Xenon scintillation response in two-phase emission detector.

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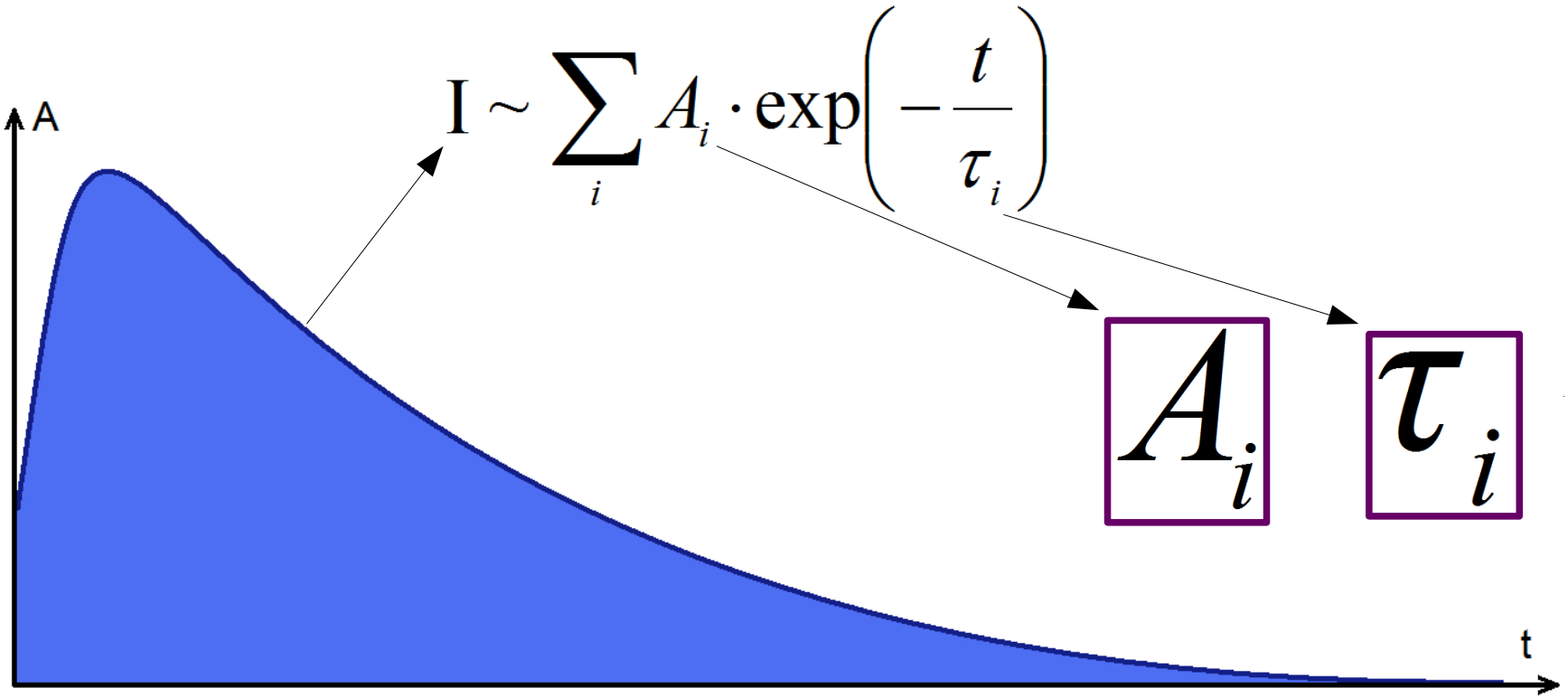
Motivation

1) Our goal is to determine the ratio between the amplitude components of the scintillation and times of deexcitation.

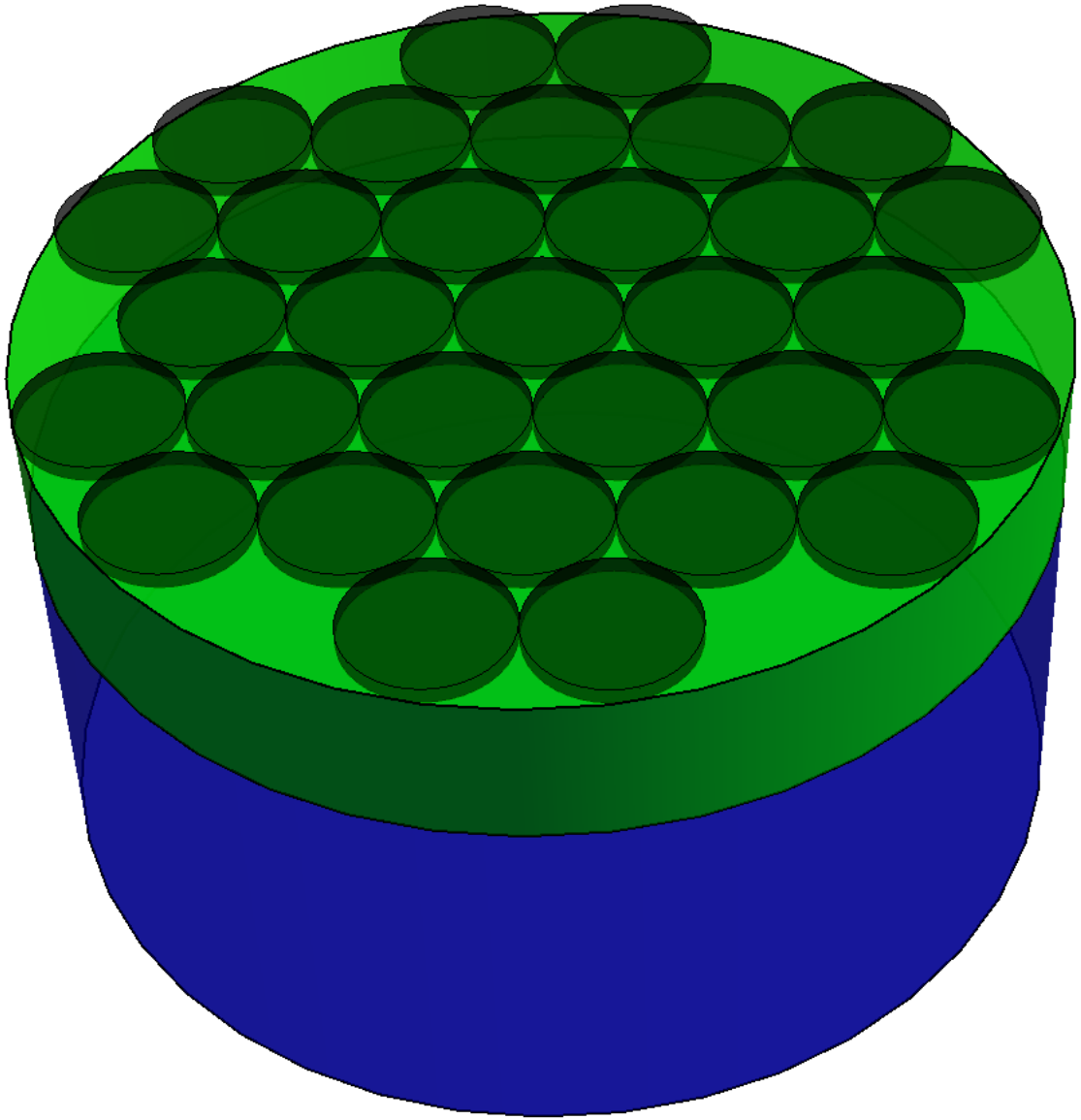
2) Our goal is to analyze the behavior of the values and extrapolate this trend in the range of low energy.

