A study of meson resonances decaying into $K^-K^+\pi^0$, with emphasis on mass(K^-K^+) near mass(ϕ)

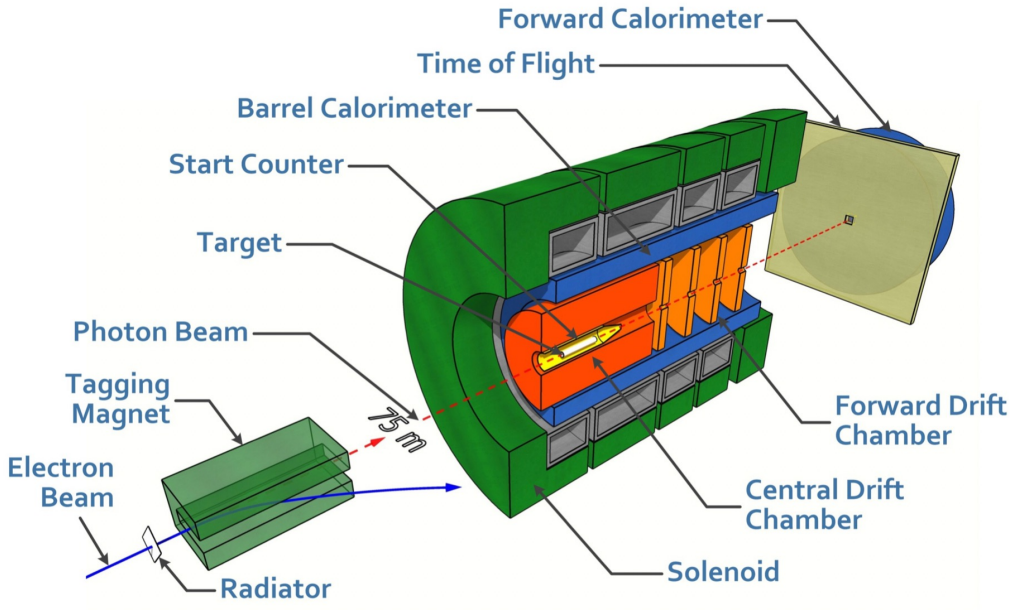
Motivation:

- Investigating K^*K final states as a decay mode of possible hybrid mesons candidates
- Mapping the low-lying meson spectrum

