

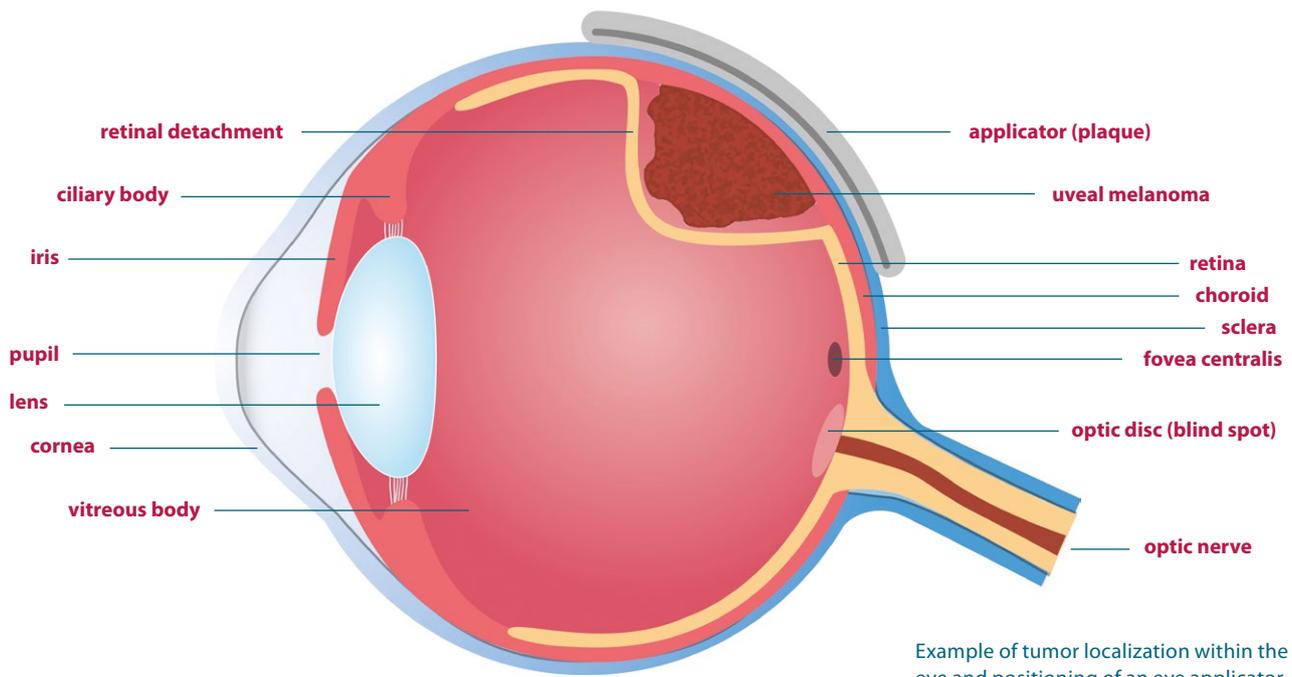
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# Ophthalmic Brachytherapy

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## Ru-106 Eye Applicators and I-125 Ophthalmic Seeds





Example of tumor localization within the eye and positioning of an eye applicator

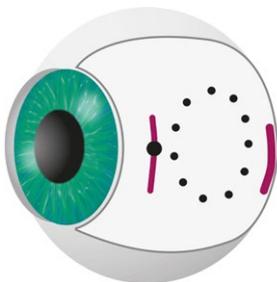
## Brachytherapy for Eye Tumors

### Ophthalmic Brachytherapy

The treatment of ocular tumors is selected according to the size and location of the lesion. Whenever possible, conservation of the eye and vision is attempted. In many centres, brachytherapy is the first choice of treatment for uveal melanomas. This modality is also useful for some retinoblastomas and conjunctival tumors. With this form

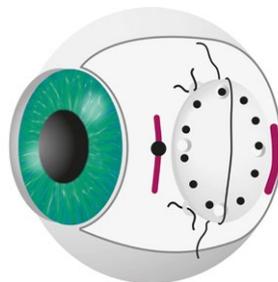
of radiotherapy, a radioactive plaque containing ruthenium-106 or iodine-125 is sutured to the wall of the eye, adjacent to the tumor, and left in place for several days until the required dose of radiation has been delivered.

