

Re-Visiting Power Measurement for the Green500

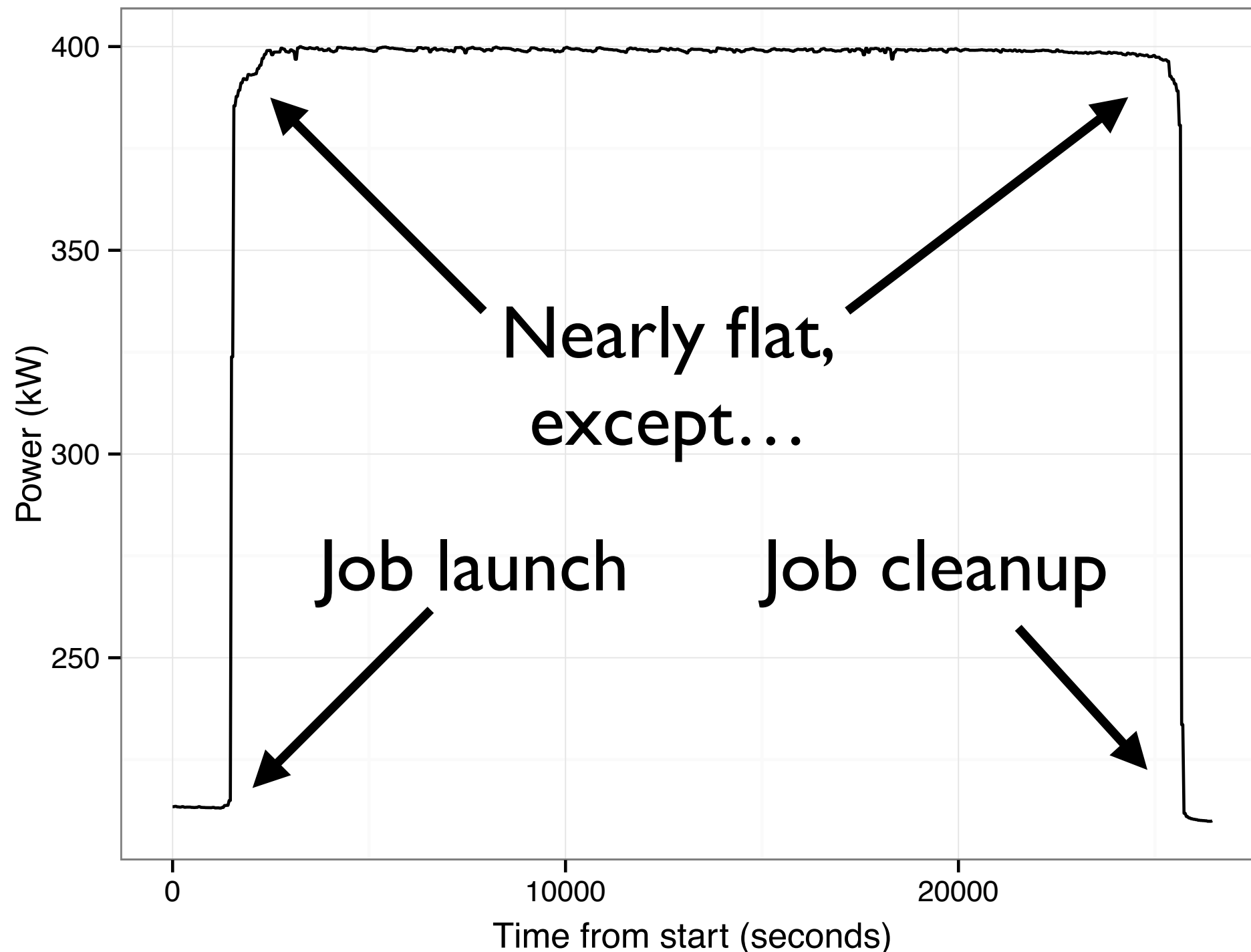
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Level I Requirements

- Workload phase: Measure at least 20% of the middle 80% of the core phase
- Machine fraction: Measure at least 1/64th of the system or 1kW, whichever is greater
- Subsystems measured: Measure the compute components, network, storage and other subsystems are not required

