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The CERN Accelerator School

Intensity Limitations in Particle Beams

Geneva, Switzerland
2–11 November 2015

Editor: W. Herr

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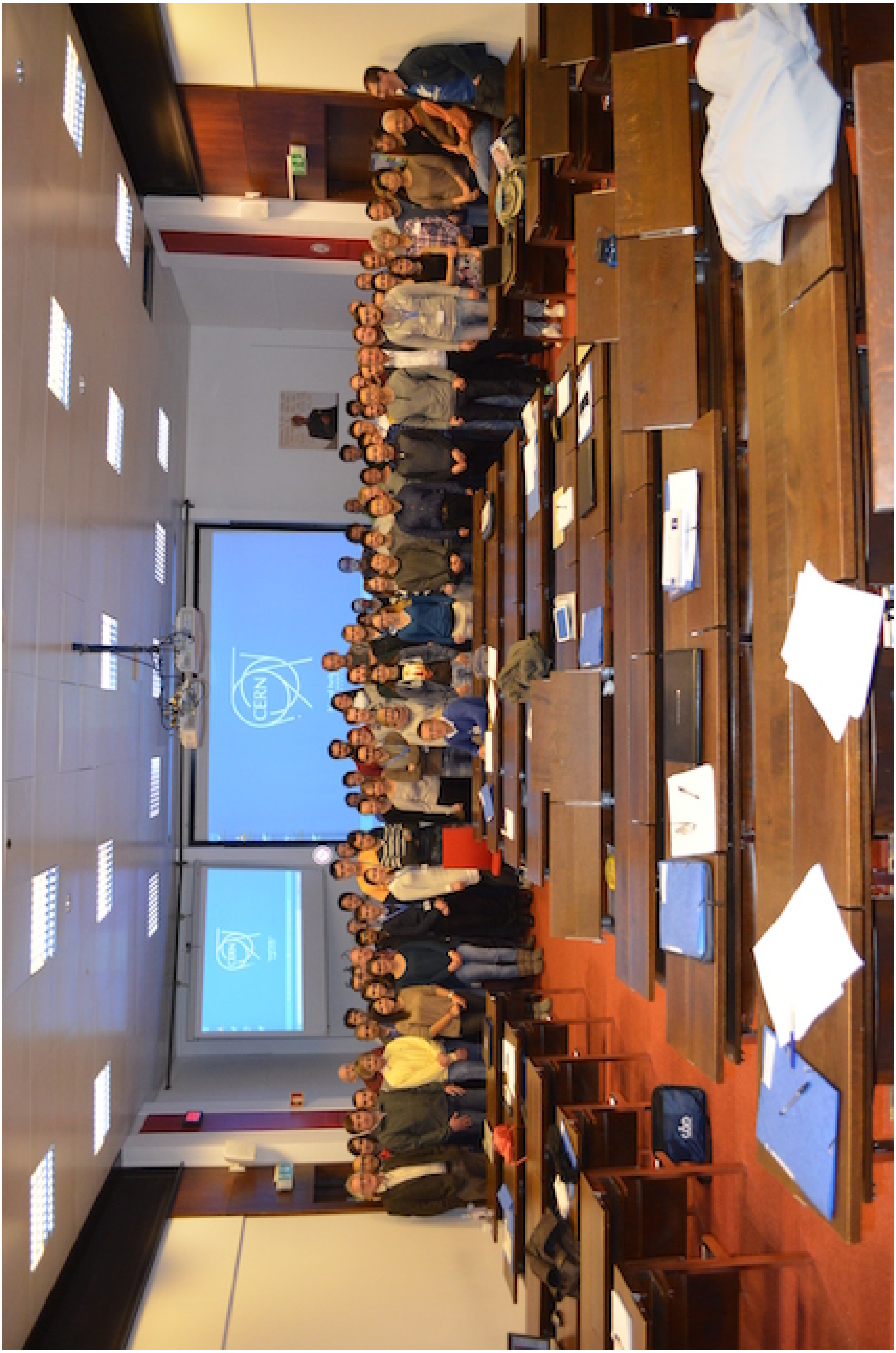
Abstract

This report presents the proceedings of a specialized course organized by the CERN Accelerator School (CAS). The topic this time being 'Intensity Limitations in Particle Beams'. The course was held at CERN, Switzerland, from 2-11 November 2015. The last course on this topic was organized in the framework of the Joint US-CERN School on Particle Accelerators in November 1990. It was felt that the progress in the field justified a revised course. The lectures addressed fundamental theory as well as experimental results. The indispensable beam diagnostics and mitigation measures were covered in dedicated lectures. The lectures were complemented by several sessions of exercises and the discussion of the solutions.



