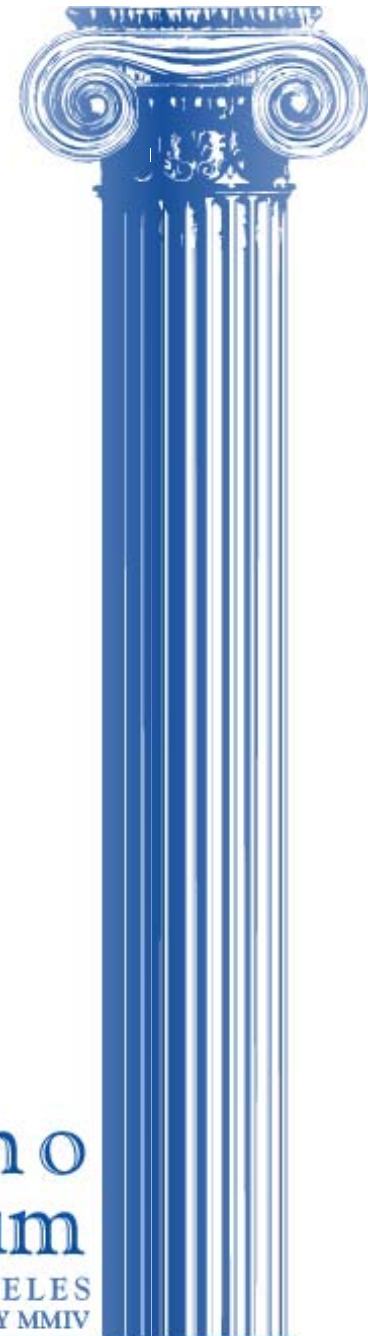


# 2004 Litho Forum Survey Results

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# Outline

- **Technology Survey Response Totals & Demographics**
- **Technology Survey Results Day One**
  - 193nm Immersion Lithography
  - 157nm Lithography
  - EUV Lithography
- **Technology Survey Results Day Two**
  - EPL
  - Maskless Charged Particle
  - Maskless Optical
  - Nano Imprint
- **Technology Survey Timing Results**
- **Technology Plans Surveys**
  - Technology Plans Responses Totals & Demographics
  - Manufacturing Plans: 2007 and 2009
  - Technology Readiness
  - Mask Magnification
- **Conclusions**

# Surveys

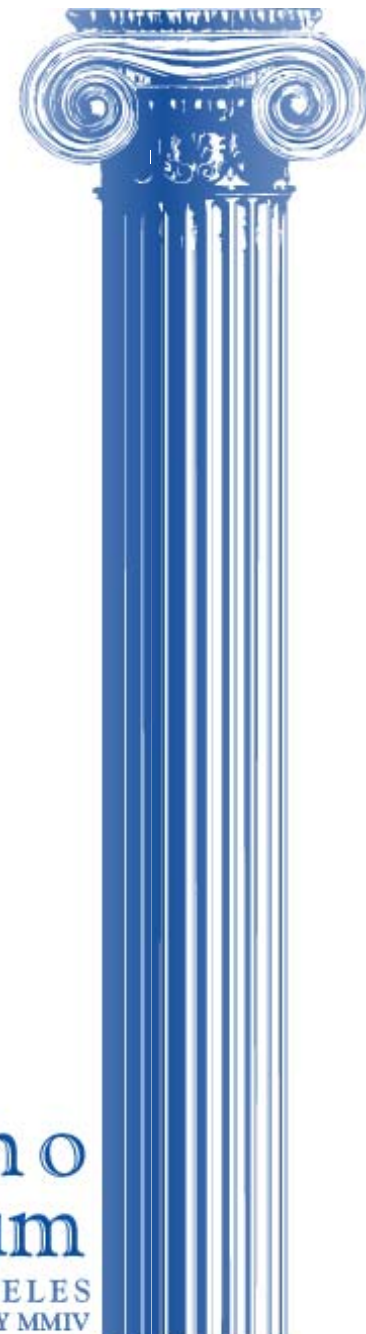
- Attendees were asked to complete a survey to evaluate the development status of each technology presented
  - Surveys were also provided for technologies presented in the poster sessions
- A final survey addressed technology plans for 2007 and 2009 volume manufacturing insertion
  - Specific questions are asked about the readiness of various technology components for the selected technology
- **Litho Forum surveys are not intended to pick “winners” but to address issues that need to be resolved before volume manufacturing**
- **The end user picks the “winner” by ordering tools!**



# Technology Surveys Responses Received & Demographic Data

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# Day One Survey Totals & Demographics

## 193nm Immersion

Total	ASIC	DRAM	Mixed	MPU	Foundry	Mask Suppliers	Process Suppliers	Tool Suppliers	Research Academic	Other	Undeclared	
93	3	2	11	1	1	10	16	23	20	6		
Chip Makers			18	19.4%	Suppliers			49	52.7%	21.5%	6.5%	

## 157nm

Total	ASIC	DRAM	Mixed	MPU	Foundry	Mask Suppliers	Process Suppliers	Tool Suppliers	Research Academic	Other	Undeclared	
102	2	3	11	1	1	10	18	25	18	13		
Chip Makers			18	17.6%	Suppliers			53	52.0%	17.6%	12.7%	

## EUV

Total	ASIC	DRAM	Mixed	MPU	Foundry	Mask Suppliers	Process Suppliers	Tool Suppliers	Research Academic	Other	Undeclared	
90	2	2	12	1	1	12	15	22	15	7	1	
Chip Makers			18	20.0%	Suppliers			49	54.4%	16.7%	7.8%	1.1%

# Day Two Survey Totals & Demographics

## EPL

Total	ASIC	DRAM	Mixed	MPU	Foundry	Mask Suppliers	Process Suppliers	Tool Suppliers	Research Academic	Other	Undeclared
75	2	3	11	1	1	7	13	18	14	5	
	Chip Makers		18	24.0%		Suppliers	38	50.7%		18.7%	6.7%

## Maskless Charged Particle

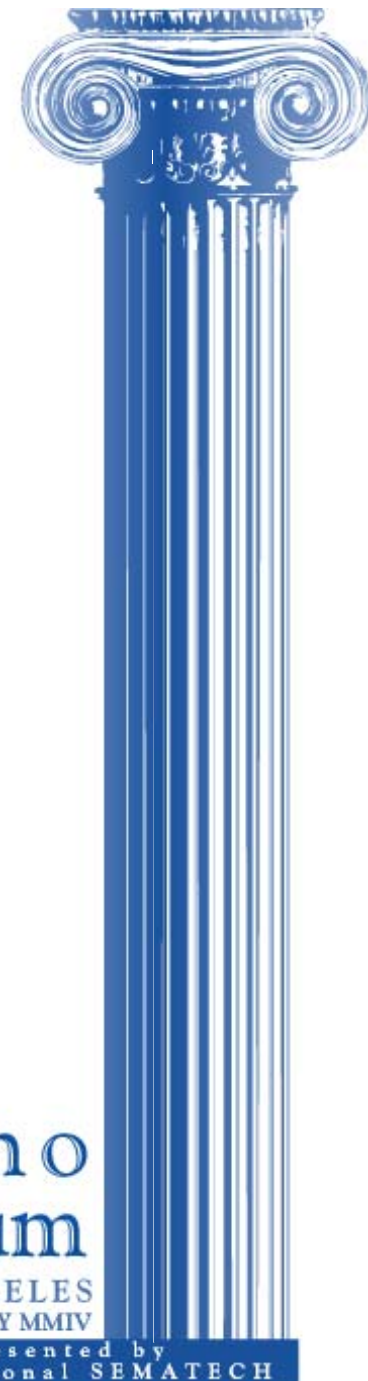
Total	ASIC	DRAM	Mixed	MPU	Foundry	Mask Suppliers	Process Suppliers	Tool Suppliers	Research Academic	Other	Undeclared
64	2	2	12	1	1	6	8	15	12	4	1
	Chip Makers		18	28.1%		Suppliers	29	45.3%		18.8%	6.3%

## Maskless Optical

Total	ASIC	DRAM	Mixed	MPU	Foundry	Mask Suppliers	Process Suppliers	Tool Suppliers	Research Academic	Other	Undeclared
67	2	2	10	1	1	8	7	21	11	4	0
	Chip Makers		16	23.9%		Suppliers	36	53.7%		16.4%	6.0%

## Nano Imprint

Total	ASIC	DRAM	Mixed	MPU	Foundry	Mask Suppliers	Process Suppliers	Tool Suppliers	Research Academic	Other	Undeclared
67	3	2	8	2	1	5	7	22	12	5	0
	Chip Makers		16	23.9%		Suppliers	34	50.7%		17.9%	7.5%

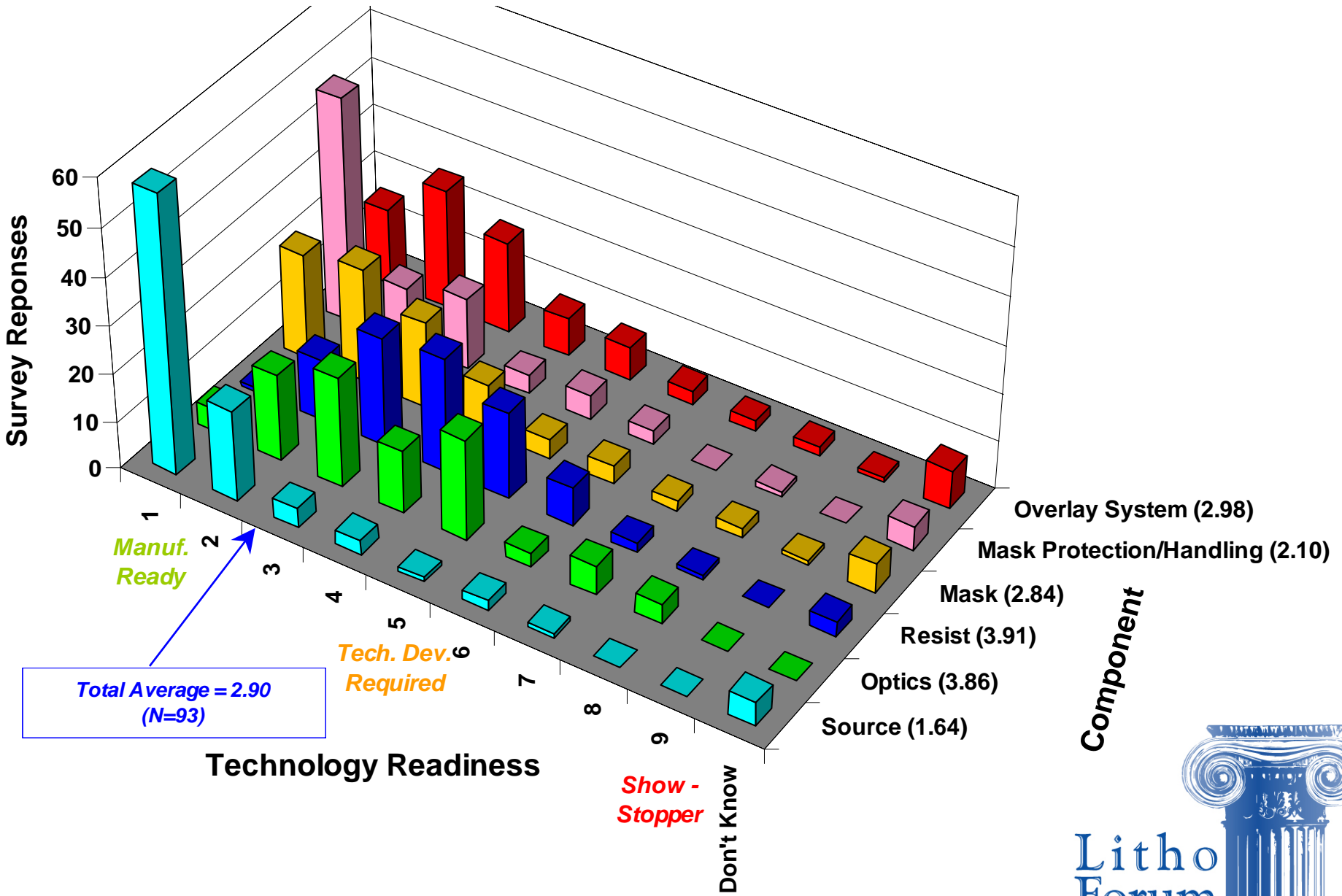


**Technology Surveys  
Results  
Component Readiness  
(Ques. #5 - #10)  
&  
Success Criteria  
(Ques #12 - #18)**

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# 193nm Immersion Component Readiness



Component

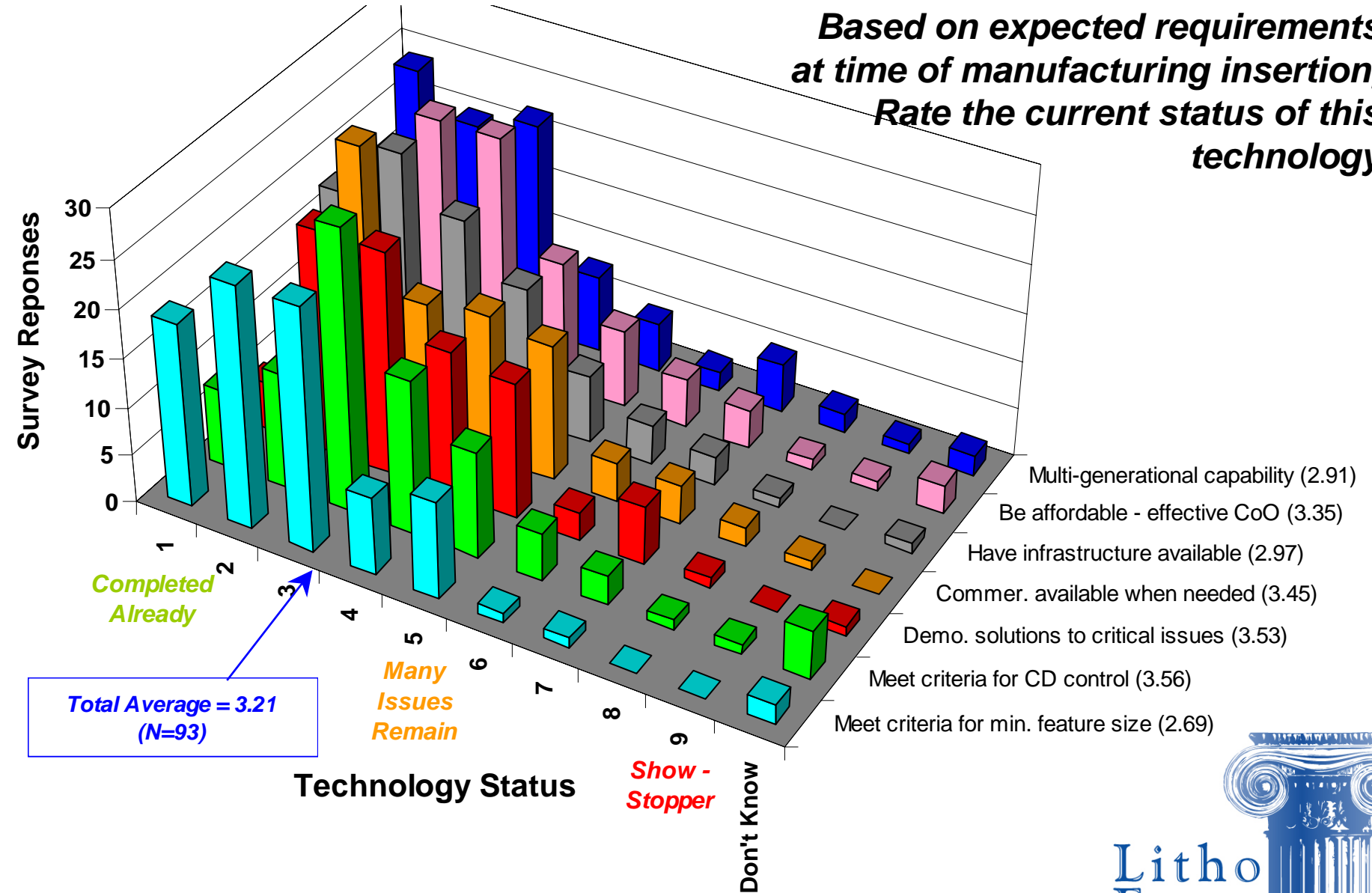


Litho Forum

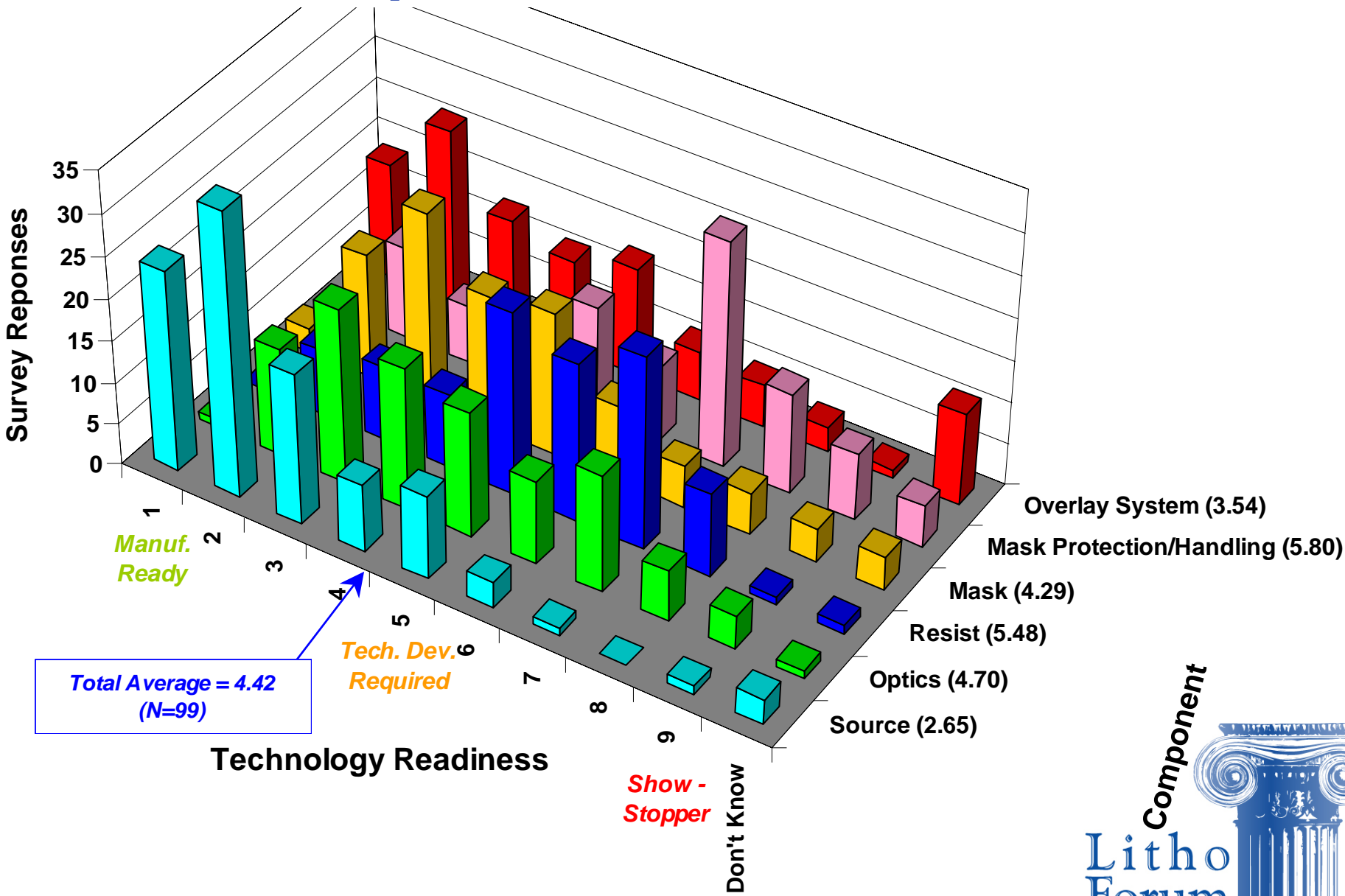
presented by International SEMATECH

# 193nm Immersion Success Criteria

*Based on expected requirements at time of manufacturing insertion, Rate the current status of this technology*

