

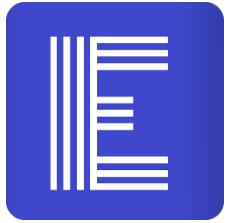
Exnodes®

The future of wafer inspection

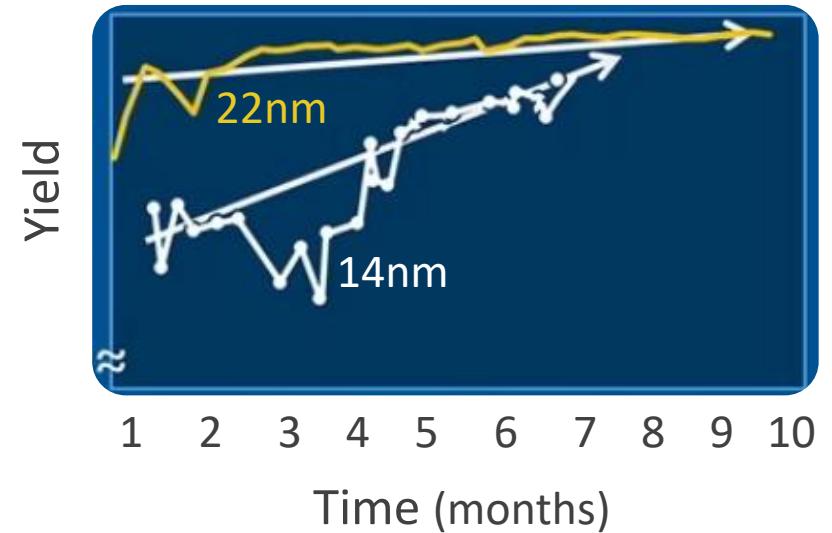
Dr. Prasanna Pavani
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Dr. Michael Varney
Founder & Chief Scientist
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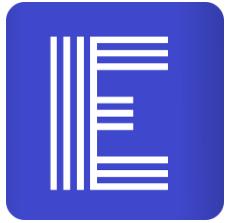
Problem



- Plummeting semiconductor yields
 - advanced fabrication → unfamiliar defects
 - rapid defect source learning → **non-existent**
- Inspection shortcomings stifle yield
 - 3.6x slower than node scaling
- **Chipmakers need a scalable inspection solution**
 - semiconductors unprofitable at low yields

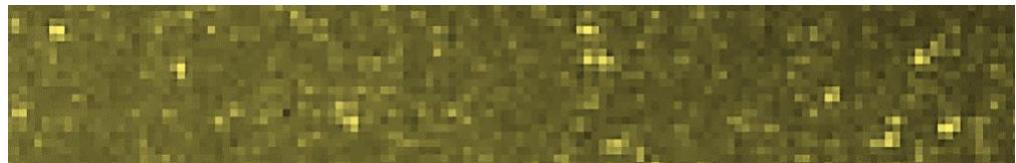


Opportunity



- Computational Parallel Inspection® (CPI) [[10 patents issued](#)]

- **Parallel Illumination:** wide field, multi-spectral, adaptive
- **Computational Imaging:** high resolution, distributed, algorithmic
- **Yield Learning:** parameter extraction, learning, inference



