Estimating the SuperB experimental reach on $(g\text{-}2)_\tau$

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Outline

- Observables
- Experimental issues
  - Diluition
  - Systematics
- Prospects & Conclusion

What are we looking for?

- We need to measure the polar distribution of τ when produced
- Need to track back the direction from its producs (and we have neutrinos...)
- Then fit cos(θ) distribution with a 2nd order polinomial: goal is to measure ratios between 2nd order and constant coefficients

Observables

- We studied for preliminary studies Re[$F_2(s)$] with $d\sigma/d\cos(\theta)$ fit (not requiring polarized beams): acording to Th. Paper more sensitive w.r.t polarized beam measurement, but more systematically limited.

$$\frac{d\sigma}{d\cos(\theta)} = a \cdot \cos(\theta)^2 + b$$

$$a \propto \beta^2 |F_1|^2 \longrightarrow \frac{b}{a} \cdot |F_1|^2 = \frac{2-\beta^2}{\beta^2} \cdot |F_1|^2 + 4\,\mathrm{Re}[F_2]$$

$$b \propto (2-\beta^2) \cdot |F_1|^2 + 4\,\mathrm{Re}[F_2]$$

Expectations from Th.

- We want to estimate the systematic limitations of the exp. measurement .
- We begin considering 1-3 prong $\tau^+\tau^-$ topologies with a 1-prong tag, whose experimental selection is cleaner
- Need to tag the sample:
  - Lepton tag: higher purity & higher diluition (at least 3 neutrinos)
  - Hadronic tag: lower purity & lower diluition (2 neutrinos)
- We will not have any reduction in statistics!!

EXPERIMENT ⇓	Cross Section $Re\{F_2\}$	Normal Asymmetry $Im\{F_2\}$
Babar+Belle $2ab^{-1}$	4.6×10^{-6}	2.1×10^{-5}
Super B/Flavor Factory (1 yr. running) $15ab^{-1}$	1.7×10^{-6}	7.8×10^{-6}
Super B/Flavor Factory (5 yrs. running) $15ab^{-1}$	7.5×10^{-7}	3.5×10^{-6}

Stat error only!!

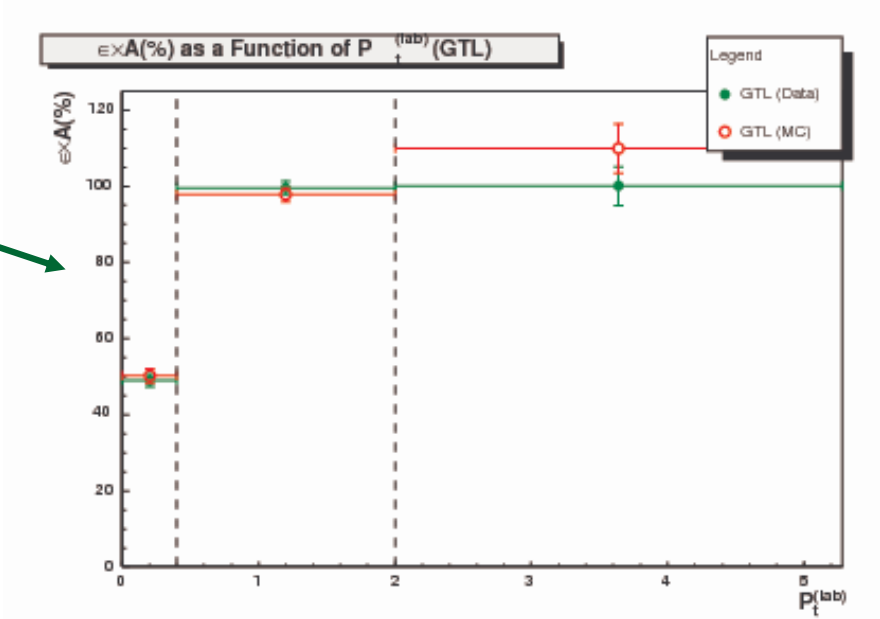
arXiv:0707.2496v1 [hep-ph] J.Bernabeu et.al
Tau anomalous magnetic moment form factor at Super B/Flavor factories