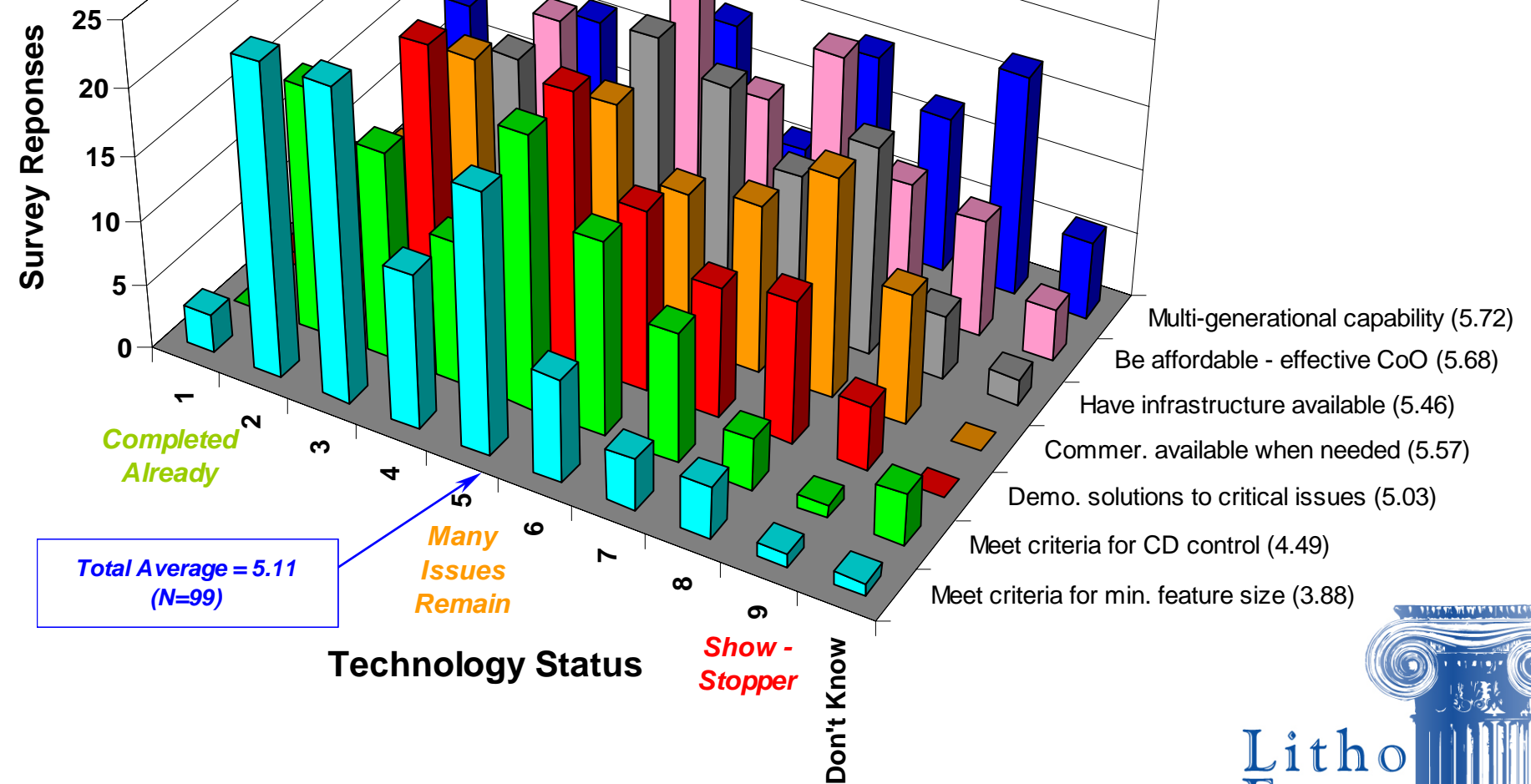


# 157nm Component Readiness

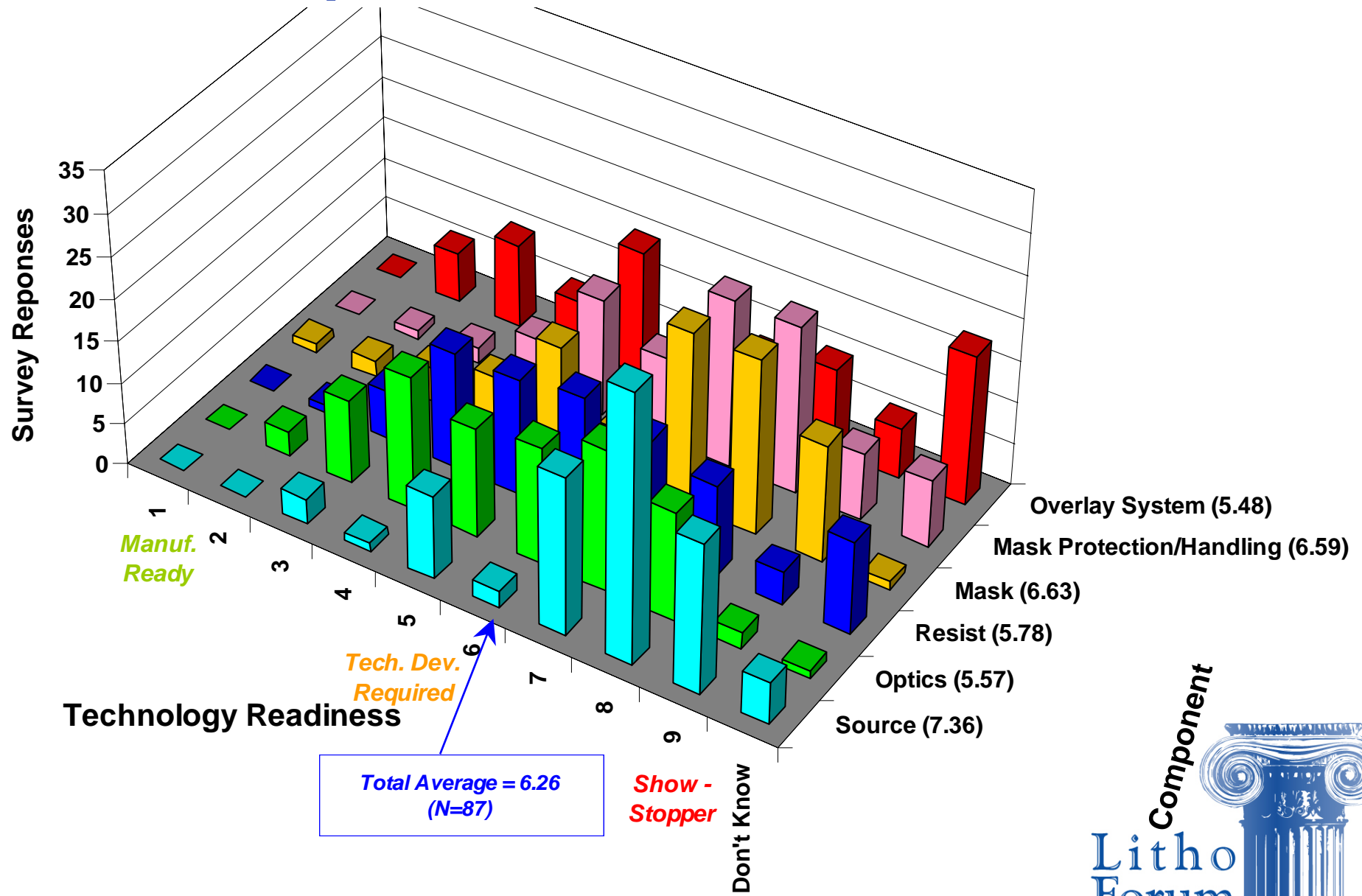


# 157nm Success Criteria

*Based on expected requirements at time of manufacturing insertion, Rate the current status of this technology*

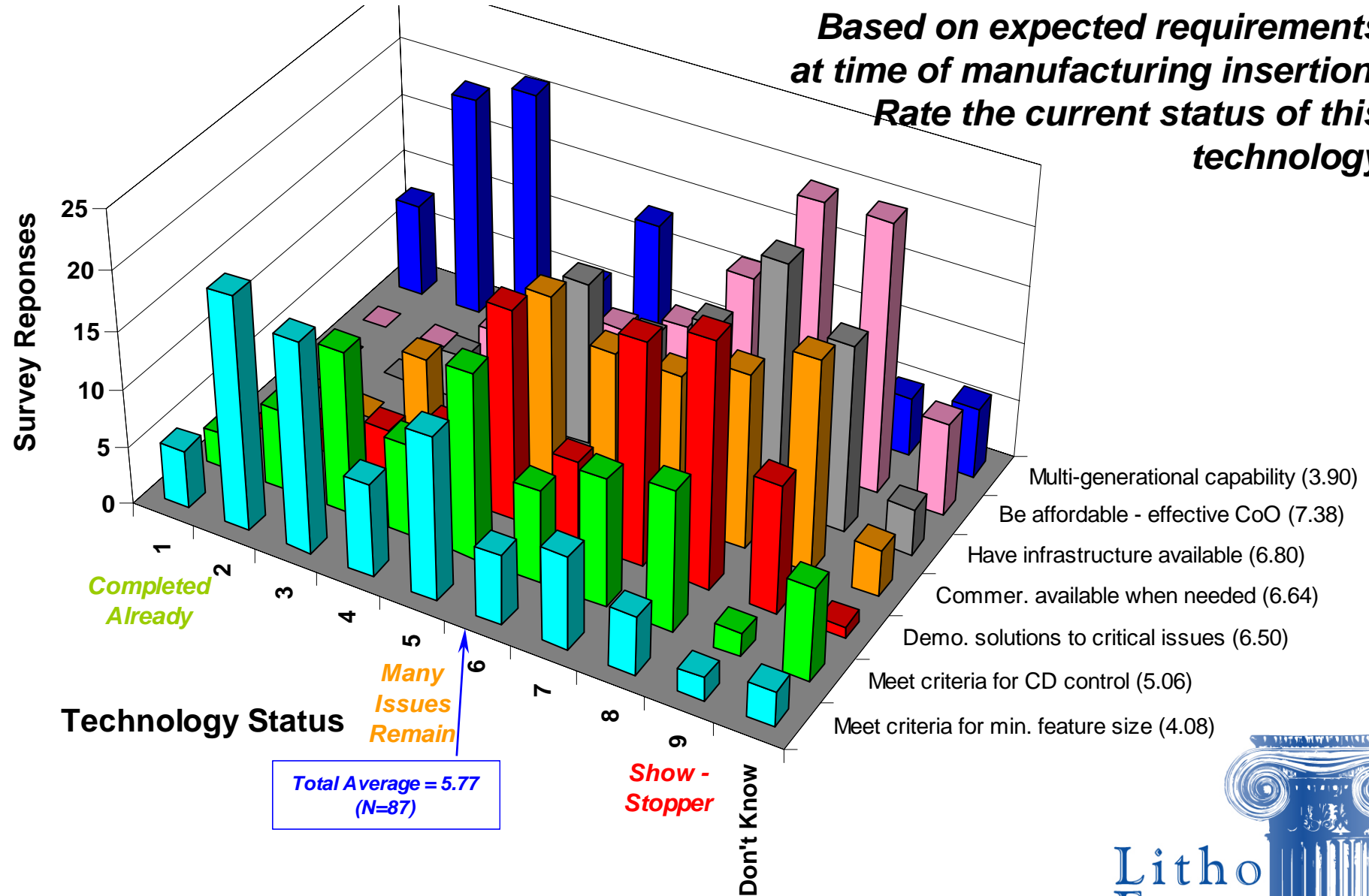


# EUV Component Readiness

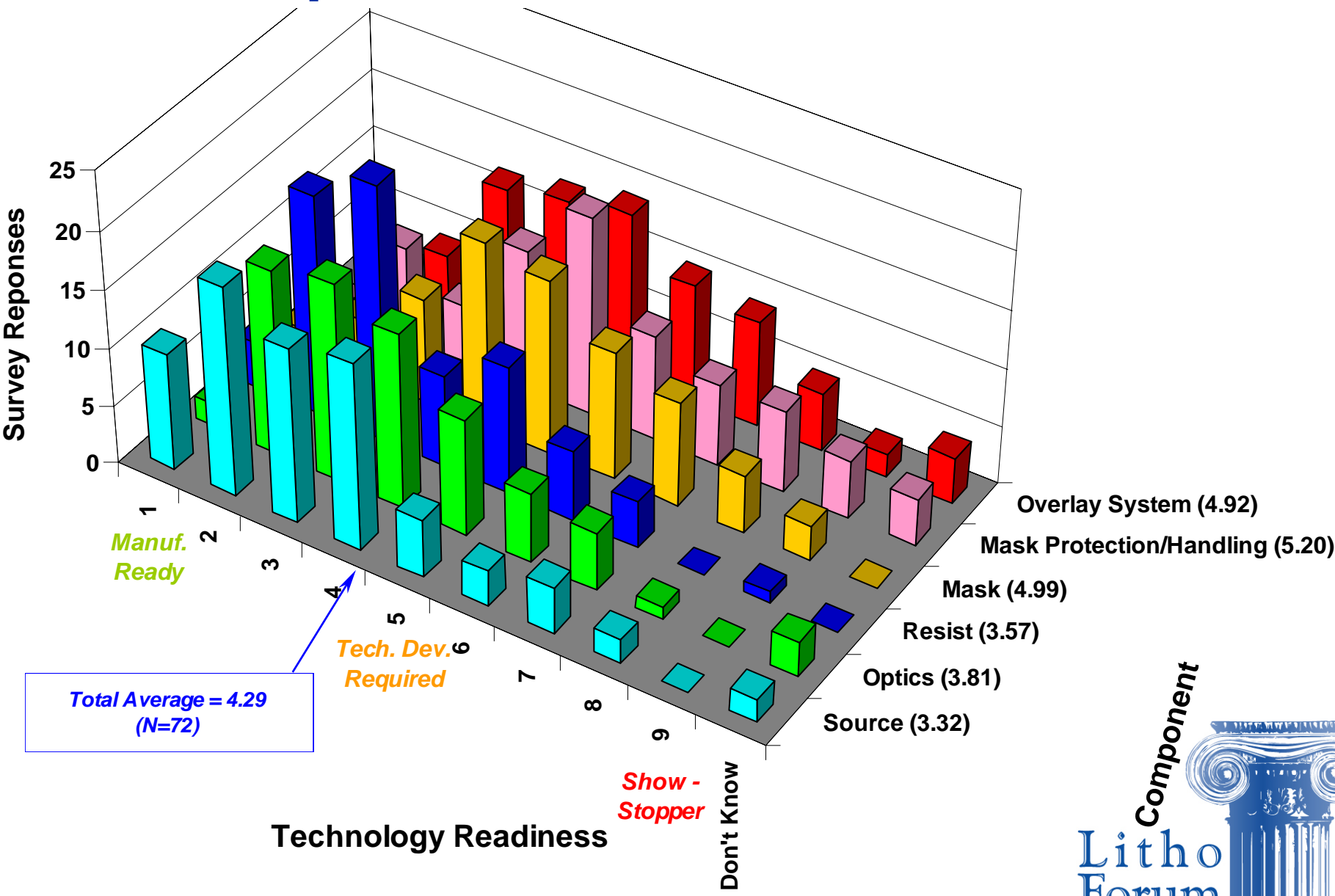


# EUV Success Criteria

*Based on expected requirements at time of manufacturing insertion, Rate the current status of this technology*

