



**NSAI**  
Standards

Irish Standard  
I.S. EN 61217:2012

# Radiotherapy equipment - Coordinates, movements and scales (IEC 61217:2011 (EQV))

## I.S. EN 61217:2012

*Incorporating amendments/corrigenda issued since publication:*

The National Standards Authority of Ireland (NSAI) produces the following categories of formal documents:

I.S. xxx: Irish Standard – national specification based on the consensus of an expert panel and subject to public consultation.

S.R. xxx: Standard Recommendation - recommendation based on the consensus of an expert panel and subject to public consultation.

SWiFT xxx: A rapidly developed recommendatory document based on the consensus of the participants of an NSAI workshop.

<i>This document replaces:</i> EN 61217:1996/A1:2001 EN 61217:1996/A2:2008	<i>This document is based on:</i> EN 61217:2012 EN 61217:1996/A1:2001	<i>Published:</i> 13 April, 2012 22 February, 2001
This document was published under the authority of the NSAI and comes into effect on:  20 April, 2012		ICS number: 11.040.50 13.280
<b>NSAI</b> 1 Swift Square, Northwood, Santry Dublin 9	T +353 1 807 3800 F +353 1 807 3838 E standards@nsai.ie  W NSAI.ie	<b>Sales:</b> T +353 1 857 6730 F +353 1 857 6729 W standards.ie
Údarás um Chaighdeáin Náisiúnta na hÉireann		

**I.S. EN 61217:2012**

**EUROPEAN STANDARD**  
**NORME EUROPÉENNE**  
**EUROPÄISCHE NORM**

**EN 61217**

April 2012

ICS 11.040.50; 13.280

Supersedes EN 61217:1996 + A1:2001 + A2:2008

English version

**Radiotherapy equipment -  
Coordinates, movements and scales  
(IEC 61217:2011)**

Appareils utilisés en radiothérapie -  
Coordonnées, mouvements et échelles  
(CEI 61217:2011)

Strahlentherapie-Einrichtungen -  
Koordinaten, Bewegungen und Skalen  
(IEC 61217:2011)

This European Standard was approved by CENELEC on 2012-01-11. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

**CENELEC**

European Committee for Electrotechnical Standardization  
Comité Européen de Normalisation Electrotechnique  
Europäisches Komitee für Elektrotechnische Normung

**Management Centre: Avenue Marnix 17, B - 1000 Brussels**

## I.S. EN 61217:2012

EN 61217:2012

- 2 -

### Foreword

The text of document 62C/530/FDIS, future edition 2 of IEC 61217, prepared by SC 62C, "Equipment for radiotherapy, nuclear medicine and radiation dosimetry", of IEC/TC 62, "Electrical equipment in medical practice" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 61217:2012.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2012-10-11
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2015-01-11

This document supersedes EN 61217:1996 + A1:2001 + A2:2008.

EN 61217:2012 constitutes a technical revision to include imager and focus coordinate systems in 3.12. Beyond this subclause, changes were only introduced where needed to include the above coordinate systems.

In this standard, the following print types are used:

– Requirements and definitions: roman type.

– *Test specifications: italic type.*

– Informative material appearing outside of tables, such as notes, examples and references: in smaller type. Normative text of tables is also in a smaller type.

– TERMS USED THROUGHOUT THIS STANDARD THAT HAVE BEEN LISTED IN THE INDEX OF DEFINED TERMS: SMALL CAPITALS.

The verbal forms used in this standard conform to usage described in Annex H of the ISO/IEC Directives, Part 2. For the purposes of this standard, the auxiliary verb:

– “shall” means that compliance with a requirement or a test is mandatory for compliance with this standard;

– “should” means that compliance with a requirement or a test is recommended but is not mandatory for compliance with this standard;

– “may” is used to describe a permissible way to achieve compliance with a requirement or test.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC [and/or CEN] shall not be held responsible for identifying any or all such patent rights.

This document has been prepared under a mandate given to CENELEC by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For the relationship with EU Directive(s) see informative Annex ZZ, which is an integral part of this document.

### **Endorsement notice**

The text of the International Standard IEC 61217:2011 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 60976:2007      NOTE   Harmonized as EN 60976:2007 (not modified).

IEC 61168:1993      NOTE   Harmonized as EN 61168:1994 (not modified).

