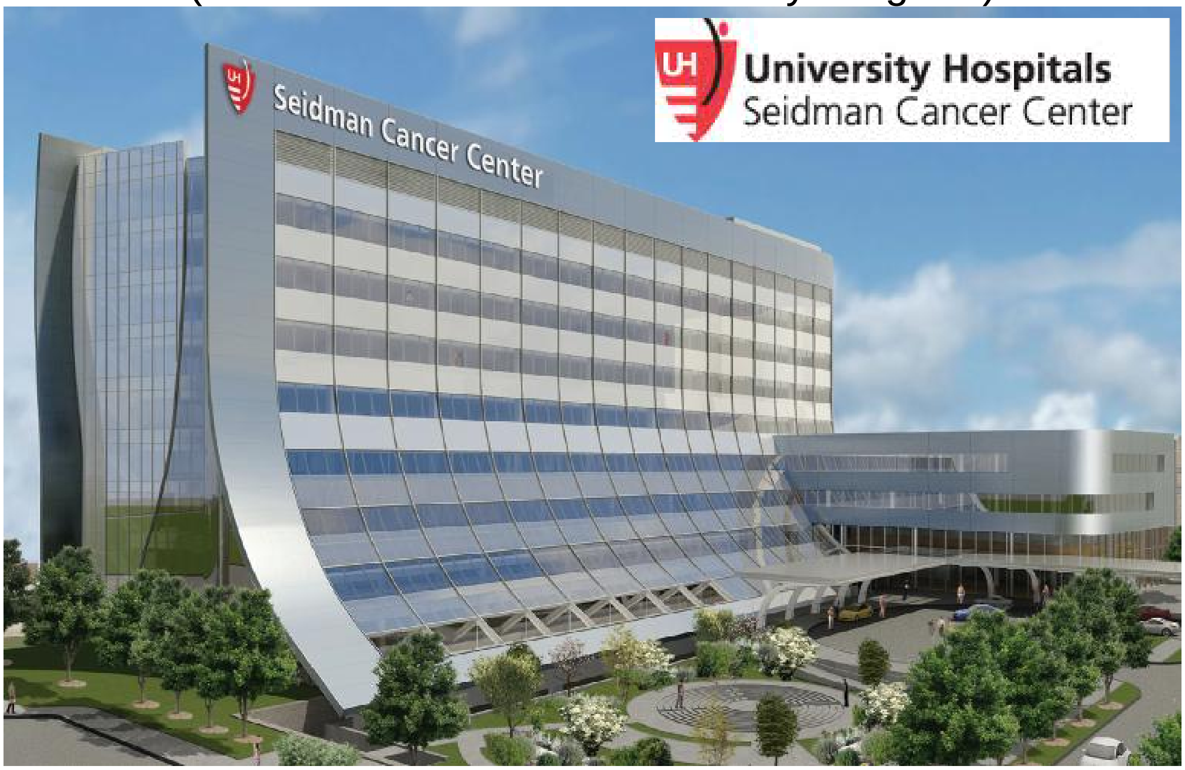
UHCMC-SCC Medical Physics Program Summary

(CAMPEP Accredited Residency Program)



A brief statistics of the Department of Radiation Oncology

RT Centers	Distance from Main Campus	No. of Physicians	No. of Physicists	Major Tx equipment	No. of pt. treatment per day (average)
Main Campus (CMC & SCC)	0 miles	9	10	Linac (3), Mobetron (1), GammaKnife (1), HDR (1), LDR Barchy, Proton (1)	100
Chagrin Highlands Health Center SCC	9 miles	1	1	Linac (1)	20
Westlake Health Center	16 miles	1	1	Linac (1)	20
Southwest General Hospital	19 miles	1	1	Linac (1)	15
Lake Health/ Univ. Hospitals SCC	25 miles	2	1	Linac (2), HDR (1)	35
Geauga Med. Center SCC	27 miles	1	1	Linac (1), LDR Brachy	15
Mercy Medical Center	32 miles	1	1	Linac (2), LDR Brachy	35
Firelands Regional Medical Center	65 miles	1	1	Linac (1)	15
Parma Comm. Gen. Hospital	16 miles	1	1	Linac (1)	10
Portage Medical Center	37 miles	1	1	Linac (1)	15
Salem Reg. Med. Center	78 miles	1	1	Linac (1)	20
6 MD residents and 3 Physics residents	TOTAL =	20	20	Linac (15), Mobetron (1), GammaKnife (1), HDR (2), LDR (3), Proton (1)	300 (approx.)

