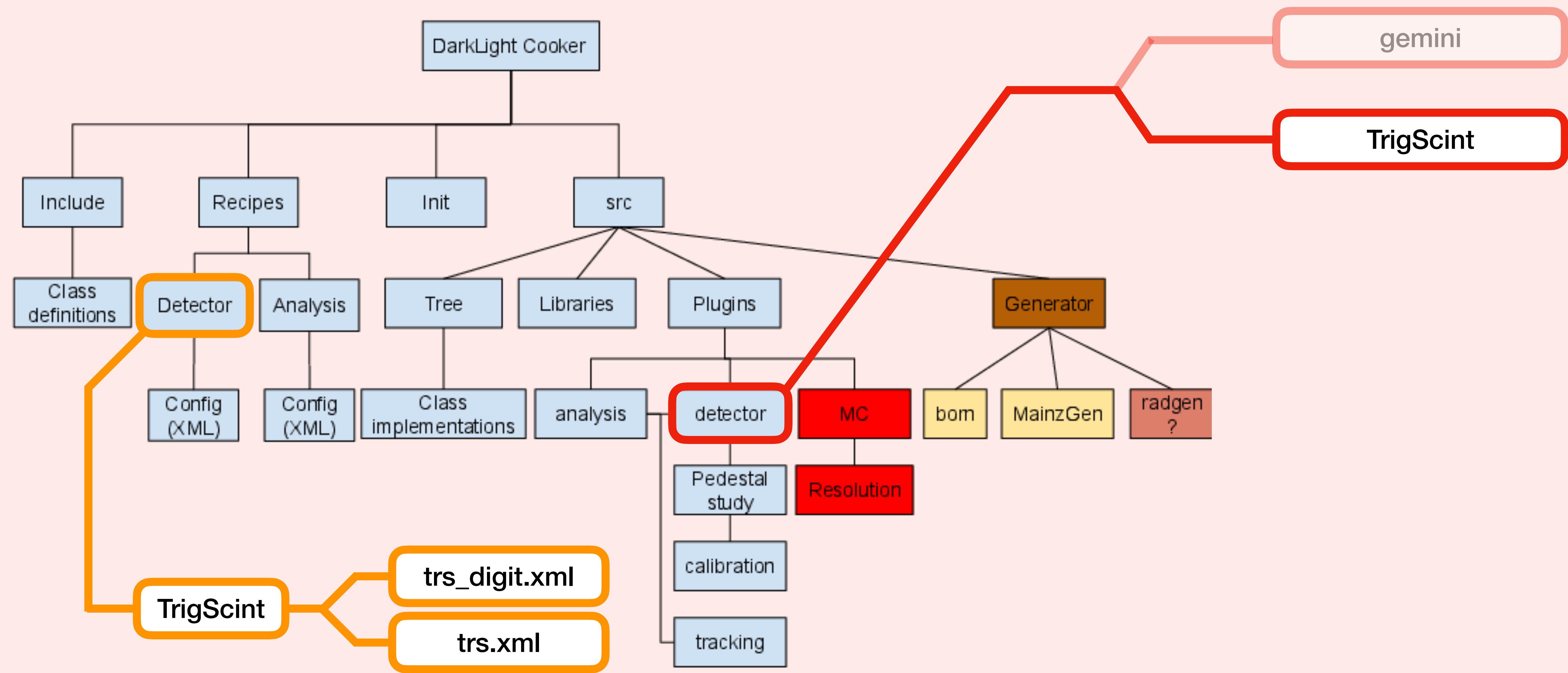
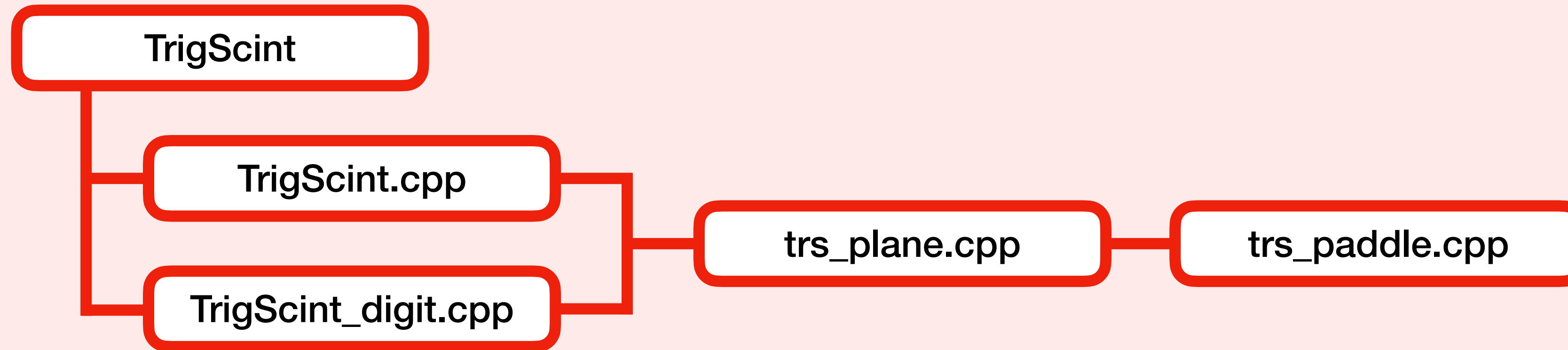


