

June 2018

# Analyst & Investor Day





# Cautionary Statement Regarding Forward Looking Statements

This presentation includes statements that constitute forward-looking statements within the meaning of safe harbor provisions of the Private Securities Litigation Reform Act of 1995 relating to future events or our future performance, such as statements regarding, but are not limited to, anticipated growth opportunities and projections about our business and its future revenues, expenses and profitability. Forward-looking statements involve known and unknown risks, uncertainties and other factors that may cause our actual results, levels of activity, performance or achievements to be materially different from any future results, levels of activity, performance or achievements expressed or implied in those forward-looking statements. You should not place undue reliance on forward-looking statements since they involve known and unknown risks, uncertainties and other factors which are in some cases beyond our control. Factors that may affect our results, performance, circumstances or achievements include, but are not limited to the following: our dependency on three product lines; our dependency on a small number of large customers and small number of suppliers; the highly cyclical and competitive nature of the markets we target and we operate in; our inability to reduce spending during a slowdown in the semiconductor industry; our ability to respond effectively on a timely basis to rapid technological changes;; our dependency on PEMs; risks related to exclusivity obligations and non-limited liability that may be included in our commercial agreements and arrangements; our ability to retain our competitive position despite the ongoing consolidation in our industry; risks related to our dependence on our manufacturing facilities; risks related to changes in our order backlog; risks related to efforts to complete and integrate current and/or future acquisitions; risks related to the worldwide financial instabilities; risks related to our intellectual property; new product offerings from our competitors; unanticipated manufacturing or supply problems; risks related

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This following presentation includes financial measures that are not calculated in accordance with generally accepted accounting principles (GAAP). The presentation of this non-GAAP financial information is not intended to be considered in isolation or as a substitute for the financial information prepared and presented in accordance with GAAP. Nova's earning release, including a presentation of the most directly comparable financial measures calculated and presented in accordance with GAAP and a reconciliation of each GAAP to non-GAAP financial measure discussed in the presentation is available at the Investors section of the company's website.

Certain of the information contained herein concerning economic trends and performance is based upon or derived from information provided by third party consultants and other industry sources. We have not independently verified and cannot assure the accuracy of any data obtained by or from these sources.

# Eitan Oppenheim – President & CEO



- President and Chief Executive Officer since 2013
- Joined Nova in 2010 as the Global Business Group Executive Vice President, responsible for the company's customers facing groups, including Global Business and Sales, Marketing and Delivery
- Served in several executive positions with global companies in the Electronics and Telecom industries
- Served as Vice President at Orbotech, where he led the Flat Panel Display global business teams, located in Asia
- Holds a BA in Economics and an MBA

# The Team



**Performance,  
Strategy &  
Growth Plans**



Eitan Oppenheim,  
President and CEO



**Sustained  
Profitable  
Growth**



Dror David,  
CFO



**Market Review  
& Growth  
Trajectory**



Zohar Gil,  
Marketing & Business  
Development Corp. VP



**Disruptive  
Innovation for  
Emerging Market**



Dr. Shay Wolfling,  
CTO



# What We'll Cover Today

Markets are healthy & fueled by multiple drivers



Emerging digital revolutions

Multiple high end applications

Technology inflections to meet challenges

Nova is well positioned to continue growing



Growing demand for metrology

Differentiated portfolio with cutting edge benefits

Elevated investment in disruptive innovation

Operational efficiency to support growth



Efficient LT model

Execution track record

Profitable growth

# KEY Facts

Leading  
Metrology  
Innovator for  
Advanced  
Process Control



**DUAL-LISTED**  
NASDAQ / TASE



**TECHNOLOGIES**  
Optical & X-Ray

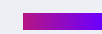


**2017  
PROFITABLE  
GROWTH**

Revenues  
**35% - 222M\$** ↑



Market cap  
**101% (YoY)** ↑



Cash Reserves  
**\$150M** ↑



**EMPLOYEES**  
650



**METROLOGY**  
Dimensions & Materials



**GLOBAL PRESENCE**  
18 world wide offices



**R&D SITES**  
USA & Israel

\*NON GAAP FINANCIAL

**NOVA**

Confidential & proprietary information

# Success Tied to FUNDAMENTALS

- Diversified Portfolio**
- X-ray & Optical
  - Dimensions & Materials

- Customers' partnership**
- Development to Manufacturing
  - Joint development programs

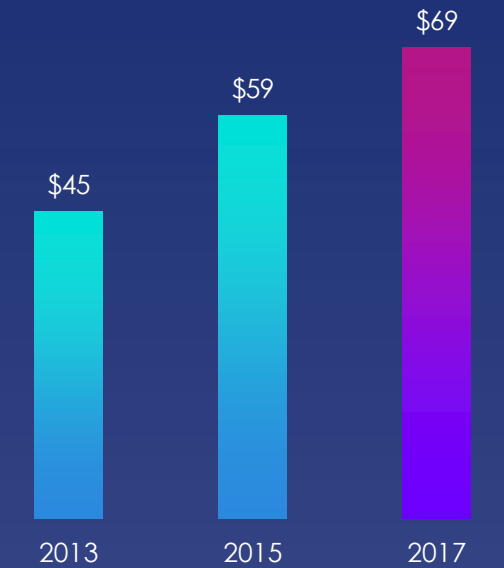
- Disruptive technologies**
- Coupling SW & HW
  - Emerging Applications

- Solid financial model**
- Operational efficiency
  - Growth by investment

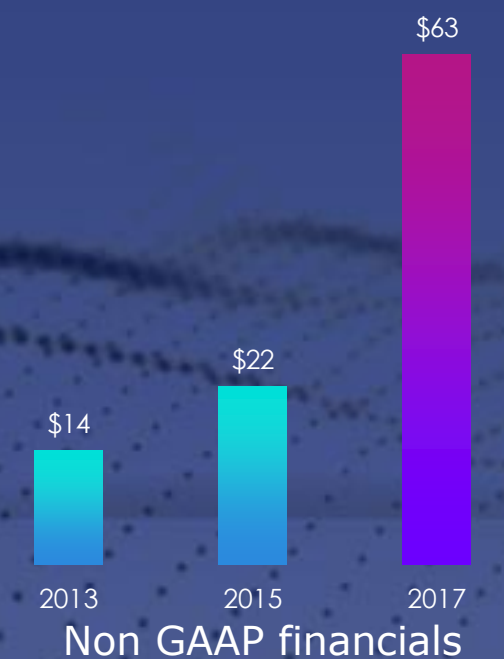
Revenue  
In Million \$



Operating expenses  
In Million \$



Operating income  
In Million \$

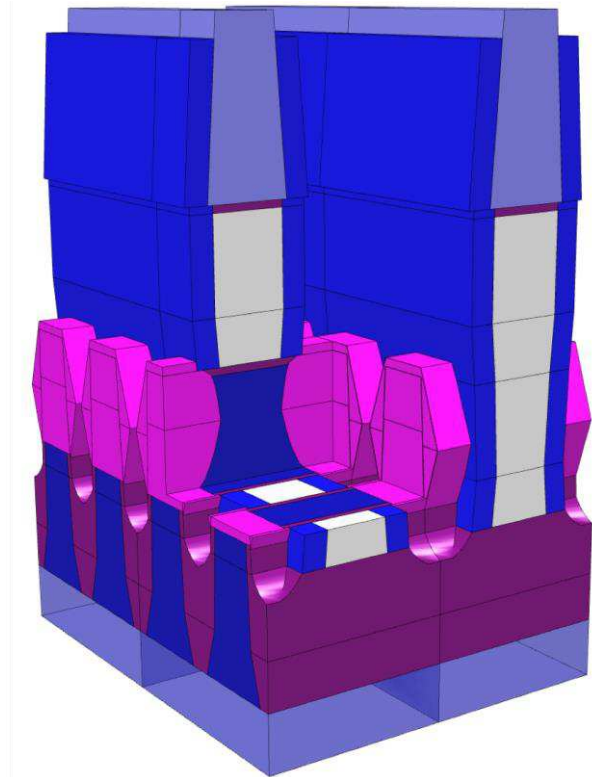
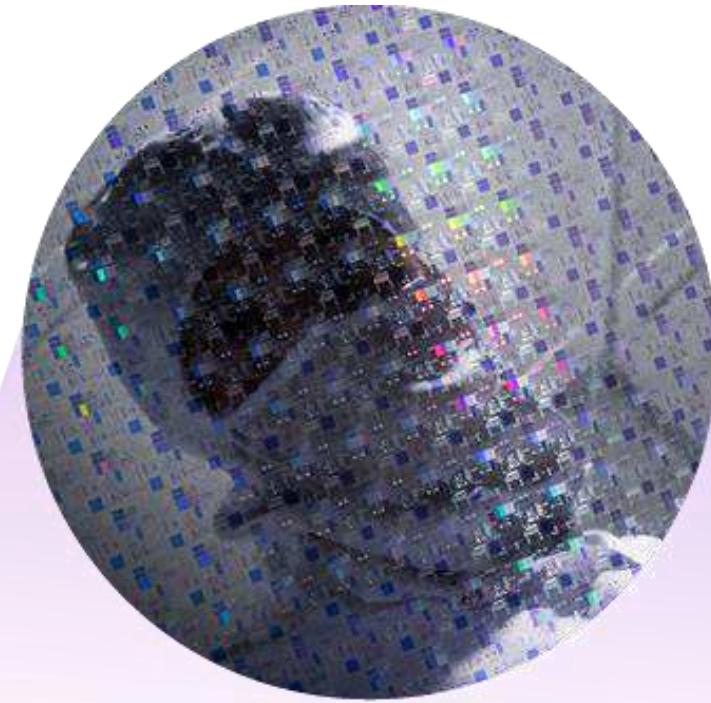




# Innovative TECHNOLOGY



Optical / X-Ray



**300mm**  
Wafer

**10um**  
Pad

**5nm**  
Pitch

**0.5Å**  
Precision



Logic



Flash



DRAM

Semiconductor  
Segment

Dimensions / Materials  
Properties



# Unique Complementary SOLUTION



## Software

- Physical & Mathematical Models
- Big Fleet Data
- Hybrid Ecosystem



## Dimensional

- Integrated & Standalone
- Critical Dimensions
- Film Thickness



## Materials

- Standalone
- Materials Properties



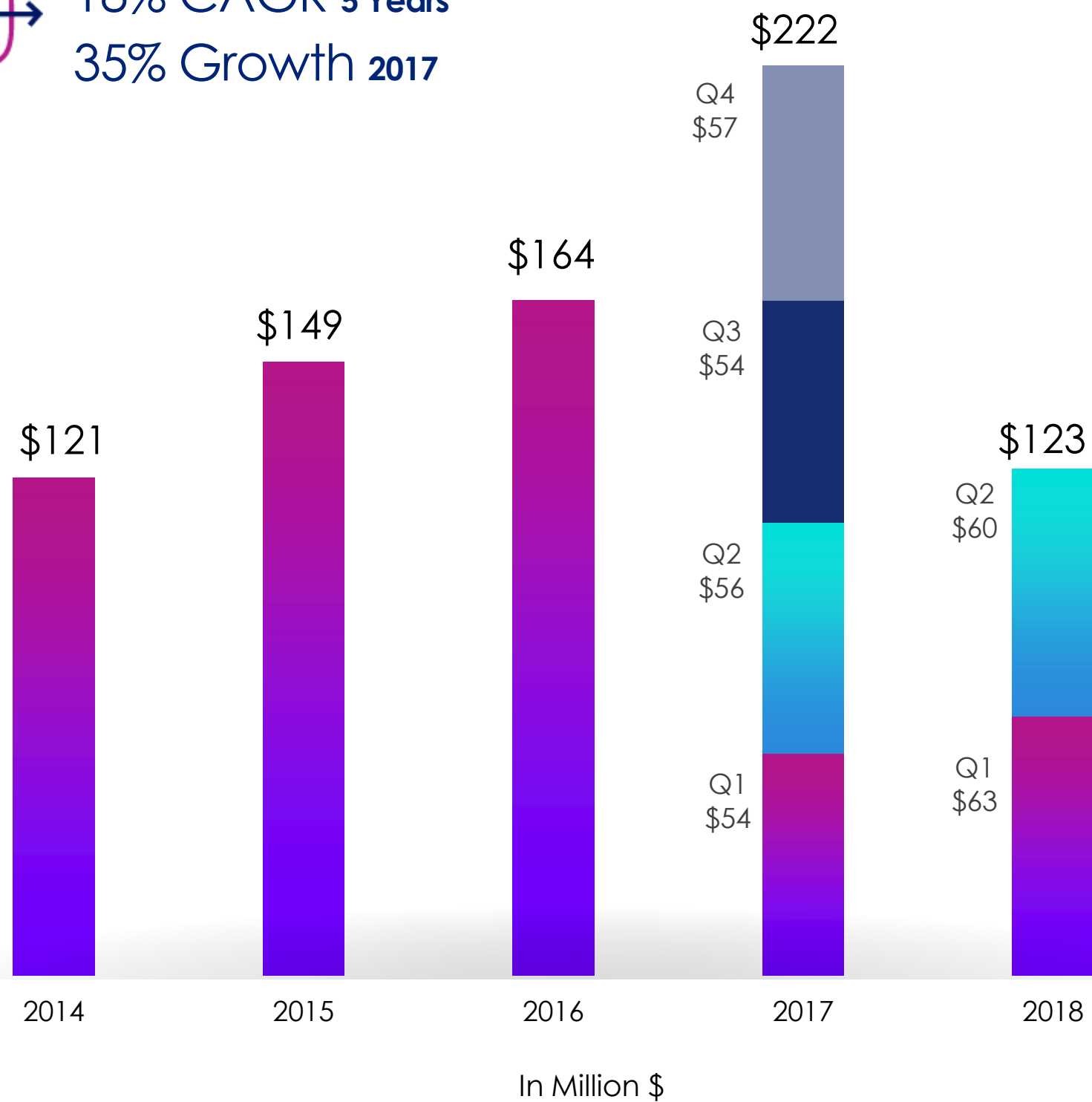
## Services

- Install Base Support
- Features UG & Utilization

# REVENUE GROWTH

## Track Record

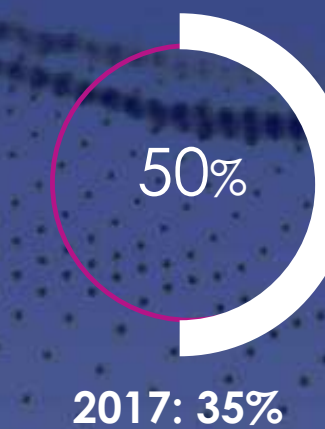

 18% CAGR 5 Years  
 35% Growth 2017



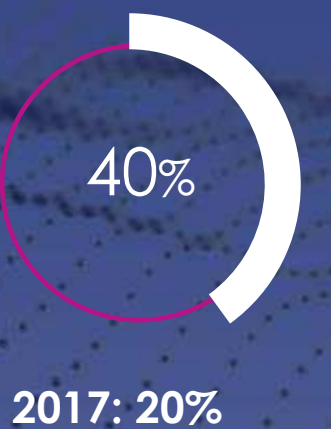
### → Q1 2018 Highlights

- Record Revenue **\$62.6M**
- Record Profit **\$15.4M**
- H1 Growth **10% YoY**
- Elevated R&D Investment
- Diversification:

Memory

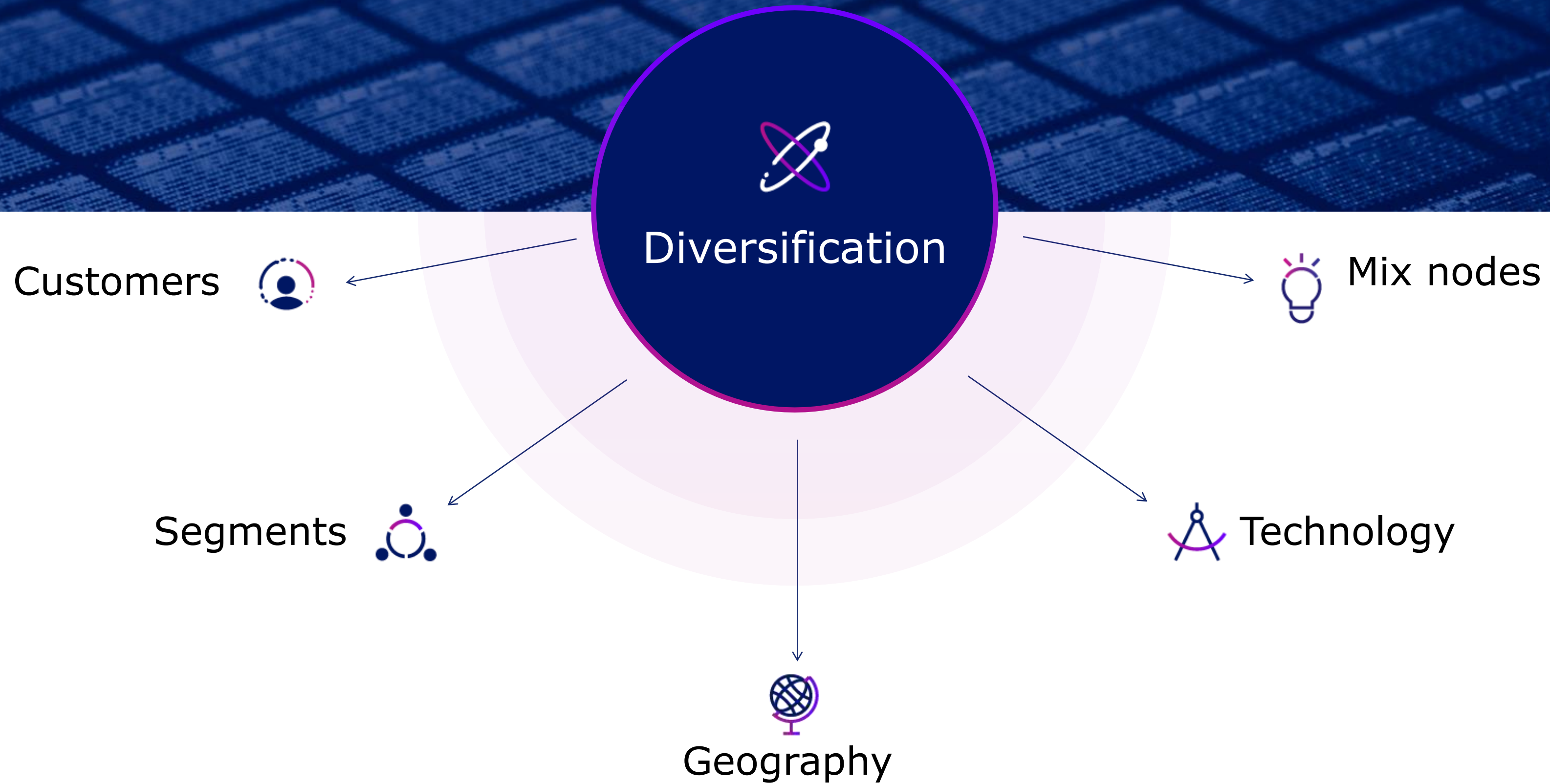


China





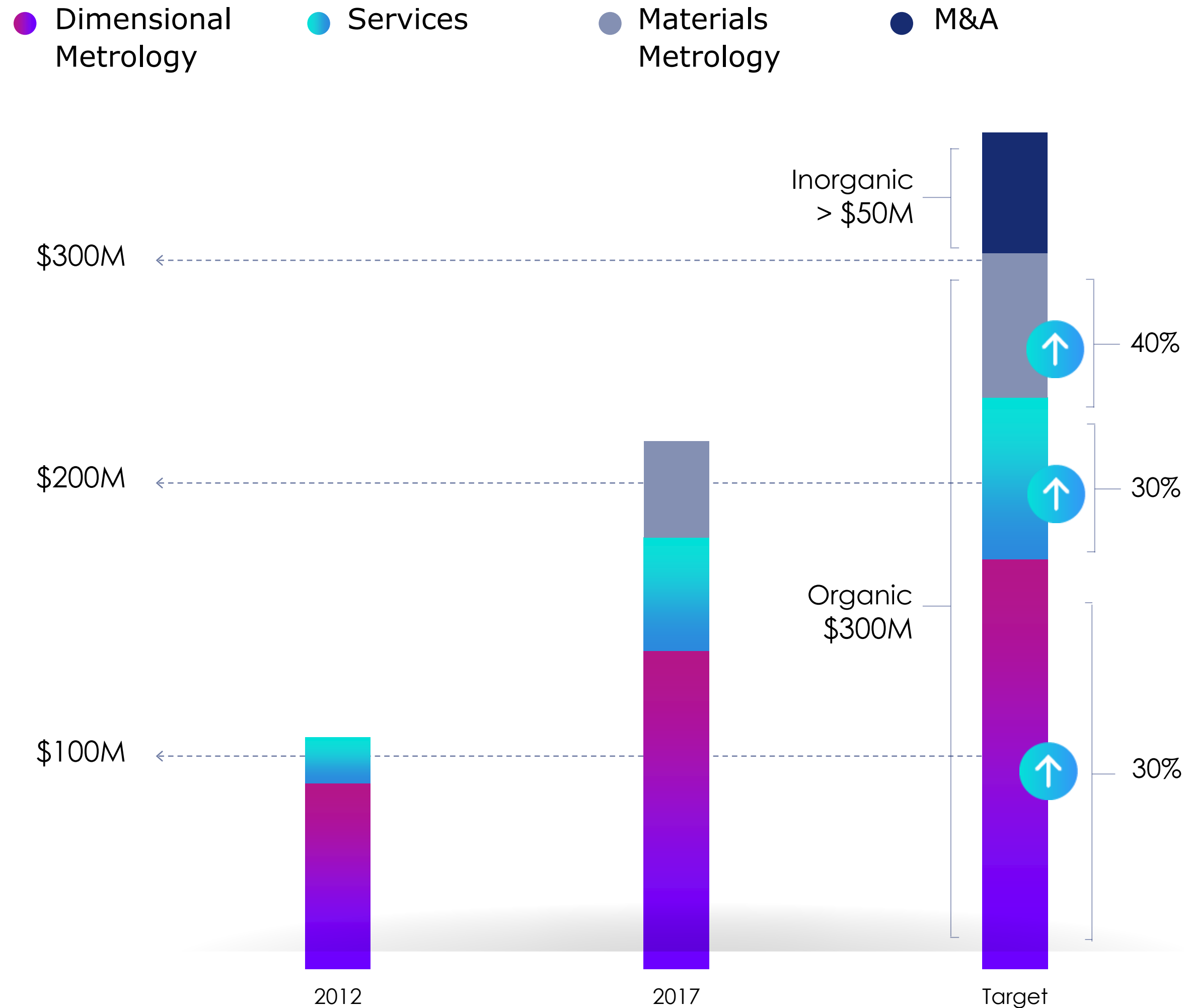
# Why do we CONTINUE GROWING?



