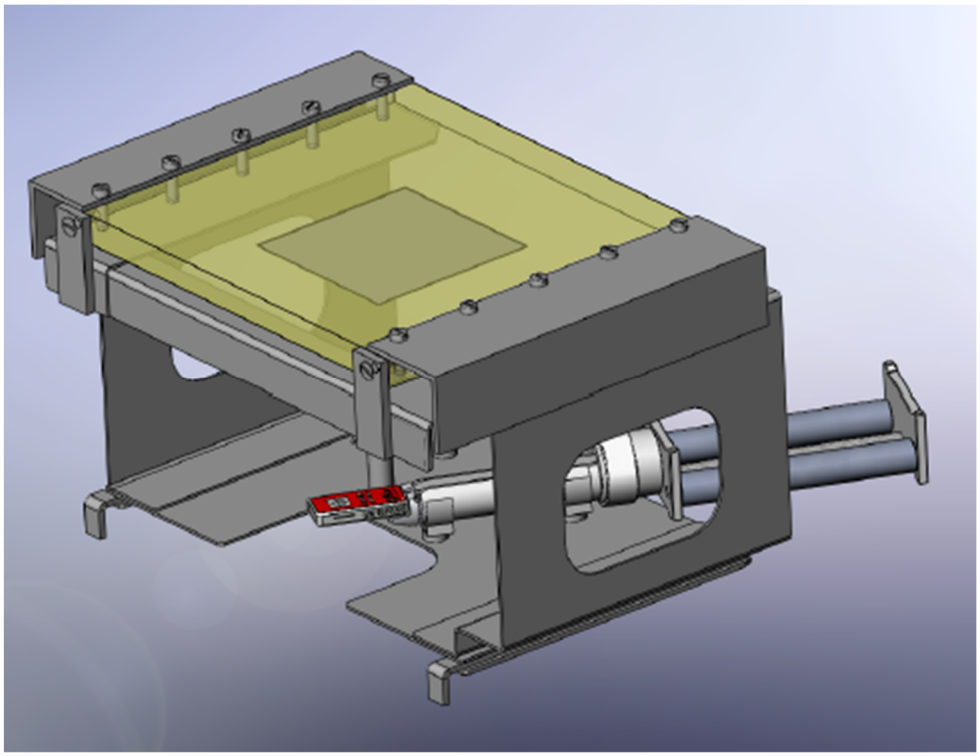
Piranha Dose Probe Holder

User Instruction for GE

Version 1.0B (2009-09)



Art.nr. 9644502-00

Congratulations for choosing the Piranha and Piranha Dose Probe Holder from RTI. This manual contains instructions for placing and using the Piranha Dose Probe Holder (DPH) in different measurement situations. The holder was developed in conjunction with the different GE measurement jigs designed to be used with the Radcal 2025 ion chambers and the Keithley Triad system.

The Piranha DPH is very similar in dimensions to the Radcal 2025 20x5-6M, 20x5-6M, and 20x5-180 ion chambers and their attached preamplifiers. This makes it possible for the DPH to be placed in the exact same positions as when using the standard GE measurement jigs as the Radcal ion chambers with their preamplifier boxes.

Note! This manual is valid for version 1.0 of the Piranha Dose Probe Holder.

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1. Important Notice for Field Engineers for Preventive Maintenance and QA

1.1. Introduction

This short description is an addition to GE's own "Operation Documentation" for measurements on different type of modalities.

This description only refers to the operational documentation and does not cover measurements on other types of X-ray modalities that are not produced by GE.

In the text, the internal detector refers to the Piranha itself whereas the external detector is the Piranha Dose Probe, in short PDP.

Piranha – the internal detector

Piranha Dose Probe – the external detector

1.2. Intended Use

The Piranha may be used instead of the Keithley/RMI/RadCal systems, which use is described in the different GE procedures (operation documentation). The use of the Dose Probe Holder in the GE jigs is described in the second part of this manual.

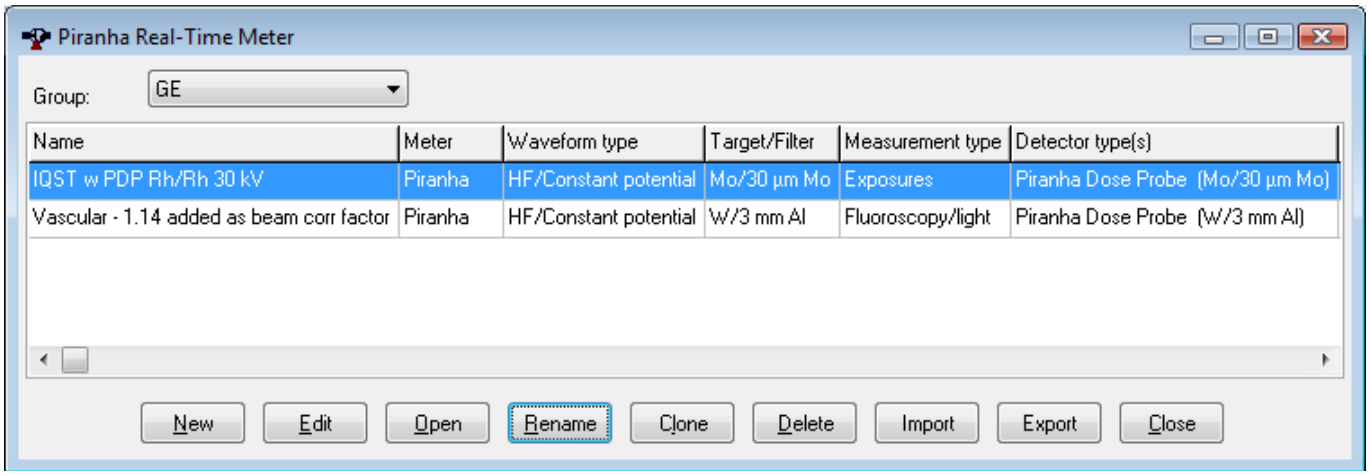
In mammography, the PDP should only be used for measurements involving the IQST phantom. All other measurements, of kVp, dose, and HVL, should be performed with the internal detector.

