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Triple-GEM detectors for electron, proton and neutron beam diagnostics

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Different detectors based on triple GEM technology realized in Frascati during the last years, will be presented.They have been used for the luminosity measurements at Dafne Phi Factory, for the beam position at BTF (Frascati) and at CERN H8 area, and for the high intensity neutron fluxes measurements at FNG and Frascati Tokamak Upgrade.We report on the design, construction and test of a GEM compact time projection chamber (TPC), for beam monitoring.A description of the detector construction and assembly, together with the results achieved during test at BTF and CERN, are here reported.The second monitor is a novel neutron detector developed and tested in the framework of a collaboration between LNF-INFN and ENEA-Frascati.The aim is to obtain a versatile device that can be employed for the simultaneous measurement of the neutron flux in various energy bands from 1 to 20 MeV. The main drive for this development is the need of neutron detectors with low sensitivity to gamma rays and high count rate capability for operation in the neutron flux environment (˜10ˆ8 Hz/cm2) expected in future controlled thermonuclear fusion reactors. In these devices the fusion power is assessed through the measurement of the 2.5 MeV and 14 MeV neutrons emitted by the plasma.Experimental tests at the Frascati Neutron Generator of two detector prototype units, respectively optimized for 2.5 MeV and 14 MeV neutrons, are presented.

Summary (Additional text describing your work. Can be pasted here or give an URL to a PDF document):

The main idea of the GEM compact TPC is to rotate a standard triple GEM detector by 90 degrees, with respect to incidence normal to the GEM foils and readout electrode, and to use it as a time projection chamber, by enlarging the drift gap.In this way the depth of the material crossed by the particle is particularly small (<0.2 X0) and the beam position measurement could be more precise, in the coordinate along the drift O(50 um), by measuring the time of arrival of the electron clusters.Moreover, a very compact detector can be realized, using standard 10x10 cm2 GEM foils and a drift gap of 5 cm.The 128 readout channels organized in a matrix of 8x16 pads allow to obtain a good resolution O(1 mm) also in the other two coordinates.

The GEM neutron detectors are realized by a first detector layer, made of polyethylene, which ensures an efficient conversion of neutrons into protons. A second layer (aluminum) provides a suitable proton energy cut-off. The third layer (a GEM structure based on a Ar/CO2/CF4 gas mixture) yields a detectable electron signal through the gas ionization caused by the protons.

Further information can be found at
http://www.lnf.infn.it/esperimenti/imagem/

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