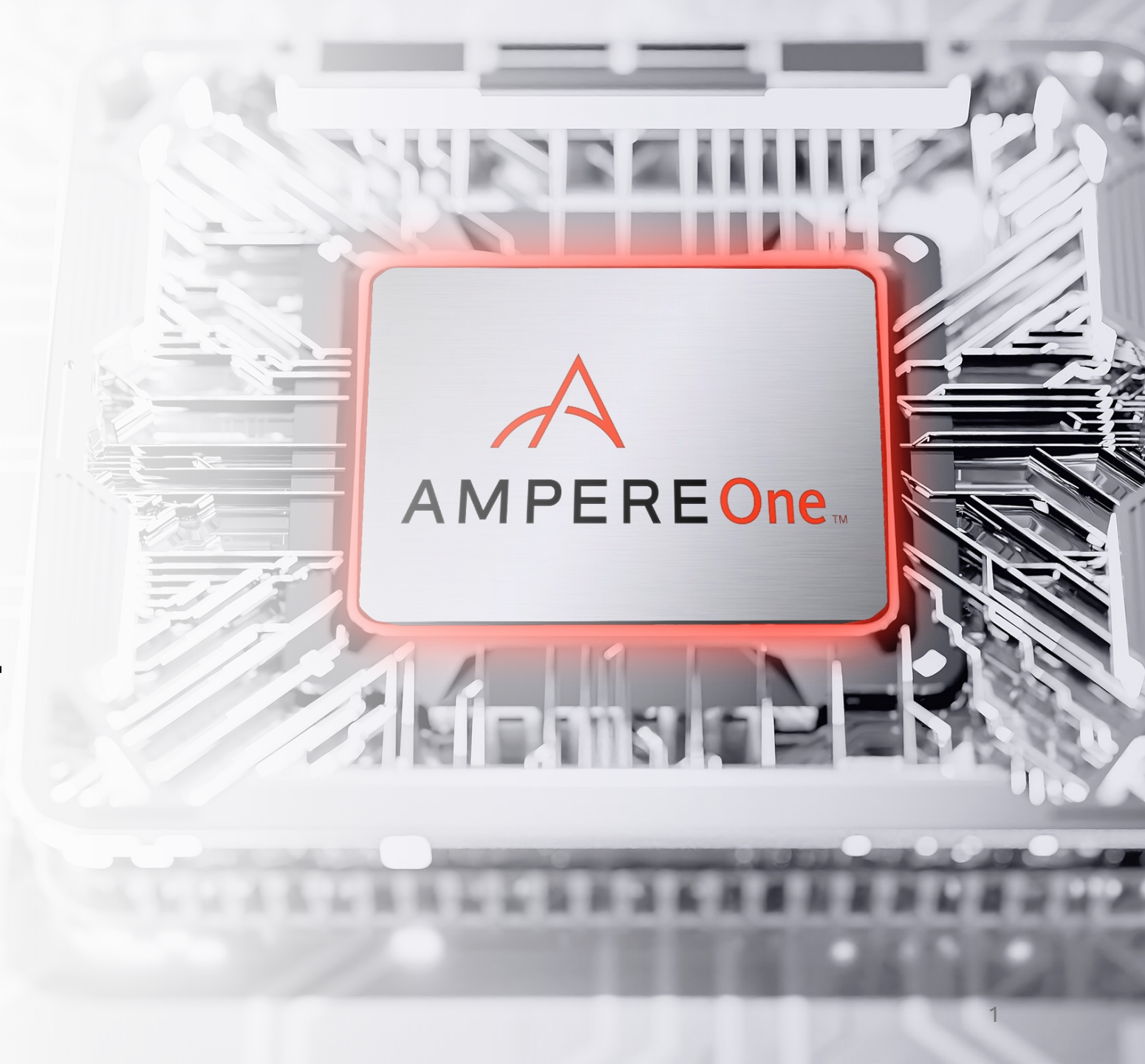# Frequency Scan and HS23 on AmpereOne A192

HEPiX Benchmarking Working Group Meeting

Natalia Szczepanek, Albane Carcenac, 05/02/2025

05/02/2025

Description

- The **AmpereOne A192** is a high-performance ARM-based processor designed for modern, scalable workloads, especially in data centers and cloud computing environments.

- Built on the 64-bit AArch64 architecture, this CPU packs an impressive **192 cores** into a single socket configuration with one thread per core, making it highly parallel and efficient for multi-threaded and high-concurrency applications.

- The processor supports dynamic frequency scaling with speeds ranging from **1000 MHz up to 3200 MHz**, which allows it to balance power consumption with performance needs.

- "The best value in terms of performance per dollar"

- By combining energy-efficient ARM design with powerful computing capabilities, it allows data centers to scale performance while managing power budgets, which is critical in large-scale deployments.
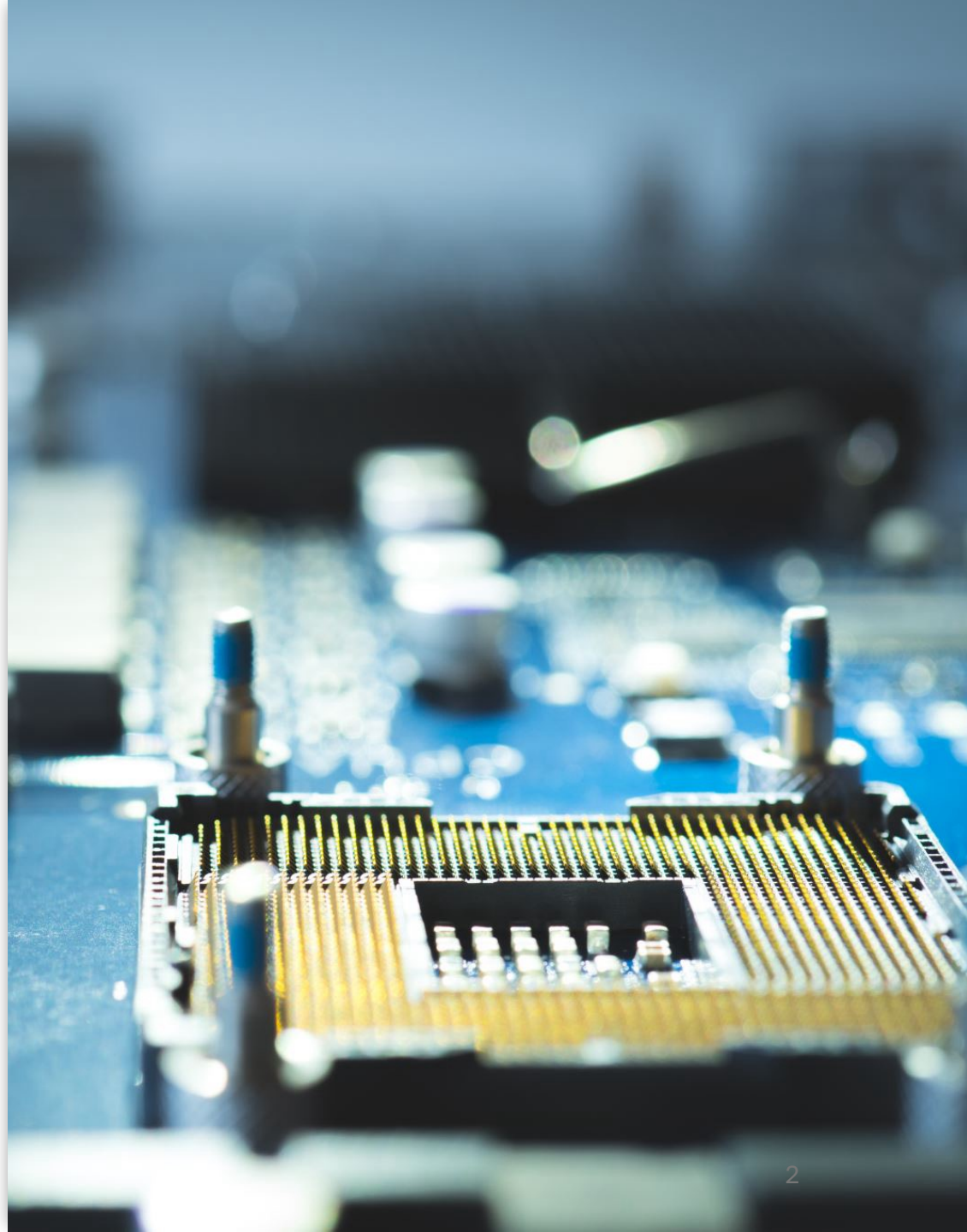
Specification AmpereOne A192

