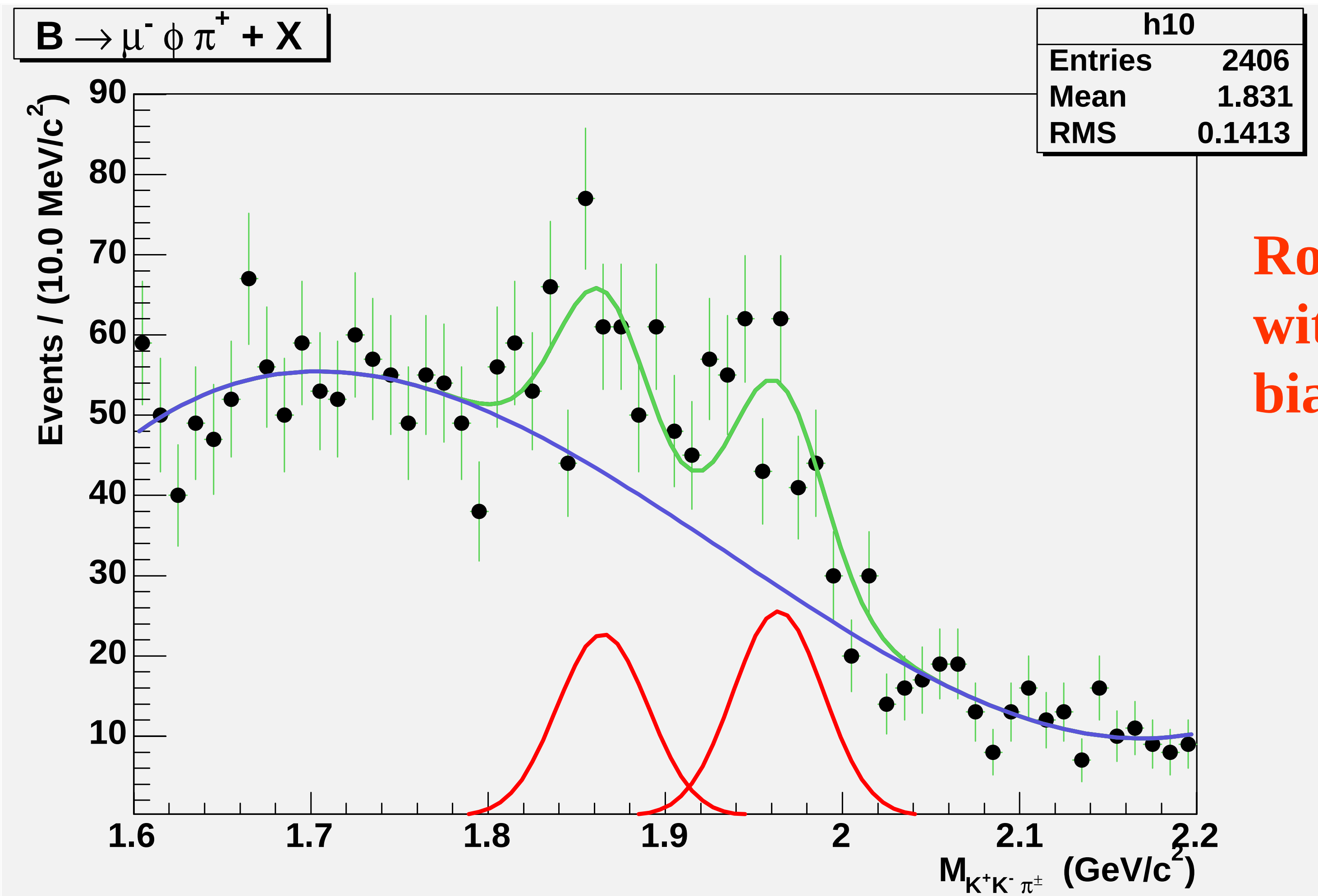
Correcting for the lifetime dependent cuts

