Reconstruction of K0s using MinBias 7 TeV data

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Neutral kaons

Properties of kaons

Particle name	Particle symbol	Antiparticle symbol	Quark content	Rest mass (MeV/c^2)	I^G	J^{PC}	S	C	B'	Mean lifetime (s)	Commonly decays to (>5% of decays)
Kaon[1]	K^+	K^-	$u\bar{s}$	0,493.677 ± 0.016	$1/2$	0^-	1	0	0	$1.2380 \pm 0.0021 \times 10^{-8}$	$\mu^+ + \nu_\mu$ or $\pi^+ + \pi^0$ $\pi^+ + \pi^+ + \pi^-$ or $\pi^0 + e^+ + \nu_e$
Kaon[2]	K^0	$\bar{K}^0$	$d\bar{s}$	0,497.614 ± 0.024	$1/2$	0^-	1	0	0	[a]	[a]
K-Short[3]	K^0_S	Self	$\frac{d\bar{s}-s\bar{d}}{\sqrt{2}}$[b]	0,497.614 ± 0.024[c]	$1/2$	0^-	(*)	0	0	$8.953 \pm 0.005 \times 10^{-11}$	$\pi^+ + \pi^-$ or $\pi^0 + \pi^0$
K-Long[4]	K^0_L	Self	$\frac{d\bar{s}+s\bar{d}}{\sqrt{2}}$[b]	0,497.614 ± 0.024[c]	$1/2$	0^-	(*)	0	0	$5.116 \pm 0.020 \times 10^{-8}$	$\pi^\pm + e^\mp + \nu_e$ or $\pi^\pm + \mu^\mp + \nu_\mu$ or $\pi^0 + \pi^0 + \pi^0$ or $\pi^+ + \pi^0 + \pi^-$

- Superposition
- Mostly created by fragmentation
- Slow decay via weak interaction
- Requires secondary vertex reconstruction (flight distance =XXX)

Goals

- Reconstruct K0s mass peak
- Compare with MC predictions (PYTHIA MinBias) (width/peak)
- Optimize selection cuts to maximize S/B ratio
- Reconstruct pT/Eta spectrum and compare with MC
- Look at the Dalitz plot
- Reconstruct K0K0 mass spectrum (if 2 candidates are found in an event)
  - S/B ratio should be further increased
  - do we see K0K0 resonances (f(1520 etc..)
- Look at Lambda/Lambda(bar) (if time allows)

Main Programs

Using MinBias D3PD ntuples on the PC farm (7 Tev data), Intg. Lumi= 400 mb-1
D3PD contains V0 information
Using C++/ROOT program
Computer farm to process data

Calculation of invariant mass

Declaring invMass with E^2=(pc)^2+(mc^2)^2

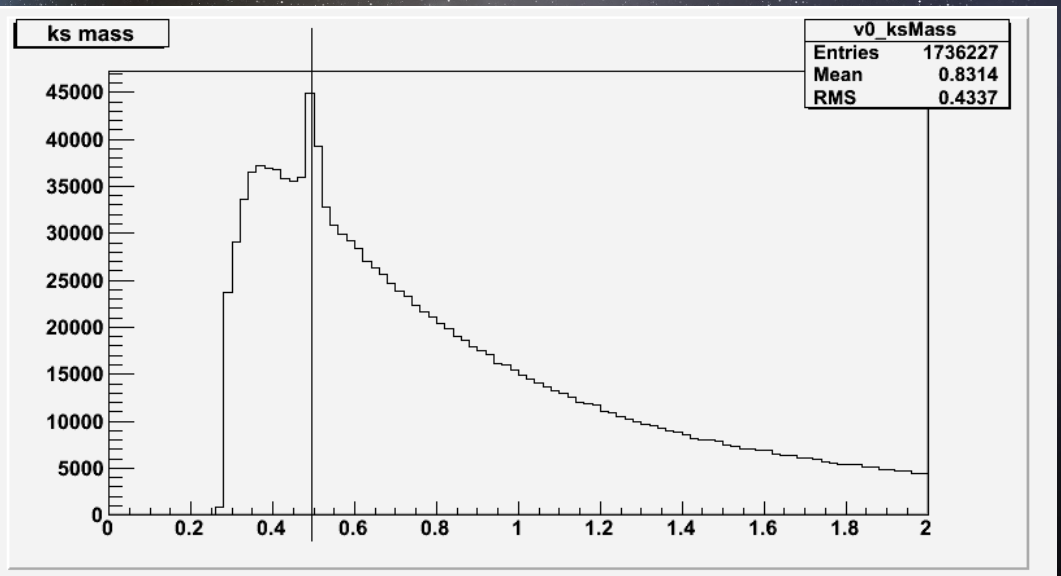
```
.....
double px1=pt * cos(phi);
double py1=pt * sin(phi);
double pz1=pt * sinh(eta);
```