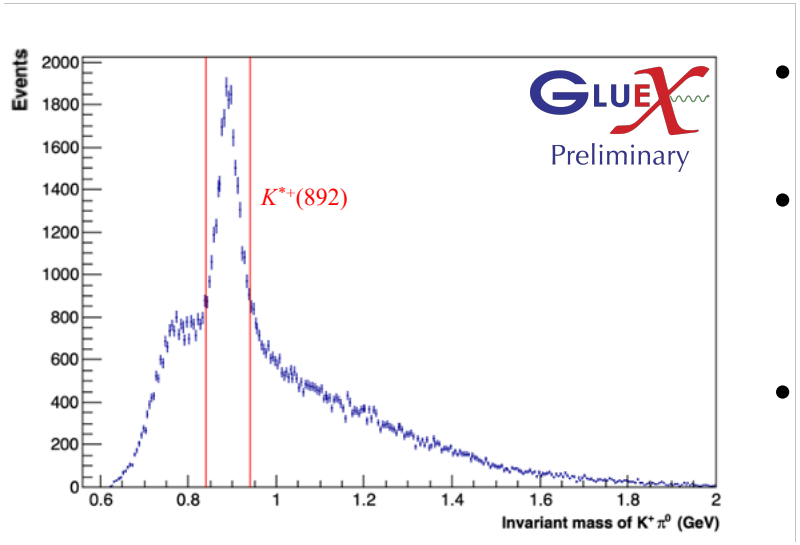
Alan Gardner
APS DNP Fall Meeting, 2021

Event Selection

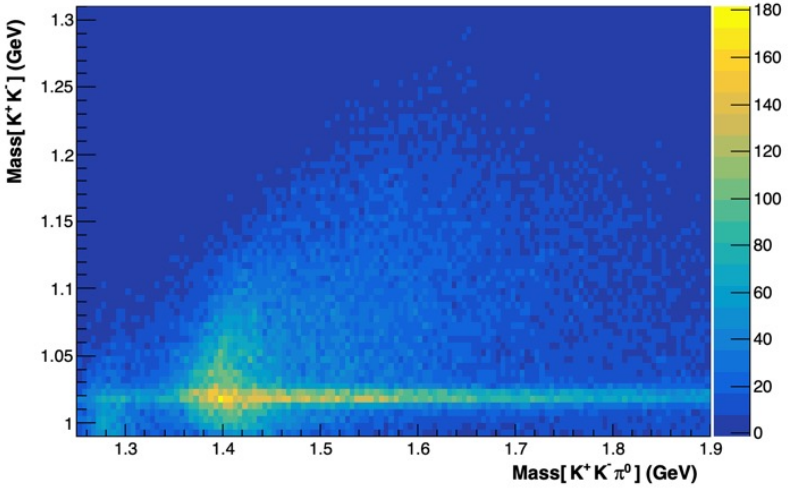
- $K^{\pm}$ hit in the Time of Flight
- $K^{\pm}$ momentum is < 3.0 GeV
- π^{0} reconstructed from $\gamma\ \gamma$

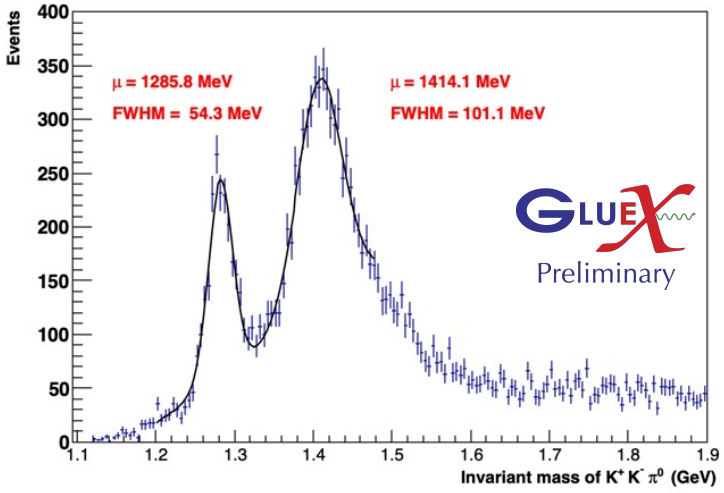


Study of $K^+K^-\pi^0$ events and contribution from K^+K^-

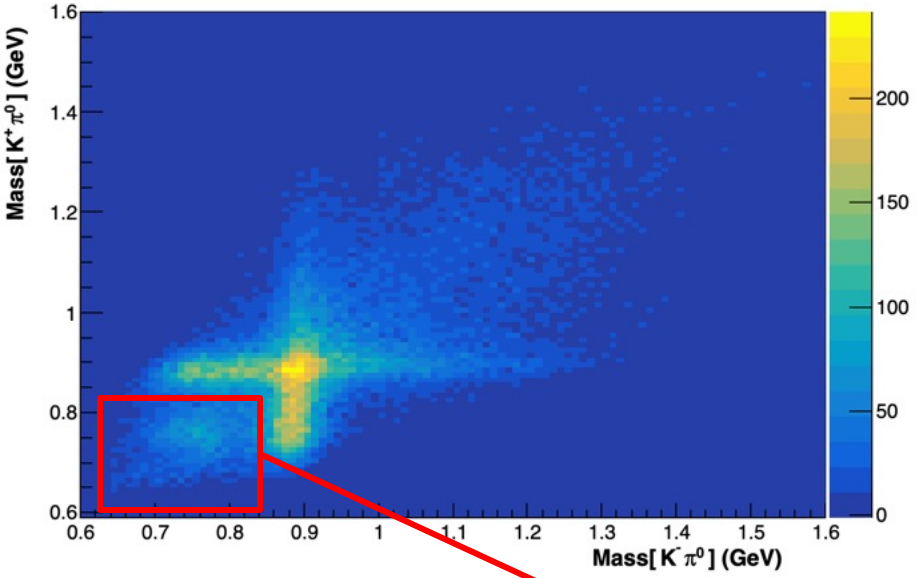


- Upper left: reconstruction of $K^{*+}(892)$ with considerable background visible
- Lower left: stripe in K^+K^- due to $\phi(1020)$ with enhancements visible in $K^+K^-\pi^0$ near 1.28 GeV and 1.4 GeV
- Lower right: $K^+K^-\pi^0$ spectrum with K^+K^- below 1 GeV

