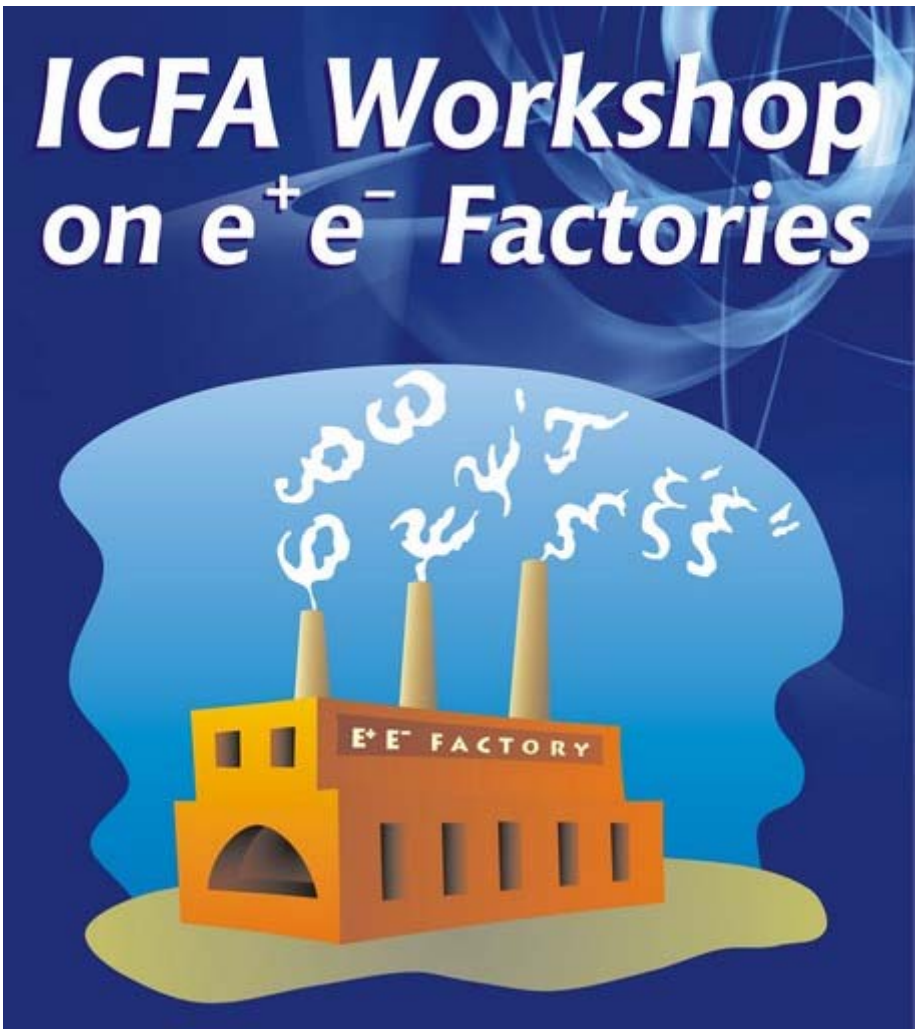
The 40th ICFA Advanced Beam Dynamics Workshop on High Luminosity e^+e^- Factories



Abstracts booklet

14 – 16 April, 2008

Budker Institute of Nuclear Physics,
Novosibirsk, Russia

MOACH - Collider reports (14-April-2008)

- **C. Zhang** for the BEPCII project team
  IHEP, CAS

The BEPCII, as a natural extension of the BEPC (Beijing Electron-Positron Collider), is a double ring e-e+ collider and a synchrotron radiation (SR) source with its outer ring, or SR ring. As an e-e+ collider, the BEPCII operates in the beam energy region of 1-2.1 GeV with design luminosity of 1*10e33 cm-2s-1 at 1.89 GeV. As a light source, the SR ring operates at 2.5 GeV and 250 mA. The project started construction in the beginning of 2004. The upgrade of the injector linac completed in late 2004. The BEPC ring dismount started in July 2005. Installation of the storage ring components completed in October 2007. The commissioning is in progress. In the meantime, the BESIII detector was constructed, assembled and tested in the off-line position beside the interaction region (IR).

