Invariant mass of the $\varphi\ \pi^0$ System

Emily LaMagna
For the ASU Meson Physics Group

Motivation

- Exotic mesons differ in composition from normal mesons
  - Glueball
  - Tetraquark
  - Hybrid
- Exotics can have unusual spin-parity combinations.
- We are interested in exotic mesons that decay $K^+K^-\,\pi^0$.
- I will report on the reaction $e\,p \rightarrow e\,p\,K^+K^-\,\pi^0$ about the $\varphi\,\pi^0$.

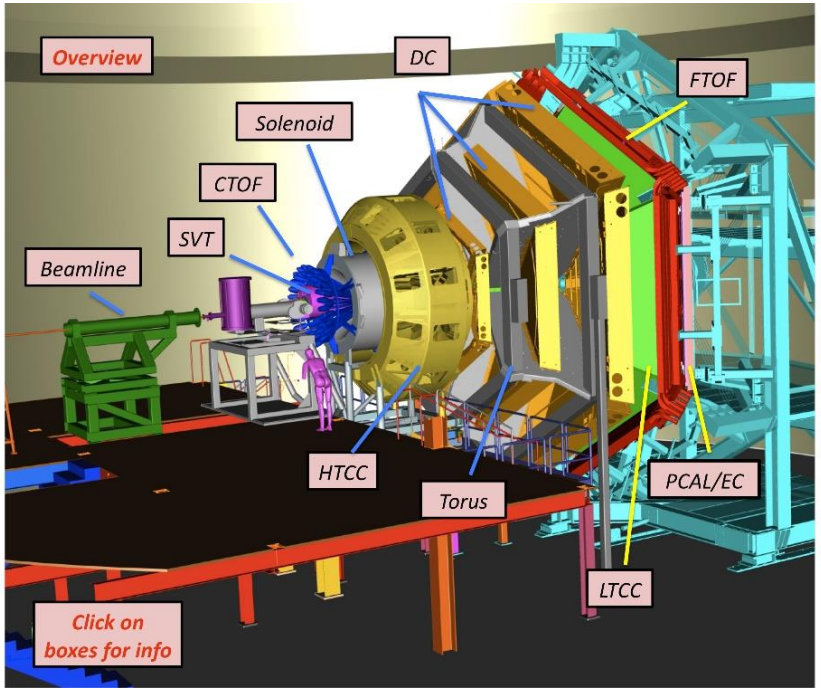
Jefferson Lab

- Electron beam up to 12 GeV
- Three experimental halls shown
- CLAS12 is inside hall B

