

How clean is it?

Surface Particulate Contamination and Cleanliness Testing

INTRODUCTION to surface cleanliness testing

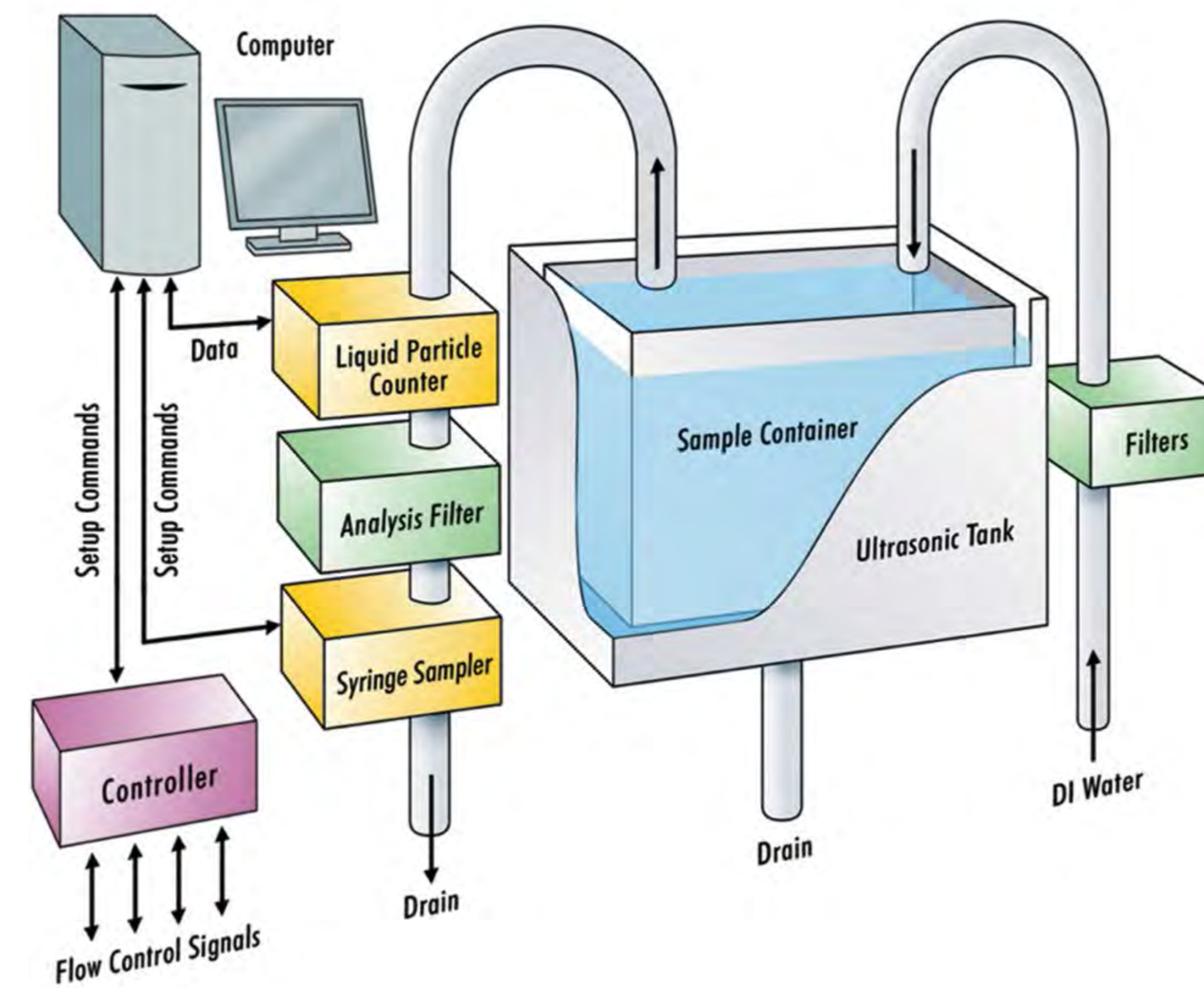
How is it accomplished?

