Measurements of $e^+e^- \to \phi K^+ K^-$ and $K^+K^- K^+K^-$ cross sections

(R-Scan Data: $\sqrt{s}$=2.0GeV~3.08GeV)

Preliminary results

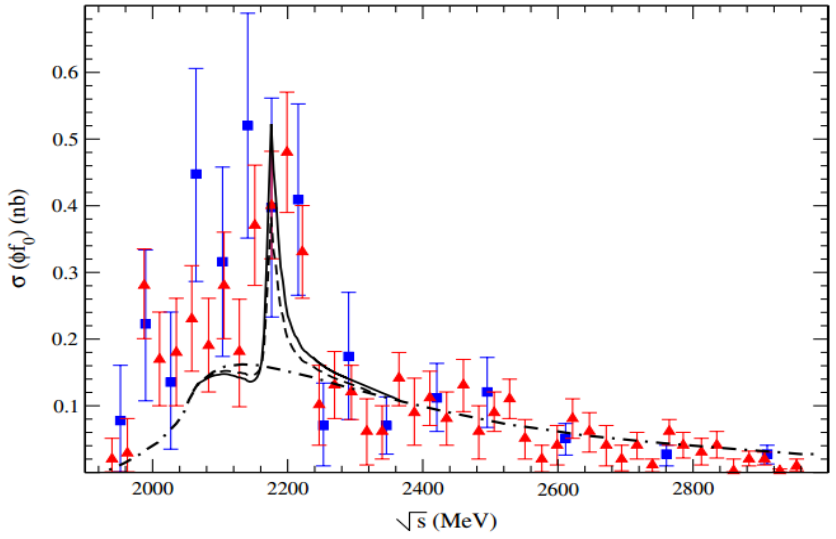
Motivation

- The states with $J^{PC} = 1^{--}$ include $\phi(2170)$, $\rho(2150)$ and so on. $\phi(2170)$ is interpreted as a $s\bar{s}g$ hybrid; a $2^3D_1 s\bar{s}$ state; or a $s\bar{s}s\bar{s}$ tetraquark state.

- Theorists have predicted a neat resonance peak around 2.150 GeV in the three-meson system ϕK^+K^- (the solid) . Experimental data is from BABAR Collaboration.