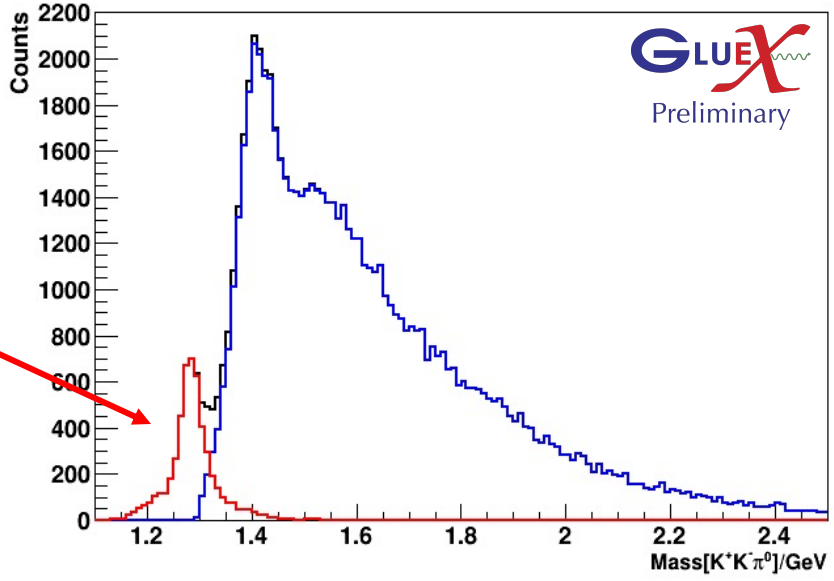




Enhancement in mass($K^{\pm}\pi^0$) < mass($K^*(892)$)



- When mass(K^+K^-) is unconstrained, exclusion of both $K^{*\pm}(892)$ states is sufficient to isolate peak in $K^+K^-\pi^0$ near 1285 MeV.



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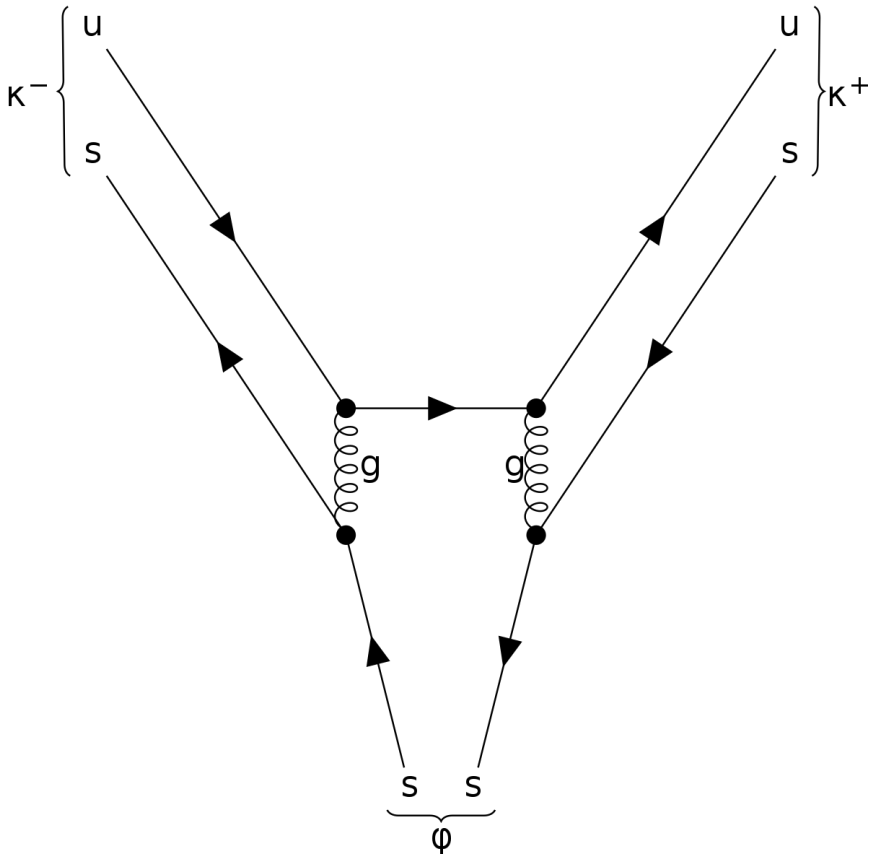
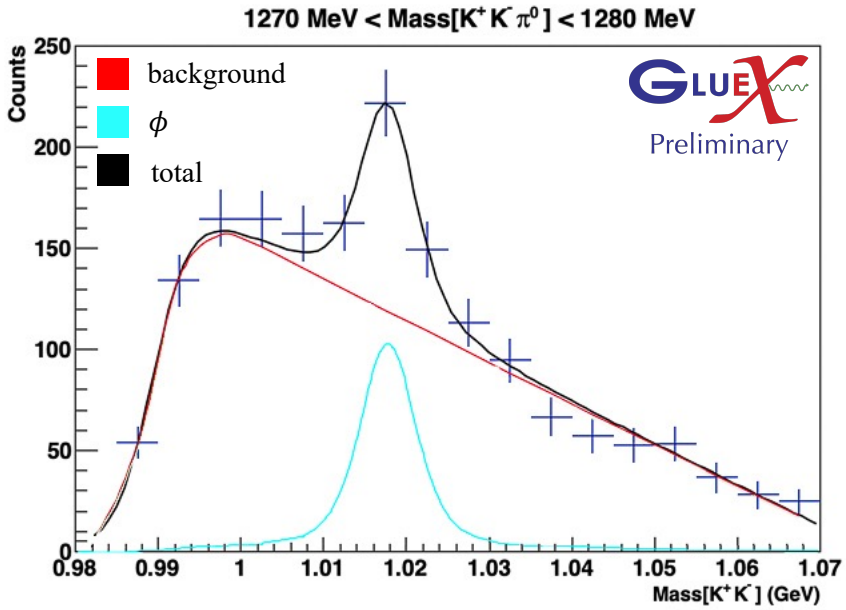
Now focusing on events with mass(K^-K^+) near mass(ϕ)

