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# Development of a water equivalent phantom to measure the physical characteristics of specific radiosurgery treatment devices

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# National foreword

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TECHNICAL REPORT

**ISO/TR 24422**

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# Development of a water equivalent phantom to measure the physical characteristics of specific radiosurgery treatment devices

*Développement d'un fantôme équivalent eau pour le mesurage des caractéristiques physiques de modèles spécifiques de dispositif de traitement de radio-chirurgie*

Reference number
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# Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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This document was prepared by Technical Committee ISO/TC 85, *Nuclear energy, nuclear technologies, and radiological protection*, Subcommittee SC 2, *Radiological protection*.


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**TECHNICAL REPORT** **ISO/TR 24422:2022**

# Development of a water equivalent phantom to measure the physical characteristics of specific radiosurgery treatment devices

## 1 Scope

A water phantom is used to ensure the accurate measurement of absorbed dose delivered by a radiation therapy machine as well as standardizing the dose distribution produced by the radiation therapy device.

This document describes a detailed procedure for the construction and calibration of a polystyrene phantom and the results of its use in measuring the absorbed dose profile around the mechanical centre of a radiosurgery medical device, the full width at half maximum (FWHM) of the field and the physical penumbra at the mechanical centre, as well as the associated uncertainties.

According to IAEA TRS-483 document, the most common design recommended in Gamma Knife® system is a hemisphere atop a water filled or compact polystyrene cylinder, and when using a polystyrene phantom, the measurement depth of the absorbed dose to water is reported to be the centre of the hemisphere with the radius of 8 cm.

This document mainly describes the procedure for measuring the absorbed dose distribution around the mechanical centre of Gamma Knife® and obtaining the FWHM and penumbra from it. The developed phantom is made of polystyrene and has a hemispherical shape in accordance with the design suggested in IAEA TRS-483.

This type of phantom is specific and adapted only for the Gamma Knife® radiosurgery facilities (Perfexion™ and Icon™ models) and does not apply to general dosimetry protocols in radiotherapy facilities that use a small radiation field to treat a disease such as LINAC or Cyberknife.

Considering that the type of medical device corresponds to treatment using external beam radiotherapy following small static fields, this technical report follows the recommendations published in the IAEA TRS-483.

## 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

IAEA TRS-483, *Dosimetry of Small Static Fields Used in External Beam Radiotherapy: An International Code of Practice for Reference and Relative Dose Determination*

AAPM TG-178, *Recommendations on the Practice of Calibration, Dosimetry, and Quality Assurance for Gamma Stereotactic Radiosurgery*

## 3 Terms and definitions

For the purposes of this document, the terms and definitions given in IAEA TRS-483 and AAPM TG-178 apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

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