

Aerosol Applications



Agenda

Aerosol Applications



- Monitoring Cleanrooms
- Special Applications
- Monitoring Isolators
- Monitoring Minienvironments
- Case Studies
- Design Tips



Monitoring Cleanrooms



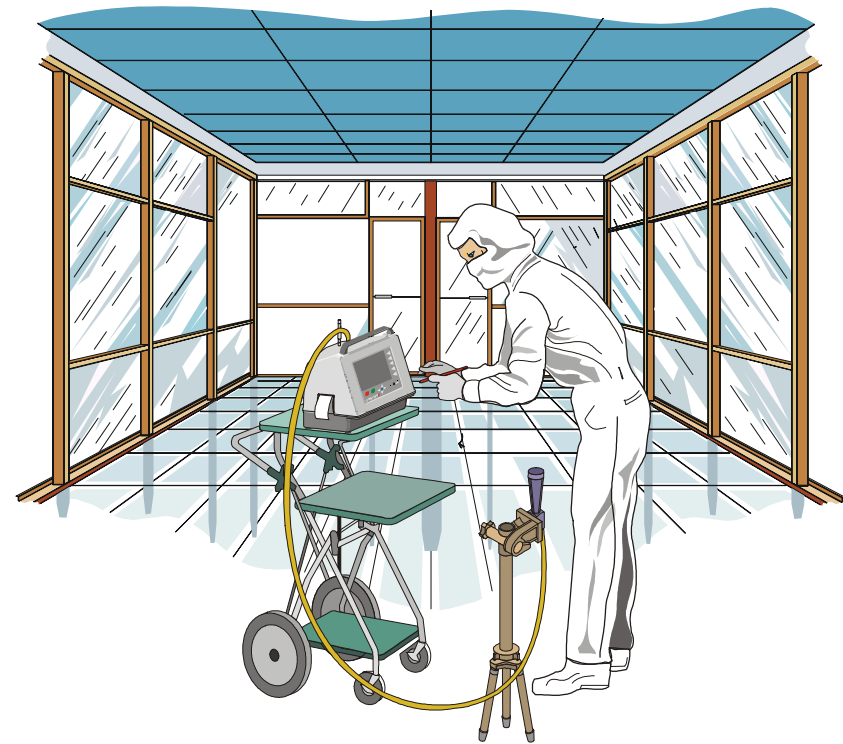
- **Mobile Monitoring**
- **Dedicated Monitoring**
- **Manifold Monitoring**



Cleanroom Mobile Sampling



- **Move particle counter from location to location**
- **Multiple, scheduled sampling locations**
 - Every day/shift
 - Cleanroom validation
- **Troubleshoot sources of contamination**
 - Filters
 - Work area
 - Process equipment



Cleanroom Mobile Sampling



■ Pros

- Good for long-term trends in less clean areas
- Deploy rapidly; Reposition easily
- Lower capital cost than dedicated system
- Good “starter system”

■ Cons

- Miss intermittent events
- High personnel costs
- Equipment gets in workers’ way
- Equipment sometimes moved in mid-sample
- Presence affects employee behavior

Particle Counters Portable

- **Pros**

- Dedicated or portable
- Fast Sampling
- Mobile
- Fully calibrated & certified
- Results saved to Memory
- Battery/Mains-operated
- Built-in Printer
- Cleanroom Validation

- **Cons**

- Labor Intensive
- More Expensive



Particle Counters HHIPA Accessory



HHIPA = Hand-Held, Isokinetic Probe, Audible

- **Filter testing or finding problem**
- **Detect source via hearing**
“Geiger counter” beeps
(no need to watch display)
- **Flexible, rapidly-deployed**
- **Labor intensive**



Particle Counters Hand Held



- **Pros**

- Lightweight
- Highly Portable
- Inexpensive
- Fully calibrated & certified
- Results stored
- Battery operated

