

## Poisson distribution

A stochastic experiment is repeated many times. Let the expected number of successes be  $\lambda$ . Then the probability of observing  $n$  successes would be

$$P_{\lambda}(n) = \frac{\lambda^n e^{-\lambda}}{n!}$$

The Poisson distribution is of interest especially for TCSPC: The expected number of photons in any TCSPC channel is given by the 'real' decay (including convolution with the IRF etc.), while the stochastic nature of the measurement process (either a photon is detected or it is not) introduces noise, which follows a Poisson distribution. In the limit of large  $\lambda$  the Poisson distribution approaches a Gaussian distribution with a width of  $\sqrt{\lambda}$  centred around  $\lambda$ .

In the Gaussian limit [least squares fitting](#) may be applied, otherwise [MLE fitting](#) is preferable.

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