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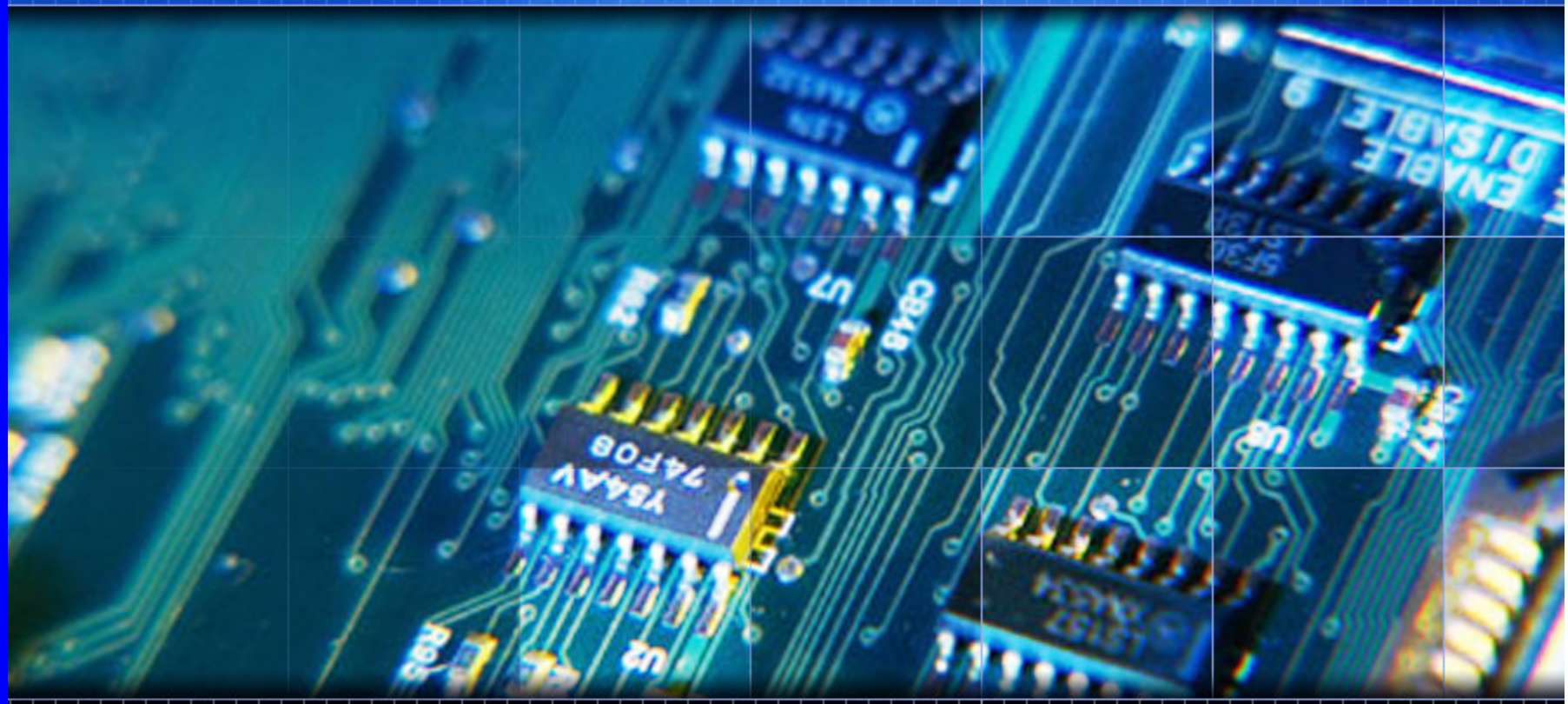
Filtration. Separation. Solu



Addressing Pricing Pressures from a Filtration Company Perspective

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Presentation Outline

- Identify the issue (pricing pressures on a CMP consumable supplier – Filters)
- How are we addressing this issue?
  - Advanced manufacturing and quality techniques
  - Development of new product platforms
  - Enhancing existing product platforms
- Conclusions

