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Game Change:
Monitoring Large Particles in Undiluted Slurry

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Agenda

- Vantage SlurryScope™ principles
- Comparison to SPOS methods
- Tales from the sub-fab
- Implications for fab operations & yield
- Conclusions

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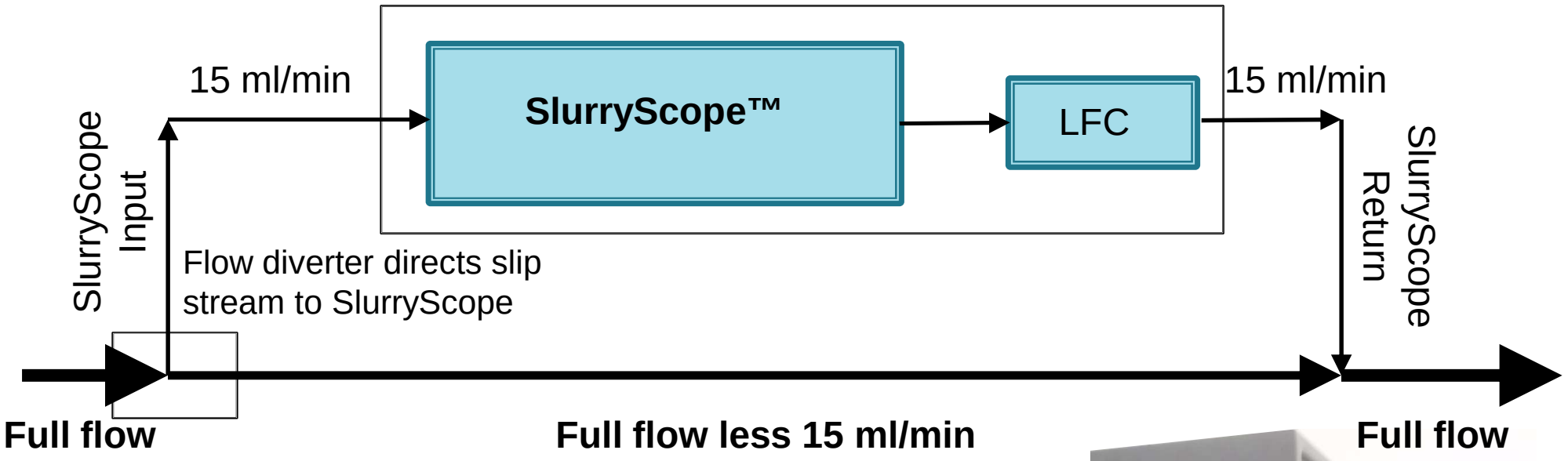
Vantage Technology SlurryScope™



- Continuous, real-time measurement @ 15 ml/min
- Detection range 1-12 µm in 0.2 µm increments
- Undiluted CMP slurry, all types

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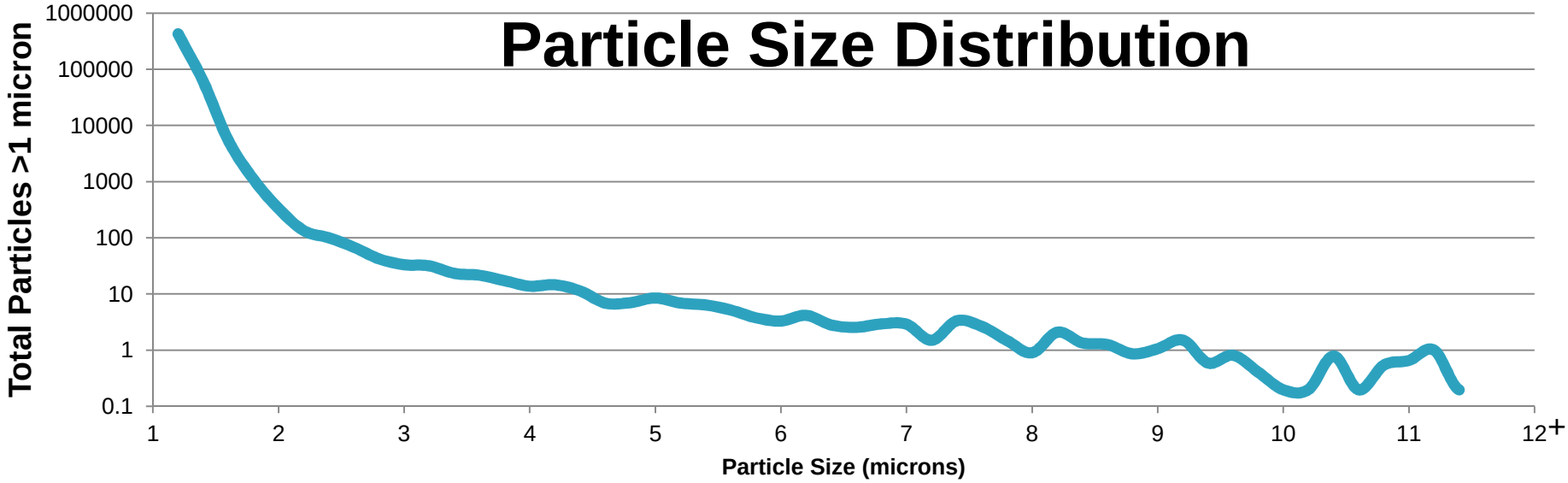
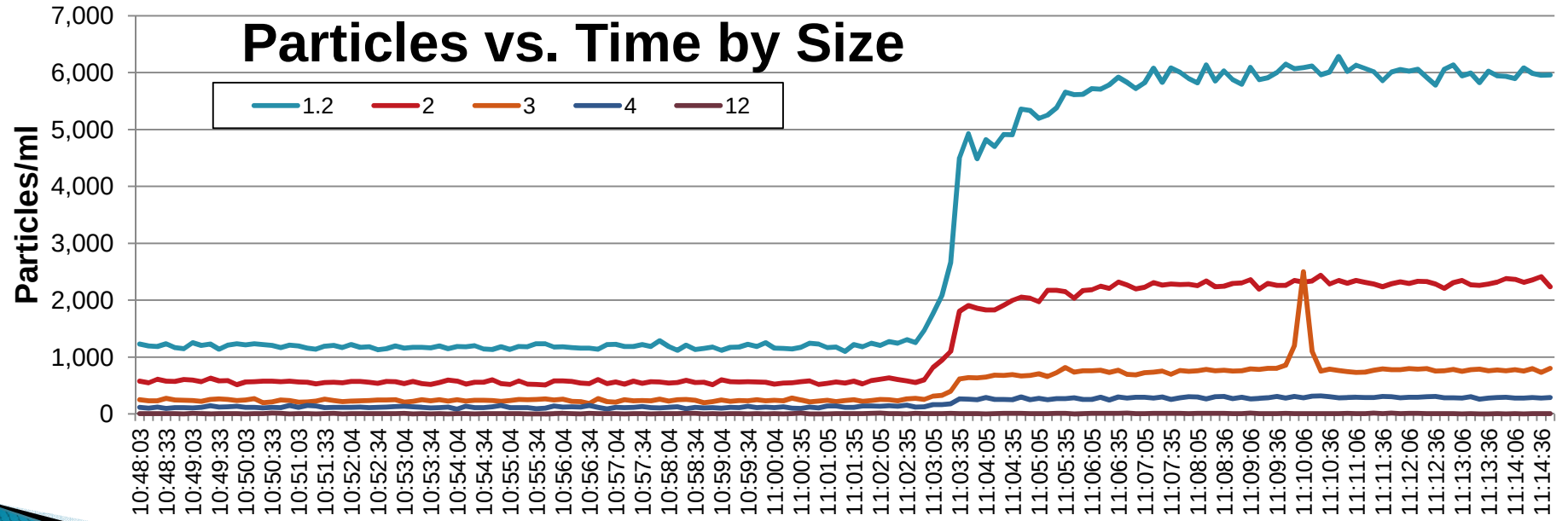
SlurryScope Typical Data





