RDK II Analysis

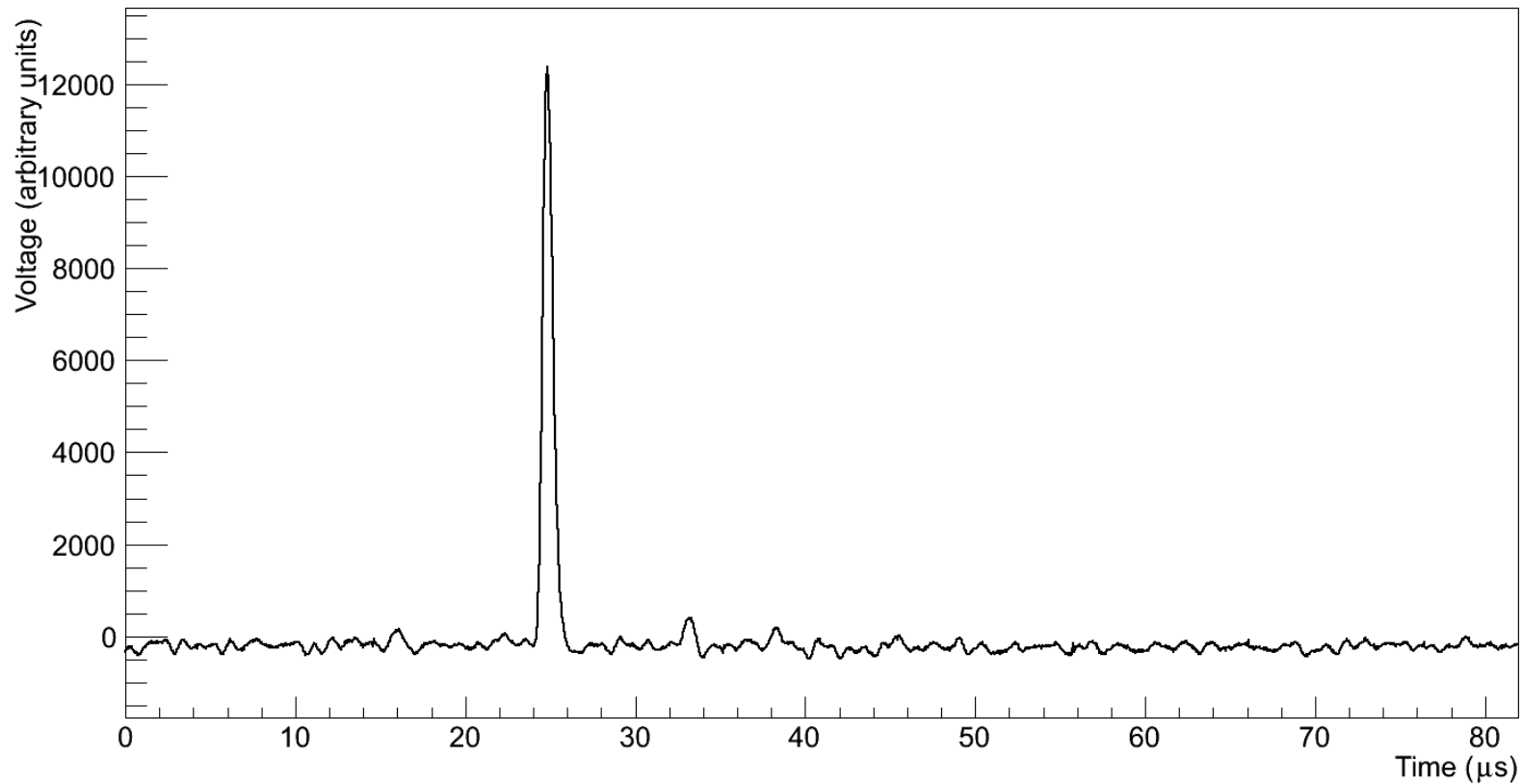## Collaboration Meeting
4/24/13

Benjamin O'Neill, PhD
Arizona State University

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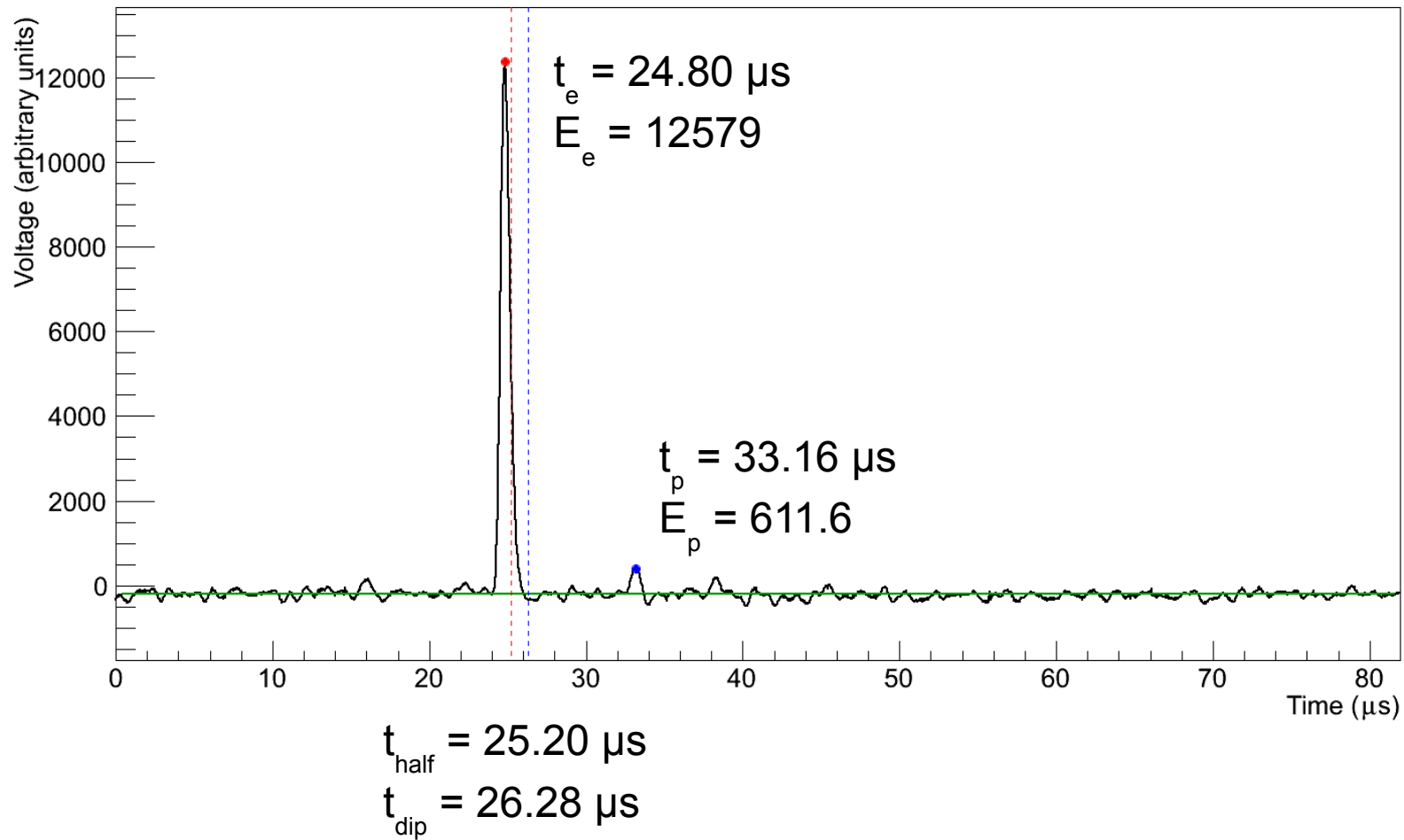   - Energy
    - Timing
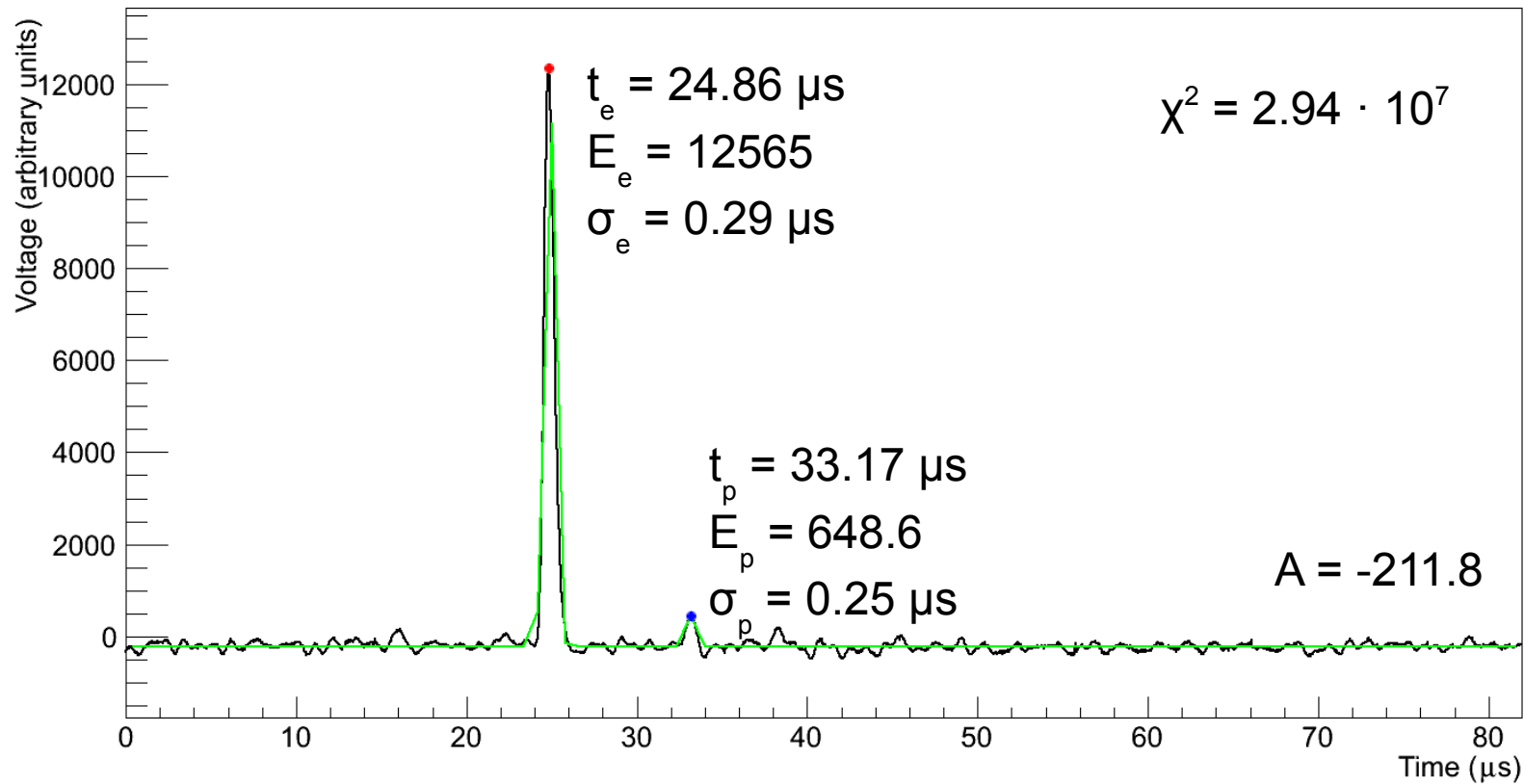   - Background sub.

