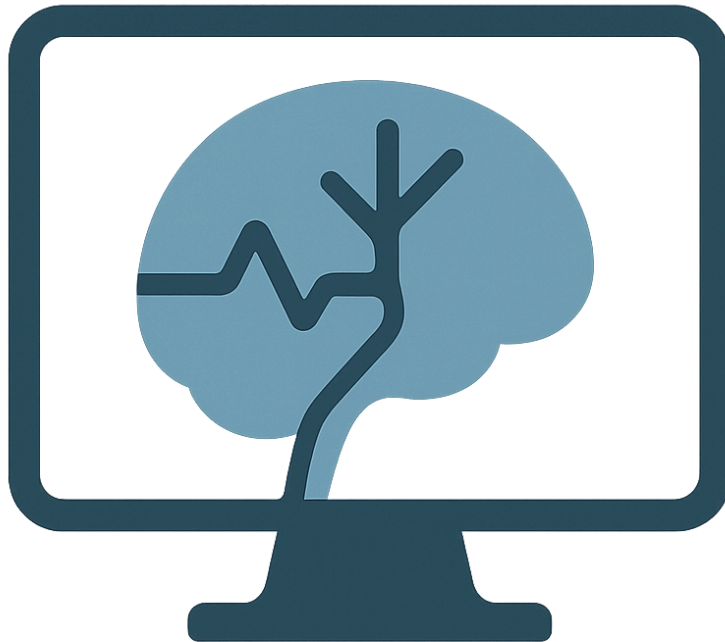# Systems Analysis & Design Report

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Executive Summary

The Neurophysiological Data Analysis Tool is a cross-platform desktop application created to modernise the way researchers process, analyse and visualise extracellular recordings, resonance-frequency sweeps and potassium clearance traces. Currently researchers rely on software which is non-user friendly, complex and lacks features and functionality.

The Neurophysiological Data Analysis Tool combines a PyQt graphical interface, NumPy/SciPy processing and Plotly/Matplotlib visualisation in a fully offline Python stack.

Key Capabilities

- Loads read-only .abf files, verifying SHA-256 checksums, 100 MB opens in < 5 seconds
- Executes FFT, ZAP resonance and K+ clearance analyses in < 3 seconds for a 10 second trace
- Renders heat-map, line and scatter plots in < 2 seconds, exports PNG/SVG/CSV/ZIP with ISO-timestamped names
- Offline installers for Windows 10/11 and macOS 12+ ensure lab-wide deployment

This System Analysis & Design Report details the solution architecture and verification strategies necessary to deliver the Neurophysiological Data Analysis Tool to production, which includes:

- Functional and Non-Functional requirements traceable to 140 comprehensive test cases
- Complete design documentation including use-case, sequence and ER diagrams, logical schema and six annotated screen designs.

All development is scheduled for completion within the current semester, followed by a two-week user acceptance period and handover to the client.

Table of Contents

Introduction

The Neurophysiological Data Analysis Tool is a cross-platform desktop application being developed to streamline the processing, analysis and visualisation of neurophysiological recordings such as extracellular signals, resonance frequency and potassium (K+) clearance traces. The tool will be written in a full-Python technology stack (PyQt for the GUI, NumPy/SciPy/NeuroDSP for numerical processing, Matplotlib/Plotly for plotting). Our tool is intended to replace the client's current workflow with an updated, modern and cohesive solution that can be installed offline on both Windows 10+ and macOS 12+ systems.

The Systems Analysis & Design Report is intended for the development team and serves the following purposes:

- Translate user needs into clear development guidelines. The functional and non-functional requirements are displayed as user stories with measurable acceptance criteria which will guide design and testing
- Document key design decisions in one place. Architecture diagrams, data models, screen layouts and message catalogues are collected here to ensure all team members work from the same blueprint
- Define how quality will be verified. The Feature/Function Test Plan and detailed Candidate Test cases describe the checks that must pass before the tool can be considered complete

The scope of the project aims to deliver the following feature set:
- Data Integrity and Data Handling: ABF loader with read-only access, large file performance and checksum verification
- Core Analysis: Episode navigation, K+ Clearance (Tau and 1/Tau), ZAP profile with resonance detection and power-spectrum heat maps
- Visualisation and Reporting: Heat-map, line and scatter plots, interactive zoom/pan and PNG/SVG export
- User-experience aids: Cross platform offline installer, Guided workflow help and Cloud experiment report
- Security & Privacy: Prevention of file modification, checksum verification and optional user accounts for cross-device access
- System Qualities: Responsive front-end/back-end, performance targets and comprehensive error logging

Collectively these components will give researchers an intuitive, high-performance environment that shortens analysis time, lowers the technical barrier to entry and delivers reliable reproducible results.

Industry Partner Statement

The Cellular Neurophysiology Lab at Western Sydney University acting as our industry partner for this project, identified a need for a user-friendly application capable of loading, analysing and visualising neurophysiology data in Axon Binary Format (ABF). The lab's current workflow involves multiple disconnected tools, requiring extensive manual intervention and technical expertise. This fragmented process presents significant barriers for students and researchers with limited technical experience who rely on timely and accurate signal analysis.

The goal of this project is to develop a cross-platform desktop application, "Neuroliser", that simplifies the analysis process while maintaining high scientific accuracy. The software will support FFT, ZAP, profiling, Tau calculation, and structured data export using DuckDB and Parquet. It will also feature local session tracking, visualisation capabilities using matplotlib, and structured data export using DuckDB and Parquet formats. The application will be built using open-source technologies such as PyQt5, pyABF, neuroDSP, ensuring maintainability and cost-free use.

The partner emphasised ease of use, local processing, and the ability to work offline as essential features due to the academic environment and varying technical experience among users. With lab researchers in mind, the development team has maintained a user-centred approach ensuring that the application's features, layout and data outputs align with the real-world workflows and research needs of the partner. Neuroliser ultimately aims to reduce analysis time, improve reproducibility and lower the entry barrier for advanced neurophysiology data interpretation.

Risks

The following table outlines key risks associated with the development and use of the application. These include technical limitations, security concerns and team-related challenges. Each risk is paired with a mitigation strategy to reduce the potential impact and ensure reliable system performance.
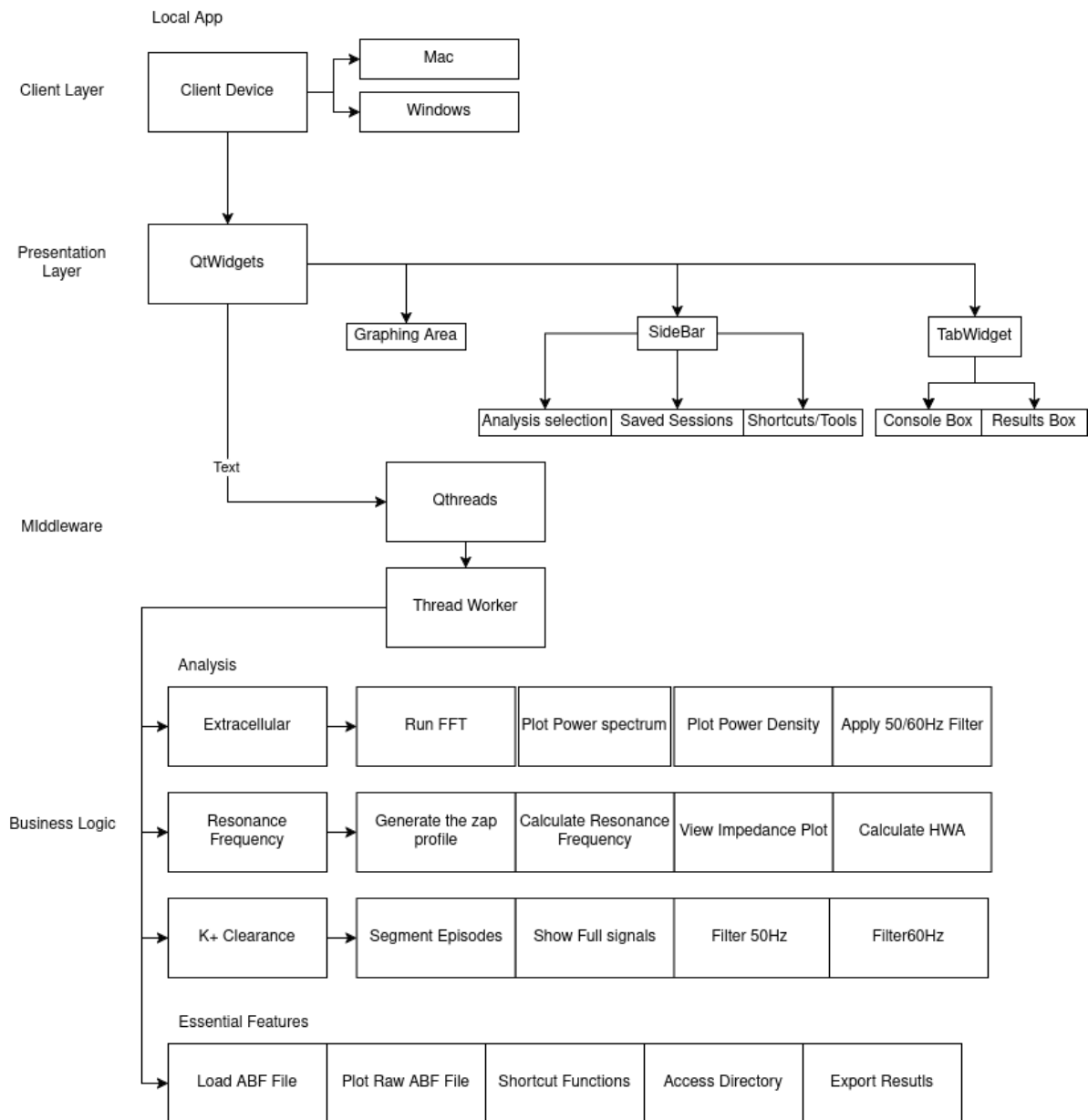
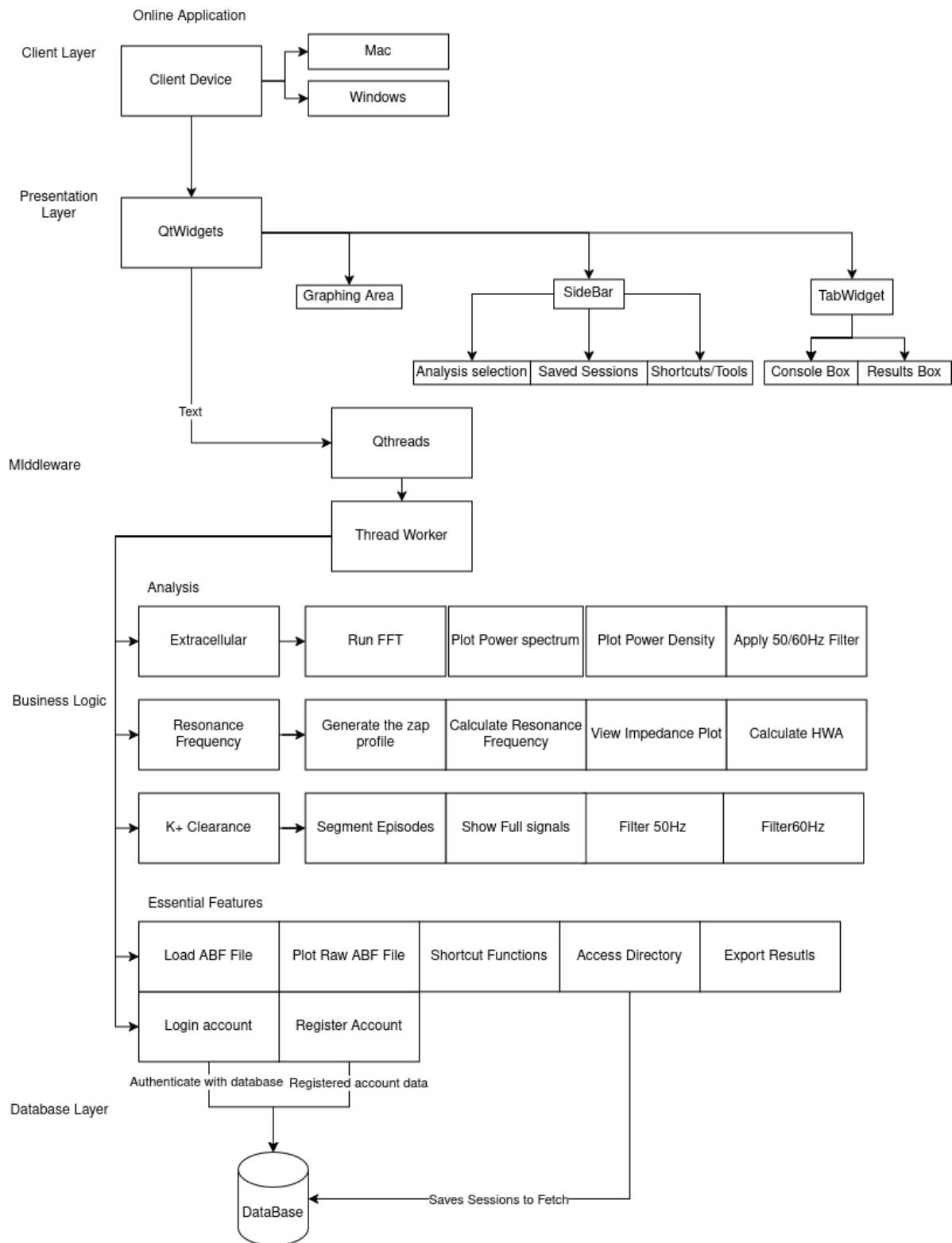|	Risk	Mitigation Strategies	Impact level	Type of Risk
1	Performance bottlenecks when analysing large ABF files	Optimise Processing with numpy, use threading or multiprocessing where appropriate, and cache reusable results to reduce reprocessing	High	Internal
2	Sensitive data exposed due to unencrypted local storage	Use secure file formats and consider encrypting exported files or limiting access with login/session control	High	Security
3	User login system introduces vulnerabilities	Implement hashed passwords, input validation, and token-based session handling for secure authentication	High	Security
4	Python's Global Interpreter Lock limits parallelism	Use multiprocessing instead of multithreading for CPU-bound tasks, or offload heavy processing to compiled extensions.	Medium	Internal
5	Cross-platform incompatibility (Windows vs macOS)	Test on both platforms regularly and use OS-agnostic file handling and UI layout. Avoid platform-dependent file paths or fonts.	Medium	Internal
6	Dependency on third-party libraries (e.g. pyABF, DuckDB)	Use version-pinned "requirements.txt", monitor library updates and keep backups of critical versions	Medium	External
7	Inconsistent skill levels and team availability	Allocate tasks based on individual strengths, conduct collaborative working sessions, and maintain detailed documentation	Medium	Internal

Constraints

The constraints listed below represent the practical limitations the system must operate within, such as hardware capabilities, platform compatibility, and required file formats. These factors have shaped design decisions and guided development to ensure the application remains accessible, efficient and suitable for its intended academic environment.

