Studies on alphas
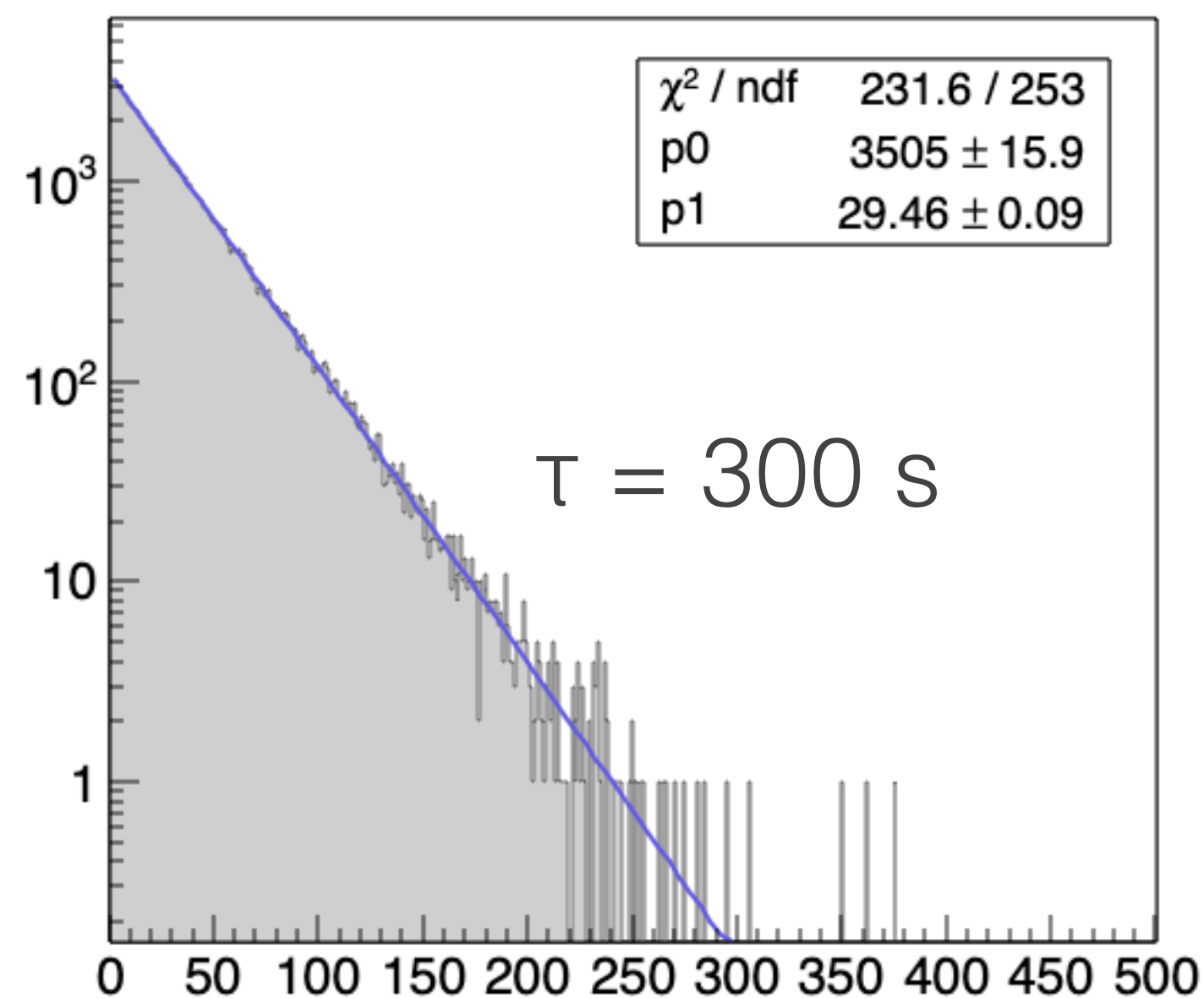# Semi-Experimental Toy-MC
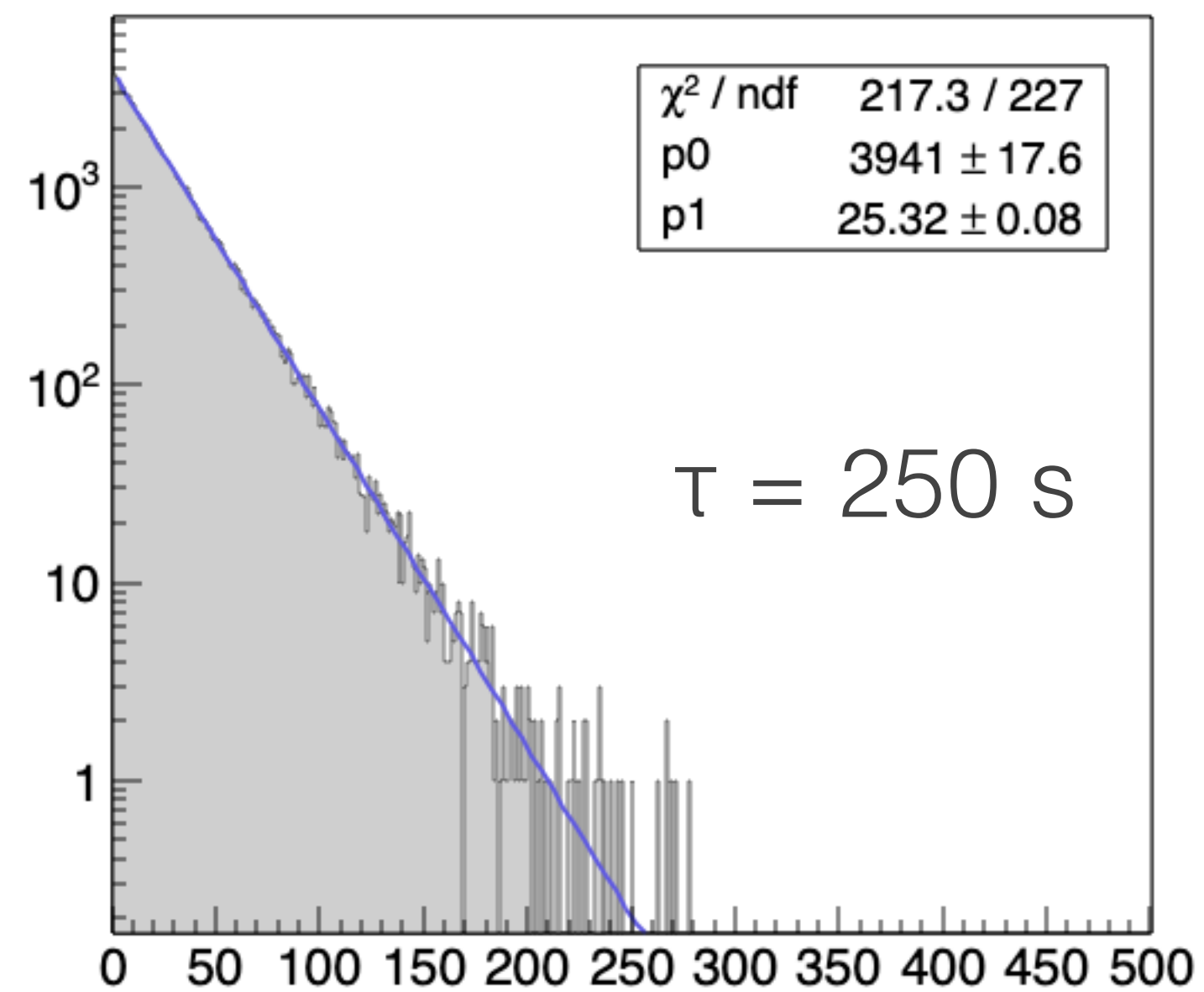
(David(e))

