$B^0 \to \eta' K$ comaprison with Belle and BaBar

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INFN Padova

No meeting,
Padova, 15/12/2016

Intro

- A more detailed description of the Yield estimate
- Comparison with Belle and BaBar
- including the educated extrapolation for missing channels:
  - using $K^0_S \to \pi^+\pi^-$ vs $K^0_S \to \pi^0\pi^0$ Belle/BaBar ratio
  - as well as K^0_S to K^0_L
- plus $\eta' \to \rho^0\gamma K^0_S$

$N_{B\overline{B}}$

Expected yield for integrated lumi L [fb^{-1}]

- $\sigma(e^+e^- \to \Upsilon(4s)) = 1.1\ nb$
- $BR(\Upsilon(4s) \to B^0\overline{B}^0) = .486$
- $N_{B\overline{B}} = L \cdot \sigma$
- $N_{B^0\overline{B}^0} = L \cdot \sigma \cdot BR$
- $N_{B^0} = 2 \cdot N_{B^0\overline{B}^0}$

L [ab^{-1}]	$N_{B\overline{B}}$ [10^6]	$N_{B^0\overline{B}^0}$ [10^6]
$0.425_{(BaBar)}$	468	232
0.701 (Belle)	771	382
1	1100	546
5	5500	2728
50	55000	27280

Branching ratio

- $BR(B^0 \to \eta' K^0) = 6.6 \cdot 10^{-5}$
- $BR(\eta' \to \eta\pi^+\pi^-) = 0.429$
- $BR(\eta' \to \rho\gamma) = 0.291$
- $BR(\eta \to \gamma\gamma) = 0.3941$
- $BR(\eta \to \pi^+\pi^-\pi^0) = 0.3268$
- $BR(\rho \to \pi^+\pi^-) = 1$

- K^0_S/K^0_L in $K^0 = 0.5$
- $BR(K^0_S \to \pi^+\pi^-) = 0.6920$
- $BR(K^0_S \to \pi^0\pi^0) = 0.3069$

Channel $B^0 \to$	BR $[\cdot 10^{-6}]$
$\eta' \to \eta_{\gamma\gamma}\pi^+\pi^-$	
$\eta' K^0_S (\to \pi^+\pi^-)$	$3.86 \cdot 10^{-6}$
$\eta' K^0_S (\to \pi^0\pi^0)$	$1.71 \cdot 10^{-6}$
$\eta' K^0_L$	$5.58 \cdot 10^{-6}$
$\eta' \to \eta_{\pi^+\pi^-\pi^0}\pi^+\pi^-$	
$\eta' K^0_{S\,\pi^+\pi^-}$	$3.20 \cdot 10^{-6}$
$\eta' K^0_L$	$4.63 \cdot 10^{-6}$
$\eta' \to \rho_{\pi^+\pi^-}\gamma$	
$\eta' K^0_{S\,\pi^+\pi^-}$	$2.85 \cdot 10^{-6}$
$\eta' K^0_{S\,\pi^0\pi^0}$	$1.26 \cdot 10^{-6}$

Signal Efficiency

Channel $B^0 \to$	Eff % Belle2	Eff (Belle) [Belle(2014)]	Eff (BaBar) [BABAR(2009)]
$\eta' \to \eta_{\gamma\gamma}\pi^+\pi^-$			
$\eta' K^0_S(\to \pi^+\pi^-)$	23.0	21.9	26.4
$\eta' K^0_S(\to \pi^0\pi^0)$	11.5*	7.9	13.2
$\eta' K^0_L$	-	19.4	14.9
$\eta' \to \eta_{\pi^+\pi^-\pi^0}\pi^+\pi^-$			
$\eta' K^0_{S\pi^+\pi^-}$	8.1	7.1	11.5
$\eta' K^0_L$	-	6.0	7.0
$\eta' \to \rho_{\pi^+\pi^-}\gamma$			
$\eta' K^0_{S\pi^+\pi^-}$	-	27.8	32.5
$\eta' K^0_{S\pi^0\pi^0}$	-	7.2	15.1

Note

* very preliminary

The effiency used for the expected yields (next page) for the channels not studied yet are taken as an average of that of Belle and BaBar

Signal Yield vs Luminosity and comparison with Belle/BaBar

L [ab^{-1}] ($N_{B\overline{B}}$)	0.425 (468M)		0.701 (771M)		1 (1100M)	5 (5500M)
Channel $B^0 \to$	B2	[BABAR(2009)]	B2	[Belle(2014)]	B2	B2
$\eta' \to \eta_{\gamma\gamma}\pi^+\pi^-$						
$\eta' K^0_S(\to \pi^+\pi^-)$	412	472	679	648	969	4840
$\eta' K^0_S(\to \pi^0\pi^0)$	91	105	151	104	215	1070
$\eta' K^0_L$	520	386	850	829	1200	6100
$\eta' \to \eta_{\pi^+\pi^-\pi^0}\pi^+\pi^-$						
$\eta' K^0_{S\,\pi^+\pi^-}$	120	171	198	174	283	1415
$\eta' K^0_L$	137	169	223	213	320	1600
$\eta' \to \rho_{\pi^+\pi^-}\gamma$						
$\eta' K^0_{S\,\pi^+\pi^-}$	894	1005	1474	1411	2100	10500
$\eta' K^0_{S\,\pi^0\pi^0}$	140	206	223	162	320	1600
All K^0_S	1654	1959	2728	2519	3891	19500
All K^0_L	657	556	1084	1042	1546	7730
All	2311	2515	3811	3541	5437	27200

