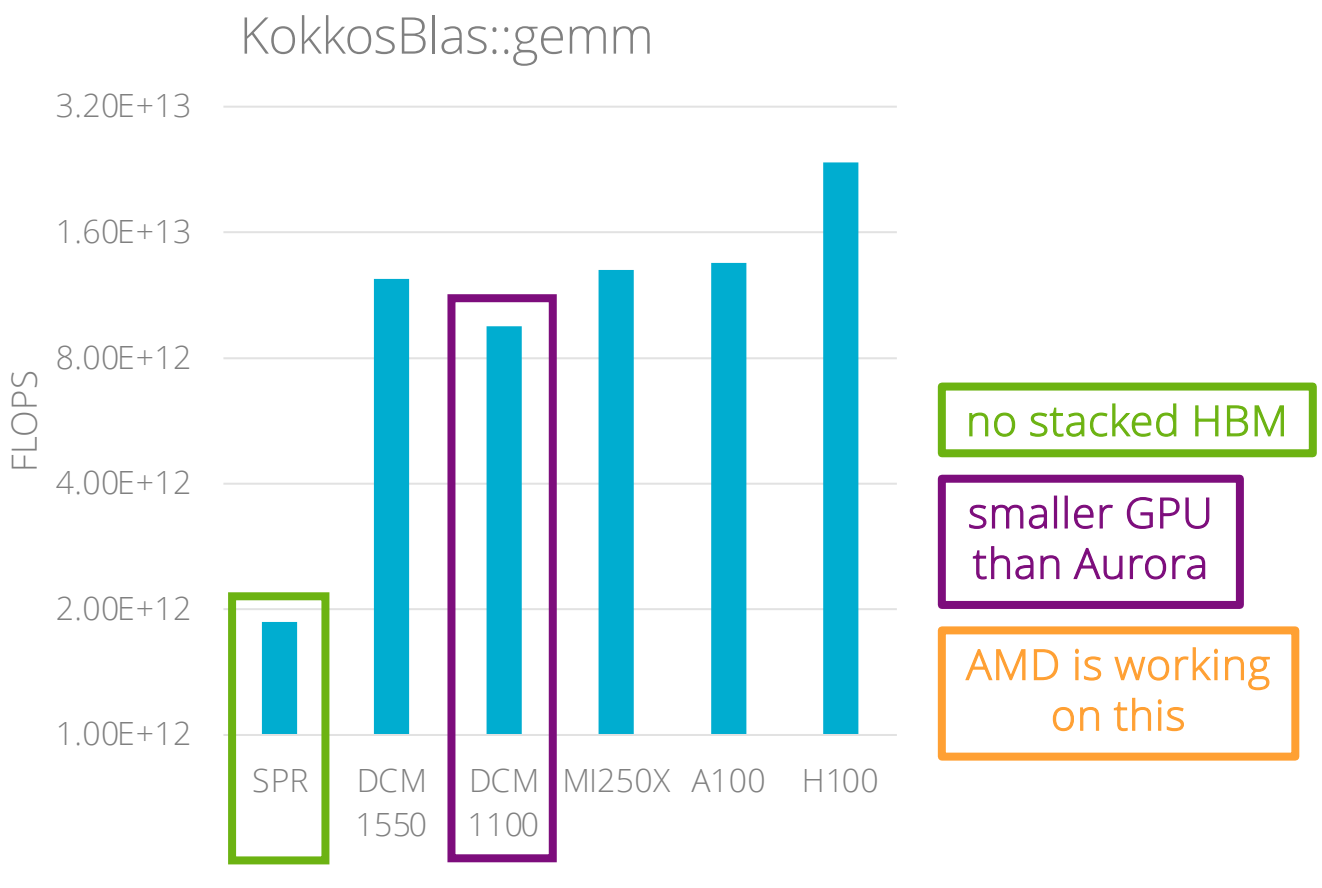
- TPLs
  - Broad coverage of BLAS and sparse from oneMKL
- Known Issues
  - Mishandling of integer size types on some oneMKL configurations
- Nightly tests with KOKKOS_ARCH_SPR