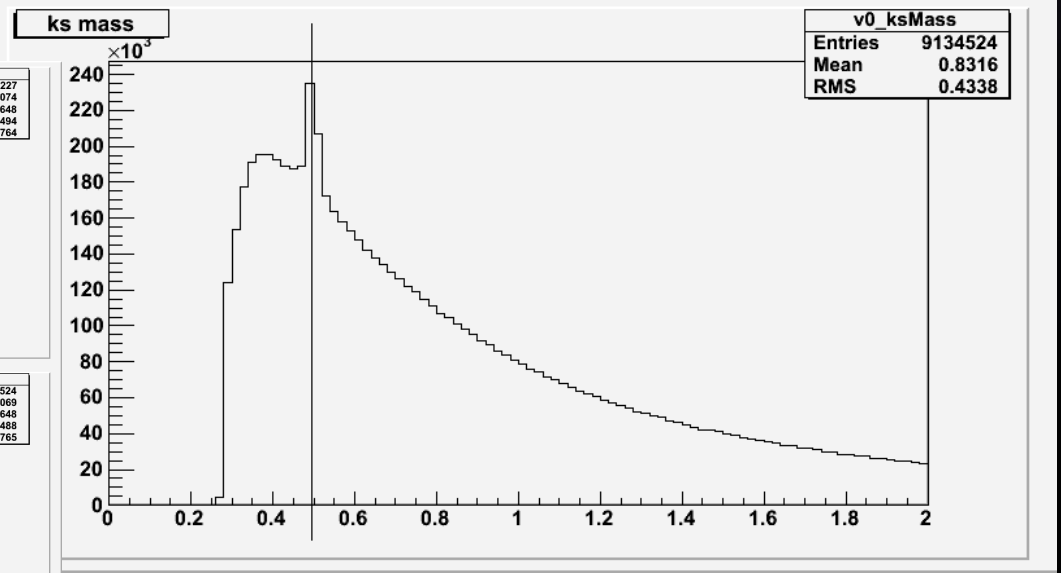
Declaring and filling histogram invMass

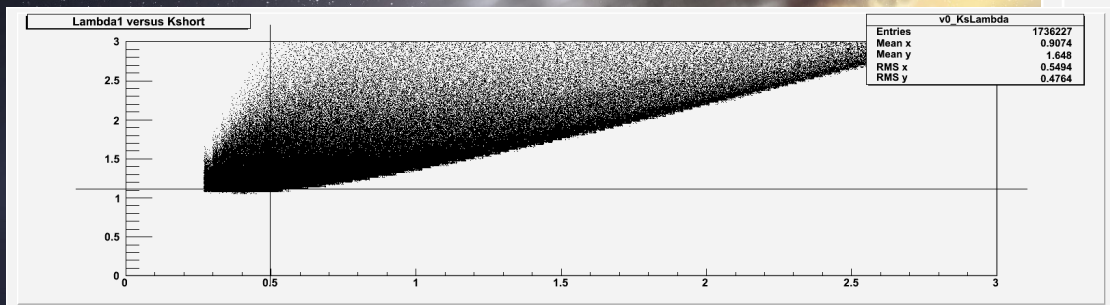
In the end, we switched to v0 variables->K0short.cxx