ASU Arizona State University

CLAS12 Detector

- Beam from left
- Solenoid and taurus magnets
- Two time-of-flight units

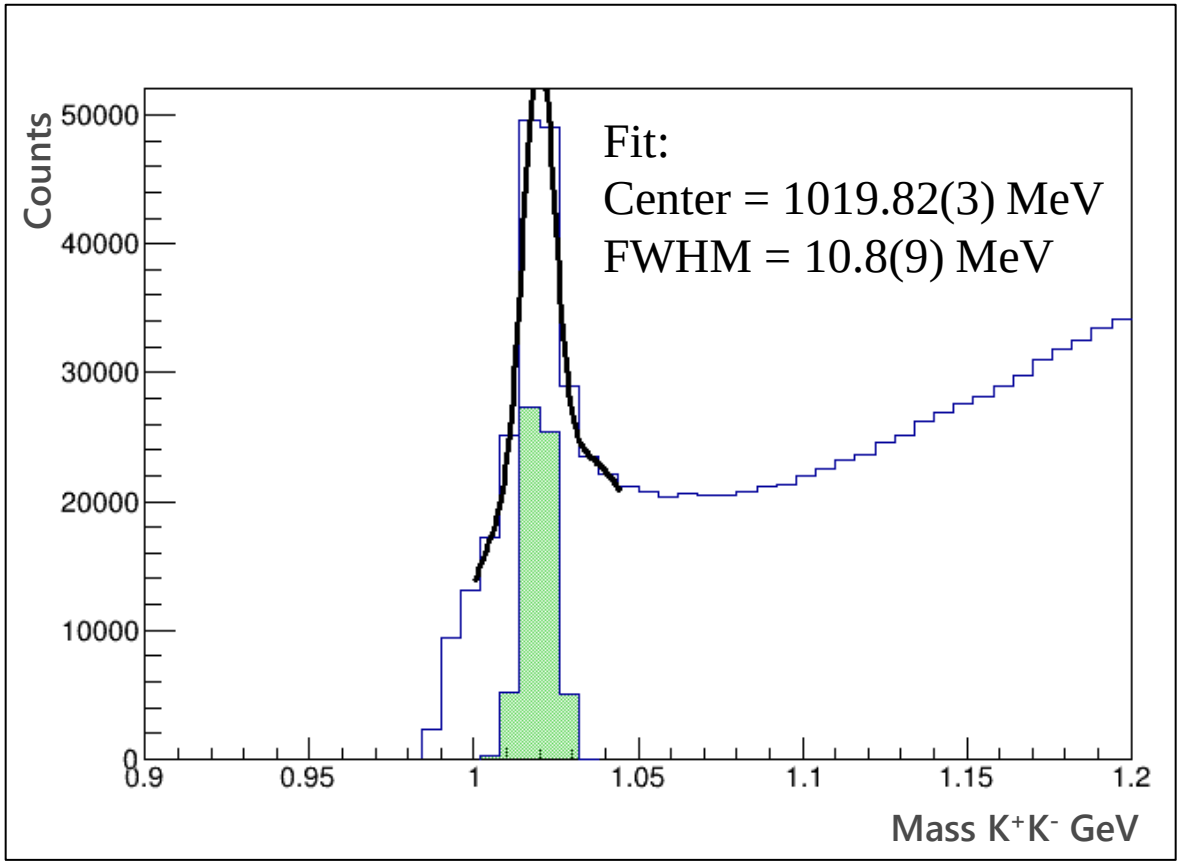


- Drift chambers
- Calorimeter
- Cerenkov detectors

ASU
Arizona State University

Analysis

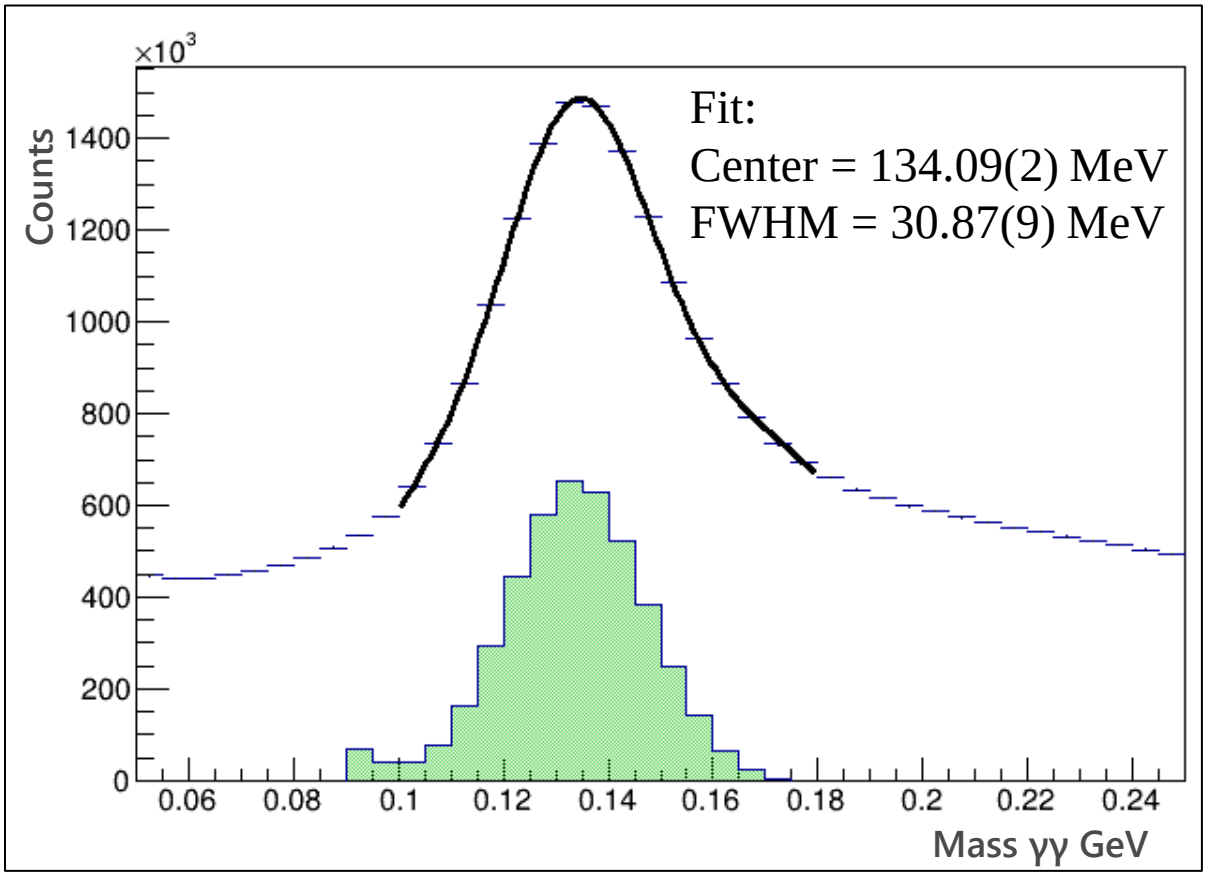
- Invariant Mass of K^+K^-
- PDG mass of φ = 1019.46(2) MeV
- PDG width 4.25(1) MeV



