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HANDBOOK of MAMMOGRAPHIC X-RAY SPECTRA

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BRH
bureau of radiological health

WHO Collaborating Center for Training and General Tasks in Radiation Medicine

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FOREWORD

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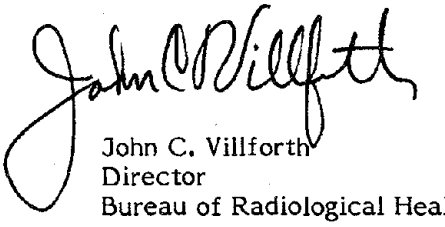
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PREFACE

The Division of Electronic Products (DEP) of the Bureau of Radiological Health, Food and Drug Administration, conducts a program of scientific and technical evaluation of radiation emitting electronic products as part of the FDA's effort to implement the Radiation Control for Health and Safety Act of 1968, PL 90-602.

Within DEP, the Image Analysis Section of the Medical Physics Branch has been developing analytical methodology for evaluating the performance of medical diagnostic x-ray systems. One facet of this effort has been the application of state-of-the-art energy dispersive x-ray spectrometry to the medical x-ray field. The work included in this report is applicable to mammography and to general diagnostic radiography performed at low energies. Comments are solicited from those who find this work useful.

Roger H. Schneider
Director
Division of Electronic Products

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ABSTRACT

This handbook is a compendium of experimentally acquired and corrected x-ray spectra obtained from three conventional mammographic x-ray tubes (tungsten, molybdenum-tungsten, and molybdenum targets) and from a special purpose tube often used for mammography (RSI tungsten anode).

The experimental data are divided into five parts. The first section presents graphical displays of exposure rate data (mR/mAs at 1 meter) that correspond to experimental spectra. The second section describes and compares parameters of 30 kVp x-ray beams produced by the anode material types used in mammographic tubes. The third section describes the data format used for displaying the graphical overlays and for the numerical tabulation of x-ray spectra. In the fourth section specifically selected spectral overlays are used to (1) compare the energy content of x-ray beams produced by different anode materials and x-ray systems, (2) illustrate x-ray beam shaping by using K-edge filters, and (3) demonstrate x-ray beam hardening with phantom materials. The last section contains numerical tabulations of x-ray spectra produced by the mammographic tubes. While these spectra may not be inclusive, they should be representative of a range of mammographic techniques for each tube and system tested. The additional information contained with each tabulation should make it possible for the experimenter to simulate each spectrum by measuring the kVp, filtration, and HVL of the x-ray beam.

HANDBOOK OF MAMMOGRAPHIC X-RAY SPECTRA

1. INTRODUCTION

Mammography has become a widely used procedure for the diagnosis of breast cancer. Its widespread acceptance and increased use have enhanced the development of a wide variety of x-ray systems that have been designed specifically for mammography. Much effort has been made to develop mammographic x-ray systems that reduce radiation dose to the patient while producing an image that is of a quality suitable for detection of breast cancer. The new mammographic x-ray systems may feature innovative development of components such as the power supplies, imaging equipment, x-ray tubes, and x-ray beam filters.

Since an accurate knowledge of the x-ray spectrum is necessary for predicting image quality and radiation dose of any system, these developments also have stimulated a real interest in mammographic x-ray spectra. The spectra produced by these special mammographic systems are not well documented; additionally, the spectra produced by conventional diagnostic equipment that is operated in the low kVp techniques applicable for mammography are limited in availability.

The main purpose of this handbook is to present typical x-ray spectra used in mammography. The experimental data in Section 4 is divided into five parts. In Section 4.1, we present graphical displays of exposure rate data (mR/mAs at 1 meter) that correspond to the spectral tabulations of Section 4.5. Section 4.2 describes and compares the parameters of the 30 kVp x-ray beams that are produced by the three anode materials used in mammographic tubes. Section 4.3 gives a description of the data format used for displaying the graphical overlays and the numerical tabulation of the x-ray spectra. Section 4.4 uses specially selected spectral overlays to (1) compare the energy content of x-ray beams produced by different anode materials and x-ray systems, (2) illustrate x-ray beam shaping by using k-edge filters, and (3) demonstrate x-ray beam hardening with phantom materials. Section 4.5 contains numerical tabulations of mammographic x-ray spectra. While these spectra may not be inclusive, they should be representative of a range of mammographic techniques for each tube and system tested. The additional information contained with each tabulation should make it possible for the experimenter to duplicate each spectrum by measuring the kVp, filtration, and HVL of the x-ray beam.

The descriptive information preceding the experimental data should be useful to the x-ray spectroscopist and should also help the user in deciding which spectra are applicable to his needs. Section 2 describes the equipment used in obtaining the data. The methods and procedures detailed in Section 3 also include a brief description of the data handling techniques used to obtain the corrected x-ray spectra.

Most of the x-ray spectra presented in this report were generated by using a high-voltage waveform that approximates constant potential conditions (< 6 percent ripple). The data include spectra from three conventional x-ray tubes and a nonconventional RSI x-ray generator (RSI systems are now sold and serviced by Pfizer). We plan to publish similar x-ray spectra that will be applicable for mammographic systems using the conventional single-phase high-voltage generator and plan to supplement these data with spectra from new mammographic systems as they become available. In addition, further spectral data that would benefit the medical physics community could be generated; if any health professional has unique spectral requirements, these may be submitted for consideration.

2. EQUIPMENT

The three conventional x-ray tubes that contained the different anode materials were energized and controlled by the same generator-control system (General Electric MSI-1250 II). This system operates as a three-phase, 12-pulse unit in the radiographic mode and as a

single-phase, full-wave rectified system in the fluorographic mode. The latter mode has been modified to make the kVp and mA continuously variable. The x-ray spectra were acquired with the system operating in the fluorographic mode at tube currents less than 2.0 mA. The mR/mAs data were taken at high tube currents with the system operating in the radiographic mode (three-phase, 12-pulse). The high voltage (HV) and the HV waveforms were measured and monitored for both modes of operation with a Phillips Model II kVp meter and an oscilloscope. The HV waveforms indicated that both modes of operation are similar and should produce x-ray spectra approximating constant potential conditions. The ripple on the HV waveform varied from approximately 4 to 6 percent for the spectral data shown here.

The three conventional x-ray tubes operated by this system were:

(1) Dynamax 69M - a glass window, tungsten (W) anode tube manufactured by Machlett for mammography. The inherent filtration was specified to be equivalent to 0.64 mm Al at 70 kVcp.

(2) Dynamax M64 - a glass window, molybdenum (Mo) anode tube manufactured by Machlett for mammography and now called the Dynamax 64. The inherent filtration was specified to be equivalent to 0.7 mm Al at 35 kVcp.

(3) MMX-2-tube - a beryllium (Be) window x-ray tube (1.0 mm Be inherent filtration) manufactured by General Electric for mammography with a Mo-W alloy anode. (Alloy composition is 70 percent Mo and 30 percent W.)

The RSI system has a conventional tungsten anode x-ray tube, but it also features a 45° target angle and focusing grids that produce a very small focal spot. The tube insert has a beryllium window but the x rays exit through an aluminum cover that is 0.5 mm thick. Because of the 45° target angle, self filtration by the anode should be less than for a conventional tube with a small target angle. The system operates as a low-mA, constant potential generator. Therefore, it produces x-ray spectra that are similar to those produced by the conventional generator operated in the fluoroscopic mode.

Exposure measurements were made with a Victoreen model 555 integrating rate meter utilizing a 1 DAS probe. Experimental half-value layers (HVL) were obtained using the above equipment and 1100 alloy aluminum filters. The data for the product of tube current and exposure time (mAs) were measured with a noninvasive meter. A description of this instrument and its development are given in a Bureau of Radiological Health publication (1).

The complete spectrometer system is illustrated (Fig. 1) and has been described previously (2). The system features a high-purity (intrinsic) germanium detector that can be stored at room temperature, but does require liquid nitrogen cooling for data collection.

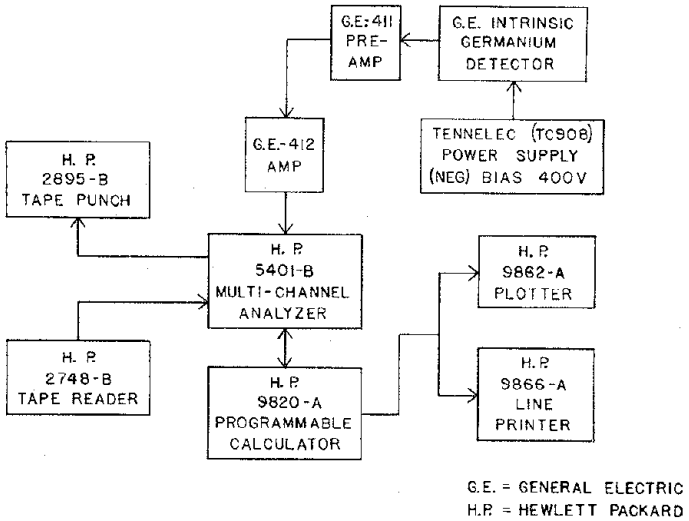


Figure 1. Block diagram of spectrometer system.

3. METHODS AND PROCEDURES

3.1 CALIBRATION PROCEDURE AND SETUP

A list of radiation sources and procedures has been presented for use in resolution measurements, linearity evaluations, and energy calibrations of the spectrometer system (2). Figure 2 illustrates the experimental configuration used to obtain spectral data. The fixture used to position phantom material for making radiographs and attenuating the x-ray beam is not illustrated, but was located approximately 70 cm from the x-ray tube focal spot or just in front of the ionization chamber. The detector aperture diameter was varied from 0.2 to 0.9 mm. Beam limiting collimators and beam shaping filters were inserted at the x-ray tube port. This experimental configuration (Fig. 2) also simulates the narrow beam geometry conditions that are recommended for HVL measurements. (Note location of collimator and filters used for measuring HVL.)

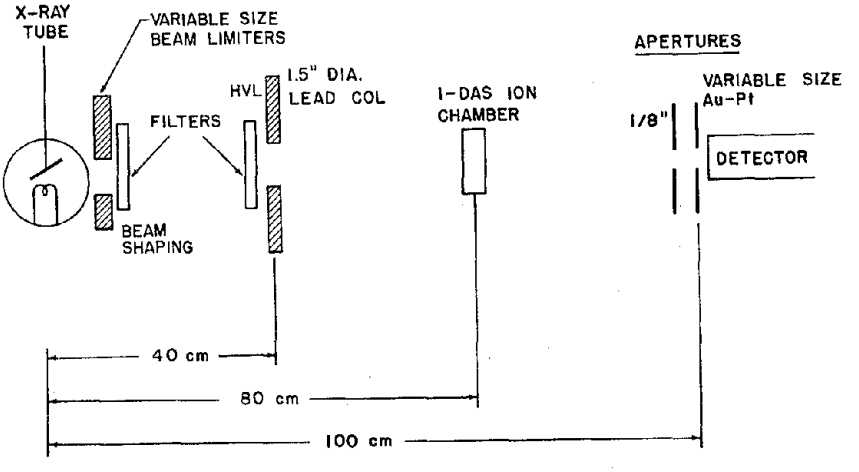


Figure 2. Experimental setup for taking data.

3.2 DETECTOR EFFICIENCY CURVE

Figure 3 illustrates the full energy efficiency curve (FEEC) for our detector. An accurate procedure for calculating its shape below 60 keV was previously reported (3). The shape of the curve above 60 keV was determined by using calculated detector response data that were obtained under Interagency Agreement from Dr. M.J. Berger and Mr. S.M. Seltzer of the National Bureau of Standards, Washington, D.C. They used Monte Carlo calculations to develop response functions for our detector to monenergetic photons. These data and our analytical formulation (3) that were developed independently gave essentially the same results for photon energies below 60 keV.

The FEEC gives the probability that an incident photon will be completely absorbed in the detector, but gives no information about the probability of a photon being partially absorbed and its presence being recorded at the wrong energy. It can be used to correct photopeak data from a monoenergetic photon source but should not be used to correct data from a source emitting a continuous distribution of photons. In the energy region below 60 keV, practically all photons undergo photoelectric interactions with the detector. The K-escape phenomenon (2-4) is the main process by which counts can be recorded incorrectly. Procedures for K-escape correction have been published (3,4). It should be pointed out that application of a simple efficiency correction based on the FEEC can easily produce an altered spectrum that is even more distorted than the original data.

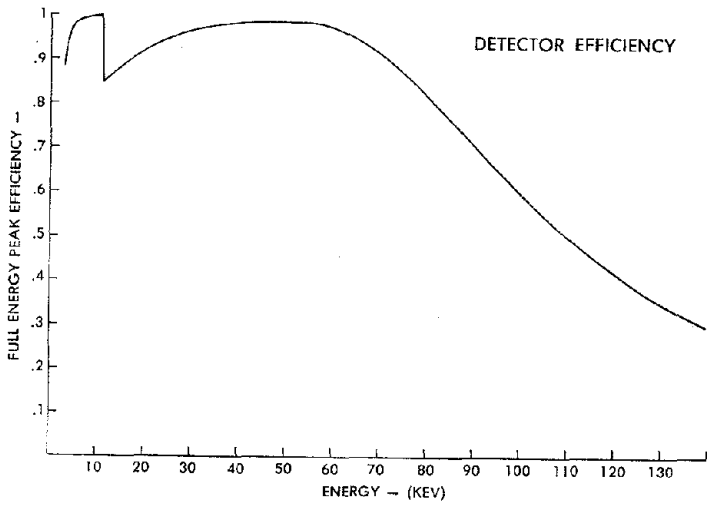


Figure 3. Full energy efficiency curve for our germanium detector.

3.3 DATA HANDLING AND CORRECTION TECHNIQUES

The spectrometer was calibrated to give an energy conversion of 0.15 keV per channel, channel zero corresponding to zero energy (2). The initial data were acquired under these conditions and then summed and averaged over 1.0 keV intervals (Fig. 4). This averaging technique was used solely for comparing the spectral shapes displayed in Figures 4 and 5. All other data in this report were obtained by summing over each keV interval and then applying the correction techniques described below. This averaging technique lowers the effective heights of the energy intervals containing the K_α and K_β x rays (Fig. 4). The location of the

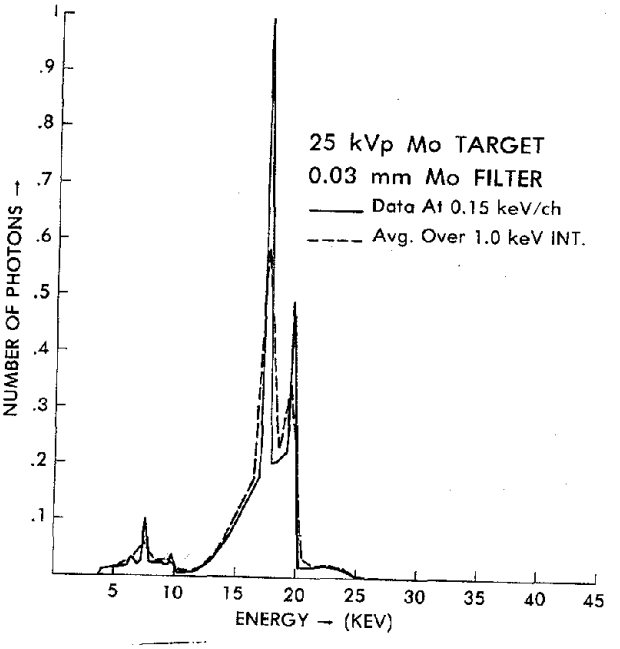


Figure 4. Comparison of data before and after averaging over 1 keV intervals. The peak point of the 0.15 keV/ch spectra has been normalized to unity by displaying all data points in the two spectra as ratios to this peak value.

keV interval must be chosen to make the K_α and K_β x-ray peaks appear approximately in the center of the interval. This procedure is necessary to assure that each K x ray appears in the correct energy interval. It also will minimize the error in our correction technique which assumes that the K_α and K_β x rays have energies of 10 and 11 keV, respectively. The data points below 10 keV in Figure 4 are due to the K-escape process rather than x rays from the tube.

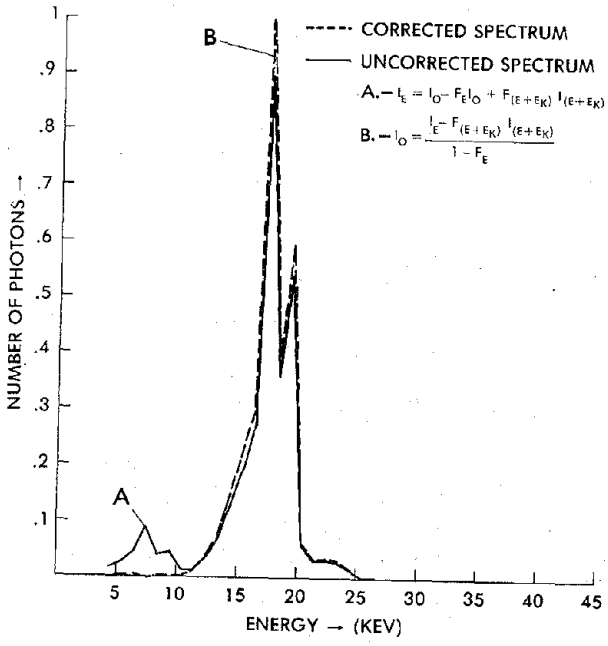


Figure 5. Correction of x-ray spectrum for K-escape distortion. The peak data point of the corrected spectrum has been normalized to unity by plotting all data points in the two spectra as ratios to this peak value.

Since analytical techniques for data correction have been published elsewhere, the correction procedure will be described only briefly. As mentioned above, we assume that the K-escape fraction, F, (3) is equal to the total probability that an incident photon will be recorded in the wrong energy interval. Thus, the measured intensity, I, at any energy, e, can be related to the true incident intensity, I_o, at that energy by:

$$I_e = I_{o,e} - F_e I_{o,e} + F_{e+e_K} + I_{o,e+e_K}, \qquad (1)$$

where e_K is the energy of the germanium K x ray. The second term corrects for the intensity lost by K-escape to a lower energy, while the third term corrects for the intensity gained by escape from a higher energy. Solving for I_o yields:

$$I_{o,e} = \left[I_e - F_{e+e_K} I_{oe+e_K} \right] / (1-F_e) \qquad (2)$$

Since the correction procedure requires a knowledge of $I_{o,e+e_K}$, it must proceed from the maximum to the minimum energy of the spectrum. Using this procedure, the terms containing $e+e_K$ are zero initially and will have been corrected when they are used in the calculation. In order to obtain the resolution shown here, a more complicated procedure was used; the quantity $e+e_K$ was separated into two components that result from the probability

of K_α and K_β escaping separately. The correction procedure is illustrated in Figure 5 and, as can be observed, the K-escape counts below 10 keV have essentially been removed. Spectra having abrupt changes in the region where the K-escape process is highly probable are the most difficult spectra to correct.

4. EXPERIMENTAL DATA

4.1 EXPOSURE RATE DATA

This section presents the exposure rates (mR/mAs) produced at 1 meter by the four x-ray tubes used in this study. Accurate mAs measurements could not be made with our experimental setup when the generator was operated at the low current levels used to acquire x-ray spectra. At the low tube currents used, the leakage current was a significant portion of the current flowing through the tube and producing x rays. The mAs measuring technique (1) used here should obviate most of the leakage current problem; unfortunately, the instrumentation is not accurate at currents below 1 mA. Therefore, the generator was operated in the radiographic mode rather than the fluoroscopic mode to obtain this data. Section 2 explains why the two modes should give similar results.

Leakage currents are also a problem with the RSI system. In fact, a plot of mR/mAs as a function of mA at 50 kVp shows the mR/mAs will increase by a factor of 3 when the mA is varied from 0.4 to 4.0 mA. The mAs data were acquired with the system operating at the highest mA setting (4 mA). The kVp and mA were measured at the console by using conventional meters across the monitoring points. The accuracy of the time setting was monitored with an oscillator that was controllable by an x-ray beam monitor.

The data are presented graphically by plotting mR/mAs as a function of kVp for various values of x-ray beam filtration. The experimental data made a very smooth curve; in fact, the plots presented here were obtained by using a computer program to fit a curve to the data and plot the data on the graphs. Figures 6-9 present this data for some typical x-ray beams produced by the four types of x-ray tubes studied. Furthermore, one could interpolate between the curves furnished here to obtain fairly accurate exposure data for the appropriate x-ray beams.

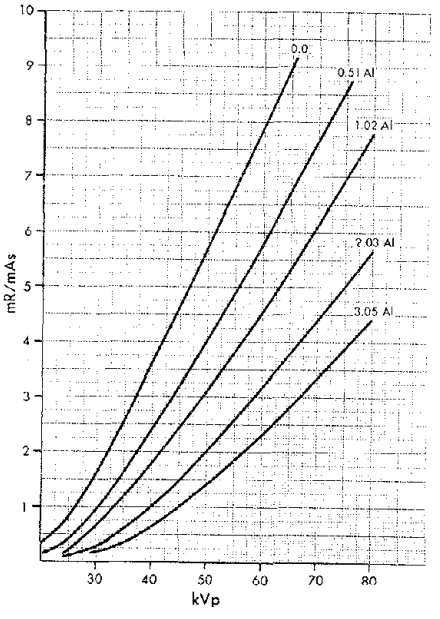


Figure 6. Exposure rates (mR/mAs) measured at 1 meter for the Dynamax 69M x-ray tube. The value listed for each curve is the filtration in mm of Al inserted in the x-ray beam. Inherent filtration is approximately 0.64 mm Al equivalent at 70 kVcp.

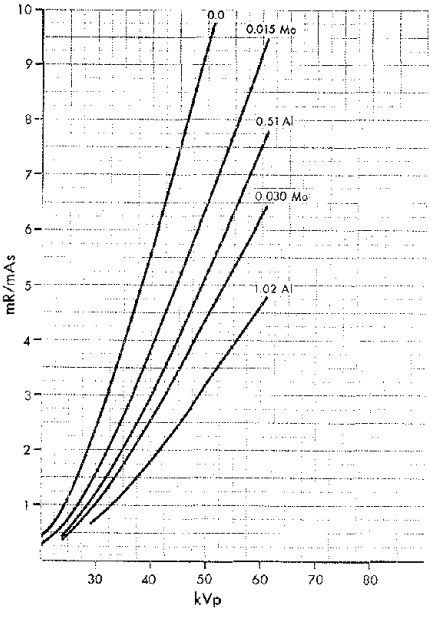


Figure 7. Exposure rates (mR/mAs) produced at 1 meter by the Dynamax M64 x-ray tube. Beam filtration is listed in mm for Al and Mo. Inherent filtration is approximately 0.7 mm Al equivalent at 35 kVcp.

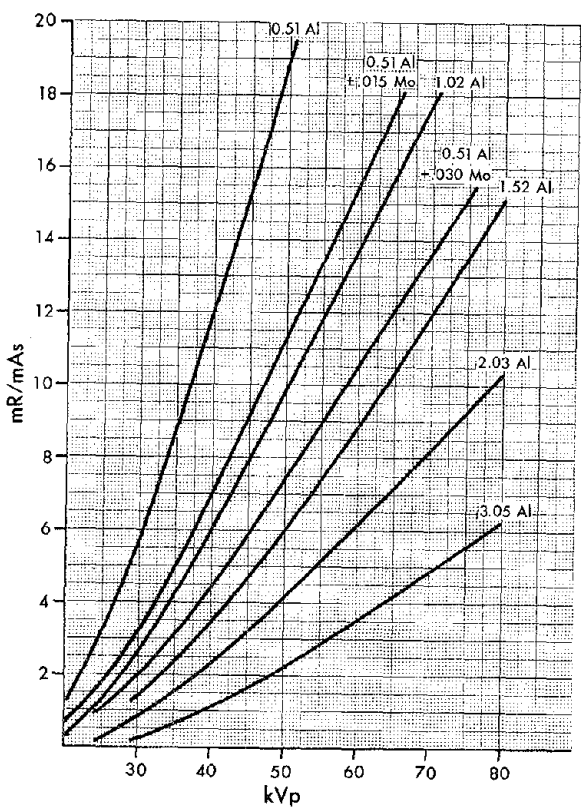


Figure 8. Exposure rates (mR/mAs at 1 meter) for the MMX-2 x-ray tube. Beam filtration is listed in mm for Al and Mo. Inherent filtration is approximately 1.0 mm Be.

