Special Topics on Basic EECS I Design Technology Co-Optimization

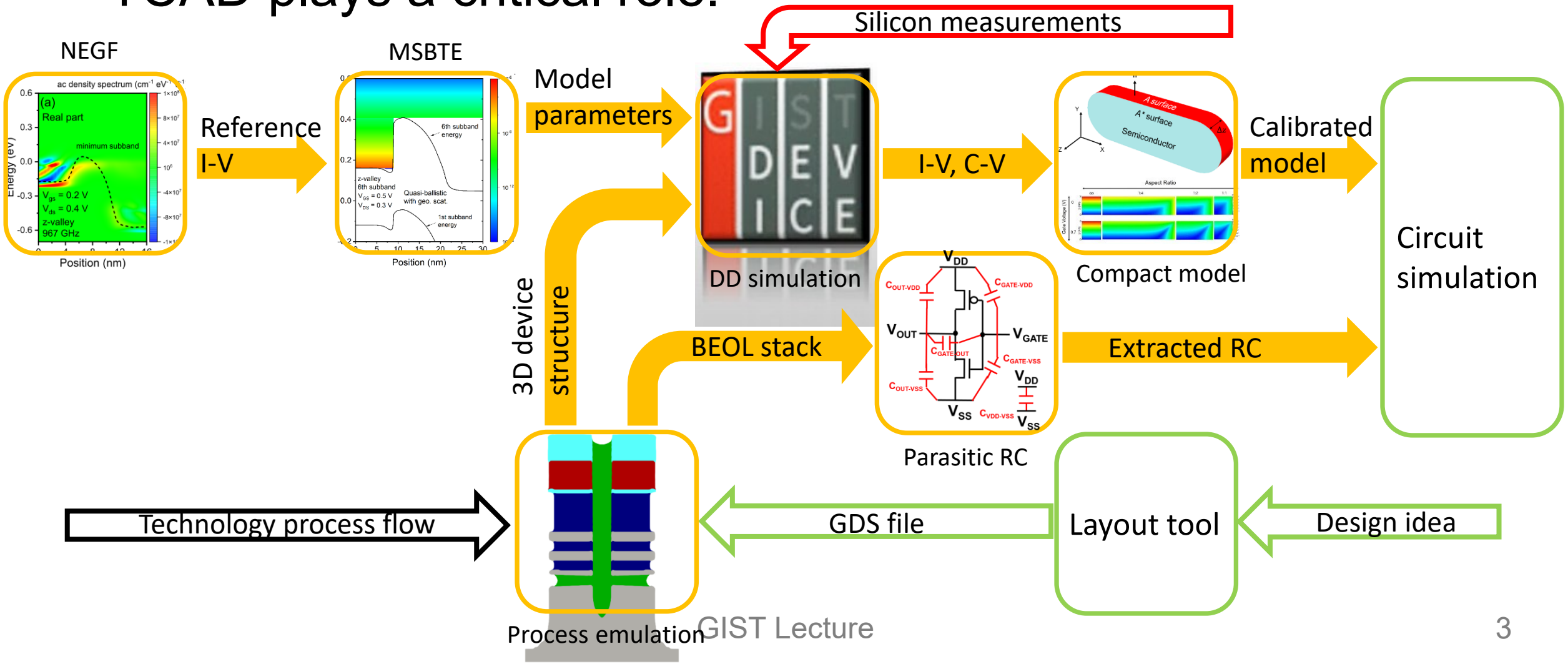
Lecture 24

Sung-Min Hong (smhong@gist.ac.kr)
Semiconductor Device Simulation Laboratory
Department of Electrical Engineering and Computer Science
Gwangju Institute of Science and Technology (GIST)

