



G450C Briefing and Supply Chain Collaboration on 450mm Transition

**SEMI Northeast Forum
Sept. 11 ,2013**

G450C Background



- Building 450mm wafer / equipment development environment
- Consists of 5 member companies (Intel, TSMC, GLOBALFOUNDRIES, IBM, Samsung) and New York State partnering with CNSE
- New York based consortium
- Built on the base program started under ISMI's 450 Program
- Collaboratively work with suppliers to develop 450mm equipments
- Using wafers, equipments, people and cleanroom to develop and test equipment and build up infrastructure to meet industry needs

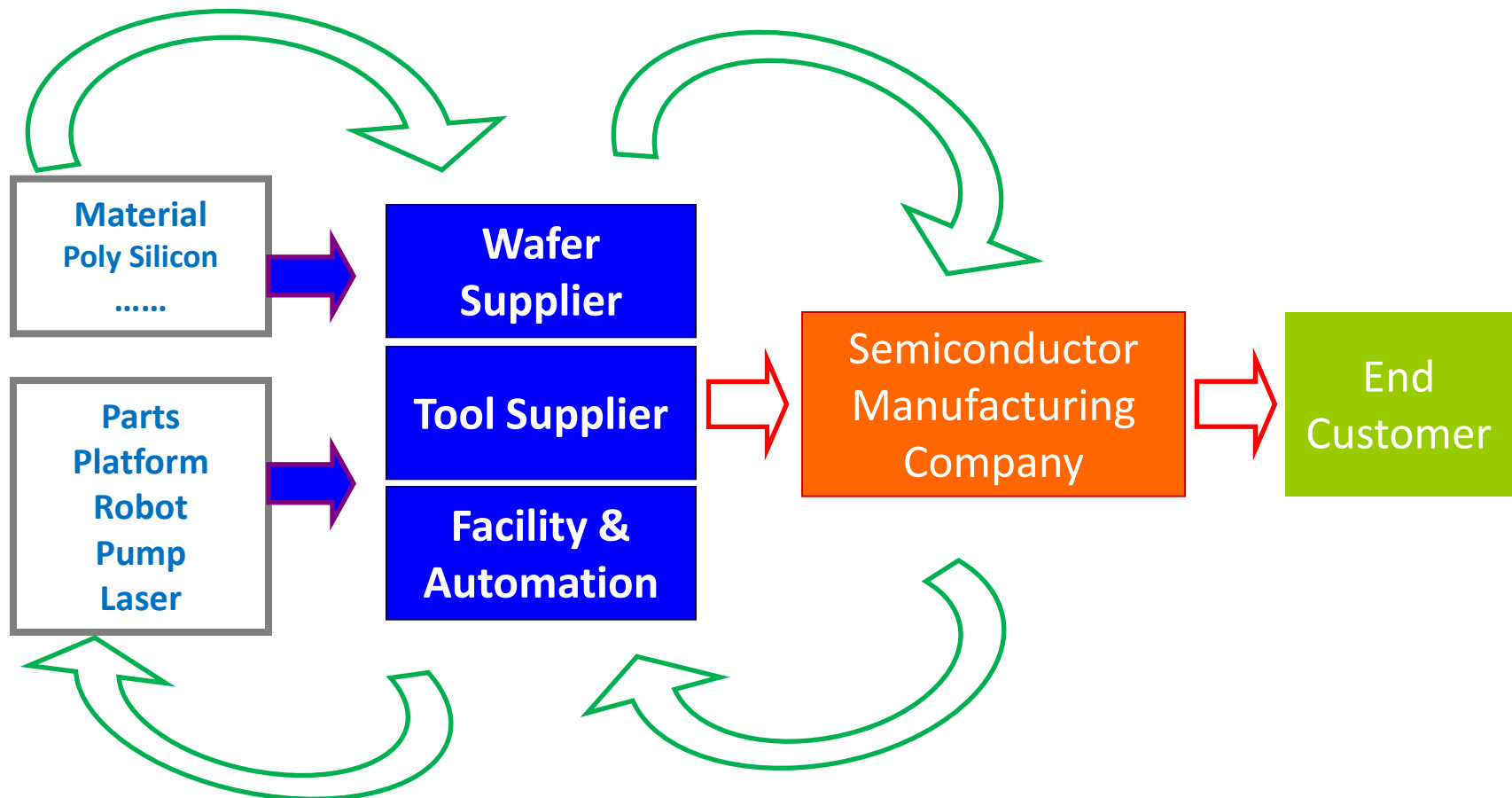


Key Messages

- Suppliers are developing the 450mm tool set with ~ more than 25 tools being delivered to G450C in 2013
- Significant progress in wafer quality
- Automation and carriers are working
- Notchless wafer and 1.5mm Edge exclusion
- Collaboration between IC makers , Tool suppliers, Material suppliers , and Facility group is key to the future 450mm success.

