Responses to Reviewers for: ***Developing A Custom-Built Metal Aerosol Processing Chamber: Analysis of Aerosol Coagulation at Low Humidities.***

Nevil A. Franco, Kyle J. Gorkowski, Katherine B. Benedict

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Responses to the reviewers are shown in blue. **Additions to the main text are bold.**

Reviewer 1 -

Franco et al. designed and developed a cloud chamber at LANL and characterized the wall loss and coagulation correction factors of sodium chloride, sucrose, and soot. Their results show similar wall loss across all particle types, while the coagulation correction factor of soot is higher than others. This manuscript is overall well written and provides many useful information for chamber design, making it good fit for AMT journal. However, before the publication, I would like the authors to address the following issues.

We would like to thank reviewer one for their helpful comments. The reviewer highlighted several points that needed additional details and explanation in the main text. We have made these changes and improved the manuscript as a result.

1. For soot experiments, the authors generated them from biomass combustion, which produces complex emissions of both gas and particles. How do the authors ensure that only soot particles were injected into the LANL chamber? For example, biomass combustion emits abundant SOA, how might these SOA contribute to or interfere with soot growth in the chamber? Additionally, VOCs and SVOCs can also play a role in particle growth, thus change particle size. How do authors account for the influence of these gas species on the observed soot behavior in the authors' soot experiments?

Response: We have changed the phrasing to smoke (or biomass burning aerosol/BB aerosol), as we are in the soot regime but do not select for soot. We added additional discussion in section 2.2 on this burning setup from our previous publication (updated text below).

As for the proof of no condensation for VOCs, we cannot prove that directly. In previous work we have burned at a lower temperature (400 C) to shift the smoke to be dominated by organics and shown this with optical and black carbon measurements. In a smaller 34 L mixing tank we could see nucleation, likely from the VOCs. In this larger Aerosol Processing chamber no nucleation was observed at these low temperature burns. This is likely due to the dilution of smoke, we inject 20 L of smoke into 906 L of clean air. The aerosol processing chamber also has no active lighting for secondary aerosol formation, so photochemistry is

unlikely to occur. We added additional text on this previous burn analysis and a section on volume conservation analysis.

Text updated and additions to manuscript: "To generate **smoke**, 0.1 – 0.5 g samples of dried biomaterial *Poa pratensis* (Kentucky bluegrass) were weighed out, placed on a quartz boat and into a quartz-tube furnace (Carbolite Gero, TS1-1200, Verder Scientific, UK) that was set to 1000°C for a flaming combustion condition. **This identical setup was used in Benedict et al. (2024) which showed that at 1000°C burn the black carbon mass fraction averaged 17% for biomass fuels with a single scattering albedo of 0.35 (at 523 nm).** We expect a similar smoke profile for the experiments presented here thus the smoke injected is a combination of soot, inorganic, and organic mass along with volatile vapors. Smoke particles were pushed to the chamber by zero-air at 4 L/min for 5 minutes, a time window used to ensure complete combustion of the sample.

Section added: **3.1 Volume Conservation Analysis**

If the corrected aerosol volumes remain consistent, within the noise measurement, we can infer that the processes described in Equation 1 accurately represent chamber behavior. Measured volume concentrations in our experiments were corrected by accounting for volume losses due to both wall-loss and chamber flow. We calculated the cumulative lost volume and added it back to the measured values at each time point.

In chamber experiments involving secondary organic aerosol formation, this volume conservation analysis provides a constraint on organic aerosol yields. Supplemental Figure S8 shows an example of our volume conservation plot from a smoke injection experiment. From this analysis, we conclude that volume is conserved and that no measurable condensation of biomass burning organic vapors occurs under our experimental conditions.

2. The manuscript presents particle number size distributions, but volume distributions are not discussed. Could the authors provide and discuss volume distribution? For example, have the dilution and wall loss corrections been validated using measured volume distributions, by quantifying the volume fraction of particles lost due to these processes?

Response: We have added the volume conservation analysis text to the manuscript (see response above). We added a graph to the supplemental information for an example volume conservation analysis.

Text added to supplemental information:

2.4 Example Volume Analysis

Figure S8 shows the time series of aerosol volume concentration for a representative chamber run of smoke, illustrating the effect of successive loss corrections. The raw measurement (grey) steadily declines because particles are removed by deposition to the walls and by the continuous push flow that maintains a slight over-pressure in the chamber. Correcting only for wall-losses (red) recovers part of the deficit, while correcting only for the push-flow dilution (gold) yields a different partial restoration. When both terms are applied simultaneously (black) the resulting curve is nearly level after the initial mixing period, indicating that the total suspended particle volume is conserved within the combined measurement uncertainty. The sharp spikes at 3 h and 5.7 h correspond to poor size distribution fits which get excluded in the final analysis. This volume conservation is confirming that no systematic bias is introduced by the procedure.