## Annex ZA (normative)

### Normative references to international publications with their corresponding European publications

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

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60601-1	2005	Medical electrical equipment -	EN 60601-1	2006
+ corr. December	2006	Part 1: General requirements for basic safety	+ corr. March	2010
+ corr. December	2007	and essential performance	+ A11	2011
IEC 60601-1-3	2008	Medical electrical equipment -	EN 60601-1-3	2008
		Part 1-3: General requirements for basic	+ corr. March	2010
		safety and essential performance - Collateral		
		Standard: Radiation protection in diagnostic		
		X-ray equipment		
IEC 60601-2-1	2009	Medical electrical equipment -	EN 60601-2-1	201X <sup>1)</sup>
		Part 2-1: Particular requirements for the basic		
		safety and essential performance of electron		
		accelerators in the range 1 MeV to 50 MeV		
IEC 60601-2-11	1997	Medical electrical equipment -	EN 60601-2-11	1997
		Part 2-11: Particular requirements for the		
		safety of gamma beam therapy equipment		
IEC 60601-2-29	2008	Medical electrical equipment -	EN 60601-2-29	2008
		Part 2-29: Particular requirements for the	+ A11	2011
		basic safety and essential performance of		
		radiotherapy simulators		
IEC/TR 60788	2004	Medical electrical equipment - Glossary of	-	-
		defined terms		
IEC 62083	2009	Medical electrical equipment - Requirements	EN 62083	2009
		for the safety of radiotherapy treatment		
		planning systems		

---

<sup>1)</sup> To be published.

**Annex ZZ**  
(informative)

**Coverage of Essential Requirements of EU Directives**

This European Standard has been prepared under a mandate given to CENELEC by the European Commission and the European Free Trade Association and within its scope the standard covers the relevant essential requirements as given in Annex I of the EC Directive 93/42/EEC for ERs 9.1 and 11.2.1 last sentence only.

Compliance with this standard provides one means of conformity with the specified essential requirements of the Directive concerned.

**WARNING:** Other requirements and other EC Directives may be applicable to the products falling within the scope of this standard.

*This page is intentionally left BLANK.*



## CONTENTS

FOREWORD.....	6
INTRODUCTION.....	8
1 Scope and object.....	10
2 Normative references .....	10
3 Coordinate systems.....	10
3.1 General.....	10
3.2 General rules .....	11
3.3 Fixed reference system ("f") (Figure 1a) .....	12
3.4 GANTRY coordinate system ("g") (Figure 4) .....	12
3.5 BEAM LIMITING DEVICE or DELINEATOR coordinate system ("b") (Figure 5) .....	13
3.6 WEDGE FILTER coordinate system ("w") (Figure 7) .....	13
3.7 X-RAY IMAGE RECEPTOR coordinate system ("r") (Figures 6 and 8) .....	14
3.8 PATIENT SUPPORT coordinate system ("s") (Figure 9).....	14
3.9 Table top eccentric rotation coordinate system ("e") (Figures 10 and 11).....	15
3.10 Table top coordinate system ("t") (Figures 10, 11, 18 and 19).....	15
3.11 PATIENT coordinate system ("p") (Figures 17a and 17b).....	16
3.12 Imager coordinate system ("i") and focus coordinate system ("o") .....	17
3.12.1 General .....	17
3.12.2 The imager coordinate system ("i") .....	17
3.12.3 Focus coordinate system ("o") .....	18
4 Identification of scales and digital DISPLAYS .....	18
5 Designation of ME EQUIPMENT movements .....	19
6 ME EQUIPMENT zero positions.....	19
7 List of scales, graduations, directions and DISPLAYS.....	20
7.1 General .....	20
7.2 Rotation of the GANTRY (Figures 14a and 14b).....	20
7.3 Rotation of the BEAM LIMITING DEVICE or DELINEATOR (Figures 15a and 15b) .....	20
7.4 Rotation of the WEDGE FILTER (Figures 7 and 14a) .....	20
7.5 RADIATION FIELD or DELINEATED RADIATION FIELD .....	21
7.5.1 General .....	21
7.5.2 Edges of RADIATION FIELD or DELINEATED RADIATION FIELD (Figure 16a).....	21
7.5.3 DISPLAY of RADIATION FIELD or DELINEATED RADIATION FIELD (Figures 16a to 16k) .....	22
7.6 PATIENT SUPPORT isocentric rotation .....	23
7.7 Table top eccentric rotation .....	23
7.8 Table top linear and angular movements .....	24
7.8.1 Vertical displacement of the table top .....	24
7.8.2 Longitudinal displacement of the table top .....	24
7.8.3 Lateral displacement of the table top .....	24
7.8.4 Pitch of the table top .....	24
7.8.5 Roll of the table top .....	24
7.9 X-RAY IMAGE RECEPTOR movements.....	24
7.9.1 X-RAY IMAGE RECEPTOR rotation.....	24
7.9.2 X-RAY IMAGE RECEPTOR radial displacement from RADIATION SOURCE (SID) .....	25
7.9.3 X-RAY IMAGE RECEPTOR radial displacement from ISOCENTRE .....	25