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Slurry Monitoring Comparison

SPOS* Methods

- Periodic sampling
- Sample size 0.25-1 ml
- Offline / near line
- Dilution to meet SPOS detector requirements

*Single Particle Optical Sizing

SlurryScope System

- Continuous monitoring
- Sampling rate 15 ml/min
- Real-time
- Undiluted at full POU concentration
- Integrates into SDS
- Integrates into polisher slurry lines at POU

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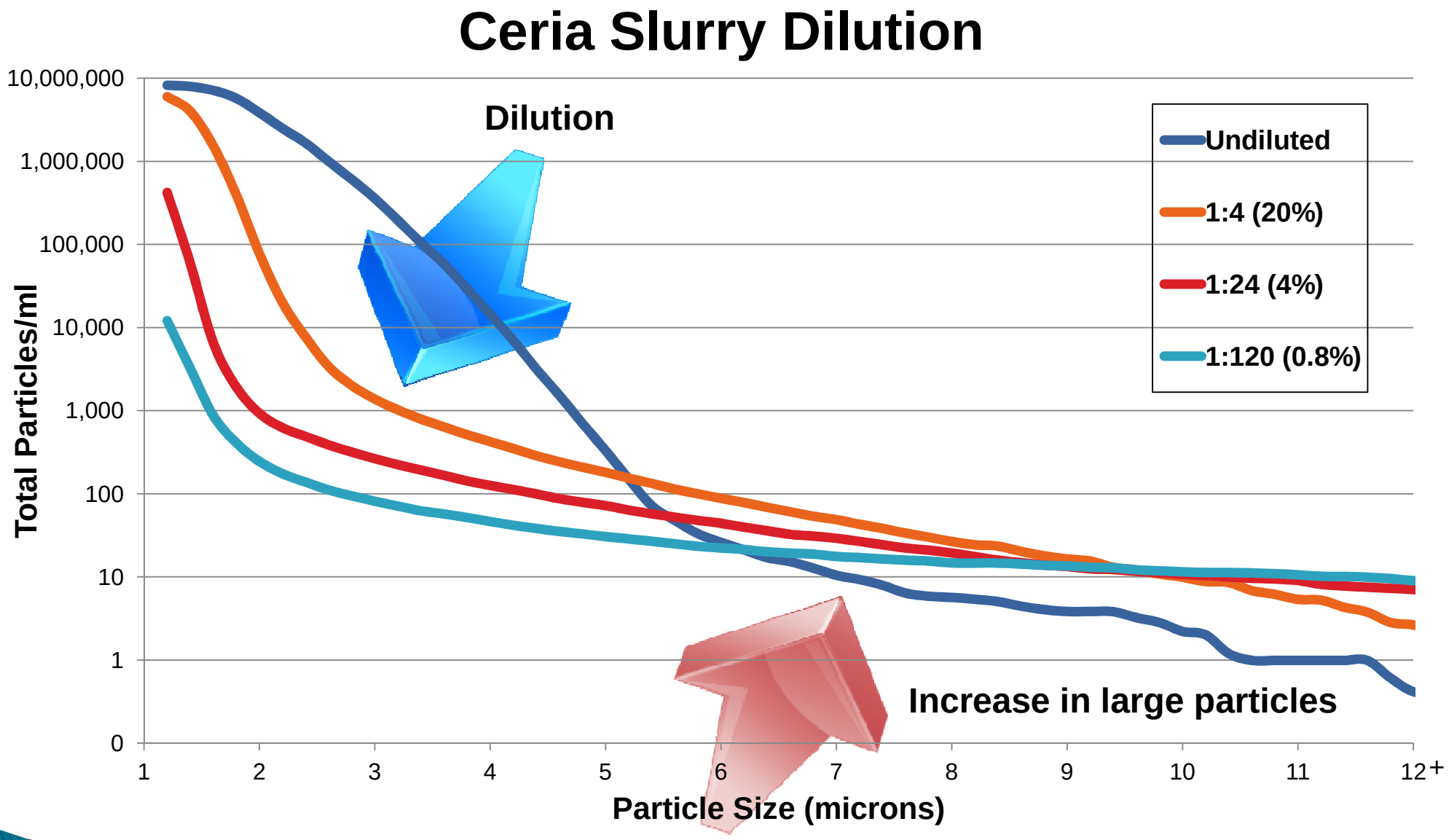
SPOS: Agglomeration On Dilution