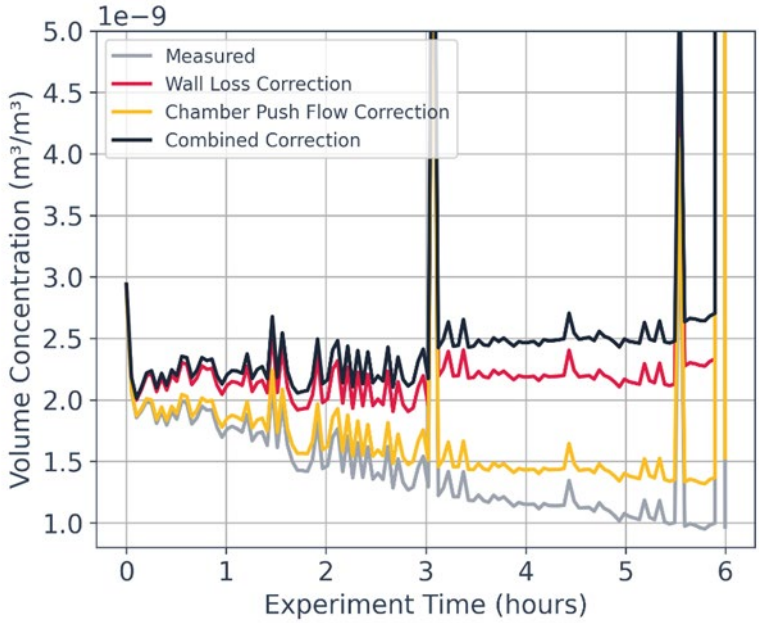

Figure S8: Volume conservation analysis for a smoke experiment.

3. Since no size selection was applied before aerosol injected into the chamber, how do the authors expect larger particles (e.g. PM>1) to influence coagulation and wall-loss behavior of submicron particles? Also, would it be possible for the authors to size-select particles to a specific mode prior to chamber injections to compare the size mode at the chamber outlet? Such an approach could help elucidate the role of coagulation in shifting size distributions.

Response: We agree that would be a good setup to clearly observe the role of coagulation. However, we did not have enough equipment to either size select or measure the size distribution at both the time of aerosol injection and at the chamber outlet.

The larger PM>1 particles could impact coagulation through sedimentation. In our experiments the higher bins (>600 nm) in the SMPS had a consistent log-normal tail. So, when we extrapolated the size distribution fit. Changing the extrapolation from 1 micron to 4 microns did not change the results noticeably. We used 4 microns, as that provides a consistent analysis method when doing dry and wet experiments.

We also added an additional bi-modal error analysis (see reviewer 2 responses) and saw that such an experiment would only have a modest reduction in the uncertainty.

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Reviewer 2-

General Comment: Experimental facility presented in this manuscript is primarily aimed to understand wall-loss and coagulation processes of aerosols under controlled temperature and humidity conditions. Such facility holds potential to improve understanding of aerosol-processes in the atmosphere as well as improving cloud-chamber. However, this facility in current stage lacks temperature and humidity control. Since current set-up and any results presented here do not involve cloud-microphysical processes like CCN activation or cloud-droplet formation, it is not appropriate to consider this facility as a cloud-chamber.

This paper describes the experimental facility, data processing, parameter fitting in details and discuss wall-loss and coagulation factor for different aerosols, by fitting observations into loss equation. Although it has significant uncertainty, studies highlight that soot particles adhere to each other, more than others in dry conditions. I have few concerns regarding set-up and data processing. Hence, I would recommend reject and resubmit when more results are available, along with addressing major and minor comments listed below.

We would like to thank reviewer two for their comments. We agree that calling the chamber a "cloud chamber" was probably a step too far at this point in its development. Therefore, we have changed the title and references to the chamber to an "aerosol-processing chamber". The characterization of the chamber, without humidity and temperature control is still valuable, since the chamber is currently being used in dry conditions to determine the charge distribution of dust and we expect future experiments to be performed under similarly dry conditions. We have responded to each point below and made changes in the text to strengthen the manuscript and conclusions.

Major Comments

Comment 1: Authors emphasize that this facility is specifically designed to investigate coagulation processes of aerosols under different conditions (line 61-63). Further, authors have

not shown any results which deal with cloud-microphysical processes like CCN activation or presence of cloud droplets. Under such limitations, it is inappropriate to call the facility as ”cloud chamber”, which appears in title, abstract and few paragraphs. Since, it mostly deals with aerosol-processes, it should be referred to as an aerosol-processing chamber.

Response: We have made the suggested change throughout the manuscript.

Comment 2: Line 17-19: Uncertainty in the fitted coagulation factor, especially for sodium chloride and sucrose is too large to conclude that soot particles adhere to each other more than others. Conclusion does not seem robust considering this uncertainty level. It needs additional observation and analysis to reduce uncertainty.

Response: We have changed it to say that the average is different, but the uncertainty is high. The uncertainty largely comes from the accuracy of the SMPS (~20%). We have tried a variety of fitting and averaging (as the reviewer notes below) to improve the uncertainty but no large improvements were found. To further explore this area and help with future studies we have added Monte Carlo error analysis to assess the percent error one would expect. We add this new section to the main text.