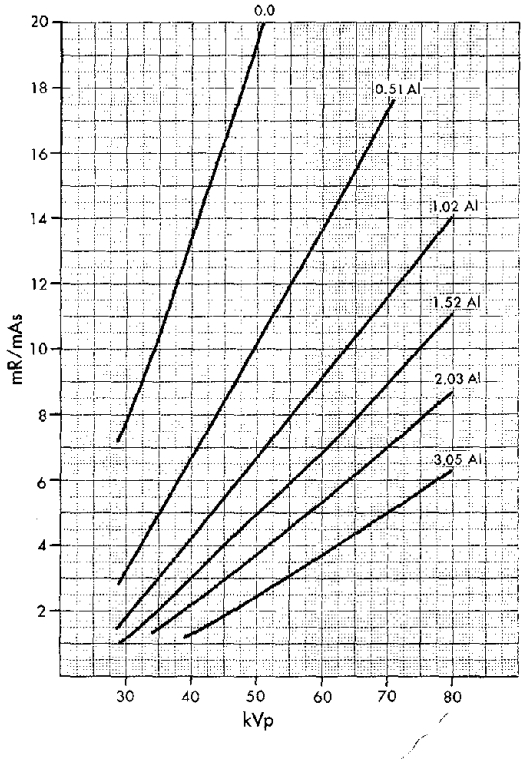


Figure 9. Exposure rates (mR/mAs) produced at 1 meter by the RSI system. The values listed for each curve are the Al filtration (mm) inserted in the x-ray beam. Inherent filtration is approximately 0.5 mm Al.

4.2 COMPARISON OF 30 kVp X-RAY BEAMS

Table 1 illustrates the relative radiation intensities (mR/mAs) for the tubes using the three anode materials at a target to detector distance of 77 cm. The output from the composite Mo-W anode is much higher than from the other two anode materials. This high output is due in part to differences in target angle and filtration. The Mo-W anode has a target angle of 15°, while the other two anodes have 12° target angles. The Mo and W anode x-ray tubes have approximately the same inherent filtration (0.7 and 0.64 mm of Al), which is almost 0.2 mm more than the Mo-W anode tube. Furthermore, an intensity comparison in terms of mR/mAs is really not fair to the W anode, because its spectrum has fewer of the low energy photons which are more efficient at ionizing air. The last column of Table 1 has made use of our spectral data to convert the ionization data (mR) to photons·cm^{-2}, and these data should be used for intensity comparisons. The data are not shown here, but we also tried to adjust filtrations to make the three tubes have equal filtration. Even after allowing for all these factors, the Mo-W anode output appears to be significantly higher than the Mo or W anode. The last row of Table 1 demonstrates the beam parameter for the RSI tube. Spectral comparisons of these x-ray beams are shown in Figures 10 and 11 of Section 4.4.

Table 1. 30 kVp x-ray beam comparisons

Anode	Filtration (mm Al) INH	Added	HVL[a]	mR/mAs[b]	Photons/cm^2/mAs (X10^7)
Mo	0.70	--	0.48	3.92	1.64
Mo-W	0.51[c]	--	0.41	9.26	3.56
W	0.64	--	0.58	2.84	1.37
RSI Tube	0.50	0.51	0.60	5.83	2.93

[a]HVL in mm of Al - measured and calculated values gave excellent agreement.

[b]Measured at 77 cm.

[c]0.51 mm Al added to inherent filtration of approximately 1 mm Be.

4.3 DESCRIPTION OF EXPERIMENTAL DATA FORMAT

The remainder of the spectra shown and all those tabulated have been corrected for K-escape and, except for the intensity comparisons shown in Figures 15 and 17, the total number of photons in each spectrum has been normalized to unity area. This type of data display facilitates comparisons of x-ray spectra and makes it possible to overlay similar spectra on the same graph. Furthermore, when the area is normalized to unity, the coordinates of each data point in these spectral displays have useful meanings--the abscissa gives the energy interval and the ordinate yields the fraction of photons contained in that energy interval of the x-ray spectrum.

The data format combines the theoretical constraints with the experimental limitations of our equipment. A 1-keV interval is necessary for separating the Mo K_α and K_β x-rays and then removing the detector distortion caused by the escape of K_α and K_β x rays from the germanium detector. The energy of the Mo K x rays further constrained the location of the 1-keV interval to be centered between the whole integer numbers. (See Section 3.3 for more information.)

The descriptive information included with each x-ray spectrum should make the data more useful to the experimenter. The experimenter can estimate the spectral distribution of an x-ray beam by measuring parameters such as filtration, HVL, and kVp. We also have included a normalization factor (3) with each spectrum; it can be used to calculate the differential photon fluence spectrum (photons/cm^2) that will produce an exposure of 1.0 mR. This is accomplished by multiplying each fractional value of a tabulated spectrum by the normalization factor for that spectrum. Conversely, if an x-ray beam quality tabulated here can be duplicated experimentally, this normalization factor and an exposure measurement also can be used to obtain the differential photon fluence spectrum of that x-ray beam.

4.4 X-RAY BEAM COMPARISONS USING SPECTRAL DISPLAYS

Figure 10 illustrates a comparison of 30 kVp x-ray spectra from three tubes having different anode materials. The spectra from Mo and Mo-W anodes have an extremely large fraction of the photons located between 16 and 20 keV. The filtrations listed for the W and Mo anodes are the manufacturers' specification for inherent filtration. Since the Mo-W anode was in a beryllium window x-ray tube, the total filtration was the amount of Al added to the x-ray beam. The spectral data (Fig. 10) indicate that the Mo and W anode x-ray tubes have

approximately the same low energy cutoff point, which must mean they also have approximately the same inherent filtration.

Figure 11 illustrates a 30 kVp spectral comparison of the RSI system with the conventional tube described in Section 2. The filtration of the RSI tube was adjusted so that the low energy sides of the two spectra were nearly identical. This was accomplished by adding 0.5 mm Al to the RSI tube; therefore, the spectra in Figure 11 were taken with total beam filtrations (mm Al equivalent) of 0.64 for the conventional tube and 1.0 for the RSI tube. This difference in filtration of approximately 0.4 mm Al is caused by the variation in anode filtration resulting from a target angle of 12° for the conventional tube and 45° for the RSI tube. The high energy end of the spectra in Figure 11 also serves to illustrate the difference between a true constant potential generator (RSI system) and one with approximately 6-percent ripple. The end-point energies of these spectra are nearly the same; however, the waveform and spectral shapes indicate that the high voltage applied to the conventional tube was above 28.5 kV for only a small fraction of the time.

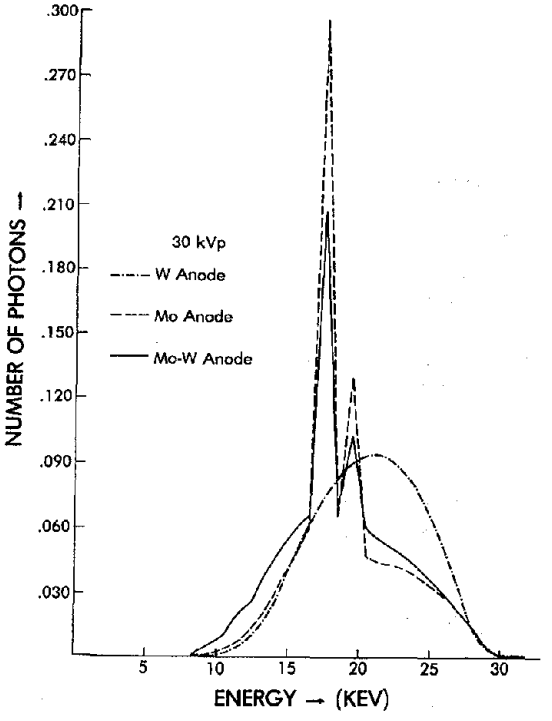


Figure 10. Comparison of 30 kVp spectra from W, Mo, and Mo-W anode x-ray tubes. (All spectra normalized to unity area).

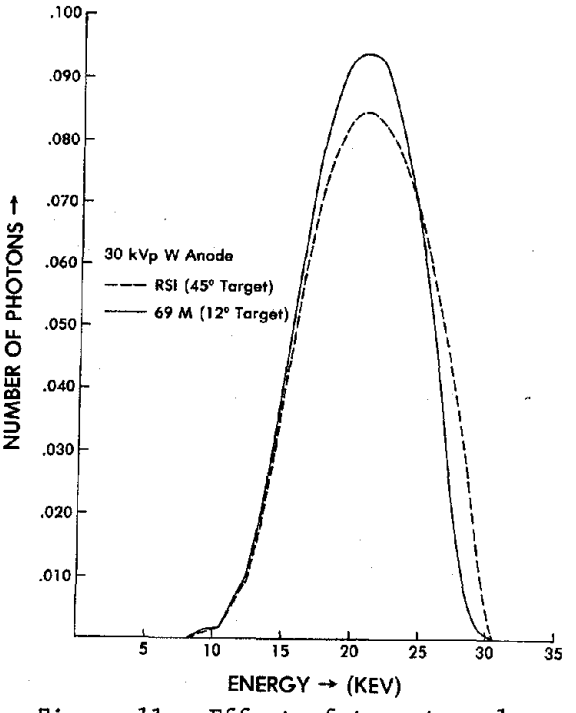


Figure 11. Effect of target angle and waveform on x-ray spectrum.

The spectra in Figure 12 illustrate the use of a K-edge filter for shaping the mammographic x-ray spectrum of the Mo-W anode tube. This technique is extremely effective when the filter and anode materials are the same and the kVp exceeds the K absorption edge of the target material. Addition of Mo filtration enhances the photon fraction just below the Mo K-edge; and, in fact, addition of 0.03 mm of Mo increases this percentage of x rays from 66 to 81 percent. Calculations also indicate that this portion of the photons (81 percent) actually produce 92 percent of the skin exposure.

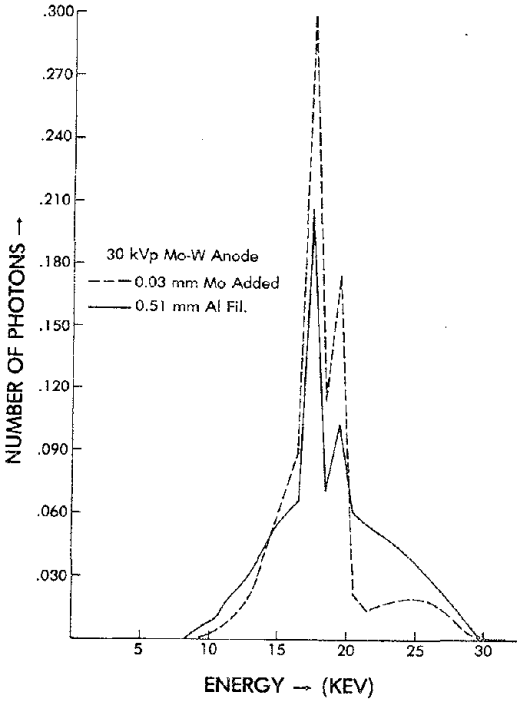


Figure 12. Effect of 0.03 mm Mo filter on spectra generated at 30 kVp by a Mo-W anode x-ray tube. (Both spectra normalized to unit area.)

The spectra from W anode tubes also can be shaped by K-edge filters. Figures 13 and 14 compare spectra using this technique and the normal technique of filtration with aluminum. The tin filter has altered the spectrum so that approximately 70 percent of the photons are located in the energy interval between 23 and 30 keV. The lanthanum filter consisted of four x-ray intensifying screens, equivalent to approximately 0.1 mm of lanthanum. Spectral shaping with these higher Z materials did not prove useful for mammographic systems using

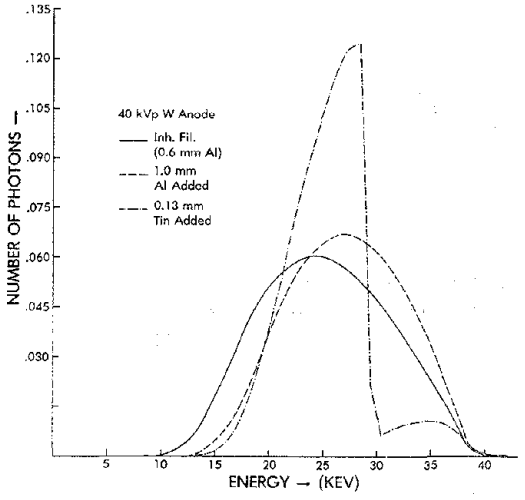


Figure 13. Comparison of effect of Al and Sn filters on 40 kVp, W anode x-ray tube operated at 50 kVp. (All spectra normalized to unity area.)

silver based film and normal imaging techniques, but might prove useful for systems using xeroradiography, ionography, or image processing. Spectral shaping is very useful for radiographic imaging when the material to be radiographed has a K-edge discontinuity below the K-edge of the filter (5,6). For example, if the tumor could be selectively loaded with iodine, normal radiography would be extremely efficient utilizing the lanthanum filtered spectrum (Fig. 11).

The three anode materials also were used to examine changes in the x-ray spectrum after it penetrated phantom materials. Various thicknesses of Lucite and polystyrene were used as phantom materials and produced practically identical results (comparing the primary beams) when the polystyrene was approximately 1.2 times thicker than the Lucite. (Lucite, Plexiglas, and Acrylic have the same chemical composition, $C_5H_8O_2$, and specific gravity--1.18 to 1.19.)

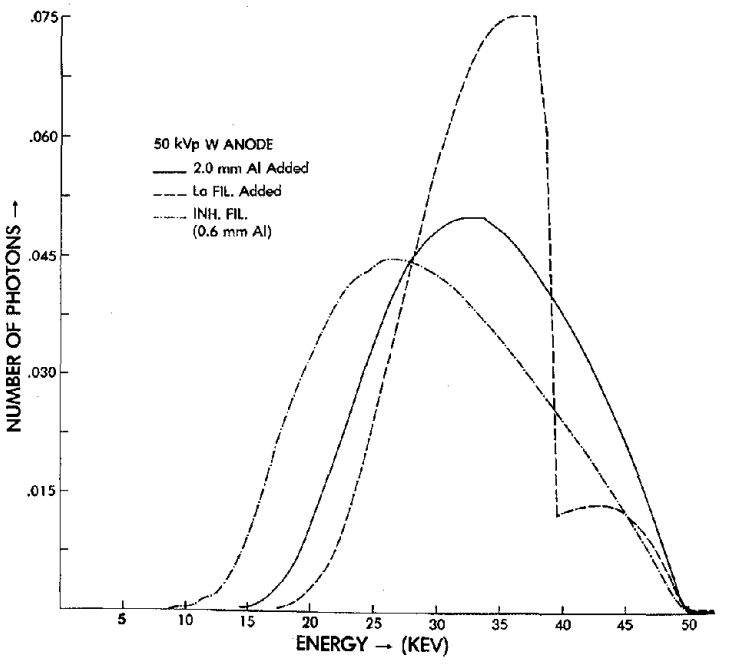


Figure 14. Effect of Al and La filters on x-ray spectra from W anode x-ray tube operated at 50 kVp. (All spectra normalized to unity area.)

All the spectra shown here were obtained with Lucite, and the Lucite thickness should be multiplied by approximately 1.25 to obtain an equivalent compressed breast thickness. (This value represents the density ratio of Lucite to breast tissue; 0.95 was assumed to be the density of breast tissue). A 40 kVp, tungsten anode x-ray beam was used to demonstrate spectral change as a function of Lucite thickness. The 30 kVp beam exhibits the same changes, but the various spectra are not well enough separated to be displayed as in Figure 16. Figure 15 illustrates the change in shape and intensity of entrance and exit spectra. Figure 16 compares two exit spectra with an entrance spectrum. This display clearly indicates hardening of the x-ray beam by preferential absorption of low energy photons.

X-ray beams that have been shaped by K-edge filters undergo a unique spectral change as a function of Lucite thickness. Figure 17 illustrates the effect of adding 3.2 cm of Lucite to a 30 kVp x-ray beam produced by a Mo anode target and filtered by 0.03 mm of Mo. Figure 18 shows the relative changes in spectral shape above and below the Mo K-edge as a function of Lucite phantom thickness. The incident spectrum has 88 percent of the photons below the Mo K-edge; but, after penetrating 6.4 cm of Lucite, this percentage has been reduced to only 42 percent. Thus even for a relatively large absorber, at 30 kVp the Mo K x rays still represent a substantial fraction of the exiting flux.

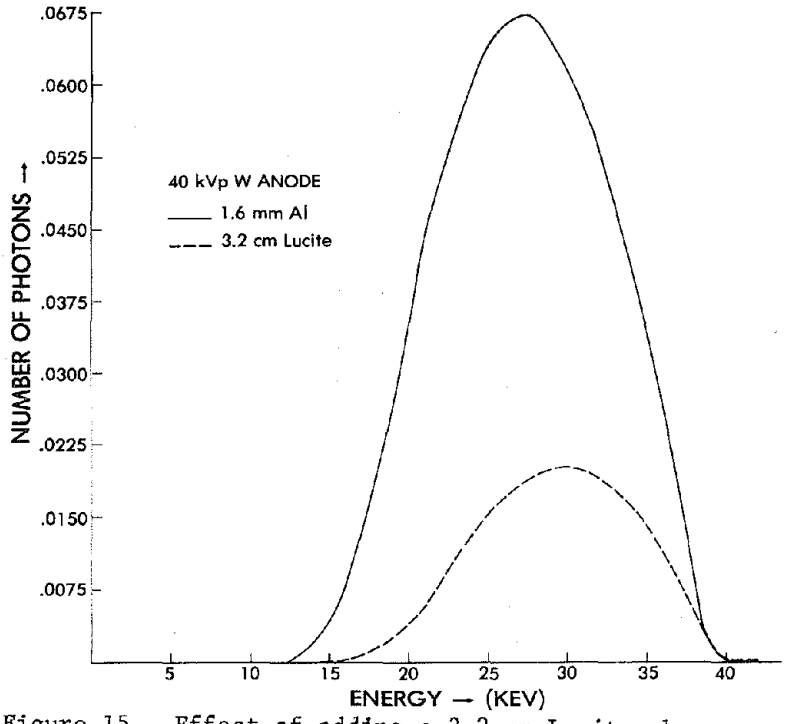


Figure 15. Effect of adding a 3.2 cm Lucite phantom to W anode x-ray spectra.

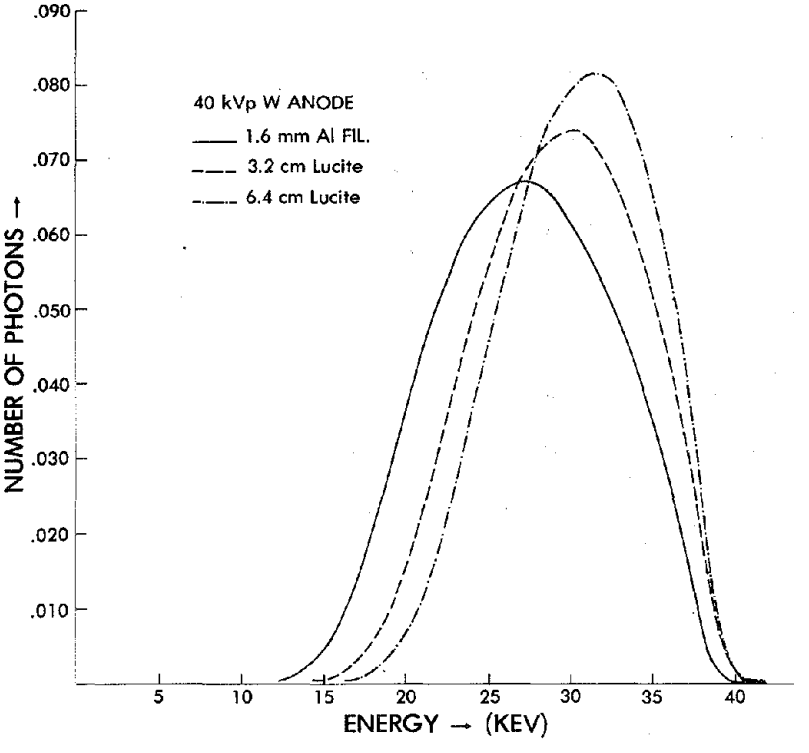


Figure 16. A 40 kVp, W anode x-ray spectra transmitted through 1.6 mm Al and 3.2 or 6.4 cm Lucite. (All spectra normalized to unity area.)

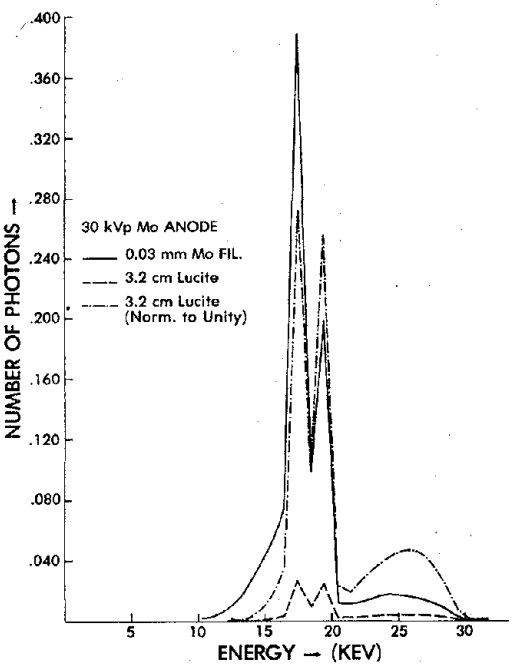


Figure 17. Effect of adding 3.2 cm Lucite phantom to Mo anode x-ray spectrum.

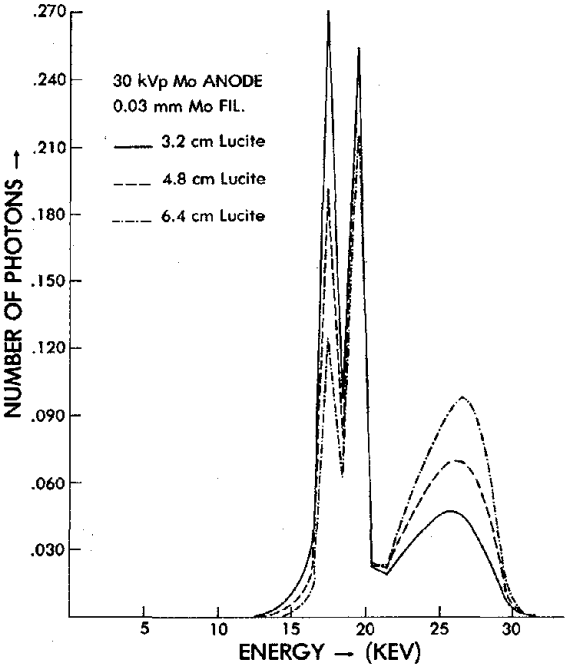


Figure 18. A 30 kVp, Mo anode x-ray spectra transmitted through 3.2, 4.8, and 6.4 cm of Lucite. (All spectra normalized to unity area.)

4.5 INTRODUCTION TO TABULATED SPECTRAL DATA

The mammographic spectra are catalogued under three functional listings entitled primary spectra, exit spectra, and RSI spectra. The spectra obtained by using K-edge filters for x-ray beam shaping are included with the entrance spectra. The data is preceded by a spectral index that lists some of the x-ray beam parameters for each tabulated spectrum. This index should aid the user to locate the spectrum that best satisfies his requirements. The equipment and data format are described in Sections 2 and 4.3, respectively. The HVL's listed here were obtained from calculations using the spectral data, and are in excellent agreement with experimental values. The total filtration given for each x-ray spectrum was obtained by assuming the following inherent filtrations for the four x-ray tubes: (1) 0.6 for W anode, (2) 0.6 for Mo anode, (3) 0.0 for Mo-W anode (1.0 mm Be was ignored), and (4) 0.5 for the tube in the RSI system. Recent data from Machlett indicates that the equivalent inherent filtrations of the tungsten and molybdenum anode tubes are 0.64 or 0.7 mm Al, respectively. The filtration is composed of glass, insulating oil, and plastic. Note that these inherent filtrations are specified at 70 and 35 kVcp, respectively, and that the actual Al equivalent value varies with voltage.

