QARC
QUALITY ASSURANCE REVIEW CENTER

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3D Conformal Treatment Planning Benchmark

This benchmark is a sample case used to evaluate the treatment planning process at your institution, i.e., data acquisition, PTV and OAR delineation, conformal treatment planning (not IMRT), dose calculation and monitor unit calculations. The aim is to demonstrate your capability to participate fully in 3D protocol studies. Your benchmark will be evaluated by QARC (Quality Assurance Review Center), and will also be shared with the RPC (Radiological Physics Center) to assess the accuracy of your dose calculation. The benchmark will cover all 3D protocols and you will not be expected to complete separate benchmarks for different 3D protocols.

The CT image set may be downloaded from the QARC website (www.QARC.org).

Institutions are strongly encouraged to submit this 3D Conformal Benchmark in digital format. Treatment planning data may be submitted in either RTOG Data Exchange Format or Dicom RT. Digital data shall include planning CT, structures, dose, plan, and dose-volume histograms. The data may be submitted on a CD or sent electronically via ftp to QARC. Instructions for digital submissions may be found on the QARC website - www.QARC.org, under Digital Data, RT Treatment Planning. If submitted by hardcopy, two (2) full sets of data should be sent to the address below.

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RPC Radiological Physics Center
Excellence through Quality Assurance

Section 1: Description of 3D Conformal Benchmark

Purpose:
This benchmark is a sample case used to evaluate the treatment planning process at your institution, i.e., data acquisition, PTV and OAR delineation, conformal treatment planning (not IMRT), dose calculation and monitor unit calculations. The aim is to demonstrate your capability to participate fully in 3D protocol studies. This benchmark will be used by both QARC (Quality Assurance Review Center) and the RPC (Radiological Physics Center) to assess your treatment planning and your dose calculation algorithm. The benchmark will cover all 3D protocols and you will not be expected to complete separate benchmarks for different 3D protocols.

1. Method:

   A CT scan set in DICOM format is to be loaded into the treatment planning system that is used for planning protocol patients.

2. Volumes:

   The Clinical Target Volume (CTV), which appears as a black outline located in the lower right temporal lobe region on the CT scan, shall be contoured on your system. The Planning Target Volume (PTV) shall be 5 mm larger than the CTV in all directions. The following organs at risk (OARs) and other structures shall be contoured on the CT scans:

   skin (or surface)
   brain stem/ spinal cord
   right globe
   right optic nerve
   left globe
   left optic nerve
   conformity volume: The conformity volume is a structure that is 5 cm greater than the PTV in all directions, excluding all that is external to the skin. (This will be used in the assessment of the conformity of the dose distribution).

3. Treatment Prescription:

A 3D conformal treatment plan (not IMRT) shall be developed to deliver a total dose of 54 Gy in 27 fractions of 2 Gy each to the isodose surface that encompasses the PTV. The prescription shall be no less than 95% relative to isocenter (or center of the target volume). The plan should be designed to deliver less than 48 Gy to all but 0.5cc of the brainstem or spinal cord, and minimal dose to the optic structures. No part of either globe shall receive more than 5 Gy. The entire PTV must receive at least 95% of the prescribed dose and no more than 1cc shall receive greater than 107%. No more than 15 % of the conformity volume shall receive more than 45 Gy.

4. Dose Calculation

The dose calculation shall take into account the effect of tissue heterogeneities. The dose calculation grid in the axial plane shall be no greater than 3 mm; the dose calculation grid in the cephalad/caudal direction shall include each axial plane on which target volume and/or normal tissue has been delineated. The monitor unit calculations for a daily fraction dose of 2 Gy shall be submitted, following the practice used clinically in your department.

5. Dose-Volume Histograms (DVHs)

Calculate the DVH for the CTV, PTV, brainstem/spinal cord, right optic nerve, right globe, left optic nerve, left globe and the conformity volume.
Histograms shall be displayed as cumulative. Dose shall be displayed in absolute dose (Gy). The volume shall be displayed in percent volume. The total volume (in cm^3) of each region of interest shall also be indicated. For digital submissions, volume should be in absolute units (cm^3).

