

Appendix

1 Wobbling test

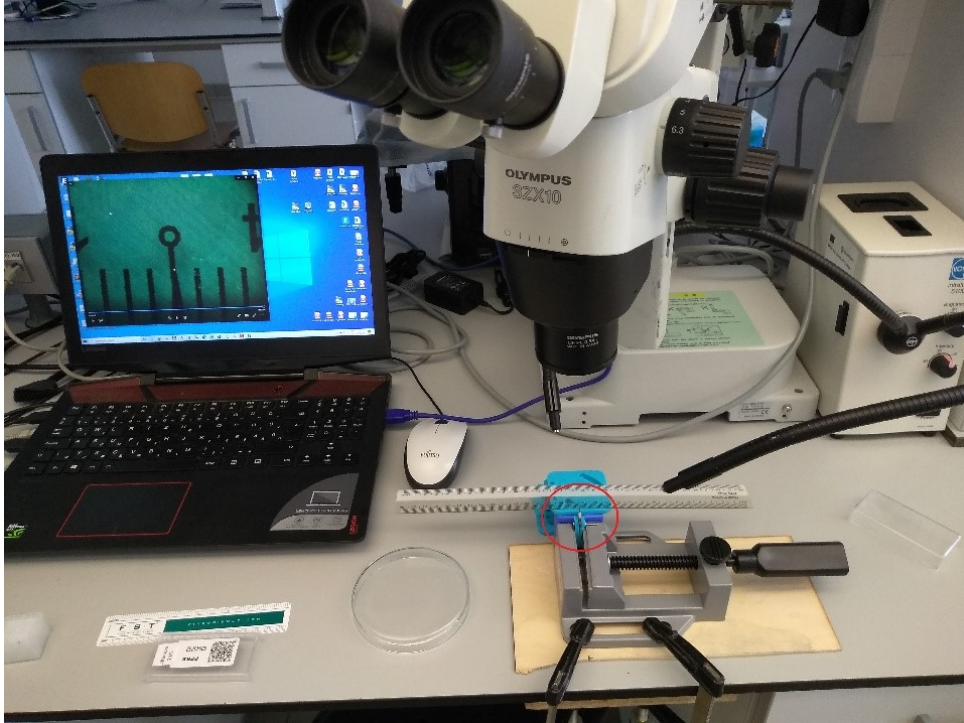


Figure 1: The measurement environment of the wobbling test.

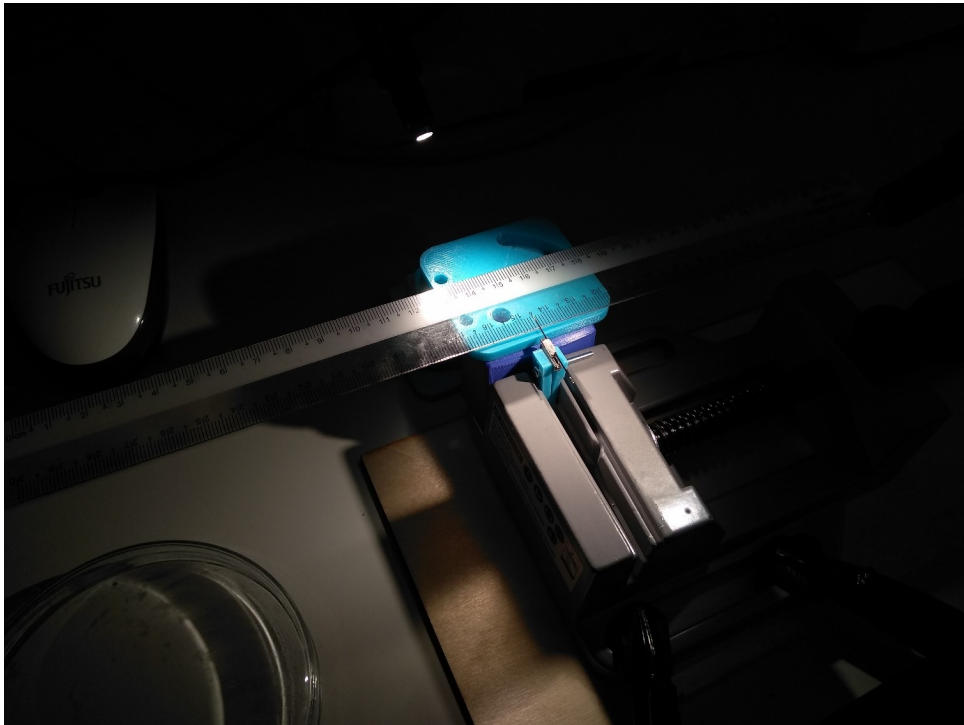


Figure 2: The wobbling test of the nano-drive from Cambridge NeuroTech.

