



TECHNICAL NOTE

DATE  
03-20-12

MARKETS

PAGE  
page 1 of 3

NUMBER  
4652-01

SUBJECT: Exradin A17 & A101 Active Length vs. Nominal Length

The following information is provided as a service to our customers:

The following diagrams are provided to help illustrate the difference between the Active Length and the Nominal Length for both the Exradin A17 (REF 92675) and the Exradin A101 (REF 92680) in order to clarify the Collecting Volume Length of each of the Exradin CT-style chambers.

**Please note** that the A17 chamber is designed for use in MVCT fan beam applications such as TomoTherapy®, and the A101 chamber is designed for use with conventional kV fan beam applications, such as slice or helical CT scanners. Use of these chambers outside their intended geometry or beam quality range may lead to significant dose miscalculations.

The **Active Length** is the length along the chamber's central axis in which any/all ionization that occurs is attracted to and collected by the collector of the chamber. The collecting volume of the chamber is comprised of the cylindrical tube defined by the inner diameter of the chamber body and outer diameter of the collector, with the addition of end volumes beyond each outer fiducial mark defined by the field lines formed between the collector, guard and chamber body at the triaxial cable end, and the collector and chamber body on the opposite end.

The **Rated Length** is defined by the International Electrotechnical Commission (IEC) as the length over which "the spatial uniformity of the response shall not vary by more than  $\pm 3.0\%$ ."<sup>1</sup> Outside this uniform region, the air-kerma response of the chamber is not proportional to the volume of the chamber irradiated, which is the underlying basis for the use of a CT ionization chamber. For this reason, measurements of an x-ray beam wider than the rated length is improper.

The **Nominal Length** is the length along the chamber's central axis between the two outer fiducial marks on the exterior of the chamber body. This is 8.0 cm for the A17 and 10.0 cm for the A101. The published Response Uniformity along this length is within  $\pm 1.5\%$  for the A17 and  $\pm 3.0\%$  for the A101, which means that the **Nominal Length** is equal to or less than the **Rated Length** for these chambers. The cross-sectional area of this Nominal Length (i.e. the region between the two outer fiducial marks) is simply defined by the inner diameter of the chamber body and the outer diameter of the collector.

SUBJECT: Exradin A17 & A101 Active Length vs. Nominal Length

The **Effective Length**,  $L_{eff}$ , is defined by the IEC as the “full-width-half-maximum (FWHM) of the plot of the response against distance along the axis of the detector.”<sup>1</sup> For Exradin chambers, the **Effective Length** is only slightly smaller than the **Active Length**. For the A101 chamber,  $L_{eff}$  is 12 cm. Because the air-kerma response of a CT ionization chamber is currently determined by calibration in an x-ray field that irradiates the entire chamber length to determine an air kerma calibration coefficient, use of the **Effective Length** or the **Active Length** is recommended in CTDI calculations. Use of the Nominal Length in these calculations is incorrect and causes large errors in CTDI calculations.

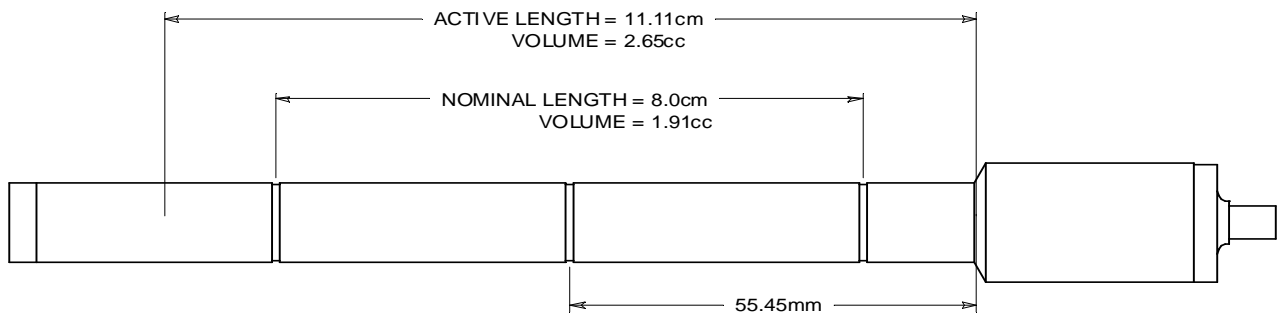


Figure 1. External view of the Exradin A17 CT Chamber.

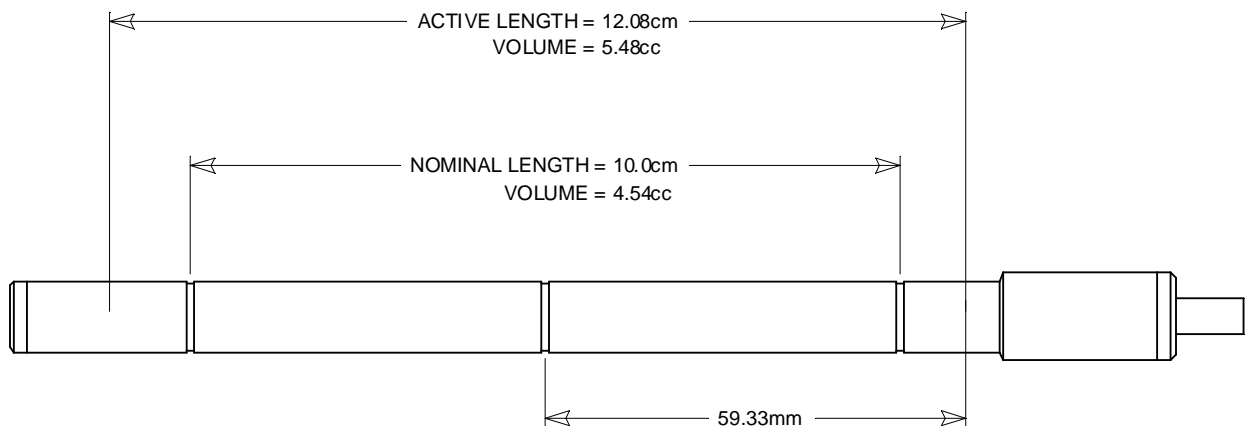


Figure 2. External view of the Exradin A101 CT Chamber.



**TECHNICAL NOTE**

DATE  
03-20-12

MARKETS

PAGE  
page 3 of 3

NUMBER  
4652-01

SUBJECT: Exradin A17 & A101 Active Length vs. Nominal Length

Please refer to the ADCL Calibration Report for Radiation Field Size and other relevant calibration details.

References:

1: International Electrotechnical Commission, "Medical Electrical Equipment – Dosimeters with Ionization Chamber and/or Semi-Conductor Devices used in X-Ray Diagnostic Imaging," IEC, **61674** (1997).