Ref: Vantage Technology Corp., unpublished

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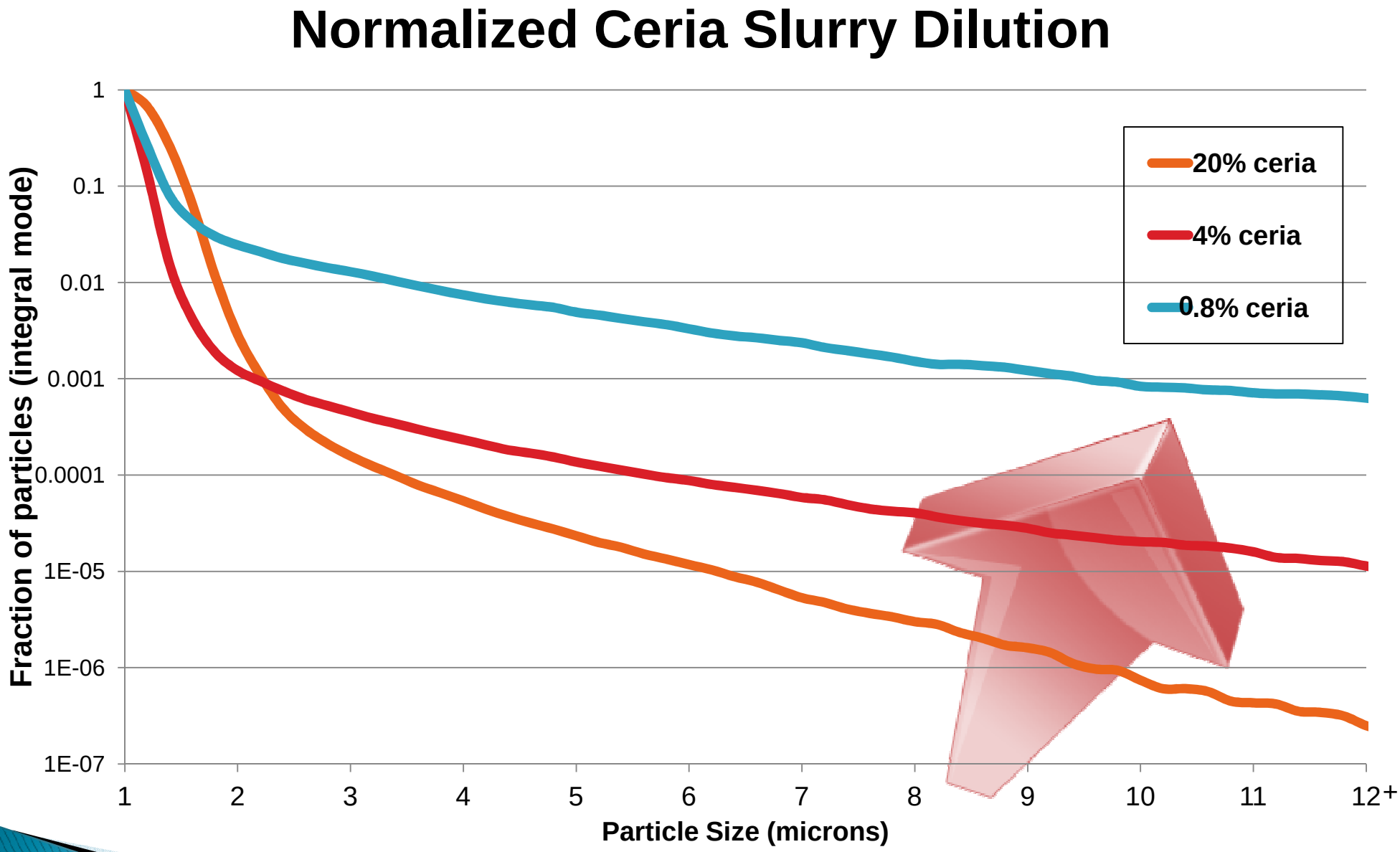
SPOS: Agglomeration On Dilution



Ref: Vantage Technology Corp., unpublished

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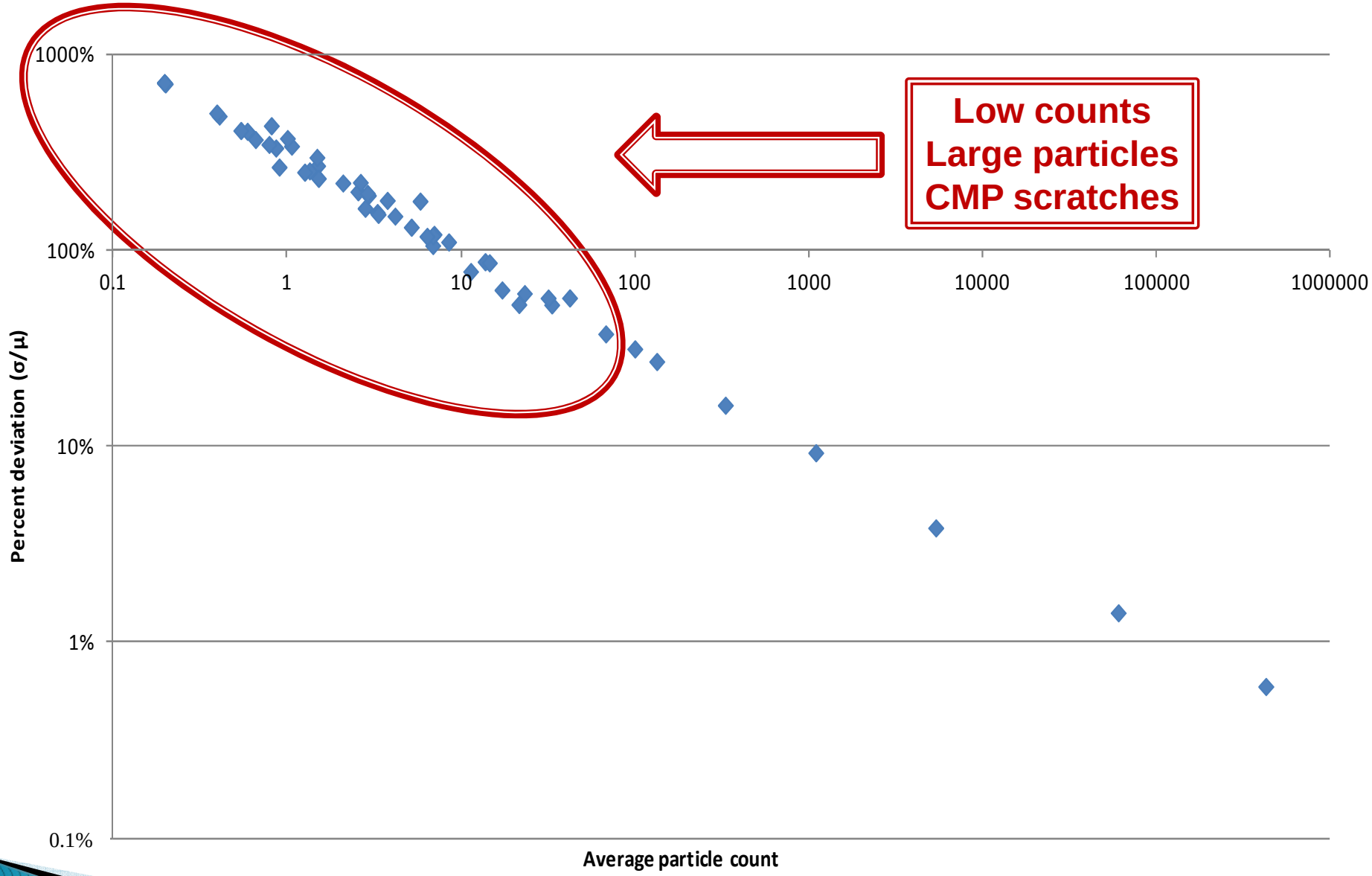
SPOS Sample Size: Percent Deviation vs. Particle Count