L24

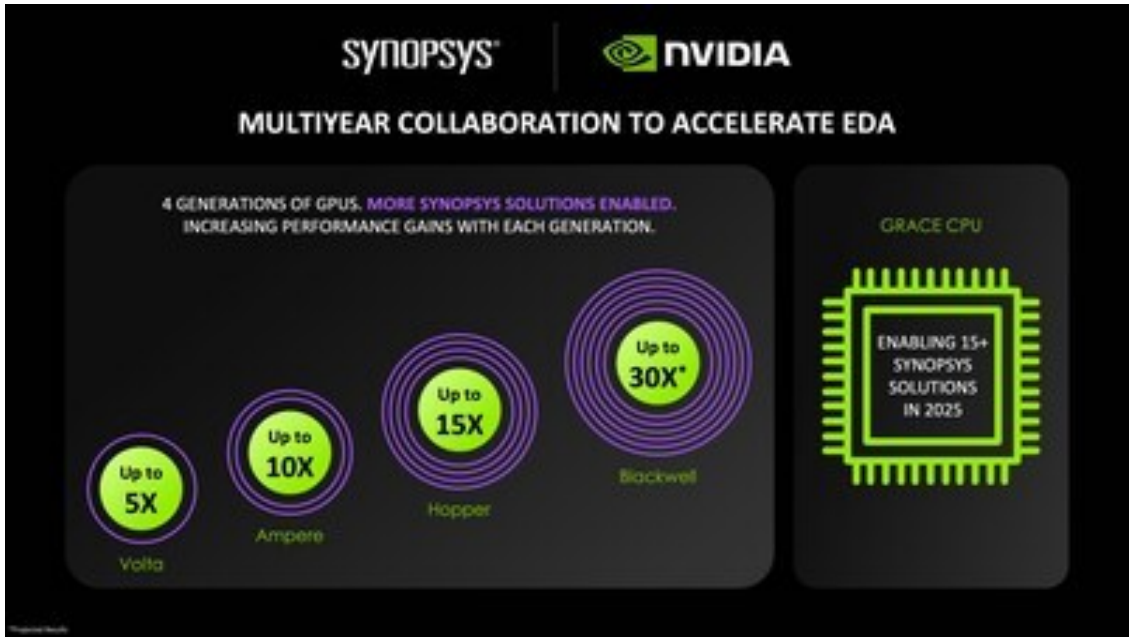
Future perspective of DTCO

- TCAD plays a critical role.



Acceleration of simulation tools

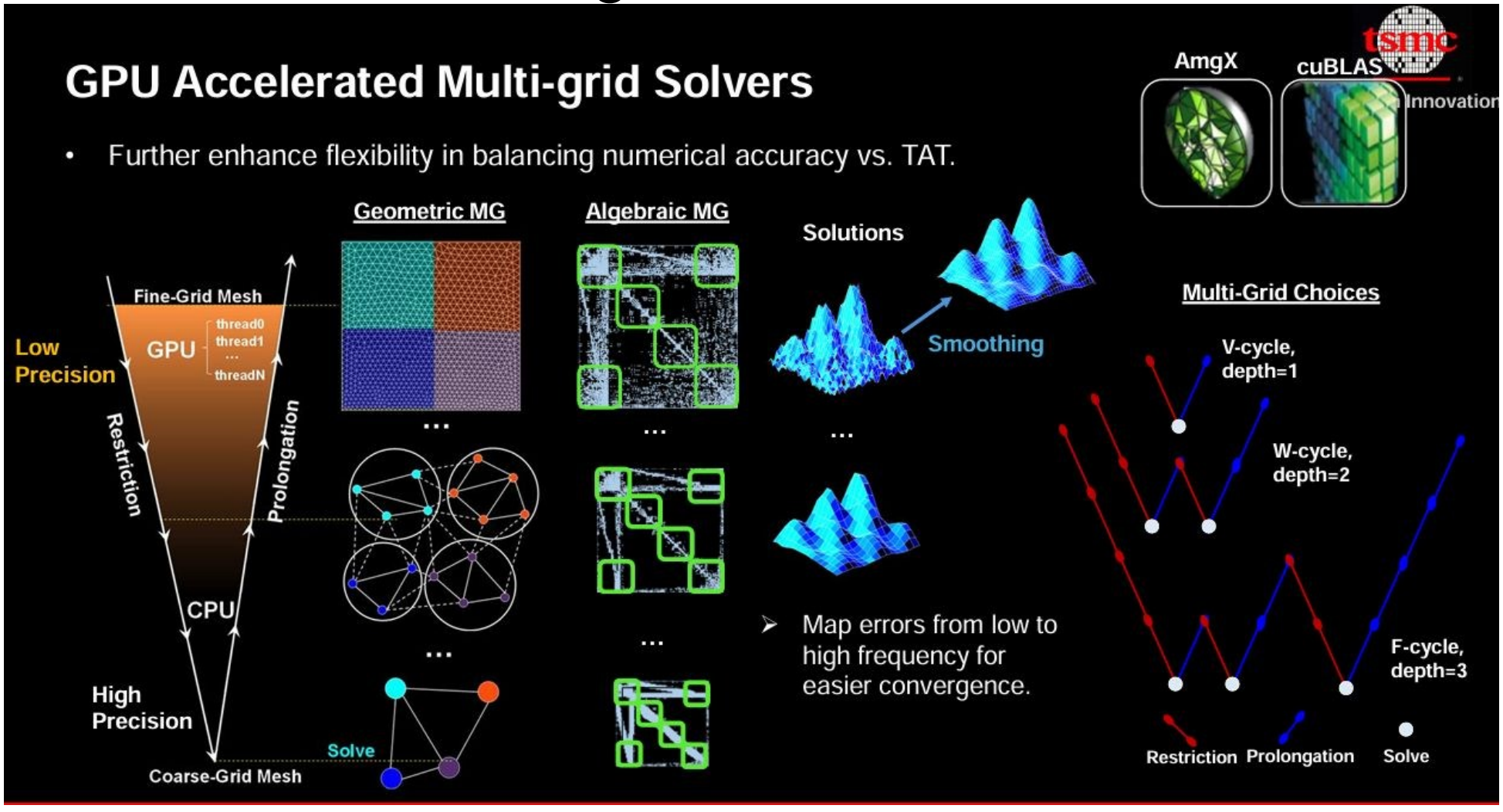
- Press release on March 18, 2025
  - Early results applying GPU-enabled capabilities and NVIDIA CUDA-X libraries to the Synopsys Sentauras™ TCAD process and device simulation solution is projected to accelerate time to results up to 10x.



