RDK II Analysis

Collaboration Meeting
10/22/13

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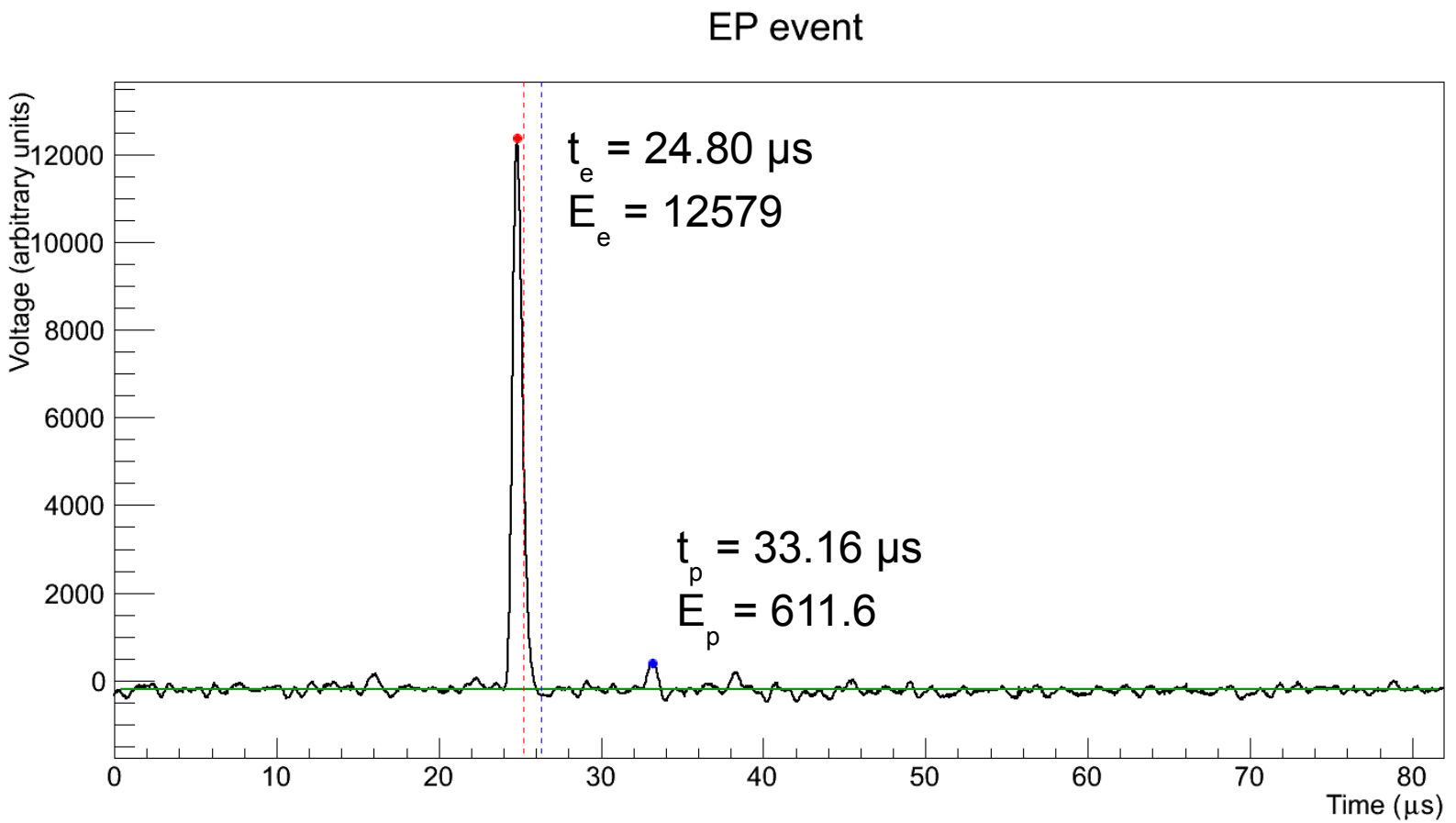
Table of Contents

- SBD
  - Peak search
  - Gaussian fit
- BGO/bAPD
  - Smoothed
  - Full signal fit
- Calibration
- Cuts
  - SBD
    - Timing
    - Energy
    - Signal shape
  - BGO/bAPD
    - Energy
    - Timing
    - Background sub.

Table of Contents

- SBD
  - Peak search
  - Gaussian fit
  - Quasi-proton
- BGO/bAPD
  - Smoothed
  - Full signal fit
- Calibration
- Cuts/Data set
  - SBD
    - Timing
    - Energy
    - Signal shape
  - BGO/bAPD
    - Energy
    - Timing
    - Background sub.

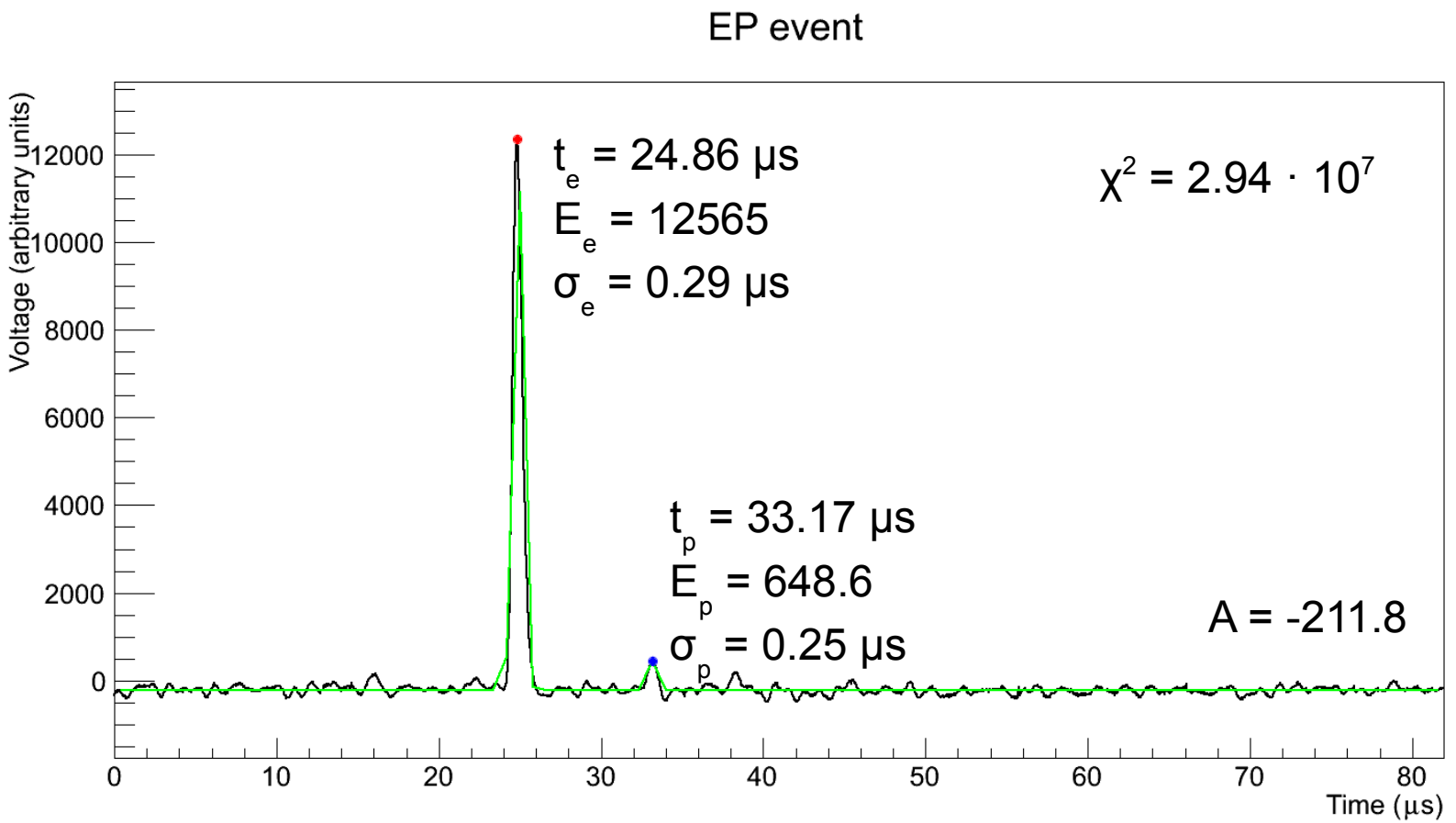
SBD – Peak Search



t_{half} = 25.20 µs

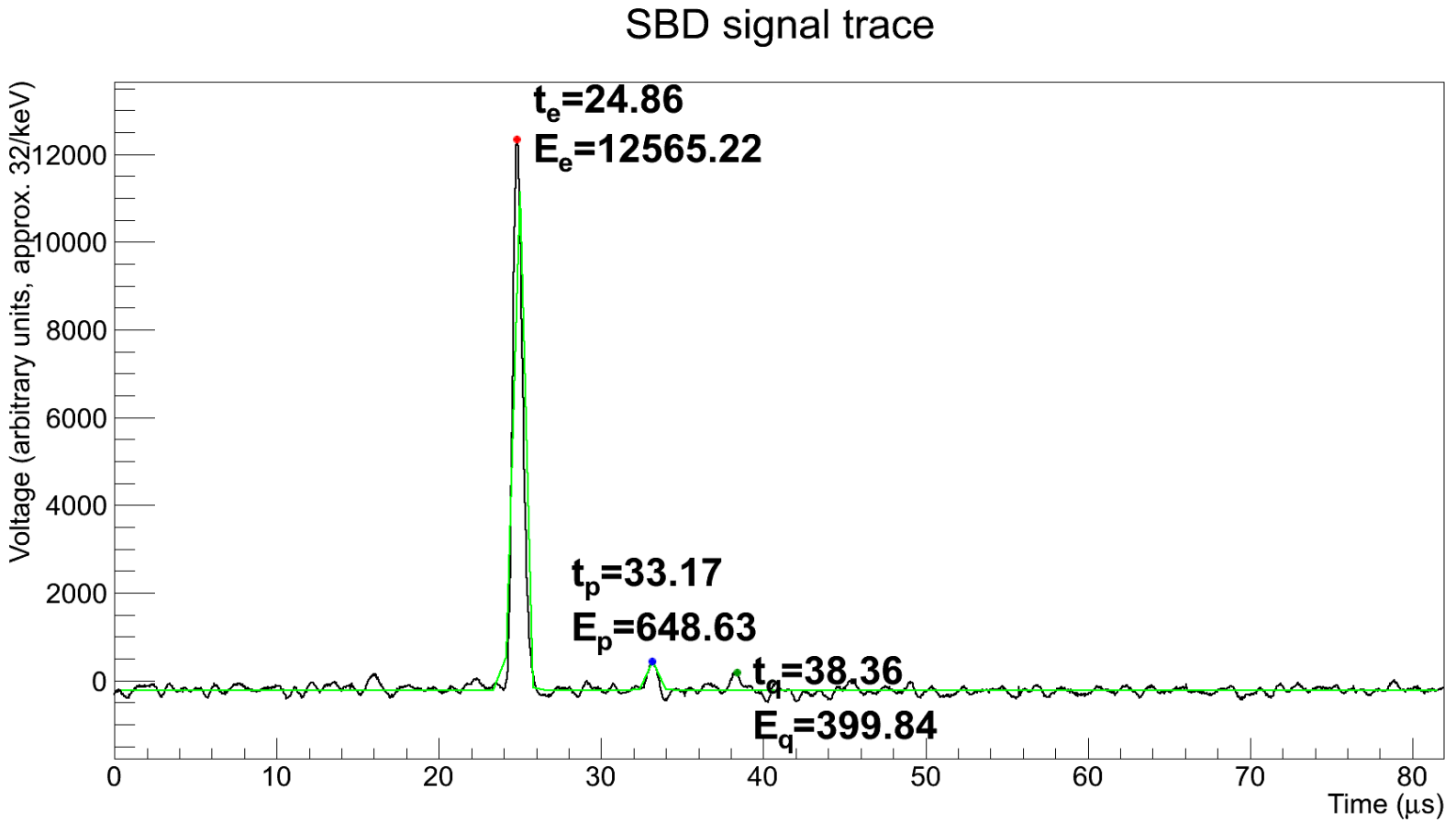
t_{dip} = 26.28 µs

SBD – Signal Fit



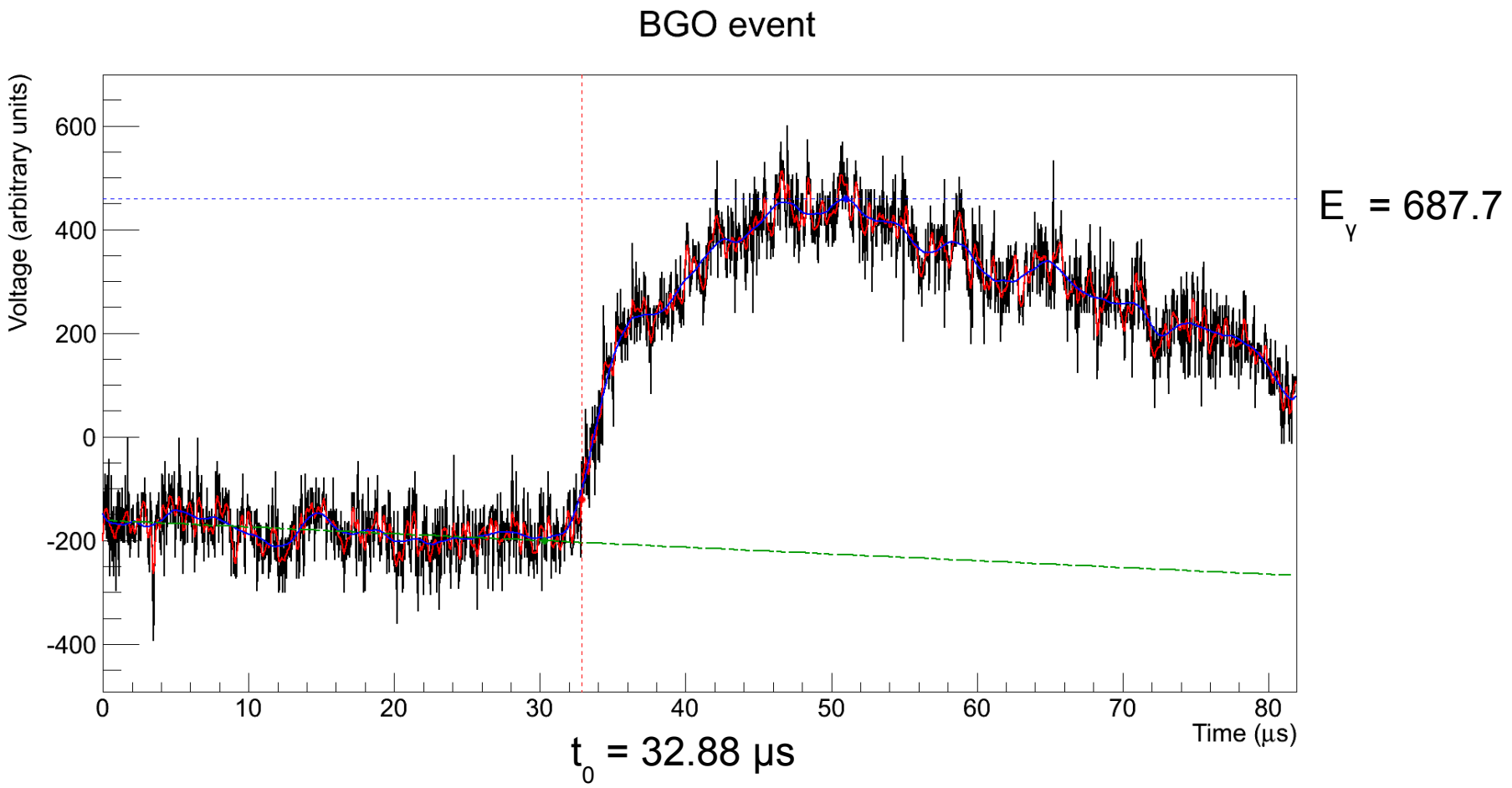
$$V(t) = A + E_e e^{-(t-t_e)^2/\left(2\sigma_e^2\right)} + E_p e^{-\left(t-t_p\right)^2/\left(2\sigma_p^2\right)}$$