NVIDIA H100, A100

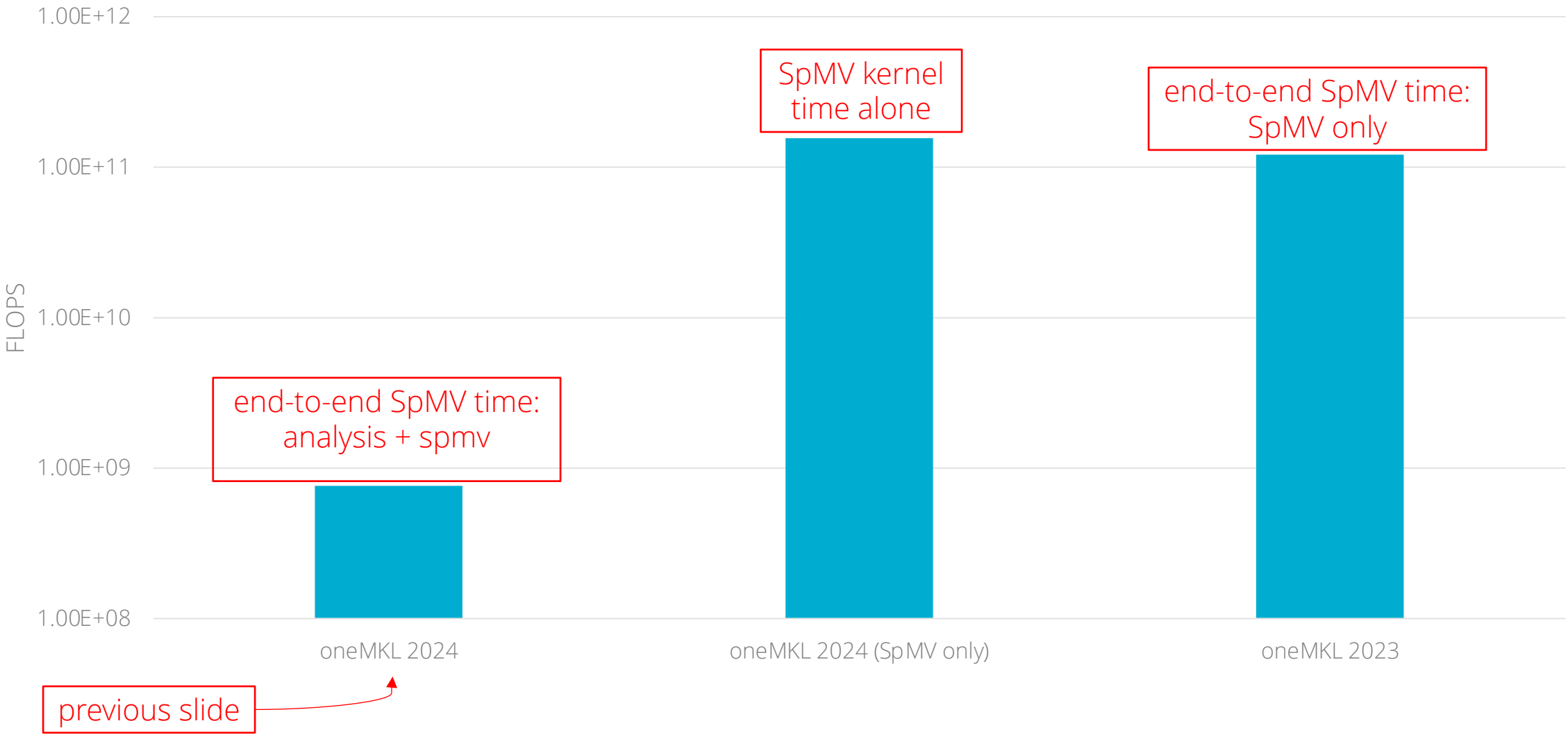
- TPLs
  - Broad coverage from cuBLAS, cuSPARSE, and cuSOLVER
- Known Issues
  - None (CUDA 11.8)
  - Batched dense (H100, CUDA 12)
- Nightly tests on H100
  - Working on transitioning V100 PR tests to A100 or H100

SPMV AND GEMM PERFORMANCE RESULTS





POSSIBLE SPMV REGRESSION IN MKL2024



NOTES ON THE PREVIOUS RESULTS

- SPR: Sandia: oneAPI 2023.1.0
- MI250X: Frontier @ OLCF, ROCm 5.3.0
- DCM 1100: Sandia, oneAPI 2023.1.0
- DCM 1550: Aurora @ ALCF, oneAPI 2024
  - preliminary investigation suggests oneMKL 2024 SpMV now includes an analysis pass, which causes a performance regression for the tested configuration compared to oneMKL 2023.
- A100: Perlmutter @ NERSC: CUDA 11.7
- H100: Sandia: CUDA 11.8

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