sub-10 nm sensitivity demonstrated with CPI

- XPRO® UW implements CPI

- detects nanoscale defects rapidly
- infers defect sources instantaneously

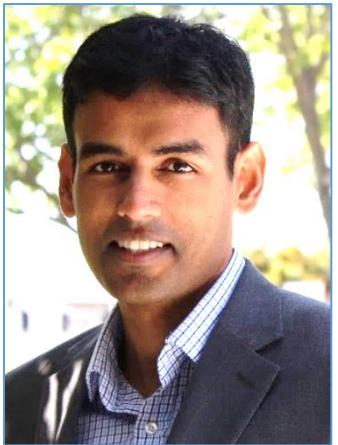


Design



Functional alpha

Team



Dr. Prasanna Pavani
Founder & CEO



Dr. Michael Varney
Founder & Chief Scientist



Dmitriy Kalugin-Balashov
Principal Software Engineer



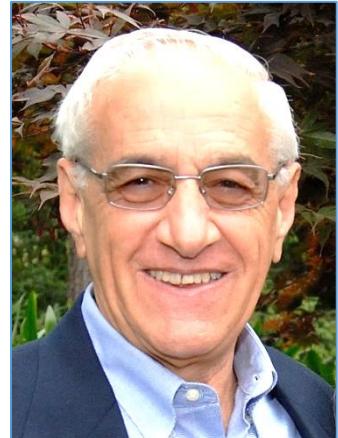
Gordon Eubanks
Board Member & Investor



Heejin Chung
Board Observer (SK hynix)



Dr. Sung Hoon Yang
Board Observer (Samsung)



Prof. Joseph Goodman
Advisor & Investor (Stanford Univ.)



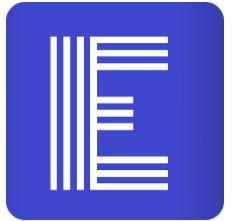
Dr. John Barrus
Advisor (Google)



Steve Levine
Legal Counsel (Fenwick)



