Estimation of the K_s^0 lifetime

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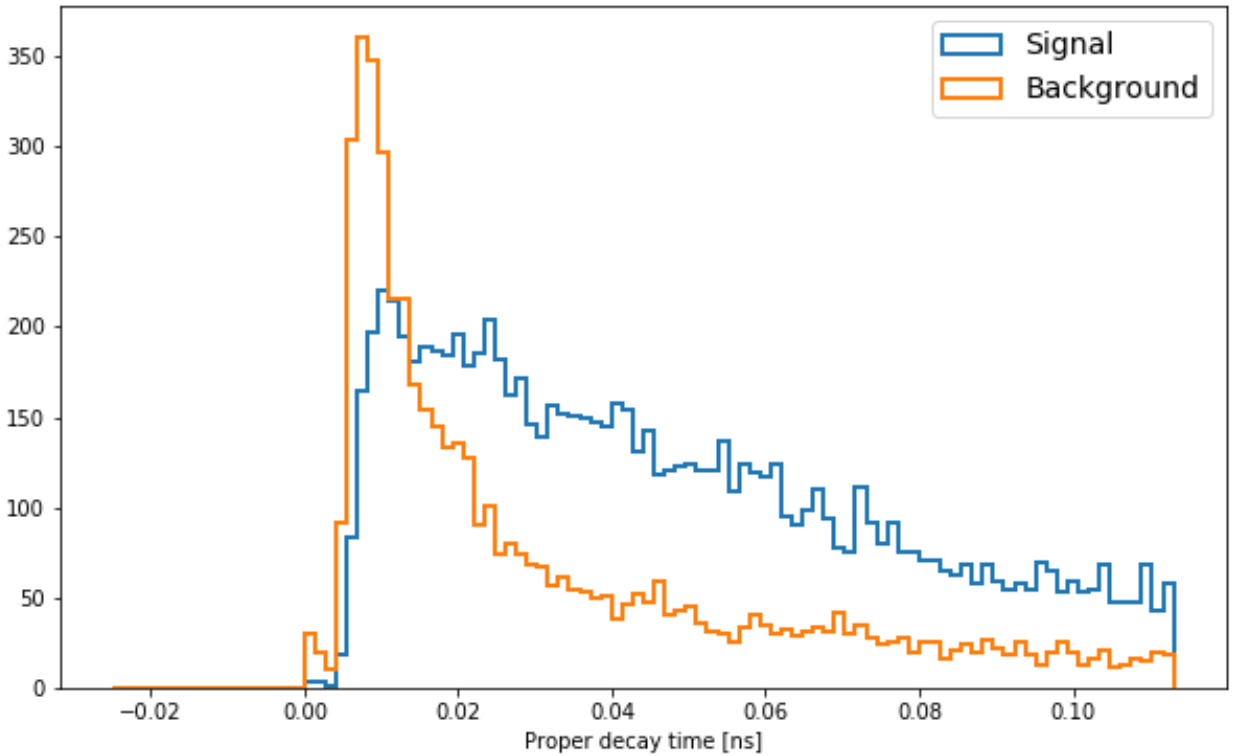
Used datasets

