

In celebration of
Neville Harnew

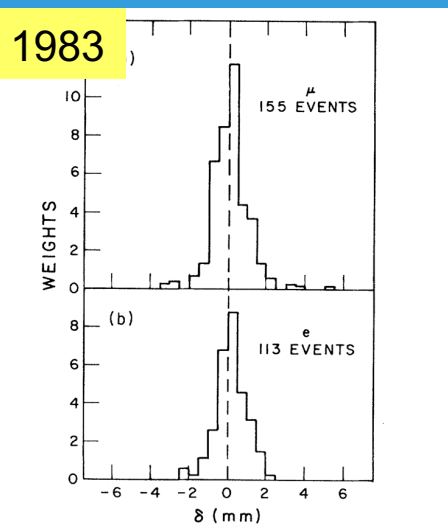
LHCb from inception
to physics



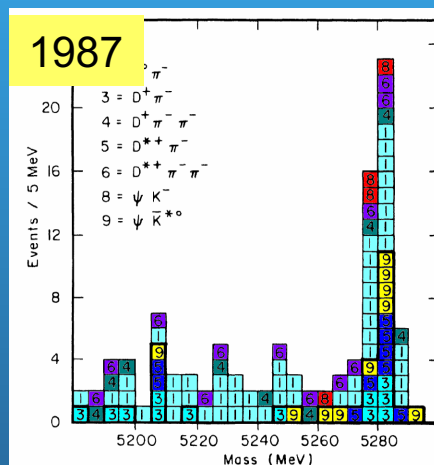
*including photos from FB/M.Harnew, G.Wilkinson, P.Collins

History of B Physics

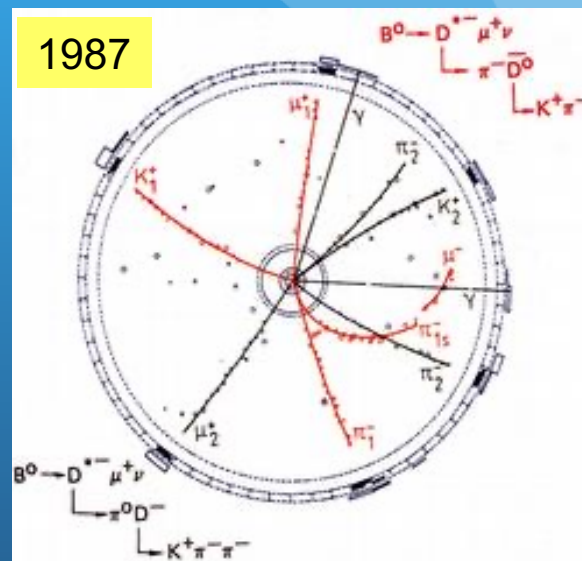
In the 1980s CP Violation in the B system became a very “hot” topic.



B meson lifetime
MAC-Mark II
 $c\tau \sim 490 \mu\text{m}$



Exclusive reconstruction of
several $b \rightarrow c$ decay modes
CLEO



B mixing observed
ARGUS

B physics dominated by Babar and Belle experiments at the asymmetric e^+e^- colliders ~2000-2010

B Physics at Hadron Machines

In 1989 a proposal was made (by Peter Schlein) to study B physics at the SPS Collider at CERN.

- Two concepts – very large B production in the forward direction and use silicon detectors inside the beam-pipe
- Proposal not approved, but a successful test was made

In 1990 LHC Project started

Alongside the GPDs, a b physics experiment was proposed.

Different modes were possible:

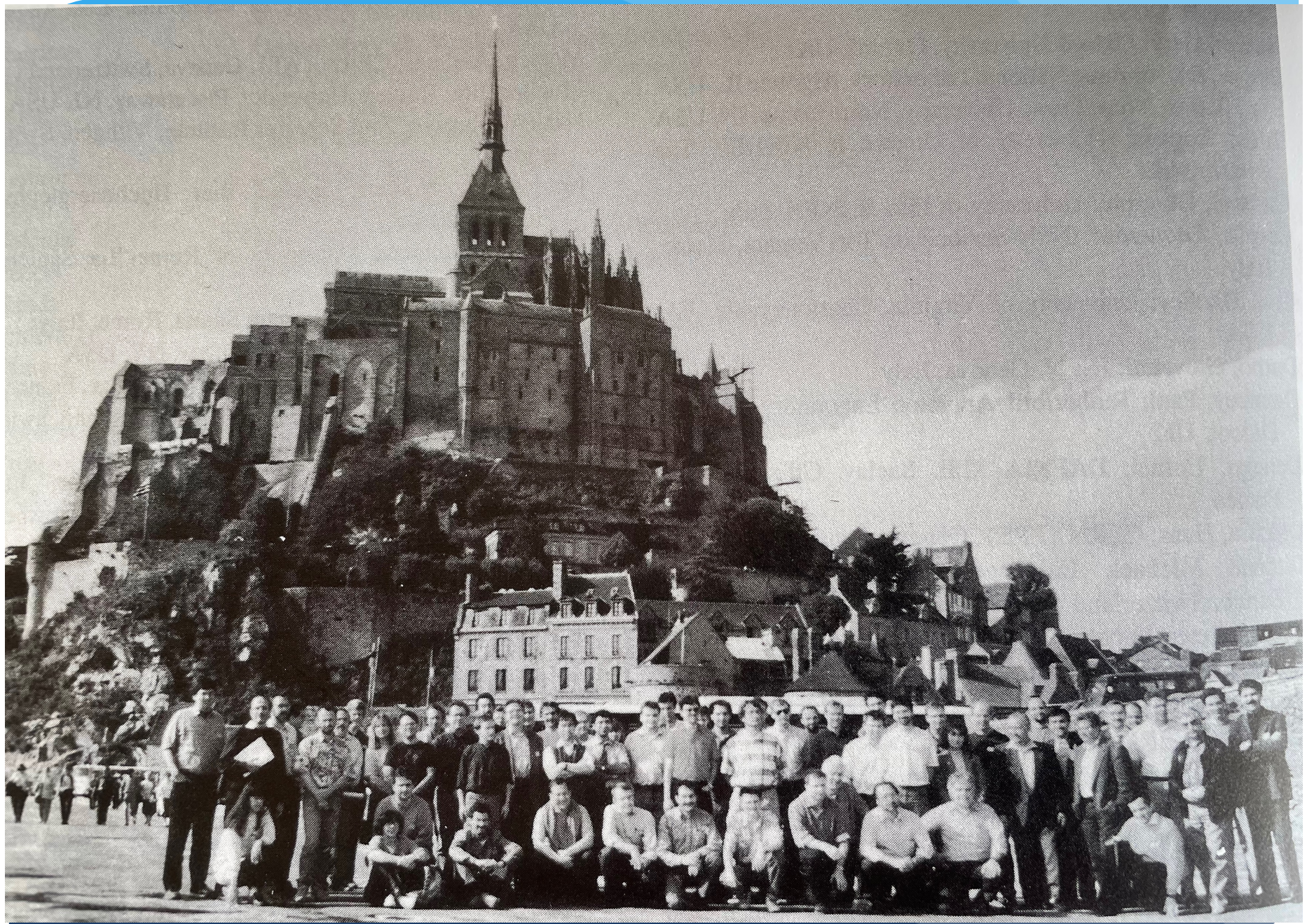
- Collider
- Fixed Target, with extracted beam

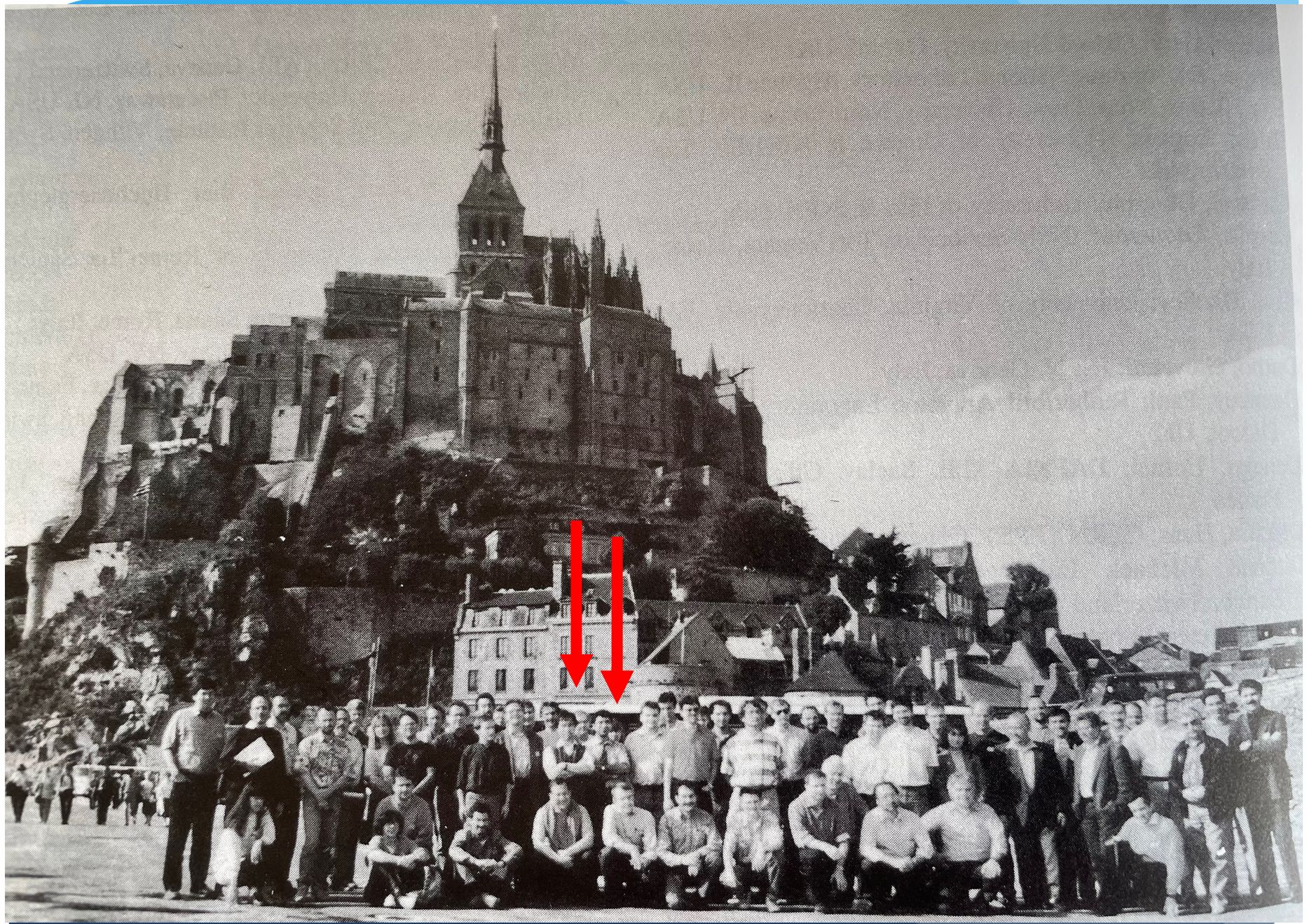
In 1992 LHCC, Large Hadron Collider Committee (LHCC) formed

