Contribution ID: **58** Type: **Poster**

Timing performance of FBK SiPM NUV-HD-MT technology

Wednesday, 22 May 2024 16:25 (5 minutes)

The improvement of the timing performance is one of the main focus for several fields from big physics experiments to biomedical applications such as Time of Flight Positron Emission Tomography (ToF-PET). In this study we will present Single Photon Time Resolution (SPTR) and Coincidence Time Resolution (CTR) results of the recently introduced FBK NUV-HD Metal in Trench (MT) SiPM technology. Thanks to the addition of the optically insulating material inside the trenches, FBK NUV-HD-MT devices show an extremely low CrossTalk (CT). Moreover, the Photon Detection Efficiency (PDE) reaches the $\simeq 65\%$ at $420nm$.
By using a femto-second laser with a wavelength of $390nm$, we have measured the SPTR for SPADs with different microcell sizes and different versions with a metal mask outside the active area (capacitive coupling). Moreover, a $1mm \times 1mm$ and a $3mm \times 3mm$ SiPM with $40\mu m$ cell size and M0 masking version have been tested. The CTR has been measured using a $4mm \times 4mm$ SiPM to match the $3mm \times 3mm \times 5mm$ LYSO:Ce:Ca crystal. By using a high frequency readout electronics, we achieved a CTR of about $\simeq 80ps$ FWHM and an outstanding SPTR of about $\simeq 19ps$ and $\simeq 30ps$ FWHM for the SPAD and $1mm \times 1mm$ SiPM with $40\mu m$ M0 masking respectively.
This work opens the door to further investigations in order to study the role of the metal masking in the timing performance and to discuss about limitations and further improvements.

Field

Detectors and electronics

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Session Classification: Poster Session

Track Classification: Fast timing