Introduction

- Description form of the xenon scintillation signal.
- Determining the parameters for the model of a light pulse.



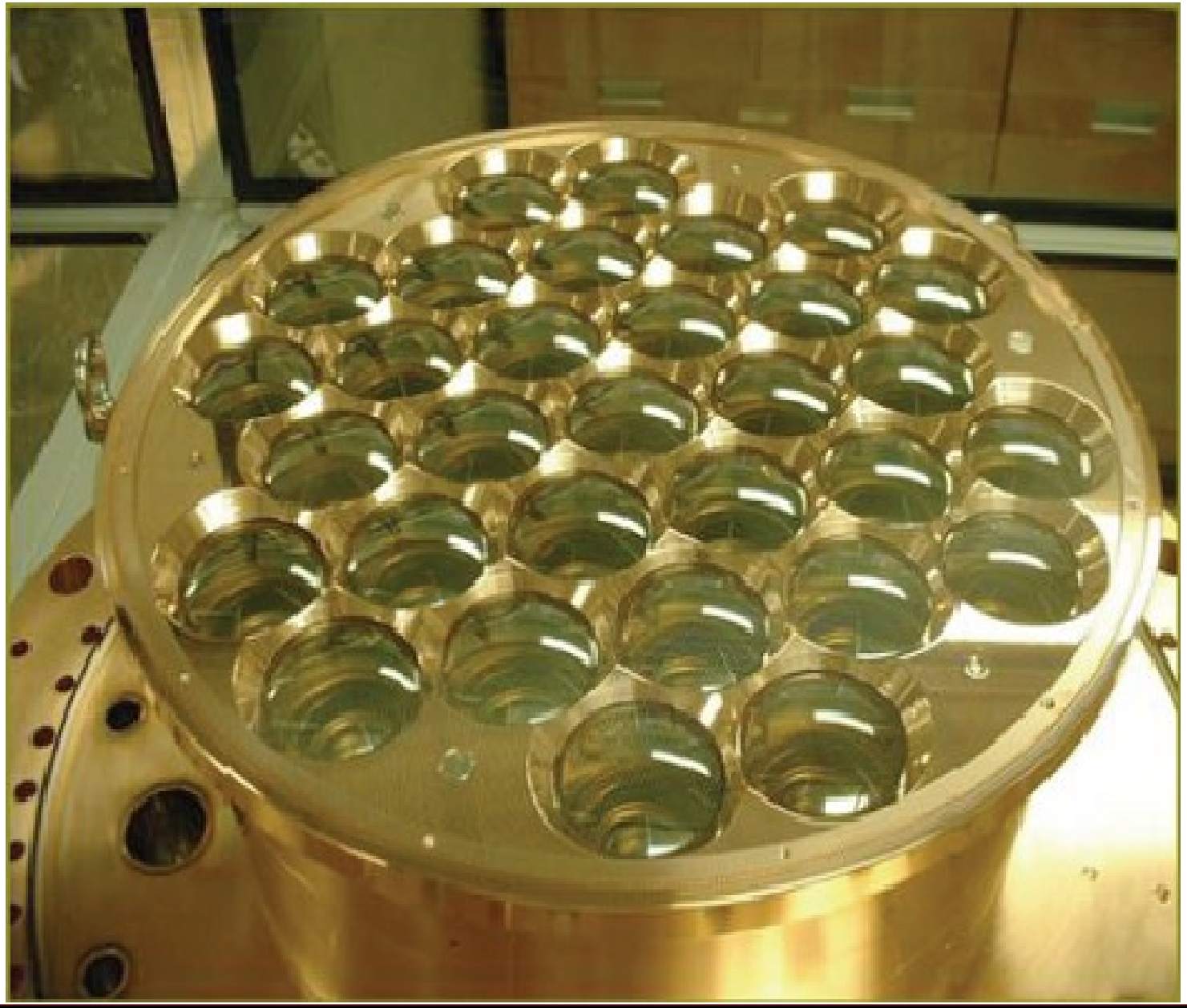
Construction of ZEPLIN III



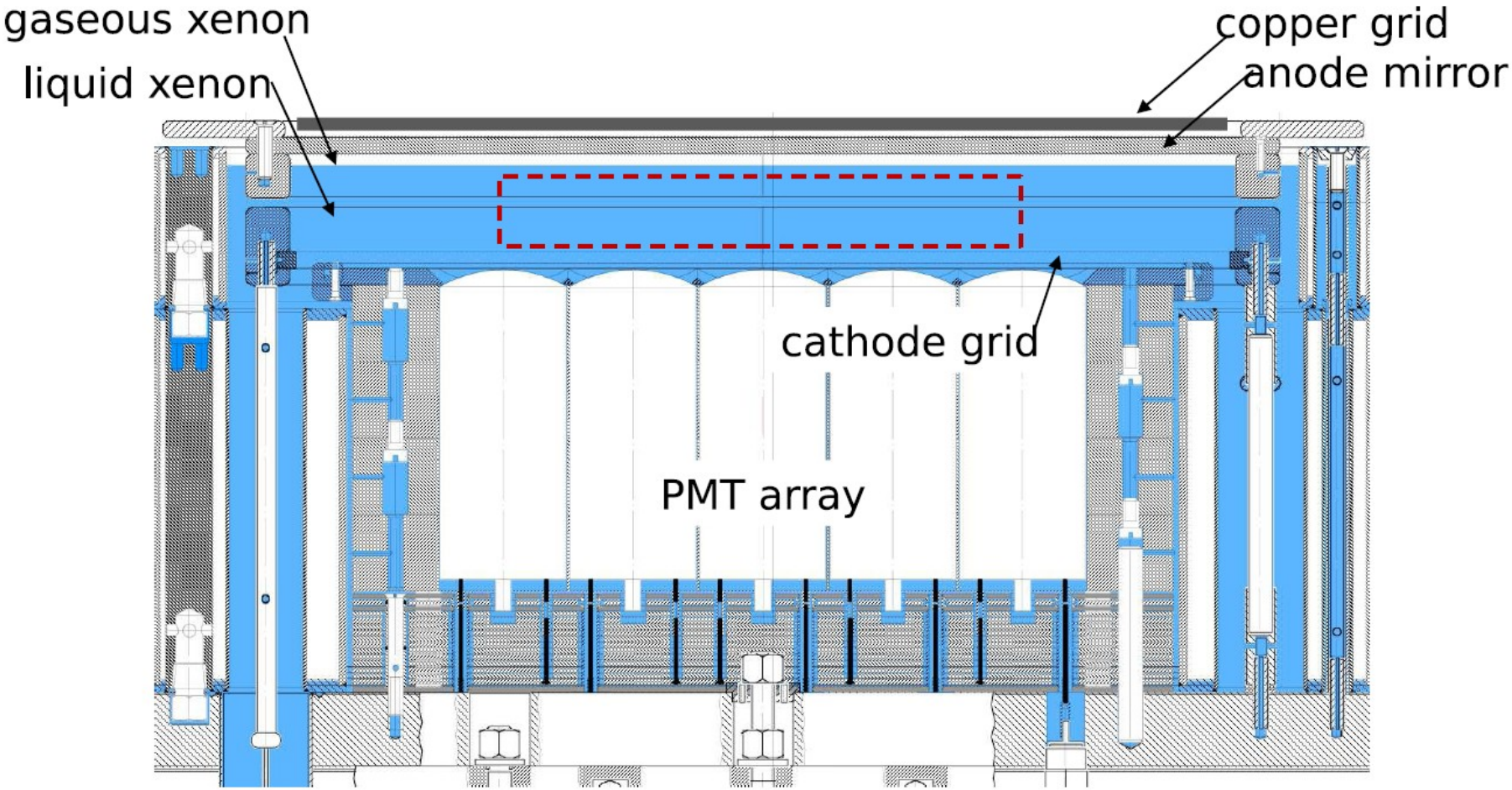
ZEPLIN III
Two-phase emission detector on xenon (liquid and gas phase)
Flat matrix of 31 PMTs

