$\phi \to K^+K^-$ and $K^0_S \to \pi^+\pi^-$ reco updates

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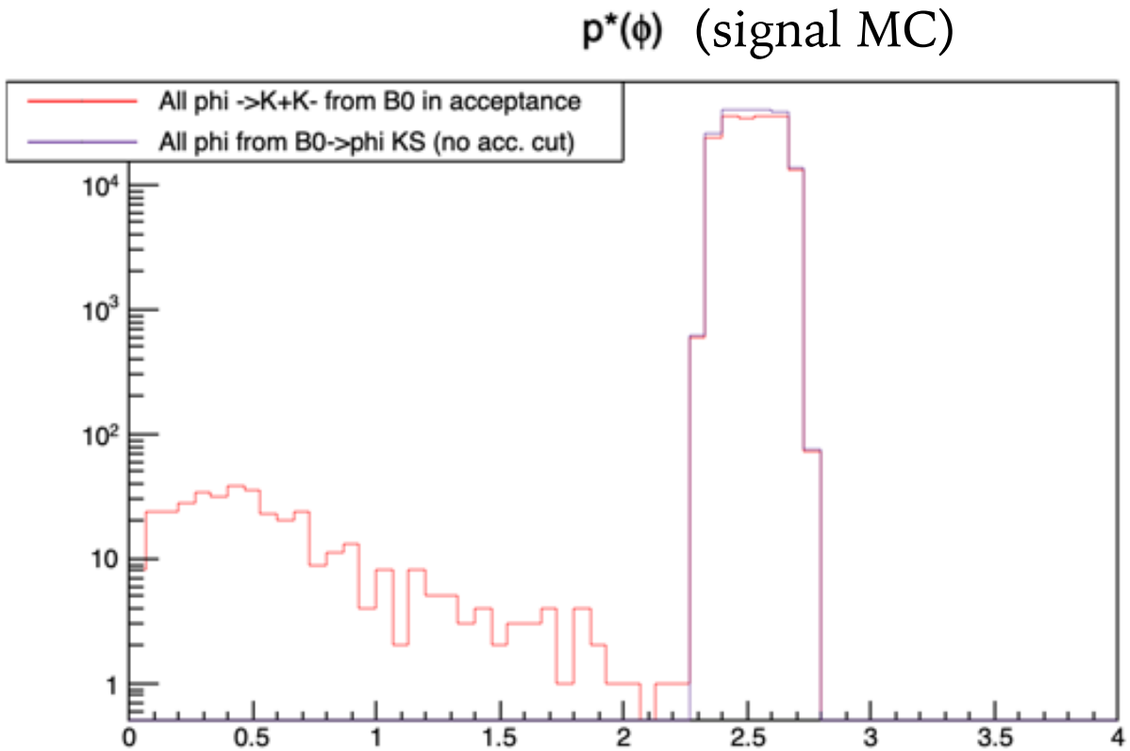
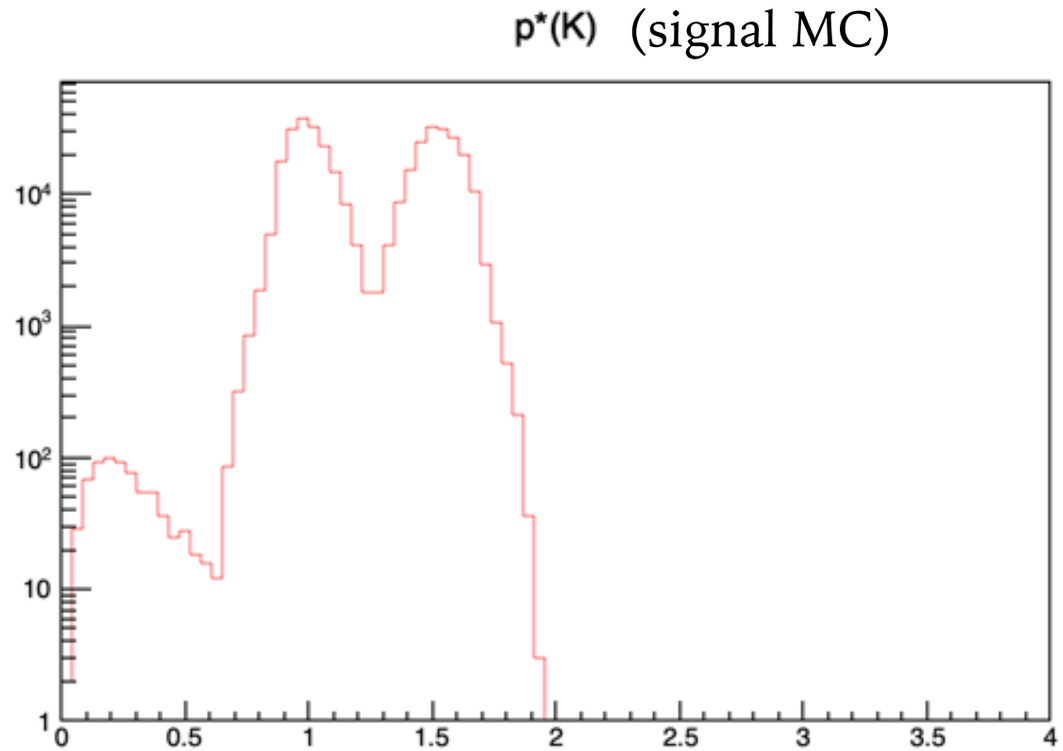
200k signal MC

