NOVA PROCESS INSIGHT

# Investor & Analyst Day

July 2021

Analyst & Investor Day 2021

Analyst & Investor Day 2021

Cautionary Statement Regarding

# Forward Looking Statements

This presentation contains 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. Factors that may affect our results, performance, circumstances or achievements include, but are not limited to, the following: catastrophic events such as the outbreak of COVID-19; increased information technology security threats and sophisticated computer crime; foreign political and economic risks; changes in U.S. trade policies; inability to protect intellectual property; open source technology exposure; failure to compete effectively or to respond to the rapid technological changes; consolidation in our industry; difficulty to predict the length and strength of any downturn or expansion period of the market we target; factors that adversely affect the pricing and demand for our product lines; dependency on a small number of large customers; dependency on a single manufacturing facility per product line; dependency on a limited number of suppliers; lengthy sales cycle and customer delays in orders; political, economic, and military instability in Israel; risks related to our convertible notes; currency fluctuations; and quarterly fluctuations in our operating results. We cannot guarantee future results, levels of activity, performance or achievements. The matters discussed in this presentation also involve risks and uncertainties summarized under the heading “Risk Factors” in Nova’s Annual Report on Form 20-F for the year ended December 31, 2020 filed with the Securities and Exchange Commission on March 1, 2021.

These factors are updated from time to time through the filing of reports and registration statements with the Securities and Exchange Commission. Nova Measuring Instruments Ltd. does not assume any obligation to update the forward-looking information contained in this presentation. This presentation includes financial measures that exclude charges for amortization of acquired intangible assets, net adjustment of deferred tax assets, stock-based compensation expenses and expense related to royalty buyout agreement with the Office of the Chief Scientist and inventory write-off and are therefore not calculated in accordance with generally accepted accounting principles (GAAP). Management believes that these non-GAAP financial measures provide meaningful supplemental information regarding Nova's performance because they reflect our operational results and enhances management's and investors' ability to evaluate Nova's performance before charges or benefits considered by management to be outside Nova's ongoing operating results. 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. Management believes that it is in the best interest of its investors to provide financial information that will facilitate comparison of both historical and future results and allows greater transparency to supplemental information used by management in its financial and operational decision making. A reconciliation of each GAAP to non-GAAP financial measure discussed in this presentation is contained in the accompanying financial tables.


© Nova Proprietary information

# Today's Agenda

**Eitan Oppenhaim**

President & CEO

Performance highlights and strategic plans

**Dror David**

CFO

Financial milestones and future directions

**Zohar Gil**

CMO & BD

Industry forecast and Nova's growth engines

**Dr. Shay Wolfling**

CTO

It's all about technology and differentiation

**Closing remarks**

**Q&A**


© Nova Proprietary information

NOVA® PROCESS INSIGHT

Analyst & Investor Day 2021

# Performance Highlights and Strategic Plans

**Eitan Oppenhaim, President & CEO**

PROCESS
INSIGHT

Nova is a leading innovator and a key provider of metrology solutions for advanced process control used in semiconductor manufacturing



© Nova Proprietary information

# Key Facts

## Post COVID

**1993**
Date Founded
Dually Traded

**Major Sites**
USA & Israel

**$325M** (TTM)
Revenues- Accelerated organic growth

**$480M**
Gross cash reserves

**25%**
R&D investment in new technologies

**800**
HQ & global employees - hiring rally

**2.8B** (TTM)
Market Cap- significant growth

**Resiliency**
50% production output growth

**3**
New technologies launched

**440**
Patents - accelerated IP Protection


© Nova Proprietary information

Non-GAAP Financials

NOVA

Analyst & Investor Day 2021

# Strong Fundamentals

**Unique Portfolio**
Dimensional and Materials

**Disruptive Technology**
X-Ray and Optical, HW and SW

**Diversified Exposure**
Segments, Customers, Territories

**Solid Operational Model**
Agility, Efficiency, Profitability

**Cultural Advantage**
Leadership, Values, Social Responsibility


© Nova Proprietary information

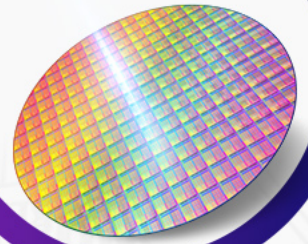
# Measuring The Invisible

## Memory
Transistor

30 Pairs → 150 Pairs

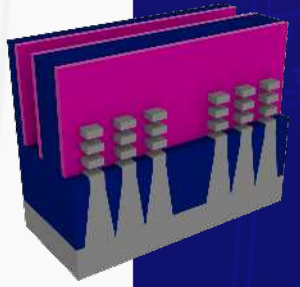


Optical/X-Ray



Physical & Mathematical Algorithms

## Logic
Transistor



150M Transistors


2015

11.8B Transistors


2020

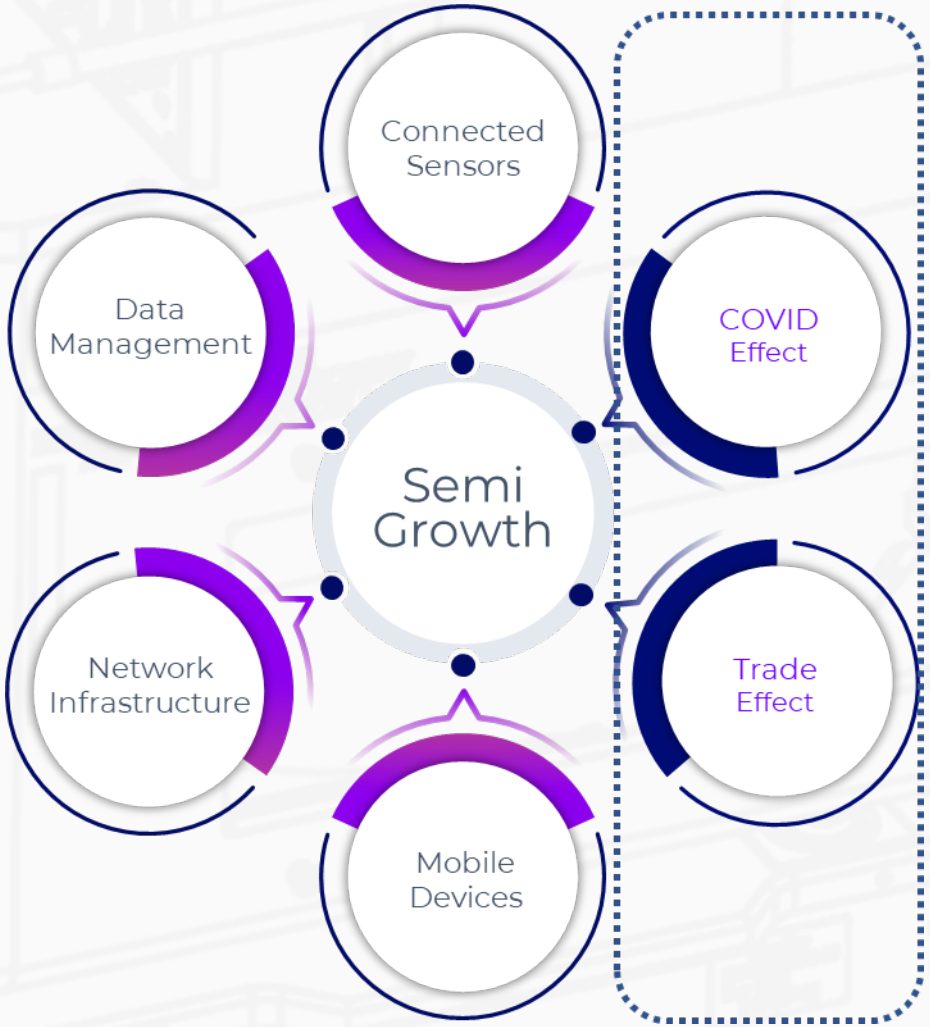

© Nova Proprietary information

# Growing Demand

Semiconductors enable advanced digitization

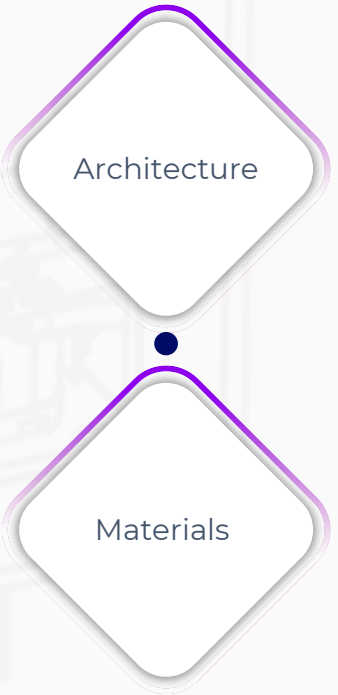
Smartphone
Gaming & Video
Cryptonomy
5G
IOT Sensors
Wearables
Cloud Data
AI
Automotive

## 1 Capacity Growth




## 2 Beyond Capacity

Performance Demand



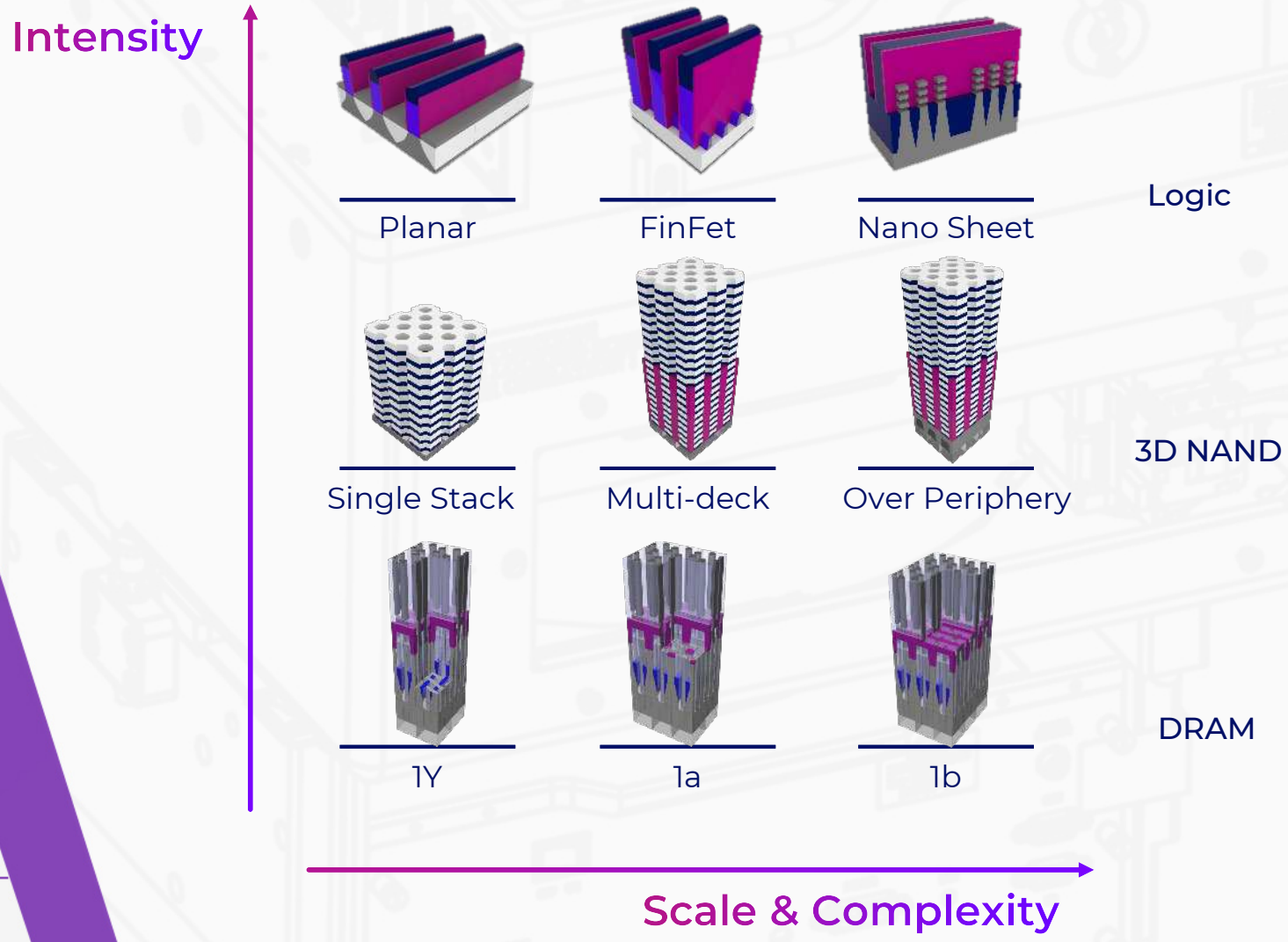

Acceleration | Explosion | Enablement


© Nova Proprietary information

# Dimensional Metrology Intensity

- Scaled devices
- 3D profiles
- Multiple parameters
- Thinner films
- Packaging

## Increasing Complexity = Growing Demand

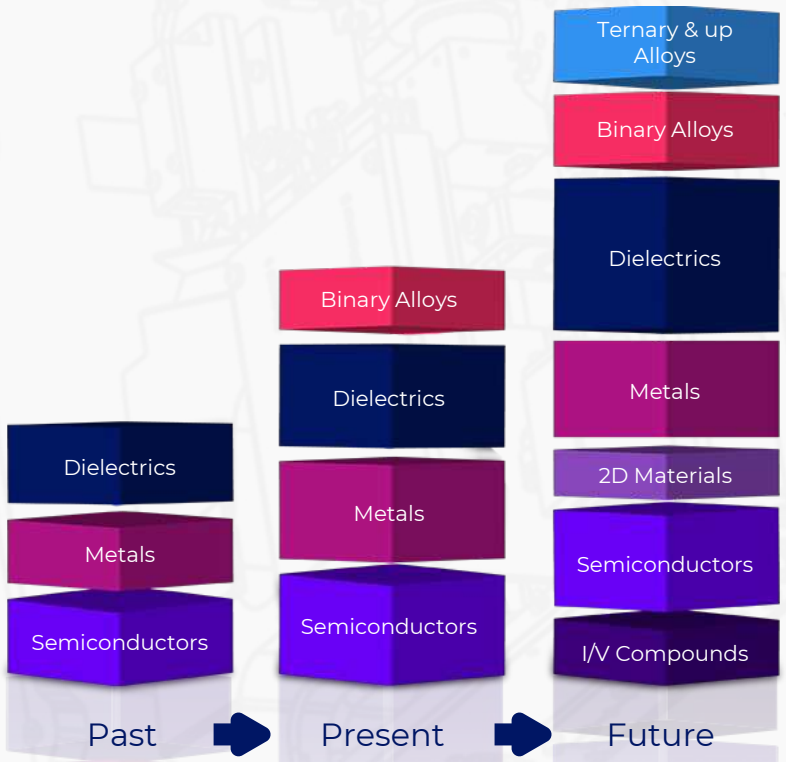




© Nova Proprietary information

# Materials Engineering
## Beyond Moore's Law

### Growth in IC Embedded Materials




### Broader Metrology Scope
(Composition, Stress, Strain)

| Past 21 | Present 62 | Future 66 |
|---|---|---|

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| H | | | | | | | | | | | | | | | | | He |
| Li | Be | | | | | | | | | | | B | C | N | O | F | Ne |
| Na | Mg | | | | | | | | | | | Al | Si | P | S | Cl | Ar |
| K | Ca | Sc | Ti | V | Cr | Mn | Fe | Co | Ni | Cu | Zn | Ga | Ge | As | Se | Br | Kr |
| Rb | Sr | Y | Zr | Nb | Mo | Tc | Ru | Rh | Pd | Ag | Cd | In | Sn | Sb | Te | I | Xe |
| Cs | Ba | 57 - 71 Lanthanoids | Hf | Ta | W | Re | Os | Ir | Pt | Au | Hg | Tl | Pb | Bi | Po | At | Rn |
| Fr | Ra | 89 - 103 Actinoids | Rf | Db | Sg | Bh | Hs | Mt | Ds | Rg | Cn | Nh | Fl | Mc | Lv | Ts | Og |

