



SLAC ITk CONSTRUCTION

DP Cable (B201-B248) QC

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Contents

1	Setup	1
1.1	DP Cables (B201-B248)	1
2	Cable Losses	2
2.1	Multi-Scatter Plots	2
2.2	Single-Scatter Plots	3
2.3	Calibration Ratio Plots	7
2.4	Calibration Ratio Data Tables	8
3	Appendix	9
	Cable Assignments	10
	miniDP13-full-20230622 Summary	12
	DP13-J246-run1 (E1) Summary	16
	DP13-J246-run2 (E2) Summary	20
	DP13-J246-run3 (E3) Summary	24
	DP13-J246-run4 (E4) Summary	28
	DP13-run1-20230622 (R1) Summary	32
	DP13-run2-20230622 (R2) Summary	36
	DP13-run3-20230622 (R3) Summary	40
	DP13-run4-20230623 (R4) Summary	44
	DP13-run5-20230623 (R5) Summary	48
	DP13-run6.3-20230626 (R6.3) Summary	52
	DP13-run7-20230622 (R7) Summary	56
	DP13-run8-20230623 (R8) Summary	60
	DP13-run9-20230622 (R9) Summary	64
	DP13-run10-20230630 (R10) Summary	68
	DP13-run1-20230630 (R11) Summary	72
	DP13-run12-20230630 (R12) Summary	76

1 Setup

1.1 DP Cables (B201-B248)

The miniDP-DP cable used was throughout testing was the QCEs 8K Mini DisplayPort to Displayport Cable 10Ft, Mini DP to DP Cable 1.4 8K@60Hz 4K@144Hz 2K@240Hz. Cables B201-B248 were connected to adaptors 23-C00-03 and 23-C00-07. The miniDP side of each cable was connected to 23-C00-03 while a DP-to-miniDP adaptor was attached to the DP end of each cable and then attached to adaptor 23-C00-07. The DP-to-miniDP adaptors connected to the 23-C00-07 adaptor board were not moved. 23-C00-03 was attached to group 3 (G3) on RTM03 and 23-C00-07 was attached to group 1 (G1) on RTM03. Each cable was connected one-to-one meaning J1 was connected to J1, J2 was connected to J2, etc. The following diagram visualizes this set up. The cable assignment table on page 10 is used as a reference to determine which J-connector each cable was attached to during the cable QC. Final testing excluded the J1/J3/J5 ports on the two adaptor boards, all cables were tested on J2/J4/J6.

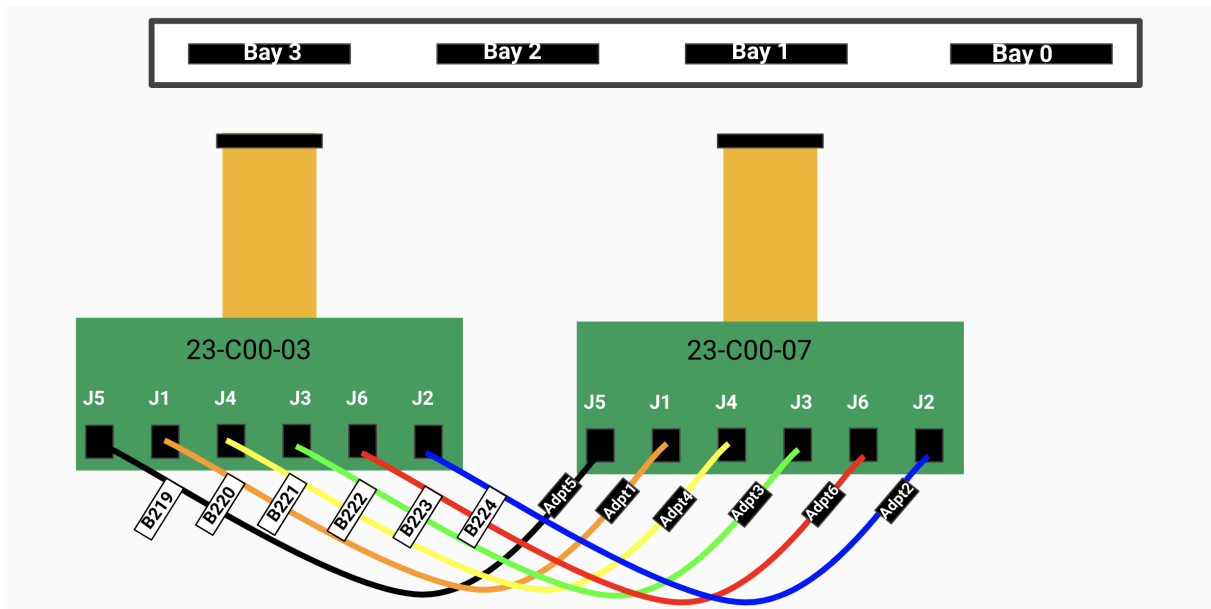


Figure 1: Example adaptor set up, this configuration was not used during final QC as J1/J3/J5 ports were excluded.

2 Cable Losses

2.1 Multi-Scatter Plots

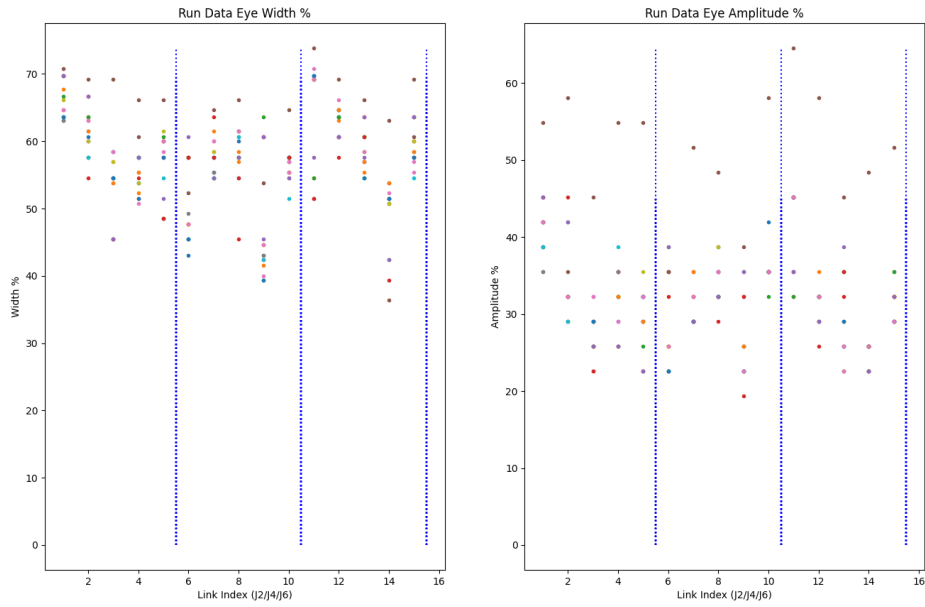


Figure 2: Eye width and amplitude compared against one another for cables B201-B248

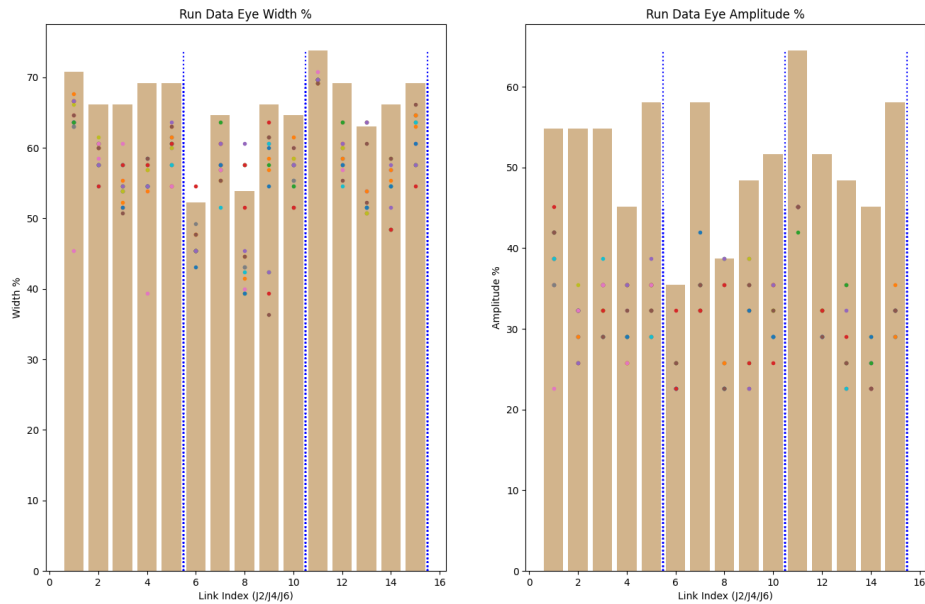


Figure 3: Eye width and amplitude of cables B201-B248 compared against miniDP cables mDP1-mDP6 (known losses, plotted as bars).

2.2 Single-Scatter Plots

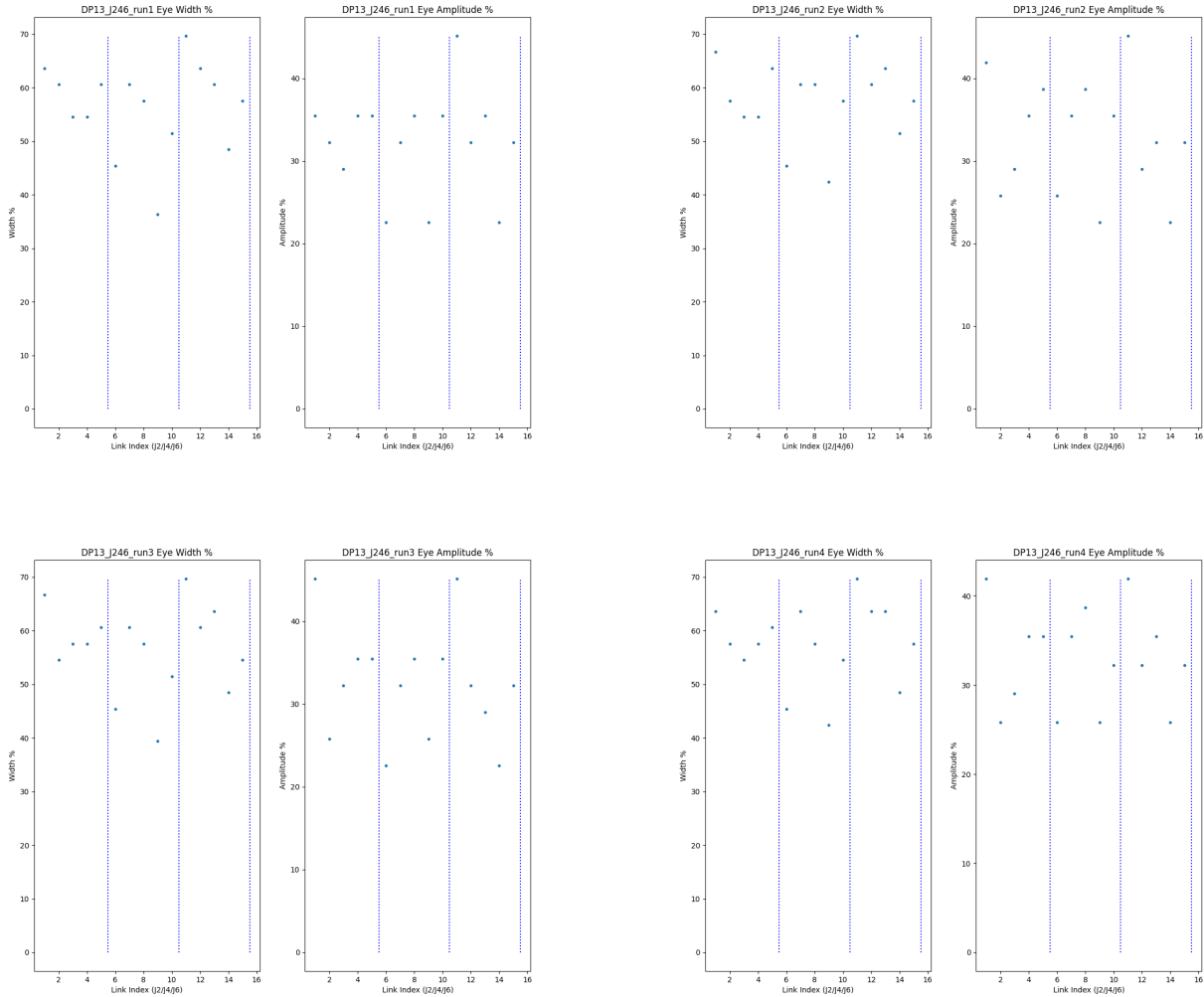


Figure 4: Single Scatter results for runs E1-E4.

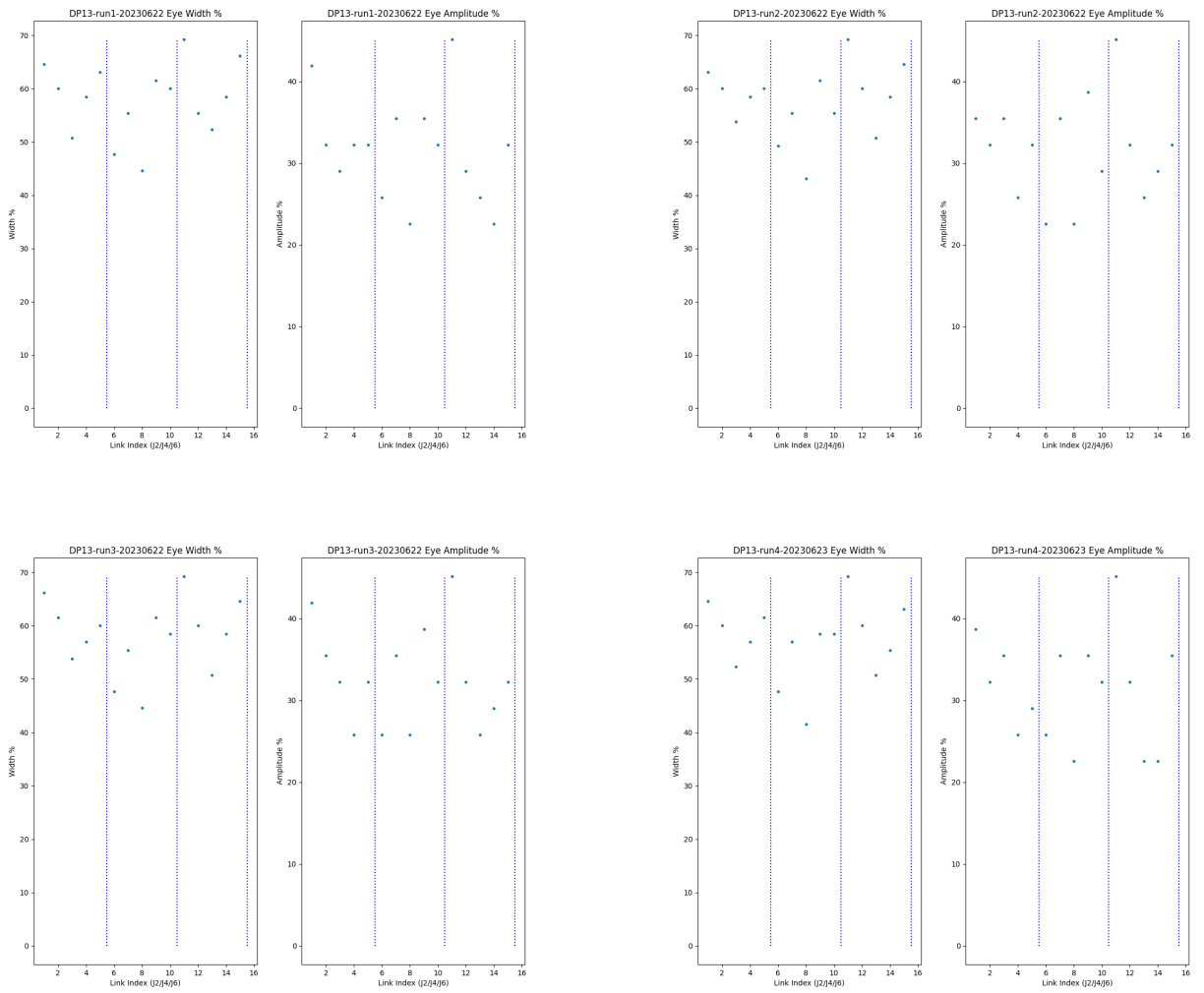


Figure 5: Single Scatter results for runs R1-R4.

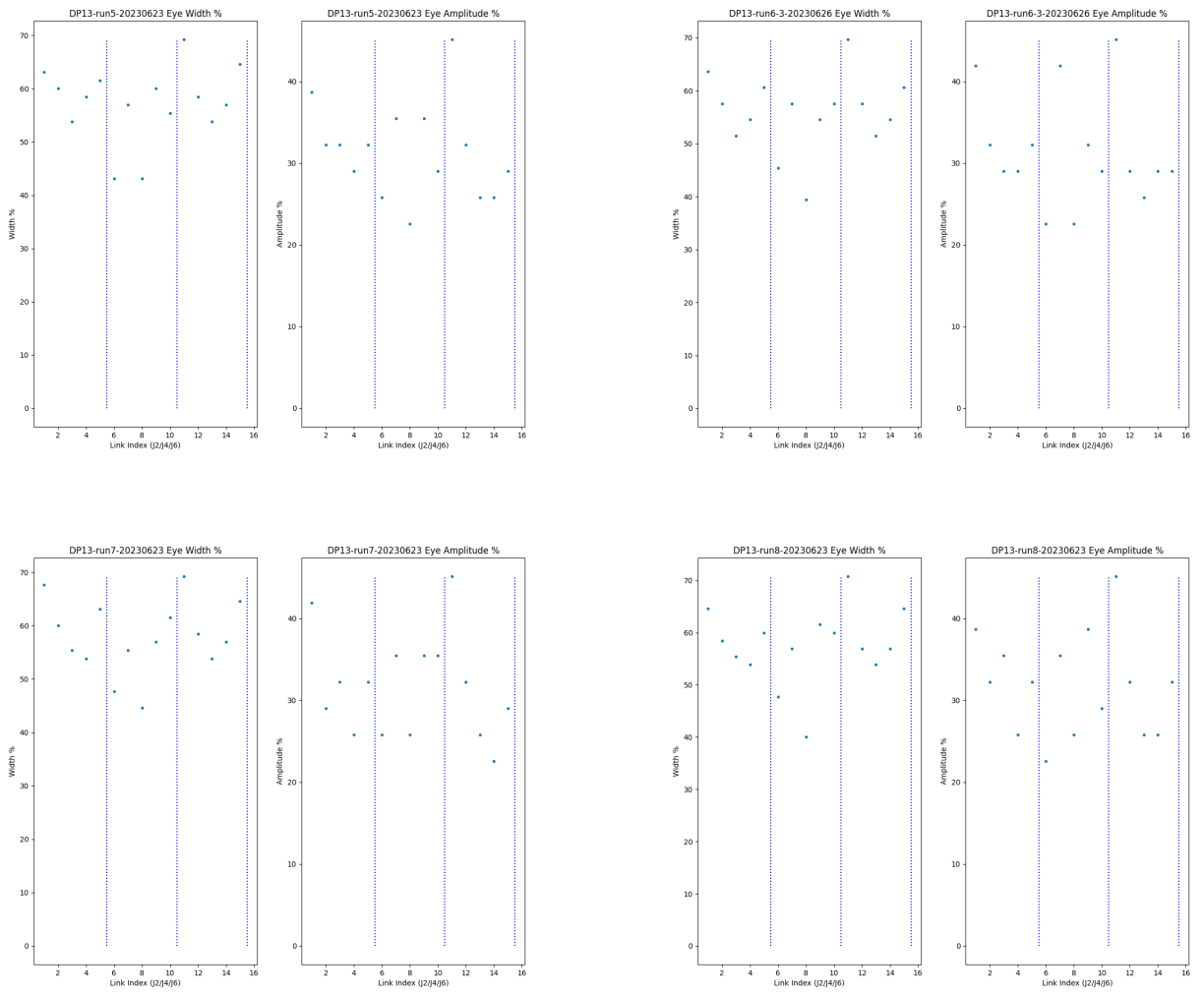


Figure 6: Single Scatter results for runs R5-R8.

