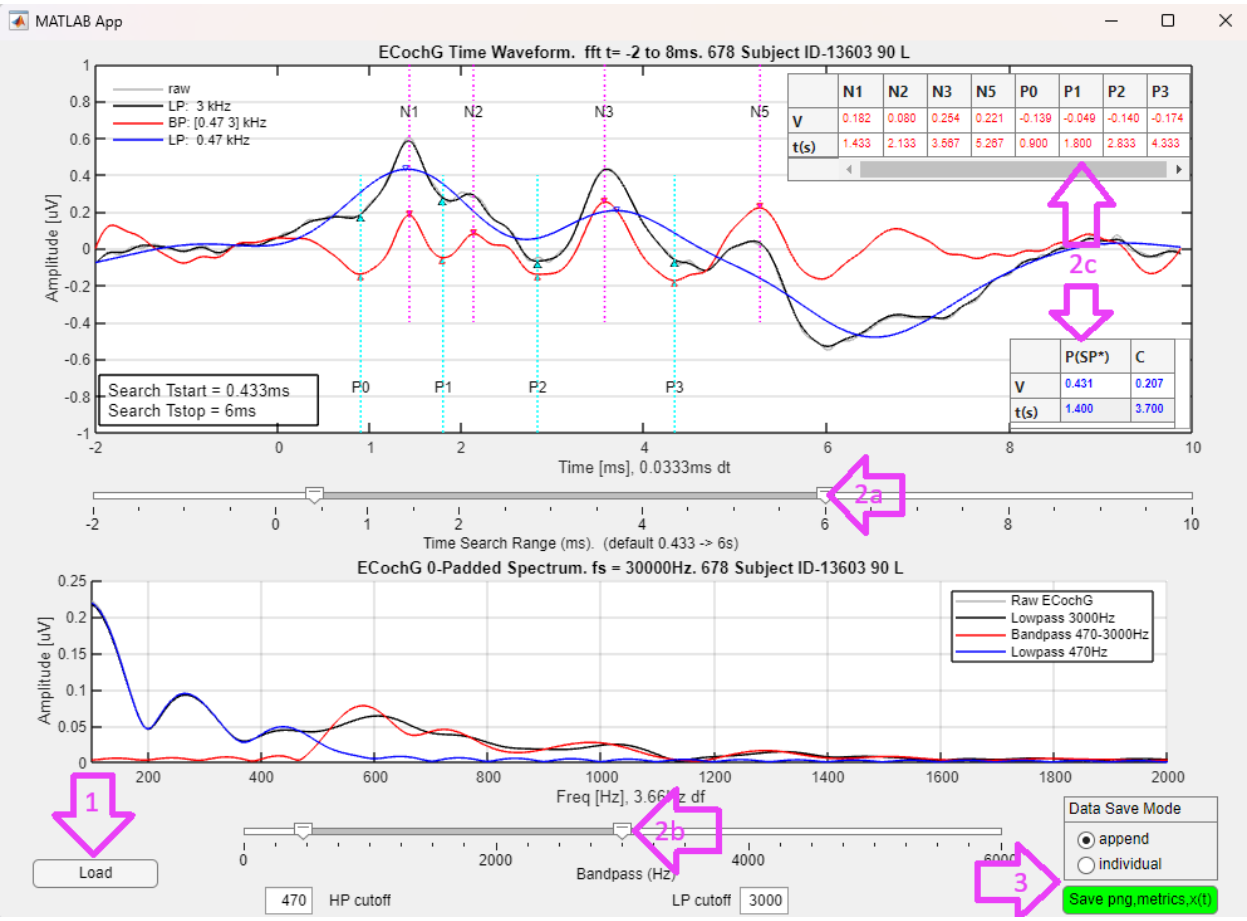
This GUI .exe is made to tag electrocochleograms (ECochG's) using a method consistent with the paper "Isolating auditory-nerve contributions to electrocochleography by high-pass filtering: A better biomarker for cochlear nerve degeneration?".

ECochGs were measured using 125 dBSPLpk 100us clicks delivered with Etymotic ER-3A earphones with tiptrodes in horizontal montage. Alternating click polarities and 9.1Hz or 40.1Hz presentation were used. The Eclipse test system took the data, which sampled at 30kHz and bandpass filtered to 3.3Hz-5kHz.

