Thermal Attacks on Storage Systems

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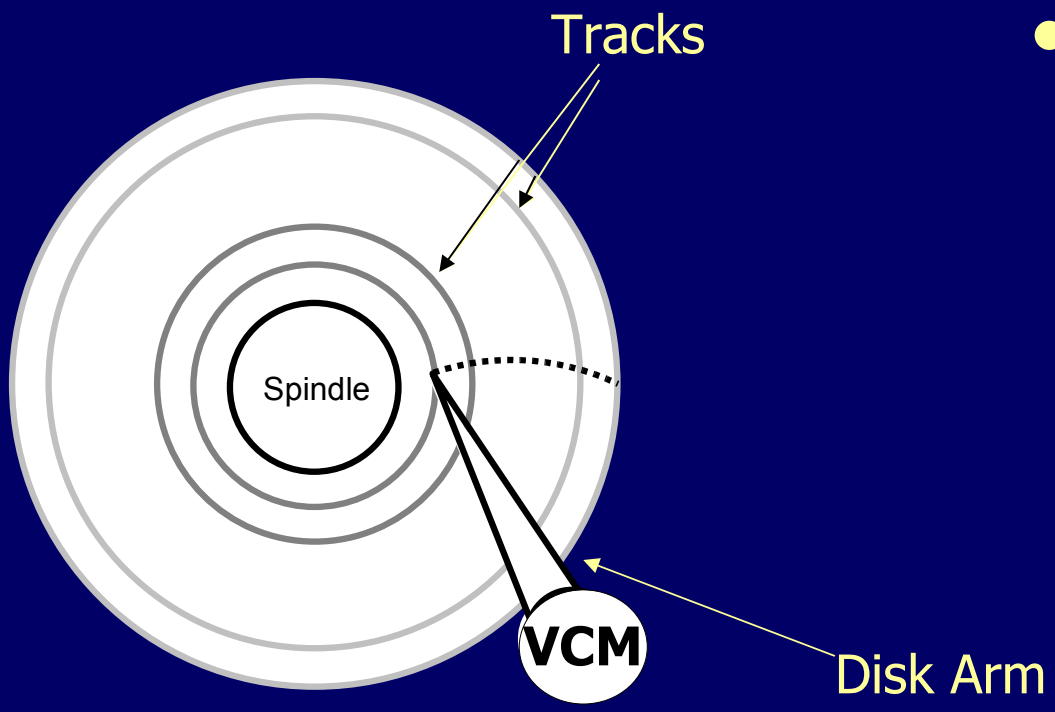
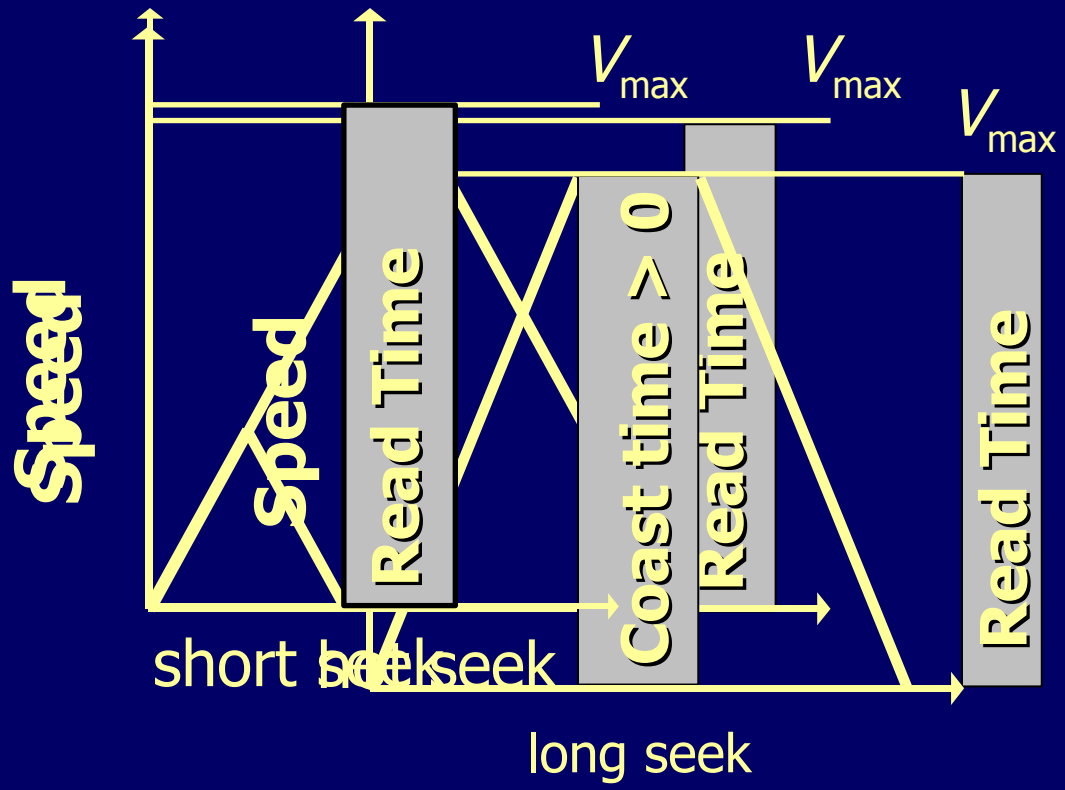
Top-Level Disk View