Future Hires



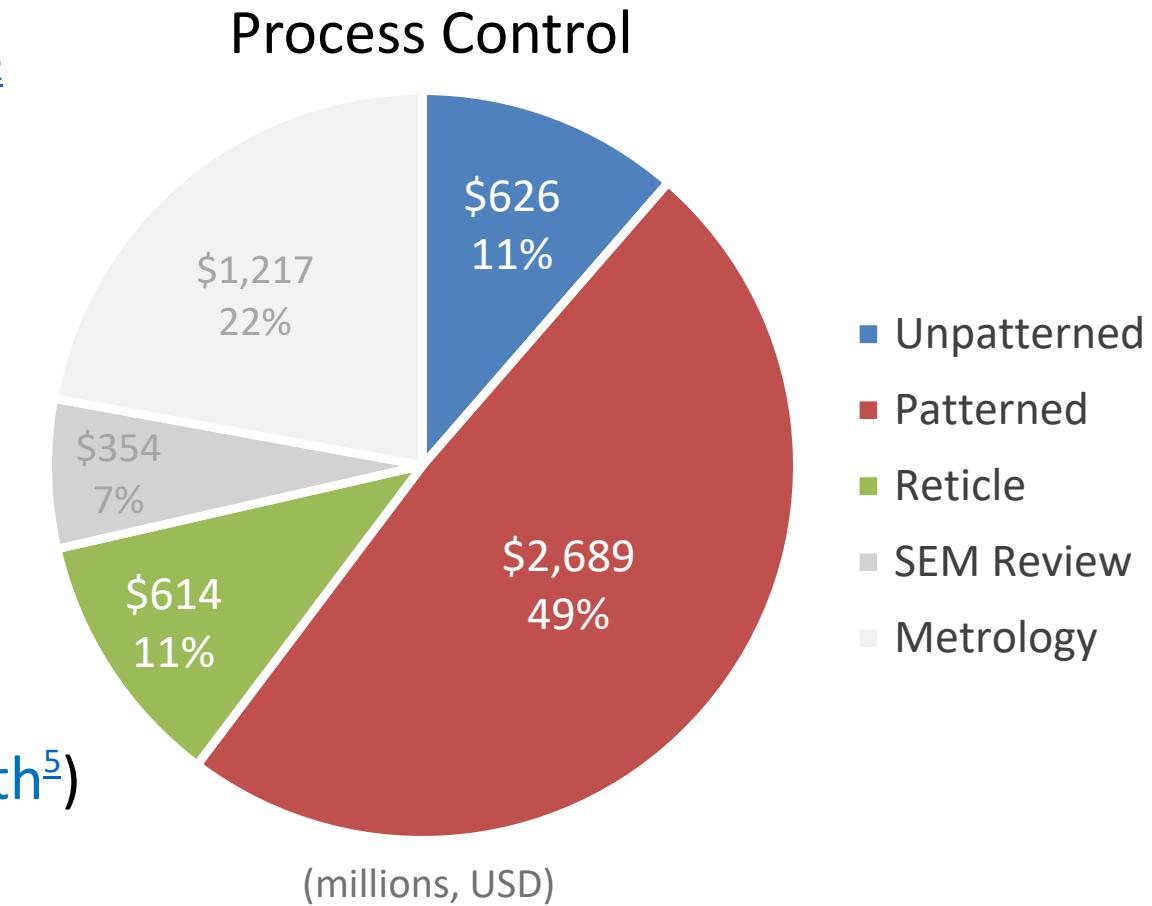
Market

- Process Control: \$5.5B¹ @ 11% CAGR²

- Exnodes TAM: \$4B
 - Unpatterned, Patterned, Reticle
 - \$45B³ wafer processing
 - \$400B⁴ semiconductor

- **Exnodes XPRO® UW**

- Revolutionizes Unpatterned (\$626M)
 - enables 3D NAND scaling (**45% bit growth⁵**)



Business Model

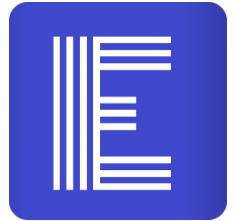


- Customers
 - chipmakers: memory, logic, foundry
 - wafer manufacturers
 - equipment manufacturers
- Pricing
 - XPRO® UW: \$4M - \$6M
 - 15-25% annual service
- Manufacturing Partnerships
 - expert assemblers of inspection tools
 - 25+ years of operations



Source: <https://www.owensdesign.com/>

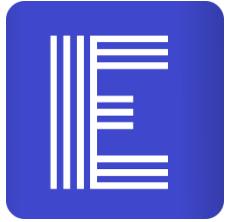
Distribution



- Lined up VP Sales, Marketing & Service
- Sales & Marketing
 - 20 major customers
 - in-house customer wafer tests
 - evaluation at customer fabs
 - qualification
- Customer Success
 - global field service
 - application support



