

$\tau\tau$ Monte Carlo in $B_A B_{AR}$

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$B_A B_{AR}$ Monte Carlo Simulation Workshop

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- Introduction
- New Code from Authors
- 5 π final states
- $e\text{-}\mu$ final states
- Outlook

Introduction

- From SP5 onwards, TauQED AWG switched from **Koralb** to **KK2F** as the default $\tau\tau$ (as well as $\mu\mu$) generator
- **Tauola** is a separate package used by both **Koralb** & **KK2F**
- Currently *BABAR* packages based on **KK2F 4.19**, **Koralb 2.5**, **Tauola 2.6**
- 22 channels (max allowed:30) were defined in **Tauola**

To accomodate need of TauQED AWG inspired analyses, several new decay modes have been added to **Tauola**:

Channel	Decay Mode
23	7 π decay
24	8 π decay
25	neutrinoless 2 body decay
26	neutrinoless 3 body decay
27	C/P $\pi\pi^0$ decay
28	C/P $k\pi$ decay
29	$\eta (\pi/k) \nu$

- In anticipation of more “inspired analyses”, increased number of allowed decay modes from 30 to 99

New Code from Z. Was (23 Apr 2004)

Tauola 2.8: 40 (max 100) extra slots for 4 (or 5) final state scalars using CLEO modelling of hadronic currents

— the used channel numbers are not consecutive : empty slots are initialized to be filled later with different choices of form factors

— overlaps with new channels added by *BABAR*

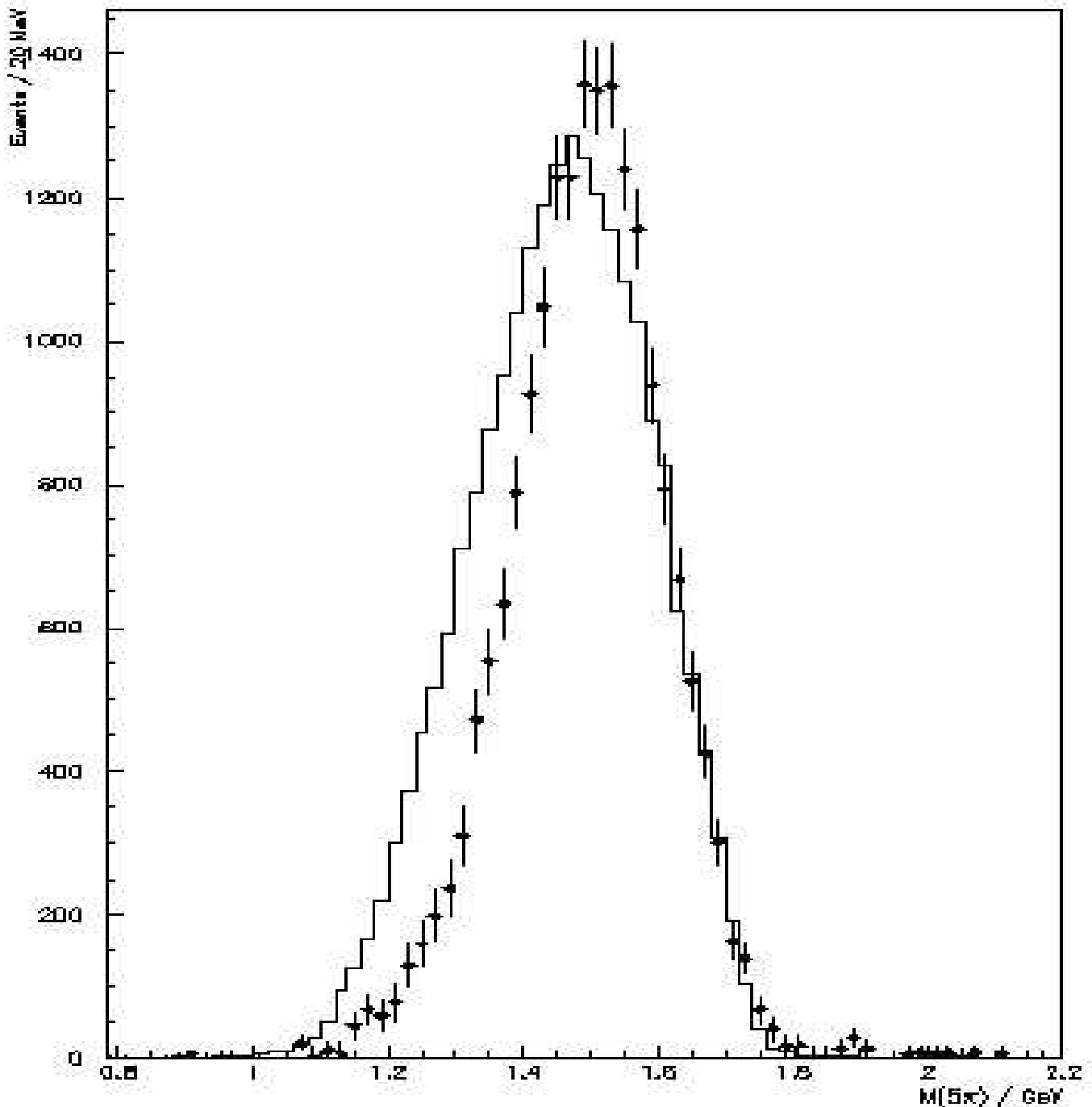
👉 Need to consolidate the 2 versions ...

