Introduction to Accelerator Physics, 18 September - 01 October 2022, Kaunas, Lithuania

Report of Contributions

Contribution ID: **122** Type: **not specified**

Opening

Monday 19 September 2022 08:30 (1 hour)

Presenter: TECKER, Frank (CERN)

Contribution ID: **123** Type: **not specified**

Electromagnetic Theory I

Presenter: SHREYBER, Irina (Tomsk State University (RU))

Contribution ID: **124** Type: **not specified**

Electromagnetic Theory II

Monday 19 September 2022 11:15 (1 hour)

The purpose of this course is to provide an introduction to Electromagnetic Theory. The foundations of electrodynamics starting from the nature of electrical force up to the level of Maxwell equations solutions are presented. It starts with the introduction of the concept of a field, which plays a very important role in the understanding of electricity and magnetism. In addition, moving electric charge is discussed as a topic of special importance in accelerator physics.

Presenter: SHREYBER, Irina

Contribution ID: **125** Type: **not specified**

Warm Magnets

Monday 19 September 2022 15:00 (1 hour)

Warm magnets are magnets that function in normal ambient temperature con- ditions. These types are mostly using a soft steel yoke for field amplifica- tion and either Copper or Aluminium coils or permanent magnets to gener- ate the field. Magnets powered with such normal-conducting coils are often also called classical, iron dominated or resistive magnets. Since decades these types of magnets are the workhorse for most linear and circular accelerators and beam transfer lines.

Presenter: DE RIJK, Gijs

Contribution ID: **126** Type: **not specified**

Transverse Linear Beam Dynamics I

Monday 19 September 2022 13:45 (1 hour)

The subject of this introductory course is transverse dynamics of charged par-ticle beams in linear approximation. Starting with a discussion of the most im-portant types of magnets and defining their multipole strengths, the linearizedequations of motion of charged particles in static magnetic fields are derivedusing an orthogonal reference frame following the design orbit. Analyticalsolutions are determined for linear elements of a typical beam transfer line(drift, dipole and quadrupole magnets), and stepwise combined by introducingthe matrix formalism in which each element's contribution is represented bya single transfer matrix. Application of this formalism allows to calculate sin-gle particle's trajectories in linear approximation. After introducing the beamemittance as the area occupied by a particle beam in phase space, a lineartreatment of transverse beam dynamics based on appropriately defined opticalfunctions is introduced. The formalism is applied to the concepts of both weakand strong focusing, in particular discussing the properties of the widely-usedFODO cell. Specific characteristics of transverse beam dynamics in periodicsystems like circular accelerators are studied in detail, emphazising the effectsof linear field errors on orbit stability and introducing the phenomena of opti-cal resonances. Finally, the dynamics of off-momentum particles is presented,introducing dispersion functions and explaining effects like chromaticity.

Presenter: HILLERT, Wolfgang (University of Hamburg)

Contribution ID: **127** Type: **not specified**

Transverse Linear Beam Dynamics II

Monday 19 September 2022 16:30 (1 hour)

The subject of this introductory course is transverse dynamics of charged particle beams in linear approximation. Starting with a discussion of the most important types of magnets and defining their multipole strengths, the linearised equations of motion of charged particles in static magnetic fields are derived using an orthogonal reference frame following the design orbit. Analytical solutions are determined for linear elements of a typical beam transfer line(drift, dipole and quadrupole magnets), and stepwise combined by introducing the matrix formalism in which each element's contribution is represented by a single transfer matrix. Application of this formalism allows to calculate single particle's trajectories in linear approximation. After introducing the beamemittance as the area occupied by a particle beam in phase space, a lineartreatment of transverse beam dynamics based on appropriately defined opticalfunctions is introduced. The formalism is applied to the concepts of both weakand strong focusing, in particular discussing the properties of the widely-used FODO cell. Specific characteristics of transverse beam dynamics in periodicsystems like circular accelerators are studied in detail, emphazising the effectsof linear field errors on orbit stability and introducing the phenomena of opti-cal resonances. Finally, the dynamics of off-momentum particles is presented,introducing dispersion functions and explaining effects like chromaticity.

