

## Experience with ARM WNs at the WLCG Tier1 GridKa

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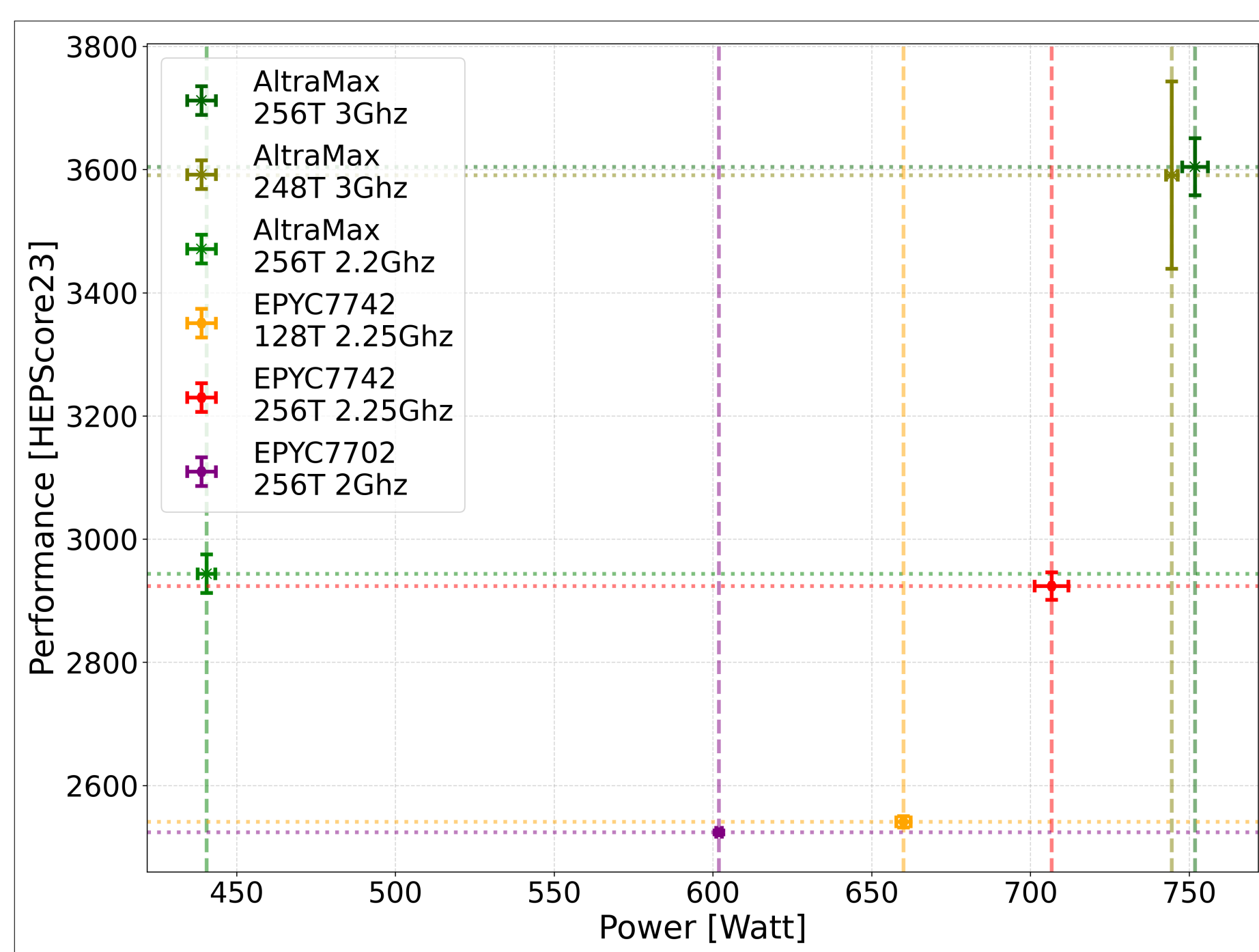
### Power Efficiency

- Power Efficiency is important for data centers
- ARM-CPU's seems to be more power efficient than x86-CPU's [1],[2]
- Results of the HEPscore23 benchmark [3] and IPMITool [4] recordings at WLCG-Tier1 Datacenter GridKa