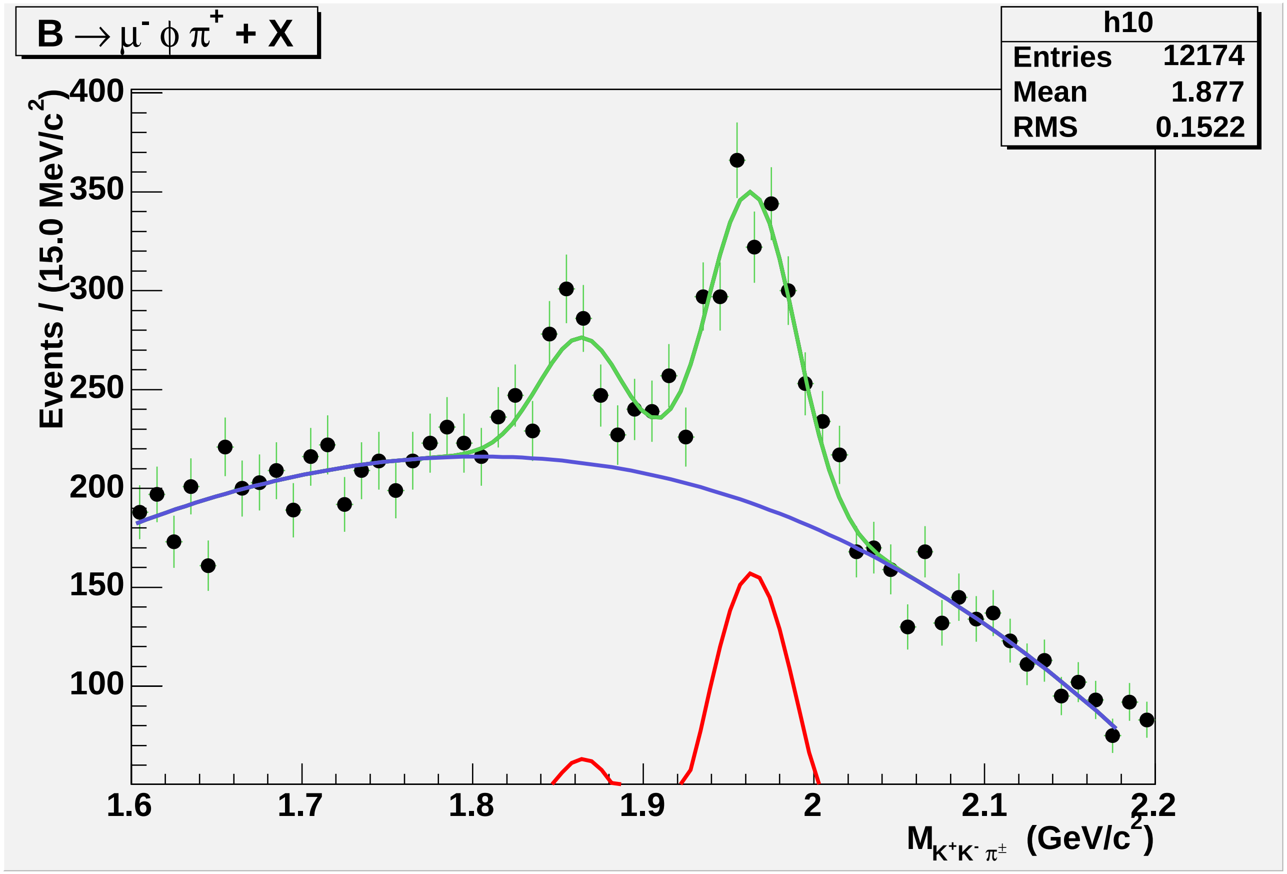
Perhaps, we may have to use lifetime dependent cuts …



Round4: without lifetime biased cuts

- **Without biases, lifetime distribution ~ $e^{-t/\tau}$**
  - **convoluted with a Gaussian in real life (RECO) due to finite detector resolution**
- **With lifetime-dependent/biased cuts, it is no longer $e^{-t/\tau}$, but (say) f(t) —— which is what I am after.**
- **Goal is to find f(t) from the Monte Carlo using the "Truth" information which does not suffer from detector resolution.**
- **Reco-ed tracks are matched with the MC:**
  - **$|\Delta pT| < 0.5$, $|\Delta\phi| < 0.02$, $|\Delta\eta| < 0.02$**

- I’ve taken Wendy’s code (on top of the bmixing_reco) to grab the necessary Monte Carlo information
  - it deals with the B_s mixing information correctly
- I’ve also used Vivek’s lifetime-dependent or independent cuts:



round4

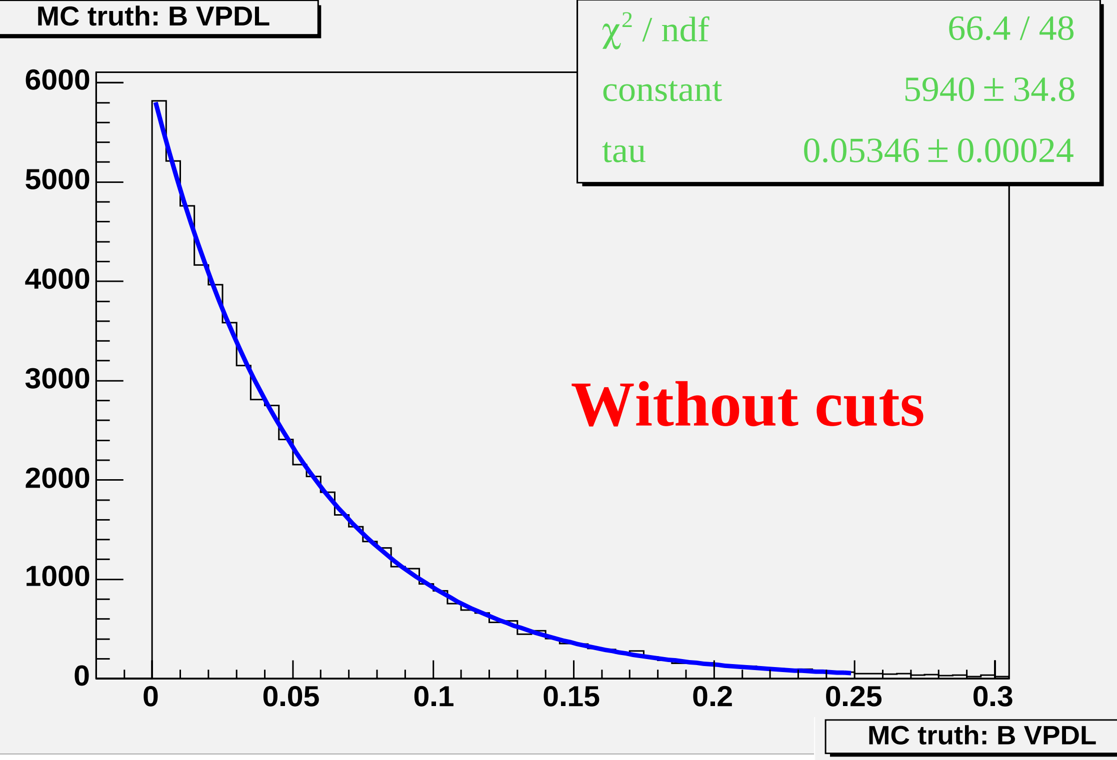
Biased cuts:

- **Imp(μ)/σ > 9 || Imp(π)/σ > 9 || Imp(K)/σ > 9 ;**
- **Imp(π)/σ alone > 2**
- **If (Lxy(D) < Lxy(B)) |Imp(BD)/σ| < 3**
- **cos(D,B) > 0.85; COLL > 0.**

Unbiased cuts:

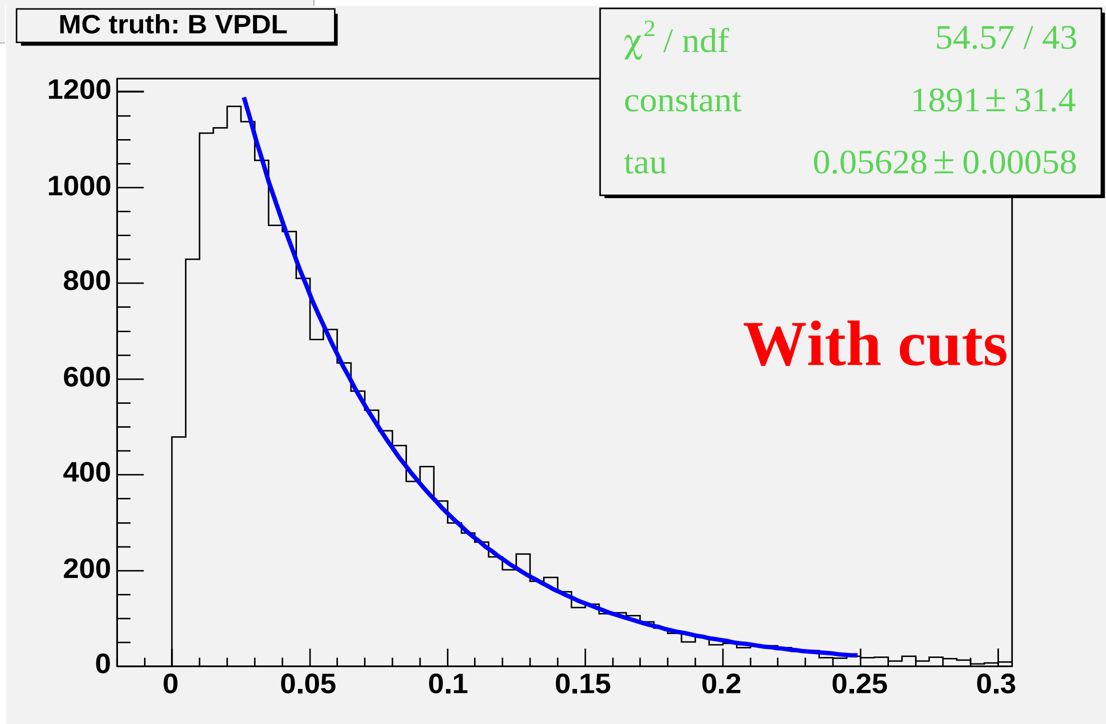
- **pT(μ) > 1.5 ; pT(π) > 0.7; pT($K^{\pm}$) > 0.7**
- **P_{tot}(B) > 8 ; P_{tot}(μ) > 3 ; P^{rel}(μ) > 1**
- **1.006 < M(ϕ) < 1.032 GeV**
- **Helicity (K,D) > 0.5**