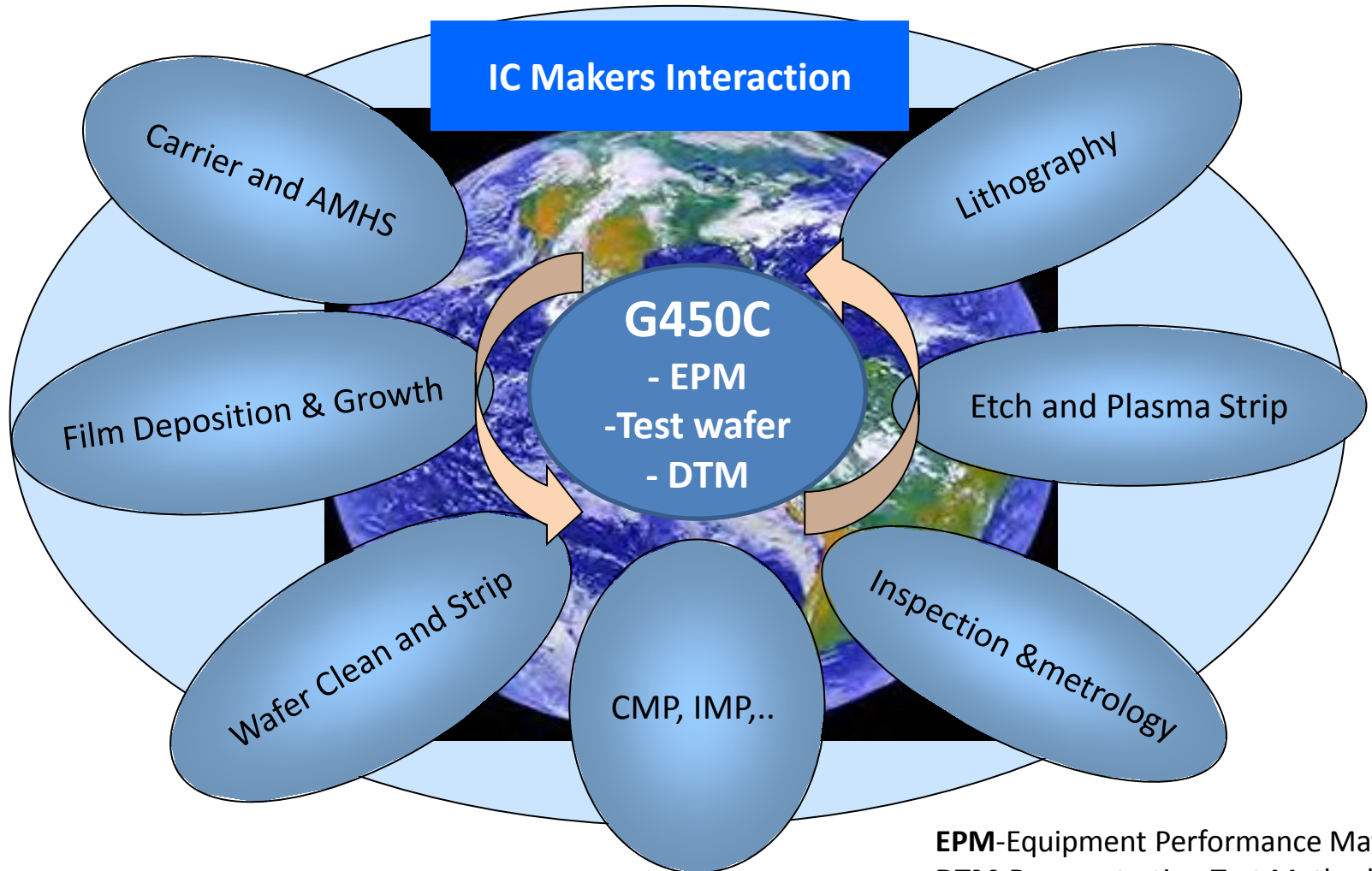
Supply Chain Collaboration

- Supply chain collaboration enables efficient and effective 450mm transition



Test Wafer Center for Tool Development

- Collaboration among IC makers and equipment suppliers
- Focused resources + share the cost + share the risk