- **J.Q.Wang**, L.Ma and C.Zhang
  IHEP, CAS

BEPCII is the upgrade project of Beijing Electron-Positron Collider (BEPC), which will operate in the beam energy region of 1-2.1 GeV with the design luminosity of 1*10e33 cm-2s-1 at 1.89 GeV. From Nov. 2006 to Aug. 2007, the phase one beam commissioning of BEPCII storage rings was carried out with the so called backup scheme which adopted conventional magnets in the IR instead of the superconducting insertion magnets (SIM). After the SIM was installed into the interaction region, the second phase commissioning began in Oct. 2007. The tuning method for high luminosity but low background has been extensively studied, and the beam current reached more than 1/2 of the design of 0.91 A, with the luminosity higher than 1*10e32 cm-2s-1, which is 10 times of BEPC. In addition, beam was delivered to SR users for about 1 month at 2.5GeV with maximum current over 250mA.

- **Q.Qin**, N. Huang, W.B. Liu, Y.D. Liu, Y.M. Peng, J. Qiu, D. Wang, X.H. Wang, N. Wang, J.Q. Wang, Y.Y. Wei, X.M. Wen, J. Xing, G. Xu, C.H. Yu, C. Zhang, Y. Zhang, Z. Zhao, D.M. Zhou
  IHEP, CAS

As an upgrade project of the Beijing Electron Positron Collider (BEPCII), the commissioning of the storage rings for both collision and synchrotron radiation modes started in Nov. 2006. Besides the normal commissioning on luminosity and beam performance, beam dynamics studies are being carried on as well. Some results on beam parameters determination, single and multi-bunch effect, and beam instabilities of two rings are given in this paper.

MOACH03 **BD Oerview in CESR**

- **A.Temnykh**
  Cornell

MOACH05 **PEP-II Status** 13

- **M.Sullivan**, K. Bertsche, M. Browne, Y. Cai, W. Cheng, W. Colocho, F.-J. Decker, M. Donald, S. Ecklund, R. Erickson, A. S. Fisher, J. Fox, S. Heifets, T. Himel, R. Iverson, A. Kulikov, A. Novokhatski, V. Pacak, M. Pivi, C. Rivetta, M. Ross, P. Schuh, J. Seeman, K. Sonnad, M. Stanek, P. Tenenbaum, D. Teytelman, J. Turner, M. Weaver, D. Van Winkle, U. Wienands, W. Wittmer, M. Woodley, Y. Yan, G. Yocky,
  SLAC, Menlo Park, CA
- W. Kozanecki,
  CEA/Saclay, France
- M. Biagini,
  INFN, Frascati, Italy

PEP-II and BaBar have just finished run 7, the last run of the SLAC B-factory. PEP-II was one of the few high-current e+e- colliding accelerators and holds the present world record for stored electrons and stored positrons. It has stored 2.07 A of electrons, nearly 3 times the design current of 0.75 A and it has stored 3.21 A of positrons, 1.5 times more than the design current of 2.14 A. High-current beams require careful design of several systems. The feedback systems that control instabilities, the RF system stability loops, and especially the vacuum systems have to handle the higher power demands. We present here some of the accomplishments of the PEP-II accelerator and some of the problems we encountered while running high-current beams.

MOACH06 **KEKB Status** 17

- **Y.Funakoshi**, Y.Funakoshi, T.Agho, K.Akai, K.Ebihara, K.Egawa, A.Enomoto, J.Flanagan, H.Fukuma, K.Furukawa, T.Furuya, J.Haba, S.Hiramatsu, T.Ieiri, N.Iida, H.Ikeda, T.Kageyama, S.Kamada, T.Kamitani, S.Kato, M.Kikuchi, E.Kikutani, H.Koiso, M.Masuzawa, T.Mimashi, A.Morita, T.T.Nakamura, K.Nakanishi, H.Nakayama, M.Nishiwaki, Y.Ogawa, K.Ohmi, Y.Ohnishi, N.Ohuchi, K.Oide, M.Ono, M.Shimada, M.Suetake, Y.Suetsugu, T.Sugimura, T.Suwada, M.Tawada, M.Tejima, M.Tobiyama, N.Tokuda, S.Uehara, S.Uno, N.Yamamoto, Y.Yamamoto, Y.Yano, K.Yokoyama, Ma.Yoshida, Mi.Yoshida, S.Yoshimoto,
  KEK, Japan
- F.Zimmermann
  visiting from CERN, Switzerland

The KEKB status is described focusing on the beam operation with crab crossing. This report deals mainly with the beam dynamics issues with crab crossing. There is a large discrepancy between the beam-beam simulation and the experiment at the high bunch currents. We discuss causes of this discrepancy in detail.