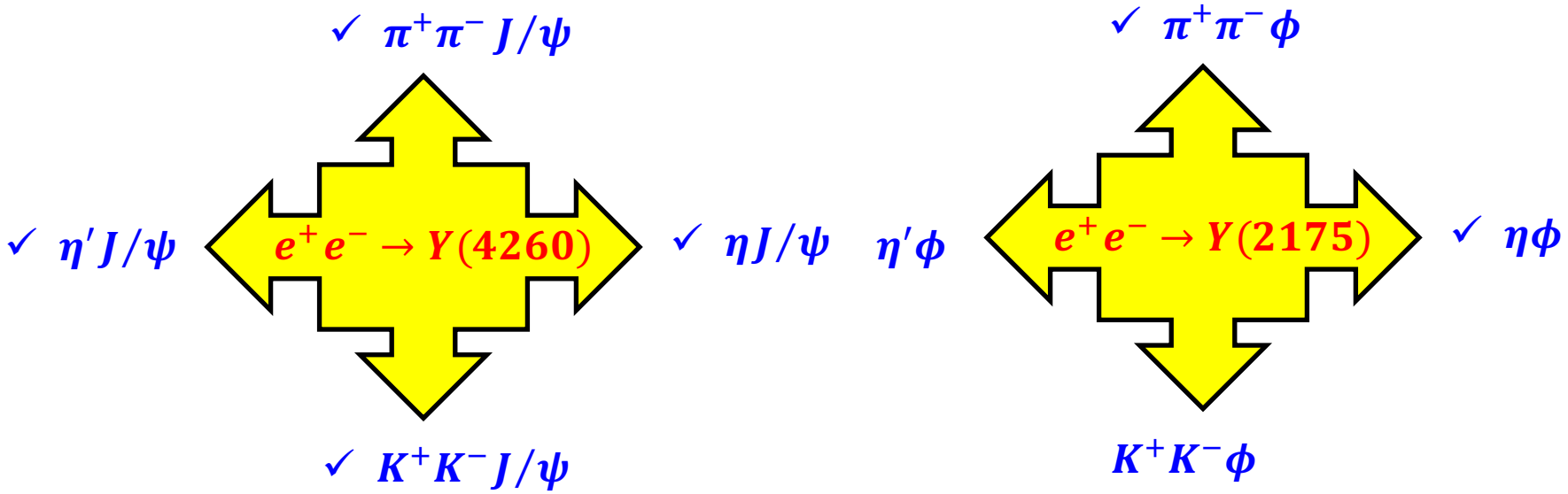
Phys. Rev. D 78, 074031

$e^+e^- \to Y(2175) \to \phi f_0(980) \to \phi K^+K^-$



Motivation

$$e^+e^- \to Y(4260) \to \pi Z_c \to \pi\pi J/\psi$$



$$e^+e^- \to Y(2175) \to \pi Z_s \to \pi\pi\phi$$

Signal extraction@3080MeV

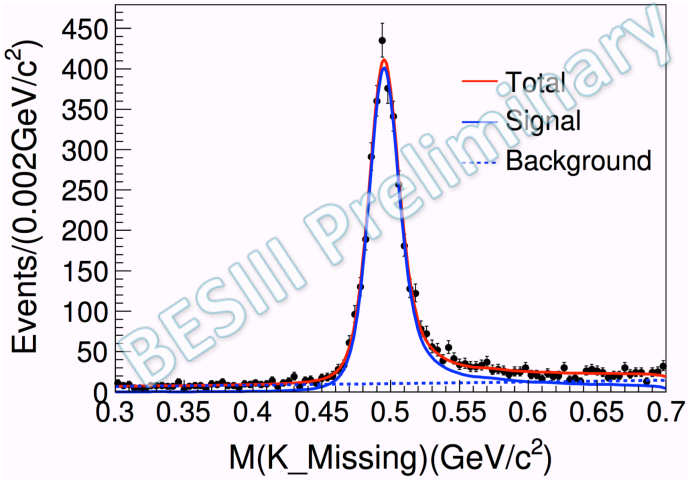
(1) K_Missing Fitting:

Signal: MCShape⊗ Gaussian;

Background:

Chebyshev Polynomial;

N=3693.7±73.1



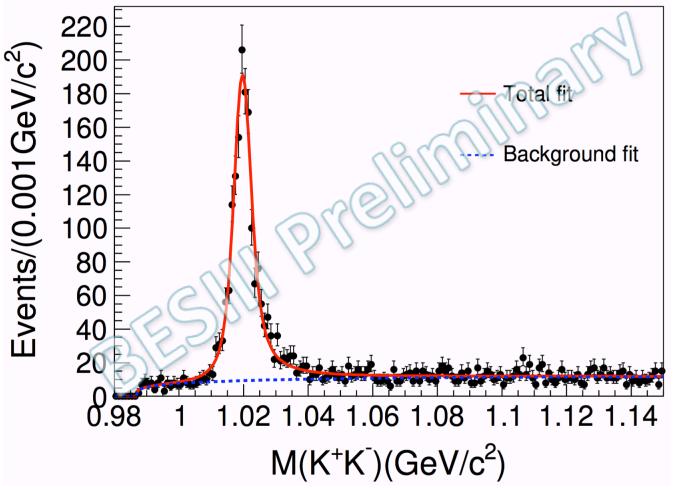
(1) $\chi^2_{1C}(K^+K^-K^+K^-) < 20$;

(2) $\phi(1020)$ Fitting:

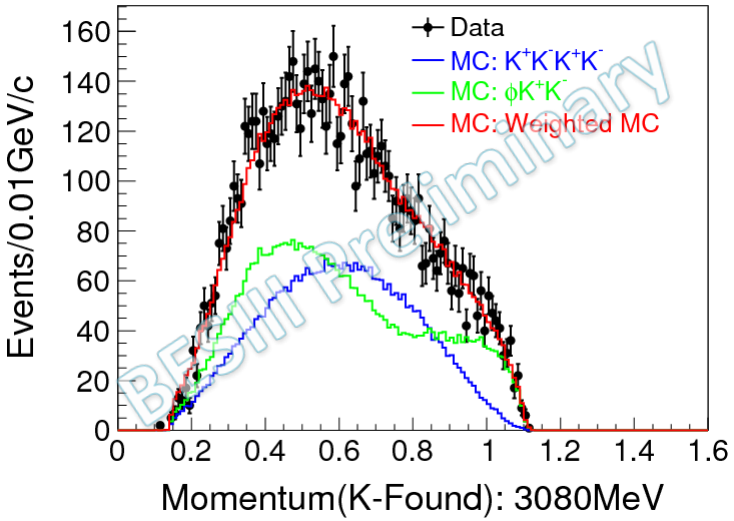
Signal: P-wave BW⊗ Gaussian;

