LBNL *BABAR* Group

Anders W. Borgland

November 6, 2003

On behalf of the LBNL *BABAR* group

LBL *BABAR* Group Members

Senior staff

G. Abrams
D. Brown
R. Cahn
R. Jacobsen
R. Kadel
Yu.Kolomensky (also E158)
P. Oddone (Deputy Director)
M. Pripstein (on leave at DOE)
N. Roe (mostly SNAP)
M. Ronan (mostly NLC)

Retirees

J. Kadyk R. Kerth G. Lynch W. Wenzel

Postdocs

A. Borgland E. Charles A. Gritsan L. Mir V. Shelkov (now BNL)

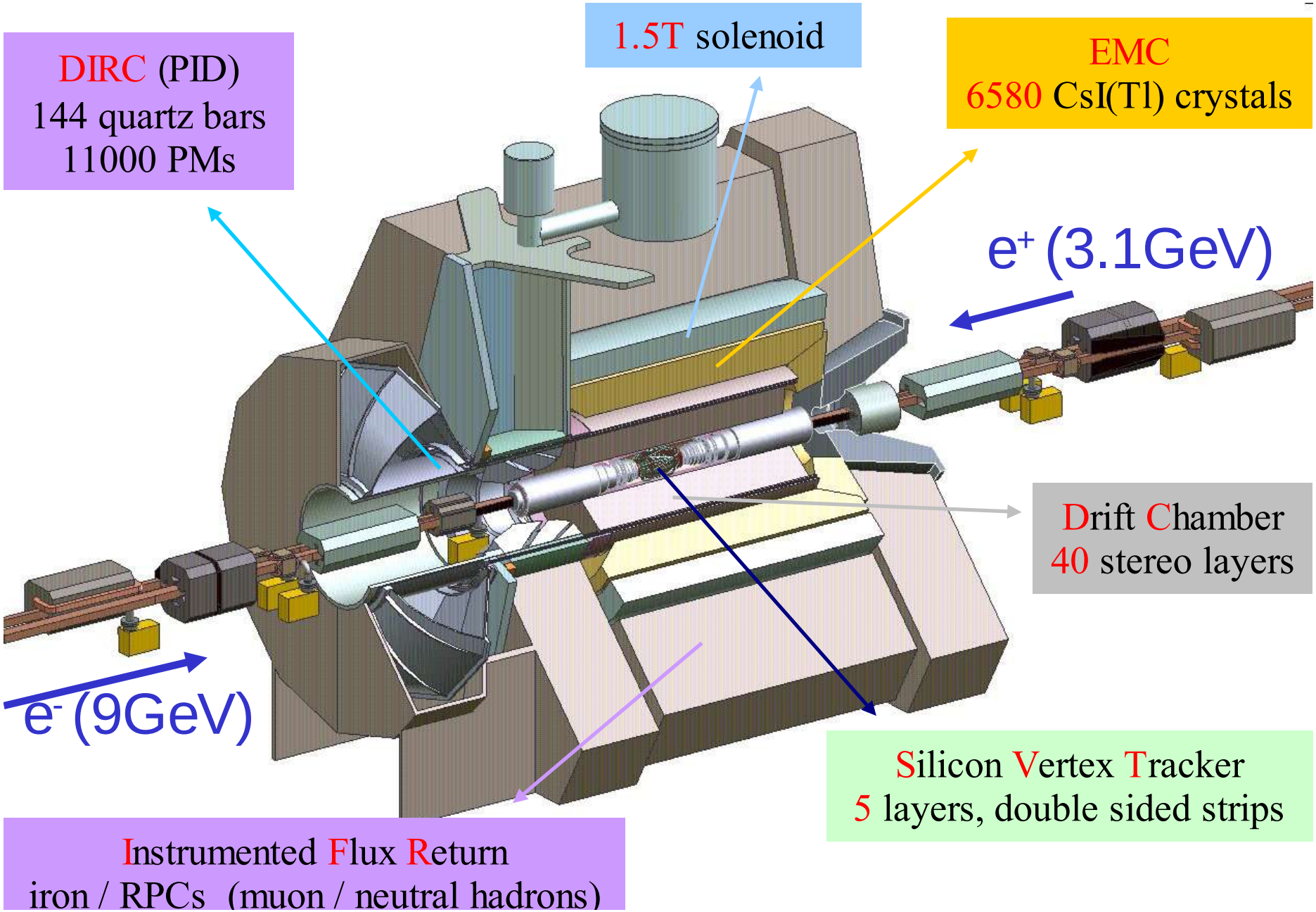
Students

A. Breon Y. Groysman A. Merchant A. Telnov (soon Princeton)
M. Gill G .Kukartsev T. Orimoto

Visitors

L. Gladney (mostly SNAP) J. Button-Shafer

The *BABAR* Detector

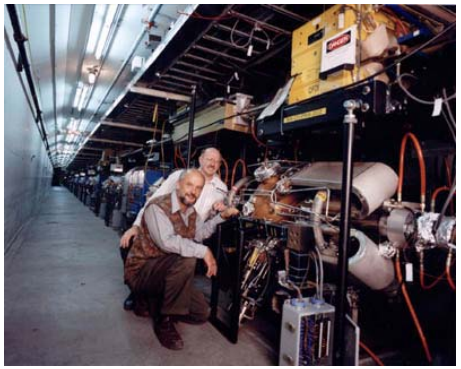


LBL Leadership Roles in *BABAR*

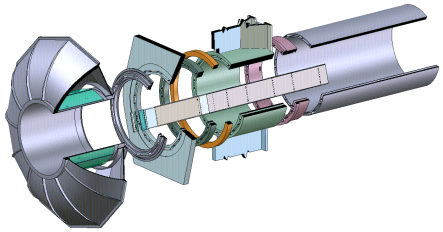
- Dave Brown: Analysis Model Working Group (Chair), Computing Model Working Group
- Bob Cahn: Publications Board (Chair)
- Andrei Gritsan: Tracking Coordinator (ret.)
- Yury Kolomensky: Computing Model Working Group (Co-Chair), Co-Convenor of the Breco AWG (ret.)
- Pier Oddone: Executive Board
- Natalie Roe: SVT Long-Range Task Force (Co-Chair), IFR Upgrade Review Committee, Membership Committee (ret.), Co-Convenor of the Exclusive Semileptonic Decays AWG (ret.)
- Vasia Shelkov: DIRC Online Coordinator (departed)

LBNL BaBar:

Doing the Physics from Start to Finish



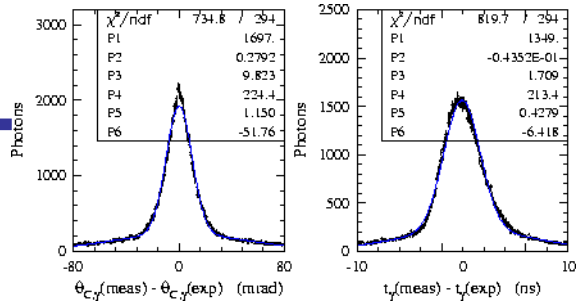
Conception



Design

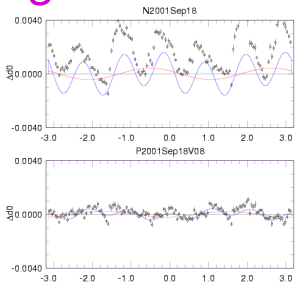
Fabrication

DIRC

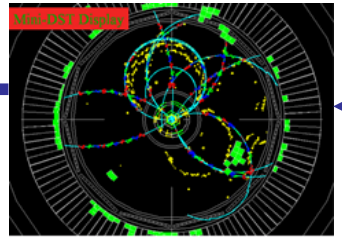


Commissioning

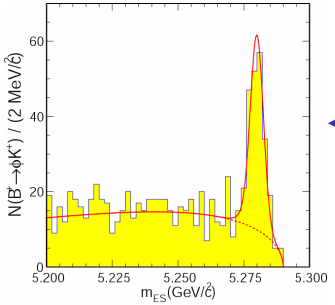
Alignment



Operations/
Calibration



Reco/
Simulation



Analysis

SVT upgrade

B→VV

B→ϕ K

B→Ds π

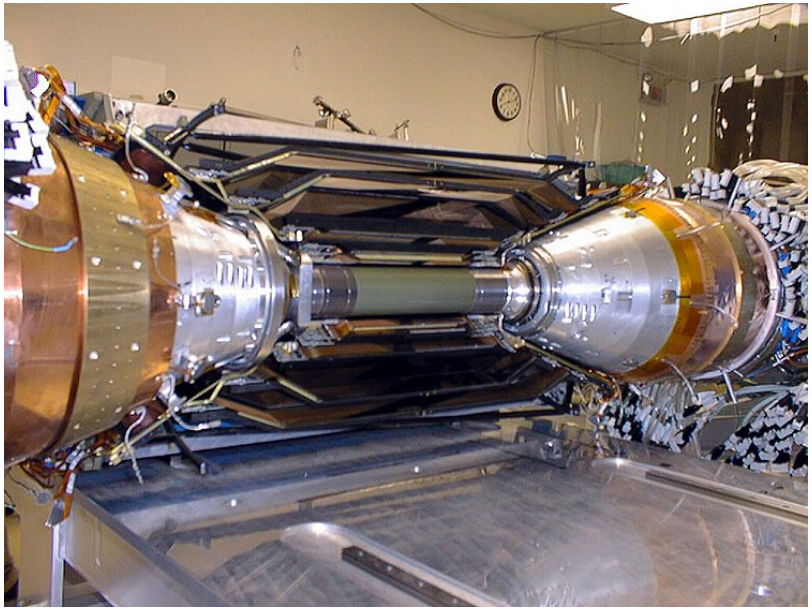
B→ρπ

CPT,ΔΓ

New computing model

Trigger

LBL responsibilities in the SVT [Kerth, Roe]



- LBL continues its strong involvement in the SVT.
- Responsible for maintaining the chiller [Kerth].
- Developing plans for the 2005 shutdown [Kerth]:
  - SVT has been a great success!
  - Less radiation damage/Replacement later than design.
  - LBL responsible for taking the SVT out of the support tube.
  - Rebuilding it with new modules in the inner layer bend plane.
- Long Range Task Force [Roe (Co-Chair)]: The task force will address
  - The long term future of the SVT (2010):
    - Upgrade the existing SVT?
    - Or start over?
  - Upgrade/replacement of the SVT Radiation system in 2005 and beyond.
  - Report by November/December 2003.

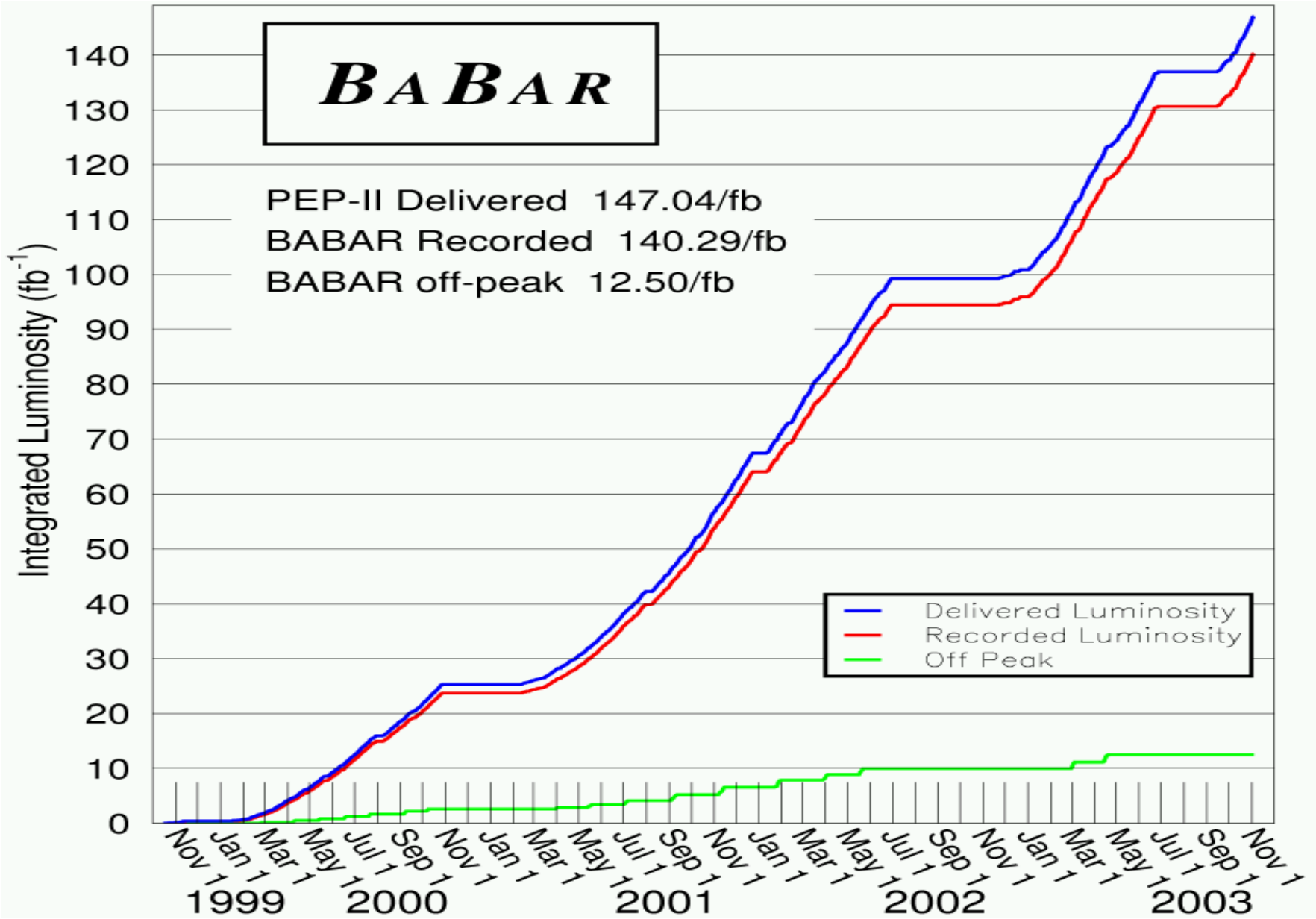
Phaseout: DIRC and Trigger

- Decreasing manpower and shift to analysis means a reduced LBL role in the running of the *BABAR* Detector.