$\phi \to K^+K^-$ kinematics

- Last time: (acceptance cuts p and cos θ^* already applied to $\phi \to K^+K^-$ MC particles)
- Require exclusive ϕ from $B^0 \to \phi K_S^0$
- Require $\phi \to K^+K^-$. Momentum region p*(ϕ) >2.2GeV
  - (Cut not needed for final analysis)

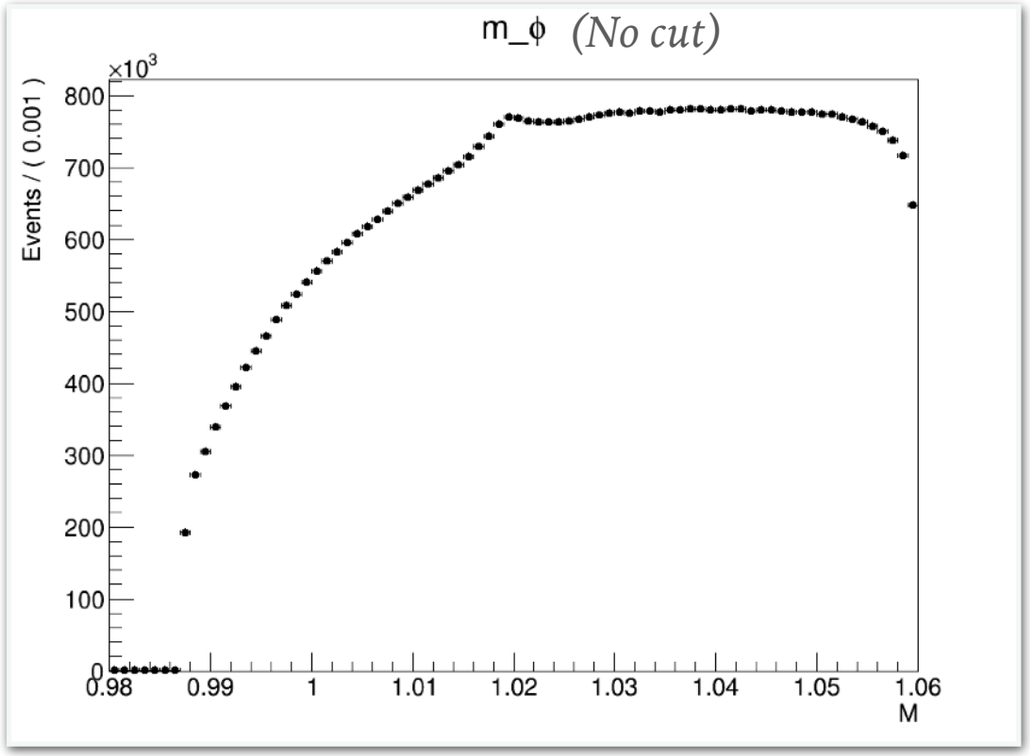




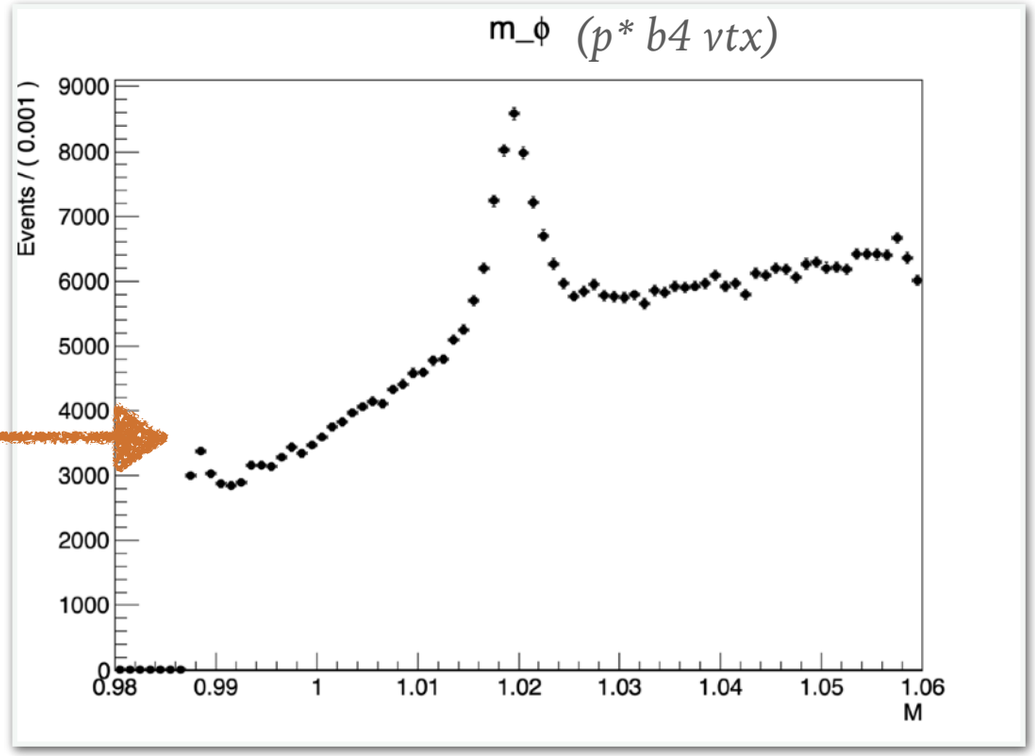
Proc11 exp8 4S hlt_hadron

$\phi \to K^+K^-$ Reco (Data)