Beauty '94

**2nd International Workshop on B-Physics at Hadron Machines,
Le Mont-Saint-Michel, Normandy, France, April 25-29, 1994**











Beauty '94

3 proposals presented (already at Beauty '93)

COBEX

Collider mode

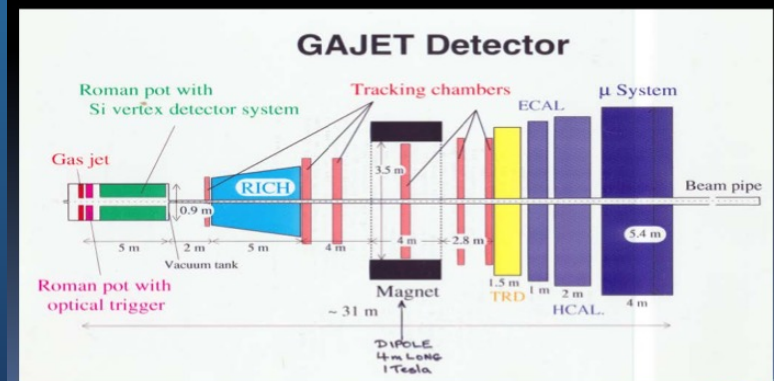
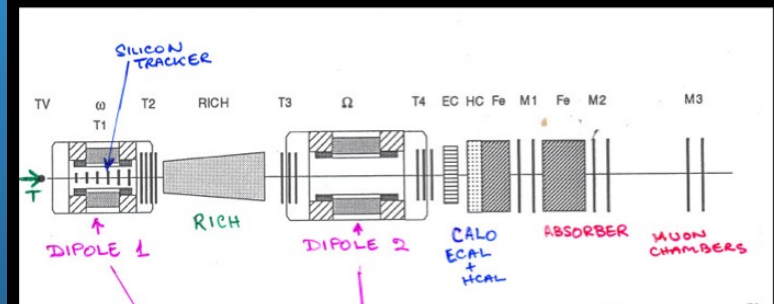
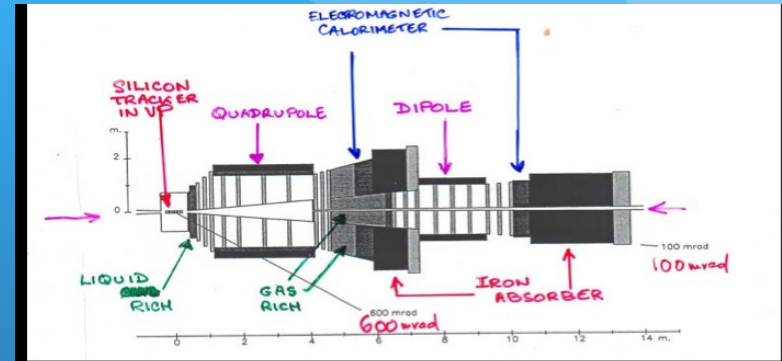
Large Hadron Beauty (LHB)

Beam extraction

GAJET

Internal gas jet target

and HERA-B at HERA



Beauty '94: April 26th 1994





Beauty '94

I.I.Bigi

“...the LHC will satisfy essential needs in a complete program of beauty physics...”

Beauty '94

I.I.Bigi

“...the LHC will satisfy essential needs in a complete program of beauty physics...”

P.Dornan

“...A decision on the future B-programme at (the) LHC will be made at the June LHCC meeting...”

LHCC (June 1994)

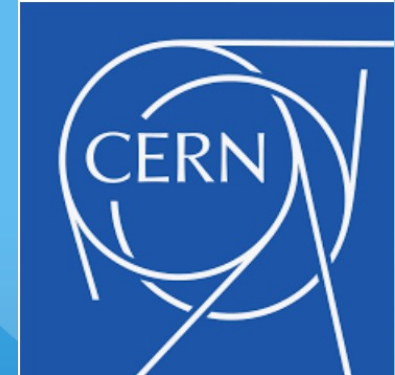
The LHCC discussed the relative merits of the 3 proposals.

Conclusion (extracts):

- None of the collaborations have the necessary resources.
- Collider mode has the greater potential.
- Detector close to the beam is very desirable, but an optimized design of spectrometer does not exist yet.
- The committee therefore encourages all participants from the three proposals to **join together** to prepare a new Letter of Intent for a new collider mode b experiment to be submitted to the LHCC.

Memorandum
30th August 1994

CERN/LHCC/94-34
30 August, 1994



LHC - B

YET
NOT b.

A Dedicated Collider Beauty Experiment
for the
Large Hadron Collider at CERN

MEMORANDUM

Abstract

This memorandum is in response to the request from the LHCC for a progress report, in time for their 31 August meeting, from the new B-collaboration formed around a "Dedicated B-Physics Experiment". We are pleased to report that the former COBEX, GAJET and LHB groups have successfully merged. We have already had two combined collaboration meetings and have a third scheduled for 1 September, 1994. A 6-member executive committee is in place. Working groups have been formed and are functioning constructively. We are proceeding towards completion of a Letter-of-Intent by the end of 1994. The present status of our new collaboration, which we are presently referring to as LHC-B, appears on the following pages.