Growing Market Share in Growing TAM

# From Nova200 to NOVA 300

Reaching revenues of \$300M organically



- Share Gains
- SAM/TAM Expansion
- Disruptive Innovation
- Market Growth

\$25M  
New Technology



Confidential & proprietary information



# Sustained Profitable Growth

Dror David, Chief Financial Officer

# Dror David – Chief Financial Officer



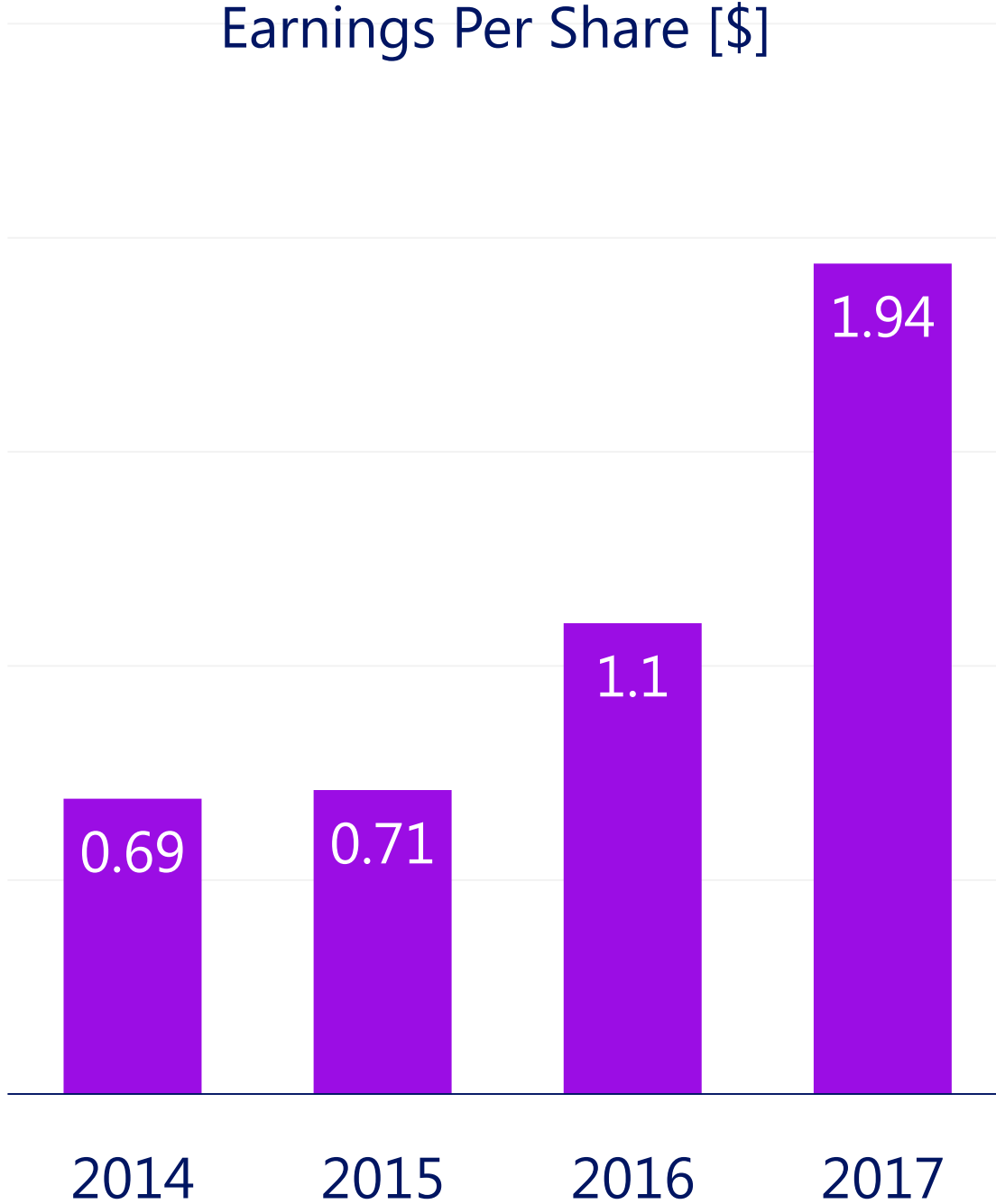
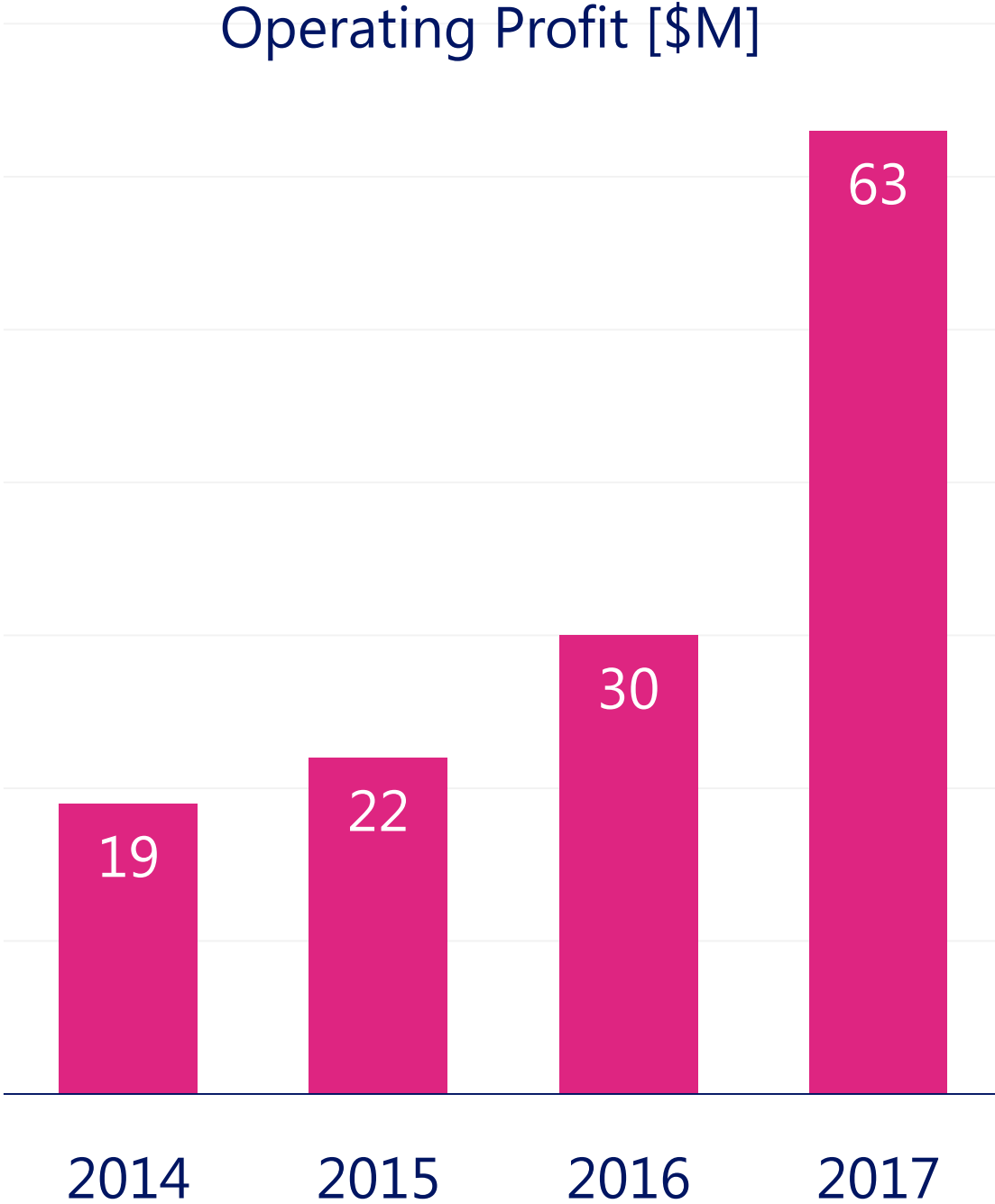
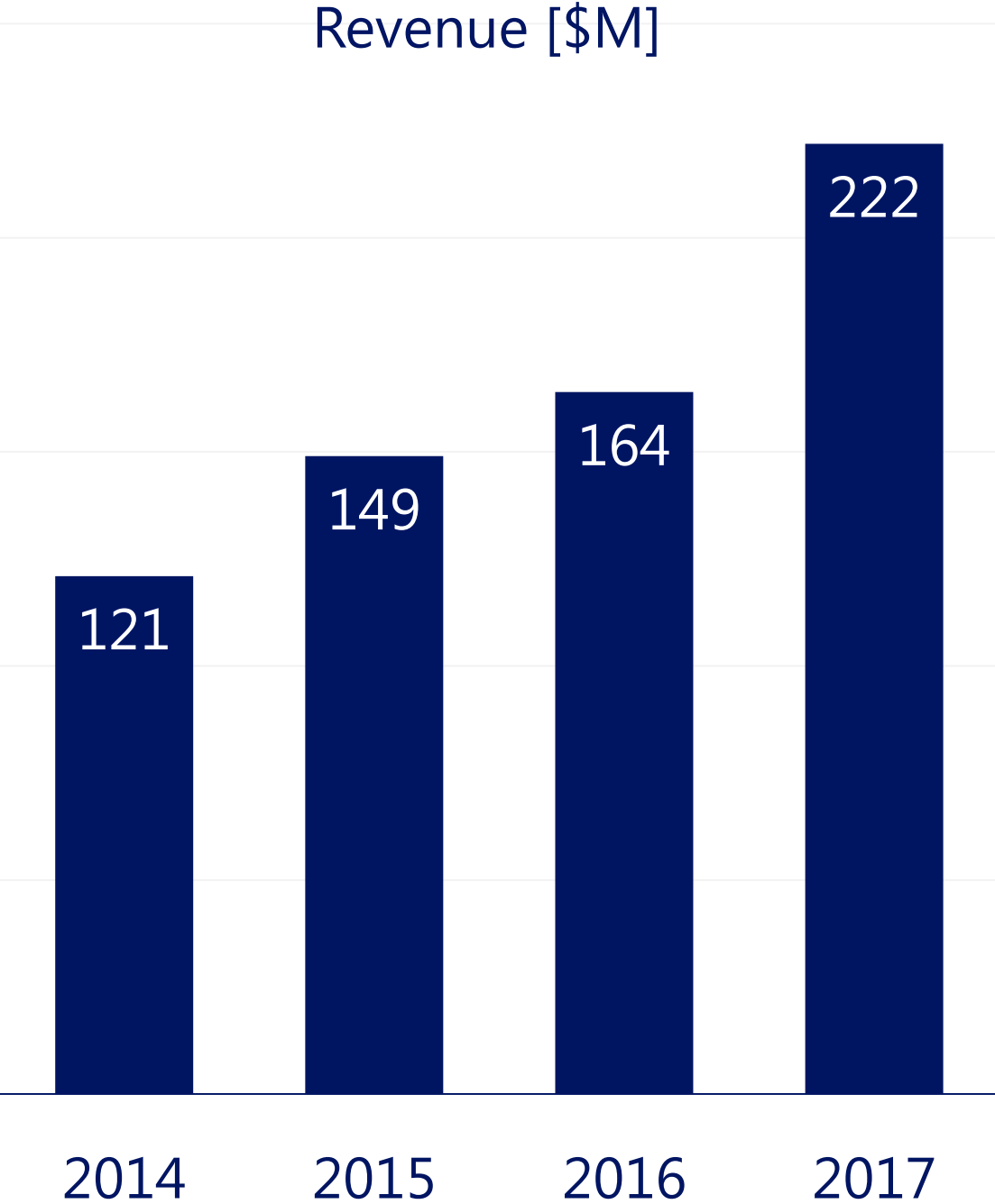
- Mr. Dror David was appointed as Nova's Chief Financial Officer in 2005. Mr. David joined Nova in April 1998, as the Company's Controller, and since then served in various financial and operational positions, including the position of Vice President of Operations, in which he was responsible for the finance, operations, information systems and human resources functions of the Company
- Mr. David played a key role in the Company's initial public offering on NASDAQ in 2000. He led the Company's private placement in 2007 and secondary public offering in 2010. Prior to joining Nova, Mr. David spent five years in public accounting with Delloitte Touch in Tel Aviv, specializing in industrial high-tech companies
- Mr. David is a Certified Public Accountant in Israel, holds a B.A. in Accounting and Economics from Bar Ilan University, and an M.B.A. from Derby University of Britain



# Executing on Profitable Growth



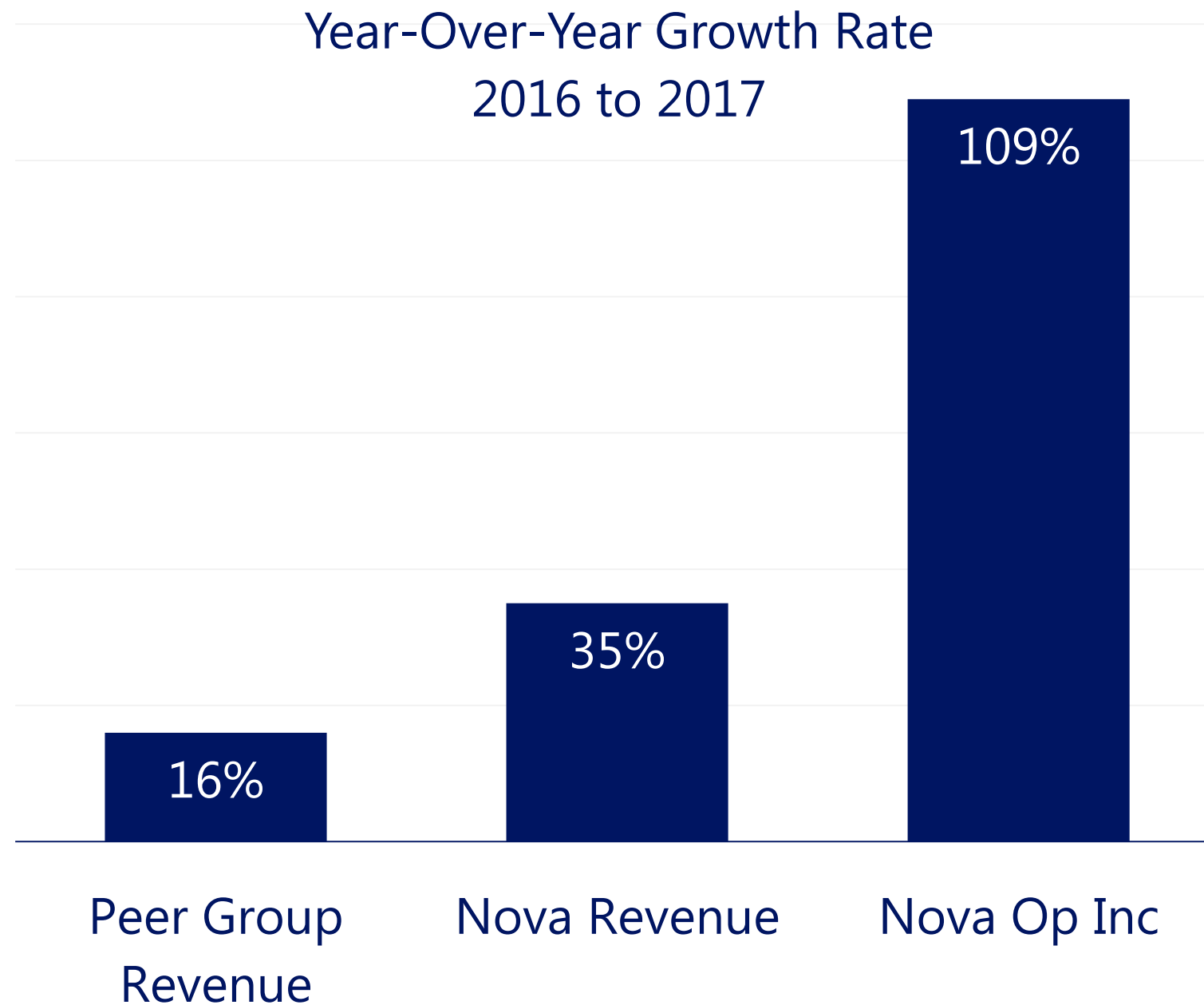
# Executing on Our Profitable Growth Commitments



\* Non-GAAP Financials



# Financial Outperformance Continues



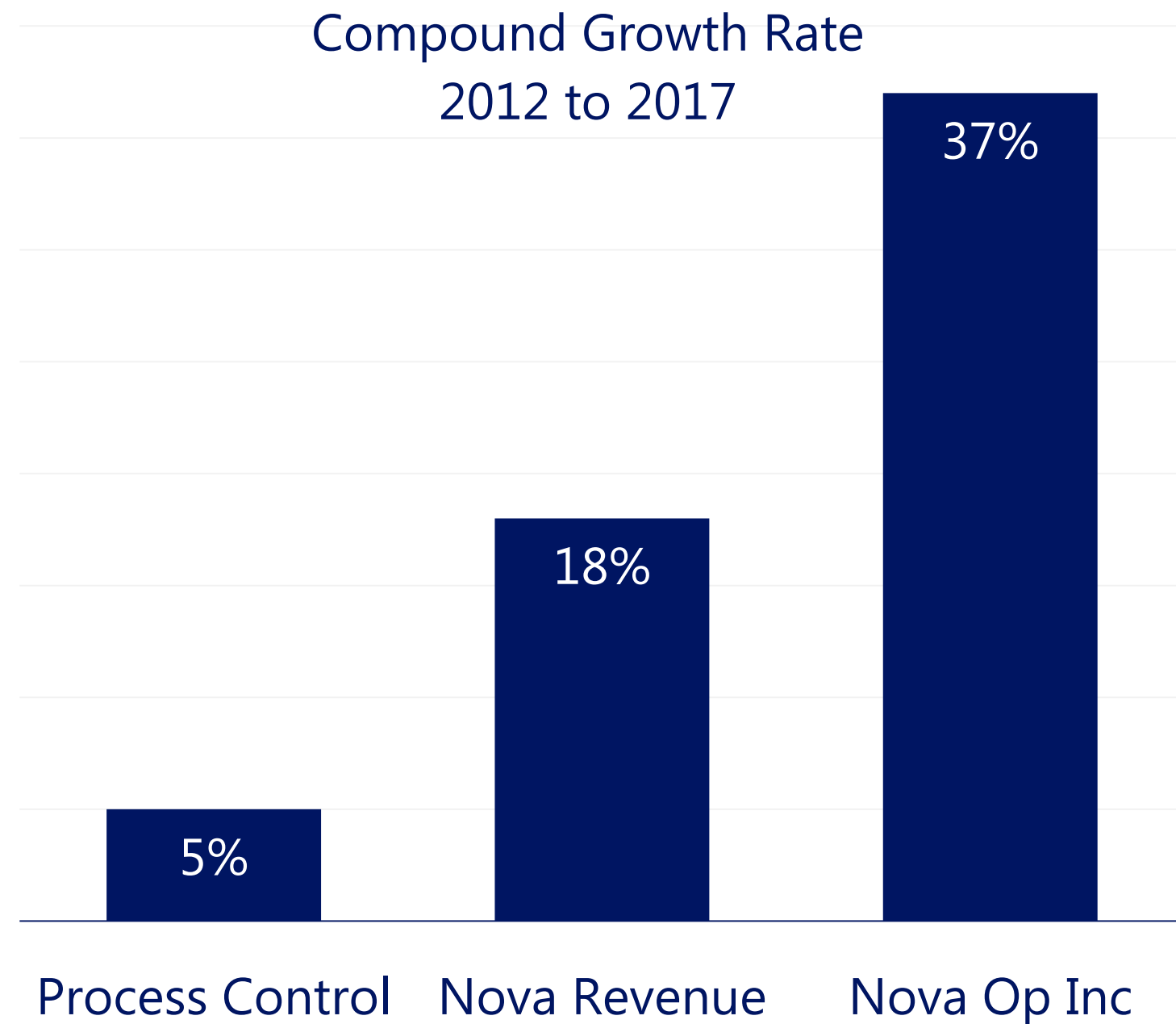
## 2017

- Achieved 2X the Peer Group Growth Rate
- Grew Operating Income at 3X Revenue
- Delivered >75% EPS Growth Year Over Year
- Generated >\$55M Free Cash Flow (25% of revenue)

\* Non-GAAP Financials

\*\* Peer Group: KLAC; NANO; CD-SEM

# Historical Outperformance Track Record



## 2012 - 2017

- Achieved >3X Process Control CAGR
- Grew operating income at >2X Revenue CAGR
- Delivered 30% Non-GAAP EPS CAGR
- Generated >\$120M in Operating Cash Flow

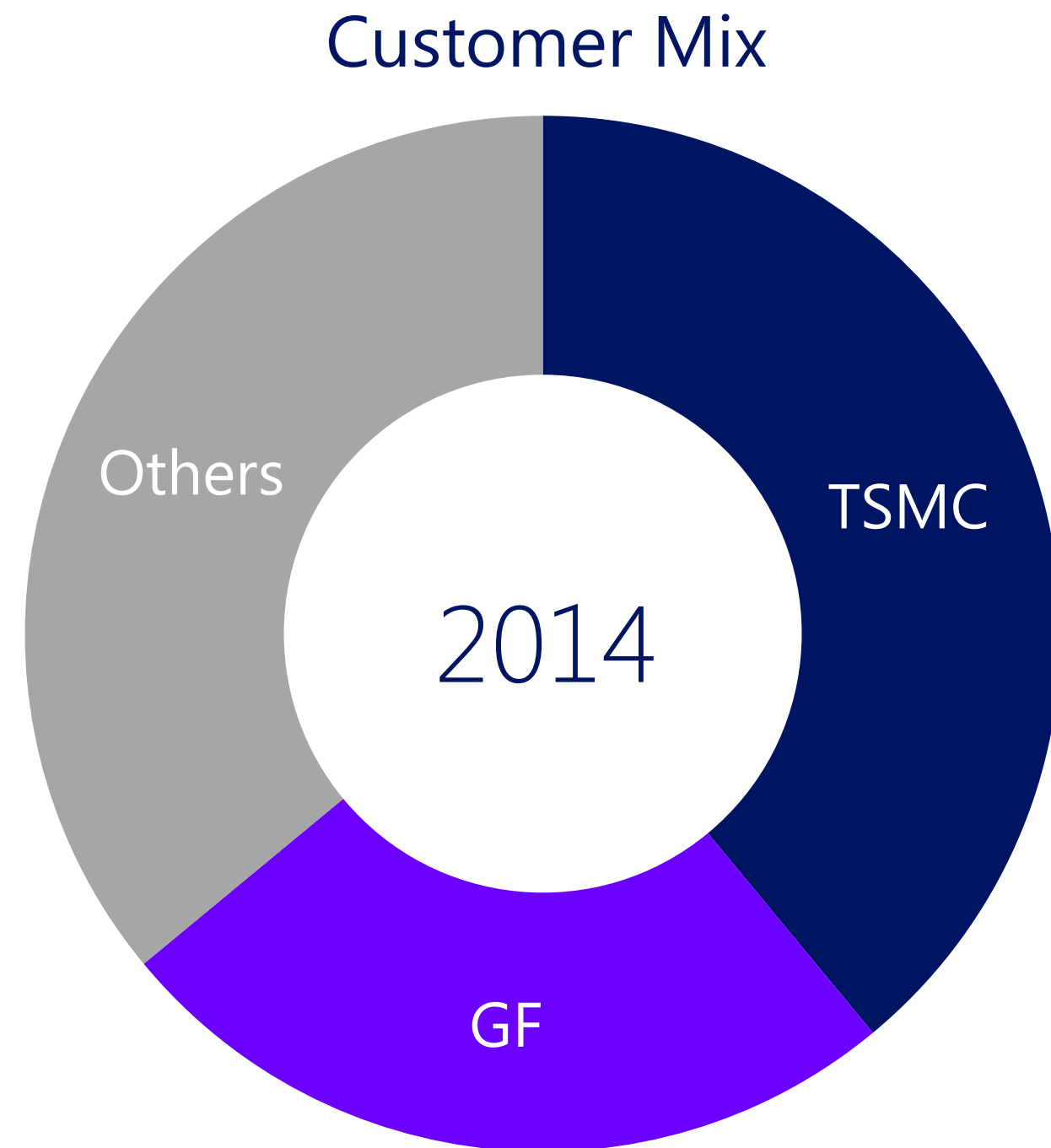
\* Non-GAAP Financials.