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Identify the issue

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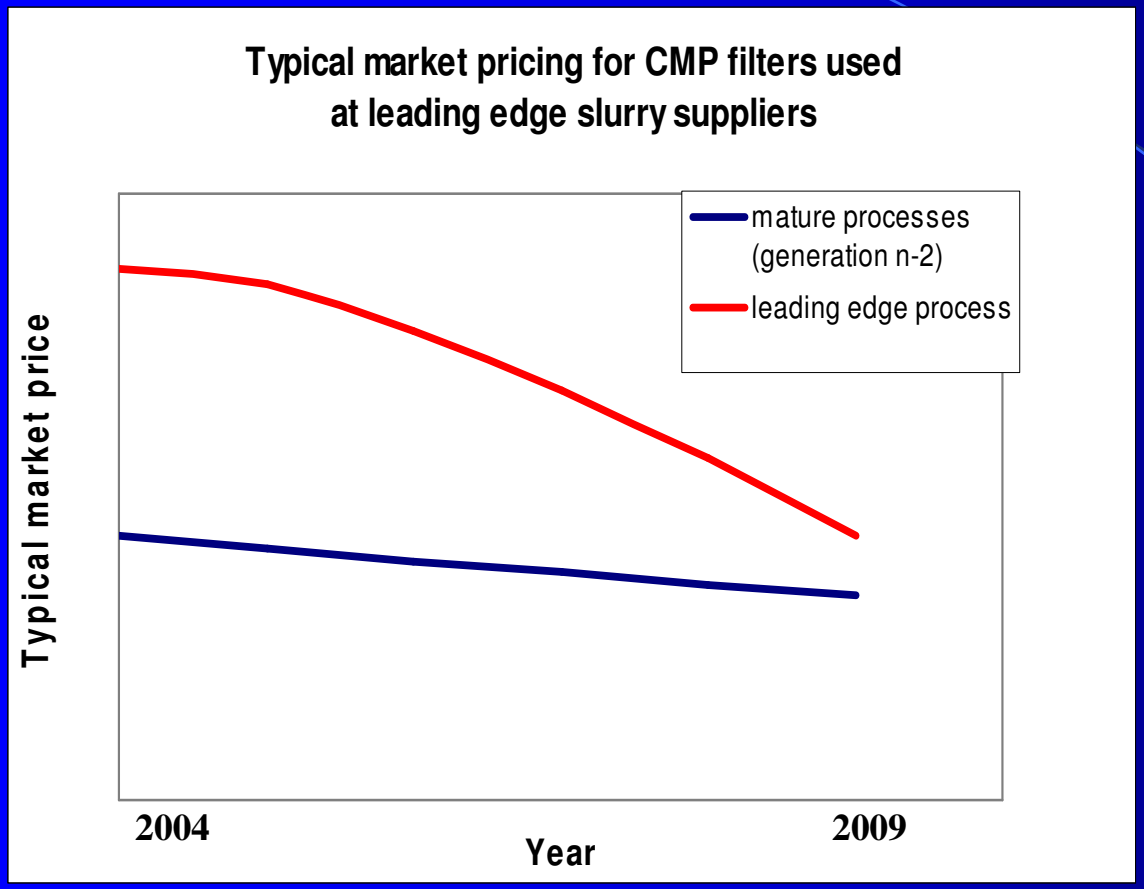
Recent trends in market price for slurry filters



SLURRY SUPPLIERS

Pricing trend causes:

- Early awareness by purchasing (especially mature , HVM products)
- Small premium still put on leading edge filtration products
- Competition among filtration companies