- No scanners exist to examine complex surfaces, so particles must be extracted from the part surface
- Once extracted, extraction fluid must be examined for particle size and number

Ultrasonic extraction

- Used for most types of parts, materials and sizes
- Ultrasonic energy tends to be uniform and removes even strongly bonded particles
- Clean a container using ultrasonics and rinsing
- Requires background measurement w/ ultrasonics
- Place part into liquid and apply ultrasonic energy
- Ultrasonic duration must be timed accurately and be repeatable
- Care must be taken to avoid part damage through erosion

SCHEMATIC of Surfex® Ultrasonic System with Particle Counter



PROCESS

1. Ultrasonic aqueous cleaning

- Variable power levels
- Variable frequencies

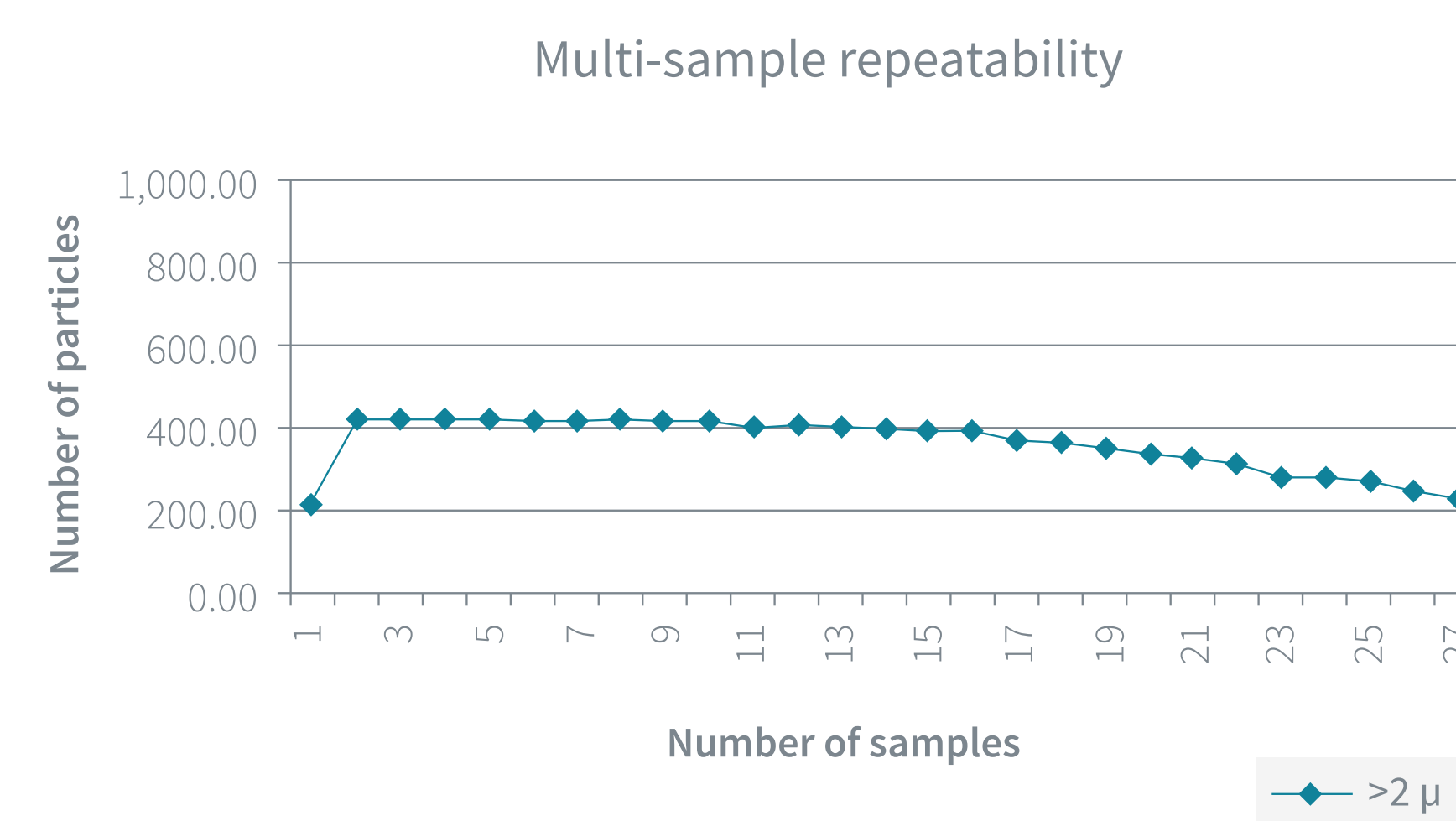
2. Continuous particle monitoring of ultrasonic tank