NVIDIA GTC AI Conference presentation (Synopsys)

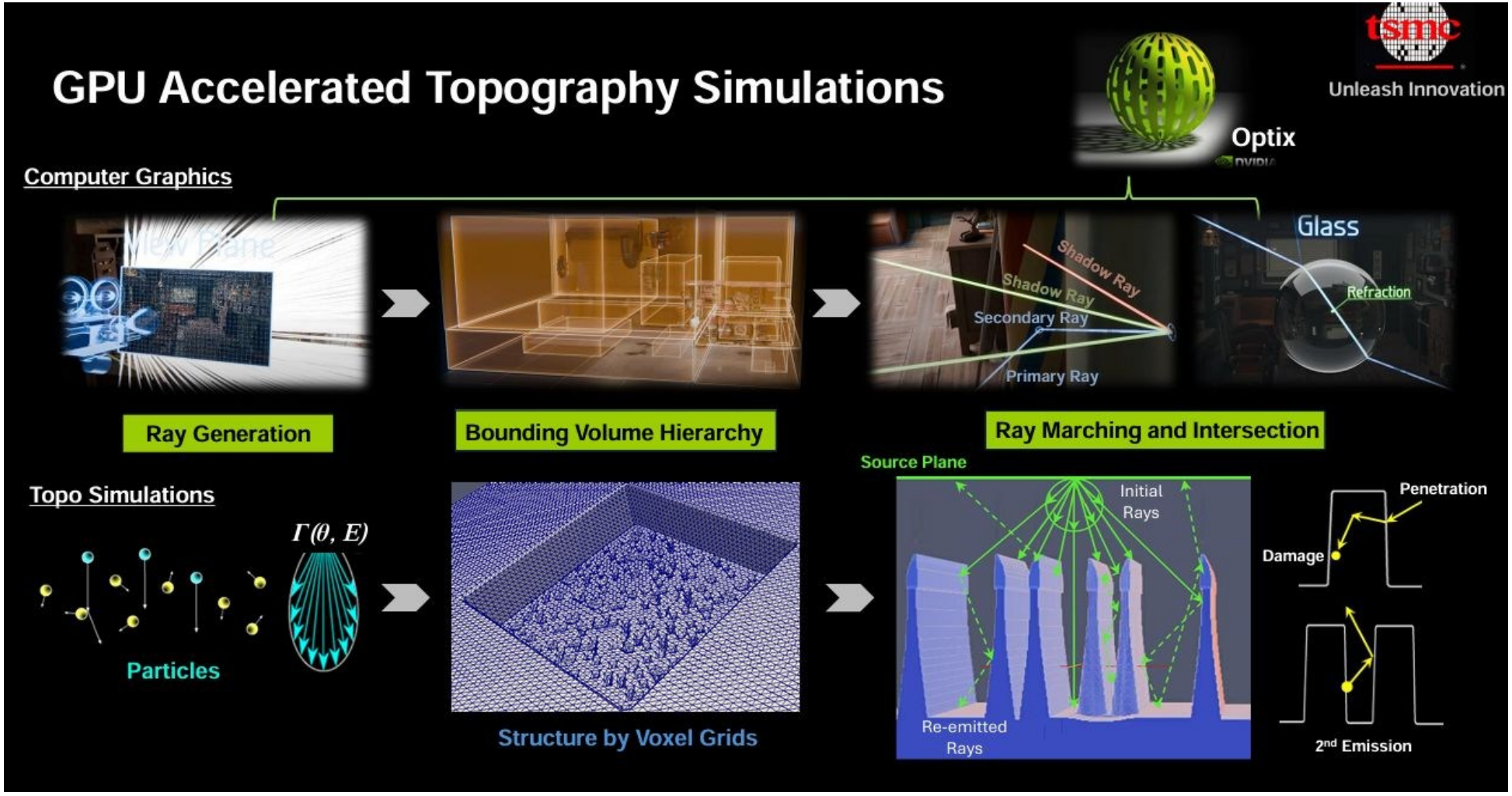
TSMC presentation @ NVIDIA GTC (1)

