BETA BEAMS

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With a Foreword by Piero Zucchelli and
a Contribution on Low Energy Beta Beams by Cristina Volpe

Imperial College Press

ICP

Published by

Imperial College Press
57 Shelton Street
Covent Garden
London WC2H 9HE

Distributed by

World Scientific Publishing Co. Pte. Ltd.

5 Toh Tuck Link, Singapore 596224

USA office: 27 Warren Street, Suite 401-402, Hackensack, NJ 07601

UK office: 57 Shelton Street, Covent Garden, London WC2H 9HE

Library of Congress Cataloging-in-Publication Data

Lindroos, Mats.

Beta beams : neutrino beams / Mats Lindroos & Mauro Mezzetto.

p. cm.

Includes bibliographical references and index.

ISBN 978-1-84816-377-5

1. Neutrinos. 2. Neutron beams. I. Mezzetto, Mauro. II. Title.

QC793.5.N425L56 2009

539.7'375--dc22

2009020410

British Library Cataloguing-in-Publication Data

A catalogue record for this book is available from the British Library.

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Printed in Singapore.

To our families.

Without the support from our wives, Rebecca and Maria-Cristina,
this book would not have been possible and more importantly,
without them life would not be worth living.

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Acknowledgments

Many thanks to all our colleagues in the world wide neutrino physics community. A special thanks to all our colleagues in the beta beam task group in the EC supported EURISOL Design Study (led by Michael Benedikt from CERN) and in the EC supported BENE network (led by Vittorio Palladino from the University of Naples and INFN) within the Infrastructure Activity CARE. Special thanks to Pierre Delahaye at GANIL for proof reading the Machine chapter. We would also like to thank John Ellis (CERN) for several precious suggestions.

The authors wish to thank their home institutes, CERN for Mats Lindroos and Istituto Nazionale di Fisica Nucleare for Mauro Mezzetto, for supporting this work. Mats Lindroos also wishes to thank the Physics Department at the University of Liverpool where he is Visiting Professor for their support.

We acknowledge the financial support of the European Community under the FP6 Research Infrastructure Action Structuring the European Research Area EURISOL DS Project Contract No. 515768 RIDS. The EC is not liable for any use that may be made of the information contained herein.

We acknowledge the support of the European Community-Research Infrastructure Activity under the FP6 Structuring the European Research Area programme (CARE, contract number RII3-CT-2003-506395).

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Foreword

Innovation can achieve its target by either an incremental or radical change in knowledge. Neutrino physics is an outstanding field in this respect since, in less than 100 years, three elusive fundamental particles have been postulated, searched for, discovered, and characterized by giant steps requiring radical innovations. In almost all cases, the innovation to be undertaken was inconceivable by the same scientific community just a few years before. Well-known are the words of W. Pauli, the neutrino inventor: “I have done a terrible thing. I have postulated a particle that cannot be detected.” And less than ten years later, F. Reines and C. Cowan were able to detect it, apparently driven by the fact that everybody said it could not be done. Not surprisingly, as F. Reines admitted “Clyne (Cowan) knew as little about the neutrino as I did but he was a good experimentalist with a sense of derring-do. So we shook hands and got off to working on neutrinos.”

The beta beam is no more than a recent invention in the neutrino physics history: invention is the first occurrence of an idea for a new product or process, while innovation is the first attempt to carry it out into practice (J.E. Faberger, 2004). However, it will become a true innovation if it benefits from the potential synergy among different scientific disciplines. If you are not an insider in neutrino physics, this is your book: you will learn about neutrino physics in the broadest sense, from theory to acceleration and detection techniques, and you will have a very different view of the challenges and applications that are critical to the expansion of the beta beams potential.

All elements are apparently present to motivate your active contribution to beta beams: just a few years ago, many scientists insisted that they are conceptually impossible (still today, all artificial neutrino beams are produced by meson decay, as pioneered by Lederman, Schwartz and

Steinberger in the 60s). Therefore, don't forget your sense of derring-do, still necessary to pioneers of any time: if there are roses, they will blossom and the next book on beta beams will include your contribution.

Piero Zucchelli