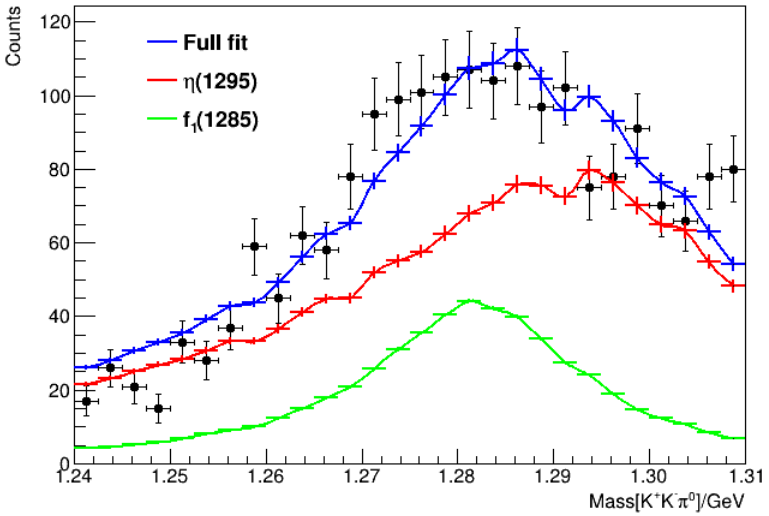
Low-mass $K^+K^-\pi^0$ study

PWA

- At the collaboration meeting I showed the plot below



PWA

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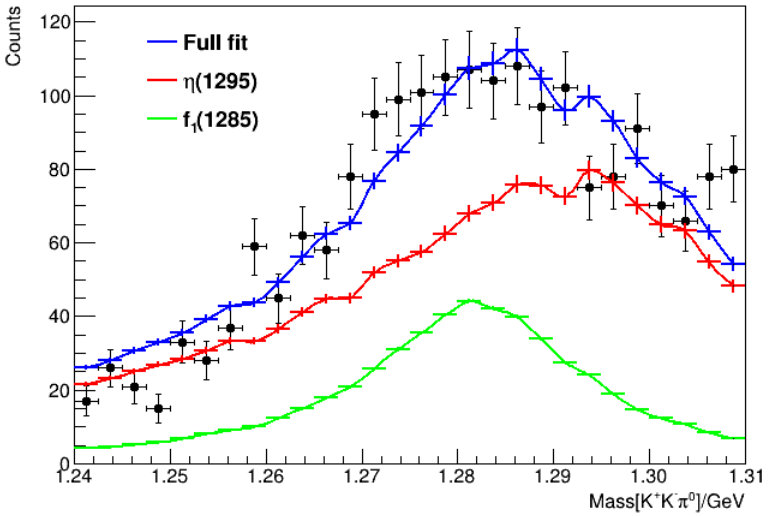
  -
  -
  -



PWA

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  - $\eta(1295) \rightarrow a_0(980)\pi^0$
  -
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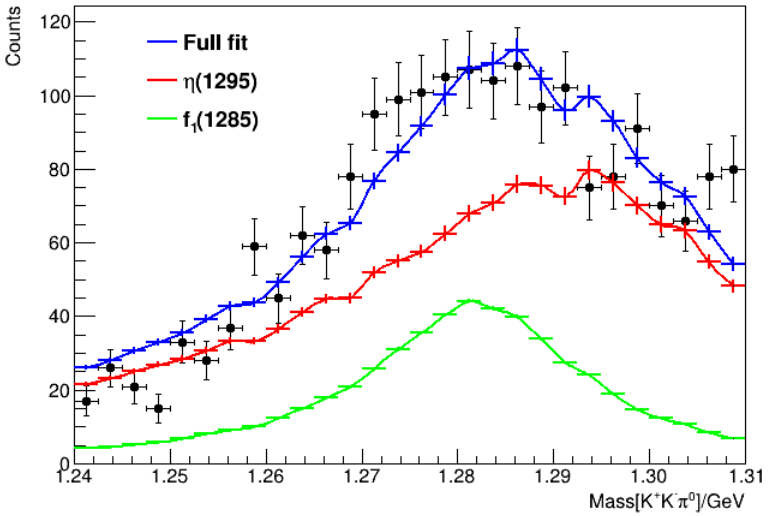

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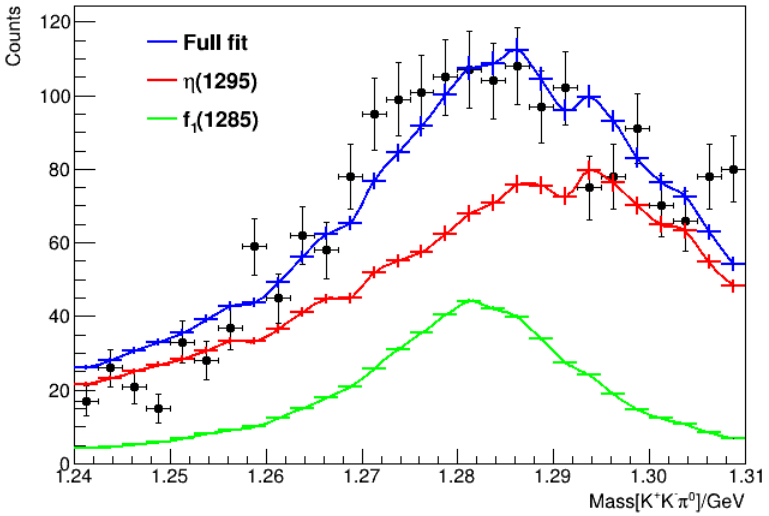

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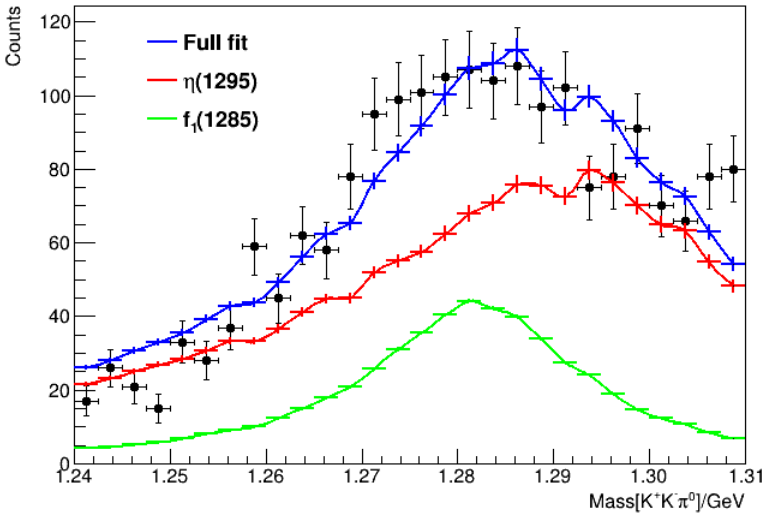

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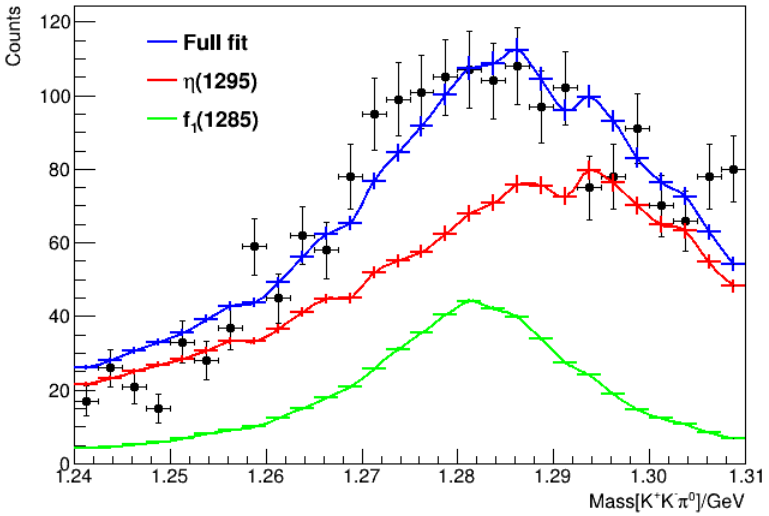
→ **Coherently added**



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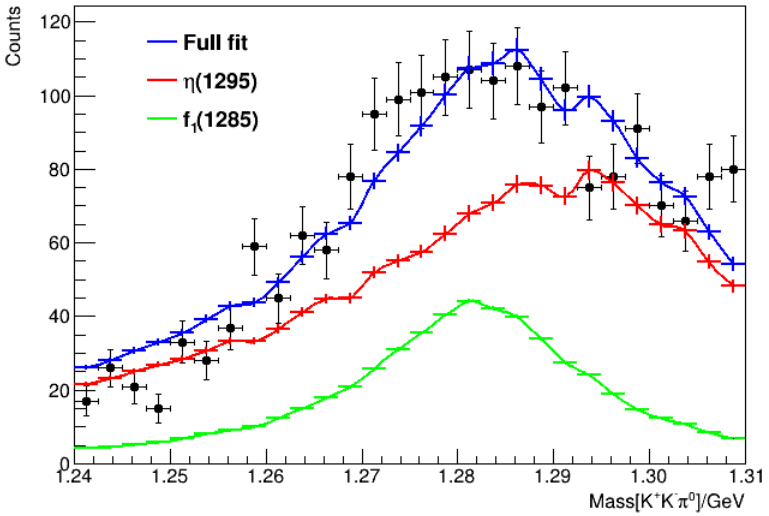

- Included Breit-Wigner factors for $\eta(1295)$, $f_1(1285)$ and $a_0(980)$ contributions:

$$\frac{m_0\Gamma}{m_0^2 - m^2 - im_0\Gamma}$$

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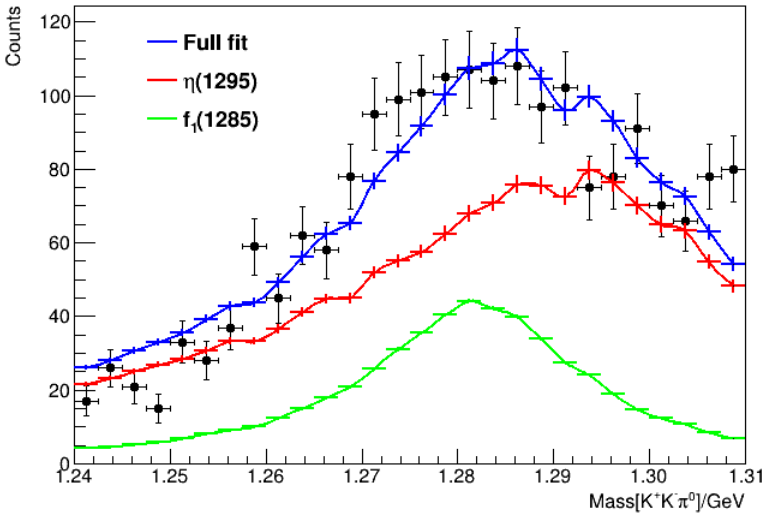

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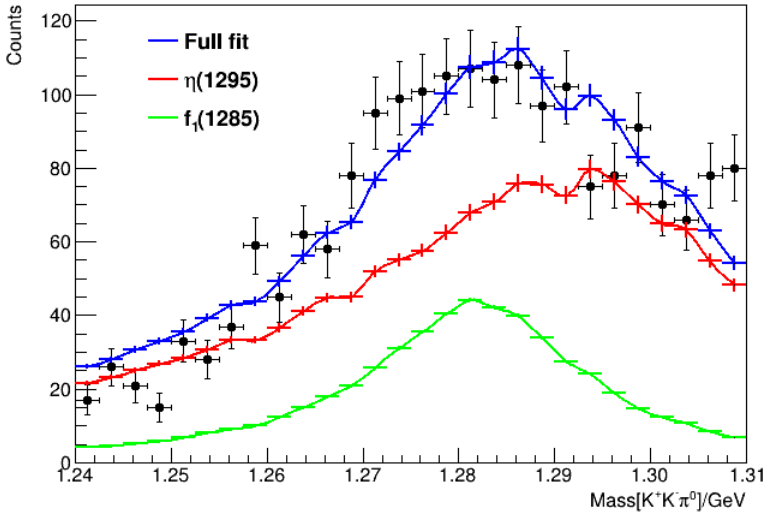
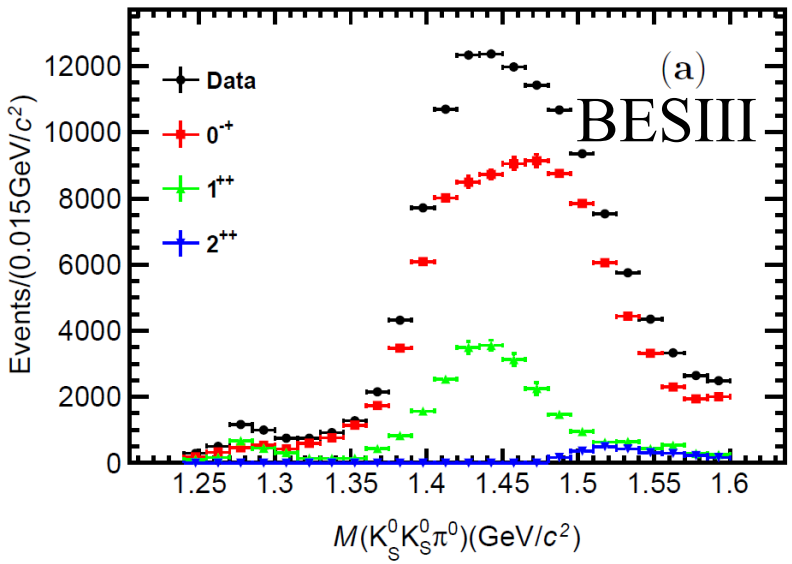
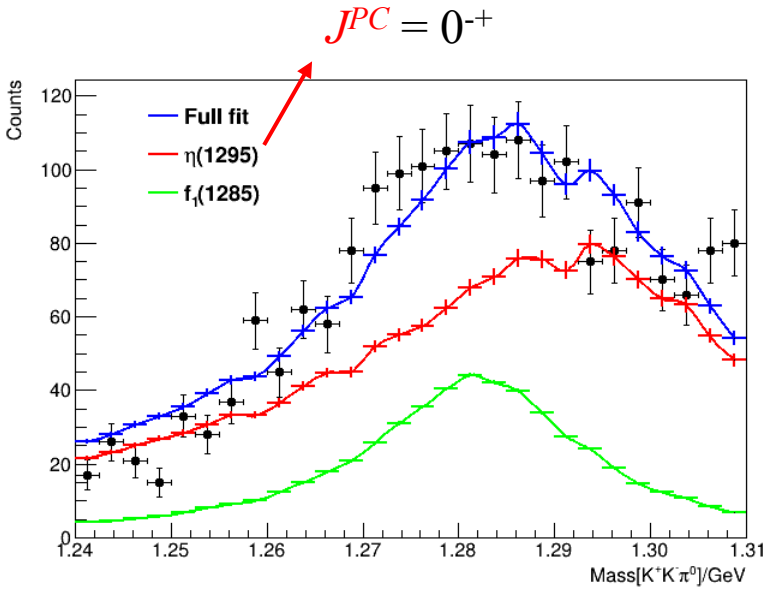
- Centers and widths locked

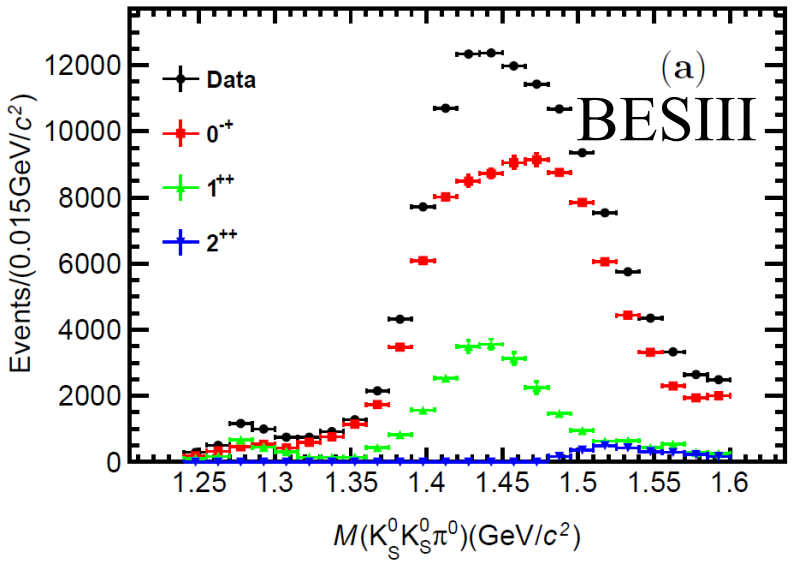
Comparison to BESIII



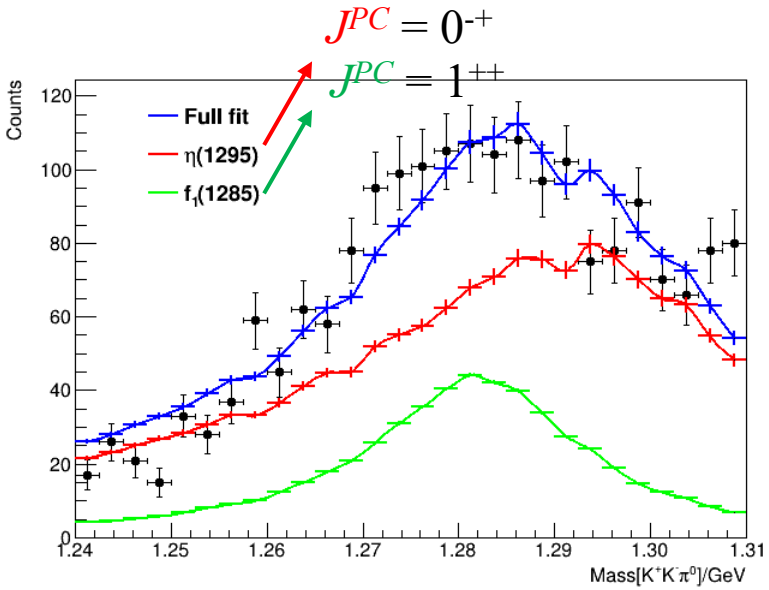


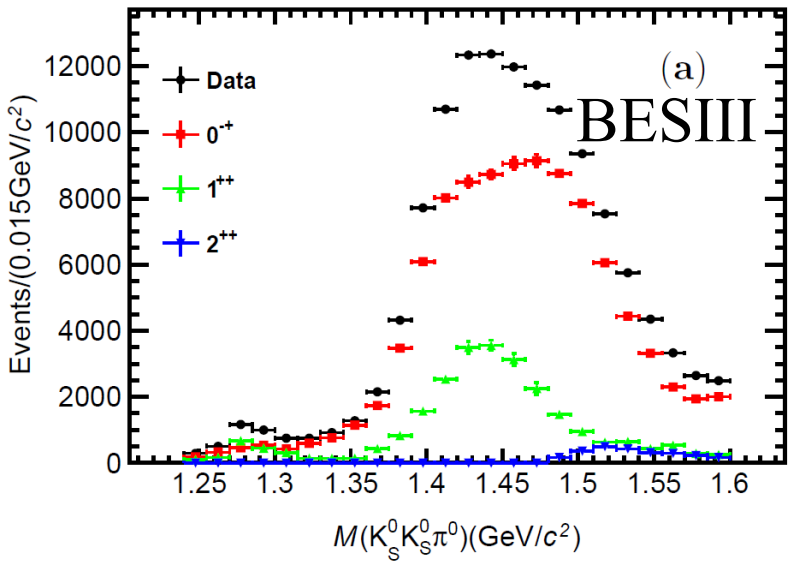
Comparison to BESIII





Comparison to BESIII





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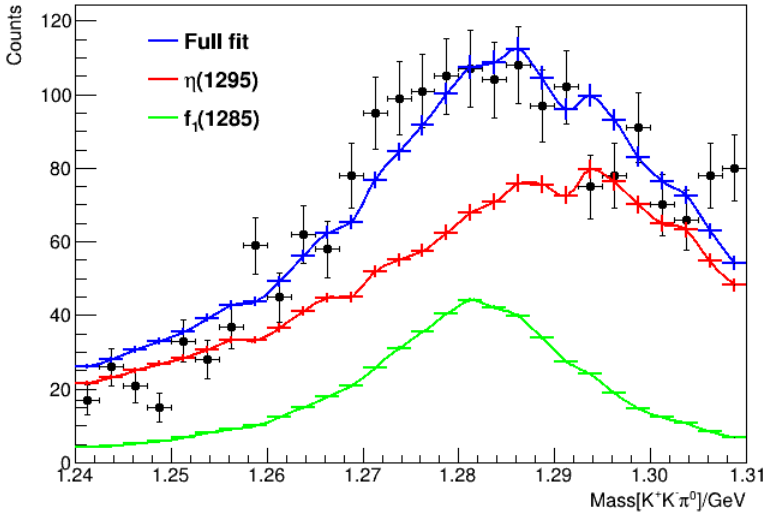