Text added to manuscript:

4.4 Monte Carlo Error Analysis

To understand the large standard deviations that emerged from our fits of wall-loss and coagulation correction, we performed a Monte Carlo error analysis. We began by constructing three number-size distributions, each formed by the sum of two log-normal modes with equal particle numbers. In the first case, both modes were centered at 100 nm but differed in geometric standard deviation, i.e., the distribution is the summation of a 100 nm mode with a GSD of 1.4 plus a 100 nm mode with a GSD of 1.8. This summation of two log-normal distributions reflects the broad distributions we observe in our measurements. The second case repeated this structure at 200 nm. The third case was a hypothetical experiment that combined narrow 100 nm and 300 nm modes (both GSD = 1.2) to test the response to a bi-modal aerosol distribution.

For every distribution we calculated Equation 1 assuming a wall-eddy diffusivity of 0.1 s^{-1} and a coagulation correction factor (W_C^{-1}) of 1.0. This is a null case in which no additional correction to the Brownian coagulation kernel is required. We then superimposed random noise of ±20 % on both the size spectrum and the rate. This noise mirrors uncertainties reported in instrument intercomparisons of ±10 % error between 20 nm and 200 nm and up to ±30 % above 200 nm (Wiedensohler et al., 2012). Thus, ±20 % is a middle point

across the range we measured. Applying the same noise to the rate represents the best-case scenario for our analysis pipeline.

With these noisy data sets created, we refit the wall-eddy diffusivity and coagulation correction 80 times at each total number concentration shown in Figure 6. From the ensemble of fits we calculated the percent error in each retrieved parameter and averaged the results.

The results in Figure 6 reveal a clear trend percent error. When total number concentration exceeds roughly 10^4 cm^{-3}, the uncertainty in the coagulation correction begins to fall. This is consistent with the fact that Brownian coagulation scales with particle number squared and becomes distinguishable from measurement noise only at higher concentrations. Conversely, the error in the wall-eddy diffusivity grows with concentration. Once coagulation dominates the particle loss budget, the data contains too little information to constrain the comparatively low wall-loss sink, increasing the relative uncertainty. In other words, when coagulation governs the system dynamics, the wall-loss term becomes a minor, poorly resolved correction.

The three analyzed distributions exhibit similar percent errors in the coagulation correction. The slightly lower error for the 100 nm mode compared to the 200 nm mode is consistent with the behavior of the Brownian coagulation kernel, where smaller particles have higher coagulation coefficients and therefore undergo more frequent collisions. This leads to a greater rate of change in the distribution for a given number concentration, resulting in better signal-to-noise. The hypothetical bi-modal distribution generally shows the lowest uncertainty among the three cases (in our experimental range), although the improvement is modest.

Annotations in Figure 6 mark the concentration ranges for the three chamber experiment series: sucrose, NaCl, and smoke aerosols. They also indicate the measured coefficient of variation in the mean coagulation correction for each case. The agreement between these annotated uncertainties and the Monte Carlo error analysis confirms that the observed variability is consistent with the measurement noise.

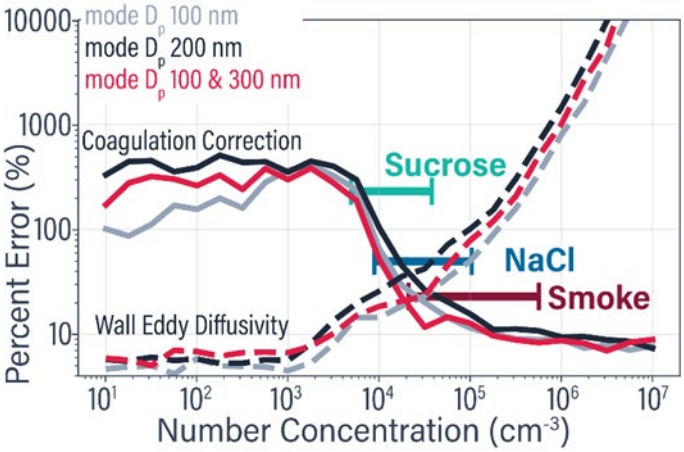

Figure 6: Percent error in fitting of coagulation correction (solid line) and wall-eddy diffusivity (dashed line) as a function of number concentration. Lines represent mean errors for size distributions with different modal diameters: 100 nm (gray), 200 nm (black), and a bi-modal 100 & 300 nm distribution (red). Annotated markers indicate representative number concentration ranges for sucrose, NaCl, and smoke experiments, along with the coefficient of variation (standard deviation divided by the mean) in the coagulation correction, reflecting relative uncertainty rather than bias.

Comment 3: Line 67-69: This study is also aimed to refine further experimental design. However, it has not been discussed the way it will help?

Response: The text added on the Monte Carlo error analysis, addresses this comment as that can be used to target the experimental conditions with lowest uncertainty for the parameters of interest. We have also updated the text to remove the specific statement about refining experimental design.

This section now reads: **Through this study, we aim to characterize the behavior of aerosol in the dry chamber (influence of particle composition and shape) and determine conditions suitable for future studies at elevated humidity including supersaturation. In addition, we perform an uncertainty analysis on the coagulation correction retrieval to determine the range of aerosol concentrations that reduce uncertainty in coagulation corrections.**

Comment 4: Line 133-138: Authors have used multiple minimization methods for fitting the size distribution each time step. Are methods same at each time-step? Do they change with aerosol species? Which methods have performed better?

