Small Field Dosimetry For Imrt And Radiosurgery Aapm Chapter

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Small Field Dosimetry Comparing Measured Data Versus the ADAC Pinnacle 3 Model CRC Press
Present Your Research to the World! The World Congress 2009 on Medical Physics and Biomedical Engineering – the triennial scientific meeting of the IUPESM - is the world's leading forum for presenting the results of current scientific work in health-related physics and technologies to an international audience. With more than 2,800 presentations it will be the biggest conference in the fields of Medical Physics and Biomedical Engineering in 2009! Medical physics, biomedical engineering and bioengineering have been driving forces of innovation and progress in medicine and healthcare over the past two decades. As new key technologies arise with significant potential to open new options in diagnostics and therapeutics, it is a multidisciplinary task to evaluate their benefit for medicine and healthcare with respect to the quality of performance and therapeutic output. Covering key aspects such as information and communication technologies, micro- and nanosystems, optics and biotechnology, the congress will serve as an inter- and multidisciplinary platform that brings together people from basic research, R&D, industry and medical application to discuss these issues. As a major event for science, medicine and technology the congress provides a comprehensive overview and in–depth, first-hand information on new developments, advanced technologies and current and future applications. With this Final Program we would like to give you an overview of the dimension of the congress and invite you to join us in Munich! Olaf Dössel Congress President Wolfgang C.

Clinical 3D Dosimetry in Modern Radiation Therapy Rutgers University Press
This book provides a first comprehensive summary of the basic principles, instrumentation, methods, and clinical applications of three-dimensional dosimetry in modern radiation therapy treatment. The presentation reflects the major growth in the field as a result of the widespread use of more sophisticated radiotherapy approaches such as intensity-modulated radiation therapy and proton therapy, which require new 3D dosimetric techniques to determine very accurately the dose distribution. It is intended as an essential guide for those involved in the design and implementation of new treatment technology and its application in advanced radiation therapy, and will enable these readers to select the most suitable equipment and methods for their application. Chapters include numerical data, examples, and case studies.

Stereotactic Radiosurgery and Stereotactic Body Radiation Therapy Springer
Presents the technical aspects of IMRT, and the clinical aspects of planning and delivery. The volulme explores a practical approach for radiation oncologists and medical physicists initiating or expanding and IMRT program, the fundamental biology and physics of IMRT, a site-by-site review of IMRT techniques with clinical examples, and reviews of published outcome studies.

Intensity Modulated Radiation Therapy Elsevier
The primary objective of this book is to teach residents, fellows, and clinicians in radiation oncology how to incorporate intensity modulated radiation therapy (IMRT) into their practice. IMRT has proven to be an extremely effective treatment modality for head and neck cancers. It is now being used effectively in other sites, including, prostate, breast, lung, gynecological, the cervix, the central nervous system, and lymph nodes. The book will provide in a consistent format an overview of the natural course, lymph node spread, diagnostic criteria, and therapeutic options for each cancer subsite.

Stereotactic Body Radiation Therapy Lippincott Williams & Wilkins
This publication is aimed at students and teachers involved in teaching programmes in field of medical radiation physics, and it covers the basic medical physics knowledge required in the form of a syllabus for modern radiation oncology. The information will be useful to those preparing for professional certification exams in radiation oncology, medical physics, dosimetry or radiotherapy technology.

Practical Essentials of Intensity Modulated Radiation Therapy CRC Press
The most important radiotherapy modality used today, intensity modulated radiation therapy (IMRT), is the most technologically advanced radiotherapy cancer treatment available, rapidly replacing conformal and three-dimensional techniques. Because of these changes, oncologists and radiotherapists need up-to-date information gathered by physicists an

World Congress on Medical Physics and Biomedical Engineering September 7 - 12, 2009 Munich, Germany Springer Science & Business Media
Clinical conformal radiotherapy is the holy grail of radiation treatment and is now becoming a reality through the combined efforts of physical scientists and engineers, who have improved the physical basis of radiotherapy, and the interest and concern of imaginative radiotherapists and radiographers. Intensity-Modulated Radiation Therapy describes in detail the physics germane to the development of a particular form of clinical conformal radiotherapy called intensity modulated radiation therapy (IMRT). IMRT has become a topic of tremendous importance in recent years and is now being seriously investigated for its potential to improve the outcome of radiation therapy. The book collates the state-of-the-art literature together with the author's personal research experience and that of colleagues in the field to produce a text suitable for new research workers, Ph.D. students, and practicing radiation physicists that require a thorough introduction to IMRT. Fully illustrated, indexed, and referenced, the book has been prepared in a form suitable for supporting a teaching course.