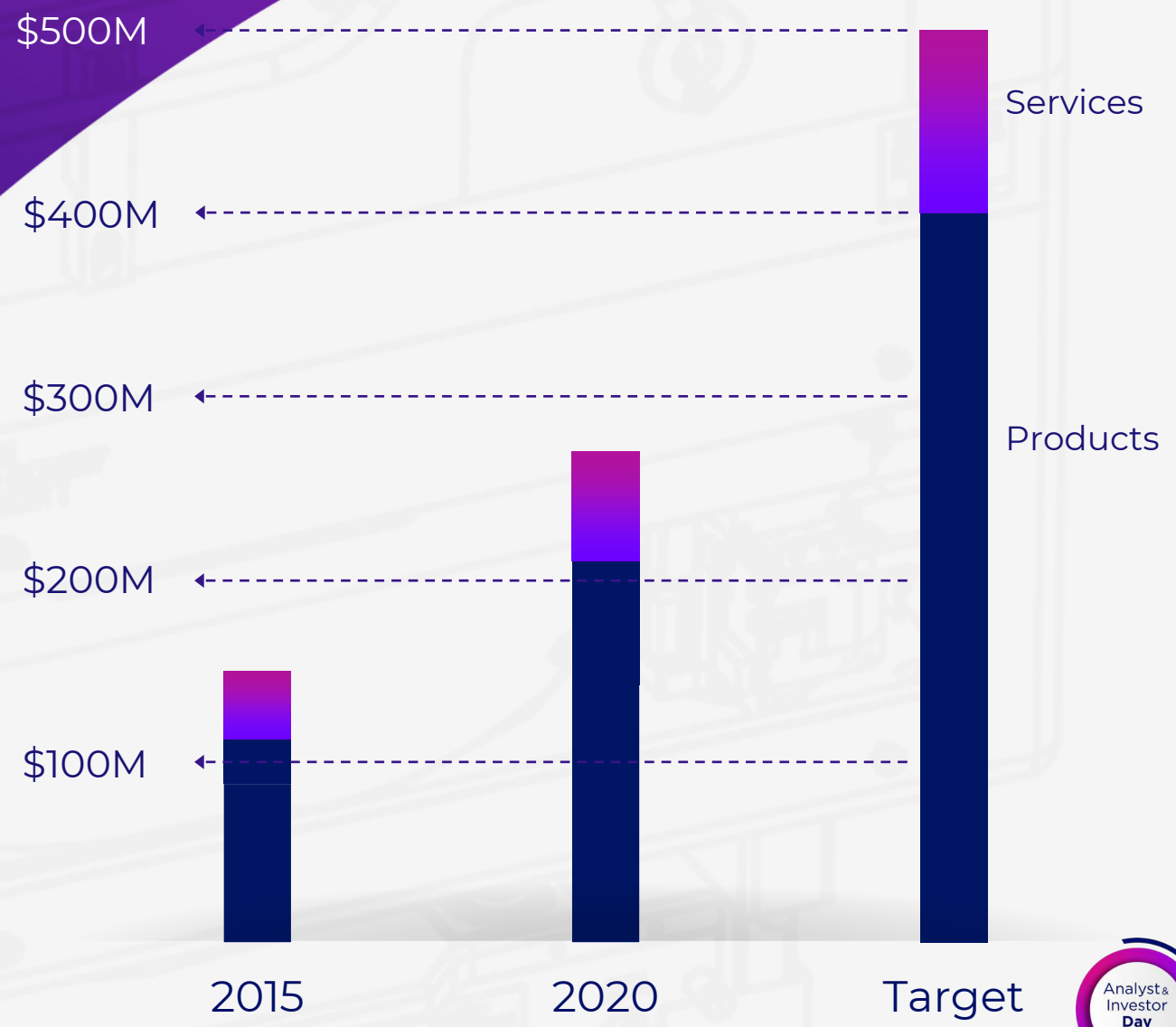
| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| La | Ce | Pr | Nd | Pm | Sm | Eu | Gd | Tb | Dy | Ho | Er | Tm | Yb | Lu |
| Ac | Th | Pa | U | Np | Pu | Am | Cm | Bk | Cf | Es | Fm | Md | No | Lr |


© Nova Proprietary information

# Nova 500

## Organic Growth

- Share gains
- TAM expansion
- Disruptive innovation
- SW HW optimization
- Installed base utilization




Source: company financial information
Non-GAAP financials


© Nova Proprietary information

Analyst & Investor Day 2021

# Organic Growth Engines

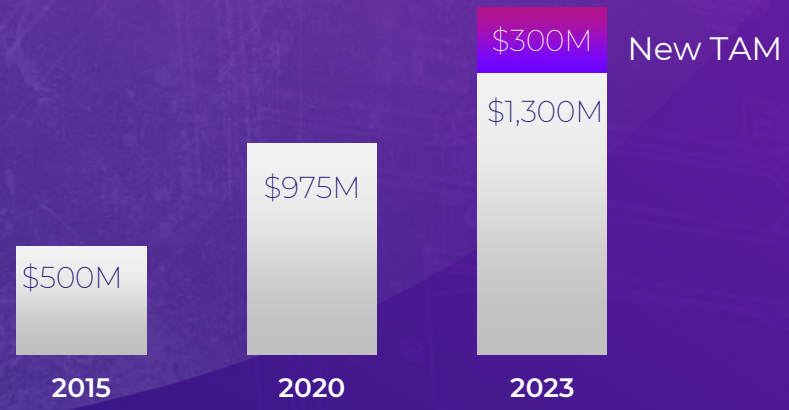
**Differentiated technology**
Innovative metrology

**Physical and ML algorithms**
Deep tech data-driven solutions

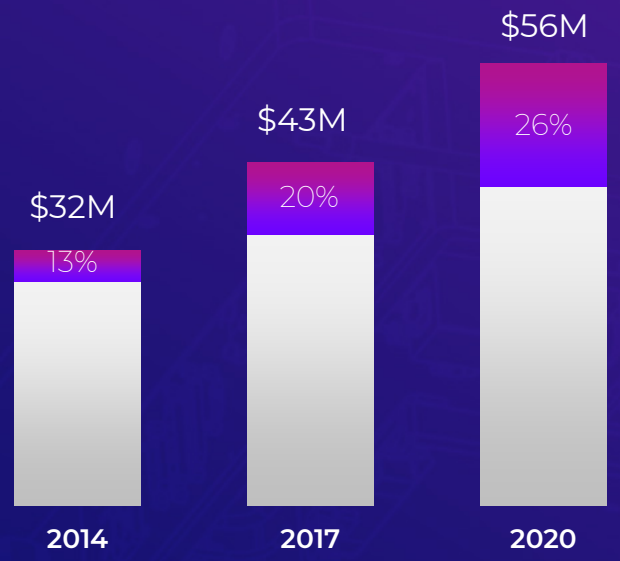
**Service revenue**
Extendibility & enhancement

**Research technologies**
LAB to FAB

## Total Organic Addressable Market




## Investment in New Technologies (of Total R&D, Gross)

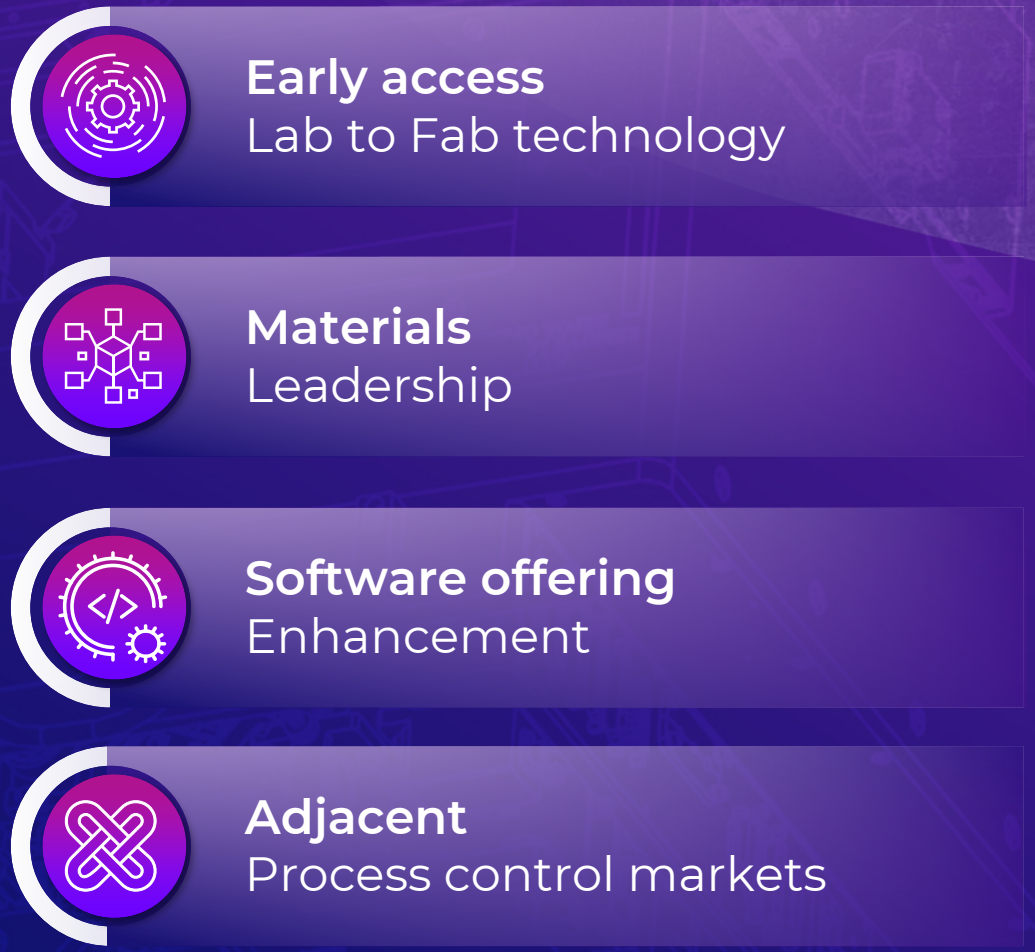



Non-GAAP Financials
Source: Gartner Research & company financial information


© Nova Proprietary information

# Inorganic Approach

## Search Guidelines




## Screening Elements

- Top line synergy
- Complementary technology
- Operational leverage (accretion)
- Diversification within core capabilities


© Nova Proprietary information

NOVA® PROCESS INSIGHT

Analyst & Investor Day 2021

# Financial Milestones & Future Directions

**Dror David, CFO**

# Dror David
## Chief Financial Officer

- Joined Nova in 1998.
- Appointed as CFO in 2005.
- Beforehand, held positions of Company Controller, Vice President of Operations and Vice President of Resources in charge of finance, operations, IT and HR.
- Led Nova's private placement in 2007, secondary public offering in 2010 and bond issuance in 2020.


© Nova Proprietary information

# H1 2021*
# Financial Performance

* Including Q2 2021 Mid-Guidance

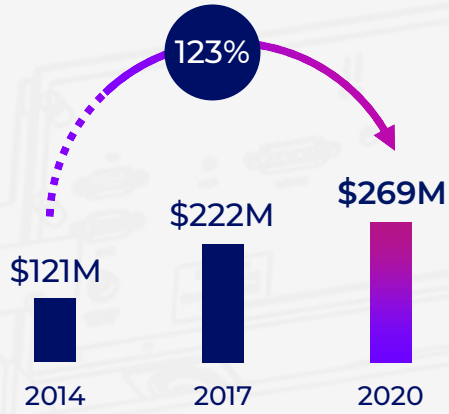

© Nova Proprietary information

# Sustainable Profitable
# Annual Growth

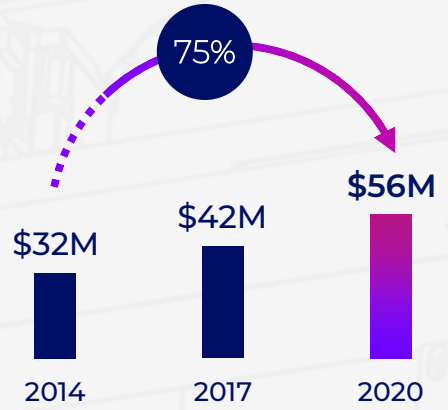
## 2020 Performance

| | |
|---|---|
| **13%** Revenue CAGR | **24%** Operating income CAGR |
| **$269M** Revenue | **24%** Operating margin |

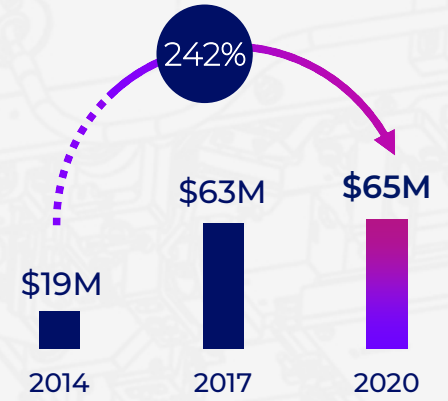
CAGR – 2015-2020
Non-GAAP Financials




**Revenue**




**R&D Investment (Gross)**




**Operating Income**

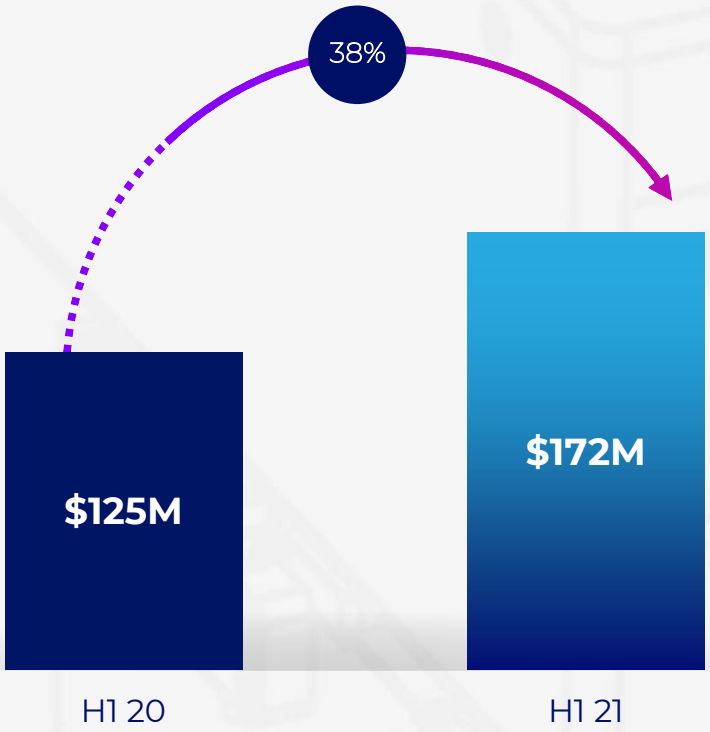
Analyst & Investor Day 2021

NOVA


© Nova Proprietary information

# Financial Performance
## Half Year

### Continuous Revenue Growth




### Earnings Per Share (Non-GAAP)


Note: Our non-GAAP measures are not meant to be considered in isolation or as a substitute for comparable GAAP measures and should be read only in conjunction with our consolidated financial statements prepared in accordance with GAAP, available on our website.