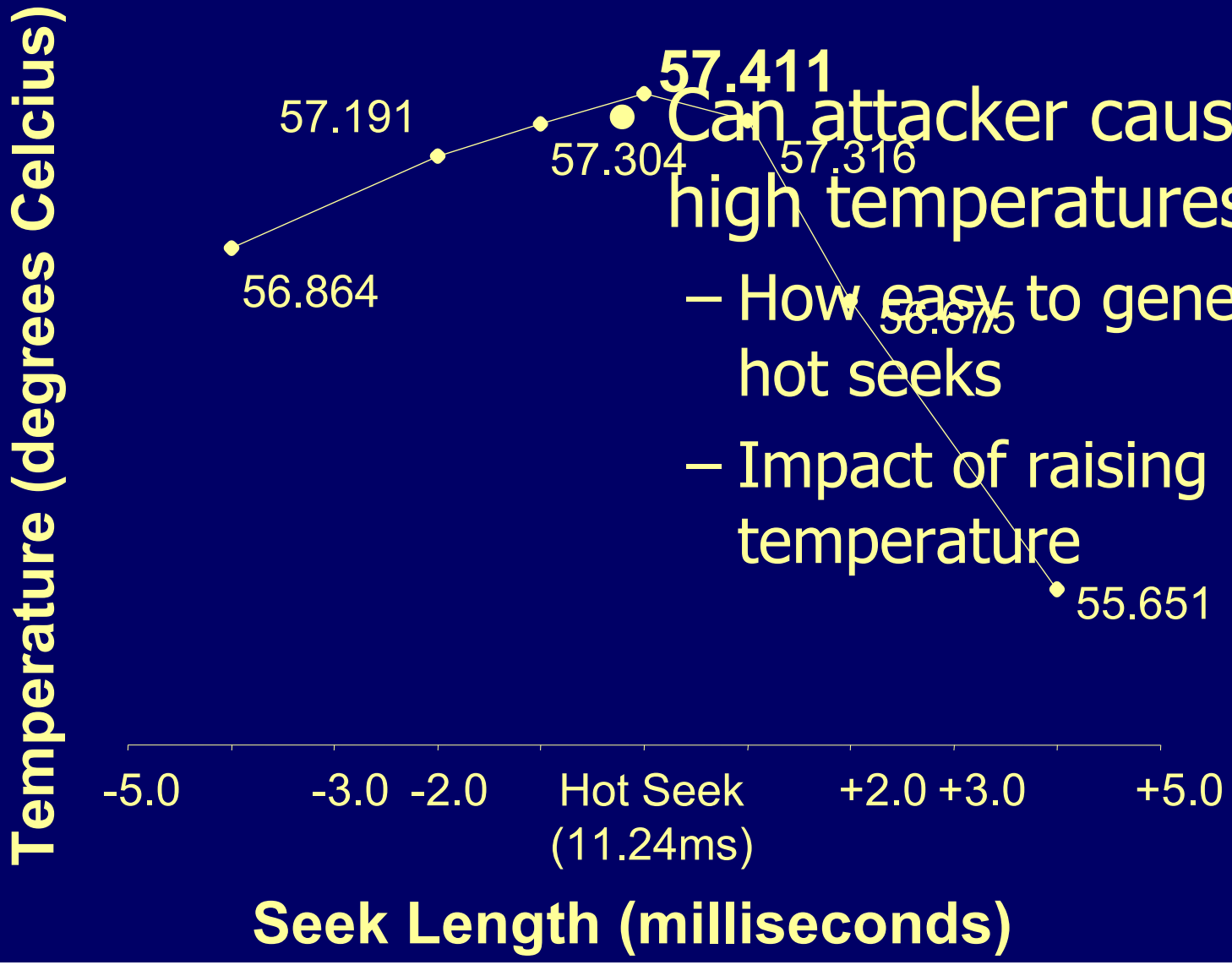


- Power comes from
  - Spindle rotating platters
  - VCM moving disk arm

Modeling a Disk Seek

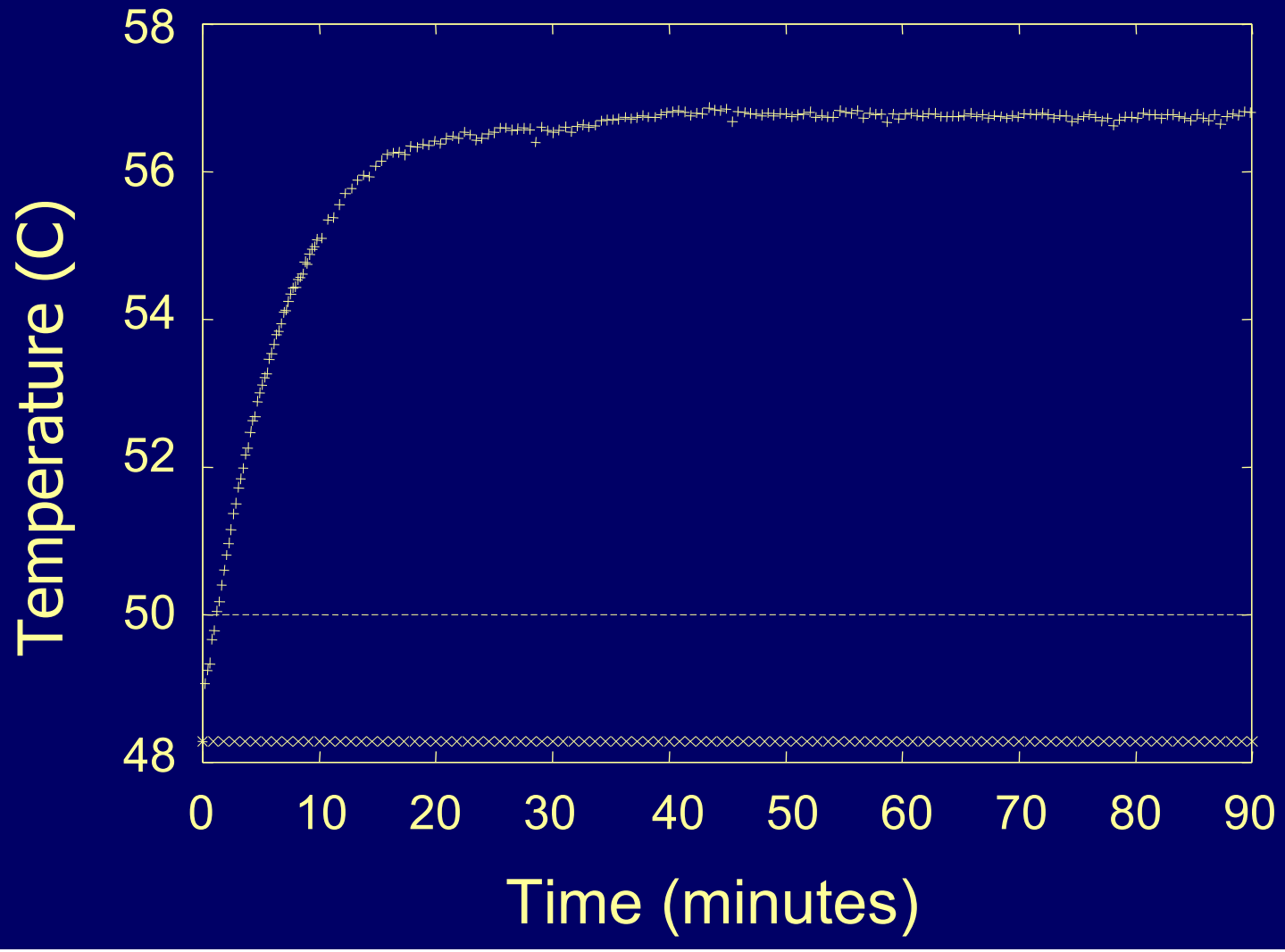


Seek Length Temperature

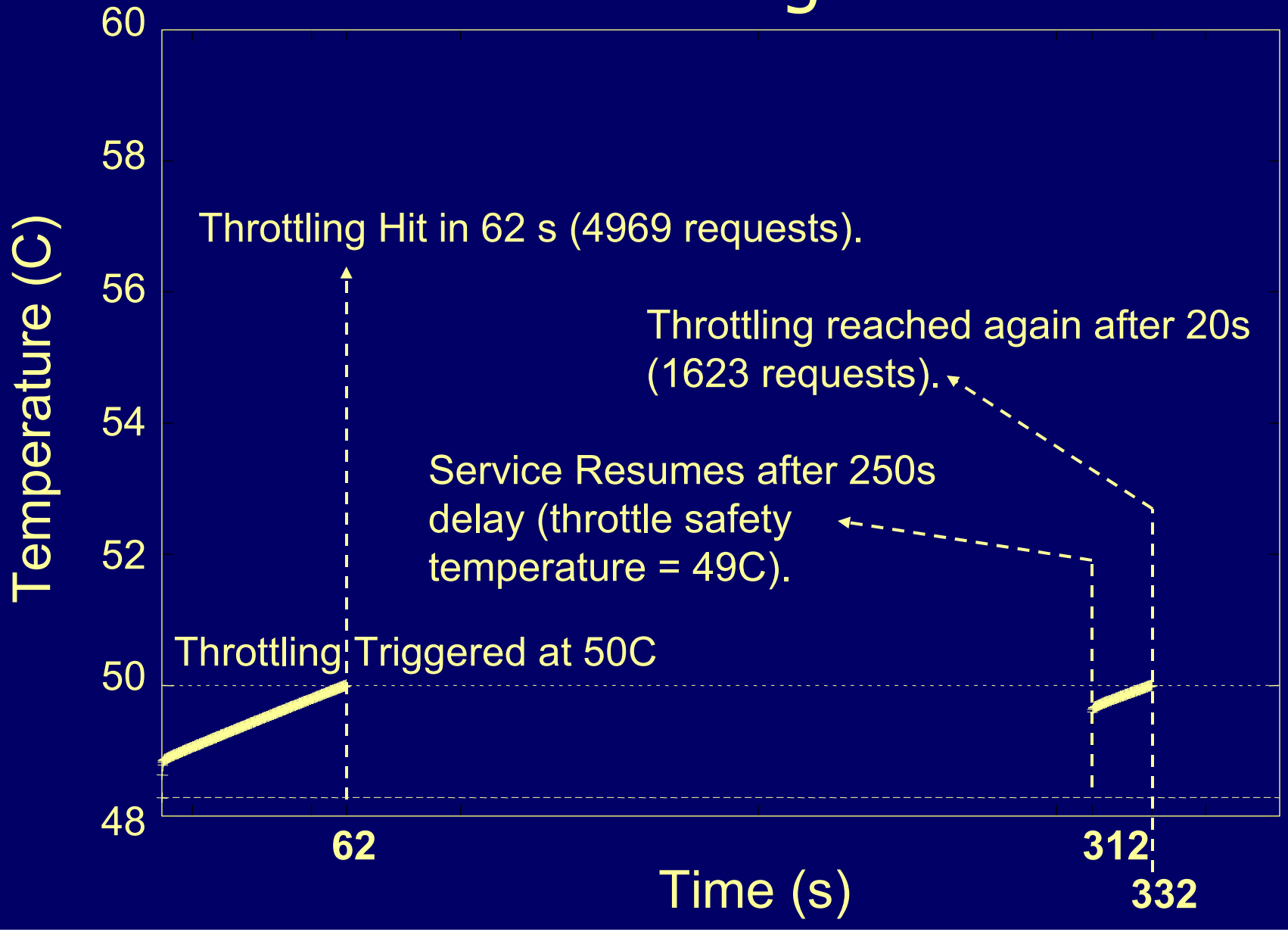


- Can attacker cause high temperatures?
  - How easy to generate hot seeks
  - Impact of raising temperature

Web Server Under Attack



DTM Throttling Attack



Impact of High Disk Temperature

- Ran disk in temperature controlled oven under heavy workload
- Ran at 81C for ~18+ hours
- Sampled SMART status
- No errors were found

Conclusion

- Temperature is a Denial of Service and Reliability issue
- Designers need to be aware of worst case and how to deal with these problems