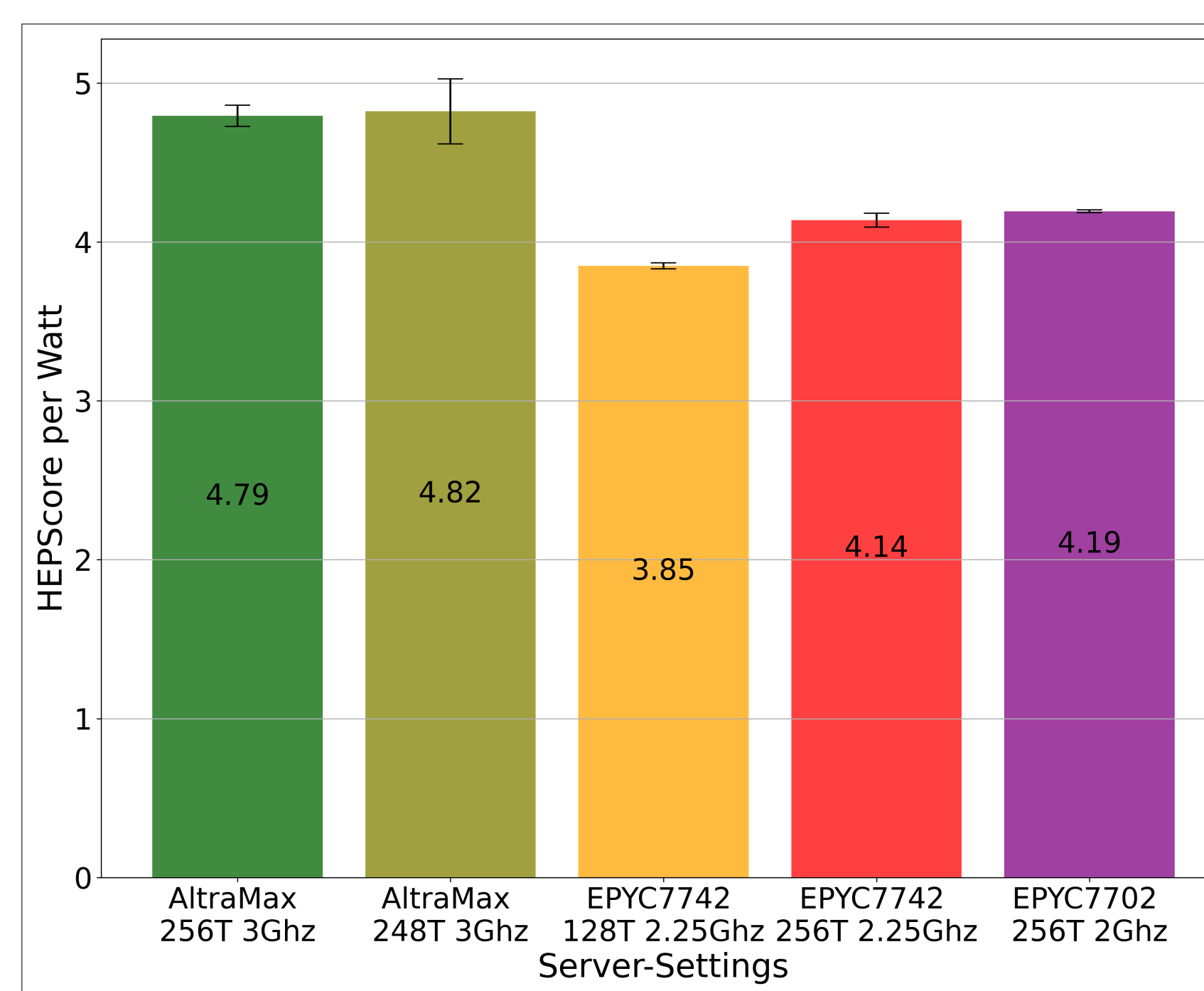
### Hardware

- ARM-Servers  
Dual socket with two Ampere Altra Max M128-30 processors with 768GiB RAM
- x86-Servers  
Dual socket configuration with two AMD EPYC 7742 (2.25 GHz) or two EPYC 7702 (2.0GHz) processors with 566GiB RAM

