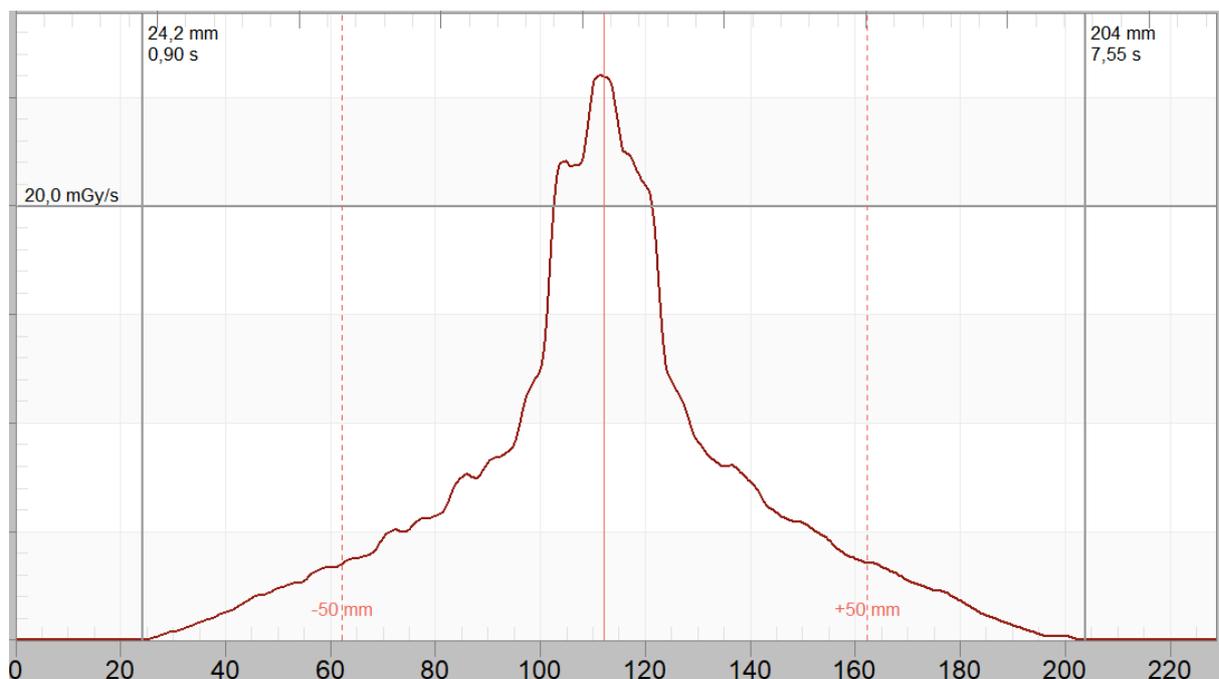


# Application Note

## CT Dose Profile - Wider than Phantom Width

This application note describes the physics behind the reason why the tail on a CT Dose Profile may be significantly wider than the CTDI Phantom in use. Below this is explained, using a standard sized CTDI phantom of 15 cm width.



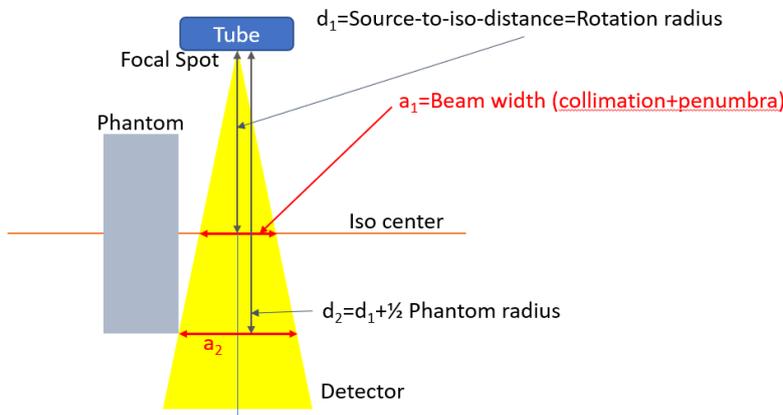
The image above shows an example of a dose profile for a nominal collimation of 20 mm in the iso-center of a 16 cm head phantom. The phantom is 15 cm wide.

The detector in use is the RTI CT Dose Profiler, where the detector volume is represented by a 0.25 mm wide silicon diode positioned in the iso-center of the phantom.

Below is a sketch that illustrates the theoretical aspect when the beam starts radiating into the phantom (assuming a Source to Image detector distance, "gantry diameter" of 1m).

These examples for 25mm and 40mm collimations, clearly illustrates the effects of penumbra and the growth of the beam as it intersects the "bottom" of the phantom.

# Application Note



$$\frac{a_1}{d_1} = \frac{a_2}{d_2} \Rightarrow a_2 = a_1 \cdot \frac{d_2}{d_1}$$

Protocol	kV	Collimation	Length of dose profile (mm)	Profile minus phantom width	Dose profile(less phant) vs Collimation	$d_1$ = rotation radius (source-to-iso-)	$d_2$ = $d_1$ + half phantom diam (mm)	$a_1$ = Beam width at iso (mm)	$a_2=a_1 \cdot d_2/d_1$ beam width at outer phantom radius (mm)
Head	120	40	233	83	208%	500	580	47	54,52
		25	208	58	232%	500	580	31,5	36,54
		10	185	35	350%	500	580		
	80	40	237	87	218%	500	580	47	54,52
		25	213	63	252%	500	580	31,5	36,54
		10	188	38	380%				
Body	120	40	257	107	268%	500	660	47	62,04
		25	223	73	292%	500	660	31,5	41,58
		10	196	46	460%				
		5	184	34	680%				
	80	40	255	105	263%	500	660	47	62,04
		25	224	74	296%	500	660	31,5	41,58
		10	203	53	530%				
		5	186	36	720%				

The values are theoretical and indicate that the complete dose profile (incl tails), in an ideal measurement situation, could be as long as 150+ 62,04= 212mm (Body phantom at 40mm collimation).

Notice that with penumbra effects and the fact that the collimation of a 40 mm wide beam in practice is slightly wider the effect will be even larger. There can also be a contribution from scatter generated by the couch during the movement when to the phantom enters the beam. Other causes to the wide tails may be presence of active collimation during the scan.

\*\*\* END \*\*\*