- Architecture: aarch64
- CPU(s): 192
- Core(s) per socket: 192
- Thread(s) per core: 1
- Socket(s): 1
- Vendor ID: Ampere
- Model name: Ampere-1a (AmpereOne®)
- CPU frequency range: 1000 MHz - 3200 MHz
- Driver: cppc_cpufreq

- Available governors:
  - conservative,
  - ondemand,
  - userspace,
  - powersave,
  - performance,
  - schedutil
- Frequency boost: disabled
- L1 cache: 12 MiB (data), 3 MiB (instruction)
- L2 cache: 384 MiB total
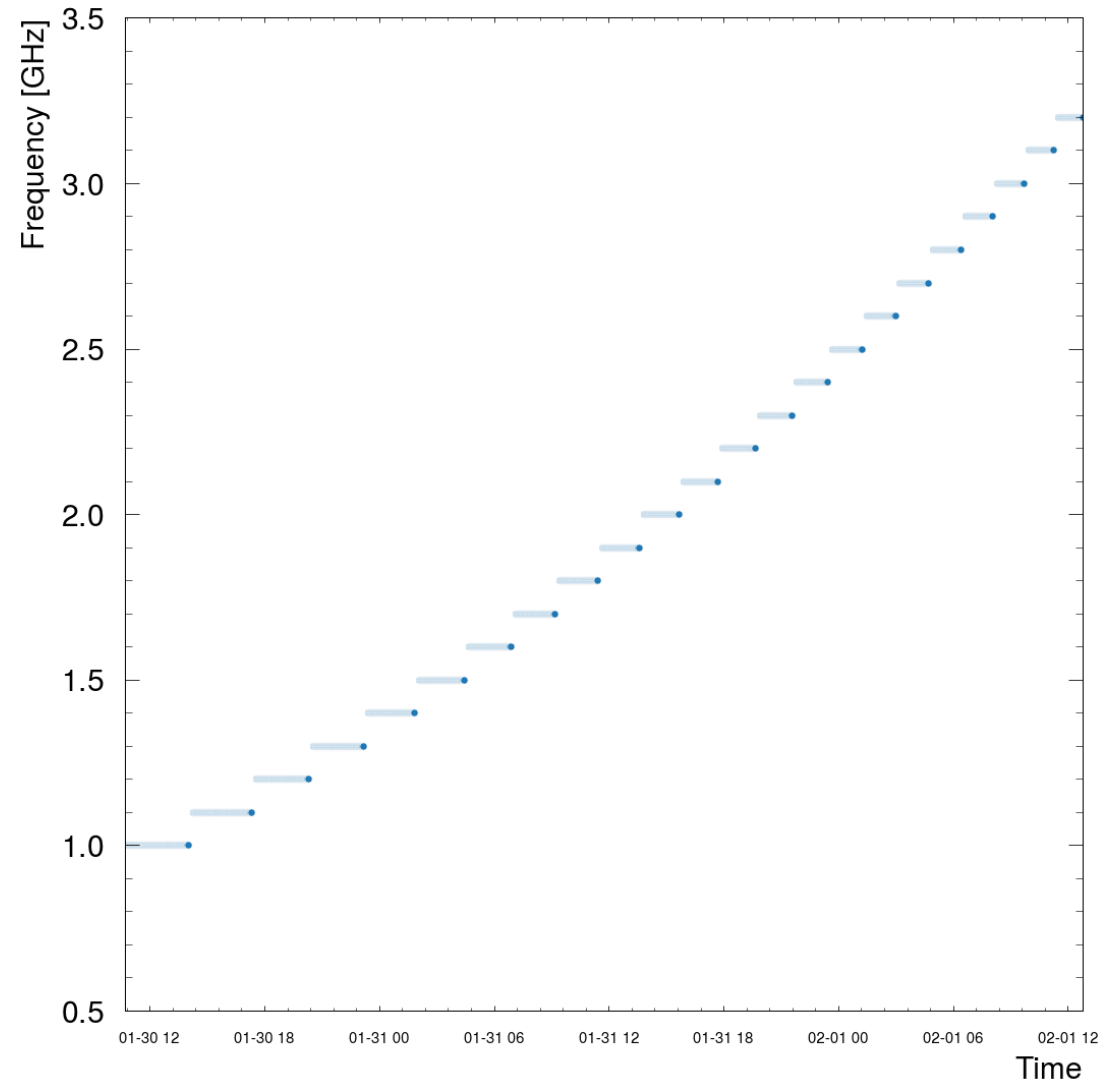- BogoMIPS: 2000

Frequency Scan

Run automatically from 1GHz to 3.2GHz with 0.1GHz step with 10min break between each run