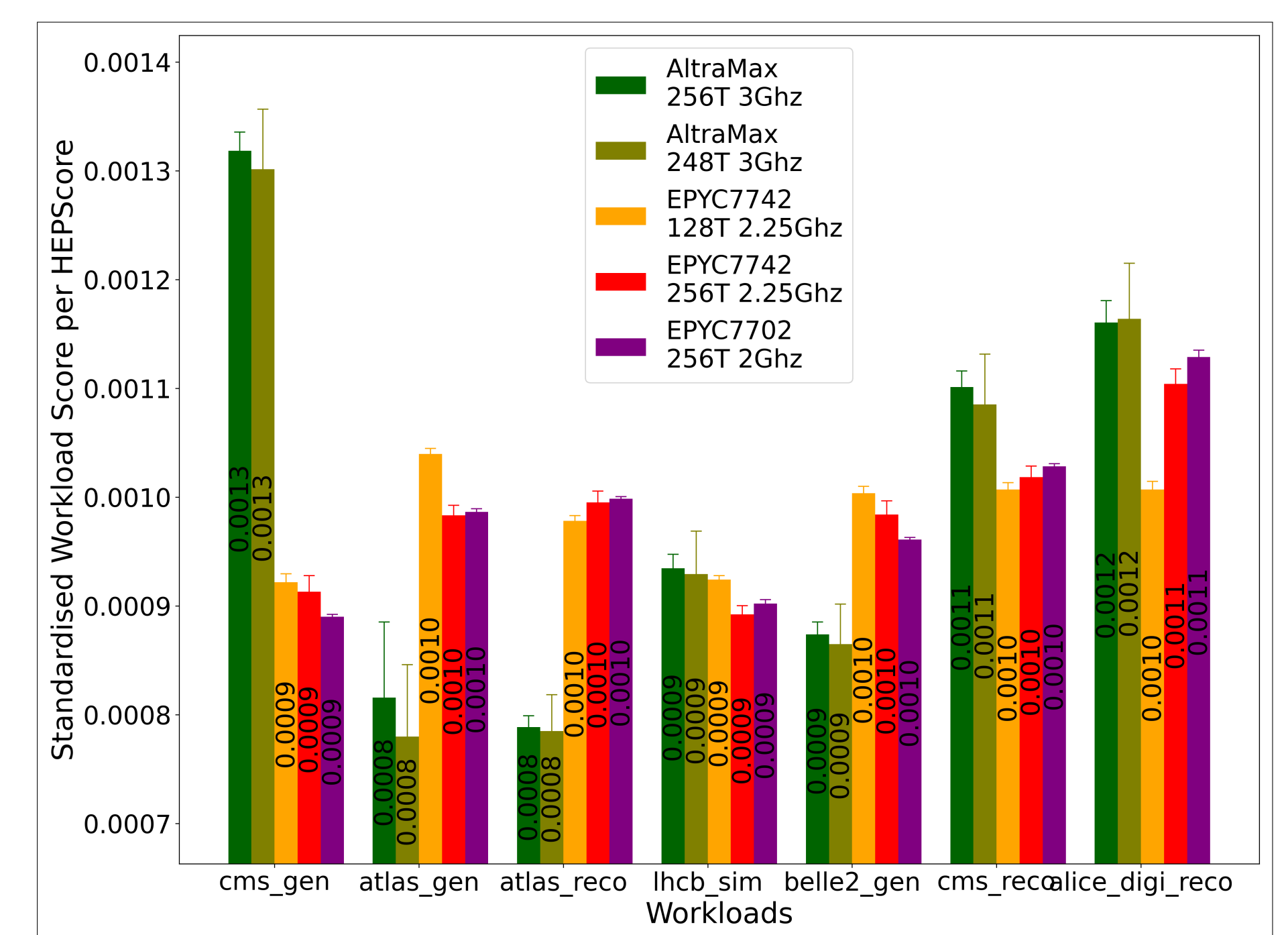
### Comparison ARM vs x86



- Comparison of HEPscore23 benchmarks, recorded with the same settings as for the x86 servers