Request to Participate in a Dedicated B Physics Experiment at the LHC

21st November 1994

S. Blyth^[4], N.H. Brook^[2], N.C. Brümmer^[3], J. Conboy^[6], M.J. Esten^[6],
V. Gibson^[1], N. Harnew^[4], J.G. McEwen^[5], C.P. Ward^[1], D. Websdale^[3],
G. Wilkinson^[4].

[1] University of Cambridge

[2] University of Glasgow

[3] Imperial College, London

[4] University of Oxford

[5] University of Southampton

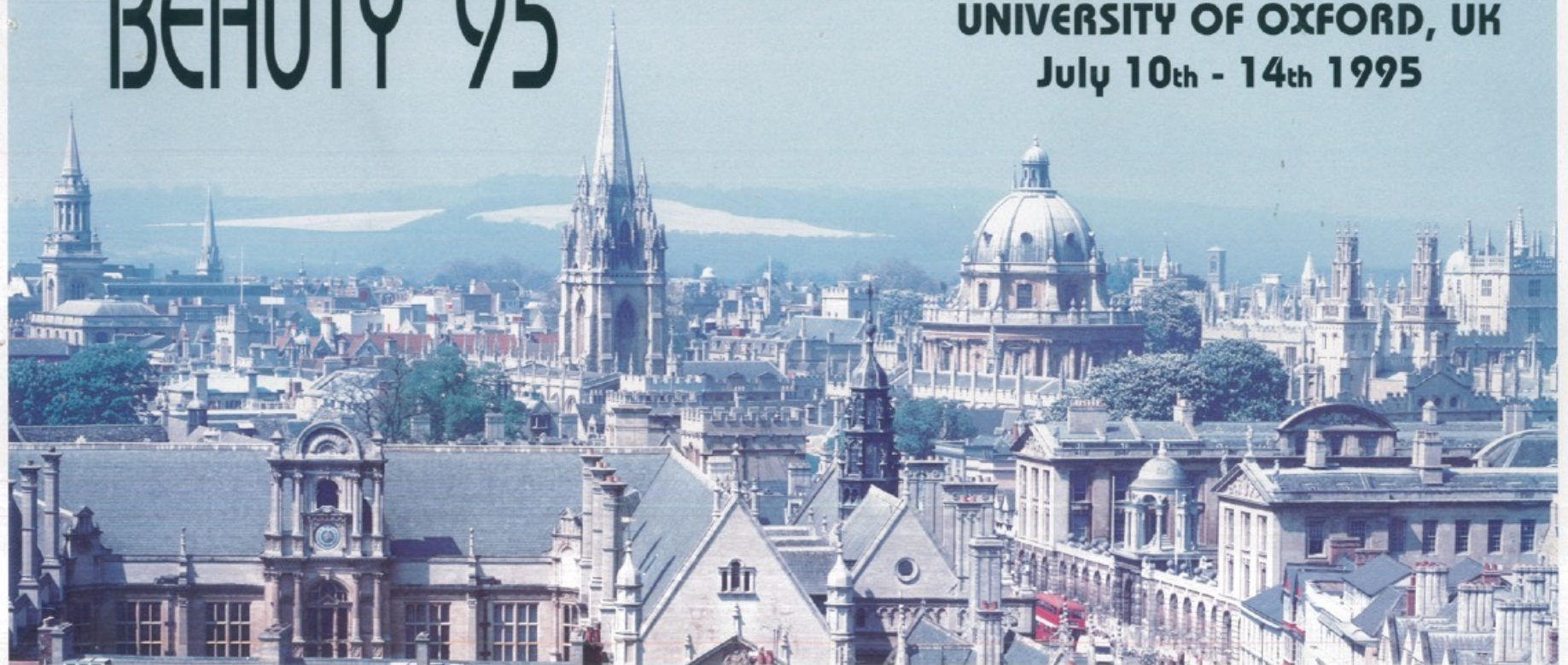
[6] University College, London

PPESP document

3rd INTERNATIONAL WORKSHOP on B-PHYSICS at HADRON MACHINES

BEAUTY '95

WADHAM COLLEGE
UNIVERSITY OF OXFORD, UK
July 10th - 14th 1995



The purpose of this Workshop is to study the experimental challenges and physics potential connected with the future generation of B-physics experiments at hadron machines. The Proceedings of BEAUTY '94 are published in Nucl. Inst. & Meth. A351.

