APPLICATION NOTE

RTI Electronics AB, Sweden

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Energy Correction Factors for the Piranha Dose Probe, R100B and R100 Solid State Detector in mammography

This application note describes the energy correction data for mammographic dose and dose rate measurements using Piranha Dose Probe, R100B and R100. The correction data can be used for traditional HVL calculations.

Piranha Dose Probe (PDP)

R100B Dose Probe

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Introduction

This application note specifies the correction factors valid for Piranha Dose Probe, R100B and R100. The kV range is 22-43 kV depending on the beam quality and the added filtration ranges from 0.0 to 0.7 mm Al. All measurement data are normalized at 28 kV with 0.0 mm Al filtration for each beam quality individually.

Correction Factors

The correction factors used for Mo/30µm Mo (M1) is shown in table 1 below. On the following pages correction factors for other beam qualities are available for the Piranha Dose Probe, R100B and R100 solid state detectors are presented.

Example:
The factors are multiplied with the measured value in the following manner:

Assume an added filtration of 0.5 mm Al, Tube voltage set to 28kVp and a measured dose of 1.12 mGy

Correction factor from table 1: 0.850
Corrected dose: 1.120*0.850 = 1.02 mGy

Mo/30µm Mo (M1)

Al (mm)	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7
22 kV	1.165	1.081	1.028	0.987				
23 kV	1.127	1.048	1.001	0.963				
24 kV	1.094	1.021	0.977	0.942	0.915			
25 kV	1.065	0.998	0.956	0.924	0.900			
26 kV	1.040	0.978	0.939	0.909	0.886	0.870	0.857	
27 kV	1.019	0.962	0.923	0.896	0.875	0.860	0.847	
28 kV	1.000	0.947	0.910	0.885	0.865	0.850	0.838	0.825
29 kV	0.984	0.934	0.899	0.875	0.856	0.841	0.829	0.818
30 kV	0.970	0.923	0.889	0.866	0.848	0.833	0.822	0.810
31 kV	0.958	0.913	0.880	0.858	0.841	0.826	0.815	0.804
32 kV	0.947	0.904	0.872	0.851	0.834	0.820	0.808	0.798
33 kV	0.937	0.895	0.866	0.845	0.828	0.814	0.803	0.792
34 kV	0.928	0.888	0.860	0.839	0.822	0.809	0.798	0.787
35 kV	0.920	0.881	0.854	0.833	0.817	0.804	0.793	0.782
36 kV	0.913	0.874	0.849	0.828	0.813	0.800	0.788	0.778
37 kV	0.906	0.868	0.844	0.823	0.808	0.796	0.785	0.774
38 kV	0.899	0.863	0.840	0.819	0.804	0.792	0.781	0.770
39 kV	0.893	0.858	0.835	0.815	0.800	0.788	0.778	0.766

Table 1. correction factors for Mo/30µm Mo (M1)

Mo/25µm Rh (M3)

Al(mm)	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7
23 kV	1.097	1.055	1.026	1.004	0.985			
24 kV	1.070	1.031	1.004	0.985	0.967	0.950		
25 kV	1.047	1.012	0.986	0.970	0.953	0.938		
26 kV	1.028	0.995	0.972	0.958	0.941	0.928	0.920	
27 kV	1.013	0.982	0.959	0.947	0.931	0.918	0.911	
28 kV	1.000	0.971	0.950	0.938	0.923	0.910	0.904	0.894
29 kV	0.990	0.962	0.942	0.930	0.917	0.903	0.897	0.888
30 kV	0.981	0.954	0.935	0.924	0.912	0.897	0.891	0.882
31 kV	0.973	0.948	0.929	0.919	0.907	0.891	0.886	0.878
32 kV	0.967	0.942	0.924	0.914	0.902	0.887	0.882	0.874
33 kV	0.961	0.937	0.920	0.909	0.898	0.883	0.878	0.870
34 kV	0.955	0.932	0.916	0.905	0.894	0.879	0.874	0.867
35 kV	0.950	0.928	0.912	0.901	0.890	0.876	0.871	0.863
36 kV	0.944	0.924	0.908	0.898	0.886	0.873	0.868	0.860
37 kV	0.939	0.920	0.905	0.894	0.882	0.870	0.865	0.857
38 kV	0.935	0.916	0.901	0.891	0.878	0.867	0.862	0.853
39 kV	0.930	0.912	0.898	0.887	0.875	0.863	0.859	0.850
40 kV	0.927	0.908	0.895	0.884	0.872	0.860	0.856	0.847