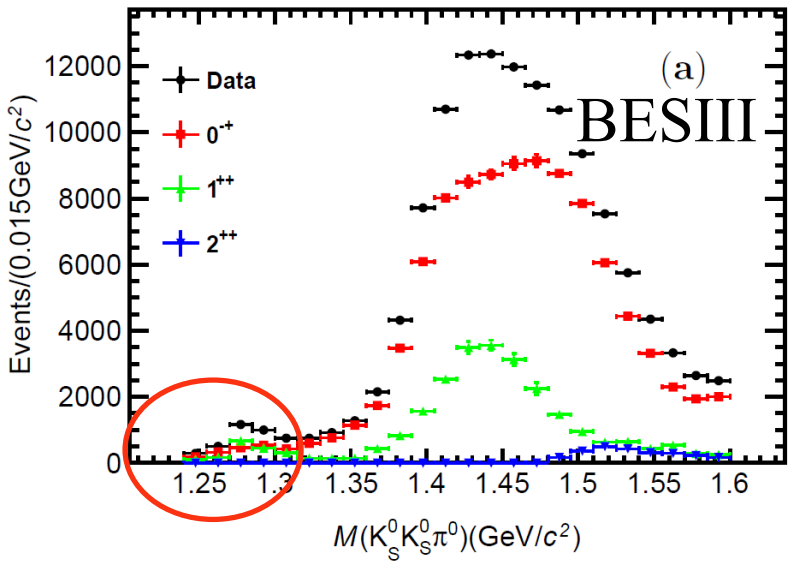

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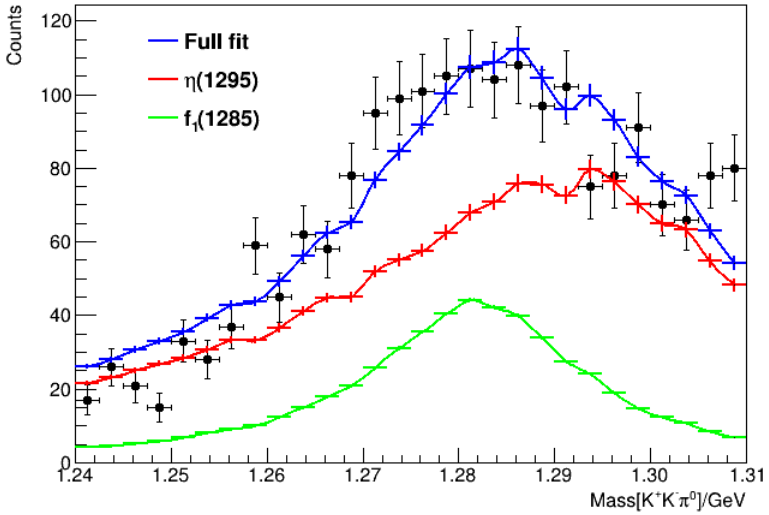

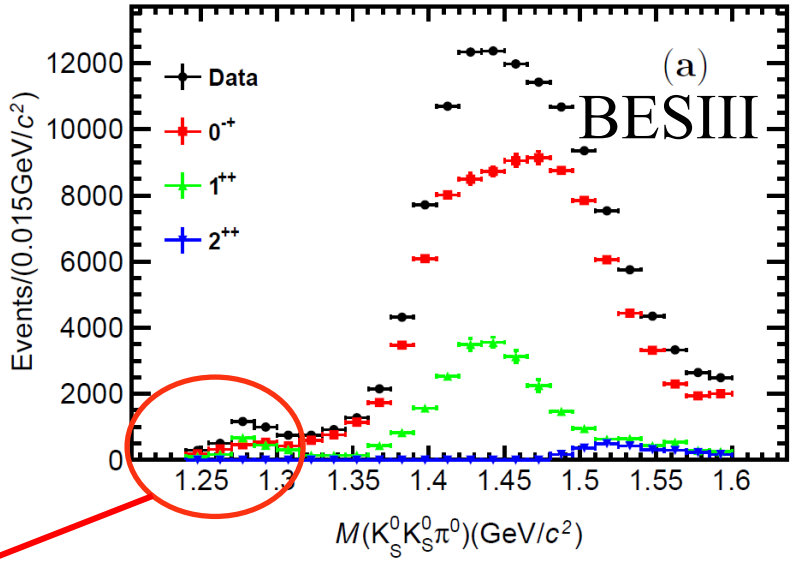

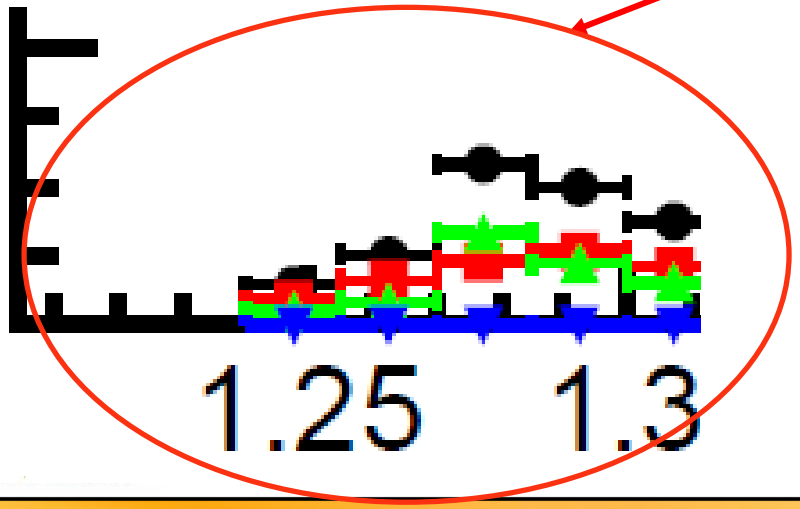

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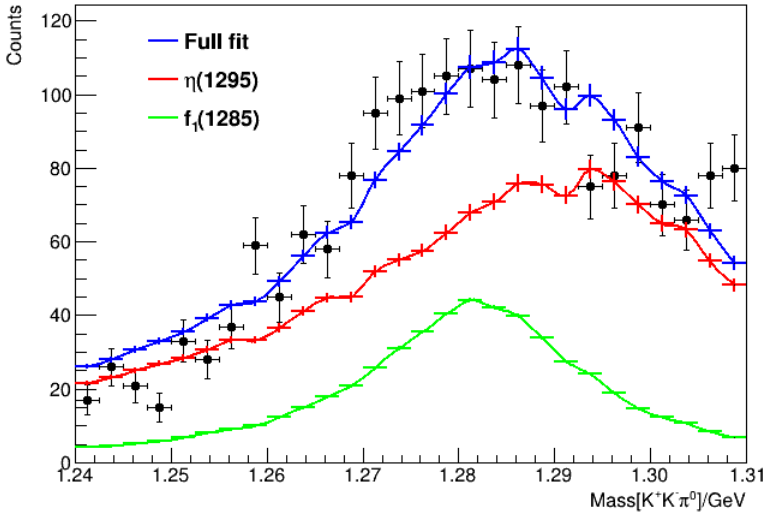
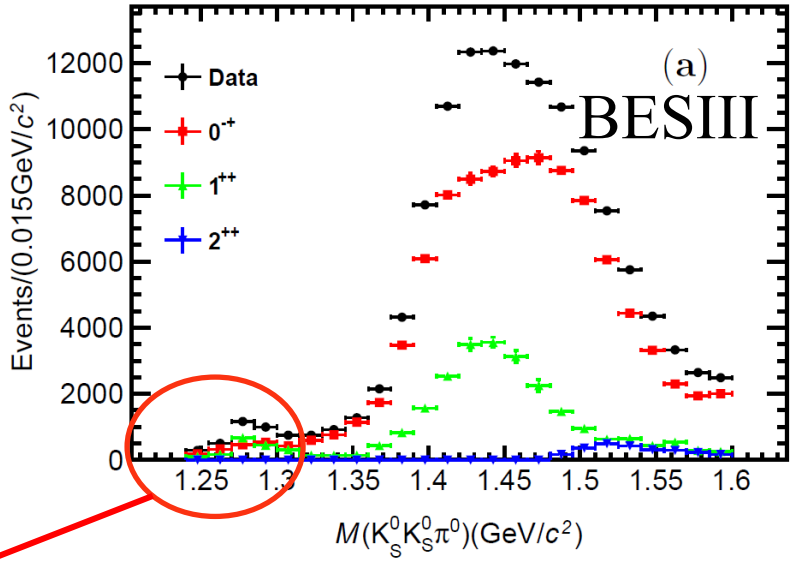
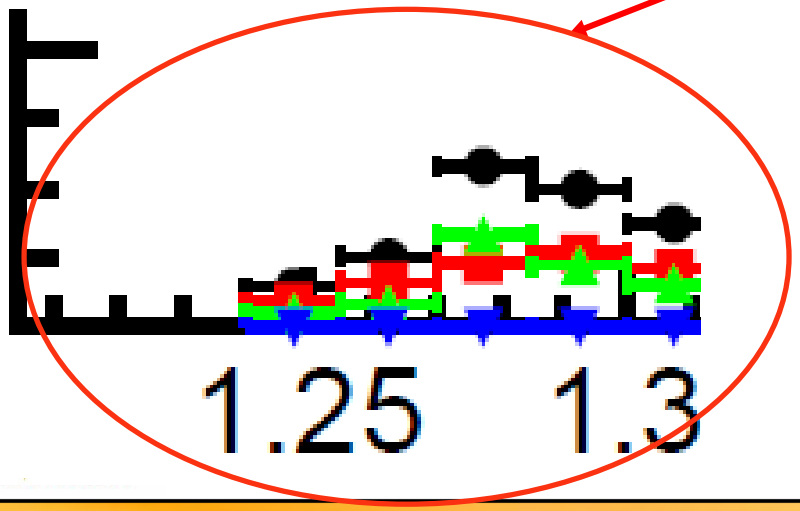
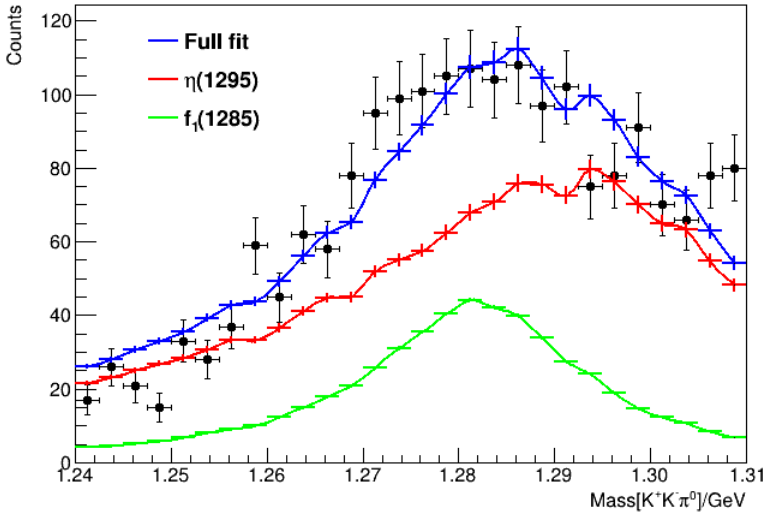


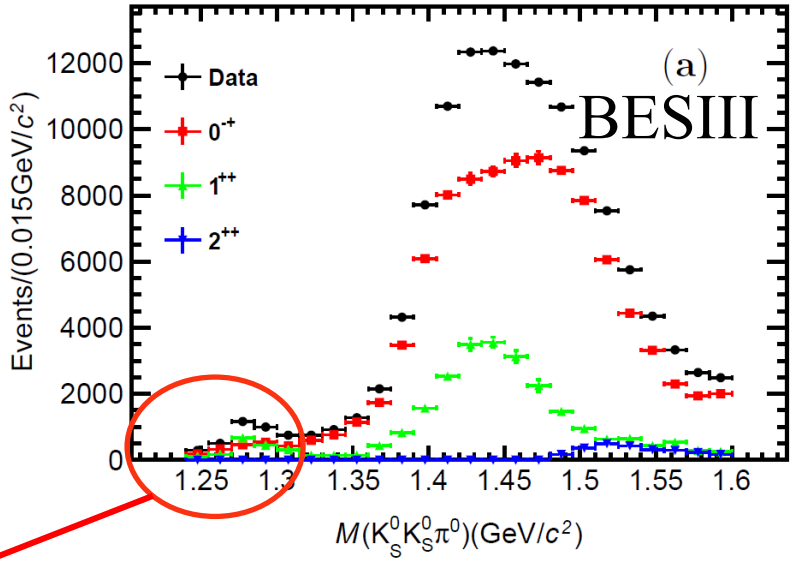


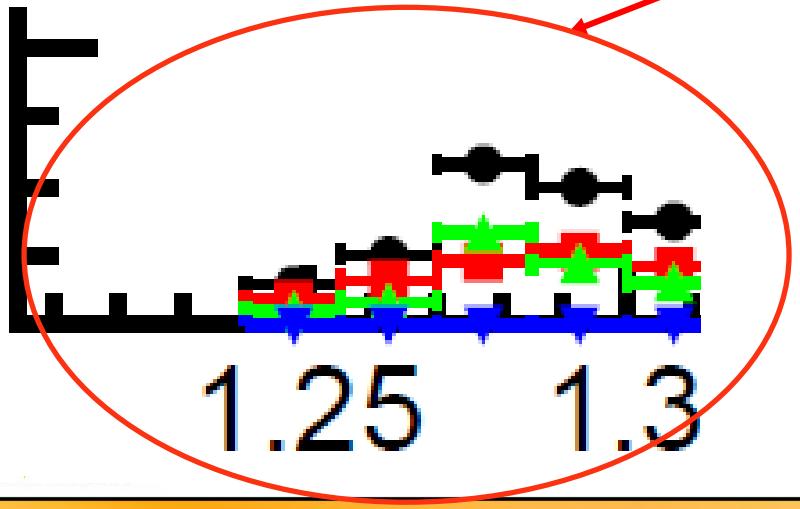


- BESIII has about equal parts of $J^P = 0^-$ and 1^+

Comparison to BESIII







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- My results are $J^P = 0^-$ dominate

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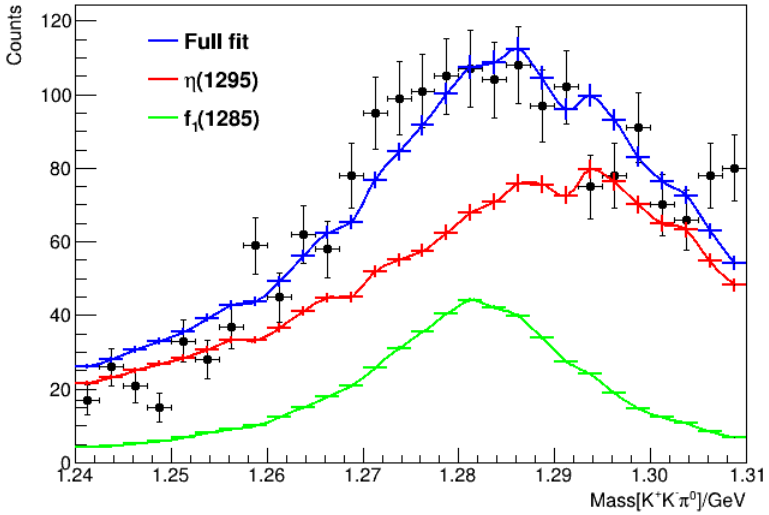