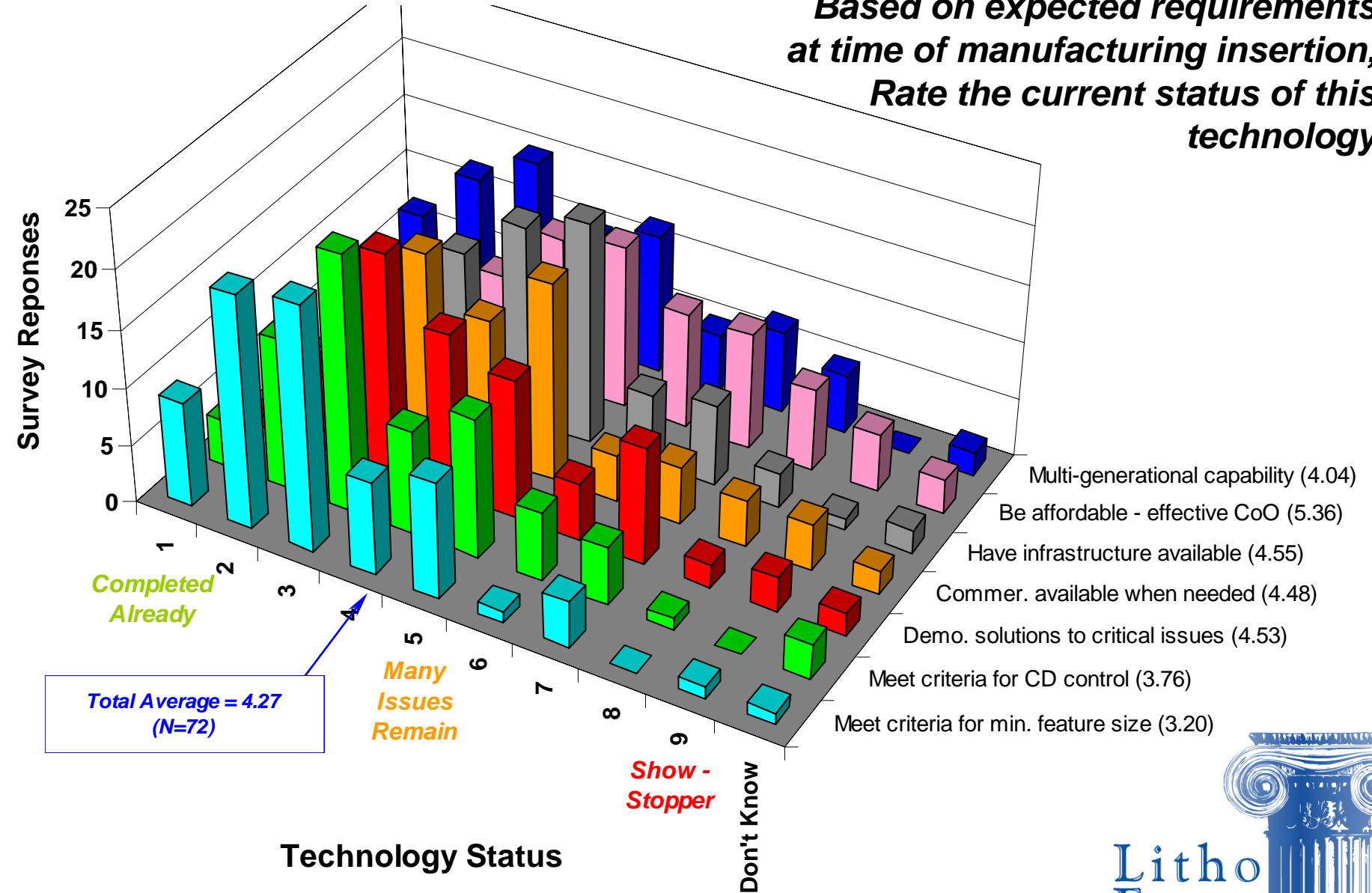


# EPL Component Readiness



# EPL Success Criteria

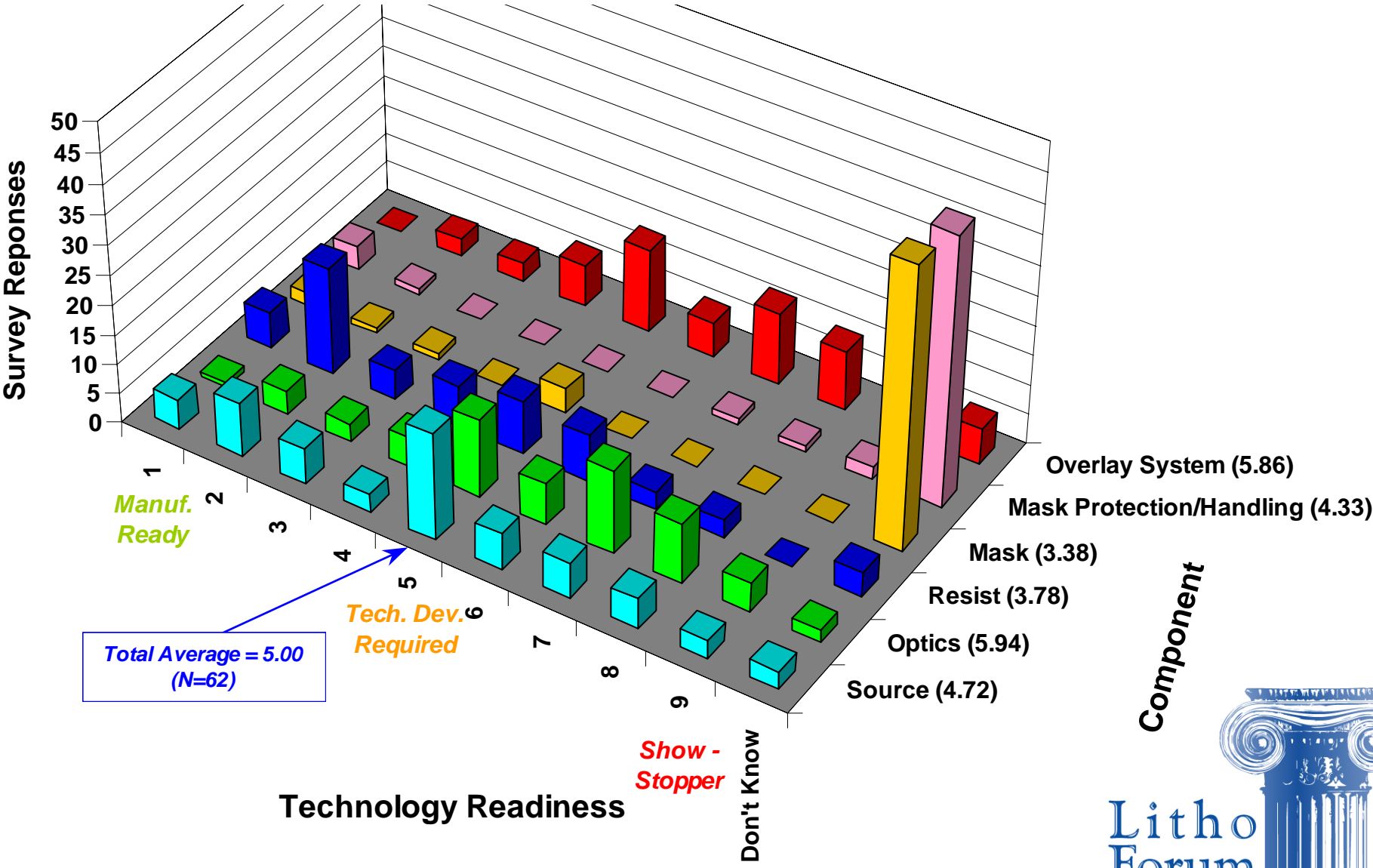
*Based on expected requirements at time of manufacturing insertion, Rate the current status of this technology*



- Multi-generational capability (4.04)
- Be affordable - effective CoO (5.36)
- Have infrastructure available (4.55)
- Commer. available when needed (4.48)
- Demo. solutions to critical issues (4.53)
- Meet criteria for CD control (3.76)
- Meet criteria for min. feature size (3.20)

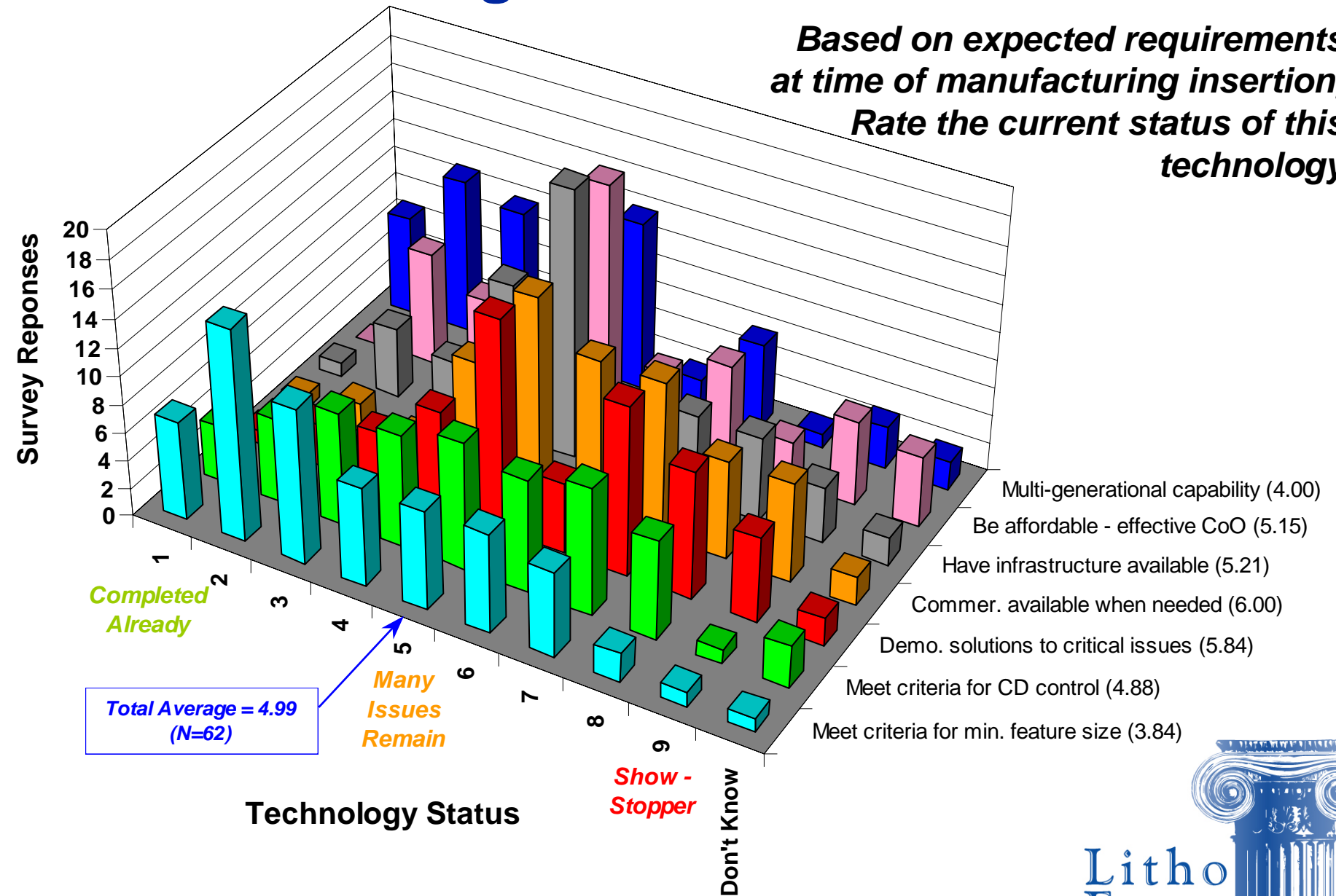


# Maskless Charged Particle Component Readiness

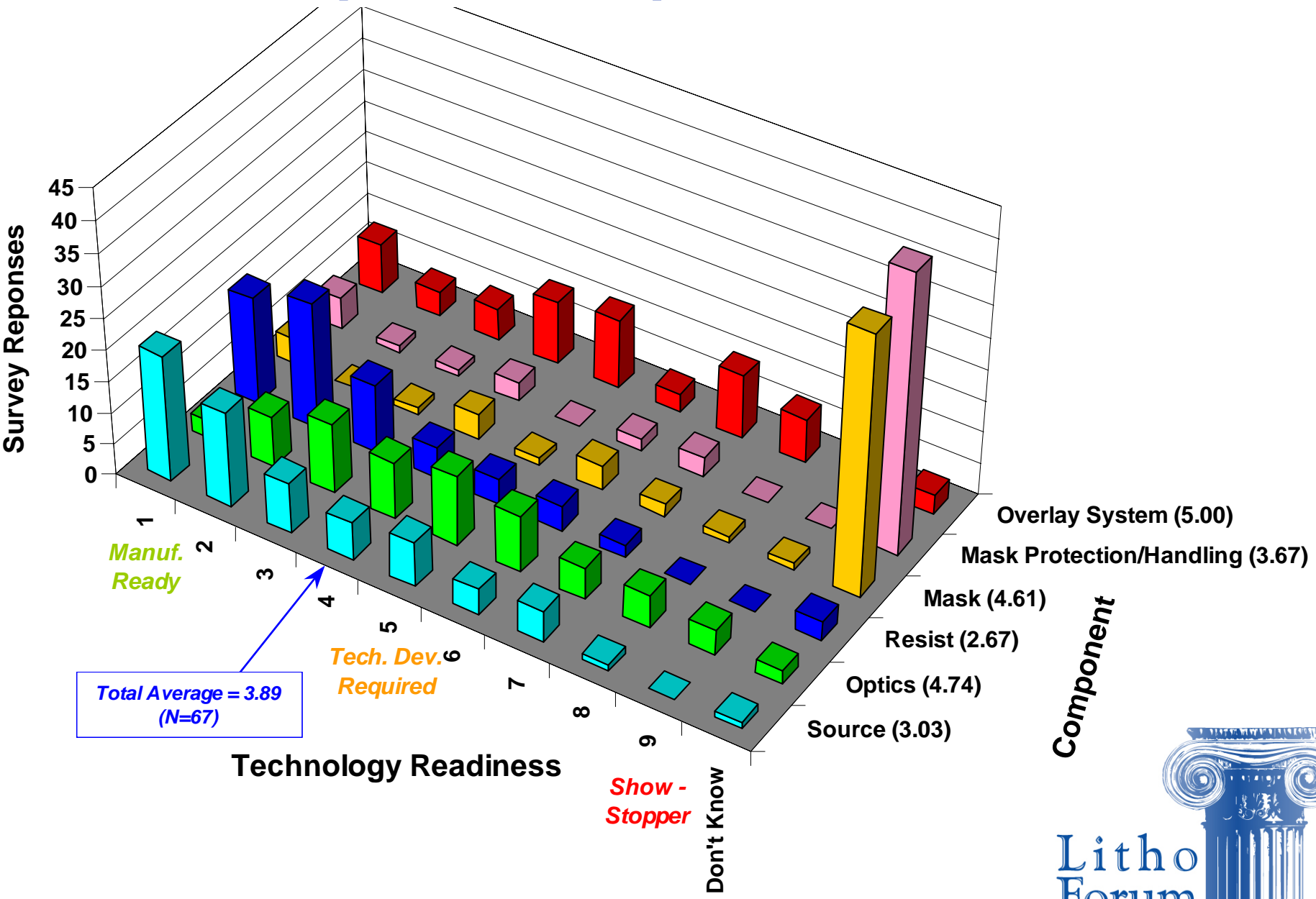


# Maskless Charged Particle Success Criteria

*Based on expected requirements at time of manufacturing insertion, Rate the current status of this technology*