Ref: M. Fury, NCCAVS CMPUG May, 2012

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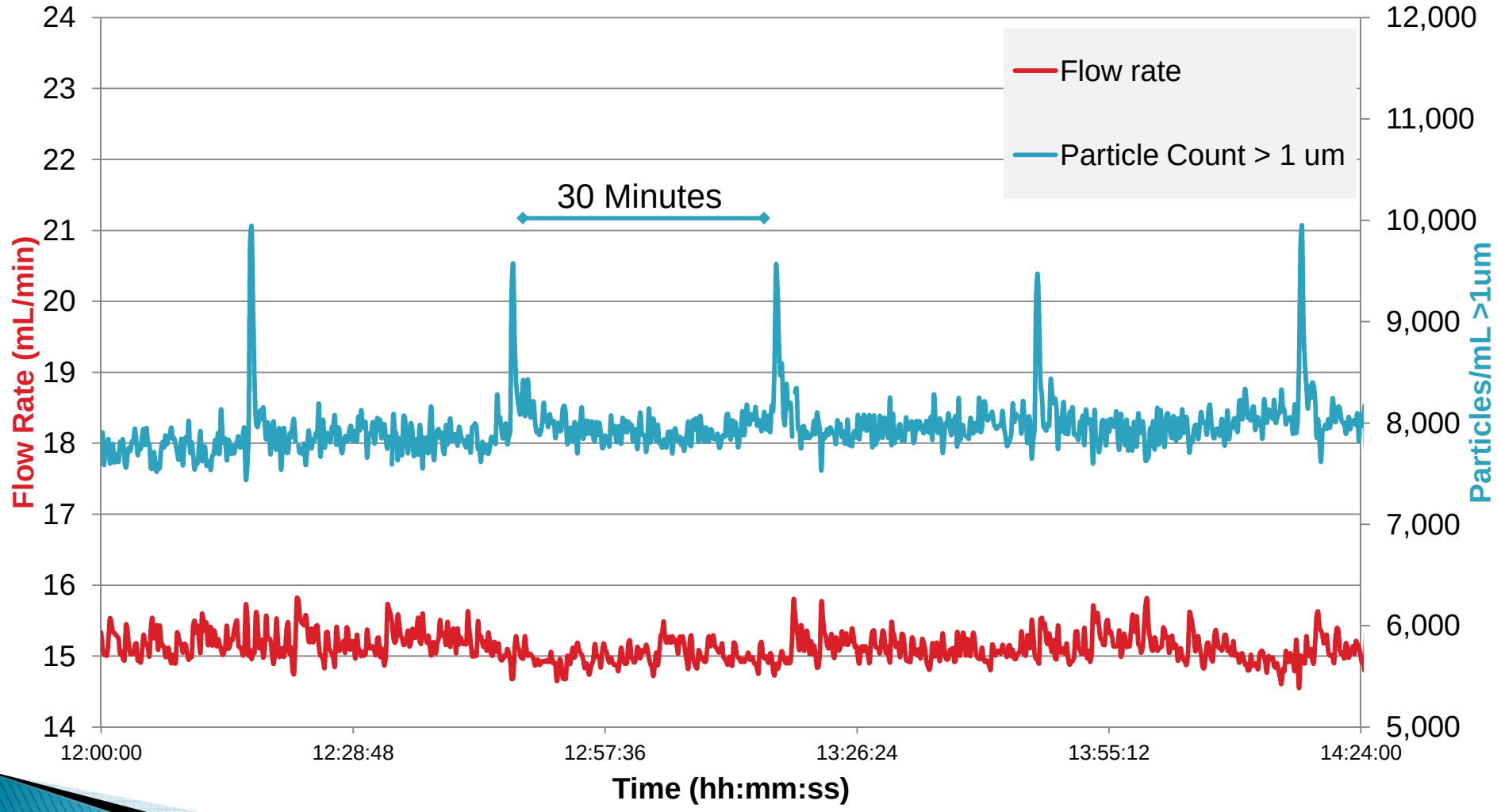
SlurryScope tales from the sub-fab

- Several examples of live sub-fab data taken from SlurryScope qualifications
- Both silica & ceria slurries are represented
- No simulations, no staged events, no chicanery of any kind
- *Wafers were probably harmed during the making of this data set*

- What's going on in ***your*** slurry?