7.9.4	X-RAY IMAGE RECEPTOR longitudinal displacement .....	25
7.9.5	X-RAY IMAGE RECEPTOR lateral displacement .....	25
7.10	Other scales .....	25
Annex A (informative)	Examples of coordinate transformations between individual coordinate systems .....	57
Annex B (informative)	Coordinate transformations between IEC and DICOM PATIENT coordinates .....	64
Bibliography	.....	65
Index of defined terms	.....	66
Figure 1a	Coordinate systems for an isocentric RADIOTHERAPY EQUIPMENT (see 3.1) with all angular positions set to zero .....	27
Figure 1b	Translation of origin $I_d$ along $X_m$ , $Y_m$ , $Z_m$ and rotation around axis $Z_d$ parallel to $Z_m$ (see 3.2d)) .....	28
Figure 1c	Translation of origin $I_d$ along $X_m$ , $Y_m$ , $Z_m$ and rotation around axis $Y_d$ parallel to $Y_m$ (see 3.2d)) .....	28
Figure 2	X Y Z right-hand coordinate mother system (isometric drawing) showing $\psi$ , $\phi$ , $\theta$ directions of positive rotation for daughter system (see 3.2a)) .....	29
Figure 3	Hierarchical structure among coordinate systems (see 3.2c) and 3.2e)) .....	30
Figure 4	Rotation ( $\phi_g = 15^\circ$ ) of GANTRY coordinate system $X_g$ , $Y_g$ , $Z_g$ in fixed coordinate system $X_f$ , $Y_f$ , $Z_f$ (see 3.4) .....	31
Figure 5	Rotation ( $\theta_b = 15^\circ$ ) of BEAM LIMITING DEVICE or DELINEATOR coordinate system $X_b$ , $Y_b$ , $Z_b$ in GANTRY coordinate system $X_g$ , $Y_g$ , $Z_g$ , and resultant rotation of RADIATION FIELD or DELINEATED RADIATION FIELD of dimensions $FX$ and $FY$ (see 3.5) .....	32
Figure 6	Displacement of image intensifier type X-RAY IMAGE RECEPTOR coordinate system origin, $I_r$ , in GANTRY coordinate system, by $R_x = -8$ , $R_y = +10$ , $R_z = -40$ (see 3.7) .....	33
Figure 7	Rotation ( $\theta_w = 270^\circ$ ) and translation of WEDGE FILTER coordinate system $X_w$ , $Y_w$ , $Z_w$ in BEAM LIMITING DEVICE coordinate system $X_b$ , $Y_b$ , $Z_b$ , the BEAM LIMITING DEVICE coordinate system having a rotation $\theta_b = 345^\circ$ (see 3.6) .....	34
Figure 8	Rotation ( $\theta_r = 90^\circ$ ) and displacement of X-RAY IMAGE RECEPTOR coordinate system $X_r$ , $Y_r$ , $Z_r$ in GANTRY coordinate system $X_g$ , $Y_g$ , $Z_g$ (see 3.7) .....	35
Figure 9	Rotation ( $\theta_s = 345^\circ$ ) of PATIENT SUPPORT coordinate system $X_s$ , $Y_s$ , $Z_s$ in fixed coordinate system $X_f$ , $Y_f$ , $Z_f$ (see 3.8) .....	36
Figure 10	Table top eccentric coordinate system rotation $\theta_e$ in PATIENT SUPPORT coordinate system which has been rotated by $\theta_s$ in the fixed coordinate system with $\theta_e = 360^\circ - \theta_s$ (see 3.9 and 3.10) .....	37
Figure 11a	Table top displaced below ISOCENTRE by $T_z = -20$ cm (see 3.9 and 3.10) .....	37
Figure 11b	Table top coordinate system displacement $T_x = +5$ , $T_y = L_e + 10$ in PATIENT SUPPORT coordinate system $X_s$ , $Y_s$ , $Z_s$ rotation ( $\theta_s = 330^\circ$ ) in fixed coordinate system $X_f$ , $Y_f$ , $Z_f$ (see 3.9 and 3.10) .....	38
Figure 11c	Table top coordinate system rotation ( $\theta_e = 30^\circ$ ) about table top eccentric system. PATIENT SUPPORT rotation ( $\theta_s = 330^\circ$ ) in fixed coordinate system $T_x = 0$ , $T_y = L_e$ (see 3.9 and 3.10) .....	38
Figure 12a	Example of BEAM LIMITING DEVICE scale, pointer on mother system (GANTRY), scale on daughter system (BEAM LIMITING DEVICE), viewed from ISOCENTRE (see 3.2f)2) and Clause 4) .....	39
Figure 12b	Example of BEAM LIMITING DEVICE scale, pointer on daughter system (BEAM LIMITING DEVICE), scale on mother system (GANTRY), viewed from ISOCENTRE (see 3.2f)2) and Clause 4) .....	40