Take Tauola 2.8 and put in *BABAR* additions

OR

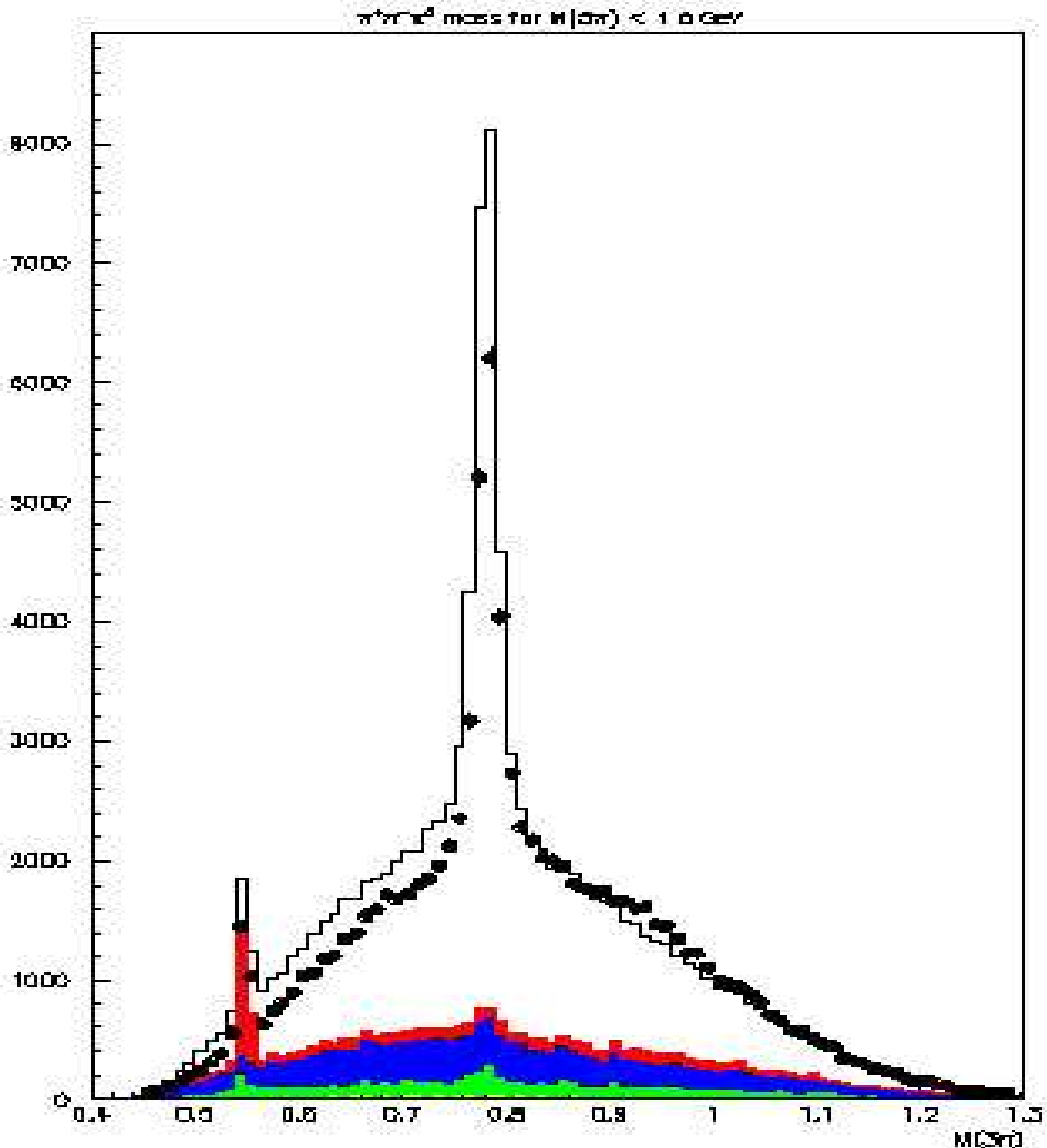
Take *BABAR* version and put in CLEO modelling of 4 (or 5) final states

