❖ Renaming-

- ➢ Files are renamed during inspection.
- ➢ I wrote a python script that will rename a set of files (you may also rename files manually)
  - ■ Example File Name- "20250110_150737_VR-6200#AC0N000003"
  - ■ Renamed File Name- "20250110_CRBack0677_VR-6200#AC0N000003"
- ➢ This renaming encodes the serial number in the file name, making it easier to keep track of files
- ➢ The renaming also prepares files to be processed for analysis

❖ Processing

- ➢ Files are processed so that ROOT can read the data easily
- ➢ The processing script iterates through all of the files in a directory, extracts only the relevant data, opens a new .txt file for that board, and writes the data to the .txt file
- ➢ The processing script *will not* extract the correct data if the inspection program is changed since the code accesses only certain cells within the original .xlsx file. Data is not extracted dynamically since we rarely alter the inspection files
  - ■ For example, we decided to stop recording the dimensional measurements for the CE-Adapter board mill pads and measure them by hand with a right angle bracket instead. When we made this change, the inspection files became smaller since we started recording less data. Thus, I had to reconfigure the processing script to extract the right data.
- ➢ Cell access rules can be changed within the script itself

❖ ROOT Analysis

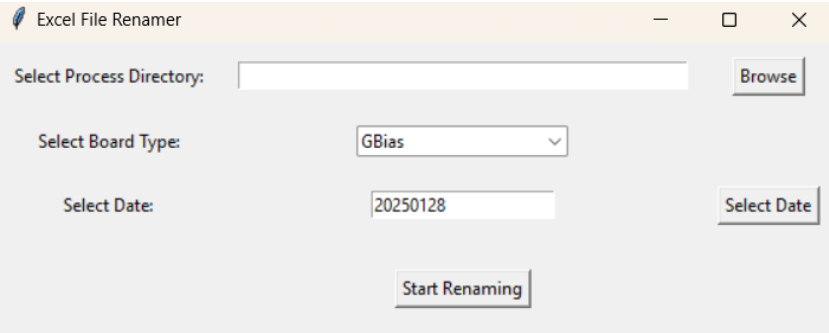
- ➢ Using ROOT to collate the data into histogram for visualization
  - ■ Helps to catch systematic errors and manufacturing defects
- ➢ I utilize a two-step system for the analysis: file reading and tree reading
  - ■ The "file reading" step accesses all of the processed files and inserts the data into a TTree
  - ■ The "tree reading" step accesses the TTree and configures the data into histograms which are later appended to a pdf file
- ➢ Each unique board face that we inspect has its own "file read" and "tree read" script
- ➢ The 'file read' script requires a serial range input parameter
  - ■ Ex: ".x AdapterFrontFileReader.C(73,852)" reads all files from the "AdaptFront" folder which have serials numbers in the range #0073-#0852
  - ■ Execution of the "file reader" script will result in the creation of a TTree
    - Ex: "newAdapterFrontTreeFile.root"

- The tree reader parses this tree and adds each measurement value to a histogram based on the associated measurement ID listed in the .txt file (i.e a unique integer tag for a particular measurement name.

USER GUIDE

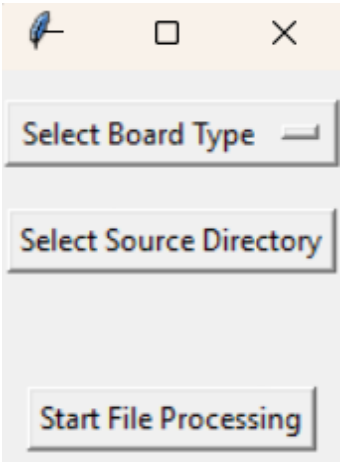
File Rename

- Initiate a text editor of your choice (I use Spyder)
  - Must be able to handle GUI packages like 'tkinter'
- Run the 'Renamer.py' script
- Select the directory of the files which you wish to rename
- Select the board type
- Select the date in which the files were inspected
- Select 'Start Rename'
- Each file in the directory will have a new file name in the desired format



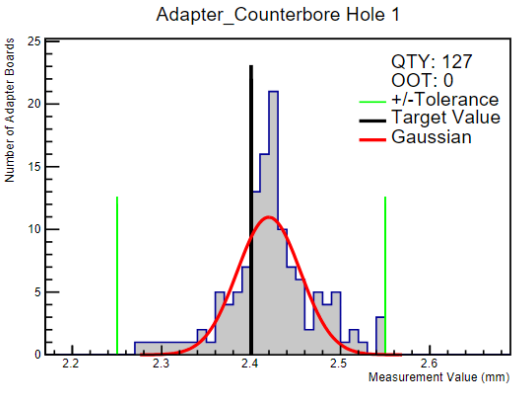
File Processing

- Initiate a text editor of your choice
  - Must be able to handle GUI packages like 'tkinter'
  - Ensure that you create a destination directory for the processed files
  - Add the address for the destination on line #150
  - The code will create subfolders for each board type on its own
- Select the board type of the files you wish to process
- Select the file source directory
- Select 'Start File Processing'



- **ROOT Analysis**
  - Open ROOT
  - Copy all of the .txt data files to the same directory as ROOT
    - I have the scripts configured to pull from a folder named “BoardData” with subfolders for each unique board face
    - Make sure you include your specific folder address into each ‘file reader’ script
  - Execute the ‘file reader’ script for the board face which you are creating Histograms for
    - Include the serial range of files that should be added to the TTree
    - Ex: “.x AdapterFrontFileReader.C(73,852)”
    - If there are files missing, ROOT will output the serial number that was skipped
    - You should notice a new TTree file in your ROOT directory
  - Execute the ‘tree reader’ script for the board face which you have created a TTree for
    - No parameters are needed
    - Depending on the number of files, this might take 1-8 minutes to run
  - Check the output
    - The histograms are a great way to check if the physical NCM report matches the data
      - Each board on the NCM report at the bottom of the PDF should correlate to an entry on the physical NCM log

UNDERSTANDING THE OUTPUT



- **Histograms**
  - Each histogram has the following elements
    - Title explaining the board face and the measurement name
    - Two green tolerance bars
      - If entries fall outside of the range between the green bars, it is out of tolerance and could possibly be removed from production
    - Black target value line
      - This is the value that we send to the manufacturer
      - Ideally, the distribution should be a spike at the target value with no spread. In reality, we have deviations and outlier boards
    - Gaussian fit

- **Data Summary Pages**
  - The first summary page describes the following
    - Manufacturer of the board batch
    - When the batch was receive at the lab
    - The yield percentage (#conforming boards in batch/total boards in batch)
    - A list of measurements that were out of tolerance for any given board. If no boards failed a certain measurement, the measurement is not displayed.
  - The second summary page is a list of boards which had at least one out of tolerance measurement. If a board did not have any out of tolerance measurements, it is not displayed on this page.

PAGE 1:

Measurement Failed: Counterbore Hole 3
Serial Numbers of failed boards:
84 (0.180)

Measurement Failed: Counterbore Hole 6
Serial Numbers of failed boards:
84 (0.239)

Measurement Failed: Counterbore Hole 7
Serial Numbers of failed boards:
84 (0.225)

Measurement Failed: Counterbore Hole 8
Serial Numbers of failed boards:
84 (0.200)

Batch Date: Received 8/24 (EPEC)

Yield Percentage: 96.67

PAGE 2:

Summary of Failed Boards:

Serial Number: 84

Failed Measurement: Counterbore Hole 3

Failed Measurement: Counterbore Hole 6

Failed Measurement: Counterbore Hole 7

Failed Measurement: Counterbore Hole 8