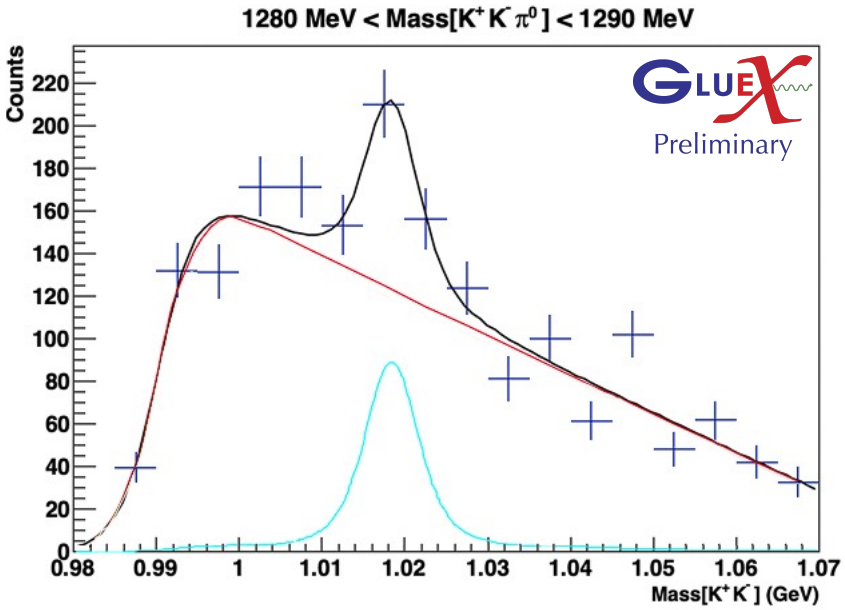


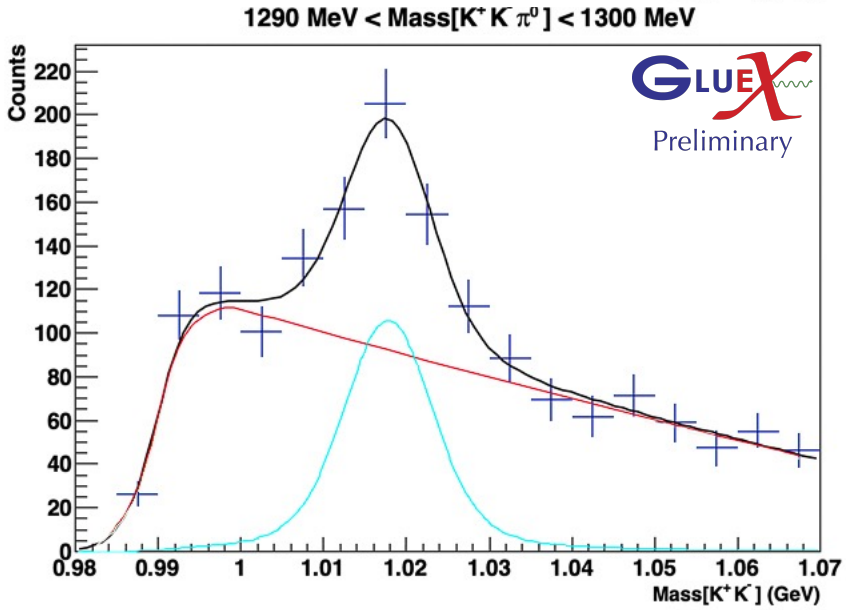
Fitting of K^+K^-

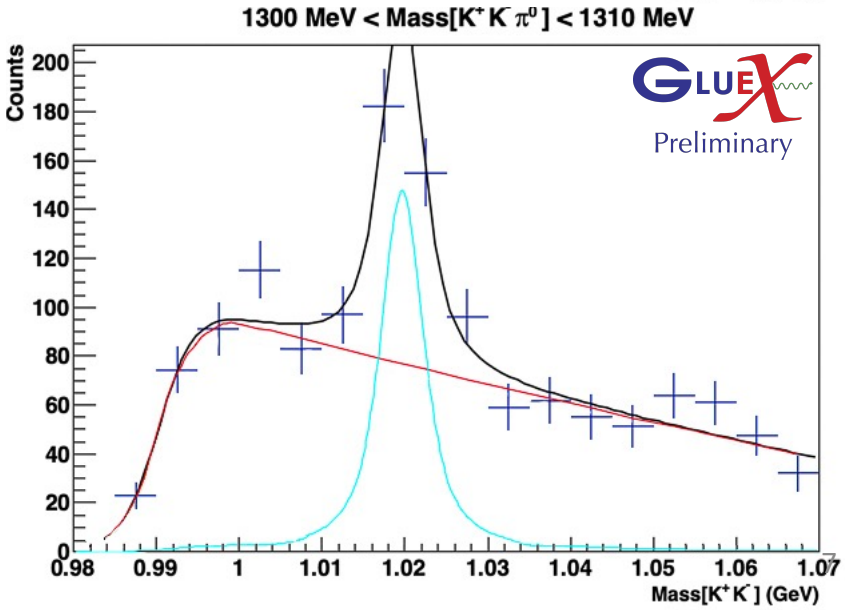
- Voigt function used
- Smear parameter calculated by fitting mass(K^+K^-) with Gaussian near mass($\phi(1020)$) and comparing resulting width to PDG width of $\phi(1020)$ equal to 4.249 MeV
- First-order polynomial multiplied by sigmoid function used for background to simulate near-threshold behavior

