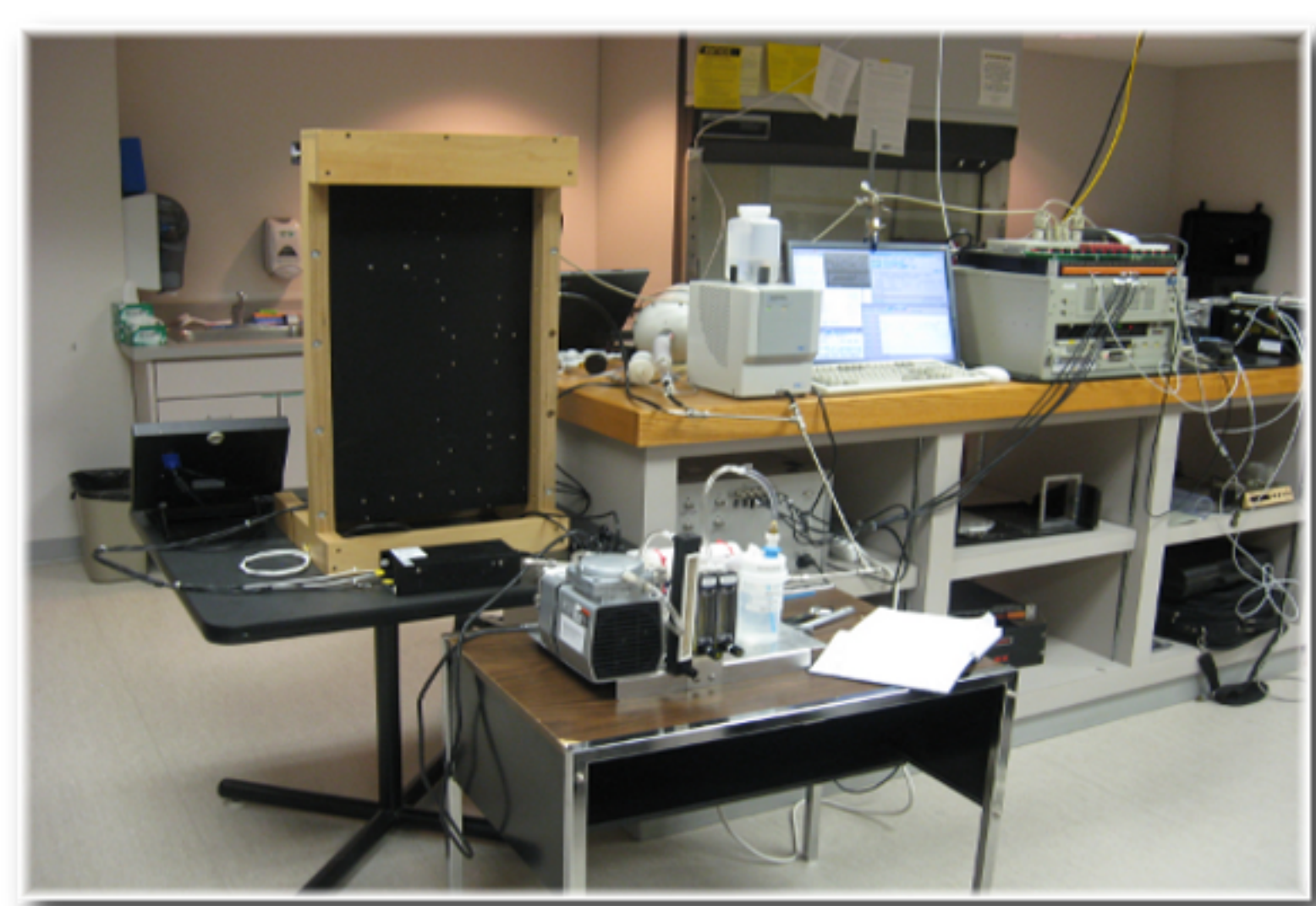


# Comparison of Two Cloud Condensation Nuclei Counters from Ground-Based Measurements



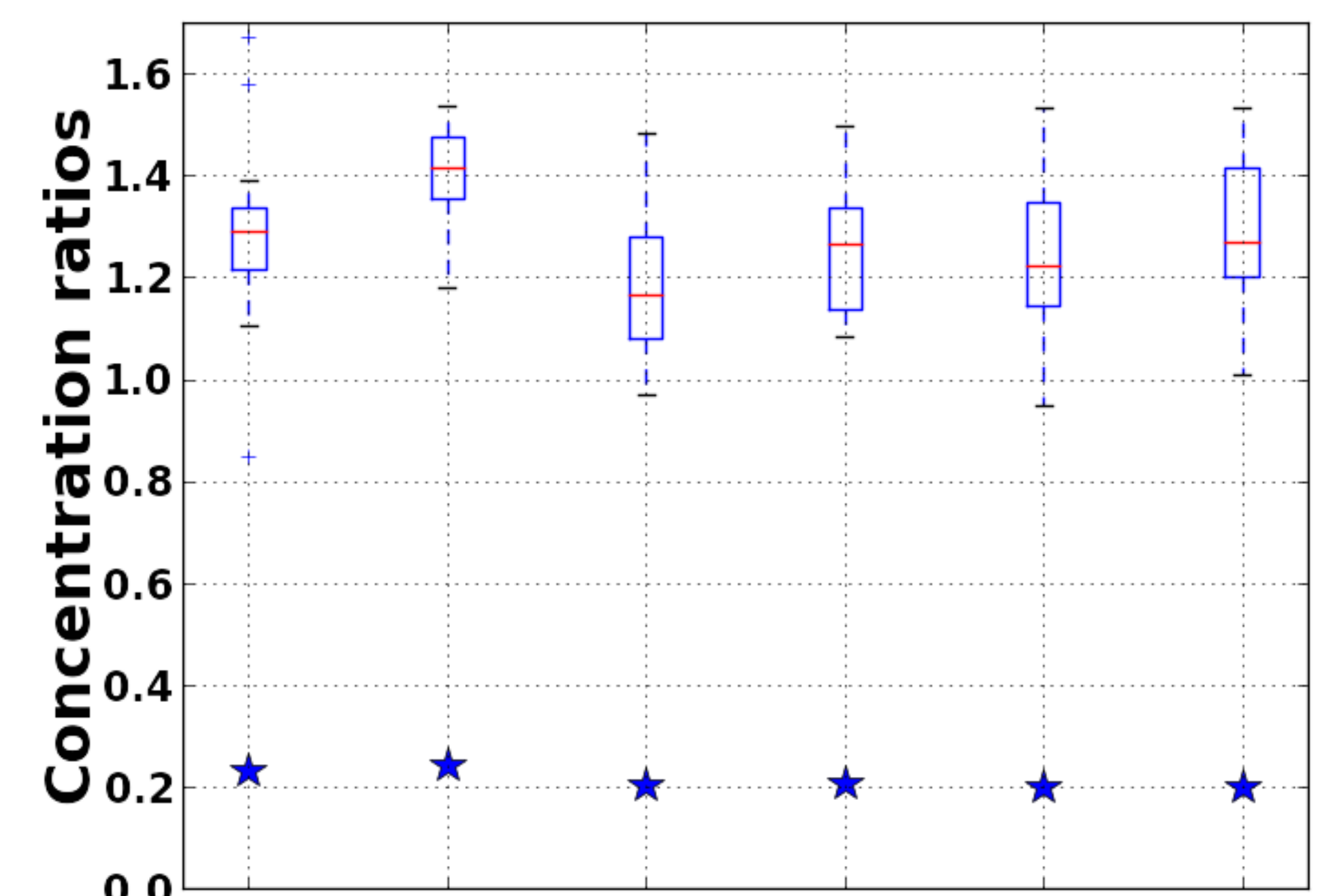
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**Objectives:** To test and compare Droplet Measurement Technologies (DMT) and University of Wyoming (UWyo) versions of Cloud Condensation Nuclei Counters (CCNC) for better understanding of CCN instruments, and to improve the quality of atmospheric field measurements.



A general view from the experimental setup. Ammonium Sulfate aerosol particles were concurrently sampled by a PMS - Passive Cavity Aerosol Spectrometer Probe (PCASP), TSI - Condensation Particle Counter (CPC), DMT and UWyo CCN Counters.

