KOPIO SIGNAL in the case of: One photon converting in the Preradiator and One photon converting in the Calorimeter

1 Quick facts

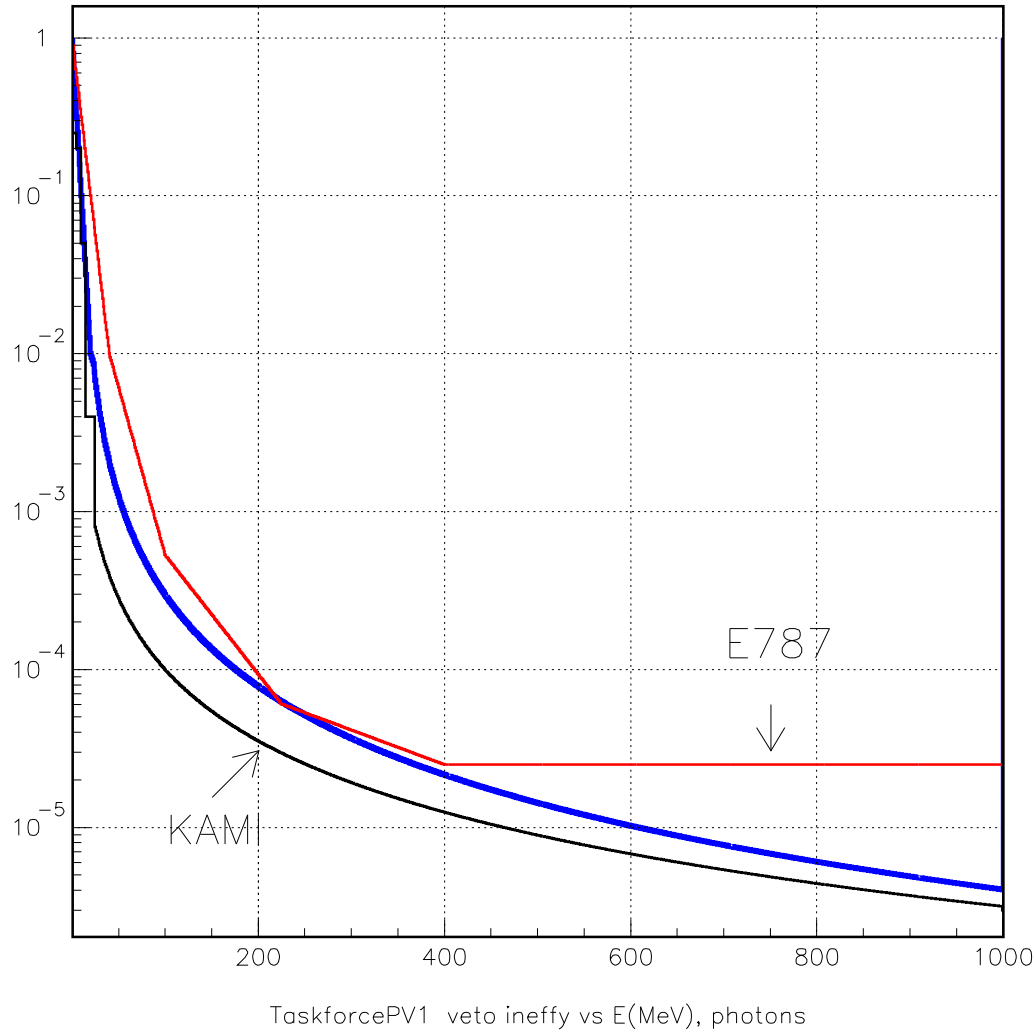
Since a photon has about a 70% chance to convert in the Preradiator, only half of the KOPIO signal events, have both photons converting before the Calorimeter. The other half is/was considered less useful. Due to the absence of the directional information of one the photons, and thus less constrained fit, it is harder to extract signal.

In the original KOPIO TDR, it was argued, that about 30% of the regular case (2 γ's converting in the Preradiator) event yield could be achieved. That means that for a defined S/B ratio, the number of events with only 1 γ converting in the Preradiator is roughly one third of regular signal events with the same S/B.

