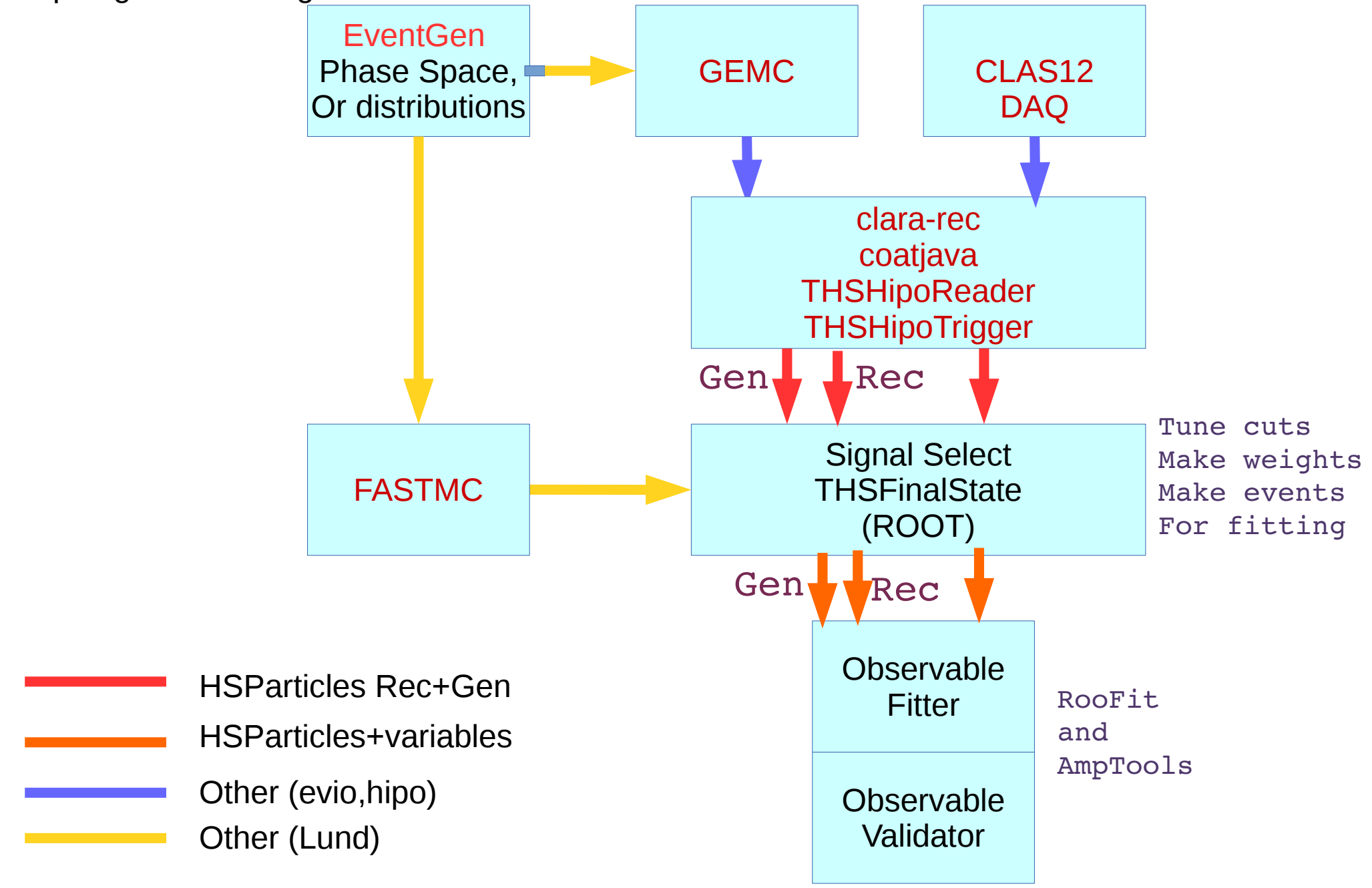
Analysis of low-q, quasi-real processes

Derek Glazier
University of Glasgow

HASPECT Data Analysis

https://www.jlab.org/indico/event/239/session/14/contribution/92/material/slides/0.pdf
https://github.com/dglazier/HASPECT6/wiki

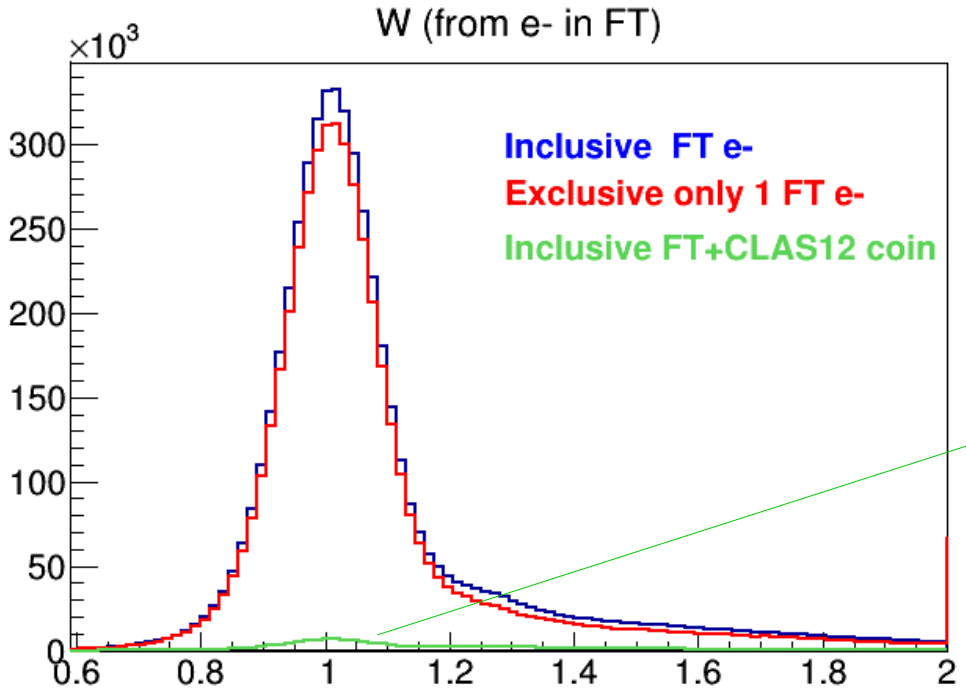


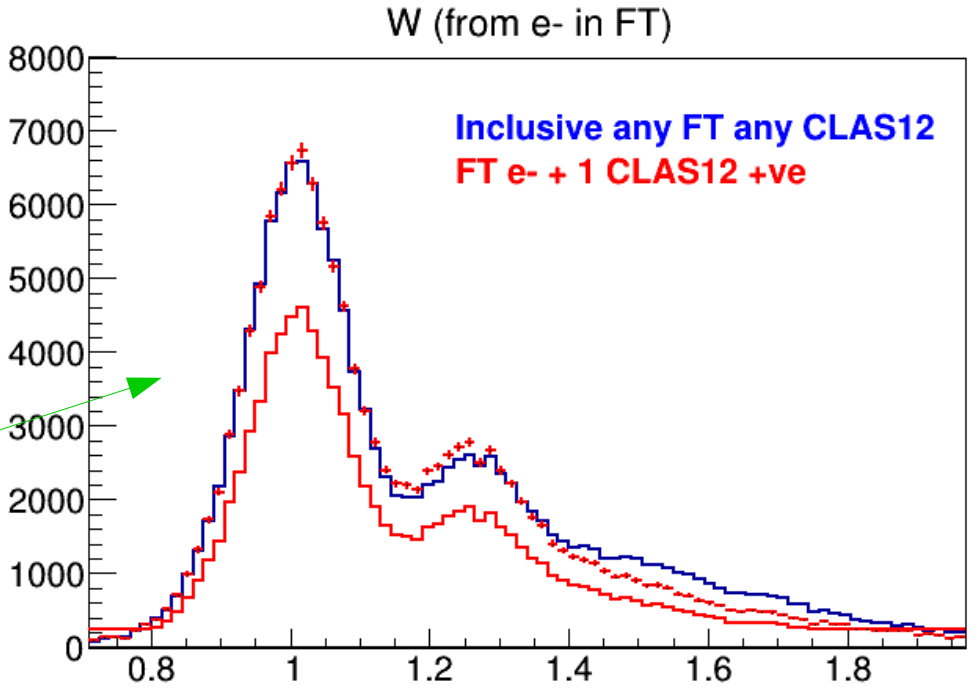
CLAS12 Data

- Engineering Run 2.2 GeV
  - 1 run with FT>100/ trigger = 2433
  - 0.6T, 3nA, 36M events
- RG-A 6.4 GeV
  - Run 3050 : -1T, 15nA, 65M
  - FT>100/256, FT>500/32
- RG-A 10.5
  - Run 3222 :+1T, 25nA, 52M events FT.FD.CD/2,FT.2FD/4,FT.3FD,FT>500/128
  - Run 3518 : -1T, 50nA, 17M FT.FD.CD/32,FT.2FD/1,FTHD>100/2048,FT>100/16k

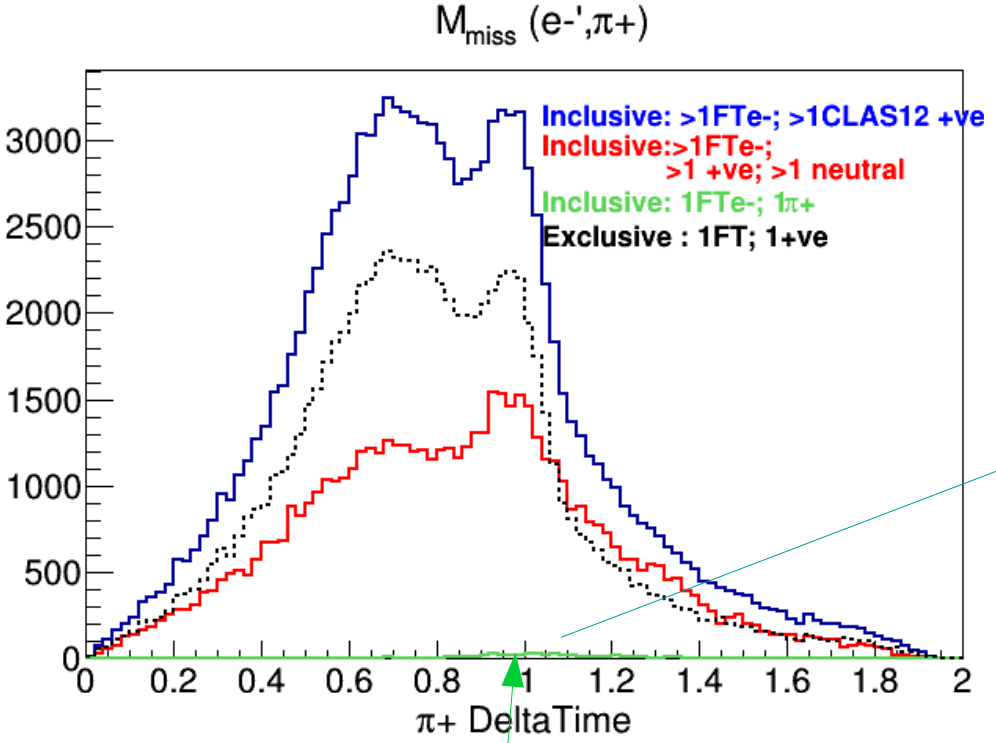
- All information taken from Eventbuilder
  - REC::Particle,….
  - Timing information missing for CD, very broad for FT
    - Mostly Ignore Time/PID here
  - Take EB momentum, make pid hypothesis, use Energy-Momentum conservation
    - Make all possible combinations