	Constraint	Mitigation Strategies
1	Mid-range student laptops must be able to run the application	Ensure performance is acceptable on approximately 8-16GB RAM machines by avoiding GPU-dependent libraries and optimising file parsing.
2	System must function offline with no cloud dependency	Store all session data locally using DuckDB and implement export options like Parquet or CSV for external use.
3	ABF is the only accepted file format	Ensure robust handling of ABF files and provide user-friendly error messages for unsupported formats.
4	GUI must be usable by non-technical users	Keep interface simple, avoid technical jargon and use clear tooltips and labels for every feature.
5	Software must work across both Windows and macOS	Regularly test both OS environments and avoid platform-specific dependencies
6	Open-source libraries only	Select Python libraries with permissive licences and active maintenance communities.

Software Architecture

Online Application

Client Layer — Client Device → Mac / Windows

Presentation Layer — QtWidgets

Graphing Area | SideBar | TabWidget

SideBar: Analysis selection | Saved Sessions | Shortcuts/Tools

TabWidget: Console Box | Results Box

Text

Middleware — Qthreads → Thread Worker

Business Logic

Analysis

| Extracellular | Run FFT | Plot Power spectrum | Plot Power Density | Apply 50/60Hz Filter |

| Resonance Frequency | Generate the zap profile | Calculate Resonance Frequency | View Impedance Plot | Calculate HWA |

| K+ Clearance | Segment Episodes | Show Full signals | Filter 50Hz | Filter60Hz |

Essential Features

| Load ABF File | Plot Raw ABF File | Shortcut Functions | Access Directory | Export Resutls |

| Login account | Register Account |

Authenticate with database   Registered account data

Database Layer — DataBase

Saves Sessions to Fetch

Our application architecture differs based on potential additions; the database aspect is added with an online version that adds the used functionality. Overall, our simple MVC styled architecture will push for a clean and well designed application. MVC separates the application into model, view and controller. In a similar fashion, our application is separated into a model, view and controller using the threading system that allows for smooth analysis whilst maintaining a reactive UI. Further, we have a widget based view, that focuses on

6

allowing for users to have the ability to segment and reshape their workspace how they see fit. The model section looks at the backend services that communicate using the controller and worker class.

Within our controller, we have a simple back and forth system to allow for the thread controller to control the queue of threads, their signals and creation or cleanup. Whilst the thread worker is in charge of calling the functionality and doing the work needed with a modular design that can be made for any task.

The online variant has that database aspect with user authentication builtin to allow for the additional features we want to add.

Network and Communication Architecture

This architecture outlines how the application handles data flow between the user interface, local analysis modules, and optional secure cloud services. It supports offline use with local storage and processing, while also allowing for future cloud integration. The design ensures a balance between usability, performance, and data security.
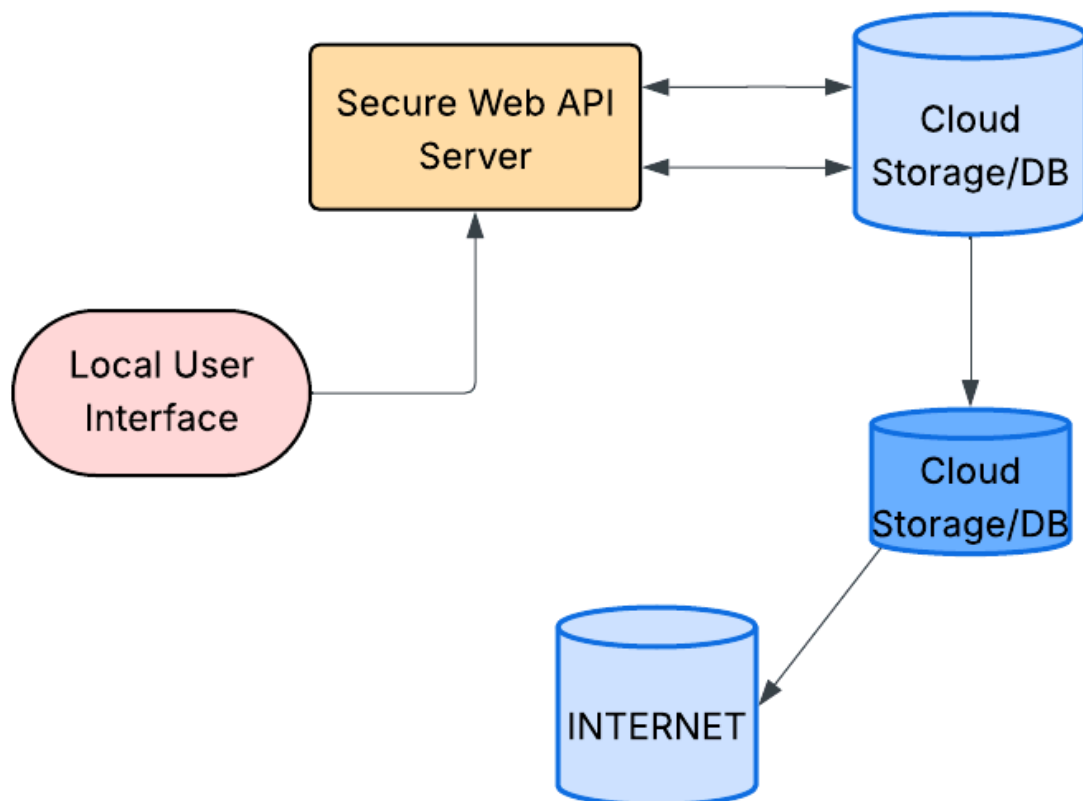
Detailed System Design

Use Case Diagram

In this section, the use case diagram provides an interaction between the client and the neurophysiological data processing software. Although the diagram describes the engagement of the software by the client to perform fundamental tasks, it also highlights its accuracy and high-quality visualization after running one of the signal types.
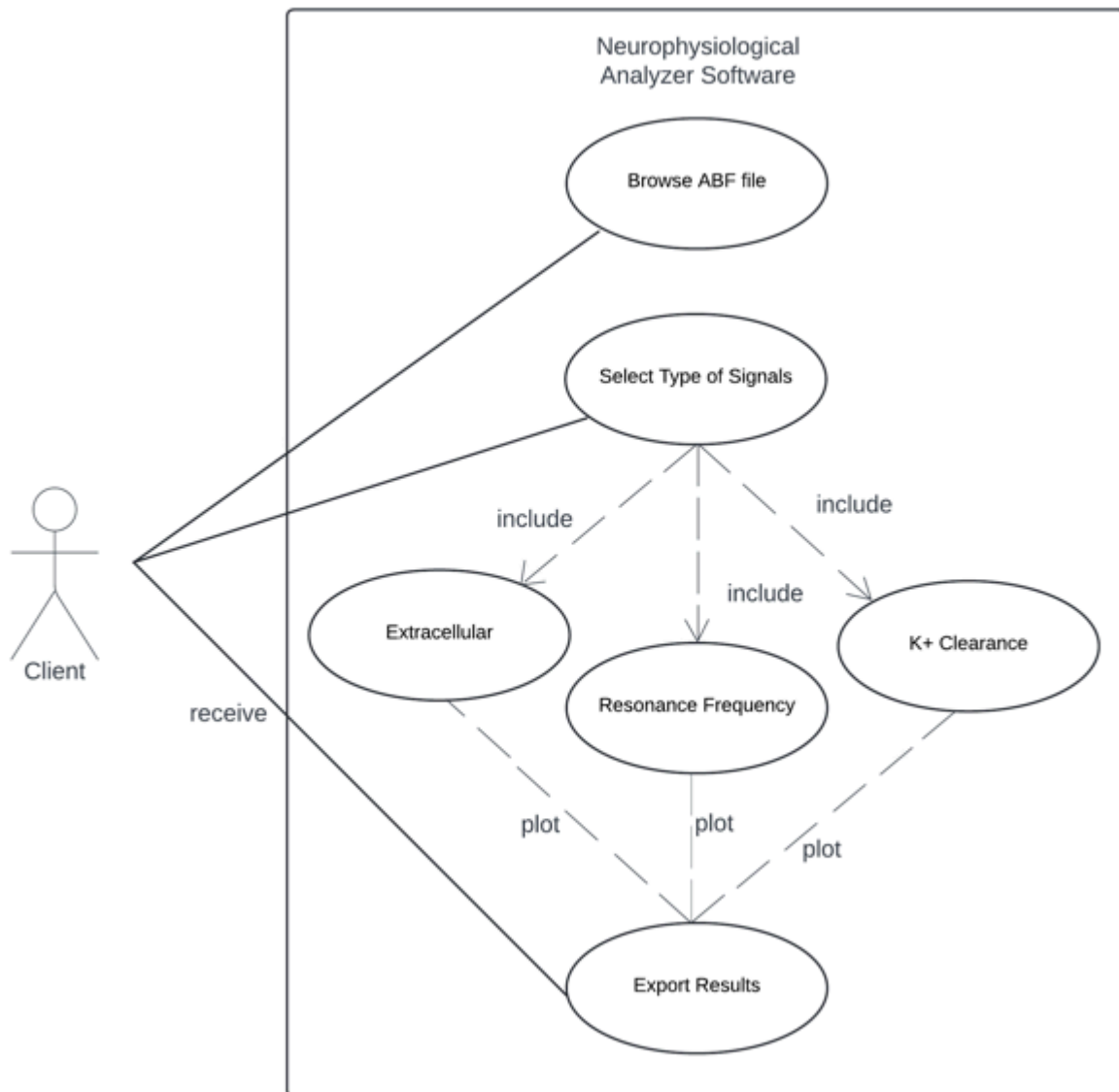
Picture 1: Use case diagram of Neurophysiological Analyzer

User Stories & Acceptance Criteria

ID: F001	Feature: ABF File Loader	Priority: Essential
BF1: Neurophysiological Data Processing		Estimate: 12 hrs

Story:
As a researcher, I want to be able to load ABF files into the software so as to analyse neurophysiological recordings.

Acceptance Criteria:
1. File Support & Integrity
    a. Only files with the .abf extension are accepted, any other extension triggers an error and aborts
    b. Original file remains unmodified (read-only)
    c. Pre and post-load SHA-256 checksums match
2. Performance
    a. Files ≤ 100MB load in < 5s on reference hardware (M1, 16GB)
3. Data Parsing
    a. Header and all channel data are parsed without error.
    b. Dataset appears in the Experiments workspace list within 1 s of load completion
4. User Feedback
    a. Success message MSG_1 - "File loaded successfully" is displayed
    b. Any load error shows MSG_2 "Unable to load file"
5. Large-file Failure
    a. Attempting to load a file > 250 MB cancels the operation

ID: F002	Feature: Episode Navigation	Priority: Essential
BF1: Neurophysiological Data Processing		Estimate: 10 hrs

Story:
As a researcher, I want to navigate through multiple episodes within a recording to analyse them individually.

Acceptance Criteria:
1. Episode Selection
    a. User can move to the next/previous episode with arrow keys
    b. User can select a specific episode
2. Viewport Update
    a. Selected episode's waveform is rendered in < 300 ms.
3. State Persistence
    a. Current episode is retained when switching tabs or graphs
4. Boundary Handling
    a. Navigation prevents moving past first or last episode
    b. Selecting episode number out of range shows error and leaves current episode unchanged

ID: F003	Feature: K^+ Clearance (Tau and Rate Constant)	Priority: Essential
BF2: Signal Analysis & Computation		Estimate: 16 hrs

Story:
As a researcher, I want to calculate Tau and 1/Tau from K^+ signals so I can measure clearance rates.

Acceptance Criteria:
1. Channel Detection
    a. If multiple channels exist the system prompts the user to pick the one labelled "K+"
2. Auto-Segmentation
    a. Trace is segmented into four episodes automatically
3. Computation
    a. Exponential decay fit returns Tau (ms)
    b. 1/Tau (rate constant) is calculated to exactly four decimal places
4. Result Storage & Display
    a. Tau and Rate Constant appear in Results table immediately
    b. Values persist when the experiment is re-opened

ID: F004	Feature: FFT Analysis	Priority: Essential
BF2: Signal Analysis & Computation		Estimate: 16 hrs

Story:
As a researcher, I want to run a FFT on signal data so I'll be able to examine its frequency components.