Figure 12c – Examples of scales (see Clause 4).....	40
Figure 13a – Rotary GANTRY (adapted from IEC 60601-2-1) with identification of axes 1 to 8, directions 9 to 13, and dimensions 14 and 15 (see Clause 5).....	41
Figure 13b – ISOCENTRIC RADIOTHERAPY SIMULATOR or TELERADIOTHERAPY EQUIPMENT, with identification of axes 1; 4 to 6; 19, of directions 9 to 12; 16 to 18 and of dimensions 14; 15 (see Clause 5).....	42
Figure 13c – View from radiation source of teleradiotherapy radiation field or radio-therapy simulator delineated radiation field (see Clause 5) .....	43
Figure 14a – Example of ISOCENTRIC TELERADIOTHERAPY EQUIPMENT (see 7.2 and 7.4).....	44
Figure 14b – Example of ISOCENTRIC RADIOTHERAPY SIMULATOR equipment (see 7.2) .....	45
Figure 15a – Rotated ( $\theta_b = 30^\circ$ ) symmetrical rectangular RADIATION FIELD ( $F_X \times F_Y$ ) at NORMAL TREATMENT DISTANCE, viewed from ISOCENTRE looking toward RADIATION SOURCE (see 7.3).....	46
Figure 15b – Same rotated ( $\theta_b = 30^\circ$ ) symmetrical rectangular RADIATION FIELD ( $F_X \times F_Y$ ) at NORMAL TREATMENT DISTANCE, viewed from RADIATION SOURCE (see 7.3).....	46
Figure 16a – Rectangular and symmetrical RADIATION FIELD or DELINEATED RADIATION FIELD, viewed from RADIATION SOURCE (see 7.5).....	47
Figure 16b – Rectangular and asymmetrical in $Y_b$ RADIATION FIELD or DELINEATED RADIATION FIELD, viewed from RADIATION SOURCE (see 7.5).....	47
Figure 16c – Rectangular and asymmetrical in $X_b$ RADIATION FIELD or DELINEATED RADIATION FIELD, viewed from RADIATION SOURCE (see 7.5).....	48
Figure 16d – Rectangular and asymmetrical in $X_b$ and $Y_b$ RADIATION FIELD or DELINEATED RADIATION FIELD, viewed from RADIATION SOURCE (see 7.5).....	48
Figure 16e – Rectangular and symmetrical RADIATION FIELD, rotated by $\theta_b = 30^\circ$ , viewed from RADIATION SOURCE (see 7.5).....	49
Figure 16f – Rectangular and asymmetrical in $Y_b$ RADIATION FIELD, rotated by $\theta_b = 30^\circ$ , viewed from RADIATION SOURCE (see 7.5).....	49
Figure 16g – Rectangular and asymmetrical in $X_b$ RADIATION FIELD, rotated by $\theta_b = 30^\circ$ , viewed from RADIATION SOURCE (see 7.5).....	50
Figure 16h – Rectangular and asymmetrical in $X_b$ and $Y_b$ RADIATION FIELD, rotated by $\theta_b = 30^\circ$ , viewed from RADIATION SOURCE (see 7.5).....	51
Figure 16i – Irregular multi-element (multileaf) contiguous RADIATION FIELD, viewed from RADIATION SOURCE, with element motion in $X_b$ direction (see 7.5) .....	52
Figure 16j – Irregular multi-element (multileaf) two-part RADIATION FIELD, viewed from RADIATION SOURCE, with element motion in $X_b$ direction (see 7.5) .....	53
Figure 16k – Irregular multi-element (multileaf) contiguous RADIATION FIELD, viewed from RADIATION SOURCE, with element motion in $Y_b$ direction (see 7.5) .....	54
Figure 17a – PATIENT coordinate system (PATIENT is supine).....	55
Figure 17b – Rotation of PATIENT coordinate system .....	55
Figure 18 – Table top pitch rotation of table top coordinate system $X_t$ , $Y_t$ , $Z_t$ (see 3.10 and 7.8.4) .....	56
Figure 19 – Table top roll rotation of table top coordinate system $X_t$ , $Y_t$ , $Z_t$ (see 3.10. and 7.8.5) .....	56
Figure B.1 – Coordinate transformations between IEC and DICOM PATIENT coordinates .....	64