- DIRC:
  - Leadership of the DIRC barrel mechanical [Kadel and Pripstein].
  - Responsible for DIRC online and online calibration [Brown and Shelkov].
  - With Shelkov's departure (not replaced), no official LBL responsibilities in the DIRC anymore.

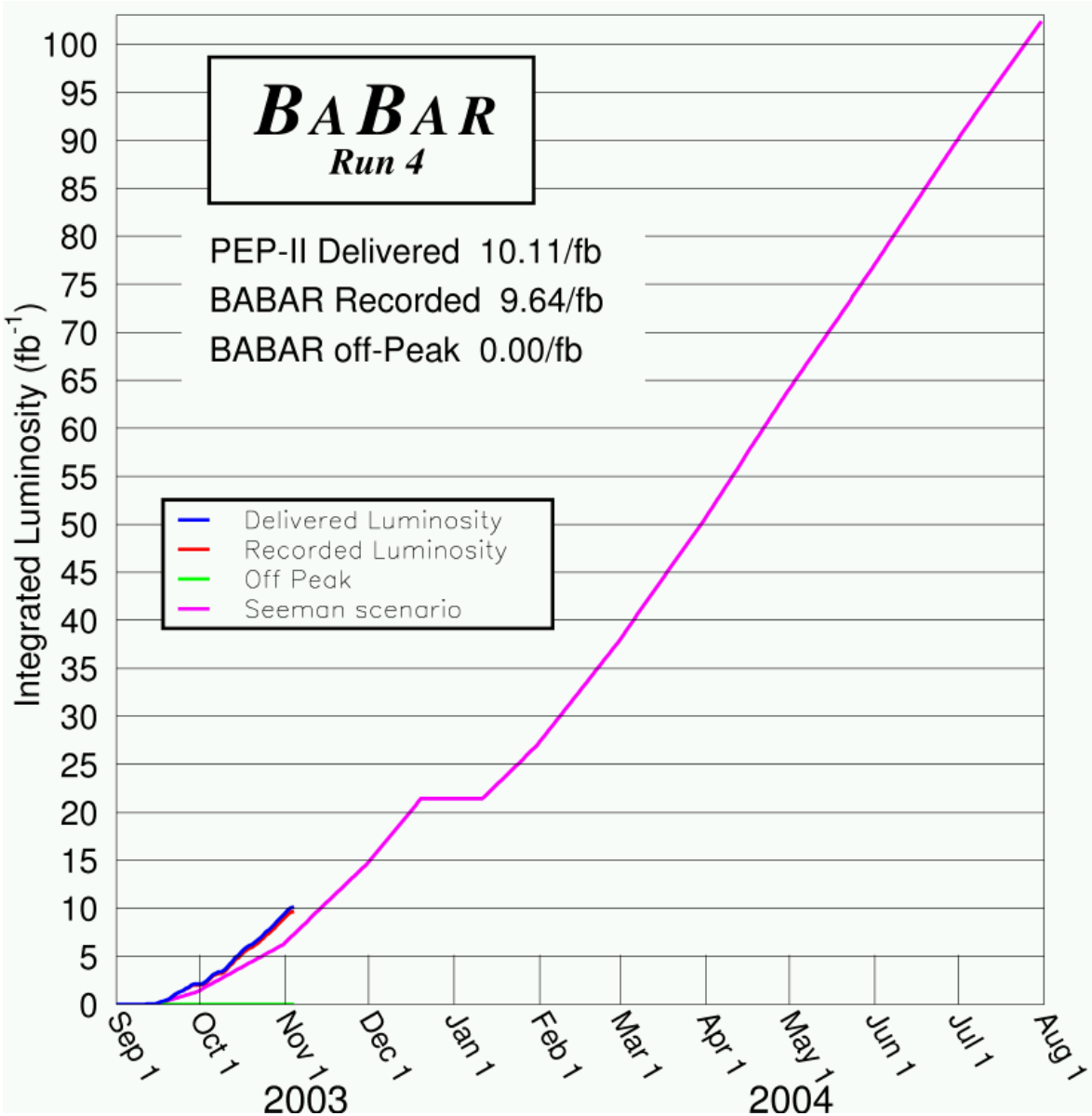
- DCT:
  - LBL built the Level 1 Drift Chamber Trigger [Levi et al].
  - Responsible for operations of both the DCT and the whole trigger (1.5 year).
  - Shift of manpower to analysis means no continuing LBL involvement in the trigger.

BABAR Integrated Luminosity: 140 fb^{-1} !



Successful 2003 startup for *BABAR*!

- Short summer shutdown.
- Remarkably successful start up!
- Goal is to add 100 fb^{-1} by summer 2004.
- And to have 500 fb^{-1} by end of 2006.
- Will need this to compete with our successful friends in Japan.



BABAR Computing - A Critical Issue!

- Old Computing Model used Objectivity database for data storage:
  - Pioneering work done by *BABAR* and LBL.
- Rapidly increasing dataset puts Computing Model under increasing stress!
  - Computing resources: Moore's Law not good enough!
  - Demands of the experiment increasingly not met by the current model.
  - Need a New Computing Model!
- *BABAR* switching to a new data format 'Mini':
  - Developed at LBL.
  - Provides both physics output and detailed detector data.
  - Improved flexibility, already essential for better alignment.
  - Integral part of the new Computing Model.
- LBL plays a crucial role in *BABAR* Computing:
  - Dave Brown, Eric Charles and Yury Kolomensky
  - NERSC: I. Gaponenko, A. Mokhtarani and C. Day

Scooped on B $\rightarrow D_{sJ}D$!!!!

First BaBar Talk on $D_{sJ}(2317)$: Feb 25

BaBar submits draft to PRL: April 11

CLEO and Belle confirm $D_{sJ}(2317)$ on June 3, 5.

Belle also finds B $\rightarrow D_{sJ}$ D.

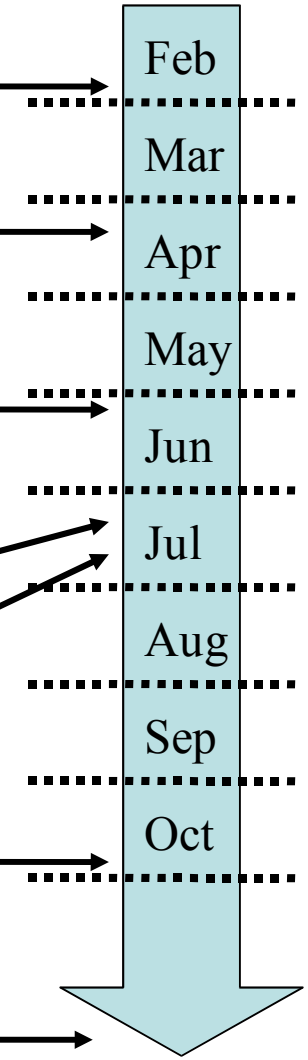
Both also show 2460 MeV state.

CLEO submits PRL (2317+2460): July 7.

Belle submits PRL (2317+2460): July 16.

BaBar submits 2460 MeV state PRL: Oct 24.

BaBar confirms B $\rightarrow D_{sJ}$ D :Winter.



Limitations of Existing Model

- Rigidity of Physics Production Mechanism:
  - Analysis production (skim) cycle / 1-year,
    - Very difficult to start new analysis;
  - No customizable output,
    - Forces users to run dedicated n-tuple production,
      - Many Grad-Student Years and Terabytes consumed.
- Very Limited Access to Detail:
  - Stark choice: four-vectors or raw data,
    - Studying detector systematic is prohibitively difficult.
- Problems with Objectivity.
  - Scaling issues recur with each new run,
  - Relying on objectivity experts reduces available workforce.

BaBar's New Computing Model

Old Model

Micro

- Candidate 4-momentum
  - Reconstructed only
- PID information
- …

Objectivity and Root

~2K bytes/event

Data duplication

Mini

- Tracks (fits and hits)
- Calorimeter clusters
- MC truth particles
- …

Objectivity only

~10K bytes/event

Combinatorics and customization (ntuples) were done in analysis jobs

New Model

LBL

Mini

Micro

- Track fits (all 5)
- PID information
- Candidate genealogy
- User-defined values
- …

~2.5K bytes/event

- Track hits
- DIRC rings
- Single-crystal clusters
- …

Root only

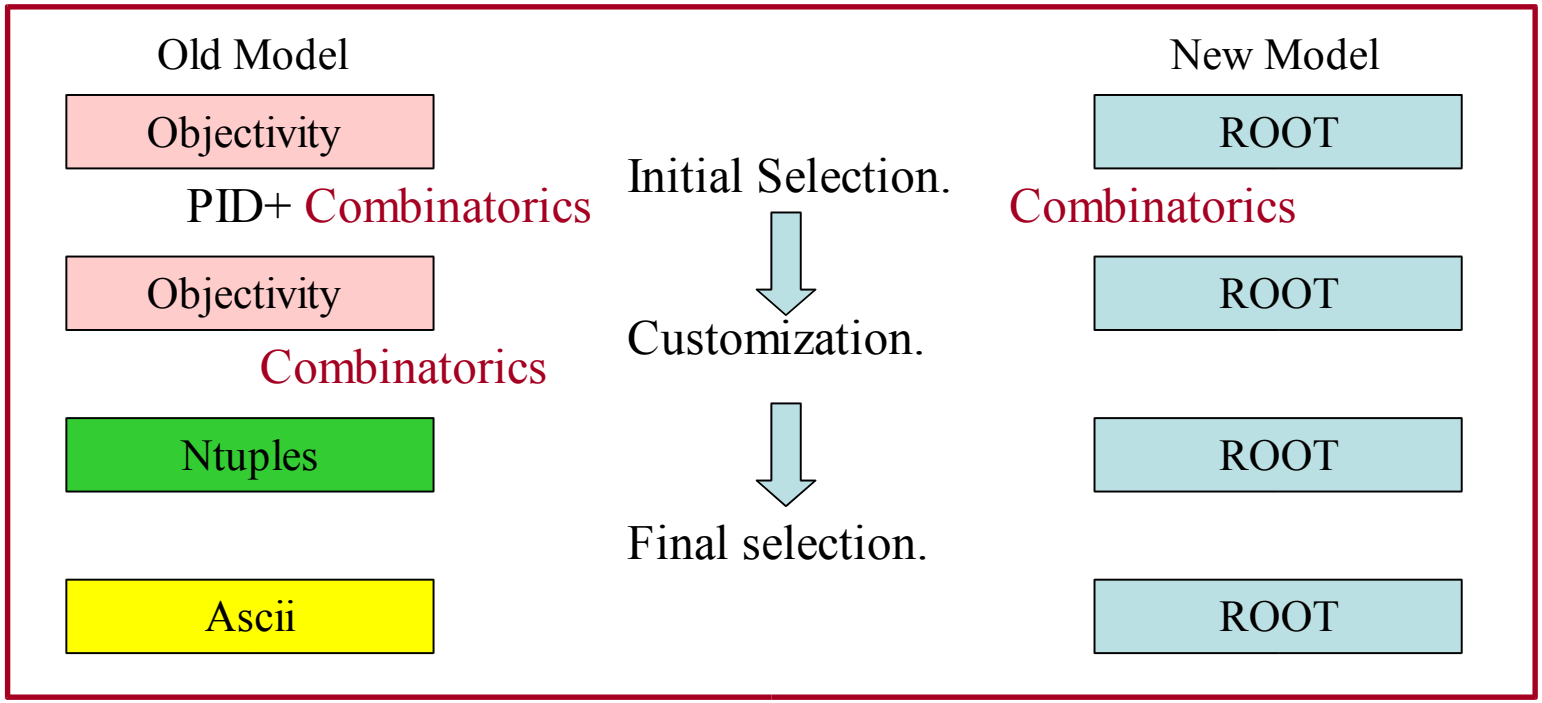
~7K bytes/event

- Persists composites
- Supports customization
- Allows data borrowing
- Provides interactive access via root/cint

LBL

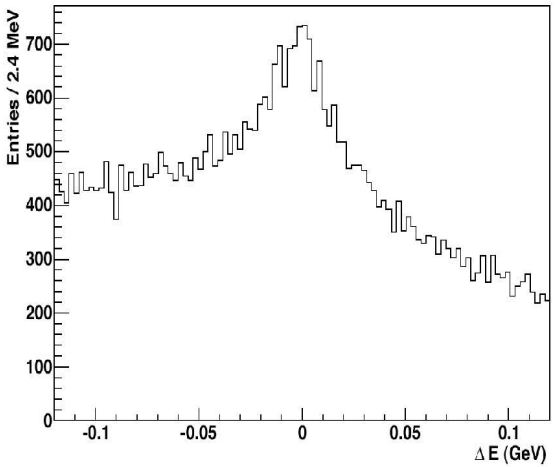
Why is the New Model Better?