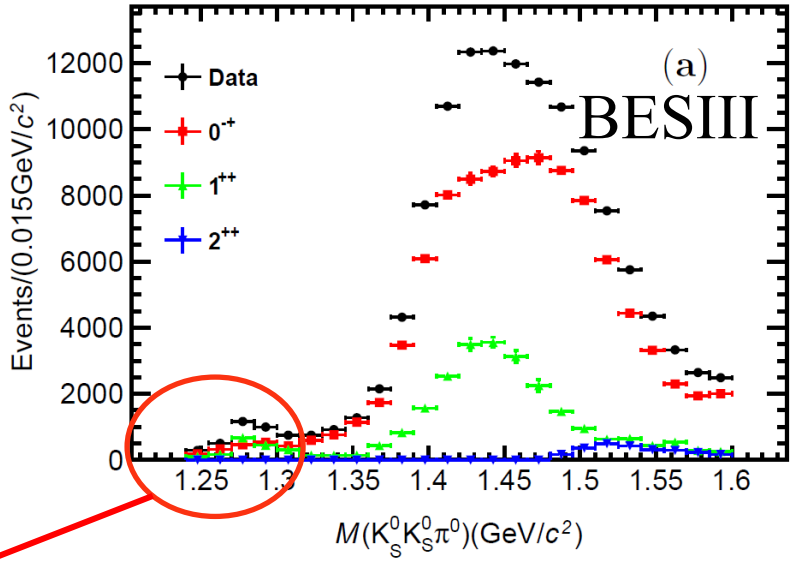

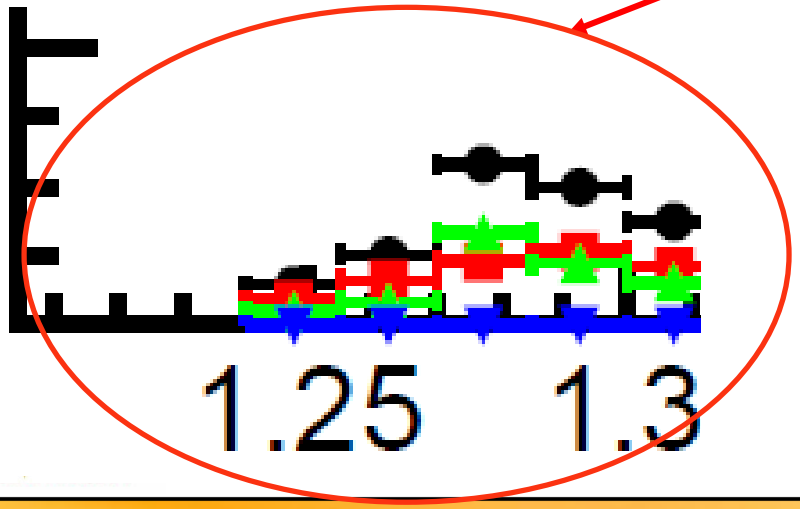

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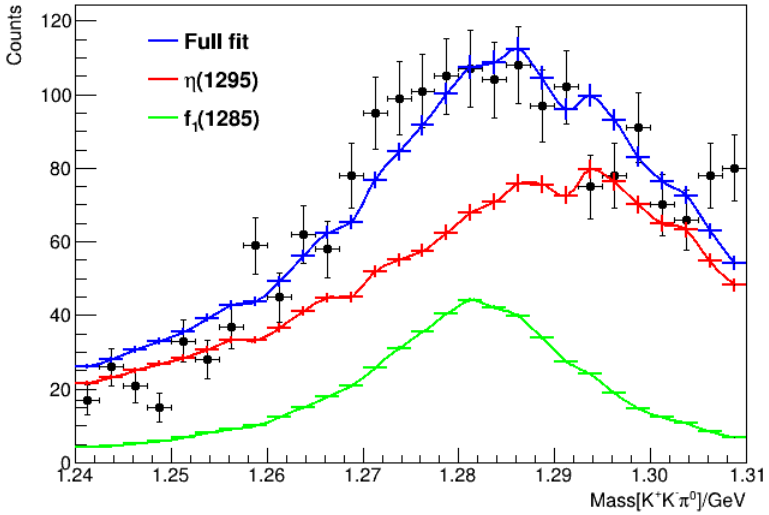

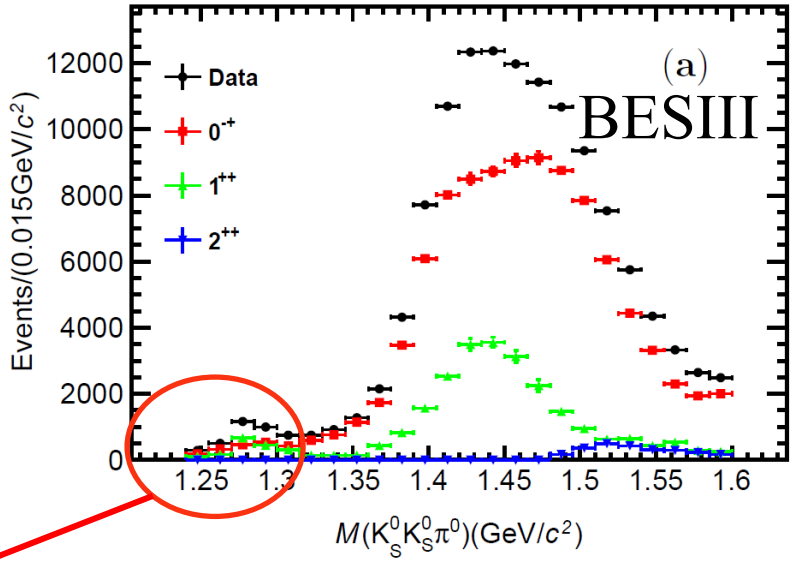

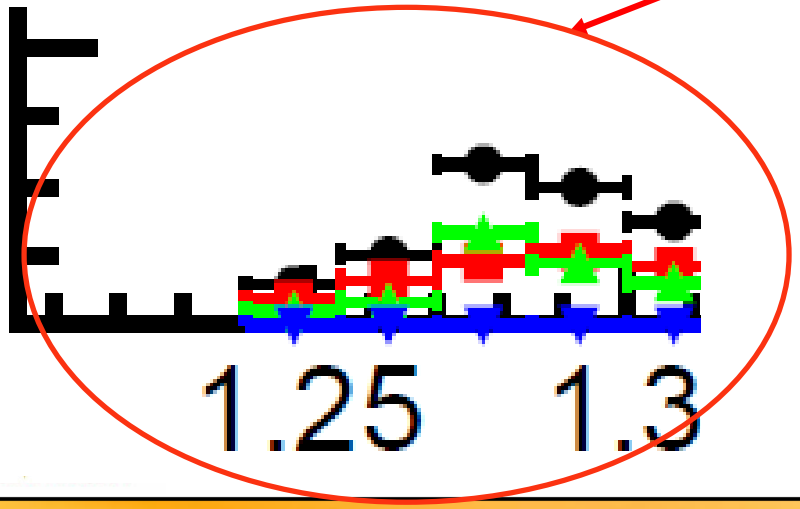

- BESIII has about equal parts of $J^P = 0^-$ and 1^+
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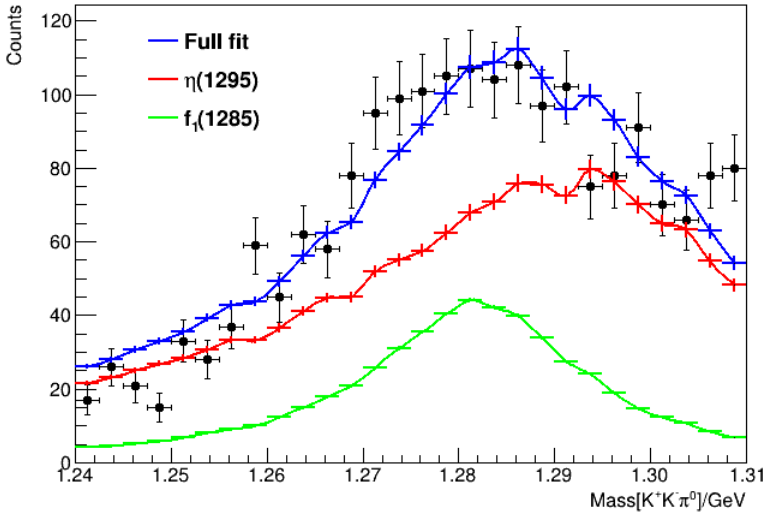
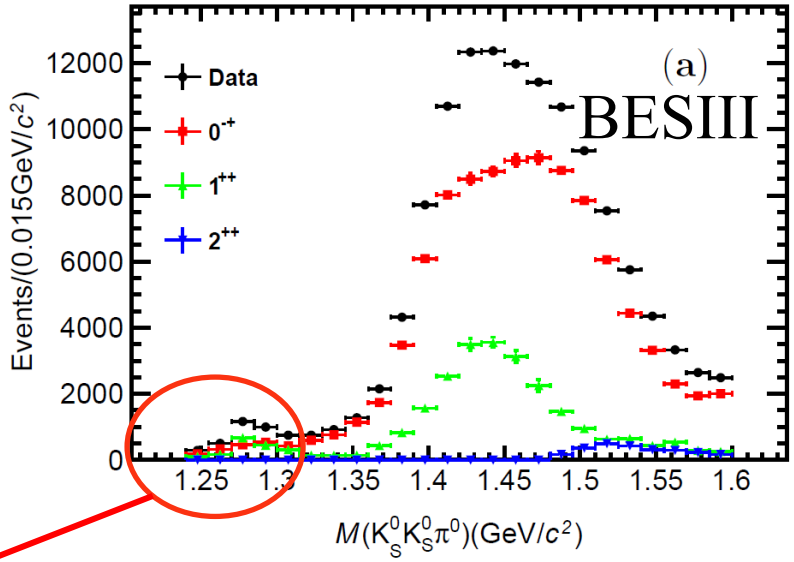
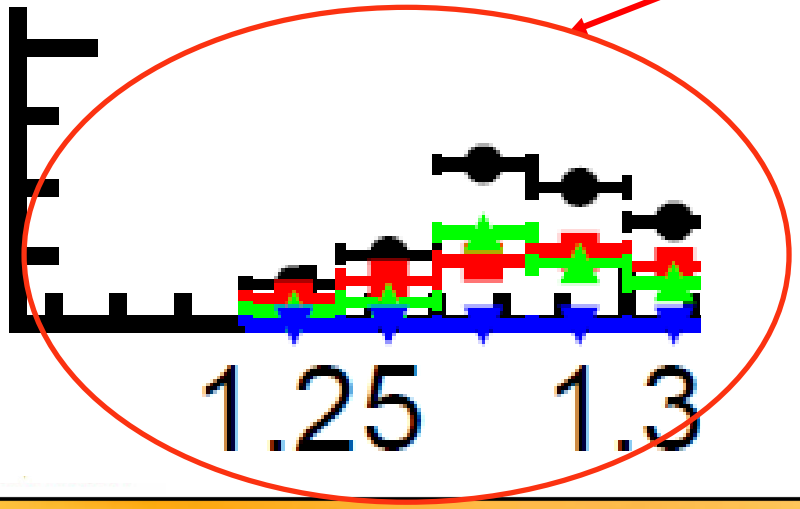
- BESIII has mass-independent fits

Comparison to BESIII







- BESIII has about equal parts of $J^P = 0^-$ and 1^+
- My results are $J^P = 0^-$ dominate ☹
- BESIII has mass-independent fits
- I need to perform mass-independent fit

Mass binned PWA^s

- Broke data into separate files for each 10 MeV-wide bin in mass[$K^+K^-\pi^0$]

Mass binned PWA^{s}

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- Removed the Breit-Wigner factors

Mass binned PWA^{s}

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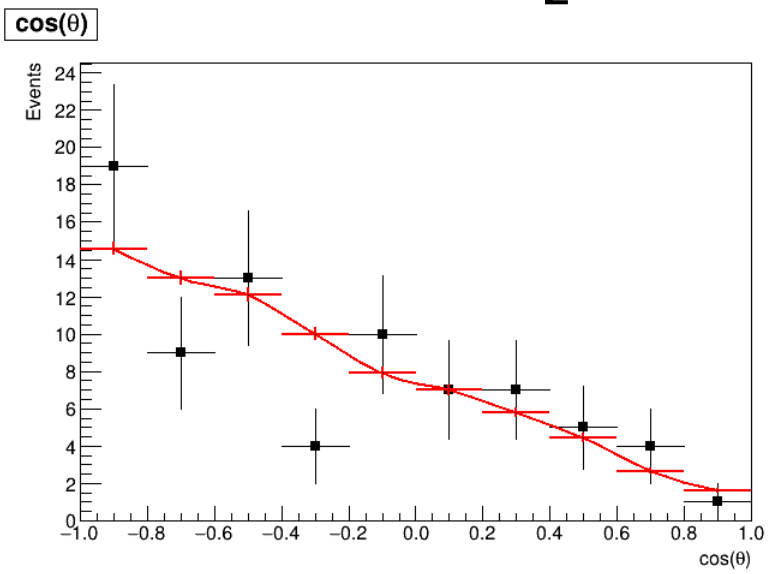
- Removed the Breit-Wigner factors
- Performed PWA independently for each 10 MeV-wide mass[$K^{+}K^{-}\pi^{0}$]

Mass[$K^+K^-\pi^0$] = 1245 MeV



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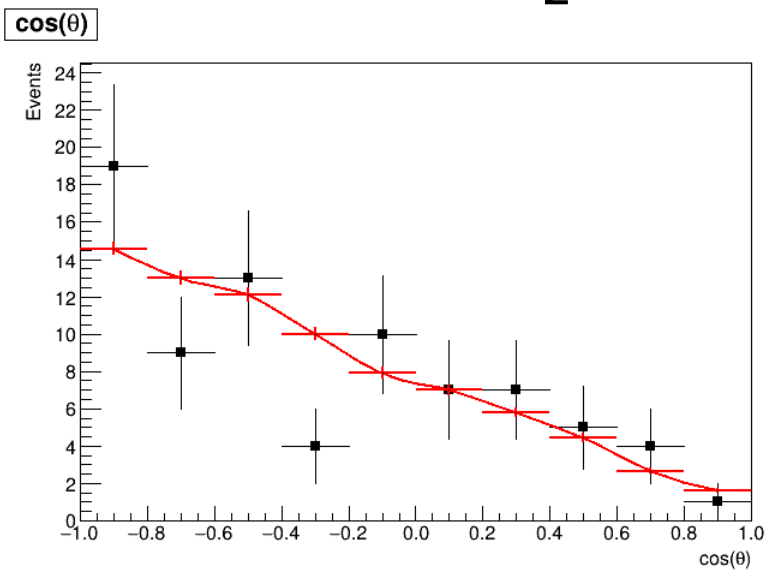

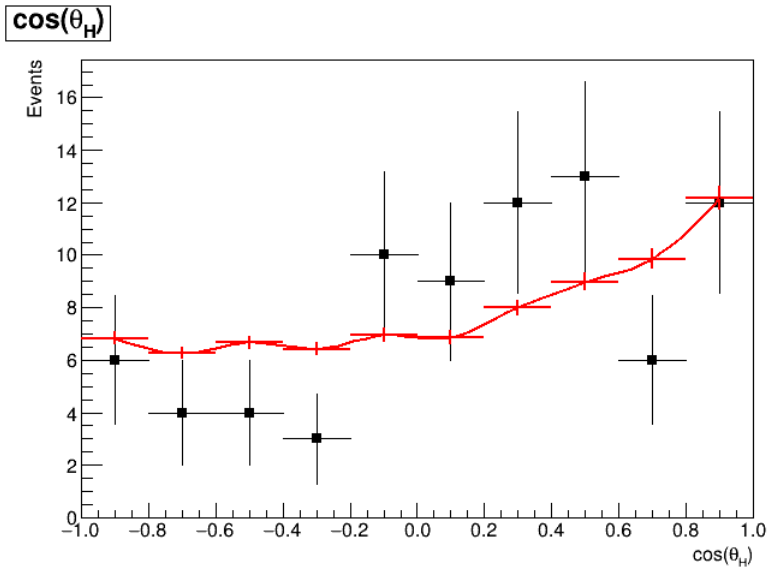

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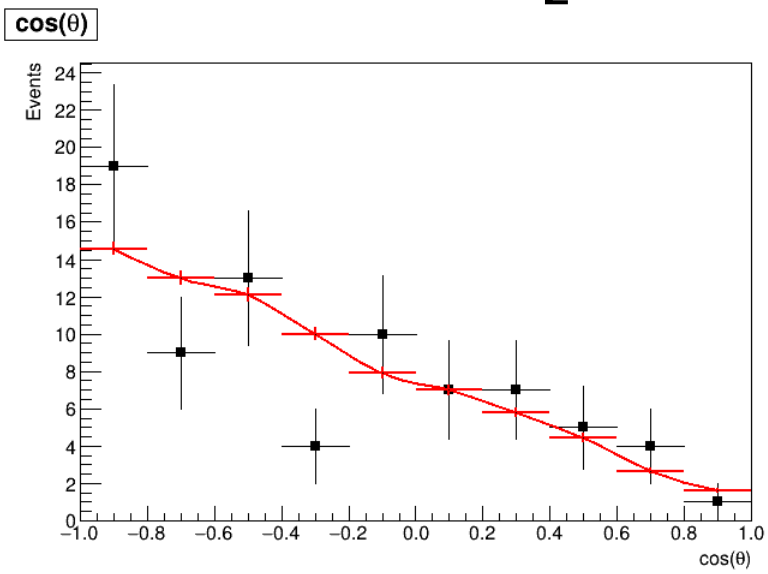