$\tau^- \rightarrow \pi^- \pi^- \pi^+ \pi^0 \pi^0 \nu$ (George Lafferty)



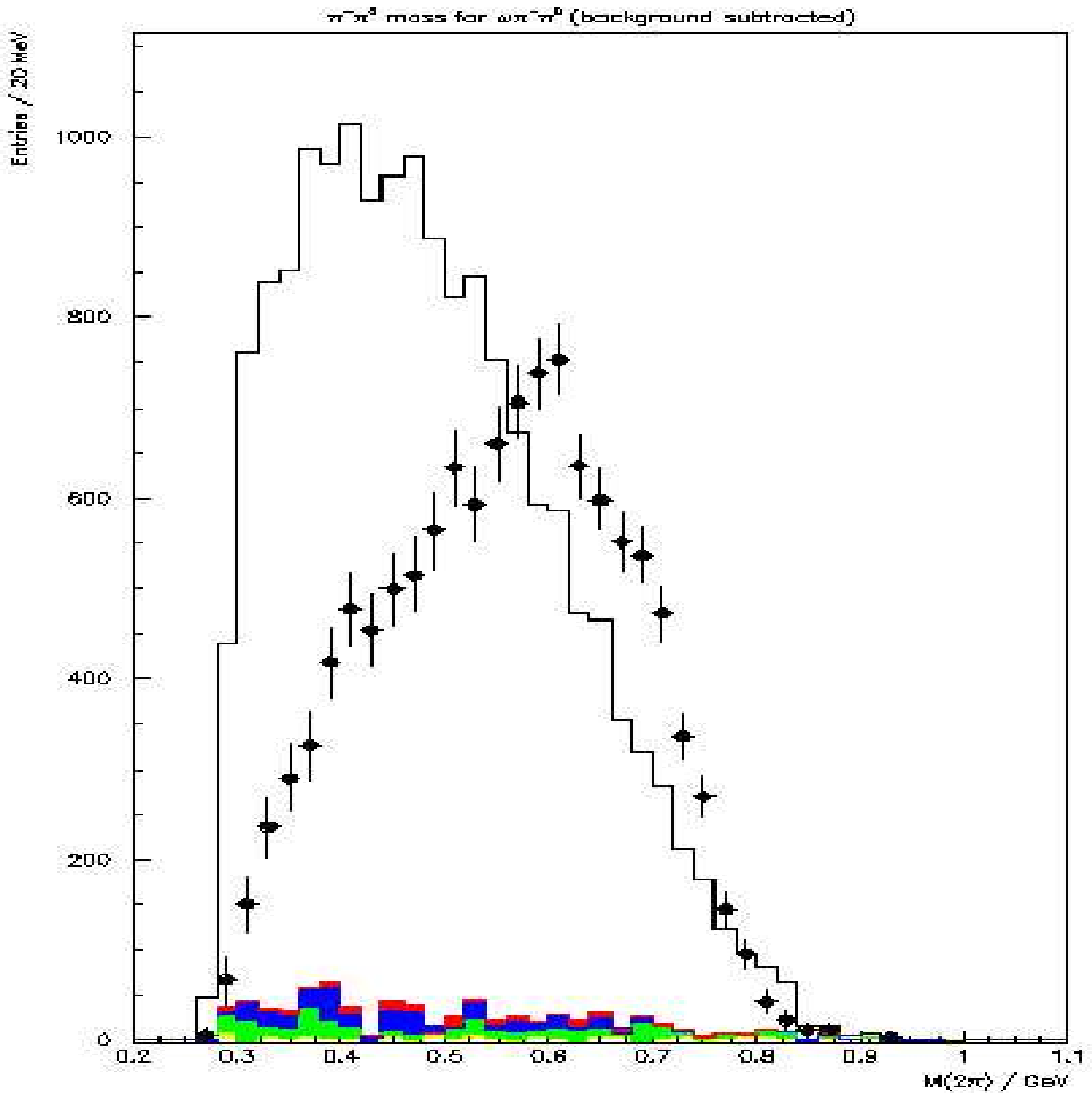
Plot of 5π mass spectrum, with data spectrum narrower and peaking to higher mass than **Tauola**

$$\tau^- \rightarrow \pi^- \pi^- \pi^+ \pi^0 \pi^0 \nu \quad (\text{George Lafferty})$$