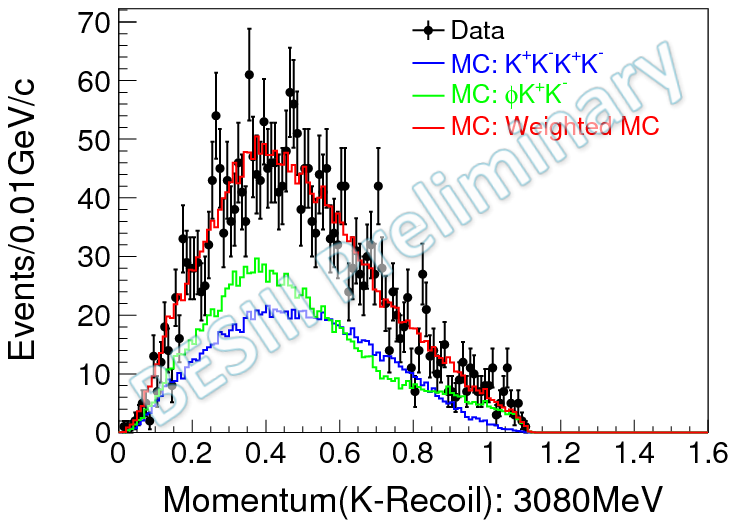
Background: Argus;

