8-26-2022

Shifts and trips

- From email today: Hall D shift swaps for DOMESTIC institutes will end in one week, on September 2

- Next round of shifts
  - September 16-19 worker shifts: Brandon
  - October 14-17 leader shifts: Brandon
    - Hotel: Booked?
    - Flight: Booked?

- NSTAR 2022 (Mike)
  - October 16-22
    - Hotel: Booked
    - Flight: Need to book
    - Registration: Need to register
    - Conference fees: Need to pay
    - Permission from Unit Head: Obtained
    - Permission from Dean: Waiting for response

Uploaded files for Ξ analysis

- Contains trees from the 2020 runs for the reactions:
  - $K^+K^+K^-\Lambda$
  - $K^+K^+\Xi^-$
  - $K^+K^+\pi^0\Xi^-$
  - $K^+K^+\pi^-\Xi^0$

- Trees in directory (as seen from lc7Poly):
  /raptor/glueXdataReal/ana-2019-11/ver04/

TPOL

- All of the 2020 TPOL trees are at ASU
- Processed thus far: 10 of 12 batches
- Stage 1 reconstruction for last 2 batches started Wednesday

Tomography

Tomography

- Tomography is a way to create a 2d cross section from a series of 1d projections

- Two undergraduates working on tomography with me:
  - Randy Montoya
  - Luis Dorantes

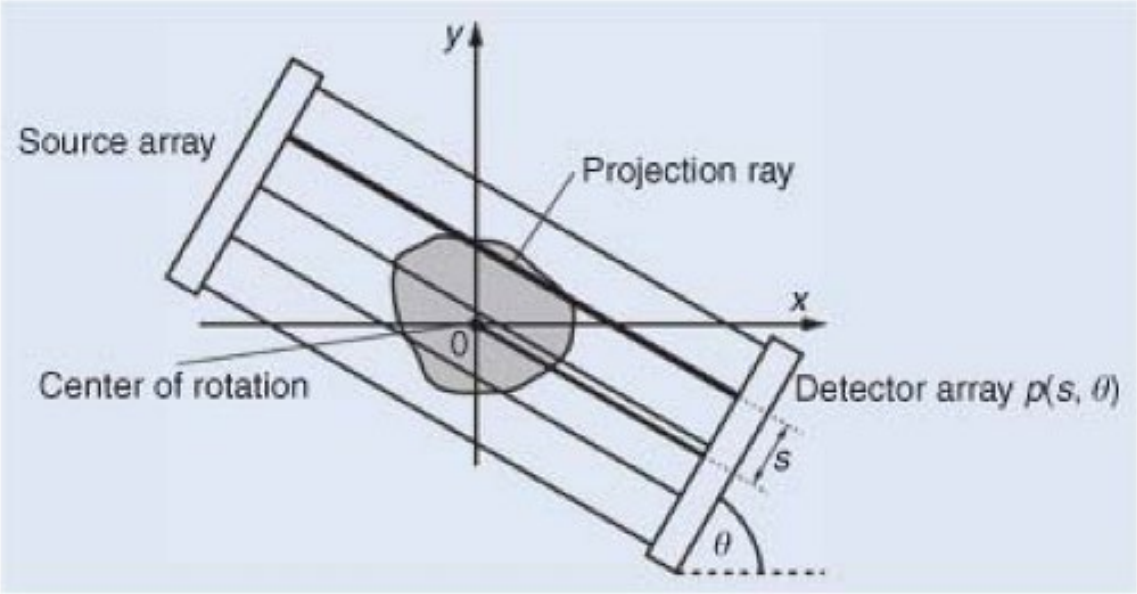
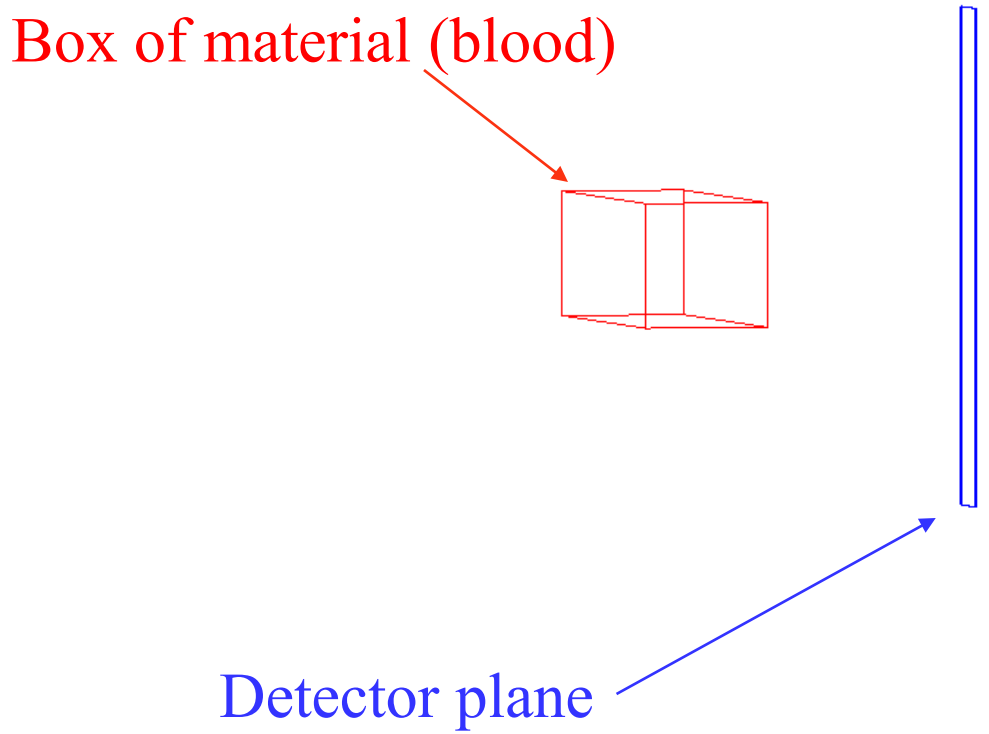


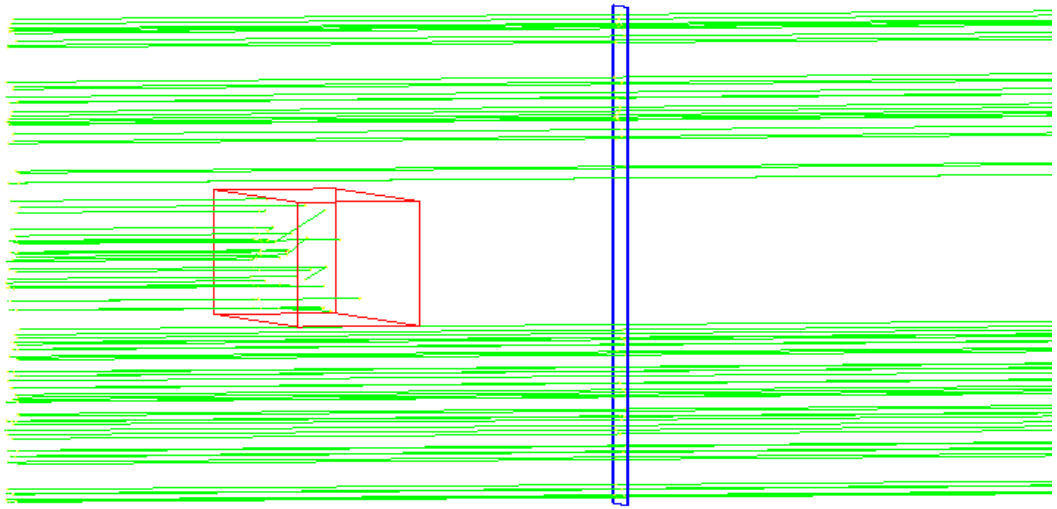
FIGURE 2.1. Parallel-beam geometry and the generation of a parallel-beam projection $p(s, \theta)$.

