Dear Editor-in-Chief, dear Reviewers

please find here the manuscript entitled “Modelling and simulations for signal loss evaluation during sampling phase for TL authenticity tests” that I, on behalf of all the co-authors, would like to submit for publication to ACTA IMEKO (Special Issue on ACTA IMEKO – Metroarcheo 2019).

This paper reports the current stage of an activity which regards measurement methods for the estimation of dissipated temperature in the context of thermoluminescence method and signal loss during drilling.

In particular this manuscript is an extended version of the proceeding of – Metroarcheo 2019: “Indirect Temperature Measurements for TL Signal Loss during Drilling” (see ref [29]), where a preliminary study based on the presentation of a non-invasive and in situ measurement methodology useful to estimate the temperature reached during the sampling phase of the authenticity test, performed by Thermoluminescence (TL) method has been presented.

Monitoring the maximum temperature achieved and knowing the heating rate is very important because the TL emission is dependent of the heating rate.

The collection of the powder sample is usually done by an adequate low speed drill in a hidden area of the ancient artefact to authenticate. During drilling, many parameters such as diameters of bit, drill speed, interval time can be changed. After exploiting the role of all these parameters and assessing that the electrical model was suitable to estimate the variation of the local temperature, in the extended manuscript we discussed the following outputs:

1. A more exhaustive model of the entire drill-based architecture and a study useful to simulate any loss of the TL signal due to heating during sampling.

By using a dynamical electro-mechanical model it is possible to simulate the drilling procedures in order to estimate the maximum temperature reached during sample collection. It is worth noting that the simulations allow also the individuation of the optimal parameters which can be used for the sampling.

1. The effect, in terms of TL signal loss, of the local temperature increasing due to the drilling.

In particular, we obtained the percentage of residual TL intensity that we could measure in the TL laboratory in specific cases. We considered the situations in which the drill bits have diameters of 2 mm, 3 mm and 5.5 mm. For these bits, thanks to the electrical model, we had the values of reached maximum temperatures that were 130 °C, 82°C and 60 °C.

1. The glow curves simulation considering the quartz peaks, commonly used in TL, at 110°C, 320°C, 325°C and 375°C and the different parameters at stake.

The glow curves are simulated in the temperature range 0-500 °C and a heating rate of 5 °C/s, typically used in laboratory during the authenticity tests.

I hope hearing from you soon and I will be at your disposal whatever additional information you would need