### Steps of Ophthalmic Brachytherapy



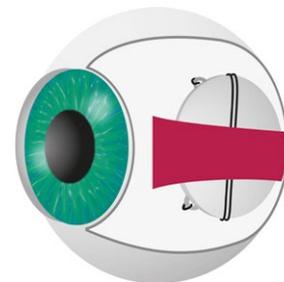
1

The conjunctiva is opened and the tumor is located by transillumination. The tumor margins and the intended location of the anterior plaque edge are marked on the sclera. If necessary, any overlying extraocular muscles (red) are disinserted.



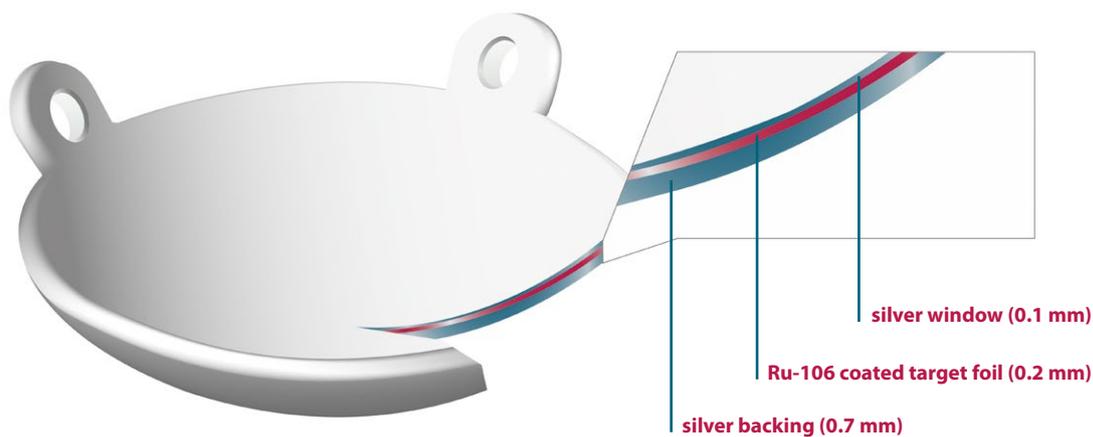
2

The dummy plaque (template) is positioned according to the scleral ink-marks and sutured to the sclera by releasable sutures placed through the eyelets of the dummy. The position of the dummy in relation to the tumor is assessed by using a right-angled transilluminator while performing binocular indirect ophthalmoscopy. Once the dummy is well positioned, a mattress suture is inserted but left loose.



3

The sutures are untied but left in place. The dummy is removed and replaced by the radioactive plaque, which is secured using the same sutures as the template. All sutures are fastened. Any dis-inserted rectus muscles are re-positioned and the conjunctiva is closed.



## Ru-106 Eye Applicators

### First Choice Treatment with Ergonomic Design

For more than 30 years, ophthalmologists have favored Ru-106 Eye Applicators due to their superior design and technical features. Owing to the long half-life of Ru-106, the applicators can be used multiple times over a one-year period. They require no assembly, just sterilization before use. Up to 50 cycles are permitted. With their slim design, they are particularly suitable for treating children.

- 13 types for individual tumor match
- Steep dose fall-off spares organs at risk
- Reusable for one year
- Provided by the only global supplier

The radioactive core of the Ru-106 Eye Applicator consists of a foil coated with ruthenium-106 that decays with a half-life of 373.6 days via rhodium-106 to stable palladium. This core is safely encapsulated within pure silver sheets. The silver backing acts as a radiation shield and absorbs approximately 95 % of the beta radiation.

### Beneficial Beta Radiation Spares Organs at Risk

The beta radiation emitted by Ru-106/Rh-106 has a maximum energy of 3.54 MeV resulting in an advantageous steep dose fall-off. The autoradiography clearly demonstrates that the dose distribution is ideal for treating tumors with a thickness of up to 5 mm. The gamma radiation emitted by Rh-106 contributes with about 1% only negligibly to the total dose in the target volume.



Autoradiography by courtesy of Prof. Lommatzsch showing the characteristic steep dose fall-off.

*"As in most centres, the first choice for treating choroidal melanoma at the Liverpool Ocular Oncology Centre is brachytherapy. Ru-106 plaques have been used there since the service was established, in 1993, with excellent results. Ru-106 offers a particularly limited range of beta radiation, delivering a sufficient dose to the tumor while minimizing collateral damage to healthy parts of the eye."*

Prof. Bertil Damato is former president of ISOO, OOG and EVER. As an ophthalmic surgeon he specialized in the treatment of adult ocular tumors since 1984 and established the Ocular Oncology Service in Liverpool in 1993, leading it for 20 years. His main research interests relate to ocular melanoma and include the development of novel therapies, prognostication and quality of life studies.