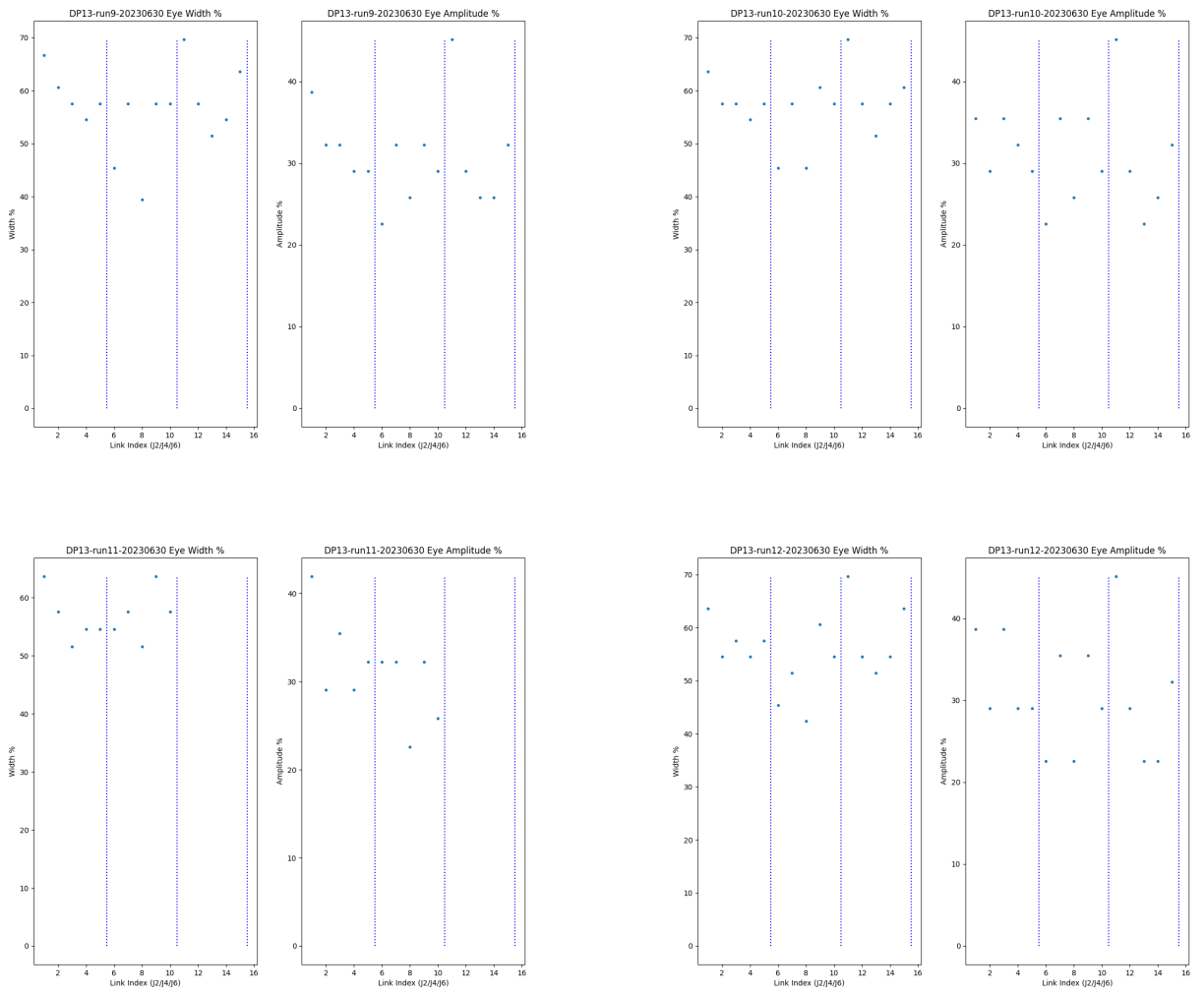


Figure 7: Single Scatter results for runs R9-R12.

2.3 Calibration Ratio Plots

The purpose of the calibration ratio is to allow us to compare the quality of different channels that exhibit different eye scan characteristics. This ratio was produced when finding power loss in the DP cables using a serial analyzer. This technique was then applied to the findings produced from the Vivado data. The ratio of the total loss over the calibration eye percentage for a given channel should match (or come close to matching) the same ratio from a different connector on the same channel. The ratio is as follows

$$\frac{\text{miniDP13Eye}\% - \text{DP13Eye}\%}{\text{miniDP13Eye}\%} \quad (1)$$

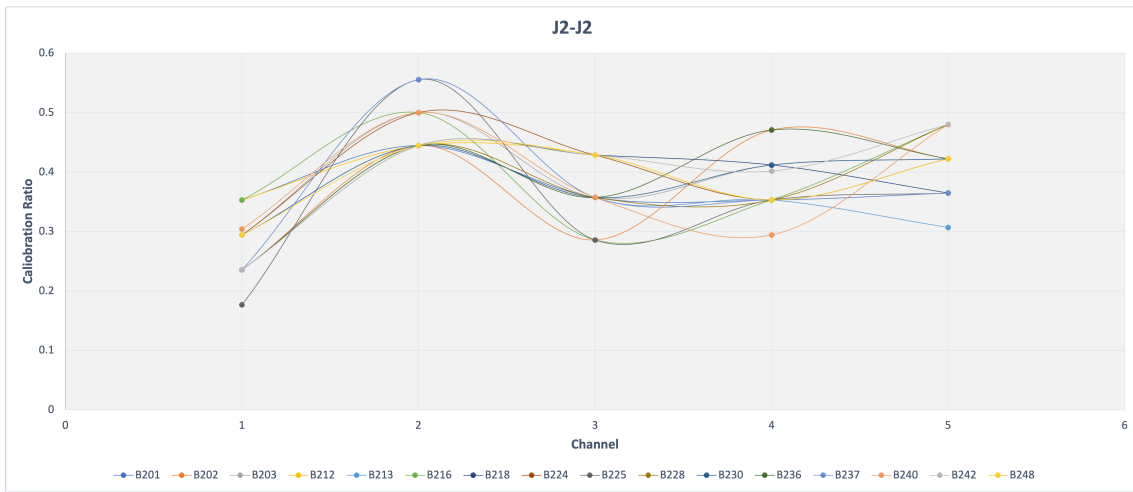


Figure 8: J2-J2 Calibration Ratio Comparison

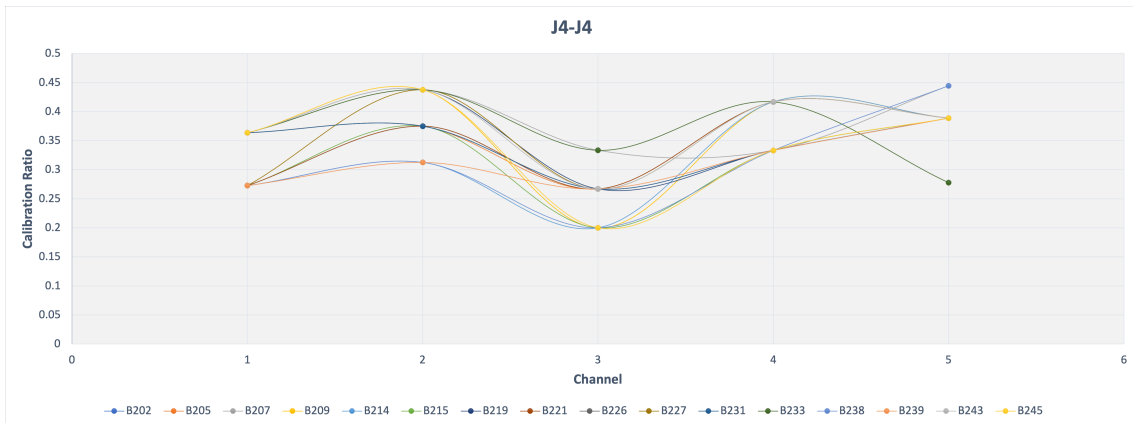


Figure 9: J4-J4 Calibration Ratio Comparison

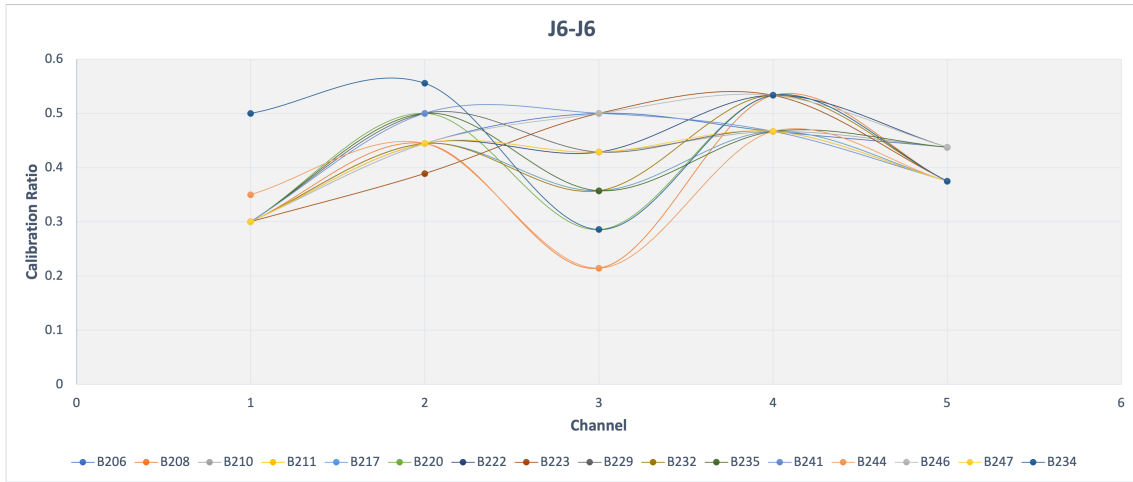


Figure 10: J6-J6 Calibration Ratio Comparison

2.4 Calibration Ratio Data Tables

Run	Cable	CMD Lane	Delta	Ratio	D0 Lane	Delta	Ratio	D1 Lane	Delta	Ratio	D2 Lane	Delta	Ratio	D3 Lane	Delta	Ratio
mDP13	mDP2	54.84			58.06			45.16			54.84			55.84		
E-1	201	35.48	19.36	0.35302699	32.26	25.8	0.4443679	29.03	16.13	0.35717449	35.48	19.36	0.35302699	35.48	20.36	0.36461318
1	202	41.94	12.9	0.23522976	32.26	25.8	0.4443679	32.26	12.9	0.28565102	29.03	25.81	0.47064187	32.26	23.58	0.42227794
9	203	38.71	16.13	0.29412837	29.03	29.03	0.5	29.03	16.13	0.35717449	32.26	22.58	0.41174325	32.26	23.58	0.42227794
2	212	35.48	19.36	0.35302699	32.26	25.8	0.4443679	25.81	19.35	0.42847653	35.48	19.36	0.35302699	32.26	23.58	0.42227794
E-2	213	41.94	12.9	0.23522976	25.81	32.25	0.55545987	29.03	16.13	0.35717449	35.48	19.36	0.35302699	38.71	17.13	0.30676934
10	216	35.48	19.36	0.35302699	29.03	29.03	0.5	32.26	12.9	0.28565102	35.48	19.36	0.35302699	29.03	26.81	0.48012178
3	218	41.94	12.9	0.23522976	32.26	25.8	0.4443679	25.81	19.35	0.42847653	32.26	22.58	0.41174325	35.48	20.36	0.36461318
4	224	38.71	16.13	0.29412837	29.03	29.03	0.5	25.81	19.35	0.42847653	35.48	19.36	0.35302699	32.26	23.58	0.42227794
E-3	225	45.16	9.68	0.17651349	25.81	32.25	0.55545987	32.26	12.9	0.28565102	35.48	19.36	0.35302699	35.48	20.36	0.36461318
11	228	41.94	12.9	0.23522976	32.26	25.8	0.4443679	29.03	16.13	0.35717449	35.48	19.36	0.35302699	29.03	26.81	0.48012178
5	230	38.71	16.13	0.29412837	32.26	25.8	0.4443679	29.03	16.13	0.35717449	32.26	22.58	0.41174325	32.26	23.58	0.42227794
6.3	236	41.94	12.9	0.23522976	32.26	25.8	0.4443679	29.03	16.13	0.35717449	29.03	25.81	0.47064187	32.26	23.58	0.42227794
E-4	237	41.94	12.9	0.23522976	25.81	32.25	0.55545987	29.03	16.13	0.35717449	35.48	19.36	0.35302699	35.48	20.36	0.36461318
12	240	38.17	16.67	0.3039752	29.03	29.03	0.5	29.03	16.13	0.35717449	38.71	16.13	0.29412837	29.03	26.81	0.48012178
7	242	41.94	12.9	0.23522976	32.26	25.8	0.4443679	25.81	19.35	0.42847653	32.81	22.03	0.40171408	29.03	26.81	0.48012178
8	248	38.71	16.13	0.29412837	32.26	25.8	0.4443679	25.81	19.35	0.42847653	35.48	19.36	0.35302699	32.26	23.58	0.42227794

Figure 11: J2-J2 Calibration Ratio Data

Run	Cable	CMD Lane	Delta	Ratio	D0 Lane	Delta	Ratio	D1 Lane	Delta	Ratio	D2 Lane	Delta	Ratio	D3 Lane	Delta	Ratio
mDP13	mDP4	35.48			51.61			48.39			38.71			58.06		
1	204	25.81	9.67	0.27254791	32.26	19.35	0.37492734	35.48	12.91	0.26679066	22.58	16.13	0.41668819	35.48	22.58	0.38890803
E-1	205	22.58	12.9	0.36358512	32.26	19.35	0.37492734	35.48	12.91	0.26679066	22.58	16.13	0.41668819	32.26	25.8	0.4443679
9	207	22.58	12.9	0.36358512	29.03	22.58	0.43751211	32.26	16.13	0.33333333	25.81	12.9	0.33324722	32.26	25.8	0.4443679
2	209	22.58	12.9	0.36358512	29.03	22.58	0.43751211	38.71	9.68	0.20004133	22.58	16.13	0.41668819	35.48	22.58	0.38890803
E-2	214	25.81	9.67	0.27254791	35.48	16.13	0.31253633	38.71	9.68	0.20004133	22.58	16.13	0.41668819	35.48	22.58	0.38890803
3	215	25.81	9.67	0.27254791	32.26	19.35	0.37492734	38.71	9.68	0.20004133	25.81	12.9	0.33324722	35.48	22.58	0.38890803
10	219	22.58	12.9	0.36358512	29.03	22.58	0.43751211	35.48	12.91	0.26679066	25.81	12.9	0.33324722	35.48	22.58	0.38890803
4	221	25.81	9.67	0.27254791	32.26	19.35	0.37492734	35.48	12.91	0.26679066	22.58	16.13	0.41668819	35.48	22.58	0.38890803
E-3	226	22.58	12.9	0.36358512	32.26	19.35	0.37492734	35.48	12.91	0.26679066	25.81	12.9	0.33324722	35.48	22.58	0.38890803
5	227	25.81	9.67	0.27254791	29.03	22.58	0.43751211	35.48	12.91	0.26679066	22.58	16.13	0.41668819	35.48	22.58	0.38890803
B231_J4	231	22.58	12.9	0.36358512	32.26	19.35	0.37492734	35.48	12.91	0.26679066	25.81	12.9	0.33324722	35.48	22.58	0.38890803
6.3	233	22.58	12.9	0.36358512	29.03	22.58	0.43751211	32.26	16.13	0.33333333	22.58	16.13	0.41668819	41.94	16.12	0.27764382
E-4	238	25.81	9.67	0.27254791	35.48	16.13	0.31253633	38.71	9.68	0.20004133	25.81	12.9	0.33324722	32.26	25.8	0.4443679
7	239	25.81	9.67	0.27254791	35.48	16.13	0.31253633	35.48	12.91	0.26679066	25.81	12.9	0.33324722	35.48	22.58	0.38890803
12	243	22.58	12.9	0.36358512	29.03	22.58	0.43751211	35.48	12.91	0.26679066	22.58	16.13	0.41668819	35.48	22.58	0.38890803
8	245	22.58	12.9	0.36358512	29.03	22.58	0.43751211	38.71	9.68	0.20004133	25.81	12.9	0.33324722	35.48	22.58	0.38890803