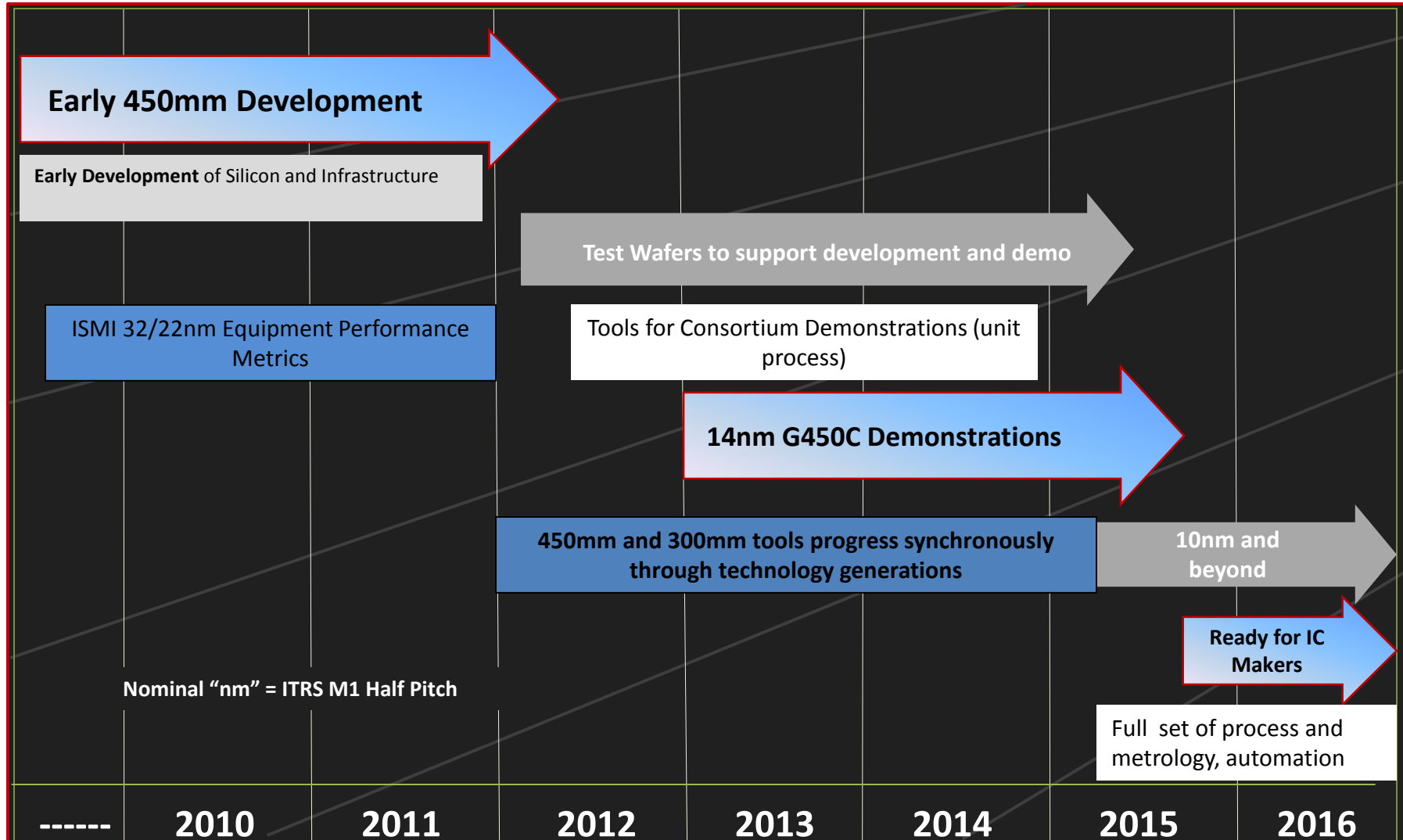


EPM-Equipment Performance Matrix
DTM-Demonstration Test Methodology

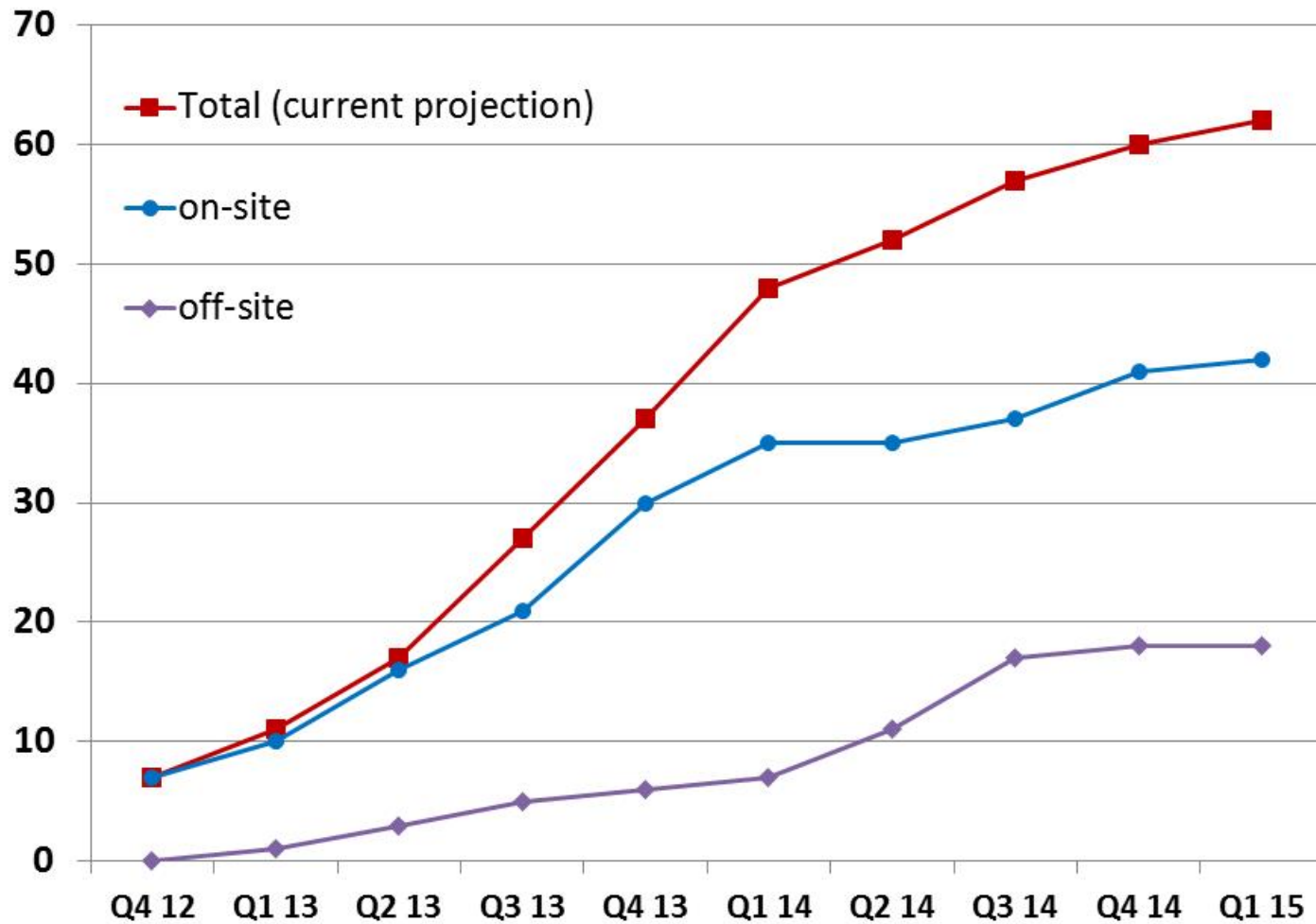
Development and Technology Intercept Targets