Plot of $\pi^+ \pi^- \pi^0$ spectrum, with more $\omega(782)$ in **Tauola** than in data.

$\tau^- \rightarrow \pi^- \pi^- \pi^+ \pi^0 \pi^0 \nu$ (George Lafferty)



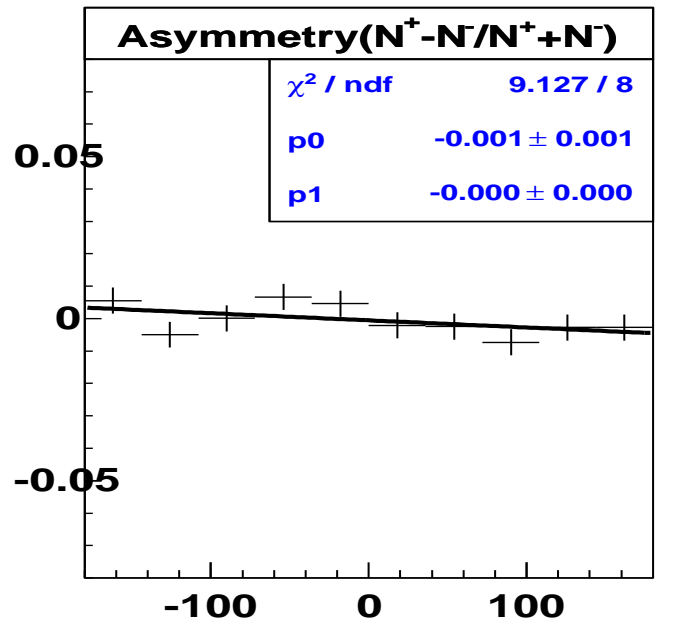
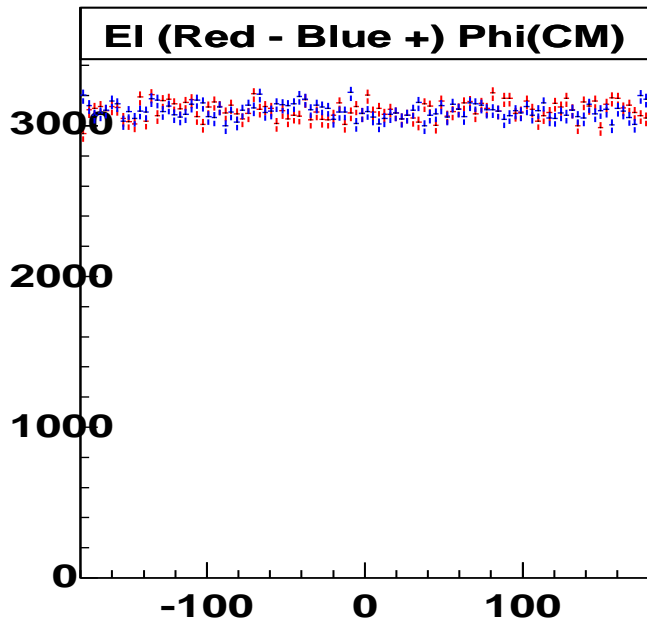
