

A decorative graphic in the top right corner consists of concentric circles in blue, green, and orange. A horizontal bar extends from the left edge of the slide, divided into four colored segments: blue, green, orange, and purple. The text 'GYN', 'SKIN', 'BREAST', and 'IORT' is written in white on these segments respectively.

GYN

SKIN

BREAST

IORT

Spectral Comparison of the Xoft and Zeiss 50 kVp X-ray Systems

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Objective

Compare spectra from the Xoft Axxent[®] and Zeiss Intrabeam[®] x-ray sources after filtration by saline-filled balloons and rigid polymer applicators, respectively, with the same diameters as a first step toward evaluating relative biological effectiveness of each dose delivery system.

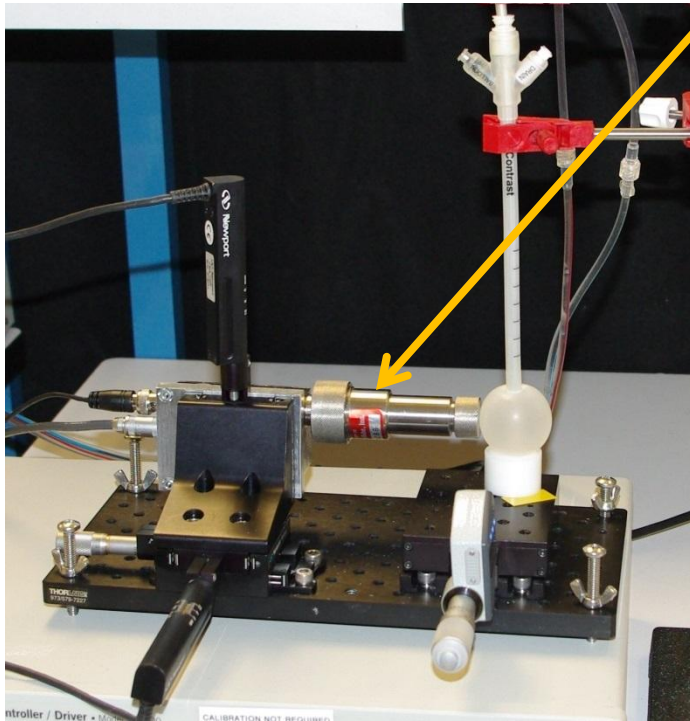
Measurement Geometry

- X-ray spectra were measured for human-use x-ray sources and applicators
 - Xoft Axxent[®] Model S700 was measured within saline-filled Axxent[®] Balloons in the Xoft corporate dosimetry lab
 - Zeiss Intrabeam[®] Model PRS 500 was measured within rigid polymer applicators using a clinically operational system in California*
- A precision X-Y-Z stage was used since source-to-spectrometer alignment was critical

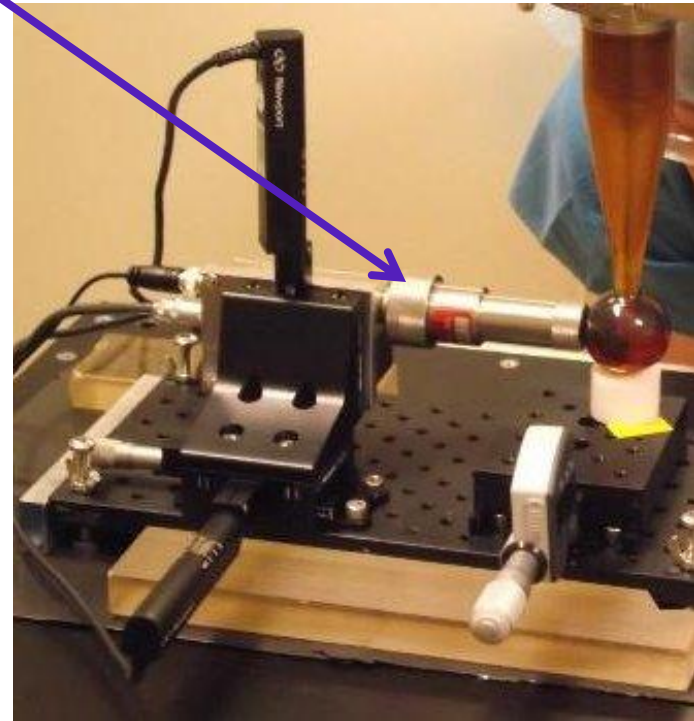
* Thank you to Sutter Medical Center, Sacramento, CA

