$B^0 \to K^*\mu^-\mu^+$ MC Filter

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A glimpse in the Run1 analysis

$\Rightarrow$ In the Run1 we have asked for a filtered MC to correct for detector acceptance.

$\Rightarrow$ Asked for $5.5M$ events (after stripping in DST), which means we generated around $110M$ events.

$\Rightarrow$ After our full selection we ended up with with only $1.4M$ events.

Warning!

The stripping line has a PID cut inside: $\mathrm{PID}_\mu > -3$.
This essentially means we model that efficiency from MC.

Run2 options

1. Repeat what we did in Run1 and keep the PID cuts.
2. Filter on stripping removing the PID cut.
3. Filter on MC truth:
   - 4 charge tracks on $\mathrm{StdAllNoPiDPions/Kaons/Muons}$
   - And truth matched the decay channel: $\mathrm{mcMatch('[B0 => K*(892)0mu+mu-]CC')}$

Why MCTruth?

$\Rightarrow$ We are using a very old stripping line that for sure can be (and should be) optimized for the final analysis of Run2!

$\Rightarrow$ Producing an MCTRUTH match sample would allow the sample to be reused for future analysis even if the stripping line will change!

Retentions

⇛ To study the solution I have used 2012 Physics MC.

⇛ I have taken 17.250 simulated events.

⇛ Here is the results:

Type	Filter retention	Events in the ntuple	Truth Matched
Strip	3447 (20 %)	4975	1648
Strip no PID$_\mu$	3504 (20.3 %)	5176	1660
MCTruth	5009 (29 %)	4456	1660

⇛ Now I have cross check this running the same algorithms on stripped and non stripped MC always getting the same numbers.

⇛ For speed purpose I have put a cut on the $m_{K^*} < 1300$ MeV (can be adjusted if needed).

⇛ Other option to consider is to remove `ISMUON` form stripping to get all efficiencies from `PIDCalib`.

Plans

$\Rightarrow$ With Tom we feel that it would be best to ask for $200M$ generated events.

$\Rightarrow$ Also we noticed that we have $50M$ events of some old MC10 (Stripping 12) MC, which we propose to delete.

$\Rightarrow$ For PPG: The $R(D^*)$ have already got green light for more then $1000M$ generated events, so we getting the $200M$ should not be a problem.

$\Rightarrow$ To discuss: Do we want a flat $m(K\pi)$ sample or we can keep the K^*?

Plans 2

⇛ Besides the normal $B \to K^*\mu\mu$ PHSP we should ask for other MC channels.

⇛ I proposed to scale the old numbers by factor: $\frac{5}{3}$.

Decay	DecFile event type	N. of events	N. of events Run2
$B \to K^*J/\psi$ (physics)	11144001	2M	3.5M
$B \to K^*J/\psi$ (PHSP?)	xxxxxxxx	0	3.5M
$B \to K^*\mu\mu$ (physics)	11114001	1M	1.5M
$\Lambda_b \to \Lambda(1530)\mu\mu$	15114000	1M	1.5M
$\Lambda_b \to pK\mu\mu$	15114011	2M	3.5M
$B_s^0 \to \phi\mu\mu$	13114002	0.6M	1M
$B_u \to K\mu\mu$	12113001	1M	1.5M

⇛ This would be unfiltered production and this MC will be needed for other analysis as well.

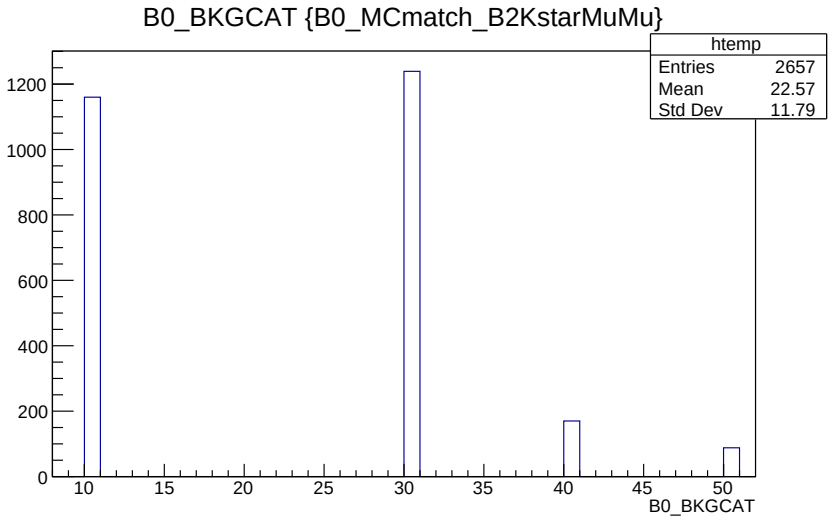
⇛ Do we want to simulate a flat q^2 in the $B \to K^*\mu\mu$?

