Radiological Measurements Laboratory QC Data Analysis

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Introduction

- In support of employee safety, Radiological Measurements Laboratory measures the presence of radioactivity around LLNL's facilities
- RML Gross Alpha Beta (GAB) and Liquid Scintillation (LSC) Counters measure radioactivity from air filters and swipes
- Measurements are validated by Quality Control (QC) Sample readings and exported to plain text files
  - In this format, data cannot be visualized over time
- Counters are required to be recalibrated every 2-5 years based on counter type
  - Recalibrations are done as-needed based on QC measurement behavior
    - RML counters have recently needed more frequent recalibrations

Objectives

In response to a higher frequency of failed runs of RML counters, my project continued development of an executable that:

- Pulls QC Sample measurements from individual runs and plots them over time
- Aids in predicting upcoming needs for counter recalibrations

Methods
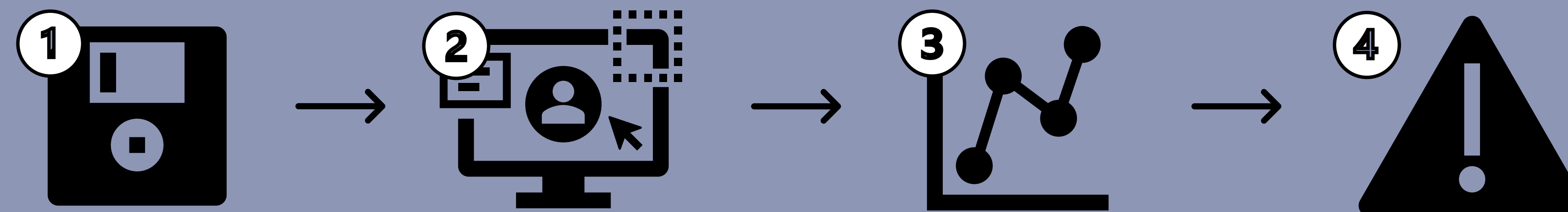
1 **Pull data from plain text files and store in tabular format**
- Iterate through .cal files, check if it has a converted .csv file in destination folder, and create one if not found

Figure 1: LSC QC Samples

2 **Take user inputs from executable for specific machine, time frame, and QC Metrics to query**
- Iterate through .csv file folders for relevant files
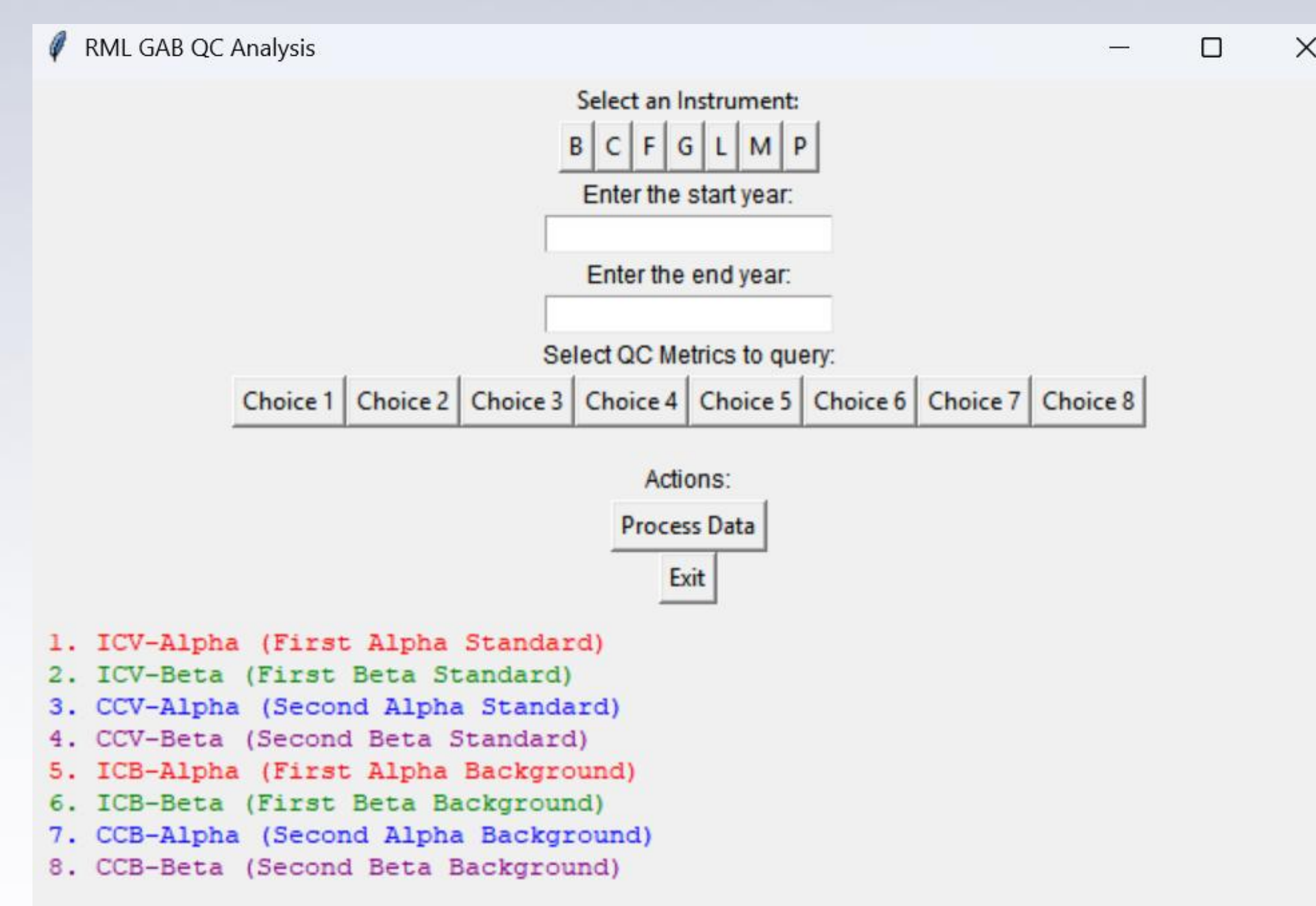- Save relevant QC values to an Excel Sheet