HDR*	LDR/ PSI*	IORT*	TBI/TSEI*	IMRT/ VMAT*	Gammaknife (SRS)*	Cyberknife/ Linac-based (SBRT)*
350	100	15	25	850	150	800 (fx)

* per year

Last update: October 2018

Clinical Rotation Summary (2-year full-time training program)

Radiation Oncology Clinical Medical Physics Resident Rotation - Year 1

Sequence	**Duration** (month)	**Rotation** (rotation #)	**Mentor**
1	0.5	Orientation	**TP** (YZZ, GP, JJ)
2	1.5	Dosimetric Systems (#1)	**VC** (YZZ, GP, ZX)
3	1.5	Treatment Planning I (#2)	**GP** (DD, MM, WS, TP)
4	1.5	Treatment Planning II (#3)	**GP (**DD, MM, WS, YZZ)
5 (flexible)	2.0	Linear Accelerator Acceptance, Commissioning, and Annual QA (#4)	**VC** (PG, GP, ZX, AB)
6 (flexible)	1.5	Treatment Planning System (TPS) Modeling, Acceptance, Commissioning and Annual QA (#5)	**YZZ** (PG, VC, JY)
7	1.0	Imaging for Simulation, Planning and Treatment Verification (IGRT) (#6)	**YZZ** (GP, AB, VC)
8	1.0	Professionalism and Ethics (#7)	**PG** (RJ, VC, JJ)
	1.5	Vacation / Sick Leave / Family Leave / Conferences	**TP** (YZZ, JJ)

Radiation Oncology Clinical Medical Physics Resident Rotation - Year 2

Sequence	Duration (month)	**Rotation** (rotation #)	**Mentor**
9 (flexible)	2.0	Brachytherapy (#8)	**TP** (ZX, VC, BK, YZZ)
10	2.0	SRS and SBRT (GK and CK/Linac-based) (#9)	**YZ** (YZZ, JY, TP)
11	1.5	Room Design, Radiation Protection and Safety (#10)	**PG** (RJ, VC, AB, JJ)
12	1.5	Physicist of the Day (POD) (#11)	**TP** (VC, YZZ, GP)
13	2.0	Proton Therapy (#12)	**RP** (RJ, MS)
14	1.5	Catch-up (#1-12) or Special Procedures (#13) or Dedicated Research (#14)	**TP, VC** (YZZ, GP, JJ)
	1.5	Vacation / Sick Leave / Family Leave / Conferences	**TP** (YZZ, JJ)

Attendance at the following conferences is required (at least 75%):
Grand Rounds: Tuesdays, 8:00-9:00am
Chart Rounds: Monday and Wednesday, 7:30-9:00am
Joint Presentation with CCF: 2nd Tuesdays, 3:00-4:00pm
Journal Club: 4th Wednesday, 3:00-4:00pm

A total of 12 core rotations out of the 14 rotations must be completed for the resident candidate to be eligible for completion of the program requirements. The mentor of the clinical rotation evaluates the resident's performance at the end of each rotation (see sefl-study Appendix J). Quarterly review of the resident's progress is performed by the Directors (see self-study Appendix J).