- **Cons**

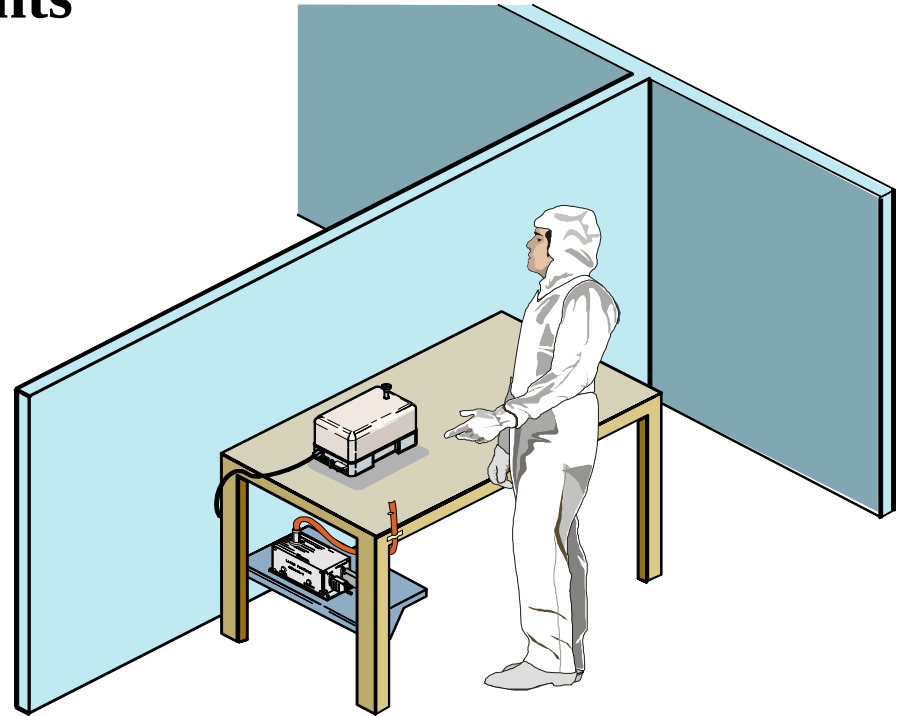
- Labor Intensive
- Low Flow Rate
- No printer
- Poor for large particles
- Not for heavy usage



Cleanroom Dedicated Monitoring



- Goal: Don't miss any important events
- Continuous monitoring of critical points
- Select critical sample points throughout production environment



Cleanroom Dedicated Monitoring



- **Pros**

- **Best monitoring possible**
- **Continuous coverage of critical points**
- **Brief, intermittent events captured**
- **Can put more emphasis on monitoring the most critical points**
 - Sample from every critical point
 - Set differing sample intervals (10 min vs. 10 sec)

Cleanroom Dedicated Monitoring



- **Pros (continued)**

- Automated, hence lower personnel costs
- Easier to rotate out for maintenance
- Allows cost-savings of using sensor units (instead of particle counters)

- **Cons**

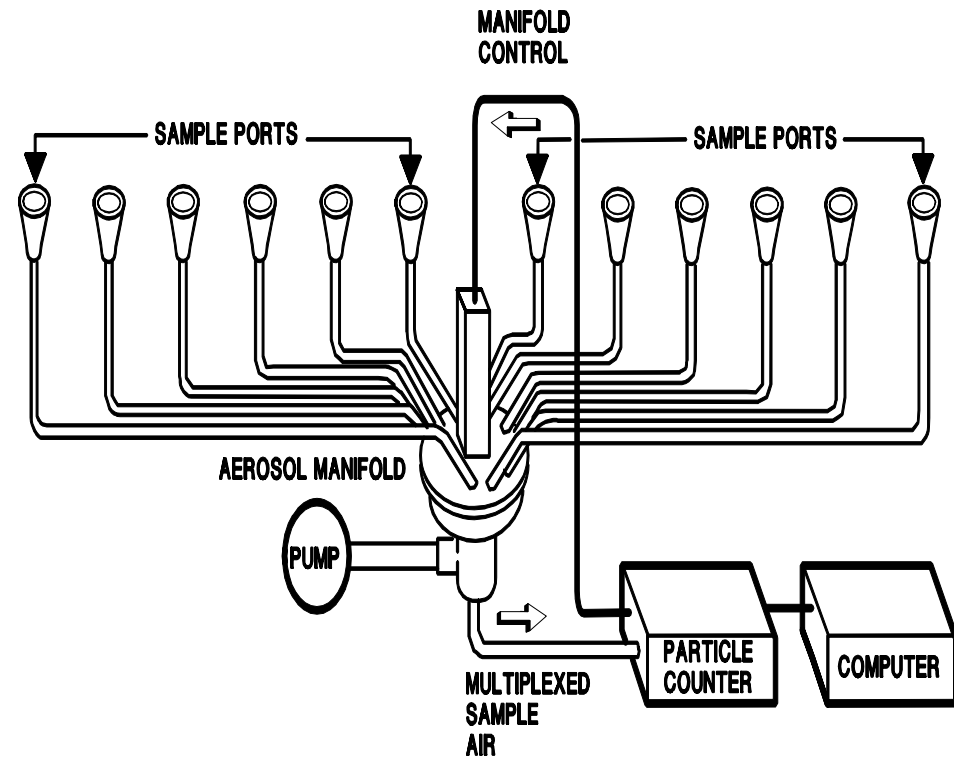
- More instruments
- Higher equipment cost
- Higher maintenance cost