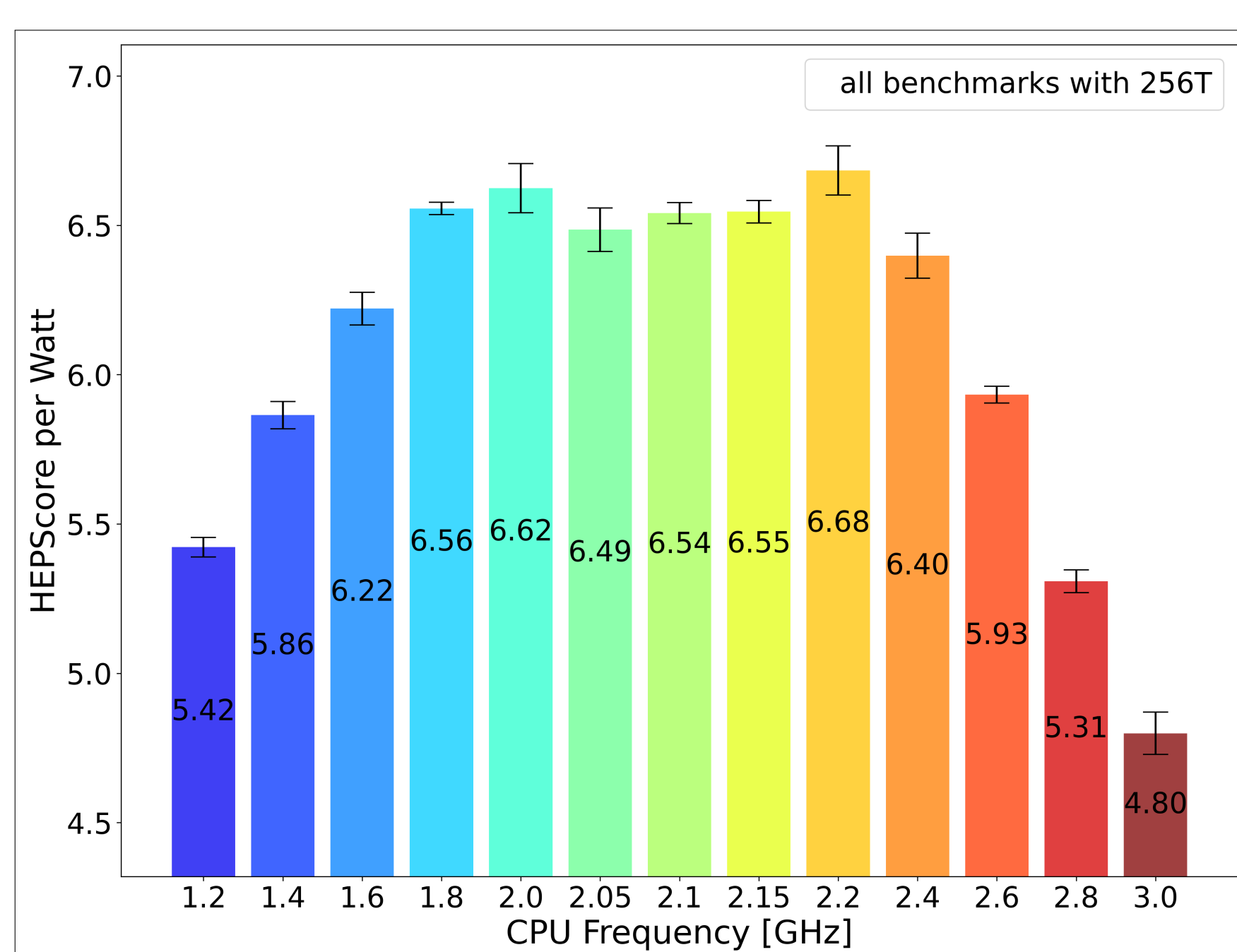


- ARM servers are around 14.3 % more energy efficient than x86 systems at default settings: ARM: 3GHz, x86: 2.25 or 2GHz