2 Appraisal of fabrication

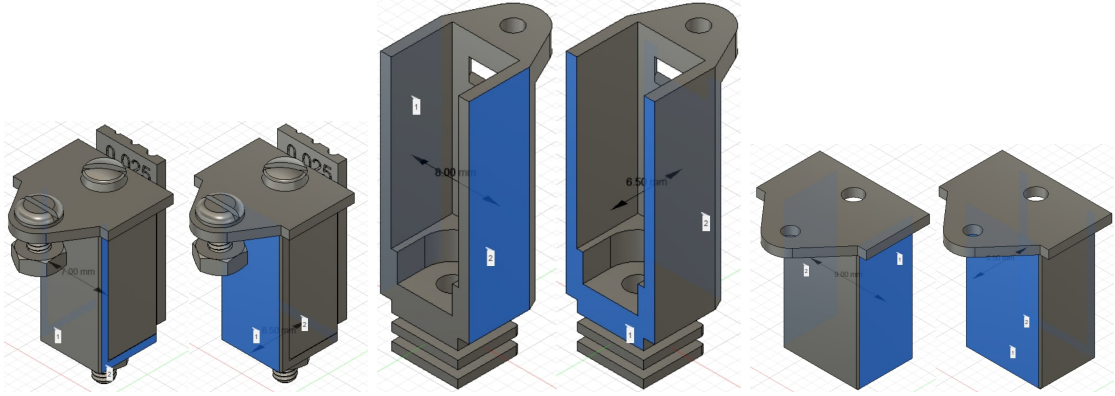


Figure 3: The measured dimensions of the components labelled with *N*. From left to right: *N1* (7x6.5 mm), *N2* (8x6.5 mm) and *N3* (9x6.5 mm).

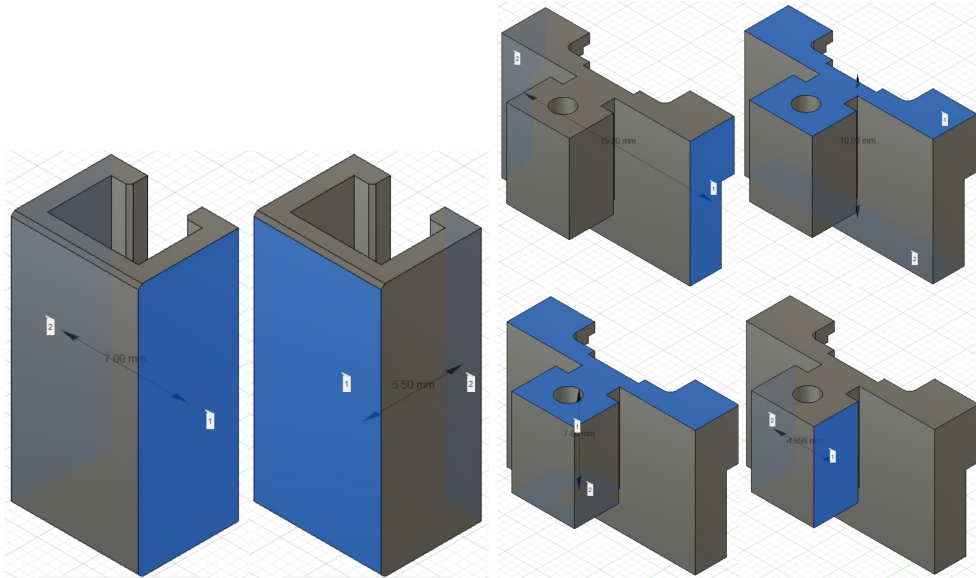


Figure 4: The measured dimensions of the components labelled with *T*. From left to right: *T1* (7x5.5 mm) and *T2* (15x10 and 4.998x7 mm). The dimensions of *T3* are equal to the dimensions of *N3* (9x6.5 mm).