Mass(K^+K^-) for ranges in Mass($K^+K^-\pi^0$) near 1.3 GeV

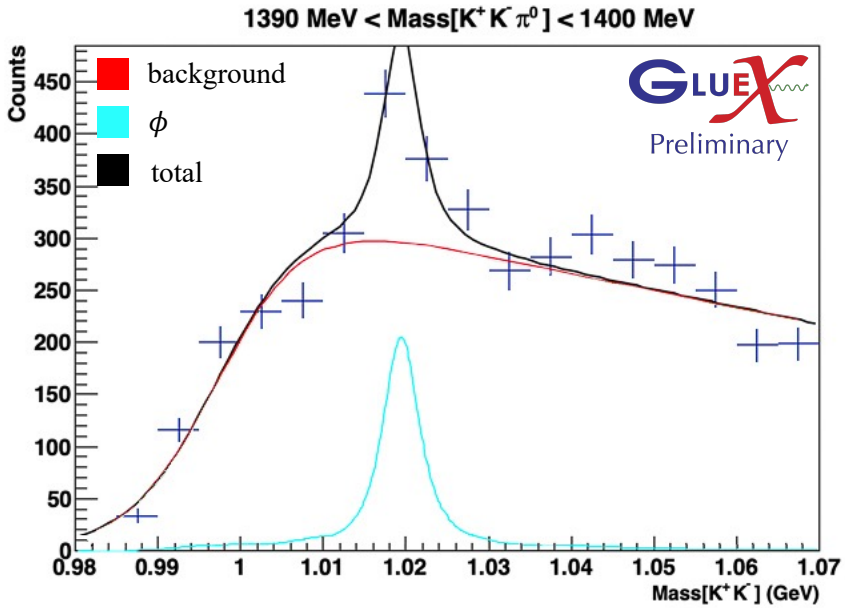


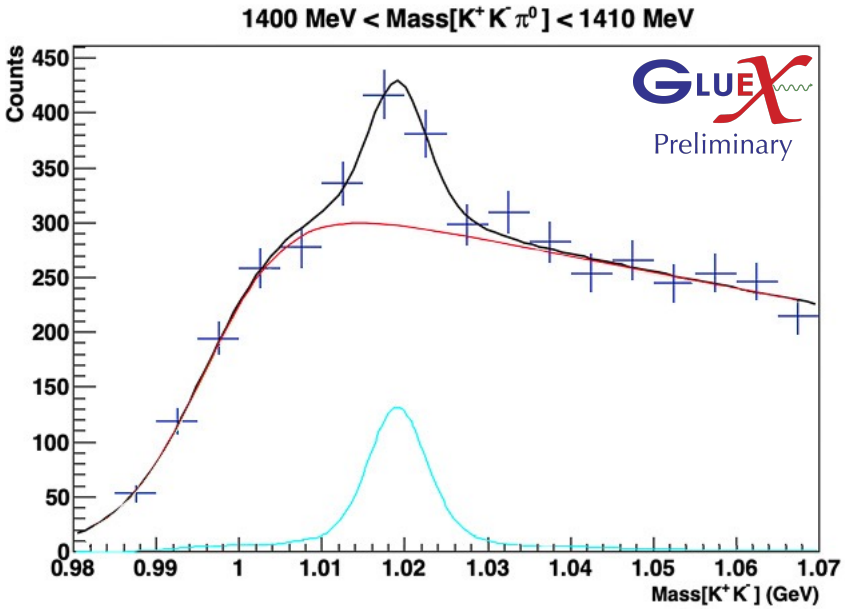