*** Cost of filtration is among the two largest consumable expenses for a slurry supplier (other is abrasive)**

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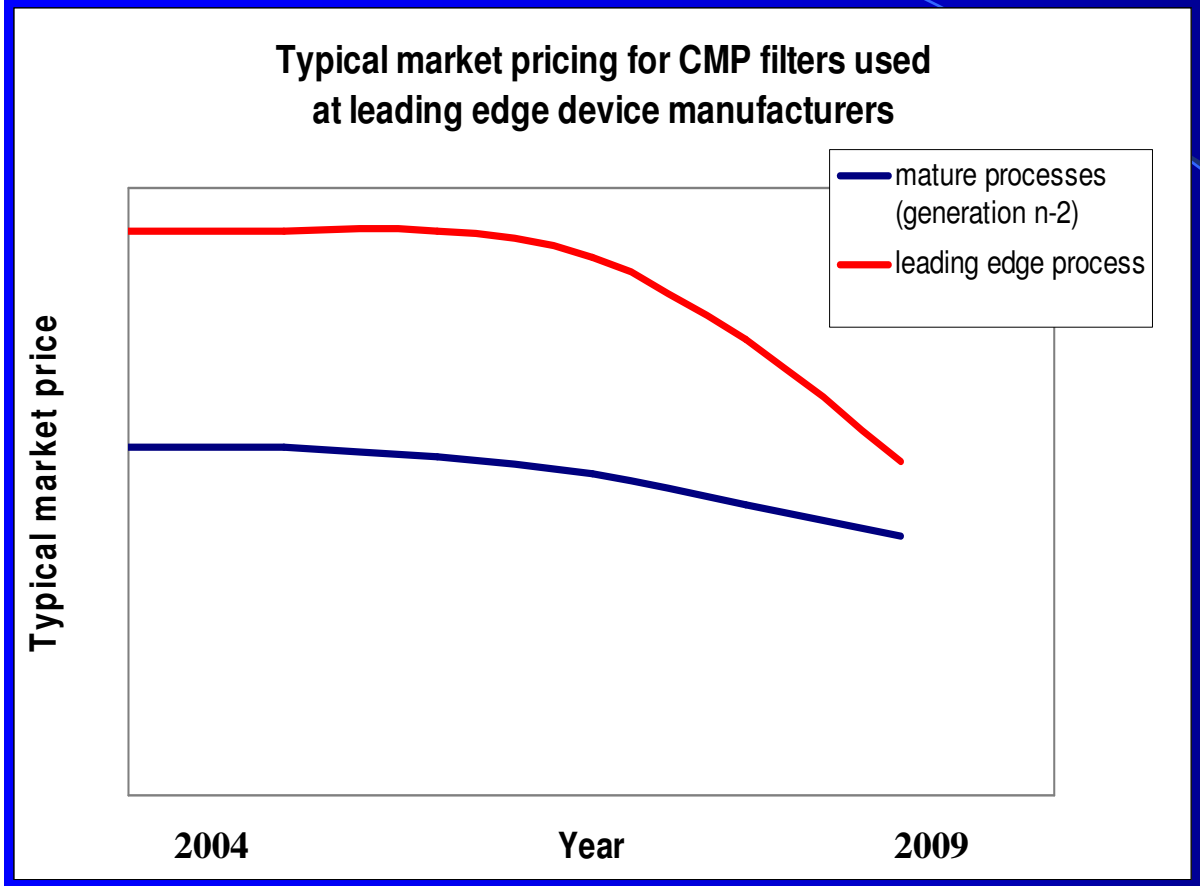
Recent trends in market price for slurry filters



DEVICE MANUFACTURES:

Pricing trend causes:

- More recently on radar of purchasing/procurement
- Consumable costs are now being considered (and driven down) during early stages of development
- Competition

*** Cost of filtration typically accounts for <5% of the overall CMP consumables cost at a Fab**

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Comments on Pricing Pressures

- Slurry Manufacturers
  - Same pricing pressures as filter companies
  - Filters are a key consumable cost
  - Profitability directly related to consumable costs
- Device Manufacturers
  - Overall consumable costs contribute signficantly to CoO
  - Filters typically account for <5% of consumable costs
  - Looking at all contributing factors (including filtration) to control CoO

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Addressing the issue
Advanced Manufacturing and Quality Techniques