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4.5.1 INDEX OF MAMMOGRAPHIC X-RAY SPECTRA

4.5.1 INDEX OF MAMMOGRAPHIC X-RAY SPECTRA

PRIMARY SPECTRA, TUNGSTEN ANODE

kVp	HVL	Filtration mm Al	Filtration mm Other	Page
25	0.43	-		22
25	0.54	0.51		22
25	0.62	1.02		22
25	0.79	3.05		23
30	0.58	-		23
30	0.71	0.51		23
30	0.81	1.02		24
30	0.96	2.03		24
30	1.08	3.05		24
30	0.99	-	0.13 Sn	25
35	0.78	-		25
35	1.11	1.02		26
40	0.83	-		26
40	1.04	0.51		27
40	1.22	1.02		27
40	1.49	2.03		28
40	1.70	3.05		28
40	1.20	-	0.13 Sn	29
40	2.03	-	0.13 La	29
45	1.01	-		30
45	1.49	1.02		30
50	1.09	-		31
50	1.39	0.51		31
50	1.61	1.02		32
50	2.01	2.03		32
50	2.32	3.05		33
50	1.40	-	0.13 Sn	33
50	2.42	-	0.13 La	34
50	2.88	-	0.15 Sm	34
50	3.36	-	0.20 Gd	35
55	1.22	-		35
55	1.83	1.02		36
55	2.60	-	0.13 La	36
60	1.29	-		37
60	1.64	0.51		38
60	1.95	1.02		39
60	2.82	3.05		40
60	2.43	2.03		41
60	2.80	-	0.13 La	42
60	3.18	-	0.15 Sm	42
60	3.89	-	0.20 Gd	43
60	4.55	-	0.23 Er	43

INDEX OF MAMMOGRAPHIC X-RAY SPECTRA

PRIMARY SPECTRA, MOLYBDENUM - TUNGSTEN ANODE

kVp	HVL	Filtration mm Al	Filtration mm Other	Page
20	0.08	-		44
20	0.23	0.51		44
25	0.09	-		44
25	0.32	0.51		45
30	0.10	-		45
30	0.41	0.51		46
30	0.57	1.02		46
30	0.31	-	0.030 Mo	47
30	0.45	0.51	0.030 Mo	47
35	0.11	-		48
35	0.45	0.51		48
40	0.54	0.51	0.030 Mo	49
40	0.50	0.51		49
40	0.70	1.02		50
40	1.00	2.03		50
40	0.12	-		51
40	0.84	1.52		51
45	0.54	0.51		52
45	0.13	-		52
50	0.13	-		53
50	0.56	0.51		53
50	0.77	1.02		54
50	0.96	1.52		54
50	1.17	2.02		55
50	1.40	2.54		55
50	1.63	3.05		56

INDEX OF MAMMOGRAPHIC X-RAY SPECTRA

PRIMARY SPECTRA, MOLYBDENUM ANODE

kVp	HVL	Filtration mm Al	Filtration mm Other	Page
20	0.30	-		57
20	0.36	-	0.030 Mo	57
25	0.42	-		58
25	0.51	0.51		58
25	0.46	-	0.030 Mo	59
25	0.44	-	0.015 Mo	59
30	0.59	0.51		59
30	0.66	1.02		60
30	0.49	-	0.015 Mo	60
30	0.54	0.51	0.030 Mo	60
30	0.48	-		61
30	0.50	-	0.030 Mo	61
35	0.53	-		62
35	0.53	-	0.030 Mo	62
35	0.58	0.51	0.030 Mo	63
35	0.63	0.51		63
40	0.56	-		64
40	0.56	-	0.015 Mo	64
40	0.56	-	0.030 Mo	65
40	0.62	0.51	0.030 Mo	65
40	0.71	1.02	0.030 Mo	66
40	0.68	0.51		66
40	0.92	1.52		67
45	0.56			67
45	0.58	-	0.030 Mo	68
50	0.61	-		68
50	0.61	-	0.015 Mo	69
50	0.61	-	0.030 Mo	69
50	0.89	1.02		70
50	1.31	2.03		70
55	0.61	-		71
55	0.91	1.02		71

INDEX OF MAMMOGRAPHIC X-RAY SPECTRA

EXIT SPECTRA, TUNGSTEN ANODE

kVp	HVL	Filtration mm Al	Filtration mm Other	cm Phantom	Page
25	0.58	-		1.59 Lu[a]	74
25	0.66	-		3.19 Lu	74
25	0.73	-		4.79 Lu	74
25	0.80	-		6.43 Lu	75
25	0.71	0.51		3.19 Lu	75
25	0.82	0.51		6.43 Lu	75
25	0.58	-		2.63 Ps[b]	76
25	0.67	-		5.25 Ps	76
25	0.73	-		7.85 Ps	76
25	0.76	0.51		7.85 Ps	77
25	0.71	0.51		5.25 Ps	77
25	0.64	0.51		2.63 Ps	77
25	0.69	1.02		2.63 Ps	78
40	1.53	0.51		3.19 Lu	78
40	1.85	0.51		6.43 Lu	79
40	1.93	1.02		6.43 Lu	79
40	1.65	1.02		3.19 Lu	80
40	1.85	2.03		3.19 Lu	80
40	2.06	2.03		6.43 Lu	81
40	1.52	0.51		5.25 Ps	81
40	1.64	1.02		5.25 Ps	82
40	1.69	0.51		7.85 Ps	82
40	1.80	1.02		7.85 Ps	83
40	1.48	1.02		2.63 Ps	83
40	1.35	0.51		2.63 Ps	84
55	2.99	-	0.13 La	4.79 Lu	84
55	2.87	-	0.13 La	5.25 Ps	85
40	1.40	-	0.13 Sn	5.25 Ps	85
40	1.48	-	0.13 Sn	4.79 Lu	86

[a]Lucite

[b]polystyrene

INDEX OF MAMMOGRAPHIC X-RAY SPECTRA

EXIT SPECTRA, MOLYBDENUM ANODE

kVp	HVL	Filtration mm Al	Filtration mm Other	cm Phantom	Page
30	0.56	-	0.030 Mo	1.59 Lu	87
30	0.63	-	0.030 Mo	3.19 Lu	87
30	0.71	-	0.030 Mo	4.79 Lu	87
30	0.81	-	0.030 Mo	6.43 Lu	88
30	0.70	-	0.030 Mo	7.85 Ps	88
30	0.63	-	0.030 Mo	5.22 Ps	88
30	0.57	-	0.030 Mo	2.60 Ps	89
30	0.61	-		2.60 Ps	89
40	1.06	-	0.030 Mo	4.79 Lu	90

EXIT SPECTRA, MOLYBDENUM - TUNGSTEN ANODE

kVp	HVL	Filtration mm Al	Filtration mm Other	cm Phantom	Page
30	0.64	0.51	0.030 Mo	3.19 Lu	91
30	0.74	0.51	0.030 Mo	4.79 Lu	91
40	0.93	0.51	0.030 Mo	3.19 Lu	92
40	1.22	0.51	0.030 Mo	4.79 Lu	92
40	1.25	0.51		4.79 Lu	93
40	1.42	0.51		6.00 WBMc	93
40	1.70	0.51		8.00 WBM	94
40	1.10	0.51		4.00 WBM	94
40	1.26	0.51		5.00 WBM	95
40	1.54	1.52		4.79 Lu	95
40	1.56	1.52		5.00 WBM	96
50	2.02	1.52		5.00 WBM	96
50	1.99	1.52		4.79 Lu	97

RSI SPECTRA

kVp	HVL	Filtration mm Al	Filtration mm Other	Page
30	0.36	-		100
30	0.60	0.51		100
30	0.75	1.02		101
30	0.86	1.52		101
40	0.44	-		102
40	0.80	0.51		102
40	1.04	1.02		103
40	1.22	1.52		103
50	1.26	1.02		104
50	1.50	1.52		104
50	1.71	2.03		105

[c]BR3, breast tissue substitute (7)

4.5.2 PRIMARY SPECTRA

4.5.2 PRIMARY SPECTRA

TUNGSTEN ANODE SPECTRUM (MW 1)

KVP: 25 *** HVL: .43 MM AL
MM AL ADDED: .00 ** AL EQUIVALENT (INH): .60 MM
NORMALIZATION FACTOR: .3770E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
7.5	.00000	17.5	.12455
8.5	.00135	18.5	.13264
9.5	.00279	19.5	.12977
10.5	.00449	20.5	.11511
11.5	.01204	21.5	.08685
12.5	.02074	22.5	.04790
13.5	.03949	23.5	.01806
14.5	.06243	24.5	.00340
15.5	.08843	25.5	.00003
16.5	.10990	26.5	.00003

TUNGSTEN ANODE SPECTRUM (MW 2)

KVP: 25 *** HVL: .54 MM AL
MM AL ADDED: .51 ** AL EQUIVALENT (INH): .60 MM
NORMALIZATION FACTOR: .4327E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
9.5	.00000	18.5	.13710
10.5	.00108	19.5	.14704
11.5	.00321	20.5	.14166
12.5	.00760	21.5	.11936
13.5	.01763	22.5	.07432
14.5	.03699	23.5	.03179
15.5	.06172	24.5	.00729
16.5	.09079	25.5	.00007
17.5	.11808	26.5	.00001

TUNGSTEN ANODE SPECTRUM (MW 3)

KVP: 25 *** HVL: .62 MM AL
MM AL ADDED: 1.02 ** AL EQUIVALENT (INH): .60 MM
NORMALIZATION FACTOR: .4721E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
10.5	.00000	18.5	.13082
11.5	.00042	19.5	.15365
12.5	.00274	20.5	.16036
13.5	.00760	21.5	.14689
14.5	.01946	22.5	.10103
15.5	.03950	23.5	.04744
16.5	.06874	24.5	.01376
17.5	.10296	25.5	.00036

TUNGSTEN ANODE SPECTRUM (MW 4)

KVP: 25 *** HVL: .79 MM AL
MM AL ADDED: 3.05 ** AL EQUIVALENT (INH): .60 MM
NORMALIZATION FACTOR: .5540E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
12.5	.00000	19.5	.13685
13.5	.00129	20.5	.18741
14.5	.00191	21.5	.21064
15.5	.00530	22.5	.17718
16.5	.01850	23.5	.09570
17.5	.04178	24.5	.03092
18.5	.08491	25.5	.00084

TUNGSTEN ANODE SPECTRUM (MW 5)

KVP: 30 *** HVL: .58 MM AL
MM AL ADDED: .00 ** AL EQUIVALENT (INH): .60 MM
NORMALIZATION FACTOR: .4840E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
8.5	.00000	20.5	.09361
9.5	.00185	21.5	.09375
10.5	.00218	22.5	.09043
11.5	.00608	23.5	.08254
12.5	.01032	24.5	.07290
13.5	.01972	25.5	.05940
14.5	.03230	26.5	.04245
15.5	.04655	27.5	.02216
16.5	.06089	28.5	.00816
17.5	.07463	29.5	.00177
18.5	.08396	30.5	.00007
19.5	.09103	31.5	.00006

TUNGSTEN ANODE SPECTRUM (MW 6)

KVP: 30 *** HVL: .71 MM AL
MM AL ADDED: .51 ** AL EQUIVALENT (INH): .60 MM
NORMALIZATION FACTOR: .5461E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
9.5	.00000	20.5	.09775
10.5	.00104	21.5	.10324
11.5	.00186	22.5	.10348
12.5	.00331	23.5	.09783
13.5	.00813	24.5	.08980
14.5	.01672	25.5	.07484
15.5	.02958	26.5	.05442
16.5	.04482	27.5	.02923
17.5	.06177	28.5	.01088
18.5	.07612	29.5	.00214
19.5	.08948	30.5	.00003

TUNGSTEN ANODE SPECTRUM (MW 7)

KVP: 30 *** HVL: .81 MM AL
MM AL ADDED: 1.02 ** AL EQUIVALENT (INH): .60 MM
NORMALIZATION FACTOR: .5920E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
10.5	.00000	21.5	.10653
11.5	.00101	22.5	.11168
12.5	.00132	23.5	.11207
13.5	.00382	24.5	.10410
14.5	.00849	25.5	.09033
15.5	.01733	26.5	.06639
16.5	.03117	27.5	.03529
17.5	.04677	28.5	.01366
18.5	.06473	29.5	.00251
19.5	.08255	30.5	.00002
20.5	.09668	31.5	.00002

TUNGSTEN ANODE SPECTRUM (MW 8)

KVP: 30 *** HVL: .96 MM AL
MM AL ADDED: 2.03 ** AL EQUIVALENT (INH): .60 MM
NORMALIZATION FACTOR: .6625E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
12.5	.00000	22.5	.11945
13.5	.00126	23.5	.12800
14.5	.00213	24.5	.12677
15.5	.00592	25.5	.11597
16.5	.01262	26.5	.09013
17.5	.02589	27.5	.05271
18.5	.04130	28.5	.02134
19.5	.06169	29.5	.00477
20.5	.08327	30.5	.00003
21.5	.10253	31.5	.00000

TUNGSTEN ANODE SPECTRUM (MW 9)

KVP: 30 *** HVL: 1.08 MM AL
MM AL ADDED: 3.05 ** AL EQUIVALENT (INH): .60 MM
NORMALIZATION FACTOR: .7165E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
13.5	.00000	22.5	.11356
14.5	.00101	23.5	.13229
15.5	.00164	24.5	.13992
16.5	.00492	25.5	.13854
17.5	.01211	26.5	.11566
18.5	.02466	27.5	.07279
19.5	.04233	28.5	.03211
20.5	.06565	29.5	.00865
21.5	.08963	30.5	.00013

TUNGSTEN ANODE SPECTRUM (MW67)

KVP: 30 *** HVL: .99 MM AL
MM AL ADDED: .00 ** AL EQUIVALENT (INH): .60 MM
BEAM SHAPING FILTER: .13 MM OF SN
NORMALIZATION FACTOR: .6731E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
12.5	.00000	22.5	.11174
13.5	.00111	23.5	.12233
14.5	.00224	24.5	.12475
15.5	.00572	25.5	.11909
16.5	.01215	26.5	.10177
17.5	.02358	27.5	.06911
18.5	.03870	28.5	.03256
19.5	.05787	29.5	.00360
20.5	.07749	30.5	.00007
21.5	.09612	31.5	.00001

TUNGSTEN ANODE SPECTRUM (MW82)

KVP: 35 *** HVL: .78 MM AL
MM AL ADDED: .00 ** AL EQUIVALENT (INH): .60 MM
NORMALIZATION FACTOR: .6256E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
8.5	.00000	22.5	.06870
9.5	.00102	23.5	.06950
10.5	.00106	24.5	.06917
11.5	.00313	25.5	.06682
12.5	.00484	26.5	.06389
13.5	.00970	27.5	.05954
14.5	.01595	28.5	.05424
15.5	.02479	29.5	.04922
16.5	.03264	30.5	.04183
17.5	.04361	31.5	.03481
18.5	.05042	32.5	.02632
19.5	.05728	33.5	.01687
20.5	.06261	34.5	.00579
21.5	.06602	35.5	.00018

TUNGSTEN ANODE SPECTRUM (MW83)

KVP: 35 *** HVL: 1.11 MM AL
MM AL ADDED: 1.02 ** AL EQUIVALENT (INH): .60 MM
NORMALIZATION FACTOR: .7725E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
11.5	.00000	24.5	.07754
12.5	.00069	25.5	.07935
13.5	.00134	26.5	.07927
14.5	.00341	27.5	.07810
15.5	.00715	28.5	.07364
16.5	.01255	29.5	.06736
17.5	.02095	30.5	.05946
18.5	.02955	31.5	.04979
19.5	.03958	32.5	.03793
20.5	.04993	33.5	.02457
21.5	.05911	34.5	.00739
22.5	.06749	35.5	.00013
23.5	.07370	36.5	.00002

TUNGSTEN ANODE SPECTRUM (MW10)

KVP: 40 *** HVL: .83 MM AL
MM AL ADDED: .00 ** AL EQUIVALENT (INH): .60 MM
NORMALIZATION FACTOR: .6762E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
8.5	.00000	25.5	.05888
9.5	.00085	26.5	.05776
10.5	.00123	27.5	.05498
11.5	.00284	28.5	.05234
12.5	.00447	29.5	.04874
13.5	.00879	30.5	.04461
14.5	.01463	31.5	.04071
15.5	.02132	32.5	.03609
16.5	.02914	33.5	.03146
17.5	.03763	34.5	.02620
18.5	.04257	35.5	.02089
19.5	.04884	36.5	.01468
20.5	.05267	37.5	.00820
21.5	.05633	38.5	.00275
22.5	.05813	39.5	.00063
23.5	.05946	40.5	.00008
24.5	.06043	41.5	.00007

TUNGSTEN ANODE SPECTRUM (MW11)

KVP: 40 *** HVL: 1.04 MM AL
MM AL ADDED: .51 ** AL EQUIVALENT (INH): .60 MM
NORMALIZATION FACTOR: .7738E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
10.5	.00000	26.5	.06314
11.5	.00084	27.5	.06250
12.5	.00145	28.5	.06000
13.5	.00321	29.5	.05654
14.5	.00648	30.5	.05327
15.5	.01166	31.5	.04849
16.5	.01827	32.5	.04385
17.5	.02589	33.5	.03756
18.5	.03292	34.5	.03158
19.5	.03999	35.5	.02535
20.5	.04723	36.5	.01773
21.5	.05326	37.5	.00939
22.5	.05723	38.5	.00283
23.5	.06085	39.5	.00054
24.5	.06231	40.5	.00005
25.5	.06338	41.5	.00004

TUNGSTEN ANODE SPECTRUM (MW12)

KVP: 40 *** HVL: 1.22 MM AL
MM AL ADDED: 1.02 ** AL EQUIVALENT (INH): .60 MM
NORMALIZATION FACTOR: .8487E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
11.5	.00000	26.5	.06682
12.5	.00046	27.5	.06693
13.5	.00123	28.5	.06534
14.5	.00282	29.5	.06281
15.5	.00587	30.5	.05914
16.5	.01083	31.5	.05556
17.5	.01750	32.5	.04979
18.5	.02379	33.5	.04416
19.5	.03228	34.5	.03770
20.5	.04025	35.5	.02948
21.5	.04757	36.5	.02114
22.5	.05364	37.5	.01175
23.5	.05838	38.5	.00377
24.5	.06295	39.5	.00059
25.5	.06508	40.5	.00003

TUNGSTEN ANODE SPECTRUM (MW13)

KVP: 40 *** HVL: 1.49 MM AL
MM AL ADDED: 2.03 ** AL EQUIVALENT (INH): .60 MM
NORMALIZATION FACTOR: .9614E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
13.5	.00000	27.5	.07087
14.5	.00079	28.5	.07339
15.5	.00173	29.5	.07264
16.5	.00370	30.5	.07047
17.5	00717	31.5	.06650
18.[illegible]	01232	32.5	.06124
19.[illegible]	.01855	33.5	.05475
20.5	.02611	34.5	.04794
21.5	.03481	35.5	.03865
22.[illegible]	04307	36.5	.02797
23.5	05123	37.5	.01553
24.5	.05810	38.5	.00522
25.5	.06417	39.5	.00097
26.5	.06878	40.5	.00002

TUNGSTEN ANODE SPECTRUM (MW14)

KVP: 40 *** HVL: 1.70 MM AL
MM AL ADDED: 3.05 ** AL EQUIVALENT (INH): .60 MM
NORMALIZATION FACTOR: .1043E+08 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
14.5	.00000	28.5	.07593
15.5	.00067	29.5	.07825
16.5	.00120	30.5	.07754
17.5	.00305	31.5	.07485
18.5	.00589	32.5	.07136
19.5	.01065	33.5	.06498
20.5	.01700	34.5	.05679
21.5	.02422	35.5	.04716
22.5	.03319	36.5	.03522
23.5	.04325	37.5	.01903
24.5	.04990	38.5	.00652
25.5	.05889	39.5	.00139
26.5	.06744	40.5	.00000
27.5	.07246	41.5	.00000

TUNGSTEN ANODE SPECTRUM (MW60)

KVP: 40 *** HVL: 1.20 MM AL
MM AL ADDED: .00 ** AL EQUIVALENT (INH): .60 MM
BEAM SHAPING FILTER: .13 MM OF SN
NORMALIZATION FACTOR: .7924E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
13.5	.00000	27.5	.12391
14.5	.00186	28.5	.12210
15.5	.00282	29.5	.01888
16.5	.00608	30.5	.00682
17.5	.01266	31.5	.00789
18.5	.01991	32.5	.00919
19.5	.03158	33.5	.01042
20.5	.04356	34.5	.01075
21.5	.05767	35.5	.01054
22.5	.07228	36.5	.00946
23.5	.08621	37.5	.00632
24.5	.09785	38.5	.00299
25.5	.10964	39.5	.00085
26.5	.11766	40.5	.00010

TUNGSTEN ANODE SPECTRUM (MW72)

KVP: 40 *** HVL: 2.03 MM AL
MM AL ADDED: .00 ** AL EQUIVALENT (INH): .60 MM
BEAM SHAPING FILTER: .13 MM OF LA
NORMALIZATION FACTOR: .1168E+08 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
16.5	.00000	29.5	.07959
17.5	.00096	30.5	.08393
18.5	.00154	31.5	.08629
19.5	.00348	32.5	.08590
20.5	.00631	33.5	.08230
21.5	.01088	34.5	.07642
22.5	.01760	35.5	.06611
23.5	.02563	36.5	.05282
24.5	.03454	37.5	.03492
25.5	.04415	38.5	.01374
26.5	.05501	39.5	.00084
27.5	.06403	40.5	.00006
28.5	.07292	41.5	.00001

TUNGSTEN ANODE SPECTRUM (MW85)

KVP: 45 *** HVL: 1.01 MM AL
MM AL ADDED: .00 ** AL EQUIVALENT (INH): .60 MM
NORMALIZATION FACTOR: .8076E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
8.5	.00000	27.5	.04877
9.5	.00065	28.5	.04813
10.5	.00083	29.5	.04695
11.5	.00193	30.5	.04498
12.5	.00277	31.5	.04273
13.5	.00500	32.5	.04111
14.5	.00890	33.5	.03846
15.5	.01371	34.5	.03564
16.5	.01933	35.5	.03285
17.5	.02599	36.5	.03027
18.5	.02995	37.5	.02738
19.5	.03519	38.5	.02394
20.5	.03913	39.5	.02045
21.5	.04306	40.5	.01744
22.5	.04508	41.5	.01399
23.5	.04786	42.5	.01042
24.5	.04893	43.5	.00667
25.5	.05000	44.5	.00214
26.5	.04924	45.5	.00008

TUNGSTEN ANODE SPECTRUM (MW84)

KVP: 45 *** HVL: 1.49 MM AL
MM AL ADDED: 1.02 ** AL EQUIVALENT (INH): .60 MM
NORMALIZATION FACTOR: .1008E+08 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
11.5	.00000	29.5	.05402
12.5	.00049	30.5	.05325
13.5	.00077	31.5	.05219
14.5	.00164	32.5	.05081
15.5	.00320	33.5	.04870
16.5	.00569	34.5	.04585
17.5	.01054	35.5	.04307
18.5	.01483	36.5	.03966
19.5	.02030	37.5	.03592
20.5	.02608	38.5	.03203
21.5	.03181	39.5	.02817
22.5	.03744	40.5	.02347
23.5	.04135	41.5	.01880
24.5	.04656	42.5	.01407
25.5	.04907	43.5	.00859
26.5	.05228	44.5	.00227
27.5	.05320	45.5	.00004
28.5	.05381	46.5	.00002

TUNGSTEN ANODE SPECTRUM (MW15)

KVP: 50 *** HVL: 1.09 MM AL
MM AL ADDED: .00 ** AL EQUIVALENT (INH): .60 MM
NORMALIZATION FACTOR: .8719E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
8.5	.00000	30.5	.04163
9.5	.00060	31.5	.04073
10.5	.00060	32.5	.03856
11.5	.00166	33.5	.03713
12.5	.00223	34.5	.03498
13.5	.00449	35.5	.03292
14.5	.00785	36.5	.03121
15.5	.01185	37.5	.02905
16.5	.01667	38.5	.02699
17.5	.02264	39.5	.02449
18.5	.02621	40.5	.02270
19.5	.03088	41.5	.02030
20.5	.03421	42.5	.01812
21.5	.03707	43.5	.01545
22.5	.04034	44.5	.01347
23.5	.04212	45.5	.01086
24.5	.04310	46.5	.00833
25.5	.04439	47.5	.00583
26.5	.04453	48.5	.00291
27.5	.04390	49.5	.00064
28.5	.04370	50.5	.00010
29.5	.04290	51.5	.00006

TUNGSTEN ANODE SPECTRUM (MW16)