- Preselection: M<1.06GeV
- ConfidenceLevel 0.1%
- No any other cuts
  - HUGE background

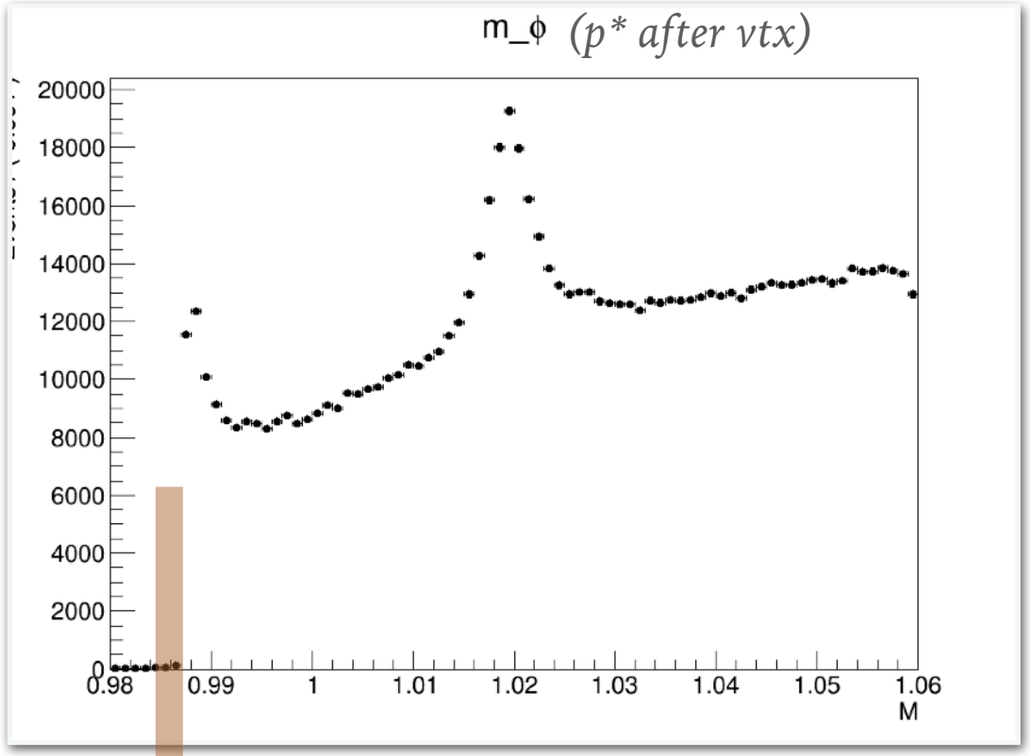


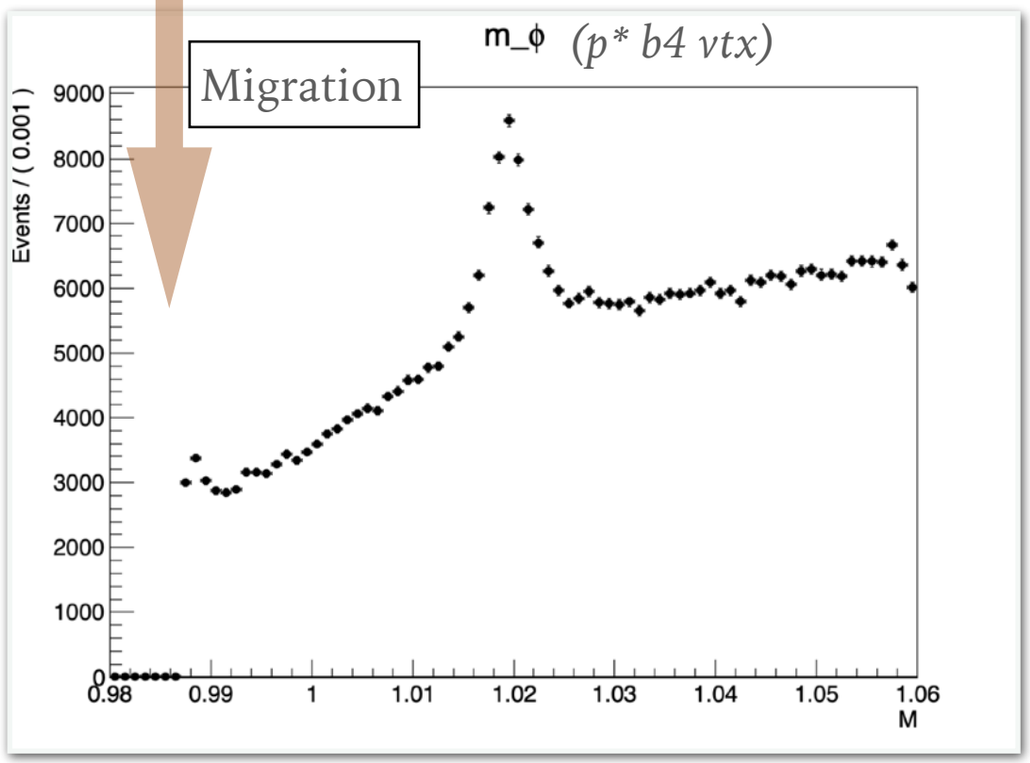
- Last time
  - Momentum cut p*(ϕ)>2.2GeV **before** vertex fitting, no PID
  - Unexpected peak at threshold



