West Virginia University
Radiation Oncology
Medical Physics
Residency Handbook

January 16, 2025

The contents of this handbook are subject to change.
This handbook will be reviewed annually
by the Program Director to ensure compliance with
CAMPEP accreditation requirements and to continuously
improve the quality of the program.

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Introduction

Welcome to the Department of Radiation Oncology at West Virginia University. Our faculty is committed to our institutional mission of education, research, and patient care.

We are pleased that you have chosen our program to learn the principles and practice of radiation oncology medical physics. Your educational experience is an important priority to us. This resident manual will serve as a guide during your residency. It outlines our ongoing educational program, including teaching conferences and scheduled classes. It also covers daily rotation activities and procedures

I hope that you will find this manual useful. If you have any questions, which are not covered in this document, please do not hesitate to contact me. Again, I look forward to working with you and helping you develop into a competent and caring medical physicist.

Sincerely,

Alf Siochi, PhD, DABR, FAAPM
Residency Program Director
Professor
Director of Medical Physics
Associate Chair of Radiation Oncology

Mike Caroll, MS, DABR
Residency Program Assistant Director
Assistant Professor

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Stipends, Benefits, and Vacation

Level	2025-2026 Annual Stipend
PG 1	$60,786
PG 2	$63,040

Benefits

See the following web page for full details:
[Salaries and Benefits | School of Medicine | West Virginia University]

Health Insurance
Faculty and Staff Assistance Program
Disability Insurance
Liability Protection

Vacation
Accrued at 15 hours per month (24 days per year)

Sick Leave
Accrued at 11.25 hours per month (18 days per year)

Maximum days out, per CAMPEP: 40 days per year. If the resident exceeds 16 sick days in a year, they will need to make up for it on weekends and holidays.

See Vacation and Leaves for more details.

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Useful Web Pages

Radiation Oncology Departmental Web Sites
For patients:
[Radiation Oncology | WVU Cancer Institute]

For Faculty and Staff:
[Radiation Oncology | School of Medicine | West Virginia University]

For the Residency Program:
(NEED THE URL FOR THE MEDICAL PHYSICS RESIDENCY PROGRAM)
This web page provides the CAMPEP required statistics of the program and will be updated annually, upon graduation of a resident. The Program Director will review the webpage after these updates for compliance with CAMPEP requirements, and to ensure that it is properly promoting the program and the accomplishments of the residents.

American Board of Radiology Web Page (Important board exam information.)
ABR

PubMed Web Page
PubMed

WVU Library and Research Resources:
Libraries at West Virginia University

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Clinical Rotations Overview

{Weeks}	**First Year** Primary Rotation	Mentor
4	1. Orientation	RAS
4	2. Clinical Equipment Operation and Workflows	AS
8*	3. Dosimetric Systems	MC / JH
8*	4. Treatment Machine Calibration and MU Calcs	BK / JH
8*	5. Linac ATP/Commissioning/Annual QA	CG / AS
4	6. TPS Modeling/ATP/Commissioning	JH
8	7. Brachytherapy	AS
8 max	Vacation / Sick Leave / Family Leave / Conferences	

{Weeks}	**Second Year** Primary Rotation	Mentor
6*	8a. Treatment Planning 1 – 3DCRT and IMRT	EB / JH
6*	8b. Treatment Planning 2 – SRS / SBRT	EB / JH
4	9. SRS and SRT (Gamma Knife and Linac Based)	JH
8*	10. Imaging for Tx Sim, Verification and Motion Management	BK / RAS
8*	11. Special Procedures and Emerging Technology	AS / JH
5	12. Shielding/Room Design/Radiation Protection Survey/Rad Safety	MC / RAS
4	13. Radiation Oncology Informatics	RAS
3	14. Administration, Leadership, and Program Development	RAS
8 max	Vacation / Sick Leave / Family Leave / Conferences	

RAS = Alf Siochi; AS = April Shorthouse; MC = Mike Carroll; JH = Josh Hack;
BK = Brian Kurko; CG = Chera Gainer; EB = Ernie Butler
Rotation Mentors are appointed by the Program Director from WVUHS faculty members that have expressed interest in being rotation mentors.

*These rotations have an indicated minimum time but may be longer by a week if not all leave is used.

Detailed Information on Clinical Rotations are in Appendix A.

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Educational Program Overview

Conferences / Lectures

Clinical conferences, seminars, small discussion groups, journal clubs and one-on-one instruction are all an integral part of the program. The resident will participate in the following:

- Medical Physics and Radiation Oncology journal clubs
- Mortality and Morbidity
- Quality Improvement and Safety Meeting
- Radiation Oncology Chart Rounds
- Medical Physics Division meetings
- Ethics and Professionalism Online Modules: RSNA Education :: Catalog

Residents are expected to attend 50% of journal clubs, and 75% of Chart Rounds and other conferences and meetings.

Once a year, in each year of residency, each medical physics resident will present one or more journal articles at a medical physics journal club.

Assignments

Written report after each rotation. Oral presentation of the written report just prior to the oral exam.

Exams

Oral exam after each rotation. This will be like the ABR Oral board examinations.

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Program Objectives

The mission of the WVU Medical Physics Residency Program in the department of Radiation Oncology is to prepare residents to practice independently as board certified clinical radiation oncology physicists in a broad range of practice settings. Clearly, few individuals can be experts in all areas of Medical Physics, but the graduate should have the experience and knowledge base necessary to implement and maintain routine clinical procedures and establish novel techniques.

Major Goals of the program include:

- Prepare the graduate for certification in the specialty of Radiation Oncology Physics by an appropriate certification Board.
- Provide a broad-based in-depth training that will permit the graduate to immediately contribute to the quality of medical care received by the radiation oncology patient.

Specific program objectives include the development in the resident of:

- an understanding of the role of patient safety in the clinical practice of medical physics;
- the technical knowledge, skills and competency required for the safe application of the technologies used in the practice of medical physics;
- an appreciation of the clinical purpose and applications of sophisticated technologies;
- an understanding of the protocols and practices essential to the employment of technologies to detect, diagnose and treat various illnesses and injuries;
- the ability to use analytical and research methods to solve problems arising in the clinical environment;
- the ability to deploy new strategies within the clinical environment;
- the ability to critically evaluate research and scholarship in medical physics;
- the communication and interpersonal skills that are necessary to function in a collaborative, multidisciplinary environment;
- the professional attributes and the ethical conduct and actions that are required of medical physicists; and
- a valuing of career-long continuing education to keep professional knowledge and skills current.

Training will take place under the close supervision of experienced radiation oncology physicists. The program emphasizes all areas of training and experience that will be needed by a radiation oncology medical physicist in a "state-of-the-art" treatment facility, as well as expose them to management of a single accelerator community-based free-standing facility.

The Residency Program Director is responsible for the coordination of training with all mentors and for compliance with the guidelines in this handbook. These guidelines have been developed in accordance with CAMPEP standards.

Program Leadership

Department Executive Committee

The Department Chair, the Department Director, and the Director of Medical Physics are members of the DEC. They are responsible for the oversight of the residency program, for appointing the Program Director, for approving nominees to the steering committee and for the position of Assistant Program Director.

Department Chair: David A. Clump, MD, PhD, DABR
Department Director: Ashford Broadwater III
Director of Medical Physics: Ramon Alfredo Siochi, PhD, DABR, FAAPM

Program Director

The responsibilities of the Program Director are to:

1) promote the program (review the website for promotion materials)
2) recruit residents (manage the information in MP-RAP and download applications)
3) determine and document that residents entering the program meet all CAMPEP admission standards
4) ensure that the residency program complies with the CAMPEP standards
5) ensure that the rotations satisfy all the curriculum requirements in the CAMPEP standards
6) ensure residents receive high quality training
7) coordinate with rotation mentors to meet all training objectives
8) evaluate mentor performance and recommend improvements in training methodology and approach
9) advise residents to ensure consistent progress through the program
10) meet with residents monthly to address concerns
11) maintain minutes of resident meetings
12) provide residents a quarterly progress report
13) evaluate and continuously improve the program
14) ensure that the residency website is up to date and provides all the CAMPEP required statistics and information
15) chair the steering committee
16) ensure that this handbook is up to date
17) appoint the assistant program director

Candidates for program director are selected from medical physics faculty members that are board certified by the ABR, CCPM, or ABMP, have 5 or more years of full-time post-graduate experience in radiation oncology medical physics, and are willing to serve as program director and accept any associated reallocation of duties. The Department Executive Committee will interview candidates and select the program director.

Program Director: Ramon Alfredo Siochi, PhD, DABR, FAAPM

Assistant Program Director

The responsibilities of the Assistant Program Director are to:

1) meet weekly with the program director to discuss the management and status of the program
2) act as the designee for the Program Director at meetings when the program director is unavailable
3) assists in the development of the curriculum
4) assists in administrative duties of the program
5) assists in clinical duties associated with the management of the program
6) serve on the steering committee

Candidates for assistant program director are selected from medical physics faculty members that are board certified by the ABR, CCPM, or ABMP, have 3 or more years of full-time post-graduate experience in radiation oncology medical physics, and are willing to serve as assistant program director and accept any associated reallocation of duties. The program director will appoint the assistant program director.

Assistant Program Director: Timothy “Mike” Carroll, MS, DABR

Steering Committee

The Medical Physics Residency Steering Committee (MPRSC) is an important component for achieving our program objectives and meets at least twice a year (June and December). The Residency Program Director is the chair of the Steering Committee. The Steering Committee is responsible for

- establishing and maintaining a process for evaluating the quality of the residency program
- assessing the quality of the residency program annually
- taking action to address improvements
- analyzing program strengths, weaknesses, needs and long-term goals of the program
- providing a mechanism for residents to communicate with the steering committee

The committee consists of

1) the Program Director, (Alf Siochi)
2) the Assistant Program Director, (Mike Carroll)
3) the WVUM Chief Medical Physicist, (Josh Hack)
4) a WVUHS Hospital Physicist, (Brian Kurko)
5) a WVUM Medical Physicist, (April Shorthouse)
6) a Certified Medical Dosimetrist, (Brenda Maxwell) and
7) a Radiation Oncologist (Phil Pifer)

The first 3 are required members (required due to the role), while the last 4 members serve a renewable two-year term, except for the first group that will have some members serving for 3 years to stagger the renewal schedule. When a committee member finishes their term, the program director and assistant program director will either renew the term or nominate the replacement for approval by the Department Executive Committee (DEC: Department Chair, Department Director, Director of Medical Physics). Once the program director and the DEC mutually agree upon a nominee, the program director will appoint the nominee to membership on the MPRSC.

Residents are encouraged to speak freely with members of the Steering Committee or the Department Executive Committee to bring up any concerns, suggestions, ideas, or other types of comments to help improve the residency program, and to help the resident maintain the appropriate progress towards graduation from the program. The minutes of the meetings of the program director with each resident will be provided to the steering committee.

The steering committee will perform an annual review of the program at the June meeting. All rotation oral exam results, resident rotation evaluation results, mentor evaluation forms, program graduate surveys, work environment surveys, program director evaluation survey, resident self-assessment, resident monthly meeting minutes and quarterly progress reports will be reviewed prior to the meeting. (Forms are in Appendix C.) In the various forms, there are numerical summaries for surveys that will be tracked for trends. There are also written comments that will be reviewed for common themes of comments, areas of weakness, areas of strength, needs, and suggestions for improvement. The steering committee members will also review the following:

1) Have all residents met their rotation objectives? If not, why? How can we help them?
2) Are residents maintaining special procedure proficiency? If not, why, and how can we help them?
3) Are residents consistently underperforming in all their rotations?
4) Are there specific rotations where all residents are underperforming?
5) Are there mentors that consistently get poor reviews?
6) Are there mentors that consistently get good reviews, and what can we learn from them?

The steering committee will identify issues, recommend remedial action, and verify that the remediation was implemented, either at the meeting in December, or at an ad-hoc meeting.