SBD – Typical Signal

EP event

SBD – Peak Search

EP event

t_e = 24.80 µs
E_e = 12579

t_p = 33.16 µs
E_p = 611.6

t_{half} = 25.20 µs
t_{dip} = 26.28 µs

SBD – Signal Fit

EP event

t_e = 24.86 µs
E_e = 12565
σ_e = 0.29 µs

$\chi^2 = 2.94 \cdot 10^7$

t_p = 33.17 µs
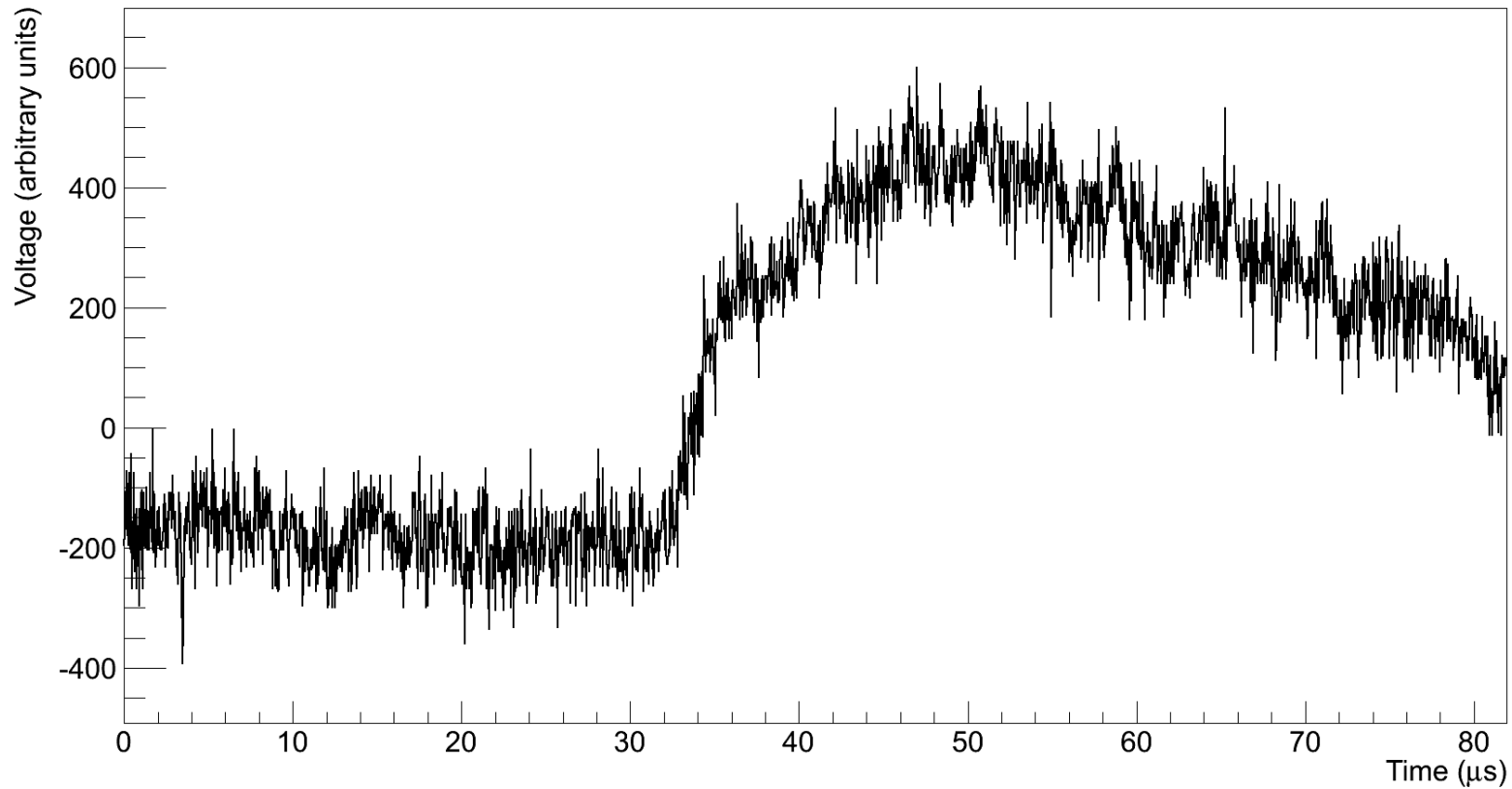E_p = 648.6
σ_p = 0.25 µs

A = -211.8

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

BGO – Typical Signal

BGO event

BGO – Smoothed
