Position sensitive GEM-based neutron detector prototype

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In response to the ^{3}He shortage [1], alternatives for thermal neutron detection are being pursued nowadays. Elements such as ^{157}Gd, ^{10}B and ^{6}Li are commonly used to substitute ^{3}He due to their high neutron capture cross section.

In this work, we present our thermal neutron detector prototype, which makes use of ^{10}B as converter. This detector works under Ar/CO_2 (90/10) open flux and uses two gas electron multipliers (GEMs) [2] microstructures to multiply the charge signal. The neutrons are detected through the gas ionization generated by the products of the $^{10}B(n, a)^{7}Li$ reaction. The neutron capture takes place in the inside face of the aluminum cathode, which is coated with a 2.2 μm thick $^{10}B_4C$ layer (deposition kindly provided by the European Spallation Source (ESS) laboratories).

Experimental measurements obtained in the IEA-R1 nuclear research reactor, at the Nuclear and Energy Research Institute (IPEN), shown that our prototype presents high stability, position sensitivity with spatial resolution better than 3 mm and an efficiency of 2.97(25)%, allowing its application as beam profiler. Methods to increase the neutron detection efficiency will then be discussed.

References

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