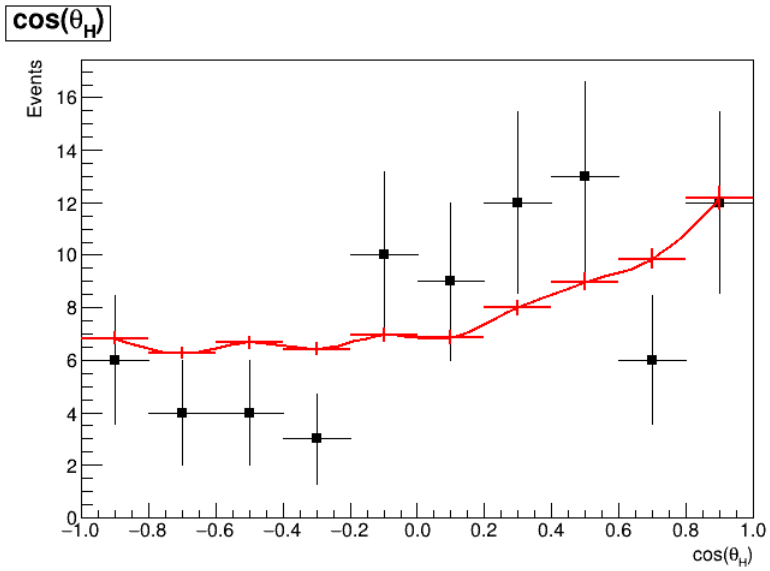

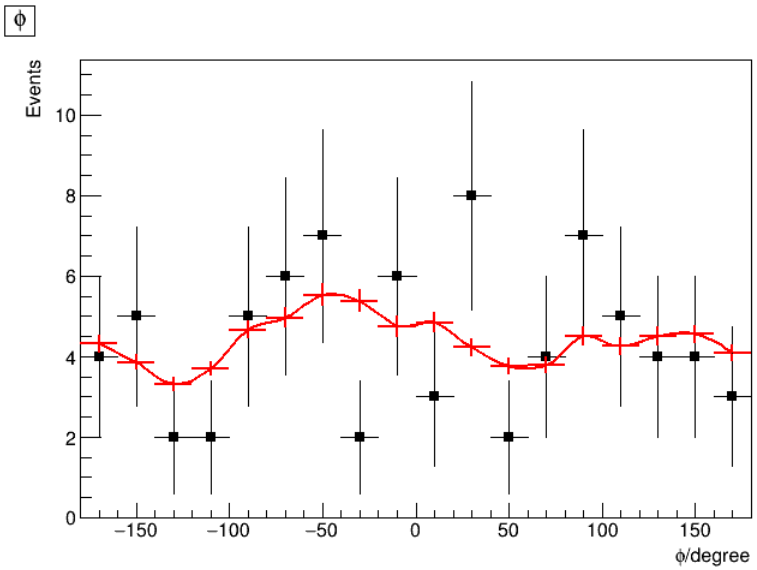

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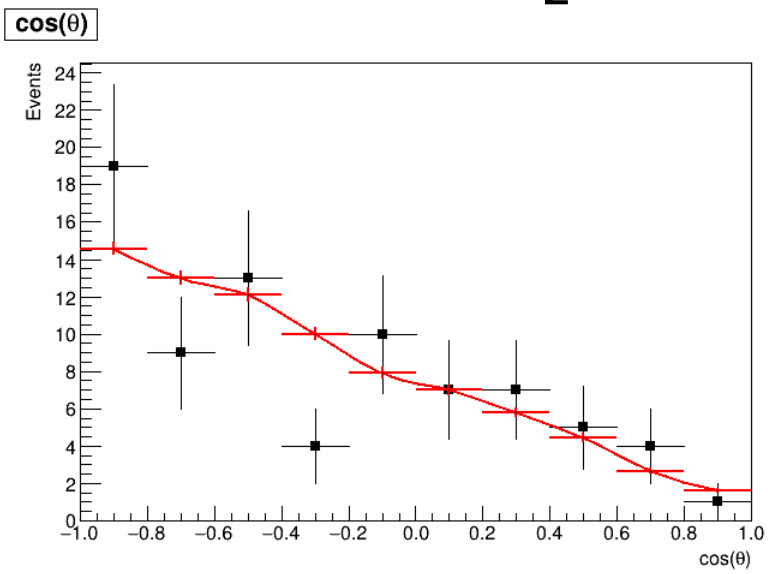
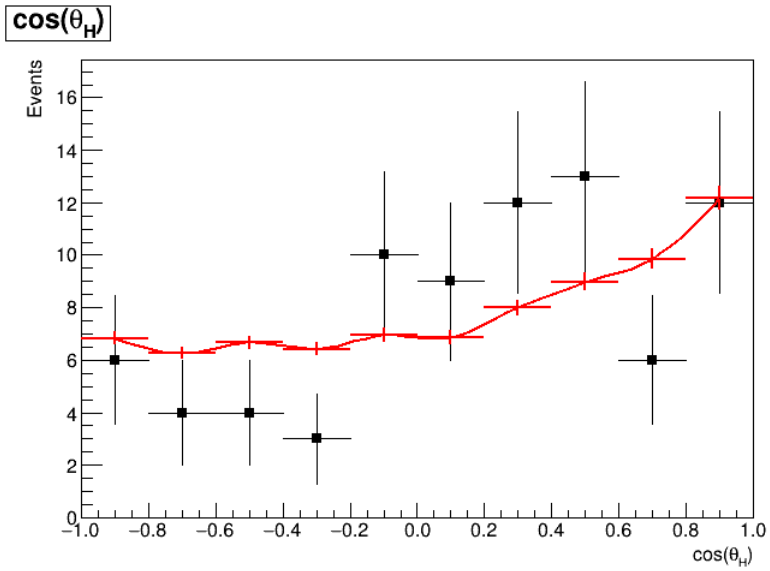
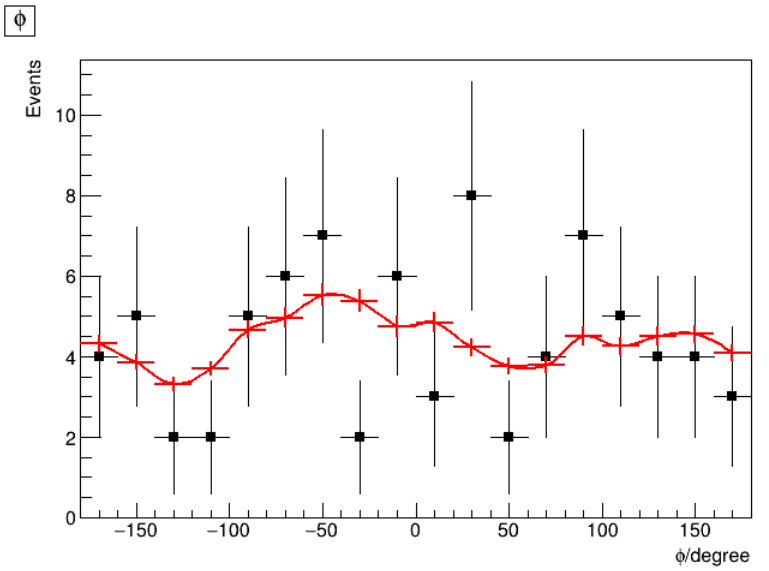
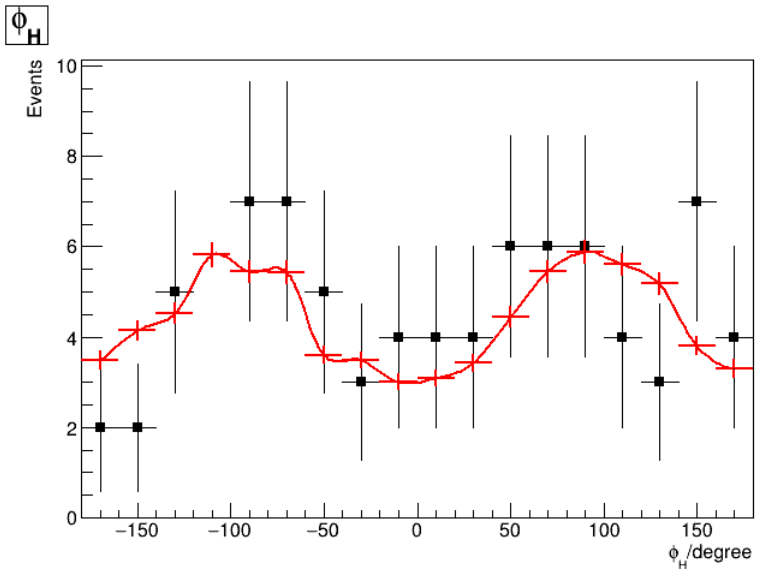
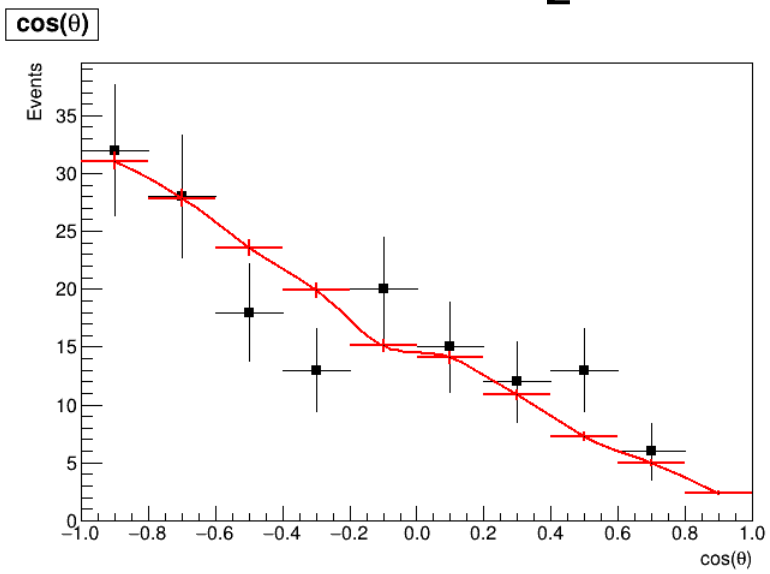