SlurryScope tales from the sub-fab

Spikes in particle counts every 30 minutes
while flow rate remains constant



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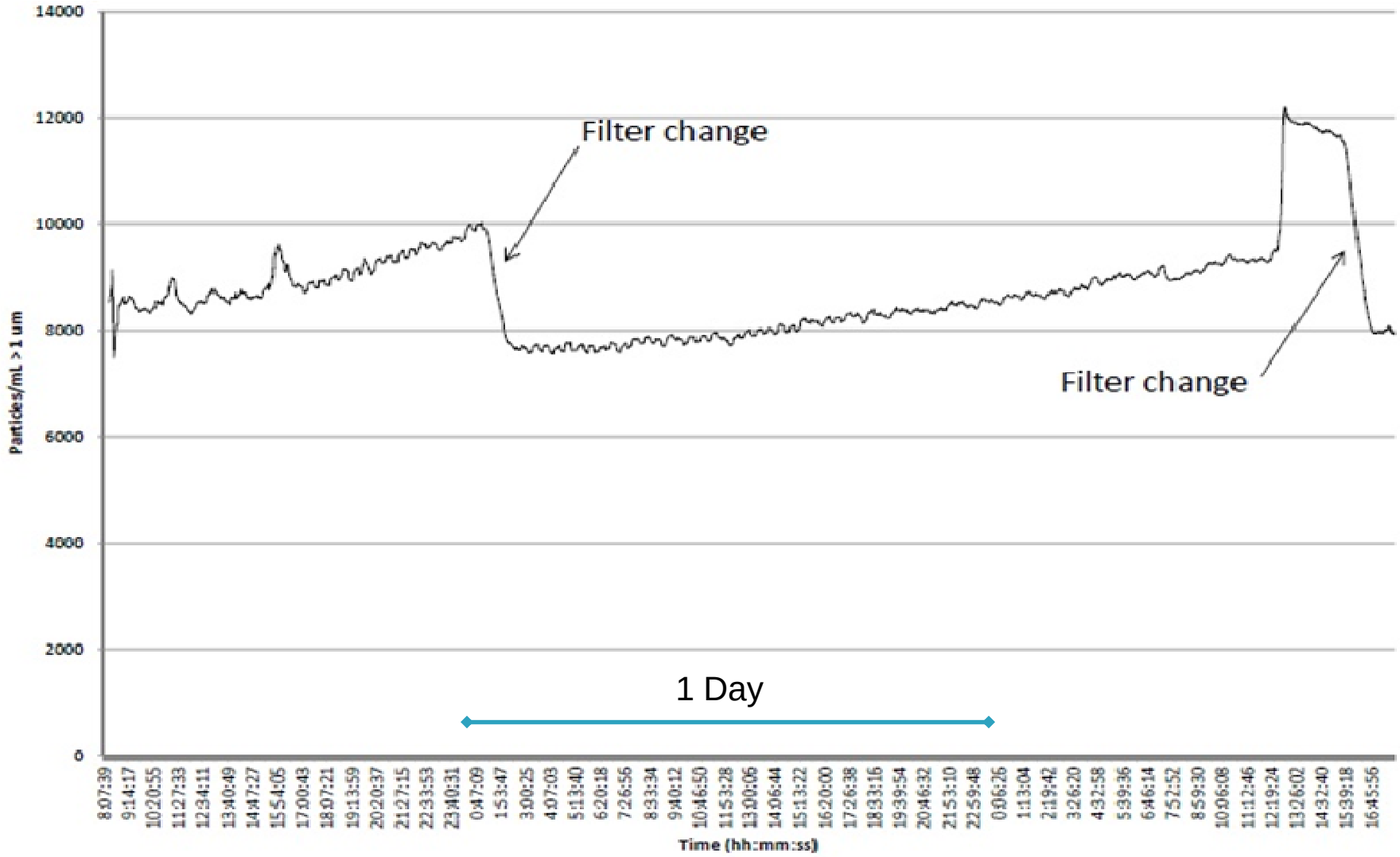
SlurryScope tales from the sub-fab

LPC Shifts Due to Filter Changes



Ref: ASMC May, 2012; A. Kim, Mega Fluid Systems & M. Parkin, Vantage Technology Corp.