Userspace governor

Running hep-benchmark-suite version 3.0rc19, 7 workloads from 5 experiments with one repetition
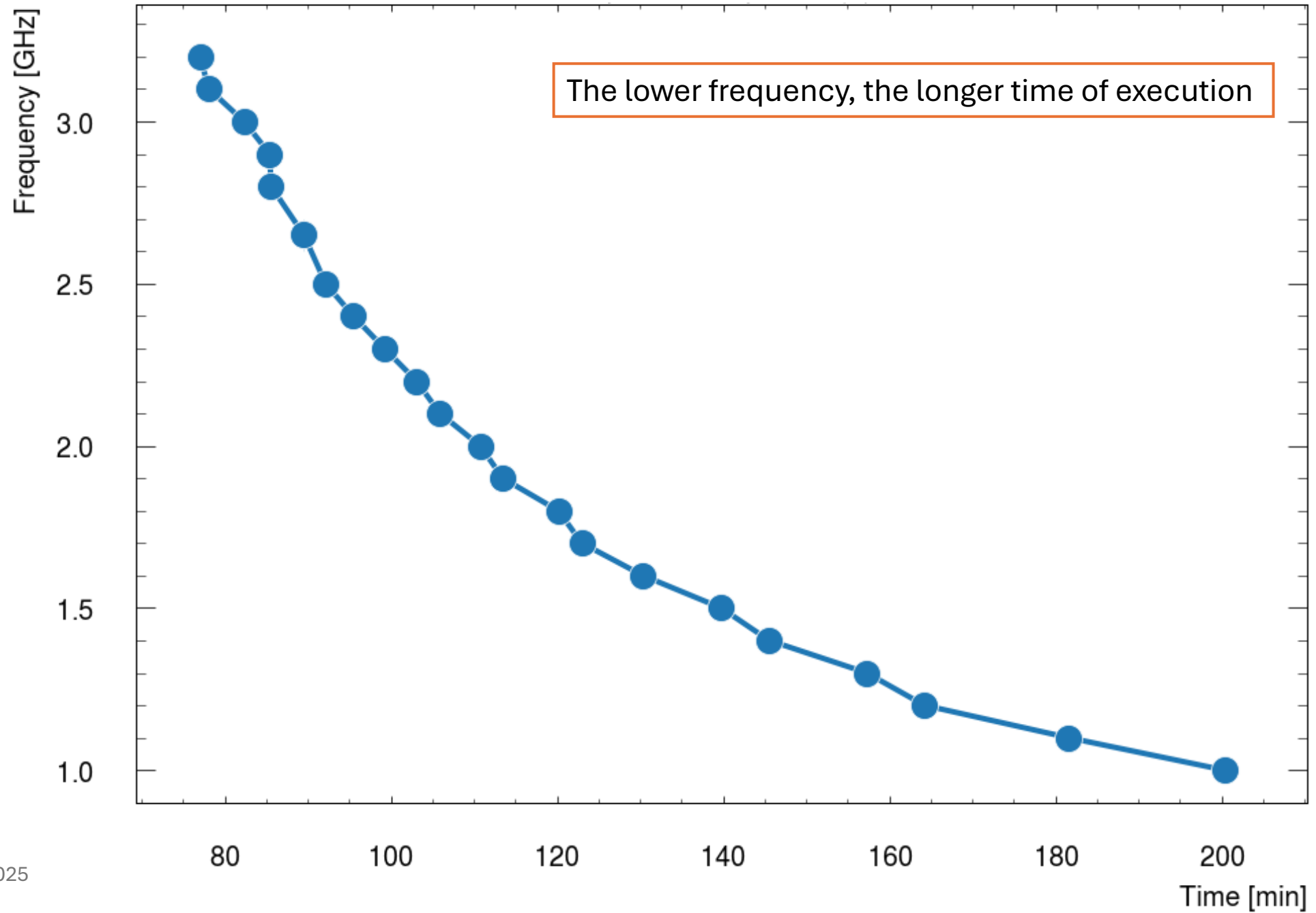
Running all available plugins: power, frequency, load, memory and swap

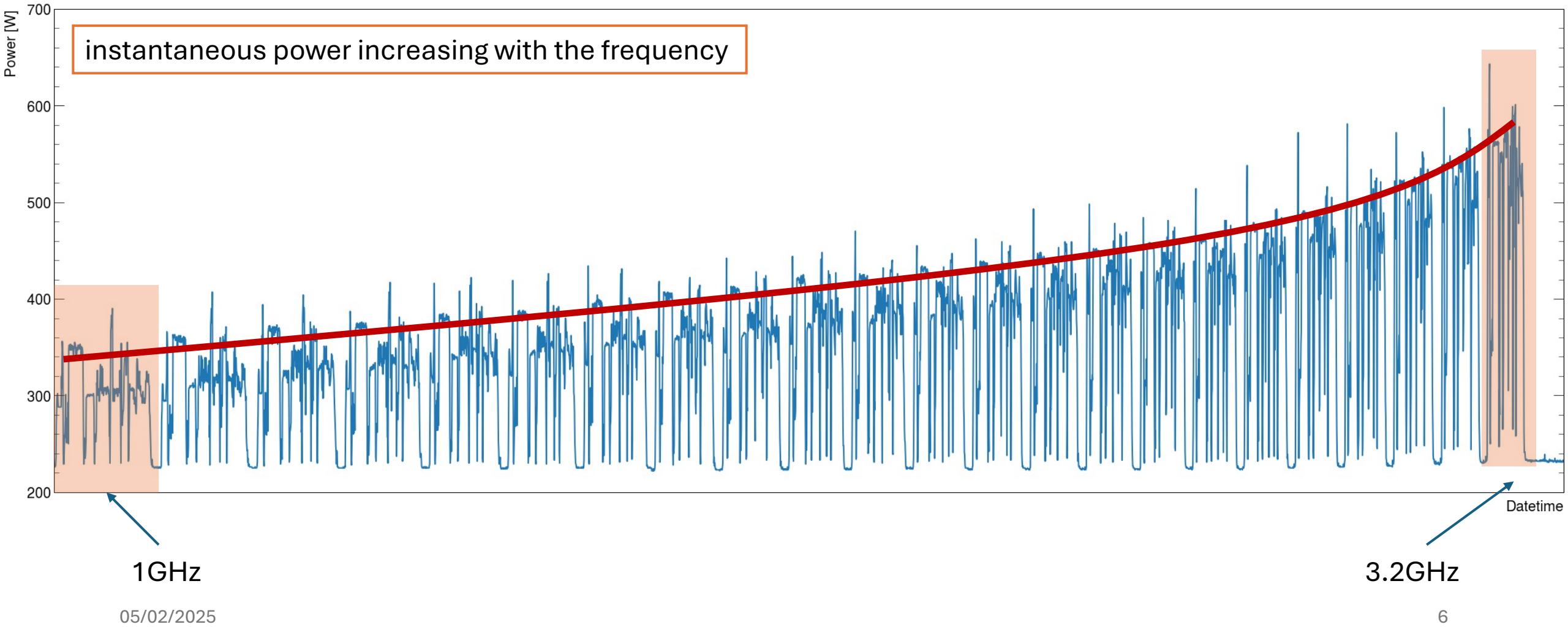Everything automated, scripts are ready to use – run full scan in 2min – link to scripts