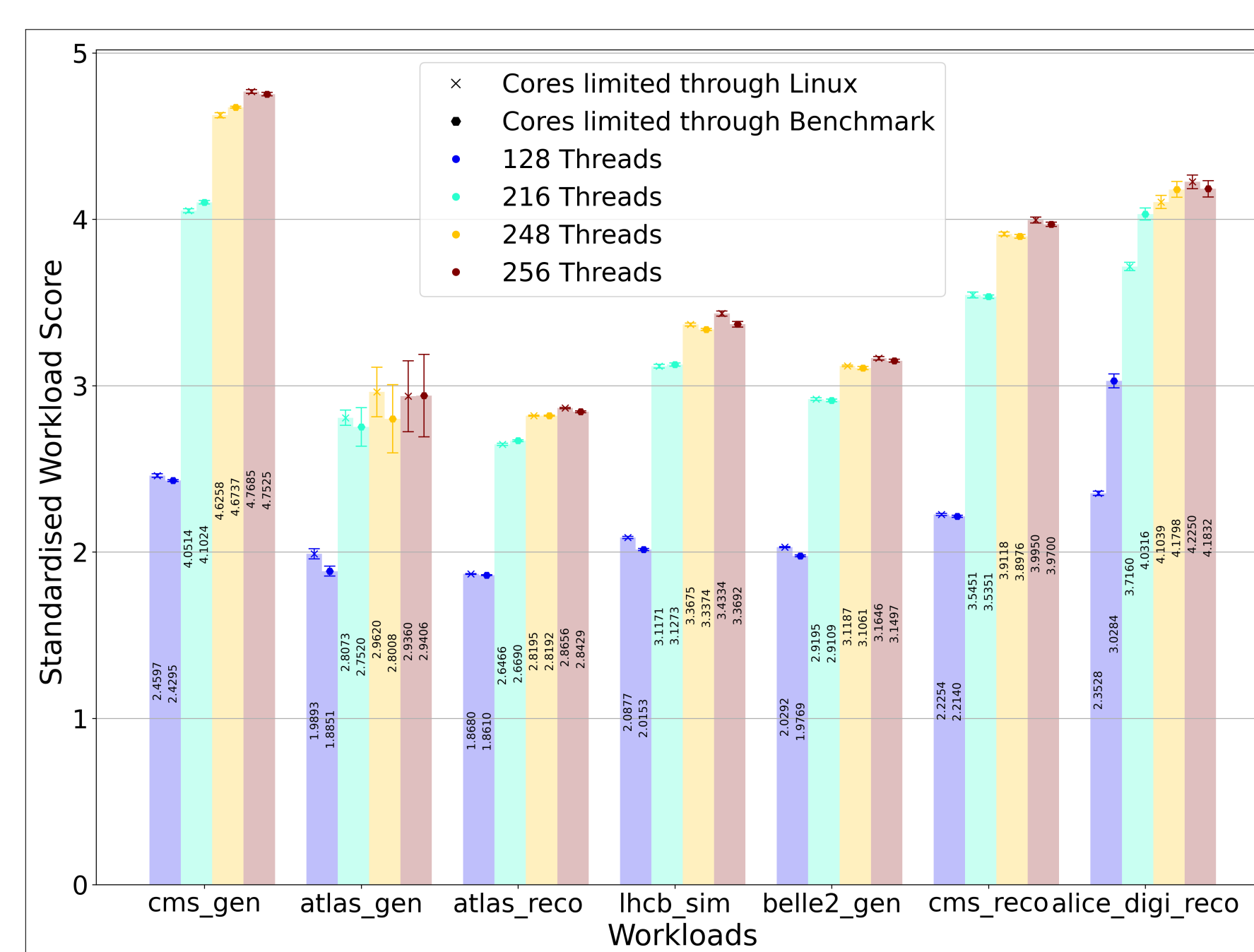


- Workloads such as cms-gen, lhcb-sim, cms-reco and alice-digi-reco appear to benefit particularly from the ARM architecture

