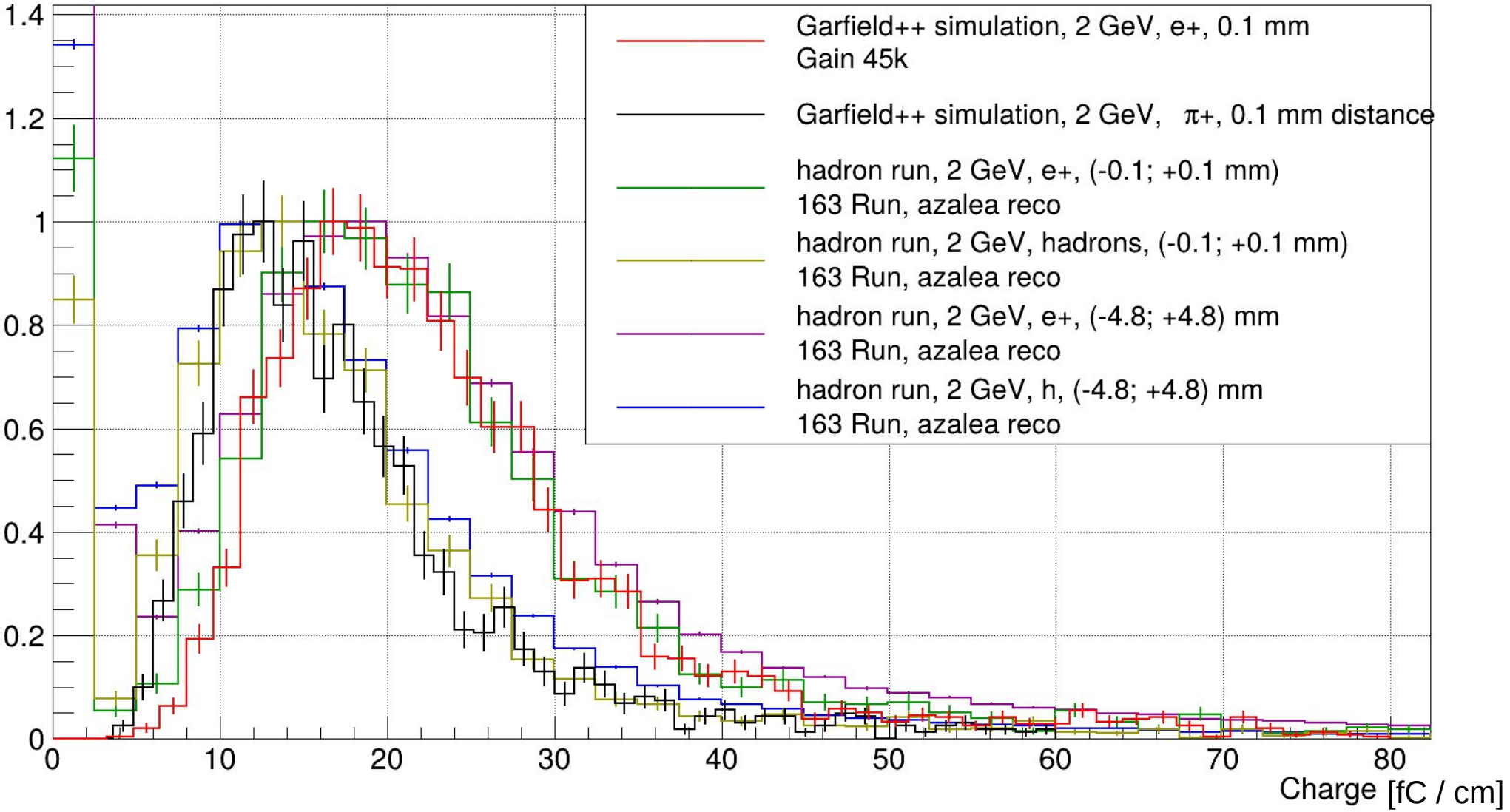
TB March 2026

November TB
Simulation for 220 ns peaking time.
Simulation as integration of the first 220 ns

e+ and pions of 2 GeV/c



Fit results

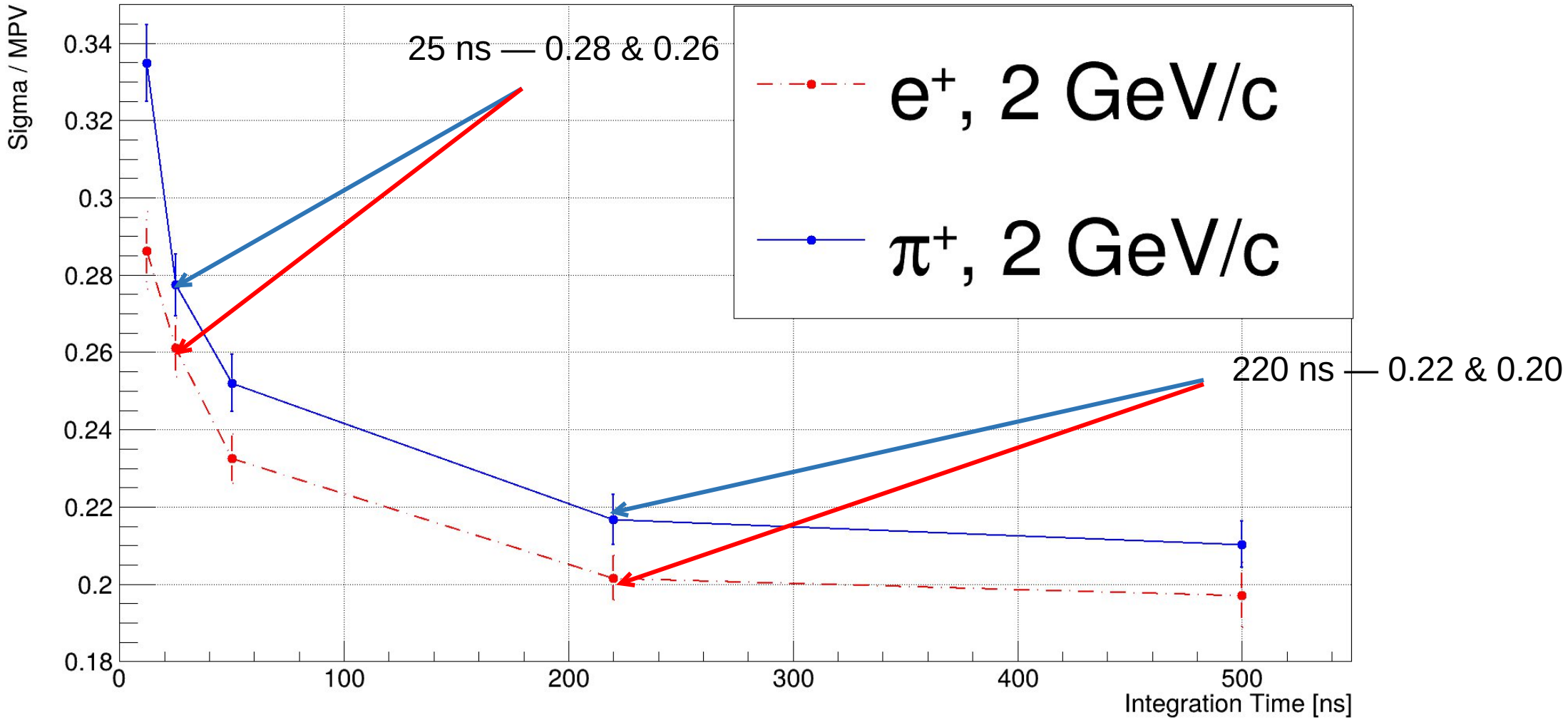
	MPV	Sigma	Sigma / MPV
Garfield++, e+	17,70	3,80	0,21
data, e+	18,40	4,11	0,22
Garfield++, pi	12,60	2,93	0,23
data, pi	12,80	3,10	0,24

Charge distributions are fitted with Landau distribution.

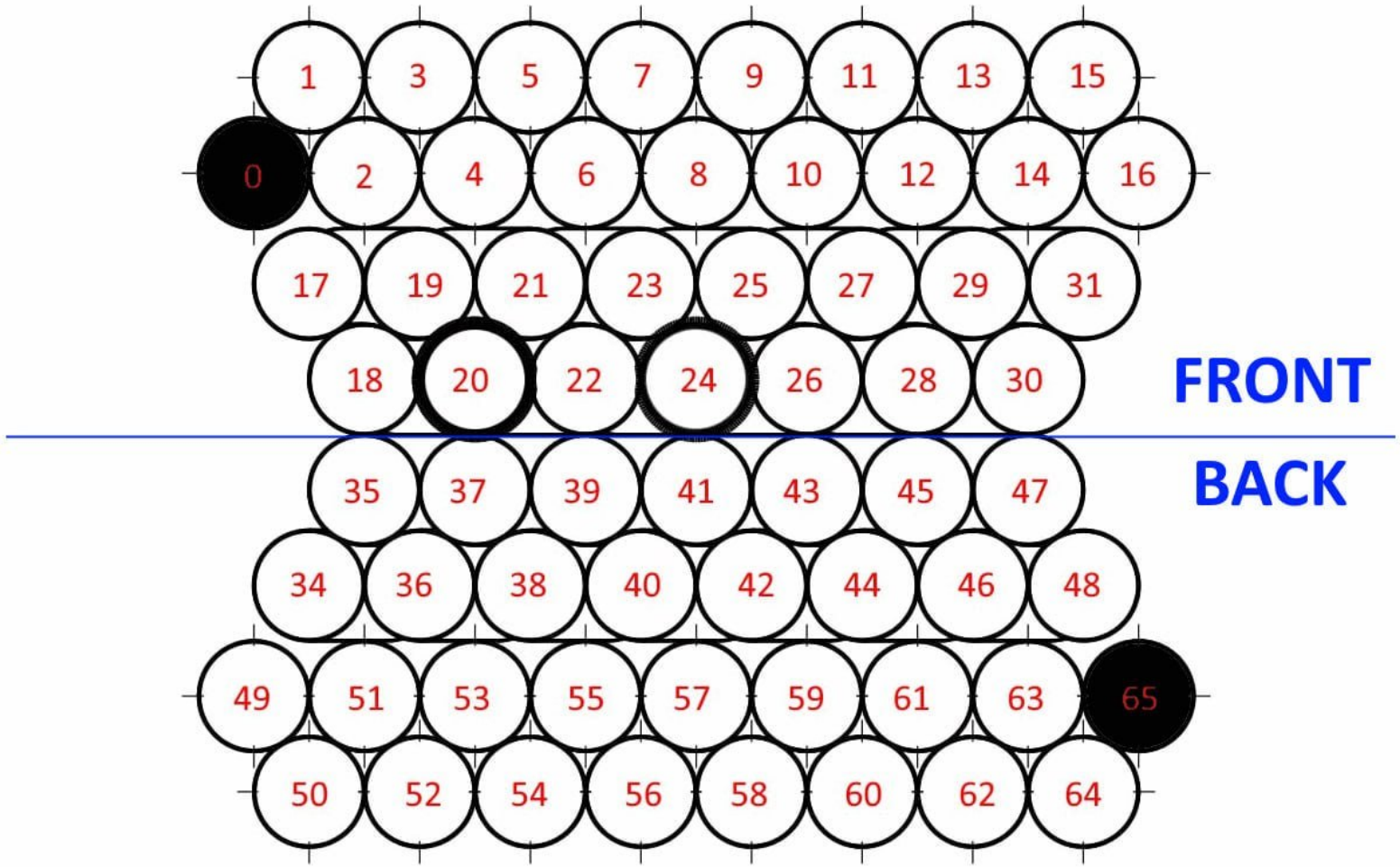
MPV of pi+ / MPV of e+
Garfield: 0,71
Experiment: 0,70

Perfect agreement between Monte Carlo and data

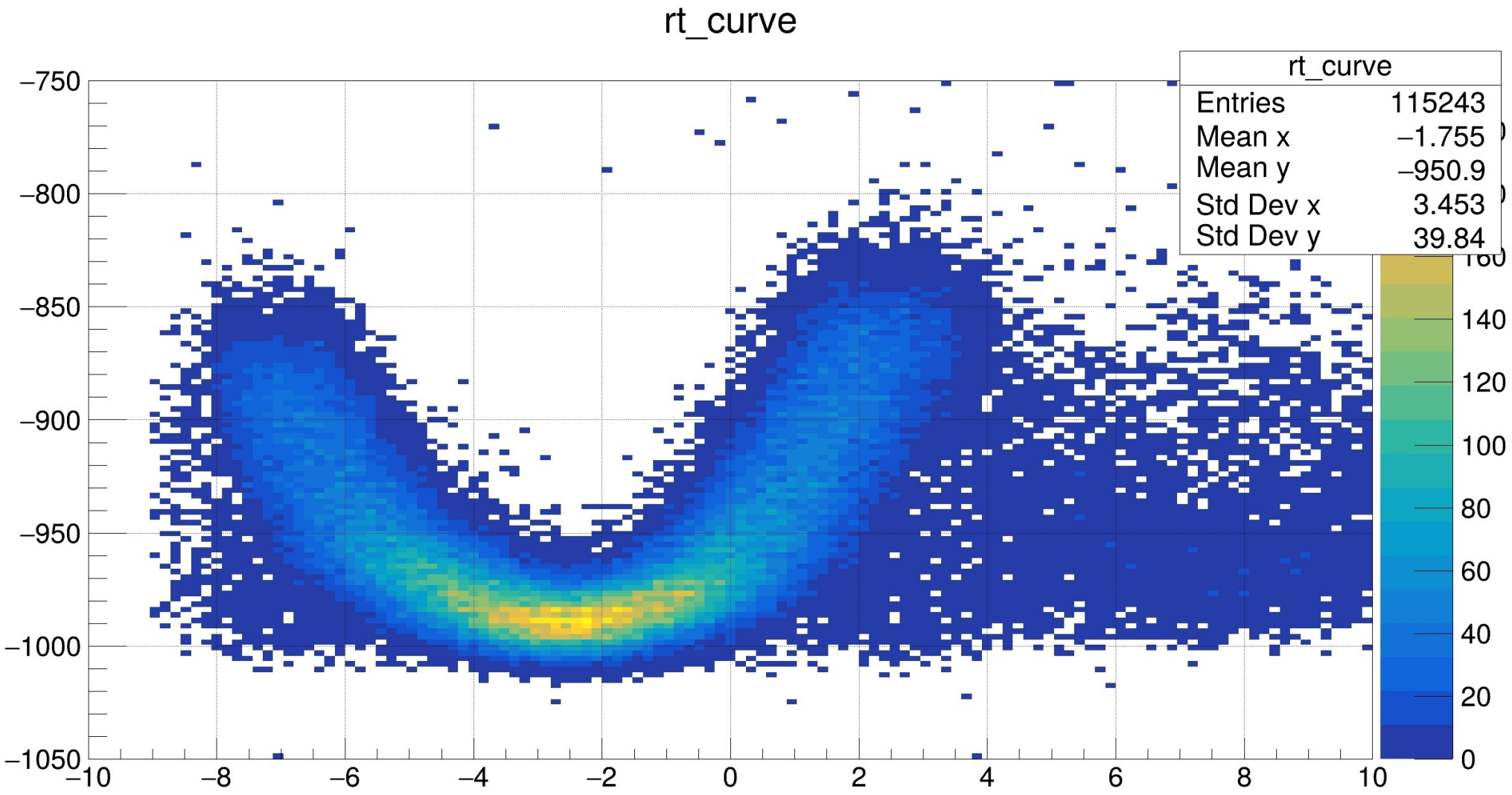
Quick reminder about Sigma / MPV relation for different peaking time values