Workload Phase:

A classic HPL Profile

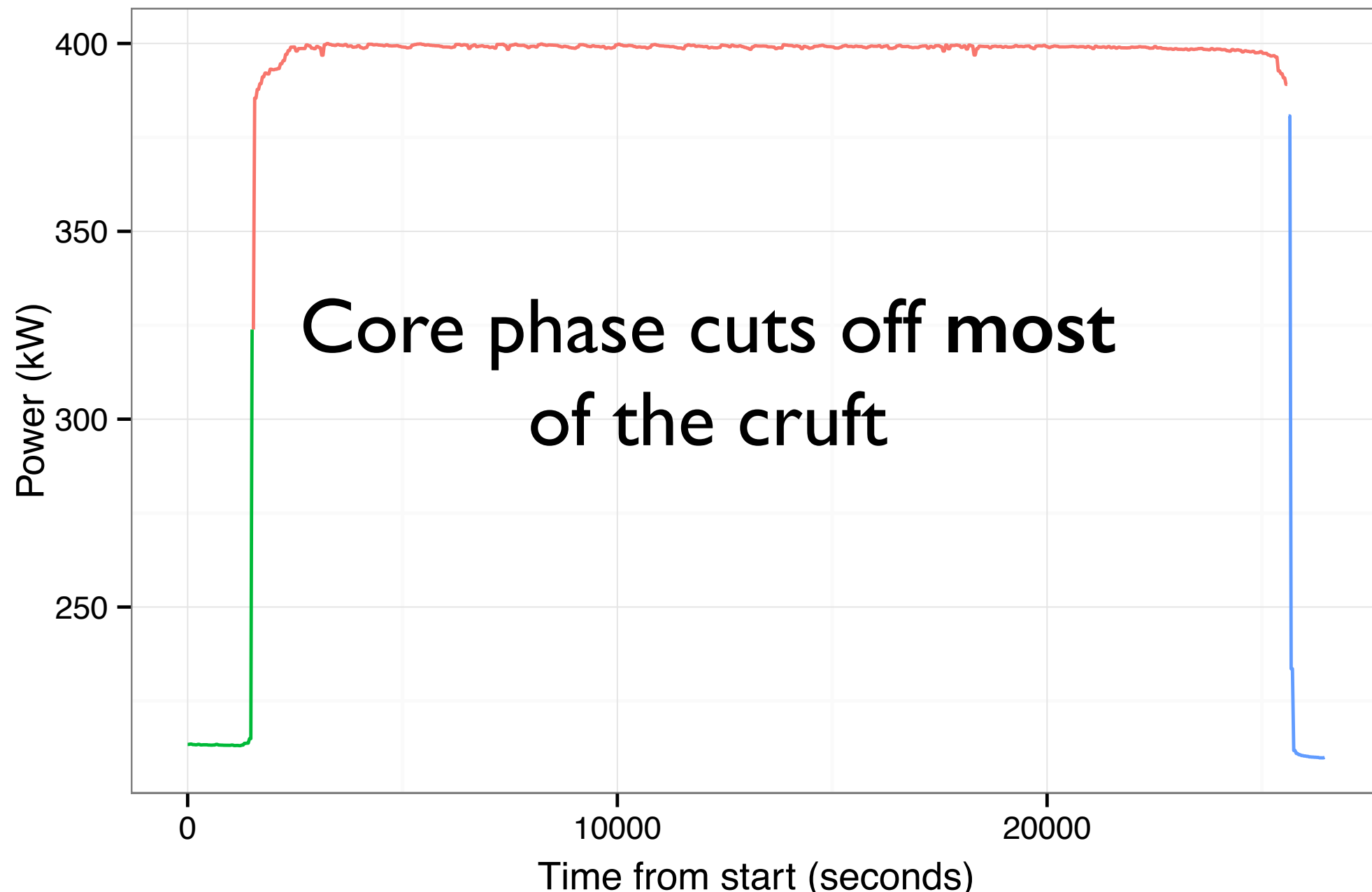


The Core Phase

- The time period under test
- Possible core phases:
 - Job scheduling -> Job completion
 - Application start -> application end
 - Benchmark start -> benchmark end
- Any is valid, so long as it matches your other metrics

