

Dynamic Bioaerosol Testing in an Aerosol Containment Chamber

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The Operational Environment and Test & Evaluation (T&E)

- Biological aerosol detectors must operate in an environment that is complex and highly variable in terms of ambient particle dynamics.
- Test and evaluation (T&E) methods must be able to reproduce real-world operational conditions to effectively evaluate bioaerosol detector performance.
- Containment chambers are required to evaluate detector performance against toxic threats that can not be released outdoors in live test exercises.
- Methods were developed to synthesize a dynamic operational background for use in an aerosol containment test chamber.

Aerosol Particle Monitoring

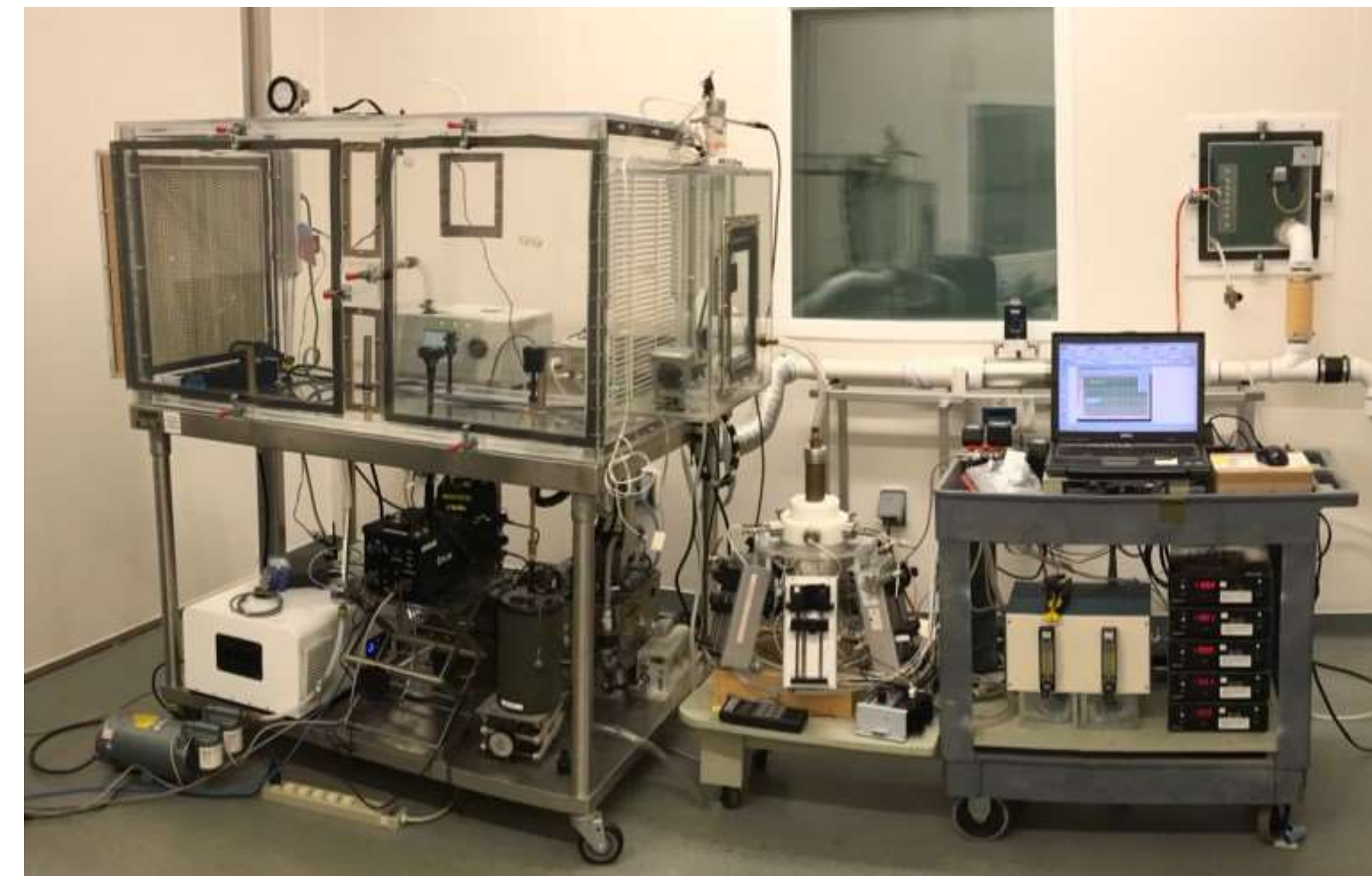
- Two commercial aerosol particle monitors were deployed in an indoor setting to gather background data over a period of two weeks: the Aerodynamic Particle Sizer (APS) [TSI Inc.] and the Wideband Integrated Bioaerosol Sensor (WIBS) [Droplet Measurement Technologies, Inc.]. A Dry Filter Unit was used to collect physical aerosol samples.