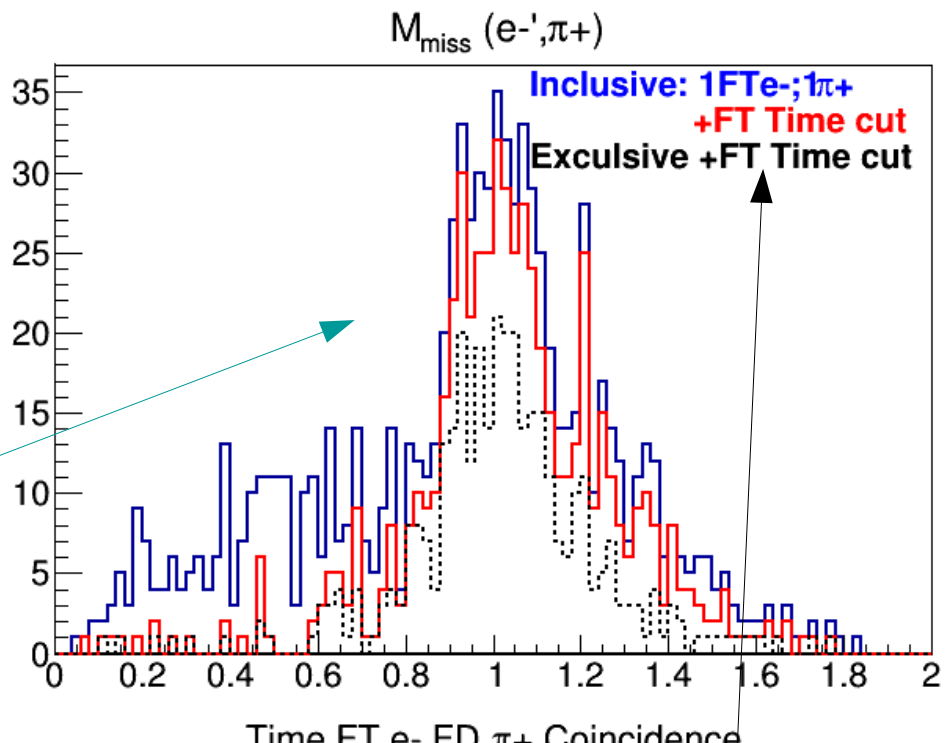
2.2 GeV

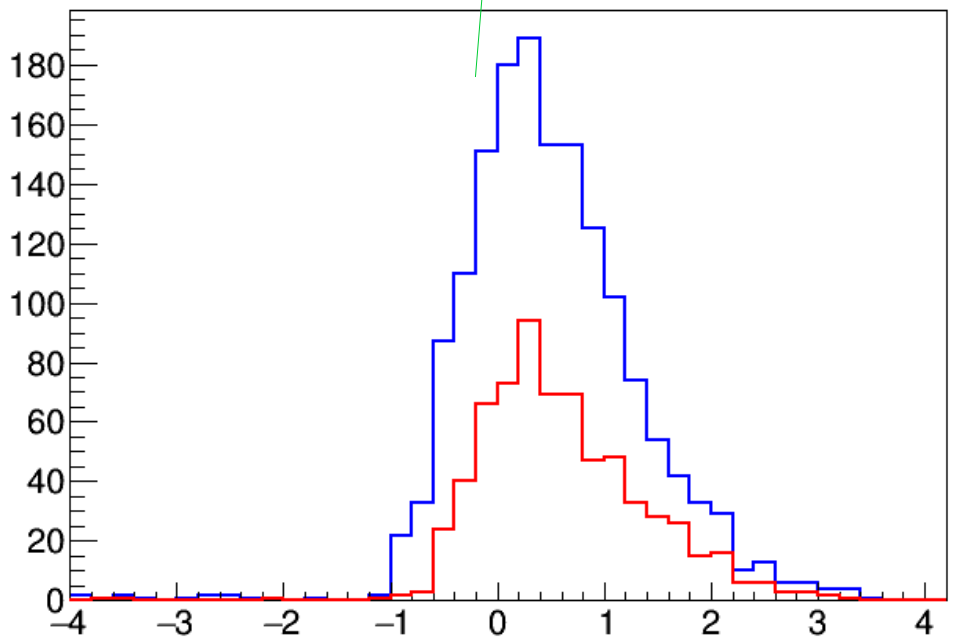

W (from e- in FT)
×10³
300
250
200
150
100
50
0
0.6
0.8
1
1.2
1.4
1.6
1.8
2
Inclusive FT e-
Exclusive only 1 FT e-
Inclusive FT+CLAS12 coin

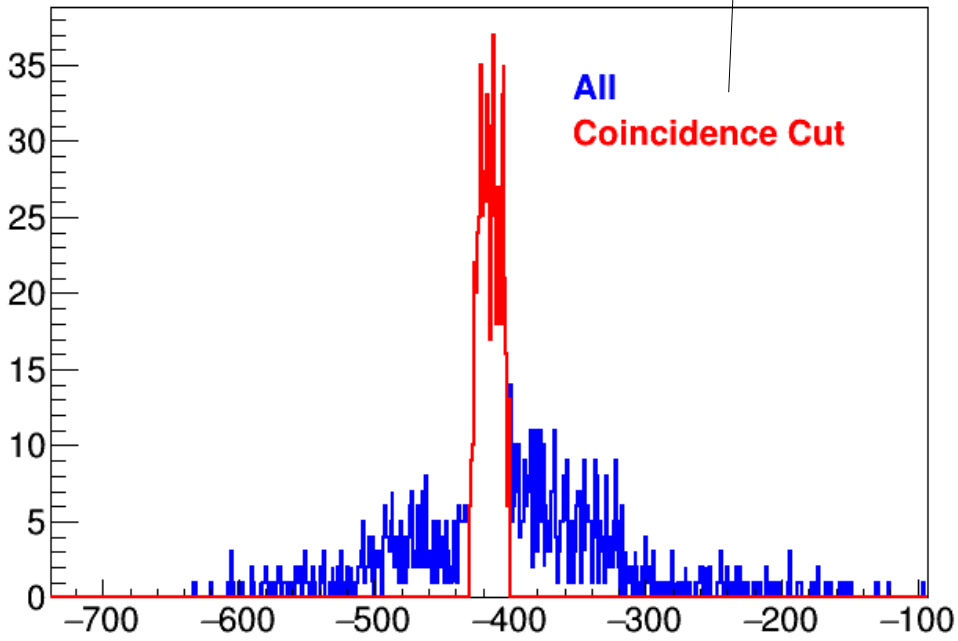

W (from e- in FT)
8000
7000
6000
5000
4000
3000
2000
1000
0
0.8
1
1.2
1.4
1.6
1.8
Inclusive any FT any CLAS12
FT e- + 1 CLAS12 +ve

2.2 GeV npi+

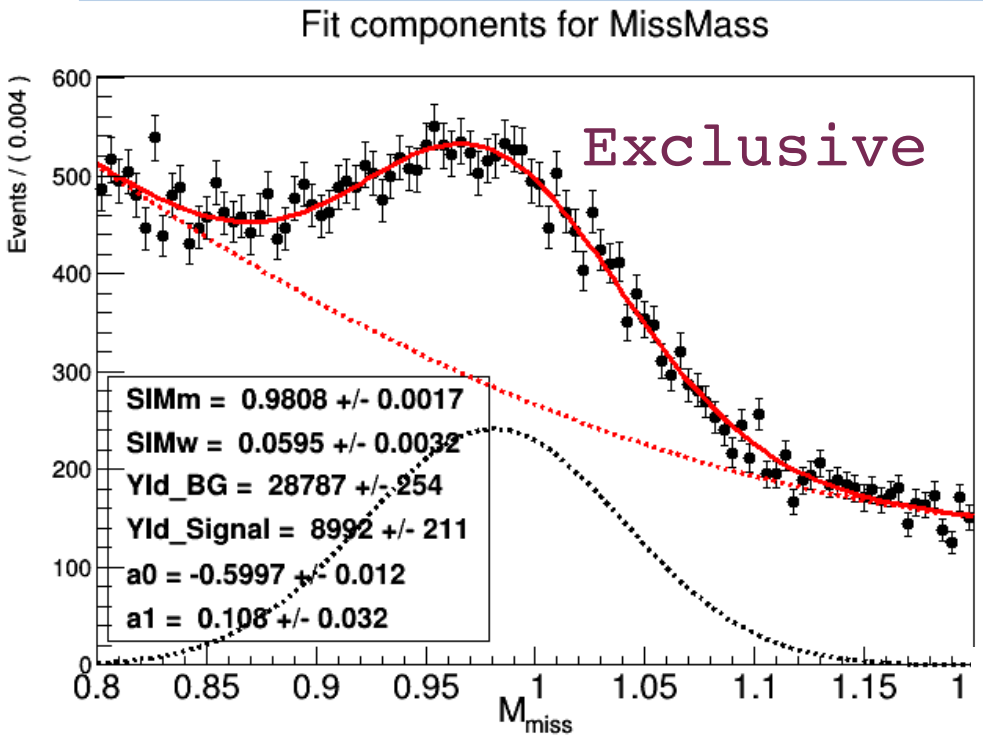

M_{miss} (e-',π+)
Inclusive: >1FTe-; >1CLAS12 +ve
Inclusive:>1FTe-;
>1 +ve; >1 neutral
Inclusive: 1FTe-; 1π+
Exclusive : 1FT; 1+ve
π+ DeltaTime