Since the Piranha system has a variety of usage options, we strongly recommend the usage of favourites. Favourites/templates are stored measurement setups that allow the user to work more efficiently without having to worry about a correct setup. For information on how to use a favourite, see section 1.3.

The favourites/templates you should use are normally distributed when the system is delivered but you can also contact your local representative or RTI to acquire them. Where to add the different beam correction factors in the software and how to store a favourite is described in the Piranha manual.

1.3. How to Use a Favourite

When you start your RTI software (QABrowser or oRTIgo) you will be presented by a list of favourites. In the screenshot below you see what such a list may look like in oRTIgo.



First make sure that you are in the correct favourite-group and then select the favourite you wish to use, for example "**IQST w PDP Rh/Rh 30 kV**".

1.4. Radiography and Fluoroscopy Systems

In all cases where the ion chambers have been used before, the external detector should be used instead.

See the second part of this manual for the setup using the PDP Holder (points 2-6). Please note that the PDP also works very well for measurements of skin dose in the range of 60-120 kV and with the filtration varying from 0-0.9 mm Cu.

For measuring kV, use the setup described under point 7 in the chapter 2 of this manual.

For more info, see further in the Piranha Reference Manual.

Note: On small OEC image intensifiers, it is of great importance to lock the AEC manually before measuring. This is done to ensure correct dose rate values. The extra filtration introduced by the PDP may otherwise affect output of the X-ray system.

1.5. Mammography Systems

The **kVp, dose, and HVL** should be measured in the direct beam with the internal detector. The HVL must be measured with the built-in HVL application in the QABrowser or in oRTIgo. For further information about how that is done, see the Piranha manuals.

Note 1: With the internal detector, the dose values given in the QABrowser or Real-Time meter are not corrected for the added filtration and the use of these as a basis for an HVL calculation will give an incorrect result.

For measurements of dose after the IQST phantom use the small external dose detector (PDP).

Note 2: This is the only measurement in mammography where this detector is used! If HVL is measured with the external detector, the dose values are not corrected for the added filtration (the aluminium filters) and the result will be incorrect.

An energy correction factor has to be added manually to the measured dose value. The factors can be seen in the table 1 on next page. Use the designated favourites.

Please verify which factor that is used in the favourite according to the info next to table 1 below.

1.6. Mammography Dose Measurements with the IQST Phantom

The setup of this type of favourite is done by first selecting to use the external dose probe (PDP), then select the correct beam quality (Mo/30 µm Mo) and finally enter the correction factor as the beam correction factor (found under settings). If the correction factor is inserted there, all dose data will be corrected. For more info, please consult the Piranha manual.

Table 1: IQST correction factors

Radiation Quality	Mo/30 µm Mo + 3 mm Al & PMMA (IQST)	Mo/25 µm Rh + 3 mm Al & PMMA (IQST)	Rh/25 µm Rh + 3 mm Al & PMMA (IQST)
Tube Voltage (kV)	RTI Radiation Quality Code		
	M1e	M3e	M4e
28.0	1.113	1.070	1.025
28.5	1.099	1.056	1.019
29.0	1.085	1.042	1.012
29.5	1.070	1.028	1.006
30.0	1.056	1.028	1.000
30.5	1.042	1.028	0.994
31.0	1.028	1.014	0.988
31.5	1.014	1.014	0.978
32.0	1.000	1.000	0.969

Important!

The typical correction factor for the PDP when measuring with Rh/Rh after the IQST phantom at 30 kV is **0.71.**

In the standard RTI favourite "IQST w PDP Rh/Rh 30 kV", this value is used.

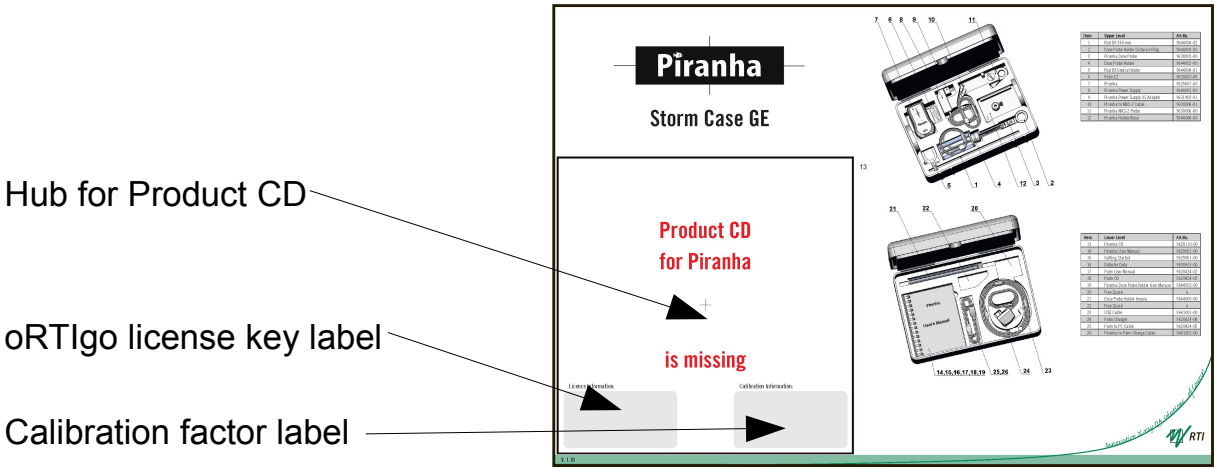
However, if you have an individual calibration factor on a sticker inside the Piranha storm case (placed on the content label, see picture below), please update the standard RTI favourite for increased accuracy. Please see the oRTIgo or QABrowser manual for details on updating a favourite.