Only MC "Truth" information

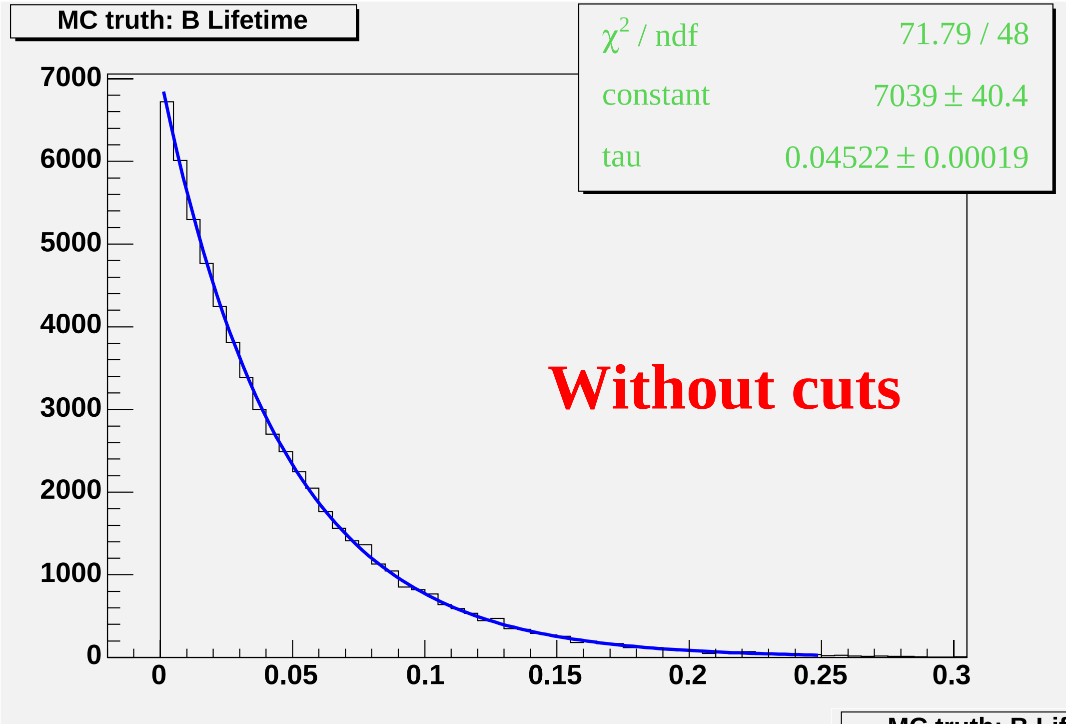


VPDL ~ $Lxy(B)*M(B)/p_T(D_s\mu)$

x–axes in cm

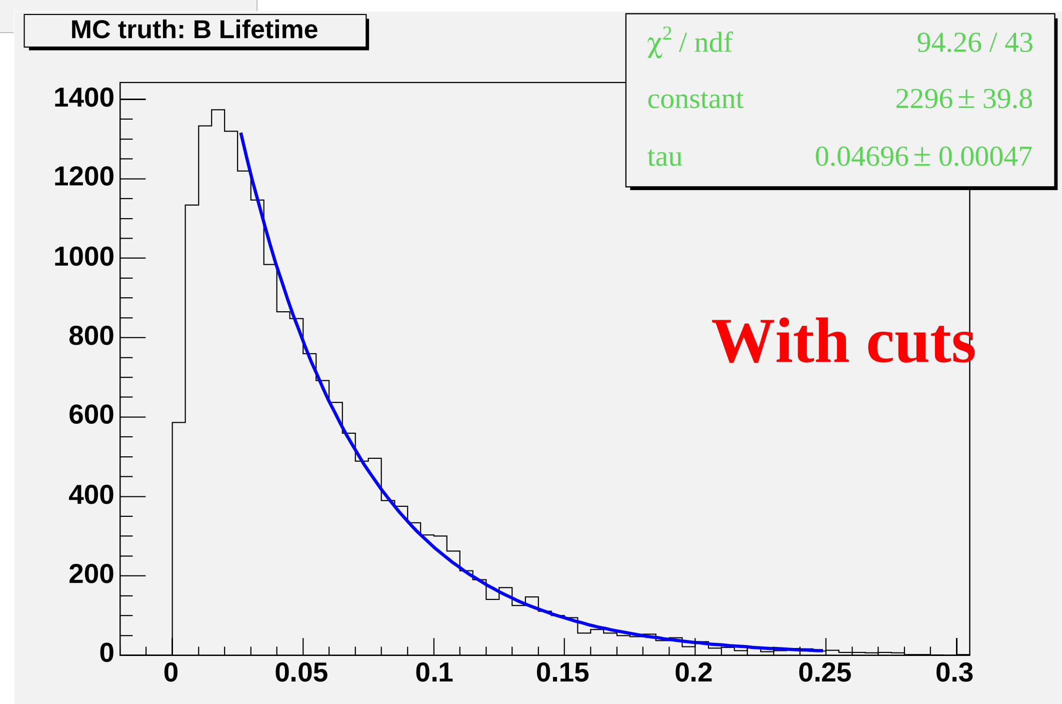


Only MC "Truth" information