# Ru-106 Eye Applicators

## Availability of 13 Different Applicator Types

The applicators are available in 13 different types to tailor the treatment to each individual tumor according to size and location. The plaques are curved, with a radius of

12 to 14 mm and have eyelets for suturing them to the sclera. The diameter of the applicators varies from 11.6 to 25.4 mm.

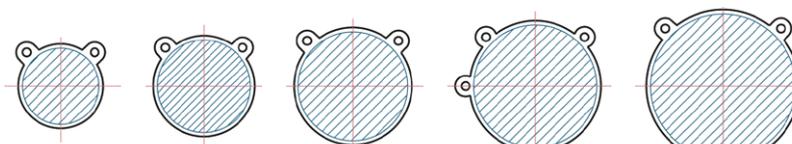
### Retinoblastoma



CCX

CXS

### Peripheral uveal/choroidal melanoma



CCA

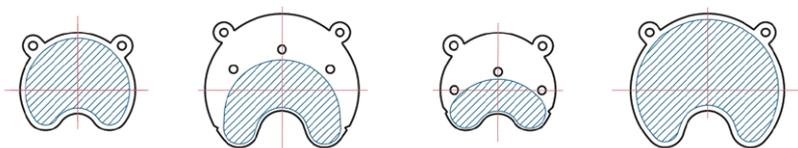
CCD

CCB

CGD

CCC

### Tumors close to the optical nerve



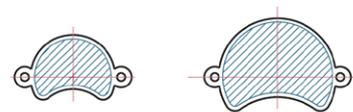
COB

COD

COE

COC

### Ciliary body melanomas or melanomas close to the iris



CIA

CIB

13 types suggested for different tumor sites and sizes

## Dummies for Improved Accuracy

Transparent or silver dummies help to improve the positioning of the Ru-106 Eye Applicators. They are available for all 13 versions of the plaque.

The Damato Templates offer an additional feature: Four holes allow checking the position of the template with respect to the tumor by inserting the tip of a fine right-angled transilluminator through each hole and observing its location by indirect ophthalmoscopy. These special transparent dummies are available for the applicator types CCA, CCB and CCC.



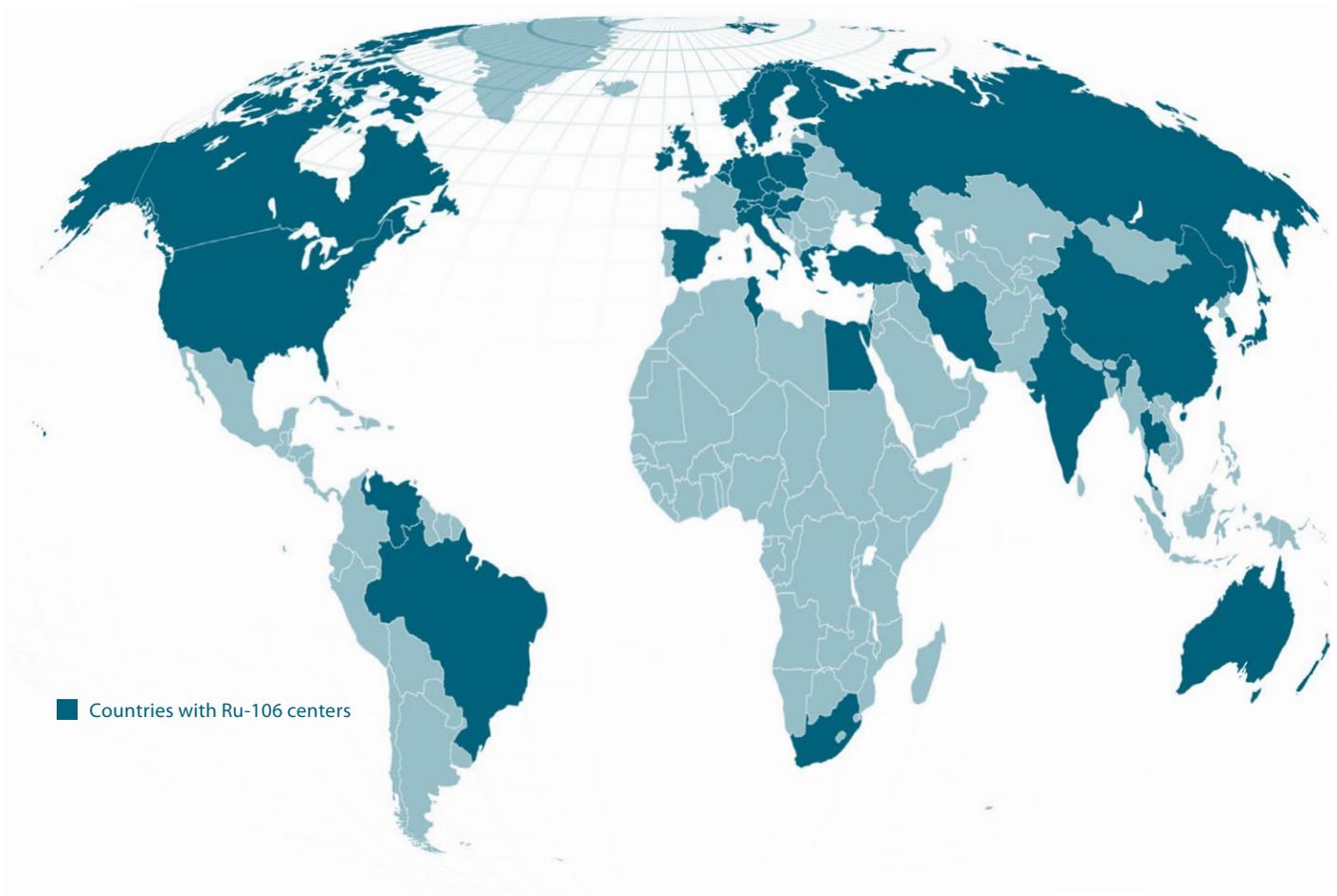
Selection of transparent dummies: Damato Template and regular CIB