Table 2. correction factors for Mo/25µm Rh (M3)

Rh/25µm Rh (M4)

Al(mm)	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7
26 kV	1.038	1.001	0.973	0.949	0.931	0.915	0.901	0.887
27 kV	1.018	0.983	0.956	0.933	0.917	0.902	0.888	0.876
28 kV	1.000	0.967	0.941	0.919	0.904	0.890	0.877	0.866
29 kV	0.984	0.952	0.927	0.906	0.893	0.879	0.867	0.856
30 kV	0.969	0.939	0.915	0.895	0.883	0.870	0.858	0.848
31 kV	0.955	0.927	0.905	0.886	0.873	0.861	0.850	0.841
32 kV	0.943	0.917	0.896	0.877	0.865	0.854	0.843	0.834
33 kV	0.933	0.908	0.887	0.870	0.858	0.847	0.837	0.828
34 kV	0.923	0.899	0.880	0.863	0.852	0.841	0.832	0.823
35 kV	0.915	0.892	0.874	0.857	0.846	0.836	0.827	0.818
36 kV	0.908	0.886	0.868	0.852	0.841	0.831	0.822	0.814
37 kV	0.901	0.880	0.863	0.848	0.837	0.827	0.819	0.810
38 kV	0.896	0.875	0.859	0.844	0.833	0.824	0.815	0.807
39 kV	0.891	0.870	0.855	0.840	0.830	0.821	0.812	0.804
40 kV	0.886	0.866	0.851	0.837	0.827	0.818	0.809	0.801
41 kV	0.882	0.862	0.848	0.834	0.824	0.815	0.807	0.798
42 kV	0.878	0.859	0.844	0.831	0.822	0.813	0.805	0.796
43 kV	0.875	0.856	0.841	0.828	0.819	0.810	0.802	0.794

Table 3. correction factors for Rh/25µm Rh (M4)

W/50µm Rh (M6)

Al(mm)	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7
22 kV	1.107	1.075	1.056	1.038				
23 kV	1.071	1.043	1.024	1.006	0.990			
24 kV	1.046	1.021	1.002	0.985	0.971	0.961		
25 kV	1.029	1.005	0.987	0.970	0.957	0.947	0.937	
26 kV	1.017	0.994	0.976	0.960	0.948	0.937	0.928	
27 kV	1.007	0.985	0.968	0.953	0.941	0.929	0.921	
28 kV	1.000	0.978	0.961	0.947	0.935	0.924	0.915	
29 kV	0.993	0.972	0.956	0.942	0.930	0.919	0.910	
30 kV	0.986	0.966	0.950	0.937	0.924	0.914	0.905	0.895
31 kV	0.980	0.960	0.944	0.931	0.918	0.909	0.899	0.889
32 kV	0.974	0.954	0.938	0.925	0.912	0.903	0.894	0.883
33 kV	0.967	0.948	0.932	0.919	0.906	0.897	0.888	0.877
34 kV	0.961	0.941	0.926	0.912	0.900	0.891	0.881	0.871
35 kV	0.955	0.935	0.920	0.906	0.894	0.884	0.875	0.865
36 kV	0.949	0.929	0.914	0.900	0.888	0.876	0.869	0.859
37 kV	0.944	0.923	0.908	0.893	0.882	0.869	0.863	0.853
38 kV	0.938	0.917	0.903	0.888	0.877	0.862	0.857	0.847
39 kV	0.933	0.912	0.897	0.882	0.871	0.856	0.851	0.840

Table 4. correction factors for W/50µm Rh (M6)

W/0.5mm Al (M7)

