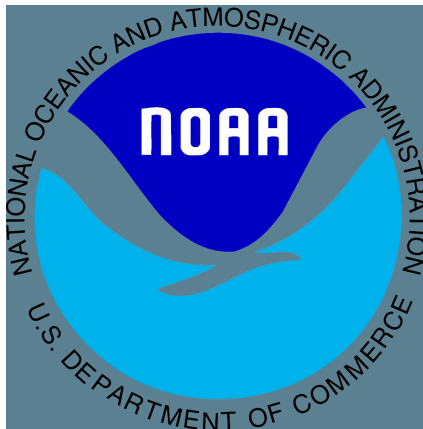


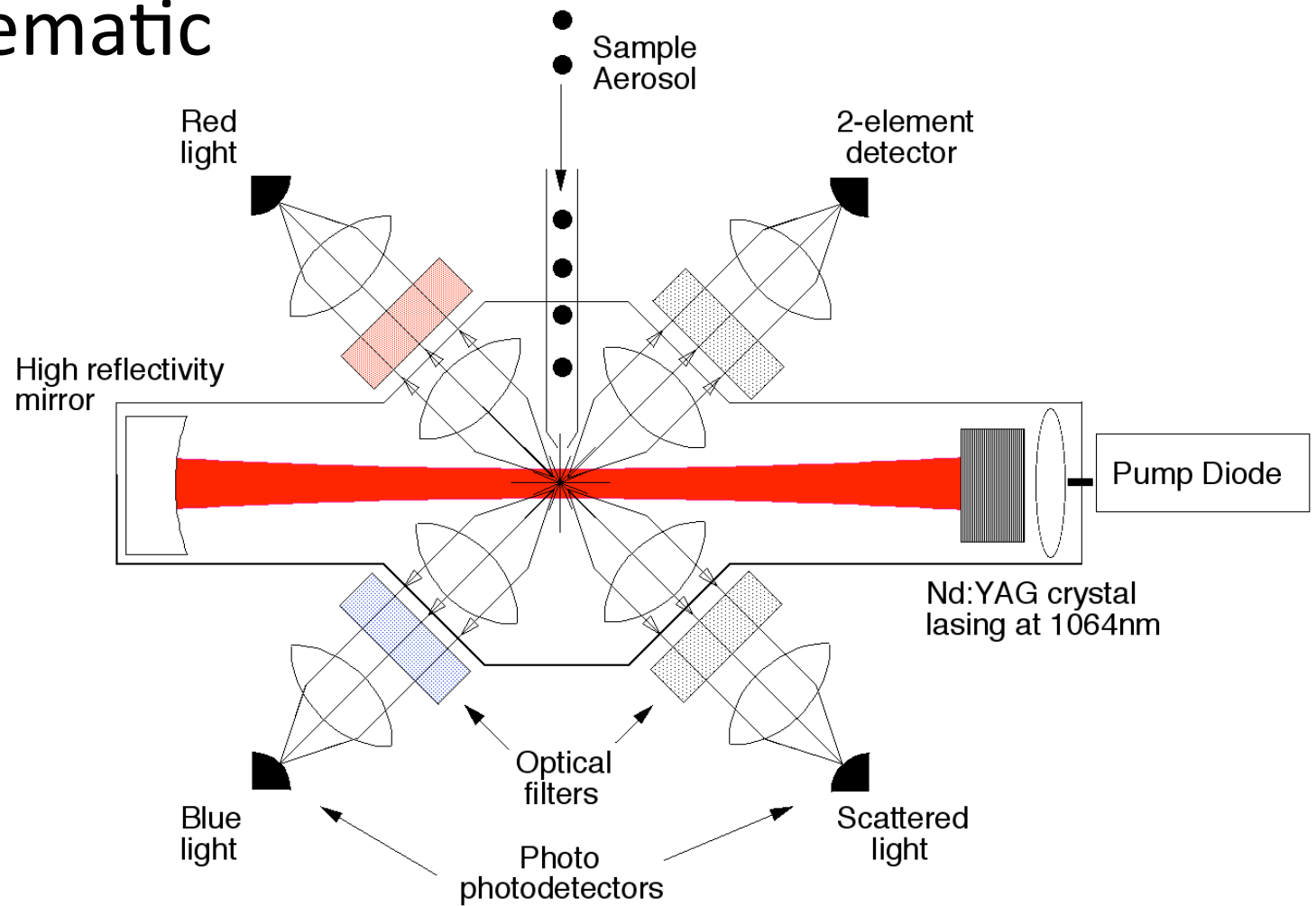
Single Particle Soot Photometer - SP2: Refractory Black Carbon Mass Mixing Ratio