**I.S. EN 61217:2012**

61217 © IEC:2011

– 5 –

Table 1 – ME EQUIPMENT movements and designations .....	19
Table 2 – Individual coordinate systems.....	26
Table A.1 – Rotation matrices .....	58

## INTERNATIONAL ELECTROTECHNICAL COMMISSION

# **RADIOTHERAPY EQUIPMENT – COORDINATES, MOVEMENTS AND SCALES**

## FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International standard IEC 61217 has been prepared by subcommittee 62C: Equipment for radiotherapy, nuclear medicine and radiation dosimetry, of IEC technical committee 62: Electrical equipment in medical practice.

This second edition cancels and replaces the first edition, published in 1996, amendment 1, published in 2000 and amendment 2, published in 2007. This edition constitutes a technical revision to include imager and focus coordinate systems in Subclause 3.12. Beyond this Subclause, changes were only introduced where needed to include the above coordinate systems.

The text of this particular standard is based on the following documents:

FDIS	Report on voting
62C/530/FDIS	62C/539/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

In this standard, the following print types are used:

- Requirements and definitions: roman type.
- *Test specifications: italic type.*
- Informative material appearing outside of tables, such as notes, examples and references: in smaller type. Normative text of tables is also in a smaller type.
- TERMS USED THROUGHOUT THIS STANDARD THAT HAVE BEEN LISTED IN THE INDEX OF DEFINED TERMS: SMALL CAPITALS.

The verbal forms used in this standard conform to usage described in Annex H of the ISO/IEC Directives, Part 2. For the purposes of this standard, the auxiliary verb:

- “shall” means that compliance with a requirement or a test is mandatory for compliance with this standard;
- “should” means that compliance with a requirement or a test is recommended but is not mandatory for compliance with this standard;
- “may” is used to describe a permissible way to achieve compliance with a requirement or test.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

## INTRODUCTION

RADIOTHERAPY is performed in medical centres where a variety of ME EQUIPMENT from different MANUFACTURERS is usually concentrated in the RADIOTHERAPY department. In order to plan and simulate the TREATMENT, set up the PATIENT and direct the RADIATION BEAM, such ME EQUIPMENT can be put in different angular and linear positions and, in the case of MOVING BEAM RADIOTHERAPY, can be rotated and translated during the IRRADIATION of the PATIENT. It is essential that the position of the PATIENT, and the dimensions, directions, and qualities of the RADIATION BEAM prescribed in the treatment plan, be set up or varied by programmes on the radiotherapy EQUIPMENT with accuracy and without misunderstanding. Standard identification and scaling of coordinates is required for ME used in RADIOTHERAPY, including RADIOTHERAPY SIMULATORS and ME EQUIPMENT used to take images during or in connection with RADIOTHERAPY, because differences in the marking and scaling of similar movements on the various types of ME EQUIPMENT used in the same department may increase the probability of error. In addition, data from ME EQUIPMENT used to evaluate the tumour region, such as ultrasound, X-ray, CT and MRI should be presented to the treatment planning system in a form which is consistent with the RADIOTHERAPY coordinate system. Coordinate systems for individual geometrical parameters are required in order to facilitate the mathematical transformation of points and vectors from one coordinate system to another.

A goal of this standard is to avoid ambiguity, confusion, and errors which could be caused when using different types of ME EQUIPMENT. Hence, its scope applies to all types of TELERADIOTHERAPY ME EQUIPMENT, RADIOTHERAPY SIMULATORS, information from diagnostic ME EQUIPMENT when used for RADIOTHERAPY, recording and verification equipment, and to data input for the TREATMENT PLANNING process.

