MEDICAL PHYSICS
The International Journal of Medical Physics Research and Practice

Particle Therapy Technology for Safe Treatment, 1st Edition, edited by Jay Flanz. Boca Raton, FL: CRC Press, 2022. ISBN 9780367640149.
Reviewed by Thomas Rockwell Mackie, PhD

DESCRIPTION

The book is a very personal (including many photos of his beautiful family) textbook/handbook by a particle therapy physicist who has about 45 years of experience honing his personal notes on the field through participation in many of the annual National Particle Therapy Schools as well as teaching at MGH and associations such as the AAPM and the Particle Therapy Cooperative Oncology Group (PTCOG). The author, Jay Flanz, is an MIT particle accelerator physicist who made the transition into a particle beam physicist at the start of the hospital-based proton radiotherapy era. There are few others who have seen this field's infancy and have stayed through to the present day.

AUDIENCE:

The author wrote the book because he wished for such a book when he started out. The book is written for physicists, physical scientists and engineers to give them the practical theory and knowledge so that "nothing goes wrong" for what are unarguably the most complex treatment systems ever devised. The book's title incorporates the word "safety" to emphasize that safety goes before all else. Many of his chapters end with a section called "What Could Go Wrong?".

PURPOSE

The book begins by giving the reader both the evolution of particle accelerators and therapy as well as a very personal historical view by the author. The book then presents "get-up-to speed-quickly" chapters on topics like setting requirements and components

for particle therapy, radiation biology, a basic review of math needed, relativity, and charged particle interactions in matter with or without the presence of a magnetic field. While most medical physicists would skip over these chapters, they could be argued to be extremely valuable for someone with an engineering background to read thoroughly anything that was not well known to them. The only topic missing in sufficient detail is that of particle inelastic nuclear scattering (or capture), which should have gone beyond treatments found in other radiological physics textbooks and for particle therapy is important from both clinical and radiation protection points of view.

CONTENT/FEATURES

For a medical physicist, the real meat of the book begins at much longer Chapters 11 and 12, which present a somewhat historical treatment of clinical particle therapy where concepts such as beam definitions, penumbra, dose, and particle fluence are introduced and the static and dynamic methods to deliver a conformal dose to the patient are elaborated. Chapter 13 on accelerator systems provides a medical physicist an unrivaled explanation of very complex systems very understandably. Topics such as temporal accelerator characteristics, energy selection systems, matrix treatment of beam optics, achromatic beam components reflect the author's expertise in accelerator physics. Chapter 14 on gantries is likely the only discourse that exists in a textbook on tradeoffs in size, performance and cost. A medical physicist who responsible for picking one of these expensive systems must read this chapter carefully so that they can justify their choice to clinicians, administrators, and architects alike. The rest of the chapters of the book cement in the message that safety is key. Safety engineering concepts such as failure mode and effects analysis (FMEA) and quality assurance, sensitivity or tolerance analysis, and accuracy and reproducibility are all well done.

Each of the chapters has a short set of exercises. A companion to the book that provided comprehensive solutions to the exercises would be valuable. There are some very useful appendices including a full list of proton centers around the world which is incredibly useful for any young person wanting to get into the field. This index is divided

into subjects (acceleration, attenuation, beam dynamics, beam parameters, beam spreading, distributions, exponentials, gantry, interactions, people, radiobiology, safety processes, and target volume). This means that with no context the reader is forced to look at to 13 lists; however, with context, the search may be faster so the utility may be either appreciated or not by readers.

ASSESSMENT/COMPARISON

It is impossible to have a first version textbook free of errors. Most textbook introductions are followed on quickly with an errata sheet (e.g., Fig 8.4 has the captions labels swapped) and no doubt this is true here. There are quite a few figures without complete labeling of the abscissa or ordinant or missing scales, which have been corrected in an errata available on the publisher website. So, don't wait for a second edition: if you are a medical physicist working in particle therapy, you need to own this book now or insist your library order it.

In summary this is a very useful book for physical scientists, engineers, and medical physicists who are or want to be involved in particle beam radiation therapy. The book has been priced reasonably at $127 hardcover or $98 for Kindle reflecting the CRC Press's expectation that it will sell well.