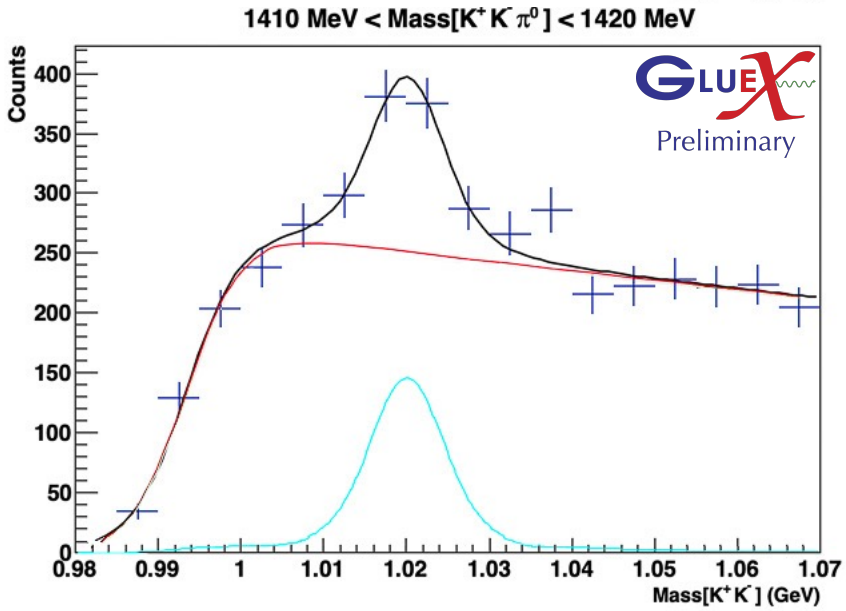


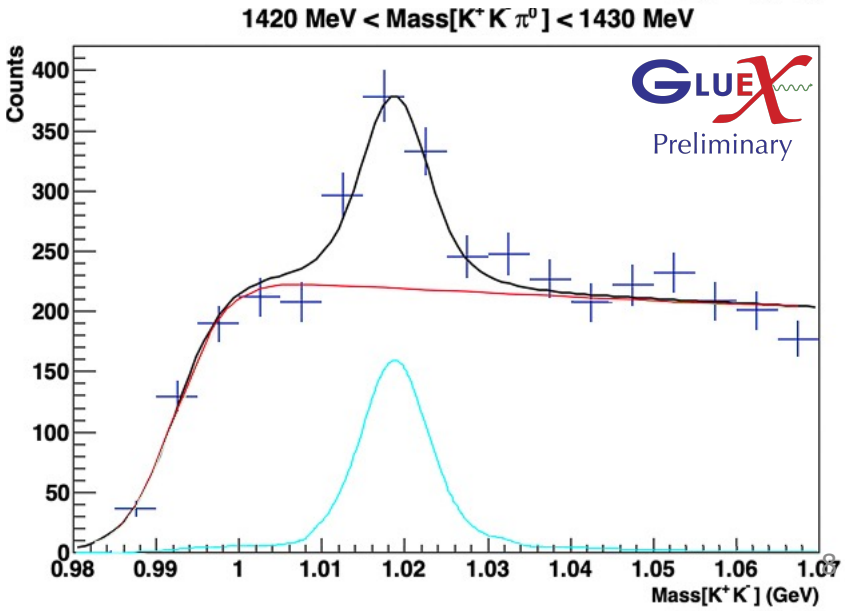


Mass(K^+K^-) for ranges in