

ITER Tokamak

Predict ITER plasma
behavior with
Tungsten impurity
ions



Divertor
Tungsten

Showcase

ExaSMR: NekRS Performance on Ponte Vecchio

Ponte Vecchio with Intel OneAPI DPC++ implementation

1.5x performance lead

ExaSMR: Small modular reactors (SMRs) and advanced reactor concepts (ARCs) will deliver clean, flexible, reliable, and affordable electricity while avoiding the traditional limitations of large nuclear reactor designs,

<https://www.exascaleproject.org/research-project/exasmr/>

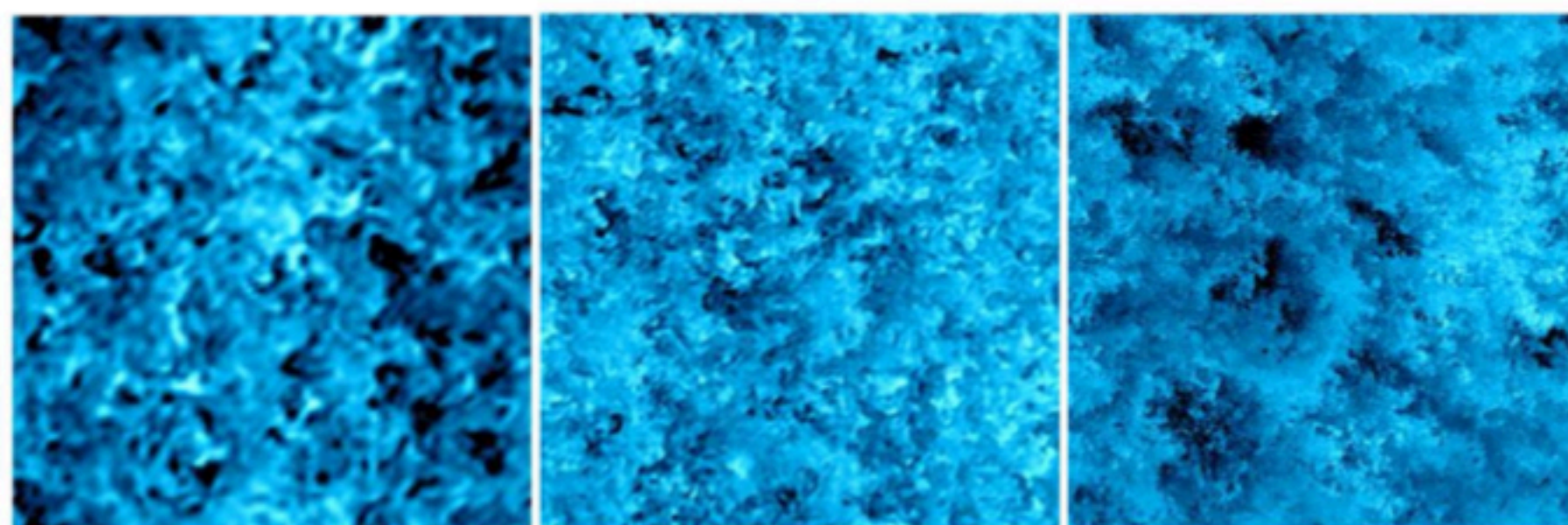
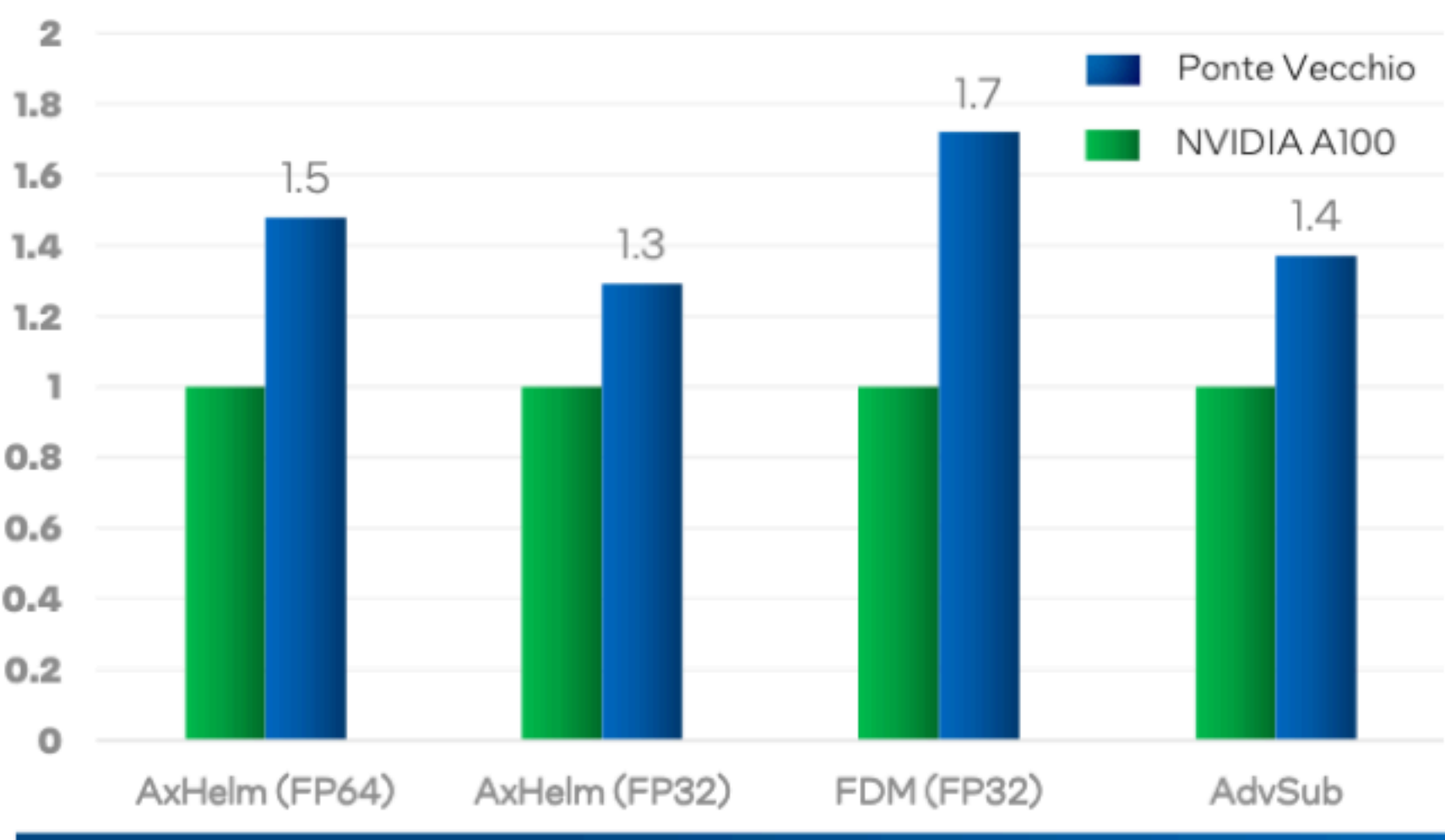


