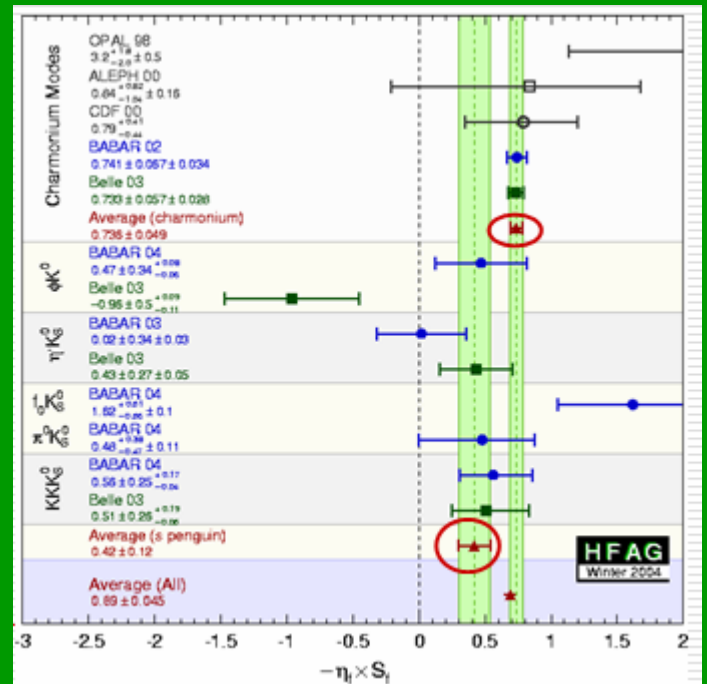
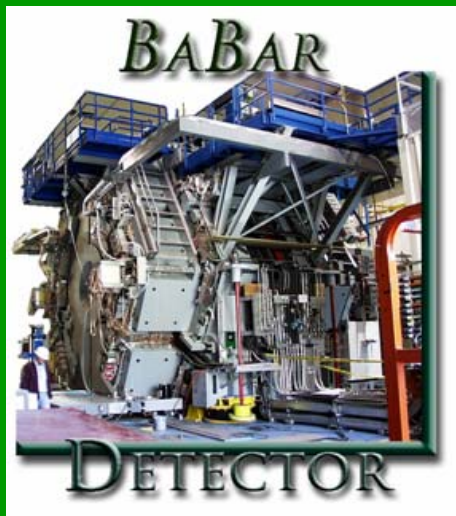


SLAC BaBar Program

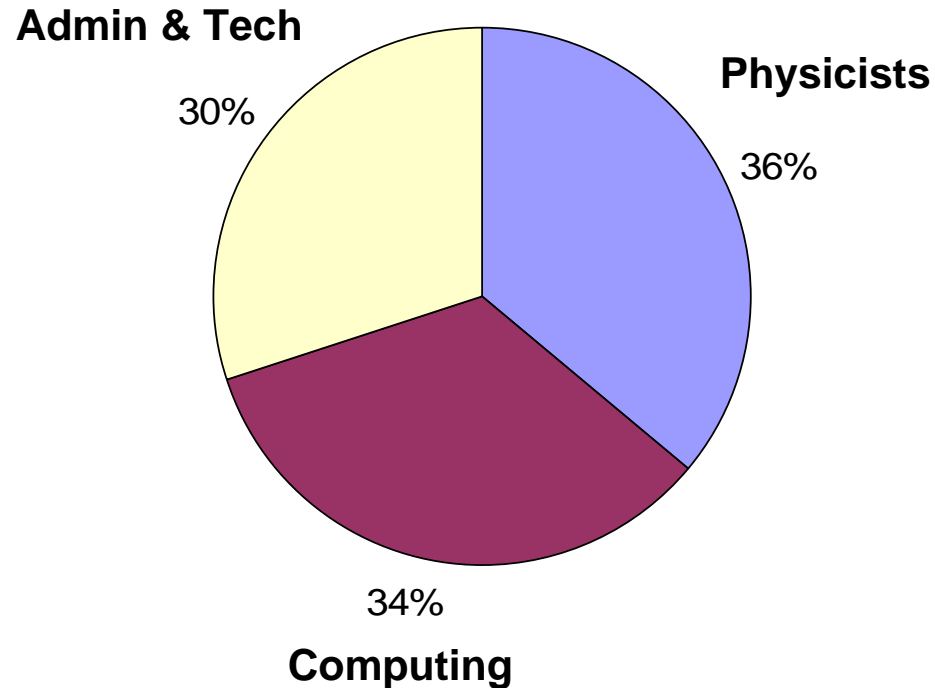


Blair Ratcliff
 SLAC BaBar Program Manager
 June 2004

Elements of SLAC BaBar Program

- Computing operations/infrastructure (Richard; Rainer)
- Detector Operations and Technical Management (Bill)
- **Physics Collaborators (David; Blair)**
 - **Detector Support (“service”) (David; Bill)**
 - **Computing (Rainer)**
 - **Leadership & Management (David; Bill)**
 - **Upgrades (David; Bill; Marcello)**
 - **Physics Analysis (David; Jeff)**

SLAC BaBar Program Manpower

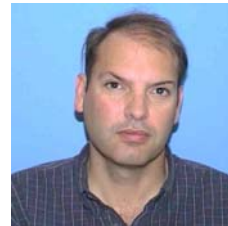


Physics Program Support

- Detector “Service”
 - (~2x nominal collaboration average)
- Leadership
 - Collaboration Management
 - Technical Coordinator
 - Computing Coordinator
 - Operations and Technical
 - Operations Manager
 - System Leadership & Technical Board
 - DCH
 - DIRC
 - Trigger
 - Physics and Tools Convenors (6/39)
 - Pentaquark Task Force
 - Hadronic Spectra
 - Radiative Penguin
 - Inclusive Semileptonic
 - PID
 - Standing and Ad-hoc Committees
 - Exec board; IFR replacement committee Co-Chair; Pub Board; CM2 Oversight; Roadmap Committee; etc.

