

## **Monthly Resident Review Session Outline**

Both PGY1 and PGY2 residents will participate in monthly review sessions guided by the radiation oncology physics staff. The topics for the review sessions are listed below and applicable references are provided to assist the residents in their learning and understanding of the topics. Residents are encouraged to prepare prior to the review sessions and be prepared to verbalize and articulate ideas, explain concepts and clinical practices pertaining to the subjects. Residents are also encouraged to reach out to other staff physicists for guidance and direction.

Following the review sessions, staff physicists will offer constructive feedback to the residents. The staff physicist will complete an evaluation form and score the residents performance as either pass, condition or fail. Should the resident condition on the topic, the staff physicist may require the resident to review various publications and meet again to discuss the deficiencies. Should the resident fail a specific review session topic, the program director will create a plan of action to enhance the residents understanding and ability to articulate the topic.

(References indicated in blue are located on the physics network drive within the /Physics Publications/RESIDENCY folder. The remaining references are physically located within the department of radiation oncology)

### **PGY-1**

#### **1. August Simulation & Treatment**

- 1.1. Sim Setup
- 1.2. Sim Techniques
- 1.3. 4DCT
- 1.4. Breath Hold / Gating
- 1.5. Treatment Setup
- 1.6. Treatment Delivery
- 1.7. Filming
  - 1.7.1.Port film
  - 1.7.2.kV
  - 1.7.3.CBCT
  - 1.7.4.
- 1.8. Warmup
- 1.9. Chart Checks
  - 1.9.1.Weekly
  - 1.9.2.Plan Check
  - 1.9.3.PHYSICS CHECK
  - 1.9.4.Final Physics Check

## Resident Review Session Schedule

### September Treatment Planning

- 1.10. Import
- 1.11. Laser Set
- 1.12. Contouring
- 1.13. Fusion
- 1.14. Beam Setup
  - 1.14.1. Energy
  - 1.14.2. Field Size
  - 1.14.3. Angles
  - 1.14.4. Bolus
- 1.15. Prescriptions
  - 1.15.1. Dose Points
  - 1.15.2. Normalization
    - 1.15.2.1. Volume vs Point
  - 1.15.3. DVH
- 1.16. 3D Conformal
- 1.17. IMRT
  - 1.17.1. Step-and-Shoot
  - 1.17.2. Sliding Window
  - 1.17.3. VMAT
  - 1.17.4. Optimization
- 1.18. SBRT
- 1.19. IGRT
- 1.20. R&V
- 1.21. MU Calcs
  - 1.21.1. FSCF
  - 1.21.2. TMR
  - 1.21.3. PDD
  - 1.21.4. Blocking
  - 1.21.5. Inverse Square
- 1.22. IMRT QA
- 1.23. Electron Cutouts
- 1.24. Wedges
  - 1.24.1. Physical
  - 1.24.2. Dynamic

#### References:

- 1) BENTEL, G.C., "Radiation therapy planning", McGraw-Hill, New York, New York, U.S.A. (1996).
- 2) Geisinger Dosimetry Staff
- 3) PODGORSAK et al "Review of Radiation Oncology Physics: A Handbook for Teachers and Students" IAEA Vienna Austria (May 2003)
- 4) INTERNATIONAL JOURNAL OF RADIATION ONCOLOGY-BIOLOGY-PHYSICS "Quantitative Analysis of Normal Tissue Effects in the Clinic" (QUANTEC), IJR Volume 76, Issue 3 (March 2010).

**2. October Linac QA**

- 2.1. TG-40, 142
- 2.2. Mechanicals
- 2.3. Safety / Interlocks
- 2.4. Outputs
  - 2.4.1.TG-51
- 2.5. EPID QA

*References:*

- 1) *AMERICAN ASSOCIATION OF PHYSICISTS IN MEDICINE (AAPM), "Comprehensive QA for Radiation Oncology", AAPM Task Group 40 Report; Med. Phys. 21, 581–618 (1994).*
- 2) *AMERICAN ASSOCIATION OF PHYSICISTS IN MEDICINE (AAPM), "Quality assurance of medical accelerators", AAPM Task Group 142 Report; (September 2009).*
- 3) *PODGORSAK et al "Review of Radiation Oncology Physics: A Handbook for Teachers and Students" IAEA Vienna Austria (May 2003)*