Response: We have added additional details to this section to clarify. The following text was added: **We took this approach since the best fit varied with concentration and shape of the distribution. L-BFGS-B was typically the best for a lognormal distribution, but as the mode became broader (lower concentrations) then TNC, SLSQP or trust-constr would do better. The transition of when this would occur was not an obvious threshold. Therefore, we used all of these optimization routines for each lognormal distribution and selected the best fit based on the lowest error.**

Comment 5: Line 140-142: Fitted size-distribution has been extrapolated on both tails of distribution. What is the observed range of the distribution? What is the extrapolation range? Have authors compared the extrapolated values with any observations? Further, 21-samples (3 minute per scan, line 118) running average is about 1-hour running average which can smoothen data significantly when observation is limited by 6 hours. Can you discuss in details?

Response: The observed range of the size distribution was 15.7 nm to 746.5 nm. We extrapolated up to 4 µm. We added text to the manuscript to clarify this and added example fits to the supplemental information. We also added clarification on how this approach is different from typical smog chamber wall-loss experiments (see response to reviewer comment 8, below).

As for comparing against smog chamber wall-loss methods, there the whole experiment time is typically used for a single time-invariant fit. Thus, our 21 samples (1-hour) running average is a higher resolution and required for our analysis.

This portion of Section 3 now reads:

Second, we fitted these observed rates to theoretical rates calculated from Particula (Particula et al., 2025), a python-based aerosol microphysics package. **The first step was to generate a new time series at a higher size resolution (log-spaced 250 bins), starting at 20 nm and extrapolating the 746 nm SMPS upper limit to 4 µm. The size-dependent particle rate was then computed as the linear slope of a 21-point moving window (10 before and 10 after). The time window (60 min) was chosen through iteration, as shorter than 20 min had too much noise to have self-consistent results and longer than 90 min had increasing fit residuals. Resulting in a smoothed time evolution, which was shown to be effective in coagulation analysis in Mahfouz and Donahue (2020a). Our moving window approach is different from smog chamber wall-loss experiments where the full 5 hours of the wall-loss experiment would be used to fit an apparent size-dependent, time-invariant wall-loss correction (Wang et al., 2018).**

Added Supplemental Information:

2.3 Example Distribution fits.

Examples of smoke, sucrose, and NaCl experiments of a distribution fit at the 2 hour experiment mark, accompanied by the Pearson R-squared fit for the experimental time used in the analysis.

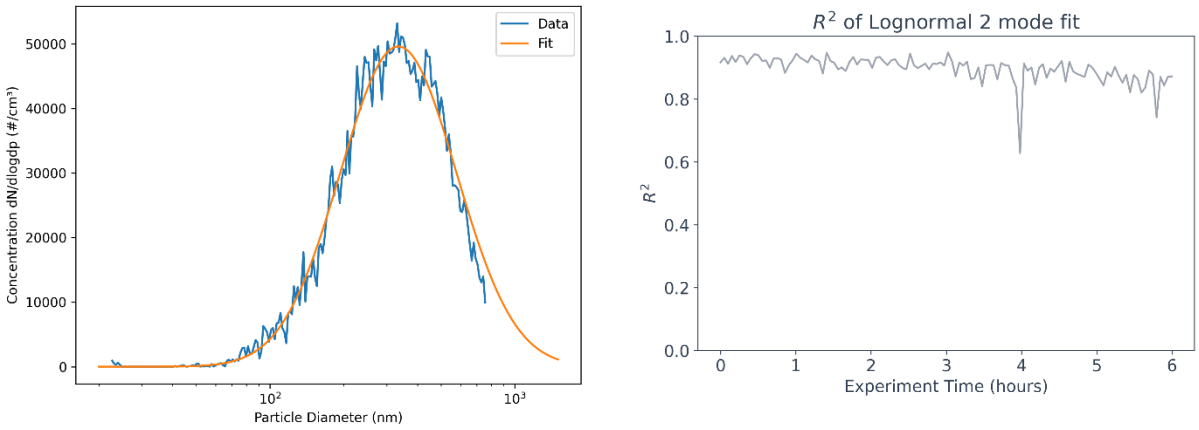

Figure S5: NaCl experiment. Left: fitted and measured size distribution. Right: Pearson R-squared of fit.