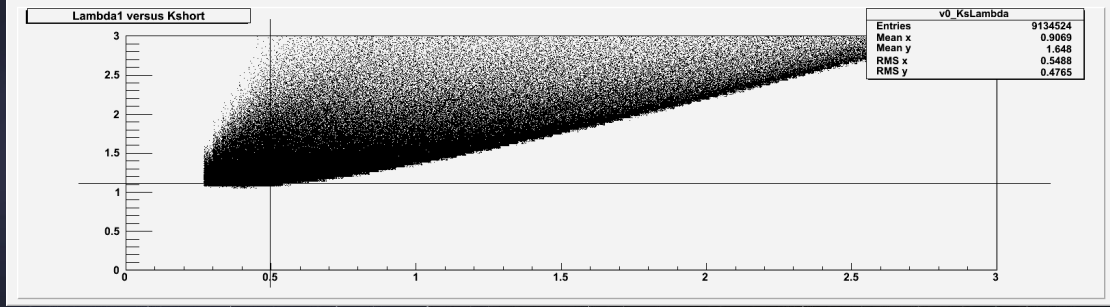
Early MC vs DATA

No cut optimization





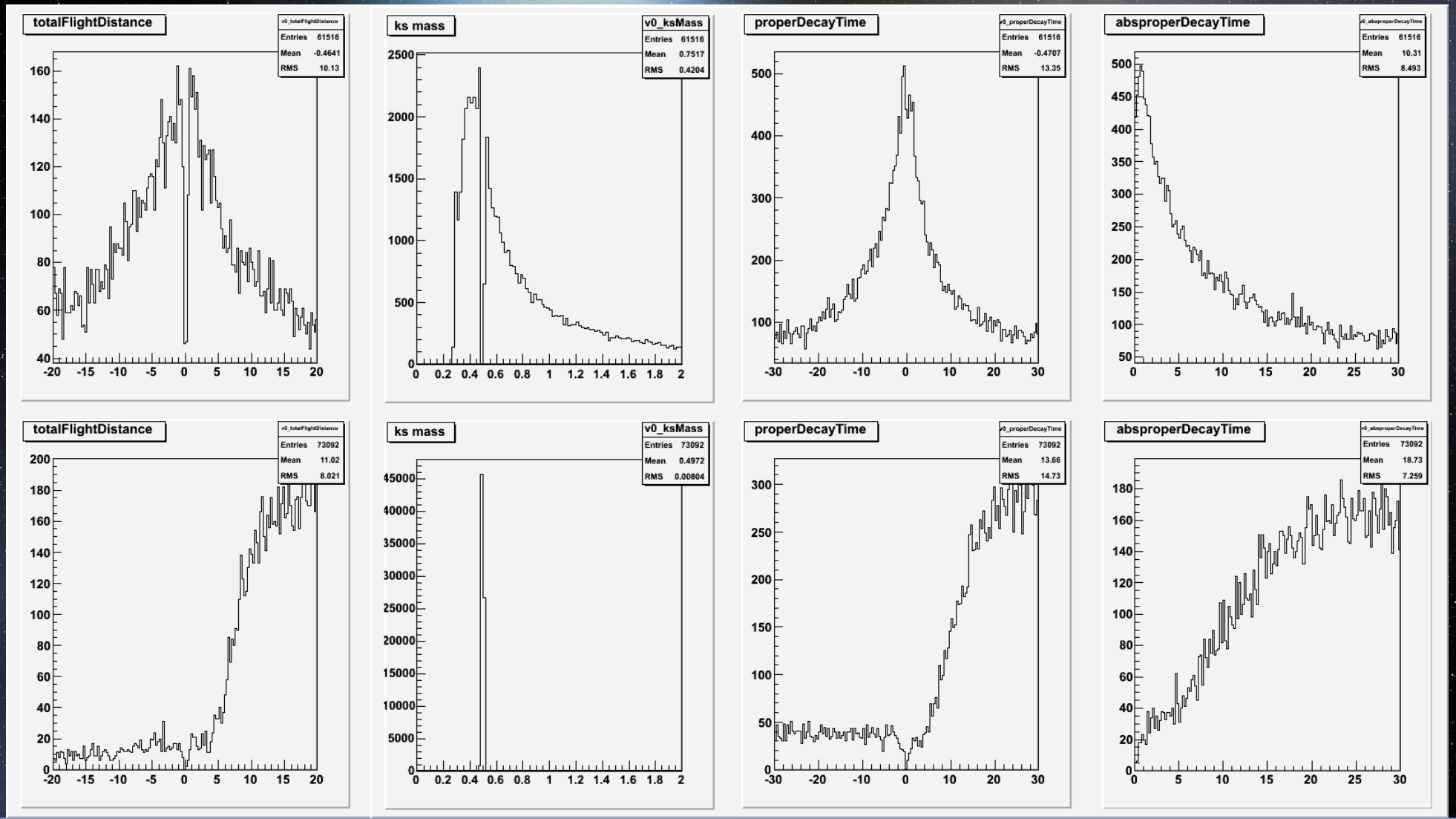




K0short mass reconstruction

- Methods:
- CutEvent.cxx: TakeEvent cut
  - Too many events had K0short
- K0short.cxx: ksMass cut
  - Signal=.497± .018GeV

