

Allegato 1a -  
Tereo Verbale

Quesito 1

Sistemi di rilevazione per microdosimetria di particelle cariche.



ALLEGATO 16 -  
terzo Verbale

Quesito 2

Sistemi di rilevazione per dosimetria di particelle cariche.









ALLEGATO 1c -  
Terzo Vehelo

Quesito 3

Sistemi di rilevazione per la dosimetria assoluta e relativa di fasci di particelle cariche ad elevata intensità.

A

B

C

W

ALLEGATO 1d -  
TERZO Verbale

Quesito 4

Metodi di simulazione Montecarlo per lo studio della interazione radiazione materia.



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Allegato n. 2 al Terzo Verbale

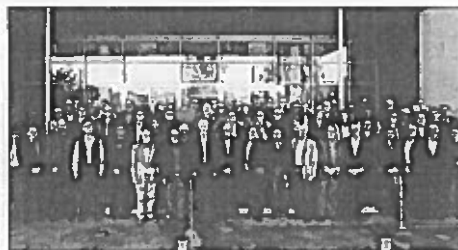
## FIELD NOTES

Reports from events, conferences and meetings

By BAR COLLABORATION

### BaBar celebrates its 25th anniversary

On 11 December 2010, 25 years after its inaugural meeting, the BaBar collaboration came together at the SLAC National Accelerator Laboratory in California to celebrate its many successes. David Hillis, BaBar's first spokesperson, described the inaugural meeting of what was then called the Detector Collaboration for the PEP-II "asymmetric" electron-positron collider, which took place at SLAC at the end of 1985. By May 2009 the collaboration had chosen the name BaBar in a contest that was held to study CP violation in the decays of B-B meson system. Jonathan Dostler, PEP-II project director, recounted how PEP-II was constructed by SLAC, LBL and LLNL. Less than six years later, PEP-II and the BaBar detector were built and the first collision events were collected on 16 May 1999.



Collegial team. Participants of the BaBar 25th anniversary event.

Twenty-five years on, and BaBar has now chalked up more than 500 papers on CP violation and many other topics. The "asymmetric" descriptor of the collider refers to Pier Oddone's concept of using unequal electron and positron beam energies - tuned to 5.9 GeV, the mass of the  $\Upsilon(4S)$  meson and just above the threshold for producing a pair of B mesons. This relativistic boost enabled measurements of the distance between the points where the mesons decay, which is critical for the study of CP violation. Equally critical was the engineering of the B meson and anti-B meson produced in the  $\Upsilon(4S)$  decay, as it worked whether it was the B or  $\bar{B}$  that decayed in the same CP final state by tagging the flavor of the other meson.

By October 2000 PEP-II had achieved its design luminosity of  $3 \times 10^{31} \text{ cm}^{-2} \text{ s}^{-1}$  and less than a year later BaBar published its observation of CP violation in the B meson system based on a sample of  $32 \times 10^6$  pairs of B-B mesons - on the same day that Belle, its competitor at Japan's KEK laboratory, published the same observation. These results led to Makoto Kobayashi and Toshihide Maskawa sharing the 2008 Nobel Prize in Physics. The ultimate luminosity achieved by PEP-II, in 2006, was  $1.3 \times 10^{31} \text{ cm}^{-2} \text{ s}^{-1}$ . BaBar continued to

collect data on as near the  $\Upsilon(4S)$  meson as it could and in 2008 collected large samples of  $\Upsilon(4S)$  and  $\Upsilon(5S)$  mesons before PEP-II was shut down. In total, PEP-II produced 471.6 M B-B pairs for BaBar studies - as well as a myriad of other particles for other investigations.

The anniversary event also celebrated technical innovations, including "firsts" in the injection of beam particles into PEP-II, which provided a nearly 20% increase in integrated luminosity - when they were first provided by hand and computing support via large "T" A corners. This innovation paved the way for CERN's Worldwide LHC Computing Grid.

