

Collaboration in High Energy Physics

M.Kobayashi

KEK & JSPS

1972 Koshiba group, Univ. of Tokyo → DASP at DESY

DESY: Deutsches Elektronen Synchrotron

DORIS(Doppel Ring Speicher)

Electron-positron colliding accelerator

$3.5 \text{ GeV} \times 3.5 \text{ GeV} \rightarrow 5 \text{ GeV} \times 5 \text{ GeV}$



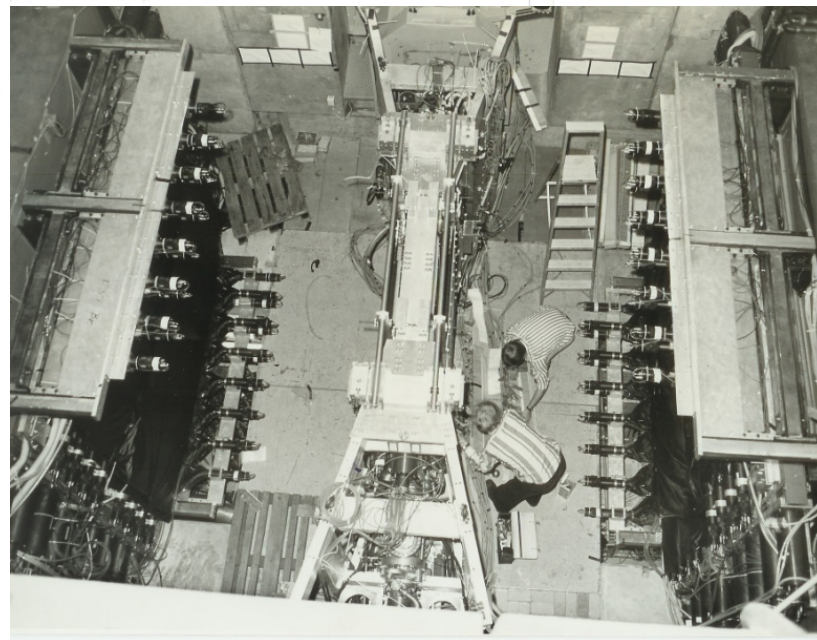
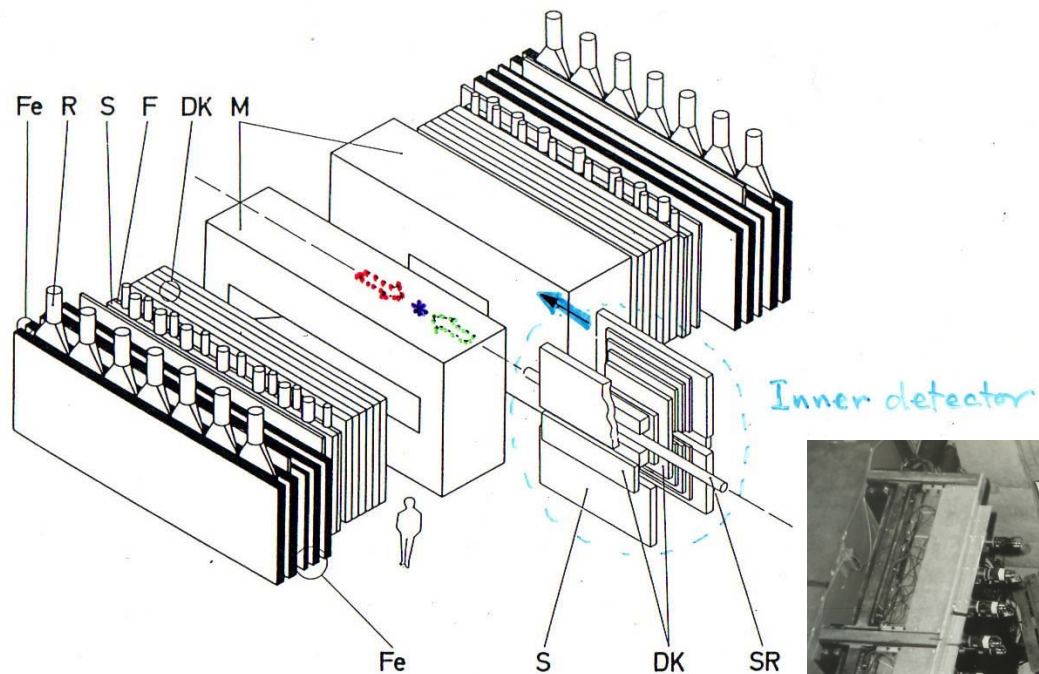
DESY-archive

DASP @ DORIS

(Aachen, DESY, MPI, Tokyo)

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R. Brandelik et al.: Results from DASP on e^+e^- Annihilation



A MEASUREMENT OF LARGE ANGLE e^+e^- SCATTERING AT THE 3100 MeV RESONANCE

DASP – Collaboration

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University of Tokyo, Tokyo

Received 19 December 1974

Elastic e^+e^- scattering has been measured at total energies covering the newly found resonance at 3100 MeV. The angular distribution is consistent with spin-parity 1^- , and the cross section integrated over energy yields $\Gamma_{ee}^2/\Gamma_{\text{tot}} = 0.23 \pm 0.05$ keV for the resonance.