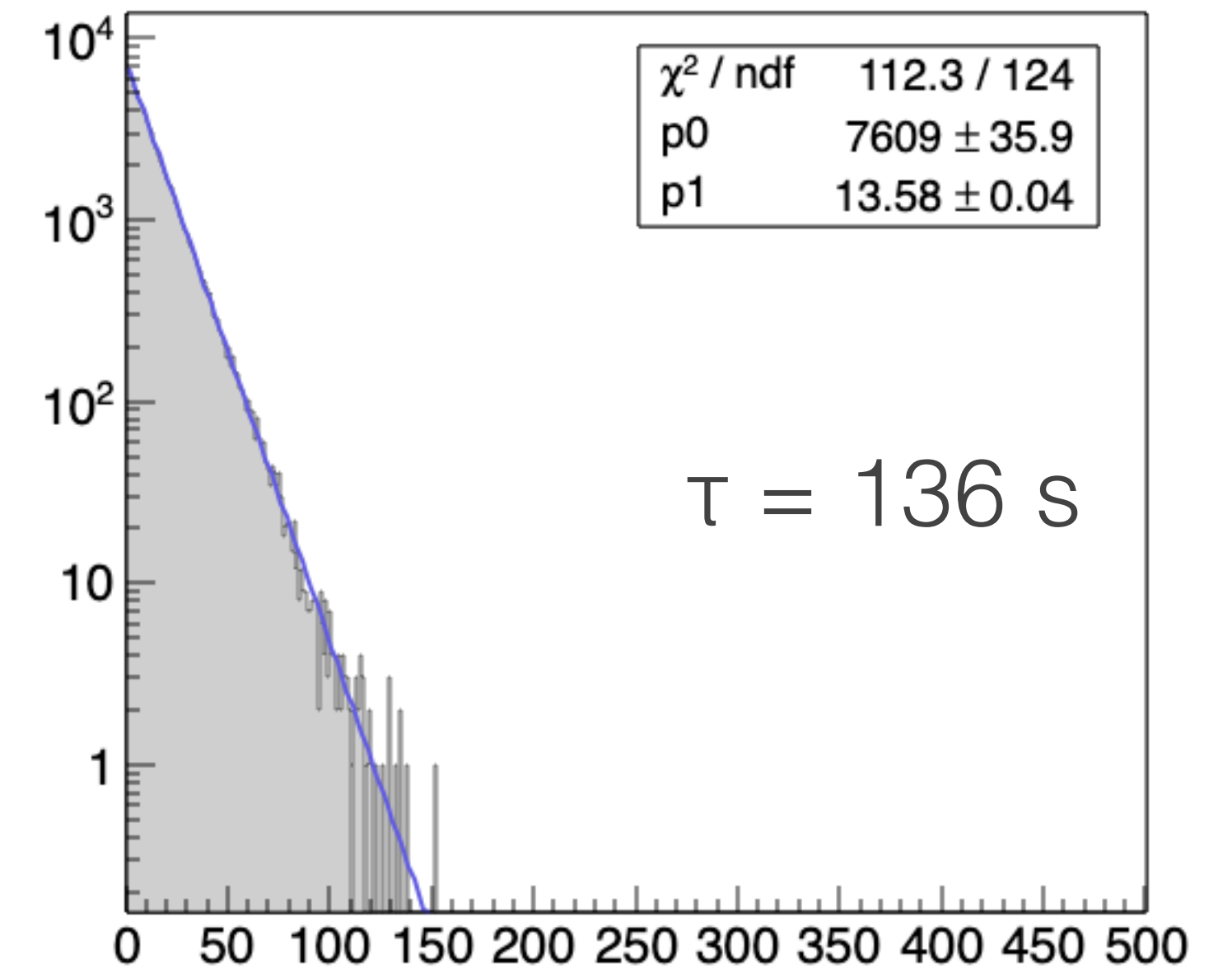# Toy MC

- Let's suppose we can identify ^{222}Rn and ^{218}Po (thanks to David Marques, we can)

- I simulated ^{222}Rn with an average time difference of 300 s and their decays with a lifetime (no half-life) of 250 s, with 100% efficiency in detecting both ^{222}Rn and ^{218}Po