MOACH07 **Upgrade Plan of KEKB** 23

- **Yu.Onishi**
  KEK, Japan

The KEKB accelerator has been achieved the luminosity larger than the design value, 10e34, and it is finding a way to an upgrade plan of KEKB. The target of the upgrade is a high luminosity that increases by a factor 10 to 30 from the present luminosity. In this report, a strategy and a design of the upgraded KEKB are presented.

TUACH01 **Overview of Beam Dynamics Studies at DAFNE** 28

- **M.Zobov**
  INFN-LNF, Frascati

Since several years the DAFNE Team has been discussing ideas and performing experimental activities aimed at the collider luminosity increase. In this paper we briefly describe the proposed ideas and discuss results of the most relevant beam dynamics experimental studies that have been carried at DAFNE. We also introduce the concept of crab waist collisions that is the base of the undergoing DAFNE upgrade.

TUACH02 **Crab Waist Experiment Result**

- **C.Milardi**
  INFN-LNF, Frascati

TUACH03 **VEPP-2000 Electron-Positron Collider Commissioning** 34

- **Yu. Shatunov**, D. Berkaev, A. Kirpotin, I. Koop, A. Lysenko, I. Nesterenko,E. Perevedentsev, Yu. Rogovsky, A. Romanov, P. Shatunov, D. Shwartz,A. Skrinsky,
  Budker INP, Novosibirsk

VEPP-2000 electron-positron collider construction has been completed in the Budker INP at the beginning of 2007 year. First beam was captured in a special lattice without final focus solenoids. In this regime all systems of power supplies, machine control and beam diagnostics were calibrated and tuned. In the same mode vacuum chamber treatment by synchrotron radiation was performed with electron beam current up to 150 mA. The first test of the round beam option was performed at the energy of 508 MeV with the solenoidal field 10 T in two interaction straight sections. Studies of the beam-beam interaction have been done in "weak-strong" and "strong-strong" regimes. Measurements of beam sizes in the both cases have indicated a beam behavior similar to expectations for the round colliding beams.

- **K.Nakanishi**, K.Hara, A.Honma, K.Hosoyama, A.Kabe, Y.Kojima, H.Nakai, K.Akai, K.Ebihara, T.Furuya, S.Mitsunobu, Y.Morita, M.Ono, Y.Yamamoto
  KEK, Japan

The electron positron collider KEKB is operating at KEK. At KEKB, the electron and positron bunches cross at an angle of 11 x 2 mrad. It is called finite angle collision. In this scheme, non-overlapping of the beam bunches at collision point causes beam instability. To cure this problem, the crab cavity was proposed. In the crab cavity, time varying magnetic field is applied to bunches. The field kicks the head and tail of bunches to opposite direction. And the axis of bunches are tilted. We called the motion crab motion. Effective head-on collisions can be realized using the crab motion while retaining the crossing angle. We called that crab crossing. The crab crossing is effective to boost the luminosity. According to the computer simulation, it is expected that the luminosity will be doubled with crab crossing.
The history of crab cavity was started about 20 years ago. The crab crossing scheme was proposed by R.B.Palmer for linear colliders in 1988. K.Oide and K.Yokoya showed the scheme for storage rings in 1989. The baseline design of crab cavity was shown by K.Akai et al in 1993 in collaboration with a Cornell university group. In that design, the shape of cavity that was called squashed cell cavity was not axial symmetric. And it has the coaxial coupler and notch filter. R&D of the crab cavity for KEKB was started in 1994. Two crab cavities were finally installed to KEKB in 2006. The first crab crossing was realized on February 20, 2007. KEKB has been operated about one year with crab cavity. Some problems appeared and were overcome.

TUACH1 - BD challenges and limitations (15-April-2008)

- **K.Ohmi,**
  KEK, Japan

In KEKB, collision with crab crossing has been examined since February 2007. The luminosity is still lower than the target. The status and studies why the luminosity is low are reported.

- **D.Pestrikov**
  Budker INP, Novosibirsk

We discuss effects of Landau damping on the stability of coherent oscillations of short identical colliding bunches. Near the sum-type resonances n/(2m), where n and m are integers, these oscillations are unstable. Comparing the stopbands calculated for monochromatic and non-monochromatic bunches, we have found that the beam-beam tunespreads increase the widths of the stopbands of coherent modes thus, resulting in Landau anti-damping of coherent beam-beam oscillations. The tunesperads due to octupole fields do not eliminate Landau anti-damping.