Tomography

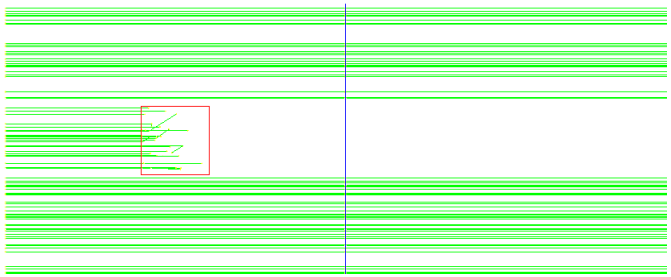


Tomography

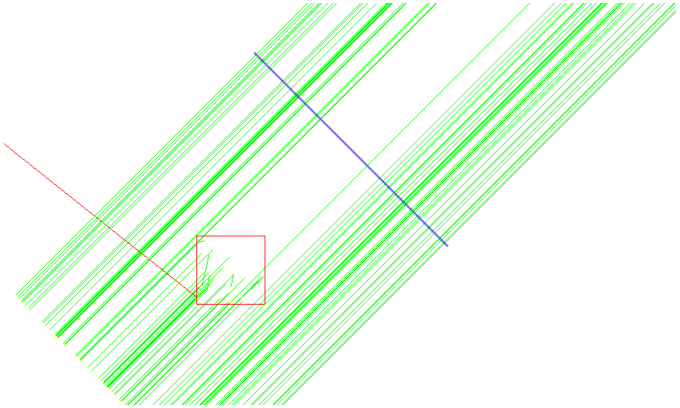
- 100 events thrown



Tomography

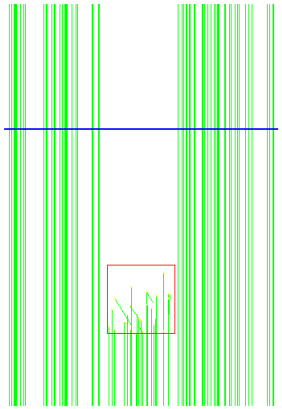


Rotation = 0°



Rotation = 45°

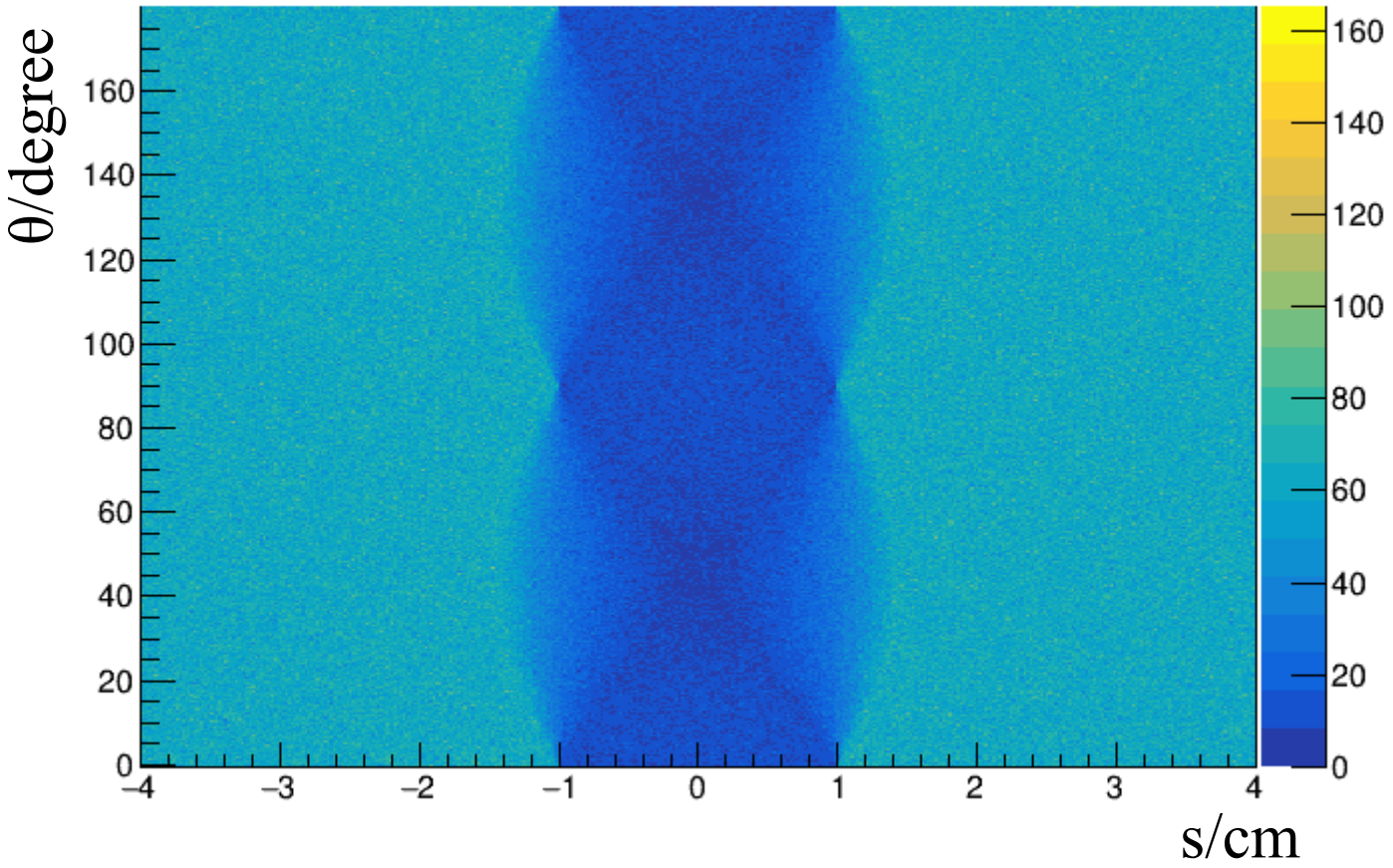
- Rotate beam and detector about box
- I use 1800 angle settings



Rotation = 90°

Sinograph

- Sinograph is a 2d histogram of the angle versus intensity profiles



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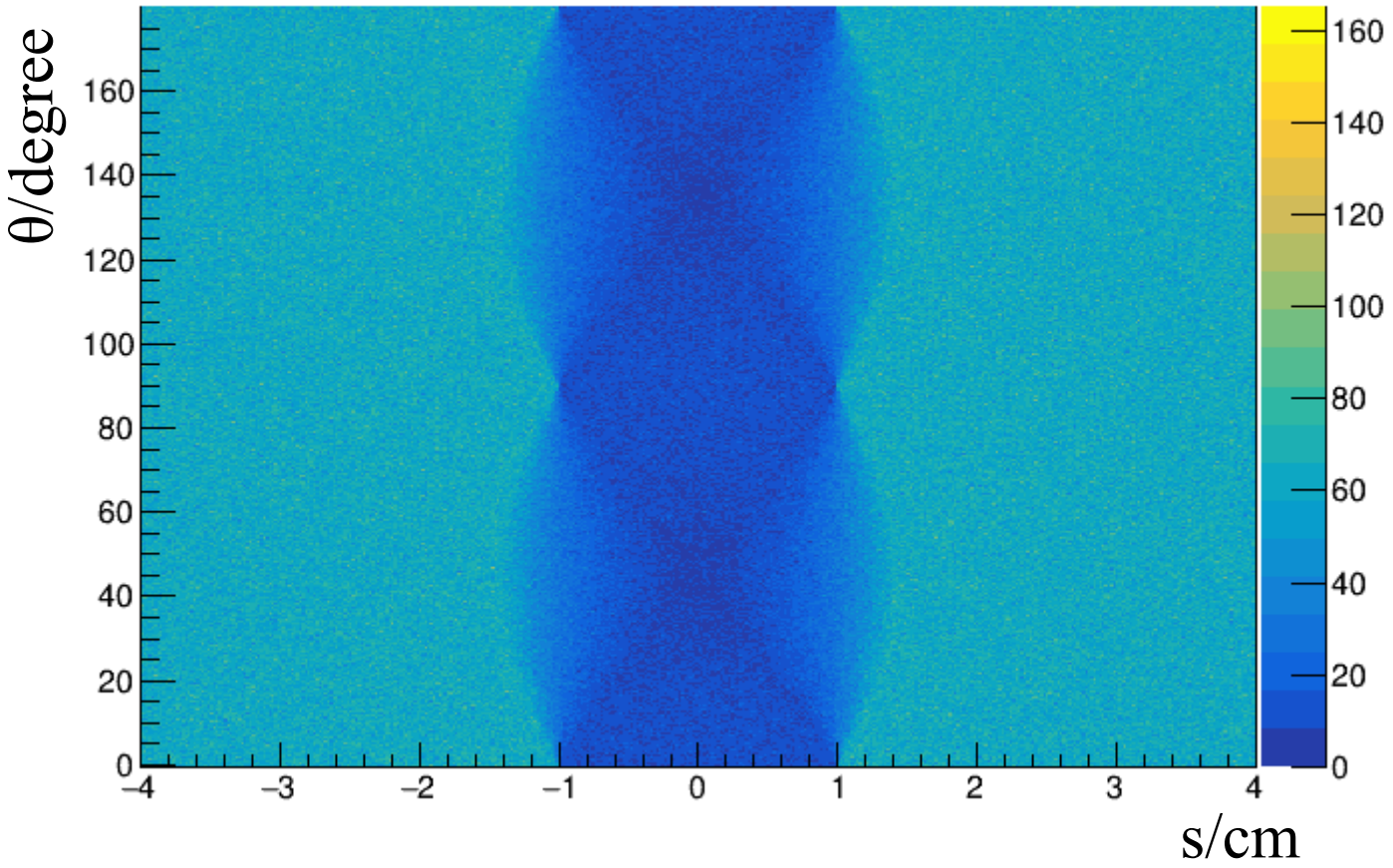