The major GUI functions are per the below, consisting of loading time data, customizing the filtering, searching, and tagging, and then saving the results:



1. **Load time data** from 1 of 2 possible formats:
    a. Load Eclipse .xml file with read_eclipse_avg.m & xml2struct.m
        i. Import 357 samples of 30kHz-sampled Eclipse data tagged with "prestimulus" time of 1ms.
        ii. This would give Tstart of -1ms, but we shift for a Tstart of -2ms so the AP spike lands at about 1ms. (I think Eclipse adds a shift)
        iii. The resulting data covers -2ms to approximately 10ms
        iv. It can also read .xml files eclipse headers which define fs, but minimal testing has been done with non-30kHz data
        v. Eclipse lists 92dB gain, which converts the Eclipse data units to nV by their equation (1.6V / 92dB gain)/32768 = ?? (where 32768 is the +/- capability of 2^16bits. see

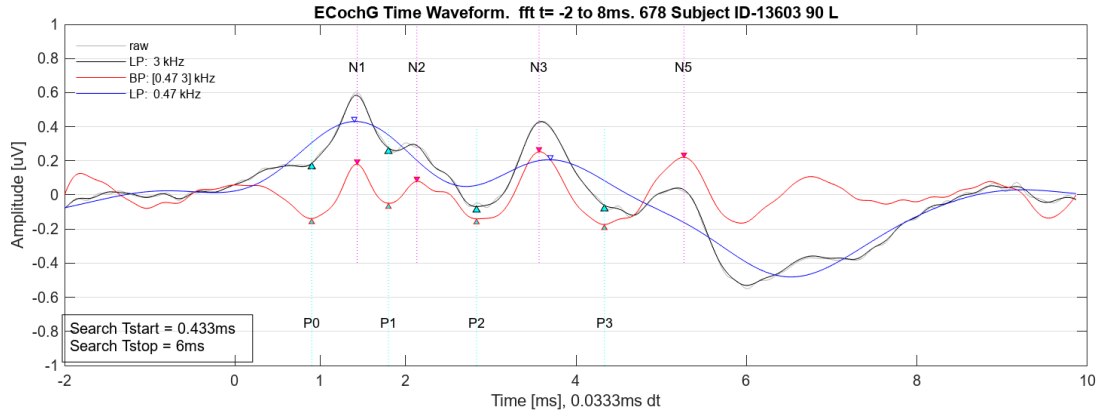
manual). This math has been commented out in lieu of a direct measurement of our system:

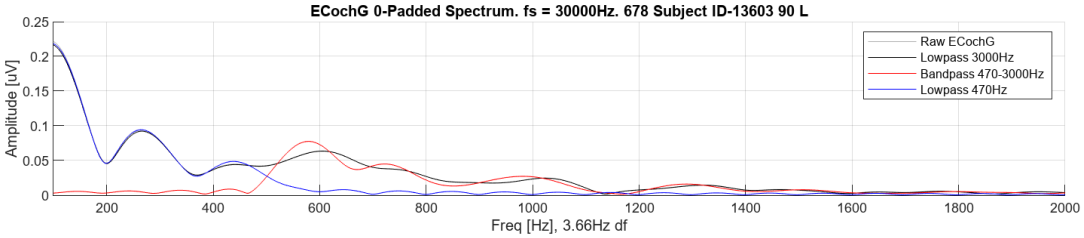
1. Slava recommended a scale factor of 1/1.6384e3, which was found by direct measurement of the MEEI setup. This is applied to Eclipse .xml data by the GUI.

b. Load Matlab .mat file
    i. The GUI will load a .mat file using 3 variables, assuming scaling is in uV:
        1. Fs (sample rate in Hz)
        2. tstart (time record start in ms. Can be negative. N1 typically lands at about 1.5ms)
        3. W (1 row by ? column data vector sampled at fs starting at tstart)
        4. (GUI app assumes .mat file is already scaled correctly in uV)

