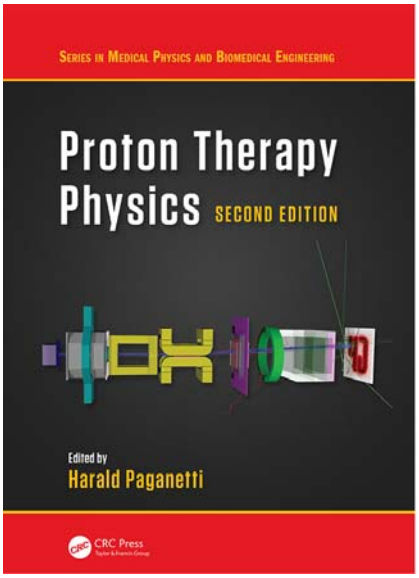
PROTON THERAPY PHYSICS (2ND EDITION) (HARALD PAGANETTI, EDITOR)

Francesco Fracchiolla[1]

[1]Department of Medical Physics,
Trento Hospital, Proton Therapy Center, Trento, Italy

I. Book details

Proton Therapy Physics (Second Edition), 772 pp, CRC Press Taylor & Francis Group
Edited by: Harald Paganetti
ISBN: 9780367570781 (paperback)
ISBN: 9781138626508 (hard cover)
ISBN: 9781315228310 (e-book)



II. Review

This is the second edition of a book published 11 years ago that had a remarkable and successful impact on the proton therapy community. The first edition deserved to be updated due to the considerable evolution and the widespread diffusion of proton therapy since then. The book was updated including new chapters organized in thematic sections named: "Background", "Beam Delivery", "Dosimetry", "Operation", "Treatment Planning/Delivery", "Imaging" and "Biological Effects". In some cases, the names given to each session were misleading and not clear of what that session was referring to. For example, the "Operation" section puts together Acceptance and Commissioning with Monitor Unit Calibration chapter that maybe would have been more relevant if grouped in the "Dosimetry" section; or the "Monte Carlo Simulations" chapter in the "Dosimetry" section would have been better placed in the "Treatment Planning/Delivery" section. Nonetheless the efforts put to improve the significance of each chapter with respect to the previous edition were massive. This resulted in a total of 23 chapters compared to the 20 of the previous edition.

The first two chapters give a complete and valid background to medical physics students that approaches proton therapy in terms of history and theory behind the rationale of using protons in clinical radiotherapy applications. Here, all the main formulae for the physics description of proton interaction with matter can be found.

One of the main improvements of the book regarded the dosimetry section. This part was enriched with an entire chapter dedicated to Monte Carlo (MC) and a whole variety of its application in proton therapy. From a general introduction to MC methods for the estimation of uncertainties due to the method itself, from the simulation of passive beam lines to the simulation of scanned beam delivery with an interesting concluding paragraph on practical MC clinical applications such as organ motion studies, simulation of LET distributions, detectors modeling etc. The section was further improved in the chapter dedicated to absolute and reference dosimetry with a new paragraph dedicated to the importance of dosimetric intercomparisons and reference dosimetry audit, confirming the clinical orientation the editor decided to give to this edition of the book.

In the section "Operation" there is an interesting chapter dedicated to the calibration of monitor units. This is one of the most interesting improvements with respect to the previous edition since it was presented as a theoretical and practical guide to the reader of one of the most delicate step during the commissioning phase of a proton therapy facility.

The section "Treatment Planning/Delivery" is very similar to the previous edition confirming the importance

the authors decided to give to the effect the uncertainties (setup, range, motion, anatomy, RBE etc.) can have on the quality of dose delivered. The robustness evaluation seems to be sacrificed in this section. The impact of this topic on clinical practice is relevant and it deserved to be treated more carefully than a single paragraph. The improvements in the section were mainly focused on how to consider the uncertainties in planning and delivery phases and on robust optimization. In particular, more space was dedicated to 4D robust optimization and the management of breath hold in the planning phase. At the end of the chapter the topic of the optimization of rotational proton therapy is also introduced. The authors decided to give a general overview on the spot scanning proton-arc with no further details that could have been misleading for the reader since this topic is constantly evolving and changing.

The "Imaging" section was enriched with new clinical applications such as the use of SGRT in clinical practice which is becoming widely used in the radiation therapy community. The paragraph on in-vivo PET and prompt gamma gave a detailed background to whoever is approaching these topics. In accordance with the rest of the book this section was improved, with respect to the previous edition, by giving feedback to the reader on how these techniques can be applied in a real clinical workflow and first clinical experience.

The section on proton biology remains, from a didactical point of view, a valid guide to medical physicists approaching this topic. It still gives a valid background of the importance of RBE and an idea of how difficult a clinical application of this concept, different from the classical formulation of the 1.1 scaling factor, can be in clinical practice. The chapter had two more paragraphs treating the problem of the biological optimization and the estimation of out-of-field effects. This was possible thanks to the LET based planning concept that is going to be clinically applicable in the new commercial treatment planning systems.

In general, the book confirmed its validity and its importance for the proton therapy community. Having a book that treats all of the above-mentioned aspects of proton therapy in a didactical form and gives all the updated references helps both the students that are approaching the field and the experts in being updated on each of these topics. The previous version of the book needed an update and the way it was done, focusing on clinical application for each section, was the best because gave an idea of the real problems a team of medical physicists has to solve every day in clinical workflows. Some topics needed more emphasis and insight like the robustness evaluation that has such a relevant impact on proton therapy clinical practice. In summary, this book is a welcome confirmation to proton therapy bibliography and should be on the bookshelf of every medical physicist in the community.

Contacts of the corresponding author:

Francesco Fracchiolla, MSc,
Medical Physicist,
Department of Medical Physics,
APSS Trento Hospital,
Department of Proton Therapy,
Via Al Desert,14, Trento, Italy