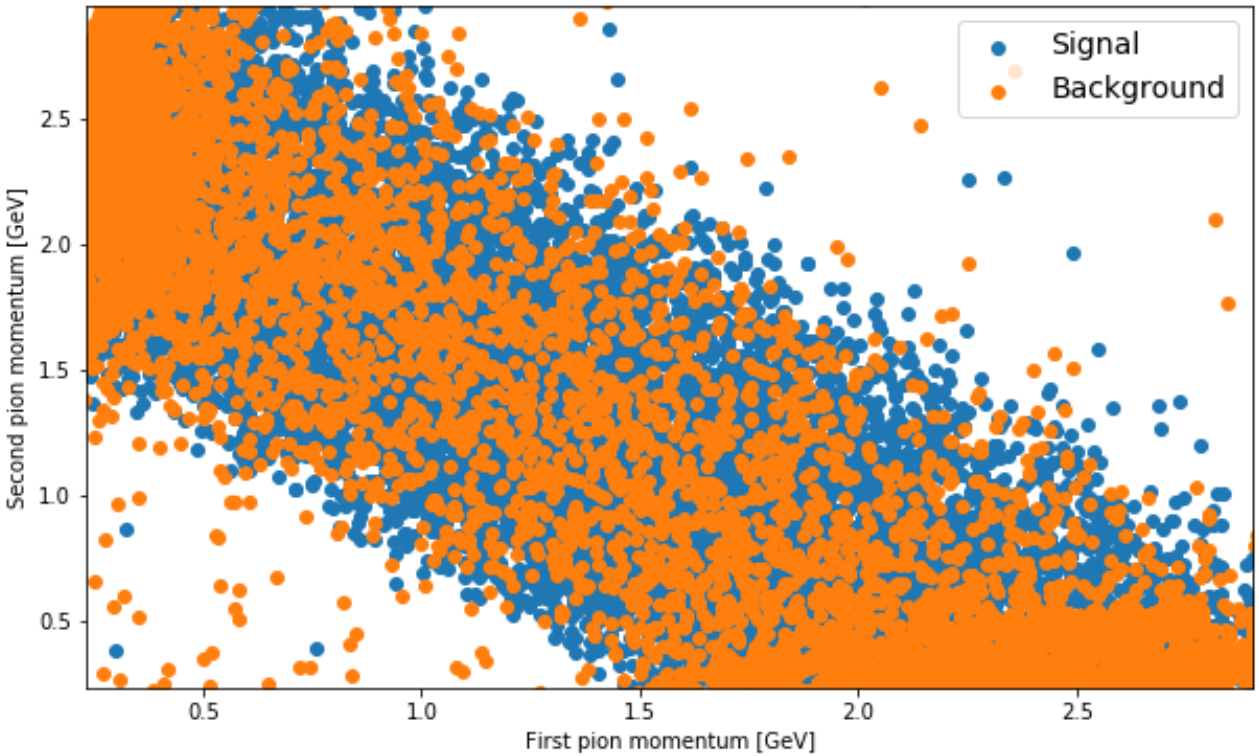
For MC tests $\rightarrow B^0 \rightarrow \eta' K$, B0ch1, unskimmed $c\bar{c}$ 9437
For data tests the Bucket 10 was used, B0ch1
The K_s^0 was reconstructed using the $\pi^+\pi^-$ decay channel

Starting condition



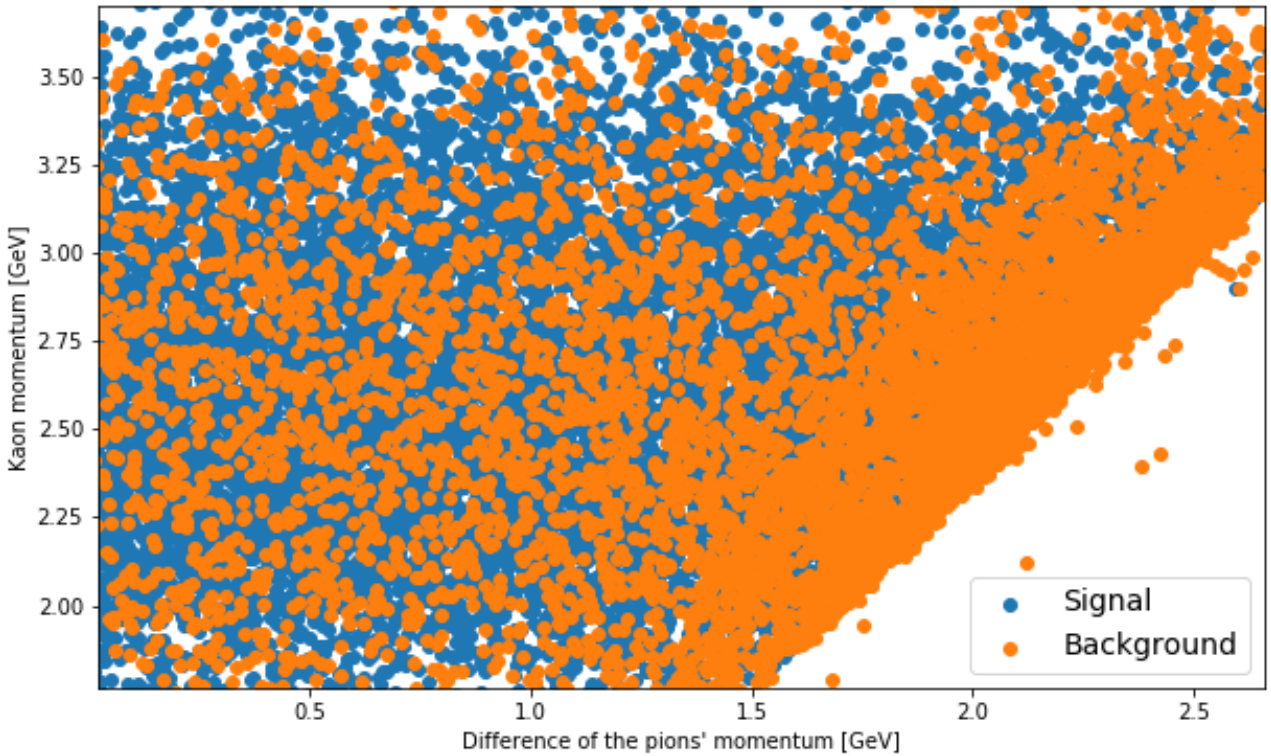
Situation before cuts $\rightarrow$ strong background $\rightarrow$ fit difficult

