We appreciate your review – it is clear and detailed and will improve our paper, so thank you for that. We are very sorry for the mistake with Fig. 4.

There are some slight discrepancies between experimental and modelled data that remain unexplained though

We agree – the edge effect is the most obvious one. We will add a figure in the supplement which illustrates the relationship between grain, aliquot and cup with respect to incident and escaping beta particles. The text (sec 4.5) will say:

Beta particles interact with the aliquot and create secondary electrons that scatter around the interaction point. In the central part of the aliquot the secondary particles interact with neighbouring grains or escape by the surface of the aliquot. If, however, the primary interaction occurs near the aliquot edge, the scattered electrons can, in addition, escape through the edge of the aliquot. The smaller the aliquot, the larger the percentage of escaping secondary electrons. Furthermore, the thicker the aliquot, the smaller the percentage of secondary electrons escaping by the aliquot surface while the escape pathway via the edge remains the same. The edge effect is therefore governed by the ratio grain size to aliquot size: the bigger the grain and the smaller the aliquot the larger the reduction of the dose-rate. In fact, the simulation shows that the number of scattered electrons decreases for the edge grains (Fig. 9). Thus, the edge effect counteracts the average beta-dose rate increase that occurs for decreasing aliquot sizes because of the radial increase of dose rate towards the centre of the cup. Possibly, it even reverses it when the ratio of grain size to aliquot size is appropriate and the grains are situated sufficiently away from the rim of the cup.

In addition, we should have stated more clearly that with given source-probe distance the radiation field is curved implying a radial decrease of dose rate from the centre to the periphery as outlined by several studies (e.g., Spooner and Allsop, 2000). This will be added to sec 2.1 (where sources are described) by saying: With a source sample distance of 6.9 mm the radiation field of all sources is expected to be curved. Veronese et al. (2007) describe the curve with a power function yielding a parabolic curve of variable width. A very wide, hence relatively flat, parabolic curve is delivered by the open-ring source (Richter et al., 2012) due to its special design.

the use of several gamma doses for beta source calibration and then taking the regression of a plot of gamma dose vs. recovered beta dose to derive the dose rate of the beta source. This is an approach that should certainly be promoted, and hence deserves a bit more weight in the manuscript

We agree. We will emphasise the approach in the abstract by saying:

We conclude that future calibration samples should consist of subsamples composed of small, medium, large and very large quartz grains each obtaining several gamma doses. The calibration value measured with small, medium and large aliquots is then obtained from the inverse slope of the fitted line, not from a single data point. In this way all possible irradiation geometries of an individual beta source are covered, and the precision of the calibration is improved.

Why are the GEANT4 simulations skipped for grain sizes >250 _m, while they were carried out for the MCNP6 simulation? - This was simply motivated by workload of the respective expert and/or the demand on the computational resource.

Fig. 4: This figure seems to be identical with Fig. 3a. Please check and update.

Apologies for this mistake. Here it is.

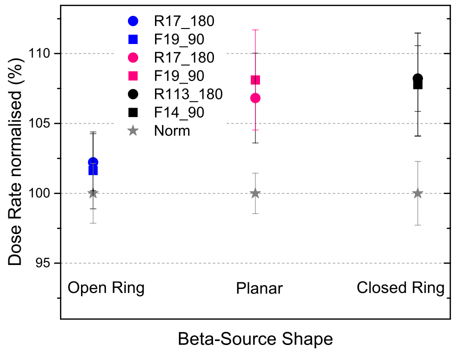

Fig. 4. Beta-dose rates of 1 mm aliquots normalised to the 8 mm aliquot size of the respective sample versus beta-source shape. For data and uncertainty see Table 3.

Fig. 7 - What is the purpose and meaning of the simulation without sample holder? Can inferences be made about the role/magnitude of electron backscatter from the sampleholder? Maybe this aspect should be shortly discussed in the manuscript.

Indeed, the purpose was to show the magnitude of electron backscatter without sample carrier. It should have been discussed in the text and we apologies for this oversight. The discussion will be included in sec 4.4 where it says "This [shape of source] is confirmed when simulating charge build-up as a function of depth in aliquot (Fig. 7). Beyond the depth of ca 150 mm the magnitude of the build-up depends on aliquot size and source shape: the increase of dose rate is small in large aliquots irradiated by the closed ring source and significant in medium to large aliquots irradiated by the planar source. It is negligible in small aliquots regardless the shape of the beta-source. For shallower depths (<150 mm) the magnitude of build-up is enhanced by the electron backscatter of the ss-cup (Fig. 7).

Fig. 8: If the dose rate is shown normalized to the 10 _m large aliquot simulations, why do the data start at _108% in the center of the sample carrier?

The figure shows the dose rate profile for various grain- and aliquot sizes. It does not show the average dose rate. The normalised average value of the 10 µm curve is at 100%. We will clarify this is the figure caption.

What is "purpose-prepared sample material"? – it is a natural sample (e.g. dune sand) prepared for the purpose of becoming beta-source calibration material. Here it is annealing and repeated irradiation and read-out using blue-light stimulation in order to sensitise the quartz.