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Front-end chip for Silicon Photo-Multipliers detector with pico-second Time-of-Flight information

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A mix-mode readout application specific integrated circuit (STiC3) has been developed for high precision timing measurements with Silicon Photomultipliers (SiPM) for medical imaging and particle physics applications. The STiC3 is 64-channel chip, with fully differential analog front-end for crosstalk and electronic noise immunity. The time and charge information from the SiPM signals are encrypted into two time stamps generated by the integrated Time to Digital Converter (TDC) modules with a resolution of less than 20 ps. The TDC data is stored in an internal memory and transferred to pc over a 160 MBit/s serial link using an 8/10 bit encoding. The chip provides a input bias tuning in a range of 0- 700mV to compensate the breakdown voltage variation of individual SiPMs. Measurements of the analog front-end show a time jitter less than 20 ps and jitter of the TDC together with the digital part is around 37 ps. A Coincidence Time Resolution (CTR) of 215 ps FWHM has been obtained with 3.1 x 3.1x 15 mm² LYSO:Ce scintillator crystals and Hamamatsu SiPM matrix (S12643-050CN(x)). Characterization measurements with the chip and its performances will be presented.

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