- Single Data Format for all Parts of Analysis;
  - Can go back to previous step whenever required.
- Storing Intermediate Data Reduces CPU load;
  - Don't have to redo data processing in every step.



Orders of Magnitude

ΔE for $B \rightarrow D^{(*)} X$ "Semi Exclusive" Selection
43,000 Selected Candidates from 2.5 M Events



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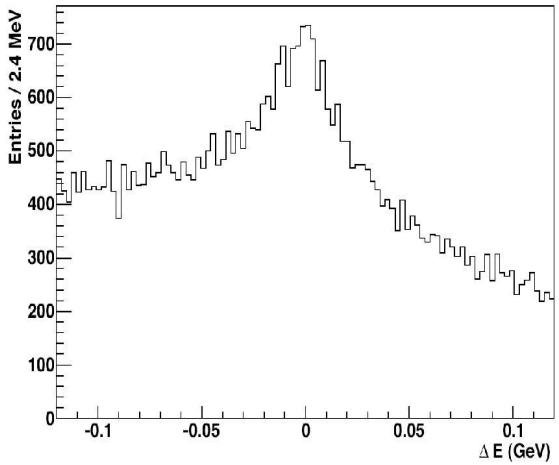
Old Model Analysis:
re-run combinatorics.



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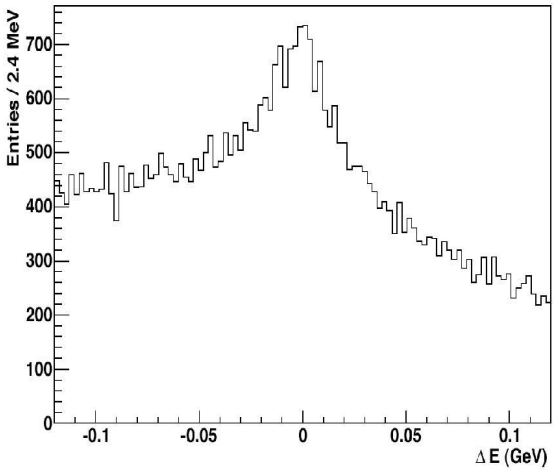
New Model Analysis:
re-build particles from stored genealogy.



10 sec.

New Model
"Data Inspection":
direct access to customized data.

LBL Provided Key Computing Model Technology

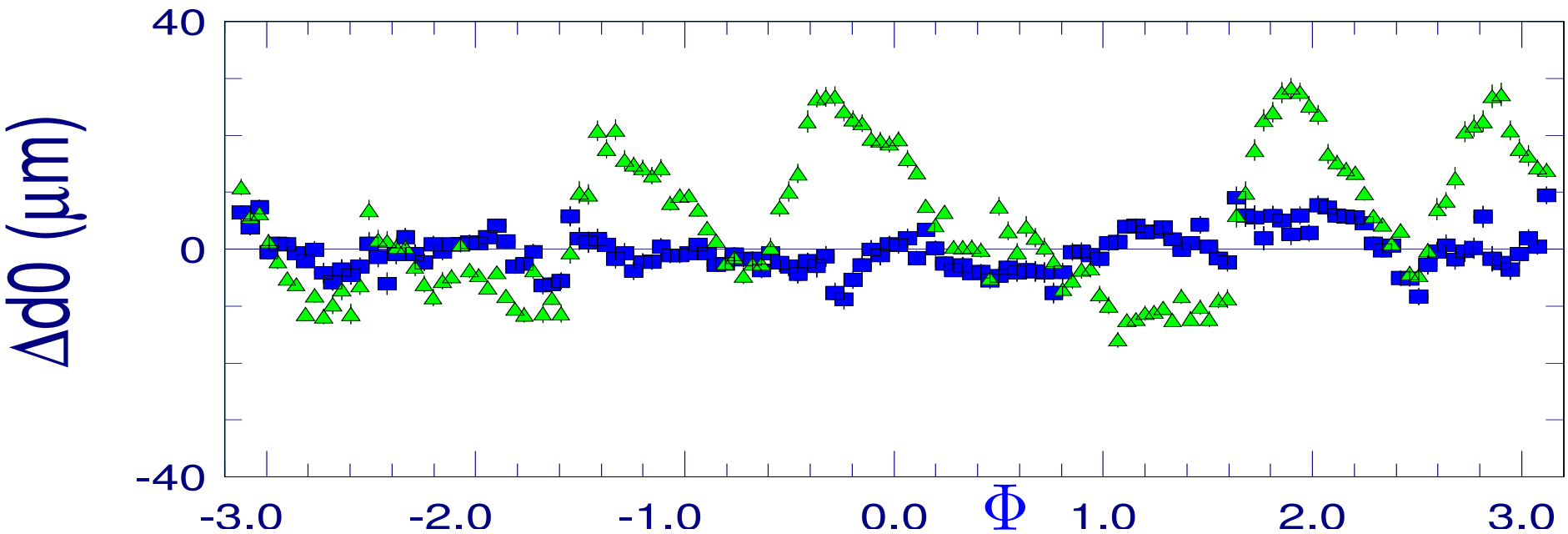
- Pioneered the Mini:
  - Data content format basis of the new model.
  - Started before the need was recognized by the collaboration.
- Contributed to the first root-based data storage:
  - Showed that root was useable for HEP applications in a real experiment.
- Provided the technology to support interactive access to root data files:
  - Allows treating data files as ntuples.
  - Supports the complex data structures expressed in the Mini.
  - Developed independently by LBL personnel before the *BABAR* Computing Model review began.

New Model is being deployed NOW!

- Run4 data are being written in the new format
- Conversion of Run1-3 data starts in 1 week
- First physics production will finish in January
  - Over 100 physics samples with custom content will be available for summer conference results
- We have met an aggressive schedule
- LBL has played a major part in the conception, leadership and implementation of the New Computing Model

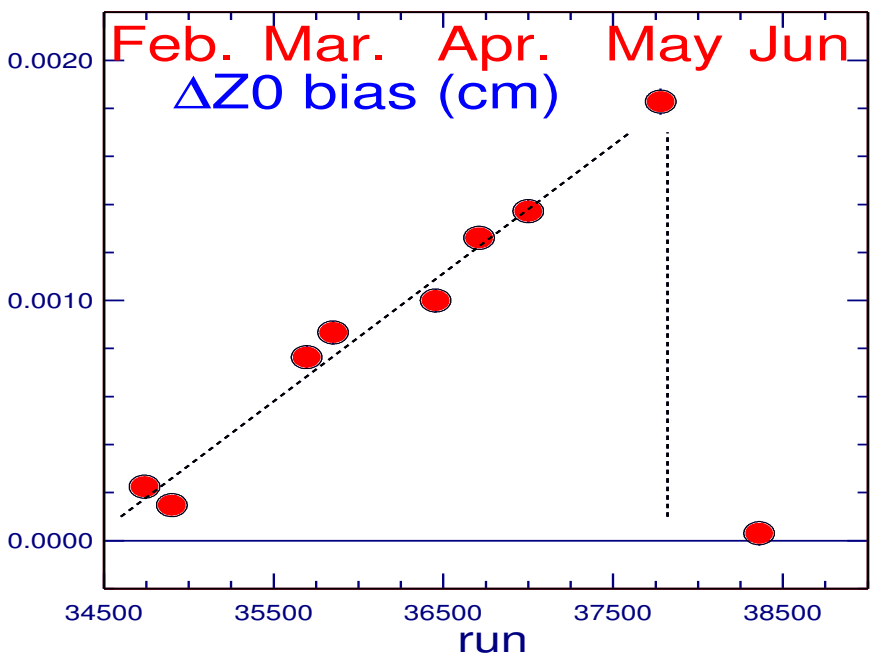
Improving Alignment [Brown, Gritsan, Kukartsev, Lynch]

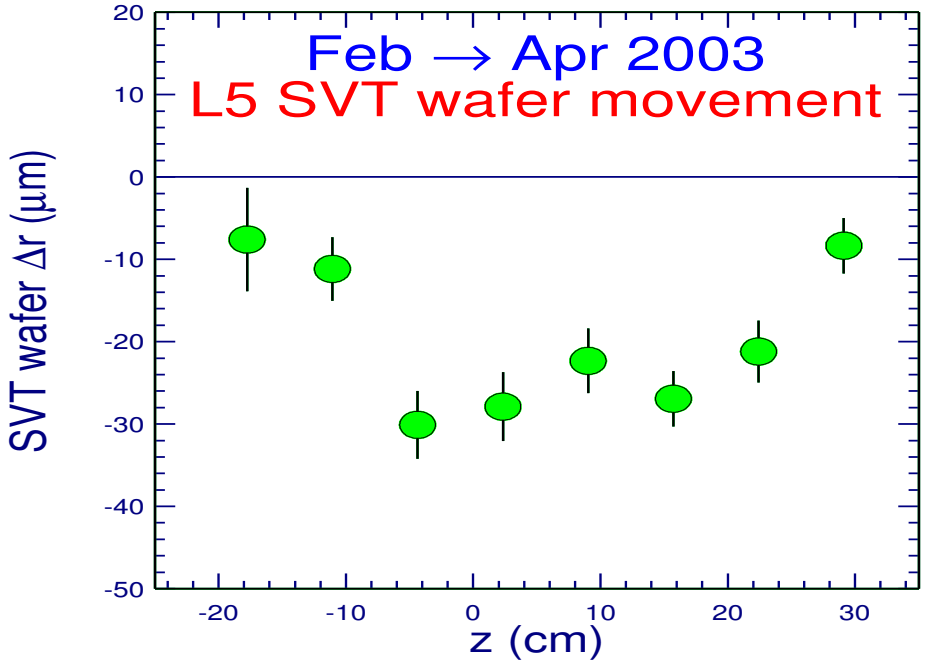
- Alignment already a dominant systematic error for the $\sin 2\beta$ measurement.
- LBL provides continuous support and improvements!
- Mini format essential for alignment:
  - Shorter turn-around - Increased statistics.
  - Removed azimuthal dependence of residuals.



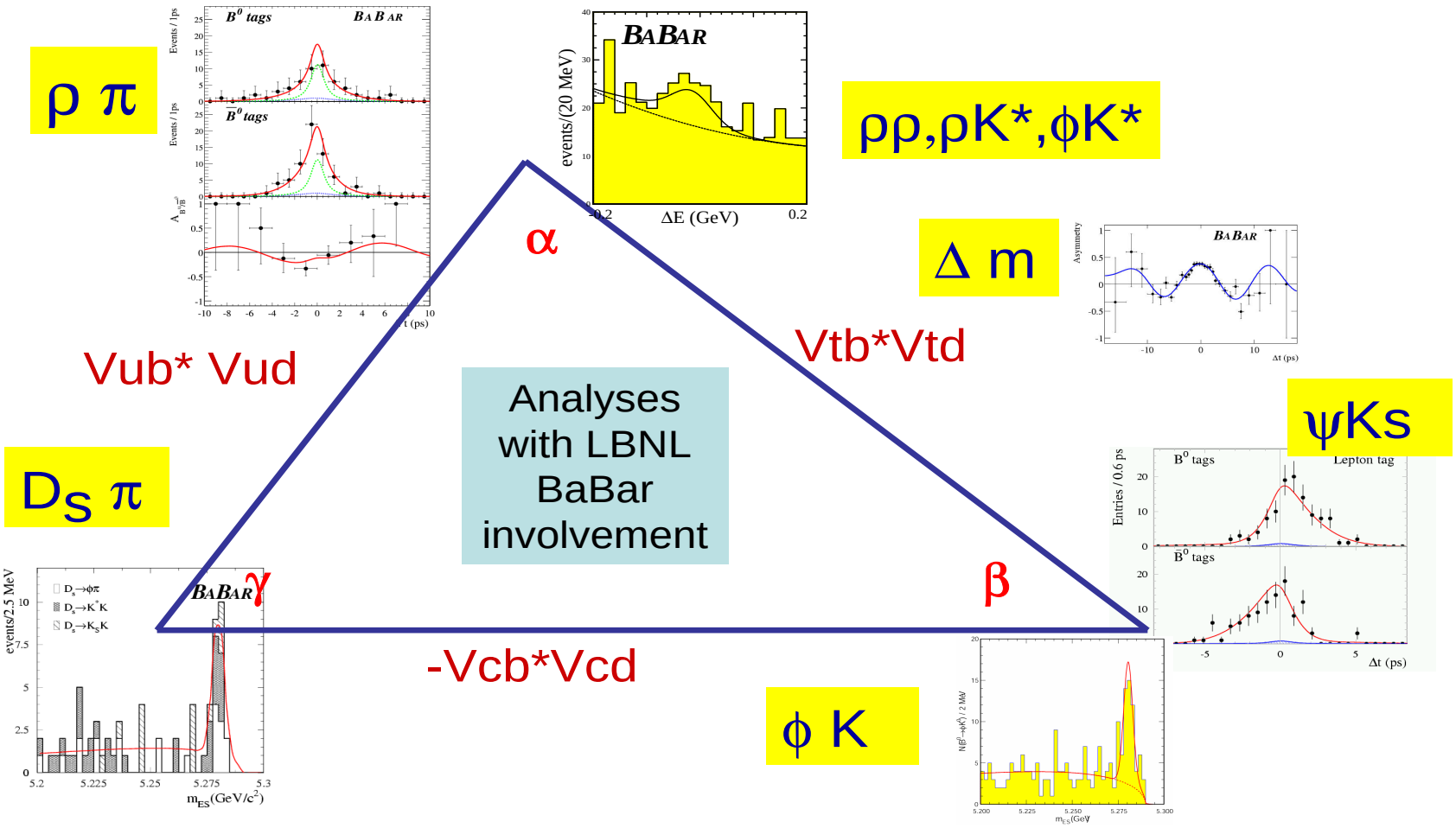
The Flexing SVT

- Improved alignment means we are:
  - Now sensitive to time variations in the internal motion of the SVT!
  - Need to provide more frequent alignments.
  - Only possible because of the Mini data format.

