

$\Upsilon \rho \rightarrow \pi^+ \pi^+ \pi^- n$

Update

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Generated Data

Generate 5000 signal events using
genr8, 1M EM background events

hdgeant, mcsmeas

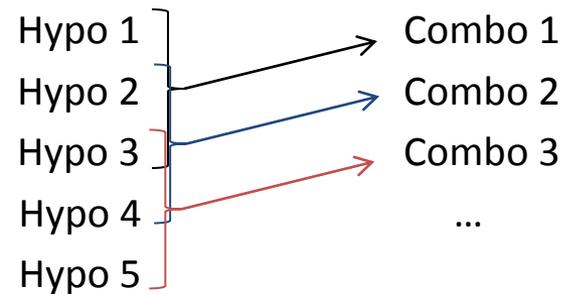
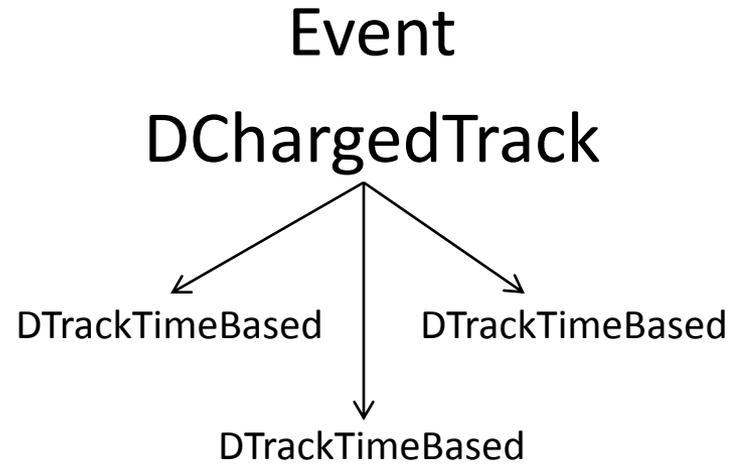
Run over events and write out
tracking information using
danahddm plugin

Each DChargedTrack has several
DTrackTimeBased objects

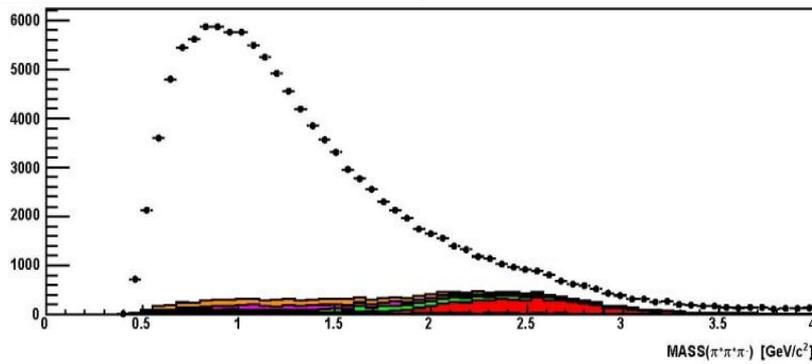
Require at least 3 tracks with net
charge of +1

