This study investigates the secondary organic aerosol (SOA) formation from photooxidation of pinanediol, chosen as a semi-volatile surrogate for first-generation oxidation products of monoterpenes. The authors found that the derived SOA mass yields, by accounting for vapor and particle wall losses, are 2-3 times larger than those from the oxidation of volatile monoterpene systems. By modeling the chamber data using a 2-D VBS set, the authors suggest that a significant fraction of pinanediol SOA comprises low volatility compounds, which is consistent with previous observations. Overall, the data analysis is thorough and the manuscript is clearly written and merits publication in ACP. Below are a few suggestions that the authors need to take into consideration for the production of a revised version of the manuscript.

General:

1. PTRMS calibration

The authors used PTRMS measurements to calculate the amount of pinanediol oxidized by OH radical in order to derive the mass yields of SOA produced. A recent study (Pagonis et al., AMT, 2017) has found that gas-wall partitioning of semi-volatile organics in Teflon tubing and inside the PTRMS could cause significant delays (up to two hours) in instrument response to step-function changes in the concentration of the semi-volatile compounds being measured.

As shown in Fig. 2, the authors in this study may have observed similar PTRMS response to the step-wise increases in the injected pinanediol in the chamber. This observation points to a very important factor that might lead to a large uncertainty in the calculated SOA yields, i.e., PTRMS calibration. The authors are suggested to describe in details how exactly PTRMS sensitivity to pinanediol was determined. If pinanediol standard was used, how was the vapor concentration calculated, and how was the vapor wall loss in the instrument accounted for?

2. Dilution experiments

Although the authors state that rapid gas-wall equilibrium partitioning of pinanediol (10-15 min?) was achieved in the chamber, no evidence could be found throughout of the manuscript. On the other hand, based on what is shown in Figure 2, it seems like there is a slowly decreasing trend in the measured concentration following each pinanediol injection. How did the authors define exactly the time it takes to reach gas-wall equilibrium partitioning?

The authors attribute the missing spike and the slow increase in the pinanediol signal upon a succession of standard injection to the slow equilibration of the PTRMS sampling line. This might also be the reason for the observed PD:AN ratio during the dilution experiment. How long does it take between the PD/AN injection and the onset of dilution? Is it possible that the PTRMS sampling line was far from equilibration with the pinanediol vapor in the sampling air during the entire dilution experiment (or at least the very first few hours)? If this is the case, then the sampling line could possibly act as a constant sink of the pinanediol vapor and the amount evaporated from the wall upon dilution of the chamber might be compensated by that deposited onto the sampling tubing. Have the authors thought about why the PD/AN ratio only started to increase after 5 hours

of dilution (or the PD concentration dropped below 2% of the initial concentration?) This gas-wall partitioning behavior seems very inconsistent with the observation from the heating experiment.

3. Vapor wall loss correction

The authors used a single wall condensation sink (0.063 min^{-1}) measured for SVOCs in the CMU chamber to account for wall losses of vapors across all the volatility range, including LVOCs. While the time for establishing gas-wall equilibrium might be similar (say 10-15 min) for different organic vapors, it has been shown, by many studies, that the amount of organic vapors that reside in the chamber wall phase upon equilibrium depends on the vapor pressure (e.g., Matsunaga and Ziemann, 2010; Zhang et al., 2014, Krechmer et al., 2016). Here by comparing the vapor condensation rate to the wall vs. particles to evaluate the underestimation of SOA yields due to vapor wall loss may bare large uncertainties, as the amount of organic vapors in the wall upon equilibrium partitioning as a dependence of vapor pressure is not accounted for.

4. Accommodation coefficient

The accommodation coefficient is widely used to represent the probability of a vapor molecule sticking onto an organic particle surface. However, the accommodation coefficient used in Equation 3 in this study is essentially an effective accommodation coefficient, as the particle-phase diffusion process needs to be accounted for. Many studies have found that under dry conditions, the phase state of a-pinene SOA is more like semi-solid, implying that the particle-phase diffusion might be the rate limiting step in the overall gas-particle partitioning process. Please comment on the range of accommodation coefficient (0.1-1) chosen here.

<u>Minor:</u>

1. Line 211: Specify how long it takes between the chemical injection into the chamber and the measurement of their concentrations by PTRMS/GCMS. What is the chamber mixing timescale?

2. Line 252: Please show evidence for the 'rapid vapor-wall equilibrium' observed in the experiments.

3. Line 295: Again, specify the time duration between chemical injection and the onset of chamber dilution.