To get the correction factor for any other situation, multiply this value with the corresponding tabulated value, as shown to the left.

Typical factor inaccuracy: <5 %
Individual factor inaccuracy: <3 %

Example of Table 1 use

Measured or set tube voltage: 30 kV
Selected Favourite: “IQST w PDP Rh/Rh 30 kV”
Radiation Quality: Mo/30 µm Mo+IQST
Measured dose: 0,50 mGy
Correction table factor Cq: 1.056 for 30 kV
Corrected dose: 1.056 × 0,50 = 0,528 mGy



Overview of the label inside the case.

1.7. Vascular Systems

When measuring with the PDP on vascular systems with 1.5 to 2.0 mm Cu additional filters, a beam correction factor has to be added. This factor is composed of the backscatter contribution, which is not detected by the dose detector since it is shielded, and the energy dependence of the ion chamber.

Typically, the backscatter is approximately 6 % and the energy dependence may be as high as 8 %. To correct for the deviation and make the probes comparable, this factor (1.14 in this example) is added as a beam correction factor in the software[1]. This factor is already added in the favourites/templates designed for vascular systems, as seen in the picture in section 1.3.

1.8. Other Measurements

For other measurements, see the Piranha manual.

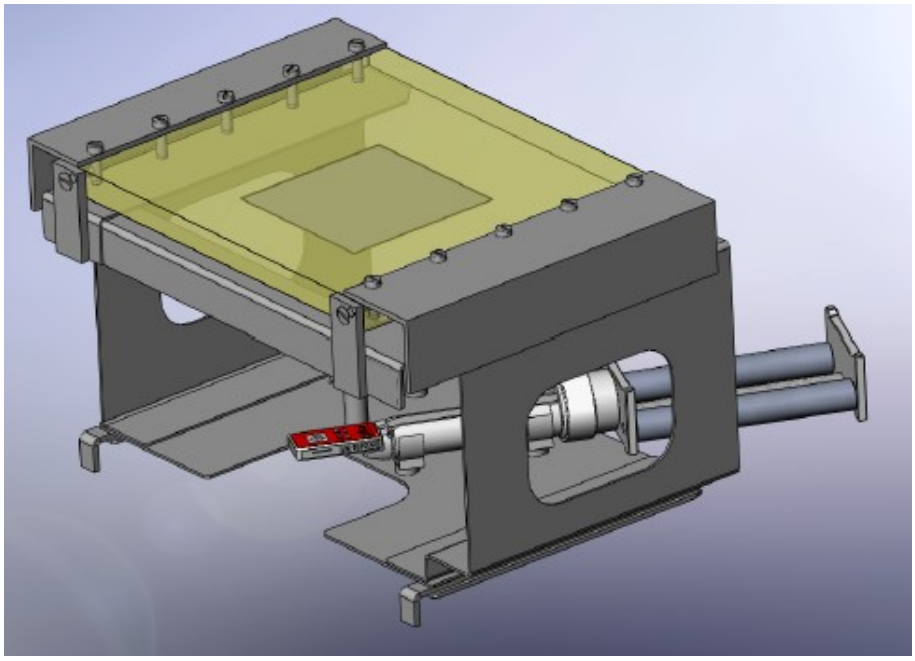
1 For more information about ion chamber sensitivity variations for cupper filters, see appendix 1.

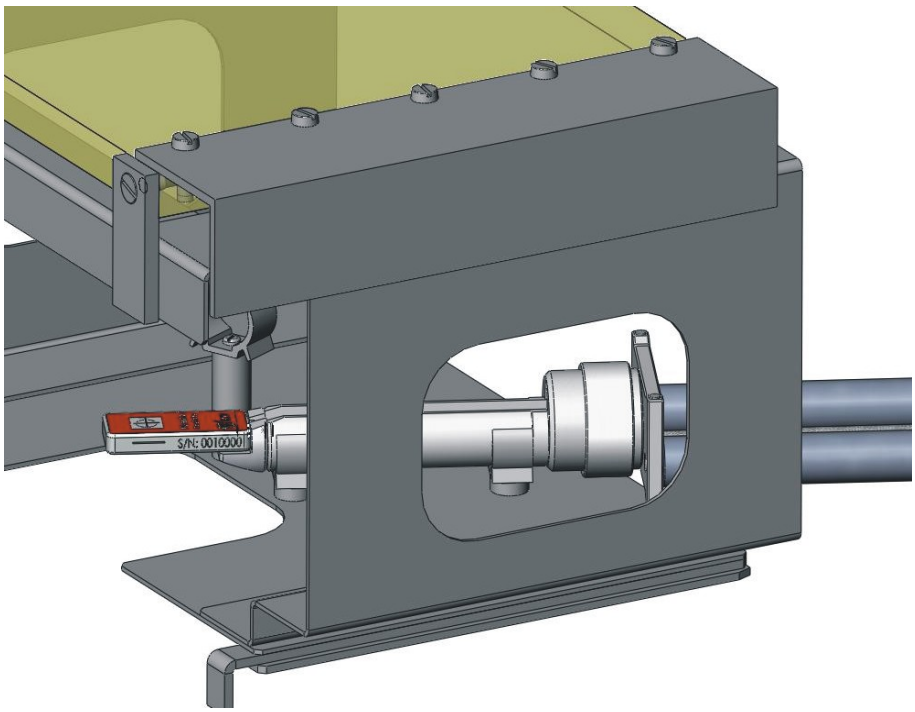
2. Using the Piranha Dose Probe Holder

Note! If you want to have the cable of the Dose Probe running through the holder, you need to mount it (starting with the detector side) from the inside of the holder sideways through the narrow opening. Note that you will need to pull out the carbon pipe to make room for the Dose Probe to pass.