Al(mm)	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7
22 kV	1.174	1.084	1.021	0.973	0.940	0.912		
23 kV	1.136	1.049	0.990	0.944	0.913	0.887		
24 kV	1.102	1.019	0.962	0.918	0.889	0.865		
25 kV	1.073	0.992	0.936	0.895	0.866	0.843		
26 kV	1.046	0.967	0.913	0.874	0.845	0.824		
27 kV	1.022	0.945	0.892	0.854	0.826	0.805		
28 kV	1.000	0.924	0.873	0.836	0.808	0.788	0.773	
29 kV	0.980	0.906	0.855	0.820	0.792	0.773	0.756	
30 kV	0.961	0.889	0.839	0.805	0.777	0.758	0.741	0.729
31 kV	0.944	0.873	0.824	0.790	0.764	0.745	0.728	0.715
32 kV	0.928	0.858	0.811	0.777	0.751	0.733	0.716	0.703
33 kV	0.914	0.844	0.798	0.765	0.740	0.722	0.705	0.692
34 kV	0.900	0.832	0.786	0.753	0.729	0.711	0.695	0.682
35 kV	0.887	0.820	0.775	0.743	0.720	0.702	0.686	0.673
36 kV	0.876	0.809	0.765	0.733	0.711	0.693	0.678	0.665
37 kV	0.865	0.799	0.756	0.725	0.703	0.686	0.670	0.658
38 kV	0.855	0.790	0.748	0.717	0.696	0.678	0.664	0.652
39 kV	0.846	0.782	0.740	0.710	0.689	0.672	0.657	0.646

Table 5. correction factors for W/0.5mm Al (M7)

W/50µm Ag (M10)

Al(mm)	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7
22 kV	1.139	1.105	1.081	1.059	1.042	1.024		
23 kV	1.103	1.071	1.047	1.028	1.013	0.996		
24 kV	1.074	1.043	1.020	1.002	0.989	0.973		
25 kV	1.049	1.020	0.998	0.981	0.969	0.953	0.939	
26 kV	1.030	1.001	0.980	0.964	0.952	0.937	0.921	
27 kV	1.013	0.986	0.965	0.950	0.938	0.924	0.908	
28 kV	1.000	0.973	0.953	0.938	0.926	0.913	0.899	0.889
29 kV	0.989	0.962	0.944	0.929	0.917	0.904	0.891	0.882
30 kV	0.980	0.954	0.935	0.921	0.908	0.896	0.885	0.875
31 kV	0.972	0.946	0.928	0.913	0.901	0.890	0.880	0.869
32 kV	0.965	0.939	0.922	0.907	0.895	0.884	0.874	0.863
33 kV	0.959	0.933	0.916	0.901	0.890	0.879	0.869	0.858
34 kV	0.953	0.928	0.910	0.895	0.884	0.874	0.863	0.852
35 kV	0.947	0.922	0.905	0.890	0.879	0.869	0.857	0.847
36 kV	0.942	0.917	0.899	0.885	0.875	0.864	0.852	0.842
37 kV	0.937	0.911	0.894	0.879	0.870	0.859	0.846	0.837
38 kV	0.931	0.906	0.889	0.874	0.865	0.854	0.840	0.832
39 kV	0.926	0.901	0.883	0.869	0.860	0.849	0.835	0.827

Table 6. correction factors for W/50µm Ag (M10)

W/75µm Ag (M11)

Al(mm)	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7
22 kV	1.125	1.105	1.088					
23 kV	1.093	1.076	1.060	1.042	1.029	1.015	1.006	
24 kV	1.066	1.051	1.036	1.020	1.007	0.995	0.987	
25 kV	1.044	1.029	1.016	1.002	0.989	0.979	0.970	
26 kV	1.026	1.012	0.999	0.987	0.975	0.965	0.957	
27 kV	1.011	0.998	0.985	0.974	0.963	0.954	0.945	
28 kV	1.000	0.987	0.975	0.964	0.953	0.944	0.936	0.929
29 kV	0.990	0.978	0.966	0.956	0.945	0.937	0.929	0.921
30 kV	0.983	0.971	0.960	0.949	0.939	0.931	0.923	0.914
31 kV	0.978	0.965	0.955	0.944	0.934	0.926	0.917	0.909
32 kV	0.973	0.961	0.951	0.939	0.929	0.921	0.913	0.905
33 kV	0.969	0.957	0.947	0.935	0.926	0.917	0.909	0.902
34 kV	0.965	0.953	0.943	0.931	0.922	0.914	0.905	0.899
35 kV	0.961	0.950	0.940	0.928	0.919	0.910	0.902	0.896
36 kV	0.958	0.946	0.936	0.924	0.916	0.907	0.898	0.893
37 kV	0.954	0.943	0.932	0.921	0.913	0.904	0.895	0.889
38 kV	0.950	0.939	0.928	0.917	0.909	0.900	0.891	0.885
39 kV	0.946	0.935	0.924	0.913	0.905	0.896	0.887	0.882

Table 7. correction factors for W/75µm Ag (M11)

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