# Trigger Digitization and Analysis

- Code structure:



- Code structure:



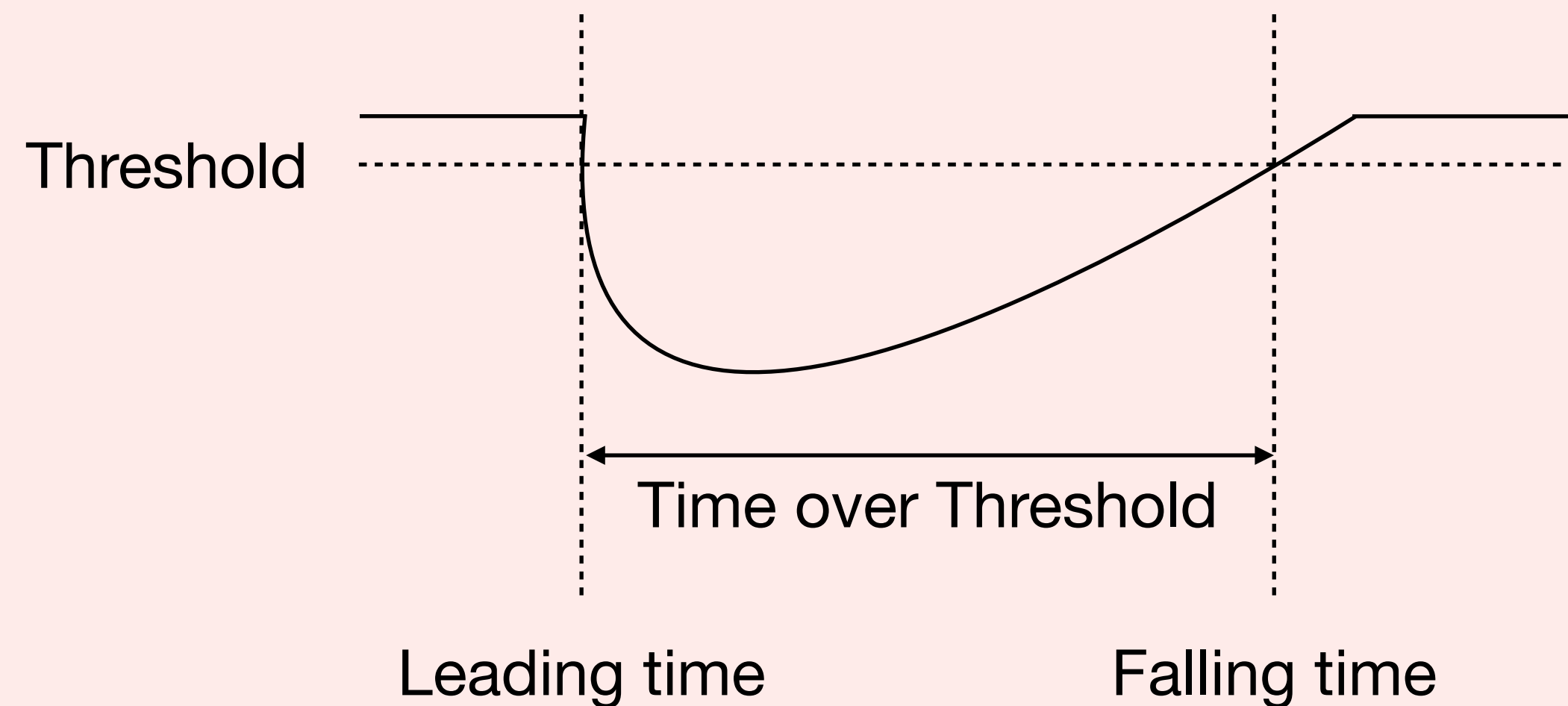
Parameters are set via Init/TrigScint.xml and stored to each paddle before startup:

load\_sc\_calibration: set resolution, time alignment etc.

