BGGEN study for $K^+K^-\pi^0$

Sebastian Cole

ASU

01/23/2020

PID selection criteria

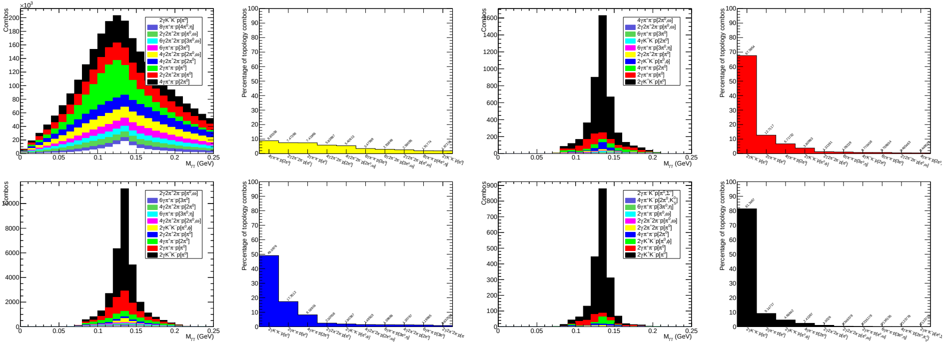
- LI 2017 BGGEN sample
- $\chi^2/n.d.f. < 2.5$ cut before looking at event in $pK^+K^-\pi^0$ events.
- Timing has to come from BCAL, FCAL, or TOF.
- Timing from START or NULL removed.
- No unused energy in photon reconstruction.
- Standard Δt cuts used in the analysis are shown in the table below.

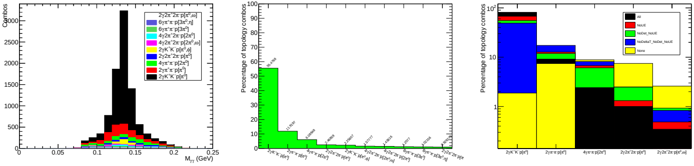
Particle	BCAL (ns)	FCAL (ns)	TOF (ns)
p	± 0.5	± 1.0	± 0.3
K^+	± 0.2	± 0.5	± 0.15
K^-	± 0.2	± 0.5	± 0.15

Description of work

- Plots of invariant mass of $\gamma\gamma$, $K^{*\pm}$, $K^{*\pm}K^{\mp}$, and $K^{+}K^{-}\pi^{0}$ as reconstructed from the BGGEN sample for top ten abundant topologies by cut.
- Plots of the number of combos for a topology with respect to the total number of combos for the top ten topologies.
- Plot of the final surviving topologies after all cuts and how their contribution changes over the cuts.
- All plots are combo based. Future work will look at number of events with respect to number of combos produced. This can be used to investigate combinatorial background.

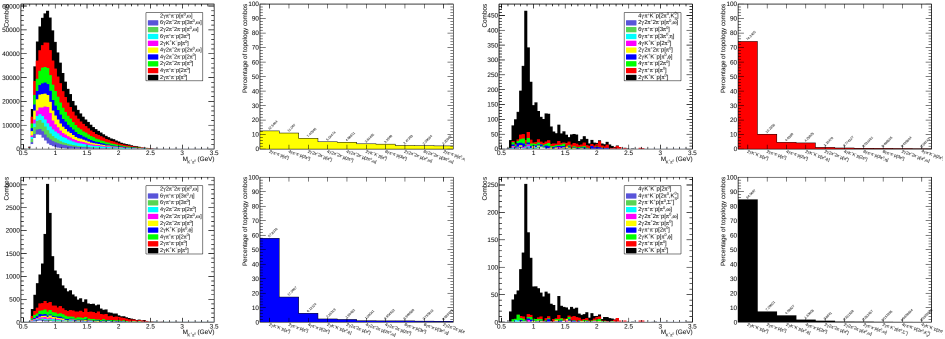
π^0 over cuts

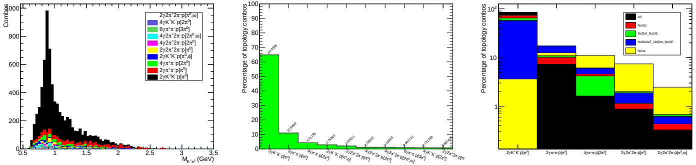




- 5 main topologies survive all cuts.
- $\chi^2/n.d.f.$ cut increases percentage of 3π topology.
- Obtain ≈ 81% $K^+K^-\pi^0$ after all cuts.