Acceptance Criteria:
1. Input Selection
    a. User can choose full trace or highlighted segment
2. Processing
    a. FFT completes in < 3 seconds for a 10 second trace
3. Output
    a. Frequency-magnitude plot opens automatically
    b. Data can be exported as a CSV. File contains frequency, magnitude headers

ID: F005	Feature: ZAP Profile and Resonance	Priority: Essential
BF2: Signal Analysis & Computation		Estimate: 16 hrs

Story:
As a researcher, I want to compute a ZAP profile and find resonance frequency to analyse the neuron's frequency-dependent impedance

Acceptance Criteria:
1. Stimulus Validation
    a. Continuous sweep trace is auto detected, if absent MSG_4 "No Continuous Sweep Detected" is shown.
2. Computation
    a. Impedance vs frequency profile is generated using > 1 second window
    b. Resonance frequency is identified and highlighted
    c. Profile and Fit completes in < 5 seconds for a 10 second sweep
3. Visual Output
    a. ZAP profile graph rendered with the peak highlighted
4. Data Storage
    a. Impedance array and Resonance frequency data are stored

ID: F006	Feature: Power Spectrum Heat Map	Priority: Essential
BF4: Data Visualisation & Reporting		Estimate: 14 hrs

Story:
As a researcher, I want to generate a heatmap of the power spectrum over a period of time to visualise its patterns.

Acceptance Criteria:
1. Rendering
    a. Heat-map renders within < 3 seconds for a 60 s trace
2. Interactivity
    a. User can zoom and hover to view power values.
3. Export
    a. Heat-map can be saved as PNG (1280 x 720) and SVG

ID: F007	Feature: Graph Output and Visualisation	Priority: Essential
BF4: Data Visualisation & Reporting		Estimate: 12 hrs

Story:
As a researcher, I want to visualise the signals and results with clear graphs to be able to interpret the data easily.

Acceptance Criteria:
1. Graph Types
    a. Heat-map, Line, Scatter all available
2. Performance
    a. Graphs render within < 3 seconds
3. Interactivity
    a. User can pan, zoom and toggle traces
4. Export
    a. Graphs are exported to PNG/SVG with axis labels and legend

ID: F008	Feature: Integrated Frontend-Backend Architecture	Priority: High
BF5: System Integration & Performance		Estimate: 10 hrs

Story:
As a researcher, I want the software to work seamlessly so that I can process and visualise data without any errors.

Acceptance Criteria:
1. Latency
    a. UI controls respond within < 1 second end-to-end
2. Error Handling
    a. Errors show a message and logs are created
3. Compatibility
    a. Full workflow operates on Windows 10/11 and macOS 12-14

ID: F009	Feature: Guided Workflow with Prompts	Priority: High
BF7: User Experience and Usability		Estimate: 11 hrs

Story:
As a user, I want guidance while using the software so it can be easier to understand what each feature does without having to need training.

Acceptance Criteria:
1. Contextual Help
    a. Toggling Help shows tooltips within 300 ms
2. Dismiss & Recall
    a. User can hide prompts, re-enabling restores them immediately
3. Coverage
    a. 100% of primary screens have access to contextual help

ID: F010	Feature: Cross-Platform Installer	Priority: High
BF6: Cross-Platform Compatibility		Estimate: 11 hrs

Story:
As a researcher, I want to be able to install the software on both Windows and Mac systems.

Acceptance Criteria:
1. Offline Package
    a. Installer includes all dependencies and runs offline
2. OS Support
    a. Successful install on Windows 10+ and macOS 12+. App launches post-install
3. Uninstall
    a. Uninstaller removes all program files and user data. Residual size < 1 MB

ID: F011	Feature: Security File Handling	Priority: Medium
BF8: Security & data Privacy		Estimate: 12 hrs

Story:
As a researcher, I want the software to avoid any modifications to the data files to maintain data integrity.

Acceptance Criteria:
1. Read-Only Access
    a. Files are opened with read-only flag by default
2. Write Prevention
    a. Any attempt to write is cancelled. User warned via MSG_10.
    b. All write attempts are logged with timestamps

ID: F012	Feature: Comprehensive Experiment Export	Priority: Medium
BF10: FTP Server Storage & Remote Access		Estimate: 8 hrs

Story:
As a researcher, I want to be able to export my entire experiment session so that I can then access it later or from another device.

Acceptance Criteria:
1. Archive Creation
    a. Export creates a ZIP containing raw data, analysis CSV and PNG/SVG plots
2. Confirmation
    a. Success message MSG_7 - "Export Complete" shown after archive/save.

ID: F013	Feature: File save integration	Priority: Low
BF10: FTP Server Storage & Remote Access		Estimate: 10 hrs

Story:
As a researcher, I want to save my results on the internet so they can be easily accessible on different computers or sharing purposes.

Acceptance Criteria:
1. Cloud Targets
    a. Users can choose between FTP and Google Drive.
2. Upload Progress
    a. Progress indicator shows bytes transferred and ETA
3. Network Failure
    a. Lost connection triggers MSG_11 and cancels upload.

ID: F014	Feature: User Account and Experiment Saving	Priority: Low
BF10: FTP Server Storage & Remote Access		Estimate: 14 hrs

Story:
As a researcher, I want to have a user account so that I can save and revisit my experiments across sessions and/or devices.

Acceptance Criteria:
1. Authentication
    a. Email and Password signup/login. Password strength ≥ OWASP moderate
2. Experiment List
    a. Saved experiments list loads in < 1 s, shows name & timestamp
3. Cross-Device Access
    a. Experiments load successfully on any logged in device with data integrity verified

Non-functional Requirements

ID: NF001	Feature: Large File Load Performance & Integrity	Priority: Essential
BF1: Neurophysiological Data Processing		Estimate: 7 hrs

Story:
As a researcher, I want the system to load larger ABF files, around up to 100MB, quickly without freezing, and be able to view the first episode within 5 seconds of loading. The files are also to never be modified during analysis to maintain data integrity.

Acceptance Criteria:
1. Performance - Load Time
    a. Load time < 5 seconds for a 100MB file. Progress bar updates at least every 500 ms
2. Performance - CPU Usage
    a. CPU usage stays < 80% during load.
3. Integrity
    a. File checksum before and after load is identical.

ID: NF002	Feature: Fast & Accurate Signal Computations	Priority: Essential
BF2: Signal Analysis & Computation		Estimate: 8 hrs

Story:
As a researcher, I want FFT and fitting computations to be completed within 3 seconds for a 10 second signal and all numerical calculations to be accurate to at least 4 decimals.

Acceptance Criteria:
1. Execution Time
    a. FFT & fitting complete in ≤ 3 seconds for a 10 second trace
2. Accuracy - Numerical Precision
    a. Numerical outputs accurate to 4 decimal places

ID: NF003	Feature: Responsive, Accessible GUI	Priority: Essential
BF3: Graphical User Interface (GUI)		Estimate: 6 hrs

Story:
As a user, I want the UI to display correctly on screen resolutions and UI buttons to react within 2 seconds for a responsive interface. All UI components need to be accessible and follow usability guidelines.

Acceptance Criteria:
1. Compatibility - Resolution Support
    a. UI renders correctly on 1280 x 720 up to 3840 x 2160 resolutions
2. Button Latency
    a. Button click response is < 200 ms
3. Contrast
    a. All interactive elements meet WCAG 2.1 AA contrast
4. Keyboard Navigation
    a. Keyboard navigation covers 100% of controls

ID: NF004	Feature: Rapid Plot Rendering & Timestamp Export	Priority: High
BF4: Data Visualisation & Reporting		Estimate: 6 hrs

Story:
As a researcher, I want all plots to render within 2 seconds after analysis with axis labels, units and a legend, and to be able to export files with a timestamp in their file names.

Acceptance Criteria:
1. Render Time
    a. Plot render time < 2 seconds for datasets up to 1M points
2. Timestamped Filenames
    a. Export filename pattern: plot_<YYYY-MM-DDThh-mm-ss>.png
3. Quality - Plot Metadata Completeness
    a. Axis labels, units and legend are present by default

ID: NF005	Feature: Modular Front/Back-end Architecture	Priority: High
BF5: System Integration & Performance		Estimate: 6 hrs

Story:
As a developer, I want backend and frontend modules to be separate for easier maintenance and its architecture to support future modular analysis integration.

Acceptance Criteria:
1. Architecture - Process Separation
    a. Front and Back-end run as separate processes/services

ID: NF006	Feature: Cross-Platform Offline Installer	Priority: High
BF6: Cross-Platform Compatibility		Estimate: 6 hrs

Story:
As a user, I want the software to run identically on Windows and MacOS as well as the installer to work offline while including all dependencies.

Acceptance Criteria:
1. Compatibility - Multi-OS Installer
    a. Single installer builds for Windows 10+ and macOS 12+
2. Reliability - Offline Functionality
    a. Installer functions without internet connection
3. Quality
    a. Post-install tests pass on both OS's

ID: NF007	Feature: Task Completion	Priority: High
BF7: User Experience & Usability		Estimate: 7 hrs

Story:
As a user, I want to complete basic tasks in under 10 minutes without reading a manual, where every analysis option includes a brief help description and access key functions with no more than 3 clicks on the main menu.

Acceptance Criteria:
1. Usability - Task Completion Time
    a. 5/5 users complete basic workflow within 10 minutes
2. Accessibility - Tooltip Reachability
    a. All help tooltips reachable within 3 clicks

ID: NF008	Feature: Local Data Integrity & Privacy Controls	Priority: High
BF8: Security & Data Privacy		Estimate: 4 hrs

Story:
As a user, I want all exported data to be saved in a separate folder to avoid overwriting any originals and no data to leave my computer unless chosen to.
 	
Acceptance Criteria:
1. Integrity - Default Export Location
    a. Exported data saved to /Exports folder by default
2. Privacy - No Unauthorised Network Calls
    a. No outbound network calls without user action		

ID: NF009	Feature: Error Logging & Messages	Priority: Medium
BF9: Error Handling & Debugging Support		Estimate: 5 hrs

Story:
As a user, I want all system errors logged with a timestamp and in a user-friendly message so that it can be troubleshooted.
 	
Acceptance Criteria:
1. Logging
    a. All exceptions are logged with a timestamp
2. Usability
    a. User-visible error messages contain plain-language summary		

ID: NF010	Feature: Error Logging & Messages	Priority: Low
BF10: FTP server Storage & Remote Access		Estimate: 8 hrs

Story:
As a user, I want to log in with Open Authorisation to save my Google Drive securely and upload files to be encrypted during transfer for data protection.
 	
Acceptance Criteria:
1. Security - Credential Safety
    a. OAuth 2.0 flow completes without exposing credentials
2. Security - Encrypted Transfer
    a. File uploads use SFTP or HTTPS TLS 1.3		

Sequence Diagrams

Sequence diagram is used to describe the specific tasks of each actor such as client, GUI components, data processor, plot module and CSV exported. Client is a first actor to engage the software by providing some tasks so that GUI components can receive client's requests and send them to the software. Data processor is responsible for activating the calculation of a signal type to deliver precise results and upload them in GUI components so that the client can observe clearly. Finally, once the client is satisfied with the results, CSV exporter is used to handle the csv file conversion.
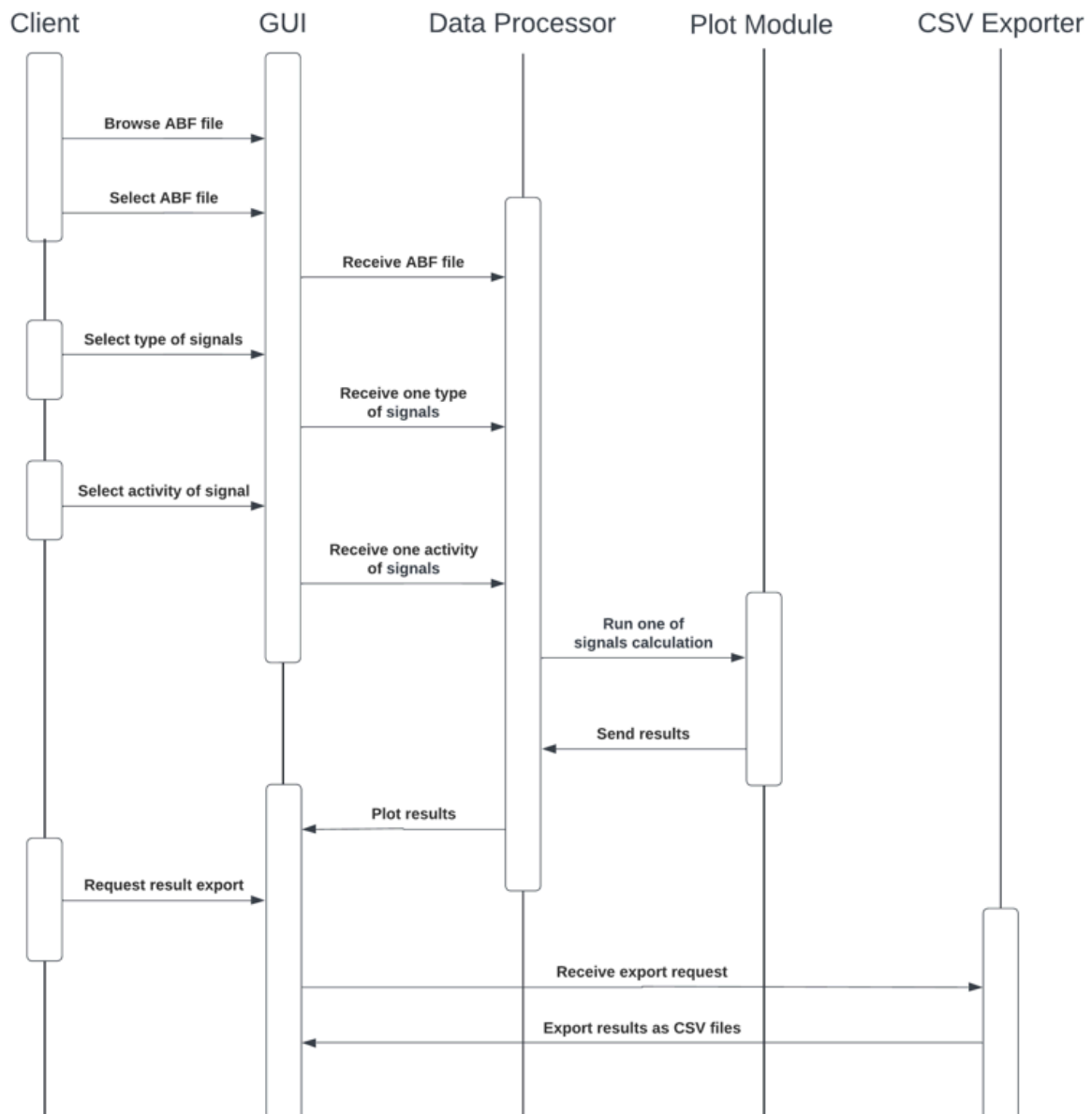
Picture 2: Sequence diagram of Neurophysiological Analyzer