International Advisory Committee

I. Bigi (Notre Dame)	W. Hofmann (MPI - Heidelberg)
L. Camilleri (CERN)	T. Nakada (PSI - Villigen)
G. Carboni (INFN - Rome II)	R. Pöccel (JCLA)
R. Cashmore (Oxford)	P. Schlein (UCLA), Chair
M. Danilov (ITEP)	R. Schwitters (Univ. Texas, Austin)
D. Denegri (Saclay)	S. Stone (Syracuse)
F. Eisele (Univ. Heidelberg)	P. Tipton (Rochester)
N. Ellis (CERN)	A. Vorobyov (PNPI - St. Petersburg)
F. Ferroni (INFN - Rome I)	D. Websdale (Imperial College)
N. Harnew (Oxford)	T. Ypsilantis (College de France)

Sponsored by:

University of Oxford
Department of Physics
UK Particle Physics &
Astronomy Research Council
UK Institute of Physics
INFN
CERN
DESY

For further information contact:

The Workshop Secretary, Sue Geddes
BEAUTY95@PHYSICS.OXFORD.AC.UK

Or for the local committee:
[N. HARNEW@PHYSICS.OXFORD.AC.UK](mailto:N.HARNEW@PHYSICS.OXFORD.AC.UK)

Or the World-Wide-Web home page
<http://www-pnp.physics.ox.ac.uk/beauty95.html>

Beauty '95



Beauty '95



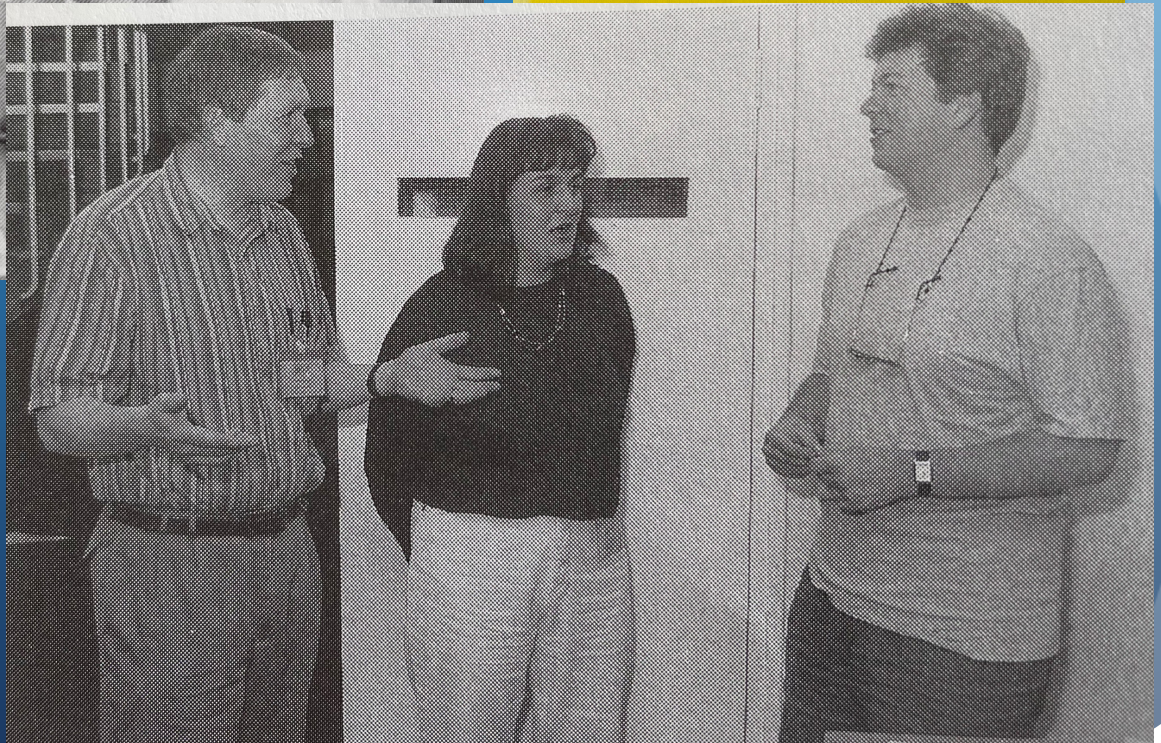
BEAUTY '95

Proceedings of the Third International Workshop on
B-Physics at Hadron Machines
University of Oxford, UK, July 10-14, 1995



Editors

N. HARNEW
P.E. SCHLEIN



Letter of Intent

25th August 1995

CERN/LHCC 95-5
LHCC/ I 8
25 August 1995

Last update
28 March 1996



LHC-B

LETTER OF INTENT

A Dedicated LHC Collider Beauty Experiment
for Precision Measurements of CP-Violation

Abstract

The LHC-B Collaboration proposes to build a forward collider detector dedicated to the study of CP violation and other rare phenomena in the decays of Beauty particles. The forward geometry results in an average 80 GeV momentum of reconstructed B-mesons and, with multiple, efficient and redundant triggers, yields large event samples. B-hadron decay products are efficiently identified by Ring-Imaging Cerenkov Counters, rendering a wide range of multi-particle final states accessible and providing precise measurements of all angles, α, β and of the unitarity triangle. The LHC-B microvertex detector capabilities facilitate multi-vertex event reconstruction and proper-time measurements with an expected few-percent uncertainty permitting measurements of B_s -mixing well beyond the largest conceivable values of x_s . LHC-B would be fully operational at the startup of LHC and requires only a modest luminosity to reveal its full performance potential.

Cambridge University, Cambridge, U.K.

V. Gibson, C.P. Ward, S. Wotton

University of Glasgow, Glasgow, U.K.

N.H. Brook, A.W. Halley

University of Liverpool, Liverpool, U.K.

S. Biagi, T. Bowcock

Imperial College, London, U.K.

A. Duane, A. Howerd, I. Last, J.G. McEwen³, D. Websdale

University of Oxford, Oxford, U.K.