χ^2 / ndf	231.6 / 253
p0	3505 $\pm$ 15.9
p1	29.46 $\pm$ 0.09

$\tau = 300$ s

χ^2 / ndf	217.3 / 227
p0	3941 $\pm$ 17.6
p1	25.32 $\pm$ 0.08

$\tau = 250$ s

χ^2 / ndf	112.3 / 124
p0	7609 $\pm$ 35.9
p1	13.58 $\pm$ 0.04

$\tau = 136$ s

time difference (in tens of seconds) between two consecutive ^{222}Rn

time difference (in tens of seconds) between a ^{222}Rn and its own ^{218}Po
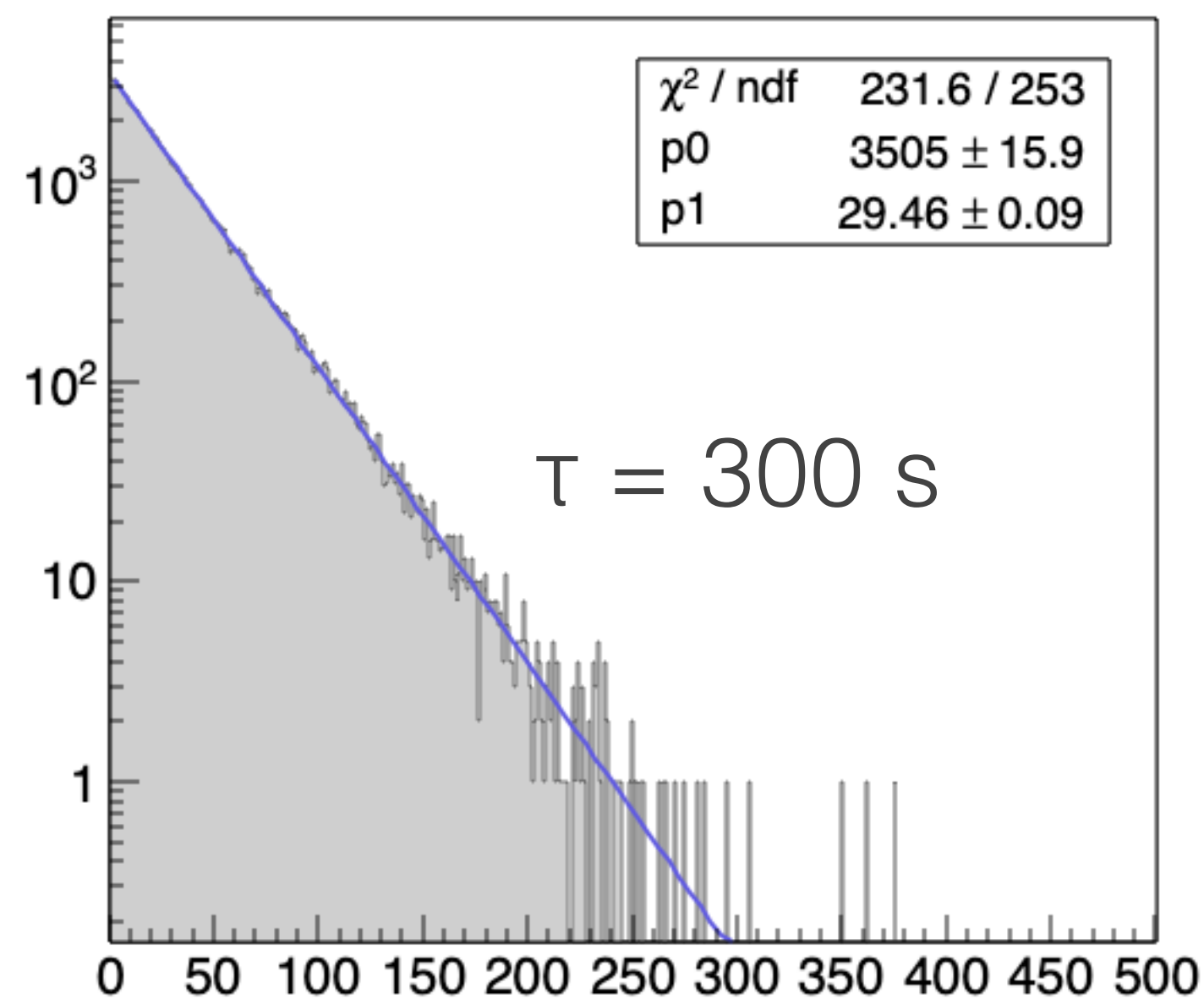
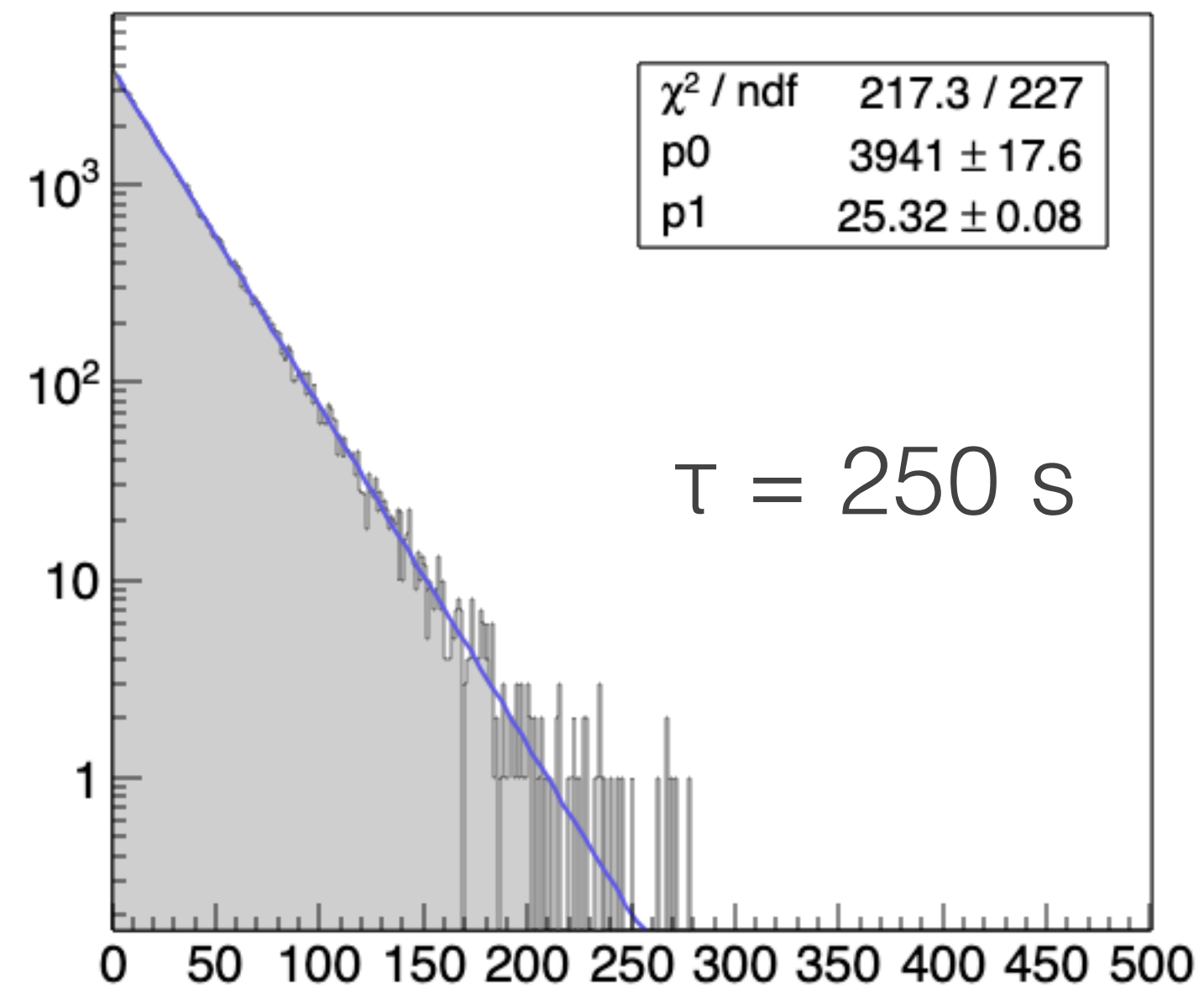time difference (in tens of seconds) between to a ^{222}Rn and the first ^{218}Po found