Take every combination of 3 tracks

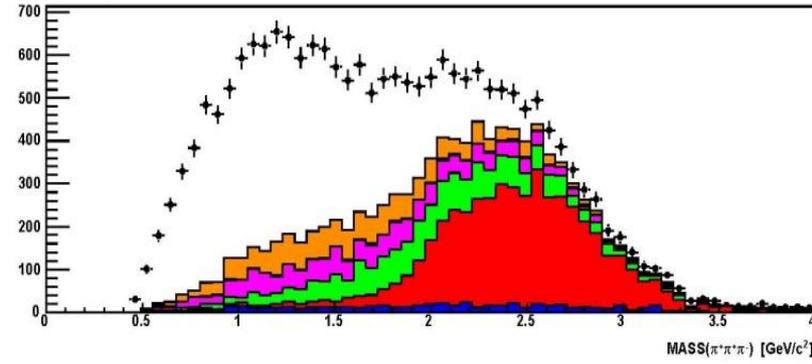
Every hypothesis for each track



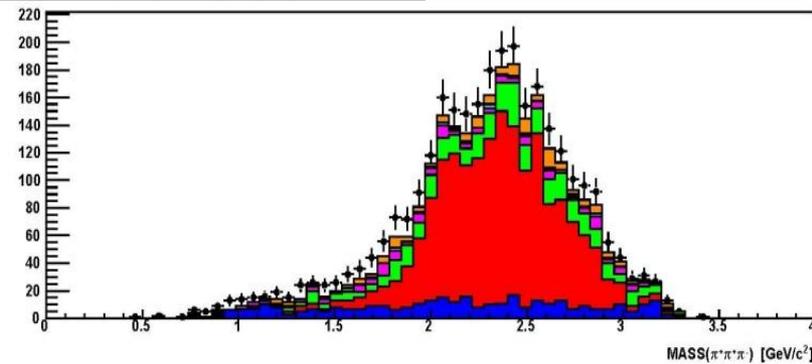
At least 3 tracks and total charge +1



3 tracks only



3 tracks only plus missing mass cut



- FOUND
- RIGHT
- pi+pi-p
- pi+pi-pi0p
- pi+pi+pi-pi0n
- K+K-pi+n
- pi+pi-pi0pi0p

sig:bkg = 639:115441

Significant background contributions from $\pi^+ \pi^- \rho$ and $\pi^+ \pi^+ \pi^- n$

Plus π^0 s

Some other large background?

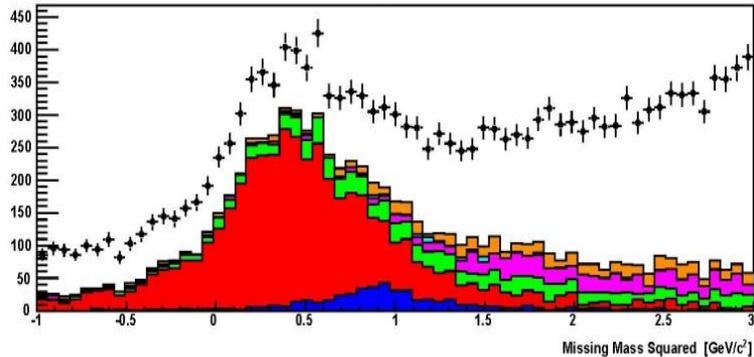
Mostly removed with subsequent cuts

Require 3 tracks

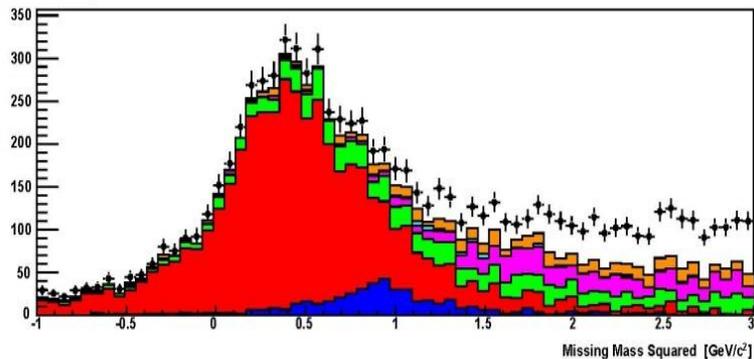
Removes significant amount of background