- Determine number and size of particles that are removed from the parts
- After cleaning/testing parts, determine when the tank is clean enough for the next batch
 - Recirculating system with filtration
 - Single-pass system

3. Particle counting

- Laser optical particle counter
- Commonly measures from 2 μ to over 125 μ diameter particles
- Can measure as small as 0.1 μ
- In well-constructed tests, it is not necessary to measure entire volume of fluid

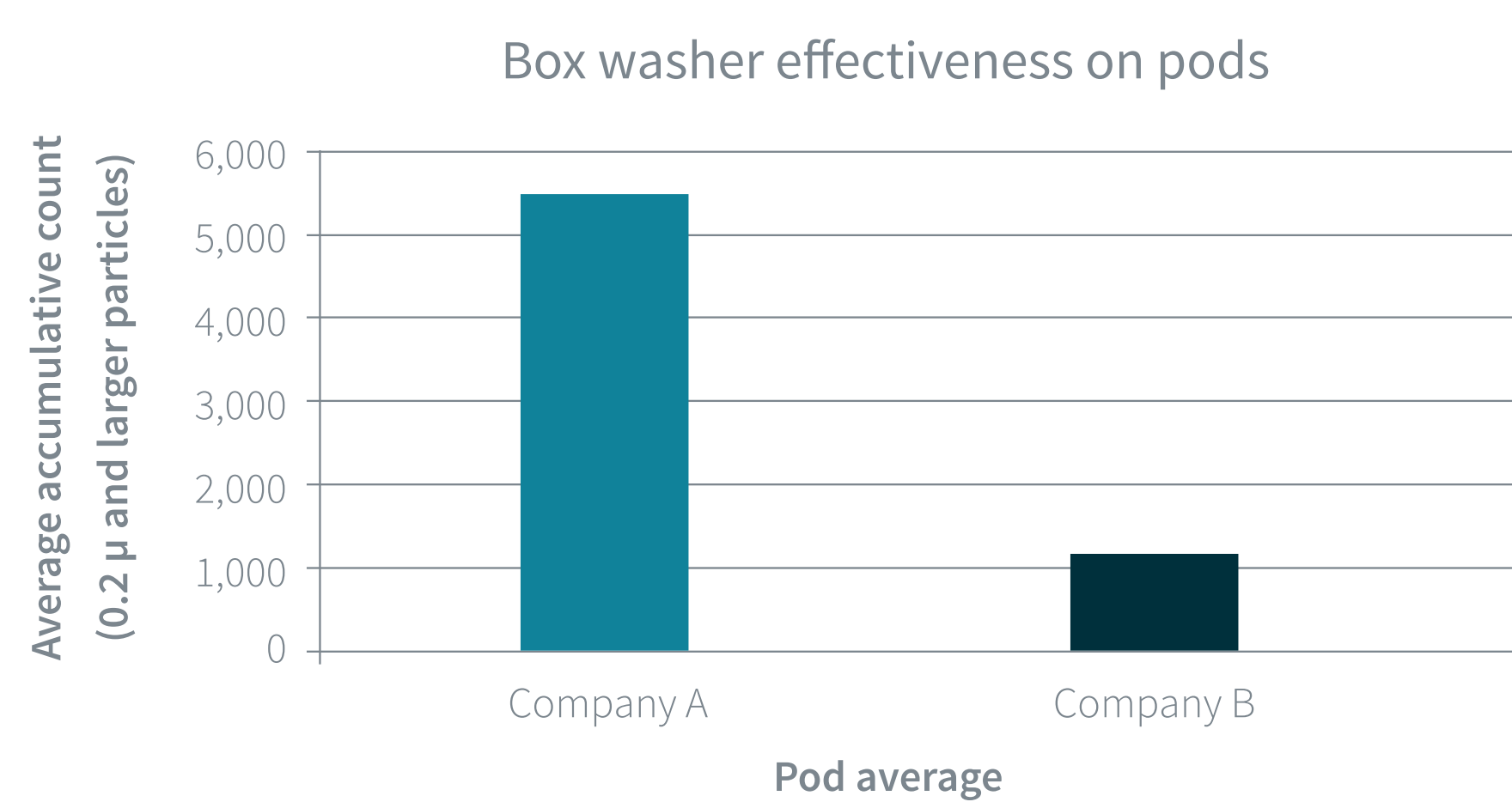
Sample repeatability



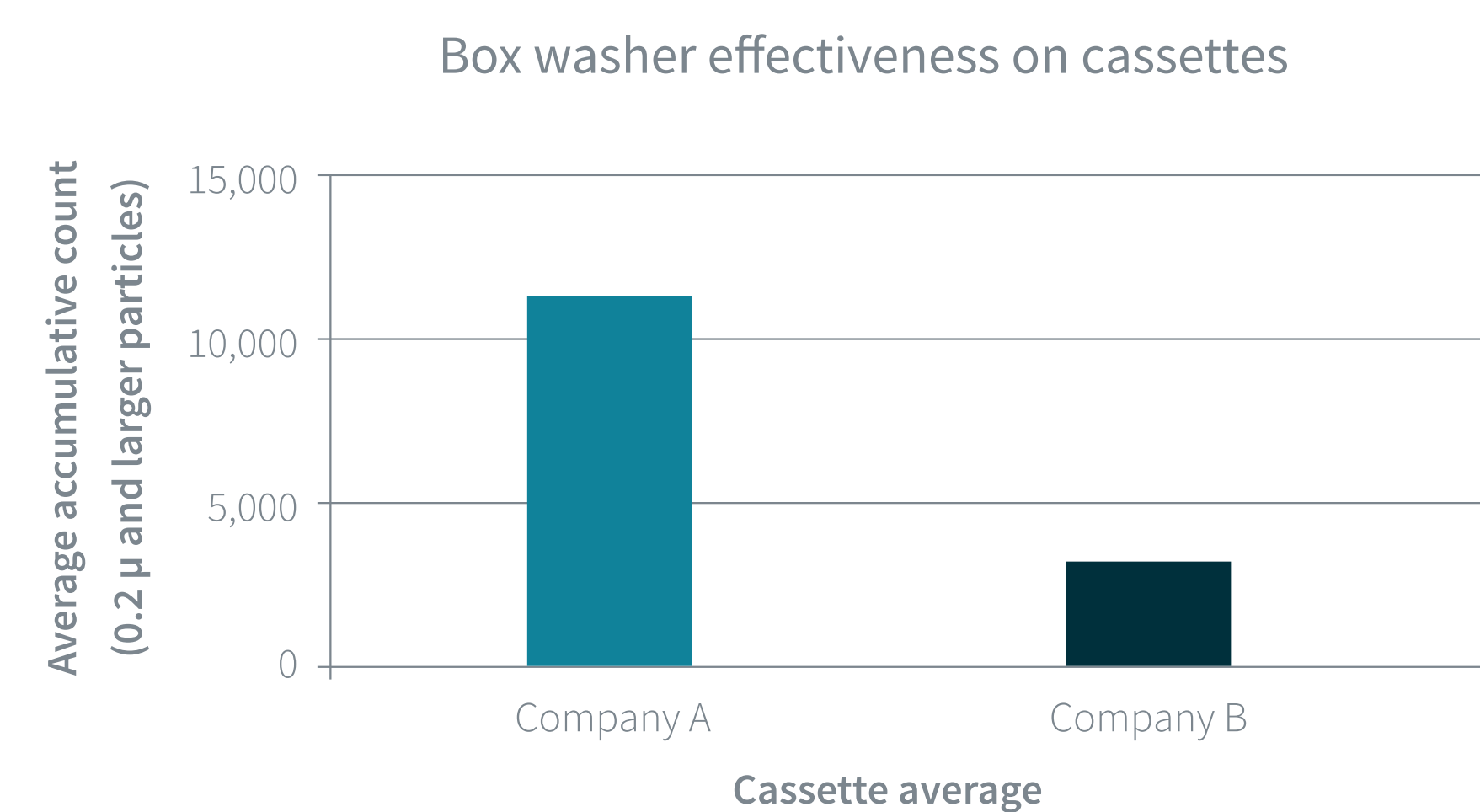
Data analysis from the systems

1. Compare performance of different cleaning systems
 - Compare consumable cleanliness