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Calliope Aerosol Test Chamber

- DEVCOM CBC has an aerosol containment test chamber that uses a 5-nozzle aerosol generator that can be programmed to produce a multi-component dynamic aerosol profile.
- Calliope is a flow-through chamber that is validated for homogeneous uniformity



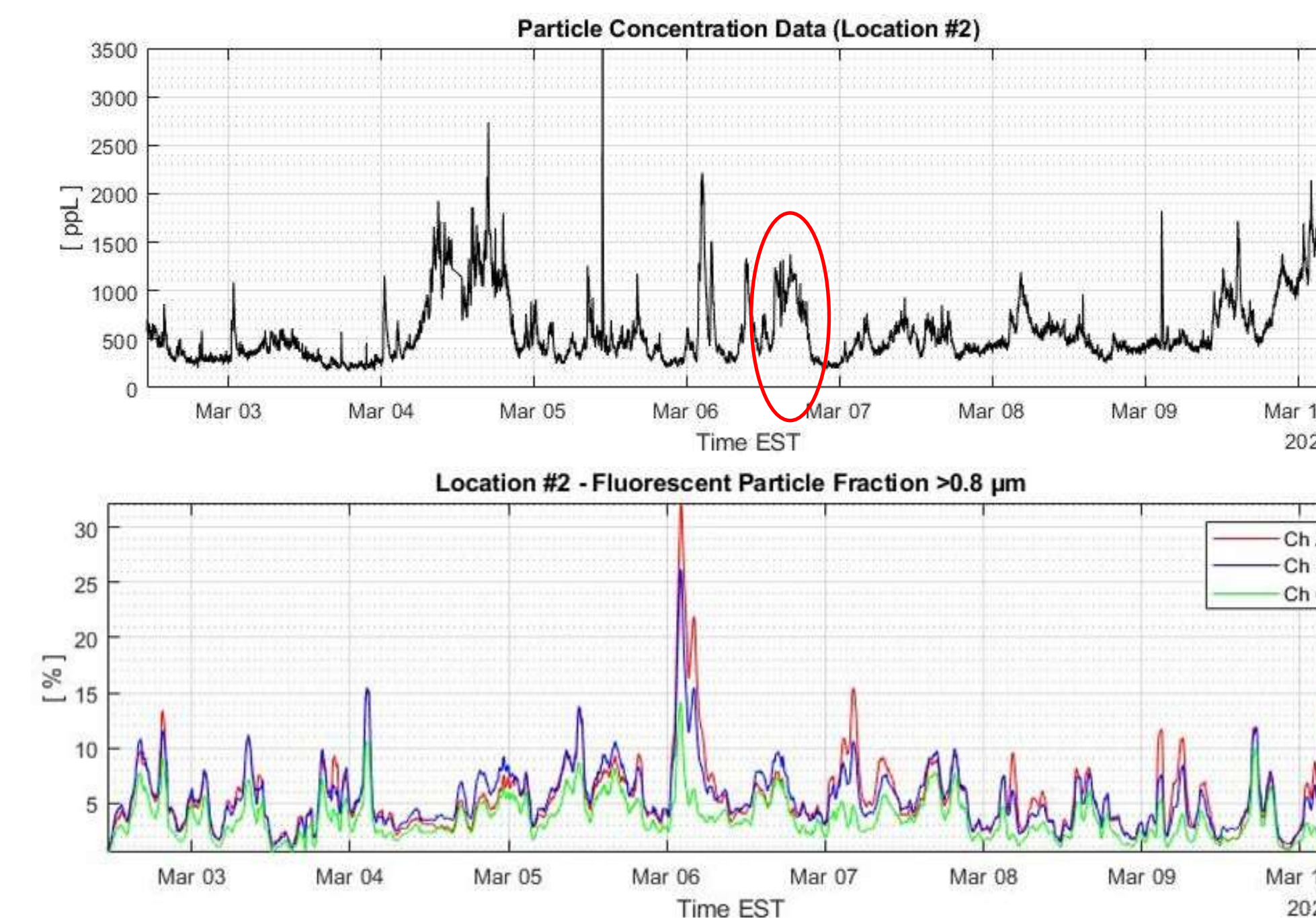
Key Aerosol Particle Parameters

- Size** – Respirable particle range from 0.5 – 20 μm
- Concentration** – Number of particles per liter of air
- Fluorescence** – Number of biological particles per liter of air
- Dynamics** – Rate of change of particle concentration
- Identity** – Molecular and biological constituents (measured with various analytical** techniques from dry filter physical aerosol samples)

