

**HACKETTSTOWN REGIONAL MEDICAL CENTER
JOAN KNECHEL CANCER CENTER
TREATMENT PLANNING SYSTEM - QA**

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Effective Date: August 2005

Policy No: ROC QA 40

Cross Referenced: /

Origin: Radiation Oncology

Reviewed Date: 5/09, 12/11, 11/12, 8/13

Authority: Medical Physicist

Revised Date: 5/09, 8/13

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SCOPE : Department of Radiation Oncology, Medical Physics

DEFINITIONS:

Qualified Medical Physicist - A board certified medical physicist who is qualified to perform QA procedures for linear accelerators and treatment simulators and is registered as such in New Jersey State.

Qualified Medical Dosimetrist – A board certified medical dosimetrist who is certified by the Medical Dosimetrist Certification Board.

PURPOSE

To ensure the treatment planning system meets standard of care practices and State and Federal safety requirements.

POLICY

Quality assurance of treatment planning system shall be performed by a qualified Medical Dosimetrist and a Qualified Medical Physicist. Any or all of the tests below can be performed for the purposes of an Annual QA and/or to validate software version changes.

SPECIFIC PROCEDURES

External Beam

A1. MU Verification

Test: Compare the plans created in the current and the previous versions of the Annual Phantom, ID number XX-XX-XX, in Eclipse. There are 23 such plans for each photon energy.

Procedure: Copy and paste, the version of the plan created in Eclipse v6.5. Rename it with current year's suffix. Open the plan. Change the "z" co-ordinate of the isocenter of each beam. This erases the plan MUs. Type back the original "z" co-ordinates for each beam and recalculate dose.

Set up the phantom on the linear accelerator table for ion chamber measurement and deliver each of the plans.

Enter the measured data into a copy of the Excel spreadsheet called Annual Dosimetric Plan Validation for Eclipse.

Tolerance: All Machine Parameters (field sizes, angles etc) are identical. MU & Point Dose agreement within: 3% on CAX

Results:

- MU agreement– *within Tolerance*

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- Point Dose agreement – *within Tolerance*

B. Point Dose Calculations

a. Unblocked SSD Calculation

Test: Compare MU & Point Doses on CAX and 1 off-axis point for a 100 cm SSD and 110 cm SSD calculation

Procedure: Copy and paste, the version of the plan created in Eclipse v6.5 and rename it with a (200x) suffix. Open the plan. . Change the “z” co-ordinate of the isocenter of each beam. This erases the plan MUs. Type back the original “z” co-ordinates for each beam and recalculate dose.

Tolerance: All Machine Parameters (field sizes, angles etc) are identical. MU & Point Dose agreement within: 2% on CAX; 3% high dose region with low dose gradient.

Results:

- Machine Parameters – *within Tolerance*
- MU & Point dose agreement – *within Tolerance (both points)*

b. Blocked Field SAD Calculation

Test: Compare MU & Point Doses on CAX for a blocked field 100 SAD calculation

Procedure: Copy and paste, the version of the plan created in Eclipse v6.5. Open the plan. Change the “z” co-ordinate of the isocenter of each beam. This erases the plan MUs. Type back the original “z” co-ordinates for each beam and recalculate dose.

Tolerance: All Machine Parameters (field sizes, angles etc) are identical. MU & Point Dose agreement within: 2% on CAX; 3% high dose region with low dose gradient.

Results:

- Machine Parameters – *within Tolerance*
- MU & Point Dose agreement – *within Tolerance at Prescription point*

c. CAX Blocked SAD Calculation

Test: Compare MU & Point Doses at off-axis Prescription Point for a calculation for a 100 SAD field with the CAX blocked.

Procedure: Copy and paste, the version of the plan created in Eclipse v6.5, renaming it with the (200x) suffix. Open the plan. Change the “z” co-ordinate of the isocenter of each beam. This erases the plan MUs. Type back the original “z” co-ordinates for each beam and recalculate dose.

Tolerance: All Machine Parameters (field sizes, angles etc) are identical. MU & Point Dose agreement within: 2% on CAX; 3% high dose region with low dose gradient (Van Dyk criteria for Photon Beam, Homogeneous)

Results:

- Machine Parameters – *within Tolerance*
- MU & Point Dose agreement – *within Tolerance at Prescription point*

d. Off-axis Points with Custom Blocking SAD Calculation

Test: Compare MU & Point Doses at CAX Prescription Point and 2 off-axis points for a calculation for a 100 SAD field with Custom Blocking.

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Procedure: Copy and paste, the version of plan created in Eclipse v6.5. Rename the plan with a (200x) suffix. Open the plan. Change the “z” co-ordinate of the isocenter of each beam. This erases the plan MUs. Type back the original “z” co-ordinates for each beam and recalculate dose.