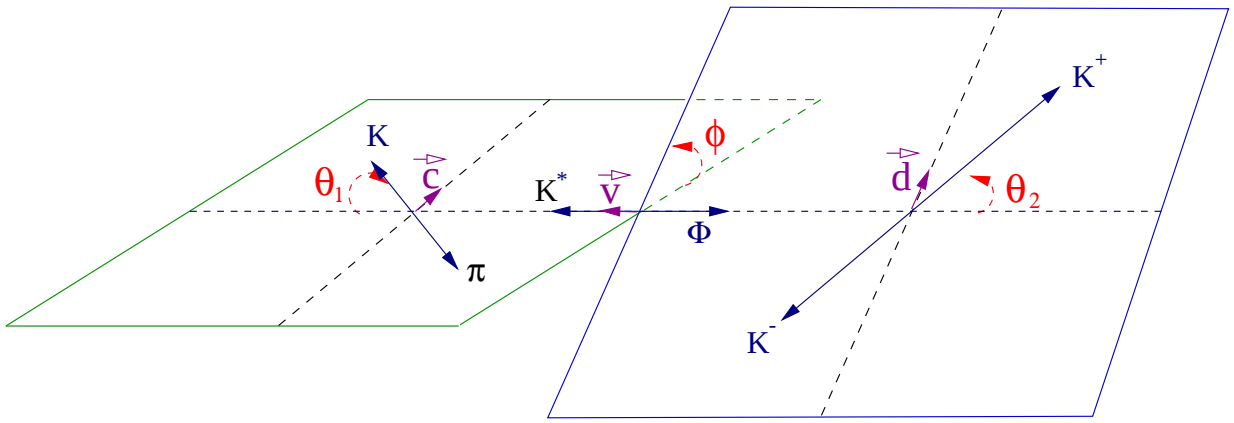




Attacking the Unitarity Triangle from All Sides (and Angles)



Rare Vector-Vector B Decays [Breon, Gritsan, Groysman, Mir]



- $B \to V_1 V_2$ decay dynamics define a rich physics program!
  - Three complex amplitudes ($S + P + D$ waves).
  - Both the strong and weak interactions.
  - CP and T violation.
  - Polarization:
    - Angular Analysis: $\frac{d^3\Gamma}{d\cos\theta_1 \; d\cos\theta_2 \; d\phi}$
    - Helicity basis: Integrate out ϕ and fit for the longitudinal fraction f_L:

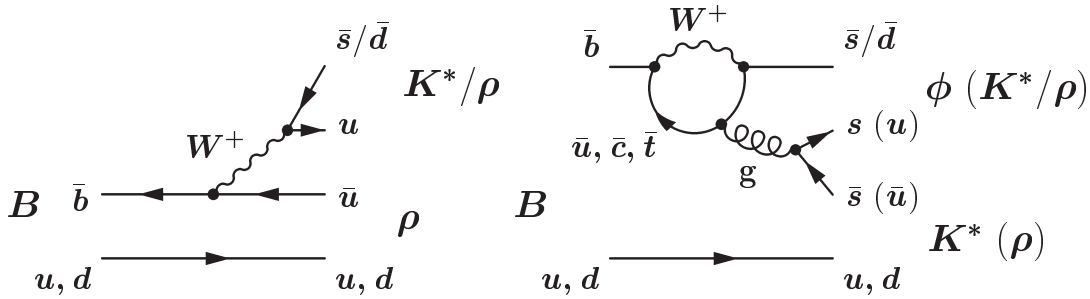
$$\frac{d^2\Gamma}{d\cos\theta_1 \; d\cos\theta_2} = \frac{9\Gamma}{4}\left(f_L \times \cos^2\theta_1 \times \cos^2\theta_2 + \frac{1}{4} \times (1 - f_L) \times \sin^2\theta_1 \times \sin^2\theta_2\right)$$

Triple Products and CP Violation

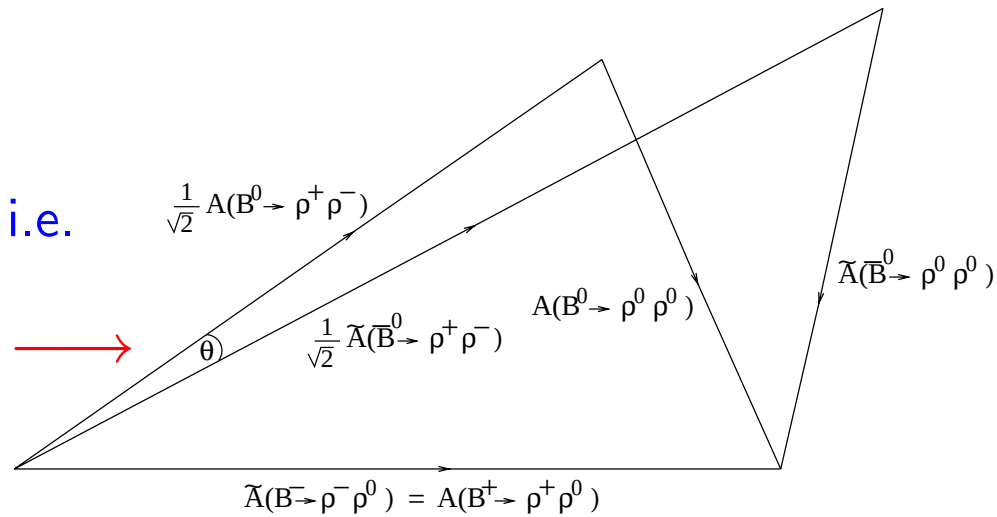
- Three complimentary measurements of CP violation:
  - Time dependent CP violation, direct CP violation and Triple product.
- Triple products in $B \to V_1(p_1, \epsilon_1)V_2(p_2, \epsilon_2)$:
  - T-odd asymmetry: $\mathcal{A}_{tp} \equiv [N(p_1 \cdot \epsilon_1 \times \epsilon_2 > 0) - N(p_1 \cdot \epsilon_1 \times \epsilon_2 < 0)]/N_{\rm tot}$
  - CP-violating Triple Product: $\mathcal{A}_T \equiv (\mathcal{A}_{tp} + \bar{\mathcal{A}}_{tp})/2 \propto \sin\Delta\phi \ \cos\Delta\delta$.
  - Maximal when strong phase is zero (unlike $\mathcal{A}_{CP} \propto \sin\Delta\delta$).
  - Do not depend on tagging or time-dependence!
- Highly suppressed in the Standard Model i.e. sensitive to New Physics.
- Full angular analysis for the future.
- First approach: Fit for raw asymmetries $n(q \cdot p_1 \times p_3 > 0)$ and $n(q \cdot p_1 \times p_3 < 0)$.

$$\mathcal{A}_T = \frac{n(q\cdot p_1 \times p_3 > 0) - n(q\cdot p_1 \times p_3 < 0)}{n(q\cdot p_1 \times p_3 > 0) + n(q\cdot p_1 \times p_3 < 0)} \qquad \mathcal{A}_{CP} = \frac{(\bar{B}\to\bar{f}) - (B\to f)}{(\bar{B}\to\bar{f}) + (B\to f)}$$

Tree, Penguins and All That



- $B \to \rho\rho$:
  - Similar to $\pi\pi$ i.e. sensitive to $\sin 2\alpha$.
  - 'Penguin Pollution': $\sin 2\alpha_{eff}$
  - α_{eff} depends on $Penguin/Tree$ ratio i.e. $\alpha_{eff}(\rho\rho) \neq \alpha_{eff}(\pi\pi)$.
  - Get $\theta = \alpha - \alpha_{eff}$ from Isospin model: $\longrightarrow$ $\rho^+\rho^-, \rho^0\rho^+$ and $\rho^0\rho^0$.



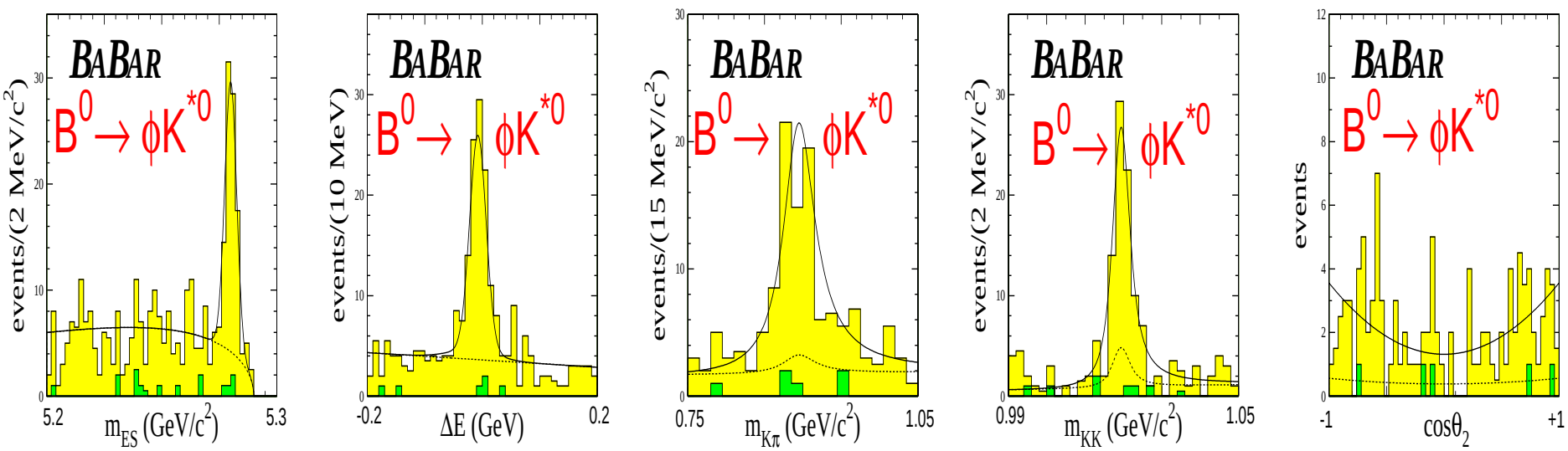
- $B \to \rho K^*$: Information about P/T ratio.

- $B \to \phi K^*$:
  - Pure penguin i.e. sensitive to new physics.
  - Sensitive to $\sin 2\beta$.

$B^0 \to \phi K^{*0}$: The Longitudinal Surprise!