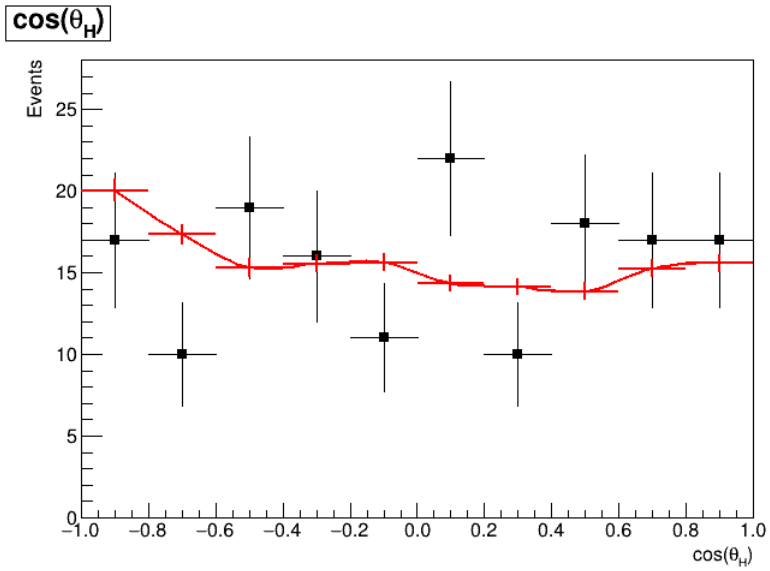


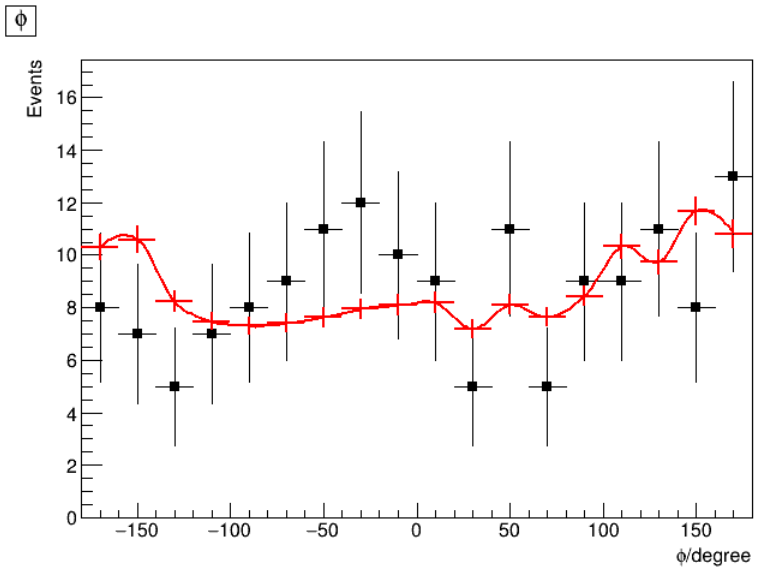


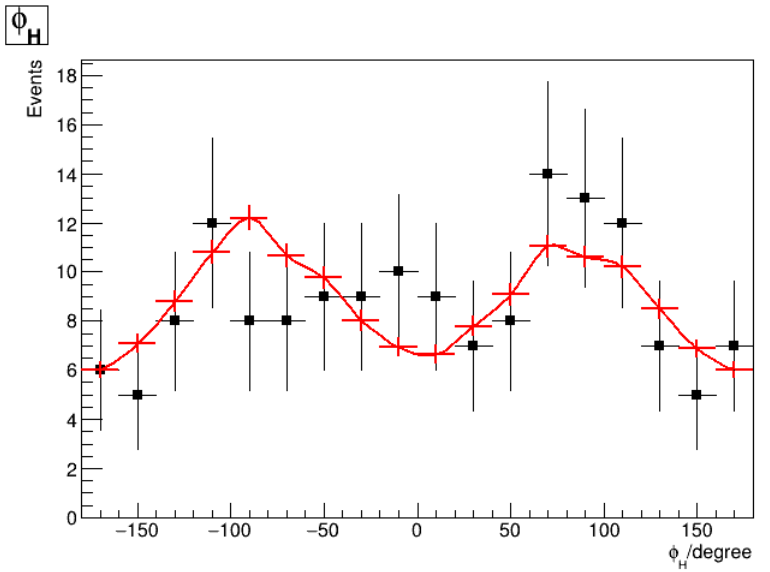


Mass[$K^+K^-\pi^0$] = 1255 MeV

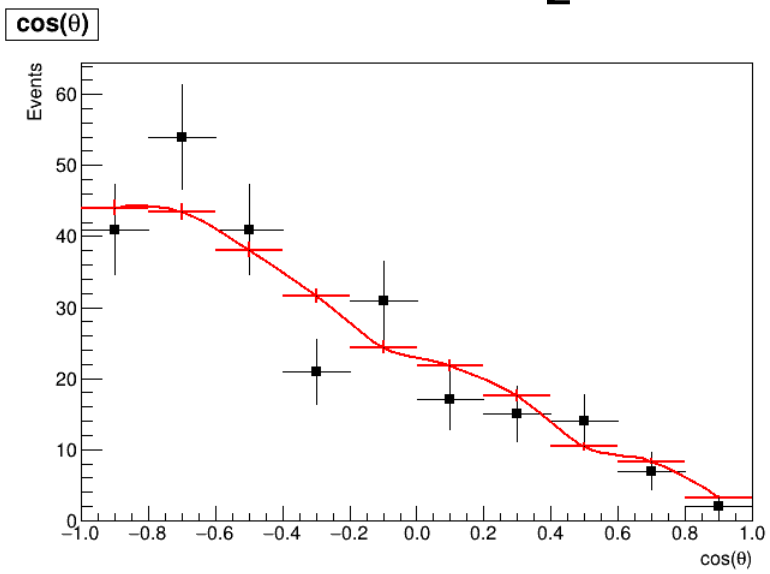


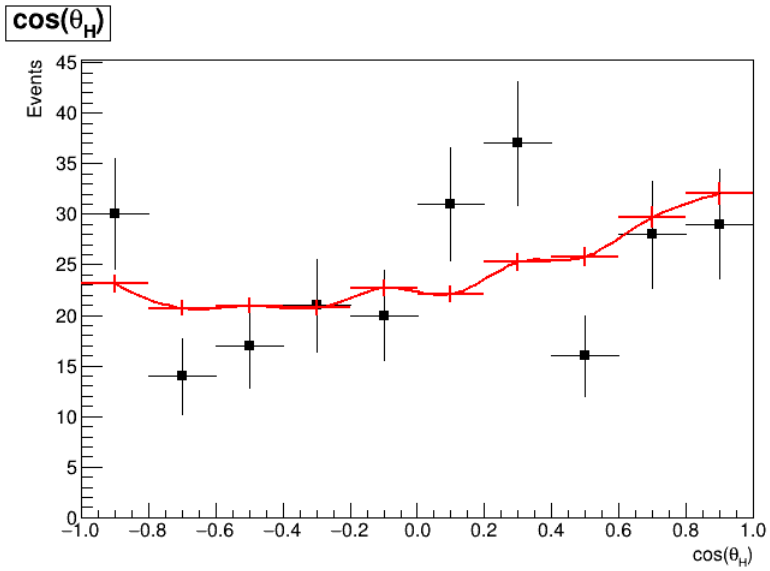


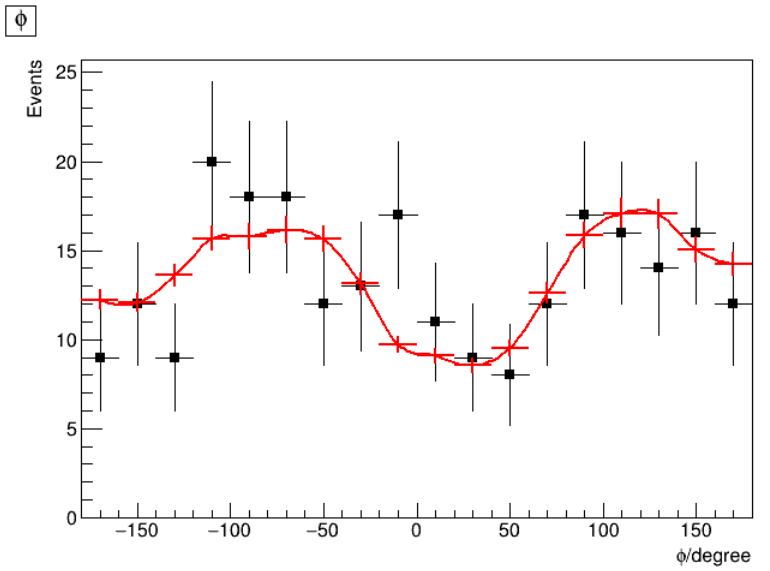


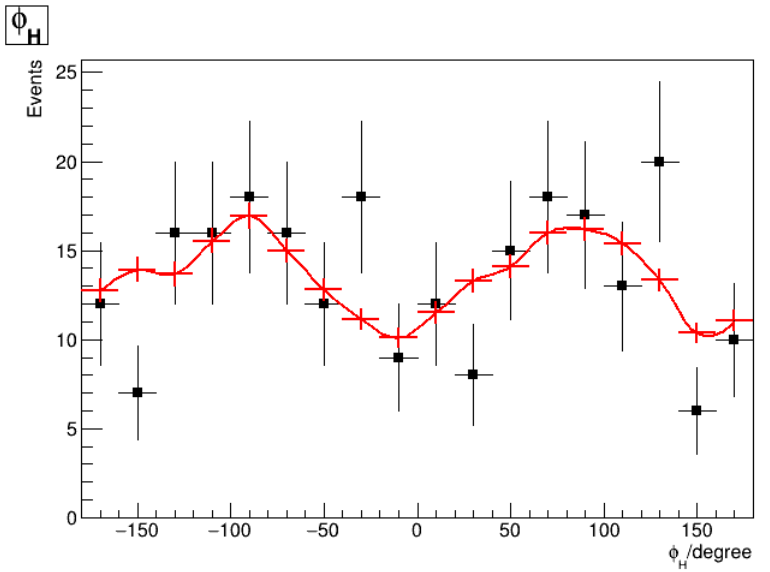


Mass[$K^+K^-\pi^0$] = 1265 MeV

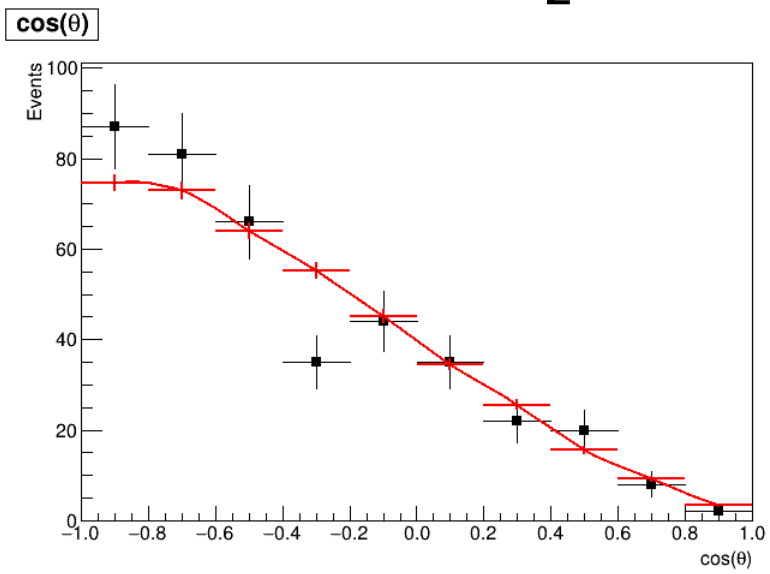


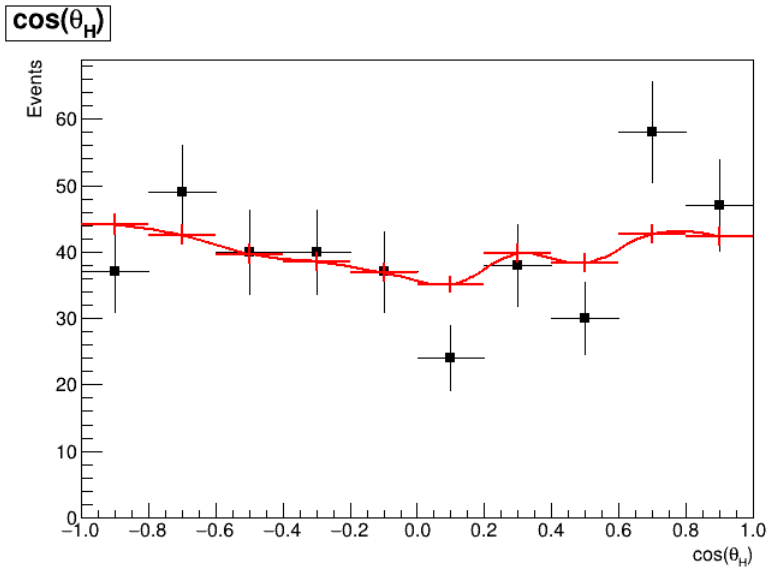


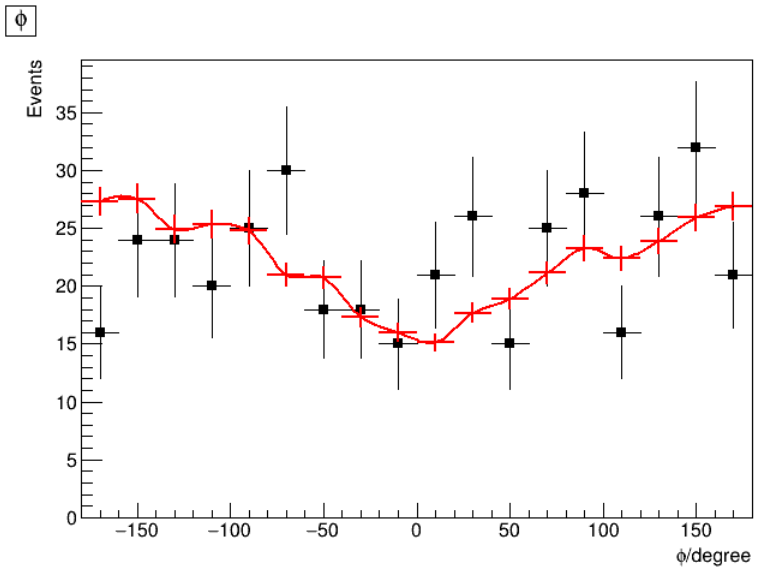


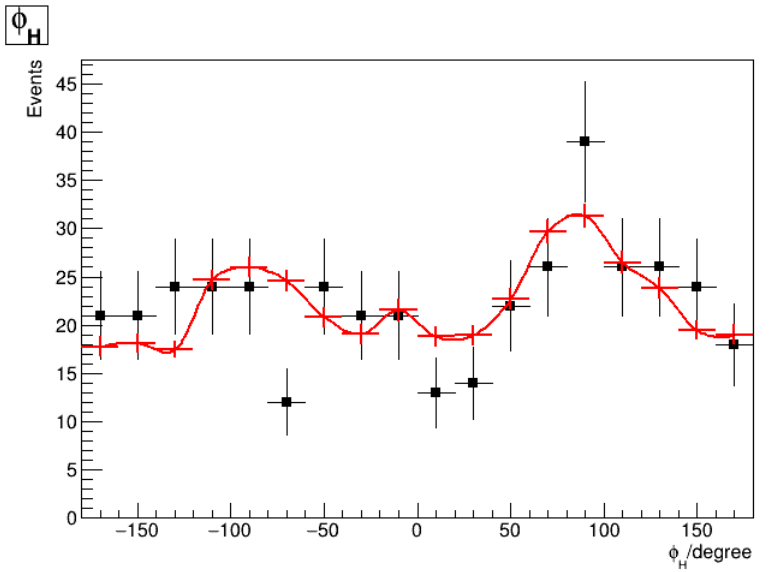


Mass[$K^+K^-\pi^0$] = 1275 MeV

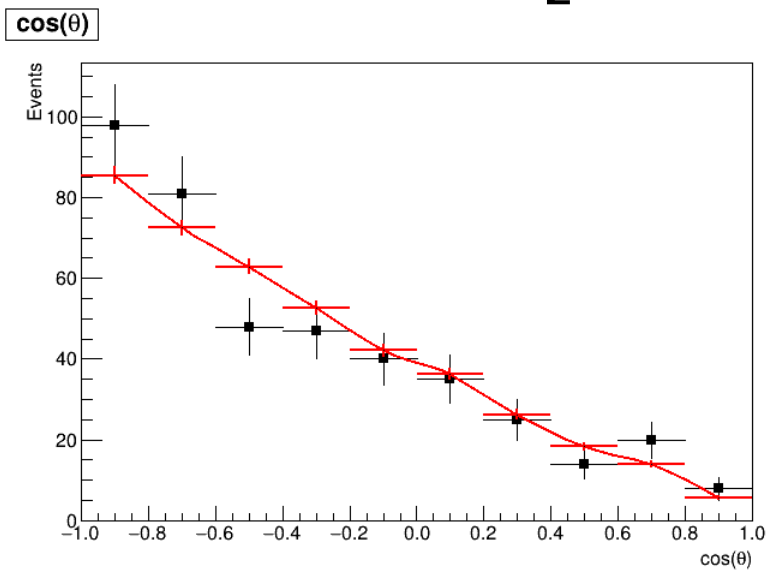


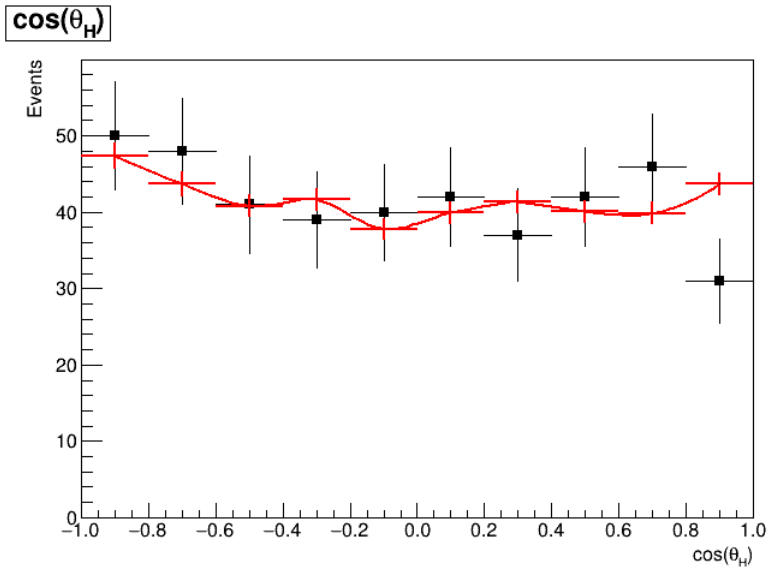


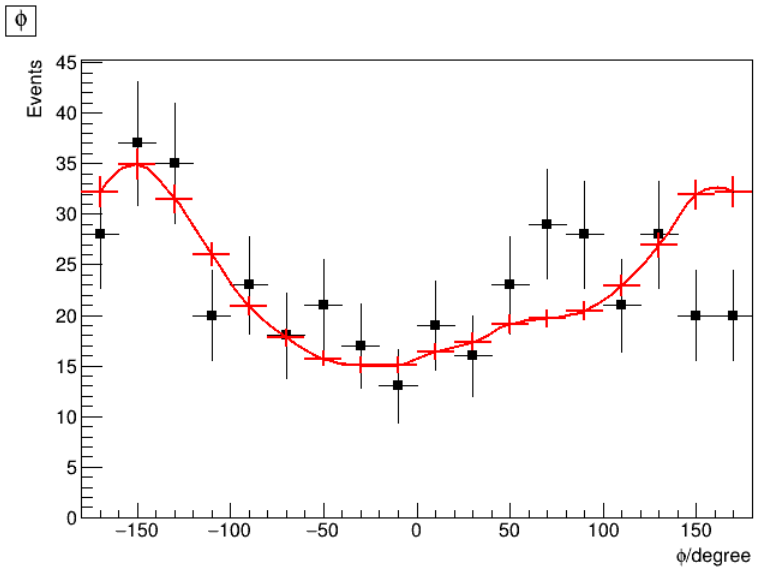


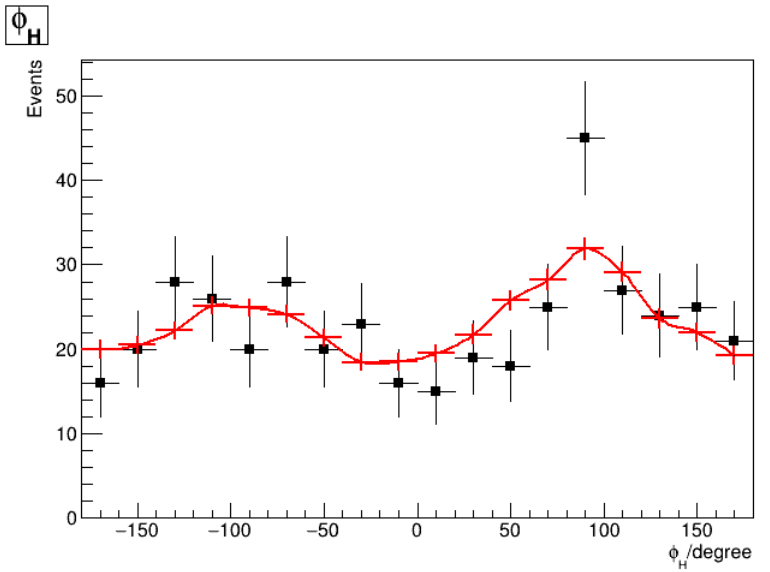


Mass[$K^+K^-\pi^0$] = 1285 MeV

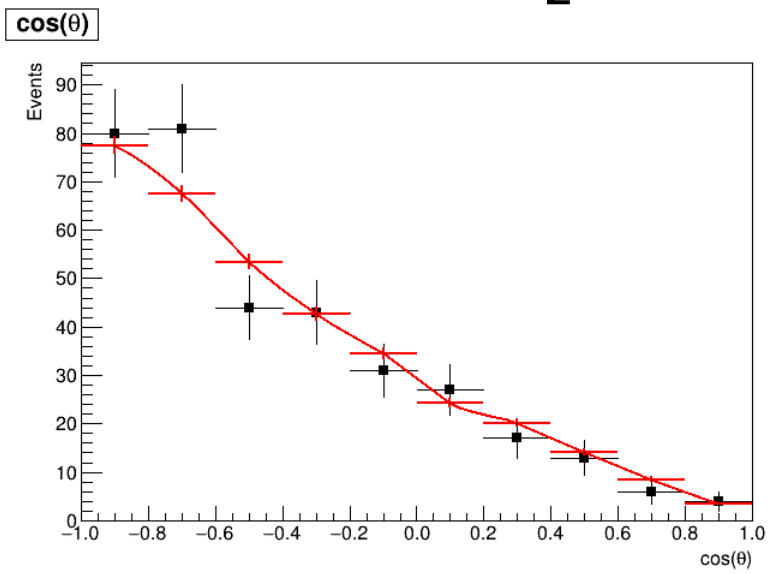


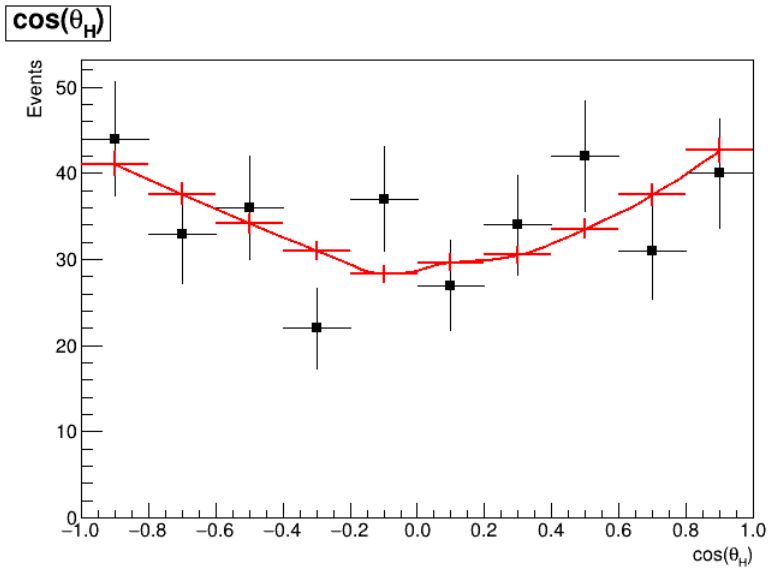


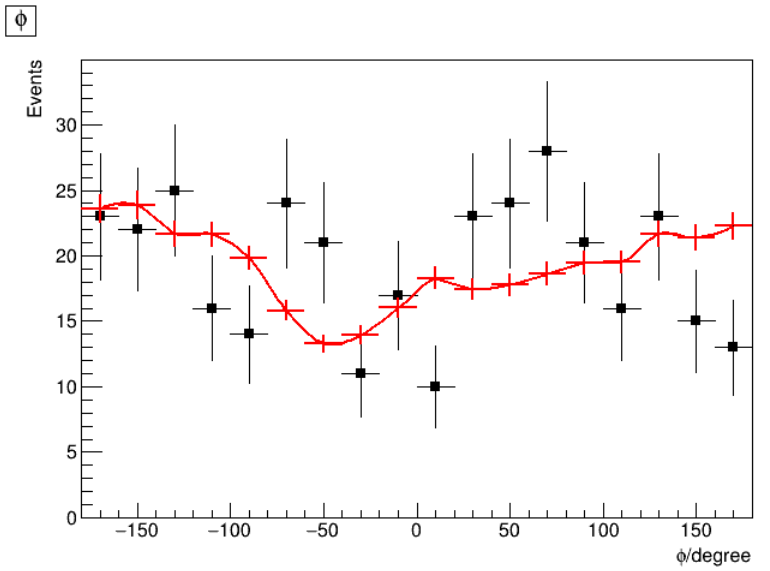


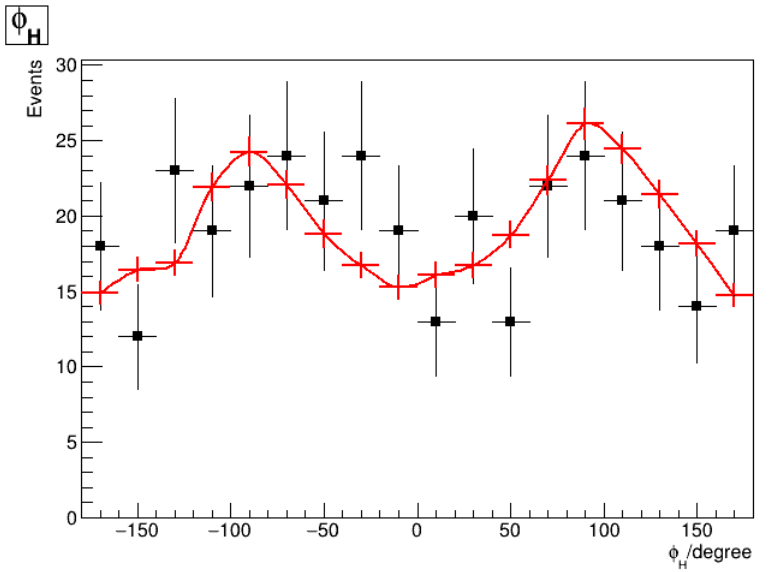


Mass[$K^+K^-\pi^0$] = 1295 MeV

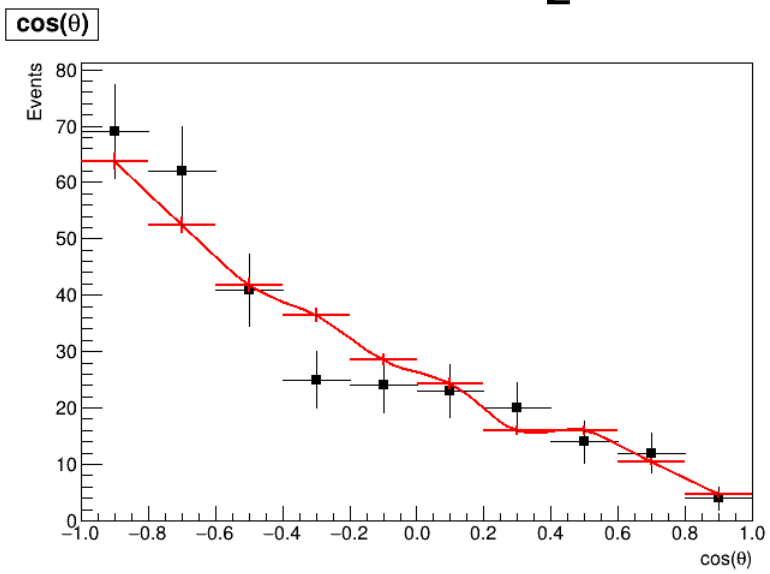


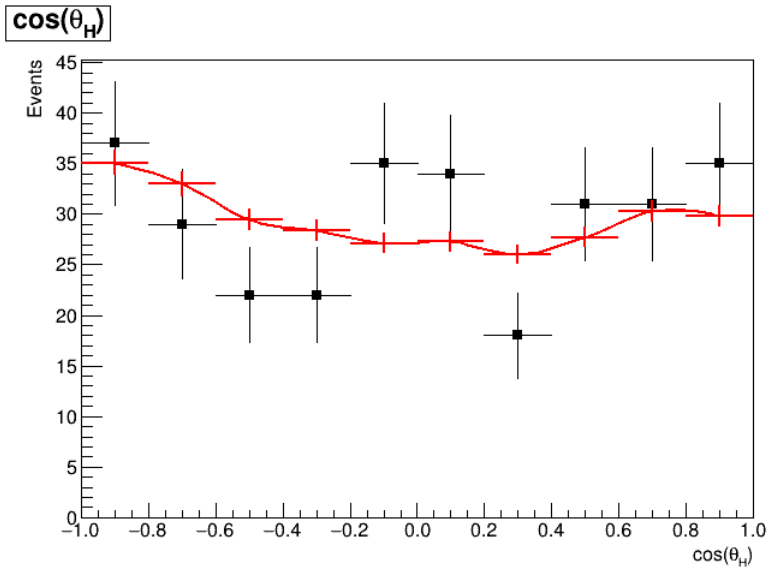


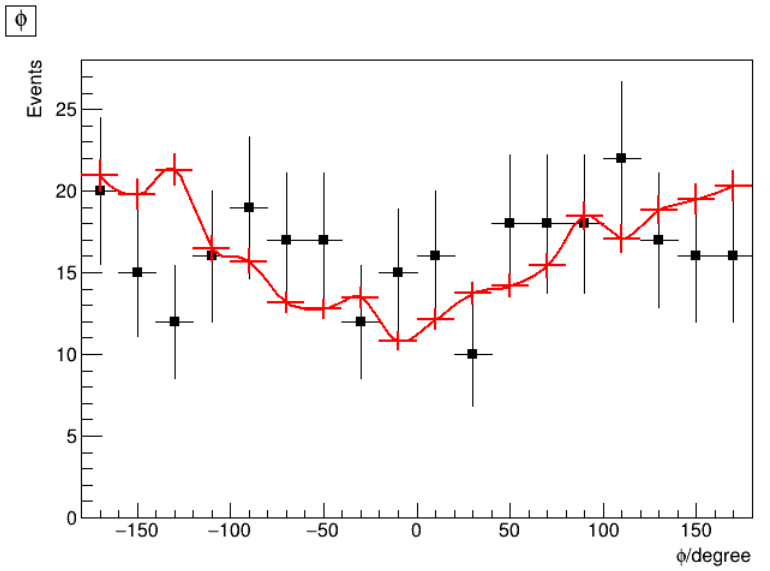


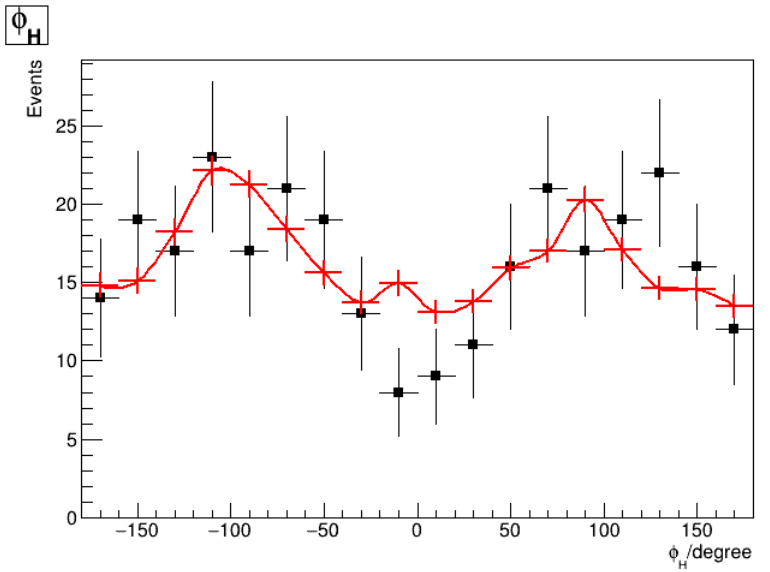


Mass[$K^+K^-\pi^0$] = 1305 MeV





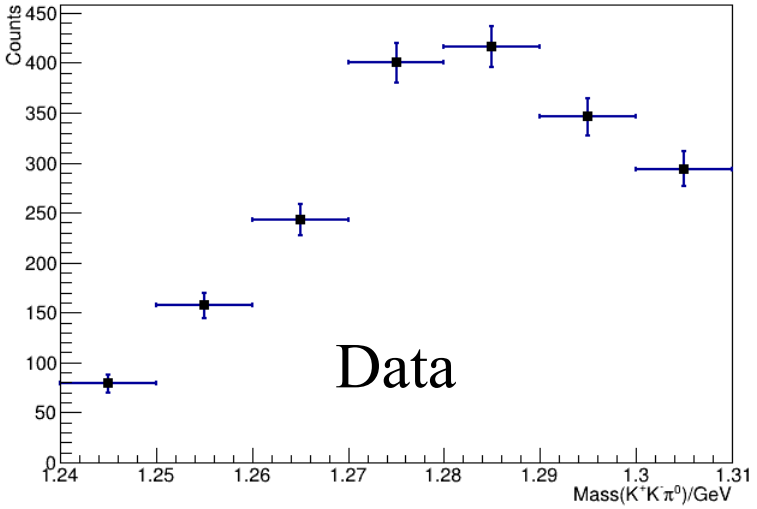




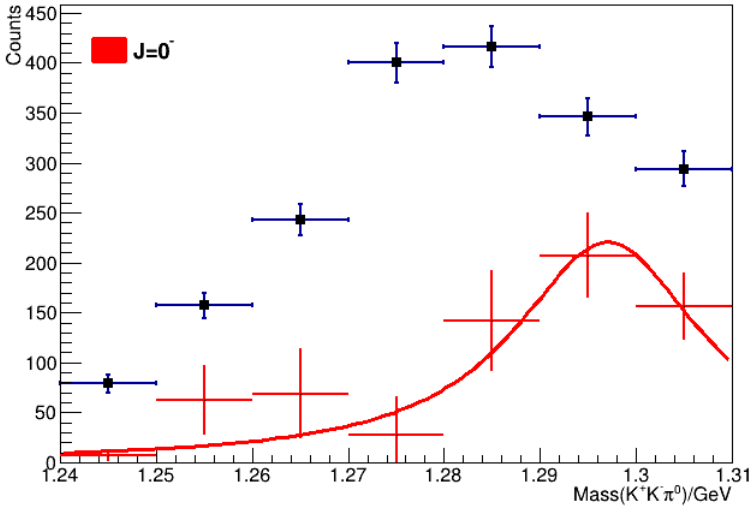
Mass binned PWA

- Put data and PWA fit results together into single plot

Mass binned PWA