XPRO® UW: Applications



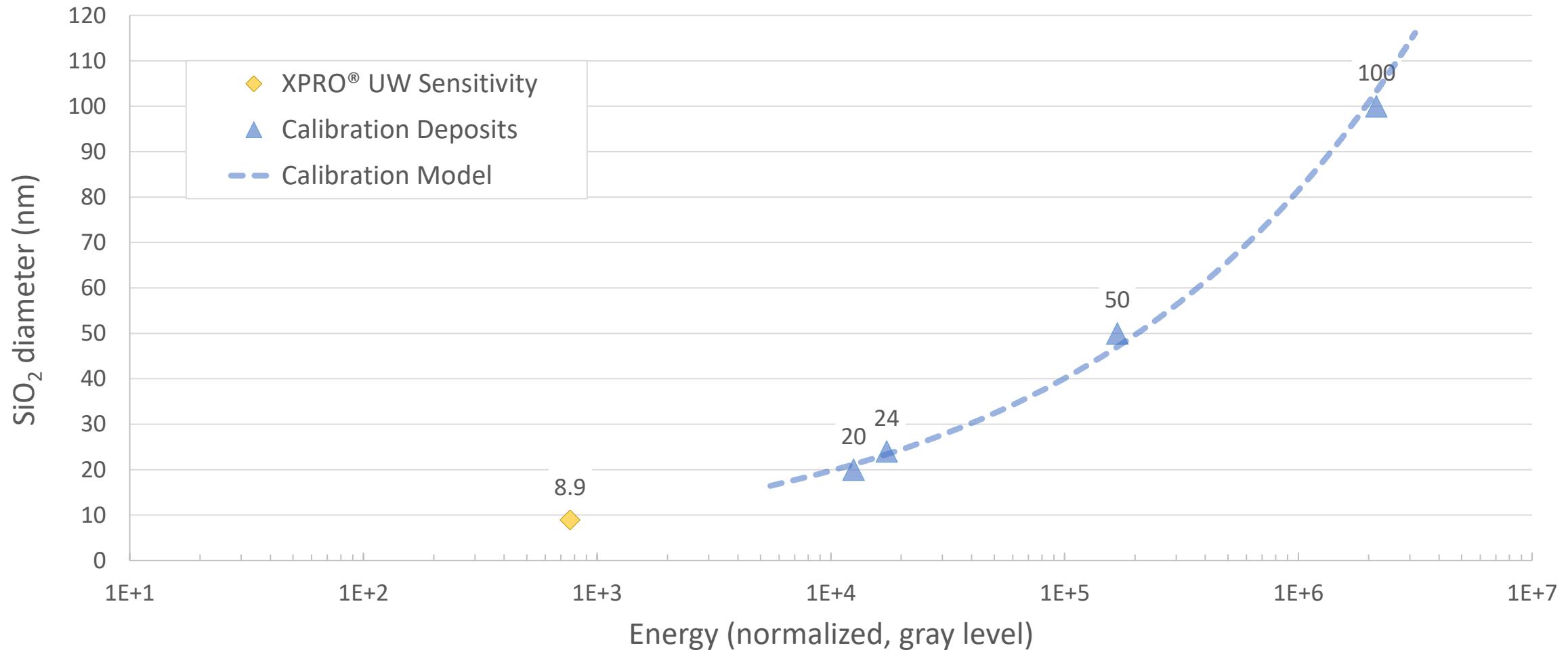
Incoming Wafer Qualification

Process Monitoring

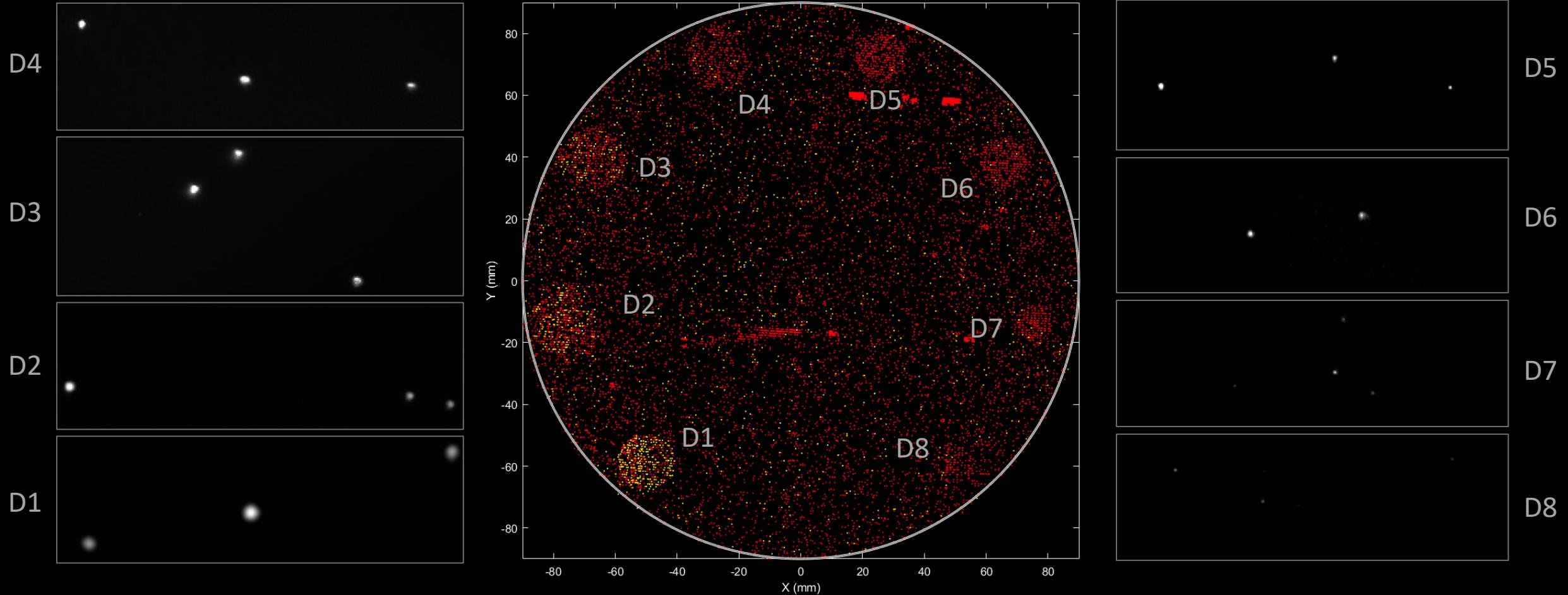
Process Tool Qualification

- unpatterned wafer inspection
 - bare & blanket film wafers
- sub-10 nm sensitivity, production throughput & root-cause prediction