KVP: 50 *** HVL: 1.39 MM AL
MM AL ADDED: .51 ** AL EQUIVALENT (INH): .60 MM
NORMALIZATION FACTOR: .1002E+08 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
10.5	.00000	31.5	.04407
11.5	.00058	32.5	.04298
12.5	.00071	33.5	.04111
13.5	.00166	34.5	.03940
14.5	.00317	35.5	.03761
15.5	.00554	36.5	.03556
16.5	.00912	37.5	.03360
17.5	.01412	38.5	.03078
18.5	.01819	39.5	.02896
19.5	.02331	40.5	.02610
20.5	.02748	41.5	.02368
21.5	.03221	42.5	.02118
22.5	.03544	43.5	.01850
23.5	.03900	44.5	.01572
24.5	.04104	45.5	.01314
25.5	.04350	46.5	.01027
26.5	.04446	47.5	.00730
27.5	.04548	48.5	.00393
28.5	.04580	49.5	.00091
29.5	.04627	50.5	.00013
30.5	.04567	51.5	.00005

TUNGSTEN ANODE SPECTRUM (MW17)

KVP: 50 *** HVL: 1.61 MM AL
MM AL ADDED: 1.02 ** AL EQUIVALENT (INH): .60 MM
NORMALIZATION FACTOR: .1094E+08 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
11.5	.00000	31.5	.04668
12.5	.00055	32.5	.04629
13.5	.00063	33.5	.04464
14.5	.00145	34.5	.04323
15.5	.00283	35.5	.04109
16.5	.00519	36.5	.03901
17.5	.00877	37.5	.03695
18.5	.01266	38.5	.03475
19.5	.01716	39.5	.03220
20.5	.02158	40.5	.02963
21.5	.02626	41.5	.02667
22.5	.03117	42.5	.02438
23.5	.03483	43.5	.02068
24.5	.03887	44.5	.01804
25.5	.04162	45.5	.01460
26.5	.04405	46.5	.01131
27.5	.04592	47.5	.00782
28.5	.04630	48.5	.00411
29.5	.04733	49.5	.00082
30.5	.04728	50.5	.00005

TUNGSTEN ANODE SPECTRUM (MW18)

KVP: 50 *** HVL: 2.01 MM AL
MM AL ADDED: 2.03 ** AL EQUIVALENT (INH): .60 MM
NORMALIZATION FACTOR: .1247E+08 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
13.5	.00000	32.5	.04982
14.5	.00041	33.5	.04975
15.5	.00075	34.5	.04827
16.5	.00147	35.5	.04727
17.5	.00327	36.5	.04507
18.5	.00519	37.5	.04325
19.5	.00859	38.5	.04093
20.5	.01235	39.5	.03828
21.5	.01700	40.5	.03512
22.5	.02195	41.5	.03248
23.5	.02694	42.5	.02920
24.5	.03183	43.5	.02585
25.5	.03561	44.5	.02240
26.5	.03894	45.5	.01873
27.5	.04304	46.5	.01461
28.5	.04585	47.5	.01014
29.5	.04747	48.5	.00559
30.5	.04907	49.5	.00117
31.5	.04919	50.5	.00011

TUNGSTEN ANODE SPECTRUM (MW19)

KVP: 50 *** HVL: 2.32 MM AL
MM AL ADDED: 3.05 ** AL EQUIVALENT (INH): .60 MM
NORMALIZATION FACTOR: .1358E+08 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
14.5	.00000	33.5	.05107
15.5	.00036	34.5	.05180
16.5	.00063	35.5	.05197
17.5	.00136	36.5	.04956
18.5	.00220	37.5	.04810
19.5	.00430	38.5	.04611
20.5	.00705	39.5	.04394
21.5	.01059	40.5	.04086
22.5	.01460	41.5	.03783
23.5	.01925	42.5	.03398
24.5	.02463	43.5	.03022
25.5	.02896	44.5	.02651
26.5	.03453	45.5	.02199
27.5	.03853	46.5	.01744
28.5	.04256	47.5	.01248
29.5	.04576	48.5	.00683
30.5	.04833	49.5	.00148
31.5	.04967	50.5	.00008
32.5	.05153	51.5	.00001

TUNGSTEN ANODE SPECTRUM (MW61)

KVP: 50 *** HVL: 1.40 MM AL
MM AL ADDED: .00 ** AL EQUIVALENT (INH): .60 MM
BEAM SHAPING FILTER: .13 MM OF SN
NORMALIZATION FACTOR: .9458E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
13.5	.00000	32.5	.00993
14.5	.00079	33.5	.01210
15.5	.00214	34.5	.01474
16.5	.00378	35.5	.01651
17.5	.00782	36.5	.01844
18.5	.01306	37.5	.01936
19.5	.02116	38.5	.02051
20.5	.03025	39.5	.02131
21.5	.03972	40.5	.02131
22.5	.05146	41.5	.02092
23.5	.06285	42.5	.02084
24.5	.07308	43.5	.02011
25.5	.08463	44.5	.01858
26.5	.09327	45.5	.01597
27.5	.10056	46.5	.01357
28.5	.10364	47.5	.00986
29.5	.01665	48.5	.00537
30.5	.00602	49.5	.00108
31.5	.00852	50.5	.00009

TUNGSTEN ANODE SPECTRUM (MW65)

KVP: 50 *** HVL: 2.42 MM AL
MM AL ADDED: .00 ** AL EQUIVALENT (INH): .60 MM
BEAM SHAPING FILTER: .13 MM OF LA
NORMALIZATION FACTOR: .1347E+08 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
17.5	.00000	34.5	.07432
18.5	.00087	35.5	.07491
19.5	.00185	36.5	.07540
20.5	.00399	37.5	.07478
21.5	.00637	38.5	.05986
22.5	.01007	39.5	.01225
23.5	.01526	40.5	.01312
24.5	.02075	41.5	.01323
25.5	.02728	42.5	.01360
26.5	.03421	43.5	.01356
27.5	.04098	44.5	.01282
28.5	.04730	45.5	.01134
29.5	.05444	46.5	.00973
30.5	.05925	47.5	.00712
31.5	.06500	48.5	.00420
32.5	.06881	49.5	.00103
33.5	.07224	50.5	.00006

TUNGSTEN ANODE SPECTRUM (MW73)

KVP: 50 *** HVL: 2.88 MM AL
MM AL ADDED: .00 ** AL EQUIVALENT (INH): .60 MM
BEAM SHAPING FILTER: .15 MM OF SM
NORMALIZATION FACTOR: .1539E+08 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
17.5	.00000	34.5	.05600
18.5	.00045	35.5	.05767
19.5	.00091	36.5	.05837
20.5	.00199	37.5	.05837
21.5	.00320	38.5	.05814
22.5	.00549	39.5	.05615
23.5	.00851	40.5	.05359
24.5	.01228	41.5	.05049
25.5	.01674	42.5	.04728
26.5	.02173	43.5	.04301
27.5	.02652	44.5	.03829
28.5	.03189	45.5	.03280
29.5	.03726	46.5	.02402
30.5	.04211	47.5	.00339
31.5	.04678	48.5	.00183
32.5	.05044	49.5	.00056
33.5	.05364	50.5	.00008

TUNGSTEN ANODE SPECTRUM (MW66)

KVP: 50 *** HVL: 3.36 MM AL
MM AL ADDED: .00 ** AL EQUIVALENT (INH): .60 MM
BEAM SHAPING FILTER: .20 MM OF GD
NORMALIZATION FACTOR: .1698E+08 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
19.5	.00000	35.5	.05640
20.5	.00045	36.5	.05978
21.5	.00106	37.5	.06082
22.5	.00182	38.5	.06155
23.5	.00313	39.5	.06256
24.5	.00517	40.5	.06151
25.5	.00787	41.5	.05848
26.5	.01173	42.5	.05575
27.5	.01607	43.5	.05178
28.5	.02148	44.5	.04677
29.5	.02673	45.5	.04015
30.5	.03212	46.5	.03258
31.5	.03768	47.5	.02440
32.5	.04357	48.5	.01401
33.5	.04807	49.5	.00359
34.5	.05268	50.5	.00022

TUNGSTEN ANODE SPECTRUM (MW86)

KVP: 55 *** HVL: 1.22 MM AL
MM AL ADDED: .00 ** AL EQUIVALENT (INH): .60 MM
NORMALIZATION FACTOR: .9674E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
8.5	.00000	32.5	.03678
9.5	.00061	33.5	.03572
10.5	.00053	34.5	.03459
11.5	.00138	35.5	.03321
12.5	.00169	36.5	.03109
13.5	.00330	37.5	.02992
14.5	.00593	38.5	.02869
15.5	.00922	39.5	.02696
16.5	.01307	40.5	.02604
17.5	.01760	41.5	.02416
18.5	.02123	42.5	.02221
19.5	.02536	43.5	.02030
20.5	.02783	44.5	.01890
21.5	.03131	45.5	.01715
22.5	.03421	46.5	.01502
23.5	.03565	47.5	.01381
24.5	.03737	48.5	.01196
25.5	.03923	49.5	.01046
26.5	.03951	50.5	.00841
27.5	.03938	51.5	.00643
28.5	.03942	52.5	.00476
29.5	.03903	53.5	.00286
30.5	.03889	54.5	.00077
31.5	.03788	55.5	.00009

TUNGSTEN ANODE SPECTRUM (MW87)

KVP: 55 *** HVL: 1.83 MM AL
MM AL ADDED: 1.02 ** AL EQUIVALENT (INH): .60 MM
NORMALIZATION FACTOR: .1208E+08 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
12.5	.00000	34.5	.04052
13.5	.00043	35.5	.03885
14.5	.00095	36.5	.03804
15.5	.00210	37.5	.03679
16.5	.00394	38.5	.03469
17.5	.00664	39.5	.03327
18.5	.00941	40.5	.03168
19.5	.01337	41.5	.03000
20.5	.01717	42.5	.02810
21.5	.02091	43.5	.02578
22.5	.02544	44.5	.02414
23.5	.02843	45.5	.02181
24.5	.03209	46.5	.01973
25.5	.03475	47.5	.01764
26.5	.03676	48.5	.01558
27.5	.03898	49.5	.01323
28.5	.04046	50.5	.01084
29.5	.04131	51.5	.00866
30.5	.04201	52.5	.00633
31.5	.04182	53.5	.00354
32.5	.04168	54.5	.00093
33.5	.04106	55.5	.00008

TUNGSTEN ANODE SPECTRUM (MW77)

KVP: 55 *** HVL: 2.60 MM AL
MM AL ADDED: .00 ** AL EQUIVALENT (INH): .60 MM
BEAM SHAPING FILTER: .13 MM OF LA
NORMALIZATION FACTOR: .1436E+08 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
17.5	.00000	37.5	.07352
18.5	.00076	38.5	.06180
19.5	.00140	39.5	.01202
20.5	.00297	40.5	.01255
21.5	.00472	41.5	.01411
22.5	.00790	42.5	.01514
23.5	.01194	43.5	.01564
24.5	.01659	44.5	.01615
25.5	.02205	45.5	.01611
26.5	.02789	46.5	.01591
27.5	.03447	47.5	.01552
28.5	.04089	48.5	.01452
29.5	.04709	49.5	.01337
30.5	.05248	50.5	.01164
31.5	.05777	51.5	.00959
32.5	.06269	52.5	.00732
33.5	.06571	53.5	.00421
34.5	.06872	54.5	.00087
35.5	.07105	55.5	.00008
36.5	.07278	56.5	.00004

TUNGSTEN ANODE SPECTRUM (MW20)

KVP: 60 *** HVL: 1.29 MM AL
MM AL ADDED: .00 ** AL EQUIVALENT (INH): .60 MM
NORMALIZATION FACTOR: .1024E+08 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
8.5	.00000	35.5	.03111
9.5	.00049	36.5	.02979
10.5	.00064	37.5	.02929
11.5	.00126	38.5	.02769
12.5	.00151	39.5	.02670
13.5	.00324	40.5	.02549
14.5	.00549	41.5	.02418
15.5	.00827	42.5	.02262
16.5	.01150	43.5	.02152
17.5	.01671	44.5	.02020
18.5	.01914	45.5	.01886
19.5	.02282	46.5	.01770
20.5	.02523	47.5	.01643
21.5	.02820	48.5	.01500
22.5	.03073	49.5	.01372
23.5	.03227	50.5	.01266
24.5	.03403	51.5	.01127
25.5	.03530	52.5	.00996
26.5	.03567	53.5	.00856
27.5	.03612	54.5	.00748
28.5	.03594	55.5	.00599
29.5	.03588	56.5	.00475
30.5	.03549	57.5	.00324
31.5	.03490	58.5	.00194
32.5	.03388	59.5	.00049
33.5	.03385	60.5	.00009
34.5	.03241	61.5	.00006

TUNGSTEN ANODE SPECTRUM (MW21)

KVP: 60 *** HVL: 1.64 MM AL
MM AL ADDED: .51 ** AL EQUIVALENT (INH): .60 MM
NORMALIZATION FACTOR: .1171E+08 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
10.5	.00000	36.5	.03303
11.5	.00049	37.5	.03200
12.5	.00076	38.5	.03039
13.5	.00113	39.5	.03031
14.5	.00220	40.5	.02809
15.5	.00393	41.5	.02678
16.5	.00636	42.5	.02517
17.5	.01015	43.5	.02422
18.5	.01246	44.5	.02248
19.5	.01621	45.5	.02152
20.5	.01993	46.5	.02048
21.5	.02339	47.5	.01869
22.5	.02529	48.5	.01702
23.5	.02888	49.5	.01579
24.5	.03117	50.5	.01426
25.5	.03328	51.5	.01301
26.5	.03462	52.5	.01150
27.5	.03592	53.5	.00981
28.5	.03686	54.5	.00827
29.5	.03679	55.5	.00683
30.5	.03707	56.5	.00576
31.5	.03651	57.5	.00389
32.5	.03675	58.5	.00232
33.5	.03536	59.5	.00067
34.5	.03490	60.5	.00007
35.5	.03420	61.5	.00005

TUNGSTEN ANODE SPECTRUM (MW22)

KVP: 60 *** HVL: 1.95 MM AL
MM AL ADDED: 1.02 ** AL EQUIVALENT (INH): .60 MM
NORMALIZATION FACTOR: .1287E+08 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
12.5	.00000	37.5	.03420
13.5	.00046	38.5	.03317
14.5	.00075	39.5	.03178
15.5	.00174	40.5	.03052
16.5	.00347	41.5	.02949
17.5	.00602	42.5	.02820
18.5	.00823	43.5	.02646
19.5	.01195	44.5	.02527
20.5	.01470	45.5	.02365
21.5	.01870	46.5	.02212
22.5	.02194	47.5	.02064
23.5	.02527	48.5	.01886
24.5	.02805	49.5	.01737
25.5	.03038	50.5	.01575
26.5	.03272	51.5	.01437
27.5	.03434	52.5	.01264
28.5	.03595	53.5	.01105
29.5	.03675	54.5	.00948
30.5	.03772	55.5	.00778
31.5	.03737	56.5	.00619
32.5	.03752	57.5	.00444
33.5	.03757	58.5	.00260
34.5	.03691	59.5	.00067
35.5	.03610	60.5	.00007
36.5	.03521	61.5	.00005

TUNGSTEN ANODE SPECTRUM (MW23)

KVP: 60 *** HVL: 2.82 MM AL
MM AL ADDED: 3.05 ** AL EQUIVALENT (INH): .60 MM
NORMALIZATION FACTOR: .1590E+08 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
15.5	.00000	38.5	.03948
16.5	.00050	39.5	.03879
17.5	.00068	40.5	.03751
18.5	.00166	41.5	.03670
19.5	.00253	42.5	.03524
20.5	.00427	43.5	.03433
21.5	.00654	44.5	.03253
22.5	.00938	45.5	.03042
23.5	.01227	46.5	.02924
24.5	.01596	47.5	.02736
25.5	.01925	48.5	.02553
26.5	.02230	49.5	.02342
27.5	.02616	50.5	.02204
28.5	.02924	51.5	.01952
29.5	.03188	52.5	.01749
30.5	.03328	53.5	.01521
31.5	.03590	54.5	.01317
32.5	.03775	55.5	.01141
33.5	.03840	56.5	.00875
34.5	.03901	57.5	.00657
35.5	.04000	58.5	.00392
36.5	.03973	59.5	.00109
37.5	.03927	60.5	.00008

TUNGSTEN ANODE SPECTRUM (MW24)

KVP: 60 *** HVL: 2.43 MM AL
MM AL ADDED: 2.03 ** AL EQUIVALENT (INH): .60 MM
NORMALIZATION FACTOR: .1460E+08 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
14.5	.00000	38.5	.03699
15.5	.00050	39.5	.03567
16.5	.00084	40.5	.03464
17.5	.00205	41.5	.03324
18.5	.00355	42.5	.03209
19.5	.00554	43.5	.03069
20.5	.00815	44.5	.02913
21.5	.01105	45.5	.02786
22.5	.01456	46.5	.02572
23.5	.01819	47.5	.02398
24.5	.02149	48.5	.02277
25.5	.02484	49.5	.02035
26.5	.02763	50.5	.01921
27.5	.03058	51.5	.01698
28.5	.03280	52.5	.01505
29.5	.03476	53.5	.01324
30.5	.03671	54.5	.01138
31.5	.03803	55.5	.00946
32.5	.03864	56.5	.00762
33.5	.03846	57.5	.00535
34.5	.03891	58.5	.00306
35.5	.03857	59.5	.00079
36.5	,03825	60.5	.00005
37.5	.03707	61.5	.00002

TUNGSTEN ANODE SPECTRUM (MW71)

KVP: 60 *** HVL: 2.80 MM AL
MM AL ADDED: .00 ** AL EQUIVALENT (INH): .60 MM
BEAM SHAPING FILTER: .13 MM OF LA
NORMALIZATION FACTOR: .1533E+08 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
17.5	.00000	39.5	.01233
18.5	.00065	40.5	.01212
19.5	.00135	41.5	.01363
20.5	.00233	42.5	.01517
21.5	.00389	43.5	.01606
22.5	.00619	44.5	.01675
23.5	.00950	45.5	.01768
24.5	.01331	46.5	.01793
25.5	.01839	47.5	.01812
26.5	.02359	48.5	.01842
27.5	.02889	49.5	.01811
28.5	.03452	50.5	.01744
29.5	.03984	51.5	.01692
30.5	.04509	52.5	.01553
31.5	.04954	53.5	.01425
32.5	.05514	54.5	.01287
33.5	.05863	55.5	.01119
34.5	.06127	56.5	.00952
35.5	.06488	57.5	.00721
36.5	.06611	58.5	.00438
37.5	.06815	59.5	.00138
38.5	.06155	60.5	.00013

TUNGSTEN ANODE SPECTRUM (MW25)

KVP: 60 *** HVL: 3.18 MM AL
MM AL ADDED: .00 ** AL EQUIVALENT (INH): .60 MM
BEAM SHAPING FILTER: .15 MM OF SM
NORMALIZATION FACTOR: .1667E+08 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
17.5	.00000	39.5	.05414
18.5	.00047	40.5	.05351
19.5	.00067	41.5	.05289
20.5	.00154	42.5	.05250
21.5	.00250	43.5	.05129
22.5	.00412	44.5	.05040
23.5	.00636	45.5	.04942
24.5	.00928	46.5	.03498
25.5	.01233	47.5	.00622
26.5	.01623	48.5	.00634
27.5	.02030	49.5	.00674
28.5	.02487	50.5	.00654
29.5	.02827	51.5	.00635
30.5	.03266	52.5	.00625
31.5	.03589	53.5	.00620
32.5	.04089	54.5	.00555
33.5	.04419	55.5	.00536
34.5	.04633	56.5	.00434
35.5	.04819	57.5	.00343
36.5	.05141	58.5	.00219
37.5	.05098	59.5	.00067
38.5	.05349	60.5	.00004

TUNGSTEN ANODE SPECTRUM (MW68)

KVP: 60 *** HVL: 3.89 MM AL
MM AL ADDED: .00 ** AL EQUIVALENT (INH): .60 MM
BEAM SHAPING FILTER: .20 MM OF GD
NORMALIZATION FACTOR: .1889E+08 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
20.5	.00000	41.5	.05377
21.5	.00053	42.5	.05470
22.5	.00087	43.5	.05459
23.5	.00181	44.5	.05459
24.5	.00305	45.5	.05368
25.5	.00468	46.5	.05253
26.5	.00695	47.5	.05081
27.5	.00979	48.5	.04847
28.5	.01300	49.5	.04554
29.5	.01697	50.5	.01441
30.5	.02114	51.5	.00364
31.5	.02478	52.5	.00363
32.5	.02957	53.5	.00374
33.5	.03348	54.5	.00359
34.5	.03775	55.5	.00337
35.5	.04136	56.5	.00297
36.5	.04443	57.5	.00237
37.5	.04643	58.5	.00160
38.5	.04976	59.5	.00047
39.5	.05168	60.5	.00004
40.5	.05341	61.5	.00001

TUNGSTEN ANODE SPECTRUM (MW26)

KVP: 60 *** HVL: 4.55 MM AL
MM AL ADDED: .00 ** AL EQUIVALENT (INH): .60 MM
BEAM SHAPING FILTER: .23 MM OF ER
NORMALIZATION FACTOR: .2092E+08 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
21.5	.00000	41.5	.04559
22.5	.00020	42.5	.04781
23.5	.00054	43.5	.04796
24.5	.00134	44.5	.04807
25.5	.00193	45.5	.04882
26.5	.00322	46.5	.04767
27.5	.00493	47.5	.04667
28.5	.00690	48.5	.04547
29.5	.00945	49.5	.04320
30.5	.01251	50.5	.03986
31.5	.01619	51.5	.03837
32.5	.01947	52.5	.03494
33.5	.02384	53.5	.03238
34.5	.02711	54.5	.02719
35.5	.03040	55.5	.02395
36.5	.03360	56.5	.01928
37.5	.03696	57.5	.00710
38.5	.03977	58.5	.00112
39.5	.04225	59.5	.00034
40.5	.04355	60.5	.00003

MOLYBDENUM-TUNGSTEN ANODE SPECTRUM (MOW35)

KVP: 20 *** HVL: .08 MM AL
MM AL ADDED,: .00 ** MM OF BE INHERENT: 1.00
NORMALIZATION FACTOR: .1234E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
3.5	.00000	12.5	.08625
4.5	.00148	13.5	.07808
5.5	.00807	14.5	.06789
6.5	.02712	15.5	.05675
7.5	.05751	16.5	.04329
8.5	.14483	17.5	.03018
9.5	.16455	18.5	.01413
10.5	.10810	19.5	.00331
11.5	.10791	20.5	.00032

MOLYBDENUM-TUNGSTEN ANODE SPECTRUM (MOW36)

KVP: 20 *** HVL: .23 MM AL
MM AL ADDED,: .51 ** MM OF BE INHERENT: 1.00
NORMALIZATION FACTOR: .2406E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
5.5	.00000	13.5	.12982
6.5	.00132	14.5	.15010
7.5	.00216	15.5	.15509
8.5	.00459	16.5	.14114
9.5	.02334	17.5	.11115
10.5	.03584	18.5	.05914
11.5	.07329	19.5	.01401
12.5	.09840	20.5	.00061

MOLYBDENUM-TUNGSTEN ANODE SPECTRUM (MOW38)

KVP: 25 *** HVL: .09 MM AL
MM AL ADDED,: .00 ** MM OF BE INHERENT: 1.00
NORMALIZATION FACTOR: .1470E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
3.5	.00000	15.5	.05671
4.5	.00081	16.5	.05177
5.5	.00517	17.5	.07766
6.5	.01804	18.5	.03849
7.5	.03950	19.5	.03807
8.5	.11766	20.5	.02213
9.5	.13868	21.5	.01620
10.5	.08263	22.5	.00943
11.5	.08687	23.5	.00272
12.5	.06876	24.5	.00032
13.5	.06591	25.5	.00018
14.5	.06208	26.5	.00020

MOLYBDENUM-TUNGSTEN ANODE SPECTRUM (MOW37)

KVP: 25 *** HVL: .32 MM AL
MM AL ADDED,: .51 ** MM OF BE INHERENT: 1.00
NORMALIZATION FACTOR: .3154E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
6.5	.00000	16.5	.10050
7.5	.00189	17.5	.17805
8.5	.00271	18.5	.09358
9.5	.01187	19.5	.10462
10.5	.01714	20.5	.06596
11.5	.03501	21.5	.05116
12.5	.04683	22.5	.03369
13.5	.06593	23.5	.01326
14.5	.08265	24.5	.00153
15.5	.09355	25.5	.00002

MOLYBDENUM-TUNGSTEN ANODE SPECTRUM (MOW 2)

