First Physics Results From Belle

Asish Satpathy

Department of Physics
University of Cincinnati, Cincinnati, OH 45221-0011, USA
(For The Belle Collaboration)

The Belle detector at the KEK-B asymmetric $e^+e^-$ collider has recorded 6.2 fb$^{-1}$ data at the $\Upsilon(4S)$ resonance by July 2000. Using this data sample, several new results on various $B$ meson branching ratio measurements are presented. We also report on the measurement of the Standard Model $CP$ violation parameter $\sin(2\phi_1)$, where $\phi_1$ is one of angles of the CKM triangle. The preliminary result is $\sin(2\phi_1) = 0.45^{+0.43}_{-0.44} \pm 0.08$.

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1 Introduction

The Belle Experiment [1] at the KEK-B asymmetric $e^+ e^-$ collider has completed its first year of operation in July 2000 accumulating data equivalent to an integrated luminosity of 6.2 fb$^{-1}$ on the $\Upsilon(4S)$. This corresponds to about $6.3 \times 10^6 B \bar{B}$'s. Apart from the early running period, the KEK-B machine operated quite well delivering a record luminosity of 94 pb$^{-1}$ per day and 504 pb$^{-1}$ per week respectively and has great prospects for further improvement towards its design goal of 100 fb$^{-1}$/Year.

We report on some of the new measurements that have been carried out using this dataset with the emphasis on the measurement of the Standard Model CP violation parameter $\sin(2\phi_1)$. The results being reported are all preliminary.

2 General Features of Data Analysis

$B$ candidates are identified using $M_b = \sqrt{E^2_{\text{beam}} - |\sum P^2_{\text{cons}}|}$, the beam constrained mass and $\Delta E = E_{\text{beam}} - E_B$, where $E_{\text{beam}} = E_{\text{cms}}/2$. While $M_b$ expresses the momentum conservation in the decay, $\Delta E$ expresses the energy conservation of the particles in the decay and is sensitive to the missing particles and $K/\pi$ misidentification.

In all the decay modes we consider here, the dominant source of background arises from $e^+ e^- \rightarrow q\bar{q}(q = u, d, c, s)$ transitions. We exploit the difference between jetty hadronization of continuum events and spherical decay of $B$’s at $\Upsilon(4S)$ center of mass frame. Continuum background is reduced using $R_2 = H_2/H_0$, where $H_l = \sum_{i,j} |\vec{p}_i| |\vec{p}_j| P_l(\cos \theta_{i,j})$, the Fox-Wolfram moment [2], that measures the shape of an event as a whole and $P_l(\cos \theta_{i,j})$ are Legendre Polynomials. In some decay modes, the continuum background is reduced using modified Fox Wolfram moments [3] where the tracks and showers coming from $B$ and the rest of the tracks and showers in the event are separated. These modified Fox-Wolfram moments are combined in a Fisher Discriminant to form the Super Fox Wolfram (SFW). The SFW has approximately $2\sigma$ separation between $q\bar{q}$ and $B \bar{B}$ events and provides a 22% increase in the expected significance for some modes as compared to $R_2$. Another popular technique to remove the continuum component in the data is to cut on $\cos(\theta_{\text{thrust}})$ variable, where $\theta_{\text{thrust}}$ is the angle between the thrust axis of the signal $B$ and the thrust axis of the rest of the event. In some analyses, the continuum variables are combined with kinematic variables in a likelihood fit to determine the signal yield.

3 Branching Ratio Measurement

We will highlight selected branching ratio measurements that were either first observation or important new measurements. The preliminary results reported in this
section are based on the first 5.3 million $B\bar{B}$ events recorded on the $\Upsilon(4S)$ resonance at KEK-B.

3.1 $B \rightarrow \phi K$

This is the first observation of $B$ decays involving a pure penguin transition, $b \rightarrow ss\overline{s}$. Two charged tracks identified as kaons are combined to form a $\phi$ meson candidate with an additional requirement that both tracks are from one vertex. The candidate $\phi$ is then combined with a charged $K$ or $K_s$ to form a $B$ candidate. Continuum background is suppressed with cuts on $\cos(\theta_{\text{thrust}})$, the $\phi$ meson helicity angle which is the angle between the direction of $K^+$ and the momentum vector of $\phi(1020)$ and the $B$ flight direction. The final yield is obtained by fitting the $M_b$ distribution (Fig. 1). The binned likelihood fit yields $9.2^{+3.6}_{-2.9} (B \rightarrow \phi K)$ events with a statistical significance of $5.4\sigma$ and $B(B^+ \rightarrow \phi(1020)K^+) = 1.72^{+0.67}_{-0.54}(\text{stat.}) \pm 0.18(\text{sys.}) \times 10^{-5}$. We also observed two events of the type $B \rightarrow \phi K_s$ in the $3\sigma$ signal box. These are consistent with the fluctuation in the $q\overline{q}$ background. A more detailed description of the analysis can be found in reference [4]. As statistics improve, this decay mode will be used to determine the CKM angle $\phi_1$.