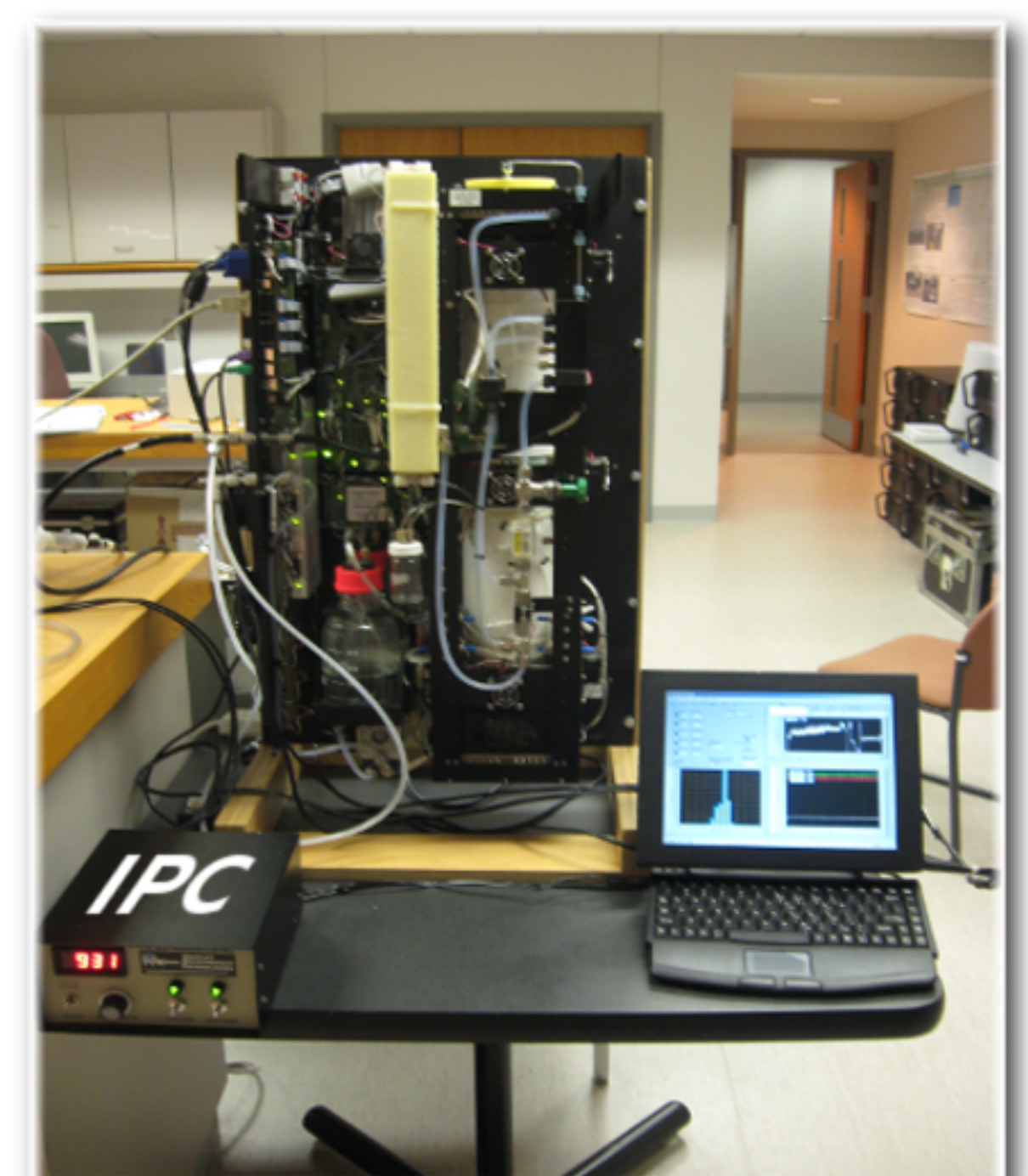
Comparisons at variable pressure, constant concentration