TOP VIEW



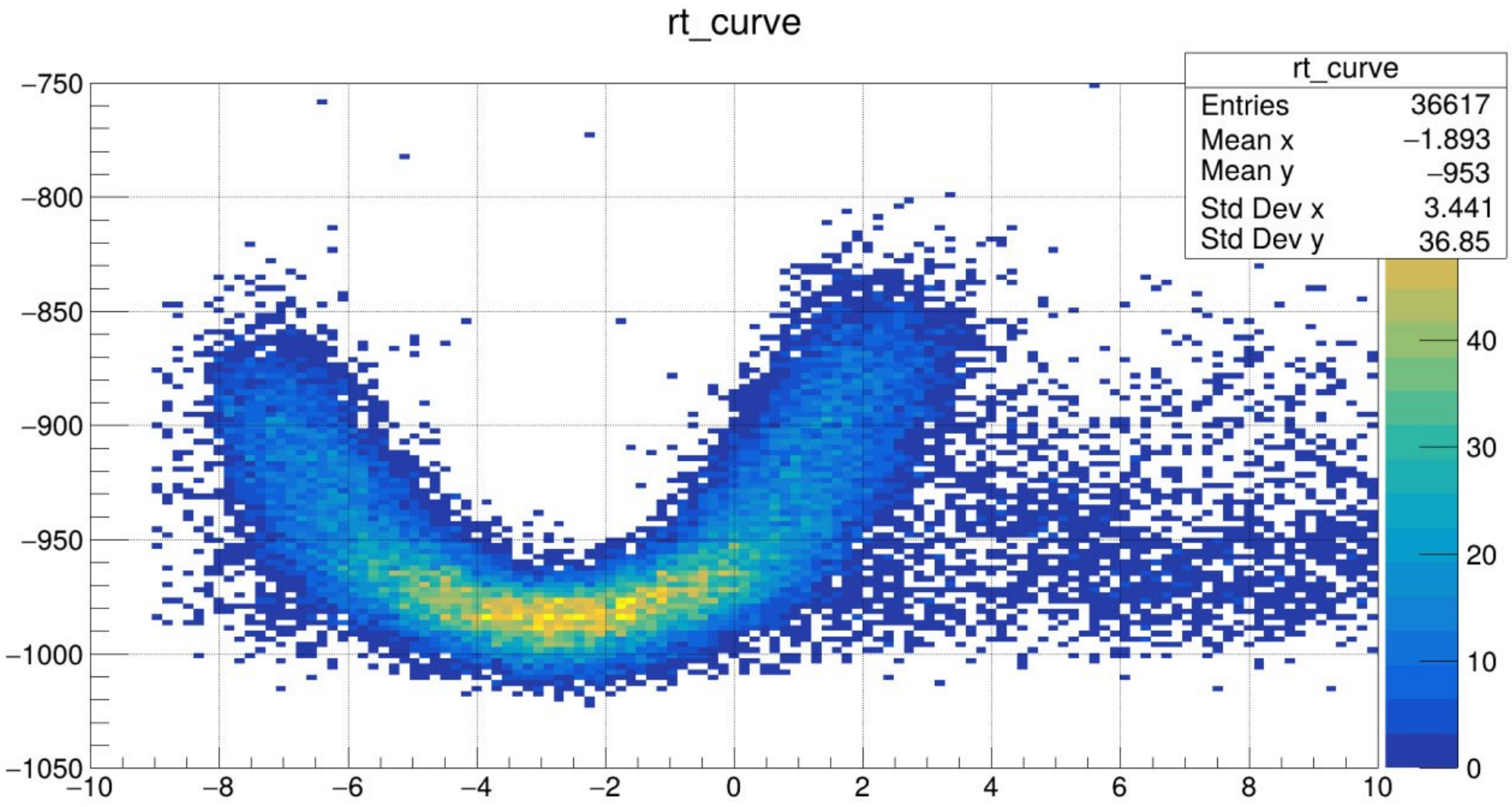
TOP VIEW



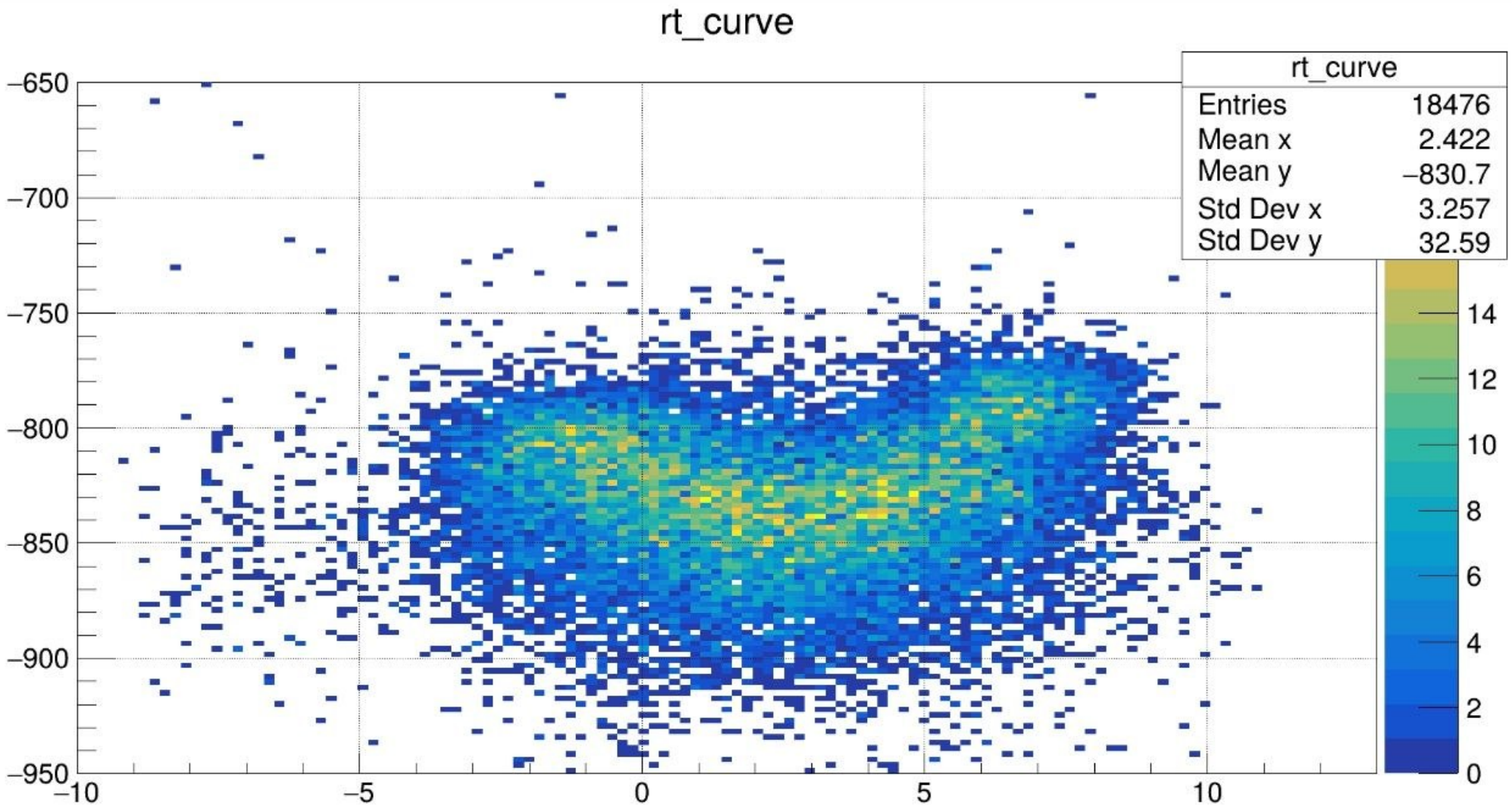
Cherenkov:
true / all = 0.92

Hadron run 482,
true/all = 0.04

Electron run 484, straw #55

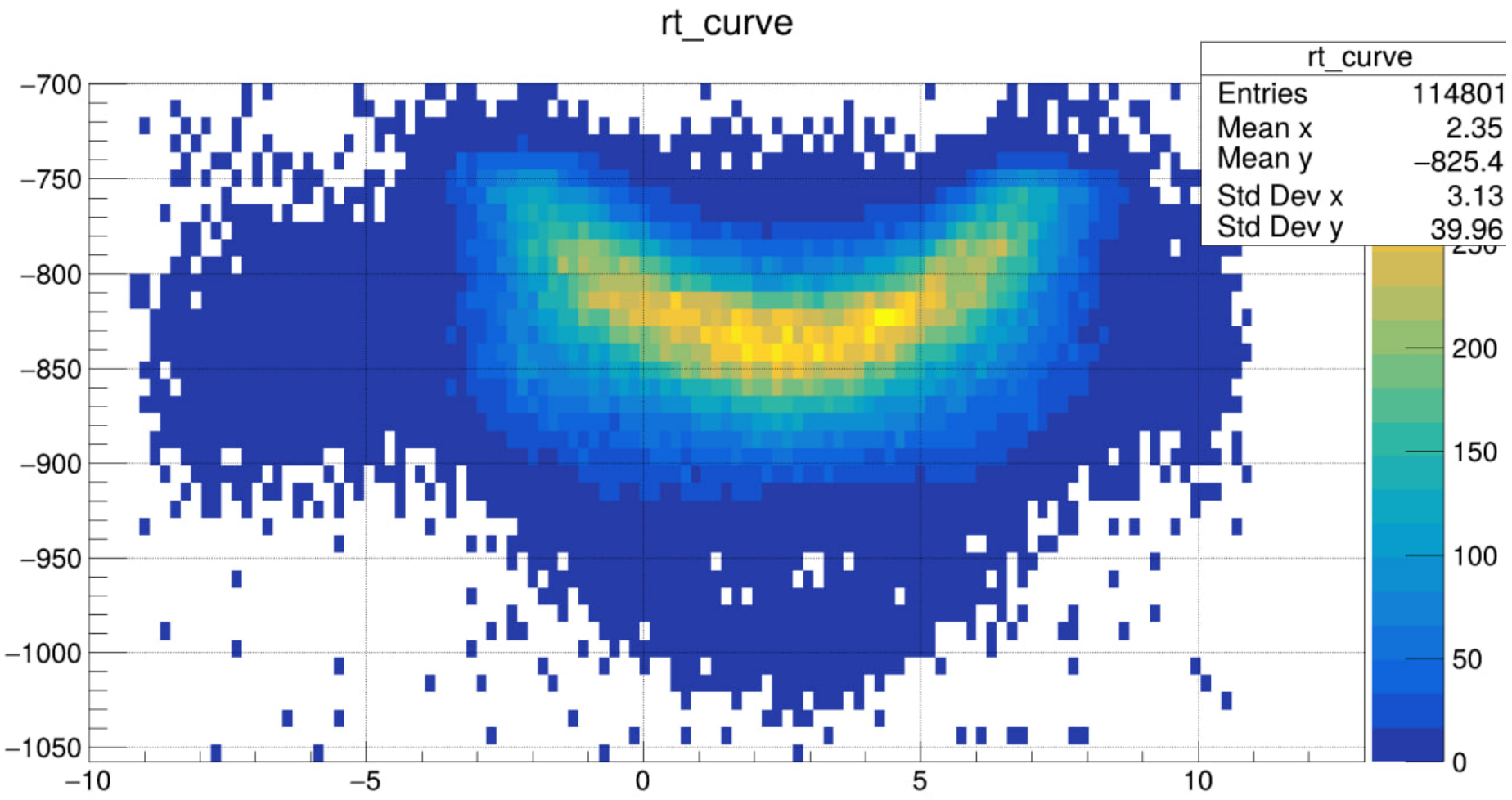


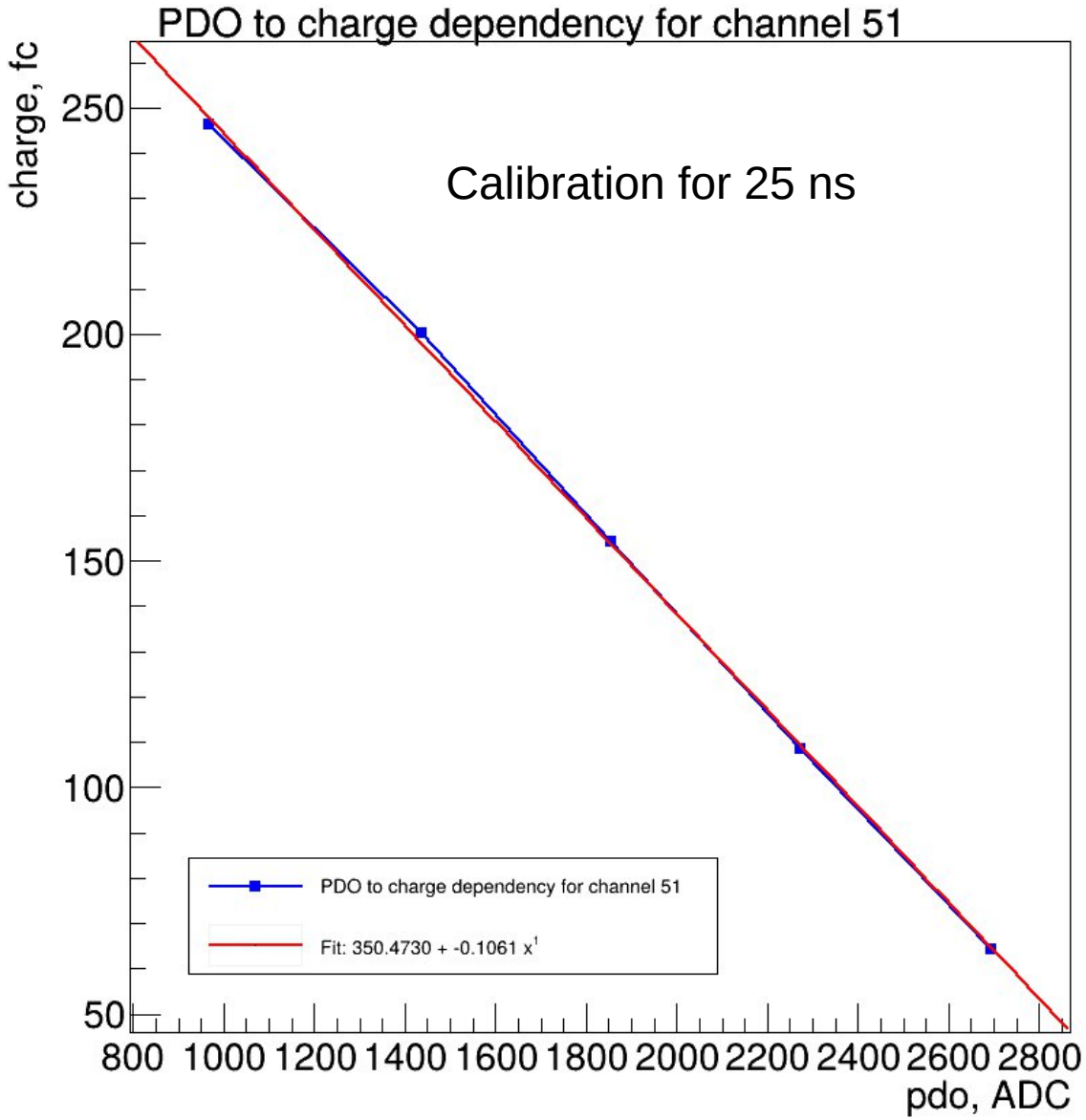
Electron run 424, straw #55. Cher true / all = 0.913



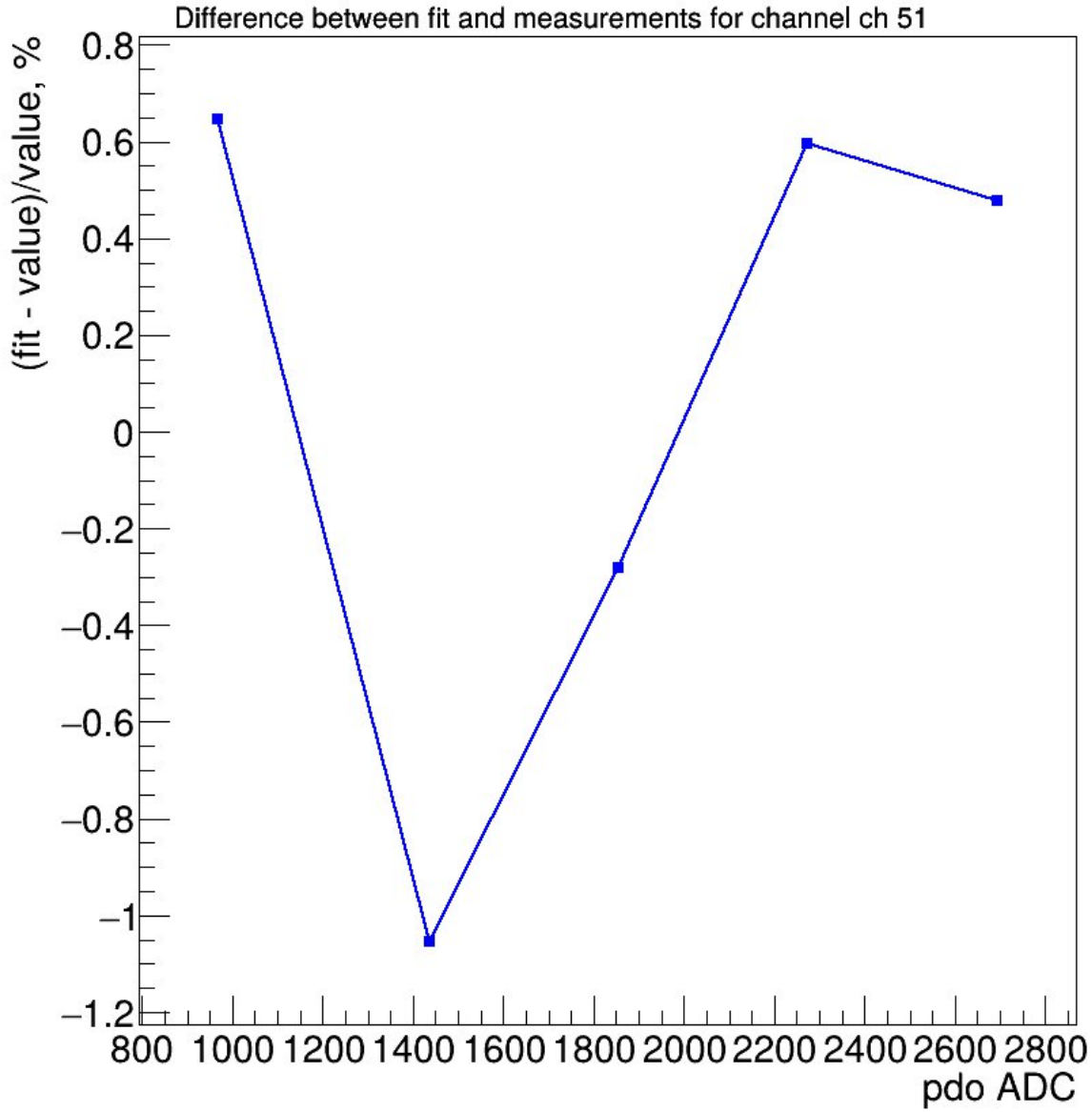
Electron run, straw #56, 1 GeV, run #430. cher true / all
= 0.927