Spectrometer and Applicator Alignment

X-ray spectrometer



Xoft balloon

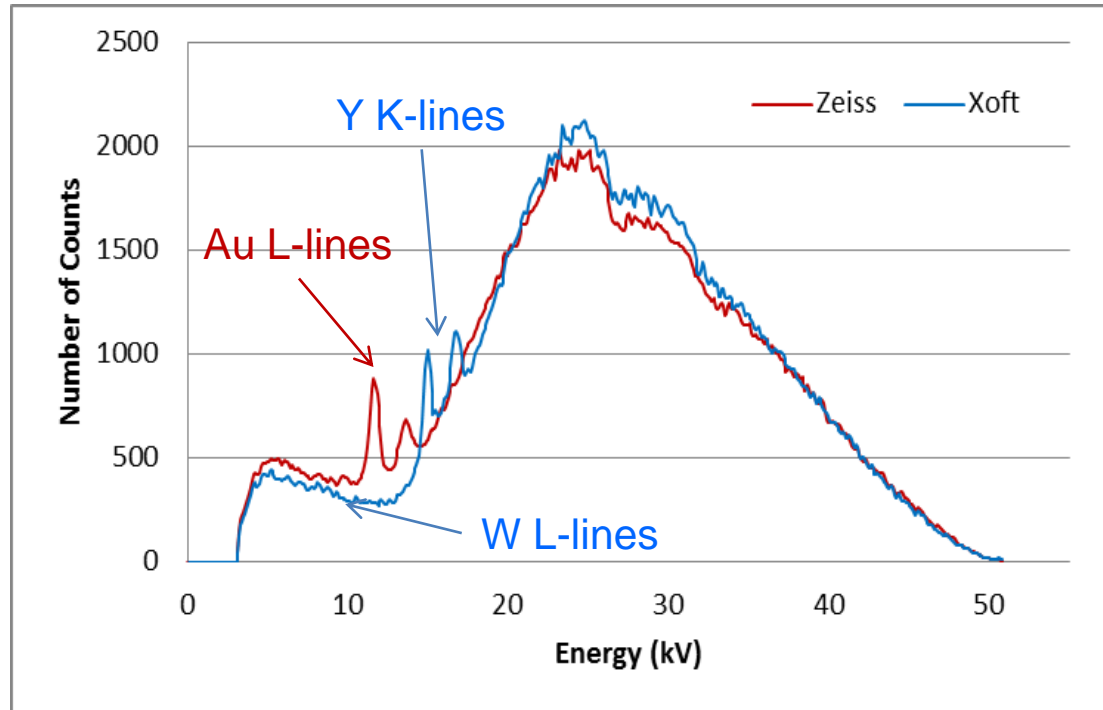


Zeiss applicator

X-ray Spectrum Measurements

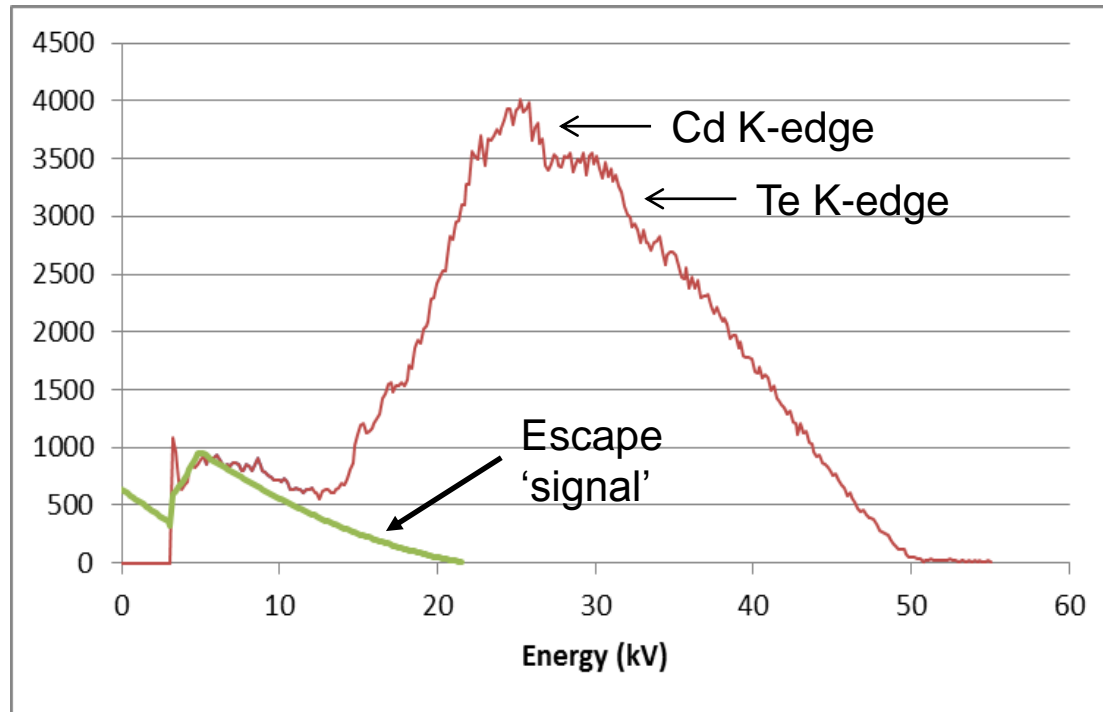
- An AmpTek XR-100T-CdTe x-ray spectrometer was used
 - Applicator surface-to-spectrometer entrance window distance was 52 mm as defined by a collimator housing