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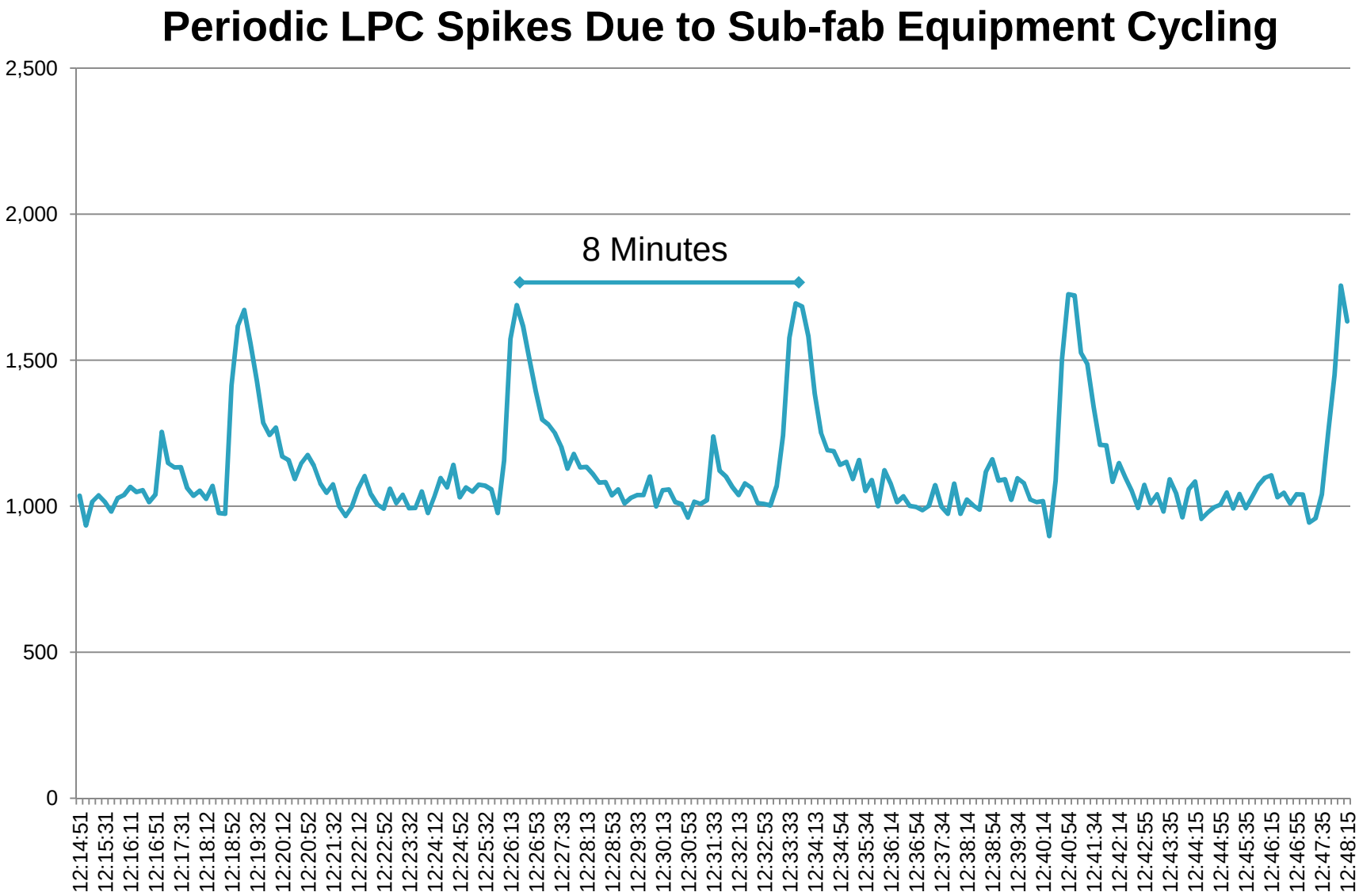
SlurryScope tales from the sub-fab



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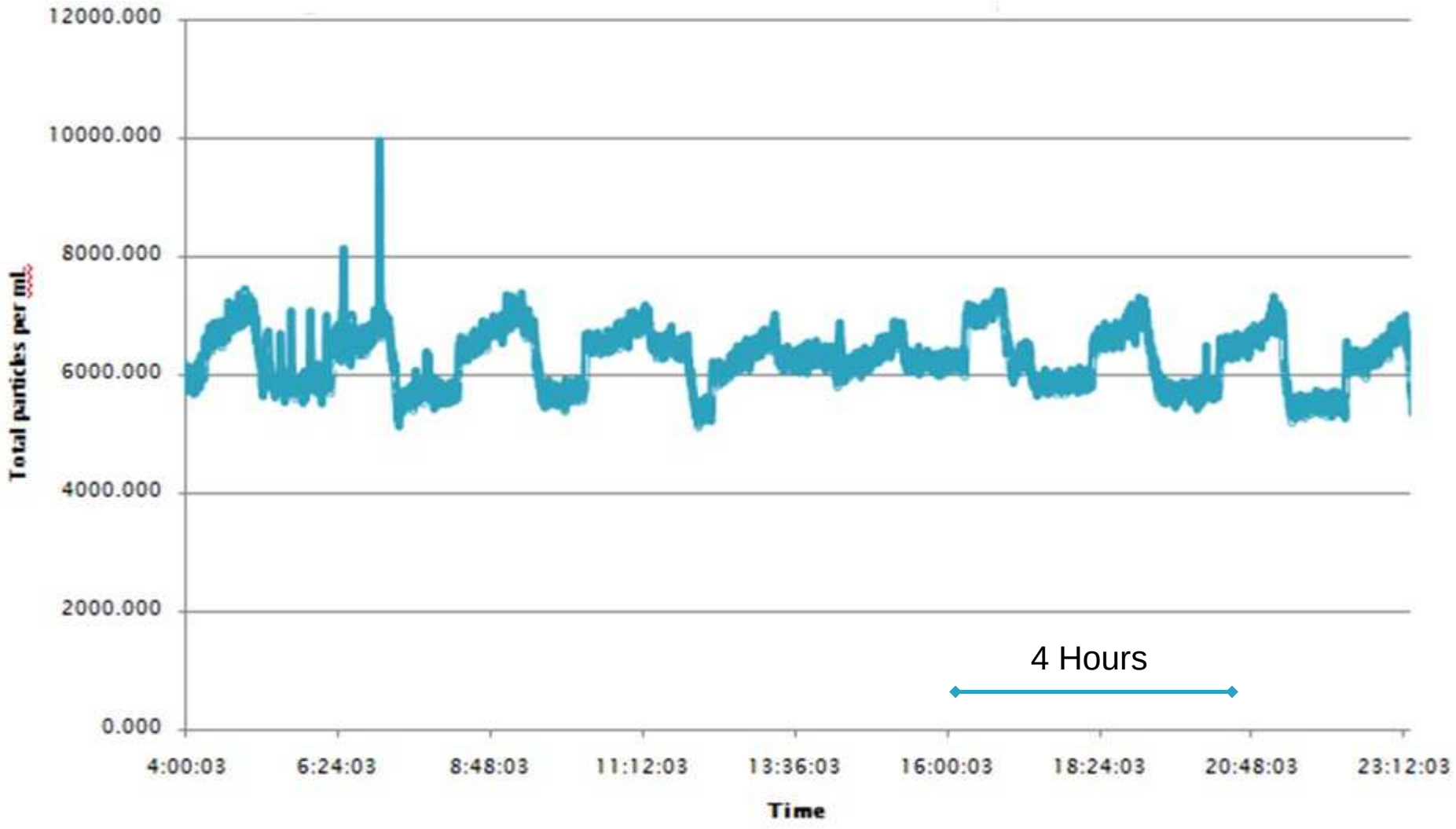
SlurryScope tales from the sub-fab