N. Harnew, F. Harris, T. Hessian, G. Wilkinson



A Proposal to Participate in Research and Development for the LHC-B Experiment

29th April 1996

The LHC-B UK Collaboration

G. Barber^{[3]†}, S. F. Biagi^[4], J. Bibby^{[5]†}, T. Bowcock^[4], N. H. Brook^[2],
D. Colling^[3], G. Doucas^[5], A. Duane^[3], A. J. Flavell^[2], V. Gibson^[1],
A. W. Halley^[2], N. Harnew^[5], F. Harris^[5], P. J. Hayman^[4], C. M. Hawkes^[1],
T. Hessian^[5], A. Howard^{[3]‡}, I. Last^[3], S. Katvars^{[1]†}, B. Knox^{[5]†}, I. McArthur^[5],
J. G. McEwen^[3], S. Topp-Jorgensen^{[5]†}, C. P. Ward^[1], D. Websdale^[3],
G. Wilkinson^[5], S. Wotton^[1].

†Engineer, ‡Student

[1] University of Cambridge

[2] University of Glasgow

[3] Imperial College, London

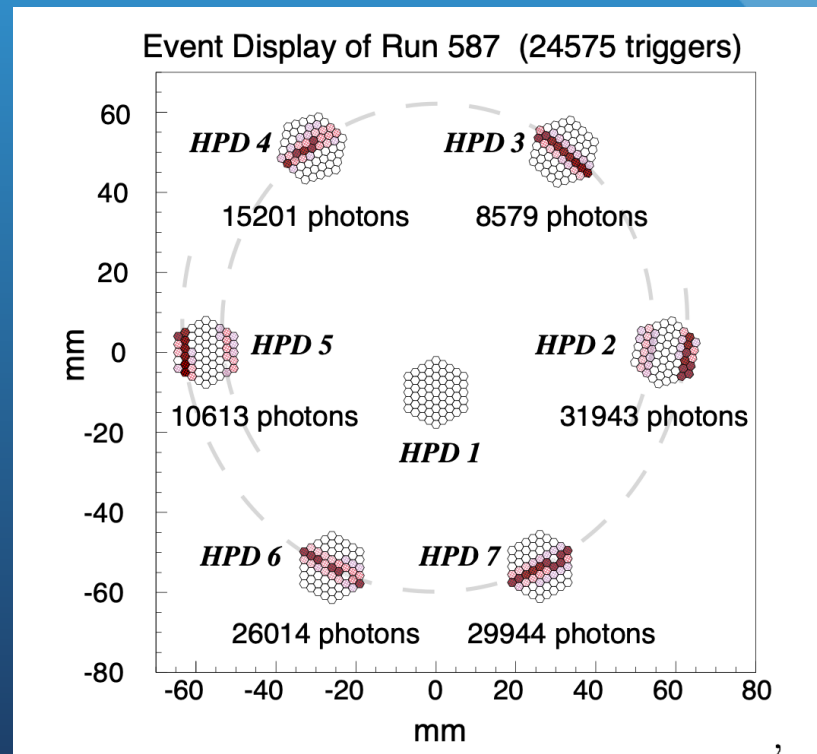
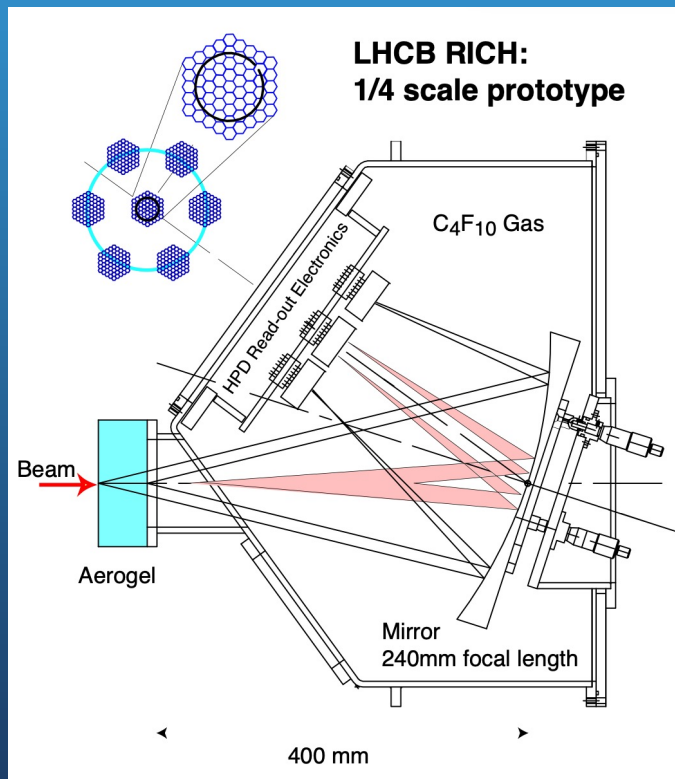
[4] University of Liverpool

[5] University of Oxford

First Observation of Cherenkov Ring Images using Hybrid Photon Detectors

9th Jan 1998

E. Albrecht²⁾, G. Barber⁴⁾, J.H. Bibby⁵⁾, N.H. Brook³⁾, A. Duane⁴⁾, M. French⁷⁾, V. Gibson¹⁾, R. Giles⁵⁾, A.W. Halley³⁾, N. Harnew⁵⁾, M. John⁴⁾, D. G. Miller⁴⁾, V.O'Shea³⁾, R. Schomaker⁶⁾, N. Smale⁵⁾, D. Websdale⁴⁾, G. Wilkinson²⁾, S.A. Wotton¹⁾.