← G450C Program →

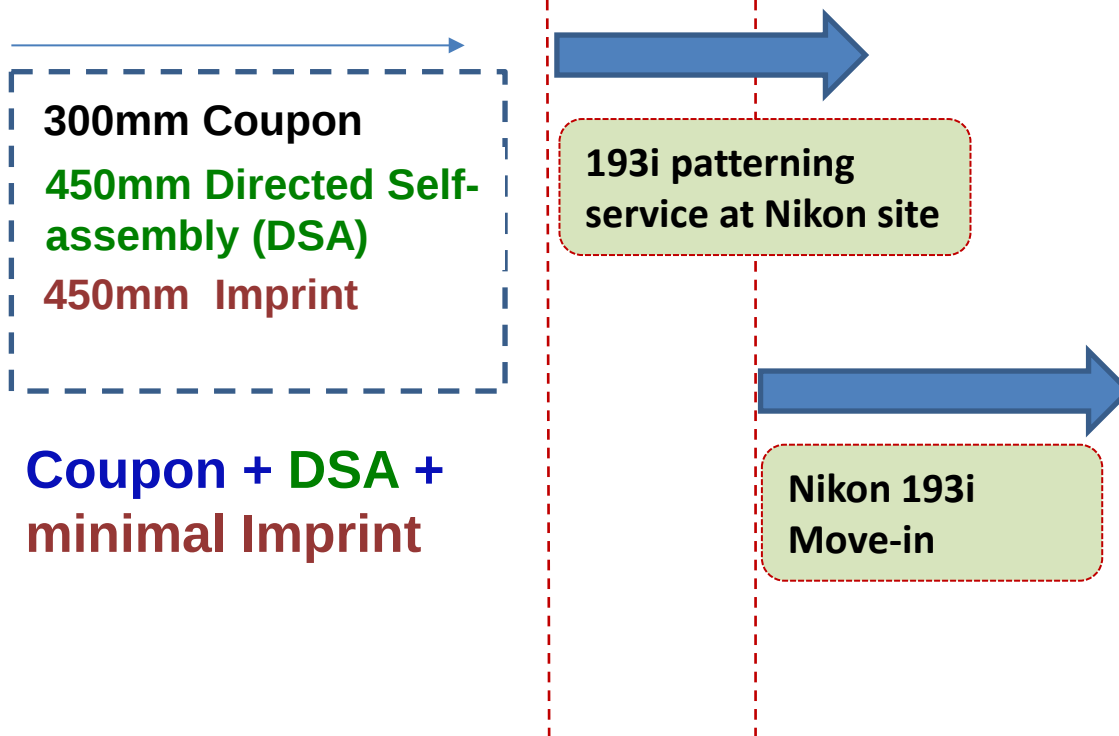


G450C Equipment Delivery Plan



G450C Lithography Tool Roadmap

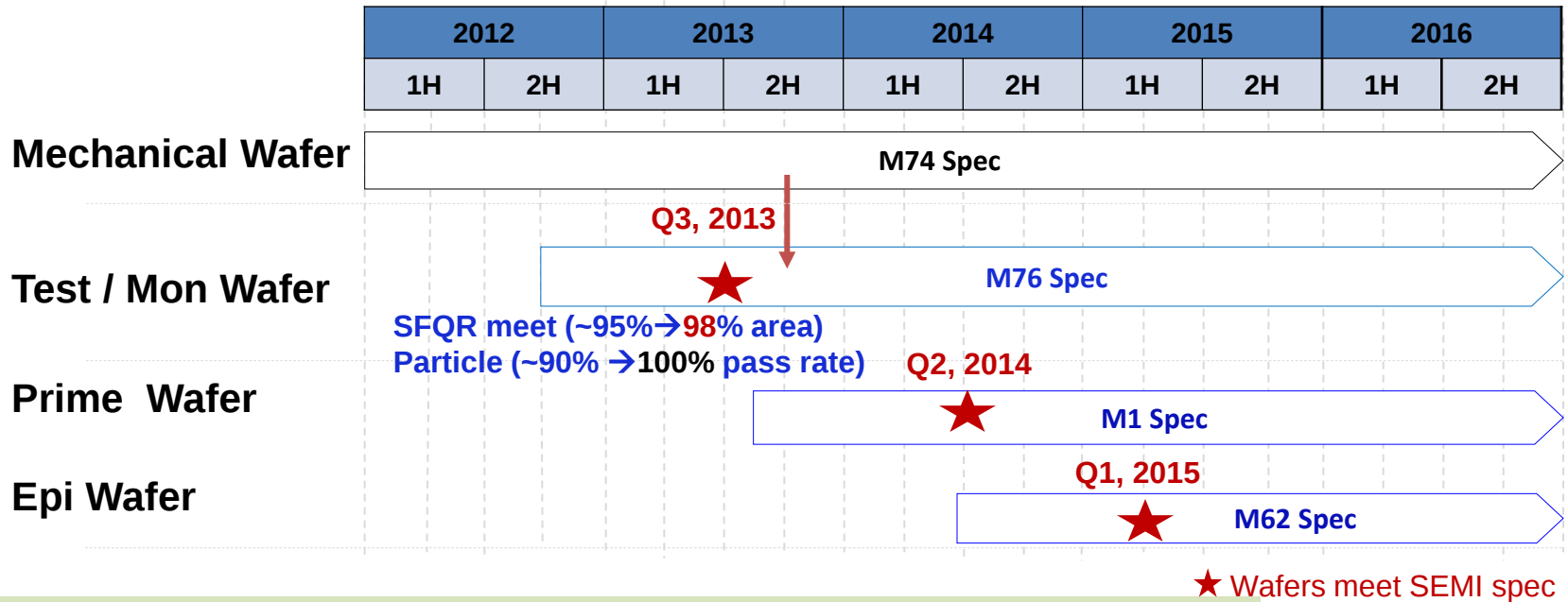
2012	2013		2014		2015		2016		2017		2018	
2H	1H	2H	1H	2H	1H	2H	1H	2H	1H	2H	1H	2H



Wafer Quality Roadmap & Reclaim Capability



● Wafer quality roadmap



● G450C Monitor Wafer reclaim capability

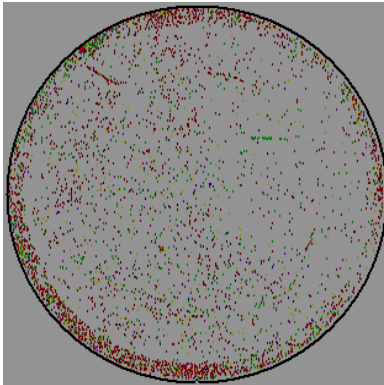
G450C On-site ready ★

Process	Film	2013 1Q			2013 2Q			2013 3Q			2013 4Q			2014 1Q			2014 2Q		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6
FEOL	Oxide / Poly / SiN									★									
	Photo Resist									★									
BEOL	Metal (Ni/TiN/W/TaN/Cu)															★			
	Lk film															★			

Wafer Quality Continues to Improve



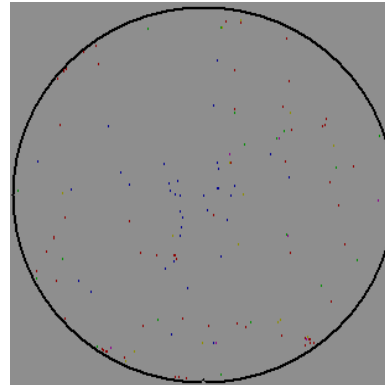
Year-to-year defect improvement on both defect size and defect density



Particles * (5)		
0.086-0.090	148	
0.090-0.110	1074	
0.110-0.120	430	
0.120-0.140	529	
0.140-Max	2308	

2010

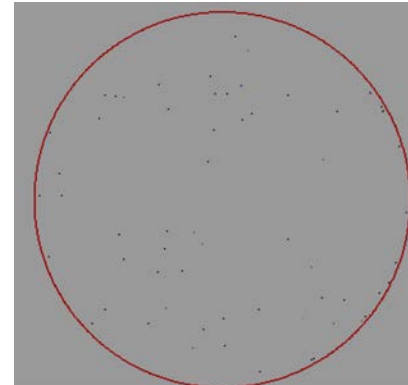
> 3000 @ 90nm
defects/ wafer



Particles * (5)		
0.086-0.090	36	
0.090-0.110	19	
0.110-0.120	7	
0.120-0.140	15	
0.140-Max	62	

2011

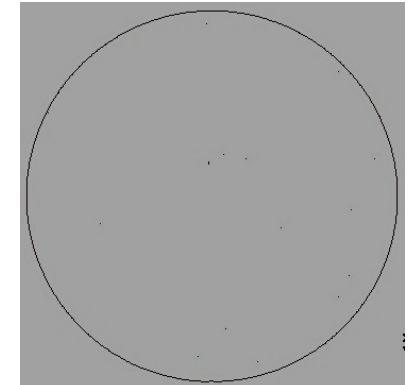
~ 175 @ 90nm
defects/ wafer



1	0.0380-0.0450	42
2	0.0450-0.0500	9
3	0.0500-0.0700	9
4	0.0700-0.0900	1
5	0.0900-0.1000	1
6	0.1000-0.2000	2
7	0.2000-0.3000	2
8	0.3000 up	0

2012

~ 66 @ 38nm
defects/ wafer



1	0.0350 up	31
2	0.0370 up	26
3	0.0450 up	14
4	0.0500 up	12
5	0.0600 up	4
6	0.0800 up	4
7	0.0900 up	4
8	0.1000 up	4
9	0.1200 up	2

