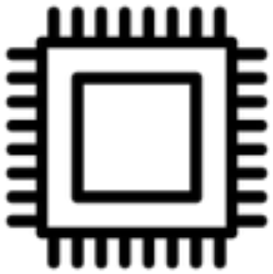
Approximate Flash Storage: A Feasibility Study

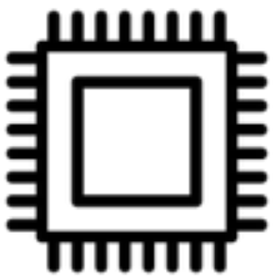
Amir Rahmati, Matthew Hicks, Atul Prakash

Introduction



Approximate computing

Introduction



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Approximate memory & storage

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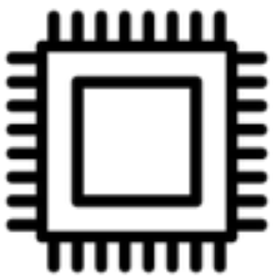

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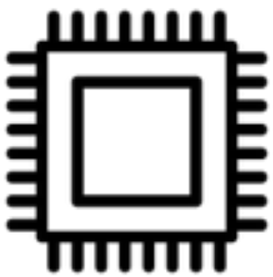

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Energy Saving / Performance Gain

Previous Work

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  Decreasing input voltage, refresh rate, number of writes

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- Under powering Flash:

  - Find minimum operable voltage (Tseng'13, Half-Wits'11)
  - 34% - 45% Energy saving
  - Repeat writes to correct error to low cases (Half-Wits'11)

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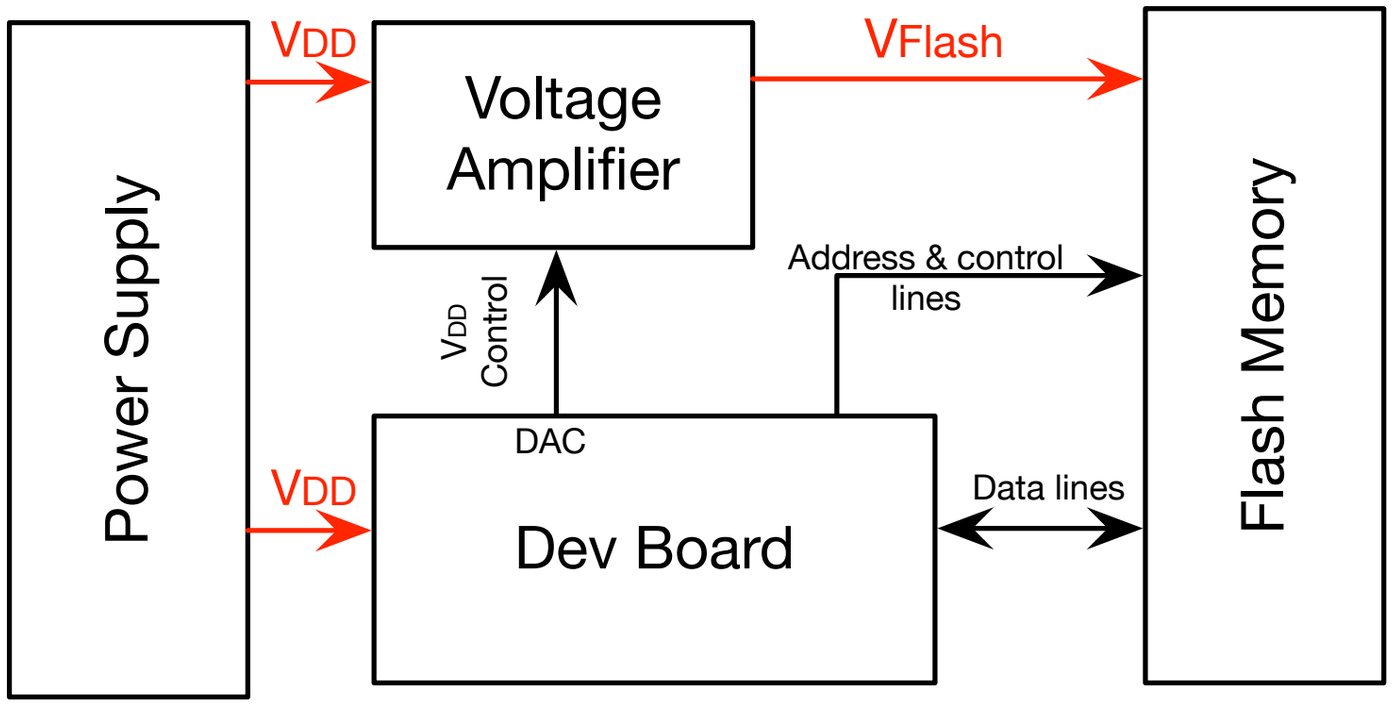
- **Summery of Findings:**
  - Spatial locality in cell volatility
  - Large effect of temperature

