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Interactive comment on "A technical description of the Balloon Lidar Experiment BOLIDE" *by* Bernd Kaifler et al.

Bernd Kaifler et al.

bernd.kaifler@dlr.de

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We thank the reviewer for the detailed and careful analysis of our paper and for suggestions for improved wording. We will address all comments in the revision of the manuscript. Answers to specific questions and comments are given below.

What is the actual chopping frequency of the chopper?

The chopper blade (104 mm diameter) has three slits 60 degrees in length. At 100 Hz rotation rate, the chopping frequency is thus 300 Hz.

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Discussion paper

What are laser replacement heater and radiator bias heaters?

From a thermal management point of view it is desirable to keep the heat load on the cooling system constant. On the one hand this simplifies the control system and avoids having to deal with transients. On the other hand, the thermal analysis, which was done when designing the instrument, is based on steady state solutions. Large transients may drive the cooling system beyond its design parameters. That should be avoided.

However, there are certain phases during the mission when the instrument needs to be reconfigured, e.g. the laser needs to be switched off. In order to keep the head load constant, whenever a component is switched off so-called replacement heaters are activated. These heaters are designed such that they dissipate as much electrical power as the components they replace. By activating replacement heaters, the total power dissipation and thus the heat load is held constant.

Still there are slow variations in the performance of the radiator. Most notably, in the course of the day the solar elevation angle changes, and this results in a varying amount of scattered solar radiation hitting the radiator surface. With increasing absorbed solar power, the total power (nominal heat generated by the instrument + absorbed heat from the environment) the radiator needs to reject also increases. Since the radiated power is proportional to the temperature to the fourth power, the coolant temperature rises when the total power increases. To counter this effect and keep the coolant temperature constant, the radiator was designed with some margin in its heat rejecting ability and electrical heaters mounted at the backside of the radiator were incorporated into the design. At low solar elevation angles, the heaters are powered to increase the temperature of the radiator surface. Hence the name bias heaters - the heaters bias the temperature of the radiator surface.

It is unclear what the actual parameters of the ground-based lidar systems are

That is true, we did not define what we mean by this statement. The instrument requirements were defined in 2015 when the PMC Turbo mission was designed. At that time it was decided that the BOLIDE instrument should have at least the same sensitivity as the largest ground-based instruments, so that the same science in terms of resolution and detection threshold can be accomplished with BOLIDE as what was then possible with ground-based instruments. The study by Fiedler et al. (2011) served as a reference for this purpose.

We acknowledge that there are more recent publications demonstrating lower detection thresholds and/or higher resolutions. As noted by the reviewer, e.g. Kaifler et al. (2018) report the instrument sensitivity $0.1 \times 10^{-10}\mathrm{m}^{-1}\mathrm{sr}^{-1}$. However, these papers were published after the BOLIDE requirements were defined. Moreover, in case of Kaifler et al. the very high performance was achieved only during a few hours in darkness, while BOLIDE acquired measurement of PMC with approximately constant performance continuously for several days.

We will change the text to make it clear that we compare the performance of BOLIDE to ground-based observations which were published before the design phase of BOLIDE.

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