Mass($K^+K^-\pi^0$) near 1.4 GeV

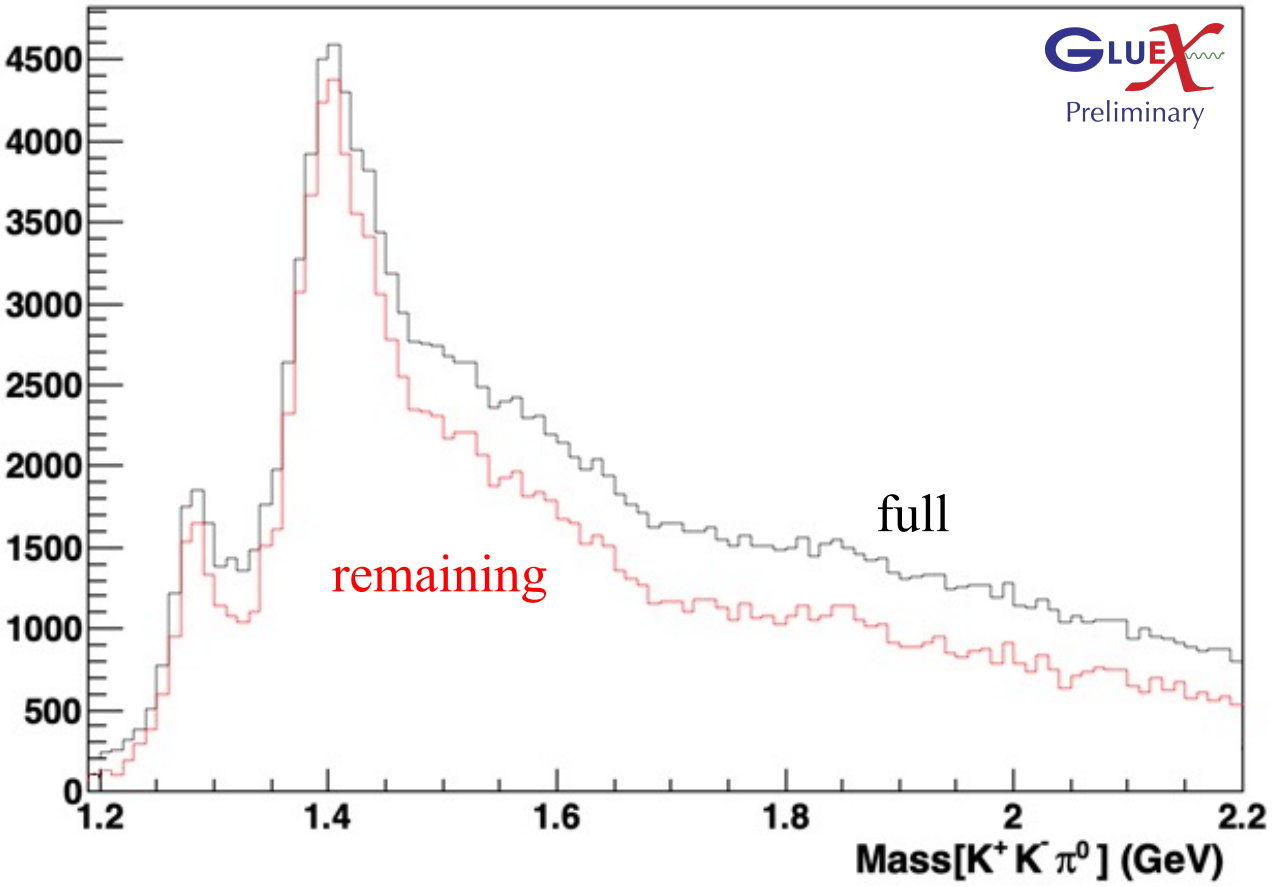








Background subtracted from mass(K^+ K^- π^0)