KVP: 30 *** HVL: .10 MM AL
MM AL ADDED,: .00 ** MM OF BE INHERENT: 1.00
NORMALIZATION FACTOR: .1748E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
3.5	.00000	17.5	.13215
4.5	.00108	18.5	.03776
5.5	.00358	19.5	.05296
6.5	.01226	20.5	.02802
7.5	.02750	21.5	.02396
8.5	.09531	22.5	.02119
9.5	.11079	23.5	.01861
10.5	.06586	24.5	.01598
11.5	.06777	25.5	.01307
12.5	.05209	26.5	.01049
13.5	.05129	27.5	.00780
14.5	.04996	28.5	.00512
15.5	.04739	29.5	.00187
16.5	.04591	30.5	.00013

MOLYBDENUM-TUNGSTEN ANODE SPECTRUM (MOW 1)

KVP: 30 *** HVL: .41 MM AL
MM AL ADDED,: .51 ** MM OF BE INHERENT: 1.00
NORMALIZATION FACTOR: .3841E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
6.5	.00000	19.5	.10353
7.5	.00120	20.5	.05955
8.5	.00169	21.5	.05352
9.5	.00707	22.5	.04981
10.5	.00942	23.5	.04487
11.5	.02043	24.5	.03943
12.5	.02668	25.5	.03292
13.5	.03832	26.5	.02649
14.5	.04935	27.5	.01820
15.5	.05863	28.5	.00985
16.5	.06620	29.5	.00197
17.5	.21071	30.5	.00013
18.5	.06994	31.5	.00011

MOLYBDENUM-TUNGSTEN ANODE SPECTRUM (MOW 3)

KVP: 30 *** HVL: .57 MM AL
MM AL ADDED,: 1.02 ** MM OF BE INHERENT: 1.00
NORMALIZATION FACTOR: .4675E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
9.5	.00000	20.5	.07155
10.5	.00168	21.5	.06973
11.5	.00460	22.5	.06696
12.5	.00884	23.5	.06292
13.5	.01750	24.5	.05609
14.5	.02881	25.5	.04816
15.5	.04162	26.5	.03784
16.5	.05539	27.5	.02648
17.5	.19481	28.5	.01279
18.5	.07330	29.5	.00306
19.5	.11759	30.5	.00025

MOLYBDENUM-TUNGSTEN ANODE SPECTRUM (MOW 4)

KVP: 30 *** HVL: .31 MM AL
MM AL ADDED,: .00 ** MM OF BE INHERENT: 1.00
MOLYBDENUM FILTER ADDED: .030
NORMALIZATION FACTOR: .3120E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
6.5	.00000	19.5	.12687
7.5	.00163	20.5	.01458
8.5	.00475	21.5	.00890
9.5	.01702	22.5	.00996
10.5	.01947	23.5	.01143
11.5	.03616	24.5	.01135
12.5	.04279	25.5	.01119
13.5	.05693	26.5	.01039
14.5	.07009	27.5	.00810
15.5	.07926	28.5	.00500
16.5	.08875	29.5	.00124
17.5	.27491	30.5	.00013
18.5	.08898	31.5	.00014

MOLYBDENUM-TUNGSTEN ANODE SPECTRUM (MOW 7)

KVP: 30 *** HVL: .45 MM AL
MM AL ADDED,: .51 ** MM OF BE INHERENT: 1.00
MOLYBDENUM FILTER ADDED: .030
NORMALIZATION FACTOR: .3863E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
8.5	.00000	20.5	.02001
9.5	.00155	21.5	.01419
10.5	.00317	22.5	.01675
11.5	.00854	23.5	.01879
12.5	.01580	24.5	.01951
13.5	.03027	25.5	.01921
14.5	.04809	26.5	.01656
15.5	.06893	27.5	.01191
16.5	.08983	28.5	.00521
17.5	.30417	29.5	.00133
18.5	.11333	30.5	.00009
19.5	.17269	31.5	.00007

MOLYBDENUM-TUNGSTEN ANODE SPECTRUM (MOW39)

KVP: 35 *** HVL: .11 MM AL
MM AL ADDED,: .00 ** MM OF BE INHERENT: 1.00
NORMALIZATION FACTOR: .1927E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
3.5	.00000	20.5	.02686
4.5	.00080	21.5	.02421
5.5	.00303	22.5	.02249
6.5	.01035	23.5	.02030
7.5	.02358	24.5	.01878
8.5	.08140	25.5	.01649
9.5	.10321	26.5	.01500
10.5	.05181	27.5	.01301
11.5	.05856	28.5	.01126
12.5	.04446	29.5	.00915
13.5	.04488	30.5	.00747
14.5	.04404	31.5	.00536
15.5	.04361	32.5	.00335
16.5	.04455	33.5	.00125
17.5	.15526	34.5	.00013
18.5	.03684	35.5	.00010
19.5	.05833	36.5	.00007

MOLYBDENUM-TUNGSTEN ANODE SPECTRUM (MOW40)

KVP: 35 *** HVL: .45 MM AL
MM AL ADDED,: .51 ** MM OF BE INHERENT: 1.00
NORMALIZATION FACTOR: .4254E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
6.5	.00000	21.5	.04666
7.5	.00079	22.5	.04454
8.5	.00181	23.5	.04320
9.5	.00612	24.5	.03989
10.5	.00730	25.5	.03639
11.5	.01542	26.5	.03323
12.5	.02000	27.5	.03028
13.5	.02889	28.5	.02629
14.5	.03707	29.5	.02215
15.5	.04571	30.5	.01789
16.5	.05462	31.5	.01331
17.5	.21399	32.5	.00868
18.5	.05688	33.5	.00333
19.5	.09755	34.5	.00022
20.5	.04768	35.5	.00005

MOLYBDENUM-TUNGSTEN ANODE SPECTRUM (MOW10)

KVP: 40 *** HVL: .54 MM AL
MM AL ADDED,: .51 ** MM OF BE INHERENT: 1.00
MOLYBDENUM FILTER ADDED: .030
NORMALIZATION FACTOR: .4744E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
9.5	.00000	25.5	.02008
10.5	.00191	26.5	.02204
11.5	.00488	27.5	.02304
12.5	.00856	28.5	.02454
13.5	.01649	29.5	.02460
14.5	.02680	30.5	.02387
15.5	.03899	31.5	.02332
16.5	.05381	32.5	.02207
17.5	.29860	33.5	.02053
18.5	.07050	34.5	.01859
19.5	.14433	35.5	.01586
20.5	.01396	36.5	.01283
21.5	.00918	37.5	.00900
22.5	.01237	38.5	.00478
23.5	.01540	39.5	.00108
24.5	.01785	40.5	.00008

MOLYBDENUM-TUNGSTEN ANODE SPECTRUM (MOW17)

KVP: 40 *** HVL: .50 MM AL
MM AL ADDED,: .51 ** MM OF BE INHERENT: 1.00
NORMALIZATION FACTOR: .4737E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
7.5	.00000	24.5	.03694
8.5	.00125	25.5	.03445
9.5	.00473	26.5	.03269
10.5	.00555	27.5	.03082
11.5	.01190	28.5	.02873
12.5	.01478	29.5	.02721
13.5	.02218	30.5	.02429
14.5	.02914	31.5	.02219
15.5	.03561	32.5	.01978
16.5	.04417	33.5	.01679
17.5	.21588	34.5	.01428
18.5	.04595	35.5	.01218
19.5	.09148	36.5	.00959
20.5	.04008	37.5	.00711
21.5	.03890	38.5	.00421
22.5	.03815	39.5	.00113
23.5	.03768	40.5	.00011

MOLYBDENUM-TUNGSTEN ANODE SPECTRUM (MOW18)

KVP: 40 *** HVL: .70 MM AL
MM AL ADDED,: 1.02 ** MM OF BE INHERENT: 1.00
NORMALIZATION FACTOR: .5902E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
10.5	.00000	26.5	.04315
11.5	.00258	27.5	.04144
12.5	.00403	28.5	.03958
13.5	.00820	29.5	.03715
14.5	.01476	30.5	.03405
15.5	.02201	31.5	.03086
16.5	.03106	32.5	.02749
17.5	.17190	33.5	.02487
18.5	.04214	34.5	.02136
19.5	.08953	35.5	.01797
20.5	.04180	36.5	.01417
21.5	.04216	37.5	.00988
22.5	.04475	38.5	.00572
23.5	.04600	39.5	.00142
24.5	.04497	40.5	.00005
25.5	.04489	41.5	.00004

MOLYBDENUM-TUNGSTEN ANODE SPECTRUM (MOW19)

KVP: 40 *** HVL: 1.00 MM AL
MM AL ADDED,: 2.03 ** MM OF BE INHERENT: 1.00
NORMALIZATION FACTOR: .7578E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
11.5	.00000	26.5	.05669
12.5	.00082	27.5	.05599
13.5	.00147	28.5	.05535
14.5	.00314	29.5	.05341
15.5	.00649	30.5	.05152
16.5	.01304	31.5	.04737
17.5	.08573	32.5	.04335
18.5	.02660	33.5	.03845
19.5	.06587	34.5	.03436
20.5	.03493	35.5	.02884
21.5	.03997	36.5	.02257
22.5	.04582	37.5	.01659
23.5	.05056	38.5	.00968
24.5	.05347	39.5	.00227
25.5	.05561	40.5	.00003

MOLYBDENUM-TUNGSTEN ANODE SPECTRUM (MOW24)

KVP: 40 *** HVL: .12 MM AL
MM AL ADDED,: .00 ** MM OF BE INHERENT: 1.00
NORMALIZATION FACTOR: .2108E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
3.5	.00000	22.5	.02172
4.5	.00067	23.5	.02052
5.5	.00274	24.5	.01923
6.5	.00890	25.5	.01784
7.5	.02155	26.5	.01646
8.5	.07099	27.5	.01500
9.5	.09426	28.5	.01407
10.5	.04269	29.5	.01246
11.5	.04843	30.5	.01113
12.5	.03792	31.5	.01004
13.5	.03871	32.5	.00868
14.5	.03917	33.5	.00788
15.5	.03810	34.5	.00642
16.5	.04384	35.5	.00495
17.5	.17388	36.5	.00412
18.5	.03420	37.5	.00283
19.5	.06130	38.5	.00161
20.5	.02443	39.5	.00031
21.5	.02281	40.5	.00007

MOLYBDENUM-TUNGSTEN ANODE SPECTRUM (MOW29)

KVP: 40 *** HVL: .84 MM AL
MM AL ADDED,: 1.52 ** MM OF BE INHERENT: 1.00
NORMALIZATION FACTOR: .6724E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
10.5	.00000	26.5	.05174
11.5	.00090	27.5	.05064
12.5	.00152	28.5	.04916
13.5	.00354	29.5	.04616
14.5	.00709	30.5	.04281
15.5	.01278	31.5	.03933
16.5	.02214	32.5	.03585
17.5	.12254	33.5	.03120
18.5	.03450	34.5	.02723
19.5	.07918	35.5	.02222
20.5	.03902	36.5	.01722
21.5	.04300	37.5	.01174
22.5	.04726	38.5	.00592
23.5	.05063	39.5	.00112
24.5	.05161	40.5	.00007
25.5	.05180	41.5	.00005

MOLYBDENUM-TUNGSTEN ANODE SPECTRUM (MOW41)

KVP: 45 *** HVL: .54 MM AL
MM AL ADDED,: .51 ** MM OF BE INHERENT: 1.00
NORMALIZATION FACTOR: .5091E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
8.5	.00000	27.5	.02972
9.5	.00400	28.5	.02822
10.5	.00456	29.5	.02687
11.5	.00980	30.5	.02492
12.5	.01283	31.5	.02338
13.5	.01827	32.5	.02137
14.5	.02448	33.5	.02018
15.5	.03084	34.5	.01850
16.5	.03955	35.5	.01631
17.5	.21311	36.5	.01458
18.5	.04042	37.5	.01317
19.5	.08854	38.5	.01112
20.5	.03550	39.5	.00901
21.5	.03412	40.5	.00757
22.5	.03456	41.5	.00575
23.5	.03419	42.5	.00387
24.5	.03358	43.5	.00207
25.5	.03288	44.5	.00035
26.5	.03178	45.5	.00003

MOLYBDENUM-TUNGSTEN ANODE SPECTRUM (MOW42)

KVP: 45 *** HVL: .13 MM AL
MM AL ADDED,: .00 ** MM OF BE INHERENT: 1.00
NORMALIZATION FACTOR: .2292E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
3.5	.00000	25.5	.01792
4.5	.00068	26.5	.01642
5.5	.00213	27.5	.01581
6.5	.00707	28.5	.01475
7.5	.01720	29.5	.01367
8.5	.06323	30.5	.01238
9.5	.08588	31.5	.01172
10.5	.03765	32.5	.01055
11.5	.04382	33.5	.00977
12.5	.03335	34.5	00861
13.5	.03480	35.5	.00794
14.5	.03529	36.5	.00706
15.5	.03542	37.5	.00616
16.5	.04124	38.5	.00521
17.5	.18913	39.5	.00453
18.5	.03251	40.5	.00357
19.5	.06391	41.5	.00267
20.5	.02336	42.5	.00188
21.5	.02182	43.5	.00108
22.5	.02081	44.5	.00017
23.5	.01992	45.5	.00003
24.5	.01883	46.5	.00005

MOLYBDENUM-TUNGSTEN ANODE SPECTRUM (MOW25)

KVP: 50 *** HVL: .13 MM AL
MM AL ADDED,: .00 ** MM OF BE INHERENT: 1.00
NORMALIZATION FACTOR: .2447E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
3.5	.00000	27.5	.01562
4.5	.00076	28.5	.01497
5.5	.00202	29.5	.01396
6.5	.00614	30.5	.01316
7.5	.01594	31.5	.01219
8.5	.05692	32.5	.01161
9.5	.07936	33.5	.01103
10.5	.03311	34.5	.01028
11.5	.03921	35.5	.00965
12.5	.02986	36.5	.00852
13.5	.03116	37.5	.00796
14.5	.03213	38.5	.00720
15.5	.03244	39.5	.00659
16.5	.04003	40.5	.00589
17.5	.19595	41.5	.00524
18.5	.03060	42.5	.00471
19.5	.06505	43.5	.00415
20.5	.02149	44.5	.00346
21.5	.02083	45.5	.00291
22.5	.01987	46.5	.00227
23.5	.01936	47.5	.00174
24.5	.01852	48.5	.00113
25.5	.01762	49.5	.00045
26.5	.01684	50.5	.00005

MOLYBDENUM-TUNGSTEN ANODE SPECTRUM (MOW26)

KVP: 50 *** HVL: .56 MM AL
MM AL ADDED,: .51 ** MM OF BE INHERENT: 1.00
NORMALIZATION FACTOR: .5424E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
8.5	.00000	30.5	.02452
9.5	.00380	31.5	.02332
10.5	.00387	32.5	.02208
11.5	.00819	33.5	.02097
12.5	.01034	34.5	.01950
13.5	.01560	35.5	.01828
14.5	.02110	36.5	.01682
15.5	.02669	37.5	.01565
16.5	.03868	38.5	.01453
17.5	.20676	39.5	.01289
18.5	.03614	40.5	.01143
19.5	.08502	41.5	.01065
20.5	.03004	42.5	.00951
21.5	.03003	43.5	.00811
22.5	.03008	44.5	.00708
23.5	.03041	45.5	.00595
24.5	.03006	46.5	.00470
25.5	.02994	47.5	.00364
26.5	.02919	48.5	.00241
27.5	.02824	49.5	.00123
28.5	.02669	50.5	.00015
29.5	.02569	51.5	.00005

MOLYBDENUM-TUNGSTEN ANODE SPECTRUM (MOW27)

KVP: 50 *** HVL: .77 MM AL
MM AL ADDED,: 1.02 ** MM OF BE INHERENT: 1.00
NORMALIZATION FACTOR: .6824E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
10.5	.00000	31.5	.03110
11.5	.00183	32.5	.02912
12.5	.00321	33.5	.02787
13.5	.00572	34.5	.02621
14.5	.01005	35.5	.02459
15.5	.01502	36.5	.02302
16.5	.02570	37.5	.02141
17.5	.15198	38.5	.01991
18.5	.03032	39.5	.01822
19.5	.07672	40.5	.01649
20.5	.02893	41.5	.01499
21.5	.03033	42.5	.01320
22.5	.03292	43.5	.01148
23.5	.03443	44.5	.00986
24.5	.03528	45.5	.00821
25.5	.03567	46.5	.00650
26.5	.03529	47.5	.00485
27.5	.03480	48.5	.00322
28.5	.03453	49.5	.00117
29.5	.03359	50.5	.00014
30.5	.03206	51.5	.00006

MOLYBDENUM-TUNGSTEN ANODE SPECTRUM (MOW32)

KVP: 50 *** HVL: .96 MM AL
MM AL ADDED,: 1.52 ** MM OF BE INHERENT: 1.00
NORMALIZATION FACTOR: .8006E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
11.5	.00000	31.5	.03736
12.5	.00100	32.5	.03612
13.5	.00227	33.5	.03431
14.5	.00451	34.5	.03262
15.5	.00808	35.5	.03079
16.5	.01467	36.5	.02886
17.5	.10483	37.5	.02651
18.5	.02311	38.5	.02485
19.5	.06338	39.5	.02278
20.5	.02599	40.5	.02089
21.5	.02939	41.5	.01857
22.5	.03266	42.5	.01639
23.5	.03512	43.5	.01421
24.5	.03723	44.5	.01212
25.5	.03849	45.5	.00970
26.5	.03956	46.5	.00748
27.5	.03982	47.5	.00537
28.5	.03979	48.5	.00264
29.5	.03923	49.5	.00054
30.5	.03864	50.5	.00005

MOLYBDENUM-TUNGSTEN ANODE SPECTRUM (MOW13)

KVP: 50 *** HVL: 1.17 MM AL
MM AL ADDED,: 2.02 ** MM OF BE INHERENT: 1.00
NORMALIZATION FACTOR: .9092E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
11.5	.00000	31.5	.04181
12.5	.00056	32.5	.04084
13.5	.00086	33.5	.03972
14.5	.00192	34.5	.03761
15.5	.00432	35.5	.03569
16.5	.00934	36.5	.03390
17.5	.06630	37.5	.03171
18.5	.01726	38.5	.02845
19.5	.04975	39.5	.02665
20.5	.02212	40.5	.02387
21.5	.02665	41.5	.02169
22.5	.03074	42.5	.01922
23.5	.03477	43.5	.01668
24.5	.03758	44.5	.01426
25.5	.04077	45.5	.01112
26.5	.04204	46.5	.00897
27.5	.04299	47.5	.00613
28.5	.04338	48.5	.00308
29.5	.04355	49.5	.00057
30.5	.04293	50.5	.00008

MOLYBDENUM-TUNGSTEN ANODE SPECTRUM (MOW15)

KVP: 50 *** HVL: 1.40 MM AL
MM AL ADDED,: 2.54 ** MM OF BE INHERENT: 1.00
NORMALIZATION FACTOR: .1017E+08 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
12.5	.00000	32.5	.04492
13.5	.00077	33.5	.04315
14.5	.00092	34.5	.04191
15.5	.00218	35.5	.04019
16.5	.00608	36.5	.03794
17.5	.03987	37.5	.03590
18.5	.01225	38.5	.03310
19.5	.03751	39.5	.03070
20.5	.01815	40.5	.02792
21.5	.02237	41.5	.02517
22.5	.02712	42.5	.02301
23.5	.03153	43.5	.01971
24.5	.03614	44.5	.01646
25.5	.03938	45.5	.01380
26.5	.04173	46.5	.01048
27.5	.04358	47.5	.00734
28.5	.04530	48.5	.00393
29.5	.04638	49.5	.00084
30.5	.04598	50.5	.00006
31.5	.04618	51.5	.00005

MOLYBDENUM-TUNGSTEN ANODE SPECTRUM (MOW14)

KVP: 50 *** HVL: 1.63 MM AL
MM AL ADDED,: 3.05 ** MM OF BE INHERENT: 1.00
NORMALIZATION FACTOR: .1110E+08 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
12.5	.00000	32.5	.04787
13.5	.00042	33.5	.04690
14.5	.00052	34.5	.04541
15.5	.00125	35.5	.04429
16.5	.00330	36.5	.04187
17.5	.02427	37.5	.03957
18.5	.00837	38.5	.03720
19.5	.02757	39.5	.03434
20.5	.01384	40.5	.03118
21.5	.01913	41.5	.02807
22.5	.02356	42.5	.02545
23.5	.02877	43.5	.02187
24.5	.03311	44.5	.01892
25.5	.03751	45.5	.01543
26.5	.04094	46.5	.01195
27.5	.04387	47.5	.00817
28.5	.04611	48.5	.00408
29.5	.04745	49.5	.00080
30.5	.04817	50.5	.00007
31.5	.04835	51.5	.00005

MOLYBDENUM ANODE SPECTRUM (MO15)

KVP: 20 *** HVL: .30 MM AL
MM AL ADDED: .00 ** AL EQUIVALENT (INH): .60 MM
NORMALIZATION FACTOR: .2835E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
7.5	.00000	14.5	.14198
8.5	.00175	15.5	.16488
9.5	.00414	16.5	.16945
10.5	.01284	17.5	.15284
11.5	.03365	18.5	.10559
12.5	.06712	19.5	.03715
13.5	.10696	20.5	.00162

MOLYBDENUM ANODE SPECTRUM (MO16)

KVP: 20 *** HVL: .36 MM AL
MM AL ADDED: .00 ** AL EQUIVALENT (INH): .60 MM
MOLYBDENUM FILTER ADDED: .030
NORMALIZATION FACTOR: .3149E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
8.5	.00000	15.5	.16629
9.5	.00199	16.5	.19484
10.5	.00389	17.5	.19534
11.5	.01303	18.5	.14527
12.5	.03344	19.5	.05251
13.5	.07211	20.5	.00113
14.5	.12015	21.5	.00001

MOLYBDENUM ANODE SPECTRUM (MO11)

KVP: 25 *** HVL: .42 MM AL
MM AL ADDED: .00 ** AL EQUIVALENT (INH): .60 MM
NORMALIZATION FACTOR: .3678E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
8.5	.00000	17.5	.26584
9.5	.00211	18.5	.09502
10.5	.00518	19.5	.13588
11.5	.01324	20.5	.06072
12.5	.02589	21.5	.05088
13.5	.04248	22.5	.03993
14.5	.06095	23.5	.02567
15.5	.07620	24.5	.00794
16.5	.09146	25.5	.00048

MOLYBDENUM ANODE SPECTRUM (MO12)

KVP: 25 *** HVL: .51 MM AL
MM AL ADDED: .51 ** AL EQUIVALENT (INH): .60 MM
NORMALIZATION FACTOR: .4150E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
9.5	.00000	18.5	.10408
10.5	.00162	19.5	.16375
11.5	.00335	20.5	.07847
12.5	.00908	21.5	.06919
13.5	.01939	22.5	.05913
14.5	.03649	23.5	.04115
15.5	.05587	24.5	.01592
16.5	.07868	25.5	.00089
17.5	.26290	26.5	.00005

MOLYBDENUM ANODE SPECTRUM (MO13)

KVP: 25 *** HVL: .46 MM AL
MM AL ADDED: .00 ** AL EQUIVALENT (INH): .60 MM
MOLYBDENUM FILTER ADDED: .030
NORMALIZATION FACTOR: .3759E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
9.5	.00000	18.5	.13078
10.5	.00204	19.5	.19657
11.5	.00498	20.5	.01838
12.5	.01301	21.5	.01163
13.5	.02775	22.5	.01169
14.5	.04933	23.5	.01002
15.5	.07451	24.5	.00457
16.5	.10365	25.5	.00035
17.5	.34067	26.5	.00007

MOLYBDENUM ANODE SPECTRUM (MO14)

KVP: 25 *** HVL: .44 MM AL
MM AL ADDED: .00 ** AL EQUIVALENT (INH): .60 MM
MOLYBDENUM FILTER ADDED: .015
NORMALIZATION FACTOR: .3694E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
8.5	.00000	17.5	.31095
9.5	.00145	18.5	.11392
10.5	.00321	19.5	.16633
11.5	.00848	20.5	.03192
12.5	.01930	21.5	.02558
13.5	.03621	22.5	.02360
14.5	.05650	23.5	.01749
15.5	.07782	24.5	.00658
16.5	.10015	25.5	.00044

MOLYBDENUM ANODE SPECTRUM (MO 7)

KVP: 30 *** HVL: .59 MM AL
MM AL ADDED: .51 ** AL EQUIVALENT (INH): .60 MM
NORMALIZATION FACTOR: .4745E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
10.5	.00000	21.5	.05464
11.5	.00227	22.5	.05563
12.5	.00481	23.5	.05380
13.5	.01089	24.5	.05040
14.5	.01985	25.5	.04478
15.5	.03189	26.5	.03742
16.5	.04897	27.5	.02940
17.5	.26582	28.5	.01825
18.5	.06627	29.5	.00635
19.5	.14299	30.5	.00044
20.5	.05509	31.5	.00004