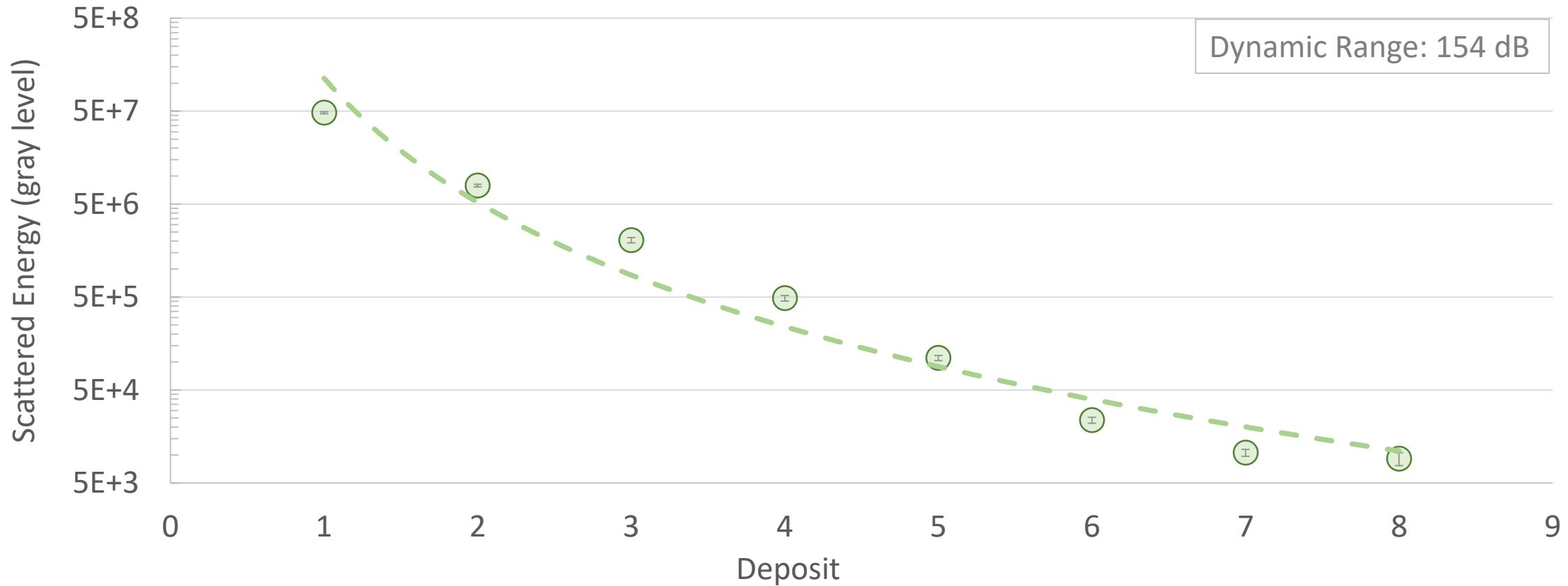
XPRO® UW: Sub-10 nm Sensitivity



Test Wafer: Deposit Images