Notable physics results from BaBar include the first observation in 2007 of D-D mixing, while in 2008 the collaboration discovered the long-sought  $\eta_c$ , the lowest energy particle of the charmonium family. The team also searched for lepton-flavor violation in tau-lepton decays, publishing in 2009 what remains the most stringent limits on  $\tau \rightarrow \mu$  and  $\tau \rightarrow e \gamma$  branching fractions. In 2005, making it soon Physics World's top-100 physics results of the year, the BaBar collabora-

tion made the first direct observation of time-reversal violation by measuring the rates at which the B meson changes quark content. Also published in 2003 was evidence for an excess of  $B \rightarrow D^* \tau \nu$  decays, which challenges lepton universality and is an important part of the current Belle II and LHCb physics programs. Several years of top data-taking ended, it was recognized that BaBar's data could also be mined for evidence of dark-sector objects such as dark photons, leading to the publication of two significant papers in 2004 and 2007. Another highlight, published last year, is a joint BaBar-Belle paper that resolved an ambiguity concerning the quark-mixing unitarity triangle.

Although BaBar stopped collecting data in 2008, this highly collegial team of researchers continues to publish important results. Moreover, BaBar alumni continue to bring their experience and expertise to subsequent experiments, ranging from ATLAS, CMS and LHCb at the LHC, Belle II at SuperKEKB, and the upcoming next-generation lepton-flavor violation in tau-lepton decays, publishing in 2009 what remains the most stringent limits on  $\tau \rightarrow \mu$  and  $\tau \rightarrow e \gamma$  branching fractions. In 2005, making it soon Physics World's top-100 physics results of the year, the BaBar collabora-

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Michael Runer, University of Victoria and David MacFarlane, SLAC

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Reports from events, conferences and meetings

BA BAR COLLABORATION

## BaBar celebrates its 25th anniversary

On 11 December 2010, 25 years after its inaugural meeting, the BaBar collaboration came together at the SLAC National Accelerator Laboratory in California to celebrate its many successes. David Hertzl, BaBar's first spokesperson, described the inaugural meeting of what was then called the Detector Collaboration for the PEP-II "asymmetric" electron-positron collider, which took place at SLAC at the end of 1985. By May 1991, the collaboration had chosen the name BaBar in recognition of its primary goal to study CP violation in the next of B-B meson system. Jonathan Dorbin, PEP-II project director, recounted how PEP-II was constructed by SLAC, LBNL and LLNL. Less than six years later, PEP-II and the BaBar detector were built and the first collision events were collected on 26 May 1999. Twenty-five years on, and BaBar has now published more than 580 papers on CP violation and many other topics. The "asymmetric" descriptor of the collider refers to Peter Odian's concept of using unequal electron and positron beam energies - tuned to 3.1 GeV, the mass of the  $\Upsilon(4S)$  meson and just above the threshold for producing a pair of B mesons. This relativistic boost enabled measurements of the distance between the points where the mesons decay, which is crucial for the study of CP violation. Equally critical was the arrangement of the B meson and anti-B meson produced in the  $\Upsilon(4S)$  decay, as it marked where it was the B or  $\bar{B}$  that decayed in the same CP final state by tagging the flavor of the other meson.

By October 2000 PEP-II had achieved its design luminosity of  $3 \times 10^{31} \text{ cm}^{-2} \text{ s}^{-1}$  and less than a year later BaBar published its observation of CP violation in the B meson system based on a sample of  $32 \times 10^6$  pairs of B-B mesons - on the same day that Belle, its competitor at Japan's KEK laboratory, published the same observation. These results led to Makoto Kobayashi and Toshihide Maskawa sharing the 2008 Nobel Prize in Physics. The ultimate luminosity achieved by PEP-II, in 2006, was  $1.3 \times 10^{32} \text{ cm}^{-2} \text{ s}^{-1}$ . BaBar continued to



Collegial team. Participants of the BaBar 25th anniversary event.

collect data on or near the  $\Upsilon(4S)$  meson until 2007 and in 2008 collected large samples of  $\Upsilon(4S)$  and  $\Upsilon(3S)$  mesons before PEP-II was shut down. In total, PEP-II produced  $471 \times 10^6$  B-B pairs for BaBar studies - as well as a myriad of other data for other investigations.