2. Validate current process
 - Determine if process changes are improvement or detriment to part cleanliness
 - Establish which part's cleanliness is critical
 - Establish cleanliness specifications on incoming parts/materials

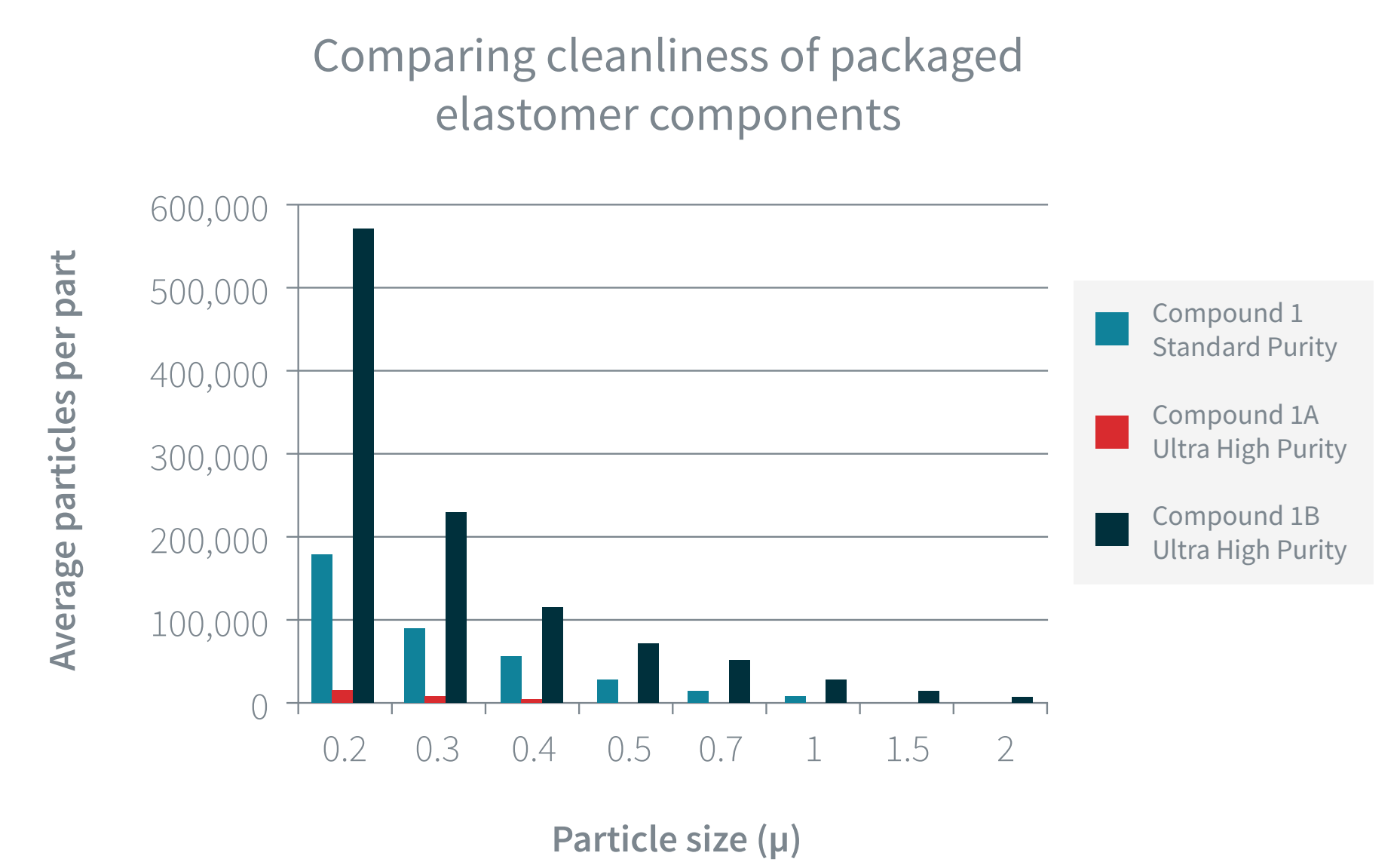
Evaluating performance of SMIF pod wash system