- The Axxent and Intrabeam sources were operated at 50 kV and 40 μA to eliminate pulse saturation
 - About 500,000 counts were accumulated for each spectrum
- Spectra were corrected using AmpTek XRF-FP software to remove escape event artifacts

Spectra for 3.5 cm Diameter Applicators



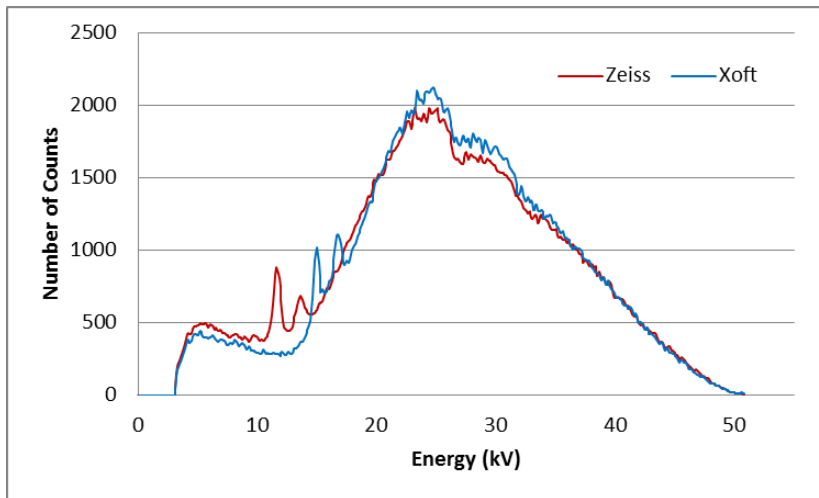
Broad Bremsstrahlung background
with low energy characteristic lines