- Alan is helping us convert the above sinogram from a ROOT file to hdf5 ☺

$$K^{+}K^{-}\pi^{0}$$

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

- Alan's dissertation is on K^*K states
- Prior to uncovering the resonances that decay to K^*K states, Alan and I are performing a parallel analysis of $KK\pi$ events, that exclude K^*K, to help in verifying his PWA tools
- I am presenting my parallel analysis of low-mass $KK\pi$ states

Data

Dataset:

- Spring 2018 data

Restrictions:

- Incident photon timed to be within central peak
- Only best Confidence Level (*CL*) per event kept
- *CL* must be above 10^{-4}
- Kaons must be seen in TOF
- Missing mass within 3 standard deviations of central peak
- 0.15 GeV < Mass[π^0] < 0.12 GeV
- Mass[$K^+K^-\pi^0$] < 1.32

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

Recent changes to the event generator:

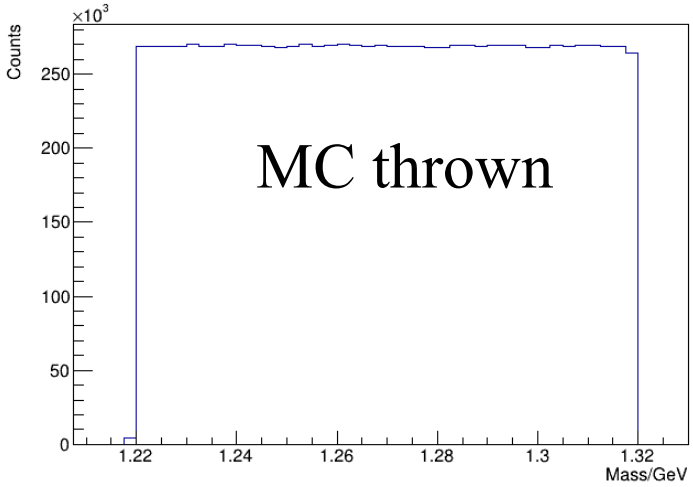
- Concentrating on low-mass region between 1.22 and 1.32
- Modified *t*-slope slightly to better match the data
- Widened the incident photon energy below coherent peak. New range: 5.4 GeV to 9 GeV. Old range: 8.4 GeV to 9 GeV
- Used actual data to model photon energy spectrum
  - Will need to use normalization distribution in next round of generator refinement
- Over 10 million thrown events

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

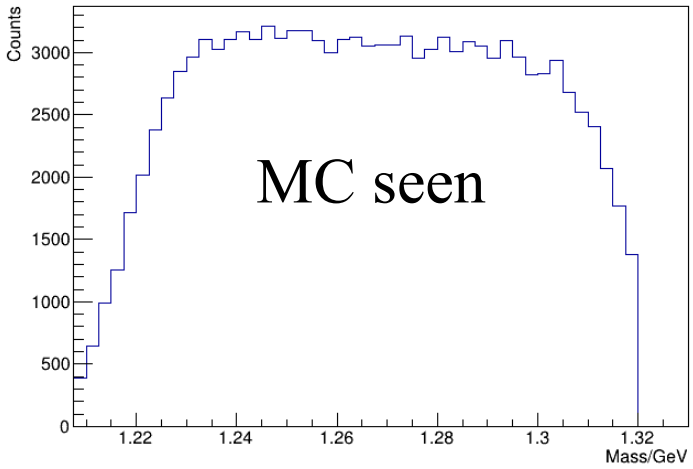
Simulation

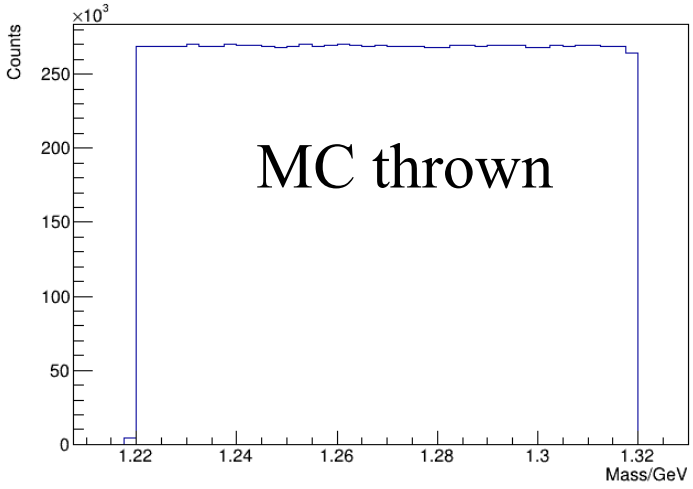
- Processed generated events through GlueX GEANT4 simulation
- Files located on web at http://meson.hldsite.com/data/kpkmpi0V2/

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


MC thrown
Counts
×10³
250
200
150
100
50
0
1.22
1.24
1.26
1.28
1.3
1.32
Mass/GeV

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


Counts
3000
2500
2000
1500
1000
500
0
1.22
1.24
1.26
1.28
1.3
1.32
Mass/GeV
MC seen


Counts
×10³
250
200
150
100
50
0
1.22
1.24
1.26
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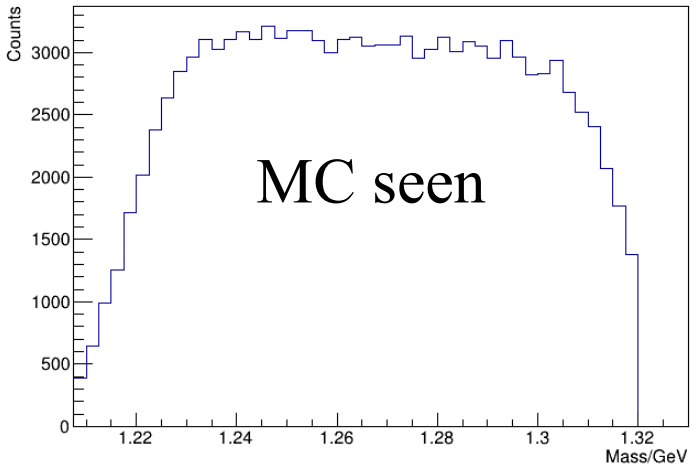
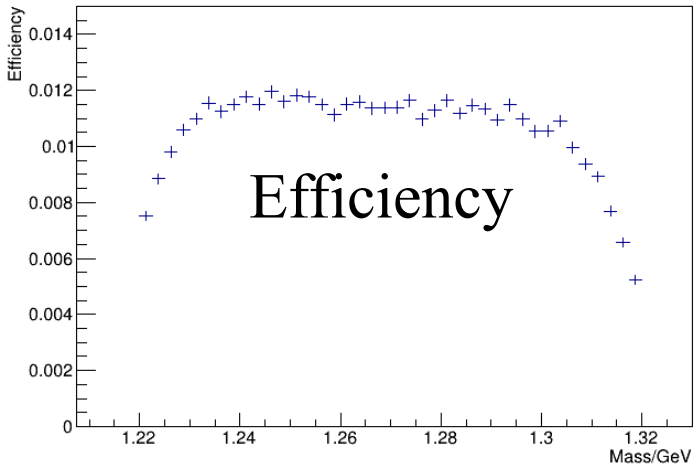
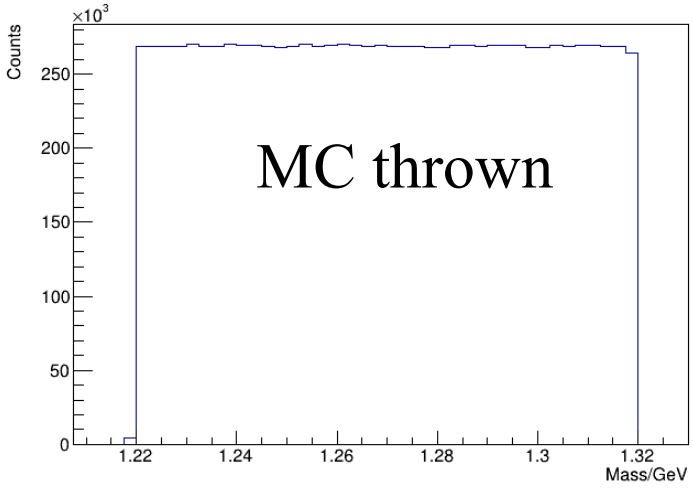
1.3
1.32
Mass/GeV
MC thrown