Non-GAAP Financials
* Including Q2 2021 Mid-Guidance


© Nova Proprietary information

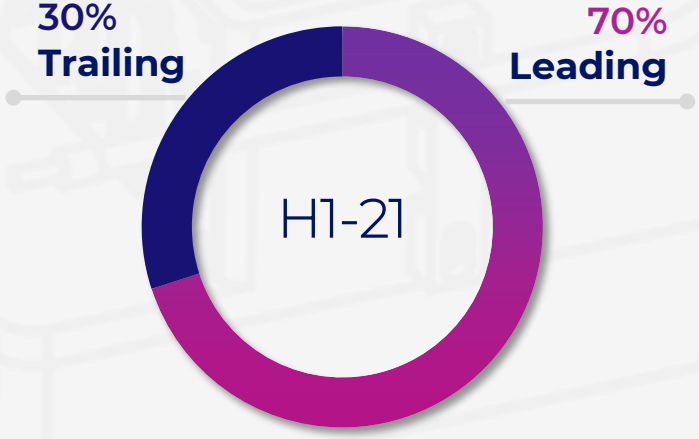
Analyst & Investor Day 2021

NOVA

## Segments

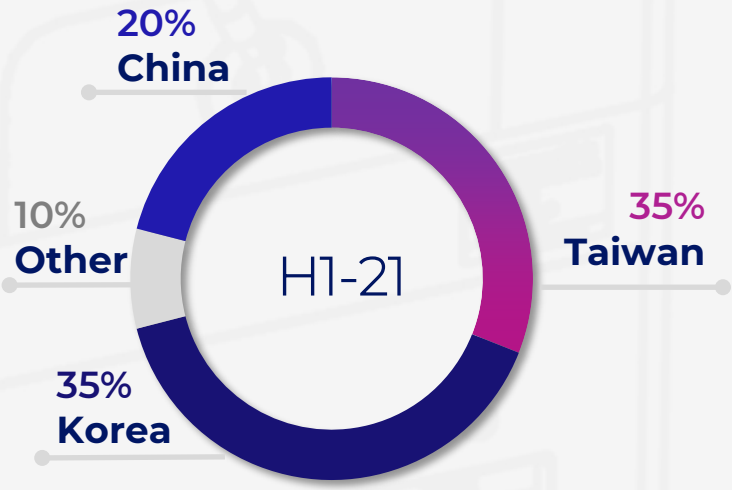

**Logic/Foundry strength**

## Nodes




**Multiple end market dynamics**

## Geography Revenues




**3 large territories**
**US gaining momentum**


© Nova Proprietary information

* Non-GAAP Financials

NOVA

Analyst & Investor Day 2021

# Nova 500 Financial Model


© Nova Proprietary information

# Business Tailwind

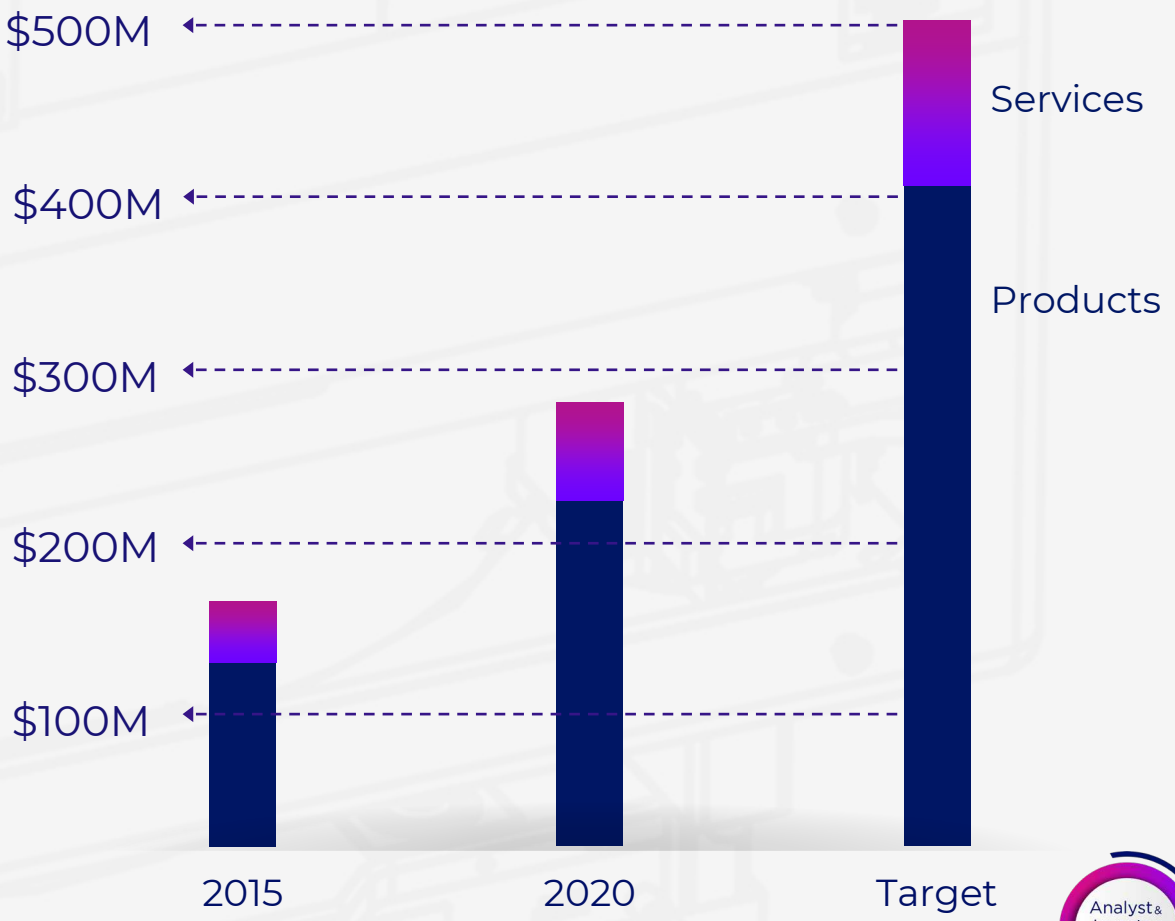
- **Overall TAM Growth**
- **Market Share Gains**
- **Software Revenues**
- **High Value of New Technologies**
- **Leverage Installed-Base**


© Nova Proprietary information

# Target Revenue

## Organic Growth

- Share gains
- TAM expansion
- Disruptive innovation
- Market tailwinds
- Installed base utilization




Source: company financial information
Non-GAAP Financials


© Nova Proprietary information

Analyst & Investor Day 2021

NOVA

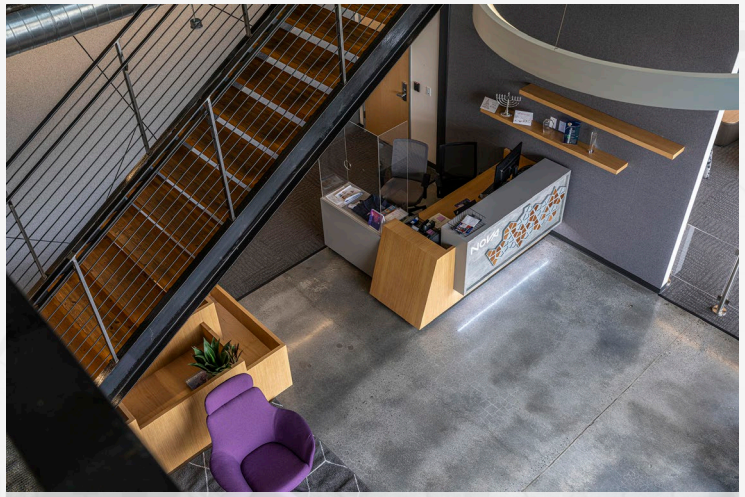
# Infrastructure Projects

Industry 4.0 and
New Cleanroom

**$12M**
(2022)

Global IT Networks
and Applications

**$5M**
(2022-2023)



Locations-
US, China, Ireland

**$2M**
(2021-2022)

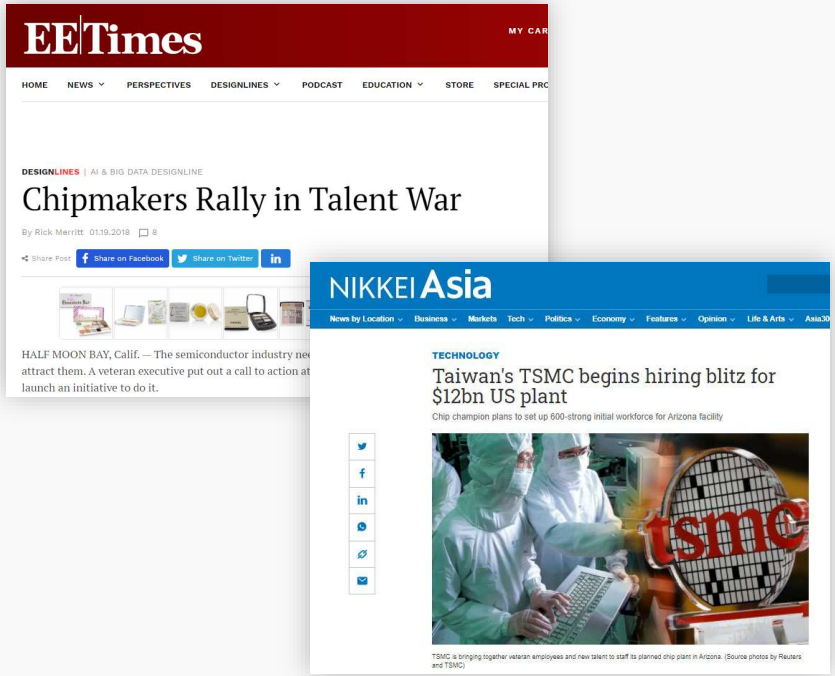
Source: company financial information
Non-GAAP Financials


© Nova Proprietary information

# Cost Trends

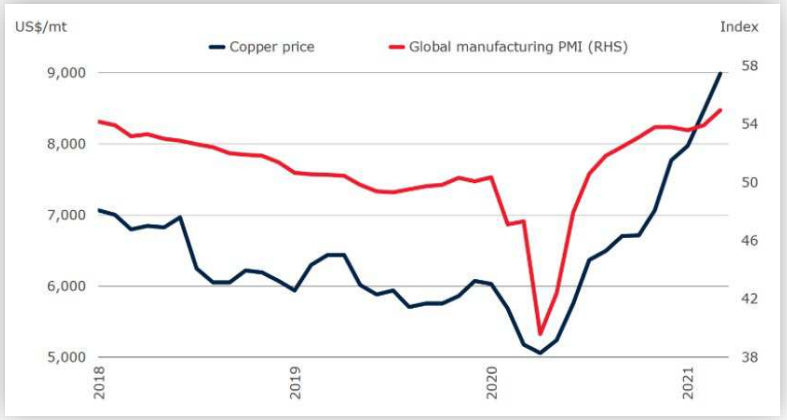
## Talent Costs

Increased demand for talent across territories:
US | Israel | Taiwan




## Macroeconomics


Exchange rates




Copper prices and global manufacturing PMI

Source: World Bank, March 2021, xe.com, June 2021


© Nova Proprietary information

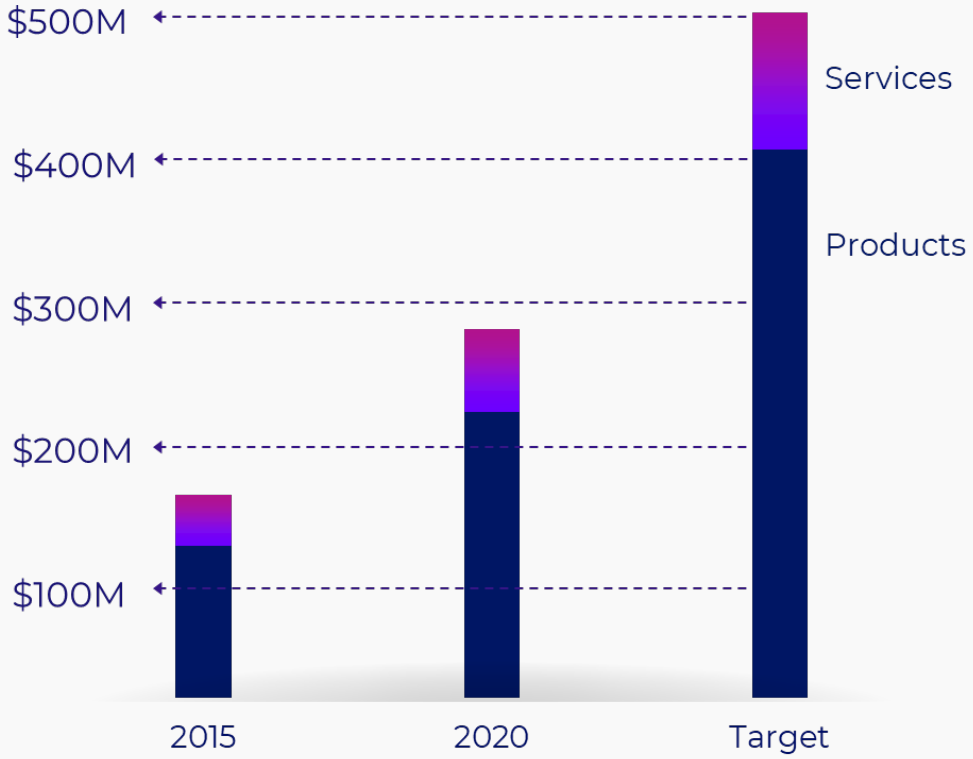
NOVA

Analyst & Investor Day 2021

# Financial Target Model

| Revenue | R&D Investment | Tax |
|---|---|---|
| **$500M** | **17%-19%** | **15%** (IL-13%, US-18%) |

| Gross Margin | SG&A | Share Count |
|---|---|---|
| **57-59%** | **13%-15%** | **32M** |