Entity Relationship Diagrams (ERD)
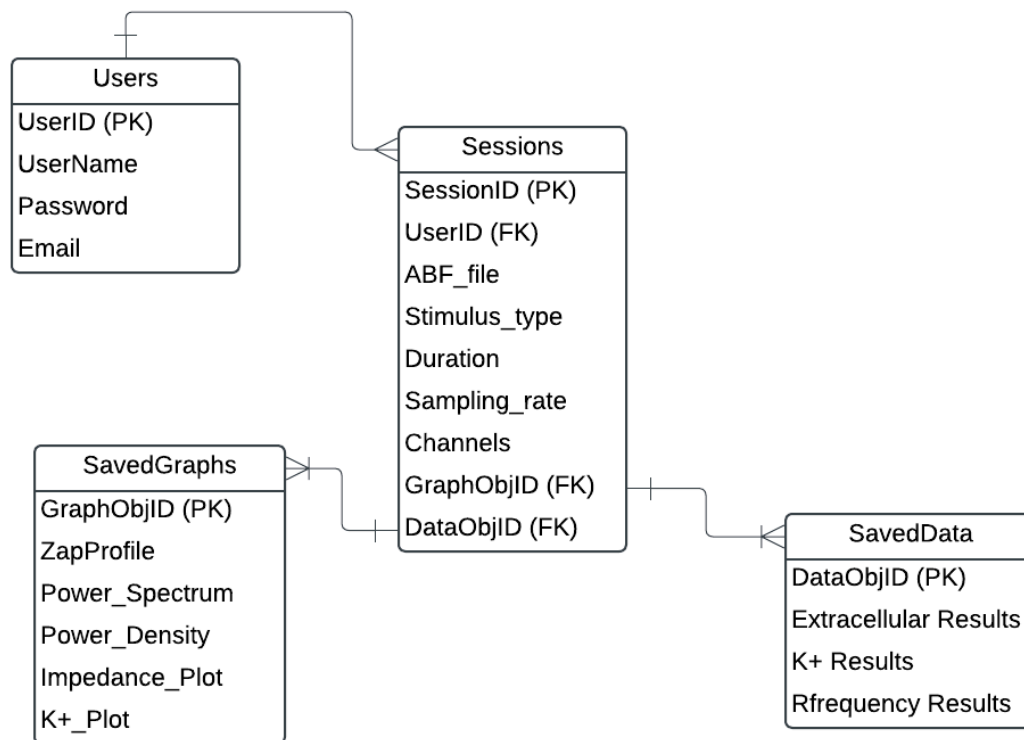
With all database aspects, it will be a future addition that comes with the Online version of our application. The local version may include the saved data sessions area as an added feature but again that is considered later down the line.

The focus of the ERD was to focus on saving user data with passwords being encrypted and authentication in mind. Then users should be able to save each session onto their accounts. This entails the abf file and some of its metadata and arrays of objects relating to both the graphing done and the results needed to be saved. The relationship between these shows that you have 1 array to many graph objects and 1 array to many data objects.

Database Schema
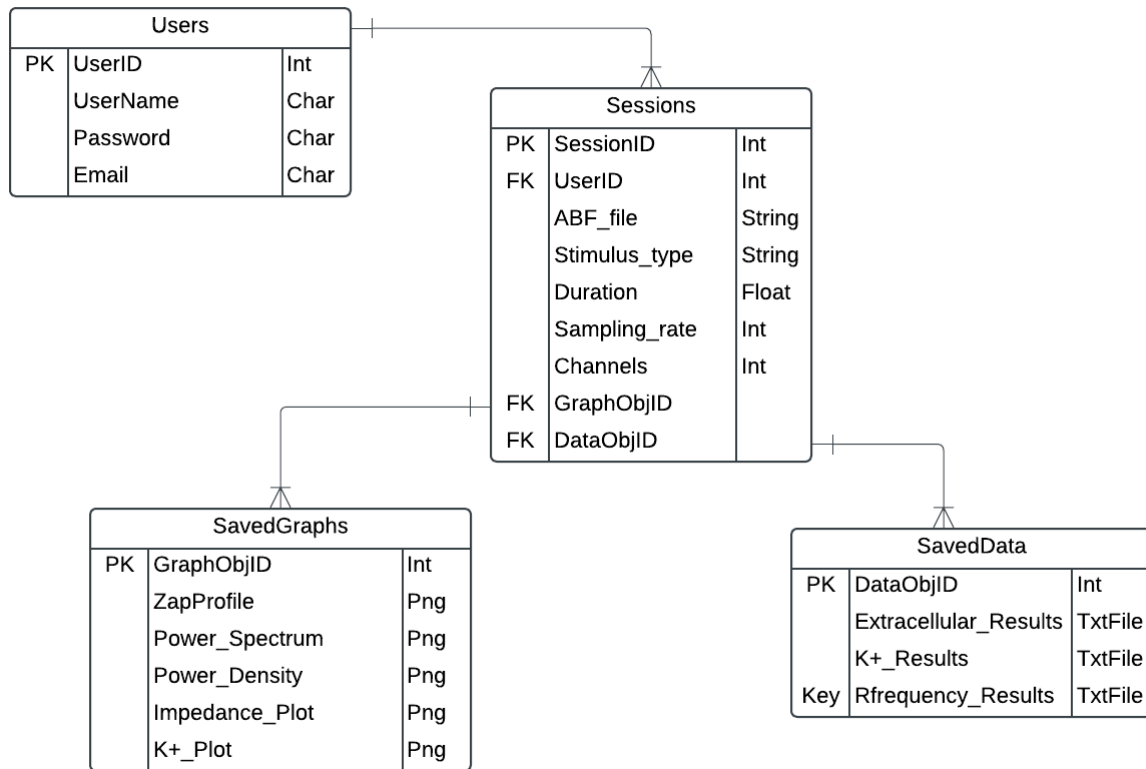
Our database schema shows the data types we are using. Each session is an object that consists of both ID integers that are used to call the needed session and cross reference it with the user. The other foreign keys are links to arrays that consists of objects that save the information that is analysed. This includes graphs and data. The graphs will be saved as PNG allowing for them to be reviewed after. The data will be saved in text files simply storing the variables and their data.