Presenter: HILLERT, Wolfgang (University of Hamburg)

Contribution ID: **128** Type: **not specified**

1 slide 1 minute

Monday 19 September 2022 17:45 (1 hour)

Contribution ID: **129** Type: **not specified**

Welcome reception

Monday 19 September 2022 18:45 (1h 15m)

Contribution ID: **130** Type: **not specified**

Electromagnetic Theory I

Monday 19 September 2022 09:45 (1 hour)

The purpose of this course is to provide an introduction to Electromagnetic
Theory. The foundations of electrodynamics starting from the nature of electrical force up to the level of Maxwell equations solutions are presented. It starts with the introduction of the concept of a field, which plays a very important role in the understanding of electricity and magnetism. In addition, moving electric charge is discussed as a topic of special importance in accelerator physics.

Presenter: SHREYBER, Irina

Contribution ID: **131** Type: **not specified**

Kinematics of Particle Beams - Relativity

Tuesday 20 September 2022 08:30 (1 hour)

This is an introductory lecture on special relativity which doesn't require much mathematical background. The theory of special relativity, originally proposed by Albert Einstein in his famous 1905 paper, has had profound consequences on our view of physics, space, and time. The goal of this lecture is to introduce the basic concepts of special relativity without overloading it with formulas. The lecture addresses Galilean and Lorentz transformations, emphasizing the conceptual incompatibility of classical kinematics and electrodynamics. The lecture also briefly introduces some famous phenomena behind special relativity including length contraction, time dilation, relativistic kinematics, practical application of the theory and more.

Presenter: SHREYBER, Irina

Contribution ID: **132** Type: **not specified**

Transverse Linear Beam Dynamics III

Tuesday 20 September 2022 09:45 (1 hour)

The subject of this introductory course is transverse dynamics of charged particle beams in linear approximation. Starting with a discussion of the most important types of magnets and defining their multipole strengths, the linearised equations of motion of charged particles in static magnetic fields are derived using an orthogonal reference frame following the design orbit. Analytical solutions are determined for linear elements of a typical beam transfer line(drift, dipole and quadrupole magnets), and stepwise combined by introducing the matrix formalism in which each element's contribution is represented by a single transfer matrix. Application of this formalism allows to calculate sin-gle particle's trajectories in linear approximation. After introducing the beamemittance as the area occupied by a particle beam in phase space, a lineartreatment of transverse beam dynamics based on appropriately defined opticalfunctions is introduced. The formalism is applied to the concepts of both weak and strong focusing, in particular discussing the properties of the widely-used FODO cell. Specific characteristics of transverse beam dynamics in periodic systems like circular accelerators are studied in detail, emphasising the effects of linear field errors on orbit stability and introducing the phenomena of optical resonances. Finally, the dynamics of off-momentum particles is presented,introducing dispersion functions and explaining effects like chromaticity.

Presenter: HILLERT, Wolfgang (University of Hamburg)

Contribution ID: **133** Type: **not specified**

Linear Accelerators I

Tuesday 20 September 2022 11:15 (1 hour)

Linear Accelerators (Linacs) are a systems that allow to accelerate charged particles through a linear trajectory by electromagnetic fields. This kind of accelerators find several applications in fundamental research and industry. The main devices used to accelerate the particle beam are described in the first part of the lecture with their main parameters. This includes both Standing (SW) and Traveling Wave (TW) radiofrequency cavities, for different type of accelerated particles (protons, ions and electrons) such as Drift Tube Linacs (DTL), multi cell cavities, Side Coupled Cell (SCC) and disk loaded structures. In the second part of the lecture, the fundamental principles of the longitudinal and transverse beam dynamics of accelerated particles will be highlighted. Finally, we briefly illustrate the radiofrequency quadrupole (RFQ) devices.