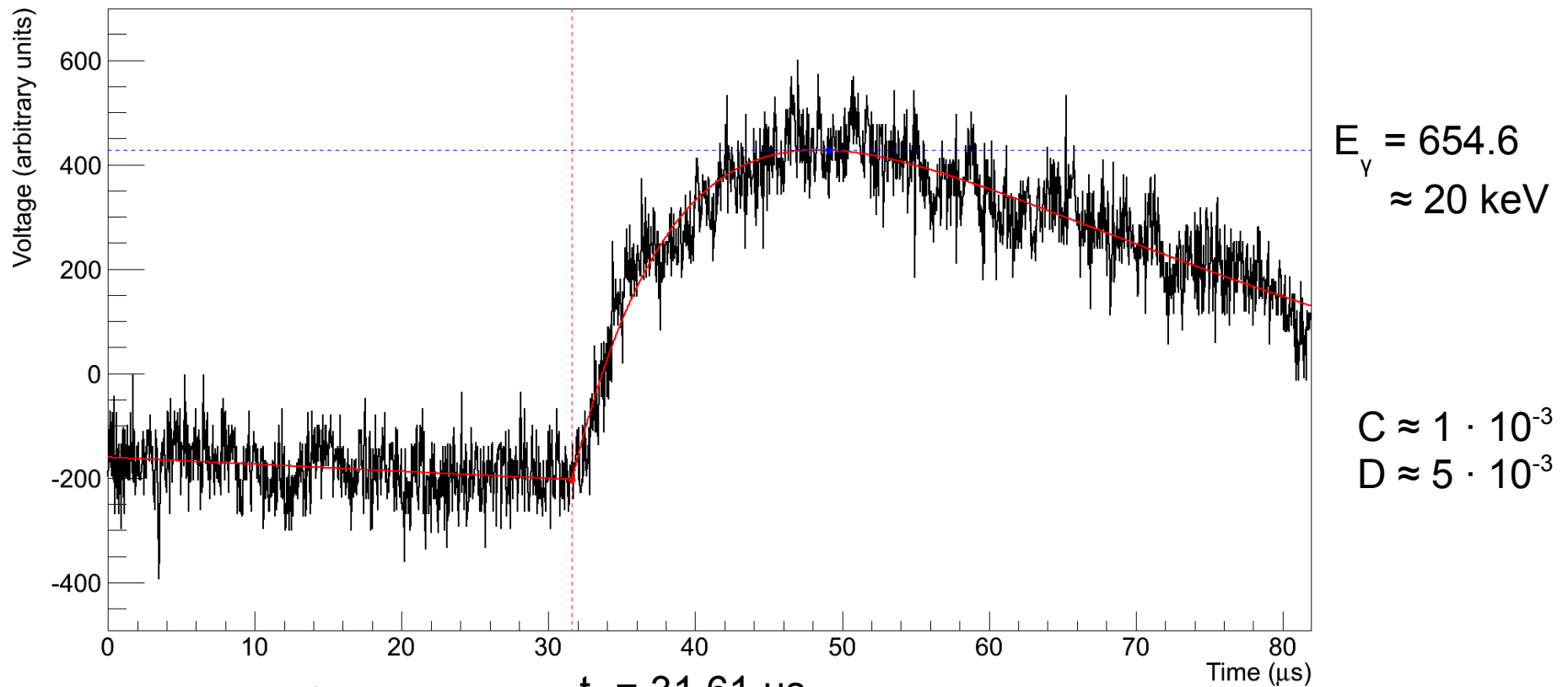

BGO event

$E_\gamma = 687.7$

$t_0 = 32.88$ μs
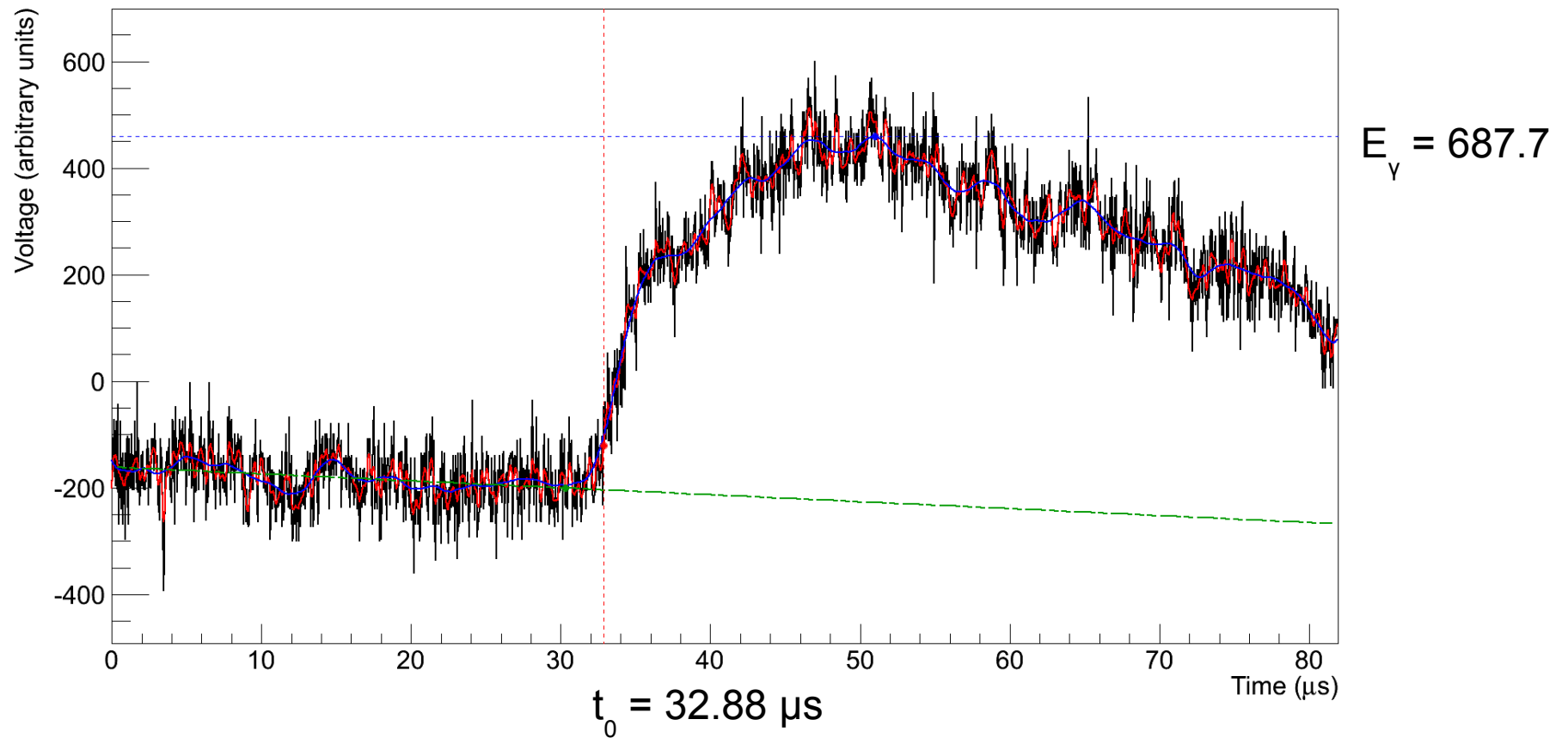
BGO – Full Signal Fit

BGO event

$E_\gamma = 654.6$
≈ 20 keV

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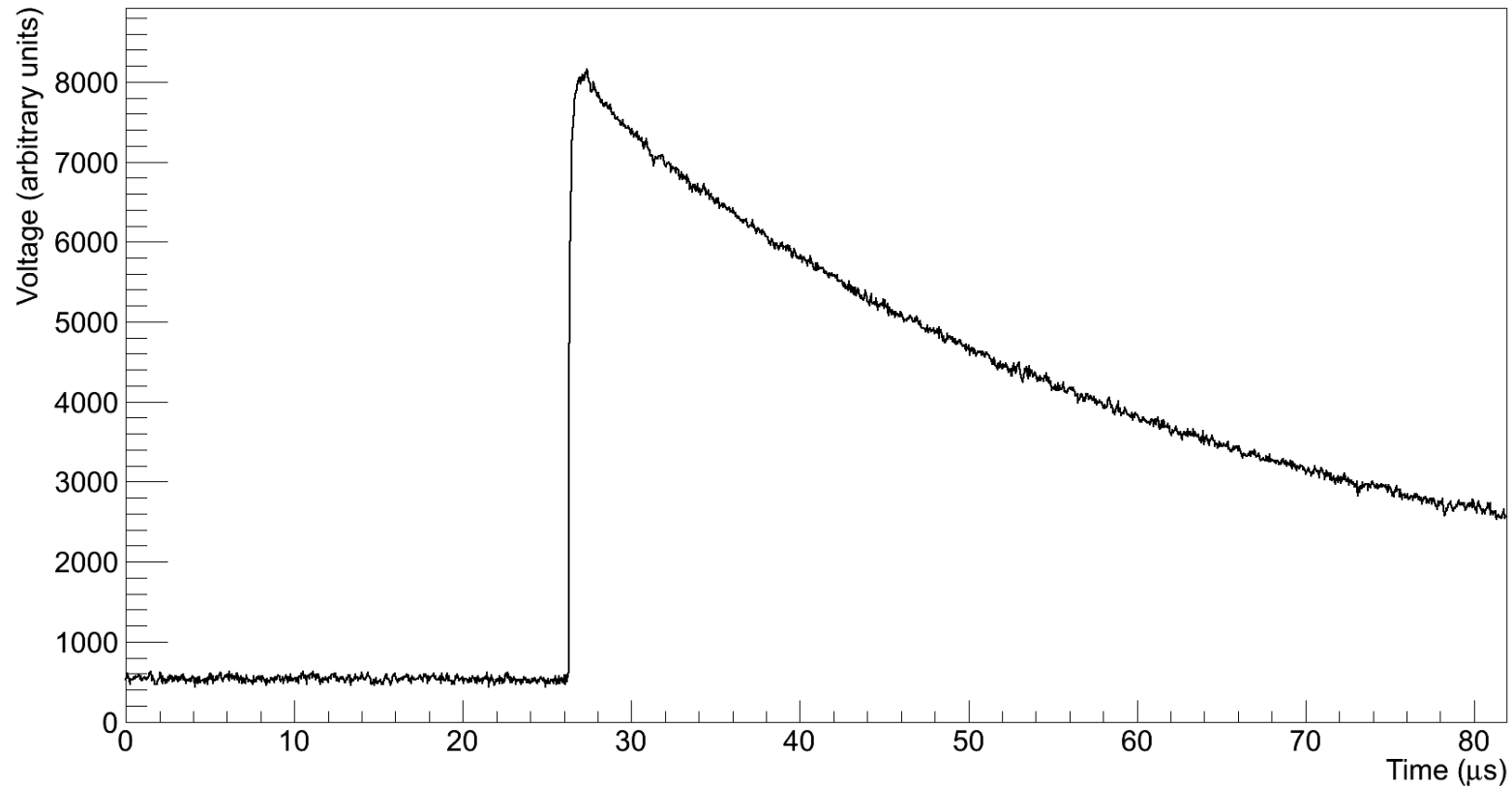$D \approx 5 \cdot 10^{-3}$

$t_0 = 31.61$ µs

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

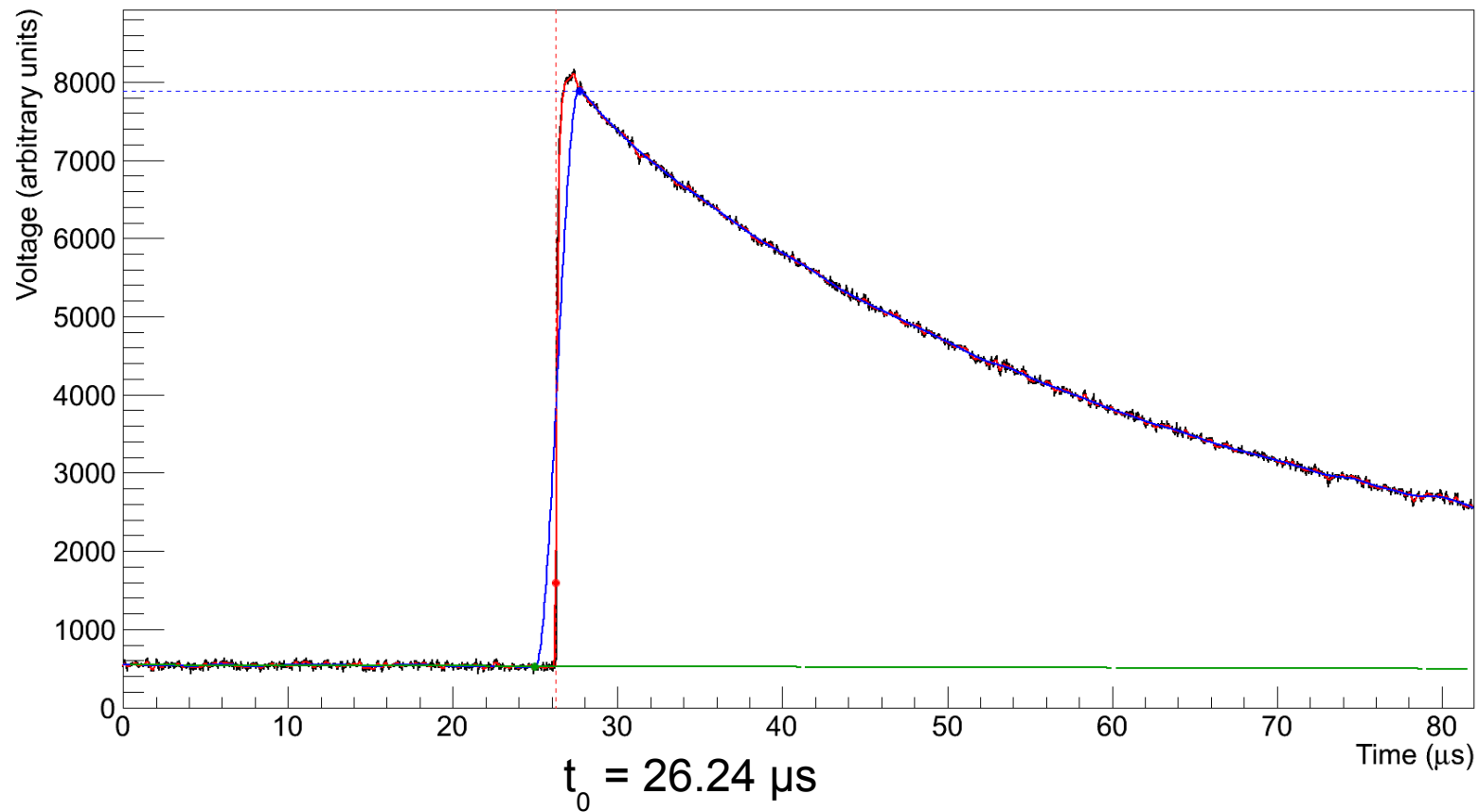$$E_\gamma = \frac{BD}{C+D}\left(\frac{C+D}{C}\right)^{-C/D}$$