Screen Designs

Figure 1 - Main Window (default state)
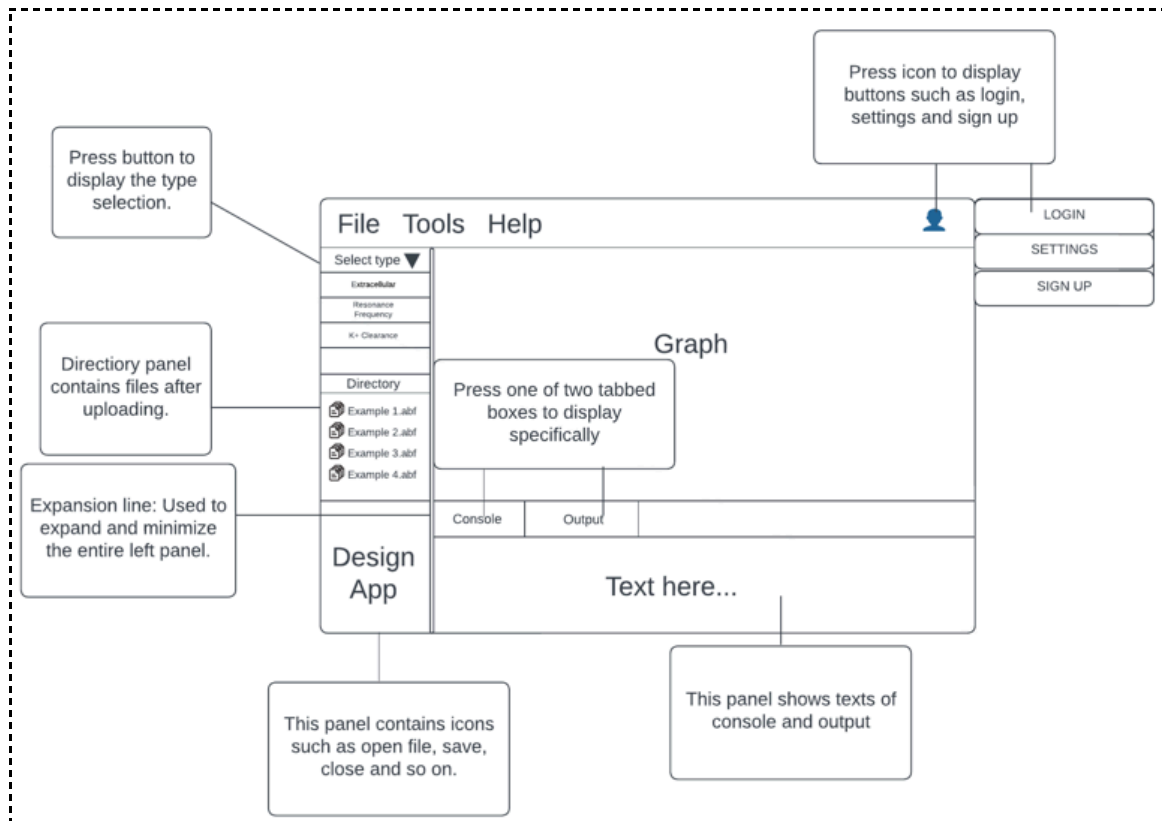
Figure 2 - Main Window (After Minimising)
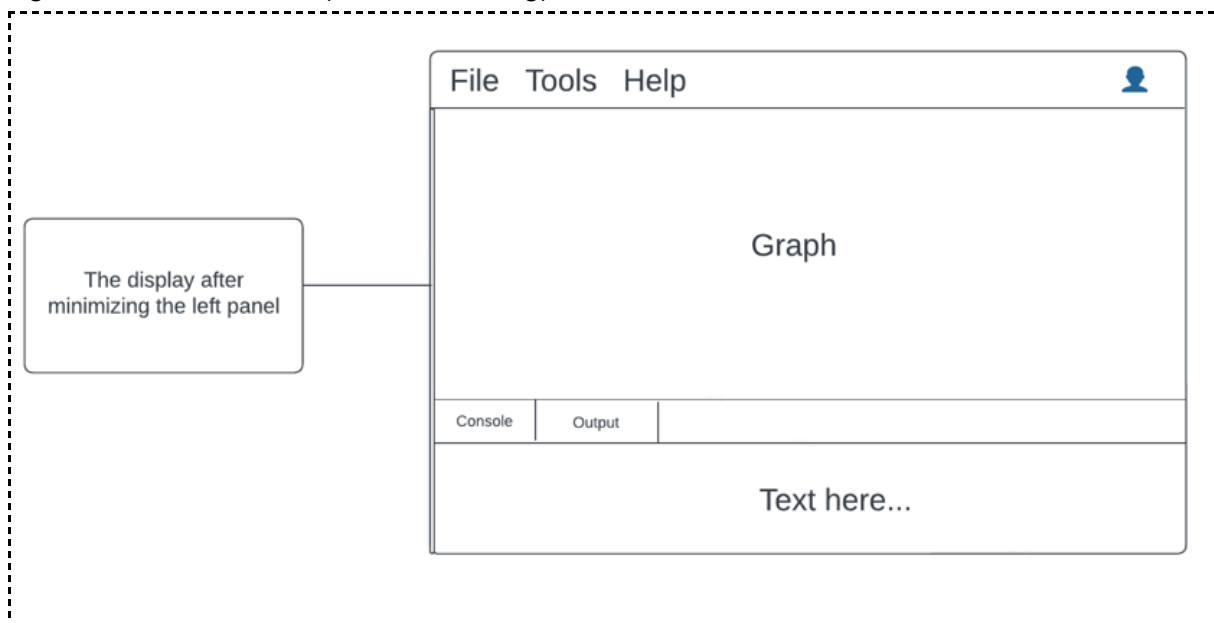
Figure 3 - Sign Up Screen
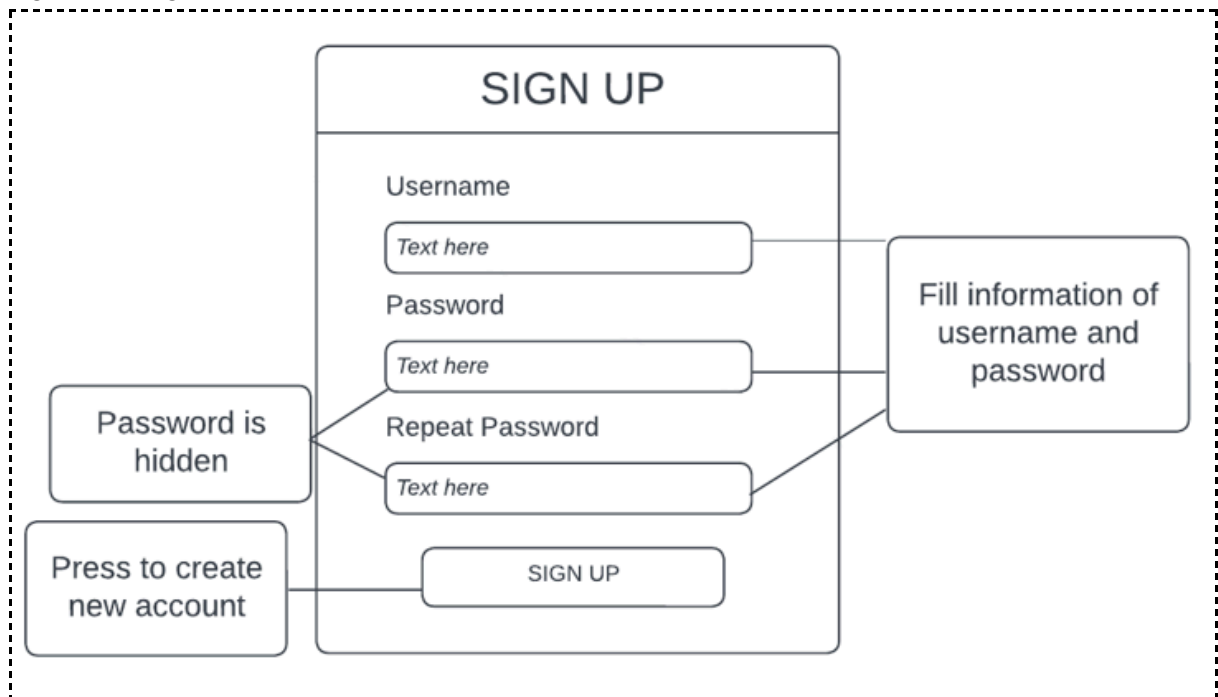
Figure 4 - Login Screen
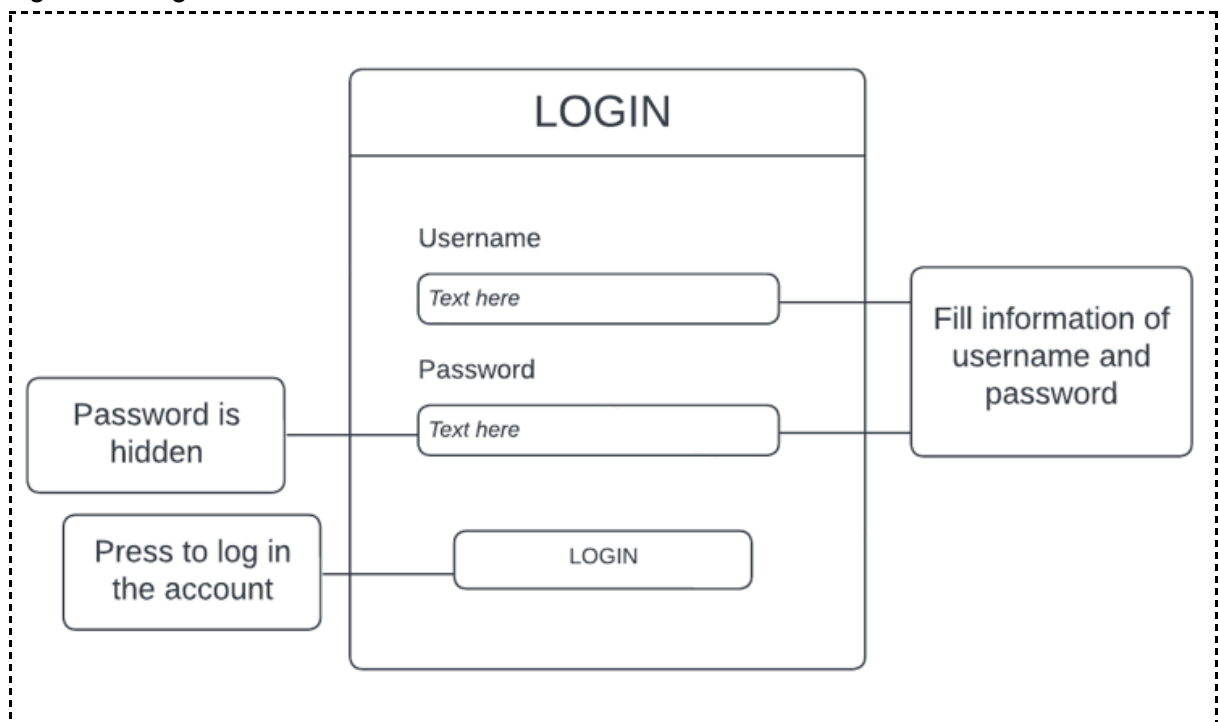
Figure 5 - Main Window (After Login)
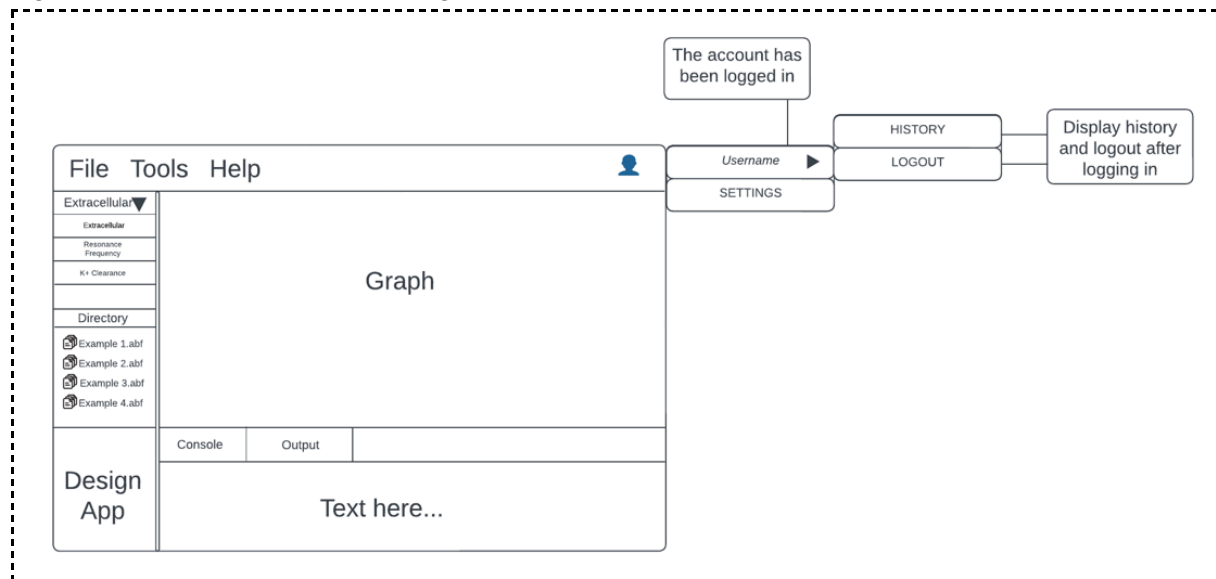
Figure 6 - History Tab (Displays previous experiments)
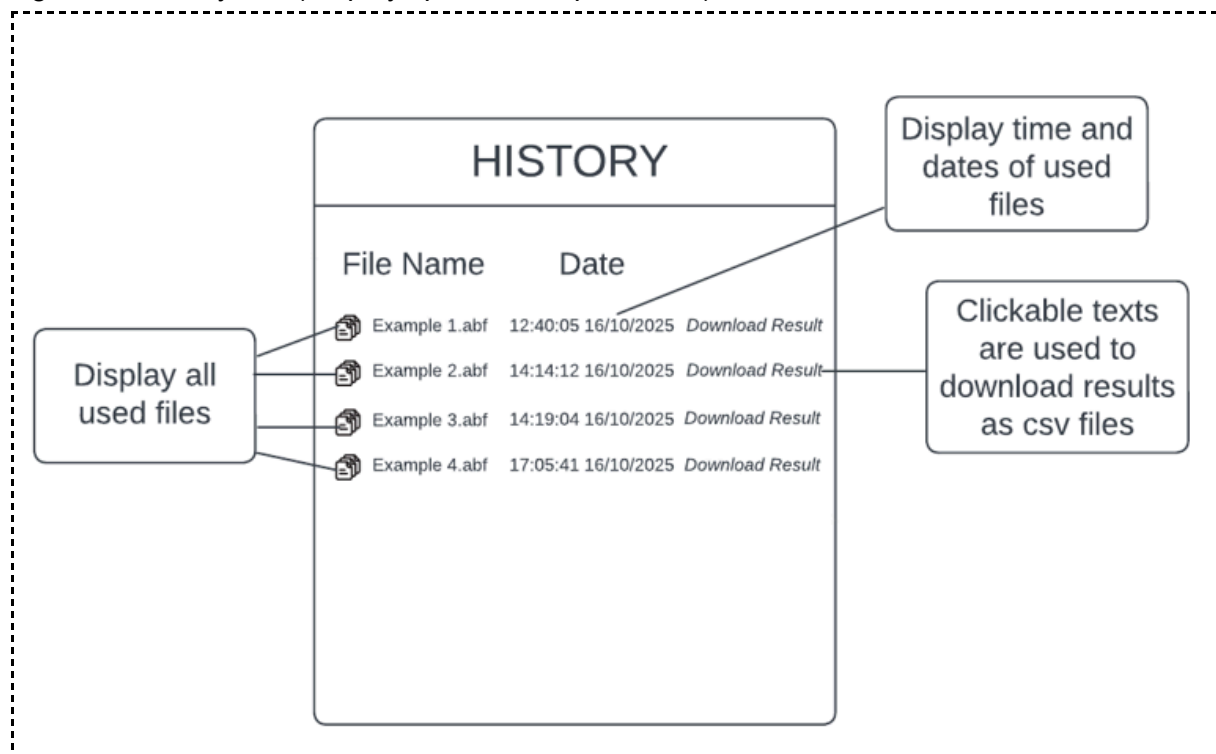
List of Messages

Msg No.	Message	User-Story	Screen Design
MSG_1	"File loaded successfully"	F001	Figure 1 - Main Window - Console
MSG_2	"Unable to load file"	F001	Figure 1 - Main Window - Console
MSG_3	"Episode {n} of {total}"	F002	Figure 1 - Main Window - Output
MSG_4	"No continuous sweep detected for ZAP Analysis"	F005	Figure 1 - Main Window - Console
MSG_5	"FFT Complete"	F004	Figure 1 - Main Window - Output
MSG_6	"Export in progress {percent}%"	F012	Figure 1 - Main Window - Output
MSG_7	"Export Complete"	F012	Figure 1 - Main Window - Output
MSG_8	"Upload finished"	F013	Figure 1 - Main Window - Output
MSG_9	"Invalid Credentials"	F014	Figure 4 - Login Screen
MSG_14	"Successfully Signed Up"	F014	Figure 3 - Sign Up Screen
MSG_10	"File is read-only - changes not saved"	F011	Figure 1 - Main Window - Output
MSG_11	"An unexpected error occurred. Please check the log"	F008, NF009	Figure 1 - Main Window - Console
MSG_12	"Installation Complete"	F010	Installer wizard finish page
MSG_13	"Upload in progress {percent}%"	F013	Figure 1 - Main Window - Console

Test Plan

Features/Use Cases to be Tested

Feature ID	Feature	Test Case ID	Test Case	Expected Result	Test Status
F001	ABF File Loader	TC-F001-1	System Accepts .abf files	File loads without error	Pending
F001		TC-F001-2	Original file remains unmodified	Checksum before/after are identical	Pending
F001		TC-F001-3	100MB file loads in < 5 seconds	Load time < 5 seconds	Pending
F001		TC-F001-4	Header & Channel data parsed correctly	Data objects created	Pending
F001		TC-F001-5	Dataset appears in Experiments list	UI list updated	Pending
F001		TC-F001-6	Success message MSG_1 displayed	Message displayed in console	Pending
F001		TC-F001-7	Load error shows descriptive dialogue	Error dialogue MSG_2	Pending
F002	Episode Navigation	TC-F002-1	Navigate with arrow keys	Waveform updates	Pending
F002		TC-F002-2	Select episode from drop-down	Selected episode displayed	Pending
F002		TC-F002-3	Current episode retained across views	State persists	Pending
F002		TC-F002-4	Prevent navigation past bounds	Application remains responsive	Pending

Feature ID	Feature	Test Case ID	Test Case	Expected Result	Test Status
F003	K+ Clearance	TC-F003-1	Prompt user to pick K+ Channel	Channel dialogue appears	Pending
F003		TC-F003-2	Auto-segment into 4 episodes	4 segments created	Pending
F003		TC-F003-3	Tau calculated	Value returned is correct	Pending
F003		TC-F003-4	Rate constant calculated to 4 decimal places	Value returned is correct & rounded to 4 decimal places	Pending
F003		TC-F003-5	Tau and Rate constant stored and shown	Results table updated	Pending
F004	FFT Analysis	TC-F004-0	User selects a highlighted segment only	FFT completes in < 3 seconds	Pending
F004		TC-F004-1	User selects full trace	FFT completes in < 3 seconds	Pending
F004		TC-F004-2	Frequency plot window opens	Plot window visible	Pending
F004		TC-F004-3	Data export to CSV	CSV file created	Pending
F005	ZAP Profile & Resonance	TC-F005-1	Continuous sweep trace detected	Dialogue closes without error messages	Pending
F005		TC-F005-2	Error is shown if sweep trace is not detected	Error dialogue shown	Pending
F005		TC-F005-3	Identify and highlight resonance	Resonance frequency visible on graph	Pending
F005		TC-F005-4	Zap graph rendered in < 3 seconds	Graph is displayed in time	Pending
F005		TC-F005-5	Impedance array and resonance frequency data stored	Data updated	Pending