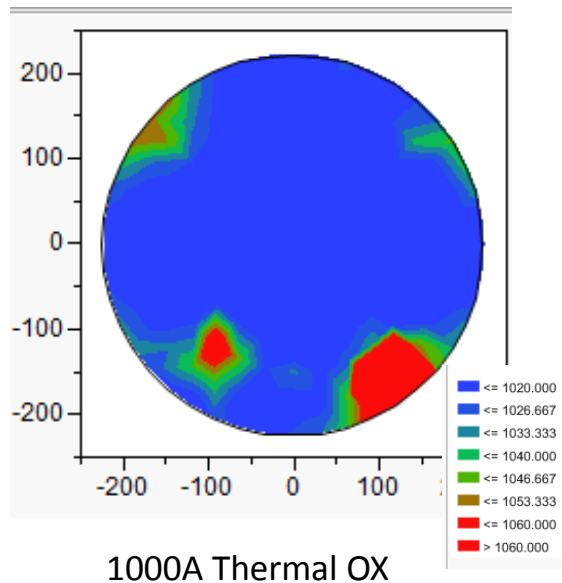
Q3-2013

~30 @ 35nm
defects/ wafer

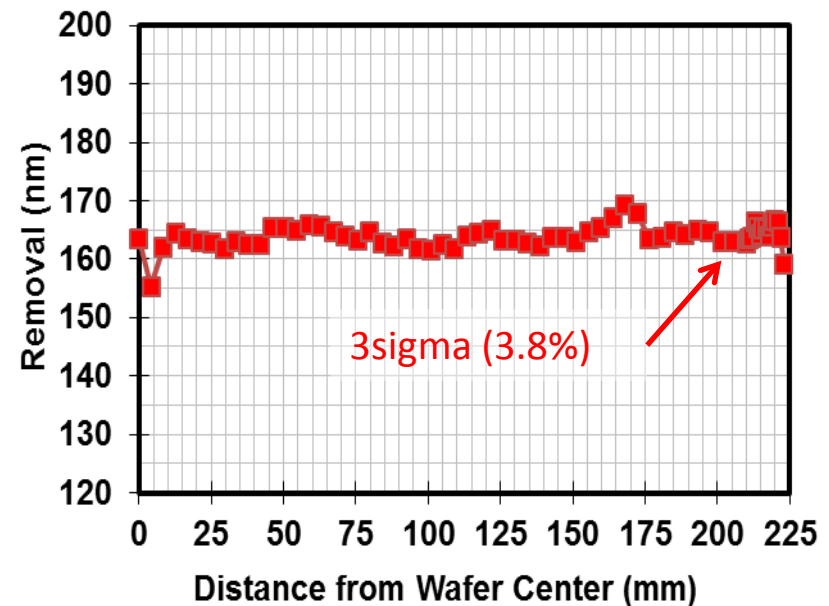
Thermal/CMP Module Data

- Demonstrate Thermal OX capability $\rightarrow U\%(3s) 1.97\%$ (EPM<2%)
- Demonstrate OX CMP capability $\rightarrow U\%(3s) 3.8\%$ (EPM<4%)

