Electron Identification at *BABAR*

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BELLE-*BABAR* Workshop

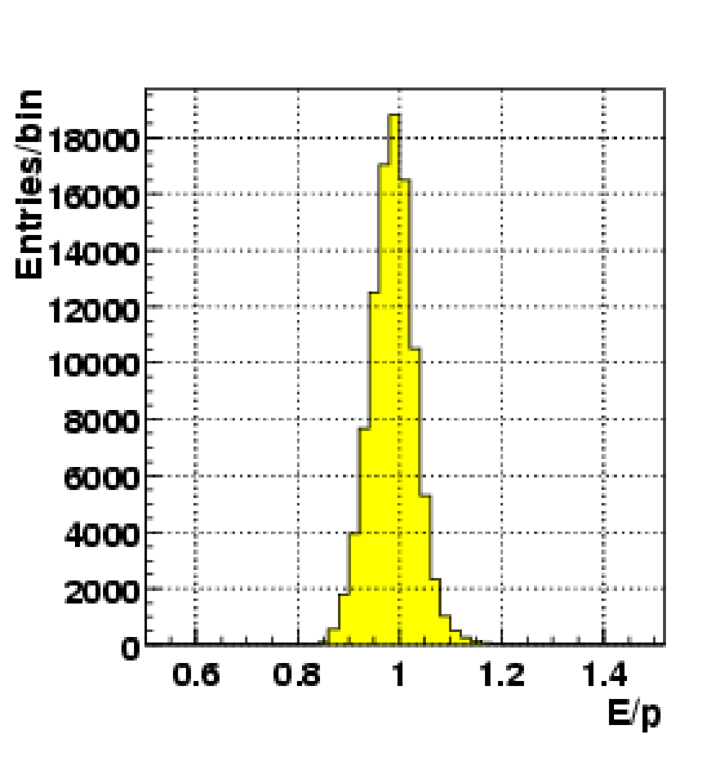
- Electron Identification Algorithm
- Results
- Charge Asymmetry
- Systematic Uncertainty
- Improvements

thanks to Urs Langenegger and Thorsten Brandt

Electron Identification Algorithm

Cut Based Algorithm

- E/P cut between 0.89-1.2
- LAT $= \frac{\sum_{i=3}^{n} E_i r_i^2}{\sum_{i=3}^{n} E_i r_i^2 + E_1 r_0^2 + E_2 r_0^2}$
- Zernicke Moment A_{42}
- track to EMC match
- DCH dE/dx cut at 2.2σ
- DIRC θ_C cut at 3σ