bAPD – Typical Signal
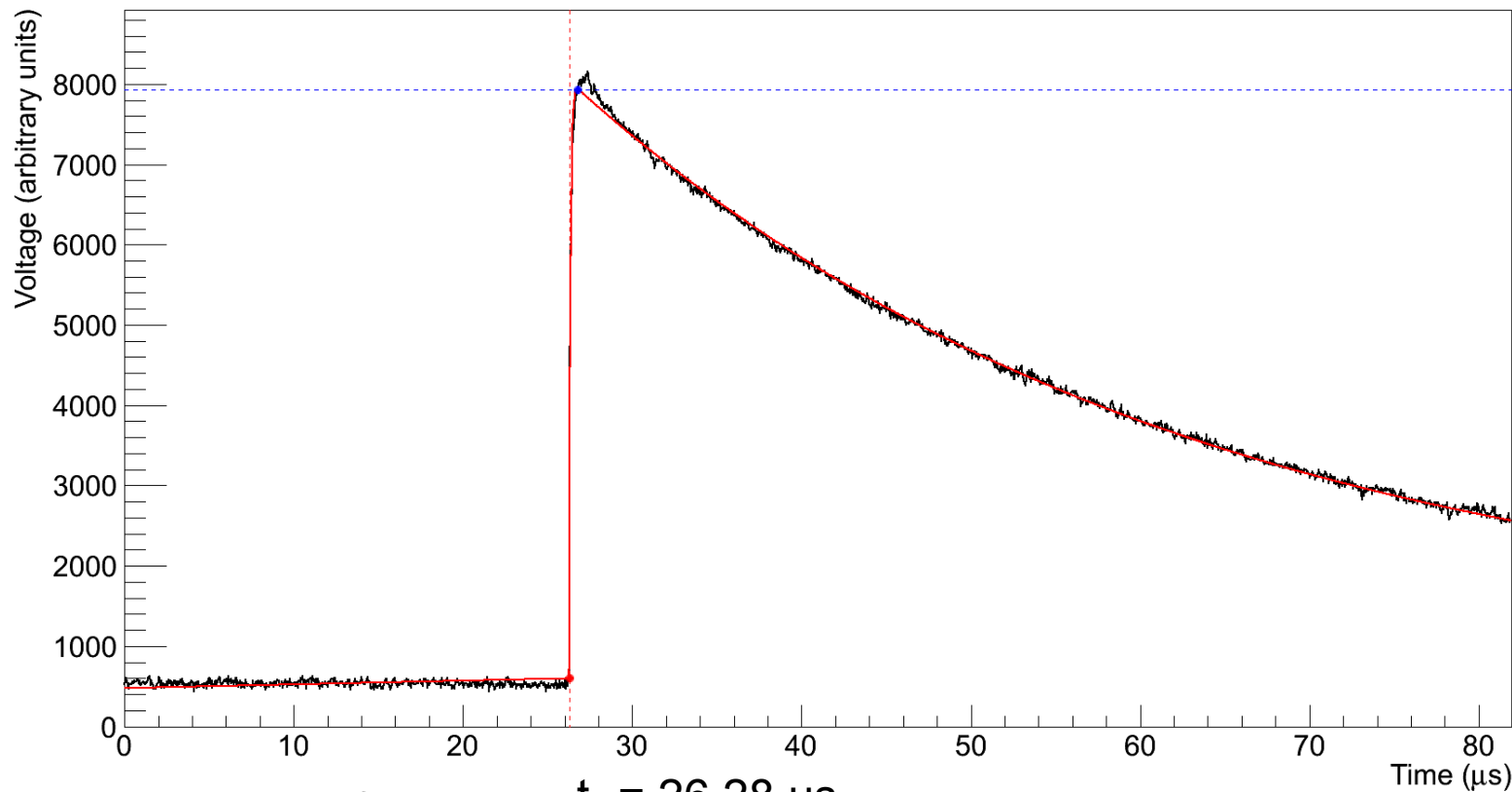

bAPD event

bAPD – Smoothed

bAPD event

$E_\gamma = 7361.3$

$t_0 = 26.24$ μs

bAPD – Full Signal Fit

bAPD event

$E_\gamma = 7326.3$
≈ 10 keV

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

$t_0 = 26.28$ µs

$$V(t) = \begin{cases} A + Ft & \text{if } t \le t_0 \\ A + Ft + Be^{-C(t-t_0)}\left(1 - e^{-D(t-t_0)}\right) & \text{if } t > t_0 \end{cases}$$