Build an Open Platform



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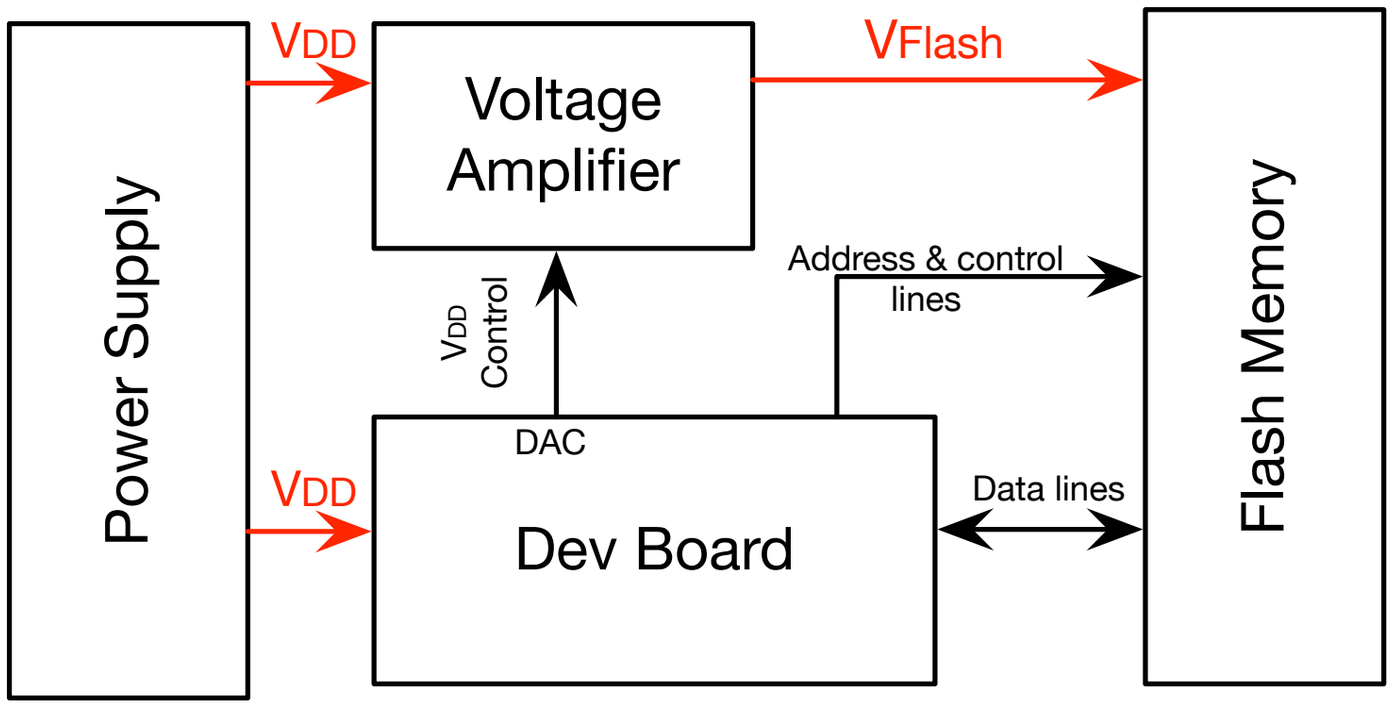
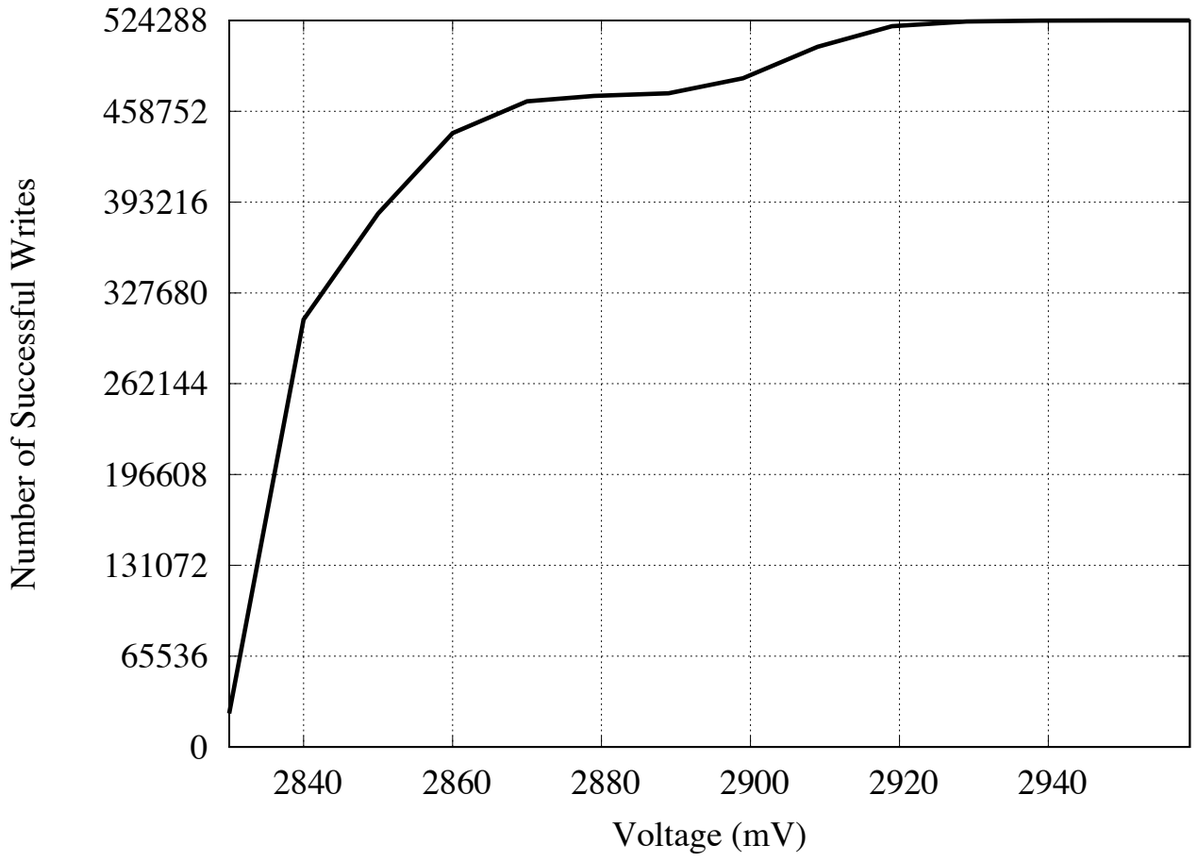


