

# Search for $B^+ \rightarrow \rho^0 K^*(892)^+$ decay

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## Overview

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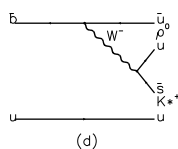
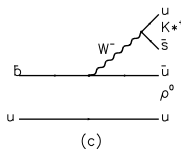
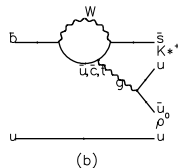
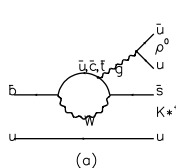
## The motivation of $B^+ \rightarrow \rho^0 K^*(892)^+$ decay

- The helicity measurement of  $B$  meson have a relation with beyond SM.
  - $B^+ \rightarrow \rho^0 K^*(892)^+$  decay;  $B \rightarrow VV$
  - From  $B \rightarrow VV$  decays, the angular correlation measurements are sensitive to beyond SM.
  - $A_0 \gg A_T$  in SM, where  $A_0$  is the longitudinal,  $A_T$  is transverse for polarization fraction.; Belle and BaBar measured  $A_0 \sim A_T$
- There are Tree and Penguin phase in  $B^+ \rightarrow \rho^0 K^*(892)^+$  decay; Direct CP measurement.

# The motivation of $B^+ \rightarrow \rho^0 K^*(892)^+$ decay

## • $B \rightarrow VV$ decays

Decays	$\mathfrak{B}(10^{-6})$	Exp	Year
$B^+ \rightarrow \omega K^+$	$6.7 \pm 0.8$	BaBar	07
$B^+ \rightarrow \omega K^{*+}$	$< 3.4$	BaBar	06
$B^+ \rightarrow \rho^0 K^+$	$4.2 \pm 0.5$	Belle	06
$B^+ \rightarrow \rho^0 K^{*+}$	$< 6.1$	BaBar	06
$B^+ \rightarrow \rho^+ K^0$	$8.0 \pm 1.5$	BaBar	07
$B^+ \rightarrow \rho^+ K^{*0}$	$9.2 \pm 1.5$	BaBar	06
$B^+ \rightarrow \phi K^{*+}$	$10.5 \pm 1.5$	BaBar	07
$B^0 \rightarrow \omega K^0$	$5.0 \pm 0.6$	BaBar	07
$B^0 \rightarrow \omega K^{*0}$	$1.8 \pm 0.7$	Belle	08
$B^0 \rightarrow \rho^0 K^0$	$5.4 \pm 0.9$	Belle	07
$B^0 \rightarrow \rho^0 K^{*0}$	$5.6 \pm 1.6$	BaBar	06
$B^0 \rightarrow \rho^- K^+$	$< 12.0$	BaBar	06
$B^0 \rightarrow \rho^- K^{*+}$	$9.2 \pm 1.5$	Belle	04
$B^0 \rightarrow \phi K^{*0}$	$9.5 \pm 0.8$	BaBar	07



Feynman Diagram of  $B^+ \rightarrow \rho^0 K^*(892)^+$  decay

- $B^+ \rightarrow \rho^0 K^{*+}$

$$\rho^0 \rightarrow \pi^+ \pi^-$$

$$K^{*+} \rightarrow K_S^0 \pi^+$$

- *BaBar*(06) found the upper limit  $< 6.1 \times 10^{-6}$
- We consider to search the decay mode.
- We will make the model of  $B^+ \rightarrow \rho^0 K^{*+}$  with 4-dim extended likelihood fit.
- Signal MC with considering the longitudinal for polarization fraction; done
- Using the  $q\bar{q}$  MC of real data  $\times 3$ ,  $b \rightarrow c$  MC of real data  $\times 6$ , rareB MC of real data  $\times 50$  ;  
skimming MC(from exp07 to exp65: 800M events):doing