Presenter: ALESINI, David

Contribution ID: **134** Type: **not specified**

Superconducting Magnets

Tuesday 20 September 2022 13:45 (1 hour)

Presenter: DE RIJK, Gijs

Contribution ID: **135** Type: **not specified**

Linear Accelerators II

Tuesday 20 September 2022 15:00 (1 hour)

Presenter: ALESINI, David

Contribution ID: **136** Type: **not specified**

Kinematics of Particle Beams - Relativity

Session Classification: Hands-ON Lattice calulations

Contribution ID: **137** Type: **not specified**

Kinematics of Particle Beams - Relativity

Session Classification: Hands-ON Lattice calulations

Contribution ID: **138** Type: **not specified**

Longitudinal BD in Circular Machines II

Wednesday 21 September 2022 13:45 (1 hour)

Presenter: TECKER, Frank (CERN)

Contribution ID: **139** Type: **not specified**

Longitudinal BD in Circular Machines I

Wednesday 21 September 2022 09:45 (1 hour)

Presenter: TECKER, Frank (CERN)

Contribution ID: **140** Type: **not specified**

Imperfections in general

Thursday 22 September 2022 15:00 (1 hour)

After briefly discussing sources of imperfections, we characterize them in terms of dipole, quadrupolar, and skew quadrupolar errors and move on to discuss how these imperfections are modeled in beam dynamics codes. We continue by reviewing the concepts of dispersion and chromaticity and explain how they are measured before turning to imperfections that are caused by multipoles, in particular, by feed-down. We conclude by addressing errors that are introduced by imperfect diagnostic equipment such as misaligned position monitors and mention means of how to identify this problem.

Presenter: ZIEMANN, Volker (Uppsala University (SE))

Contribution ID: **141** Type: **not specified**

Transverse Linear Beam Dynamics V

Wednesday 21 September 2022 08:30 (1 hour)

Presenter: HILLERT, Wolfgang (University of Hamburg)

Contribution ID: **142** Type: **not specified**

Time and Frequency domain signals I

Wednesday 21 September 2022 11:15 (1 hour)

Presenter: SCHMICKLER, Hermann (CERN)

Contribution ID: **143** Type: **not specified**

Hands-ON Lattice calulations I

Wednesday 21 September 2022 16:30 (1 hour)

Presenters: GAMBA, Davide (CERN); ZIEMANN, Volker (Uppsala University (SE))

Contribution ID: **144** Type: **not specified**

Hands-ON Lattice calulations II

Wednesday 21 September 2022 17:45 (1 hour)

Presenters: GAMBA, Davide (CERN); ZIEMANN, Volker (Uppsala University (SE))

Contribution ID: **145** Type: **not specified**

Free

Thursday 22 September 2022 08:30 (3h 45m)

Contribution ID: **146** Type: **not specified**

History of particle acceleration

Thursday 22 September 2022 13:45 (1 hour)

Presenter: Dr SHEEHY, Suzie (University of Oxford and University of Melbourne)

Contribution ID: **147** Type: **not specified**

Time and Frequency domain signals II

Wednesday 21 September 2022 15:00 (1 hour)

Presenter: SCHMICKLER, Hermann (CERN)

Contribution ID: **148** Type: **not specified**

Accelerator Applications

Thursday 22 September 2022 16:30 (1 hour)

Presenter: Dr SHEEHY, Suzie (University of Oxford and University of Melbourne)

Contribution ID: **149** Type: **not specified**

Imperfections and their correction in beam lines and linacs

Thursday 22 September 2022 17:45 (1 hour)

“
We introduce the BPM-corrector response coefficient R12 as the key quantity to characterise the effect of imperfections on the beam dynamics before addressing how the effect of multiple imperfections are combined. We then introduce local beam bumps as a means to adjust the beam position locally and move on to discuss orbit correction and the orbit response matrix.
We place special attention to different methods, including singular value decomposition, to invert the response matrix. After covering quadrupolar errors and their detrimental effects, such as beta beating and filamentation, we learn how to measure beam sizes with quadrupole scans and with multiple wire scanners. We close this session with a discussion of how to adjust beam size parameters with so-called matching quadrupoles.”