With $82 fb^{-1}$, PRL 91, 171802 (2003):

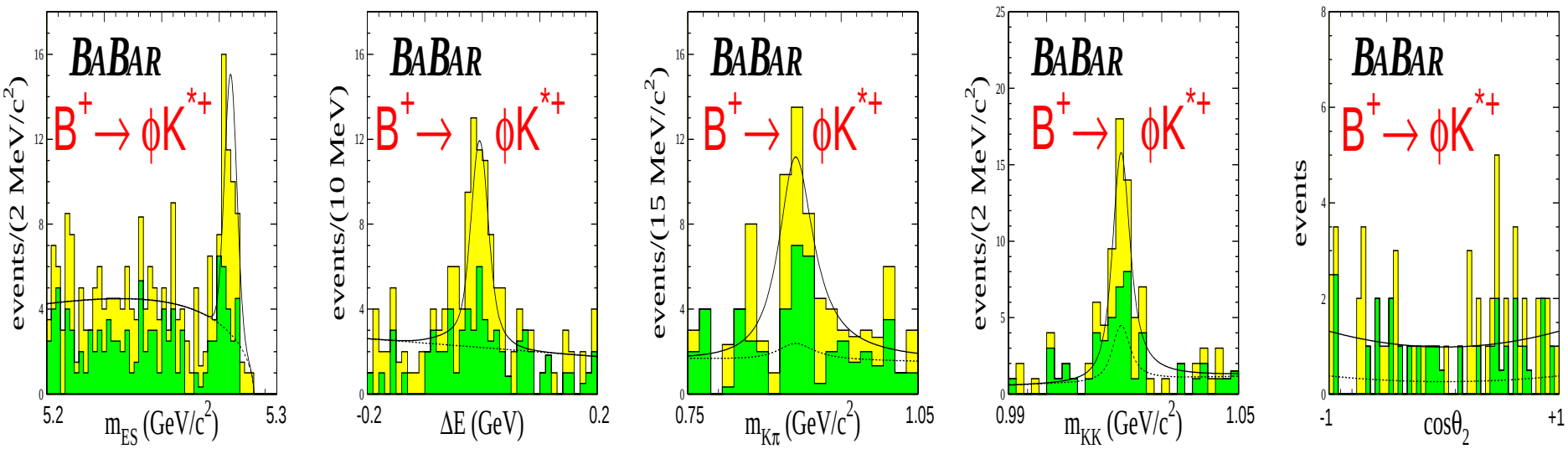
	$\phi K^{*0}_{K^+\pi^-}$ (●)	$\phi K^{*0}_{K^0\pi^0}$ (●)	ϕK^{*0}
Signal yield ($n_{\rm sig}$)	$101^{+12}_{-11} \pm 3$	$2.0^{+3.4}_{-1.3} \pm 0.6$	–
Polarization (f_L)	$0.64 \pm 0.07 \pm 0.02$	$1.00\ ^{+0.00}_{-0.66} \pm 0.25$	$0.65 \pm 0.07 \pm 0.02$
Direct-CP ($\mathcal{A}_{CP}$)	$+0.04 \pm 0.12 \pm 0.02$	–	$+0.04 \pm 0.12 \pm 0.02$
TP-asymm. ($\mathcal{A}_{\rm tp}$)	$+0.06 \pm 0.12 \pm 0.02$	–	$+0.06 \pm 0.12 \pm 0.02$
$\mathcal{B}$ ($\times 10^{-6}$)	$11.7 \pm 1.4 \pm 0.8$	$3.8^{+6.6}_{-2.5} \pm 1.1$	$11.2 \pm +1.3 \pm 0.8$



$B^+ \to \phi K^{*+}$: Confirms The Surprise!

With $82 fb^{-1}$, PRL 91, 171802 (2003):

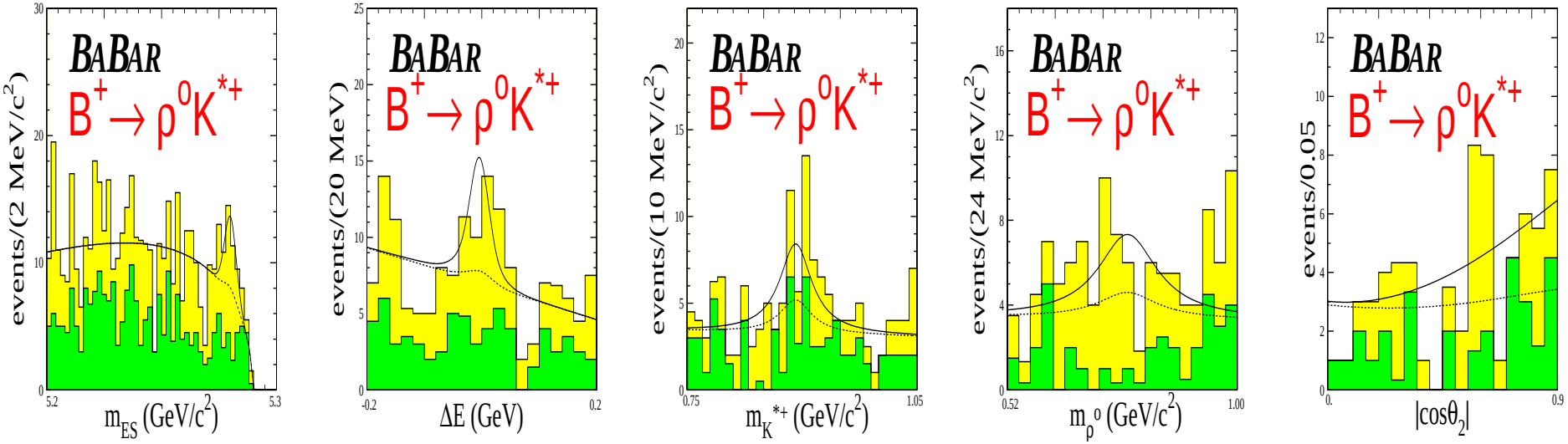
	$\phi K^{*+}_{K^0\pi^+}$ (●)	$\phi K^{*+}_{K^+\pi^0}$ (●)	ϕK^{*+}
Signal yield (n_{sig})	$33.3^{+7.2}_{-6.4} \pm 1.2$	$22.3^{+7.5}_{-6.5} \pm 3.2$	–
Polarization (f_L)	$0.50\ ^{+0.14}_{-0.15} \pm 0.03$	$0.40\ ^{+0.20}_{-0.19} \pm 0.06$	$0.46 \pm 0.12 \pm 0.03$
Direct-CP ($\mathcal{A}_{CP}$)	$-0.02 \pm 0.20 \pm 0.03$	$+0.63\ ^{+0.25}_{-0.31} \pm 0.05$	$+0.16 \pm 0.17 \pm 0.03$
TP-asymm. ($\mathcal{A}_{\rm tp}$)	$-0.28\ ^{+0.21}_{-0.20} \pm 0.03$	$+0.12\ ^{+0.34}_{-0.35} \pm 0.06$	$-0.02 \pm 0.18 \pm 0.03$
$\mathcal{B}$ ($\times 10^{-6}$)	$13.9\ ^{+3.0}_{-2.7} \pm 1.2$	$10.7\ ^{+3.6}_{-3.1} \pm 1.8$	$12.7\ ^{+2.2}_{-2.0} \pm 1.1$



Observation of $B^+ \to \rho^0 K^{*+}$

With $82 fb^{-1}$, PRL 91, 171802 (2003): More difficult - broader distributions.

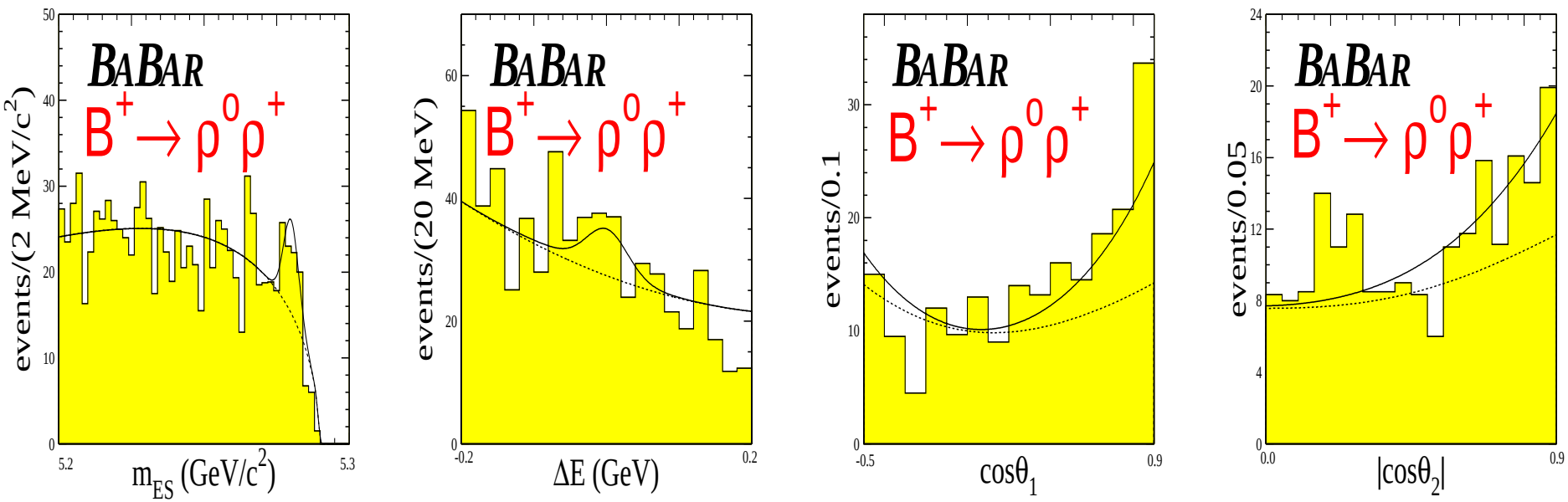
	$\rho^0 K^{*+}_{K^0\pi^+}$ (●)	$\rho^0 K^{*+}_{K^+\pi^0}$ (●)	$\rho^0 K^{*+}$
Signal yield (n_{sig})	$35.7^{+11.8}_{-11.0} \pm 3.6$	$8.5^{+8.2}_{-6.6} \pm 5.2$	–
Polarization (f_L)	$0.90\ ^{+0.10}_{-0.16} \pm 0.04$	$1.00\ ^{+0.00}_{-0.20} \pm 0.03$	$0.96\ ^{+0.04}_{-0.15} \pm 0.04$
Direct-CP ($\mathcal{A}_{CP}$)	$0.17\ ^{+0.34}_{-0.31} \pm 0.04$	$0.28\ ^{+0.72}_{-0.82} \pm 0.19$	$+0.20\ ^{+0.32}_{-0.29} \pm 0.04$
TP-asymm. ($\mathcal{A}_{\rm tp}$)	–	–	$0.03 \pm 0.29 \pm 0.03$
$\mathcal{B}$ ($\times 10^{-6}$)	$14.3\ ^{+4.7}_{-4.4} \pm 2.9$	$4.8\ ^{+4.6}_{-3.7} \pm 3.2$	$10.6\ ^{+3.0}_{-2.6} \pm 2.4$



Closing in on α: $B^+ \to \rho^0\rho^+$ and $B^0 \to \rho^0\rho^0$

With $82 fb^{-1}$, PRL 91, 171802 (2003):

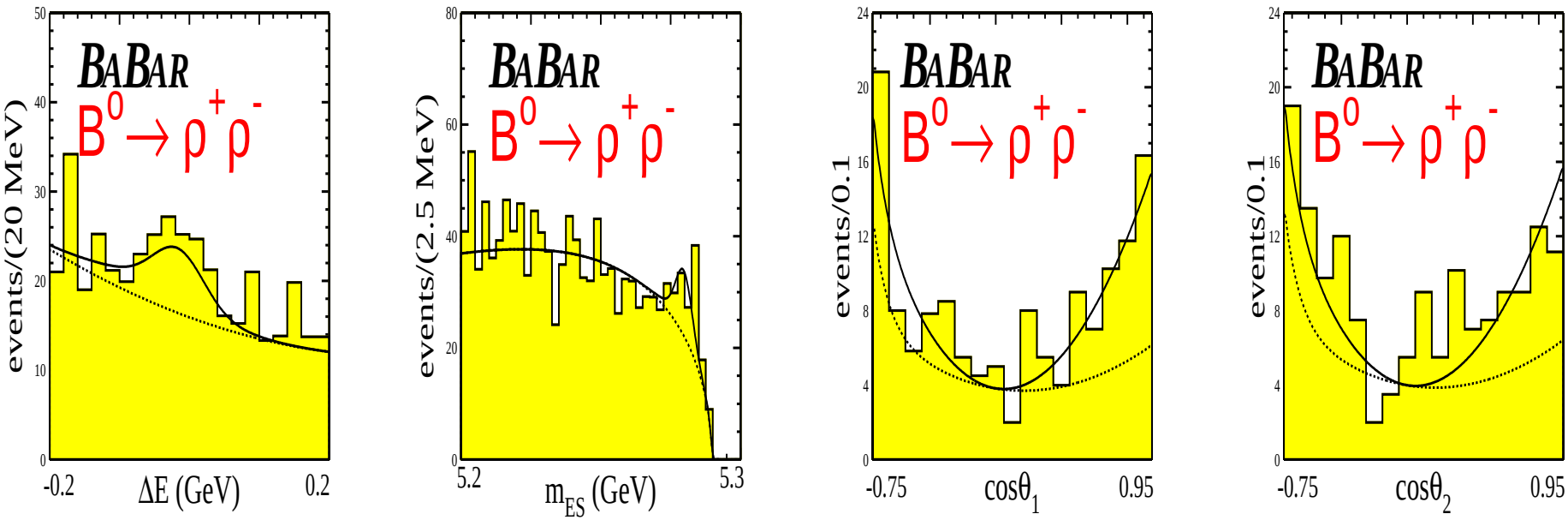
	$\rho^0\rho^+$	$\rho^0\rho^0$
Signal yield (n_{sig})	$93^{+24}_{-22} \pm 10$	$9.7^{+11.9}_{-9.4} \pm 2.0$
Polarization (f_L)	$0.97\ ^{+0.03}_{-0.07} \pm 0.04$	
Direct-CP ($\mathcal{A}_{CP}$)	$-0.19 \pm 0.23 \pm 0.03$	
TP-asymm. ($\mathcal{A}_{\rm tp}$)	$0.09 \pm 0.24 \pm 0.04$	
$\mathcal{B}$ ($\times 10^{-6}$)	$22.5\ ^{+5.7}_{-5.4} \pm 5.8$	< 2.1 (90% C.L.)



