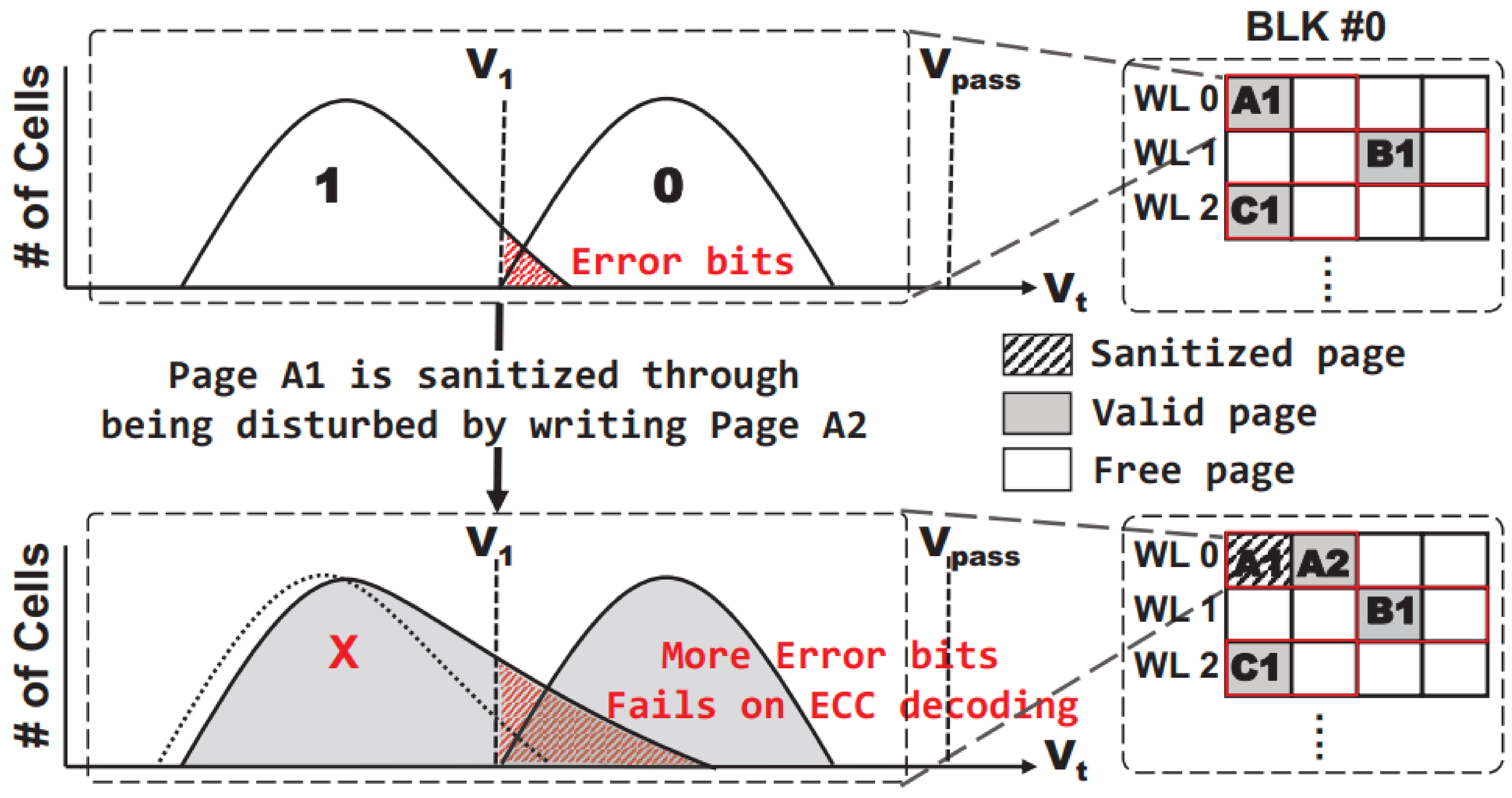
Efficient Sanitization Design for LSM-based Key-Value Store over 3D NAND Flash

Liang-Chi Chen[1], Shu-Qi Yu[2], Chien-Chung Ho[1], Wei-Chen Wang[3], Yung-Chun Li[4]

[1] CSIE, National Cheng Kung University [2] CSIE, National Taiwan University
[3] EECS, Massachusetts Institute of Technology [4] Macronix International Co., Ltd

