

Position Resolution - Update 3-1

Pulse width and timing resolution connection

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This document compares the data from update 2 and update 3 to examine how pulse width impacts timing resolution as defined using the time difference plots. Time difference plots were selected for this investigation instead of absolute time plots because time difference plots showed the most consistent and logical results in position resolution studies (for example, did not show the doubling problem).

1 Data

For improved readability, the relevant tables from update 2, 2-1, and 3 are presented here.

Table 1: Width plot fit parameters for boards 2, 3, 6, and 7 with the source directly over the scintillator with 2-3 from update 2.

		w2		w3		w6		w7	
Run	Position (cm)	Centroid (ns)	σ (ns)	Centroid (ns)	σ (ns)	Centroid (ns)	σ (ns)	Centroid (ns)	σ (ns)
86	3.0	43.637	6.552	36.446	7.022	48.325	5.945	49.878	5.985
88	5.0	40.281	6.904	35.193	7.113	47.653	5.885	48.113	5.948
89	7.0	38.598	6.905	35.762	7.121	48.315	5.908	47.766	5.692
90	9.0	38.303	7.266	37.091	7.107	49.023	5.92	47.293	5.824
91	11.0	38.328	6.948	38.018	7.159	49.751	6.034	46.864	5.963
92	13.0	37.325	7.092	39.591	6.574	50.236	6.131	45.681	7.376
93	15.0	37.028	7.104	41.031	6.235	50.514	6.091	45.296	6.435
94	17.0	36.896	7.115	41.831	6.243	51.047	6.202	44.838	7.362

Table 2: Plots of time difference along a scintillator fit parameters for boards 2, 3, 6, and 7 with the source directly over the scintillator with 2-3. Combination of information from tables 1 and 2 in update 2-1.

		t23 twc		t23 2367 twc		t67 twc		t67 2367 twc	
Run	Position (cm)	Centroid (ns)	σ (ns)	Centroid (ns)	σ (ns)	Centroid (ns)	σ (ns)	Centroid (ns)	σ (ns)
86	3.0	0.751	0.315	0.730	0.293	-1.003	0.414	-1.081	0.359
88	5.0	0.496	0.336	0.497	0.310	-0.809	0.452	-0.865	0.395
89	7.0	0.062	0.344	0.069	0.320	-0.513	0.484	-0.443	0.413
90	9.0	-0.119	0.341	-0.106	0.315	-0.247	0.520	-0.170	0.423
91	11.0	-0.499	0.34	-0.486	0.316	0.02	0.536	0.146	0.427
92	13.0	-0.579	0.334	-0.572	0.314	0.353	0.516	0.531	0.430
93	15.0	-1.006	0.329	-1.000	0.309	0.615	0.479	0.831	0.402
94	17.0	-1.255	0.321	-1.242	0.303	0.779	0.430	1.070	0.367

Table 3: Width plot fit parameters for boards 1, 4, 5, and 8 with the source directly over scintillator 1-4 from update 3.

		w1		w4		w5		w8	
Run	Position (cm)	Centroid (ns)	σ (ns)	Centroid (ns)	σ (ns)	Centroid (ns)	σ (ns)	Centroid (ns)	σ (ns)
104	3	40.647	6.791	38.285	7.062	48.000	6.918	51.4	6.412
105	7	39.425	6.833	38.907	7.078	48.784	7.367	50.393	6.121
106	11	38.081	7.109	40.033	7.418	48.986	7.29	49.473	5.967
108	15	37.232	7.037	41.76	6.572	49.631	6.252	47.827	6.55

Table 4: Time difference of along a scintillator with and without a coincidence condition (time walk corrected) fit parameters for boards 1, 4, 5, and 8 with the source directly over scintillator 1-4 from update 3.

		t14 twc		t14 1458 twc		t58 twc		t58 1458 twc	
Run	Position (cm)	Centroid (ns)	σ (ns)	Centroid (ns)	σ (ns)	Centroid (ns)	σ (ns)	Centroid (ns)	σ (ns)
104	3	0.424	0.325	0.409	0.300	-1.01	0.414	-1.035	0.365
105	7	0.155	0.324	0.157	0.299	-0.505	0.465	-0.512	0.400
106	11	-0.439	0.325	-0.435	0.297	0.046	0.477	0.066	0.401
108	15	-1.283	0.322	-1.270	0.298	0.640	0.456	0.676	0.384

2 Combining Data

Table 5

width	1	2	3	4	5	6	7	8	top	bottom
average width centroid (ns)	38.846	38.800	38.120	39.746	48.850	49.358	46.966	49.773	38.739	48.545
average width sigma (ns)	6.943	6.986	6.822	7.033	6.957	6.015	6.323	6.263	6.932	6.316
peak (counts)	26662	21482	22680	27363	2727	2644	2545	2770	24547	2671