2. **Process time data**
    a. Normalize level so average of t<0 is at 0uV
    b. Take 8192pt fft of time interval from -2ms to 8ms by 0-padding, resulting in df=3.66Hz, for fft display
    c. Bandpass-filter time signal from 470Hz-3kHz, using Matlab highpass and lowpass functions with Steepness of 0.95
    d. Automatically search filtered time waveform from 0.433ms to 6ms for markers
    e. NOTE: Custom slider values are persistent. Restart GUI .exe to restore default values.
3. **Customize search & marking**
    a. The top slider changes the search time range
    b. The bottom slider changes the bandpass cutoff frequencies by slider or typing a value
    c. If you single-click on any column in the right-side tables with N's, P's, and SP, you will get a crosshair which lets you move the respective marker to a location of your choice on the curves with matching colors
        i. NOTE: moving the sliders will re-apply the automatic search algorithm and override your customized markers
4. **Save data and plots** ("append" keeps 3 running files, "individual" makes 3 files per processed waveform):
    a. GUI plots (.pdf for append, .png for individual)
    b. .csv of raw & filtered time waveforms
    c. .csv of metrics picked from plot (time waveform markers)

Saved GUI plot example:





Saved time data example:

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA
1	t(ms)	-2	-1.96667	-1.93333	-1.9	-1.86667	-1.83333	-1.8	-1.76667	-1.73333	-1.7	-1.66667	-1.63333	-1.6	-1.56667	-1.53333	-1.5	-1.46667	-1.43333	-1.4	-1.36667	-1.33333	-1.3	-1.26667	-1.23333	-1.2	-1.16667
2	W_438 Subject ID-9803 60 L	0.139109	0.142771	0.143382	0.127513	0.104319	0.097605	0.108592	0.12324	0.109202	0.099436	0.084178	0.071971	0.069529	0.075022	0.080516	0.078074	0.064036	0.045115	0.027415	0.017039	0.004832	0.003001	0.003001	0.012156	0.01887	0.029246
3	Wbp_438 Subject ID-9803 60 L	-2.44E-05	0.031777	0.053564	0.065566	0.069026	0.066156	0.059686	0.052215	0.045559	0.040362	0.03606	0.031249	0.024286	0.013963	-2.60E-06	-0.01678	-0.03461	-0.05125	-0.06459	-0.07316	-0.07643	-0.07486	-0.06964	-0.06229	-0.05425	-0.04656
4	Wlp_3K_438 Subject ID-9803 60 L	0.135816	0.136152	0.13427	0.129176	0.121046	0.111155	0.101409	0.093672	0.089096	0.087715	0.088411	0.089273	0.088214	0.083647	0.074985	0.062827	0.04877	0.03494	0.023384	0.015533	0.01188	0.011957	0.014572	0.018217	0.021481	0.02337
5	Wlp_470_438 Subject ID-9803 60 L	0.071813	0.06924	0.066665	0.064104	0.06157	0.059075	0.056628	0.054237	0.051906	0.049639	0.047437	0.045298	0.043219	0.041195	0.039218	0.037279	0.035366	0.033466	0.031566	0.029648	0.027697	0.025695	0.023623	0.021462	0.019195	0.016801
6	t(ms)	-2	-1.96667	-1.93333	-1.9	-1.86667	-1.83333	-1.8	-1.76667	-1.73333	-1.7	-1.66667	-1.63333	-1.6	-1.56667	-1.53333	-1.5	-1.46667	-1.43333	-1.4	-1.36667	-1.33333	-1.3	-1.26667	-1.23333	-1.2	-1.16667
7	W_438 Subject ID-9803 60 R	-0.01395	-0.02432	-0.03287	-0.03958	-0.04202	-0.03958	-0.03409	-0.02737	-0.02127	-0.01639	-0.01395	-0.01089	-0.00549	9.1552734	0.003143	0.003143	0.001923	0.002533	0.008026	0.019012	0.028778	0.031219	0.023285	0.008636	-0.00479	-0.01085
8	Wbp_438 Subject ID-9803 60 R	-1.82E-05	0.003261	0.006444	0.010689	0.015849	0.020922	0.024694	0.026333	0.025706	0.02337	0.020267	0.017308	0.015016	0.013392	0.012019	0.010347	0.007995	0.004942	0.001504	-0.00187	-0.00488	-0.00761	-0.01052	-0.0143	-0.01947	-0.02607
9	Wlp_3K_438 Subject ID-9803 60 R	-0.01946	-0.03048	-0.03742	-0.03972	-0.03807	-0.03396	-0.02909	-0.02469	-0.02126	-0.01857	-0.01594	-0.01269	-0.00851	-0.00358	0.001515	0.006097	0.009668	0.012119	0.0137	0.014814	0.015723	0.016329	0.016141	0.014476	0.010808	0.005128
10	Wlp_470_438 Subject ID-9803 60 R	-0.06065	-0.05878	-0.05687	-0.0549	-0.05286	-0.05074	-0.04855	-0.04627	-0.04391	-0.04148	-0.03896	-0.03636	-0.0337	-0.03097	-0.0282	-0.02537	-0.02252	-0.01965	-0.01677	-0.0139	-0.01107	-0.00827	-0.00554	-0.0029	-0.00035	0.002082