**3. November OBI QA**

- 3.1. kV
  - 3.1.1.Iso Check
  - 3.1.2.Iso Shift
  - 3.1.3.Blade Position
  - 3.1.4.Leeds
- 3.2. CBCT
  - 3.2.1.Iso Check
  - 3.2.2.Iso Shift
  - 3.2.3.CatPhan

*References:*

- 1) *AMERICAN ASSOCIATION OF PHYSICISTS IN MEDICINE (AAPM), "Quality assurance of medical accelerators", AAPM Task Group 142 Report; (September 2009).*
- 2) *Yoo et al, "A quality assurance program for the on-board imager", Med Physics, 33, 11, 4431-4447 (2006).*
- 3) *Bissonnette et al, "Quality assurance for image-guided radiation therapy utilizing CT-based technologies: A report of the AAPM TG-179", Med Physics, 39, (4), (1946-1963), (2012).*

**4. December CT QA**

- 4.1. CatPhan
  - 4.1.1.Slice Thickness
  - 4.1.2.Low Contrast
  - 4.1.3.High Resolution
  - 4.1.4.CT Numbers
- 4.2. Wilke
- 4.3. Lasers
- 4.4. Annual
  - 4.4.1.kV
  - 4.4.2.mA Linearity
  - 4.4.3.Dose

*References:*

- 1) *AMERICAN ASSOCIATION OF PHYSICISTS IN MEDICINE (AAPM), "Quality assurance for computed tomography simulators and the computed-simulation process: Report of the AAPM Radiation Therapy Committee Task Group No. 66", AAPM Task Group 66 Report; Med. Phys. 30(10), 2762-2792 (October 2003).*

**5. January Linac Annuals**

- 5.1. Mechanicals
  - 5.1.1. Star Shots
- 5.2. Beam
  - 5.2.1. Flatness/Symmetry
  - 5.2.2. Output vs Gantry
  - 5.2.3. Dose Rate Linearity
  - 5.2.4. MU Linearity
  - 5.2.5. FSCF / Cone Factors
  - 5.2.6. Energy Checks / PDD
  - 5.2.7. Transmission Factors
  - 5.2.8. Chamber Factors

**References:**

- 1) AMERICAN ASSOCIATION OF PHYSICISTS IN MEDICINE (AAPM), "Quality assurance of medical accelerators", AAPM Task Group **142** Report; (September 2009).
- 2) PODGORSAK et al "Review of Radiation Oncology Physics: A Handbook for Teachers and Students" IAEA Vienna Austria (May 2003)
- 3) KHAN, F., "The physics of radiation therapy", Williams and Wilkins, Baltimore, Maryland, U.S.A. (1994).

**6. February Brachytherapy**

**7.**

- 7.1. LDR
  - 7.1.1. Isotopes
  - 7.1.2. Planning
    - 7.1.2.1. Pre-Plan
    - 7.1.2.2. Intra-Op
    - 7.1.2.3. Post Plan
  - 7.1.3. Radiation Safety
    - 7.1.3.1. Handling
    - 7.1.3.2. Shielding
    - 7.1.3.3. Receipt
    - 7.1.3.4. Logging
    - 7.1.3.5. Surveys
    - 7.1.3.6. Return
    - 7.1.3.7. Patient Instruction

**References:**

- 1) PODGORSAK et al "Review of Radiation Oncology Physics: A Handbook for Teachers and Students" IAEA Vienna Austria (May 2003)
- 2) KHAN, F., "The physics of radiation therapy", Williams and Wilkins, Baltimore, Maryland, U.S.A. (1994).
- 3) AMERICAN ASSOCIATION OF PHYSICISTS IN MEDICINE (AAPM), "AAPM recommendations on dose prescription and reporting methods for permanent interstitial brachytherapy for prostate cancer", AAPM Task Group **137** Report; (November 2009).
- 4) AMERICAN ASSOCIATION OF PHYSICISTS IN MEDICINE (AAPM), "Code of Practice for brachytherapy physics". AAPM Task Group **56** Report; (October 1997).