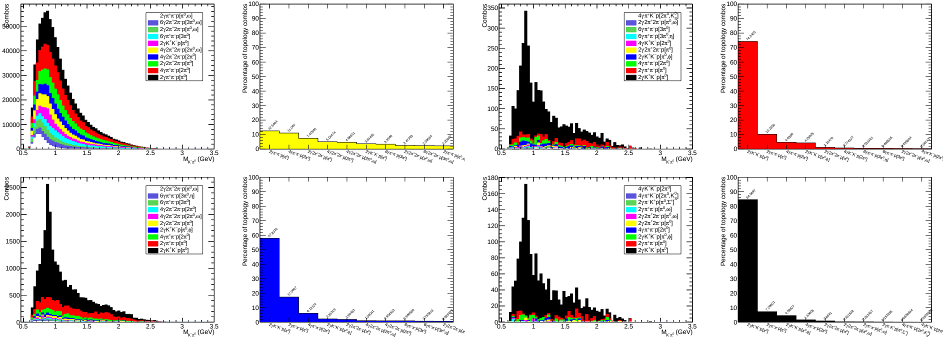
K^{*+} over cuts

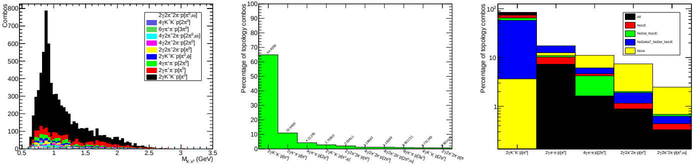




- 5 main topologies survive all cuts.
- 3π, 4π, and 5π contribute to the background.
- Obtain $\approx 84.5\%$ $K^+K^-\pi^0$ after all cuts.

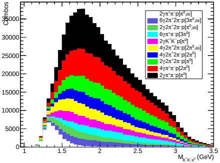
K^{*-} over cuts

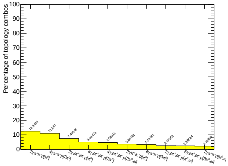


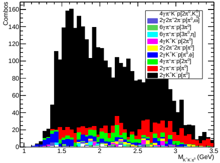


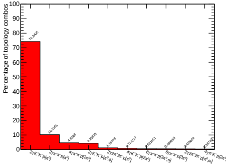
- 5 main topologies survive all cuts.
- 3π, 4π, and 5π contribute to the background.
- Obtain ≈ 84.5% $K^+K^-\pi^0$ after all cuts.