Physics Program Support-Education

- 8 Stanford Ph.D. Graduate Students
- 14 RAs
- Last year's Research Associates/Fellows
 - How many did we turnover? 6
 - Where are they now?
 - Mark Convery - SLAC Staff
 - Oliver Buchmueller - CERN Staff
 - Urs Langenegger - Hiedelberg → ETH
 - Collin Jessop - Notre Dame, Assoc. Professor
 - Sibylle Petrak - Darmstadt, RA in Renewable Energy
 - Steve Robertson - NSERC Fellow; Assist. Professor, McGill

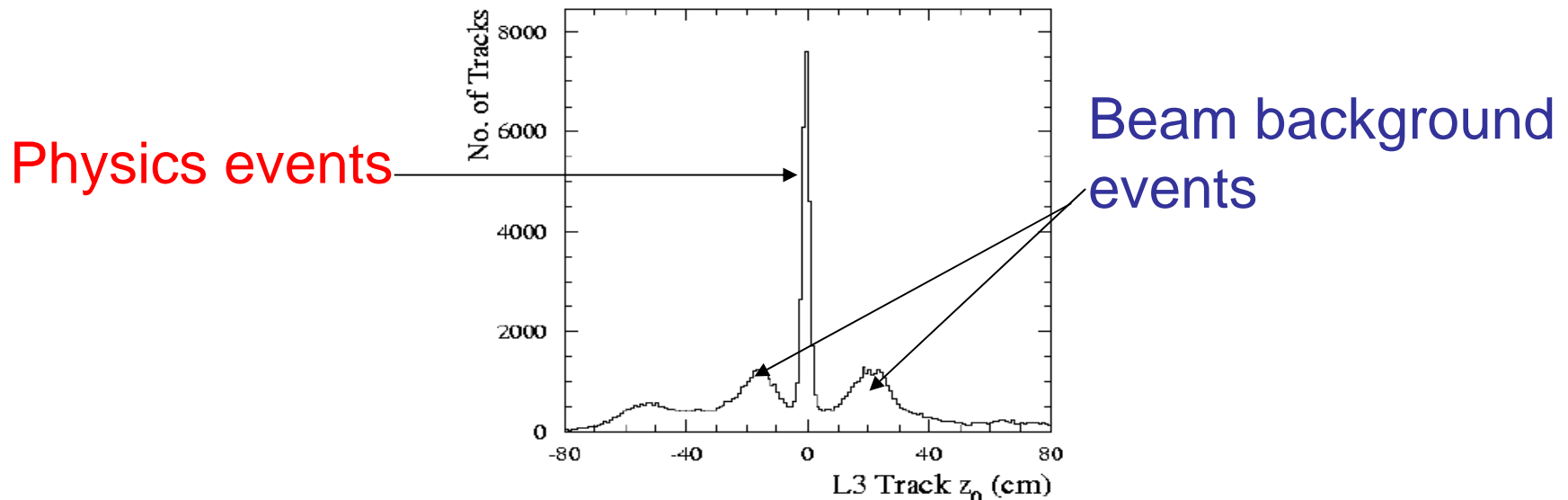


Future Challenges-as Lumi Grows

- Static (or modestly shrinking) Collaboration Manpower
 - Ever larger data sets for Physics Analyses
 - Necessary Computing Base Growth
 - Long Term Plans
- Detector Upgrades to cope with increasing backgrounds
 - Trigger
 - IFR Barrel
 - DCH Electronics

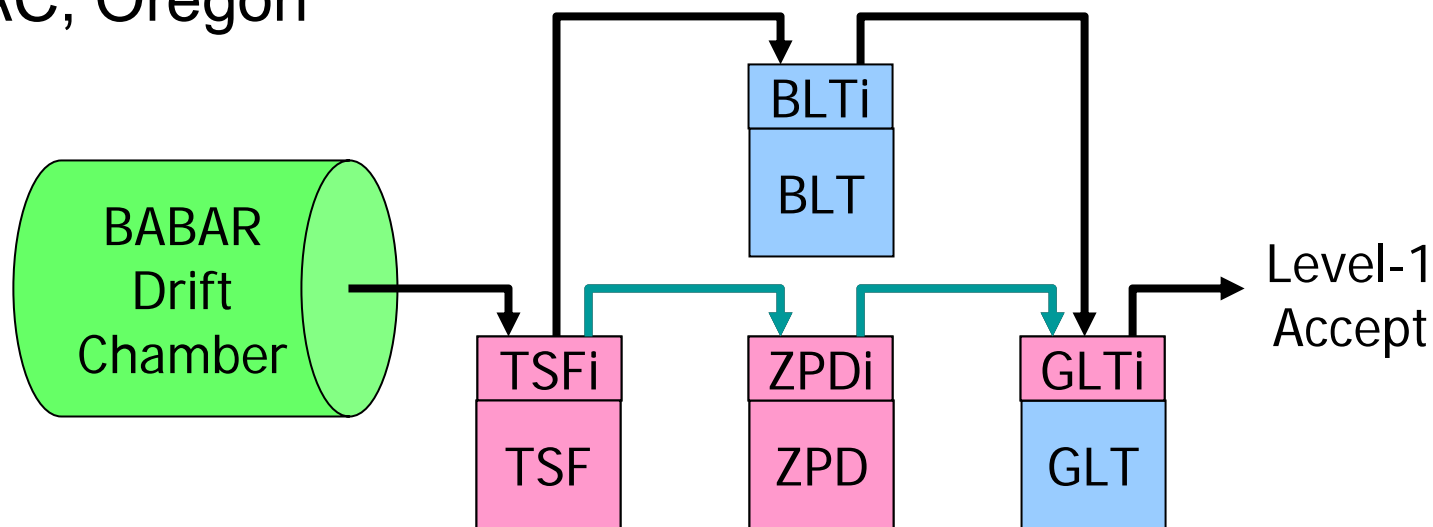
L1 Trigger Upgrade (DCZ)

- DCT (current) selects tracks with high Pt (PTD)
- New system (DCZ) will also allow selection on Z_0 of track
 - ❑ Will reduce L1 rate due to beam related background.
 - ❑ Essential for running at luminosities $> \sim 10^{34}$



L1 Trigger Upgrade

Inst. involved: Harvard, Manchester, Bristol, Iowa, RAL, SLAC, Oregon



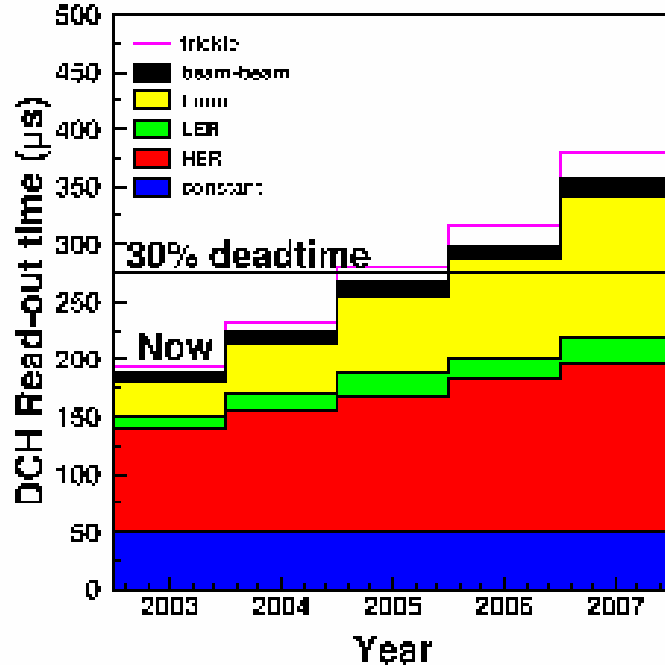
Need:

- 8 ZPD boards (to do the track fit in 3D)
- 24 New TSF boards to replace existing TSF (need to ship out axial & stereo layers to ZPD)
- Interface cards (24 TSFi, 8 ZPDi and 1 GLTi)
- Some modification to the GLT firmware

Trigger Upgrade

- New TSF board production started and delivery in May
- TSF/ZPD firmware in good shape
- First triggering BaBar with New trigger system by the end this run (July).