Residency Curriculum

A. Requirements for Successful Program Completion

The Clinical Medical Physics Residency Program is 2 years in length to include a minimum of 12 rotations, attendance at case conferences, recommended readings, a maximum of 2 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 monthly and annual quality assurance on the linear accelerators, perform patient-specific IMRT quality assurance measurements with a gantry-mounted diode array and/or with film and ionization chambers as well as perform electron cutout measurements. The resident will become familiar with all aspects of treatment planning (from manual calculation to computer-assisted planning) for both electron and phone clinical cases. As the resident progresses through the clinical rotations, they begin to participate in post-planning and weekly chart review, high dose rate brachytherapy quality assurance, and assist the "physicist of the day" providing first response physics support to all activities within the clinic. Attendance in required courses (if any) and required number conferences (75% attendance) are mandatory. The resident is expected to participate in research studies and publish in scientific conferences/meetings such as AAPM and ASTRO as well as in journals. The resident must follow the department policy and behave as per clinical, departmental and institutional norms. The progression of the resident through these clinical responsibilities is evaluated and discussed with the resident during regular weekly meetings with the program directors. The purpose of these meetings is to discuss with the residents their progression through the program; i.e., successful completion of each rotation, participation in conferences and courses, their evolution in QA participation, and general performance within the department. These meetings also provide the residents an opportunity to voice any concerns they may have about the learning environment. Minutes of the meetings are taken and stored on the L-drive of a server computer which is accessible to department staffs and residents.

B. Design and Content

Medical physics residents are trained by rotating through a minimum 12 (core) out of 14 possible comprehensive clinical and didactic rotations (details are below in this section and also in Appendix C). Each rotation has an evaluation for the resident's performance at the end of the rotation (Appendix J1). Written acceptance of the Clinic Module and/or graded Radiation Laboratory are administered and reviewed following each clinical rotation. All core rotations (total 12) must be completed for the resident to be eligible for completion of the program requirements. However, the resident is encouraged to complete all 14 rotations.

The evaluation is specified either as a written "Clinical Competency" or graded "Radiation Laboratory" review of the rotation subspecialty. The highlights of the knowledge base acquired and the learning opportunities they experience in each rotation are summarized below in the order experienced by the resident.

Orientation of New Resident: A new resident starts with a two week long formal rotation in the department and facilities to become familiar with the department and staff as well as to become comfortable in the work environment. A senior medical physicist (normally the Director or Associate Director of the program) is in-charge of this orientation. Details regarding new resident orientation are provided in Appendix C.

1. Dosimetric Systems rotation (core): Two weeks orientation of the new resident is followed by the Dosimetric Systems rotation which is the first in the series of the 15 rotations (see rotation schedule in Appendix C). 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 and radiochromic film, diodes, thermoluminescent dosimeters, diode arrays and ion chamber arrays. All radiation measurement systems to be used by the resident throughout the program are to be operated by the resident during this rotation under the supervision of a qualified Medical Physicist. 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 multiple phantom systems, with the most complex system (3D water tank) being operated by the resident during linear accelerator (LINAC) annual QA and calibrations. The resident compiles the signed clinical module and associated documentation regarding the learning opportunities that were experienced during the rotation. The rotation concludes with an oral exam or a presentation organized by the mentor, who is a qualified staff physicist. For more details see Appendix C.

2. Treatment Planning rotation I (core): This rotation is the resident's introduction into treatment planning, which includes observing the Medical Dosimetrists during the treatment planning process of multiple anatomical sites (Brain, Head and Neck, Lung & Esophagus, Breast, Abdomen & Rectum, Pelvis & Bladder, Skin, Sarcoma, whole CNS, and Prostate) and develops treatment plan for each site observed. Additionally, the resident 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. The resident performs treatment plans cases for wide range of anatomical sites, transfers all data to required information systems, and performs all required quality assurance for those plans. The resident compiles a clinical module detailing the learning opportunities that were experienced during the rotation. The rotation concludes with an oral exam or a presentation organized by the mentor. For more details see Appendix C.

