#### Effect of boost on timedependent CP measurements

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#### Outline

- SuperB Svt baseline
- Time dependent measurements vs boost:
  - $B^0 \rightarrow \phi K_S$   $B^0 \rightarrow K_S K_S$
- Sensitivity to S at high luminosity
- Conclusions











Relative amount of material for AI bus and support-cooling requires small adjustments.

# Proper time resolution vs boost value



 $\bullet B^0 \rightarrow K_S K_S \quad \text{(partially benefits of L0 measurement for}$ 

exclusive vertex reconstruction)

Error on time dependent asymmetry can be parameterized according to:

$$\sigma_{CP} = \sigma[\sin(2\phi)] = \frac{1}{d} \frac{1}{\sqrt{N}} \frac{1}{1 - 2\omega} \sqrt{1 + R\eta} \quad \Sigma$$

- $sin(2\Phi)$ , or S parameter, assumed 0.7
- d = dilution factor depending on statistical method
- N = n. signal events
- $\omega = mistag probability$
- $R = signal to noise ratio; \eta bkg dilution factor$
- $\Sigma$ =accounts for experimental resolution on proper time

parameterization works fine for most BaBar published results within 10-15% accuracy.





## $B^0 \rightarrow \phi K_s$ proper time resolution with reduced boost: 6.7 vs 4.18 GeV



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#### Sensitivity to S for $B^0 \rightarrow \phi K_S$



Assuming identical reco efficiency, flavor tagging and bkg level: SuperB sensitivity to S is comparable with BaBar. In a smaller boost scenario, reduction of the sensitivity at the level of 6% for the statistical error and at 4% level for the total error at 75 ab<sup>-1</sup> in presence of systematic error (1/2 BaBar one).



#### $B^0 \rightarrow K_S K_S$ proper time resolution with reduced boost: 6.7 vs 4.18 GeV



### ToyMC experiments

#### Toy MC results: Per Event Error on S

 $\sigma_{BaBar} = 1.431$   $\sigma_{SuperB} = 1.608 (+12\%)$  $\sigma_{RedBoost} = 1.689 (+18\%)$  No efficiency correction applied though SuperB has larger acceptance

Reduction in sensitivity at high lumi is mitigated by the systematic error:  $\sigma \!=\! \sigma_{stat} / \sqrt{N \!\oplus\! \sigma_{syst}}$ 

As in the previous case we are assuming identical reco efficiency, flavor tagging and bkg level: SuperB sensitivity to S is reduced by 12% wrt BaBar in this decay mode for the statistical error. A smaller boost scenario would reduce further of the sensitivity at the level of 18%.

### Summary

- In the conservative scenario where SuperB detector has identical reco efficiency, flavor tagging performances and bkg rejection to BaBar:
  - $B^0 \rightarrow \phi K_S$  has comparable performances with BaBar. Impact of boost reduction is moderate: few percent sensitivity reduction wrt BaBar;
  - $B^0 \rightarrow K_S K_S$  time dependent measurement has slightly worse sensitivity wrt BaBar. Reducing the boost would further worsen the sensitivity from 12% to 18% for the statistical error.