Evaluating performance of particle removal from cassettes

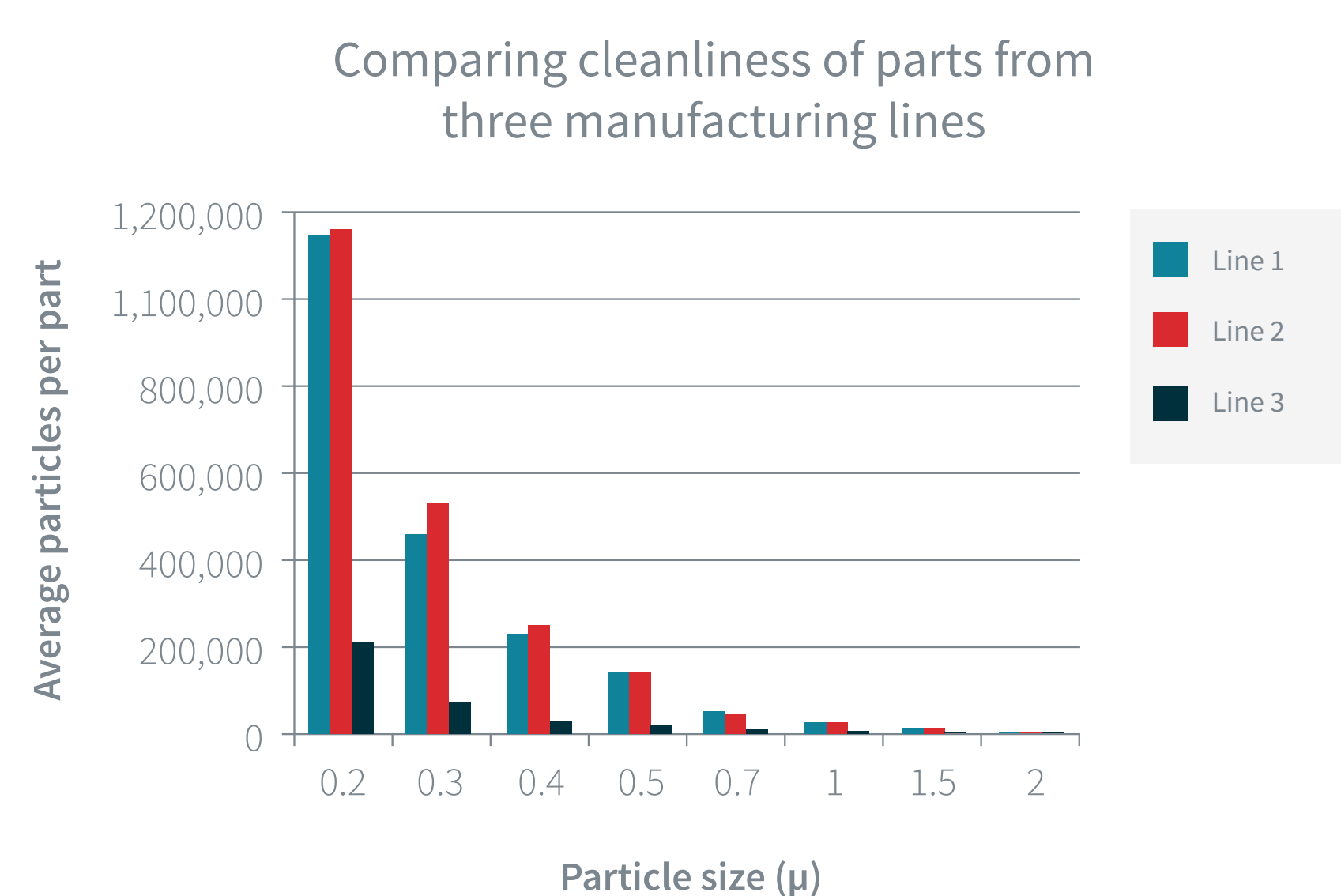


Troubleshooting incoming components

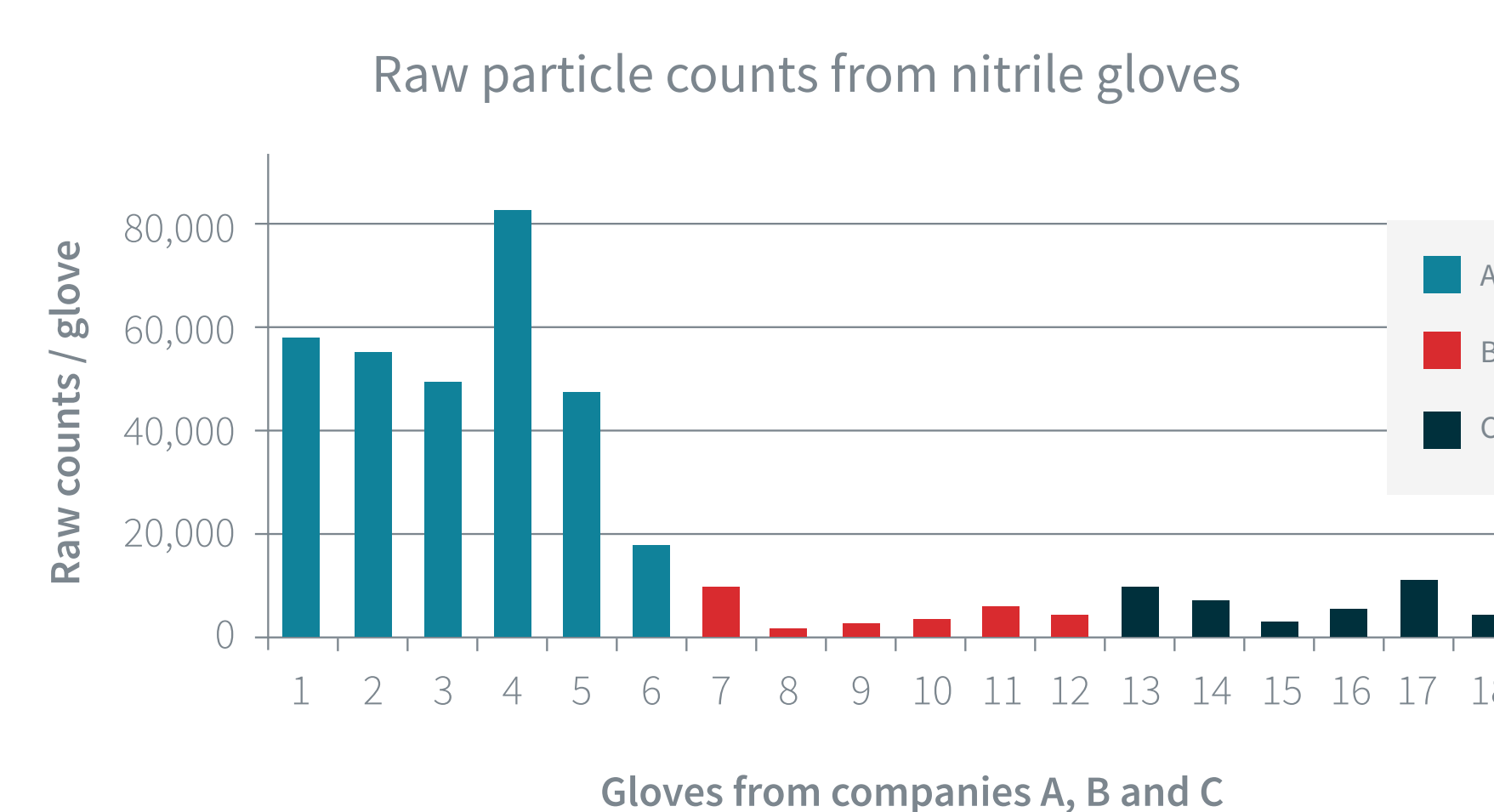


Identifying source of contaminated parts

Manufacturing lines in three different countries