3 Animal surgery

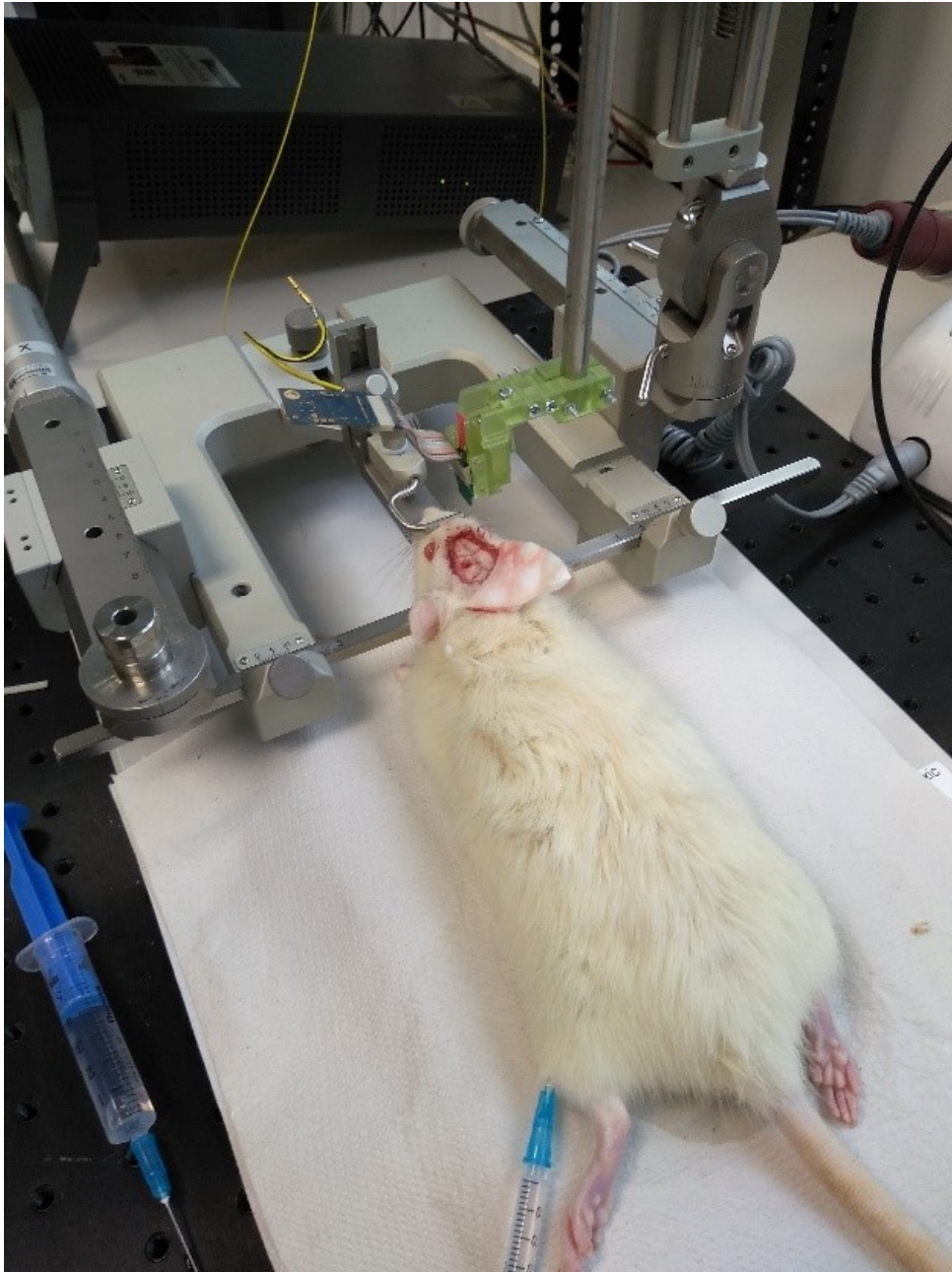


Figure 5: The experimental setup prior to the insertion of the optrode. The micro-drive and the handle (green) are in the upper center part of the image.

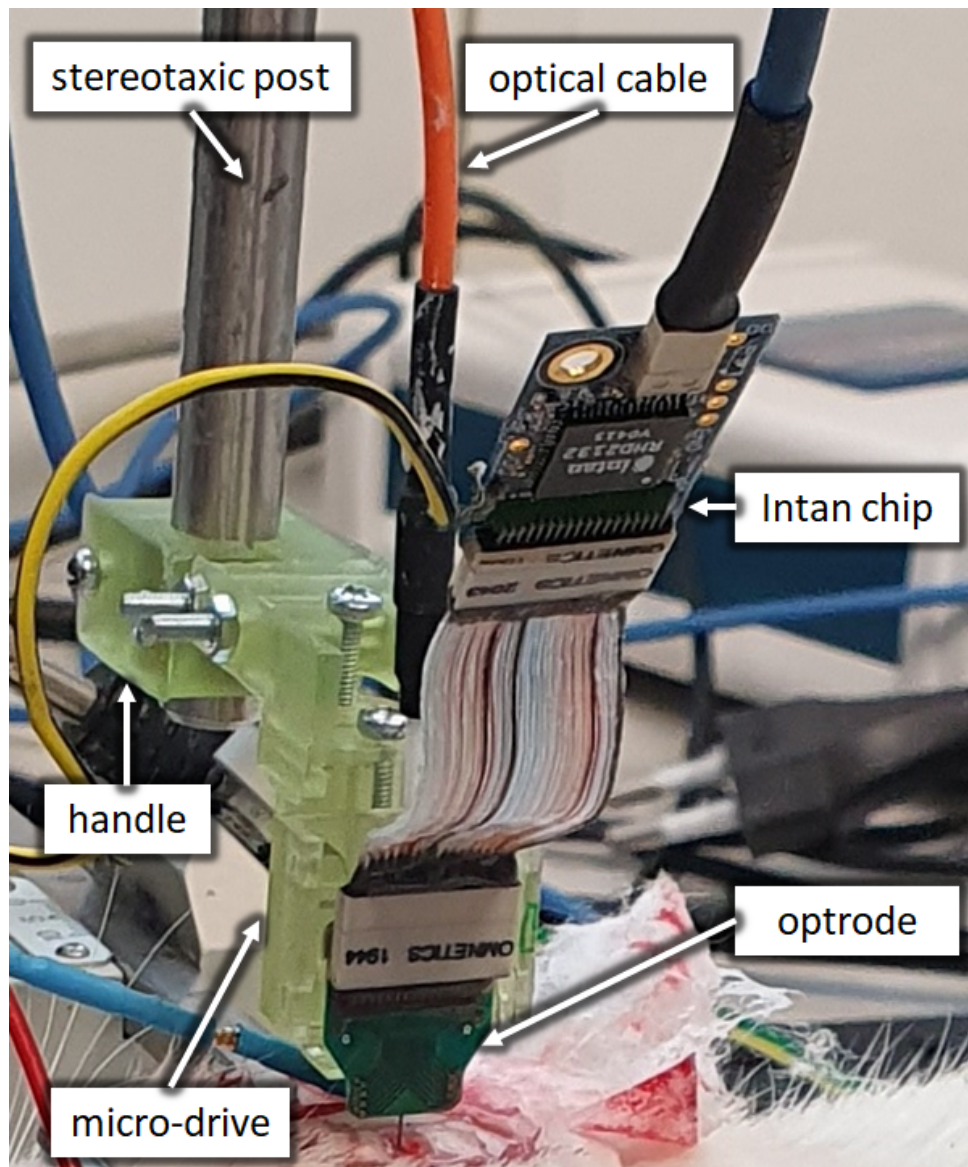


Figure 6: The assembly of the optrode with the optical cable and the Intan RHD-2000 electrophysiological recording system during an acute experiment.