2.1. Setup for IQST jig and phantom

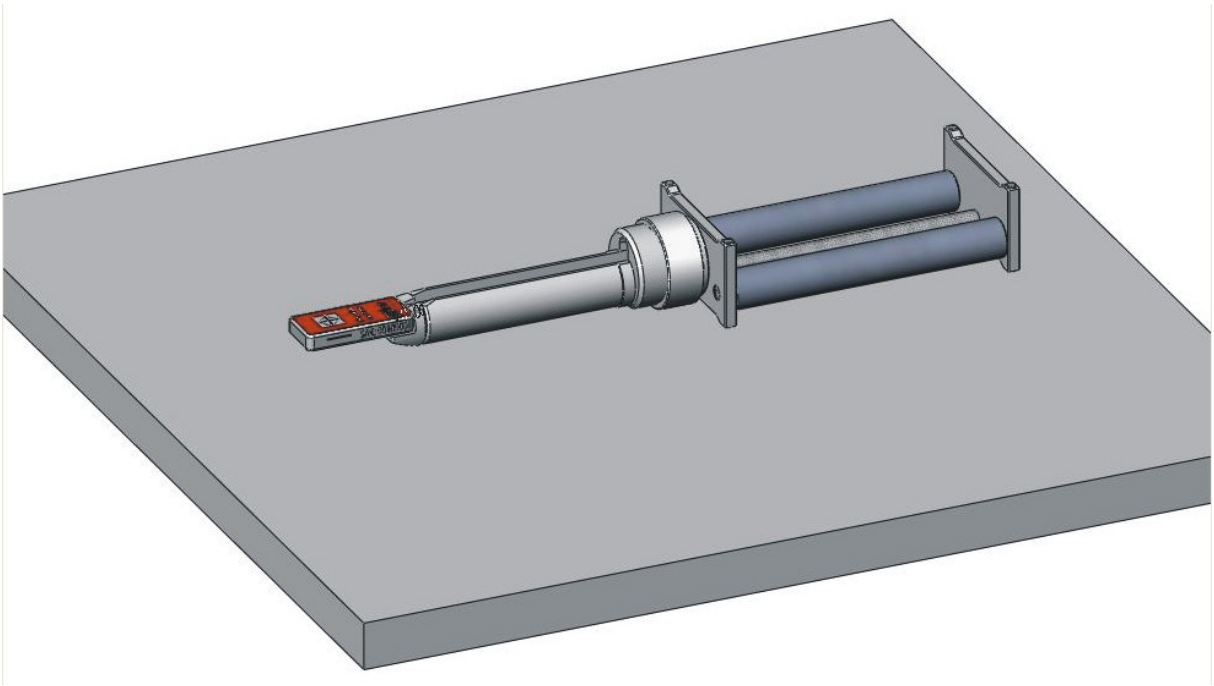
The Piranha DPH (Dose Probe Holder) is placed in the same position as the Radcal 6M chamber in the GE mammo IQST jig. The edge on the shaft of the DPH should be placed right next to the clip. Please note the pictures below indicating this position.





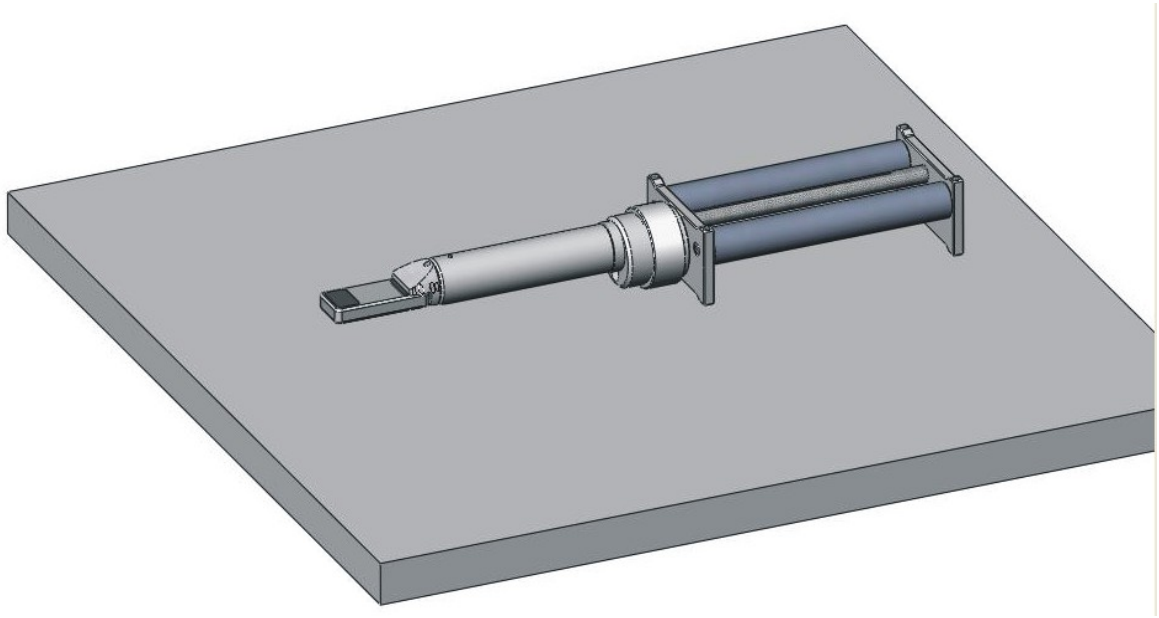
2.2. Setup for Rad and Flu Above Table Measurements

A typical setup for measurements in radiography and fluoroscopy with the Piranha DPH directly on the table, is shown below.
Note: The Piranha Dose Probe is directionally sensitive, thus the detector surface should be facing upwards for radiation coming from above the table.