SBD – Signal Fit

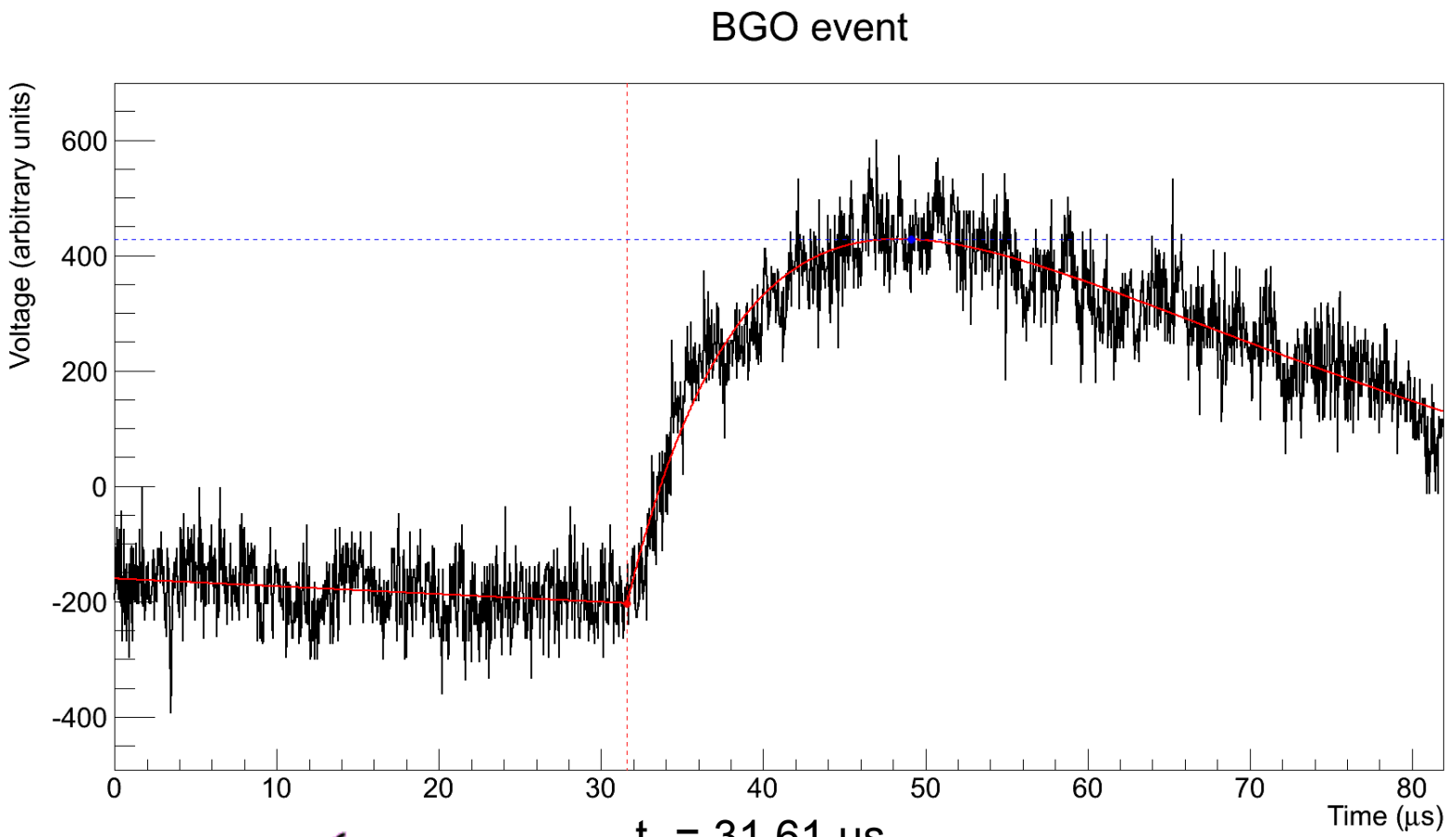


$$V(t) = A + E_e e^{-(t-t_e)^2/\left(2\sigma_e^2\right)} + E_p e^{-\left(t-t_p\right)^2/\left(2\sigma_p^2\right)}$$

BGO – Smoothed



BGO – Full Signal Fit



t_0 = 31.61 μs

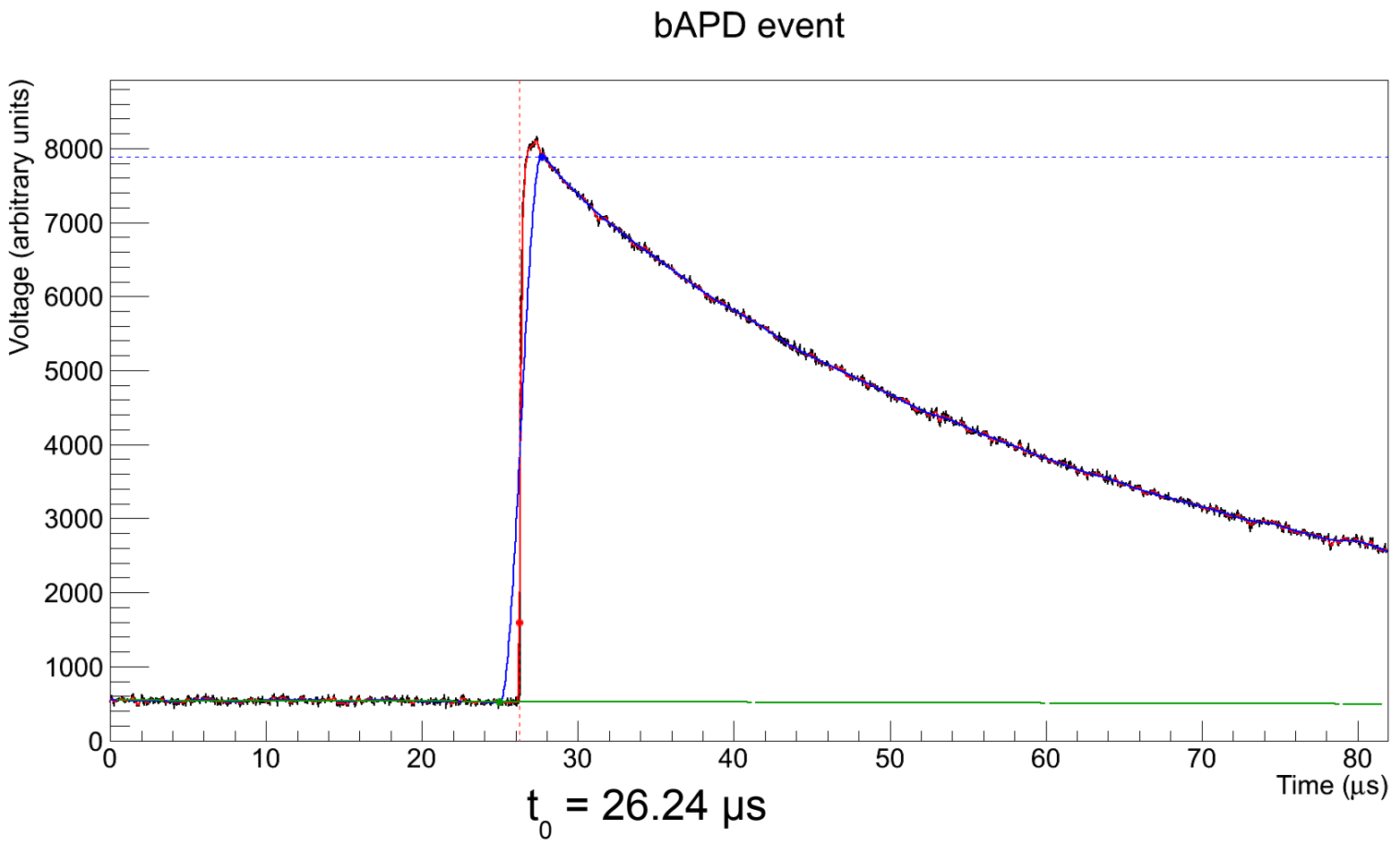
E_γ = 654.6
≈ 20 keV

C ≈ $1 \cdot 10^{-3}$
D ≈ $5 \cdot 10^{-3}$

$$V(t) = \begin{cases} A + Ft & \text{if } t \leq t_0 \\ A + Ft + Be^{-C(t-t_0)}\left(1 - e^{-D(t-t_0)}\right) & \text{if } t > t_0 \end{cases}$$