Feature ID	Feature	Test Case ID	Test Case	Expected Result	Test Status
F006	Power Spectrum Heat Map	TC-F006-1	Heat map renders within < 3 seconds	Heat-map visible	Pending
F006		TC-F006-2	Zoom & hover show power values	Interactivity works	Pending
F006		TC-F006-3	Export heat-map PNG/SVG	PNG/SVG file exported	Pending
F007	Graph Output & Visualisation	TC-F007-1	Create Heat-map, line, scatter	All graph types available	Pending
F007		TC-F007-2	Graphs render within < 3 seconds	Graph renders in time	Pending
F007		TC-F007-3	Pan, zoom, toggle traces	Interactivity works	Pending
F007		TC-F007-4	Export graph PNG/SVG with labels	File exported with metadata	Pending
F008	Integrated FE/BE Architecture	TC-F008-1	Input latency < 1 second	Interactivity is responsive	Pending
F008		TC-F008-2	Errors show message in console	User sees plain language error	Pending
F008		TC-F008-3	Program executed on Windows and macOS	Program is completely functional	Pending
F009	Guided Workflow	TC-F009-1	Help icon shows contextual tips	Tooltip visible	Pending
F009		TC-F009-2	Dismiss and re-enable prompts	Setting toggles help prompts	Pending

Feature ID	Feature	Test Case ID	Test Case	Expected Result	Test Status
F010	Cross-Platform Installer	TC-F010-1	Offline install on Windows 10+	Install succeeds offline	Pending
F010		TC-F010-2	Offline install on macOS 12+	Install succeeds offline	Pending
F010		TC-F010-3	Uninstaller removes files	No residual files	Pending
F010		TC-F010-4	Launch application after installer	Splash screen appears and main window loads without error	Pending
F011	Secure File Handling	TC-F011-1	Open file is read only	File handle is read-only and cannot be modified	Pending
F011		TC-F011-2	Attempt to write to file	Prompt displayed, Attempt cancelled	Pending
F012	Experiment Export	TC-F012-1	Create ZIP archive	Archive created	Pending
F012		TC-F012-2	MSG_7 confirmation shown	Success dialogue visible	Pending
F013	File Save Integration	TC-F013-1	Upload file via FTP	FTP target selected	Pending
F013		TC-F013-2	Upload file via Google Drive	Google Drive target selected	Pending
F013		TC-F013-3	Progress bar shows ETA	Progress bar updates	Pending
F013		TC-F013-4	Upload interrupted - network loss mid-upload	Upload aborts Error toast MSG_11 shown	Pending
F014	User Account & Saving	TC-F014-1	Sign up / login with email	Authentication succeeds	Pending
F014		TC-F014-2	View saved experiment list	List is displayed	Pending
F014		TC-F014-3	Load experiment on alternate device	Data loads successfully	Pending

Candidate Test Cases/Test Data

Field	System Accepts .abf files
Feature ID	F001
Feature	ABF File Loader
Test Case ID	TC-F001-1
Test Purpose	Ensure the system loads supported .abf files
Screen ref	Figure 1 - Main Window Figure 2 - Main Window Figure 5 - Main Window
Expected Results	1. System accepts .abf files 2. File loads in < 5 seconds for < 100MB 3. Success toast MSG_1 is displayed
Test Status	Pending
Test-Case Data	

Field Name	Set 1	Set 2	Set 3
File Name	v1_10MB.abf	v2_50MB.abf	v3_100MB.abf
File Size	10 MB	50 MB	100 MB
Expected Result	Pass	Pass	Pass
Status	Pending	Pending	Pending
Date Tested	-	-	-
Action to be Taken	-	-	-

Field	Original file remains unmodified
Feature ID	F001
Feature	ABF File Loader
Test Case ID	TC-F001-2
Test Purpose	Verify original file remains unmodified (checksum match)
Screen ref	Figure 1 - Main Window Figure 2 - Main Window Figure 5 - Main Window
Expected Results	1. Pre-load and post-load SHA-256 checksums match 2. Integrity log entry created with timestamps
Test Status	Pending

Test-Case Data

Field Name	Set 1	Set 2	Set 3
File Name	integrity.abf	integrity.abf	integrity.abf
Pre-Load Checksum	auto	auto	auto
Post-Load Checksum	auto	auto	auto
Expected Result	Pass	Pass	Pass
Status	Pending	Pending	Pending
Date Tested	-	-	-
Action to be Taken	-	-	-

Field	100MB File loads in < 5 seconds
Feature ID	F001
Feature	ABF File Loader
Test Case ID	TC-F001-3
Test Purpose	Confirm files up to 100 MB load within 5 seconds
Screen ref	Figure 1 - Main Window Figure 2 - Main Window Figure 5 - Main Window
Expected Results	1. Progress bar appears 2. Total load time is < 5 seconds 3. No UI freeze
Test Status	Pending

Test-Case Data

Field Name	Set 1	Set 2	Set 3
File Name	test_20MB.abf	test_50MB.abf	test_100MB.abf
Size	20 MB	50 MB	100 MB
Expected Result	Pass	Pass	Pass
Status	Pending	Pending	Pending
Date Tested	-	-	-
Action to be Taken	-	-	-

Field	Header & Channel data parsed correctly		
Feature ID	F001		
Feature	ABF File Loader		
Test Case ID	TC-F001-4		
Test Purpose	Verify header and all channel data are parsed without error		
Screen ref	Figure 1 - Main Window Figure 2 - Main Window Figure 5 - Main Window		
Expected Results	1. Header metadata displayed correctly 2. All channels present in channel list		
Test Status	Pending		
Test-Case Data			
Field Name	**Set 1**	**Set 2**	**Set 3**
File Name	test_20MB.abf	test_50MB.abf	test_100MB.abf
Channels	2	4	8
Expected Result	Pass	Pass	Pass
Status	Pending	Pending	Pending
Date Tested	-	-	-
Action to be Taken	-	-	-

Field	Dataset appears in Experiments list
Feature ID	F001
Feature	ABF File Loader
Test Case ID	TC-F001-5
Test Purpose	Ensure parsed dataset is listen in Experiments workspace
Screen ref	Figure 6 - History Tab
Expected Results	1. New entry added to list immediately after load 2. Entry shows file name and timestamp
Test Status	Pending

Test-Case Data			
Field Name	**Set 1**	**Set 2**	**Set 3**
File Name	expA.abf	expB.abf	expC.abf
Expected Result	Pass	Pass	Pass
Status	Pending	Pending	Pending
Date Tested	-	-	-
Action to be Taken	-	-	-

Field	Arrow-Key Navigation		
Feature ID	F002		
Feature	Episode Navigation		
Test Case ID	TC-F002-1		
Test Purpose	Validate arrow keys move to previous/next episode		
Screen ref	Figure 1 - Main Window - Graph Figure 2 - Main Window - Graph Figure 5 - Main Window - Graph		
Expected Results	1. Waveform updates < 500ms 2. Status label shows "Episode n of total"		
Test Status	Pending		
Test-Case Data			
Field Name	**Set 1**	**Set 2**	**Set 3**
Current Episode	1	5	last-1
Key Press	→	←	→
Expected Result	2	4	last
Status	Pending	Pending	Pending
Date Tested	-	-	-
Action to be Taken	-	-	-

Field	Drop-Down Episode Selection		
Feature ID	F002		
Feature	Episode Navigation		
Test Case ID	TC-F002-2		
Test Purpose	Ensure user can select any episode from drop-down		
Screen ref	Figure 1 - Main Window - Select Type Tab Figure 2 - Main Window - Select Type Tab Figure 5 - Main Window - Select Type Tab		
Expected Results	1. Selected episode loads < 500ms 2. Drop down highlights chosen episode		
Test Status	Pending		
Test-Case Data			
Field Name	**Set 1**	**Set 2**	**Set 3**
Selected Episode	3	10	1
Expected Result	Pass	Pass	Pass
Status	Pending	Pending	Pending
Date Tested	-	-	-
Action to be Taken	-	-	-

Field	State Persistence Across Views
Feature ID	F002
Feature	Episode Navigation
Test Case ID	TC-F002-3
Test Purpose	Verify current episode pointer persists when switching screens
Screen ref	Figure 1 - Main Window Figure 2 - Main Window Figure 5 - Main Window
Expected Results	1. After navigating to _ screen and back, same episode is still selected
Test Status	Pending

Test-Case Data			
Field Name	**Set 1**	**Set 2**	**Set 3**
Episode Before Switch	2	7	last
Expected Result After Switch	2	7	last
Status	Pending	Pending	Pending
Date Tested	-	-	-
Action to be Taken	-	-	-

Field	Boundary Navigation Handling
Feature ID	F002
Feature	Episode Navigation
Test Case ID	TC-F002-4
Test Purpose	Ensure keys do not move past first or last episode
Screen ref	Figure 1 - Main Window - Graph Figure 2 - Main Window - Graph Figure 5 - Main Window - Graph
Expected Results	1. On first episode, ← does nothing 2. On last episode, → does nothing
Test Status	Pending

Test-Case Data			
Field Name	**Set 1**	**Set 2**	**Set 3**
Position	First	Last	First
Key Press	←	→	←
Expected Result	Pass	Pass	Pass
Status	Pending	Pending	Pending
Date Tested	-	-	-
Action to be Taken	-	-	-

Field	K+ Channel Selection Prompt		
Feature ID	F003		
Feature	K+ Clearance		
Test Case ID	TC-F003-1		
Test Purpose	Confirm prompt appears when multiple channels exist		
Screen ref	Figure 1 - Main Window - Select Type Figure 2 - Main Window - Select Type Figure 5 - Main Window - Select Type		
Expected Results	1. Channel selection dialog opens 2. User must choose channel to proceed		
Test Status	Pending		
Test-Case Data			
Field Name	**Set 1**	**Set 2**	**Set 3**
File Name	k1_singleCh.abf	k2_multiCh.abf	k3_noK.abf
Channels in file	1	4	2
Channel labels	K+	K+, Temp	Vm
Expected Result	Prompt not shown - analysis proceeds directly	Channel-select dialogue opens. User selects K+, dialogue closes, analysis continues	Dialogue opens, "No channel labelled K+" (MSG_11), Analysis blocked
Status	Pending	Pending	Pending
Date Tested	-	-	-
Action to be Taken	-	-	-

Field	Auto-Segmentation into Episodes		
Feature ID	F003		
Feature	K+ Clearance		
Test Case ID	TC-F003-2		
Test Purpose	Verify trace is segmented into four episodes automatically		
Screen ref	Figure 1 - Main Window - Graph Figure 2 - Main Window - Graph Figure 5 - Main Window - Graph		
Expected Results	1. Four segment markers appear on timeline 2. Segment durations are equal		
Test Status	Pending		
Test-Case Data			
Field Name	**Set 1**	**Set 2**	**Set 3**
Trace Length	40s	20s	60s
Expected Result	Pass	Pass	Pass
Status	Pending	Pending	Pending
Date Tested	-	-	-
Action to be Taken	-	-	-

Field	Tau Fit Calculation
Feature ID	F003
Feature	K+ Clearance
Test Case ID	TC-F003-3
Test Purpose	Confirm exponential decay fit meets threshold
Screen ref	Figure 1 - Main Window - Graph Figure 2 - Main Window - Graph Figure 5 - Main Window - Graph
Expected Results	1. Fit curve overlays trace 2. Correct value returned
Test Status	Pending

Test-Case Data			
Field Name	**Set 1**	**Set 2**	**Set 3**
Input Data	120 ms	50 ms	8 ms
Expected Result	Pass	Pass	
Status	Pending	Pending	Pending
Date Tested	-	-	-
Action to be Taken	-	-	-

Field	1/Tau Precision
Feature ID	F003
Feature	K+ Clearance
Test Case ID	TC-F003-4
Test Purpose	Verify 1/Tau is displayed with four decimal places of precision
Screen ref	Figure 1 - Main Window - Output Figure 1 - Main Window - Graph Figure 2 - Main Window - Output Figure 2 - Main Window - Graph Figure 5 - Main Window - Output Figure 5 - Main Window - Graph
Expected Results	1. 1/Tau value shows exactly four digits after the decimal 2. No rounding errors visible in export CSV
Test Status	Pending

Test-Case Data

Field Name	Set 1	Set 2	Set 3
Tau (ms)	123.4567	50.0000	7.8901
Expected 1/Tau	0.0081	0.0200	0.1268
Expected Result	Pass	Pass	Pass
Status	Pending	Pending	Pending
Date Tested	-	-	-
Action to be Taken	-	-	-

Field	Result Storage & Display		
Feature ID	F003		
Feature	K+ Clearance		
Test Case ID	TC-F003-5		
Test Purpose	Ensure Tau and 1/Tau values are saved with dataset metadata and displayed in Results table		
Screen ref	Figure 1 - Main Window - Output Figure 2 - Main Window - Output Figure 5 - Main Window - Output		
Expected Results	1. New row appears in Results table with Tau and 1/Tau columns populated		
Test Status	Pending		
Test-Case Data			
Field Name	**Set 1**	**Set 2**	**Set 3**
Dataset ID	1001	1002	1003
Tau (ms)	auto	auto	auto
1/Tau	auto	auto	auto
Expected Result	Pass	Pass	Pass
Status	Pending	Pending	Pending
Date Tested	-	-	-
Action to be Taken	-	-	-