![Figure 1: $B \rightarrow \phi K$ signal yield. [left:] Beam constrained mass distribution [right:] $\Delta E$ distribution](image)

3.2 $B \rightarrow K\pi, KK, \pi\pi$

The study of charmless hadronic $B$ meson decays offers a variety of test of Standard Model physics and beyond. Our immediate motivation was to measure the branching fraction of those decay modes which are either not measured or are limited by statistics. We have summarized the current Belle branching fraction measurements of charmless $B \rightarrow hh$ decays in Table 1. Thanks to the excellent performance of the
Table 1: Belle preliminary results for charmless $B \to PP$ decays. The first error is statistical, the second error is systematic. Upper limits are given at the 90 % C.L.

| Decay Modes | Signal Yield | $\mathcal{B}(\times10^{-5})$ | U.L.$(\times10^{-5})$ |
|-------------|--------------|-----------------------------|------------------------|
| $B^0 \to K^+\pi^-$ | $25.6^{+4.3}_{-6.8}$ | $1.74^{+0.51}_{-0.46} \pm 0.34$ | |
| $B^0 \to K^+\pi^0$ | $32.3^{+9.4}_{-8.4}$ | $1.88^{+0.55}_{-0.49} \pm 0.23$ | |
| $B^0 \to K^0\pi^+$ | $5.75^{+3.4}_{-2.7}$ | $1.66^{+0.98}_{-0.78} \pm 0.24$ | $<3.4$ |
| $B^0 \to K^0\pi^0$ | $10.8^{+4.8}_{-4.0}$ | $2.10^{+0.93}_{-0.78} \pm 0.23$ | |
| $B^0 \to K^+K^-$ | $0.8^{+0.8}_{-0.8}$ | | $<0.6$ |
| $B^0 \to K^+K^0$ | $0.0^{+0.5}_{-0.0}$ | | $<0.51$ |
| $B^0 \to \pi^+\pi^-$ | $9.3^{+5.3}_{-5.1}$ | $0.63^{+0.39}_{-0.35} \pm 0.16$ | $<1.65$ |
| $B^0 \to \pi^+\pi^0$ | $5.4^{+5.7}_{-4.4}$ | $0.33^{+0.35}_{-0.27} \pm 0.07$ | $<1.01$ |

3.3 Radiative $B$ Meson Decays

Flavor-changing neutral decays involving $b \to s$ or $b \to d$ transition have received much attention in recent years. The inclusive decay $B \to X_s\gamma$ where $X_s$ is a strange hadronic state, is of particular interest to the experimentalist since the theoretical description of the decay mode is rather clean and can be related to the partonic weak decay $b \to s\gamma$. A short term motivation in this direction was to measure the branching fraction with a better particle identification device and a high resolution electro-magnetic calorimeter. Table 2 summarizes the signal yield and corresponding branching fraction measurement of radiative $B$ meson decays at Belle. The results are comparable to the recent CLEO results [8]. Our current 90 % C.L. upper limit on the ratio is $\mathcal{B}(B \to \rho\gamma)/\mathcal{B}(B \to K^*\gamma) <0.28$. This is an important result because it constrains $|V_{ts}/V_{td}|$ within the Standard Model. A detailed description of the analysis method can be found in reference [9].