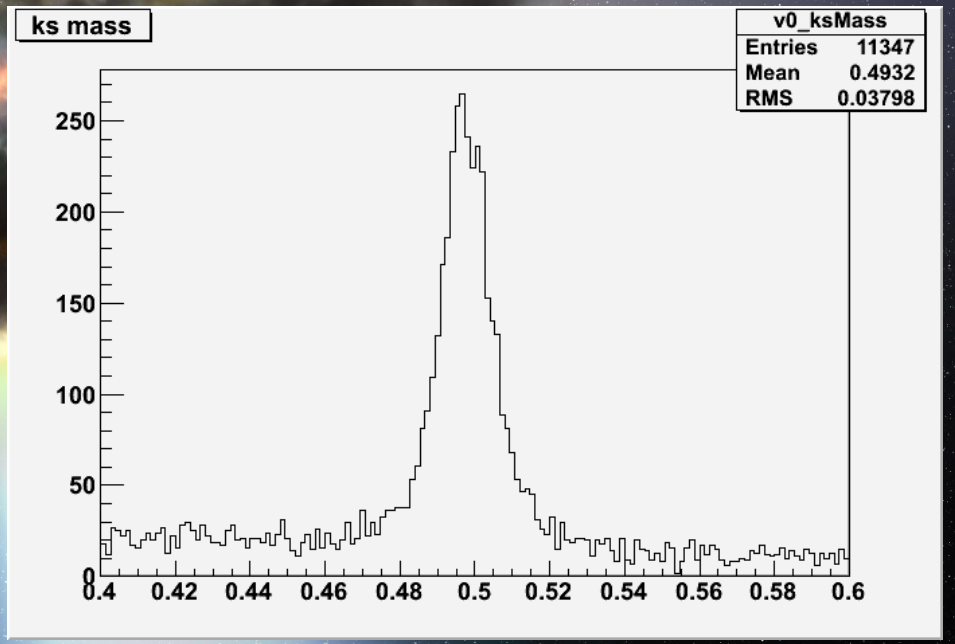
K0short mass reconstruction



Signal versus background (top) after setting fabs(cosThetaPointing)>.999

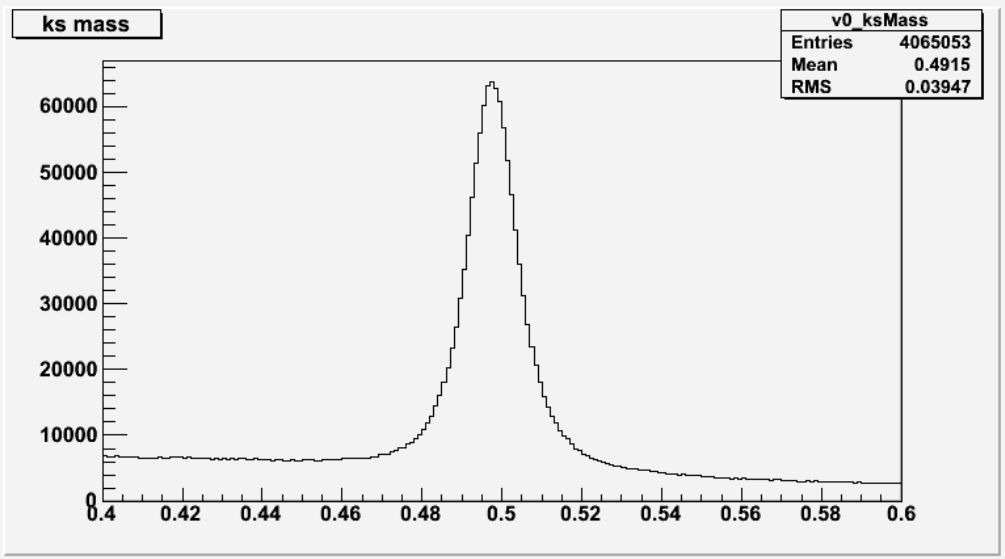
K0short cuts

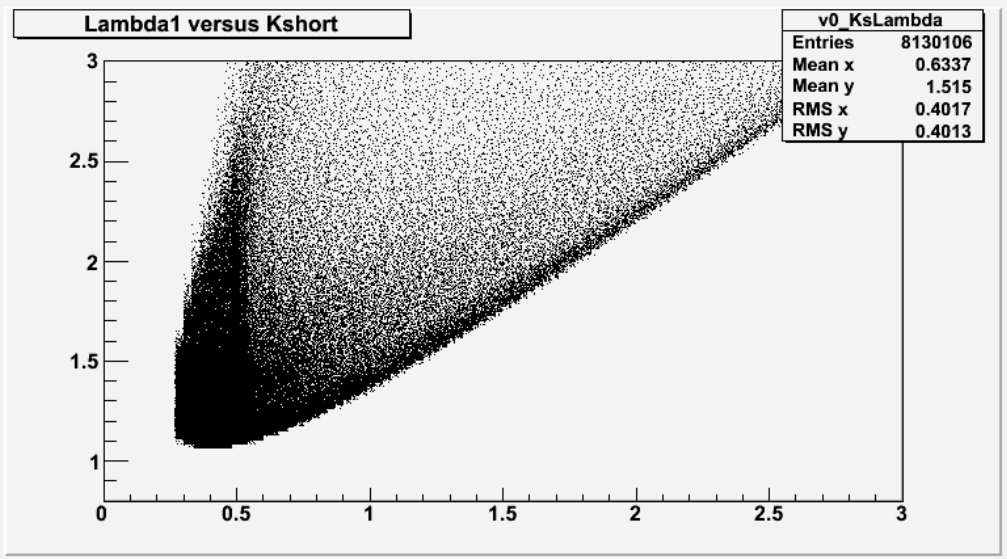
- Event cuts
  - MinBias MBTS_1 trigger
  - PileUp cleaning cut
  - Vertex selection, cut for 2 tracks, etc
- Cuts on tracks:
  - |eta|<MaxEta
  - pt>MinPt
  - |d0|>5mm or |z0|>5mm
- Cuts on V0:
  - fabs(v0_costhetapointing)>.999
  - v0_totalFlightDistance>4
  - v0_properDecayTime>11