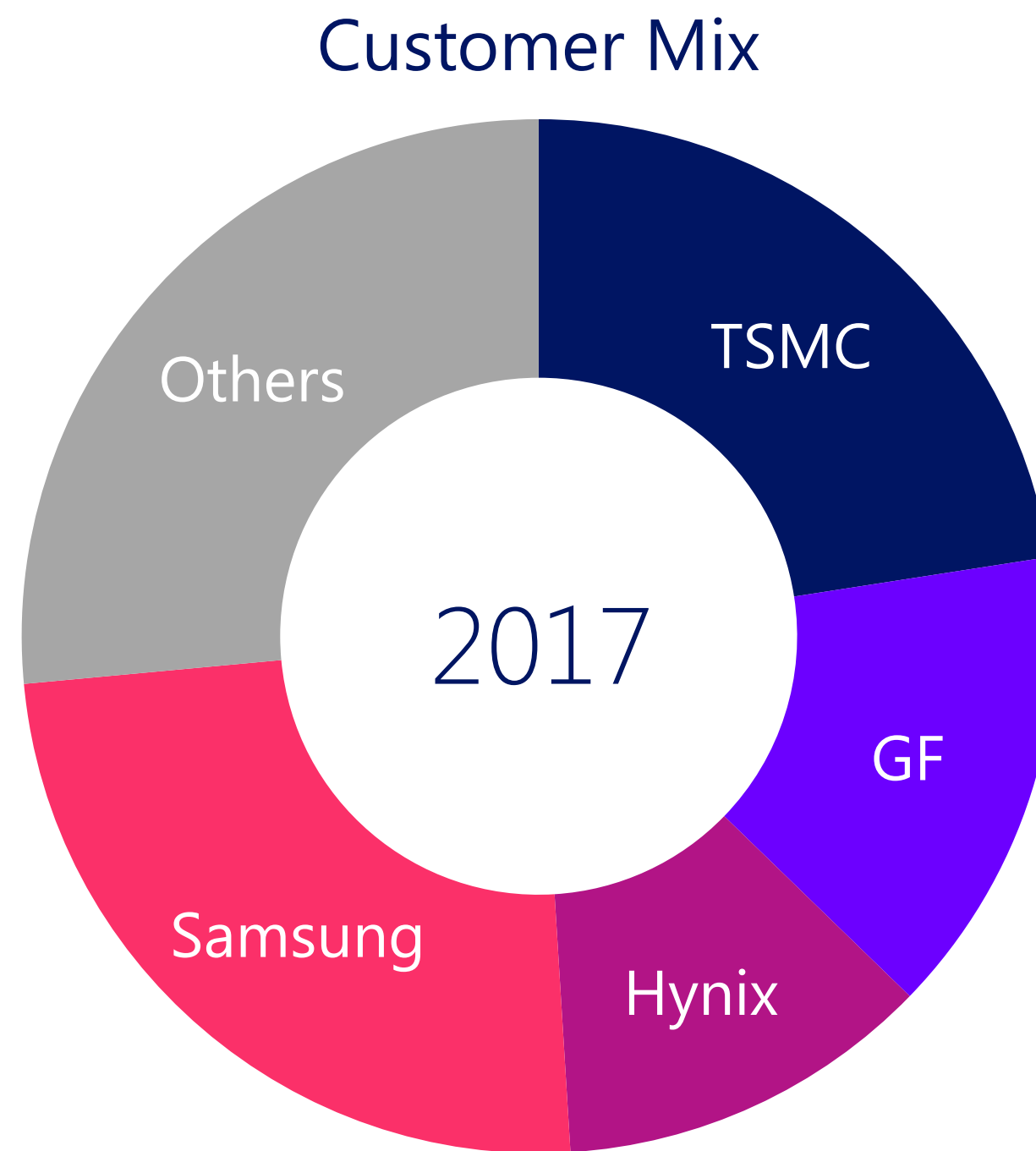
# Diversification



# Diversification - Customer Exposure



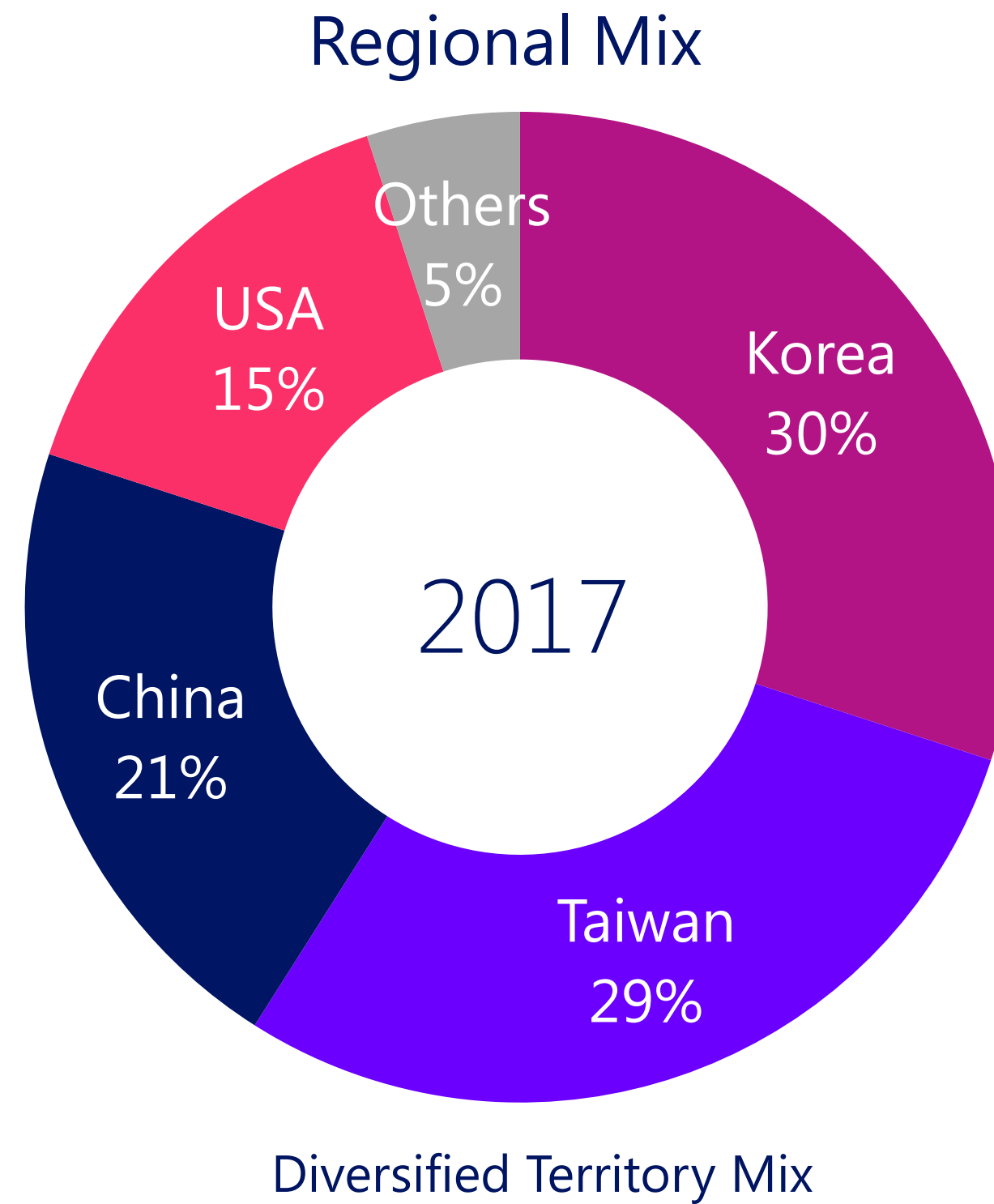
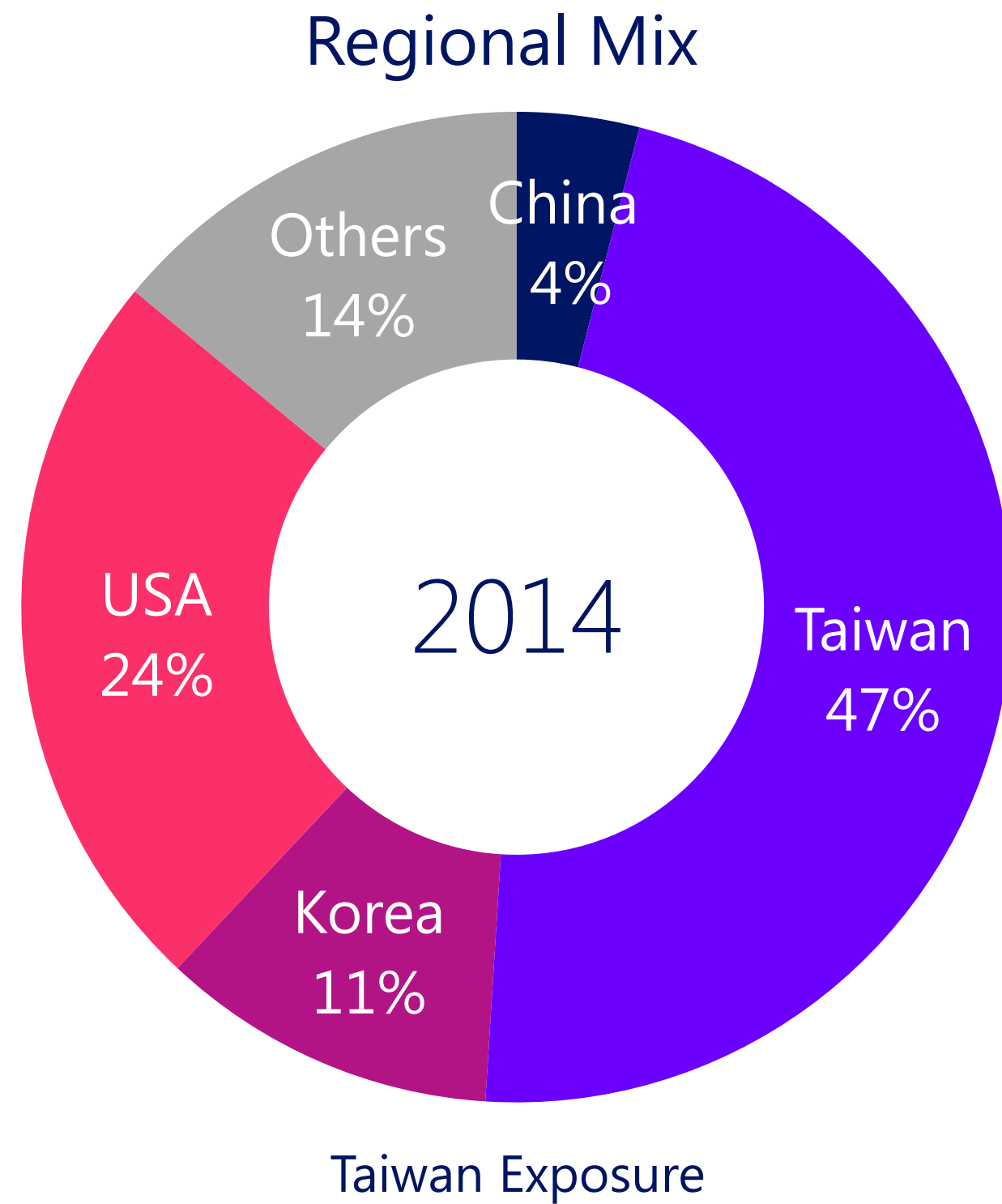
Foundry Exposure  
2 major customers



Memory Growth  
4 major customers

- Foundry Leadership
- Memory Growth

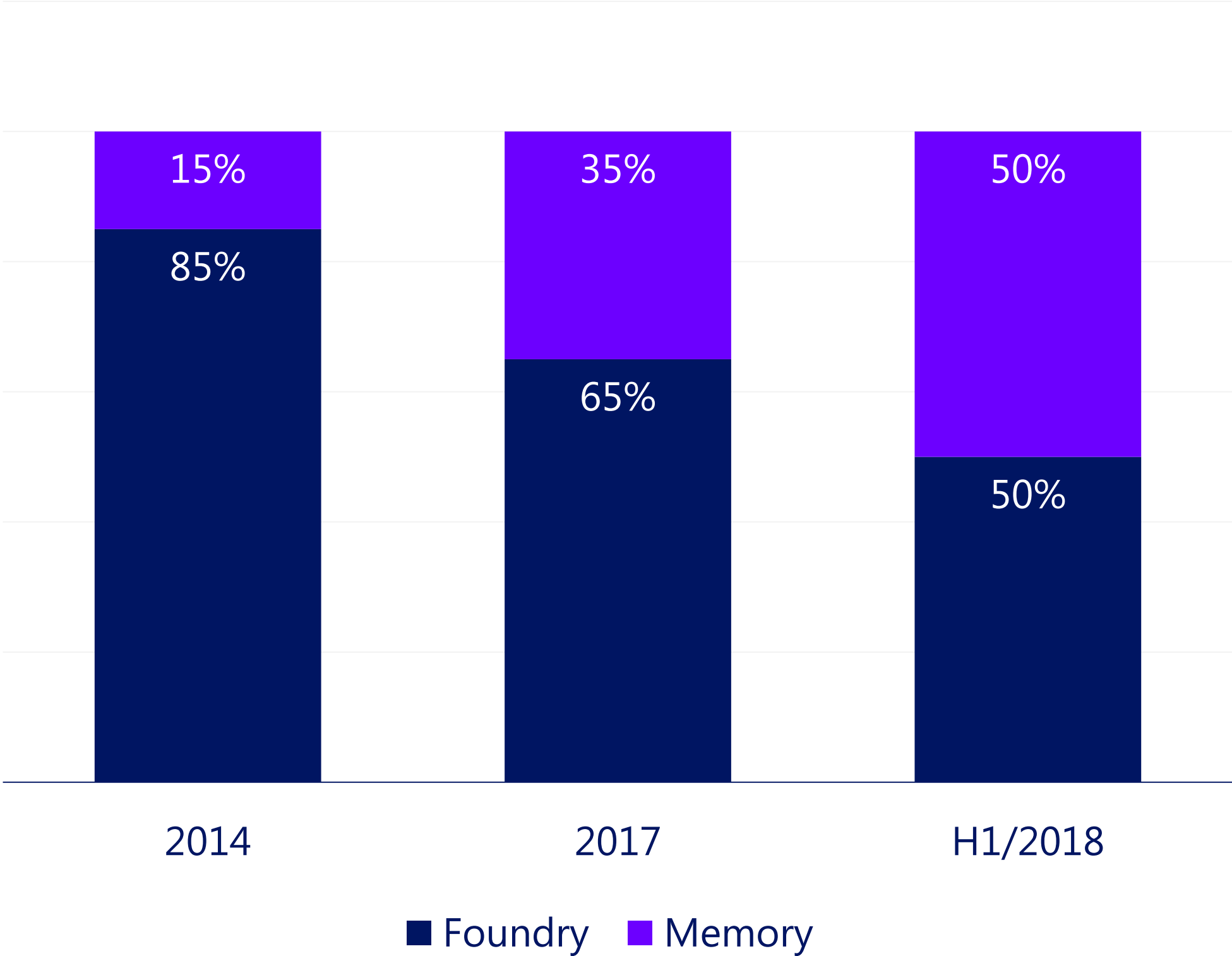
# Diversification - Regional Exposure



- China & Korea Growth
- 3 Large Territories

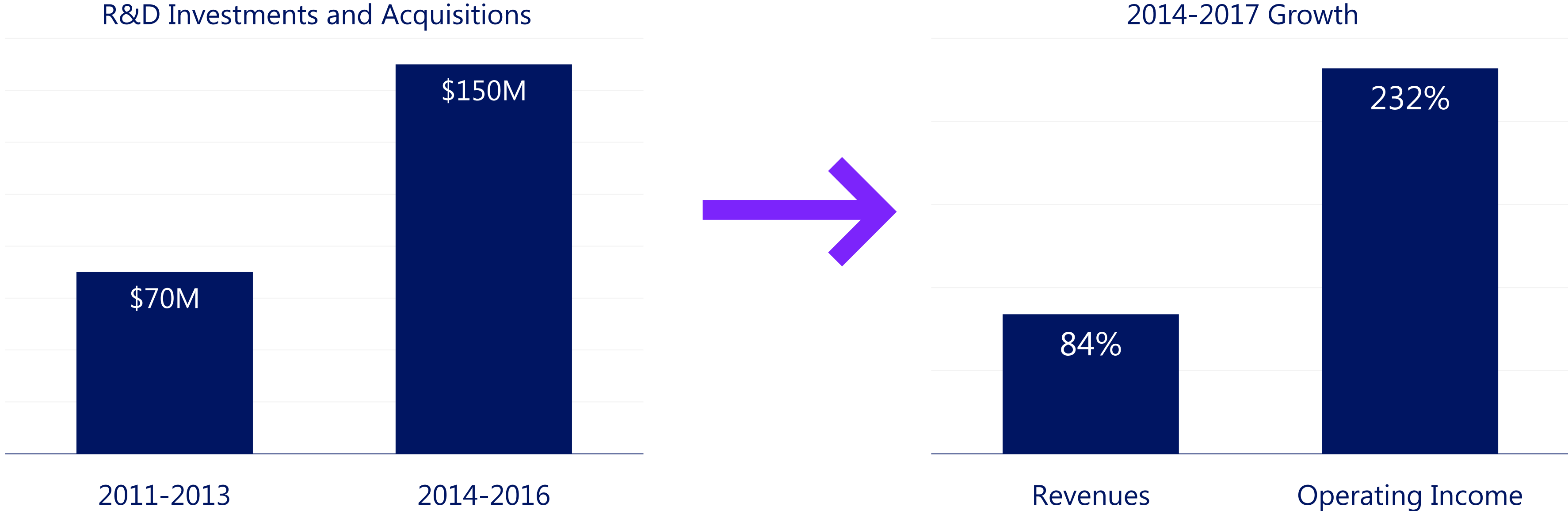


# Diversification - Segments



- Balanced Exposure
- Leading & Trailing Edge
- Mitigating Seasonality

# Diversification - Technology



**Expanded Technology Base Driving Growth**

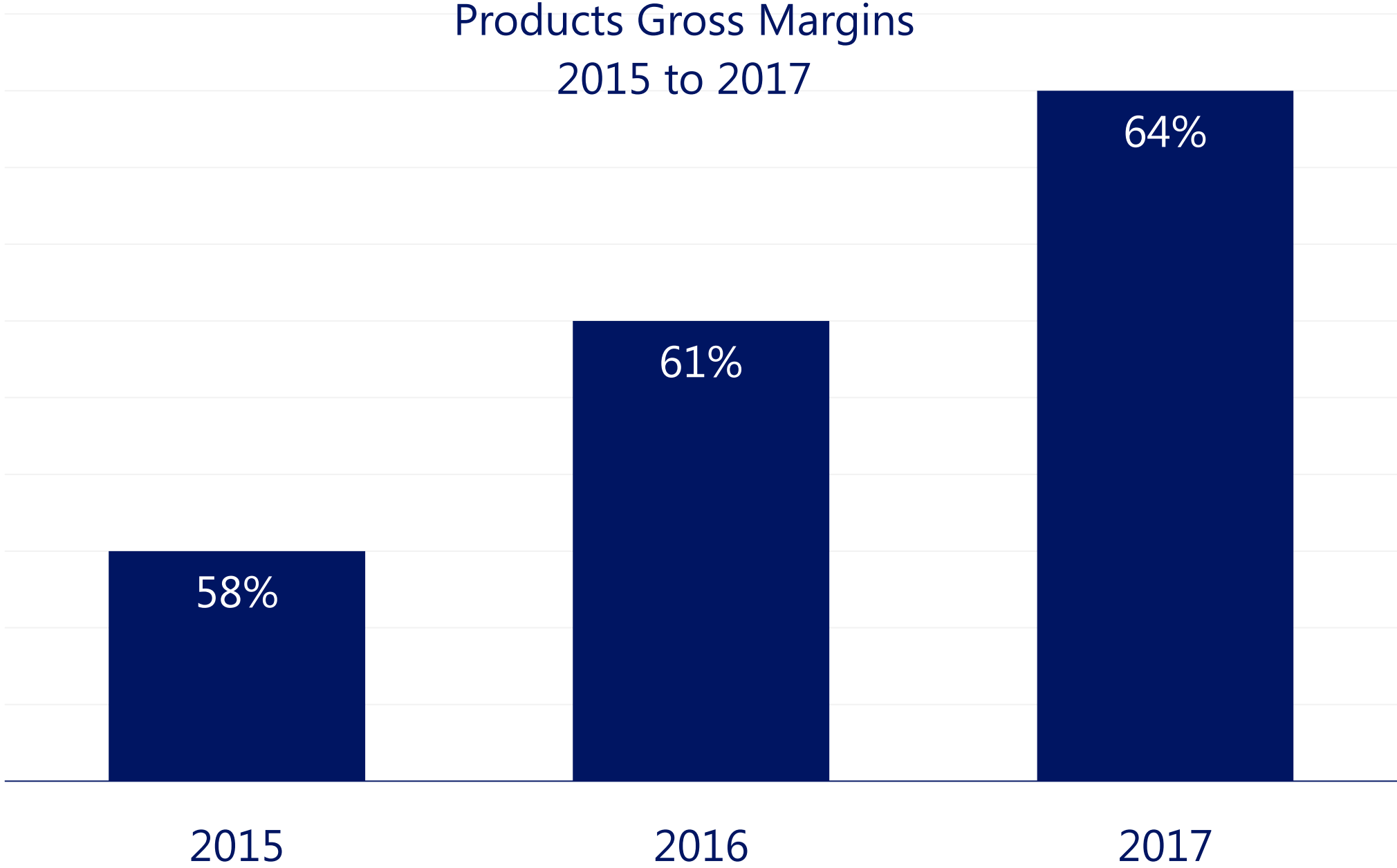
\* Non-GAAP Financials.



# Target Financial Model



# Gross Margins - Products & Services



**Targets:**

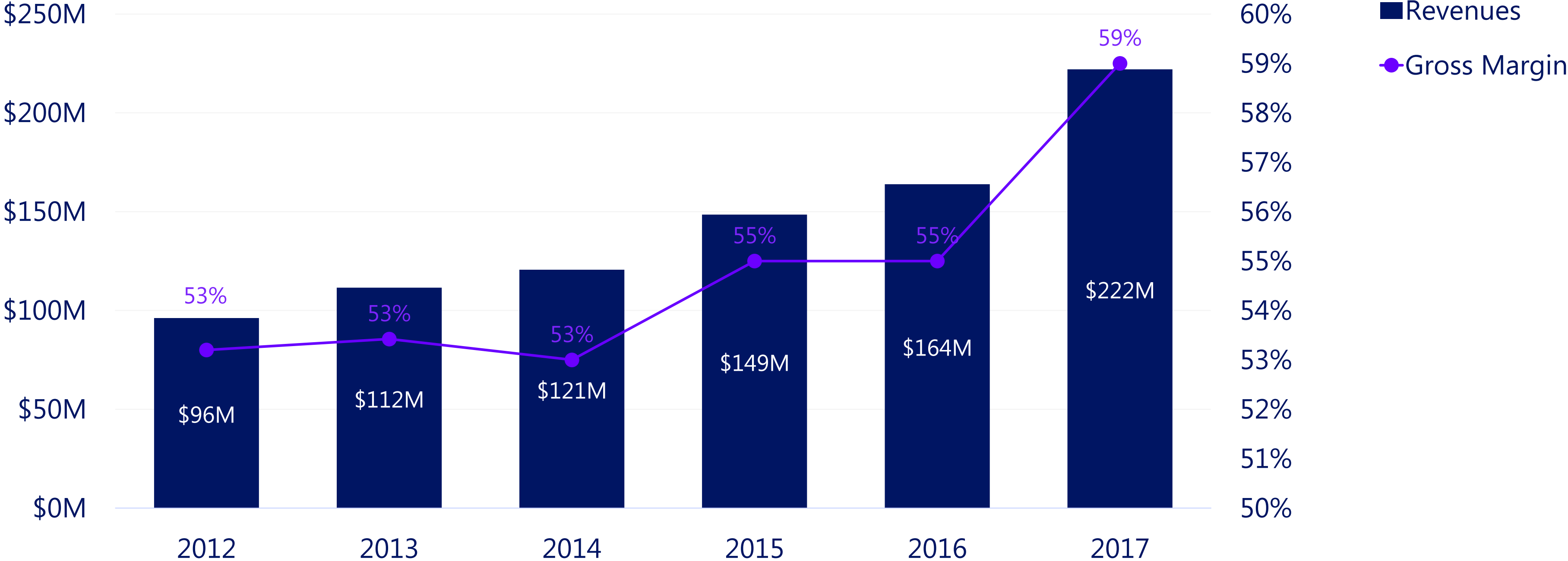
- Products Gross Margins of 61%-64%
- Services Gross Margins 35%-40%

\* Non-GAAP Financials.



# Gross Margins - Blended

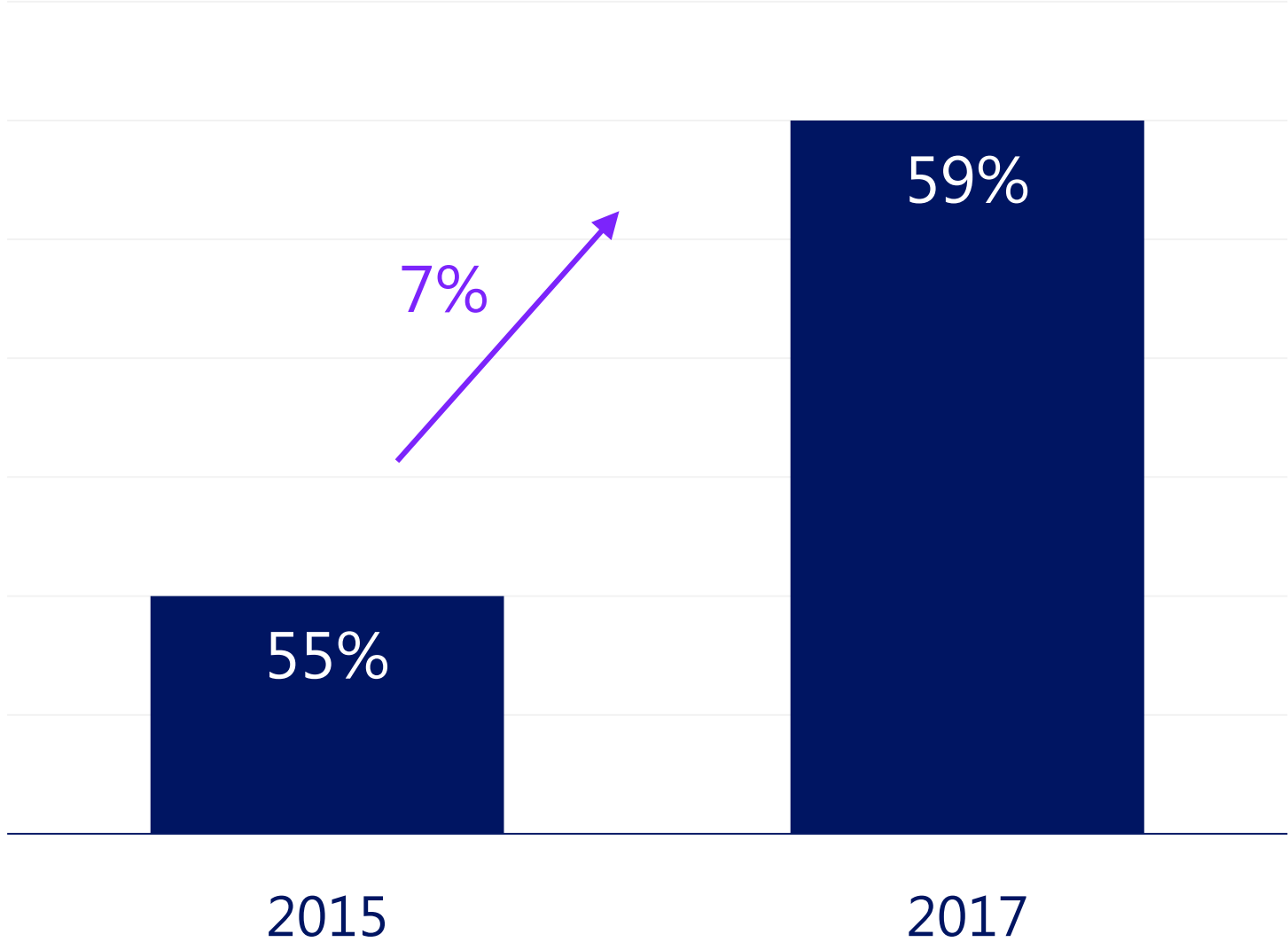
Revenues and Gross Margins  
2012 to 2017



\* Non-GAAP Financials.