⇛ Do we want to have a flat $K\pi$ mass distribution in the simulation?

This is not related to MC requests.

MCmatching studies.

⇛ Let's look how the candidates that have been matched by: $\mathrm{mcMatch}(\prime[\mathrm{B0} => \mathrm{K} * (892)0\mathrm{mu} + \mathrm{mu}-]\mathrm{CC}\prime)$ look like:

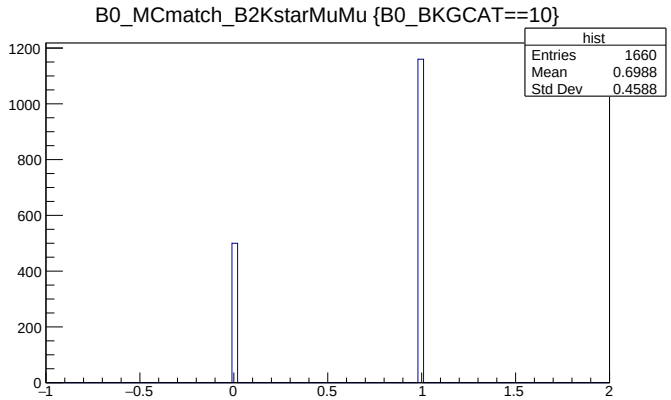


⇛ `BKGCAT==10` is the pure signal. The mcMatch is not changing anything in that number of entries.

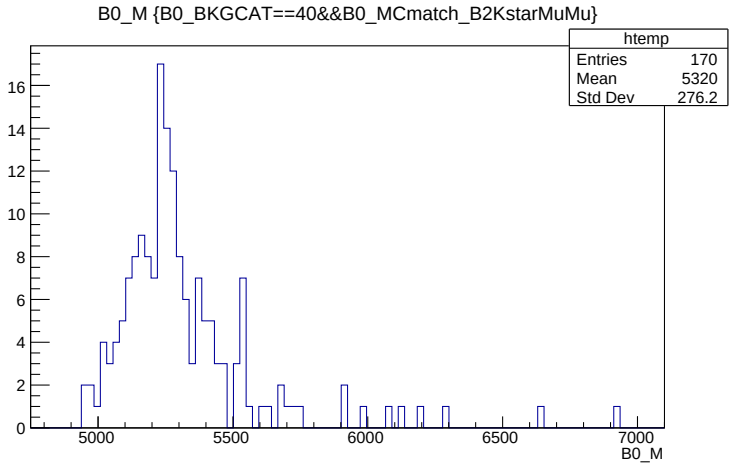
⇛ `BKGCAT==30` is the K=$K \leftrightarrows \pi$ swaps. This goes away with some PID selection

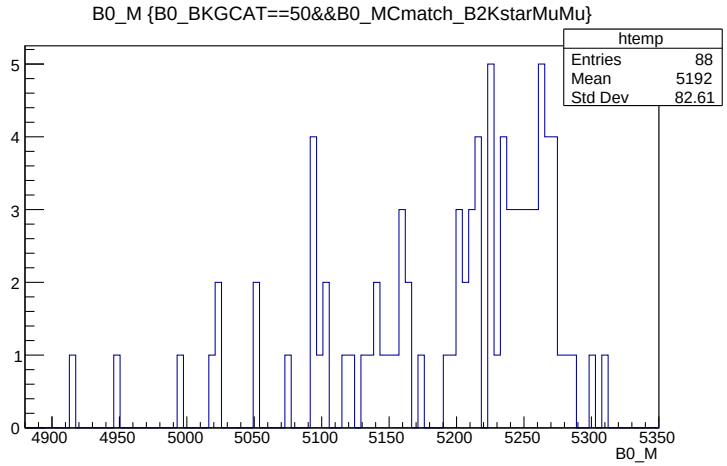
MCmatching studies.

⇛ Now all `BKGCAT==10` have true mcMatch:



⇛ How does `BKKCAT==50,40` (missID +FSR, FSR)look like:





⇛ We need to consider which `BKGCAT` we should use for the analysis

Backup