MOLYBDENUM ANODE SPECTRUM (MO 8)

KVP: 30 *** HVL: .66 MM AL
MM AL ADDED: 1.02 ** AL EQUIVALENT (INH): .60 MM
NORMALIZATION FACTOR: .5154E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
11.5	.00000	21.5	.06338
12.5	.00222	22.5	.06635
13.5	.00497	23.5	.06679
14.5	.01100	24.5	.06504
15.5	.02090	25.5	.05854
16.5	.03713	26.5	.05024
17.5	.21958	27.5	.03770
18.5	.06198	28.5	.02251
19.5	.14500	29.5	.00586
20.5	.06060	30.5	.00020

MOLYBDENUM ANODE SPECTRUM (MO 9)

KVP: 30 *** HVL: .49 MM AL
MM AL ADDED: .00 ** AL EQUIVALENT (INH): .60 MM
MOLYBDENUM FILTER ADDED: .015
NORMALIZATION FACTOR: .4096E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
9.5	.00000	20.5	.02544
10.5	.00235	21.5	.02359
11.5	.00541	22.5	.02558
12.5	.01195	23.5	.02669
13.5	.02242	24.5	.02576
14.5	.03554	25.5	.02420
15.5	.05069	26.5	.02099
16.5	.07008	27.5	.01627
17.5	.35254	28.5	.01004
18.5	.08234	29.5	.00275
19.5	.16515	30.5	.00016

MOLYBDENUM ANODE SPECTRUM (MO26)

KVP: 30 *** HVL: .54 MM AL
MM AL ADDED: .51 ** AL EQUIVALENT (INH): .60 MM
MOLYBDENUM FILTER ADDED: .030
NORMALIZATION FACTOR: .4286E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
10.5	.00000	21.5	.01425
11.5	.00161	22.5	.01827
12.5	.00374	23.5	.02185
13.5	.00965	24.5	.02421
14.5	.02052	25.5	.02395
15.5	.03715	26.5	.02186
16.5	.06576	27.5	.01643
17.5	.36390	28.5	.00786
18.5	.10510	29.5	.00170
19.5	.22645	30.5	.00004
20.5	.01569	31.5	.00002

MOLYBDENUM ANODE SPECTRUM (M039)

KVP: 30 *** HVL: .48 MM AL
MM AL ADDED: .00 ** AL EQUIVALENT (INH): .60 MM
NORMALIZATION FACTOR: .4124E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
8.5	.00000	20.5	.04734
9.5	.00152	21.5	.04498
10.5	.00355	22.5	.04193
11.5	.00848	23.5	.03874
12.5	.01631	24.5	.03404
13.5	.02641	25.5	.02945
14.5	.03847	26.5	.02276
15.5	.04958	27.5	.01626
16.5	.06341	28.5	.00833
17.5	.30347	29.5	.00220
18.5	.06830	30.5	.00025
19.5	.13416	31.5	.00005

MOLYBDENUM ANODE SPECTRUM (M030)

KVP: 30 *** HVL: .50 MM AL
MM AL ADDED: .00 ** AL EQUIVALENT (INH): .60 MM
MOLYBDENUM FILTER ADDED: .030
NORMALIZATION FACTOR: .4020E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
10.5	.00000	21.5	.01056
11.5	.00391	22.5	.01294
12.5	.00935	23.5	.01539
13.5	.01930	24.5	.01636
14.5	.03361	25.5	.01652
15.5	.05146	26.5	.01496
16.5	.08177	27.5	.01198
17.5	.39041	28.5	.00718
18.5	.09714	29.5	.00208
19.5	.19452	30.5	.00025
20.5	.01021	31.5	.00009

MOLYBDENUM ANODE SPECTRUM (M028)

KVP: 35 *** HVL: .53 MM AL
MM AL ADDED: .00 ** AL EQUIVALENT (INH): .60 MM
NORMALIZATION FACTOR: .4516E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
9.5	.00000	23.5	.03541
10.5	.00260	24.5	.03478
11.5	.00586	25.5	.03229
12.5	.01117	26.5	.02972
13.5	.01861	27.5	.02643
14.5	.02729	28.5	.02326
15.5	.03661	29.5	.01961
16.5	.04784	30.5	.01580
17.5	.31327	31.5	.01192
18.5	.05453	32.5	.00747
19.5	.12828	33.5	.00255
20.5	.04050	34.5	.00039
21.5	.03678	35.5	.00015
22.5	.03665	36.5	.00022

MOLYBDENUM ANODE SPECTRUM (M029)

KVP: 35 *** HVL: .53 MM AL
MM AL ADDED: .00 ** AL EQUIVALENT (INH): .60 MM
MOLYBDENUM FILTER ADDED: .030
NORMALIZATION FACTOR: .4304E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
10.5	.00000	23.5	.01427
11.5	.00315	24.5	.01635
12.5	.00693	25.5	.01782
13.5	.01386	26.5	.01899
14.5	.02466	27.5	.01925
15.5	.03851	28.5	.01842
16.5	.06063	29.5	.01715
17.5	.39622	30.5	.01429
18.5	.07811	31.5	.01133
19.5	.18893	32.5	.00676
20.5	.01095	33.5	.00177
21.5	.00899	34.5	.00040
22.5	.01182	35.5	.00021

MOLYBDENUM ANODE SPECTRUM (M027)

KVP: 35 *** HVL: .58 MM AL
MM AL ADDED: .51 ** AL EQUIVALENT (INH): .60 MM
MOLYBDENUM FILTER ADDED: .030
NORMALIZATION FACTOR: .4722E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
11.5	.00000	24.5	.02189
12.5	.00259	25.5	.02509
13.5	.00636	26.5	.02715
14.5	.01366	27.5	.02865
15.5	.02587	28.5	.02790
16.5	.04977	29.5	.02624
17.5	.34869	30.5	.02309
18.5	.07653	31.5	.01829
19.5	.20339	32.5	.01247
20.5	.01247	33.5	.00473
21.5	.01061	34.5	.00099
22.5	.01468	35.5	.00016
23.5	.01853	36.5	.00020

MOLYBDENUM ANODE SPECTRUM (M047)

KVP: 35 *** HVL: .63 MM AL
MM AL ADDED: .51 ** AL EQUIVALENT (INH): .60 MM
NORMALIZATION FACTOR: .5146E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
10.5	.00000	23.5	.04425
11.5	.00178	24.5	.04332
12.5	.00391	25.5	.04229
13.5	.00805	26.5	.04014
14.5	.01482	27.5	.03752
15.5	.02314	28.5	.03356
16.5	.04070	29.5	.02953
17.5	.26030	30.5	.02532
18.5	.05008	31.5	.01989
19.5	.13226	32.5	.01436
20.5	.03964	33.5	.00843
21.5	.04147	34.5	.00196
22.5	.04314	35.5	.00008

MOLYBDENUM ANODE SPECTRUM (MO40)

KVP: 40 *** HVL: .56 MM AL
MM AL ADDED: .00 ** AL EQUIVALENT (INH): .60 MM
NORMALIZATION FACTOR: .4862E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
9.5	.00000	25.5	.02912
10.5	.00204	26.5	.02805
11.5	.00487	27.5	.02652
12.5	.00874	28.5	.02525
13.5	.01454	29.5	.02358
14.5	.02112	30.5	.02133
15.5	.02806	31.5	.01963
16.5	.03955	32.5	.01774
17.5	.31310	33.5	.01538
18.5	.04270	34.5	.01339
19.5	.12139	35.5	.01076
20.5	.03165	36.5	.00868
21.5	.03011	37.5	.00605
22.5	.03069	38.5	.00373
23.5	.03074	39.5	.00127
24.5	.02996	40.5	.00015

MOLYBDENUM ANODE SPECTRUM (MO 1)

KVP: 40 *** HVL: .56 MM AL
MM AL ADDED: .00 ** AL EQUIVALENT (INH): .60 MM
MOLYBDENUM FILTER ADDED: .015
NORMALIZATION FACTOR: .4765E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
10.5	.00000	26.5	.02408
11.5	.00336	27.5	.02447
12.5	.00695	28.5	.02380
13.5	.01325	29.5	.02284
14.5	.02078	30.5	.02206
15.5	.03020	31.5	.02051
16.5	.05184	32.5	.01876
17.5	.34366	33.5	.01693
18.5	.05222	34.5	.01435
19.5	.14626	35.5	.01198
20.5	.01510	36.5	.00904
21.5	.01524	37.5	.00592
22.5	.01801	38.5	.00277
23.5	.02019	39.5	.00036
24.5	.02191	40.5	.00004
25.5	.02307	41.5	.00005

MOLYBDENUM ANODE SPECTRUM (MO41)

KVP: 40 *** HVL: .56 MM AL
MM AL ADDED: .00 ** AL EQUIVALENT (INH): .60 MM
MOLYBDENUM FILTER ADDED: .030
NORMALIZATION FACTOR: .4705E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
10.5	.00000	26.5	.01708
11.5	.00219	27.5	.01869
12.5	.00482	28.5	.01970
13.5	.01011	29.5	.02034
14.5	.01760	30.5	.01989
15.5	.02808	31.5	.01986
16.5	.04543	32.5	.01888
17.5	.38597	33.5	.01754
18.5	.05953	34.5	.01555
19.5	.17318	35.5	.01361
20.5	.01032	36.5	.01119
21.5	.00686	37.5	.00805
22.5	.00876	38.5	.00491
23.5	.01118	39.5	.00147
24.5	.01352	40.5	.00007
25.5	.01560	41.5	.00002

MOLYBDENUM ANODE SPECTRUM (MO43)

KVP: 40 *** HVL: .62 MM AL
MM AL ADDED: .51 ** AL EQUIVALENT (INH): .60 MM
MOLYBDENUM FILTER ADDED: .030
NORMALIZATION FACTOR: .5233E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
11.5	.00000	26.5	.02459
12.5	.00211	27.5	.02690
13.5	.00454	28.5	.02859
14.5	.01031	29.5	.02932
15.5	.01885	30.5	.02918
16.5	.03923	31.5	.02880
17.5	.31812	32.5	.02746
18.5	.05729	33.5	.02534
19.5	.17725	34.5	.02229
20.5	.00878	35.5	.01860
21.5	.00830	36.5	.01458
22.5	.01142	37.5	.00943
23.5	.01499	38.5	.00362
24.5	.01849	39.5	.00020
25.5	.02137	40.5	.00003

MOLYBDENUM ANODE SPECTRUM (M044)

KVP: 40 *** HVL: .71 MM AL
MM AL ADDED: 1.02 ** AL EQUIVALENT (INH): .60 MM
MOLYBDENUM FILTER ADDED: .030
NORMALIZATION FACTOR: .5976E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
12.5	.00000	27.5	.03435
13.5	.00227	28.5	.03764
14.5	.00522	29.5	.03925
15.5	.01118	30.5	.03979
16.5	.02866	31.5	.03917
17.5	.24182	32.5	.03799
18.5	.05008	33.5	.03596
19.5	.16474	34.5	.03268
20.5	.00809	35.5	.02774
21.5	.00875	36.5	.02217
22.5	.01282	37.5	.01491
23.5	.01748	38.5	.00644
24.5	.02205	39.5	.00109
25.5	.02662	40.5	.00004
26.5	.03098	41.5	.00003

MOLYBDENUM ANODE SPECTRUM (MO 4)

KVP: 40 *** HVL: .68 MM AL
MM AL ADDED: .51 ** AL EQUIVALENT (INH): .60 MM
NORMALIZATION FACTOR: .5637E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
11.5	.00000	26.5	.03903
12.5	.00276	27.5	.03740
13.5	.00594	28.5	.03579
14.5	.01096	29.5	.03312
15.5	.01765	30.5	.03130
16.5	.03142	31.5	.02836
17.5	.24372	32.5	.02549
18.5	.03965	33.5	.02219
19.5	.11846	34.5	.01882
20.5	.03298	35.5	.01517
21.5	.03377	36.5	.01153
22.5	.03684	37.5	.00746
23.5	.03836	38.5	.00323
24.5	.03917	39.5	.00041
25.5	.03886	40.5	.00006

MOLYBDENUM ANODE SPECTRUM (MO 5)

KVP: 40 *** HVL: .92 MM AL
MM AL ADDED: 1.52 ** AL EQUIVALENT (INH): .60 MM
NORMALIZATION FACTOR: .7168E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
12.5	.00000	27.5	.05436
13.5	.00133	28.5	.05337
14.5	.00265	29.5	.05200
15.5	.00583	30.5	.04979
16.5	.01319	31.5	.04643
17.5	.12487	32.5	.04166
18.5	.02591	33.5	.03777
19.5	.09120	34.5	.03129
20.5	.02968	35.5	.02628
21.5	.03375	36.5	.01965
22.5	.04026	37.5	.01272
23.5	.04586	38.5	.00492
24.5	.04866	39.5	.00047
25.5	.05236	40.5	.00002
26.5	.05371	41.5	.00002

MOLYBDENUM ANODE SPECTRUM (MO46)

KVP: 45 *** HVL: .56 MM AL
MM AL ADDED: .00 ** AL EQUIVALENT (INH): .60 MM
NORMALIZATION FACTOR: .4921E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
9.5	.00000	28.5	.02367
10.5	.00192	29.5	.02261
11.5	.00432	30.5	.02071
12.5	.00831	31.5	.01941
13.5	.01367	32.5	.01784
14.5	.01954	33.5	.01622
15.5	.02651	34.5	.01422
16.5	.04729	35.5	.01295
17.5	.31187	36.5	.01080
18.5	.04035	37.5	.00935
19.5	.12370	38.5	.00733
20.5	.02658	39.5	.00557
21.5	.02692	40.5	.00369
22.5	.02782	41.5	.00190
23.5	.02810	42.5	.00032
24.5	.02807	43.5	.00008
25.5	.02709	44.5	.00008
26.5	.02616	45.5	.00009
27.5	.02486	46.5	.00009

MOLYBDENUM ANODE SPECTRUM (M045)

KVP: 45 *** HVL: .58 MM AL
MM AL ADDED: .00 ** AL EQUIVALENT (INH): .60 MM
MOLYBDENUM FILTER ADDED: .030
NORMALIZATION FACTOR: .5021E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
11.5	.00000	29.5	.01955
12.5	.00407	30.5	.02005
13.5	.00830	31.5	.02061
14.5	.01503	32.5	.02020
15.5	.02384	33.5	.01985
16.5	.04070	34.5	.01906
17.5	.36718	35.5	.01807
18.5	.05090	36.5	.01703
19.5	.16314	37.5	.01516
20.5	.00846	38.5	.01349
21.5	.00578	39.5	.01155
22.5	.00792	40.5	.00908
23.5	.01012	41.5	.00697
24.5	.01187	42.5	.00435
25.5	.01388	43.5	.00149
26.5	.01583	44.5	.00007
27.5	.01774	45.5	.00003
28.5	.01858	46.5	.00004

MOLYBDENUM ANODE SPECTRUM (M017)

KVP: 50 *** HVL: .61 MM AL
MM AL ADDED: .00 ** AL EQUIVALENT (INH): .60 MM
NORMALIZATION FACTOR: .5464E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
10.5	.00000	31.5	.02115
11.5	.00311	32.5	.02016
12.5	.00600	33.5	.01927
13.5	.01003	34.5	.01832
14.5	.01465	35.5	.01717
15.5	.02033	36.5	.01555
16.5	.02814	37.5	.01460
17.5	.30272	38.5	.01353
18.5	.03263	39.5	.01228
19.5	.10942	40.5	.01119
20.5	.02636	41.5	.00983
21.5	.02177	42.5	.00908
22.5	.02313	43.5	.00778
23.5	.02434	44.5	.00662
24.5	.02450	45.5	.00536
25.5	.02438	46.5	.00426
26.5	.02393	47.5	.00327
27.5	.02388	48.5	.00189
28.5	.02308	49.5	.00079
29.5	.02315	50.5	.00012
30.5	.02219	51.5	.00005

MOLYBDENUM ANODE SPECTRUM (M020)

KVP: 50 *** HVL: .61 MM AL
MM AL ADDED: .00 ** AL EQUIVALENT (INH): .60 MM
MOLYBDENUM FILTER ADDED: .015
NORMALIZATION FACTOR: .5449E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
11.5	.00000	31.5	.02094
12.5	.00436	32.5	.02067
13.5	.00821	33.5	.02019
14.5	.01347	34.5	.01959
15.5	.01995	35.5	.01867
16.5	.03049	36.5	.01753
17.5	.33205	37.5	.01675
18.5	.03719	38.5	.01547
19.5	.13029	39.5	.01442
20.5	.01488	40.5	.01315
21.5	.01074	41.5	.01201
22.5	.01273	42.5	.01044
23.5	.01454	43.5	.00906
24.5	.01678	44.5	.00770
25.5	.01797	45.5	.00640
26.5	.01898	46.5	.00498
27.5	.02021	47.5	.00347
28.5	.02085	48.5	.00199
29.5	.02097	49.5	.00051
30.5	.02132	50.5	.00005

MOLYBDENUM ANODE SPECTRUM (M021)

KVP: 50 *** HVL: .61 MM AL
MM AL ADDED: .00 ** AL EQUIVALENT (INH): .60 MM
MOLYBDENUM FILTER ADDED: .030
NORMALIZATION FACTOR: .5453E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
11.5	.00000	31.5	.01956
12.5	.00301	32.5	.02005
13.5	.00660	33.5	.01981
14.5	.01168	34.5	.02022
15.5	.01880	35.5	.01971
16.5	.03063	36.5	.01931
17.5	.34607	37.5	.01891
18.5	.04120	38.5	.01804
19.5	.14880	39.5	.01688
20.5	.01036	40.5	.01551
21.5	.00460	41.5	.01424
22.5	.00626	42.5	.01281
23.5	.00813	43.5	.01130
24.5	.01025	44.5	.00998
25.5	.01240	45.5	.00842
26.5	.01369	46.5	.00616
27.5	.01526	47.5	.00448
28.5	.01652	48.5	.00258
29.5	.01788	49.5	.00081
30.5	.01898	50.5	.00006

MOLYBDENUM ANODE SPECTRUM (M018)

KVP: 50 *** HVL: .89 MM AL
MM AL ADDED: 1.02 ** AL EQUIVALENT (INH): .60 MM
NORMALIZATION FACTOR: .7554E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
12.5	.00000	32.5	.03392
13.5	.00154	33.5	.03296
14.5	.00345	34.5	.03129
15.5	.00630	35.5	.02977
16.5	.01192	36.5	.02866
17.5	.15734	37.5	.02652
18.5	.02107	38.5	.02462
19.5	.08506	39.5	.02239
20.5	.02358	40.5	.02036
21.5	.02210	41.5	.01767
22.5	.02590	42.5	.01615
23.5	.02856	43.5	.01403
24.5	.03167	44.5	.01162
25.5	.03319	45.5	.00918
26.5	.03484	46.5	.00711
27.5	.03620	47.5	.00495
28.5	.03626	48.5	.00245
29.5	.03591	49.5	.00046
30.5	.03557	50.5	.00003
31.5	.03538	51.5	.00003

MOLYBDENUM ANODE SPECTRUM (M019)

KVP: 50 *** HVL: 1.31 MM AL
MM AL ADDED: 2.03 ** AL EQUIVALENT (INH): .60 MM
NORMALIZATION FACTOR: .9923E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
12.5	.00000	32.5	.04478
13.5	.00047	33.5	.04409
14.5	.00086	34.5	.04251
15.5	.00187	35.5	.04162
16.5	.00408	36.5	.03931
17.5	.06252	37.5	.03634
18.5	.01037	38.5	.03407
19.5	.05156	39.5	.03165
20.5	.01516	40.5	.02928
21.5	.01684	41.5	.02667
22.5	.02210	42.5	.02365
23.5	.02621	43.5	.02019
24.5	.03025	44.5	.01737
25.5	.03418	45.5	.01429
26.5	.03805	46.5	.01060
27.5	.04036	47.5	.00726
28.5	.04303	48.5	.00402
29.5	.04351	49.5	.00079
30.5	.04462	50.5	.00002
31.5	.04546	51.5	.00001

MOLYBDENUM ANODE SPECTRUM (M048)

KVP: 55 *** HVL: .61 MM AL
MM AL ADDED: .00 ** AL EQUIVALENT (INH): .60 MM
NORMALIZATION FACTOR: .5624E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
10.5	.00000	33.5	.01870
11.5	.00300	34.5	.01769
12.5	.00556	35.5	.01688
13.5	.00897	36.5	.01587
14.5	.01361	37.5	.01506
15.5	.01876	38.5	.01433
16.5	.03368	39.5	.01331
17.5	.29531	40.5	.01261
18.5	.03006	41.5	.01181
19.5	.11097	42.5	.01103
20.5	.01919	43.5	.00999
21.5	.01874	44.5	.00903
22.5	.02031	45.5	.00841
23.5	.02085	46.5	.00754
24.5	.02125	47.5	.00683
25.5	.02167	48.5	.00566
26.5	.02169	49.5	.00516
27.5	.02154	50.5	.00420
28.5	.02145	51.5	.00325
29.5	.02062	52.5	.00266
30.5	.02051	53.5	.00189
31.5	.01972	54.5	.00104
32.5	.01928	55.5	.00023

MOLYBDENUM ANODE SPECTRUM (M049)

KVP: 55 *** HVL: .91 MM AL
MM AL ADDED: 1.02 ** AL EQUIVALENT (INH): .60 MM
NORMALIZATION FACTOR: .8023E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
12.5	.00000	34.5	.02945
13.5	.00154	35.5	.02841
14.5	.00308	36.5	.02751
15.5	.00605	37.5	.02662
16.5	.01409	38.5	.02497
17.5	.14654	39.5	.02417
18.5	.01940	40.5	.02217
19.5	.08281	41.5	.02159
20.5	.01645	42.5	.01962
21.5	.01861	43.5	.01818
22.5	.02131	44.5	.01674
23.5	.02397	45.5	.01555
24.5	.02651	46.5	.01385
25.5	.02802	47.5	.01194
26.5	.02874	48.5	.01082
27.5	.03023	49.5	.00936
28.5	.03155	50.5	.00769
29.5	.03166	51.5	.00650
30.5	.03141	52.5	.00468
31.5	.03158	53.5	.00330
32.5	.03104	54.5	.00164
33.5	.03025	55.5	.00031

4.5.3 EXIT SPECTRA

4.5.3 EXIT SPECTRA

TUNGSTEN ANODE SPECTRUM (MW35)

KVP: 25 *** HVL: .58 MM AL
MM AL ADDED: .00 ** AL EQUIVALENT (INH): .60 MM
PHANTOM MATERIAL: 1.59 CM OF LUCITE
NORMALIZATION FACTOR: .4497E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
9.5	.00000	18.5	.13766
10.5	.00107	19.5	.15541
11.5	.00208	20.5	.15448
12.5	.00417	21.5	.13397
13.5	.01157	22.5	.08476
14.5	.02625	23.5	.03621
15.5	.05031	24.5	.00914
16.5	.08023	25.5	.00021
17.5	.11243	26.5	.00005

TUNGSTEN ANODE SPECTRUM (MW36)

KVP: 25 *** HVL: .66 MM AL
MM AL ADDED: .00 ** AL EQUIVALENT (INH): .60 MM
PHANTOM MATERIAL: 3.19 CM OF LUCITE
NORMALIZATION FACTOR: .4908E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
11.5	.00000	19.5	.16219
12.5	.00156	20.5	.17900
13.5	.00354	21.5	.16706
14.5	.01113	22.5	.11282
15.5	.02623	23.5	.05167
16.5	.05311	24.5	.01298
17.5	.09068	25.5	.00012
18.5	.12789	26.5	.00001

TUNGSTEN ANODE SPECTRUM (MW37)

KVP: 25 *** HVL: .73 MM AL
MM AL ADDED: .00 ** AL EQUIVALENT (INH): .60 MM
PHANTOM MATERIAL: 4.79 CM OF LUCITE
NORMALIZATION FACTOR: .5213E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
12.5	.00000	19.5	.15547
13.5	.00141	20.5	.19088
14.5	.00424	21.5	.19439
15.5	.01330	22.5	.14100
16.5	.03311	23.5	.07001
17.5	.06619	24.5	.01869
18.5	.11100	25.5	.00029

TUNGSTEN ANODE SPECTRUM (MW38)