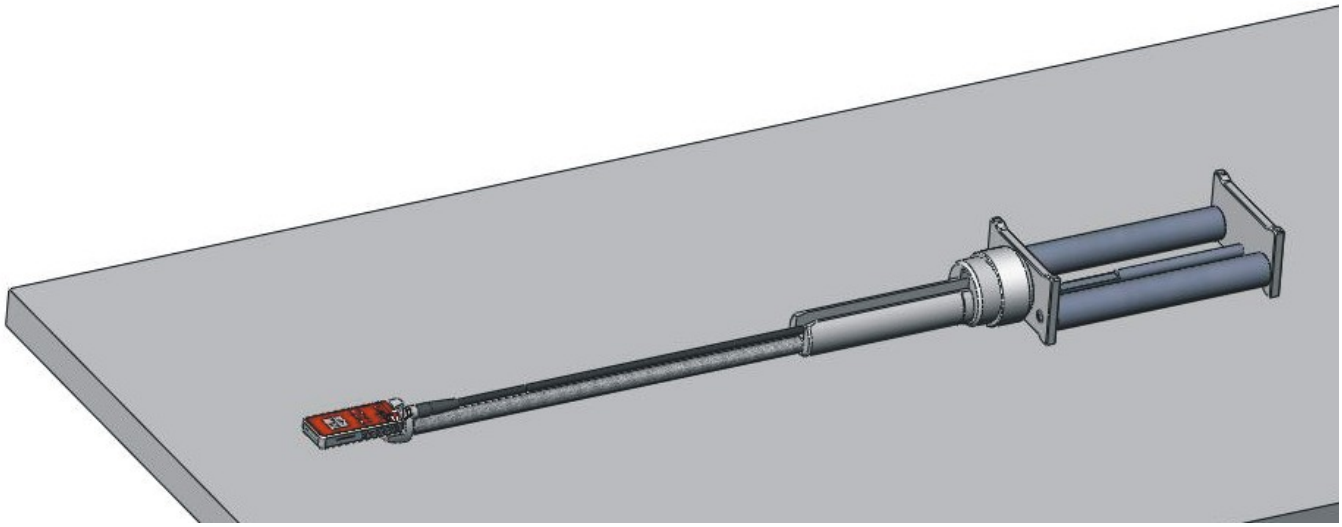
2.3. Setup for Rad and Flu Under Table Measurements

The Piranha Dose Probe detector surface facing downwards for radiation coming from under the table.



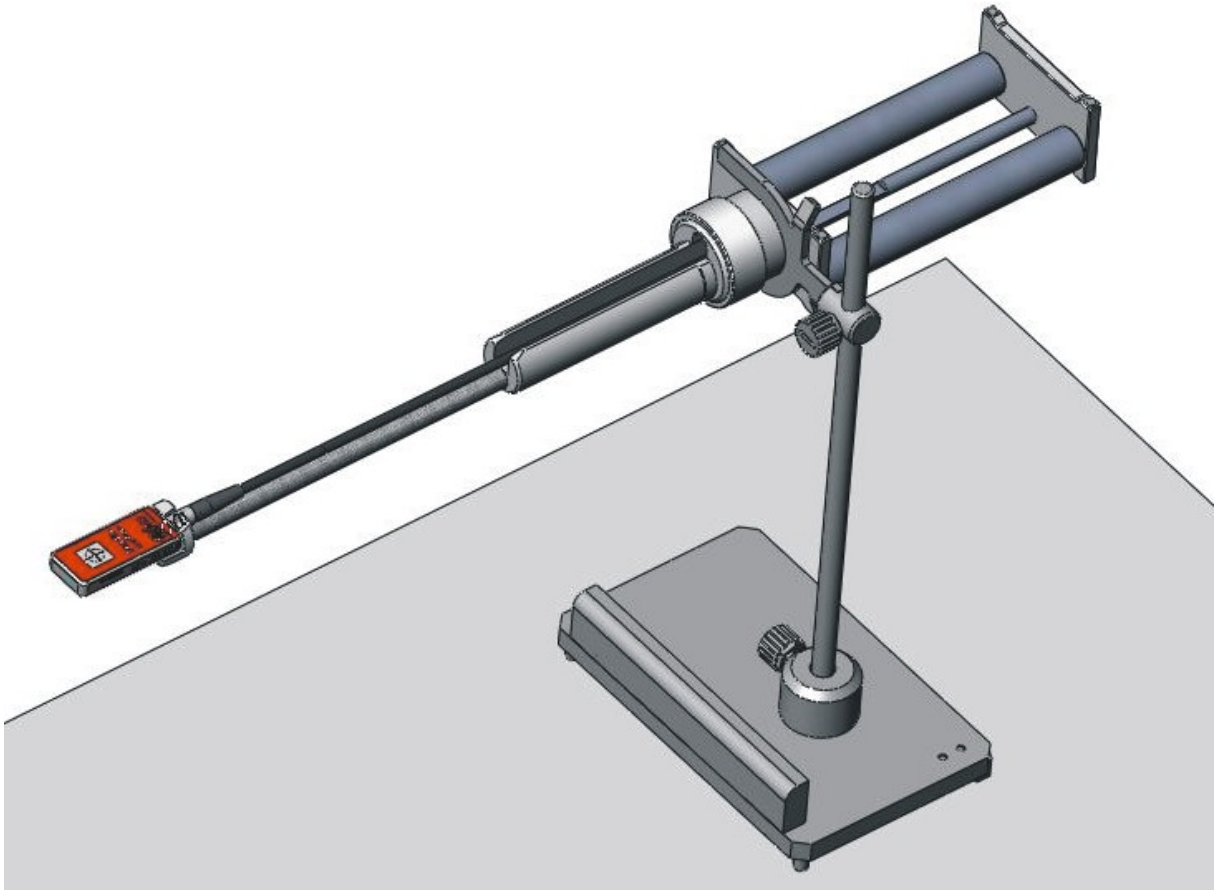
2.4. Setup for Rad and Flu with Max Extension