$$\mathrm{E}_\gamma = \frac{BD}{C+D}\left(\frac{C+D}{C}\right)^{-C/D}$$

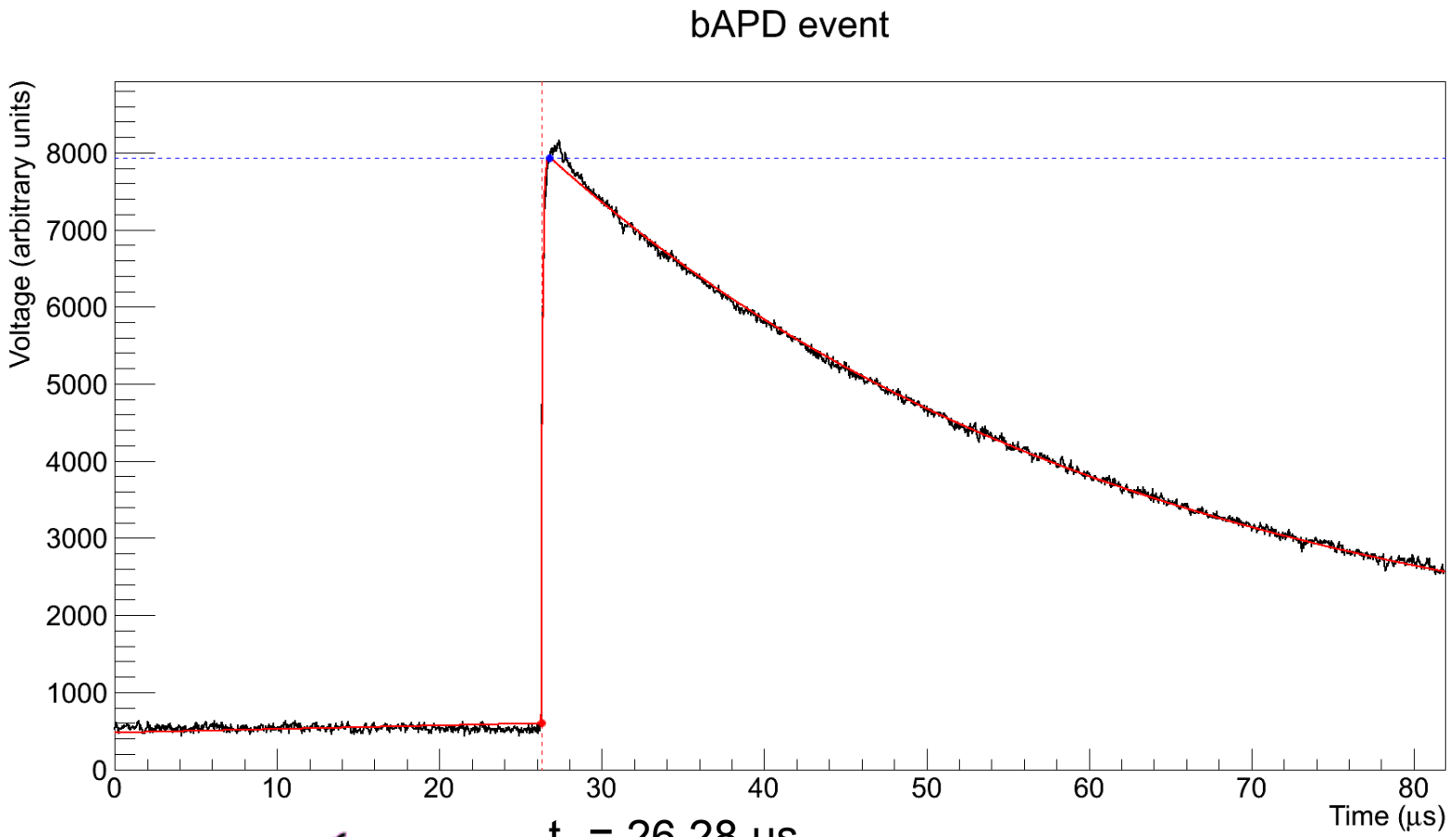
bAPD – Smoothed



t_0 = 26.24 µs

E_γ = 7361.3

bAPD – Full Signal Fit



E_γ = 7326.3
≈ 10 keV

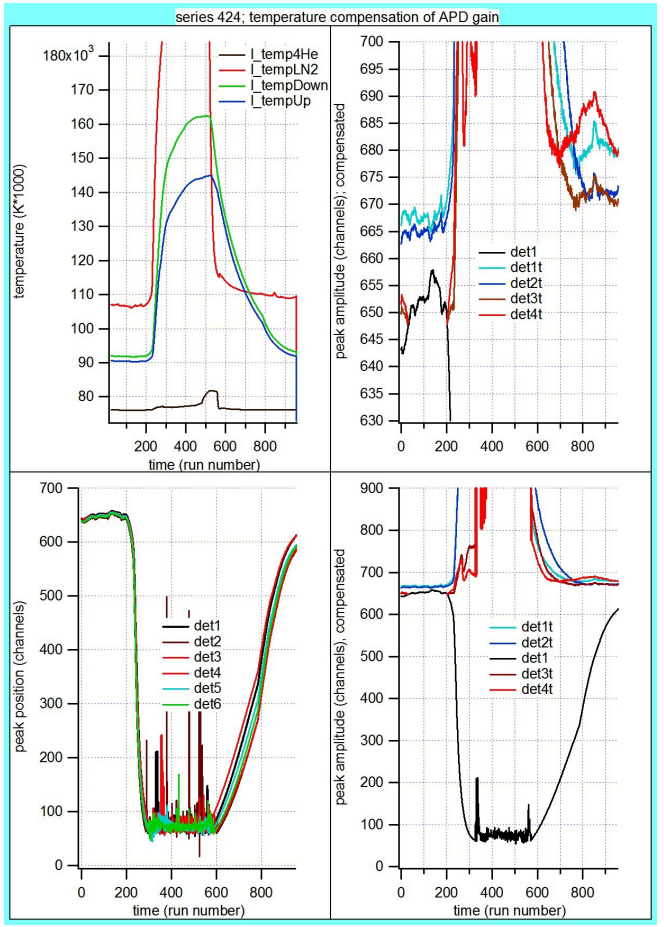
C ≈ 1 · 10^{-3}
D ≈ 1

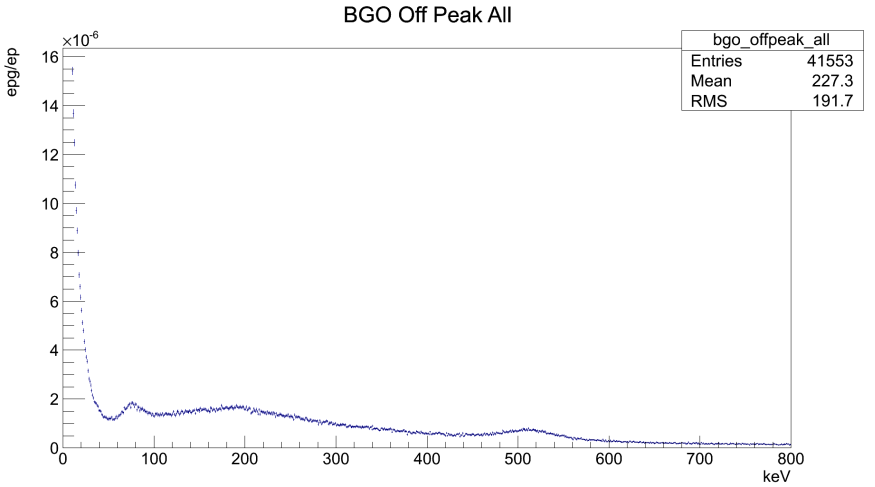
t_0 = 26.28 µs

$$V(t) = \begin{cases} A + Ft & \text{if } t \leq t_0 \\ A + Ft + Be^{-C(t-t_0)}\left(1 - e^{-D(t-t_0)}\right) & \text{if } t > t_0 \end{cases}$$