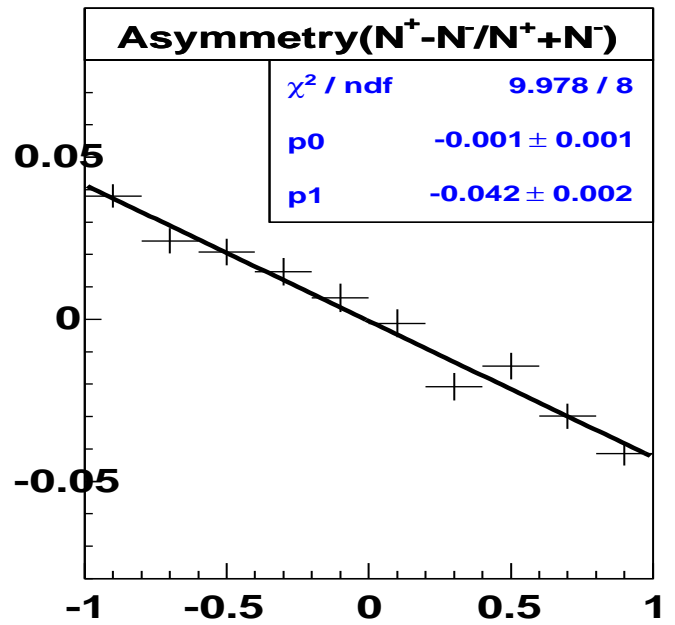
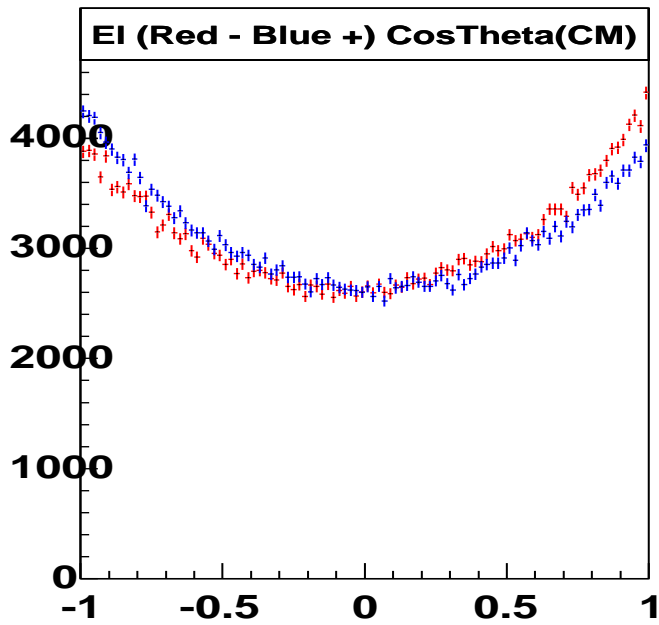
Plot of $\pi^- \pi^0$ mass recoiling against $\omega(782)$. Strong peaking to higher mass in data, possibly the reason for the discrepancy.