**Operating Margin**

**26-29%**

**Quarterly Earnings**

**Power of $1 EPS**

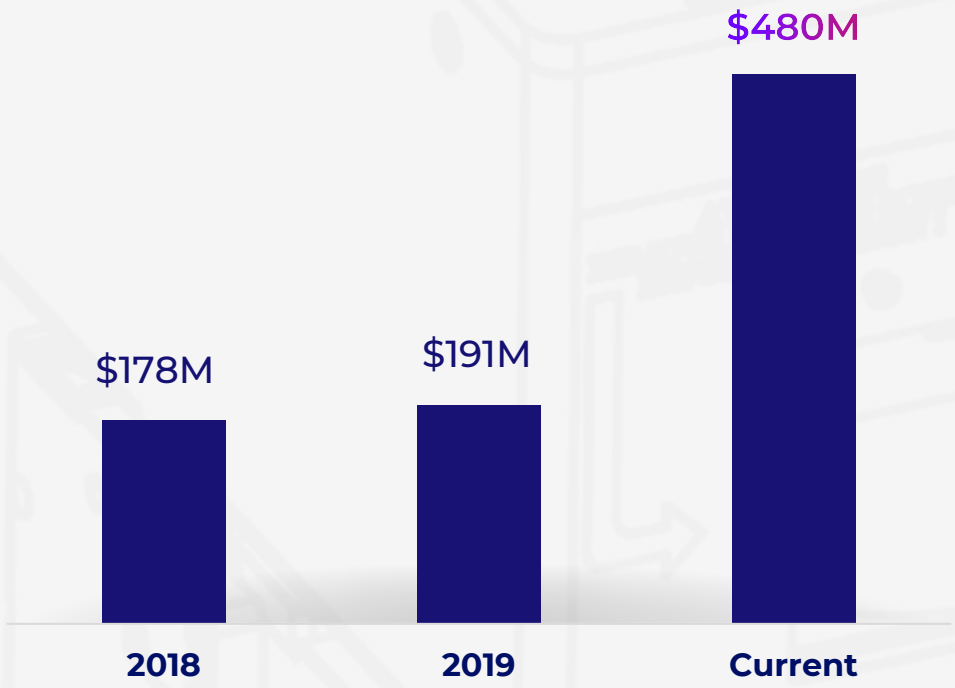
* Non-GAAP Financials


© Nova Proprietary information

# Capital Allocation Plans


© Nova Proprietary information

# Gross Cash Reserves




- Enabling inorganic growth
- Facilitating continuous investment
- $200M convertible debt due 2025

Non-GAAP Financials


© Nova Proprietary information

NOVA

Analyst & Investor Day 2021

# Capital Allocation Plans

IT & New Sites:
**$10M**

Manufacturing Facilities:
**$12M**

Working Capital:
**$40M-$50M**

Baseline 20% Revenue:
**$80M-$100M**

M&A Opportunities:
**$300M-$350M**

**Shareholders Return**


© Nova Proprietary information

Non-GAAP Financials

NOVA

Analyst & Investor Day 2021

# Inorganic Approach

## Search Guidelines

**Early access**
Lab to Fab technology

**Materials**
Leadership

**Software offering**
Enhancement

**Adjacent**
Process control markets

| Screening Elements | Revera Case Study |
| --- | --- |
| Top line synergy | X-Ray revenue growth |
| Complementary technology | X-Ray & Optical synergy |
| Operational leverage (accretion) | Accretion day 1<br>50% EPS growth Y2 |
| Diversification within core capabilities | Within process control |

Non-GAAP Financials

Analyst & Investor Day 2021

NOVA


© Nova Proprietary information

NOVA® PROCESS INSIGHT

Analyst & Investor Day 2021

# Industry Forecast and Nova's Growth Engines

**Zohar Gil, CMO & BD**

# Zohar Gil

## Chief Marketing and Business Development Officer

- Joined Nova in 2011.
- Appointed as CMO in 2016.
- Beforehand, held senior positions of marketing and business development at Nova and in Israeli high-tech companies.
- Engineering and Executive MBA from Tel Aviv and Northwestern Universities.


© Nova Proprietary information

# The Revolution of Digitization and Deep Tech Innovation

**Semiconductors are the Foundation for this Revolution**


© Nova Proprietary information

# Semiconductor Demand Driven **By Multiple Catalysts**

Robotic Process Automation

**25%**
CAGR


VR

**36%**
CAGR

Cloud Computing

**25%**
CAGR

Industrial IoT

**23%**
CAGR

Autonomous Vehicle

**20 TB**
Per Car Daily


5G

**37%**
CAGR

AI

**42%**
CAGR

**2010**
Mobile Internet
**Mobility**

**2015**
Data Augmentation
**Productivity**

**2020**
Enhanced Connectivity
**Resiliency**

**2025**
Data Efficiency
**Veracity**


© Nova Proprietary information

Source: IDC, Yole Research Company Information, Statista

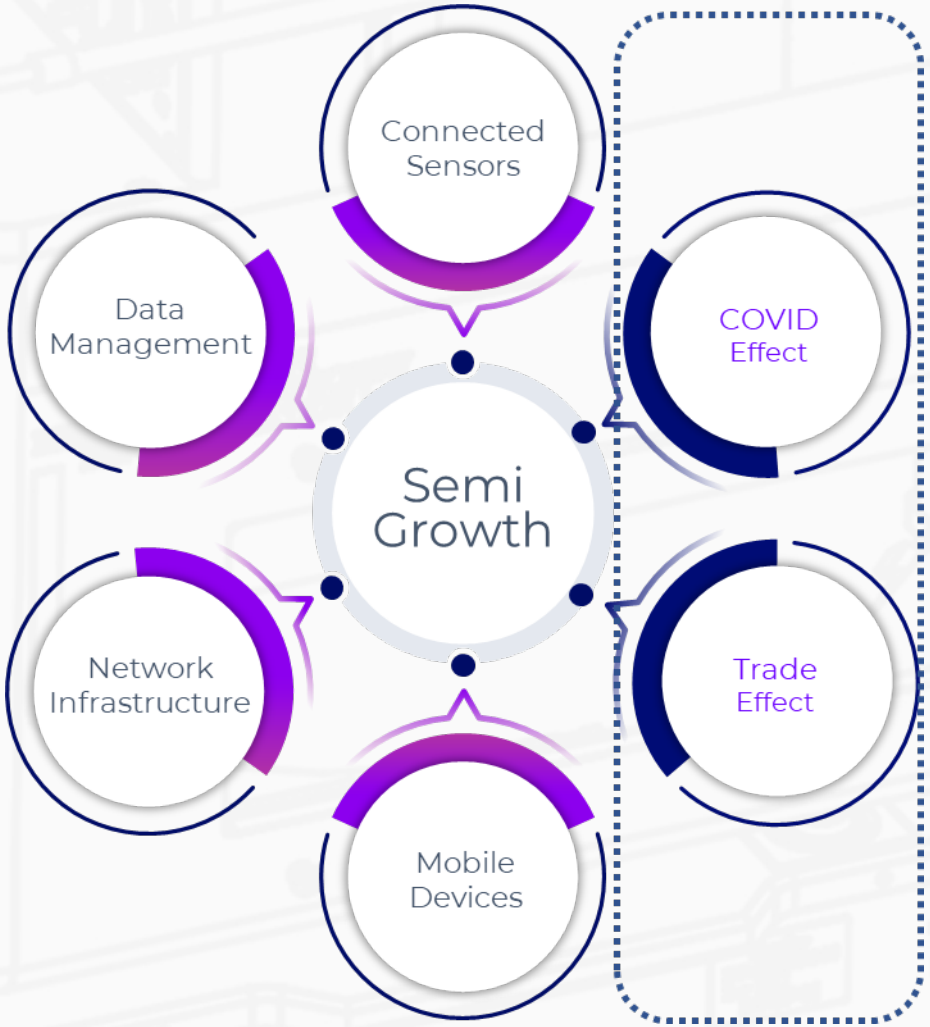
NOVA

# Growing Demand

Semiconductors enable advanced digitization

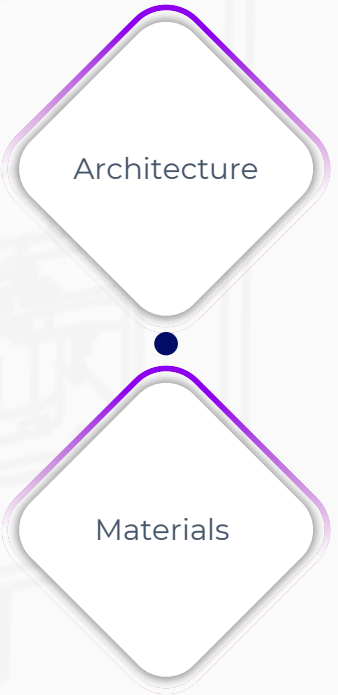
Smartphone
Gaming & Video
Cryptonomy
5G
IOT Sensors
Wearables
Cloud Data
AI
Automotive

## 1 Capacity Growth




## 2 Beyond Capacity

Performance Demand

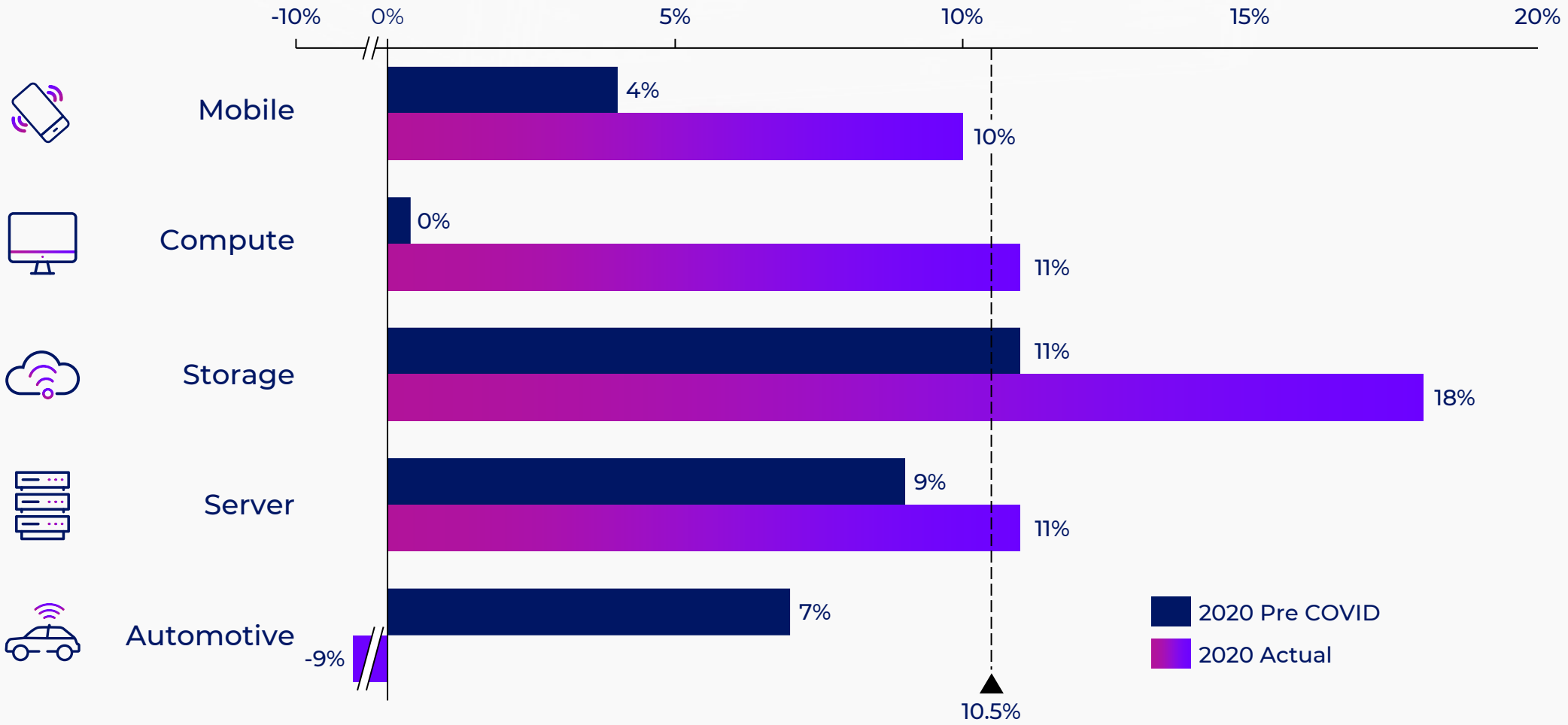



Acceleration | Explosion | Enablement


© Nova Proprietary information

# Semiconductor 2020 – COVID Impact

## Semiconductor Segments in 2020 – Pre Covid Prediction vs Actual Growth, %




Source – McKinsey Analysis, May 2021, Gartner Q1/2021


© Nova Proprietary information

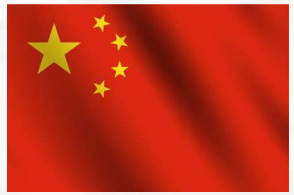
NOVA

Analyst & Investor Day 2021

# Increase in National Investment in Semi

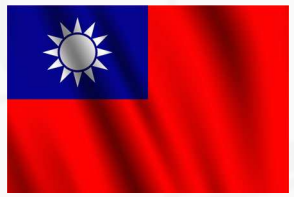
## Government Incentives

**CHIPs for America Act**



**Made in China 2025**

**2030 Digital Compass**



**InvesTaiwan**

**System chips vision and strategy**

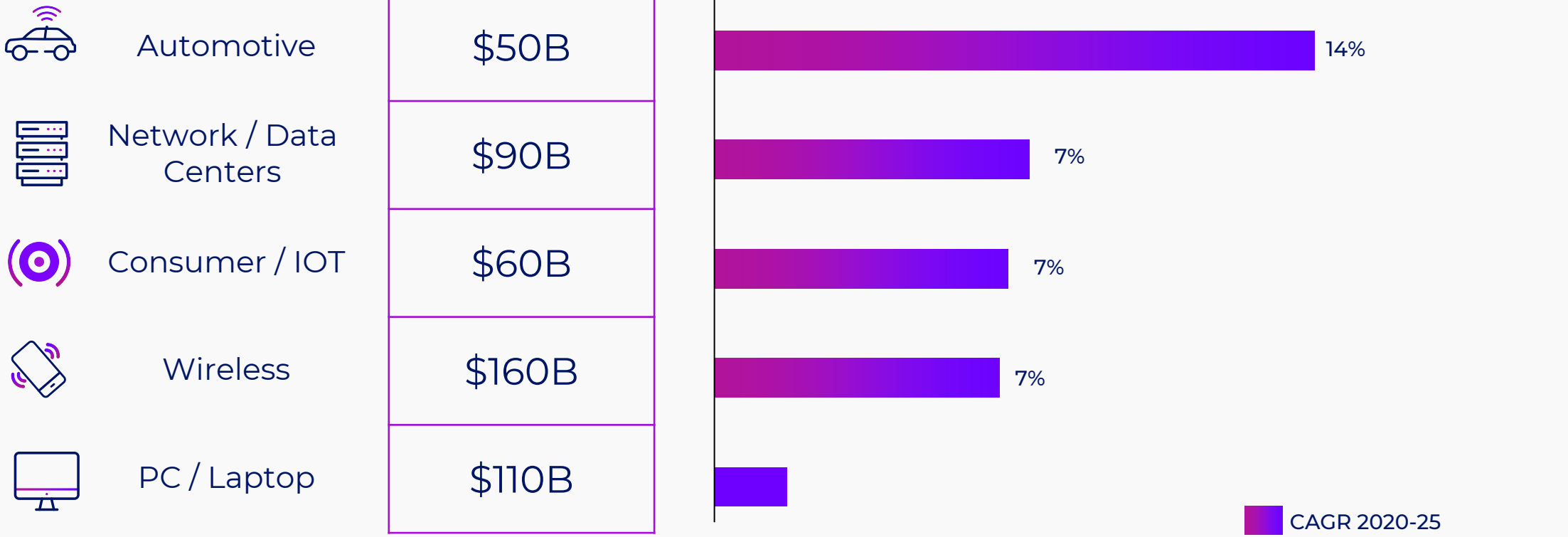
Source – BCG Sept 2020, BofA Global Research, April 2021