To assess long-term goals of the program, the steering committee will also review the clinical rotations and comment on any forthcoming medical physics practice trends that should be included in the rotation. They will also comment on any outdated practices that need to be mentioned for historical purposes and context, and how the rotation should incorporate the new practice.

All mentors will be expected to revise their clinical rotations annually based on the feedback from the steering committee.

Rotation Mentors

Rotation Mentors assigned to the various clinical rotations are listed in the rotation plans. Some rotations have co-mentors. For rotations with multiple mentors, the mentors must meet at the beginning of the rotation to discuss schedules and coordinate rotation responsibilities.

Mentors have the following responsibilities:

1. Manage the progress of the resident through the rotation
2. Meet with the resident weekly and initial completed items in the rotation plan
3. Provide the resident with opportunities to complete all items in the rotation plan
4. Identify and coordinate with the weekly clinical mentor to support opportunities for clinical procedures
5. Engage the resident in discussions of safety, radiation safety, and TG100 concepts as it relates to the workflows of special procedures and tasks in the rotation
6. Work with the resident to identify ethics and professionalism issues associated with the special procedures and tasks in the rotation
7. Engage the resident in discussions of rotation plan topics
8. Evaluate the resident’s performance

9. Review the rotation plan annually
10. Revise the rotation plan to remain up to date and to respond to issues raised by the steering committee

Residency Program Manager

All residency programs that are part of the WVU Graduate Medical Education are assigned a program manager. The program manager will assist the program director with offer letters, resident contracts, resident agreements, and request for resident agreements. They will help with the logistics of the program, tracking of statistics, budgets, on-boarding, resident progress tracking, and compliance with GME policies.

Residency Program Manager: TBD

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Program Completion Requirements

The Clinical Medical Physics Residency Program is 24 months in length to include 14 rotations, attendance at various departmental conferences, recommended readings, didactic courses, written report assignments, and oral examinations. In addition to the experiences from didactic training and clinical rotations, the Medical Physics residents receive clinical training through their participation in quality assurance on all departmental radiation producing devices, perform IMRT quality assurance measurements, perform electron cutout measurements, and miscellaneous tasks such as prior RT record gathering. As residents progress through the clinical rotations, they begin to participate in post-planning and weekly chart review, high dose rate brachytherapy quality assurance, Gamma Knife quality assurance, and become the "physicist of the day" providing first response physics support to all activities within the clinic. The progression of the resident through these clinical responsibilities is evaluated and discussed with the resident during monthly reviews with the program director.

Competency Overview

By the end of training, the resident must demonstrate that they are able to perform clinical tasks expected of a practicing radiation oncology medical physicist. Initial competency requirements of observation, performance under guidance, and solo performance with a sign off from the supervising faculty member are met during the rotation where the skillsets are taught, and additional maintenance of competency requirements throughout the course of the 2-year training must be met before graduation. To facilitate meeting these requirements, each resident will be assigned a weekly clinical mentor who will be performing these clinical tasks. The weekly clinical mentor will meet with the resident every morning to touch base on the tasks for the day and to coordinate the observation or performance and supervision of these tasks.

Competency requirements are detailed in Appendix B.

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Requirements of Residents

Daily Schedule

Below is a summary of a sample day on any given rotation. This does not reflect individual rotation requirements.

8:00 – 9:00	Conference or Chart Rounds
9:00 – 5:00	Review literature Collect and analyze data Document findings Meet with mentor Work on rotation report Called to clinic to observe/perform procedures and / or tasks
5:00 – ?	IMRT QA, monthly QA, electron cut-out, QA documentation, analysis, and reporting

Clinical procedure scheduling and weekly mentorship

The residents are expected to participate in clinical activities outside the scope of the assigned rotation. In order to coordinate such activities, each week the resident will be paired with a faculty physicist. When appropriate, the resident will participate in the same clinical activities as the weekly mentor. Scheduling for participation in clinical procedures will be determined by the weekly clinical mentor and by the rotation mentor. These will be reviewed on Monday mornings.

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Special Procedures, Tasks, and Other Activities

Competency Activities

The following lists specific learning opportunities to Observe, Perform with Guidance, or Perform Solo**.** These activities will need to be logged so that competencies can be evaluated (see Appendix B). Note that these procedures can only be started after certain rotations have begun, while others that have limited opportunities will be done as cases arise or will be performed as mock cases.

Special Procedures

HDR Brachytherapy (Brachytherapy, rotation 7)

SRS – Gamma Knife (SRS, rotation 9)

SRT – HyperArc (Treatment Planning part 2, rotation 8b)

SBRT (Treatment Planning part 2, rotation 8b)

IORT (as cases occur, or with phantoms + craniotomy observation)

Tasks

IMRT QA (Orientation, rotation 1)

Prior RT Data Request and Import (Orientation, rotation 1)

Plan Checks (Treatment Planning Part 1, rotation 8a)

Chart Checks (Treatment Planning Part 1, rotation 8a)

3D Printed Bolus (Treatment Planning Part 1, rotation 8a)

4DCT Motion Analysis (Imaging and Motion Analysis, rotation 10)

Image Registration (Imaging and Motion Analysis, rotation 10)

Re-irradiation Analysis (Imaging and Motion Analysis, rotation 10)

Non-Patient Tasks

Quality Assurance is performed on the following equipment, with different tests performed at different frequencies.

Linac: Daily, Monthly, Annual, Validation after repair

Gamma Knife QA: Day of Treatment, Monthly, Annual, Validation after repair

HDR QA: Day of Treatment, Source Exchange, Validation after repair

IORT QA: Day of Treatment, Quarterly, Loaner Source, Annual

Other Activities

Residents are involved in other activities besides the competency related activities. Residents will maintain a journal where they log their activities. The journal will have table entries using the following format:

Activity Type	Activity Description	Date(s) performed
{Clinical, Research, or Education}	{Describe the activity, such as journal club presentation, journal club attendance, chart round attendance, physics meeting attendance, national meeting, regional chapter conference, etc}	{provide a single date if it is started and completed on that date, or provide a start and end date}

Satellite Clinic

WVU Medical Physicists are responsible for a variety of activities at our satellite clinic. Residents begin participating in the second month of residency on a rotating basis.

Activities to be performed on-site at the satellite:

1. Monthly Linac QA
2. Annual Linac QA
3. Validation of Equipment after repair
4. IMRT QA

Activities to be performed in Morgantown for patients treated at the satellite:

1. Plan Checks
2. Chart Checks
3. Plan Reviews with Physician

Fairmont Regional Cancer Center (FRCC)

The Fairmont, WV site 25 miles away treats 10-15 patients per day and has a Varian iX linac. Residents will travel to FRCC to perform on-site activities.

WVUHS Hospitals

There are several hospitals within the WVU Health System. While these are not training sites for the resident, they may offer some unique training activities and provide insight into community practice settings. Residents will coordinate with their rotation mentor, program director, and the qualified medical physicist (QMP) at the WVUHS Hospital.

QMPs at WVUHS Hospitals are faculty members of the Radiation Oncology department in Morgantown (MBRCC). They may serve as mentors on rotations, alongside local co-mentors at MBRCC.

Wheeling Hospital Schiffler Cancer Center (WHSCC):
Special Procedures: I-131
Mentors: Brian Kurko, Ernie Butler
Other QMPs: Amber Hines

Thomas Memorial Hospital Cancer Center (TMHCC):
Mentor: Chera Gainer

Camden Clark Regional Cancer Center (CCRCC):
Special Procedures: I-131
QMP: Scott Mange

Berkeley Medical Center (BMC):
Special Procedures: I-131, Lutathera, Plavicto, Xofigo
QMP: Harold D'Souza

Princeton Community Hospital (PCH):
Different Machine: Halcyon
QMP: Larry Hambrick

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Evaluations

After each rotation, the resident submits a written report. At the end of the report, the resident indicates which sections of his report fulfill the goals and objectives of the rotation plan. This is evaluated by each physics faculty and graded, along with an evaluation of the resident's ability to articulate their knowledge developed during the rotation in a 30-minute oral presentation of the report, and ability to respond to a 50-minute oral examination that immediately follows the oral presentation of the report. Each faculty member submits an evaluation form for the written report (which includes the assessment for the oral presentation of the report) and oral examination to the mentor of the rotation. The form includes a written report grade, oral exam grade, comments, recommendations, overall recommended grade of pass, fail or conditional pass and remediation if conditional pass.

The mentor of the rotation reviews these forms, discusses them with examiners, and completes an evaluation form constituting the final and definitive evaluation for the rotation. The mentor discusses the conclusions with the resident and provides the resident and the program director a copy of the mentor's evaluation for the rotation.

The resident will also provide an evaluation of the rotation content, training environment, availability of resources, mentor, training methodology and approach. They will also provide a self-assessment of their performance on the rotation. The Program Director will review the evaluations and work with the mentor to recommend improvements for the rotation.

Residents meet with the program director once every month to discuss optional research opportunities and the resident's progress. With the resident, the program director reviews the rotations since the last progress meeting, conference participation, recommended readings, activity journal entries, remediation, if necessary, and outstanding assignments. The program director writes the minutes of the monthly meeting and provides it to the resident. The program director completes a quarterly progress report and discusses it with the resident.

The monthly meeting of the program director with the resident will have a standing agenda: 1) Review the progress of the resident towards achieving the current rotation learning objectives, 2) Review any comments of the rotation mentor with the resident, 3) Review the progress of the resident towards proficiency for various special procedures, 4) Review the progress of the resident for development of soft skills, professionalism, or other aspects of practice that are not explicitly covered in rotations, 5) Ask the resident what is going well, 6) Ask the resident what is not going well, 7) Solicit suggestions for improvements from the resident, and 8) Ask the resident for anything they would like to have the steering committee know. The minutes of this monthly meeting will be forwarded to the steering committee for review at the next meeting. If issues are raised that require immediate attention, an ad hoc steering committee meeting will be held to resolve the matter.

The mentor responsible for a given rotation will evaluate the rotation and propose the creation or modification of the rotation's design and content. This proposal is submitted to the program director. The program director will send the proposal to an ad hoc rotation review committee comprised of selected physics faculty that are affected by the change or that are experts in the topic. The committee will review the changes and recommend any revisions. Once it is revised, it will be sent back to the committee for final approval.

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Professionalism / Dress Code
Residents are expected to appear professional at all times. Men are expected to wear a shirt and tie. The tie will be up and the shirt not unbuttoned until after hours. Jeans and tennis shoes are not allowed.

Residents' relationships with departmental personnel should be cordial and friendly. Under no circumstance is a resident allowed to reprimand ancillary staff for what they determine is poor execution of their duties.

If a resident encounters problems regarding other residents, ancillary staff, or faculty members, these problems should be discussed with the Program Director.

Residents must promptly answer pages.

More information on professionalism and ethics will be reviewed in the first rotation (orientation).

The WVU GME also has professionalism policies, which can be reviewed here:
GME Policies | School of Medicine | West Virginia University

Specifically, there is a code of professionalism: code-of-professionalism.pdf
And a form to report lack of professionalism or exemplary professionalism:
Professionalism Form | School of Medicine | West Virginia University

There is also a mistreatment form:
Mistreatment Form | School of Medicine | West Virginia University

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Travel, Vacation, Leave, Interview Time, Book Money

Conference Attendance Policy

Residents may go to a national meeting once during their residency if they are not presenting a paper and be reimbursed within University guidelines for travel. Residents may attend a national meeting more than once during their residency at their own expense, if they are not presenting. Residents may attend one regional AAPM meeting per year during their residency and be reimbursed.

Board certification exam dates will not count as conference days. Every effort must be made to minimize the time away from the training program for exams.

Reimbursement of expenses when research is presented may be approved by the Program Director with approval of the Executive Committee of the department. There will be no support for meetings outside of North America unless special approval is obtained. Approval from the Program Director is required prior to submission of an abstract.