3.4 $B \to D^{(*)}K$

We report the observation of the Cabibbo-suppressed decay modes $\overline{B}^0 \to D^{(*)}K^-$ and $B^- \to D^{(*)}K^-$ (Fig. 2). In addition, we also report a new measurement of $\mathcal{B}(\overline{B}^+ \to D^0 K^+)$. Thanks to the excellent particle identification at Belle, one can clearly separate the signal from the background originating from the Cabibbo-favored decay modes with more than 3$\sigma$ significance. We measured the ratio $R$ of the branching
Decay Modes | Signal Yield | $B(\times 10^{-5})$ | U.L.$(\times 10^{-5})$
---|---|---|---
$b \rightarrow s\gamma$ | 92 ± 14 | 33.4 ± 5.0$^{+0.33+2.6}_{-0.37-2.8}$ | |
$B^0 \rightarrow K^{*0}\gamma$ | 33.7 ± 6.9 | 4.94 ± 0.93$^{+0.55}_{-0.52}$ | |
$B^+ \rightarrow K^{*+}\gamma$ | 8.7 ± 4.2 | 2.87 ± 1.20$^{+0.55}_{-0.40}$ | |
$B^0 \rightarrow \rho^0\gamma$ | | < 0.56 | |
$B^+ \rightarrow \rho^+\gamma$ | | < 2.27 | |

Table 2: Belle preliminary results for radiative $B$ meson decays. The first error is statistical, the second error is systematic. Upper limits are given at the 90 % C.L.

| Decay Modes | Ratio | 
|---|---|
| $B(B^- \rightarrow D^0K^-)/B(B^- \rightarrow D^0\pi^-)$ | $0.081 \pm 0.014 \pm 0.011$ |
| $B(B^- \rightarrow D^{*0}K^-)/B(B^- \rightarrow D^{*0}\pi^-)$ | $0.134^{+0.045}_{-0.038} \pm 0.015$ |
| $B(B^- \rightarrow D^{*+}K^-)/B(B^- \rightarrow D^{*+}\pi^-)$ | $0.062^{+0.039}_{-0.024} \pm 0.013$ |

Table 3: Belle preliminary results for Cabibbo-suppressed $B$ meson decays. The first error is statistical, the second error is systematic.

fraction for the Cabibbo suppressed decay $B \rightarrow D^{(*)}K^-$ normalized relative to the Cabibbo allowed decay $B \rightarrow D^{(*)}\pi^-$. The observed ratios are summarized in Table 3. The detailed description of the analysis method can be found in the reference [10].

As statistics improve, the analysis will shift towards the extraction of the CKM angle $\phi_3$.

### 3.5 $B \rightarrow J/\psi K_1$

Inclusive $B \rightarrow J/\psi X$ decays are not saturated by the sum of observed exclusive modes. This motivates the search for new exclusive modes that we are reporting here. $K_1$ candidates were reconstructed from $K^+\pi^+\pi^-, K^+\pi^-\pi^0$ and $K^0\pi^+\pi^-$. We have verified the signal is due to $B \rightarrow J/\psi K_1(1270)$ (Fig. 3) and determine the branching fractions as summarized in Table 4.

### 4 Measurement of $\sin(2\phi_1)$

Experimentally, $CP$ asymmetry is observed in the distribution of the proper time difference of two $B$ decays produced in pairs in the decays of the $\Upsilon(4S)$, one to $CP$ eigenstate and another to any final state where the flavor is identified. For a $B$ decaying to a $CP$ eigenstate, the time dependent asymmetry $a(t)$ can be non-zero,
indicating CP violation:

\[ a(t) = \frac{N(B^0(t) \to f) - N(B^0(t) \to f)}{N(B^0(t) \to f) + N(B^0(t) \to f)} = \frac{(1 - |\lambda_f|^2) \cos(\Delta m_d t) - 2i m \lambda_f \sin(\Delta m_d t)}{(1 + |\lambda_f|^2)} \]  

(1)

where \( \lambda_f = \frac{\Delta \Gamma_f}{\Gamma_f} \), \( \Delta m_d \) is the \( B_d \) mixing frequency, \( \Gamma \) its width and \( Im \lambda_f = \sin(2\phi_1) \) that arises from the interference between the decays with and without mixing.

When \( B^0 \to f = \bar{B}^0 \to f \) and assuming only one diagram dominates the decay process, \( |\lambda_f|^2 = 1 \). Then the time dependent asymmetry would be

\[ a(t) \sim \eta_{CP} \sin(2\phi_1) \sin(\Delta m_d t) \]  

(2)

where \( \eta_{CP} = -1 \) for \( \psi K_s \) type modes and \( \eta_{CP} = 1 \) for \( J/\psi K_L \) and \( \psi \pi^0 \) modes. One of the important and immediate goal for the Belle experiment is to measure \( \sin(2\phi_1) \) to see if the CKM model is correct.