3. Treatment Planning rotation II (core): This rotation is focused on Intensity Modulated Radiation Therapy (IMRT) and Volumetric Modulated Arc Therapy (VMAT). The medical physics resident will be introduced to optimization, critical organ doses, parallel vs. serial organs, typical dose-volume constraints, and dose calculation algorithms specific to IMRT/ VMAT, film as a dose measuring device, small field dosimetry, and the basics of imaging for IMRT/ VMAT. During the rotation, residents will follow a patient from the CT scan process all the way through the initial treatment delivery. This will require shadowing the CT therapists, the dosimetrist, the medical physicist, and the linac therapists. With the first patient, it will be observation. With the second patient, it will be supervised performance of the tasks. With a phantom, it will be an independent performance of the tasks. There are a fair number of IMRT/ VMAT patients (H&N, Lung, GI and GU) in our department, and there will be no lack of opportunities. The resident will work through the Competency Module detailing the learning opportunities that were experienced during each part of the process. The resident compiles a clinical module detailing the learning opportunities that were experienced during the rotation. The rotation concludes with an oral exam or a presentation organized by the mentor. For more details see Appendix C.

4. Linear Accelerator (Linac) Acceptance, Commissioning and Annual QA rotation (core): During this rotation, the medical physics resident performs the tasks necessary to accept and commission a Linac, including the annual QA of the system. The resident will develop an understanding of linear accelerator fundamentals relevant to commissioning, beam optics, flattening, and control parameters, collimation, 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 Pinnacle 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 (including TG-51 calibration) will be performed for one of the systems during this rotation. The resident compiles the signed clinical module and associated documentation regarding the learning opportunities that were experienced during the rotation. The rotation concludes with an oral exam given by the mentor. For more details see Appendix C.

5. TPS Modeling, Acceptance and Commissioning rotation (core): The TPS modeling rotation provides the medical physics resident the opportunity to accept and commission a three-dimensional treatment planning system. During the rotation resident will determine all input data needed to characterize the CT scanner, linear accelerator, photon beam energy, and electron beam energy. The resident will utilize data acquired during the previous rotations to commission the system for 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. The resident compiles clinical module detailing the learning opportunities that were experienced during the rotation. The rotation concludes with an oral exam or a presentation organized by the mentor. For more details see Appendix C.

6. Imaging for Simulation, Planning, Treatment Verification rotation - IGRT (core): During this rotation, the medical physics resident will gain an understanding of the Radiotherapy Simulation process, ranging from CT-based virtual simulation to 4DCT and the utility of multimodality imaging. Also, the resident will follow a patient through the CT (PET/CT) simulation process, with an emphasis being on 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 understand the virtual simulation process and perform a virtual simulation procedure on a phantom – from start to finish with portal film verification. Finally, the resident will observe the use of combined imaging modalities in the simulation process (such as MRI and CT for SRS) and follow a patient through the image-guided setup simulation process. The resident will develop knowledge in basic medical imaging physics and the terms that impact image quality, the design and application of different electronic portal imaging systems, and the necessary processes for commissioning and continuing quality assurance of portal imaging systems. During the rotation, the resident will perform monthly and annual quality assurance on 4DCT and different portal imaging systems. The resident compiles a written report detailing the learning opportunities that were experienced during the rotation. The rotation concludes with an oral exam given by the mentor. The treatment verification part of the rotation is structured to provide the medical physics resident with knowledge of portal imaging systems used either during the simulation/planning process or during treatment verification. In the IGRT part of the rotation, the resident will participate in the clinical implementation of prospective and retrospective CT image acquisition, gated treatment delivery, treatment planning process for IGRT (including multi-modality image registration and fusion), and data export/import into each system. The resident will observe and participate in the IGRT treatment planning and delivery process and understand the functionality of the systems utilized. Quality assurance of every aspect of each IGRT system will be studied, from image acquisition through verification and treatment delivery. The resident compiles the signed clinical module and associated documentation regarding the learning opportunities that were experienced during the rotation. The rotation concludes with an oral exam or a presentation organized by the mentor. For more details see Appendix C.

7. **Professionalism and Ethics rotation (core):** In this rotation, the resident will learn about his/her legal, professional, and ethical commitments as a medical physicist. The NRC and the state regulations governing the practice of radiation therapy will be reviewed. The resident will participate in hospital inspections conducted by state or other agencies providing oversight of the radiation therapy program. The resident will gain an understanding of the cooperative trials process and entities involved: NRG Oncology, Imaging and Radiation Oncology Core (IROC), and the hospital's Institutional Review Board (IRB). The resident will also learn about the ethical and professional aspects of medical physics such as patient and colleague relationships, ethical encounters or dilemmas, employer/employee relationships, conflicts of interest, human/ animal research principles, scientific misconduct and publication ethics as well as the role of leadership in the profession. The resident is expected to be very familiar with the legal, professional, and ethical issues related to medical physics practice. The rotation concludes with an oral exam or a presentation organized by the mentor. For more details see Appendix C.