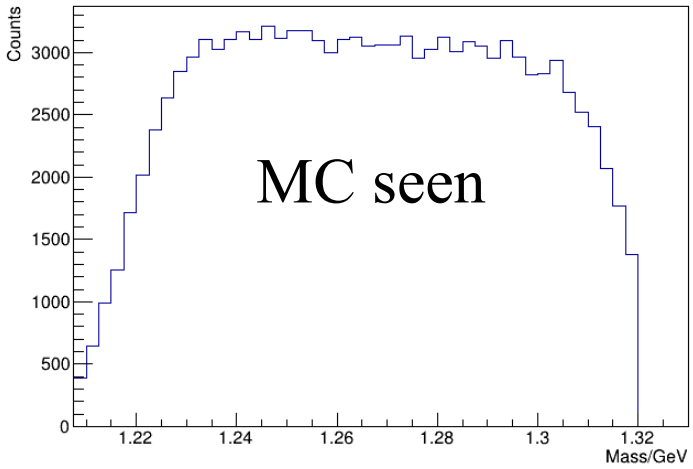
$K^+K^-\pi^0$

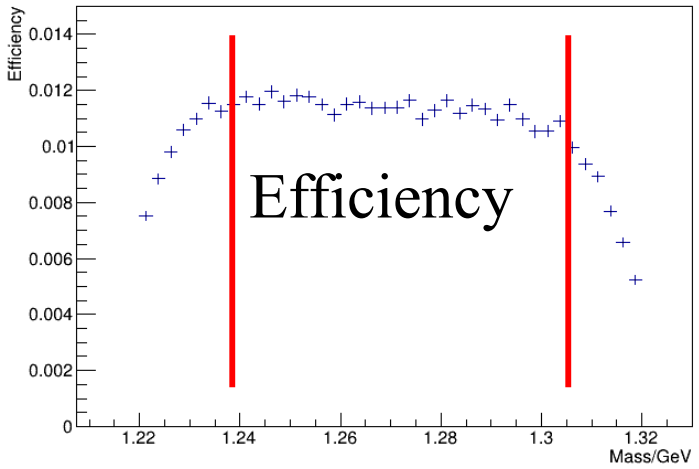

Counts
3000
2500
2000
1500
1000
500
0
1.22
1.24
1.26
1.28
1.3
1.32
Mass/GeV
MC seen

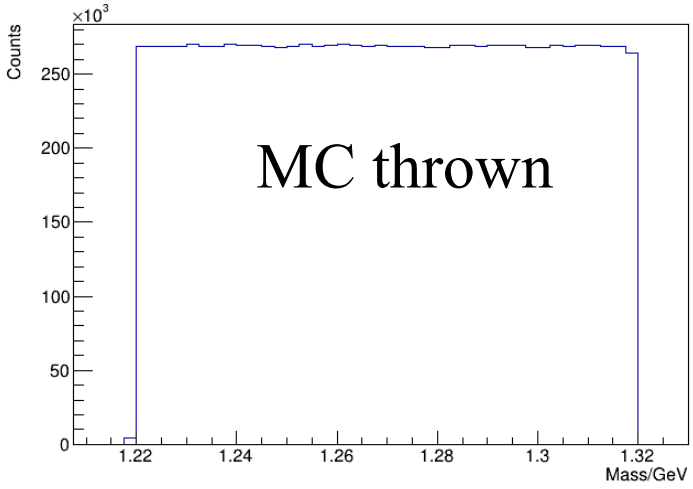

Efficiency
0.014
0.012
0.01
0.008
0.006
0.004
0.002
0
1.22
1.24
1.26
1.28
1.3
1.32
Mass/GeV
Efficiency


Counts
×10³
250
200
150
100
50
0
1.22
1.24
1.26
1.28
1.3
1.32
Mass/GeV
MC thrown

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

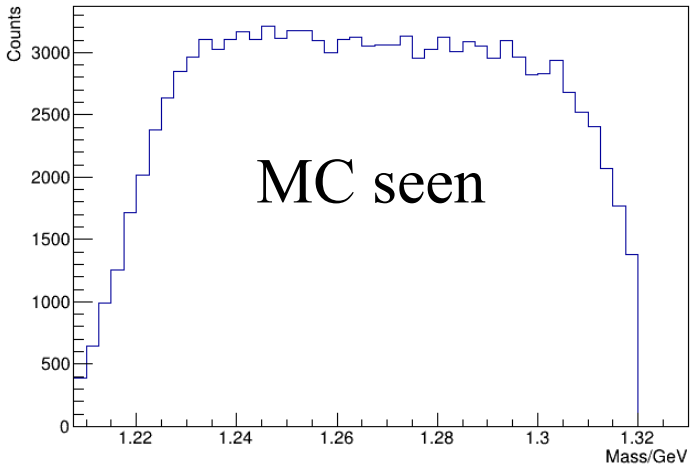


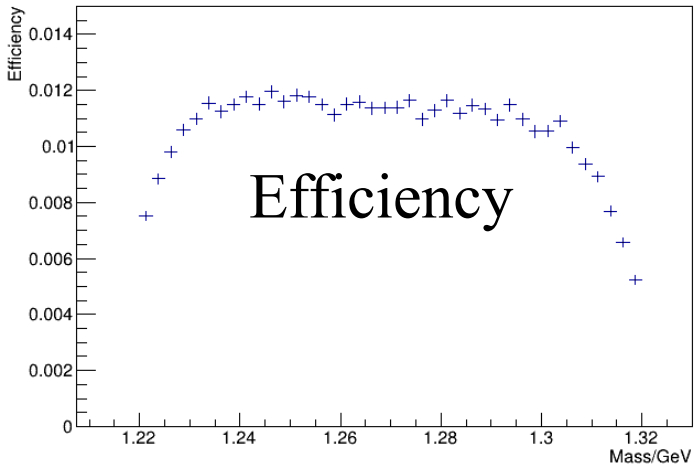


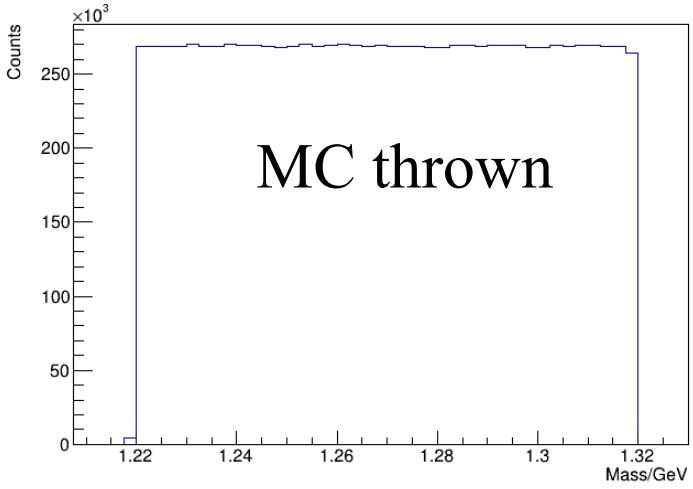


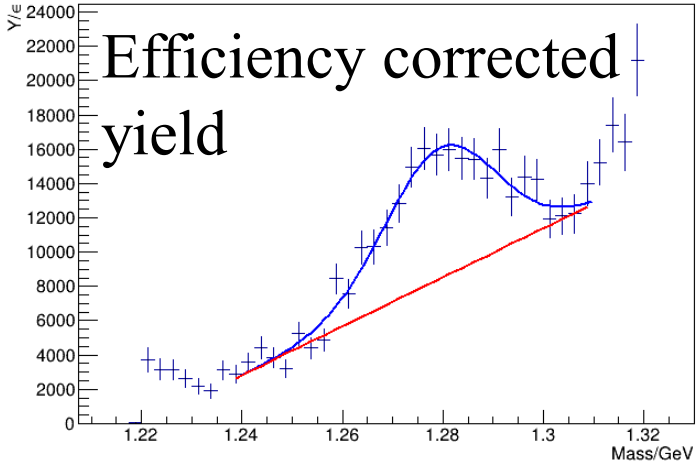
Fairly flat over region 1.24 to 1.31 GeV

