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Photosensitive Gaseous Detectors for Cryogenic Temperatures Applications

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Noble liquids are excellent detecting medias: they have a rather high stopping power, allow electrons and ions to drift and they have an exceptionally high scintillation yield. All these properties are simultaneously exploited in the noble liquid Time Projecting Chambers (TPCs) which allow to visualize charge tracks, measure the deposited energy and the light to charge ratio [1]. One of the critical elements of noble liquid TPCs are photosensitive detectors. Nowadays, vacuum PMs are usually used for this purpose. The main drawbacks of these detectors are: the high cost and sensitivity to magnetic fields (desirable for some experiments).

We have demonstrated recently that some gaseous detectors combined with CsI photocathodes could operate at cryogenic temperatures [2,3]. Such detectors are much cheaper than PMs and they are insensitive to magnetic fields. In this report we will present our new and yet unpublished results on the development of sealed planar gaseous detectors (wire- type and hole- type) combined with reflective and semitransparent CsI photocathodes and present the studies of their operation inside LAr and LN2. Results of systematic measurements of their quantum efficiencies, the maximum achievable gains and long-term stabilities will be presented. In addition the operation of gaseous detectors combined with other solid photocathodes was also studied.

We will also present the results on the operation of windowless photosensitive detectors (parallel-mesh-type and hole-type) placed either in cooled gases or directly in vapours a few cm above the noble liquid level will. Based on the obtained results a comparison will be done between the sealed and windowless photosensitive gaseous detectors. Note that the windowless detectors could also be used for the detection of the charge tracks. As an example we will describe our first experiments with muon's charge track extraction from the LAr and detected by a specially developed hole-type detector made of G10 [4].

The successful operation of these detectors open realistic possibilities in replacing PMs by photosensitive gaseous detectors in some applications dealing with cryogenic liquids. Examples could be: the ICARUS experiment, WIPMs search LAr/Xe detectors, noble liquid scintillating calorimeters and cryogenic PETs.

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