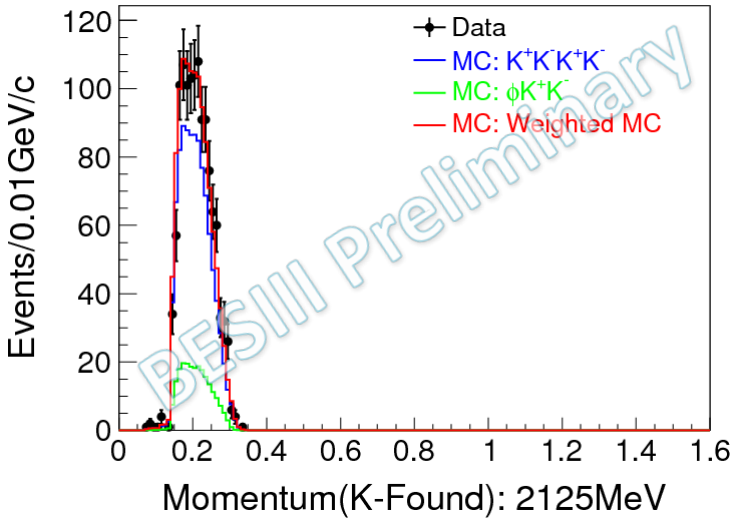
N=1690.8± 50.1

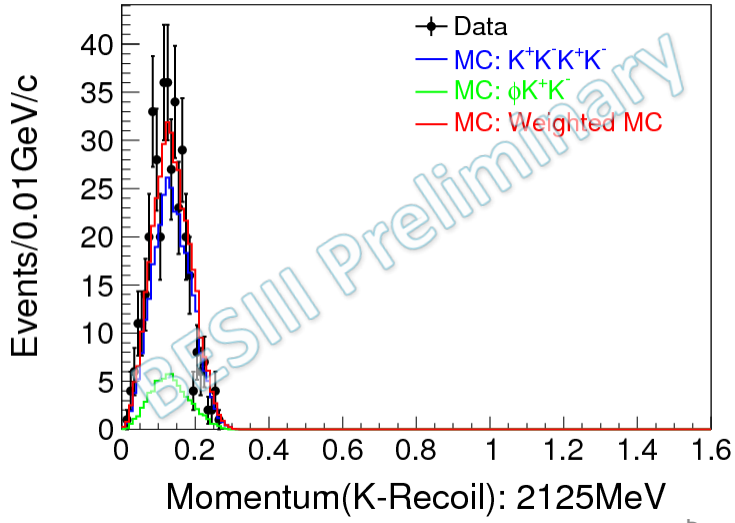


Weighted MC of $e^+e^- \to K^+K^- K^+K^-$

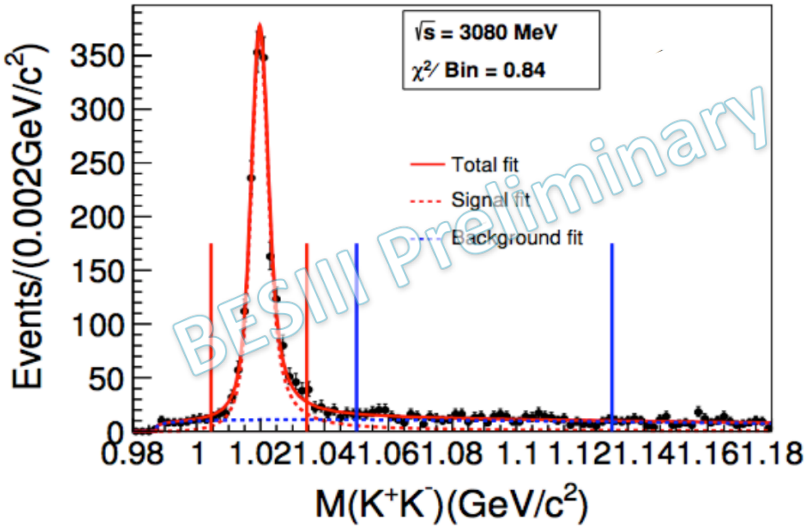


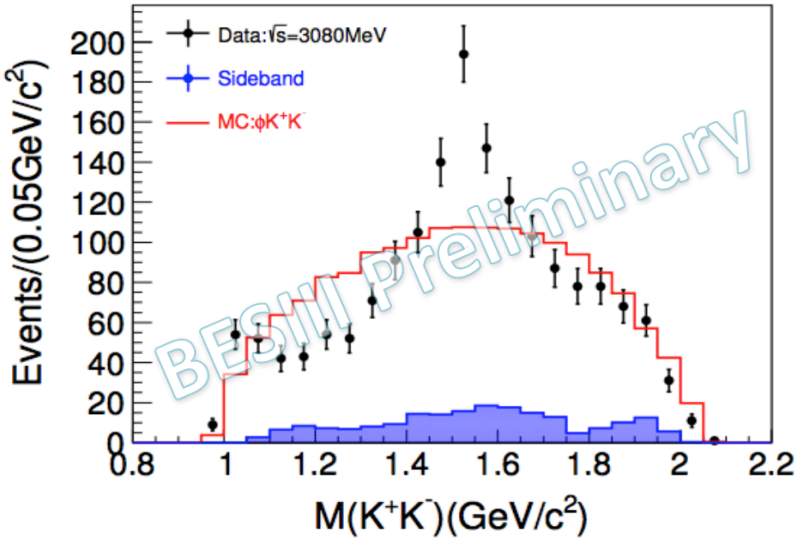






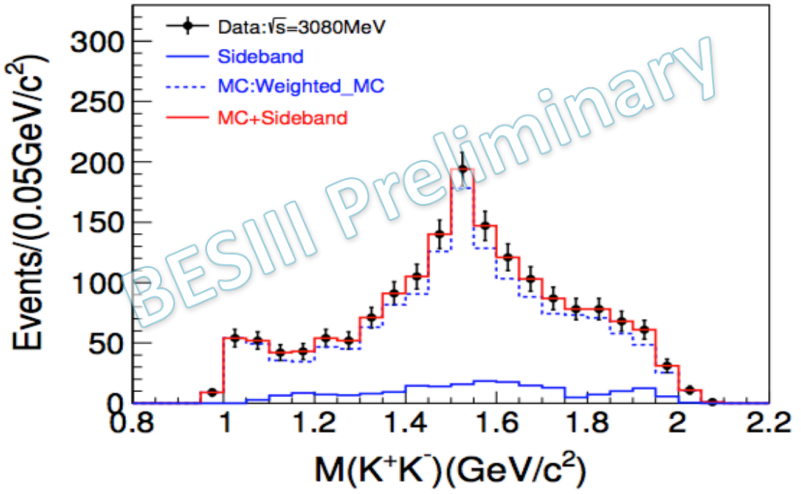
Weighted MC of $e^+e^- \to \phi K^+K^-$





$$|M(K^+\mathrm{K}^-) - 1.01946| \leq 0.015\mathrm{GeV}$$

- ✓ The method of event-by-event weight is applied for M(K+K-) from ϕK^+K^-. The weight factor obtained by calculating the ratio of the number of signal events from data and MC bin-by-bin.
- ✓ Raw_MC from $e^+e^- \to \phi K^+K^-$ (PHSP).



Summary

- With R-scan data sets [2.0, 3.08]GeV, we search for new decay mode of Y(2175).
  - Measurements of cross sections of $e^+e^- \to \phi K^+ K^-$ and $K^+K^- K^+K^-$, we only observe an enhancement near threshold in the line shape of cross section.