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Study of ageing of the Straw Tube detectors

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We have studied the ageing behaviour of 6~mm diameter straw tubes and found the ageing rates with the binary gas mixture - Ar/CO_2 to justify its use in future high energy physics experiments. Two separate experiments are performed with the straw tube detector prototypes in the laboratory. In the first experiment, the performance of the straw tube detector is studied using a single straw irradiated with 40 kHz/mm X-rays for more than 800 hrs at a stretch (charge accumulation of 0.6 C/cm). In the second experiment, the gain and energy resolution measurements with two straws (one is the straw under test and the other is the reference straw) connected in parallel to the same gas line are carried out for a total period of 1200 hrs under constant irradiation. The test straw is operated at high gain($\sim 10^4$) and high X-ray flux($\sim$35 kHz/mm) whereas the reference straw is operated at a low gain($\sim 6 \times 10^3$) and low X-ray flux($\sim$0.9 kHz/mm) purposely to observe the effect of high radiation doses. The gain of the aged straw is found to have gas flow rate dependence. This is called 'transient ageing' which is typically observed in the straw tubes. We have also estimated the time required for the gain of an aged straw tube detector to recover on increasing the gas flow rate. Our observations for the ageing behaviour of straw tubes have also been compared to the results in the past. The details of the measurement process and the experimental results will be presented.

Collaboration

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