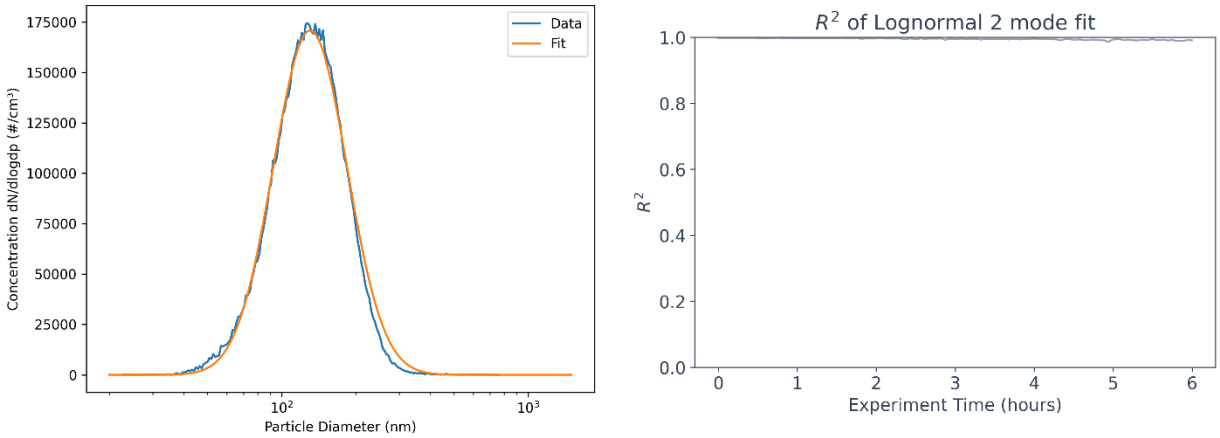

Figure S6: Smoke experiment. Left: fitted and measured size distribution. Right: Pearson R-squared of fit. Note the R-squared line is very close to 1 for most of this experiment.

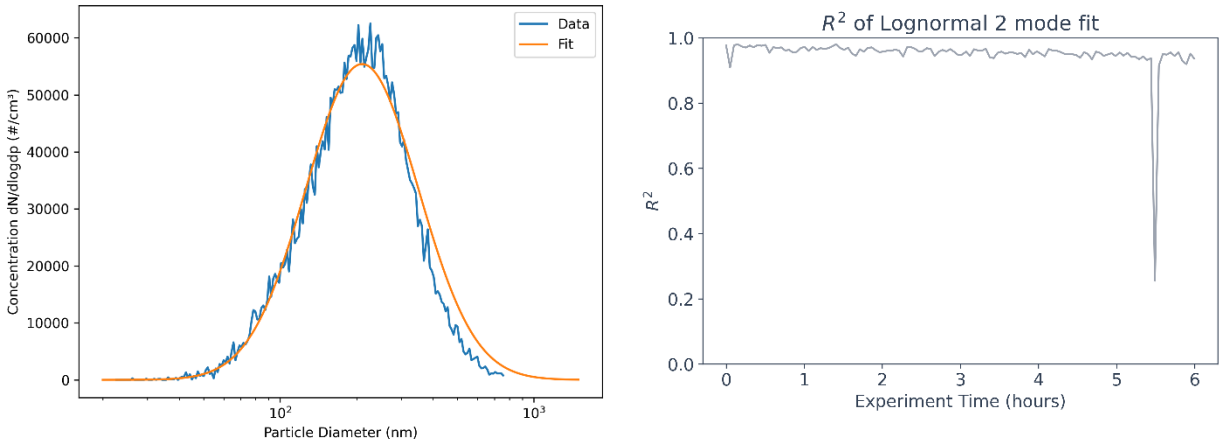

Figure S7: Sucrose experiment. Left: fitted and measured size distribution. Right: Pearson R-squared of fit.

Comment 6: In Fig. 4(a), there is significant drop in wall-eddy diffusivity between 4 and 5 hours for soot particles, before it increases again. Can authors explain the reason?

Response: We do not have a specific explanation for that change in the smoke experiments. There is a similar change in the NaCl experiments, dropping at 2.9 to 3.7 hr then higher at 3.7 to 4.6 hr.

Comment 7: Coagulation and wall-loss factor can be very different for cloud-chambers, because of wet walls and supersaturated conditions. What is the insights from current results that can be helpful for moist cloud-chamber?

Response: Our dry-wall experiments establish the usage of a physics-based size-dependent wall-loss coefficient and show that coagulation corrections depend on concentration (see response above). These experiments and error analysis let us target concentration ranges for just wall-loss vs. coagulation corrections, in the future. These target ranges are important when assessing additional processes introduced by humidity and supersaturation (e.g., enhanced deposition to wet surfaces or condensational growth). Using the same analysis framework on humid runs, any increase in the loss rate or redistribution of sizes can be quantified as a deviation from this dry baseline, directly isolating moisture-specific impacts.

Comment 8: There is a large literature on aerosol chambers, including wall-loss models and coagulation. This should be reviewed and the originality of this chamber should be discussed.

Response: We have updated the manuscript to include more details on previous chamber work including published reviews. We added context on the wall-loss correction compared to other methods used in smog chamber experiments.

Updated text on previous chambers:

Aerosol chambers are used to understand the chemical and microphysical transformation in controlled conditions (Becker, 2006; Doussin et al., 2023). Many were built for gas-phase and secondary organic aerosol experiments and feature large volumes with Teflon walls to reduce wall-losses (Hynes et al., 2005; Shao et al., 2022b). Others are optimized for specific aerosol processes, like bioaerosols (Massabo, 2018).

Cloud chambers are a class of chambers for investigating cloud microphysical mechanisms under well-controlled conditions (Chang et al., 2016; Khlystou et al., 1996; Niedermeier et al., 2020; Shao et al., 2022). Existing cloud chambers are their own institutional facility in the case of CLOUD at CERN (The Cloud Collaboration, 2001), AIDA Chamber EUROCHAMP (Wagner et al., 2006), and PI-chamber at MTU (Chang et al., 2016). **These types of facilities are critical for advancing science but are often oversubscribed and require significant support to operate.**

As outlined in many of the papers cited in the previous paragraph, all chambers however, come with artifacts—most notably, the loss of particles to chamber walls through gravity, diffusion, convection, and electrostatic forces (Corner and Pendlebury, 1951; Fotou and Pratsinis, 1993; Mahfouz and Donahue, 2020a; Wang et al., 2018).

