

# On-the-Fly ML model for Future 3D NAND Trim Optimization



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W



[Public]

WISH 2025 (→) AI Technical Session

Rachel Son, Youtian Zhang, Wei Cao, Xiang Yang, DeepanShu Dutta

# NANDISK™



## Rachel Son



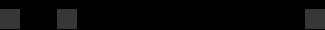
**Staff Engineer,  
Technology Development Engineering**

**On-the-Fly ML model for  
Future 3D NAND Trim Optimization**

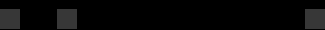
# Technical Talk Agenda

01

Background

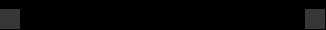


3D NAND  
Scaling

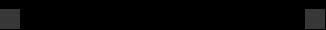


02

Legacy

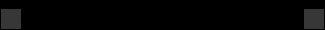


Legacy Trim  
Optimization  
Strategy



03

Innovation



Bayesian  
Optimization  
based On-The-Fly  
Trim Optimization



04

Implementation &  
Benefits



BICS8  
Implementation





# Innovation : A world of new parameters



**1970**  
**12 MPG**



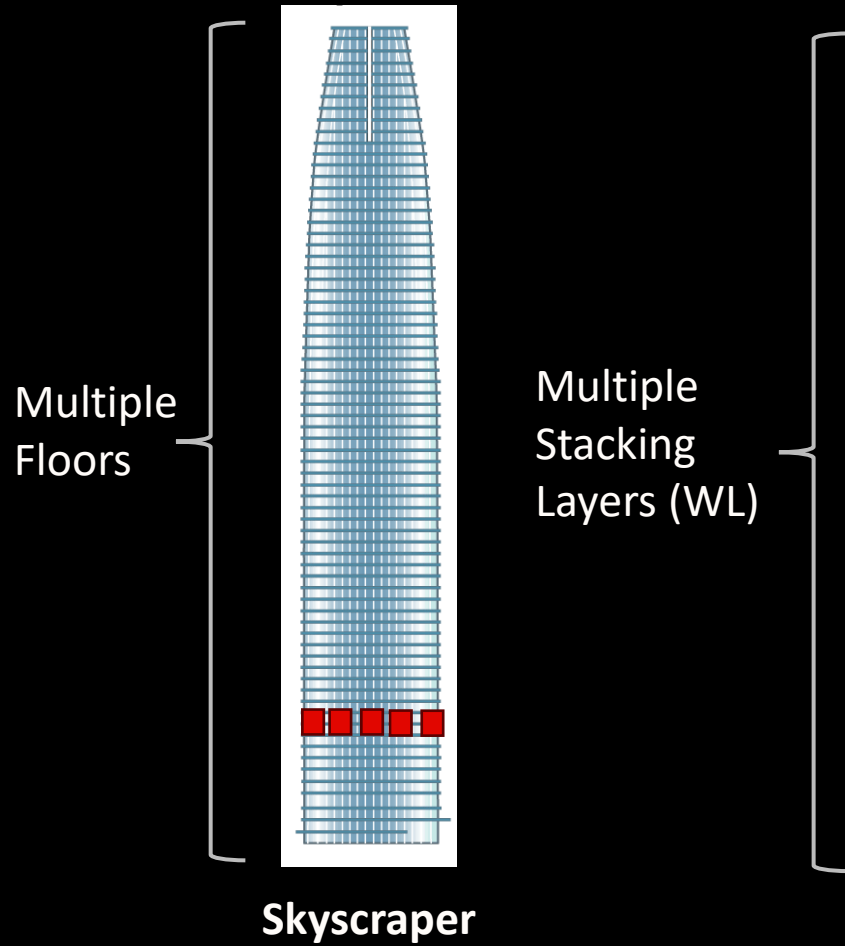