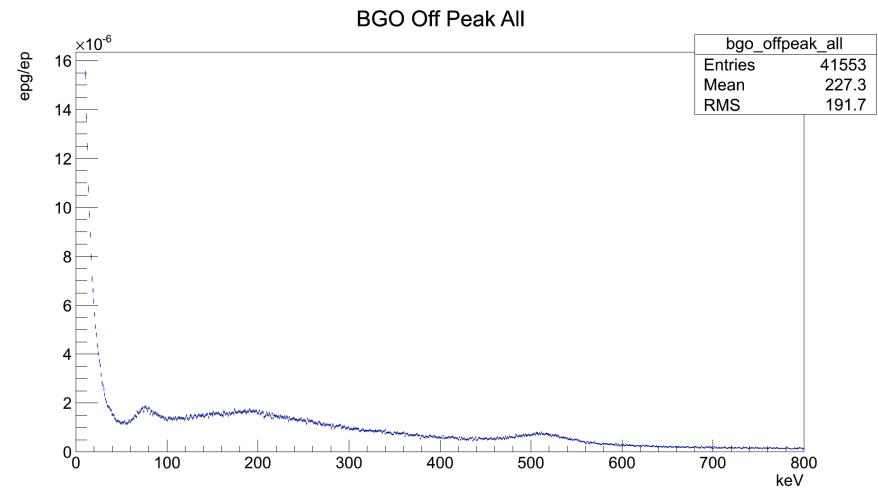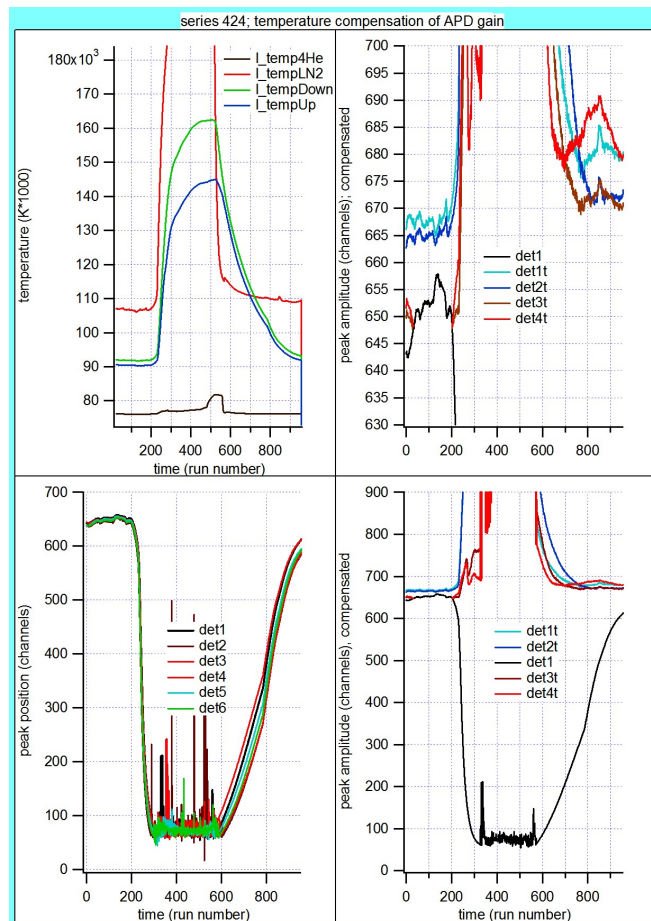
$$E_\gamma = \frac{BD}{C+D}\left(\frac{C+D}{C}\right)^{-C/D}$$
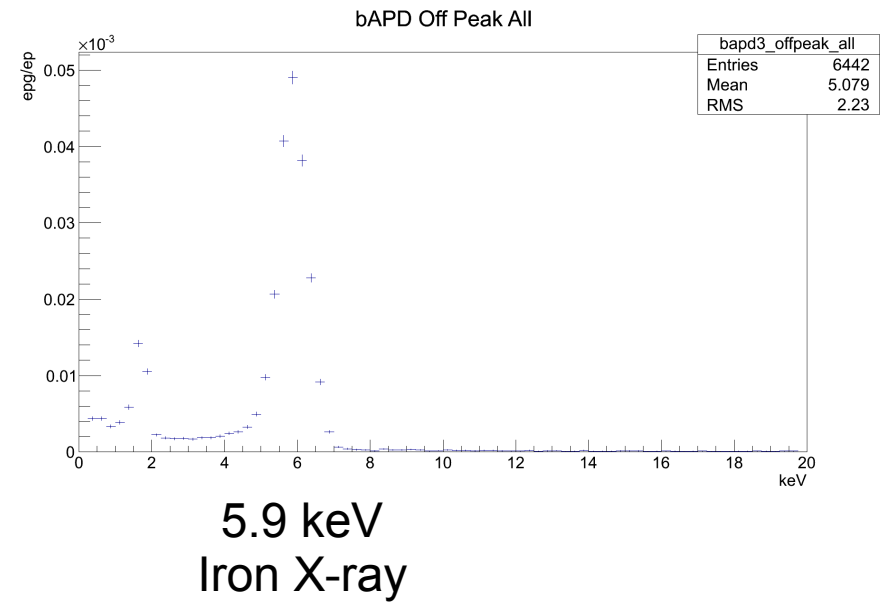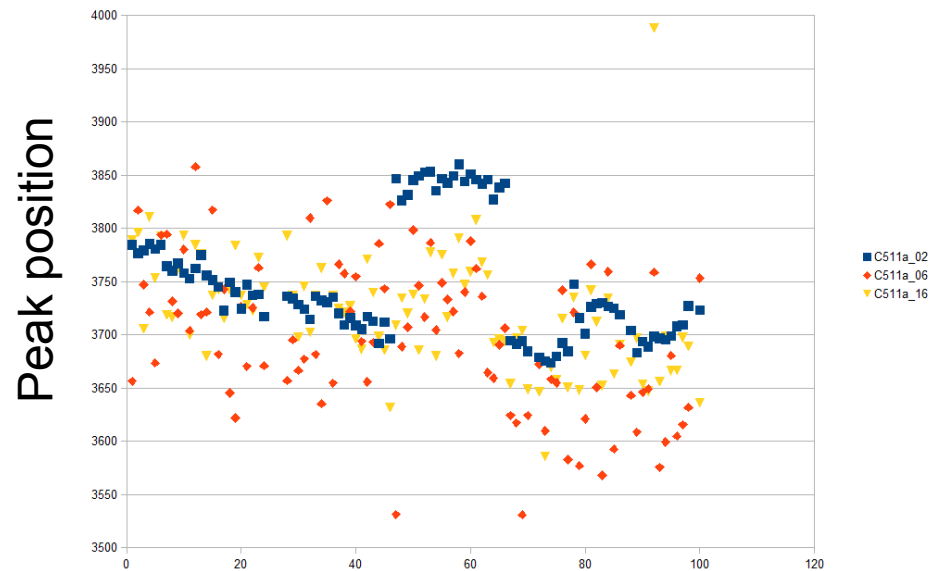
Calibration – BGO
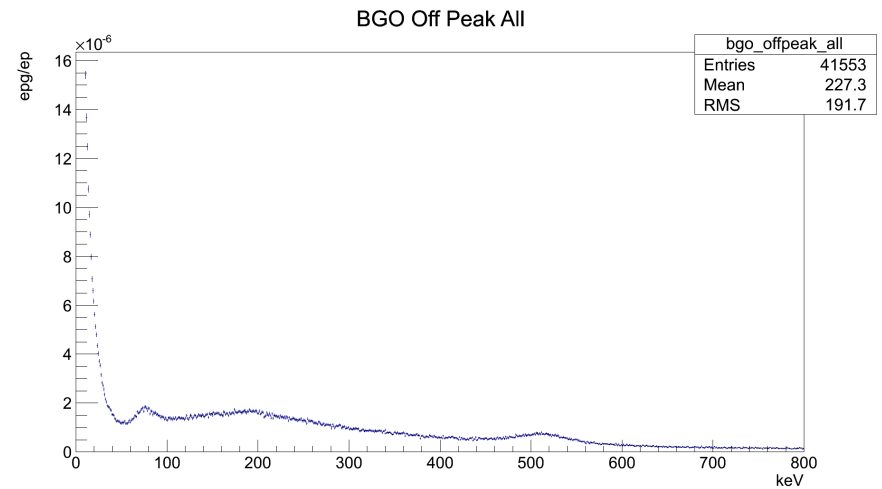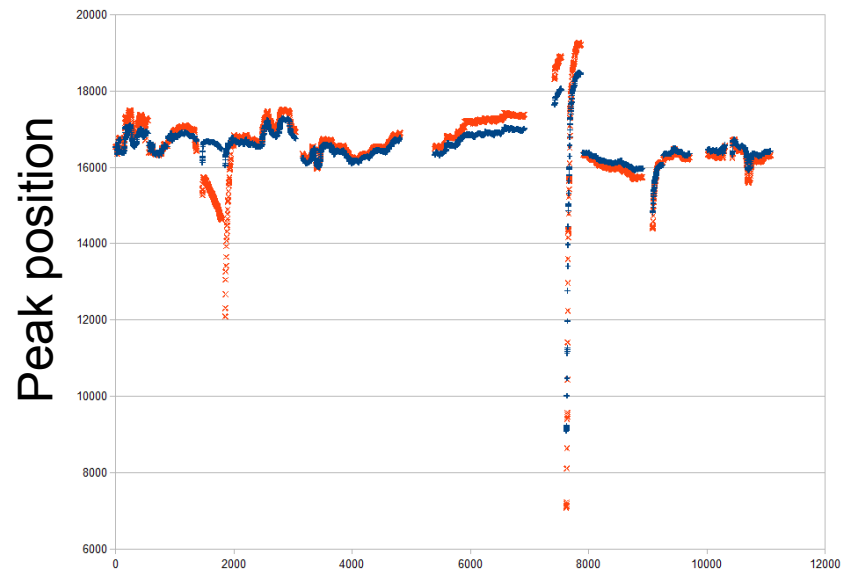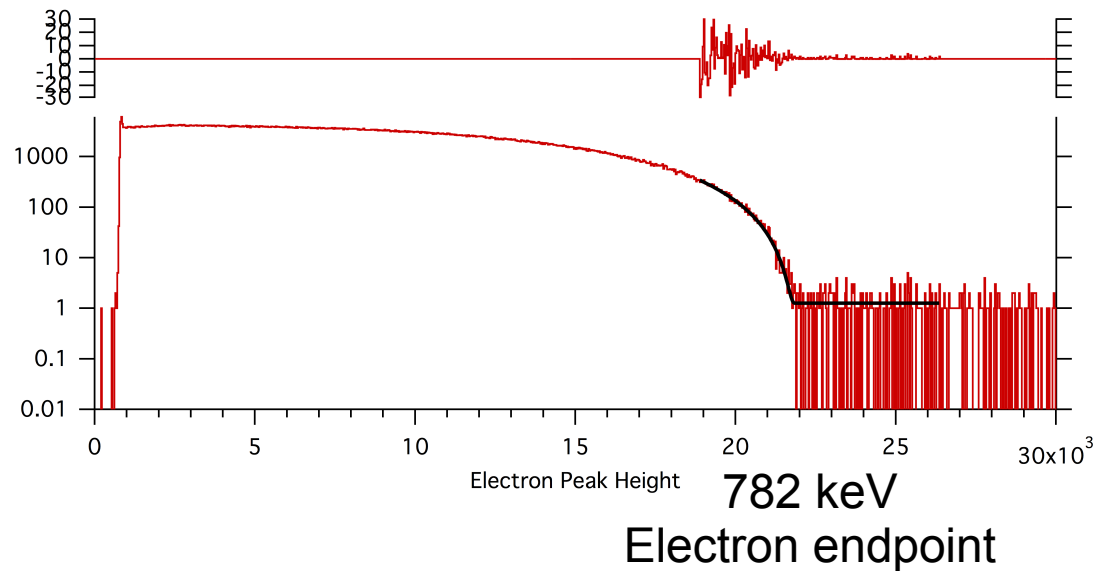