sig:bkg = 348:2649

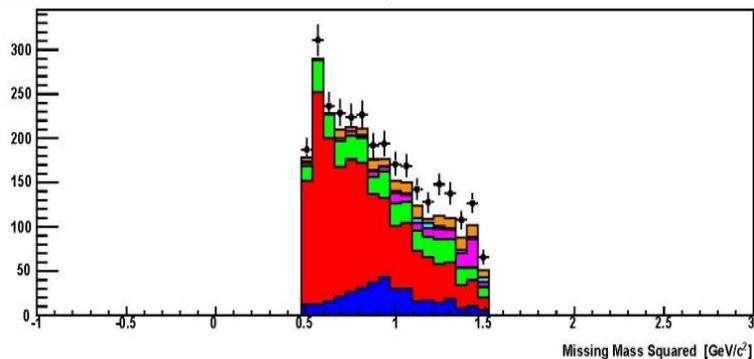
At least 3 tracks and total charge +1



3 tracks only



3 tracks only plus missing mass cut



$$\text{FOM} = \text{sig}/\sqrt{\text{sig}+\text{bkg}}$$

Figure of Merit for Missing Mass

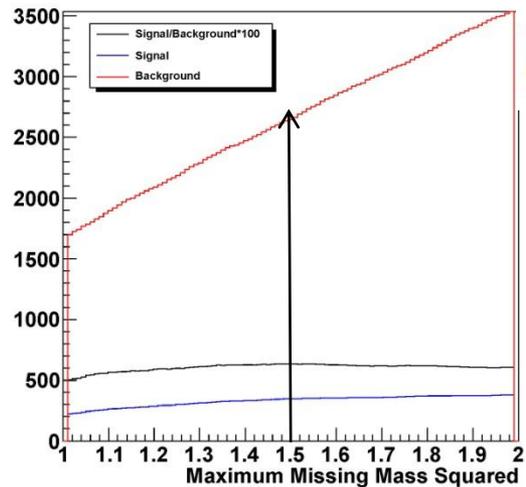
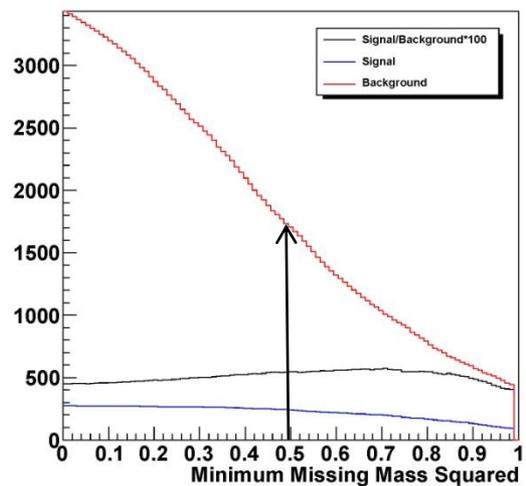


Figure of Merit for Missing Mass

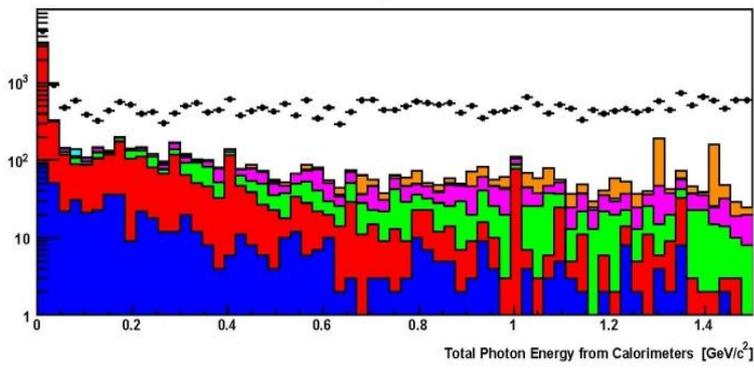


- FOUND
- RIGHT
- pi+pi-p
- pi+pi-pi0p
- pi+pi+pi-pi0n
- K+K-pi+n
- pi+pi-pi0pi0p