Figure 2: Interface of executable for GAB Counters

3 **Generate Excel file of standard and background QC sample data:**
- Standards Metrics Data
- Graph of Standards over time
- Calibration data
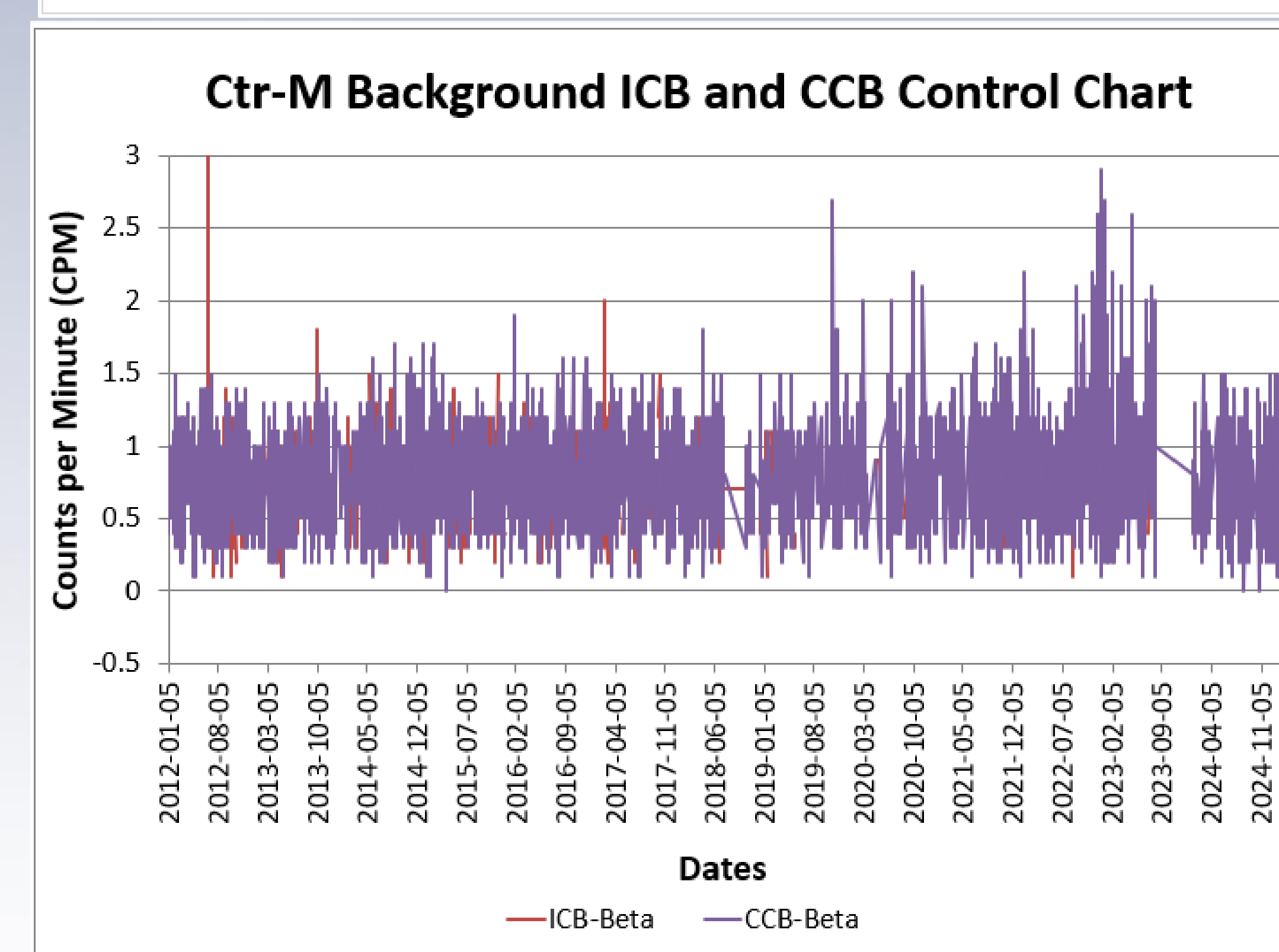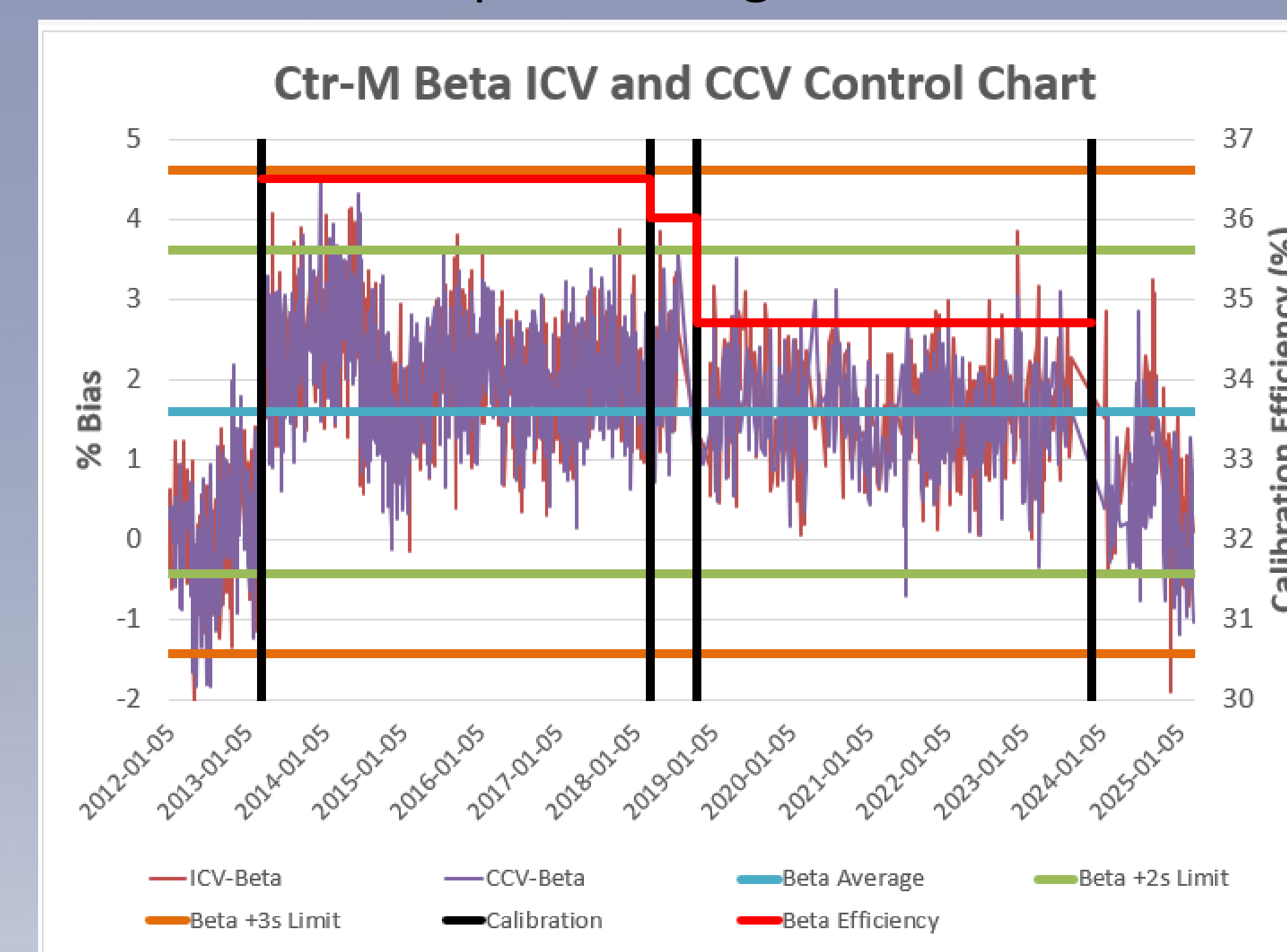- Backgrounds Metrics Data
- Graph of Backgrounds over time