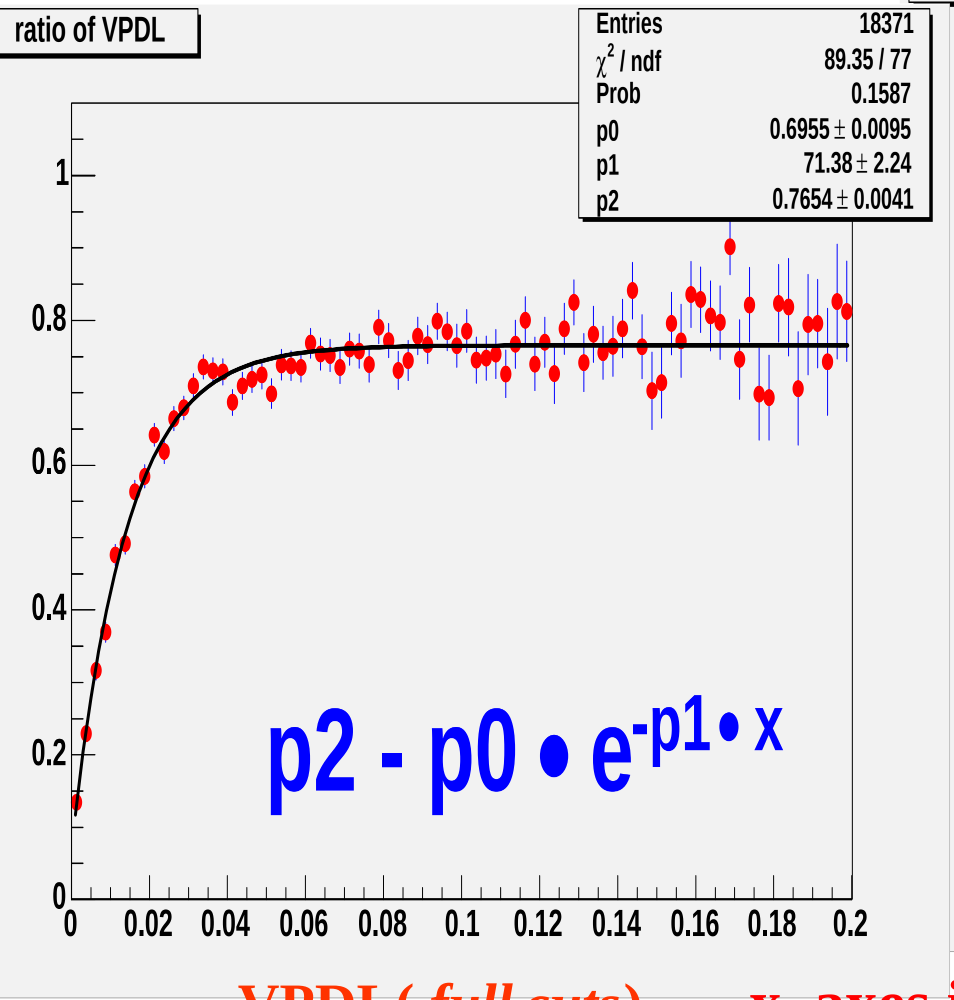


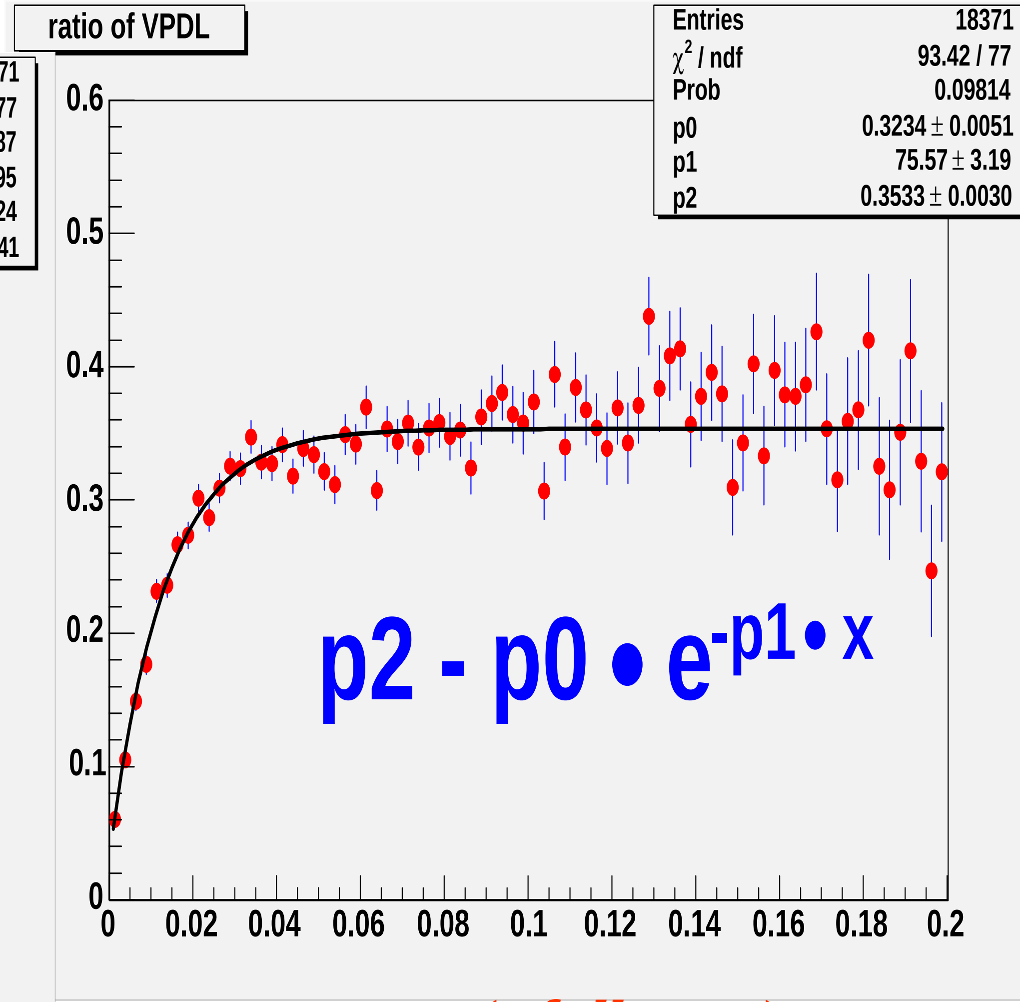
Lifetime ~ $Lxy(B)*M(B)/p_T(B)$

x–axes in cm



For now (at least), we consider the ratios of lifetime with and without certain cuts.