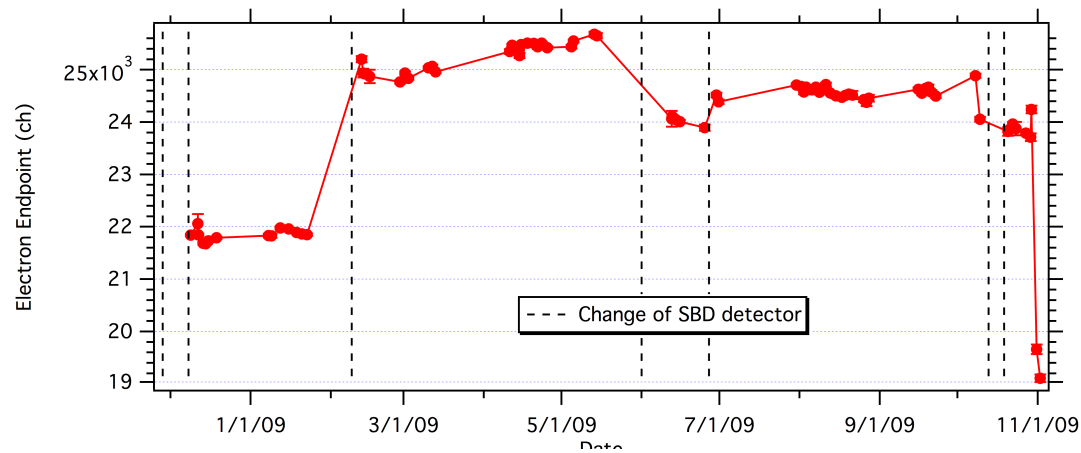511 keV
Positron annihilation

Calibration – BGO

511 keV
Positron annihilation

Calibration – bAPD

Peak position

Legend:
- C511a_02
- C511a_06
- C511a_16

bAPD Off Peak All

bapd3_offpeak_all	
Entries	6442
Mean	5.079
RMS	2.23

5.9 keV
Iron X-ray

Calibration – SBD

782 keV
Electron endpoint

SBD – Timing Cuts

Electron-proton TOF
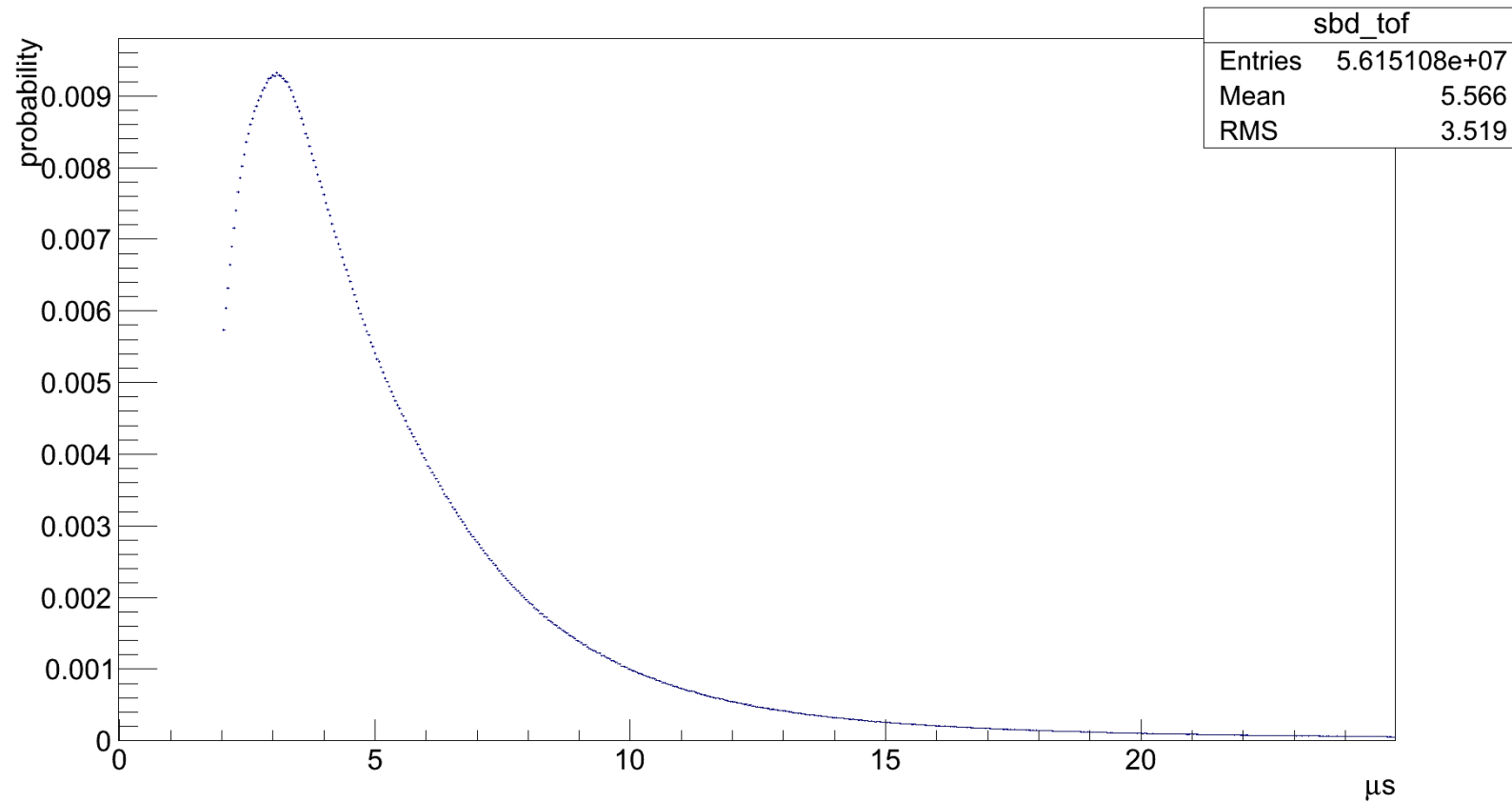
$2\ \mu s < t_p - t_e < 25\ \mu s$

SBD – Energy Cuts

Electron energy
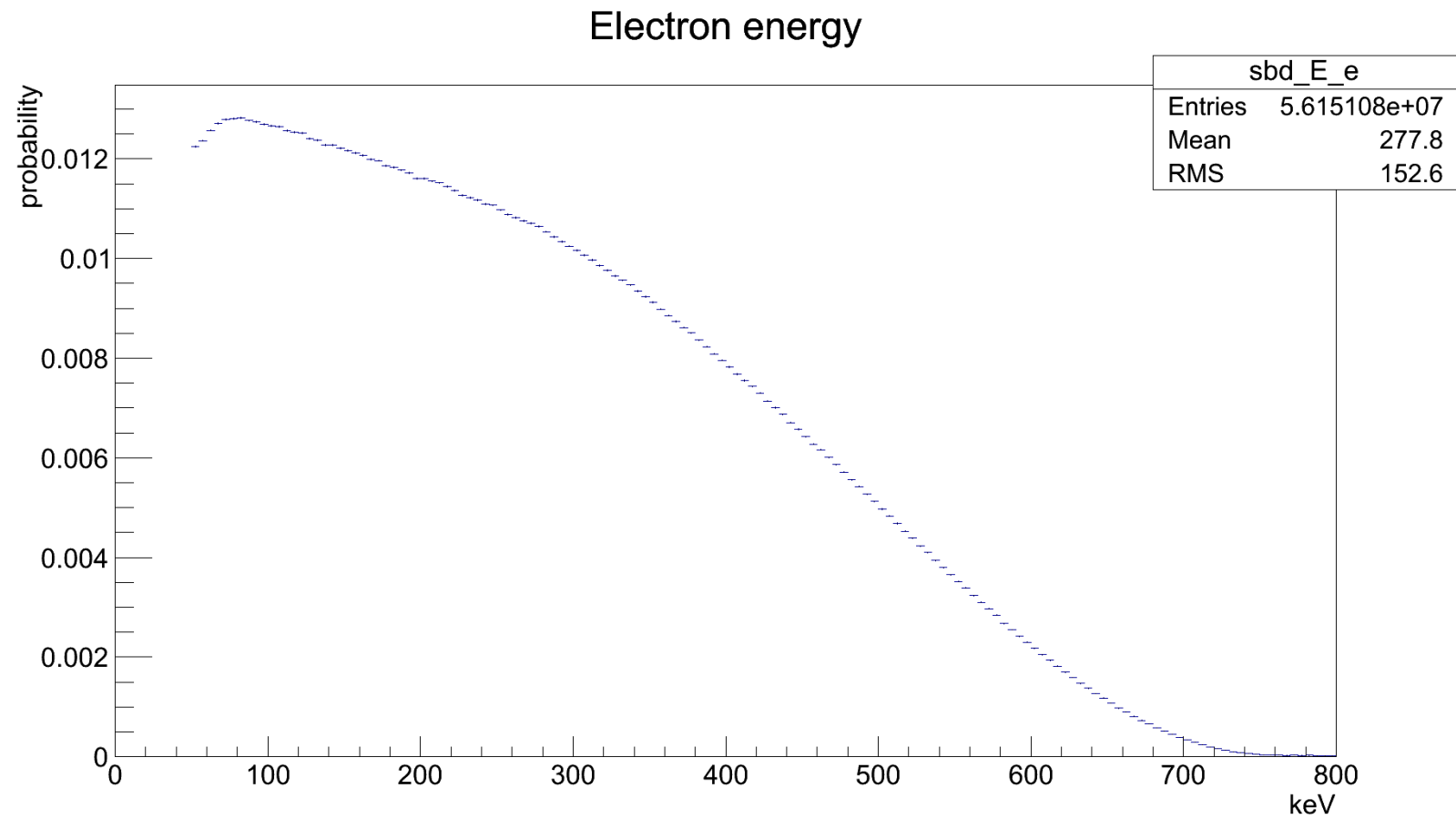
50 keV < E_e < 800 keV

SBD – Energy Cuts

Proton energy

7 keV < E$_p$ < 31 keV
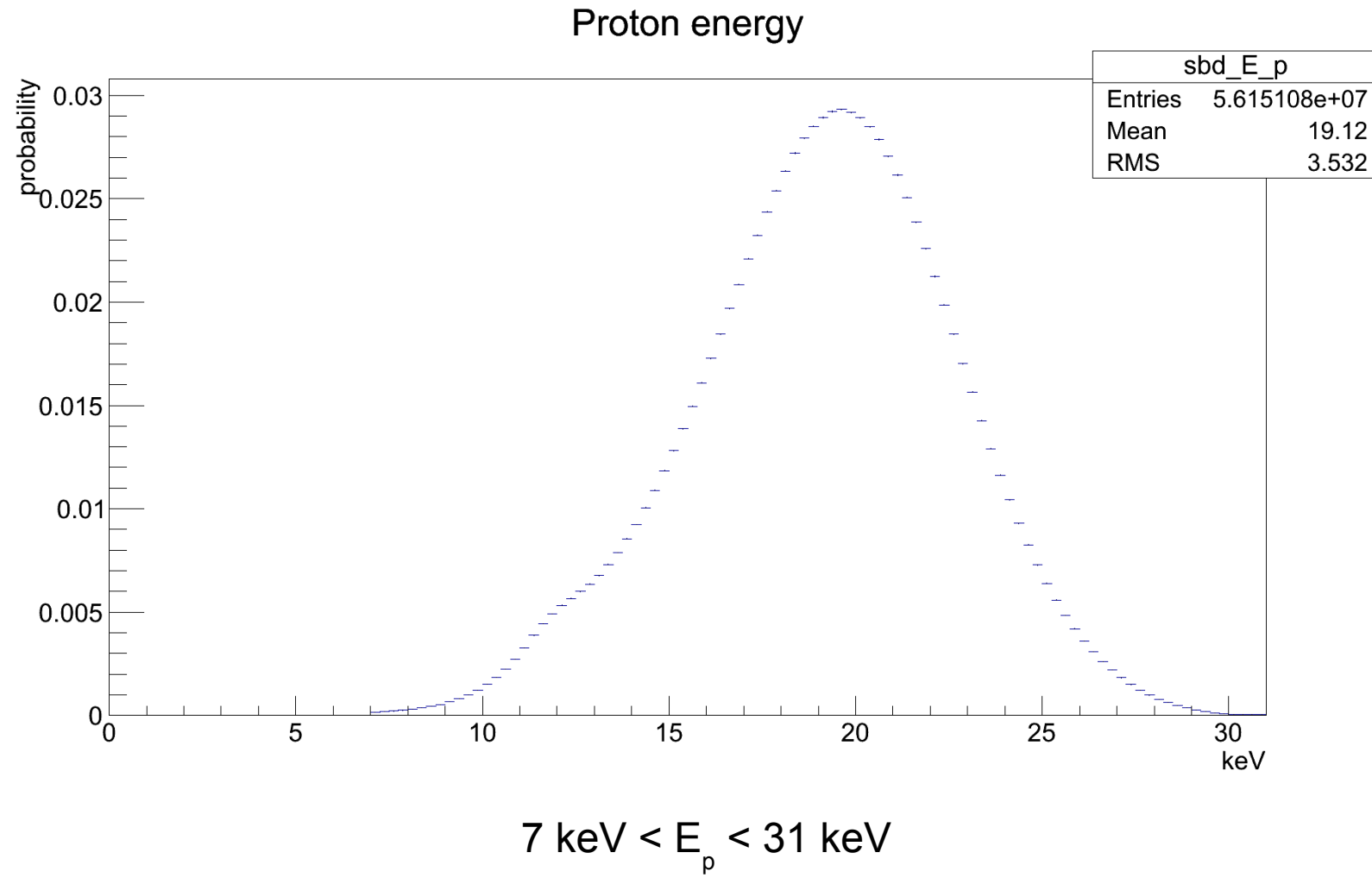
SBD – Signal Shape