Figure 12: J4-J4 Calibration Ratio Data

Run	Cable	CMD Lane	Delta	Ratio	D0 Lane	Delta	Ratio	D1 Lane	Delta	Ratio	D2 Lane	Delta	Ratio	D3 Lane	Delta	Ratio
mDP13	mDP6	64.52			58.06			45.16			48.39			51.61		
1	206	45.16	19.36	0.300062	32.26	25.8	0.4443679	22.58	22.58	0.5	25.81	22.58	0.4666253	29.03	22.58	0.4375121
E-1	208	45.16	19.36	0.300062	32.26	25.8	0.4443679	35.48	9.68	0.214349	22.58	25.81	0.5333747	32.26	19.35	0.3749273
9	210	45.16	19.36	0.300062	32.26	25.8	0.4443679	25.81	19.35	0.4284765	25.81	22.58	0.4666253	29.03	22.58	0.4375121
2	211	45.16	19.36	0.300062	32.26	25.8	0.4443679	29.03	16.13	0.3571745	25.81	22.58	0.4666253	32.26	19.35	0.3749273
3	217	45.16	19.36	0.300062	32.26	25.8	0.4443679	29.03	16.13	0.3571745	25.81	22.58	0.4666253	32.26	19.35	0.3749273
E-2	220	45.16	19.36	0.300062	29.03	29.03	0.5	32.26	12.9	0.285651	22.58	25.81	0.5333747	32.26	19.35	0.3749273
10	222	45.16	19.36	0.300062	32.26	25.8	0.4443679	25.81	19.35	0.4284765	22.58	25.81	0.5333747	29.03	22.58	0.4375121
4	223	45.16	19.36	0.300062	35.48	22.58	0.388908	22.58	22.58	0.5	25.81	25.81	0.5333747	32.26	19.35	0.3749273
5	229	45.16	19.36	0.300062	29.03	29.03	0.5	25.81	19.35	0.4284765	25.81	22.58	0.4666253	32.26	19.35	0.3749273
E-3	232	45.16	19.36	0.300062	32.26	25.8	0.4443679	29.03	16.13	0.3571745	22.58	25.81	0.5333747	32.26	19.35	0.3749273
11	234	32.26	32.26	0.5	25.81	32.25	0.5554599	32.26	12.9	0.285651	22.58	25.81	0.5333747	32.26	19.35	0.3749273
6.3	235	45.16	19.36	0.300062	29.03	29.03	0.5	29.03	16.13	0.3571745	25.81	22.58	0.4666253	29.03	22.58	0.4375121
7	241	45.16	19.36	0.300062	29.03	29.03	0.5	22.58	22.58	0.5	25.81	22.58	0.4666253	32.26	19.35	0.3749273
E-4	244	41.94	22.58	0.349969	32.26	25.8	0.4443679	35.48	9.68	0.214349	25.81	22.58	0.4666253	32.26	19.35	0.3749273
12	246	45.16	19.36	0.300062	32.26	25.8	0.4443679	22.58	22.58	0.5	22.58	25.81	0.5333747	29.03	22.58	0.4375121
8	247	45.16	19.36	0.300062	32.26	25.8	0.4443679	25.81	19.35	0.4284765	25.81	22.58	0.4666253	32.26	19.35	0.3749273

Figure 13: J6-J6 Calibration Ratio Data

3 Appendix

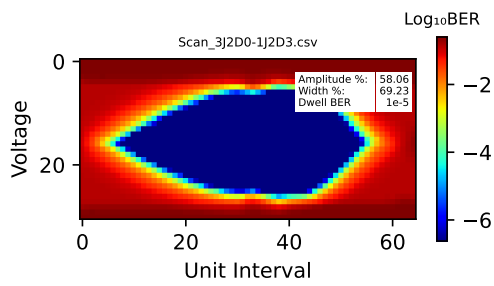
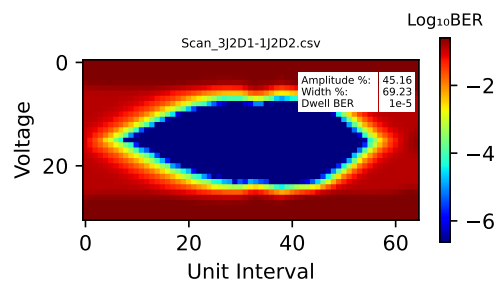
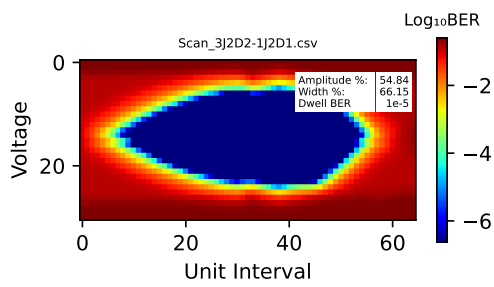
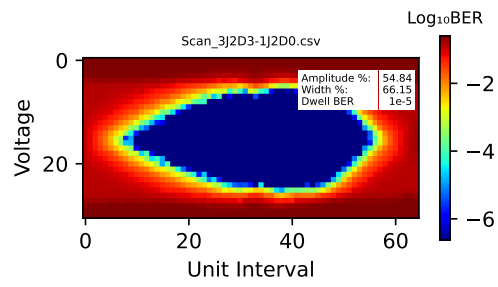
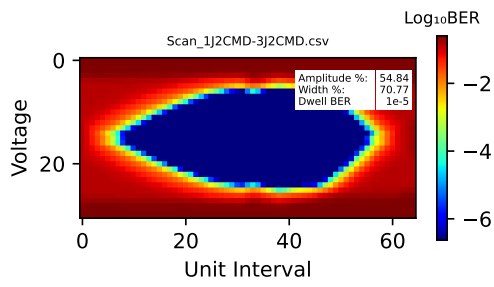
Included below are the eye scan pdf files for each run conducted during the QC process. The 17 summary documents contain eye scan information for the miniDP cables as well as cables B201-B248 tested on the J2, J4, and J6 connectors.

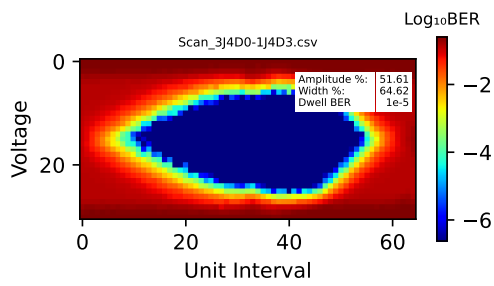
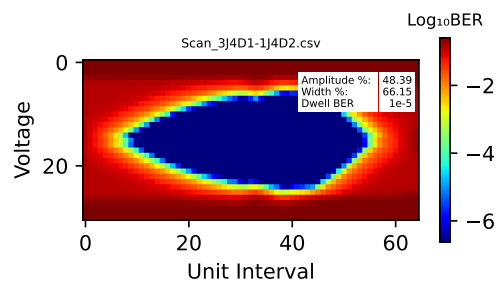
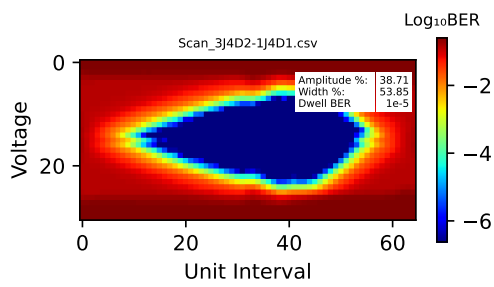
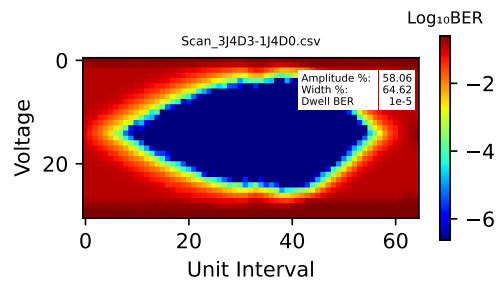
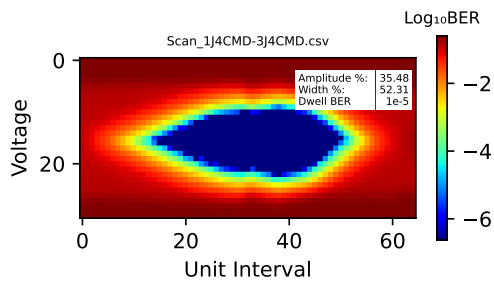
Cable Assignments

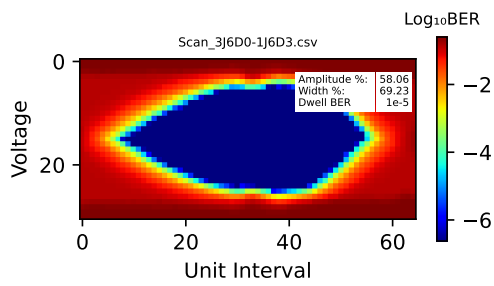
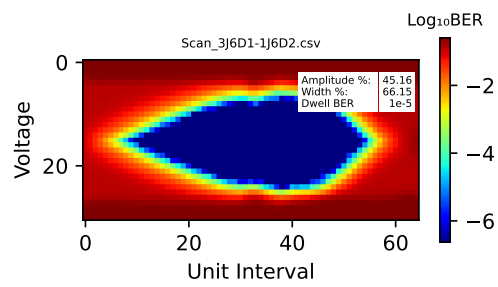
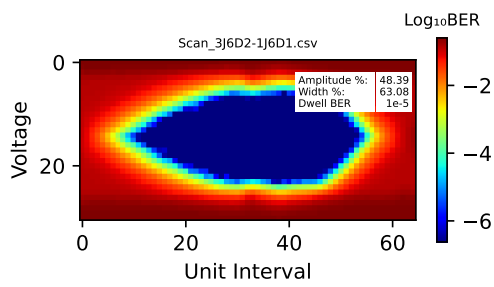
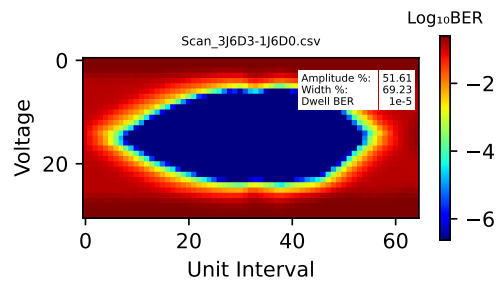
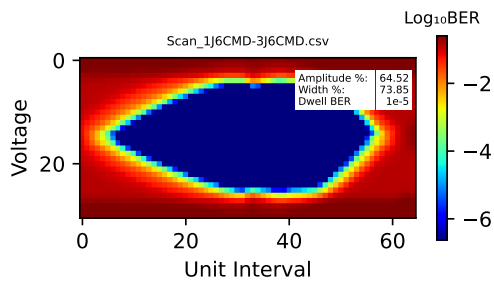
Cable	Run	Port
mDP2	mDP13	J2
mDP4	mDP13	J4
mDP6	mDP13	J6
B201	E-1	J2
B202	R-1	J2
B203	R-9	J2
B204	R-1	J4
B205	E-1	J4
B206	R-1	J6
B207	R-9	J4
B208	E-1	J6
B209	E-2	J4
B210	R-9	J6
B211	R-2	J6
B212	R-2	J2
B213	E-2	J2
B214	E-2	J4
B215	R-3	J4
B216	R-10	J2
B217	R-3	J6
B218	R-3	J2
B219	R-10	J4
B220	E-2	J6
B221	R-4	J4

B222	R-10	J6
B223	R-4	J6
B224	R-2	J2
B225	E-3	J2
B226	E-3	J4
B227	R-5	J4
B228	R-11	J2
B229	R-5	J6
B230	R-5	J2
B231	R-11	J4
B232	E-3	J6
B233	R-6.3	J4
B234	R-11	J6
B235	R-6.3	J6
B236	R-6.3	J2
B237	E-4	J2
B238	E-4	J4
B239	R-7	J4
B240	R-12	J2
B241	R-7	J6
B242	R-7	J2
B243	R-12	J4
B244	E-4	J6
B245	R-8	J4
B246	R-12	J6
B247	R-8	J6
B248	R-8	J2

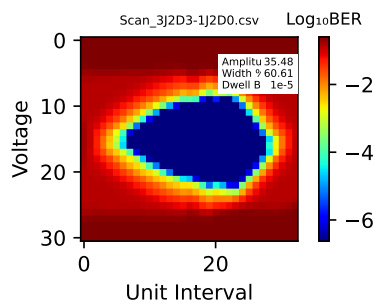
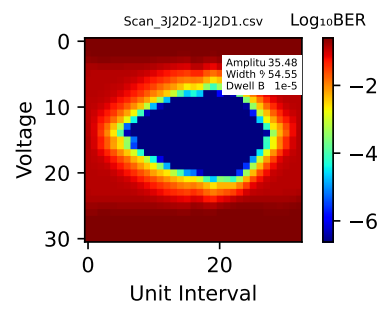
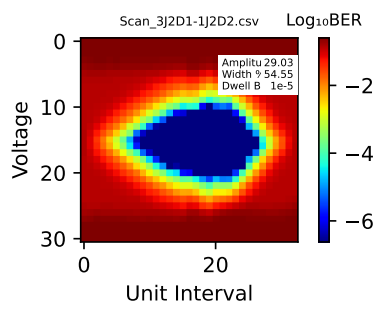
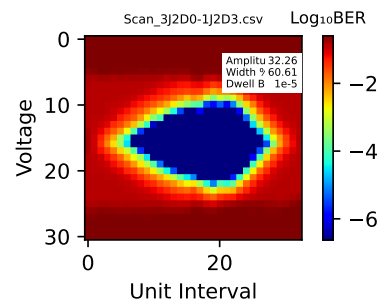
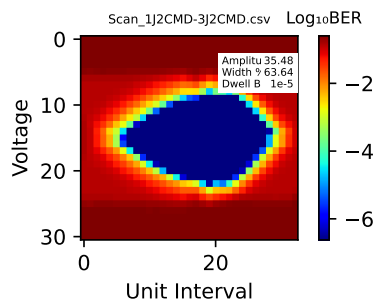
miniDP13-full-20230622 Calibration Summary

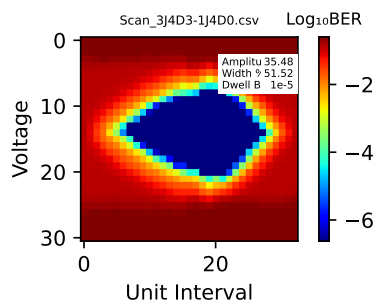
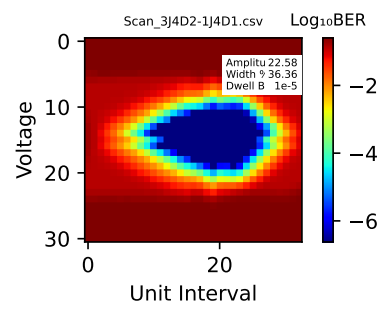
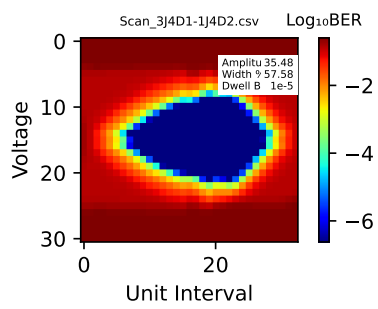
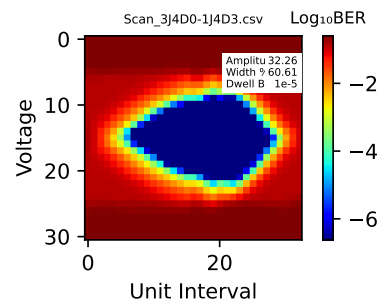
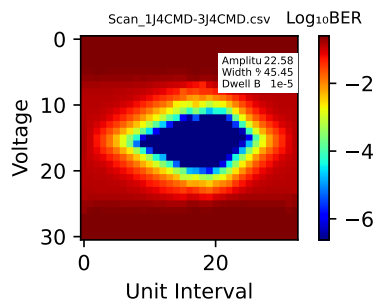


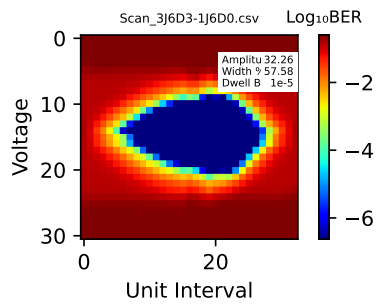
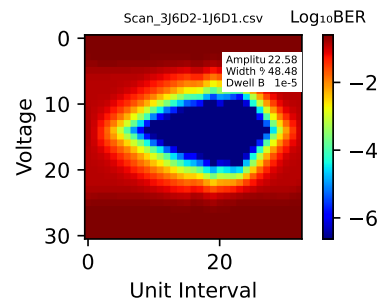
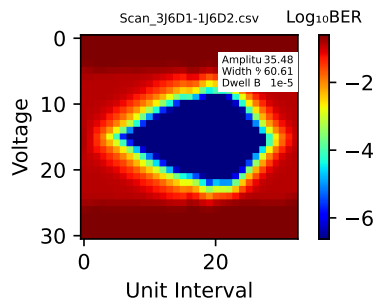
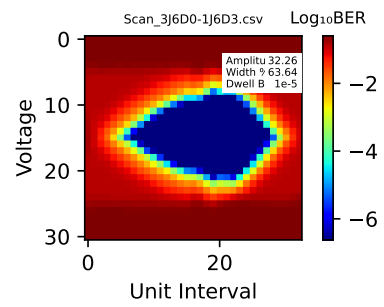
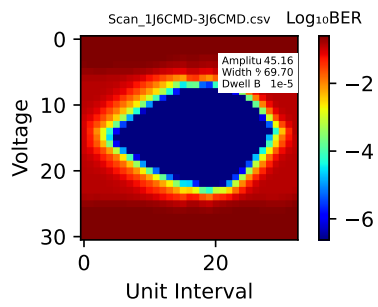