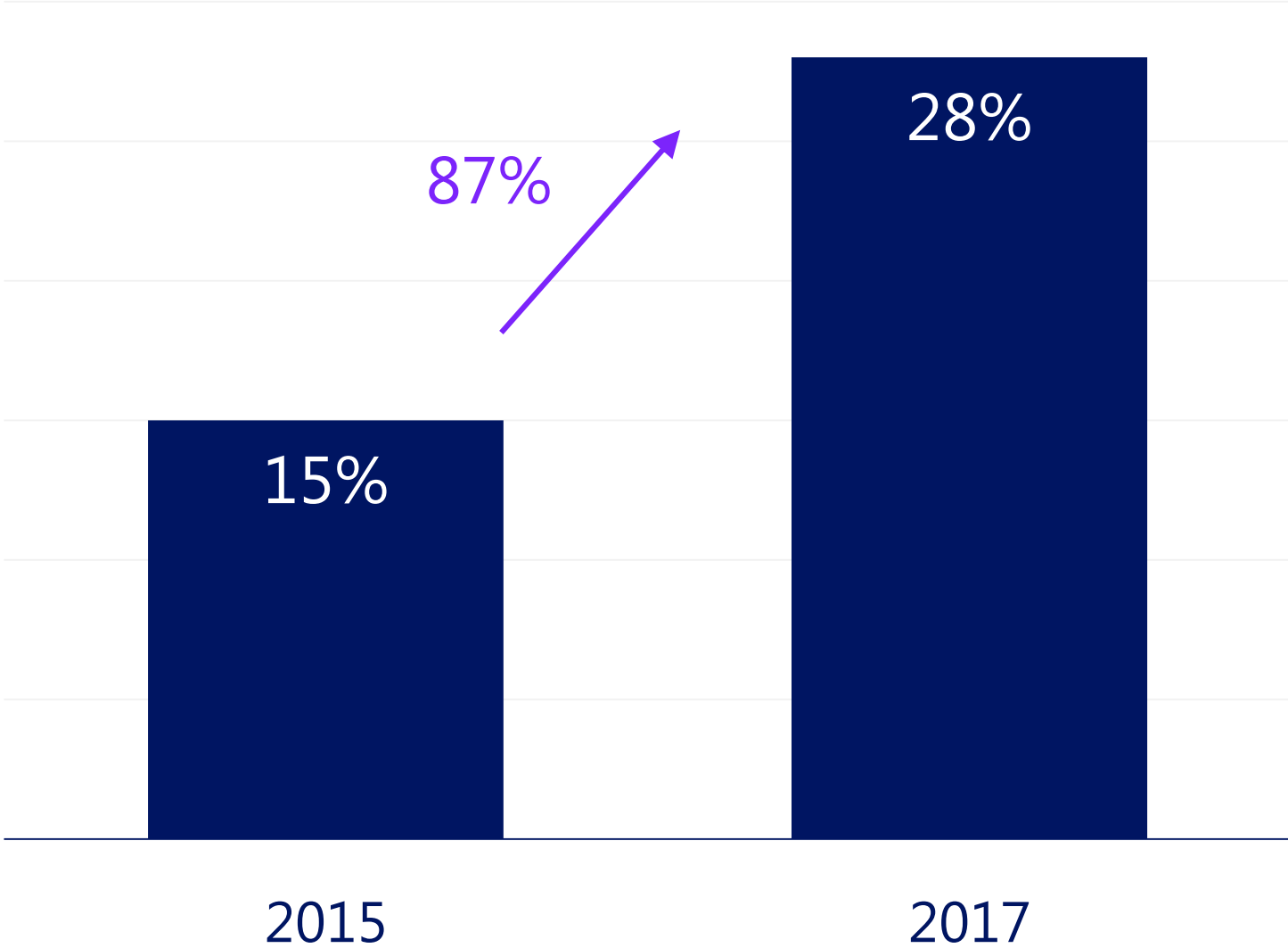
# Gross and Operating Margins

Gross Margin [%]



Nova300 Model 56%-59%

Operating Margin [%]



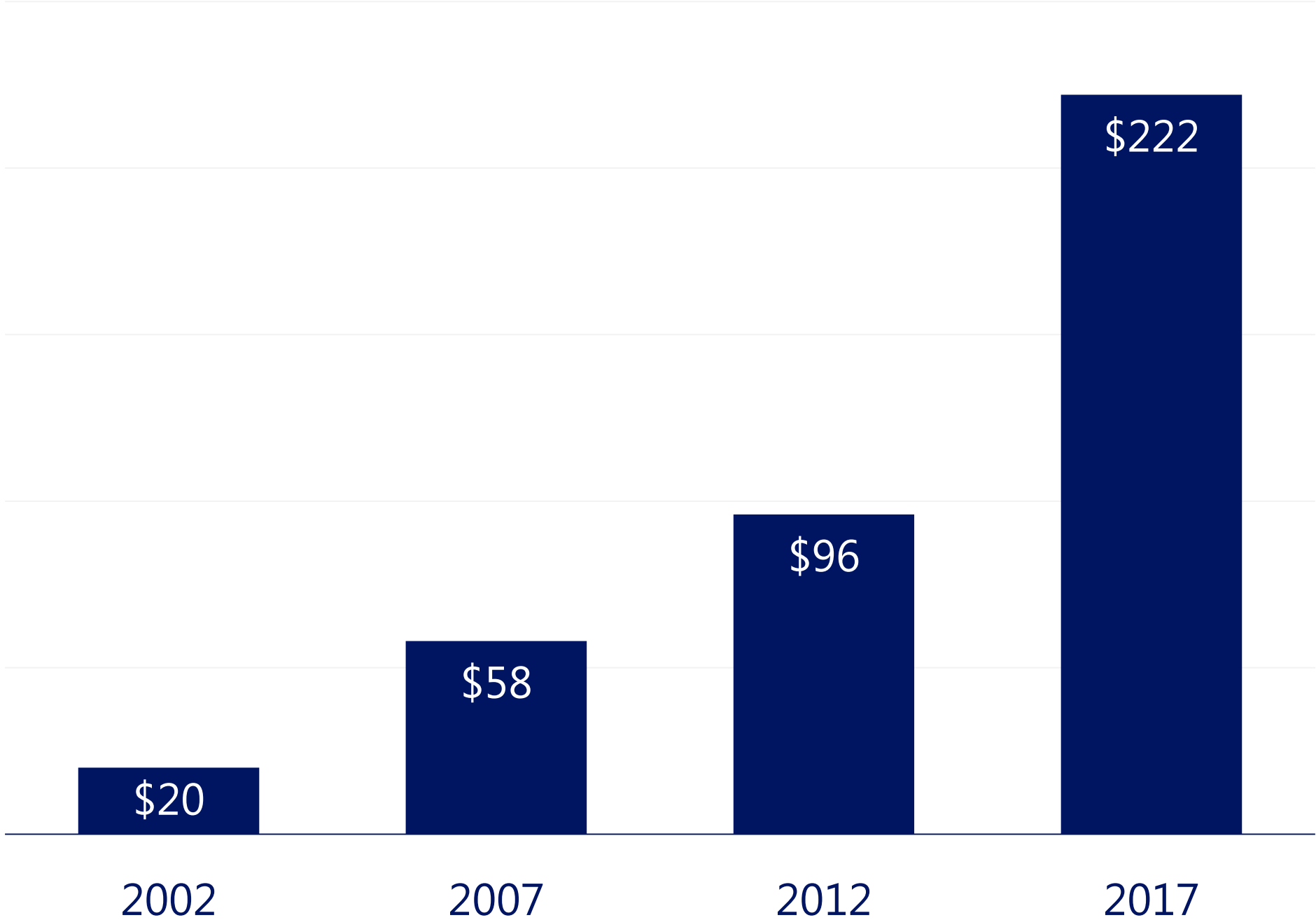
Nova300 Model 26%-29%

\* Non-GAAP Financials.



# Outperformance

Revenue Growth [\$M]



- Unique differentiated offering
- Disruptive innovation
- Inorganic growth >\$50M revenues
- New emerging metrology markets
- Solid operational model

Revenue Doubled  
Every 5 Years

\* Non-GAAP Financials.

# Market Review & Growth Potential

Zohar Gil, Corporate VP Marketing & BD



# Zohar Gil – Corporate VP Marketing & BD



- Joined Nova as head of marketing in 2011
- Led Nova Foundry business mgmt. in APAC during 2014-15
- Appointed Corp VP Marketing & BD in 2016
- Prior to Nova, was General Manager for the Carrier Line of Business and Vice President of Product Management at Alvarion Ltd.
- B.Sc. in Industrial Engineering from Tel-Aviv University and Executive MBA from Northwestern and Tel-Aviv Universities

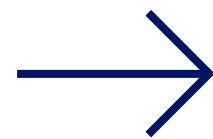
# Market Review Outline

Outlook for Electronics  
and Semiconductor



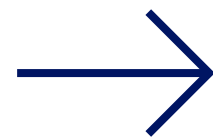
➤ Driving growth in Semiconductor CAPEX

Technology Inflections



➤ Increasing Metrology Intensity  
➤ Growth in Dimensional & Materials Metrology

Market Share Gains



➤ Business Growth and Diversification

New Innovative Solutions

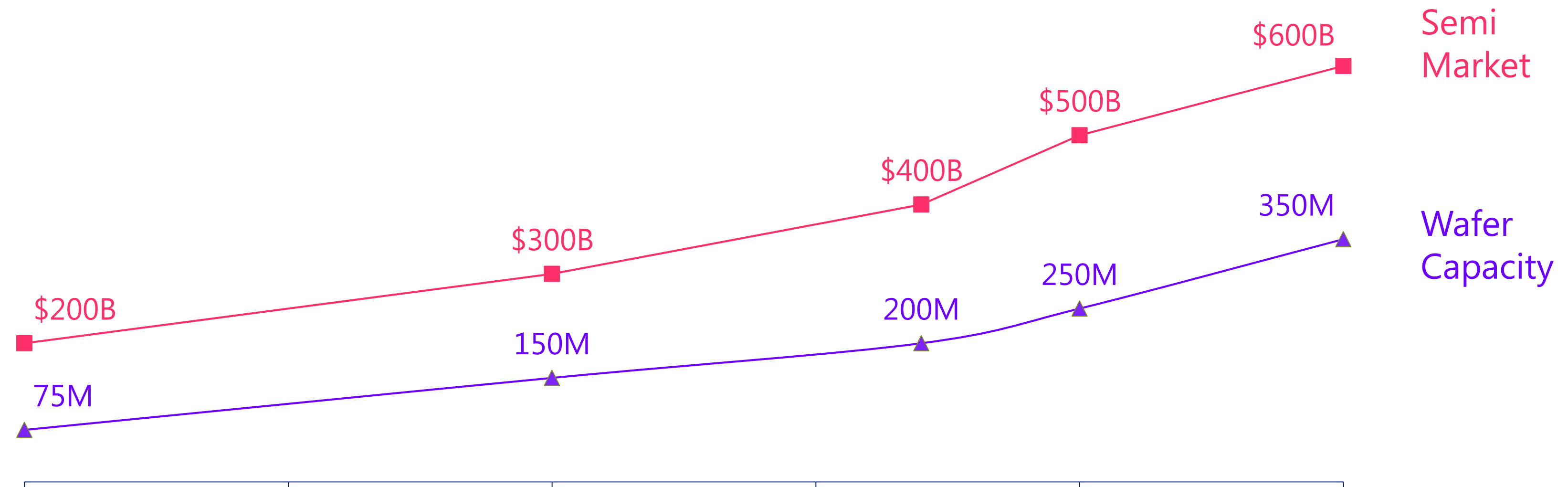


➤ Increasing Addressable Market

Positive Outlook for Continued Growth

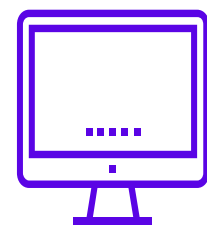


# Semiconductor Evolution Cycles

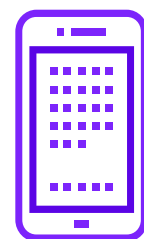


Source: Gartner, IC Insights

2000  
Internet  
**Connectivity**



2010  
Mobile Internet  
**Mobility**



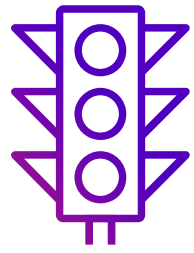
2020  
Connected world  
**Productivity**



2025  
Data Economy  
**Veracity**

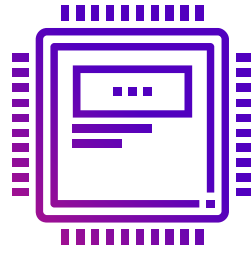


# Multiple Catalysts for Semiconductor Demand



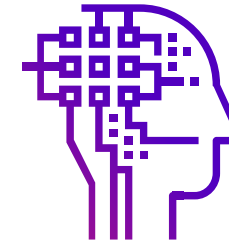
**Smart City**

25% CAGR



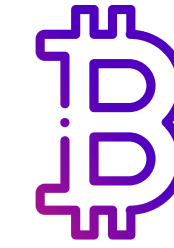
**Smart Sensors**

30% CAGR



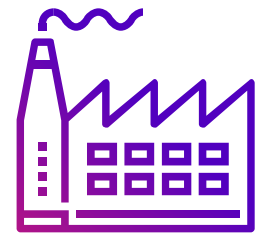
**AI**

50% CAGR



**Cryptonomy**

30% CAGR



**Smart Industry**

1 PB per day



**Autonomous Vehicle**

4 PB per day



**AR / VR**

70% CAGR

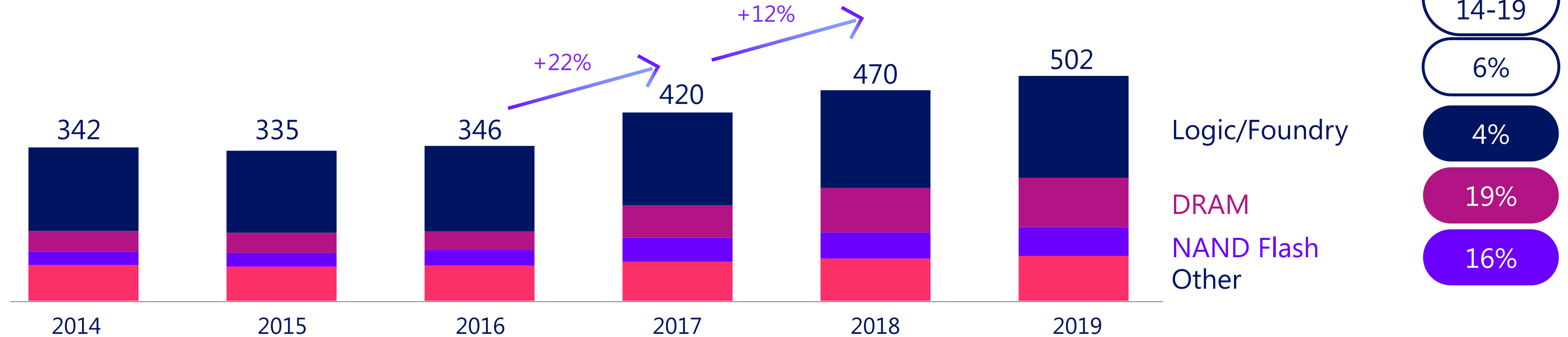


Demand for Semiconductor will triple in 2025



# Semiconductor Revenue

WW Semiconductor Revenue by Technology, \$B



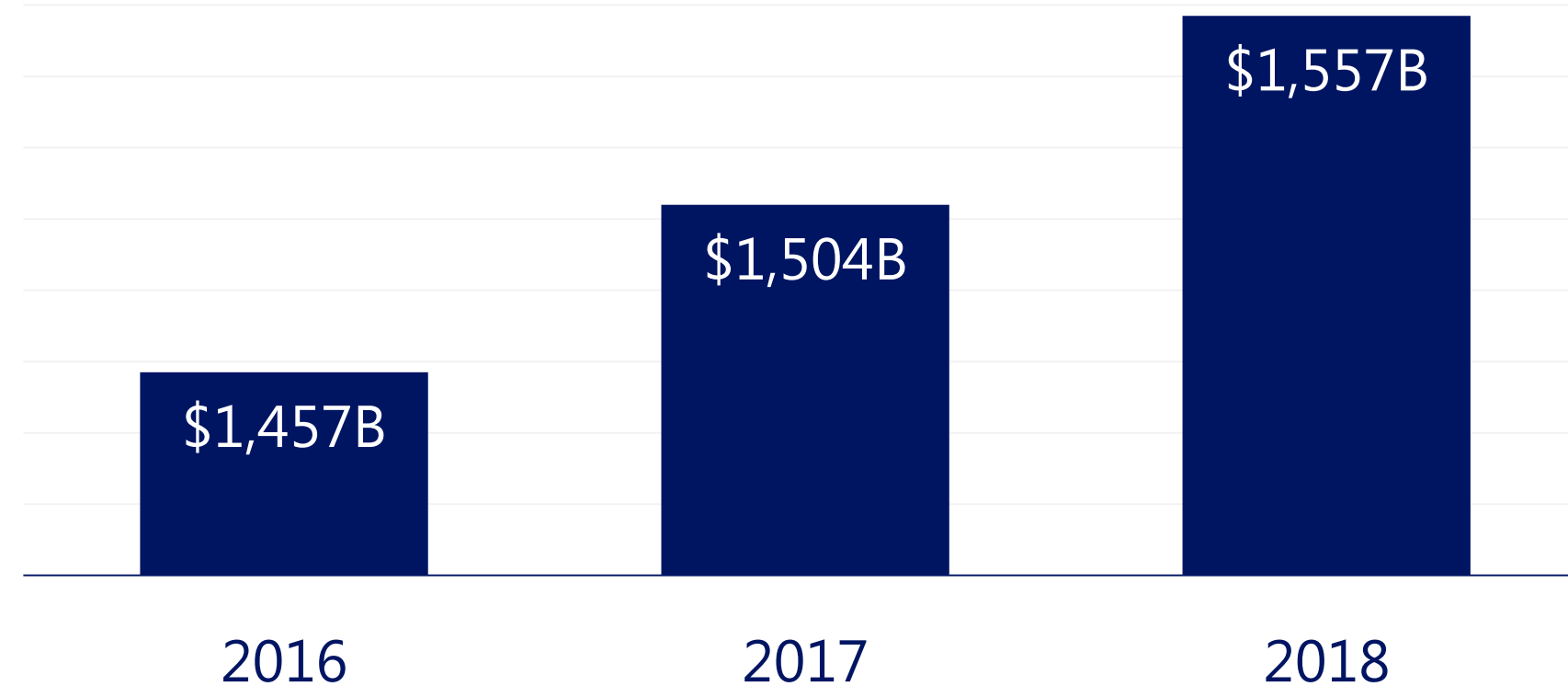
## Key Takeaways

- All semiconductor major segments are growing significantly
- **Memory** (DRAM, NAND) leading this growth
- **Foundry** expected to pick up in coming years

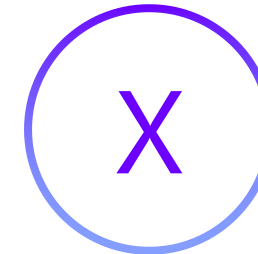
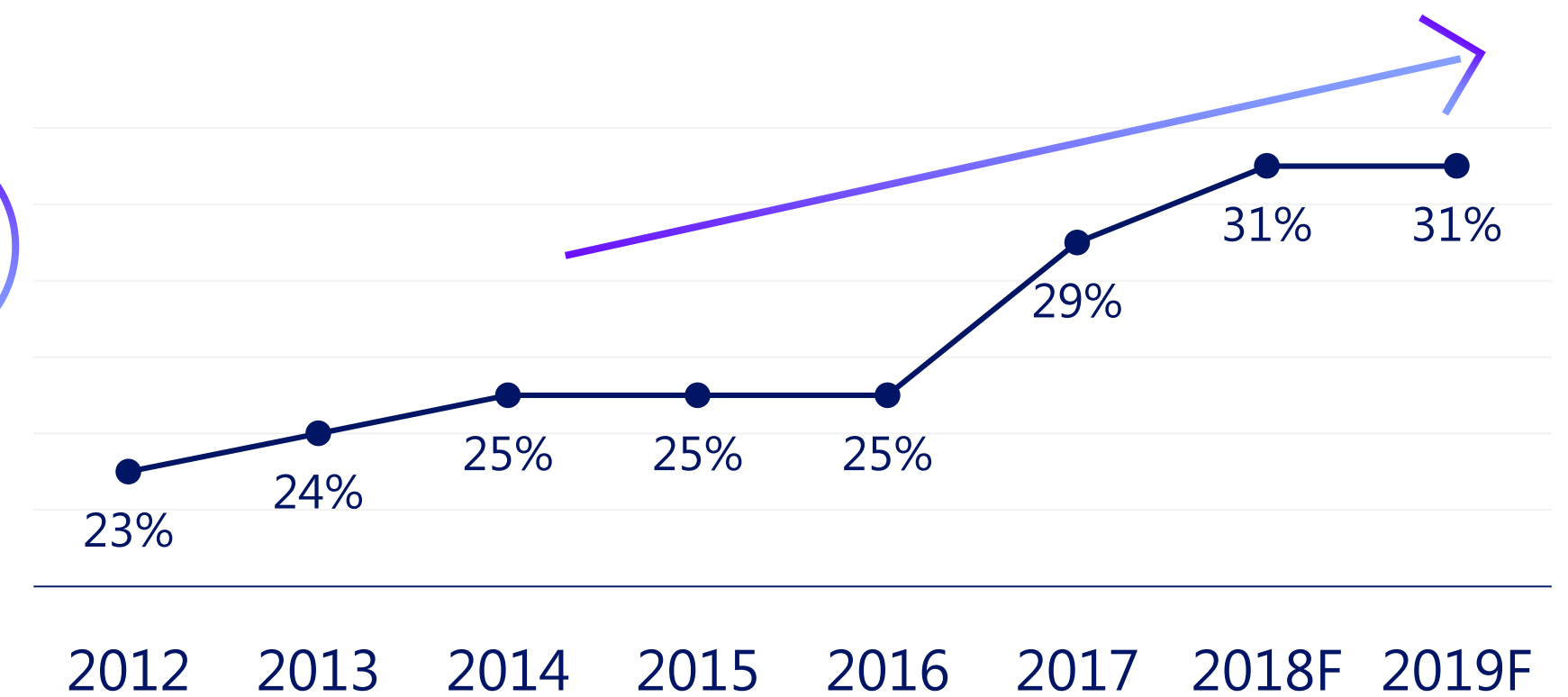
# Semiconductor Growth Drivers