$$\mathrm{E}_\gamma = \frac{BD}{C+D}\left(\frac{C+D}{C}\right)^{-C/D}$$

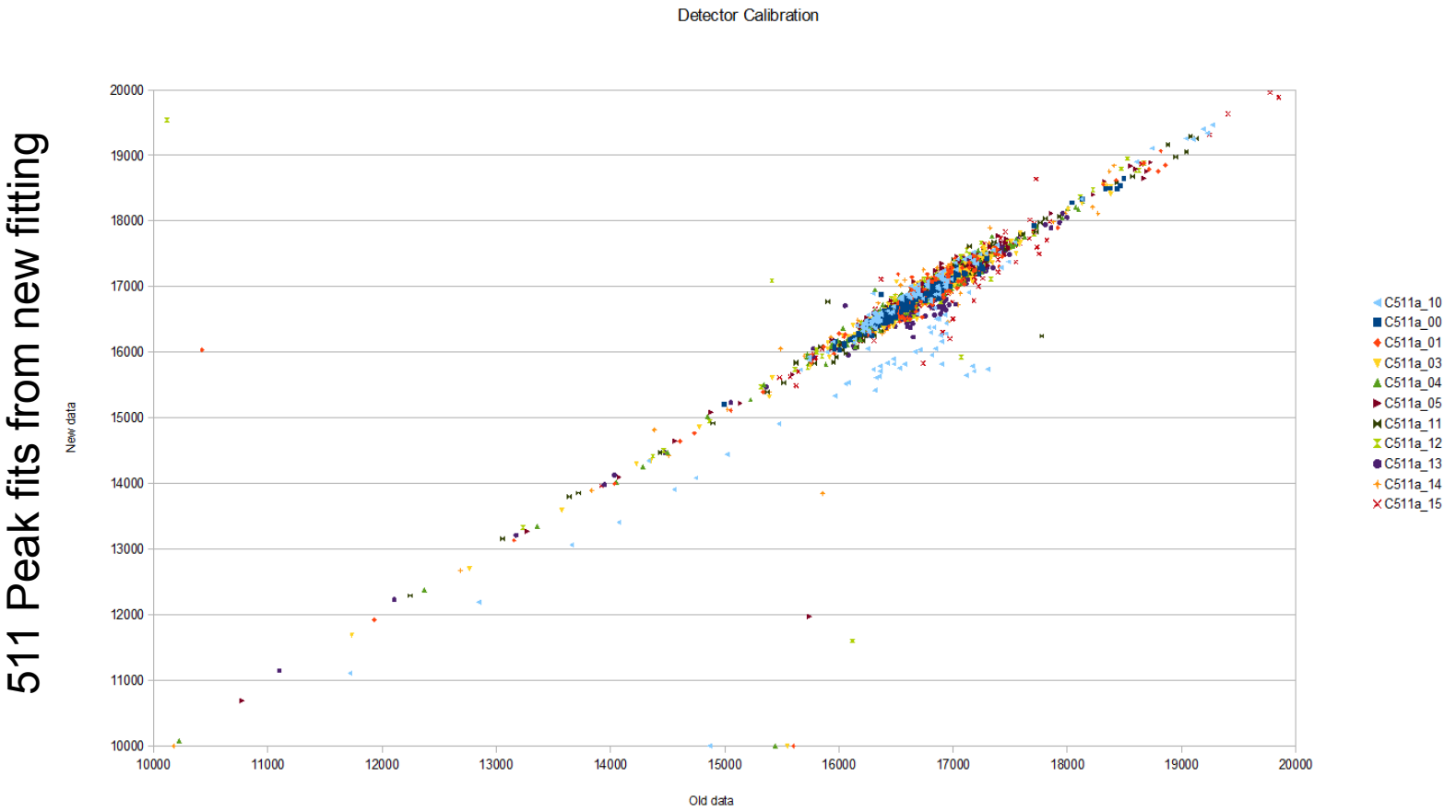
Calibration – BGO





511 keV
Positron annihilation

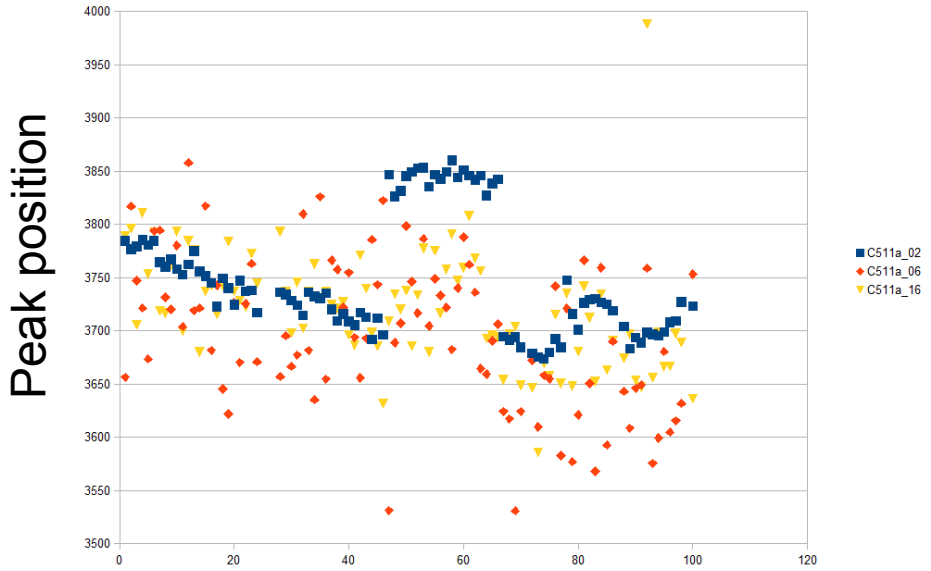
Calibration – BGO

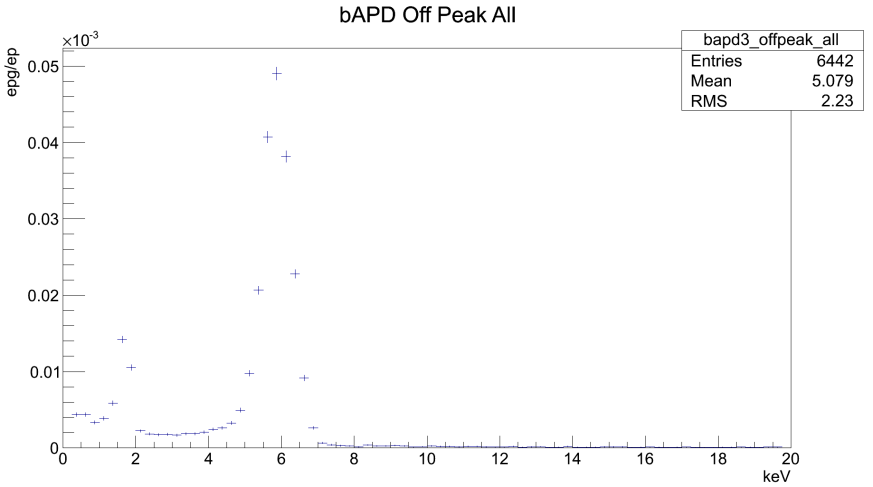


Herbert's calibration points

Approx. 120 unit shift or 0.75% change

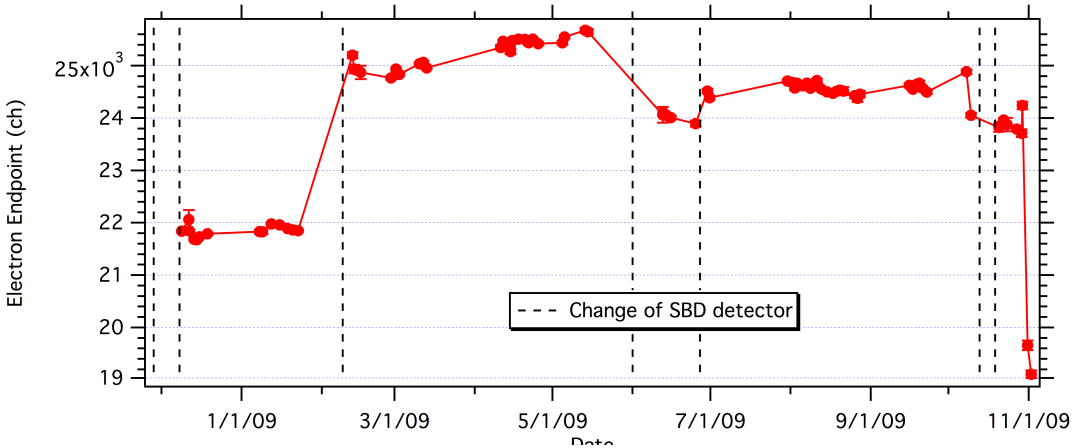
Calibration – bAPD

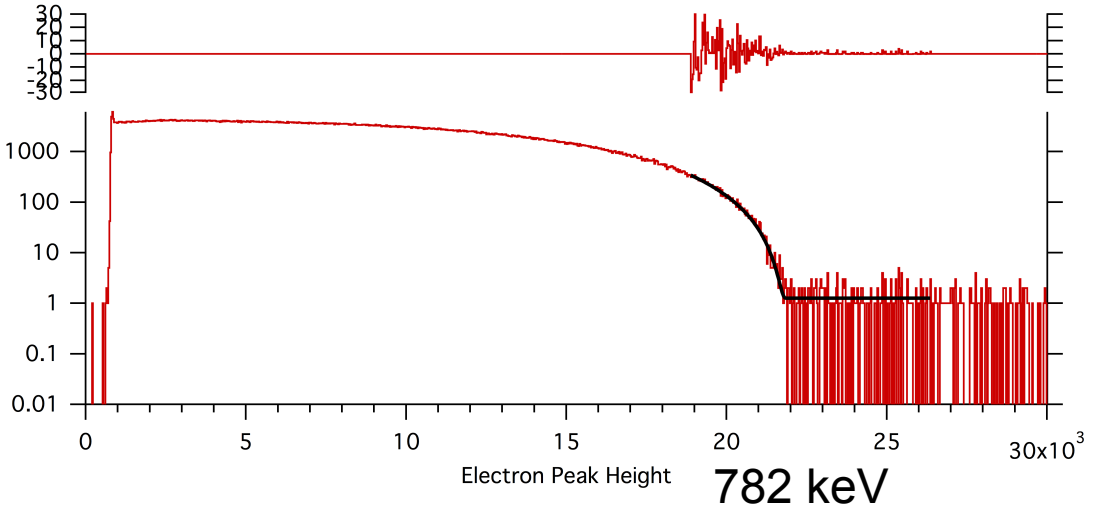




5.9 keV
Iron X-ray

Calibration – SBD



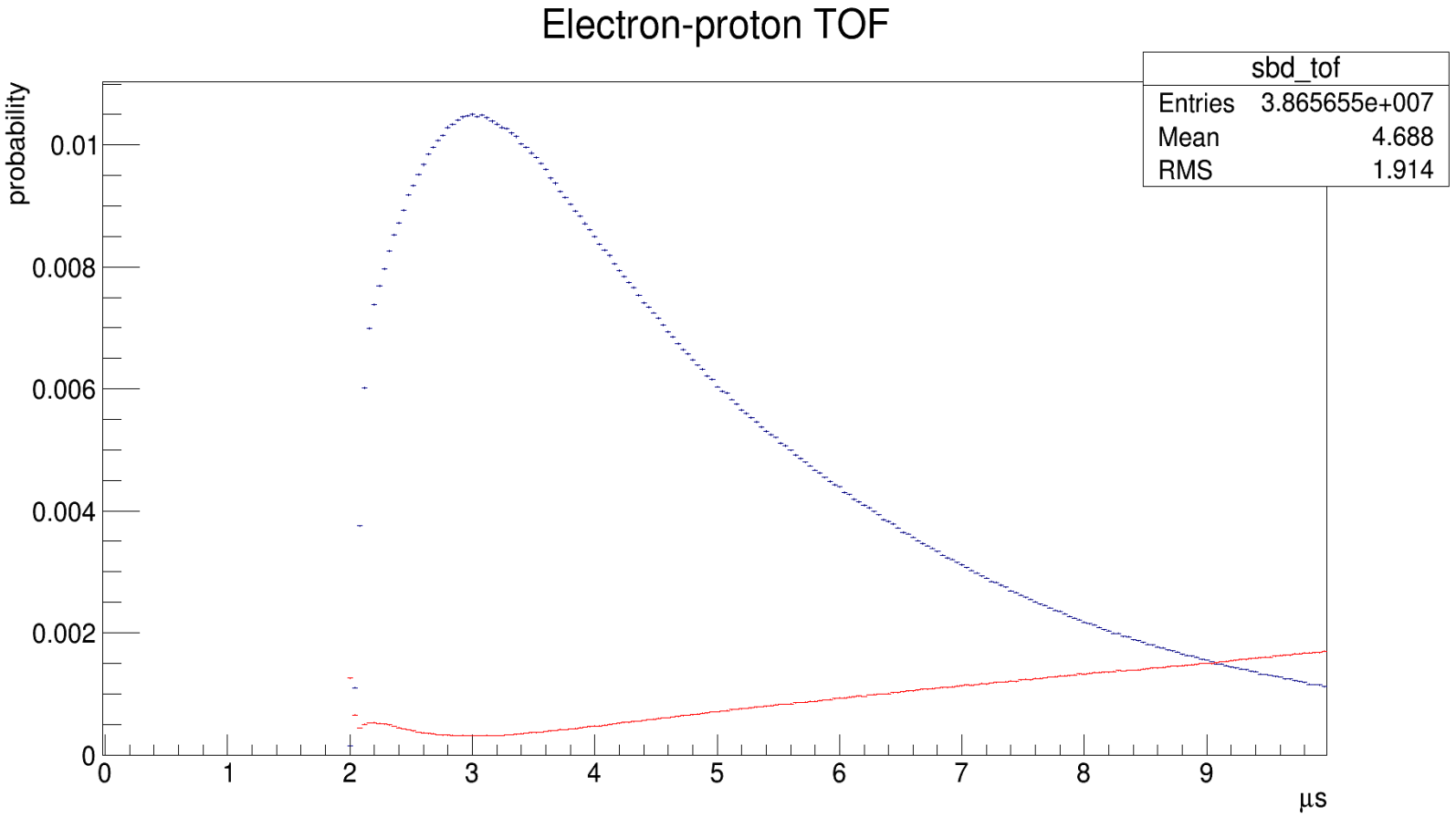


782 keV
Electron endpoint

Data Set Changes

- Eliminated series with too few events (<100k)
  - S108, S154, S213, S314
- Double peak e-p TOF
  - S256, S258, S260, S262, S263, S265, S267
- Oddly shaped electron spectrum (SBD dying)
  - S318, S319, S321

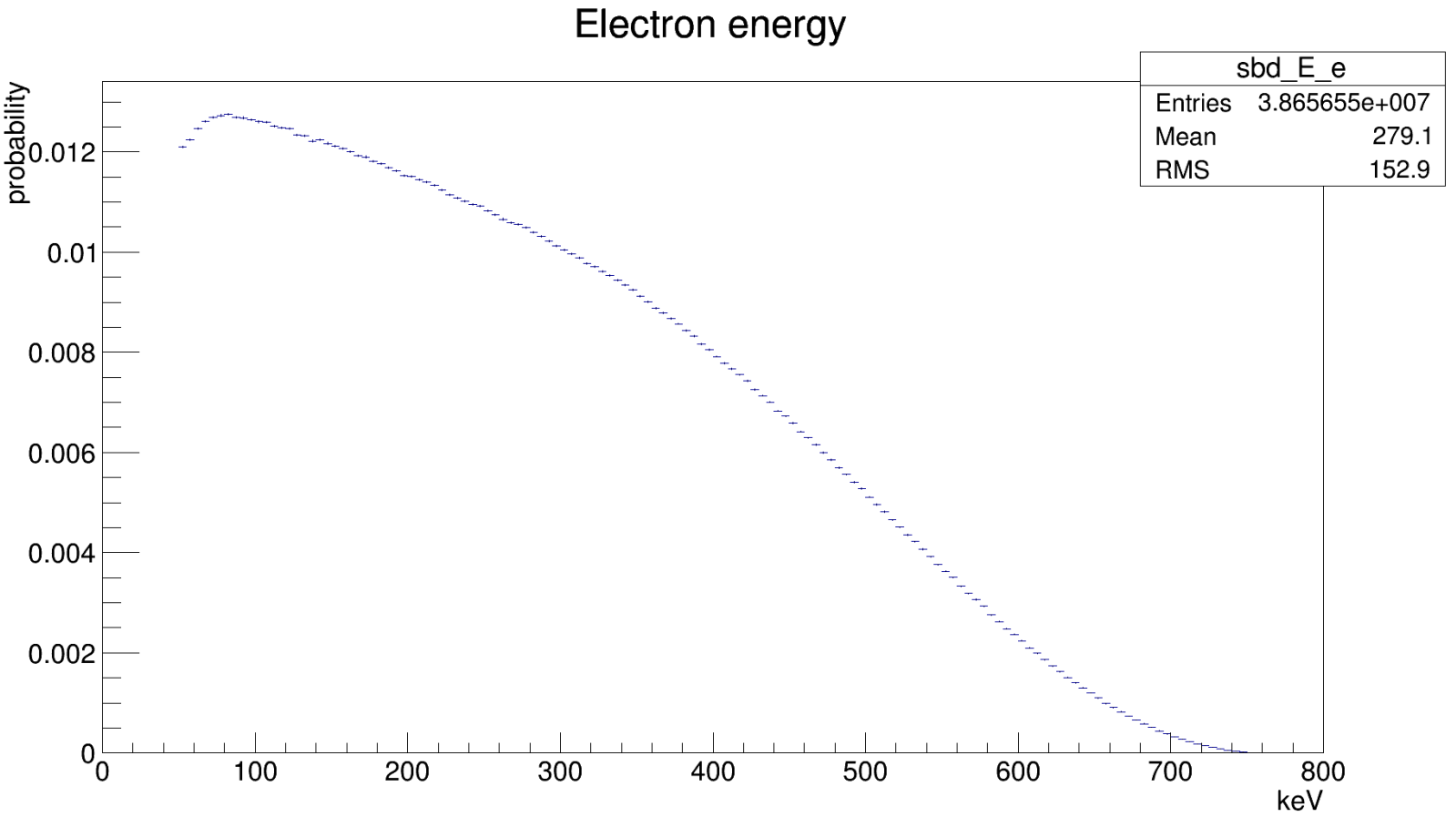
SBD – Timing Cuts



$2\ \mu s < t_p - t_e < 10\ \mu s$

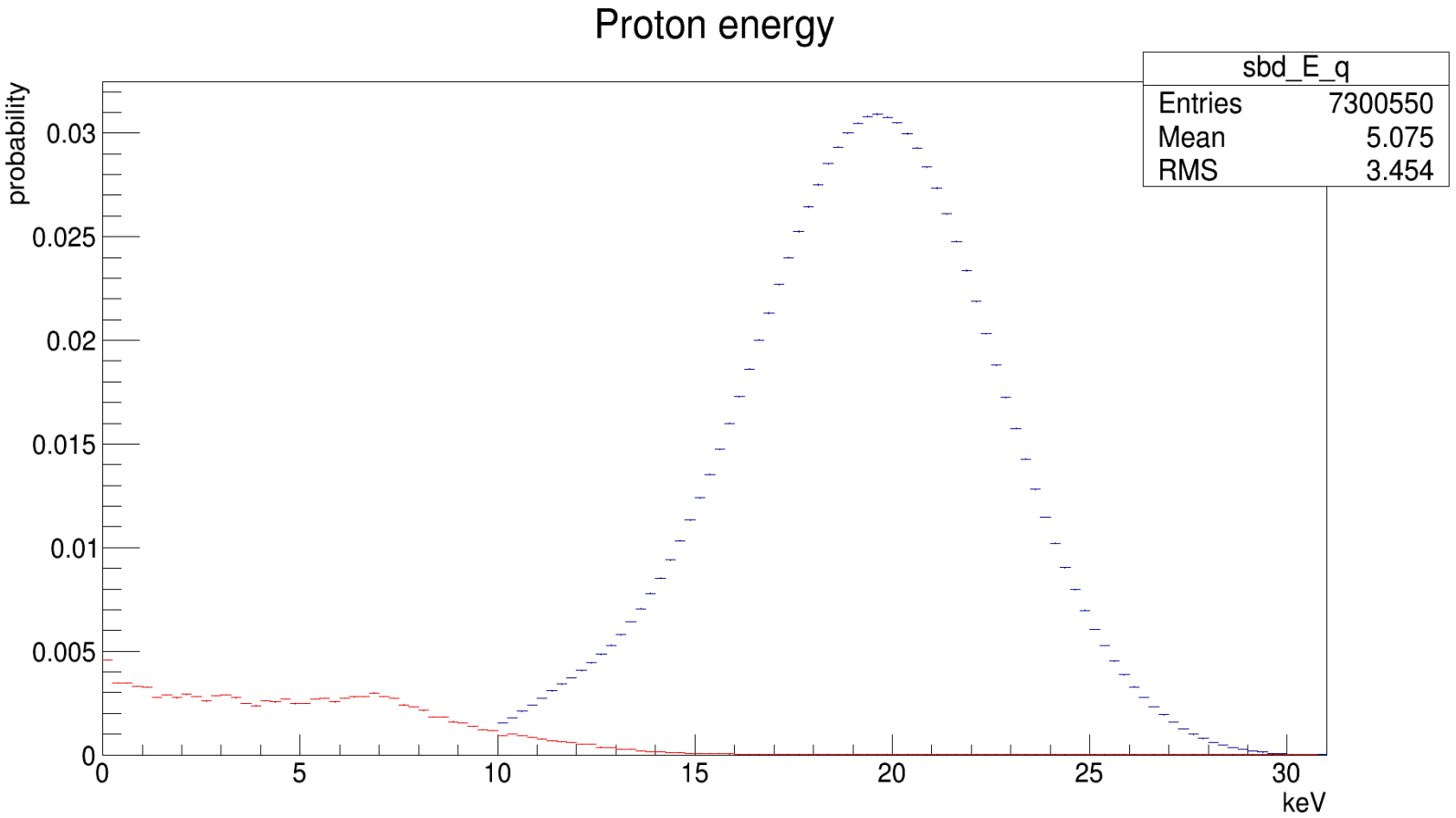
Proton (blue) and quasi-proton (red) spectra after all EP cuts