$$\tau^- \tau^+ \rightarrow e^- \mu^+ \text{ Vs } \tau^+ \tau^- \rightarrow e^+ \mu^-$$

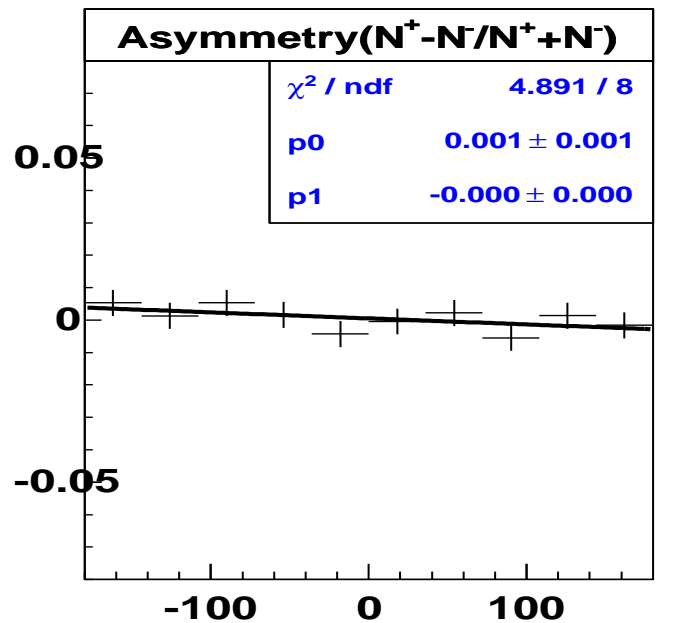
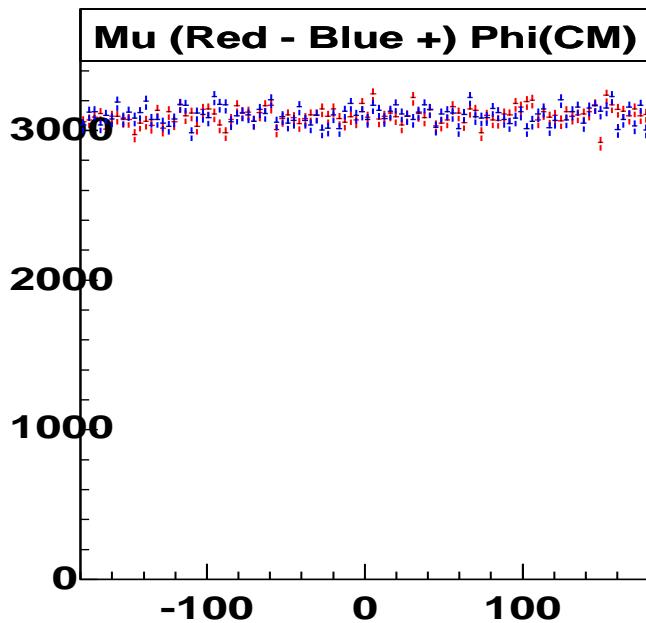
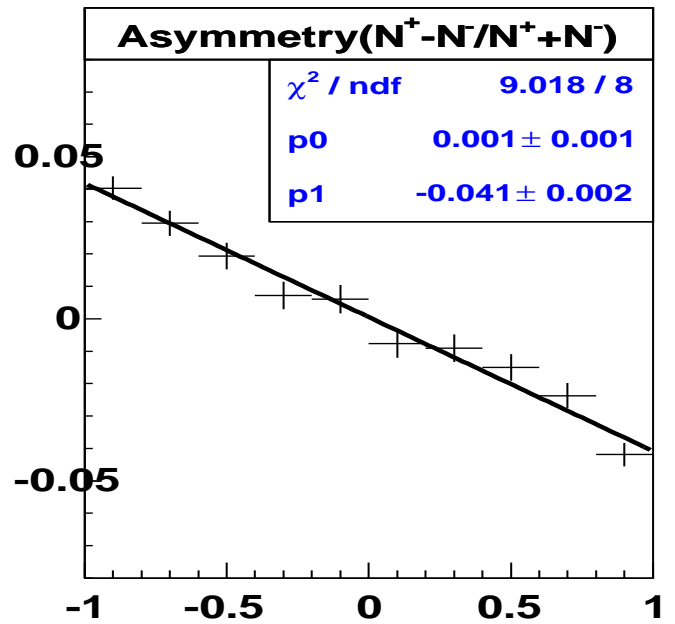
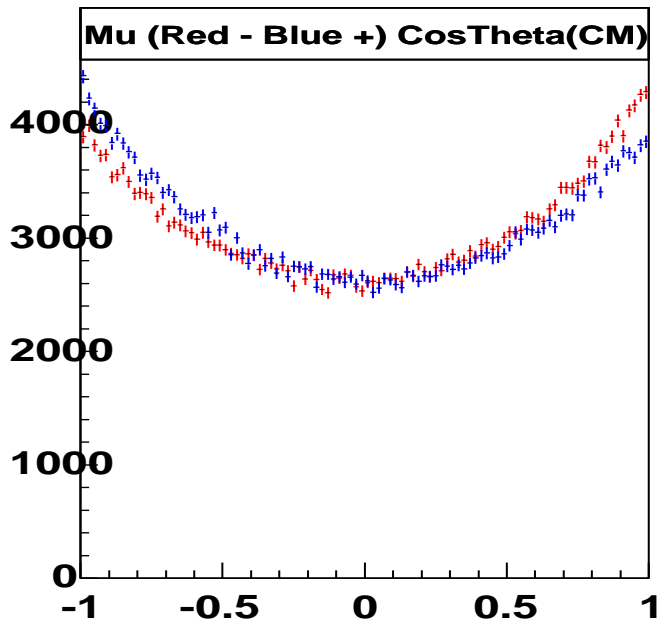
Total $\tau\tau$: 10 M events