Figure 10: NekRS: potential temperature distributions in [K] at time 6h and $z=100\text{m}$ on different resolutions of $\Delta x=3.12\text{m}$ (left), 1.56m (center), and 0.78m (right) corresponding to the number of grid points, $n=128^3$, 256^3 , and 512^3 , respectively. Δx represents the average grid-spacing for the spectral elements, $E=16^3$, 32^3 and 64^3 and the polynomial order $N=8$ on the domain $400\text{m} \times 400\text{m} \times 400\text{m}$.

<https://ceed.exascaleproject.org/docs/ceed-ms38-report.pdf>

Relative Performance of NekRS Benchmarks w/ problem size of 8196 (Averaged throughput, higher is better)



Application Summary:

NekRS is an open-source Navier Stokes solver based on the spectral element method targeting classical processors and accelerators like GPUs. The code started as a fork of libParanumal in 2019. For API portable programming OCCA is used.

<https://github.com/argonne-lcf/nekRS/>

OCCA is an open-source library which aims to make it easy to program different types of devices (e.g. CPU, GPU, FPGA). It provides a unified API for interacting with backend device APIs (e.g. OpenMP, CUDA, OpenCL), uses just-in-time compilation to build backend kernel, and provide a kernel language, a minor extension to C, to abstract programming for each backend.

<https://libocca.org>



- See backup for workloads and configurations. Results may vary.
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intel.

H. Jiang, "Intel's Ponte Vecchio GPU : Architecture, Systems & Software," 2022 IEEE Hot Chips 34 Symposium (HCS), 2022, pp. 1-29, doi: 10.1109/HCS55958.2022.9895631.