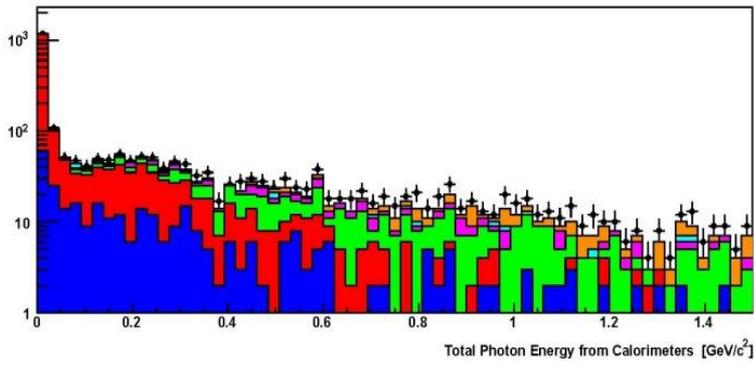
- FOUND
- RIGHT
- pi+pi-p
- pi+pi-pi0p
- pi+pi+pi-pi0n
- K+K-pi+n
- pi+pi-pi0pi0p

Look at the energy of photons in the calorimeter, i.e. not from charged tracks

At least 3 tracks and total charge +1



3 tracks only plus missing mass cut



Add calorimeter energy cut

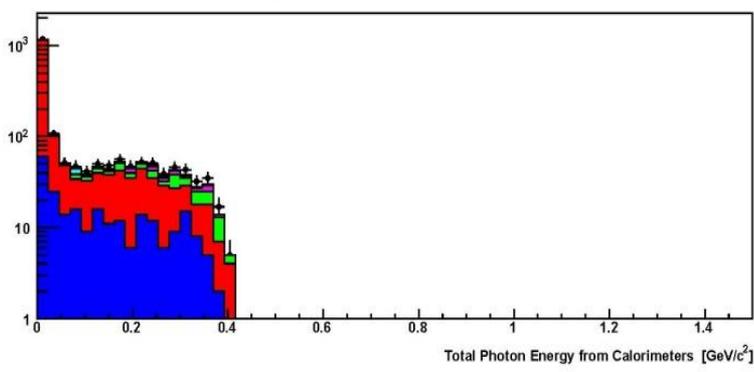
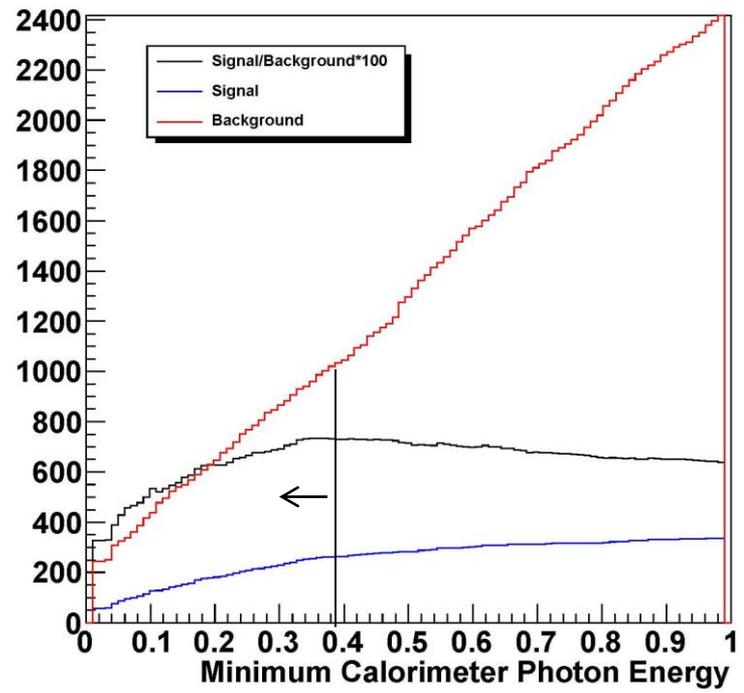
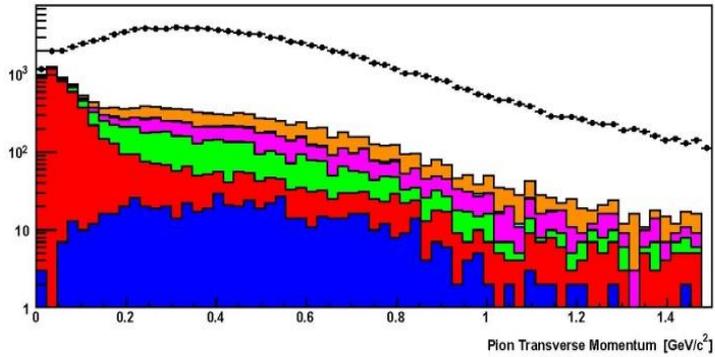