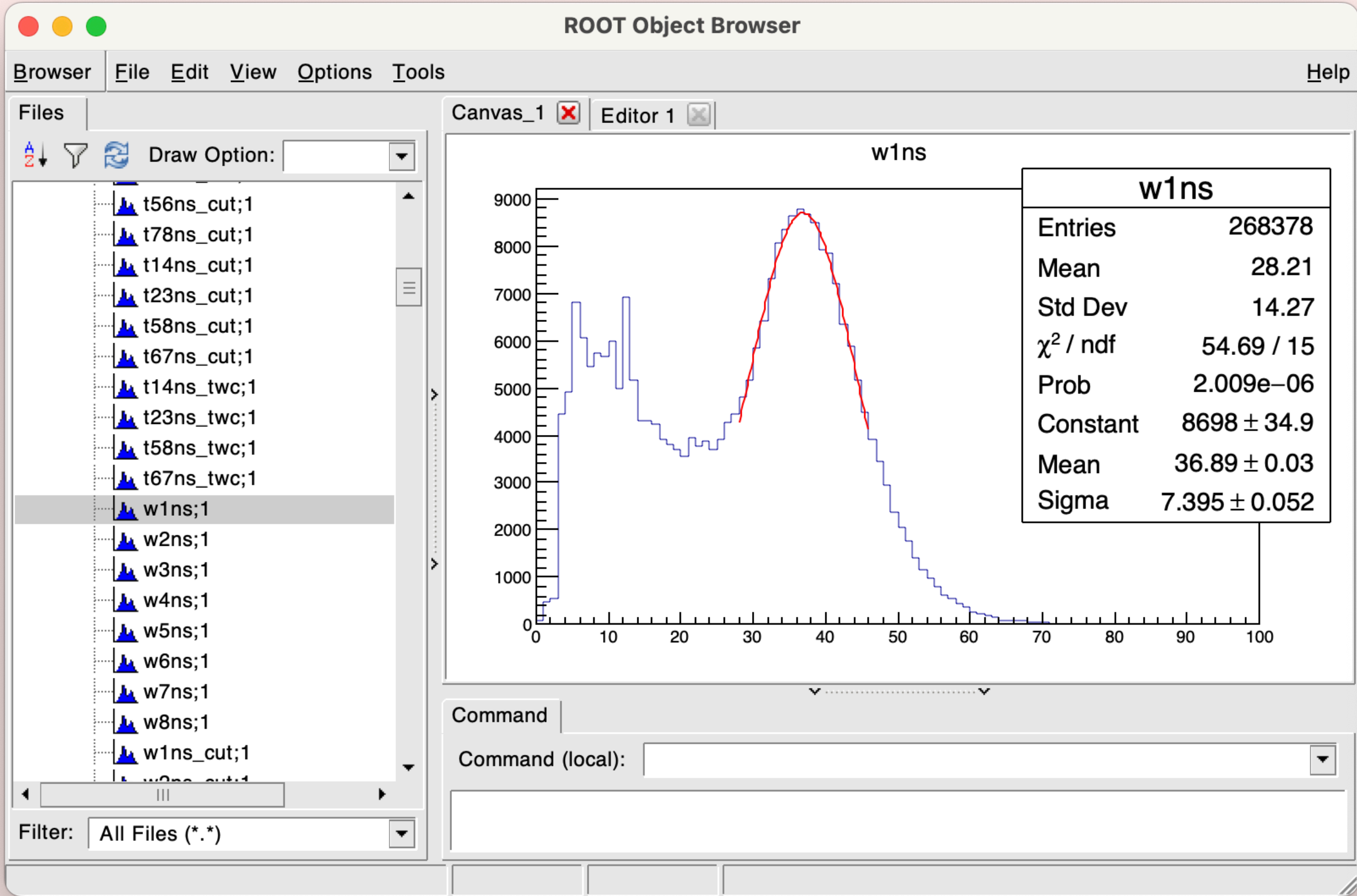
load\_tdc\_calibration: set time range of trigger events within trigger window

- Analysis:
  - Leading edge and trailing edge are recorded. Time over threshold is used for time-walk correction.
- Simulation:
  - Leading time: randomize simulated time using Gaussian with  $\sigma = 160$  ps
  - Trailing time: leading + time over threshold, then randomized using Gaussian with  $\sigma = 160$  ps
  - Time over Threshold:  $\text{Sqrt}(\text{energy deposited with added resolution} * \text{factor})$