$\phi \to K^+K^-$ Reco (Data)

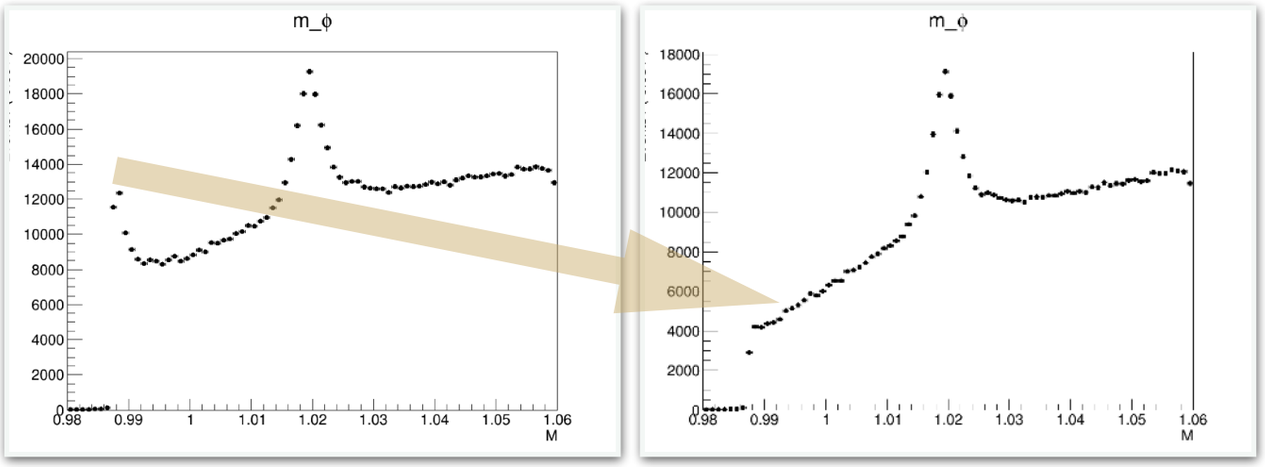
- Preselection: M<1.06GeV
- p* cut before **after** fitting
  - Result: peak more pronounced
  - **"Fake peak region" ={M<0.992, p*>2.2}**
- Effects:
  - no PID
  - peak from pairs of other opposite-charged tracks
  - Migration
- (No such peak in MC)



