RTI | From Radiation to Information

How the Piranha measures Quick HVL in mammography

The Quick HVL or "one shot HVL" measures the HVL in one single exposure. It is done by using multiple diode detectors inside the Piranha. The Piranha is individually calibrated against a range of reference HVL[1] values during calibration. This calibration is made free in air, without a compression paddle. The Quick HVL method accurately measures the HVL for normal variations in radiation quality, such as minor variations in beam filtrations.
If one wants to measure the HVL including the compression paddle, the Piranha has to "know" that the compression paddle is in place to give an accurate result. This is also valid for the kV and dose measurements. By checking the box "Use Compression Paddle", corrections will be applied to give an accurate HVL.

How to Measure HVL by using layers of Al filters

The internal detectors in the Piranha have a built-in energy dependence which is internally compensated for when measuring kV and dose without any added Al filters. As in the explanation above, when a compression paddle is in the beam, the Piranha has to "know", to compensate correctly.

Due to this built-in energy dependence, the Piranha in Mammography cannot detect by itself the amount of added filtration during a traditional HVL measurement. The dose (and kV) measurement will not be correct other than at the measurement of 0 mm Al. The dose when adding filters will become overestimated due to the energy dependence that is not compensated for. By "telling" the Piranha, from Ocean or QABrowser, the set value of kV and the amount of added filtration, the dose value will be accurately compensated. For this purpose the QABrowser and Ocean have easy to use applications for the traditional HVL method.

If the Piranha user wishes to make his/her own calculations based on dose readings this can be easily done.

If working with Ocean use the function *added filtration* to get correct dose values.

If working with the QABrowser use the application *HVL* to get correct dose values.

Advantages and disadvantages to ion chambers

Using an ion chamber with a flat energy response and narrowest beam geometry will be as close as possible to the definition of an HVL measurement. The drawback of using the ion chamber is its relatively high sensitivity to scattered radiation in filters and in the compression paddle. When a compression paddle is in the beam it becomes harder to get a good gemetry.

The Piranha has the advatage of having a construction that is much less sensitive to scattered radiation. That makes the geometry and collmation less important than when using an ion chamber. Also the sensitivity is much higher which gives less uncertainty without having to increase the x-ray output. The Quick HVL saves time and exposures by giving the HVL from only one exposure without the repetition of exposures and placing various filters in the beam.

RTI reccommends the Quick HVL due to its ease of use and accuracy.

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[1] The reference HVL values are measured with a good narrow gemetry using an ion chamber with a known flat energy responce.