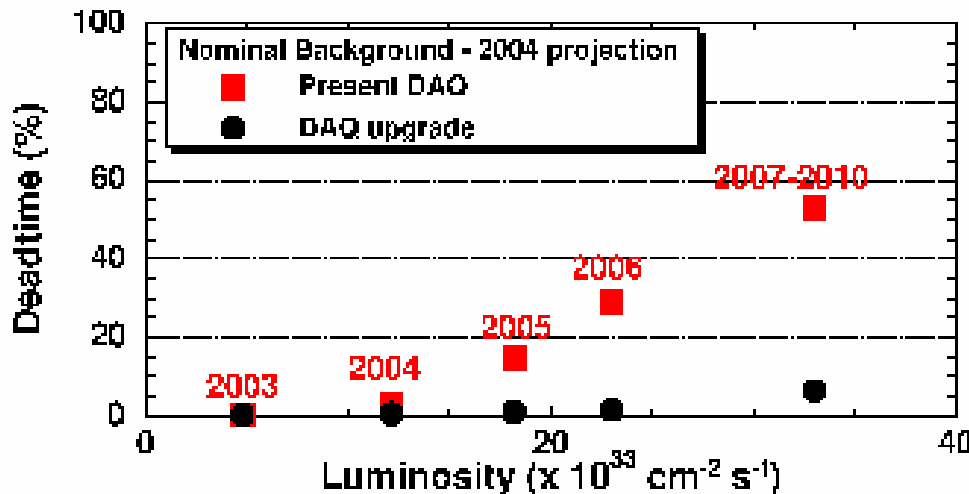
BaBar Drift Chamber Electronics Upgrade



- Dead-time induced by data transfer will soon be a serious issue as Lumi continues to increase.
- Drift Chamber Upgrade Task Force formed July 2003 (ISU, Notre Dame, SLAC).

Proposal:

- Move feature extraction into front-end → factor of 5 gain.
- Replace FPGAs on 3 front-end boards.
- Engineering started at SLAC May 17
- **To be deployed 2005.**



IFR Barrel Upgrade Responsibilities

INFN: Ferrara, Frascati,
Genova, Padova, Roma,
Torino

LST Tube Production and Factory QA;
Front End Electronics; Installation

US: LLNL, Ohio State,
Oregon, Princeton, SLAC,
UCSD

Readout Planes; Module Assembly; HV
System; Cabling; Gas System;
Installation

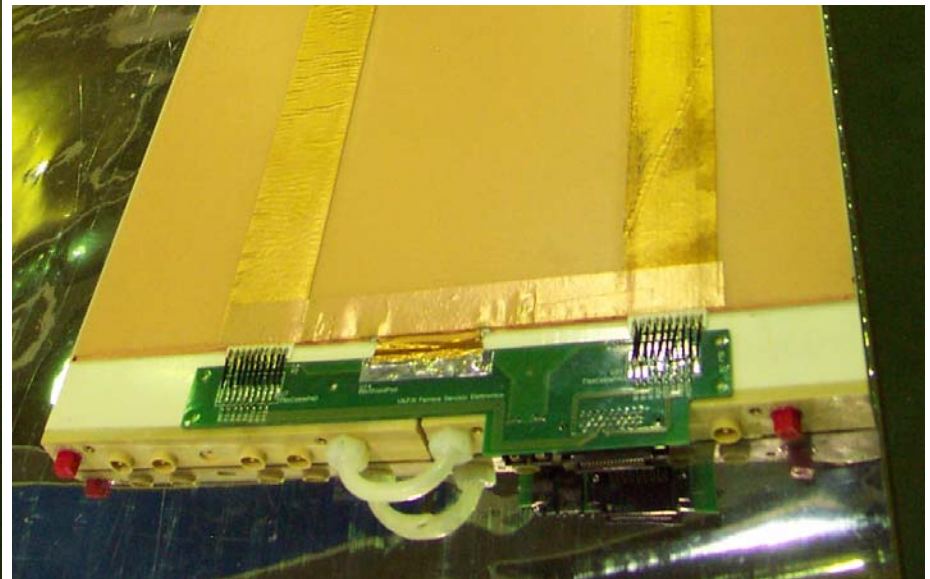
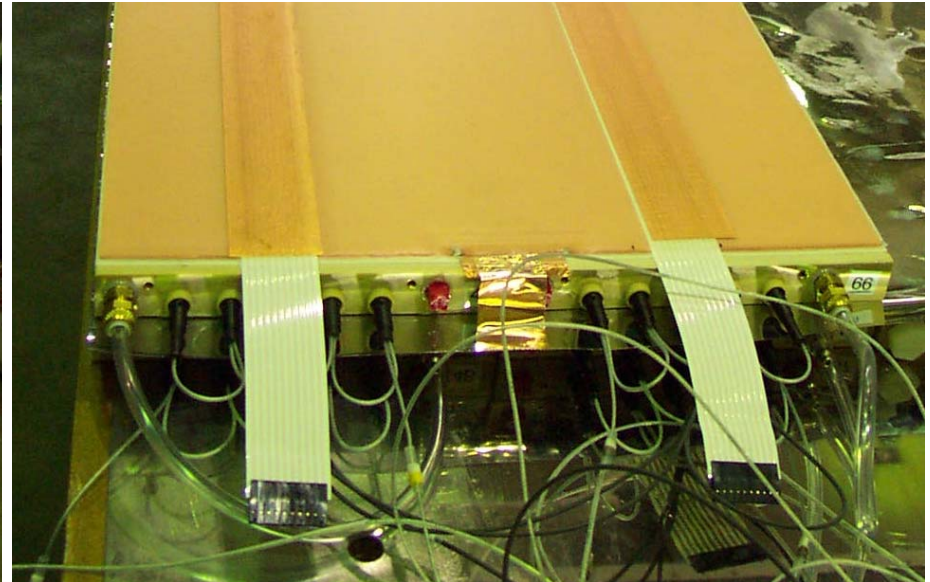
Readout Plane Production

- Manufactured at SLAC using “Large scale lamination.”
- Only Z-planes provide a position. Phi planes serve as the ground plane and transmit wire signals to forward end.
- Manufactured at SLAC using “Large scale lamination”
- Production of ~700 Phi planes now completed and shipped to Princeton and OSU for module production.
- Z-planes now in production. Summer 2004 needs will be completed by June 15.