More α: $B^0 \to \rho^+\rho^-$

With $82 fb^{-1}$, hep-ex/0308024: Challenging with two π^0.

	$\rho^+\rho^-$
Signal yield (n_{sig})	$93^{+23}_{-21} \pm 9$
Polarization (f_L)	$0.99\ ^{+0.01}_{-0.07} \pm 0.03$
$\mathcal{B}$ ($\times 10^{-6}$)	$27\ ^{+7}_{-6}\ ^{+5}_{-7}$



$B \to V_1 V_2$: Outlook

- $B \to \rho\rho$ more useful than $B \to \pi\pi$:
  - Smaller 'Penguin Pollution'.
  - Higher branching ratios.
  - $B^0 \to \rho^0\rho^0$ is experimentally cleaner than $B^0 \to \pi^0\pi^0$.
  - Grossman-Quinn bound:
    $$\sin^2(\alpha - \alpha_{eff}) \leq \frac{\mathcal{B}(B^0 \to \rho^0\rho^0) + \mathcal{B}(\overline{B^0} \to \rho^0\rho^0)}{\mathcal{B}(B^+ \to \rho^+\rho^0) + \mathcal{B}(B^- \to \rho^-\rho^0)}$$
  - α_{eff} closer to the real α in $B \to \rho\rho$: $\leq 17^o$ vs. $\leq 47^o$
- Closing in on the Isospin triangle.
- $B \to \rho\rho$ fully longitudinally polarized (CP-even state).
- $B^0 \to \rho^+\rho^-$ time dependence and CP-violation for the future.
- Small value of f_L (expected > 0.8) in $B \to \phi K^*$ sign of New Physics?
  - Full angular analysis in the future.

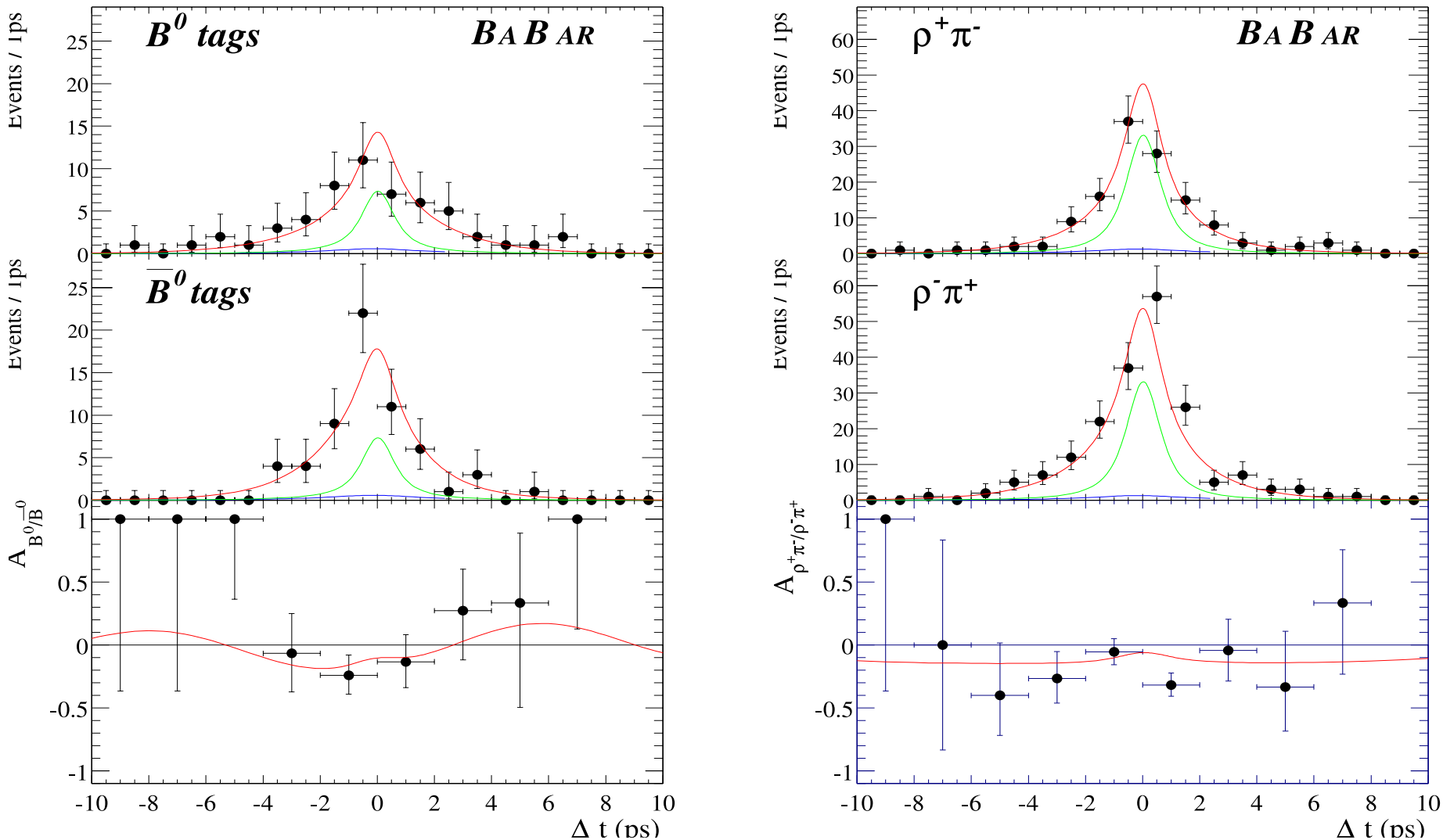
Even More α: $B^0 \to \rho^{\pm}\pi^{\mp}$ [Shelkov]

- Another alternative to $B \to \pi\pi$ to measure $\sin 2\alpha$.
- Penguins mean we have $\sin 2\alpha_{eff}$.
- Goal is time dependent Dalitz plot analysis - work in progress!
- For now: Quasi two-body decay
  - Treat the ρ as final particle.
  - Ignore interference regions of Dalitz plot.
- Measure CP violation from time dependence ($h = \pi, K$):

$$f^{\rho^{\pm}h^{\mp}}_{B^0(\overline{B^0})tag}(\Delta t) \propto (1 \pm A^{\rho h}_{CP})[1 + (-)((S_{\rho h} \pm \Delta S_{\rho h})\sin(\Delta m_d \Delta t) - (+)(C_{\rho h} \pm \Delta C_{\rho h})\cos(\Delta m_d \Delta t))]$$

- CP violating parameters: $A^{\rho K}_{CP}, A^{\rho\pi}_{CP}, C^{\rho\pi}_{CP}, S^{\rho\pi}_{CP}$.

$B^0 \to \rho^{\pm}\pi^{\mp}$ Time Dependence

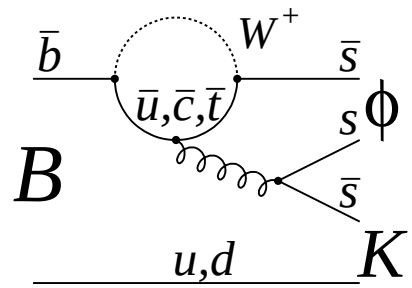


$B^0 \to \rho^\pm\pi^\mp$ Experimental Results

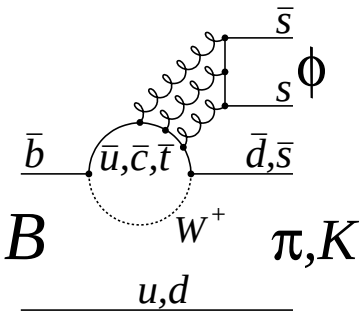
To be published in PRL, $88 fb^{-1}$:

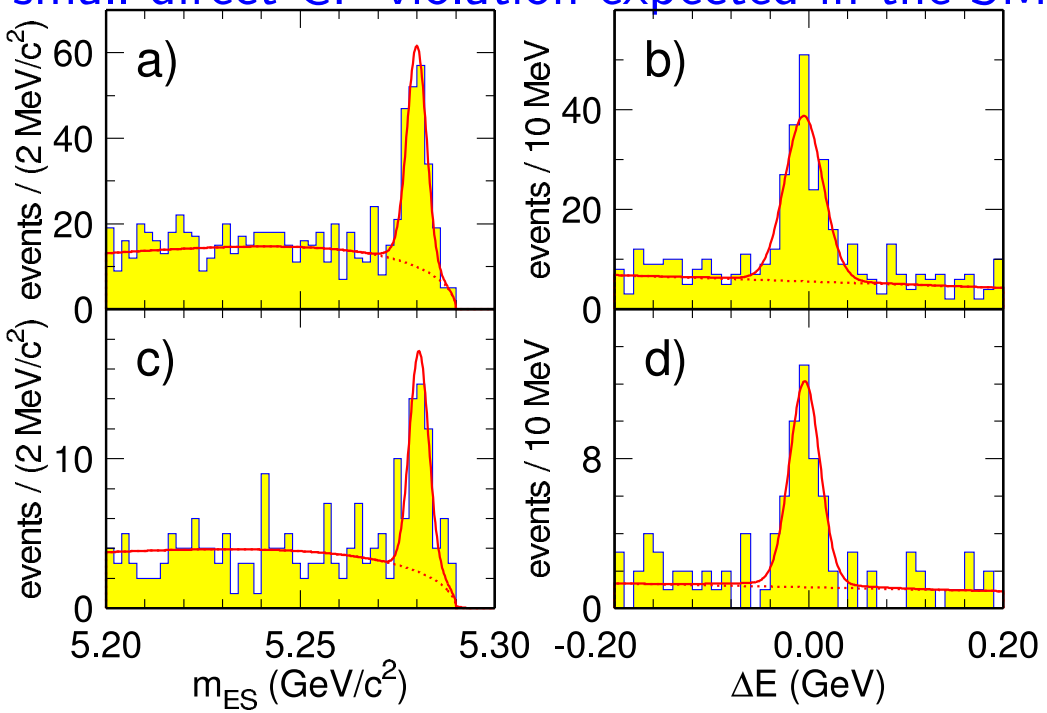
- Yields: $N^{\rho\pi} = 428\ ^{+34}_{-33}$ and $N^{\rho K} = 120\ ^{+21}_{-20}$.
- Branching ratios:
  - $\mathcal{B}(B^0 \to \rho^\pm\pi^\mp) = (22.6 \pm 1.8(stat.) \pm 2.2(syst.)) \times 10^{-6}$
  - $\mathcal{B}(B^0 \to \rho^- K^+) = (7.3\ ^{+1.3}_{-1.2}(stat.) \pm 1.3(syst.)) \times 10^{-6}$
- CP violating parameters: Some 2σ effects ....
  - $A^{\rho\pi}_{CP} = -0.18 \pm 0.08(stat.) \pm 0.03(syst.)$
  - $A^{\rho K}_{CP} = 0.28 \pm 0.17(stat.) \pm 0.08(syst.)$
  - $C_{\rho\pi} = 0.36 \pm 0.18(stat.) \pm 0.04(syst.)$
  - $S_{\rho\pi} = 0.19 \pm 0.24(stat.) \pm 0.03(syst.)$
- To complete the time dependence description:
  - $\Delta C_{\rho\pi} = 0.28\ ^{+0.18}_{-0.19}(stat.) \pm 0.04(syst.)$
  - $\Delta S_{\rho\pi} = 0.15 \pm 0.25(stat.) \pm 0.03(syst.)$

$B \to \Phi K$ [Gritsan, Telnov]



- Penguin transition - sensitive to New Physics.
- Very small direct CP-violation expected in the SM.

