



Contribution ID: 297

Type: **Poster**

## **A new THGEM-based thermal neutron detector for high detection efficiency**

*Saturday 6 August 2016 18:00 (2 hours)*

The THGEM-based detector with cascade boron coating structure is a promising solution for high efficiency thermal neutron detection, instead of those  $^3\text{He}$ -based. The general idea is to coat boron on the surfaces of several layers of THGEMs. However, the gain difference and neutron scattering and absorption due to THGEMs themselves are problems. A new idea is proposed to avoid these problems. The boron can be coated on surfaces of cascade conversion meshes, such as stainless steel, copper, PCB and aluminum, and only one layer of THGEM for avalanche. In this way, the conversion layers are independent and both surfaces could be coated with boron to double conversion efficiency. More importantly, the material, thickness, hole diameter and hole pitch of each layer can be optimized for better boron film quality, higher conversion efficiency, higher collection efficiency and lower neutron scattering and absorption. In this case, four or five conversion layers are possible. For alpha detection, one layer of THGEM is enough and can ensure the gain uniformity. If the readout board were designed as mirror-pad structure, i.e., both sides of board are pad readout but each two mirrored pads are connected, then one detector can combine with two cascade modules to double detection efficiency without increasing the readout channels. The details of the detector structure, simulation results of thermal neutron conversion efficiency, ionized electron collection efficiency, and detection efficiency will be presented. The primary neutron test results will be showed.

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