SBD – Energy Cuts



$50\ \text{keV} < E_e < 800\ \text{keV}$

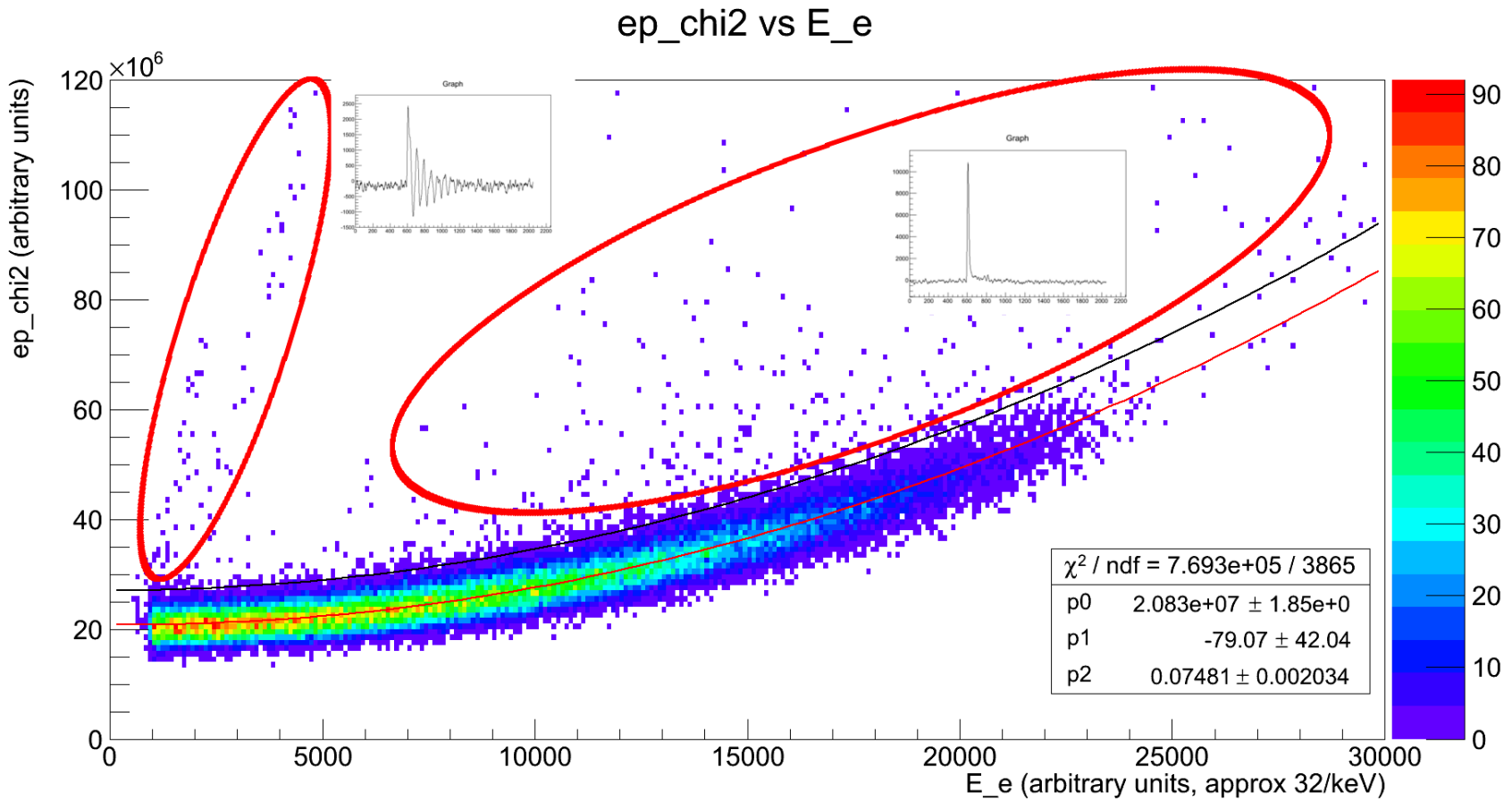
SBD – Energy Cuts



10 keV < E_p < 31 keV

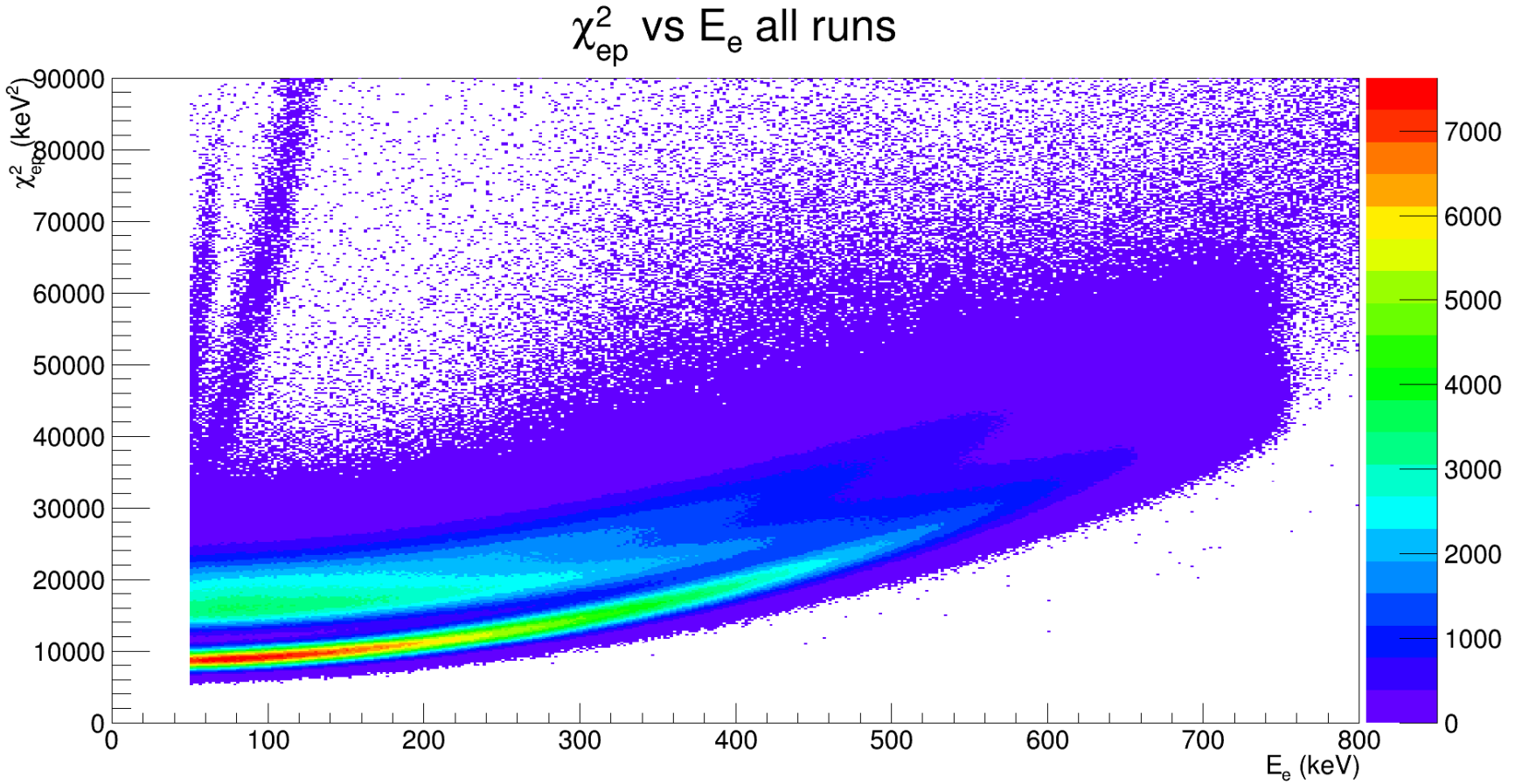
Proton (blue) and quasi-proton (red) spectra after all EP cuts

SBD – Signal Shape

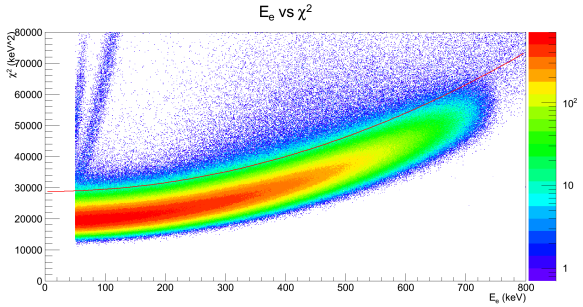


Series 256 data

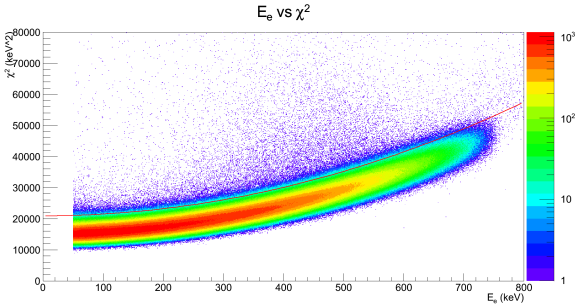
SBD – Signal Shape



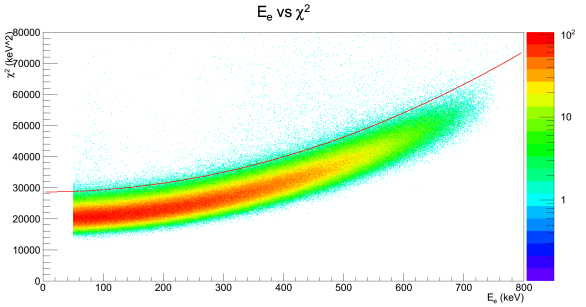
SBD – Signal Shape



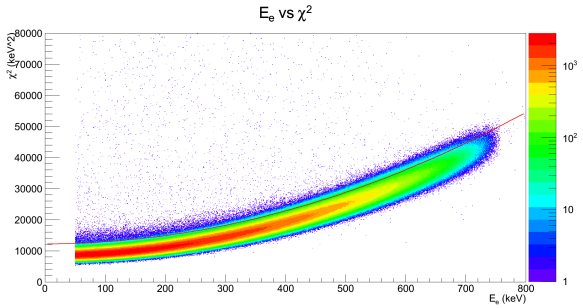
42-117A
S60-69 & 225-306



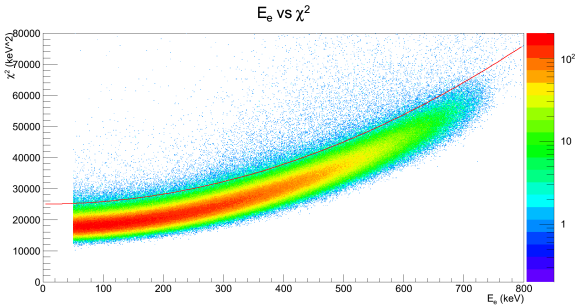
42-117C
S70-101



42-117C
S201-224

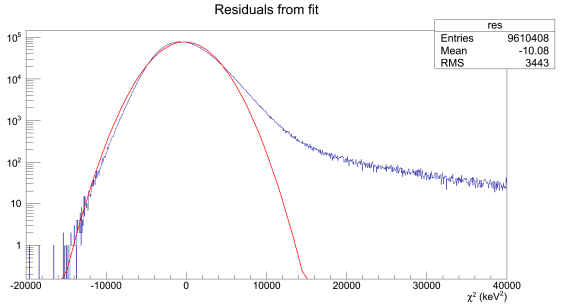


47-113B
S102-197 & 307-309

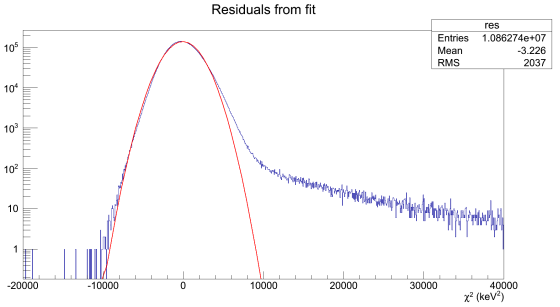


48-162B
S310-327

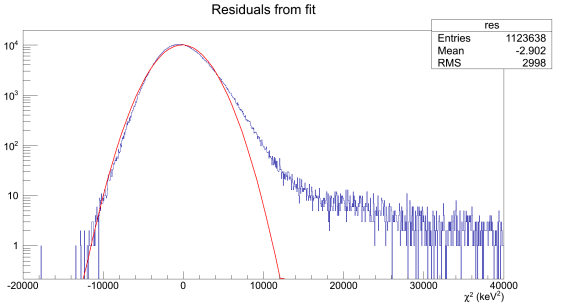
SBD – Signal Shape



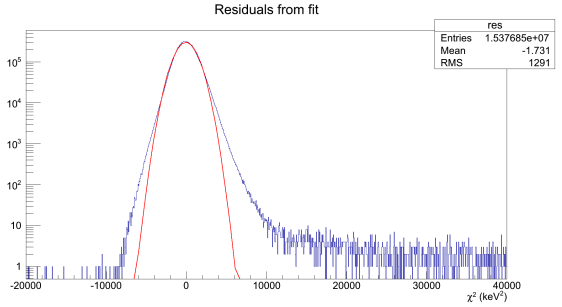
42-117A
S60-69 & 225-306



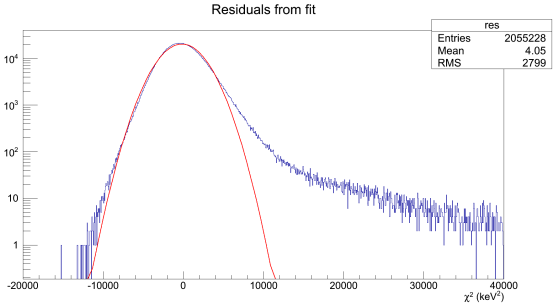
42-117C
S70-101



42-117C
S201-224



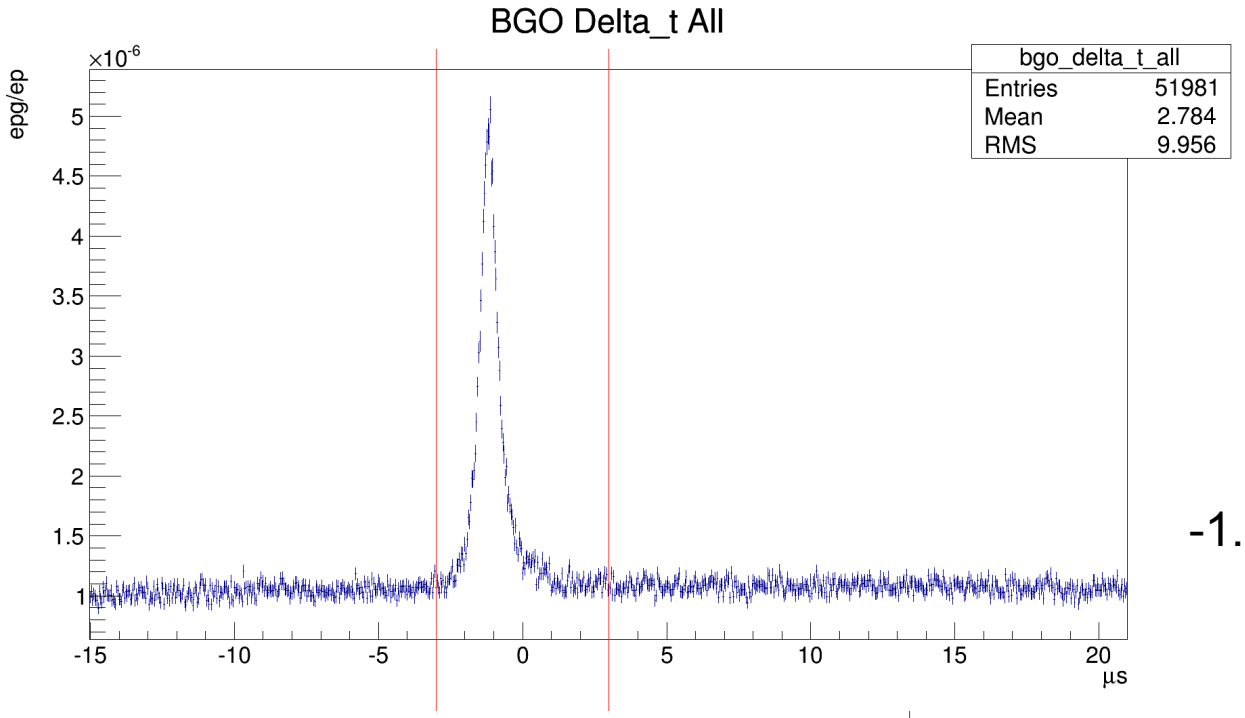
47-113B
S102-197 & 307-309



48-162B
S310-327

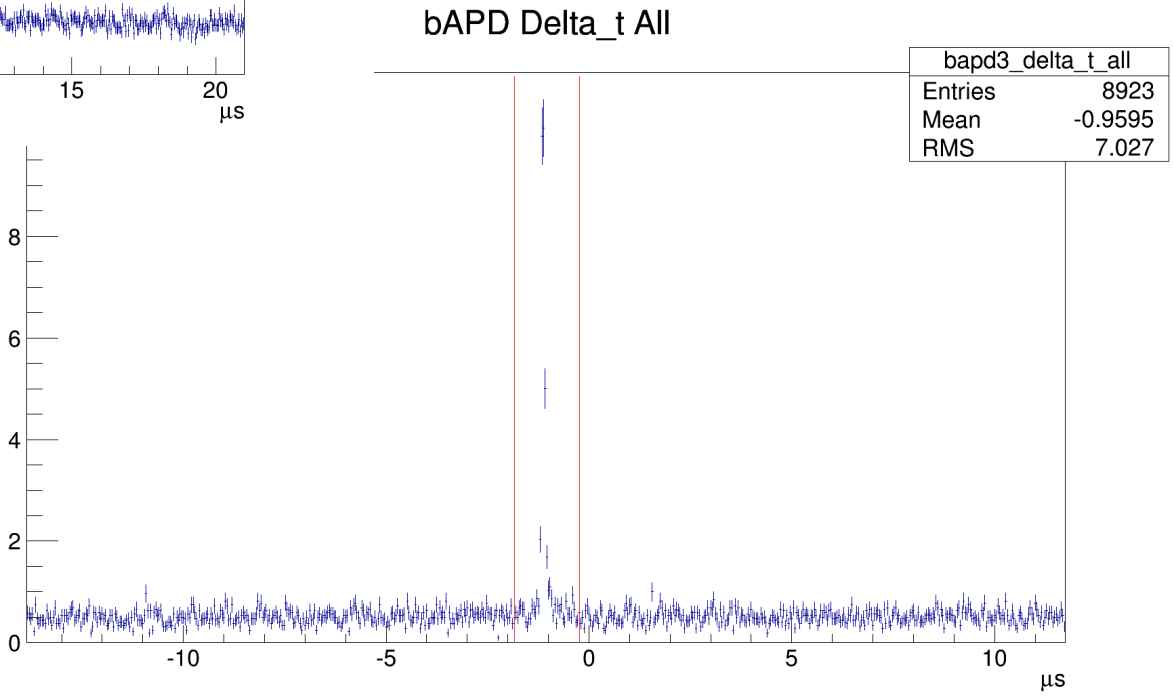
3σ upper bound
Approx. 0.36% of events cut