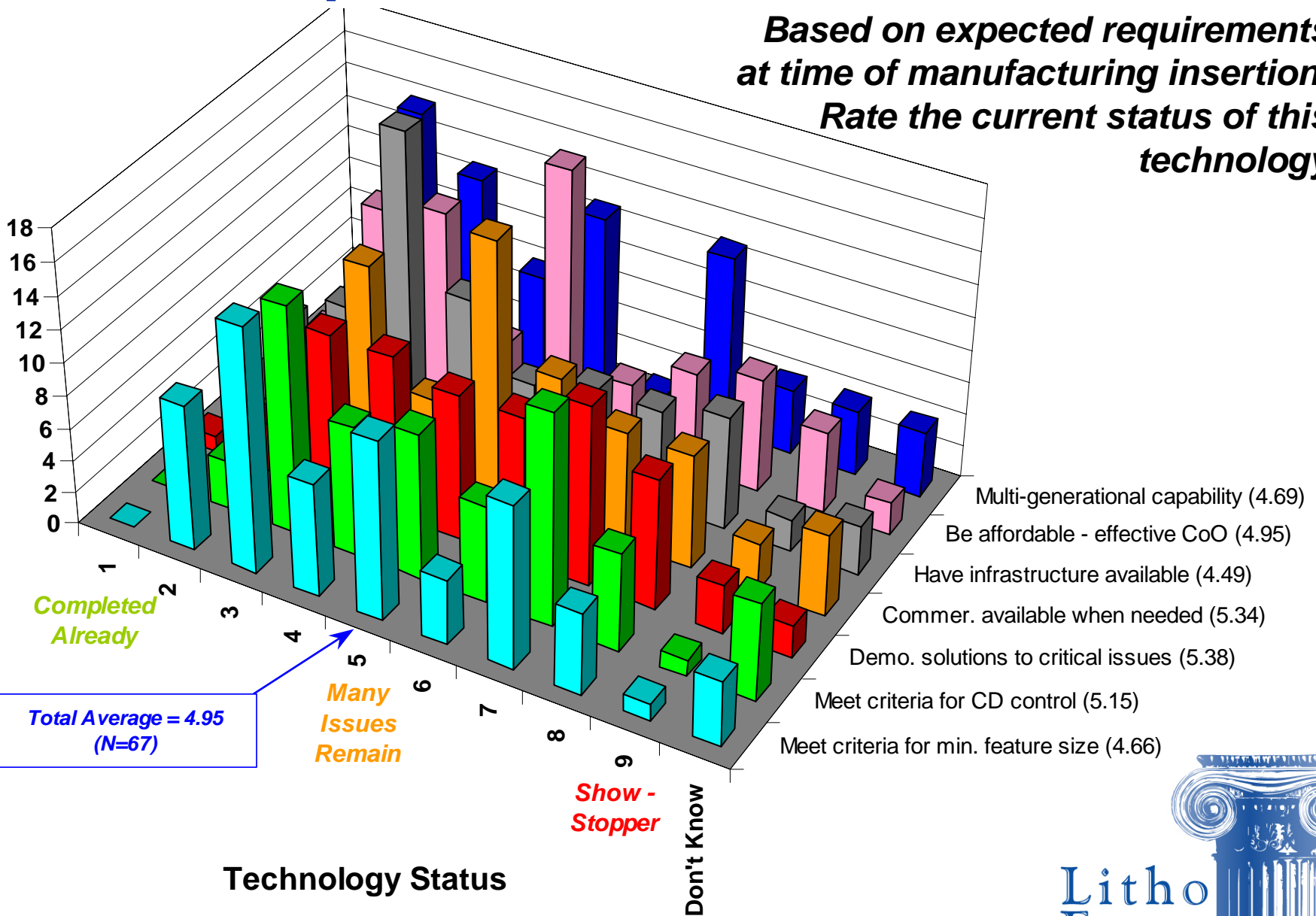
# Maskless Optical Component Readiness



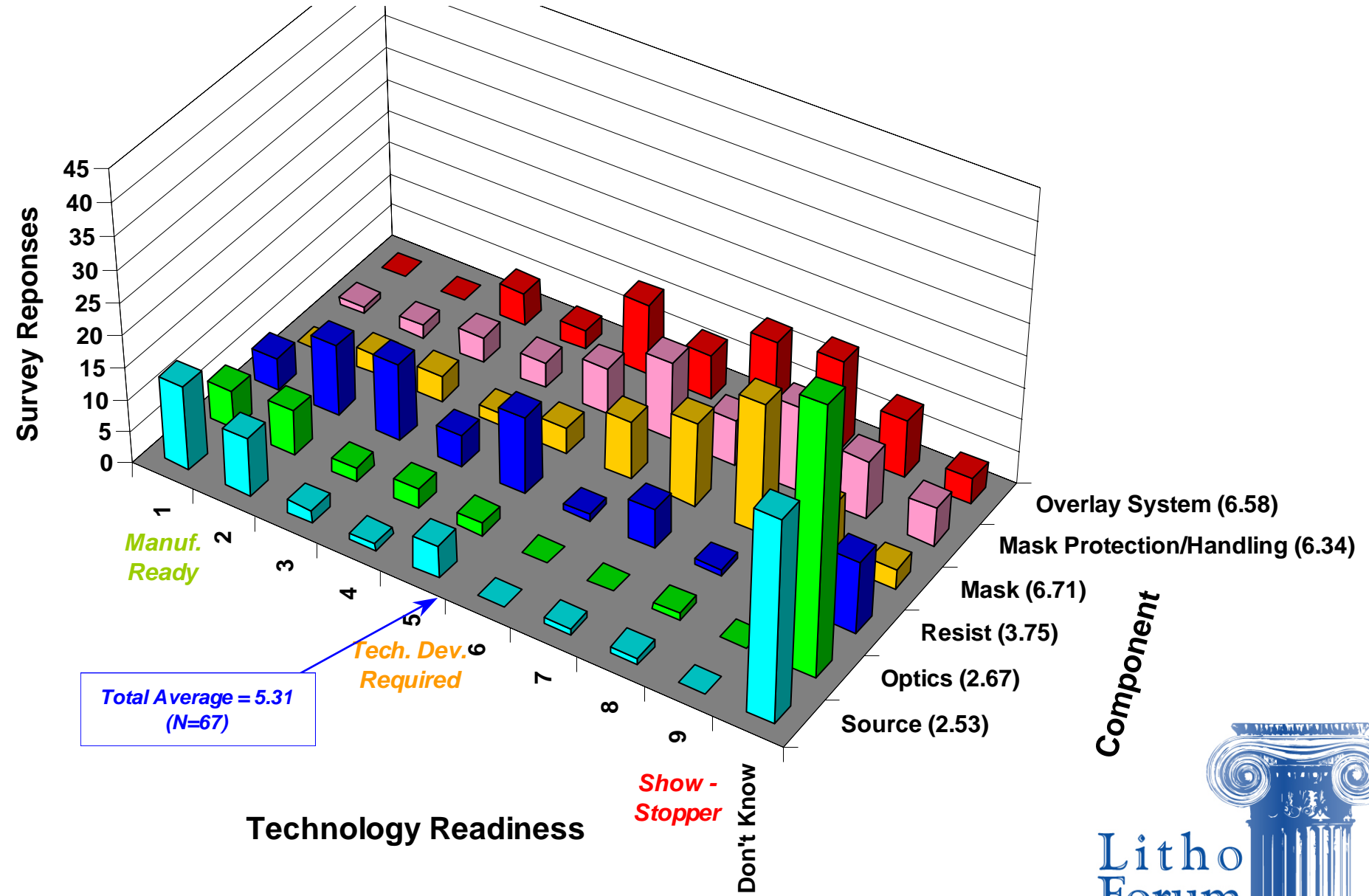
# Maskless Optical Success Criteria

*Based on expected requirements at time of manufacturing insertion, Rate the current status of this technology*

Survey Responses

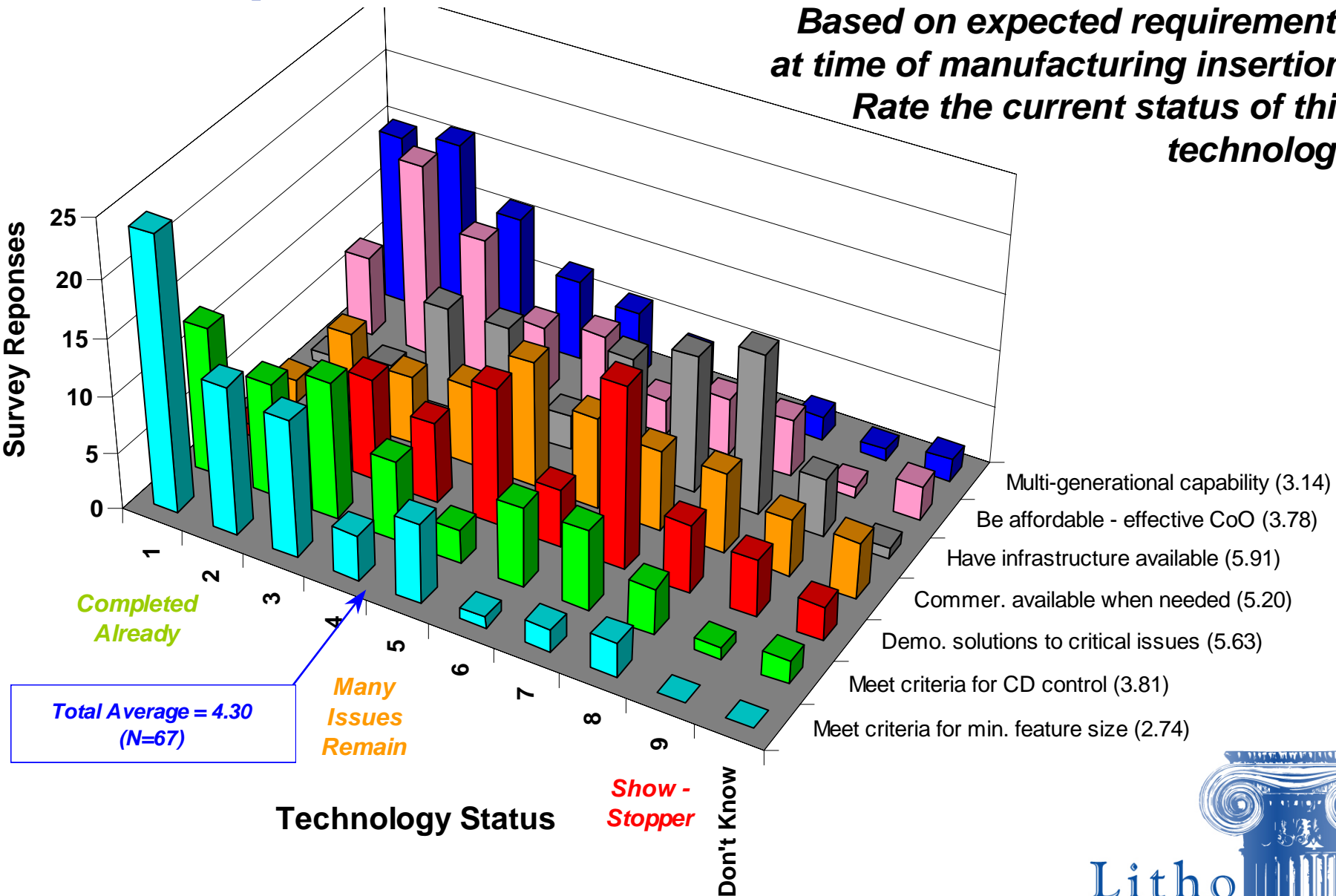


# Nano Imprint Component Readiness



# Nano Imprint Particle Success Criteria

*Based on expected requirements at time of manufacturing insertion, Rate the current status of this technology*



# **Technology Surveys Results**

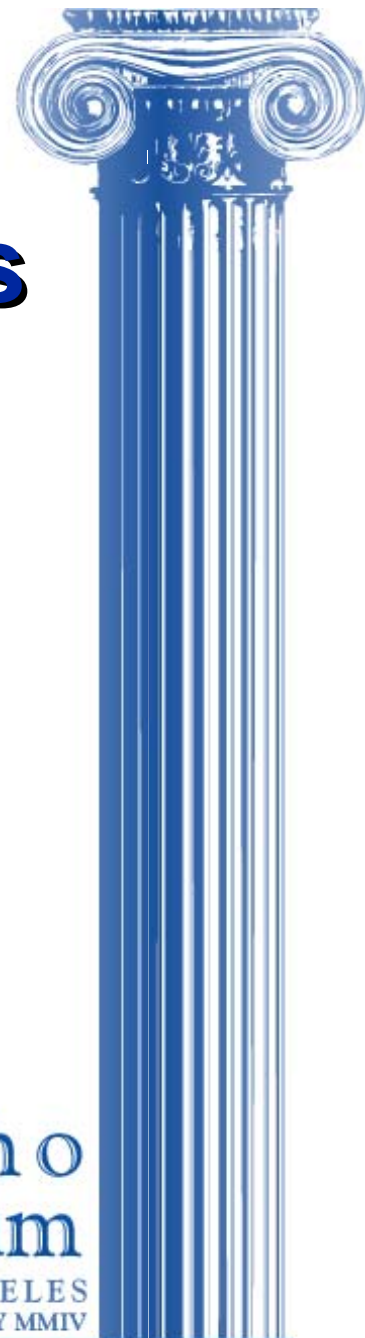
## **Technology Ready For Manufacturing Insertion (Ques.#11)**

**Day 1 Technologies**

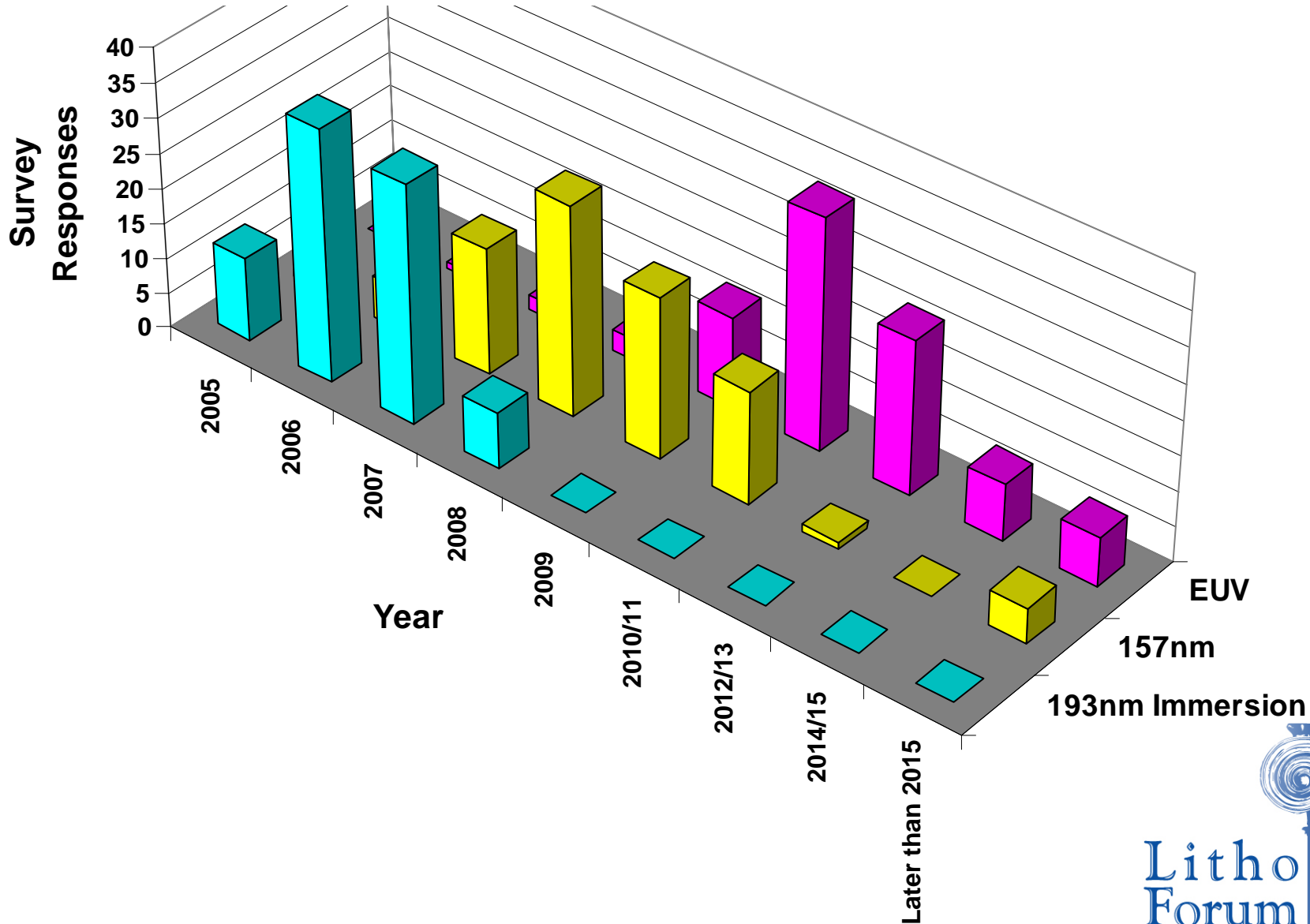
**Day 2 Technologies**

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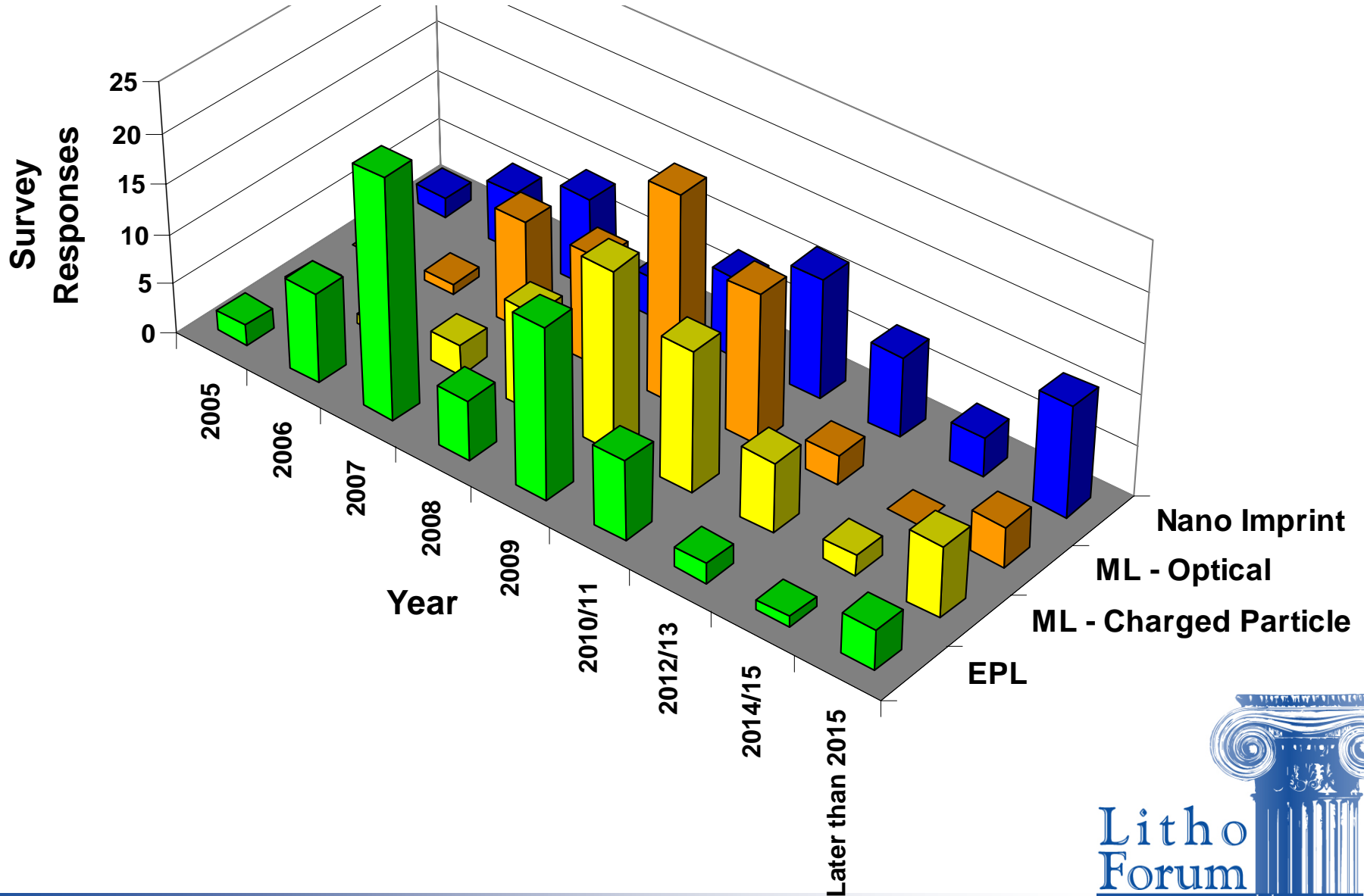
presented by  
**International SEMATECH**