AmpereOne A192

The lower frequency, the longer time of execution

AmpereOne A192

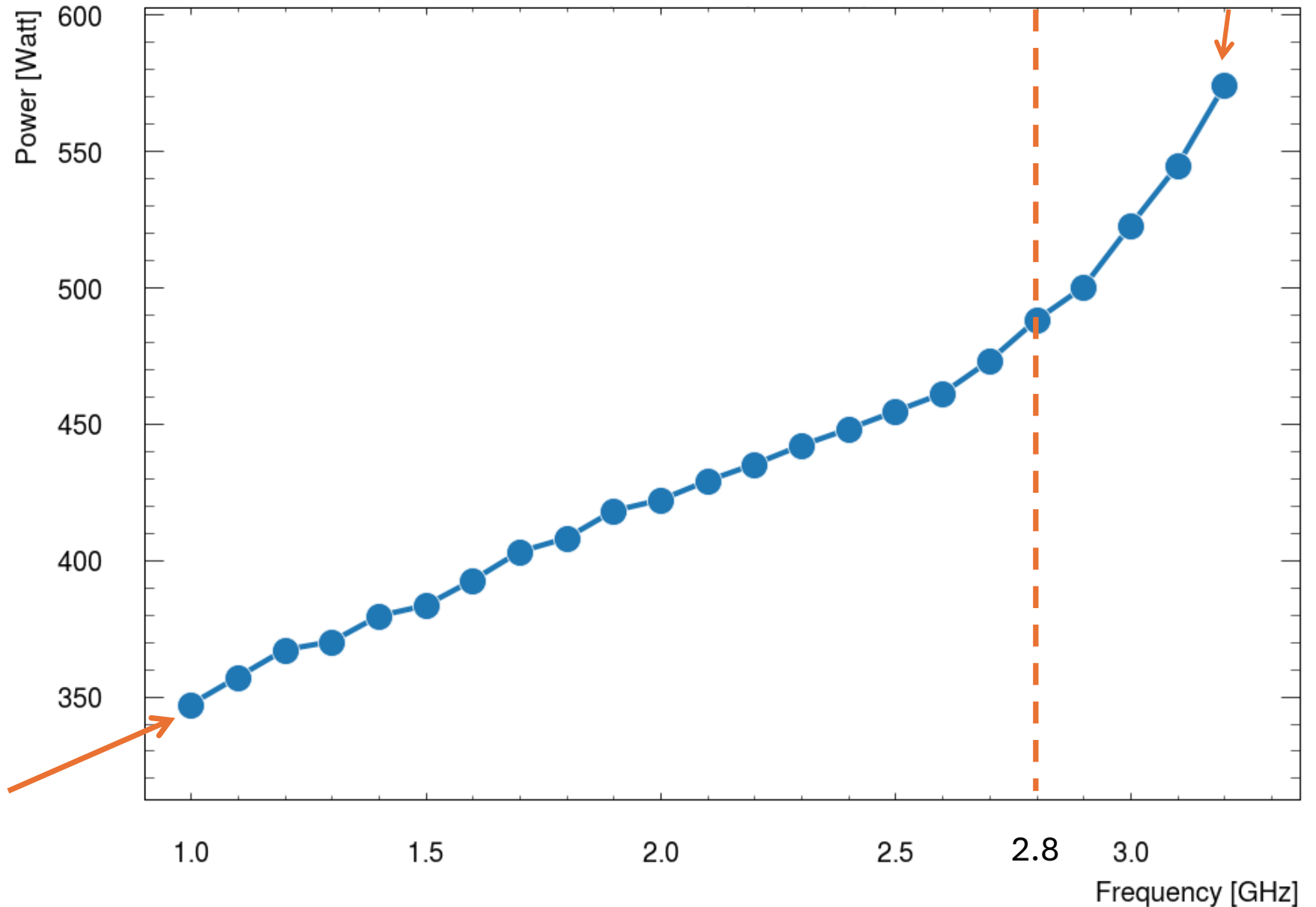instantaneous power increasing with the frequency
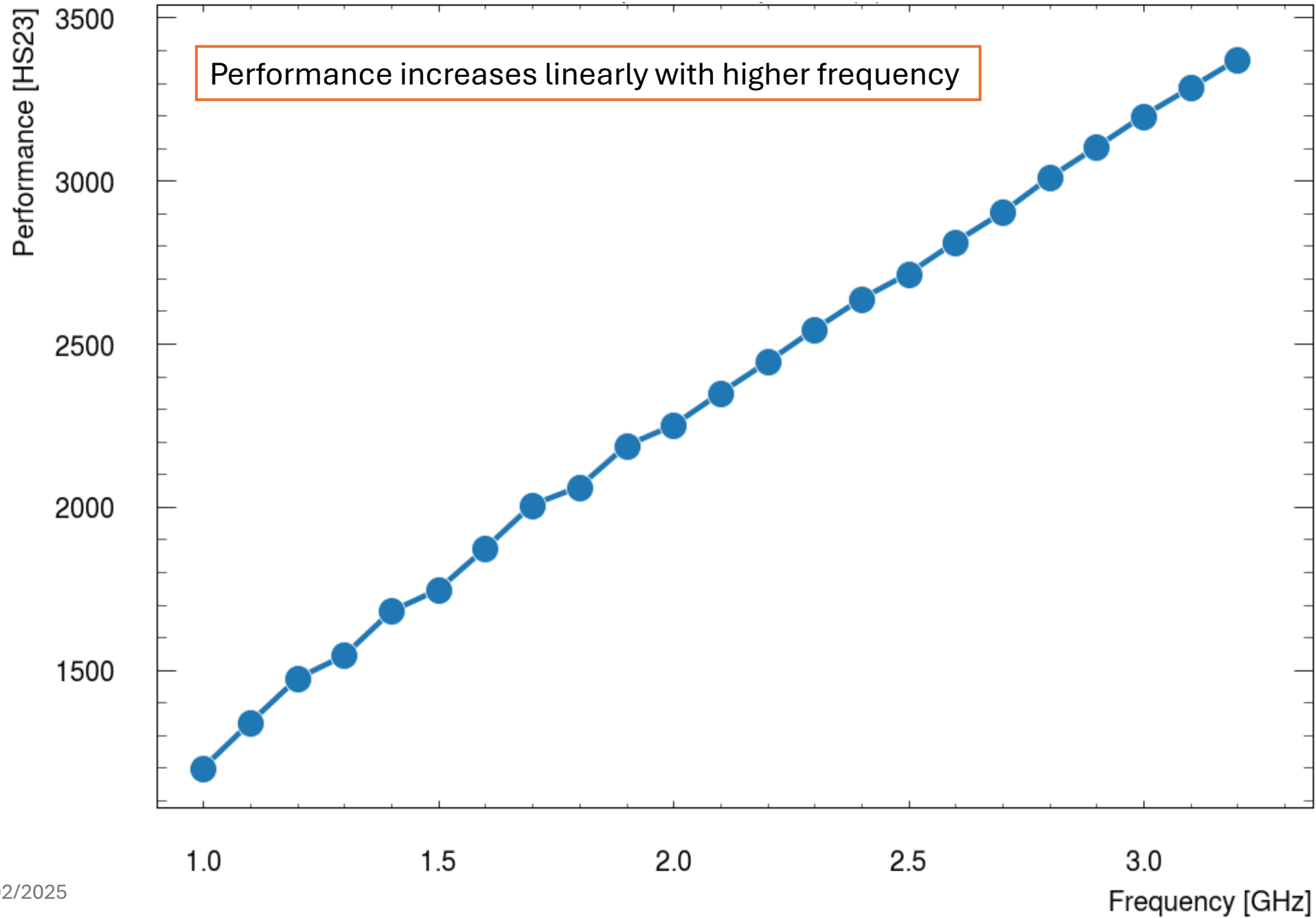
1GHz