Selection of silver dummies: Type CIA and CCB

# Eckert & Ziegler BEBIG: The ONLY Global Supplier for Ru-106 Eye Applicators

Each single applicator is produced, tested and certified in Berlin, Germany, in compliance with high quality standards.



## Source Strength and Depth Dose Rate

All plaques come with an extensive individual source certificate. The source strength is stated as the reference dose rate at the axis at a distance of 2 mm from the applicator surface. Beyond the reference dose rate, the respective certificate provides the absolute depth dose rate as well as a relative dose rate distribution at a 1 mm distance from the applicator surface.

## Safety and Sterilization Container

This specialized container combines an aluminum insert and an outer stainless steel container for shielding of beta and gamma radiation. It facilitates safe and convenient steam sterilization and transportation of Ru-106 Eye Applicators within the clinic. Neither for the treatment room nor for the storage are any structural measures required.



### Dimensions

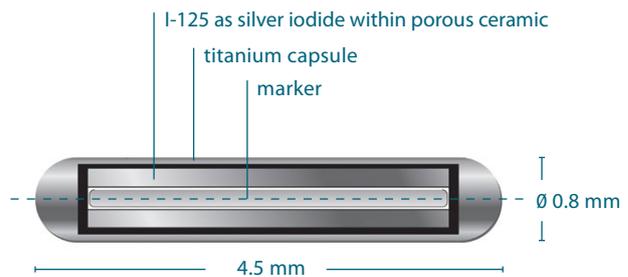
Weight	ca. 2.8 kg
Height with lid	7.6 cm
Total height with handle	19 cm
Diameter	10 cm

# I-125 Ophthalmic Seeds and COMS Eye Applicators

## IsoSeed® I25.S16

With a maximum photon energy of 35 keV, iodine-125 is suitable for treating medium and large uveal melanomas and retinoblastomas, with an apex height of up to 10 mm. IsoSeed® I25.S16 is available in a wide range of apparent activities up to 25 mCi, according to clinical requirements. The number and location of seeds on each plaque can be adjusted to tailor the dosimetry to each individual tumor. They can be reused for up to 6 months, depending on the activity.

- Treatment of even medium and large tumors
- For use with COMS Applicators



IsoSeed® I25.S16 details

## COMS Applicators

For application, IsoSeed® I25.S16 can be inserted via silicone inserts into COMS Plaque Shells, both available from Eckert & Ziegler BEBIG in different sizes. After steam sterilization, the individually assembled COMS Applicator is ready for use.