The new 3100 MeV resonances [1] has been studied in the reaction $e^+e^- \rightarrow e^+e^-$ at the DESY colliding beam facility DORIS using a non-magnetic spectrometer. The rings were normally filled every 6 hours, and the luminosity averaged over one fill was about $2 \times 10^{29} \text{ cm}^{-2}$. The luminosity was monitored by observing the rate of small angle Bhabha scattering using a set of four counter telescopes located in the horizontal plane symmetrically with respect to the interaction point. Each telescope consists of three scintillation counters and one shower counter. The scintillation counters define the direction of the scattered electron or positron, and the shower counter measures its energy. A Bhabha event is defined as a coincidence between two such telescopes located on opposite sides of the beam pipe at a mean scattering angle of 8° . With the

threshold of the shower counter set at 500 MeV the accidental rate is negligible. For this experiment the luminosity monitor was used as a relative monitor only.

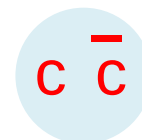
The apparatus shown in fig. 1 is a part of the Double Arm Spectrometer (DASP) and consists of two identical detectors mounted above and below the beams. Events were accepted for θ between 40° and 140° in a total solid angle of 1.2 sterad. The basic unit of this detector is made of a scintillation counter hodoscope, a sheet of lead 5 mm thick, and a proportional tube chamber [2]. Each chamber (see insert of fig. 1) has three layers of brass tubes, 10 mm in diameter and with 0.25 mm wall thickness, oriented at 0° and $\pm 30^\circ$ with respect to the beam axis. The efficiency for detecting one charged particle is 95% per plane, a value consistent with the geometric efficiency. Each of the scattered particles passes through a layer of scintillation counters surrounding the beam pipe, then through four of the units just described, and finally

* On leave from Cornell University, Ithaca, N.Y.

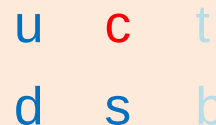
** Now at CERN, Geneva.

*** On leave from the University of Illinois, Urbana, Illinois.

J/ψ particle



Quark



• DASP discovered

$P_c(3.5)$

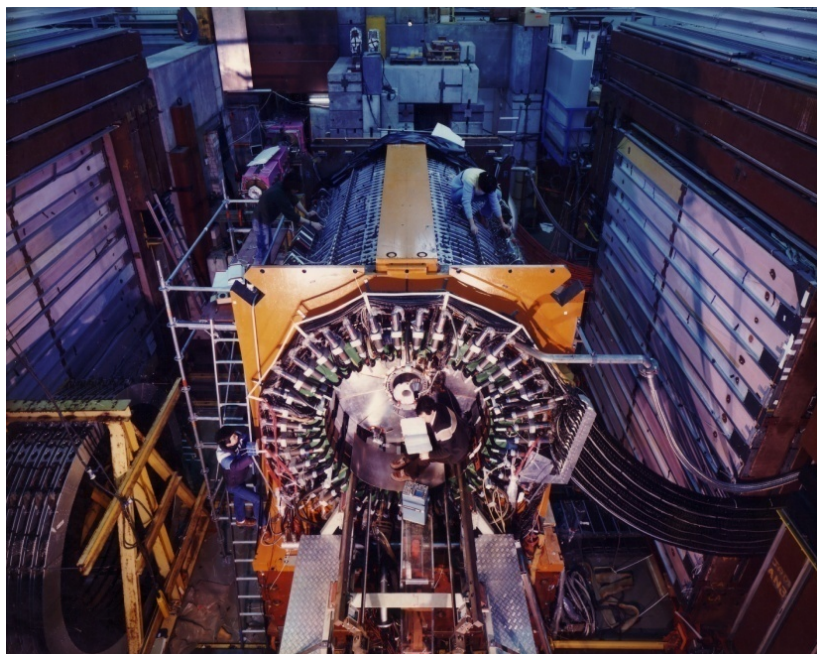
- Total cross section
- τ decay
- Inclusive e/K from charm

JADE

(Japan-Deutschland-England)

1979-1984

PETRA: e^+e^- collider
19 GeV x 19 GeV



DESY-archive

J A D E

Proposal for a Compact Magnetic Detector at PETRA
=====

D.P. Barber, J. Dainton, and R. Marshall

Daresbury Laboratory

W. Bartel, Th. Canzler, D. Cords, P. Dittmann, R. Felst,
E. Gadermann*, M. Helm*, H. Krehbiel, J. Olsson,
L.H. O'Neill, A. Petersen*, D. Pandoulas,
M. Schädlich*, and P. Steffen

DESY, Hamburg

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P. Brauel*, G. Grindhammer, W.D. Kollmann, and K. Sauerberg*
II. Institut für Experimentalphysik der Universität Hamburg

W. Farr, B. Granz, J. Heintze, G. Heinzelmann, R.D. Heuer*,
P. Lennert, H. Rieseberg, A. Wagner, and A.H. Walenta
Physikalisches Institut der Universität Heidelberg

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D. Darvill, F. Foster, and G. Hughes
Physics Department, University of Lancaster