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Lean Manufacturing

- **Manufacture to order (not stock)**

  - reduction of material and product inventory

- **Cellular Flow**

  - minimizes processing steps

  - reduces product handling

  - improves inventory turns

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Lean Manufacturing (Results)

- **Lead times reduced 20%**

  - reduces costs associated with carrying excess inventory

- **Labor costs reduced when operating optimally**

- **Helped to partially offset cost increases related to polypropylene and energy**

  - polypropylene costs mirror petroleum

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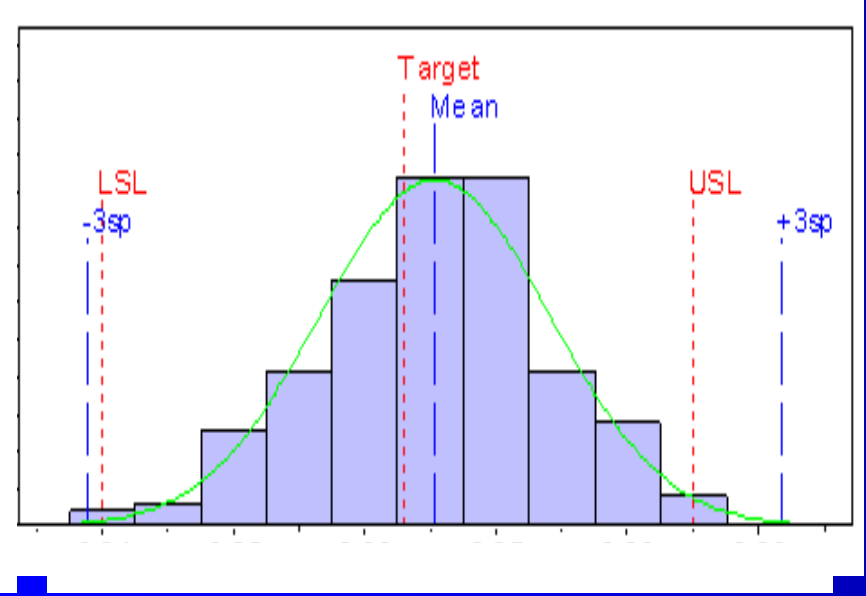
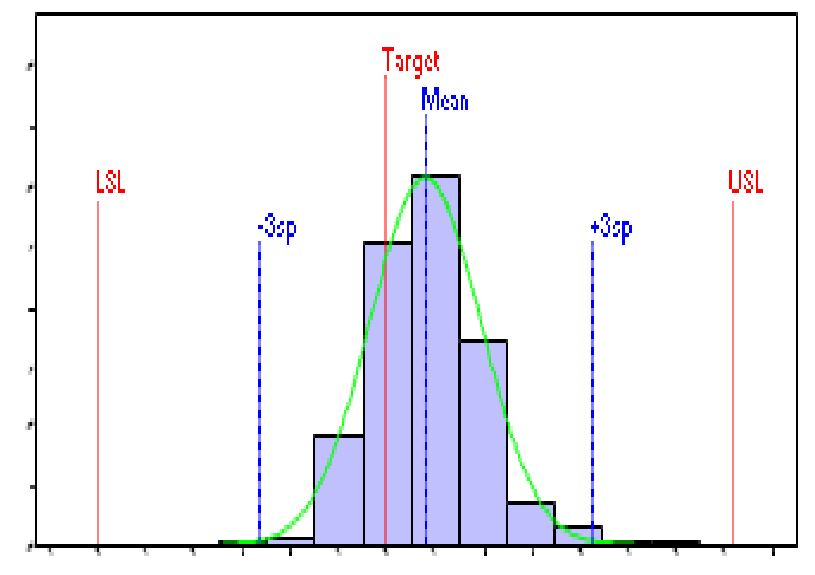
Improving Product Consistency by Incorporating Quality Methodology



Typical manufacturing data for a legacy CMP product



Manufacturing data for a recently developed CMP product

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Comments on Manufacturing/Quality