**2025**  
**~57 MPG**

**4.75X**

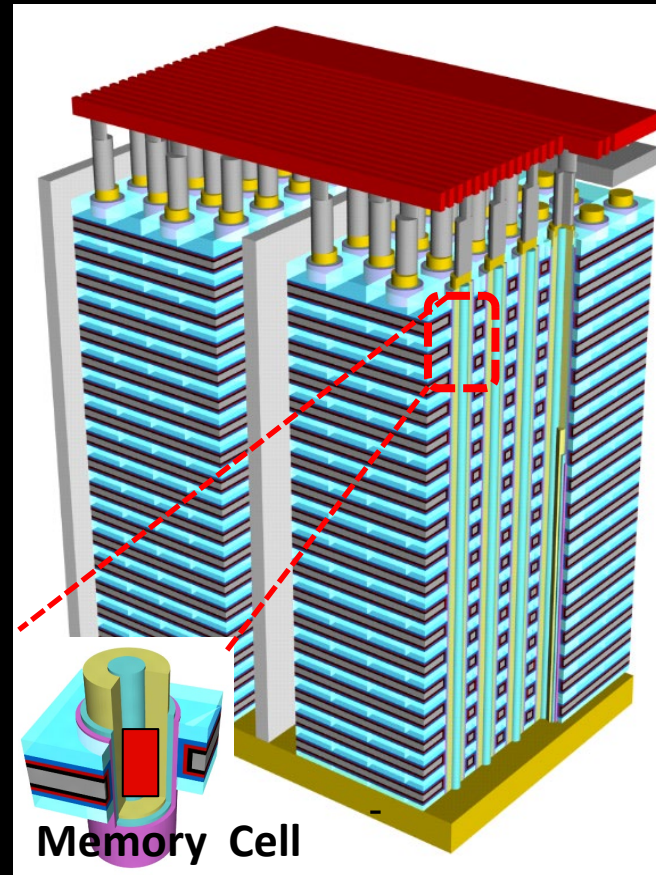


# 3D NAND Scaling Trend

How we increase storage capacity

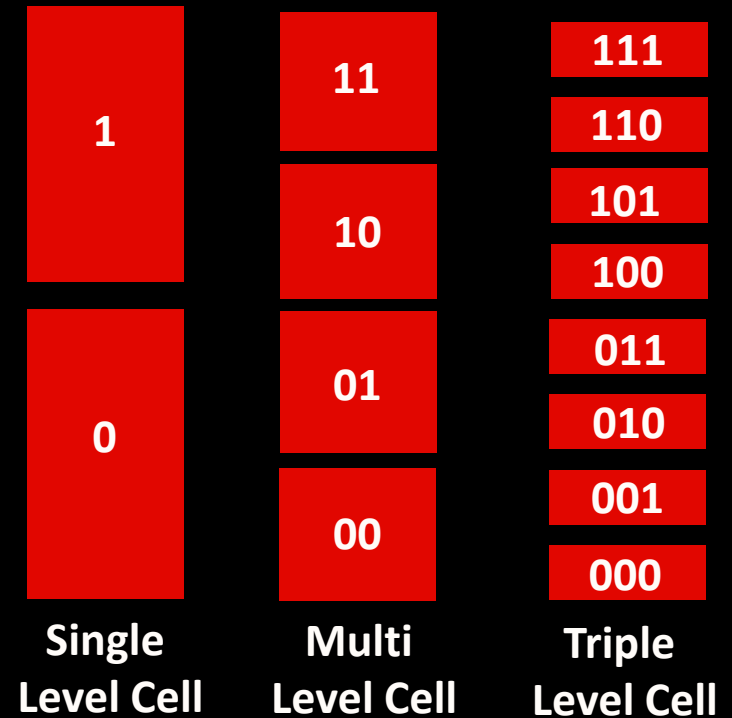


## Vertical Scaling



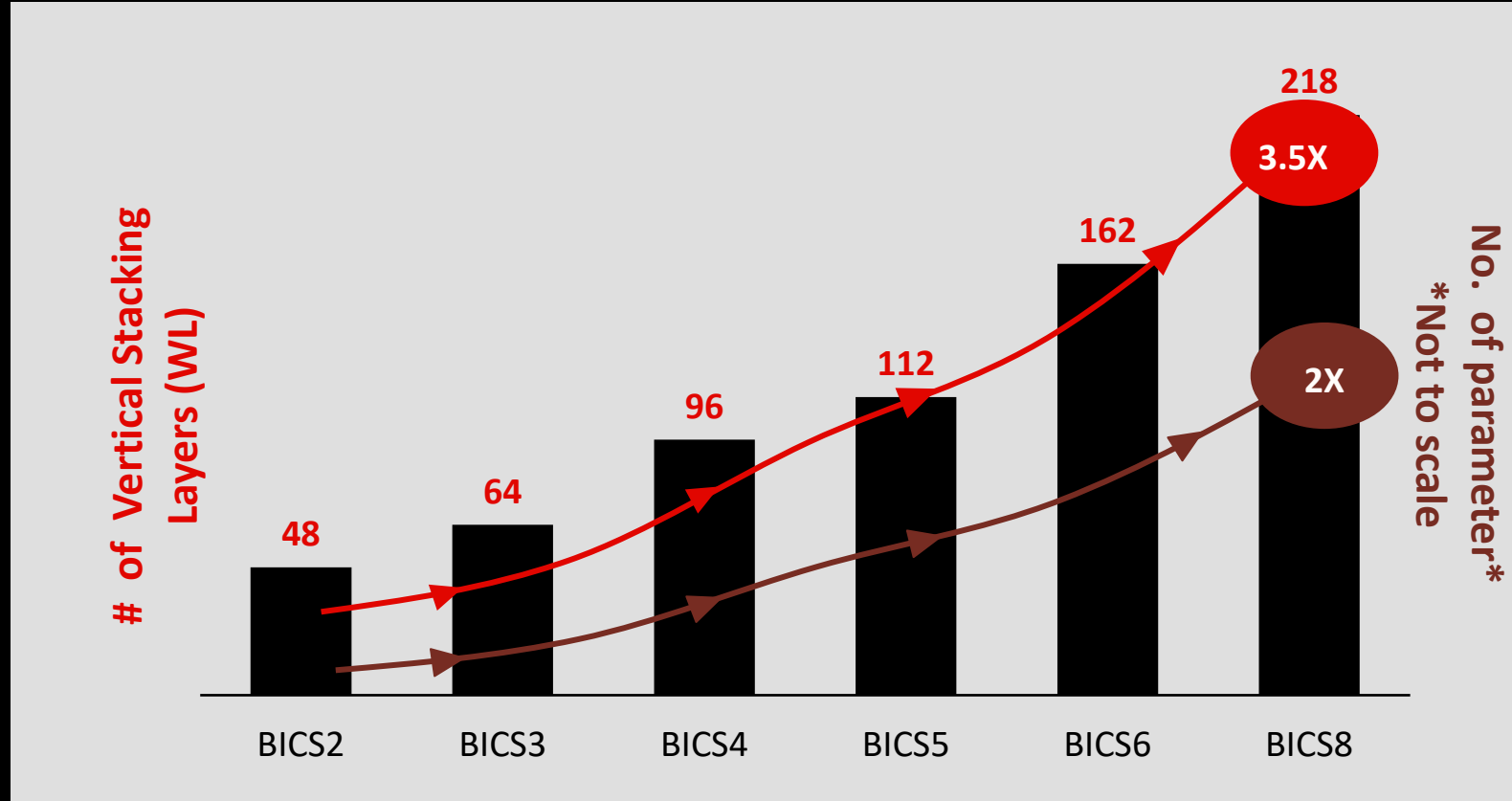
3D NAND

## Logical Scaling



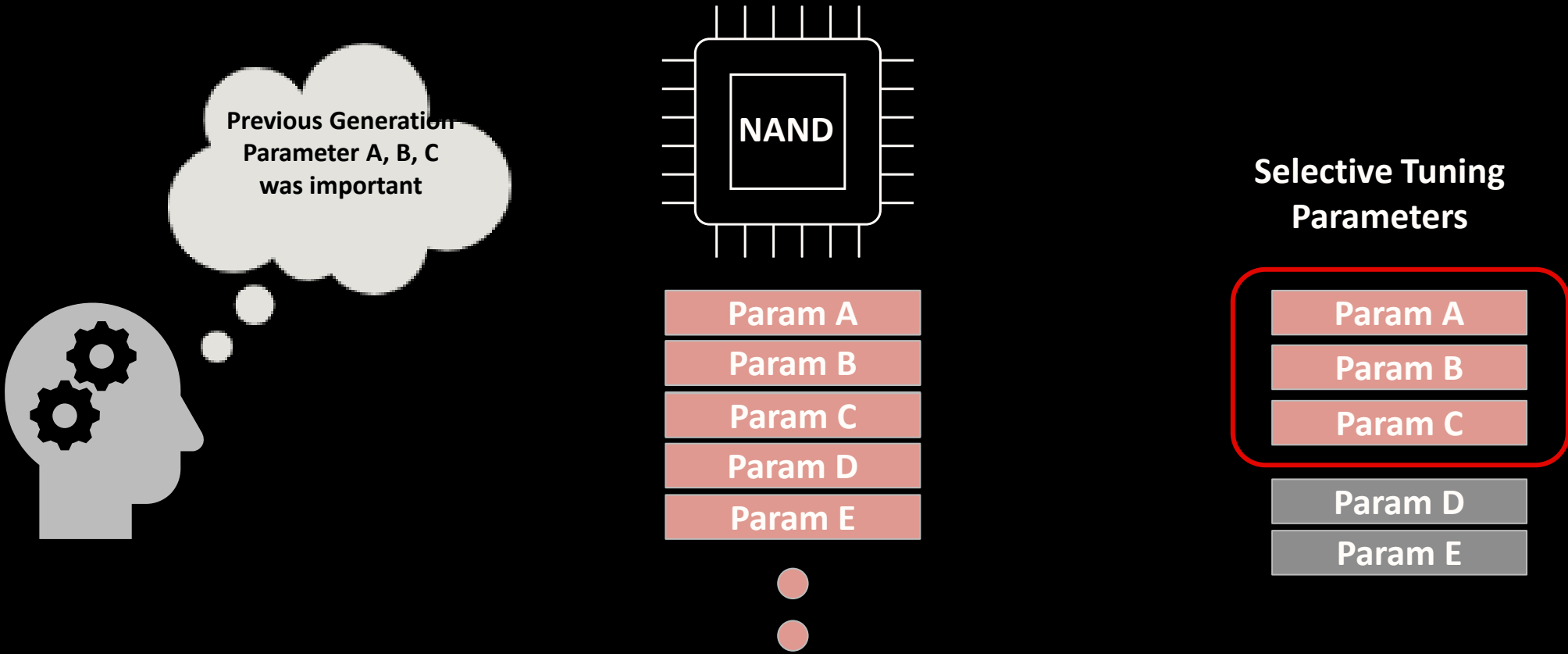
# 3D NAND Scaling Trend

How we increase storage capacity