**8. March HDR**

- 8.1.1. Planning
  - 8.1.1.1. Cylinder
  - 8.1.1.2. Tandem & Rings
  - 8.1.1.3. Breast
  - 8.1.1.4. Interstitial
- 8.1.2. Daily QA
- 8.1.3. Source Change
  - 8.1.3.1. Activity
  - 8.1.3.2. Timer Linearity
  - 8.1.3.3. Safety

**References:**

- 1) PODGORSAK et al "Review of Radiation Oncology Physics: A Handbook for Teachers and Students" IAEA Vienna Austria (May 2003)
- 2) AMERICAN ASSOCIATION OF PHYSICISTS IN MEDICINE (AAPM), "High Dose -Rate brachytherapy treatment delivery", AAPM Task Group **59** Report; (April 1998).
- 3) AMERICAN ASSOCIATION OF PHYSICISTS IN MEDICINE (AAPM), "Remote Afterloading Technology", AAPM Task Group **41** Report; (May 1993).

## Resident Review Session Schedule

- 8.1.3.3.1. Emergency Stop
- 8.1.3.3.2. PrimeAlert Battery Backup
- 8.1.3.3.3. Power Fail
- 8.1.3.3.4. Survey

### 9. **April SRS**

- 9.1.1. Sites
- 9.1.2. Immobilization
- 9.1.3. Planning
  - 9.1.3.1. MLC
    - 9.1.3.1.1. Dynamic
    - 9.1.3.1.2. Static
  - 9.1.3.2. Cones
- 9.1.4. Treatment
  - 9.1.4.1. CBCT
  - 9.1.4.2. TaPo
- 9.1.5. QA
  - 9.1.5.1. Wendell-Lutz
  - 9.1.5.2. Lasers

#### References:

- 1) *PODGORSAK et al "Review of Radiation Oncology Physics: A Handbook for Teachers and Students" IAEA Vienna Austria (May 2003)*
- 2) *AMERICAN ASSOCIATION OF PHYSICISTS IN MEDICINE (AAPM), "Stereo-tactic radiosurgery", AAPM Task Group 42 Report, AAPM, New York, New York, U.S.A. (1995).*

### 10. **May GWV – Ethics**

- 10.1 Ethical Principles, Historical Perspective
- 10.2 Ethical Encounters or Dilemmas
- 10.3 Professional Conduct
- 10.4 Clinical Practice Ethics
- 10.5 Research Ethics
- 10.6 Educational Ethics

#### References:

- 1) *AMERICAN ASSOCIATION OF PHYSICISTS IN MEDICINE (AAPM), "Code of Ethics for the American Association of Physicists in Medicine: Report of Task Group 109", AAPM Task Group 109; Med. Phys. 36(1), (2009).*
- 2) *AMERICAN ASSOCIATION OF PHYSICISTS IN MEDICINE (AAPM), "Recommended ethics curriculum for medical physics graduate and residency programs: Report of Task Group 159", AAPM Task Group 159 Report; (August 2010).*

### 11. **June GWV – (No Review Session)**

## **PGY-2**

### **12. July Detectors**

- 12.1. Ionization Chambers
  - 12.1.1. Cylindrical
  - 12.1.2. Parallel Plate
- 12.2. TLD
- 12.3. Diodes
  - 12.3.1. Scanning
- 12.4. Film
- 12.5. MOSFET
- 12.6. GM Tubes
  - 12.6.1. Theory & Operation
    - 12.6.1.1. Saturation
- 12.7. Scintillation Detectors
  - 12.7.1. Theory & Operation
    - 12.7.1.1. Spectrum
      - 12.7.1.1.1. Escape Peaks (Single – Double)
      - 12.7.1.1.2. Compton Edge

*References:*

- 1) *PODGORSAK et al "Review of Radiation Oncology Physics: A Handbook for Teachers and Students" IAEA Vienna Austria (May 2003)*

### **13. August Dosimetry**

- 13.1. Kerma
- 13.2. Beta
- 13.3. Stopping Power
- 13.4. Mass Attenuation Coefficient
- 13.5. Bragg-Gray
- 13.6. TG-51
- 13.7. TG-21