- Advanced Manufacturing techniques like Lean can be utilized to improve process flow and reduce costs
- Lean also provides an added benefit of improving quality by eliminating unnecessary manufacturing steps
  - less handling decreases the possibility of contamination
- Utilizing quality metrics early in process development can lead to improved product consistency
  - longer qualification runs lead to greater process knowledge and ultimately greater consistency

Addressing the issue
Developing New Product Platforms

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Finer Product Development

Methods for Manufacturing Finer Melt blown Filters

	Potential Impact on Filter Performance		
Manufacturing Methods	Efficiency	Differential Pressure	Life
Produce finer fibers	↑	↑	↔
Increase media depth	↑	↑	↔
Reduce void volume (media calendaring)	↑	↑	↓

- Finer fibers and increased media depth can lead to improved performance without significant filter life tradeoff
- Customer results have shown microscratch defects are reduced using finer filtration

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Finer Melt-blown Filter Development (media comparison)

Media Properties	Finest layer Y003	Finest layer Y002	Finest layer New Melt-blown filter
Mean pore size (normalized)	1.1X	x	0.4x
PSL challenge % efficiency (0.8μm bead) log removal	<70 % (<0.5 log)	70 % (0.5 log)	>99 % (>2 log)

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Finer Melt-blown Filter Development (cartridge comparison)

Media Properties	Y003 filter	Y002 filter	New Melt-blown filter
Mean Pore size (normalized)	1.1X	x	0.4X
PSL challenge % efficiency (0.8μm bead) (log removal)	70 % (<0.5 log)	90 % (1 log)	99.9 % (3 log)

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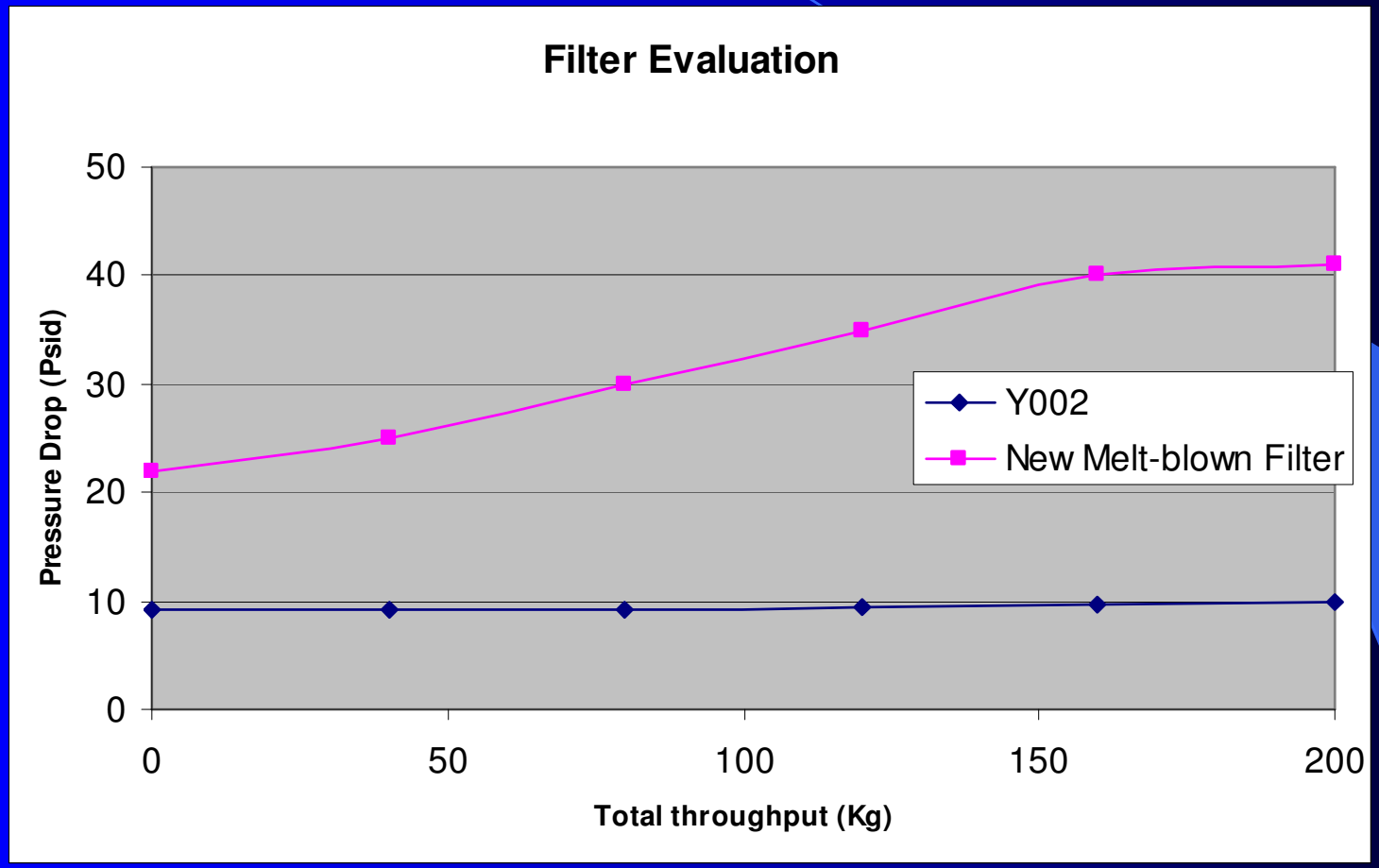
Finer Melt-blown Depth Filter (Field Results)