Field	Highlighted-Segment FFT
Feature ID	F004
Feature	FFT Analysis
Test Case ID	TC-F004-0
Test Purpose	Ensure FFT completes within 3 s when the user selects only a highlighted segment.
Screen ref	Figure 1 - Main Window - Graph Figure 2 - Main Window - Graph Figure 5 - Main Window - Graph
Expected Results	1. FFT completes in < 3 seconds 2. Frequency plot window opens automatically 3. MSG_5 FFT Complete appears
Test Status	Pending

Test-Case Data

Field Name	Set 1	Set 2	Set 3
Segment length	1 s	5 s	10 s
Expected Result	Pass	Pass	Pass
Status	Pending	Pending	Pending
Date Tested	-	-	-
Action to be Taken	-	-	-

Field	Full-Trace FFT Performance
Feature ID	F004
Feature	FFT Analysis
Test Case ID	TC-F004-1
Test Purpose	Verify FFT completes within 3 seconds for a 10 second trace and frequency plot window opens
Screen ref	Figure 1 - Main Window - Graph Figure 2 - Main Window - Graph Figure 5 - Main Window - Graph
Expected Results	1. FFT Computation finishes < 3 seconds 2. Frequency plot window opens automatically 3. Info toast MSG_5 - "FFT complete" appears
Test Status	Pending

Test-Case Data

Field Name	Set 1	Set 2	Set 3
Trace Length	10 seconds	10 seconds	10 seconds
Sampling Rate (kHz)	10	20	50
Expected Result	Pass	Pass	Pass
Status	Pending	Pending	Pending
Date Tested	-	-	-
Action to be Taken	-	-	-

Field	Frequency-Plot Window Opens		
Feature ID	F004		
Feature	FFT Analysis		
Test Case ID	TC-F004-2		
Test Purpose	Verify frequency plot appears after FFT		
Screen ref	Figure 1 - Main Window - Graph Figure 2 - Main Window - Graph Figure 5 - Main Window - Graph		
Expected Results	1. Plot window is visible and in focus within 0.5 seconds of FFT completion		
Test Status	Pending		
Test-Case Data			
Field Name	**Set 1**	**Set 2**	**Set 3**
Input Type	Full	Segment	Segment
Expected Result	Pass	Pass	Pass
Status	Pending	Pending	Pending
Date Tested	-	-	-
Action to be Taken	-	-	-

Field	CSV Data Export
Feature ID	F004
Feature	FFT Analysis
Test Case ID	TC-F004-3
Test Purpose	Validate FFT output can be exported as CSV with correct headers
Screen ref	Figure 1 - Main Window - Toolbar (File) Figure 2 - Main Window - Toolbar (File) Figure 5 - Main Window - Toolbar (File)
Expected Results	1. "Export CSV" button enabled after FFT completes 2. CSV file contains frequency and magnitude columns 3. Row count matches FFT array length
Test Status	Pending

Test-Case Data			
Field Name	**Set 1**	**Set 2**	**Set 3**
FFT Size	1024	2048	4096
Expected rows in CSV	513	1025	2049
Status	Pending	Pending	Pending
Date Tested	-	-	-
Action to be Taken	-	-	-

Field	Continuous Sweep Detection
Feature ID	F005
Feature	ZAP Profile & Resonance
Test Case ID	TC-F005-1
Test Purpose	Ensure system detects a continuous sweep trace or alerts the user
Screen ref	Figure 1 - Main Window - Graph Figure 2 - Main Window - Graph Figure 5 - Main Window - Graph
Expected Results	1. If sweep detected analysis proceeds 2. If no sweep detected error dialogue MSG_4 - "No continuous sweep detected"
Test Status	Pending

Test-Case Data

Field Name	Set 1	Set 2	Set 3
Sweep Present	Yes	No	Yes
Expected Result	Pass	Error Dialogue	Pass
Status	Pending	Pending	Pending
Date Tested	-	-	-
Action to be Taken	-	-	-

Field	Error - No Continuous Sweep
Feature ID	F005
Feature	ZAP Profile & Resonance
Test Case ID	TC-F005-2
Test Purpose	Verify error dialogue appears when no sweep trace detected
Screen ref	Figure 1 - Main Window - Graph Figure 2 - Main Window - Graph Figure 5 - Main Window - Graph
Expected Results	1. Error dialogue MSG_4 displayed 2. Analysis aborted
Test Status	Pending
Test-Case Data	

Field Name	Set 1	Set 2	Set 3
Sweep Present	No	No	No
Expected Result	Pass	Pass	Pass
Status	Pending	Pending	Pending
Date Tested	-	-	-
Action to be Taken	-	-	-

Field	Resonance Frequency Identification
Feature ID	F005
Feature	ZAP Profile & Resonance
Test Case ID	TC-F005-3
Test Purpose	Ensure resonance peak is correctly identified and highlighted on graph
Screen ref	Figure 1 - Main Window - Graph Figure 2 - Main Window - Graph Figure 5 - Main Window - Graph
Expected Results	1. Peak impedance value detected 2. Marker placed on graph 3. Resonance peak value displayed in Results panel
Test Status	Pending

Test-Case Data

Field Name	Set 1	Set 2	Set 3
Expected Resonance (Hz)	5.0	7.5	12.0
Sweep length (s)	10	10	10
Expected Result	Pass	Pass	Pass
Status	Pending	Pending	Pending
Date Tested	-	-	-
Action to be Taken	-	-	-

Field	Graph Rendering Performance
Feature ID	F005
Feature	ZAP Profile & Resonance
Test Case ID	TC-F005-4
Test Purpose	Confirm ZAP graph renders within 3 seconds with interactive zoom
Screen ref	Figure 1 - Main Window - Graph Figure 2 - Main Window - Graph Figure 5 - Main Window - Graph
Expected Results	1. Graph displayed < 3 seconds after analysis 2. User can zoom and pan without lag
Test Status	Pending

Test-Case Data			
Field Name	**Set 1**	**Set 2**	**Set 3**
Sweep length (s)	2	5	10
Expected Result	Pass	Pass	Pass
Status	Pending	Pending	Pending
Date Tested	-	-	-
Action to be Taken	-	-	-

Field	Result Storage with Dataset		
Feature ID	F005		
Feature	ZAP Profile & Resonance		
Test Case ID	TC-F005-5		
Test Purpose	Verify impedance array and Resonance peak are saved with dataset metadata		
Screen ref	Figure 1 - Main Window - Output Figure 2 - Main Window - Output Figure 5 - Main Window - Output		
Expected Results	1. Results table stores resonance peak value		
Test Status	Pending		
Test-Case Data			
Field Name	**Set 1**	**Set 2**	**Set 3**
Dataset ID	2001	2002	2003
Expected Result	Pass	Pass	Pass
Status	Pending	Pending	Pending
Date Tested	-	-	-
Action to be Taken	-	-	-

Field	Heat-Map Rendering Performance
Feature ID	F006
Feature	Power Spectrum Heat Map
Test Case ID	TC-F006-1
Test Purpose	Verify the heat-map renders within 3 seconds for typical datasets
Screen ref	Figure 1 - Main Window - Graph Figure 2 - Main Window - Graph Figure 5 - Main Window - Graph
Expected Results	1. Heat map fully visible and interactive in < 3 seconds 2. UI remains responsive
Test Status	Pending

Test-Case Data			
Field Name	**Set 1**	**Set 2**	**Set 3**
Trace Length	5	30	60
Expected Result	Pass	Pass	Pass
Status	Pending	Pending	Pending
Date Tested	-	-	-
Action to be Taken	-	-	-

Field	Interactivity (Zoom & Hover)
Feature ID	F006
Feature	Power Spectrum Heat Map
Test Case ID	TC-F006-2
Test Purpose	Validate user can zoom and hover to view power values
Screen ref	Figure 1 - Main Window - Graph Figure 2 - Main Window - Graph Figure 5 - Main Window - Graph
Expected Results	1. Mouse wheel zooms in/out smoothly 2. Hover tool-tip shows time, frequency, power (dB) 3. Values match underlying data
Test Status	Pending

Test-Case Data			
Field Name	**Set 1**	**Set 2**	**Set 3**
Zoom Level	2x	4x	1x
Expected Result	Pass	Pass	Pass
Status	Pending	Pending	Pending
Date Tested	-	-	-
Action to be Taken	-	-	-

Field	PNG/SVG Export
Feature ID	F006
Feature	Power Spectrum Heat Map
Test Case ID	TC-F006-3
Test Purpose	Ensure heat-map can be exported as PNG and SVG with correct dimensions and metadata
Screen ref	Figure 1 - Main Window - Toolbar (File) Figure 2 - Main Window - Toolbar (File) Figure 5 - Main Window - Toolbar (File)
Expected Results	1. Export PNG saves a .png image 2. Export SVG saves a vector file 3. Image size = 1280 x 720 px
Test Status	Pending

Test-Case Data

Field Name	Set 1	Set 2	Set 3
Export Format	PNG	SVG	PNG
Expected File	heatmap.png	heatmap.svg	heatmap.png
Expected Result	Pass	Pass	Pass
Status	Pending	Pending	Pending
Date Tested	-	-	-
Action to be Taken	-	-	-

Field	Graph Type Generation
Feature ID	F007
Feature	Graph Output & Visualisation
Test Case ID	TC-F007-1
Test Purpose	Verify that the three required graph types can be generated
Screen ref	Figure 1 - Main Window - Graph Figure 2 - Main Window - Graph Figure 5 - Main Window - Graph
Expected Results	1. Selected graph type renders without error
Test Status	Pending
Test-Case Data	

Field Name	Set 1	Set 2	Set 3
Graph Type	Heat-map	Line	Scatter
Expected Result	Pass	Pass	Pass
Status	Pending	Pending	Pending
Date Tested	-	-	-
Action to be Taken	-	-	-

Field	Rendering Performance
Feature ID	F007
Feature	Graph Output & Visualisation
Test Case ID	TC-F007-2
Test Purpose	Confirm graphs render in < 3 seconds for typical datasets
Screen ref	Figure 1 - Main Window - Graph Figure 2 - Main Window - Graph Figure 5 - Main Window - Graph
Expected Results	1. Render time < 2 seconds 2. UI remains responsive
Test Status	Pending

Test-Case Data			
Field Name	**Set 1**	**Set 2**	**Set 3**
Data Points	100 k	500 k	1M
Expected Result	Pass	Pass	Pass
Status	Pending	Pending	Pending
Date Tested	-	-	-
Action to be Taken	-	-	-

Field	Graph Interactivity - Pan, Zoom, Toggle
Feature ID	F007
Feature	Graph Output & Visualisation
Test Case ID	TC-F007-3
Test Purpose	Ensure user can pan, zoom, and toggle are functional across all graphs
Screen ref	Figure 1 - Main Window - Graph Figure 2 - Main Window - Graph Figure 5 - Main Window - Graph
Expected Results	1. Mouse drag pans graph smoothly 2. Scroll wheel zooms in/out 3. Legend click toggles trace visibility
Test Status	Pending
Test-Case Data	

Field Name	Set 1	Set 2	Set 3
Graph Type	Heat-map	Line	Scatter
Interaction Tested	Pan	Zoom	Toggle
Expected Result	Pass	Pass	Pass
Status	Pending	Pending	Pending
Date Tested	-	-	-
Action to be Taken	-	-	-

Field	PNG/SVG Export with Metadata		
Feature ID	F007		
Feature	Graph Output & Visualisation		
Test Case ID	TC-F007-4		
Test Purpose	Validate graphs export to PNG/SVG including axis labels and legend		
Screen ref	Figure 1 - Main Window - Toolbar (File) Figure 2 - Main Window - Toolbar (File) Figure 5 - Main Window - Toolbar (File)		
Expected Results	1. PNG and SVG saved to chosen path 2. Axis labels & legend visible in both formats		
Test Status	Pending		
Test-Case Data			
Field Name	**Set 1**	**Set 2**	**Set 3**
Export Format	PNG	SVG	PNG
Expected Result	Pass	Pass	Pass
Status	Pending	Pending	Pending
Date Tested	-	-	-
Action to be Taken	-	-	-

Field	UI Latency
Feature ID	F008
Feature	Integrated Frontend/Backend Architecture
Test Case ID	TC-F008-1
Test Purpose	Verify response time for common UI actions is < 1 second end-to-end
Screen ref	Figure 1 - Main Window Figure 2 - Main Window Figure 3 - Sign Up Screen Figure 4 - Login Screen Figure 5 - Main Window Figure 6 - History Tab
Expected Results	1. Action completes and UI updates within 1 second 2. No freeze, UI remains responsive
Test Status	Pending

Test-Case Data			
Field Name	**Set 1**	**Set 2**	**Set 3**
Action	Load File	Menu Toggle	Zoom Graph
Expected max (ms)	1000	1000	1000
Status	Pending	Pending	Pending
Date Tested	-	-	-
Action to be Taken	-	-	-

Field	Error Handling
Feature ID	F008
Feature	Integrated Frontend/Backend Architecture
Test Case ID	TC-F008-2
Test Purpose	Confirm errors show a friendly message and are logged with a timestamp.
Screen ref	Figure 1 - Main Window - Console Figure 2 - Main Window - Console Figure 5 - Main Window - Console
Expected Results	1. Errors are shown in console 2. Log file entry created with timestamp
Test Status	Pending

Test-Case Data

Field Name	Set 1	Set 2	Set 3
Error Trigger	Corrupt ABF	Backend crash	Invalid filetype
Expected Result	Pass	Pass	Pass
Status	Pending	Pending	Pending
Date Tested	-	-	-
Action to be Taken	-	-	-