Questions

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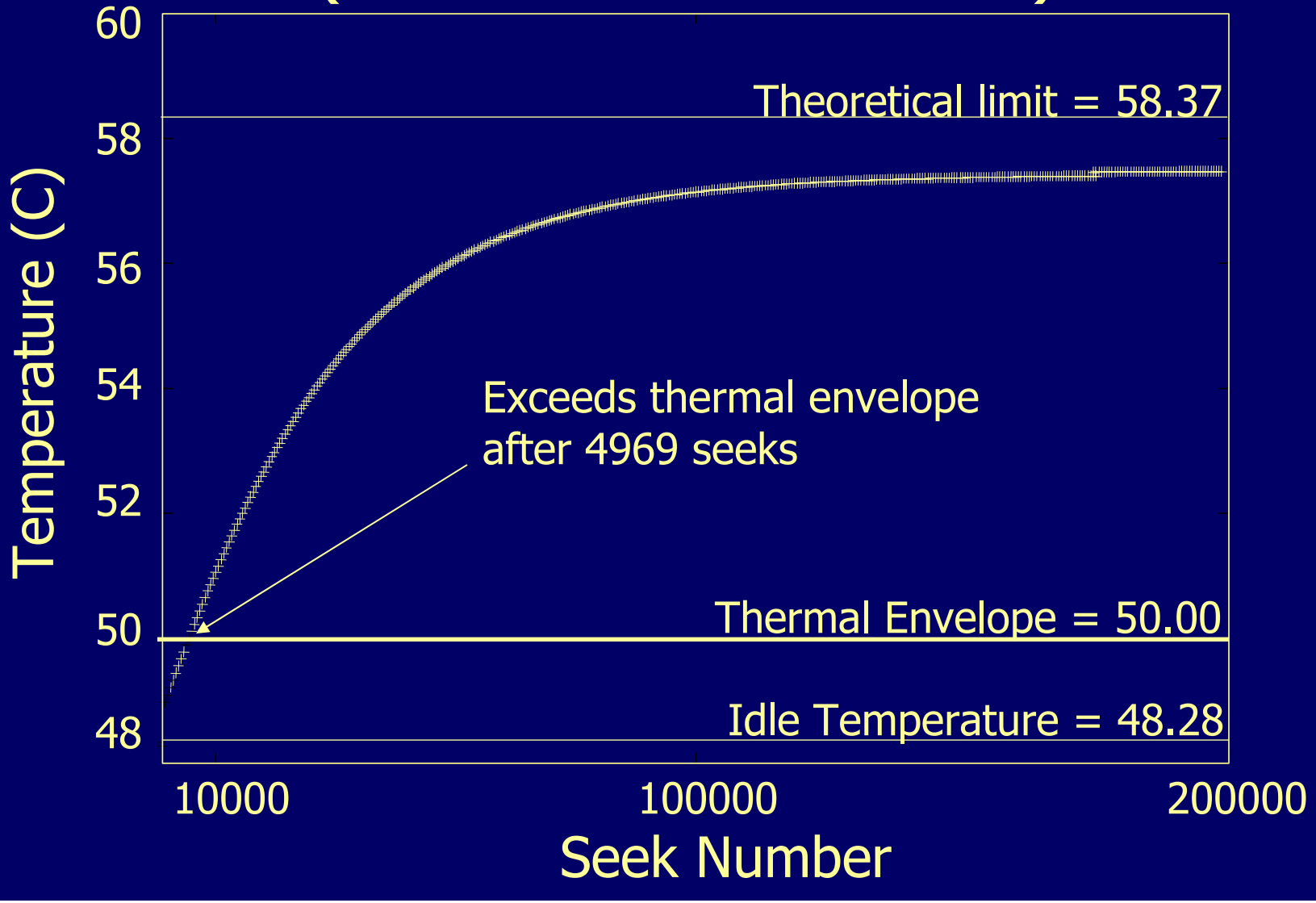
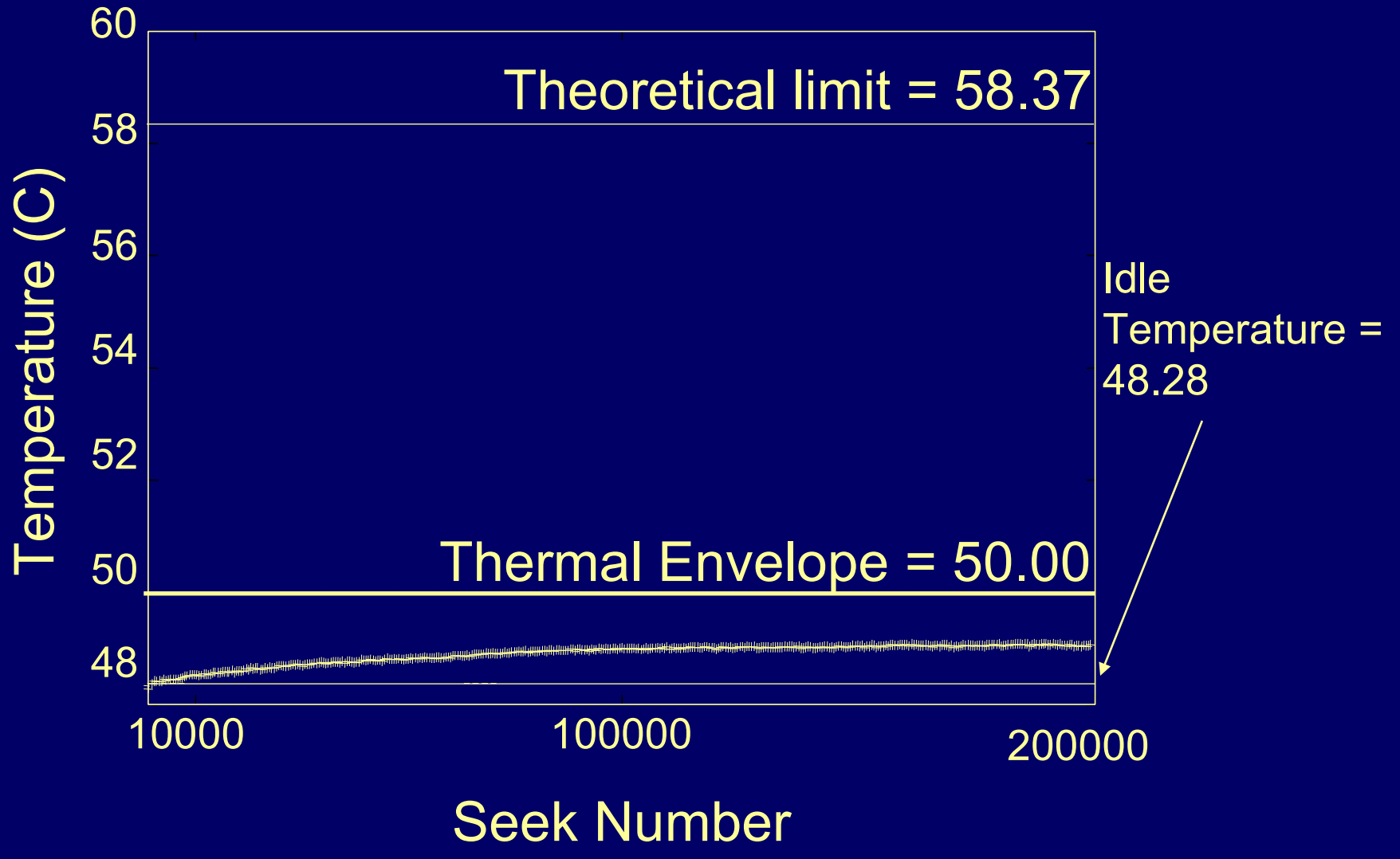
Worst Scenario Attack (No other interference)



Making the Disk Hot

- Issue hot requests or seeks
  - Must hit the disk and not hit cache
  - OS and disk I/O schedulers
  - Network latencies
  - Competing Traffic
  - Rotational Delay
  - Disk Layout