© Nova Proprietary information

# Key Semi Applications

## Growth & Size

| | Market Size | CAGR 2020-25 |
|---|---|---|
| Automotive | $50B | 14% |
| Network / Data Centers | $90B | 7% |
| Consumer / IOT | $60B | 7% |
| Wireless | $160B | 7% |
| PC / Laptop | $110B | |




Source – Gartner Q1/2021


© Nova Proprietary information

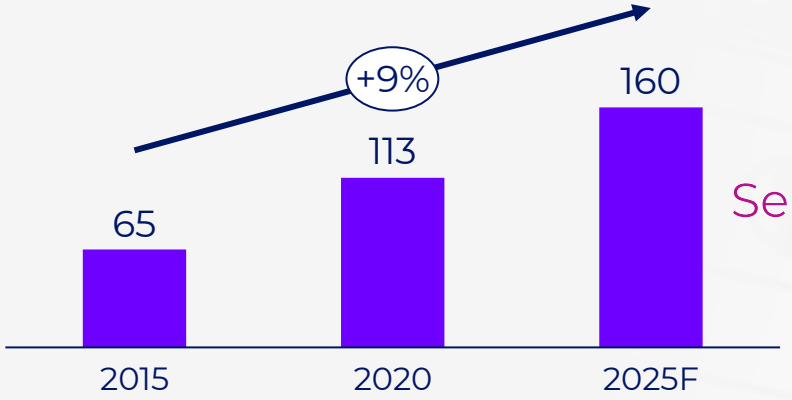
# Silicon Content Increase

| | Mobile | Data Storage | Video Game Consoles | Driver Assistance |
|---|---|---|---|---|
| |  |  |  |  |
| **Trend** | 4G to 5G | Data Explosion | Cloud & Next Gen | L1/2 to L4/5 |
| **Content** | +30% | +30% | +150% | +200% |

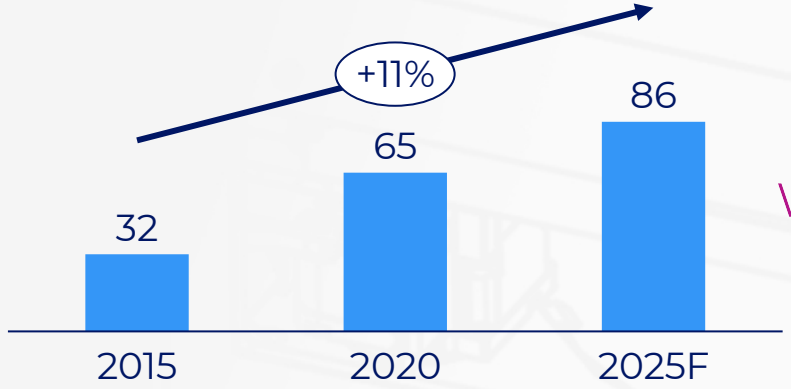
Source – Gartner Q1/21 Semiconductor Forecast Database by Application


© Nova Proprietary information

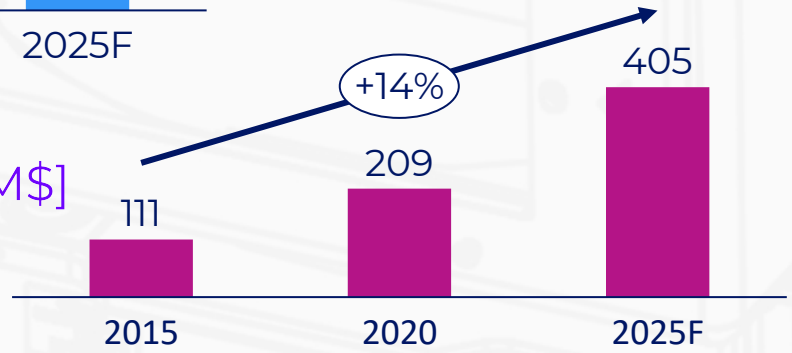
# CAPEX and WFE Outlook




Semi CAPEX [B$]




WFE [B$]




Nova Products [M$]

- Semi CAPEX reaching **$160B** in 2025
- Investment in **all** device segments
- Nova **outperforming** the market

Source – IC Insights & Gartner 2021 reports, Nova

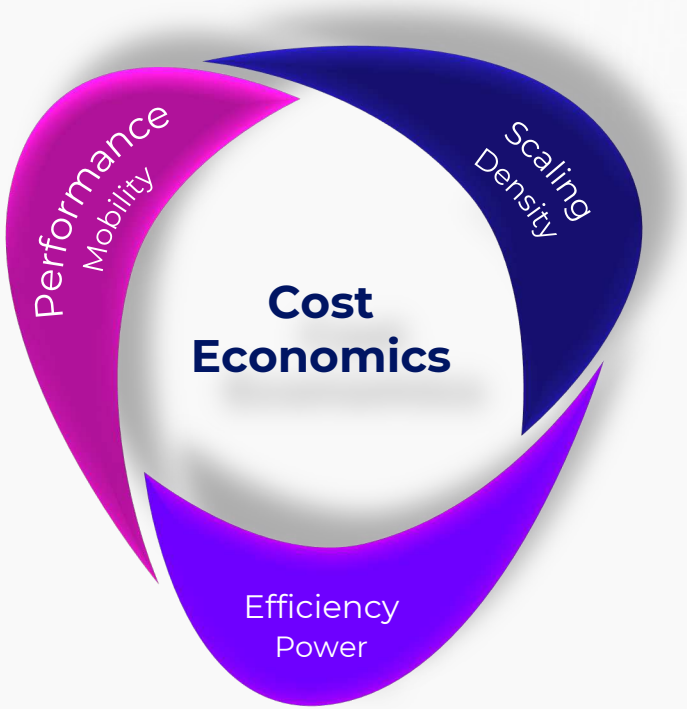

© Nova Proprietary information

Analyst & Investor Day 2021

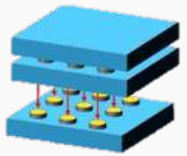
NOVA

# Semi Technology Inflections

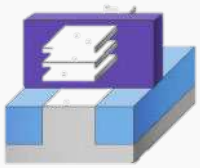
## Architectures and Materials



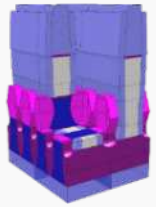

Packaging Schemes



Device Architecture

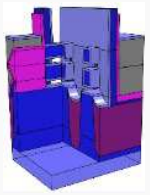


Materials Engineering



3D Memory Structures

Device Scaling




© Nova Proprietary information

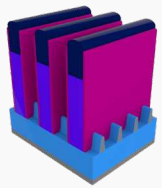
NOVA

Analyst & Investor Day 2021

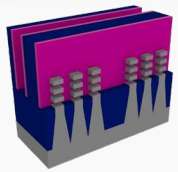
# Device Technology Roadmap
## Trends and Challenges

2021 → 2022 → 2023 → 2024 → 2025

### Logic



Transition to Nanosheet devices



### NAND

3D scaling to multi/triple deck 3D-NAND

### DRAM

Continued scaling to 1c/1d DRAM

### Challenges

- Increased complexity
- More CDs
- Individual properties measurement
- New materials, new metals in BEOL

- CMOS under array/wafer bonding
- Multi/triple-deck - high aspect ratio
- Structural and Material challenges

- Scaling, process margin (overlay and CD)
- Wafer edge yield, storage capacitor
- CDs, films, profiles, residues, defectivity


© Nova Proprietary information

NOVA Analyst & Investor Day 2021

# Dimensional Metrology

## Integrated Metrology

### NOVA i570


### NOVA ASTERA


- Extending Nova IM Leadership
- Targeting high volume production and R&D of next generation nodes
- Adopted by all leading customers

## Stand Alone Metrology

### NOVA PRISM


- A New Dimension in Optical CD
- Addressing advanced metrology challenges in logic,3D-NAND and DRAM
- Adopted by leading logic and memory customers

**Over $700M Addressable Market**


© Nova Proprietary information

# Materials Metrology

## X-Ray Metrology

NOVA VERAFLEX IV


- Adopted by all the leading customers
- Marking Nova's materials metrology leadership

## Optical Metrology

NOVA ELIPSON


- In-line Raman Spectroscopy
- Adopted by leading logic and memory customers

**Over $500M Addressable Market**

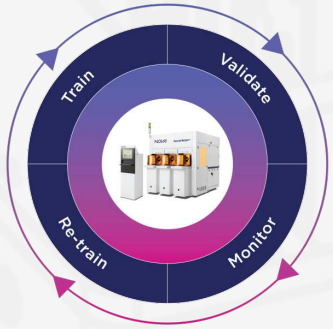

© Nova Proprietary information

# Modeling & Fleet SW Solutions

## Physical and Mathematical Modeling

### NOVA MARS

### NOVA FIT




- Holistic Approach to Modeling Driven Insights
- Unique algorithms solutions and Machine learning leadership

## Fleet SW Solutions

### Fleet Management

- Central management
- Performance monitoring
- Big data analytics

**Adopted by all leading customers**


© Nova Proprietary information

NOVA® PROCESS INSIGHT

Analyst & Investor Day 2021

# It’s all About Technology and Differentiation

**Dr. Shay Wolfling, CTO**

# Dr. Shay Wolfling
## Chief Technology Officer

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


© Nova Proprietary information

# Outline

Key Challenges

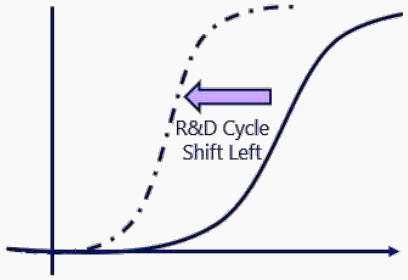
Unique Technology Solutions

Future Plans


© Nova Proprietary information

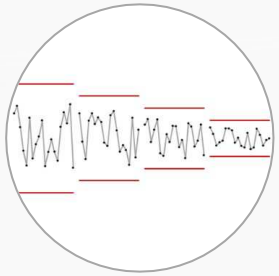
# Expanding Challenges at the Advanced Nodes

## Process Challenges ⇨ Metrology Opportunity

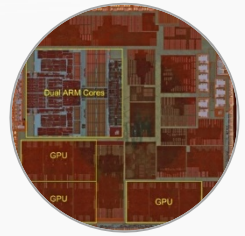



**Shorter R&D cycles**

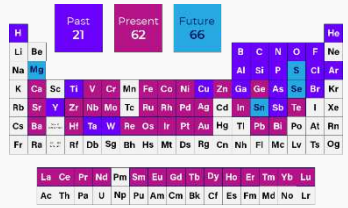
**More steps & higher sampling**



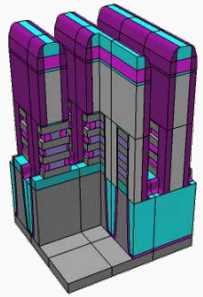
**Tighter specs as design rule shrinks**




**In-die & complex structures**

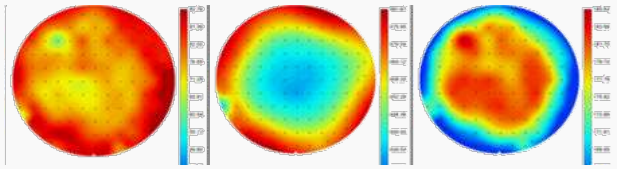



**New materials**

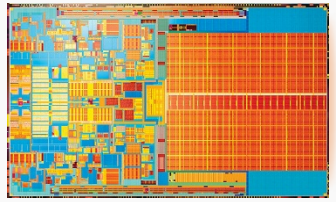


**Dimensional complexity increases: 3D devices**

**High aspect ratio structures**



**Local variation is critical: local density, Z Profiling**



**Monitoring more parameters → broader metrology scope**


© Nova Proprietary information

NOVA

Analyst & Investor Day 2021

# Key Challenges

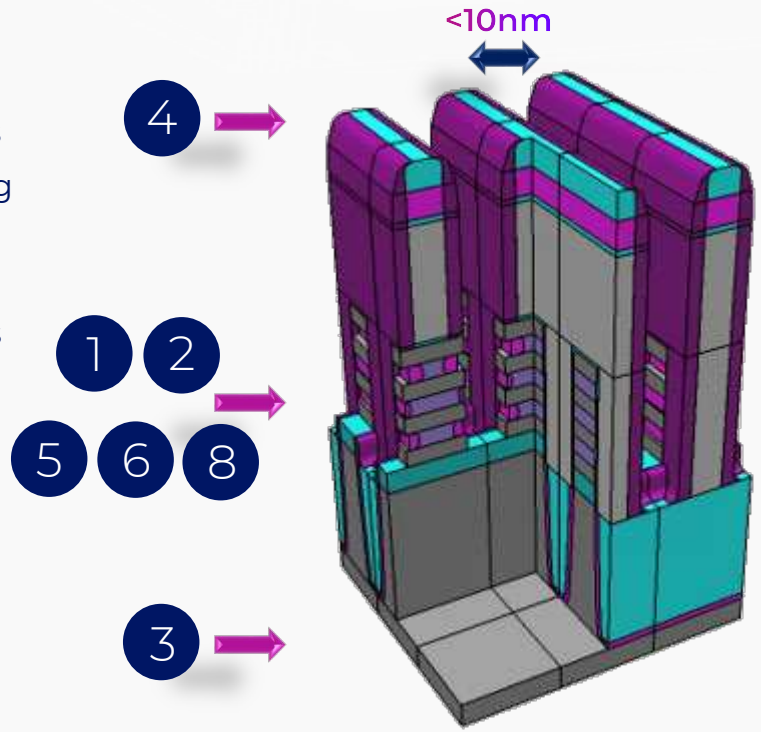
## Across all device segments

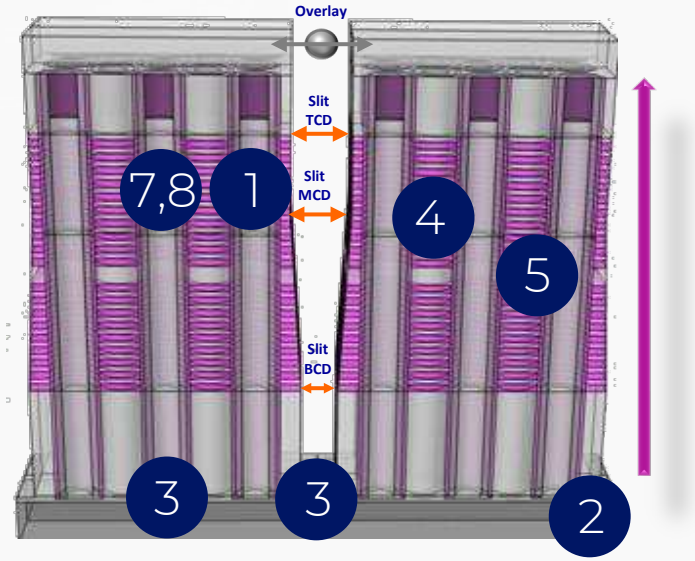
### Dimensional

1. Multiple Nanowires – shapes, spacing & thickness
2. Thin deposition surrounding nanosheets
3. Buried structures
4. Local topography variations