Spectral Correction

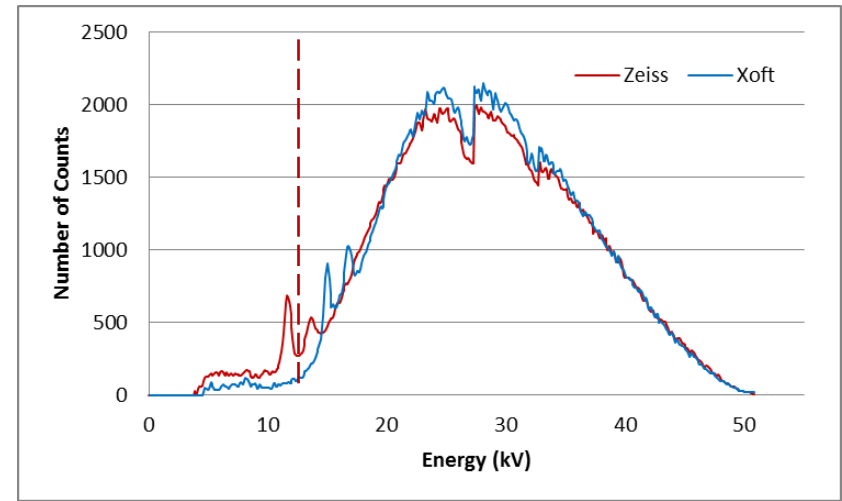


Escape event correction (green) for the 4 cm Xoft balloon spectrum

3.5 cm Diameter Applicators

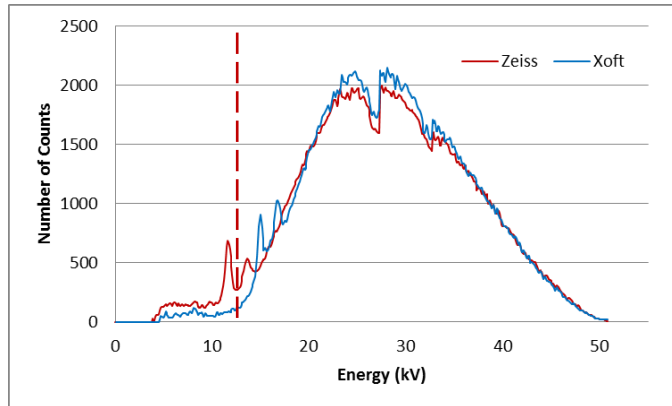


Xoft and Zeiss spectra

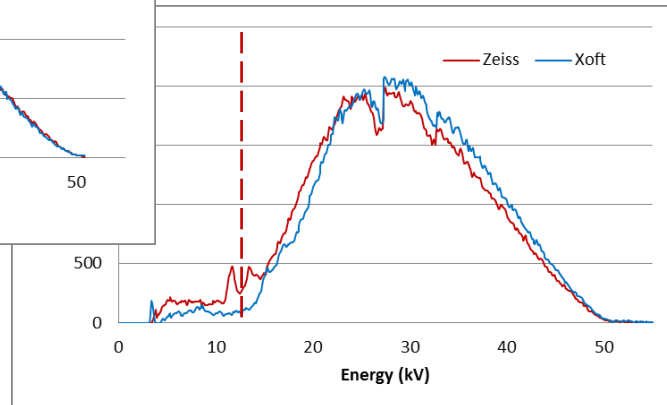


After escape correction

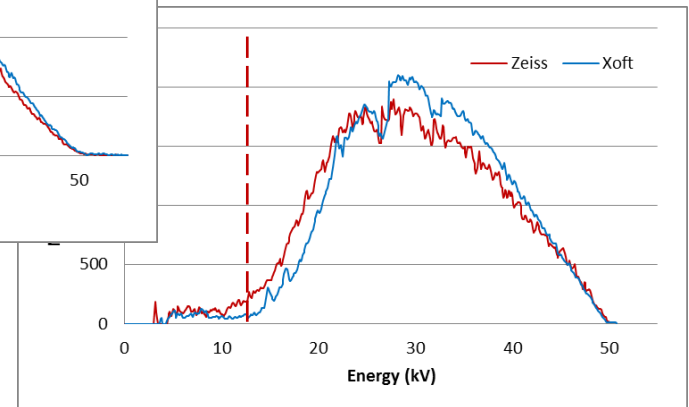
Effect of Applicator Diameter



3.5 cm



4.0 cm



5.0 cm

Relatively more low energy attenuation
by larger diameter saline-filled balloons

Observations on Spectra

- Xoft anode: Tungsten film on an aluminum nitride substrate with yttria binder
 - Tungsten L-lines at 8.4, 9.8 and 11.3 keV
 - Yttrium K-lines at 14.9 and 16.7 keV
- Zeiss anode: Gold film on a beryllium substrate
 - Gold L-lines at 9.7, 11.5 and 13.4 keV
- After filtration by the applicators, the spectral shapes are essentially identical
 - Broad Bremsstrahlung distributions
 - Minor contribution from characteristic x-rays

Quantitative Comparison of Spectra

Applicator Diameter (cm)	After Escape Correction			Above 12 keV After Escape Correction		
	Average Energy (keV)		Percent Difference	Average Energy (keV)		Percent Difference
	Xoft	Zeiss		Xoft	Zeiss	
3.5	28.5	27.9	2.0%	28.7	28.7	0.1%
4.0	29.6	28.3	4.6%	30.0	29.2	2.8%
5.0	32.6	30.8	5.6%	32.8	31.1	5.1%

- Average energies are equal within 1.7 keV

Summary

- X-ray spectra were measured with a Cd-Te spectrometer
 - Xoft source in 3.5, 4.0 and 5.0 cm diameter saline-filled balloons
 - Zeiss source in 3.5, 4.0 and 5.0 cm diameter solid applicators
- Applicator size determines average energies rather than type of x-ray source
- For Xoft and Zeiss applicators of the same diameter
 - Average energies were the same within 1.7 keV or 5.6%

A decorative graphic consisting of a horizontal bar with four colored segments: blue, green, orange, and purple. To the right of the bar is a large circular graphic divided into four quadrants by a vertical white line. The quadrants are colored blue, green, purple, and orange. The circular graphic has concentric rings within each quadrant.