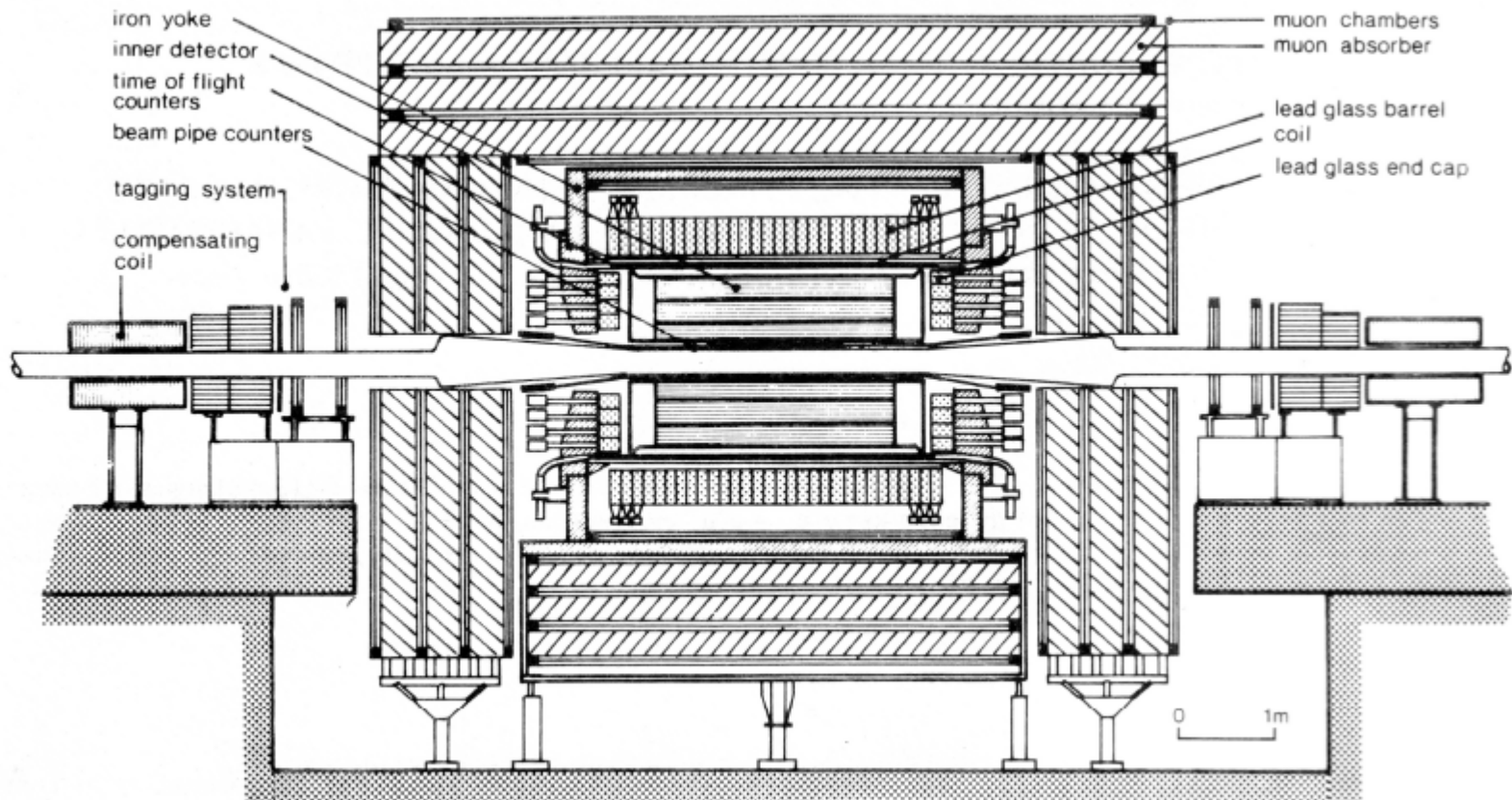
J. Allison, B. Dickinson, F.K. Loebinger, P.G. Murphy,
and K. Stephens
Physics Department, University of Manchester

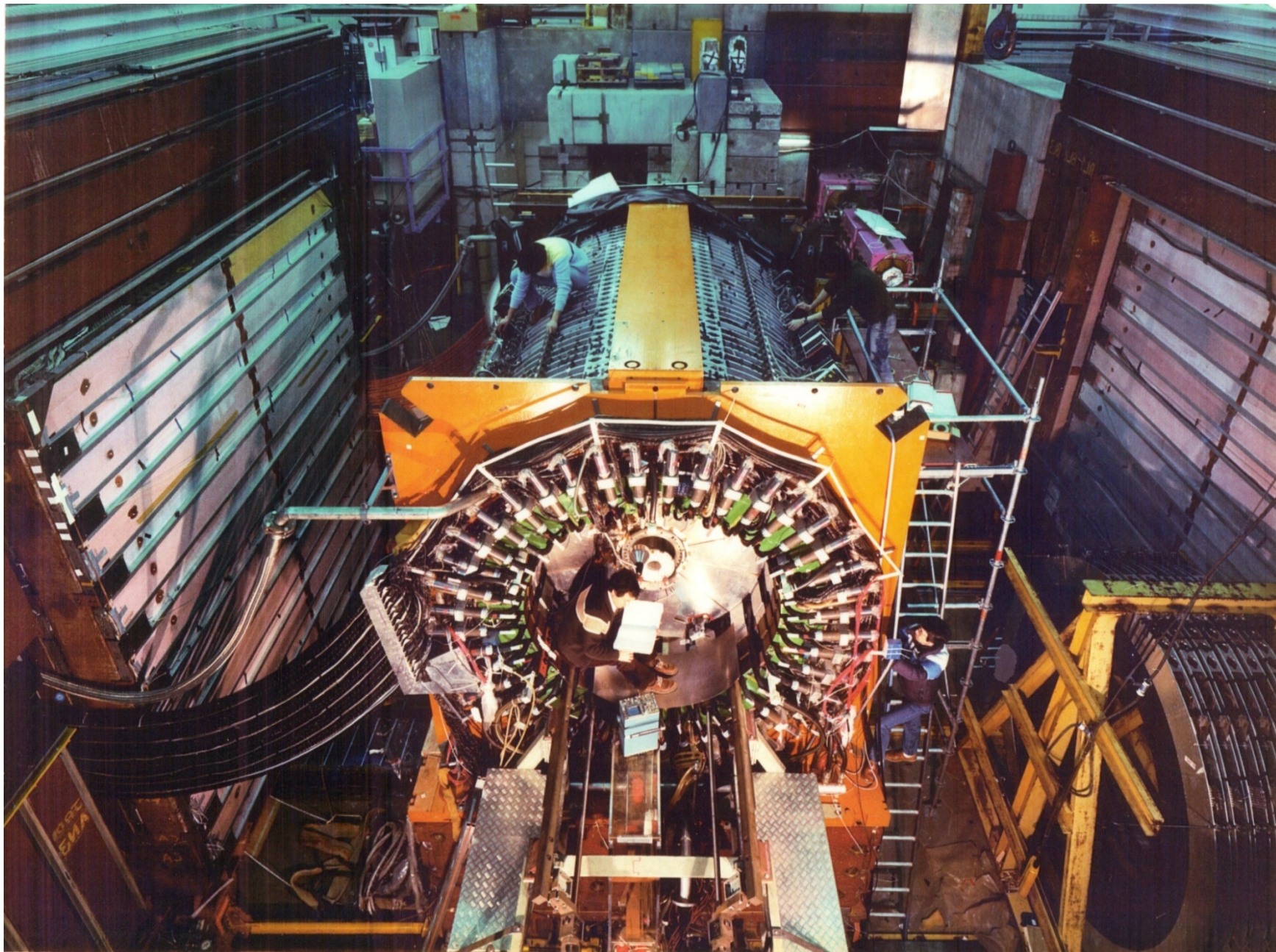
M. Imori, T. Kobayashi*, S. Komamiya*, M. Koshiba, S. Orito,
A. Sato*, T. Suda, Y. Totsuka, S. Yamada, and C. Yanagisawa*
High Energy Physics Laboratory and Department of Physics,
University of Tokyo