### Material

5. Si / SiGe uniformity
6. SiGe residues
7. Doping control
8. Stress & strain on multiple nanosheets




### Dimensional:

1. HAR channel-hole full profile
2. Underlying logic cell (CuA)
3. Bottom parameters
4. Tiers and liner thickness
5. Multi-deck alignment

### Material:

5. Dielectric composition & thickness control
6. Channel Poly Si crystallinity & grain size
7. Channel sidewall
8. Chemical residues


© Nova Proprietary information

## Core Technology

- Spectral Reflectometry (SR)
- X-Ray Photoelectron Spectroscopy (XPS)
- X-Ray Fluorescence (XRF)
- Physical Modeling
- Fleet Management


## Disruptive Technology

- Spectral Interferometry (SI)
- Multi Channel Integrated Metrology
- Advanced X-Ray
- Raman Spectroscopy
- Mathematical Modeling & Big Data


© Nova Proprietary information

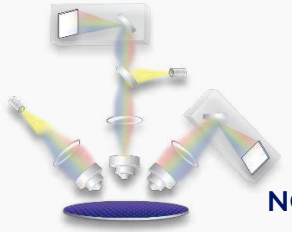
Analyst & Investor Day 2021

NOVA

# Unique Technology Solutions

## Dimensional

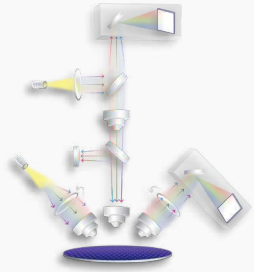
- Critical Dimensions



**NOVA ASTERA**

### Multi-Channel Integrated Metrology

Stand Alone performance in IM



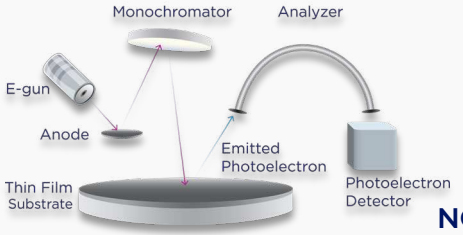
**NOVA PRISM**

### Spectral Interferometry

OCD Full Wavefront Metrology

## Materials

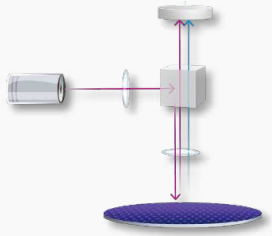
- Material Properties




**NOVA VERAFLEX**

### X-Ray: XPS and XRF

In-Line composition & thickness



**NOVA ELIPSON**

### Optical: Raman Spectroscopy

In-Line stress / strain and crystallinity

## Software & Algo

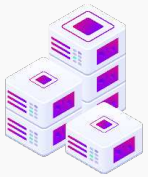
- Physical & Machine Learning Models
- Big Data Analytics

**Nova MARS**

**Nova FIT**

### Physical & Mathematical Modeling

Combining all types of modeling



**Fleet Management**

### Cloud Based Fleet Management

Smart connectivity


© Nova Proprietary information

Analyst & Investor Day 2021

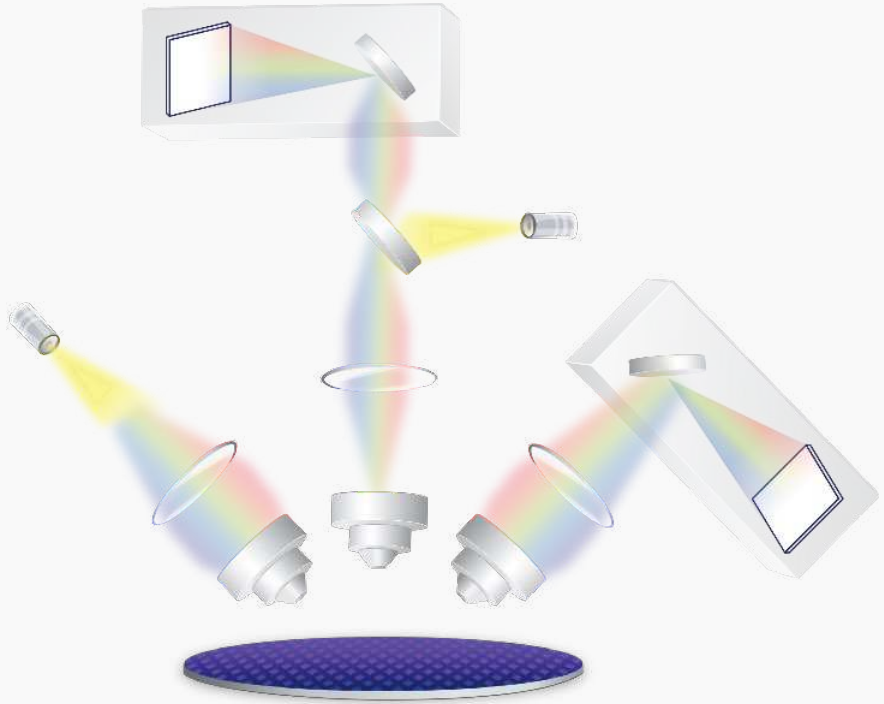
# Multi-Channel Integrated Metrology

## World-Leading IM Performance

Unique to Nova

### Stand-alone performance in Integrated Metrology form factor

- **World's first** IM with both oblique and normal incidence spectral information
- **Stand-alone level performance**: accuracy, sensitivity, parameters de-correlation
- **Algo:** dedicated modeling and ML package



### Multiple use-cases

- R&D and pilot
- Complex CMP & etch layers
- Ultra-thin film
- Residue detection

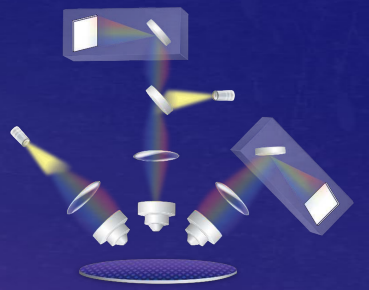

© Nova Proprietary information

NOVA

Analyst & Investor Day 2021

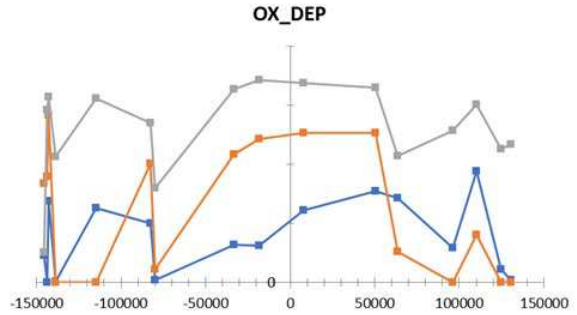
# Multi-Channel Integrated Metrology

## Case Study: Residue Detection in 3D NAND

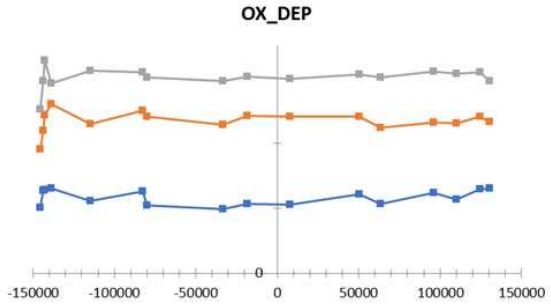


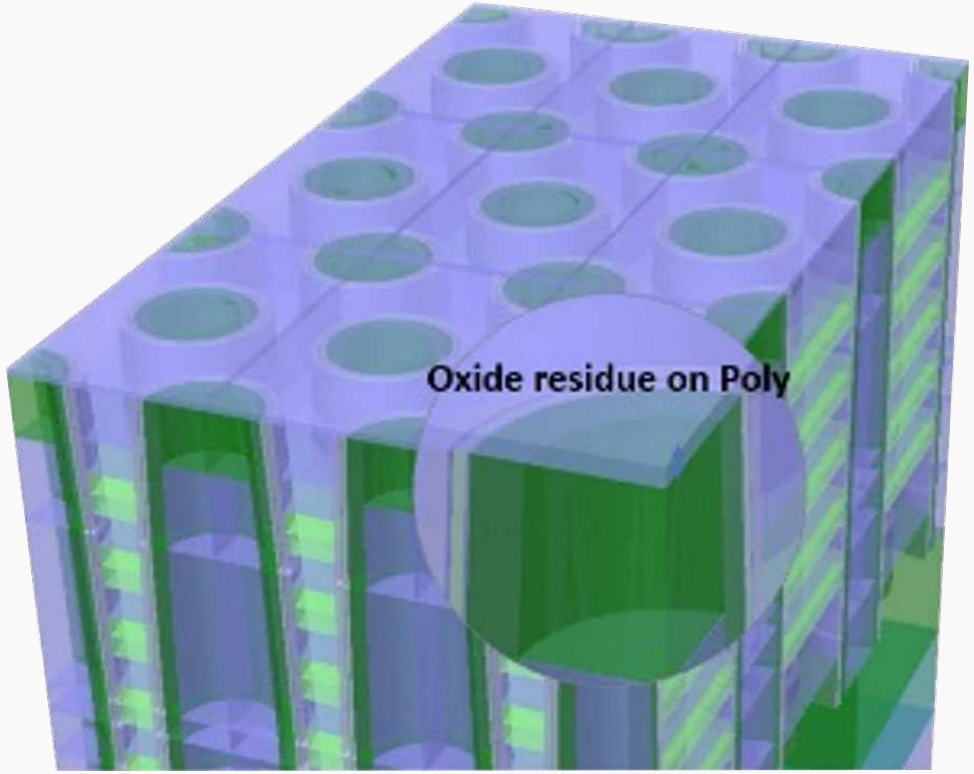
- Demonstrated measurement sensitivity of below 20A
- Oblique channel as enabler to solve thin film on structure
- Improved accuracy and stable WiW variation
- 50% precision improvement VS normal only

**Normal only**




**Multi-Chanel (ASTERA)**





© Nova Proprietary information

Analyst & Investor Day 2021

NOVA

# Spectral Interferometry (SI)

## Unique Optical CD Technology: Hardware & Software

Unique to Nova

### SI

Added on top of advanced Reflectometry (SR) & Ellipsometry (SE)

### New Data

Extract complete wave-front of measured sample
(inaccessible by other methods)

### Unique HW

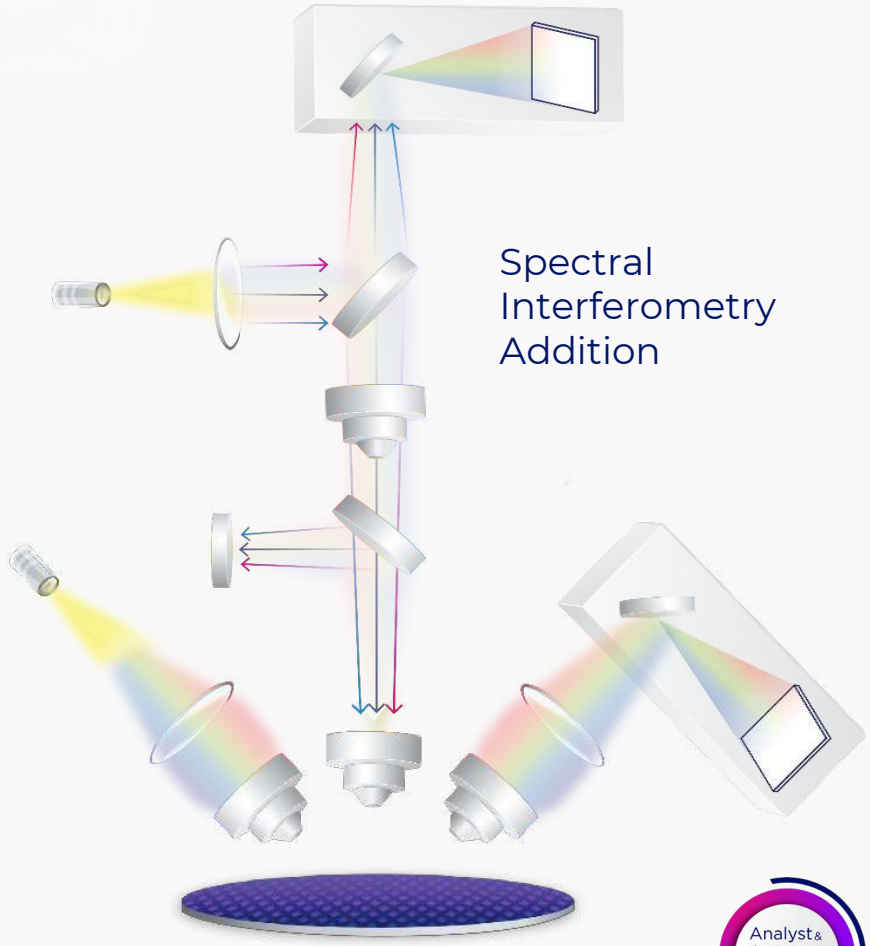
“Interferometry-like”

### HW-SW Synergy

Proprietary algorithms using unique information
(physical & mathematical modeling)

### Synergy Enables

- Depth-profiling and underlayer filtering
- Enhanced performance on multiple use-cases