Table 4: Belle preliminary results for \( B \to J/\psi K_1(1270) \). The first error is statistical, the second error is systematic.

| Decay Modes | Branching Ratio \((\times 10^{-3})\) |
|-------------|---------------------------------|
| \( B(B^0 \to J/\psi K_{1}^{0}(1270)) \) | \( 1.5^{+0.5}_{-0.4} \pm 0.4 \) |
| \( B(B^+ \to J/\psi K_{1}^{+}(1270)) \) | \( 1.7^{+0.5}_{-0.4} \pm 0.4 \) |

Figure 2: \( \Delta E \) distribution of (left) \( B^0 \to D^{*+}K^- \) (right) \( B^- \to D^{*0}K^- \). The signal yield is obtained from the fit to the distribution with a double Gaussian signal function and a MC determined background shape.
Figure 3: Signal yield for the decay $B \to J/\psi K_1(1270)$ (left) $M_b$ distribution (right) $\Delta E$ distribution.

Table 5: Summary of Signal Yield of CP eigenstate $B$ meson decays.

| Modes                     | CP  | S / N   | Tagged |
|----------------------------|-----|---------|--------|
| $J/\psi(l^+l^-)K_s(\pi^+\pi^-)$ | -1  | 70 / 3.4 | 40     |
| $J/\psi(l^+l^-)K_s(\pi^0\pi^0)$  | -1  | 4 / 0.3 | 4      |
| $\psi'(l^+l^-)K_s(\pi^+\pi^-)$   | -1  | 5 / 0.2 | 2      |
| $\psi'(J/\psi\pi^+\pi^-)K_s(\pi^+\pi^-)$ | -1  | 8 / 0.6 | 3      |
| $\chi_{c1}(J/\psi\gamma)K_s(\pi^+\pi^-)$ | -1  | 5 / 0.75 | 3   |
| $J/\psi(l^+l^-)\pi^0$            | +1  | 10 / 1  | 4      |
| **Total**                      |     | 102 / 6.25 | 56    |
| $J/\psi(l^+l^-)K_L$             | +1  | 102 / 48 | 42     |

4.1 Event Reconstruction: $B$ Decaying to CP Eigenstate

Table 5 summarizes the decay modes that are reconstructed for the CP analysis. $J/\psi$ and $\psi(2S)$ candidate events were reconstructed from dileptons ($\mu^+\mu^-, e^+e^-$), correcting for the final state radiation in the electron channel. For $\psi(2S)$ candidates we also used the $J/\psi\pi^+\pi^-$ mode. $\chi_{c1}$ candidates were reconstructed using only the $J/\psi\gamma$ decay mode. $K_s$ candidates were reconstructed in the $\pi^+\pi^-$ and $\pi^0\pi^0$ modes. We reconstructed 102 CP eigenstate candidate with 6 estimated background (Fig. 4(left)).

We also reconstructed 102 CP even $B \to J/\psi K_L$ candidate events (Fig. 4(right)) with 48 estimated background. Among the backgrounds which contain CP asymmetry, major contributions come from physics events such as $B$ decays to $\chi_{c1}K_L$, $J/\psi K_s$, $J/\psi K^*$ and $J/\psi$ non-resonant $K_L\pi^0$. 
4.2 Measurement of $B$ Life Time: A Benchmark Test

Extraction of $CP$ asymmetry requires the knowledge of proper time distribution of tagged and fully reconstructed $B_{CP}$ event. For $CP$ eigenstate modes, the proper time, $\Delta t = \Delta z/c\beta\gamma$ at $\beta\gamma = 0.425$, was calculated by measuring the difference between the decay vertices of $B_{CP}$ decay vertex and tagging side $B_{tag}$ vertex. The vertex point of $B_{CP}$ was established by the two tracks associated with the $J/\psi$ decay. The vertex position in the tagging side was determined from the tracks not assigned to $B_{CP}$ by an algorithm that removes tracks from the secondary vertices or tracks which makes a large increase in the $\chi^2$ of the vertex fit.

The proper time resolution function $R_{sig}(\Delta t)$ was parameterized from MC simulation studies and a multi-parameter fit to $B \to D^*l\nu$ data (Fig. 5). A double Gaussian parameterization results from various detector characteristics, error in the event by event vertex fit, error in the $\Delta t$ approximation, the scale factor and charm lifetime.