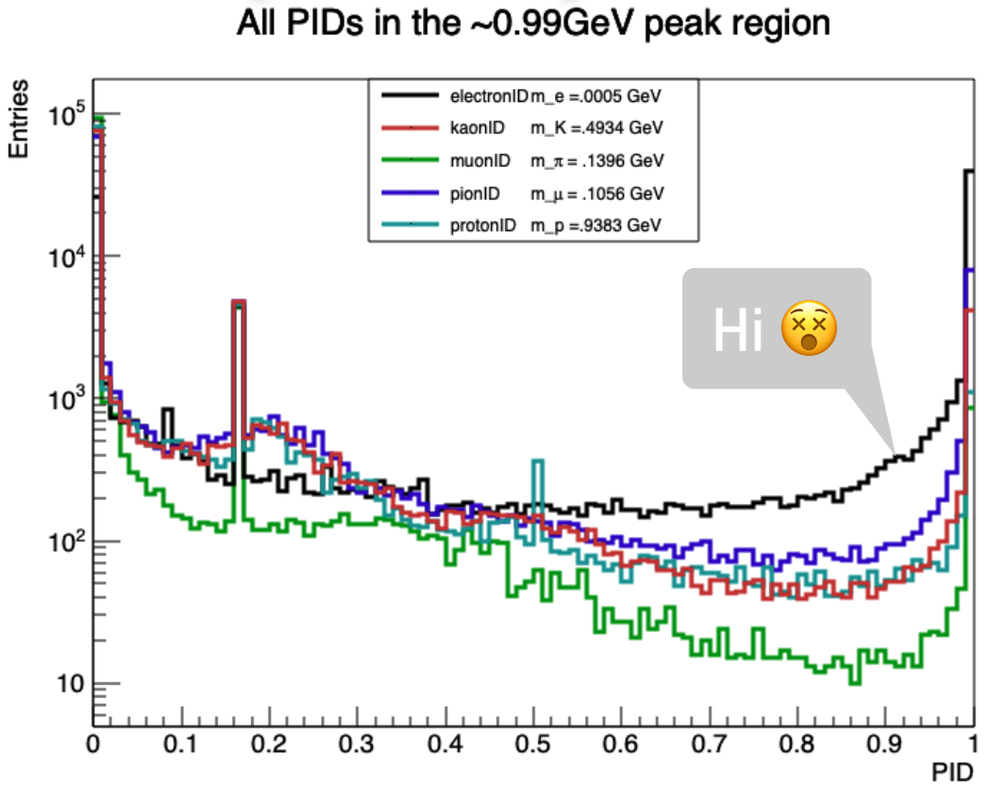


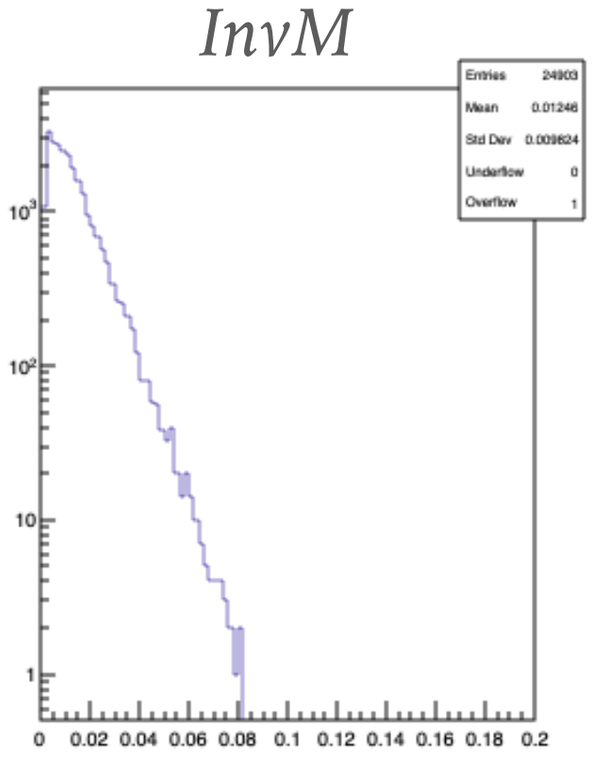
A lot of electrons (Data)

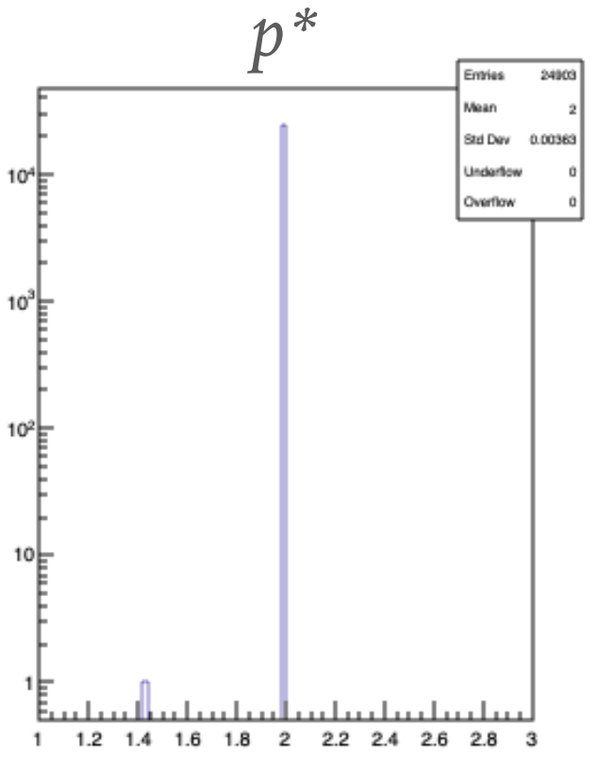
- "Fake peak region"
  - Daughters forced to $m_{K^{\pm}}$
  - A lot of high eID particles (right)
- (Below) An eID≤0.7 cut



- Revert forced daughter mass
  - $v_i = (\overrightarrow{p_i^*}, m_e)$, $v_{reco} = v_1 + v_2$
  - Photon conversion electrons

