Supplementary Information

Annealing Accelerator for Ising Spin Systems based on In-memory Complementary 2D FETs

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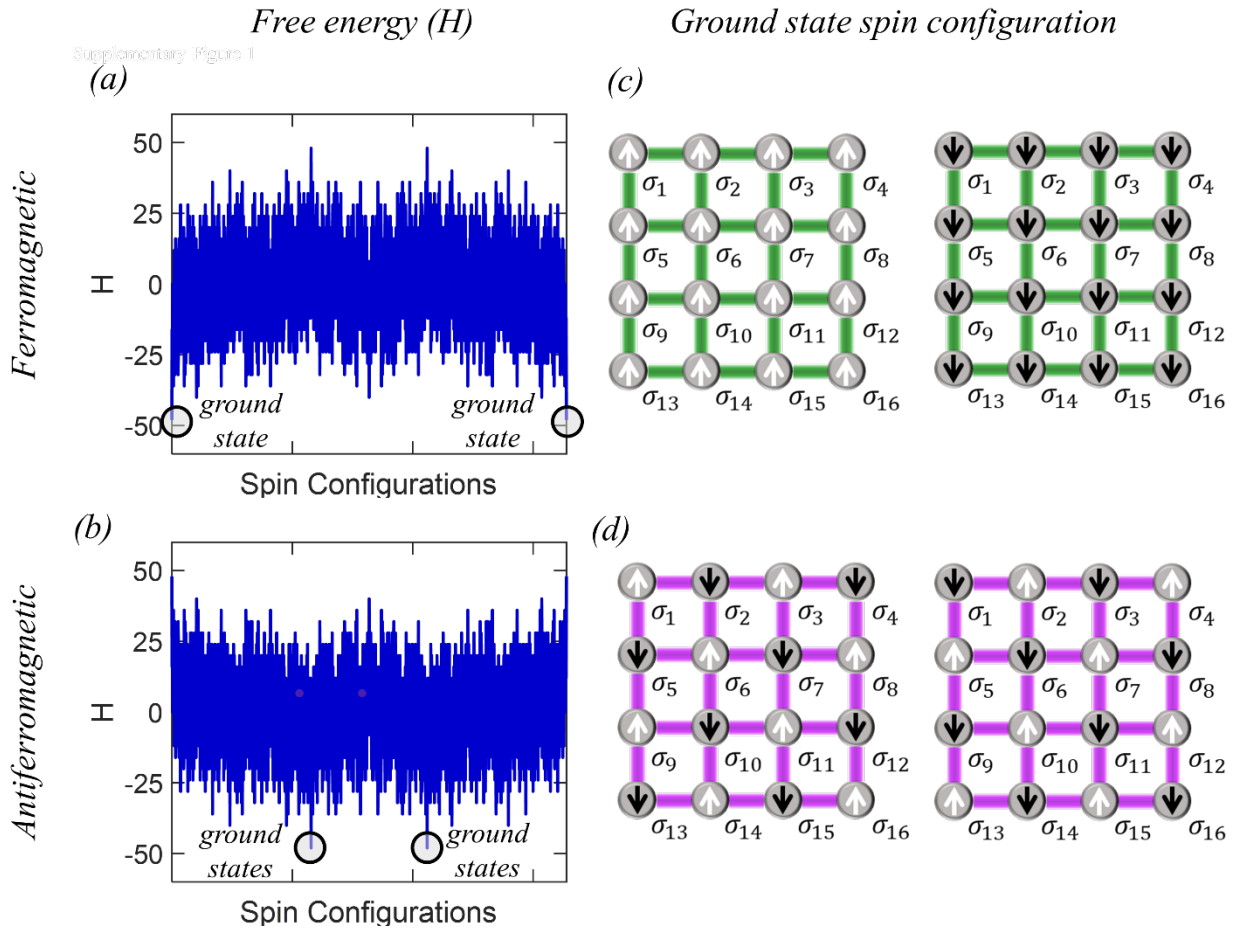
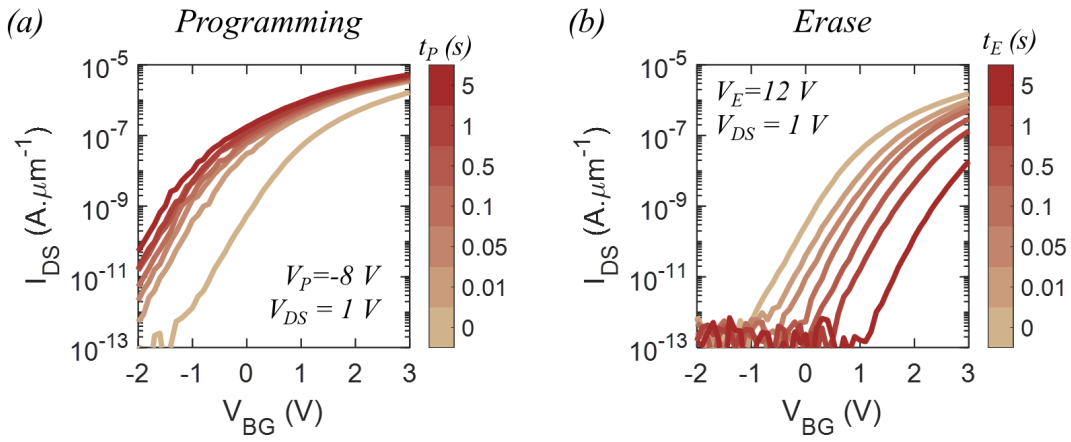
Supplementary Figure 1