Intensity-Modulated Radiation Therapy Springer Science & Business Media
These proceedings of the World Congress 2006, the fourteenth conference in this series, offer a strong scientific program covering a wide range of issues and challenges which are currently present in Medical physics and Biomedical Engineering. About 2,500 peer reviewed contributions are presented in a six volume book, comprising 25 tracks, joint conferences and symposia, and including invited contributions from well known researchers in this field.

Radiation Oncology Physics Advanced Medical Pub Incorporated
This comprehensive book covers the everyday use and underlying principles of radiation dosimeters used in radiation oncology clinics. It provides an up-to-date reference spanning the full range of current modalities with emphasis on practical know-how. The main audience is medical physicists, radiation oncology physics residents, and medical physics graduate students. The reader gains the necessary tools for determining which detector is best for a given application. Dosimetry of cutting edge techniques from radiosurgery to MRI-guided systems to small fields and proton therapy are all addressed. Main topics include fundamentals of radiation dosimeters, brachytherapy and external beam radiation therapy dosimetry, and dosimetry of imaging modalities. Comprised of 30 chapters authored by leading experts in the medical physics community, the book: Covers the basic principles and practical use of radiation dosimeters in radiation oncology clinics across the full range of current modalities. Focuses on providing practical guidance for those using these detectors in the clinic. Explains which detector is more suitable for a particular application. Discusses the state of the art in radiotherapy approaches, from radiosurgery and MR-guided systems to advanced range verification techniques in proton therapy. Gives critical comparisons of dosimeters for photon, electron, and proton therapies.

Radiation Physics for Medical Physicists Springer
The Monte Carlo method is a numerical technique to model the probability of all possible outcomes in a process that cannot easily be predicted due to the interference of random variables. It is a technique used to understand the impact of risk, uncertainty, and ambiguity in forecasting models. However, this technique is complicated by the amount of computer time required to achieve sufficient precision in the simulations and evaluate their accuracy. This book discusses the general principles of the Monte Carlo method with an emphasis on techniques to decrease simulation time and increase accuracy.

Perez and Brady's Principles and Practice of Radiation Oncology
Implementation of small field dosimetry to optimize the commissioning of a treatment planning system for stereotactic and intesity modulated radiotherapyThis project is realized at the hospital Landesklinikum Wiener Neustadt and consists of two parts. The first part contains the measurements of small fields with different detectors. A water phantom is used for these detectors: Semiflex, Pinpoint, Micro-Diamond and Micro-Lion. The main task of this part is to find a proper detector to obtain the highest measurement accuracy. In the second part, a comparison is made between the dose of the measurements and the dose calculated in the treatment planning system, to evaluate the results. Finally, it should be justified whether a more precise determination of doses for small fields translates into a higher accuracy for the dose modelling in the treatment planning system (TPS) for volumetric modulated arc therapy (VMAT), intensity-modulated radiation therapy (IMRT) or stereotactic treatments. In conclusion, the detector microDiamond shows good behaviour for small fields and the deviations between measurements and calculations of larger fields are still smaller.*****This project is realized at the hospital Landesklinikum Wiener Neustadt and consists of two parts. The first part contains the measurements of small fields with different detectors. A water phantom is used for these detectors: Semiflex, Pinpoint, Micro-Diamond and Micro-Lion. The main task of this part is to find a proper detector to obtain the highest measurement accuracy. In the second part, a comparison is made between the dose of the measurements and the dose calculated in the treatment planning system, to evaluate the results. Finally, it should be justified whether a more precise determination of doses for small fields translates into a higher accuracy for the dose modelling in the treatment planning system (TPS) for volumetric modulated arc therapy (VMAT), intensity-modulated radiation therapy (IMRT) or stereotactic treatments. In conclusion, the detector microDiamond shows good behaviour for small fields and the deviations between measurements