# Day One Technologies Readiness For Manufacturing Insertion (Ques. #11)



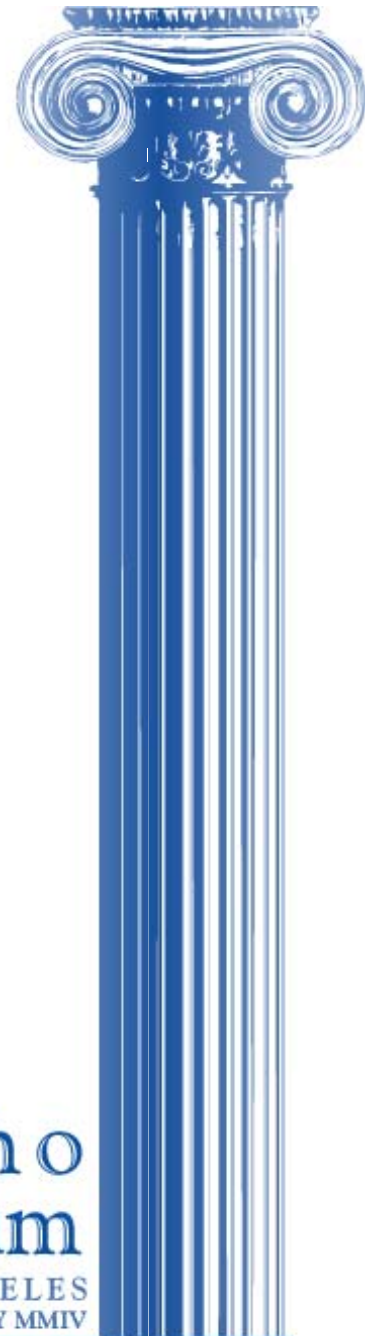
# Day Two Technologies Readiness For Manufacturing Insertion (Ques. #11)



# Technology Plans Surveys Results

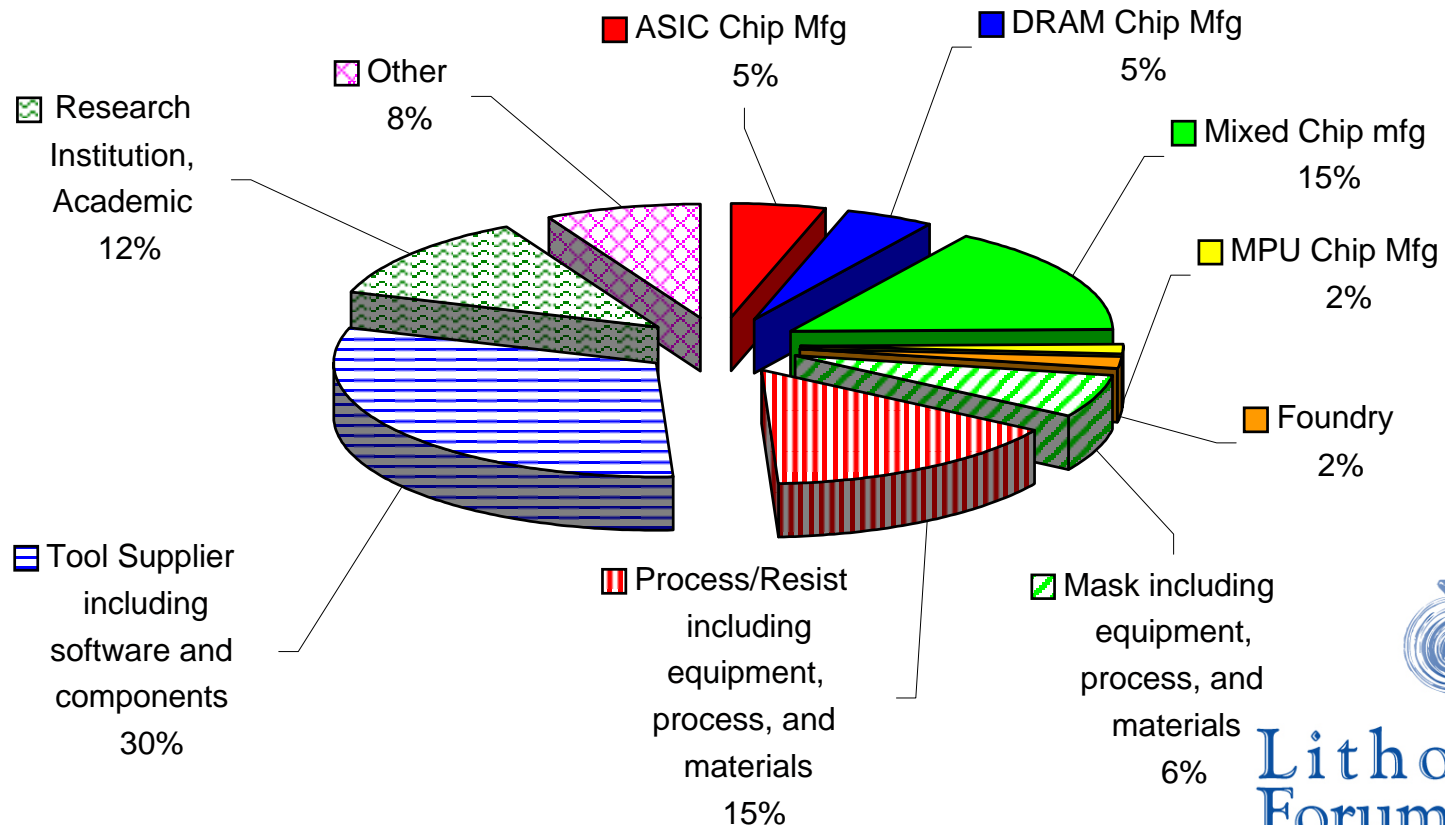
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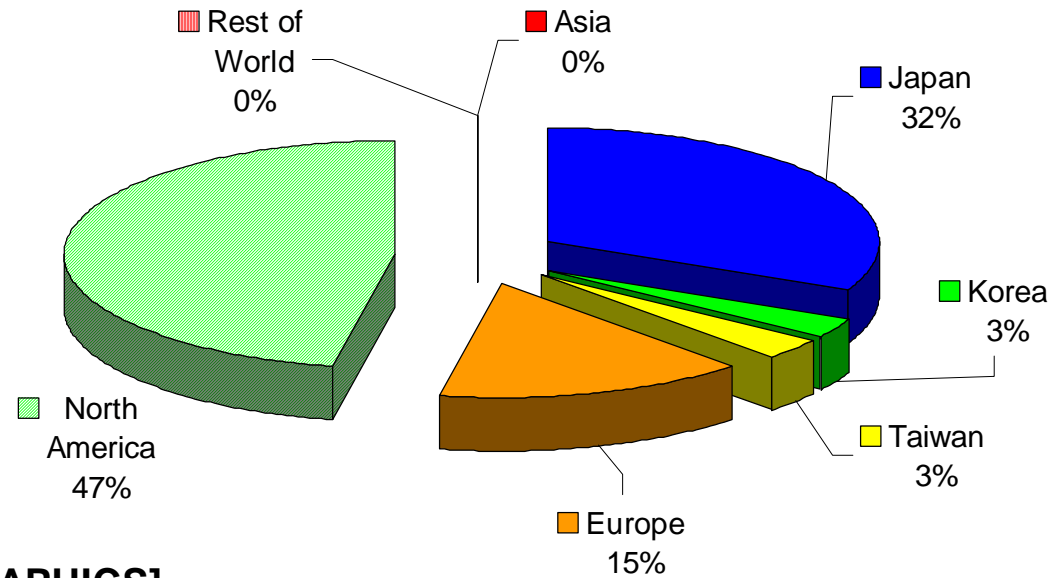
# Technology Plans Survey Total & Organizational Representations

TOTAL	ASIC	DRAM	Mixed	MPU	Foundry	Mask Suppliers	Process Suppliers	Tool Suppliers	Research Academic	Other
66	4	3	10	1	1	4	10	20	8	5
	Chip Makers 19 29%					Suppliers 34 52%			12%	8%

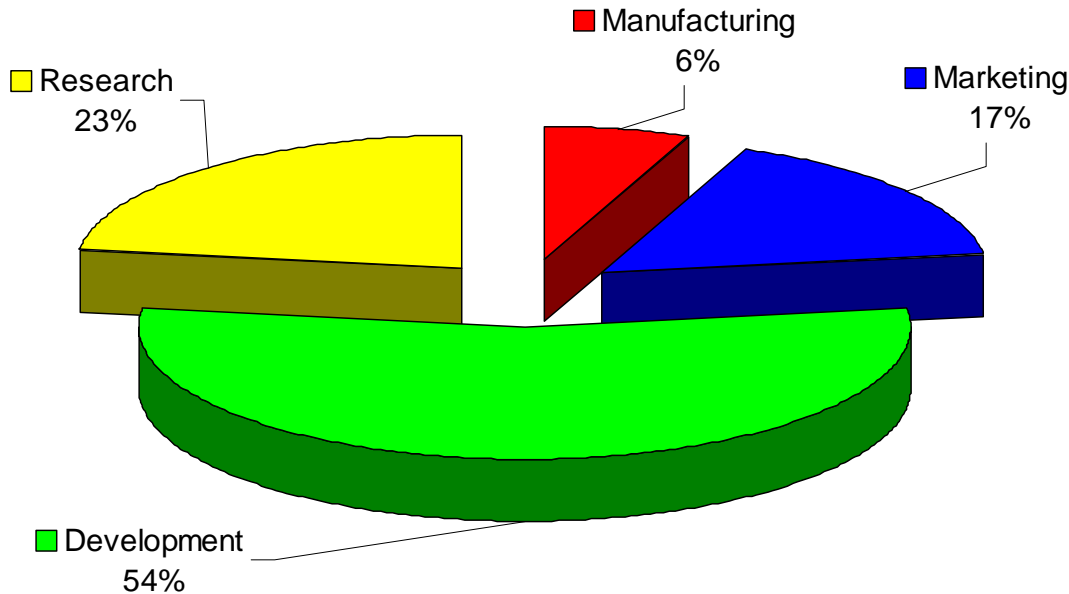


# Regional & Functions Representation

## COMPANY GEOGRAPHIC REGION DEMOGRAPHICS



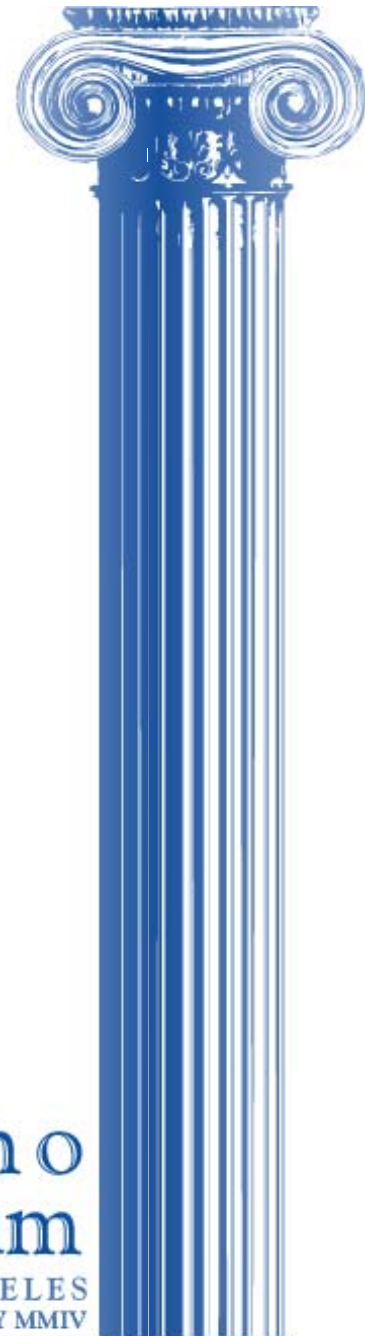
## [JOB DESCRIPTION DEMOGRAPHICS]



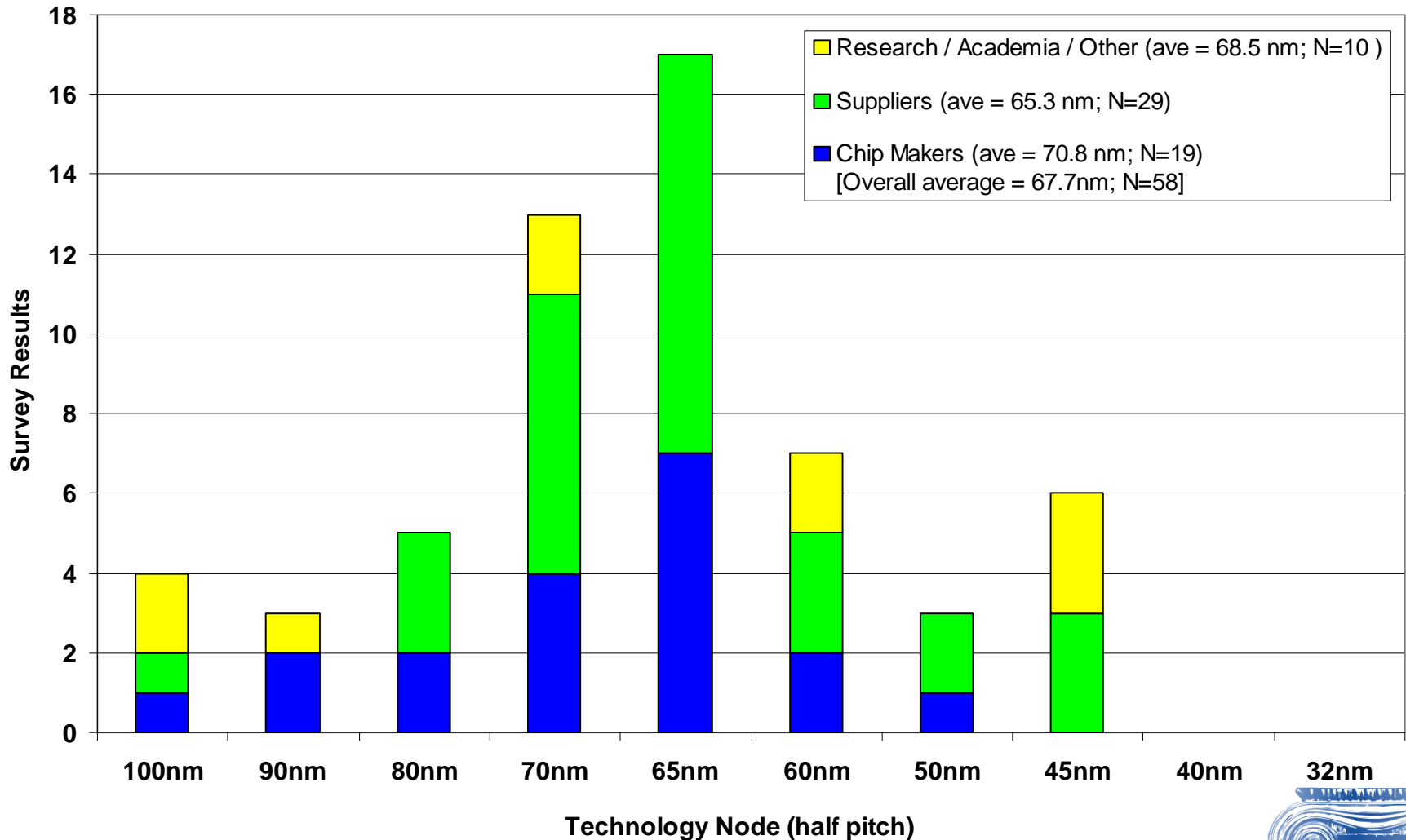
# 2007 Manufacturing Survey Results

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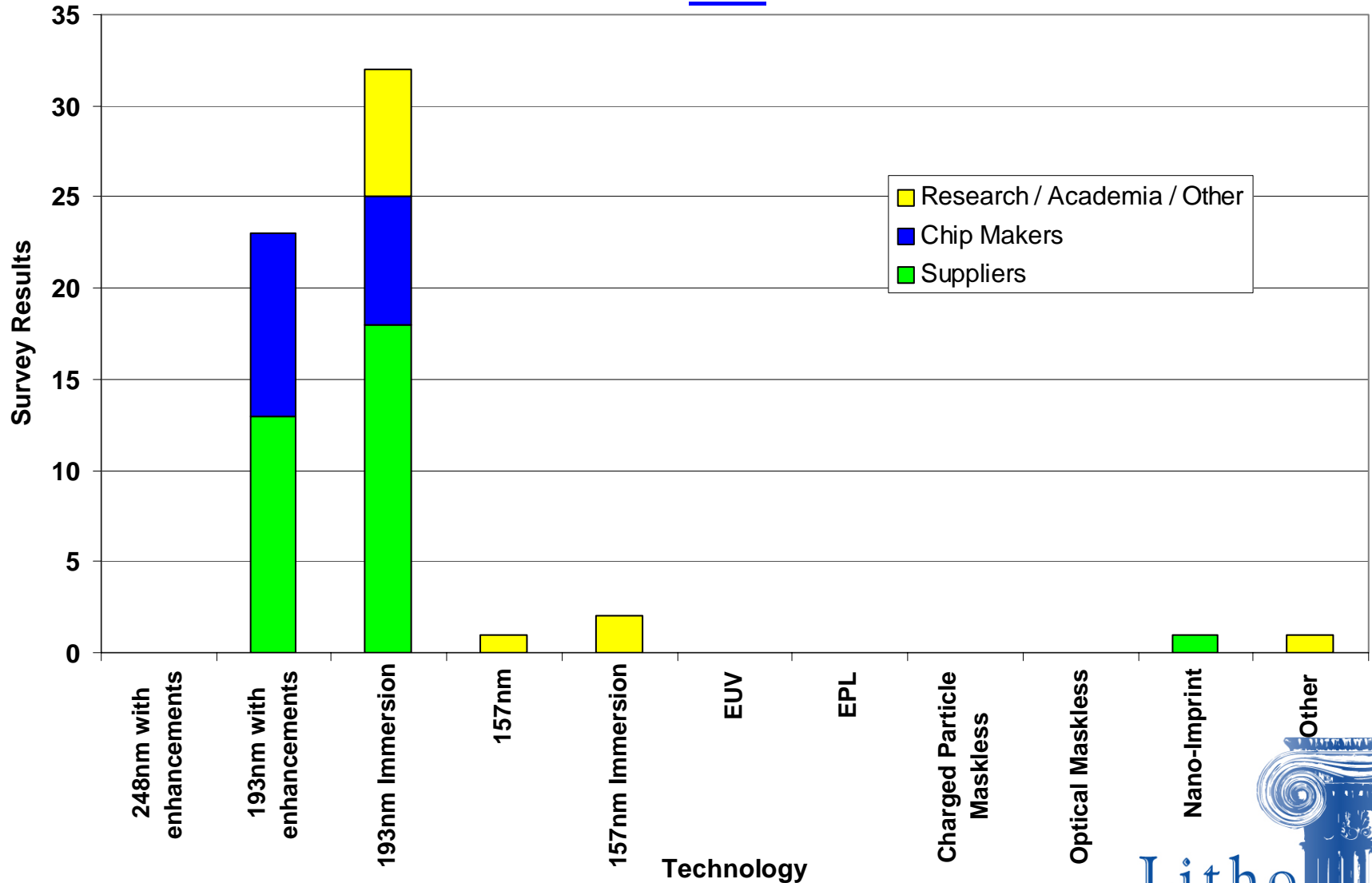