All travel must be pre-approved by the Residency Program Director. The program coordinator will make most arrangements. This includes plane reservations, hotel reservations, motor pool car reservations, and registration fees.

All reimbursements will be made within the University guidelines for travel. Details are in the operations manual. Receipts are required for department approved expenses. This includes food, transportation, and lodging. Transportation to and from the airport and hotel will be covered by the department. Transportation to dinner is not reimbursed. All receipts should be turned in to the program coordinator.

If you have any questions about university travel processes please see the program coordinator.

Vacations and Leaves

1. Residents may not be absent more than 40 working days per year.
2. Residents have a maximum of 24 vacation days per year. They are accrued at a rate of 2 days per month and will cease to accrue after 24 vacation days. They must be accrued prior to use. If you work past a year without using vacation, you will not accrue additional vacation days until after you use vacation days.
3. Sick days accrue at a rate of 1.5 days per month, a maximum of 18 days per year. They must be accrued prior to use, in almost all cases.
4. If a resident uses more than 16 sick days in one year, then the resident will use vacation time, holidays, or weekends to cover the additional sick days, so that they do not miss more than 40 working days.
5. Attendance at a national conference does not count against your vacation or sick time.
6. Residents are not allowed to take vacation during the last week of their training.
7. When requesting a vacation day, the request must be approved by the program director.
8. Vacation and sick leave may not be taken in increments less than ½ day (4 hours).
9. If a resident is absent more than 42 days per year (24 vacation and 18 sick), it is leave without pay. Absences over 40 days in a year will need to be made up on holidays and weekends. The resident must submit a written request to the Program Director, for leave without pay, including the reason for the leave. The physics faculty will either approve the request, with an extension of residency if permitted by the GME or deny the request.

Time away from training for leaves which are necessary due to illness will be made up at the discretion of the Program Director in accord with the needs of the resident to complete essential components of his/her training program. In general, time missed due to illness of a few days duration will be made up during a contract year; training missed because of prolonged illness or disability may necessitate additional training time which will be provided if the resident's performance is otherwise satisfactory and the WVU GME allows it. Leave requested under the federal Family and Medical Leave Act of 1993 will be treated in accord with the rules and regulations of the West Virginia University GME as set forth in the GME Institutional Leave Policy : Resident and Fellow Leaves | Talent and Culture | West Virginia University.

Parental Leave:
"Both the birthing parent and non-birth parent may use sick leave for their time spent in the hospital before and after the birth. Additionally, the birthing parent may use up to six weeks of sick leave after a healthy delivery without complications, or up to 8 weeks of sick leave after delivery for a C-section. In the case of a healthy birth without complications, the spouse must use annual leave upon returning from the hospital. However, if complications related to the birth require the non-birthing spouse to provide care either to the child or the birthing parent beyond discharge from the hospital, the non-birth parent may use sick leave for these absences. Sick leave exceeding 5 consecutive workdays will require medical documentation. Once additional care is no longer required, the non-birth parent will be required to use annual leave for the remainder of the leave period. Both the birthing and non-birthing parents are eligible for up to six-weeks of paid leave." "An additional reserved week of paid leave outside of the six weeks is to be available within the appointment year(s) in which the leave is taken" (Paraphrased from resident-leave-faqs-final.pdf)

Other Leave Information
FMLA, Medical, Caregiver, Adoption, Catastrophic, CME, Personal Leave of Absence Without Pay, Grievance, Witness, Jury, Emergency, Inclement Weather, Leave Request Forms:

The Medical Physics Residency Program will follow the WVU GME Institutional Leave Policy. Please refer to
gme-institutional-leave-policy-final.pdf

Interview Time
During the last 12 months of their residency, residents may take up to six days to interview for a post-training position at the discretion of the Program Director.

Book Money

Residents are allotted $1500 per year which they should use on books, practice board exams (mock orals) or computer software pertaining to their training. Unused money will carry over to the next year. **Any transactions** must go through the program coordinator. The approval of a purchase ultimately lies with the program director. Book money that is not used will remain with the Department.

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Resident Selection, Promotion, and Dismissal

Resident Selection

The radiation oncology residency is a two-year program. Applicants to the program must provide proof that they graduated from a CAMPEP accredited MS or PhD program, or from a CAMPEP accredited certificate program, or that they are making satisfactory progress towards graduation from these programs.

Applications will be accepted through the MPRAP (Medical Physics Residency Application Program). The Program Director will manage WVUs MPRAP data, information and configuration, and will download all resident applications immediately after the MPRAP application deadline. The program director will examine all applications and exclude those that do not meet the application requirements indicated above.

All complete and valid applications are divided amongst the physicists to review and score.

The faculty physicists and the program director meet to review application evaluations to determine the ~5 individuals to whom an invitation to interview will be extended.

Candidates rotate through interviews with the Selection Committee:
Radiation Oncology Medical Residency Program Director
Radiation Oncology Medical Residency Assistant Program Director
Each of the faculty physicists
Dosimetrist on the steering committee
Chief Therapist

Each Selection Committee member submits an evaluation form for each interviewee to the program coordinator. In the selection meeting the strengths and weaknesses of each candidate are discussed and each member of the Selection Committee ranks the candidates. The composite ranking is provided to the program director for the selection of candidates.

While the candidate will meet the current residents, the feedback from the residents will be considered as additional information to help in the selection process, but the current residents will not be part of the selection committee and will not need to fill out an evaluation form.

For candidates that have not graduated from a CAMPEP graduate or certificate program at the time of the application, a complete set of transcripts and graduation certificates will be required before admission into the program. The program director will review the transcripts and certificates of all candidates offered a position and verify that they have met all the requirements before starting the residency.

NOTE: During the first few years of the program, preference will be given to MPAs being trained at WVU.

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Resident Evaluation and Promotion

Quarterly, the Program Director will evaluate the resident's overall progress and provide him/her with a written progress report. Part of this assessment is based on the monthly meeting with residents, while the rest is based on the performance in each rotation (see the section on Evaluations).

Progress in the training program includes development of clinical knowledge, skills and professional development as outlined in our program goals and clinical rotation goals. Residents who have serious deficiencies will be informed of these concerns, and plans for remediation will be made. Residents who successfully complete their rotations for the first year will be promoted to the second year. They will need to fill out a request for a resident agreement for their second year. The Residency Program Manager will provide the needed forms.

Records Retention

The resident's training record consists of the following:

- Competency Forms
- Rotation Reports
- Evaluations of Resident's performance on rotations
- Quarterly Progress Reports
- Resident's Activity Journal
- Rotation Plan Printout with initials of mentor
- PowerPoint Slides of any presentations associated with the residency program

The resident's training record, and any other materials submitted to the steering committee will be retained by the radiation oncology department for 3 years after the resident graduates.

Program Graduate Statistics

Residents are requested to provide an email address where they can be reached once they graduate. They will be sent an email requesting the following information:

1. Residency Start Date
2. Residency Graduation Date
3. Current Occupation
4. Date of Board Certification
5. Certifying Board (ABR, ABMP, CCOMP)

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Guidelines for Resident Dismissal

Failing one rotation will stop progress in the program and require the completion of remediation, that follows specific requirements, in a specific timeline or it will be grounds for dismissal. Failing a second rotation is grounds for dismissal. All rotations must be passed to complete the residency program. Residents may be discharged by the Program Director for failing a required course, unprofessional or unethical conduct, illegal actions, or gross unsatisfactory performance. A decision not to renew a contract made within 4 months of expiration or a decision to cancel a renewed contract before the beginning of the contract period shall be considered a discharge. After explaining the grounds for discharge to the resident, the Program Director shall give written notice of the discharge to the resident, including a statement of the grounds for the action.

For performance on activities that are not tied to a specific rotation, or for behavioral issues, the program director will outline any corrective actions that are needed to address behavioral issues, a lack of clinical competency and / or a failure to meet learning metrics during the monthly resident meeting. The corrective actions will include evaluation metrics that the resident must meet to complete this remediation. Minutes of this meeting will be provided to the resident. Failure to comply with the remediation plan may result in dismissal from the program, which will be determined by the steering committee. If the resident is issued corrective actions 3 times, the steering committee will meet to review grounds for dismissal from the program.

Individual disciplinary actions (except suspension or discharge) and other departmental actions affecting the individual resident will be reviewed by a committee selected by the Program Director, if an affected resident requests such a review within ten days of his or her becoming aware of the action, unless the resident has already been afforded an opportunity to present information to such a committee which advised the Program Director before the action and the resident has been informed of the Program Director's action in writing. The committee will be composed of at least two active clinical staff members and one resident. After its review, the committee will submit its recommendations to the Program Director. If the committee recommends a change in the action, the Program Director will then reconsider the action, giving due consideration to the review committee's recommendation. The resulting decision of the Program Director shall be provided to the resident and the Chair of the Department of Radiation Oncology in writing and shall be final, unless the resident believes that the action could significantly threaten his or her intended career development. Actions will not be postponed while they are being reviewed, unless the Program Director in his or her discretion decides to do so.

If the resident submits a written request to the Chair of the Department of Radiation Oncology within 10 days of receipt of the Program Director's written decision (described in the previous paragraph) and the request includes the reasons for the belief that the action could significantly threaten the house staff member's intended career development, the Chair will review the decision, if he or she finds the alleged threat to be significant. The Chair may seek the advice of an ad hoc committee as part of the review. If the action is nonrenewal of a contract prior to completion of the training program, the decision of the Chair shall be given to the resident and Program Director in writing and is final. For all other actions, if the Chair recommends that the Program Director modify the decision, the Program Director will then reconsider the action, in consultation with the Chair. The resulting decision of the Program Director shall be provided to the resident and the Chair in writing.

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Appendix A - Rotation Plans

The rotation plans listed in this appendix are current as of 1/15/2025. They are static copies of the rotation plans. For up-to-date descriptions, use the Medical Physics Residency Teams page. The descriptions in the handbook will be updated once a year to match the current description. Rotation Plans are reviewed to ensure compliance with the curriculum and progress assessment requirements of the most recently published CAMPEP standards.

Rotation Plans consist of objectives, skills, knowledge base items, clinical processes, and a reading list. Residents will prepare a report showing that they have achieved each of the items in the plan. Residents should print out the rotation plan. To track progress, the rotation mentor will meet with the resident weekly and initial the items, on the rotation plan printout, that have been completed. No research is required in the rotation plan, however, there may be optional research opportunities involving clinical problems associated with the clinical services of the rotation. The mentor will mention these to the resident during their weekly meeting.

Standard Reading List Items
Most of the rotations will have content that are described in the following texts, and it is recommended that residents own them:

1. The Physics of Radiation Therapy, 5^{th} ed, Faiz Khan.
2. Radiation Oncology Physics: A Handbook for Teachers and Students, IAEA, Vienna Austria. (This text is free and digitally available. A new edition is being prepared. The current edition is from 2005.)

Other texts that the resident should get are task group reports and MPPGs associated with the rotations. These are freely available on the AAPM website.

Rotation Report
All rotations require residents to complete a report, summarizing the material learned during the rotation, activities performed, experiments and results, and acquired skills. At the oral exam, the resident will provide a 30-minute presentation summarizing the written report. At the end of each report, the resident will include 1) a summary of radiation safety and other safety lessons from the rotation, 2) a summary of ethics and professionalism lessons from the rotation, 3) a summary of any research done related to the topics in the rotation, and 4) a completion checklist. The standard table format for the completion checklist has the following headings and contents:

Rotation Completion Checklist:

Learning Activity	Date Completed	Comments
{Skill item}		{provide information on how skills were acquired}
{Knowledge Base item}		{Provide references for materials used to learn the item}
{Clinical Process item}		{indicate sections of report that cover this clinical process}

Rotation Evaluations
All rotations have a standard evaluation process. Faculty members that participate in the oral exam must read the resident's rotation report. Faculty fill out a written report evaluation form and an oral exam evaluation form and provide it to the rotation mentor who fills out the rotation evaluation form. The resident fills out a rotation evaluation form and a mentor evaluation form. The forms are in Appendix C.