and calculaThe Effects of Small Field Dosimetry on the Biological Models Used in Evaluationg IMRT Dose DistributionsSmall Field Dosimetry Comparing Measured Data Versus the ADAC Pinnacle 3 ModelEffect of Small Field Dosimetry on Accuracy of Dose Calculation Using AAA 8.6 Algorithm in Head and Neck IMRTA Novel Equivalent Squares Formalism for Use in Small Field DosimetryWith advancements in Linear Accelerators and other therapeutic radiation delivery systems, the use of highly modulated treatments (IMRT and VMAT) has become more common. Consequently, the use of high dose, hypo-fractionated treatments (Stereotactic Radio Surgery a.k.a SRS) for small lesions is also becoming increasingly common. Due to the hypo-fractionated and high dose nature of SRS the accuracy of small field dose calculation is of utmost importance. Additionally, the optimization of Intensity Modulated Radio Therapy (IMRT) or Volumetric Modulated Arc Therapy (VMAT) plans can result in the use of small fields. Accurate calculation of dose in small fields is dependent upon the certainty and precision of small field dose measurement, and subsequently the accurate determination of machine output based upon these measurements. Each of the three Treatment Planning Systems (TPS) (Phillps' Pinnacle3, Varian's Eclipse, and Raysearch's Raystation), available at the University of Toledo, make use of Output Factors (OF) to characterize machine output as well as to simplify the commissioning process. Each TPS makes use of Equivalent Square Fields (ESF) to minimize the number of fields for which percent depth dose curves, and inline & crossline profiles that must be measured. The use of ESFs allows the TPSs to interpolate and/or extrapolate output factors for fields which were not measured, thus simplifying the commissioning process. First, the traditional formalism for ESF must be evaluated for use in small fields. This is accomplished by measuring a series of small fields ranging from 0.6x0.6cm2 to 3.0x3.02 with three different types of detectors designed for use in small field dosimetry (Sun Nuclear Edge Diode, Standard Imaging Exradin A26, and the Standard Imaging Exradin W1 Plastic Scintillator) at 6MV and 6FFF photon beam energies along Central Axis (CAX) at 100cm Source to Surface Distance (SSD) and 10cm depth in a large water phantom. Next the dose calculation of each of the three TPSs was evaluated by comparison to measurements made with the Standard Imaging W1 Plastic Scintillator horizontally oriented. The same fields, varying from 0.6x0.6cm2 to 3.0x3.02, were calculated in each of the three TPSs with a 1mm3 dose grid, along CAX at 100cm SSD and 10cm depth in a simulated large water phantom. Finally, data acquired using the Standard Imaging W1 Plastic Scintillator was used to inform a novel formalism for Equivalent Squares which more accurately describes the output of the Varian Edge at 6MV and 6FFF. First the actual equivalent square was determined by assigning each unique output factor to a unique field size by determining a best fit equation from the output factors of the square fields. Both an experimental fit and a correction factor approach were used to determine the equivalent square field equation (function of X and Y jaw dimension) based on the newly determined equivalent square field sizes. It was determined that the traditional formalism for equivalent squares is inaccurate in the calculation of small equivalent square fields, with errors as high as 9% at 6MV and 8.4% at 6FFF. The Standard Imaging W1 Plastic Scintillator was found to be the most consistent and accurate dosimeter in the evaluation of equivalent square fields. Additionally, it was shown that the Pinnacle3 TPS was the most accurate in the calculation of small field dose because of its limitation to interpolation between commissioned output factors. While the experimental fit used to determine the new equation for equivalent square fields was more accurate, the more practical formalism for equivalent squares involves the use of correction factors. It was also determined that a machine specific, and quality specific correction factor should be used in the calculation of equivalent square fields.Scintillation Dosimetry
Implementation of small field dosimetry to optimize the commissioning of a treatment planning system for stereotactic and intesity modulated radiotherapy