# What minimum M1 contacted, half-pitch will you have in volume production in 2007? (Corporate Surveys - Technology Plans)

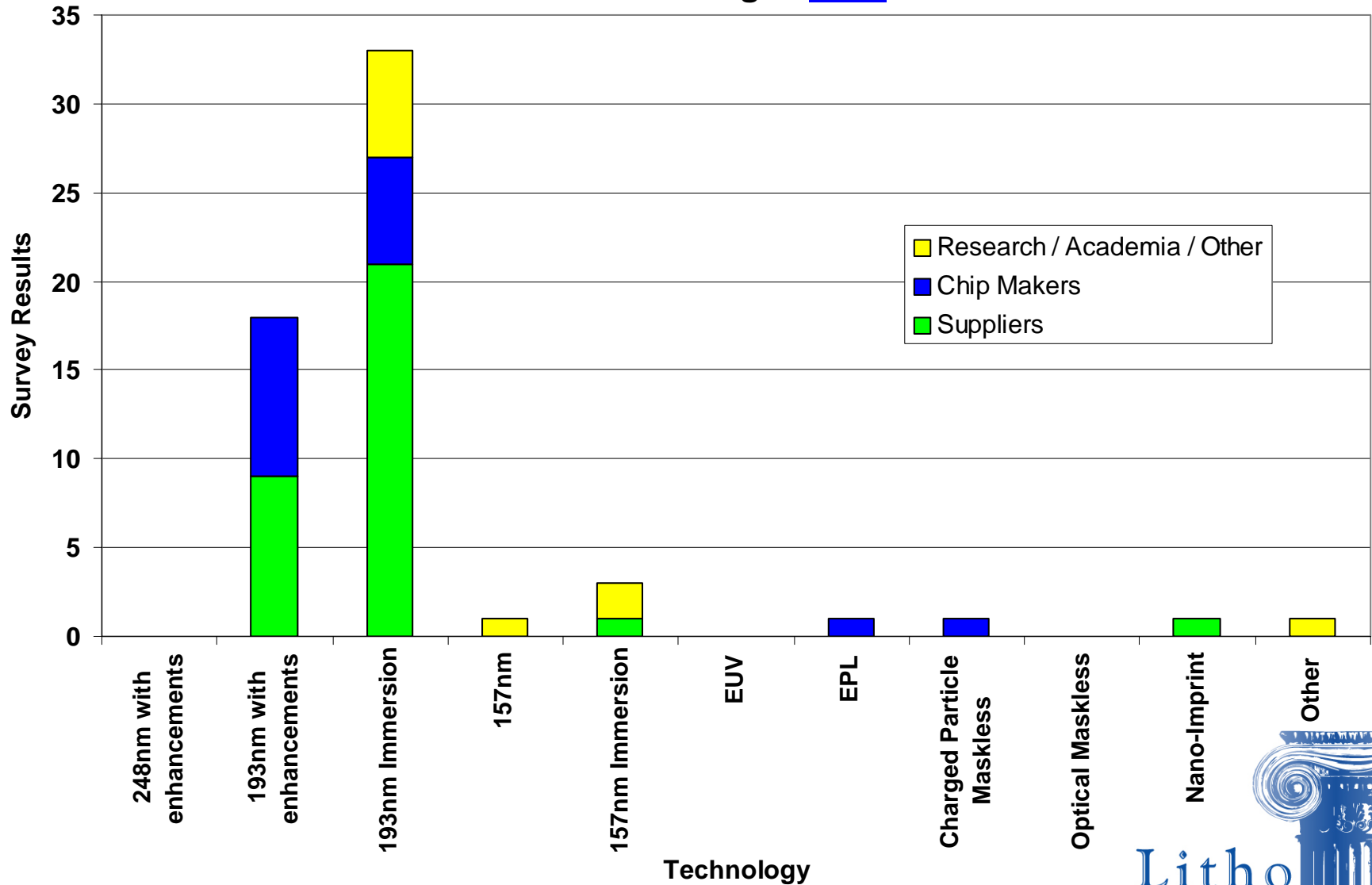


*Results from additional survey analysis after 01/29/04 Dinner Session; overall results showed little variation from previous results*

# What Technology will you employ for leading edge gate manufacturing in 2007?



# What Technology will you employ for leading edge contacts manufacturing in 2007?

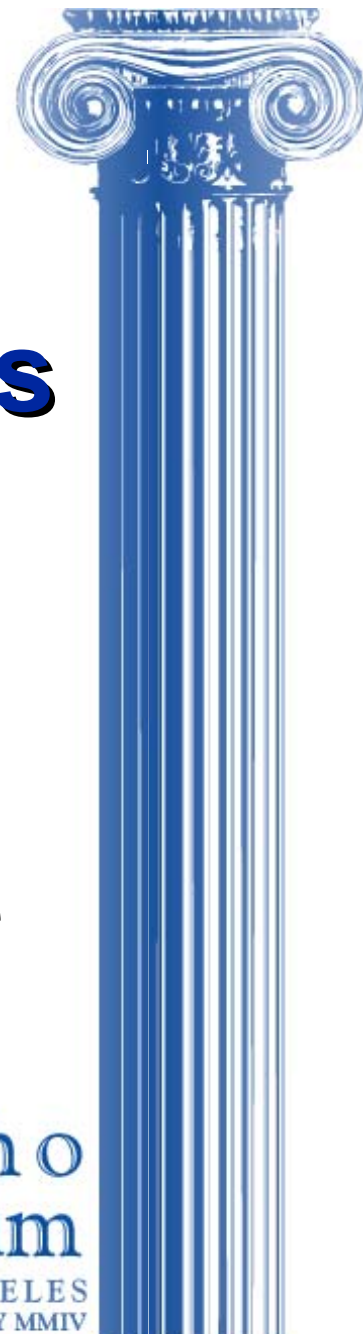


# **2007 Technology Readiness 193nm Immersion**

**This is the opinion of those who  
selected 193nm Immersion  
technology for 2007 Leading Edge  
Gates**

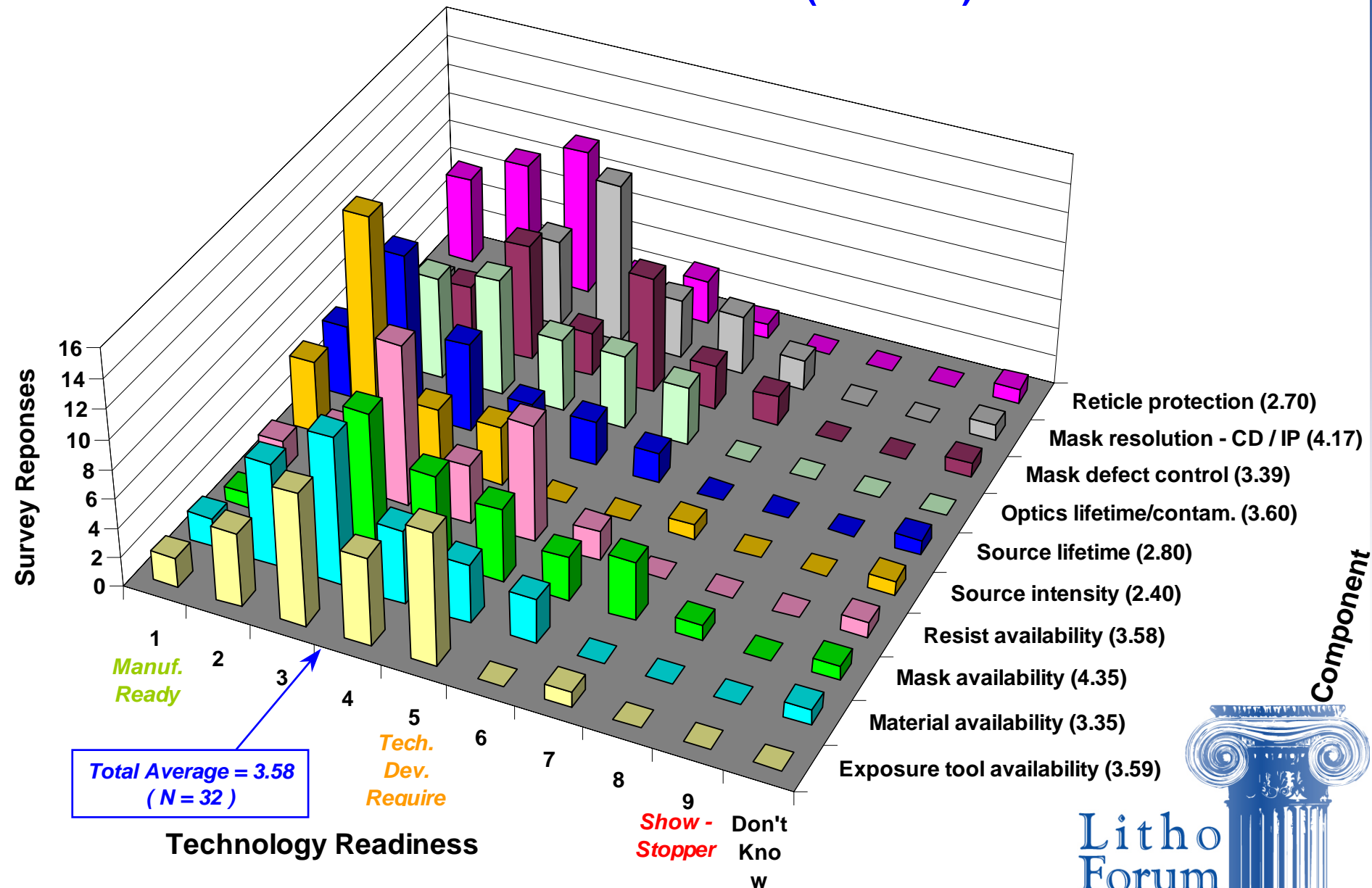
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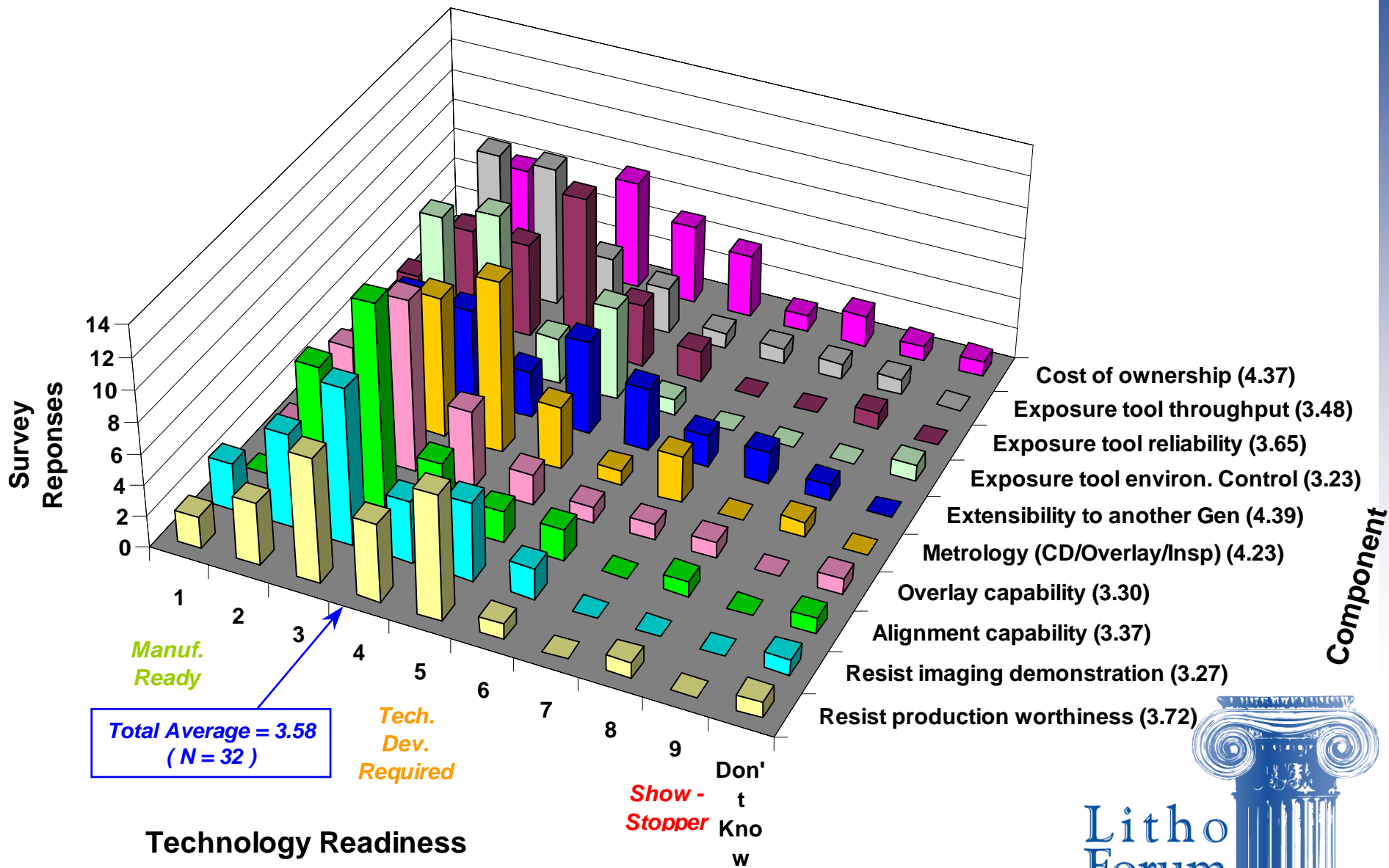
# 2007 Technology Component Readiness (Part A)

