

Updates on the $B^\pm \rightarrow K^\pm \tau^\pm \ell^\mp$

Inclusion of $\tau \rightarrow \rho \nu_\tau$ mode

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Selection criteria

Charged tracks

- Impact parameters: $|dr| < 1 \text{ cm}$ & $|dz| < 4 \text{ cm}$.
- Track momentum $p > 50 \text{ MeV}/c$.
- *electrons* : $e_{\text{ID}} > 0.6, \mu_{\text{ID}} < 0.98$,
 $\text{atcPIDBelle}(K, e) < 0.98$
- *muons* : $\mu_{\text{ID}} > 0.6, e_{\text{ID}} < 0.98$,
 $\text{atcPIDBelle}(K, \mu) < 0.98$
- *pions* : $\mu_{\text{ID}} < 0.6, e_{\text{ID}} < 0.6$,
 $\text{atcPIDBelle}(\pi, K) > 0.4$
- *Kaons* : $\mu_{\text{ID}} < 0.98, e_{\text{ID}} < 0.98$,
 $\text{atcPIDBelle}(K, \pi) > 0.6$

ECL Clusters, π^0 , & ρ^+

- goodBelleGamma: $E_{\gamma}^{\text{FE}} > 100 \text{ MeV}$, $E_{\gamma}^{\text{BR}} > 50 \text{ MeV}$, $E_{\gamma}^{\text{BE}} > 150 \text{ MeV}$.
- FakePhoton > 0.3 , BeamBackground > 0.3
- π^0 : $80 < M_{\gamma\gamma} < 180 \text{ MeV}/c^2$ & $\text{chiProb} > 0.001$
- ρ^+ : $570 < M_{\pi^+\pi^0} < 970 \text{ MeV}/c^2$.

$B^\pm$ signal and ROE side

- $m_{D^{0(*)} \text{ inclusive}} < 2.15 \text{ GeV}/c^2$, $|M_{\gamma\gamma} - m_{\pi^0}| < 20 \text{ MeV}/c^2$, & $|\sin \phi| < 1.0$.

Veto conditions

- $|m_{K^+\pi^-} - m_{D^0}| > 200 \text{ MeV}/c^2$ for the $B^+ \rightarrow K^+\tau^-[\pi^-\pi^0\nu_\tau]\ell^+$ system.
- $m_{K^+\rho^-} > 1.95 \text{ GeV}/c^2$ for the $B^+ \rightarrow K^+\tau^-[\rho^-\nu_\tau]\ell^+$ system.
- $m_{e_{\text{sig}}^\pm e_{\text{tag}}^\mp} > 100 \text{ MeV}/c^2$.

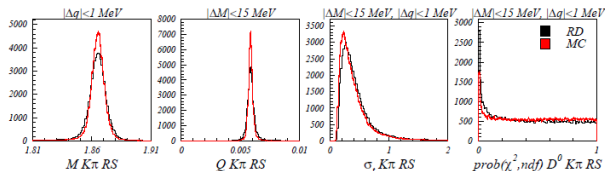
Randomisation of the selected candidates



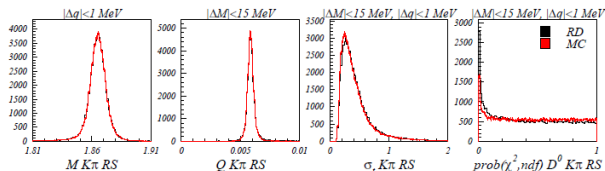
Results



$D^0 \rightarrow K^- \pi^+$, exp. 31, caseB (no track smearing)



$D^0 \rightarrow K^- \pi^+$, exp. 31, caseB (track smearing)

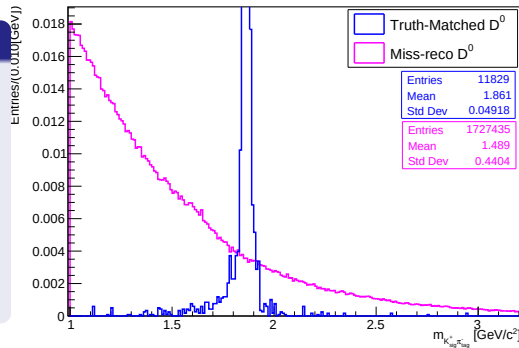


- Details can be find [here](#)
- SmearTrack=0 $\Rightarrow$ No smearing
- SmearTrack=1 $\Rightarrow$ smears track parameters in `mdst_trk_fit`, and applies `scale_error` if not yet applied.
- SmearTrack=2 $\Rightarrow$ smears momenta in `mdst_charged` as well as track params. in `mdst_trk_fit`, and applies `scale_error` if not yet applied.
- To reproduce the results, either choose no smearing or set the random seed to be a constant.