ep_chi2 vs E_e
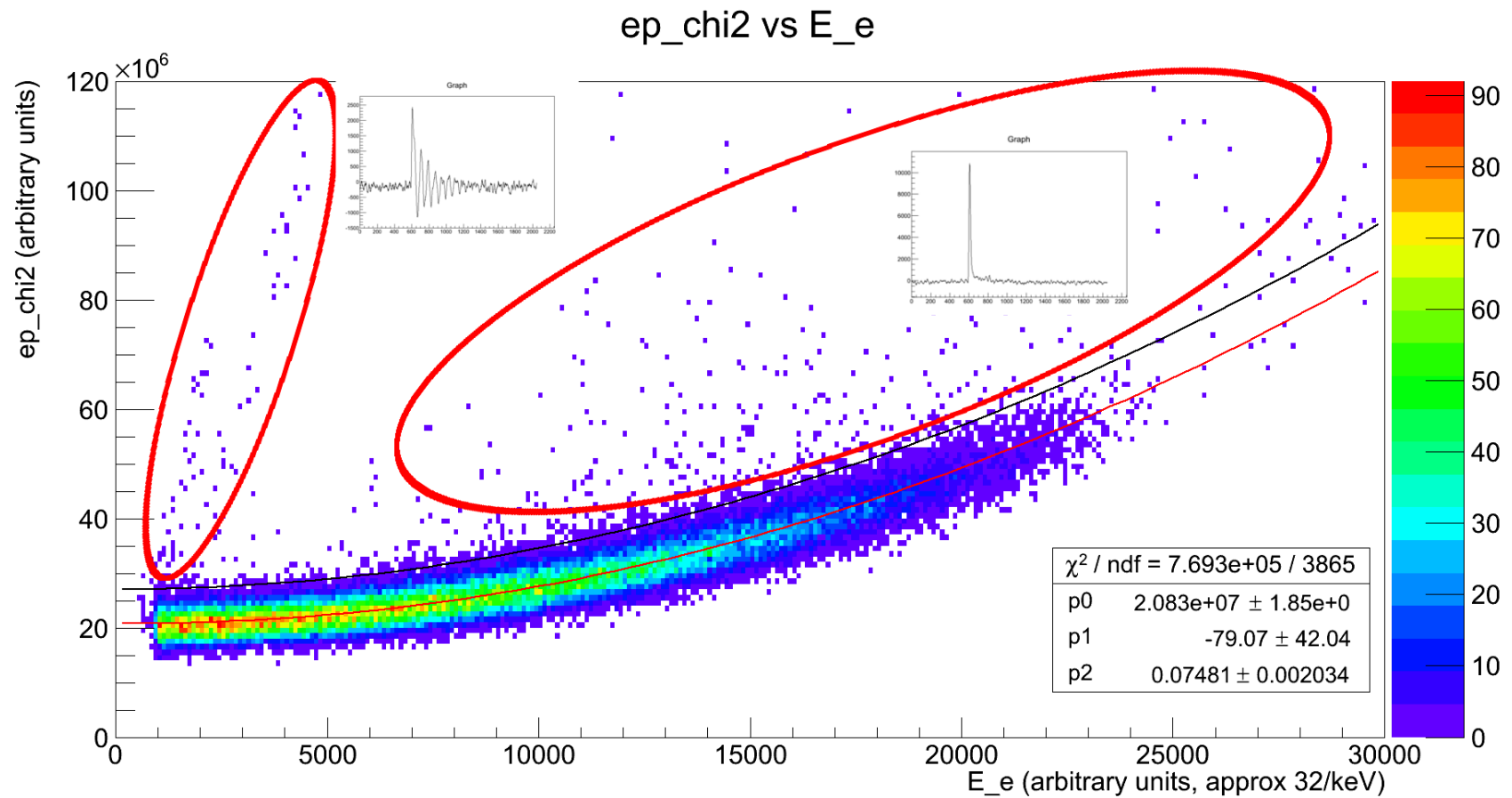
Series 256 data.
Not yet implemented.

BGO/bAPD – Timing Cuts

BGO Delta_t All

bgo_delta_t_all	
Entries	76054
Mean	5.332
RMS	9.005

-3 µs < Δt < 1 µs

-1.84 µs < Δt < -0.24 µs

bAPD Delta_t All

bapd3_delta_t_all	
Entries	17666
Mean	-0.9907
RMS	7.046
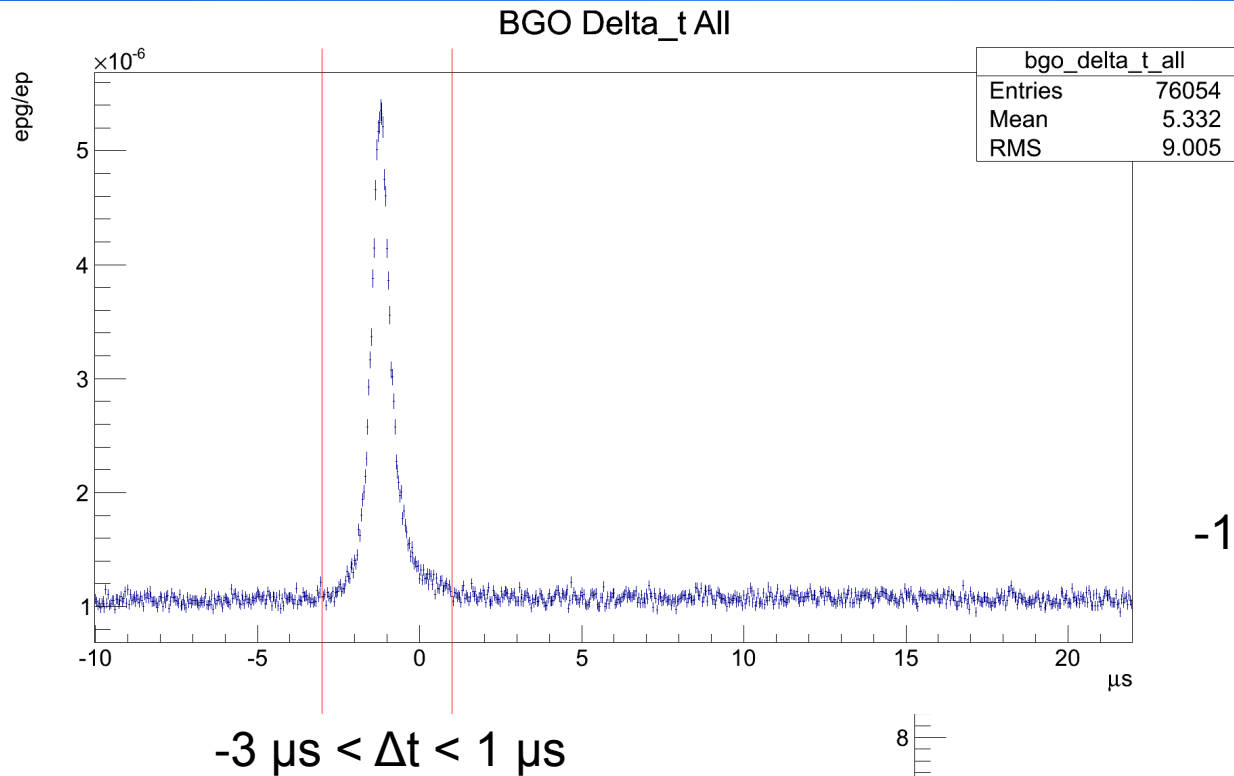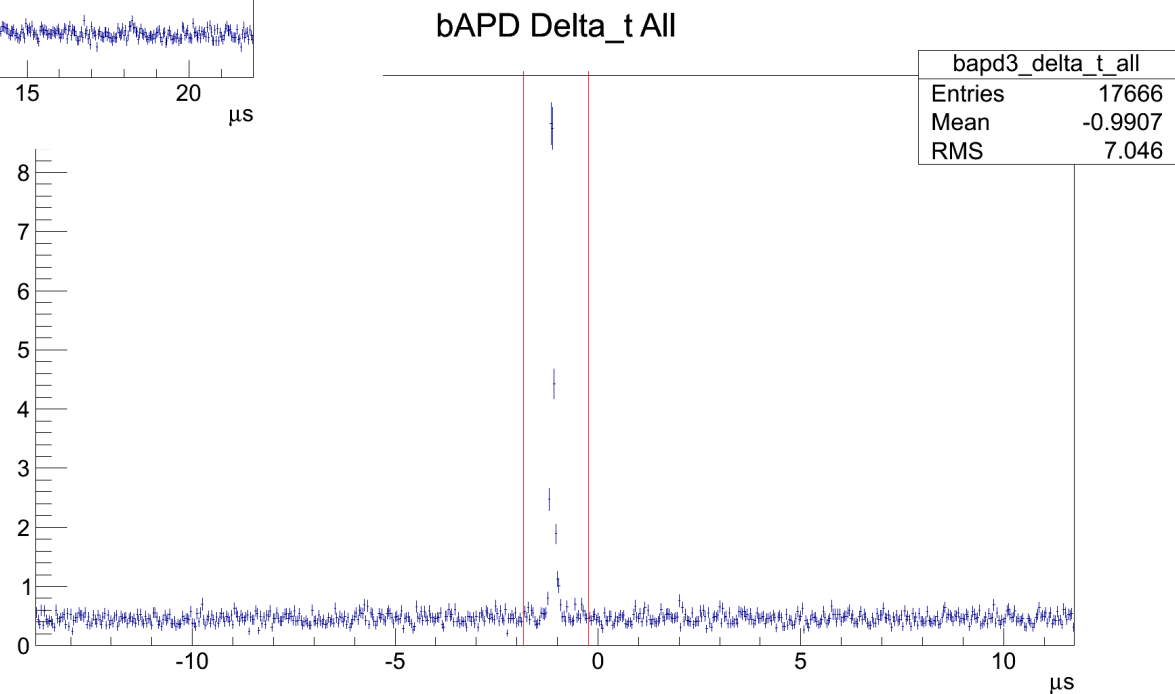
BGO/bAPD – Energy Cuts
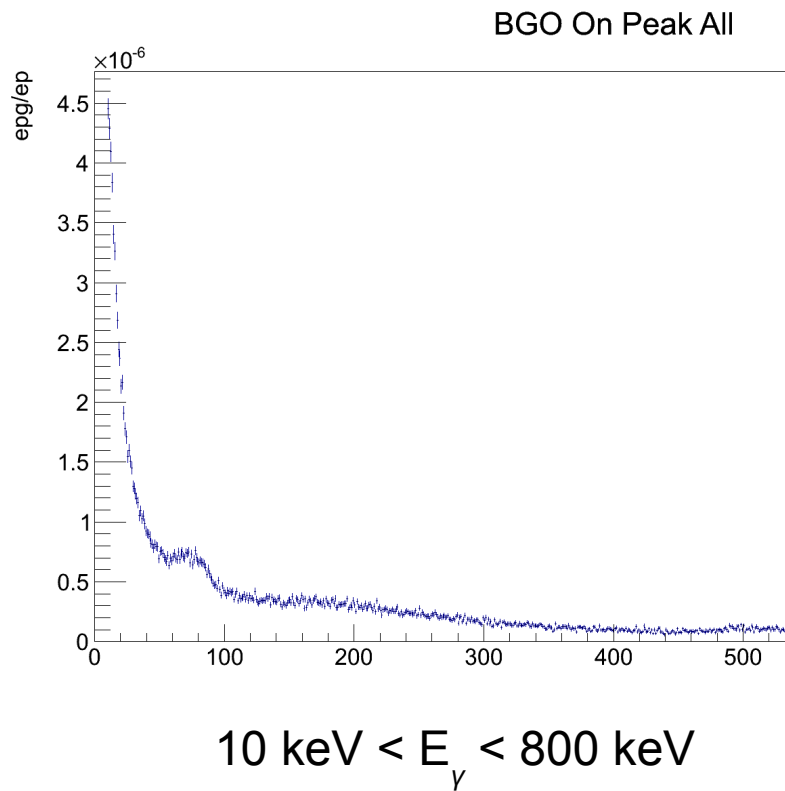
BGO On Peak All

