

# Search for a Light Higgs Boson at BABAR

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## 1 Introduction

A light CP-odd Higgs Boson ( $A^0$ ) is predicted in extensions to the Standard Model such as Next-to-Minimal Supersymmetry (NMSSM) [1]. Such Higgs with a mass less than two bottom quarks is not excluded from LEP constraints. We search for  $\Upsilon \rightarrow \gamma A^0$ ;  $A^0 \rightarrow$  muons, tauons, invisible, hadrons or photons at BABAR. We have a sample of 122M  $\Upsilon(3S)$ , 99M  $\Upsilon(2S)$ , and 23M  $\Upsilon(1S)$ .

## 2 Results

BABAR could not find evidence of such Higgs. We exclude some parameters space of NMSSM as shown in Figure 1 for Higgs goes to muons [2] and tauons [3]. The dots come from Dermisek's theory paper [1] and boxes are parameters space excluded by BABAR data. Other analyses are still in progress.

## References

- [1] R. Dermisek, J. F. Gunion, and B. McElrath, "Probing next-to-minimal-supersymmetric models with minimal fine tuning by searching for decays of the  $\Upsilon$  to a light  $CP$ -odd Higgs", Phys. Rev. D **76**, 051105(R) (2007).
- [2] B. Aubert *et al.* (BABAR Collaboration), "Search for dimuon decays of a light scalar boson in radiative transitions  $\Upsilon \rightarrow \gamma A^0$ ", Phys. Rev. Lett. **103**, 081803 (2009).
- [3] B. Aubert *et al.* (BABAR Collaboration), "Search for a low-mass Higgs boson in  $\Upsilon(3S) \rightarrow \gamma A^0$ ,  $A^0 \rightarrow \tau^+\tau^-$  at BABAR", Phys. Rev. Lett. **103**, 181801 (2009).

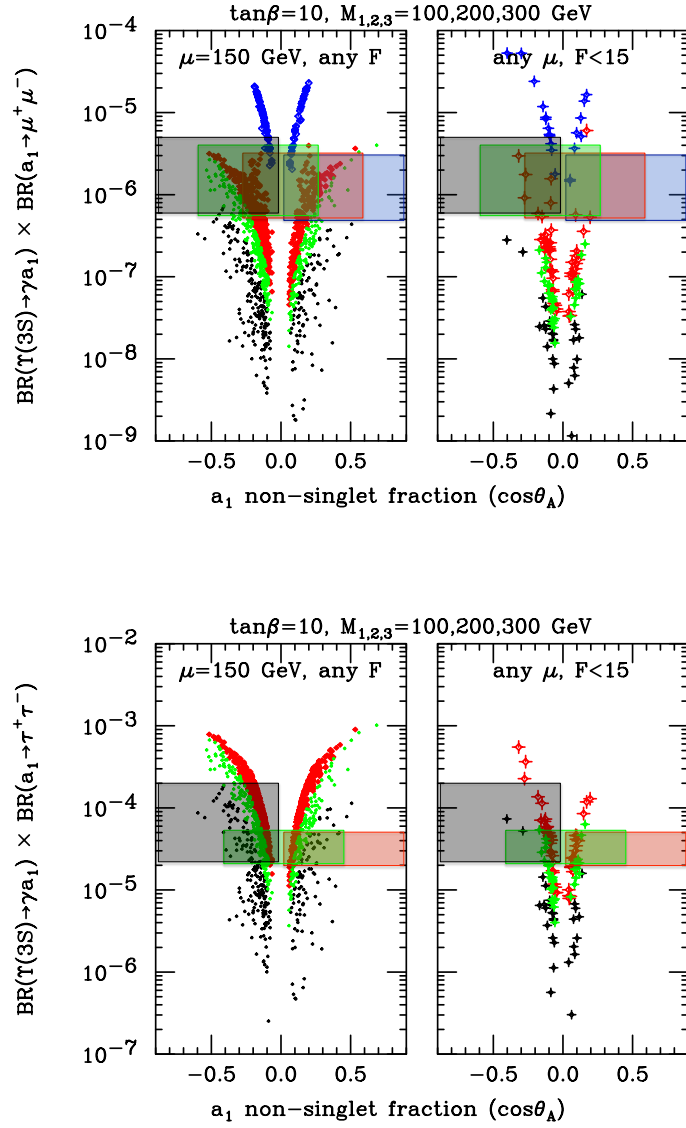


Figure 1: NMSSM parameters space excluded by BABAR data for Higgs goes to muons (upper) or tauons (lower). Dots are branching fraction predictions. Boxes are our ranges of exclusion at different masses. The horizontal positions of different coloured boxes are separated for clarity. Blue is for Higgs mass less than two tauons, red is for Higgs mass less than  $7.5 \text{ GeV}/c^2$ , green is for Higgs mass less than  $8.8 \text{ GeV}/c^2$ , and black is for Higgs mass less than  $9.2 \text{ GeV}/c^2$ .