Follow up questions

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$B \to K e \mu$ RC meeting, April 24, 2019

Reminder

⇛ In the last meeting 3 things were requested:

1. Increase the systematic due to VTX χ^2 reweighing.
   Done, nothing changed due to rounding precision.

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1. Increase the systematic due to VTX χ^2 reweighing.
   Done, nothing changed due to rounding precision.

2. Tackle the large weight problems.
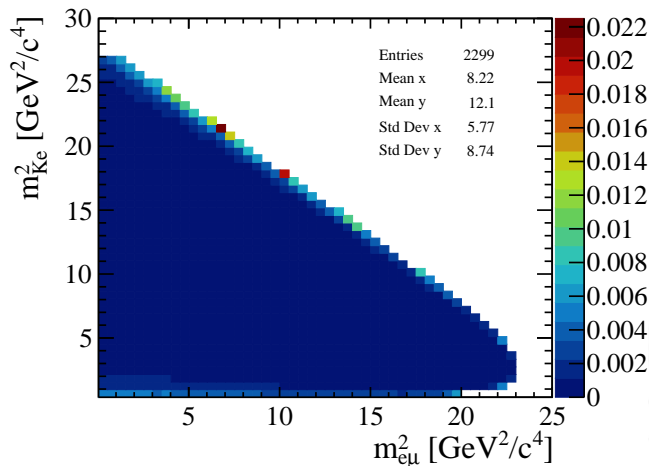
3. Provide a better efficiency maps.

The problem of efficiency maps

⇒ After we divide the 2 histograms we have large weights on the edges:
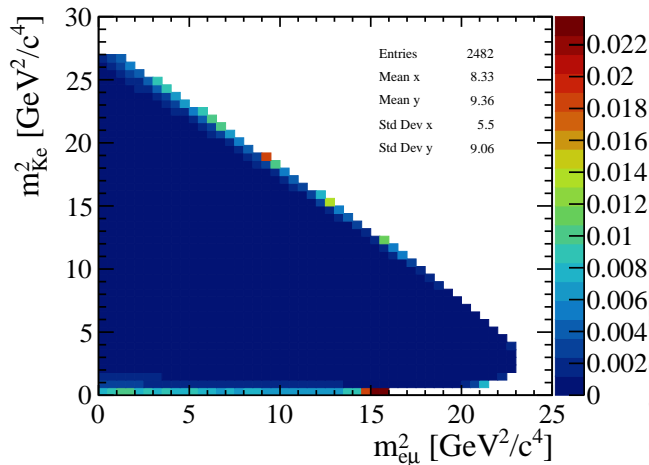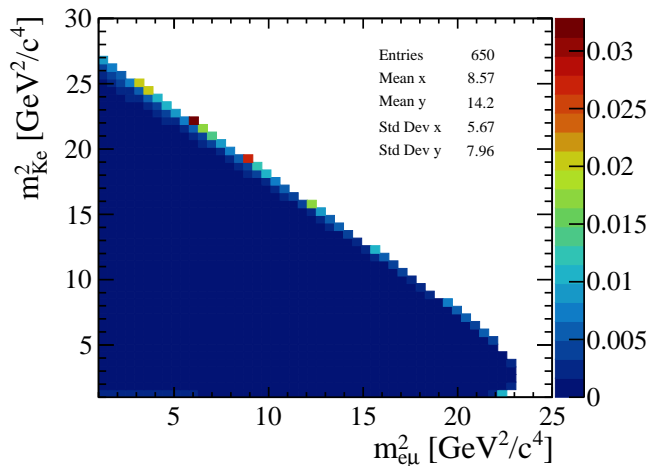
The (NOT)solution

$\Rrightarrow$ Apply cuts: $m_{Ke} > 0.6$ GeV and $m_{e\mu} > 0.2$ GeV

$\Rrightarrow$ Not really solving the problem...