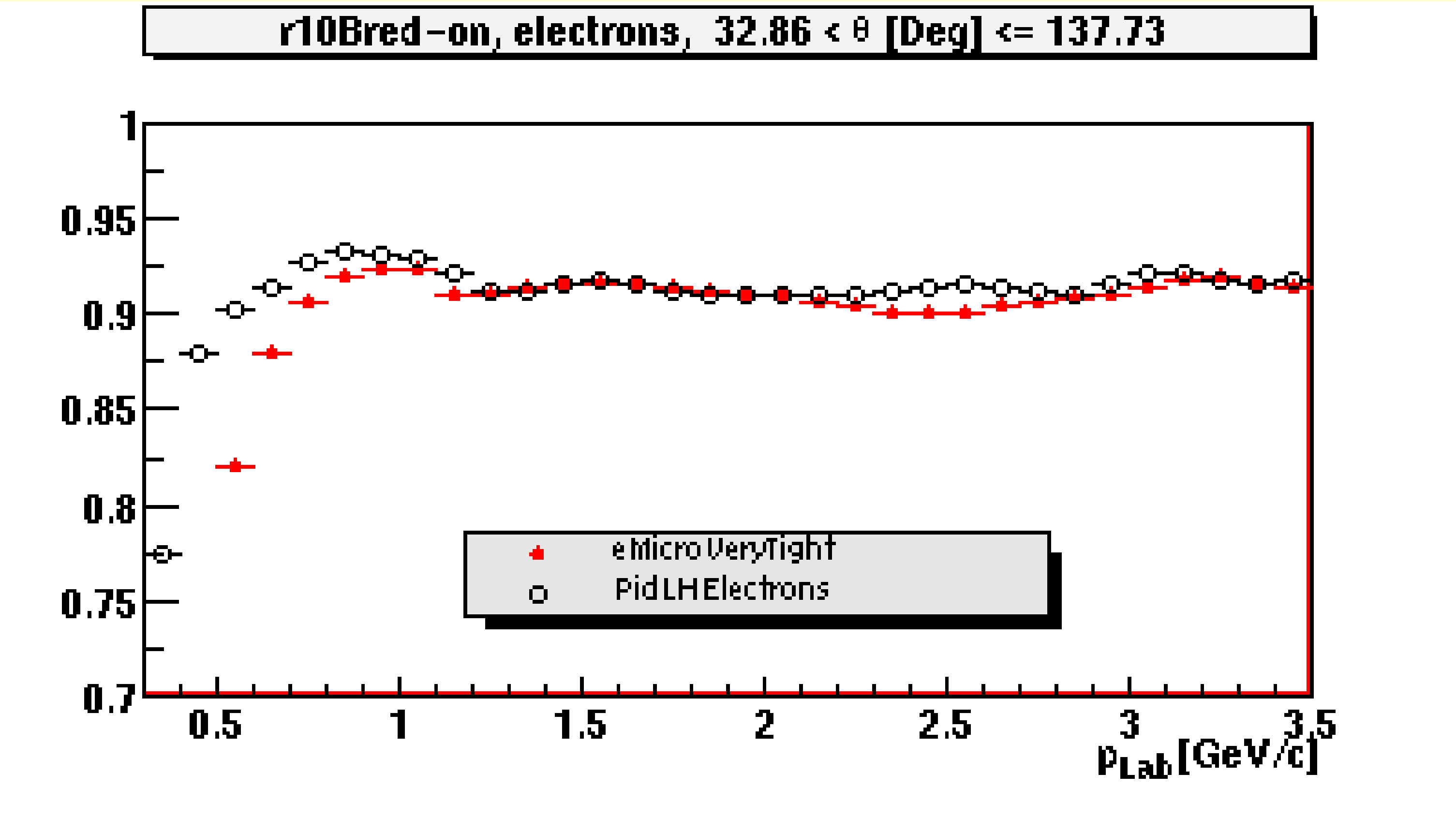


Electron Identification Algorithm

Likelihood Method

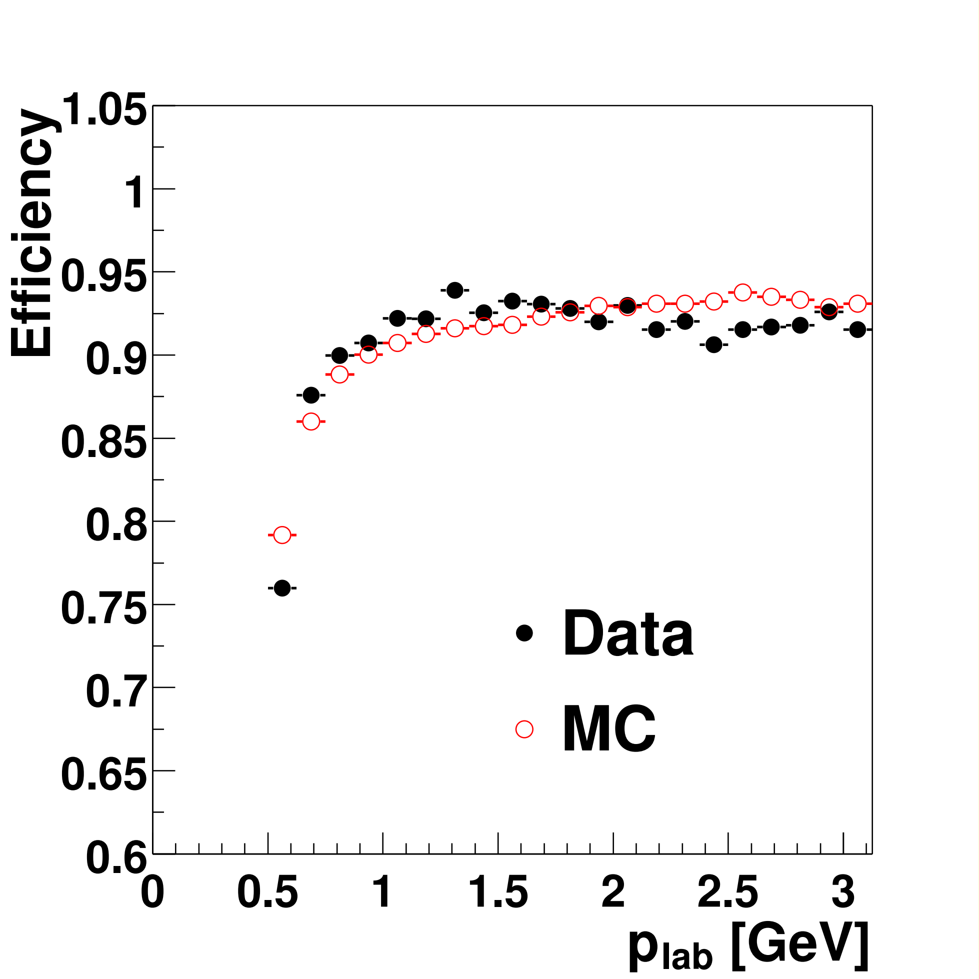
- E/P in bins of p_{LAB}
- LAT $= \frac{\sum_{i=3}^{n} E_i r_i^2}{\sum_{i=3}^{n} E_i r_i^2 + E_1 r_0^2 + E_2 r_0^2}$ in bins of p_{LAB} and E/P
- track to EMC $\Delta\phi$
- DCH dE/dx in bins of p_{LAB} with non-Gaussian tails
- DIRC θ_C in bins of p_{LAB} with non-Gaussian tails