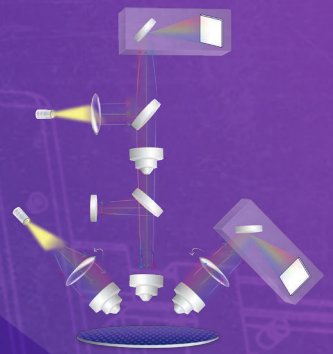


Spectral Interferometry Addition


© Nova Proprietary information

Analyst & Investor Day 2021

NOVA

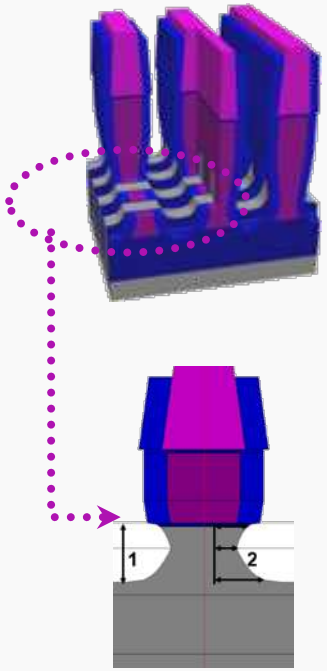


# Spectral Interferometry

Example Use Cases

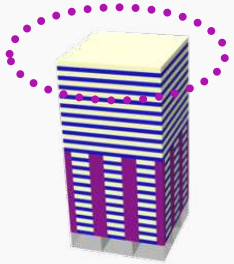
## Unique profile information

Logic Source/ Drain etch




## Underlayer filtering depth-based separation

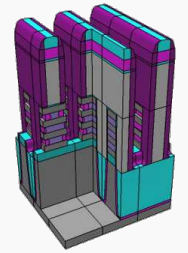
Top deck applications



CMOS underlayer architecture

## Depth-based separation

Individual Nanosheet properties (*)



(*) SPIE 2021: OCD enhanced: implementation and validation of spectral interferometry for nanosheet inner spacer indentation


© Nova Proprietary information

NOVA

Analyst & Investor Day 2021

# XPS In-Line for Materials Metrology

## The Market Standard for Ultra Thin Films

Unique to Nova

**XPS**

Inline non-destructive X-Ray for composition & thickness (World unique)

**Beyond optics**

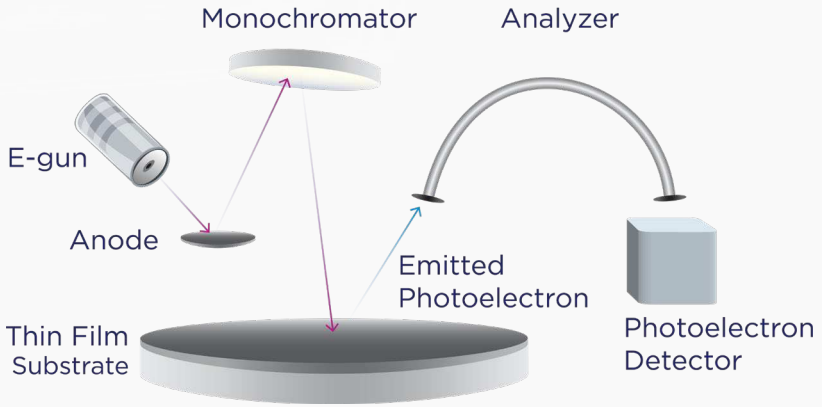
Precise control of ultra-thin films (e.g. HfO), enabling accurate Vt tuning

**XRF**

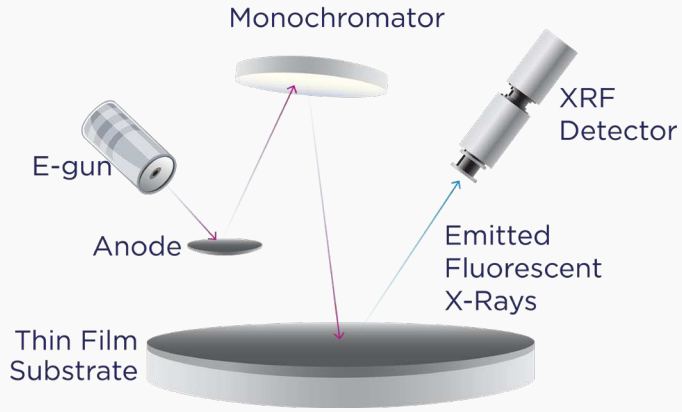
Simultaneous measurement for complex multi-stacks (e.g. SiGeB)

**In-die on-product** measurement of advanced DRAM and HAR 3DNAND (e.g. SiON)

Enabling process innovation – pattern selectivity and partial coverage in **Selective Deposition**




**Non-Destructive**



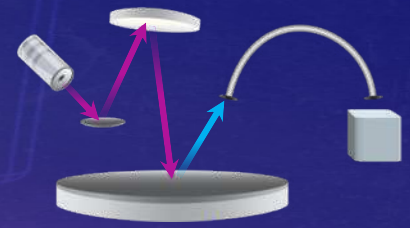


© Nova Proprietary information

Analyst & Investor Day 2021

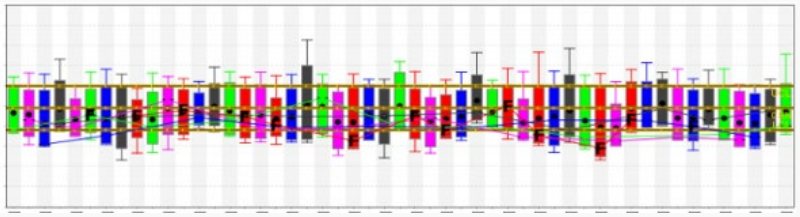
# XPS for Materials Metrology

## Example Use Cases

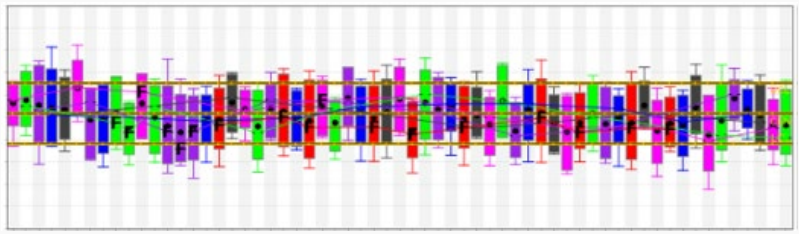


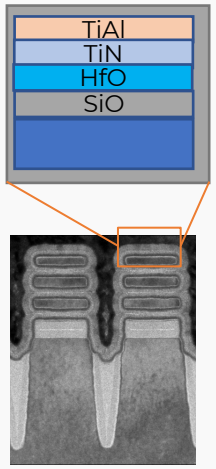
### Nanosheet: Thickness and composition control

Ti:Al % Composition Control



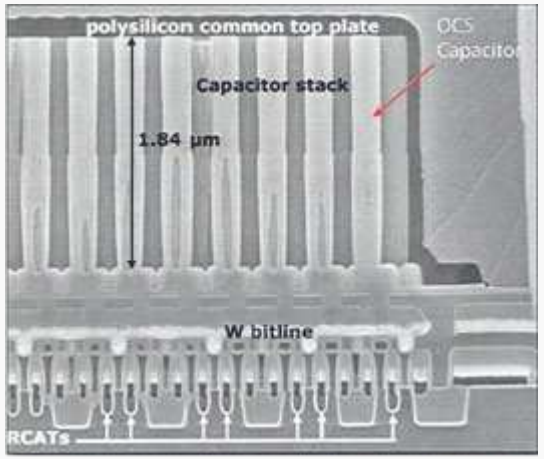
HfO Thickness Control

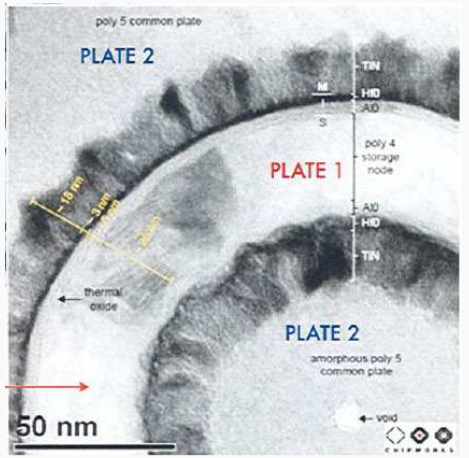





In line XPS and XRF deliver precise control of thickness and composition for complex gate stack film structures

### DRAM: Complex High-K multi stack thickness control




Only surface sensitive XPS can provide direct control of complex High-K dielectric stack in-die


© Nova Proprietary information

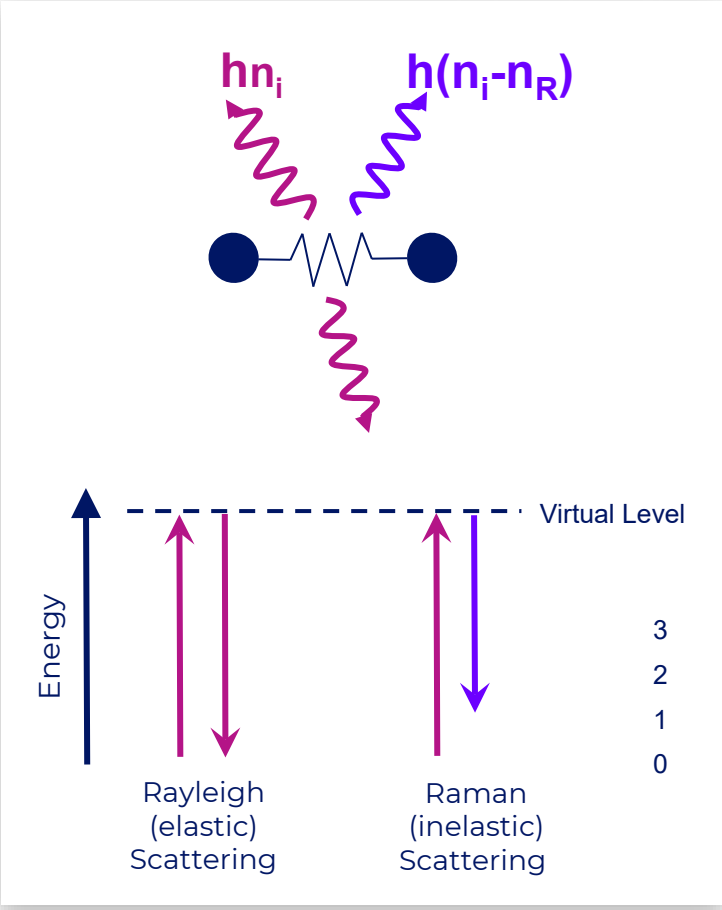
Source: TechInsights, IBM, Chipworks, Product data

Analyst & Investor Day 2021

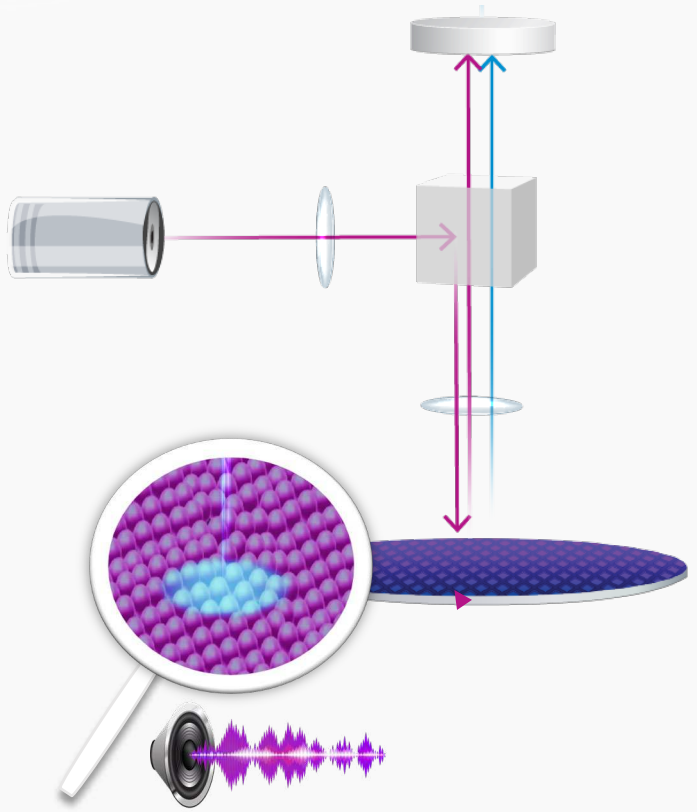
# Raman Spectroscopy

## For Materials Metrology

Unique to Nova




- Known powerful, optical technique for material characterization
- Small-spot on-structure metrology
- Sensitive to multiple material properties
- HVM-ready in-line Raman
- Algorithm and modeling: translating raw Raman spectra to SPC level data




© Nova Proprietary information

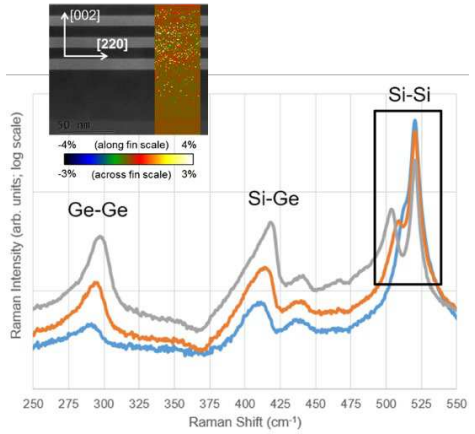
NOVA

Analyst & Investor Day 2021

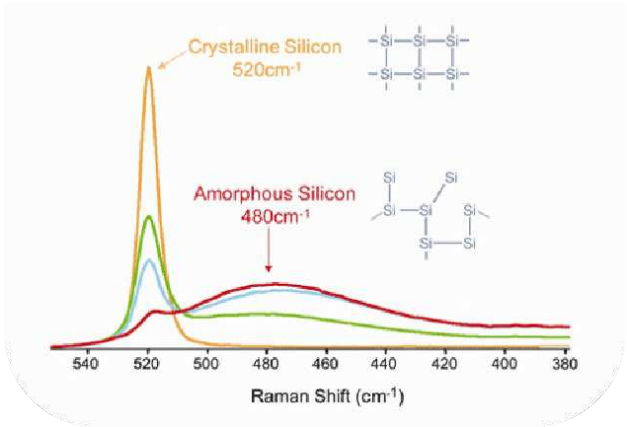
# Raman Application Space

Validated by Leading Logic & Memory Customers

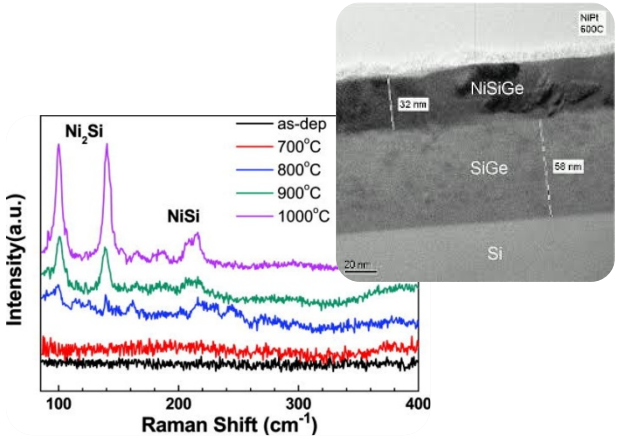
## Strain in Channel and Source/ Drain*



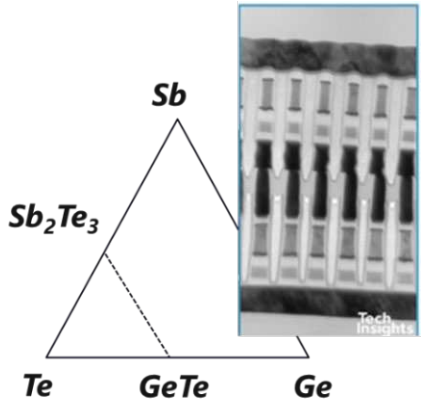

## Crystallinity



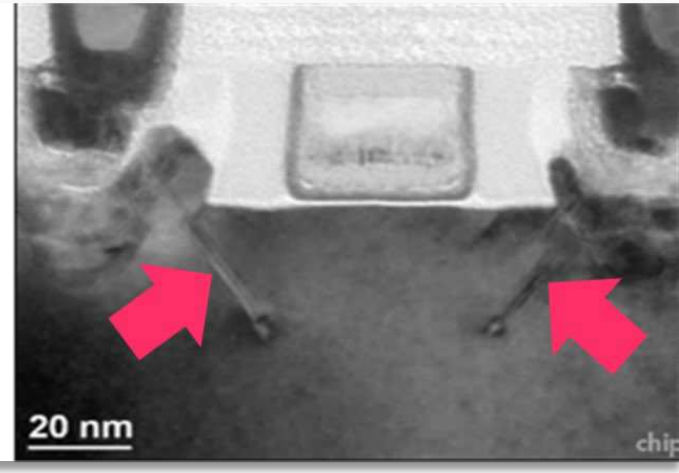

## Phases and Grain-size




## PCM Crystallinity




## Defectivity




* SPIE 2021: In-line Raman spectroscopy for stacked nanosheet device manufacturing