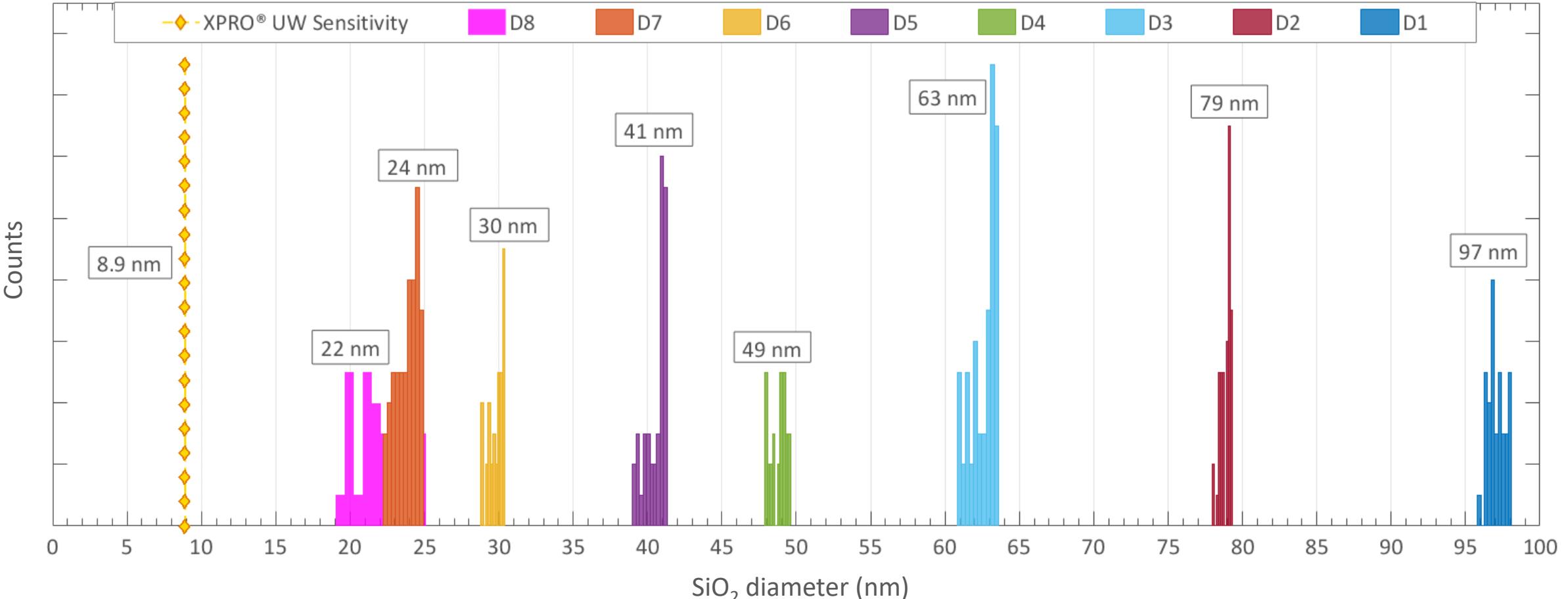


Test Wafer: Scattered Energy



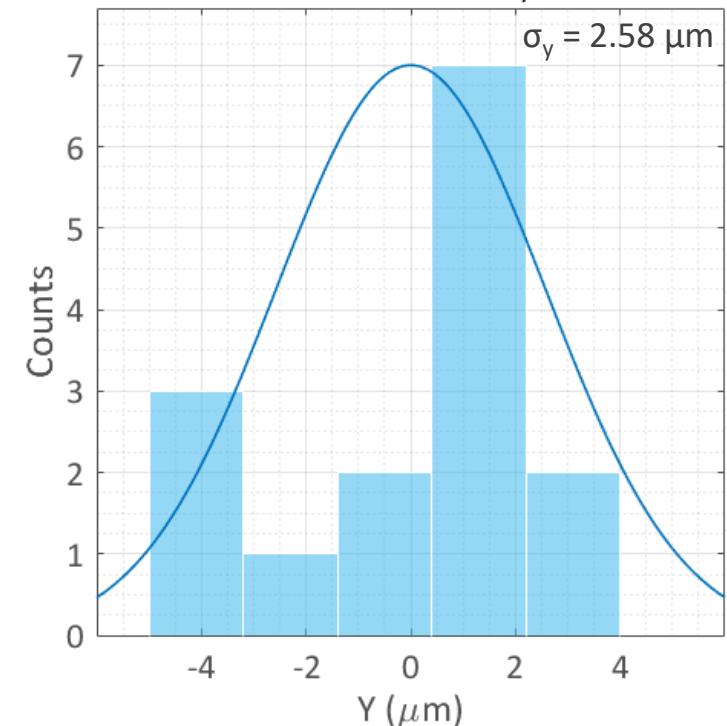