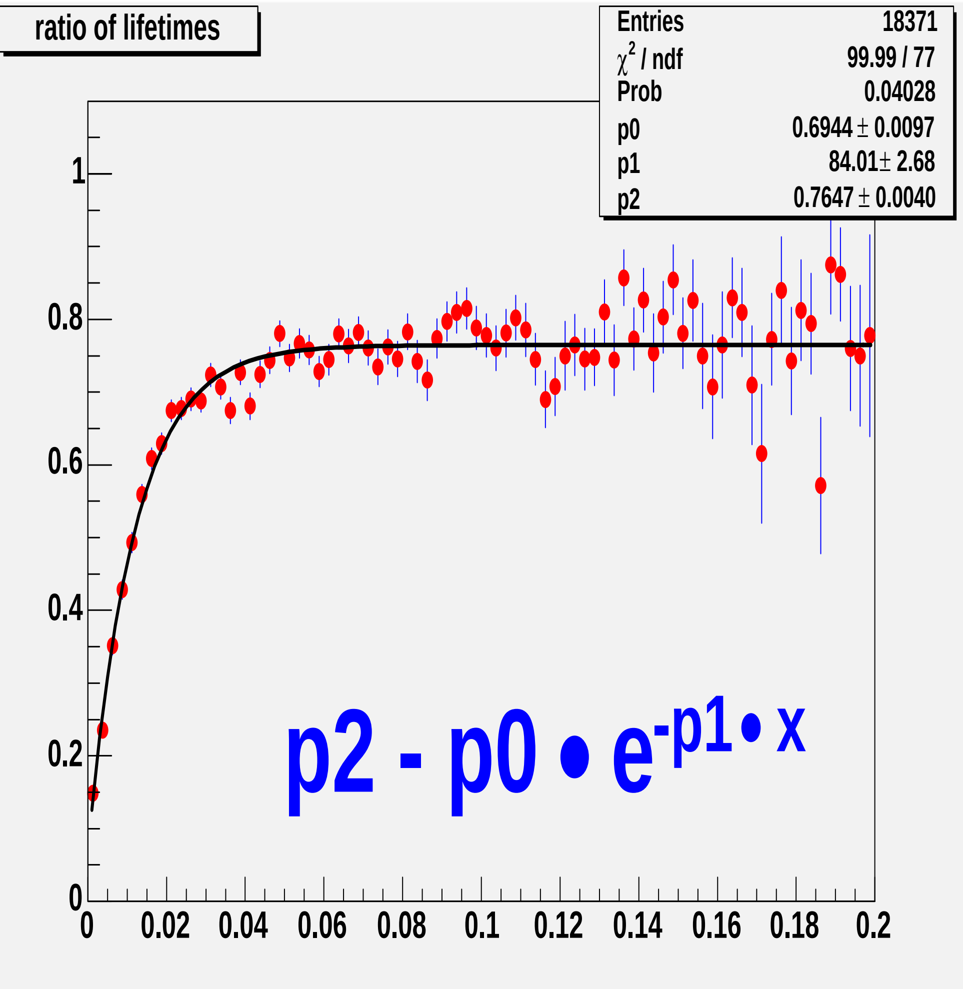


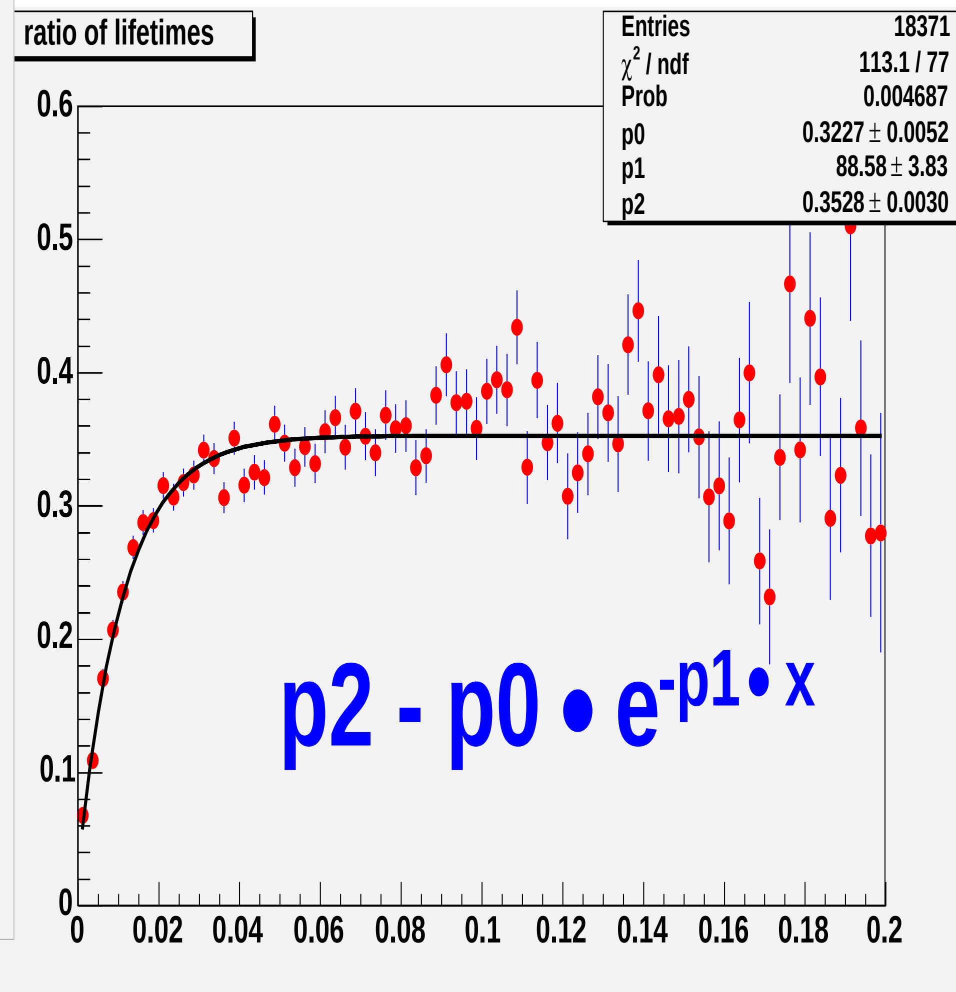


$$\frac{\text{VPDL}(\textit{ full cuts })}{\text{VPDL}(\textit{unbiased cuts})}$$

x–axes in cm

$$\frac{\text{VPDL}(\textit{ full cuts })}{\text{VPDL}(\textit{ no cuts })}$$





$$\frac{\text{Lifetime}(\textit{full cuts})}{\text{Lifetime}(\textit{unbiased cuts})}$$

x–axes in cm

$$\frac{\text{Lifetime}(\textit{full cuts})}{\text{Lifetime}(\textit{no cuts})}$$

Thinking …

- $f(t) \sim (\, p_2 - p_0 e^{-p_1 \bullet t}\,) \bullet e^{-t/\tau}$
- **With no biased cuts, reconstructed lifetime distribution in data** $\sim \int E \bullet G \, dt'$