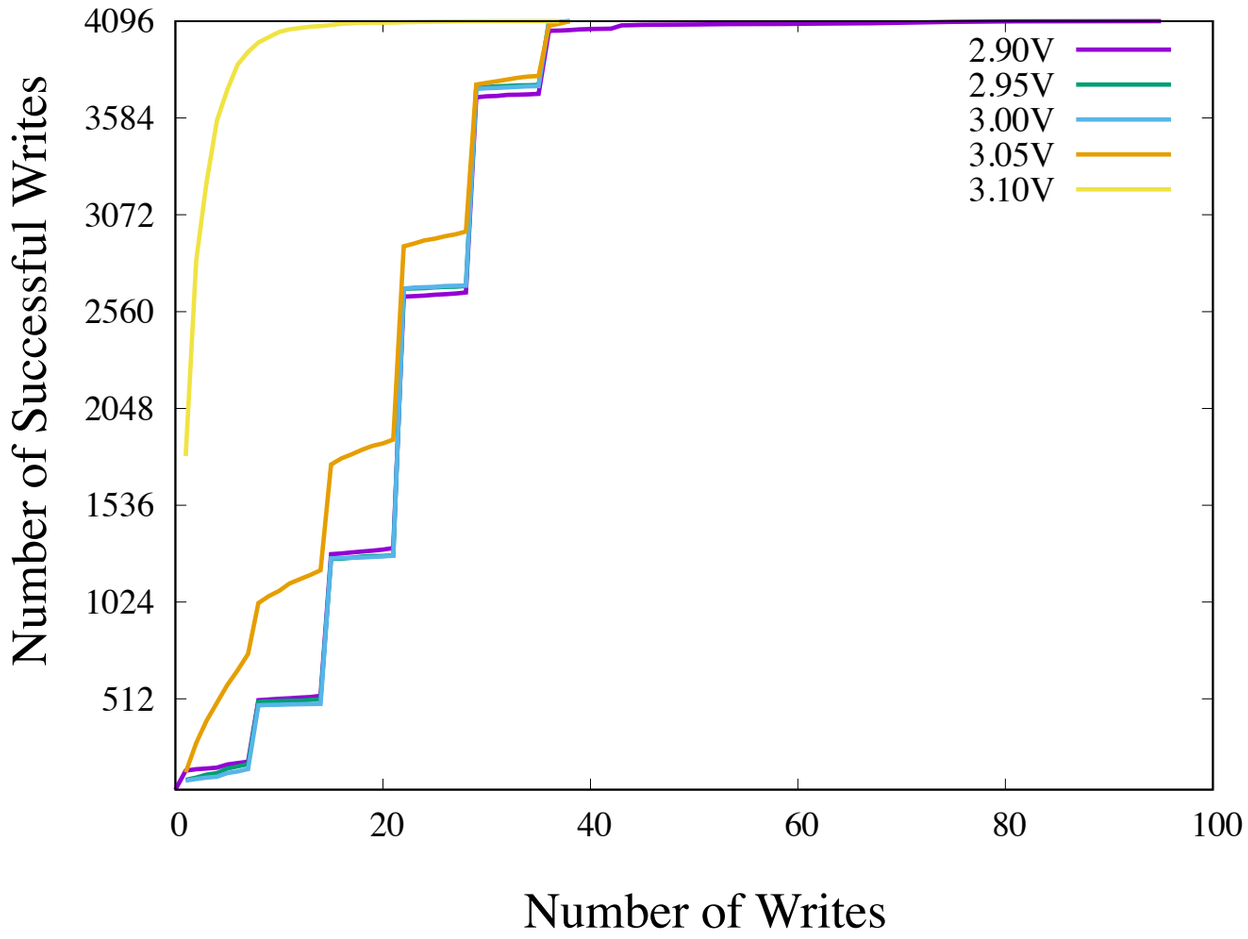
Part #, codes, and blueprints are available at

