Quark charge identification for e+e- to qq study

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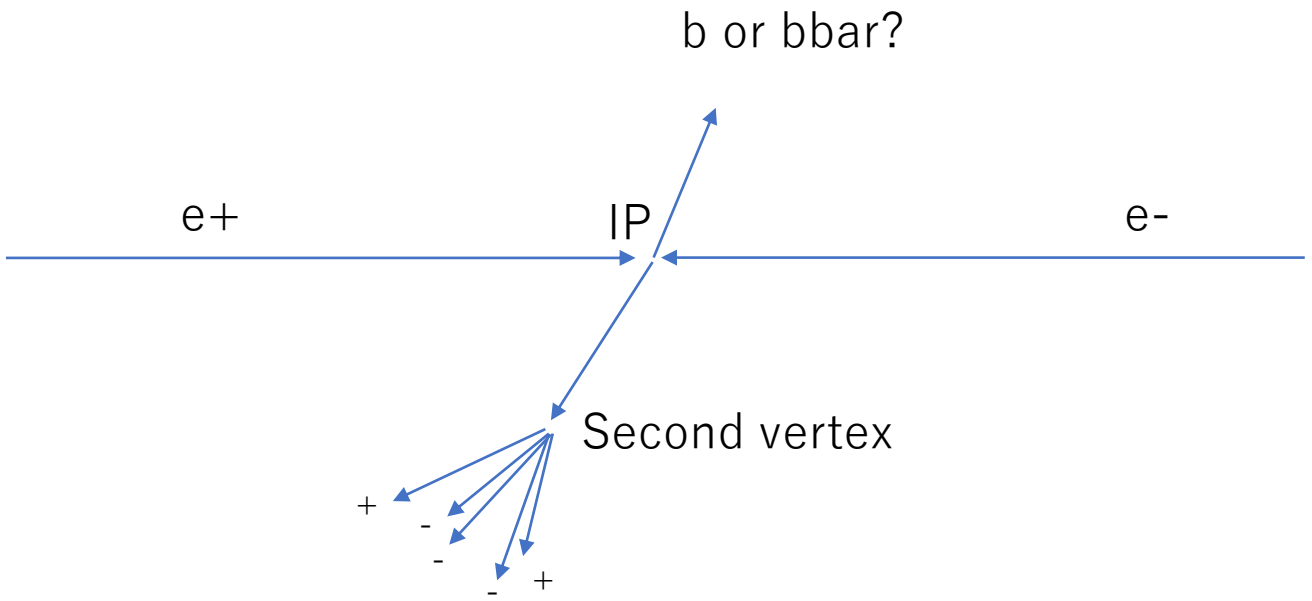
Hadron channel

- b(c) and bbar(cbar) decay to B(C) hadrons.



- By Calculating the vertex charges , we could separate b and $\bar{b}$.