Updated text on wall-loss:

Equation 2 shows the wall-loss rate (β) varies with particle size, derived from a rectangular-chamber formulation adapted from Crump and Seinfeld (1981) and Crump (1982). It incorporates both diffusion-driven transport and gravitational settling. In this formulation, L, W, and H denote the chamber's length, width, and height, respectively; k_e is the wall-eddy diffusivity (a free fit parameter); D is the particle diffusion coefficient; and v_p is the particle gravitational settling velocity. **This physics-based wall-loss coefficient is different from Wang et al. (2018) method of apparent size-dependent wall-loss fit. In the apparent size-dependent wall-loss fit the rate equation is a two-term first-order rate equation. In the apparent size-dependent wall-loss fit the rate equation is a two-term first-order rate equation, where there are no physical terms for the size of the chamber or particle settling velocity, in contrast to what we use in Equation 2. The apparent size-dependent wall-loss approach is common for smog chamber experiments (Doussin et al., 2023; Keywood et al., 2004; Loza et al., 2012; Nah et al., 2017; Ng et al., 2007) but would not work here since one of our goals is to specifically determine coagulation. In our case, we need a physics-based wall-loss rate equation to determine if there are any coagulation corrections that could be**

applied. If we had used the apparent size-dependent wall-loss fit, then there would be little to no residuals for a coagulation correction analysis.

Minor comments:

Comment 1: Line-183: Indicate the plot number in the supplement.

Response: We have made this update.

Comment 2: Line-201: Why does gravitational settling diminish over time as mixing subsides? Please include the reference here.

Response: During the revision we realized there was an error in the calculation. With the error fixed the gravitational settling no longer shows this trend. We have updated the text to reflect this correction: Over longer times (>1 hours), all three aerosol types converge toward similar wall-loss rates, in agreement with the literature indicating that chamber turbulence diminishes over time as mixing subsides.

Comment 3: Lines 91-93: Does dilution line affect the residence time in the chamber? How?

Response: No, it does not. Upon reflection we recognize that our discussion of the rate equation may have been confusing. In the experiments we push clean air into the chamber to get a sample out, we now call this the "chamber flow coefficient" (see below, which determines the residence time and is a dilution step of the aerosol inside the chamber). After the aerosol sample comes out there is a sample dilution step, so we have enough sample to be measured by all instruments and lowers the sample humidity when operating the chamber with humidity.

Updated text: The resulting size-dependent rate was subsequently used to fit the underlying aerosol processes in Equation 1 where $N(D_p)$ represents the number concentration of particles of diameter, D_p, K_{12} is the coagulation kernel, W_C^{-1} is the coagulation correction factor, N_1 and N_2 are the concentrations of particles in the bins for K_{12}, k_{flow} is the **chamber flow coefficient**, and β is the wall-loss rate.

The **chamber flow coefficient**, $k_{flow} = Q/V$, characterizes how the clean air flow rate (Q) is used to push sample flow out of the chamber volume (V).

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Reviewer 3

Franco et al., describes a new design of "Cloud chamber" and gives a characterization of dry particle experiments using sodium chloride, sucrose and soot particles. In these experiments, the wall loss rate, particle coagulation rate and dilution rate are estimated under dry conditions. Results show similar wall loss rate and different coagulation behaviors among these aerosols.

In this article, several key information on the aerosol generation, chamber characterization and result illustrations are missing. It is suggested to reject and resubmit the article after completing these informations.

Major comments:

1/ It is believed that authors would like to build a "Cloud chamber" in order to study physical and/or chemical processes during the cloud process and this is the first publication on this new design. However, the characterization of this new stainless-steel chamber is not complete, such as Surface/Volume ratio, working pressure, mixing ratio, gas monitoring (VOC from the combustion), etc.

Response: We have added some of the requested parameters (Surface/Volume ratio, working pressure) however, we disagree that concentrations of gases are important for chamber characterization in the current experimental design. Concentrations of gases could be measured in the future, and will be, for specific experiments designed to look at gas-aerosol interactions in the chamber.

2/ The research on the literature is not fully enough.

2.1/ Authors made a short introduction on the Cloud chamber. It is well known that RH is one of the most important parameters that impacts on the wall loss ratio and particle coagulation in

the cloud chamber (Doussin et al., 2023). It is not clear why authors specifically made the study under dry conditions and would like to make a cloud chamber in the future.

Response: As we have modified the title and goals of the paper due to comments from other reviews by changing from cloud chamber to aerosol processing chamber, now humidity is not a specific target. As for Doussin et al., they suggest wall-loss experiments at low and higher humidity ranges, but do not offer a physics-based correction for high humidity conditions. Thus, keeping with low humidity conditions for this manuscript, seems sufficient.