The "biased" association shortens the visible lifetime from 250 s to 136 s

Toy MC

- Let's suppose we have a 30% efficiency in detecting both ^{222}Rn and ^{218}Po (e.g. mainly for geometrical reasons);

- According to toyMC the visible lifetime increases

χ^2 / ndf	231.6 / 253
p0	3505 ± 15.9
p1	29.46 ± 0.09

τ = 300 s

χ^2 / ndf	217.3 / 227
p0	3941 ± 17.6
p1	25.32 ± 0.08

τ = 250 s

χ^2 / ndf	136.6 / 145
p0	664 ± 8.7
p1	19.98 ± 0.18

τ = 200 s

time difference (in tens of seconds) between two consecutive ^{222}Rn

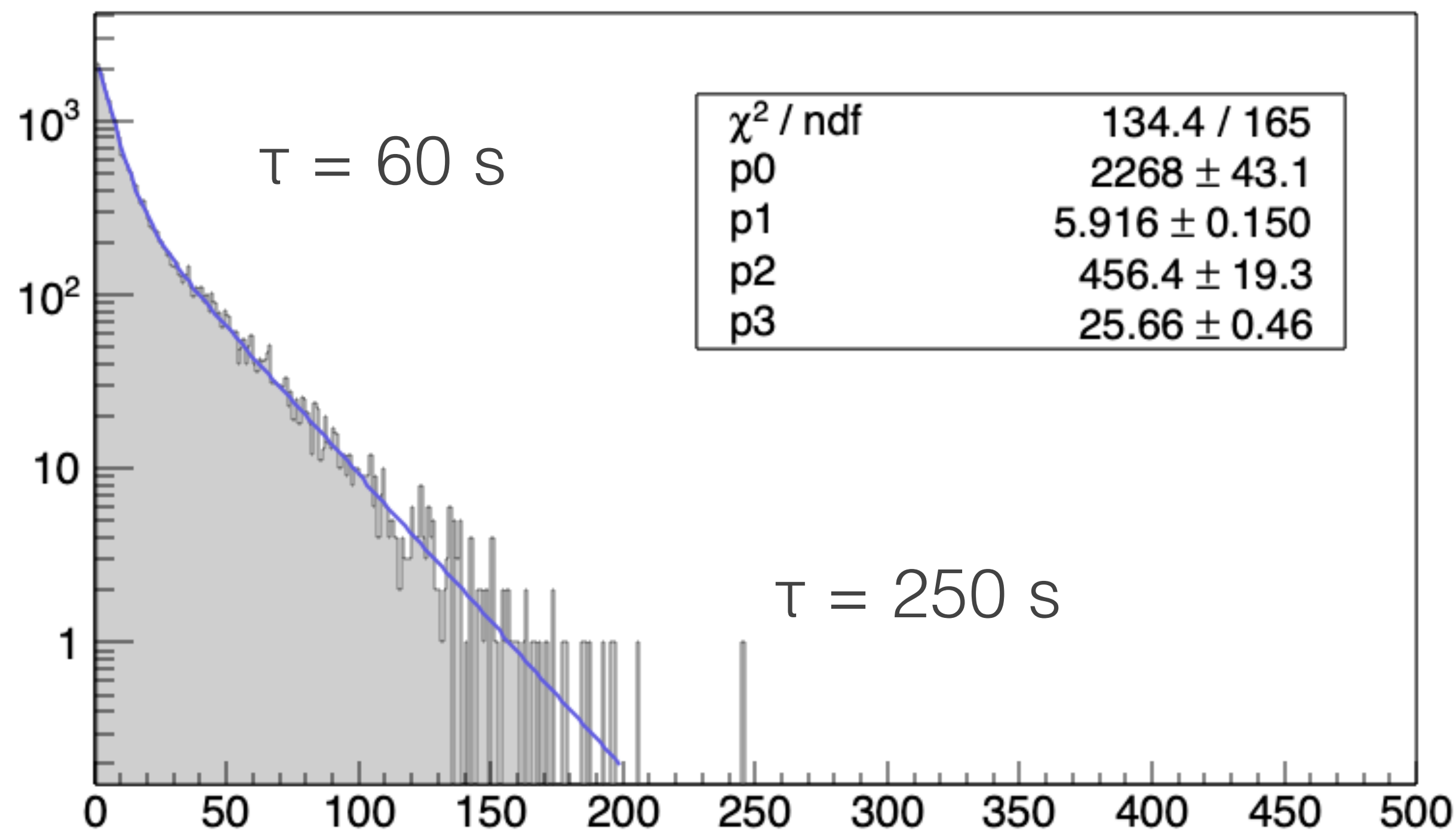time difference (in tens of seconds) between a ^{222}Rn and its own ^{218}Po
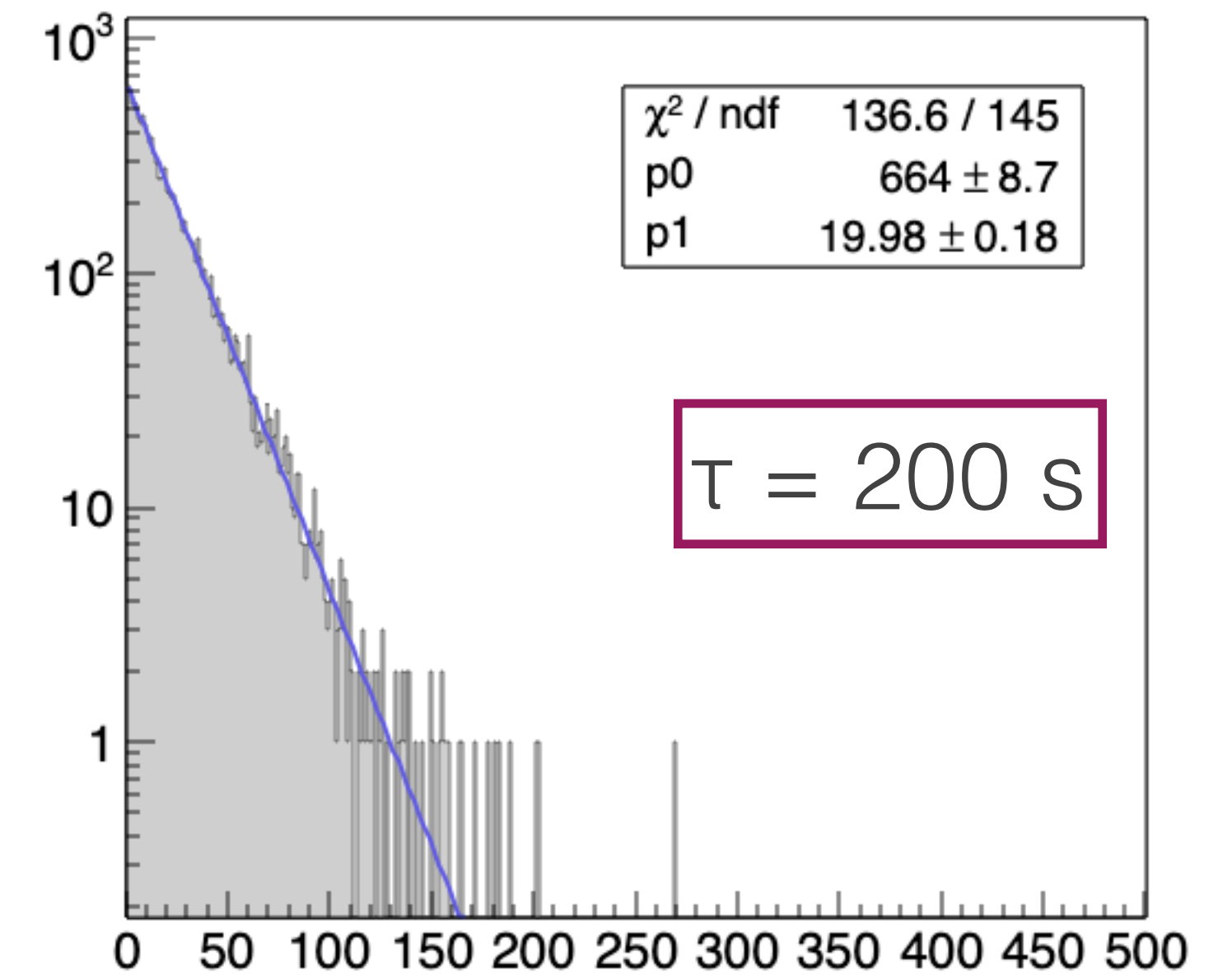
time difference (in tens of seconds) between to a ^{222}Rn and the first ^{218}Po found