3.2GHz

AmpereOne A192

594 W

Up to 2.8 GHz: The voltage remains relatively constant, so power scales nearly linearly with frequency.
Beyond 2.8 GHz: The need for a higher voltage causes power to increase exponentially due to the quadratic (and sometimes even exponential) relationship between voltage and power, coupled with increased leakage currents.
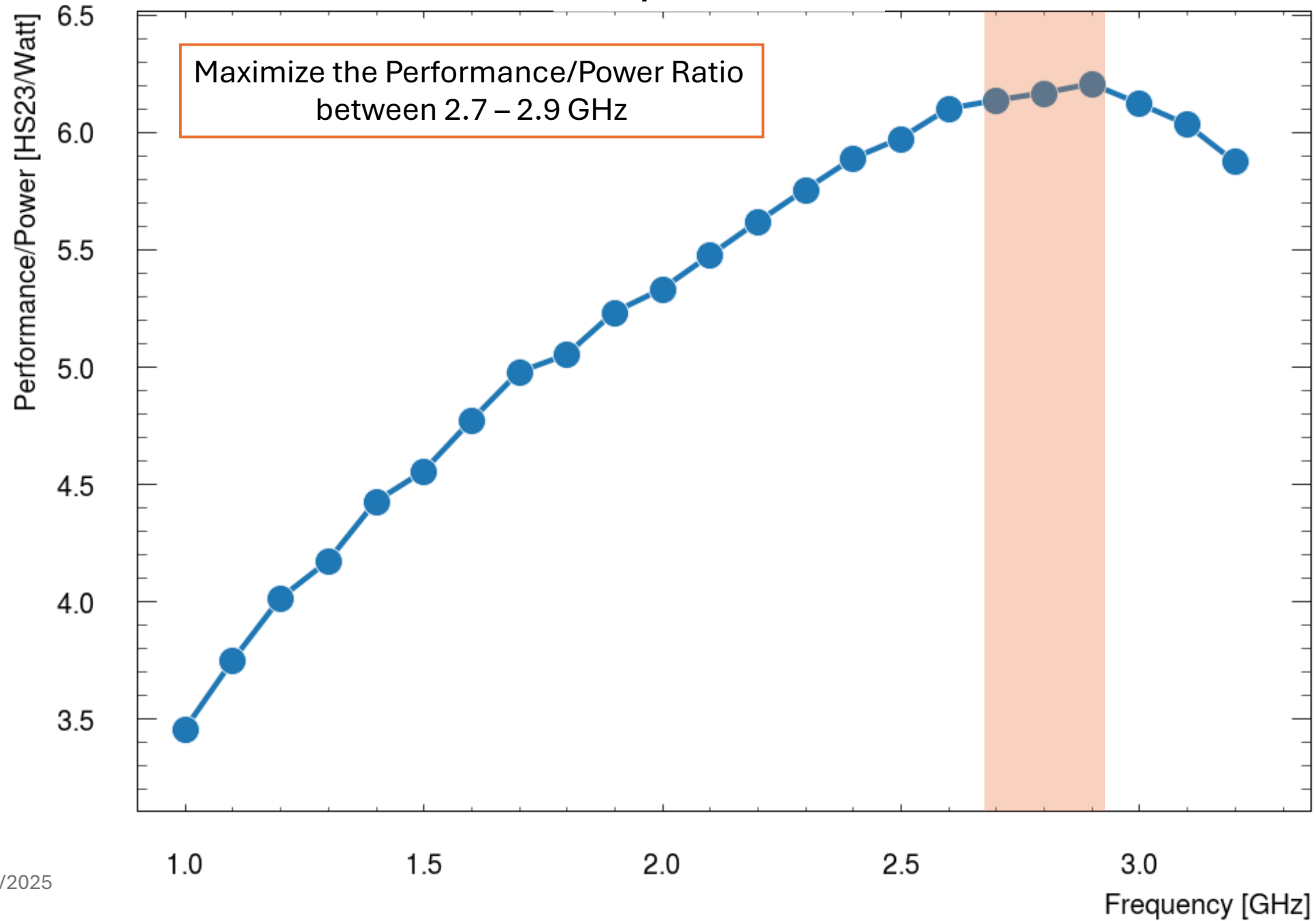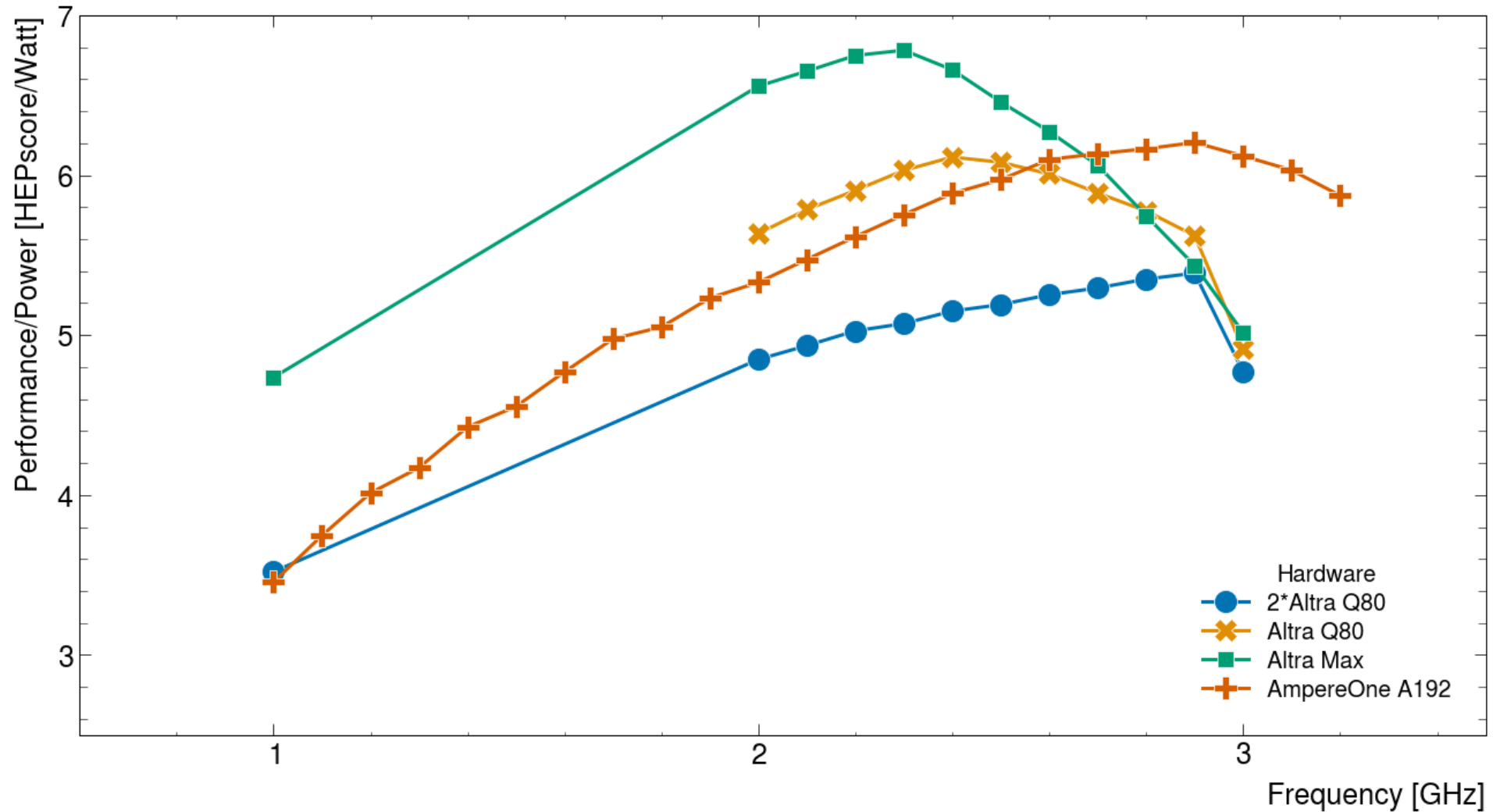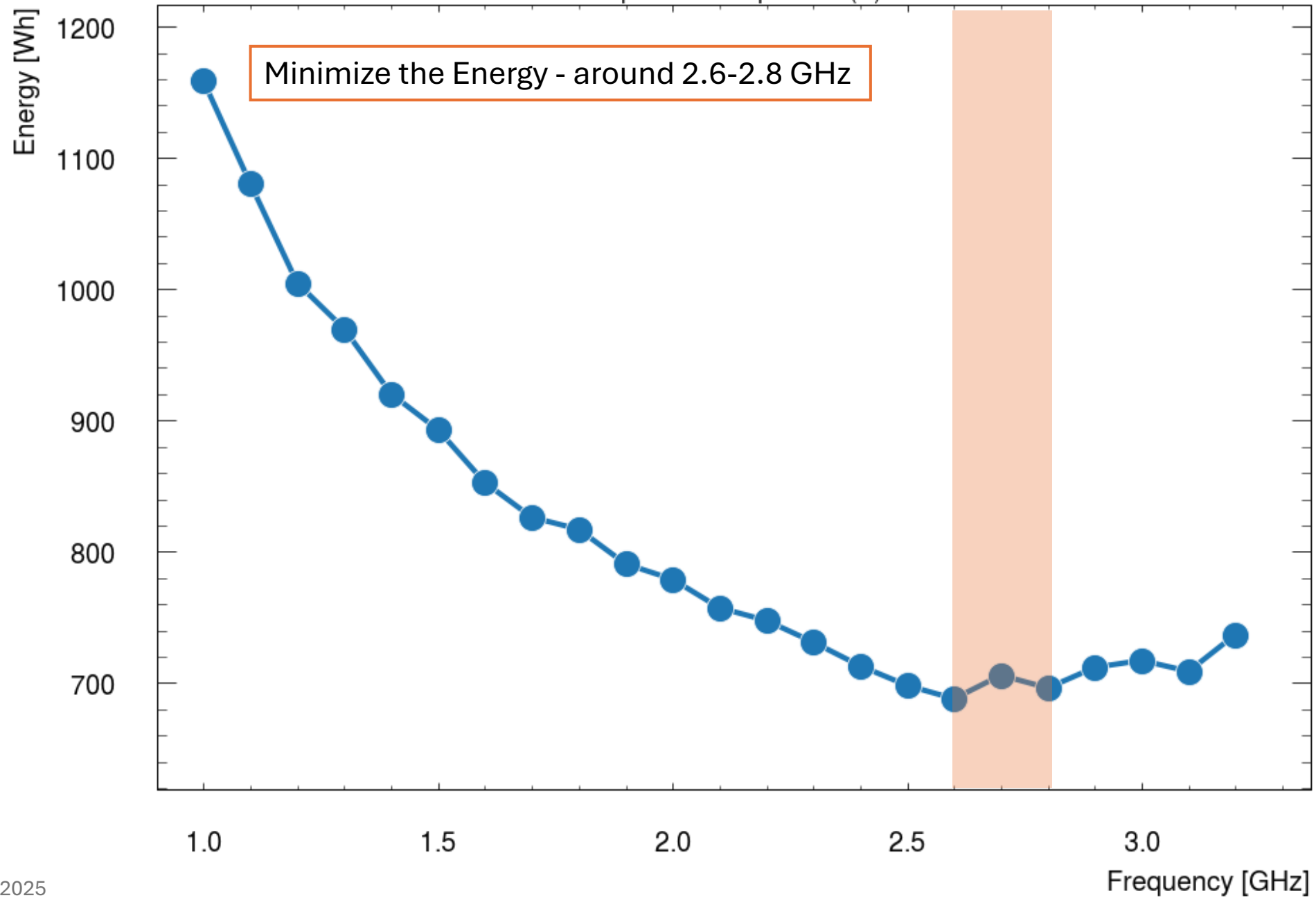
347 W