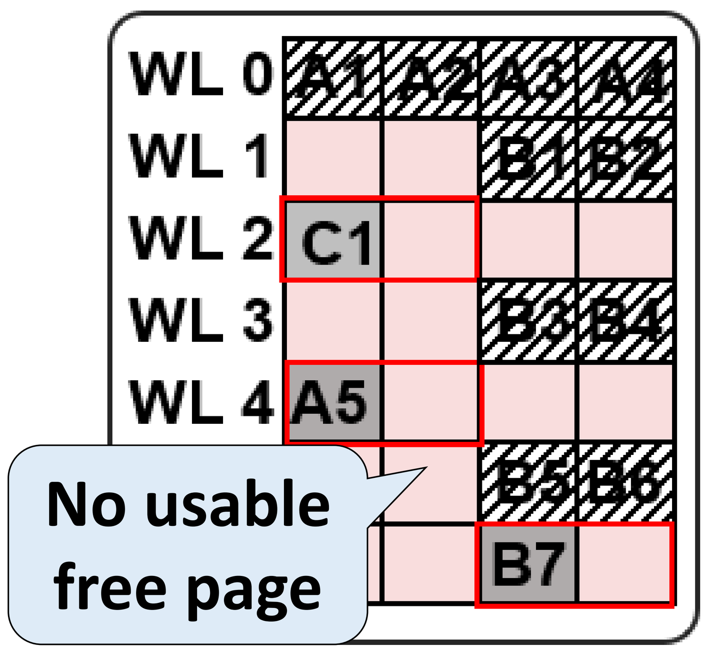
The 38th ACM/SIGAPP SAC
March 27 – 31, 2023
Tallinn, Estonia