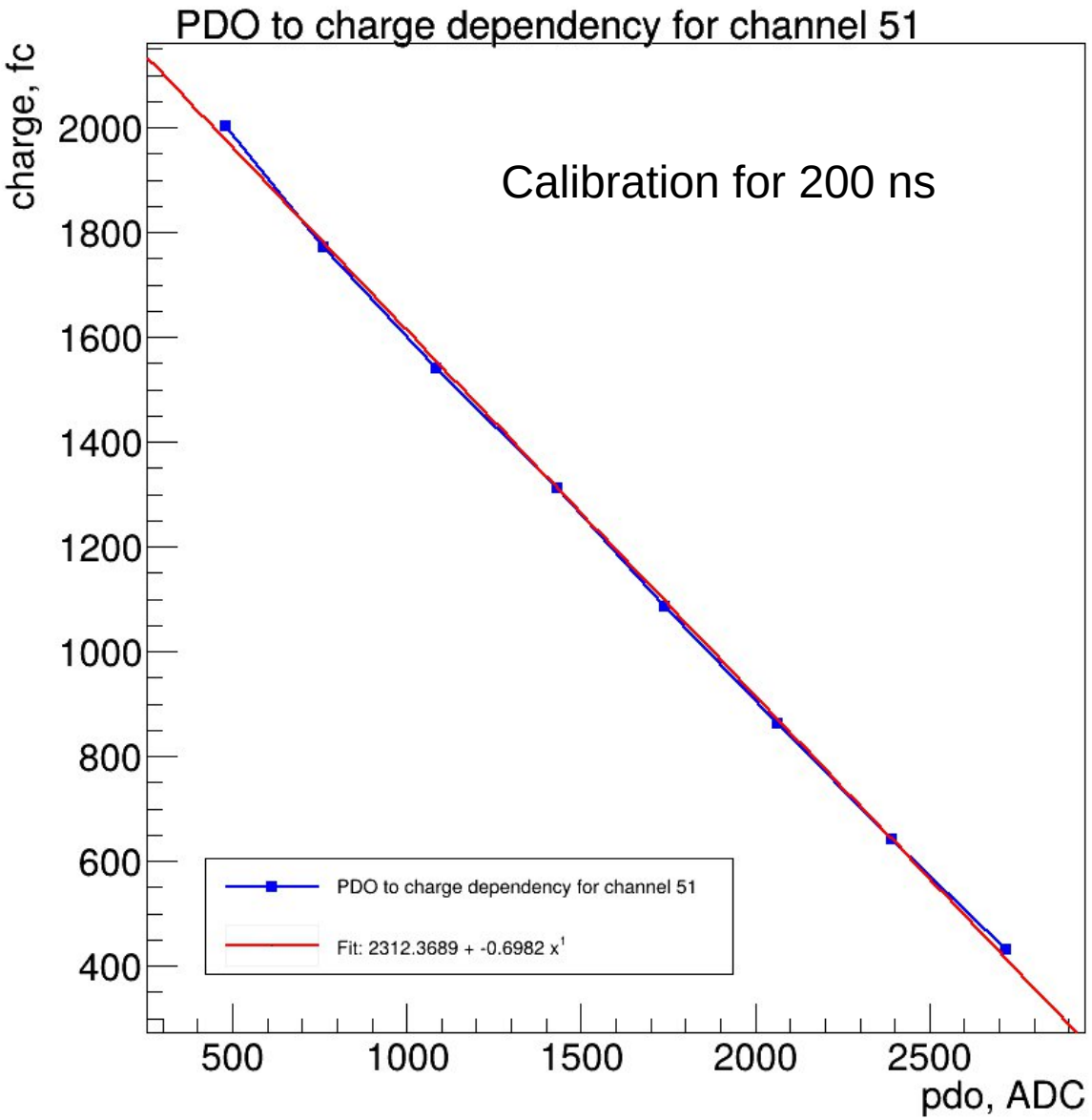
RT for 200 ns electron run

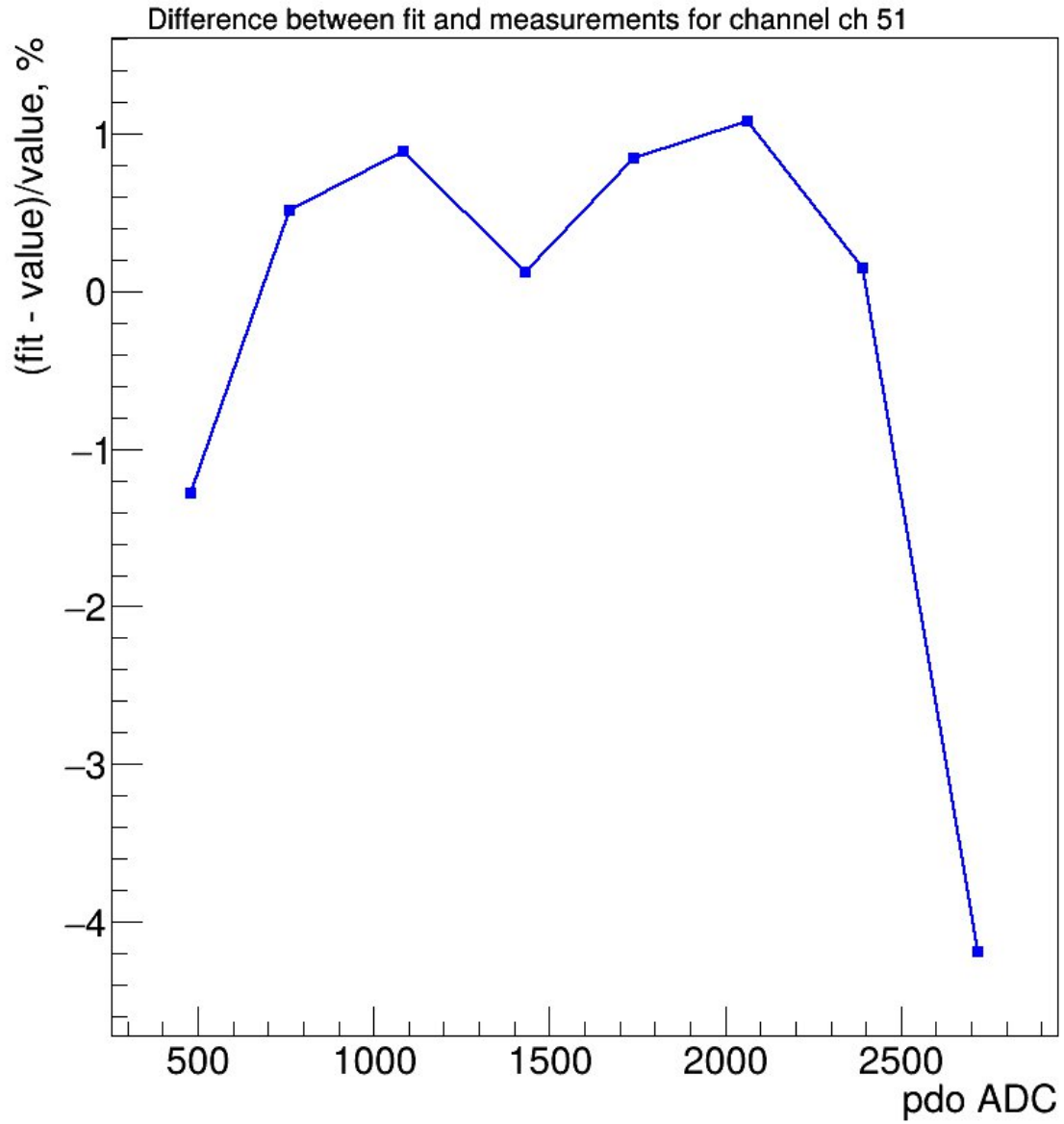


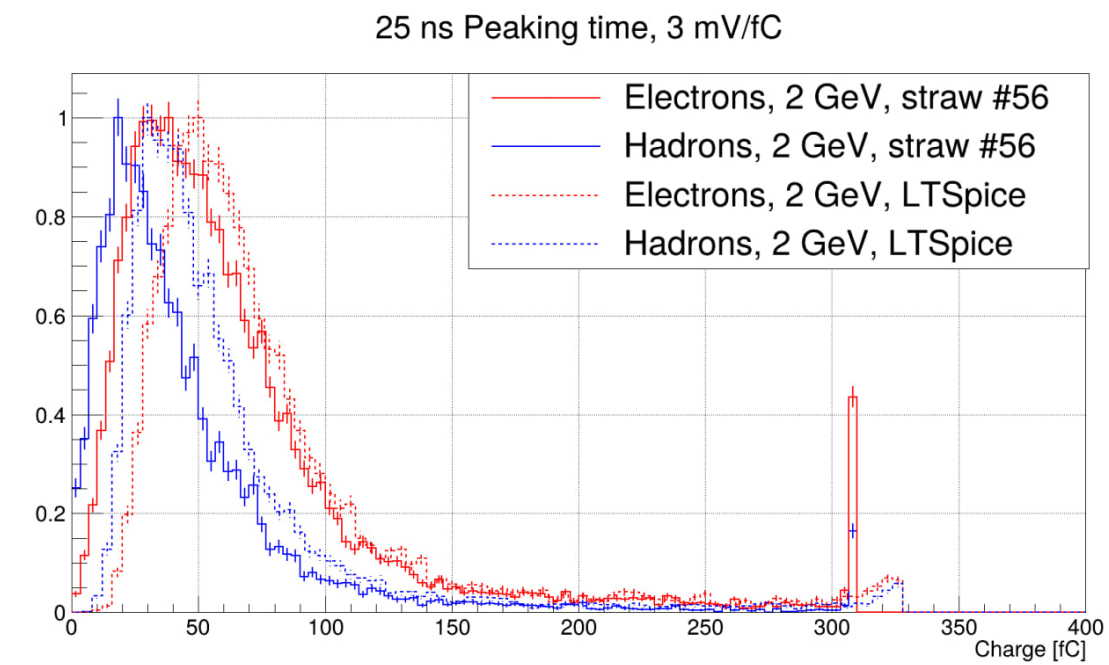


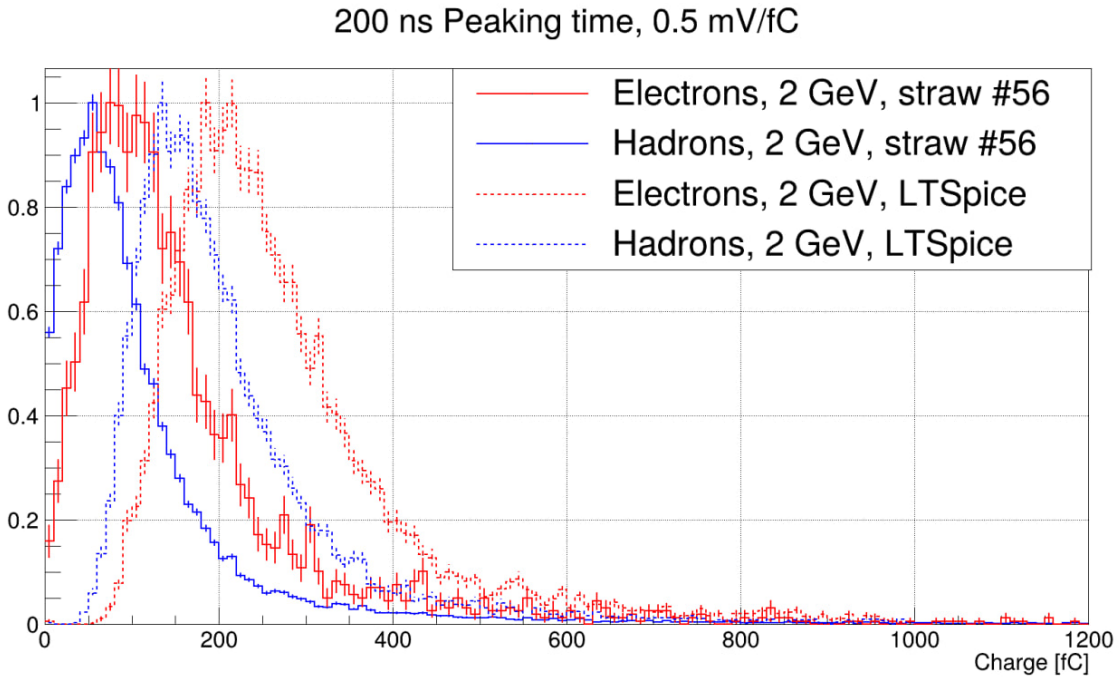
Calibration for 25 ns




PDO to charge dependency for channel 51
Calibration for 200 ns
charge, fc
2000
1800
1600
1400
1200
1000
800
600
400
500
1000
1500
2000
2500
pdo, ADC
PDO to charge dependency for channel 51
Fit: 2312.3689 + -0.6982 x^1


Difference between fit and measurements for channel ch 51
(fit - value)/value, %
1
0
−1
−2
−3
−4
500
1000
1500
2000
2500
pdo ADC





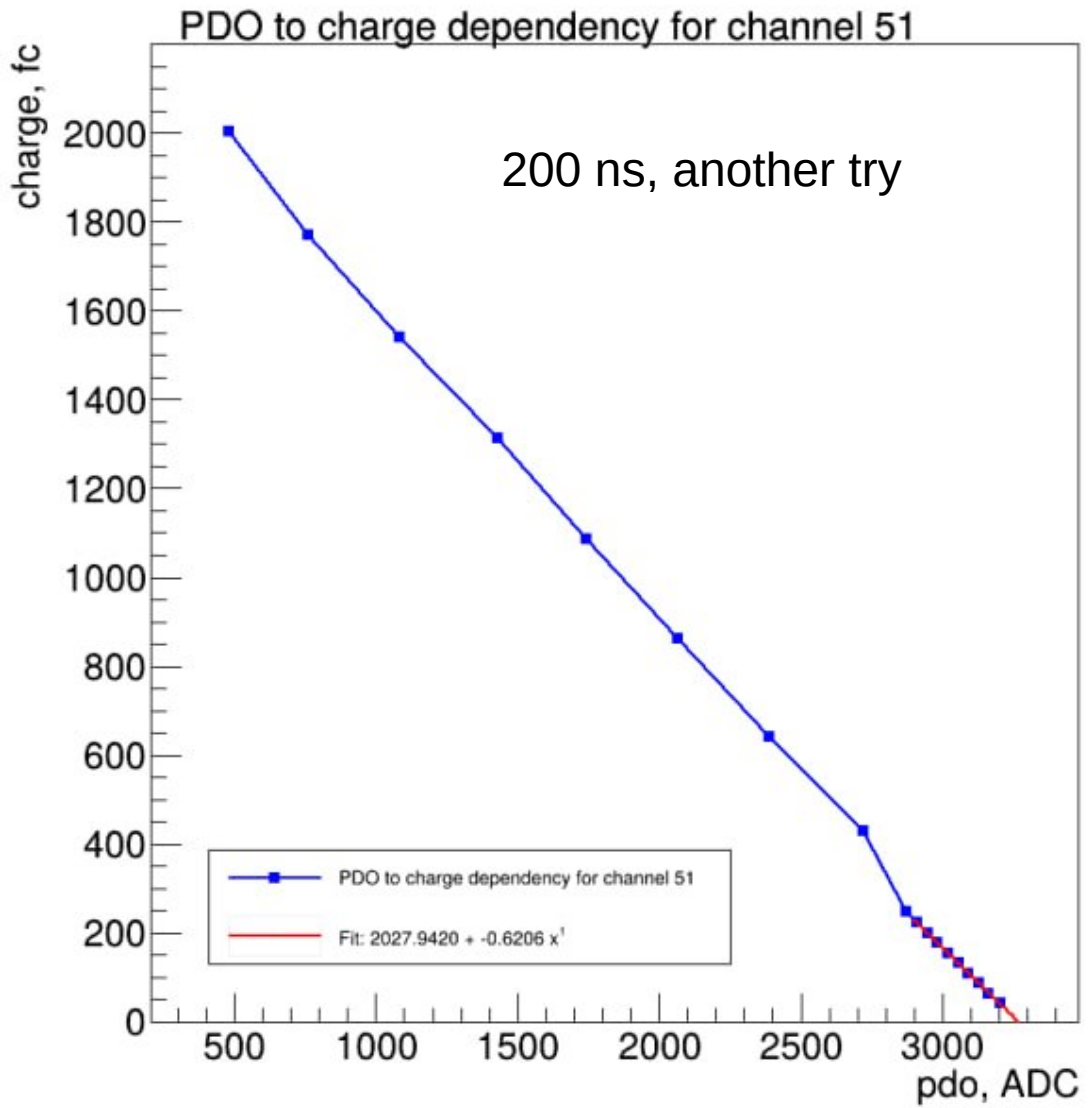
Calibration with parameters:
charge = 350.5 - 0.1061 * pdo() — for 25 ns

charge = 2312.4 - 0.6982 * pdo() — for 200 ns

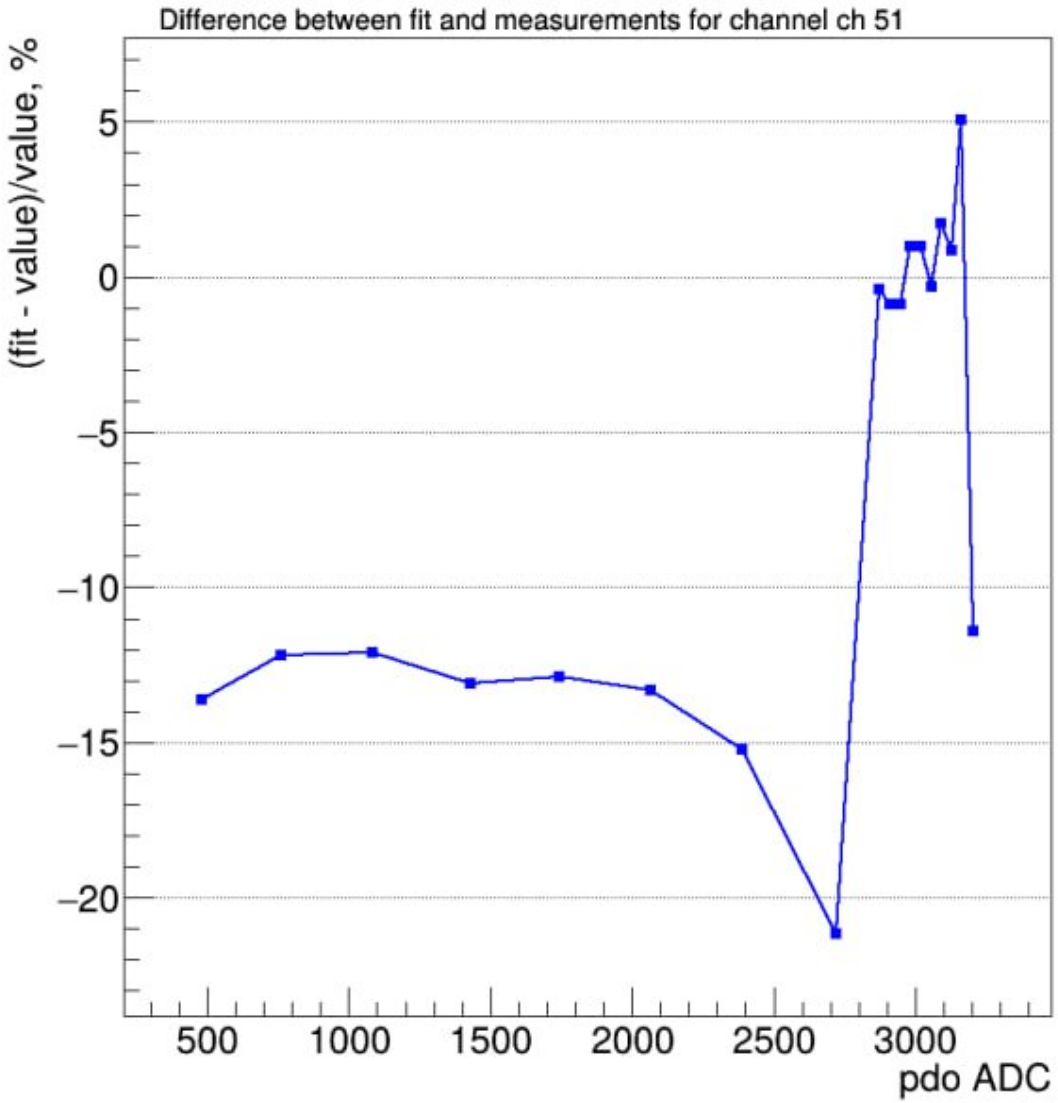
		sigma / MPV 25 ns	sigma / MPV 200 ns
Integration	e-	0,24	0,21
	pi-	0,27	0,21
LTSpice	e-	0,24	0,19
	pi-	0,26	0,22
Straw #56	e-	0,34	0,33
	pi-	0,40	0,41