Saved metrics example:

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA
1	Subject #	SP* amp	C* amp	SP* lat	C* lat	AP* amp	N1P1* am	N1*/N2*	N1*/N3*	N1*/N5*	N1* amp	N2* amp	N3* amp	N5* amp	N1* lat	N2* lat	N3* lat	N5* lat	N5*-N1* l	fs	lb_ms	rb_ms	lb	rb	mp	fp1	fp2
2	438 Subject ID-9803 60 L	0.048056	-0.1404	1.3	3.6	0.278103	0.325789	5.220744	1.24945	1.219421	0.189167	0.036234	0.1514	0.155128	1.5	2.466667	3.4	5.033333	3.533333	30000	0.43333	6	74	241	0.02	3000	470
3	438 Subject ID-9803 60 R	0.13231	0.038159	1.466667	4.733333	0.340704	0.443233	1.64971	1.401508	2.295918	0.255439	0.154838	0.18226	0.111258	1.433333	2.4	3.5	5.1	3.666667	30000	0.43333	6	74	241	0.02	3000	470
4	441 Subject ID-9753 80 L	0.11569	0.251785	1.1	3.533333	0.246944	0.1967	8.378687	0.814878	0.64451	0.158042	0.018862	0.193945	0.245212	1.233333	1.9	3.133333	4.733333	3.5	30000	0.43333	6	74	241	0.02	3000	470
5	441 Subject ID-9753 85 L	0.2759	0.553899	1.233333	3.566667	0.336582	0.210937	1.06637	1.061258	1.705799	0.159086	0.149184	0.149903	0.093262	1.033333	1.8	3.4	5	3.966667	30000	0.43333	6	74	241	0.02	3000	470
6	441 Subject ID-9753 90 L	0.140836	0.462748	1.133333	3.233333	0.302384	0.176522	7.830011	0.924326	0.849268	0.143977	0.018388	0.155764	0.169531	1.066667	1.9	3.066667	4.5	3.433333	30000	0.43333	6	74	241	0.02	3000	470
7	441 Subject ID-9753 95 L	0.075318	0.236771	1.2	3.5	0.249995	0.131111	1.59928	0.757199	0.602743	0.121483	0.075961	0.160438	0.201551	1.166667	1.9	3.4	4.9	3.733333	30000	0.43333	6	74	241	0.02	3000	470
8	678 Subject ID-13603 90 L	0.430638	0.206589	1.4	3.7	0.320585	0.231103	2.2657	0.717407	0.821542	0.181934	0.080299	0.2536	0.221455	1.433333	2.133333	3.566667	5.266667	3.833333	30000	0.43333	6	74	241	0.02	3000	470
9	714 Subject ID-14037 90 R	0.393074	0.442133	1.6	4.566667	0.200213	0.262117	0.888134	0.78978	1.244779	0.114342	0.128744	0.144777	0.091857	1.266667	2.266667	3.566667	5.333333	4.066667	30000	0.43333	6	74	241	0.02	3000	470

Version	Date	Author	Comments
V1	Nov 30, 2024	Rich Herr	First draft
V2	Feb2, 2025	Rich Herr	Correct curve labeling. Make color-coded and add “P” and “C” fields
V4(old)	Nov 16, 2025	Rich Herr	Generalize for frequencies and having tstart and fs in .mat file. Debug, and prepare for dataverse upload
V4	Nov 23, 2025	Rich Herr	Use cleaner ECochg for plot examples