Electron Efficiency



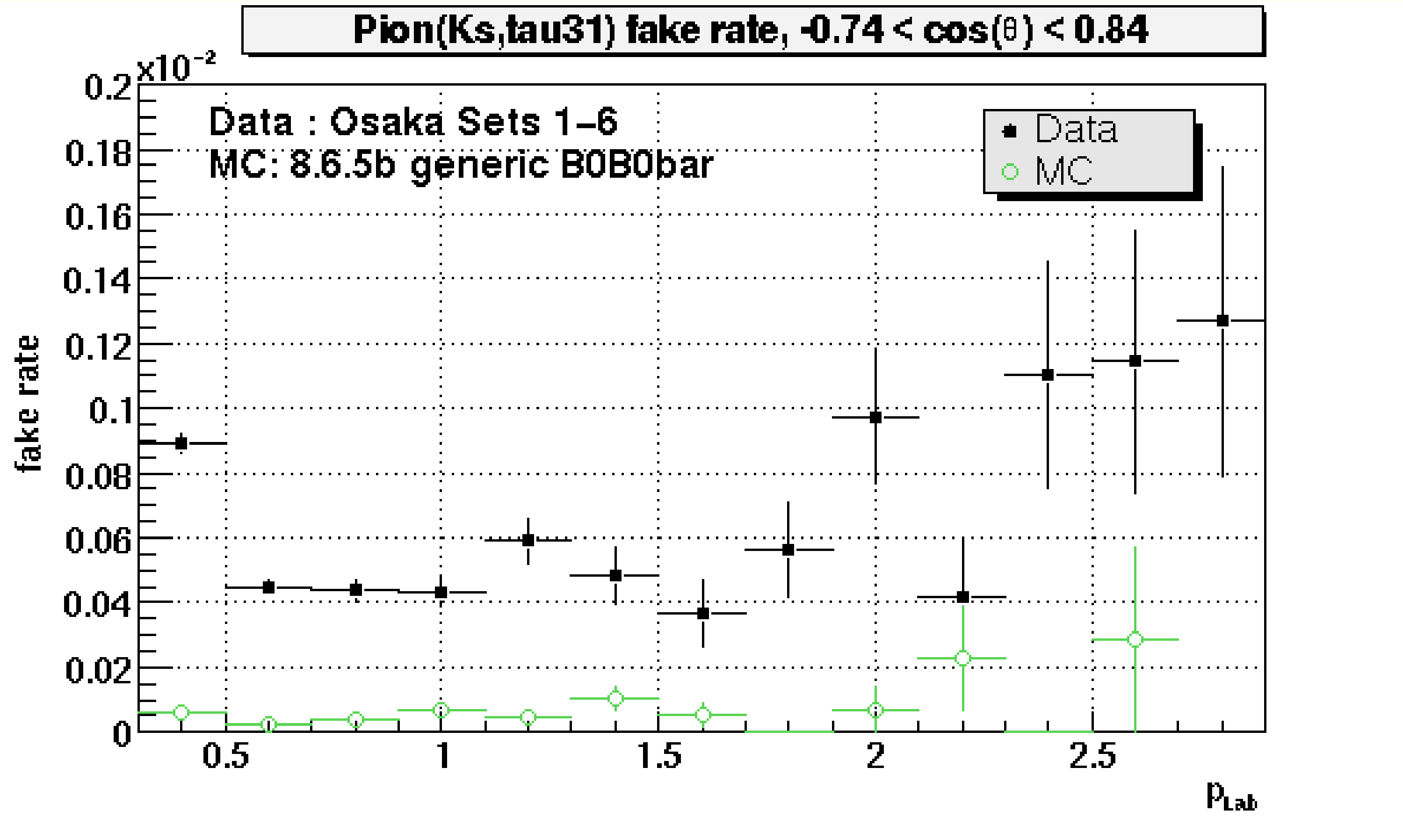
Electron sample taken from radiative Bhabha events
Almost all of the 2001 data run.

Electron Efficiency in Simulation



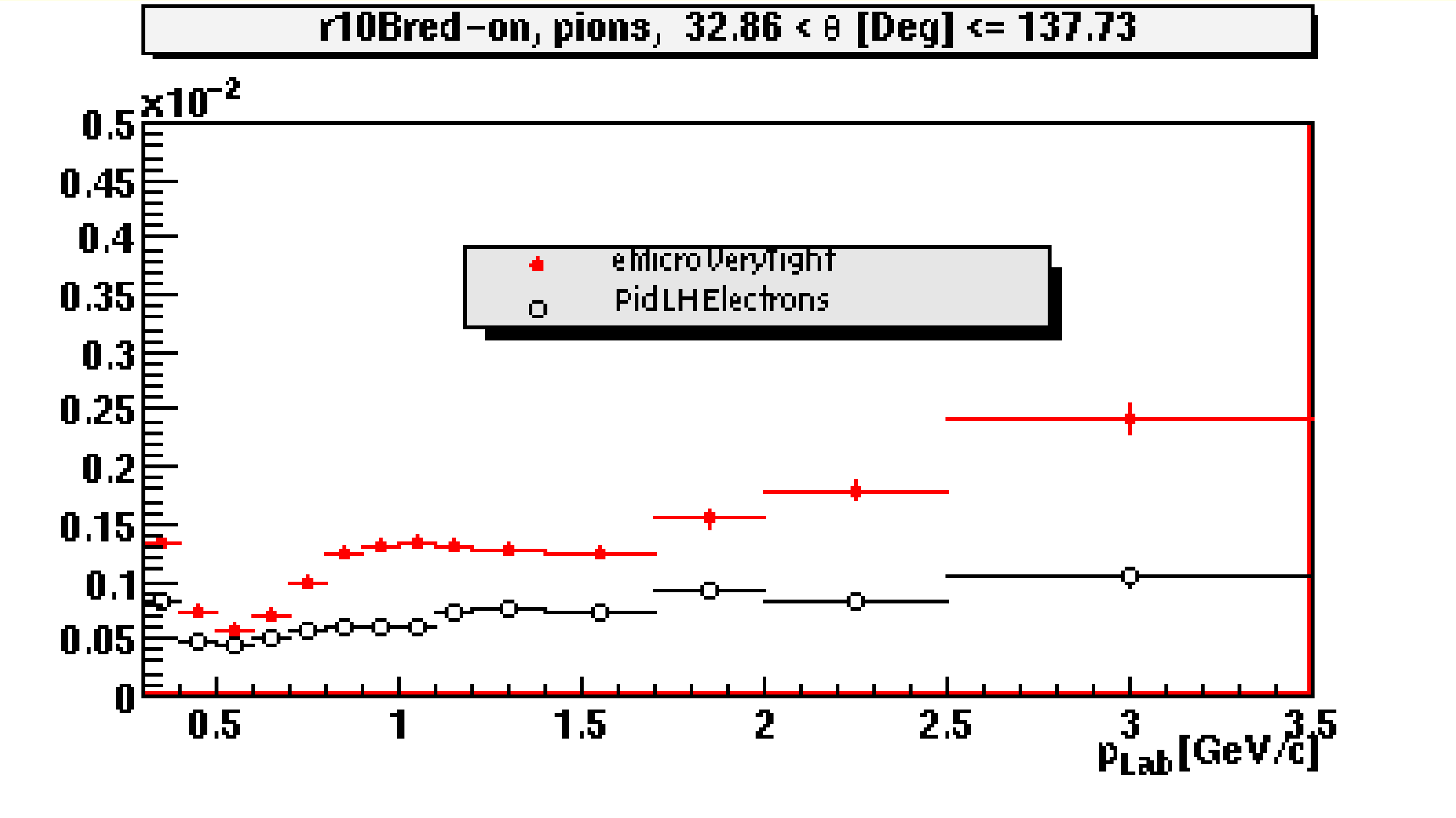
Data is from radiative Bhabhas, Simulation is from Hadronic Events

