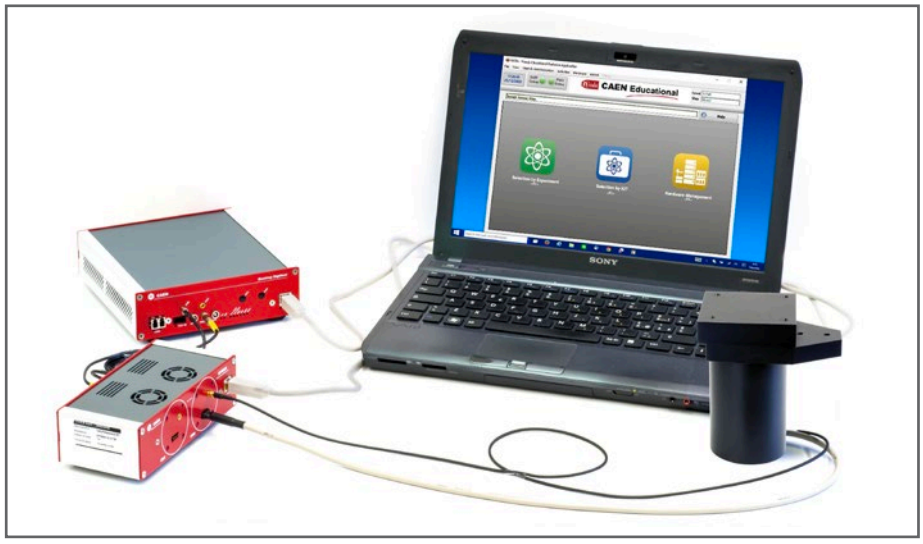
B.4.4 SG6124 β Radiation as a Method to Measure Paper Sheet Grammage and Thin Layer Thickness



Ordering Options

Equipment	
Code	**Description**
WK5600XDAAAA	SP5600D - Educational Beta Kit
or the all inclusive Premium Version	
WK5600XANAAA	SP5600AN - Educational Kit - Premium Version

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.

Equipment

SP5600D - Educational Beta Kit

Model	SP5600	SP5608	DT5720A
Description	Power Supply and Amplification Unit	Scintillating tile	Desktop Digitizer 250 MS/s
			
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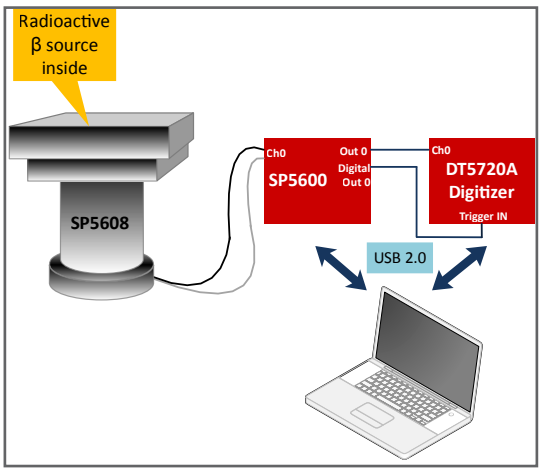
Requirements

Beta Radioactive Source

Gravitational Wave Detected 100 Years After Einstein's Prediction.

For the first time, scientists have observed ripples in the fabric of spacetime called gravitational waves, arriving at the earth from a cataclysmic event in the distant universe. This confirms a major prediction of Albert Einstein's 1915 general theory of relativity and opens an unprecedented new window onto the cosmos. Gravitational waves carry information about their dramatic origins and about the nature of gravity that cannot otherwise be obtained. Physicists have concluded that the detected gravitational waves were produced during the final fraction of a second of the merger of two black holes to produce a single, more massive spinning black hole. This collision of two black holes had been predicted but never observed.
The gravitational waves were detected on September 14, 2015 at 5:51 a.m. Eastern Daylight Time (09:51 UTC) by both of the twin Laser Interferometer Gravitational-wave Observatory (LIGO) detectors, located in Livingston, Louisiana, and Hanford, Washington, USA. The LIGO Observatories are funded by the National Science Foundation (NSF), and were conceived, built, and are operated by Caltech and MIT. The discovery, accepted for publication in the journal Physical Review Letters, was made by the LIGO Scientific Collaboration (which includes the GEO Collaboration and the Australian Consortium for Interferometric Gravitational Astronomy) and the Virgo Collaboration using data from the two LIGO detectors.

https://www.ligo.caltech.edu/news/ligo20160211



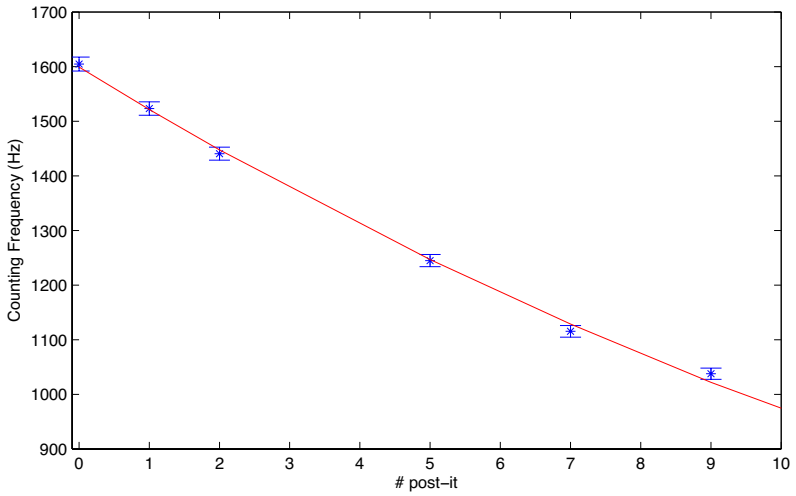
Experimental setup block diagram.

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.

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.