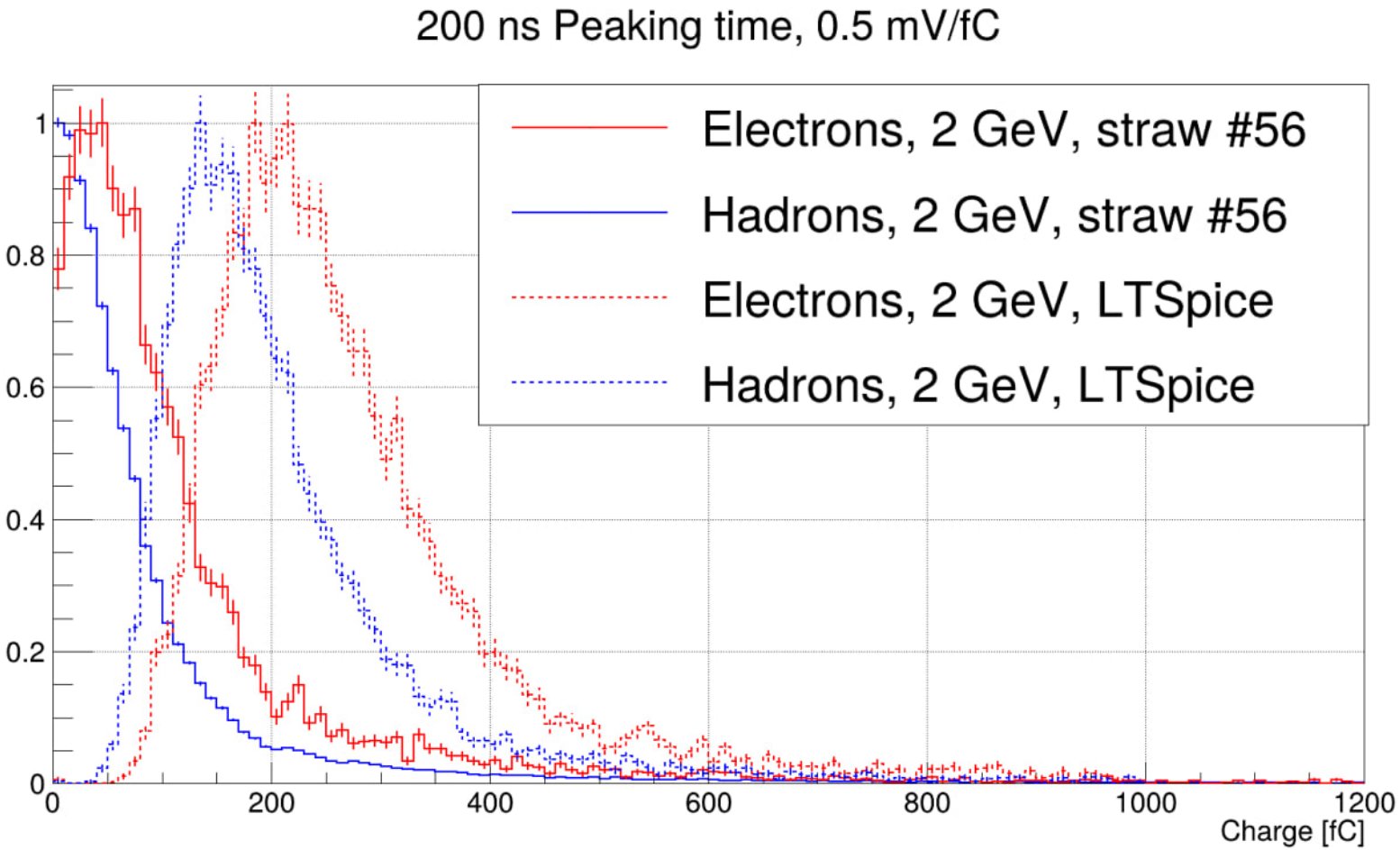
	MPV 200 / MPV 25
e-	5,3
pi-	5,5
e-	1,5
pi-	1,5
e-	2,44
pi-	2,5

	MPV pi / MPV e (25 ns)	MPV pi / MPV e (200 ns)
Integration	0,73	0,77
LTSpice	0,74	0,72
Straw #56	0,63	0,60

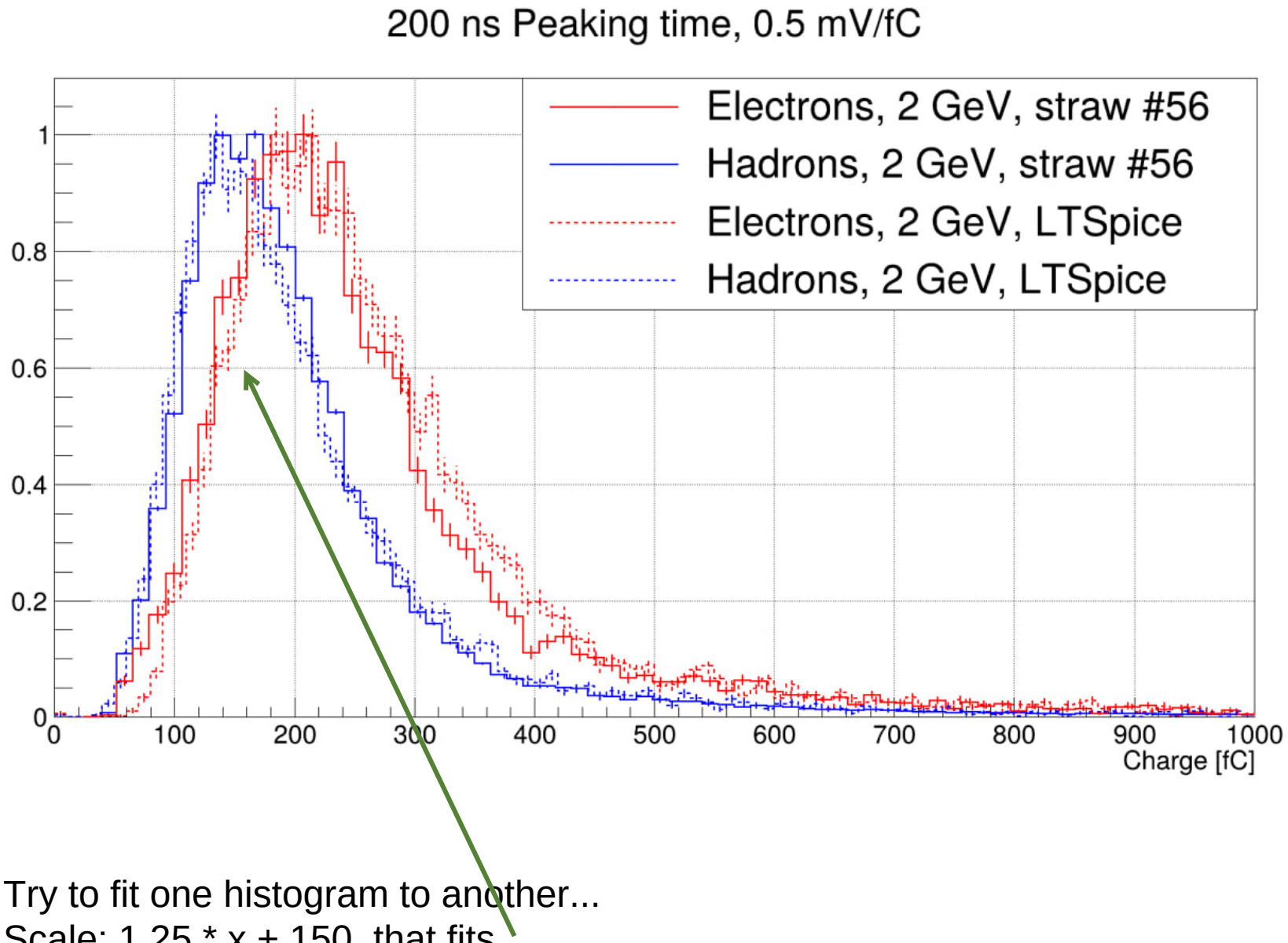


200 ns, another try

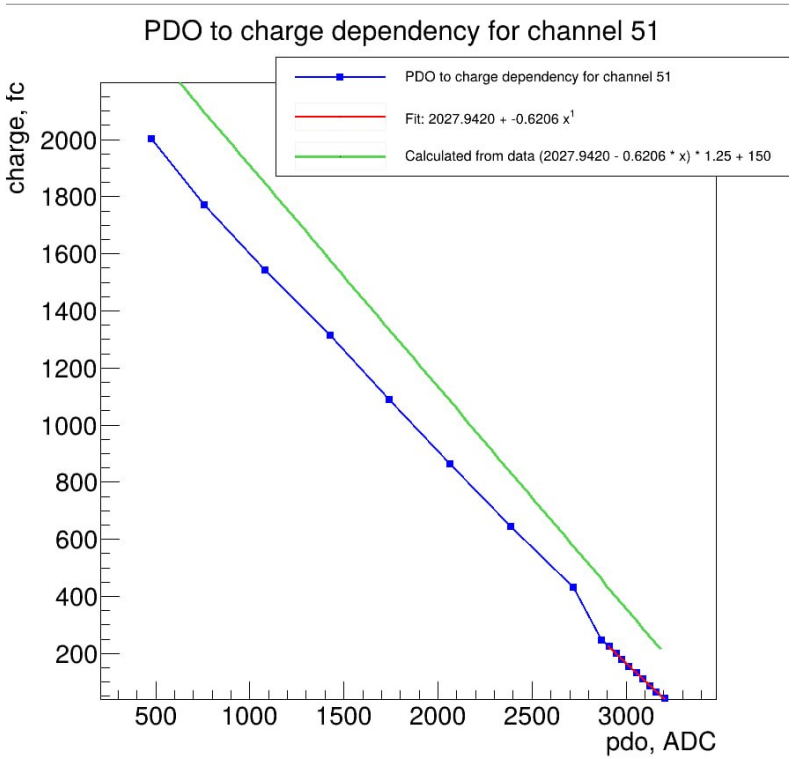




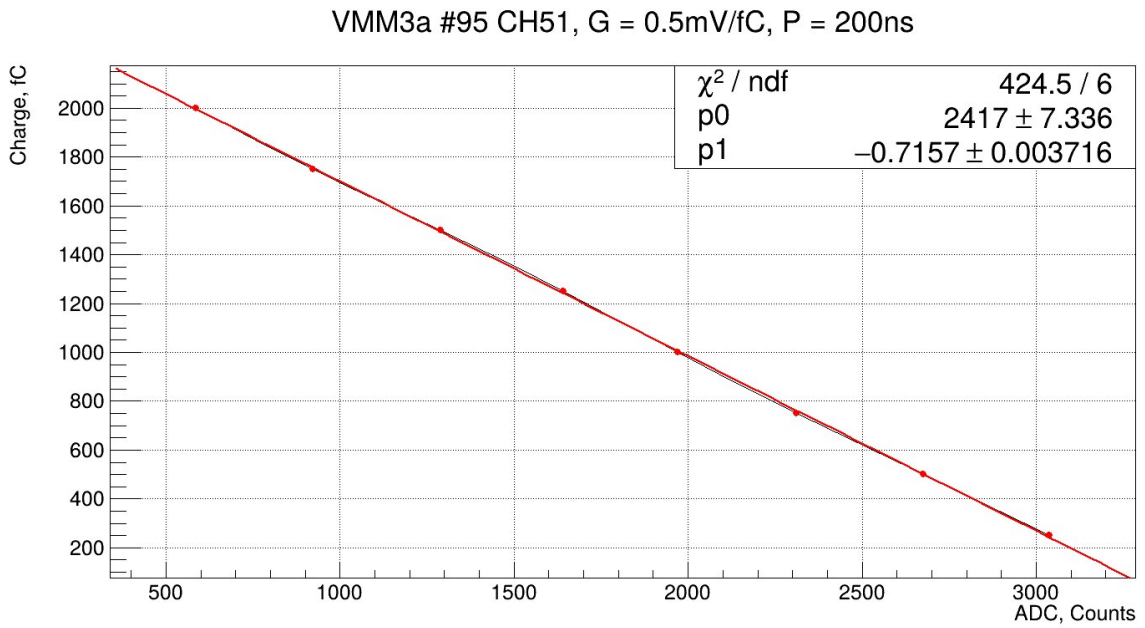
Another calibration:
charge = 2027.9 - 0.6249 * pdo()

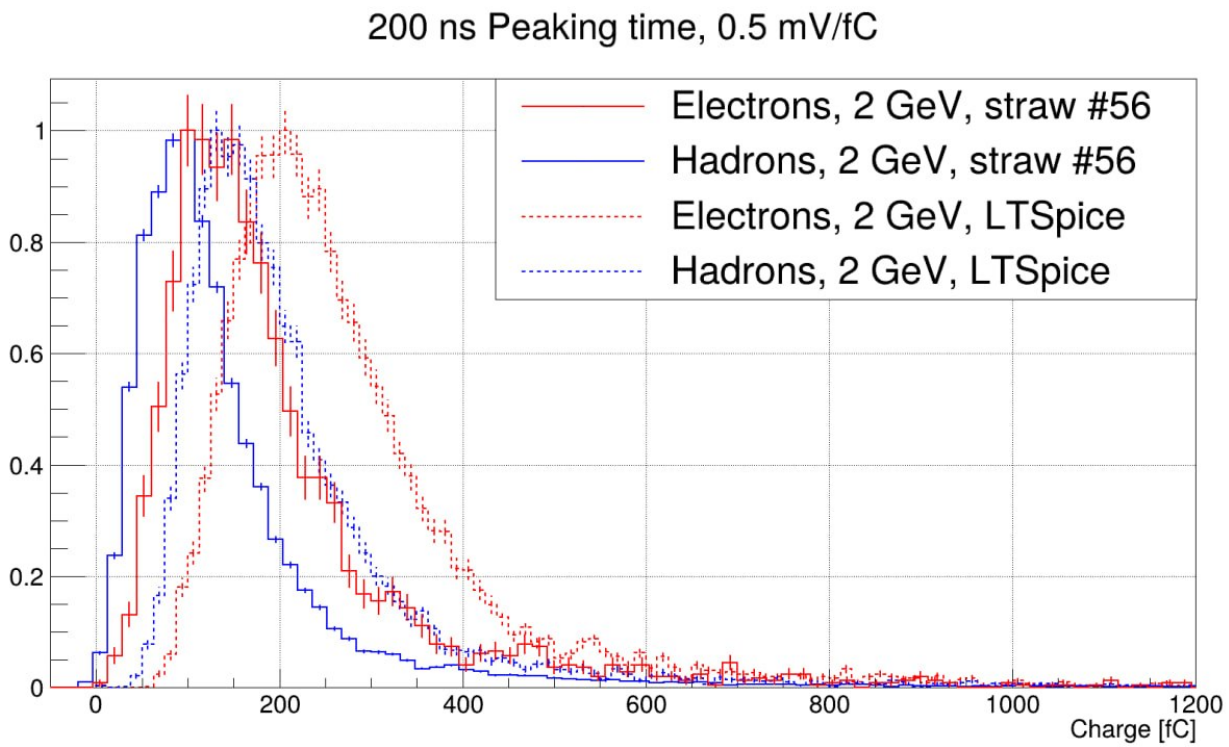


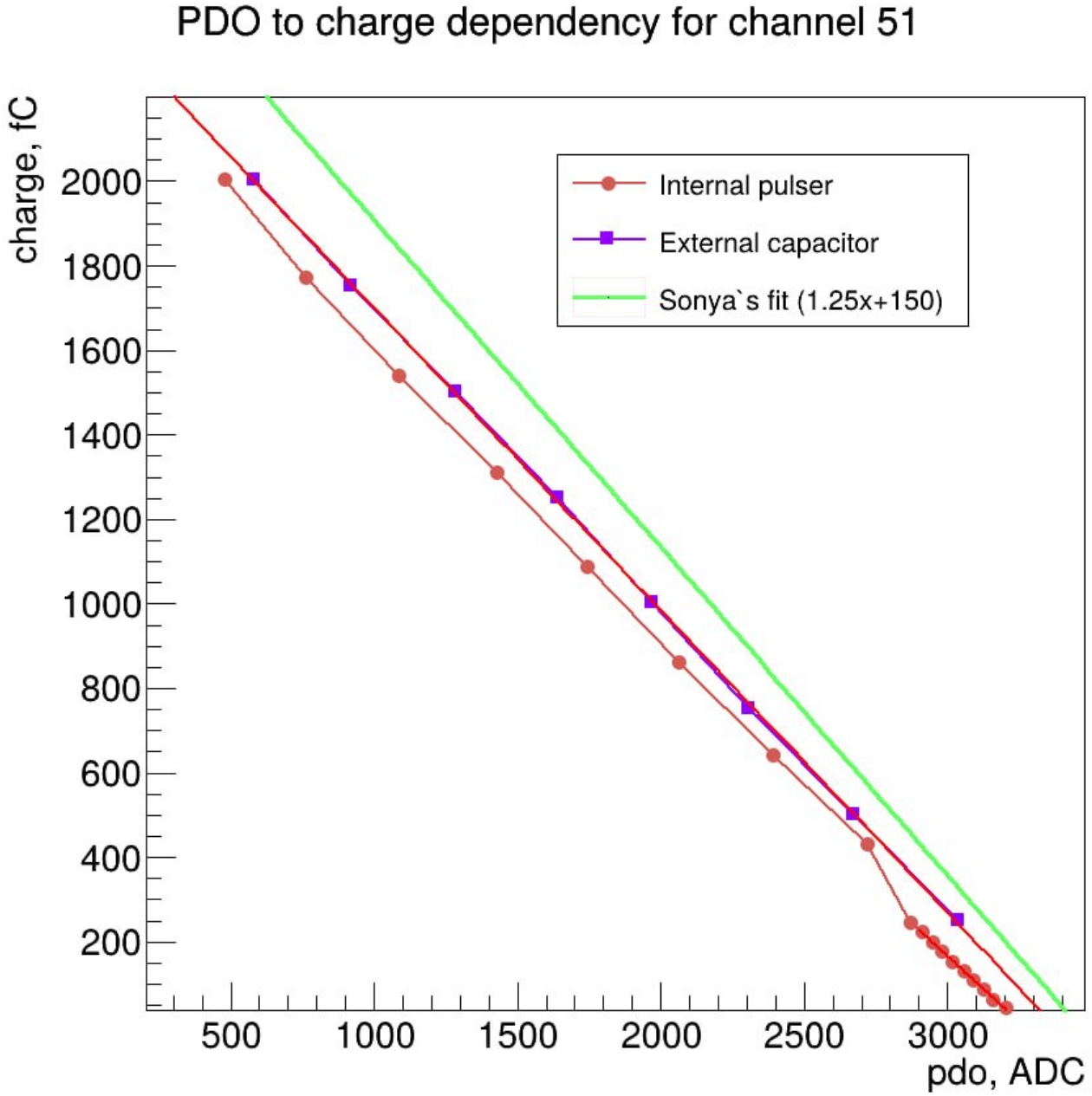
Calibration was performed for pdo < 3200. But we have almost 50% with pdo > 3267