4 RMS-based signal-to-noise ratio

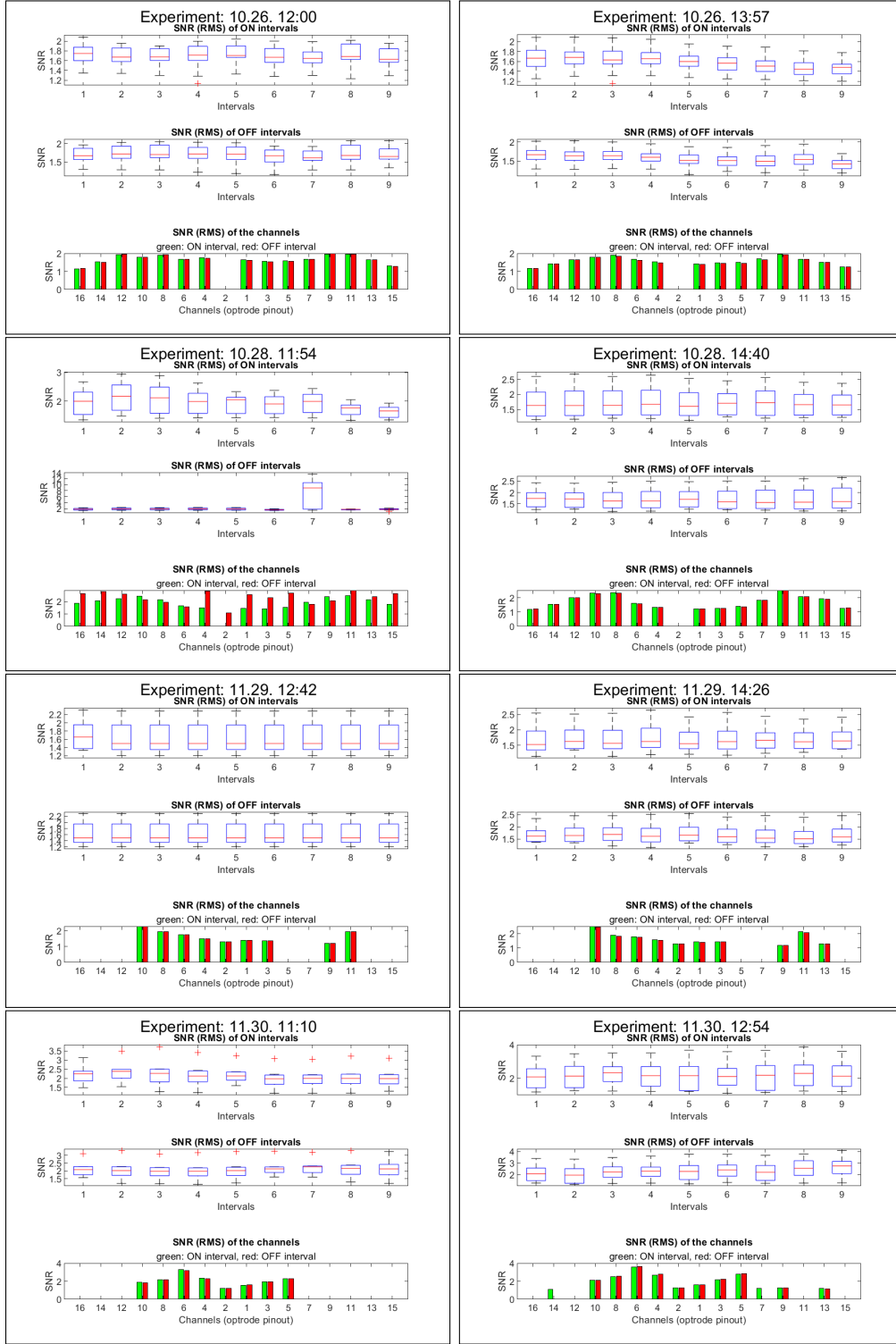


Figure 7: The summary of the RMS-based signal-to-noise ratio values. To provide a comprehensive analysis, each plot displays data for 9 intervals of IR stimulation, alternated with periods of rest (ON and OFF respectively). The first two plots contain SNR values for the ON and OFF intervals, respectively. The third plot shows the SNR values for individual channels for the ON (green) and OFF (red) IR stimulation intervals.