Normal Web Server Traffic



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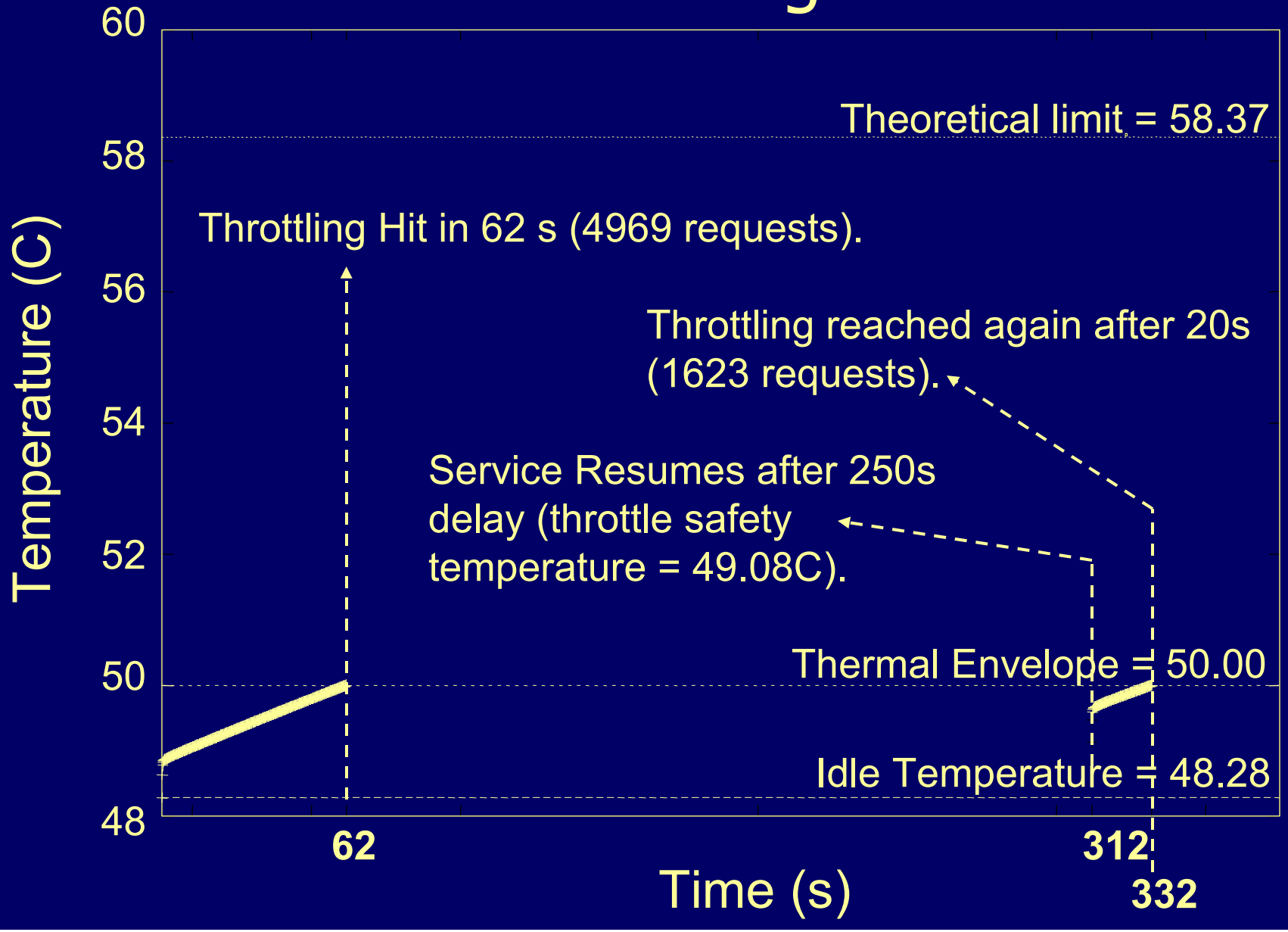

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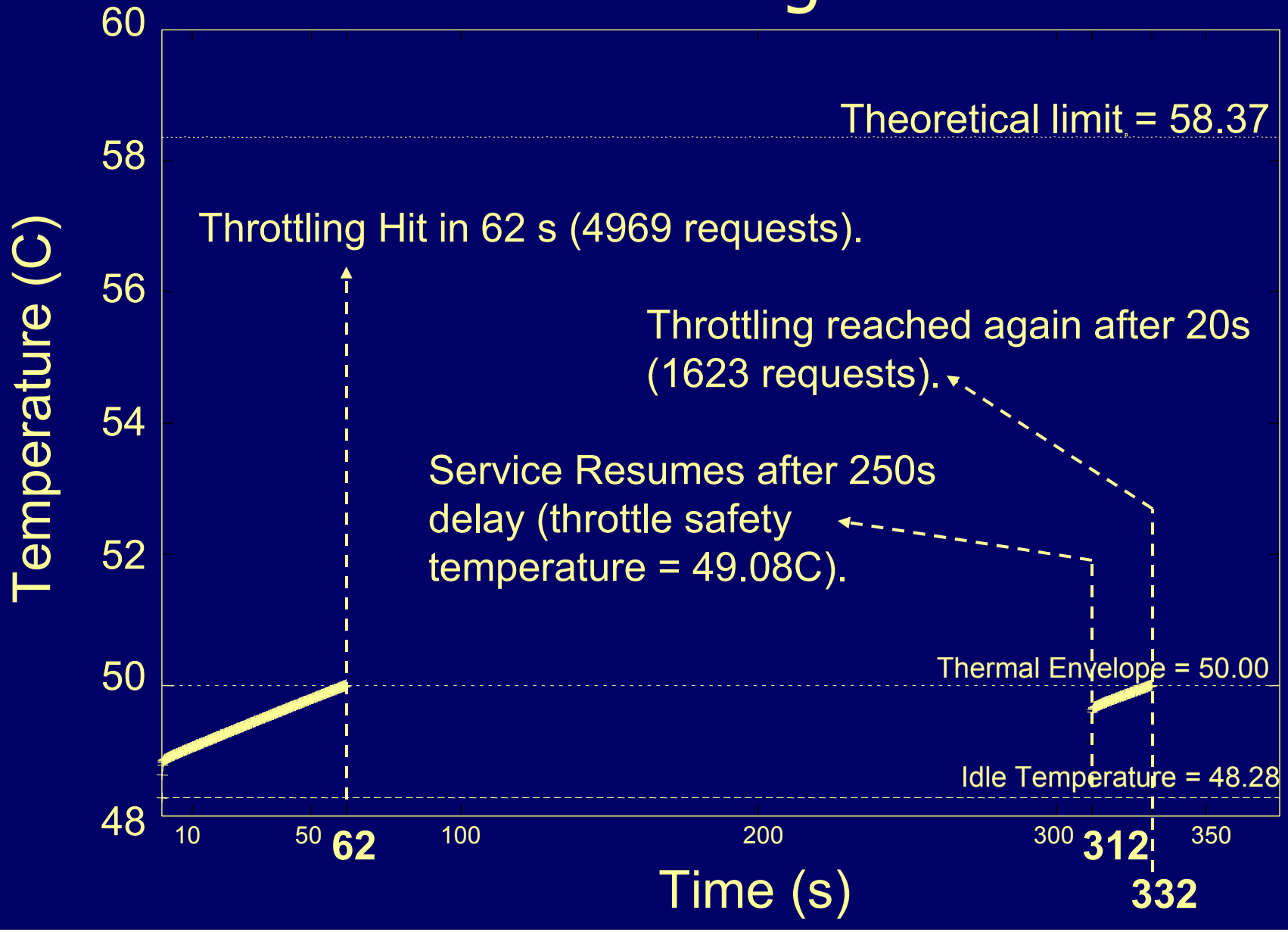