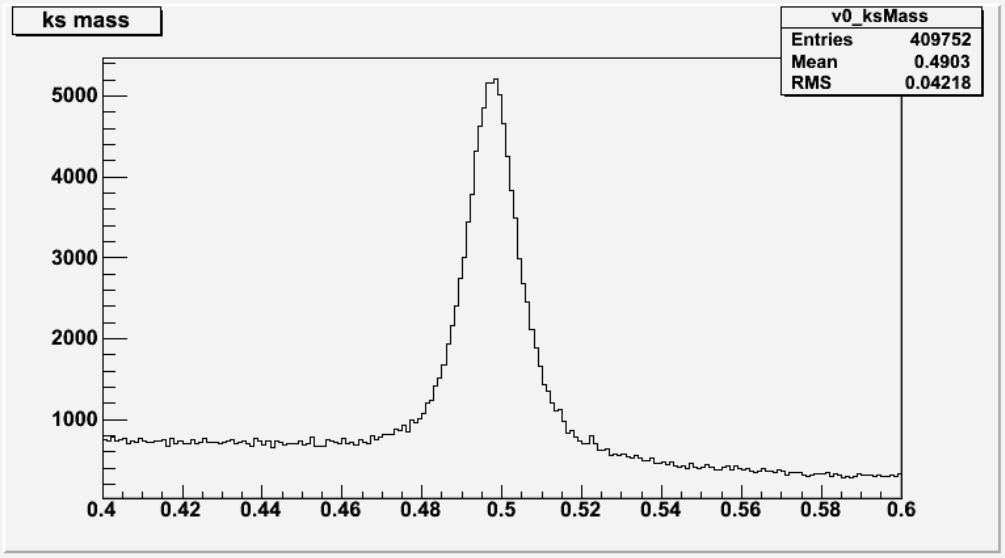


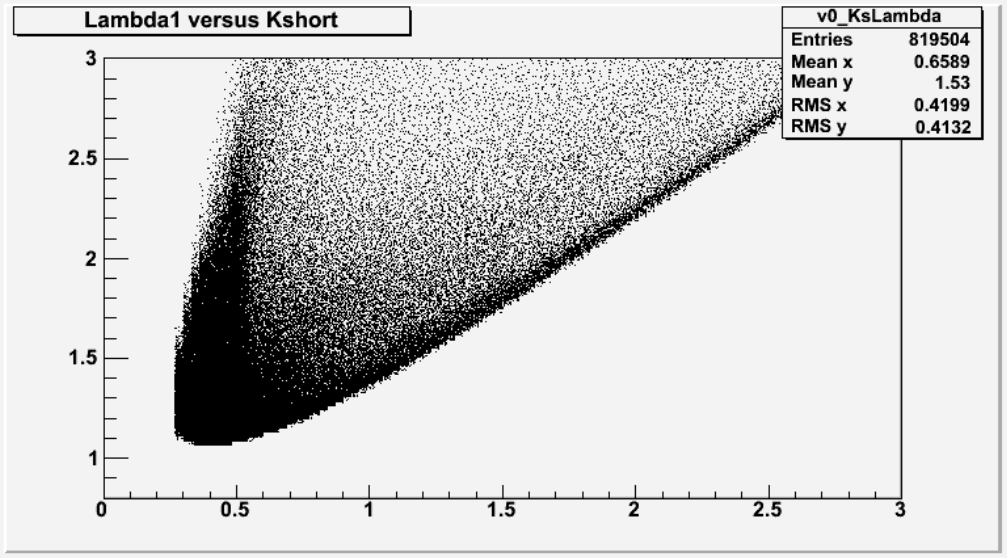
MC

Later MC vs Data



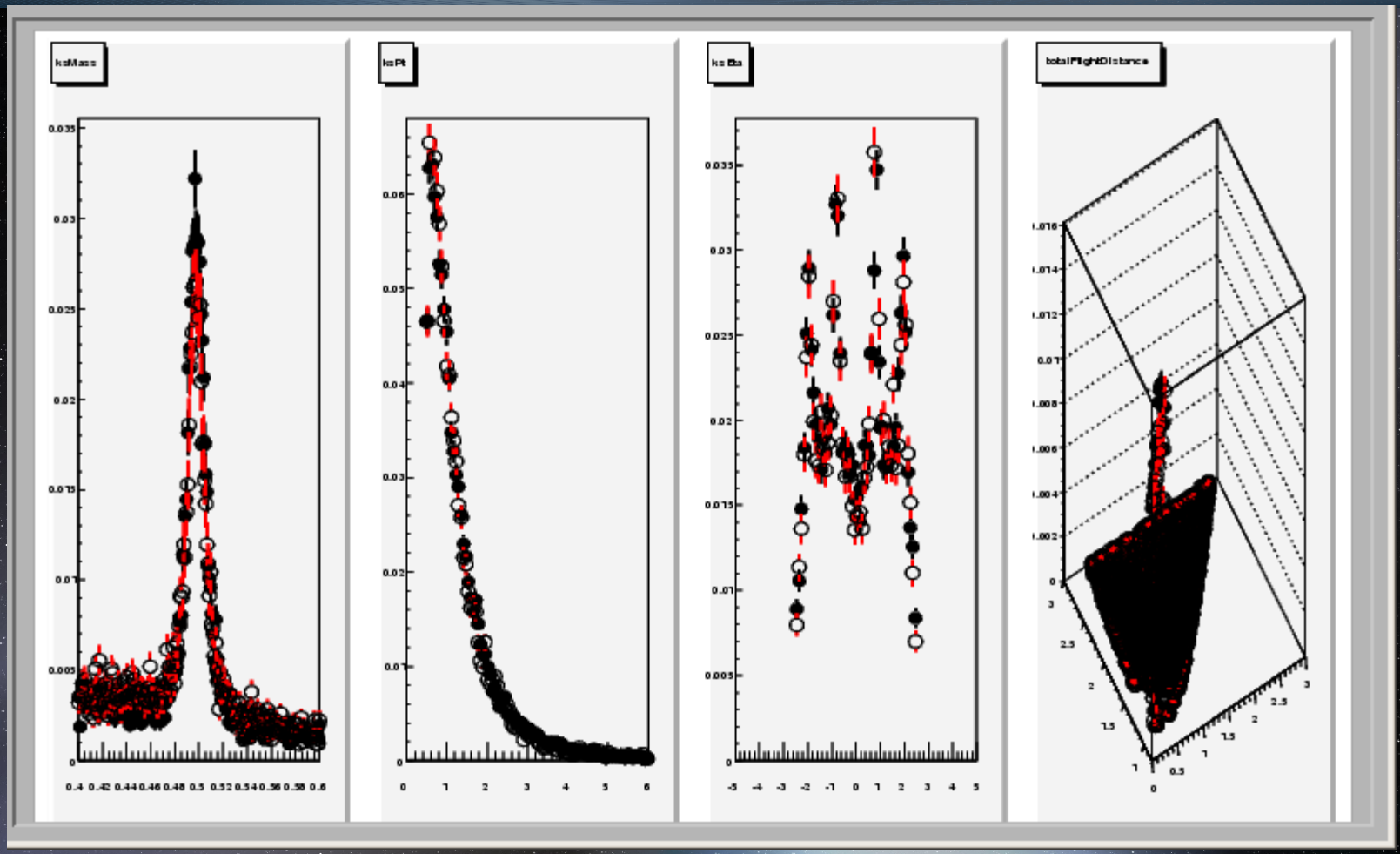