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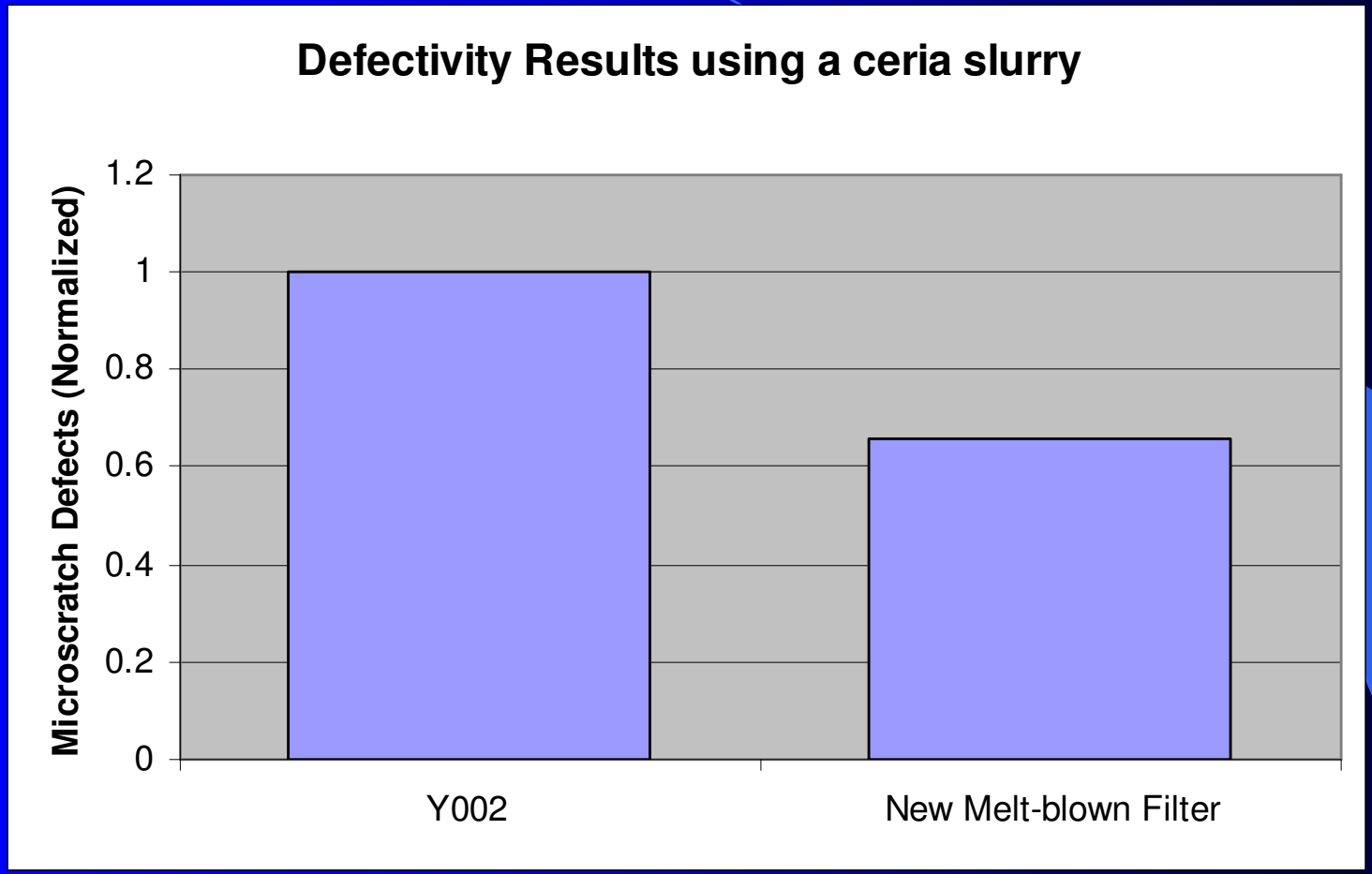
Finer Melt-blown Depth Filter (Field Results)