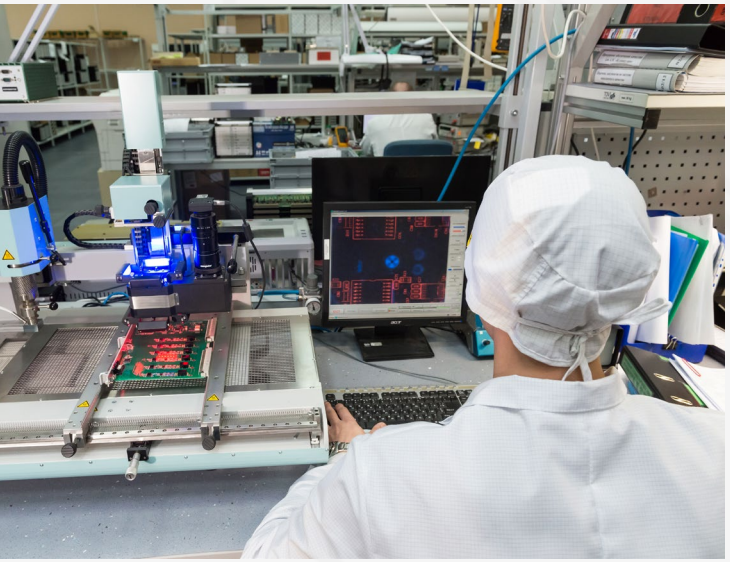

© Nova Proprietary information

NOVA

Analyst & Investor Day 2021

# From Lab to Fab

## A Complex Journey



### Automation

- Fully automated HW and measurement sequence
- Recipe-driven 300mm wafers

### HVM Worthy

- Fab connectivity for statistical process control
- Non-destructive

### Peak Performance

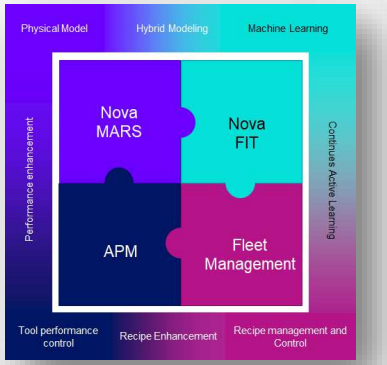
- High throughput, accuracy & repeatability
- Algorithm suite for material information analysis




© Nova Proprietary information

fractalmonster / Shutterstock.com

# Comprehensive Modeling

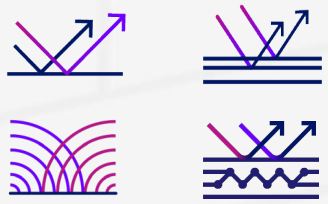



## Benefits

- Accuracy & robustness → tighter process specs
- Reduce (destructive) reference → time to market
- Expand applications → more process control
- More parameters → deeper process insights

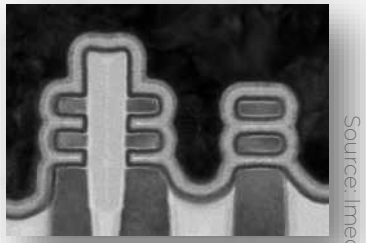
## Unique Directions: Physical Modeling with Machine Learning

**Physical Modeling**



**Nova Unique Reference**

SI, Raman, XPS, Multichannel IM

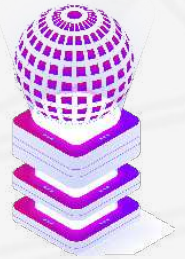


**External Reference**

TEM, E-test

Source: Imec, 2021

**Nova Machine Learning**




© Nova Proprietary information

Analyst & Investor Day 2021

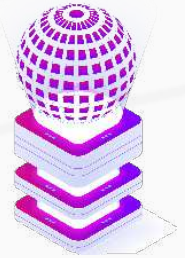
# Software & Hardware Synergy

The Best of Both Worlds

- Unique HW & dedicated algorithms
- Cross – platform synergy
- Continuously and actively optimize machine learning models

**Nova PRISM**

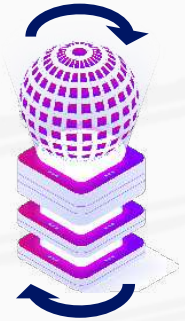
**Nova MARS**

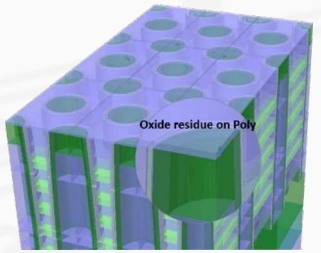


**Nova FIT**

**IM for CMP**

Under layer filtering via PRISM SI – Robust in-die solution for multi deck and CuA – Enhanced CMP control




Enhancing IM with XPS data via dedicated Machine Learning


© Nova Proprietary information

Analyst & Investor Day 2021

# Summary

## Unique Technologies to Answer Key Challenges


NOVA PRISM

Spectral Interferometry

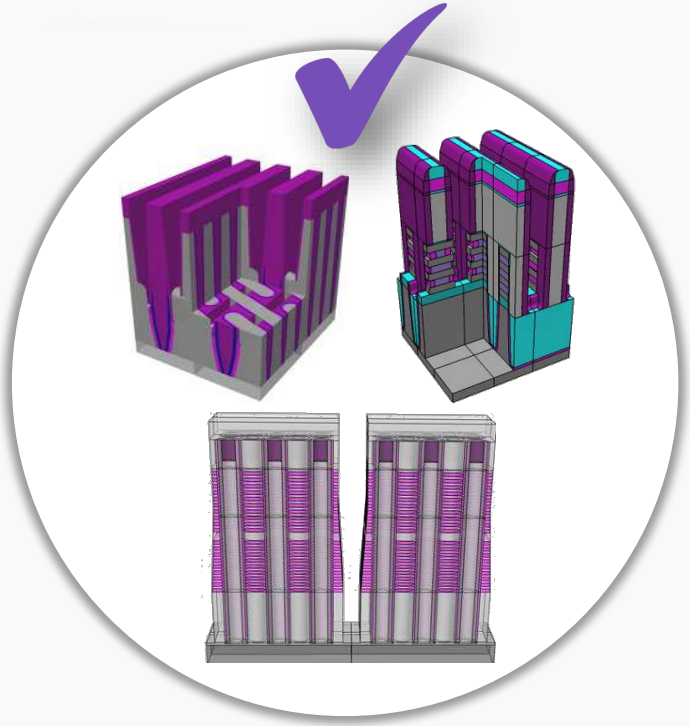
NOVA ASTERA

Multi-Channel
Integrated
Metrology

Nova MARS

Nova FIT

Physical & Mathematical modeling



NOVA VERAFLEX

X-Ray:
XPS
and XRF


NOVA ELIPSON

Optical:
Raman
Spectroscopy

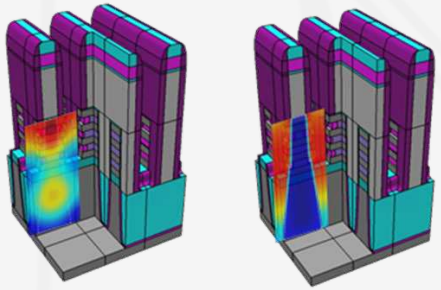


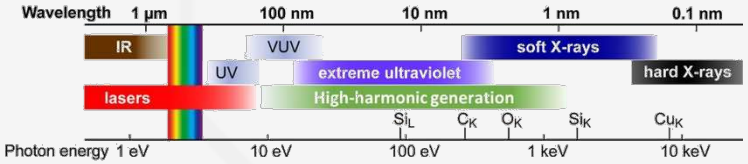
© Nova Proprietary information

Analyst & Investor Day 2021

# Future Directions

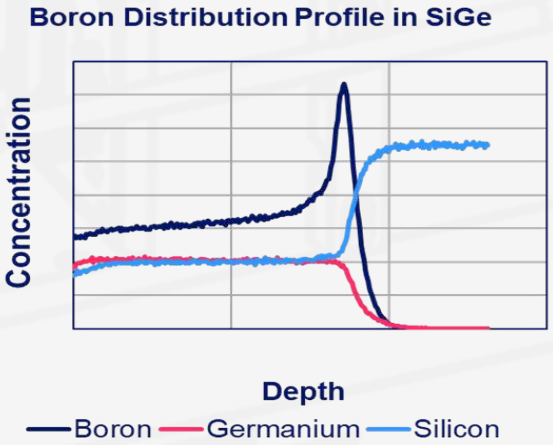
## Dimensional





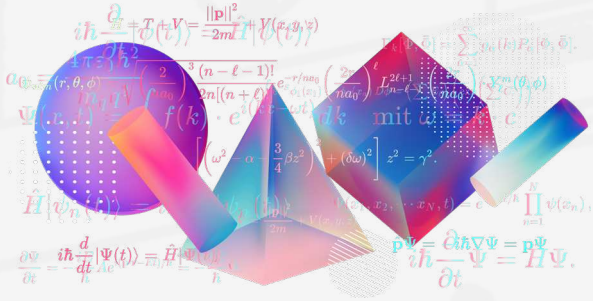

Different energy sources probe different dimensions of the structure

## Materials




Depth-profile measurement

## Software and Algorithms



Comprehensive Modeling – Physical and Mathematical


© Nova Proprietary information

NOVA® PROCESS INSIGHT

Analyst & Investor Day 2021

# Closing Remarks

**Eitan Oppenhaim, President & CEO**

# Key Takeaways

## Positioned for Continuous Growth

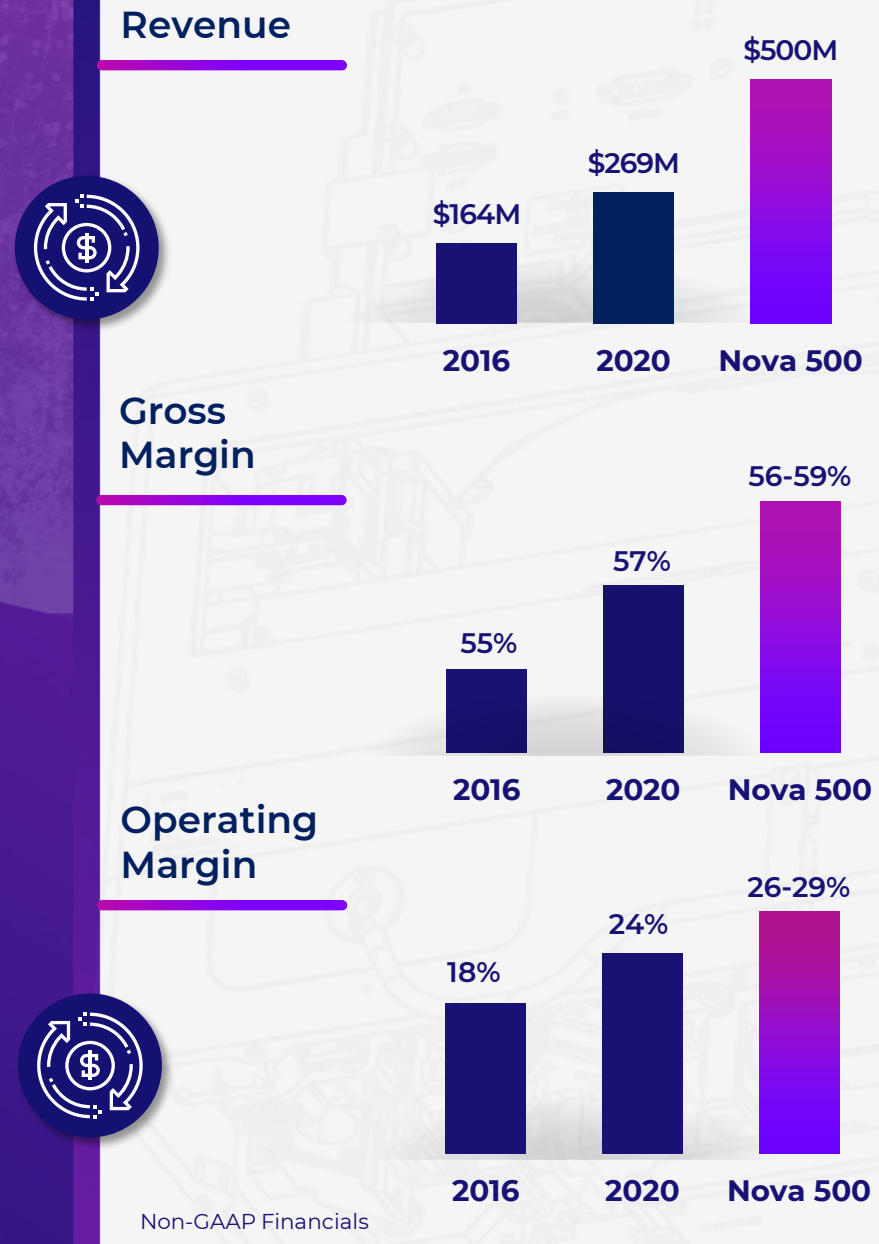
**Growing demand for IC drives capacity & Increasing complexity**
Increasing need for advanced metrology solutions

**Unique and disruptive technology portfolio**
Driving a stronger position and expanding TAM

**Solid operational model**
Supports clear strategy for growth

**Proven performance towards Nova 500**
Outperforming the Industry

**Cultural elevation with new CSR strategy**
Combining businesses ethics with culture and social conciseness




Non-GAAP Financials


© Nova Proprietary information

NOVA® PROCESS INSIGHT

# Thank You


© Nova Proprietary information