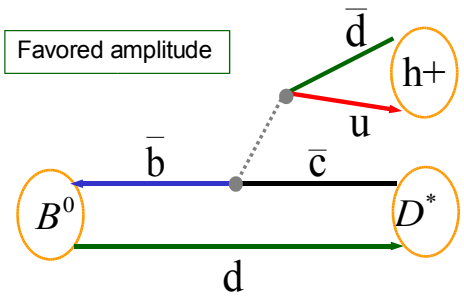


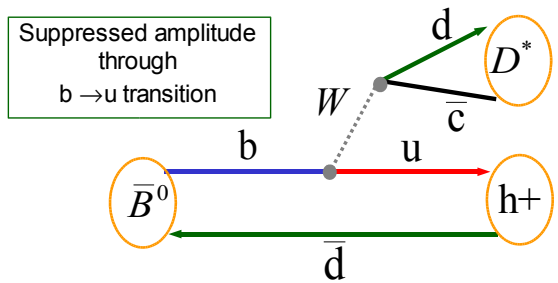


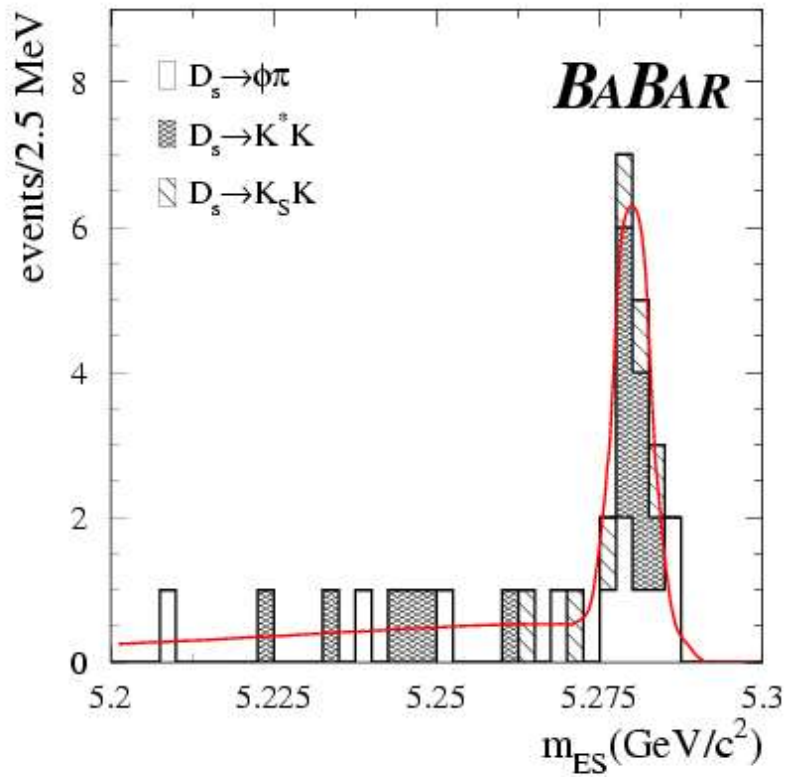
$\mathcal{B}(B^+ \to \Phi K^+)$	$=$	$(10.0^{+0.9}_{-0.8} \pm 0.5) \times 10^{-6}$	a),b)
$\mathcal{B}(B^0 \to \Phi K^0)$	$=$	$(8.4^{+1.5}_{-1.3} \pm 0.5) \times 10^{-6}$	c),d)
$\mathcal{B}(B^+ \to \Phi \pi^+)$	$\leq$	0.41×10^{-6} (90% C.L.)	
$A_{CP}(B^\pm \to \Phi K^\pm)$	$=$	$0.04 \pm 0.09 \pm 0.01$, [-0.10, 0.18] (90% C.L.)	Submitted to PRD-RC

$B \to D_s Light$ and $\sin(2\beta+\gamma)$

- $B^0 \to D^{(*)-}\pi^+$ is sensitive to $\sin(2\beta+\gamma)$ - needs suppressed decay rate $B^0 \to D^{(*)+}\pi^-$ as external input.







- $B^0 \to D^{(*)+}\pi^-$ rate can be estimated from $B^0 \to D_s^{(*)+}\pi^-$ using SU(3) symmetry [Kolomensky, Orimoto].
  $\mathcal{B}(B^0 \to D_s^+\pi^-) = (3.20 \pm 0.9(stat.) \pm 1.0(syst.)) \times 10^{-5}$

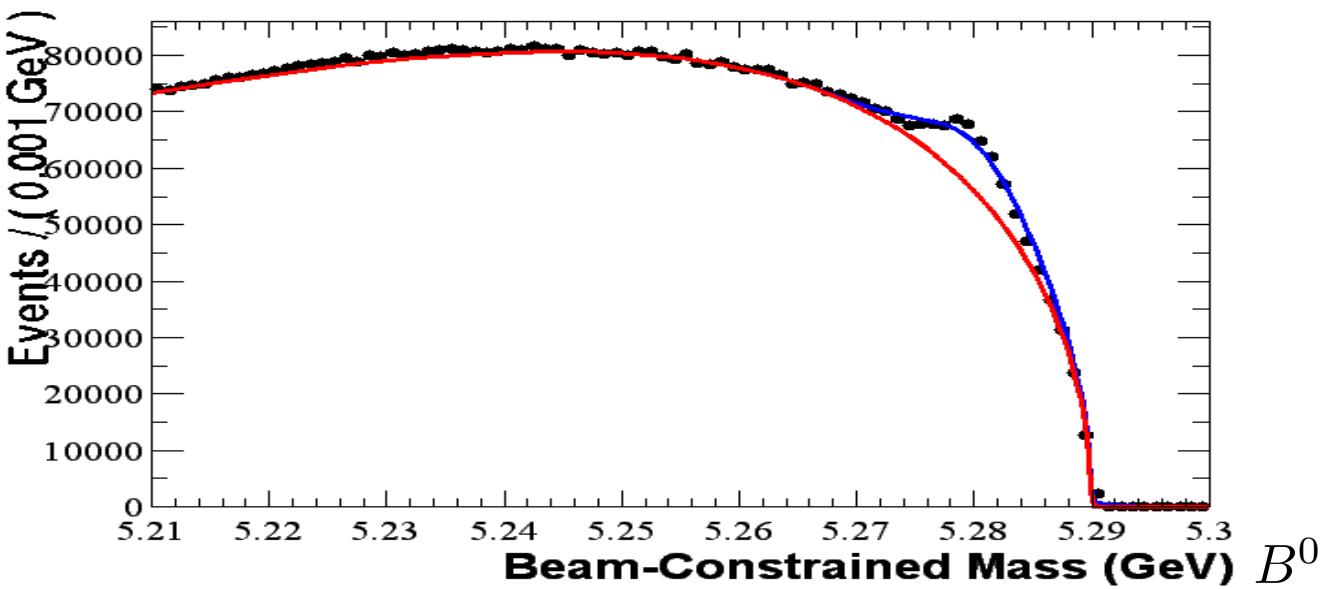
- Currently being extended to vector meson decays like $B^0 \to D_s^{(*)+}\rho^-$ and $B^0 \to D_s^{(*)+}a_1^-$ [Borgland, Kolomensky, Merchant, Orimoto].

Exclusive $\Upsilon(4S)$ Reconstruction [Charles]

- Precise measurement of $\frac{\Upsilon(4S)\to B^0\overline{B^0}}{\Upsilon(4S)\to B^+B^-}$ needed for normalization of branching ratios.

- Deviation as large as 20% from unity (Coulomb effects, strong interactions).

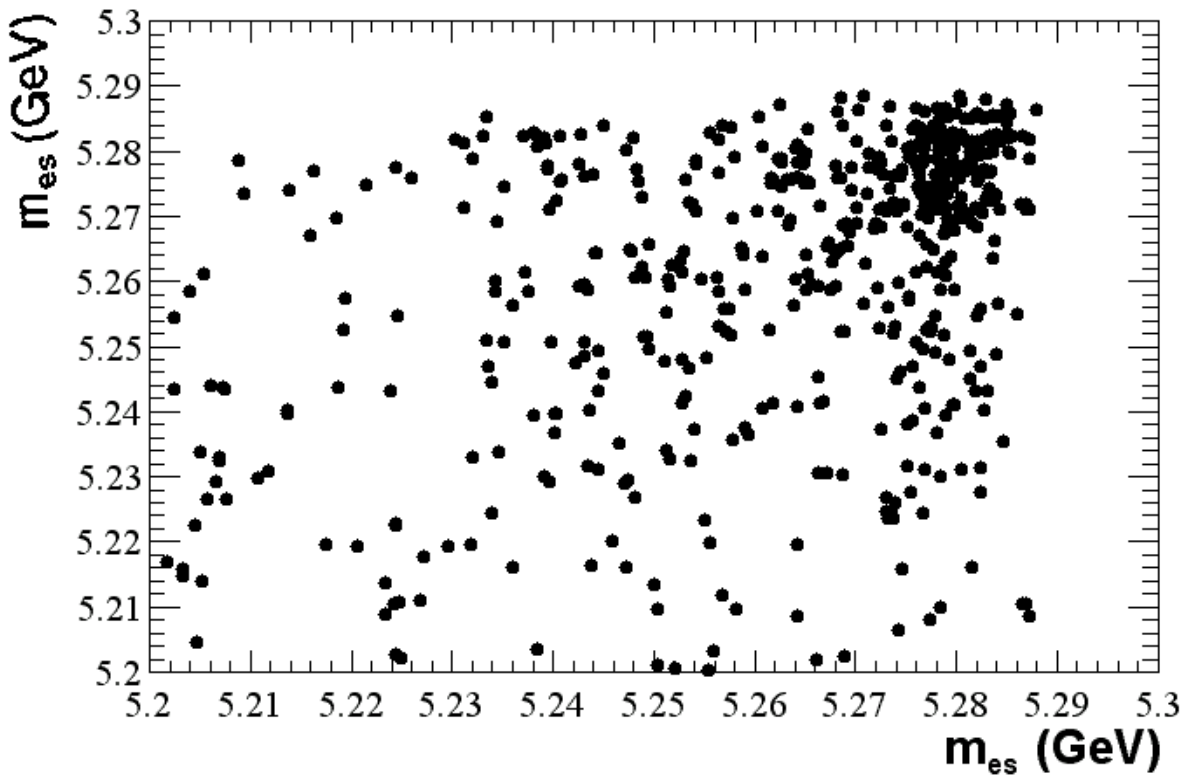
- Experimental method:
  - Compare rates of single and double "semi-exclusive" reconstruction of B mesons.
  - Start with a $D^{(*)}$ seed, add pions, kaons, neutrals and make a B meson.



B^0

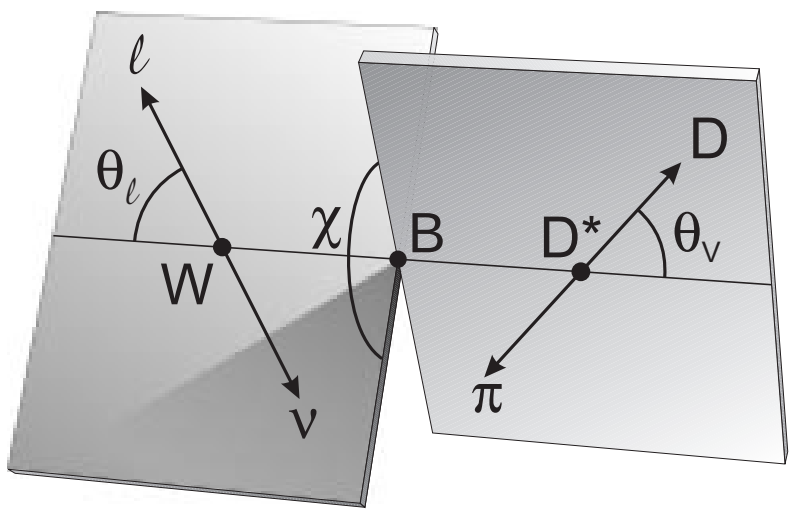
Computing Intensive Analysis

- Very computing intensive analysis:
  - The fact that it can be done at all is a success of the old Computing Model.
  - Not feasible in Belle!
  - Final sample:

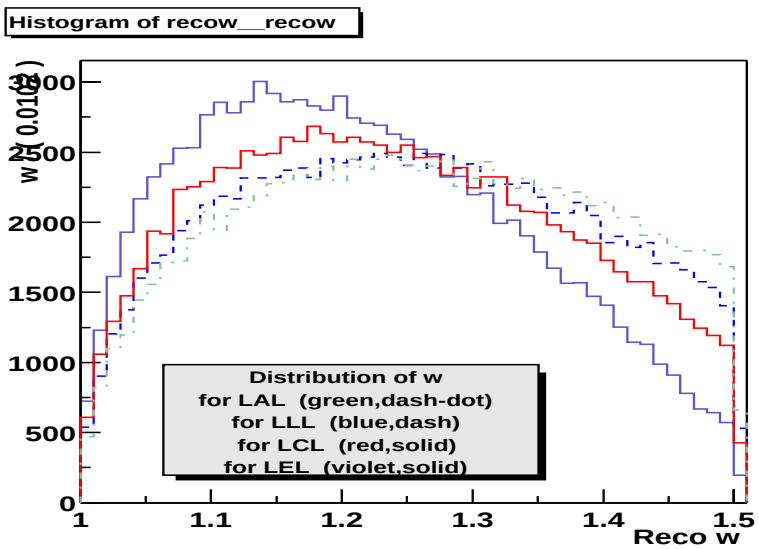


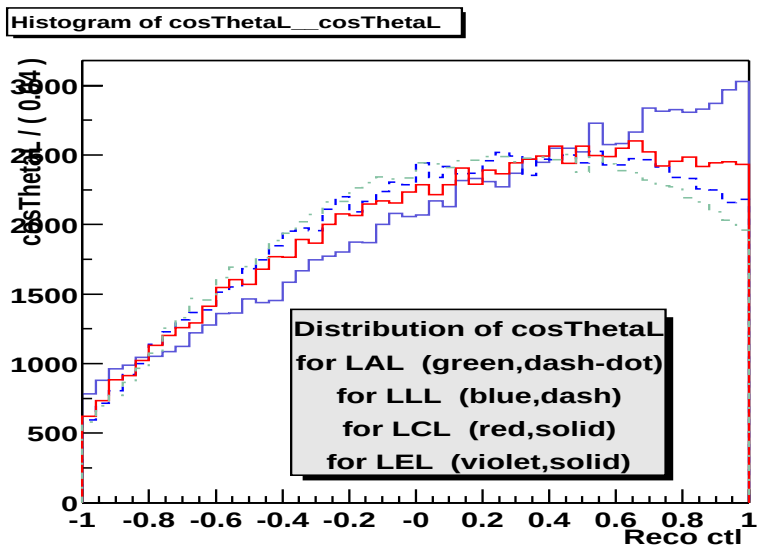
B Meson Form Factors [Gill]