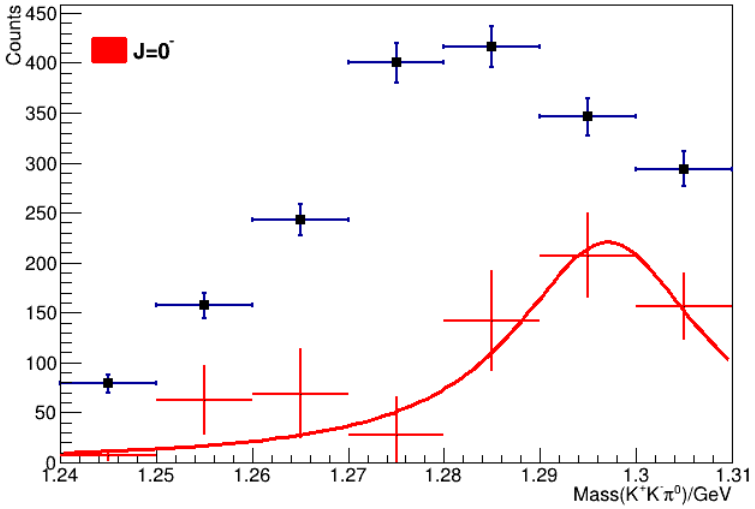


Mass binned PWA



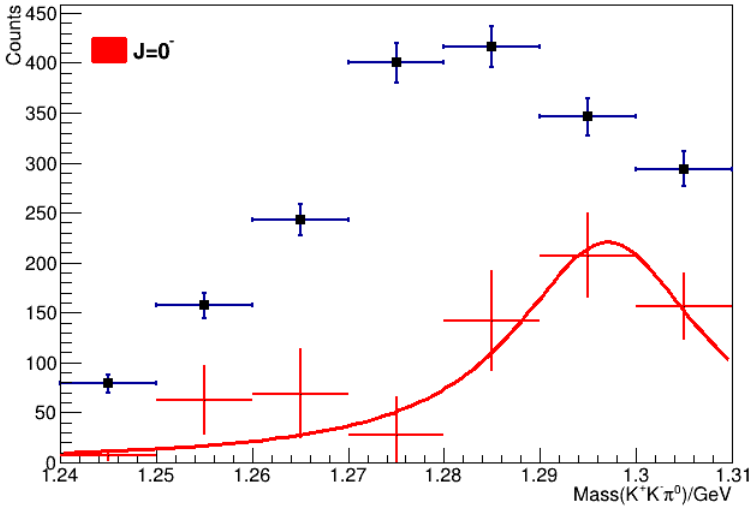
- **Fit:**
  - Center = 1297 +/- 2 MeV
  - FWHM = 24 +/- 5 MeV

Mass binned PWA



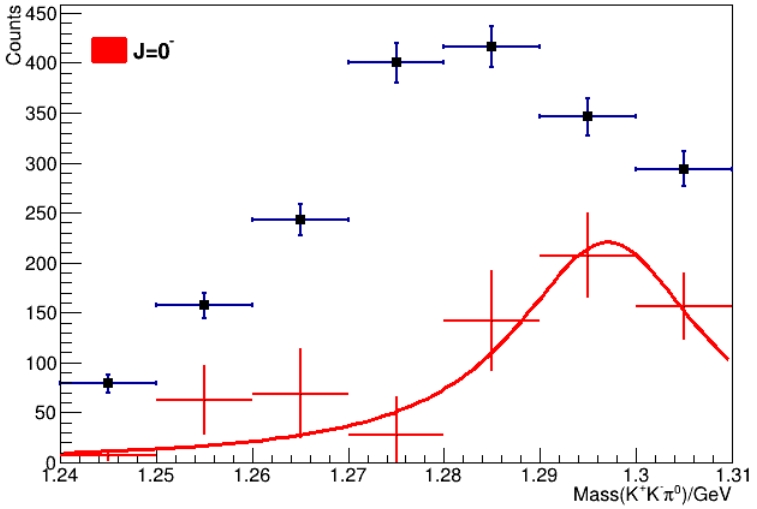
- **Fit:**
  - Center = 1297 +/- 2 MeV
  - Width = 24 +/- 5 MeV
- **PDG $\eta(1295)$:**
  - Center = 1294 +/- 4 MeV
  - Width = 55 +/- 5 MeV

Mass binned PWA



- **Fit:**
  - Center = 1297 +/- 2 MeV
  - Width = 24 +/- 5 MeV
- **PDG $\eta(1295)$:**
  - Center = 1294 +/- 4 MeV
  - Width = 55 +/- 5 MeV

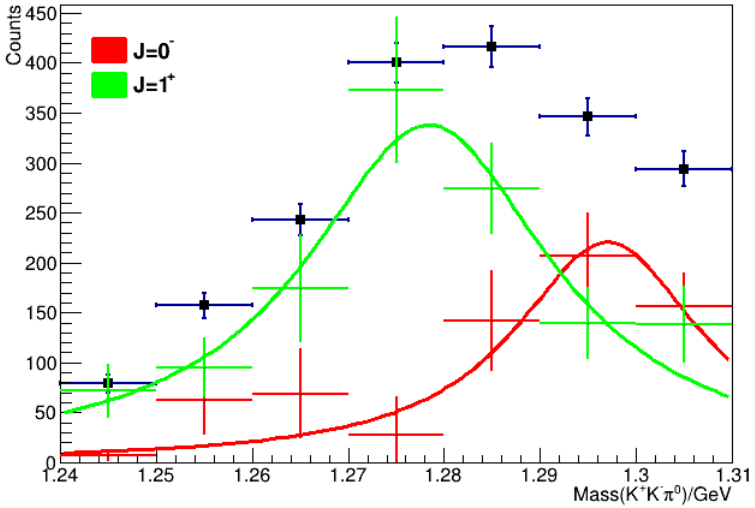
Mass binned PWA



- **Fit:**
  - Center = 1297 +/- 2 MeV
  - Width = 24 +/- 5 MeV
- **PDG $\eta(1295)$:**
  - Center = 1294 +/- 4 MeV
  - Width = 55 +/- 5 MeV

Data to narrow ☹

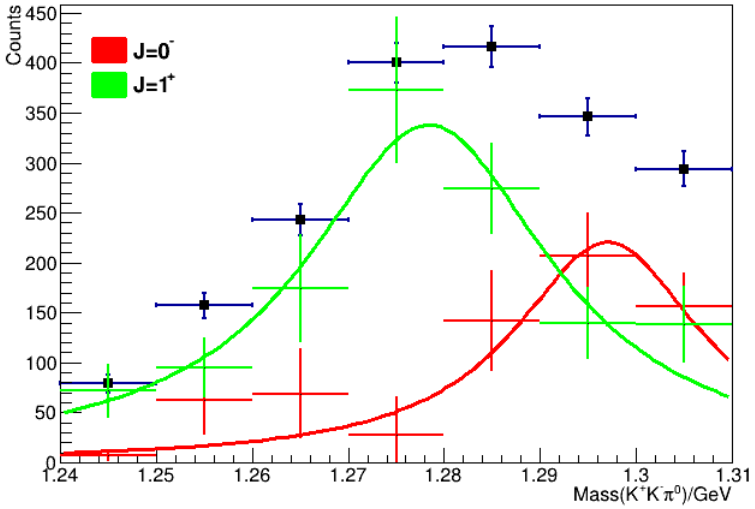
Mass binned PWA



- **Fit:**
  - Center = 1297 +/- 2 MeV
  - Width = 24 +/- 5 MeV
- **PDG $\eta(1295)$:**
  - Center = 1294 +/- 4 MeV
  - Width = 55 +/- 5 MeV

- **Fit:**
  - Center = 1278 +/- 2 MeV
  - Width = 31 +/- 7 MeV

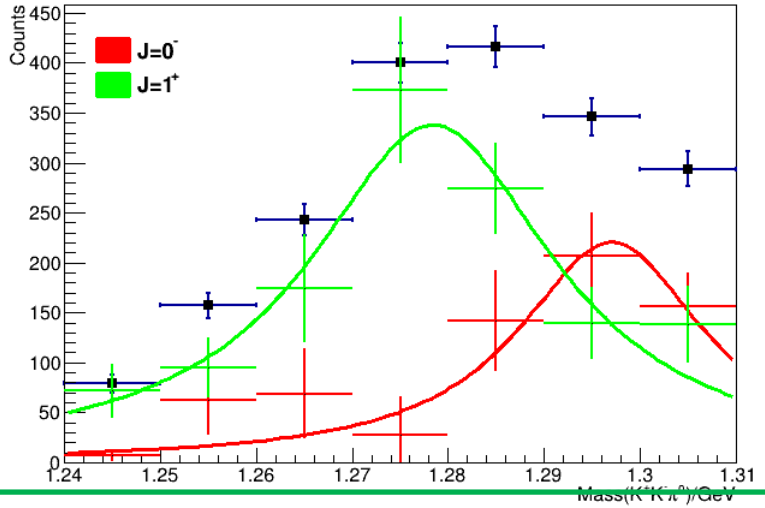
Mass binned PWA



- **Fit:**
  - Center = 1297 +/- 2 MeV
  - Width = 24 +/- 5 MeV
- **PDG $\eta(1295)$:**
  - Center = 1294 +/- 4 MeV
  - Width = 55 +/- 5 MeV

- **Fit:**
  - Center = 1278 +/- 2 MeV
  - Width = 31 +/- 7 MeV
- **PDG $f_1(1285)$:**
  - Center = 1282 +/- 1 MeV
  - Width = 23 +/- 1 MeV