Instantaneous Sanitization

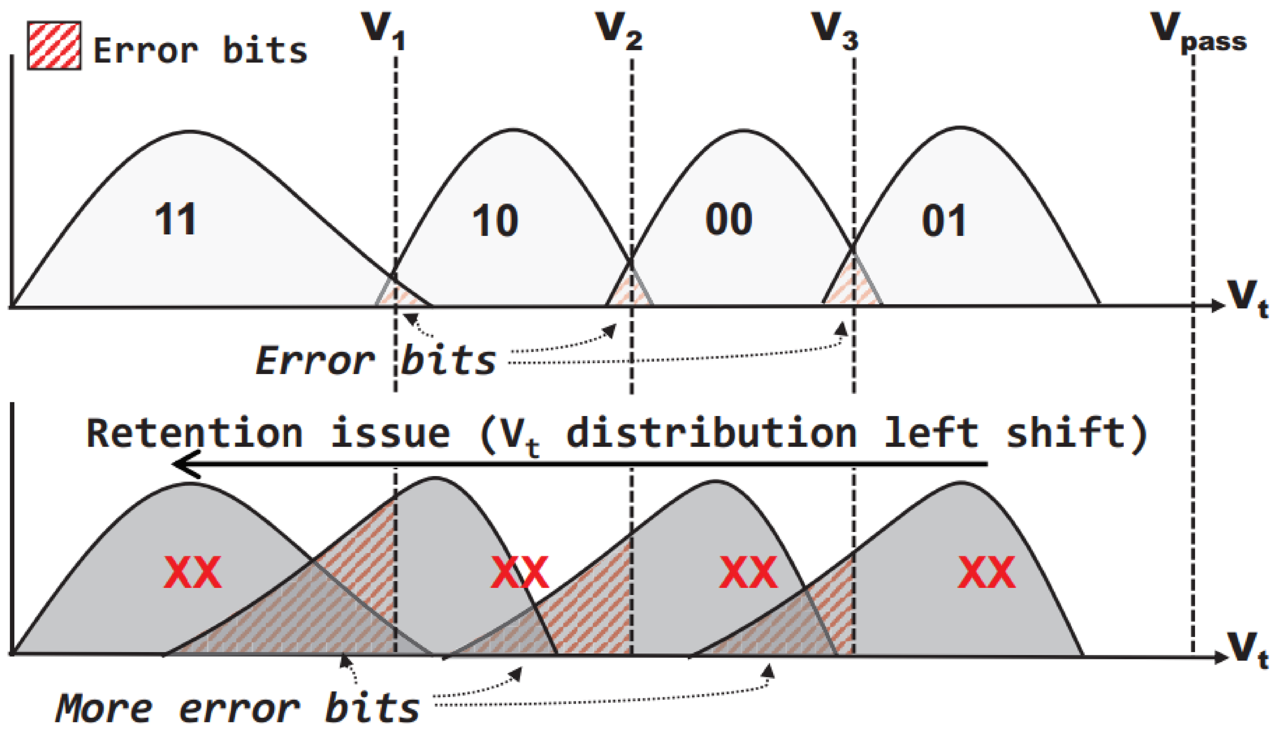


≈ *zero overhead (fast)*

1. *Only for SLC*
2. *Space waste*

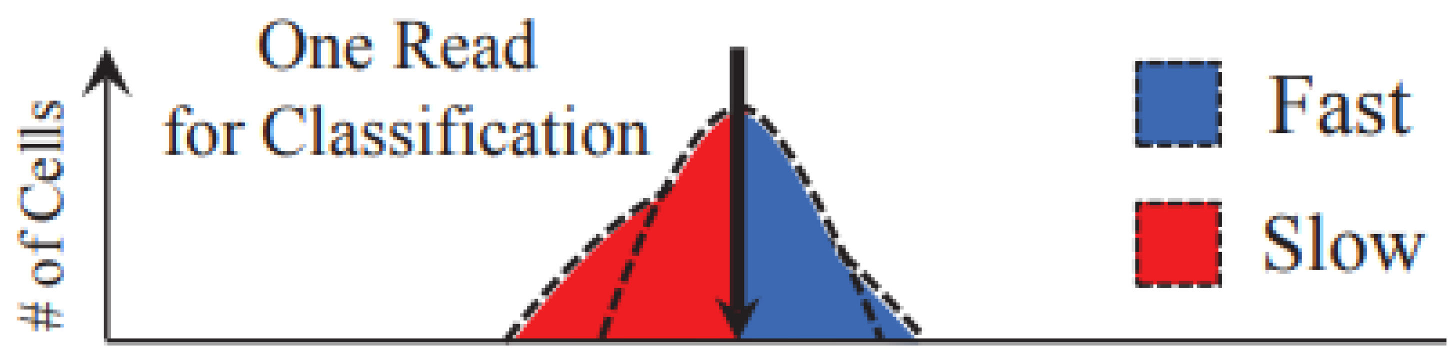


Directly adopting the instantaneous sanitization on MLC : *Poor retention*

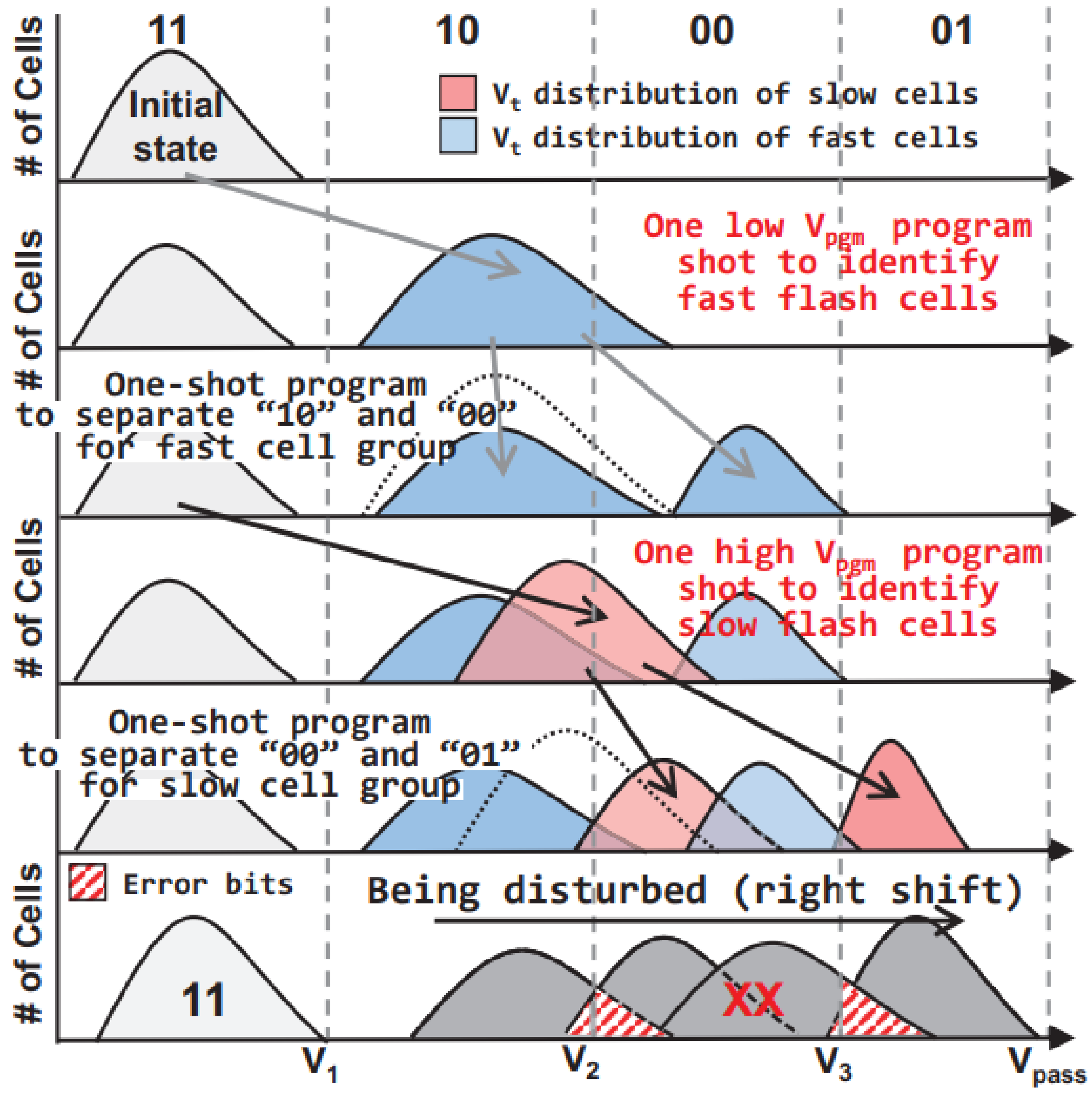


Influence-Conscious Programming

The programmability classification



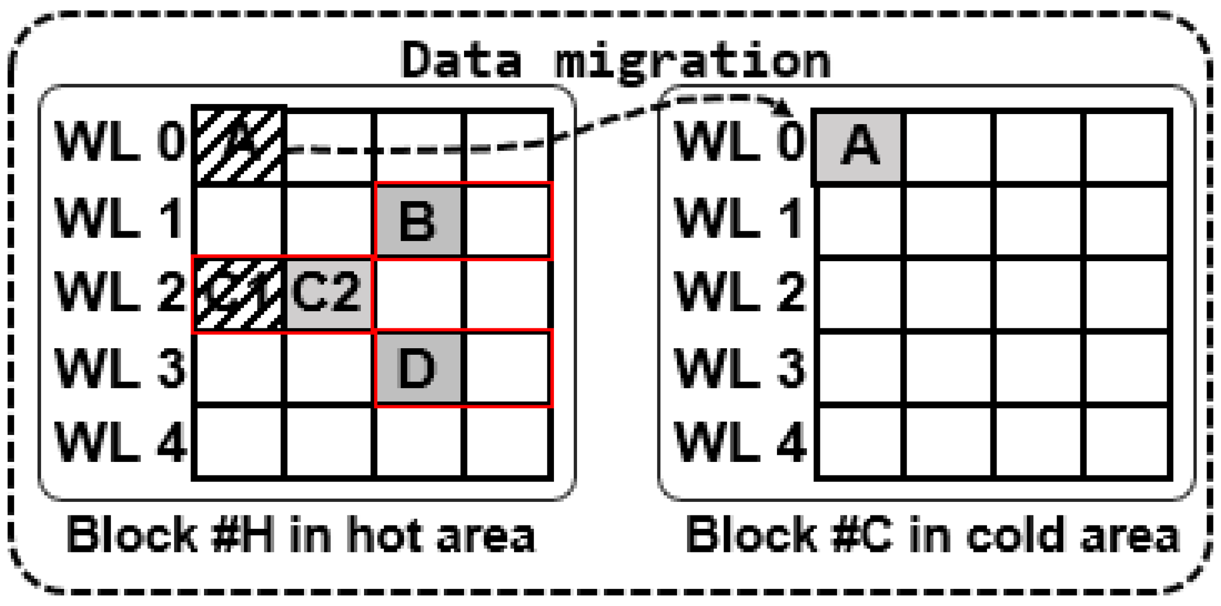
- *Fast cells help sanitization*
  - More errors to fail ECC (*easily to interference*)
- *Slow cells help improving reliability*
  - No charge loss (*easily to keep in the current Vt*)



Hot-Cold Separation Allocation Policy

- *Hot area: Using ICP (better sanitization performance)*
- *Cold area: Using scrubbing (better space usage)*

Cold data identifying is supported by compaction in LSM-tree



Experiment Result