Cleanroom Manifold Monitoring



- Goal: Multiply particle counter coverage by multiplexing samples from many locations
- Sample tubing runs from manifold to each location

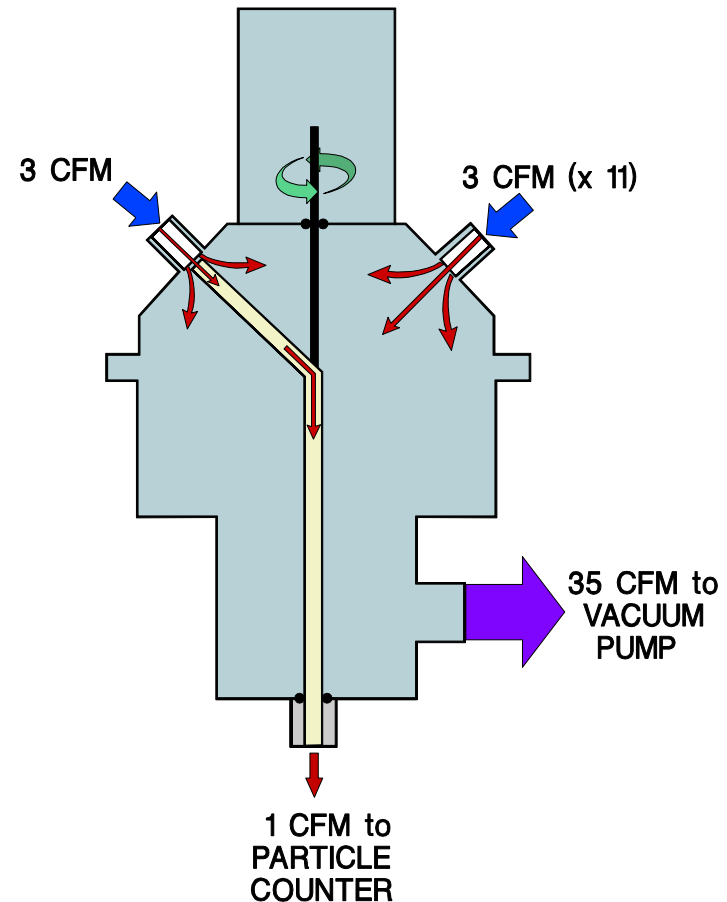


Multiplexed Monitoring of a Facility using an Aerosol Manifold

Cleanroom Manifold Monitoring



- Manifold's pump draws 2-3 CFM continuously from each sample location
- Manifold "sipper tube" samples from ports sequentially
- Particle counter's pump draws continuously from "sipper tube"
- Counter monitors ports sequentially



Cleanroom Manifold Monitoring



■ Pros

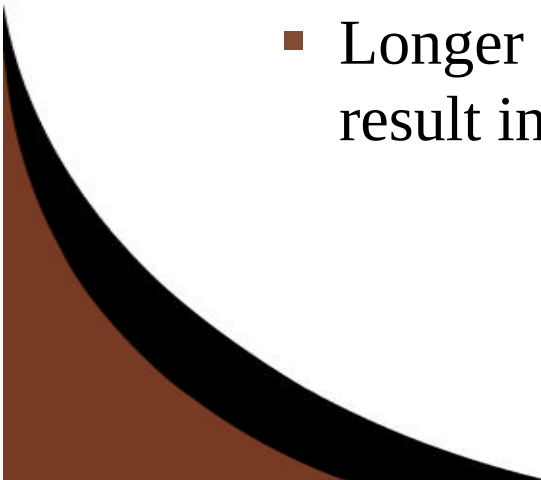
- Increased coverage area
- Samples from more points than single, dedicated particle counter
- Good for detecting long-term trends
- Lower cost per sample point (than dedicated)
- Automated, hence lower personnel costs (than mobile sampling)
- Good solution for less critical areas