Mass binned PWA

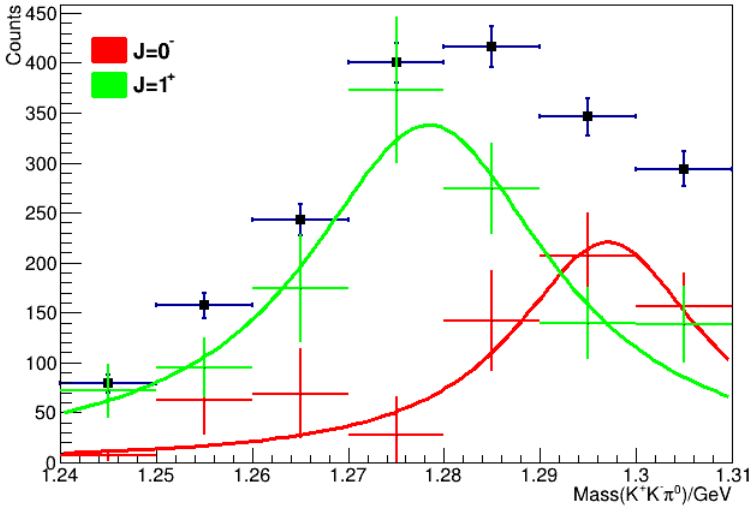


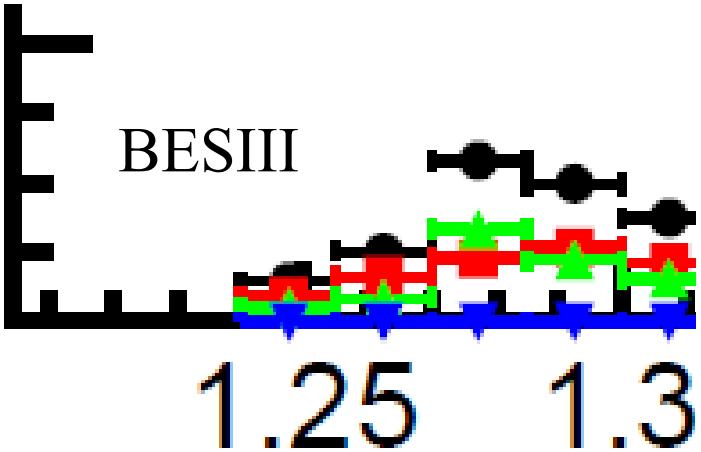
- **Fit:**
  - Center = 1297 +/- 2 MeV
  - Width = 24 +/- 5 MeV
- **PDG $\eta(1295)$:**
  - Center = 1294 +/- 4 MeV
  - Width = 55 +/- 5 MeV

- **Fit:**
  - Center = 1278 +/- 2 MeV
  - Width = 31 +/- 7 MeV
- **PDG $f_1(1285)$:**
  - Center = 1282 +/- 1 MeV
  - Width = 23 +/- 1 MeV

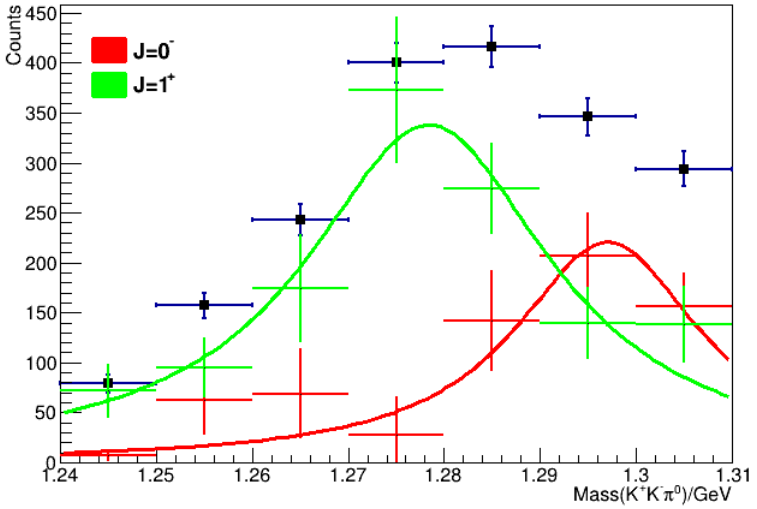
→ **Data is close to PDG ☺**

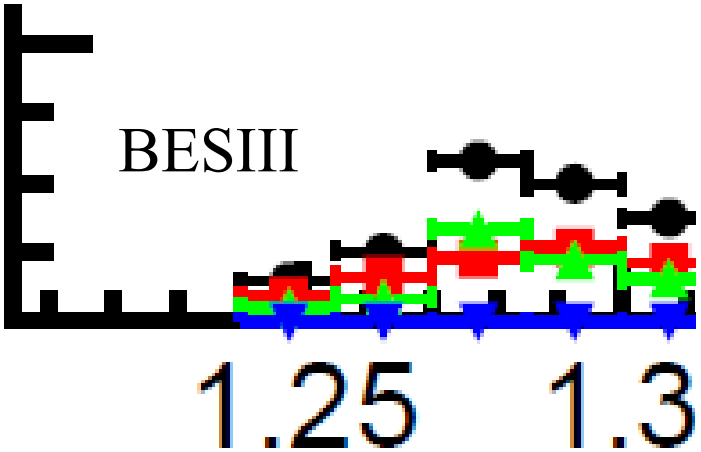
Comparison to BESIII





Comparison to BESIII

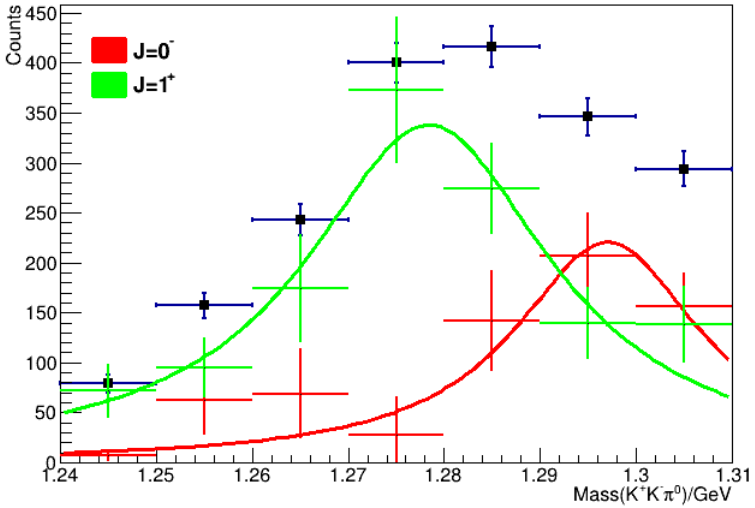


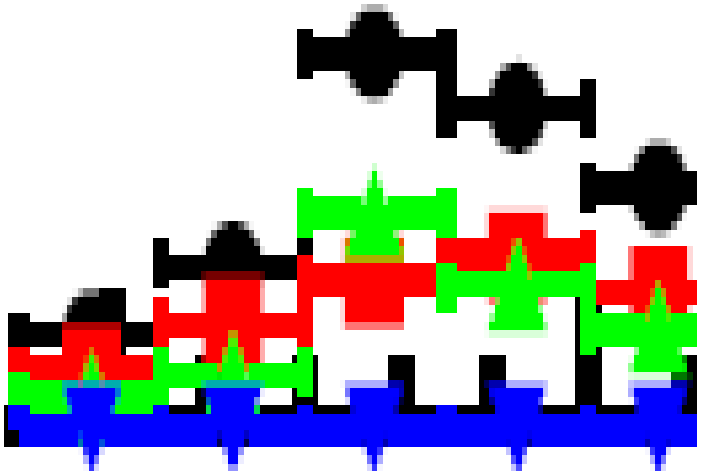


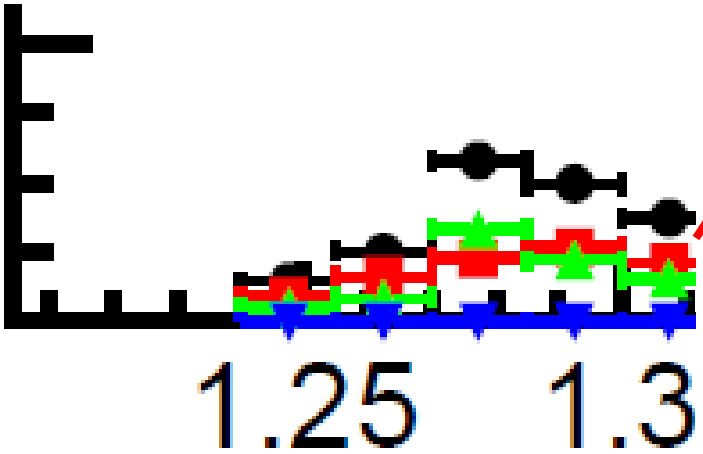
Note:

- Same color coding between GlueX and BESIII for J=0 and J=1 ☺

Comparison to BESIII

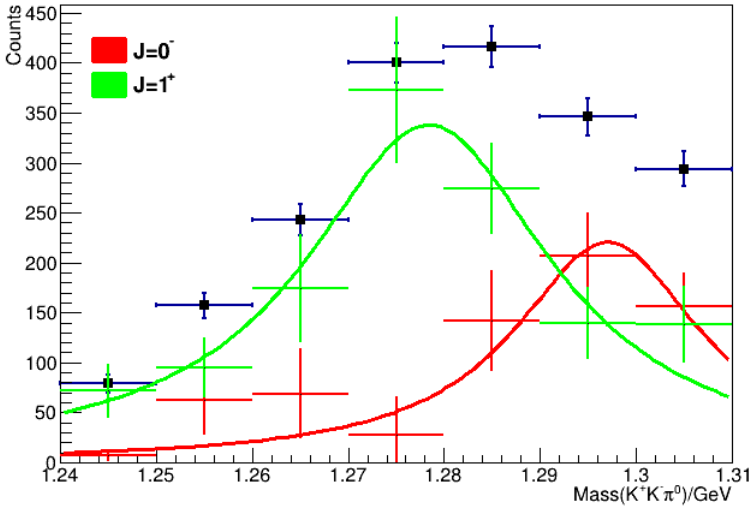


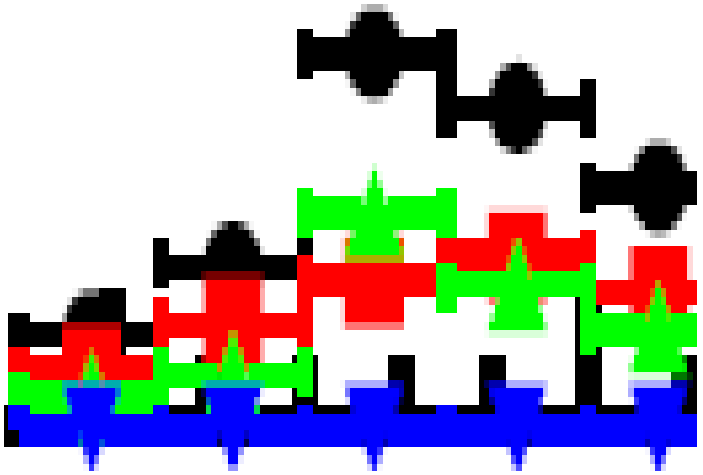




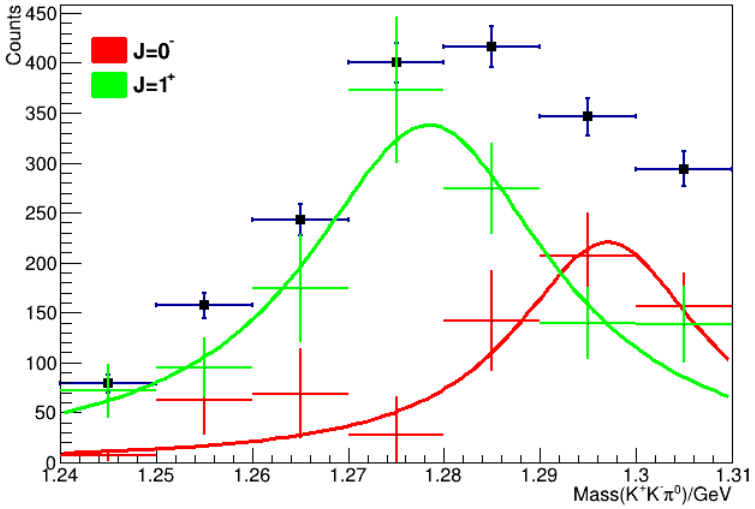
Changed aspect ratio for purposes of comparison

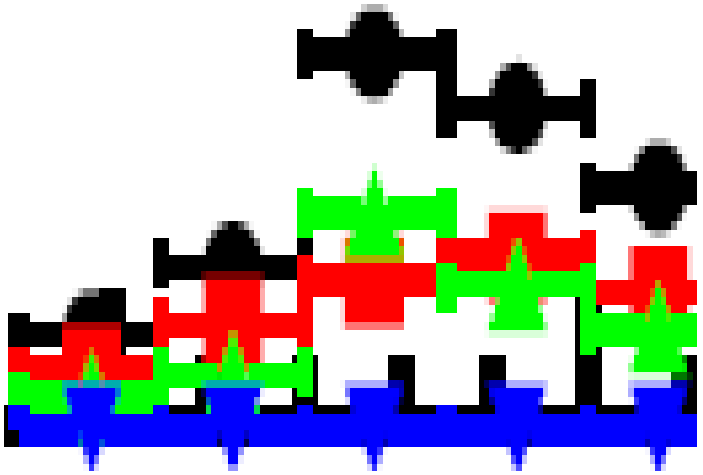
Comparison to BESIII





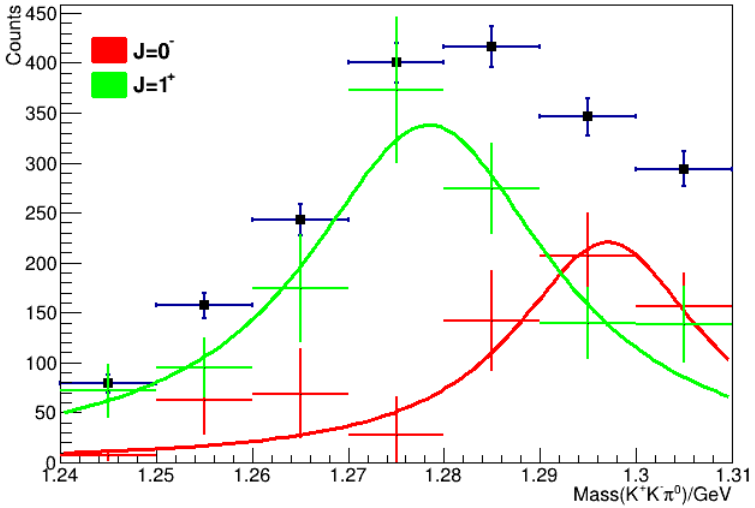
Comparison to BESIII

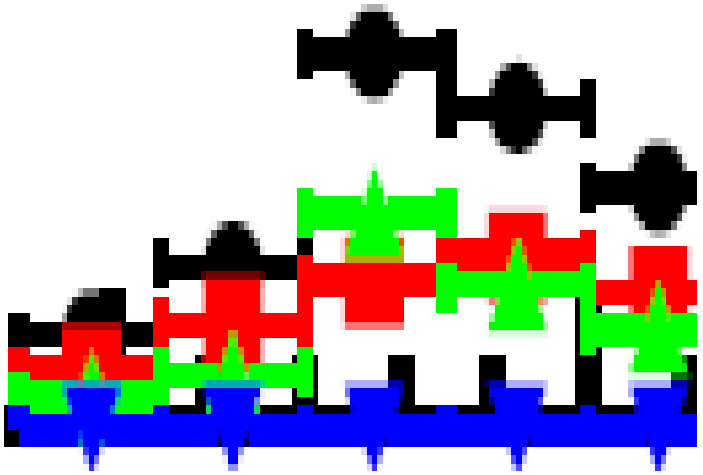




- The GlueX and BESIII binning is not the same

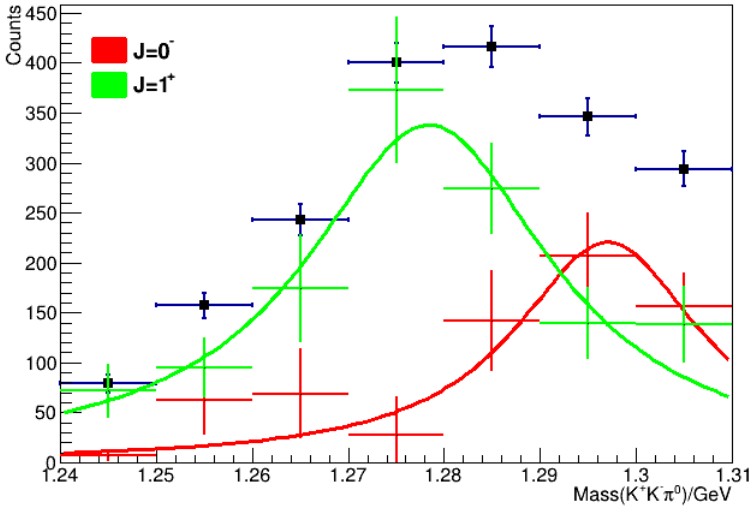
Comparison to BESIII

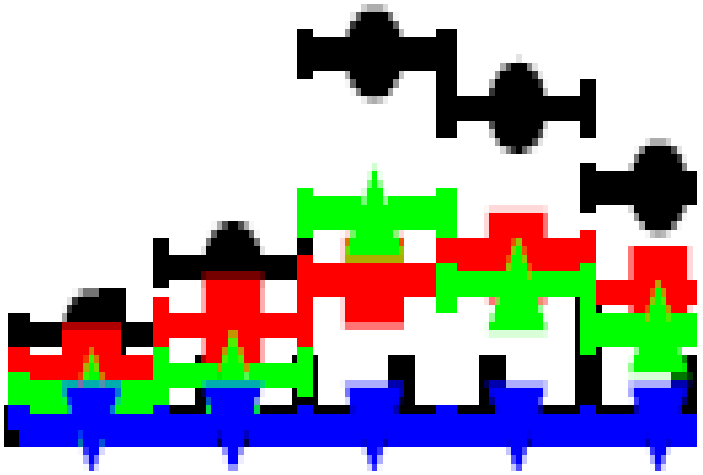




- The GlueX and BESIII binning is not the same
  - GlueX: 7 bins between 1.24 and 1.31 GeV