AmpereOne A192

Performance increases linearly with higher frequency

AmpereOne A192

Maximize the Performance/Power Ratio between 2.7 – 2.9 GHz

Y-axis: Performance/Power [HS23/Watt]

X-axis: Frequency [GHz]

Taking a closer look at the various Ampere frequency scans

AmpereOne A192

Minimize the Energy - around 2.6-2.8 GHz

Conclusions

- Performed Frequency Scan for AmpereOne using HEP-Benchmark-Suite 3.0rc19, operating from 1 – 3.2GHz

- Automated scripts allow to run the scan in around 2minutes

- The performance increases linearly with higher frequencies

- In terms of power it increases linearly up to 2.8GHz and then it's increasing expotentialy up to 3.2GHz, which is connected with the need for a higher voltage

- The energy minimizes around 2.6 – 2.8GHz

05/02/2025
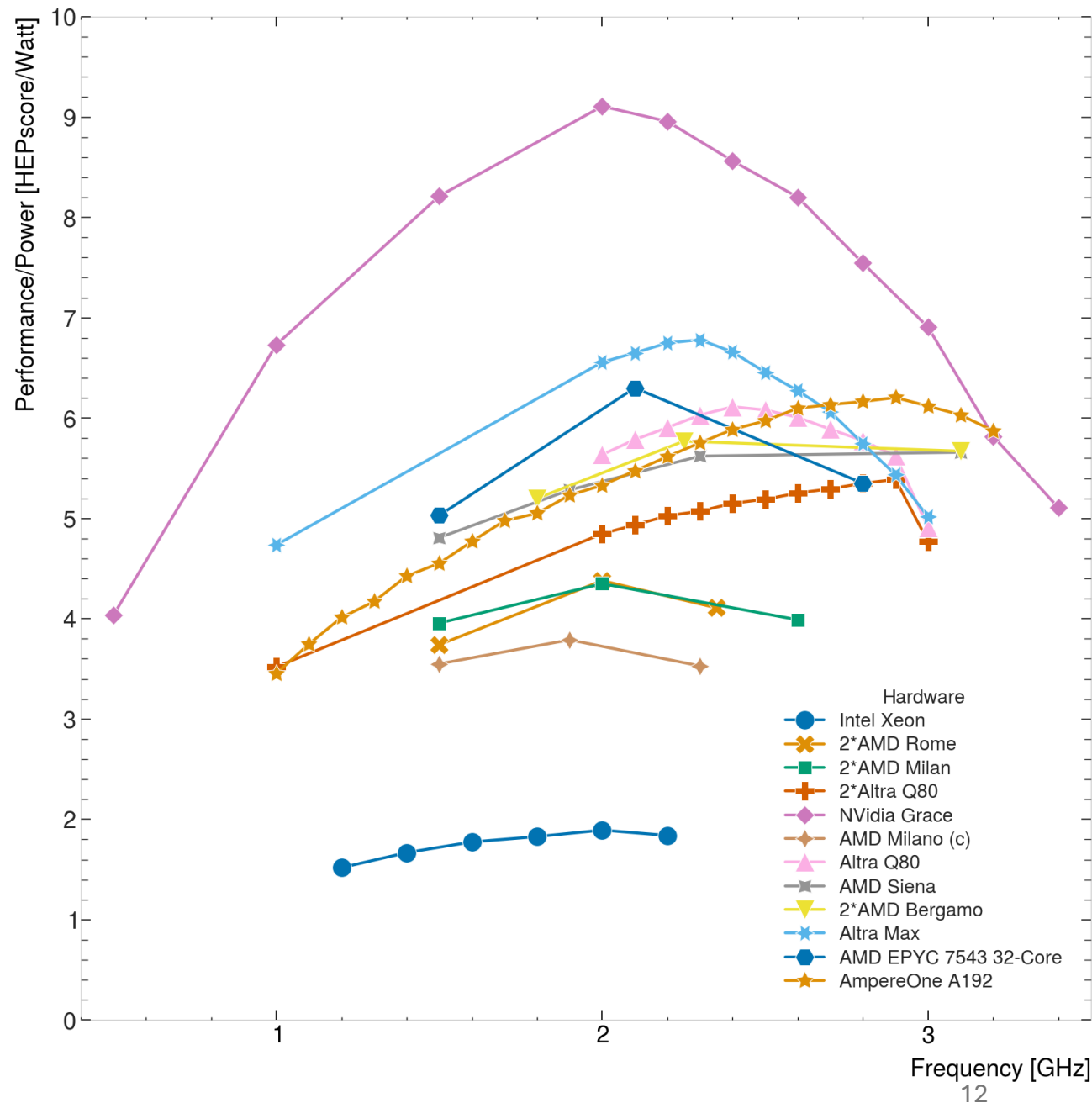
Private-tools migrated to hep-benchmark-studies
Frequency scan scripts available [here](#)

main ⌄ / hep-benchmark-studies / analysis / hepscore23 / tasks / frequency_scan / **scripts** / + ⌄   Lock   Find file   Edit ⌄   **Code** ⌄