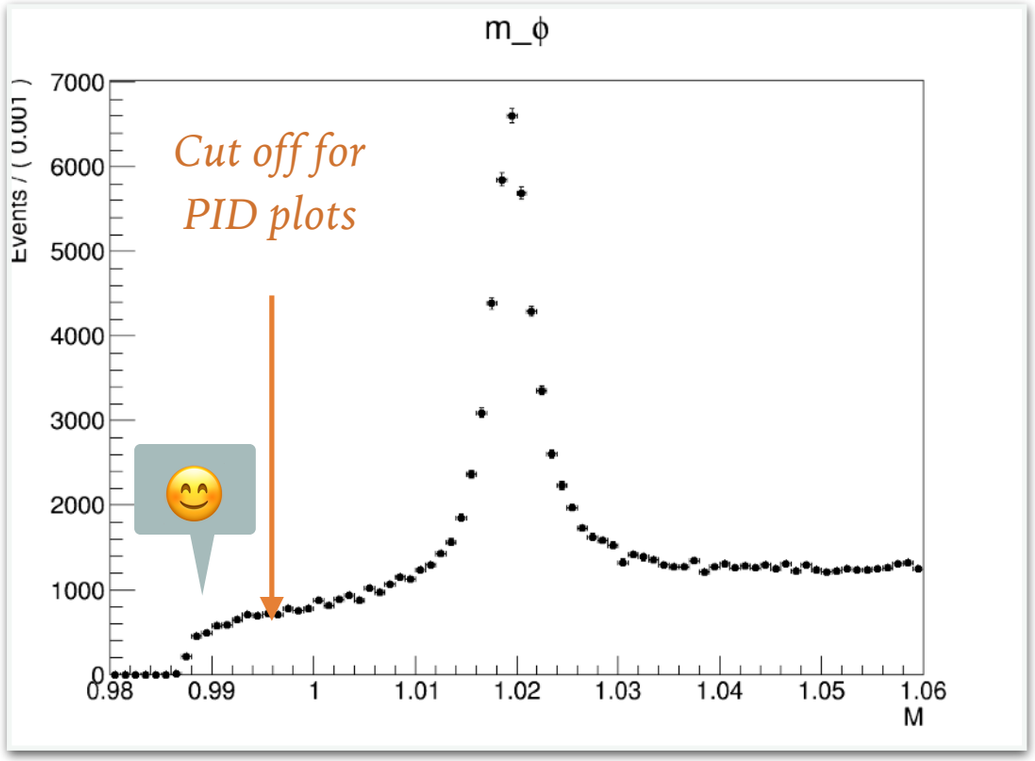


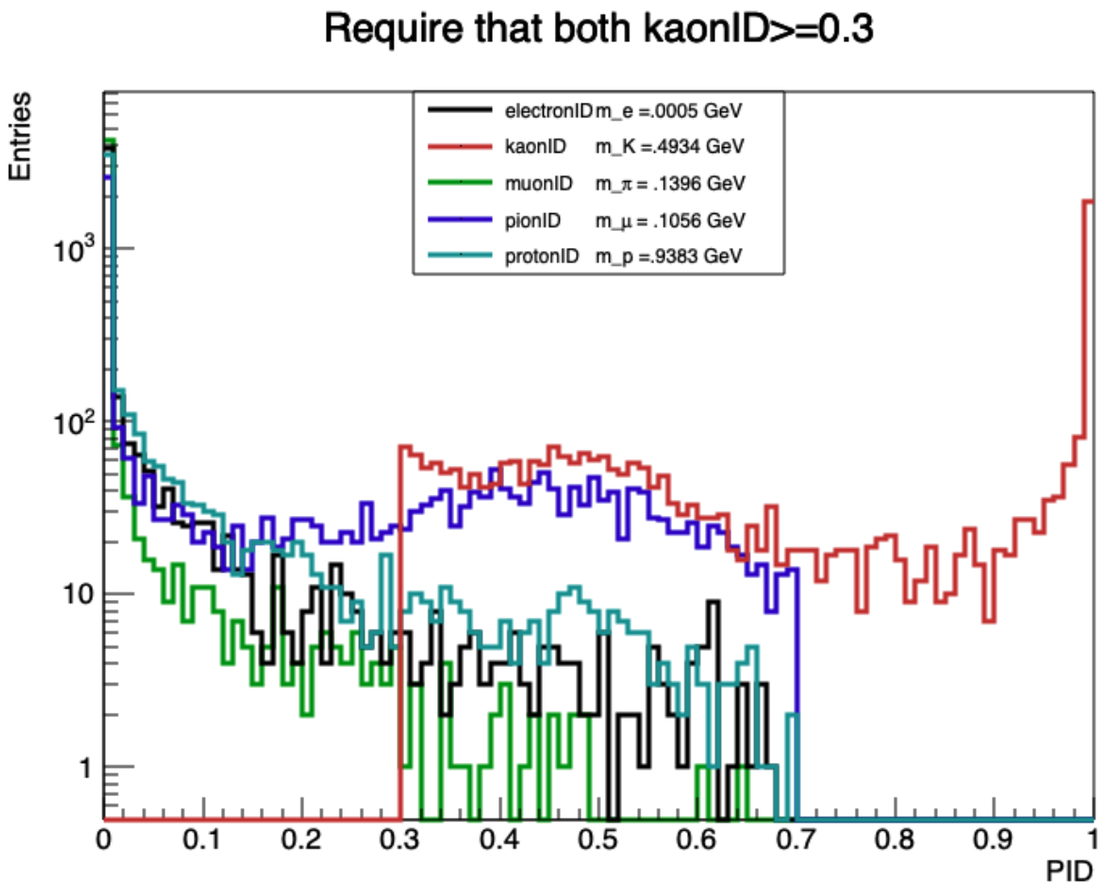




kaonID to the rescue (Data)

- Fake peak region after p*>2.2GeV
  - Loose kaonID>0.3 cut
  - Peak gone
  - Other particles greatly suppressed, especially electron
- Estimation of kaonID >= 0.3 efficiency using truth matching in MC combo files
  - ~66% (ϕ)~82% ($K^{\pm}$)
- For kaonID >=0.2, 70%, 84%
- To-do: check $\pi^{\pm}$ misID rate as $K^{\pm}$