$\tau^- \tau^+ \rightarrow e^- \bar{\nu}_e \mu^+ \nu_\mu$: 310359 events

$\tau^+ \tau^- \rightarrow e^+ \nu_e \mu^- \bar{\nu}_\mu$: 310032 events



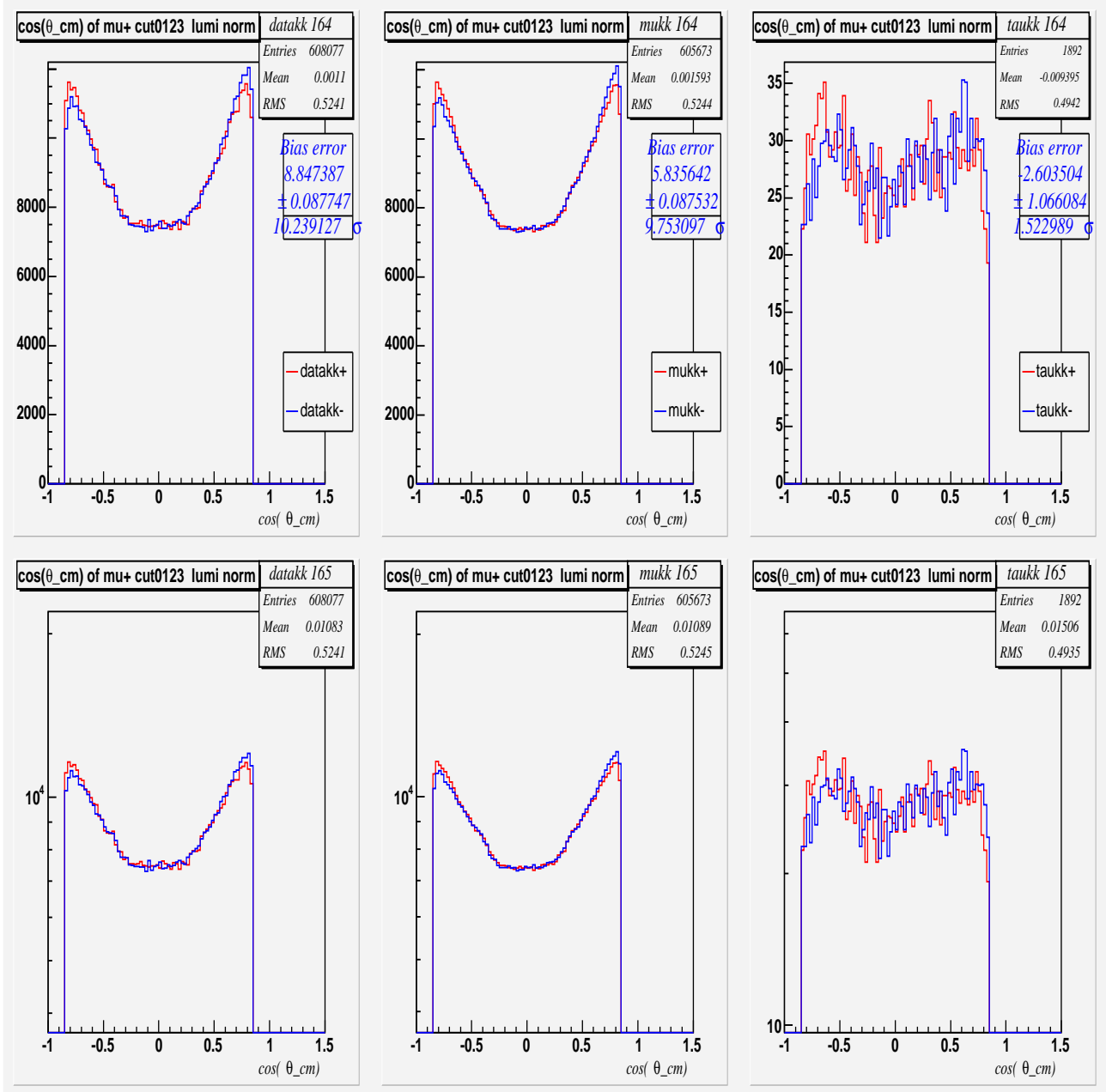
$$\tau^- \tau^+ \rightarrow e^- \mu^+ \text{ Vs } \tau^+ \tau^- \rightarrow e^+ \mu^-$$



Is this asymmetry compatible with Electroweak prediction?

$$\tau^- \tau^+ \rightarrow e^- \mu^+ \text{ Vs } \tau^+ \tau^- \rightarrow e^+ \mu^-$$

sig_mc0 : mukk
 bag_mc0 : taukk udskk



Bias error means (<-> - <+>)/<+>

/home1x/hep/semi/ro/babarwork/d30/./unni.C

Outlook

- $B_A B_{AR}$ data to be used as input to form factors not modelled in generator
- Need to understand if Electroweak asymmetry is modelled correctly
- Consolidate $B_A B_{AR}$ and new **Tauola** versions
- Discuss with Z. Was at Tau04 worksop