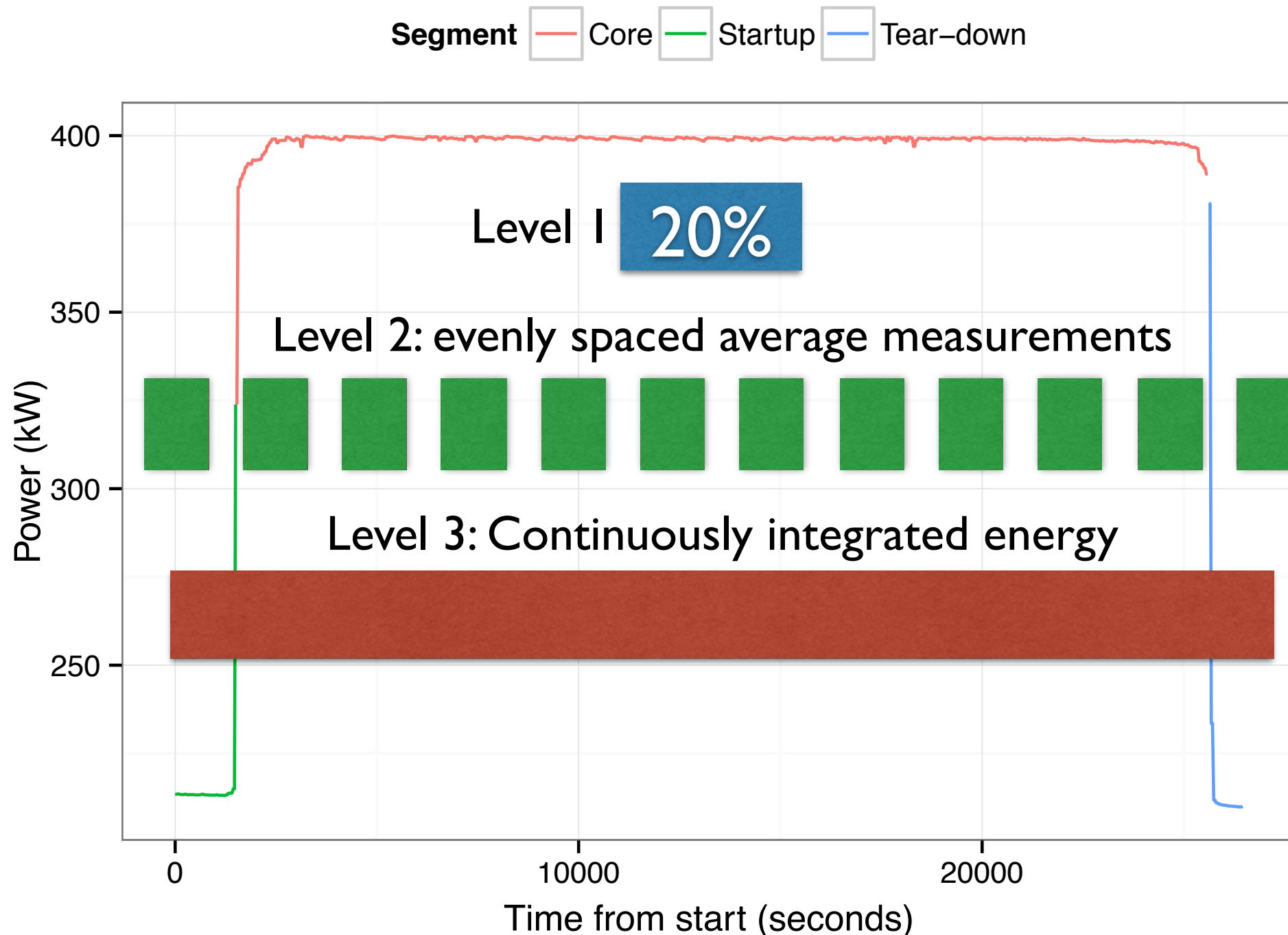
The Core Phase: Linpack Example

Segment — Core — Startup — Tear-down

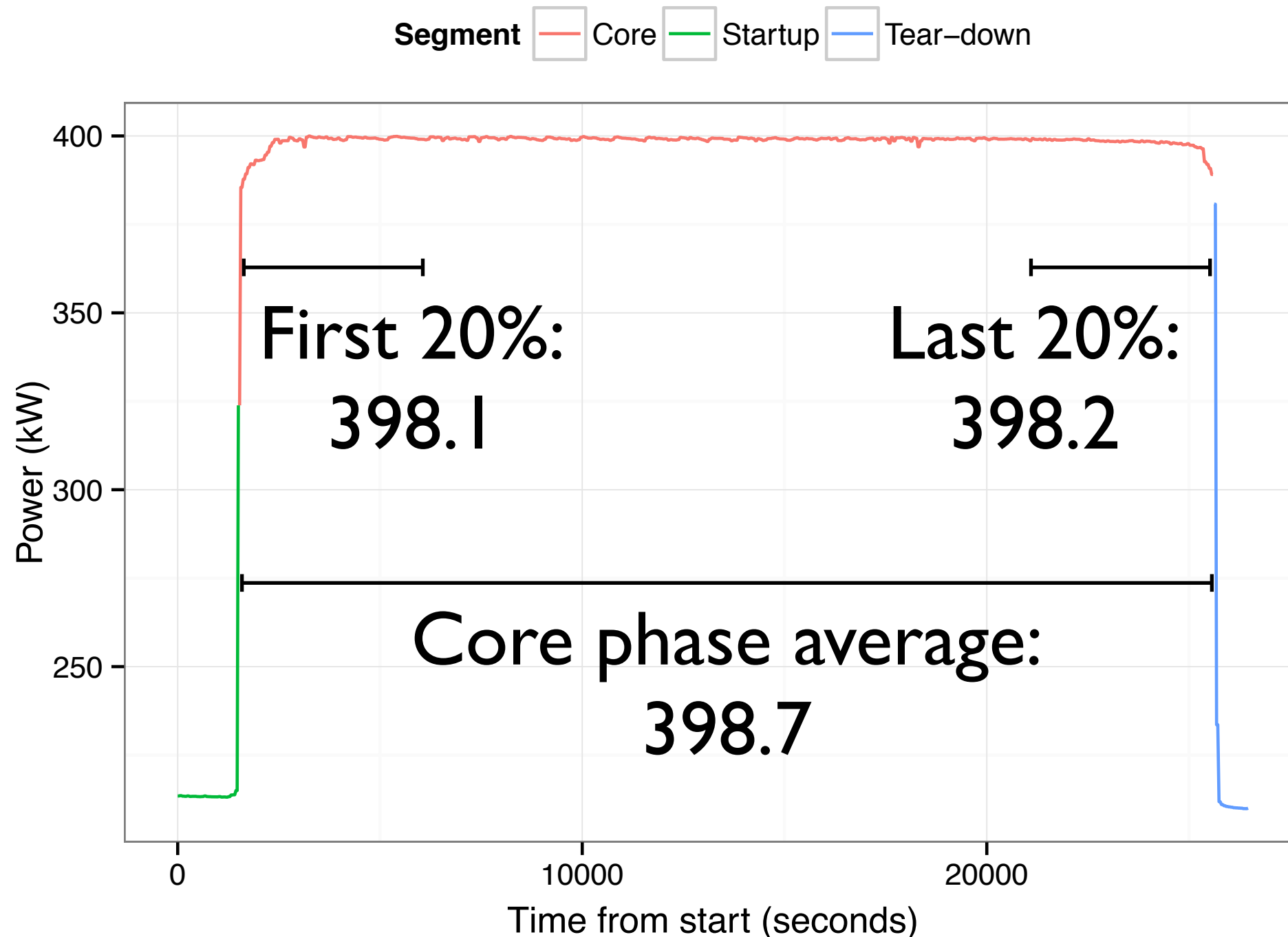


What do we require now?