The anniversary event also celebrated technical innovations, including "triple injection" of beam particles into PEP-II which provided a nearly 14% increase in integrated luminosity; BaBar's impressive particle identification, made possible by the DIRC detector; and the implementation of a computing model - inspired by PEP-II's pioneering significantly more than provided in-kind computing support via large "Tiger-A" centers. This innovation paved the way for CERN's Worldwide LHC Computing Grid.

Notable physics results from BaBar include the first observation in 2001 of  $D_s^* \rightarrow D_s \pi$  mixing, while in 2008 the collaboration discovered the long-sought, the lowest energy particle of the charm quark family. The team also searched for lepton-flavor violation in the leptonic decays, publishing in 2008 what remains the most stringent limits on  $\tau \rightarrow e \gamma$  and  $\mu \rightarrow e \gamma$  in such transitions. In next-generation Physics World's top-ten physics results of the year, the BaBar collabora-

tion made the first direct observation of time-reversal violation by measuring the rates at which the B mesons change quantum states. Also published in 2008 was evidence for an excess of  $B \rightarrow D^* \tau^+ \nu_\tau$  decays, which challenges lepton universality and is an important part of the current Belle II and LHCb physics programmes. Several years after data-taking ended, it was recognized that BaBar's data could also be mined for evidence of dark-sector objects such as dark photons, leading to the publication of two significant papers in 2012 and 2013. Another highlight, published last year, is a joint BaBar-Belle paper that resolved an ambiguity concerning the quark-mixing unitarity triangle.

Although BaBar stopped collecting data in 2008, this highly collegial team of researchers continues to publish impartial results. Moreover, BaBar alumni continue to bring their expertise and experience to subsequent experiments, ranging from ATLAS, CMS and LHCb at the LHC, Belle II at SuperKEKB, and long-baseline neutrino experiments (T2K, DUNE, HyperK) to dark-matter (LZ, CDMS) and dark-energy (LSST) experiments in particle astrophysics.

J Michael Roney University of Toronto and David MacFarlane SLAC

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SLAC high energy laser technician

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Allegato n. 2 e Terzo Verbale

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Reports from events, conferences and meetings

## BaBar Collaboration BaBar celebrates its 25th anniversary

On 11 December 2010, 25 years after its inaugural meeting, the BaBar collaboration came together at the SLAC National Accelerator Laboratory in California to celebrate its 25th anniversary. David Helling, BaBar's first spokesperson, described the inaugural meeting of what was then called the Detector Collaboration for the PEP-II "symmetric" electron-positron collider, which took place at SLAC at the end of 1985. By May 1986, the collaboration had chosen the name BaBar in recognition of its primary goal to study CP violation in the neutral B meson system. Jonathan Dorfan, PEP-II project director, recounted how PEP-II was constructed by SLAC LBL and LLNL. Less than six years later, PEP-II and the BaBar detector were built and the first collision events were collected on 26 May 1999. To mark five years on, BaBar has now published more than 500 papers on CP violation and many other topics.



Collegial team. Participants of the BaBar 25th anniversary event.

The "asymmetric" descriptor of the collider refers to the Odette's concept of using several electron and positron beams energies - tuned to 5.0 GeV, the mass of the  $\Upsilon(4S)$  meson and just above the threshold for producing a pair of B mesons. This relativistic boost enabled measurements of the distance between the points where the mesons decay, which is critical for the study of CP violation. Equally critical was the engineering of the B meson and anti-B meson produced in the  $\Upsilon(4S)$  decay, as it marked whether it was the B or  $\bar{B}$  that decayed to the same CP final state by tagging the flavor of the other meson.

