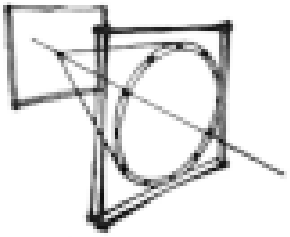

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Recent Developments with Microchannel-Plate PMTs

Tuesday 6 September 2016 09:35 (25 minutes)

PANDA will be one of the pillar experiments at the new FAIR facility at GSI. With a high intensity antiproton beam its objectives will be, among others, charmonium spectroscopy and the search for gluonic excitations. These scientific goals require a high performance PID system which will consist of DIRC detectors residing inside a magnetic field of 2 Tesla.

Microchannel-plate (MCP) PMTs are very attractive photon sensors for low light level applications in B-fields. Until recently the main drawback of MCP-PMTs was aging. This causes a limited lifetime due to a rapidly decreasing quantum efficiency (QE) of the photo cathode (PC) as the integrated anode charge (IAC) increases. In the latest models of PHOTONIS, Hamamatsu, and BINP innovative techniques are applied to avoid aging which is mainly caused by ion backflow impinging on the PC and damaging it.

Since five years we are running an aging test for new lifetime-enhanced MCP-PMTs by simultaneously illuminating various PMT models with roughly the same photon rate. This allows a fair comparison of the lifetime of these MCP-PMTs and gave some insight in the best techniques for a lifetime enhancement. Also conclusions about the aging mechanisms may be possible.

In this presentation the results of comprehensive aging tests will be discussed. The QE dependent on the IAC was measured as a function of the wavelength and the position across the PC. For the best performing tubes the lifetime improvement in comparison to the older MCP-PMTs is a factor of 50 based on an IAC of meanwhile 10 C/cm2. This tremendous lifetime increase was accomplished by coating the MCP pores using an atomic layer deposition (ALD) technique.

In addition, we will present performance results of a new 2-inch lifetime-enhanced MCP-PMT with a very high position resolution (128x6 anode pixel) which was recently developed by Hamamatsu. The effects of electron focussing on the position resolution inside a high magnetic field will also be discussed.

Registered

Yes

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