- GPU accelerated multi-grid solvers



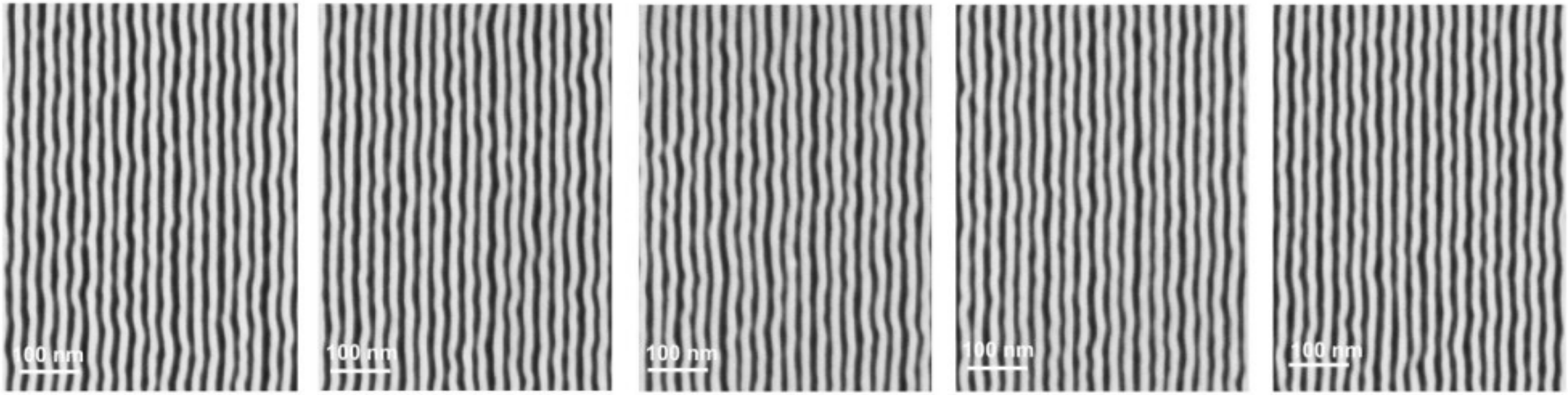
TSMC presentation @ NVIDIA GTC (2)

- GPU accelerated topography simulations



Variability

- We consider the “norminal” device.
  - In real manufacturing, we cannot perfectly control the variability.
  - Variability sources: Random dopant fuluctiaon, line edge roughness, workfunction variation, inner spacer variation, …



SEM images of 28-nm pitch Si fins (D. Dixit et al.)

Digital twin

- A buzzword
  - Difference between TCAD model & digital twin?

	Model	Digital twin
Purpose	High-fidelity physics simulation	Real-time virtual replica
Operation	Offline, static analysis	Online, continuously updated
Data flow	No real-time data	Connected to sensors & fab data streams
Updates	Manual parameter updates	Data-driven automated updates
Use case	R&D, process modeling, device exploration	Manufacturing control, predictive maintenance, system optimization

Thank you!