D^0 veto: $K^-_{\text{signal side}} \& \pi^+_{\text{ROE side}}$

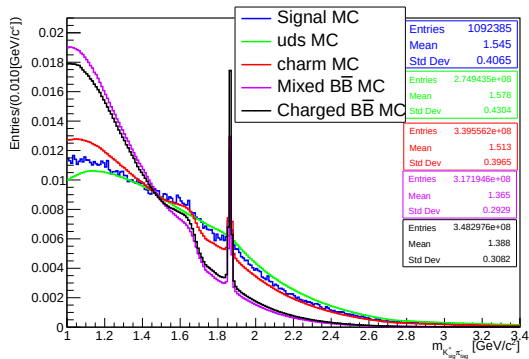
Procedure

- Select K^+ from the decay chain $B^+ \rightarrow K^+ \tau^\pm \ell^\mp$.
- Select good π^- from the charged particles in ROE.
- Combine to reconstruct the decay $\bar{D}^0 \rightarrow K^+ \pi^-$.

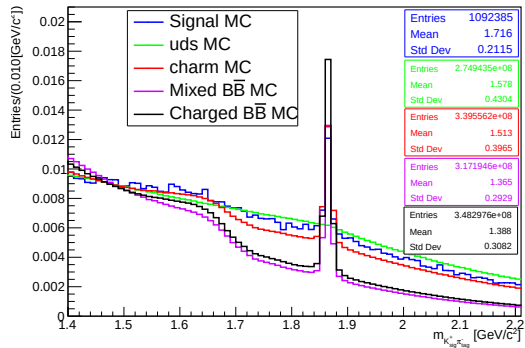


- **Important note:** Here, a D^0 list is selected for each B^+ candidate.
- **Next:** I will select the best $K\pi$ combination with invariant mass closest to D^0 nominal mass.

D^0 InvM: Signal and Background distributions



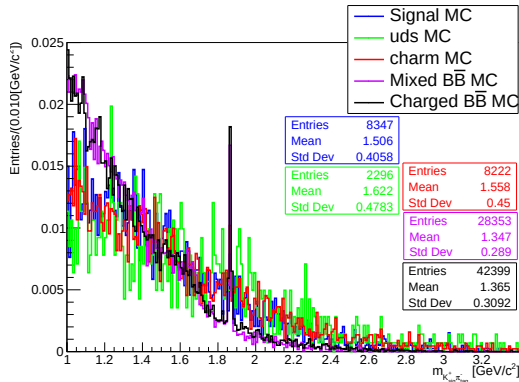
Wide range



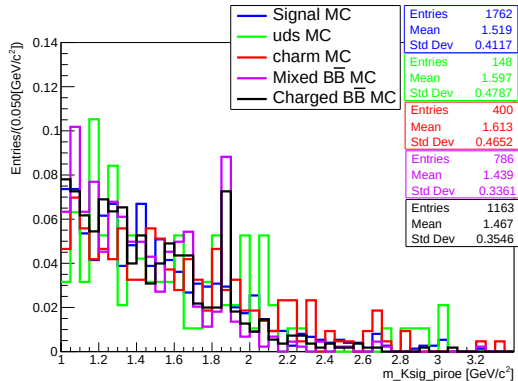
Zoomed in

- **Next:** Assign this information to the $\Upsilon(4S)$ tree and require $|\sin \phi| < 1$.