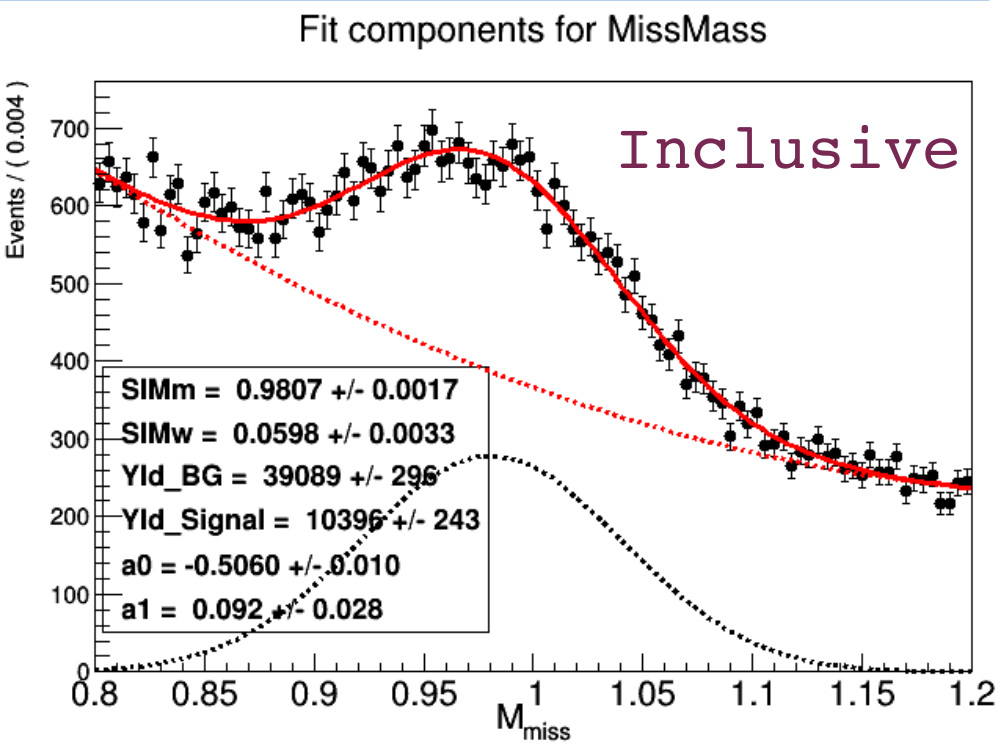

M_{miss} (e-',π+)
Inclusive: 1FTe-;1π+
+FT Time cut
Exculsive +FT Time cut



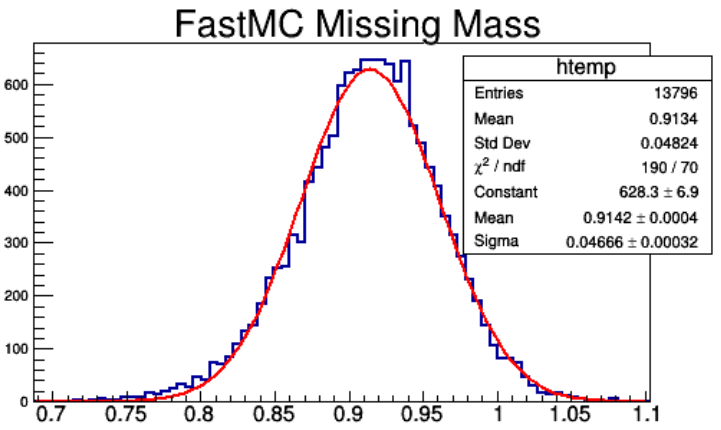

Time FT e- FD π+ Coincidence
All
Coincidence Cut

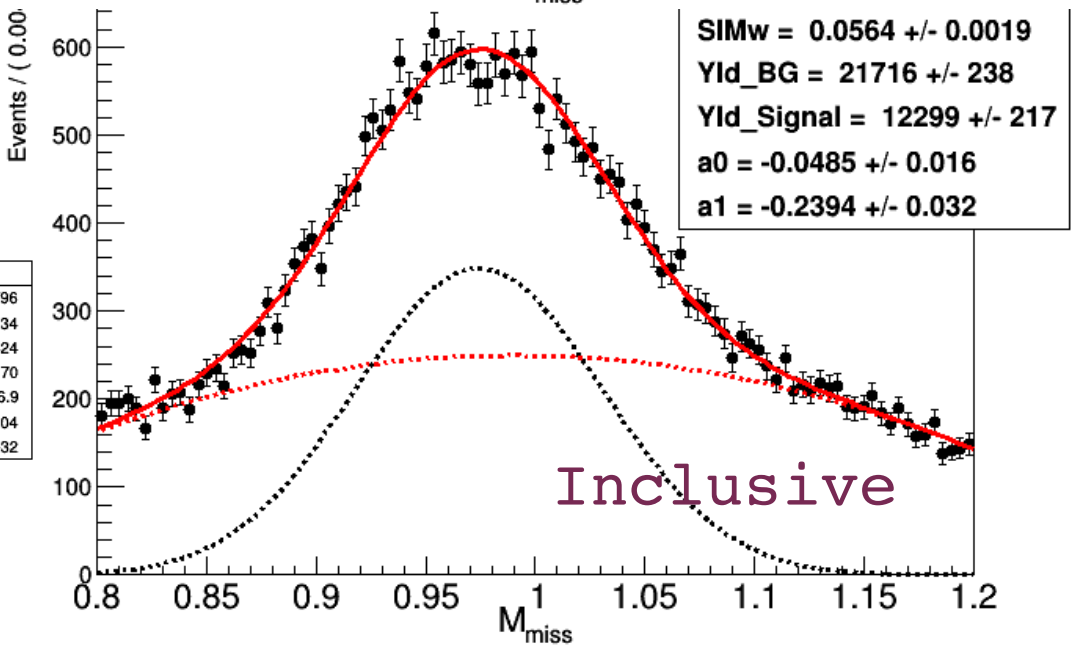
2.2 GeV npi+ sPlots



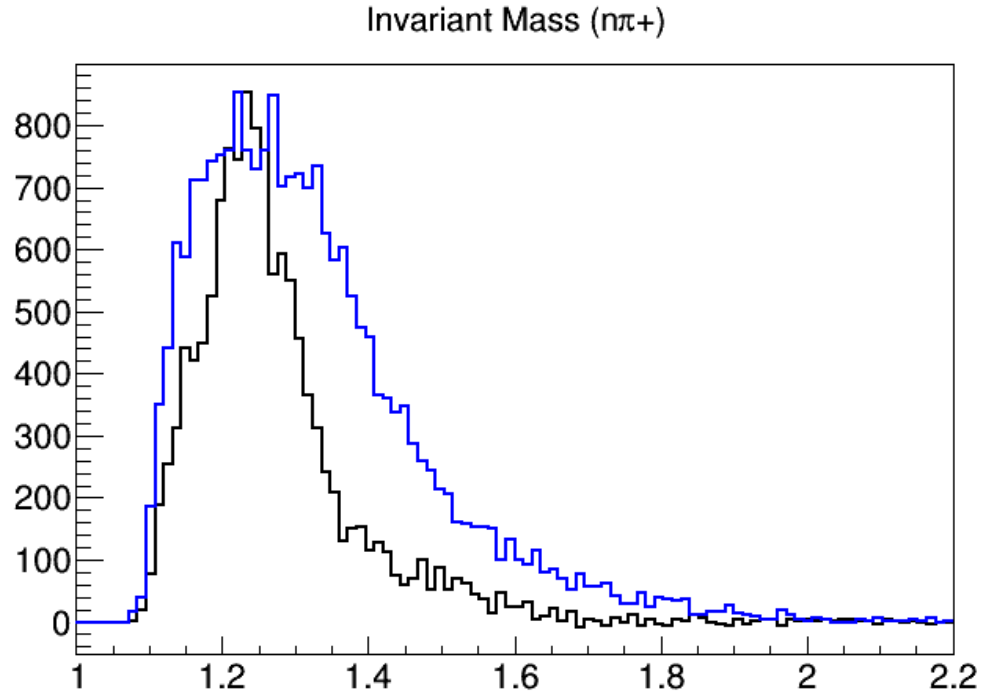


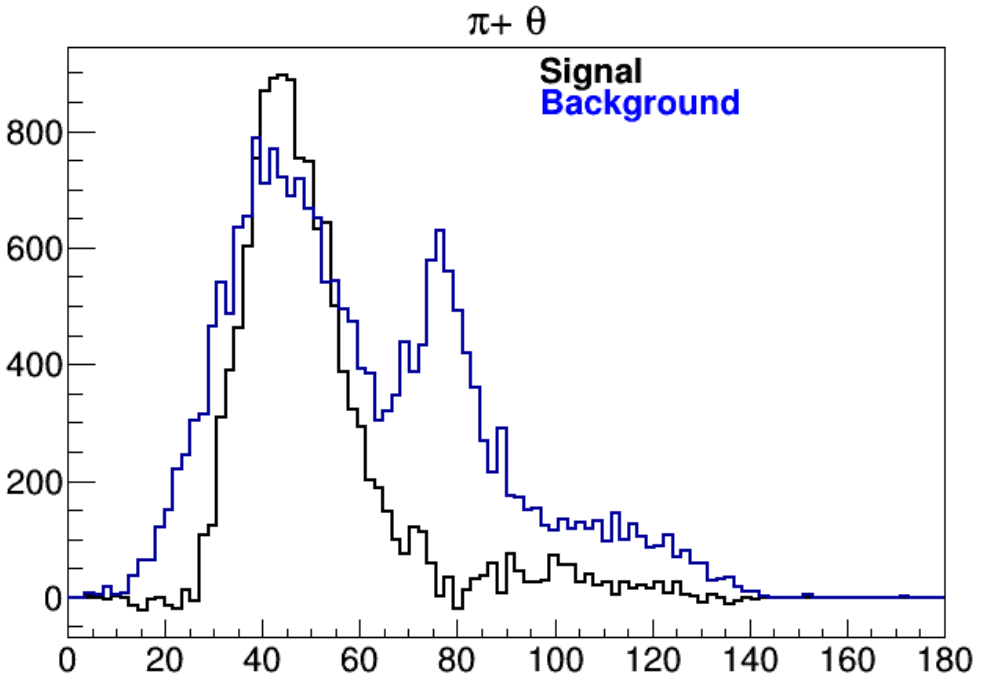
Reduce background by Cut on neutron angle 20<theta<60