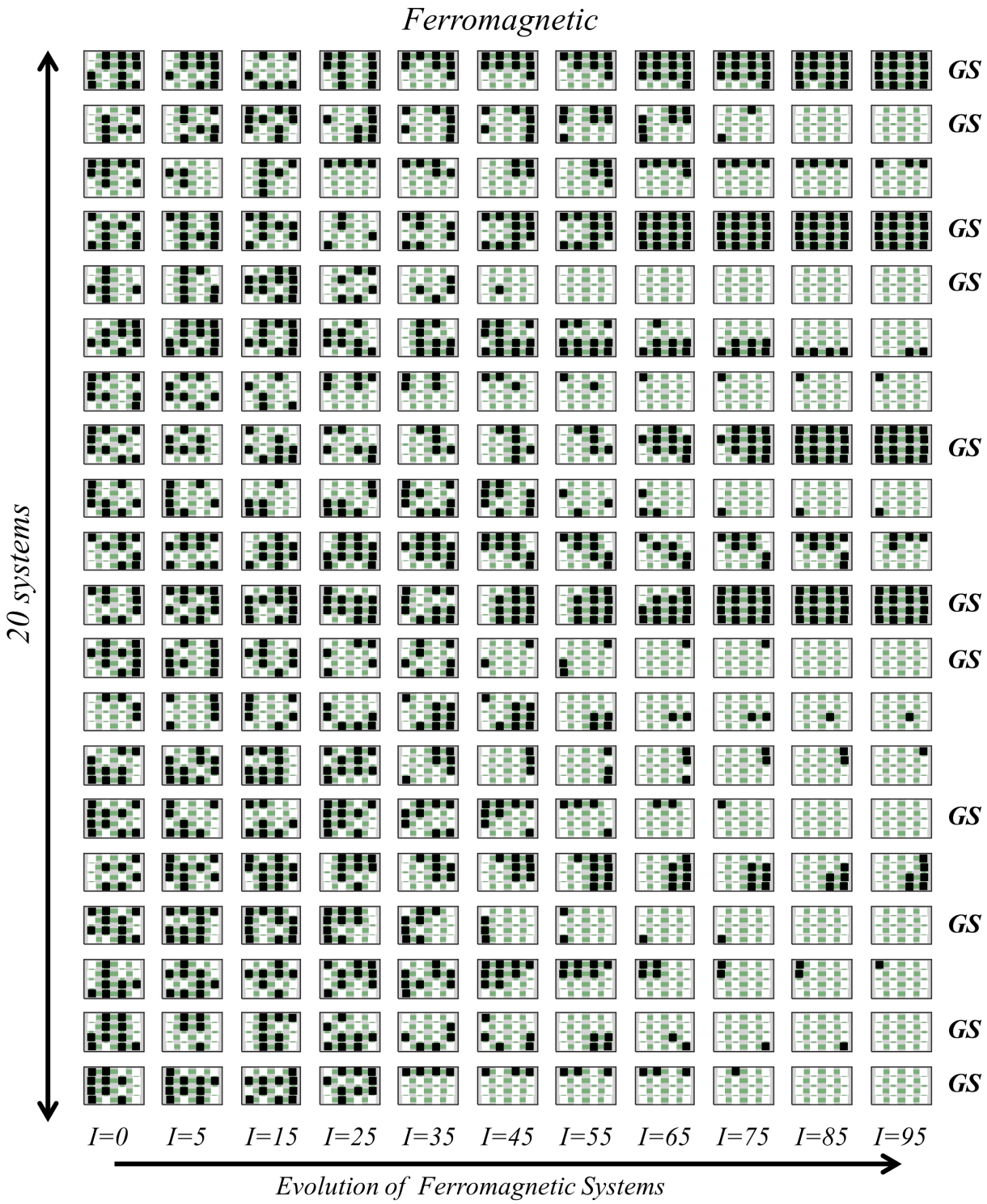
Supplementary Figure 1. Ferromagnetic and antiferromagnetic spin systems. *Free energy (H) for a* 4×4 *a) ferromagnetic and b) antiferromagnetic systems with ground states degeneracy of 2. Corresponding ground-state spin configurations for a) ferromagnetic and b) antiferromagnetic systems.*