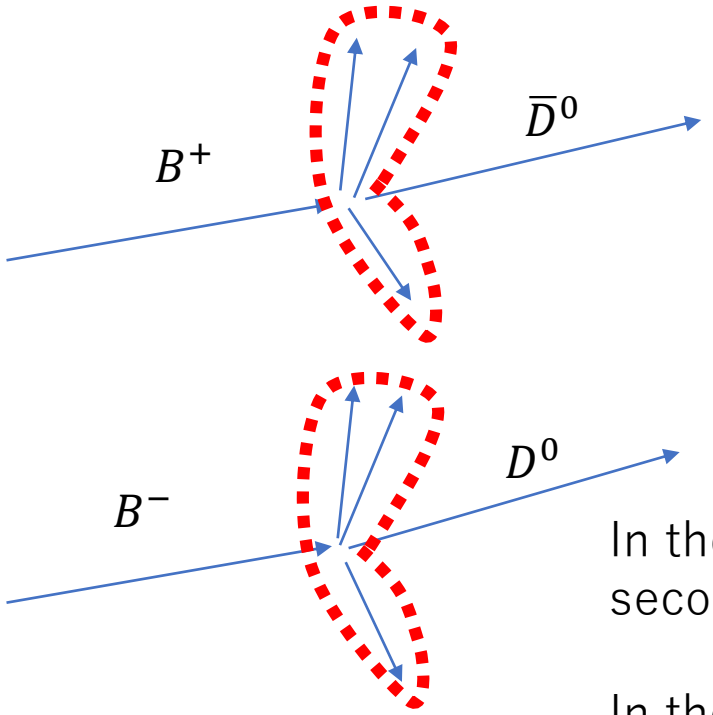
b quark charge ID

charge=+1	b	B^+ $u\bar{b}$	B_c^+ $c\bar{b}$	Ξ_b^+ $\bar{d}\bar{s}\bar{b}$	Ω_b^+ $\bar{s}\bar{s}\bar{b}$
charge=0		B^0 $d\bar{b}$	B_s $s\bar{b}$	$\overline{\Lambda_b^0}$ $\bar{u}\bar{d}\bar{b}$	$\overline{\Xi_b^0}$ $\bar{u}\bar{s}\bar{b}$
	$\bar{b}$	$\overline{B^0}$ $\bar{d}b$	$\bar{B}_c$ $\bar{s}b$	Λ_b^0 udb	Ξ_b^0 usb
charge=-1		B^- $\bar{u}b$	B_c^- $\bar{c}b$	Ξ_b^- dsb	Ω_b^- ssb

- There are two groups of B hadrons from b and $\bar{b}$.
- With case analysis as shown in the above figure, we study how to optimize charge ID in each individual case.
- In the previous study, charges were calculated collectively.
  →efficiency upgrade

For example B^+ or B^-

- The branching ratio of $B^+ \to \overline{D}^0 X$ is 79%



D^0 decay
- $K^- X$ 54.7%
- $K^+ X$ 3.4%

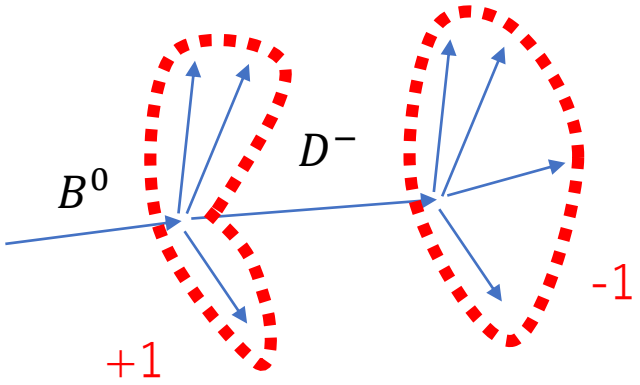
B^+ decay
- $D^0 X$ 8.6%
- $\overline{D^0} X$ 79%
- $D^+ X$ 2.5%
- $D^- X$ 9.9%

In the case of B^+ decay, sum charge in the second vertex tend to be +

In the case of B^- decay, sum charge in the second vertex tend to be -

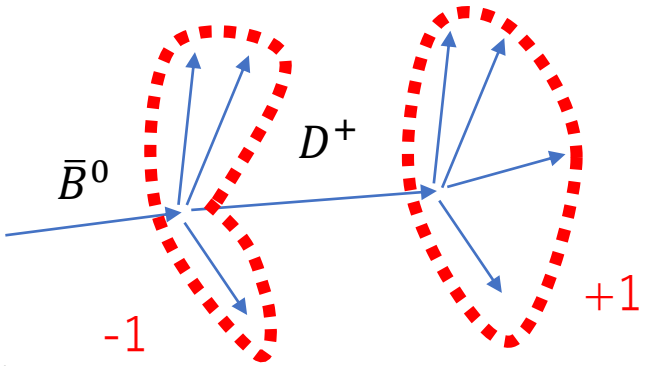
For example B^0 or $\bar{B}^0$

- The branching ratio of $B^0 \to D^- X$ is 47.4%



B^0 decay

- $D^0\, X$ 8.1%
- $\overline{D^0}\, X$ 47.4%
- $D^+\, X$ <3.9%
- $D^-\, X$ 36.9%



In the case of B^0 decay, sum charge in the second and third vertex tend to be +1 and -1 respectively.

In the case of $\bar{B}^0$ decay, sum charge in the second and third vertex tend to be vice versa.

Summary and Plan

- The process e+e- →qq plays an important role in electroweak precision measurements.
- The key to reconstruct events in the quark pair final state (bb, cc) is quark charge identification (ID).
- calculate the efficiency of charge ID in each B or C hadron case
- look for the best conditioning of charge ID.