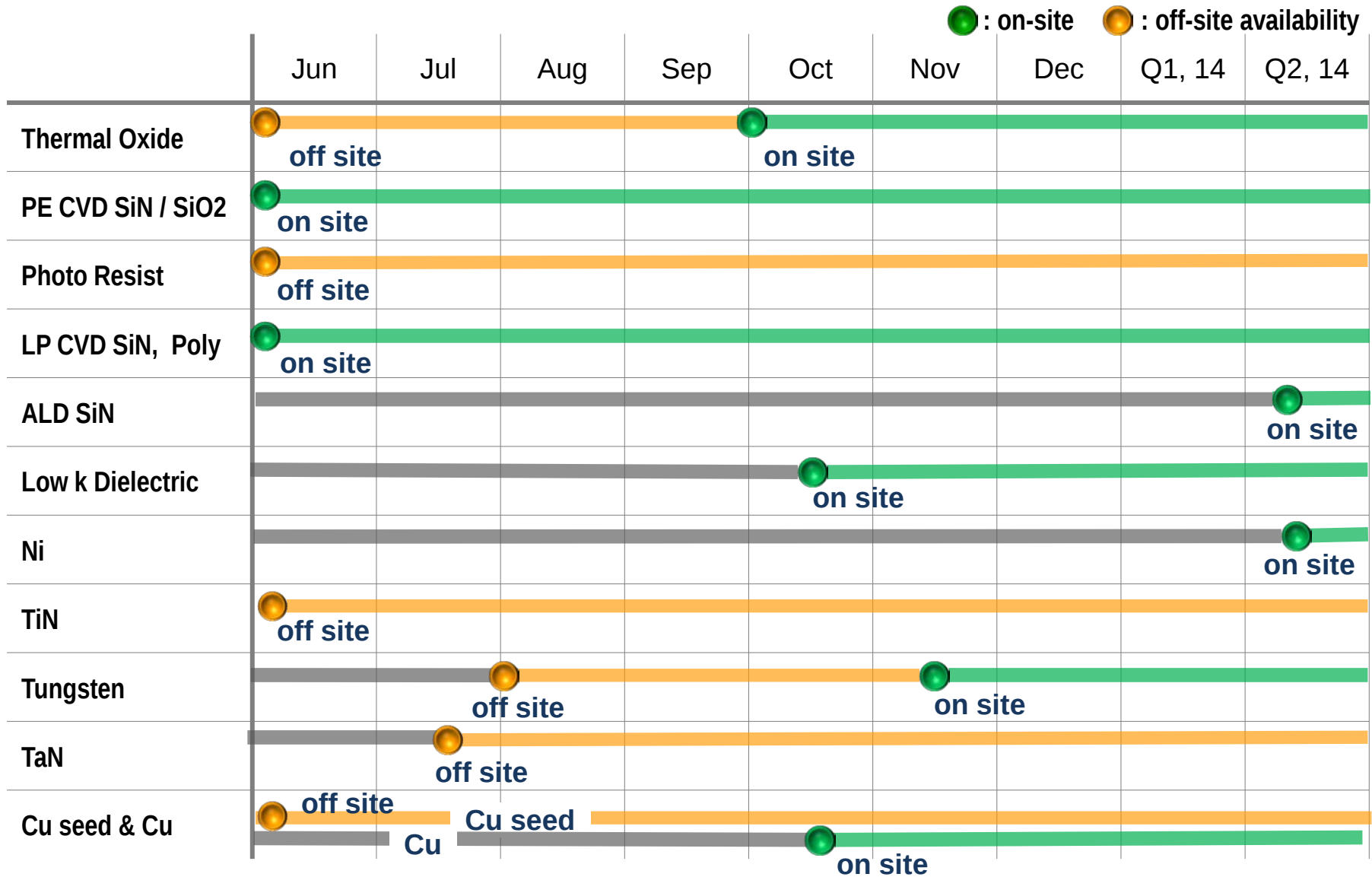
Thermal OX



OX CMP



Film Test Wafer Availability Schedule



Metrology Readiness

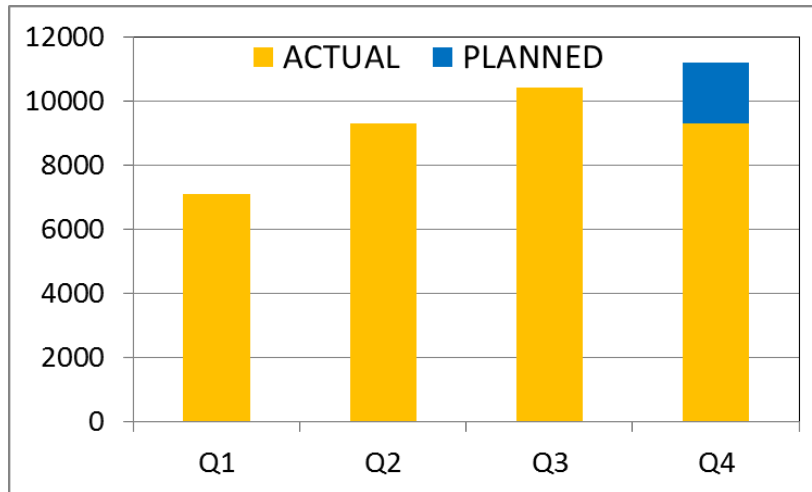
Tool Type	On-Site Tool Status	Applications
Bare Wafer Particle	1 st Tool Operational 2 nd Tool Ready	bare Si or films particle
SE/OCD	Thickness - Operational OCD – Ready to Measure	dielectric or thin metal film thickness
4P Probe	Ready	sheet resistance
3DAFM	Operational	surface roughness, pattern CD and depth
TXRF	Operational	metal ion concentration
XRR/XRF Opaque Film Thickness	Operational	metal thickness
Macro Inspection	Operational	macro defect inspection, EBR distance
Defect Review SEM	Ready	defect review, pattern CD

- All basic metrologies for demonstrations are ready now
- Advanced wafer geometry working on supplier's site
- Overlay Tool Q1, 2014

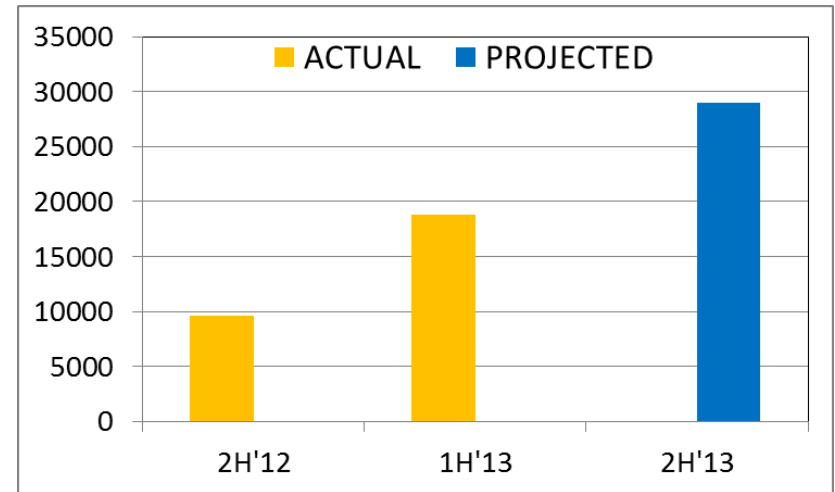
G450C Operations - Status



2013 WAFER INVENTORY



WAFER MOVES



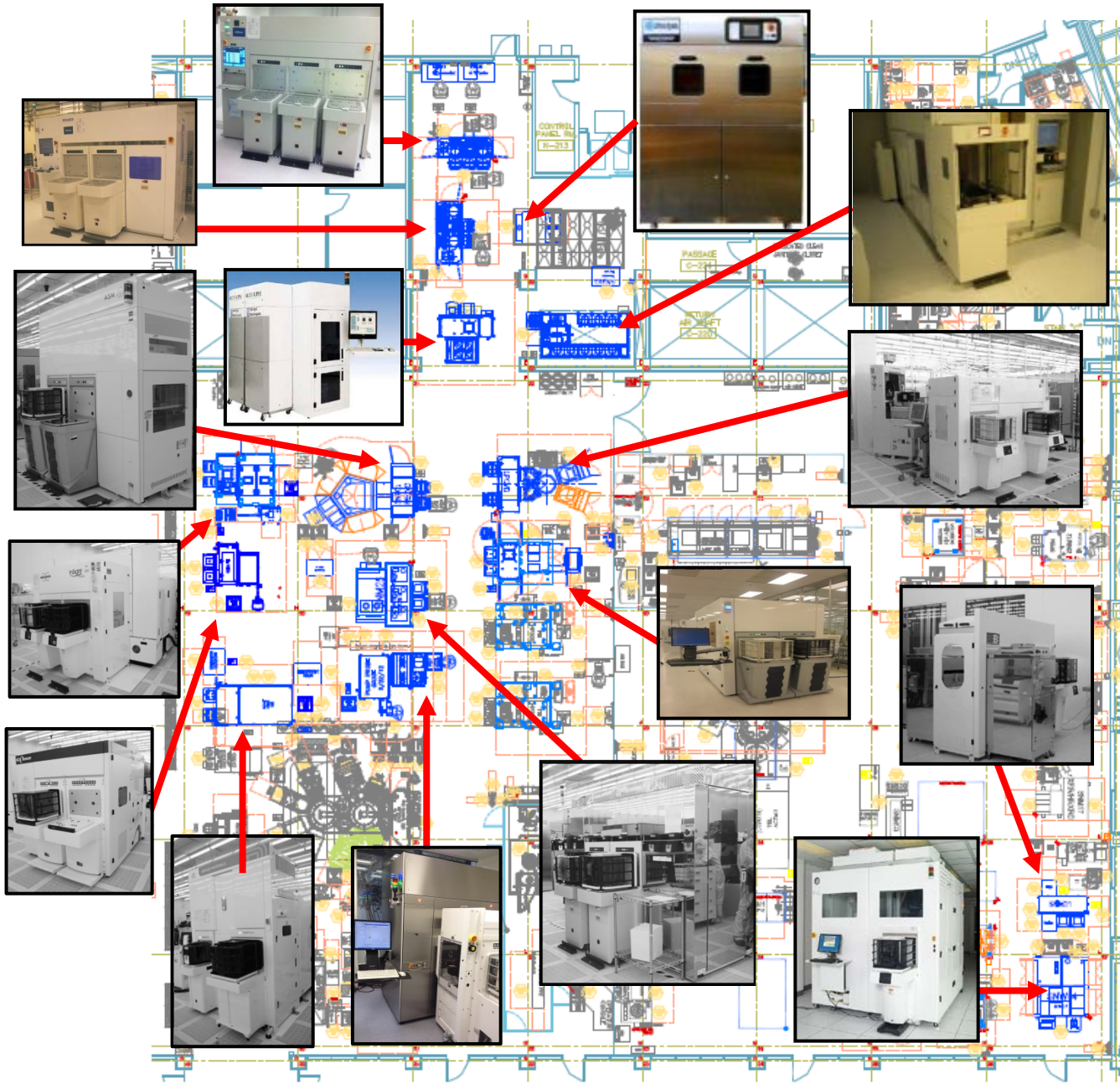
- 50% wafer increases Q1-> Q4 (onsite + offsite)
- Wafer moves are also increase rapidly