http://amir.rahmati.com

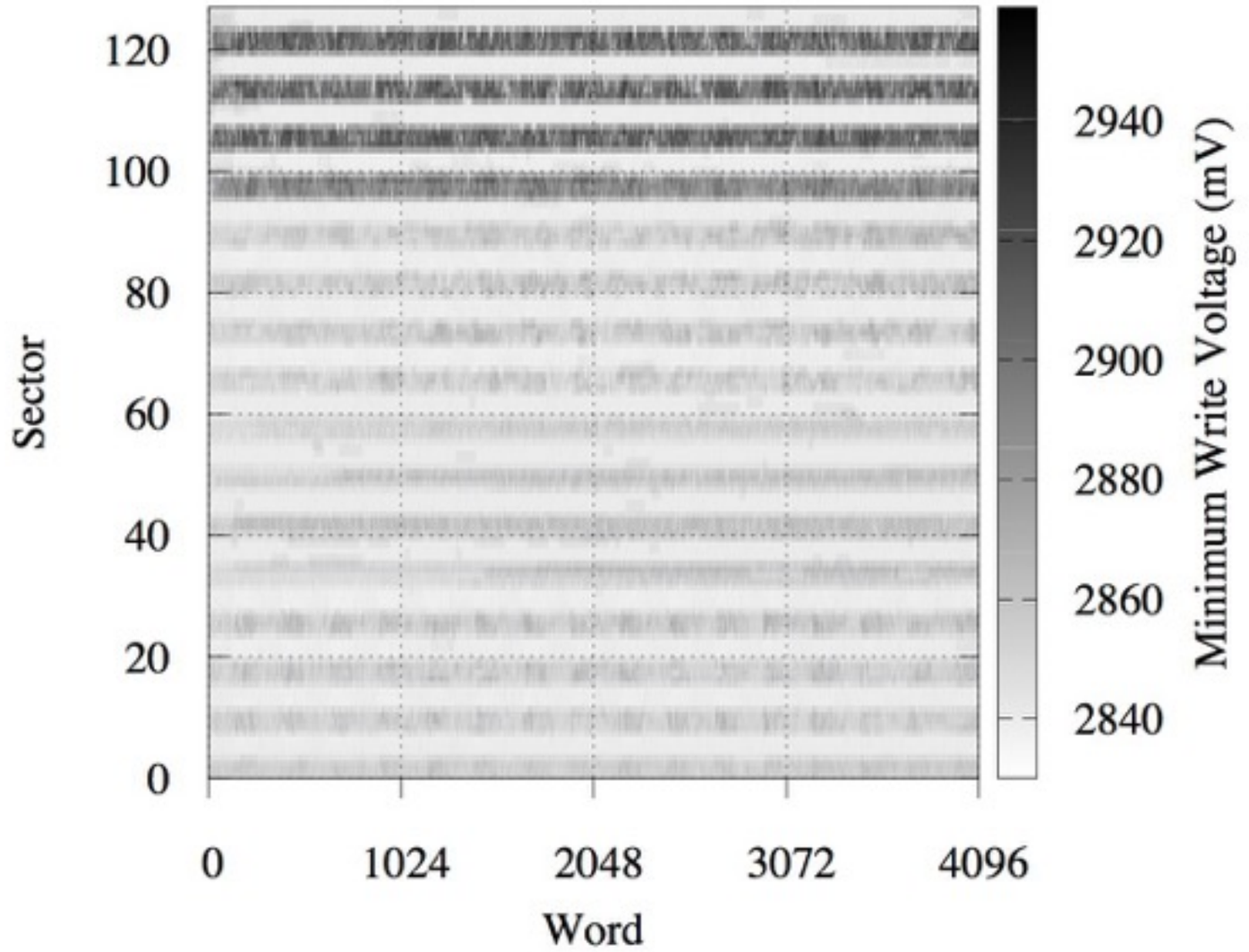
Memory cells are successfully written at a voltage well below their minimum recommended of 4.5V