Assuming a 30% efficiency, the visible lifetime is 200 s

Toy MC

- Let's suppose we can identify ^{222}Rn and ^{218}Po (thanks to David Marques, we can)

- I simulated ^{222}Rn with an average time difference of 30 s and their decays with a lifetime (no half-life) of 250 s

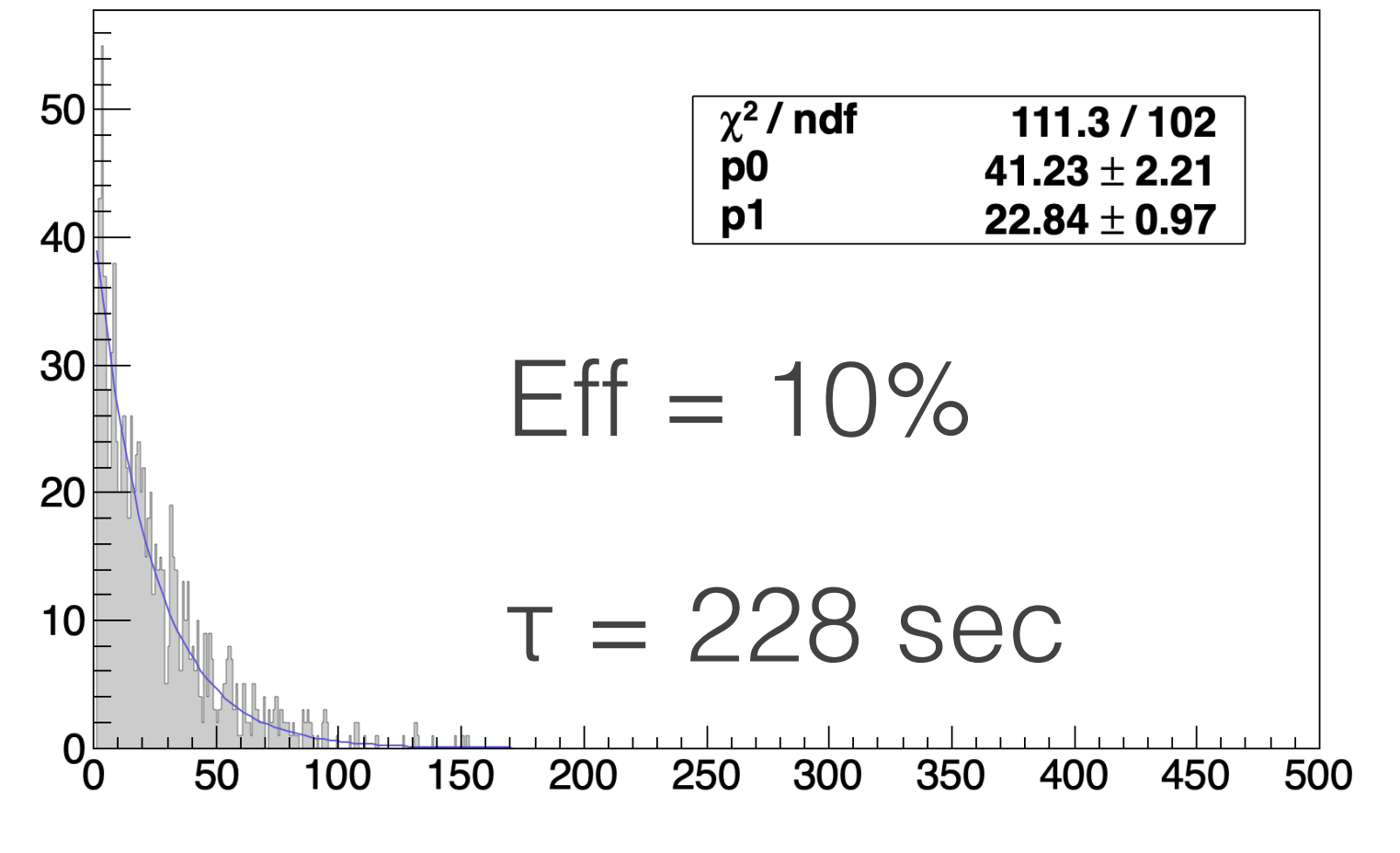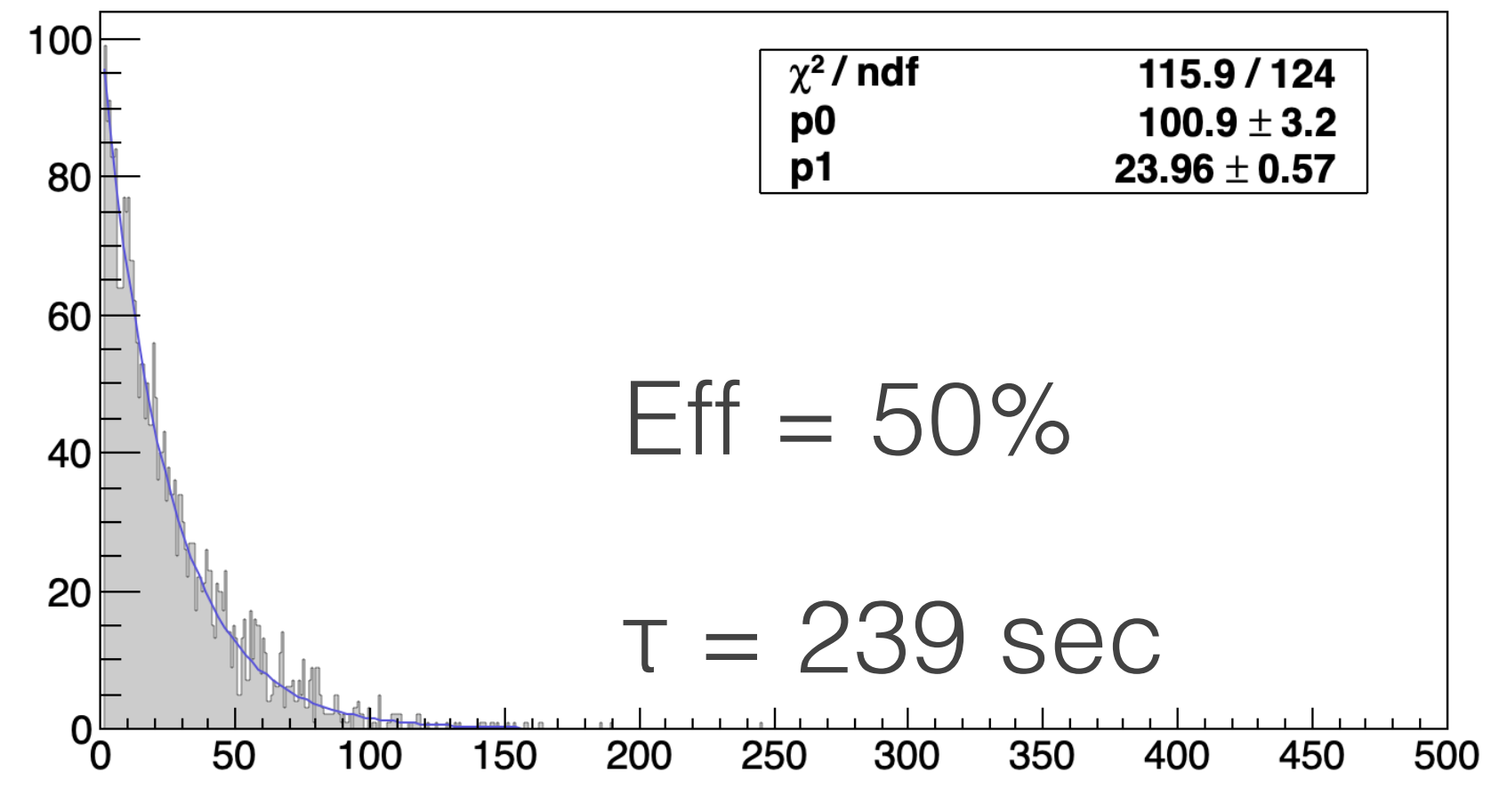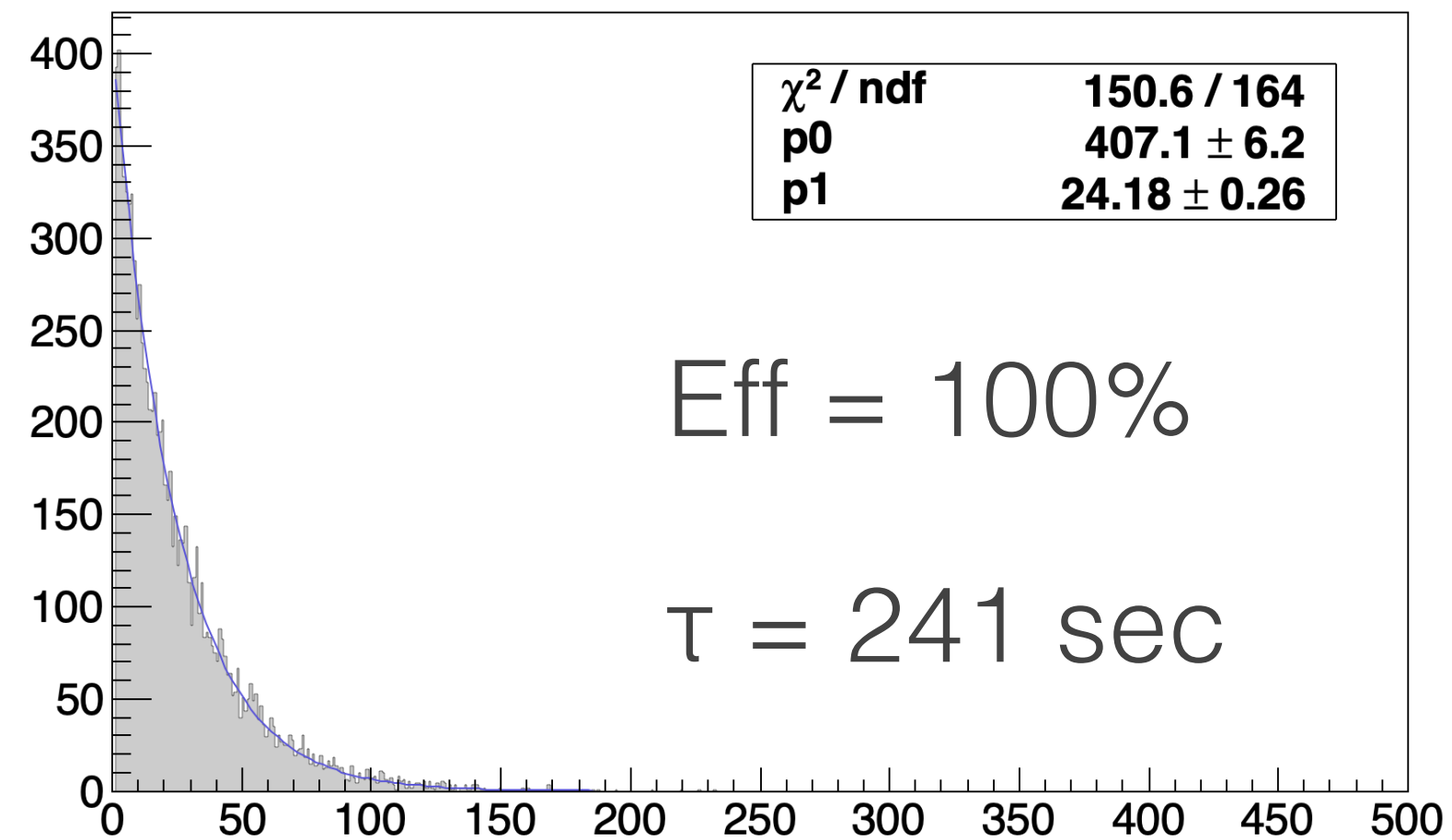| χ^2 / ndf	134.4 / 165
p0	2268 ± 43.1
p1	5.916 ± 0.150
p2	456.4 ± 19.3
p3	25.66 ± 0.46

