

# Basics of Particle Counting, Part 2

by Jason Kelly

## Basics of Particle Counting - Part 2

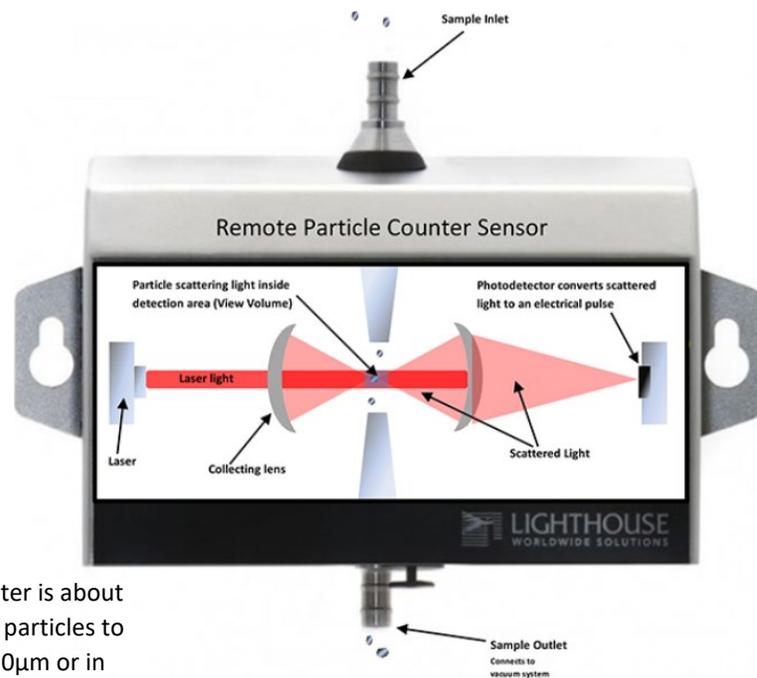
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A particle counter is an instrument that detects and counts particles not visible to the naked eye. Airborne Particle Counters (APC's) specifically use light scattering techniques to count particles in an air sample. A light source (typically a laser light) is used to illuminate the particle as it passes through the sensor. As the particle passes through the laser light it scatters the light onto a photodetector.



The proportion of light scattered is directly proportionate to the size of the particle and the photodetector converts this light energy into an electrical signal based on the magnitude of the light energy.

The diagram above illustrates the particle as it is pulled through the APC sensor. The scattered light reflects onto a photodetector cell. The light energy is converted into a millivolt signal and this pulse or signal is sized appropriately and counted. This is the basic principal of particle counter operation.

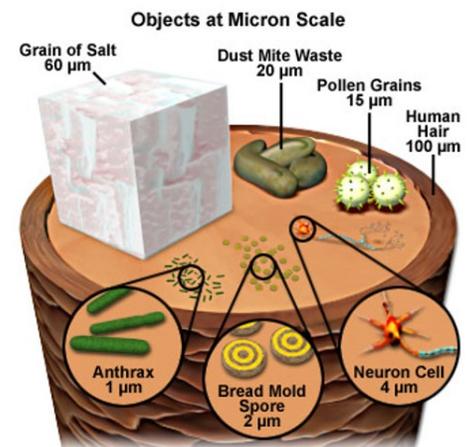


### How big is 1µm?

1µm is a relatively small size. The average human hair diameter is about 100µm. A grain of salt can be as small as 60µm. The types of particles to be monitored in a cleanroom range from 0.1µm up to over 20µm or in some cases in the automotive industry larger particles up to 100 can affect the spray paint process causing defects and costly reworks.

### What does Particle Counter resolution mean?

When selecting an APC it is important to consider the smallest size that needs to be recorded. The resolution of a particle counter should be defined in the instrument specification sheet. The resolution is basically the smallest size the APC can record data for. In the Pharmaceutical Industry 0.5µm is typically the smallest size (resolution) that is required to be recorded GMP purposes.