Workload Timing by Measurement Level



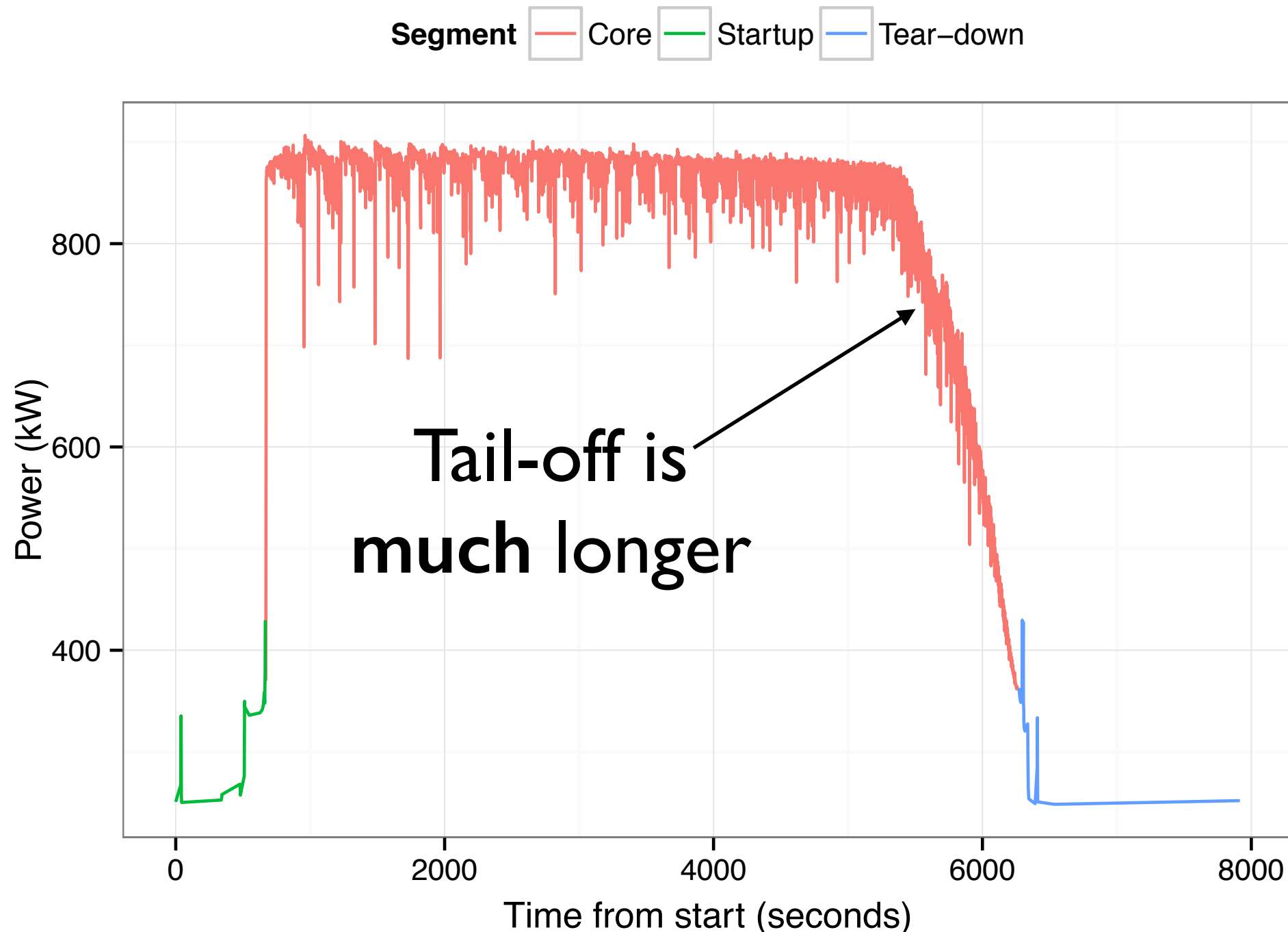
Power Variability



