

AS/NZS 4545.2:1999

IEC 61675-2:1998

AS/NZS 4545.2

Australian/New Zealand Standard™

**Radionuclide imaging devices—
Characteristics and test conditions**

**Part 2: Single photon emission
computed tomographs**

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PREFACE

This Standard was prepared by the Joint Standards Australian/Standards New Zealand Committee HE/3, Medical Electrical Equipment.

It is identical with and reproduced from IEC 61675-2:1998, *Radionuclide imaging devices—Characteristics and test conditions Part 2: Single photon remission computed tomographs*.

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<i>Reference to International Standard or other Publication</i>		<i>Australian/New Zealand Standard</i>	
IEC		AS/NZS	
60788	Medical radiology—Terminology	—	
60789	Characteristics and test conditions of radionuclide imaging devices—Anger type gamma cameras	4378	Characteristics and test conditions of radionuclide imaging devices—Anger type gamma cameras
61675	Radionuclide imaging devices—Characteristics and test conditions	4545	Radionuclide imaging devices—Characteristics and test conditions
61675-1	Part 1: Positron emission tomographs	4545.1	Part 1: Positron emission tomographs

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AUSTRALIAN/NEW ZEALAND STANDARD

**RADIONUCLIDE IMAGING DEVICES –
CHARACTERISTICS AND TEST CONDITIONS –****Part 2: Single photon emission computed tomographs****1 General****1.1 Scope and object**

This part of IEC 61675 specifies terminology and test methods for describing the characteristics of Anger type rotational GAMMA CAMERA SINGLE PHOTON EMISSION COMPUTED TOMOGRAPHS (SPECT), equipped with parallel hole collimators. As these systems are based on Anger type GAMMA CAMERAS this part of IEC 61675 shall be used in conjunction with IEC 60789. These systems consist of a gantry system, single or multiple DETECTOR HEADS and a computer system together with acquisition, recording, and display devices.

The test methods specified in this part of IEC 61675 have been selected to reflect as much as possible the clinical use of Anger type rotational GAMMA CAMERA SINGLE PHOTON EMISSION COMPUTED TOMOGRAPHS (SPECT). It is intended that the test methods be carried out by manufacturers thereby enabling them to describe the characteristics of SPECT systems on a common basis.

No test has been specified to characterize the uniformity of reconstructed images because all methods known so far will mostly reflect the noise of the image.

1.2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of IEC 61675. At the time of publication, the editions indicated were valid. All normative documents are subject to revision, and parties to agreements based on this part of IEC 61675 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 60788:1984, *Medical radiology – Terminology*

IEC 60789:1992, *Characteristics and test conditions of radionuclide imaging devices – Anger type gamma cameras*

IEC 61675-1, — *Radionuclide imaging devices – Characteristics and test conditions – Part 1: Positron emission tomographs*

2 Terminology and definitions

For the purpose of this part of IEC 61675 the definitions given in IEC 60788, IEC 60789 and IEC 61675-1 (see annex A), and the following definitions apply.

Defined terms are printed in small capital letters.

2.1**SYSTEM AXIS**

Axis of symmetry characterized by geometrical and physical properties of the arrangement of the system

NOTE – The SYSTEM AXIS of a GAMMA CAMERA with rotating detectors is the axis of rotation.

2.1.1**COORDINATE SYSTEMS****2.1.2****FIXED COORDINATE SYSTEM**

Cartesian system with axes X , Y , and Z , Z being the SYSTEM AXIS. The origin of the FIXED COORDINATE SYSTEM is defined by the centre of the TOMOGRAPHIC VOLUME (see figure 1). The SYSTEM AXIS is orthogonal to all TRANSVERSE SLICES.

2.1.3**COORDINATE SYSTEM OF PROJECTION**

Cartesian system of the IMAGE MATRIX of each two-dimensional projection with axes X_p and Y_p (defined by the axes of the IMAGE MATRIX). The Y_p axis and the projection of the system axis onto the detector front face have to be in parallel. The origin of the COORDINATE SYSTEM OF PROJECTION is the centre of the IMAGE MATRIX (see figure 1).

2.1.4**CENTRE OF ROTATION (COR)**

Origin of that COORDINATE SYSTEM, which describes the PROJECTIONS of a TRANSVERSE SLICE with respect to their orientation in space

NOTE – The CENTRE OF ROTATION of a TRANSVERSE SLICE is given by the intersection of the SYSTEM AXIS with the mid-plane of the corresponding OBJECT SLICE.

2.1.5**OFFSET**

Deviation of the position of the PROJECTION of the COR (X'_p) from $X_p = 0$. (See figure 1)

2.2**TOMOGRAPHY (see annex A)****2.2.1****TRANSVERSE TOMOGRAPHY**

In TRANSVERSE TOMOGRAPHY the three-dimensional object is sliced by physical methods, e.g. collimation, into a stack of OBJECT SLICES, which are considered as being two-dimensional and independent from each other. The transverse image planes are perpendicular to the SYSTEM AXIS.