Silicone COMS insert allows for reproducible seed positioning



COMS Plaque Shell made of a gold alloy that serves as carrier and shield

## Calibration Traceable to PTB

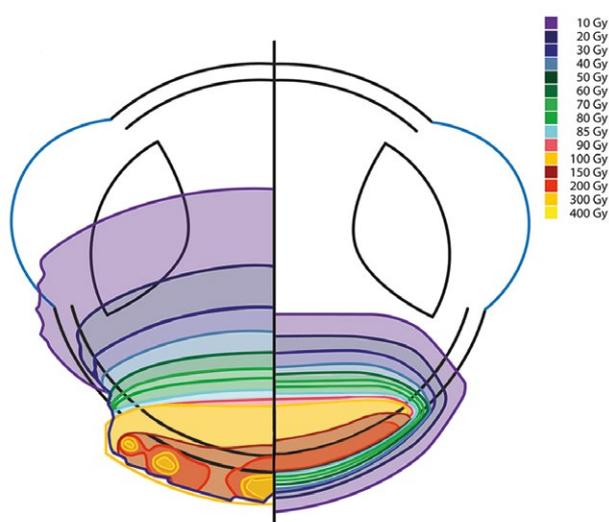
The certified source strength is based on air kerma measurement of IsoSeed® which are traceable to the primary standard of the National Metrology Institute of Germany PTB (Physikalisch-Technische Bundesanstalt). Along with the NIST (National Institute of Standards and Technology), the PTB is a member of the Mutual Recognition Agreement.

IsoSeed® I25.S16 is also suitable for other ophthalmic seed applicators.

# Comparison of Ru-106 and I-125 Applicators

## Dosimetric Comparison

A plot of the 2D dose distributions clearly shows the differences between Ru-106 and I-125 plaques. In their publication, Wilkinson et al.\* demonstrate that for the treatment of thin melanoma Ru-106 plaques generally deliver the dose to a smaller volume and with less side-scatter than I-125 plaques of the same size.



Comparison of the 2D dose distributions of two plaques with 18 mm diameter. Both planned with a dose of 85 Gy to the apex of a thin tumor. I-125 shown on the left and Ru-106 on the right.

*"In addition, for a given tumor, treatment modeling with a Ru-106 plaque gives statistically significant smaller doses to the optic disc and macula. This is advantageous when assessing the risks for radiation retinopathy and radiation optic neuropathy."*

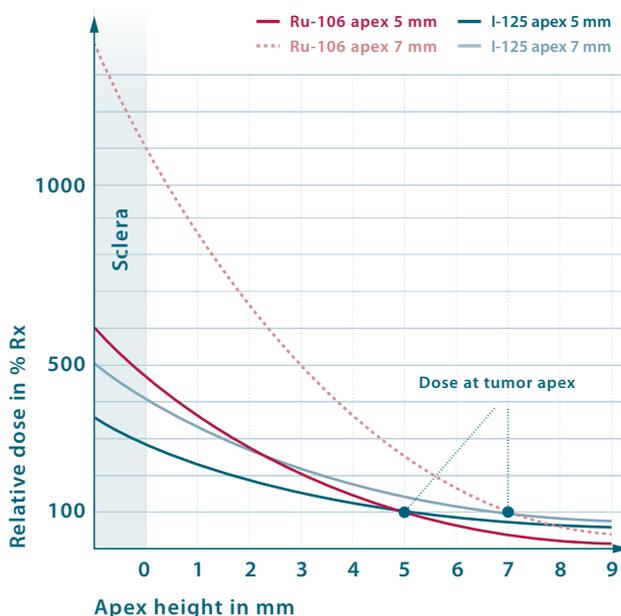
\* The British Journal of Radiology, 81 (2008), Comparison of Ru-106 and I-125 plaques for treatment of shallow choroidal melanoma lesions, Wilkinson DA, Kolar M, Fleming PA, Singh AD.

## Individual Advantages of Ru-106 and I-125

*"Both <sup>125</sup>I and <sup>106</sup>Ru eye plaque brachytherapy treatment result in encouraging tumor control for patients with uveal melanoma. We demonstrate that <sup>106</sup>Ru offers these benefits with reduced toxicity in patients treated for uveal melanomas ≤5 mm in apical height."*