ASU Arizona State University

Analysis

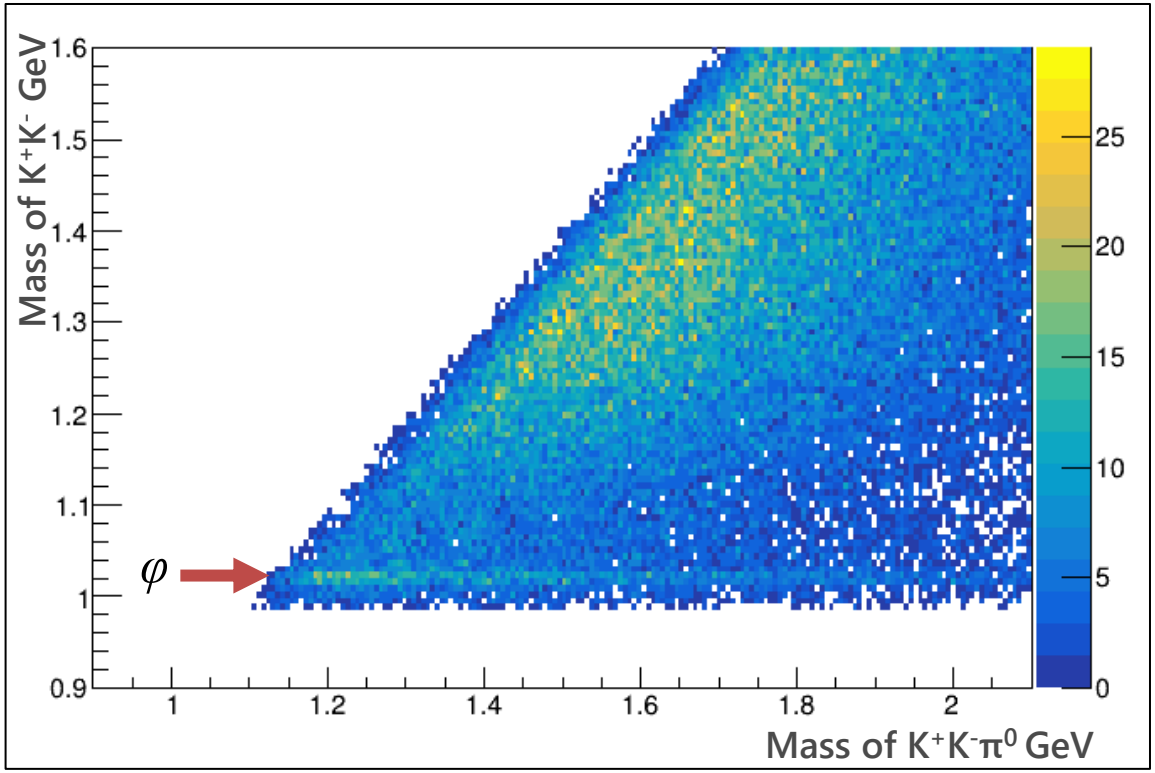
- Invariant mass of two photons
- Peak is π^0
- PDG mass of π^0 is 134.976(5) MeV