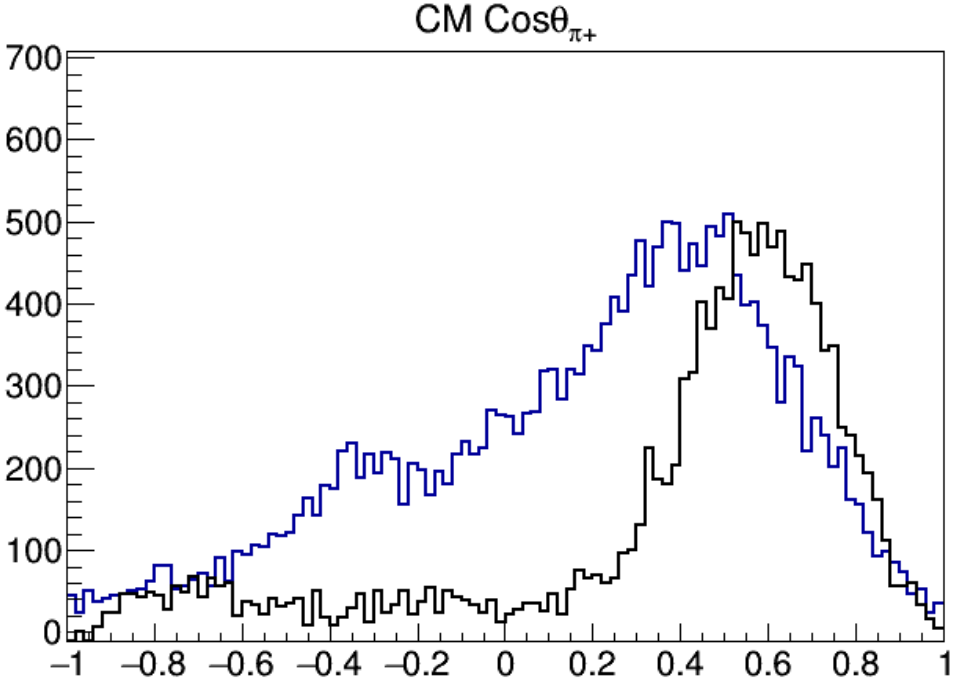


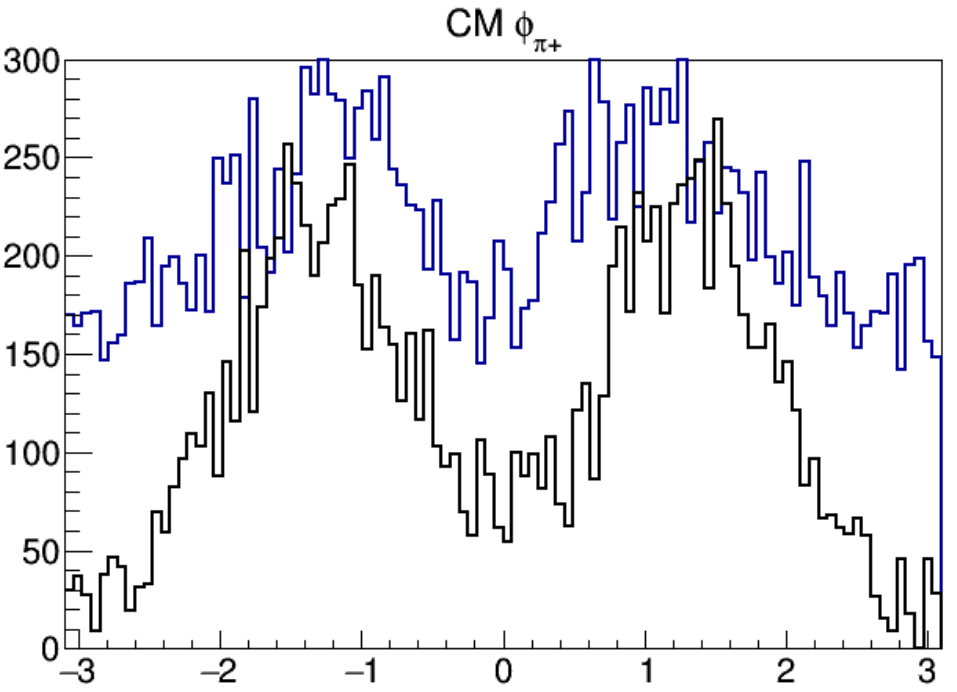


2.2 GeV npi+ sPlot distributions







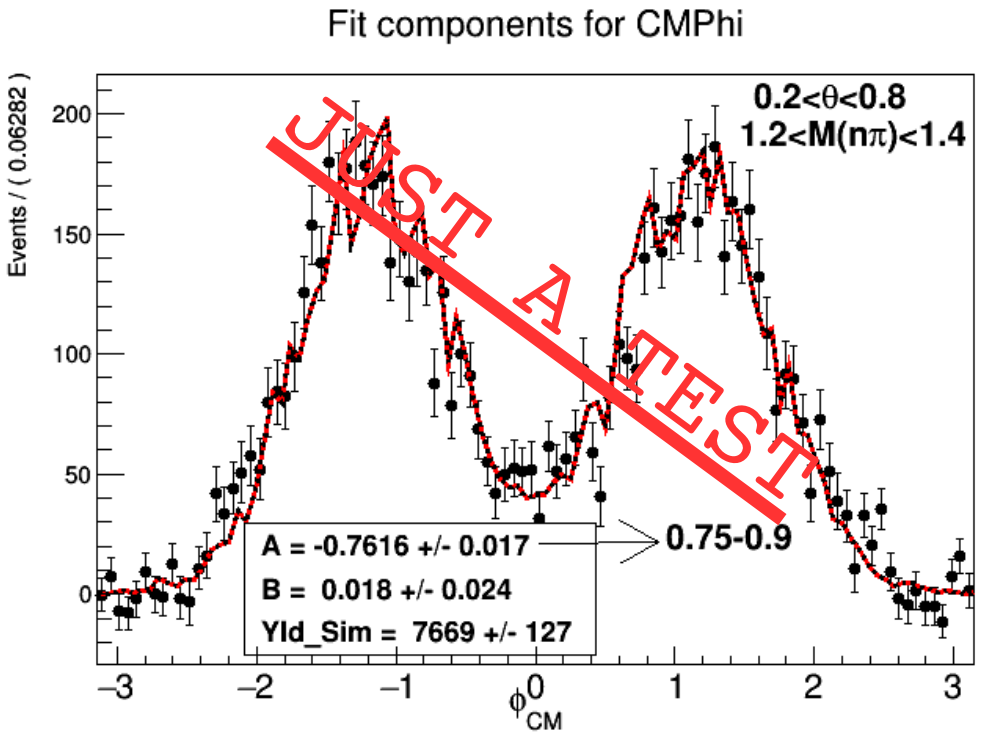


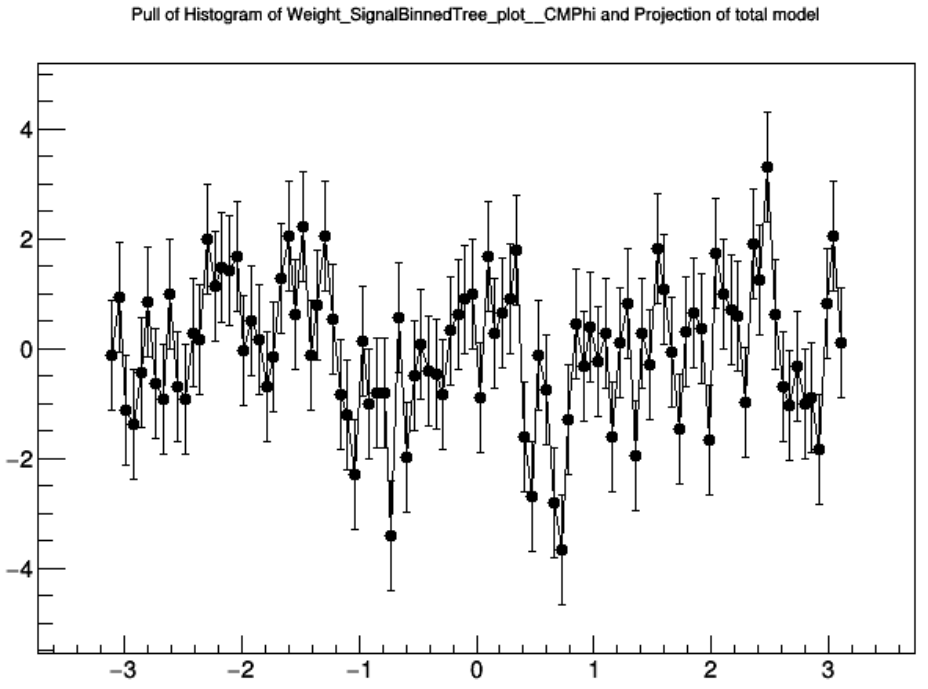
2.2 GeV npi+ Full Chain Observables

Maximum likelihood fit to beam asymmetry

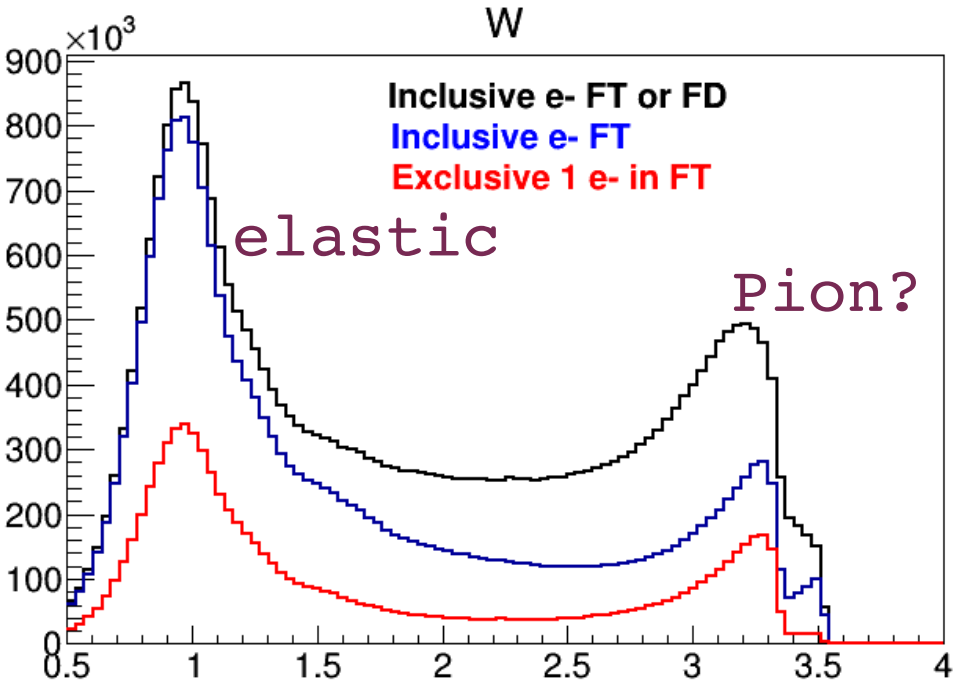
Acceptance corrected via fastmc interface