### HEPscore23 benchmarks for different CPU freq. and number of threads

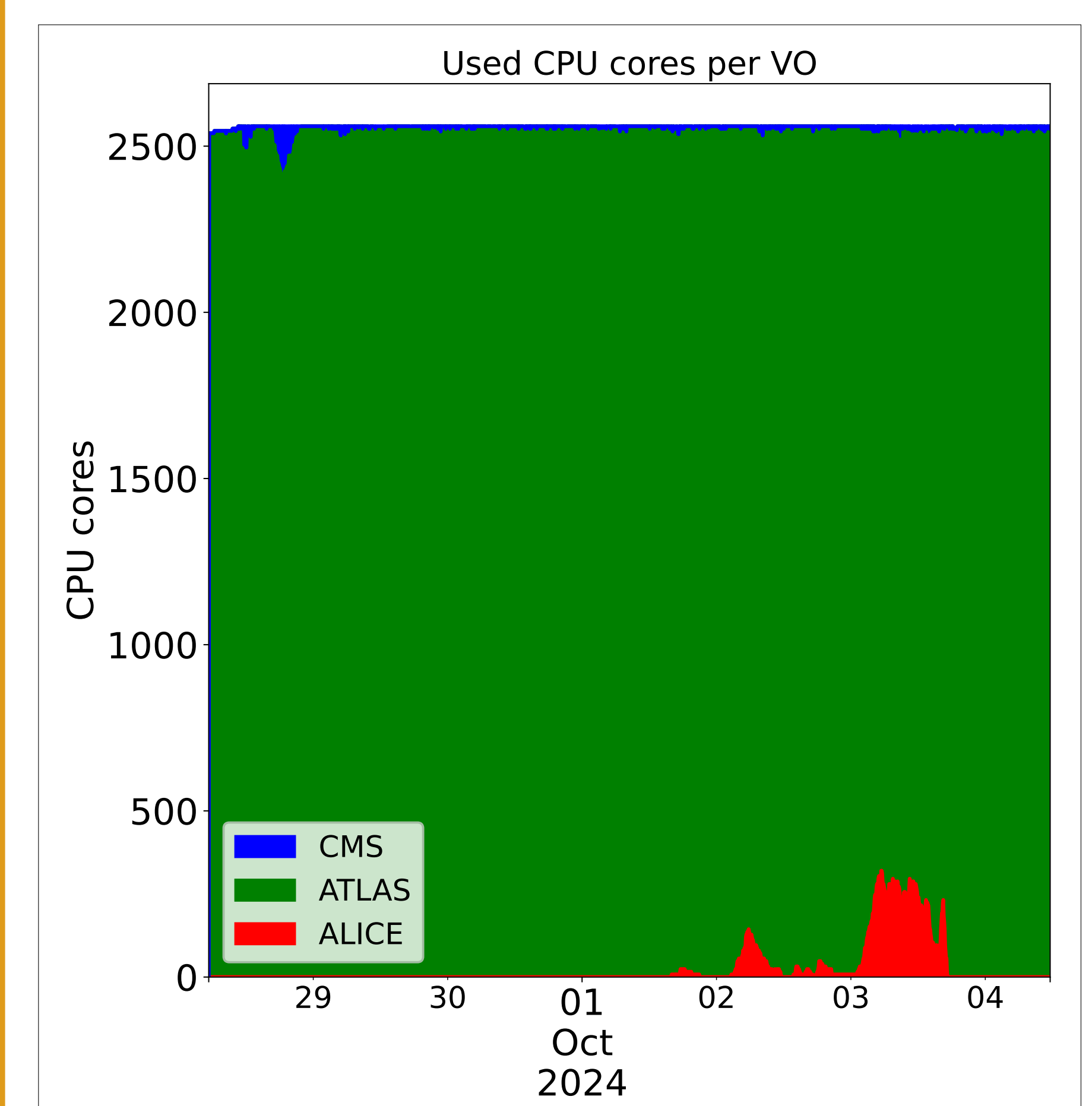


- Power efficiency can be increased considerably by regulating the CPU frequency. Benchmarks on 256 threads on different CPU frequencies show a power efficiency maximum at around 2.2 GHz



- No significant difference between Linux and benchmark limitation of threads. Only the alice-digi-reco workload seems to overstep the set limits

### Experience



- 12 ARM Workernodes are in use currently at WLCG-Tier1 Datacenter GridKa without major problems
- IPMITool on ARM has a longer readout time than on x86

[1] Emanuele Simili; Energy Efficiency in H.E.P. (ARM vs. x86 and beyond); to be published; CHEP 2023 Proceedings Publication through EPJ Web of Conferences  
 [2] Talk: Heterogeneous Computing and Power Efficiency in HEP by Emanuele Simili; Track 7; 23 Oct 2024, 17:09  
 [3] HEP-Benchmark Suite: <https://gitlab.cern.ch/hep-benchmarks/hep-benchmark-suite>  
 [4] D. Laurie, IPMITool: <https://github.com/ipmitool/ipmitool>