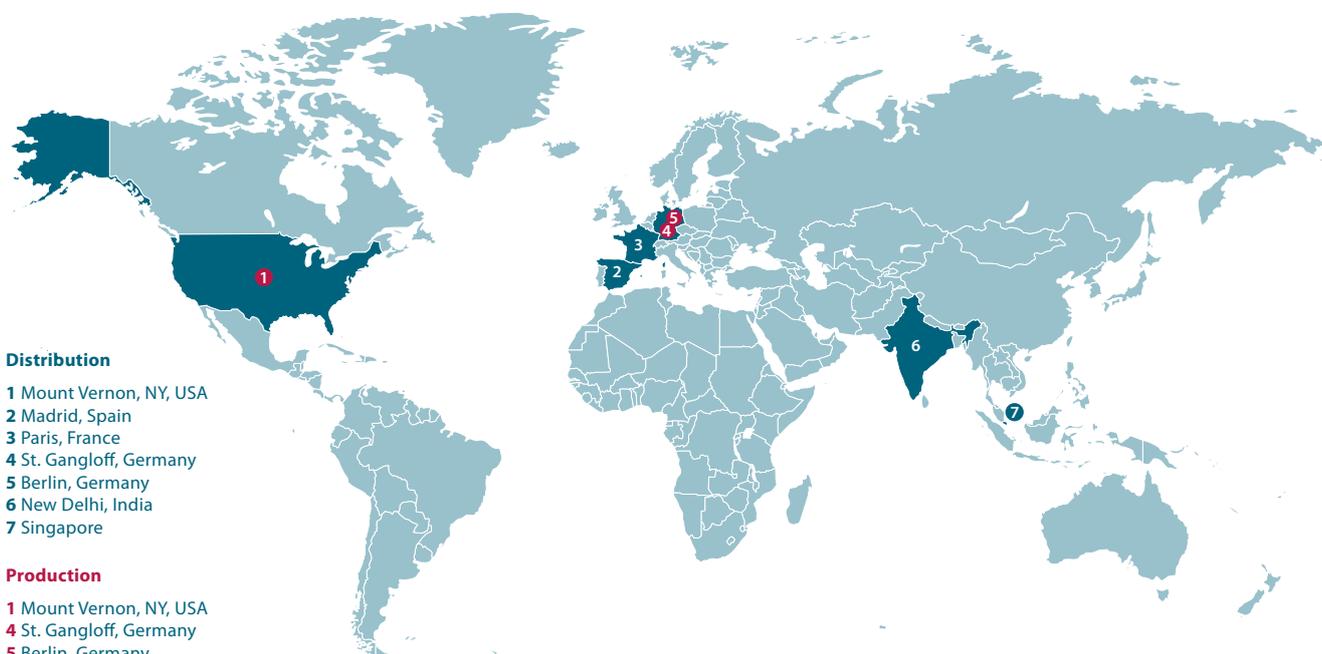
Practical Radiation Oncology, 2015, A Choice of Radionuclide: Comparative Outcomes and Toxicity of Ruthenium-106 and Iodine-125 in the Definitive Treatment of Uveal Melanoma, Takiar V, Gombos DS, Mourtada F, Rechner LA, Lawyer AA, Morrison WH, Garden AS, Beadle BM

The graph of the dose-depth curves of Ru-106 (CCB) and I-125 (COMS) plaques of similar size (Ø 20 mm) clearly shows the individual advantages of the two nuclides. Ru-106 is characterized by a particularly steep dose fall-off, which allows delivery of a sufficient dose to the tumor while effectively sparing adjacent healthy tissue. Beyond a tumor thickness of 5 mm, I-125 provides a sclera dose within well-accepted limits, while for Ru-106 (dashed line) the dose gets quite high.



# Eckert & Ziegler BEBIG

Eckert & Ziegler BEBIG is a global provider of radiotherapy products and a brachytherapy leader in Europe. The company's offices and subsidiaries are located throughout Europe, Asia and the United States. In addition, Eckert & Ziegler BEBIG has a worldwide network of distributors and agents to support the international marketing and distribution of its product lines. In recent years, Eckert & Ziegler BEBIG grew through the acquisitions of US-based Mick Radio-Nuclear Instruments, Inc. and the x-ray devices manufacturer WOLF-Medizintechnik GmbH (Womed). Eckert & Ziegler BEBIG belongs to the Medical Segment of the Eckert & Ziegler Group. The Eckert & Ziegler Group is one of the world's largest providers of isotope technology for medical, scientific and industrial use. The core businesses of the Group are cancer therapy, industrial radiometry and nuclear-medical imaging.



## Distribution

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- 3 Paris, France
- 4 St. Gangloff, Germany
- 5 Berlin, Germany
- 6 New Delhi, India
- 7 Singapore

## Production

- 1 Mount Vernon, NY, USA
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- 5 Berlin, Germany

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