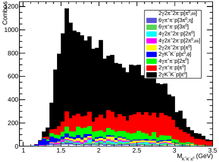
$K^+K^-\pi^0$ over cuts

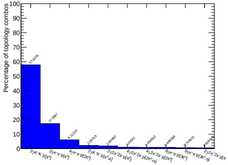


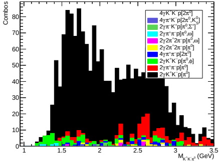


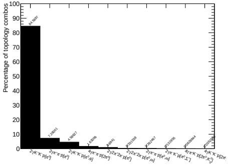


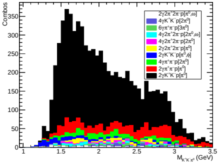


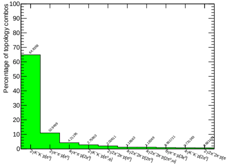


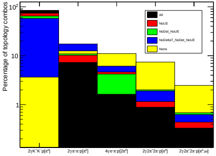






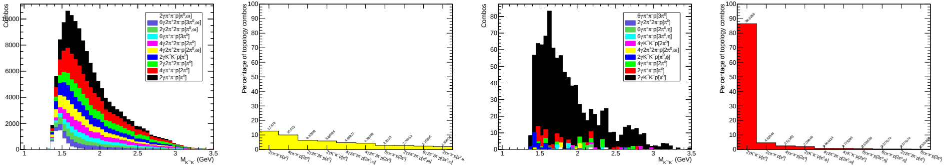


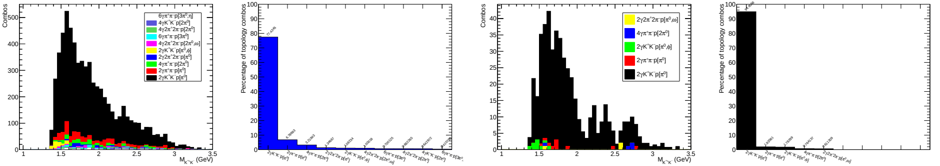


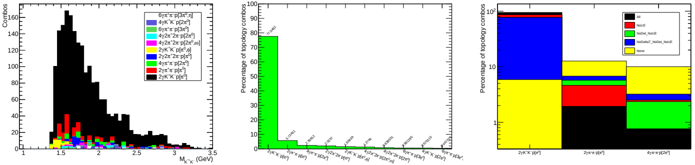


- 5 main topologies survive all cuts.
- 3π, 4π, and 5π contribute to the background.
- Obtain $\approx$ 84.5% $K^+K^-\pi^0$ after all cuts.

$K^{*+}K^{-}$ over cuts

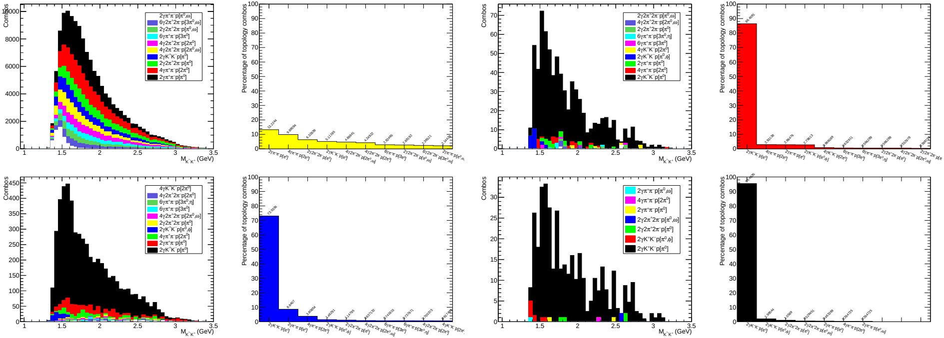


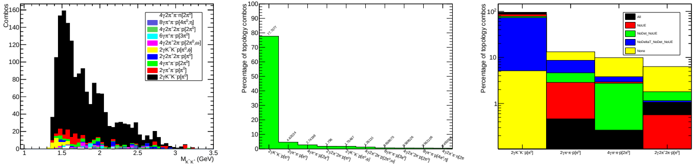




- 3 main topologies survive all cuts.
- 3π and 4π contribute to the background.
- Obtain $\approx$ 94.9% $K^{+}K^{-}\pi^{0}$ after all cuts.

$K^{*-}K^+$ over cuts

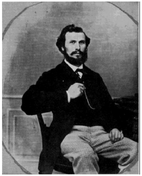




- 4 main topologies survive all cuts.
- 3π, 4π, and 5π contribute to the background.
- Obtain $\approx 95.4\%$ $K^+K^-\pi^0$ after all cuts.

Conclusions and future work

- 3π and 4π background found to survive all cuts in all invariant mass plots.
- 3π dominant background in $K^+K^-\pi^0$ at high mass, as expected.
- Why is 5π in $K^{*-}K^+$, but not $K^{*+}K^-$?
- $\phi\pi^0$ is a contributor, as seen in the data.
- Working on more MC and PID improvements.



I am think I am the better painter than Piet Mondrian, but that might be my ego talking.