## Semi Growth

WW Electronics System Production



Semiconductor % of Electronic Equipment



Source: IC Insights

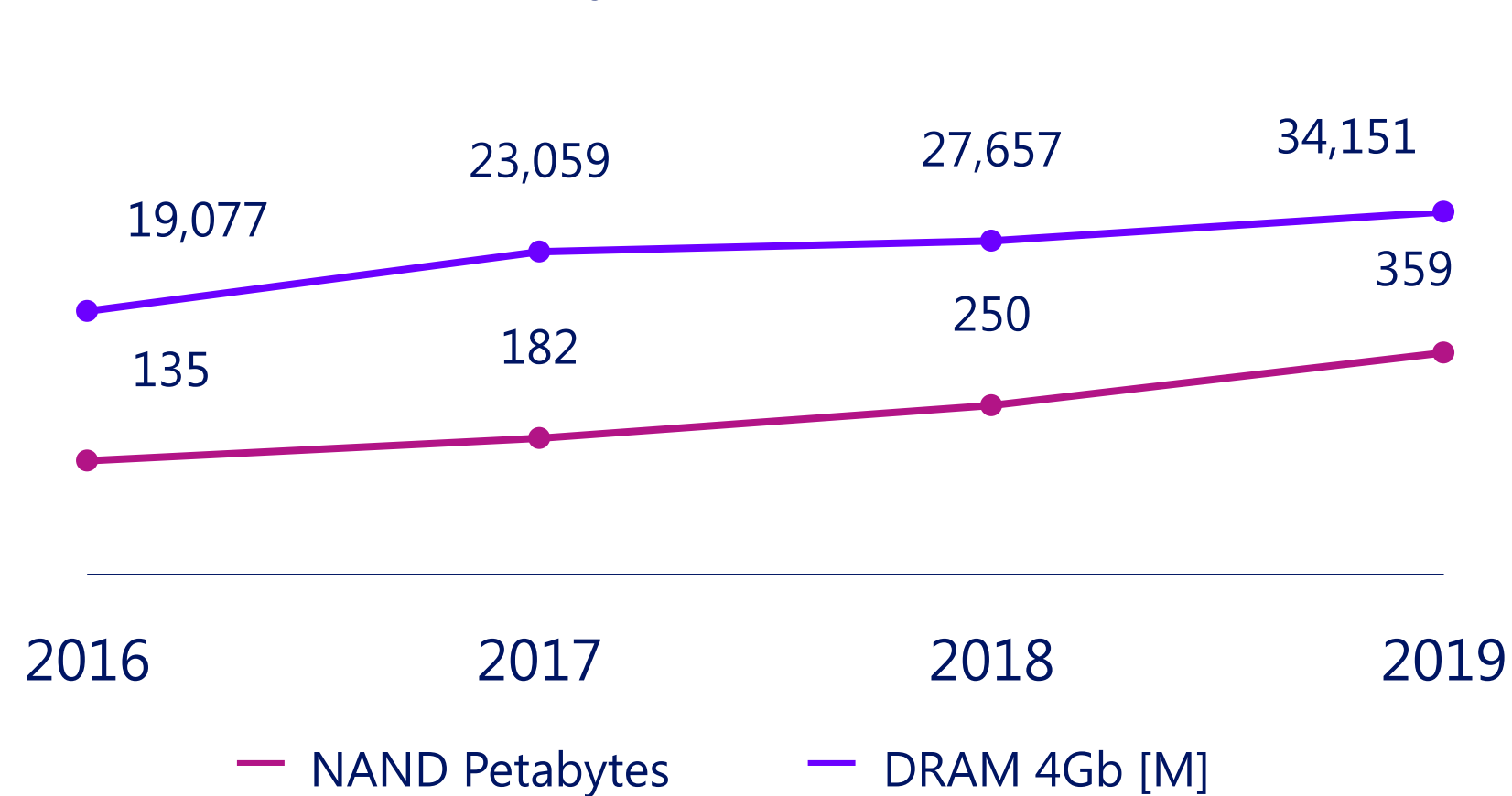
### Key Takeaways

- Semi growth effected by electronics market & content growth
  - Electronics market – growing consistently (also due to GDP resilience)
  - Content also growing over time, driven by both mobile & IoT, likely to continue



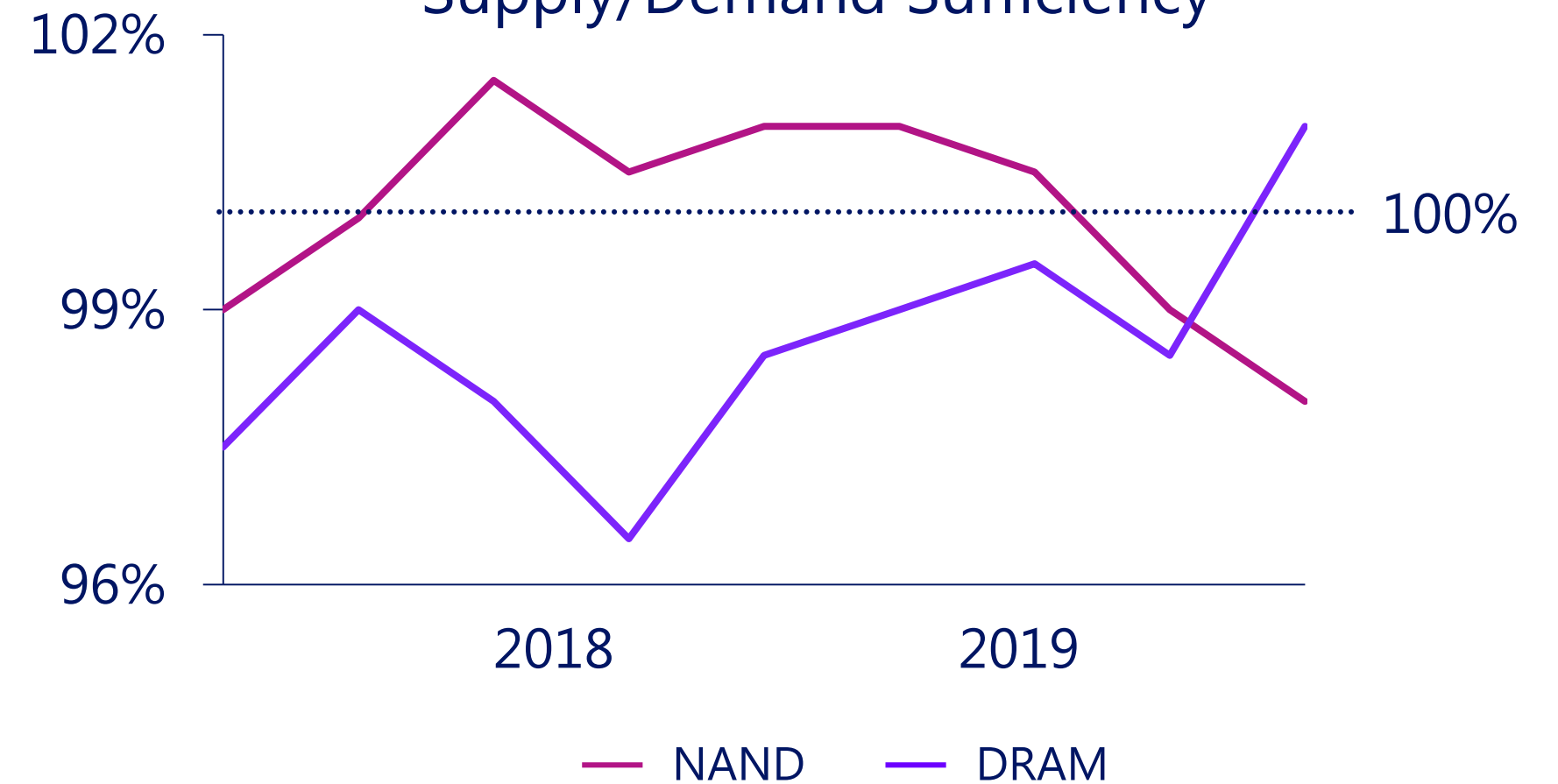
# Capacity Demand Driving Investment

Memory Demand



Source: Gartner

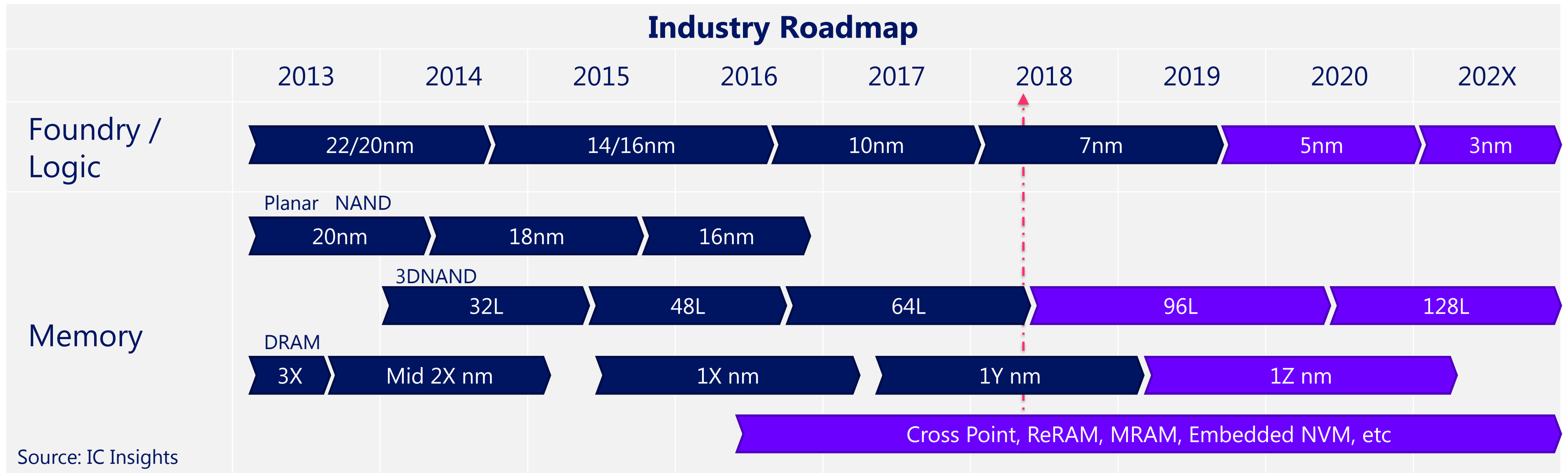
Supply/Demand Sufficiency



## Key Takeaways

- **NAND** - Demand growth of over 35% per year driven by high end smartphones and SSD
- **DRAM** - Demand growth of over 20% driven by Smartphones and Servers
- **Capacity** - Continued increase in memory capacity driving investment

# Industry Inflection Points (Logic/DRAM/NAND)



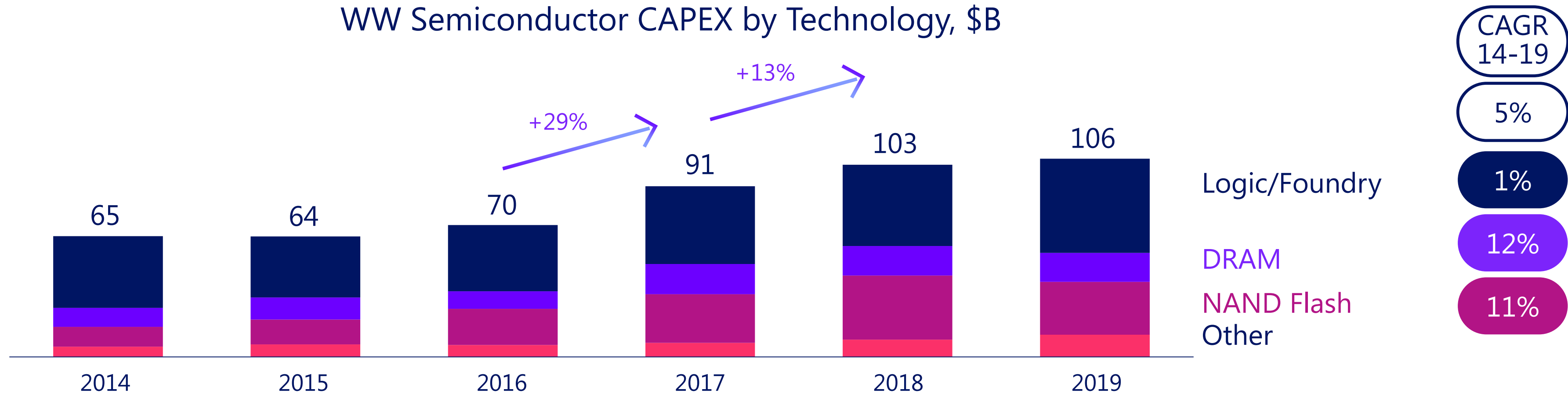
Inflection points in all major IC segments, driving significant investments in:

- Advanced memory nodes – Flash, DRAM and combinations (Xpoint)
- Logic advanced nodes – scaling, new dimensions and materials



# Semiconductor CAPEX

WW Semiconductor CAPEX by Technology, \$B

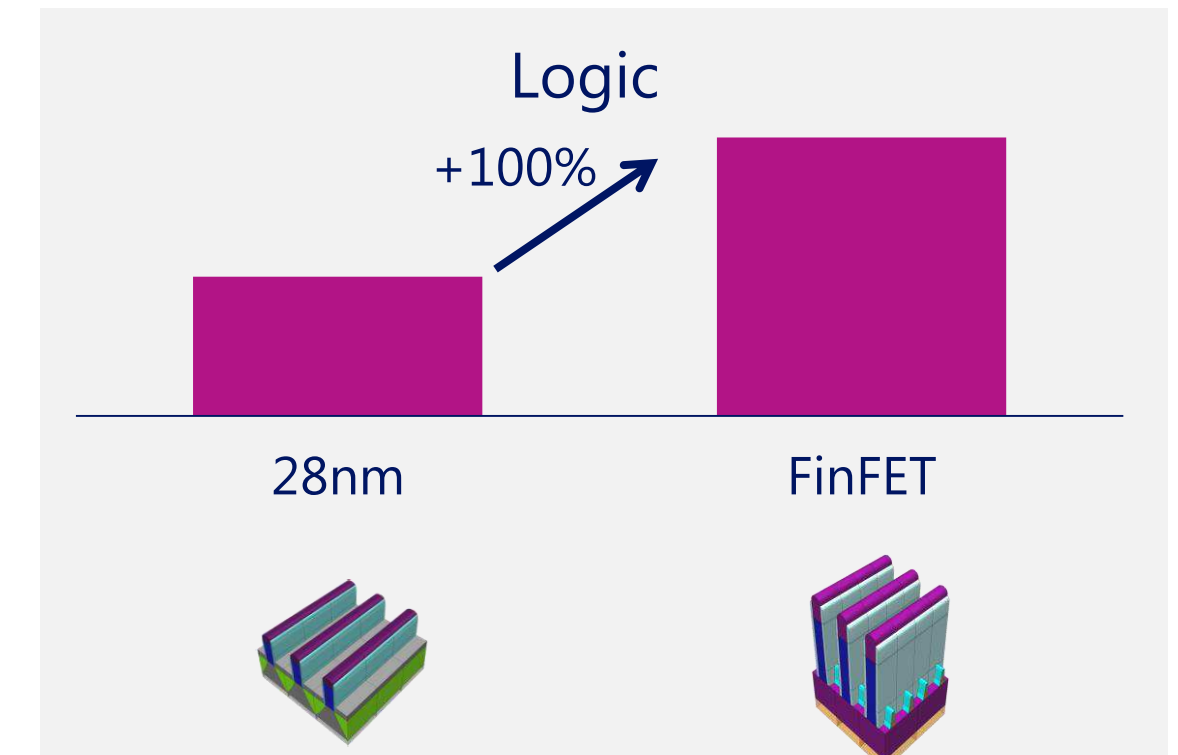
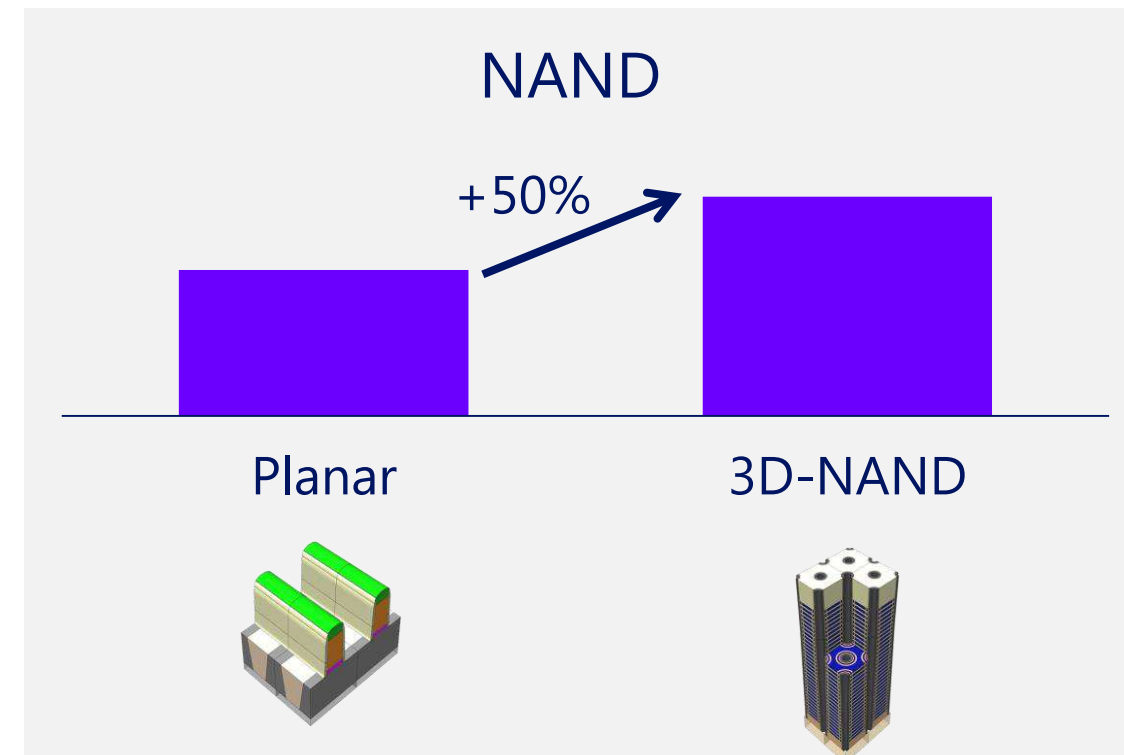
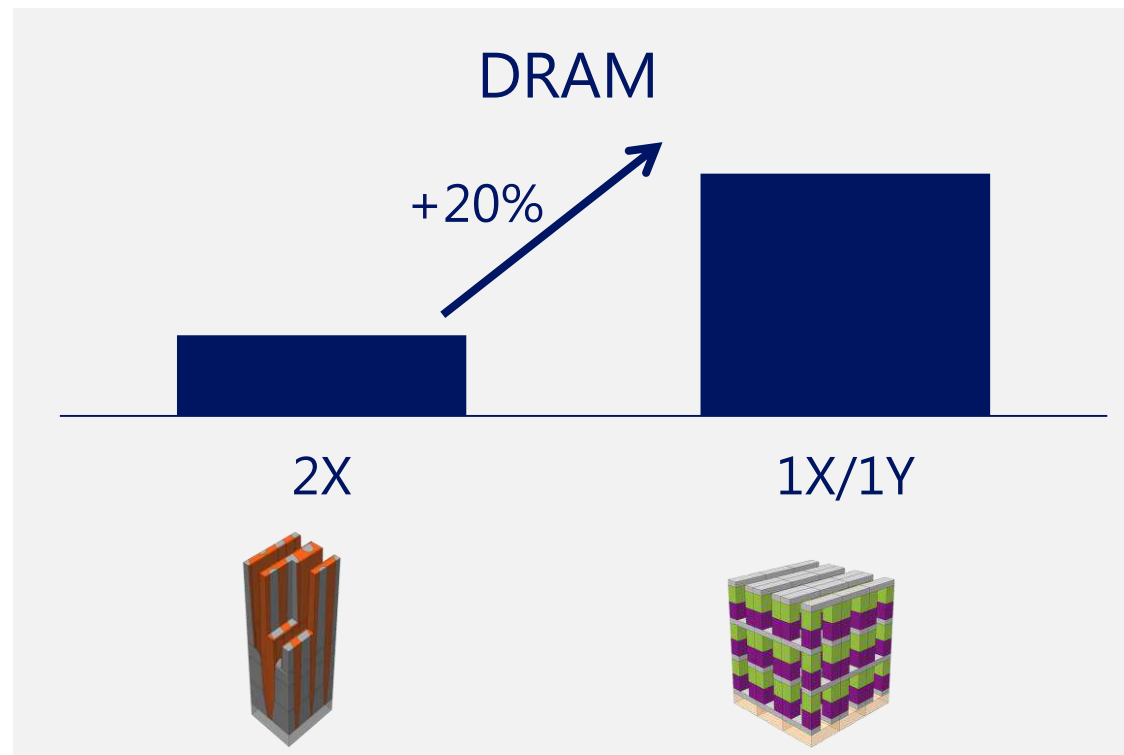


## Key Takeaways

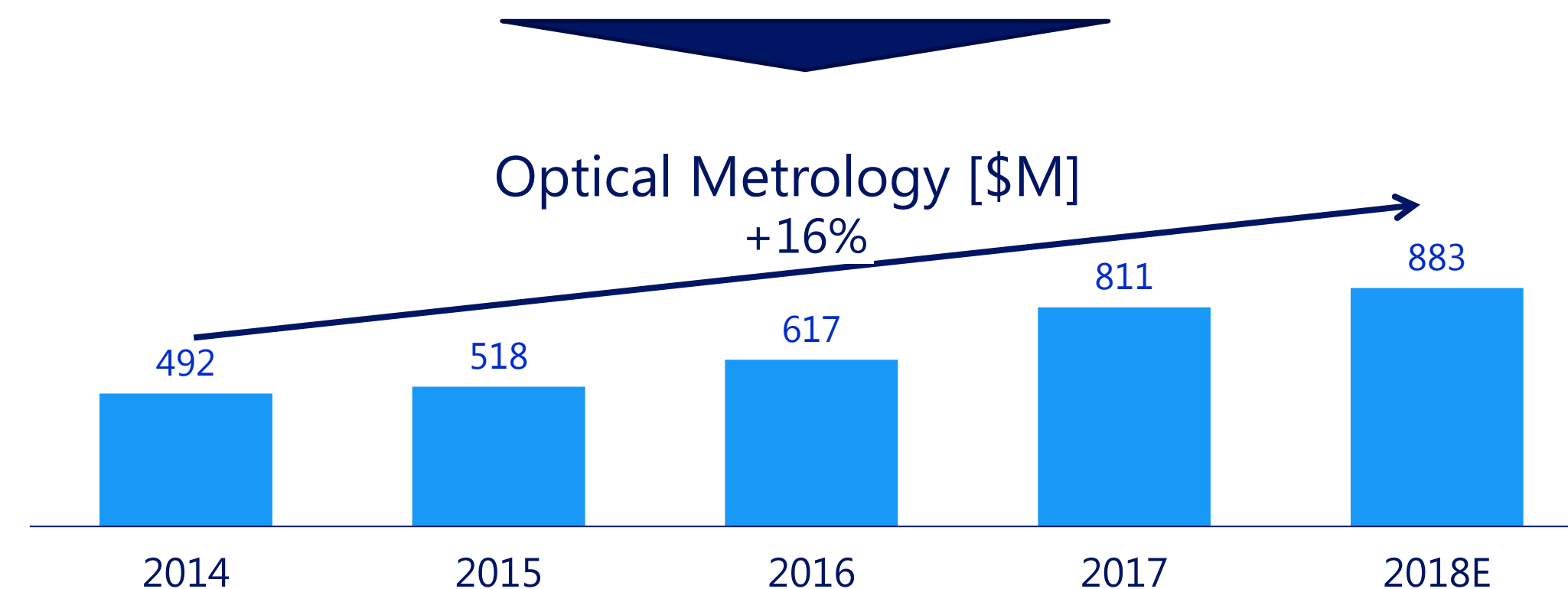
- CAPEX growing significantly in both 2018, and 2019
  - DRAM and NAND overperforming
  - Foundry/logic regaining momentum in 2018/2019

# Applications Growth Projection

Increasing Complexity = Rising Metrology Intensity



Source: company data



Sources: Gartner

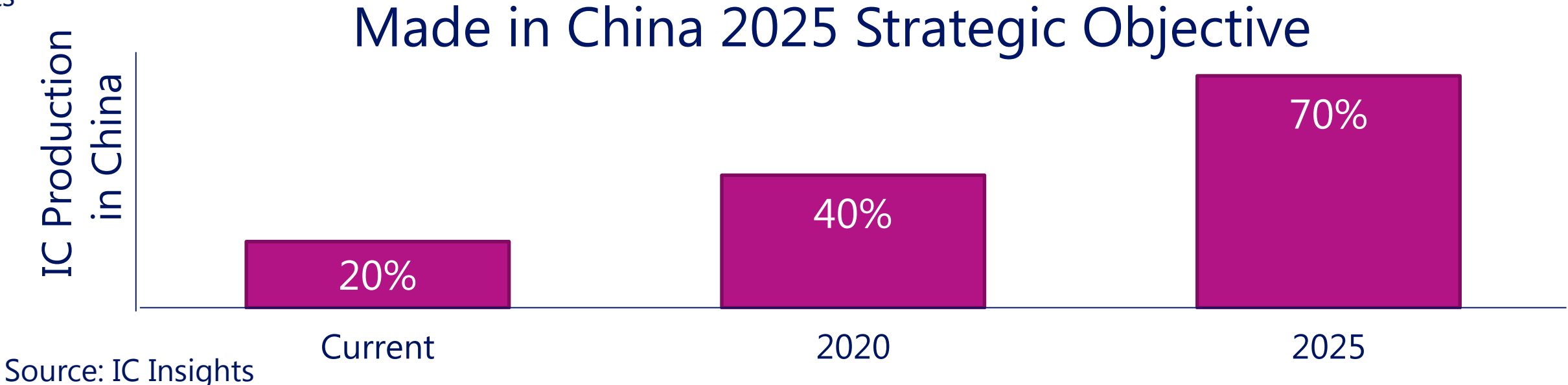


# China's IC Strategy of Massive Investment

## China's Semiconductor Industry Investment Funds

Fund	Amount	Purpose
China Government Fund for National IC Industry Support	120B RMP (\$19.5B)	National Level Support for IC Industry 40% wafer manufacturing, 30% chip design, 30% wafer packaging
Local Government and Private Equity investment in China	600 Billion RMP (\$97.4B)	Promote and support IC industry, key enterprises, projects and innovation