G450C Operations - NFN Cleanroom



15 tools
installed in NFN
cleanroom

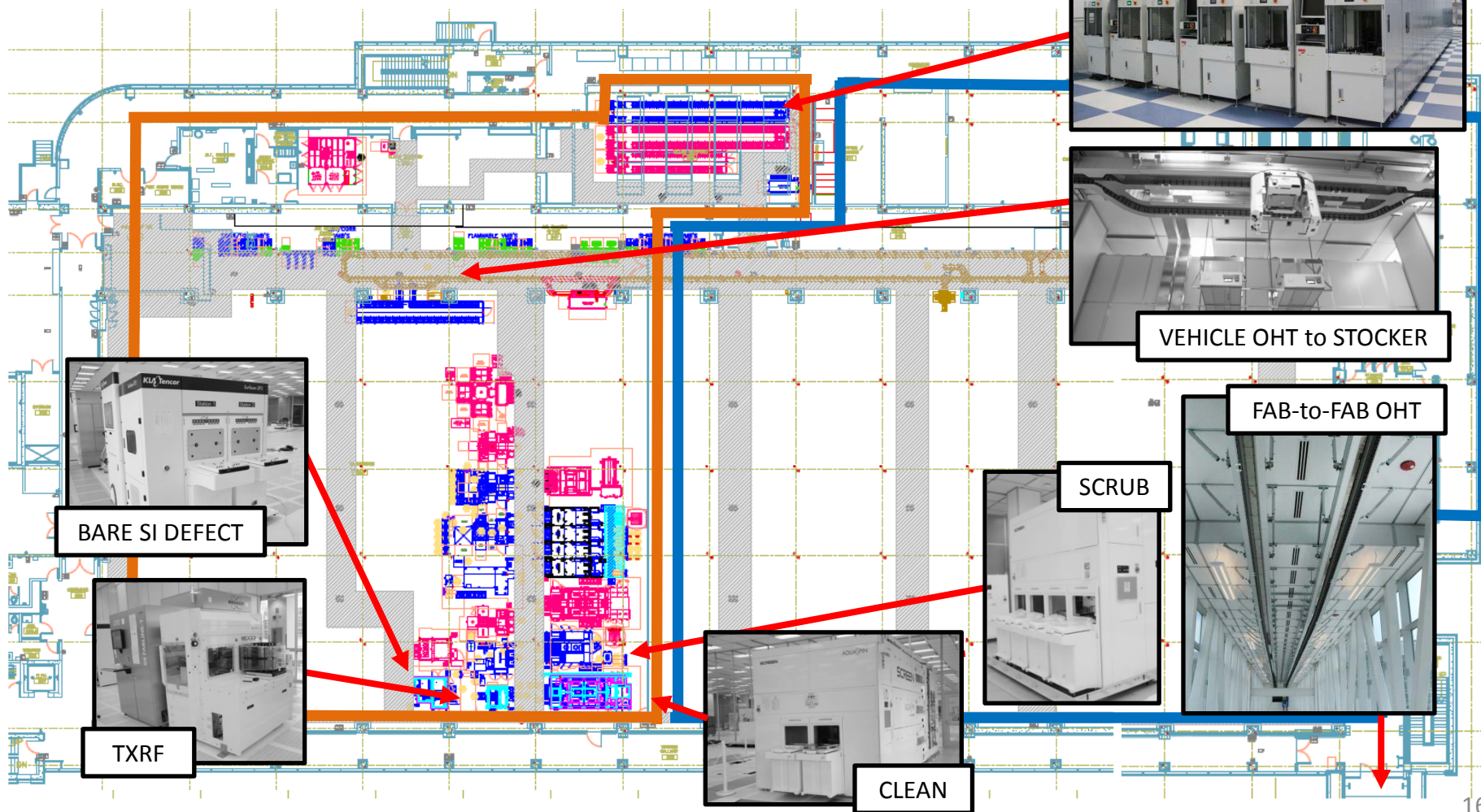
3 Process
8 Measurement
4 Ops Support



G450C Operations - NFX Cleanroom



- 450mm OHT is ready for inter-fab transfer
- 15 tools in-fab (2 metro, 7 process, 6 stocker/sorter)
- +3 tools ODD 3Q2013, +10 tools ODD 4Q2013



Notchless Wafer Standardization



Key dates:

June – Start tests to select the design of laser fiducial marks

July – TF submit SNARF to Si committee (North America)