Square wave caused by shift between tank A & tank B in SDS



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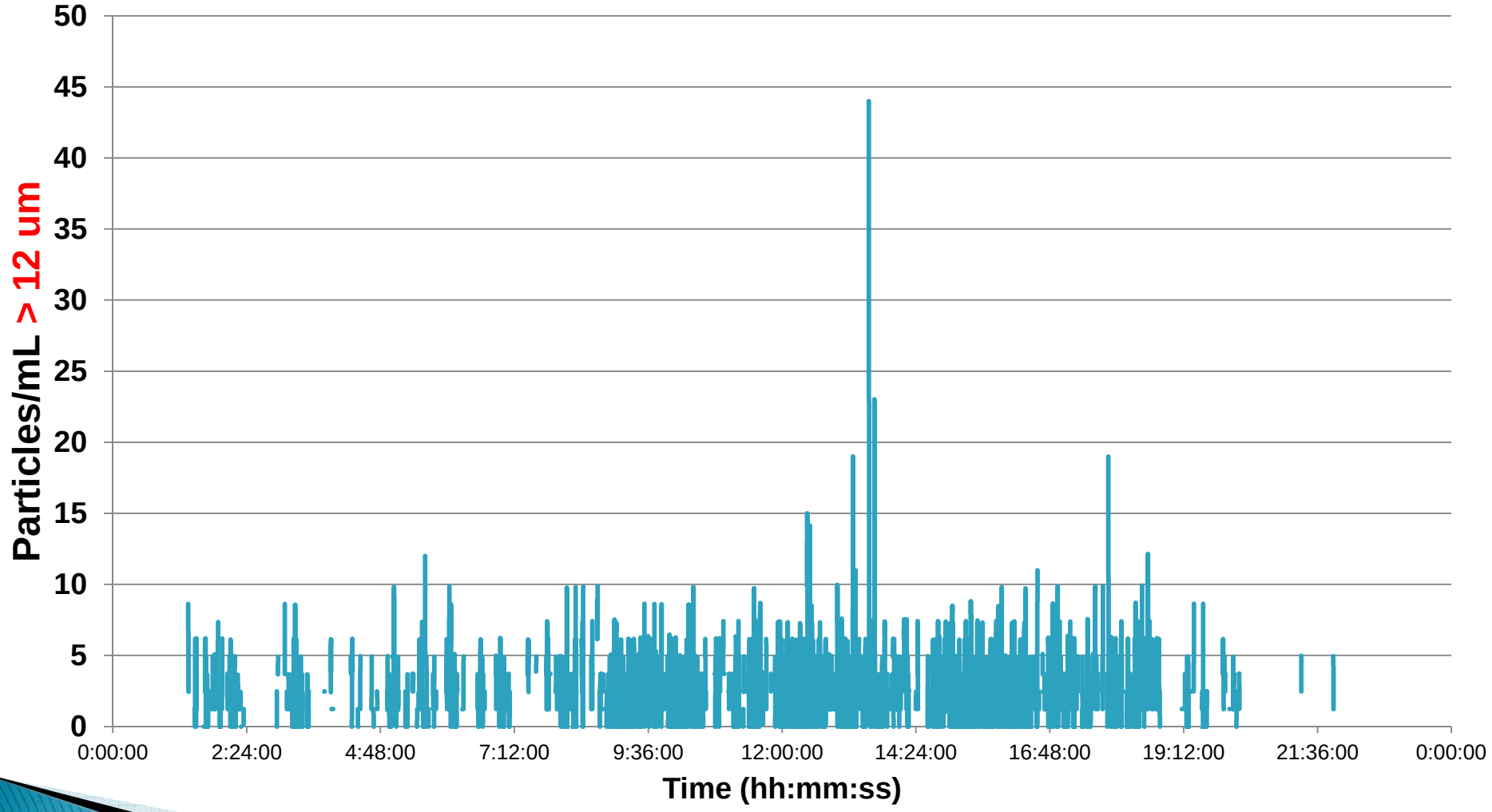
SlurryScope tales from the sub-fab

Point excursion observed in >12µm range

with no evidence of same in 1-12µm range



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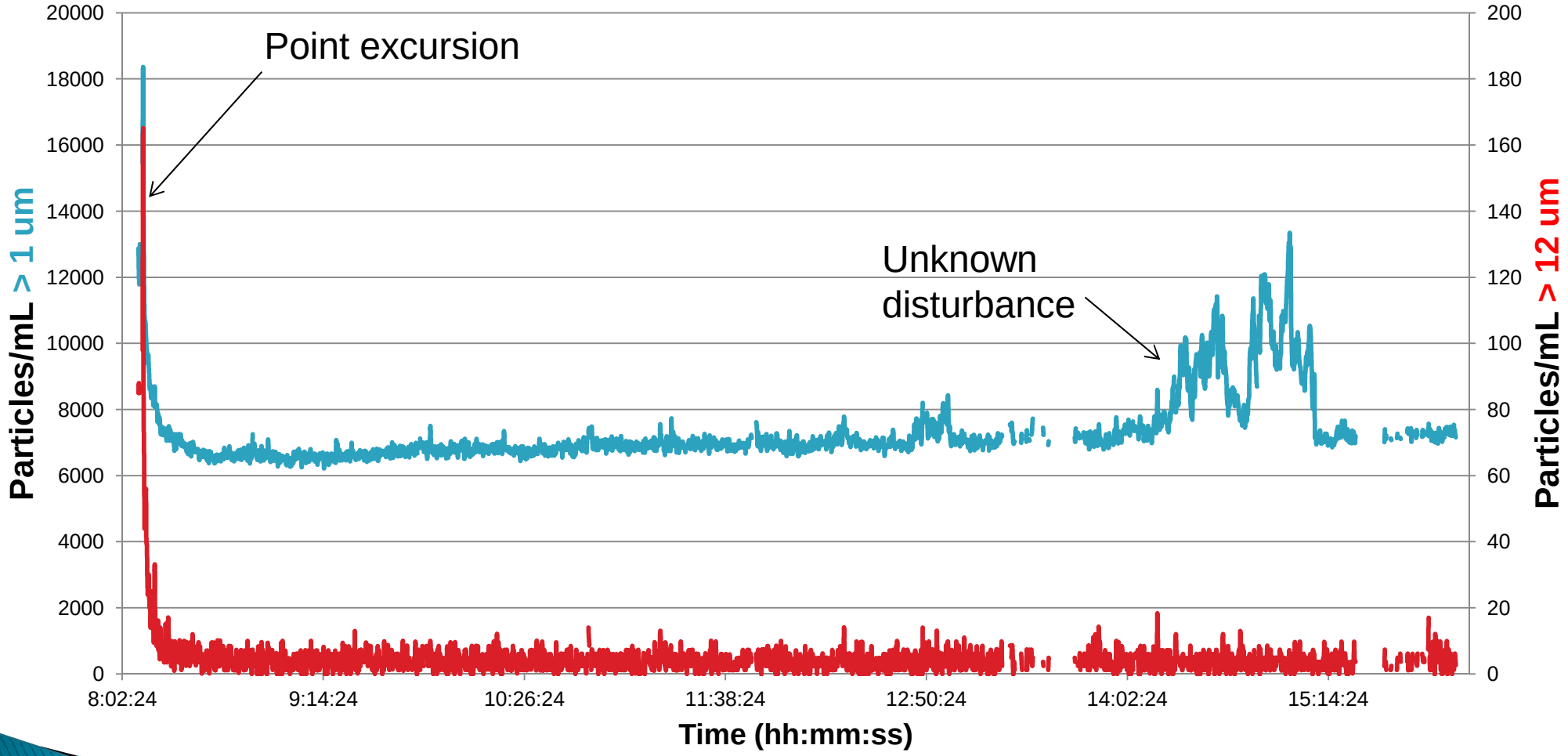
SlurryScope tales from the sub-fab