1. Rotation Plan for Orientation

Mentor: Alf Siochi
Duration: 4 weeks

Objectives: Residents will learn the operations of the department and the WVUHS and will receive their onboarding. They will read the resident handbook, take the Computer Based Learning Modules and the employee orientation required by WVU (covering hospital benefits, safety, and standards of behavior), radiation safety rules and regulations, and go through the self-learning modules of the AAPM for professionalism & ethics. They will also learn basic informatics concepts (such as file storage, databases, data security and privacy, and networks) to discuss the department's data infrastructure. Additionally, their ability for independent learning will be evaluated and they will be given guidance on how to approach learning the material in each rotation.

I. Skills
   a. Time Management
   b. Communication
   c. Self-accountability
   d. Independent learning

II. Knowledge Base
   a. Hospital Computer Based Learning Topics
   b. Hospital Radiation Safety Topics
   c. Department Radiation Safety Topics
   d. Basic Informatics Concepts and Department's Data Infrastructure
   e. Resident Handbook and associated GME Residency Links
   f. Ethics and Professional Behavior

III. Clinical Processes
   a. Observe Patient Consult, OTV, or follow up / Shadow Physician
   b. Observe Warm-up and Daily QA for Linac
   c. Observe Warm-up and Daily QA for CT
   d. Observe Treatments on Linac
   e. Observe CT-Sim
   f. Observe Physics Initial Plan Check
   g. Observe Physics Weekly Chart Check
   h. Shadow Clinical Physicist

IV. Reading List
   a. AAPM Report 109: Code of Ethics for the American Association of Physicists in Medicine, 2019. AAPM Code of Ethics learning modules
   b. ABR Professionalism and Ethics content guide
   c. AAPM TG 159: Recommended ethics curriculum for medical physics graduate and residency programs (2010)
   d. Radiation Oncology Physics: A Handbook for Teachers and Students, IAEA Vienna Austria, 2^{nd} ed., to be published, Chapter 18. Advance Draft of Chapter 18 from Dr. Siochi

V. Assessment

Residents will prepare a rotation report, summarizing the key points from their CBLs, professionalism and ethics modules, and methods for optimizing their learning experience. Noting that safety, professionalism, and ethics lessons are practiced throughout their entire career, residents will continue to note these aspects of practice in all their rotations. All remaining rotation reports (2 through 14) will include a section on radiation safety and a section on ethics and professionalism. Residents must pass all their CBLs. They will be given an oral exam on the professionalism and ethics modules of the AAPM, and on the networking and data transfers that occur within the various applications used in the department.

2. Rotation Plan for Clinical Equipment Operation and Workflows

Mentor: April Shorthouse
Duration: 4 weeks

Objectives: Residents learn how to operate the CT scanner and linear accelerators, use the Radiation Oncology Information Systems (Aria) and the hospital Electronic Medical Record (EMR), understand clinical workflows by inspecting care paths, encounters, questionnaires, and tasks, and learn basic principles of clinical workflow design through TG 100.

I. Skills
   a. Operate the Linac (Treat a phantom, take an image)
   b. Operate the CT (image a phantom)
   c. Navigate Care Paths, Encounters, Questionnaires and Tasks

II. Knowledge Base
   a. Process Map
   b. Failure Modes and Effects Analysis
   c. Fault Trees
   d. Linac Safety and Emergency Procedures
   e. CT Safety and Emergency Procedures

III. Clinical Processes
   a. Diagram the department's Process Map for an IMRT treatment
   b. Indicate hazard mitigations in the IMRT process map
   c. Diagram the care path for an SBRT treatment
   d. Perform IMRT QA
   e. 3D Print a test object

IV. Reading List
   a. AAPM TG100: The report of Task Group 100 of the AAPM: Application of risk analysis methods to radiation therapy quality management (2016)
   b. Varian instructions for use for Aria (download from MyVarian)

V. Assessment

Residents will prepare a rotation report explaining the operation of the various equipment. This should be written in a way that the resident can refer to as a guide or "cheat sheet" for using the equipment. They will be given an oral exam to test their understanding of workflow development.

3. Rotation Plan for Dosimetric Systems

Mentors: Mike Carroll and Josh Hack
Duration: 8 weeks

Objectives: During this rotation the medical physics resident develops a basic understanding of the design, characteristics, and clinical limitations of several radiation measurement systems: ionization chambers, radiographic film, solid state detectors, re-entrant well chambers, and survey meters. All radiation measurement systems to be used by the resident throughout the program are to be commissioned by the resident during this rotation. During this process the resident develops an understanding of the specifications and capabilities of these systems. The resident also develops an understanding of the design and utility of water scanning systems, with a 3D system being commissioned by the resident.

I. Skills
   a. Linac Operation – Service Mode
   b. Use of Ionization Chamber and Electrometer to read dose
   c. Film Densitometry

II. Knowledge Base
   a. Exposure and Dose
   b. Charged Particle and Radiation Equilibrium
   c. Cavity Theory
   d. Dosimetry by Pulse Mode Detectors
   e. Design and Basic Operation of Dose Measurement Devices
   f. Details for Ionization Chambers
   g. Design and Basic Operation of Electrometers
   h. Phantoms and water tanks

III. Clinical Processes
   a. Commissioning of Ion Chambers and Electrometers
   b. Commissioning of Film Dosimetry System (GafChromic Film)
   c. Commissioning of Solid State Detectors (OSLDs, Diodes)
   d. Comparison of PDD and profiles for various detectors (Farmer, mini and micro chambers)
   e. Commissioning of 1D and 3D Water Tanks
   f. Response, Accuracy and Measurement Range of Survey Meters (kV, MV, electrons, Ir-192)
   g. Review of ADCL reports and calibration data for various dosimetry equipment

IV. Reading List
   a. Introduction to Radiological Physics and Radiation Dosimetry, Attix
   b. PODGORSAK et al “Review of Radiation Oncology Physics: A Handbook for Teachers and Students” IAEA Vienna Austria (May 2003), chapters 2, 3, 4
   c. Diode in Vivo Dosimetry for Patients Receiving External Beam Radiation Therapy (2005) Radiation Therapy Committee Task Group #62; 84pp.
   d. Acceptance testing of an automated scanning water phantom, David E. Mellenberg, Robert A. Dahl, and C. Robert Blackwell, Med. Phys. 17, 311 (1990)
   e. Radiochromic Film Dosimetry (Reprinted from Medical Physics, Vol. 25, Issue 11) (1998) Radiation Therapy Committee Task Group #55.

f. Comprehensive QA for Radiation Oncology (Reprinted from Medical Physics, Vol. 21, Issue 4) (1994) Radiation Therapy Committee Task Group #40; 37 pp, focus on Table IV
g. AAPM TG 191: Clinical use of luminescent dosimeters: TLDs and OSLDs, 2019.
h. AAPM TG 235: Radiochromic film dosimetry: An update to TG55, 2020.

V. Assessment

The resident will present a report that describes each of these systems, how they operate, and results from their commissioning process. The report must give an overview of all the processes, describing the individual steps conceptually. Finally, the resident will take an oral exam. An understanding of the principles behind the processes as well as comprehension of other relevant information from the reading lists must be demonstrated.

4. Rotation Plan for Treatment Machine Calibration and MU Calculations

Mentors: Brian Kurko and Josh Hack
Duration: 8 weeks

Objectives: Under the supervision of a staff physicist, the medical physics resident performs an accelerator calibration using the AAPM's TG-51 protocol. The resident generates a report of his/her results for the calibrated accelerator. The report will include a summary of the processes describing the individual steps that were taken to perform the calibration. The MU calc portion is designed for residents to develop the knowledge base required for MU calculations. The concepts and terminology behind these calculations (TMR, PDD, PSF, CSF, ISF, OAR, WF, TF, VWOAR, Clarkson integration, Day's method, calculation Point's Eye View and multiple source models, surface irregularities, tissue inhomogeneities, electrons) are covered. During the rotation the resident looks for initial plan checks of cases in the task list, performs calculations from the field data, and independently verifies the results provided by the treatment planning system and the MU Check software.

I. Skills
   a. Operation of ionization chamber and electrometer
   b. Operation of linac in service mode
   c. Adjust linac output
   d. Spreadsheet development and verification
   e. Use and understand second check software
   f. Determine needed beam data for MU Calc

II. Knowledge Base
   a. TG 51 protocol
   b. Dosimetry parameters: reference point, calibration point, normalization point, TMR, PDD, PSF, CSF, ISF, OAR, WF, TF, WOAR, etc.
   c. Irregular field methods (Clarkson, Day, etc)
   d. Surface Irregularities
   e. Tissue Inhomogeneities
   f. Electrons: VSID, Obliquity, field size limits

III. Clinical Processes
   a. Set up water tank, chamber, electrometer
   b. Measure ionization and convert to dose/MU at reference point
   c. Demonstrate ability to change accelerator output*
   d. Develop TG-51 reference data for future use
   e. MU calcs for Sim and Treat patients
   f. MU Calcs for simple plans
   g. MU Calcs for breast – flash, off-axis, and irregular contours
   h. MU Calcs for electrons
   i. MU Calcs for complex plans (IMRT, VMAT, SBRT)

IV. Reading List
   a. AAPM TG 51 Protocol
   b. AAPM TG 51 Addendum: Addendum to Protocol for clinical reference dosimetry of high energy

photon and electron beams, 2014

c. AAPM TG 21 Protocol
d. AAPM TG 25 Protocol
e. The Physics of Radiation Therapy, 4th ed., Khan, all of Chs.9 and 10, Ch 11, (focus on section 1 to 5), Ch. 12 (focus on sections 4 and 5), ch. 14 (focus on sections 1 to 6).
f. AAPM TG71 Monitor unit calculations for external photon and electron beams, 2014.
g. AAPM TG70 Recommendations for clinical electron beam dosimetry: Supplement to the recommendations of Task Group 25 (2009)
h. AAPM TG114: Verification of monitor unit calculations for non-IMRT clinical radiotherapy: Report of AAPM Task Group 114 (2011)
i. AAPM TG 219: Report of AAPM Task Group 219 on independent calculation-based dose/MU verification for IMRT (2021)
j. AAPM TG 158: Measurement and calculation of doses outside the treated volume from external-beam radiation therapy, 2017.

V. Assessment

Residents will present a report that includes hand calculations and semi-automated hand calculations (excel spreadsheets, etc.) for representative cases. They should demonstrate an understanding of the differences in dose calculations between the planning system and the hand calculation. Finally, the resident will take an oral exam. An understanding of the principles behind the processes as well as comprehension of other relevant information from the reading lists must be demonstrated.

*NOTE: Residents are not allowed to permanently change the calibration of the machine. The mentor must be present with the residents when they demonstrate that they can adjust the calibration, and the mentor must ensure the return of the system to the previous state or verify that the system is properly calibrated.

5. Rotation Plan for Linear Accelerator Acceptance Testing/Commissioning/Annual QA

Mentor: Chera Gainer / April Shorthouse
Duration: 8 weeks

Objectives: Residents will perform the tasks necessary to accept and commission a linear accelerator, including the annual QA of the system. The resident will develop an understanding of linear accelerator fundamentals relevant to acceptance and commissioning, beam optics, flattening, control parameters, collimation, safety interlocks, beam specs and non-beam specs, and more. Residents will also determine the data necessary to commission 1 photon and 1 electron beam in the Eclipse treatment planning system, collect that data, and format it for commissioning, as well as determine the data necessary to perform MU calculations for 1 photon and 1 electron beam. Finally, an Annual Quality Assurance procedure will be performed for one or more of the systems during the residency.