Frequency scan scripts added
Natalia Diana Szczepanek authored 2 minutes ago   8f466962 📋   History

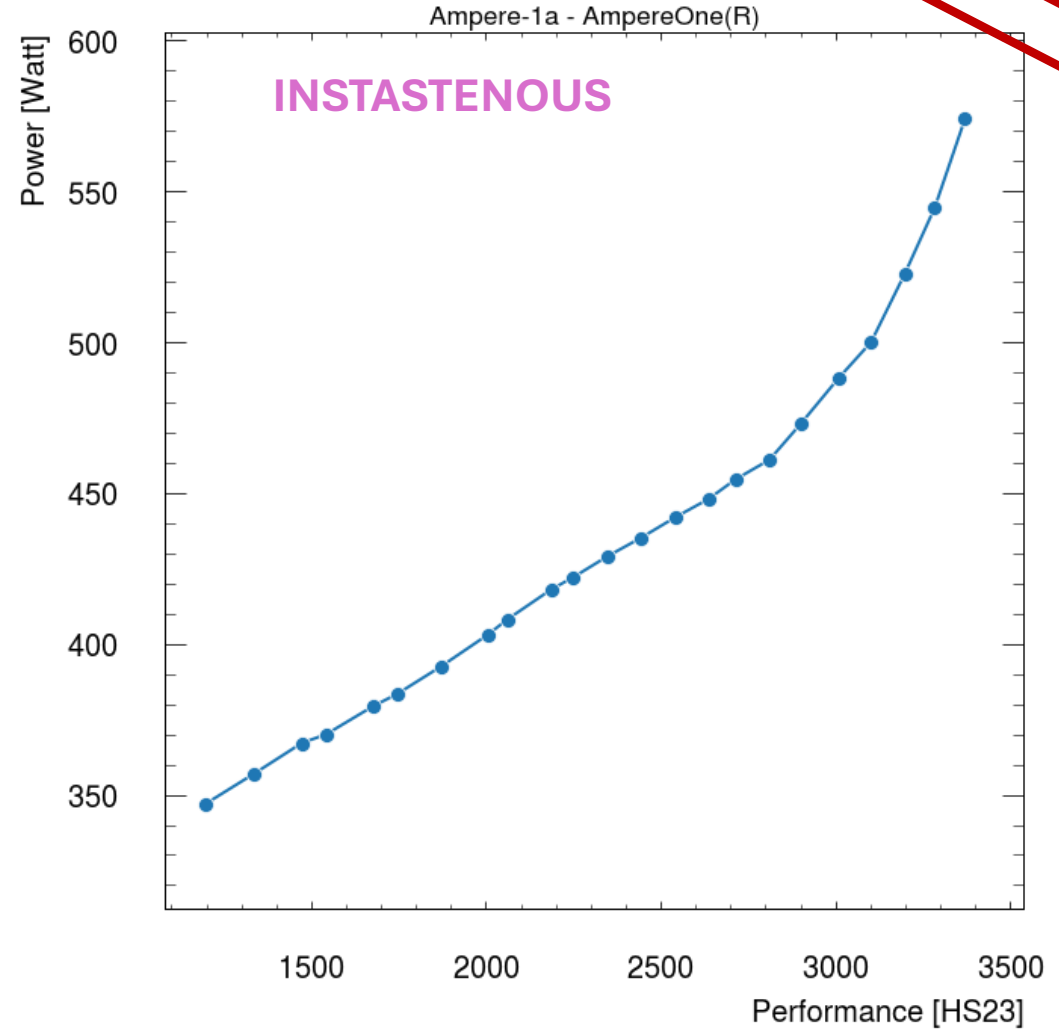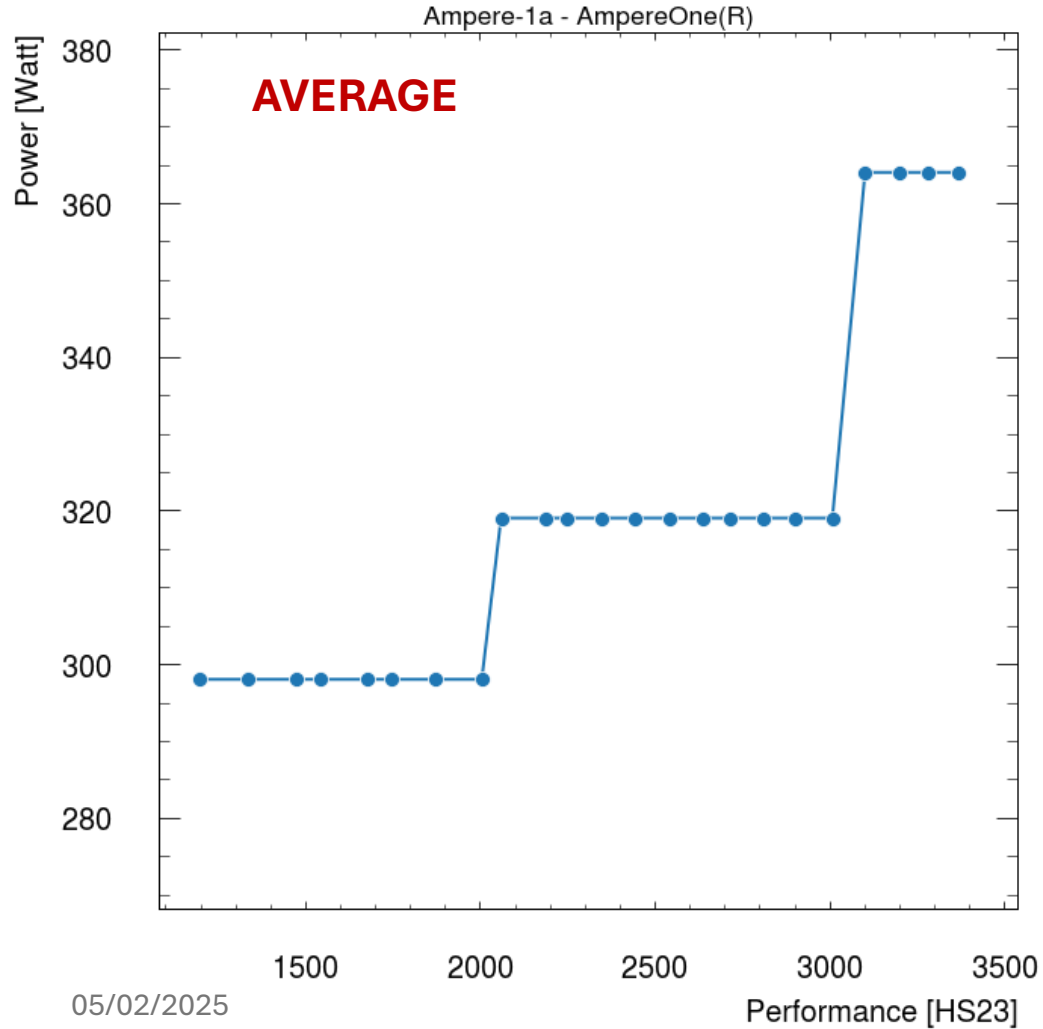👥 **Code owners** Assign users and groups as approvers for specific file changes. Learn more.   Manage branch rules