Module Assembly

SLAC readout strip plane



2004-5 Milestones

- **Aug 1 -- RPC Removal begins**
 - **Oct 6 -- Installation Complete (2 Sextants)**
 - **Oct 10 -- Close Detector**
 - **Oct 15 -- Run 5 Begins**
 - **Oct 1, '04 -- Module construction complete**
 - **Aug 1 '05 -- RPC removal begins**
 - **Jul 2005 -- Install remaining 4 Sextants**
- The project remains on schedule, though clearly tight. All detectors and components perform at design specifications.**

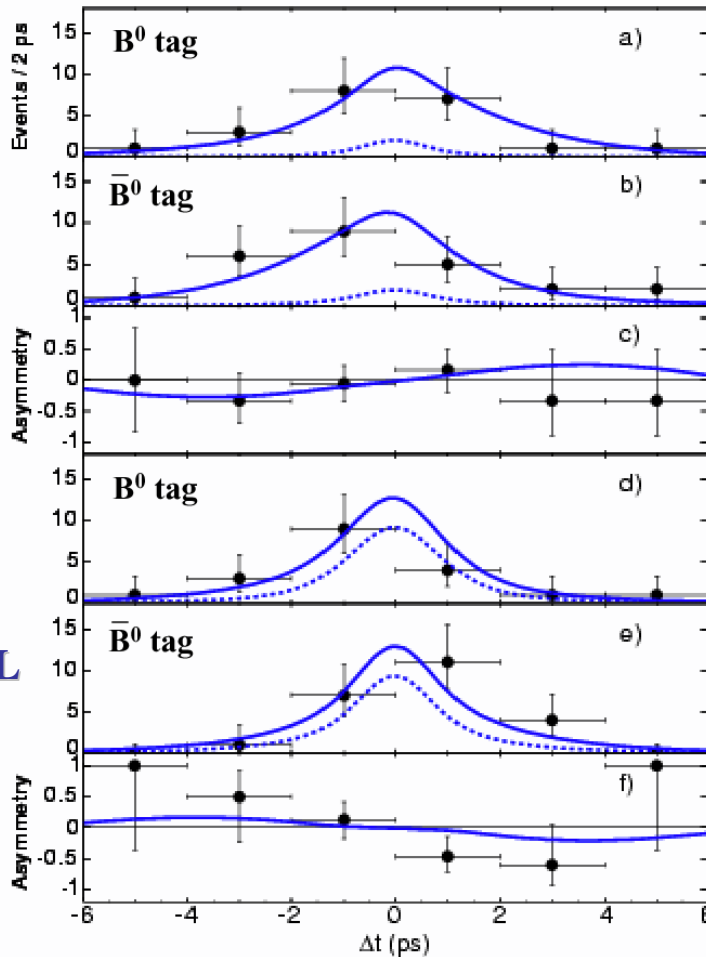
Physics Analysis

- Fully collaborative physics analysis model..... across institutions and groups.
- Broad program. Many different “key” results.
- Some examples of SLAC BaBar’s interests:
 - CP Violation in $B \rightarrow \pi^0 \pi^0$ &, more generally, $B \rightarrow mm'$ where m and m' are charmless mesons.
 - Inclusive semi-leptonic B decays and the extraction of $|V_{ub}|$ & $|V_{cb}|$
 - CP Violation in $B \rightarrow \phi K_s$; $B \rightarrow K^+ K^- K_s$; $B \rightarrow K_L K_s K_s$
 - Search for Exotic Baryons (Pentaquarks)
 - Search for narrow mesonic resonances (D_s , X(3872), etc.)
 - Inclusive Hadronic Spectra; $\pi, K, p, \phi, \eta, \Lambda_c, \dots$
 - Radiative Penguin decays; Inclusive $b \rightarrow s \gamma$; Inclusive $b \rightarrow d \gamma$; $B \rightarrow K^* \gamma$; $B \rightarrow \rho \gamma$; $B \rightarrow \phi \gamma$; etc.
 - ISR; Exclusive hadronic final states; Inclusive and exclusive measurements of R.
 - Leptonic b & c decays; (e.g., $B \rightarrow \tau \nu(e \nu)(\mu \nu)$; $D \rightarrow \mu \nu$; $D_s \rightarrow \mu \nu (\tau \nu)$)
 - Exclusive B decays; $B \rightarrow p+p-\pi, K, K^*$; $B \rightarrow \eta' K^*$
- A couple of recent results....just for fun.

$B \rightarrow \phi K_S, \phi K_L$

S. Spanier and M. Krishnamurthy; presented by M. Verderi at Moriond EW. Submitted to PRL.

$B \rightarrow \phi K_S$



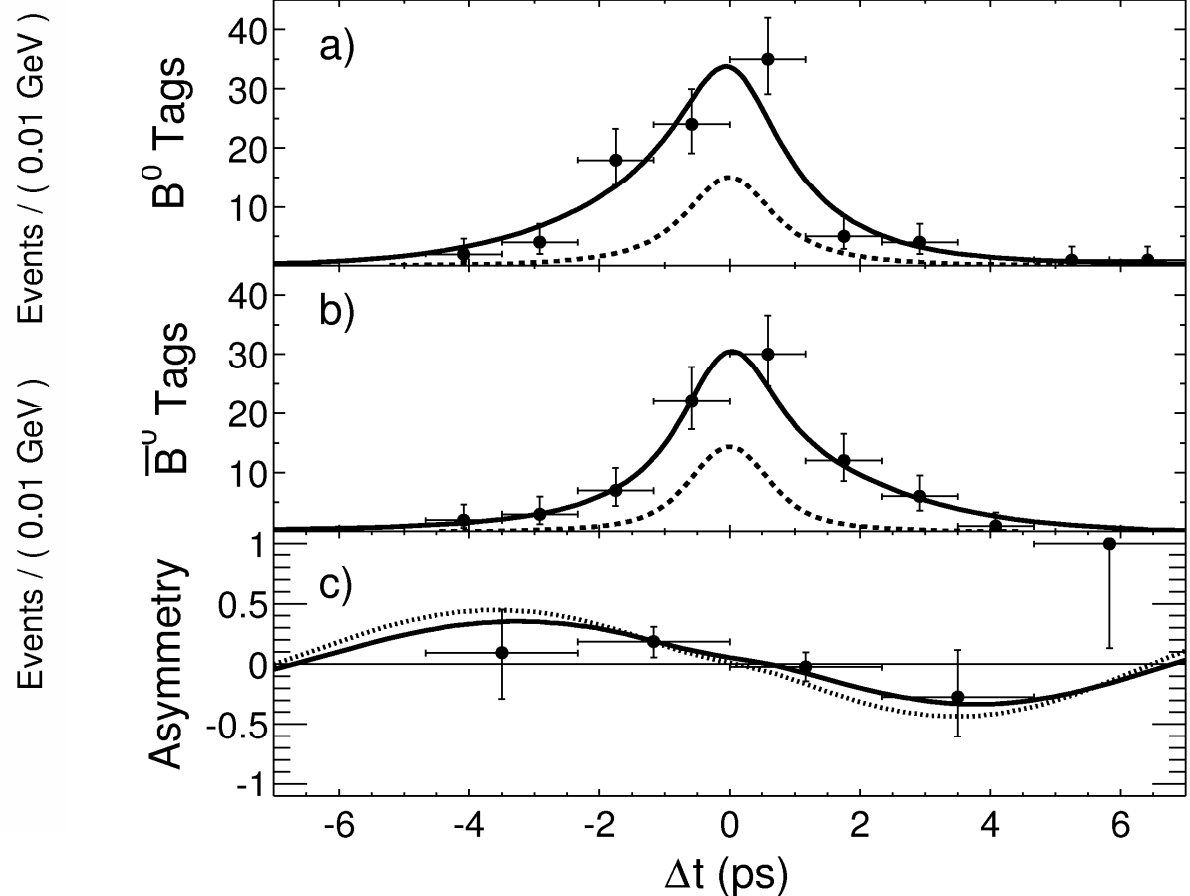
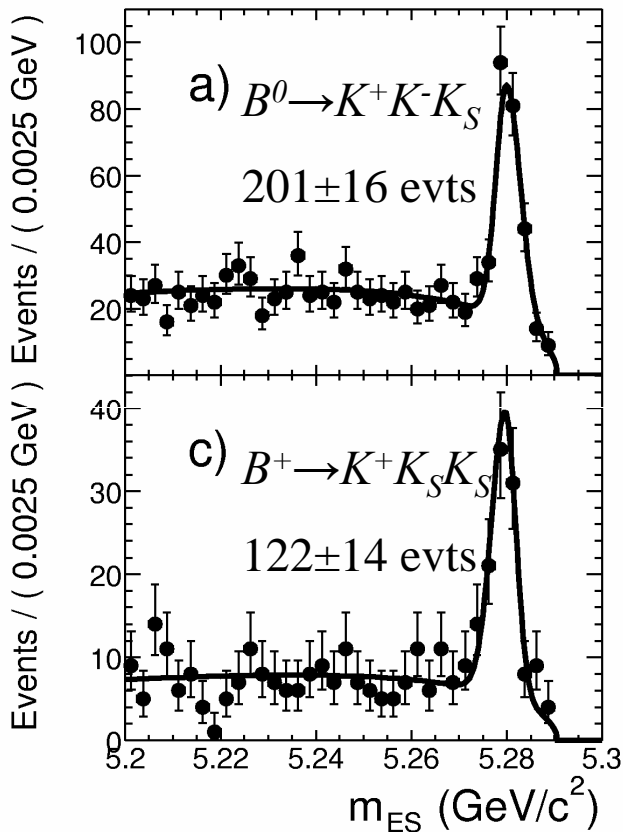
$$S_{\phi K} = 0.47 \pm 0.34 + 0.08 - 0.06$$