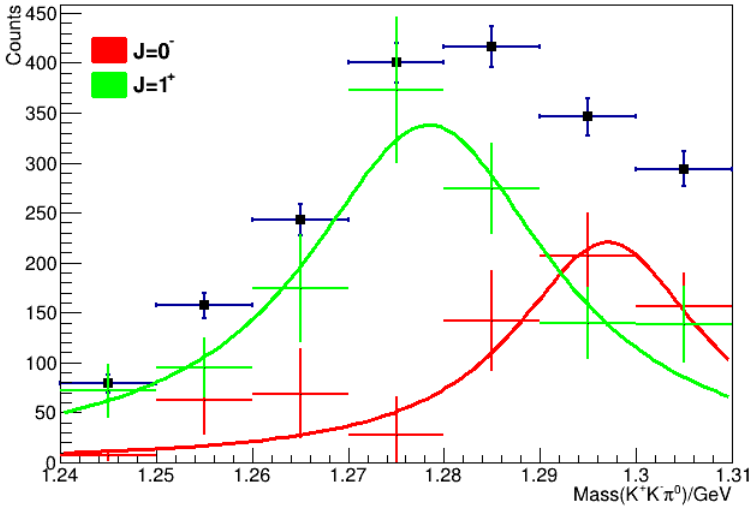
Comparison to BESIII

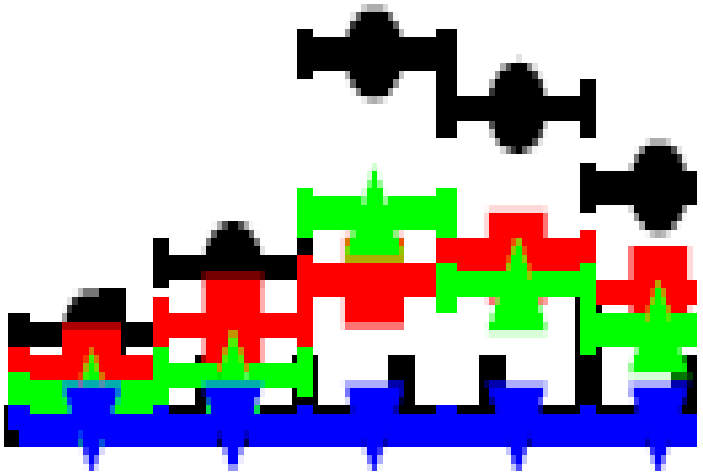




- The GlueX and BESIII binning is not the same
  - GlueX: 7 bins between 1.24 and 1.31 GeV
  - BESIII: 5 bins between 1.24 and 1.31 GeV

Comparison to BESIII





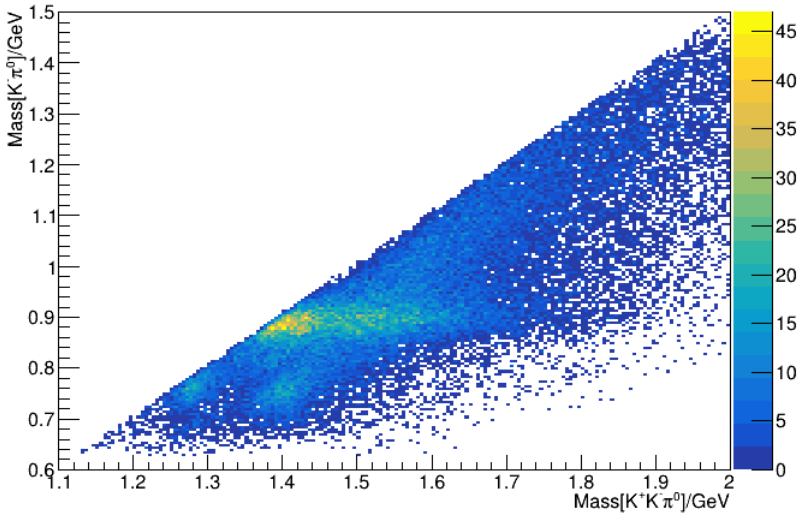
- The GlueX and BESIII binning is not the same
  - GlueX: 7 bins between 1.24 and 1.31 GeV
  - BESIII: 5 bins between 1.24 and 1.31 GeV

- The *J*=0 portion from BESIII looks far more broad

Next

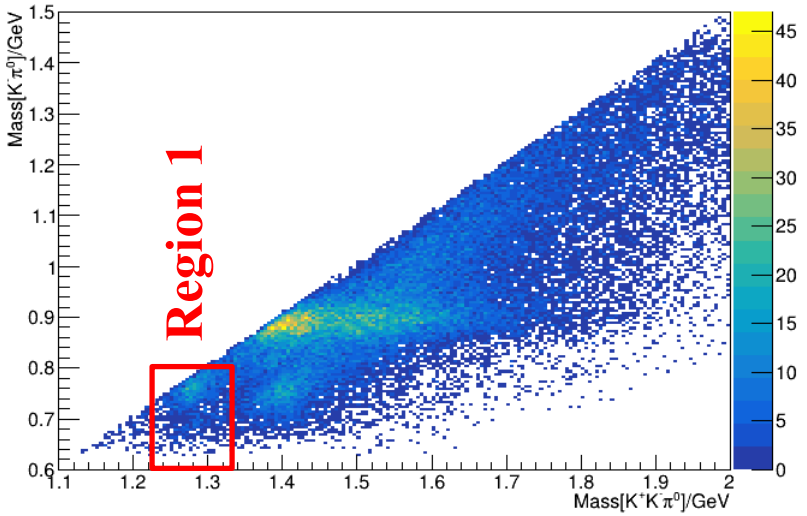
- Pushing up in mass

Data



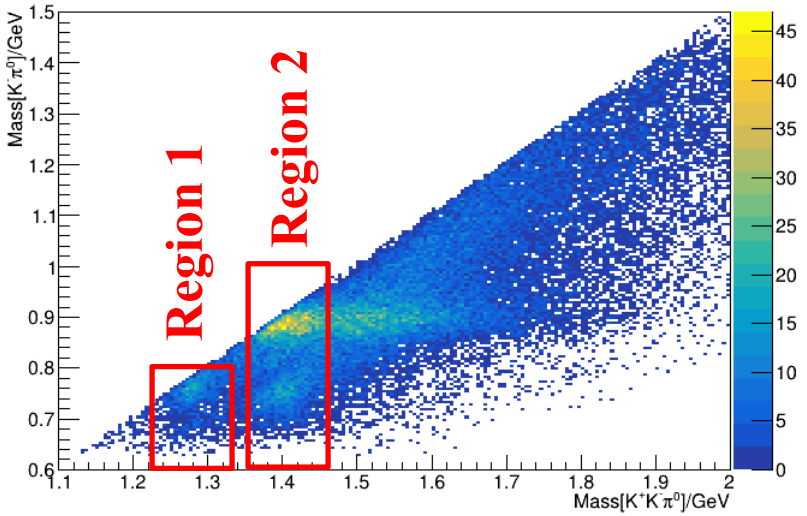
- Three distinct mass regions

Data



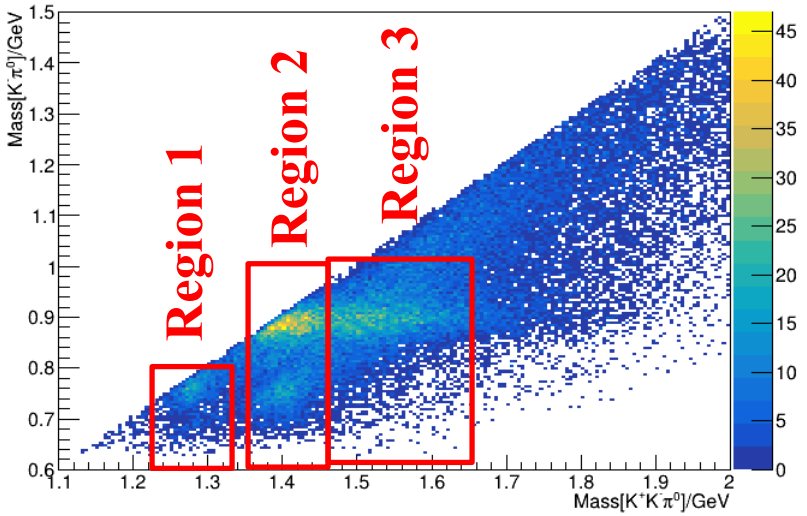
- Three distinct mass regions

Data



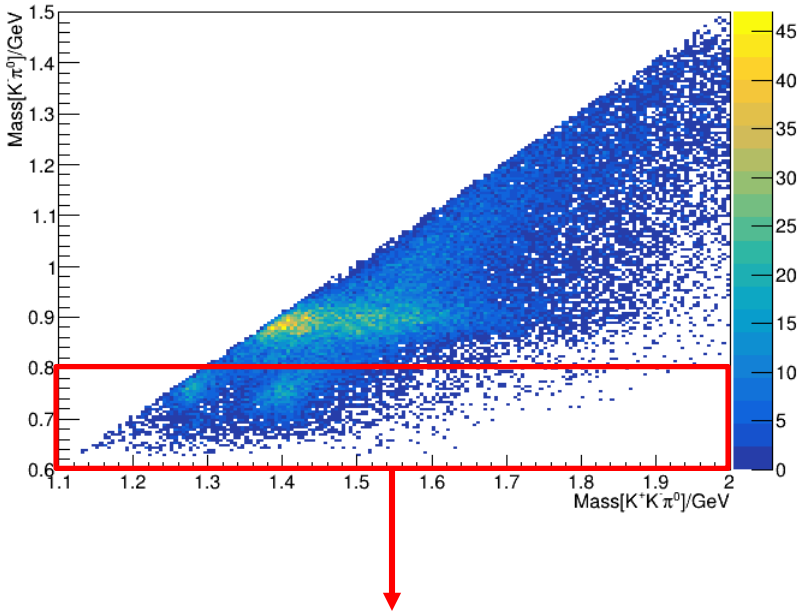
- Three distinct mass regions

Data

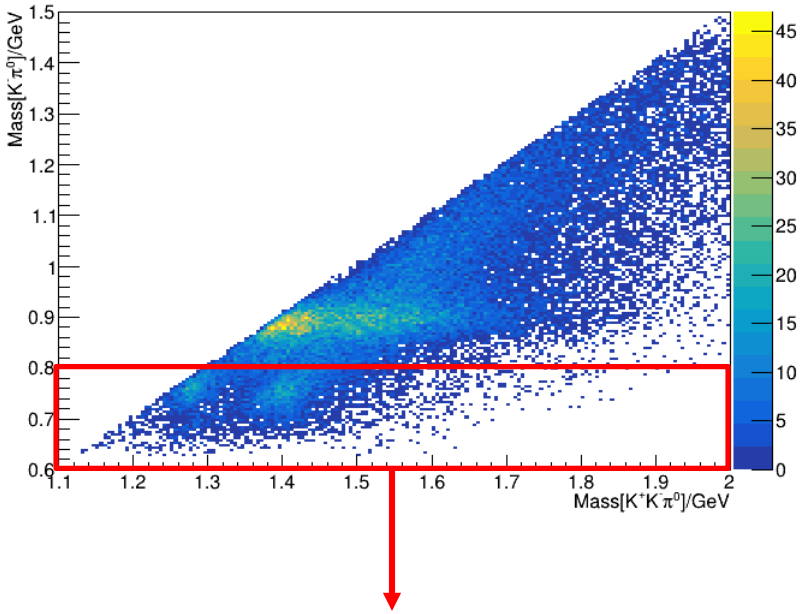


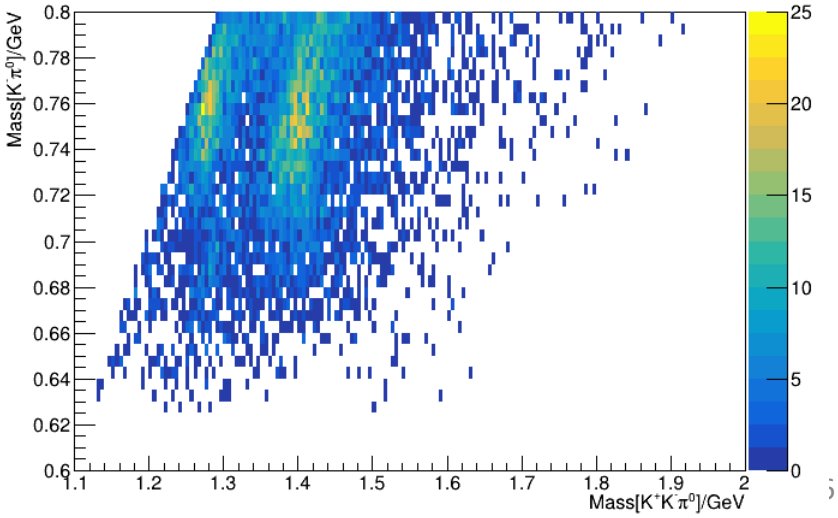
- Three distinct mass regions

Data

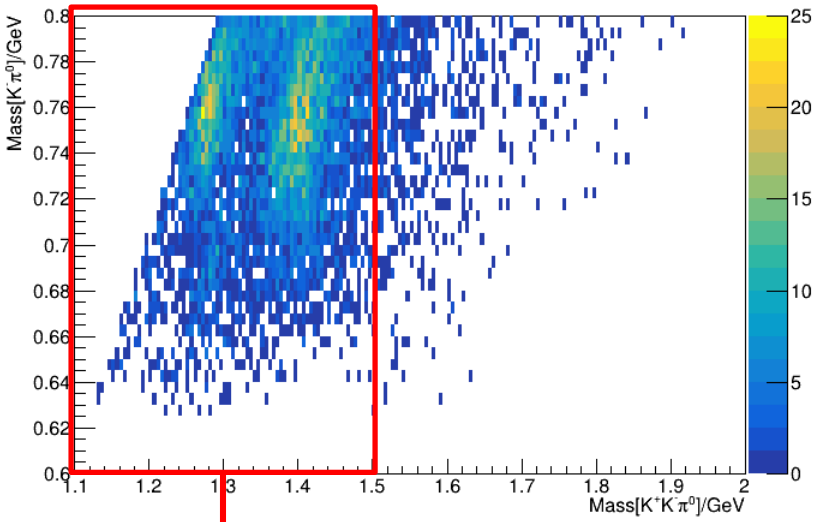

Mass[K⁻π⁰]/GeV
Mass[K⁺K⁻π⁰]/GeV
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
1.1
1.2
1.3
1.4
1.5
1.6
1.7
1.8
1.9
2
45
40
35
30
25
20
15
10
5
0

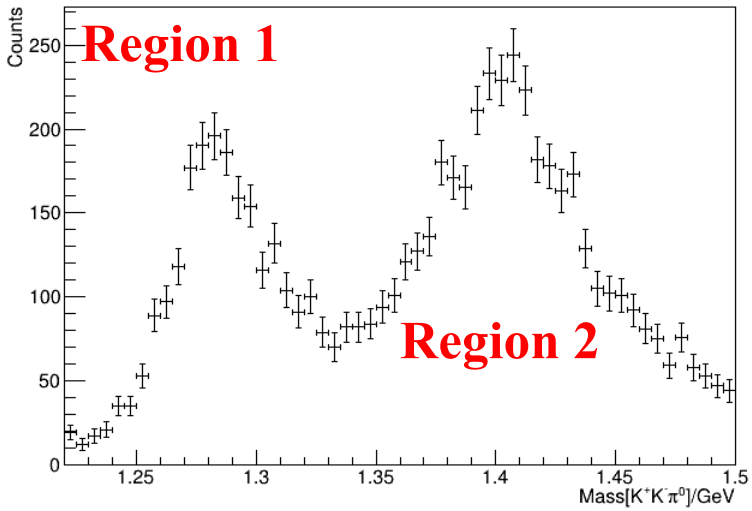
Data



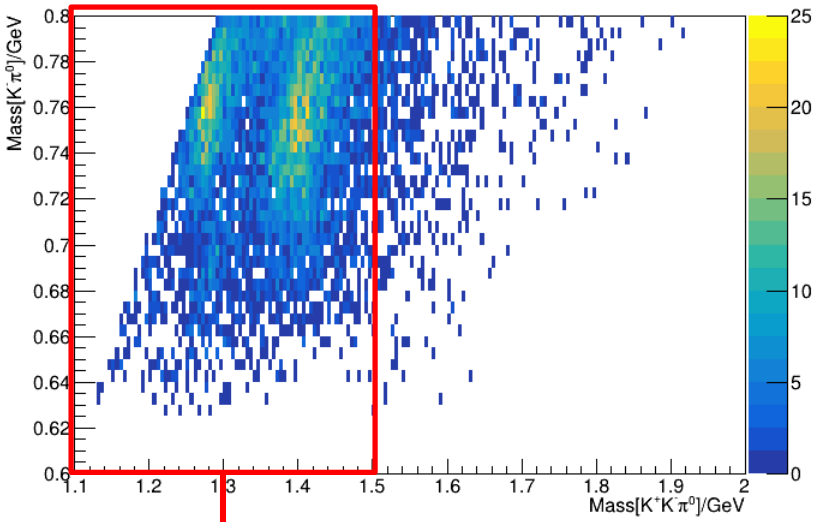


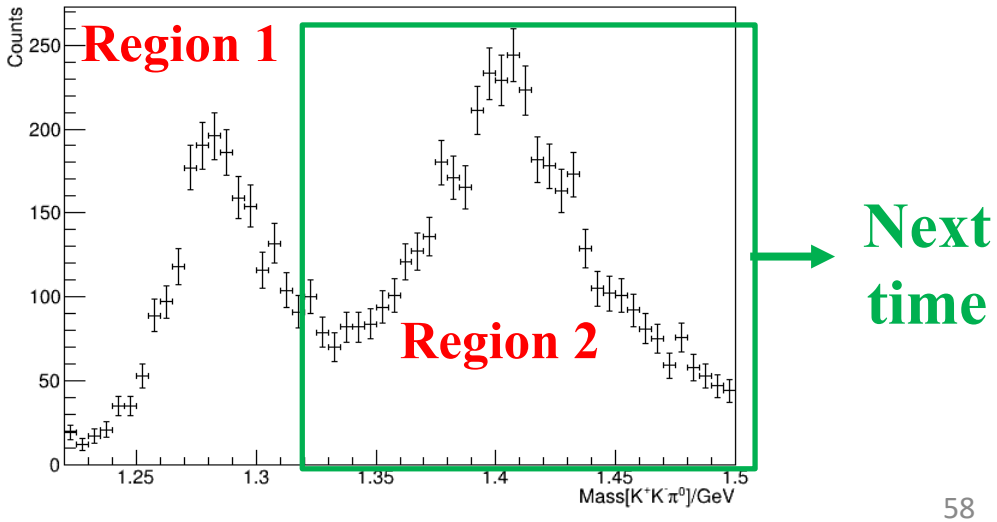
Data


Mass[K⁻π⁰]/GeV
Mass[K⁺K⁻π⁰]/GeV


Counts
Region 1
Region 2
Mass[K⁺K⁻π⁰]/GeV

Data





Next time