Presenter: ZIEMANN, Volker (Uppsala University (SE))

Contribution ID: **150** Type: **not specified**

Discussion session

Thursday 22 September 2022 18:45 (1h 15m)

Contribution ID: **151** Type: **not specified**

Beam Instrumentation

Friday 23 September 2022 08:30 (1 hour)

Presenter: FORCK, Peter

Contribution ID: **152** Type: **not specified**

Computational tools II

Friday 23 September 2022 09:45 (1 hour)

Presenter: LATINA, Andrea (CERN)

Contribution ID: **153** Type: **not specified**

Beam Diagnostics

Friday 23 September 2022 11:15 (1 hour)

Presenter: FORCK, Peter

Contribution ID: **154** Type: **not specified**

Sources

Friday 23 September 2022 15:00 (1 hour)

Presenter: FAIRCLOTH, Dan (STFC)

Contribution ID: **155** Type: **not specified**

”Imperfections and their correction in rings ”

Friday 23 September 2022 13:45 (1 hour)

“After discussing how to account for the periodicity in rings, we first generalise the response coefficient R12, and then the orbit response matrix to such systems.
We move on to use the response matrix to correct the orbit and generalise the concept by introducing dispersion-free steering before turning to gradient errors and stop bands. Measuring and correcting the tune addresses one parameter of great importance for operating rings, whereas analysing the orbit response matrix with codes like LOCO measures many more, including the beta functions. We then digress on skew quadrupolar errors and betatron coupling and their detrimental effect.
Before closing we describe how to correct the chromaticity and mention a number of non-standard imperfections, so-called bloopers.

“

Presenter: ZIEMANN, Volker (Uppsala University (SE))

Contribution ID: **156** Type: **not specified**

Hands-ON Lattice calulations III

Friday 23 September 2022 16:30 (1 hour)

Presenters: GAMBA, Davide (CERN); ZIEMANN, Volker (Uppsala University (SE))

Contribution ID: **157** Type: **not specified**

Hands-ON Lattice calulations IV

Friday 23 September 2022 17:45 (1 hour)

Presenters: GAMBA, Davide (CERN); ZIEMANN, Volker (Uppsala University (SE))

Contribution ID: **158** Type: **not specified**

Electron Beam Dynamics I

Saturday 24 September 2022 08:30 (1 hour)

Presenter: RIVKIN, Lenny (Paul Scherrer Institute (CH))

Contribution ID: **159** Type: **not specified**

Electron Beam Dynamics II

Saturday 24 September 2022 09:45 (1 hour)

Presenter: RIVKIN, Lenny (Paul Scherrer Institute (CH))

Contribution ID: **160** Type: **not specified**

Discussion electron beam dynamics

Saturday 24 September 2022 11:15 (1 hour)

Presenter: RIVKIN, Lenny (Paul Scherrer Institute (CH))

Contribution ID: **161** Type: **not specified**

Machine & People Protection Issues

Saturday 24 September 2022 13:45 (1 hour)

Presenter: FORCK, Peter

Contribution ID: **162** Type: **not specified**

Secondary beams and targets

Saturday 24 September 2022 15:00 (1 hour)

Presenter: FAIRCLOTH, Dan (STFC)

Contribution ID: **163** Type: **not specified**

Hands-ON Lattice calulations V

Saturday 24 September 2022 16:30 (1 hour)

Presenters: GAMBA, Davide (CERN); ZIEMANN, Volker (Uppsala University (SE))

Contribution ID: **164** Type: **not specified**

Arrival day and registration

Sunday 18 September 2022 08:30 (12 hours)