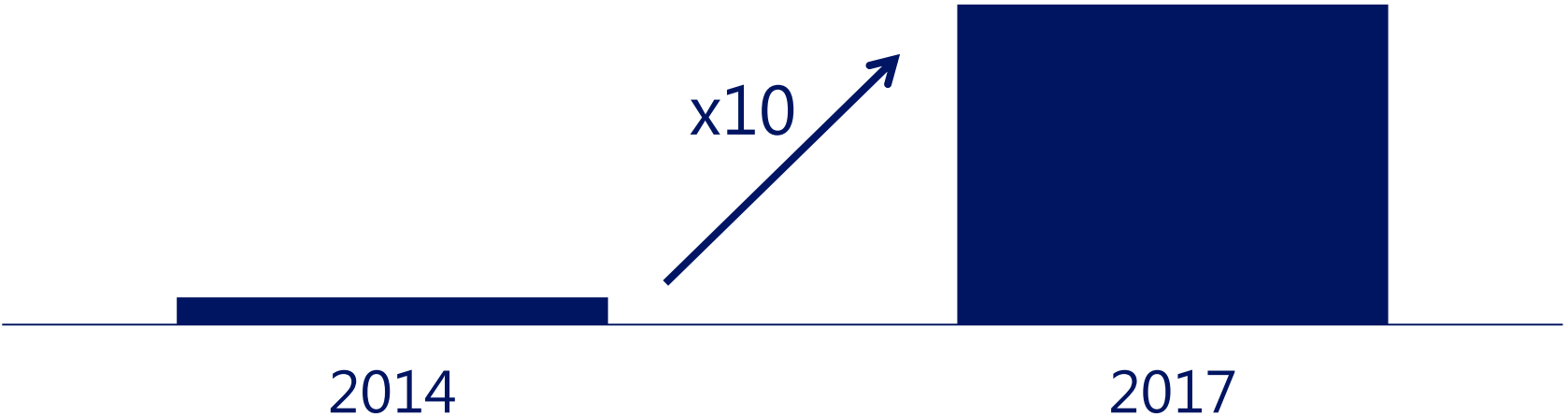
Source: IC Insights



**Objective: Reach 70% Self Sufficiency in IC Production by 2025**

# Nova Business Performance in China

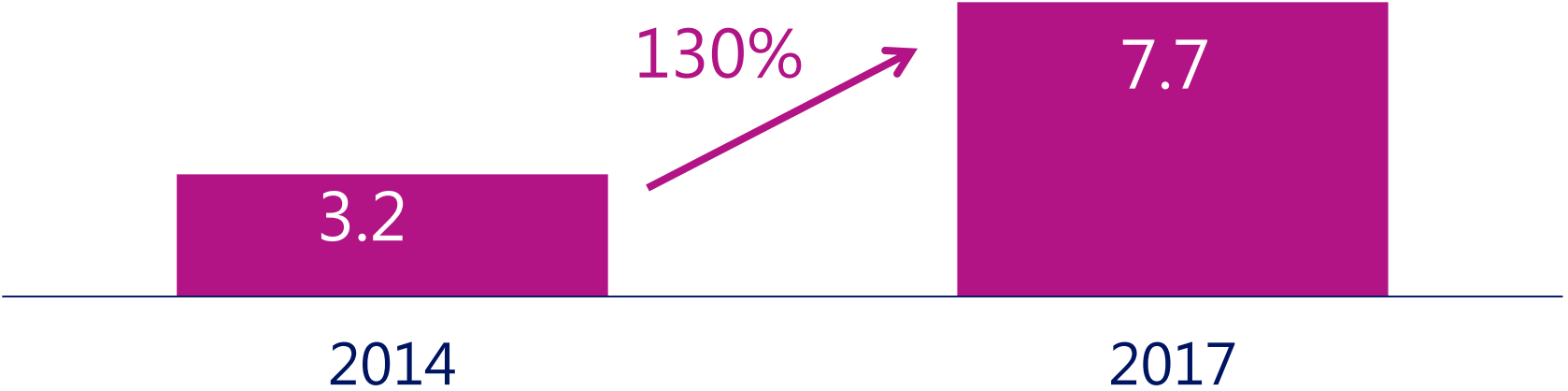
Nova Revenue China Region



Source: Company data

- Tool-of-Record position in major IC establishments
- Dimensional and Materials metrology
- Memory and Foundry customers

WFE Growth in China

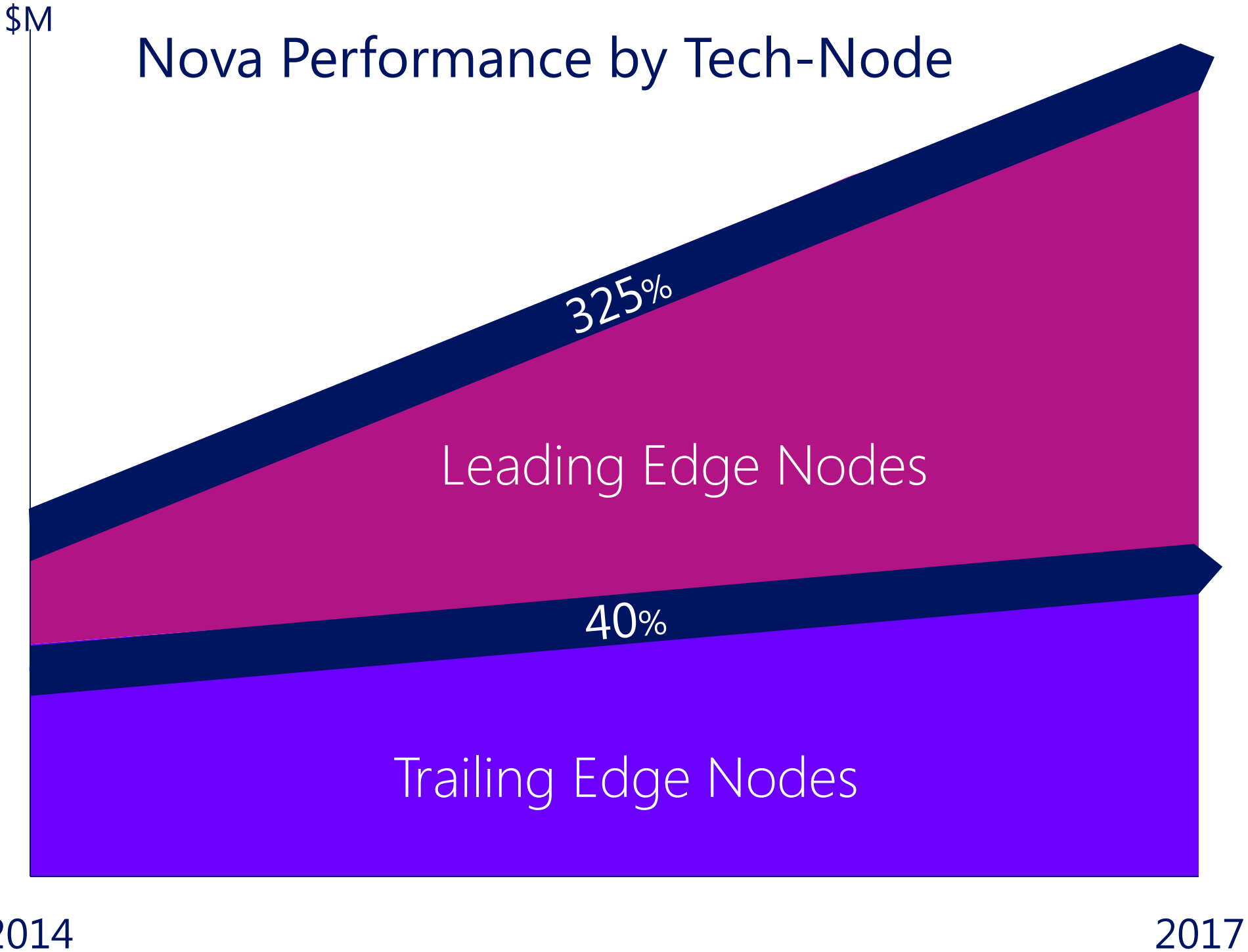


Source: Gartner

Exceeding Industry Benchmark



# Growth Drivers – Advanced Nodes

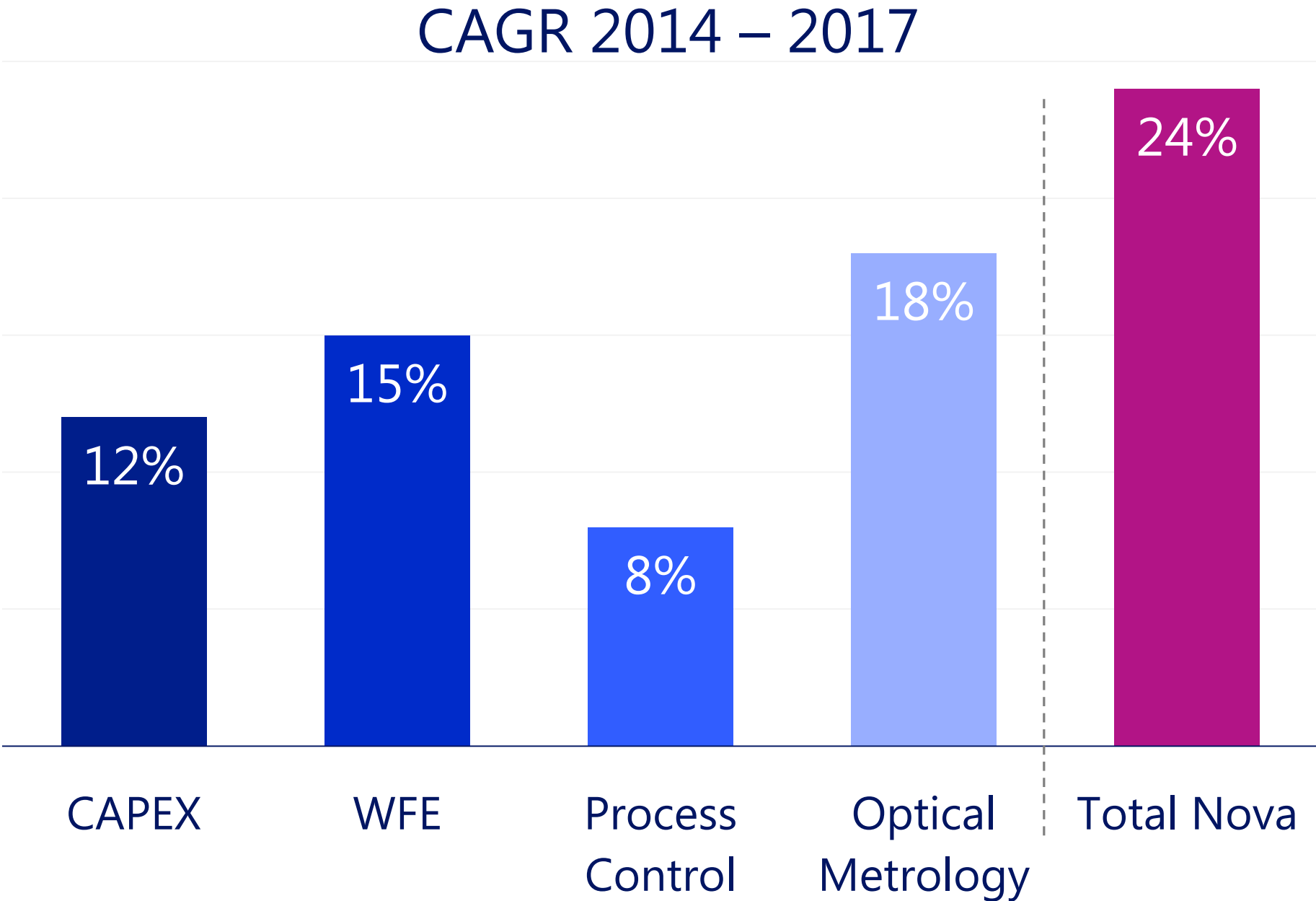


## Matching Foundry Spending

- 40% from trailing nodes
- 60% in advanced nodes
- Optical and Material Metrology solutions

Source: Company data

# Nova Versus Industry Performance Benchmark



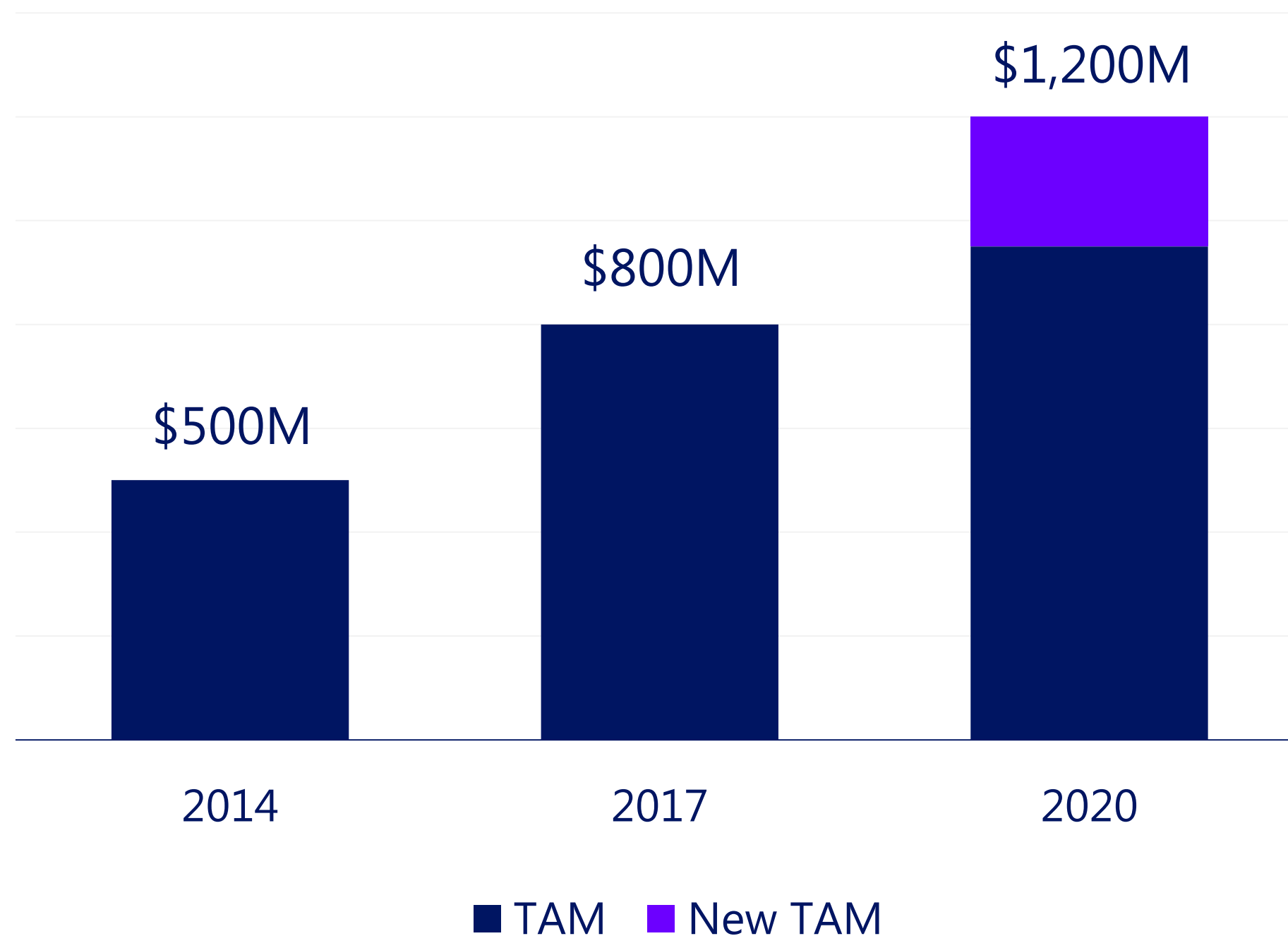
Source: Gartner

- Multi-year growth exceeding Process Control and Metrology
- Contributed by:
  - Leading position in IM market
  - Growth in SA CD and material metrology
  - Business growth in China
  - Growth in memory customers

Exceeding Industry Benchmark – Growing Market Share

# Growing TAM – Market Exposure

Growing Addressable Market



## New TAM expansion:

- Material-Dimensional Integration
- Lab to Fab Metrology
- Machine Learning & Big Data
- Expand IM to new process steps

Source: Company data, Gartner



# Disruptive Innovation for Emerging Market

Shay Wolfling, PhD, Chief Technology Officer

# Shay Wolfling – Chief Technology Officer



- Joined Nova as CTO in 2011
- R&D manager at KLA-Tencor-Belgium, leading multidisciplinary metrology & inspection development projects
- Founder and VP R&D of Nano-Or-Technologies, a start-up company with a proprietary technology for 3D optical measurements, acquired in 2005
- B.Sc. in physics & mathematics, and a PhD in physics from the Hebrew University of Jerusalem

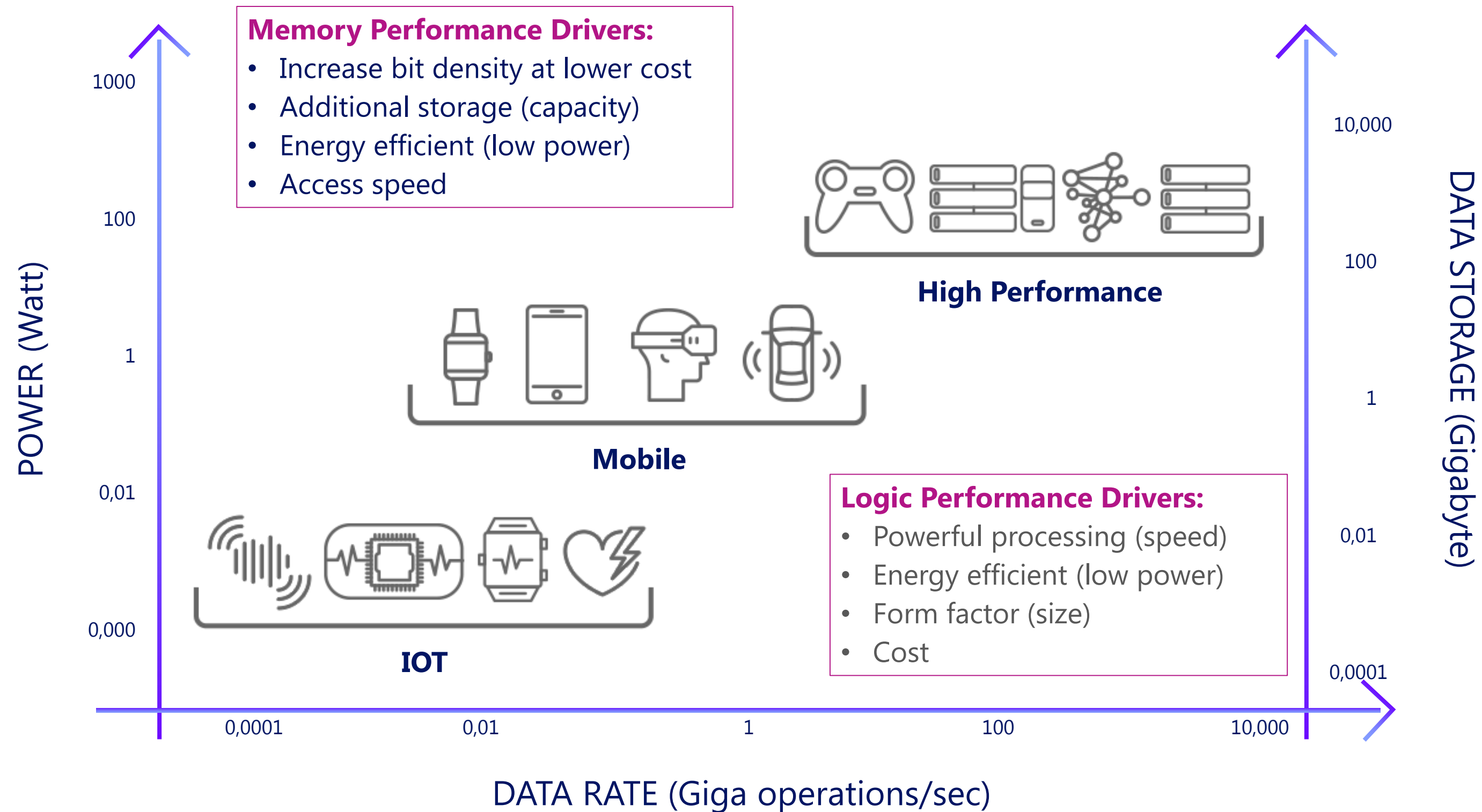
# Outline

Process Challenges – Metrology Opportunity

Differentiated Technology Directions

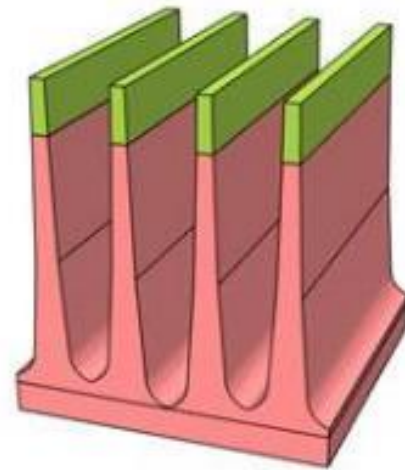


# Variety of Different Requirements



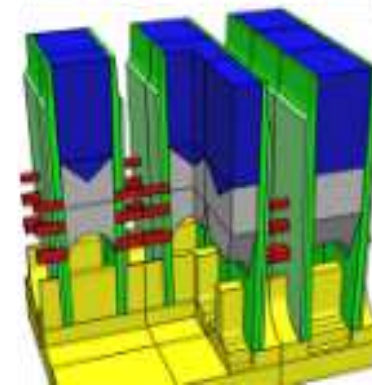
# Logic Roadmap Enablers

## Device Scaling



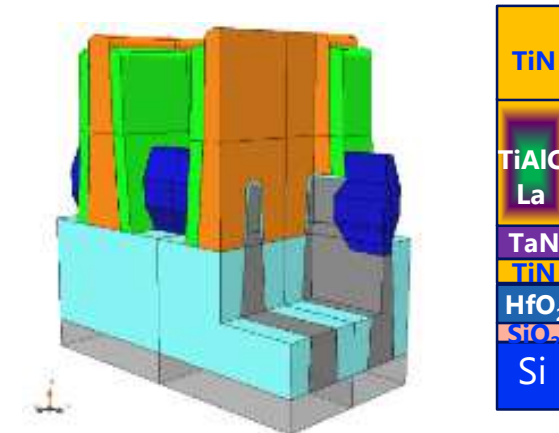
- Shrink
- Multi Patterning
- EUV
- Alternative Litho:  
DSA, Multi E-beam, Nano-Imprint
- Atomic Layer  
Etch & Deposition

## Vertical Integration



- 3D Transistors
- Vertical architecture
- FinFETs
- Gate-All-Around -  
Multiple Nanowires
- Films on structure

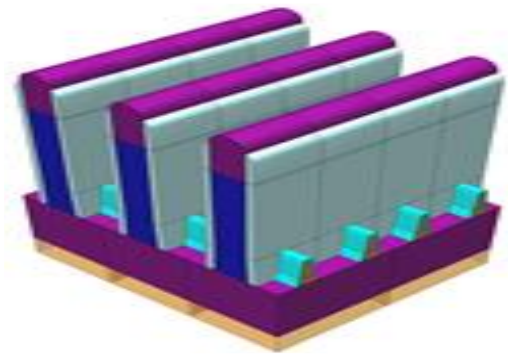
## Novel Materials



- HKMG stack control
- Complex Epi process
- BE: alternative metals
- Channel stress
- On-structure material
- III-V & Ge materials

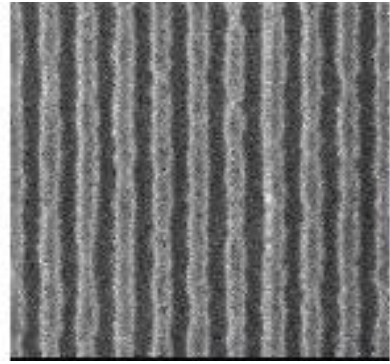
Environment Rich in CD & Material Metrology Opportunities