bgo_onpeak_all	
Entries	10859
Mean	163.1
RMS	174

0.25 keV $< E_\gamma < 20$ keV

bAPD On Peak All

bapd3_onpeak_all	
Entries	1069
Mean	4.146
RMS	3.012

10 keV $< E_\gamma < 800$ keV
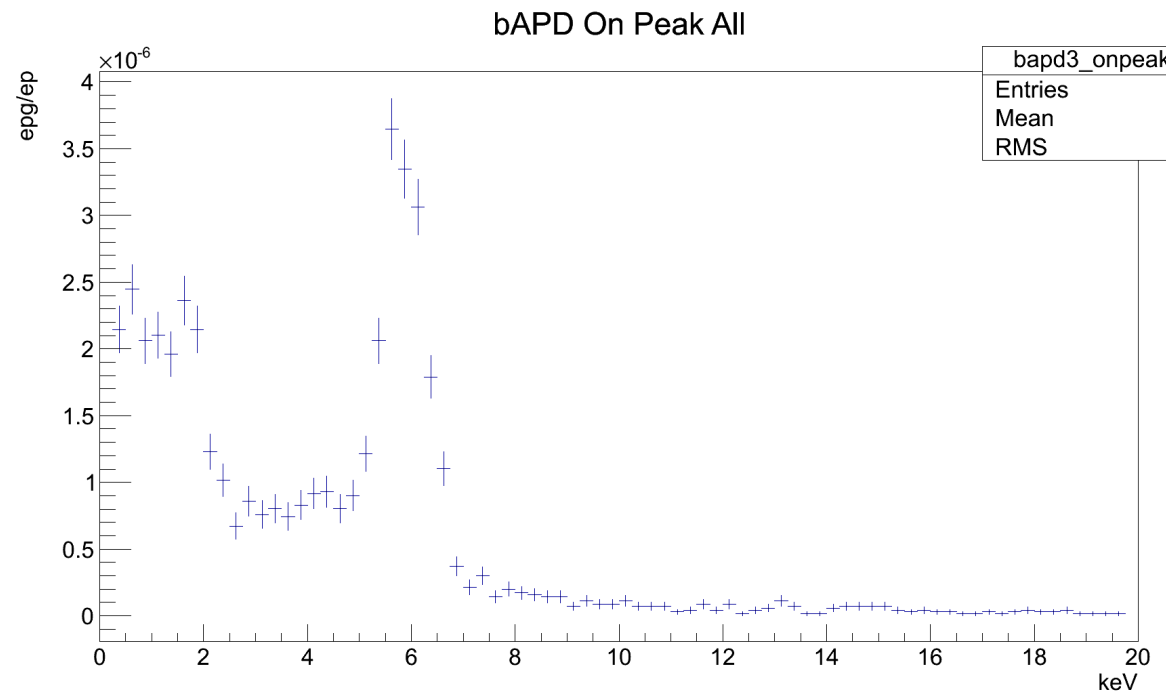
BGO/bAPD – Background Sub.
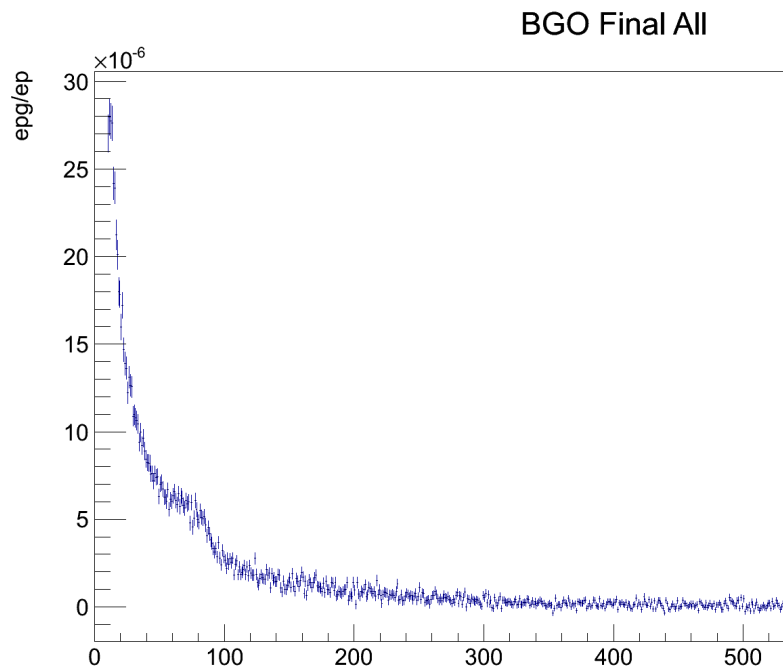
BGO Final All

bgo_final_all	
Entries	22763
Mean	85.82
RMS	107.5

bAPD sum of 3 det.
$\underline{epg} = (8.23 \pm 0.25) \cdot 10^{-5}$
ep

bAPD Final All

BGO weighted average
$\underline{epg} = (8.893 \pm 0.059) \cdot 10^{-5}$
ep

$\underline{Exp-MC} = 18.95\%$
MC
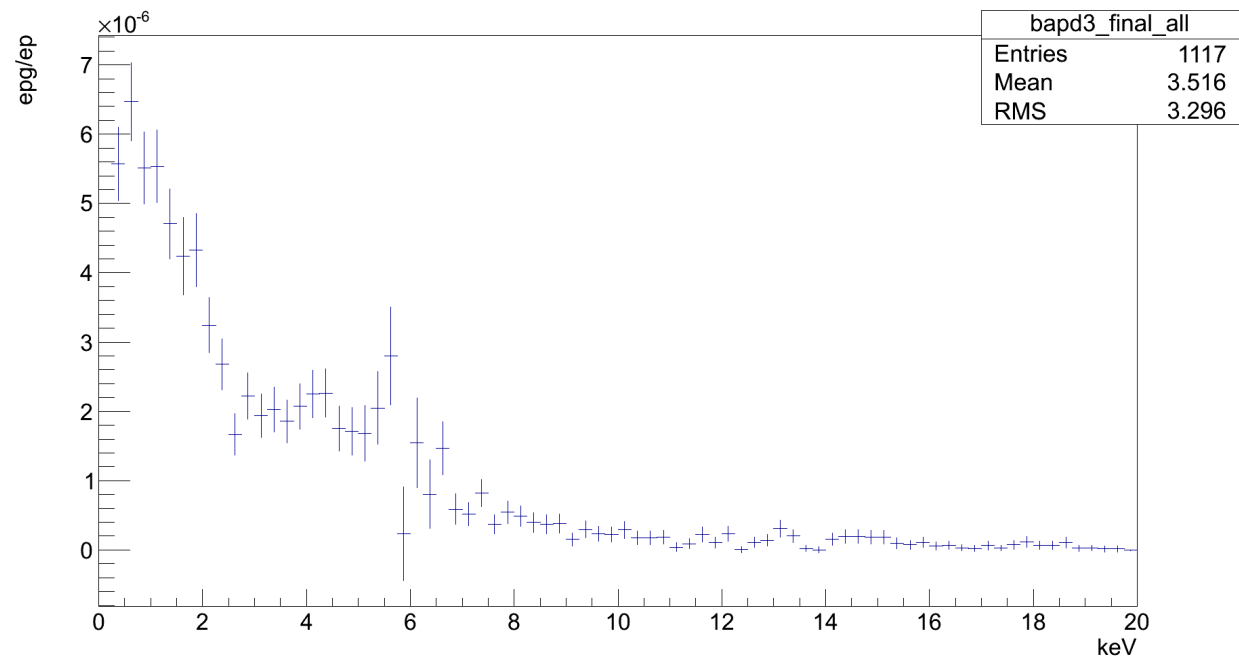
bapd3_final_all	
Entries	1117
Mean	3.516
RMS	3.296

What's Next

- Finish chi2 cuts

  – Series-by-series fits?

- Recalibrate BGO

  – Calibration based on old analysis

- Check bAPD fits