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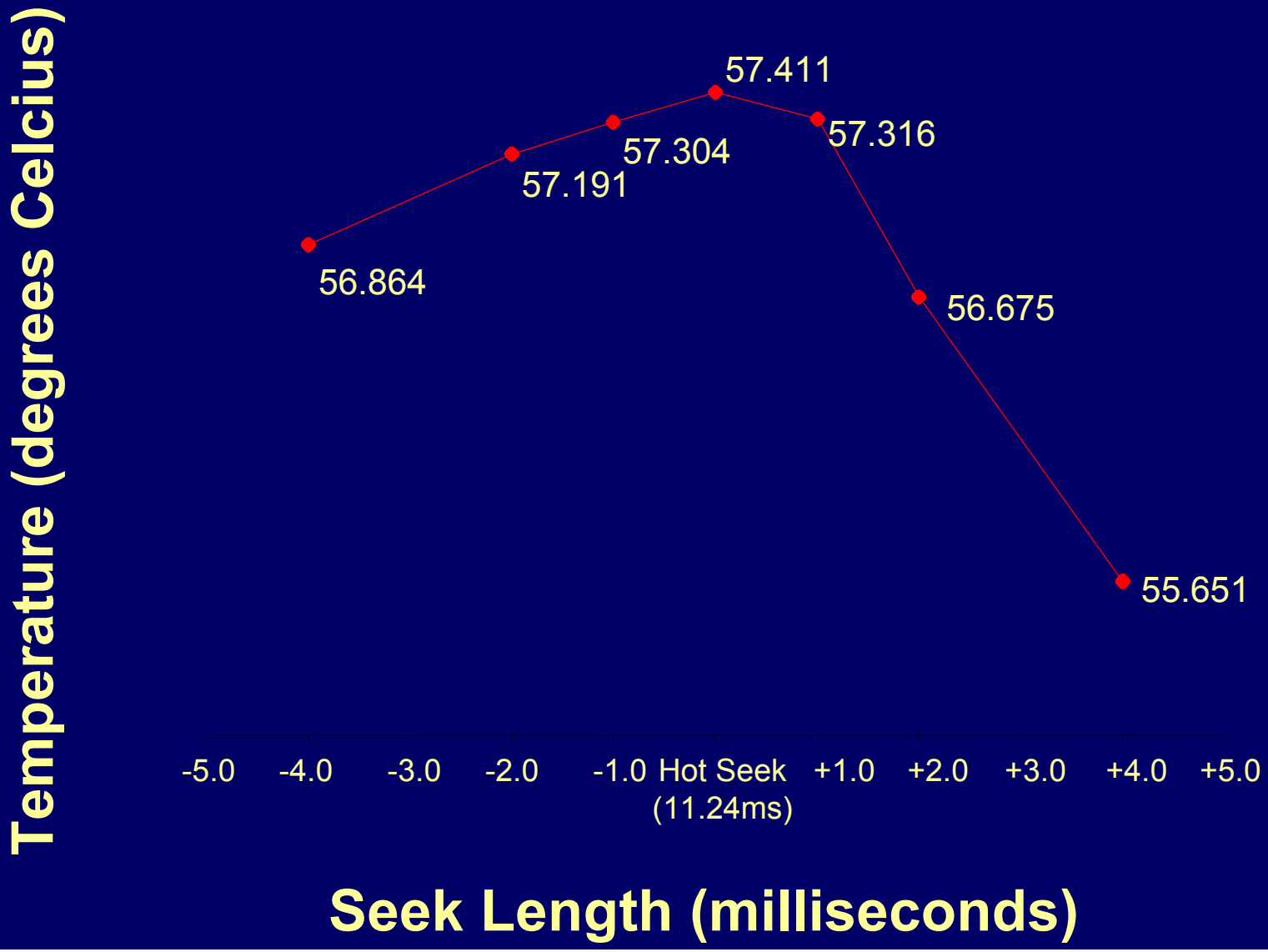

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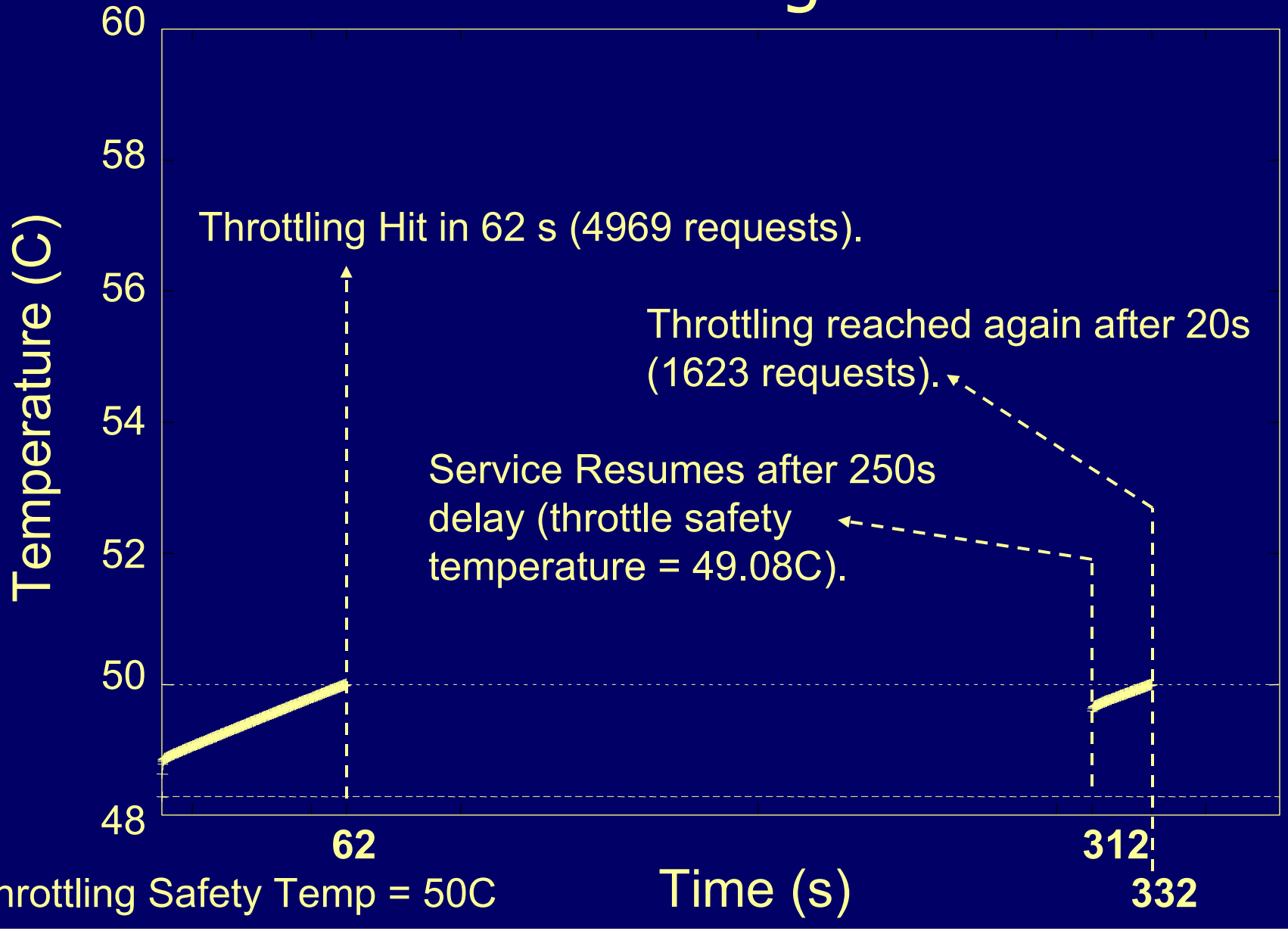