Radiochromic Film Springer Science & Business Media
This book is a concise and well-illustrated review of the physics and biology of radiation therapy intended for radiation oncology residents, radiation therapists, dosimetrists, and physicists. It presents topics that are included on the Radiation Therapy Physics and Biology examinations and is designed with the intent of presenting information in an easily digestible format with maximum retention in mind. The inclusion of mnemonics, rules of thumb, and reader-friendly illustrations throughout the book help to make difficult concepts easier to grasp. Basic Radiotherapy Physics and Biology is a valuable reference for students and prospective students in every discipline of radiation oncology.
World Congress of Medical Physics and Biomedical Engineering 2006 BoD – Books on Demand
Stereotactic body radiation therapy (SBRT) has emerged as an important innovative treatment for various primary and metastatic cancers. This book provides a comprehensive and up-to-date account of the physical/technological, biological, and clinical aspects of SBRT. It will serve as a detailed resource for this rapidly developing treatment modality. The organ sites covered include lung, liver, spine, pancreas, prostate, adrenal, head and neck, and female reproductive tract. Retrospective studies and prospective clinical trials on SBRT for various organ sites from around the world are examined, and toxicities and normal tissue constraints are discussed. This book features unique insights from world-renowned experts in SBRT from North America, Asia, and Europe. It will be necessary reading for radiation oncologists, radiation oncology residents and fellows, medical physicists, medical physics residents, medical oncologists, surgical oncologists, and cancer scientists.
A Monte Carlo Simulation and Deconvolution Study of Detector Response Function for Small Field Measurements PMPH-USA
Different types of radiation detectors are routinely used for the dosimetry of photon beams. Finite detector sizes have certain effects to the broadening of the measured beam penumbra. The problem is more important in small field measurement, such as stereotactic radiosurgery, small beamlet IMRT, etc. The dosimetry associated with small fields is very difficult because of the steep dose gradients and the lack of lateral electronic equilibrium conditions that complicate the interpretation of the dose measurement. Many Researchers have investigated this problem from different points of view utilizing, for example, extrapolation method, analytical method. But their studies were all measurements based. In this study, we investigated the problem using Monte Carlo simulation method. Compared with practical measurements, the advantages of using Monte Carlo simulation are: 1. Simulation can be performed in a scenario where radiation dosimetry is technically difficult or even impossible to accomplish; 2. Possible systematic errors, e.g., setup errors, reading errors, can be eliminated; 3. Simulation of radiation detectors which are not readily available allowed the study of a wider range of detector sizes. In this study we used Monte Carlo methods to develop and apply detector response functions (DRFs) for three types of clinically available radiation detectors and two theoretical detectors. Detector response functions were determined by deconvolving known values of input (simulated true data from Monte Carlo simulation) and output (simulated empirical data from Monte Carlo simulation or empirical data from radiation dosimetry). Deconvolved detector response functions were applied to typical stereotactic radiosurgery fields to obtain the true beam profile. This application was then benchmarked by both Monte Carlo simulation method and dosimetry methods, which include diode dosimetry, radiographic film dosimetry, and Gafchromic film dosimetry. The results of this research demonstrate: 1. Detector response function of cylindrical detectors can be approximately represented as a Gaussian distribution dependent upon the radius of the detector; 2. Deconvolution method can create a more realistic beam profile by reducing the detector size effect, however it can not completely remove this effect limited by the inaccuracy derived from the Fourier transform-based nature of this procedure; 3. Diode dosimetry and Gafchromic film dosimetry both yield satisfactory beam profiles in small field relative measurements and are the preferred measurement techniques.

Accuracy Requirements and Uncertainties in Radiotherapy Springer
Provides an account of the perspective, methodology, and experience in the physical and medical aspects of IMRT at Memorial Sloan-Kettering Cancer Center (MSKCC).

