Proportional Counter

Nordic Detector Technology Course,
Helsinki 2. - 6.11.2015
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1. Introduction

The proportional counter is a type of gas-filled detector that was introduced in the late 1940s, in common with the Geiger-Müller tubes. Proportional tubes are almost always operated in pulse mode and rely on the phenomenon of gas multiplication. This last is a consequence of increasing the electric field within the gas to a sufficient high value. One important application of these counters has been in the detection and spectroscopy of low-energy X- rays. Below in Figure 1, schematics of such a device is shown.

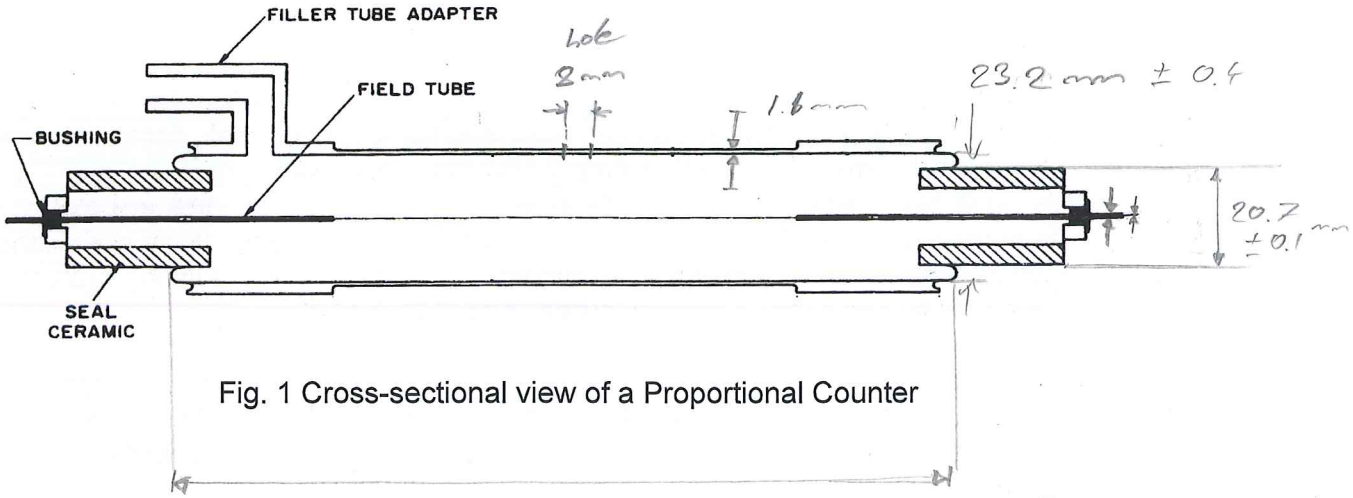
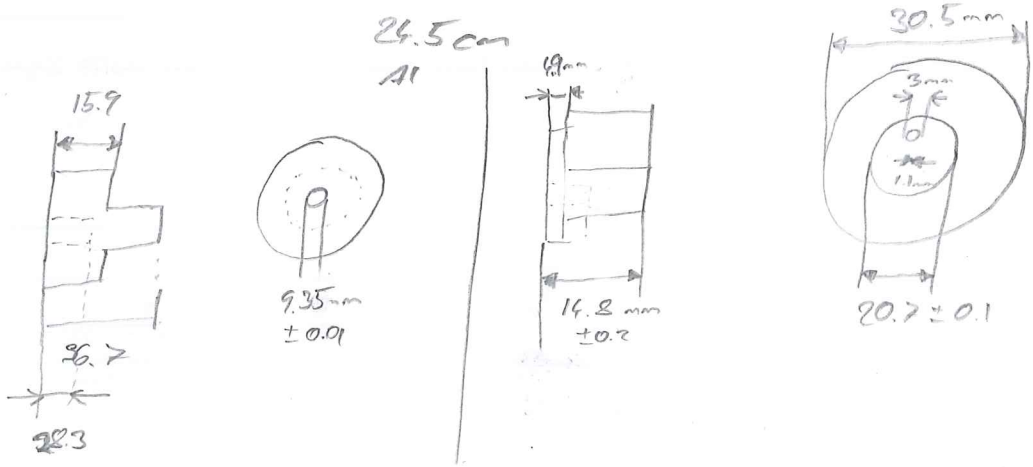