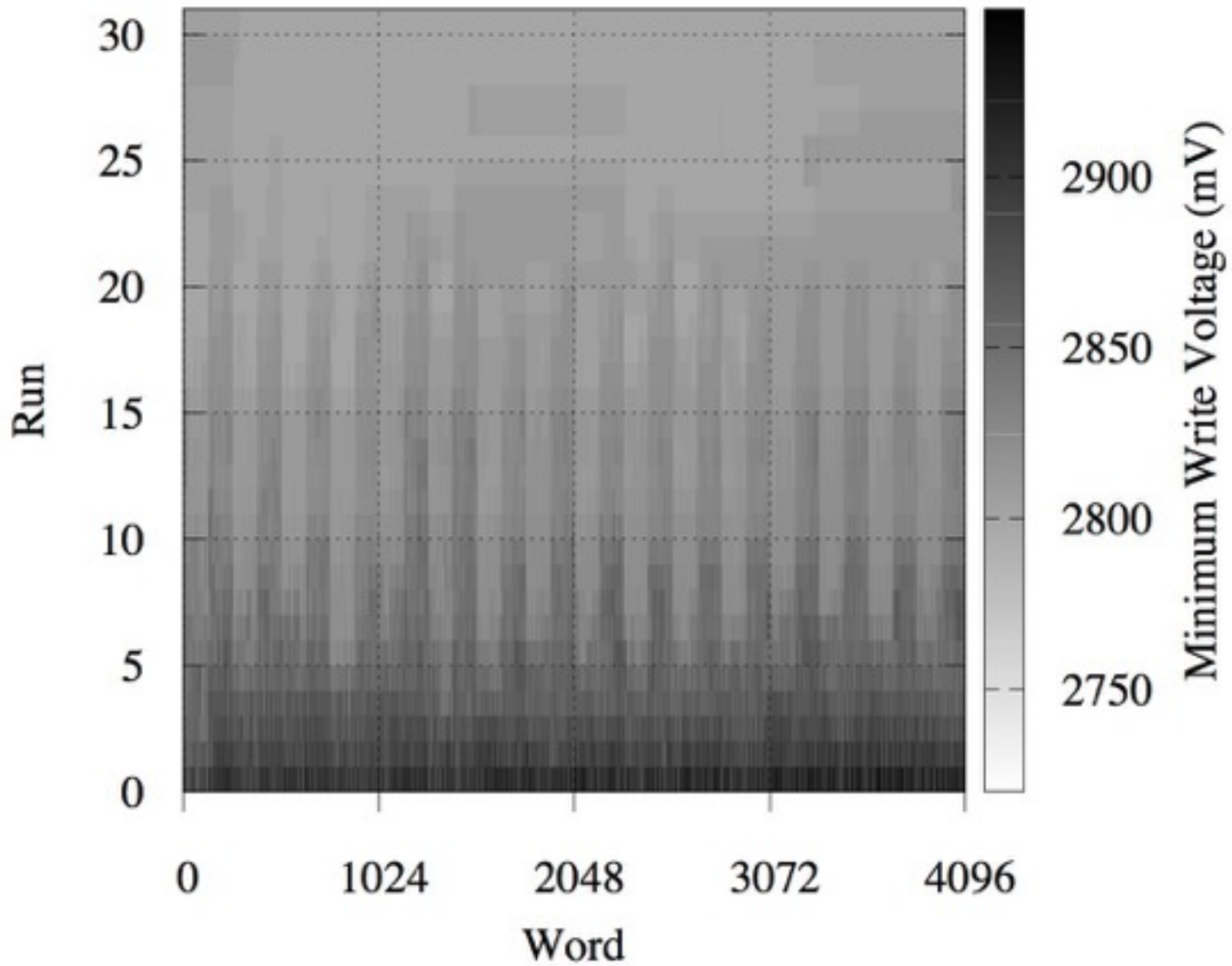
Groups of cells in a sector behave similarly to write iterations



Minimum write voltage of cells in a sector are closely related



Temperature increase caused by continuous experiments reduce minimum write voltage variations



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- Choose write location based on energy and storage availability.

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