Tolerance: All Machine Parameters (field sizes, angles etc) are identical. MU & Point Dose agreement within: 2% on CAX; 3% high dose region with low dose gradient (Van Dyk criteria for Photon Beam, Homogeneous)

Results:

- Machine Parameters – *within Tolerance*
- MU & Point Dose agreement – *within Tolerance all points*

2. Two-dimensional Treatment Plans

a. *Three-field Sinus Patient with bolus*

Test: Compare versions of a 3-field sinus plan, no inhomogeneity correction.

Procedure: Copy and paste, the version of the plan created in Eclipse v6.5 adding a (200x) suffix to the plan name. Open the plan. Change the “z” co-ordinate of the isocenter of each beam. This erases the plan MUs. Type back the original “z” co-ordinates for each beam and recalculate dose. Visually compare isodose distributions, including effect of bolus, and quantify regions of interest (ROI) doses.

Tolerance: All Machine Parameters (field sizes, angles etc) are identical. Visual inspection of isodoses – hotspots within 3% and in same physical location. Visual inspection of bolus – bolus appears and modifies dose in surface region. MU & Point Dose agreement within: 2% on CAX; 3% high dose region with low dose gradient (Van Dyk criteria for Photon Beam, Homogeneous). For regions of interest (ROIs): Mean & Max Doses within 3%; Minimum dose within 4mm (translates to 40% at 10% per mm gradient, Van Dyk criteria for Photon Beam, Homogeneous).

Results:

- Machine Parameters – *within Tolerance*
- Point Dose agreement – *within Tolerance at Prescription point*
- Visual inspection of bolus - *within Tolerance*
- Visual inspection of isodoses - *within Tolerance*
- Comparison of ROIs - *within Tolerance*

3. Three-dimensional Treatment Plans

a. *Breast Patient*

Test: Compare the current and last year's versions of a 2-field breast plan, with inhomogeneity correction.

Procedure: Copy and paste, the version of the plan created in Eclipse v6.5. Open the plan. Change the “z” co-ordinate of the isocenter of each beam. This erases the plan MUs. Type back the original “z” co-ordinates for each beam and recalculate dose. Visually compare isodose distributions and quantify regions of interest (ROI) doses.

Tolerance: All Machine Parameters (field sizes, angles etc) are identical. Visual inspection of isodoses – hotspots within 4% and in same physical location. MU & Point Dose agreement within: 3% on CAX; 4% high dose region with low dose gradient (Van Dyk criteria for Photon Beam, inhomogeneity correction). For regions

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of interest: Mean & Max Doses within 4%; Minimum dose within 4mm (translates to 40% at 10% per mm gradient, Van Dyk criteria for Photon Beam, inhomogeneity correction).

Results:

- Machine Parameters – *within Tolerance*
- Point Dose agreement – *within Tolerance at Prescription point*
- Visual inspection of isodoses - *within Tolerance*
- Comparison of ROI - *within Tolerance*

b. Lung Patient

Test: Compare the current and the previous year's versions of a 3-field lung plan, with heterogeneity correction.

Procedure: Copy and paste, the version of the plan created in Eclipse v6.5. Add a (200x) suffix to the plan name. Open the plan. Change the "z" co-ordinate of the isocenter of each beam. This erases the plan MUs. Type back the original "z" co-ordinates for each beam and recalculate dose. Visually compare isodose distributions and quantify regions of interest (ROI) doses.

Tolerance: All Machine Parameters (field sizes, angles etc) are identical. Visual inspection of isodoses – hotspots within 4% and in same physical location. Visual inspection of DVHs – same general shape and hotspots within 4%. MU & Point Dose agreement within: 3% on CAX; 4% high dose region with low dose gradient (Van Dyk criteria for Photon Beam, inhomogeneity correction). For regions of interest: Mean & Max Doses within 4%; Minimum dose within 4mm (translates to 40% at 10% per mm gradient, Van Dyk criteria for Photon Beam, inhomogeneity correction).

Results:

- Machine Parameters – *within Tolerance*
- Point Dose agreement – *within Tolerance at Prescription point*
- Visual inspection of isodoses - *within Tolerance*
- Visual Comparison of DVHs - *within Tolerance*
- Comparison of ROI - *within Tolerance*

4. Three-dimensional Treatment Plan Comparisons

a. Partial Brain

Test: Compare the current and last year's versions of a 2-field partial brain plan, with inhomogeneity correction.

Procedure: Copy and paste, the version of the plan created in Eclipse v6.5. Open the plan. Change the "z" co-ordinate of the isocenter of each beam. This erases the plan MUs. Type back the original "z" co-ordinates for each beam and recalculate dose. Visually compare isodose distributions and quantify regions of interest (ROI) doses.

Tolerance: All Machine Parameters (field sizes, angles etc) are identical. Visual inspection of isodoses – hotspots within 4% and in same physical location. MU & Point Dose agreement within: 3% on CAX; 4% high dose region with low dose gradient (Van Dyk criteria for Photon Beam, inhomogeneity correction). For regions of interest: Mean & Max Doses within 4%; Minimum dose within 4mm (translates to

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40% at 10% per mm gradient, Van Dyk criteria for Photon Beam, inhomogeneity correction).