- Particle Identification
- $q\bar{q}$  study with KSFW,  $\cos\theta^{B*}$ ,  $\Delta Z$  and  $\cos\theta_H$
- B background & Veto
- PDF modeling & Fitter check
- Control sample
- To estimate the peak
- To estimate the branch fraction: if we can observe (O,X)
- If we have the enough yields, to measure the direct CP

# Starting the analysis with signal MC

- $B^+ \rightarrow \rho^0 K^{*+}$

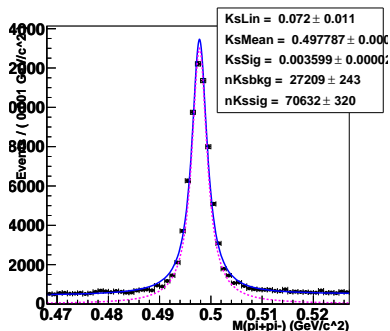
- $\rho^0 \rightarrow \text{free}$

- $K^{*+} \rightarrow \text{free}$

- Signal MC with considering the longitudinal for polarization fraction : 0.3M events
- We don't use the best candidate with  $\chi^2$  of vertex fit,  $dr$  and  $dz$ .
- It should be # of tracks is  $\geq 5$  and Ks is existed and Ks is goodKs.

- Ks mass: to perform the fit within  $M(\pi^+\pi^-) \in (0.468, 0.527)\text{GeV}/c^2$

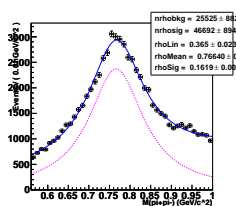
- The signal region in  $2.5\Gamma$   
 $M(\pi^+\pi^-) \in (0.489, 0.507)\text{GeV}/c^2$  (by fitting)



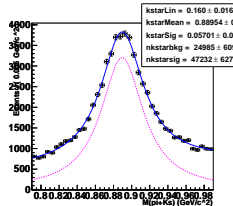
# Starting the analysis with signal MC

- $\rho^0$  mass: the window region is in  $1.5\Gamma$   
 $M(\pi^+\pi^-) \in (0.56, 1.00)\text{GeV}/c^2$  (by PDG)
- $K^{*+}$  mass: the window region in  $2.0\Gamma$   
 $M(\pi^+K_S^0) \in (0.79, 0.99)\text{GeV}/c^2$  (by PDG)
- $\Delta E$ : the window region is in  
 $\Delta E \in (-0.12, 0.12)\text{GeV}$
- $M_{bc}$ : the window region in  $2.0\Gamma$   
 $M_{bc} \in (5.20, 5.30)\text{GeV}/c^2$

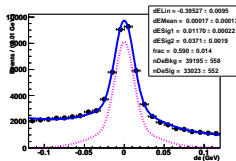
$M(\pi^+\pi^-)$ ;



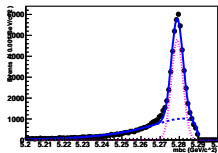
$M(\pi^+K_S^0)$ ;



$\Delta E$ ;



$M_{bc}$ ;





- We define the the criteria based on the signal MC
- We consider  $K^{*+} \rightarrow \pi^+ K_S^0$ 
  - $K^{*+} \rightarrow \pi^+ K_S^0$ : it should be existed the Ks(mdst\_vee2 and kind == 1) and the number of mdst\_charged > 5
  - $\rho$  mass;  $M(\pi^+ \pi^-) < 1.9\text{GeV}/c^2$
  - $K^{*+}$  mass;  $M(\pi^+ K_S^0) < 1.9\text{GeV}/c^2$
  - $\Delta E \in (-0.42, 0.42)\text{GeV}$
  - $M_{bc} > 5.19\text{GeV}/c^2$

## Summary and Next step

- Started the analysis
- The signal MC study : done
- Determined to the skim criteria : done
- Skimming for  $q\bar{q}$  MC : doing
- Particle identification: will do