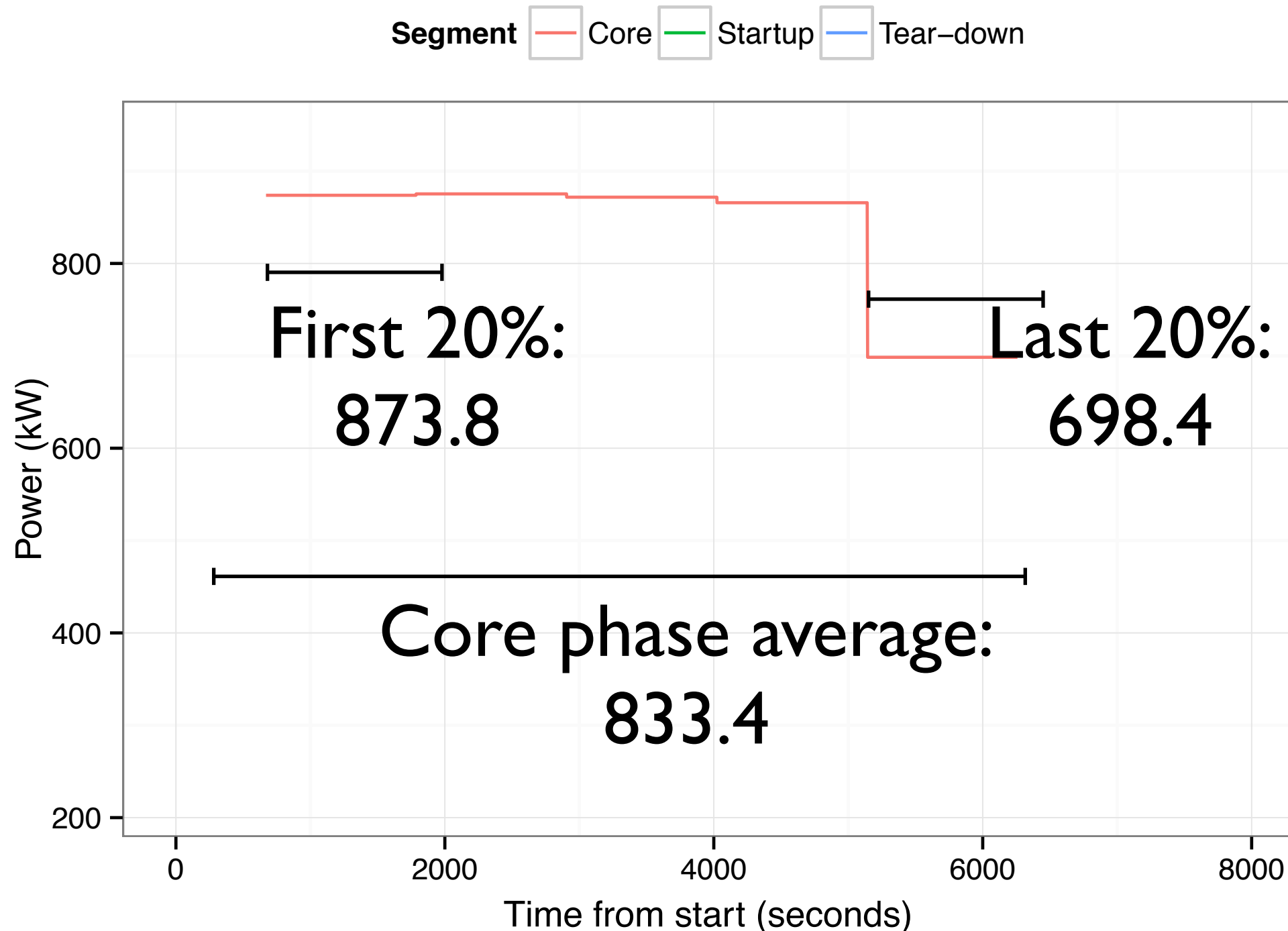
Why Change the Requirement?

Newer system designs have a different pattern.