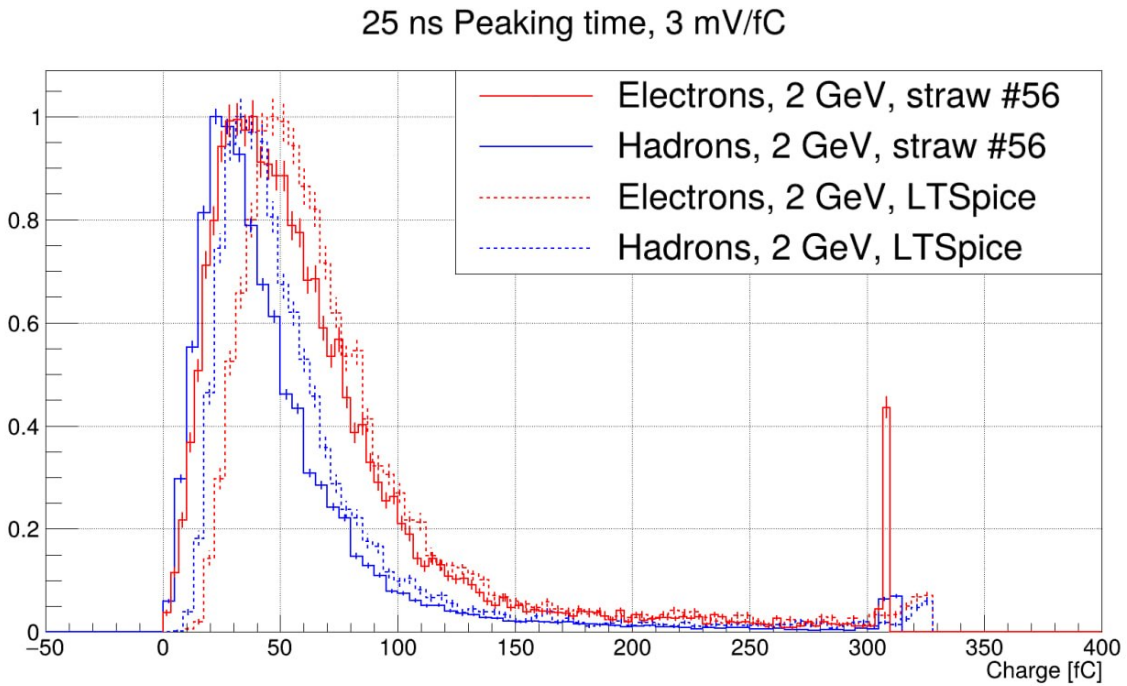
Try to fit one histogram to another...
Scale: 1.25 * x + 150, that fits

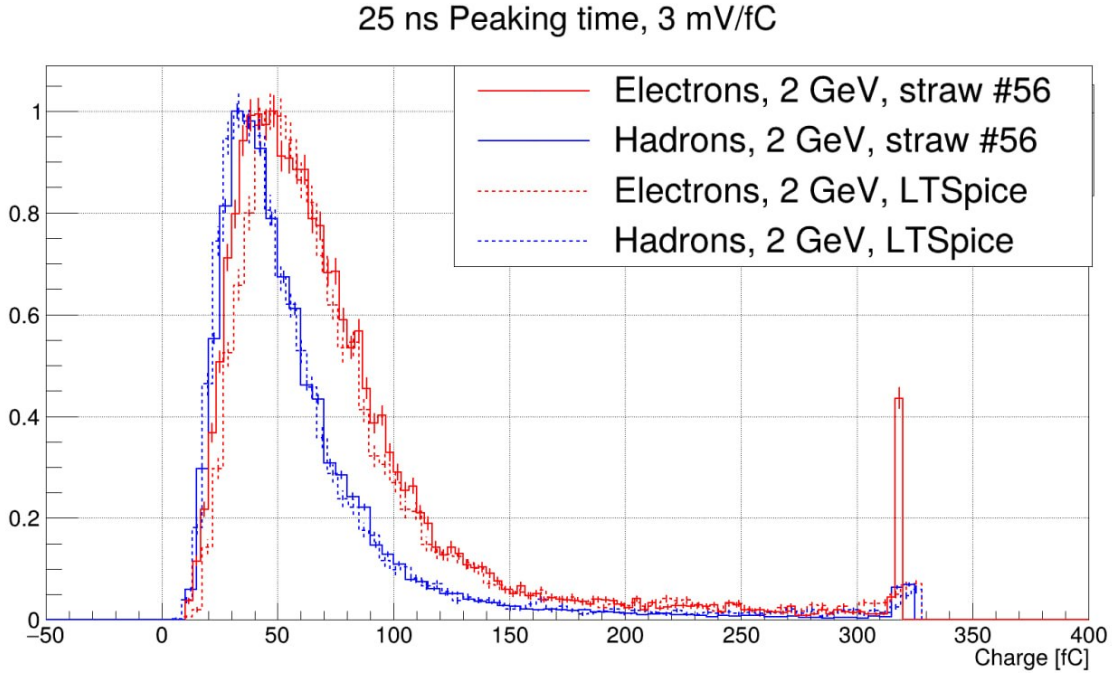

VMM3a #95 CH51, G = 0.5mV/fC, P = 200ns
Charge, fC
ADC, Counts
χ² / ndf 424.5 / 6
p0 2417 ± 7.336
p1 −0.7157 ± 0.003716


200 ns Peaking time, 0.5 mV/fC
Electrons, 2 GeV, straw #56
Hadrons, 2 GeV, straw #56
Electrons, 2 GeV, LTSpice
Hadrons, 2 GeV, LTSpice
Charge [fC]



Updated situation... Added calibration with external capacitor.

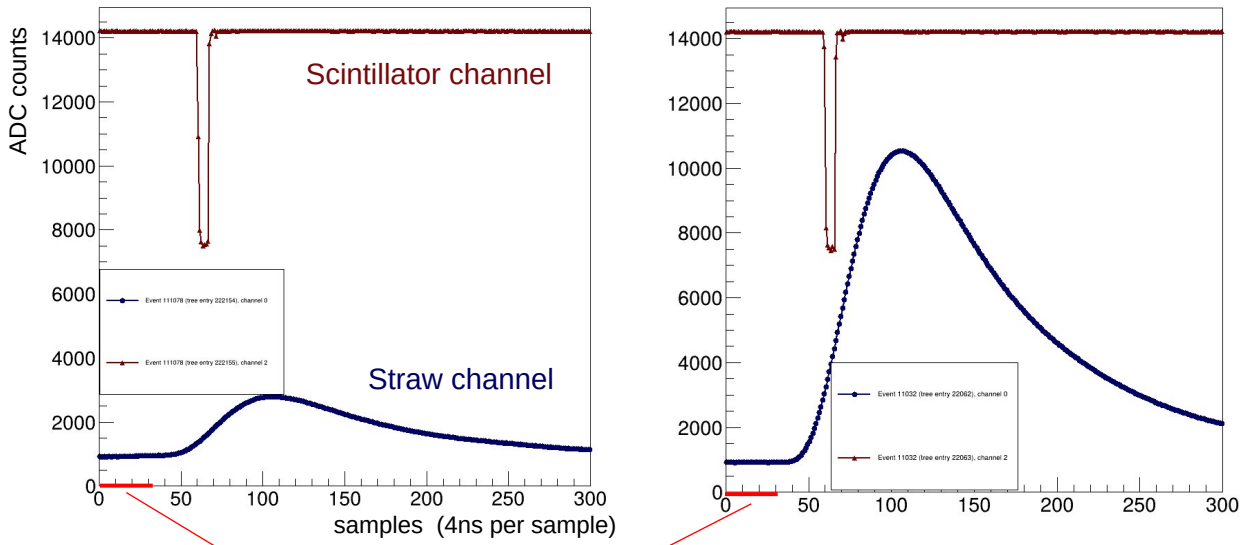




Did not change width, only shift by 10 fC

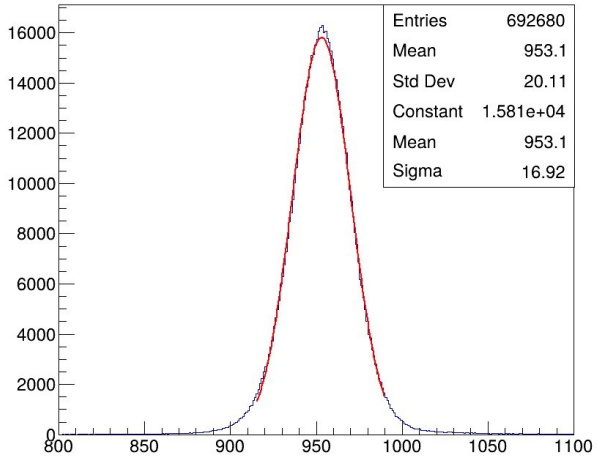
CAEN signal preparation

Typical CAEN waveforms



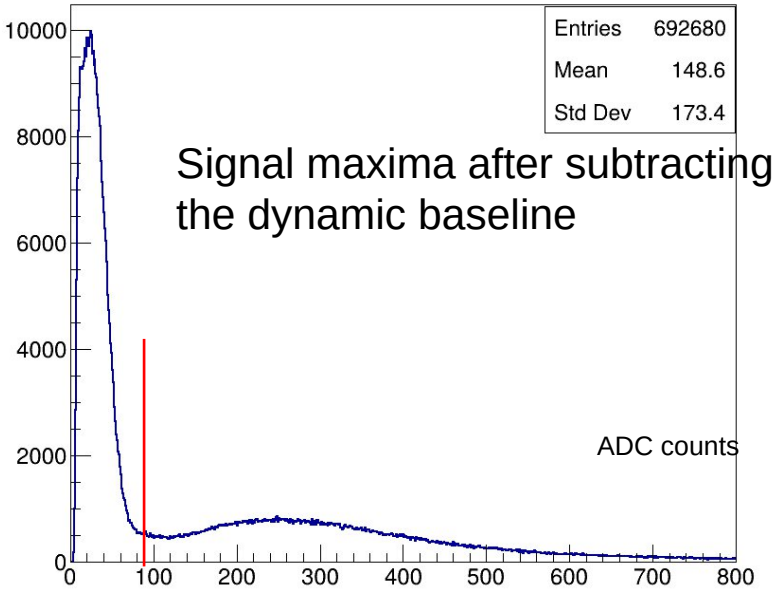
Dynamic baseline is calculated based on the first 30 samples

Baseline distributions



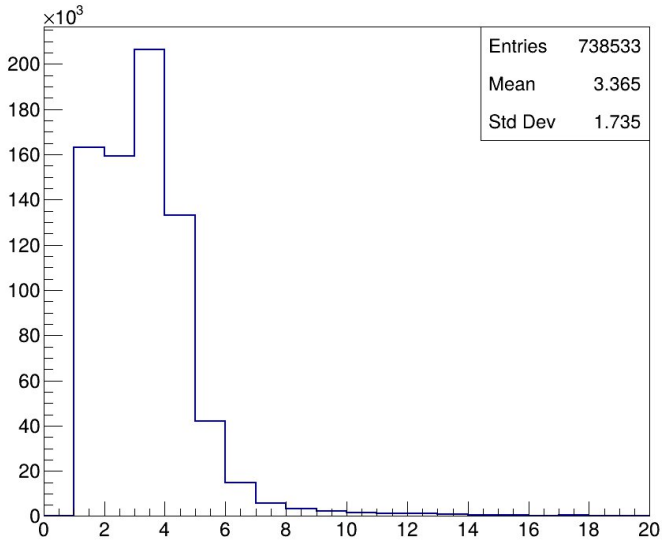
RUN 84
Protons: p = 1.6 GeV/c
Ekin = 0.9 GeV
220 ns peaking time

Electronics is similar to November TB

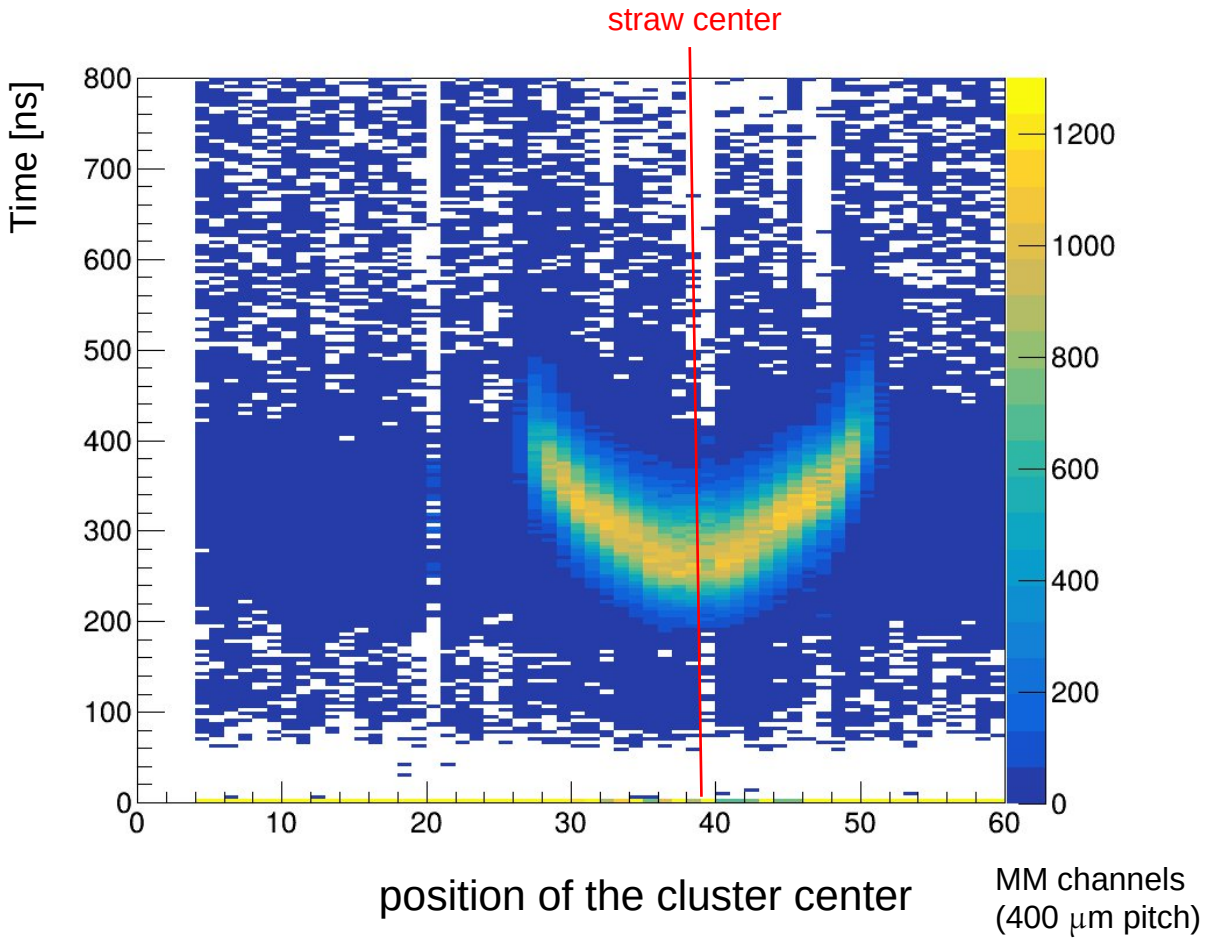


Choosing a threshold for noise subtraction

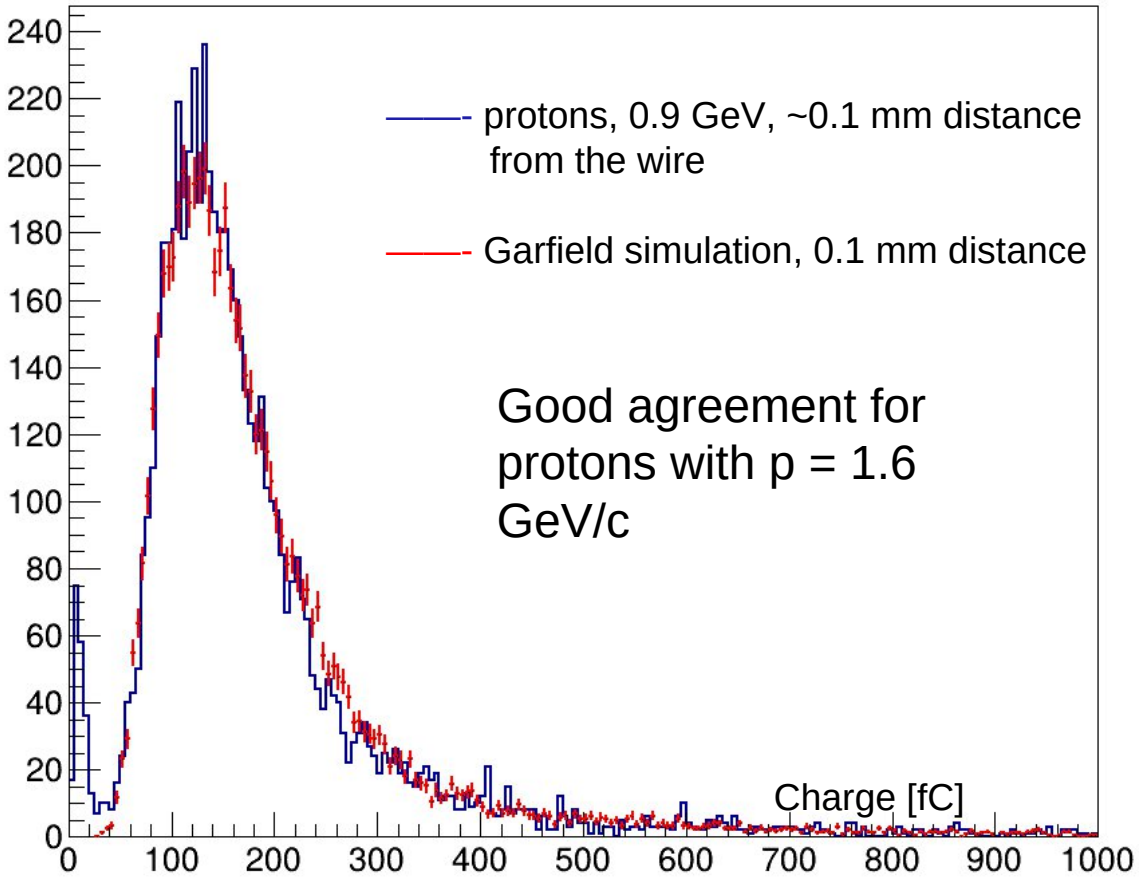
Clustering of channels of the reference MM detector: adjacent triggered channels are merged in one cluster. If during cluster construction a "dead" channel appears on the way followed by a triggered one, both channels are included in the cluster.