Field	Operating System Compatibility
Feature ID	F008
Feature	Integrated Frontend/Backend Architecture
Test Case ID	TC-F008-3
Test Purpose	Ensure core workflow runs on Windows & macOS
Screen ref	-
Expected Results	1. App launches 2. User loads sample file 3. No runtime errors
Test Status	Pending

Test-Case Data			
Field Name	**Set 1**	**Set 2**	**Set 3**
Operating System	Windows	macOS	Windows
Expected Result	Pass	Pass	Pass
Status	Pending	Pending	Pending
Date Tested	-	-	-
Action to be Taken	-	-	-

Field	Contextual Help Icon
Feature ID	F009
Feature	Guided Workflow
Test Case ID	TC-F009-1
Test Purpose	Verify each major screen has a "Help" toggle that is shown and accessible.
Screen ref	Figure 1 - Main Window - Toolbar (Help) Figure 2 - Main Window - Toolbar (Help) Figure 5 - Main Window - Toolbar (Help)
Expected Results	1. Ensure help tips appear when the Help-Toggle is enabled 2. Help appears within 300 ms of a user selecting it
Test Status	Pending

Test-Case Data			
Field Name	**Set 1**	**Set 2**	**Set 3**
Screen	Main Window	ZAP Analysis Graph	Heat-Map Viewer
Expected Result	Pass	Pass	Pass
Status	Pending	Pending	Pending
Date Tested	-	-	-
Action to be Taken	-	-	-

Field	Dismiss and Recall Prompt
Feature ID	F009
Feature	Guided Workflow
Test Case ID	TC-F009-2
Test Purpose	Verify users can hide tips and later restore them
Screen ref	Figure 1 - Main Window - Toolbar (Help) Figure 2 - Main Window - Toolbar (Help) Figure 5 - Main Window - Toolbar (Help)
Expected Results	1. Clicking dismiss stops further prompts 2. Toggling Show Tips ON restores prompts
Test Status	Pending

Test-Case Data

Field Name	Set 1	Set 2	Set 3
Initial Tips State	On	On	Off
Action	Dismiss	Dismiss + Re-enable	Re-enable
Expected Result	Prompts stop	Prompts stop then resume	Prompts resume
Status	Pending	Pending	Pending
Date Tested	-	-	-
Action to be Taken	-	-	-

Field	Offline Install on Windows 10+
Feature ID	F010
Feature	Cross-Platform Installer
Test Case ID	TC-F010-1
Test Purpose	Verify the Windows installer functions offline and completes without errors
Screen ref	-
Expected Results	1. Installer runs without internet connection. 2. Application files copied to C:\Program Files\BrainWave
Test Status	Pending

Test-Case Data			
Field Name	**Set 1**	**Set 2**	**Set 3**
Windows Version	10	11	11
Internet	Disabled	Disabled	Disabled
Expected Result	Pass	Pass	Pass
Status	Pending	Pending	Pending
Date Tested	-	-	-
Action to be Taken	-	-	-

Field	Offline Install on macOS 12+
Feature ID	F010
Feature	Cross-Platform Installer
Test Case ID	TC-F010-2
Test Purpose	Ensure macOS installer functions offline and completes without errors
Screen ref	-
Expected Results	1. .dmg mounts and copies app to /Applications 2. No internet required
Test Status	Pending

Test-Case Data			
Field Name	**Set 1**	**Set 2**	**Set 3**
macOS Version	12.0	13.0	15.0
Internet	Disabled	Disabled	Disabled
Expected Result	Pass	Pass	Pass
Status	Pending	Pending	Pending
Date Tested	-	-	-
Action to be Taken	-	-	-

Field	Uninstall Removes All Files		
Feature ID	F010		
Feature	Cross-Platform Installer		
Test Case ID	TC-F010-3		
Test Purpose	Confirm uninstaller removes all application files and shortcuts		
Screen ref	-		
Expected Results	1. Uninstaller deletes install directory and shortcuts 2. No residual files in user profile folders		
Test Status	Pending		
Test-Case Data			
Field Name	**Set 1**	**Set 2**	**Set 3**
Install path	C:\Program Files\BrainWave	/Applications/Brain Wave.app	C:\Program Files\BrainWave
Expected Result	Pass	Pass	Pass
Status	Pending	Pending	Pending
Date Tested	-	-	-
Action to be Taken	-	-	-

Field	Read-Only File Access
Feature ID	F011
Feature	Secure File Handling
Test Case ID	TC-F011-1
Test Purpose	Ensure ABF files are opened in read-only mode
Screen ref	-
Expected Results	1. File handle flags indicate read-only mode 2. File attributes unchanged after load
Test Status	Pending

Test-Case Data			
Field Name	**Set 1**	**Set 2**	**Set 3**
File Size	5 MB	50 MB	100 MB
File System	NTFS	APFS	NTFS
Expected Result	Pass	Pass	Pass
Status	Pending	Pending	Pending
Date Tested	-	-	-
Action to be Taken	-	-	-

Field	Write Attempt Prevention & Logging
Feature ID	F011
Feature	Secure File Handling
Test Case ID	TC-F011-2
Test Purpose	Confirm any write attempt is blocked, user warned, and event logged.
Screen ref	Figure 1 - Main Window (Default State) - Console Figure 2 - Main Window (After Minimising) - Console Figure 5 - Main Window (After Login) - Console
Expected Results	1. Write cancelled, warning MSG_10 shown 2. Checksum of original file unchanged
Test Status	Pending

Test-Case Data

Field Name	Set 1	Set 2	Set 3
File Name	test.abf	test.abf	test.abf
Expected Result	Pass	Pass	Pass
Status	Pending	Pending	Pending
Date Tested	-	-	-
Action to be Taken	-	-	-

Field	ZIP Archive Creation		
Feature ID	F012		
Feature	Experiment Report		
Test Case ID	TC-F012-1		
Test Purpose	Verify export creates a ZIP containing raw data and analysis results.		
Screen ref	-		
Expected Results	1. ZIP file generated in chosen directory 2. ZIP contains .abf + results.csv 3. File size > 0 bytes		
Test Status	Pending		
Test-Case Data			
Field Name	**Set 1**	**Set 2**	**Set 3**
Dataset size (MB)	2	25	75
Expected Result	Test.zip created	Test.zip created	Test.zip created
Status	Pending	Pending	Pending
Date Tested	-	-	-
Action to be Taken	-	-	-

Field	Success Confirmation Message
Feature ID	F012
Feature	Experiment Report
Test Case ID	TC-F012-2
Test Purpose	Verify success dialogue MSG_7 appears after archive save/upload
Screen ref	Figure 1 - Main Window (Default State) - Console Figure 2 - Main Window (After Minimising) - Console Figure 5 - Main Window (After Login) - Console
Expected Results	1. MSG_X displayed within 1 second of archive completion
Test Status	Pending

Test-Case Data			
Field Name	**Set 1**	**Set 2**	**Set 3**
Upload Enabled	No	Yes	Yes
Upload Result	N/A	Success	Success
Expected Result	Pass	Pass	Pass
Status	Pending	Pending	Pending
Date Tested	-	-	-
Action to be Taken	-	-	-

Field	Upload Target - FTP Server
Feature ID	F013
Feature	File Save Integration
Test Case ID	TC-F013-1
Test Purpose	Verify user can select FTP as the upload target and upload completes
Screen ref	Figure 1 - Main Window (Default State) - Toolbar Figure 2 - Main Window (After Minimising) - Toolbar Figure 5 - Main Window (After Login) - Toolbar
Expected Results	1. FTP option selectable and highlighted 2. Upload completes, MSG_7 displayed
Test Status	Pending

Test-Case Data			
Field Name	**Set 1**	**Set 2**	**Set 3**
File Size (MB)	1	25	80
FTP credentials valid	Yes	Yes	Yes
Expected Result	Pass	Pass	Pass
Status	Pending	Pending	Pending
Date Tested	-	-	-
Action to be Taken	-	-	-

Field	Upload Target - Google Drive
Feature ID	F013
Feature	File Save Integration
Test Case ID	TC-F013-2
Test Purpose	Verify user can select Google Drive as the upload target and upload completes
Screen ref	Figure 1 - Main Window (Default State) - Toolbar Figure 2 - Main Window (After Minimising) - Toolbar Figure 5 - Main Window (After Login) - Toolbar
Expected Results	1. Upload completes 2. MSG_7 displayed
Test Status	Pending

Test-Case Data			
Field Name	**Set 1**	**Set 2**	**Set 3**
File Size (MB)	1	25	80
FTP credentials valid	Yes	Yes	Yes
Expected Result	Pass	Pass	Pass
Status	Pending	Pending	Pending
Date Tested	-	-	-
Action to be Taken	-	-	-

Field	Upload Progress Indicator
Feature ID	F013
Feature	File Save Integration
Test Case ID	TC-F013-3
Test Purpose	Confirm progress indicator shows bytes transferred and ETA
Screen ref	Figure 1 - Main Window (Default State) - Console Figure 2 - Main Window (After Minimising) - Console Figure 5 - Main Window (After Login) - Console
Expected Results	1. Progress indicator shows % and ETA 2. Updates at least once per second
Test Status	Pending

Test-Case Data			
Field Name	**Set 1**	**Set 2**	**Set 3**
Upload Size	10 MB	100 MB	500 MB
Network Speed	100 Mbps	50 Mbps	10 Mbps
Expected Result	Pass	Pass	Pass
Status	Pending	Pending	Pending
Date Tested	-	-	-
Action to be Taken	-	-	-

Field	Upload Interrupted - Network Loss
Feature ID	F013
Feature	File Save Integration
Test Case ID	TC-F013-4
Test Purpose	Verify graceful handling when network connection drops mid-upload
Screen ref	Figure 1 - Main Window (Default State) - Console Figure 2 - Main Window (After Minimising) - Console Figure 5 - Main Window (After Login) - Console
Expected Results	1. Upload aborts 2. Error MSG_11 displayed 3. No partial files remain on server
Test Status	Pending

Test-Case Data			
Field Name	**Set 1**	**Set 2**	**Set 3**
File Size (MB)	1	25	80
Network drop (%)	50	20	90
Expected Result	Pass	Pass	Pass
Status	Pending	Pending	Pending
Date Tested	-	-	-
Action to be Taken	-	-	-

Field	User Sign-Up
Feature ID	F014
Feature	User Account & Experiment Saving
Test Case ID	TC-F014-1
Test Purpose	Verify new users can create an account with email + password
Screen ref	Figure 3 - Sign Up Screen
Expected Results	1. Account created 2. User logged in automatically 3. MSG_14 displayed
Test Status	Pending

Test-Case Data

Field Name	Set 1 - normal	Set 2 - weak pwd	Set 3 - duplicate email
Email	user1@email.com	user2@email.com	user1@email.com
Password	Abc123!!	123	Abc123!!
Expected Result	Pass	Fail	Fail
Status	Pending	Pending	Pending
Date Tested	-	-	-
Action to be Taken	-	-	-

Field	User Log-In		
Feature ID	F014		
Feature	User Account & Experiment Saving		
Test Case ID	TC-F014-1		
Test Purpose	Verify users can log in with valid credentials		
Screen ref	Figure 4 - Login Screen Figure 5 - Main Window (After Login)		
Expected Results	1. Main window opens with user name in title bar		
Test Status	Pending		
Test-Case Data			
Field Name	**Set 1**	**Set 2**	**Set 3**
Email	user1@email.com	user2@email.com	user1@email.com
Password	Abc123!!	123	Abc123!!
Expected Result	Pass	Fail	Pass
Status	Pending	Pending	Pending
Date Tested	-	-	-
Action to be Taken	-	-	-

Field	Experiment List Visible After Login
Feature ID	F014
Feature	User Account & Experiment Saving
Test Case ID	TC-F014-2
Test Purpose	Confirm saved experiments list appears after successful login.
Screen ref	Figure 6 - History Tab
Expected Results	1. List shows at least one experiment with name & timestamp columns
Test Status	Pending

Test-Case Data			
Field Name	**Set 1**	**Set 2**	**Set 3**
User	user1@email.com	user2@email.com	user3@email.com
Saved Experiments	3	2	1
Status	Pending	Pending	Pending
Date Tested	-	-	-
Action to be Taken	-	-	-

Field	Cross-Device Access		
Feature ID	F014		
Feature	User Account & Experiment Saving		
Test Case ID	TC-F014-4		
Test Purpose	Ensure experiment loads successfully on any logged-in device		
Screen ref	Figure 6 - History Tab		
Expected Results	1. Experiment opens without missing files. 2. Version history intact 3. Data identical		
Test Status	Pending		
Test-Case Data			
Field Name	**Set 1**	**Set 2**	**Set 3**
Device A	Win PC	Mac Laptop	Lab Workstation
Device B	macOS	Win PC	Win PC
Experiment ID	exp-2025-01-01	exp-2025-01-01	exp-2025-01-01
Status	Pending	Pending	Pending
Date Tested	-	-	-
Action to be Taken	-	-	-

Conclusion

The Systems Analysis and Design report is a critical guideline to help users understand the whole process of the software. It plays an important part in explaining both functional and non-functional requirements, and the scope of the project. While the report delivers user stories which provide clear descriptions based on users' expectations, diagrams are intended to perform in a visual method so that users can comprehend each stage of the software. Moreover, the test plan is responsible for displaying the outcome of the project and also examining whether it meets users' requirements or not. In spite of explaining how the software works accordingly, it is important to include related risks and constraints as these factors focus on potential drawbacks of the software, which notifies both developers and users to mitigate its impact immediately. In conclusion, this report is successful in highlighting the correlation between the proposal and the technical specification for the software development.