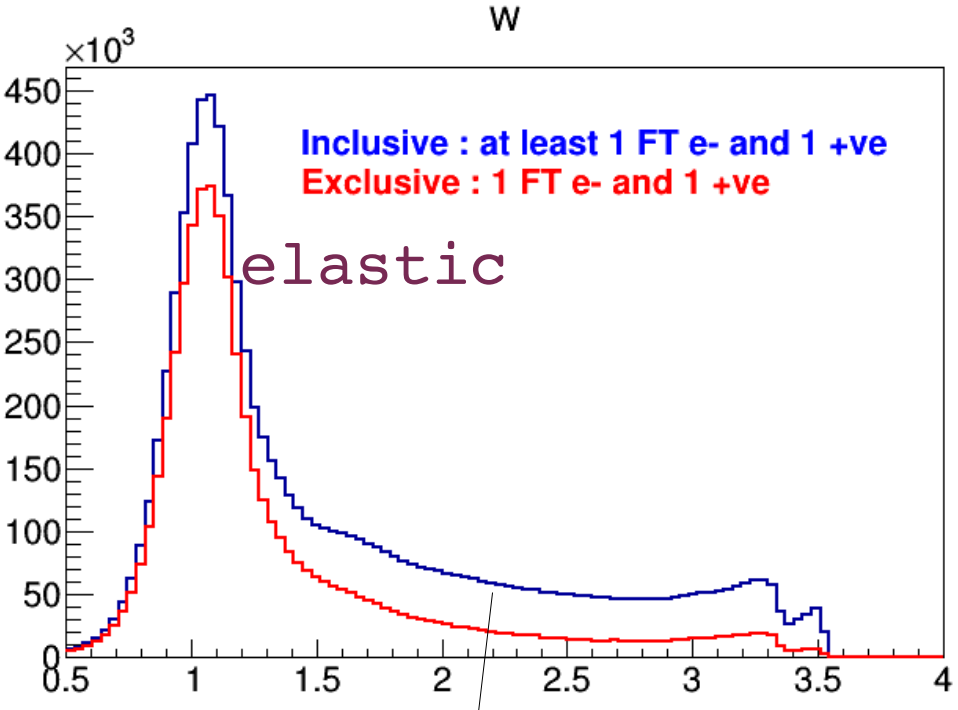
Background subtracted via sWeights

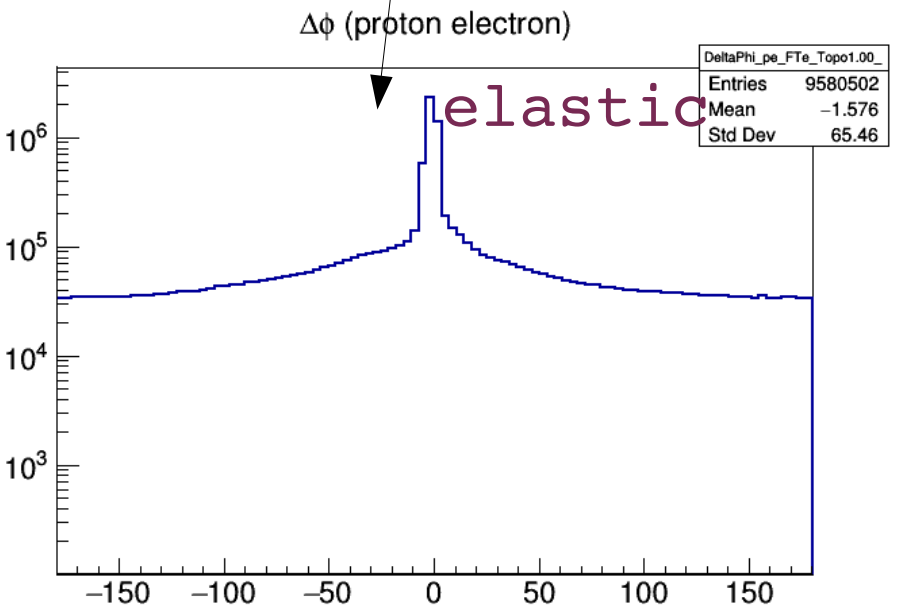




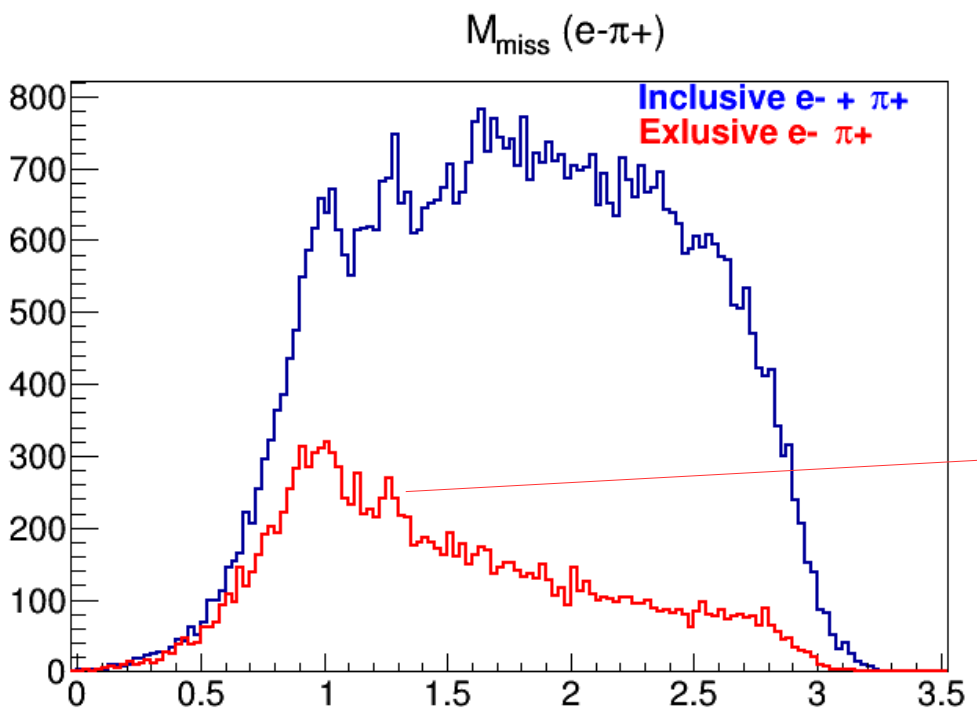
6.4 GeV e-

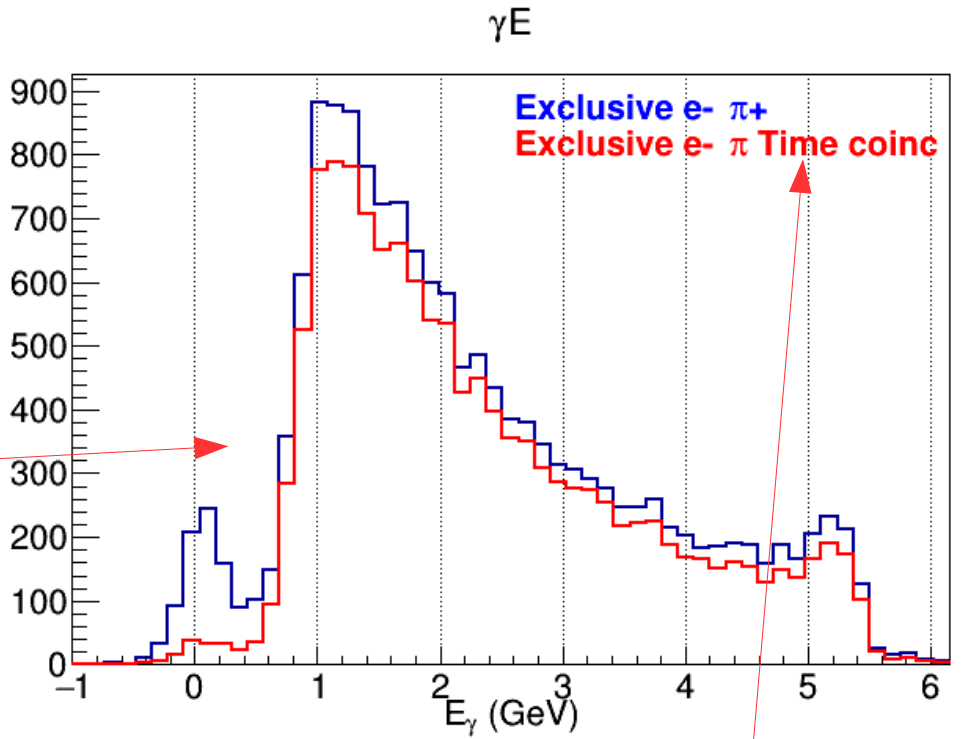

W
×10^3
Inclusive e- FT or FD
Inclusive e- FT
Exclusive 1 e- in FT
elastic
Pion?

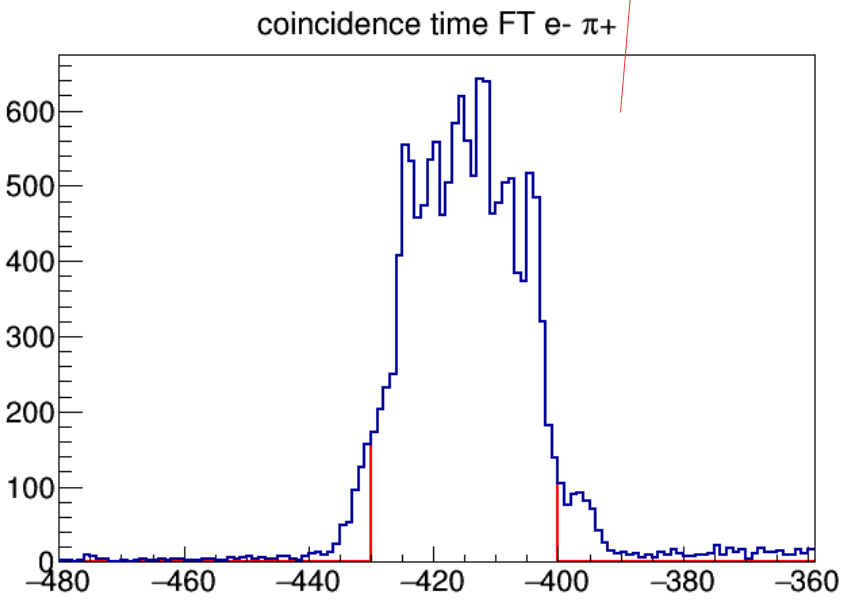

W
×10^3
Inclusive : at least 1 FT e- and 1 +ve
Exclusive : 1 FT e- and 1 +ve
elastic


Δϕ (proton electron)
DeltaPhi_pe_FTe_Topo1.00_
Entries 9580502
Mean −1.576
Std Dev 65.46
elastic