$\tau = 60$ s

$\tau = 250$ s

time difference (in tens of seconds) between to a ^{222}Rn and the first ^{218}Po found

I found a double exp, where at the beginning I got 50 sec (probably due to the wrong pairing Rn-Po) and in the second part 250 sec probably due to the righe association when a second radon doesn't arrive in time

ToyMC: Test I

- Made some tests to check possible bugs
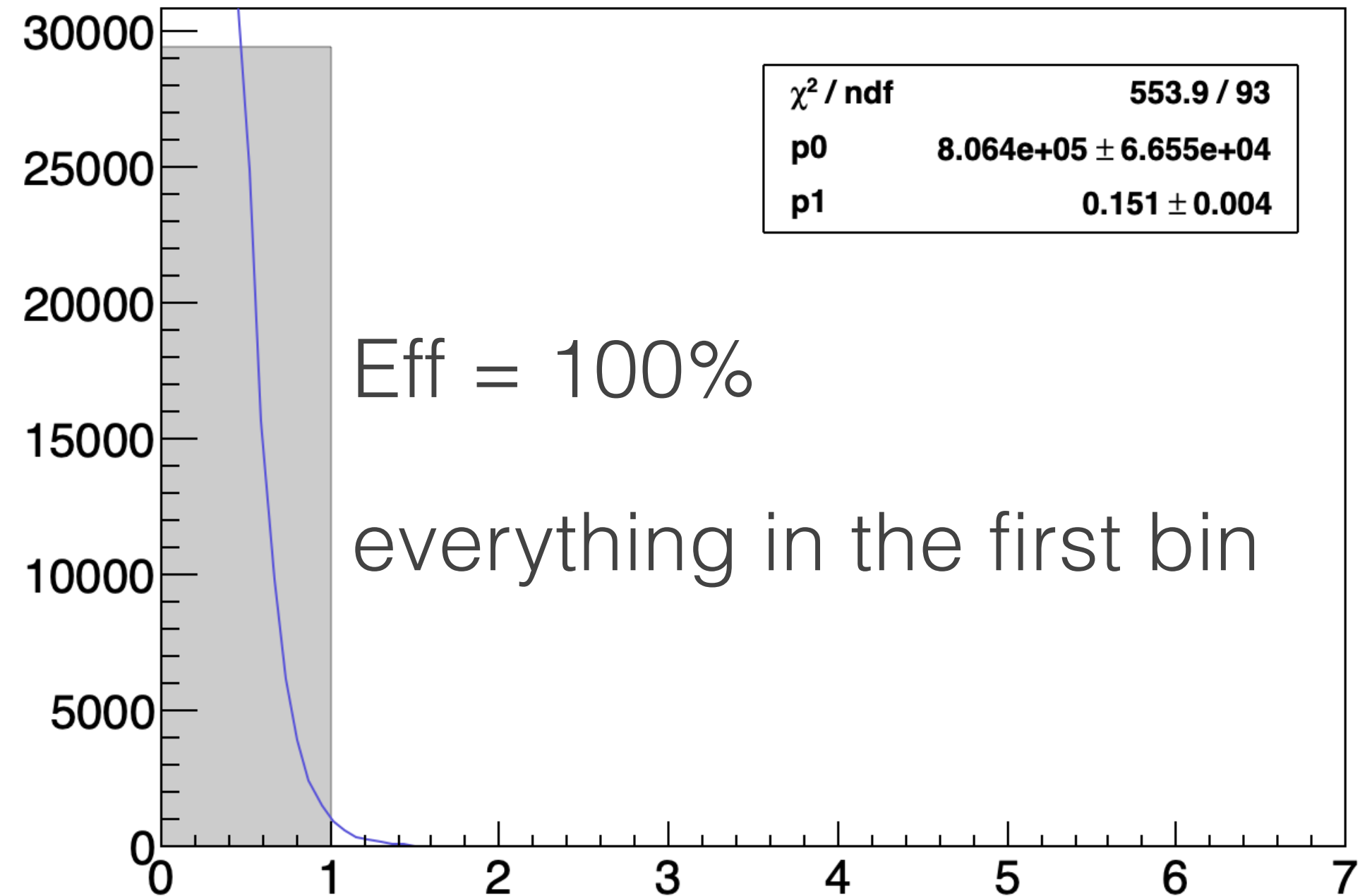
- With very low radon (1 parent each 1e4 sec)