- Point excursion observed across full size range ***(typical)***
- Unknown LPC excursion at small particles only



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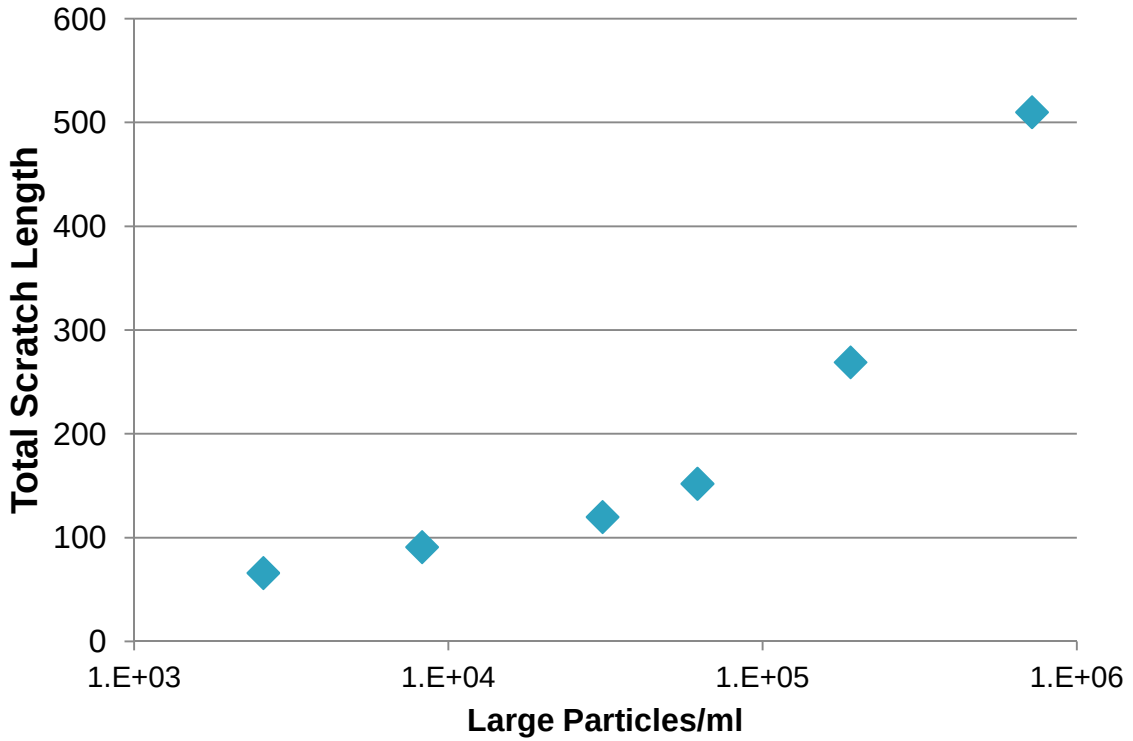
Implications for Fab Operations

- Periodic slurry monitoring *can* assist *post-mortem* diagnosis of wafer scratching
  - Cannot prevent wafer scratching from occurring
  - Low probability of capturing brief LPC excursions
  - Low probability of capturing LPC periodicity

- Continuous online slurry monitoring can identify patterns and practices that contribute to LPC excursions
  - Identify and eliminate root causes of LPC shifts
  - Reduce the incidence of slurry-induced wafer scratching
  - Applies 6σ principles to prevent wafer scratching

Implications for Fab Yield

- Vantage / Ebara experimental data shows a quantitative relationship between LPC and wafer scratches
- Customer feedback corroborates quantitative correlation across a variety of fab conditions and slurry types



Ref: Feb. 22, 2012 webcast at http://techcet.com/presentations/

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Conclusions

- Periodic sampling does not reflect the dynamic behavior – *and misbehavior* – of slurry systems in a fab environment
- Continuous monitoring of undiluted slurry provides ***new information*** that allows LPC sources to be traced and eliminated, bringing CMP in line with 6σ process defect control principles
- You won't know what's happening in your slurry line until you look…

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Additional Information

- Semicon West 2012: Malema Booth 625
- Semicon West 2012: Levitronix Booth 1440
- NCCAVS CMPUG May, 2012; M. Fury
- ASMC May, 2012; A. Kim, Mega Fluid Systems & M. Parkin, Vantage Technology Corp.
- Feb 22 2012 webcast: http://Techcet.com/presentations/
- ICPT 2011
- Solid State Technology, July 2011

- http://www.VantageTechCorp.com/