2 FASTMC Assumptions

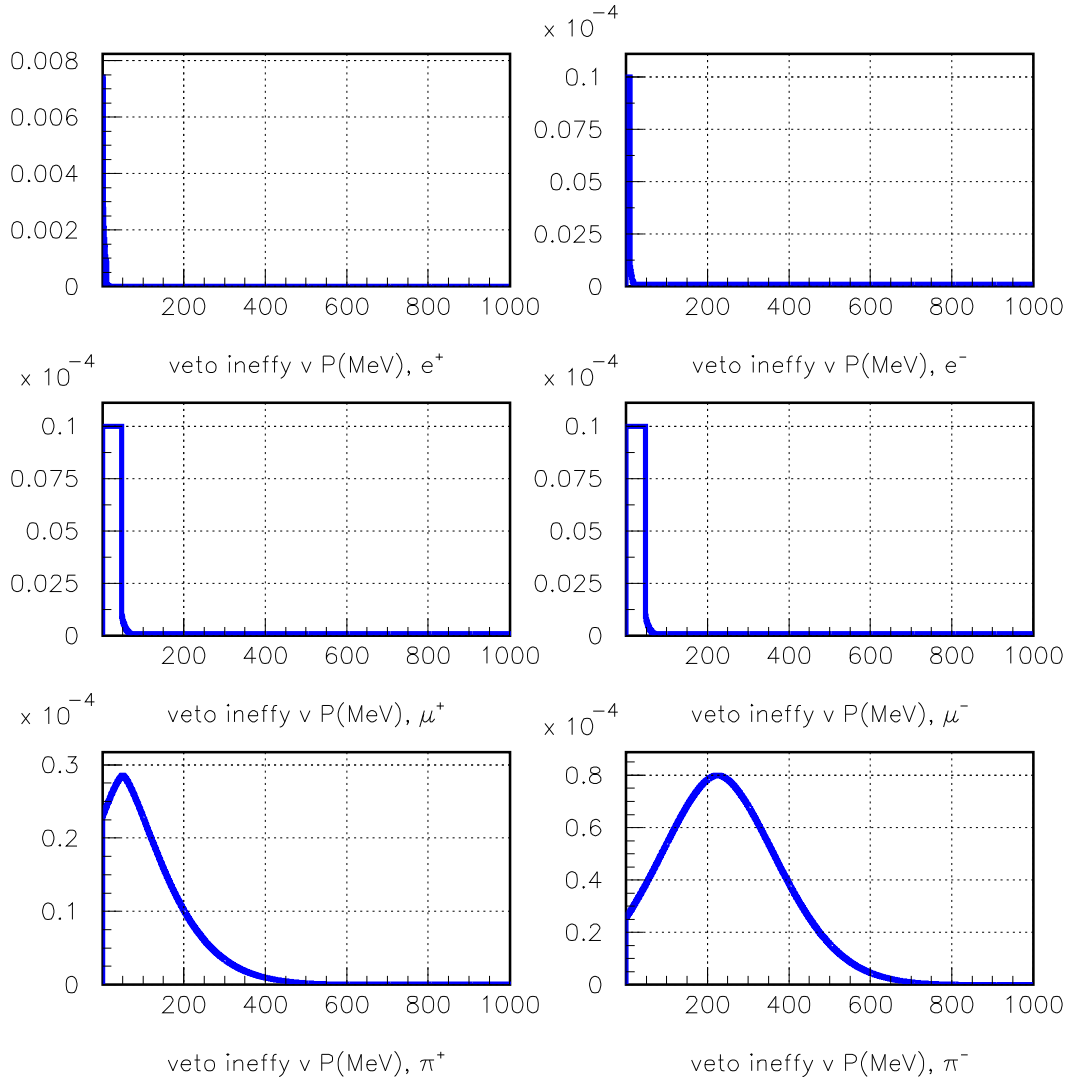
2.1 Photon Veto

photon veto inefficiency versus momentum is presented below:



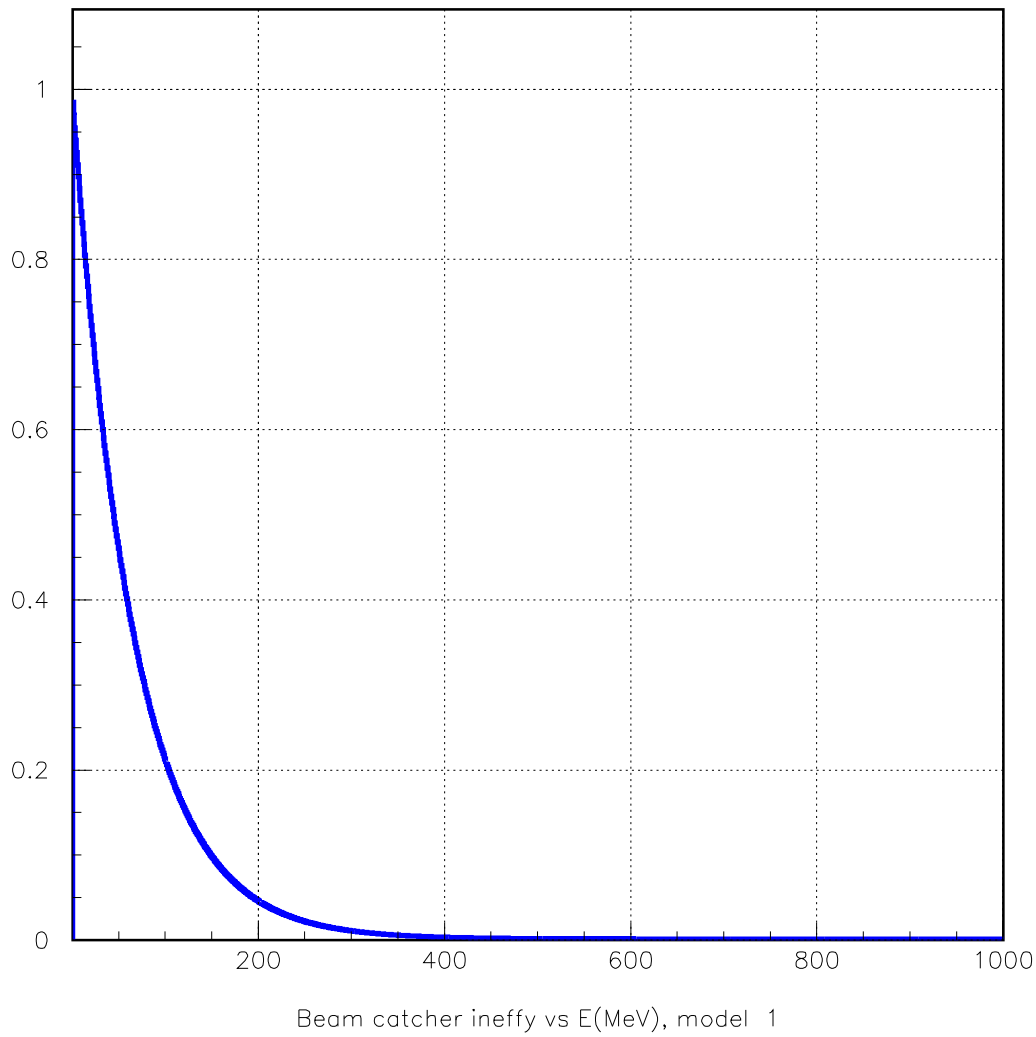
2.2 CPV

Charged particles veto inefficiencies are presented below



2.3 Catcher

Catcher inefficiency is presented below



2.4 Resolution (smearing)

Energy resolution = 3% /sqrt(E(GeV))

Coordinate and angular resolution is approximated by the Bryman model

For photons converting in the Calorimeter, spacial resolution is derived from the Shashlyk's granularity and is postulated as 11/sqrt(12) cm.

Time resolution is energy dependent and is assumed 90ps/sqrt(E(GeV) which is close to what was previously used (0.2 ns).

3 FASTMC running on RareK cluster at TRIUMF

Due to scripts and code development, done skillfully by Joe, S/B Task Force members can now effectively run full FastMC jobs (generation of signal and major bg + analysis) in a matter of several hours.

3.1 Initial FastMC Results

As a starting point, with no modification to the cuts, events with one gamma converting in the Preradiator and one in the Calorimeter, were generated and analyzed by standard routine.

some of the results for **kpnn** can be seen below:

cut set	NeV	dNeV
Zcuts DSV	11.61078	0.1529190
Jcuts DSV	**45.32751**	**0.2843906**
AK prebasic	105.7726	0.4510166
AK basic	22.43081	0.2067780
AK loose	11.34051	0.1481130
AK lominal	9.415985	0.1358249
AK tight	6.585261	0.1138075
AK tighter	4.083750	0.9060727E-01
AK tightest	3.008413	0.7712443E-01

Background rates for Jcuts, which are basically Andries's contour cut and some David cuts, are given below:

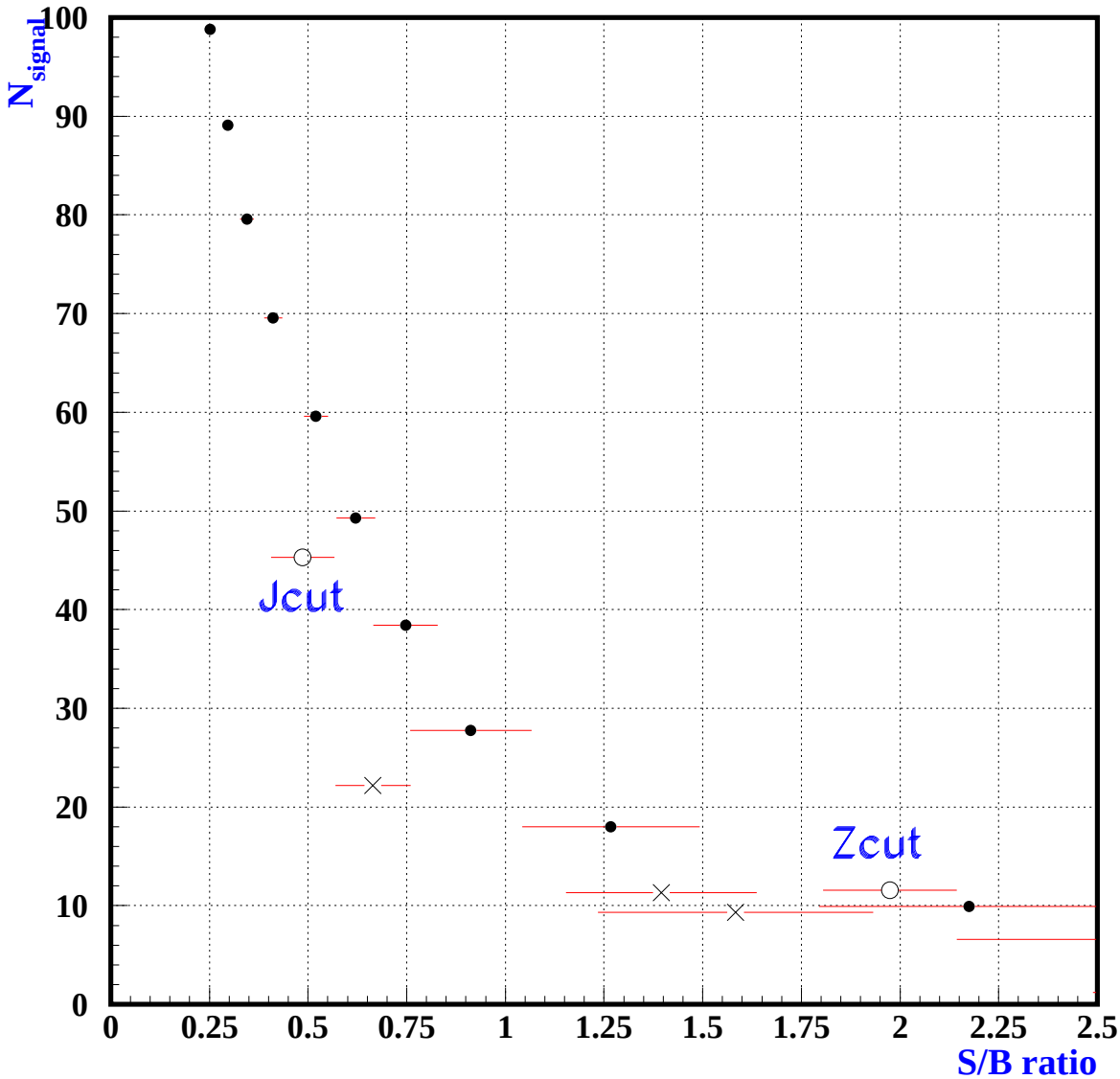
mode	cut set	NeV	dNeV
kp2	Jcuts DSV	93.06612	15.25768
ke3g	Jcuts DSV	156.0201	13.40668
kcp3	Jcuts DSV	218.8889	75.16254
kp3	Jcuts DSV	1.306454	0.3765114
ke4	Jcuts DSV	0.3413885	0.1607306

need to look into radiative ke3, and kcp3 backgrounds. High uncertainty in the kcp3 background estimate is an indication of just several high weight events.

3.2 Likelihood application

In the light of the modifications to the code, and job distribution ability of the RareK cluster, the code for fast(effective) likelihoods application is under development.

Initial results are presented below. For this example only kp2 background is considered.



Improvement over regular cuts is marginal, but visible Soon it would be possible to include all/any other backgrounds as well. Moreover, an option to form p.d.f.(probability density functions) using combined background distributions, weighted by their appropriate contribution, could be achieved.

4 Plans for future developments

- Finalize likelihood code, and implement it into the analysis routine, as an option.
- Study dependence of the S/B on the resolution parameters (calorimeter spacial), time resolution, Preradiator resolution (also required for the Preradiator design)
- Further relax 'set-up' criteria for p.d.f's determination and try more variables in the likelihood
- Implement Dima's smoothing algorithm for developing contour cuts to 2-D p.d.f's creation.