AmBe-source

Construction of ZEPLIN III



Construction of ZEPLIN III

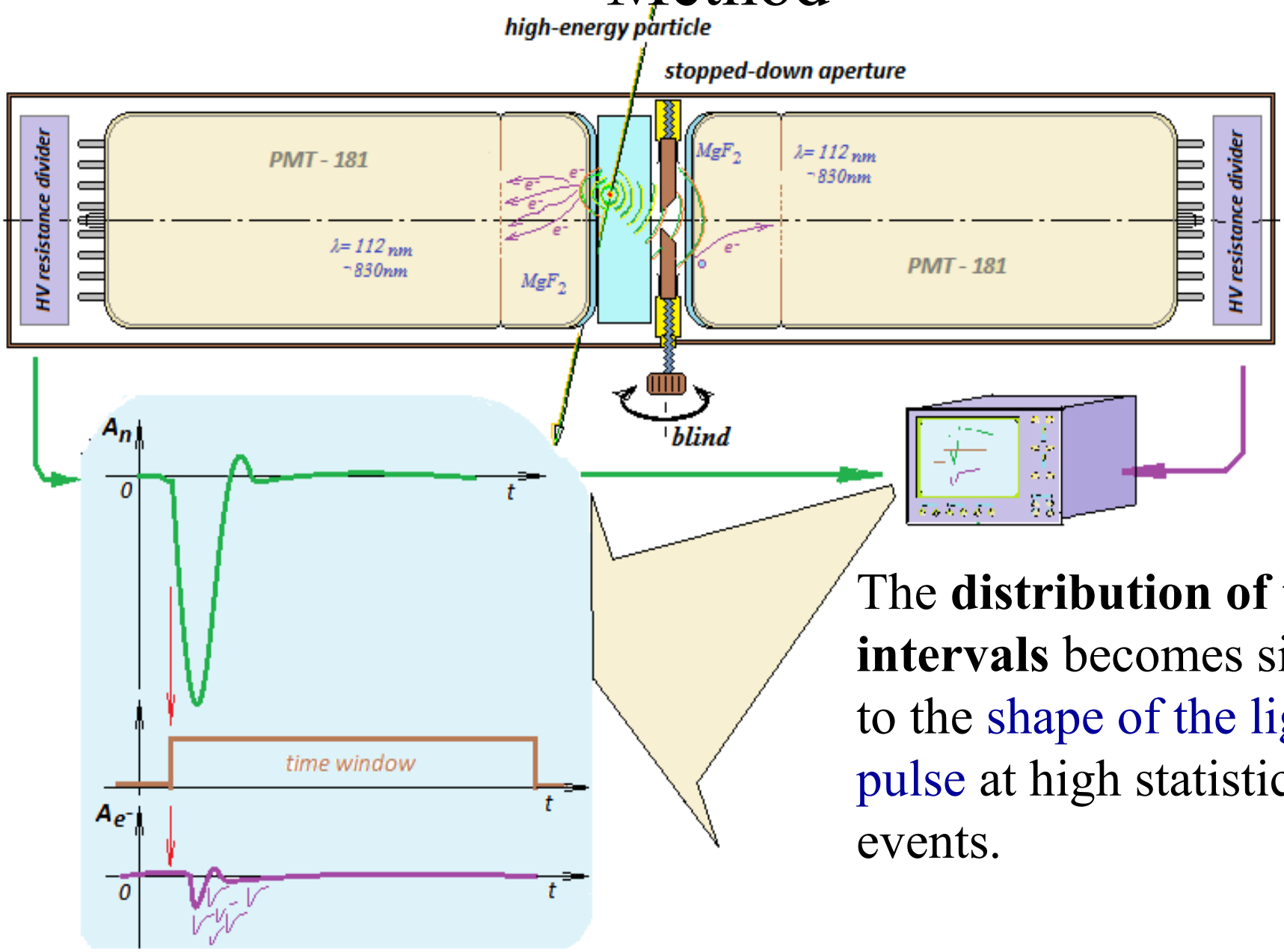


D=340 mm D_{PMT}=51 mm

H_{Liquid}=35 mm $d_{SpPitch}$=54 mm

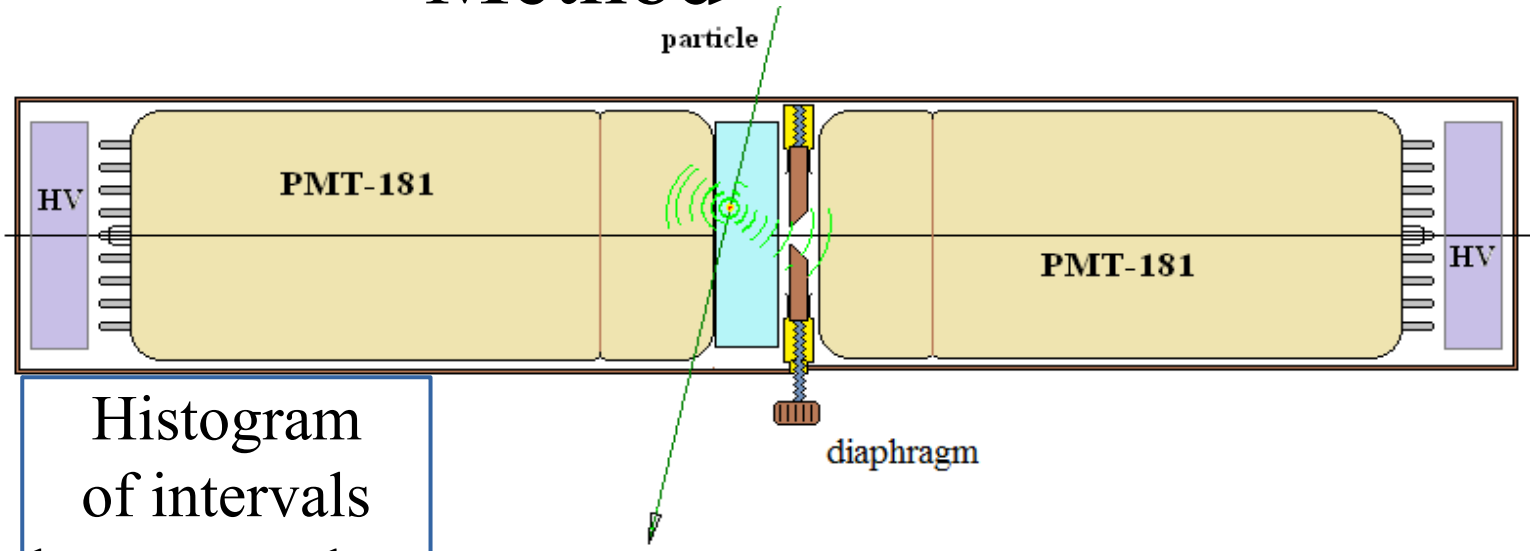
