Proposal for Continuum Data Taking at $\sqrt{s} = 3.67$ GeV

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Abstract

In order to get physics results from the newly taken 14 M $\psi(2S)$ data on hadronic decays of $\psi(2S)$, 10 pb^{-1} data at $\sqrt{s} = 3.67$ GeV is needed, at the mean time, a $\psi(2S)$ sample at $\psi(2S)$ peak of the size around 4 M is needed to calibrate the data sample at $\sqrt{s} = 3.67$ GeV.

It has already known that $\psi(2S)$ analysis is very important for understanding the QCD at low energy, BES is now at the leading position both in hadronic decay studies of orthocharmonium for a deep understanding of the hadronic decay puzzles, and in charmonium physics study, based on a limited data sample taken with BESI [1].

Thanks to the excellent performance of BESII and the accelerator during last running year (2001-02), 14 M $\psi(2S)$ data at peak were accumulated with reasonable good quality, with this sample, lots of preliminary studies have been performed and interesting results were got [2].

The study on $\psi(2S)$ data indicates the continuum process may have non-negligible effect on $\psi(2S)$ hadronic decay study [3], and this basically prevent any experiment from giving physics results without considering the contribution from the continuum process.

As suggested in Ref. [3], the best way to disentangle the continuum contribution in $\psi(2S)$ hadronic decays is to measure the contribution from continuum for every exclusive mode. This will need a data sample of around 10 pb^{-1} at $\psi(2S)$ off peak. From Ref. [3], the best choice of the center of mass energy for off peak data taking is at $\sqrt{s} = 3.67$ GeV.

Since this data sample would have very different experimental conditions compared to the existing $\psi(2S)$ data sample, the calibration of the data sample in particle identification codes, in detector simulation codes and so on will need special $\psi(2S)$ runs during continuum data taking, from the experience in dealing with the existing 14 M $\psi(2S)$ data, it seems that a $\psi(2S)$ sample of size around 4 M events would fulfill this requirement.

The required data sample at $\psi(2S)$ off peak will not only benefit $\psi(2S)$ analysis, but also the study on the possible existing non-$D\bar{D}$ decays of $\psi(3770)$, although it is a bit far from the $\psi(3770)$ peak, it is still the best place for continuum study considering the radiative tail of $\psi(2S)$ and large width of $\psi(3770)$. Furthermore, this sample will also allow a precision R measurement, a careful study on the hadronic events shape and some other QCD studies.

In summary, we ask for 10 pb^{-1} data at $\sqrt{s} = 3.67$ GeV for a better study of the existing $\psi(2S)$ data samples at BES, at the mean time, a $\psi(2S)$ sample at peak of the size around 4 M is needed for related software development.

Note added: If we take 10 M $\psi(2S)$ data in 2002-03 running year, we will meet the annoucement of BES collaboration on $\psi(2S)$ data taking at ICHEP2002 [4] ("BES obtained 14 M $\psi(2S)$ events, plan to obtain 24 M events total").

References

[1] Gu Yifan, 'Experimental Study on Charmonium Physics at Beijing Electro-Positron Collider" in 'China Basic Science(2002.2)" (in Chinese), page 7-17.

[2] Yuan Changzheng, 'First Glance at 2001-02 $\psi(2S)$ Data', BES annual meeting, Chengdu, 2002.

[3] Wang Ping, Yuan Changzheng and Mo Xiaohu, 'The Contribution of One-photon Annihilation at $\psi(2S)$ in e^+e^- Experiment', submitted to High Energy Phys. and Nucl. Phys..

[4] F. A. Harris, 'Recent $\psi(2S)$ and η_c Results from BES", report at ICHEP2002, Amsterdam, Holland, July 24-31, 2002.