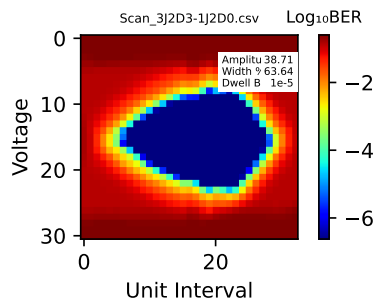
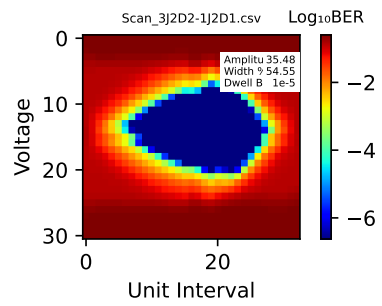
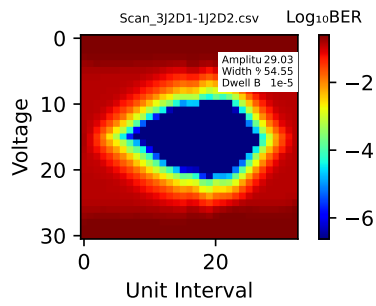
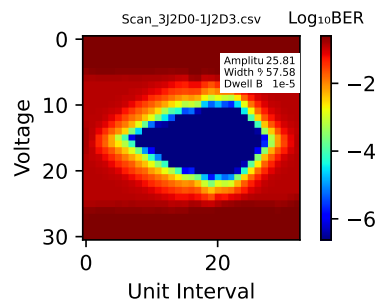
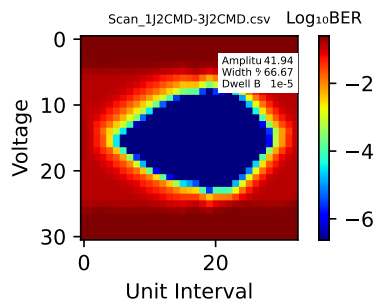
DP13_J246_run1 Calibration Summary

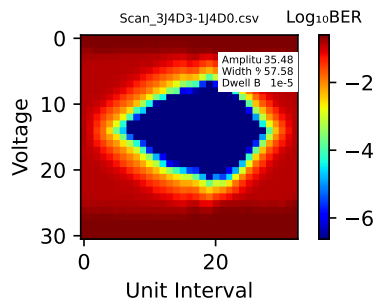
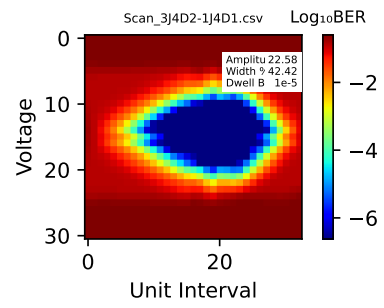
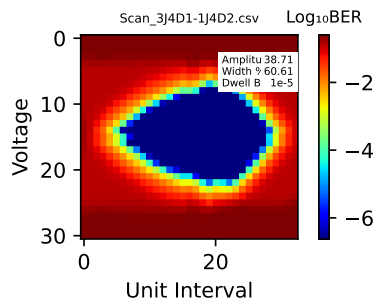
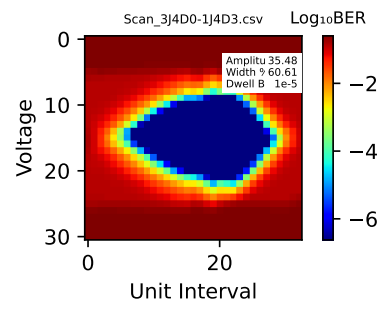
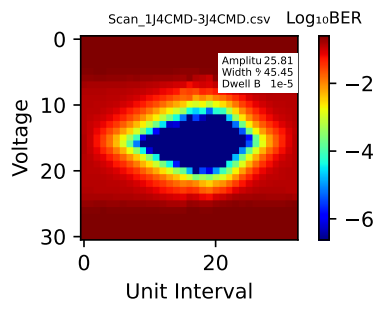


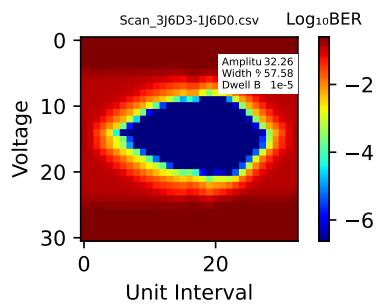
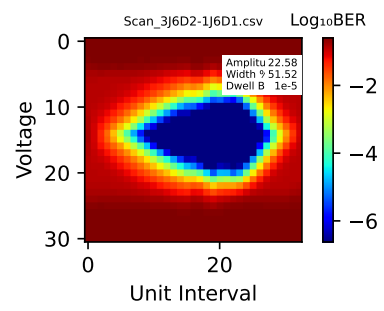
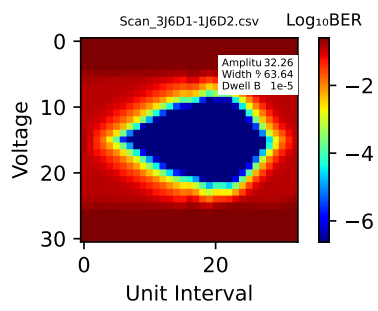
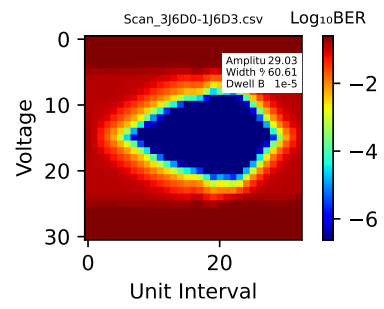
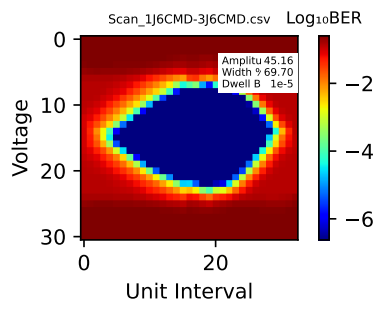




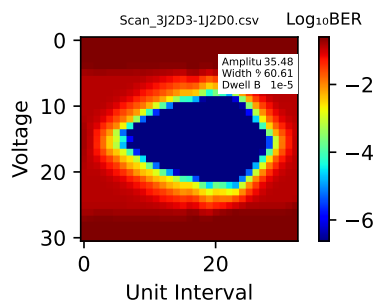
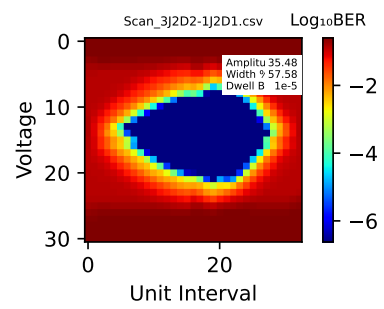
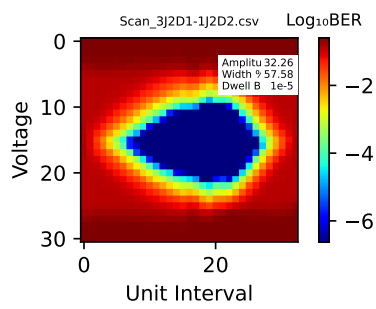
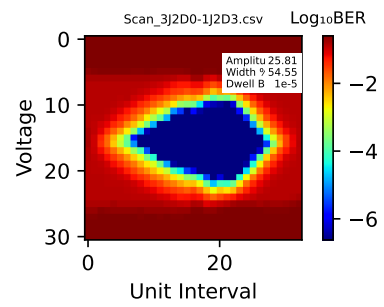
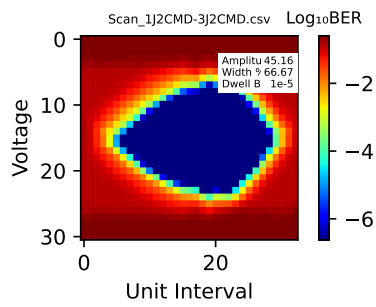
DP13_J246_run2 Calibration Summary

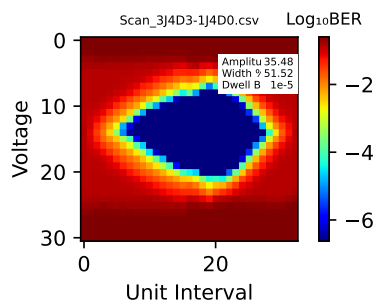
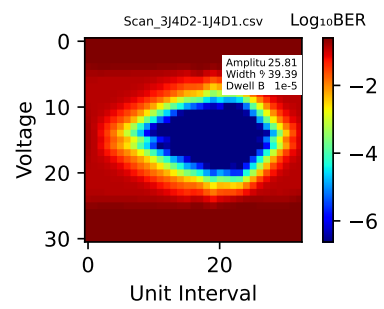
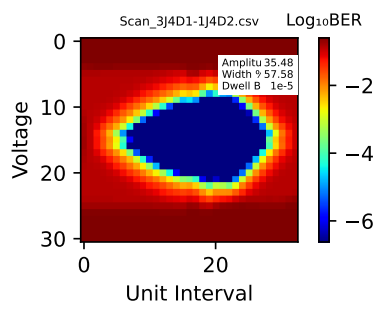
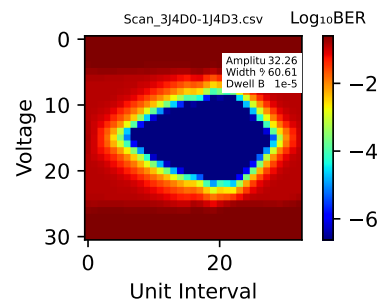
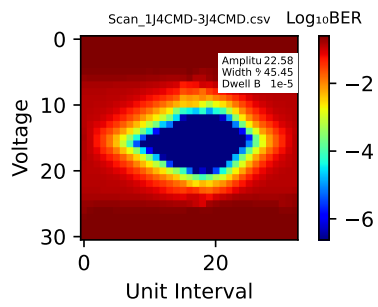


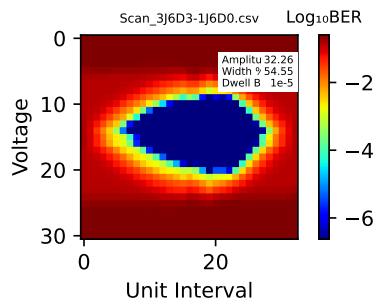
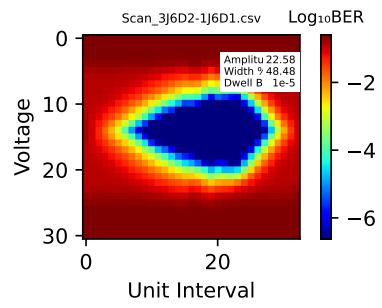
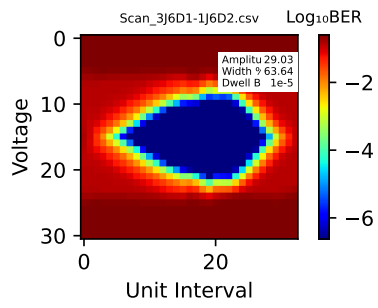
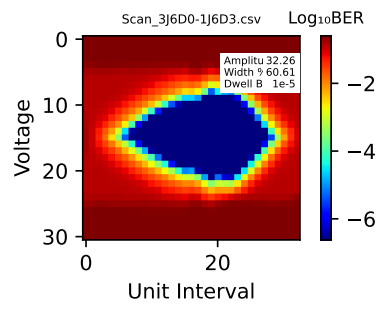
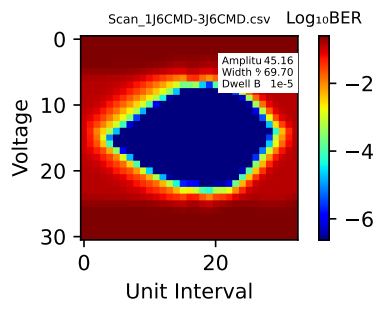




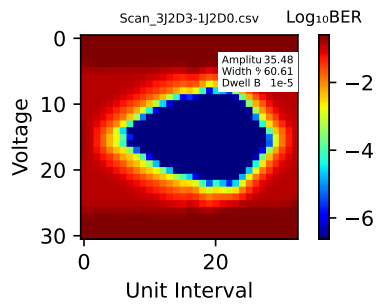
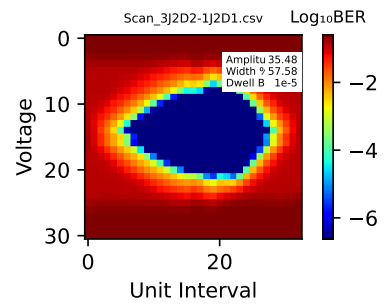
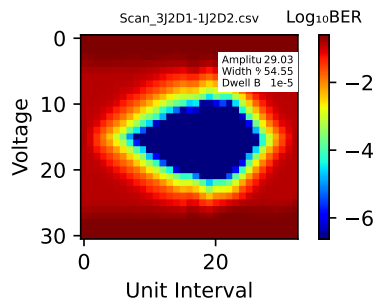
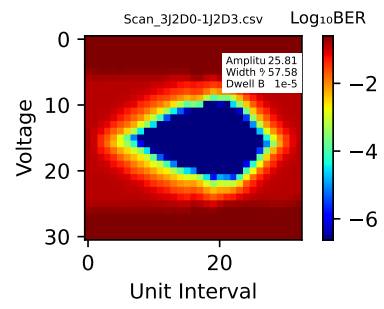
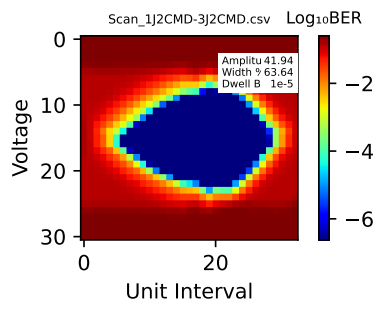
DP13_J246_run3 Calibration Summary

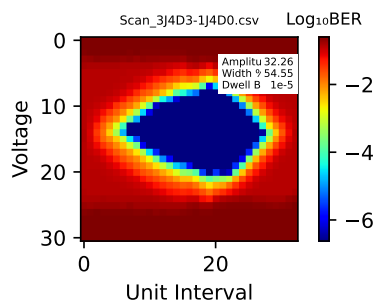
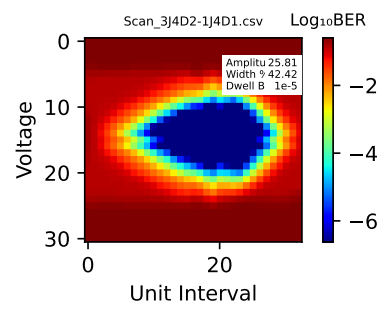
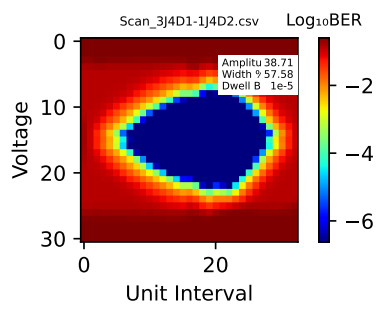
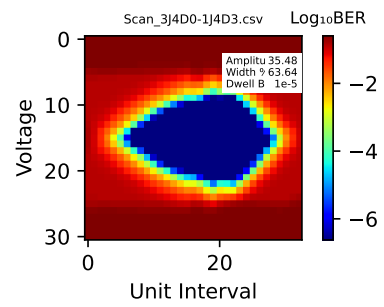
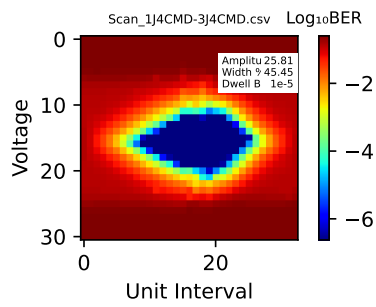


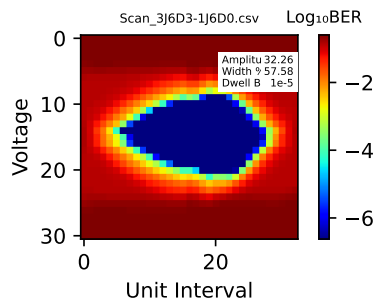
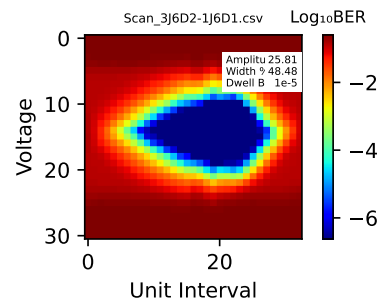
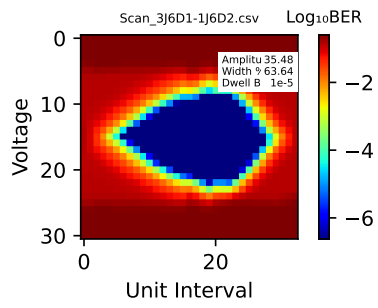
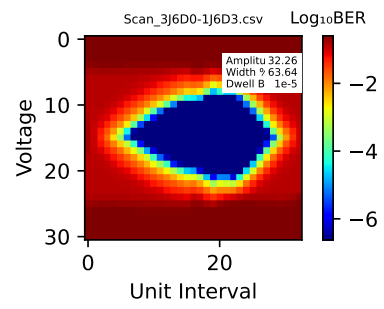
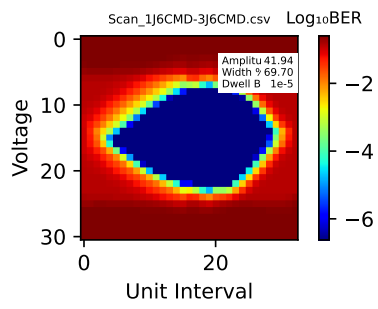




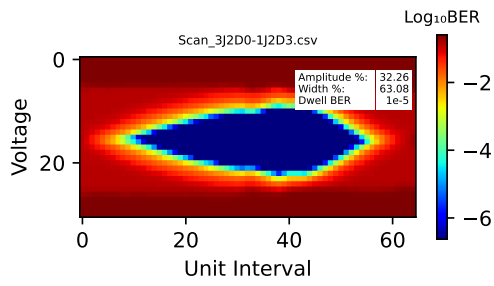
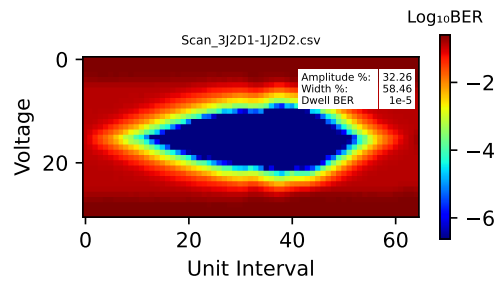
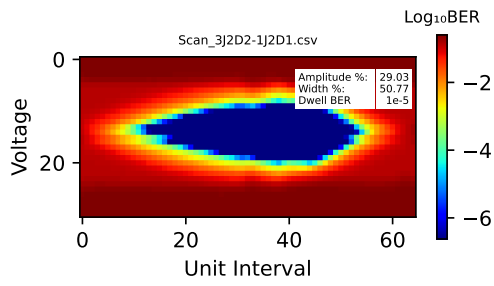
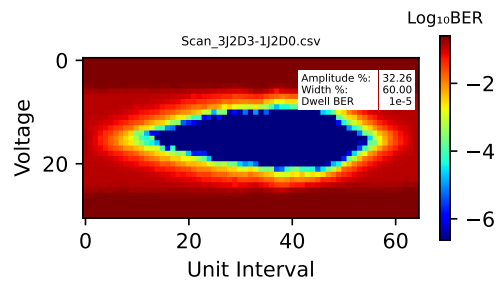
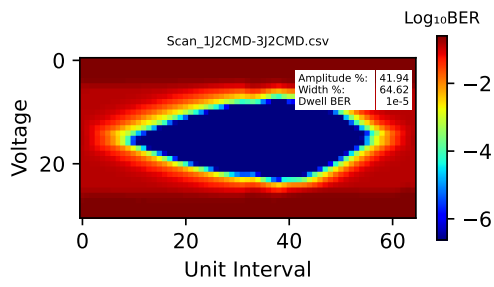
DP13_J246_run4 Calibration Summary

