

Lecture Notes in Physics

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M. Month S. Turner (Eds.)

Frontiers of Particle Beams; Observation, Diagnosis and Correction

Proceedings of a Topical Course
Held by the Joint US-CERN School on Particle Accelerators
at Anacapri, Isola di Capri, Italy, October 20–26, 1988



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JOINT US-CERN SCHOOL ON PARTICLE ACCELERATORS

FRONTIERS OF PARTICLE BEAMS;
OBSERVATION, DIAGNOSIS AND CORRECTION

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JOINT US-CERN SCHOOL ON PARTICLE ACCELERATORS
FRONTIERS OF PARTICLE BEAMS, OBSERVATION, DIAGNOSIS AND CORRECTION

| Time | Thursday 20th October | Friday 21st October | Saturday 22nd October | Monday 24th October | Tuesday 25th October | Wednesday 26th October |
|-------|---|--|--|---|--|--|
| 08.30 | Introductory talk H. Grunder M. Month | Overview for single particle parameters III R. Talman | Transverse betatron tune measurement M. Serio | Measurement of longitudinal parameters S. Krinsky | Polarisation M. Placidi | Signal analysis D. Boussard |
| 09.15 | B R E A K | | | B R E A K | | |
| 09.25 | Overview for single particle parameters I R. Talman | Closed orbit correction J.-P. Koutchouk | Betatron coupling L. Teng | Measurement of luminosity and absolute energy R.P. Johnson | Experimental study of resonances L. Evans | Theory of emittance invariants A. Dragt |
| 10.10 | C O F F E E | | | C O F F E E | | |
| 10.30 | Overview for single particle parameters II R. Talman | Electromagnetic detectors G. Lambertson | Intercepting monitors R. Jung | Diagnostics with synchrotron light G. Dattoli | Diagnostics with Schottky noise S. van der Meer | Closing talk G. Voss |
| 11.15 | B R E A K | | | B R E A K | | |
| 11.25 | Physical phenomena used in beam observation A. Hofmann | Overview of collective effects III R. Ruth | Landau damping & beam transfer function J.M. Wang | Seminar Experimental particle tracking R. Talman | Cures for instabilities II R.-D. Kohaupt | |
| 12.10 | L U N C H | | | L U N C H | | |
| 16.00 | Overview of collective effects I R. Ruth | Beam mode observation F. Pedersen | FREE AFTERNOON | Wakefields and measurement of machine impedance I II L. Palumbo | | |
| 16.45 | T E A | | | T E A | | |
| 17.15 | Overview for collective effects II R. Ruth | Seminar Monitoring in future e ⁺ e ⁻ colliders R.A. Erickson | | Cures for instabilities I R.-D. Kohaupt | Seminar Non-planar machines D. Ritson | |
| | COCKTAIL | FOLKLORIC EVENING | | | BANQUET | |

PREFACE

"Frontiers of Particle Beams; Observation, Diagnosis and Correction" is the third in a series of specialized courses jointly organized by the US Particle Accelerator School and the CERN Accelerator School. The first of these courses was on non-linear dynamics and its relationship to accelerator physics. It was held in Santa Margherita di Pula, Sardinia, in January 1985 and its proceedings were published as number 247 of the Lecture Notes in Physics series of Springer-Verlag. The second school, held in South Padre Island, Texas, in October 1986, was entitled "Frontiers of Particle Beams", and was an introduction to the latest concepts in the physics and technology of particle accelerators. Its proceedings formed number 296 of the Lecture Notes series. The present volume arises from the latest of these schools, which was held in Anacapri, Isola di Capri from 20-26 October 1988 and which concentrated on the techniques of observing, diagnosing and correcting the properties of particle beams being accelerated or circulating in accelerators and storage rings, a topic which has not received wide coverage in the past.

The lecture programme can be broadly classified under three headings:

- Phenomena used in beam observation
- Single particle parameters
- Collective parameters

Each of the above was introduced by one or more general lectures followed by detailed lectures on specific topics such as Schottky noise, closed orbits, or impedance measurements. The theme underlying these topics was to show how to observe the diverse behaviour of a beam, how to interpret and classify the observations, and then how to control or correct the relevant parameters. The result is a single volume, which contains much of the information needed when operating or preparing the commissioning of a machine. The lecture programme was supplemented by three seminars which looked at the future of monitoring in e^+e^- colliders and at the special problems of non-planar machines and experimental particle tracking.

More than 150 participants attended the course, of whom 40 came from the North American continent, a scattering from the Asian countries, and the remainder from Europe. They represented a very wide selection of accelerator laboratories and the many different types of accelerators and storage rings. Half of the lecturers were American, the remainder European, and all are internationally recognized as experts in their field.

On this occasion a great deal of the local organization of the school was carried out from the Physics Department of Naples University, which also acted as host and provided some financial support. The other sponsors were the Università

Degli Studi di Napoli, the Naples section of the Istituto Nazionale di Fisica Nucleare, the US Department of Energy, the National Science Foundation, and the European Centre for Nuclear Research.

On behalf of the US and CERN accelerator schools we wish to record our appreciation of all the material and moral support received for this course. Special thanks are due to the US Particle Accelerator School Executive Board and the CERN Accelerator School Advisory Committee as well as the Programme Committee for this event. The lecturers also deserve a very special tribute for their willingness to undertake the task and for the hard work they put into preparing and presenting the lectures and writing the chapters of this volume. Finally, the help of the Azienda Autonoma di Cura, Soggiorno et Turismo, Isola di Capri and the great effort made by the Manager and staff of the Europa Palace Hotel, Anacapri to ensure that we enjoyed and benefitted from our stay on the island were highly appreciated.

Stuart Turner
CERN Accelerator School

Melvin Month
US Particle Accelerator School

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