Movement nomenclature is classified as defined terms according to IEC/TR 60788:2004 as well as terms defined in IEC 60601-2-1 and IEC 60601-2-29 (see index of defined terms).

This standard is issued as a publication separate from the IEC 60601 series of safety standards. It is not a safety code and does not contain performance requirements. Thus, the present requirements will not appear in future editions of the IEC 60601-2 series, which deals exclusively with safety requirements.

IEC 60601-2-1, IEC 60601-2-11, IEC 60601-2-29, IEC 60976, IEC 60977, IEC 61168 and IEC 61170 include ME EQUIPMENT movements and scale conventions. A number of changes and additions have been made in this standard.

A major value of a standard coordinate system is its contribution to safety in RADIOTHERAPY TREATMENT PLANNING. The scales that are demonstrated in this standard are consistent with the coordinate systems described herein. USERS may use other scale conventions. It is anticipated that MANUFACTURERS will normally employ the scale conventions of this standard for new ME EQUIPMENT.

It is anticipated that future amendments may address the following:

- three-dimensional RADIOTHERAPY SIMULATORS;
- CT type RADIOTHERAPY SIMULATORS.

Amendment 2, published in 2007, had extended the rotation of the PATIENT support devices around the Z-axis in the IEC fixed coordinate system to two additional rotations – rolling around the PATIENT'S longitudinal axis and pitching around the patient's transversal axis.

The use of the two new additional degrees of freedom (pitch and roll) generalizes the coordinate systems to include systematically 3 rotations and 3 translations, therefore supporting 6 degrees of freedom in a systematic way. Modern patient support devices with 6 degrees of freedom can use a combined translation and rotation to get the same result as the eccentric table top rotation. When changing table position data using the new IEC systems,

**I.S. EN 61217:2012**

61217 © IEC:2011

– 9 –

the definition of isocentric rotations is sufficient to transfer all treatment-related information. The eccentric table top coordinate system is however maintained for backward compatibility.

NOTE It is quite common in proton therapy to use a treatment chair, where the PATIENT can be rotated and tilted, while the beam line has a fixed direction.



## RADIOTHERAPY EQUIPMENT – COORDINATES, MOVEMENTS AND SCALES

### 1 Scope and object

This International Standard applies to equipment and data related to the process of TELERADIOTHERAPY, including PATIENT image data used in relation with RADIOTHERAPY TREATMENT PLANNING SYSTEMS, RADIOTHERAPY SIMULATORS, isocentric GAMMA BEAM THERAPY EQUIPMENT, isocentric medical ELECTRON ACCELERATORS, and non-isocentric equipment when relevant.

The object of this standard is to define a consistent set of coordinate systems for use throughout the process of TELERADIOTHERAPY, to define the marking of scales (where provided), to define the movements of ME EQUIPMENT used in this process, and to facilitate computer control when used.

### 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.

IEC 60601-1:2005, *Medical electrical equipment – Part 1: General requirements for basic safety and essential performance*

IEC 60601-1-3:2008, *Medical electrical equipment – Part 1-3: General requirements for basic safety and essential performance – Collateral Standard: Radiation protection in diagnostic X-ray equipment*

IEC 60601-2-1:2009, *Medical electrical equipment – Part 2-1: Particular requirements for the basic safety and essential performance of electron accelerators in the range 1 MeV to 50 MeV*

IEC 60601-2-11:1997, *Medical electrical equipment – Part 2: Particular requirements for the safety of gamma beam therapy equipment*

IEC 60601-2-29:2008, *Medical electrical equipment – Part 2-29: Particular requirements for the basic safety and essential performance of radiotherapy simulators*

IEC 60788:2004, *Medical electrical equipment – Glossary of defined terms*

IEC 62083:2009, *Medical electrical equipment – Requirements for the safety of radiotherapy treatment planning systems*

### 3 Coordinate systems

#### 3.1 General

An individual coordinate system is assigned to each major part of the ME EQUIPMENT which can potentially be moved in relation to another part, as illustrated in Figure 1a and summarized in Table 1. Furthermore a fixed reference system is defined. Each major part (e.g. GANTRY, RADIATION HEAD) is always stationary with respect to its own coordinate system.

This is a free preview. Purchase the entire publication at the link below:

[Product Page](#)

- 
- Looking for additional Standards? Visit Intertek Inform Infostore
  - Learn about LexConnect, All Jurisdictions, Standards referenced in Australian legislation
-