KVP: 25 *** HVL: .80 MM AL
MM AL ADDED: .00 ** AL EQUIVALENT (INH): .60 MM
PHANTOM MATERIAL: 6.43 CM OF LUCITE
NORMALIZATION FACTOR: .5558E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
12.5	.00000	19.5	.13124
13.5	.00156	20.5	.18189
14.5	.00157	21.5	.21148
15.5	.00534	22.5	.18402
16.5	.01678	23.5	.10507
17.5	.03958	24.5	.03842
18.5	.08080	25.5	.00225

TUNGSTEN ANODE SPECTRUM (MW39)

KVP: 25 *** HVL: .71 MM AL
MM AL ADDED: .51 ** AL EQUIVALENT (INH): .60 MM
PHANTOM MATERIAL: 3.19 CM OF LUCITE
NORMALIZATION FACTOR: .5162E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
11.5	.00000	19.5	.15668
12.5	.00114	20.5	.18802
13.5	.00224	21.5	.19062
14.5	.00522	22.5	.13751
15.5	.01462	23.5	.06882
16.5	.03563	24.5	.01792
17.5	.07092	25.5	.00026
18.5	.11039	26.5	.00000

TUNGSTEN ANODE SPECTRUM (MW40)

KVP: 25 *** HVL: .82 MM AL
MM AL ADDED: .51 ** AL EQUIVALENT (INH): .60 MM
PHANTOM MATERIAL: 6.43 CM OF LUCITE
NORMALIZATION FACTOR: .5671E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
13.5	.00000	20.5	.18081
14.5	.00139	21.5	.22562
15.5	.00315	22.5	.19842
16.5	.01123	23.5	.11384
17.5	.03139	24.5	.03763
18.5	.07057	25.5	.00090
19.5	.12504	26.5	.00000

TUNGSTEN ANODE SPECTRUM (MW41)

KVP: 25 *** HVL: .58 MM AL
MM AL ADDED: .00 ** AL EQUIVALENT (INH): .60 MM
PHANTOM MATERIAL: 2.63 CM OF POLYSTYRENE
NORMALIZATION FACTOR: .4505E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
9.5	.00000	18.5	.13520
10.5	.00101	19.5	.15127
11.5	.00193	20.5	.15219
12.5	.00463	21.5	.13399
13.5	.01199	22.5	.08853
14.5	.02685	23.5	.04040
15.5	.05075	24.5	.01029
16.5	.07986	25.5	.00024
17.5	.11083	26.5	.00003

TUNGSTEN ANODE SPECTRUM (MW42)

KVP: 25 *** HVL: .67 MM AL
MM AL ADDED: .00 ** AL EQUIVALENT (INH): .60 MM
PHANTOM MATERIAL: 5.25 CM OF POLYSTYRENE
NORMALIZATION FACTOR: .4951E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
11.5	.00000	19.5	.15434
12.5	.00149	20.5	.17319
13.5	.00423	21.5	.16807
14.5	.01110	22.5	.12256
15.5	.02607	23.5	.06052
16.5	.05151	24.5	.01736
17.5	.08640	25.5	.00051
18.5	.12263	26.5	.00000

TUNGSTEN ANODE SPECTRUM (MW43)

KVP: 25 *** HVL: .73 MM AL
MM AL ADDED: .00 ** AL EQUIVALENT (INH): .60 MM
PHANTOM MATERIAL: 7.85 CM OF POLYSTYRENE
NORMALIZATION FACTOR: .5245E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
12.5	.00000	19.5	.15138
13.5	.00186	20.5	.18018
14.5	.00466	21.5	.19153
15.5	.01357	22.5	.15072
16.5	.03311	23.5	.07791
17.5	.06550	24.5	.02396
18.5	.10459	25.5	.00102

TUNGSTEN ANODE SPECTRUM (MW44)

KVP: 25 *** HVL: .76 MM AL
MM AL ADDED: .51 ** AL EQUIVALENT (INH): .60 MM
PHANTOM MATERIAL: 7.85 CM OF POLYSTYRENE
NORMALIZATION FACTOR: .5404E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
12.5	.00000	19.5	.14282
13.5	.00142	20.5	.18608
14.5	.00252	21.5	.20477
15.5	.00892	22.5	.16664
16.5	.02371	23.5	.08998
17.5	.05160	24.5	.02850
18.5	.09226	25.5	.00079

TUNGSTEN ANODE SPECTRUM (MW45)

KVP: 25 *** HVL: .71 MM AL
MM AL ADDED: .51 ** AL EQUIVALENT (INH): .60 MM
PHANTOM MATERIAL: 5.25 CM OF POLYSTYRENE
NORMALIZATION FACTOR: .5133E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
11.5	.00000	19.5	.15535
12.5	.00080	20.5	.18254
13.5	.00203	21.5	.18413
14.5	.00595	22.5	.13825
15.5	.01715	23.5	.06860
16.5	.03921	24.5	.01908
17.5	.07340	25.5	.00029
18.5	.11321	26.5	.00001

TUNGSTEN ANODE SPECTRUM (MW46)

KVP: 25 *** HVL: .64 MM AL
MM AL ADDED: .51 ** AL EQUIVALENT (INH): .60 MM
PHANTOM MATERIAL: 2.63 CM OF POLYSTYRENE
NORMALIZATION FACTOR: .4811E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
10.5	.00000	18.5	.12943
11.5	.00123	19.5	.15792
12.5	.00193	20.5	.16950
13.5	.00537	21.5	.15597
14.5	.01431	22.5	.10963
15.5	.03257	23.5	.05210
16.5	.06073	24.5	.01425
17.5	.09474	25.5	.00030

TUNGSTEN ANODE SPECTRUM (MW47)

KVP: 25 *** HVL: .69 MM AL
MM AL ADDED: 1.02 ** AL EQUIVALENT (INH): .60 MM
PHANTOM MATERIAL: 2.63 CM OF POLYSTYRENE
NORMALIZATION FACTOR: .5065E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
11.5	.00000	19.5	.15500
12.5	.00130	20.5	.17830
13.5	.00260	21.5	.17751
14.5	.00782	22.5	.13145
15.5	.02001	23.5	.06604
16.5	.04344	24.5	.01925
17.5	.07851	25.5	.00053
18.5	.11824	26.5	.00001

TUNGSTEN ANODE SPECTRUM (MW48)

KVP: 40 *** HVL: 1.53 MM AL
MM AL ADDED: .51 ** AL EQUIVALENT (INH): .60 MM
PHANTOM MATERIAL: 3.19 CM OF LUCITE
NORMALIZATION FACTOR: .9797E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
13.5	.00000	27.5	.06978
14.5	.00079	28.5	.07129
15.5	.00136	29.5	.07139
16.5	.00321	30.5	.07004
17.5	.00644	31.5	.06745
18.5	.01064	32.5	.06281
19.5	.01721	33.5	.05671
20.5	.02460	34.5	.05003
21.5	.03247	35.5	.04216
22.5	.04090	36.5	.03264
23.5	.04922	37.5	.02146
24.5	.05640	38.5	.00955
25.5	.06228	39.5	.00260
26.5	.06633	40.5	.00020

TUNGSTEN ANODE SPECTRUM (MW49)

KVP: 40 *** HVL: 1.85 MM AL
MM AL ADDED: .51 ** AL EQUIVALENT (INH): .60 MM
PHANTOM MATERIAL: 6.43 CM OF LUCITE
NORMALIZATION FACTOR: .1099E+08 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
15.5	.00000	28.5	.07469
16.5	.00084	29.5	.07727
17.5	.00164	30.5	.07950
18.5	.00344	31.5	.07858
19.5	.00656	32.5	.07590
20.5	.01156	33.5	.07067
21.5	.01776	34.5	.06395
22.5	.02645	35.5	.05463
23.5	.03507	36.5	.04433
24.5	.04529	37.5	.02996
25.5	.05398	38.5	.01332
26.5	.06187	39.5	.00370
27.5	.06878	40.5	.00025

TUNGSTEN ANODE SPECTRUM (MW50)

KVP: 40 *** HVL: 1.93 MM AL
MM AL ADDED: 1.02 ** AL EQUIVALENT (INH): .60 MM
PHANTOM MATERIAL: 6.43 CM OF LUCITE
NORMALIZATION FACTOR: .1131E+08 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
15.5	.00000	28.5	.07418
16.5	.00067	29.5	.07856
17.5	.00099	30.5	.08039
18.5	.00237	31.5	.08216
19.5	.00488	32.5	.08028
20.5	.00906	33.5	.07584
21.5	.01442	34.5	.06915
22.5	.02218	35.5	.05913
23.5	.03081	36.5	.04749
24.5	.04132	37.5	.03188
25.5	.04983	38.5	.01439
26.5	.05888	39.5	.00393
27.5	.06688	40.5	.00033

TUNGSTEN ANODE SPECTRUM (MW51)

KVP: 40 *** HVL: 1.65 MM AL
MM AL ADDED: 1.02 ** AL EQUIVALENT (INH): .60 MM
PHANTOM MATERIAL: 3.19 CM OF LUCITE
NORMALIZATION FACTOR: .1026E+08 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
13.5	.00000	27.5	.06990
14.5	.00058	28.5	.07223
15.5	.00080	29.5	.07399
16.5	.00189	30.5	.07384
17.5	.00405	31.5	.07137
18.5	.00743	32.5	.06698
19.5	.01255	33.5	.06196
20.5	.01897	34.5	.05556
21.5	.02660	35.5	.04693
22.5	.03548	36.5	.03717
23.5	.04437	37.5	.02505
24.5	.05212	38.5	.01177
25.5	.05953	39.5	.00341
26.5	.06512	40.5	.00033

TUNGSTEN ANODE SPECTRUM (MW52)

KVP: 40 *** HVL: 1.85 MM AL
MM AL ADDED: 2.03 ** AL EQUIVALENT (INH): .60 MM
PHANTOM MATERIAL: 3.19 CM OF LUCITE
NORMALIZATION FACTOR: .1100E+08 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
15.5	.00000	28.5	.07453
16.5	.00085	29.5	.07880
17.5	.00164	30.5	.07947
18.5	.00332	31.5	.07842
19.5	.00681	32.5	.07665
20.5	.01160	33.5	.07175
21.5	.01818	34.5	.06412
22.5	.02625	35.5	.05523
23.5	.03467	36.5	.04339
24.5	.04400	37.5	.02936
25.5	.05362	38.5	.01285
26.5	.06172	39.5	.00350
27.5	.06897	40.5	.00029

TUNGSTEN ANODE SPECTRUM (MW53)

KVP: 40 *** HVL: 2.06 MM AL
MM AL ADDED: 2.03 ** AL EQUIVALENT (INH): .60 MM
PHANTOM MATERIAL: 6.43 CM OF LUCITE
NORMALIZATION FACTOR: .1179E+08 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
16.5	.00000	29.5	.08095
17.5	.00040	30.5	.08410
18.5	.00127	31.5	.08586
19.5	.00241	32.5	.08741
20.5	.00577	33.5	.08298
21.5	.00913	34.5	.07583
22.5	.01664	35.5	.06687
23.5	.02389	36.5	.05296
24.5	.03378	37.5	.03377
25.5	.04441	38.5	.01504
26.5	.05366	39.5	.00346
27.5	.06494	40.5	.00011
28.5	.07436	41.5	.00000

TUNGSTEN ANODE SPECTRUM (MW54)

KVP: 40 *** HVL: 1.52 MM AL
MM AL ADDED: .51 ** AL EQUIVALENT (INH): .60 MM
PHANTOM MATERIAL: 5.25 CM OF POLYSTYRENE
NORMALIZATION FACTOR: .9745E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
13.5	.00000	27.5	.06979
14.5	.00086	28.5	.07151
15.5	.00154	29.5	.07076
16.5	.00332	30.5	.06953
17.5	.00669	31.5	.06677
18.5	.01115	32.5	.06182
19.5	.01799	33.5	.05701
20.5	.02528	34.5	.04978
21.5	.03338	35.5	.04139
22.5	.04131	36.5	.03247
23.5	.04944	37.5	.02119
24.5	.05622	38.5	.00920
25.5	.06212	39.5	.00252
26.5	.06672	40.5	.00020

TUNGSTEN ANODE SPECTRUM (MW55)

KVP: 40 *** HVL: 1.64 MM AL
MM AL ADDED: 1.02 ** AL EQUIVALENT (INH): .60 MM
PHANTOM MATERIAL: 5.25 CM OF POLYSTYRENE
NORMALIZATION FACTOR: .1022E+08 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
13.5	.00000	27.5	.07033
14.5	.00027	28.5	.07327
15.5	.00086	29.5	.07448
16.5	.00196	30.5	.07366
17.5	.00403	31.5	.07071
18.5	.00779	32.5	.06694
19.5	.01331	33.5	.06185
20.5	.01957	34.5	.05493
21.5	.02751	35.5	.04647
22.5	.03612	36.5	.03601
23.5	.04383	37.5	.02422
24.5	.05291	38.5	.01084
25.5	.05940	39.5	.00297
26.5	.06555	40.5	.00022

TUNGSTEN ANODE SPECTRUM (MW56)

KVP: 40 *** HVL: 1.69 MM AL
MM AL ADDED: .51 ** AL EQUIVALENT (INH): .60 MM
PHANTOM MATERIAL: 7.85 CM OF POLYSTYRENE
NORMALIZATION FACTOR: .1042E+08 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
14.5	.00000	28.5	.07266
15.5	.00071	29.5	.07438
16.5	.00170	30.5	.07449
17.5	.00321	31.5	.07263
18.5	.00660	32.5	.06958
19.5	.01120	33.5	.06383
20.5	.01792	34.5	.05710
21.5	.02531	35.5	.04853
22.5	.03441	36.5	.03848
23.5	.04210	37.5	.02665
24.5	.05078	38.5	.01213
25.5	.05781	39.5	.00361
26.5	.06440	40.5	.00033
27.5	.06947	41.5	.00002

TUNGSTEN ANODE SPECTRUM (MW57)

KVP: 40 *** HVL: 1.80 MM AL
MM AL ADDED: 1.02 ** AL EQUIVALENT (INH): .60 MM
PHANTOM MATERIAL: 7.85 CM OF POLYSTYRENE
NORMALIZATION FACTOR: .1081E+08 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
14.5	.00000	28.5	.07426
15.5	.00066	29.5	.07691
16.5	.00089	30.5	.07777
17.5	.00200	31.5	.07648
18.5	.00420	32.5	.07340
19.5	.00798	33.5	.06839
20.5	.01321	34.5	.06243
21.5	.02008	35.5	.05288
22.5	.02883	36.5	.04222
23.5	.03771	37.5	.02918
24.5	.04674	38.5	.01330
25.5	.05504	39.5	.00387
26.5	.06264	40.5	.00037
27.5	.06856	41.5	.00001

TUNGSTEN ANODE SPECTRUM (MW58)

KVP: 40 *** HVL: 1.48 MM AL
MM AL ADDED: 1.02 ** AL EQUIVALENT (INH): .60 MM
PHANTOM MATERIAL: 2.63 CM OF POLYSTYRENE
NORMALIZATION FACTOR: .9595E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
12.5	.00000	27.5	.06941
13.5	.00068	28.5	.07029
14.5	.00117	29.5	.07003
15.5	.00213	30.5	.06879
16.5	.00389	31.5	.06380
17.5	.00765	32.5	.06083
18.5	.01246	33.5	.05418
19.5	.01939	34.5	.04908
20.5	.02680	35.5	.04148
21.5	.03468	36.5	.03126
22.5	.04208	37.5	.02112
23.5	.05049	38.5	.00976
24.5	.05644	39.5	.00282
25.5	.06236	40.5	.00026
26.5	.06666	41.5	.00001

TUNGSTEN ANODE SPECTRUM (MW59)

KVP: 40 *** HVL: 1.35 MM AL
MM AL ADDED: .51 ** AL EQUIVALENT (INH): .60 MM
PHANTOM MATERIAL: 2.63 CM OF POLYSTYRENE
NORMALIZATION FACTOR: .9060E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
12.5	.00000	27.5	.06734
13.5	.00081	28.5	.06737
14.5	.00153	29.5	.06599
15.5	.00381	30.5	.06294
16.5	.00693	31.5	.06031
17.5	.01253	32.5	.05435
18.5	.01836	33.5	.04925
19.5	.02614	34.5	.04381
20.5	.03293	35.5	.03589
21.5	.04063	36.5	.02804
22.5	.04756	37.5	.01885
23.5	.05380	38.5	.00855
24.5	.06007	39.5	.00244
25.5	.06402	40.5	.00022
26.5	.06551	41.5	.00001

TUNGSTEN ANODE SPECTRUM (MW78)

KVP: 55 *** HVL: 2.99 MM AL
MM AL ADDED: .00 ** AL EQUIVALENT (INH): .60 MM
BEAM SHAPING FILTER: .13 MM OF LA
PHANTOM MATERIAL: 4.79 CM OF LUCITE
NORMALIZATION FACTOR: .1572E+08 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
19.5	.00000	38.5	.07136
20.5	.00064	39.5	.01449
21.5	.00164	40.5	.01541
22.5	.00296	41.5	.01689
23.5	.00498	42.5	.01871
24.5	.00855	43.5	.02030
25.5	.01284	44.5	.02124
26.5	.01784	45.5	.02107
27.5	.02395	46.5	.02085
28.5	.03009	47.5	.02124
29.5	.03777	48.5	.01962
30.5	.04532	49.5	.01847
31.5	.05177	50.5	.01655
32.5	.05893	51.5	.01360
33.5	.06626	52.5	.01025
34.5	.06996	53.5	.00586
35.5	.07551	54.5	.00145
36.5	.07950	55.5	.00008
37.5	.08402	56.5	.00001

TUNGSTEN ANODE SPECTRUM (MW79)

KVP: 55 *** HVL: 2.87 MM AL
MM AL ADDED: .00 ** AL EQUIVALENT (INH): .60 MM
BEAM SHAPING FILTER: .13 MM OF LA
PHANTOM MATERIAL: 5.25 CM OF POLYSTYRENE
NORMALIZATION FACTOR: .1529E+08 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
18.5	.00000	37.5	.08002
19.5	.00061	38.5	.06863
20.5	.00109	39.5	.01356
21.5	.00255	40.5	.01454
22.5	.00435	41.5	.01636
23.5	.00684	42.5	.01744
24.5	.01098	43.5	.01840
25.5	.01558	44.5	.01906
26.5	.02078	45.5	.01943
27.5	.02742	46.5	.01973
28.5	.03347	47.5	.01919
29.5	.04030	48.5	.01784
30.5	.04730	49.5	.01711
31.5	.05453	50.5	.01486
32.5	.06003	51.5	.01259
33.5	.06631	52.5	.00971
34.5	.07020	53.5	.00547
35.5	.07450	54.5	.00153
36.5	.07759	55.5	.00008

TUNGSTEN ANODE SPECTRUM (MW80)

KVP: 40 *** HVL: 1.40 MM AL
MM AL ADDED: .00 ** AL EQUIVALENT (INH): .60 MM
BEAM SHAPING FILTER: .13 MM OF SN
PHANTOM MATERIAL: 5.25 CM OF POLYSTYRENE
NORMALIZATION FACTOR: .8747E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
14.5	.00000	28.5	.15097
15.5	.00097	29.5	.02684
16.5	.00146	30.5	.00904
17.5	.00384	31.5	.01141
18.5	.00825	32.5	.01373
19.5	.01577	33.5	.01541
20.5	.02584	34.5	.01639
21.5	.04010	35.5	.01600
22.5	.05682	36.5	.01428
23.5	.07583	37.5	.01021
24.5	.09446	38.5	.00441
25.5	.11206	39.5	.00119
26.5	.12924	40.5	.00008
27.5	.14543	41.5	.00001

TUNGSTEN ANODE SPECTRUM (MW81)

KVP: 40 *** HVL: 1.48 MM AL
MM AL ADDED: .00 ** AL EQUIVALENT (INH): .60 MM
BEAM SHAPING FILTER: .13 MM OF SN
PHANTOM MATERIAL: 4.79 CM OF LUCITE
NORMALIZATION FACTOR: .9100E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
15.5	.00000	28.5	.16332
16.5	.00117	29.5	.02876
17.5	.00206	30.5	.01020
18.5	.00489	31.5	.01298
19.5	.01025	32.5	.01590
20.5	.01904	33.5	.01830
21.5	.03162	34.5	.02007
22.5	.04840	35.5	.01963
23.5	.06717	36.5	.01736
24.5	.09060	37.5	.01242
25.5	.11274	38.5	.00515
26.5	.13309	39.5	.00142
27.5	.15340	40.5	.00006

MOLYBDENUM ANODE SPECTRUM (M031)

KVP: 30 *** HVL: .56 MM AL
MM AL ADDED: .00 ** AL EQUIVALENT (INH): .60 MM
PHANTOM MATERIAL: 1.59 CM OF LUCITE
MOLYBDENUM FILTER ADDED: .030
NORMALIZATION FACTOR: .4436E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
11.5	.00000	21.5	.01509
12.5	.00238	22.5	.02062
13.5	.00646	23.5	.02503
14.5	.01534	24.5	.02761
15.5	.03100	25.5	.02929
16.5	.06497	26.5	.02745
17.5	.34435	27.5	.02183
18.5	.10456	28.5	.01332
19.5	.23305	29.5	.00384
20.5	.01342	30.5	.00037

MOLYBDENUM ANODE SPECTRUM (M032)

KVP: 30 *** HVL: .63 MM AL
MM AL ADDED: .00 ** AL EQUIVALENT (INH): .60 MM
PHANTOM MATERIAL: 3.19 CM OF LUCITE
MOLYBDENUM FILTER ADDED: .030
NORMALIZATION FACTOR: .4883E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
12.5	.00000	22.5	.02783
13.5	.00250	23.5	.03603
14.5	.00665	24.5	.04255
15.5	.01609	25.5	.04681
16.5	.03888	26.5	.04525
17.5	.27479	27.5	.03794
18.5	.09839	28.5	.02352
19.5	.25512	29.5	.00713
20.5	.02028	30.5	.00077
21.5	.01947	31.5	.00000

MOLYBDENUM ANODE SPECTRUM (M033)

KVP: 30 *** HVL: .71 MM AL
MM AL ADDED: .00 ** AL EQUIVALENT (INH): .60 MM
PHANTOM MATERIAL: 4.79 CM OF LUCITE
MOLYBDENUM FILTER ADDED: .030
NORMALIZATION FACTOR: .5412E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
12.5	.00000	22.5	.03513
13.5	.00123	23.5	.04833
14.5	.00290	24.5	.06037
15.5	.00819	25.5	.06796
16.5	.02411	26.5	.06871
17.5	.19479	27.5	.06177
18.5	.08278	28.5	.03993
19.5	.24541	29.5	.01273
20.5	.02134	30.5	.00157
21.5	.02272	31.5	.00001

MOLYBDENUM ANODE SPECTRUM (M034)

KVP: 30 *** HVL: .81 MM AL
MM AL ADDED: .00 ** AL EQUIVALENT (INH): .60 MM
PHANTOM MATERIAL: 6.43 CM OF LUCITE
MOLYBDENUM FILTER ADDED: .030
NORMALIZATION FACTOR: .6011E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
13.5	.00000	22.5	.04153
14.5	.00131	23.5	.06023
15.5	.00444	24.5	.07536
16.5	.01410	25.5	.08967
17.5	.12676	26.5	.09752
18.5	.06365	27.5	.08702
19.5	.21675	28.5	.05727
20.5	.02030	29.5	.01770
21.5	.02441	30.5	.00199

MOLYBDENUM ANODE SPECTRUM (M035)

KVP: 30 *** HVL: .70 MM AL
MM AL ADDED: .00 ** AL EQUIVALENT (INH): .60 MM
PHANTOM MATERIAL: 7.85 CM OF POLYSTYRENE
MOLYBDENUM FILTER ADDED: .030
NORMALIZATION FACTOR: .5317E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
12.5	.00000	22.5	.03447
13.5	.00130	23.5	.04624
14.5	.00311	24.5	.05700
15.5	.00957	25.5	.06428
16.5	.02639	26.5	.06578
17.5	.20719	27.5	.05713
18.5	.08646	28.5	.03627
19.5	.24722	29.5	.01164
20.5	.02263	30.5	.00121
21.5	.02209	31.5	.00000

MOLYBDENUM ANODE SPECTRUM (M036)

KVP: 30 *** HVL: .63 MM AL
MM AL ADDED: .00 ** AL EQUIVALENT (INH): .60 MM
PHANTOM MATERIAL: 5.22 CM OF POLYSTYRENE
MOLYBDENUM FILTER ADDED: .030
NORMALIZATION FACTOR: .4862E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
12.5	.00000	22.5	.02681
13.5	.00233	23.5	.03451
14.5	.00696	24.5	.04120
15.5	.01717	25.5	.04464
16.5	.03925	26.5	.04416
17.5	.28133	27.5	.03823
18.5	.09705	28.5	.02425
19.5	.25412	29.5	.00793
20.5	.02083	30.5	.00080
21.5	.01842	31.5	.00000