6.4 GeV npi+



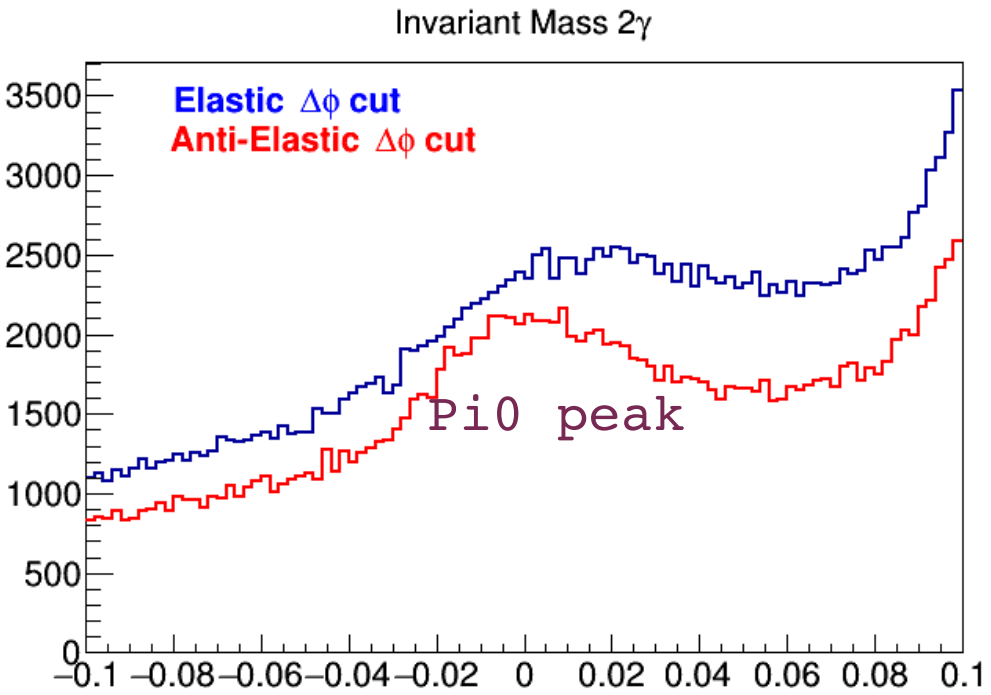


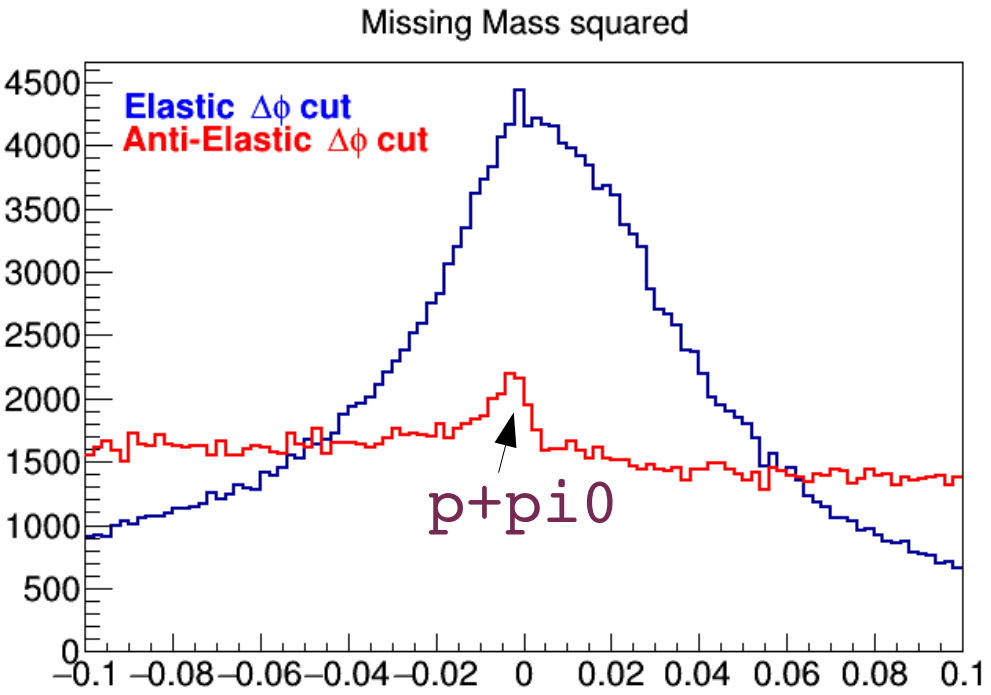


FT – CLAS12 coincidence time needs some work.

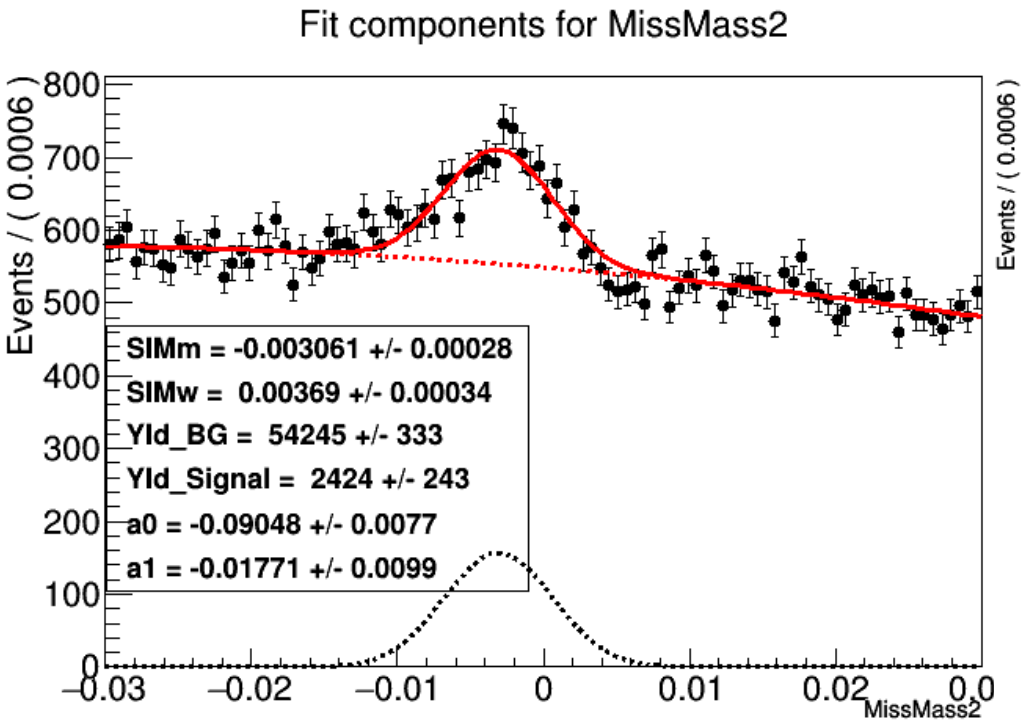
6.4 GeV ppi0

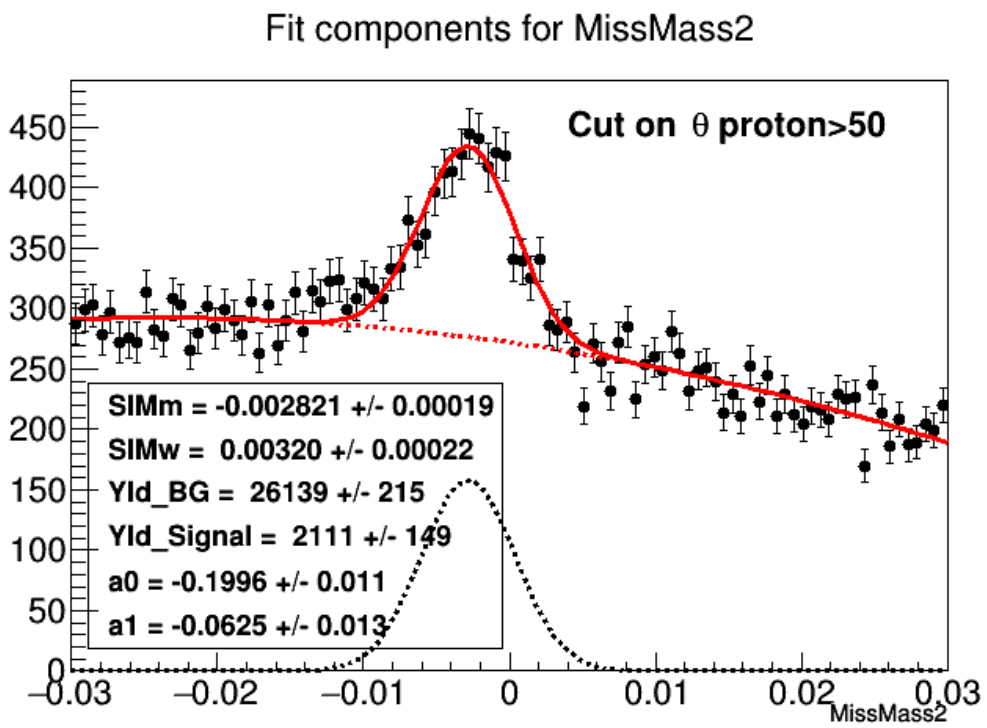
Look for exclusive final state





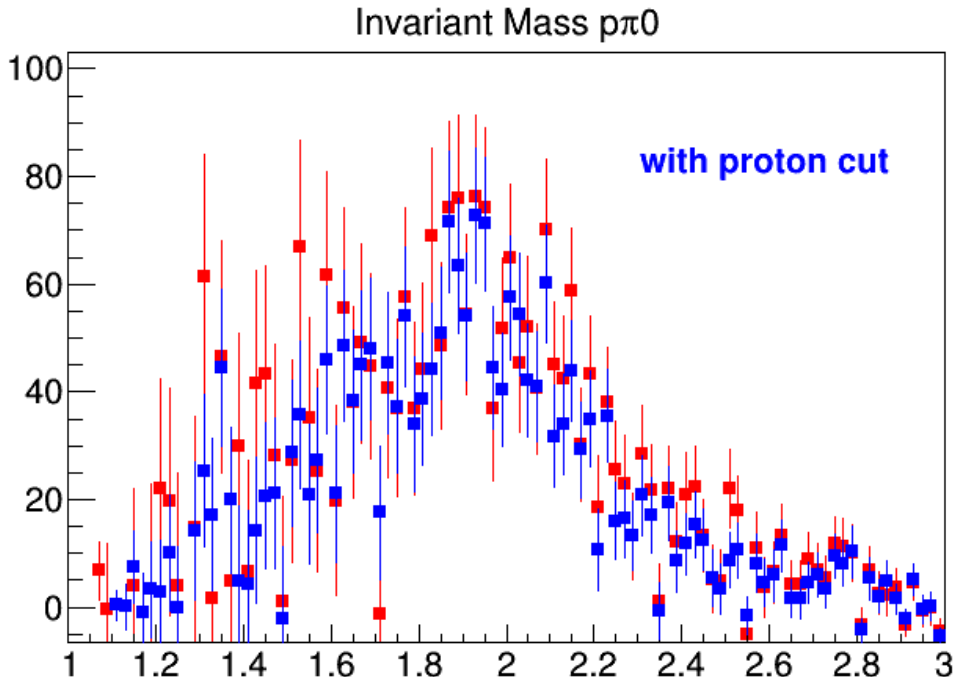
6.4 GeV ppi0 sPlot

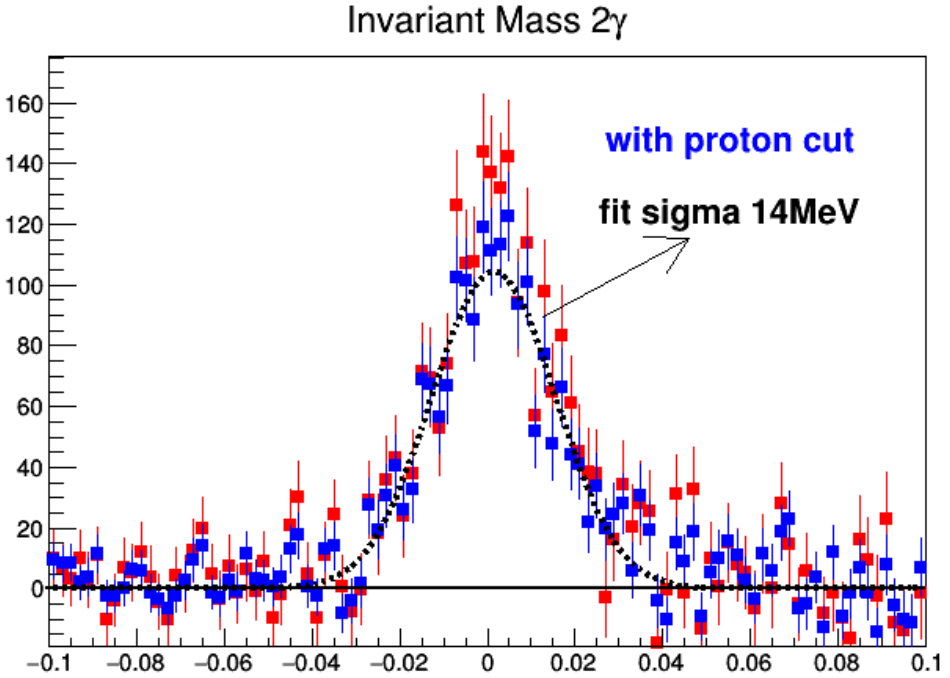


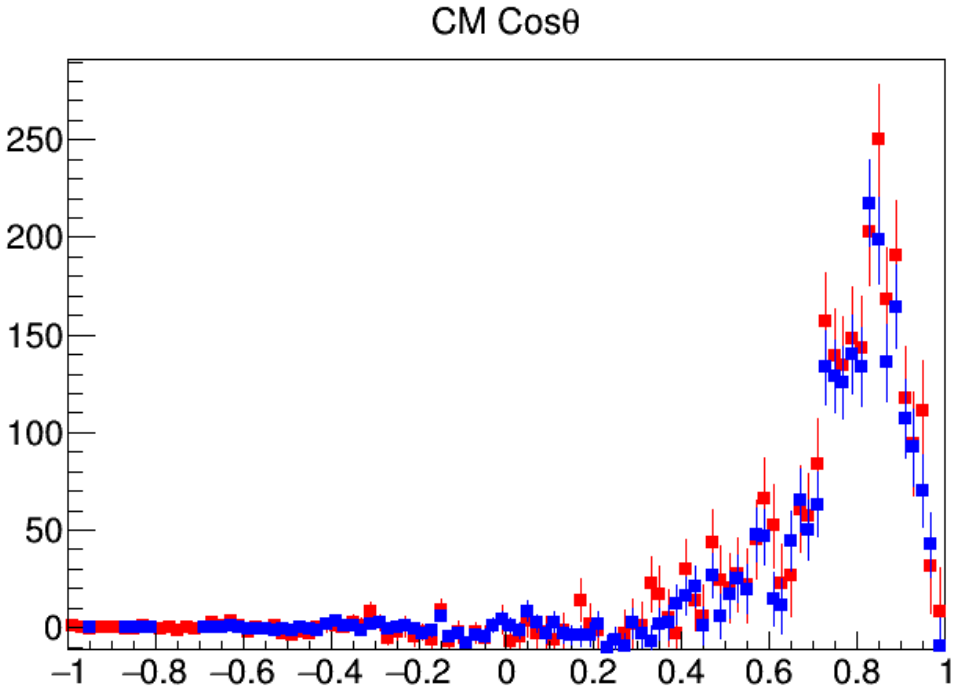


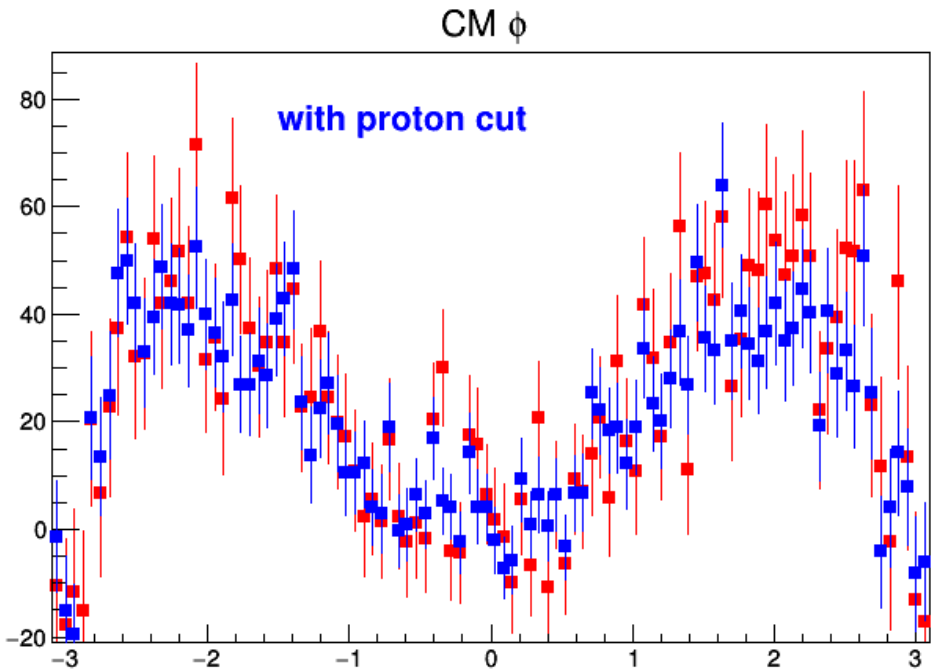
Reduce background with Cut on proton angle