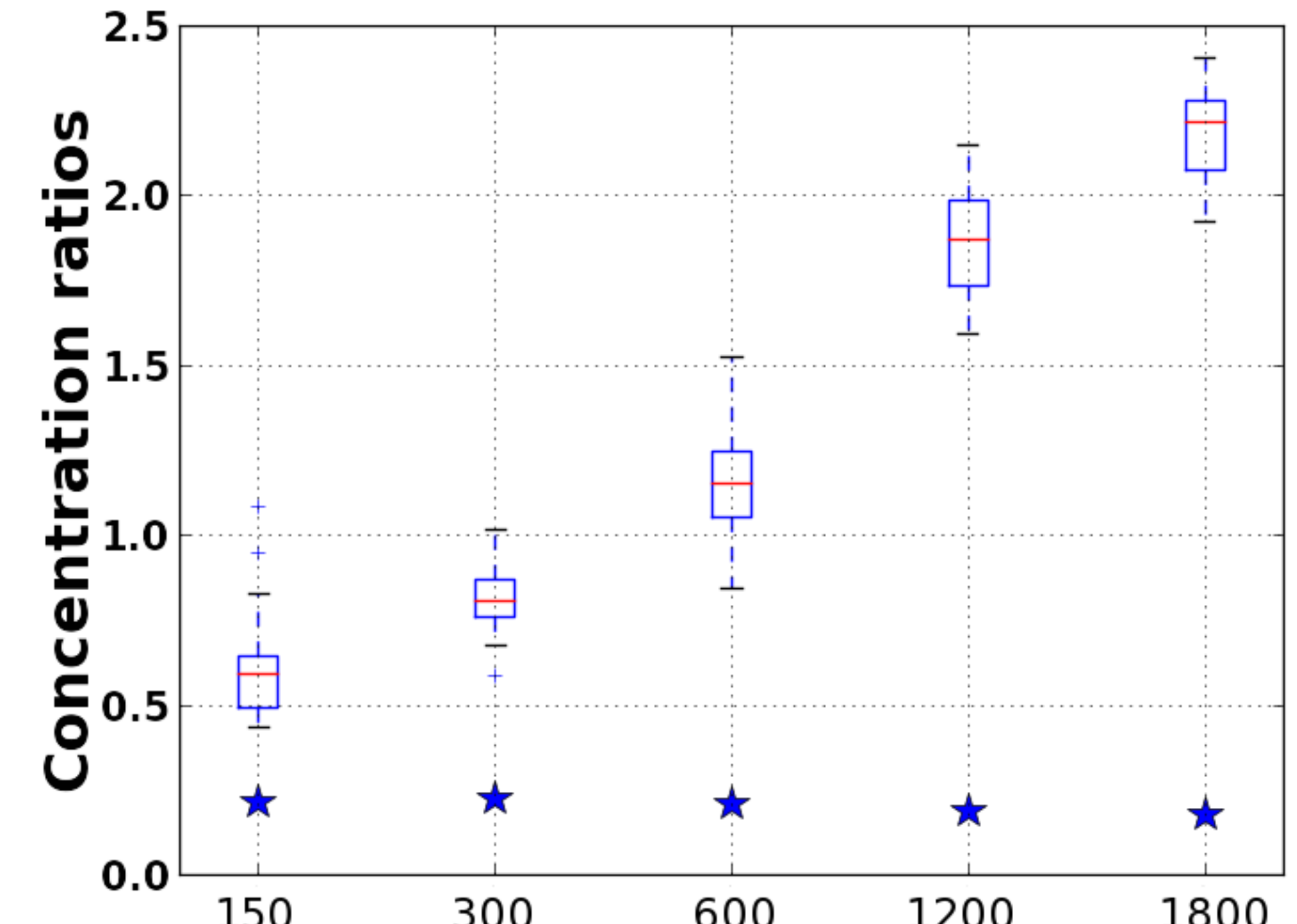
Box-and-whisker plots are representative of DMT-CCNC/UWyo-CCNC concentration ratios at six different DMT-CCNC set pressure level, while stars denote average PCASP-to-CPC ratios.

In the first leg of these experiments, the DMT-CCNC's pressure was varied from 460 to 950 mB in six steps [460, 500, 600, 700, 800, 950] while sample aerosol concentration was held at 600 #/cm<sup>3</sup> based on the UWyo-CCNC readings. For this case and the following two cases, nine minutes measurement portions of the acquired data were analysed. On the left DMT to UWyo CCNC concentration ratios are shown with box-and-whisker plots for each nine minute interval. Average PCASP-to-CPC ratios are presented with blue stars to demonstrate the concentration variations.

A front view of the DMT-CCNC, along with an Inlet Pressure Controller (IPC) and a screen showing the system running. The counter simply measures how many cloud droplets exit its cylindrical chamber. An IPC prevents the variations in supersaturation due to the changes in sample pressure, which frequently occurs in airborne experiments.