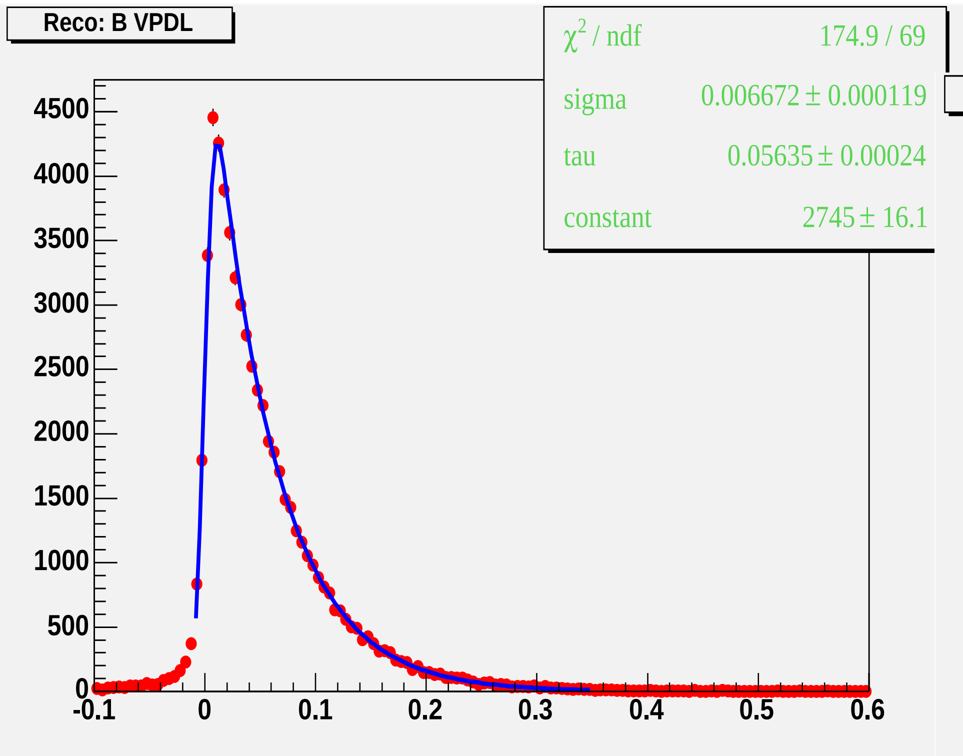
  where $E \sim e^{-t'/\tau}$ **when** $t \geq 0$; **otherwise** $E=0$;

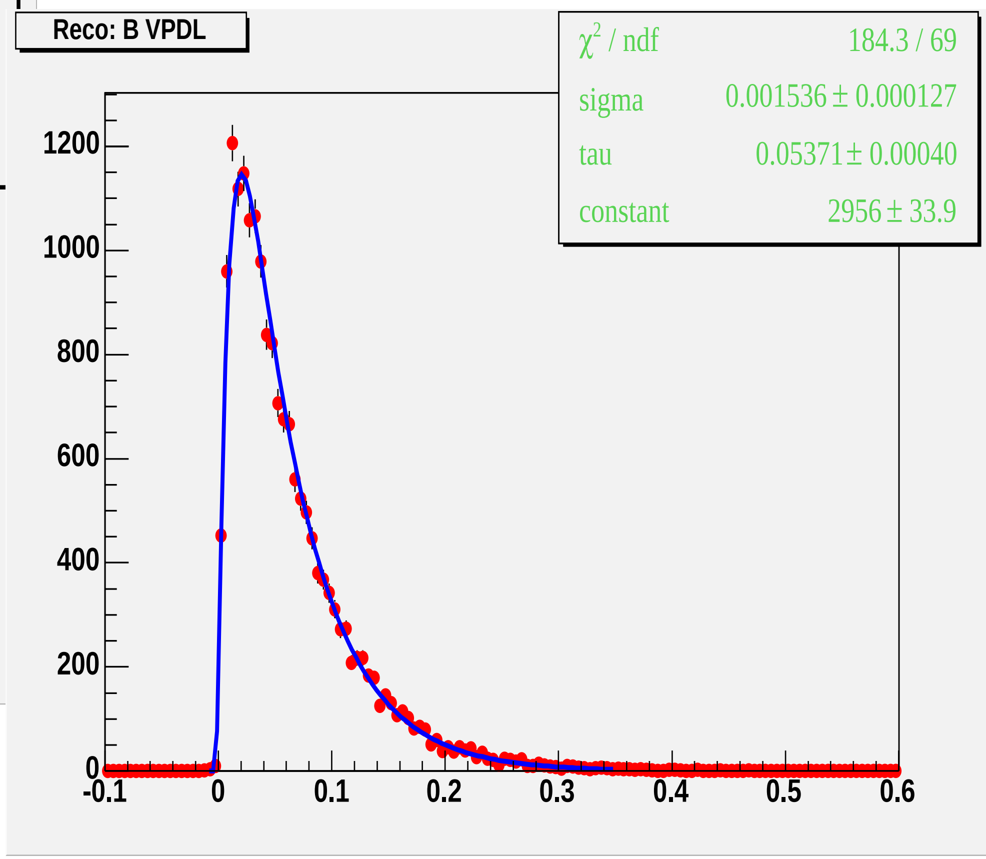
- **With biased cuts, the distribution is**

  $\sim \int E \bullet (\, p_2 - p_0 e^{-p_1 \bullet t'}\,) \bullet G \, dt'$

Fitting ∫ E • G dt′ against the reconstructed VPDL when there is no cut applied.