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



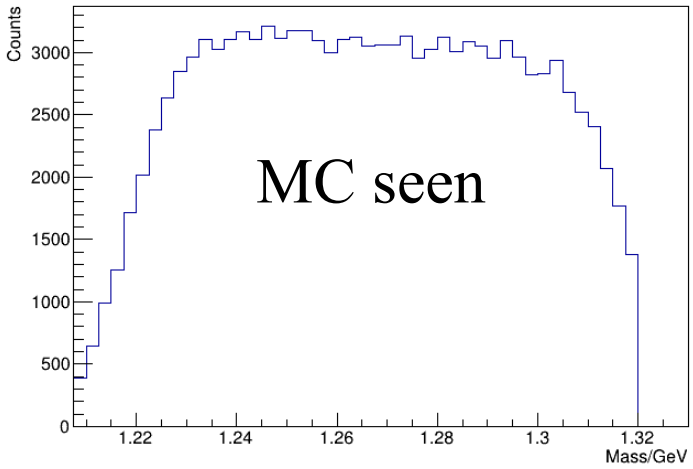


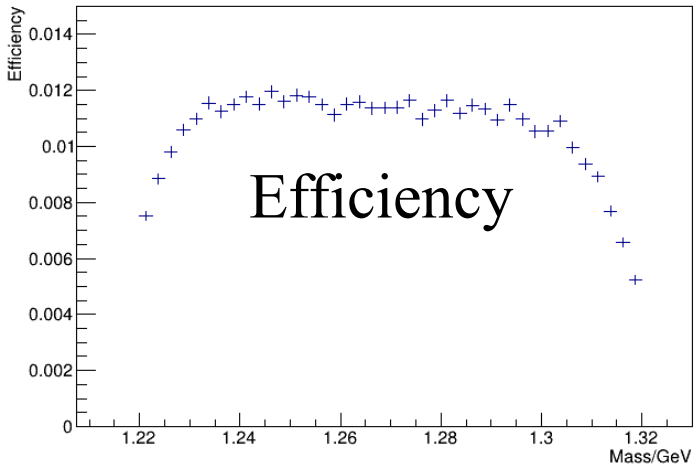


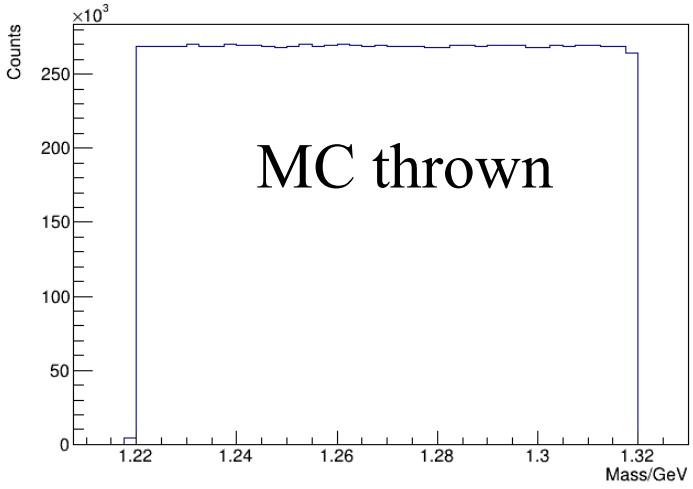


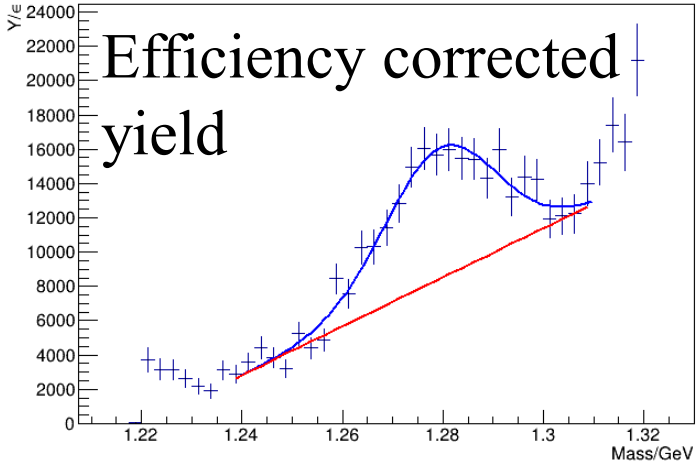
Background subtracted peak is 22% of total counts

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





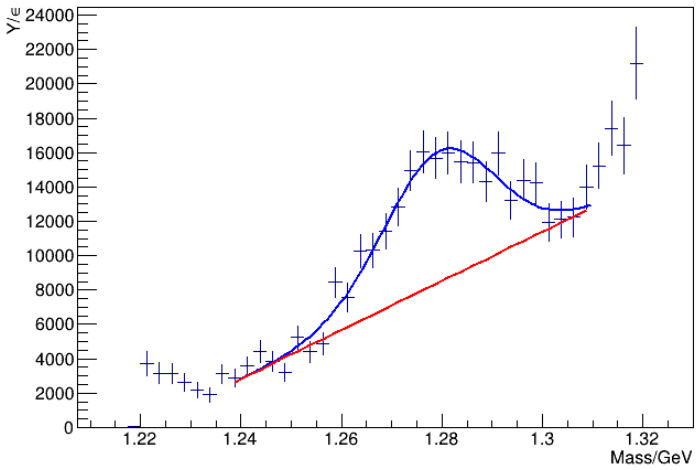




Center = 1279(2) MeV

FWHM = 24(5) MeV

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



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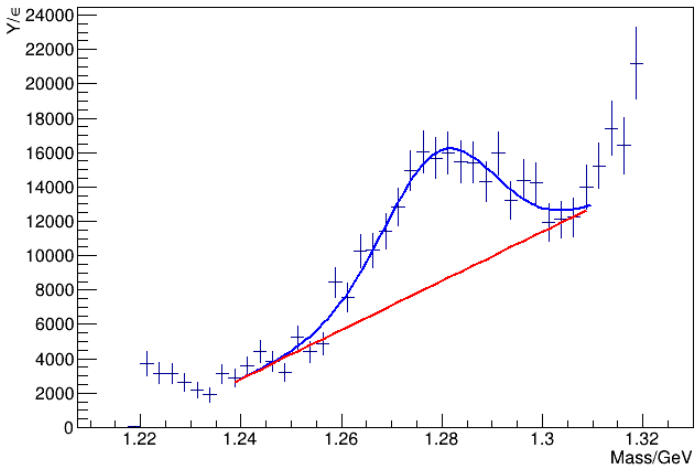
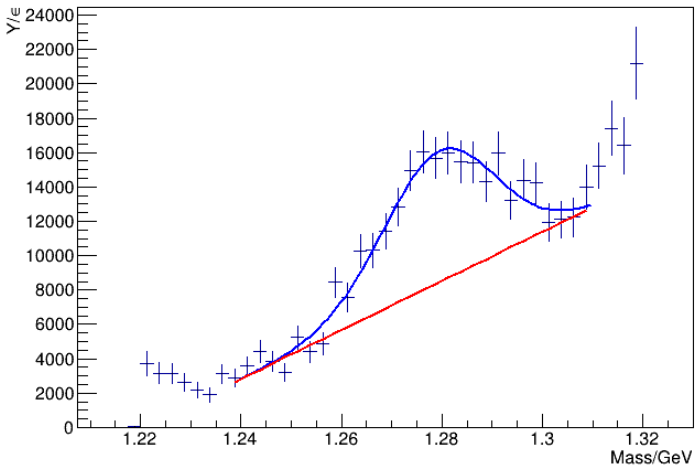


Center = 1279(2) MeV
FWHM = 24(5) MeV

No PDG meson state at 1280 MeV
But…

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



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Show affiliations

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Publication: American Physical Society, 2009 APS April Meeting, May 2-5, 2009, abstract id. Q10.004

Pub Date: May 2009

Bibcode: 2009APS..APRQ10004D

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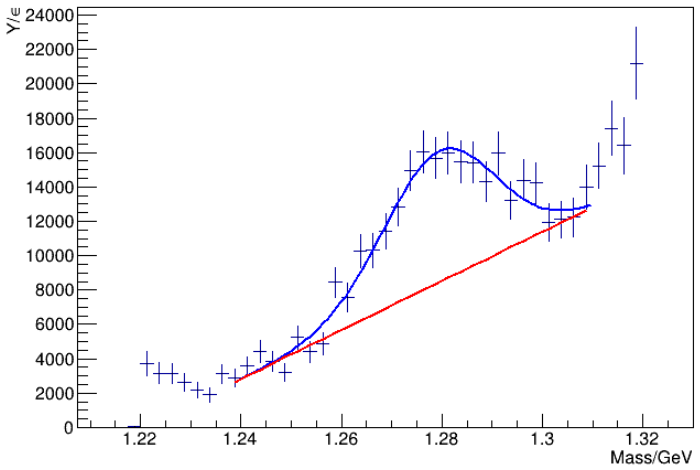

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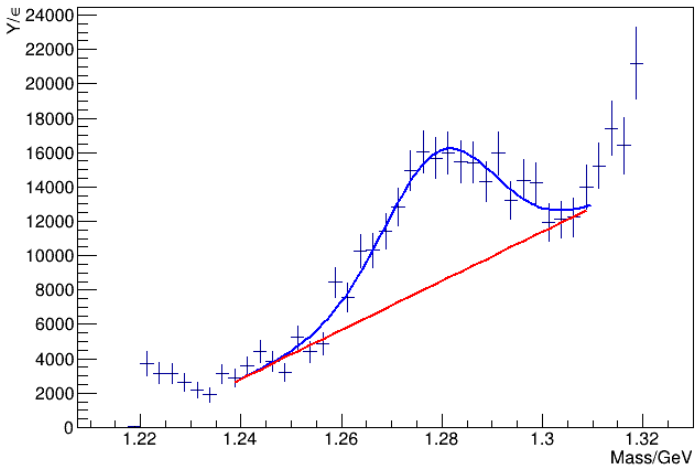