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Addressing the issue
Enhancing Existing Product Platforms

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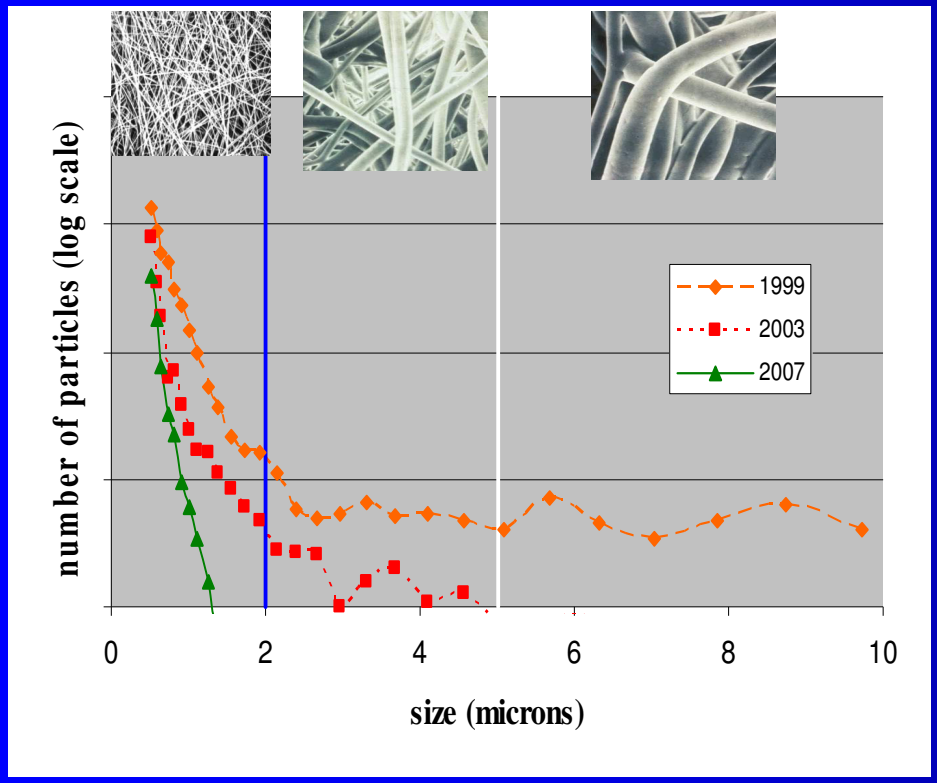
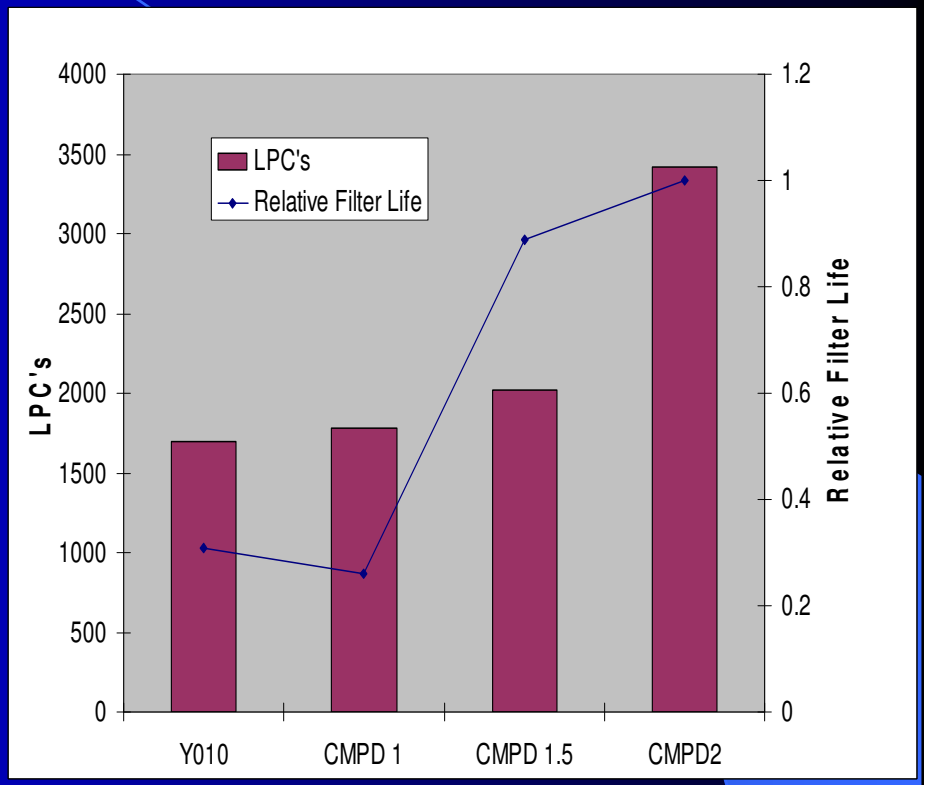
Development Based upon Slurry Characteristics

Evolution of typical LPC distributions for fumed silica CMP slurries



Filter efficiency and life testing with 12% solids fumed silica CMP slurry



***Improving CoO by developing products for CMP slurries based upon PSD**

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New Extended Life filter (Lab Results using fumed silica slurry)

	LPC @ 0.56 μm (normalized)	Differential Pressure (normalized)	Filter Life (normalized)
Standard Product	1.00	1	1
Extended life product	1.08	0.5	*up to 4*

- Product is made using existing Pall technology (product performance is enhanced utilizing an existing product platform)
- Best benefit (4x life of. the standard product) occurred with fumed silica slurry targeting 0.2μm (Y002) filter retention

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Comments on Product Development

- New technology developments will always be important since they enable solutions for the next generation applications
- Utilizing application knowledge (slurry PSD) to improve an existing product is a means to address customer (both supplier and device manufacturers) CoO issues
- Applying product knowledge (modifying pore taper to extend life) is the best way to make significant improvements to existing product platforms

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Summary

- Efforts by device manufacturers to control costs have put enormous pricing pressures on CMP consumable suppliers
- Filtration companies see these pressures from both the device manufacturers and the slurry suppliers
- A multi-step approach is needed to address this issue
- Advanced manufacturing and quality techniques can be implemented to increase efficiency and reduce scrap
- New media and product developments by Pall can lead to reduced on wafer defects
- Enhancing existing product platforms allows Pall to meet the ever changing needs of the semiconductor industry in a manner that is both timely and less costly than traditional product development

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