I. Skills
   a. Linac Operation / Rad Safety
   b. Use of Radiation detectors and dosimeters
   c. Use of radiographic film
   d. Use of diode array systems for QA

II. Knowledge Base
   a. Linac Fundamentals relevant to commissioning (beam optics, flattening, beam control, safety, collimation)
   b. Linac Specifications
   c. Acceptance Tests
   d. Commissioning Data Acquisition Tasks
   e. Analysis of Measurements and Preparation for MU Calcs and TPS beam data
   f. Annual QA Tests

III. Clinical Processes
   a. On going QA – use of constancy values and standards
      i. Linac Daily QA
      ii. Linac Monthly QA
   b. Non-routine QA and Commissioning
   c. Post repair QA
   d. IROC OSL irradiation

IV. Reading List
   a. AAPM Report #46, TG-40 Report "Comprehensive QA for Radiation Oncology"
   b. AAPM Report #106, TG-106 Report "Accelerator beam data commissioning equipment and procedures"
   c. AAPM Report #16, TG-142 Report "Quality assurance of medical accelerators"
   d. AAPM Report 198: An Implementation Guide for TG 142 Quality Assurance of Medical Accelerators, 2021
   e. AAPM Report #19, TG-27 Report "Neutron Measurements around high energy x-ray radiotherapy machines"
   f. AAPM Report #7, TG-18 Report on Neutron dosimetry

g. Karzmark and Morton, “A primer on theory and operation of linear accelerators in radiation therapy”, Medical Physics Publishing, 1998.
h. AAPM MPPG 2a: Commissioning and quality assurance of X-ray based image guided therapy
i. AAPM MPPG 8a: Linear accelerator performance tests
j. AAPM Report 56 (TG-35): Medical Accelerator Safety Considerations, 1993.
k. AAPM TG 155: Megavoltage photon beam dosimetry in small fields and equilibrium conditions,2021

V. Assessment

The resident will provide a written report of principles and process of Linear Acceptance Testing, Commissioning Measurements and Annual QA with an overview and detailed descriptions of the relevant underlying principles for each major step. The report should also contain data acquired through measurements or experiment as well as analysis thereof. Finally, an understanding of the principles behind the processes as well as comprehension of other relevant information from the reading lists must be demonstrated in an oral exam setting.

6. Rotation Plan for TPS Modeling

Mentor: Josh Hack
Duration: 4 weeks

Objectives: Residents will accept and commission a three-dimensional treatment planning system. They will determine all input data needed to characterize the CT scanner, linear accelerator, a single photon beam energy, and a single electron beam energy. The resident will utilize data acquired during the previous rotations to commission the system for a single photon and electron beam energy and compare the results with measurements. The resident is expected to learn each component of the beam modeling within the planning system, as well as treatment planning dose engines for both photons and electrons. The resident will learn to evaluate their results in the context of published literature including task group reports.

I. Skills
   a. Operation of 3D water tank database software
   b. Transfer of required data in proper format to TPS system
   c. TPS system operation for beam data modeling
   d. Comparison of measured and computed dose

II. Knowledge Base
   a. Determination of data required for TPS Modeling
   b. Eclipse TPS Dose Engines / calculation algorithms
   c. Eclipse Photon Beam Modeling
   d. Eclipse Electron Beam Modeling

III. Clinical Processes
   a. Commission 1 photon beam in Eclipse
   b. Commission 1 electron beam in Eclipse
   c. Commission 1 photon beam in MU check software (RadCalc)
   d. Commission 1 electron beam in MU check software (RadCalc)
   e. Generate HU to electron density table
   f. Independent validation of dose calculations

IV. Reading List
   a. Eclipse Photon and Electron Algorithms Reference Guide (from myVarian)
   b. Eclipse Beam Configuration Reference Guide (from myVarian)
   c. P. W. Hoban, D. C. Murray and W. H. Round, "Photon beam convolution using polyenergetic energy deposition kernels," Phys Med Biol 39, 669-685 (1994).
   d. A. Ahnesjo, "Collapsed cone convolution of radiant energy for photon dose calculation in heterogeneous media," Medical physics 16, 577-592 (1989)
   e. Ahnesjo, A. and M.M. Aspradakis, Dose calculations for external photon beams in radiotherapy. Physics in Medicine and Biology, 1999. 44(11): p. R99-155.
   f. K. R. Hogstrom, M. D. Mills and P. R. Almond, "Electron beam dose calculations," Phys Med Biol 26, 445-459 (1981).
   g. A Shiu, S Tung, K Hogstrom, J Wong, R Gerber, W Harms, J Purdy, R Ten Haken, D McShan, B Fraass. Verification data for electron beam dose algorithms, Medical Physics, Vol. 19, Issue 3 (1992).

h. Fraass, B., et al., American Association of Physicists in Medicine Radiation Therapy Committee Task Group 53: Quality assurance for clinical radiotherapy treatment planning. Medical Physics, 1998. 25(10): p. 1773-829.
i. Van Dyk J, Barnett R B, Cygler J E and Shragge P C. "Commissioning and quality assurance of treatment planning computers." Int J Radiat Oncol Biol Phys 26 261-73 (1993).

V. Assessment

The resident will present a report giving an overview of all the processes, describing the individual steps conceptually, and results from their modeling/commissioning process. Finally, the resident will take an oral exam. An understanding of the principles behind the processes as well as comprehension of other relevant information from the reading lists must be demonstrated.

7. Rotation Plan for Brachytherapy

Mentor: April Shorthouse
Duration: 8 weeks

Objectives: The resident will learn brachytherapy basics and applications such as radioactive decay, characteristics of radioactive sources, source calibration, calculation of dose distributions, different systems of implant dosimetry and implantation techniques. Basic definitions in dose specification will be covered, along with an overview of remote afterloading systems. During the rotation the resident will observe the medical physicist during brachytherapy procedures, perform source calibration checks, and perform low dose rate dosimetry calculations, including fundamental calculation techniques. The resident will develop an understanding of the imaging and treatment planning of brachytherapy, along with patient specific and system quality assurance. The resident will also learn the principles of prostate seed implant brachytherapy, MR image guided HDR brachytherapy, and eye plaque brachytherapy. During the rotation the resident will assist the medical physicist during brachytherapy procedures and reproduce treatment plans and quality assurance tests for multiple procedures.

I. Skills
   a. Safe source handling
   b. Brachy dosimetry
   c. Brachy Treatment Planning – HDR, LDR

II. Knowledge Base
   a. Radioactive Decay
   b. Radioactive sources for Brachytherapy
   c. Radiation Protection in Brachytherapy
   d. Radiobiology for Brachytherapy
   e. Calibration of Brachytherapy sources
   f. Dose Calculation Algorithms, TG43
   g. Systems of Implant Dosimetry
   h. Implantation Techniques
   i. Dose Specification
   j. HDR Remote Afterloaders
   k. Eye Plaques
   l. Prostate Seed Implants

III. Clinical Processes
   a. Source Calibration Check
   b. Commissioning Eclipse for HDR planning
   c. Eye Plaque Procedure
   d. HDR Vaginal Cylinders Planning and Delivery
   e. HDR Tandem and Rings Planning and Delivery
   f. HDR hybrid applicators Planning and Delivery
   g. HDR Interstitial cases for extremities Planning and Delivery
   h. HDR – Endobronchial - Planning and Delivery

IV. Reading List

a. AAPM TG 56: Code of practice for brachytherapy physics: Report of the AAPM Radiation Therapy Committee Task Group No. 56 (1997)
b. AAPM TG-43: Dosimetry of Interstitial Brachytherapy Sources, 1995.
c. AAPM Update of TG-43: A revised AAPM protocol for brachytherapy dose calculations, 2004.
d. ABS Consensus Guidelines for Interstitial Brachytherapy for Vaginal Cancer, 2012
e. ABS Consensus Guidelines for Locally Advanced Carcinoma of the Cervix, Parts 1, 2, 3, 2012.
f. Nag S et al, The American brachytherapy society recommendations for permanent prostate brachytherapy postimplant dosimetric analysis, IJROBP 46, 221 (2000)
g. ICRU. Dose and volume specification for reporting intracavitary therapy in gynecology. ICRU Report No. 38 and No. 89.
h. Pötter R, Tanderup K, Kirisits C, de Leeuw Astrid, Kirchheiner K, Nout R, et al. The EMBRACE II study: The outcome and prospect of two decades of evolution within the GEC-ESTRO GYN working group and the EMBRACE studies. Clinical and Translational Radiation Oncology 2018; 9:48-60.
i. The GEC-ESTRO Handbook of Brachytherapy (Radiobiology of LDR, HDR, PDR and VLDR Brachytherapy), https://user-swndwmf.cld.bz/Radiobiology-of-LDR-HDR-PDR-and-VLDR-Brachytherapy-GEC-ESTRO-Handbook-of-Brachytherapy/3#3
j. BrachyVision Algorithms Reference Guide (from My Varian)
k. BrachyVision Reference Guide
l. BrachyVision Instructions for Use

V. Assessment

Residents will prepare a rotation report, relating their clinical experiences with the underlying knowledge base. Residents will also keep a log of all observed procedures for competency evaluations. See appendix B for competency requirements. Finally, the resident will take an oral exam. An understanding of the principles behind the processes as well as comprehension of other relevant information from the reading lists must be demonstrated.

8. Rotation Plan for Treatment Planning

Mentors: Ernie Butler and Josh Hack
Duration: 12 weeks, roughly 6 weeks for each part.

Objectives: This rotation consists of two parts. The first part is the resident's introduction into treatment planning, which includes observing the entire clinical staff during the treatment planning process of multiple anatomical sites (Brain, Head and Neck, Lung & Esophagus, Breast, Abdomen & Rectum, Pelvis & Bladder, and Prostate). Residents will first simply observe, and then actively participate in the treatment planning and QA process for each site. Additionally, they will develop an understanding of the different 3D photon beam dose algorithms, electron beam dose algorithms, non-dosimetric calculations performed by the planning system (e.g., DRRs, contouring tools, etc.), and dose evaluation tools. They will learn about optimization, critical structure constraints, field-in-field techniques, IMRT, Knowledge Based Planning, and plan checking. The resident learns to import all necessary data, transfers all data to required information systems, and performs all required quality assurance for those plans. In the second part, the resident will learn about planning techniques and special considerations for Stereotactic Body Radiotherapy (SBRT) and Linac-based Stereotactic Radiotherapy. They will also learn about re-irradiation protocols and procedures. During this rotation, the resident will perform an end-to-end test with a phantom, from the CT scan, to planning, treatment and dosimetry measurement.