By October 2000 PEP-II had achieved its design luminosity of  $1 \times 10^{31} \text{ cm}^{-2} \text{ s}^{-1}$  and less than a year later BaBar published its observation of CP violation in the B meson system based on a sample of  $14 \times 10^6$  pairs of B<sup>0</sup> mesons - on the same day that Belle, its competitor at Japan's KEK laboratory, published the same observation. These results led to Makoto Kobayashi and Toshihide Maskawa sharing the 2008 Nobel Prize in Physics. The ultimate luminosity achieved by PEP-II, in 2006, was  $2 \times 10^{31} \text{ cm}^{-2} \text{ s}^{-1}$ . BaBar continued to

collect data on or near the  $\Upsilon(4S)$  meson in 2007 and in 2008 collected large samples of  $\Upsilon(4S)$  and  $\Upsilon(5S)$  mesons before PEP-II was shut down. In total, PEP-II produced  $431 \times 10^6$  B<sup>0</sup> pairs for BaBar studies - as well as a myriad of other collider investigations.

The anniversary event also celebrated technical innovations, including "tribe operation" of beam pipelines using PEP-II, which provided a nearly 20% increase in integrated luminosity; BaBar's innovative particle identification, made possible by the DRAC detector, and the implementation of a computing model - spurred by PEP-II driving signal to the maximum design luminosity - whereby a majority provided in-kind computing support to a large "T12-A" center. This innovation paved the way for CERN's Worldwide LHC Computing Grid.

Notable physics results from BaBar include the first observation of an asymmetry in D-D mixing, while in 2008 the collaboration discovered the long-sought  $\psi(3770)$ , the lowest energy particle of the bottomonium family. The team also searched for lepton-flavor violation in low-lepton decays, publishing in 2008 what remains the most stringent limits on  $\tau \rightarrow \mu e$  and  $e \rightarrow \mu \tau$  branching fractions. In 2008, making it one of the top-ten physics results of the year, the BaBar collaboration made the first direct observation of time-reversal violation

in time-reversed radiation by measuring the rates at which the B meson changes quantum states. Also published in 2008 was evidence for an excess of  $B \rightarrow D^* \tau \nu$  decays, which challenges lepton universality and is an important part of the physics Belle II and LHCb physics program. Several years after data-taking ended, it was recognized that BaBar's data could also be mined for evidence of dark-sector objects such as dark photons, leading to the publication of two significant papers in 2014 and 2015. Another highlight, published last year, is a joint BaBar-Belle paper that provided an unambiguous constraint on the quark-mixing unitarity triangle.

Although BaBar stopped collecting data in 2008, this highly collegial team of researchers continues to publish impactful results. Moreover, BaBar should continue to bring the expertise and expertise to subsequent experiments, ranging from ATLAS, CMS and LHCb at the LHC, Belle II at SuperKEKB, and long-baseline neutrino experiments (T2K, DUNE, HyperK) to dark-matter (LZ, SCISSAR) and dark-energy (LSST) experiments in particle astrophysics.

Michael Ramsey University of Victoria and David Danzhausen SLAC

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BaBar COLLABORATION

### BaBar celebrates its 25th anniversary

On 11 December 2018, 25 years after its inaugural meeting, the BaBar collaboration came together at the SLAC National Accelerator Laboratory in California to celebrate its 25th anniversary. David Hillis, BaBar's first spokesperson, described the inaugural meeting of what was then called the Detectors Collaboration for the PEP-II "asymmetric" electron-positron collider, which took place at SLAC at the end of 1993. By May 1994, the collaboration had chosen the name BaBar in recognition of its primary goal to study CP violation in the event of B-B meson systems. Jonathan Drees, PEP-II project director, recounted how PEP-II was constructed by SLAC, LBNL and LLNL. Less than six years later, PEP-II and the BaBar detectors were built and the first collision events were collected on 24 May 1999.