6.4 GeV sPlot Distribution





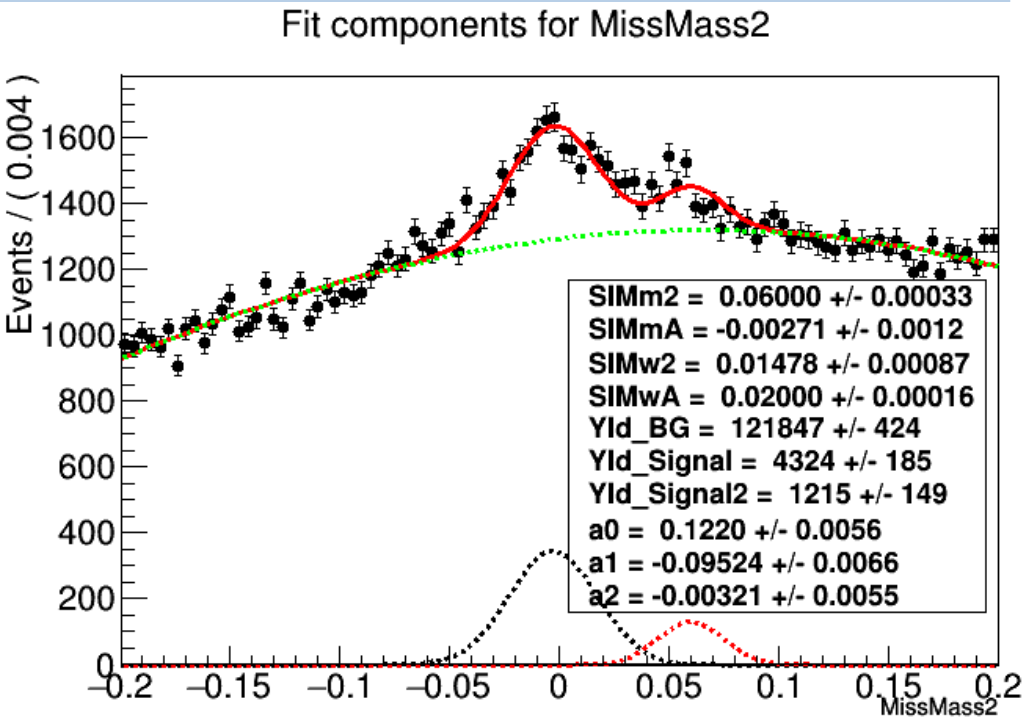


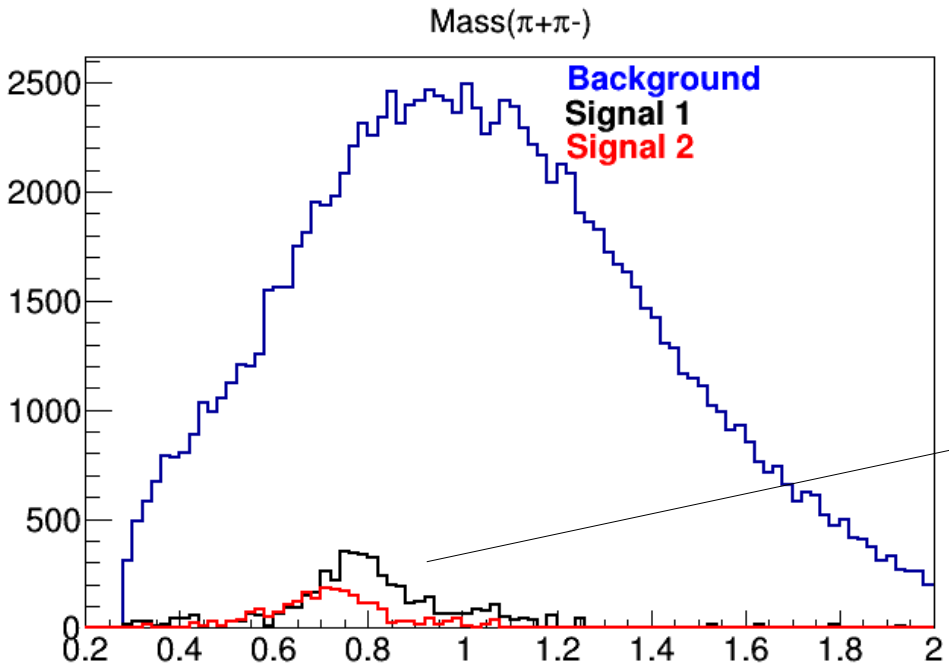


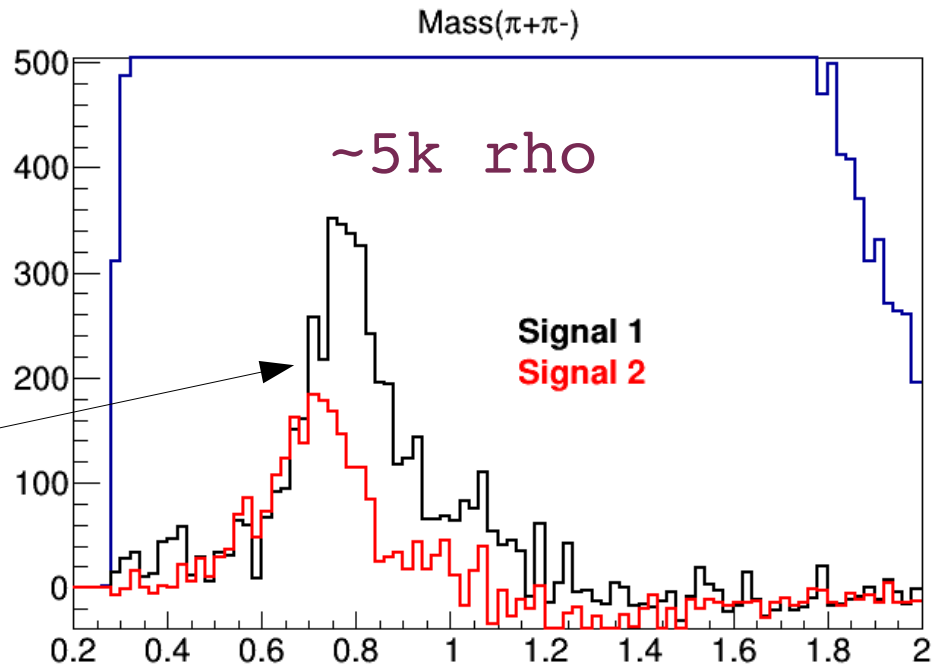
6.4 GeV ppi+pi-

Detect either exlusive
Or 1 missing pion

Similar small signal on
Large background

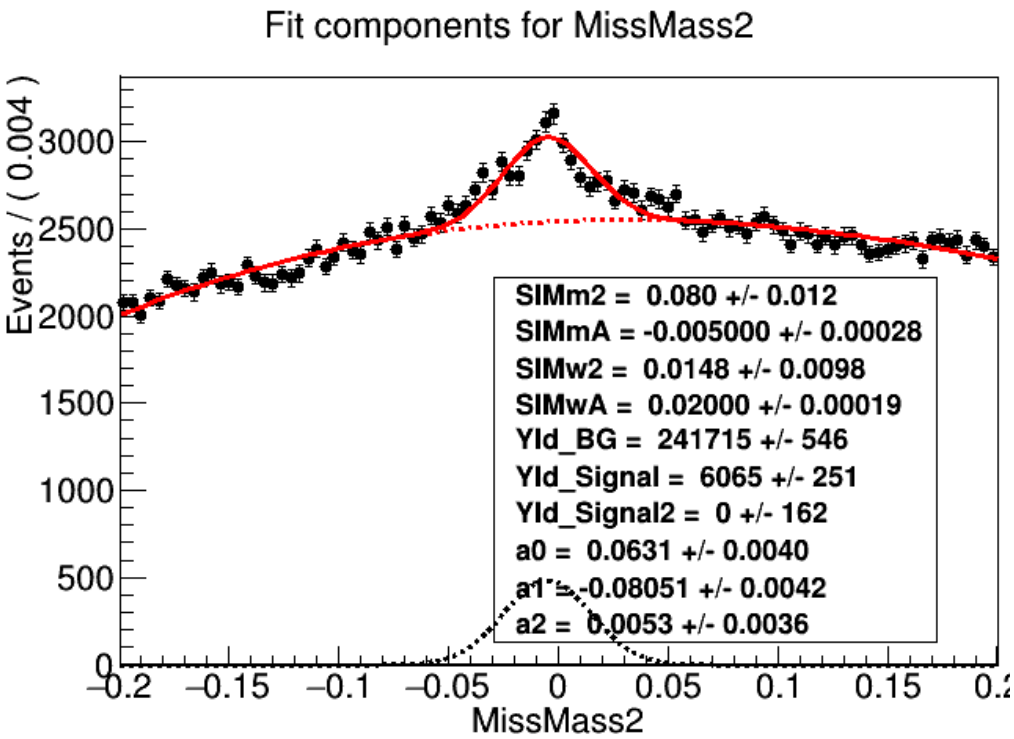


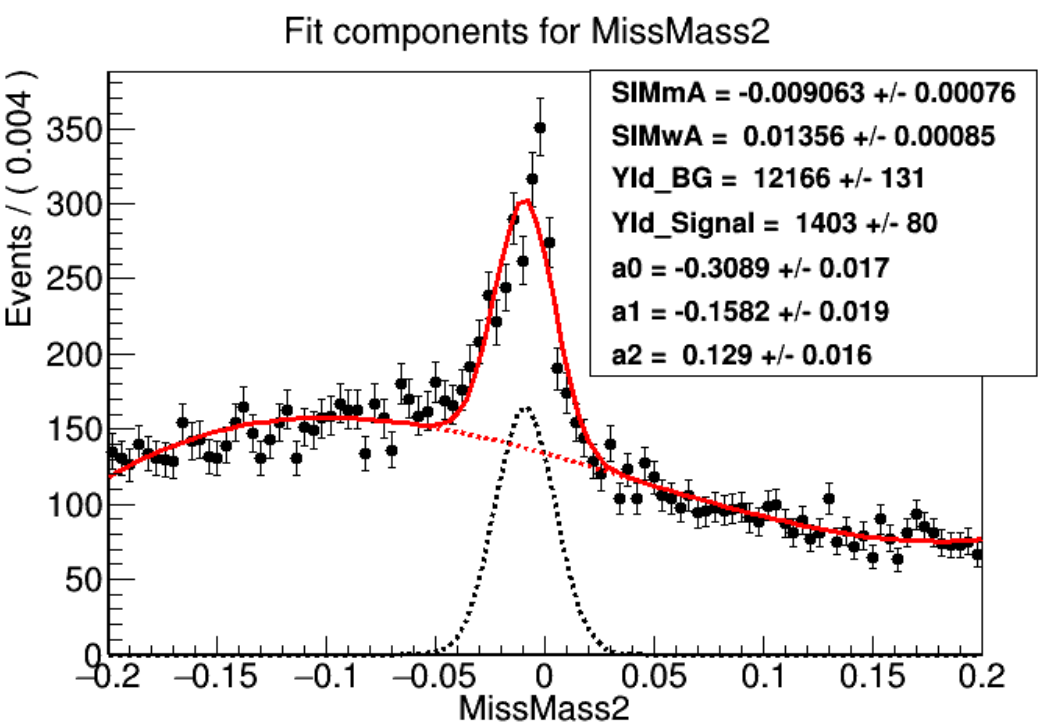




Using Time information

Pion delta time +-1ns



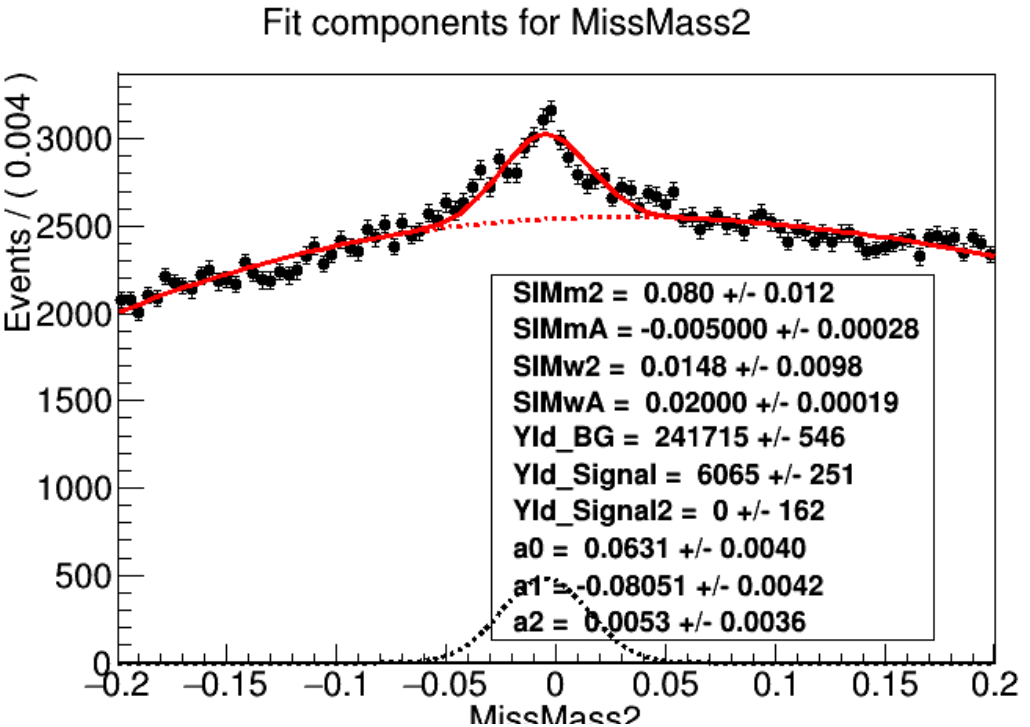


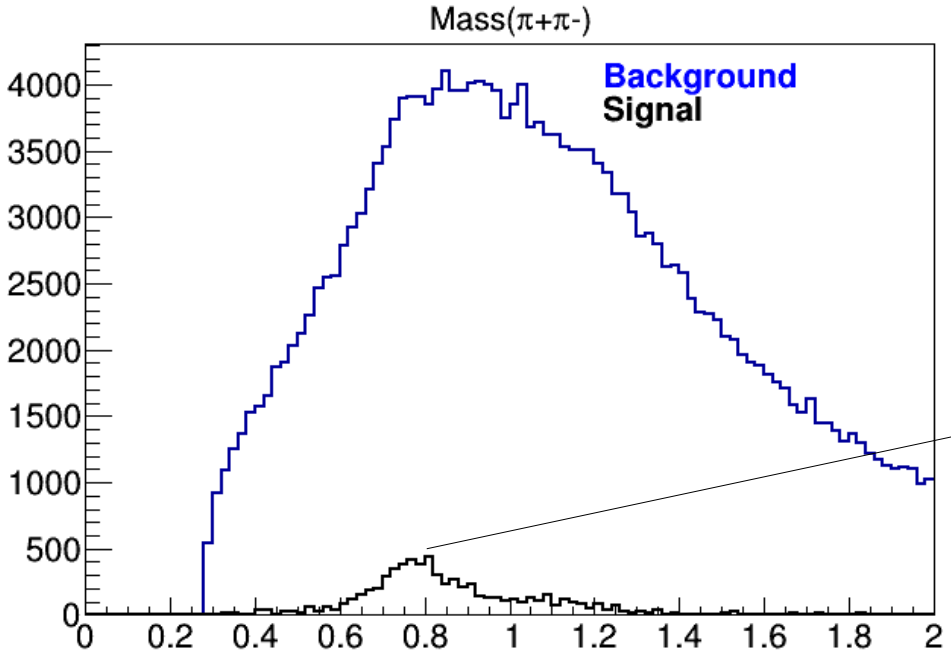
Great reduction in background
but signal also down factor ~4

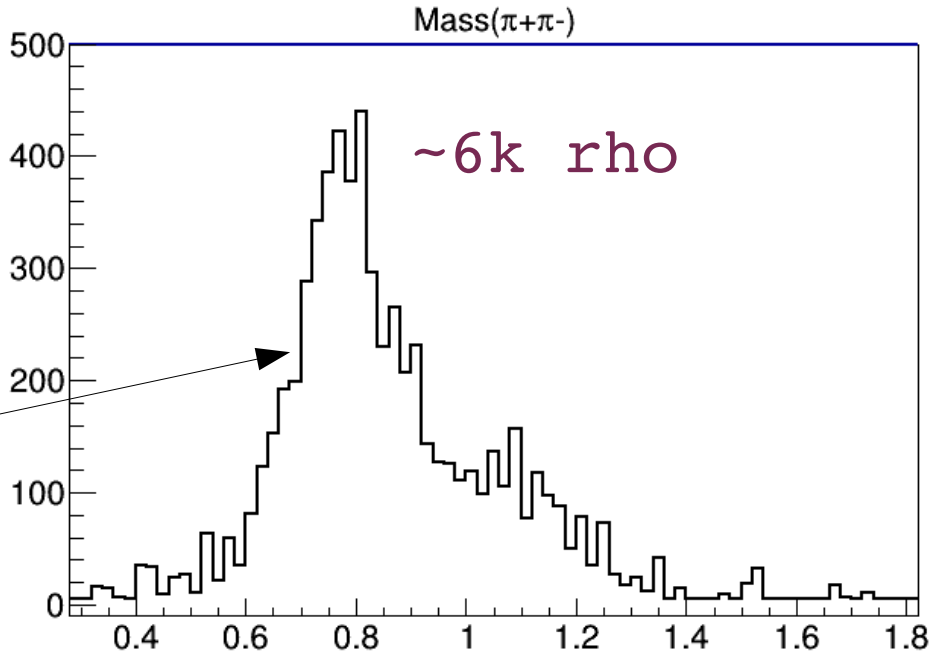
10.5 GeV ppi+pi-

Detect either exlusive
Or 1 missing pion

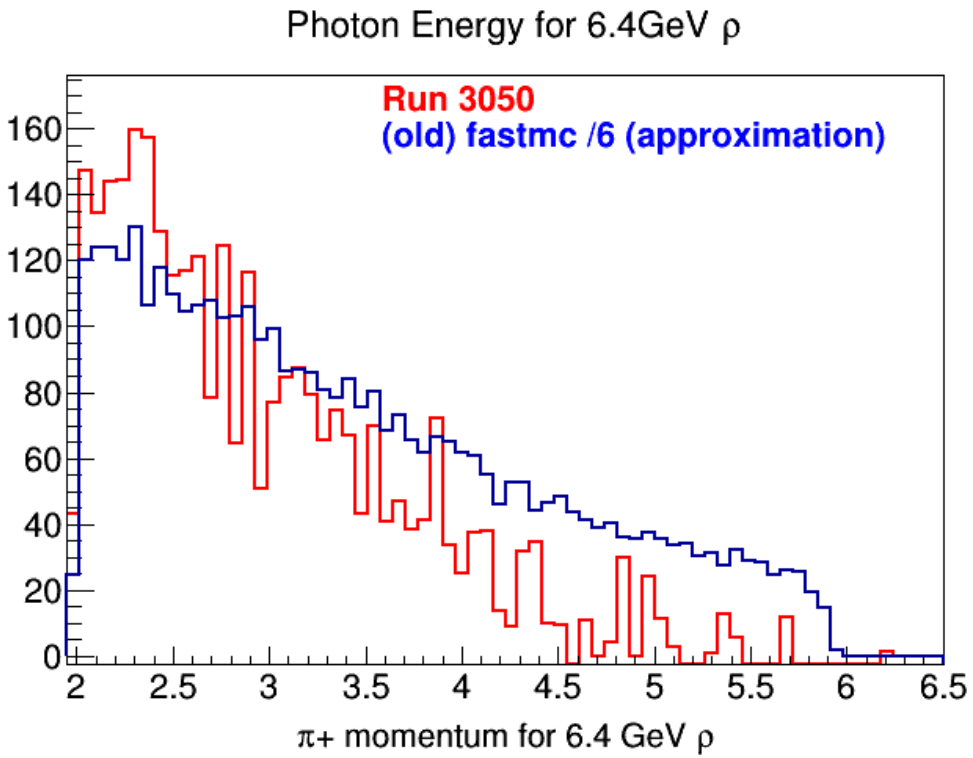
Similar small signal on
Large background