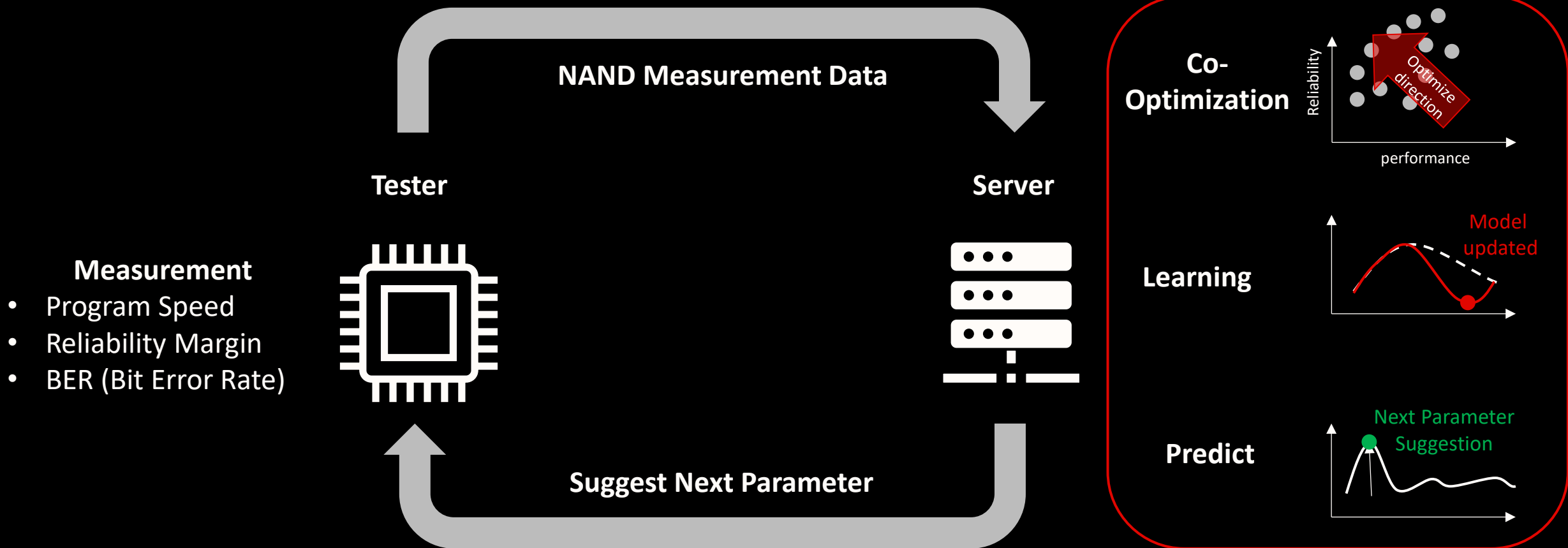
3.5x more layers in 3D NAND has doubled tunable parameters – driving up tuning complexity.

# Legacy Trim Optimization



Engineers choose tuning parameters based on their knowledge and experience.

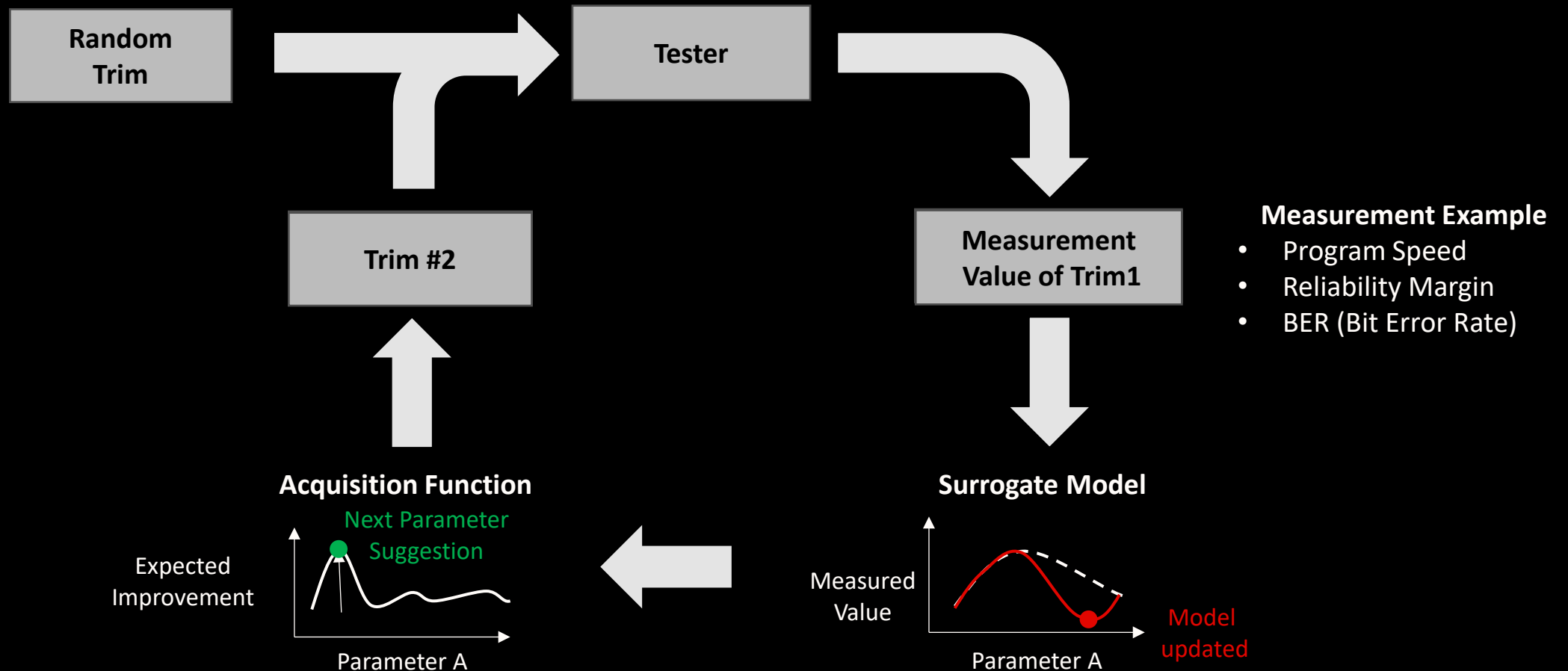
# On-The-Fly Trim Optimization (OFTO)