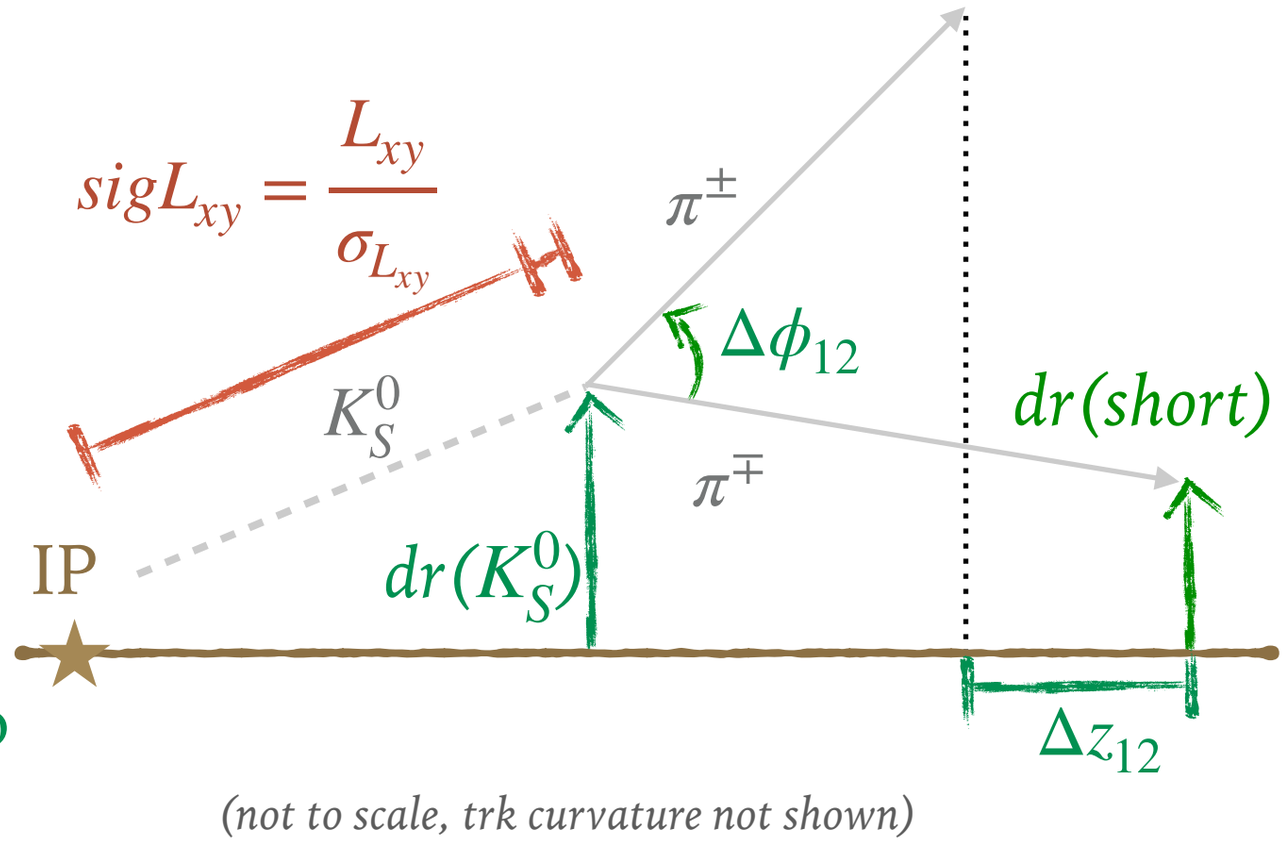




MC13a 200k combo

Hello K_S^0 my old friend...

- "K_S0:2trk" of 2 oppo charges
  - Vertex fitting chiProb $\geq 0.1\%$
  - SigLxy > 3 cut
- Basf2 default "K_S0:merged"
  - Mdst V0 objects and $\pi^+\pi^-$ reco
  - Vertex fitting chiProb ≥ 0
  - goodBelleKshorts==true



(not to scale, trk curvature not shown)

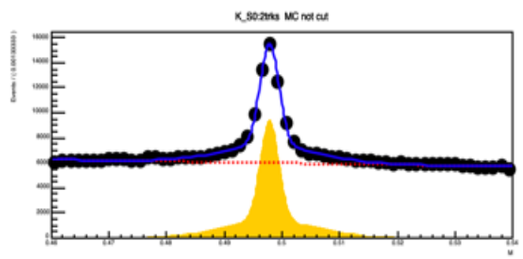
- if $p < 0.5\,\mathrm{GeV}/c$, $|\Delta z_{12}| < 0.8\,\mathrm{cm}$, $\mathtt{dr}(\mathrm{short}) > 0.05\,\mathrm{cm}$ and $\Delta\phi_{12} < 0.3\,\mathrm{rad}$;
- if $0.5 < p < 1.5\,\mathrm{GeV}/c$, $|\Delta z_{12}| < 1.8\,\mathrm{cm}$, $\mathtt{dr}(\mathrm{short}) > 0.03\,\mathrm{cm}$, $\Delta\phi_{12} < 0.1\,\mathrm{rad}$ and $\mathtt{dr}(K_S^0) > 0.08\,\mathrm{cm}$;
- if $p > 1.5\,\mathrm{GeV}/c$, $|\Delta z_{12}| < 2.4\,\mathrm{cm}$, $\mathtt{dr}(\mathrm{short}) > 0.02\,\mathrm{cm}$, $\Delta\phi_{12} < 0.3\,\mathrm{rad}$ and $\mathtt{dr}(K_S^0) > 0.22\,\mathrm{cm}$.