Results:

- Machine Parameters – *within Tolerance*
- Point Dose agreement – *within Tolerance at Prescription point*
- Visual inspection of isodoses - *within Tolerance*
- Comparison of ROI - *within Tolerance*

b. Rt Mid.C.Fossa

Test: Compare the current and the previous year's versions of a 3-field RT Middle C. Fossa plan, with heterogeneity correction.

Procedure: Copy and paste, the version of the plan created in Eclipse v6.5. Add a (200x) suffix to the plan name. Open the plan. Change the "z" co-ordinate of the isocenter of each beam. This erases the plan MUs. Type back the original "z" co-ordinates for each beam and recalculate dose. Visually compare isodose distributions and quantify regions of interest (ROI) doses.

Tolerance: All Machine Parameters (field sizes, angles etc) are identical. Visual inspection of isodoses – hotspots within 4% and in same physical location. Visual inspection of DVHs – same general shape and hotspots within 4%. MU & Point Dose agreement within: 3% on CAX; 4% high dose region with low dose gradient (Van Dyk criteria for Photon Beam, inhomogeneity correction). For regions of interest: Mean & Max Doses within 4%; Minimum dose within 4mm (translates to 40% at 10% per mm gradient, Van Dyk criteria for Photon Beam, inhomogeneity correction).

Results:

- Machine Parameters – *within Tolerance*
- Point Dose agreement – *within Tolerance at Prescription point*
- Visual inspection of isodoses - *within Tolerance*
- Visual Comparison of DVHs - *within Tolerance*
- Comparison of ROI - *within Tolerance*

c. Rt Brain

Test: Compare the current and last year's versions of a 3-field Rt Brain plan, with inhomogeneity correction.

Procedure: Copy and paste, the version of the plan created in Eclipse v6.5. Open the plan. Change the "z" co-ordinate of the isocenter of each beam. This erases the plan MUs. Type back the original "z" co-ordinates for each beam and recalculate dose. Visually compare isodose distributions and quantify regions of interest (ROI) doses.

Tolerance: All Machine Parameters (field sizes, angles etc) are identical. Visual inspection of isodoses – hotspots within 4% and in same physical location. MU & Point Dose agreement within: 3% on CAX; 4% high dose region with low dose gradient (Van Dyk criteria for Photon Beam, inhomogeneity correction). For regions of interest: Mean & Max Doses within 4%; Minimum dose within 4mm (translates to

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40% at 10% per mm gradient, Van Dyk criteria for Photon Beam, inhomogeneity correction).

Results:

- Machine Parameters – *within Tolerance*
- Point Dose agreement – *within Tolerance at Prescription point*
- Visual inspection of isodoses - *within Tolerance*
- Comparison of ROI - *within Tolerance*

B Electrons

1 Point Dose Calculations

Test: Compare MU to dose to dmax in Eclipse and RadCalc at 100cm SSD and MU to dose to dmax at 120cm SSD.

Procedure: Copy and paste, the version of the plan created in Eclipse v6.5. Rename it with current year's suffix. Open the plan. Change the "z" co-ordinate of the isocenter of the beam. This erases the plan MUs. Type back the original "z" co-ordinates for the beam and recalculate dose.

Tolerance: MU & Point Dose agreement within: 3% on CAX.

Results:

- MU agreement– *within Tolerance*
- Point Dose agreement – *within Tolerance*

2 Plans

2 a Head and Neck plan

Test: Compare the current version of the Head and Neck plan created in Eclipse v6.5.

Procedure: Copy and paste, the version of the plan created in Eclipse v6.5. Rename it with current year's suffix. Open the plan. . Change the SSD value of the beam. This erases the plan MUs. Type back the original SSD value of the beam and recalculate dose.

Tolerance: All Machine parameters eg field sizes, angles etc, are identical. Hot spots are within 5% and in the same physical location. MU & Point Dose agreement to be within 3% on CAX.

Results:

- MU agreement– *within Tolerance*
- Point Dose agreement – *within Tolerance*
- Visual comparisons of isodoses – *within Tolerance*

2 b Chestwall

Test: Compare the current version of the chestwall plan created in Eclipse v6.5.

Procedure: Copy and paste, the version of the plan created in Eclipse v6.5. Rename it with current year's suffix. Open the plan. Change the SSD value of the beam. This erases the plan MUs. Type back the original SSD value of the beam and recalculate dose.

Tolerance: All Machine parameters eg field sizes, angles etc, are identical. Hot spots are within 5% and in the same physical location. MU & Point Dose agreement to be within 3% on CAX.

Results:

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- MU agreement– *within Tolerance*
- Point Dose agreement – *within Tolerance*
- Visual comparisons of isodoses – *within Tolerance*