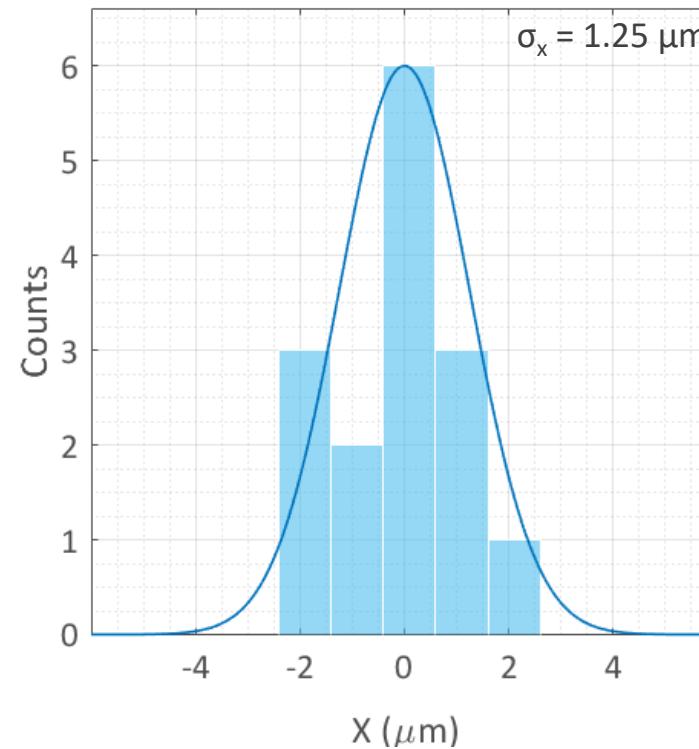
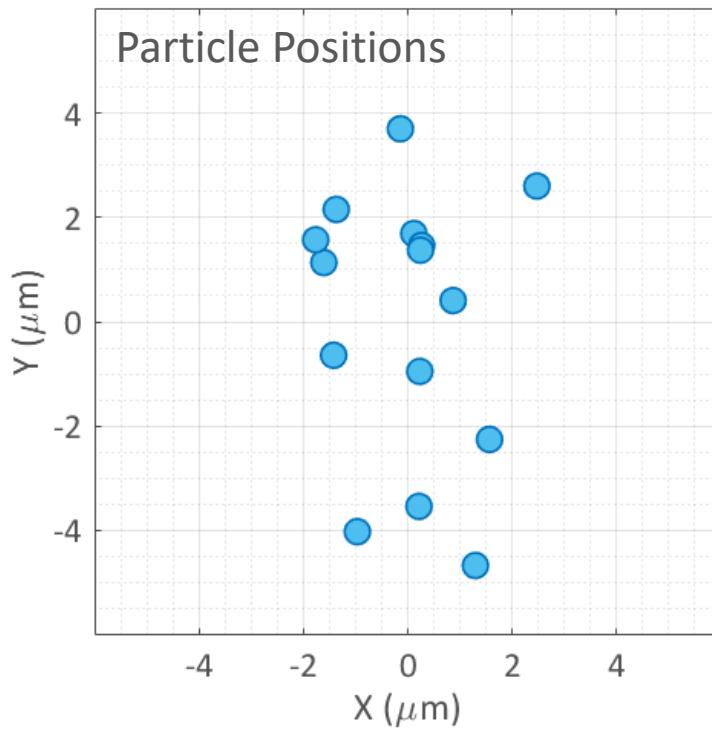