H_{Gas}=5 mm

Method

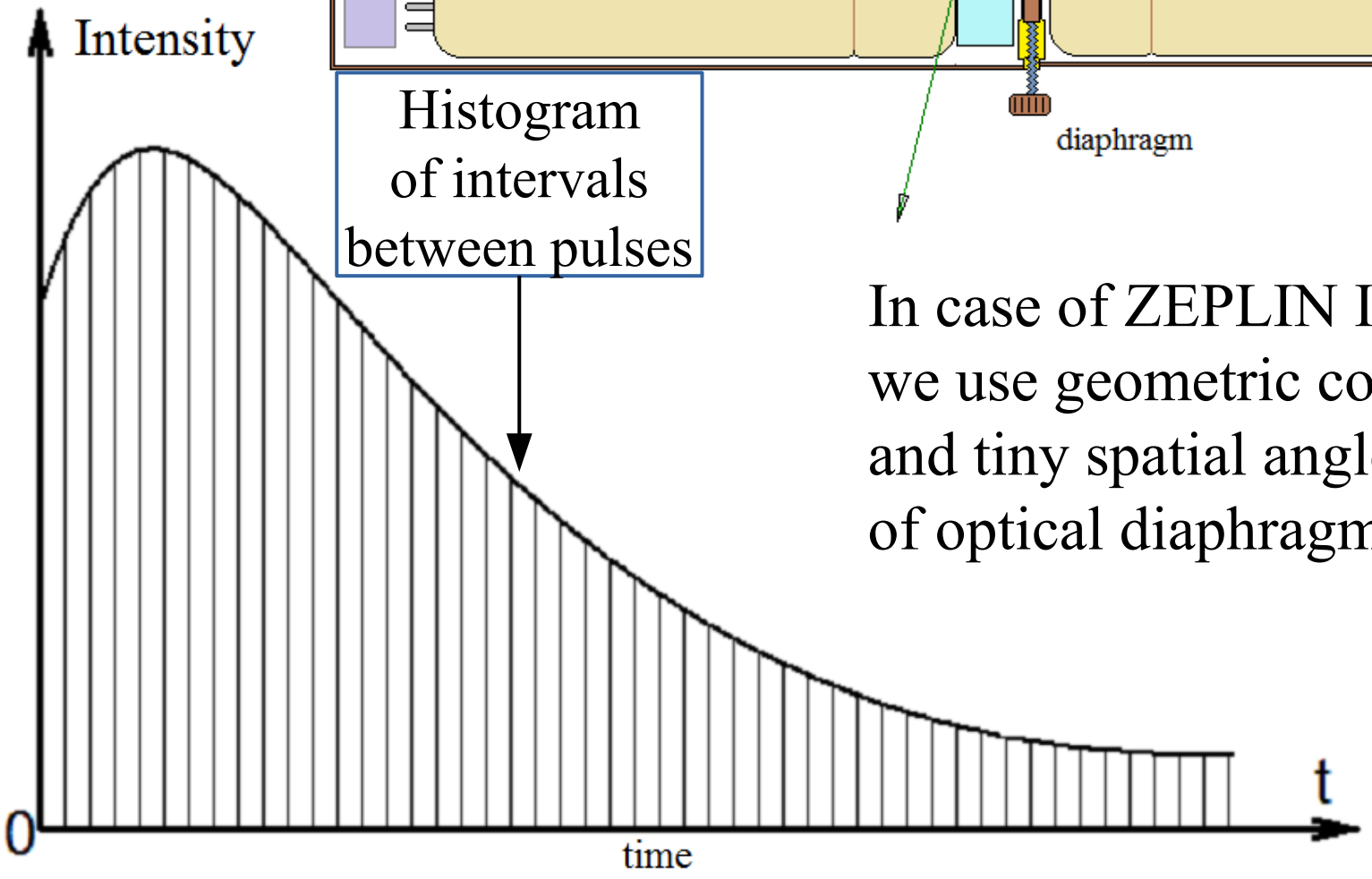


The **distribution of time intervals** becomes similar to the shape of the light pulse at high statistic of events.