Experiment	Channel																Interval									All
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	1	2	3	4	5	6	7	8	9	
#1 ON	mean	1.65	NaN	1.56	1.77	1.60	1.68	1.68	1.91	1.96	1.78	1.96	1.94	1.65	1.53	1.30	1.75	1.70	1.69	1.70	1.76	1.70	1.69	1.72	1.67	1.70
	std	0.03	NaN	0.03	0.03	0.04	0.05	0.04	0.08	0.05	0.05	0.07	0.04	0.05	0.05	0.04	0.19	0.17	0.17	0.25	0.20	0.19	0.19	0.23	0.20	0.20
#1 OFF	mean	1.62	NaN	1.53	1.74	1.57	1.67	1.68	1.92	1.98	1.80	1.96	1.96	1.65	1.52	1.29	1.69	1.74	1.73	1.72	1.70	1.63	1.65	1.73	1.70	1.71
	std	0.04	NaN	0.04	0.02	0.03	0.04	0.04	0.07	0.06	0.05	0.06	0.07	0.05	0.04	0.03	0.18	0.21	0.21	0.22	0.25	0.23	0.18	0.23	0.21	0.21
#2 ON	mean	1.41	NaN	1.47	1.53	1.50	1.68	1.69	1.90	1.96	1.80	1.68	1.64	1.50	1.43	1.26	1.69	1.69	1.67	1.69	1.62	1.57	1.53	1.48	1.47	1.60
	std	0.09	NaN	0.09	0.08	0.07	0.11	0.11	0.16	0.12	0.10	0.12	0.11	0.11	0.10	0.04	0.24	0.22	0.25	0.21	0.19	0.19	0.19	0.18	0.17	0.22
#2 OFF	mean	1.40	NaN	1.44	1.49	1.46	1.63	1.65	1.85	1.92	1.79	1.66	1.64	1.50	1.43	1.25	1.68	1.65	1.66	1.62	1.54	1.53	1.52	1.57	1.42	1.57
	std	0.07	NaN	0.09	0.09	0.08	0.10	0.09	0.12	0.11	0.07	0.09	0.07	0.06	0.07	0.04	0.20	0.21	0.20	0.19	0.21	0.18	0.21	0.20	0.15	0.20
#3 ON	mean	1.44	NaN	1.41	1.50	1.54	1.65	1.94	2.16	2.38	2.44	2.46	2.22	2.13	2.08	1.78	1.98	2.19	2.11	2.00	1.91	1.90	1.94	1.72	1.63	1.93
	std	0.05	NaN	0.05	0.07	0.06	0.09	0.15	0.25	0.32	0.31	0.35	0.26	0.23	0.23	0.17	0.47	0.51	0.50	0.42	0.32	0.34	0.35	0.22	0.21	0.41
#3 OFF	mean	2.55	1.10	2.32	2.86	2.70	1.59	1.79	1.94	2.07	2.15	2.91	2.61	2.39	2.81	2.66	1.79	1.89	1.87	1.90	1.87	1.59	7.20	1.69	1.75	2.39
	std	3.33	0.00	2.64	3.99	3.45	0.08	0.13	0.19	0.25	0.23	2.26	1.79	1.35	2.72	3.07	0.32	0.34	0.31	0.34	0.33	0.17	4.40	0.10	0.26	2.23
#4 ON	mean	1.24	NaN	1.26	1.34	1.40	1.62	1.85	2.37	2.53	2.34	2.08	2.01	1.93	1.56	1.28	1.76	1.78	1.78	1.79	1.73	1.74	1.77	1.71	1.69	1.75
	std	0.02	NaN	0.02	0.03	0.02	0.04	0.07	0.13	0.11	0.10	0.06	0.07	0.05	0.05	0.02	0.49	0.51	0.48	0.49	0.46	0.41	0.46	0.40	0.39	0.45
#4 OFF	mean	1.25	NaN	1.27	1.33	1.39	1.60	1.83	2.34	2.51	2.31	2.07	2.01	1.92	1.54	1.29	1.74	1.73	1.72	1.73	1.75	1.73	1.73	1.73	1.77	1.74
	std	0.04	NaN	0.03	0.04	0.03	0.02	0.03	0.04	0.08	0.06	0.08	0.05	0.05	0.02	0.03	0.42	0.41	0.42	0.42	0.42	0.45	0.47	0.48	0.51	0.43
#5 ON	mean	1.41	1.31	1.37	1.50	NaN	1.77	NaN	1.95	1.21	2.29	1.95	NaN	NaN	NaN	NaN	1.70	1.64	1.64	1.64	1.64	1.64	1.64	1.64	1.64	1.64
	std	0.01	0.01	0.00	0.01	NaN	0.01	NaN	0.00	0.00	0.01	0.00	NaN	NaN	NaN	NaN	0.36	0.36	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.35
#5 OFF	mean	1.41	1.30	1.37	1.50	NaN	1.77	NaN	1.95	1.21	2.28	1.95	NaN	NaN	NaN	NaN	1.64	1.64	1.64	1.64	1.64	1.64	1.64	1.64	1.64	1.64
	std	0.00	0.00	0.00	0.00	NaN	0.00	NaN	0.00	0.00	0.00	0.00	NaN	NaN	NaN	NaN	0.37	0.37	0.37	0.37	0.36	0.37	0.37	0.36	0.36	0.35
#6 ON	mean	1.41	1.28	1.43	1.57	NaN	1.77	NaN	1.87	1.16	2.49	2.12	NaN	1.27	NaN	NaN	1.66	1.73	1.70	1.76	1.68	1.71	1.70	1.68	1.71	1.71
	std	0.03	0.07	0.03	0.03	NaN	0.07	NaN	0.07	0.03	0.09	0.09	NaN	0.00	NaN	NaN	0.46	0.41	0.45	0.47	0.41	0.46	0.39	0.36	0.37	0.40
#6 OFF	mean	1.39	1.29	1.41	1.54	NaN	1.73	NaN	1.80	1.17	2.45	2.06	NaN	1.28	NaN	NaN	1.68	1.73	1.74	1.74	1.75	1.68	1.64	1.61	1.68	1.69
	std	0.03	0.07	0.04	0.04	NaN	0.06	NaN	0.05	0.02	0.06	0.06	NaN	0.00	NaN	NaN	0.34	0.39	0.40	0.44	0.41	0.39	0.41	0.39	0.41	0.38
#7 ON	mean	1.57	1.21	1.96	2.34	2.30	3.28	NaN	2.19	NaN	1.88	NaN	NaN	NaN	NaN	NaN	2.20	2.35	2.27	2.16	2.21	1.98	2.00	2.03	2.02	2.13
	std	0.05	0.05	0.08	0.13	0.13	0.23	NaN	0.14	NaN	0.09	NaN	NaN	NaN	NaN	NaN	0.53	0.61	0.74	0.65	0.53	0.56	0.54	0.59	0.54	0.57
#7 OFF	mean	1.59	1.20	1.95	2.28	2.27	3.21	NaN	2.14	NaN	1.84	NaN	NaN	NaN	NaN	NaN	2.13	2.06	2.00	2.00	2.04	2.19	2.21	2.15	2.13	2.10
	std	0.02	0.05	0.05	0.07	0.08	0.08	NaN	0.09	NaN	0.08	NaN	NaN	NaN	NaN	NaN	0.51	0.62	0.55	0.58	0.59	0.53	0.51	0.60	0.62	0.54
#8 ON	mean	1.59	1.27	2.17	2.67	2.79	3.58	1.22	2.50	1.25	2.09	NaN	NaN	1.20	1.10	NaN	2.09	2.17	2.30	2.19	2.08	2.17	2.15	2.32	2.22	2.18
	std	0.08	0.04	0.08	0.09	0.08	0.15	0.02	0.12	0.04	0.08	NaN	NaN	0.04	0.00	NaN	0.70	0.75	0.72	0.75	0.84	0.76	0.83	0.85	0.79	0.75
#8 OFF	mean	1.63	1.27	2.22	2.79	2.83	3.65	NaN	2.55	1.28	2.13	NaN	NaN	1.18	NaN	NaN	2.12	1.99	2.26	2.32	2.29	2.42	2.28	2.56	2.67	2.31
	std	0.08	0.04	0.15	0.24	0.23	0.23	NaN	0.23	0.03	0.17	NaN	NaN	0.00	NaN	NaN	0.69	0.71	0.70	0.70	0.82	0.76	0.80	0.85	0.87	0.75