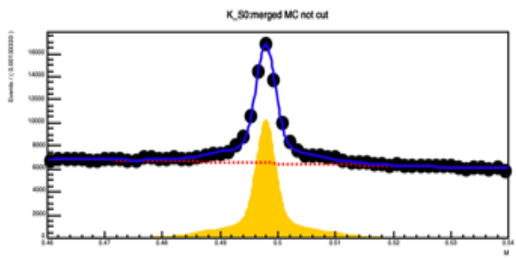
[BELLE2-NOTE-PH-2020-013]

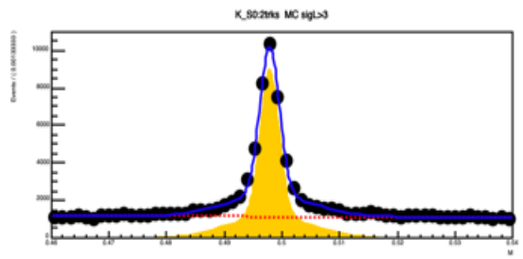
MC13a 200k combo

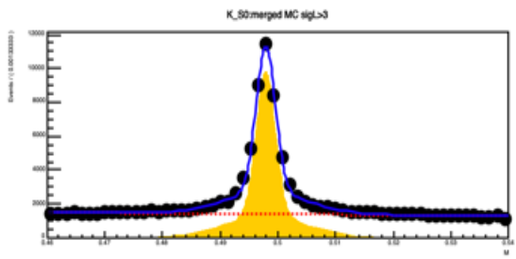
Hello K_S^0 my old friend...

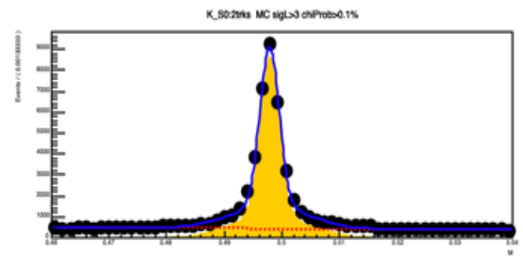
	KS:2trk	KS:merged	2trk/merge
No cut	46,621	49,129	94.9%
SigLxy > 3	41,175 68,213	44,947 83,662	91.6% 81.5%
SigLxy>3 confL>0.1%	36,889 26,482	40,530 35,921	91.0% 73.7%
goodBelleKs	33,625 6,605	37,101 8,549	90.6% 77.3%
goodBelleKs confL>0.1%	31,980 5,162	35,310 6,845	90.6% 75.4%
Time took to run (no cut)	4min	2hr50min	2.4% yep
Comment	Faster Okay eff.?	Better eff. So slow? 🐢	

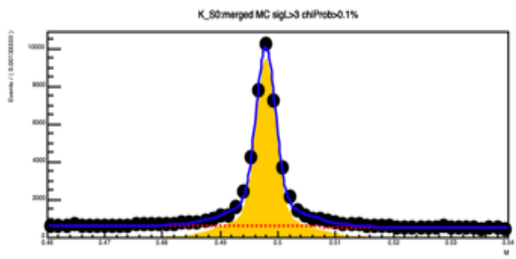


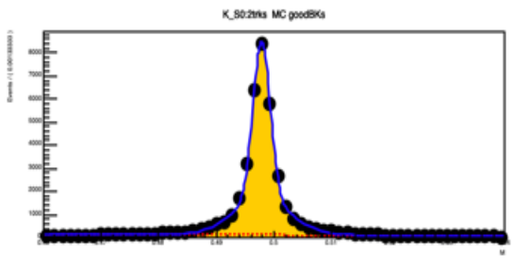


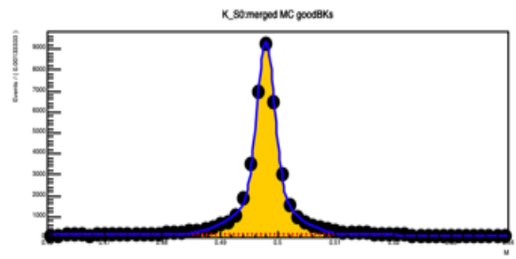


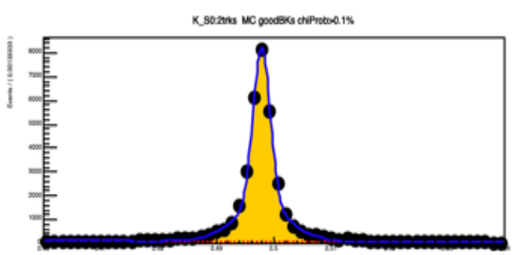


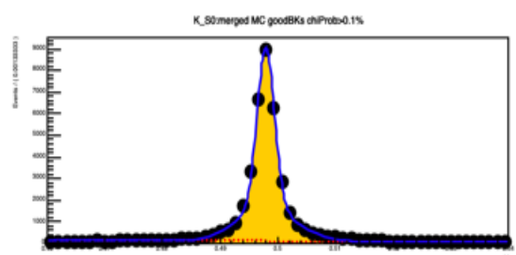












- My selection
- Default selection stdKshorts

Backup slides?