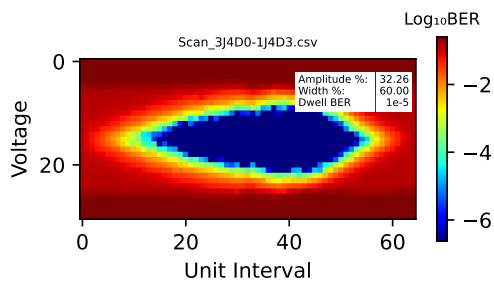
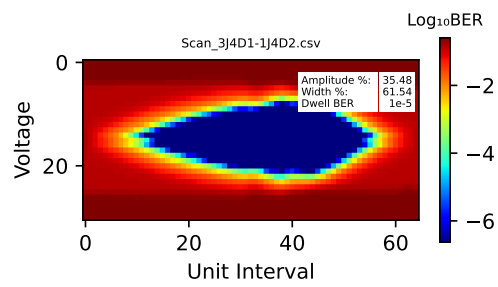
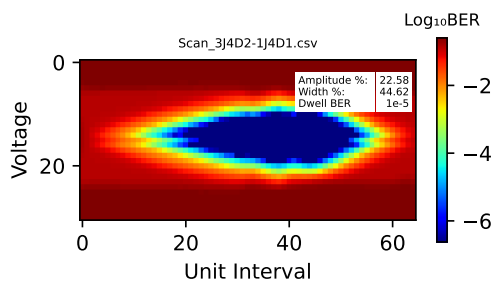
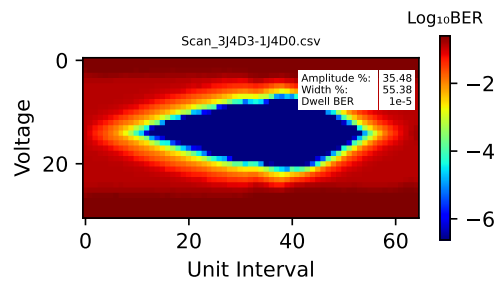
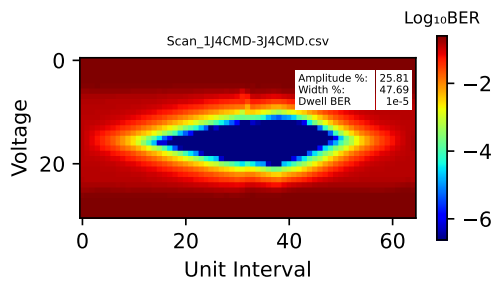


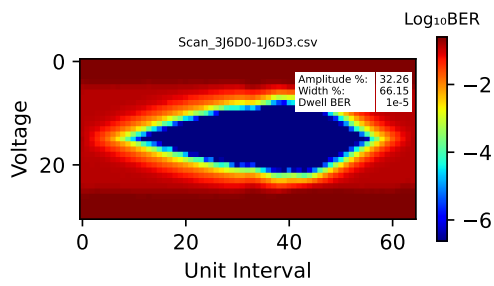
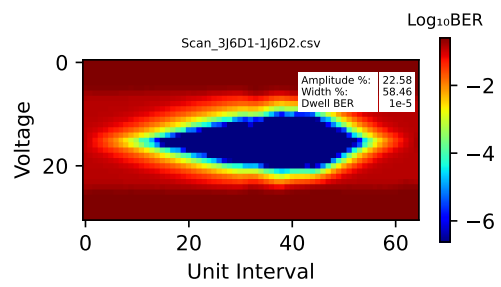
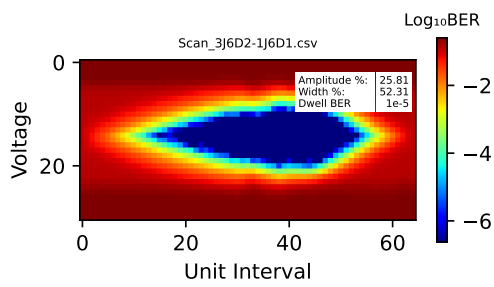
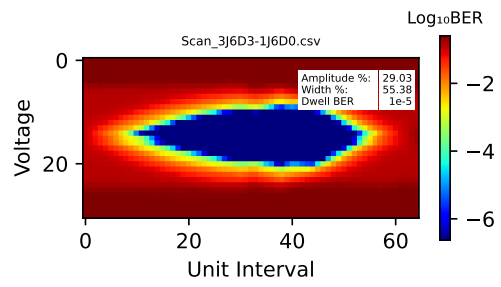
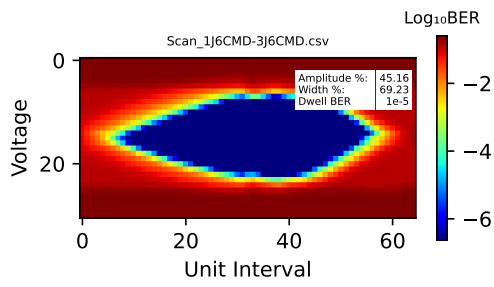




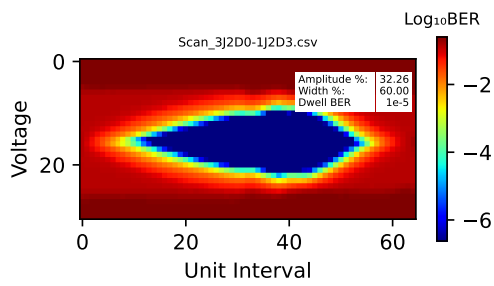
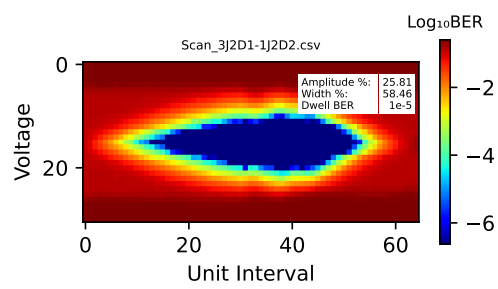
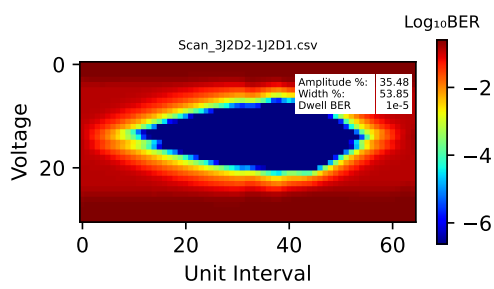
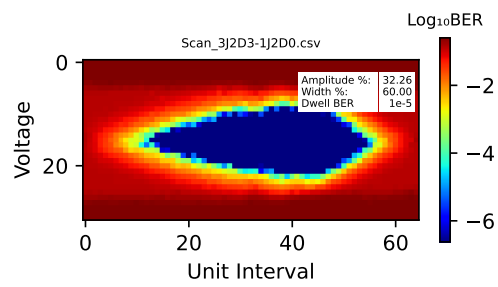
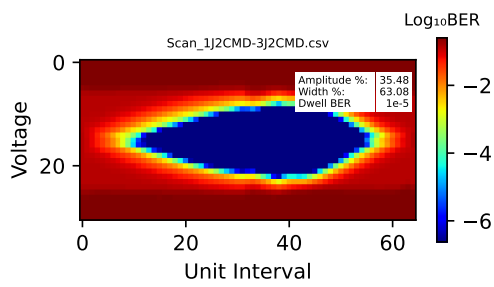
DP13-run1-20230622 Calibration Summary

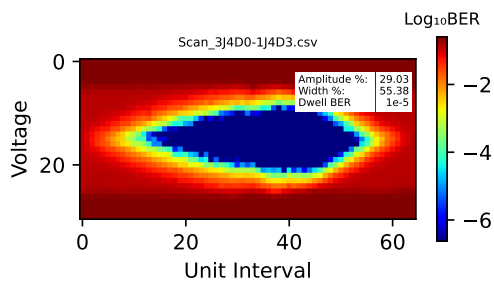
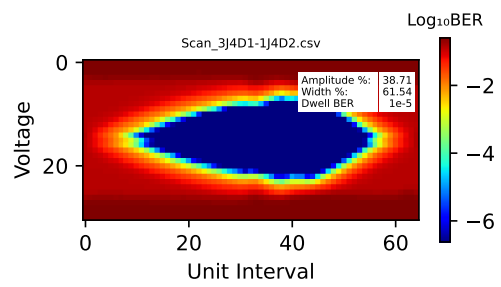
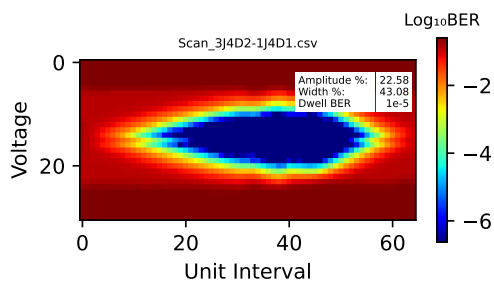
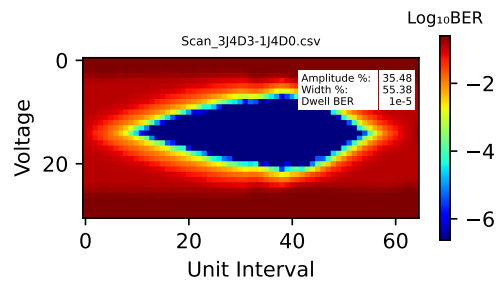
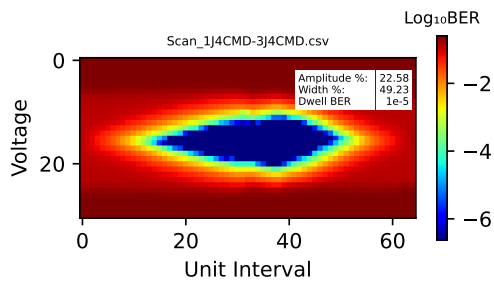


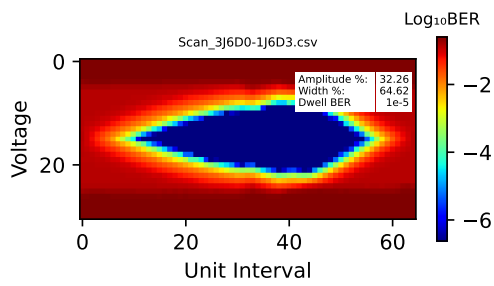
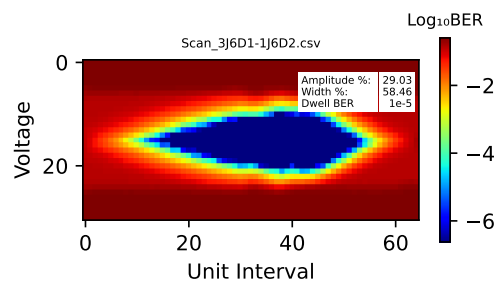
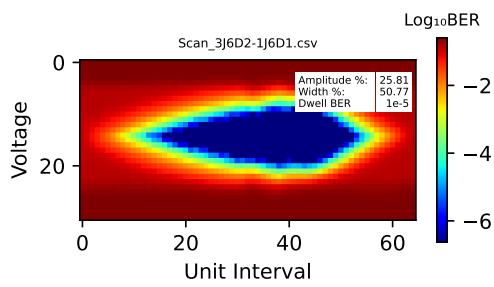
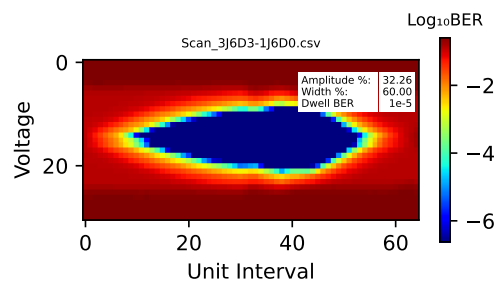
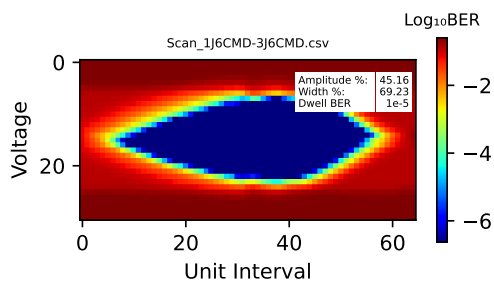




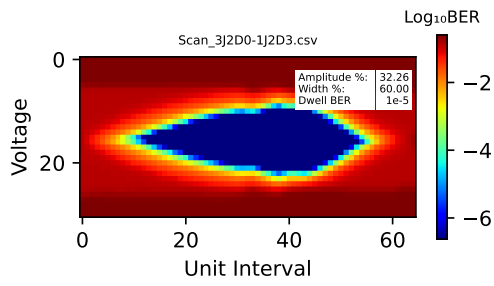
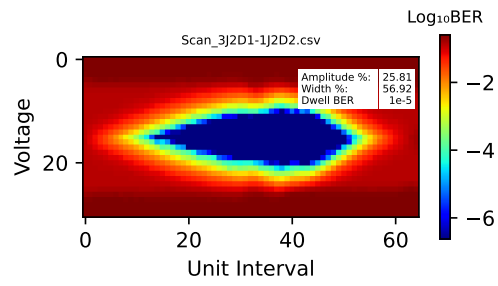
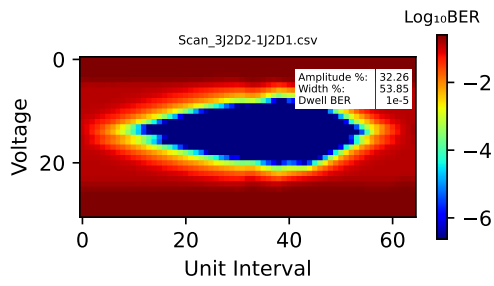
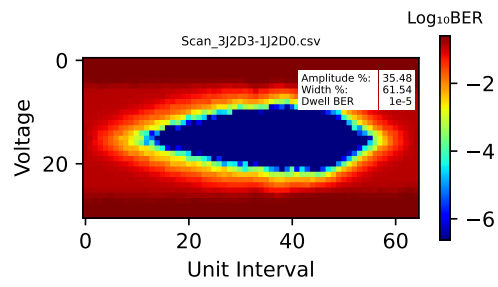
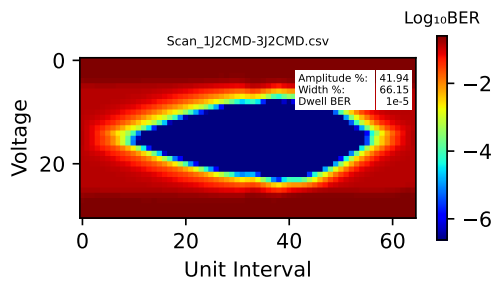
DP13-run2-20230622 Calibration Summary

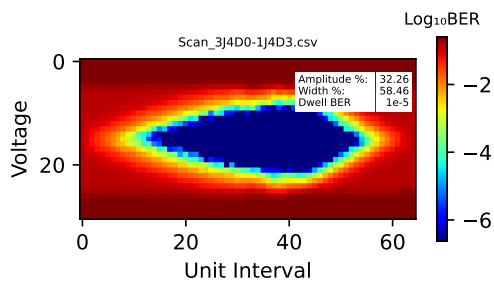
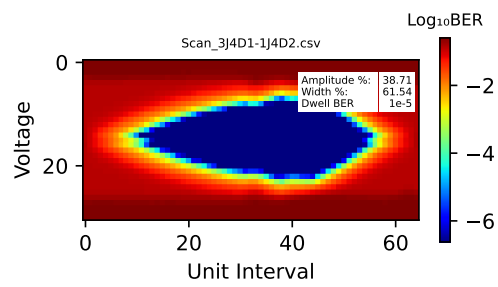
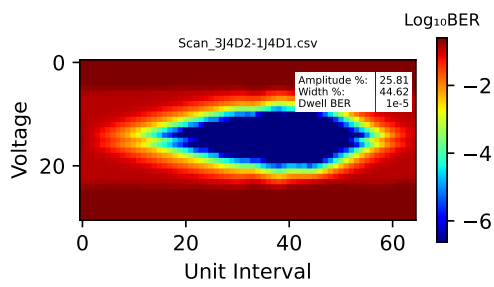
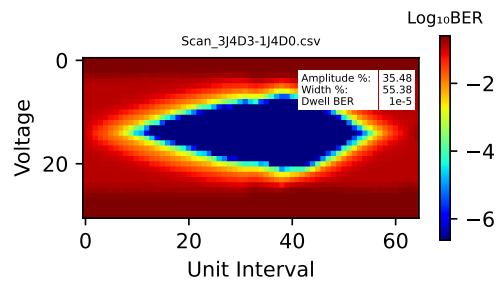
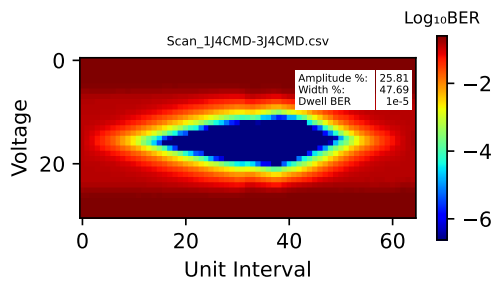