Figure 8: The mean and standard deviation of the RMS-based signal-to-noise ratio (SNR) values for each channel and interval.

5 Amplitude-based signal-to-noise ratio

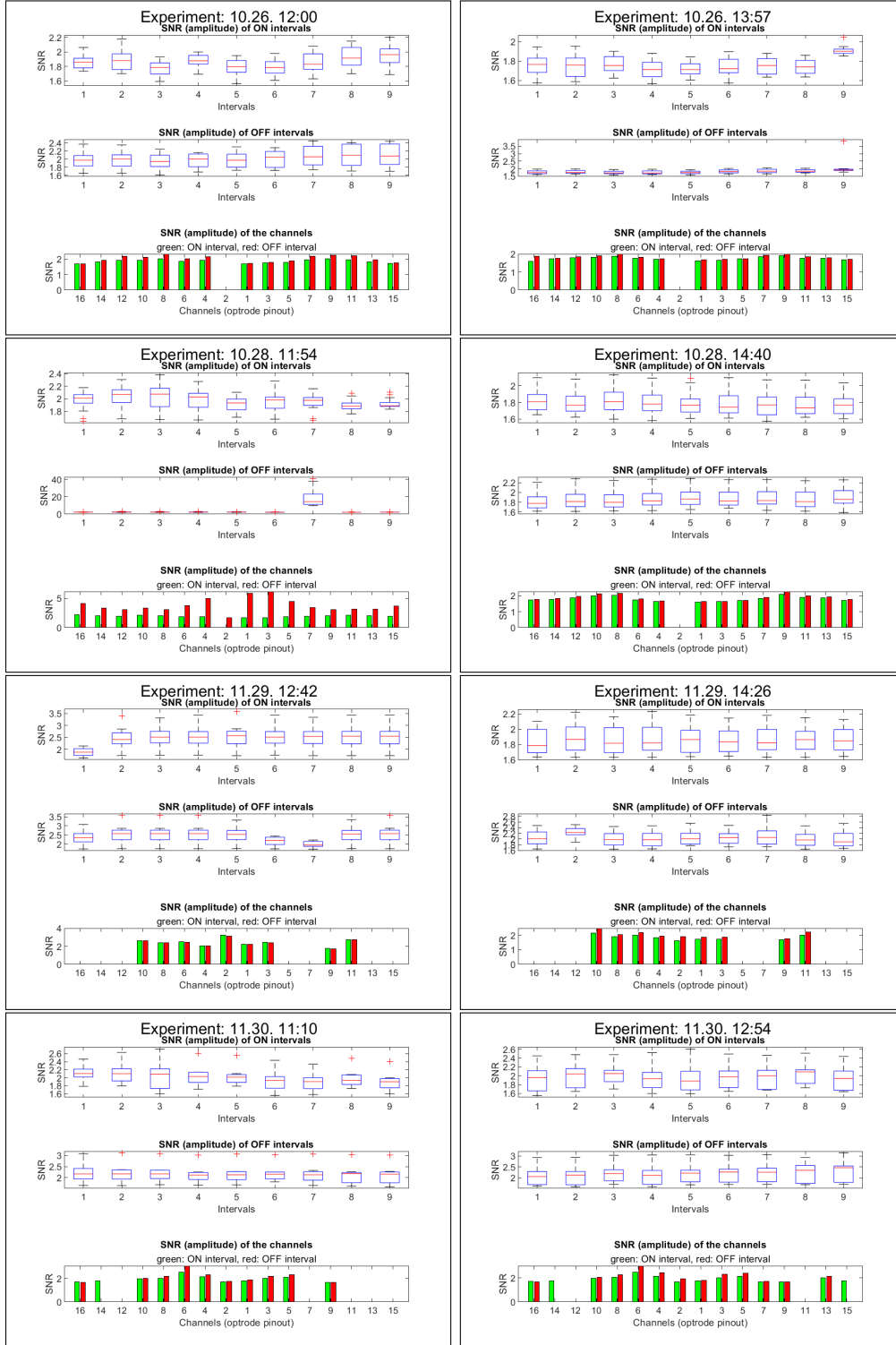


Figure 9: The summary of the amplitude-based signal-to-noise ratio values. To provide a comprehensive analysis, each plot displays data for 9 intervals of IR stimulation, alternated with periods of rest (ON and OFF respectively). The first two plots contain SNR values for the ON and OFF intervals, respectively. The third plot shows the SNR values for individual channels for the ON (green) and OFF (red) IR stimulation intervals.