Collegial team Participants of the BaBar 25th anniversary event.

Twenty-five years on, and BaBar has now realized up more than 50 papers on CP violation and many other topics. The "asymmetric" design of the collider refers to the Odessa's concept of using unequal electron and positron beam energies – tuned to 5.1 GeV, the mass of the  $\Upsilon(4S)$  meson and just above the threshold for producing a pair of B mesons. This reference is best enabled measurements of the distance between the points where the minimum decay, which is critical for the study of CP violation. Equally critical was the enhancement of the  $\Upsilon(4S)$  decay, as it marked whether it was the  $B^0$  or  $\bar{B}^0$  that decayed to the same CP final state by tagging the flavor of the other meson.

By October 2000 PEP-II had achieved its design luminosity of  $3 \times 10^{31} \text{ cm}^{-2} \text{ s}^{-1}$  and less than a year later BaBar published its observation of CP violation in the B meson system based on a sample of  $3 \times 10^6$  pairs of  $B^0$ - $\bar{B}^0$  mesons – on the same day that Belle, its competitor at Japan's KEK Laboratory, published the same observation. These results led to Makoto Kobayashi and Toshihide Maskawa sharing the 2008 Nobel Prize in Physics. The ultimate sensitivity achieved by PEP-II, in 2006, was  $1.2 \times 10^{31} \text{ cm}^{-2} \text{ s}^{-1}$ . BaBar continued to collect data on or near the  $\Upsilon(4S)$  meson until 2007 and in 2008 collected large samples of  $\Upsilon(4S)$  and  $\Upsilon(5S)$  mesons before PEP-II was then shut down. In total, PEP-II produced  $475 \times 10^6$  B-B pairs for BaBar studies – as well as a myriad of other data for other investigations.

The anniversary event also celebrated technical innovations, including "spark injection" of beam particles into PEP-II, which provided a nearly 40% increase in integrated luminosity; BaBar's large-angle particle identification, made possible by the EMC detector; and the implementation of a computing model – spurred by PEP-II delivering significantly more than design luminosity – when the constraints provided in-kind computing support via Large "Tier-A" centers. This innovation paved the way for CERN's Worldwide LHC Computing Grid.

Notable physics results from BaBar include the first observation in 2007 of D-D mixing, while in 2008 the collaboration discovered the large-angle  $\eta_c$ , the lowest energy particle of the bottomonium family. The team also searched for lepton-flavor violation in tau-lepton decays, publishing in 2006 what remains the most stringent limits on  $\tau \rightarrow \mu \mu \gamma$  and  $\tau \rightarrow e \mu \gamma$  branching fractions. In 2004, making it from Physics World's top ten physics results of the year, the BaBar collaboration made the first direct observation of time-reversal violation by measuring the rates at which the B meson changes quantum states. Also published in 2004 was evidence for an excess of  $B \rightarrow D^{*+} \pi^-$  decays, which challenges lepton universality and is an important part of the current Belle II and LHCb physics programs. Several years after data-taking ended, it was recognized that BaBar's data could also be mined for evidence of dark-sector objects such as dark photons. Leading to the publication of two significant papers in 2014 and 2017. Another highlight, published last year, is a joint BaBar-Belle paper that revealed an ambiguity concerning the quark-mixing unitarity triangle.

Although Belle II stopped collecting data in 2008, this highly collegial team of researchers continues to publish impactful results. Moreover, BaBar alumni continue to bring their expertise and expertise to subsequent experiments, ranging from ATLAS, CMS and LHCb at the LHC, Belle II at SuperKEKB, and long-baseline neutrino experiments (T2K, DUNE, HyperK) to dark-matter (LZ, SCDA) and dark-energy (LSST) experiments in particle astrophysics.

Michael Runey University of Texas at Austin and David MacFarlane SLAC

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