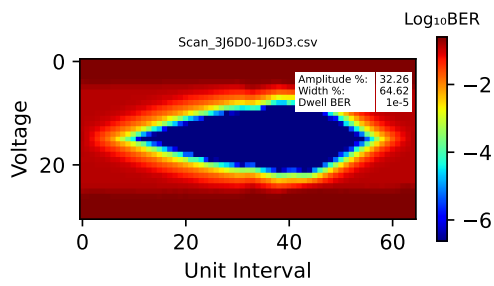
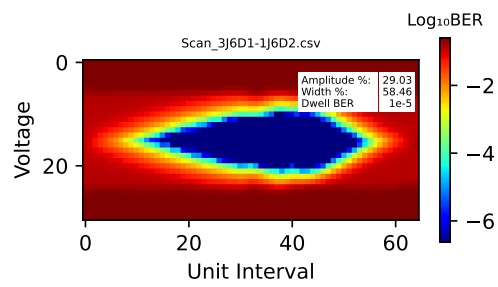
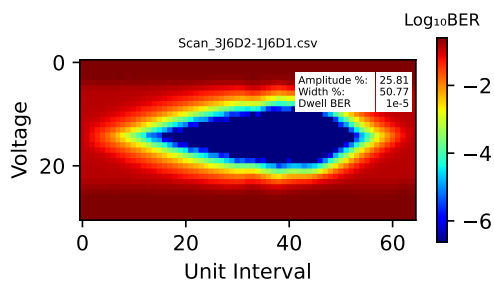
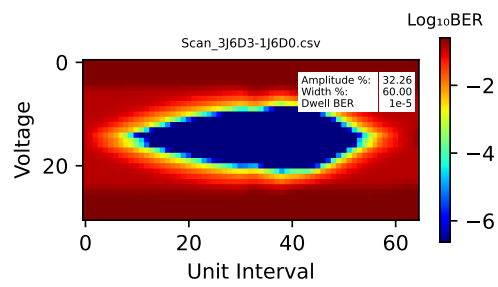
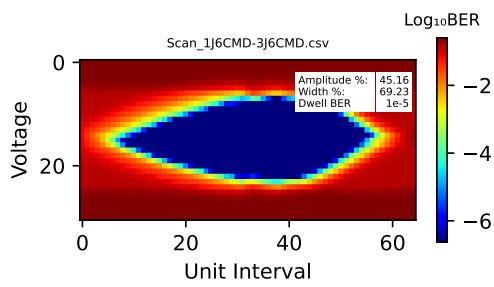




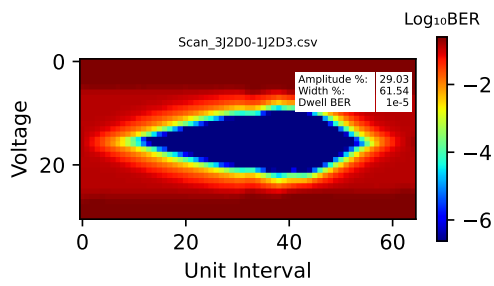
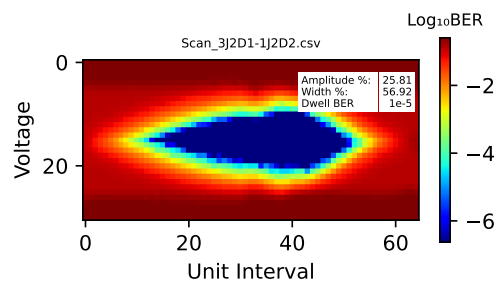
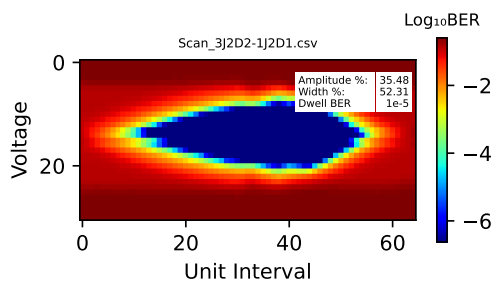
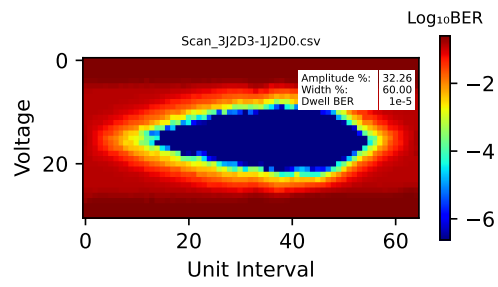
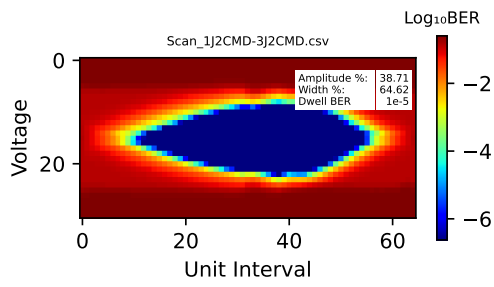
DP13-run3-20230622 Calibration Summary

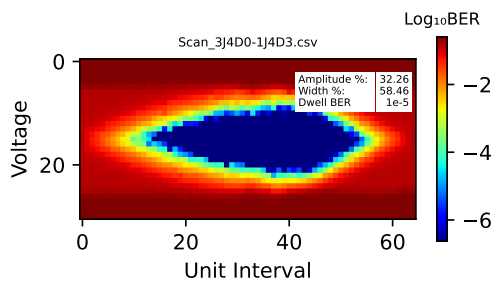
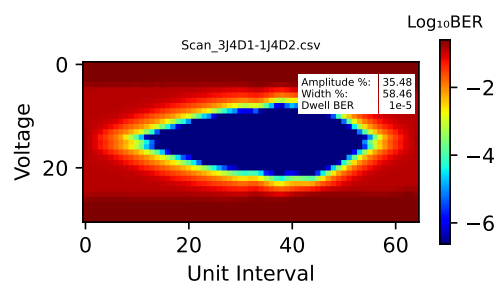
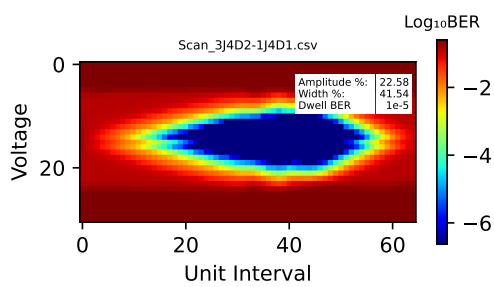
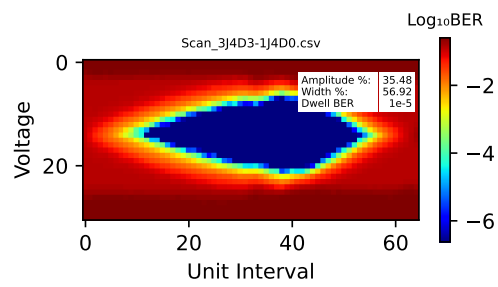
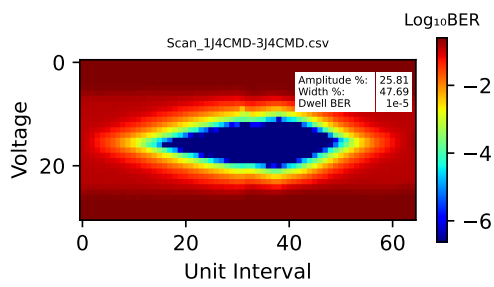


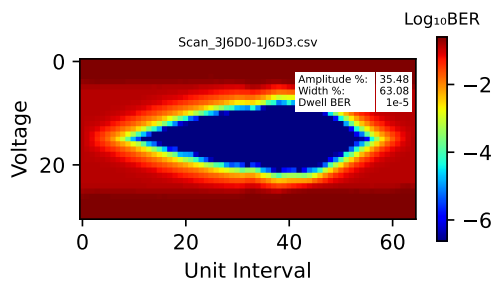
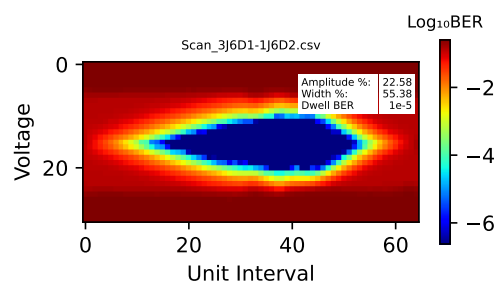
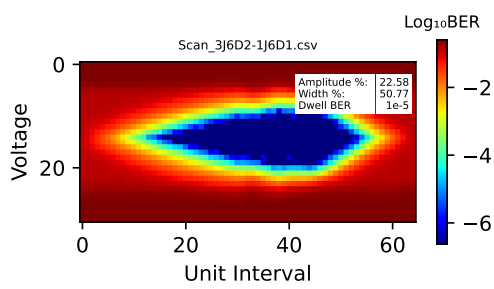
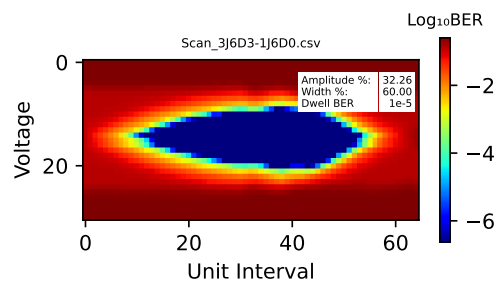
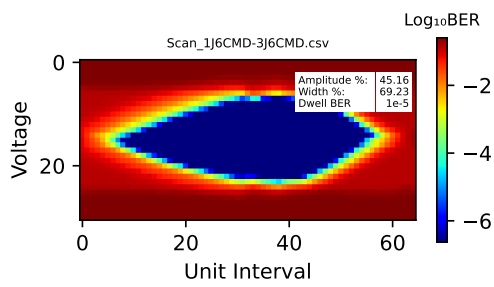




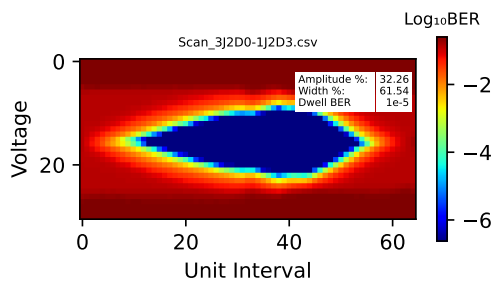
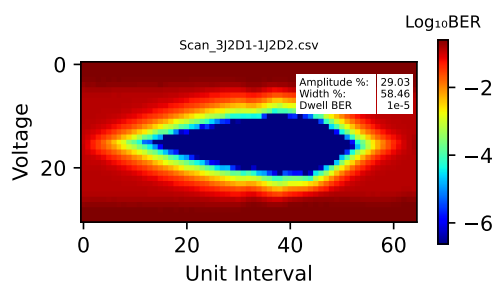
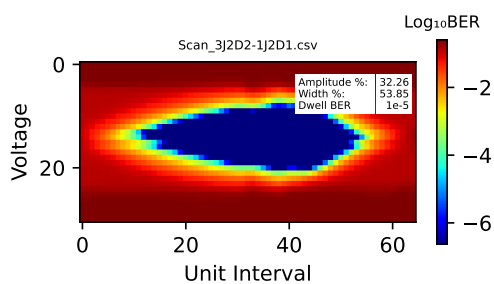
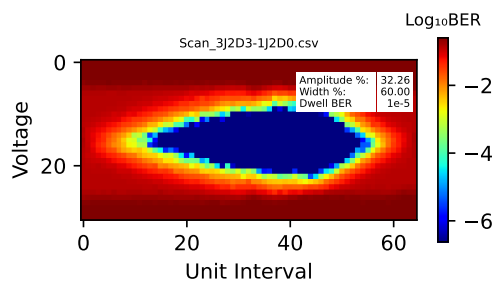
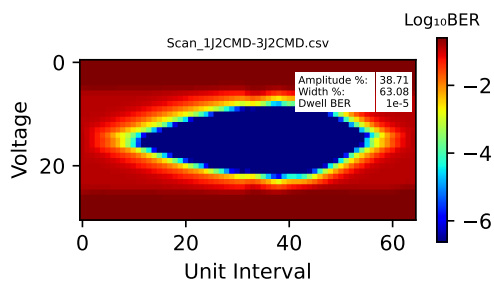
DP13-run4-20230623 Calibration Summary

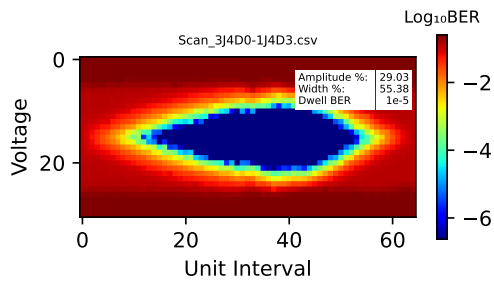
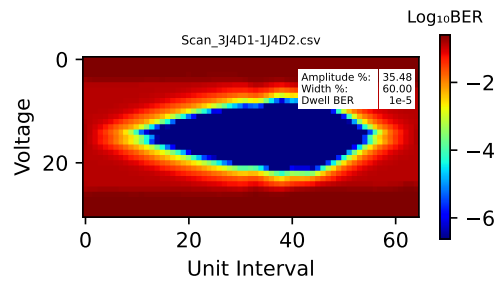
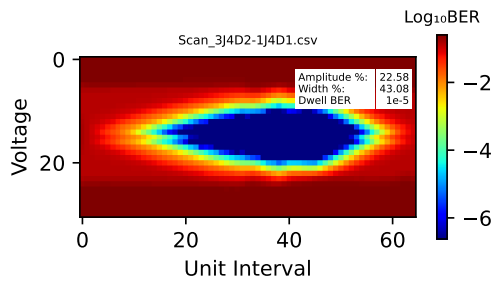
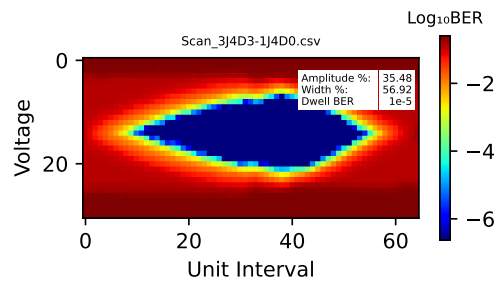
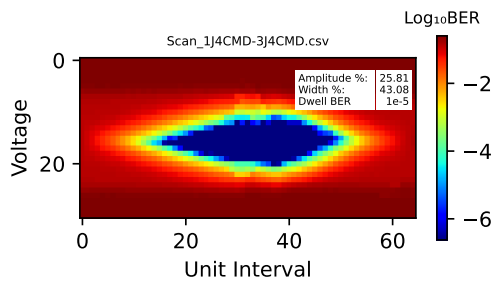


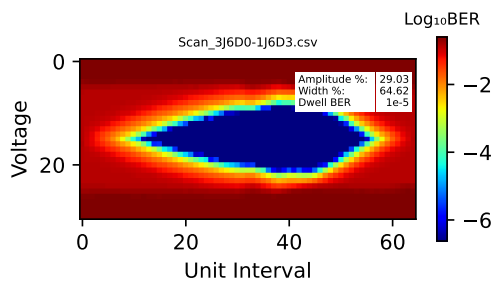
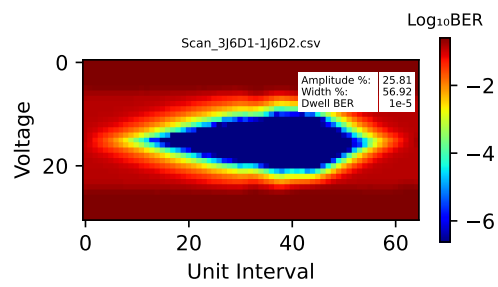
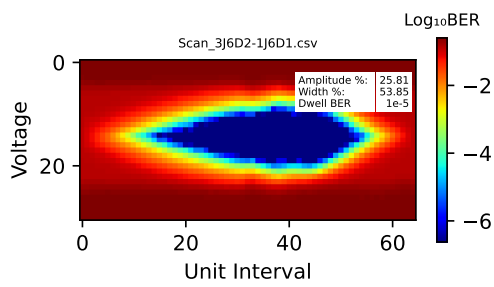
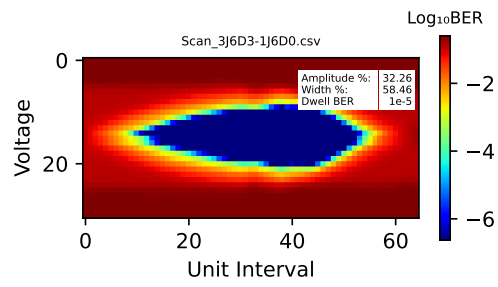
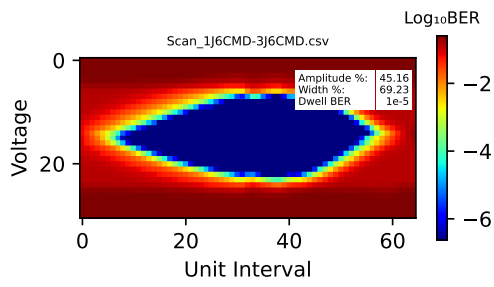




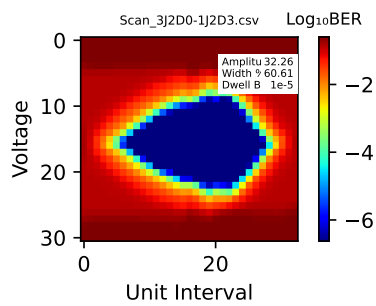
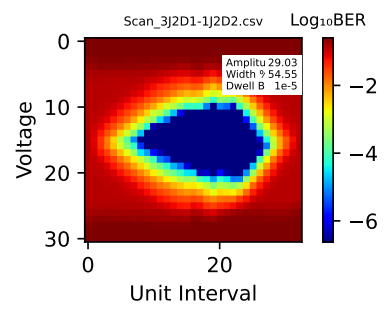
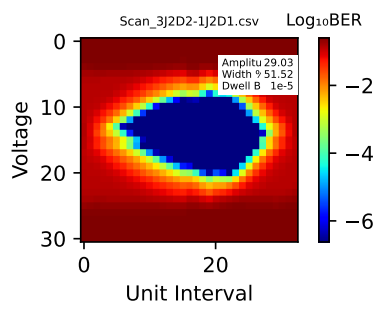
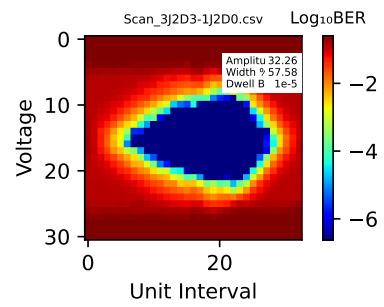
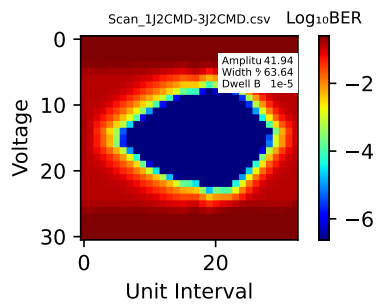
DP13-run5-20230623 Calibration Summary