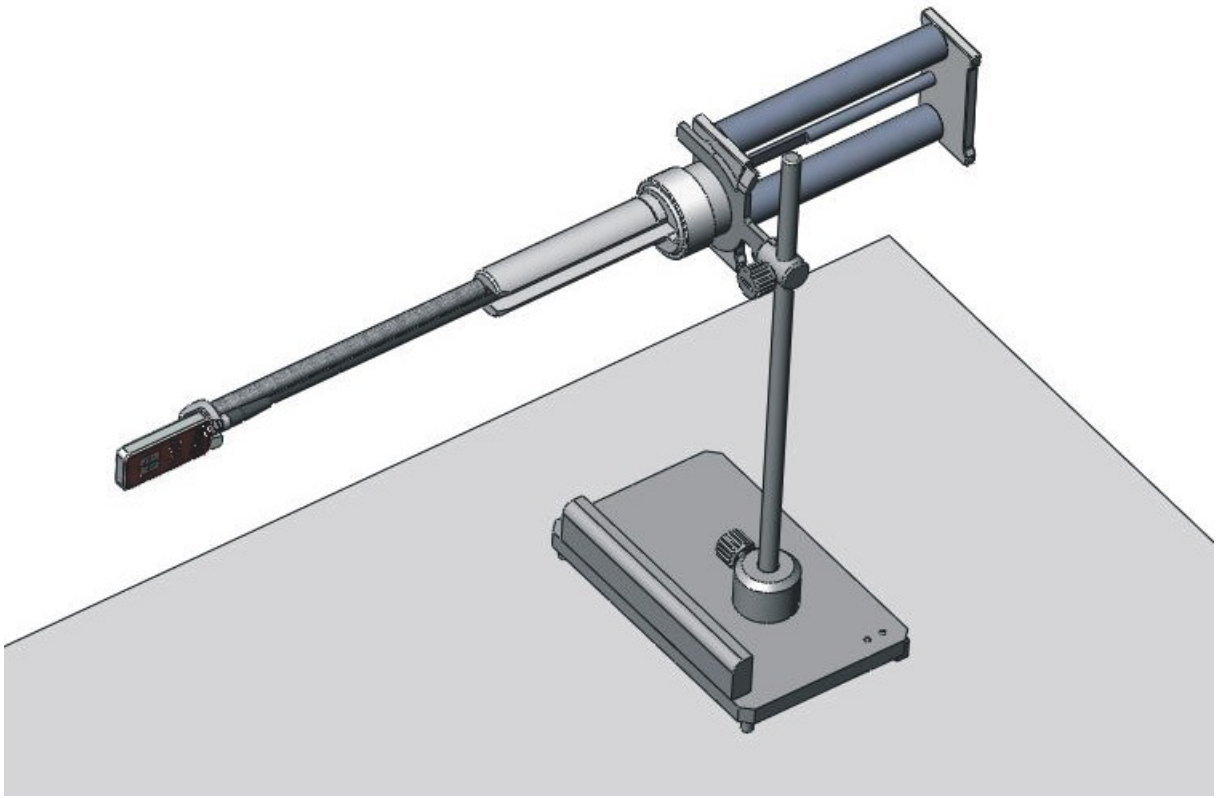
Setup for measurements in radiography and fluoroscopy with the Piranha DPH directly on the table with the carbon fiber rod extended to the maximum. The detector surface may be directed upwards or downwards. This is used when you do not want to have the aluminum part of the DPH in the x-ray beam, e.g. when you would not want the mass of aluminum material of the DPH driving up the mA or kV by the auto brightness mechanism in the system.



2.5. Setup for Measuring Fluoro Dose on an R&F System

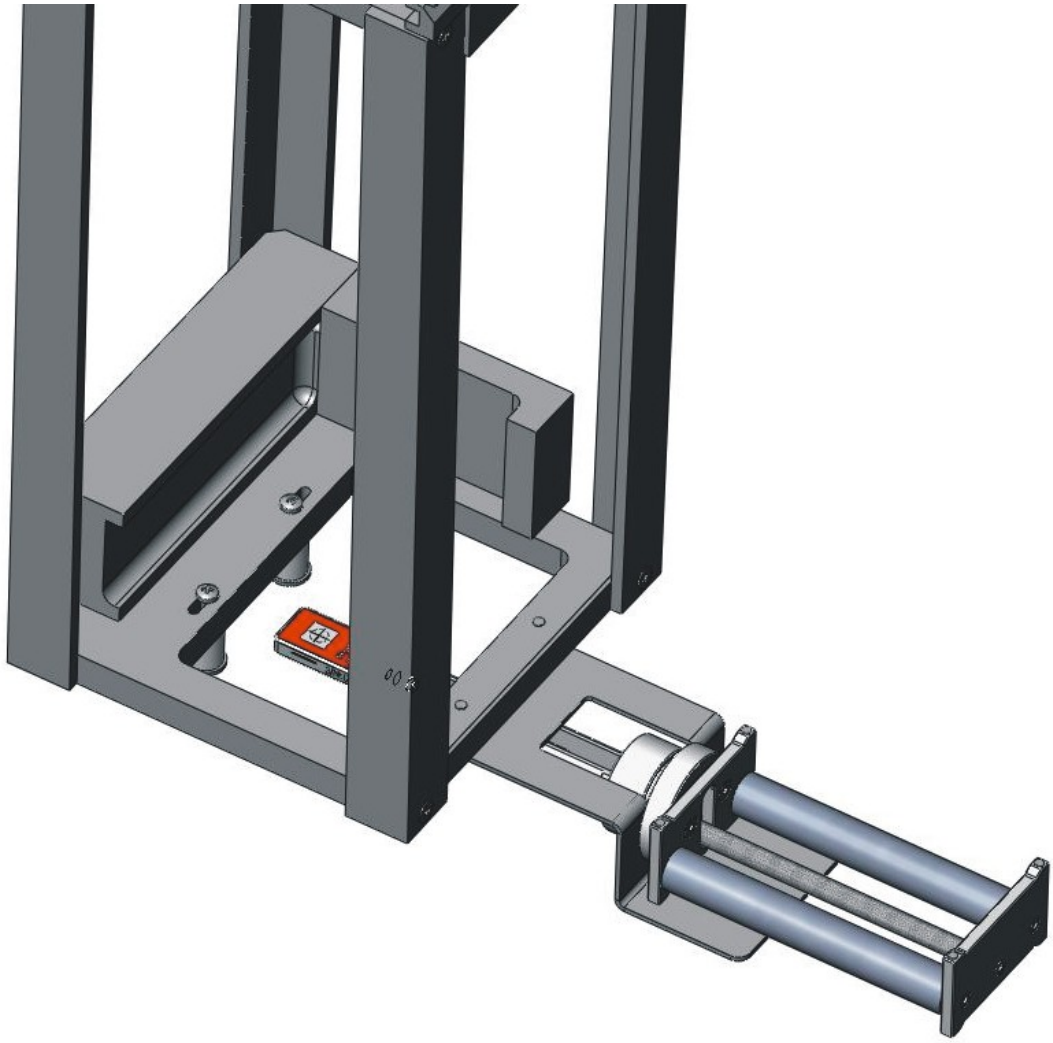
Using the base of the stand along with the rod, the junction box and the fork, fit the DPH onto the stand. Extend the carbon fiber rod to its full length and place it at the proper distance from the table top for fluoro dose rate measurements. The holder can also be rotated 90 degrees for a vertical positioning of the Piranha Dose Probe.