MC is on top here

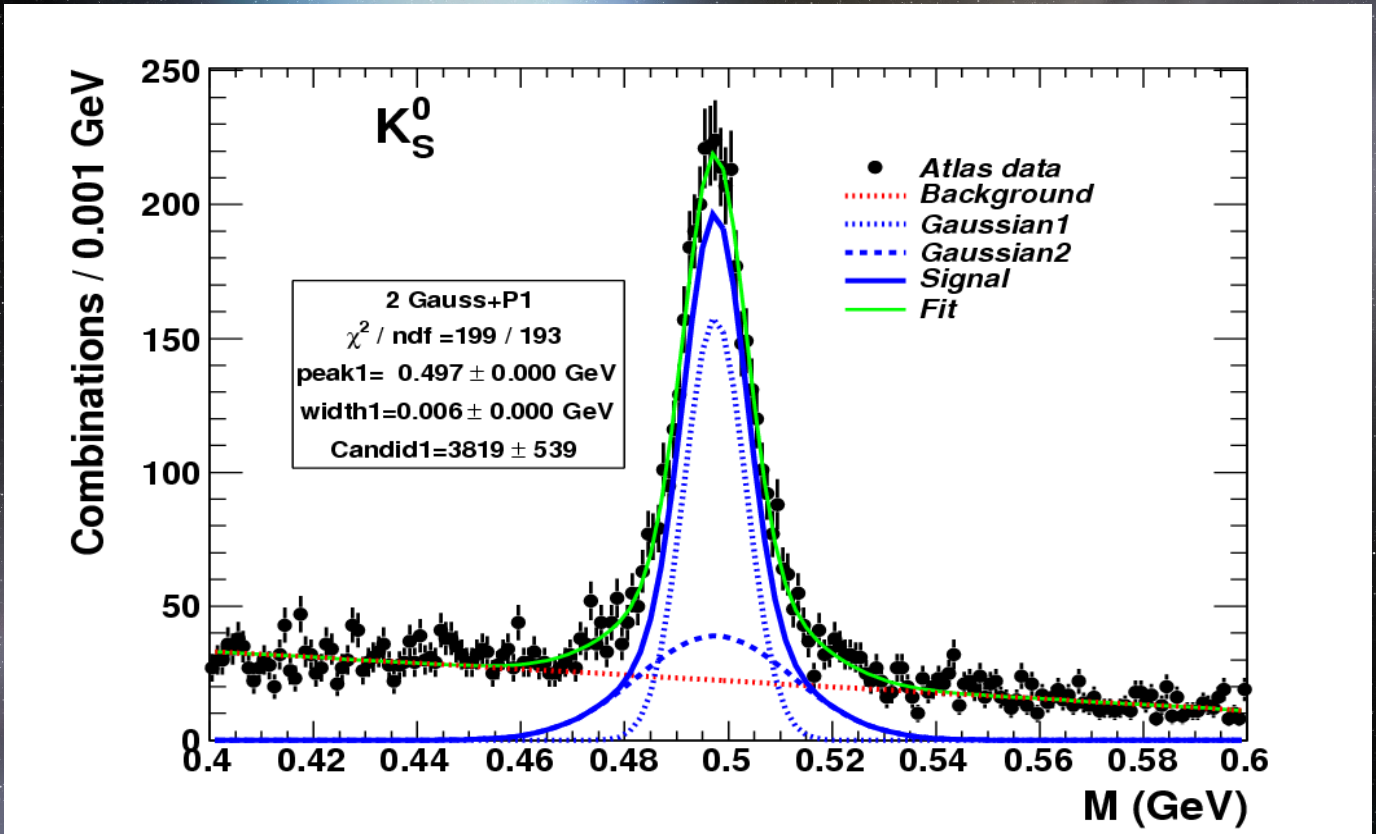
Comparison of MC vs Data



Red is Data here

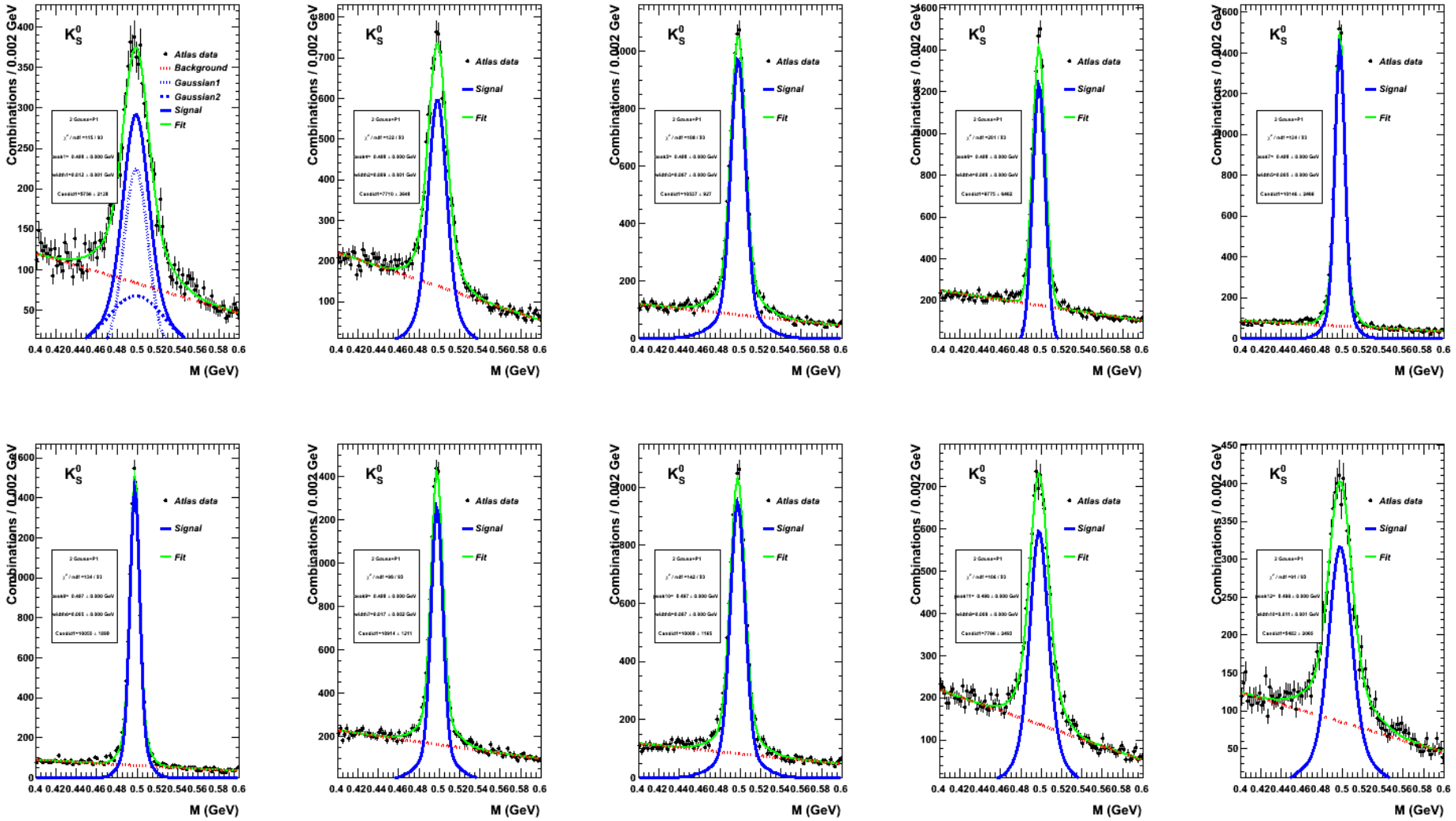
Test for accuracy of QCD prediction

Data Fitting



- Two Gaussians for signal
- Line for background
- Adding a Gaussian and manually defining the second Gaussian

