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A New Front-end ASIC for GEM detectors with Time and Charge Measurement Capabilities

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GEM detectors offer interesting solutions for particle detection in several application fields, thanks to their excellent features in terms of spatial resolution, gain, flexibility and cost. In the framework of the project AMIDERHA, which aims at building a new hadrontherapy facility, GEM is the detector of choice for beam monitoring and the associated front-end electronics must be able to provide measurements of the charge delivered by the detector, in order to improve the spatial resolution of the detection system by exploiting charge centroid algorithms. For this purpose, a 32 channel front-end ASIC has been designed in a standard 0.35um CMOS technology. The analog channel is based on the classic CSA+shaper architecture, followed by a peak detector (PD) which works as an analog memory during the read-out phase. A multiplexer routes the outputs of the PDs towards an integrated 8-bit subranging ADC. A trigger signal is generated by fast-ORing the outputs of 32 voltage discriminators which compare the shaper outputs with a programmable threshold. The digital part of the ASIC manages the read-out of the channels, the A/D conversion and the configuration of the programmable features of the chip, via SPI interface. A 100Mbit/s LVDS serial link is used for data communication. The sensitivity of the analog channel is 15mV/fC and the dynamic range is 80fC, with a linearity error less than 1%. The ENC is about 650e- for a detector capacitance of 10pF.

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