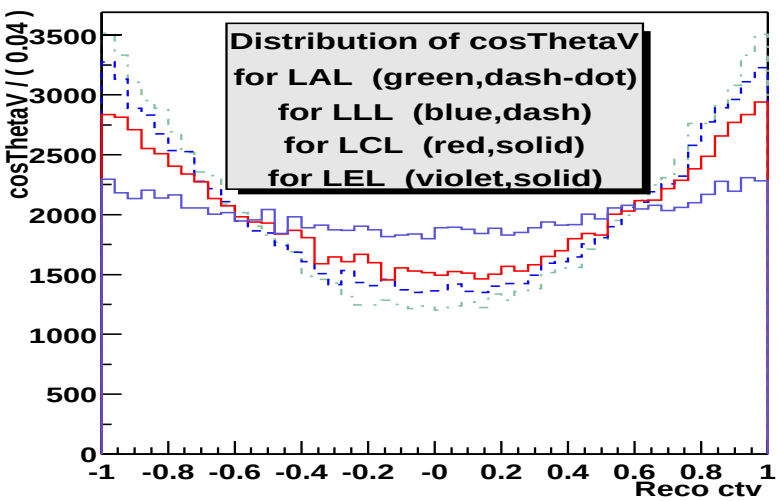
- Measure neutral B meson form factors in $B^0 \to D^* l \nu$ decays.
- Precise determination needed for ever improving V_{cb} measurements.
- Test of Heavy Quark Effective Theory.
- Exploit the much larger BaBar data set to improve previous CLEO results (x80).
- Use four kinematic variables to extract the form factors: $\omega, \cos\theta_l, \cos\theta_V, \chi$.

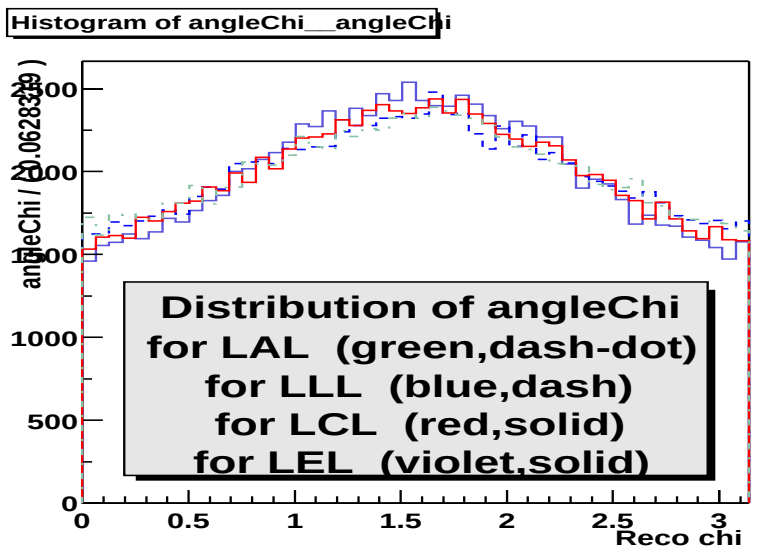


Input Variables Sensitive to Form Factors



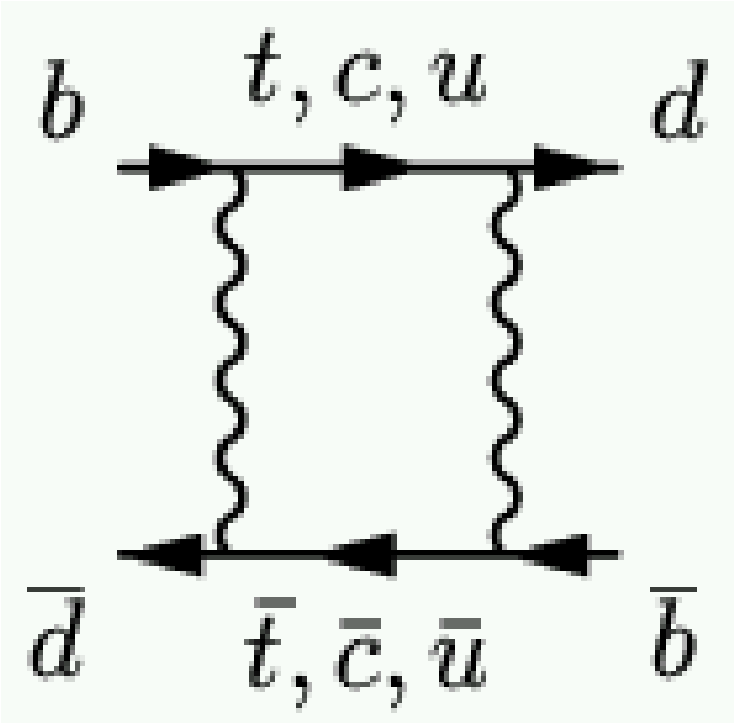






$\Delta\Gamma$ and CP/CPT Violation in B Mixing [Cahn]

- Use fully reconstructed 'flavour' and CP eigenstates.
- Fit the time dependence.
- Extract:
  - Decay width difference $\Delta\Gamma/\Gamma$
  - CP-violation in mixing only: $|q/p|^2$
  - CPT violation: z
- Small effects expected in the Standard Model:
  - $\Delta\Gamma/\Gamma \approx -0.003$
  - $(|q/p| - 1) \approx 4 \times 10^{-4}$
  - $z = 0$

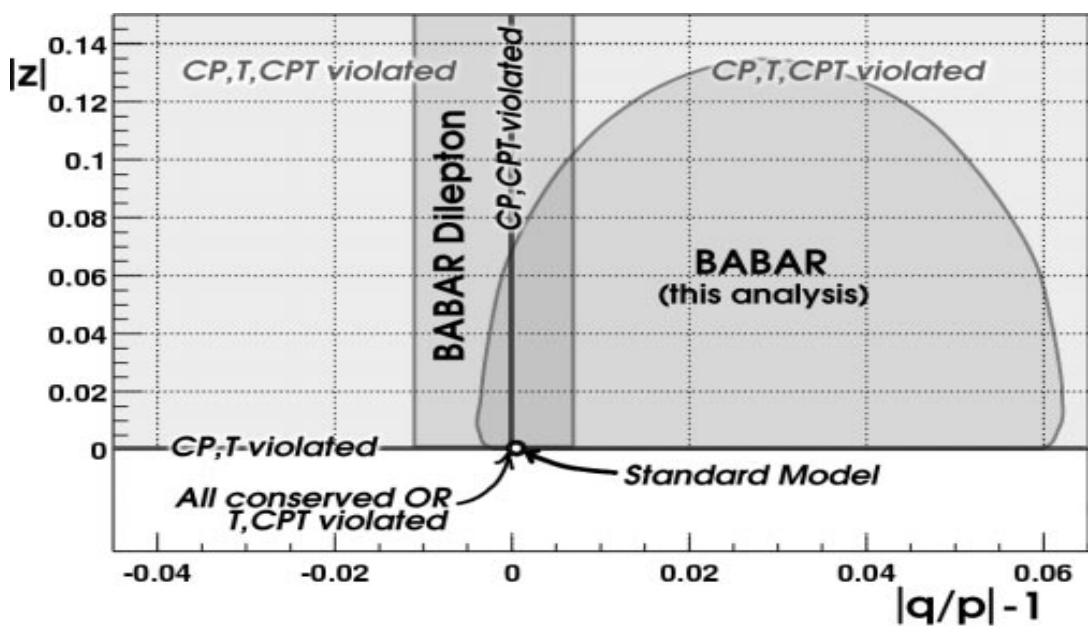


Stringent Limits

- Most precise limits on $\Delta\Gamma/\Gamma$ and CPT violation:

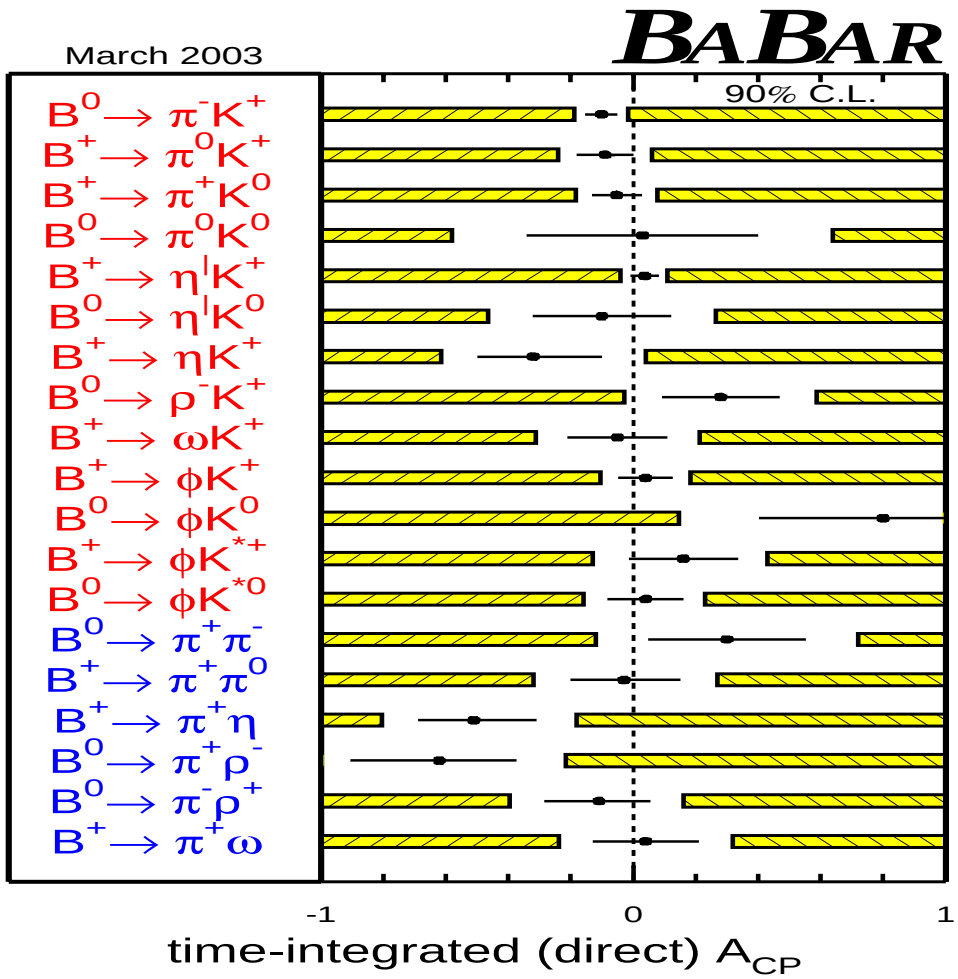
$sgn(Re\ \lambda_{CP})\Delta\Gamma/\Gamma$	$=$	$-0.008 \pm 0.037(stat.) \pm 0.018(syst.)$	[-0.084, 0.068]
$\lvert q/p \rvert$	$=$	$1.029 \pm 0.013(stat.) \pm 0.011(syst.)$	[1.001, 1.057]
$Re\ \lambda_{CP}/\lambda_{CP})Re\ z$	$=$	$0.014 \pm 0.035(stat.) \pm 0.034(syst.)$	[-0.072, 0.101]
$Im\ z$	$=$	$0.038 \pm 0.029(stat.) \pm 0.025(syst.)$	[-0.028, 0.104]

- Sets new standard for analyses of the 'golden mode' $\sin 2\beta$.



(No) Direct CP Violation (Yet!) [Gritsan]

Compilation of direct-CP results from *BABAR* shown at Moriond(QCD)-2003:
No significant deviations from 0 ..... yet!



Summary

- BaBar producing lots of data and physics results
- BaBar challenged by size of dataset and by KEK-B and Belle's outstanding performance.
- LBNL BaBar contributing to analysis of $B \to VV, B \to D_s\pi, \Upsilon \to B\bar{B}, CPT$ and $\Delta\Gamma/\Gamma$.
- LBNL innovations in computing centerpiece of new computing model.
- LBNL active in leadership of collaboration.
- Too early to phase out this pioneering effort!