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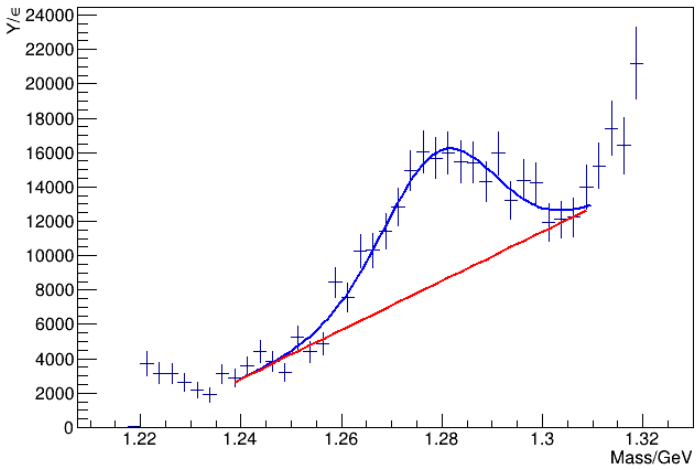

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Definition of (θ,φ) and (θ_H,φ_H)

- The (θ,φ) angles defined from polar and azimuthal angles of the K^+K^- isobar in the Gottfried-Jackson frame of $K^+K^-\pi^0$ system: z-axis coincident with the incident photon and y-axis normal to the production plane

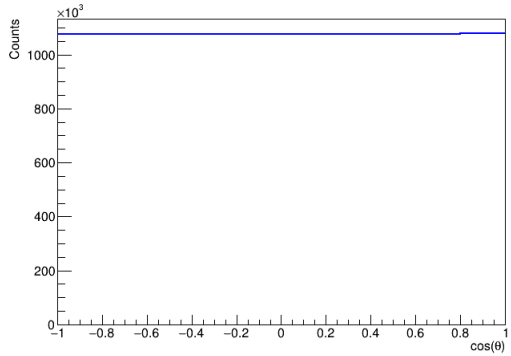
Definition of (θ,φ) and $(\theta_H,\varphi_{\mathrm{H}})$

- The (θ,φ) angles defined from polar and azimuthal angles of the K^+K^- isobar in the Gottfried-Jackson frame of $K^+K^-\pi^0$ system: z-axis coincident with the incident photon and y-axis normal to the production plane

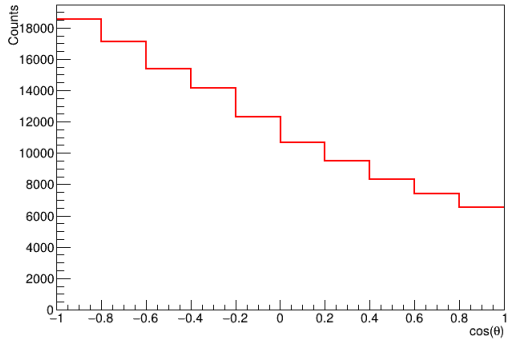
- The (θ_H,φ_H) angles defined from polar and azimuthal angles of the K^+, in the helicity frame of the K^+ K^- : z_{H}-axis coincident with the K^+ K^- and the y-axis normal to the production plane