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HIPPO SCIENCE: 3/16/11

SP2 Schematic

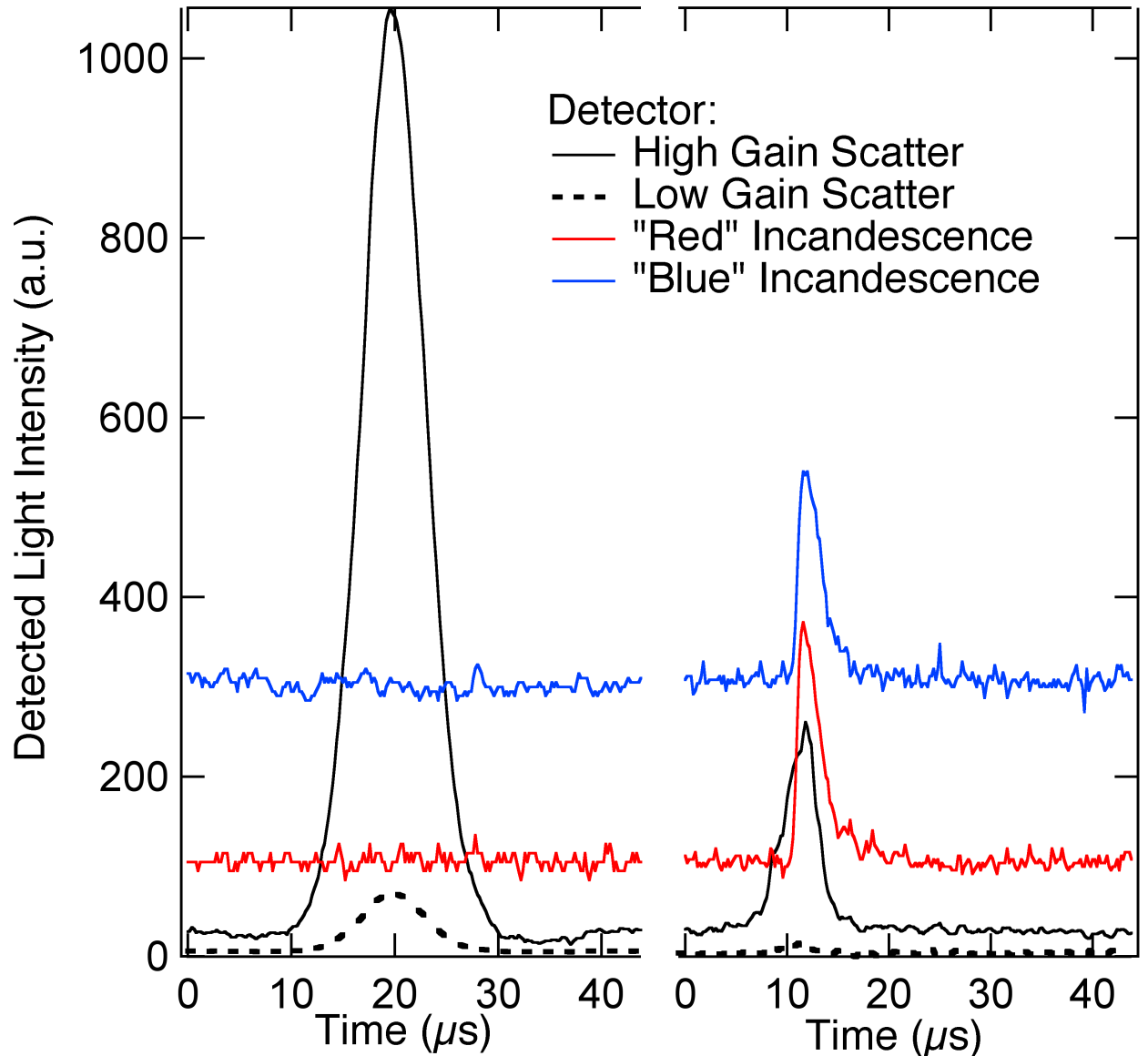


BC detection ~90 - 600 nm Volume Equivalent Diameter
Sampling = 1/4 l/m

Concept demonstrated at Research Electro Optics, Inc. Instrument refined, developed and