BGO/bAPD – Timing Cuts

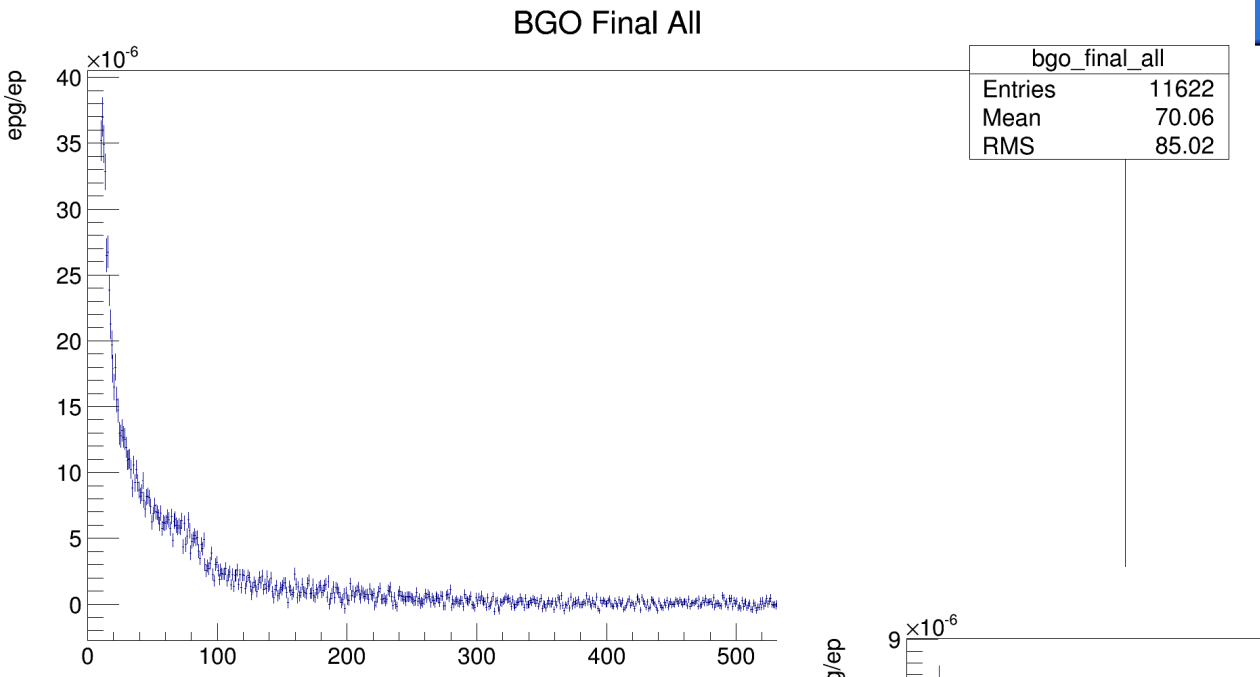


-3 μs < Δt < 3 μs

-1.84 μs < Δt < -0.24 μs



BGO/bAPD – Background Sub.



BGO weighted average

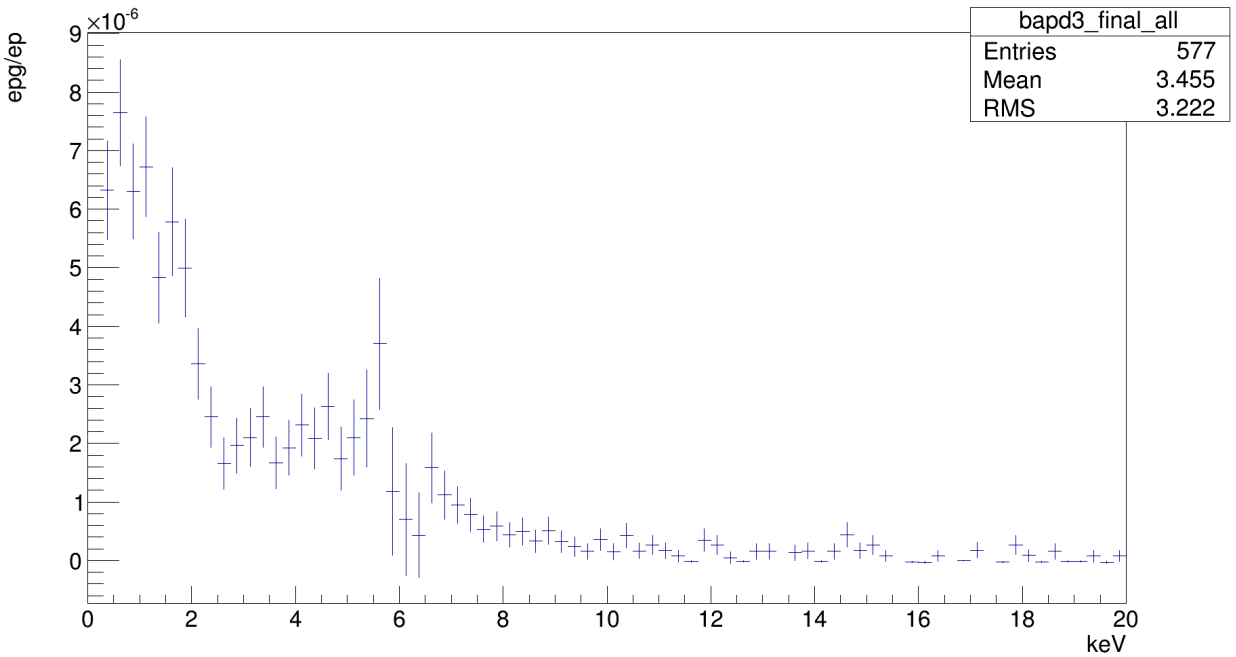
$\underline{Epg}$ = (8.826 ± 0.081) · 10^{-5}

ep

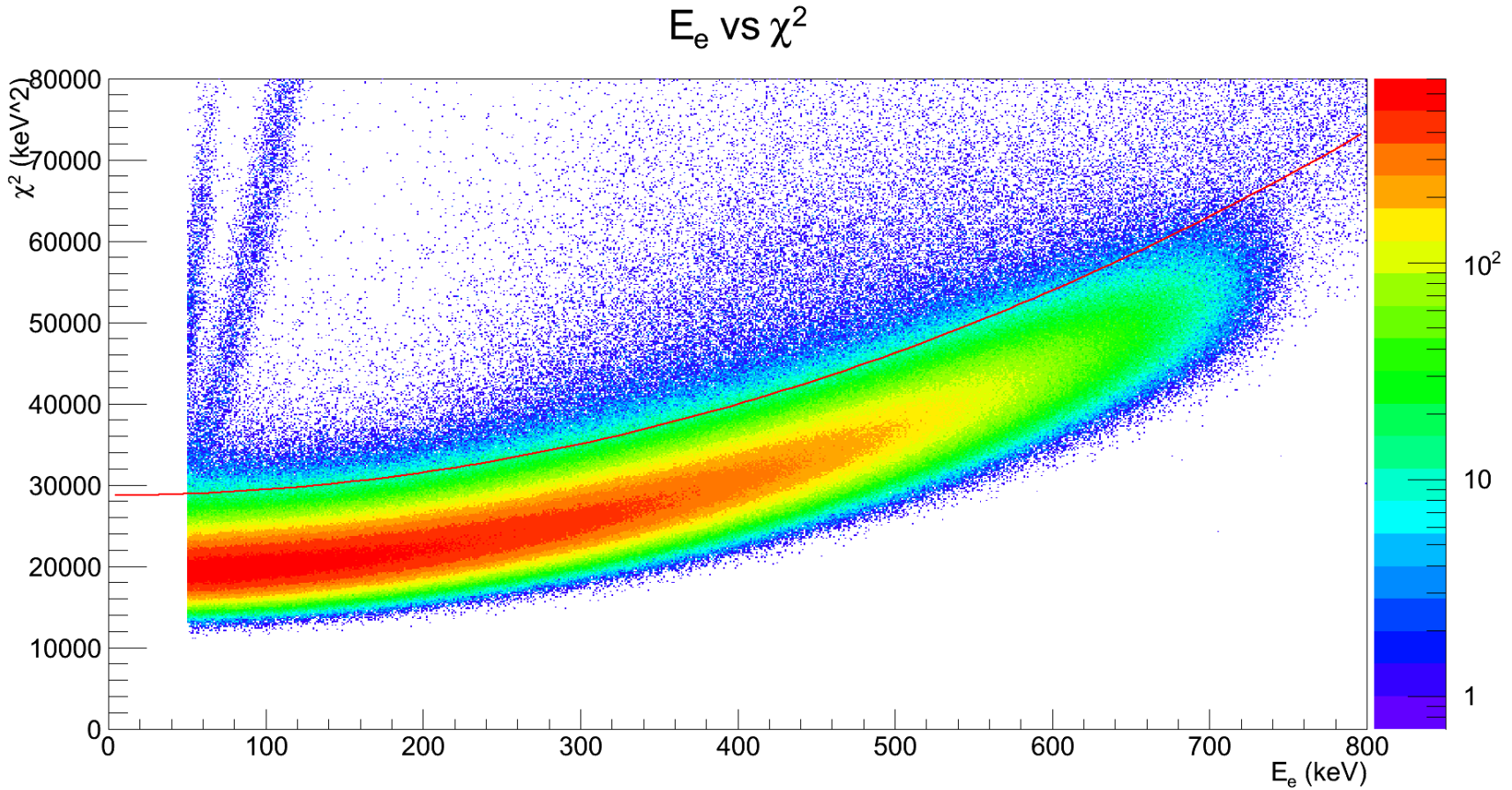
bAPD sum of 3 det.