Preface

The aim of the CERN Accelerator School is to collect, preserve and disseminate the existing knowledge accumulated in the world's accelerator laboratories and universities. In addition to courses on general accelerator physics, specialized courses are organized to deepen the knowledge and increase technical competencies on specific topics in accelerator science. While most specialized courses treat related sub-systems and acccelerator technology, this course focuses on an advanced topic in beam dynamics. Intensity limitations do not only occur in High Energy Particle Accelerators but are of increasing importance in other types of accelerators. Accelerators for medical and industrial applications have an increasing need for high intensity and high quality beams.

The last course on this topic was organized in the framework of the Joint US-CERN School on Particle Accelerators in November 1990. It was felt that the rapid progress in this field motivated a revised course. Therefore the organization of such a course was fully supported by the CAS Advisory Committee.

This course was held at CERN, Switzerland from 2-11 November 2015 and its proceeding are compiled in the present volume. The backing of the CERN management and the provision of the necessary infrastructure have made this course possible.

The programme of the course was elaborated with the help of a dedicated Scientific Programme Committee, composed of experts in this field. They deserve our sincere thanks for their effort to ensure a good coverage of this very demanding topic. It was possible to attract world-reknowned experts as lecturers at this course and this ensured the high level of the presented material. The tremendous amount of work in preparing, presenting and writing-up of their topics for the present proceedings deserves the thanks of the organizers as well as the participants who came from all over the world to attend this course.

Finally, the quality of the contributions to these proceedings and the professional preparation will be highly appreciated by many people who will use the proceedings in the future.

These proceedings have been published in paper (black and white) and electronic form. The electronic version, with full colour figures, can be found at https://e-publishing.cern.ch/index.php/CYRSP/issue/view/37.

Werner Herr, Editor
CERN Accelerator School

Draft Programme

Intensity Limitations in Particle Beams, CERN, Geneva, Switzerland, 2-11 November, 2015

Time	Monday 2 November	Tuesday 3 November	Wednesday 4 November	Thursday 5 November	Friday 6 November	Saturday 7 November	Sunday 8 November	Monday 9 November	Tuesday 10 November	Wednesday 11 November
8:30 9:30	ARRIVAL DAY	Opening Talks	Bench Measurements and Simulations of Beam Coupling Impedance U. Niedermayer	Beam Instabilities in Linear Machines II M. Ferrario	Observations and Diagnostics in High Brightness Beams A. Cianchi	Space Charge in Linacs I. Hofmann	EXCURSION	Electron Cloud I G. Rumolo	High Brightness Photo Injectors E. Chiadroni	DEPARTURE AFTER BREAKFAST
9:30 10:30		Introduction and Needs for High Intensity and High Brightness L. Rivkin	Beam Dynamics with High Intensity II A. Chao	Beam-Beam Effects in Hadron Colliders I T. Pieloni	Sources and and Low Energy Beam Transfer R. Scrivens	Intrabeam Scattering M. Martini		Beam-Beam Effects in Linear Colliders D. Schulte	Electron Cloud II G. Rumolo	
		COFFEE	COFFEE	COFFEE	COFFEE	COFFEE		COFFEE	COFFEE	
11:00 12:00		Overview of Limitations W. Herr	Beam Based Impedance Measurements E. Shaposhnikova	Effects near Transition E. Metral	Space Charge and Impedances O. Boine-Frankenheim	Space Charge in Circular Machines G. Franchetti		Passive Mitigation V. Kornilov	Active Mitigation H. Schmickler	
12:00 13:00		Wakefield and Impedances I M. Dohlus	Beam Instabilities in Circular Machines II A. Chao	Beam-Beam Effects in Hadron Colliders II T. Pieloni	Numerical Methods I K. Li	Coherent Beam-Beam Effects X. Buffat		Machine Protection R. Schmidt	Beam Loss Consequences F. Cerutti	
		LUNCH	LUNCH	LUNCH	LUNCH	LUNCH		LUNCH	LUNCH	
14:30 15:30		Beam Dynamics with High Intensity I A. Chao	Beam Instabilities in Linear Machines I M. Ferrario	FREE AFTERNOON	Study	CERN VISIT		Study	Ions R. Nagaoka	
		TEA	TEA		TEA			TEA	TEA	
16:00 17:00		Wakefield and Impedances II R. Wanzenberg	Observations and Diagnostics in High Intensity Beams V. Kornilov		Beam-Beam Effects in Circular Lepton Colliders C. Milardi			Vacuum Issues P. Chiggiato	Numerical Methods II K. Li	
17:00 18:00	**Registration**	Beam Instabilities in Circular Machines I A. Chao	Study		Tutorial			Tutorial	Seminar D. McGinnis	
		Welcome Drink								
19:00	DINNER	DINNER	DINNER	DINNER	DINNER	DINNER	Special Dinner	DINNER	DINNER	

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