

The performance of a wire chamber with a light sensitive mixture methane -TMAE at high counting rates

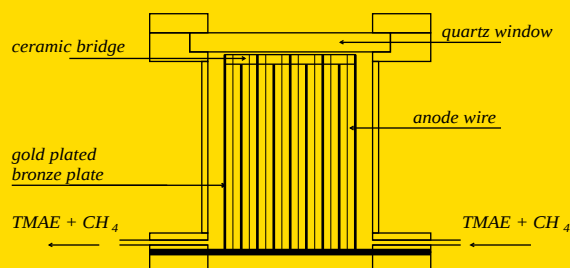
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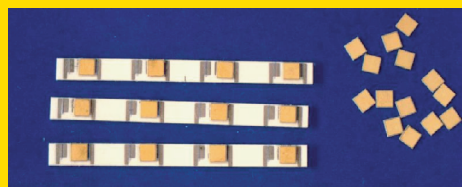
INTRODUCTION

A multiwire photon detector with the addition of the TMAE vapour to achieve photosensitivity has been tested as a possible candidate for the HERA-B RICH detector. The main obstacle for use of such a methane-TMAE filled gas detector in a high rate experiment, appears to be prohibitive ageing in the form of rapid loss of chamber gas gain and thus of efficiency. The lower efficiency in turn reduces the number of detected photons per Cherenkov ring below a critical minimum. The gain reduction is attributed to polymer deposits on the anode wires. In order to remove these deposits, a special circuit has been constructed, which enabled heating of the anode wires in-situ with elevated currents.

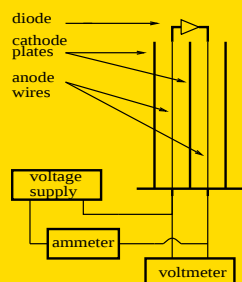
EXPERIMENTAL SETUP



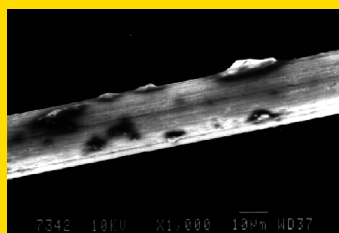
Schematic diagram of the experimental apparatus.



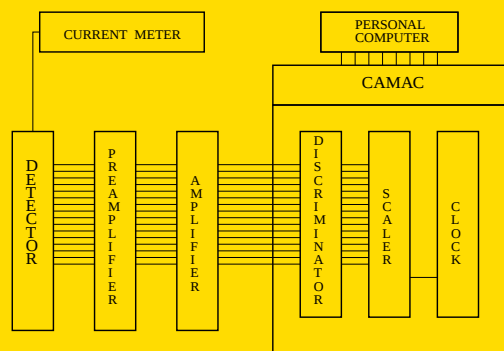
Ceramic bridges with diodes.



Schematic diagram illustrating the setup used to perform in-situ anode wire heating.



Electron microscope picture of an aged anode wire.

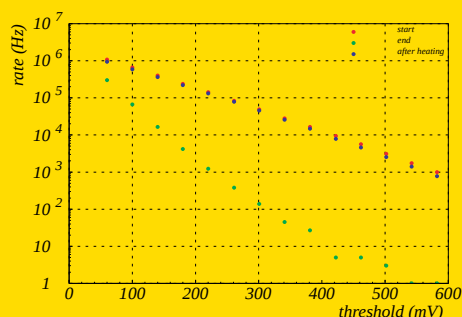


Block diagram of the readout electronic modules

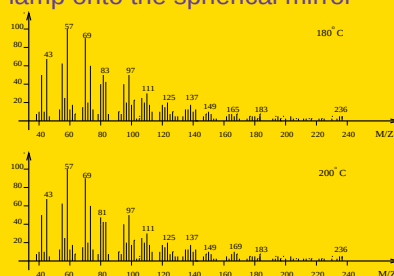
MEASUREMENTS AND RESULTS



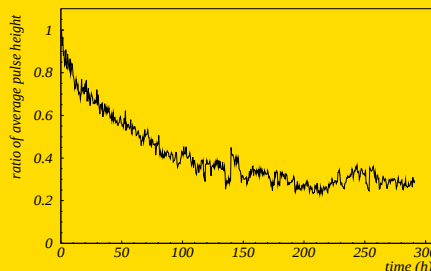
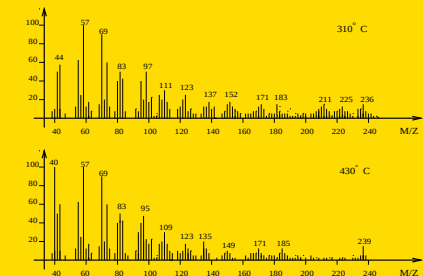
The chamber was illuminated indirectly by shining the UV lamp onto the spherical mirror



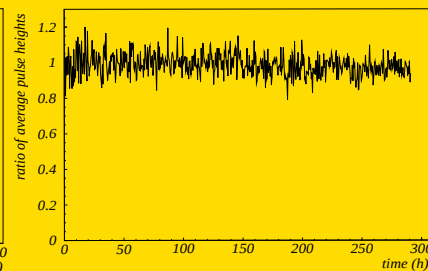
Dependence of the count rate on threshold voltage at the beginning of illumination (red circles), at the end of illumination (green circles) and after heating for 60 minutes at 200°C (blue circles).



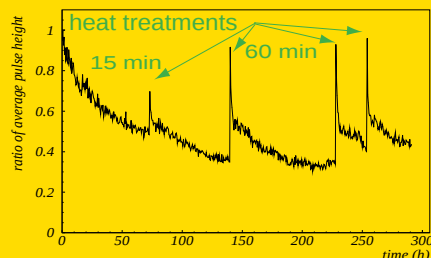
Relative abundances of products evaporated from an aged anode wire at different temperatures, depending on their atomic masses, as obtained by mass spectrometry.



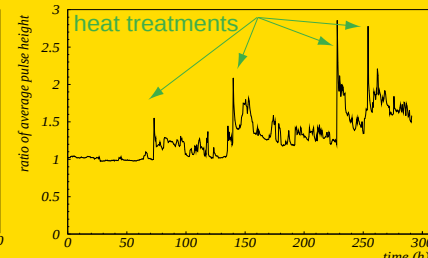
Time dependence of the ratio of average pulse heights between illuminated to non-illuminated cells which have not been heated.



Time dependence of the ratio of average pulse heights between heated to non-heated cells which have not been illuminated.



Time dependence of the ratio of average pulse heights between illuminated to non-illuminated cells which have been heated.



Time dependence of the ratio of average pulse heights between heated to non-heated cells which have been illuminated.

CONCLUSIONS

The rejuvenation with heating almost compensates the ageing due to illumination. Unfortunately this recovery is not of long duration, but is followed by a quick drop in gain. Nevertheless, the heating of anode wires has an overall beneficial effect. With periodic short heat treatments, an average gain considerably higher than for the non-heated wires could be achieved. Although this rejuvenation of the aged wires was not sufficient for HERA-B, it could be useful in experiments with somewhat lower rates.