Number of K0short candidates for Pt and Eta Range

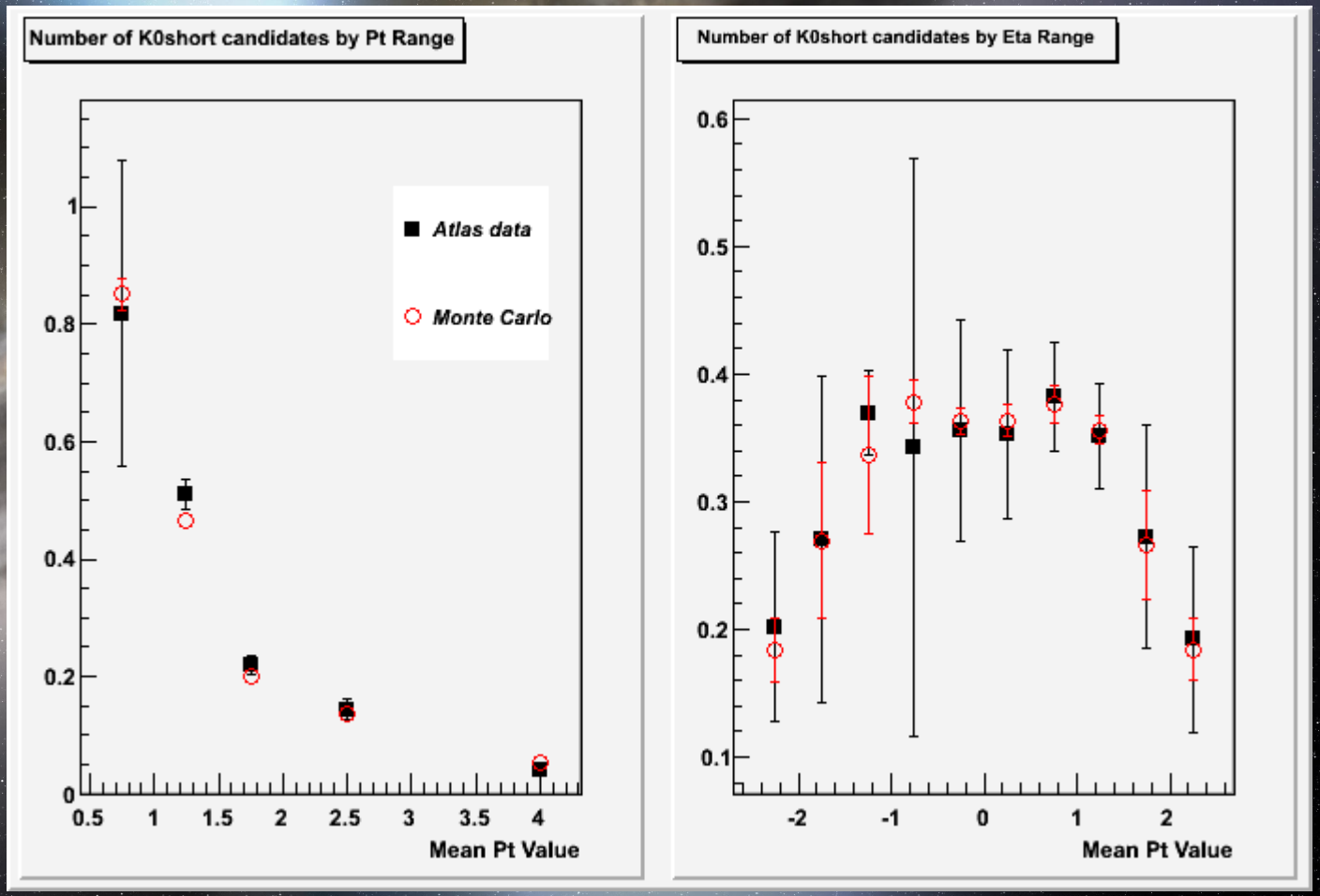


- Dividing integral by bin width
- if (v0_ksEta->at(j) >-2.5 && v0_ksEta->at(j) <=-2.0) {
  h.v0_Eta1Mass->Fill (v0_ksMass->at(j)/GeV); }

K0short candidates by Pt and Eta Range

Red is MC here

- Method
  - conjoin.cxx
- Consistent with QCD predictions?
- Conclusions



Future Goals

- Reduce background for K0short
- Reduce background for lambda
- K0K0
- K0short vs Lambda (#candidates)
- Lambda vs lambda bar (#candidates)-> remembering that it's matter?