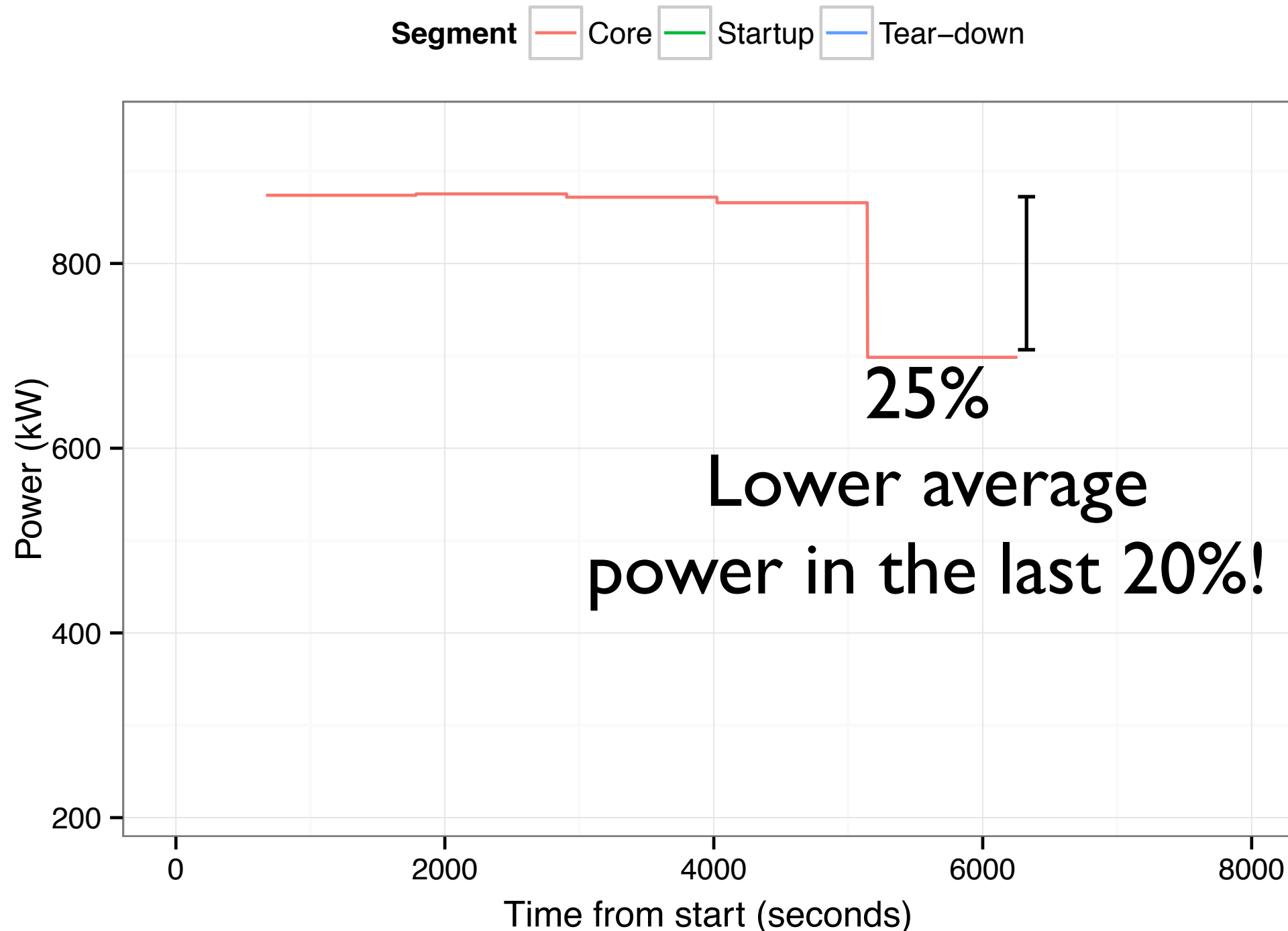
Piz Daint (GPU accelerated) Linpack Profile