Sep – MC review to start supplier engagement

Oct ~ Jan '14 – Submit ballot at SEMI

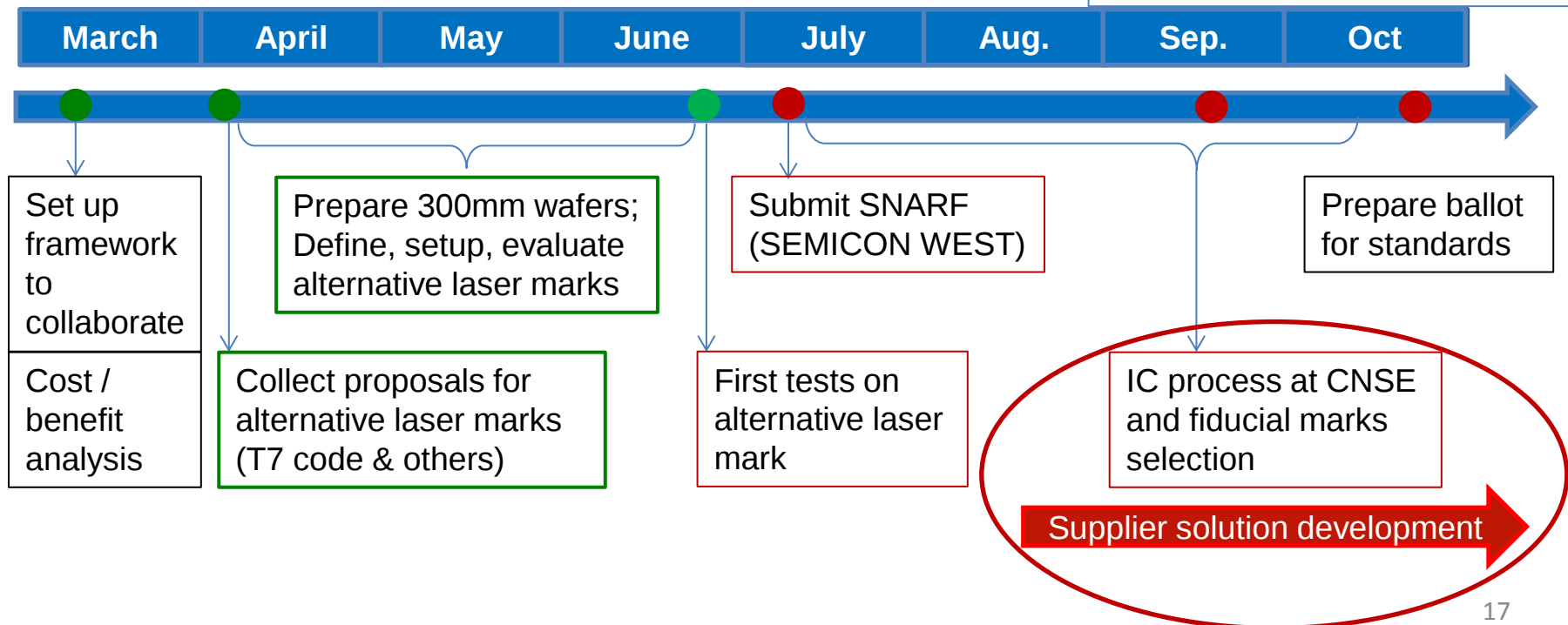
~ Mar '14 – Ballot adjudication by Si Committee

Member company representatives:

GLOBALFOUNDRIES	Dave Gross
Intel	John Williams
IBM	Gerd Pfeiffer
Samsung	Samjong Choi
tsmc	Vincent YH Chou
G450C staff	

Participating companies:

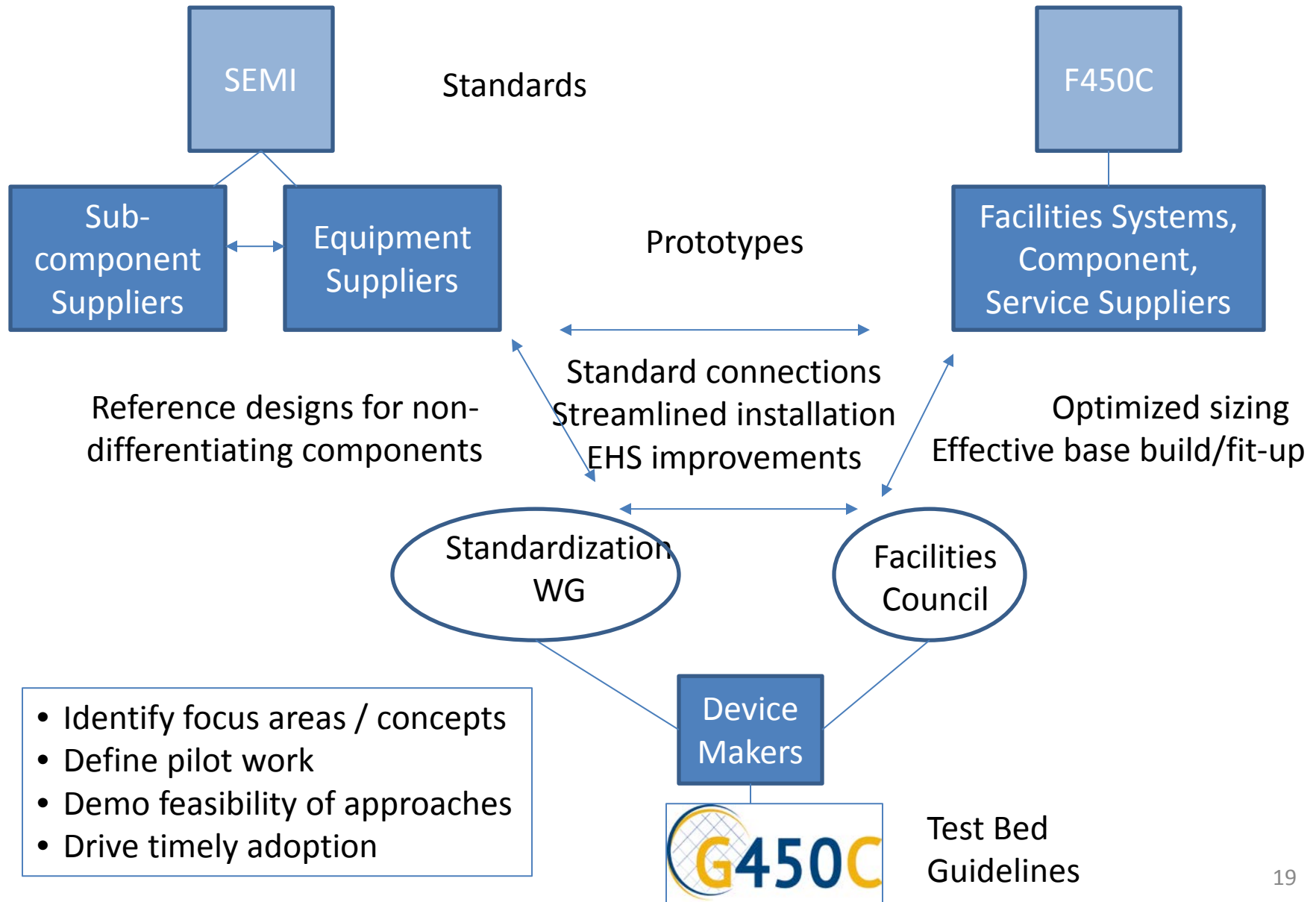
Applied Materials, ASML, KLA-Tencor, Lam Research, Nikon, Tokyo Electron, Sumco, GSI Group, Cognex, Sinfonia, Keyence, Brooks, etc.



Other Standardization activities

- **1.5mm Edge Exclusion**
 - M1 FQA Radius from 223mm to 223.5mm
 - Collaborating with SEMI Si committee and AWG TF
- **Industry Alignment on Component Lifting**
 - Productivity
 - Safety
 - Discussing industry guidelines- development of reference designs and/or relevant standard

Precompetitive Cooperation for Cost Reduction



Summary

- G450C has launched with full industry momentum
- Significant progress is continuing in all areas of the supply chain
- Suppliers are developing the 450mm tool set with >25 new tools being delivered in 2013
- Significant progress in wafer quality
- Automation and carriers are working
- Global collaboration is picking up steam

Questions and Discussion