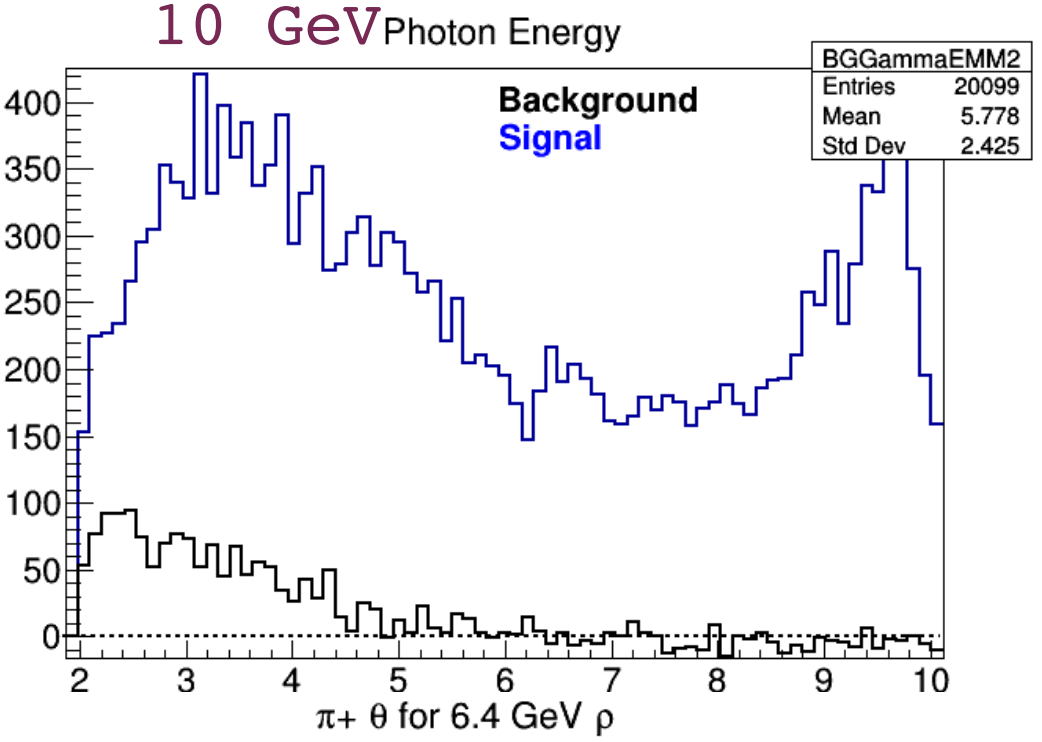


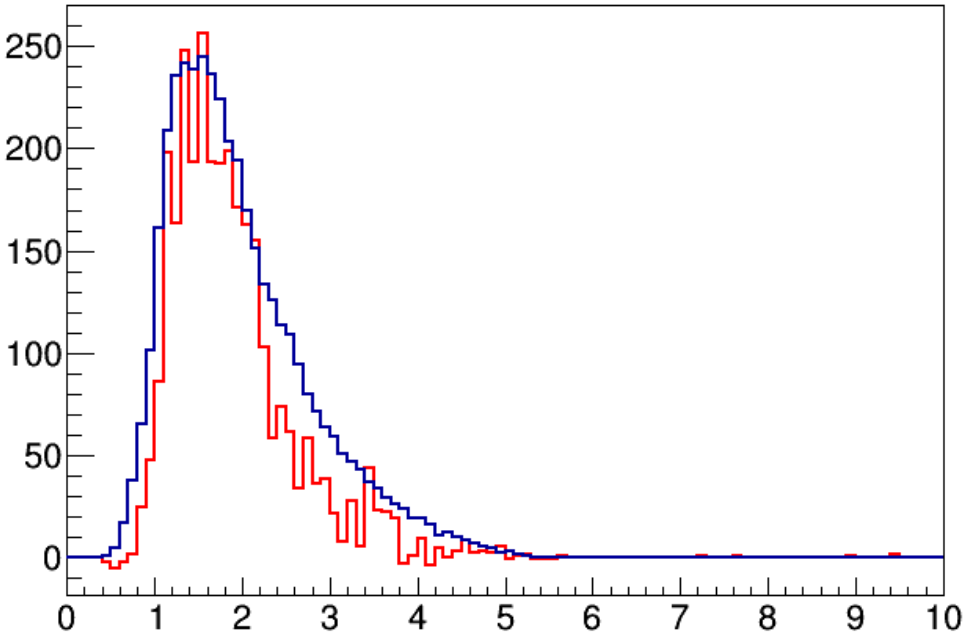


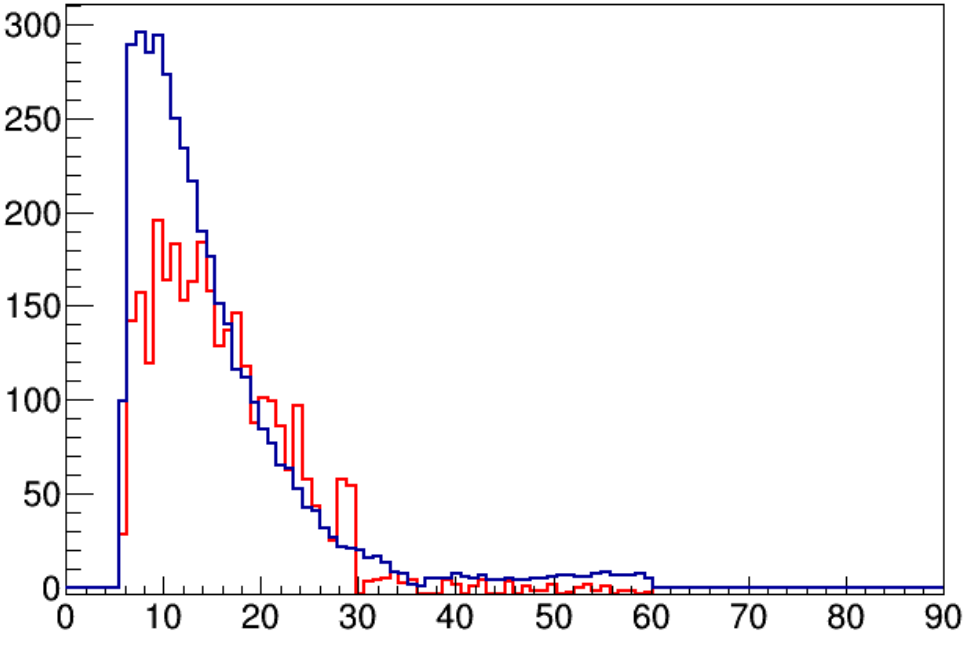


QuasiReal Photon Energy





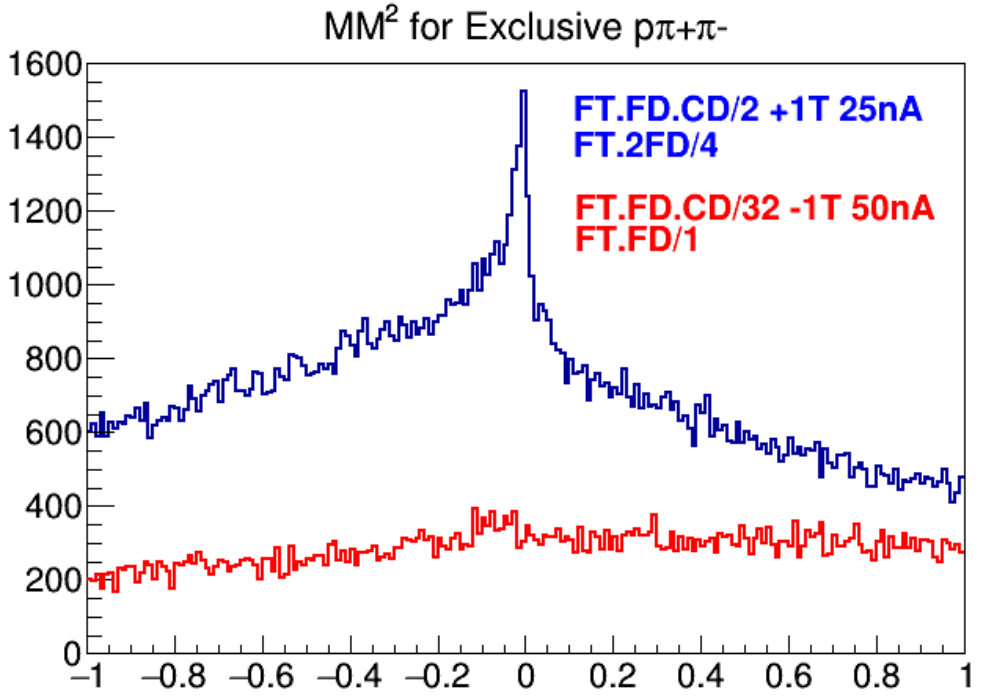


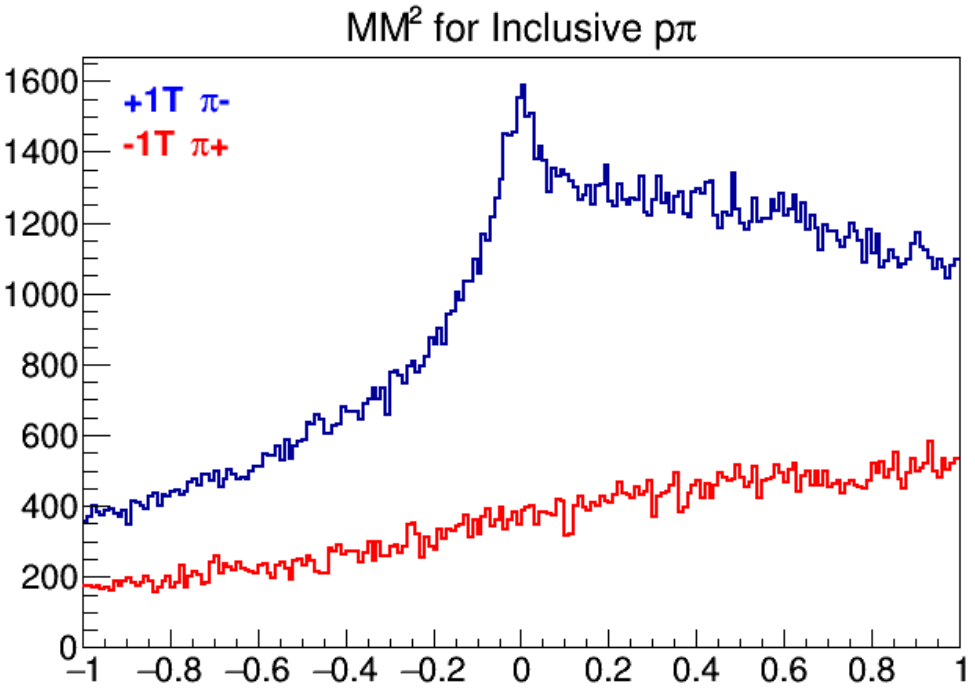


Comparison of 10GeV triggers

Yields for Run 3222 and 3518

Normalised to total gated charge



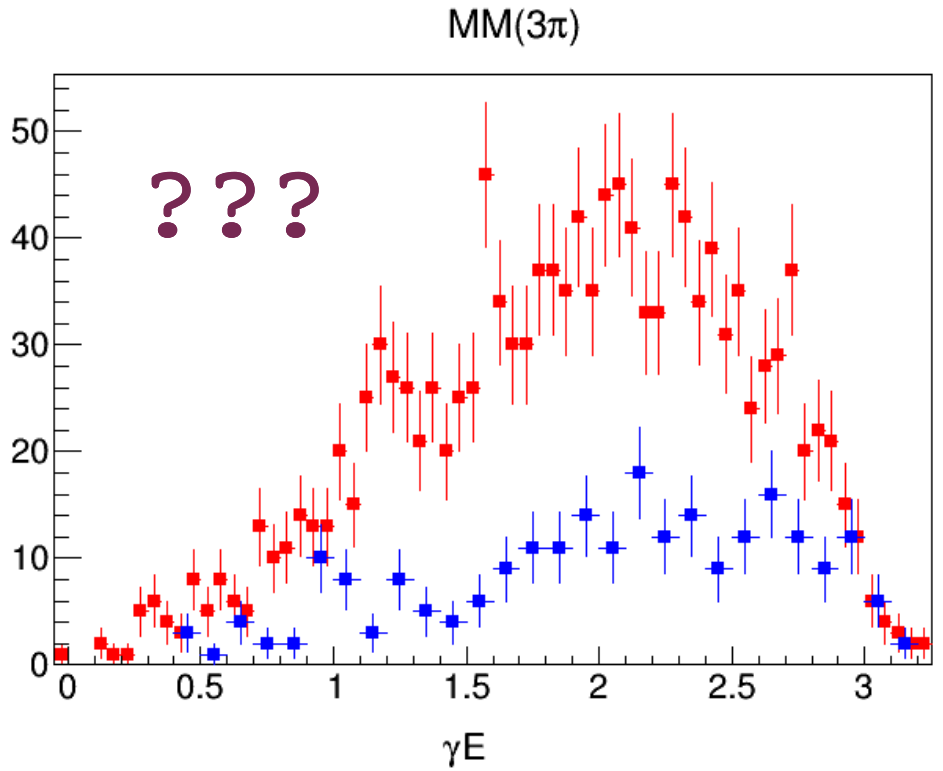


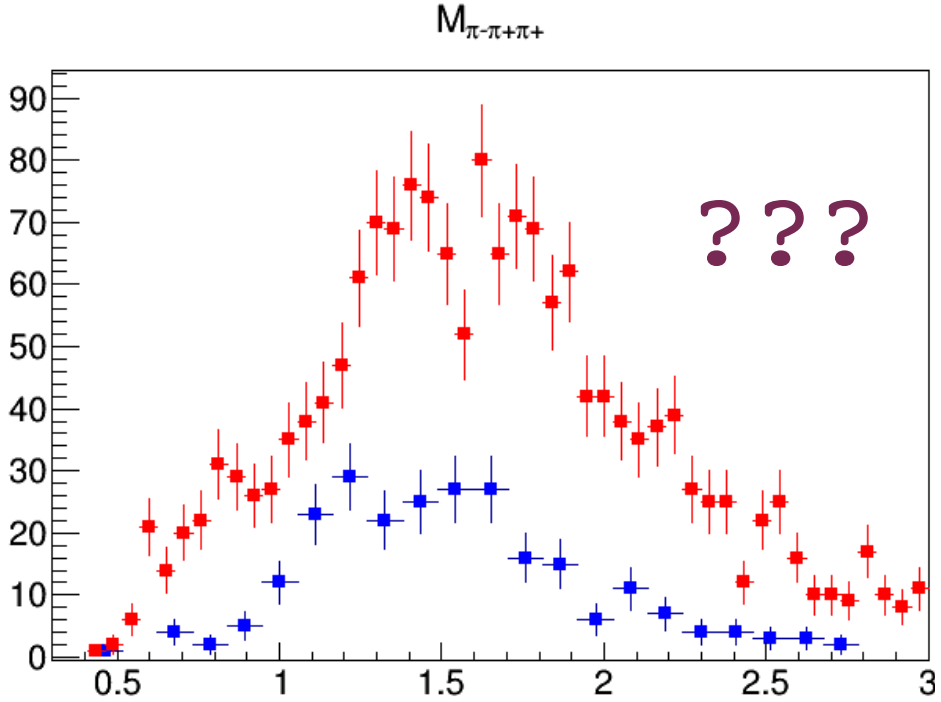
As expected, lose vector meson production without CD trigger

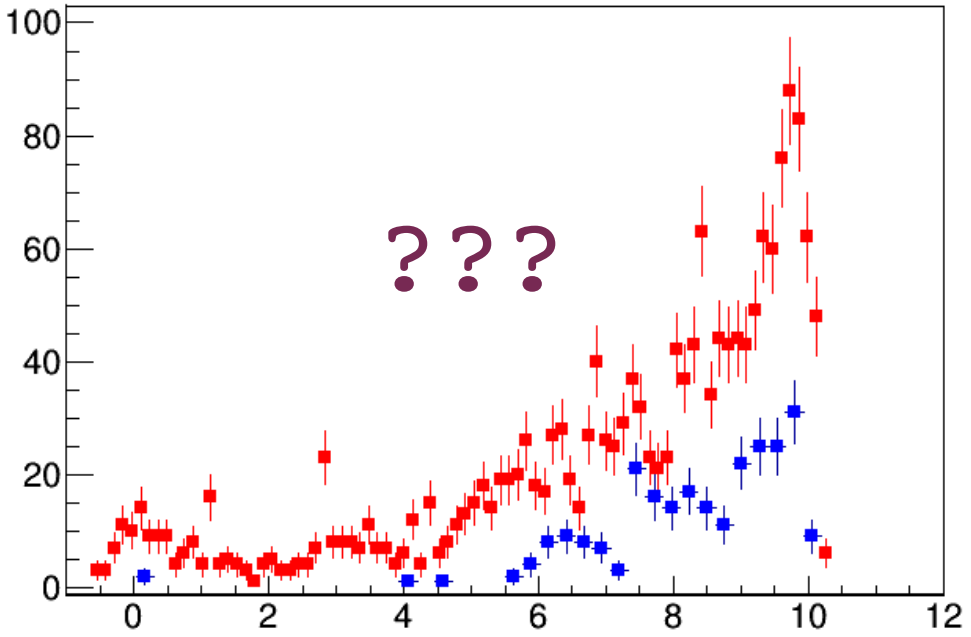
3pi at 10.5 GeV

Measure 2pi+,pi-
(Time cut)

Run 3222
Run 3518



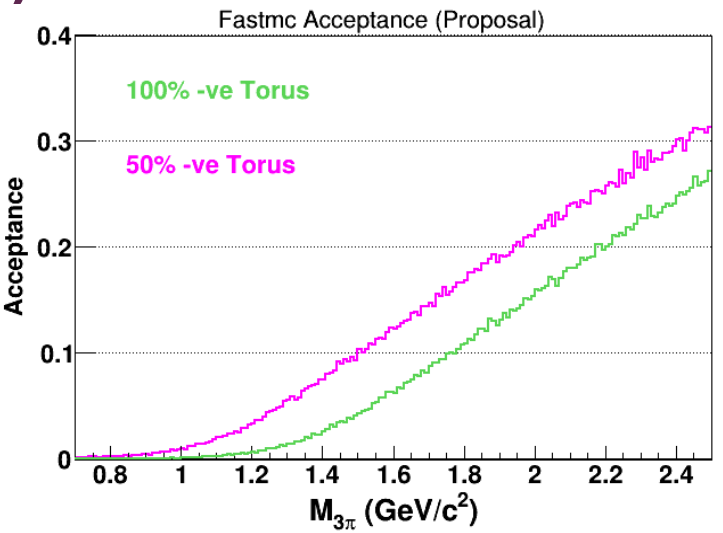




Summary

- FT working well!
- Several exclusive reactions identified at all beam energies
- Current Trigger not optimal for vector mesons
- No strong signal seen in 3pi yet

  (not ideal torus field)



- HipoInRoot Interface
  - Extract info direct from hipo banks (THSHipoReader)
  - Insert tracks into HSParticle event array (THSHipoReader)
  - Additional trigger information (THSHipoTrigger)
- HSParticle class
  - 4-vector; vertex; path; ToF; time for PID hypothesis; DOCA; truth information; …
- HSFinalState class
  - Decode particle event array into exclusive final state – include all topologies
  - Use COATJAVA PID or just charge/time info
    - Iterate all possible combinations of like tracks, FT electrons,...
  - Same code for simulation and real data
  - Use with ROOT TSelector – PROOF (parallel processing)
- Generate event ntuple for observable extraction