Figure 3: Plots for GAB Counter M Standard (above) and Background (below) Beta Values in 2012-present

Methods (cont'd)

4 **Run prediction model on runs since previous calibration → display a warning to user if model predicts need for recalibration**

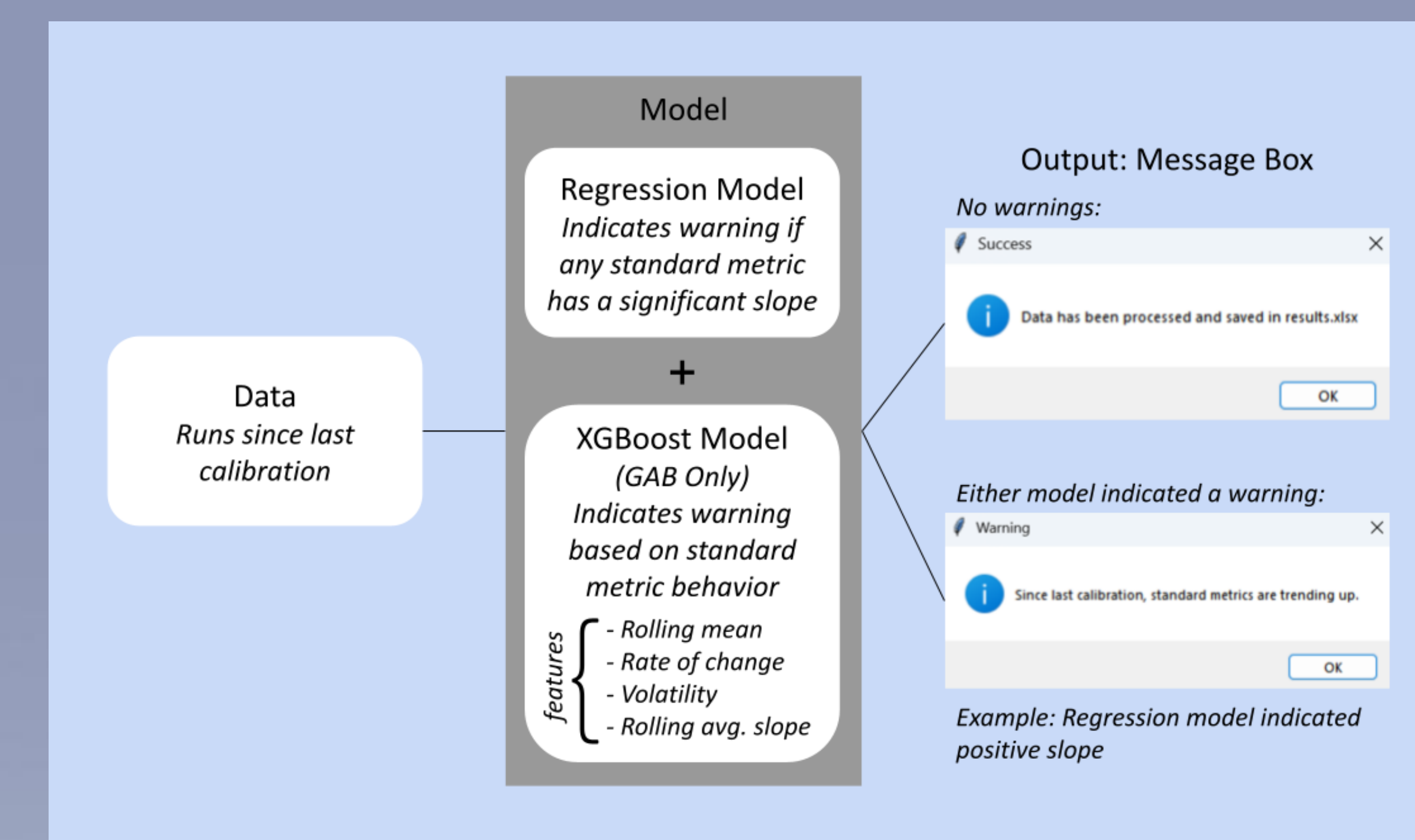Regression + XGBoost (Extreme Gradient Boosting) Ensemble Model

Figure 4: Warning prediction model and example outputs

Outcomes

The executables created allows us to visualize QC data over time and make data-driven decisions for instrument recalibrations, supporting employee safety and day-to-day lab activities.

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