MOLYBDENUM ANODE SPECTRUM (M037)

KVP: 30 *** HVL: .57 MM AL
MM AL ADDED: .00 ** AL EQUIVALENT (INH): .60 MM
PHANTOM MATERIAL: 2.60 CM OF POLYSTYRENE
MOLYBDENUM FILTER ADDED: .030
NORMALIZATION FACTOR: .4443E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
11.5	.00000	21.5	.01435
12.5	.00250	22.5	.01916
13.5	.00633	23.5	.02417
14.5	.01506	24.5	.02711
15.5	.03067	25.5	.02810
16.5	.05612	26.5	.02677
17.5	.35211	27.5	.02194
18.5	.10191	28.5	.01340
19.5	.23646	29.5	.00413
20.5	.01918	30.5	.00050

MOLYBDENUM ANODE SPECTRUM (M038)

KVP: 30 *** HVL: .61 MM AL
MM AL ADDED: .00 ** AL EQUIVALENT (INH): .60 MM
PHANTOM MATERIAL: 2.60 CM OF POLYSTYRENE
NORMALIZATION FACTOR: .4838E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
10.5	.00000	21.5	.05960
11.5	.00133	22.5	.05922
12.5	.00358	23.5	.05784
13.5	.00764	24.5	.05488
14.5	.01642	25.5	.04712
15.5	.02819	26.5	.03897
16.5	.04440	27.5	.02720
17.5	.25691	28.5	.01461
18.5	.06788	29.5	.00359
19.5	.14967	30.5	.00033
20.5	.06060	31.5	.00002

MOLYBDENUM ANODE SPECTRUM (M042)

KVP: 40 *** HVL: 1.06 MM AL
MM AL ADDED: .00 ** AL EQUIVALENT (INH): .60 MM
PHANTOM MATERIAL: 4.79 CM OF LUCITE
MOLYBDENUM FILTER ADDED: .030
NORMALIZATION FACTOR: .8295E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
12.5	.00000	27.5	.04838
13.5	.00052	28.5	.05404
14.5	.00110	29.5	.05887
15.5	.00296	30.5	.06294
16.5	.01003	31.5	.06405
17.5	.09284	32.5	.06390
18.5	.02645	33.5	.06229
19.5	.10638	34.5	.05736
20.5	.00633	35.5	.05130
21.5	.00801	36.5	.04083
22.5	.01281	37.5	.02996
23.5	.01873	38.5	.01609
24.5	.02610	39.5	.00275
25.5	.03393	40.5	.00004
26.5	.04098	41.5	.00001

MOLYBDENUM-TUNGSTEN ANODE SPECTRUM (MOW 8)

KVP: 30 *** HVL: .64 MM AL
MM AL ADDED,: .51 ** MM OF BE INHERENT: 1.00
PHANTOM MATERIAL: 3.19 CM OF LUCITE
MOLYBDENUM FILTER ADDED: .030
NORMALIZATION FACTOR: .4984E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
11.5	.00000	21.5	.02595
12.5	.00137	22.5	.03672
13.5	.00319	23.5	.04691
14.5	.00885	24.5	.05359
15.5	.02173	25.5	.05672
16.5	.04471	26.5	.05303
17.5	.21514	27.5	.04097
18.5	.11481	28.5	.01933
19.5	.22263	29.5	.00484
20.5	.02932	30.5	.00019

MOLYBDENUM-TUNGSTEN ANODE SPECTRUM (MOW 9)

KVP: 30 *** HVL: .74 MM AL
MM AL ADDED,: .51 ** MM OF BE INHERENT: 1.00
PHANTOM MATERIAL: 4.79 CM OF LUCITE
MOLYBDENUM FILTER ADDED: .030
NORMALIZATION FACTOR: .5576E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
12.5	.00000	22.5	.04477
13.5	.00157	23.5	.05915
14.5	.00375	24.5	.07188
15.5	.01042	25.5	.07991
16.5	.02663	26.5	.07931
17.5	.15021	27.5	.06730
18.5	.09345	28.5	.03390
19.5	.20827	29.5	.00952
20.5	.02937	30.5	.00052
21.5	.03008	31.5	.00000

MOLYBDENUM-TUNGSTEN ANODE SPECTRUM (MOW11)

KVP: 40 *** HVL: .93 MM AL
MM AL ADDED,: .51 ** MM OF BE INHERENT: 1.00
PHANTOM MATERIAL: 3.19 CM OF LUCITE
MOLYBDENUM FILTER ADDED: .030
NORMALIZATION FACTOR: .7536E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
12.5	.00000	27.5	.04540
13.5	.00106	28.5	.05047
14.5	.00253	29.5	.05338
15.5	.00655	30.5	.05579
16.5	.01440	31.5	.05607
17.5	.12202	32.5	.05472
18.5	.04006	33.5	.05238
19.5	.10630	34.5	.04804
20.5	.01841	35.5	.04220
21.5	.01003	36.5	.03492
22.5	.01529	37.5	.02631
23.5	.02155	38.5	.01592
24.5	.02771	39.5	.00416
25.5	.03405	40.5	.00021
26.5	.04003	41.5	.00004

MOLYBDENUM-TUNGSTEN ANODE SPECTRUM (MOW12)

KVP: 40 *** HVL: 1.22 MM AL
MM AL ADDED,: .51 ** MM OF BE INHERENT: 1.00
PHANTOM MATERIAL: 4.79 CM OF LUCITE
MOLYBDENUM FILTER ADDED: .030
NORMALIZATION FACTOR: .9063E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
12.5	.00000	27.5	.05082
13.5	.00048	28.5	.05691
14.5	.00106	29.5	.06303
15.5	.00260	30.5	.06640
16.5	.00650	31.5	.06771
17.5	.06160	32.5	.06798
18.5	.02424	33.5	.06587
19.5	.07417	34.5	.06212
20.5	.01334	35.5	.05453
21.5	.00897	36.5	.04627
22.5	.01386	37.5	.03506
23.5	.02096	38.5	.02216
24.5	.02779	39.5	.00638
25.5	.03524	40.5	.00029
26.5	.04365	41.5	.00002

MOLYBDENUM-TUNGSTEN ANODE SPECTRUM (MOW20)

KVP: 40 *** HVL: 1.25 MM AL
MM AL ADDED,: .51 ** MM OF BE INHERENT: 1.00
PHANTOM MATERIAL: 4.79 CM OF LUCITE
NORMALIZATION FACTOR: .8771E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
12.5	.00000	27.5	.06223
13.5	.00062	28.5	.06400
14.5	.00110	29.5	.06351
15.5	.00246	30.5	.06079
16.5	.00599	31.5	.05793
17.5	.04320	32.5	.05330
18.5	.01645	33.5	.04924
19.5	.04602	34.5	.04326
20.5	.02710	35.5	.03696
21.5	.03301	36.5	.03006
22.5	.04075	37.5	.02306
23.5	.04724	38.5	.01416
24.5	.05333	39.5	.00421
25.5	.05769	40.5	.00015
26.5	.06213	41.5	.00002

MOLYBDENUM-TUNGSTEN ANODE SPECTRUM (MOW21)

KVP: 40 *** HVL: 1.42 MM AL
MM AL ADDED,: .51 ** MM OF BE INHERENT: 1.00
PHANTOM : 6.00 CM OF WHITE BREAST MATERIAL
NORMALIZATION FACTOR: .9462E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
13.5	.00000	27.5	.06679
14.5	.00059	28.5	.06691
15.5	.00120	29.5	.06749
16.5	.00371	30.5	.06767
17.5	.02504	31.5	.06426
18.5	.01159	32.5	.06065
19.5	.03441	33.5	.05484
20.5	.02107	34.5	.04973
21.5	.02901	35.5	.04190
22.5	.03654	36.5	.03424
23.5	.04517	37.5	.02534
24.5	.05252	38.5	.01480
25.5	.05815	39.5	.00324
26.5	.06305	40.5	.00007

MOLYBDENUM-TUNGSTEN ANODE SPECTRUM (MOW22)

KVP: 40 *** HVL: 1.70 MM AL
MM AL ADDED,: .51 ** MM OF BE INHERENT: 1.00
PHANTOM : 8.00 CM OF WHITE BREAST MATERIAL
NORMALIZATION FACTOR: .1054E+08 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
14.5	.00000	28.5	.07012
15.5	.00038	29.5	.07341
16.5	.00136	30.5	.07455
17.5	.00925	31.5	.07264
18.5	.00556	32.5	.07047
19.5	.01877	33.5	.06486
20.5	.01341	34.5	.06074
21.5	.01992	35.5	.05226
22.5	.02865	36.5	.04314
23.5	.03639	37.5	.03255
24.5	.04554	38.5	.01928
25.5	.05403	39.5	.00484
26.5	.06179	40.5	.00004
27.5	.06606	41.5	.00000

MOLYBDENUM-TUNGSTEN ANODE SPECTRUM (MOW23)

KVP: 40 *** HVL: 1.10 MM AL
MM AL ADDED,: .51 ** MM OF BE INHERENT: 1.00
PHANTOM : 4.00 CM OF WHITE BREAST MATERIAL
NORMALIZATION FACTOR: .8094E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
11.5	.00000	26.5	.05865
12.5	.00067	27.5	.05871
13.5	.00121	28.5	.05925
14.5	.00229	29.5	.05664
15.5	.00440	30.5	.05483
16.5	.01028	31.5	.05108
17.5	.06397	32.5	.04825
18.5	.02184	33.5	.04385
19.5	.05712	34.5	.03832
20.5	.03103	35.5	.03273
21.5	.03776	36.5	.02655
22.5	.04363	37.5	.02008
23.5	.04939	38.5	.01276
24.5	.05329	39.5	.00422
25.5	.05698	40.5	.00018

MOLYBDENUM-TUNGSTEN ANODE SPECTRUM (MOW28)

KVP: 40 *** HVL: 1.26 MM AL
MM AL ADDED,: .51 ** MM OF BE INHERENT: 1.00
PHANTOM : 5.00 CM OF WHITE BREAST MATERIAL
NORMALIZATION FACTOR: .8829E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
12.5	.00000	27.5	.06280
13.5	.00055	28.5	.06295
14.5	.00108	29.5	.06366
15.5	.00265	30.5	.06136
16.5	.00573	31.5	.05916
17.5	.04101	32.5	.05500
18.5	.01583	33.5	.04965
19.5	.04491	34.5	.04404
20.5	.02629	35.5	.03806
21.5	.03338	36.5	.03036
22.5	.03998	37.5	.02272
23.5	.04763	38.5	.01405
24.5	.05375	39.5	.00360
25.5	.05846	40.5	.00009
26.5	.06123	41.5	.00002

MOLYBDENUM-TUNGSTEN ANODE SPECTRUM (MOW30)

KVP: 40 *** HVL: 1.54 MM AL
MM AL ADDED,: 1.52 ** MM OF BE INHERENT: 1.00
PHANTOM MATERIAL: 4.79 CM OF LUCITE
NORMALIZATION FACTOR: .9900E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
13.5	.00000	27.5	.06790
14.5	.00039	28.5	.07079
15.5	.00096	29.5	.07210
16.5	.00261	30.5	.07087
17.5	.01619	31.5	.06867
18.5	.00854	32.5	.06546
19.5	.02652	33.5	.05954
20.5	.01772	34.5	.05374
21.5	.02511	35.5	.04544
22.5	.03374	36.5	.03677
23.5	.04299	37.5	.02615
24.5	.05034	38.5	.01353
25.5	.05724	39.5	.00261
26.5	.06400	40.5	.00009

MOLYBDENUM-TUNGSTEN ANODE SPECTRUM (MOW31)

KVP: 40 *** HVL: 1.56 MM AL
MM AL ADDED,: 1.52 ** MM OF BE INHERENT: 1.00
PHANTOM : 5.00 CM OF WHITE BREAST MATERIAL
NORMALIZATION FACTOR: .1001E+08 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
13.5	.00000	27.5	.06720
14.5	.00035	28.5	.07016
15.5	.00092	29.5	.07159
16.5	.00230	30.5	.07134
17.5	.01567	31.5	.06964
18.5	.00786	32.5	.06615
19.5	.02553	33.5	.06137
20.5	.01683	34.5	.05441
21.5	.02455	35.5	.04741
22.5	.03292	36.5	.03771
23.5	.04090	37.5	.02751
24.5	.04903	38.5	.01593
25.5	.05669	39.5	.00341
26.5	.06251	40.5	.00012

MOLYBDENUM-TUNGSTEN ANODE SPECTRUM (MOW33)

KVP: 50 *** HVL: 2.02 MM AL
MM AL ADDED,: 1.52 ** MM OF BE INHERENT: 1.00
PHANTOM : 5.00 CM OF WHITE BREAST MATERIAL
NORMALIZATION FACTOR: .1254E+08 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
13.5	.00000	32.5	.05017
14.5	.00033	33.5	.05063
15.5	.00050	34.5	.04929
16.5	.00127	35.5	.04872
17.5	.01020	36.5	.04728
18.5	.00400	37.5	.04518
19.5	.01554	38.5	.04236
20.5	.00885	39.5	.03985
21.5	.01229	40.5	.03704
22.5	.01722	41.5	.03449
23.5	.02251	42.5	.03094
24.5	.02753	43.5	.02726
25.5	.03280	44.5	.02364
26.5	.03670	45.5	.01955
27.5	.04014	46.5	.01557
28.5	.04398	47.5	.01094
29.5	.04655	48.5	.00629
30.5	.04875	49.5	.00148
31.5	.05009	50.5	.00006

MOLYBDENUM-TUNGSTEN ANODE SPECTRUM (MOW34)

KVP: 50 *** HVL: 1.99 MM AL
MM AL ADDED,: 1.52 ** MM OF BE INHERENT: 1.00
PHANTOM MATERIAL: 4.79 CM OF LUCITE
NORMALIZATION FACTOR: .1246E+08 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
13.5	.00000	32.5	.04978
14.5	.00036	33.5	.04962
15.5	.00055	34.5	.04932
16.5	.00144	35.5	.04834
17.5	.01064	36.5	.04628
18.5	.00418	37.5	.04466
19.5	.01620	38.5	.04161
20.5	.00893	39.5	.03956
21.5	.01278	40.5	.03715
22.5	.01772	41.5	.03379
23.5	.02286	42.5	.03045
24.5	.02811	43.5	.02722
25.5	.03291	44.5	.02341
26.5	.03718	45.5	.01996
27.5	.04065	46.5	.01553
28.5	.04414	47.5	.01132
29.5	.04681	48.5	.00686
30.5	.04823	49.5	.00175
31.5	.04957	50.5	.00011

4.5.4 RSI SPECTRA

4.5.4 RSI SPECTRA

RSI TUNGSTEN ANODE SPECTRUM (RSI 1)

KVP: 30 *** HVL: .36 MM AL
MM AL ADDED: .00 ** AL EQUIVALENT (INH): .50 MM
NORMALIZATION FACTOR: .3795E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
5.5	.00000	18.5	.07582
6.5	.00080	19.5	.07465
7.5	.00108	20.5	.07192
8.5	.00283	21.5	.06832
9.5	.01552	22.5	.06332
10.5	.01225	23.5	.05774
11.5	.02941	24.5	.05163
12.5	.03078	25.5	.04409
13.5	.04321	26.5	.03650
14.5	.05414	27.5	.02876
15.5	.06364	28.5	.01979
16.5	.07058	29.5	.00900
17.5	.07379	30.5	.00039

RSI TUNGSTEN ANODE SPECTRUM (RSI 2)

KVP: 30 *** HVL: .60 MM AL
MM AL ADDED: .51 ** AL EQUIVALENT (INH): .50 MM
NORMALIZATION FACTOR: .5020E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
8.5	.00000	20.5	.08475
9.5	.00128	21.5	.08446
10.5	.00202	22.5	.08190
11.5	.00592	23.5	.07798
12.5	.00972	24.5	.07123
13.5	.01880	25.5	.06359
14.5	.03088	26.5	.05362
15.5	.04461	27.5	.04226
16.5	.05774	28.5	.02958
17.5	.06880	29.5	.01190
18.5	.07661	30.5	.00027
19.5	.08204	31.5	.00002

RSI TUNGSTEN ANODE SPECTRUM (RSI 3)

KVP: 30 *** HVL: .75 MM AL
MM AL ADDED: 1.02 ** AL EQUIVALENT (INH): .50 MM
NORMALIZATION FACTOR: .5741E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
9.5	.00000	20.5	.08700
10.5	.00057	21.5	.09100
11.5	.00172	22.5	.09387
12.5	.00321	23.5	.09169
13.5	.00745	24.5	.08587
14.5	.01511	25.5	.07968
15.5	.02646	26.5	.06837
16.5	.03943	27.5	.05514
17.5	.05359	28.5	.03823
18.5	.06705	29.5	.01554
19.5	.07881	30.5	.00021

RSI TUNGSTEN ANODE SPECTRUM (RSI 4)

KVP: 30 *** HVL: .86 MM AL
MM AL ADDED: 1.52 ** AL EQUIVALENT (INH): .50 MM
NORMALIZATION FACTOR: .6247E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
10.5	.00000	21.5	.09482
11.5	.00082	22.5	.09997
12.5	.00083	23.5	.10042
13.5	.00320	24.5	.09856
14.5	.00737	25.5	.09152
15.5	.01453	26.5	.08242
16.5	.02649	27.5	.06754
17.5	.04055	28.5	.04587
18.5	.05592	29.5	.01501
19.5	.07069	30.5	.00005
20.5	.08341	31.5	.00001

RSI TUNGSTEN ANODE SPECTRUM (RSI 5)

KVP: 40 *** HVL: .44 MM AL
MM AL ADDED: .00 ** AL EQUIVALENT (INH): .50 MM
NORMALIZATION FACTOR: .4822E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
5.5	.00000	23.5	.05014
6.5	.00071	24.5	.04726
7.5	.00073	25.5	.04499
8.5	.00204	26.5	.04227
9.5	.01149	27.5	.03978
10.5	.00850	28.5	.03649
11.5	.01931	29.5	.03351
12.5	.01903	30.5	.03110
13.5	.02745	31.5	.02777
14.5	.03512	32.5	.02470
15.5	.04175	33.5	.02216
16.5	.04794	34.5	.01894
17.5	.05135	35.5	.01596
18.5	.05412	36.5	.01293
19.5	.05478	37.5	.00965
20.5	.05467	38.5	.00603
21.5	.05331	39.5	.00167
22.5	.05215	40.5	.00010

RSI TUNGSTEN ANODE SPECTRUM (RSI 6)

KVP: 40 *** HVL: .80 MM AL
MM AL ADDED: .51 ** AL EQUIVALENT (INH): .50 MM
NORMALIZATION FACTOR: .6662E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
8.5	.00000	25.5	.05587
9.5	.00072	26.5	.05364
10.5	.00082	27.5	.05046
11.5	.00305	28.5	.04770
12.5	.00500	29.5	.04467
13.5	.00959	30.5	.04220
14.5	.01596	31.5	.03777
15.5	.02428	32.5	.03477
16.5	.03202	33.5	.02974
17.5	.03923	34.5	.02729
18.5	.04553	35.5	.02238
19.5	.05101	36.5	.01813
20.5	.05461	37.5	.01376
21.5	.05649	38.5	.00892
22.5	.05759	39.5	.00252
23.5	.05727	40.5	.00007
24.5	.05690	41.5	.00005

RSI TUNGSTEN ANODE SPECTRUM (RSI 7)

KVP: 40 *** HVL: 1.04 MM AL
MM AL ADDED: 1.02 ** AL EQUIVALENT (INH): .50 MM
NORMALIZATION FACTOR: .7775E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
10.5	.00000	26.5	.05966
11.5	.00104	27.5	.05786
12.5	.00140	28.5	.05523
13.5	.00318	29.5	.05272
14.5	.00669	30.5	.04953
15.5	.01229	31.5	.04616
16.5	.01889	32.5	.04207
17.5	.02630	33.5	.03755
18.5	.03370	34.5	.03319
19.5	.04120	35.5	.02868
20.5	.04767	36.5	.02377
21.5	.05229	37.5	.01827
22.5	.05653	38.5	.01215
23.5	.05846	39.5	.00455
24.5	.05941	40.5	.00009
25.5	.05940	41.5	.00003

RSI TUNGSTEN ANODE SPECTRUM (RSI 8)

KVP: 40 *** HVL: 1.22 MM AL
MM AL ADDED: 1.52 ** AL EQUIVALENT (INH): .50 MM
NORMALIZATION FACTOR: .8571E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
11.5	.00000	26.5	.06213
12.5	.00078	27.5	.06249
13.5	.00129	28.5	.06099
14.5	.00275	29.5	.05877
15.5	.00646	30.5	.05576
16.5	.01112	31.5	.05263
17.5	.01712	32.5	.04857
18.5	.02476	33.5	.04379
19.5	.03201	34.5	.03961
20.5	.04027	35.5	.03352
21.5	.04676	36.5	.02772
22.5	.05185	37.5	.02163
23.5	.05658	38.5	.01444
24.5	.05979	39.5	.00483
25.5	.06149	40.5	.00008

RSI TUNGSTEN ANODE SPECTRUM (RSI 9)

KVP: 50 *** HVL: 1.26 MM AL
MM AL ADDED: 1.02 ** AL EQUIVALENT (INH): .50 MM
NORMALIZATION FACTOR: .9432E+07 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
10.5	.00000	31.5	.04139
11.5	.00071	32.5	.03962
12.5	.00097	33.5	.03744
13.5	.00213	34.5	.03578
14.5	.00443	35.5	.03423
15.5	.00790	36.5	.03209
16.5	.01230	37.5	.03011
17.5	.01736	38.5	.02811
18.5	.02258	39.5	.02599
19.5	.02780	40.5	.02402
20.5	.03221	41.5	.02186
21.5	.03626	42.5	.01951
22.5	.04022	43.5	.01733
23.5	.04210	44.5	.01511
24.5	.04439	45.5	.01280
25.5	.04463	46.5	.01049
26.5	.04516	47.5	.00817
27.5	.04523	48.5	.00543
28.5	.04500	49.5	.00247
29.5	.04345	50.5	.00013
30.5	.04303	51.5	.00005

RSI TUNGSTEN ANODE SPECTRUM (RSI10)

KVP: 50 *** HVL: 1.50 MM AL
MM AL ADDED: 1.52 ** AL EQUIVALENT (INH): .50 MM
NORMALIZATION FACTOR: .1044E+08 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
11.5	.00000	31.5	.04499
12.5	.00051	32.5	.04360
13.5	.00086	33.5	.04211
14.5	.00175	34.5	.04006
15.5	.00364	35.5	.03805
16.5	.00652	36.5	.03584
17.5	.01081	37.5	.03414
18.5	.01548	38.5	.03157
19.5	.02052	39.5	.02946
20.5	.02570	40.5	.02731
21.5	.03089	41.5	.02444
22.5	.03492	42.5	.02213
23.5	.03885	43.5	.01974
24.5	.04169	44.5	.01705
25.5	.04471	45.5	.01453
26.5	.04543	46.5	.01180
27.5	.04659	47.5	.00848
28.5	.04681	48.5	.00507
29.5	.04663	49.5	.00111
30.5	.04615	50.5	.00003

RSI TUNGSTEN ANODE SPECTRUM (RSI11)

KVP: 50 *** HVL: 1.71 MM AL
MM AL ADDED: 2.03 ** AL EQUIVALENT (INH): .50 MM
NORMALIZATION FACTOR: .1127E+08 PHOTONS/SQ.CM/MR

KEV	NORMALIZED SPECTRUM	KEV	NORMALIZED SPECTRUM
12.5	.00000	32.5	.04556
13.5	.00054	33.5	.04480
14.5	.00101	34.5	.04272
15.5	.00178	35.5	.04159
16.5	.00366	36.5	.03950
17.5	.00670	37.5	.03742
18.5	.01027	38.5	.03483
19.5	.01525	39.5	.03216
20.5	.02014	40.5	.03028
21.5	.02528	41.5	.02798
22.5	.03004	42.5	.02469
23.5	.03476	43.5	.02192
24.5	.03829	44.5	.01959
25.5	.04139	45.5	.01671
26.5	.04435	46.5	.01336
27.5	.04610	47.5	.01029
28.5	.04703	48.5	.00649
29.5	.04719	49.5	.00204
30.5	.04769	50.5	.00003
31.5	.04655	51.5	.00003

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