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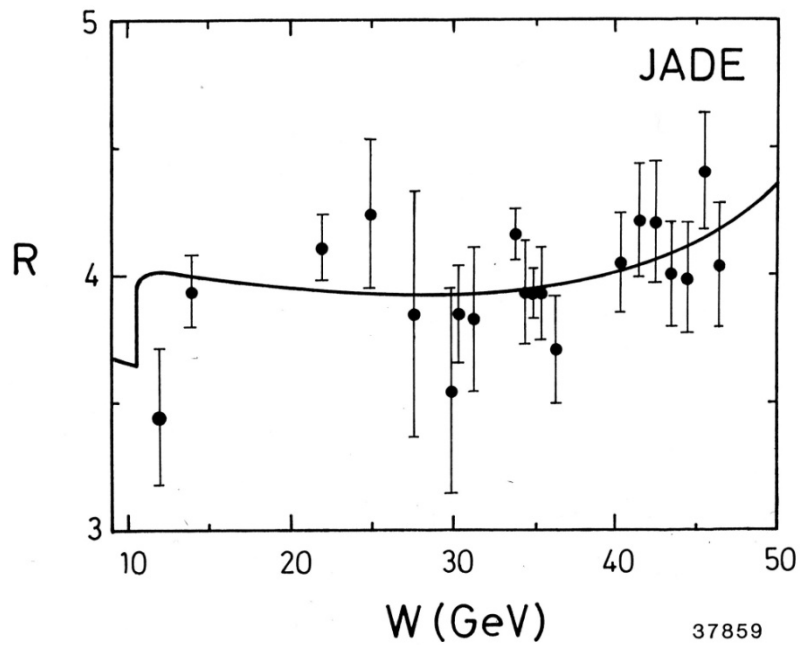
* graduate student