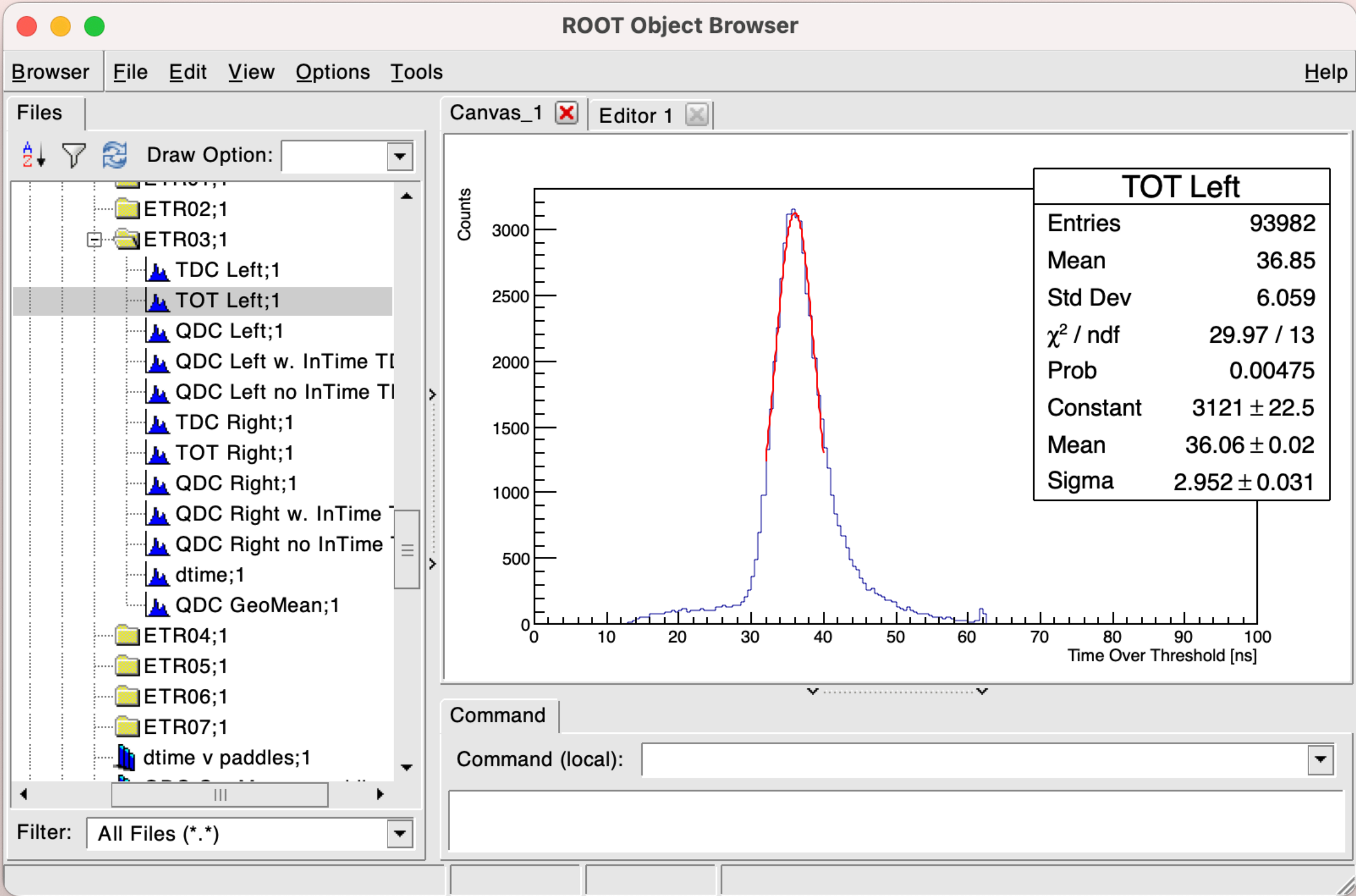
**Need more tuning!**

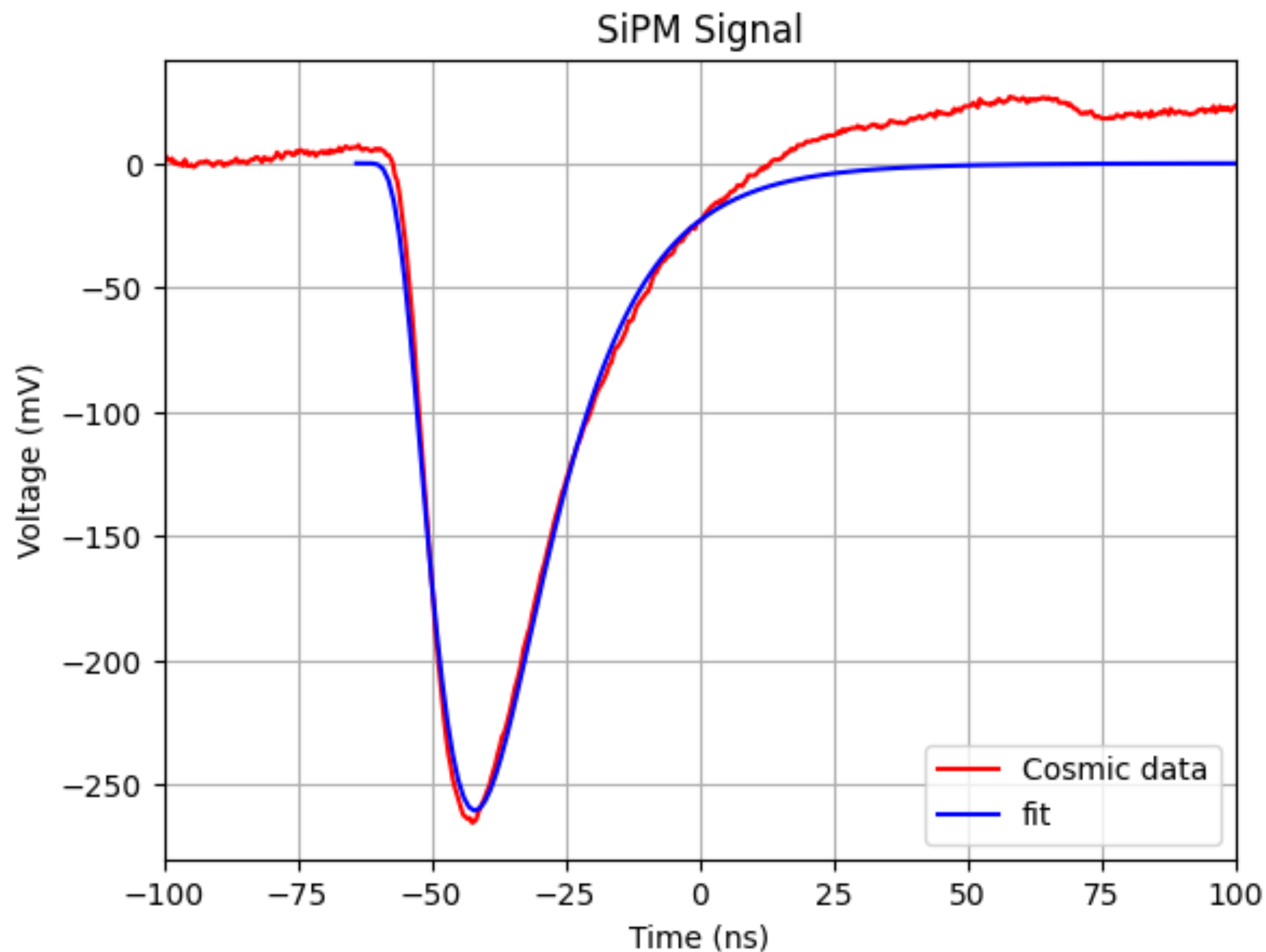


## Cosmic Data



## Simulation





Fit:

$$U = U_0 \cdot \exp\left(-\frac{1}{2} \left(\frac{\ln(t/\tau)}{\sigma}\right)^2\right)$$

$$U_0 = -260.28\text{mV}$$

$$\tau = 22.11\text{ns}$$

$$\sigma = 0.48$$



$$U = U_0 \cdot \exp \left( -\frac{1}{2} \left( \frac{\ln(t/\tau)}{\sigma} \right)^2 \right)$$