## 193 Immersion 2007 (Ques 31)



# 2007 Technology Component Readiness (Part B)

## 193 Immersion 2007 (Ques 31)

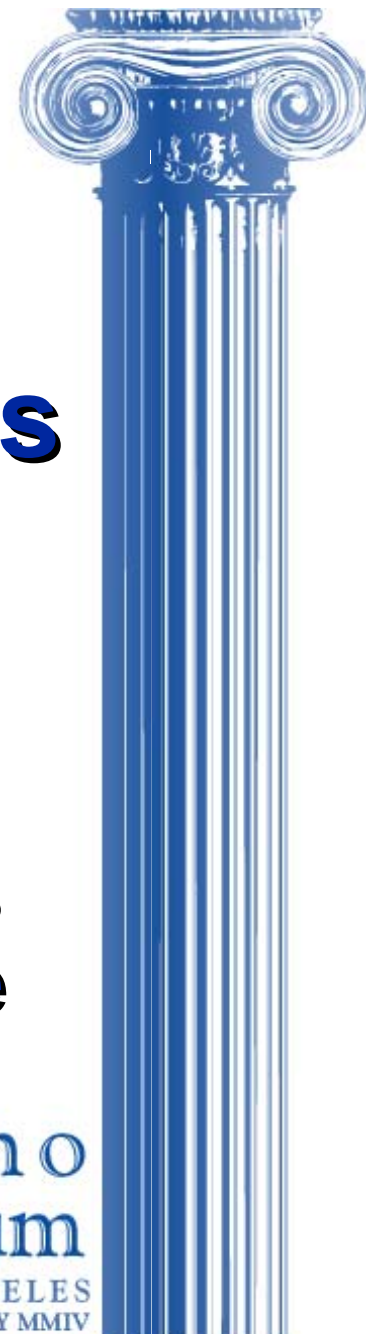


# **2007 Technology Readiness 193nm w/ Enhancements**

**This is the opinion of those who  
selected 193nm w/ Enhancements  
technology for 2007 Leading Edge  
Gates**

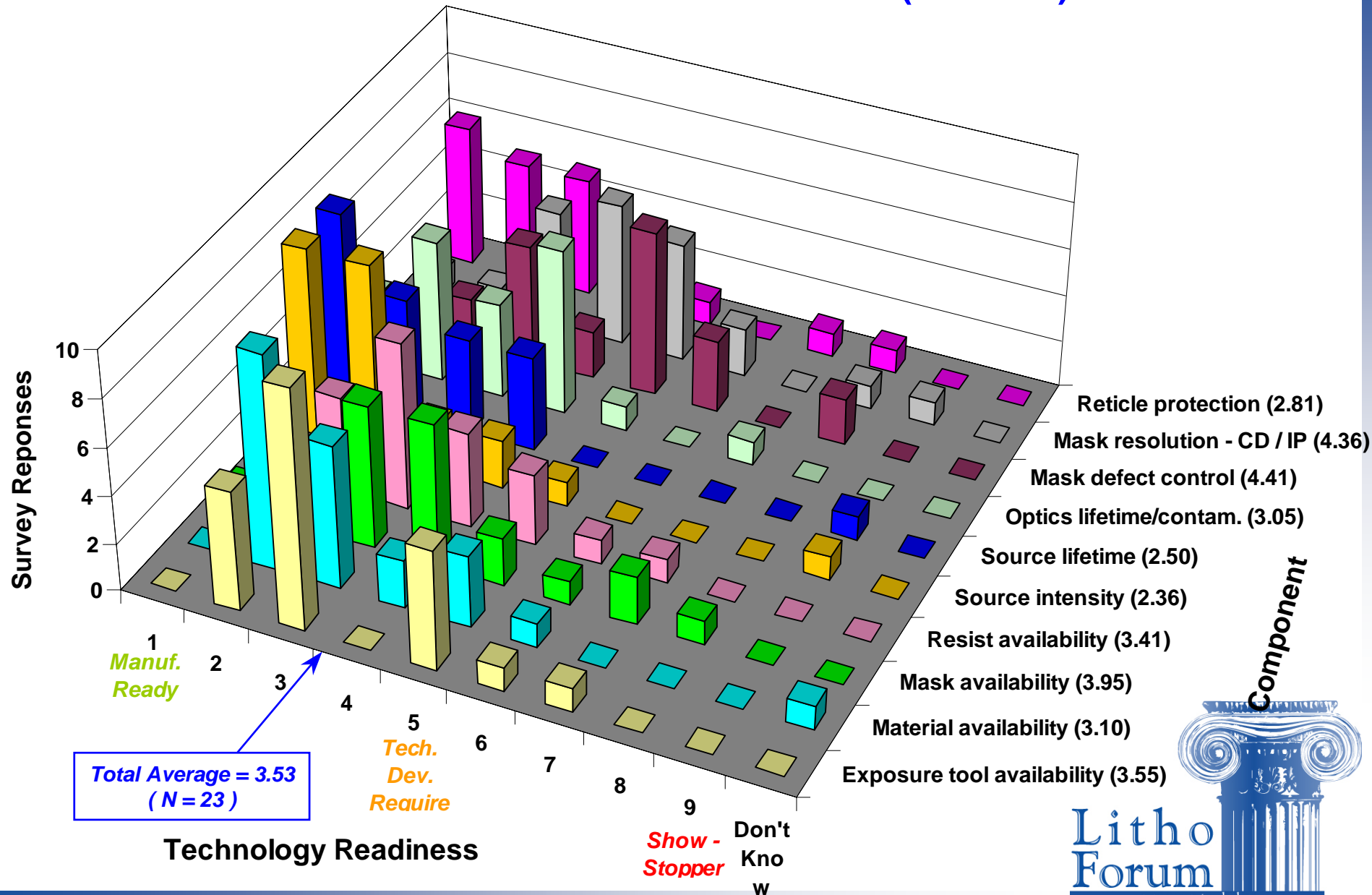
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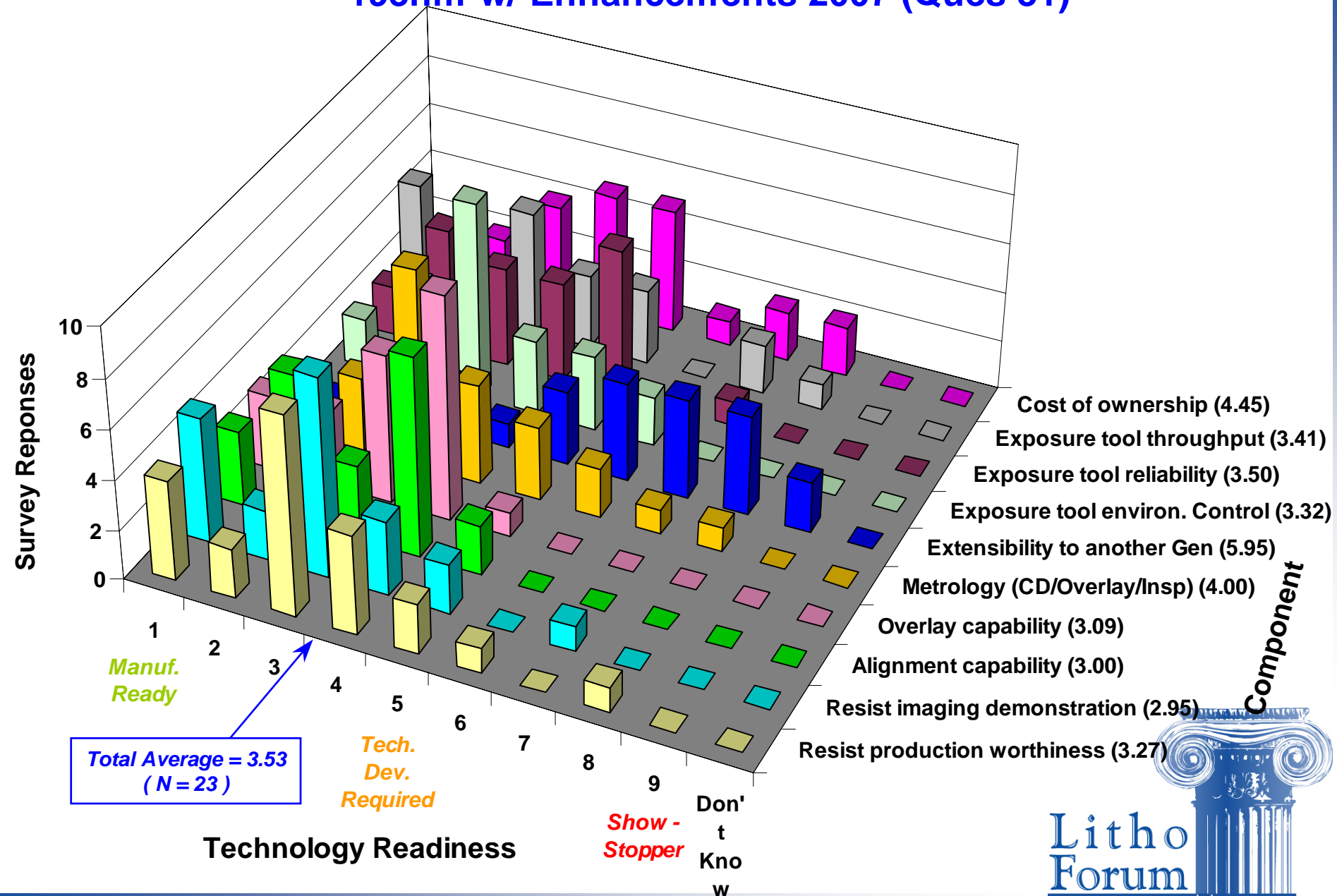
# 2007 Technology Component Readiness (Part A)

## 193nm w/ Enhancements 2007 (Ques 31)



# 2007 Technology Component Readiness (Part B)

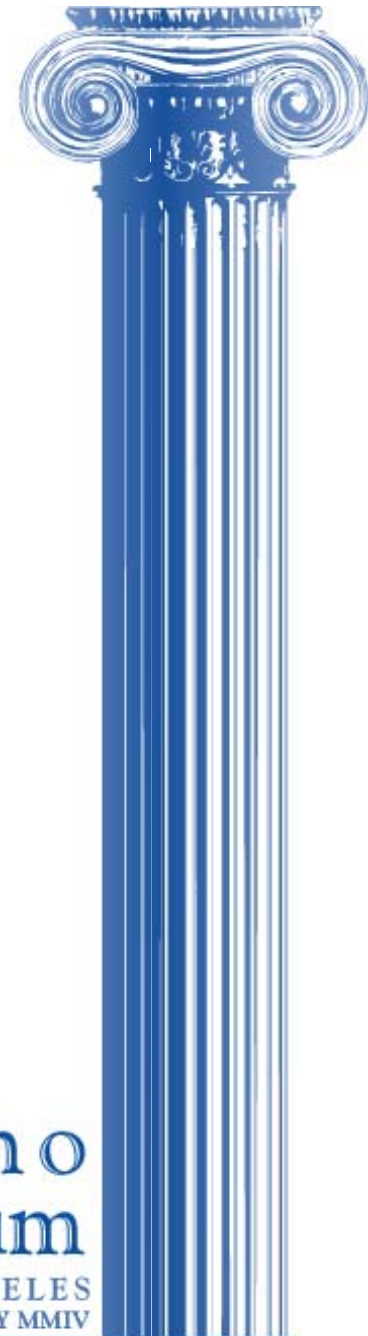
## 193nm w/ Enhancements 2007 (Ques 31)



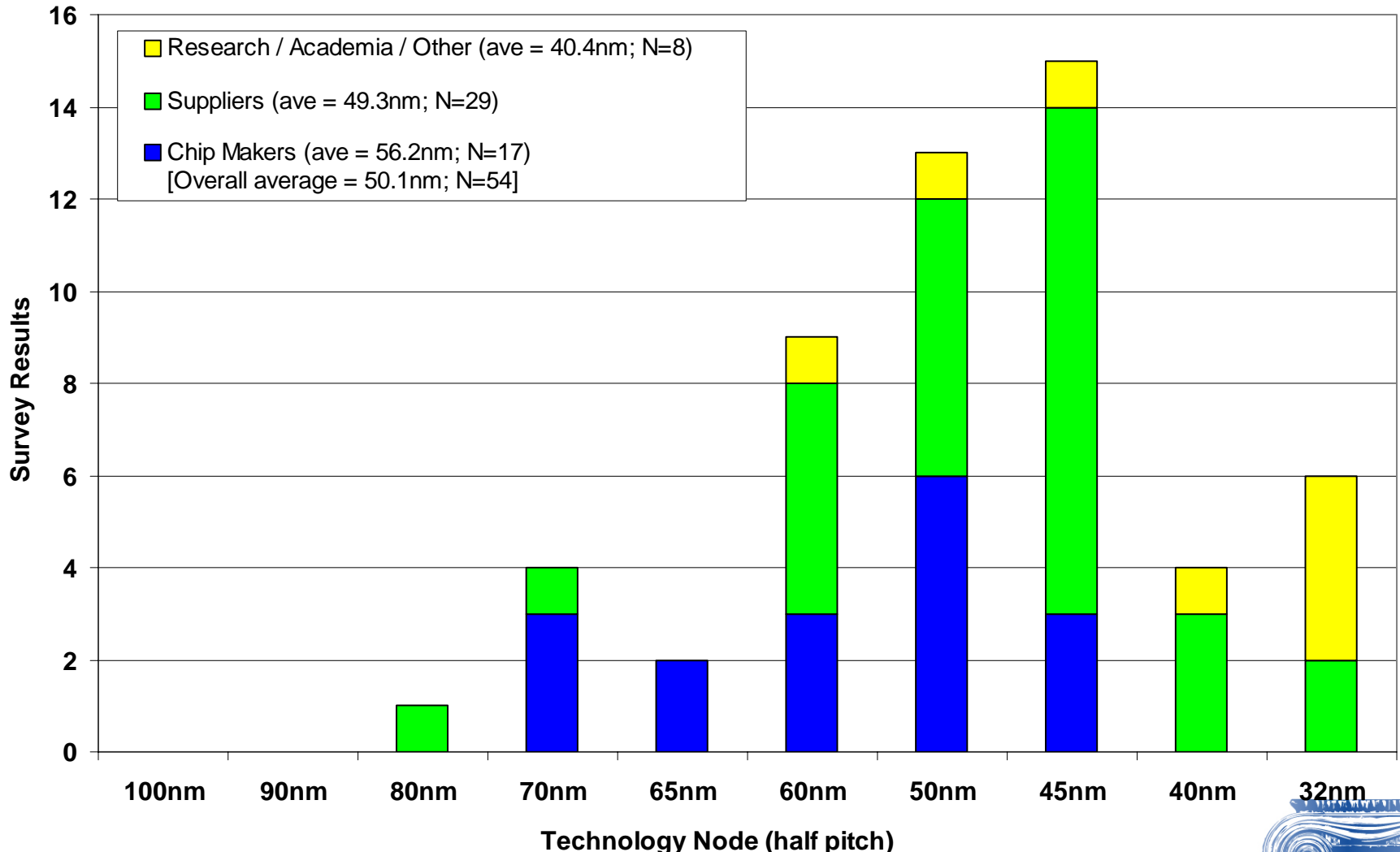
# 2009 Manufacturing Survey Results

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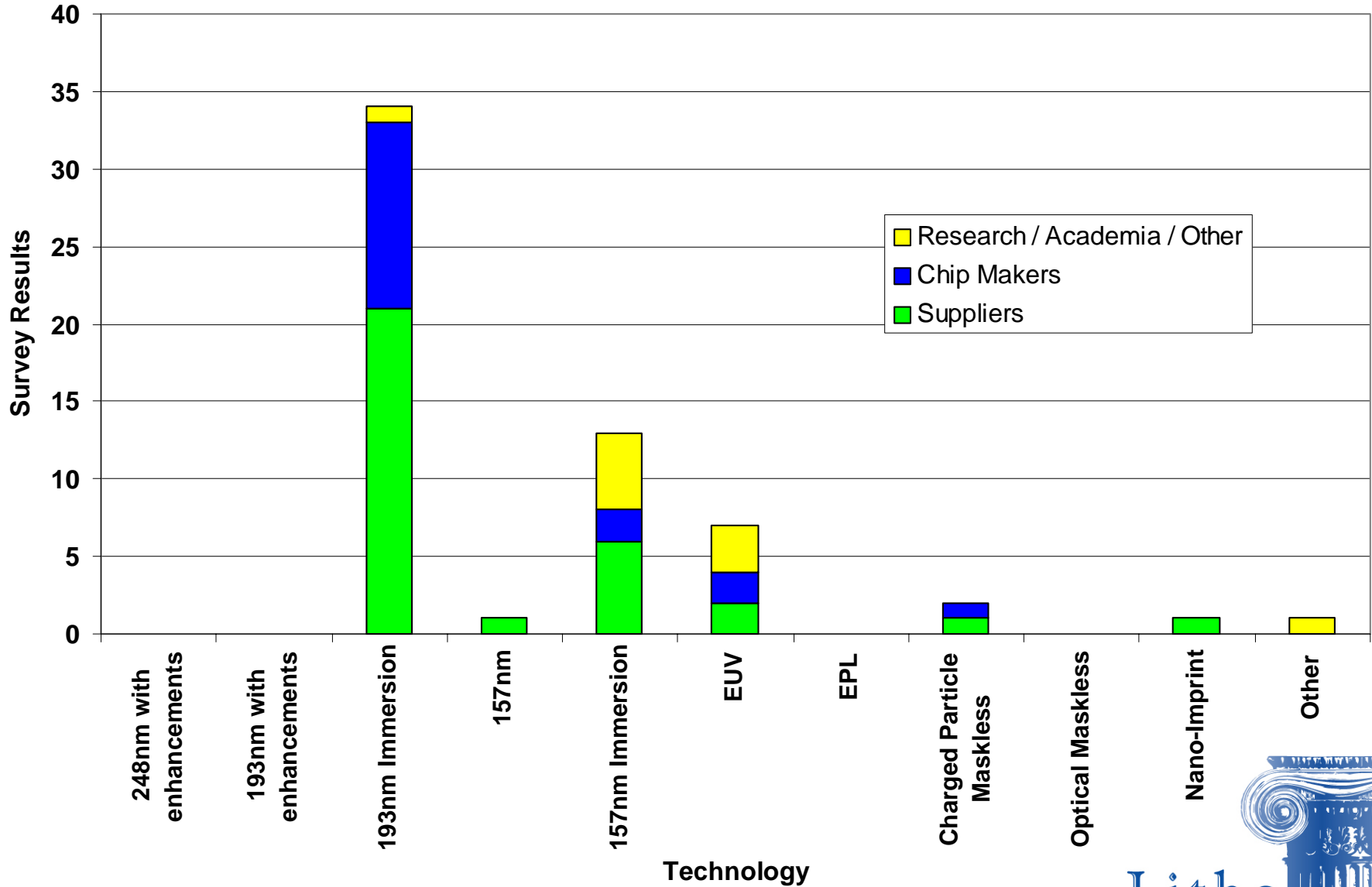


# What minimum M1 contacted, half-pitch will you have in volume production in 2009? (Corporate Surveys - Technology Plans)

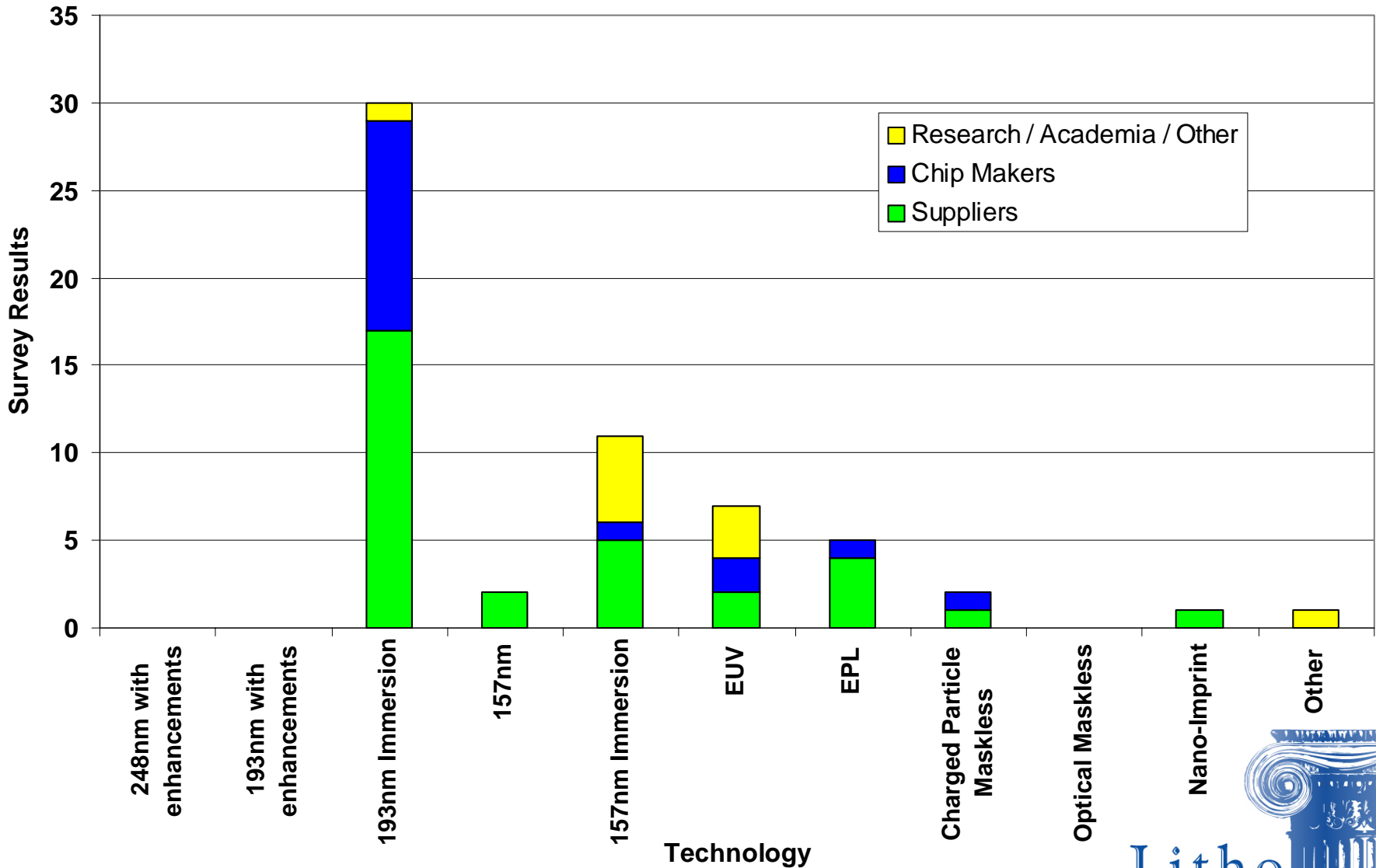


*Results from additional survey analysis after 01/29/04 Dinner Session; overall results showed little variation from previous results*