Section 2: Data to be Submitted

Institutions are strongly encouraged to submit this 3D Conformal Benchmark in digital format.

I. For digital data submission, an institution's treatment planning system must have the capability of exporting data in one of two formats:

- RTOG Data Exchange Format, Version 3.20 or later (specifications at http://itc.wustl.edu/exchange_files/tapeexch400.htm); or
- DICOM 3.0 in compliance with the Advanced Technology Consortium's (ATC) DICOM 3.0 Conformance Statement

A list of commercial systems that are known to have this capability are listed on the ATC website (http://atc.wustl.edu/credentialing/atc_compliant_tps.html).

Two copies of additional hard copy data (or screen capture images) to accompany digital submissions shall include:

1. Digitally reconstructed radiograph (DRR) from the beam's eye view (BEV) of each portal showing the beam aperture and CTV and PTV.

2. A printout of beam specifications, including at a minimum, the beam energy, gantry, couch, and collimator positions, field sizes, aperture names, wedge specifications, and depth of isocenter (or SSD).

3. Completion of the Questionnaire in Section 3.

II. For non-digital submission, two copies of the following must be submitted, as original hardcopy and in color. Please ensure that target volumes, normal tissues, and isodose contours are readily identifiable.

1. All axial CT images on which the CTV, PTV and/or OARs (other than skin) are delineated.
2. Clear indications, with "room's eye" views or axial, sagittal and coronal slices, of the beams used.
3. Digitally reconstructed radiographs (DRR) from the beam's eye view (BEV) of each portal showing the beam aperture and CTV and PTV.
4. Axial, sagittal and coronal CT slices through isocenter with CTV, PTV and isodose contours superimposed. Dose shall be in Gy (54 Gy prescription). Show at least the 58, 55.5, 54, 48, 45, and 30 Gy contours.
5. Dose-volume histograms for the CTV, PTV, brainstem/spinal cord, right optic nerve, right globe, left optic nerve, left globe and conformity volume. Indicate the volumes of CTV and PTV that receive the prescription dose. Indicate the minimum dose to the PTV and the maximum dose to 1 cc of the PTV.
6. A printout of beam specifications, including at a minimum, the beam energy, gantry, couch, and collimator positions, field sizes, aperture names, wedge specifications, and depth of isocenter (or SSD) and monitor unit calculations.
7. Completion of the Questionnaire in Section 3 below.

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Section 3: 3d Conformal Benchmark Questionnaire

Institution: _____

City: _____ **State/Province:** _____ **Country:** _____

Treatment Planner: _____

Telephone: _____ **FAX:** _____ **e-mail:** _____

1. Treatment machine _____ & photon energy (MV _____ used.
   a. For this accelerator, 1 MU = _____ cGy, for a _____ cm x _____ cm field, at _____ cm depth and _____ cm SSD.

   Calibration protocol used: _____

   Dose defined in ❑ water ❑ muscle ❑ other.
2. Treatment Planning System *(manufacturer, version)*: _____
3. What 3D planning techniques are routinely used with this planning system?

   ❑ field in field ❑ conformal arcs ❑ IMRT
4. Indicate which of these are used routinely in your department:

   ❑ Multi-leaf collimators ❑ Dynamic wedge ❑ Portal imaging

   ❑ MV or ❑ KV accelerator based CT imaging
5. For this benchmark case what grid size is used on the axial slices for the dose calculation? _____ mm
6. ROI volumes

ROI volumes	Volume (cc)		Volume (cc)
Clinical Target Volume (CTV)	_____	Right Globe	_____
Planning Target Volume (PTV)	_____	Right Optic Nerve	_____
Brainstem/Spinal Cord	_____	Left Globe	_____
Conformity Volume	_____	Left Optic Nerve	_____

Please save and submit with supporting documents to QARC via sFTP.

Or

Click to Submit