

# Feasibility study on thermoluminescence measurement using a silicon photomultiplier for a portable TL system

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Replacing traditional vacuum tubes with semiconductor-based photo sensors provides a better solution for a portable TL reader due to their mechanical robustness, lower operation voltage, and lower production cost. In this work, feasibility tests of silicon photomultipliers (SiPMs) as a photodetector for thermoluminescence measurements (TL) were carried out. The TL reading were based on Hamamatsu S13360-MPPC series with a active area of  $3 \times 3 \text{ mm}^2$  and microcell pitches from  $25 \text{ }\mu\text{m}$  to  $75 \text{ }\mu\text{m}$ . A conventional TL reader (Risø TL/OSL DA-20) was applied as a stable heating system and a test dose was given using a built-in beta source. A LiF:Mg,Cu,Si (MCS) was chosen as a reference TL material to exhibit well known TL responses. The results showed that the typical TL glow curves can be obtained with SiPMs, despite their lower geometric efficiencies. For a given dose range from 6 to 66 mGy, a higher linearity was confirmed in SiPMs with three different threshold levels compared to the built-in PMT. The detection limits was around 0.2 mSv, 0.08 mSv, and 0.17 mSv for  $25 \text{ }\mu\text{m}$ ,  $50 \text{ }\mu\text{m}$ , and  $75 \text{ }\mu\text{m}$  SiPMs, respectively. A sensitivity change of the system and sensor temperature depending on sequential TL readings was monitored. Consequently, possible advantages and disadvantages of SiPM-based TL measurements in comparison to PMT-based TL measurements were discussed.

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