$$C_{\phi K} = 0.01 \pm 0.33 \pm 0.10$$

$S_{\phi K}$ differs from Belle result by 2.3σ .

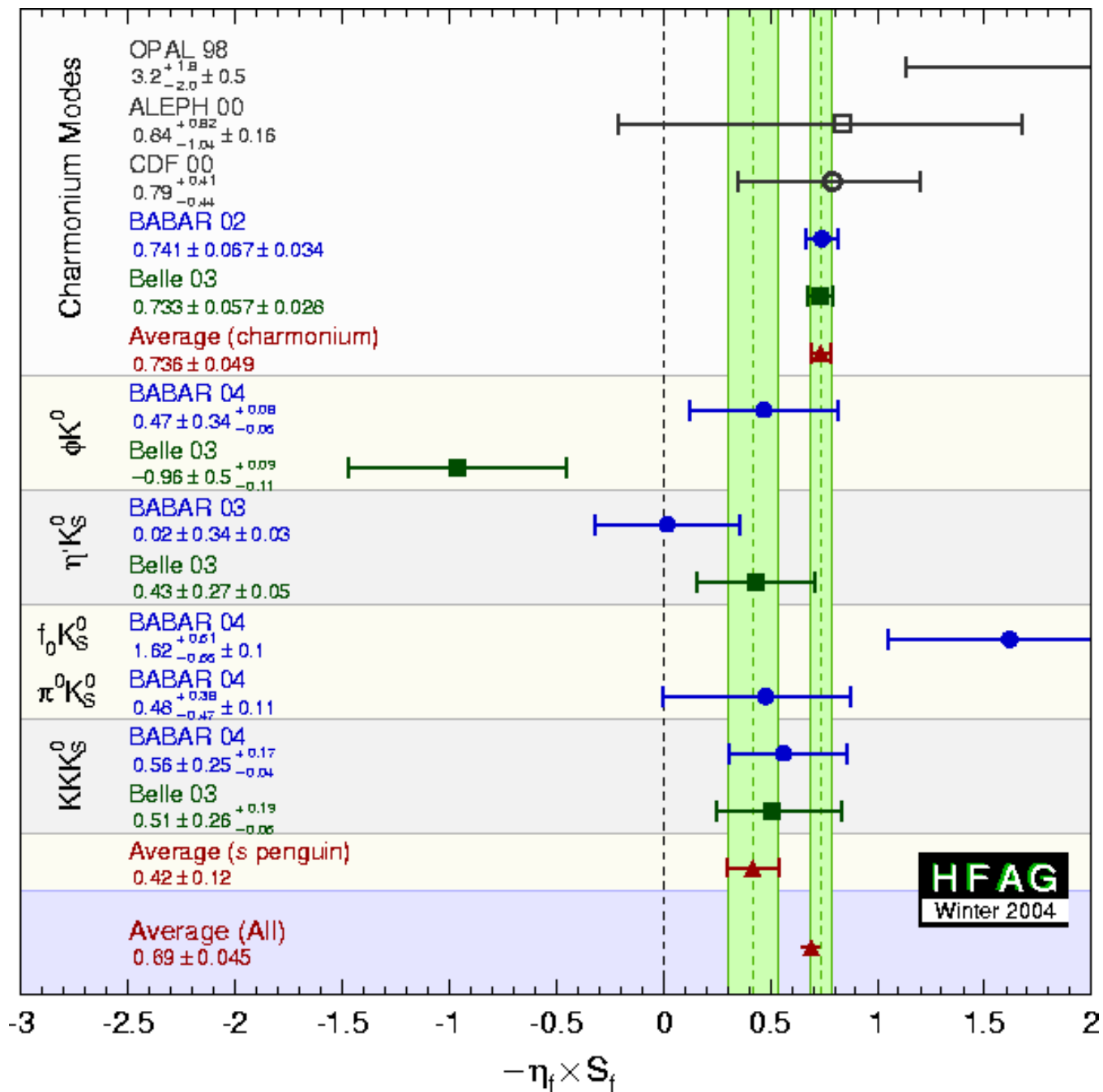
$B \rightarrow K^+ K^- K_S$

D. Dujmic and J. Thompson. Preliminary result presented by M. Verderi at Moriond EW. Now in CWR.

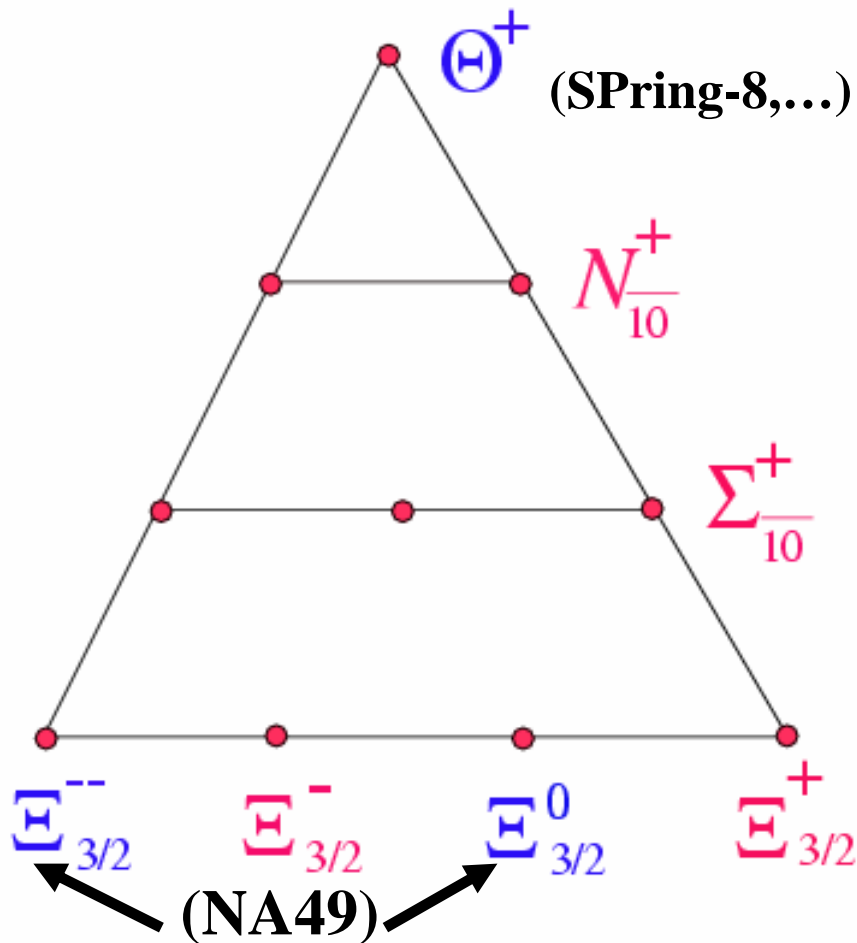


$$S(K^+ K^- K_S^0) = -0.56 \pm 0.25(\text{stat}) \pm 0.04(\text{syst})_{-0.17}^{+0} (f_{\text{even}})$$

$$C(K^+ K^- K_S^0) = -0.10 \pm 0.19(\text{stat}) \pm 0.09(\text{syst})$$



Pentaquark states in $\bar{10}$



BaBar Strategy:

Look for all of them!

A. Inclusively

B. Exclusive B decays

C. ISR

Inclusive e⁺e⁻ Pentaquark Searches