15th March 1999



Proposal for UK Participation in the LHCb Experiment

The LHCb UK Collaboration

15th March 1999

V. Gibson, S. G. Katvars, C. Shepherd-Themistocleous, D. R. Ward, C. P. Ward,
S. A. Wotton.

University of Cambridge.

R. Bernet, S. Eisenhardt, F. Muheim, S. Playfer.

University of Edinburgh.

R. Bates, N. H. Brook, S. Easo, A. Flavell, A. W. Halley, V. O'Shea,
P. Teixeira-Dias.

University of Glasgow.

G. J. Barber, D. Clarke, P. Dauncey, A. Duane, J. Hassard, M. J. John[‡],
D. R. Price, B. Simmons[‡], L. Toudup, D. M. Websdale.

Imperial College, London.

S. F. Biagi, T. Bowcock, R. Gamet, P. J. Hayman, M. McCubbin, C. Parkes,
G. D. Patel, P. Sutcliffe, D. Wells, V. Wright[‡].

University of Liverpool.

J. Bibby, N. Harnew, F. Harris, P. J. Holt, J. Libby, I. McArthur, J. Rademacker[‡],
N. Smale, S. Topp-Jorgensen, G. Wilkinson.

University of Oxford.

J. Baker, M. French, R. N. J. Halsall, J. Lidbury.

Rutherford Appleton Laboratory.

UK Spokesperson
Neville Harnew

15th March 1999



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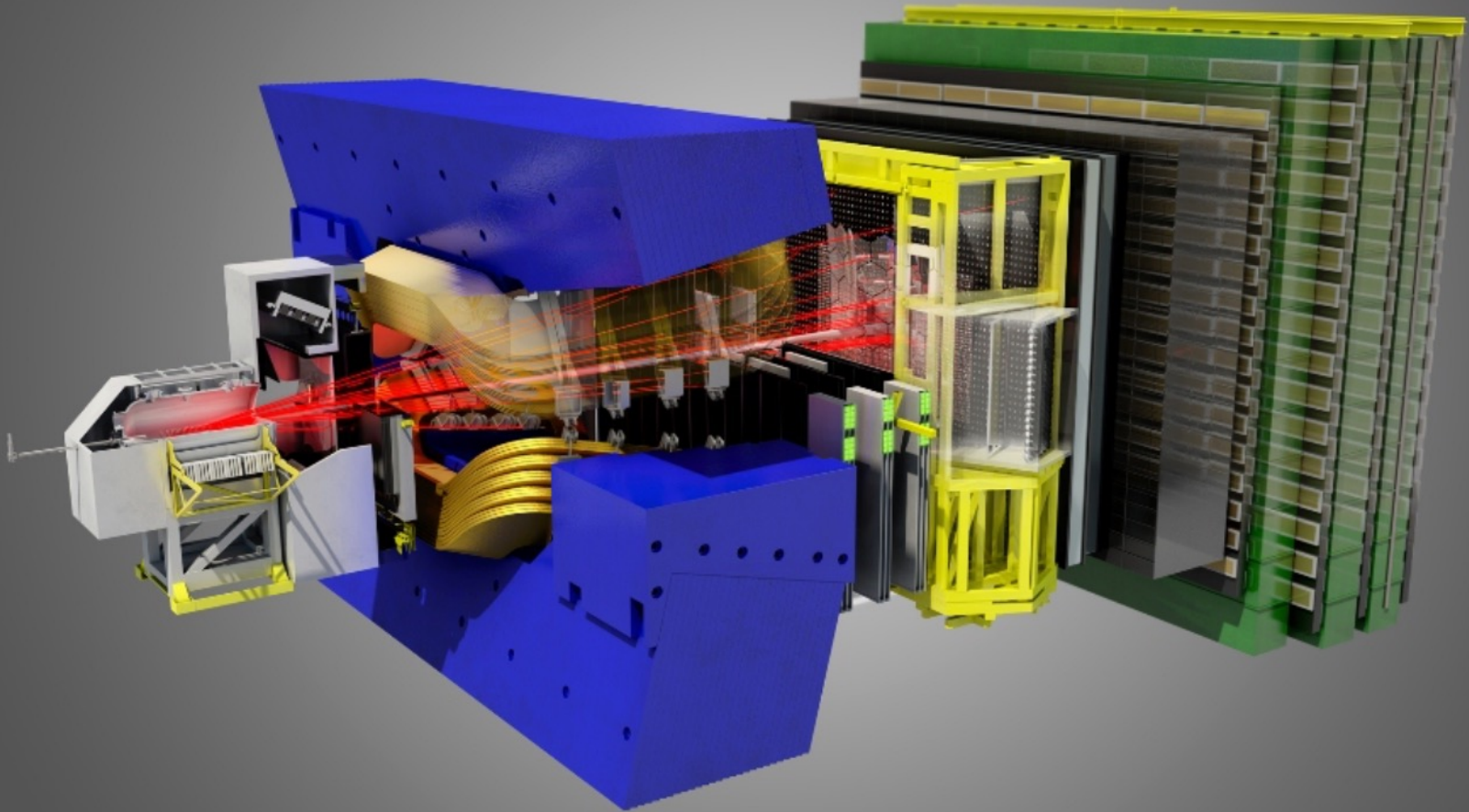
Rutherford Appleton Laboratory.

UK Spokesperson
Neville Harnew

2000 Bristol joined

2009 Manchester, Warwick
Birmingham

LHCb... a beautiful experiment at the LHC



Neville...