JADE Detector

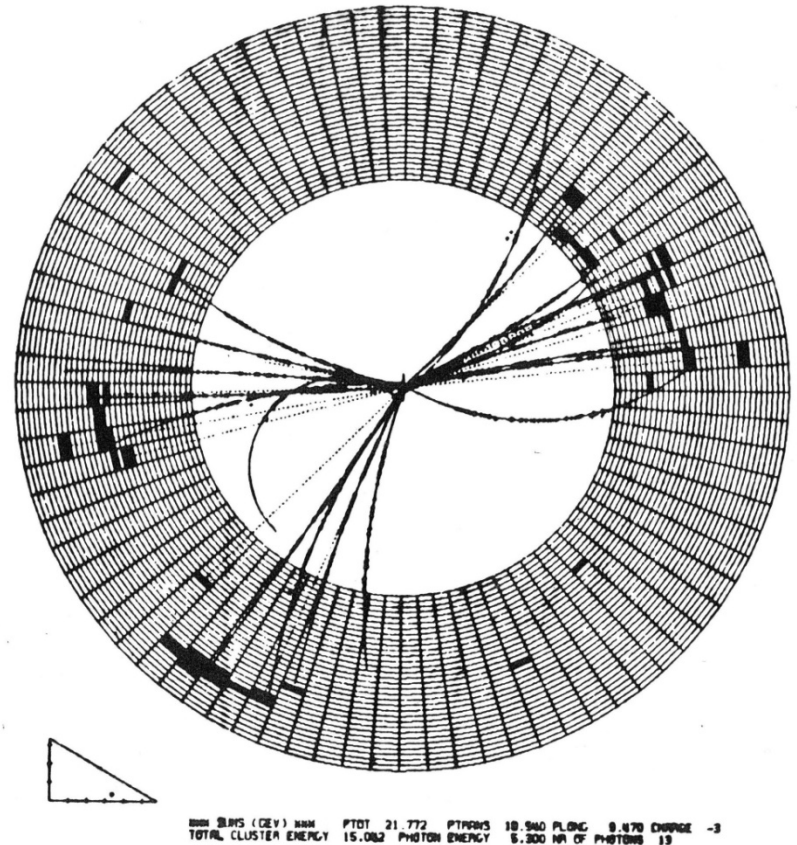




Discovery of gluon



37859
Provided by JADE group



Provided by JADE group

Das Grosse Verdienkreuz awarded to Koshiba



Courtesy of Koshiba

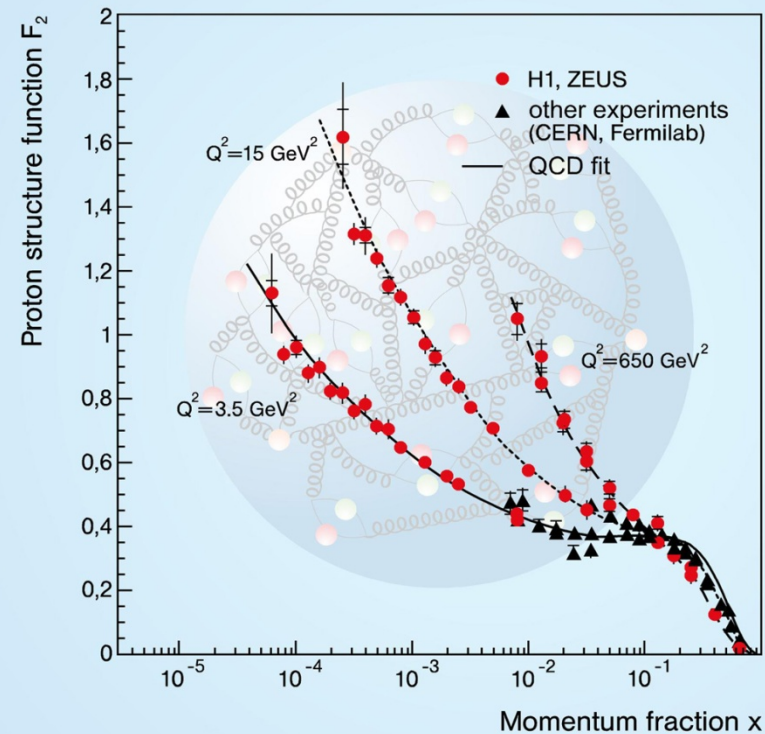
HERA 30 GeV electron x 820(920) GeV proton

ZEUS 1992-2007



DESY-archive

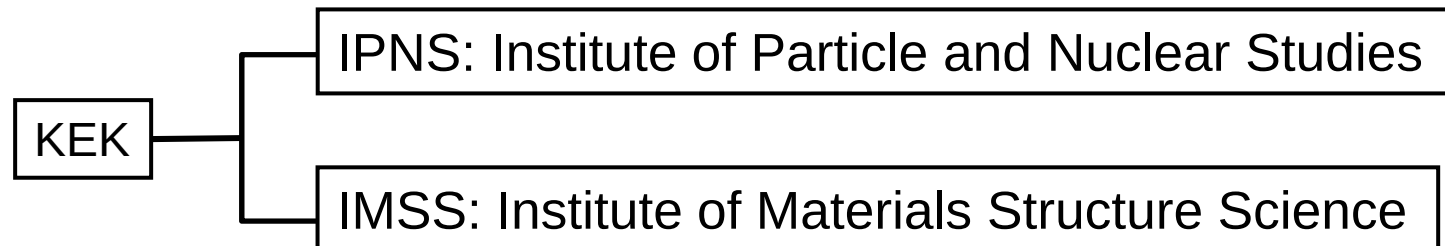
Inner structure of the proton



DESY-archive

1971 Establishment of KEK

- 12 GeV proton synchrotron 1976-2006
- TRISTAN 30 GeV x 30 GeV e^+e^- 1986-1995
- B-factory 1999-2010
- J-PARC 50 GeV proton synchrotron 2009-