We measured the $B$ life time in various decay modes to test the proper time resolution function that we derived from MC studies. The $B$ lifetime was extracted from an event by event likelihood fit with a P.D.F given by

$$P(\Delta t) = f_{sig} \int_{-\infty}^{\infty} d(\Delta t') \frac{e^{-|\Delta t'|/\tau_{sig}}}{2\tau_{sig}} R_{sig}(\Delta t - \Delta t')$$

$$+(1 - f_{sig}) \int_{-\infty}^{\infty} d(\Delta t') [f_{bg} \frac{\lambda_{bg}}{2} e^{-|\Delta t'|\lambda_{bg}} + (1 - f_{bg}) \delta(\Delta t')] R_{bg}(\Delta t - \Delta t')$$

Minimization of the likelihood gives $\tau_B$ which is one of the free parameters determined from the fit. It should be noted that $R_{bg}(\Delta t)$ was parameterized in the same way.
Figure 5: (left): Average shape of the event by event resolution function. (right): Lifetime fit results for $B^0 \rightarrow D^{*+} l^- \nu$.

|               | Belle               | Particle Data group               |
|---------------|---------------------|-----------------------------------|
| $\tau_{B^0}$ | $1.50 \pm 0.05 \pm 0.07$ ps | $1.548 \pm 0.032$ ps             |
| $\tau_{B^-}$ | $1.70 \pm 0.06^{+0.11}_{-0.10}$ ps | $1.653 \pm 0.028$ ps             |
| $\tau_{B^-}/\tau_{B^0}$ | $1.14 \pm 0.06^{+0.06}_{-0.05}$ | $1.062 \pm 0.029$               |

Table 6: Summary of the measured $B$ lifetime at Belle.

as of $R_{sig}(\Delta t)$ using background events from the sideband region of the $\Delta E$ and $M_b$ scatter plot.

The superimposed solid line on the data points in the right plot of Fig. 5 is the result of the refit for $B^0 \rightarrow D^{*+} l^- \nu$. The measured $\tau_B$ agrees with the world average value proving that the parameterization of the resolution function is correct. Table 6 summarizes the measured combined results for the $B$ lifetime from various charged and neutral $B$ decays.

### 4.3 Flavor Tagging and Wrong Tag Fraction

To measure the $CP$ asymmetry, we need to determine the flavor of the $B_{CP}$ candidates from the remaining tracks of the event. We use the following algorithm in sequence to tag a certain $B$ in an event. (0) Require tight PID probability for lepton and kaon selection, (1) Obtain the sign of the high momentum lepton ($p_T^l > 1.1$ GeV) $\rightarrow$ positive lepton tags $B^0$, (2) Obtain sum of $K$ charges $\rightarrow$ positive sum tags $B^0$, ...
Table 7: Tagging efficiency and wrong tagging fraction at Belle

| Method           | $\epsilon_{\text{tag}}$ | $w$ (%) | $\epsilon_{\text{eff}}$ |
|------------------|--------------------------|---------|------------------------|
| High $p^*$ Lepton| 14.2±2.1                 | 7.1±4.5 | 10.5±2.7               |
| Kaons            | 27.9±4.2                 | 19.9±7.0| 10.1±4.9               |
| Mid $p^*$ Lepton | 2.9±                     | 29.2±15.0| 0.5                    |
| Soft pion        | 7.0±3.5                  | 34.1±15.0| 0.7                    |
| Total            | 52.0                     | 21.2                |

(3) Look for medium momentum leptons ($0.6 < p^*_l < 1.1$ GeV) and large missing momenta $\rightarrow$ positive charged lepton tags $B^0$, (4) Sign of slow pions from $D^{*+}$ decays $\rightarrow$ charge of slow pion and hence flavor of $D^*$ tags the flavor of $B$.

The algorithm was tested on a sample of self tagging exclusively reconstructed $B \rightarrow D^{(*)} l \nu$ decays. We extract the wrong tag fraction ($w$) and $\Delta m_d$ from a maximum likelihood fit to the $\Delta t$ distribution (eqn. 4) of $OF$ (opposite flavor) and $SF$ (same flavor) events with a function that includes the effect of $\Delta t$ resolution and background.

$$A_{mix}(\Delta t) = \frac{N(\Delta t)^{OF} - N(\Delta t)^{SF}}{N(\Delta t)^{OF} + N(\Delta t)^{SF}} = (1 - 2w) \cos(\Delta m_d \Delta t) \tag{4}$$

The measured value $\Delta m_d = 0.488 \pm 0.026$ (stat.) ps$^{-1}$ verifies the consistency of the tagging algorithm. In an independent approach, $\Delta m_d$ was determined from the time evolution of dilepton yields in $\Upsilon(4S)$ decays. The proper-time difference distribution for same-sign and opposite-sign dilepton events were simultaneously fitted to an expression containing $\Delta m_d$ as a free parameter. Using both electrons and muons, we obtain $\Delta m_d = 0.463 \pm 0.008$ (stat.)$\pm 0.016$ (sys) ps$^{-1}$ \cite{11}. This is the first determination of $\Delta m_d$ from time evolution measurements at the $\Upsilon(4S)$. Previous measurements at the $\Upsilon(4S)$ only used time integrated distributions.

