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PHARMACEUTICAL INDUSTRY STANDARD OF THE PEOPLE'S REPUBLIC OF CHINA

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Requirements and test methods for the accuracy of dose calculation for high energy X-ray and gamma beams in teletherapy treatment planning systems

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Foreword

All technical content of this Standard is mandatory. This Standard was drafted in accordance with the rules given in GB/T 1.1-2009. The test data and examples in this Standard adopt the test data (machine configuration data) and examples in IAEA No.1540 Technical Report. Please note that some of the content of this document may involve patents; the issuing agency of this document does not undertake the responsibility for the identification of these patents. This Standard was proposed by and shall be under the jurisdiction of Sub- committee on Radiotherapy, Nuclear medicine and Radiation Dosimetry Equipment of National Technical Committee on Medical Electrical Equipment of Standardization Administration of China (SAC/TC 10/SC 3). Drafting organizations of this Standard. Beijing Institute for Medical Device Quality Supervision and Testing of State Food and Drug Administration. Main drafters of this Standard. Zhang Xin, Zhang Zhaoyuan, Yan Xu, Hu Jia and Qing Hou. Teleradiotherapy treatment planning system accuracy of

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dosimetric calculation and test methods for high energy X (gamma) beam

1 Scope

YY 0775 sets the accuracy requirements for how a radiotherapy treatment planning system calculates dose from high energy X-ray and gamma beams, and the test methods that verify them. The planning system is where the prescription becomes a delivery: it predicts what dose each part of the patient will receive, and every subsequent step assumes that prediction is right. Errors concentrate exactly where planning is hardest, at tissue interfaces, in the presence of inhomogeneities and at field edges, which is where tumours and critical organs often sit. This standard defines the test geometries, the tolerances and how conformance is demonstrated. Being a YY standard without the /T suffix, compliance is compulsory in China, and it is what a radiotherapy physics commissioning process refers to.

This Standard specifies the accuracy of dosimetric calculation and test methods of Radiotherapy Treatment Planning Systems (hereinafter referred to as RTPS). This Standard applies to RTPS with dosimetric calculation and display function of high energy X rays (4 MV ~ 25 MV), 60Co gamma rays remote radiotherapy treatment on photon radiation. This Standard does not apply to the radiation treatment planning systems that are used by stereotactic radiotherapy, intensity modulated radiation therapy (IMRT) or other specialized radiotherapy techniques. However, the developers are encouraged to use this Standard in development, and use as reference standard in verifying dosimetric calculation algorithm. Test packets in this Standard cannot be used for clinical treatment planning.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

GB/T 17857-1999 Medical radiology - Terminology (Equipment for radiotherapy, nuclear medicine and radiation dosimetry)

GB/T 18987-2003 Radiotherapy equipment - Coordinates, movements and scales

3 Terms and definitions

The terms and definitions defined by GB/T 17857-1999 and the following ones apply to this document.

3.1 dose calculated values (calculated values) Absorbed dose values of measurement points of RTPS, calculated under predetermined conditions.

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4 Requirements

4.1 Simple geometric conditions For each dosimetric calculation algorithm used, under simple geometric conditions (square or rectangular radiation field, uniform body model, vertical irradiation, etc.).

4.2 Complex geometric conditions For each dosimetric calculation algorithm used, under complex geometric conditions (wedge field, uneven body model, irregular field, asymmetric collimator settings, etc.).

4.3 Combination of complex geometric conditions For each dosimetric calculation algorithm used, under combination of complex geometric conditions.

4.4 The outer edge of radiation field For each dosimetric calculation algorithm used, under simple geometric conditions, in test example 1, 2, 3, 6, the allowable error between RTPS's calculated values and reference values at the measurement points of the outer edge of radiation field is ± 3%.

4.5 The outer edge of radiation field, complex geometric conditions and the central axis is blocked For each dosimetric calculation algorithm used.

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5.1 General test conditions

5.1.1 Test data This Standard uses the test data stated in Appendix A as a RTPS test data package (see Appendix A). This data package is for four different ray quality, including the corresponding input data sets as well as a series of tests.

5.1.2 Material and position of body model The test requires to calculate point dose of a series of positions in a cube water body model. Users are recommended to specify a cube water body model of which the side length is 40 cm for RTPS, before test.

5.1.3 Beam dose setting In some RPTS, beam dose setting is corresponding to the dose when beam is transferred to dmax. While in some other systems, beam dose setting is corresponding to the dose when beam is transferred to reference radiation field size (i.e., 10 cm x 10 cm). Some other systems use different setting ways to set beam dose. Users shall be familiar with beam dose setting ways and ensure that calculation result is consistent to the conditions of obtaining corresponding test data.

5.2 Test example Description of test example is shown in Appendix B. Test list of dosimetric calculation accuracy that shall be conducted during type test and site inspection is shown in Table 1.

5.3 Simple geometric conditions Test example conducted under simple geometric conditions and error calculation method are as bellow.

5.5 Combination of complex geometric conditions Test shall conduct test example 12;

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calculate error according to formula (1). Test results shall comply with requirements of 4.3.

5.6 The outer edge of radiation field Test on measurement point of the outer edge of radiation field shall conduct test example 1, 2, 3, 6; calculate error according to formula (2).

5.7 The outer edge of radiation field, complex geometric conditions and the central axis is blocked Test on central beam measurement point of the outer edge of radiation field under complex geometric conditions and the central axis is blocked shall conduct test example 5, 7; calculate error according to formula (3).

Appendix A

(Normative) Test data This Standard introduces data package in IAEA No.1540 Technical Report [1] as predefined test conditions and test data of this Standard. The data package is divided into four parts, respectively including input data and test results of 6 MV, 10 MV, 18 MV and 60Co gamma. When using data package, it shall select suitable data sets, input data by combining corresponding RTPS requirements, select appropriate radiation beam model, build up test's geometric conditions, calculate dose of measurement point and input calculated values into evaluation table for error calculation.

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