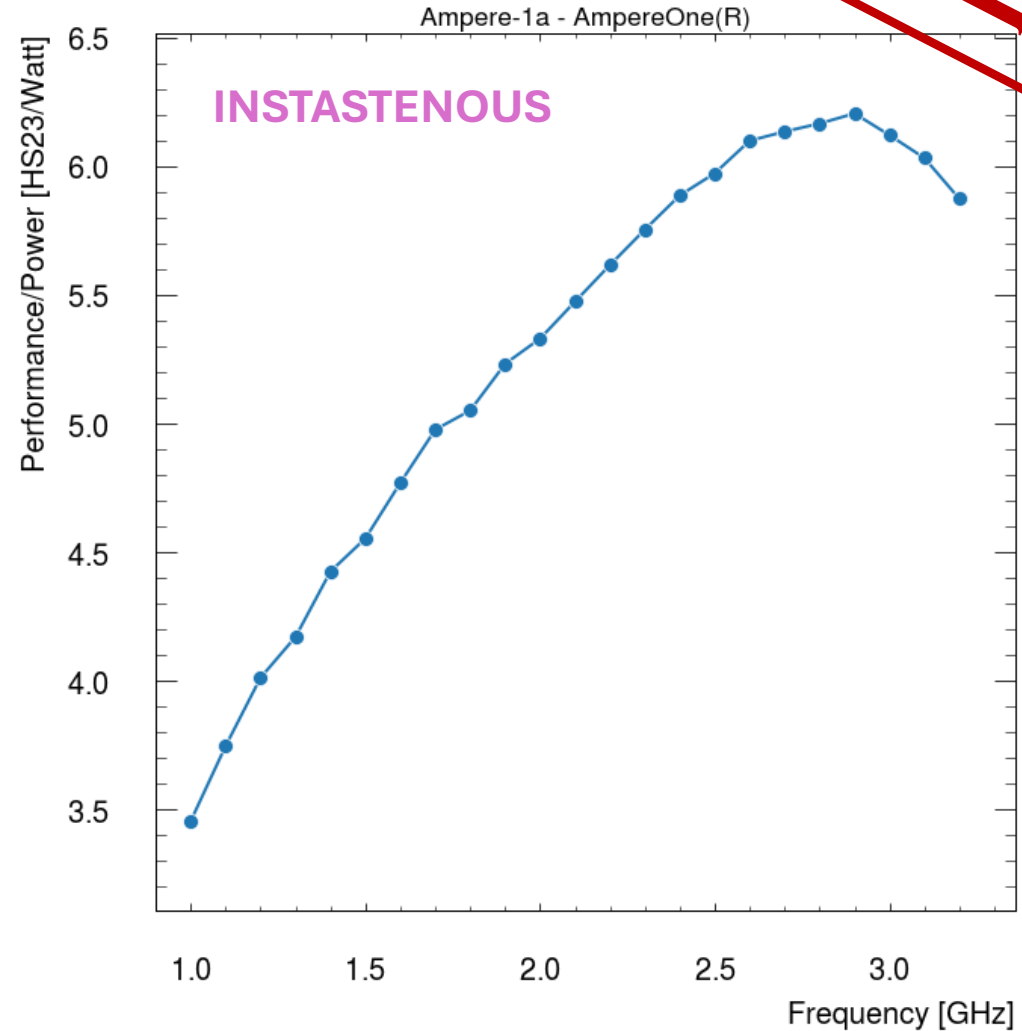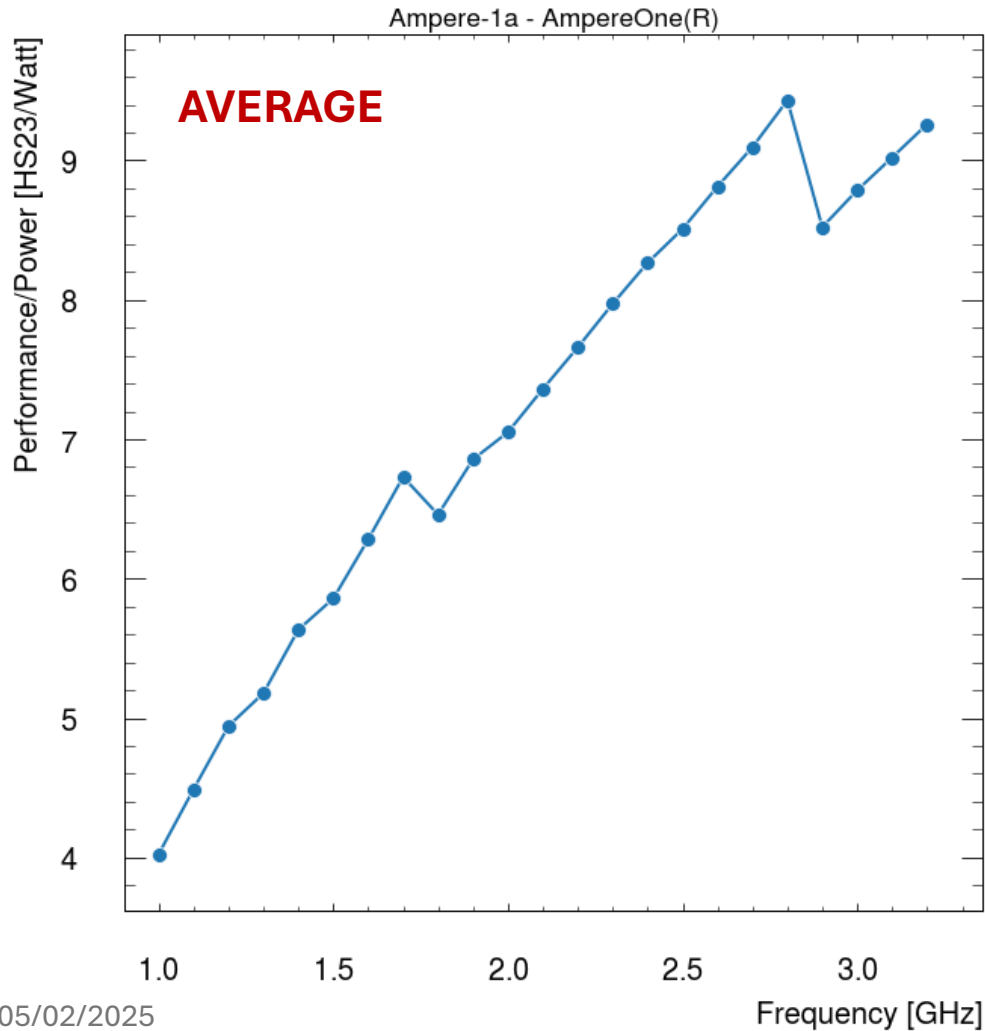| Name	Last commit	Last update
..		
📄 .DS_Store	Frequency scan scripts added	2 minutes ago
▶ change_frequency.sh	Frequency scan scripts added	2 minutes ago
▶ change_governor.sh	Frequency scan scripts added	2 minutes ago
▶ collect_statistics_dcmi.sh	Frequency scan scripts added	2 minutes ago
▶ run_HEPscore_configurable_ncores.sh	Frequency scan scripts added	2 minutes ago
▶ run_frequency_scan.sh	Frequency scan scripts added	2 minutes ago

Average VS Instantaneous Power...

Average VS Instantaneous Power…

Average VS Instantaneous Power...

Ampere-1a - AmpereOne(R)