

interoffice



to Kevin Fitzsimmons
from Gene Tochilin *ET* ext.
date June 5, 1987
subject Depleted Uranium in Varion Clinacs & Linatrons

Here is the information on the depleted uranium components found in our medical electron accelerators. Both the early Clinac 4 and 6X had identical shielding. The uranium pieces are shown in Figure 1, with their weight tabulated in Table 1. The total weight of uranium is approximately 270 pounds.

These machines were eventually replaced with the Clinac 4/100 and Clinac 6/100. While the same shielding configuration was used as before, the primary collimator was made slightly larger. Also, the elliptical gunshield has been replaced by three (3) uranium backplates, to provide better shielding. The total weight of these present units is approximately 400 pounds, as tabulated in Table 1.

Because a small amount of radioactivity is emitted from uranium, a decision was made about one year ago to replace the upper and lower uranium jaws with tungsten jaws. As a result the Clinac 4 and 6/100 accelerators presently being delivered, contain approximately 240 pounds of depleted uranium.

Depleted uranium is a bi-product of the gaseous diffusion process where fissionable U-235 is extracted from natural uranium. It consists of at least 99.7% U-238 and less than 0.3% U-235. Because the metal is highly reactive, each piece of depleted uranium is cadmium plated to prevent surface corrosion. Present accelerator shielding components are manufactured with a depleted uranium alloy containing 0.75% titanium, which can readily be identified by its metallic green surface. The alloy is stable and does not require plating. Each piece of depleted uranium is steel stamped with the impression "Caution Radioactive Material - Depleted Uranium." Depleted uranium is only mildly radioactive (specific activity of 3.6×10^{-7} Ci/g) and as a shielding material presents no significant external radiation hazard. More than 500 such licenses have been granted by both state and Federal agencies for this application.

Finally, three of our industrial x-ray accelerators are equipped with depleted uranium primary collimators. The Linatron 200, a 2 MeV unit contains 40 pounds of uranium, while the Linatrons 400 and 1000 (4 MeV and 5 MeV) contain 70 pounds of depleted uranium.

Provided to Region I by Paul Stingelin of Varian on 2/26/2002



DEPLETED URANIUM COMPONENTS
IN THE CLINAC 4, 4S, 6X, 4/100, 6/100, AND 600C

Clinac 4, 4S and 6X

<u>Part Containing Uranium</u>	<u>No. of Parts</u>	<u>(pounds)</u>	
		<u>Unit Weight</u>	<u>Total Weight</u>
Primary collimator	1	68	68
Upper jaw	2	31	62
Lower jaw	2	53	106
Face plate shield	2	8.5	17
Gun shield	1	18.5	18.5
Gun shield disks	-	-	-
Total Pounds:			271.5

Clinac 4/100, 6/100 and 600C

<u>Part Containing Uranium</u>	<u>No. of Parts</u>	<u>(pounds)</u>	
		<u>Unit Weight</u>	<u>Total Weight</u>
Primary collimator	1	96	96
Upper jaw		Tungsten replacement	
Lower jaw		Tungsten replacement	
Face plate shield	2	8.5	17
Gun shield	-	-	-
Gun shield disks	3	40	120
Total Pounds:			233

Element and Mass Number: U-238
Physical Form: Metal Alloy U-0.75% Titanium
Specific Activity: 3.6×10^{-7} Ci/gm
Purpose of Use: Shielding
Isotope U-235 is less than 0.25 weight percent of total uranium present.

These machines have been manufactured in accordance with Radioactive Material License Number 1025-43 issued to Varian Associates, Inc. by the California Department of Health Services.

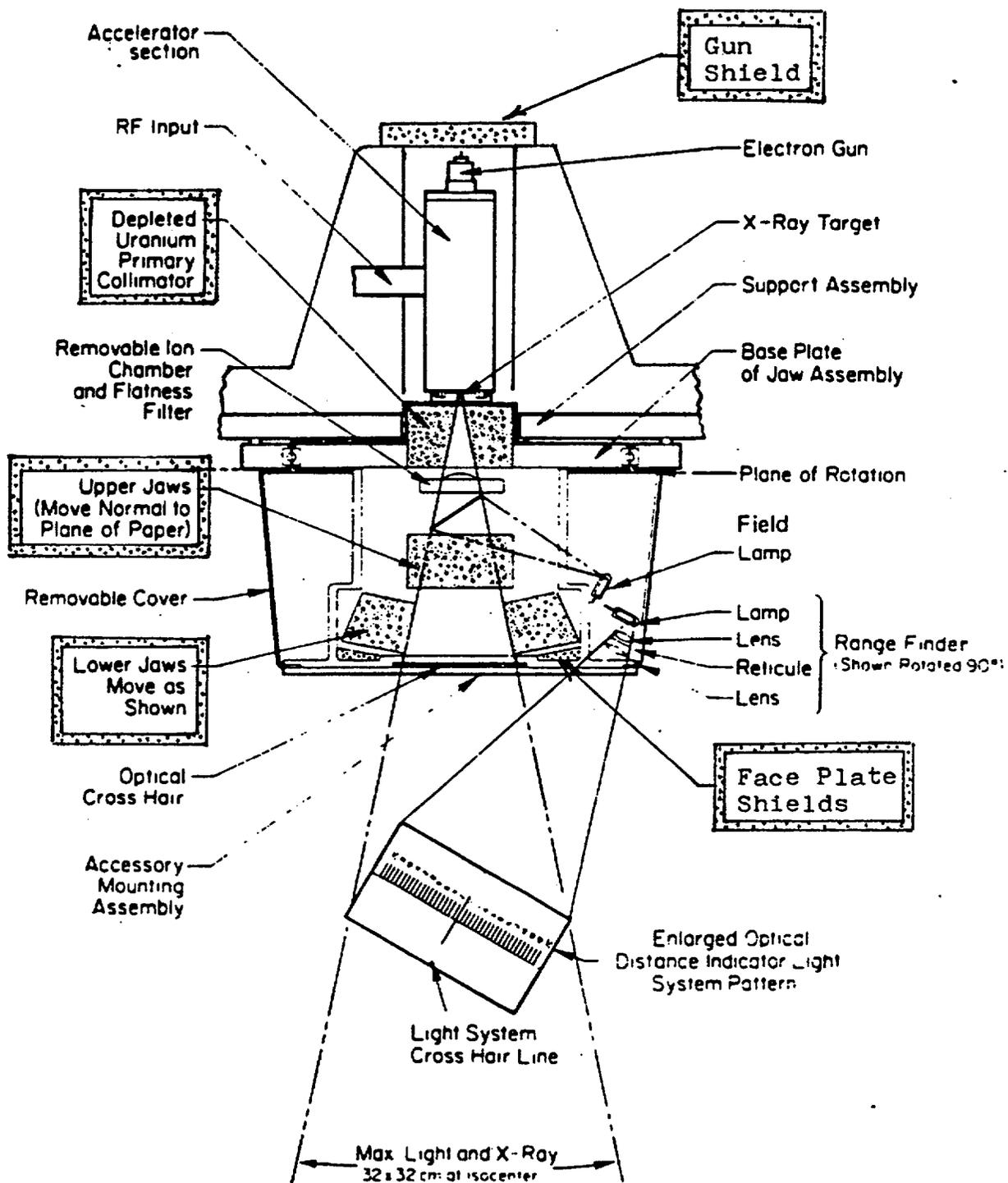


Figure 1 Collimator Head Assembly

(CLINAC 4 AND 6 X)