Background removal



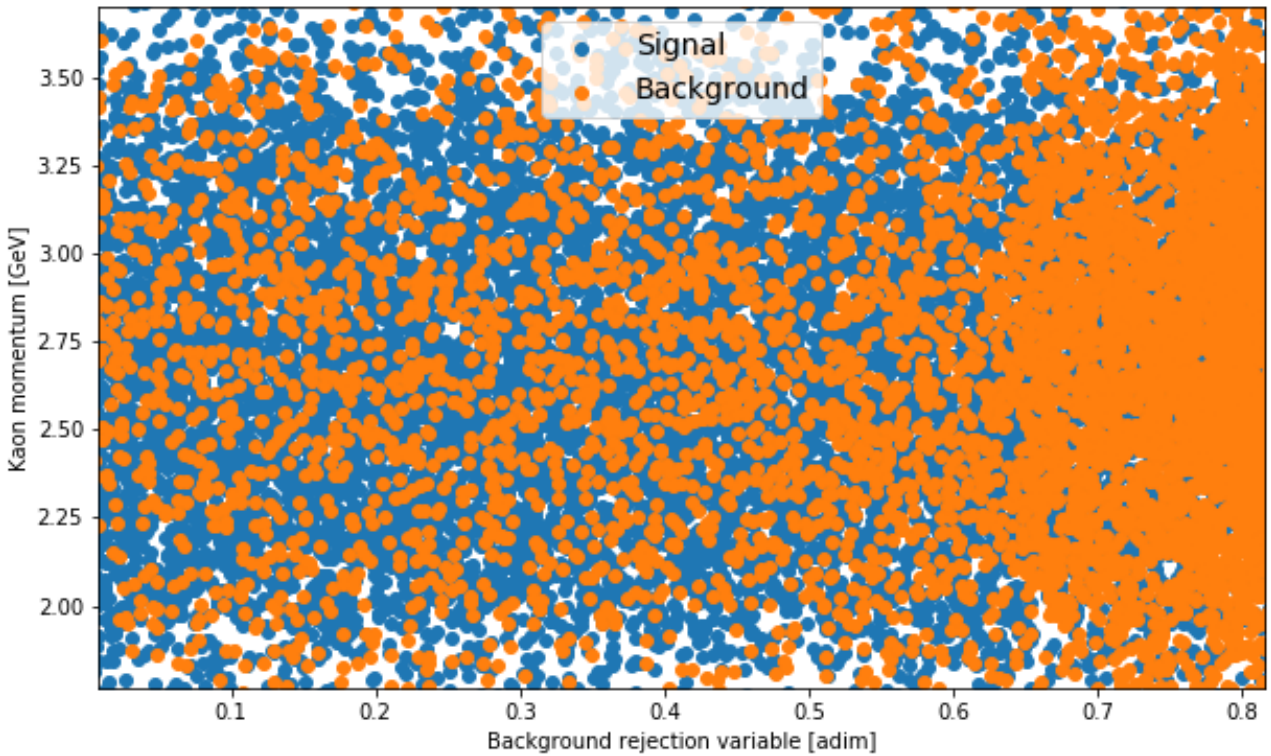
Background "prefers" maximum momentum difference