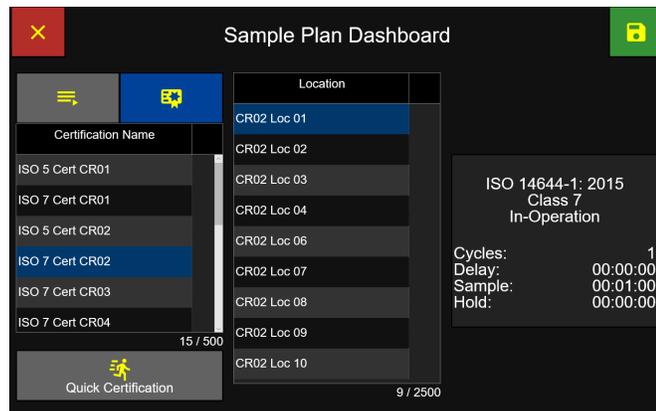
## What is GMP?

GMP refers to the Good Manufacturing Practice regulations promulgated by the US Food and Drug Administration under the authority of the Federal Food, Drug, and Cosmetic Act. These regulations, which have the force of law, require that manufacturers, processors, and packagers of drugs, medical devices, some food, and blood take proactive steps to ensure that their products are safe, pure, and effective.

## Do Particle Counters record data based on GMP regulations?

Yes APC's have the ability for special programs to be setup within the particle counters firmware. Most APC's on today's market can be set up so a specific standard can be selected and based on the sampling completed a Pass/Fail report can be generated.

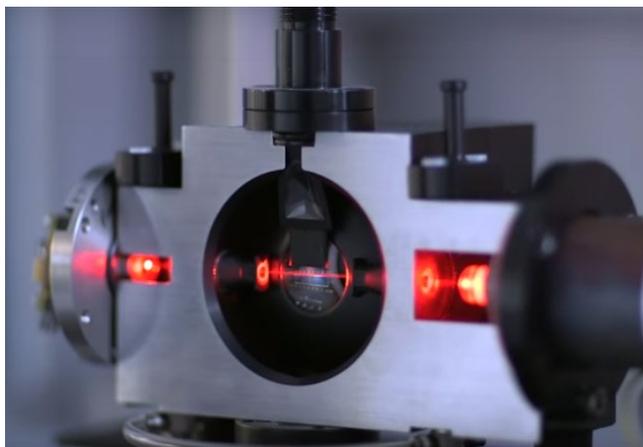
The example here shows a Sample Plan from our ApexZ Portable Particle Counter. The ISO 14644-1 certificate can be printed once the samples have been taken for each of the locations listed. This feature simplifies the whole process and eliminates any operator errors. This enhanced feature and the additional features of the ApexZ interface enables sample plans to be configured and mitigates from operator sampling errors which cause issues such as wasted time, report delays, delays in product release and issues around data integrity.



## Why is the flowrate of the particle counter important?

Flowrate is a critical parameter within particle counters for a couple of reasons. Firstly having accurate flow is tied into the sizing accuracy of the particle counter. The flowrate is tuned into the sensor of the particle counter and since the technology of light scattering depends on an air sample being pulled into the sensor the velocity the particles pass through the sensor must be maintained and monitored continuously. If the flow is too fast then the particle dwell time in the laser is less than expected so the amount of light energy from the particle counter is less therefore the particle is sized smaller than it actually is. The inverse is true if the velocity of the particle is less than expected and the particle dwells longer in the laser light it scatters more light energy and the photodetector converts this light energy to a larger millivolt signal and the particle is sized larger than it is incorrectly.

## How robust is the particle counter?



Particle Counters require careful handling and should be treated with care. With the laser and optic's sensitivity alignment critical to the counting and sizing accuracy of the data particle counters should be treated with respect. Excessive vibration, heavy handling and any mishandling can result in laser misalignment if the sample inlet was to take a knock, or if liquid contamination like aerosol cleaning solution sprays or even liquid product splashes enter the sensor the risk of bad data is high.