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Interactive comment on "The Caltech Photooxidation Flow Tube Reactor – I: Design and Fluid Dynamics" *by* Y. Huang et al.

Anonymous Referee #4

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The manuscript "The Caltech Photooxidation Flow Tube Reactor – I: Design and Fluid Dynamics" by Huang et al. presents a very detailed description of the design and characterization of a new laminar flowtube reactor (CPOT) for oxidation reactions of vapor molecules and particles at high oxidant levels. The paper focuses on the simulation of fluid dynamics of several fundamental components, such as inlet and exit section, and residence time distributions (RTD) under conditions deviating from the ideal situation. Modeled RTDs are finally compared to experimental RTDs in order to evaluate the performance of the CPOT. Exploring chemical aging of gas phase molecules and particles relevant in the environment and optimizing measurement techniques is certainly of fundamental interest. Given the complexity these kinetics, laboratory experiments on confined and characterized systems in a well-defined environment are required for developing a better understanding of the complex processes occurring in the atmo-

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Discussion paper

sphere. The manuscript is well written and clearly structured, and although the novelty of the presented material is questionable, it provides a detailed summary of important factors that need to be considered when building a new flow reactor system. One weakness of the presented flow reactor is the high level of oxidant that is required. The authors write in the introduction that high OH exposures are equivalent to multiple days of atmospheric OH concentrations. However, whether high oxidant levels can be extrapolated to atmospherically relevant conditions has yet to be determined. In fact, it is very likely that the chemical reaction pathway might change as a function of reaction time and oxidant concentration. The authors attribute in section 5.1.2 RTD discrepancy to the evaporation of particle-borne water. It would be interesting to see how relative humidity affects CPOT performance.

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