Background removal



Can we remove this momentum dependence?

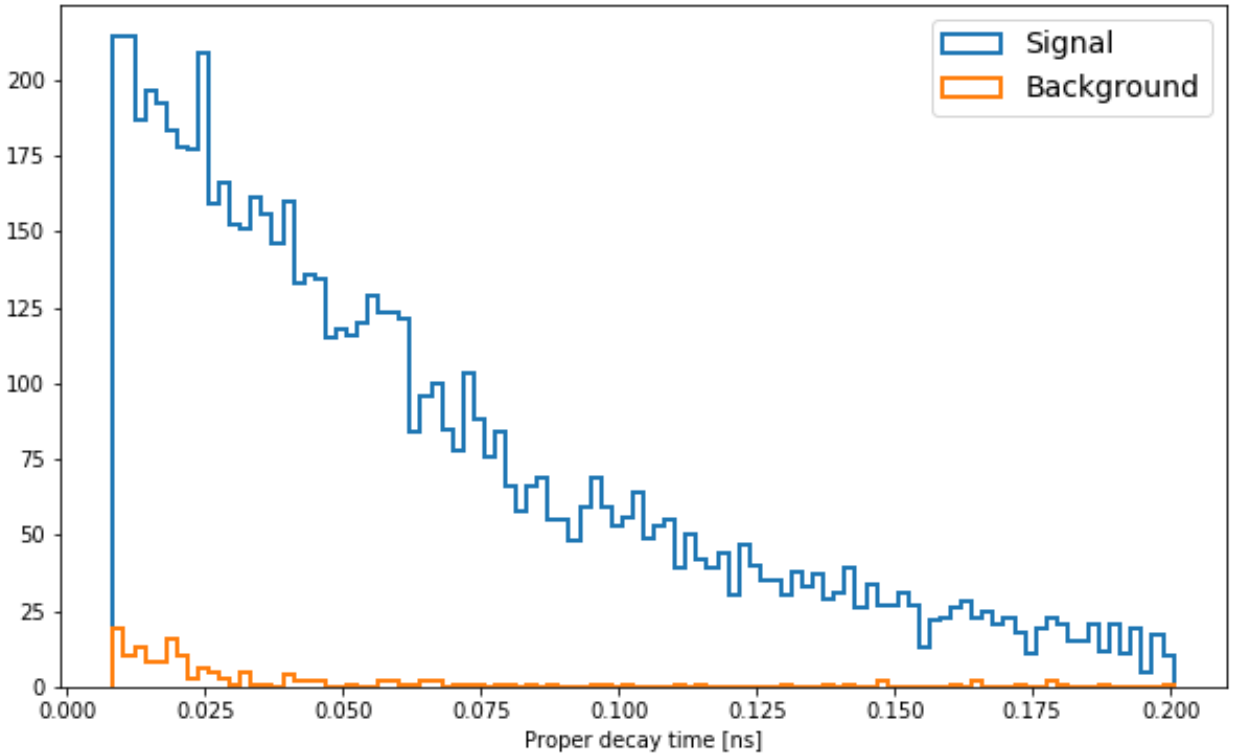
Background removal



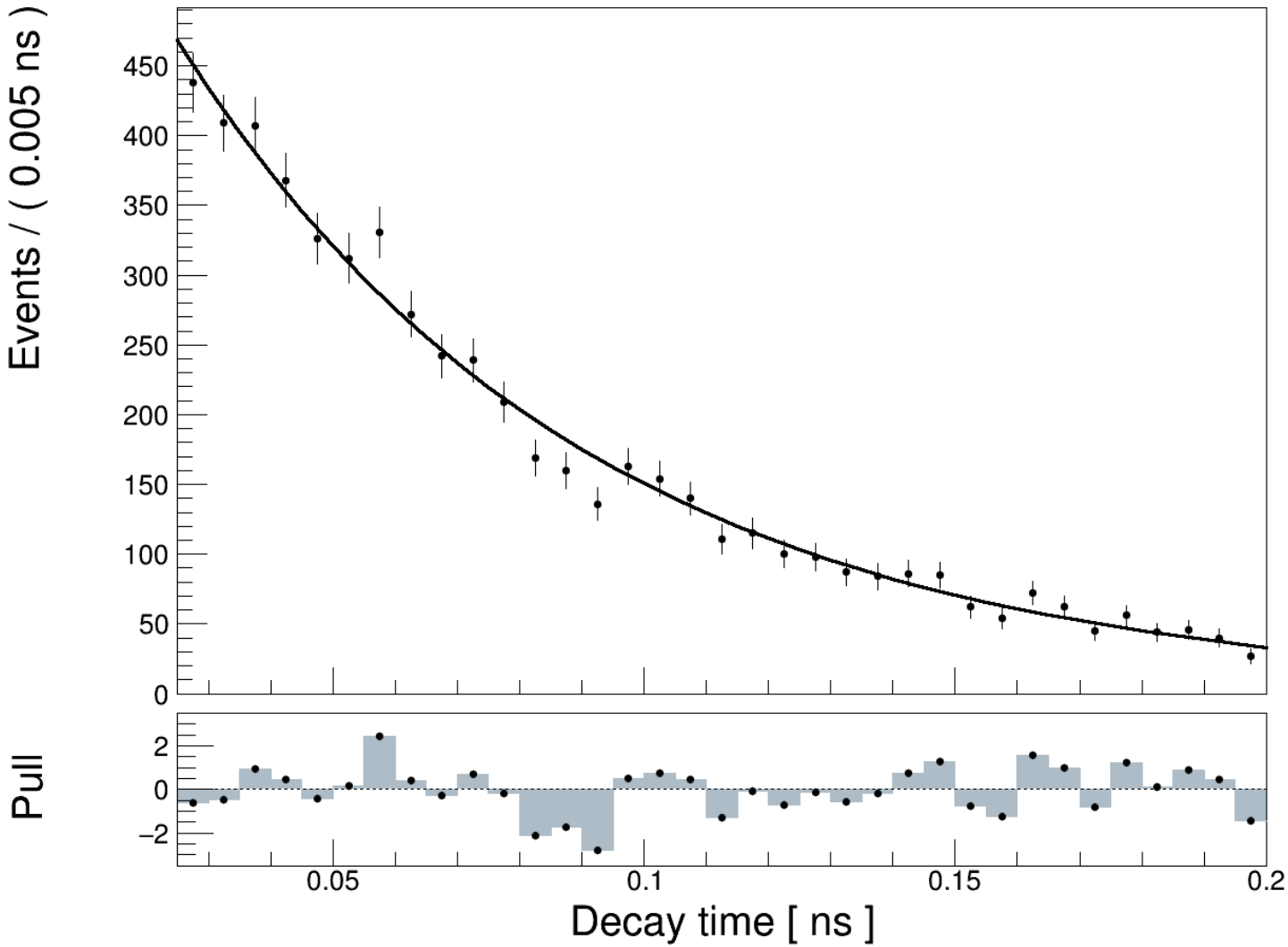
Yes, by diving momentum difference by K_s^0 energy $\rightarrow$ expected value of 0.83

More cuts

K_s^0 mass before kinematic fit constrained in $[0.490, 0.506]$ GeV
Variable discussed before < 0.63
Cosine of angle between momentum and vertex vector > 0.99