Electron MisIdentification in Simulation



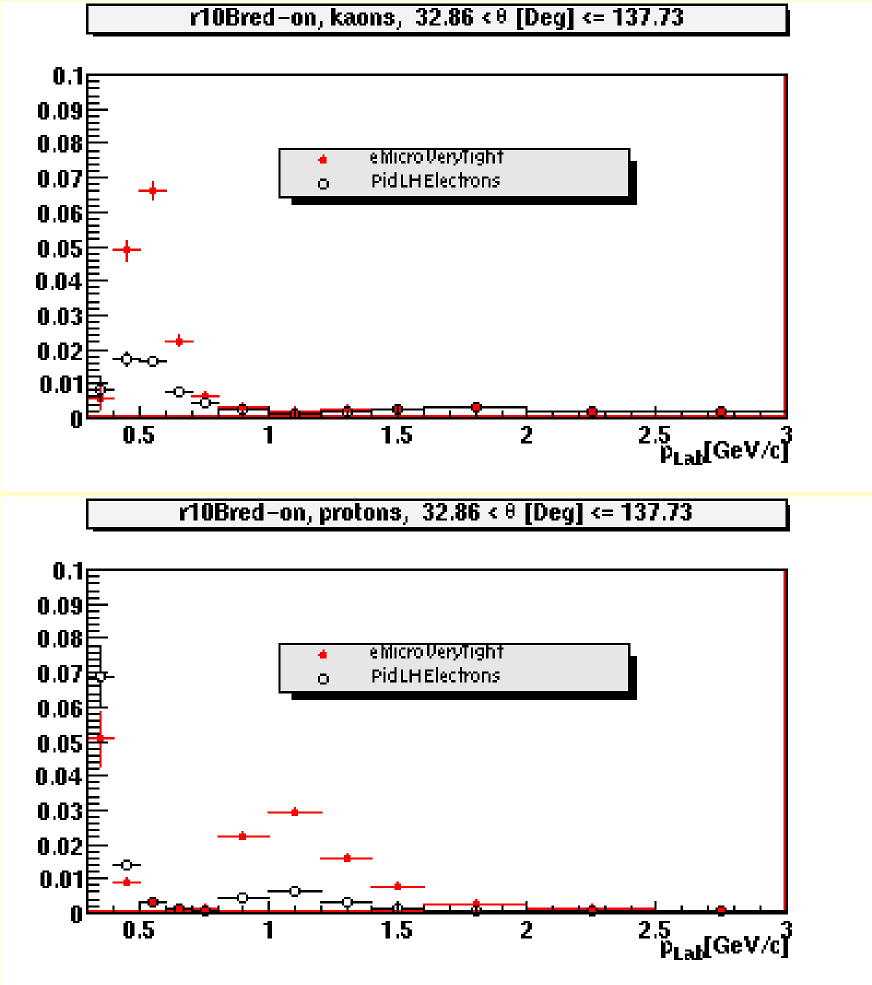
Pion sample from $K_S^0 \to \pi^- \pi^+$ and τ decays