Contribution ID: **165** Type: **not specified**

Transverse Linear Beam Dynamics IV

Tuesday 20 September 2022 16:30 (1 hour)

Presenter: HILLERT, Wolfgang (University of Hamburg)

Contribution ID: **166** Type: **not specified**

Computational tools I

Tuesday 20 September 2022 17:45 (1 hour)

Presenter: LATINA, Andrea (CERN)

Contribution ID: **167** Type: **not specified**

Hands-ON Lattice calulations VI

Saturday 24 September 2022 17:45 (1 hour)

Presenters: GAMBA, Davide (CERN); ZIEMANN, Volker (Uppsala University (SE))

Contribution ID: **168** Type: **not specified**

Cyclotrons I

Presenter: SEIDEL, Mike

Contribution ID: **169** Type: **not specified**

RF systems I

Monday 26 September 2022 08:30 (1 hour)

Presenter: VOLLINGER, Christine (CERN)

Contribution ID: **170** Type: **not specified**

Cyclotrons II/FFAs

Monday 26 September 2022 11:15 (1 hour)

Presenter: SEIDEL, Mike

Contribution ID: **171** Type: **not specified**

RF systems II

Monday 26 September 2022 13:45 (1 hour)

Presenter: VOLLINGER, Christine (CERN)

Contribution ID: **172** Type: **not specified**

Cyclotrons I

Presenter: SEIDEL, Mike

Contribution ID: **173** Type: **not specified**

Hands-ON calculations (longitudinal) - Intro

Monday 26 September 2022 15:00 (1 hour)

Presenter: LASHEEN, Alexandre (CERN)

Contribution ID: **174** Type: **not specified**

Cyclotrons I

Monday 26 September 2022 09:45 (1 hour)

Presenter: SEIDEL, Mike

Contribution ID: **175** Type: **not specified**

Hands-ON calculations (longitudinal) - I

Monday 26 September 2022 16:30 (1 hour)

Presenter: LASHEEN, Alexandre (CERN)

Contribution ID: **176** Type: **not specified**

Hands-ON calculations (longitudinal) - II

Monday 26 September 2022 17:45 (1 hour)

Presenter: LASHEEN, Alexandre (CERN)

Contribution ID: **177** Type: **not specified**

Vacuum

Tuesday 27 September 2022 09:45 (1 hour)

Presenter: SEIDEL, Mike

Contribution ID: **178** Type: **not specified**

Collective Effects I

Tuesday 27 September 2022 08:30 (1 hour)

Presenter: LI, Kevin Shing Bruce (CERN)

Contribution ID: **179** Type: **not specified**

Introduction to Non- Linear longitudinal Beam Dymanics

Tuesday 27 September 2022 11:15 (1 hour)

Presenter: LASHEEN, Alexandre (CERN)

Contribution ID: **180** Type: **not specified**

Collective Effects II

Tuesday 27 September 2022 13:45 (1 hour)

Presenter: LI, Kevin Shing Bruce (CERN)

Contribution ID: **181** Type: **not specified**

Hands-ON calculations (longitudinal) - III

Tuesday 27 September 2022 15:00 (1 hour)

Presenter: LASHEEN, Alexandre (CERN)

Contribution ID: **182** Type: **not specified**

Hands-ON calculations (longitudinal) - IV

Tuesday 27 September 2022 16:30 (1 hour)

Presenter: LASHEEN, Alexandre (CERN)

Contribution ID: **183** Type: **not specified**

Hands-ON calculations (longitudinal) - v

Tuesday 27 September 2022 17:45 (1 hour)

Presenter: LASHEEN, Alexandre (CERN)

Contribution ID: **184** Type: **not specified**

Free

Wednesday 28 September 2022 08:30 (3h 45m)

Contribution ID: **185** Type: **not specified**

Collective Effects III

Wednesday 28 September 2022 13:45 (1 hour)

Presenter: LI, Kevin Shing Bruce (CERN)