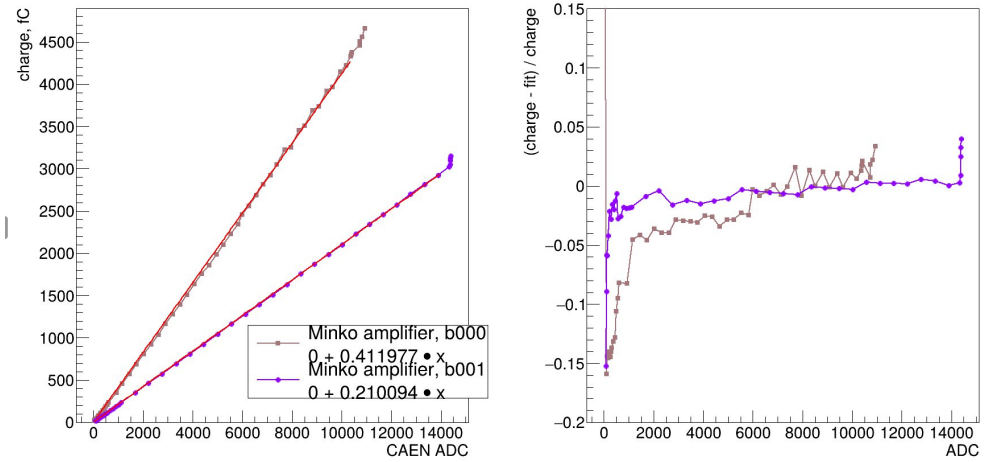
RT-curve: the time when the straw signal crosses the noise threshold



Ionization losses for protons Ek=0.9 GeV on a track length ~1 cm



CAEN preamplifier calibration used to get signal in fC

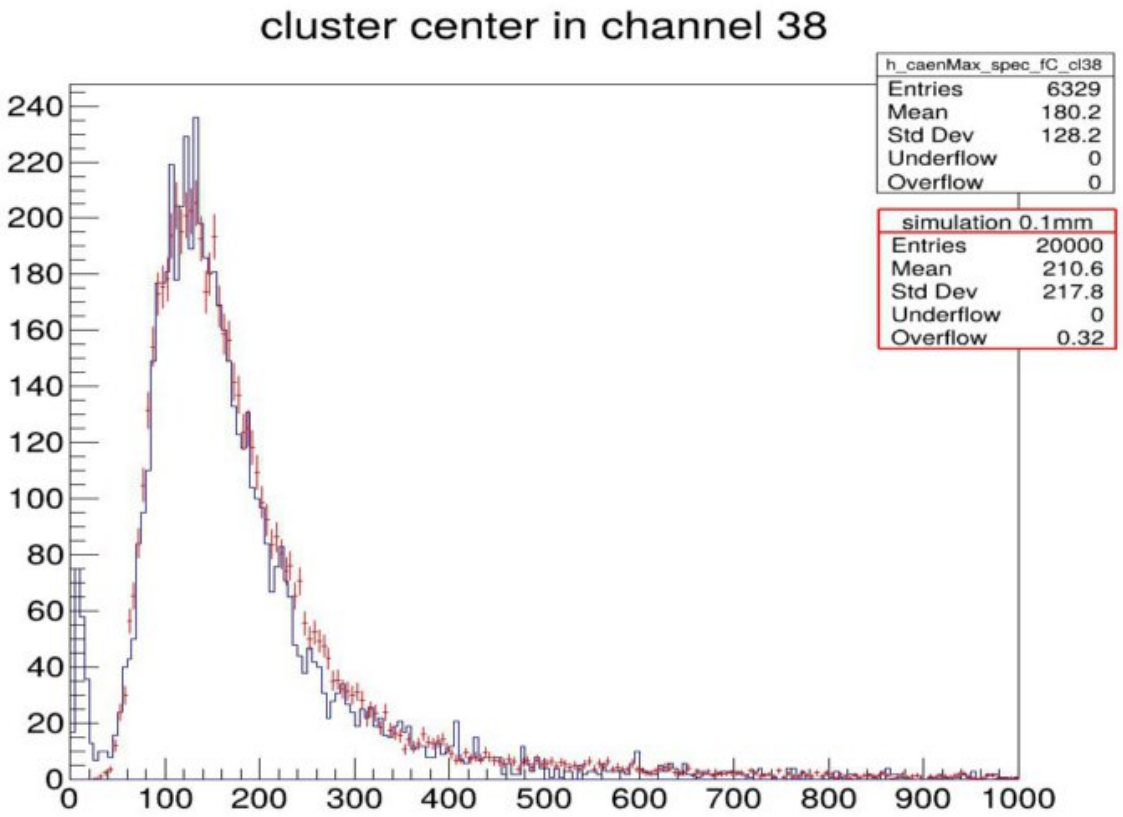


Here is the results of only one short run for protons with Ek=0.9 Gev, p=1.6 GeV/c. Analysis of other runs with protons in energy range Ek=0.1-0.9 GeV/c is ongoing.

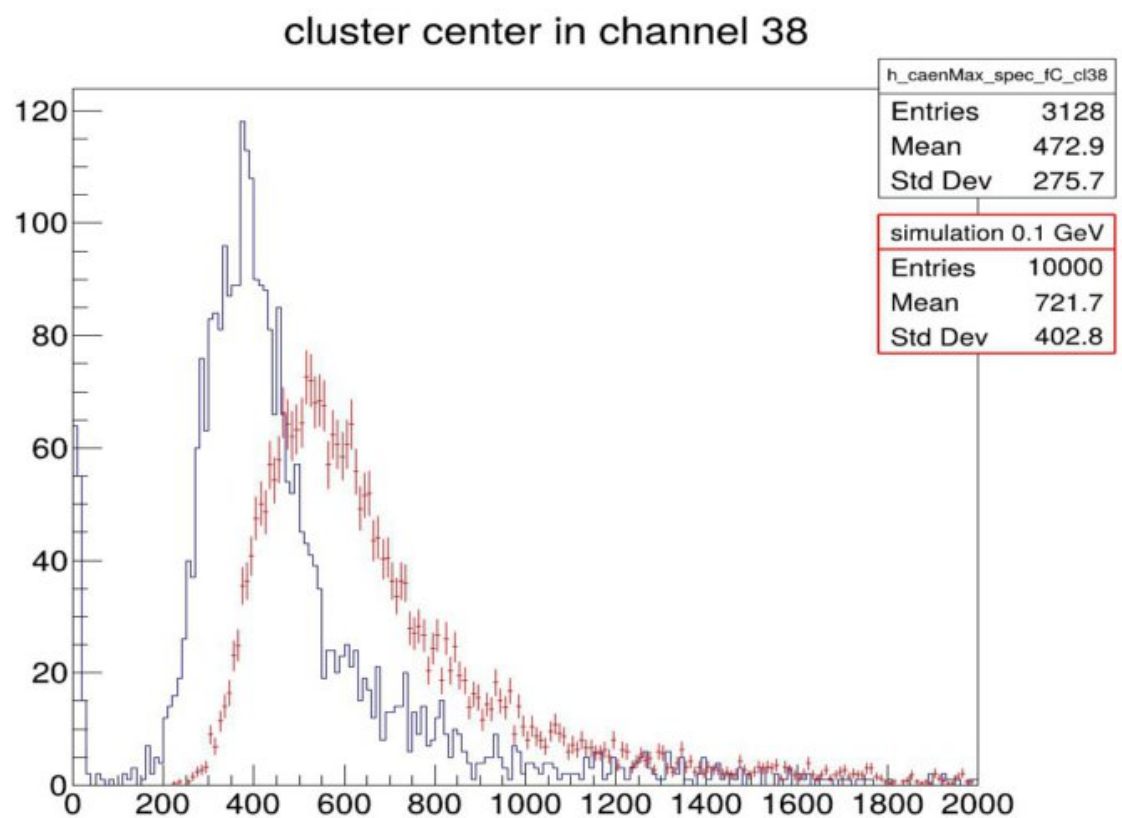
Max signal divided by track length (in cm)

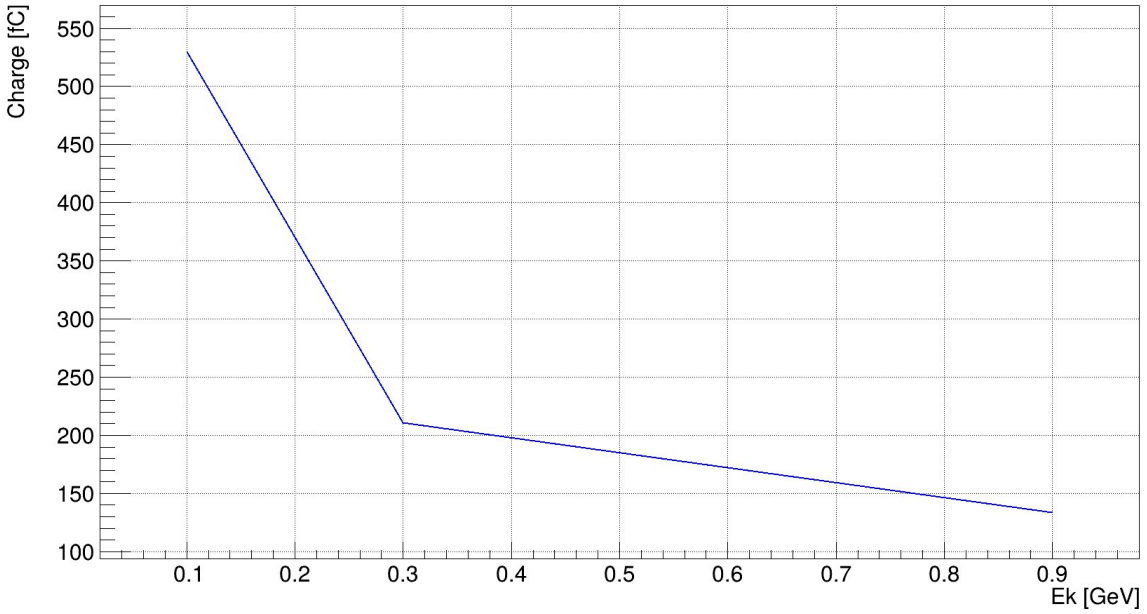
Waveform maxima distribution in channels 38 (~0.2 mm from the wire) in fC **compared with Sonya's simulation**: protons with Ek=900 MeV and Ek=100 MeV, angle 90 deg. between track and the wire, 250 ns integration time

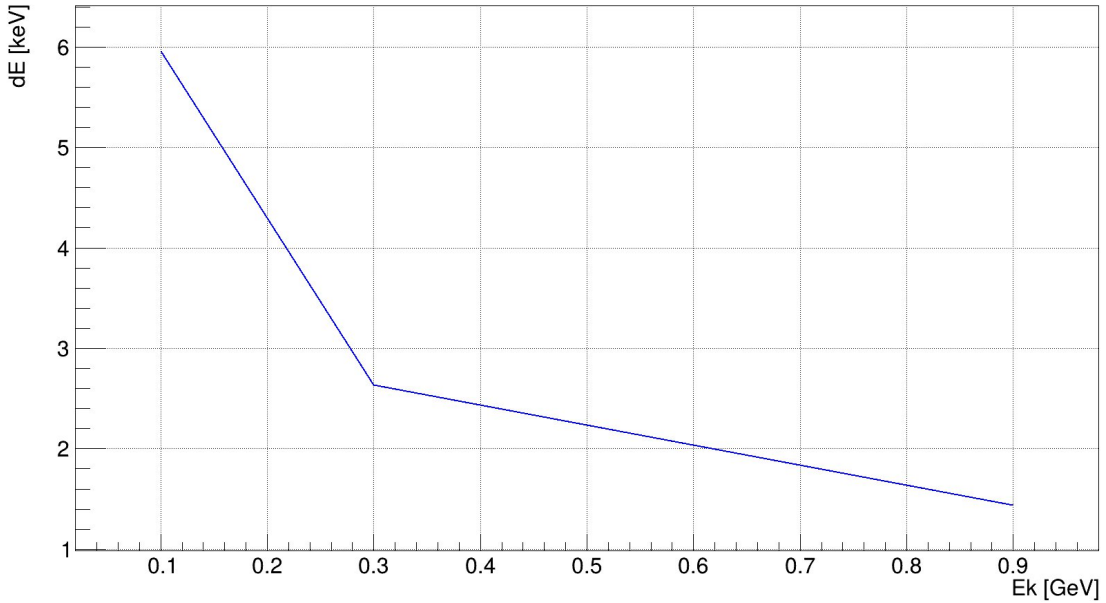
run 84 Ek=900 MeV



run 53 Ek=100 MeV







Expected ionization energy loss values for different Ekin

Ekin [GeV]	Charge [fC]	dE [keV]	[fC / keV]
0.1	530	5.96	89
0.3	210	2.64	79
0.9	123	1.44	85

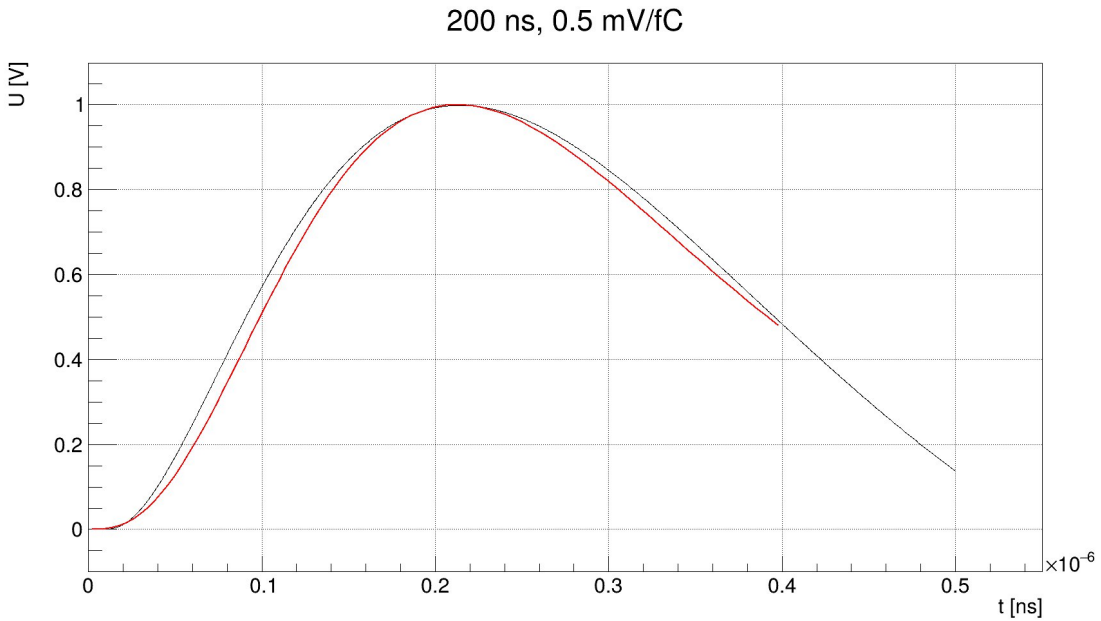
$$\frac{\text{Ekin} = 0.9}{\text{Ekin} = 0.1} = \frac{123}{530} = 0.23$$

VMM3 Model Convolution

takes four arguments: n is the order of the shaper, τ is the time constant, g is the gain factor, and `shaperType` is either `"unipolar"` or `"bipolar"`. In the first case (unipolar shaper), the transfer function is given by

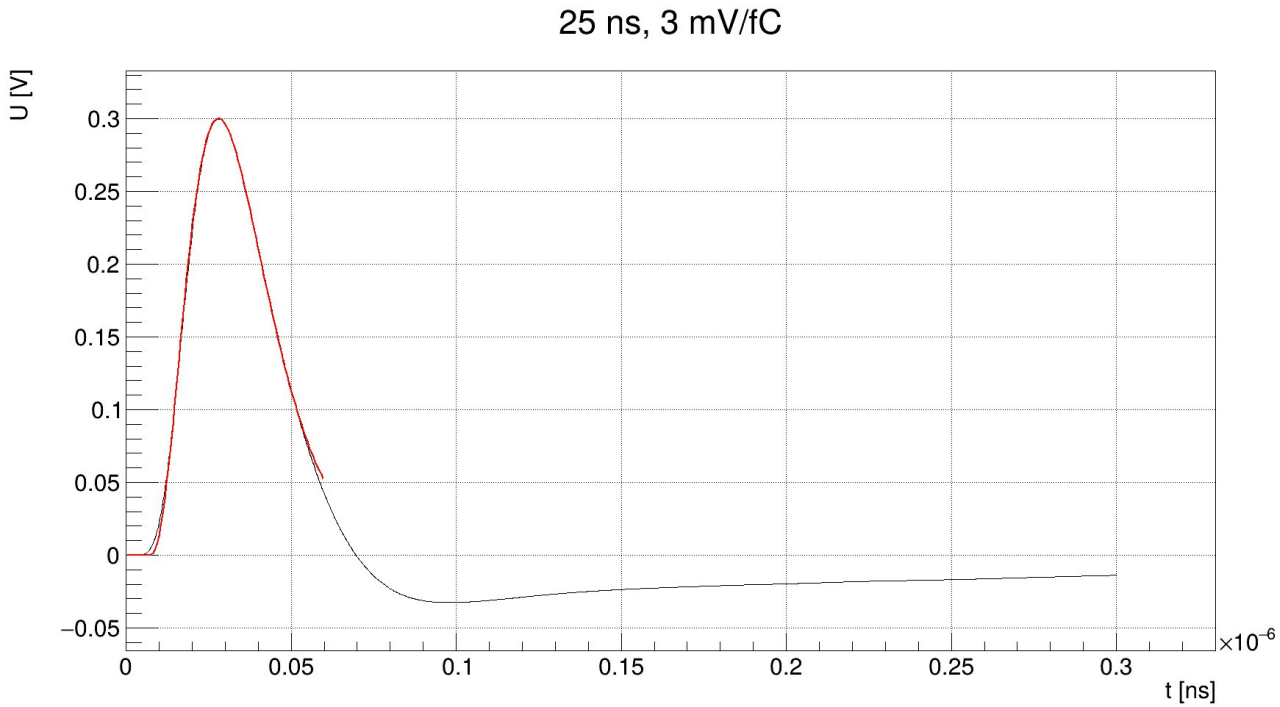
$$f(t) = g\exp(n)\left(\frac{t}{t_p}\right)^n \exp(-t/\tau), \qquad t_p = n\tau,$$

