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A synchronization and data acquisition system for silicon detectors

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A dedicated synchronization bus has been developed and its support has been integrated into the FITPix COMBO device. It can be used as Timepix read-out (involving back-side-pulse acquisition) or as a simple spectrometer device (when an external single pad sensor is connected, e.g. ΔE detector). The synchronization bus allows to build-up a system comprising up to 32 separated devices running in clock locked mode while the absolute value of the timestamp is distributed to all involved devices. Any combination of Timepix or spectrometer devices (up to 32, i.e. max number) can be connected-up to create a final measurement set-up. The synchronization bus was also designed regarding the controlling of a trigger signal and busy signal to allow effective filtration of unpaired events when coincidence measurement is performed. The system has been tested with a ΔE -E telescope consisting of a thin detector and Timepix. The thin detector has been used for ΔE and the Timepix detector for E measurements. The ΔE detector has an area of $10 \times 10 \text{ mm}^2$ and a thickness of $12 \mu\text{m}$ with non-uniformity of 8%. An area and thickness of Timepix is $14 \times 14 \text{ mm}^2$ and $300 \mu\text{m}$, respectively. The detection system can provide simultaneous information about position, energy, time and type of registered particles with high synchronization accuracy. Some measurements have been carried out with alpha particle sources (U-233, U-235, and Pu-239) in a vacuum and obtained results are presented.

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