$\Theta^+ (K_S p)$

Θ^+
 $p^+ K^0$

$S = +1$

$\Xi \pi$

N^0
 ΛK^0
 $\Sigma^0 K^0$

N^+
 ΛK^+
 $\Sigma^0 K^+$

$S = 0$

$\Lambda/\Sigma^0 K$

Σ^-
 $\Lambda \pi^-$
 $\Sigma^0 \pi^-$
 $\Xi^- K^0$

Σ^0
 $\Lambda \pi^0$
 $\Xi^0 K^0$
 $\Xi^- K^+$

Σ^+
 $\Lambda \pi^+$
 $\Sigma^0 \pi^+$
 $\Xi^0 K^+$
 $p^+ \bar{K}^0$

$S = -1$

Ξ^{--}
 $\Xi^- \pi^-$

Ξ^-
 $\Xi^0 \pi^-$
 ΛK^-
 $\Sigma^0 K^-$

Ξ^0
 $\Xi^- \pi^+$
 $\Lambda \bar{K}^0$
 $\Sigma^0 \bar{K}^0$

Ξ^+
 $\Xi^0 \pi^+$

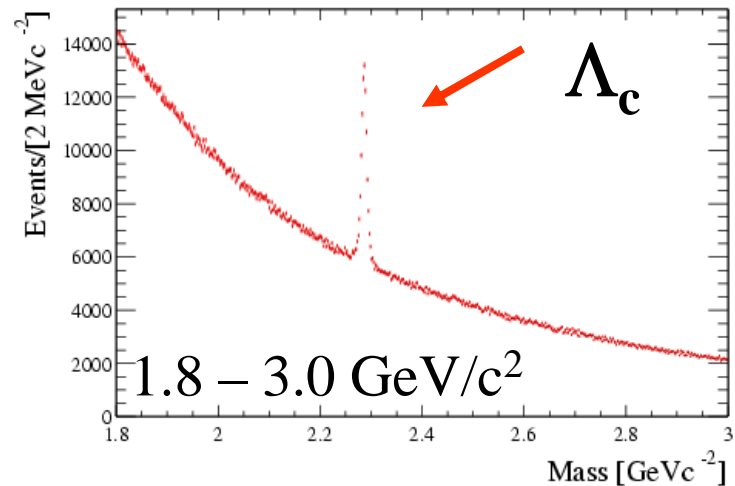
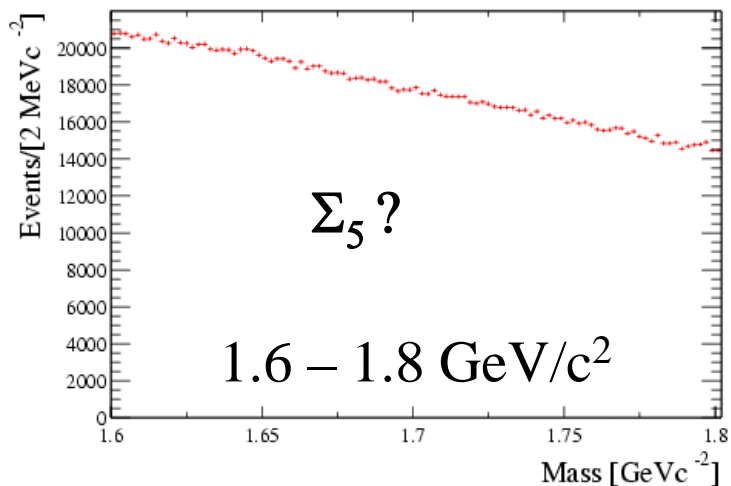
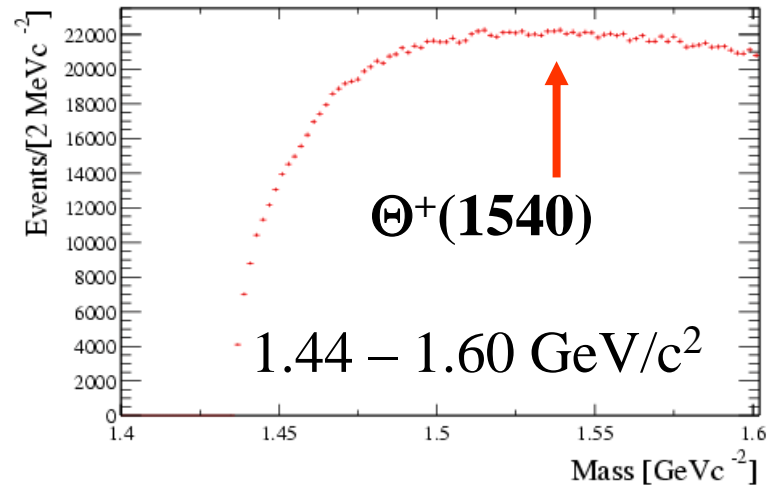
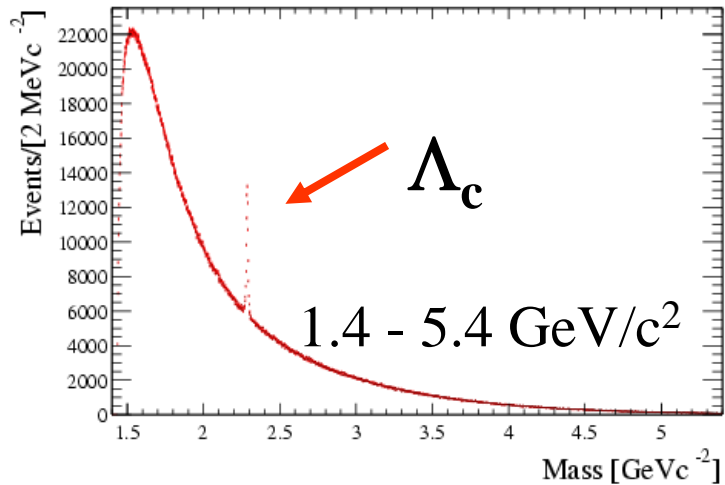
$S = -2$