Method

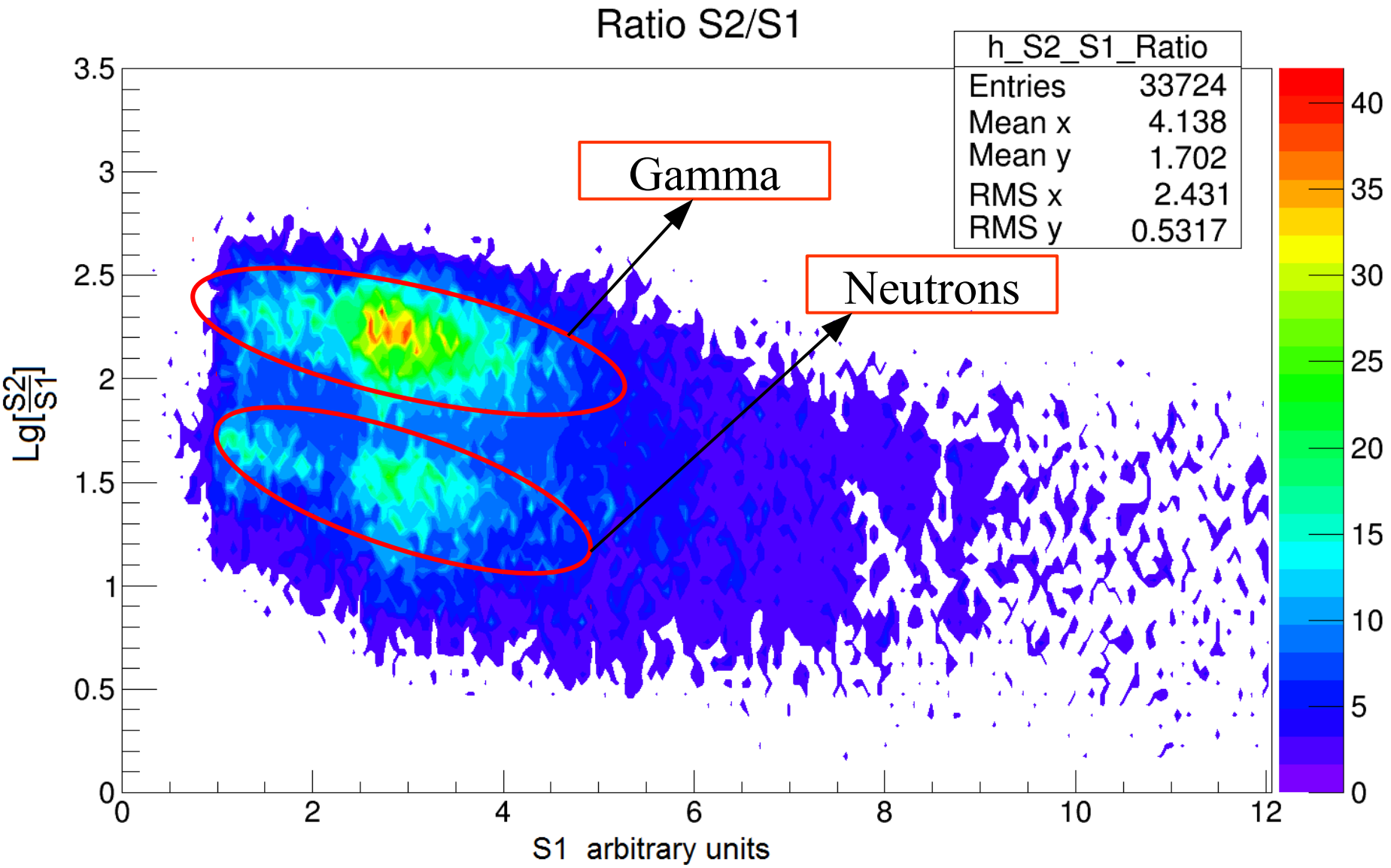


Histogram of intervals between pulses

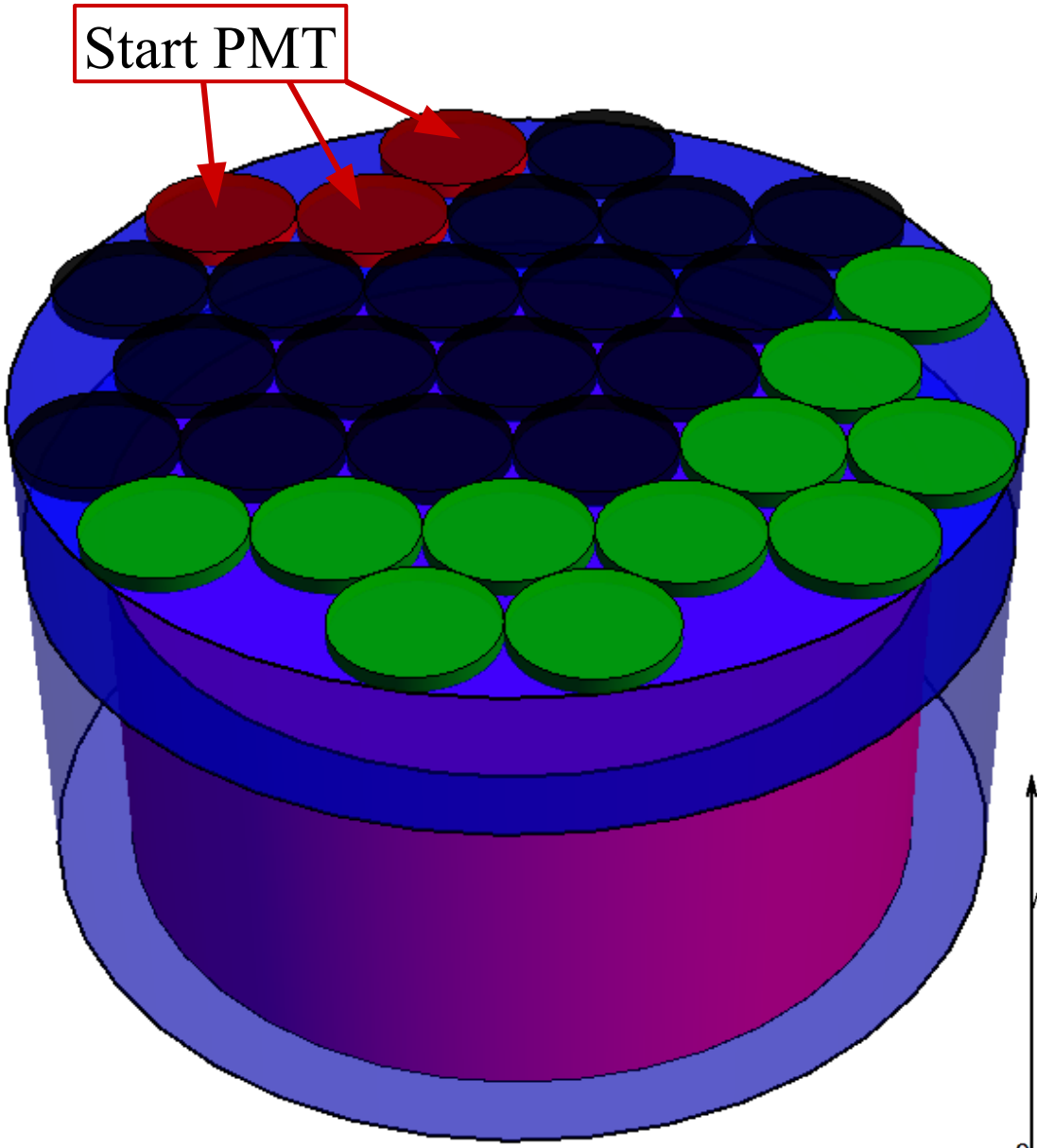


In case of ZEPLIN III detector we use geometric conditions and tiny spatial angles instead of optical diaphragm.

