Gas Electron Multiplier (GEM) is one of new position sensitive gas detector developed by CERN. Its basic component is the kapton foil coated with copper on double sides, and etched with high density of micro holes. In working condition, high voltage is applied between the two copper sides, the electrons can be avalanch inside the holes, leading the amplification of primary ionization. GEM detector has a lot of excellent performance, such as high counting rate, high space and time resolution, it shows potential applications in many fields.

The upgrade of Beijing Synchrotron Radiation Facility (BSRF) need two-dimensional position-sensitive detection equipment to improve the experimental performance. GEM detector, in particular, pixel-based GEM detector has good respects in the domain of synchrotron radiation and high energy physics experiments for its simple structure, superior performance and the flexible way of read-out.

For the read-out of larger scale pixel-based GEM detector, we proposed a circuit structure based on the capacitor switch array circuit, we did analyze and simulation of the circuit. Then, we designed the chip GEM400, a 600channel ASIC based on capacitor switch array circuit. The simulation results show that the chip can allow the maximum amount of input charge 70pC on the condition of 100Gf external integrator capacitor. Besides, the chip has good channel consistency and better noise performance and lower consumption. We proposed a readout scheme for pixel-based GEM detector, this scheme is based on GEM400 chip and System-in-Package technology.

The GEM400 ASIC chip is built with Global Foundries 0.35um CMOS 2P4M process. The basic functional circuitry in this chip includes analog switch, analog buffer, voltage amplifier, bandgap and control logic block. Its layout takes 5mm x 5mm area.

For the readout system can be very simple. Using the capacitor switch circuit, the int. capacitor of line2 is measured, after that, switches of line1 are open and line2 are closed, the voltage on the int. capacitor of line1 is accumulated on the integration capacitor, it is consume lower power, and the int. capacitor is discharged.

GEM400: A Front-End Readout Chip Based on Capacitor-Switch Array For Pixel-based GEM Detector

Li Huaisen, Jiang Xiaoshan, Liu Gang, Wang Na, Sheng Huayi, Zhuang Baoan, Zhao Jingwei
Institute of High Energy Physics, Chinese Academy of Sciences, P. R. China