Experiment	Channel																Interval									All
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	1	2	3	4	5	6	7	8	9	
#1 ON	mean	NaN	1.75	1.92	1.78	1.84	1.97	2.02	2.03	1.92	1.94	1.93	1.83	1.81	1.72	1.70	1.86	1.89	1.78	1.88	1.79	1.79	1.85	1.93	1.96	1.86
	std	NaN	0.08	0.05	0.04	0.07	0.10	0.12	0.09	0.07	0.08	0.09	0.06	0.05	0.09	0.14	0.09	0.14	0.11	0.09	0.12	0.10	0.14	0.15	0.16	0.13
#1 OFF	mean	NaN	1.80	2.14	1.88	2.00	2.18	2.33	2.25	2.11	2.23	2.17	1.97	1.91	1.76	1.70	1.96	1.96	1.94	1.96	1.99	2.01	2.09	2.10	2.10	2.01
	std	NaN	0.05	0.13	0.06	0.04	0.08	0.09	0.11	0.08	0.12	0.15	0.08	0.09	0.06	0.06	0.19	0.19	0.19	0.17	0.18	0.20	0.25	0.26	0.26	0.22
#2 ON	mean	NaN	1.66	1.70	1.72	1.77	1.85	1.88	1.89	1.83	1.77	1.79	1.75	1.74	1.69	1.60	1.76	1.75	1.76	1.71	1.72	1.74	1.75	1.74	1.91	1.76
	std	NaN	0.02	0.09	0.12	0.05	0.05	0.04	0.04	0.03	0.04	0.05	0.06	0.07	0.09	0.04	0.12	0.12	0.09	0.09	0.07	0.09	0.08	0.07	0.05	0.10
#2 OFF	mean	NaN	1.71	1.73	1.74	1.83	1.94	1.97	1.98	1.91	1.84	1.83	1.78	1.76	1.69	1.89	1.77	1.79	1.75	1.75	1.75	1.81	1.85	1.85	2.04	1.82
	std	NaN	0.08	0.08	0.07	0.05	0.02	0.04	0.05	0.05	0.05	0.07	0.06	0.09	0.06	0.73	0.12	0.12	0.12	0.12	0.11	0.12	0.13	0.10	0.50	0.21
#3 ON	mean	NaN	1.72	1.87	1.82	1.90	1.96	2.01	2.05	2.16	2.15	1.99	1.99	2.03	1.96	2.18	1.97	2.04	2.04	1.99	1.92	1.96	1.96	1.90	1.92	1.97
	std	NaN	0.08	0.05	0.03	0.04	0.05	0.09	0.09	0.07	0.11	0.08	0.06	0.06	0.07	0.12	0.15	0.18	0.22	0.18	0.12	0.17	0.14	0.09	0.08	0.16
#3 OFF	mean	NaN	1.67	6.15	5.00	4.47	3.76	3.44	3.09	3.04	3.17	3.08	3.13	3.33	3.65	4.09	2.13	2.18	2.14	2.17	2.16	2.01	18.21	1.98	2.08	3.87
	std	NaN	0.01	13.02	8.93	7.51	5.36	4.07	2.98	2.59	2.60	2.37	2.93	3.10	3.70	4.75	0.25	0.29	0.28	0.28	0.25	0.18	10.21	0.12	0.28	6.02
#4 ON	mean	NaN	1.63	1.65	1.69	1.75	1.84	2.02	2.09	1.99	1.88	1.85	1.85	1.75	1.71	1.73	1.83	1.81	1.84	1.81	1.79	1.79	1.78	1.78	1.78	1.80
	std	NaN	0.03	0.03	0.03	0.04	0.04	0.04	0.03	0.04	0.03	0.03	0.01	0.04	0.04	0.04	0.14	0.14	0.14	0.16	0.15	0.15	0.15	0.15	0.14	0.14
#4 OFF	mean	NaN	1.65	1.68	1.72	1.80	1.91	2.16	2.26	2.12	1.99	1.96	1.94	1.81	1.76	1.78	1.84	1.87	1.86	1.88	1.91	1.89	1.90	1.87	1.89	1.88
	std	NaN	0.03	0.03	0.02	0.01	0.01	0.02	0.02	0.03	0.04	0.03	0.04	0.03	0.05	0.05	0.18	0.20	0.20	0.20	0.20	0.19	0.19	0.20	0.20	0.19