Contribution ID: **186** Type: **not specified**

Colliders and luminosity

Wednesday 28 September 2022 15:00 (1 hour)

Presenter: SCHMICKLER, Hermann (CERN)

Contribution ID: **187** Type: **not specified**

Collective Effects IV

Wednesday 28 September 2022 16:30 (1 hour)

Presenter: LI, Kevin Shing Bruce (CERN)

Contribution ID: **188** Type: **not specified**

Discussion collective effects

Wednesday 28 September 2022 17:45 (1 hour)

Presenter: LI, Kevin Shing Bruce (CERN)

Contribution ID: **189** Type: **not specified**

Poster session

Contribution ID: **190** Type: **not specified**

A first taste of Non- Linear Beam Dynamics I

Thursday 29 September 2022 08:30 (1 hour)

Presenter: BARTOSIK, Hannes (CERN)

Contribution ID: **191** Type: **not specified**

Injection and Extraction

Thursday 29 September 2022 13:45 (1 hour)

Presenter: TECKER, Frank (CERN)

Contribution ID: **192** Type: **not specified**

A first taste of Non- Linear Beam Dynamics II

Thursday 29 September 2022 11:15 (1 hour)

Presenter: BARTOSIK, Hannes (CERN)

Contribution ID: **193** Type: **not specified**

Advanced accelerator concepts I

Thursday 29 September 2022 09:45 (1 hour)

Presenter: FERRARIO, Massimo

Contribution ID: **194** Type: **not specified**

Particle motion in Hamiltonian Formalism I

Thursday 29 September 2022 15:00 (1 hour)

Presenter: PAPAPHILIPPOU, Yannis (CERN)

Contribution ID: **195** Type: **not specified**

Q&A/study time

Thursday 29 September 2022 16:30 (2h 15m)

Contribution ID: **196** Type: **not specified**

Seminar (tbc)

Contribution ID: **197** Type: **not specified**

Advanced accelerator concepts II

Friday 30 September 2022 09:45 (1 hour)

Presenter: FERRARIO, Massimo

Contribution ID: **198** Type: **not specified**

Particle motion in Hamiltonian Formalism II

Friday 30 September 2022 08:30 (1 hour)

Presenter: PAPAPHILIPPOU, Yannis (CERN)

Contribution ID: **199** Type: **not specified**

Synchrotron light circular machines and free-electron lasers I

Friday 30 September 2022 11:15 (1 hour)

Presenter: PRAT COSTA, Eduard

Contribution ID: **200** Type: **not specified**

Synchrotron light circular machines and free-electron lasers II

Friday 30 September 2022 13:45 (1 hour)

Presenter: PRAT COSTA, Eduard

Contribution ID: **201** Type: **not specified**

Designing a synchrotron - a real life example

Friday 30 September 2022 15:00 (1 hour)

Presenter: PAPAPHILIPPOU, Yannis (CERN)

Contribution ID: **202** Type: **not specified**

Closing

Friday 30 September 2022 16:30 (1 hour)

Presenter: TECKER, Frank (CERN)

Contribution ID: **203** Type: **not specified**

Departure Day

Saturday 1 October 2022 08:30 (6 hours)

Contribution ID: **204** Type: **not specified**

Seminar - Ultrasonic measurement

Monday 26 September 2022 18:45 (1 hour)

Development and applications of ultrasonic measurement, monitoring, non-destructive testing and diagnostic techniques

Presenter: Prof. RAIŠUTIS, Renaldas

Session Classification: Seminar

Contribution ID: **205** Type: **not specified**

Nonlinear dynamical systems

Thursday 29 September 2022 18:45 (1 hour)

Nonlinear dynamical systems - mathematical modelling and applications

Presenter: Prof. RAGULSKIS, Minvydas

Session Classification: Seminar

Contribution ID: **206** Type: **not specified**

Poster session

Wednesday 28 September 2022 18:45 (1 hour)

Poster session

Session Classification: Poster session