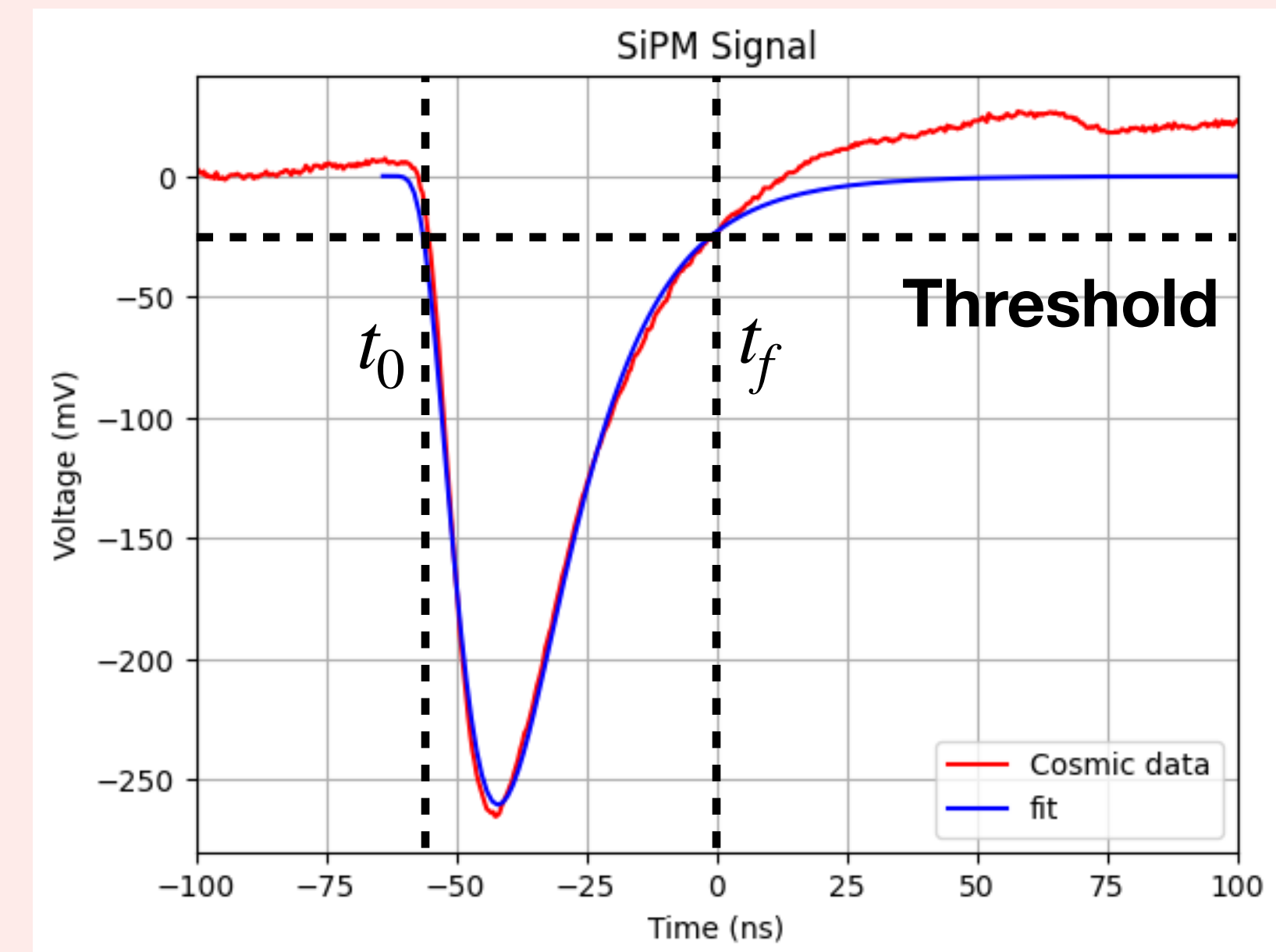
$$U_0 = f \cdot E_{\text{hit}}$$

$f$ : conversion factor related to SiPM

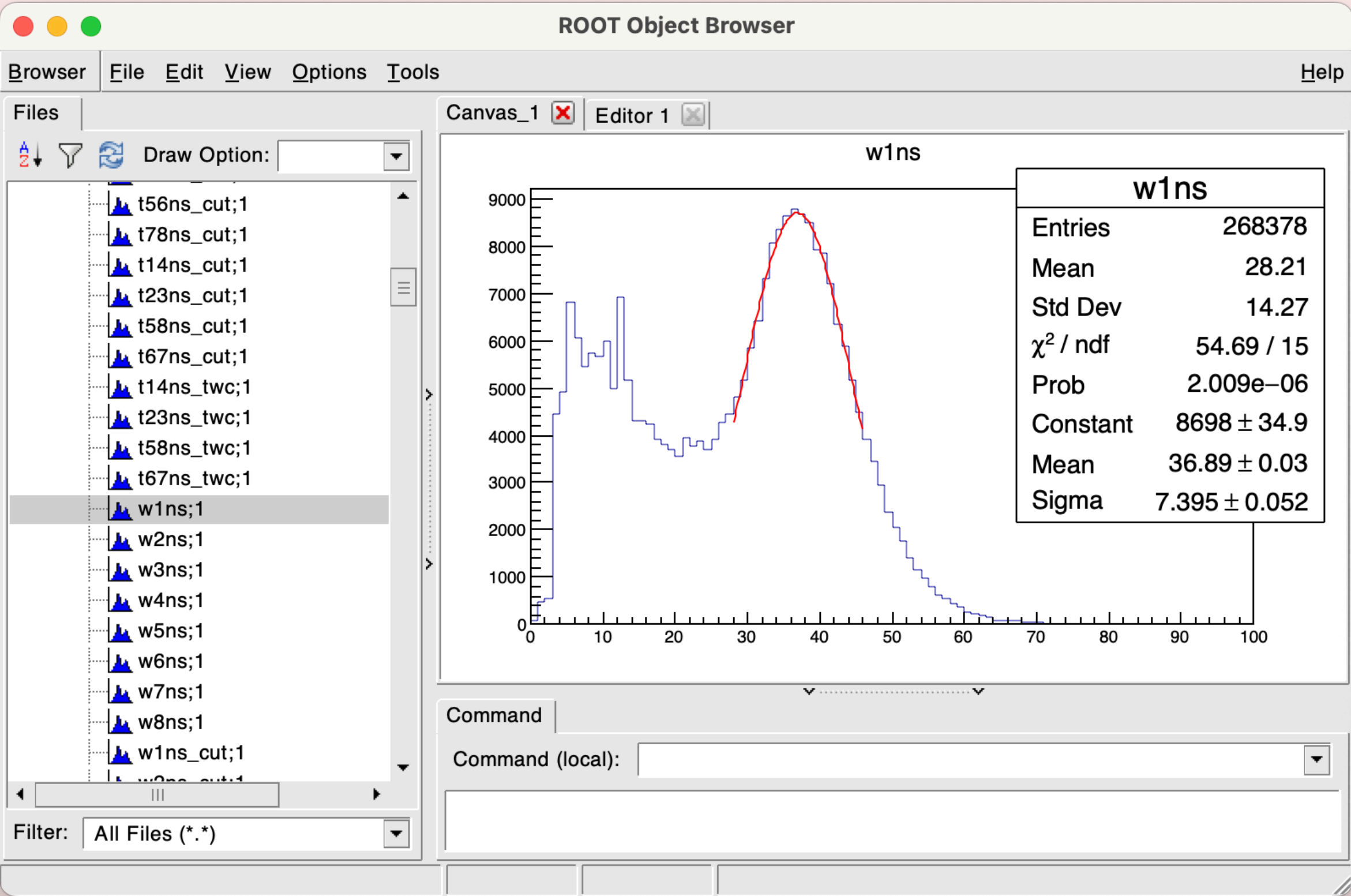
efficiency

$\tau, \sigma$ : parameters that describe the shape of signal

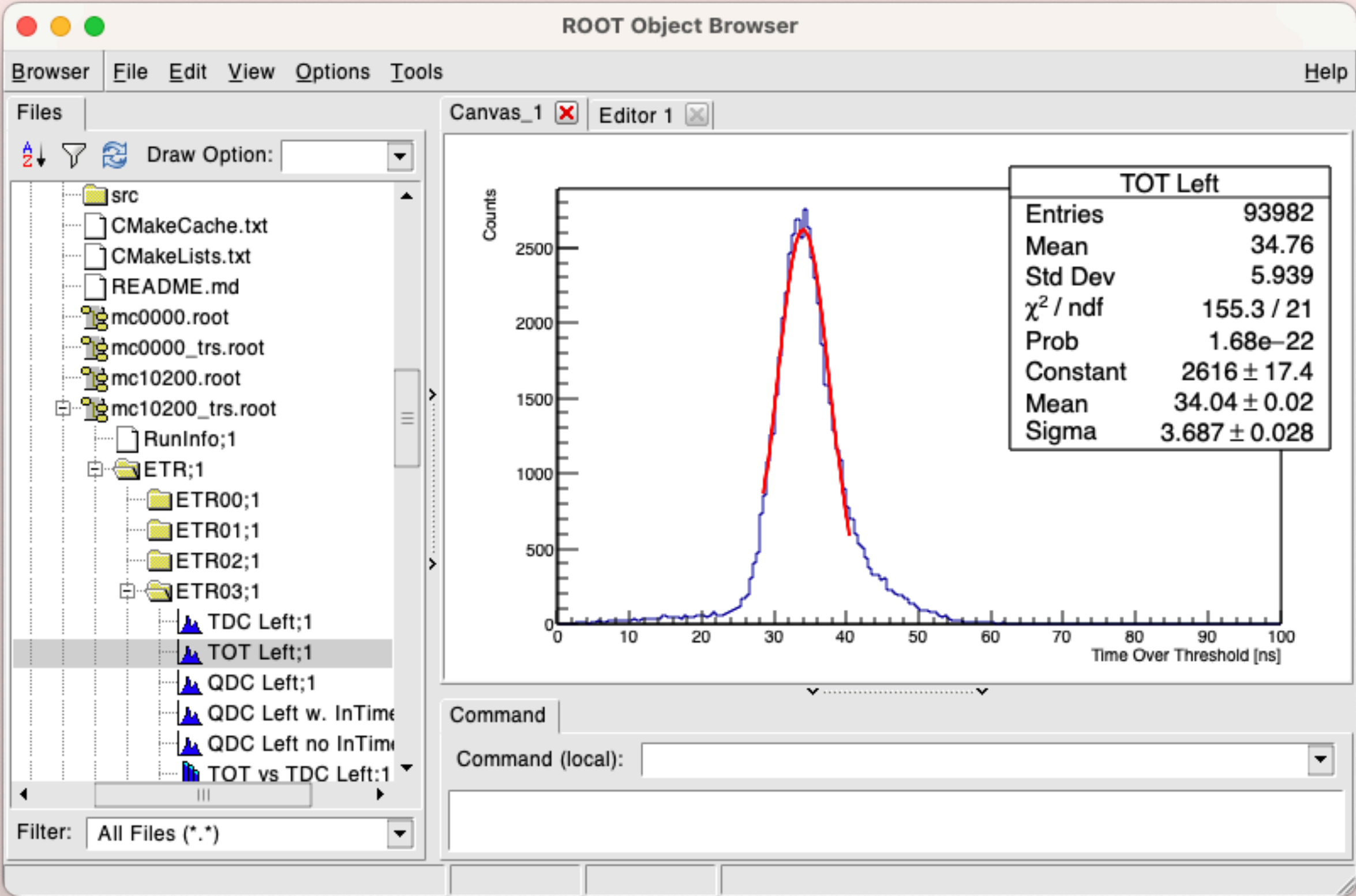
- Function is defined, with two parameters that can be adjusted for each channel
- For each event, the amplitude ( $U_0$ ) is calculated from the energy deposit ( $E_{\text{hit}}$ ) in the bar given by Geant4
- To find  $t_0$  and  $t_f$ , the code will solve the equation for the times when signal cross threshold (LD mode).
- Code can be adjusted to CFD mode where the zero cross is found.