*References:*

- 1) *PODGORSAK et al "Review of Radiation Oncology Physics: A Handbook for Teachers and Students" IAEA Vienna Austria (May 2003)*
- 2) *AMERICAN ASSOCIATION OF PHYSICISTS IN MEDICINE (AAPM), "A protocol for the determination of absorbed dose from high-energy photon and electron beams", AAPM Task Group 21 Report; Med. Phys. 10, 741-771 (1983).*
- 3) *AMERICAN ASSOCIATION OF PHYSICISTS IN MEDICINE (AAPM), "AAPM's TG-51 protocol for clinical reference dosimetry of high energy photon and electron beams", AAPM Task Group 51 Report; Med. Phys. 26, 1847-1870 (1999).*

**14. September Shielding**

- 14.1. Primary
  - 14.1.1. Workload
    - 14.1.1.1. IMRT vs  
Conventional vs  
Arc/Radiosurgery
  - 14.1.2. Use Factors
  - 14.1.3. Occupancy
- 14.2. Secondary
- 14.3. Maze/Door
- 14.4. Neutrons
- 14.5. Surveys
- 14.6. CT Shielding
- 14.7. Brachy Shielding

*References:*

- 1) *McGINLEY, "Shielding techniques for radiation oncology facilities", Medical Physics Publishing, Madison, Wisconsin, U.S.A. (1998).*
- 2) *PODGORSAK et al "Review of Radiation Oncology Physics: A Handbook for Teachers and Students" IAEA Vienna Austria (May 2003)*
- 3) *NATIONAL COUNCIL ON RADIATION PROTECTION AND MEASUREMENTS (NCRP), Report 151, "Structural Shielding Design and Evaluation for Megavoltage X and Gamma-Ray Radiotherapy Facilities", NCRP, Bethesda, MD (2005).*

**15. October Radiation Safety**

- 15.1. NRC/DEP
- 15.2. Regulations
- 15.3. Handling
- 15.4. Meters
  - 15.4.1. Calibration
- 15.5. Monitoring
  - 15.5.1. Badges
  - 15.5.2. Personal Dosimeters
  - 15.5.3. Reporting
    - 15.5.3.1. Monthly/Quarterly/Annual
  - 15.5.4. Declared Pregnant Workers (DPW)
  - 15.5.5. Inspections
- 15.6. Shipping/Receiving
  - 15.6.1. Wipe Tests
  - 15.6.2. Surveys
  - 15.6.3. Log books
  - 15.6.4. Labeling
  - 15.6.5. Leak Tests

*References:*

- 1) *PODGORSAK et al "Review of Radiation Oncology Physics: A Handbook for Teachers and Students" IAEA Vienna Austria (May 2003)*
- 2) *AMERICAN SOCIETY FOR RADIATION ONCOLOGY (ASTRO) "Safety is No Accident", 2012*
- 3) *INTERNATIONAL ATOMIC ENERGY AGENCY (IAEA) Report 17. "Lessons Learned from Accidental Exposures in Radiotherapy", 2000*

**16. November External Beam Planning Systems**

- 16.1. Algorithms
  - 16.1.1. Modified Batho
  - 16.1.2. Pencil Beam
  - 16.1.3. Convolution/Superposition
  - 16.1.4. Monte Carlo
- 16.2. Heterogeneity Corrections
- 16.3. Acceptance
- 16.4. Commissioning
  - 16.4.1. Scanning
    - 16.4.1.1. Detectors
    - 16.4.1.2. Fields Sizes
    - 16.4.1.3. MLC Position
    - 16.4.1.4. Small fields
    - 16.4.1.5. MLC
  - 16.4.2. Modeling
- 16.5. QA