OFTO is implemented into the 3D NAND parameter tuning process using the BO algorithm.

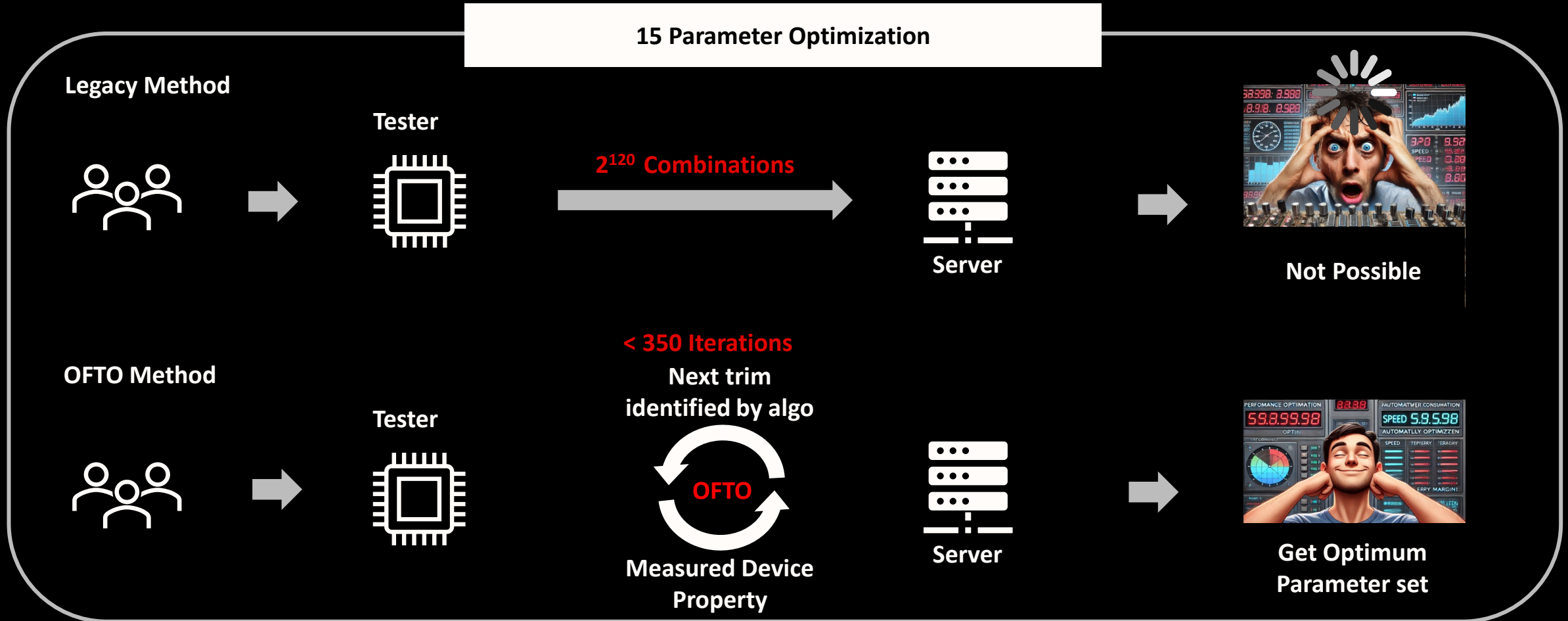


# Bayesian Optimization (BO)



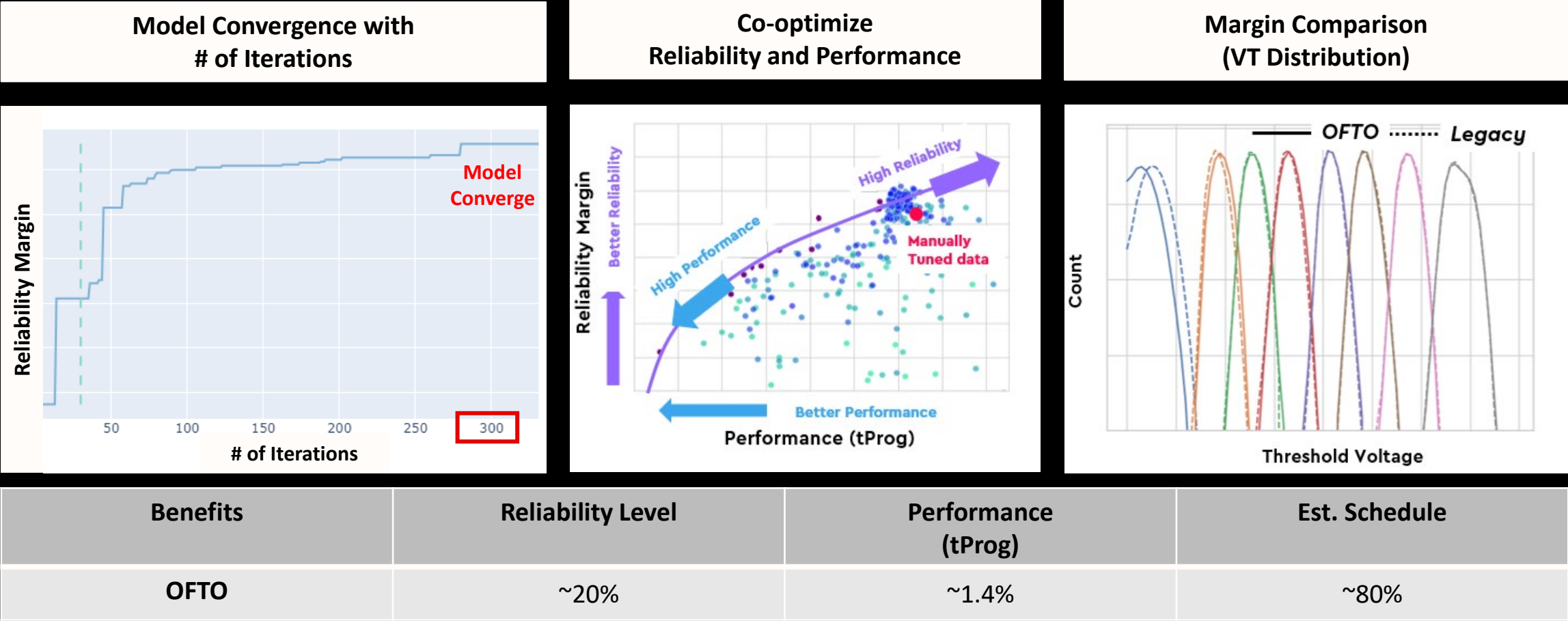
Sequentially optimize a black-box function to find trim setting that maximize objectives.

# On-The-Fly Trim Optimization (OFTO) Method Comparison



OFTO enables **one-shot optimization** of 15 parameters, something legacy method cannot achieve.

