

# SP2-D

Single Particle Soot Photometer



## Outcome

The Single Particle Soot Photometer (SP2-D) is the ultimate single particle instrument for super sensitive measurements of refractory black carbon (rBC). With its ability to measure the mass of rBC in individual aerosol particles, it provides the level of detail that no other instrument in the world can.

Soot, i.e., black carbon (BC), is an ubiquitous particles that has a significant impact on human health, structural damage through soiling and, after carbon dioxide, is the most potent pollutant driving climate change through localized warming. Accurate measurements of BC allows us to put protective measures and regulations in place to reduce emissions from wildfires, combustion engines, micro-plastics, and industrial processing plants. The SP2-D also allows researchers to evaluate historical traces of black carbon found in ancient glaciers and in ice cores take from the cleanest of environments such as the Antarctic and Greenland. These ice core records are important because they serve as the only record by which we can understand historical events like wildfires and the evolution of the industrial revolution. As more people move out of rural areas to denser populated cities, air quality and human health become increasingly important global issues; understanding how aerosol particles affect us all, in particular those containing BC, can help to reduce common everyday health problems such as breathing issues and asthma, not to mention the considerable damage soot does to the ecosystem.

## Overview

The SP2-D is Droplet's premier instrument for direct measurement of black carbon in individual aerosol particles. The SP2-D combines unmatched particle-by-particle analysis of black carbon, with a comprehensive toolkit for creating journal-quality reports. Where non-research grade devices deliver aggregated data, the SP2-D delivers detail about each detected black carbon particle, including mass, size, heat of vaporization, and coating. This is all critical information for characterization of pollution sources, accurate description of optical properties, and prediction of health effect.

## Applications

- Pollution characterization
- Air quality and visibility
- Atmospheric and climate research
- Health effects studies
- Combustion emissions
- Black carbon in water, ice, snow

## Advantages

The SP2-D directly measures the black carbon (soot) in individual aerosol particles, not just aggregates of particulates like other instruments. The SP2-D provides single-particle sensitivity, BC coating information, and fast time response. Its high sensitivity, fast response, and specificity to elemental carbon make it the premier instrument for characterizing air pollution sources and documenting thin, atmospheric layers of contamination. It is also ideal for measuring soot in snow, ice or water. The SP2 -D is the reference standard for black carbon measurement.

The instrument comes complete with analyzer, computer, optical head, and analysis software and is suitable for airborne or ground-based use (fixed-site or mobile sampling).



## Product Specifications

### Measured Parameters:

- Single-particle laser incandescence
- Single-particle light scattering
- Temperature
- Pressure

### Derived Parameters:

- BC mass distribution as a function of particle diameter
- Particle number distribution as a function of particle size
- Aerosol medium: Air, 0-40°C
- Response time: 1Hz for standard output products
- Sample flow: 30-180 volumetric cm<sup>3</sup>/minute (typically 120)
- Particle size range:
  - Scattering signal: 200-430nm diameter (this range encompasses the accumulation mode of most particles, i.e., range where most mass is found). This range can be extended to 700nm by doing post-processing of saturated signals.
  - Incandescent signal: Depends on particle density, but 70-500nm mass-equivalent diameter assuming a black carbon density of 1.8g/cm<sup>3</sup>
- Number concentration range:
  - 25,000 particles/second.
  - 0-12,500 particles/cm<sup>3</sup> at standard flow rate of 120 volumetric cm<sup>3</sup>/minute

### Environmental Operating Conditions:

- Temperature: 0°-40°C
- Relative humidity: 0-100% non-condensing
- IP20 rated

### Data System and Power Requirements:

- Data system: On-board CPU, 8 GB RAM, 750 GB hard drive for data storage, user interface via standard keyboard, mouse and monitor (included)
- Software: SP2-D Executable program in LabVIEW and PSI SP2-D Toolkit, IGOR
- Data storage: About 56 hours depending on number of particles
- Power requirements: SP2-D: Universal voltage, external pump 30W

### Weight:

- SP2-D: 26.1kg
- Pump: 3.4kg
- 19" monitor: 3kg
- Dimensions:
  - SP2-D: 48cmW x 61cmL x 26cmH
  - Pump: 20cmW x 25cmL x 10cmH
  - 19" monitor: 37cmW x 22cm L x 39cm H

## Available Accessories

- SP2 Consumables Kit
- Beam Scan Camera Kit
- Nebulizer (for ice core and water)
- Aircraft Inlet
- Science Care Program
- 1 and 2 Year Extended Warranty
- Lifecycle Care Program

## The Droplet Guarantee

Droplet understands how the versatility and performance of an instrument can impact your research, career, and the world we live in. As you strive to provide a better understanding of our planet, we guarantee to be here to support you through your journey.

Whether you are establishing your first laboratory or are a tenured researcher; we have a team of scientists, engineers, and technical staff available to assist with application questions, technical support, data analysis, and training.