Table 7 summarizes the estimated tagging efficiency in each of the above steps. The effective tagging efficiency $\epsilon_{\text{eff}} = \epsilon_{\text{tag}}(1 - 2w)^2$ is found to be 21.2 %. We also determined the tagging efficiency from the same test sample. Depending on the tag type, we used the numbers in the table for the fit to extract $\sin(2\phi_1)$.

4.4 CP Fit: Extraction of $\sin(2\phi_1)$

Using the tagging method described above, from a sample of 102 $CP$ odd and $J/\psi \pi^0$ events and 102 $J/\psi K_L$ events, a total of 98 events were tagged. The likelihood for each tagged event is calculated as

$$P(\Delta t) = \int_{-\infty}^{\infty} f_{\text{sig}} \int_{-\infty}^{\infty} \text{Sig}(\Delta t', \eta_{\text{CP}}) R_{\text{sig}}(\Delta t - \Delta t') d(\Delta t')$$

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\begin{equation}
+(1 - f_{sig}) \int_{-\infty}^{\infty} Bkg(\Delta t') R_{sig}(\Delta t - \Delta t') d(\Delta t')
\end{equation}

where the P.D.F expected for the signal distribution with CP eigenvalue \( \eta_{CP} \) is:

\[ Sig(\Delta t, \eta_{CP}) = \frac{1}{\tau_{B^0}} \exp\left(-|\Delta t|/\tau_{B^0}\right) \{1 \mp \eta_{CP}(1 - 2w) \sin(2\phi_1) \sin(\Delta m_d \Delta t)\} \]

and that of background distribution is:

\[ Bkg(\Delta t') = \frac{1}{2\tau_{bkg}} \exp\left(-|\Delta t|/\tau_{bkg}\right) \]

\( w \) depends on the method of flavor tagging for each event.

The values of \( \Delta m_d \) and \( \tau_{B^0} \) are fixed to the ones in the P.D.G. We use an unbinned maximum likelihood fit to extract the possible CP asymmetry. Before doing a CP fit, we wanted to make sure that the whole fitting procedure is bias free. We performed the same analysis procedure including tagging to several non-CP eigenstate decay modes, such as \( B^0 \rightarrow J/\psi K^{*0}, B^- \rightarrow J/\psi K^- \), \( D^0 \pi^- \) and found \( \sin(2\phi_1) \) is consistent with zero within fitting errors. Our result from the likelihood fit to the fully tagged sample is:

\[ \sin(2\phi_1) = +0.45^{+0.43}_{-0.44} (\text{stat.})^{+0.07}_{-0.09} (\text{syst.}) \]

(Fig. 6). Clearly the measurement is statistics limited. It should be noted that the uncertainty in determining the wrong tag fraction is the largest contribution in the systematics.

\begin{figure}
\includegraphics[width=\textwidth]{cp_fit_results.png}
\caption{CP fit results for a combined CP even and CP odd events.}
\end{figure}

## 5 Conclusion and Prospect

Belle had a very successful and exciting first year run and is marching along a well defined road to measuring \( \sin(2\phi_1) \) with a very good precision. First preliminary results were reported. We need a lot more data to constrain the CKM triangle with small errors. We observed the first evidence of Cabibbo suppressed \( B \rightarrow D^*K^- \) process, and made first measurements of \( \mathcal{B}(B \rightarrow J/\psi K_1(1270)) \) and \( \mathcal{B}(B^+ \rightarrow \phi K^+) \). New results on many rare decays which will be used to search
for direct $CP$ violation have also been reported. The physics scope at Belle is not limited to $B$ physics only. We have reported five different $\tau$ and two-photon physics related results at the ICHEP2000 conference. Please check out for more: http://www.bsunsrv1.kek.jp/conferences/ichep2000.html.

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