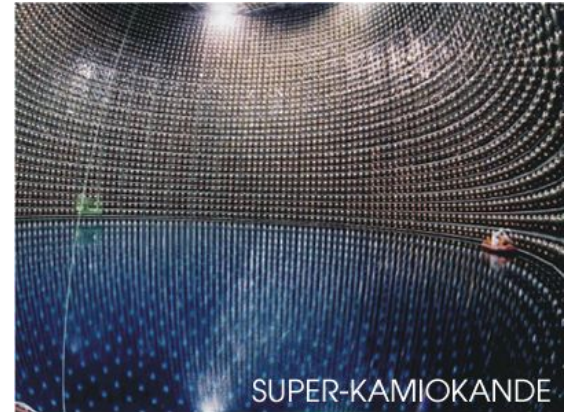


KAMIOKANDE 1985~

3000t pure water

Supernova 1987a

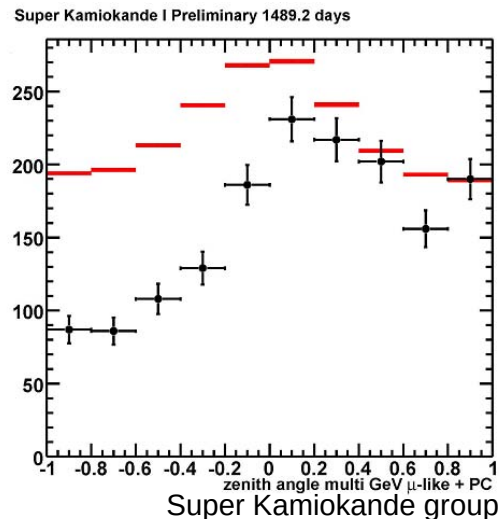
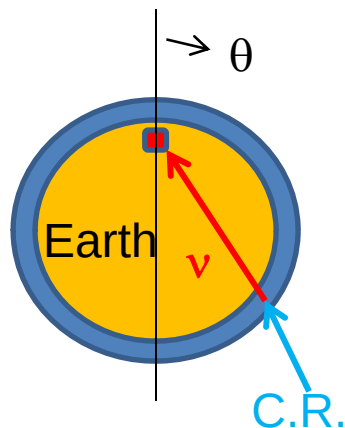
→ Nobel Prize to Koshiba



SUPER-KAMIOKANDE 1996~

15000t pure water

Discovery of neutrino oscillation 1998



KEK-archive

Yoji Totsuka

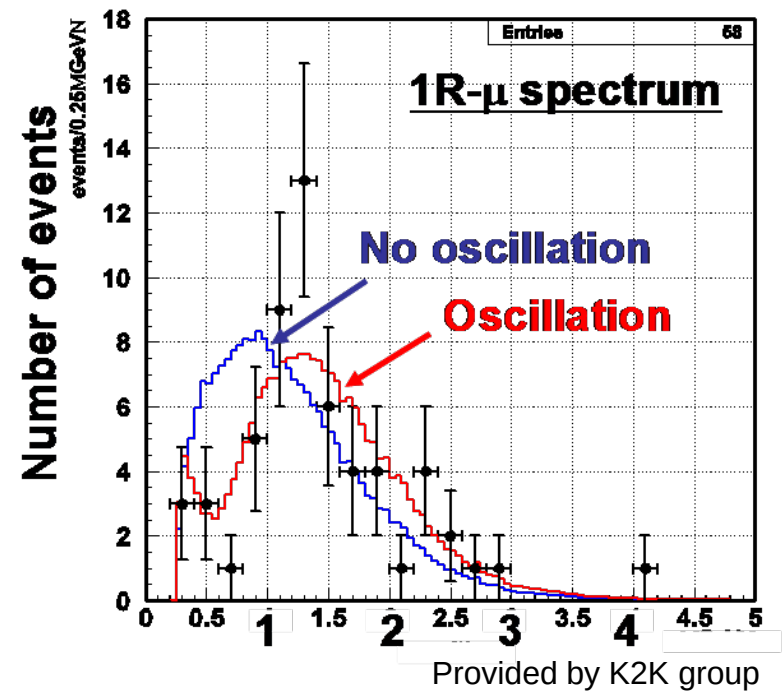
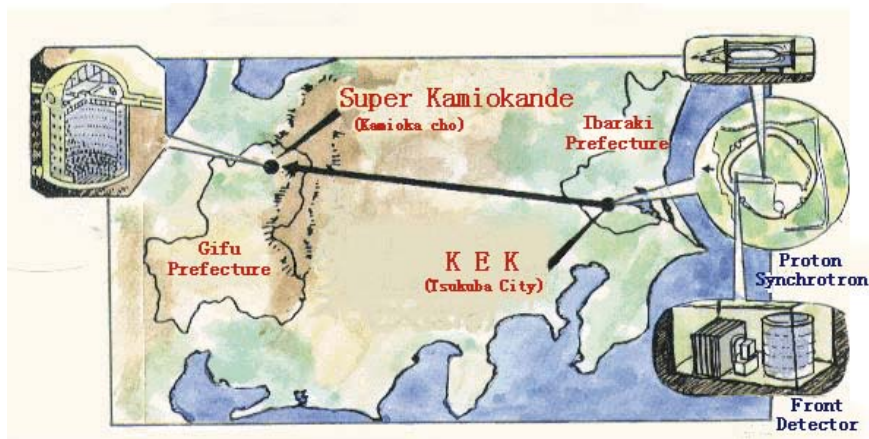
1942-2008