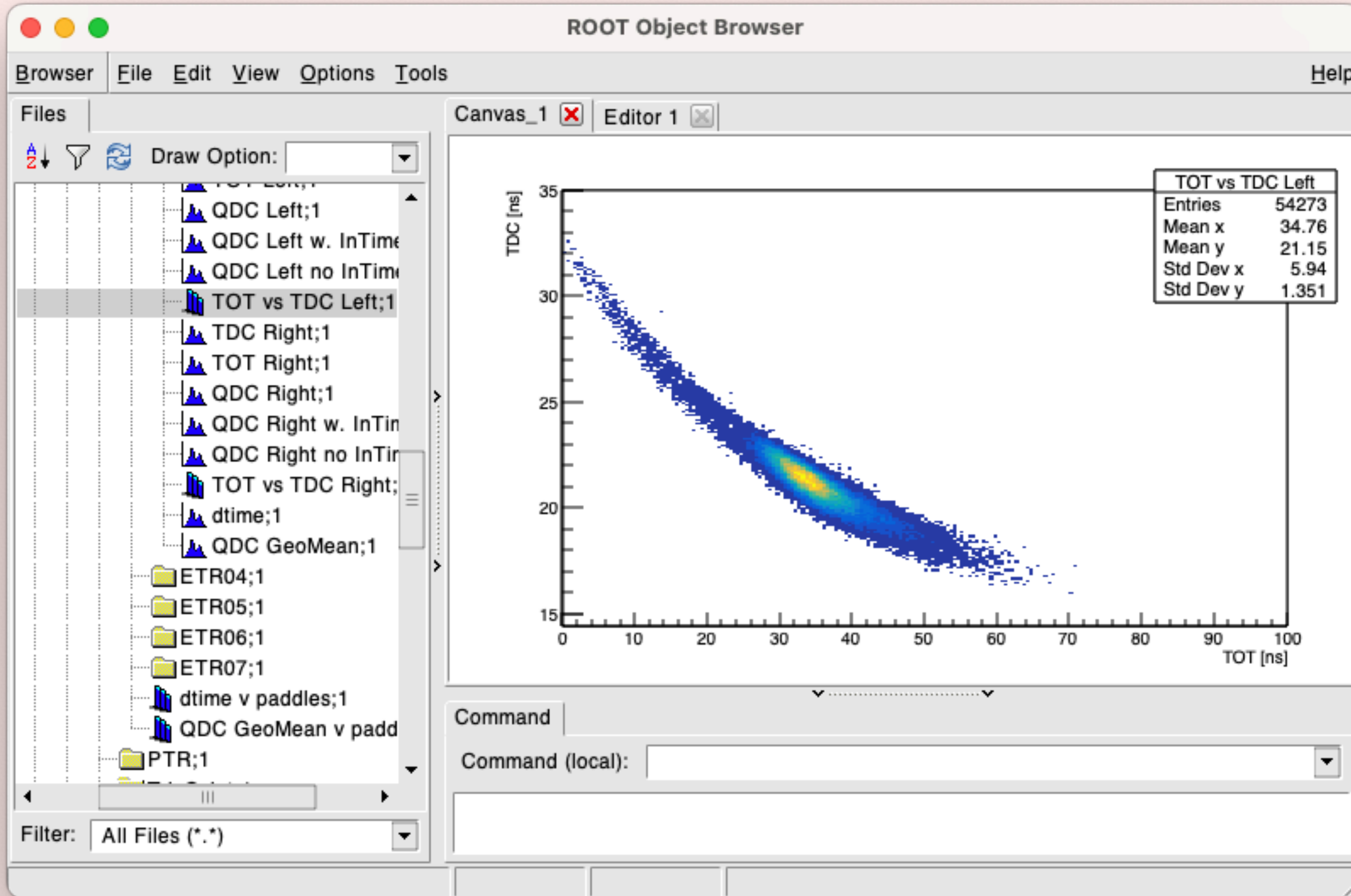
Cosmic Data



Simulation (with beam)



- Timing resolution added: 200 ps



- Walk correction parameters should be the same for data and simulation?
- Use simulation to help with walk correction?