8. **Brachytherapy rotation (core):** The rotation is structured to provide the medical physics resident with knowledge of brachytherapy basics and brachytherapy applications. The resident should develop a knowledge base including 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 and various applicators. During the rotation, the resident will observe the medical physicist during brachytherapy procedures, perform source calibration checks, and perform computerized and hand calculated dosimetry to include fundamental calculation techniques. The resident should develop the imaging and treatment planning of brachytherapy, along with patient-specific and system quality assurance. The resident will learn the principles of both interstitial brachytherapy (e.g. prostate seed implantation for LDR) and intracavitary brachytherapy (e.g., cervix, uterus/vagina treatment for HDR). During the rotation, the resident will assist the medical physicist during brachytherapy procedures and reproduce treatment plans and quality assurance tests for multiple procedures. The resident compiles the signed clinical module and associated documentation regarding the learning opportunities that were experienced during the rotation. The rotation concludes with an oral exam or a presentation organized by the mentor. For more details see Appendix C.

9. **Stereotactic Radiosurgery (SRS) and Stereotactic Body Radiation Therapy (SBRT) rotation (Core):** The SRS-SBRT rotation is designed to give the medical physics resident experience with a intracranial and extracranial hypofractionated radiation therapy with GammaKnife and/or CyberKnife/ Linac. The resident first reviews the key principles of SRS and SBRT, then actively participates in both the treatment process and the quality assurance process. The treatment process for a patient involves image acquisition, treatment planning, and treatment delivery. The resident will participate alongside a staff physicist in clinical SRS and SBRT treatments during this rotation. The resident compiles the signed clinical module and associated documentation regarding the learning opportunities that were experienced during the rotation. The resident is given an oral exam or asked for a presentation at the end of the rotation. For more details see Appendix C.

10. **Room Design, Radiation Protection and Radiation Safety rotation (core):** The shielding and design rotation is structured to give the medical physics resident experience in designing facilities appropriate for radiation oncology equipment. 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 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. The resident compiles a written report detailing the learning opportunities that were experienced during the rotation. The rotation concludes with an oral exam or a presentation organized by the mentor. For more details see Appendix C.

11. Physicist of the Day (POD) rotation (core): This rotation will provide the resident with the fundamental knowledge and practical training for proficiency with day-to-day clinical operations as the floor physicist. Resident performs all clinical tasks under the supervision of a senior staff physicist, i.e. the mentor. The resident is expected to learn and become experience with all the details about the clinical tasks that need to be performed in the clinical workflow and the responsibilities of the physicist on clinical duty. The rotation concludes with an oral exam or a presentation organized by the mentor. For more details see Appendix C.

12. Proton Therapy rotation (Core): In this rotation, the resident will be given an overview of the proton therapy physics and treatment techniques. The resident will learn through observation and direct participation in the clinical physics activities. The resident will participate in technical aspects of patient care under the supervision of staff proton physicists. These activities include quality assurance (daily, monthly, annual, and patient-specific), patient treatment simulation, treatment planning, review of patient positioning and immobilization. The resident is expected to gain experience in both technical and clinical aspects of proton therapy. At the end of the rotation the resident's performance will be evaluated by the mentor by taking an oral examination or a presentation on proton therapy. For more details see Appendix C.