12 GeV proton synchrotron

Construction 1971-1976

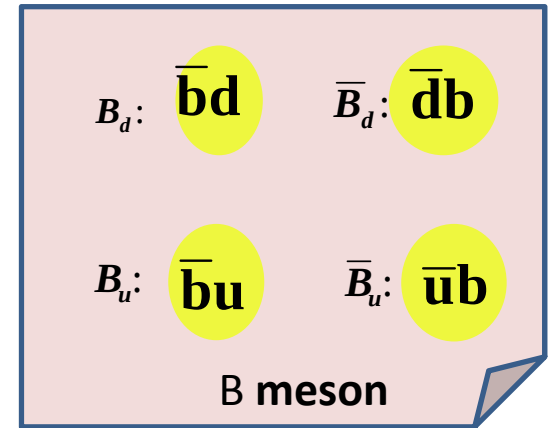
Operation 1976-2006

➡ K2K experiment 1999-2004



B-factory

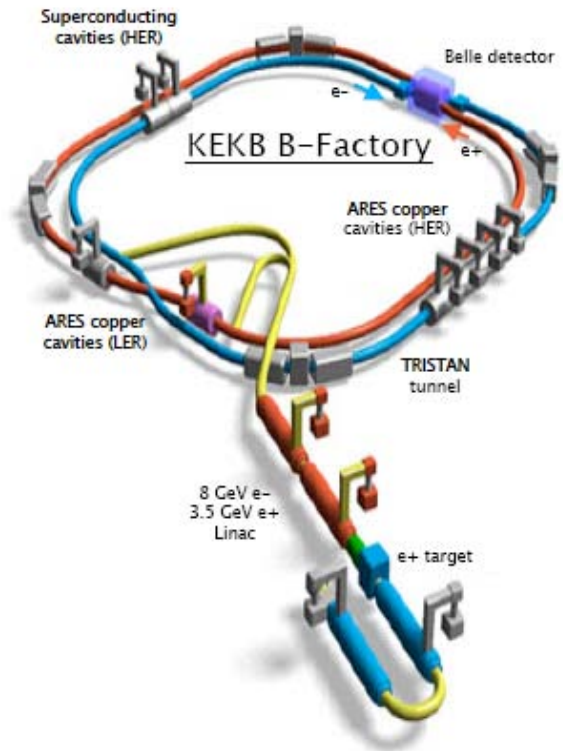
- e^+e^- collider
- optimized for B-meson production
- asymmetric energy 3.5GeVx8GeV

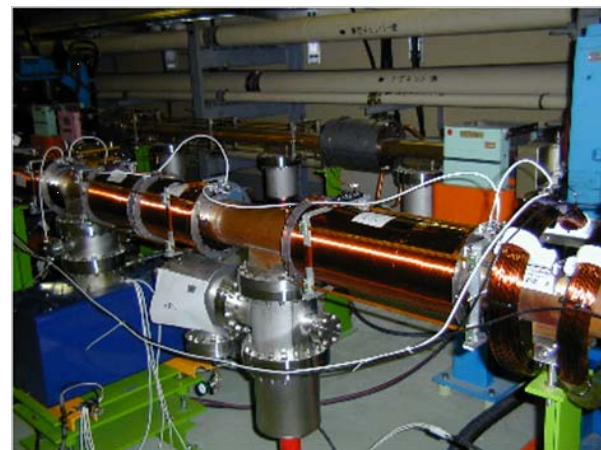
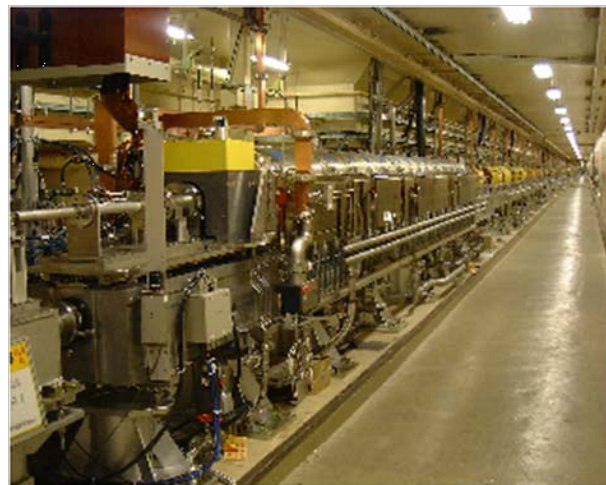