Neville...



Led the UK on the LHCb experiment from its inception

Project Leader for the RICH detectors, delivering them on budget and on schedule (see Carmelo)

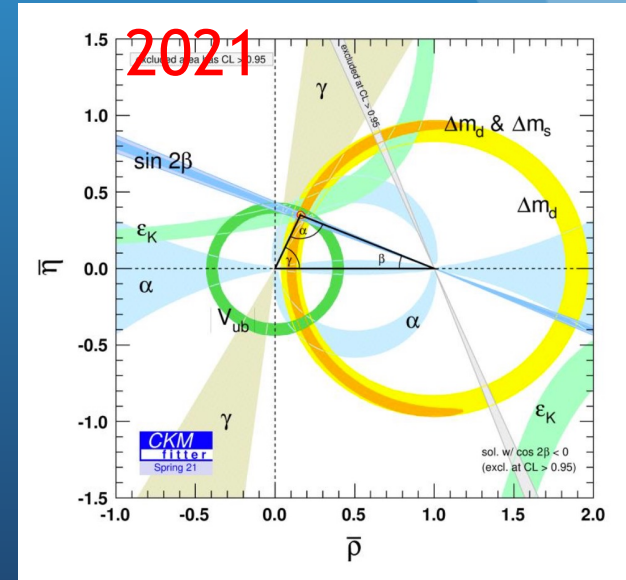
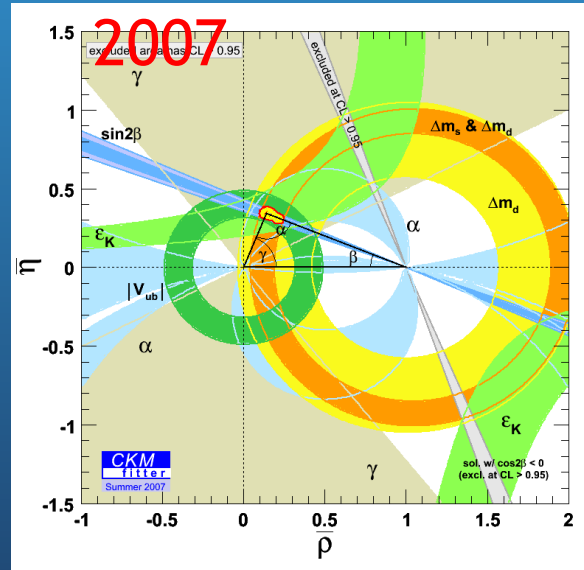
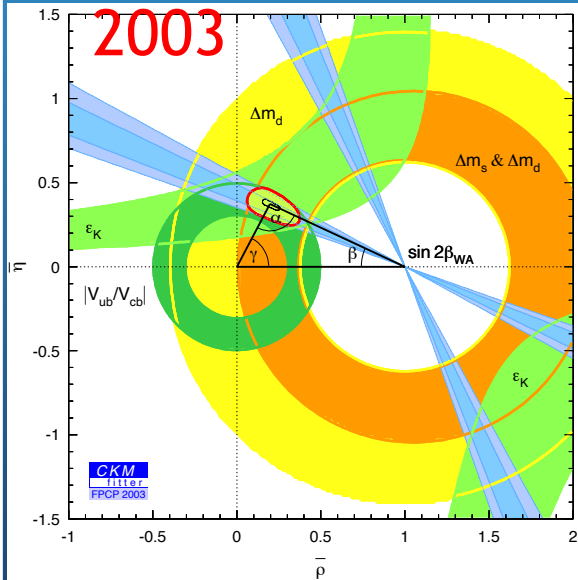
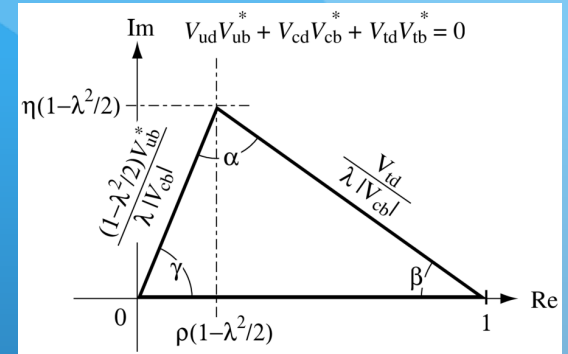
Oxford group (led by Neville) became central to LHCb physics

Measurement of CP Phase γ

The Unitarity Triangle

$$V_{\text{CKM}} = \begin{pmatrix} V_{ud} & V_{us} & V_{ub} \\ V_{cd} & V_{cs} & V_{cb} \\ V_{td} & V_{ts} & V_{tb} \end{pmatrix}$$

$$V_{ud}V_{ub}^* + V_{cd}V_{cb}^* + V_{td}V_{tb}^* = 0$$



<http://ckmfitter.in2p3.fr>

LHCb Collaboration Board Chairs (1996-2020)

Neville Collaboration Board Chair 1996-2000



Negotiating some tricky collaboration decisions, including

- LHCb Spokesperson (T.Nakada)
- Established trigger scenario
- Writing the LHCb constitution

LHCb Collaboration Week – Marseille 1998

LHCb Collaboration Week – Marseille 1998

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By Tom Rostance
BBC Sport

17 June 2018 | World Cup |



Marseille city authorities said 63 people were injured in the three days of fighting in June 1998

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Marseille city authorities said 63 people were injured in the three days of fighting in June 1998



Thank you Neville!

