

7th Annual eBeam Initiative Luncheon SPIE – February 24, 2015

Aki Fujimura CEO – D2S, Inc. Managing Company Sponsor – eBeam Initiative

40+ Member Companies & Advisors abeam **ADVANTEST** ADVANCED MASK technologies TECHNOLOGY CENTER Beam **APPLIED** MATERIALS® alchip CONVERSION Initiative cādence" 🖙 Leti aselta[.] www.ebeaminitiative.org EQUICON **Dai Nippon Printing** ∈Silicon[®] **FA ISys**[®] Welcome GLOBALF John Chen Holon and Photronics! **NVIDIA** HOYA HOLON i kinschips arris Graphics MULTBEAM ACS PMC-Sierra **IAGLEN** NUFL/XRE SAMSUNG DESIGN AUTOMATION PETERSEN ADVANCED LITHOGRAPHY **Riko Radojcic** Qualcomm PHOTRONICS I Tela nnovations THE P **SYNOPSYS**° tau-Metrix Jean-Pierre Geronimi TÍCÍL ST Accelerating Innovation istec TOPPAN Hugh Durdan Xilinx



eBeam Writes All Chips

The eBeam Initiative:

- Is an educational platform for eBeam technology and its impact on all lithography approaches
- Open to any company in the semiconductor design chain with an interest in eBeam technologies





Colin Harris, COO PMC Sierra A Chipmaker's Perspective on Moore's Law





How Can the SPIE Community Help?

- EUV, DSA, NIL
- Restrictive design rules
- Direct-write / complimentary eBeam
- Multiple patterning
- ILT
 - complex shapes
- Multi-beam
- Simulation-based processing



Keeping the Bridge to the Next Node Intact









The Bridge Is Intact; Is the Toll Too High?





Moore's Law: Benefits are Worth the Toll



Density Used to Double Every Node







Density No Longer Scales



Worst-Case Rules Constrain Density







Design Rules Reach the Breaking Point



Simulation Is the Answer





Source: Tesla via orzzz.com



Simulation Reactivates the Density Benefits of Moore's Law



Use Simulation to Reactivate Density Benefits



- Even 10,000 rules can't express every case
 - Conservative rules erode the benefits of Moore's Law
- Simulation-based processing enables context-dependency
- Leads to no rectilinear constraint on mask shapes
- Enables ILT programs the freedom to improve lithography

Use the power of computation provided by Moore's Law to reactivate the density benefits of Moore's Law