2.2/ Authors highlighted in this work one critical aerosol: soot. Apparently, the characterization of soot is missing. Soot is generally fractal-like and highly dependent on the combustion conditions. The aggregation of soot particles is one of the most important parameters that impacts the mobility diameter measured by the SMPS, i.e., for a single freshly emitted soot particle, the different aggregation due to the aging processes (lifetime, RH, VOCs and chemical processes) brings different mobility diameters (Peng et al., 2017).

Response:
We appreciate the reviewer's point and fully agree that soot morphology (fractal dimension, aggregation state, aging) influences mobility diameter. However, as reviewer 1 pointed out, our study used biomass-burning aerosol smoke which is a complex mixture, that includes but is not limited to soot/black carbon, rather than on pure, well-characterized soot standards (e.g., diesel or propane flame soot). The objective of this project was to quantify size-dependent wall-losses and coagulation behavior in our chamber using realistic smoke, NaCl and sucrose particles, not to perform a full morphological characterization of soot aggregates vs time.

Comprehensive determination of soot fractal properties (e.g., via SEM/TEM image analysis or SP2-based methods proxies) was beyond the scope and timeline of this project.

We now clarify in the manuscript that our particles originated from biomass burning smoke, and they are a combination of soot, organics and inorganics. We changed the language throughout using smoke instead of soot. We also added more to the discussion that soot is just one part of the smoke from biomass burning smoke.

Text Updated: To generate smoke, 0.1 – 0.5 g samples of dried biomaterial *Poa pratensis* (Kentucky bluegrass) were weighed out, placed on a quartz boat and into a quartz-tube furnace (Carbolite Gero, TS1-1200, Verder Scientific, UK) that was set to 1000°C for a flaming combustion condition**. This identical setup was used in Benedict et al. (2024) which showed that at 1000°C burn the black carbon mass fraction averaged 17% for biomass fuels with a single scattering albedo of 0.35 (at 523 nm). We expect a similar smoke profile for the experiments presented here thus the smoke injected is a combination of soot, inorganic, and organic mass along with volatile vapors.**

Text updated: Early-time coagulation factors for smoke were moderately elevated, suggesting that **soot-fractal aggregates within smoke** can promote sticking or increased collisional radius.

3/ Lack of results. Even the size distribution is shown in figure 3, but the total number concentration of each experiment is never presented in the article. Authors fitted observed rates to theoretical rates (line 139). However, no results are shown how difference between the fitting and experimental results.

Response: We have added examples of number concentrations and distribution fitting to the supplementary material.

Added Supplemental Information:

2.3 Example Distribution fits.

Examples of smoke, sucrose, and NaCl experiments of a distribution fit at the 2 hour experiment mark, accompanied by the Pearson R-squared fit.

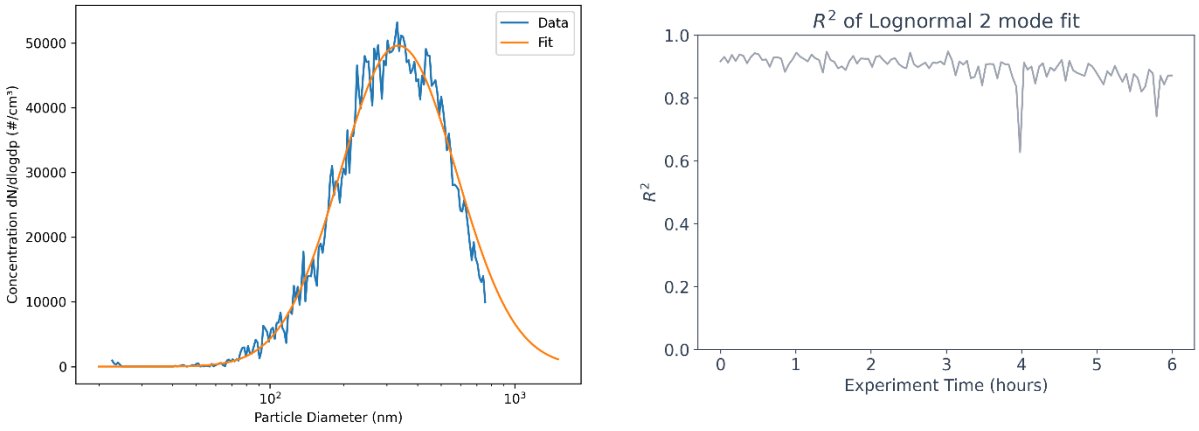

Figure S5: NaCl experiment. Left: fitted and measured size distribution. Right: Pearson R-squared of fit.