#5 ON	mean	NaN	3.22	2.45	2.03	NaN	2.50	NaN	2.40	1.75	2.64	2.75	NaN	NaN	NaN	NaN	1.89	2.47	2.51	2.51	2.55	2.51	2.51	2.52	2.52	2.45
	std	NaN	0.59	0.26	0.08	NaN	0.16	NaN	0.16	0.01	0.21	0.29	NaN	NaN	NaN	NaN	0.18	0.47	0.45	0.45	0.47	0.52	0.47	0.46	0.48	0.47
#5 OFF	mean	NaN	3.15	2.41	2.03	NaN	2.48	NaN	2.38	1.74	2.61	2.71	NaN	NaN	NaN	NaN	2.36	2.55	2.55	2.55	2.51	2.16	1.99	2.51	2.55	2.41
	std	NaN	0.60	0.26	0.05	NaN	0.18	NaN	0.13	0.01	0.20	0.26	NaN	NaN	NaN	NaN	0.40	0.52	0.52	0.52	0.45	0.24	0.18	0.46	0.52	0.46
#6 ON	mean	NaN	1.64	1.74	1.83	NaN	2.00	NaN	1.93	1.69	2.17	2.02	NaN	NaN	NaN	NaN	1.84	1.89	1.86	1.88	1.87	1.85	1.86	1.87	1.86	1.86
	std	NaN	0.04	0.01	0.02	NaN	0.04	NaN	0.04	0.01	0.04	0.02	NaN	NaN	NaN	NaN	0.17	0.20	0.19	0.19	0.19	0.17	0.18	0.17	0.16	0.17
#6 OFF	mean	NaN	1.88	1.87	1.95	NaN	2.20	NaN	2.06	1.77	2.49	2.21	NaN	NaN	NaN	NaN	2.04	2.24	2.00	2.00	2.05	2.03	2.12	1.99	2.05	2.05
	std	NaN	0.23	0.40	0.17	NaN	0.05	NaN	0.02	0.08	0.04	0.02	NaN	NaN	NaN	NaN	0.27	0.19	0.26	0.26	0.27	0.26	0.23	0.36	0.26	0.27
#7 ON	mean	NaN	1.72	2.01	2.13	2.09	2.51	NaN	2.00	1.64	1.95	NaN	NaN	NaN	NaN	1.68	2.12	2.11	2.05	2.05	2.03	1.92	1.89	1.99	1.90	2.00
	std	NaN	0.05	0.07	0.10	0.09	0.12	NaN	0.08	0.08	0.00	0.07	NaN	NaN	NaN	0.22	0.21	0.27	0.35	0.35	0.27	0.23	0.25	0.22	0.23	0.25
#7 OFF	mean	NaN	0.02	0.05	0.07	0.10	0.12	NaN	0.08	0.08	0.00	0.07	NaN	NaN	NaN	0.22	0.22	2.21	2.21	2.16	2.17	2.20	2.14	2.12	2.11	2.17
	std	NaN	0.02	0.05	0.07	0.09	0.12	NaN	0.08	0.00	0.07	NaN	NaN	NaN	NaN	0.22	0.43	0.44	0.41	0.41	0.40	0.42	0.38	0.39	0.43	0.39
#8 ON	mean	NaN	1.76	2.04	2.13	2.15	2.49	1.69	2.05	1.67	1.97	NaN	NaN	2.00	1.78	1.74	1.91	2.00	2.03	1.93	1.93	1.96	1.96	2.04	1.92	1.96
	std	NaN	0.02	0.04	0.02	0.01	0.05	0.02	0.02	0.03	0.02	NaN	NaN	0.14	0.08	0.13	0.28	0.27	0.24	0.24	0.26	0.29	0.25	0.26	0.23	0.25
#8 OFF	mean	NaN	1.79	2.31	2.42	2.41	3.02	1.71	2.28	1.70	2.05	NaN	NaN	2.13	NaN	1.70	2.07	2.07	2.21	2.10	2.10	2.15	2.19	2.23	2.24	2.29
	std	NaN	0.04	0.31	0.10	0.10	0.07	0.01	0.12	0.02	0.07	NaN	NaN	0.00	NaN	0.16	0.40	0.40	0.42	0.44	0.40	0.42	0.42	0.45	0.48	0.41

Figure 10: The mean and standard deviation of the amplitude-based signal-to-noise ratio (SNR) values for each channel and interval.