The Use of Ge-doped Optical Fibres in External Beam Radiotherapy Dosimetry Springer Science & Business Media
Stereotactic Radiosurgery and Stereotactic Body Radiation Therapy (SBRT) is a comprehensive guide for the practicing physician and medical physicist in the management of complex intracranial and extracranial disease. It is a state-of-the-science book presenting the scientific principles, clinical background and procedures, treatment planning, and treatment delivery of SRS and SBRT for the treatment of tumors throughout the body. This unique textbook is enhanced with supplemental video tutorials inclusive to the resource. Beginning with an overview of SRS and SBRT, Part I contains insightful coverage on topics such as the evolving radiobiological principles that govern treatment, imaging, the treatment planning process, technologies and equipment used, as well as focused chapters on quality assurance, quality management, and patient safety. Part II contains the clinical application of SRS and SBRT for tumors throughout the body including those in the brain, head and neck, lung, pancreas, adrenal glands, liver, prostate, cervix, spine, and in oligometastatic disease. Each clinical chapter includes an introduction to the disease site, followed by a thorough review of all indications and exclusion criteria, in addition to the important considerations for patient selection, treatment planning and delivery, and outcome evaluation. These chapters conclude with a detailed and site-specific dose constraints table for critical structures and their suggested dose limits. International experts on the science and clinical applications of these treatments have joined together to assemble this must-have book for clinicians, physicists, and other radiation therapy practitioners. It provides a team-based approach to SRS and SBRT coupled with case-based video tutorials in disease management, making this a unique companion for the busy radiosurgical team. Key Features: Highlights the principles of radiobiology and radiation physics underlying SRS and SBRT Presents and discusses the expected patient outcomes for each indicated disease site and condition including a detailed analysis of Quality of Life (QOL) and Survival Includes information about technologies used for the treatment of SRS and SBRT Richly illustrated with over 110 color images of the equipment, process flow diagrams and procedures, treatment planning techniques and dose distributions 7 high-quality videos reviewing anatomy, staging, treatment simulation and planning, contouring, and management pearls Dose constraint tables at the end of each clinical chapter listing critical structures and their appropriate dose limits Includes access to the fully-searchable downloadable eBook
CRC Press
The thoroughly updated fifth edition of this landmark work has been extensively revised to better represent the rapidly changing field of radiation oncology and to provide an understanding of the many aspects of radiation oncology. This edition places greater emphasis on use of radiation treatment in palliative and supportive care as well as therapy.
Tg-69 IAEA
Precision medicine is a rapidly-evolving field in the management of cancer. The use of novel molecular or genetic signatures in local-regional management is still in its infancy. Precision Radiation Oncology demystifies this state-of-the-art research and technology.

By describing current existing clinical and pathologic features, and focusing on the ability to improve outcomes in cancer using radiation therapy, this book discusses incorporating novel genomic- or biology-based biomarkers in the treatment of patients moving radiation oncology into precision/personalized medicine. Precision Radiation Oncology provides readers with an overview of the new developments of precision medicine in radiation oncology, further advancing the integration of new research findings into individualized radiation therapy and its clinical applications.

Microdosimetric Response of Physical and Biological Systems to Low- and High-LET Radiations Springer Science & Business Media

Written by internationally known experts in the field, Stereotactic Radiosurgery and Stereotactic Body Radiation Therapy examines one of the fastest-developing subspecialties within radiation oncology. These procedures deliver large doses of radiation in one to five sessions to a precisely determined target. Often these techniques have proven to be as or more effective than traditional radiation therapy techniques, while at the same time being cost-efficient and convenient for the patient. These techniques, however, require careful planning, specialized equipment, and well-trained staff. This volume provides a cutting-edge look at the biological and technical underpinnings of SRS and SBRT techniques. It includes a history of the development of SRS and SBRT; clinical applications of the techniques; dedicated devices for delivering precisely shaped, high doses of radiation; use of in-room imaging for treatment planning and treatment guidance; immobilization techniques for accurate targeting; and future developments that will continue to evolve and refine existing techniques. A valuable introduction to those just learning about these specialized techniques, and an ideal reference for those who are already implementing them, this book covers a wide variety of topics, with clear discussions of each aspect of the technology employed.

World Congress on Medical Physics and Biomedical Engineering, June 7-12, 2015, Toronto, Canada CRC Press

The large amount of information in this title is presented in twelve chapters. The physics of small fields is explained and the potential error in delivering small fields is discussed. The challenges in absolute, reference and relative dosimetry are addressed in detail as well as the difficulties in making small field measurements. The potential errors in dose models is presented with a discussion on the necessary elements in fluence and dose calculation methods that are needed to model small collimator settings in order to achieve acceptable computational accuracy. Attention is drawn to relevant aspects of quality assurance for the treatment machine and collimating jaws. The characteristics of commercially available detectors for small field applications are summarised. The majority of the report presents established or newly proposed methodologies on the determination of dosimetric parameters (profiles, depth functions and output factors) for single narrow collimated fields. Recommendations of good working practice to be consulted and used alongside the clinical experience, scientific judgement and existing expertise are provided. The report suggests future directions and future work required to reduce uncertainty in the determination of dose in small MV photon fields.