Consumable testing – nitrile gloves

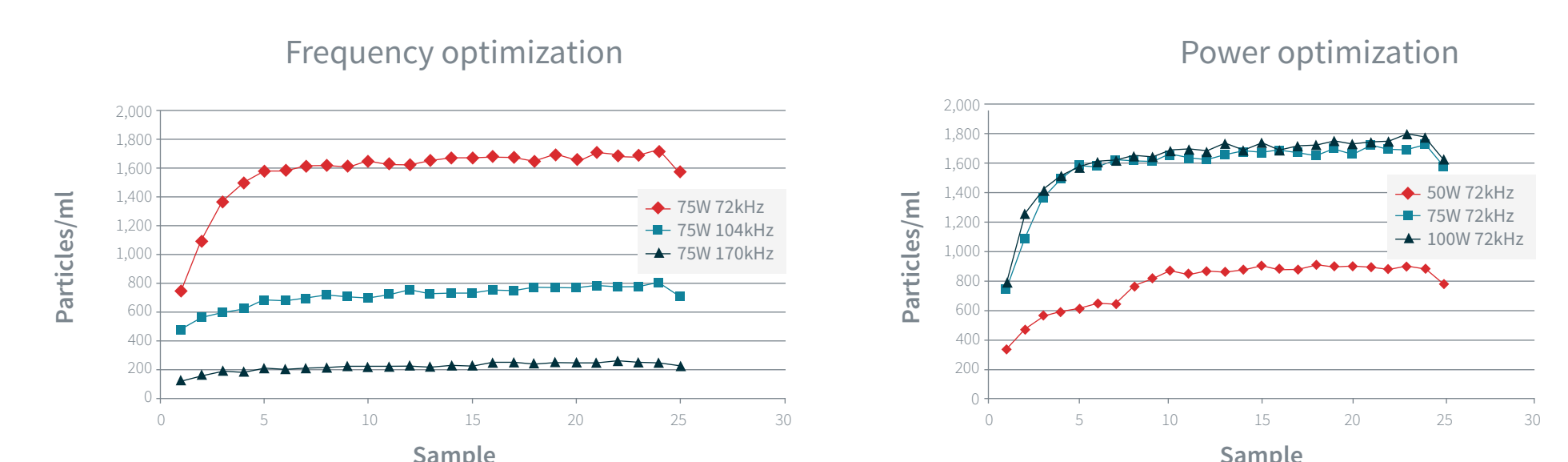


Cleaning optimization

Optimization procedure to determine:

- Ultrasonic frequency
- Ultrasonic power
- Extraction time

Without damaging part and maximizing particle extraction



CONCLUSION

- Surface contamination testing provides valuable information about the cleanliness of critical components
- It helps gauge the performance of the cleaning system
- It reduces uncertainty about the final assembly