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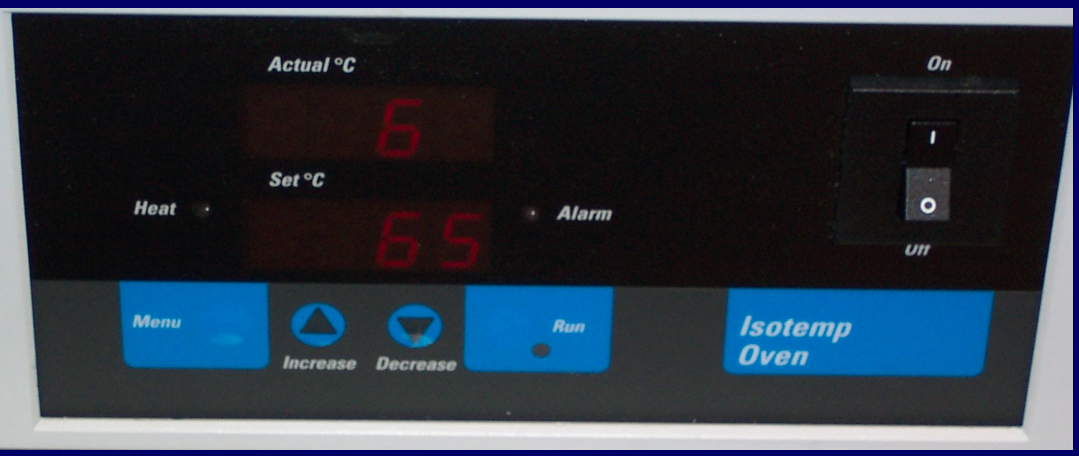

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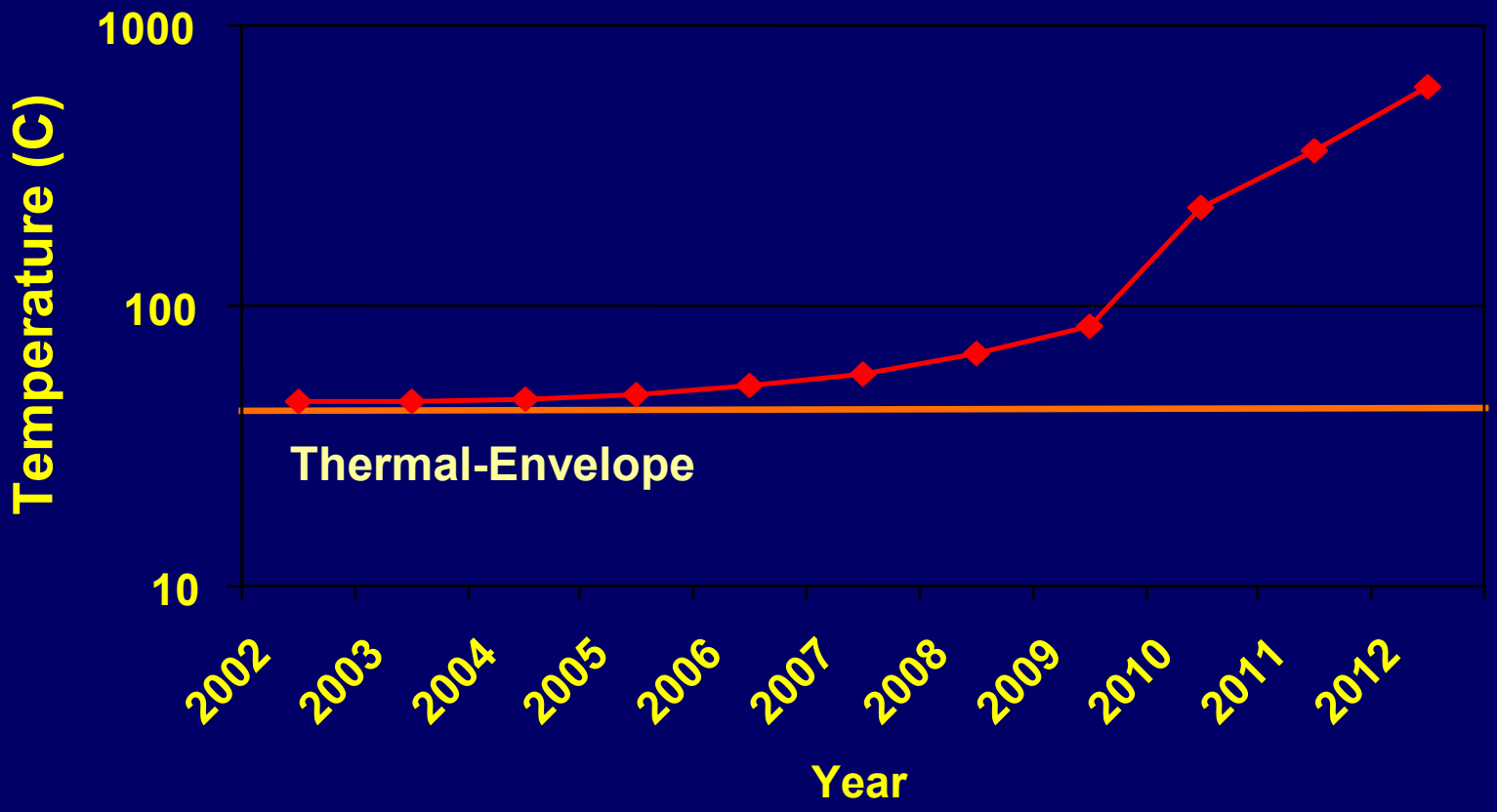
Thermal Problems in Disks