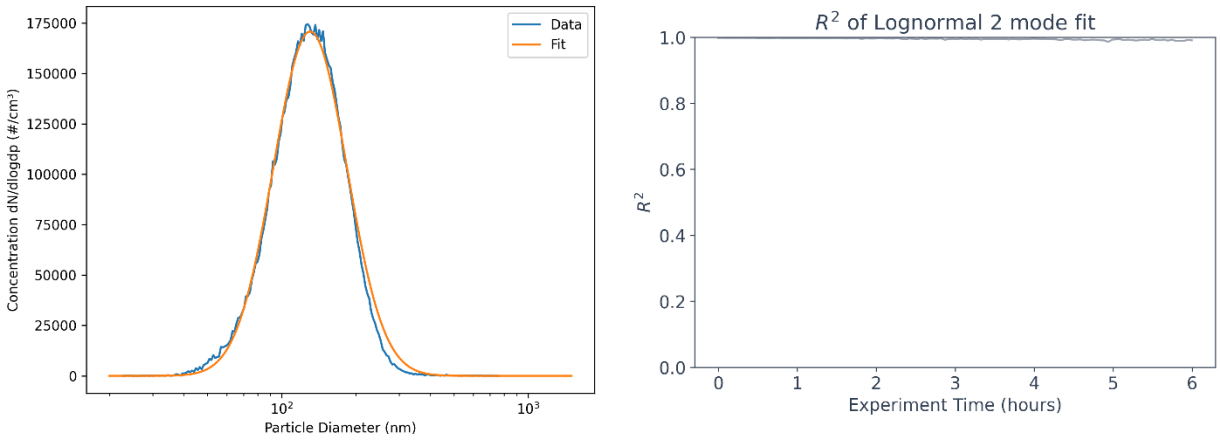

Figure S6: Smoke experiment. Left: fitted and measured size distribution. Right: Pearson R-squared of fit.

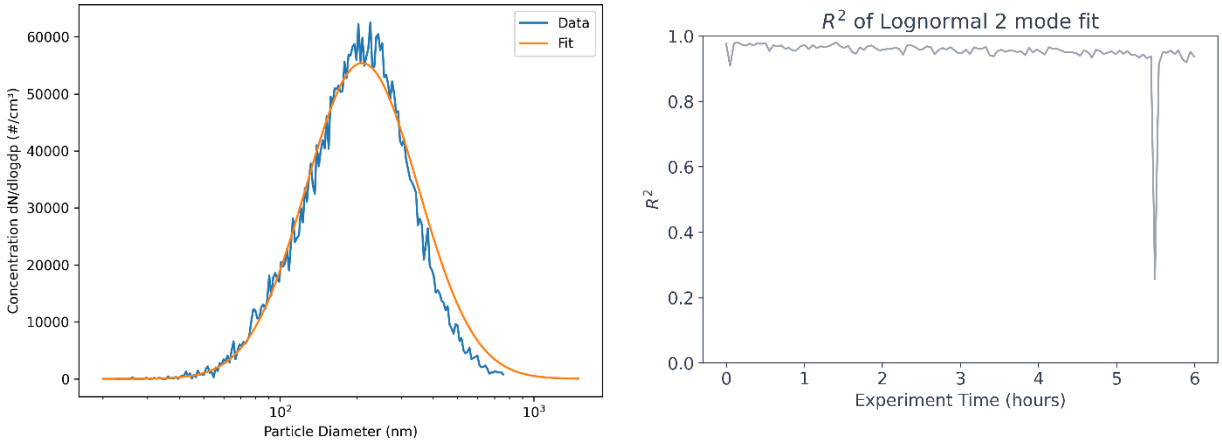

Figure S7: Sucrose experiment. Left: fitted and measured size distribution. Right: Pearson R-squared of fit.

2.5 Example Number Concentrations

Figure S9 shows the evolution of the typical total particle number concentration during the different species studies. The smoke injection produced the highest initial loading (>10^6 cm^{-3}) and maintained concentrations above 10^5 cm^{-3} for more than an hour (solid line). The NaCl was consistently the next highest, which was followed by sucrose. All experiments were conducted under identical chamber conditions (25 °C, <10 % RH, well-mixed).

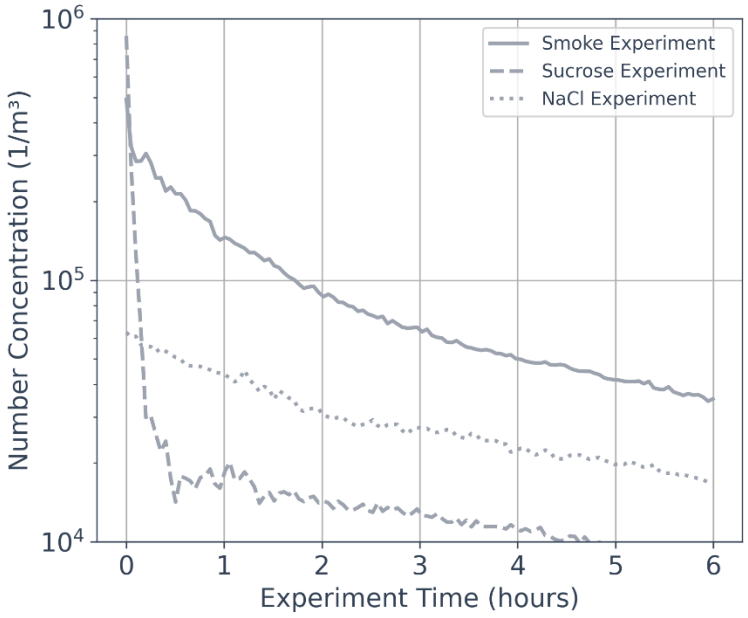

Figure S9: Evolution of the typical total particle number concentration during the three chamber experiment series.

References

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