χ^2 / ndf	150.6 / 164
p0	407.1 ± 6.2
p1	24.18 ± 0.26

Eff = 100%

τ = 241 sec

χ^2 / ndf	115.9 / 124
p0	100.9 ± 3.2
p1	23.96 ± 0.57

Eff = 50%

τ = 239 sec

χ^2 / ndf	111.3 / 102
p0	41.23 ± 2.21
p1	22.84 ± 0.97

Eff = 10%

τ = 228 sec

- Found right tau (250 sec) independently form the efficiency

ToyMC: Test II
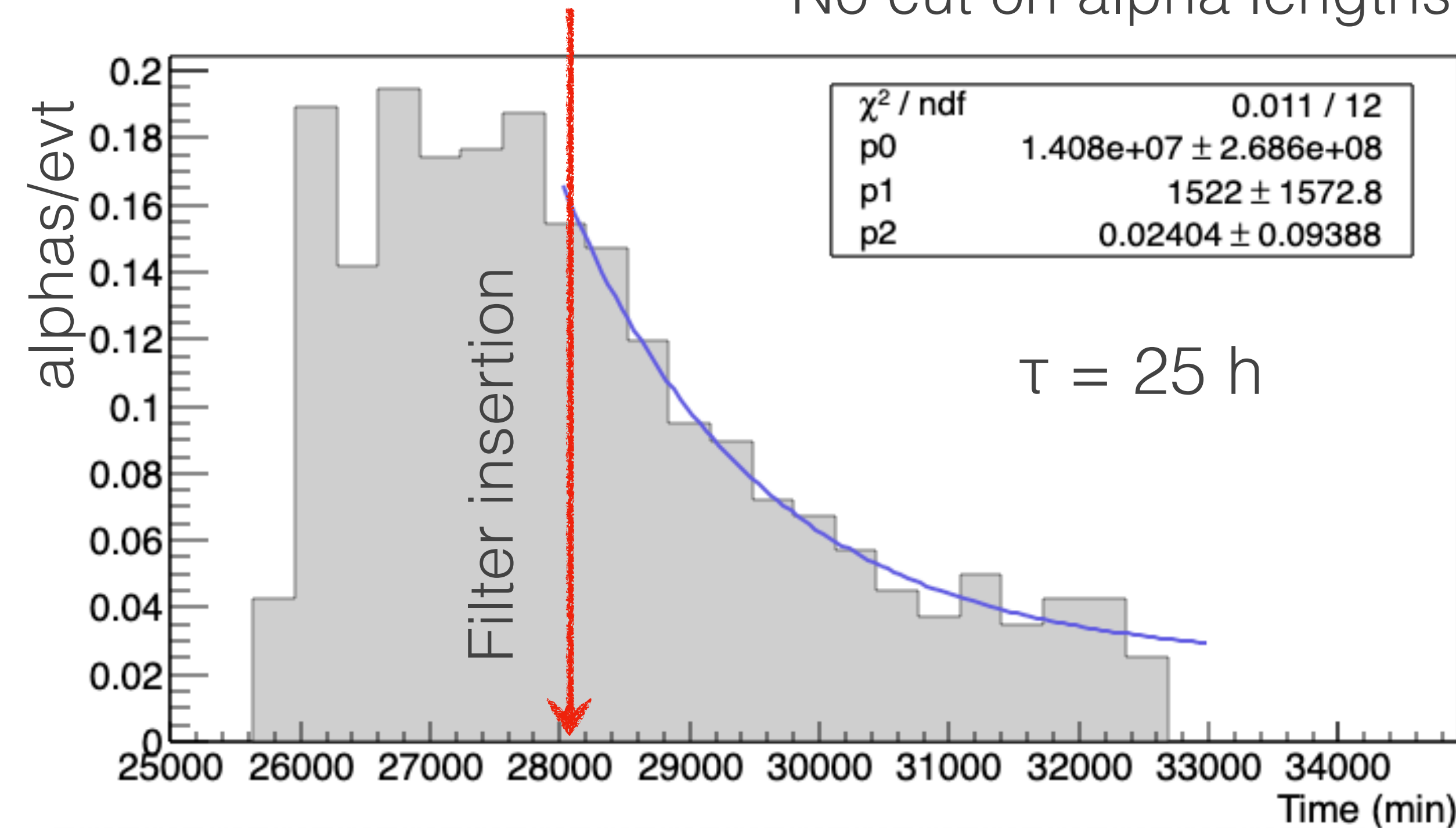
- Made some tests to check possible bugs

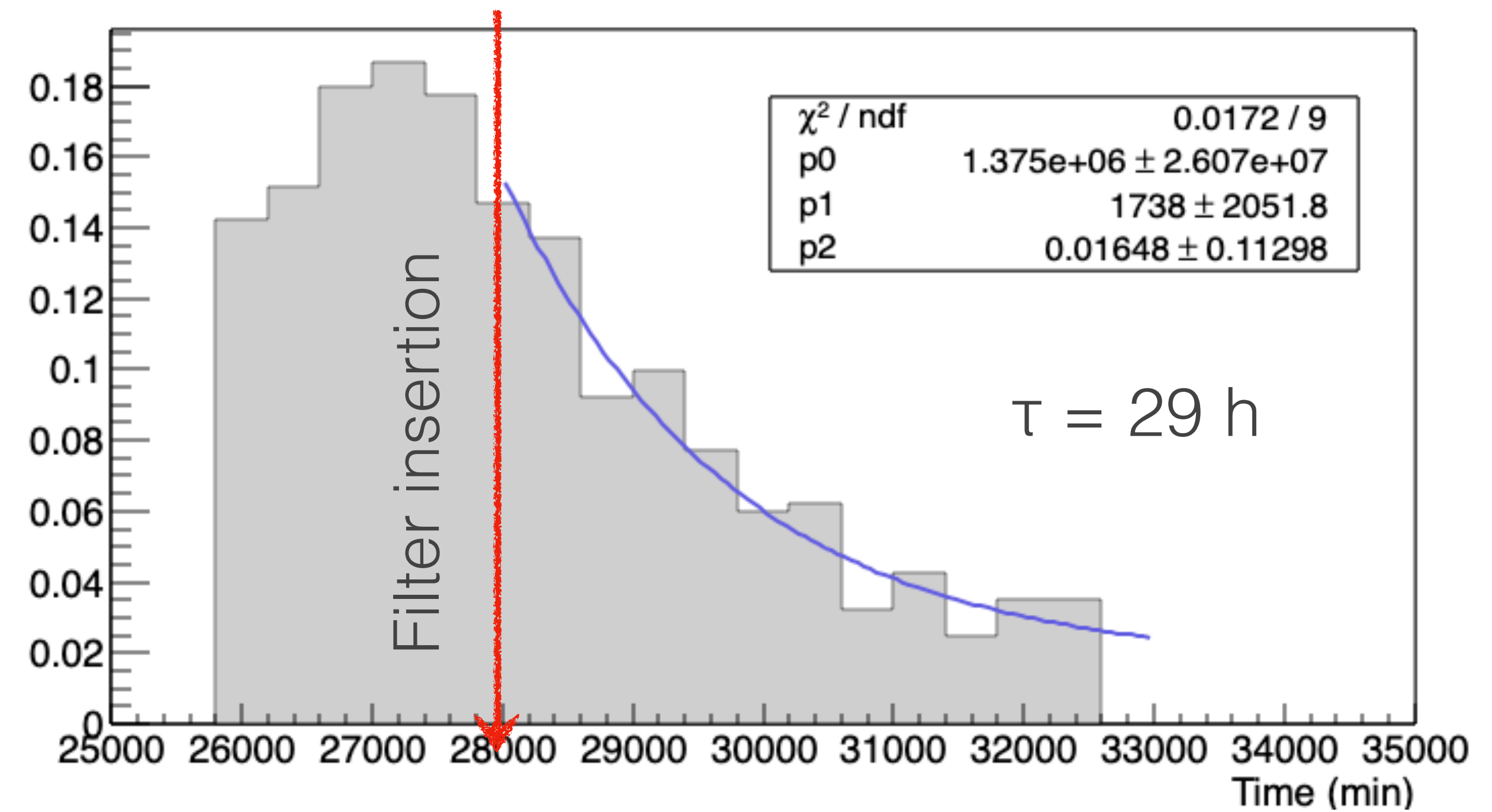- With very high radon (1 parent each 10 sec, i.e. the minimum possible for my Toy).

χ^2 / ndf	553.9 / 93
p0	$8.064e+05 \pm 6.655e+04$
p1	0.151 ± 0.004

Eff = 100%

everything in the first bin

Radon decrease

- Behavior of number of alphas after filter insertion

No cut on alpha lengths

$\tau = 25$ h

35mm<alpha lengths<70mm (2D)

$\tau = 29$ h

- Filter effect clearly visibile, decrease is faster the Rn lifetime (130h)