$\underline{epg}$ = (9.22 ± 0.38) · 10^{-5}

ep

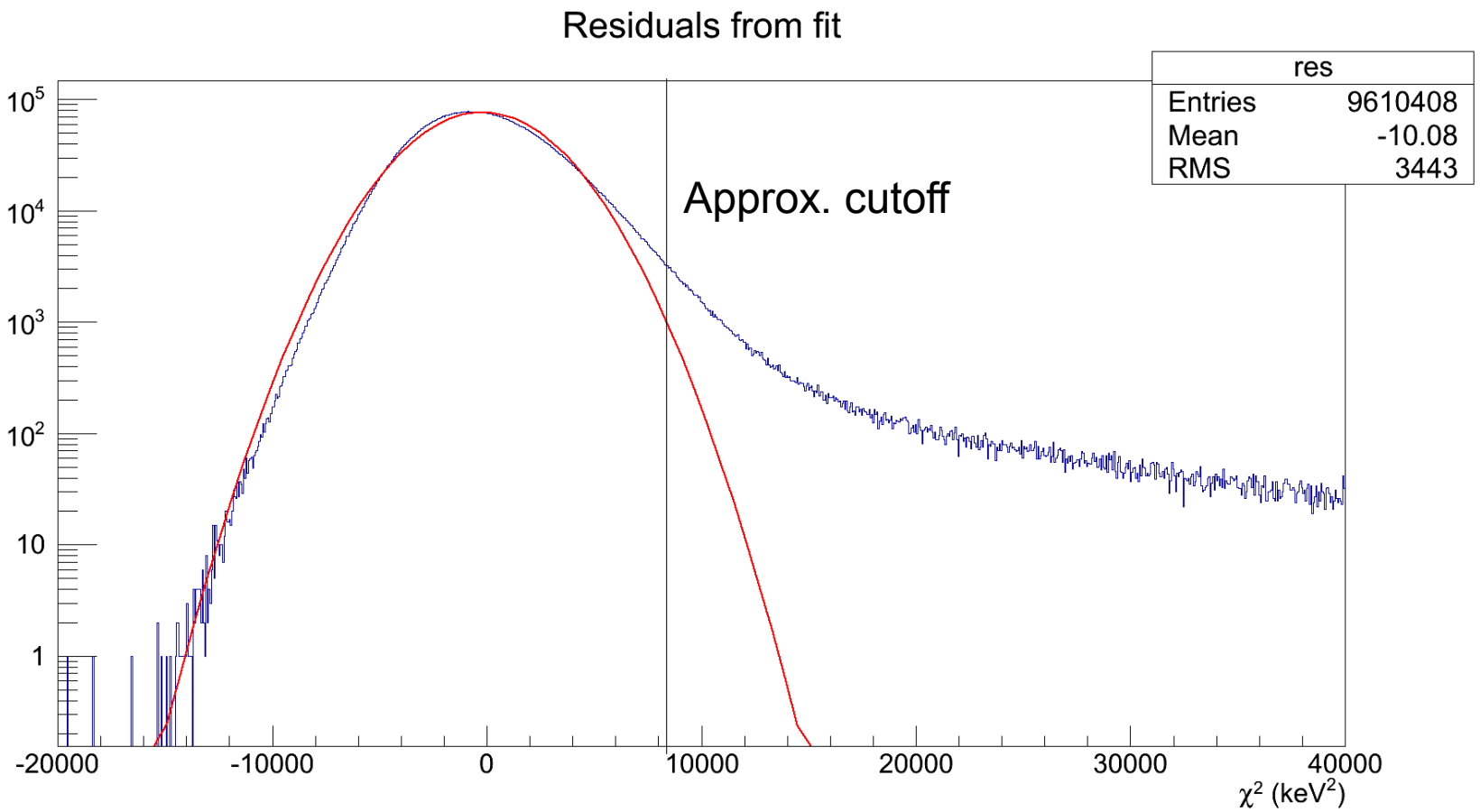


SBD – Signal Shape



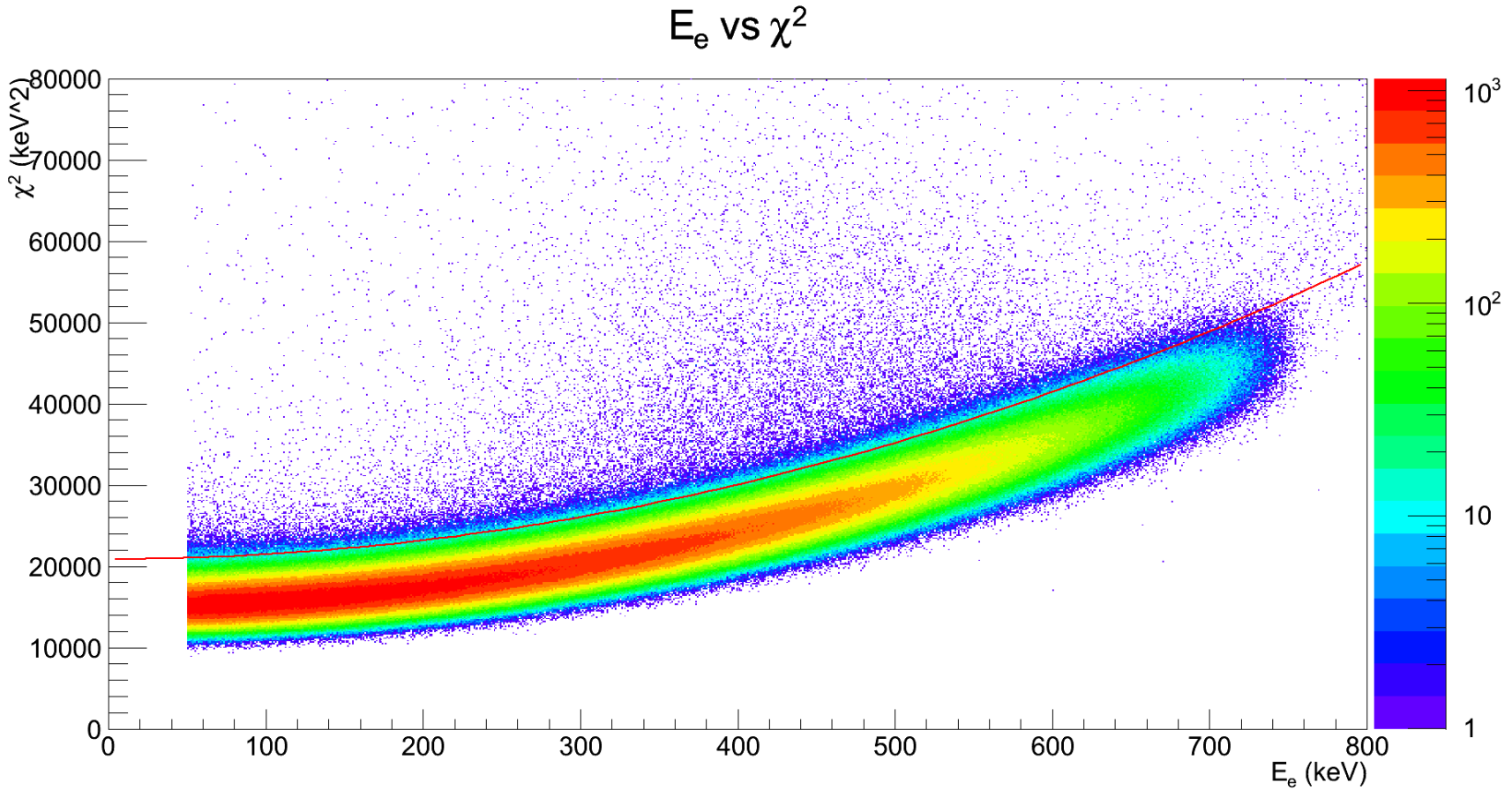
Set 1

SBD – Signal Shape



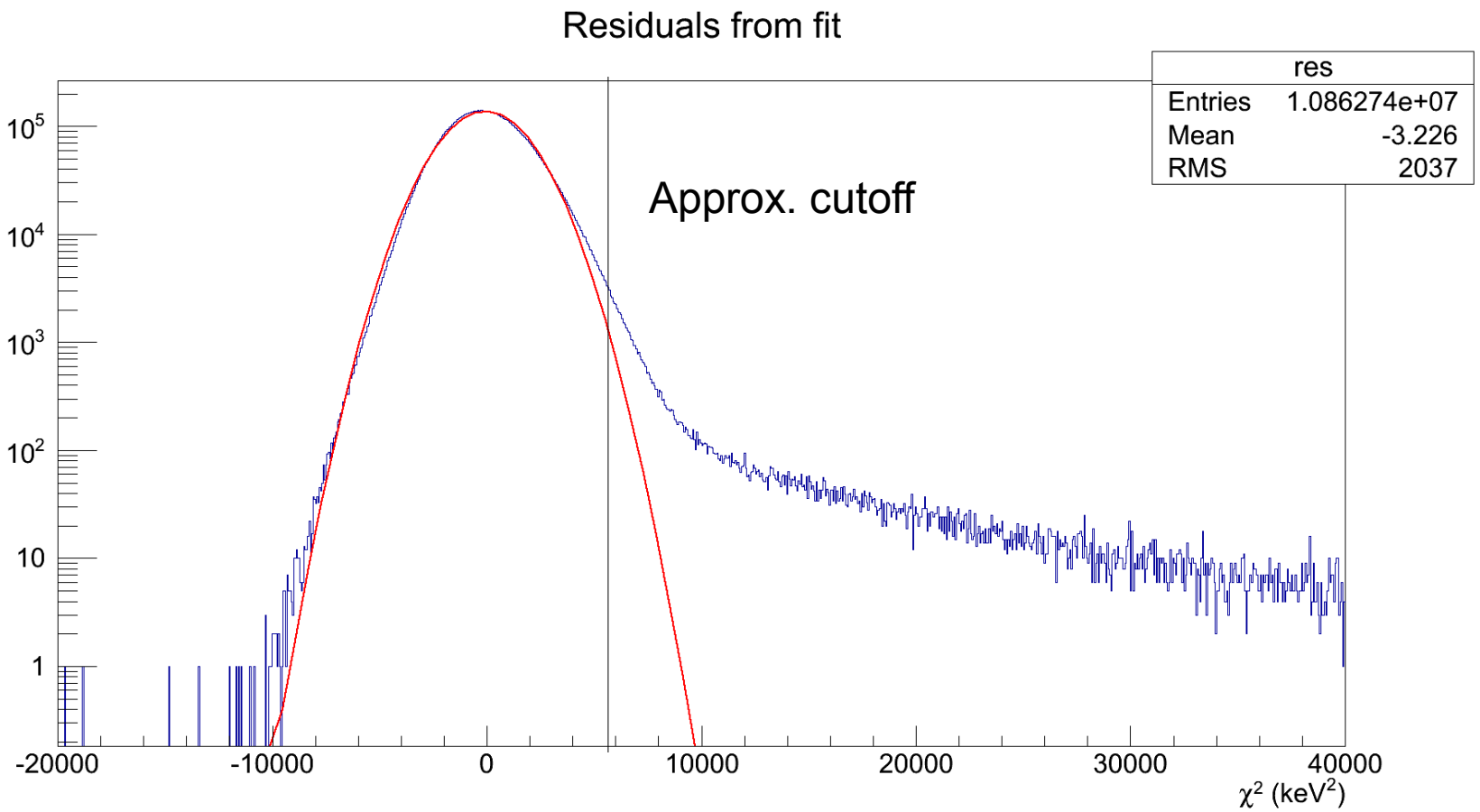
Set 1
σ=2919

SBD – Signal Shape



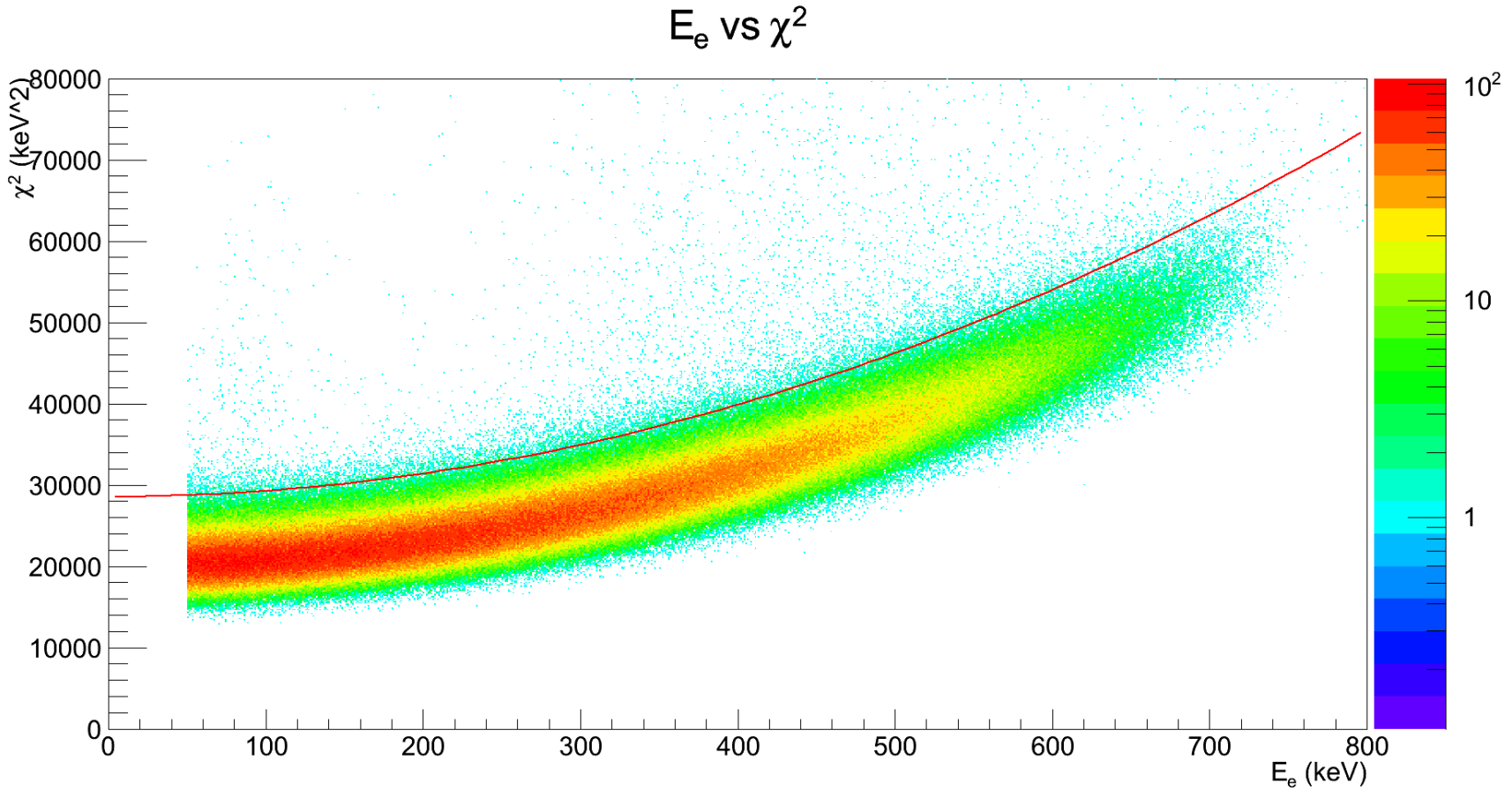
Set 2a

SBD – Signal Shape



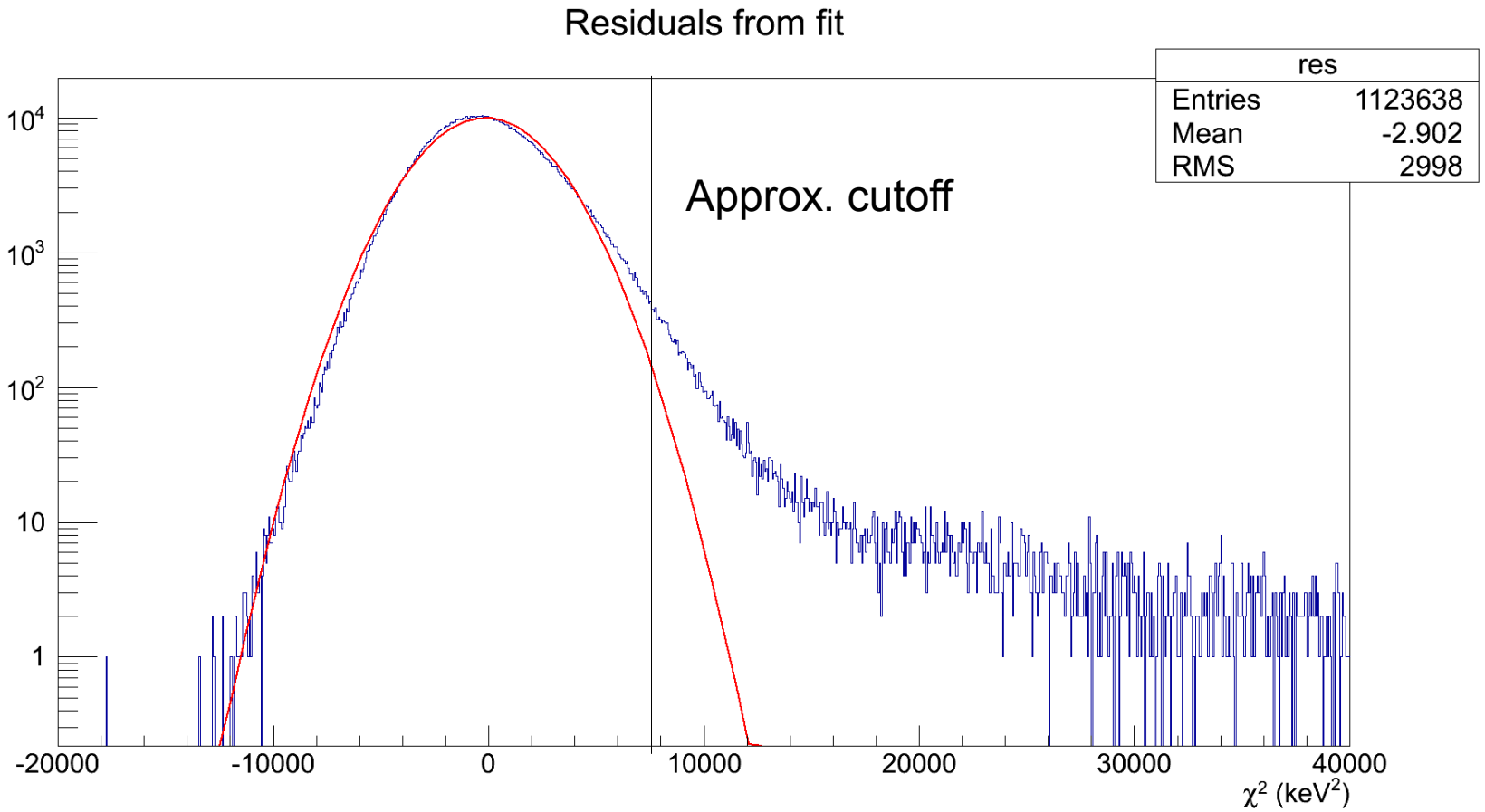
