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The timing upgrade project of the TOTEM RP detectors

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We describe the upgrade project developed by the TOTEM Collaboration to measure the time of flight (TOF) of the protons in the vertical Roman Pot detectors. The physics program that the upgraded system aims to accomplish will be addressed. Simulation studies allowed to define a geometry of the sensor such that the detection inefficiency due to the pile-up of the particles in the same electrode is low even with a small amount of read-out channels. The measurement of the protons TOF with ∼50 ps time resolution requires the development of several challenging technological solutions. The arrival time of the protons will be measured by sCVD diamond detectors, for which a dedicated fast and low-noise electronics for the signal amplification has been designed. Indeed, while diamond sensors have the advantage of higher radiation hardness, lower noise and faster signal than silicon sensors, the amount of charge released in the medium is lower. The sampling of the waveform is performed at a rate up to 10 GS/s with the SAMPIC chip. The sampled waveforms are then analysed offline where optimal algorithms can be implemented to reduce the time walk effects. The clock distribution system, based on the Universal Picosecond Timing System developed at GSI, is optimized in order to have a negligible uncertainty on the TOF measurement. Finally an overview of the control system which will interface the timing detectors to the experiment DAQ is given.

Collaboration

On behalf of the TOTEM Collaboration

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