The (NOT)solution 2

$\Rightarrow$ Apply cuts: $m_{Ke} > 1.0$ GeV and $m_{e\mu} > 1.0$ GeV

$\Rightarrow$ Not really solving the problem...
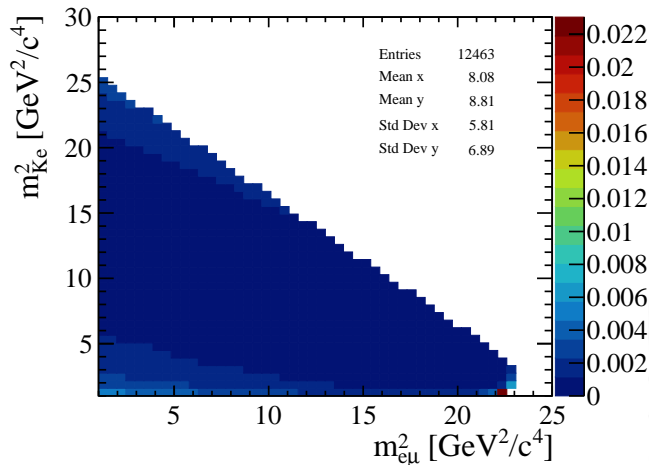
The (NOT)solution 3

$\Rightarrow$ Apply cuts: $m_{Ke} > 1.0$ GeV and $m_{e\mu} > 1.0$ GeV and $m_{K\mu} > 0.7$ GeV
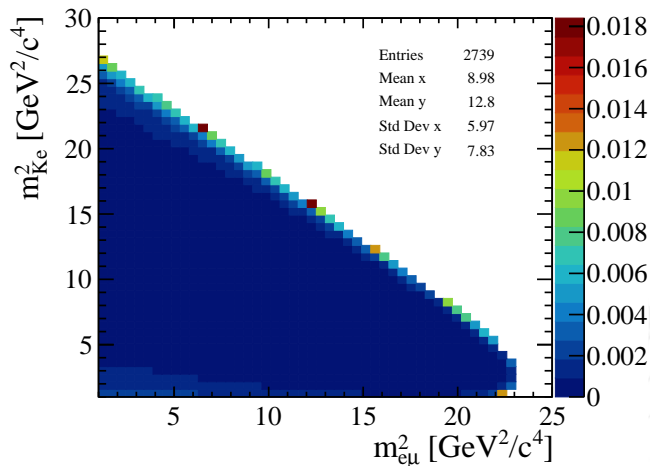
$\Rightarrow$ Not really solving the problem...

The (NOT)solution 3

$\Rightarrow$ Apply cuts: $m_{Ke} > 1.0$ GeV and $m_{e\mu} > 1.0$ GeV and $m_{K\mu} > 1.5$ GeV

$\Rightarrow$ Not really solving the problem...

The (NOT)solution

$\Rrightarrow$ No matter what you do you will not avoid this problem, due to geometry.

The solution

⇒ We determine the change induced by the weight cut on the BALL sample (0.5%, by counting the candidates on the unweighted simulation)

⇒ We determine the change induced by the weight cut on the PHSP sample (0.2%, by determining the sum of weights with and w/o including the large weights)

⇒ The larger number is conservatively assigned as systematic uncertainty

Lucky mistake

⇛ During this we noticed that the large weights have not been removed in the efficiency calculation but only in the plots.

⇛ We therefore propose to leave them in, as we checked their effect is 0.2-0.5%.
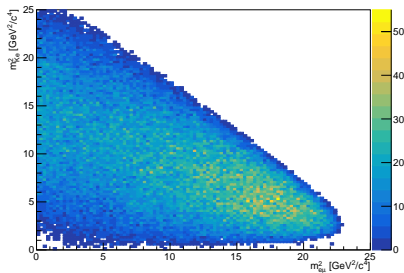
Efficiency maps