*References:*

- 1) *PODGORSAK et al "Review of Radiation Oncology Physics: A Handbook for Teachers and Students" IAEA Vienna Austria (May 2003)*
- 2) *AMERICAN ASSOCIATION OF PHYSICISTS IN MEDICINE (AAPM), "Tissue Inhomogeneity corrections for Megavoltage Photon Beams", AAPM Task Group 65 Report; (August 2004).*
- 3) *AMERICAN ASSOCIATION OF PHYSICISTS IN MEDICINE (AAPM), "Quality assurance for clinical radiotherapy treatment planning", AAPM Task Group 53 Report; Med. Phys. 25(10), 1773-1829 (1998).*
- 4) *AAPM Medical Physics Practice Guideline 5a: "Commissioning and QA of Treatment Planning Dose Calculations – Megavoltage Photon and Electron Beams", JACMP 17 (2016).*

**17. December Brachytherapy Calculations**

- 17.1. TG-43
  - 17.1.1. Anisotropy
  - 17.1.2. Geometry
  - 17.1.3. Dose Rate Constant
  - 17.1.4. Gamma Constant
  - 17.1.5. Inverse Square
- 17.2. Planning Systems
  - 17.2.1. Patterson-Parker
  - 17.2.2. Quimby
  - 17.2.3. Paris
  - 17.2.4. Real-time
  - 17.2.5. "Bard" Method
  - 17.2.6. Nomogram
- 17.3. Calibration
  - 17.3.1. Air Kerma
  - 17.3.2. Apparent Activity
  - 17.3.3. Activity
- 17.4. TPS QA
  - 17.4.1. 2<sup>nd</sup> Check
  - 17.4.2. Quarterly QA

*References:*

- 1) *PODGORSAK et al "Review of Radiation Oncology Physics: A Handbook for Teachers and Students" IAEA Vienna Austria (May 2003)*
- 2) *AMERICAN ASSOCIATION OF PHYSICISTS IN MEDICINE (AAPM), "A revised AAPM protocol for brachytherapy dose calculations", AAPM Task Group 43 Report; (March 2004).*



**18. January Special Procedures**

- 18.1. Total Body Photons
  - 18.1.1. Setup
  - 18.1.2. Measurements
  - 18.1.3. Shielding
- 18.2. TBE
  - 18.2.1. Setup
  - 18.2.2. Measurements
- 18.3. Pediatrics
  - 18.3.1. Cranio-Spinal
- 18.4. CyberKnife
- 18.5. GammaKnife
- 18.6. Protons
- 18.7. Xofig Electronic Brachytherapy
- 18.8. Eye Applicators (Sr-90)
- 18.9. Injectables
  - 18.9.1. SIRSphere
  - 18.9.2. Sr-90/Yt-90 (Bone Mets)
  - 18.9.3. I-131

*References:*

- 1) *PODGORSAK et al "Review of Radiation Oncology Physics: A Handbook for Teachers and Students" IAEA Vienna Austria (May 2003)*
- 2) *AMERICAN ASSOCIATION OF PHYSICISTS IN MEDICINE (AAPM), "The Physical Aspects of Total and Half Body Photon Irradiation", AAPM Report 17; (June 1986).*

**19. February Acceptance & Commissioning**

- 19.1. Acceptance
  - 19.1.1. Tests
  - 19.1.2. Responsibilities
- 19.2. Commissioning
  - 19.2.1. Calibration
  - 19.2.2. Surveys
  - 19.2.3. Scanning
  - 19.2.4. Modeling
  - 19.2.5. "End-to-end" Testing
- 19.3. Policies & Procedures
- 19.4. Special Procedures
  - 19.4.1. SRS
  - 19.4.2. IMRT
  - 19.4.3. IGRT

*References:*

- 1) *PODGORSAK et al "Review of Radiation Oncology Physics: A Handbook for Teachers and Students" IAEA Vienna Austria (May 2003)*
- 2) *AMERICAN ASSOCIATION OF PHYSICISTS IN MEDICINE (AAPM), "Accelerator beam data commissioning equipment and procedures: Report of the TG-106 of the Therapy Physics Committee of the AAPM", AAPM Task Group 106 Report; (September 2008).*
- 3) *AAPM Medical Physics Practice Guideline 2a: "Commissioning and quality assurance of X-ray based image-guided radiotherapy systems", JACMP 15 (2014).*

**20. March GWV (No Review Session)**

**21. April GWV (No Review Session)**

**22. May (Open)**

**23. June (Open)**