VMM3 Model Convolution



200 ns, 0.5 mV/fC

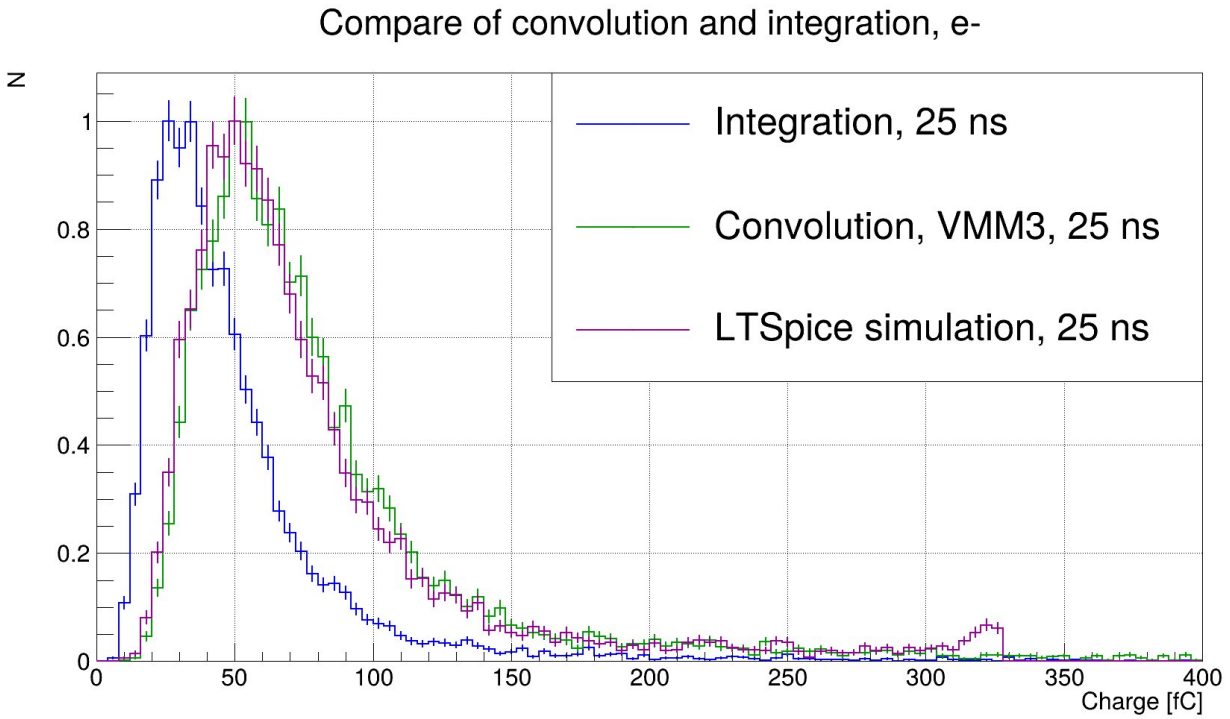
fit parameters:
Amplitude = 1 V;
tau = 70.8 ns
n = 3
t0 = 0 ns

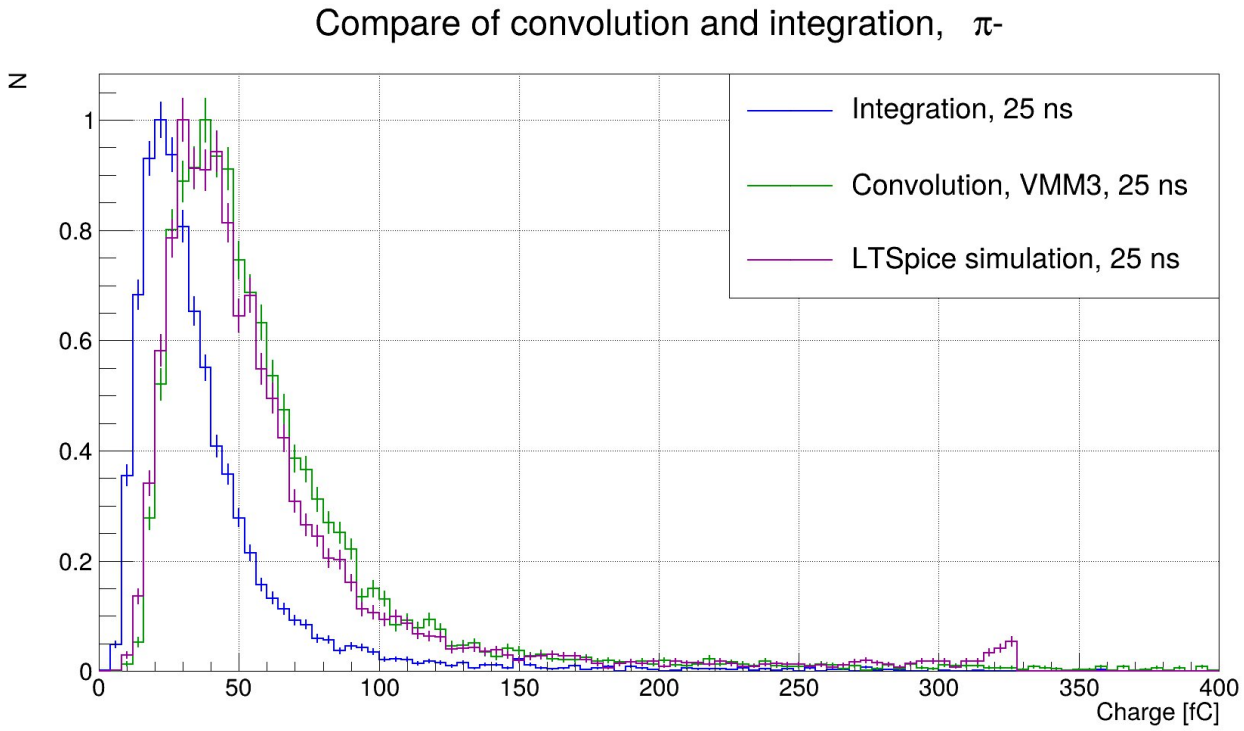


25 ns, 3 mV/fC

fit parameters:
Amplitude = 0.3 V;
tau = 7.08 ns
n = 3
t0 = 6.71 ns

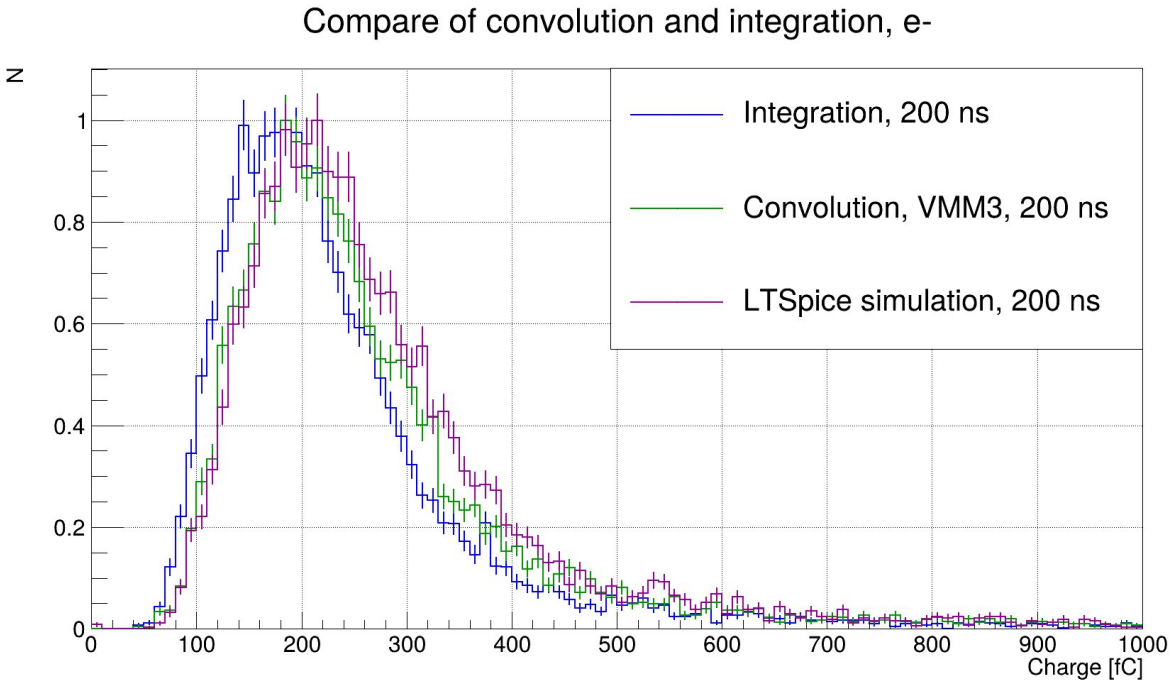
Simulation methods comparison. 25 ns & 3 mV/fC

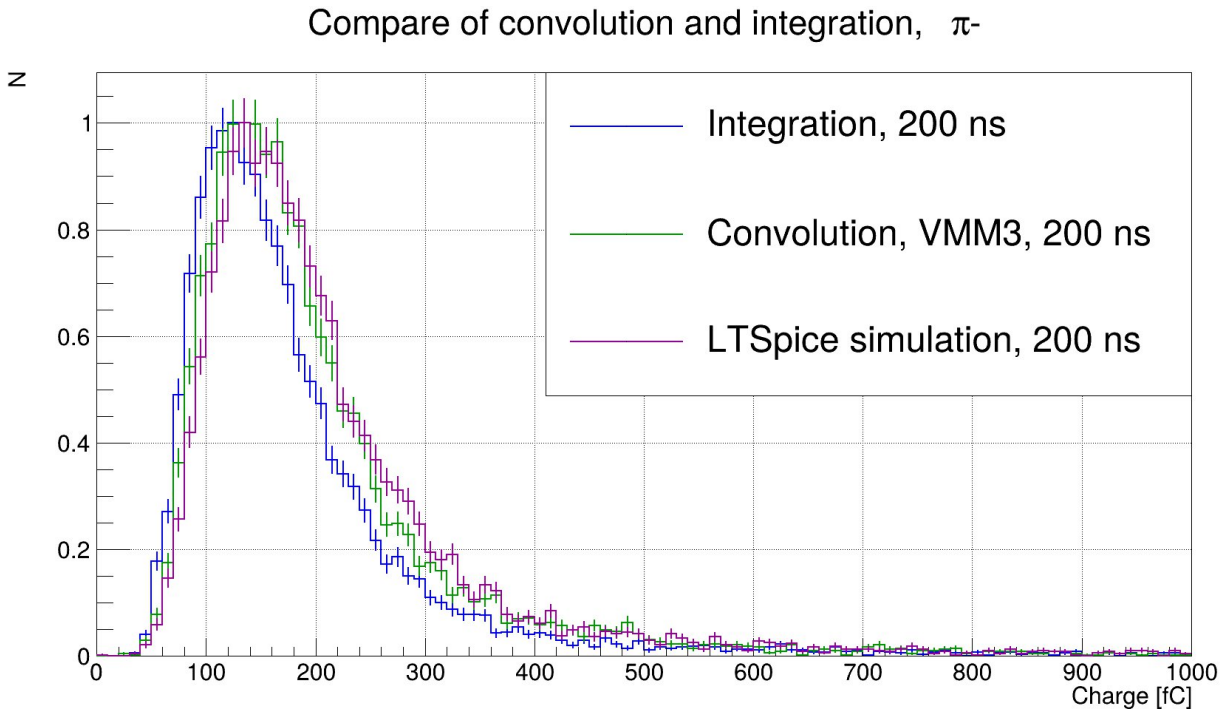




Garfield++ units after convolution:
[V] * [fC]
divide by delta-function maximum

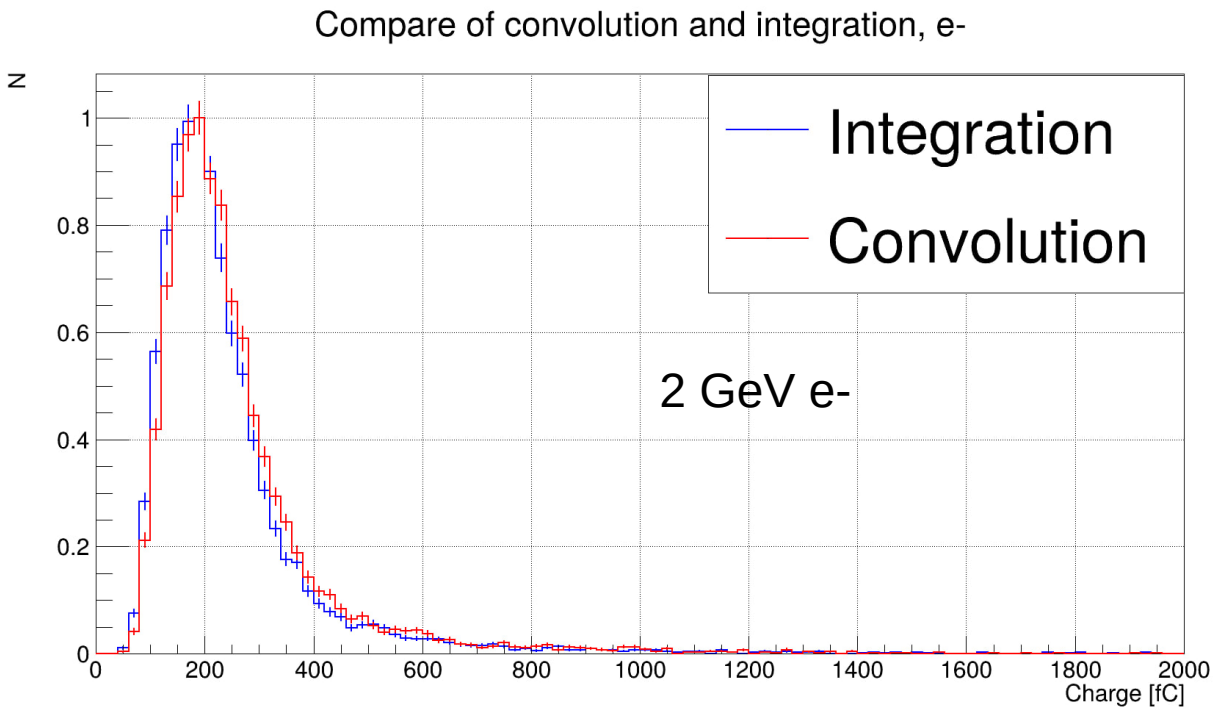
Simulation methods comparison. 200 ns & 0.5 mV/fC

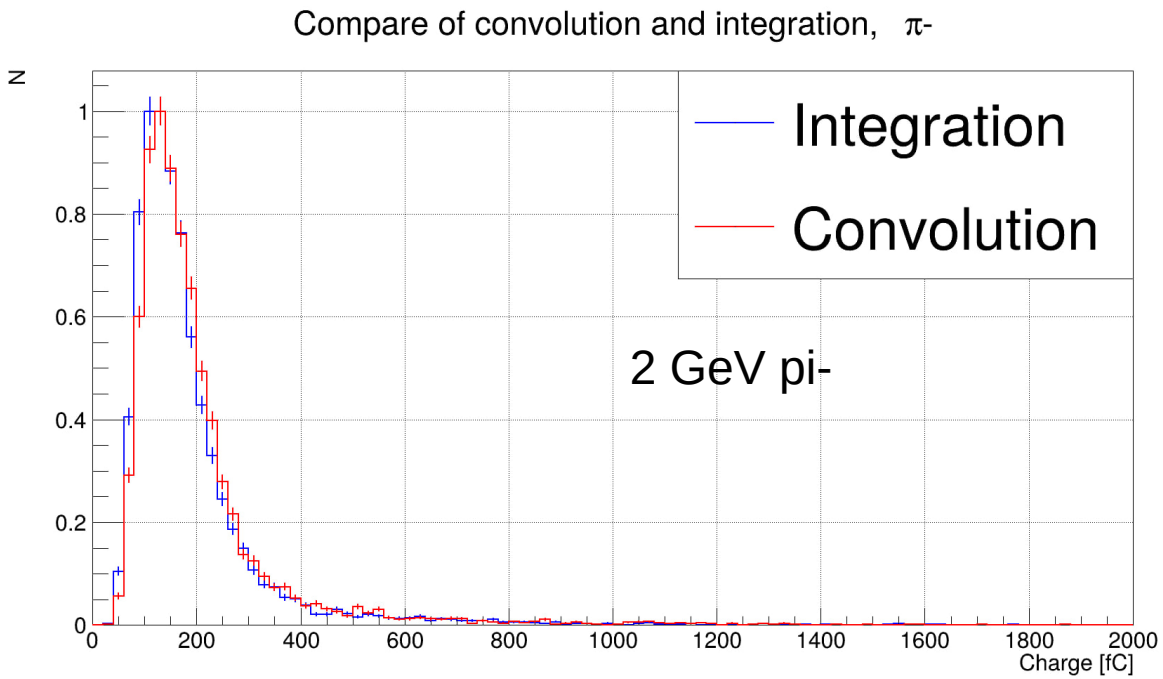




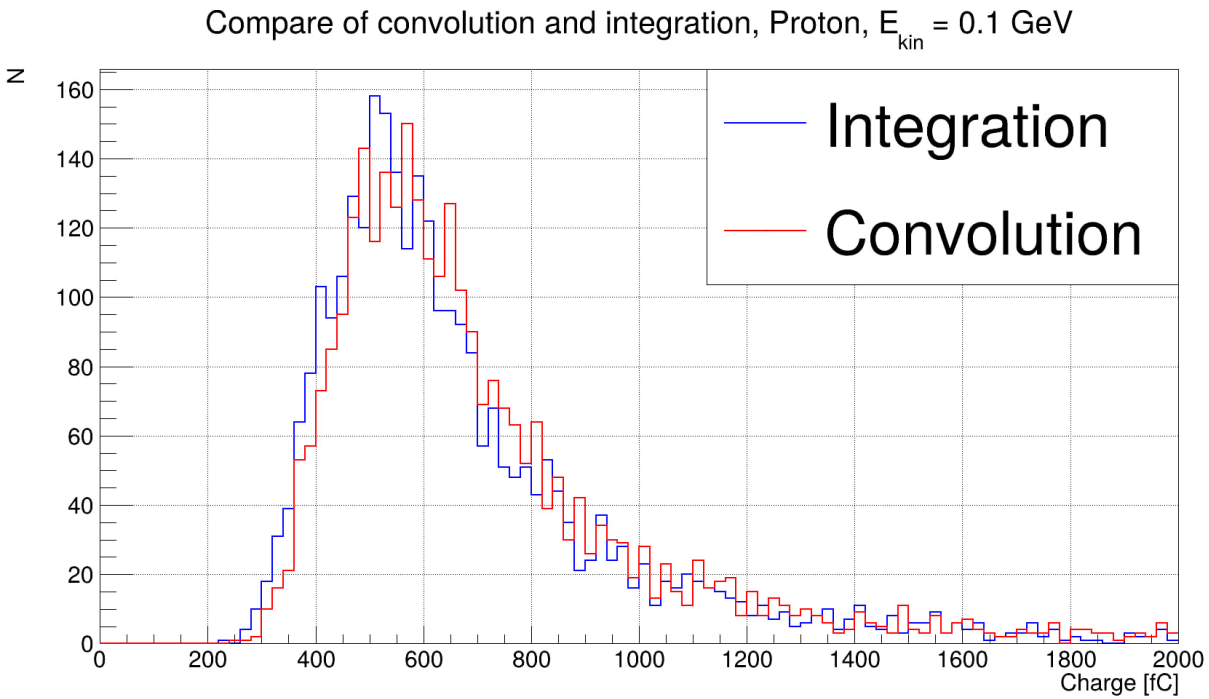
Garfield++ units after convolution:
[V] * [fC]
divide by delta-function maximum

