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Updates on S2 pulse shape

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- Analytical convolution of DS-50 model and single-photo electron model:

$$y(t; \tau_1, \tau_2, p, T, \sigma, spe) =$$

$$p \cdot y'(t; \tau_1, T, \sigma, spe) + (1 - p) \cdot y'(t; \tau_2, T, \sigma, spe)$$

$$y'(t; \tau, T, \sigma, spe) = \frac{y''(t; \tau, \sigma, spe) - y''(t - T; \tau, \sigma, spe)}{2T}$$

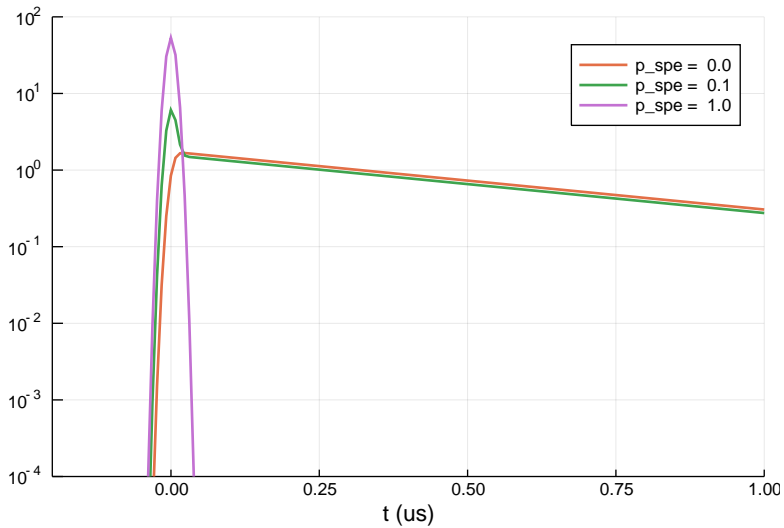
$$aux(t; \tau, \sigma) = e^{-t/\tau} e^{\sigma^2/2\tau^2} \operatorname{erfc} \left(\frac{\sigma^2 - t\tau}{\sqrt{2}\sigma\tau} \right)$$

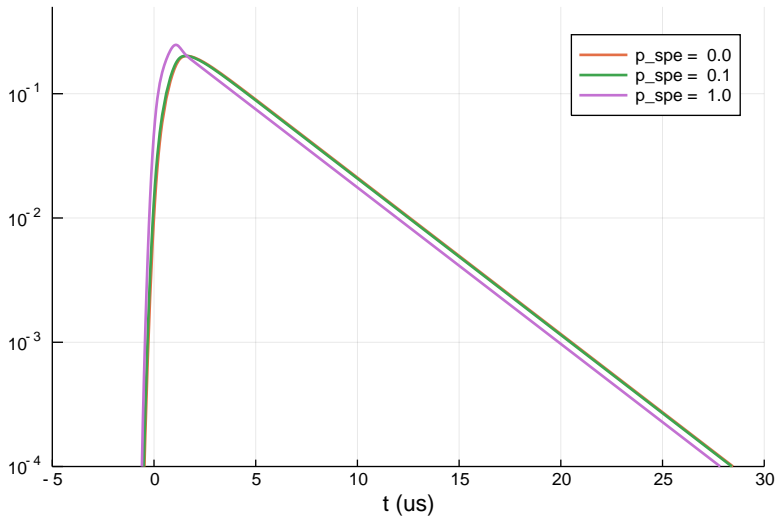
$$y''(t; \tau, \sigma, spe) = \operatorname{erf} \left(\frac{t}{\sqrt{2}\sigma\tau} \right) -$$

$$\frac{(\tau - p_s \cdot \tau_s) \cdot aux(t; \tau, \sigma_T) - (1 - p_s) \cdot \tau_s \cdot aux(t; \tau_s, \sigma_T)}{\tau - \tau_s}$$

where $\sigma_T = \sqrt{\sigma^2 + \sigma_s^2}$ and *spe* stand for τ_s, p_s, σ_s are the parameters of single photo–electron response of SiPM.

$$spe(t; \tau_s, p_s, \sigma_s) = p_s \frac{e^{-t^2/2\sigma_s^2}}{\sqrt{2\pi} \sigma_s} + (1-p_s) \frac{e^{-t/\tau_s} e^{\sigma_s^2/2\tau_s^2}}{2\tau_s} \operatorname{erfc} \left(\frac{\sigma_s^2 - t\tau_s}{\sqrt{2} \sigma_s \tau_s} \right)$$





- Fit the total waveform for laser run 997 in order to investigate the spe parameters.
- Once this parameters are well known they will be fixed on the S2 pulse fit.