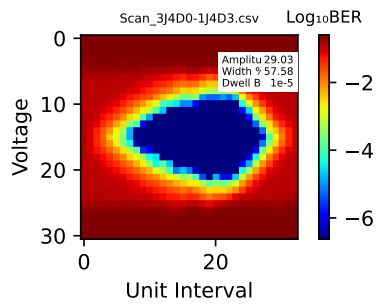
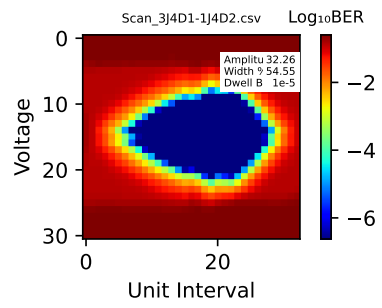
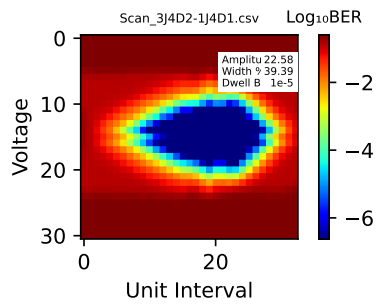
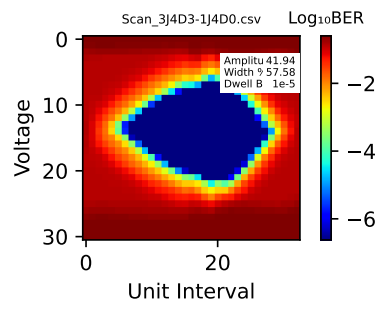
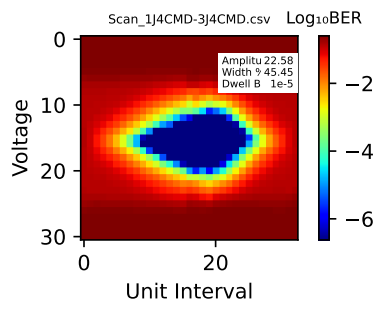


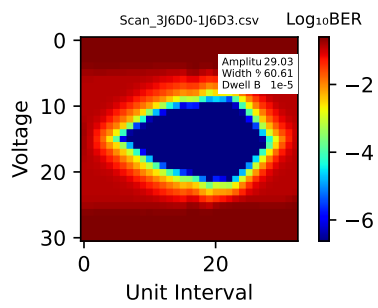
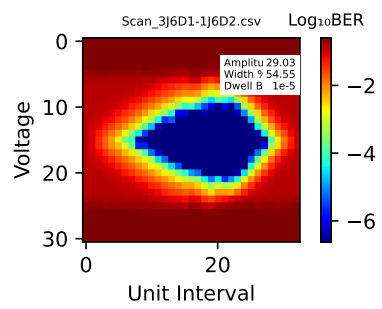
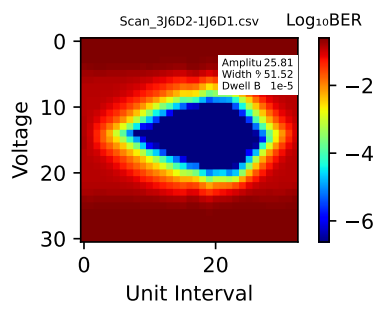
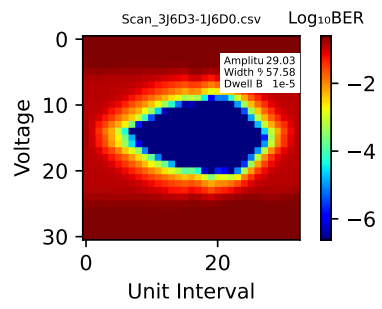
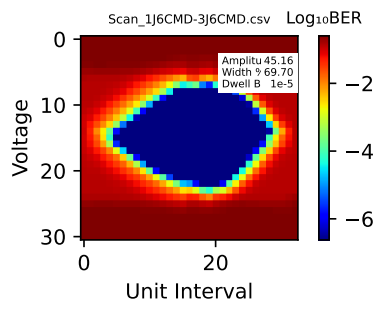




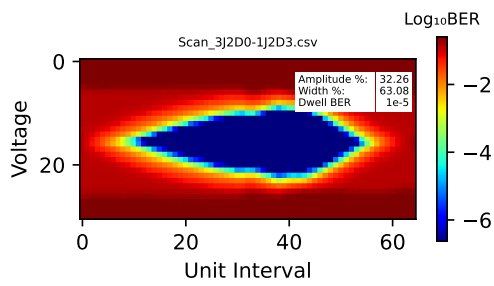
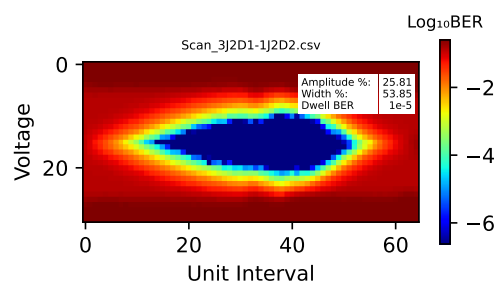
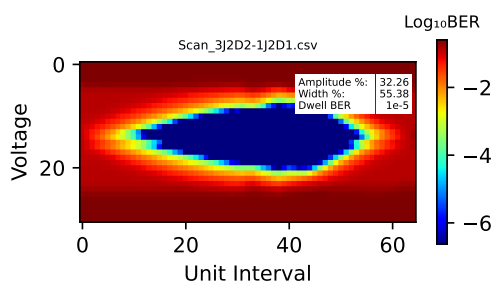
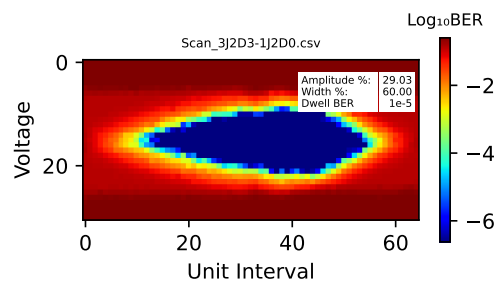
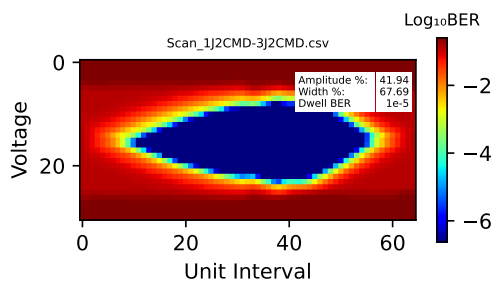
DP13-run6-3-20230626 Calibration Summary

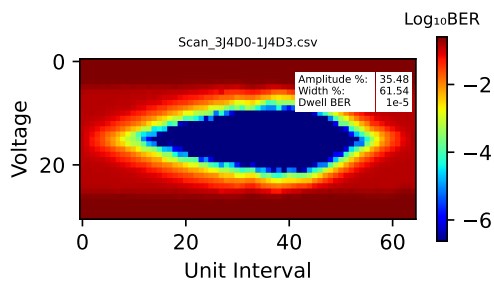
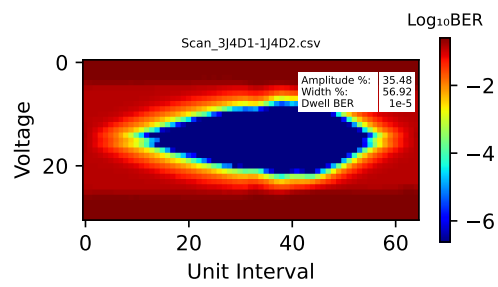
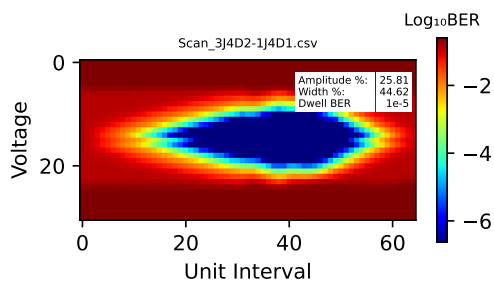
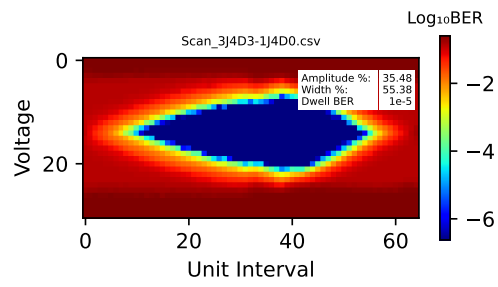
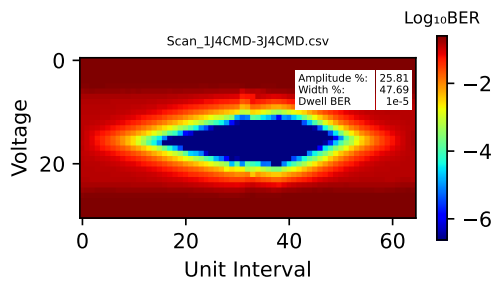


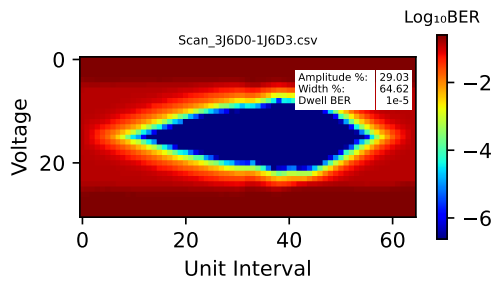
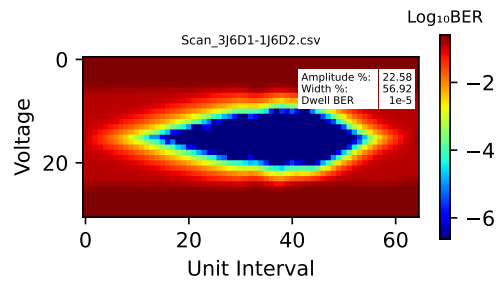
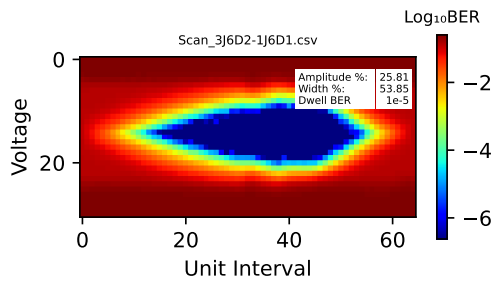
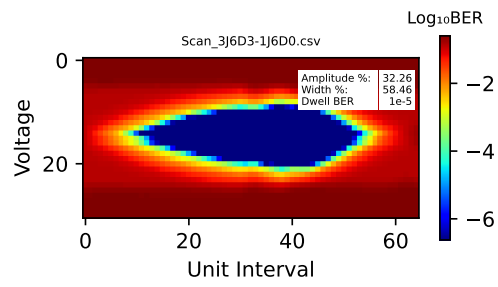
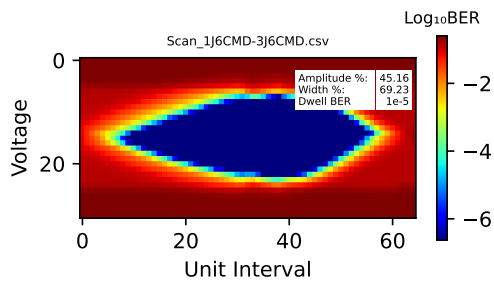




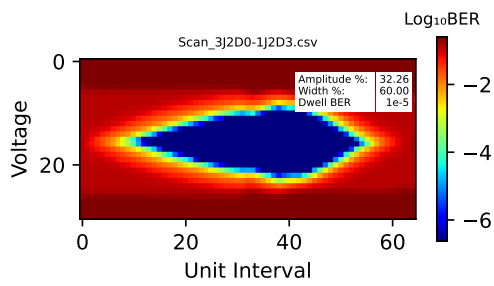
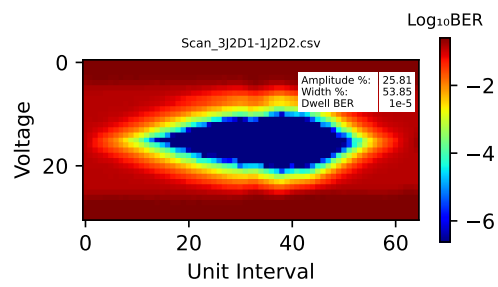
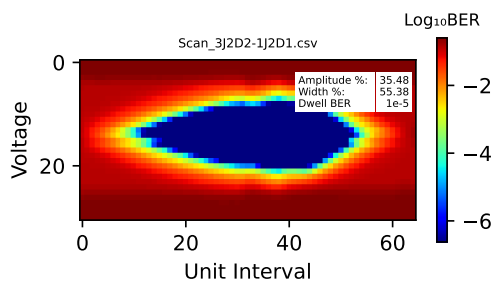
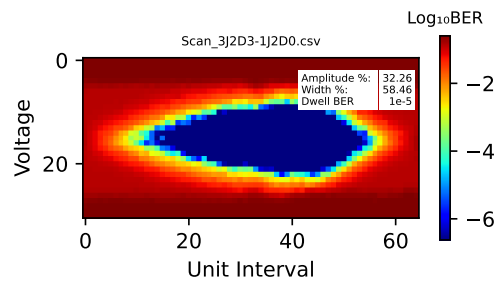
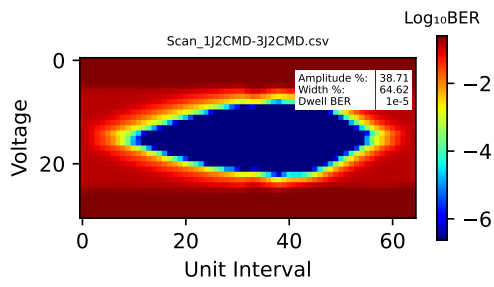
DP13-run7-20230623 Calibration Summary

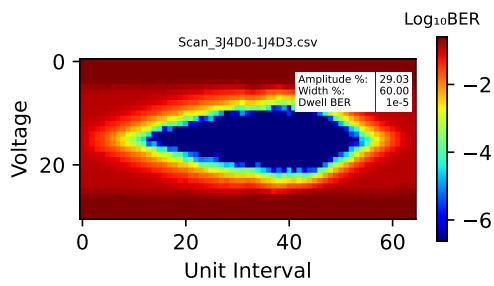
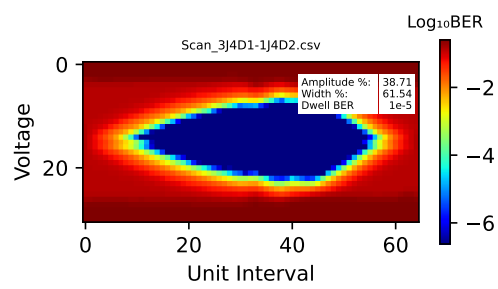
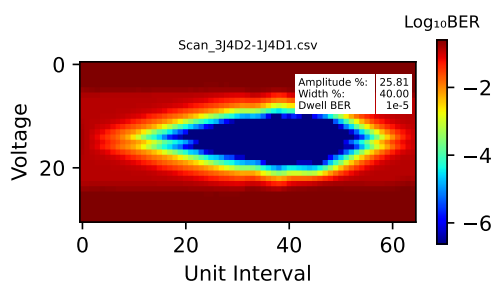
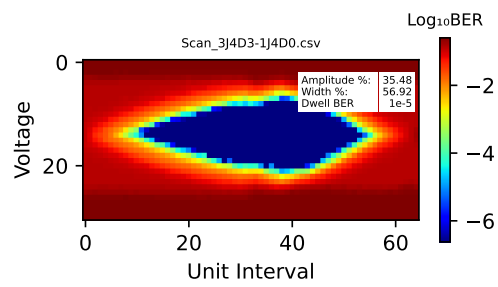
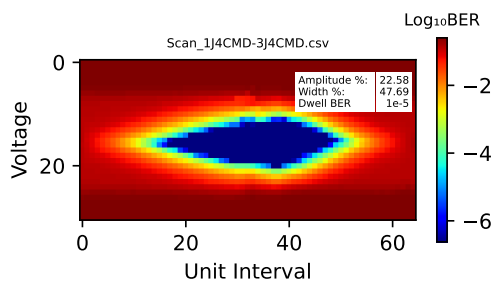


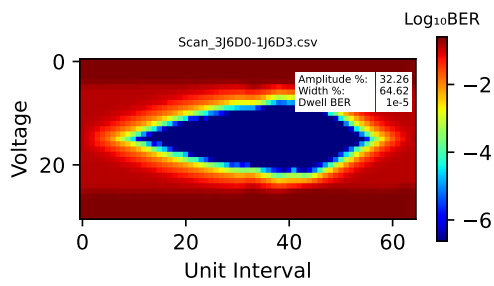
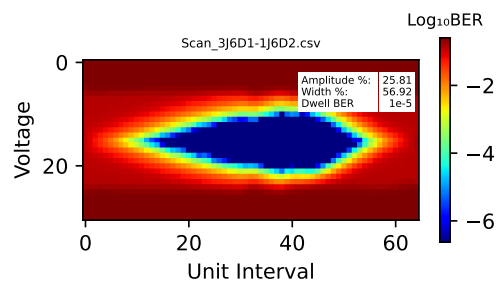
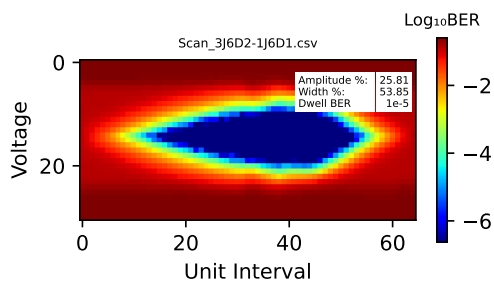
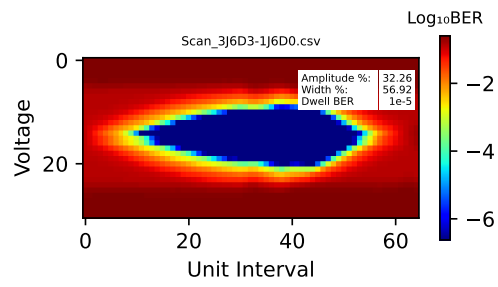
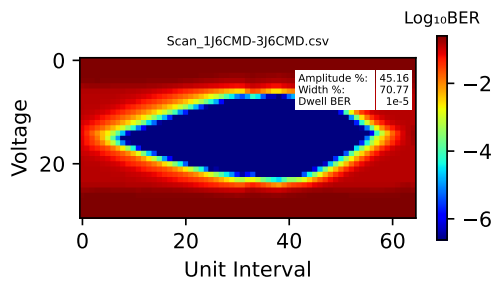