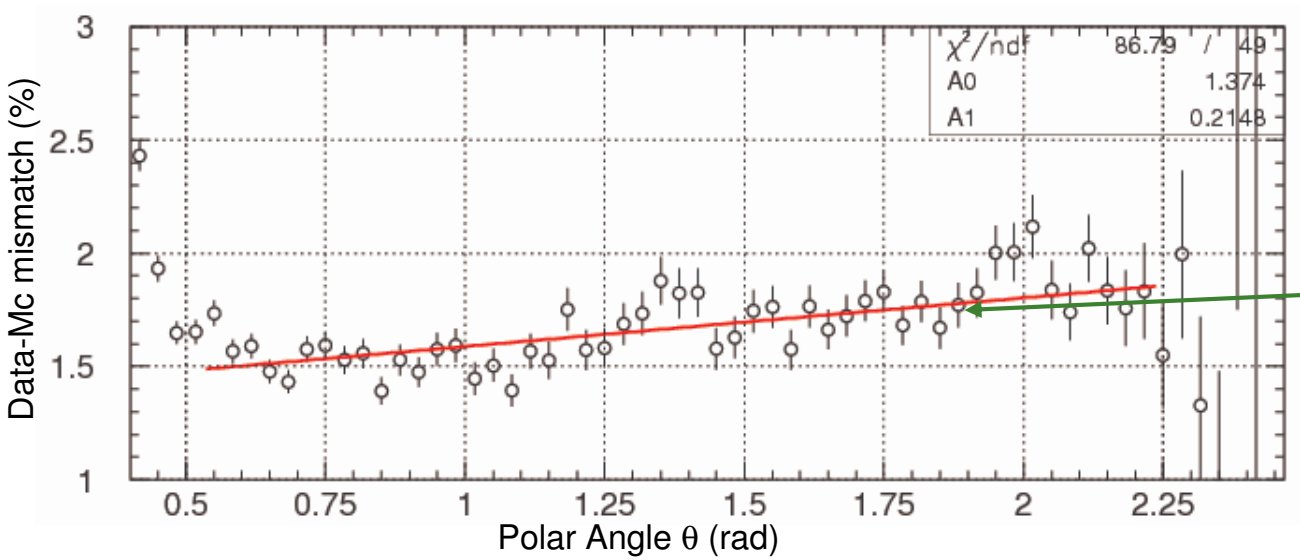
Experimental issues: tracking

- Main issues come from tracking efficiency and data-MC match in reconstruction.
- one can expect to understand the event efficincy up to 0.1% (without dedicated studies)
- Interplay of 2 distinct effects:
  - Diluition: Symmetrical effects affecting reconstruction will smear the cos(θ) distribution introducing systematical errors during unfolding, mainly affects constant term of polynomial ***b***
  - Systematic error: Asymmetrical effects could introduce a bias in the cos(θ) distribution altering the shape ***a***
- These effects introduce further uncertainty ~0.05% but it can be reduced using dedicated studies and control samples

Prospects

Improving knowledge of detector and reconstruction can reduce diluition.
Probably we need to constrain pt to improve data-MC match. Dedicated studies





Control samples from ISR decays shown a data-MC mismatch proportional to polar angle.

This will introduce a linear slope in the cos(θ) distribution.

Not Physical can be used to reduce systematics

Conclusion

- We are working to estimate the exp. systematic limitations that will affect the expectations of hep-ph 0707.2496
- Due to many detector based issues the time scale should be revised too... (we need a great knowledge of detector and reco.. Not feasible on 1st year of running)
- Systematicals coming from tracking will reduce sensitivity as well but we can work around them
- From (very) preliminary studies I would expect a sensitivity of ~1-1.2 10^{-6} @ 75 ab^{-1}

Experimental issues for Magnetic FF

- Using physical constraints (no dependence on the cosine of the polar angle for the cross section) the systematical uncertainty can be reduced.
- Using dedicated studies we can take the systematics under control achieving sensitivities for the Magnetic FF as high as 10^{-6}

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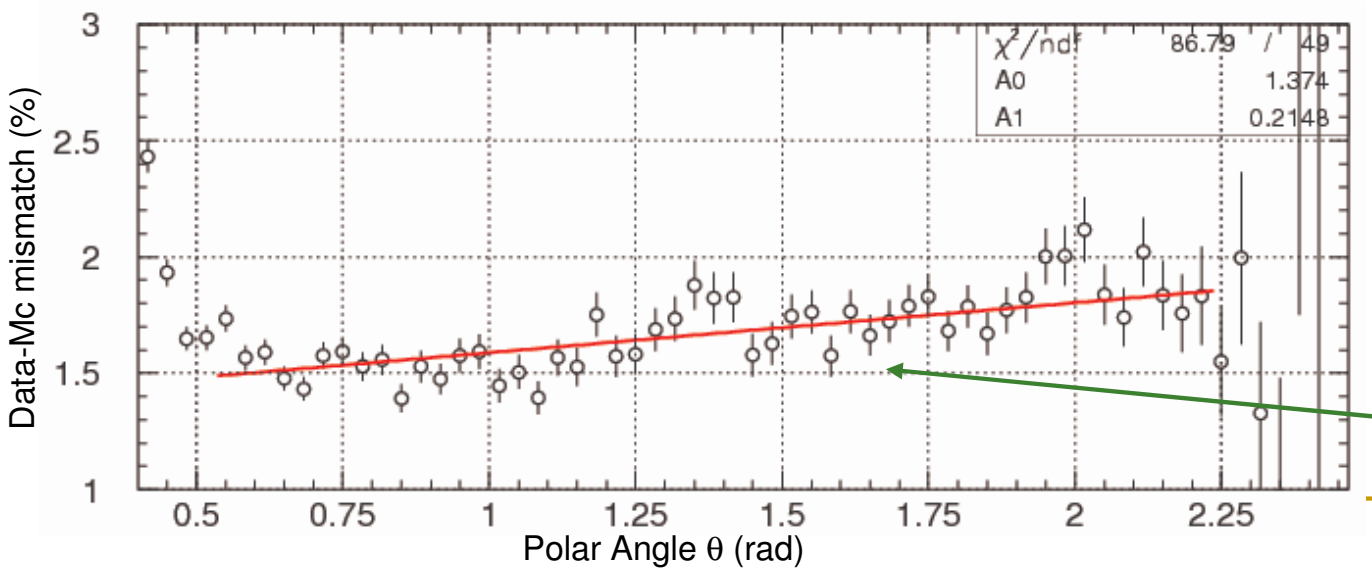
hep-ph 0707.2496

Results achievable



Data-Mc mismatch proportional to polar angle