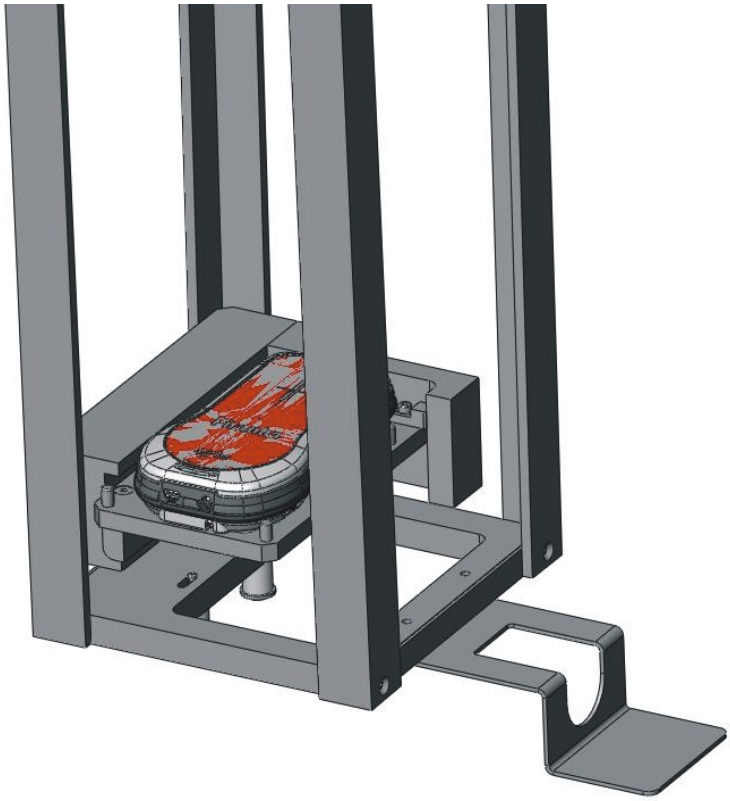
2.6. Rad Dose Measurements Using the GE Standard Jig

Setup for measuring dose in radiography using the GE Standard jig and the Piranha DPH is shown below.
Note: Remove the small locking ring and thread the large locking ring onto the DPH then fit the DPH into the jig and lock it in place with the small lock ring.



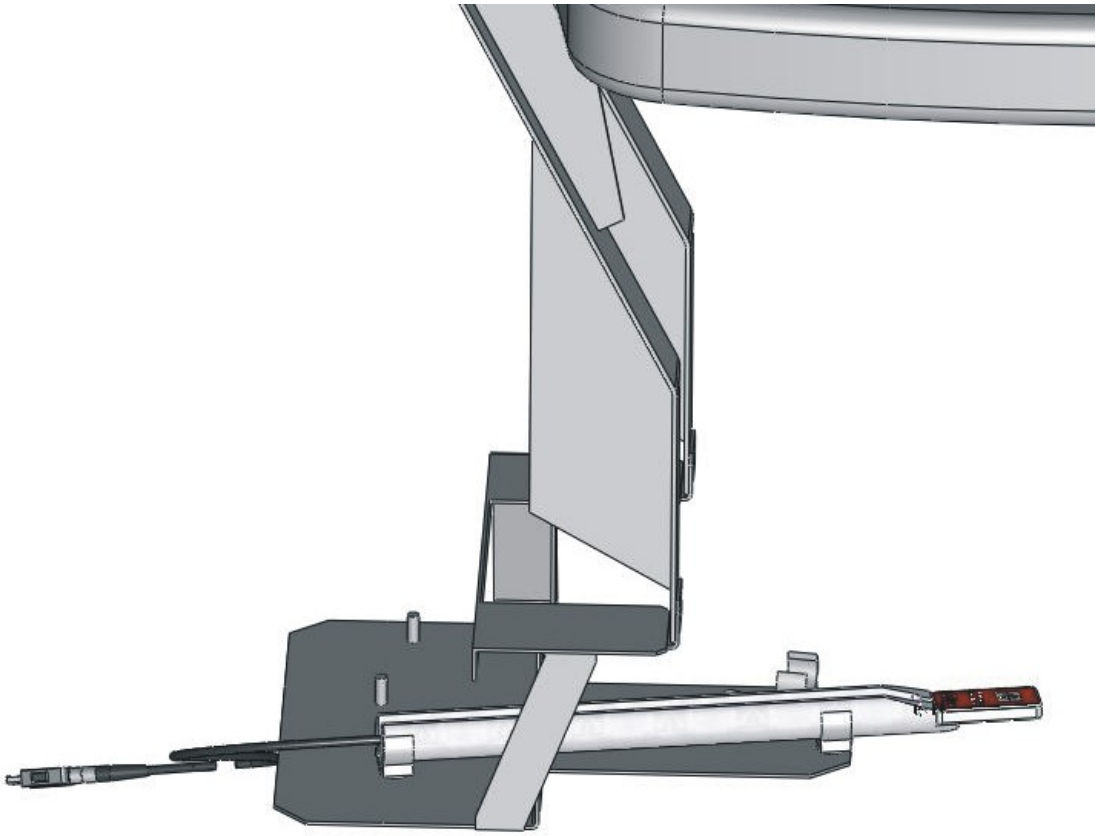
2.7. Rad kV Measurements Using the GE Standard Jig