Pion MisIdentification



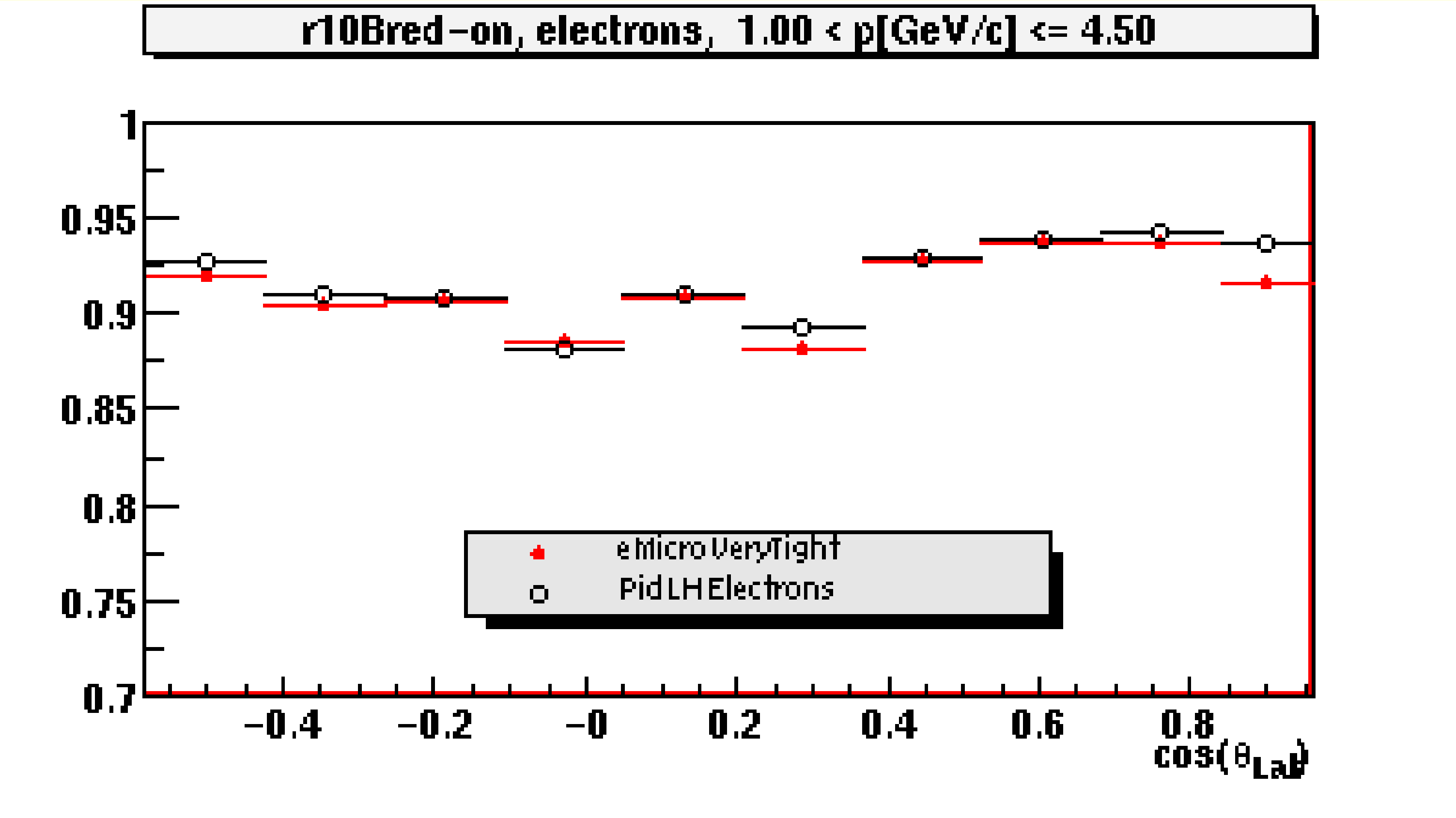
Pion sample from $K_S^0 \to \pi^-\pi^+$ and τ decays.