I. Skills
   a. Navigating through Eclipse
   b. Contouring
   c. Creating Beams
   d. Calculating Dose
   e. Transferring plans for QA
   f. Dicom Import-Export
   g. Taking measurements with MapCheck, SRS MapCheck
   h. Using a 3D Printer

II. Knowledge Base
   a. 3D Photon Beam Dose Algorithms
   b. Electron Beam Dose Algorithms
   c. Beam Geometries
   d. Normal Tissue Tolerances, conventional and hypofractionation
   e. BED and EQD2
   f. Dose Evaluation Concepts
   g. Treatment Planning System QA
   h. Data Transfer of Planning Data
   i. IMRT optimization
   j. Knowledge Based Planning

III. Clinical Processes
   a. Non-dosimetric commissioning of TPS
   b. Set up Phantoms for IMRT Verification in Eclipse
   c. Observe Management of Patients from Consult to Tx Delivery

        i. Brain
        ii. Breast
        iii. Head and Neck
        iv. Lung and Esophagus
        v. Abdominal and Rectum
        vi. Pelvis and Bladder
        vii. Prostate
    d. Create Treatment Plans – at least one for each of the sites listed in b.
    e. Perform Physics Initial Chart Checks on at least 2 plans for each of the sites listed in b.
    f. Create a custom 3D printed bolus

IV. Reading List

a. Quantitative Analysis of Normal Tissue Effects in the Clinic (QUANTEC), IJROBP 76, Issue 3, pp. S10-S19 (March 2010)
b. Tolerance of normal tissue to therapeutic irradiation, B Emami, J Lyman, A Brown, L Cola, M Goitein, JE Munzenrider, B Shank, LJ Solin, M Wesson, Int J Radiation Onc Bio Phys, Vol. 21, Issue 1 (1991).
c. Dose-volume histograms, RE Drzymala, R Mohan, L Brewster, J Chu, M Goitein, W Harms, M Urie, Int J Radiation Onc Bio Phys, Vol. 21, Issue 1 (1991)
d. Quality Assurance for Clinical Radiotherapy Treatment Planning (Reprinted from Medical Physics, Vol. 25, Issue 10) (1998) Radiation Therapy Committee Task Group #53; 57 pp
e. The Physics of Radiation Therapy, 4th ed., Khan, Chs.11-14, 19 and 20
f. Radiation Oncology Physics: A Handbook for Teachers and Students, IAEA Vienna Austria (2005)
g. BENTEL, G.C., "Radiation therapy planning", McGraw-Hill, New York, New York, U.S.A. (1996)
h. ICRU Report 71, Prescribing, Recording and Reporting Electron Beam Therapy
i. Eclipse Photon and Electron Algorithms Reference Guide (from myVarian)
j. AAPM Report 91 (TG 76): The management of Respiratory Motion in Radiation Oncology, 2006
k. AAPM TG 101: Stereotactic body radiation therapy: The report of AAPM Task Group 101 (2010)
l. TRS-483: Dosimetry of small static fields used in external photon beam radiotherapy: Summary of TRS-483, the IAEA-AAPM international Code of Practice for reference and relative dose determination, 2018
m. AAPM TG 218: Tolerance Limits and Methodologies for IMRT Measurement-Based Verification QA: Recommendations of AAPM Task Group No. 218 (2018)
n. AAPM Report 120 (TG-120): Dosimetry tools and techniques for IMRT, 2011.
o. AAPM TG 119: Commissioning Tests Instructions for Planning, Measurement, and Analysis, 2009
p. AAPM TG 176: Dosimetric effects caused by couch tops and immobilization devices, 2014
q. AAPM Report 203 (TG-203): Management of Radiotherapy Patients with Implanted Cardiac Pacemakers and Defibrillators, 2019
r. AAPM TG 36: Fetal Dose from Radiotherapy with Photon Beams

V. Assessment

The resident will present a report giving an overview of all the processes, describing the individual steps conceptually, and results from their treatment planning and QA. Finally, the resident will take an oral exam. An understanding of the principles behind the processes as well as comprehension of other relevant information from the reading lists must be demonstrated.

9. Rotation Plan for SRS and SRT

Mentor: Josh Hack
Duration: 4 weeks

Objectives: The SRS rotation is designed to give the medical physics resident experience in commissioning a stereotactic radiosurgery system. The resident first reviews the key principles of SRS then actively commissions a system (GammaKnife or HyperArc) by measuring the geometrical and dosimetric parameters of a clinically operational SRS system. The commissioning process involves all aspects of a clinical SRS system including localization, dosimetry, treatment planning, and delivery. The resident will participate alongside a staff physicist in clinical SRS treatments during this rotation

I. Skills
   a. Operation of Linac for SRS
   b. Operation of Gamma Knife
   c. Navigate through Eclipse and HyperArc modules
   d. Navigate through Gamma Plan

II. Knowledge Base
   a. Small Field Dosimetry
   b. SRS Beam Modeling
   c. Patient Immobilization
   d. Principles of Stereotaxy
   e. SRS QA principles

III. Clinical Processes
   a. Beam Data Acquisition
   b. Planning System Commissioning
   c. GK Treatment Planning
   d. Linac SRT Treatment Planning, with HyperArc
   e. Plan Checks
   f. GK Treatment Delivery
   g. Hyperarc Treatment Delivery
   h. GK Daily QA
   i. GK Monthly QA
   j. GK Annual QA

IV. Reading List
   a. AAPM report 54, Stereotactic Radiosurgery
   b. AAPM TG68, Med Phys 32(7), July 2005
   c. The Physics of Radiation Therapy, 4th ed., Khan, Ch.21
   d. Radiation Oncology Physics: A Handbook for Teachers and Students 2005 (IAEA), Ch.15.2 Stereotactic irradiation
   e. TRS-483: Dosimetry of small static fields used in external photon beam radiotherapy: Summary of TRS-483, the IAEA-AAPM international Code of Practice for reference and relative dose determination, 2018.
   f. Meeks, S.L., et al., Treatment planning optimization for linear accelerator radiosurgery. IJROBP,

1997. 41(1): p. 183-197.

V. Assessment

The resident will acquire data for 2 small collimator / fields. Upon successful demonstration of the acquired data, the staff physicist will give the resident data for all other collimator / field sizes. The resident will assemble a data book of the SRS planning data. He/she will format the data for entry into the planning system and for independent calculations.

The resident will perform QA on the systems, from localization to delivery giving quantitative analysis of the geometrical errors at each step of the process. The resident will be expected to observe as many actual SRS plans and treatments as possible during their rotation. Residents will also keep a log of all observed procedures for competency evaluations. See appendix B for competency requirements. The resident will take an oral exam at the conclusion of the rotation. The resident should be able to demonstrate knowledge of these processes and other relevant information obtained from the reading lists.

10. Rotation Plan for Imaging for Treatment Simulation, Verification, and Motion Management

Mentors: Brian Kurko and Alf Siochi
Duration: 8 weeks

Objectives: This rotation covers basic medical imaging physics, the design and application of different imaging systems, parameters that affect (1) the image quality, (2) treatment planning process, and (3) the treatment verification process of multiple imaging modalities. The resident will learn how to perform quantitative quality assurance tests to assess planar and 3-D image quality. Clinically important properties commonly encountered in the commissioning and continuing quality assurance of imaging systems are examined. During the rotation the resident will perform monthly and annual quality assurance on computed tomography (CT), portal imaging and cone-beam CT (CBCT). They will observe annual quality assurance tests on ultrasound, positron emission tomography (PET), and MR imaging systems. The medical physics resident will observe and participate in the Radiotherapy Simulation process, with an emphasis on imaging and geometric aspects of the process (setup geometry specification, immobilization, marking, tattoos, CT including x-ray technique, and transfer to planning system). The resident is expected to perform an end-to-end test in which a phantom is sent through the clinical process from CT simulation to image verification at a linear accelerator. The resident observes the use of combined imaging modalities in the simulation process (such as MR, PET, and CT), performs image registration (Rigid and Deformable) and follows patients through the optical image guided setup simulation process. The resident will observe 4DCT simulations, perform motion analysis, and perform quality assurance tests on surface guidance systems and gated delivery systems. The resident will also read about other imaging systems such as MR-CT and MR-Sim.

I. Skills
   a. Operating the CT scanner
   b. Operating the OBI for kV planar images and CBCT
   c. Operating the motion phantom
   d. Navigating MIM Maestro

II. Knowledge Base
   a. Radiotherapy Simulation concepts
   b. Imaging Science Concepts (Image quality)
   c. Image Registration Algorithms
   d. CT
   e. 4DCT
   f. Gated RT
   g. MR
   h. PET
   i. PET-CT
   j. CBCT
   k. Surface Guidance
   l. MR-CT
   m. MR-Sim

III. Clinical Processes
   a. CT Simulation
   b. Verification Sim - Patient Setup at Linac; 2D and 3D

c. Generation and use of Digitally Reconstructed Radiographs
d. Daily, Monthly, Annual QA for CT-Sim
e. Daily, Monthly, Annual QA for OBI
f. Daily, Monthly, Annual QA for Surface Guidance System
g. ATP and Commissioning of Image Registration System (MIM Maestro)
h. Observation of MR Daily and Monthly QA
i. Observation of PET Daily and Monthly QA
j. Observation of U/S Daily and Monthly QA
k. Motion Analysis
l. Rigid and Deformable Image Registration

IV. Reading List

a. Bushberg JT, Seibert JA, Leidholdt EM, Boone JM, "The essential physics of medical imaging," Lippincott Williams & Williams, 2002
b. Herman MG, Balter JM, Jaffray DA, McGee KP, Munro P, Shalev S, Van Herk M, Wong JW, "Clinical use of electronic portal imaging: report of AAPM Radiation Therapy Committee Task Group 58," Med Phys 28, 712-737 (2001)
c. Klein EE, Hanley J, Bayouth J, Yin F-F, Simon W, Dresser S, Serago C, Aguirre F, MA L, Arjomandy B, Liu C, "Task Group 142 report: Quality assurance of medical accelerators," Med Phys 36, 4197-4212 (2009)
d. Sherouse G, Novins K, Chaney E, Computation of digitally reconstructed radiographs for use in radiotherapy treatment design, Int J Radiat Oncol Biol Phys 18, 651-658 (1990)
e. Nicole M Wink, Michael F McNitt-Gray and Timothy D Solberg. Optimization of multi-slice helical respiration-correlated CT: the effects of table speed and rotation time. Phys. Med. Biol. 50 (2005) 5717–5729
f. AAPM TG-179: Quality assurance for image-guided radiation therapy utilizing CT-based technologies: A report of the AAPM TG-179, Medical Physics, Vol 39, Issue 4 (2012)
g. AAPM TG-66: Quality assurance for computed-tomography simulators and the computed-tomography-simulation process, 2003
h. AAPM TG-132: Use of Image Registration and Fusion Algorithms and Techniques in Radiotherapy, 2017.
i. AAPM TG-180: Image Guidance Doses Delivered During Radiotherapy: Quantification, Management, and Reduction, 2018
j. AAPM TG 284: Magnetic Resonance Imaging Simulation in Radiotherapy: Considerations for Clinical Implementation, Optimization, and Quality Assurance, 2021.
k. AAPM TG 126: PET/CT Acceptance Testing and Quality Assurance
l. AAPM TG 233: Performance Evaluation of Computed Tomography Systems
m. AAPM TG 104: The Role of In-Room kV X-ray Imaging for Patient Setup and Target Localization
n. AAPM TG 174: Utilization of [18F]Fluorodeoxyglucose Positron Emission Tomography ([18F]FDG-PET) in Radiation Therapy
o. AAPM TG 147: Quality assurance for nonradiographic radiotherapy localization and positioning systems
p. Wang, Ge, et al. Vision 20/20: Simultaneous CT-MRI – next chapter of multimodality imaging, Medical Physics, 42, 10, pp 5879-5889, 2015

V. Assessment

The resident will present a report giving an overview of all the processes, describing the individual steps conceptually, and results from their experimental studies and quality assurance verification measurements in IGRT. Current capabilities and remaining challenges of the use of multimodality imaging in radiation therapy treatment planning should be discussed. Finally, the resident will take an oral exam. An understanding of the principles behind the processes as well as comprehension of other relevant information from the reading lists must be demonstrated.

11. Rotation Plan for Special Procedures and Emerging Technology: Total Body Irradiation, Total Skin Electron, and Intraoperative Radiation Therapy

Mentor: April Shorthouse, Josh Hack, and Alf Siochi
Duration: 8 weeks

Objectives: This rotation prepares the medical physics resident to develop and commission these modalities in the clinic. The resident will develop a knowledge of the clinical basis for TBI, equipment, dosimetry issues in TBI, field uniformity, beam energy/penetration, blocking, beam data for TBI, and hand calculations. During the rotation the resident will observe/attend a TBI simulation, fabricate the blocks under supervision, verify the block attenuation on the machine, collect sufficient TBI beam data to perform hand calculations, perform measurements to determine efficacy of various beam modifiers (compensators, etc), attend/observe in-vivo dose measurements for TBI, perform hand calcs and compare to measured data. The resident gains an understanding of total skin electron and intraoperative irradiation. The resident will reinforce their basic knowledge of electron beam dosimetry and develop knowledge in the clinical basis and beam data required for TseT in such areas as field uniformity, beam energy/penetration, field shaping, patient alignment, collimation, and energy adjustment. During the rotation the resident will perform measurements of the scattering or "spoiling" effect on electron beams at different source distances and develop an understanding of intraoperative cone effects on electron beams, as well as the effect of different electron applicators. Electron shielding using lead sheets vs. cerrobend blocks will also be measured. The resident will gain experience in Intraoperative Radiation Therapy (IORT) through beam data acquisition and QA procedures for a mobile 50 kVp intraoperative x-ray system. The resident will observe the use of this system in the surgical setting, which involves aspects of radiation safety, dose calculation and multidisciplinary professional interaction. The resident will read about particle therapy, Ultrasound therapy, MRI Linacs, and PET-RT Linacs. The resident will observe theranostics procedures as they occur (Xofigo, Plavicto, Lutathera, I-131). The resident compiles a written report detailing the learning opportunities that were experienced during the rotation. A special procedures checklist is given to the resident. This guides the resident and faculty in what special procedures need to be observed and performed if possible.