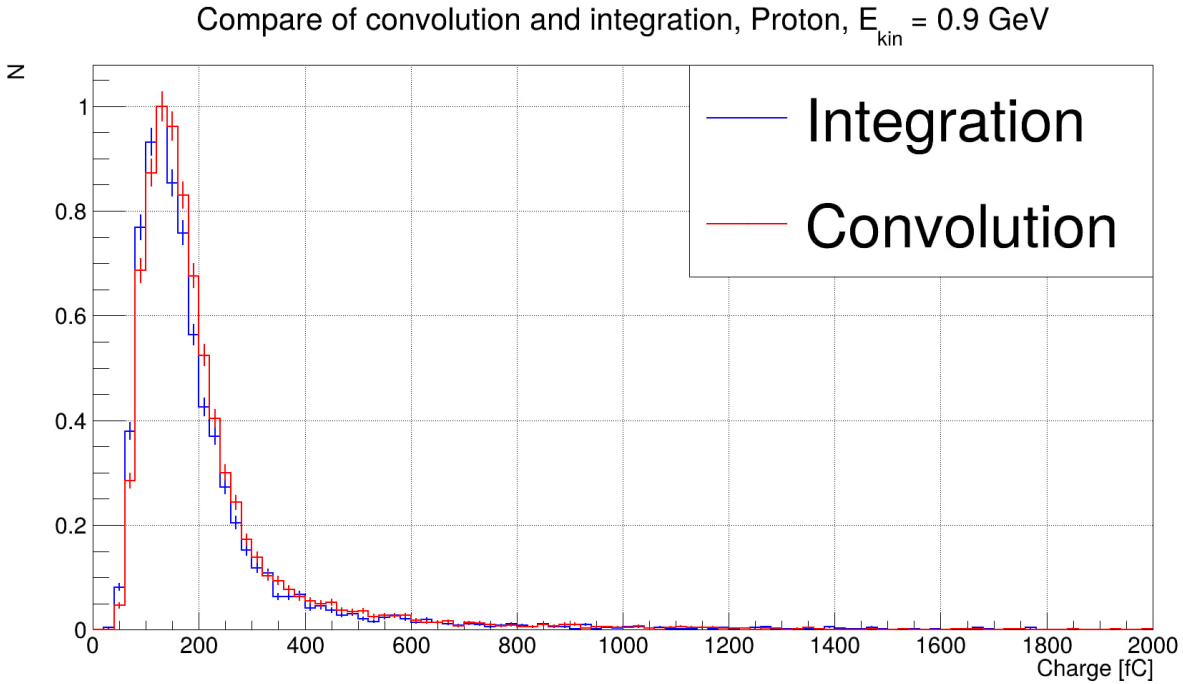
Minko preamplifier



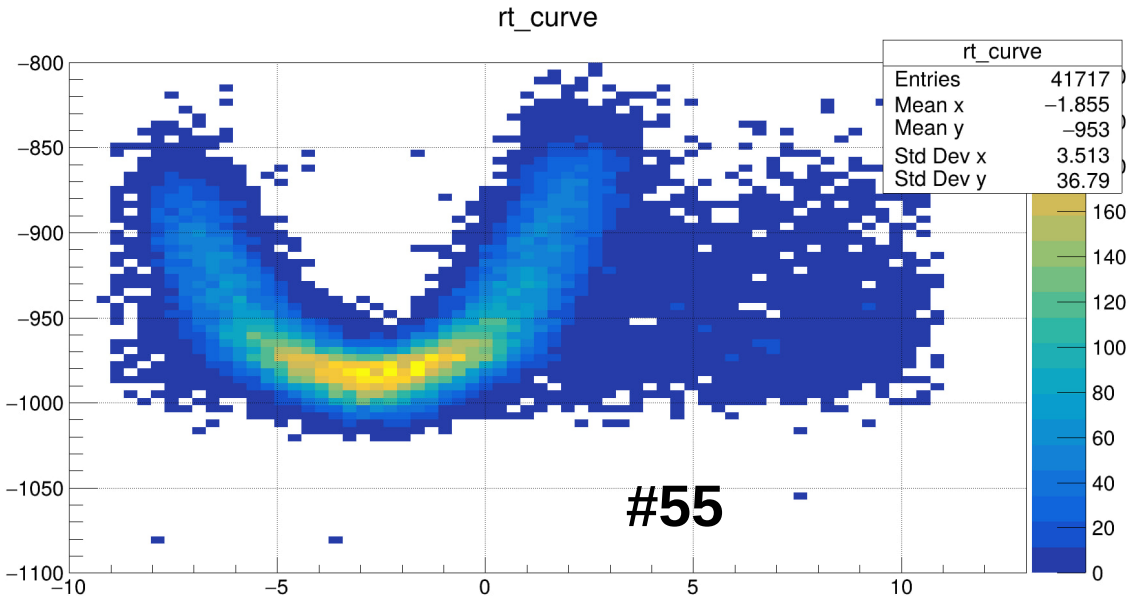


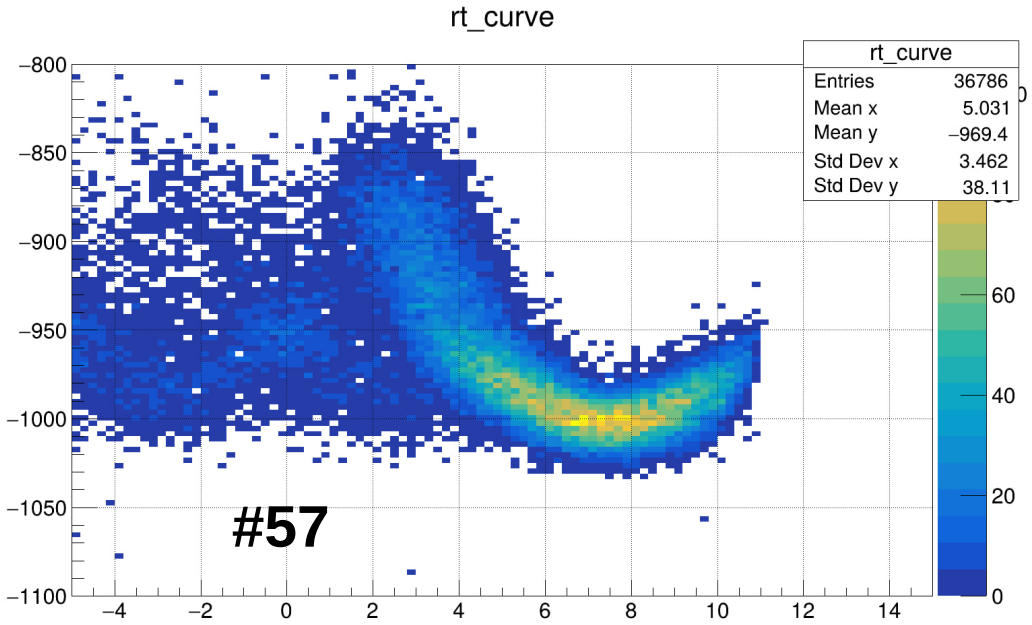
220 ns of peaking time & 1 mV / fC gain
NB: factor 1.16 for Convolution curve was applied to correct LTSpice amplitude inaccuracy

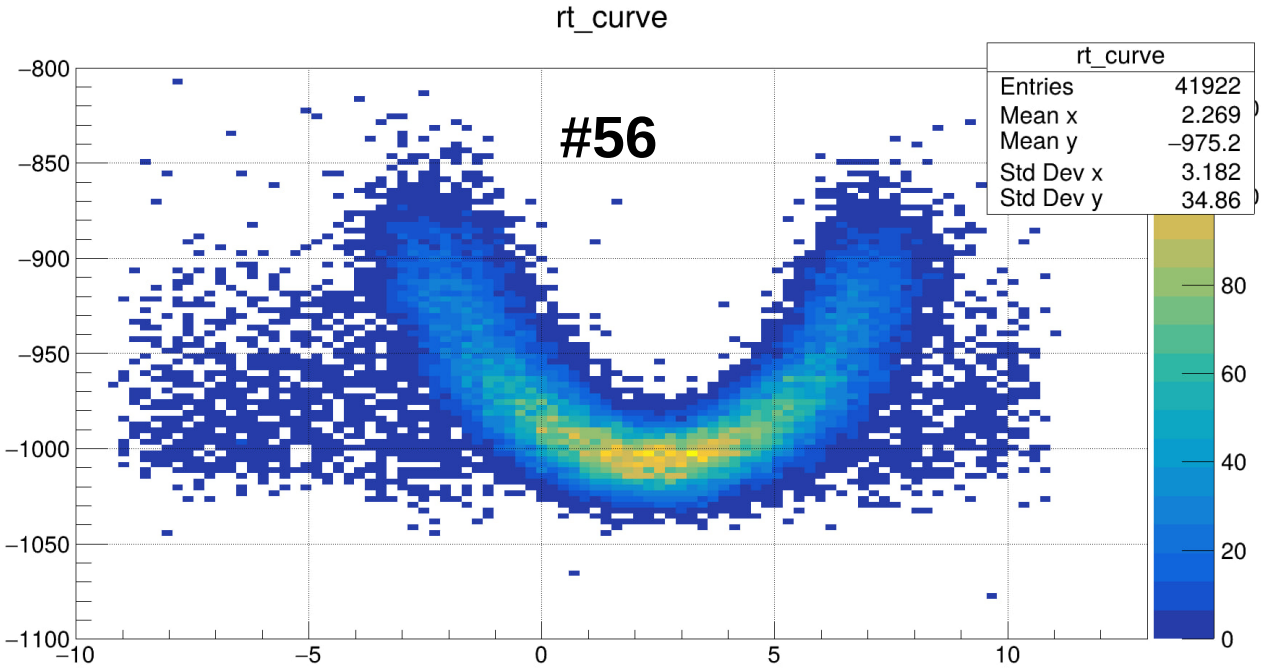




The same idea is applied to protons with E_kin = 0.1 GeV and E_kin = 0.9 GeV

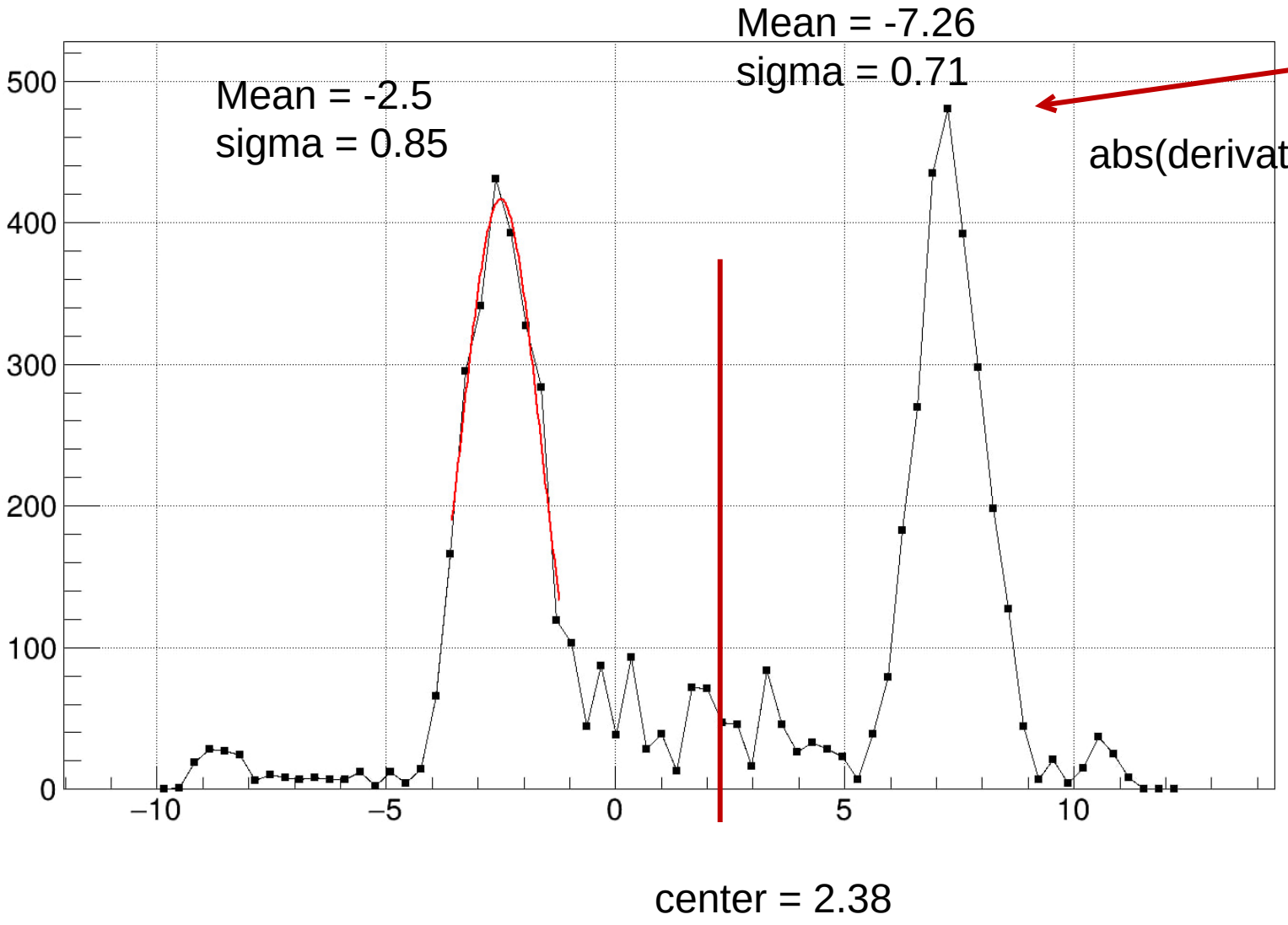




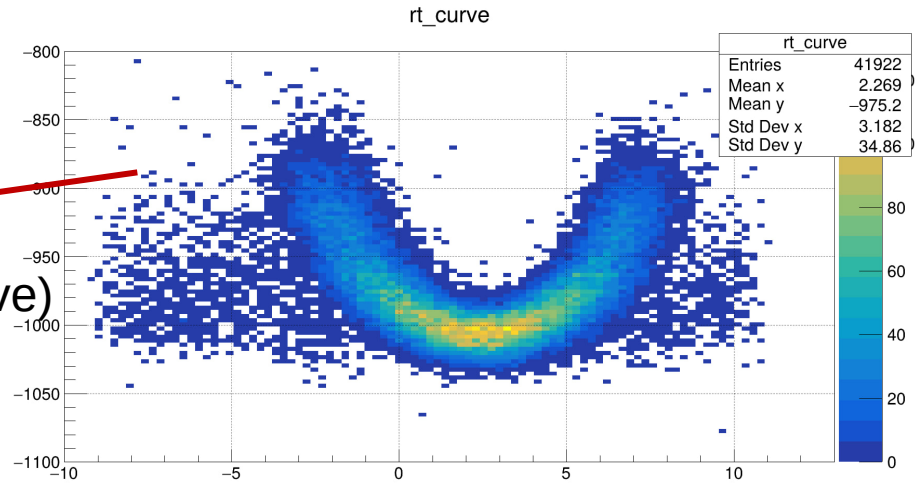


Run e- 2 GeV, 25 ns, 3 mV/fC

Straw center finding (tube #**56**)



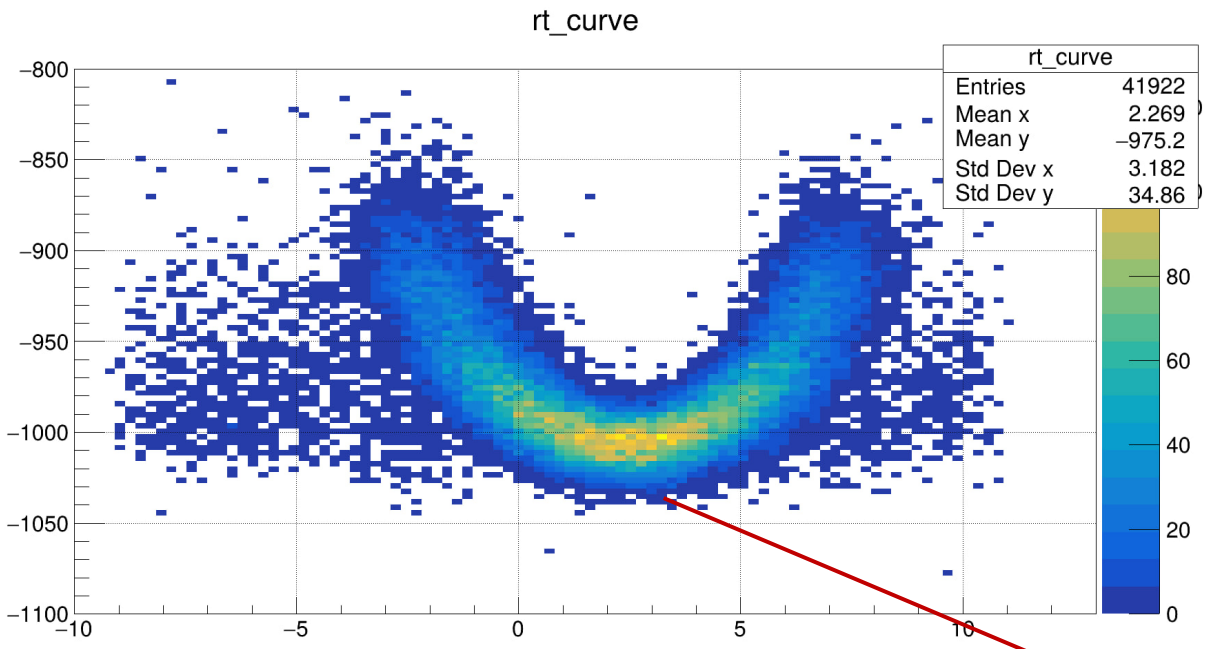
center = 2.38



Run e- 2 GeV,
25 ns, 3 mV/fC

Straw center finding (tube #**56**)

Run e- 2 GeV,
25 ns, 3 mV/fC



Fit with pol2
center ~ 2.48