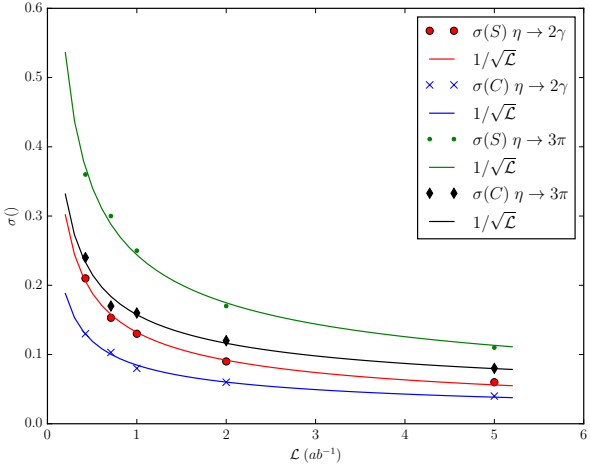
Estimated sensitivity (and comparison with Belle/BaBar)

L [ab^{-1}] ($N_{B\bar{B}}$)	0.425 (468M)				0.701 (771M)			
Channel $B^0 \to$	σ_S	σ_C	σ_S	σ_C	σ_S	σ_C	σ_S	σ_C
$\eta' \to \eta_{\gamma\gamma}\pi^+\pi^-$	B2		[BABAR(2009)]		B2		[Belle(2014)]	
$\eta' K^0_S(\to \pi^+\pi^-)$	0.21	0.13	0.17	0.11	0.15	0.10	0.15	0.10
$\eta' K^0_S(\to \pi^0\pi^0)$	0.45	0.28	0.34	0.30	0.26	0.17	*0.21	*0.18
$\eta' K^0_L$	0.19	0.14	0.22	0.16	0.11	0.09	n.a.	
$\eta' \to \eta_{\pi^+\pi^-\pi^0}\pi^+\pi^-$								
$\eta' K^0_{S\,\pi^+\pi^-}$	0.36	0.24	0.26	0.20	0.30	0.20	0.26	0.18
$\eta' K^0_L$	0.33	0.28	0.36	0.25	0.20	0.17	n.a.	
$\eta' \to \rho_{\pi^+\pi^-}\gamma$								
$\eta' K^0_{S\,\pi^+\pi^-}$	0.10	0.12	0.12	0.09	0.08	0.07	0.09	0.07
$\eta' K^0_{S\,\pi^0\pi^0}$	0.26	0.22	0.33	0.26	0.21	0.18	*0.21	*0.18
All K^0_S	0.100	0.063	0.08	0.06	0.071	0.045	0.074	0.052
All K^0_L	0.165	0.13	0.18	0.13	0.21	0.14	0.21	0.14
All	0.086	0.056	0.08	0.06	0.067	0.043	0.07	0.049

Estimated sensitivity

L [ab^{-1}] ($N_{B\bar{B}}$)	1 (1100M)		2 (2200M)		5 (5500M)	
Channel $B^0 \to$	σ_S	σ_C	σ_S	σ_C	σ_S	σ_C
$\eta' \to \eta_{\gamma\gamma}\pi^+\pi^-$						
$\eta' K^0_S(\to \pi^+\pi^-)$	0.13	0.08	0.09	0.06	0.06	0.04
$\eta' K^0_S(\to \pi^0\pi^0)$	0.27	0.17			0.12	0.09
$\eta' K^0_L$	0.12	0.09			0.06	0.04
$\eta' \to \eta_{\pi^+\pi^-\pi^0}\pi^+\pi^-$						
$\eta' K^0_{S\,\pi^+\pi^-}$	0.25	0.16	0.17	0.12	0.11	0.08
$\eta' K^0_L$	0.22	0.18			0.10	0.08
$\eta' \to \rho_{\pi^+\pi^-}\gamma$						
$\eta' K^0_{S\,\pi^+\pi^-}$	0.06	0.07			0.04	0.03
$\eta' K^0_{S\,\pi^0\pi^0}$	0.10	0.17			0.10	0.07
All K^0_S	0.065	0.040			0.028	0.02
All K^0_L	0.17	0.111			0.08	0.05
All	0.060	0.038			0.027	0.020

Resolution vs Luminosity



Additional stuff

Additional or backup slides

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