Hadron MisIdentification



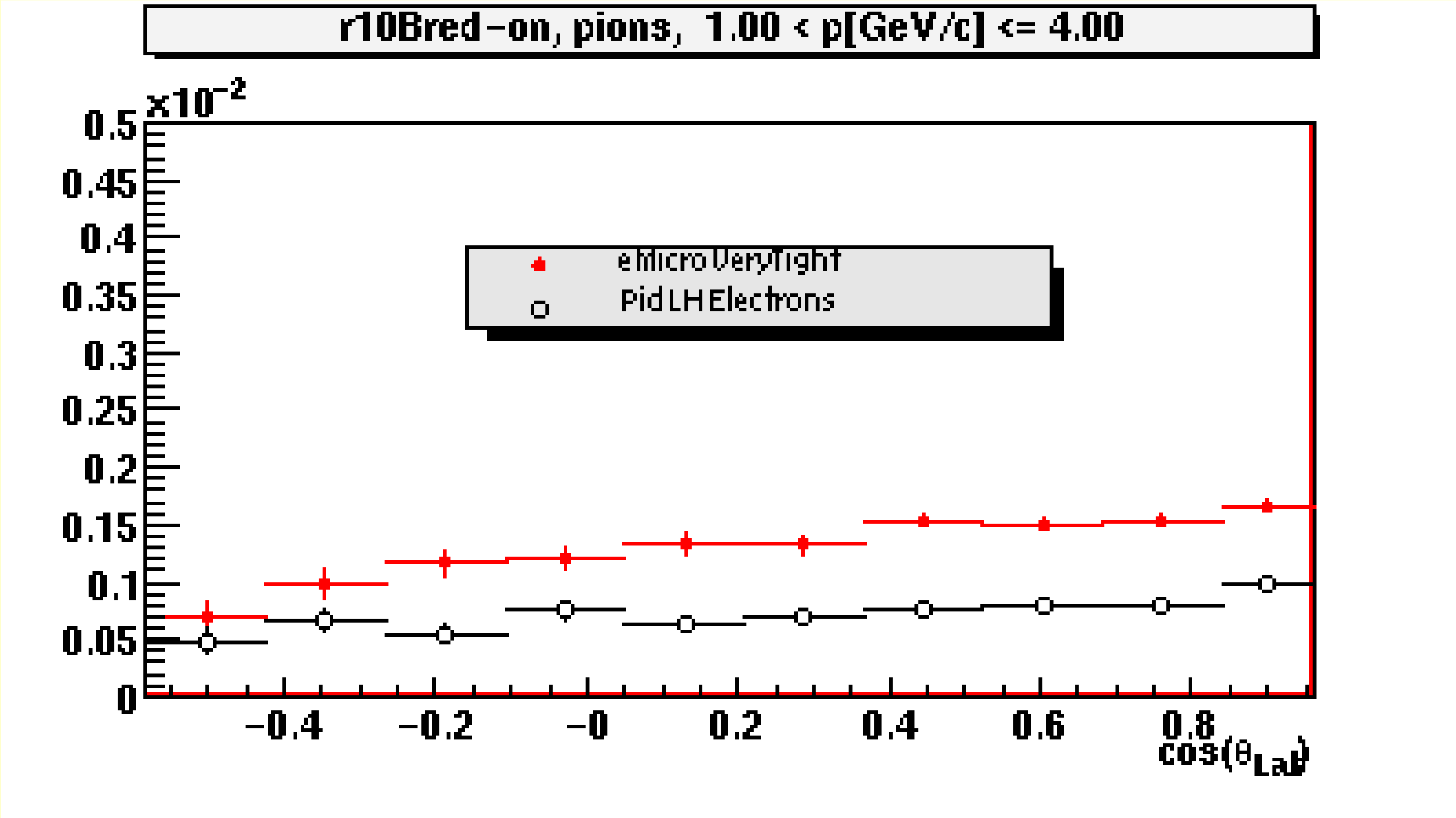
Kaon sample from D^* and $D \to K^+\pi^-$ decays
Proton sample from Λ decays

Electron Efficiency



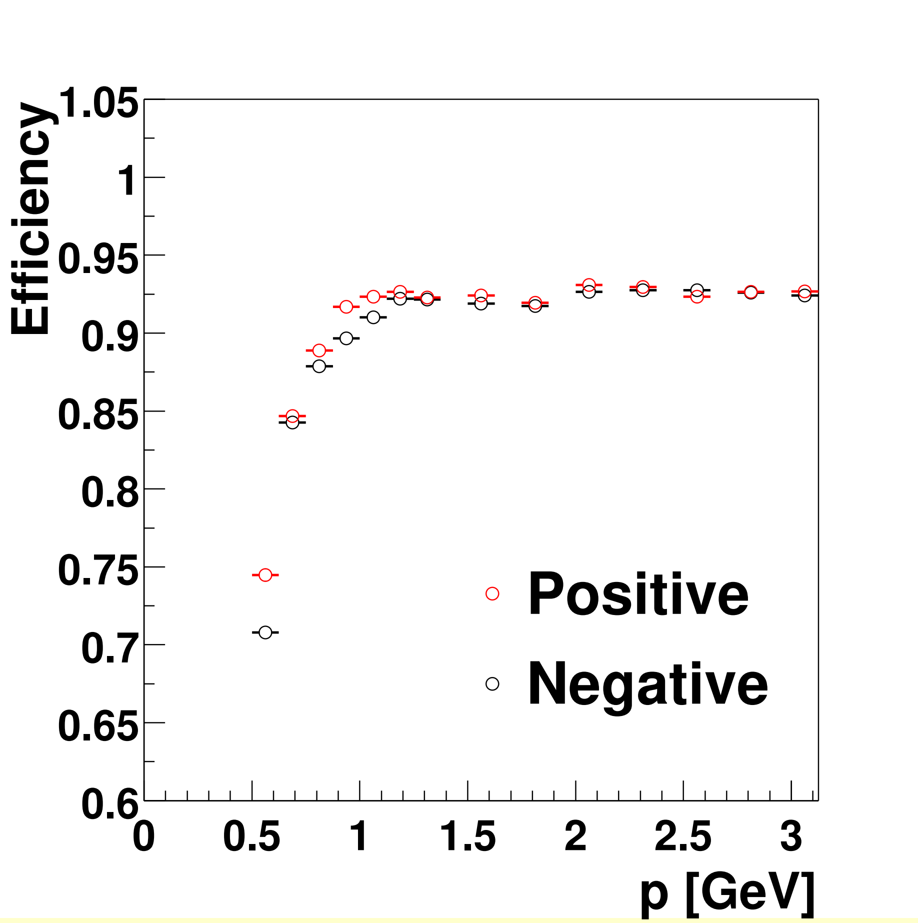
Electron efficiency as a function of $\cos\theta$