Setup for measuring kV in radiography using the GE Standard jig and the Piranha. Place the Piranha on the underside of the base of the stand and slide it into the GE jig as shown in the picture. This is similar to the way the Keithley 35080 non-invasive divider is placed in the GE jig.



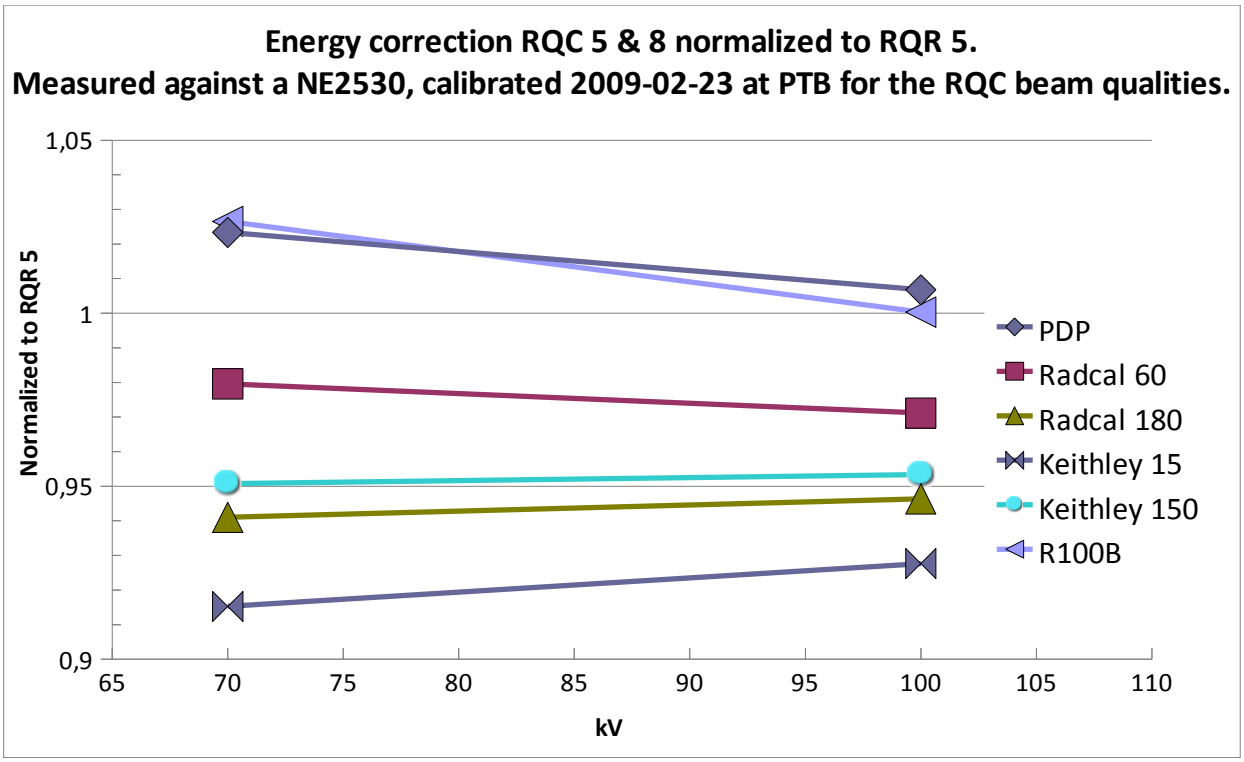
2.8. Innova Measurements

Setup for measurements on a Innova machine using the Piranha Dose Probe where the Radcal 180 cc is usually placed. There is a specific rod used for the Innova setup. Place the end at the end position of the rear clip to get it positioned in the central X-ray beam.



Appendix 1 – Ion chamber energy correction factors for Cu

An investigation has been conducted to cover the energy dependence of RTI's solid state detectors compared to presently used ion chambers when the detectors are used on vascular systems (when the beam is filtered by cupper). The result explains why the X-ray systems sometimes fail the pass/fail criteria when using the RTI detectors.



An example:

When comparing the Dose Probe from RTI to a Radcal 180 cc at RQC 5 (70 kV and 2.83 mm Al + 1.5 mm Cu) a relative difference of 8 % (1.02 - 0.94) can be read out from the graph above. An additional 6 % is added due to the scattered radiation that is not registered by the Dose Probe. In this case, when comparing the two detectors, the reading from the ion chamber will be 14 % higher than the reading from the Dose Probe.