Test Wafer: Size Distribution



Position Repeatability

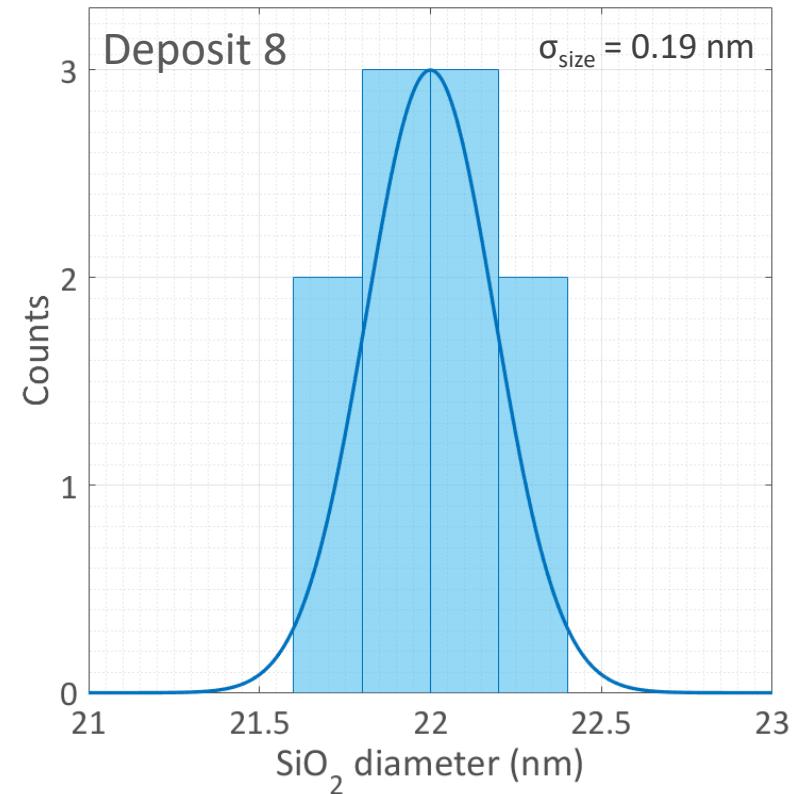
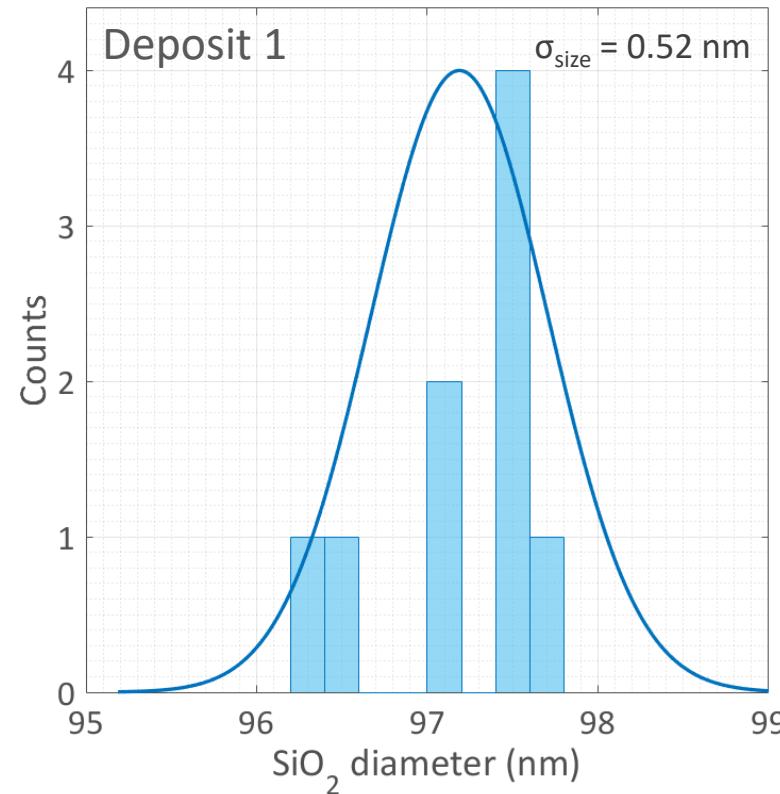
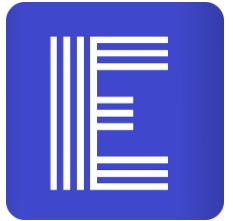
(XPRO® UW alpha)



Sub 0.5 μm Position Repeatability target in XPRO® UW beta

Size Repeatability

(XPRO® UW alpha)



Sub 0.5 nm Size Repeatability in XPRO® UW beta

XPRO UW

xnodes





Exnodes[®]

The future of wafer inspection