Physics aim: CP violation

1973 Kobayashi, Maskawa

Good competition with SLAC





KEK B-factory

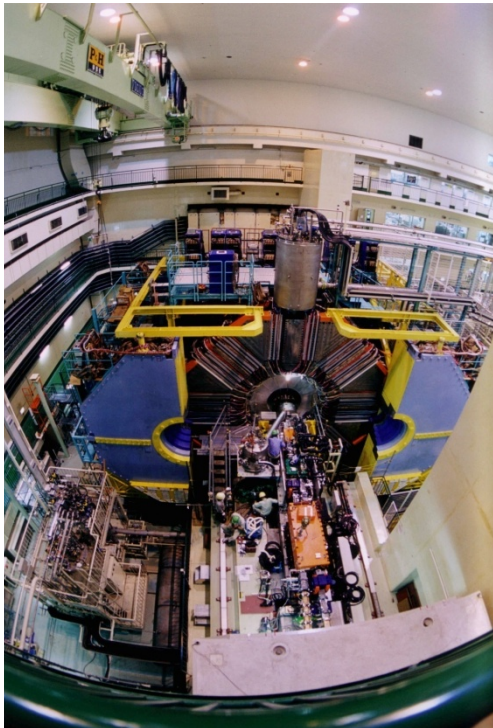
Construction 1994-1998

Operation 1999-2010

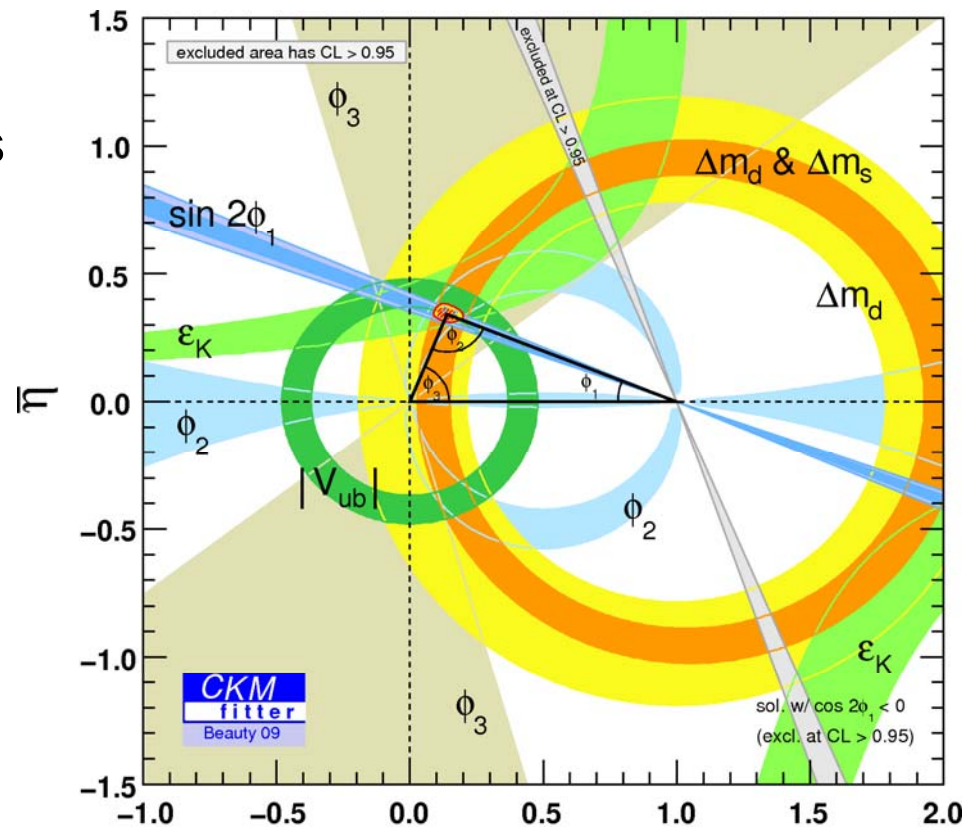
Achieved luminosity of $2.11 \times 10^{34} \text{ cm}^2/\text{s}$

Belle group

15 countries, 63 institutes



KEK-archive



CKMfitter Group (J. Charles *et al.*), $\bar{p}$
Eur. Phys. J. C41, 1-131 (2005) [hep-ph/0406184],
updated results and plots available at: <http://ckmfitter.in2p3.fr>

Super KEKB under constr

Target luminosity

$$8 \times 10^{35} \text{ cm}^2/\text{s}$$

Belle II

13 countries, 58 institutes

Germany:
the largest foreign group!!

Belle II Members

Institutions in Belle II collaboration 110307 : 20110307

Institutions in Belle II Collaboration

13 countries
58 institutes

2011 February

Country	No. of Colleagues	Institute	Total
Australia	10	Univ. of Melbourne AUSTRALIA	5
		Univ. of Sydney AUSTRALIA	5
Austria	11	Austrian Academy of Sciences AUSTRIA	11
China	18	Institute of High Energy Physics CHINA	11
		Univ. of Science and Technology of China CHINA	7
Czech	7	Charles University in Prague CZECH	7
Germany	50	Karlsruhe Institute of Technology(KIT) GERMANY	5
		Univ. of Karlsruhe GERMANY	7
		Univ. of Goettingen GERMANY	3
		Max-Planck-Institut für Physik Muenchen GERMANY	15
		Univ. of Giessen GERMANY	3
		Ludwig Maximilians University Muenchen(LMU) GERMANY	2
		Univ. of Heidelberg GERMANY	2
		Technical Univ. of Munich(Technische Universität Muenchen) GER	5
		Univ. of Bonn GERMANY	8
India	11	Indian Institute of Technology Guwahati INDIA	3
		Indian Institute of Technology Madras INDIA	2
		Institute of Mathematical and Sciences INDIA	1
		Panjab Univ. Union Territory INDIA	3
		Tata Institute of Fundamental Research INDIA	2
Korea	41	Hanyang Univ. KOREA	6
		Gyeongsang National Univ. KOREA	1
		Korea Institute of Science and Technology Information(KISTI) KOR	5
		Korea Univ. KOREA	11
		KyungPook National Univ. KOREA	7
		Seoul National Univ. KOREA	6
Poland	12	Institute of Nuclear Physics PAN POLAND	12
Russia	34	Budker Institute of Nuclear Physics(BINP) RUSSIA	17
		Institute for High Energy Physics RUSSIA	4
		Institute for Theoretical and Experimental Physics RUSSIA	13
Slovenia	14	Jozef Stefan Institute SLOVENIA	7
		Univ. of Maribor SLOVENIA	1
		Univ. of Ljubljana SLOVENIA	5
		Univ. of Nova Gorica SLOVENIA	1
Taiwan	23	Fu Jen Catholic Univ. TAIWAN	5
		National Central Univ. TAIWAN	2
		National Taiwan Univ. TAIWAN	13
		National United Univ. TAIWAN	3
U.S.A.	33	Luther College U.S.A	1
		Indiana Univ. U.S.A.	3
		Pacific Northwest National Laboratory(PNNL) U.S.A.	4
		Univ. of Cincinnati U.S.A.	6
		Univ. of Hawaii U.S.A.	12
		Virginia Polytechnic Institute and State Univ. U.S.A	5
		Wayne State Univ. U.S.A.	2
sub total	264		
Japan	121	High Energy Accelerator Research Organization (KEK) JAPAN	47
		Nagoya Univ. JAPAN	15
		Nara Univ. of Education JAPAN	1
		Nara Women's Univ. JAPAN	9
		Niigata Univ. JAPAN	5
		Osaka City Univ. JAPAN	4
		Toho Univ. JAPAN	3
		Tohoku Univ. JAPAN	14
		Tokyo Metropolitan Univ. JAPAN	4
		U-Tokyo JAPAN	4
		Nuclear Physics Consortium (NPC)	15
sub total	121		
			TOTAL 385

Super KEKB construction time-line

