Single Particle Soot Photometer (SP2)

A High-Precision Instrument for Measuring Black Carbon Aerosols in Real-Time

INTRODUCTION:

The Single Particle Soot Photometer (SP2) is a state-of-the-art instrument designed to detect and analyze individual black carbon (BC) particles in the atmosphere. Utilizing the Laser-Induced Incandescence (LII) technique, the SP2 offers real-time data on black carbon mass, size, and mixing state—parameters critical for understanding climate impacts, air quality, and health effects.

OBJECTIVES:

- Accurate detection and quantification of black carbon particles
- Real-time analysis of particle size, mass, and number concentration
- Assessment of mixing state (coated vs uncoated BC)
- Support for climate change studies, aerosol-cloud interactions, and source apportionment

KEY SPECIFICATIONS:

- Detection Size Range: 70–500 nm (BC core diameter)
- Detection Limit: <1 ng/m³
- Laser Source: 1064 nm Nd:YAG
- Flow Rate: ~120 mL/min
- Time Resolution: 1 second to 1 minute (configurable)

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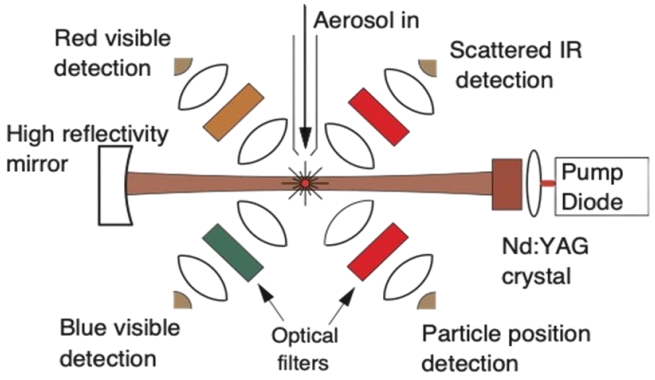
DATA OUTPUT:

- Mass and size of individual BC particles
- Particle number concentration
- Mixing state classification
- Time-resolved BC mass loadings

MEASUREMENT & WORKING PRINCIPLE:

The SP2 uses a continuous-wave laser to heat individual aerosol particles to incandescence. The emitted light from black carbon cores is detected and used to calculate the particle's mass. Scattered light is simultaneously measured to determine particle size and mixing state.



KEY FEATURES:

- High sensitivity for detecting low BC concentrations
- Real-time, single-particle resolution
- Distinguishes between coated and uncoated particles
- Suitable for urban, rural, and remote field deployments
- Integrated with aerosol systems for multi-instrument experiments