GYN

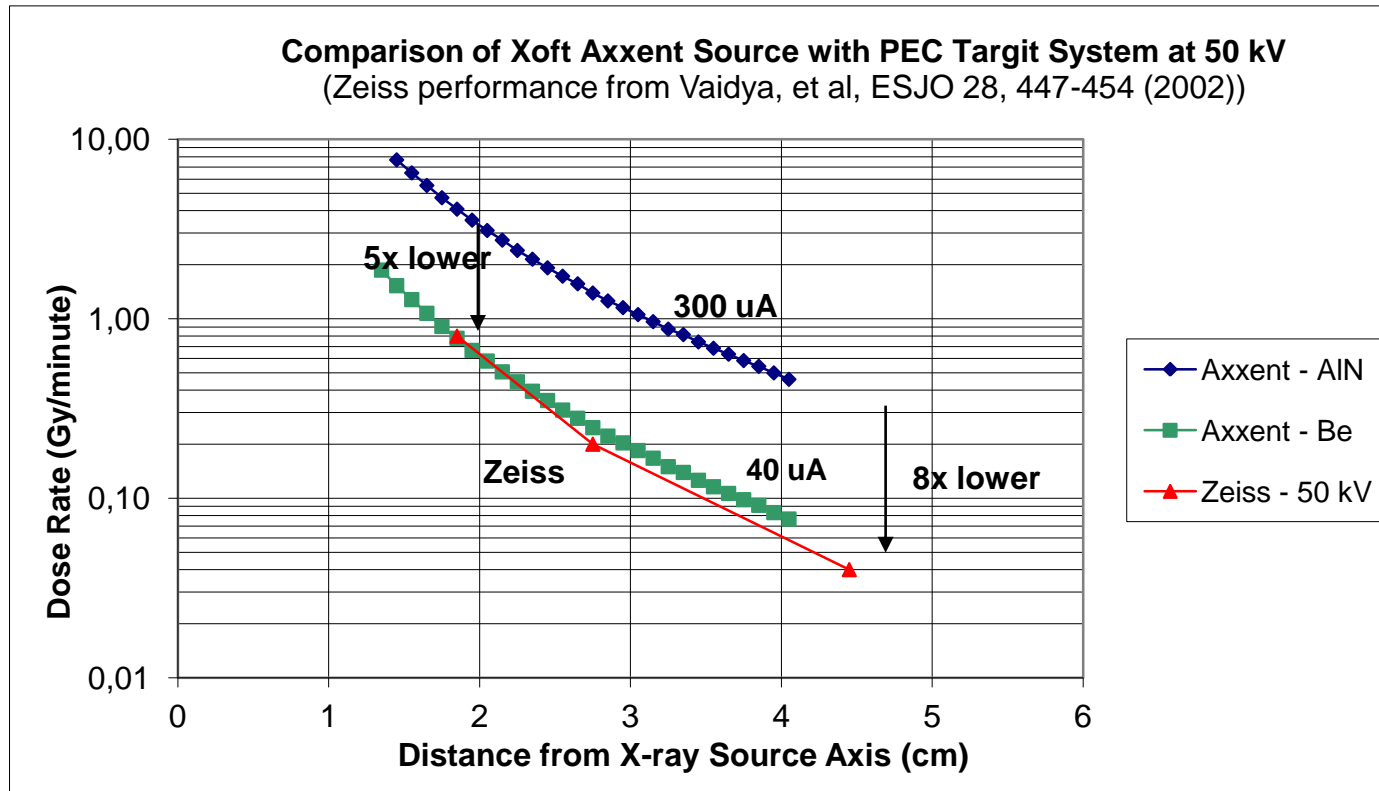
SKIN

BREAST

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Thank you

Comparison of Depth-Dose Curves



About 25% higher dose in water for the Axxent source at 4 cm from the source axis