MEASUREMENT OF FOCAL SPOT SIZE OF DIAGNOSTIC X-RAY TUBES

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Dimensions of a focal spot have been measured using three methods: 1)pinhole camera, 2)star test pattern, 3)multiple bar pattern. The pinhole image gives more insight into size, configuration and intensity distribution of the focal spot, while the star or bar resolution test pattern is more amenable to a quantitative analysis of the resolution capability. Diameter of the pinhole has been 30μ, as recommended(1) for focal spot sizes below 1.0 mm.

A radiographic unit with nominal focal spot sizes of 0.6 and 1.2 mm has been used. Three applied methods agree within 20%. Width of the examined focal spot has been found to be within tolerance limits(2), but its length (anode--cathode direction) is twice larger than the nominal one.

Dependance of the focal spot size on radiographic exposure factors has been examined. The focal spot size increases with tube current (blooming). These increase is greater in the anode-cathode direction than in the perpendicular direction. Some authors have noticed even a decrease of the focal spot size in the direction perpendicular to the anode-cathode axis(3). Focal spot bloom perpendicular to the anode-cathode tube axis depends on the accuracy of the focusing of the electron beam, and measurements with a star pattern show wide variations between identical models of tubes.

Focal spot size decreases slightly with increasing kVp. As measured by Chaney and Hendee(4) this change is approximately proportional to kVp . The focal spot size increases with film density when measured with the pinhole technique.

References:

1. International Commision of Radiological Units and Measurements, ICRU Report 10f (1962)
2. National Electrical Manufacturers Association, NEMA Standards Publication No. XR5 (1974)
3. H. Bernstein, R.T. Bergeron and D.J. Klein, Radiology 111 421 (1974)
4. E.L. Chaney and W.R. Hendee, Medical Physics 1 141 (1974)