I. Skills
   a. Operating the Zeiss Intrabeam system
   b. Setting up the TBI stand
   c. Operating the Linac in service mode

II. Knowledge Base
   a. Clinical Basis for TBI
   b. TBI Dosimetry Issues
   c. TBI Equipment
   d. TSET Methodology
   e. IORT Dosimetry
   f. Clinical Basis for IORT
   g. Proton Therapy
   h. MR Linacs
   i. PET Linacs
   j. Radiopharmaceuticals for theranostics
   k. Ultrasound Therapy (HIFU)

III. Clinical Processes

a. Commissioning a TBI system
b. TBI Simulation
c. TBI Treatment Planning
d. TBI Block Fabrication
e. TBI initial chart check
f. TBI delivery
g. In-Vivo dosimetry verification for TBI
h. Commissioning and Acceptance of IORT
i. IORT Equipment QA
j. IORT Patient QA
k. Experimental demonstrations of TSET Principles
l. Observe radiopharmaceutical administration – I-131, Xofigo, Plavicto

IV. Reading List

a. Van Dyk et al, AAPM Report 17 /TG-29 "Physical Aspects of Total and Half Body Irradiation"
b. Thomas, Oliver et al, "Long-term complications of total body irradiation in adults", IJBORP 49 (1) p.125, 2001
c. Faraci, Maura, et al, "Very late nonfatal consequences of fractionated TBI in children undergoing bone marrow transplant", IJORBP 63(5) p. 1568, 2005
d. The Physics of Radiation Therapy, 4th ed., Khan, Ch. 14, 18, 26
e. Intraoperative radiation therapy using mobile electron linear accelerators: Report of AAPM Radiation Therapy Committee Task Group No. 72. (2006); 43pp
f. Commissioning of a mobile electron accelerator for intraoperative radiotherapy, Michael D. Mills, Lisa C. Fajardo, David L. Wilson, Jodi L. Daves, and William J. Spanos. J. Appl. Clin. Med. Phys. 2, 121 (2001)
g. AAPM TG 224: comprehensive proton therapy machine quality assurance (2019)
h. AAPM TG 185: Clinical commissioning of intensity modulated proton therapy systems: Report of AAPM Task Group 185 (2020)
i. AAPM TG23 - Total Skin Electron Therapy: Technique and Dosimetry (1987)
j. Total skin electron irradiation techniques: a review. Postepy Dermatol Alergol 30(1), 2013, pp.50–55.
k. Total skin high-dose-rate electron therapy dosimetry using TG-51. Gossman et.al, Medical Dosimetry 29(4), 2004, pp. 285-287
l. Essentials of Theranostics: A Guide for Physicians and Medical Physicists, Sedlack, et al, Radiographics 2024; 44(1):e230097
m. AAPM TG 241: A medical physicist's guide to MRI-guided focused ultrasound body systems, 2021.

V. Assessment

The resident will present a report giving an overview of all the processes, describing the individual steps conceptually, and results from their experimental studies and quality assurance verification measurements for TBI, IORT, and TSET. They will summarize key points for the clinical and technological aspects of protons, MR Linacs, PET Linacs, theranostics, and radiation safety topics learned from observations of theranostic procedures. Finally, the resident will take an oral exam. An understanding of the principles behind the processes as well as comprehension of other relevant information from the reading lists must be demonstrated.

12. Rotation Plan for Shielding/ Room Design /Radiation Safety

Mentors: Mike Carroll and Alf Siochi
Duration: 5 weeks

Objectives: The resident will gain experience in designing facilities appropriate for radiation oncology equipment and review the associated radiation safety rules and regulations. The resident is asked to design the shielding for different types of rooms typically found in a radiation oncology department, including a high energy linear accelerator vault, a CT-Sim vault and an HDR vault. The resident consults with the physics mentor during the rotation to discuss the specifics of the design process. The mentor will propose alternate scenarios that force the resident to re-work the design using different clinical or occupancy criteria. The resident is also expected to perform portions of a radiation survey around existing vaults to gain practical experience in obtaining and analyzing low level radiation data. Radiation safety topics that were discussed as part of other rotations will be reviewed.

I. Skills
   a. Interpret architectural drawings
   b. Survey Meter Operation
   c. Linac / HDR / CT operation

II. Knowledge Base
   a. Radiation Safety Principles
   b. Regulatory Requirements – Federal and State
   c. Barrier material composition and preferences
   d. Neutron Production Process
   e. Barrier HVL / TVL
   f. Barrier Thickness Calculation Method
   g. Primary, Leakage and Scatter differences

III. Clinical Processes
   a. Identify sources of radiation exposure in typical radiation therapy facility
   b. Identify radiation safety principles in use for
      i. HDR Brachytherapy
      ii. Eye Plaques
      iii. Gamma Knife SRS
      iv. IORT
      v. External Beam Treatments
   c. Determine Design Goals based on recommended weekly limits for the public and for occupationally exposed workers
   d. Determine Workloads
      i. Linac
      ii. HDR
      iii. CT-Sim
      iv. PET-CT
   e. Determine Use Factors
   f. Determine Occupancy Factors
   g. Calculate Barrier Thicknesses

h. Measure actual exposure rates and annual exposure estimates outside linac/hdr vault

IV. Reading List

a. NCRP Report 49
b. NCRP Report 147
c. NCRP Report 151
d. The Physics of Radiation Therapy, 4th ed, Khan, Ch. 16
e. Shielding Techniques, 2nd ed, McGinley
f. AAPM TG 32 – Fetal Dose
g. Pawlicki, et al ASTRO’s Safety is No Accident, 2019.

V. Assessment

The resident will compile a report describing the individual steps that were taken to perform the shielding analysis. A second report should be written of the shielding requirements for the linear accelerator vault and HDR suite assigned in the learning opportunities. This report should be written as if the intended recipient was the architect in charge of designing the facility. A third report will be created estimating the yearly dose that one would expect in selected areas based on actual measurements.

While the bulk of this rotation involves a shielding design project, the resident's overall understanding of radiation safety will be evaluated during this rotation. Radiation safety training is a continuous process throughout the 2-year residency. Specific safety topics should have been addressed in previous rotations. The mentor will use this rotation to evaluate the resident on their understanding of safety issues by asking pertinent questions that the resident should be able to answer. Should the resident fail to answer any questions to the mentor's satisfaction he/she will be asked to write a report covering the specific safety issues that need further study.

The resident will take an oral exam at the conclusion of the rotation. The resident should be able to demonstrate knowledge of these processes and other relevant information obtained from the reading lists.

13. Rotation Plan for Radiation Oncology Informatics

Mentor: Alf Siochi
Duration: 4 weeks

Objectives: Residents will review data storage, retrieval, and networking concepts, and learn about the flow of information within the radiation oncology department. While these basic concepts are presented during the orientation, they will review it in greater depth. They will learn about DICOM-RT, HL7, FHIR, IHE-RO, Cybersecurity, business continuity, the QA of radiation oncology informatics systems, the basics of querying the Aria database, the IT responsibilities of a medical physicist and the collaboration with IT.

I. Skills
   a. Using the windows command line for network analysis
   b. Diagramming data flows
   c. Analyzing file structures
   d. Inspecting binary files
   e. Navigating Database Inspection and Analysis Software
   f. Navigating DICOM editors

II. Knowledge Base
   a. Encoding text and images
   b. File, Database, Compute and Application Servers
   c. Networks
   d. PACS
   e. Virtualization
   f. Communication Protocols
   g. DICOM-RT
   h. HL7 and FHIR
   i. IHE-RO and connectivity
   j. Cybersecurity
   k. Business Continuity and Disaster Recovery
   l. Backups and Archives
   m. Data Privacy and Protection
   n. QA of Radiation Oncology Informatics Systems
   o. Basics of Language Integrated Query (LINQ)
   p. Scripting and Programming

III. Clinical Processes
   a. Diagram the department's network
   b. Diagram data flow amongst applications and devices
   c. Determine all DICOM Application Entities on the network and review their configuration
   d. Transfer images from the CT to Eclipse
   e. Transfer RT plans and doses to MIM
   f. Review IHE-RO profiles for connectivity
   g. Inspect the Aria database using LinqPad
      i. Find patients for a given disease site
      ii. Determine patients that are scheduled on a particular linac

h. Anonymize a patient
i. Change the contents of a DICOM file in MIM
j. Create an Encounter in Aria
k. Create a Dynamic Document in Aria
l. Create a questionnaire in Aria
m. Review various aspects of Aria Data Admin and its configuration
n. Review configuration of Varian VSP
o. Design a dry run for Business Continuity and Disaster Recovery

IV. Reading List

a. Radiation Oncology Physics: A Handbook for Teachers and Students, IAEA Vienna Austria, 2nd ed., to be published, Chapter 18. Advance Draft of Chapter 18 from Dr. Siochi
b. Siochi RA, Balter P, Bloch CD, Bushe HS, Mayo CS, Curran BH, Feng W, Kagadis GC, Kirby TH, Stern RL. Information technology resource management in radiation oncology. Journal of applied clinical medical physics. 2009 Sep;10(4):16-35
c. Siochi RA, et al. AAPM TG 201: Quality Management of External Beam Therapy Data Transfer, 2021.
d. Starkschall and Siochi (eds.), Informatics in Radiation Oncology
e. Law and Lui et al; DICOM-RT and Its Utilization in Radiation Therapy, Radiographics 2009;29:655-667

V. Assessment

Residents will prepare a rotation report detailing the activities performed. For any activities involving the creation of software, dynamic documents or other electronic system involving user interaction, the lifecycle of the created product must be described. The resident will take an oral exam at the conclusion of the rotation. The resident should be able to demonstrate knowledge of these processes and other relevant information obtained from the reading lists.

14. Rotation Plan for Administration, Leadership, and Program Development

Mentor: Alf Siochi
Duration: 3 weeks

Objectives: Residents will learn about project management, budgeting, accreditation, and the business and logistics operations of a radiation therapy department, including human resource management, staffing levels, market studies, mining business data, and workload projections. They will learn about leadership skills and qualities, organizational structure, billing, process improvement, and hazard analysis. This will be done with a project case study requiring the analysis of a proposal for a new clinical service. They will review the department policy and procedure for new technology or procedure proposal and development.