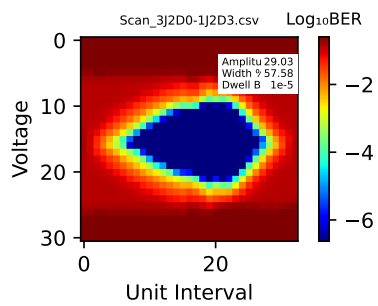
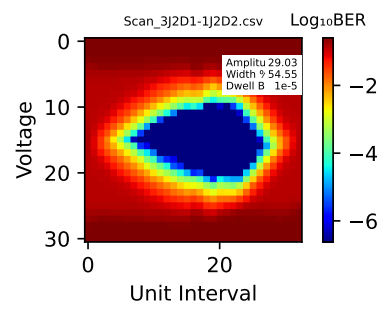
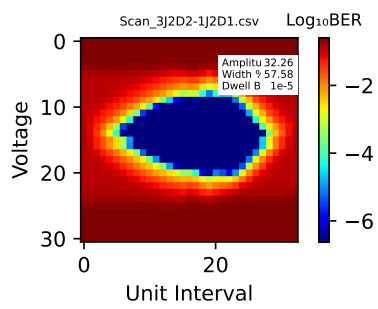
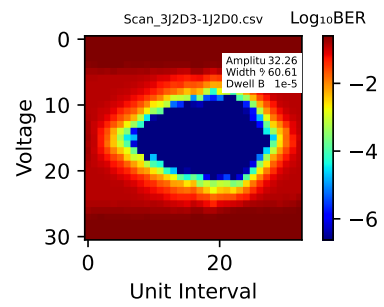
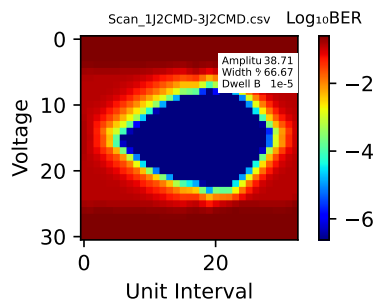
DP13-run8-20230623 Calibration Summary

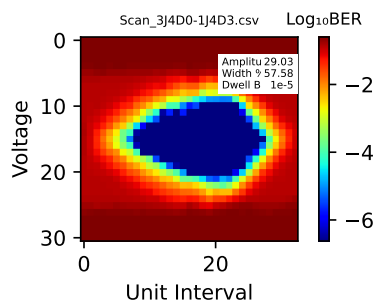
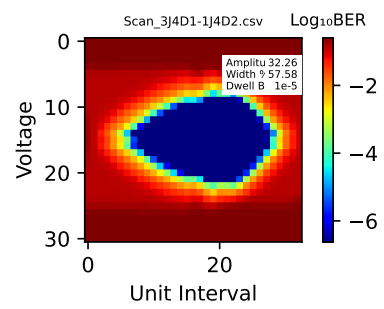
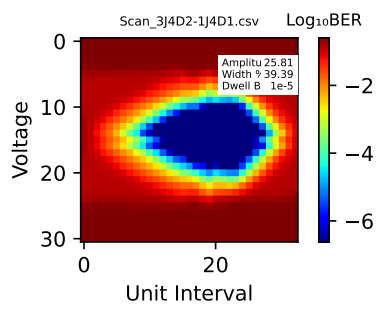
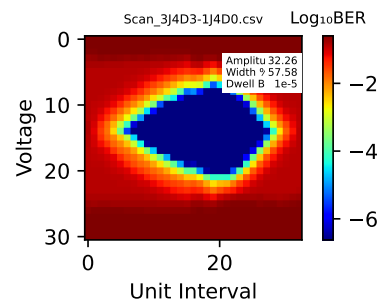
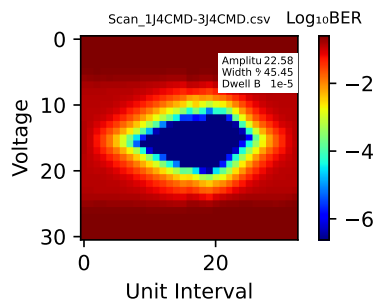


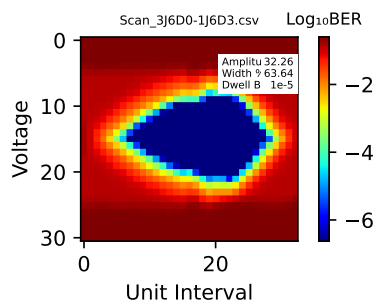
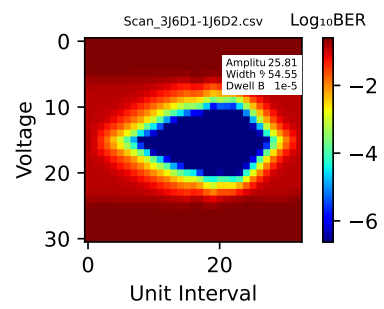
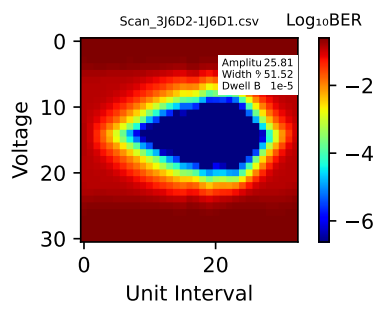
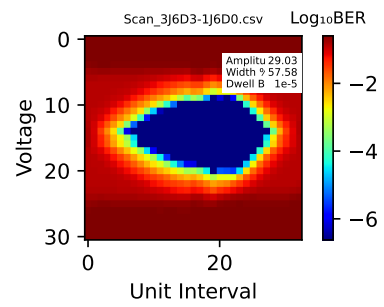
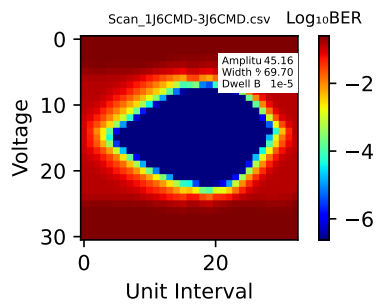




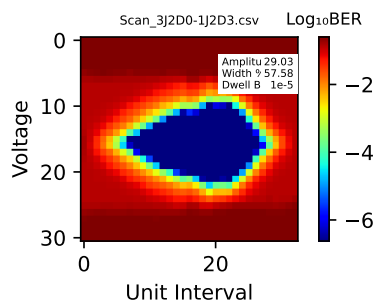
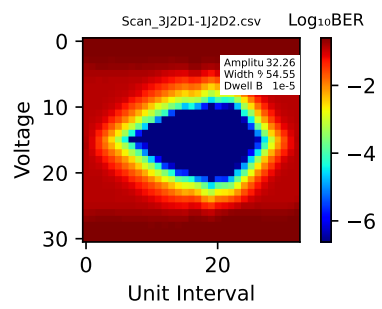
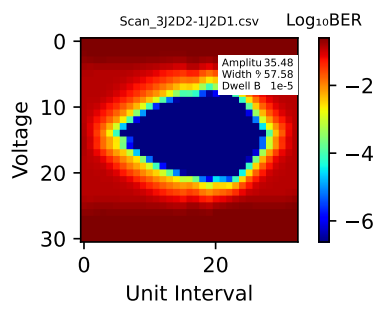
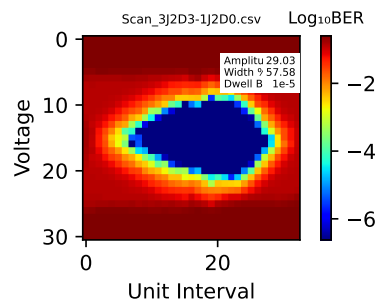
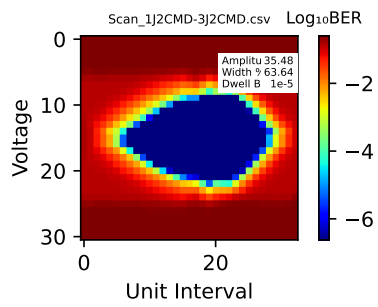
DP13-run9-20230630 Calibration Summary

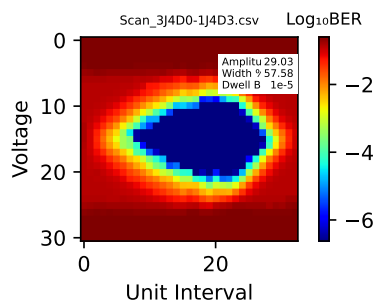
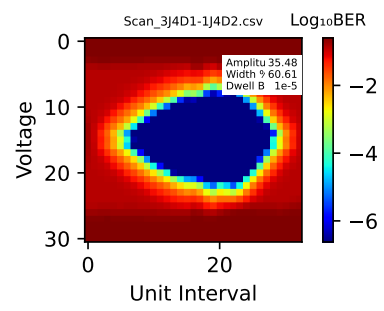
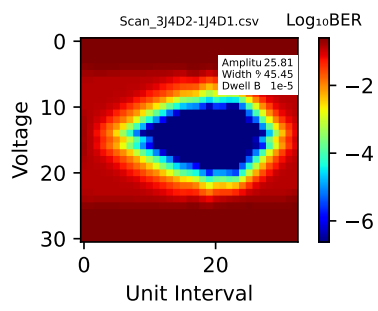
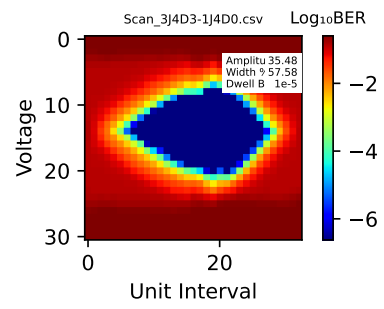
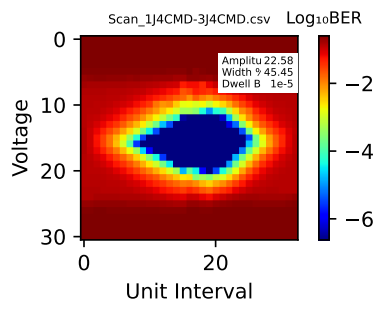


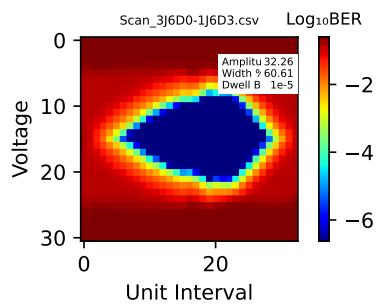
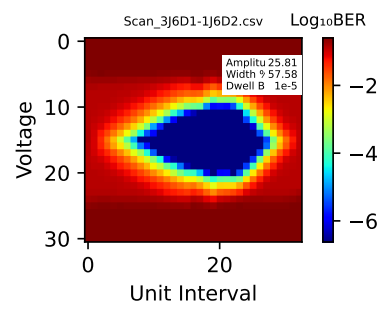
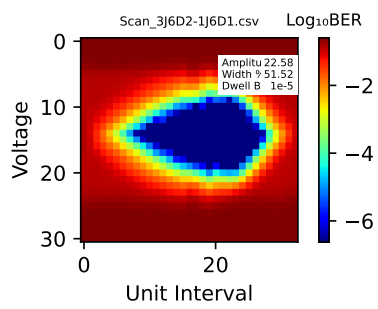
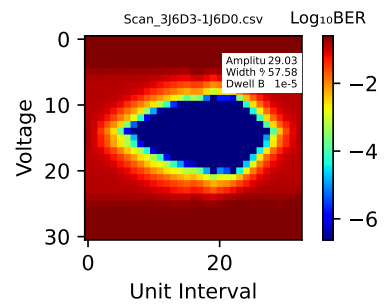
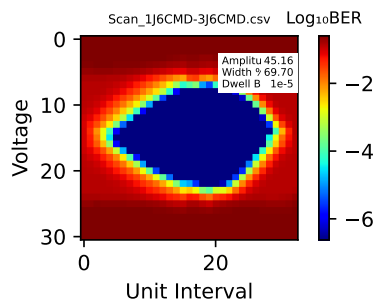




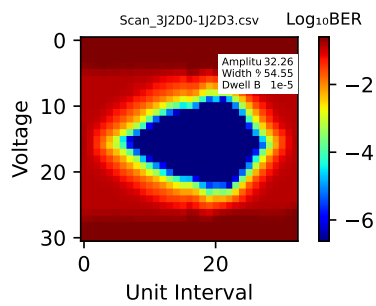
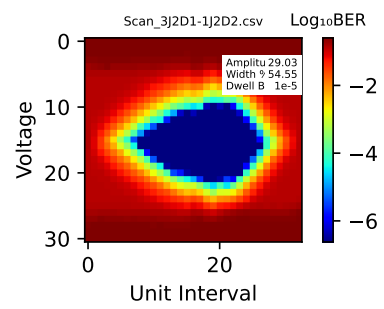
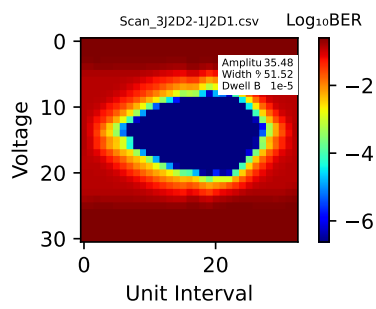
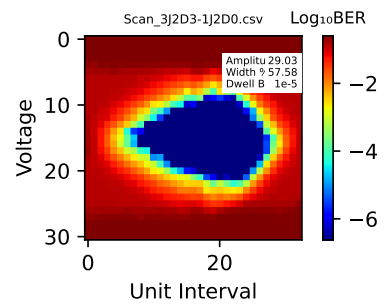
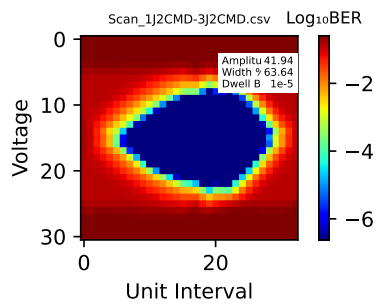
DP13-run10-20230630 Calibration Summary

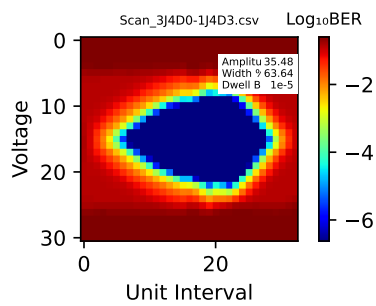
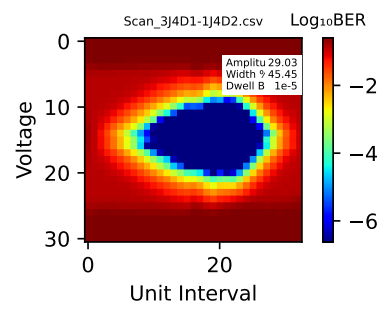
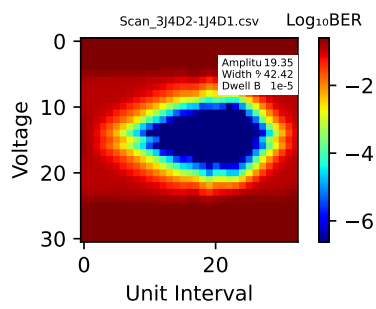
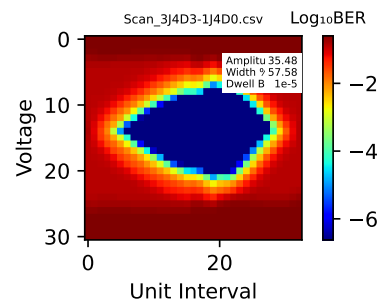
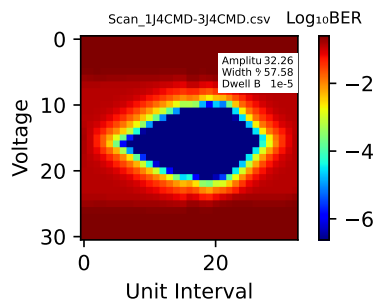


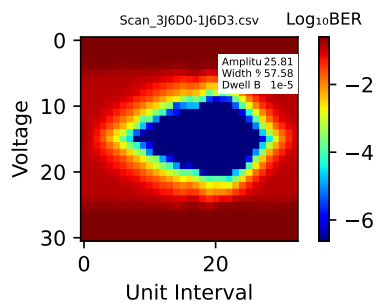
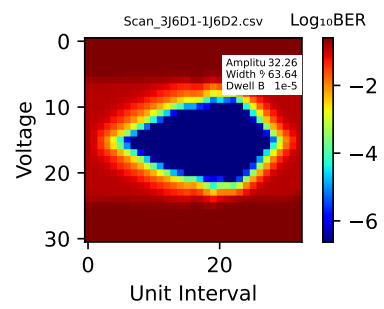
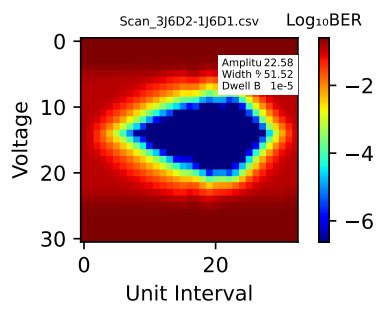
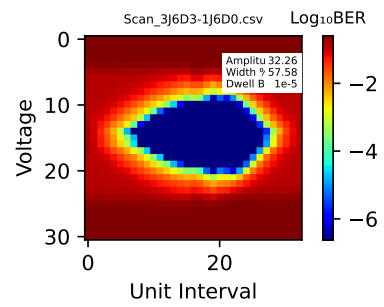
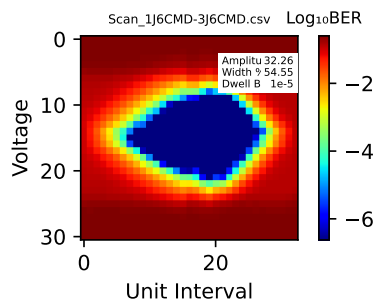




DP13-run11-20230630 Calibration Summary







DP13-run12-20230630 Calibration Summary