Separation of events

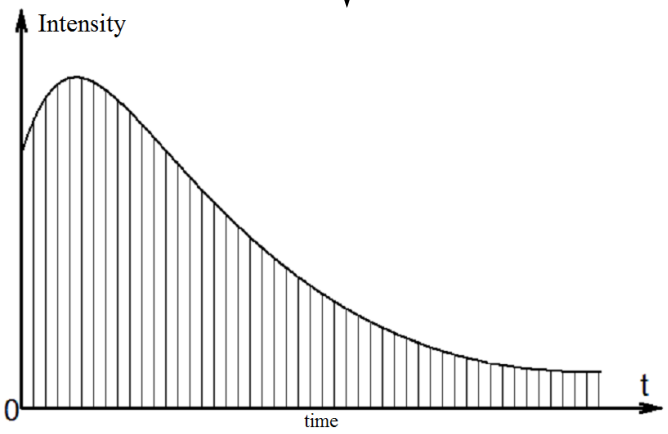


Compilation of deexcitation time spectra



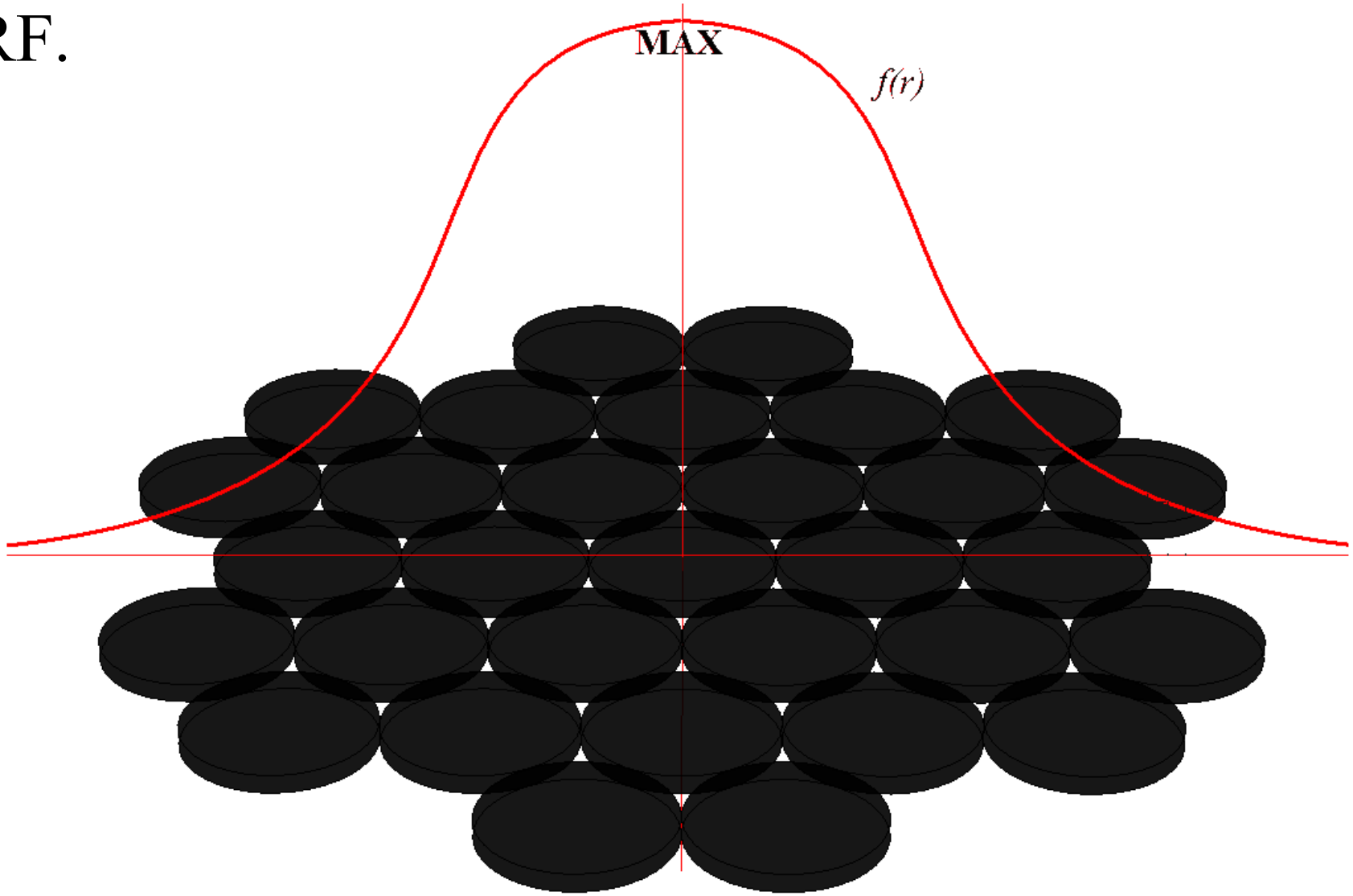
Start PMT

Stop PMT



Consistance of deexcitation time spectra

Mercury package was used for the reconstruction of LRF.



Fitting

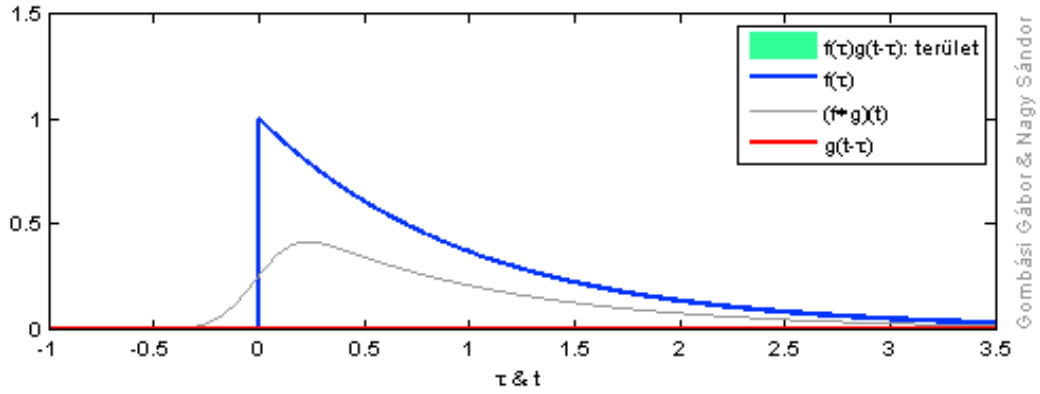
$$Y(t) = A_1\left\{1+erf\left[h(t-t_0)-\frac{1}{2h\tau_1}\right]\right\}\exp\left(\frac{1}{4h^2\tau_1^2}-\frac{(t-t_0)}{\tau_1}\right)+$$

$$+A_2\left\{1+erf\left[h(t-t_0)-\frac{1}{2h\tau_2}\right]\right\}\exp\left(\frac{1}{4h^2\tau_2^2}-\frac{(t-t_0)}{\tau_2}\right)+B$$