produced by Droplet Measurement Technology, Inc.

SP2 Schematic

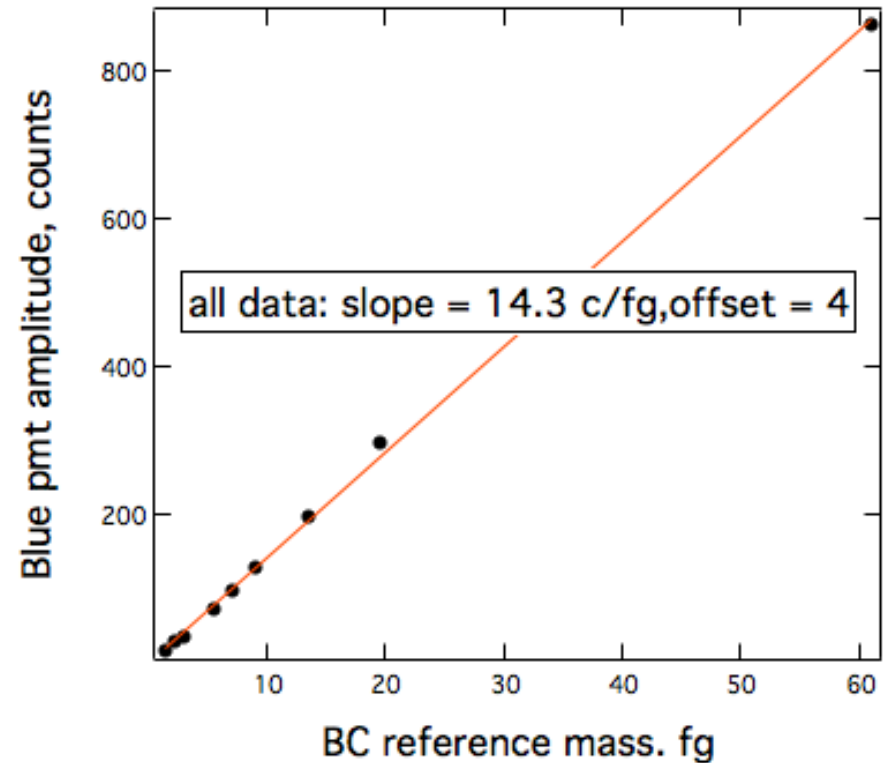
- Gaussian laser beam
- Scattering particles show no sign of heating
- Color of thermal light indicates particle temperature
- Black carbon refractory mass is proportional to peak light intensity



