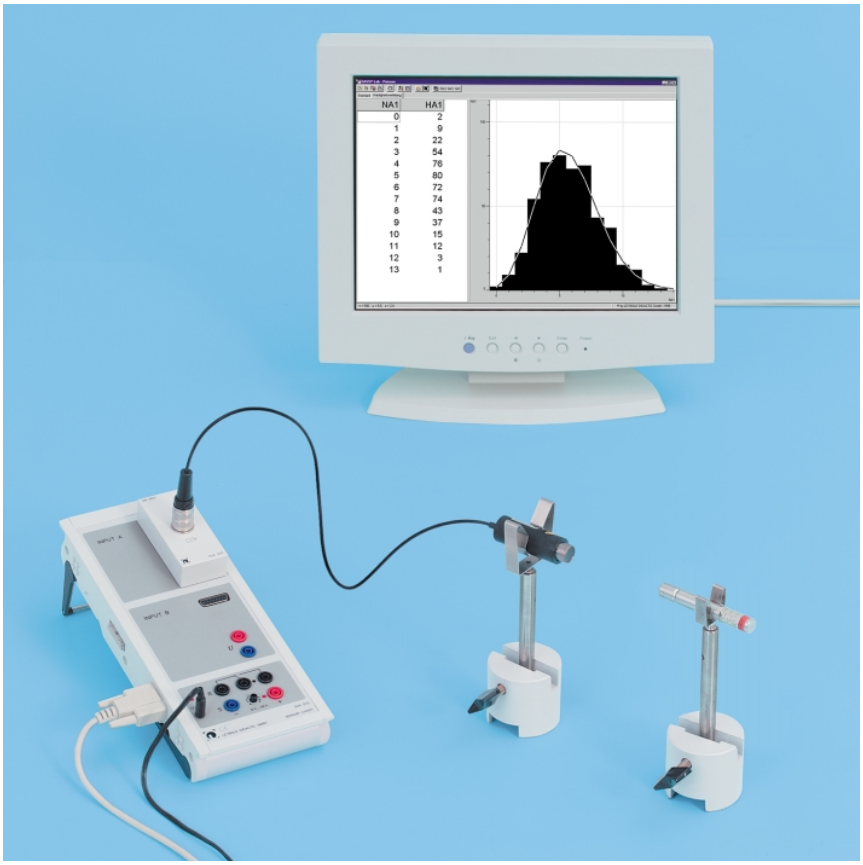
P 6.4.2

Poisson distribution

P 6.4.2.1 Statistical variations in determinating counting rates



Statistical variations in determinating counting rates (P 6.4.2.1)

For each individual particle in a radioactive preparation, it is a matter of coincidence whether it will decay over a given time period Δt. The probability that any particular particle will decay in this time period is extremely low. The number of particles n which will decay over time Δt thus shows a Poisson distribution around the mean value μ. In other words, the probability that n decays will occur over a given time period Δt is

$$w_\mu(n) = \frac{\mu^n}{n!}\, e^{-\mu}$$

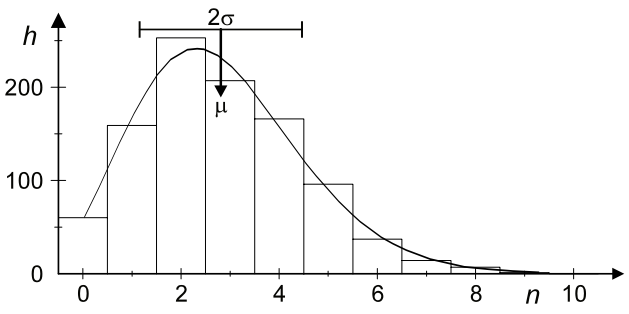
μ is proportional to the size of the preparation and the time Δt, and inversely proportional to the half-life $T_{1/2}$ of the radioactive decay.

Using a computer-assisted measuring system, this experiment determines multiple pulse counts n triggered in a Geiger-Müller counter tube by radioactive radiation over a selectable gate time Δt. After a total of N counting runs, the frequencies $h(n)$ are determined at which precisely n pulses were counted, and displayed as histograms. For comparision, the evaluation program calculates the mean value μ and the standard deviation

$$\sigma = \sqrt{\mu}$$

of the measured intensity distribution $h(n)$ as well as the Poisson distribution $w_\mu(N)$.

Cat. No.	Description	P 6.4.2.1
559 83	Set of 5 radioactive preparations	1
559 01	End-window counter for α, β, γ and x-rays	1
524 033	GM-box	1
524 010	Sensor-CASSY	1
524 200	CASSY Lab	1
591 21	Large clip plug	1
590 02	Small clip plug	1
532 16	Connection rod	2
300 11	Saddle base	2
	additionally required: PC with Windows 95/NT or higher	1



Measured and calculated Poisson distribution
Histogram: $h(n)$, curve: $N \cdot w_\mu(n)$