# High Performance Logic Roadmap



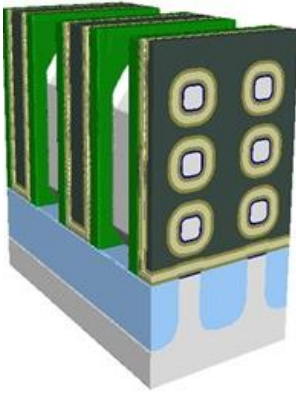
FinFET introduction

14nm



EUV introduction

7nm



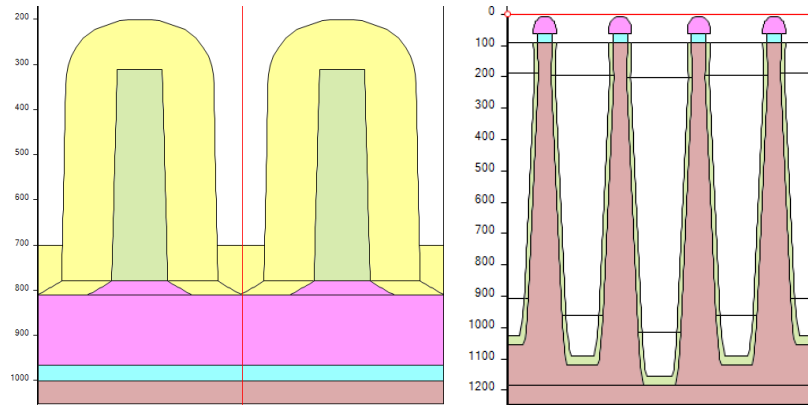
Nanowires Gate-All-Around

Sub 5nm

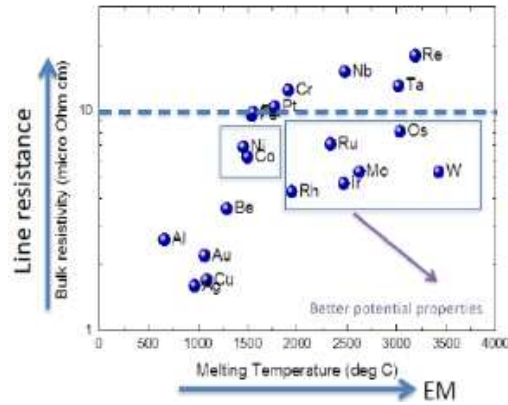
Sub 3nm



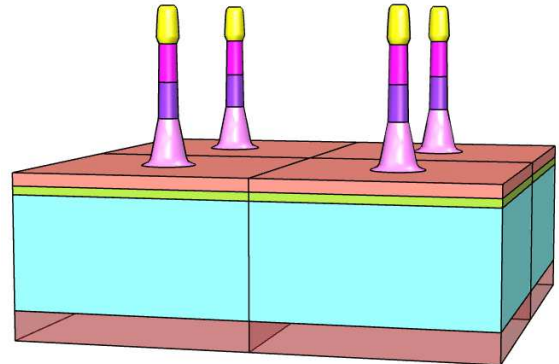
Quadruple patterning



Alternative metals in BEOL

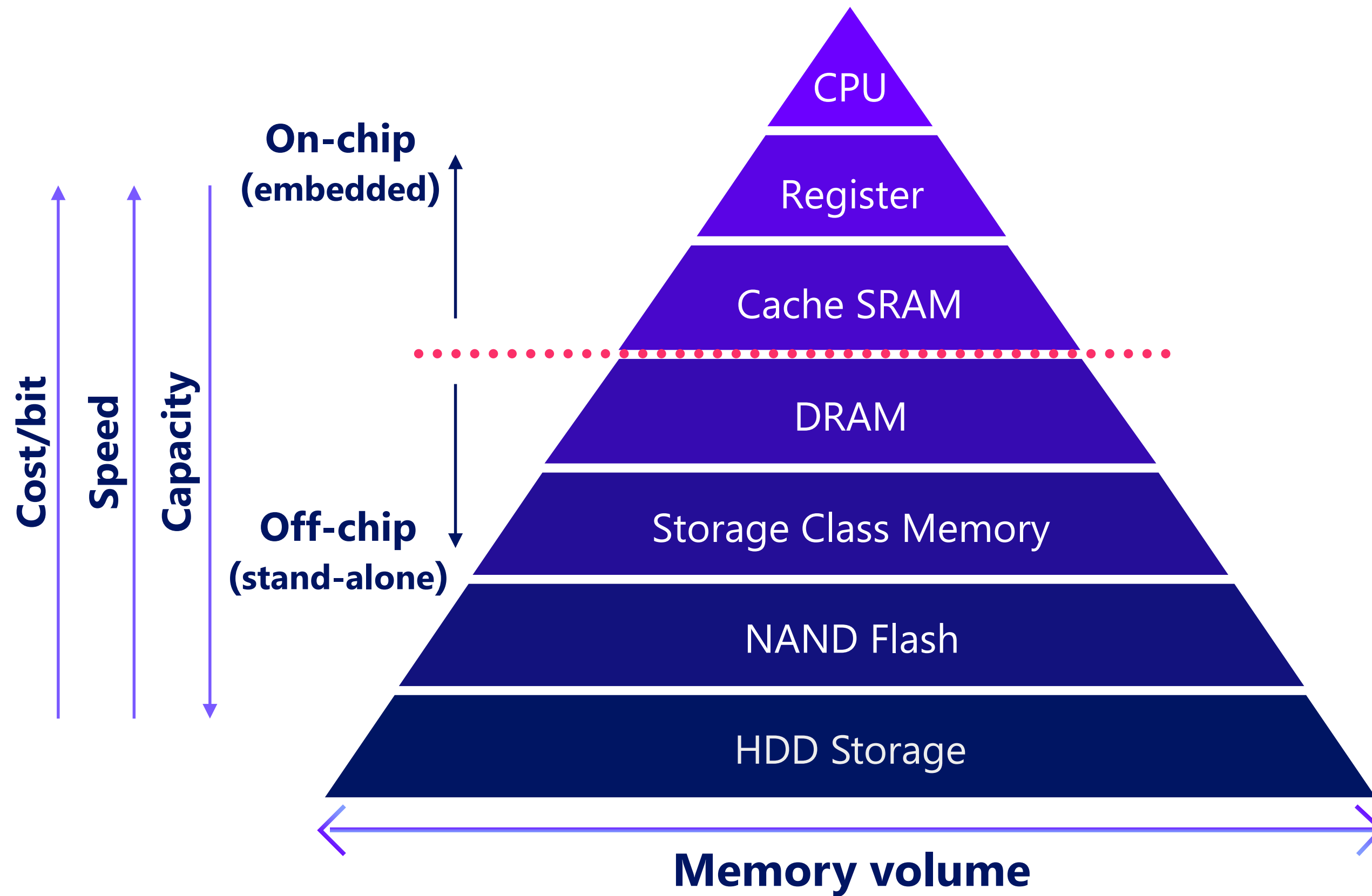


Vertical Nano-Wires



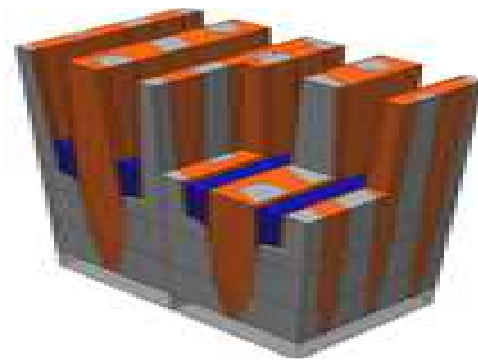


# Various Types of Memory



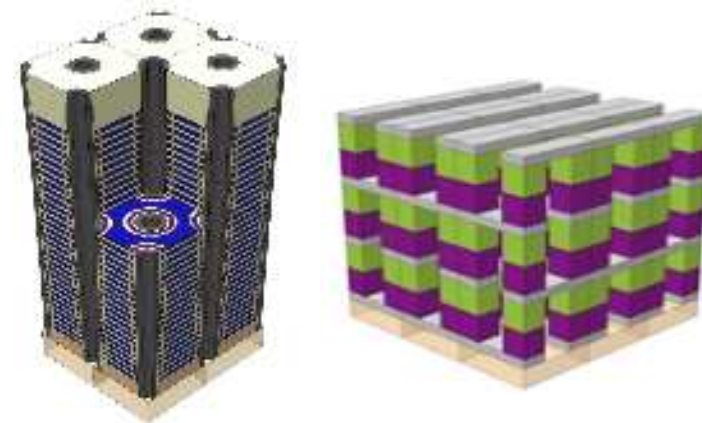
# Memory Roadmap Enablers

## Scaling (DRAM)



- Scaling capacitors
- Multiple patterning (Quadruple & Octuple)
- Multiple CDs & profile @ Litho & Etch
- Pitch walking
- Tighter tolerance per step

## Vertical Integration



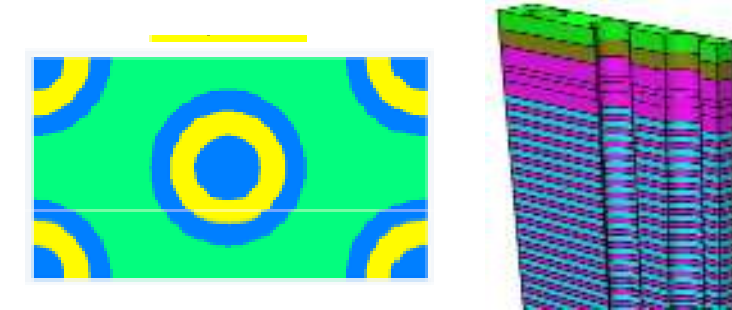
### 3D NAND

- Multi-Layers > 128
- 1:60 Aspect Ratio
- Underlayer Logic

### DRAM

- High Aspect-Ratios
- "Buried" structures

## Novel Materials



- **3DNAND:** Complex stacks of new-materials
- **DRAM:** Advanced materials (High-K)
- **MRAM:** new materials with critical properties
- Conformal deposition

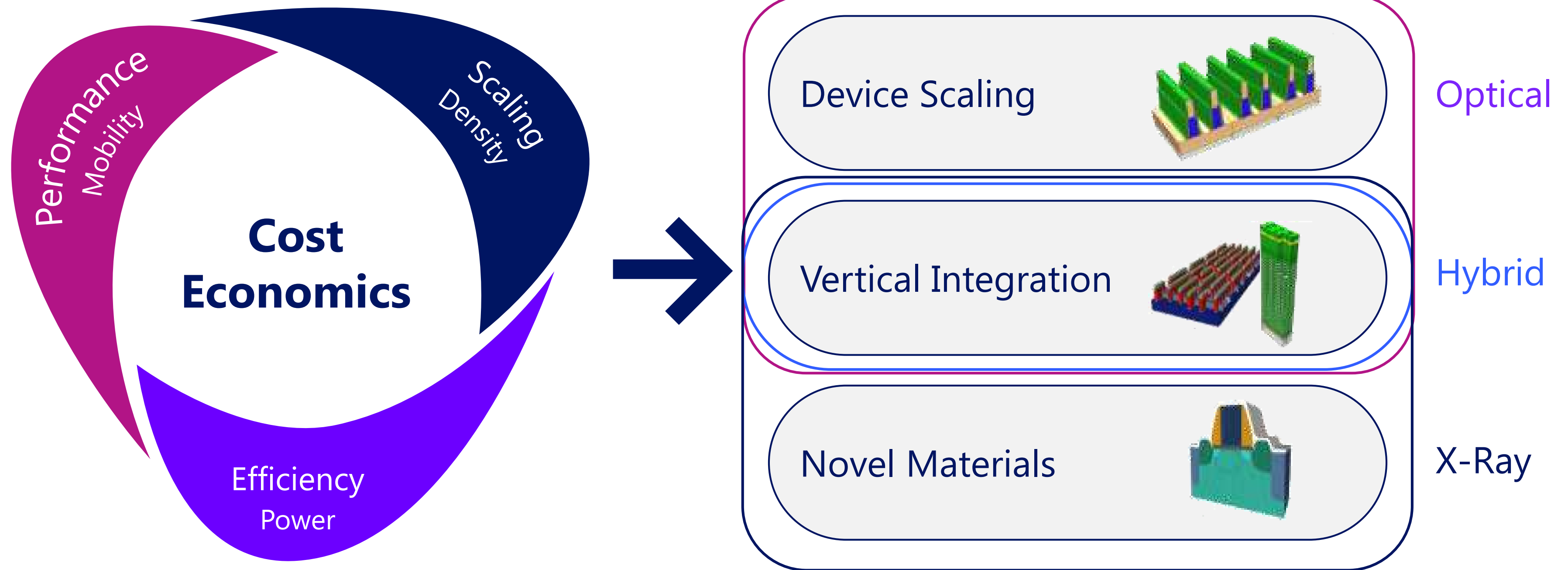
Environment Rich in CD & Material Metrology Opportunities

# Memory Roadmap

	2018/9	3-5 years
Embedded Memory	STT MRAM (N18-N14) 	STT MRAM (N5) SOT MRAM 
DRAM	Pillar D16 	Pillar, FE, STT MRAM <D10 
Storage Class Memory	Cross-point Phase Change Memory 	Multi-Level Cross-Point Resistive RAM 
3D NAND	96-128 Tiers 	>512 Tiers 



# Technology Inflection Points

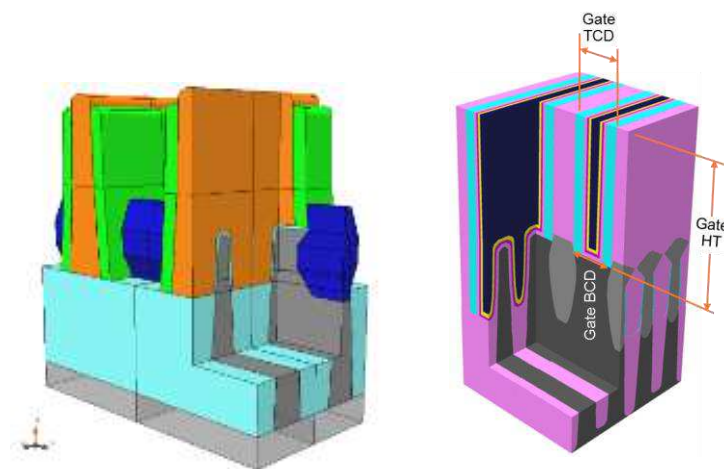


Complex Inflection Points – Metrology Growth Driver

# Logic – Key Metrology Challenges

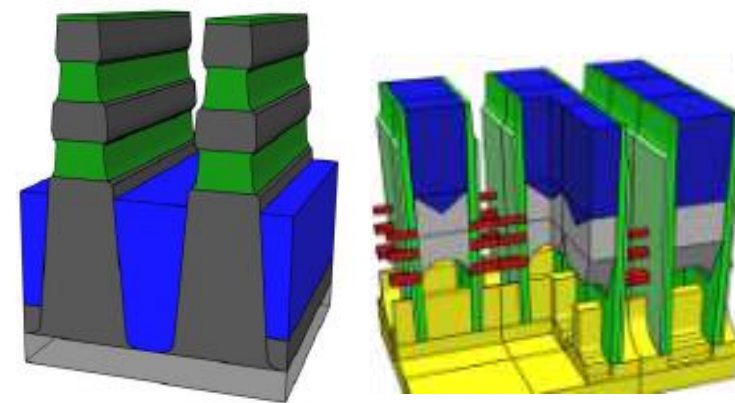
## FinFET

- Multiple parameters
- On-structure metrology
- Material & Dimensional
- Ultra thin film on structure
- HKMG stack control
- Complex Epi process



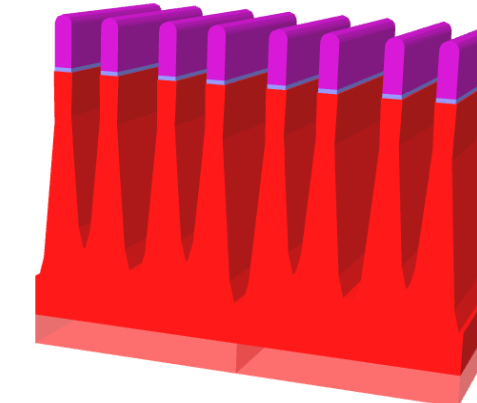
## Nano-Wires

- Complex stack (Ge / Si)
- Multiple Nanowires – additional variability of dimensions
- Vertical architecture geometrical challenges



## BEOL

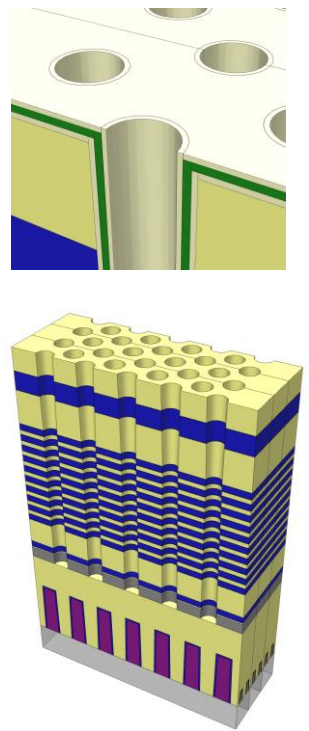
- Multi-patterning – SAQP and beyond
- EUV – Roughness control
- Alternative metal properties
- New processes – selective deposition



# 3D NAND – Key Metrology Challenges

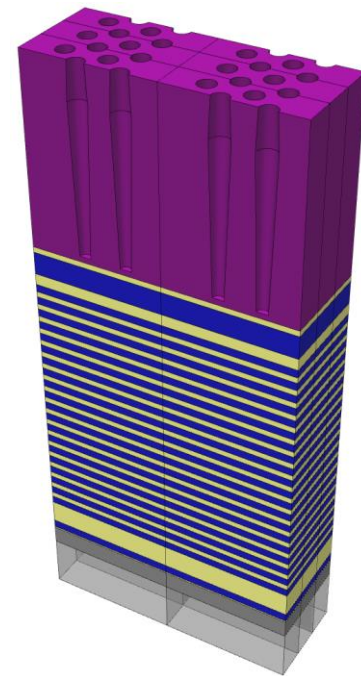
## Deposition

- Tiers thickness
- Liner thickness
- Under-array CMOS



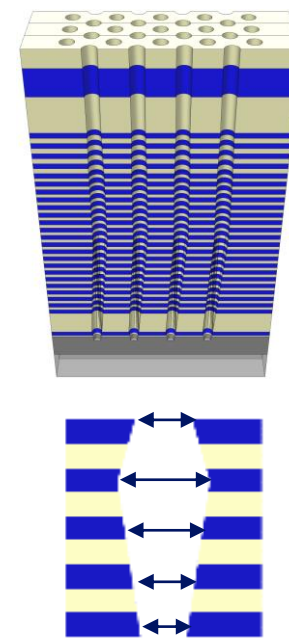
## Hard Mask

- HAR
- Dark



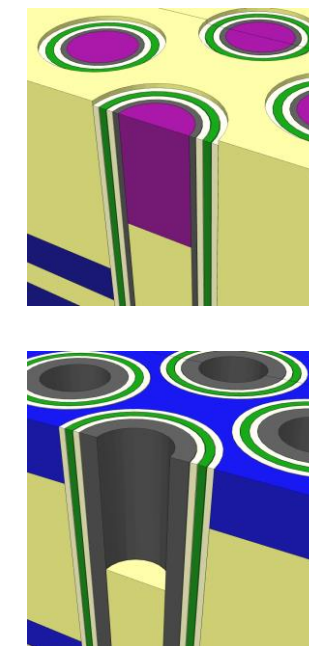
## Channel Etch

- HAR
- Multiple CDs
- Bow & Tilt



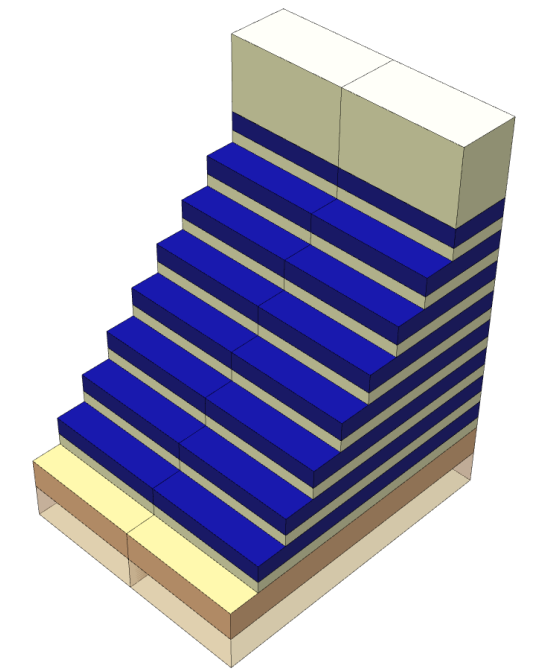
## Post Channel

- Oxide Recess
- Pre & post CMP



## Channel Etch

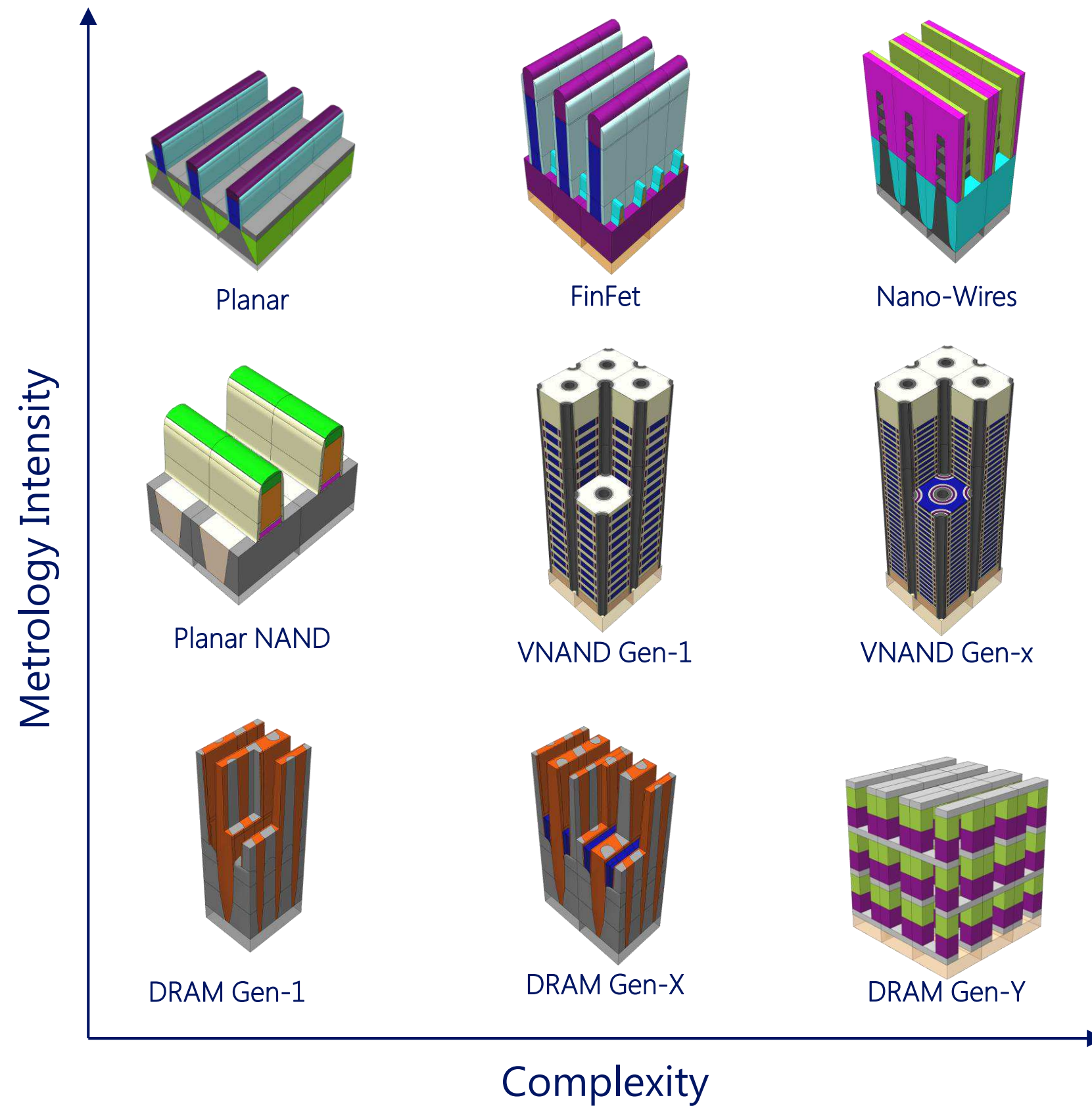
- Non-periodic & in-die



Multi-Tiers, High-Aspect-Ratio, Bottom Parameters



# Intensity Growth Beyond Demand



Growing Complexity  
=  
Growing Intensity

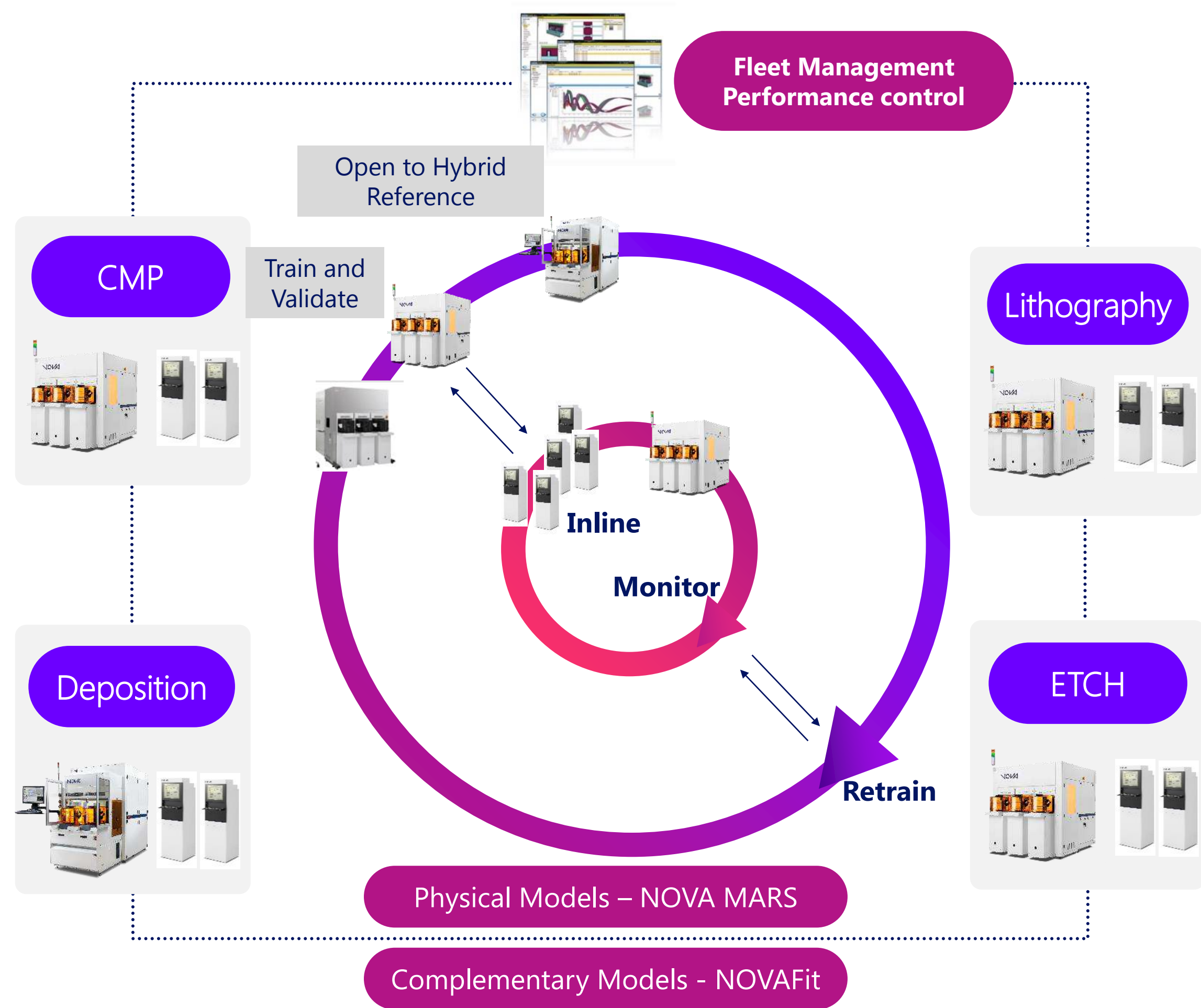
Complex transitions - Environment rich in opportunities