Calibration

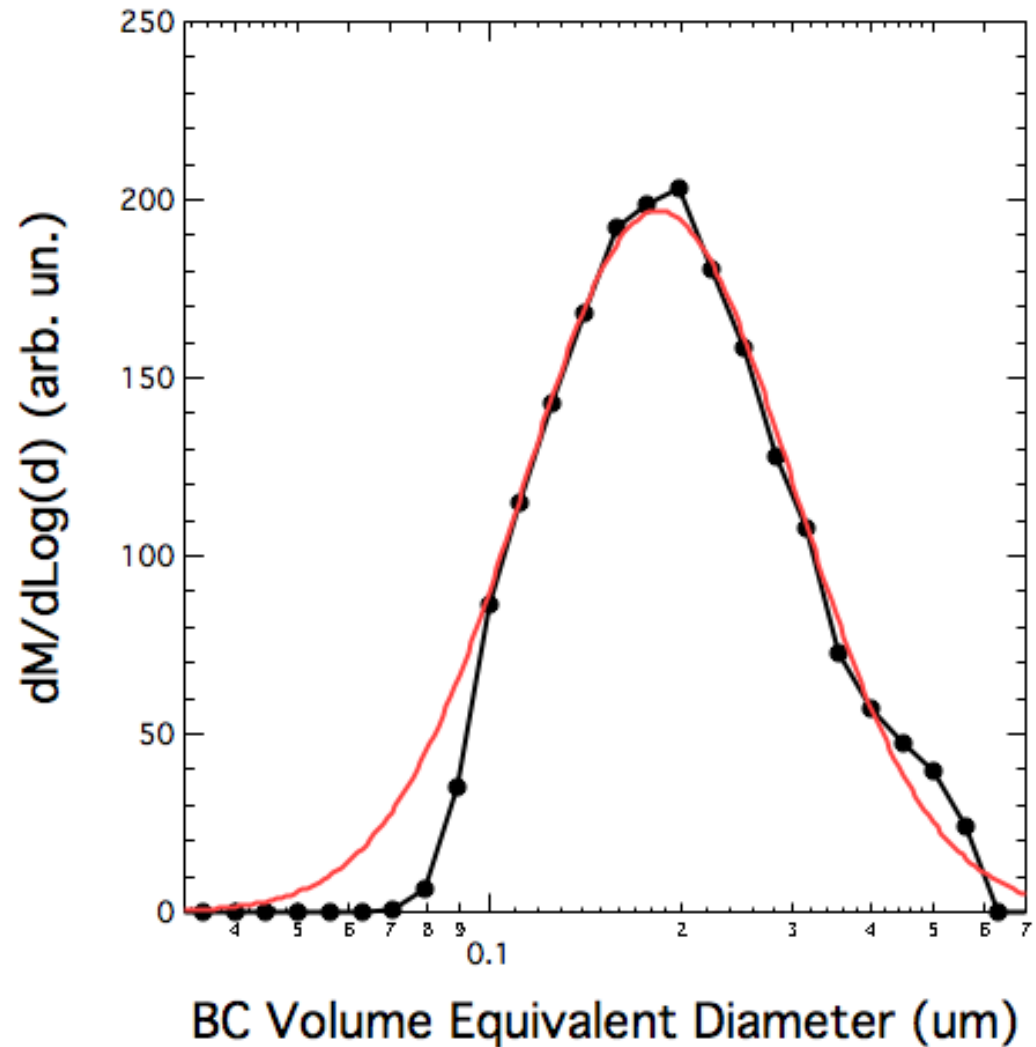
1) Detector sensitivity – size selected BC reference materials. Calibrations at \sim few % stability over each HIPPO.

2) Only one fundamental measure \sim 5% to our standard. However, range of response is on order 40%



Size Distributions to BC Mixing Ratios

Assume all BC mass in single log-normal accumulation mode distribution. Correct observed MMR upwards by ~10% to account for BC mass outside of SP2 detection range.



1. SP2 Data Products:

1. Refractory Black Carbon Mass mixing ratio
 1. At low MMR, poor statistics
 2. At high MMR, $\sim 20\%$ variation due to 1 second sample flow noise
2. BC Size distributions
 1. Require sufficient number particle detections
 2. Missed mass inferred from log-normal fit
3. BC mixing state information

SP2 Data Quirks

- Data only in cloud-free air (at present)
- Rarely sample flow becomes negative
- Very very rarely: BC “burst”
- No time delay correction applied.

H1: Very clear contamination.

H2: Some clear contamination.

H3: Little clear contamination.

Clouds removed via
inspection of (in conjunction):

RICE

PLWC

2DC

CDP

UHAS

SP2

Data Status:

H1: FINAL

H2 and H3: Final quality
check needed.

Higher-order deliverables

- BC Mixing state
- BC-containing particle unperturbed dry optical size
- Coating thickness on BC cores.