TUACH2 - Optics and Background (15-April-2008)

Experimental beam-related background study is intro-duced with the BEijing Spectrometor (BESIII) off the interaction region (IR) of the BEPCII [2]. Only safety issues are studied carefully so far for the not good enough detectors' accuracy. Various experiments are carried out and effective ways to reduce the doses to the IR are found. The results show that the BESIII is safe enough when it is pulled to the IR.

The BEPC (Beijing Electron Positron Collider) is being upgraded as a double-ring factory-like collider (BEPCII). A New and compact interaction region (IR) has been designed to afford a peak luminosity of 10e33 cm-2s-1 with an equal beam energy of 1.89 GeV, a cross angle of +/-11 mrad, 93 bunches and maximum beam current of 0.91 A. All the components of the IR have been fabricated successfully. During the commissioning of BEPCII the operation experience shows that the IR components have excellent performance and meet the design requirements. The design and realization of the interaction region for the BEPCII will be introduced in detail.

The second phase commissioning of the BEPCII (Beijing Electron Positron Collider II) had been made a great progress. The optics correction using LOCO based on orbit response matrix contributed a lot to the successful commissioning. This paper discusses mainly on the procedure and results of optics correction at BEPCII. Using LOCO, we have determined the errors of quadrupole strengths, BPM gains and corrector kicks, and found the quadrupole strengths that restore the design optics well. Optics measurement after correction also shows the real optics agrees well with the design one.

TUACH3 - Instabilities and Feedback (15-April-2008)

WEACH - SuperB and Crab Waist Related Topics (16-April-2008)

WEACH04 **Beam-beam Resonances for Different Collision Schemes** 71

- **D.Shatilov**
  Budker INP, Novosibirsk

One of the main advantages of proposed by P. Raimondi "Crab Waist" collision scheme is a strong suppression of betatron resonances excited by beam-beam interaction. Some qualitative explanations with numerical examples, describing beam-beam resonances for different collision schemes, were given in [2]. This paper can be considered as an "appendix" (additional illustration) to that one. We performed a number of full 2D betatron tune scans (beam-beam simulations) for different collision schemes, so one can easily see how the beam-beam resonances appear and disappear, depending on the colliding conditions.

WEACH05 **Longitudinally Polarized Electrons in SuperB-factory**

- **I.Koop**
  Budker INP, Novosibirsk

WEACH06 **Problem of the Beam-Beam Depolarization Effect in Super Dense Colliding Beams**

- **S.Nikitin**
  Budker INP, Novosibirsk

WEACH07 **Damping Ring Issues**

- **S.Guiducci**
  INFN-LNF, Frascati

WEACH08 **High Precision Energy Measurement at VEPP-4M**

- **N.Muchnoi**
  Budker INP, Novosibirsk

WEACH09 **The Project of T-Charm Factory with Crab Waist in Novosibirsk** 77

- **E.Levichev**, A.Blinov, A.Bogomyagkov, A.Bondar, V.Kiselev, I.Koop, G.Kurkin, P.Logachev, S.Nikitin, I.Okunev, V.M.Petrov, P.Piminov, Yu.Pupkov, D.Shatilov, S.Sinyatkin, V.Smaluk, A.Skrinsky, P.Vobly,
  Budker INP, Novosibirsk

The project of a new-generation t-charm factory is now under consideration in Novosibirsk. A novel approach of the Crab Waist collision scheme allows reaching the luminosity of 1-2*10e35 cm-2s-1. The other features of the facility are: variable energy from 2 GeV to 4.5 GeV (c.m.), longitudinal polarization of electrons at IP, usage of damping wigglers to keep high luminosity for all energy levels, etc. We discuss some of the challenges and opportunities available with the development of the project.

- **A.Bogomyagkov**
  Budker INP, Novosibirsk

Interaction region of Super-ct-factory is designed to bring stored electron-positron beams into collision with luminosity of 10e35 cm-2sec-1. In order to achieve that CRAB waist collision scheme is implemented, which requires cross angle collision with high Piwinski angle. The small values of the beta functions at the interaction point and distant final focus lenses are the reasons for high nonlinear chromaticity which limits energy acceptance of the whole ring. The present design is based on chromatic properties of telescopic transformation, on local chromaticity correction schemes and on as close as possible placement of CRAB sextupole.

- **P.Piminov**
  Budker INP, Novosibirsk