

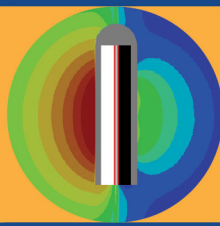
HDR UNIT ACCEPTANCE, COMMISSIONING & QA

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2017



AAPM
SUMMER
SCHOOL



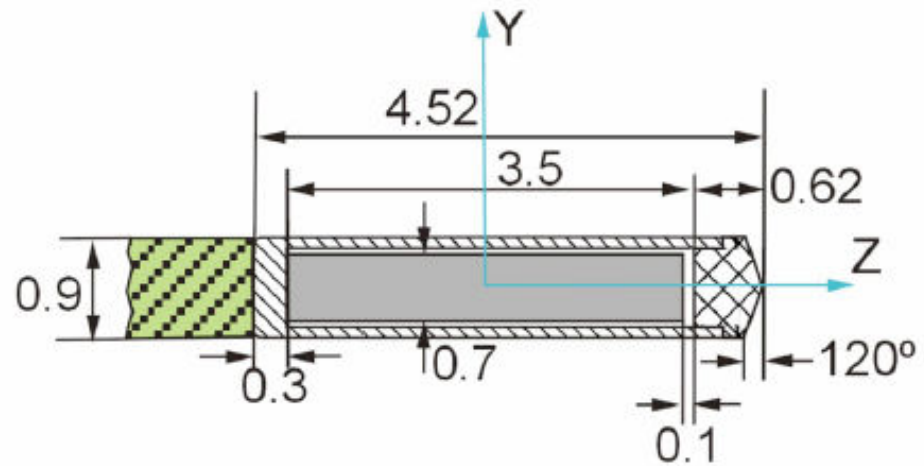
CLINICAL
BRACHYTHERAPY
PHYSICS

In conjunction with the
American Brachytherapy Society

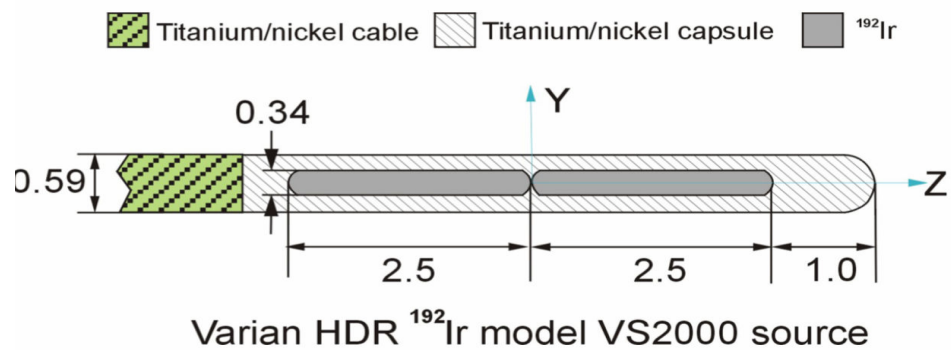
FLEXITRON TECHNOLOGY



 316L steel weld  ^{192}Ir  Air



VARISOURCE TECHNOLOGY

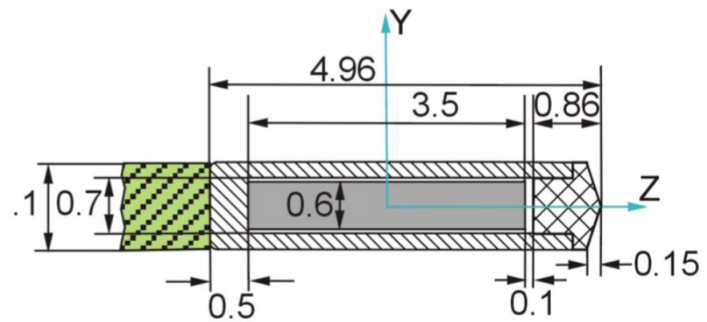


GAMMAMED TECHNOLOGY



Steel cable 316L steel capsule

316L steel weld ^{192}Ir Air



GammaMed HDR ^{192}Ir model 12i source

ACCEPTANCE & COMMISSIONING

HDR Program:

References: (TG41, TG43, 43U1, TG53, TG56, TG186, The GEC ESTRO Handbook of Brachytherapy, ACR Practice Guidelines and Technical Standards)

- Acceptance testing: prior to use
- Calibration protocol
- Commissioning (source, transfer tubes, applicators, TCS)
- Daily/monthly (optional)/quarterly/annual Q.A. program

ACCEPTANCE

Purpose of acceptance is to test that the HDR unit

I. Meets all safety standards (safety checks has to be adapted to the local standards)

1. Safety interlocks,
2. emergency functionality
3. Radiation indicators/Signage
4. Radiation surveys: facility & afterloader

II. Meets specification of the unit

1. Source strength,
2. Positional accuracy of the source (Applicator and transfer tubes)
3. Timer accuracy (timer linearity, timer accuracy, and source transit time),
4. Treatment planning system: functionality

COMMISSIONING

- Test the accuracy of all system specific parameters in the treatment process (Source wire length, transfer tube length, offsets required by the unit, validity of applicator modeling)
- Input and verify the source data into TPS
- Review and test all available dose algorithms (Intersource, heterogeneity, and applicator effects on dose)
- For image guided brachytherapy test the integration and perform commissioning tests on all image guidance systems.
- Development of operational procedures including a detailed emergency plan of action & training for emergency situations. Natural (hurricane), minor (HDR system faults) and major (source stuck, medical condition of patient)
- Establishment of complete quality control procedures for the program
- Appropriate training of all staff involved in HDR patient care (RTT, Nurse, Physician, Dosimetrist, other Physicists)

QUALITY ASSURANCE

1. Safety checks: All functional (Daily/Quarterly/Annual)<http://www.nrc.gov/reading-rm/doc-collections/cfr/part035/part035-0643.html>

2. Source position accuracy < 1mm. (Daily/Quarterly/Annual)

3. Temporal accuracy < 2% (Daily/Quarterly/Annual)

4. Dosimetry: calibration <3%, TPS < 2% (Quarterly/Annual)

5. Treatment QA: Daily QA of the afterloader, Plan verification by QMP, Second check of dwell times, written directive, applicator-TT connection verification by QMP/Physician, AU&QMP presence @treatment delivery, Pre/post patient survey

Covered in other Workshops:

6. Applicator QA: (Initial/ Annual)

7. Planning system QA (TG-53)

8. Image guidance QA (TG-128)

ACCEPTANCE AND COMMISSIONING

Daily QA

HDR System

- Source positioning accuracy with film (<1mm)
- Transfer tubes condition (avoid surprises with source stuck)
- Timer termination (reasonable)

Console

- Console source position indicator
- Catheter attachment lock system
- Emergency stop (inside and outside the room)
- Treatment interrupt system
- Date and time on control unit (incorrect decay)

Safety

- Warning light outside the room
- Door interlock system
- Emergency plan in place with proper tools (forceps, lead container, surgical supplies, syringes)
- Radiation monitor inside and outside the room
- Communication system: camera and intercom (backup plan for both)
- Survey meter/hand held radiation monitor
- Catheter with/without connected applicator: force the system to fail.
- Verification of treatment time (calc.)

ACCEPTANCE AND COMMISSIONING

Quarterly QA

- Source exchange (wipe test, log book&records, calibration, safety checks, TPS, TCS, Decay tables, independent calc system)
- All of daily checks
- Backup batteries (radiation monitor, HDR unit, HDR Computer)
- Evaluate all transfer tubes
- TG 56 Recommendations

Annual QA

- Repeat acceptance testing
- Review/update all documentation, procedure checklists and Forms
- Perform a dry run to evaluate the emergency plan/response in place