Pion MisIdentification



Pion misidentification as a function of $\cos\theta$

Charge Asymmetry



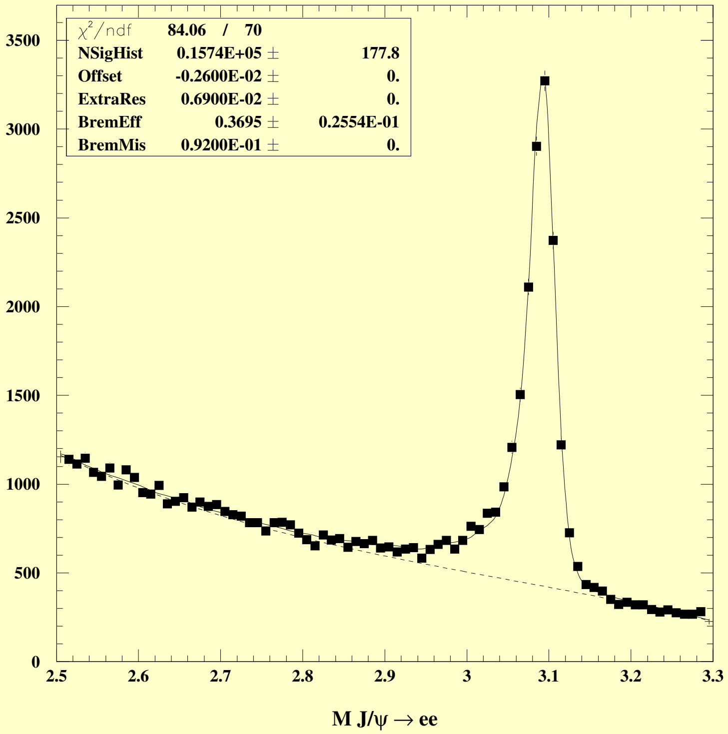
Some of the charge asymmetry comes from the DCH dE/dx requirement. Looser selections omitting dE/dx show less charge asymmetry.

Relevant for measurement of the dilepton CP asymmetry

Systematic Uncertainty

Relevant for measurements of $|V_{cb}|$ and branching fraction measurements of $B \to J/\psi$

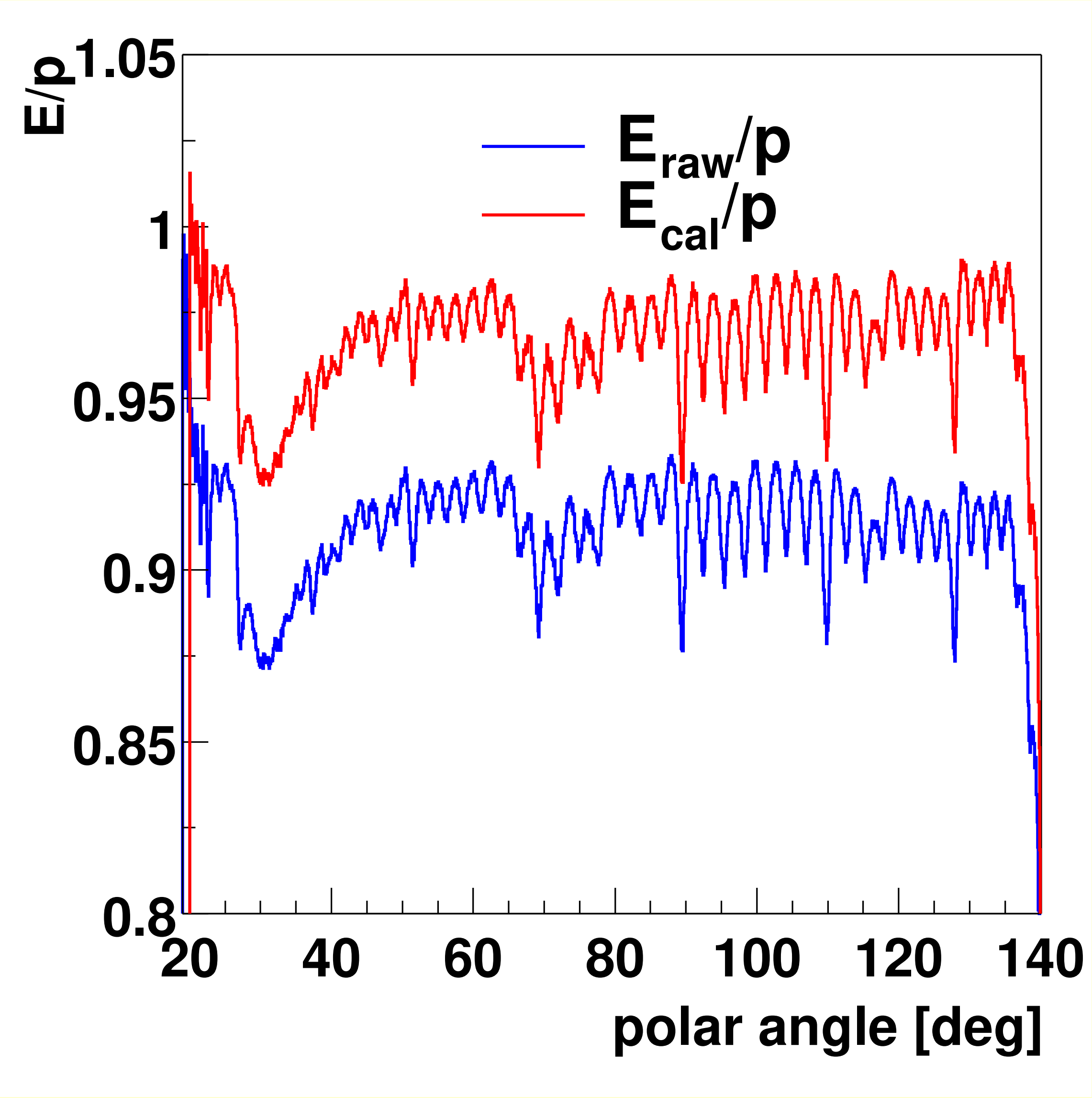
Evaluate systematic uncertainty from using sparse radiative Bhabha events to measure the efficiency in hadronic events. Use $J/\psi \to l^+l^-$ decays to evaluate efficiency in hadronic events.