# What Technology will you employ for leading edge gate manufacturing in 2009?



# What Technology will you employ for leading edge contacts manufacturing in 2009?

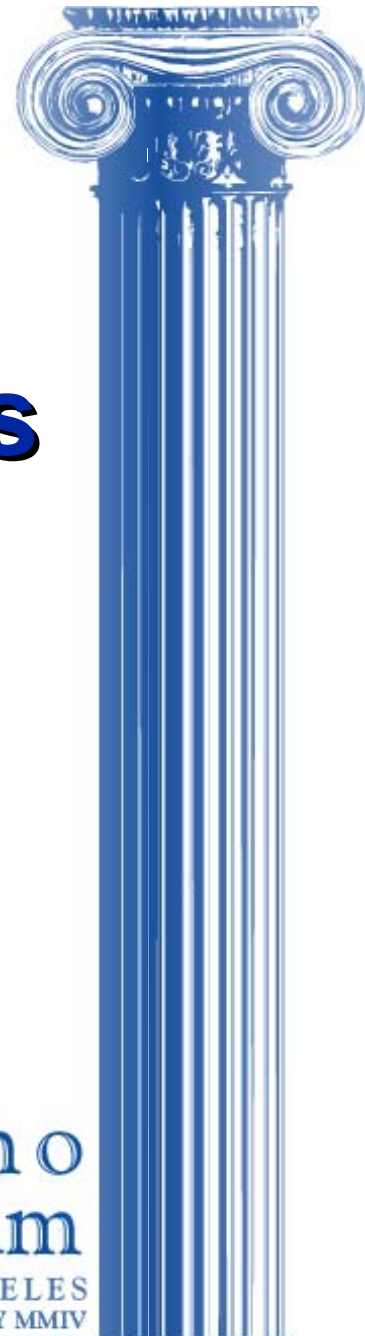


# **2009 Technology Readiness 193nm Immersion**

**This is the opinion of those who  
selected 193nm Immersion  
technology for 2009 Leading Edge  
Gates**

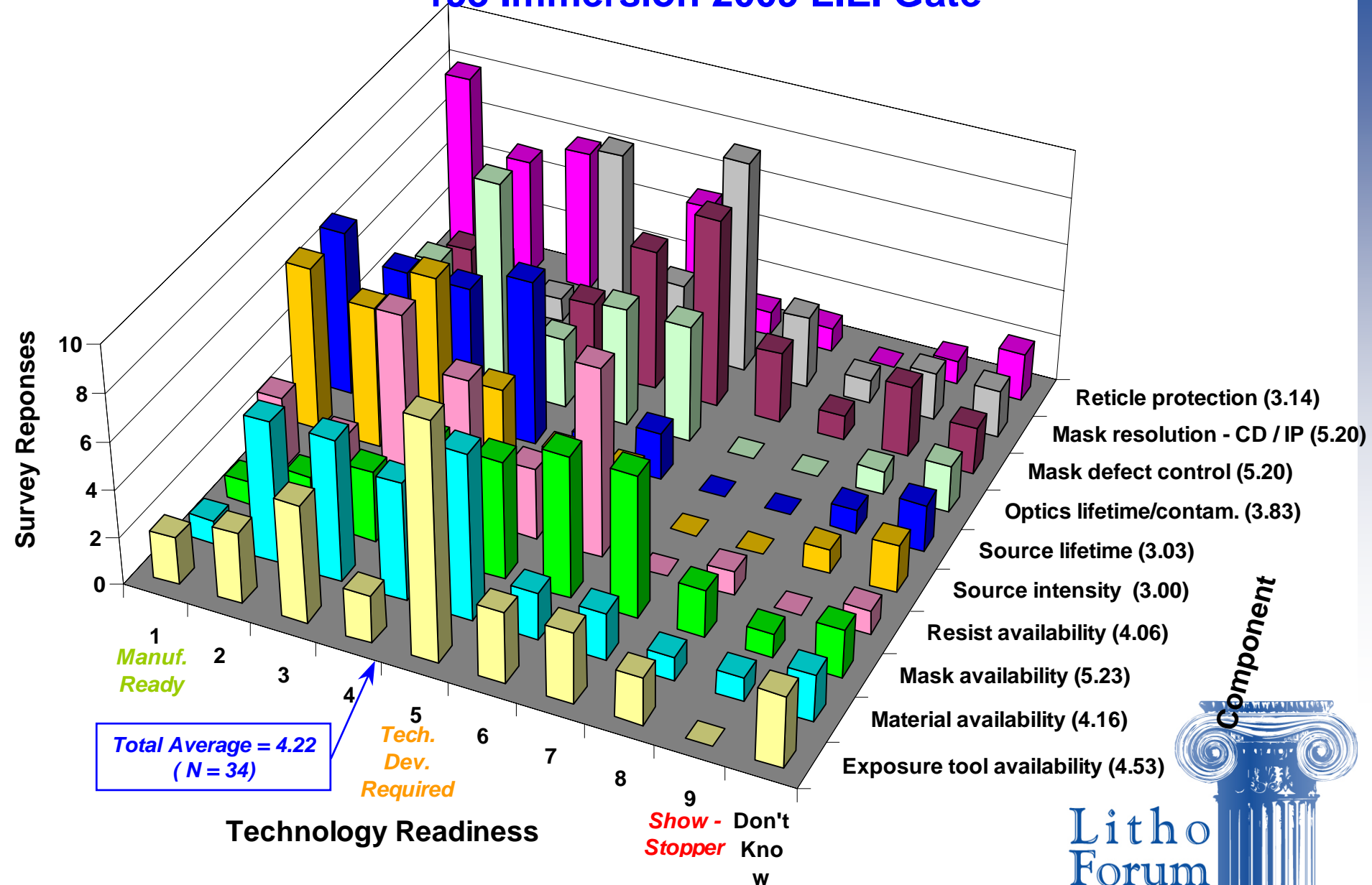
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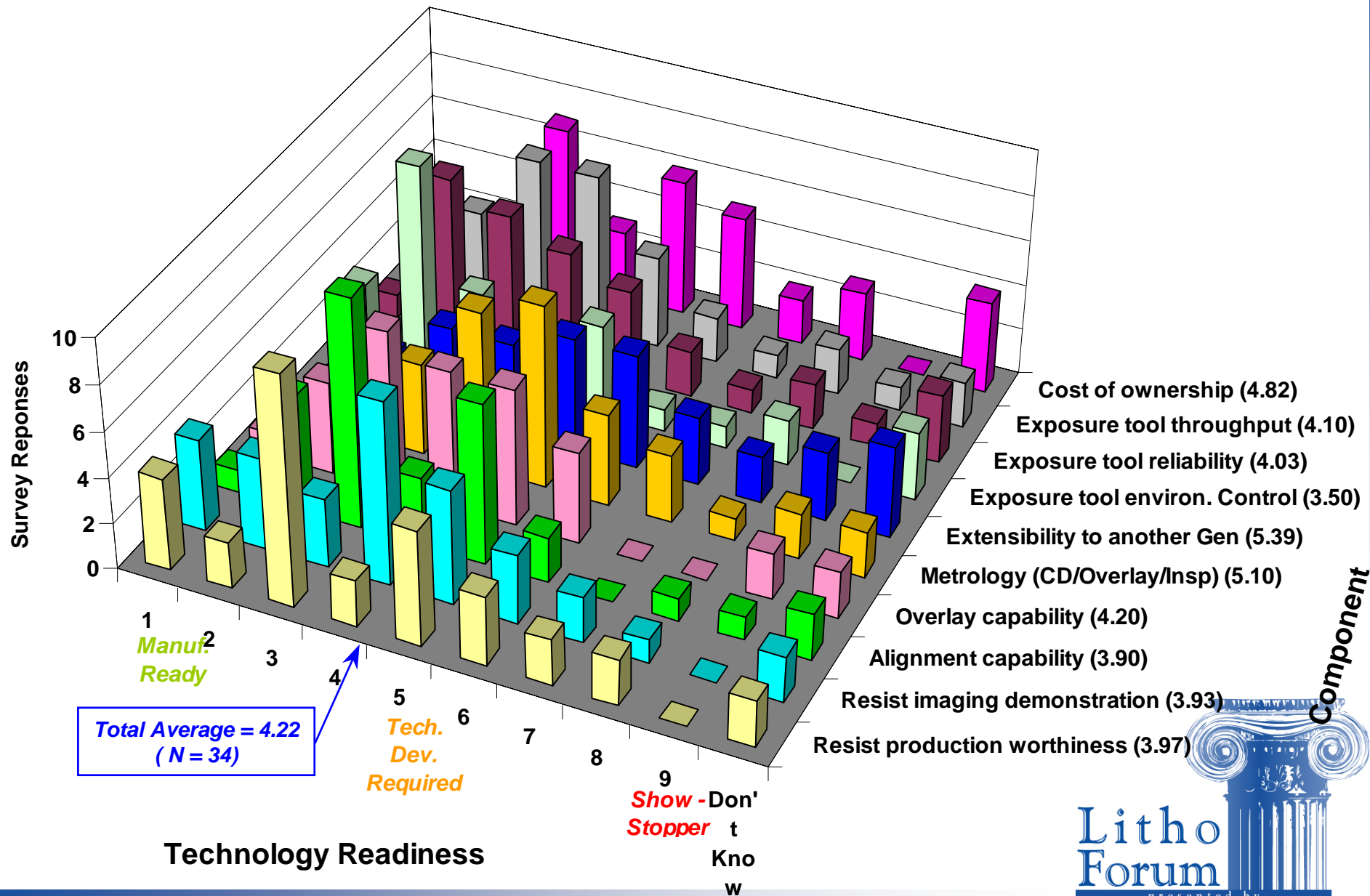
# 2009 Technology Component Readiness (Part A)

## 193 Immersion 2009 L.E. Gate

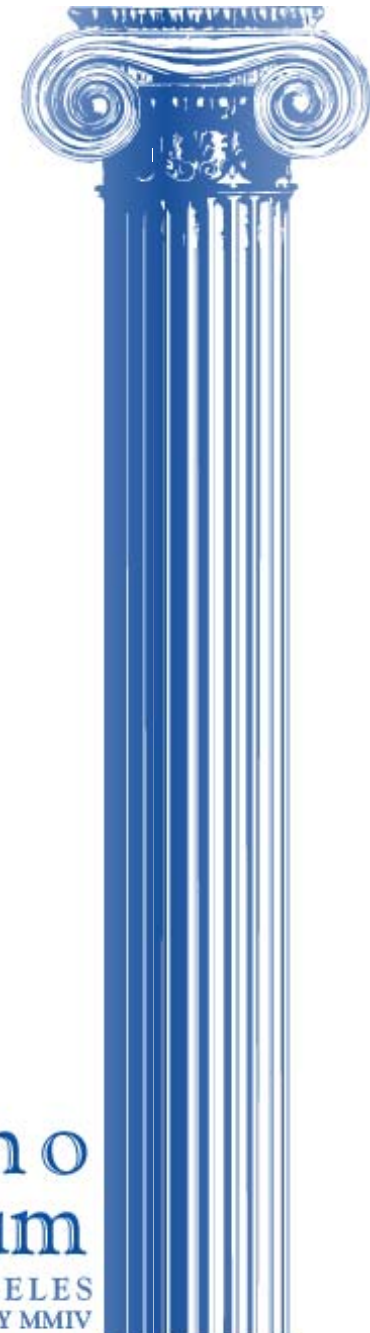


# 2009 Technology Component Readiness (Part B)

## 193 Immersion 2009 L.E. Gate



# Mask Magnification



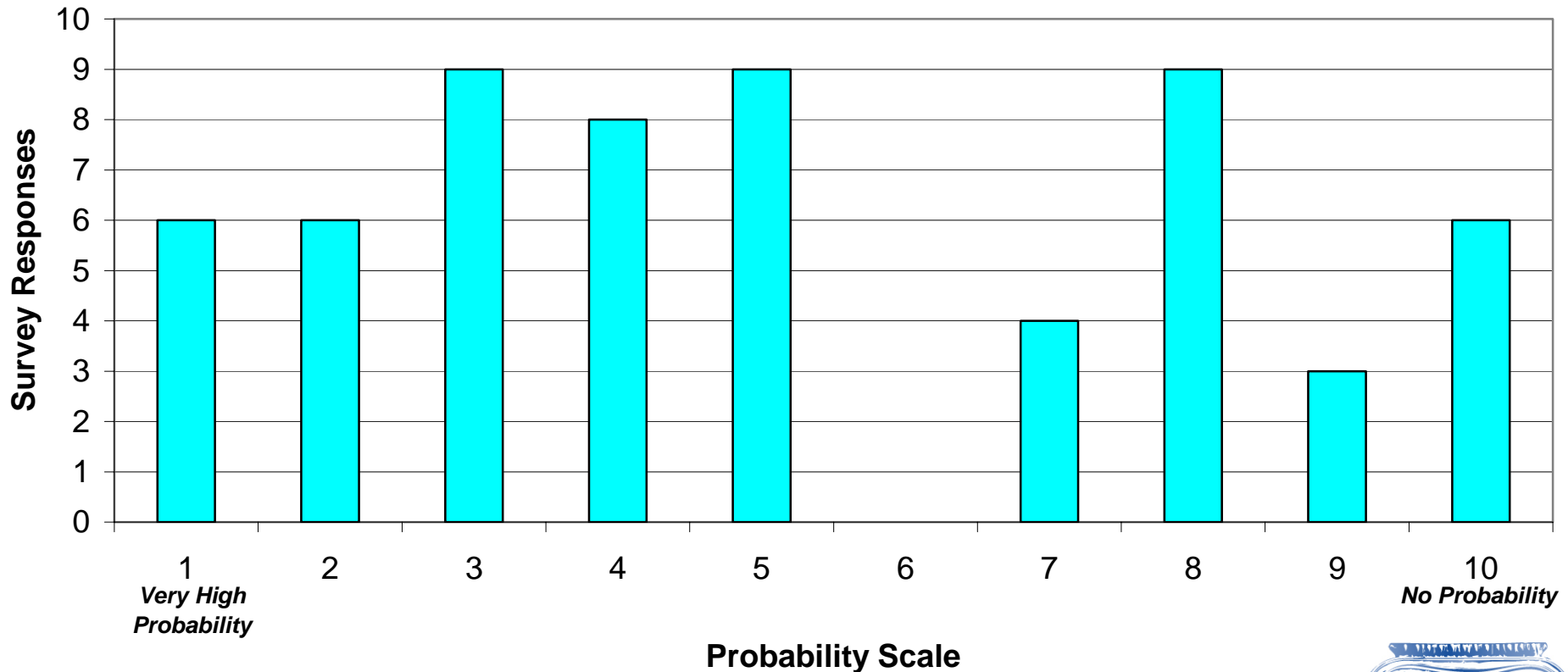
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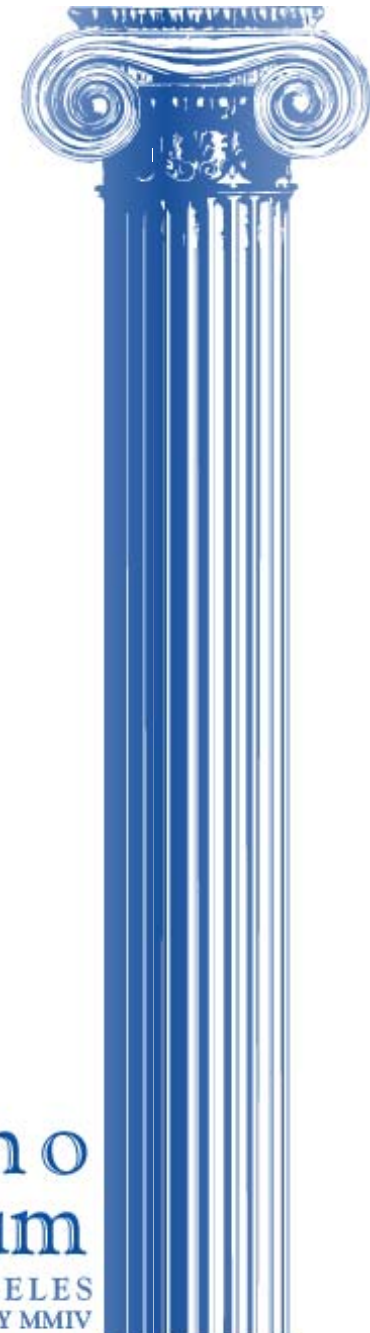
# Mask Magnification Question

- There has been a question on whether the Industry should consider a change in magnification to 5x, 6x, or 8x.
- A larger magnification may provide reduced mask and exposure tool cost at the expense of throughput and field utilization.
- Scott Hector, U.S. Litho iTWG Chair provided an overview of the investigations by the sub-committee.
- Attendees were asked to indicate their support for a magnification change.

If mask magnification choices were available for the 45nm node and smaller, "What is the "probability" you would utilize 5X, 6X, or 8X instead of 4x in volume production ?"



# Conclusions



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# Conclusions

- **2007 Manufacturing**

- Overall Response was that 193nm immersion and 193nm (dry) with enhancements are perceived as the most probable technologies.
- Response of the chip manufacturers only indicated stronger support for 193nm (dry) with enhancements than 193nm immersion.

- **2009 Manufacturing**

- 193nm immersion is perceived as the most probable technology for manufacturing in 2009, with EUVL and 157nm immersion also receiving support.

- **Concerns**

- There appear to be relatively few concerns about the readiness of 193nm immersion for 2007. Mask availability at the required CD and defect specifications are the most significant issues.

- **Technologies**

- 193nm immersion, 157nm, and EUV are perceived to be on schedule for manufacturing readiness with median dates of 2006, 2008 and 2010/11 respectively - although there are large variances in responses.

# Overall Impressions

- **The Forum had a high interest level with over 350 people registered. This was the first meeting addressing technology status of the numerous NGL type technologies since August 2001.**
- **The Forum was clearly perceived as being of significant value to the industry.**
- **The Litho Forum organizers received overwhelmingly positive feedback from attendees on the organization and technical content of the meeting.**
- **The technologists appreciated the opportunity to update the industry on the status of their efforts.**
- **Respondents strongly supported holding similar events on a regular basis with every year or every two years being the most popular.**