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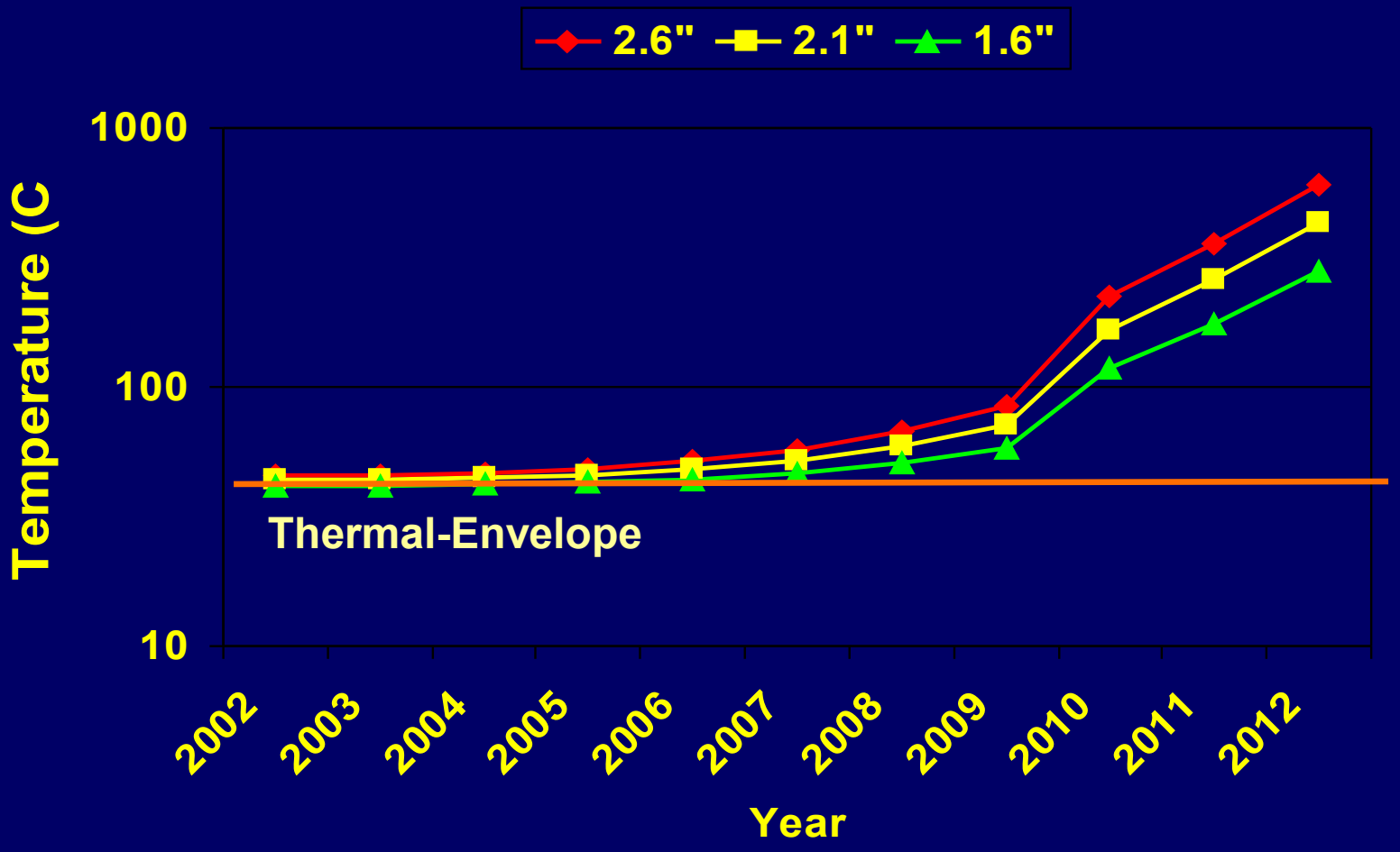

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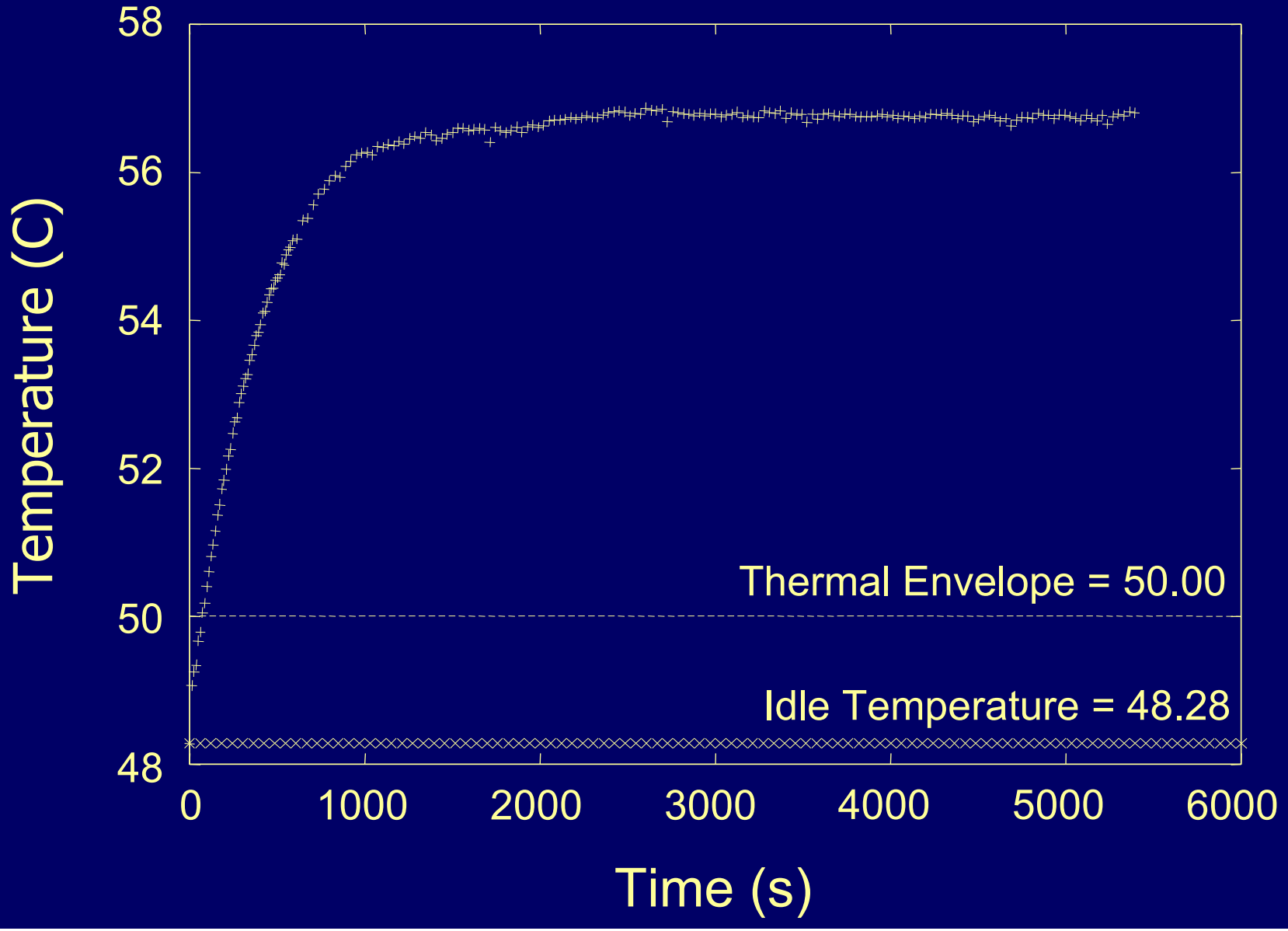

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