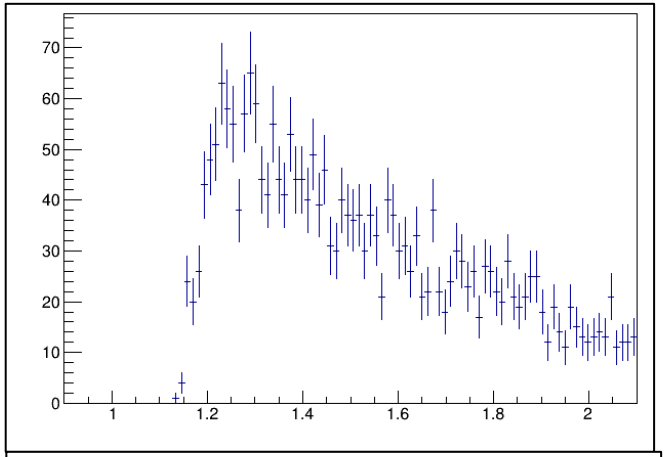
ASU Arizona State University

Analysis

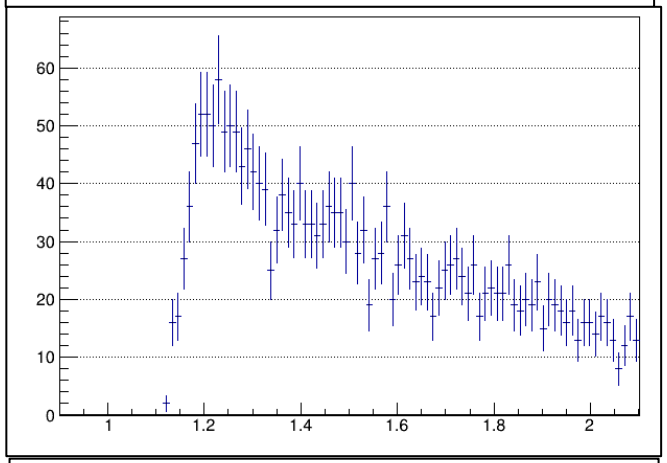
- K^+K^- vs $K^+K^-\ \pi^0$
- Projecting bands onto x :
  - Upper
  - Center
  - Lower



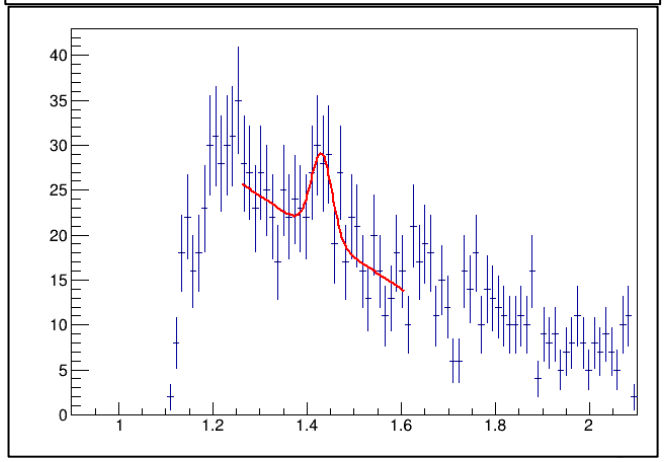
Upper
Mass (K^+K^-) from 1026 to 1054 MeV