Fig. 1 Cross-sectional view of a Proportional Counter



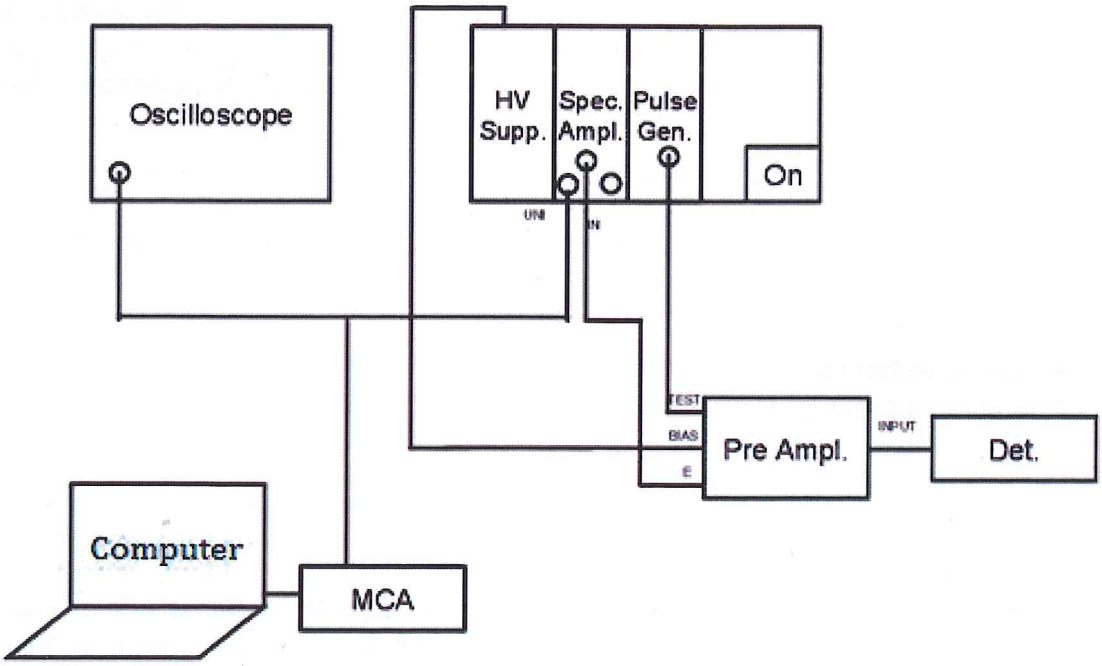


Fig 3: Schematic drawing of the setup. Note: Power cables are not included in the drawing.

The MCA software starts and pauses measurement by pressing F3. The histogram is cleared by pressing the button A and time is reset to 0 by pressing the button T. The region of interest (ROI) is cleared by pressing the button R.

3.1. Calibration

In the calibration a test pulse with known pulse height is fed through the electronics. You need to measure the electronics response with six different pulse heights. You can use for example 20, 50, 70, 100, 120 and 150 mV pulses, with spec. amplifier gain = 10 or use your own set of pulse heights. The calibration pulse height is measured using the oscilloscope, while the corresponding MCA channel is discovered by saving a single histogram with all the calibration points and fitting eg. a Gaussian[1].

[1] Check the software preferences that the centroid/ FWHM detection mode is set to Gaussian mode.

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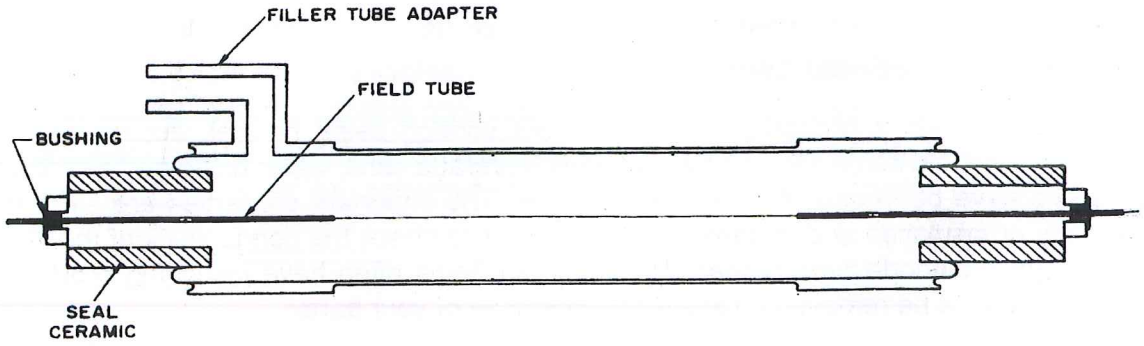

Fig. 1 Cross-sectional view of a Proportional Counter