- No discernible peaks in ϕ π^0 background
- Remaining distribution fitted on next slide

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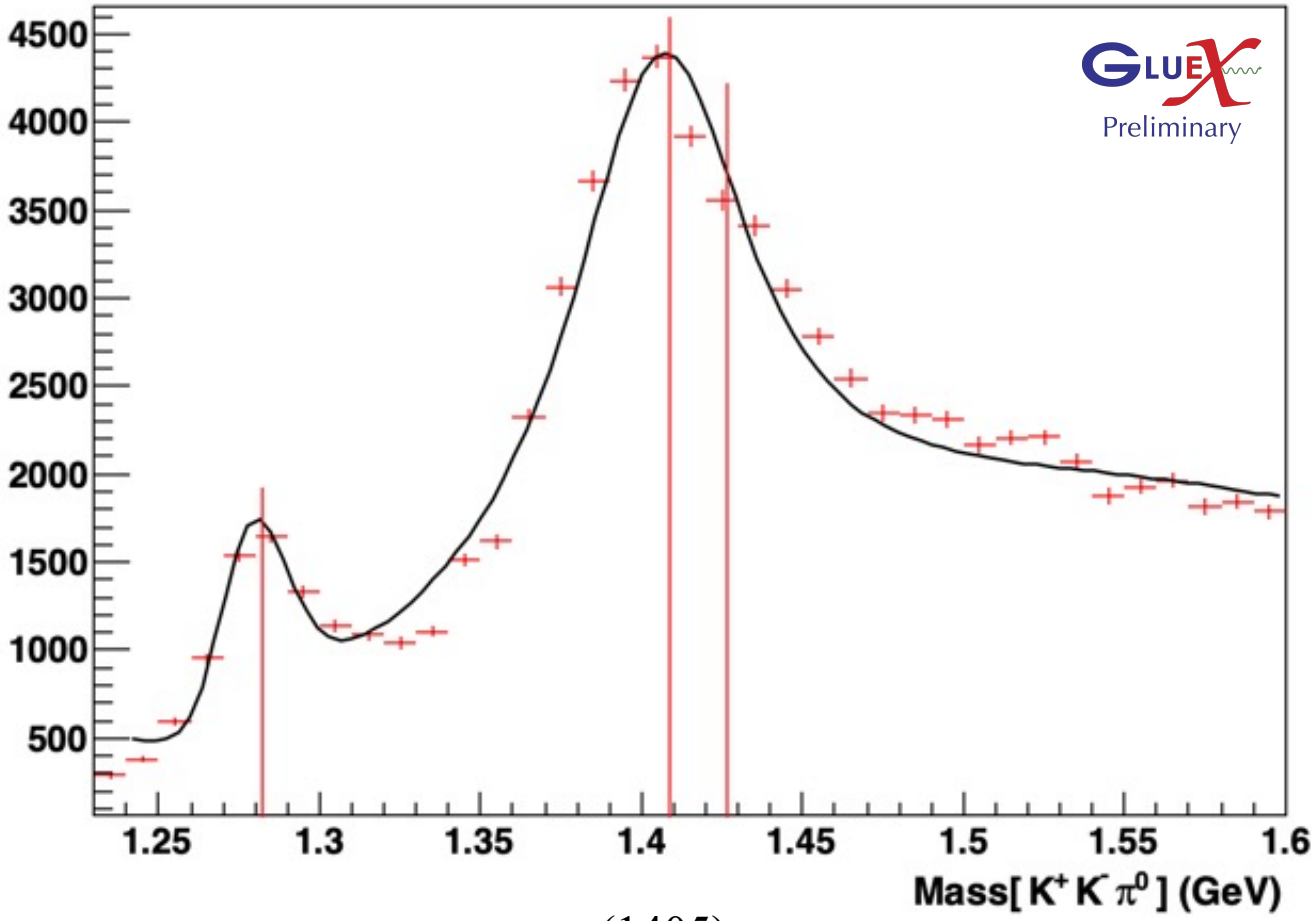
$\phi\ \pi^0$ and $K^*(892)$ excluded



* Red vertical lines to indicate PDG mass values of the meson states given below

$f_1(1285)$

$\eta(1405)$

$f_1(1420)$

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Forward direction

- Perform a partial wave analysis of the K^*K final states
- Investigate K^*K final states in the study of possible hybrid mesons candidates

http://gluex.org/thanks/