D^0 InvM: $|\sin \phi| < 1$



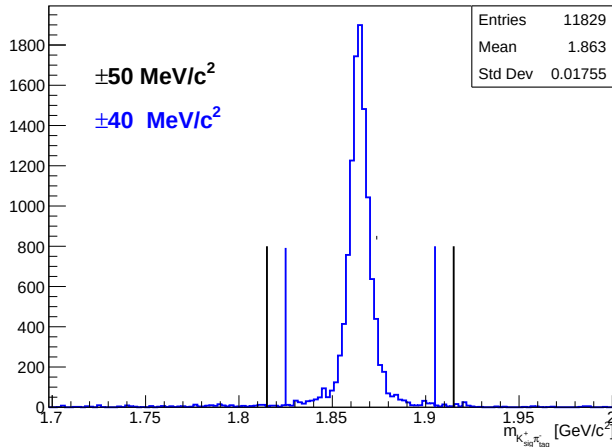
$|\sin \phi| < 1$



Other vetos

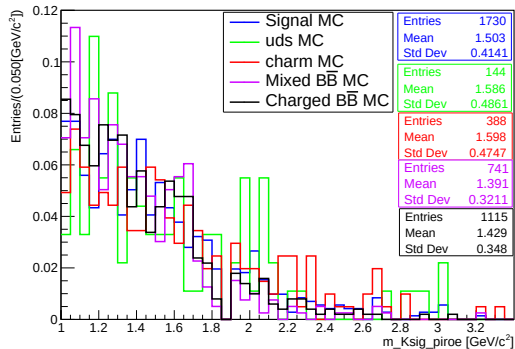
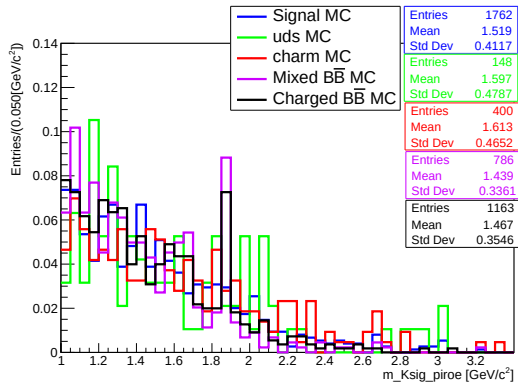
- **Next:** Compute a window to veto the peaking candidates.

D^0 InvM: Veto



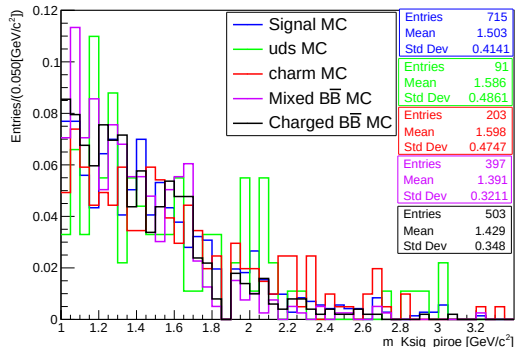
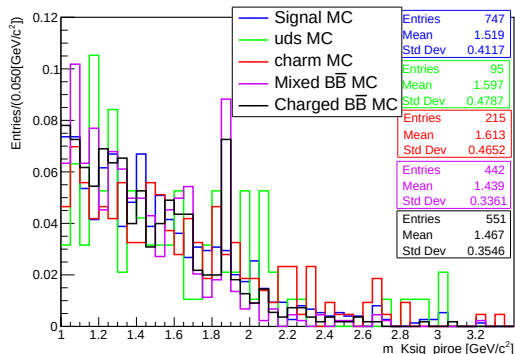
- Veto: $|m_{K^+\pi^-} - 1.865| > 0.04 \text{ GeV}/c^2$.

Impact: Including NAN



- % signal loss: 1.8%, True signals: 2.0% and Miss-reconstructed signals: 1.4%
- uds: 4.3%, Charm: 3.0%, mixed- $B\bar{B}$: 5.7%, & charged- $B\bar{B}$: 4.1%

Impact: Excluding NAN



- % signal loss: 4.3%, True signals: 5.3% and Miss-reconstructed signals: 2.7%
- uds: 4.3%, Charm: 5.6%, mixed-B $\bar{B}$: 10.2%, & charged-B $\bar{B}$: 8.7%

Next to do

- Raise a flag if a D^0 is reconstructed so that it does not affect the candidate for which no D^0 veto is found.

Back Up