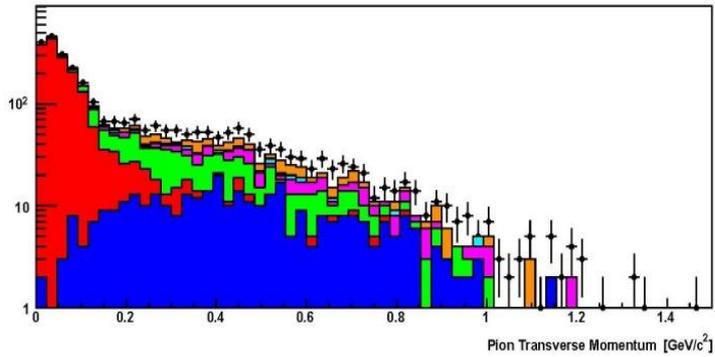
Figure of Merit for Photon Energy



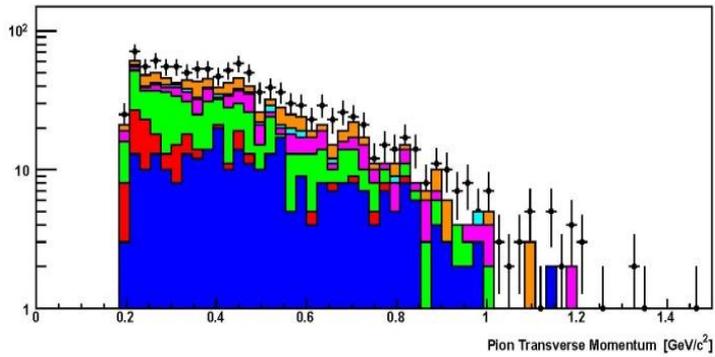
At least 3 tracks and total charge +1



3 tracks only plus missing mass cut



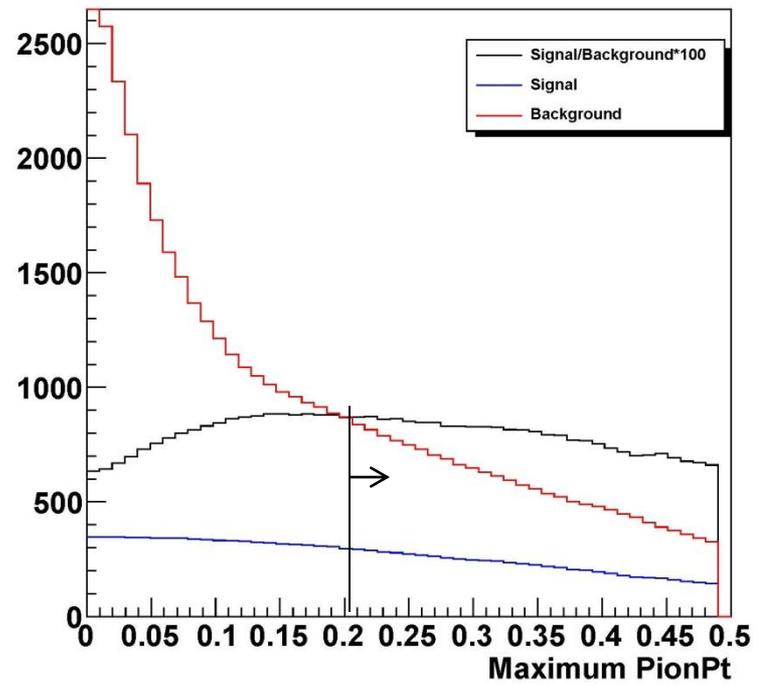
Add calorimeter energy cut



Transverse momentum of “pions” seems to isolate $\pi^+ \pi^- \rho$ background

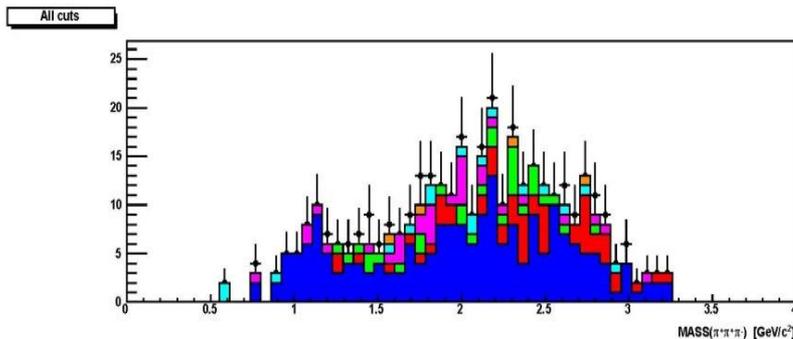
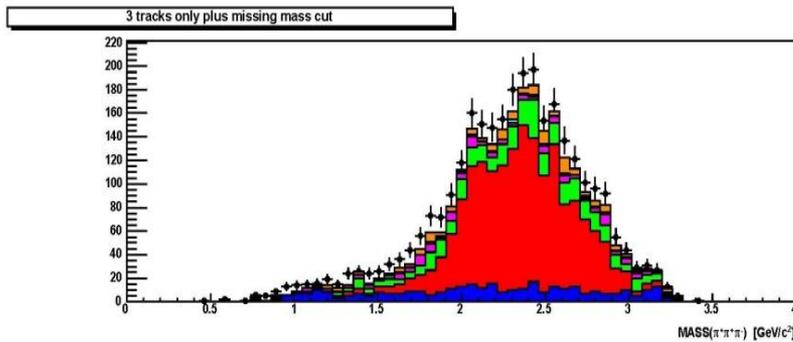
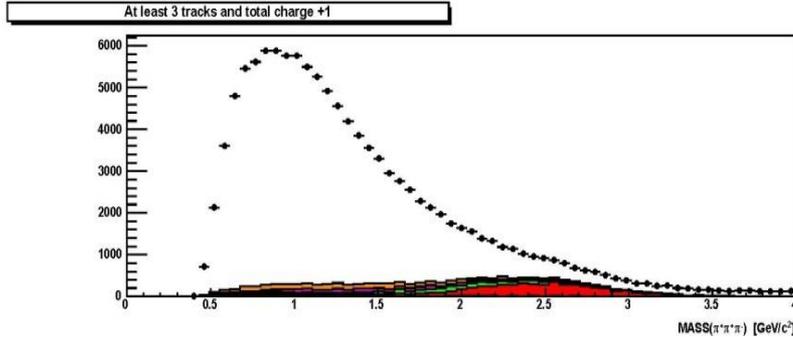
- FOUND
- RIGHT
- pi+pi-p
- pi+pi-pi0p
- pi+pi+pi-pi0n
- K+K-pi+n
- pi+pi-pi0pi0p

Figure of Merit for PionPt



All Cuts

- FOUND
- RIGHT
- pi+pi-p
- pi+pi-pi0p
- pi+pi+pi-pi0n
- K+K-pi+n
- pi+pi-pi0pi0p



sig:bkg = 206:160

$$\text{FOM} = \text{sig}/\sqrt{\text{sig}+\text{bkg}}$$

Cut	Sig Efficiency	FOM
Initial	0.51	1.876
3 Tracks only	0.42	3.407
Missing mass	0.31	4.191
Pion Pt*	0.22	8.705
Calorimeter energy*	0.23	5.463
All Cuts	0.17	10.768

* With tracks and MM cuts

In Progress

Kinematic fit to data

Fit to $\pi^+ \pi^- p$ and use χ^2 as a cut

Error matrices getting filled?

Transform tracking error matrix?

PID should improve signal FOM

Investigate low signal efficiency

Fragments getting counted as tracks?