I. Skills
   a. Negotiation
   b. Communication
   c. Organization
   d. Teamwork

II. Knowledge Base
   a. Radiation Oncology Billing
   b. Project Management
   c. Hazard Analysis and Mitigation
   d. Continuous Quality Improvement
   e. Accreditation and Regulatory Agencies

III. Clinical Processes
   a. Diagram the reporting structure of the Radiation Oncology Department
   b. Auditing a patient's activity capture in Aria
   c. Perform an FMEA
   d. Develop a process improvement plan
   e. Develop a new technology or clinical service proposal
   f. Preparing an equipment budget for a new single linac clinic
   g. Estimating staffing needs / managing personnel
   h. Querying Aria for numbers of consults, treatment fractions, plans and preparing workload projections

IV. Reading List
   a. AAPM TG100
   b. AAPM Code of Ethics
   c. 2017 AAPM Annual Meeting - Session: Professional Council Symposium: Communicating with Patients: A Vital Skill for a Medical Physicist
   d. 2015 AAPM Spring Clinical Meeting - Session: Professional Economics
   e. 2014 AAPM Annual Meeting - Session: Lean Tools and Methods
   f. 2014 AAPM Spring Clinical Meeting - Session: Leadership and Project Management
   g. https://www.astro.org/ASTRO/media/ASTRO/Patient%20Care%20and%20Research/PDFs/Safety_is_No_Accident.pdf
   h. https://conferences.iaea.org/indico/event/162/contributions/7277/attachments/3203/3851/IAEA-

_Radiotherapy_Facilities_Master_Planning_and_Concept_Design_Considerations.pdf

V. Assessment

Residents will prepare a rotation report, explaining the management of a single linac clinic. The resident should be able to demonstrate knowledge of these business processes and other relevant information obtained from the reading lists.

Appendix B - Competencies

Residents must practice special procedures and tasks to attain a level of proficiency that enable them to perform independently. For each procedure, they must observe it, perform it under guidance, then perform it independently but under the supervision of a qualified medical physicist. The minimum number of times these activities should be done to be considered competent is listed in the table below. To achieve competency, the lead faculty member for the competency must sign off on the resident's activity log. For maintenance of competency (MOC), a certain number of procedures must be performed solo with a given frequency until graduation.

Residents need to keep track of the dates and times when the activity was performed. See the Competency Tracking Form in Appendix C.

Competency	Observations	Guided Performance	Solo Performance / MOC
HDR Cylinder	3	3	3 / 1 per month
HDR Tandem and Ring	3	3	3 / 1 per month
HDR hybrid/interstitial	3	3	3 / 1 per month
HDR Source Exchange QA	1	1	1 / 1 per quarter
HDR Daily QA	3	3	3 / 2 per month
GK Daily QA	3	3	3 / 2 per month
GK Monthly QA	1	2	2 / 1 per quarter
GK Planning	3	3	3 / 2 per month
GK Delivery	3	3	3 / 2 per month
SRT – Linac Based – HyperArc Plan	2	2	2 / 1 per quarter
SBRT Plan	2	2	2 / 1 per month
SBRT Delivery	2	2	2 / 2 per month
IORT Day of Treatment QA	1 (mock)	2 (mock)	2
IORT Quarterly QA	1	1	1
IORT Annual QA / Loaner QA	1	1 (mock)	1
IORT Treatment	1 (mock)	2 (mock)	2
IMRT QA	3	3	3 / continuous duties
Prior RT Data Request and Import	2	2	2 / continuous duties
Plan Checks	3	3	3 / 1 per week
Chart Checks	3	3	3 / 1 per week
3d Printed Bolus	1	1	1
4DCT Motion Analysis	3	3	3 / continuous duties
Image Registration	3	3	3 / continuous duties
Re-irradiation Analysis	3	3	3 / 2 per month
Linac Daily QA	1	1	1
Linac Monthly QA	1	1	1 / continuous duties
Linac Annual QA	1	1	1
Linac Troubleshooting	2	2	2 / continuous duties

Appendix C –Forms

Descriptions of Forms

Faculty's Evaluation of Resident Performance on Rotation
The form includes written report grade, oral exam grade, comments, recommendations, overall recommended grade of pass, fail or conditional pass and remediation if conditional pass.

Primary Mentor's Evaluation of Resident Performance on Rotation
The form contains similar information as the Faculty Evaluation Form but summarizes the information from all faculty and provides a final grade.

Resident's Evaluation of Rotation
The resident will provide an evaluation of the rotation content, resources, and training environment. They will also provide a self-assessment of their performance on the rotation.

Resident's Evaluation of Mentor
The resident will provide an evaluation of the mentor, training methodology and approach.

Resident Monthly Meeting Minutes
The program director will record the minutes of the monthly meeting standing agenda items on this form and provide it to the resident and the steering committee.

Quarterly Progress of Resident
The program director will use the forms evaluating the resident since the beginning of the quarter to prepare the progress report. This will be provided to the resident and the steering committee.

Competency Tracking Form
The resident needs to log the observations, guided performance, and solo performance of various special procedures and tasks. Each Competency will need its own tracking form. No patient names are to be recorded, but rather information about the case such as the treatment site, date, time, and faculty involved in the case must be included for each activity.

Program Graduate Evaluation Form
Graduates of the program will be sent a survey form to collect statistics for the program and feedback to improve the program.

Annual Work Environment Survey
Residents will fill out this survey to evaluate their work environment. They will provide this to the program director.

Annual Program Director Evaluation Survey
Residents will fill out this survey to evaluate the program director. They will provide this to the physician member of the steering committee.

Faculty's Evaluation of Resident Performance on Rotation

This form is to be completed by faculty members who reviewed the written report and participated in or attended the oral exam.

Resident: ________________________ Faculty: ________________________

Rotation: ____

Written Report Score (note: this includes the oral presentation of the report) (1= poor, 5 = excellent): __

Comments: ____

____

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Oral Exam: Two examiners are assigned to prepare and ask 5 questions.
NOTE: 5 minutes per question. All faculty in attendance score the answers.
For each question on the exam, provide the ABR oral exam score (68 – 72) and the main topic of the question.
ABR scoring guide: 68 = minimum, 69 = significant knowledge gaps, 70 = average, 71 = advanced, 72 = expert

Examiner 1

Question #	Topic	Score	Notes
1			
2			
3			
4			
5			

Examiner 2

Question #	Topic	Score	Notes
1			
2			
3			
4			
5			

Overall oral exam score (68 to 72): __

Overall Grade: (Pass, Conditional, Fail): ________________

If Conditional, provide Remediation Recommendation: ______________________________________

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____

____

Signature: ____ Date: ________________

Primary Mentor's Evaluation of Resident Performance on Rotation

This form is to be completed by the primary mentor.

Resident: ________________________ Mentor: _________________________

Rotation: ____

Written Report Average (from all evaluating faculty) Score (1= poor, 5 = excellent): __

Mentor Final Report Score (1= poor, 5 = excellent): __

Comments: ____

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Oral exam Average (from all evaluating faculty) Score (68 to 72): ___

Mentor Final Oral Exam score (68 to 72): ___

Comments: ____

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____

Overall Grade: (Pass, Conditional, Fail): ________________

If Conditional, provide Remediation Recommendation: ____

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____

Signature: ____ Date: ________________

Resident's Evaluation of the Rotation

Rotation: ____

Mentor(s): ______________________________________ Evaluation Date: ___________

Provide a score of 0 to 5 for the following items.
(0 = NA, 1=Strongly Disagree, 2 = Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree)

1. The rotation and its content were relevant to my training. ____
2. The rotation and its content were well designed. ____
3. Adequate time and resources were provided during this rotation. ____
4. All equipment needs necessary for this rotation were available and in expected condition. ____
5. Software and computer resources were readily available. ____
6. The condition of both the facility and learning environment were as expected. ____
7. This rotation provided me with many opportunities to learn something new. ____

Self-Assessment:

Areas where I did well on this rotation: ____

Areas where I needed help on this rotation: ____

Comments:

Resident's Evaluation of the Mentor

Rotation: ____
Mentor(s): ______________________________________ Evaluation Date: ____________

Provide a score of 0 to 5 for the following items.
(0 = NA, 1=Strongly Disagree, 2 = Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree)
1. The mentor clearly presented the rotation goals and objectives. ____
2. The mentor clearly presented the expectations for the rotation. ____
3. The mentor presented materials in an organized manner with emphasis of major points. ____
4. The mentor demonstrated a command of the subject matter. ____
5. The mentor presented materials at an appropriate level. ____
6. The mentor was enthusiastic about the subject matter. ____
7. The mentor was available and responsive to the resident's needs. ____
8. The mentor provided sufficient oversight and supervision. ____
9. The mentor demonstrated interest in your learning. ____
10. The mentor encouraged the resident to ask questions and discuss ideas. ____

Overall Evaluation of Mentor: (1=Unsatisfactory, 2=less than Satisfactory 3 = Satisfactory, 4=more than satisfactory, 5=Outstanding)
Score: ____

Comments:

Resident’s Monthly Meeting with Program Director – Minutes

Resident: ________________________________
Program Director or Designee: ________________________________
Date: ____________

1) Review the progress of the resident towards achieving the current rotation learning objectives:
2) Review any comments of the rotation mentor with the resident
3) Review the progress of the resident towards proficiency for various special procedures
4) Review the progress of the resident for development of soft skills, professionalism, or other aspects of practice that are not explicitly covered in rotations
5) What is going well?
6) What is not going well?
7) Suggestions for improvement
8) What would you like the steering committee to know?

Quarterly Progress of Resident

Resident: ________________________________
Program Director: ________________________________
Evaluation Period: Year: ____ Quarter: _____

Conference Participation (number attended):
Medical Physics and Radiation Oncology journal clubs: ____
Mortality and Morbidity: ____
Quality Improvement and Safety Meeting: ____
Radiation Oncology Chart Rounds: ____
Medical Physics Division meetings: ____

Summary of Progress towards Competencies:

Area	Status	Area	Status

Summary of Performance on Rotations this quarter:

____
____
____

Program Director's Comments:

____
____
____
____
____
____

Signatures:

Program Director	Date	Resident	Date

Competency Tracking Form

Resident: ________________________________
Competency: ________________________________

Level (observe, guided, solo)	Case Details	Date	Time	Faculty initials

Signing this form indicates that:
The resident has completed all required observations, guided performances and solo performances of the special procedure or task.
The resident has achieved competency for this special procedure or task.

Signatures:

________________________________ ________________ ____________________________ ________________

Lead Faculty Physicist for Procedure/Task Date Resident Date

Program Graduate Evaluation Form

Name: ______________________________
Residency Start Date: _____________
Residency Graduation Date: _____________
Survey Date: _____________

Current Occupation: _______________________
Certifying Board (ABR, ABMP, CCOMP): _______________
Date of Board Certification: _____________

We would like your feedback to help us improve our program. Please comment on the following:

Program Strengths:

____
____
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____
____
____

Program Weaknesses:

____
____
____
____
____
____

Program Relevance and Preparation for your career:

____
____
____
____
____
____

Annual Work Environment Survey

Please fill out this form by May 31st and give the completed form to the program director.

Survey Date: _____________

Regarding the workplace, please rate the following items on a scale from 1 (not satisfied) to 5 (very satisfied):
(if you are leaving the program early, then rate the items in terms of their importance as a reason for leaving the program, where 1 = not important and 5 = very important)

1. Orientation / Training ____
2. Professional Development ____
3. Interactions with colleagues ____
4. Interactions with supervisor ____
5. Interactions with medical staff ____
6. Adequate job autonomy ____
7. Workplace stress ____
8. challenges at work ____
9. Opportunities for career growth ____
10. Use of my skills or experience ____
11. Barriers in the workplace ____

Would you recommend this medical physics residency program? Yes ___ No ___

Regarding your work environment, what has contributed most to your satisfaction?

____
____
____
____
____
____

If you could change one thing about your work environment, what would it be?

____
____
____
____
____
____

Annual Program Director Evaluation Survey

Please fill out this form by May 31st and give the completed form to the radiation oncologist on the steering committee.

Survey Date: _____________

Regarding the Residency program director, please rate the following items on a scale from 1 (not satisfied) to 5 (very satisfied):
(if you are leaving the program early, then rate the items in terms of their importance as a reason for leaving the program, where 1 = not important and 5 = very important)

1. Supported my professional growth ____
2. Was open to ideas and concerns ____
3. Gave feedback in a constructive and caring manner ____
4. Kept me informed about issues important to my job ____
5. Gave me ideas about how to do a better job ____
6. Listened to my concerns and took action to improve things ____
7. Was accessible if needed ____
8. Overall, I was satisfied ____