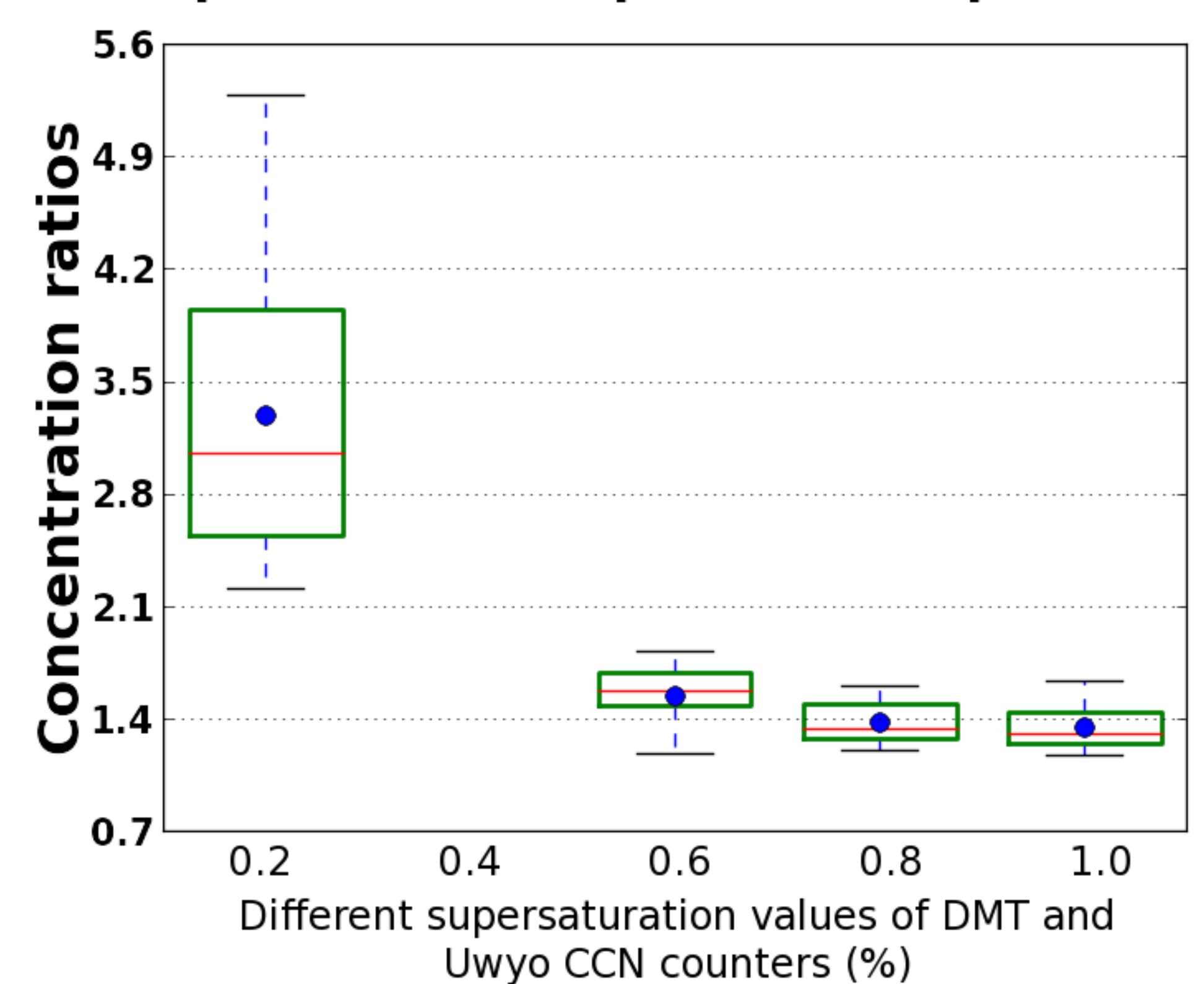


Comparisons at constant pressure, variable concentration



In the second test, the DMT-CCNC inlet pressure value was hold constant at 500 mB, UWyo-CCNC concentration readings changed from 150 #/cm<sup>3</sup> to 1800 #/cm<sup>3</sup> in five steps. Box-and-whiskers denote CCNC concentration ratios, while stars average PCASP-to-CPC ratios.

Supersaturation spectrum comparisons



In the last experiment, both the DMT and UWyo CCNC SS were varied from %0.2, 0.6, 0.8 to %1.0, while DMT-CCNC inlet pressure was constant at 500 mB. Circles indicate average DMT-to-UWyo CCNC concentration ratios.



Front view of a UWyo CCNC is shown, similar to that used in these experiments. Due to the static design constraints of the instrument each measurement takes about 30 seconds, since the aerosol sample is required to be isolated in the sampling chamber of the device.

## Conclusions:

The ratio of the DMT to UWyo-CCNC concentration was independent of the DMT CCNC chamber pressure.  
The concentration ratio of the two instruments increases with increasing sample aerosol concentrations.

The DMT-CCNC was found to count the particles 35-55% higher than the UWyo-CCNC for supersaturations in the range of 0.6 to 1.0%.  
At 0.2% SS level, the DMT-CCNC measures 3.29 times more than the UWyo-CCNC in terms of average concentration comparison.

## Future Work:

To further improve the quality of CCN measurements, a Scanning Mobility Particle Sizer (SMPS) integrated system will be used, and supersaturation calibrations performed.  
Similar instrument performance tests will be repeated using a better aerosol generator and another frequently used aerosol specie: Sodium Chloride (NaCl)  
Device concentration comparisons will be extended to the dataset that were collected during Saudi Arabia atmospheric field campaigns.

We would like to acknowledge Weather Modification, Inc. (Fargo, ND) for lending their DMT-CCNC to perform these experiments.