Set 2a
σ=1871

SBD – Signal Shape



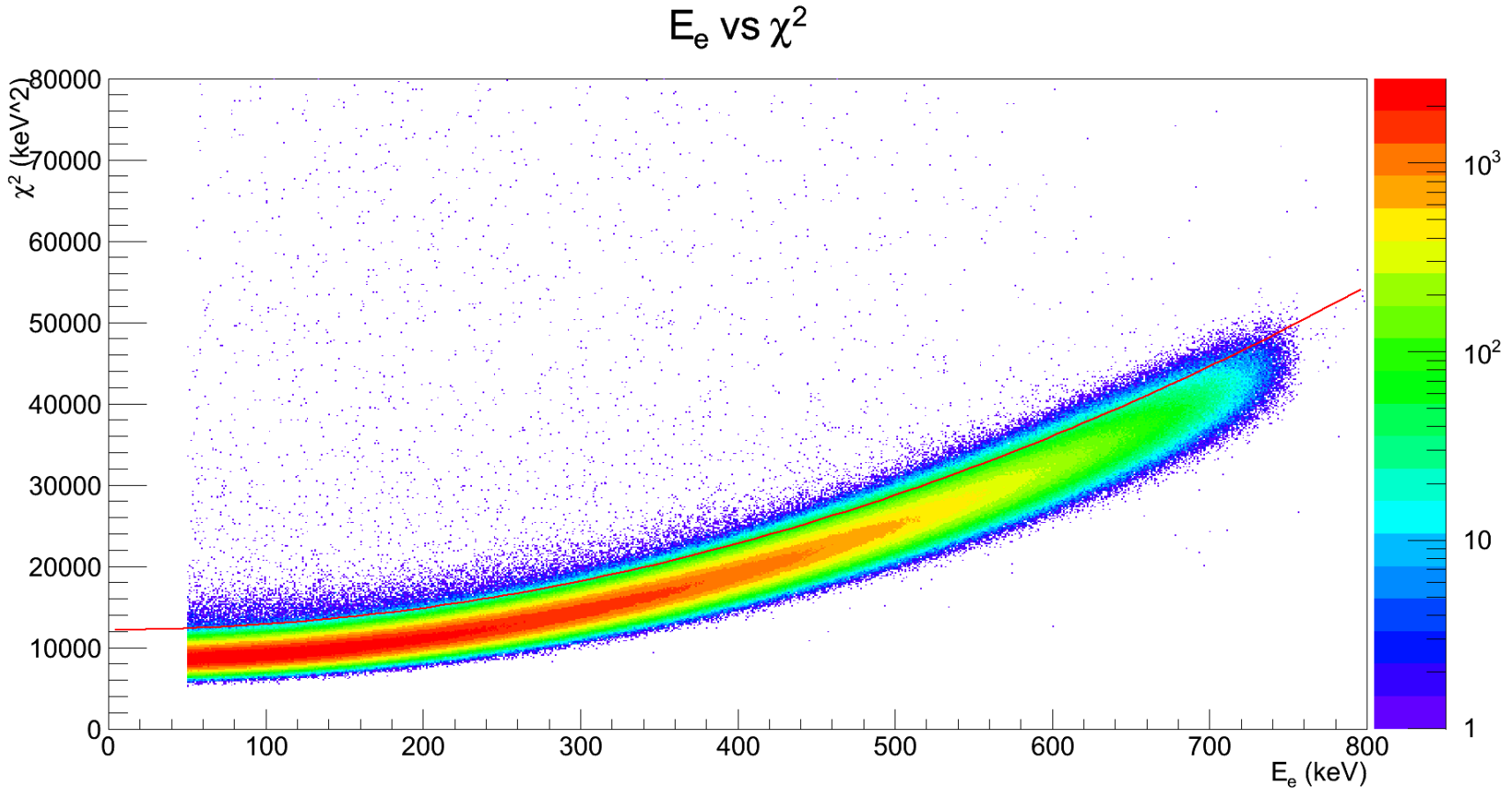
Set 2b

SBD – Signal Shape



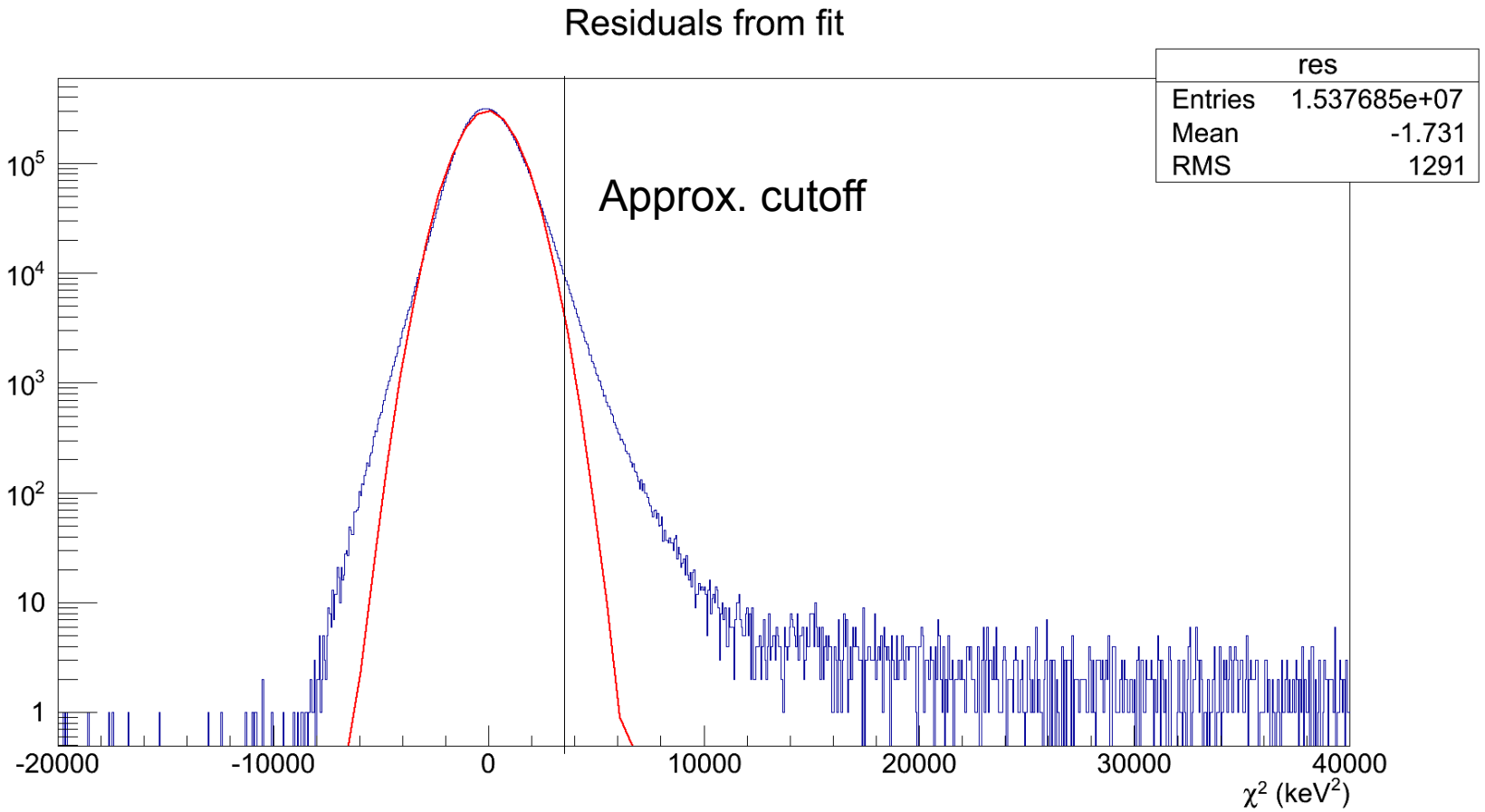
Set 2b
σ=2647

SBD – Signal Shape



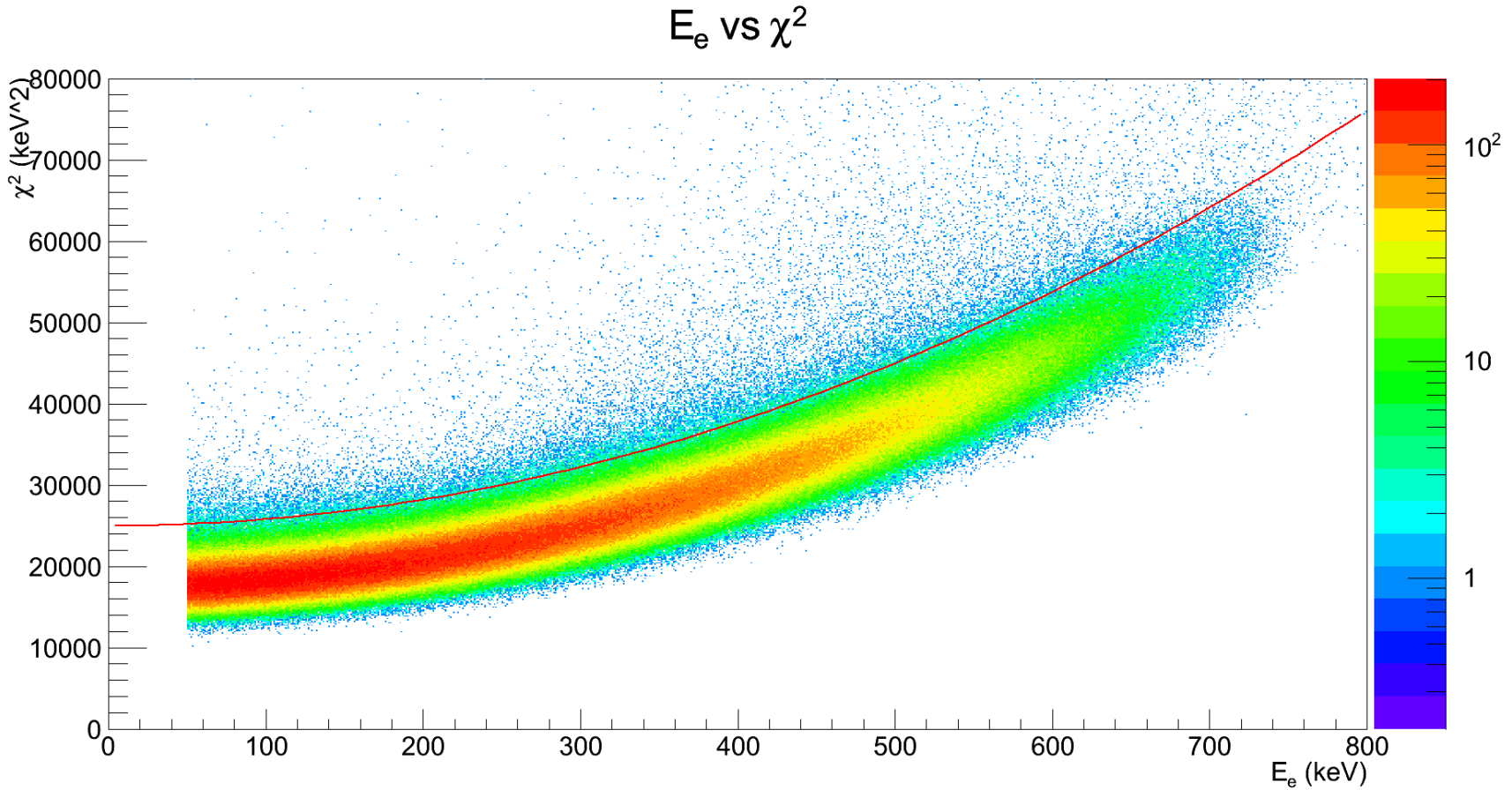
Set 3

SBD – Signal Shape



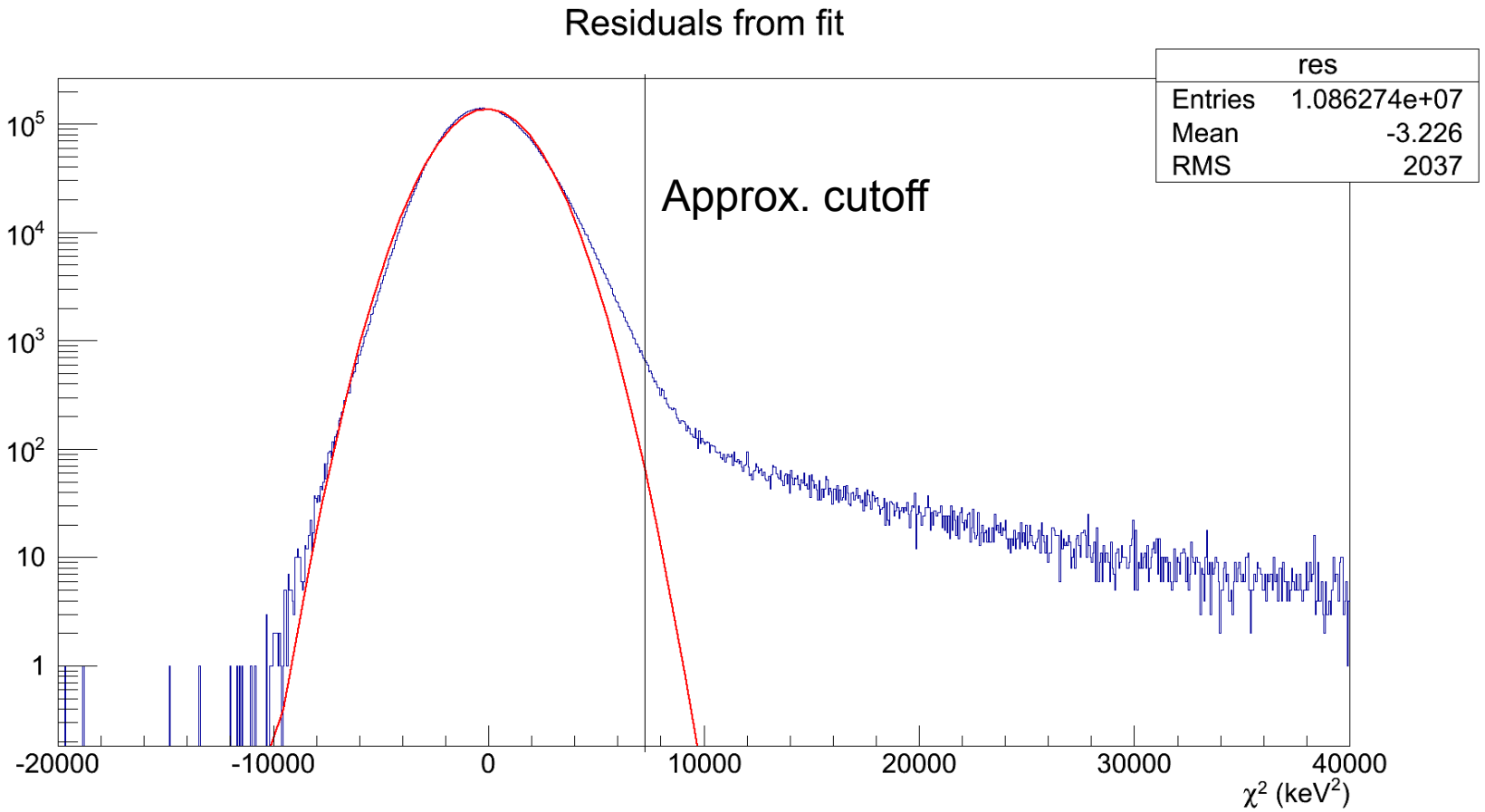
Set 3
σ=1215

SBD – Signal Shape



Set 4

SBD – Signal Shape



Set 4
σ=2367