2.2.2**EMISSION COMPUTED TOMOGRAPHY (ECT)**

Imaging method for the representation of the spatial distribution of incorporated RADIONUCLIDES in selected two-dimensional SLICES through the object

2.2.2.1**PROJECTION**

Transformation of a three-dimensional object into its two-dimensional image or of a two-dimensional object into its one-dimensional image, by integrating the physical property which determines the image along the direction of the PROJECTION BEAM

NOTE – This process is mathematically described by line integrals in the direction of projection and called the Radon-transform.

2.2.2.2**PROJECTION BEAM**

Determines the smallest possible volume in which the physical property which determines the image is integrated during the measurement process. Its shape is limited by the SPATIAL RESOLUTION in all three dimensions.

NOTE – In SPECT the PROJECTION BEAM usually has the shape of a long thin diverging cone.

2.2.2.3**PROJECTION ANGLE**

Angle at which the PROJECTION is measured or acquired

NOTE – For illustration see figure 1.

2.2.2.4**SINOGRAM**

Two-dimensional display of all one-dimensional PROJECTIONS of an object slice, as a function of the PROJECTION ANGLE

The PROJECTION ANGLE is displayed on the ordinate. The linear PROJECTION coordinate is displayed on the abscissa.

2.2.2.5**OBJECT SLICE**

A slice in the object. The physical property of this slice that determines the measured information is displayed in the tomographic image.

2.2.2.6**IMAGE PLANE**

A plane assigned to a plane in the OBJECT SLICE

NOTE – Usually the IMAGE PLANE is the mid-plane of the corresponding OBJECT SLICE.

2.2.2.7**TOMOGRAPHIC VOLUME**

Ensemble of all volume elements which contribute to the measured PROJECTIONS for all PROJECTION ANGLES

NOTE – For a rotating GAMMA CAMERA with a circular field of view the TOMOGRAPHIC VOLUME is a sphere provided that the radius of rotation is larger than the radius of the field of view. For a rectangular field of view, the TOMOGRAPHIC VOLUME is a cylinder.

2.2.2.7.1**TRANSVERSE FIELD OF VIEW**

Dimensions of a slice through the TOMOGRAPHIC VOLUME, perpendicular to the SYSTEM AXIS. For a circular TRANSVERSE FIELD OF VIEW it is described by its diameter.

NOTE – For non-cylindrical TOMOGRAPHIC VOLUMES the TRANSVERSE FIELD OF VIEW may depend on the axial position of the slice.

2.2.2.7.2**AXIAL FIELD OF VIEW**

Dimensions of a slice through the TOMOGRAPHIC VOLUME parallel to and including the SYSTEM AXIS. In practice it is specified only by its axial dimension given by the distance between the centres of the outermost defined IMAGE PLANES plus the average of the measured AXIAL SLICE WIDTH measured as EQUIVALENT WIDTH (EW).

2.2.2.7.3**TOTAL FIELD OF VIEW**

Dimensions (three-dimensional) of the TOMOGRAPHIC VOLUME

2.3

IMAGE MATRIX

Arrangement of MATRIX ELEMENTS in a preferentially cartesian coordinate system

2.3.1

MATRIX ELEMENT

Smallest unit of an IMAGE MATRIX, which is assigned in location and size to a certain volume element of the object (VOXEL)

2.3.1.1

PIXEL

MATRIX ELEMENT in a two-dimensional IMAGE MATRIX

2.3.1.2

TRIXEL

MATRIX ELEMENT in a three-dimensional IMAGE MATRIX

2.3.2

VOXEL

Volume element in the object which is assigned to a MATRIX ELEMENT in the IMAGE MATRIX (two-dimensional or three-dimensional). The dimensions of the VOXEL are determined by the dimensions of the corresponding MATRIX ELEMENT via the appropriate scale factors and by the system's SPATIAL RESOLUTION in all three dimensions.

2.4

POINT SPREAD FUNCTION (PSF)

Scintigraphic image of a POINT SOURCE

2.4.1

PHYSICAL POINT SPREAD FUNCTION

For tomographs, a two-dimensional POINT SPREAD FUNCTION in planes perpendicular to the PROJECTION BEAM at specified distances from the detector

NOTE – The PHYSICAL POINT SPREAD FUNCTION characterizes the purely physical imaging performance of the tomographic device independent from, e.g. sampling, image reconstruction and image processing, but dependent on the COLLIMATOR. A PROJECTION BEAM is characterized by the entirety of all PHYSICAL POINT SPREAD FUNCTIONS as a function of distance along its axis.

2.4.2

AXIAL POINT SPREAD FUNCTION

Profile passing through the peak of the PHYSICAL POINT SPREAD FUNCTION in a plane parallel to the SYSTEM AXIS

2.4.3

TRANSVERSE POINT SPREAD FUNCTION

Reconstructed two-dimensional POINT SPREAD FUNCTION in a tomographic IMAGE PLANE

NOTE – In TOMOGRAPHY, the TRANSVERSE POINT SPREAD FUNCTION can also be obtained from a line source located parallel to the SYSTEM AXIS.

2.5

SPATIAL RESOLUTION

Ability to concentrate the count density distribution in the image of a POINT SOURCE to a point

2.5.1

TRANSVERSE RESOLUTION

SPATIAL RESOLUTION in a reconstructed plane perpendicular to the SYSTEM AXIS