Distributions of cos(θ) and φ

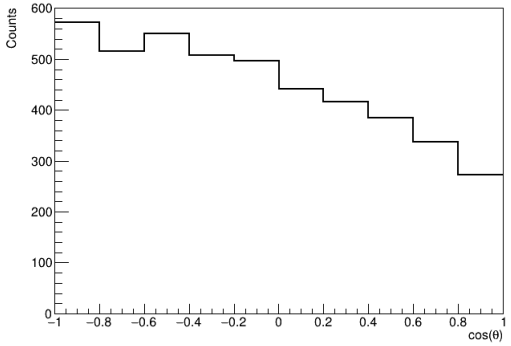
MC thrown



MC seen

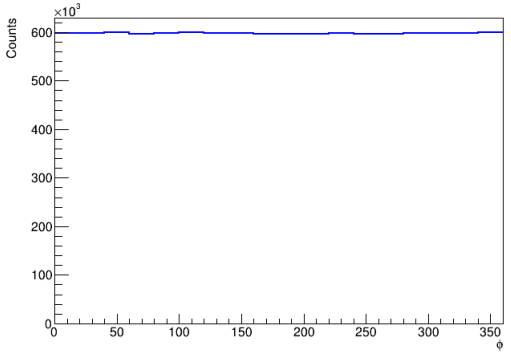


Real data

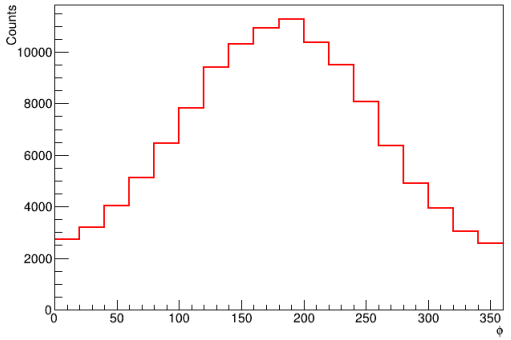


cos(θ) distributions

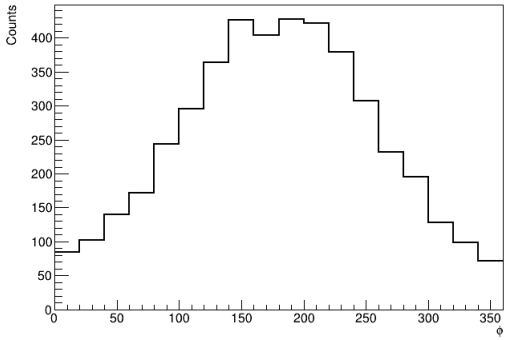
MC thrown



MC seen



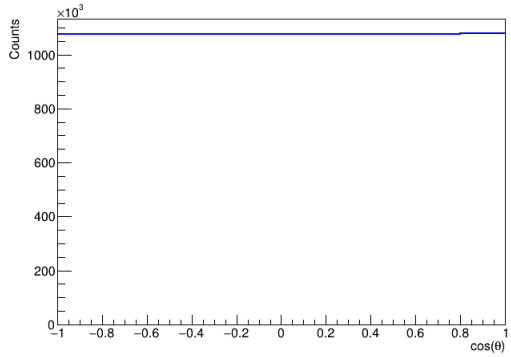
Real data



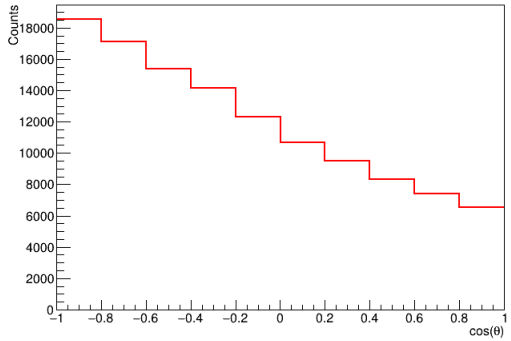
φ distributions

Distributions of cos(θ) and φ

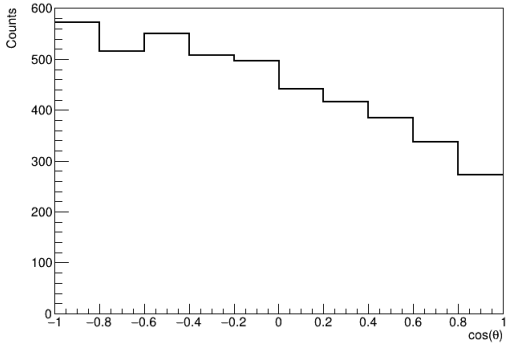
MC thrown



MC seen

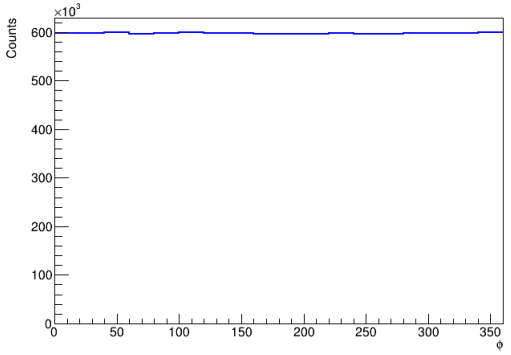


Real data

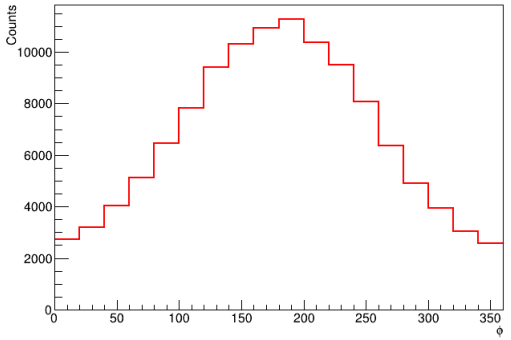


cos(θ) distributions

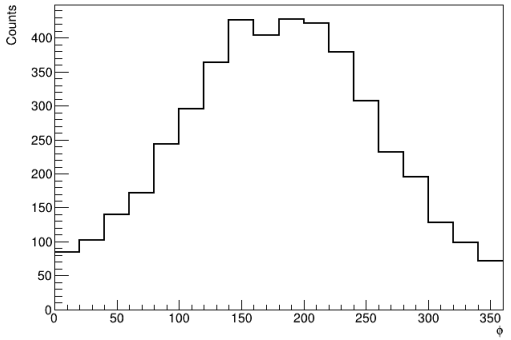
MC thrown



MC seen



Real data

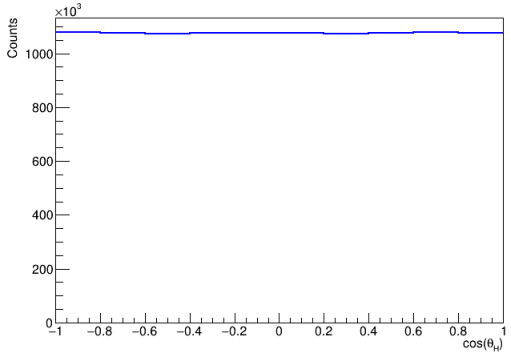


φ distributions

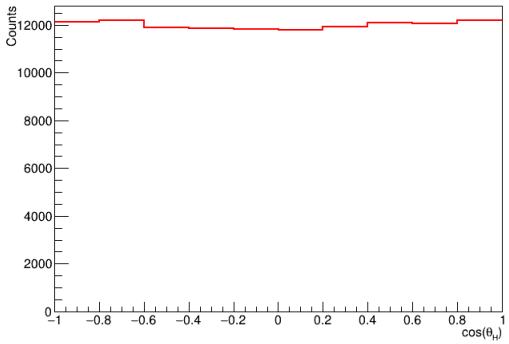
- Real data looks similar to detector accepted phase space