Efficiency maps
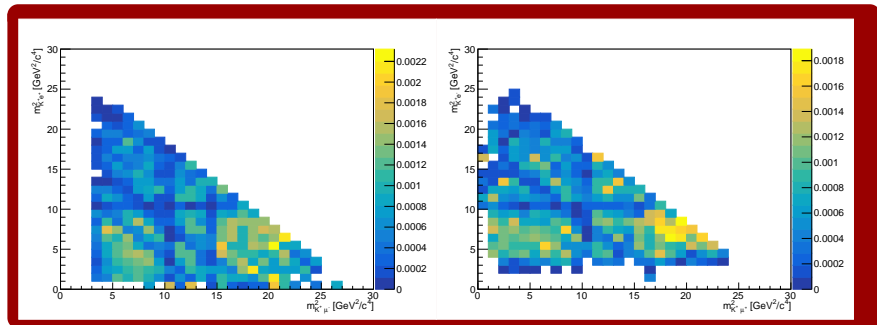
mass swap	mass region vetoed
K with μ mass	$3000 < m_{K^-\mu^+} < 3200$
	$3630 < m_{K^-\mu^+} < 3740$
e with μ mass	$2950 < m_{e^-\mu^+} < 3200$
	$3630 < m_{e^-\mu^+} < 3740$
K with e mass	$3000 < m_{K^+e^-} < 3200$
	$3630 < m_{K^+e^-} < 3740$
μ with e mass	$3000 < m_{\mu^+e^-} < 3200$
	$3630 < m_{\mu^+e^-} < 3740$

The problem with this is that the mass hypothesis are not the same as in the Dalitz plane so the efficiency of this cuts is not 0.
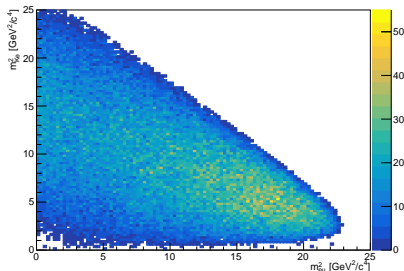
No veto

Single veto
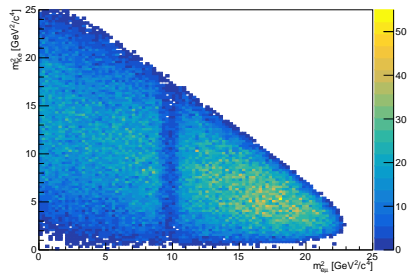
No veto

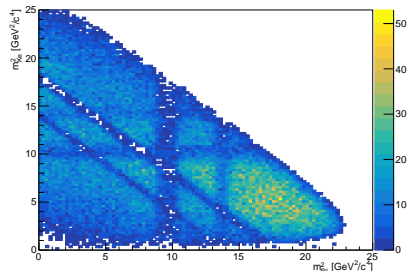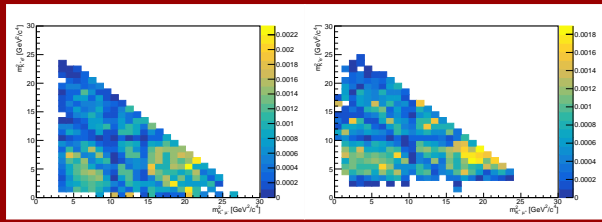All vetos

$\Rightarrow$ The non-zero bins in the veto areas of the maps are not binning effects but genuine due to the mass hypothesis swap. $\Rightarrow$ The choice of the binning becomes an editorial one (next slide)
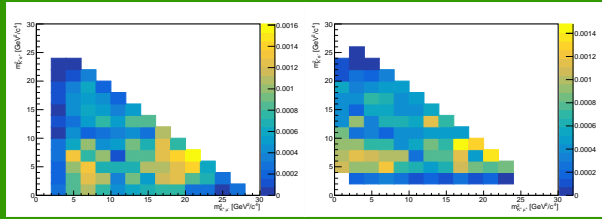
Proposed solution

⇒ To make the plots nicer we proposed to enlarge the bins:
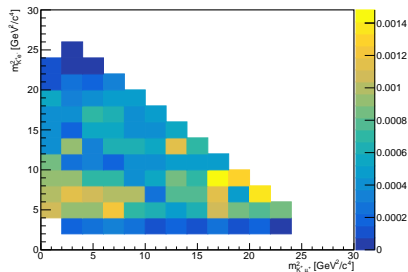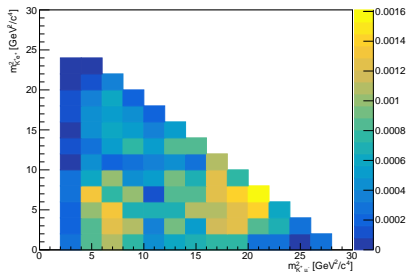
Old plots:

New plots:

Proposed solution

New plots:

$\Rrightarrow$ Since we have handful of events the coarse binning is ok.

Backup

Illustration