....and more with a charm quark



$K_S p$ Invariant Mass

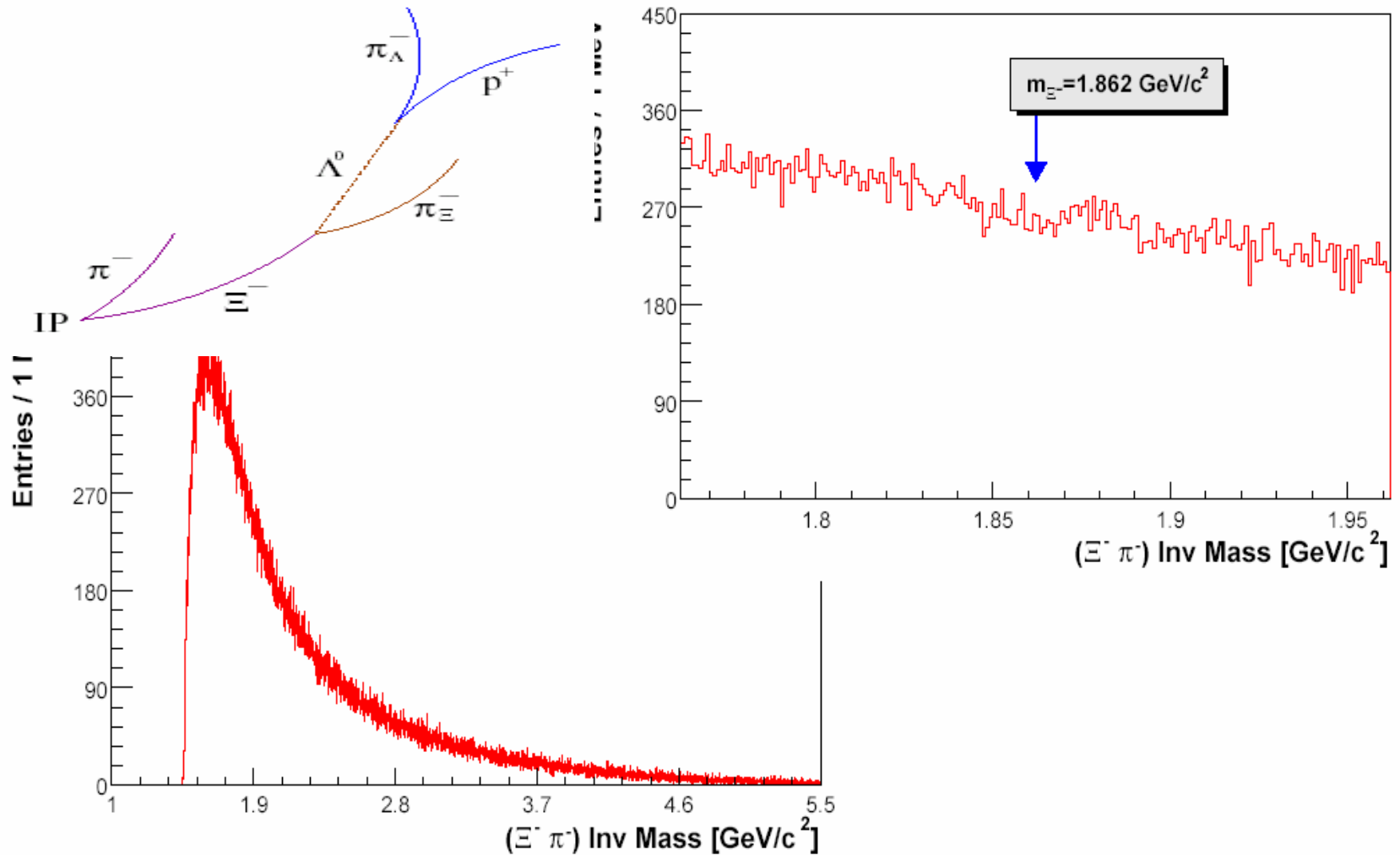
J. Coleman, W. Dunwoodie



Λ_c is the only clear structure

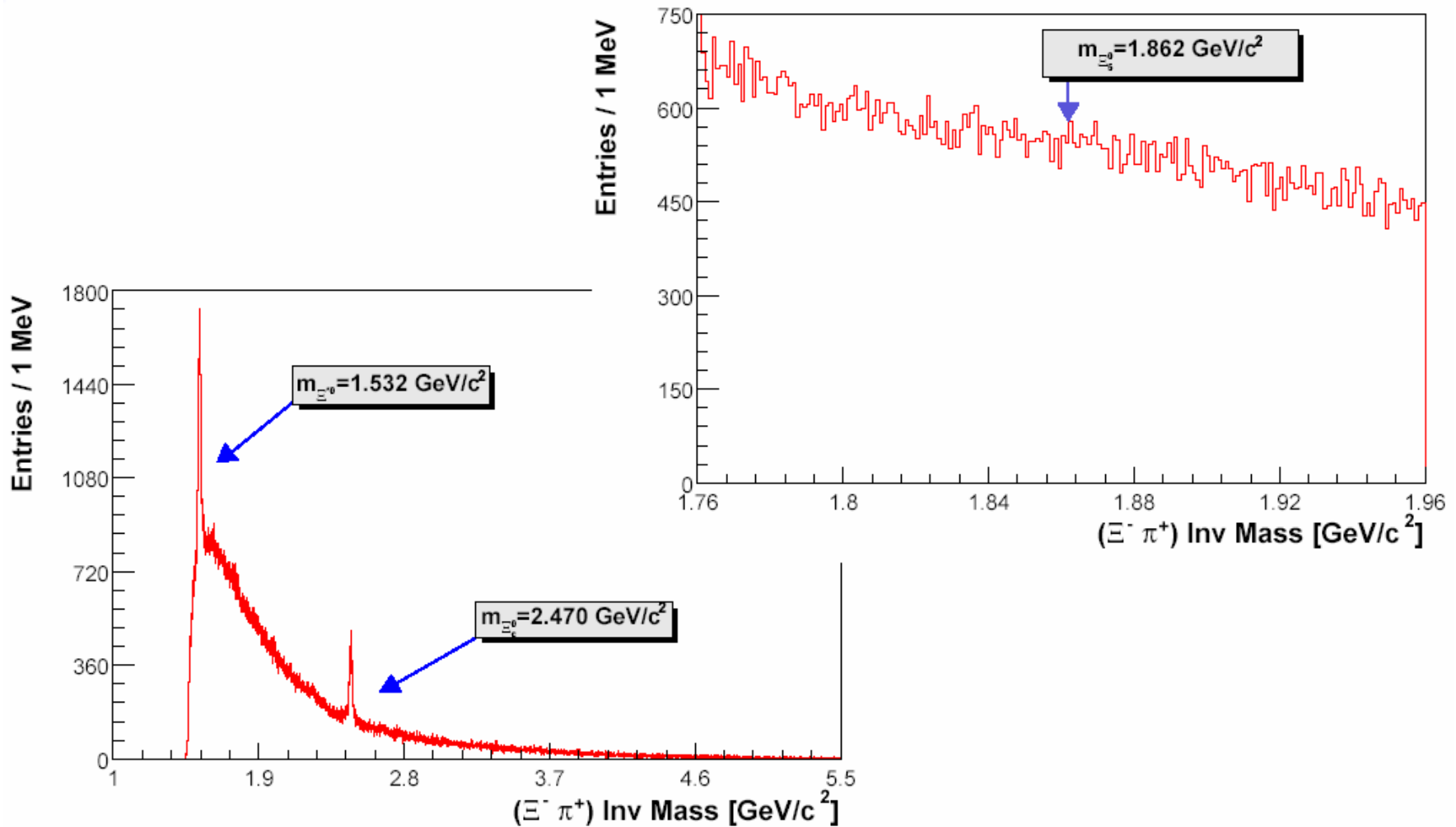
$e^+e^- \rightarrow \Xi_{5}^{--} X$ using $(\Xi_{5}^{--} \rightarrow \Xi^- \pi^-)$

V. Halyo



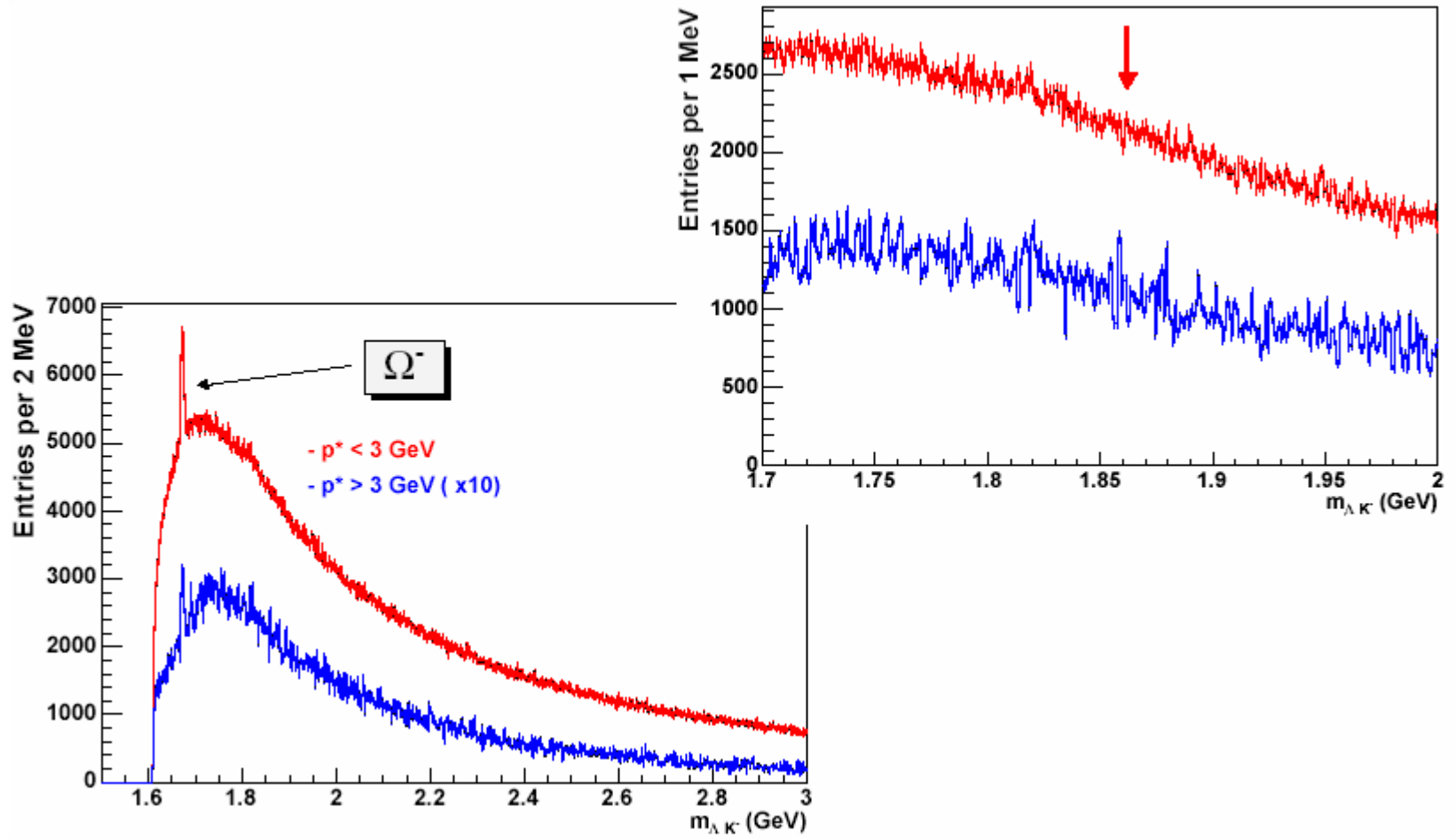
$e^+e^- \rightarrow \Xi^0 X$ using $(\Xi^0 \rightarrow \Xi^- \pi^+)$

V. Halyo



$e^+e^- \rightarrow \Xi^- X$ using $(\Xi^- \rightarrow \Lambda^0 K^-)$

N. Berger, S. Dong



Outlook for Pentaquark Searches

- Large “conventional” baryon samples (good physics)....but....
- No evidence for exotics yet....Still looking.
- Lots of places to look.
- Setting cross section upper limits for inclusive modes.

Summary

- **SLAC BaBar:**
 - **Support and infrastructure for detector and computing.**
 - **Physics groups are active partners with the Collaboration.**