Distributions of $\cos(\theta_H)$ and φ_H

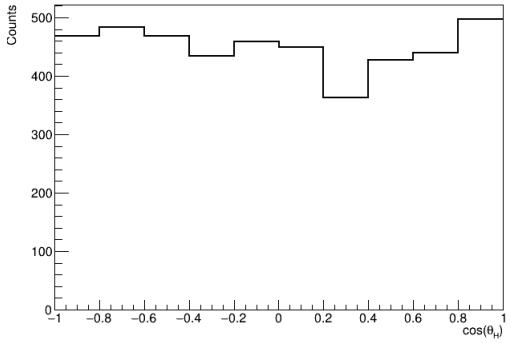
MC thrown



MC seen

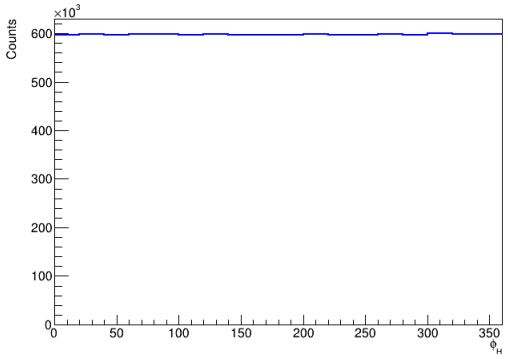


Real data

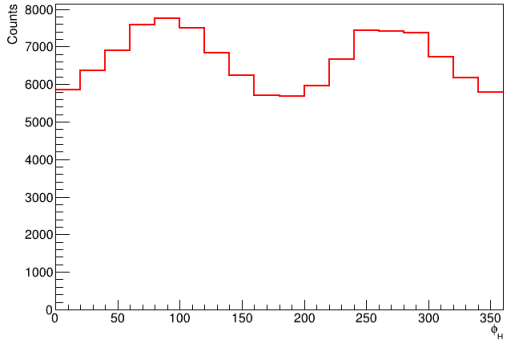


$\cos(\theta_H)$ distributions

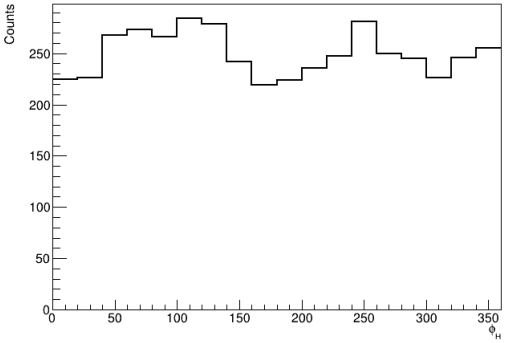
MC thrown



MC seen



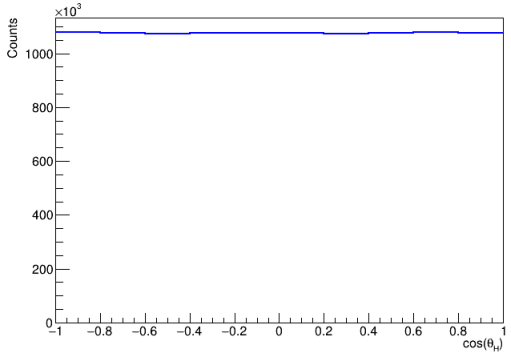
Real data



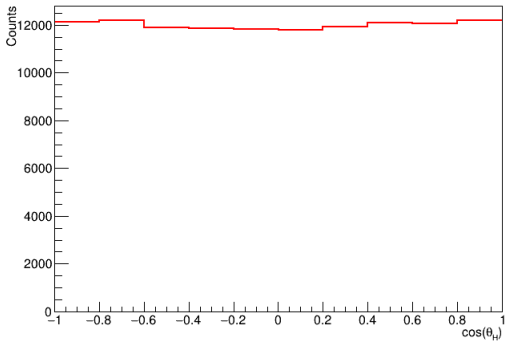
φ_H distributions

Distributions of $\cos(\theta_H)$ and φ_H

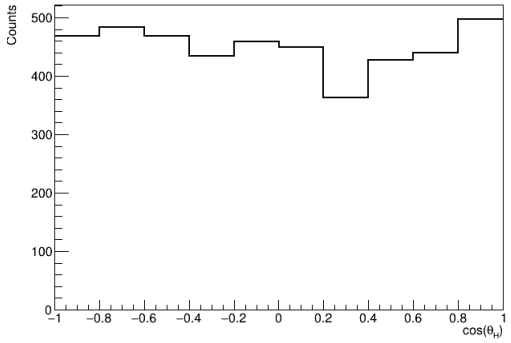
MC thrown



MC seen

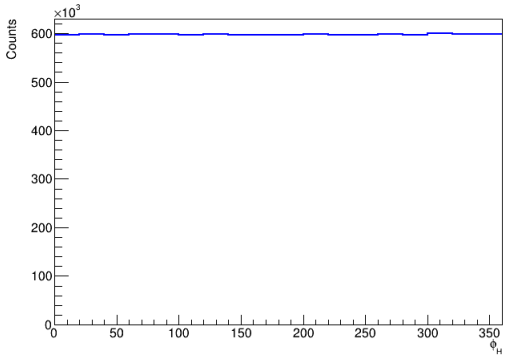


Real data

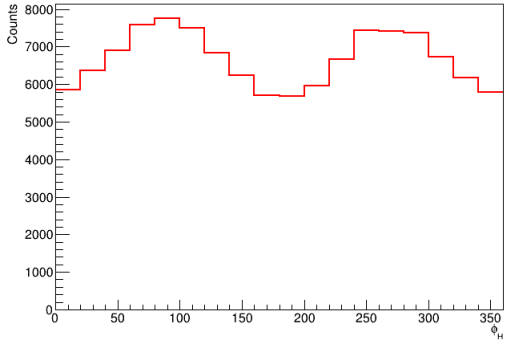


$\cos(\theta_H)$ distributions

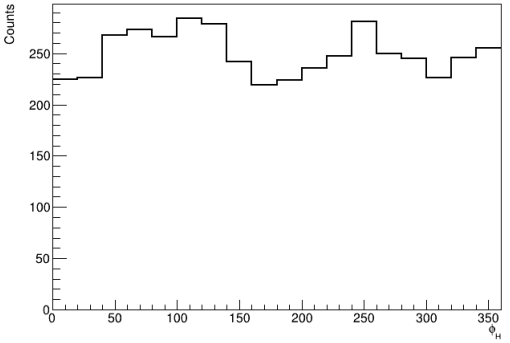
MC thrown



MC seen



Real data



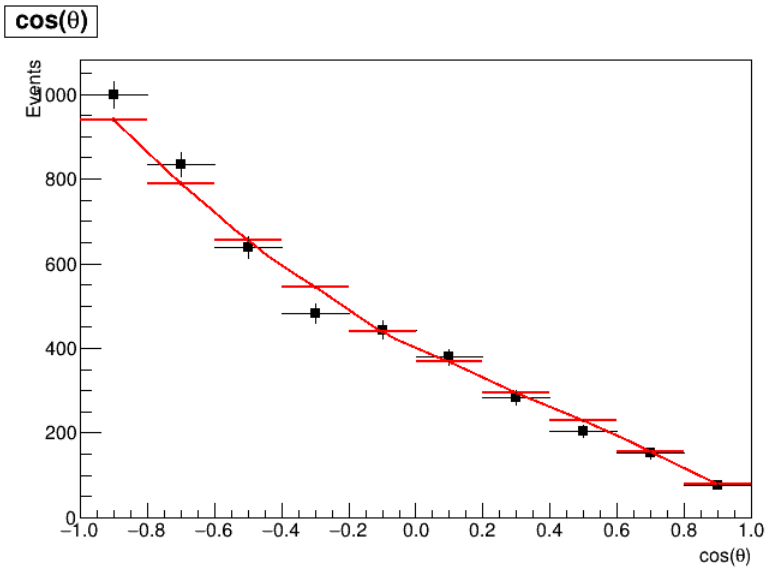
φ_H distributions

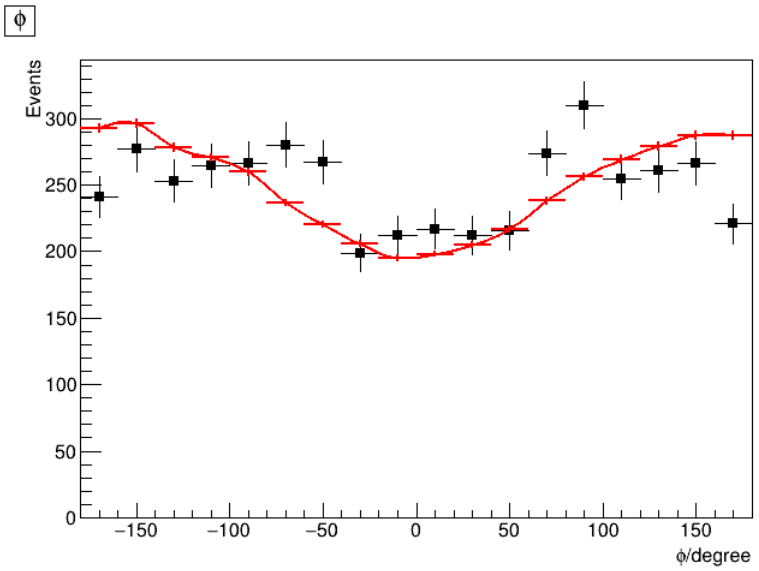
- Real data looks similar to detector accepted phase space

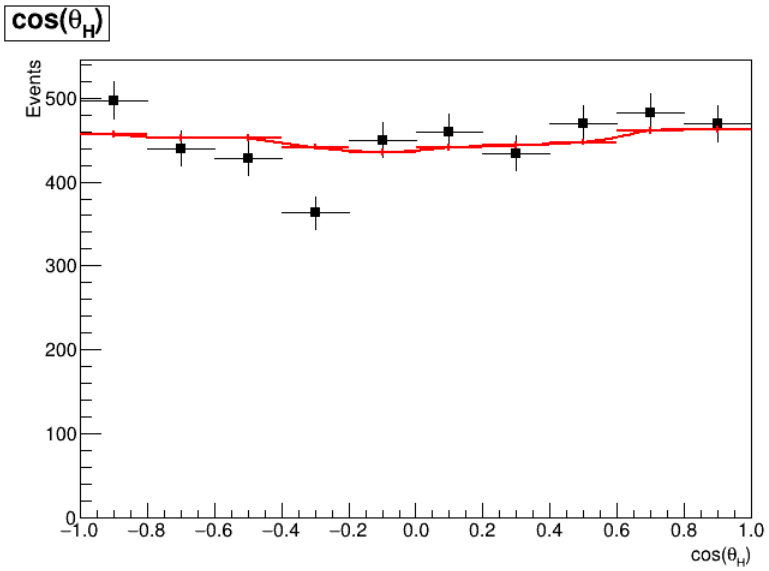
Initial PWA setup

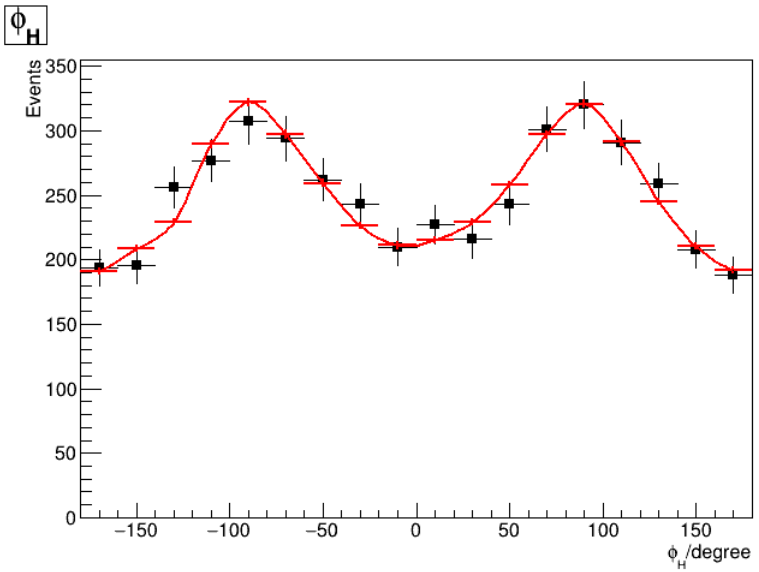
- Used AmpTools for PWA
- Meson Resonance (R) = $KK\pi$ system
- Decay modeled as $R \rightarrow$ Isobar π, where Isobar $\rightarrow K\,K$
- Coherently added:
  - j=0, l=0, s=0
  - j=1, with
    - l=1, s=0, m_j = -1,0,1
    - l=0, s=1, m_j = -1,0,1
    - l=1, s=1, m_j = -1,0,1

Initial PWA results









Initial PWA results

Fit fraction j=0, l=0, s=0	: 0.889781 +- -0.0217382
Fit fraction j=1, l=1, s=0, m_j = -1	: 0.00871226 +- -0.00621642
Fit fraction j=1, l=1, s=0, m_j = 0	: 0.00602355 +- -0.00225263
Fit fraction j=1, l=1, s=0, m_j = 1	: 0.00372569 +- -0.00357181
Fit fraction j=1, l=0, s=1, m_j = -1	: 0.00440462 +- -0.00310331
Fit fraction j=1, l=0, s=1, m_j = 0	: 0.0823949 +- -0.021007
Fit fraction j=1, l=0, s=1, m_j = 1	: 0.00266052 +- -0.0024404
Fit fraction j=1, l=1, s=1, m_j = -1	: 0.00107445 +- -0.00154346
Fit fraction j=1, l=1, s=1, m_j = 0	: 0.00066086 +- -0.00167736
Fit fraction j=1, l=1, s=1, m_j = 1	: 0.000603949 +- -0.00123617

Initial PWA results

By far, the most important contribution

Fit fraction j=0, l=0, s=0	: 0.889781 +- -0.0217382
Fit fraction j=1, l=1, s=0, m_j = -1	: 0.00871226 +- -0.00621642
Fit fraction j=1, l=1, s=0, m_j = 0	: 0.00602355 +- -0.00225263
Fit fraction j=1, l=1, s=0, m_j = 1	: 0.00372569 +- -0.00357181
Fit fraction j=1, l=0, s=1, m_j = -1	: 0.00440462 +- -0.00310331
Fit fraction j=1, l=0, s=1, m_j = 0	: 0.0823949 +- -0.021007
Fit fraction j=1, l=0, s=1, m_j = 1	: 0.00266052 +- -0.0024404
Fit fraction j=1, l=1, s=1, m_j = -1	: 0.00107445 +- -0.00154346
Fit fraction j=1, l=1, s=1, m_j = 0	: 0.00066086 +- -0.00167736
Fit fraction j=1, l=1, s=1, m_j = 1	: 0.000603949 +- -0.00123617

Initial PWA results

By far, the most important contribution

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Fit fraction j=1, l=1, s=0, m_j = -1	: 0.00871226 +- -0.00621642
Fit fraction j=1, l=1, s=0, m_j = 0	: 0.00602355 +- -0.00225263
Fit fraction j=1, l=1, s=0, m_j = 1	: 0.00372569 +- -0.00357181
Fit fraction j=1, l=0, s=1, m_j = -1	: 0.00440462 +- -0.00310331
Fit fraction j=1, l=0, s=1, m_j = 0	: 0.0823949 +- -0.021007
Fit fraction j=1, l=0, s=1, m_j = 1	: 0.00266052 +- -0.0024404
Fit fraction j=1, l=1, s=1, m_j = -1	: 0.00107445 +- -0.00154346
Fit fraction j=1, l=1, s=1, m_j = 0	: 0.00066086 +- -0.00167736
Fit fraction j=1, l=1, s=1, m_j = 1	: 0.000603949 +- -0.00123617

More work needed to see if $x(1280)$ is $J = 0$ and is perhaps the poorly known $\eta(1295)$

Title