Supplementary Figure 2



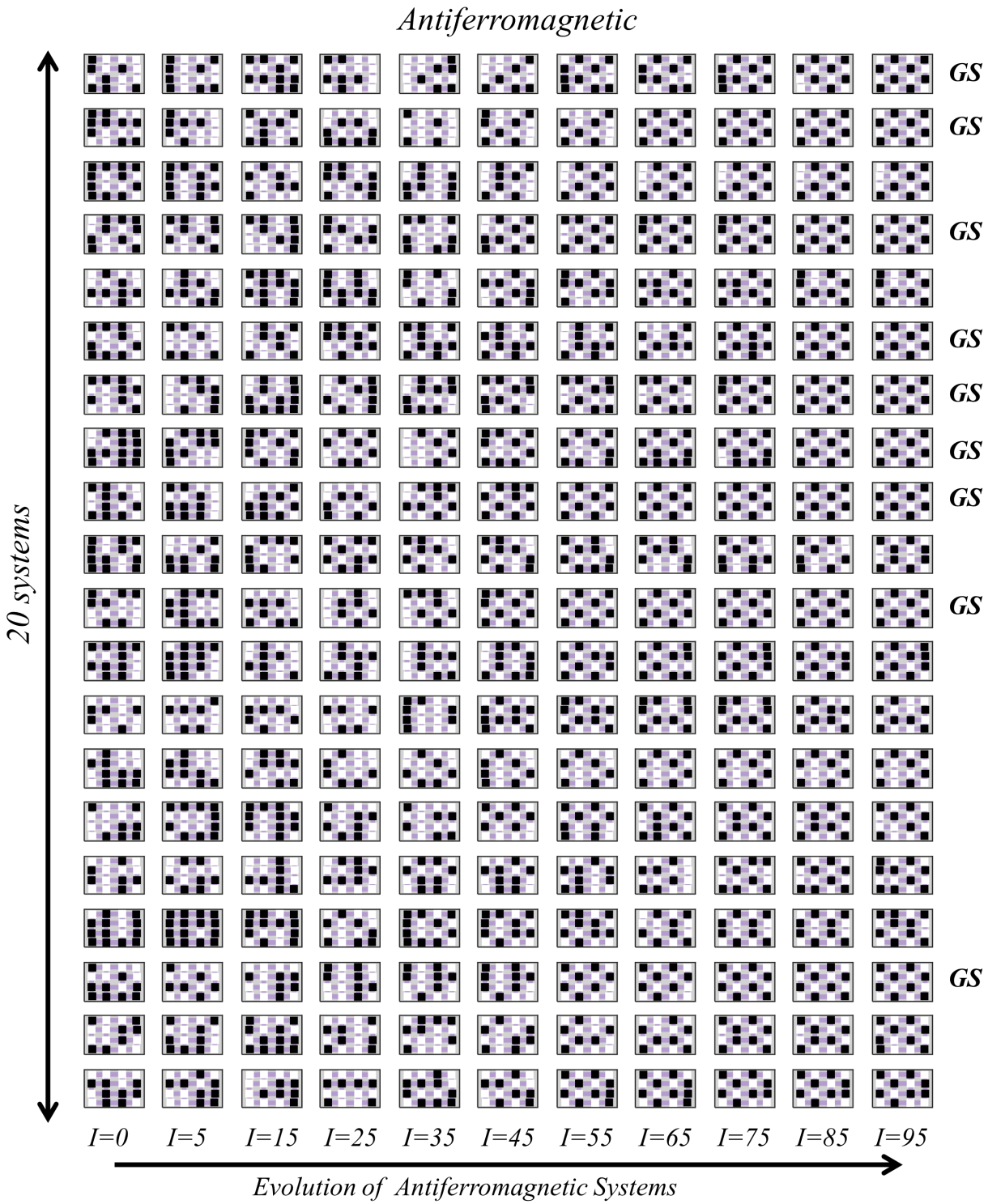
Supplementary Figure 2. Pulse width dependent programmability of MoS_2 FET. *a) Transfer characteristics of post-programmed MoS_2 FET by applying constant Vp for varying t_P. b) Transfer characteristics of post-erased MoS_2 FET by applying constant V_E for varying t_E*

