



CAEN Educational Handbook

Nuclear and Particle Physics Experiments



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β RADIATION AS A METHOD TO MEASURE PAPER SHEET GRAMMAGE AND THIN LAYER THICKNESS



Difficulty



Execution Time



SP5600D - EDUCATIONAL BETA KIT

Purpose of the experiment

Estimate of the instrument sensitivity in the measurement of thin layer thickness by beta particle attenuation.

Fundamentals

Beta attenuation represents a golden standard in the quality control of paper industry and in the measurement of thin layer thickness. The latter has several applications, including the

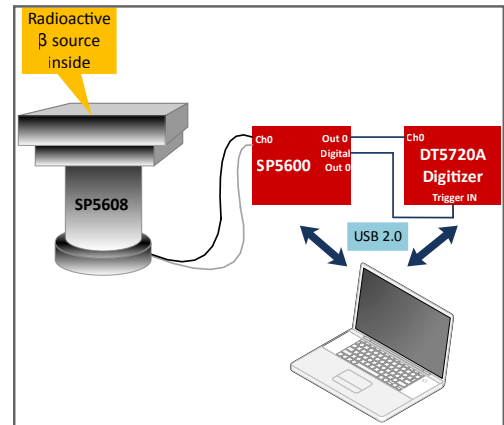
concentration of fine particulate matter deposited on a filter. The use of high activity sources with relatively soft spectrum and highly efficient detectors guarantees that this technique, used since the 50's, is yet today a standard.

Requirements

Beta Radioactive Source. 

Carrying out the experiment

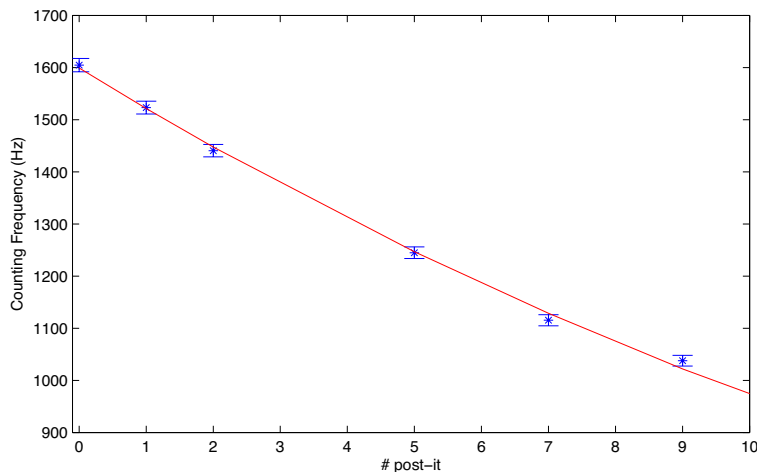
Insert the beta source support in the SP5608 and connect power and MCX cables to one channel of the SP5600. Connect the two channel outputs to DT5720A: the analog output to the channel 0 and the digital output to "trigger IN" of the digitizer. Use the default software values or optimize the parameters to evaluate the contribution not coming from the beta source and choose the discrimination threshold in mV. After that, switch off the power supply, open the SP5608 top and place the beta source on the plastic support and close the support top. Switch ON the power supply and measure the counting rate. Repeat the measurement by adding paper sheets.



Experimental setup block diagram.

Results

The industrial results are provided by using high activity β source (1 GBq). This experiment allows to estimate the instrument sensibility and the time needed to obtain a certain percentage of sensibility through the attenuation curve of a β source with "student compliant" activity. The results are very surprising: 3σ of confidence level to distinguish one or two post-it in 250 ms and 25 seconds to reach sensibility 10%.



Counting frequency of the beta rays as a function of the number of crossed paper sheets.