Center (φ region)
Mass (K^+K^-) from 1012 to 1026 MeV



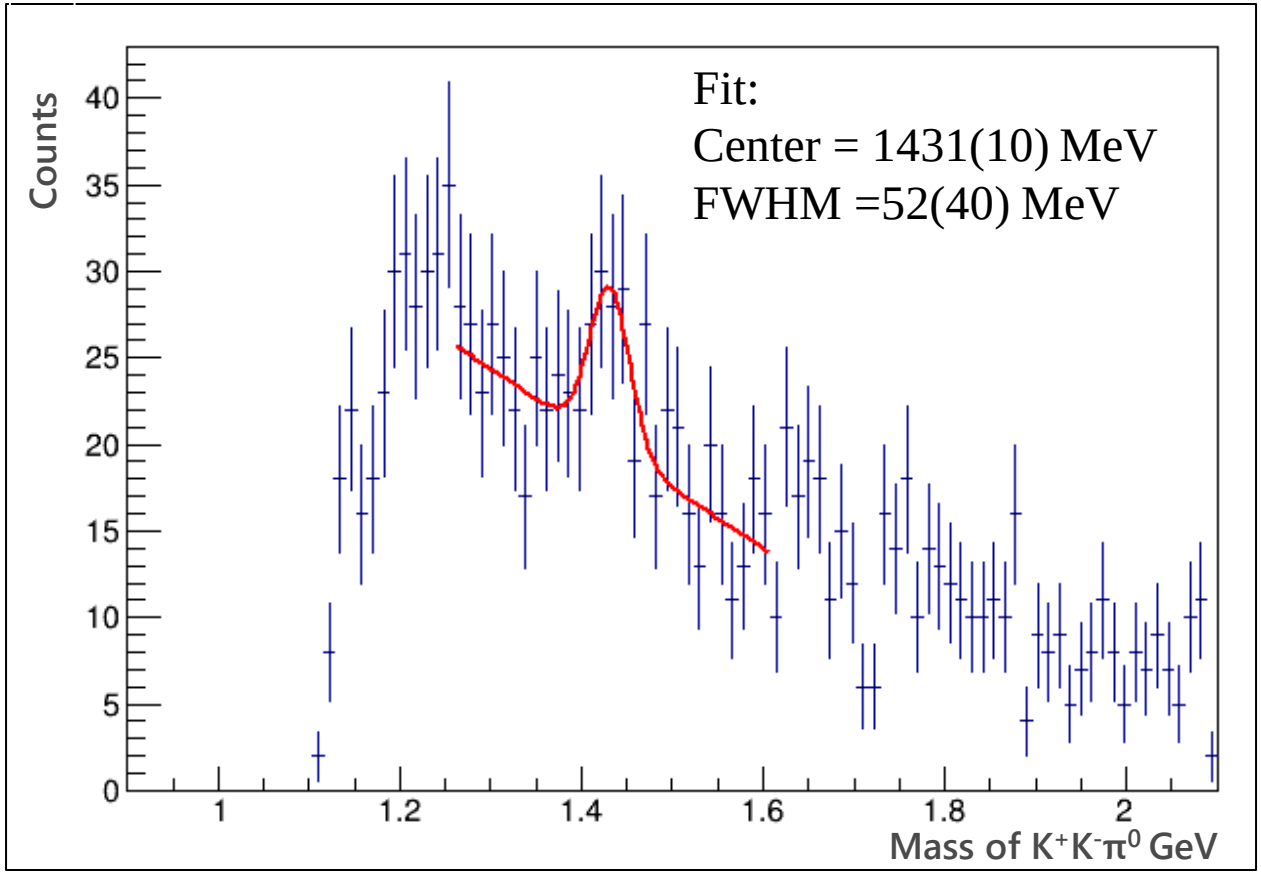
Lower
Mass (K^+K^-) from 984 to 1012 MeV



ASU
Arizona State University

Analysis

- Lower Band
- PDG mass for $f_1(1420)$ is 1426.3(9) MeV
- PDG width 54(3) MeV



Summary and Path Forward

- Peak consistent with $f_1(1420)$
- Larger statistics would be useful
- Detector efficiency studies required
- Explore different data cuts

ASU Arizona State University

U.S. DEPARTMENT OF ENERGY