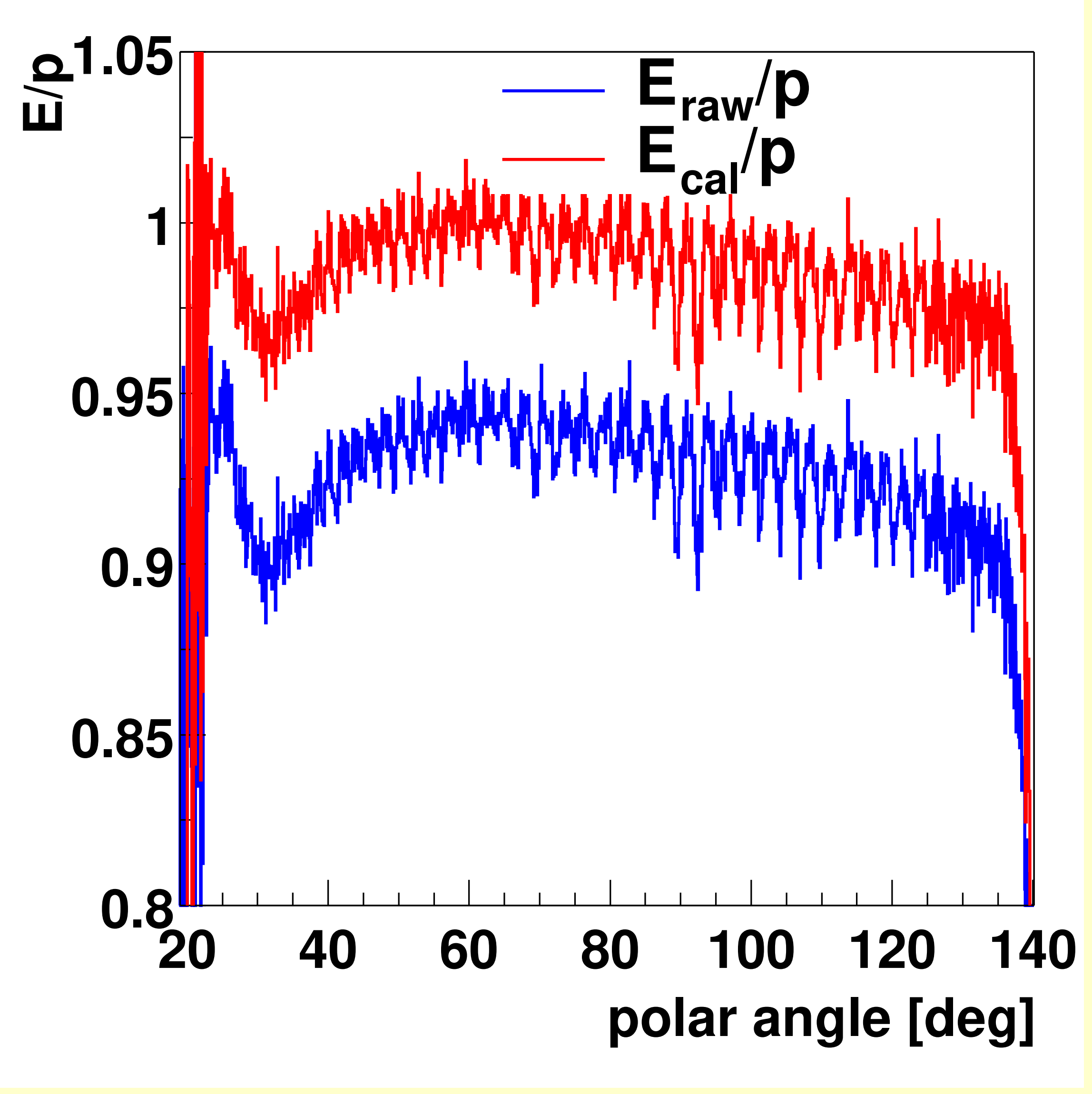
Criteria	J/ψ /Bhahba +(-)	Syst. +(-) (%)
VeryTight	0.968 (0.978)	1.9 (1.9)
Tight	0.980 (0.980)	1.4 (1.4)
Loose	0.990 (0.981)	1.4 (1.4)
VeryLoose	0.991 (0.983)	1.3 (1.3)

Electron Id improvements

E/P variations within crystals



E/P variations within crystals in Simulation



Conclusions

- **Electron efficiency of 91%** above .75 GeV and over (almost) entire calorimeter
- **Pion misidentification of 0.05%**
- Systematic uncertainty on the efficiency of less than 2%
- Charge asymmetry of less than 1%
- Electron identification works extremely well at *BABAR*