** NOTE: Analytical data was used to determine the component makeup of the multi-nozzle background generator.

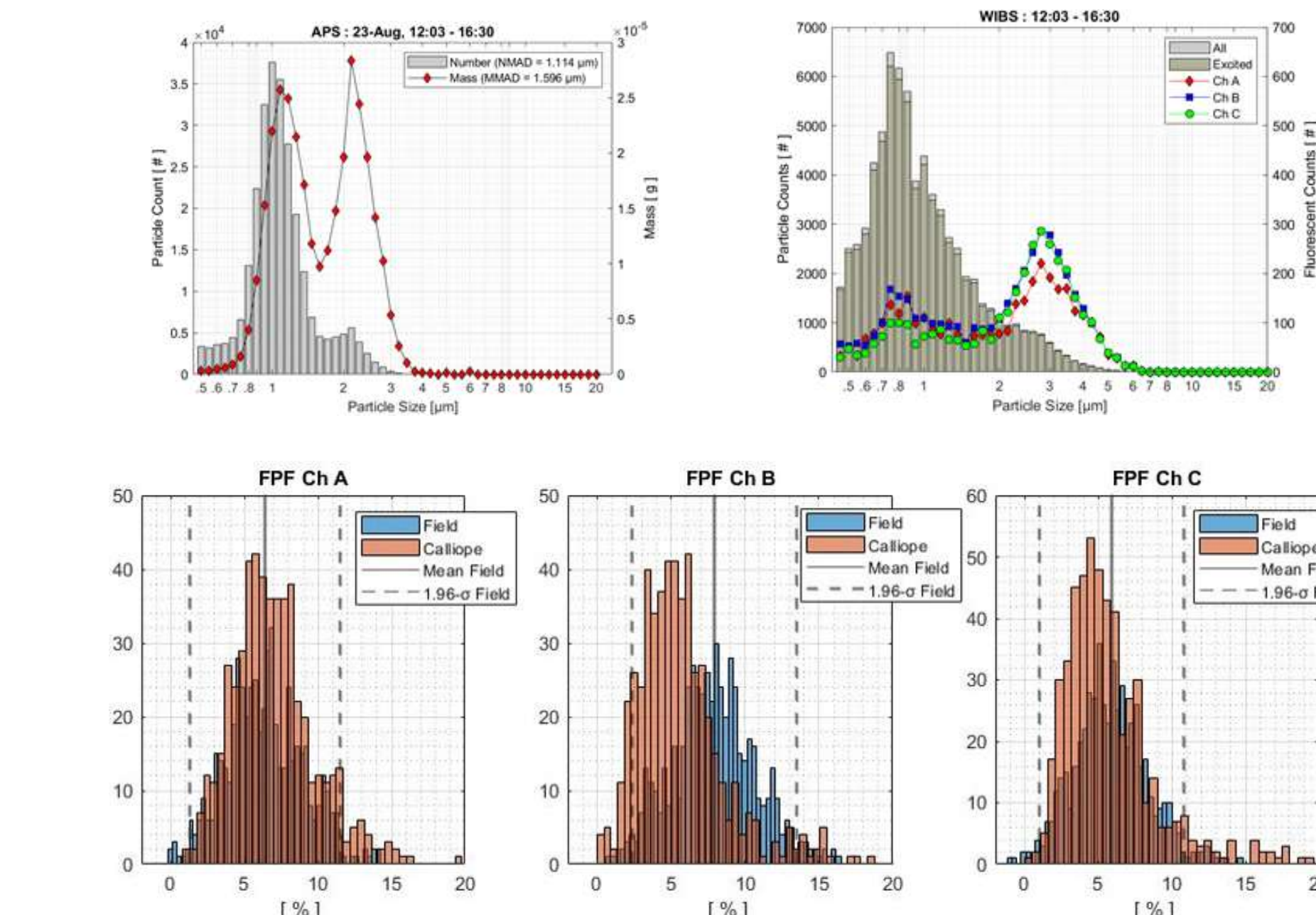
Aerosol Particle Dynamics

- Field data over a one-week period shows fluctuation of total particle concentration (upper) and biological fluorescent particles (lower).



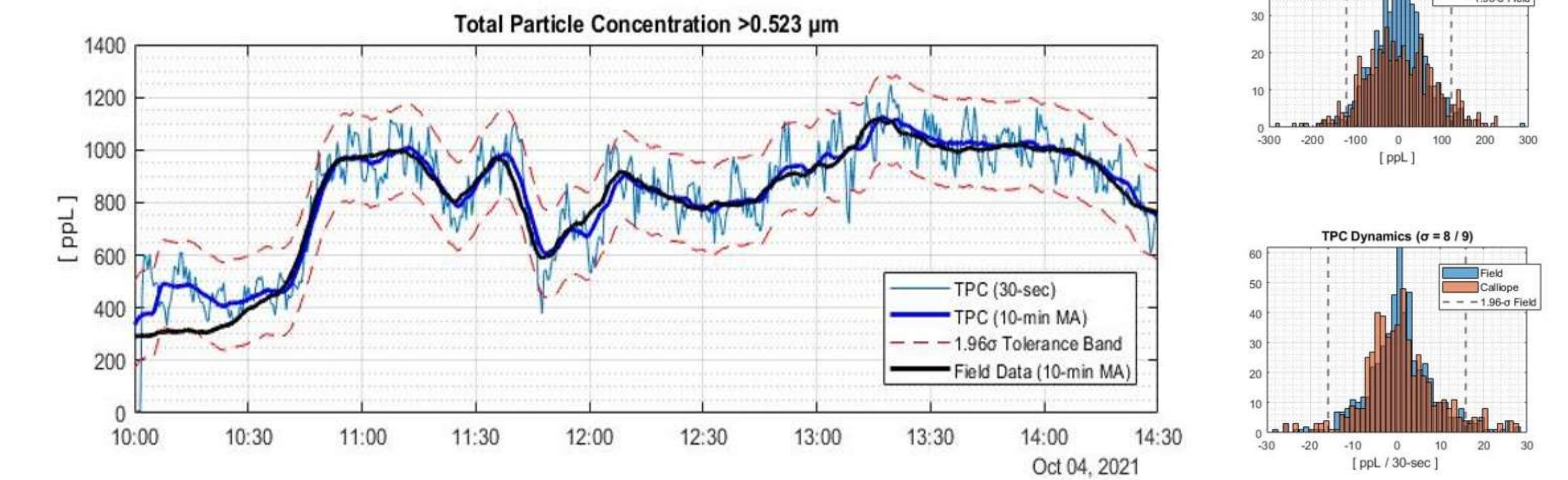
Aerosol Particle Sizing

- Two important size distributions are considered: Total Particle Size Distribution (TPSD) as measure with both APS and WIBS, and Fluorescent Particle Size Distribution (FPSD) as measured with the WIBS. Histogram tolerance reports verify generator performance.



Creating the Dynamic Profile

- A 4.5-hour test segment was selected from the field data. Calliope nozzles were then programmed to generate a test profile that matched the field segment to a 95% confidence interval as verified with variability and dynamics tolerance histogram reports.



Generating Simulant Challenges with the Dynamic Background

- Eight challenges were presented every 30 minutes on top of the live dynamic background. Aerodynamic and fluorescence particle monitors were used to referee and verify the challenge concentrations.