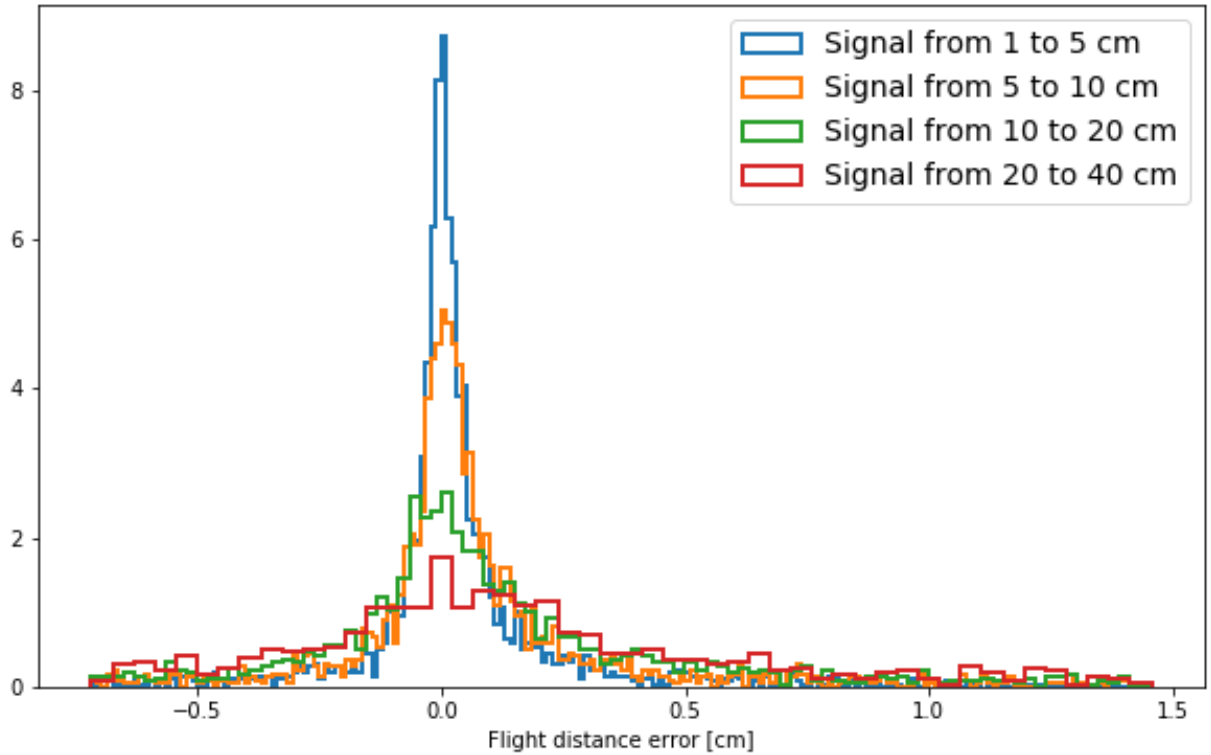
Lifetime fit



Obtained value of 66 ± 1 ps, 20% difference with PDG value of 89 ps

Resolution

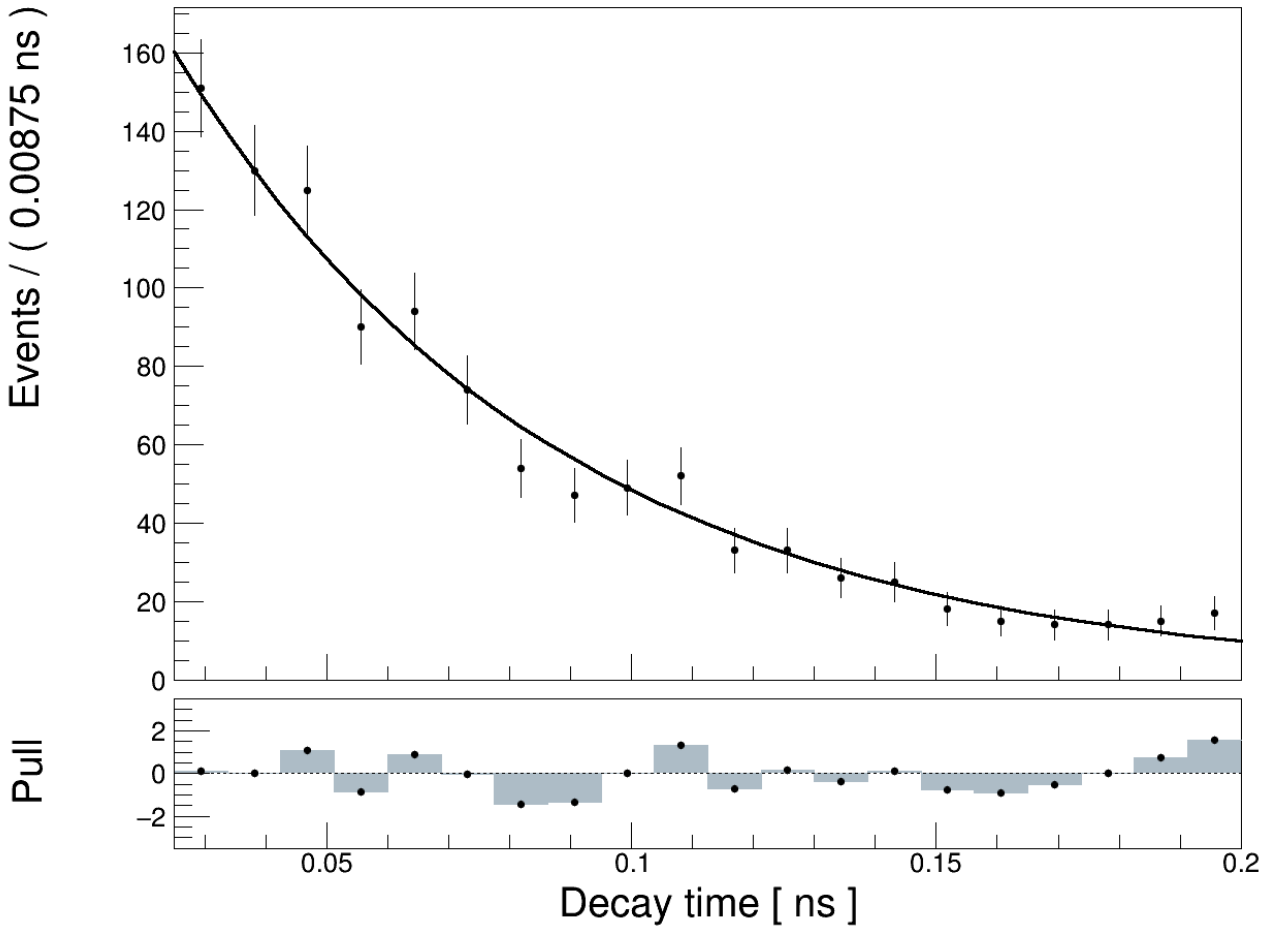
Used MC vertex position, but "measured" momentum to evaluate resolution



Lifetime fit gave exactly same result

Real data

Same procedure as above, real data



Obtained value of 63 ± 3 ps

Thank you!

Backup

Two pions four momentums will be

$$p_1 = (E, \vec{p})$$

$$p_2 = (E, -\vec{p})$$

E and p are constant. Maximum momentum difference in the lab frame when pion momenta is parallel to the kaon momentum.

$$p^{\text{lab}}_{\text{max}} = \gamma(p + \beta E)$$

$$p^{\text{lab}}_{\text{min}} = \gamma(-p + \beta E)$$

So

$$\Delta p^{\text{lab}}_{\text{max}} = p^{\text{lab}}_{\text{max}} - p^{\text{lab}}_{\text{min}} = 2\gamma p$$

$$\frac{\Delta p^{\text{lab}}_{\text{max}}}{E_K} = \frac{2\gamma p}{m_K \gamma} = \frac{2p}{m_k}$$

Remember p is constant, thus giving us the wanted observable.