This study describes a smog chamber facility that is designed for studying the physicochemical and optical properties of biomass burning aerosols. Characterization experiments, including measurements of particle size distribution, gas and particle wall loss rates, chamber dilution rates, light intensity, and chamber mixing timescale, are presented. These characterization experiments have been routine practices in the majority of laboratory chambers around the world that are employed to study atmospheric chemistry. The authors did not bring any new scientific advances but simply repeated a selection of well-established experimental procedures. I would not recommend publication on AMT in the current form. Significant revisions are needed, as described in the individual points below.

General:

The authors constantly claim the novelty of their newly constructed chamber, yet fail to provide any experimental evidence that could help to identify any unique aspect of the current chamber setup. What new discoveries could potentially be produced by the NCAT chamber compared with all the other chambers that are also equipped to study BB aerosols? One novel aspect of this chamber, as the authors state in the conclusion section, is 'the use of a tube furnace …., that enables the simulation of different burning stages …'. However, the authors did not provide any experimental observations in terms of the physical, chemical, and optical properties of BB aerosols produced from different burning stages of a given fuel. Relevant measurements need to be added in the manuscript to support this claimed novelty of the chamber.

While the title highlights that the NCAT chamber is particularly suitable to study the aging processes of BB aerosols, the authors emphasize their focus on primary organic aerosols throughout of the main text. One illustration experiment that shows how photochemical aging would affect the optical properties of BB aerosols needs to be provided.

The authors spend an entire paragraph in the introduction section discussing the need to investigate the effect of relative humidity on the evolution of BB aerosols. Can relative

humidity be well controlled in the NCAT chamber? If so, the humidity effect on the SMPS measured size distribution of BB aerosols needs to be given.

A large body of discussions in the main text, such as air purification, chamber flushing and cleaning, light spectra shown in Figure 6, and temperature profiles shown in Figure 8, have been well established routine chamber operation procedures for many years and can be moved to Supplement. Experimental evidence needs to be given in Section 3.5 to support the statement 'the setup in our laboratory will allow us to sample particles directly from and chamber, and measure their size distributions and optical properties as a function of aerosol age'. As suggested earlier, one experiment that illustrates changes in the optical properties of BB aerosols as a function of photochemical aging needs to be given.

Specific:

Page 3, Line 87: Most static Teflon chambers are actually not ideal for studying aerosol aging. As the experiment proceeds, the Teflon bag volume will be continuously depleted, eventually leading to significant particle wall losses. A typical chamber experiment usually lasts for 24-36 hours, which equals to approximately one to two days of atmospheric OH exposure given the average OH concentration of ~10^6 molecules cm^{-3} generated in the chamber.

Page 5, Line 165: Measurements need to be provided in the Supplement to support the statement 'gas purity is less than …and both methane and non-methane hydrocarbons'.

Page 7, Line 228-230: Have the authors tried to vary the atomizing pressure or use other solvents (e.g., acetonitrile) to dissolve impinger collected BB aerosols to see if these procedures would make a difference on the measured aerosol size distribution?

Page 8, Line 275-280: How was the onset of gas chamber losses defined here? It seems like over the entire course of gas chamber loss measurements, standard gases are continuously injected into the chamber and withdrawn out of the chamber with a balanced flow rate. If so, uncertainties caused by chamber mixing timescale need to be considered. To fully isolate the effect of dilution on the measured gas wall loss rate, the authors are

suggested to inject standard gases, turn off the injection flow and wait till well mixed, and then start the wall loss measurement.

Page 10, Line 338: Initial particle number concentration might be an indicator of the particle pysicochemical properties, e.g., phase state. Understanding the relationship between initial particle number concentration and the loss rate needs to be included in the current study.

Page 10, Line 346: When BB aerosols produced from a 500 °C furnace are introduced into a chamber operated at room temperature, organic vapors generated together with BB aerosols will undergo condensation on existing particles. On the other hand, organic compounds may evaporate from BB aerosols upon dilution in the chamber. So strictly speaking, the focus here is not POA.

Page 23, Figure 5: Please also provide the measured particle wall loss rate as a function of the particle diameter.

Page 27, Table 1: What type of detector is attached to GC for the identification of hydrocarbons?