# Differentiated Technology Directions



# Nova's HW & SW Interlaced Solutions





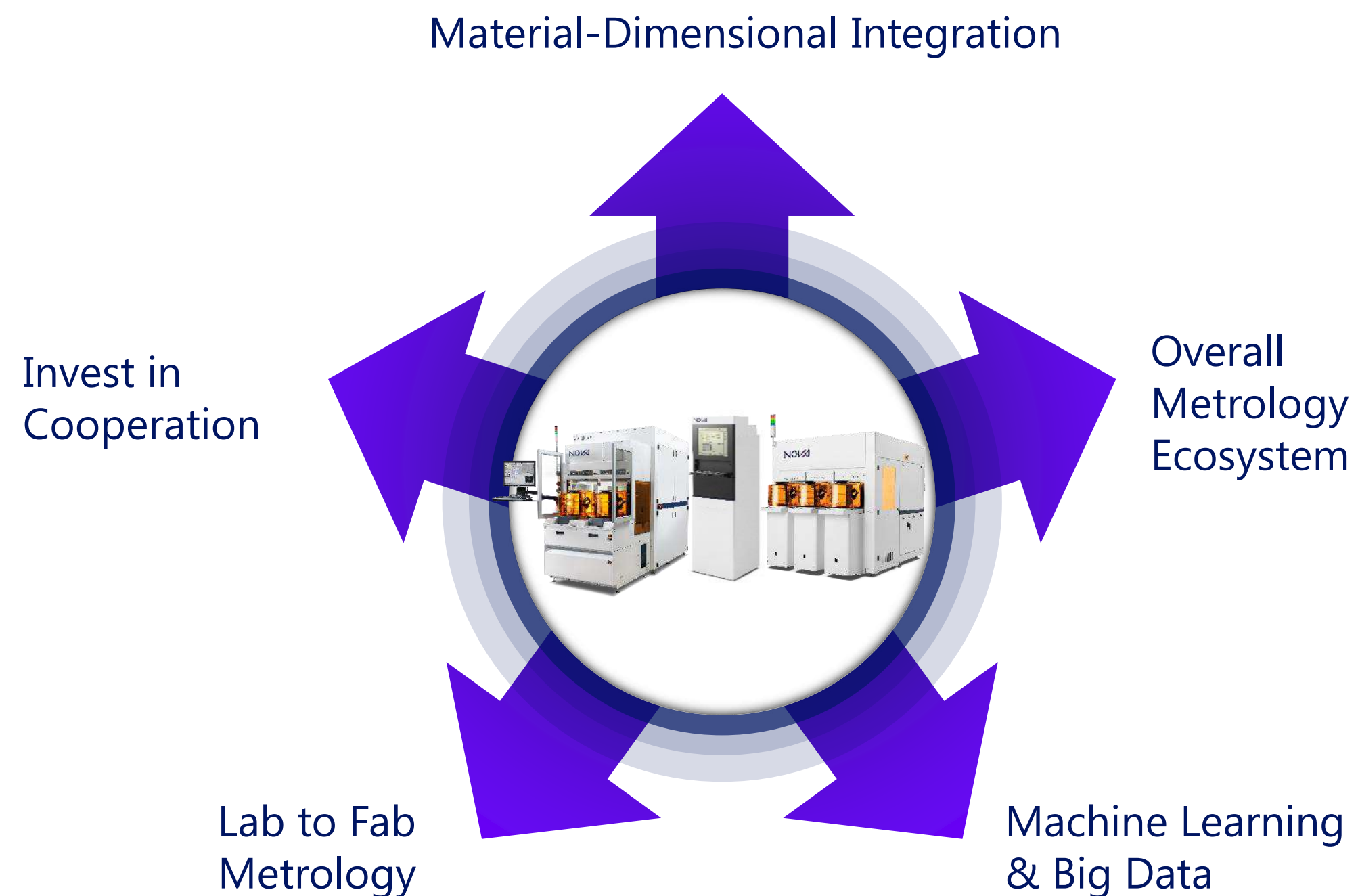
# Innovative Technological Directions

Compete with unique **Coupled HW/SW solutions**

Divert from the crowded landscape – lead the **Emerging Metrology** markets

Invest in **Sustaining** and **Disruptive** innovation

From single tool to **Fleet** approach - infrastructure



# Material-Dimensional Integration

## Conventional Perspective – Separate Metrology

	Material Metrology	Dimensional Metrology
Technology	X-Ray (XPS, XRF)	Optical (OCD)
Modeling	Direct measurement	Physical modeling

## New Directions

- Combine Material & Dimensional on-structure metrology
- Adding modeling value for all metrology
- Optical technologies for material metrology
- X-Ray for dimensional metrology

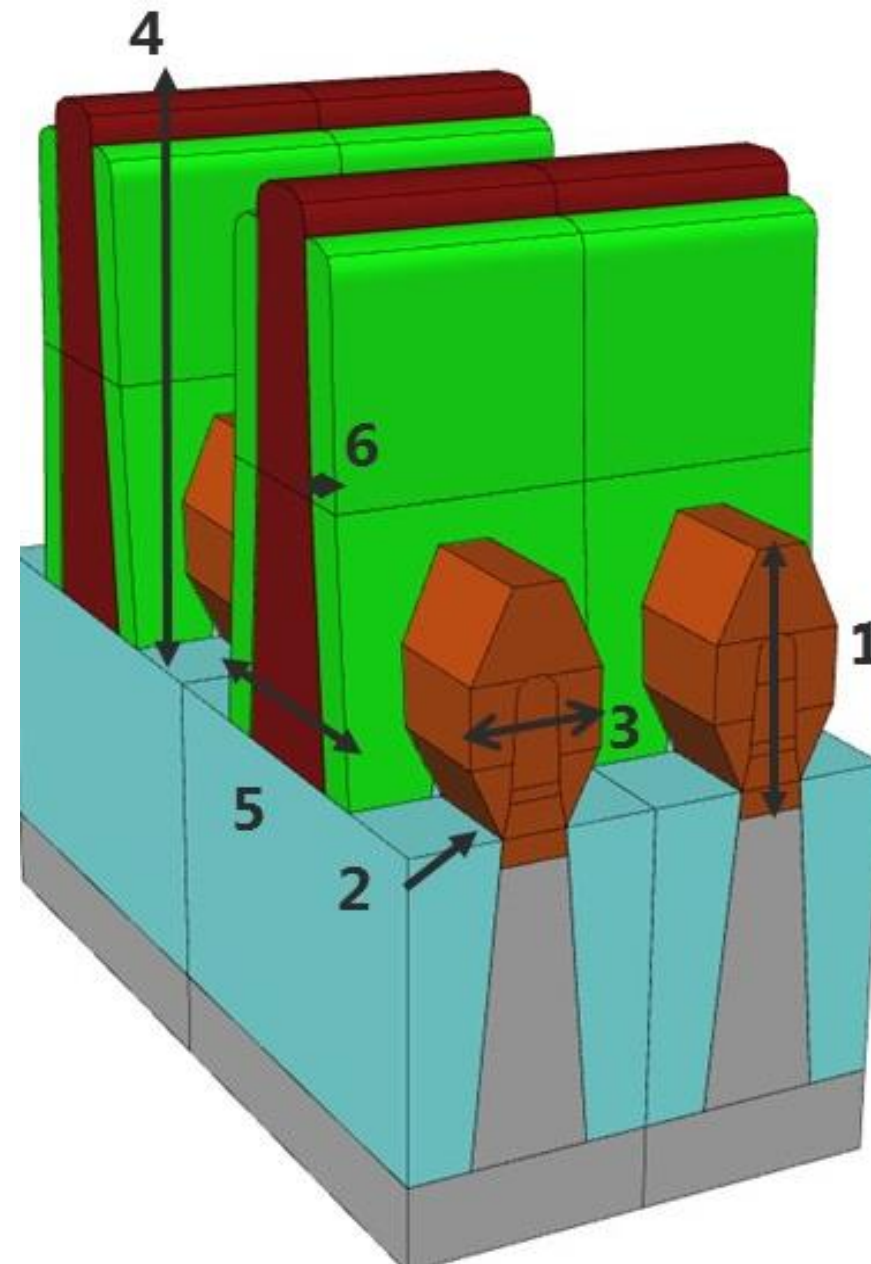
Optical Technologies for  
Material properties

X-Ray Technologies for  
Dimensional measurements

# Example - FinFET Epi Challenges

## Dimensional Challenges

- SiGe (1-3)
- Poly-Si (4-5)
- Spacer (6)
- High-K MG thickness
- Complete Fin morphology
- Variability (device, wafer)



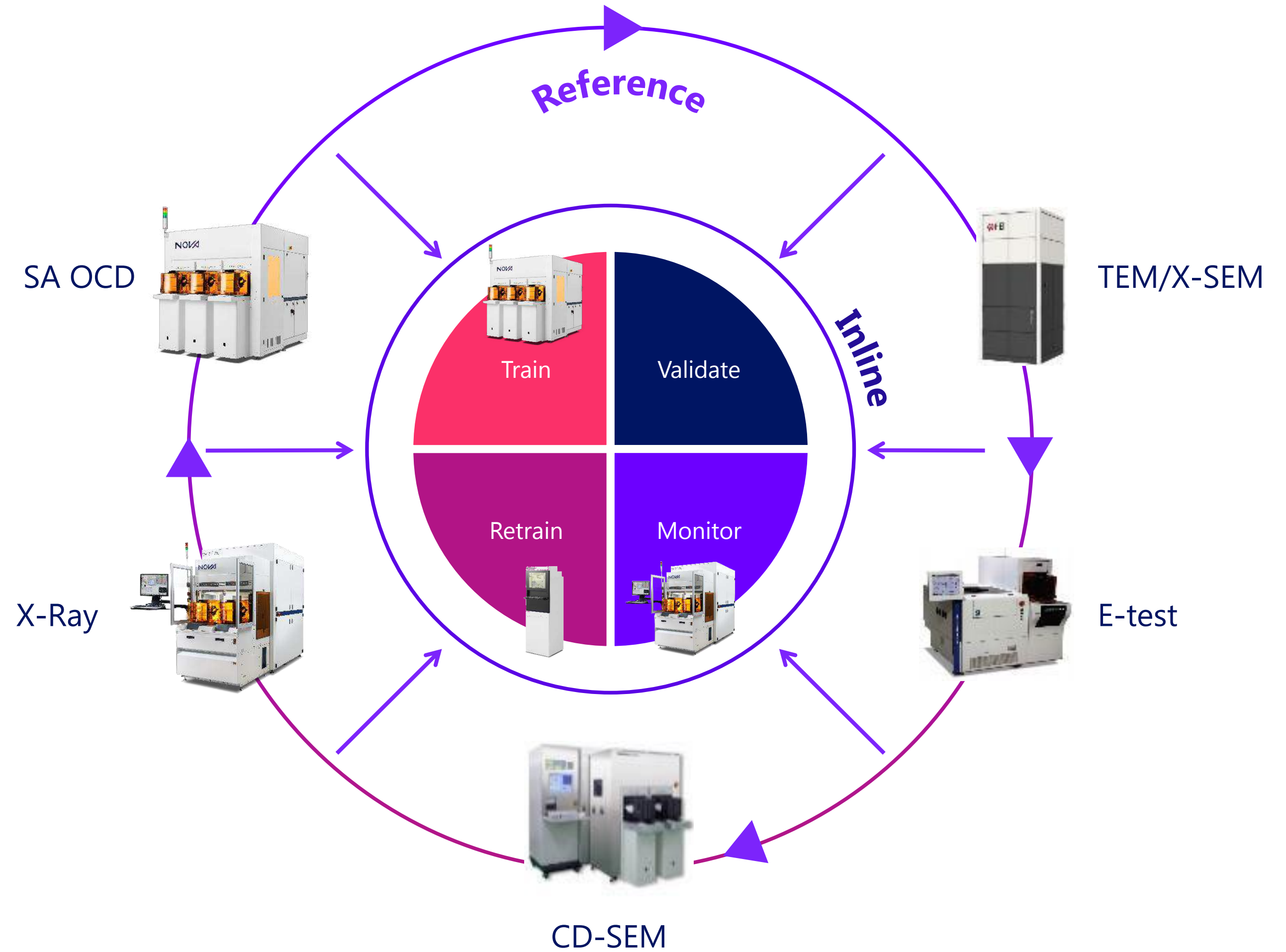
## Material Challenges

- Ge composition
- Stress & Strain
- Doping (B & P)
- HKMG composition
- Alternative Channels (III-V materials)
- On-structure

Optics and X-Ray for On-Structure Material & Dimensional Metrology



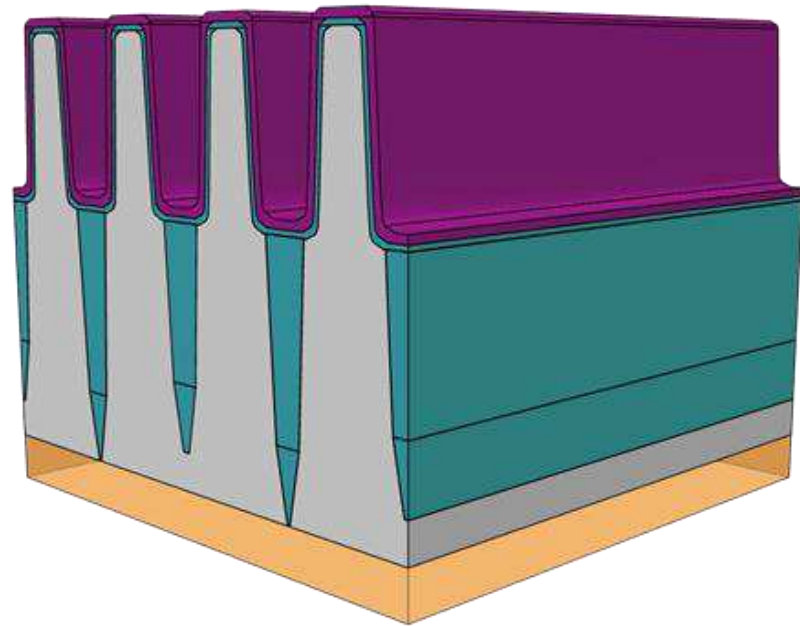
# Metrology Eco-System – In-Line & Reference



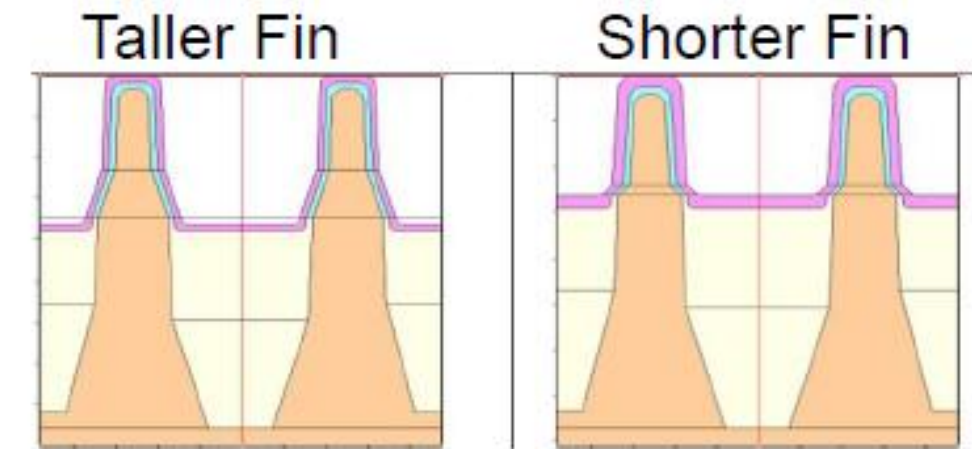
# Example: Hybrid Optics & X-Ray

## FEOL Gate use case: Two ultra thin layers on structure

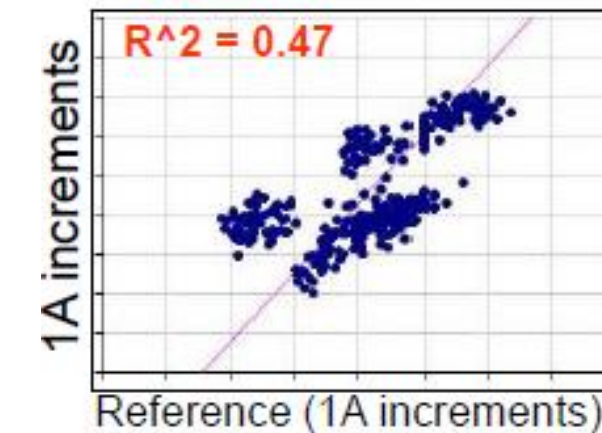
- Optics – cannot accurately resolve the layers
- X-Ray – cannot resolve profile from IL



Only XPS + Optical CD combination can resolve both layers on structure

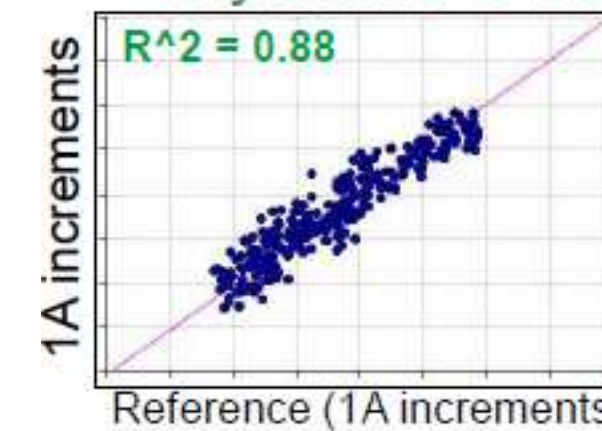


Conventional XPS vs. Reference



Normalized TMU	Norm. TMU UL	Norm. TMU LL
1.00	1.07	0.94
Slope	3 $\sigma$ Slope	Data Pairs
1.76	0.30	335

Hybrid XPS vs. Reference



Normalized TMU	Norm. TMU UL	TMU LL
0.28	0.30	0.26
Slope	3 $\sigma$ Slope	Data Pairs
1.02	0.06	335

# Big Data & Machine Learning - Key Semi Drivers



Increase in Process **Complexity**  
(3D integration, complex materials)



Huge **amount** of data  
collected in the fab



## Machine Learning



Increasing challenges to  
achieve **Yield** fast enough



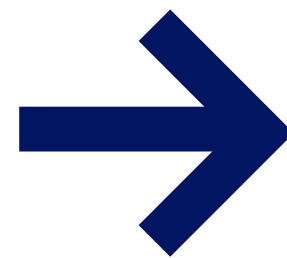
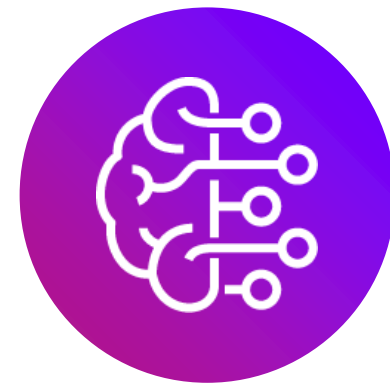
Only **small** part of the  
collected data is used



# Example: Machine Learning in Metrology



Inline:  
Integrated / SA  
Minutes



Reference:  
TEM / Electrical Test  
Days / Weeks

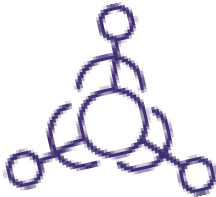
- “Train” complex connections between inline data & reference data
- Combine with physical modeling knowhow
- In production: use the inline data to “predict” the reference

Outcome

- Optical measurements predicting electrical-tests parameters
- Reference-metrology quality early in the process

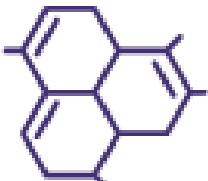
# Lab To Fab Metrology

## Variety of Metrology Technologies



**LAB**

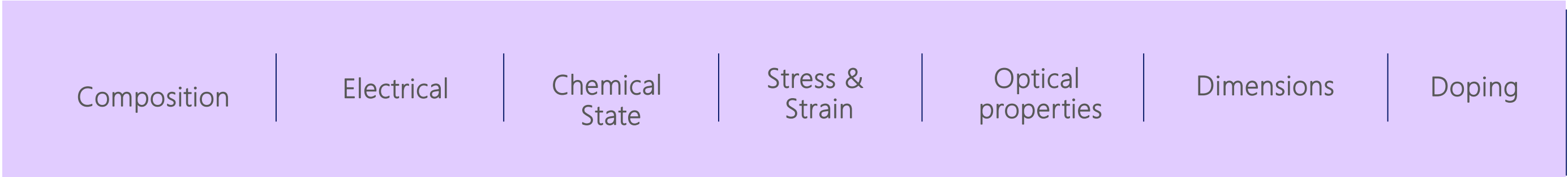
HAXPES: High Energy XPS  
CD-SAXs  
TEM  
Self Focusing SIMS  
Nano Raman Spectroscopy  
Scanning Probe Microscopy  
Kelvin Probe  
Rutherford Spectrometry  
Atom Probe Tomography  
Other



**FAB**

OCD  
CD-SEM  
XPS  
XRF  
XRD / XRR  
AFM  
LEXES  
4pt probe

## Variety of Physical Properties



**Many Fab technologies were once Lab-based | The Lab-to-Fab trend continues**

# Summary

- Process challenges - **metrology opportunity**
- **Broad portfolio** of differentiated solutions
  - Dimensional & Material
  - Integrated & Stand-alone
  - Optics & X-Ray
  - Hardware & Software
- **Innovative technology** for increased TAM
  - Material-Dimension Synergy
  - Disruptive Technologies to control Variety of Physical Properties
  - Connected Metrology Eco-system

Differentiated Technology Roadmap to Meet Industry Challenges



# What We Covered Today

## Growth Strategy



Diversification as Key

\$300M Plan - Organically

Built to grow

- Healthy demand
- Inflection points

## Technology Innovation



MS Growth in growing TAM

New Emerging Technologies

Differentiated Direction

- SW & HW
- Hybrid Eco system

## Profitable Growth



Efficient financial model

Execution track record

Elevated investment to  
generate the next growth

Thank You