Fitting ∫ E • (p2 - p0e$^{-p1 \cdot t'}$) • G dt′ against the reconstructed VPDL when all the cuts are applied.





x–axes in cm

To do …

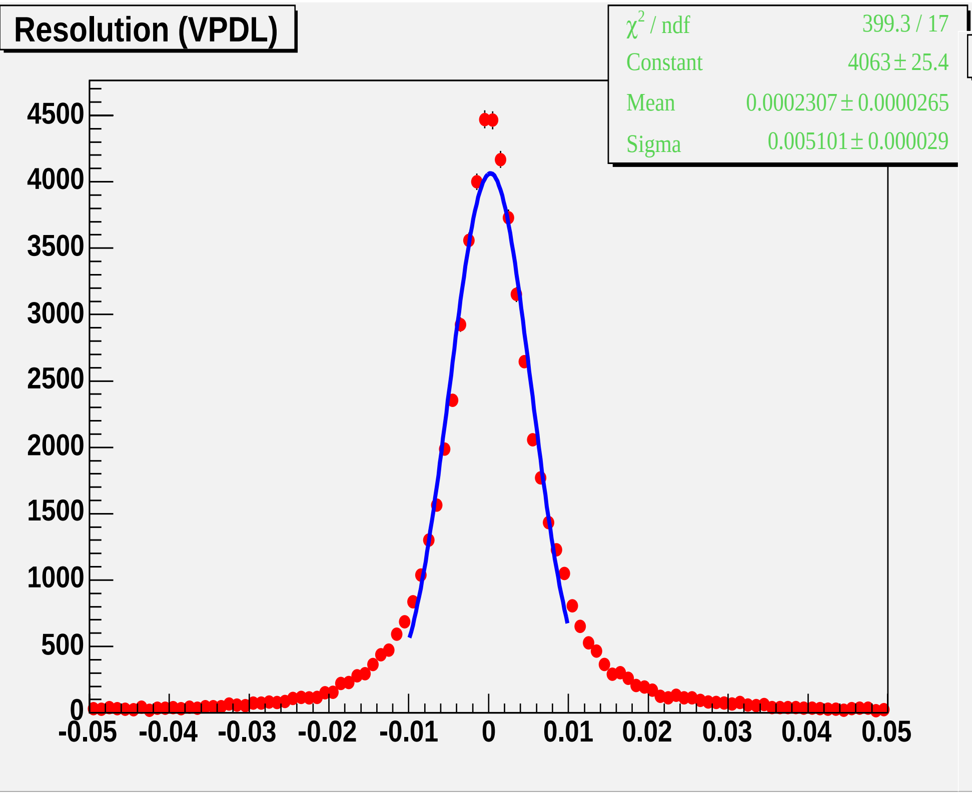
- The 2 Gaussian σ's are quite different in the 2 fits
- Need to understand what it is going on … I've checked by
  - fitting the 2 convoluted functions on the MC "Truth" lifetime and I do get very small Gaussian σ.
  - fitting the 2 convoluted on the toy MC distributions to get the right sigma that I put in.
- Tried adding mass cuts/separating events into 2 groups … don't help

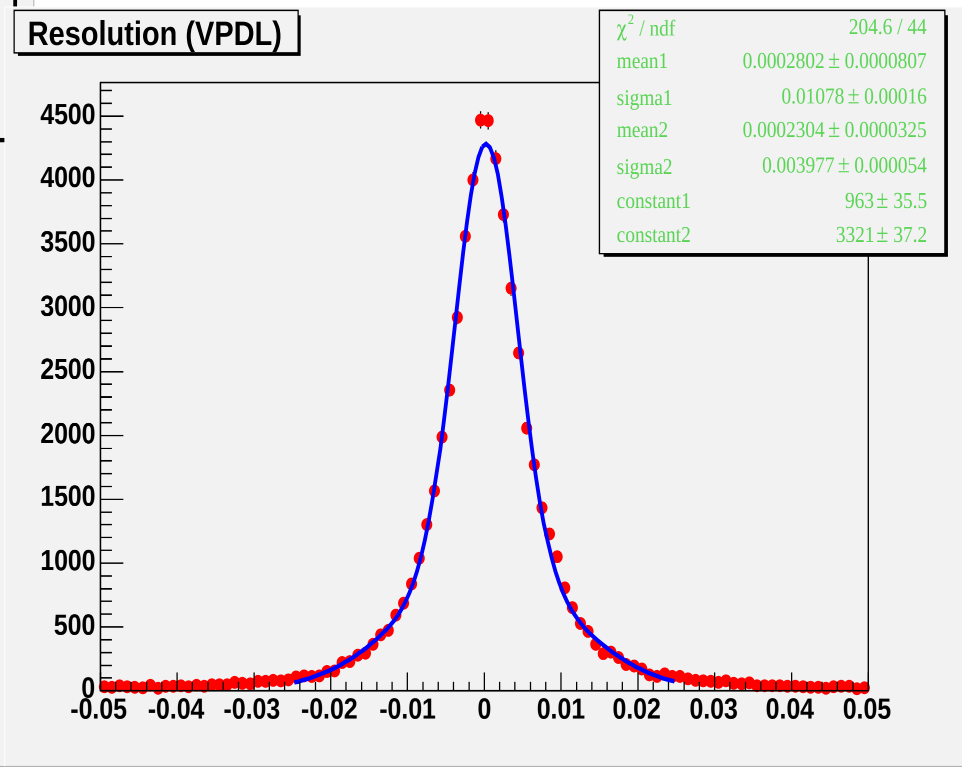
Backup Slides

VPDL resolution

One Gaussian fit

Two Gaussian fit





x–axes in cm