MCP Pore Angle Calculation

Guilherme Nettesheim

May 22, 2009

1 Introduction

A typical microchannel plate's pores run through it at a small angle, usually around 8°.[1] This experiment's goal, therefore, was to find this angle.

2 Set up

The idea was to pass light through the MCP, and have the intensity of the light be detected by a photocathode tube. By aligning the MCP glass such that its pores were parallel to the incoming light, a maximum amount of light would pass through the MCP. The experiment was conducted inside a black box which did not allow light in. Inside was an LED, a photocathode tube, and the MCP.

2.1 LED

The light emitting diode was placed 2" from the MCP, behind a linear polarizer, and pulsed with an amplitude of 3V, and a period of $100\,\mu$s. By linearly polarizing the light, the reflection from the surface of the MCP was maximized, and therefore made the principle factor in the light instensity the angle of the pores.

2.2 MCP

The microchannel plate was put on a swiveling stand which measured the angle the plate made with the ground, such that as the stand measured 90°, the plate was normal to the floor. Care was also taken that the pores lay in the plane of rotation of the MCP, so that as it swiveled, the angle between the floor and pores was indeed changing. The LED and the photocathode tube were placed so that even as the MCP swivelled to vary the angles, there was no direct line-of-sight between the LED and the photocathode.

[1] See Joseph Ladislas Wiza, *Microchannel Plate Detectors*

2.3 Photocathode tube

The photocathode tube was placed 2" from the MCP plate. The photocathode tube, the MCP, and the LED were kept on the same plane. The sides of the photocathode were wrapped in black electrical tape to remove the contribution of any light reflecting off the sides of black box. This photocathode was connected of an oscilloscope.

3 Procedure

After closing the black box and turning on the pulse generator, the amplitude of the pulse coming through the photocathode was measured using the oscilloscope. The values recorded are averages taken over 3000 counts, at which point the average became sufficiently stable. This was repeated for every angle between 75° and 106°. After collecting this data, the MCP was turned upside down, and the measurements were taken again. This was done so that any error in the first measurement due to miscalibration of the stand apparatus would cancel with a second measurement with the MCP upside down after the values were averaged.

4 Results

The results show a single peak at 81° where the photocathode detected the hightest intensity of light, for both orientations of the MCP, giving an overall angle of 9°.
As the channel axis is usually biased at roughly 8° this result is reasonable.

Table 1: Measurements

Angle of MCP $\pm.5°$	Amplitude I (mV) $\pm 5mV$	Amplitude II (mV) $\pm 5mV$
75°	470	430
76°	510	490
77°	560	545
78°	580	580
79°	600	605
80°	615	620
81°	625	630
82°	615	615
83°	605	600
84°	560	555
85°	550	540
86°	500	500
87°	450	455
88°	400	405
89°	325	325
90°	290	290