Core Phase Averaged for Piz Daint

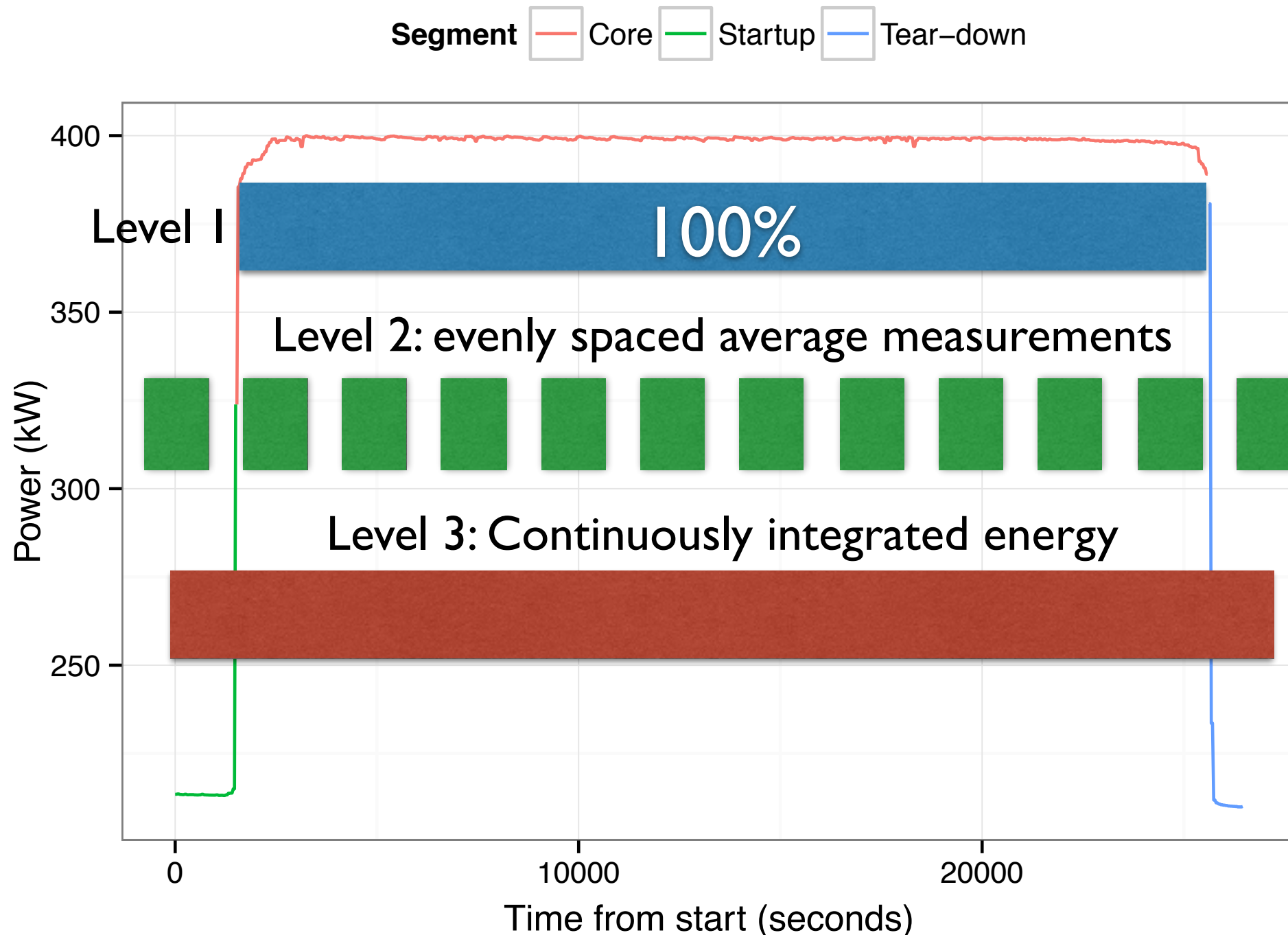


Core Phase Averaged for Piz Daint



What do we propose?

Workload Timing by Measurement Level



Measurement Fraction

- Level 1 requires 1/64th of the machine
- Which 64th of the machine?

Variability Across Levels: SuperMUC

Quality Level	Mflops/Watt full run	Efficiency Drop From Level 1
L1 (compute only)	1055	0
L2 (>10kW) (compute and interconnect)	1011	44 (~4%)
L2 (>1/8) (compute and interconnect)	994	61 (~6%)
L3 (compute, interconnect, storage, cooling, power distribution)	887	168 (~16%)

Subsystem Contribution

- Networks have been considered “in the noise” by Level 1 to this point
- We have increasing reports of the network contributing 10-20% of overall power use

Conclusions

- Our current requirements for level I are no longer sufficient
- We propose raising the requirements of Level I:
 - Measurement phase: 100% of the core phase
 - System fraction: 1/16th or more
 - Subsystems included: Compute and networking