Supplementary Figure 3



Supplementary Figure 3. Experimental demonstration of SA on ferromagnetic system. *Progression of 20 randomly initiated 4×4 ferromagnetic systems as successive iterations (I) are performed using SA in hardware. 11 systems converged and reached their ground states.*

Supplementary Figure 4

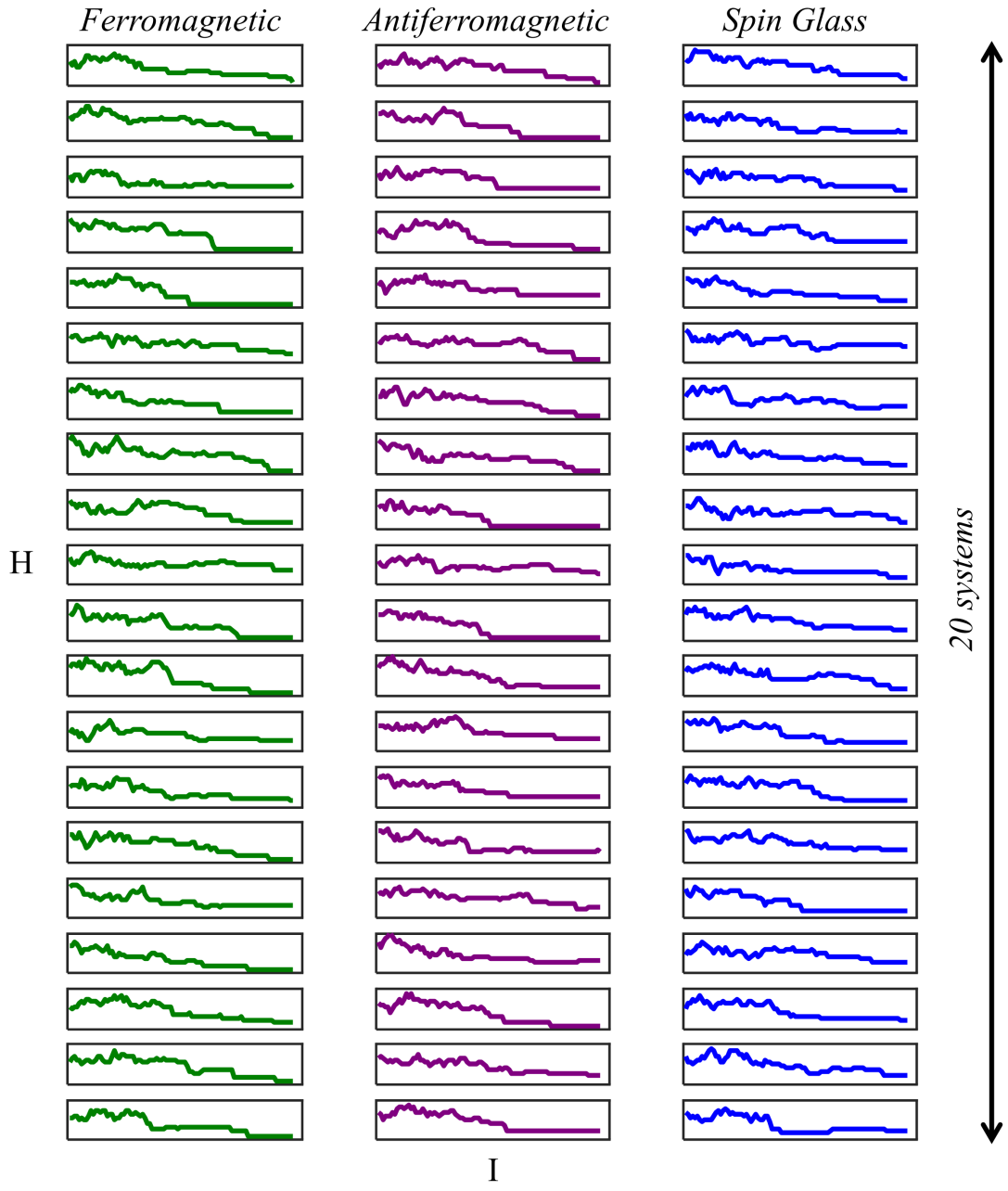


Supplementary Figure 4. Experimental demonstration of SA on antiferromagnetic system. *Progression of 20 randomly initiated 4×4 antiferromagnetic systems as successive iterations (I) are performed using SA in hardware. 9 systems converged and reached their ground states.*

Supplementary Figure 5

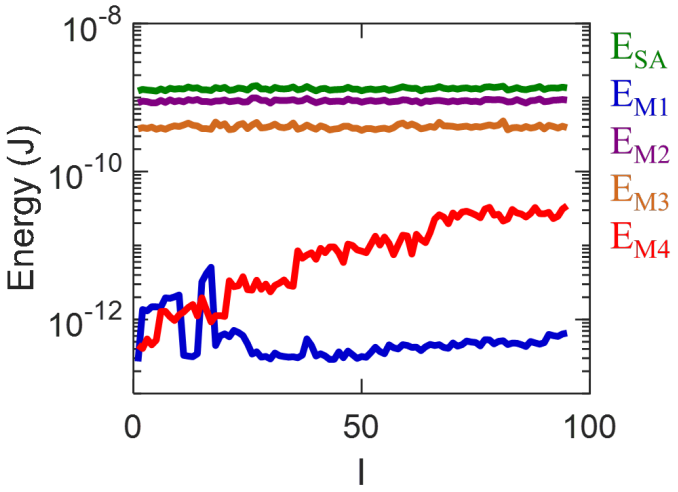
Supplementary Figure 5. Experimental demonstration of SA on a spin glass system. *Progression of 20 randomly initiated 4×4 spin glass system systems as successive iterations (I) are performed using SA in hardware. 8 systems converged and reached their ground states.*

Supplementary Figure 6



Supplementary Figure 6. Evolution of free energy (H) during SA. *Evolution of free energy (H) for 20 ferromagnetic, antiferromagnetic and spin glass systems as a function of iterations.*

Supplementary Figure 7



Supplementary Figure 7. Energy expenditure for hardware acceleration of SA. *Energy expenditure by hardware modules M1 (E_{M1}), M2 (E_{M2}), M3 (E_{M3}), M4 (E_{M4}), and total energy (E_{SA}) averaged over 60 spin systems as a function of iterations (I).*