# Implementation & Benefits



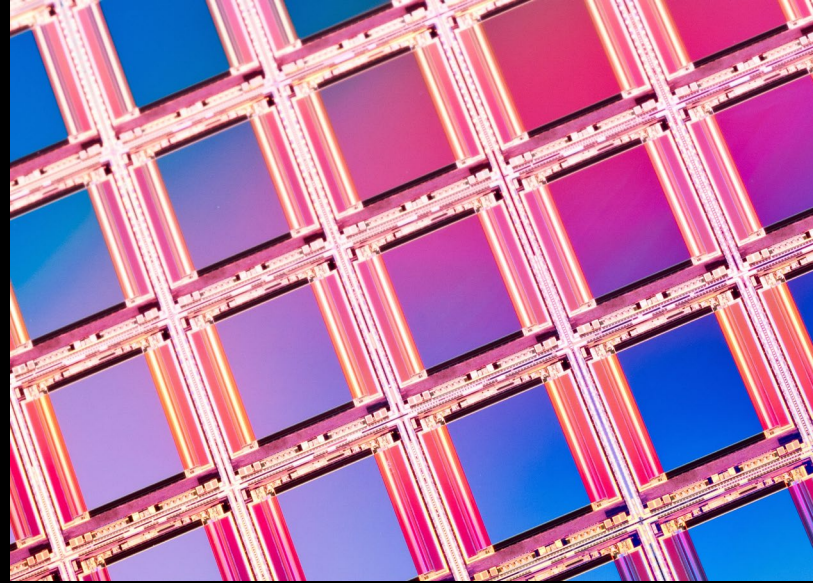
OFTO enhance optimization efficiency while improving chip reliability and performance.



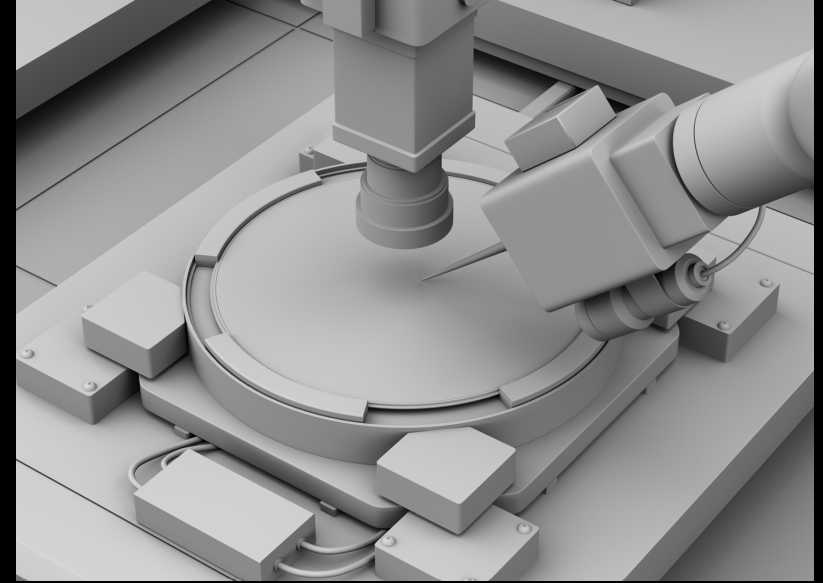
# Key Technical Insights



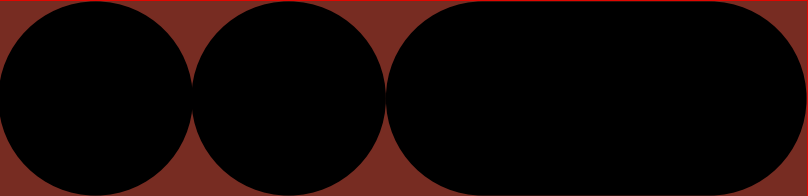
Scaling Innovation is essential for future 3D NAND demand.



Trim Parameter will continue to rise with increasing device complexity.



OFTO accelerates scaling, paving the way for 1,000-layer 3D NAND.



י. מנחם כו. י. א.™