13. Special Procedures rotation (elective I): Total Body Irradiation (TBI), Total Skin Electron Irradiation (TSEI), and Intraoperative Irradiation (IORT). This rotation prepares the medical physics resident to develop and commission a total body irradiation program. The resident will develop 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, attend/observe in-vivo dose measurements for TBI, perform hand calcs and compare to diode results. Additionally, 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 TSEI and IORT, equipment, dosimetry issues in TSEI and IORT, field uniformity, beam energy/penetration, field shaping, collimation and patient alignment, collimation and energy adjustment. During the rotation, the resident will develop an understanding of intraoperative cone effects on electron beam, as well as the effect of different electron applicators (including IORT cones and TSEI beam definer on effective source position). Electron shielding using lead sheets vs. cerrobend blocks will also be measured. The resident compiles a written report detailing the learning opportunities that were experienced during the rotation. The rotation concludes with an oral exam or a presentation organized by the mentor. For more details see Appendix C.

14. Dedicated Research rotation (elective II): Resident may opt for dedicated research time, provided he/she is in a good position to complete the 12 core rotations successfully and on-time. Research topic(s) can be elected based on the resident's interest and availability of a suitable guide/ supervisor. Details of this rotation are provided in Appendix C.

Research and Development

The UH Cleveland Medical Center (UHCMC), (note that Seidman Cancer Center is a part of UHCMC) Clinical Trials Unit (CTU) provides a centralized infrastructure to support cancer related research. The CTU's mission is to provide the highest quality nursing, data management, regulatory, financial and quality assurance services for the conduct of clinical trials for the benefit of our patients and investigators. Many of our UHSCC clinical trials are offered at regional sites and affiliates. Faculty members of the Radiation Oncology Department participate in clinical trials of various cooperative groups such as RTOG, ACOSOG, COG, GOG, ZCOG, NSABP, NCCTG, and ACRIN. There are several funded projects (funded by federal, agencies state, industries) in the department in which some of the physics faculties along with the faculties from Radiation Oncology and Radiation Biology are involved as principal investigators (PIs), Co-PIs, and Co-Investigators (Co-Is). The Medical Physics division is actively involved in translational research. There are collaboration opportunities for the residents with basic scientists in Radiation Biology as well as scientists in Bioengineering, Electrical and Computer Engineering, and Radiology. Participation in these research and development activities provides the residents a very good opportunity to extend their knowledge and experience in the field. Moreover, these activities enable the residents to attend scientific conferences and meetings as well as publish in peer-reviewed journals.

C. Evaluation of the Curriculum

The mentor responsible for a given rotation proposes the creation or modification of the rotation's design and content. At the end of each rotation, the resident is also given the evaluation form for evaluating the content of the clinical rotation as well as to evaluate the faculty mentor (see Appendix J2). The resident submits the evaluated form and suggestions to the program director. Additionally, at the end of the residency program (at the end of final rotation), the resident is asked to evaluate the whole program and make suggestions for improvement (see Appendix J3). The proposal by the mentor and the comments by the residents are then reviewed by the program director and associate directors for approval and implementation. Suggestions about content, effectiveness, and areas of improvement of the program from each of the mentors of the rotations and the residents are reviewed and compiled by the program director and associate directors. The compiled review report is then presented to the CMPRP Education Committee for further discussion and implementation. The clinical rotation contents and the residency program curriculum are revised as per any modifications approved by the program director and/or the CMPRP Education Committee. Then the modifications are informed to the residents in writing. Any substantial modifications are implemented in such a way so that they do not affect the current residents adversely.

Note: All the referred Appendices can be found in the "Medical Physics Program Self-Study" document available in the residency website.
https://case.edu/medicine/radiation-oncology/media/school-of-medicine/radiation-oncology/documents/Self-Study_PhyResidency_(UHCMC)_Oct2018.pdf

Application Requirements

Applicants will submit the following items for initial evaluation:

1. Official transcripts from college and graduate schools
2. A personal essay describing career goals and interest in medical physics
3. Three letters of recommendation from the applicant's college/graduate instructors, and/or employers
4. A curriculum vitae

Applications are primarily accepted through the AAPM MP-RAP (CAP) - http://www.aapm.org/MPRAP/

Note: Candidates with either an MS degree or a PhD degree are encouraged to apply.

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More details about the program can be found below in the webpage (download **Self Study pdf**).

Website: http://casemed.case.edu/radonc/education/physics-residency/