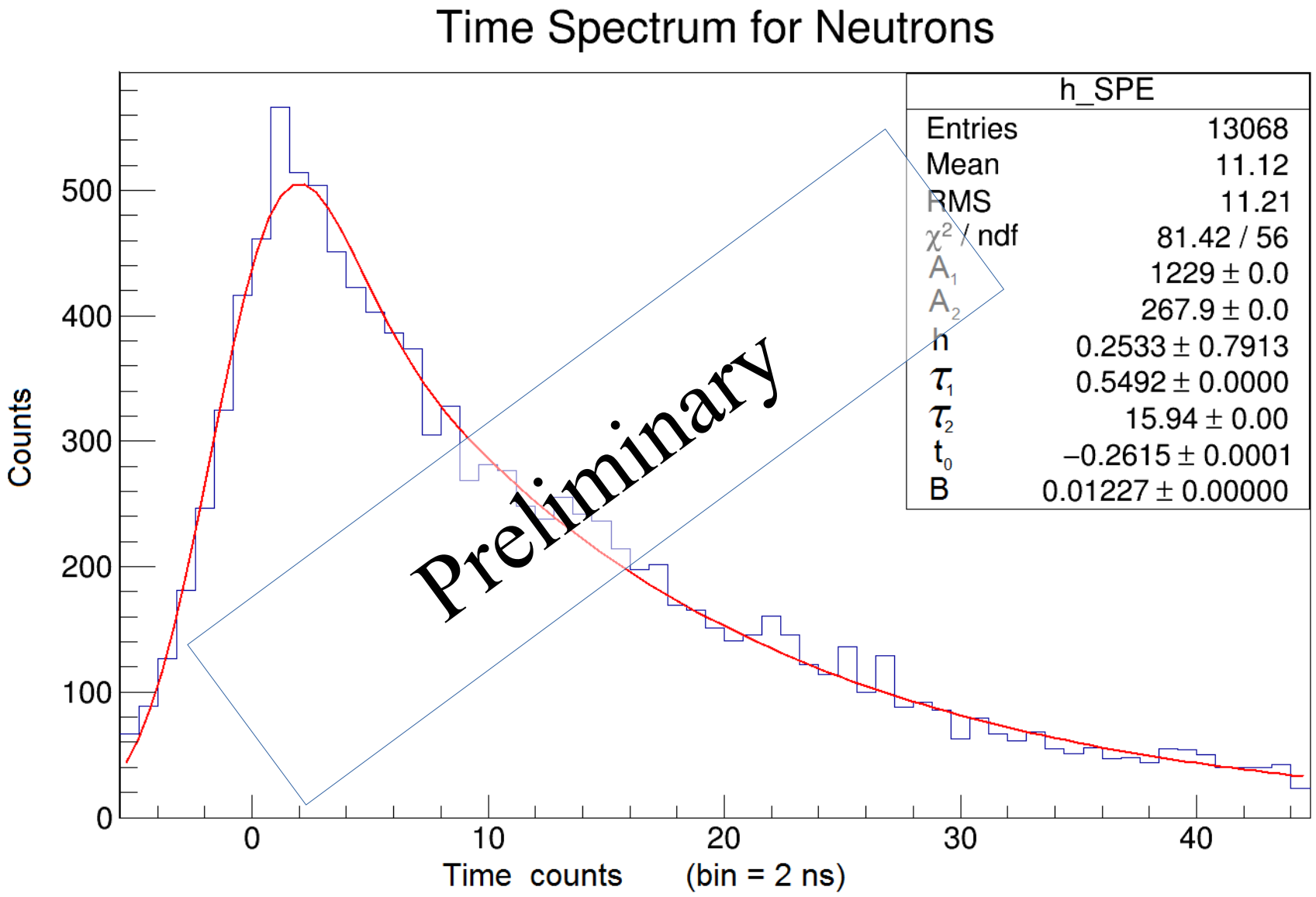
$$erf(z)=\frac{2}{\sqrt{\pi}}\int_0^z e^{-t^2}dt$$

Gale equation

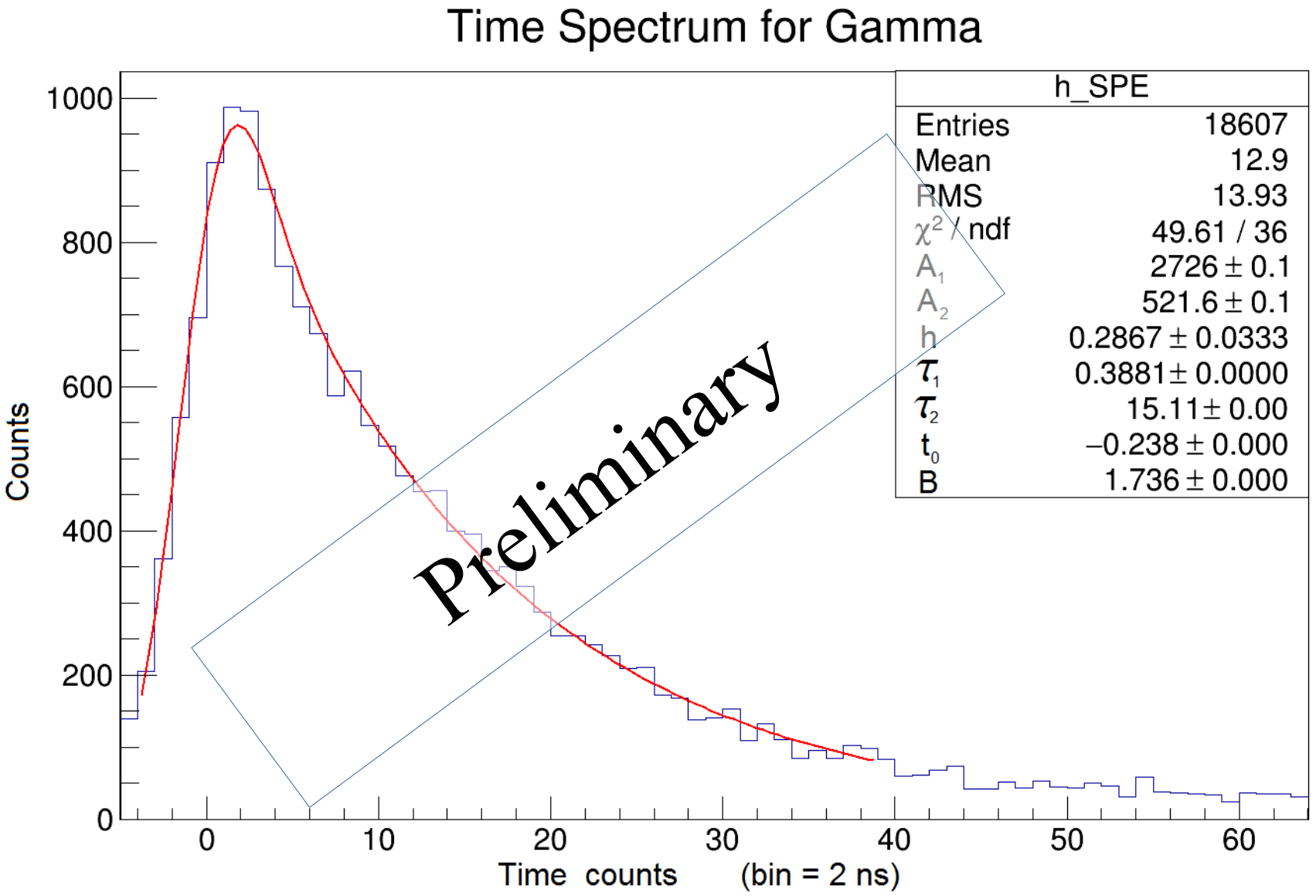
$$h=\frac{1}{\sqrt{2\sigma}}$$



Preliminary spectra + fit



Preliminary spectra + fit



Preliminary results

		τ 1 (ns)	τ 2 (ns)	χ2/ndf
Gamma		0,78 ± 2,5	30,2 ± 2,5	1,36
Neutrons		1,1 ± 2,8	31,9 ± 2,8	1,45

Thank you for attention!

Backup