Cleanroom Manifold Monitoring



■ Cons

- Sequential instead of Continuous Sampling
- Samples a point <10% of time
- Can miss intermittent events
- No redundancy; can't rotate unit out for maintenance
- Difficult to install (or alter) in existing facilities
- Longer lengths of (and more bends in) sample tubing result in drop-out of larger particles



Monitoring Modes Comparison



	<u>Dedicated</u>	<u>Manifold</u>	<u>Mobile</u>
Detection	High	Medium	Low
Equipment Cost	High	Low	Low
Installation Cost	Medium	High	Low
Labor Cost	Low	Low	High

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Aerosol Applications



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- **Special Applications**
- **Monitoring Isolators**
- **Monitoring Minienvironments**
- **Case Studies: 300 mm Fab**
- **Design Tips**

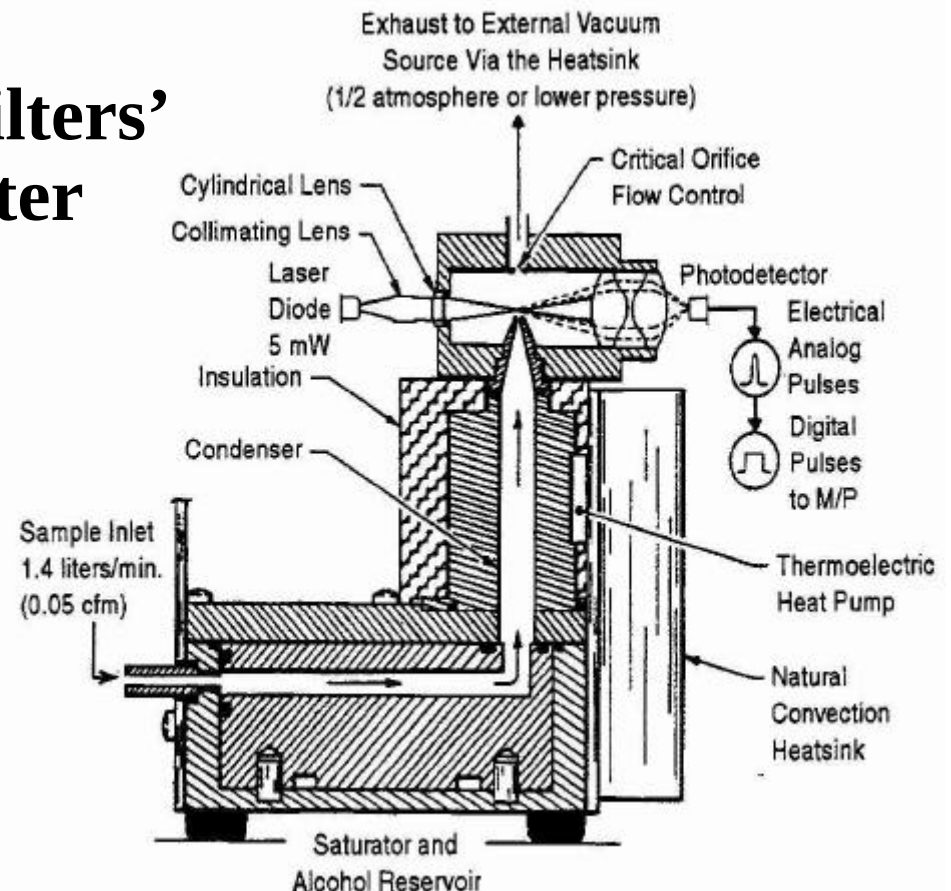


Counting the Smallest Particles

Condensation Nucleus Counter (CNC)



- As small as $0.01 \mu\text{m}$ particle sensitivity
- Sensitive below HEPA filters' most-penetrating diameter
- Considerations
 - Can't tell size
 - Low flow rates
 - High-maintenance
 - Consumes fluids
 - e.g., Butyl Alcohol



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