

Automated Analysis of Plastic Inspection Data

By

Ronald J. Cochran
Engineer, Measurement & Automation
Data Science Automation Inc.
USA

Category

Products Used

LabVIEW 8.0

LabVIEW State Diagram Toolkit

The challenge

Develop an automated analysis application for a client to save time and effort in the analysis of data acquired by a LabVIEW application created to measure the amount and volume of contaminants or un-melted plastic pellets used to produce a plastic film. The data and results of the analysis are used for determining quality requirements and customer satisfaction. This application required that peaks of a minimum value or greater be identified and measured providing an indication of the amount of defects and the area size of the defects. To perform this task a baseline was created to establish a true height for each of the peaks. After the peaks were identified the area of each peak was determined and compared to the configuration parameters. The peaks that fall over the limits are sorted along with the area displacement and displayed on a histogram. The final values of each test are saved to Excel along with histograms for the heights and areas of abnormalities found on the film. The client also required that this application be in the form of an executable with an installer for other colleges to be able to review the results of the data. It was also requested that this be a VI that could be placed into the original application to automate the process when the test was run.

The solution

The solution was implemented with LabVIEW 8.0. The application implemented a state machine architecture that monitored an input selecting the mode of operation. The application has two modes of operation. The first being sub VI mode and the second being manual mode. If the mode of operation is set to "True" the application will be set to the sub VI mode of operation. In the sub VI mode the application will read the configuration file and use all of the parameters defined there. This will load a set of parameters for filtering and smoothing the raw data sets

and create a baseline for the application to perform the peak detection from. Once the peaks have been established the start and end of each peak are determined. The final step in the analysis of the peak is the area beneath the peak. After all the peaks and corresponding areas are calculated verification of height and area size are performed and the resulting data is saved to an Excel file. The Path to write analyzed data is based on the name of the raw data file used. This path will consist of the raw data path without the channel name and time and date appended to it. If the mode of operation is set to “False” the application will operate as a stand alone application. The “Setup” tab shown in “Figure 1” displays the user selected file and all the files from that test run that are automatically detected and loaded along with the destination path for the Excel file. The manual mode of operation will let the user select the files that the application will analyze. The operator only needs to select one of the data channels for the test run that is to be analyzed and the application will find all of the associated channel files based on there file name. The Path to write analyzed data can also be selected using the brows feature of by typing in the desired path and file name. If no Path to write analyzed data is provided the raw data file selected will be appended and used to store the results of the analysis just like the VI were in the sub VI mode. The user can also change the controls on the front panel for the threshold of the height and the minimum area threshold to be applied for the analysis of data. In manual mode the user will define the output file, but if no file name is provided the application will create one based on the selected raw data file name.

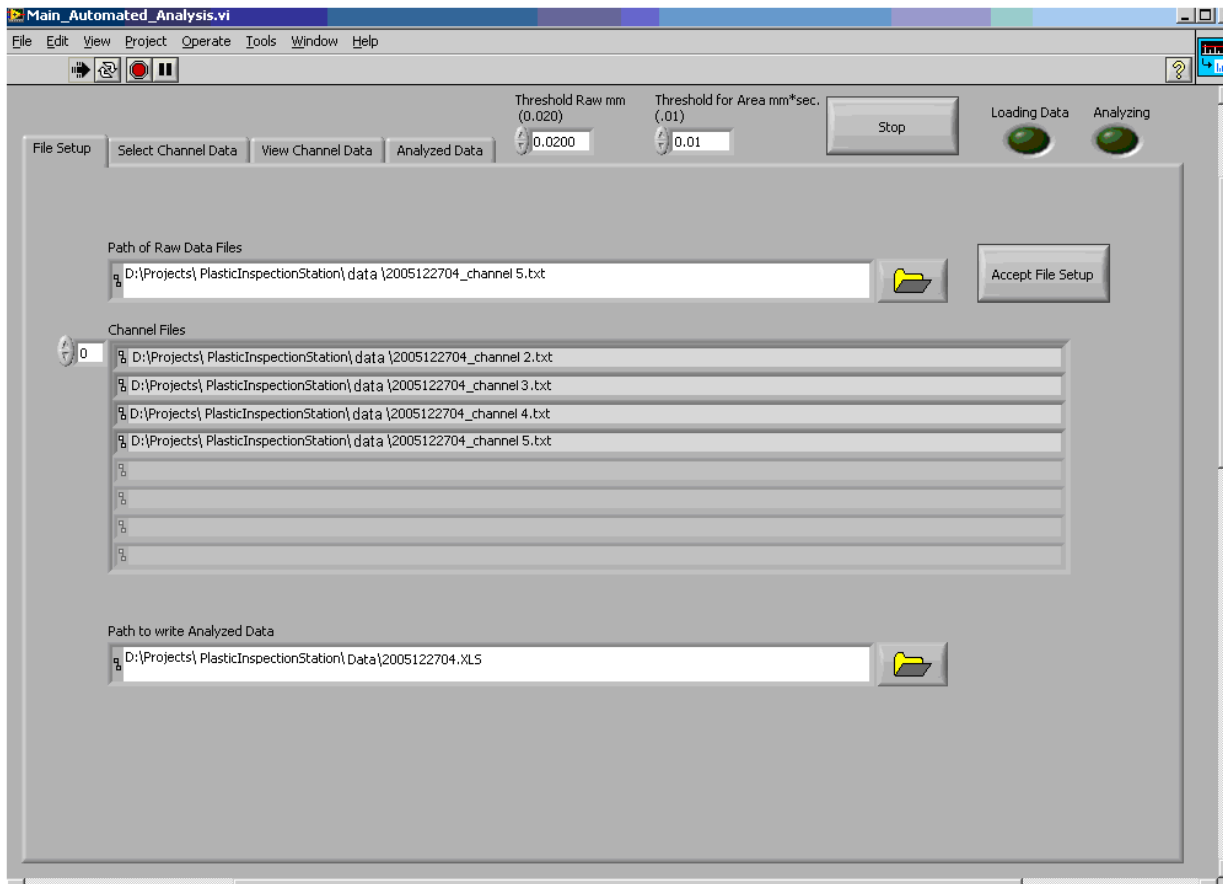


Figure 1 "File Setup"

In “Manual Mode” the channels to be analyzed are selected from the list of loaded files by clicking to highlight, click + shift, or click + ctrl as with most spread sheet applications. The operator also has the option to click the “Select All” button to load all of the channels without needing to highlight them as shown in “Figure 2”. Once a selection is made the application will start the analysis of the data using the configuration parameters along with the parameters previously entered during setup. After the analysis is completed the report based on an Excel template will be generated and saved. The Excel file contains the peaks that are detected, the areas for those peaks and two histograms displaying that data.

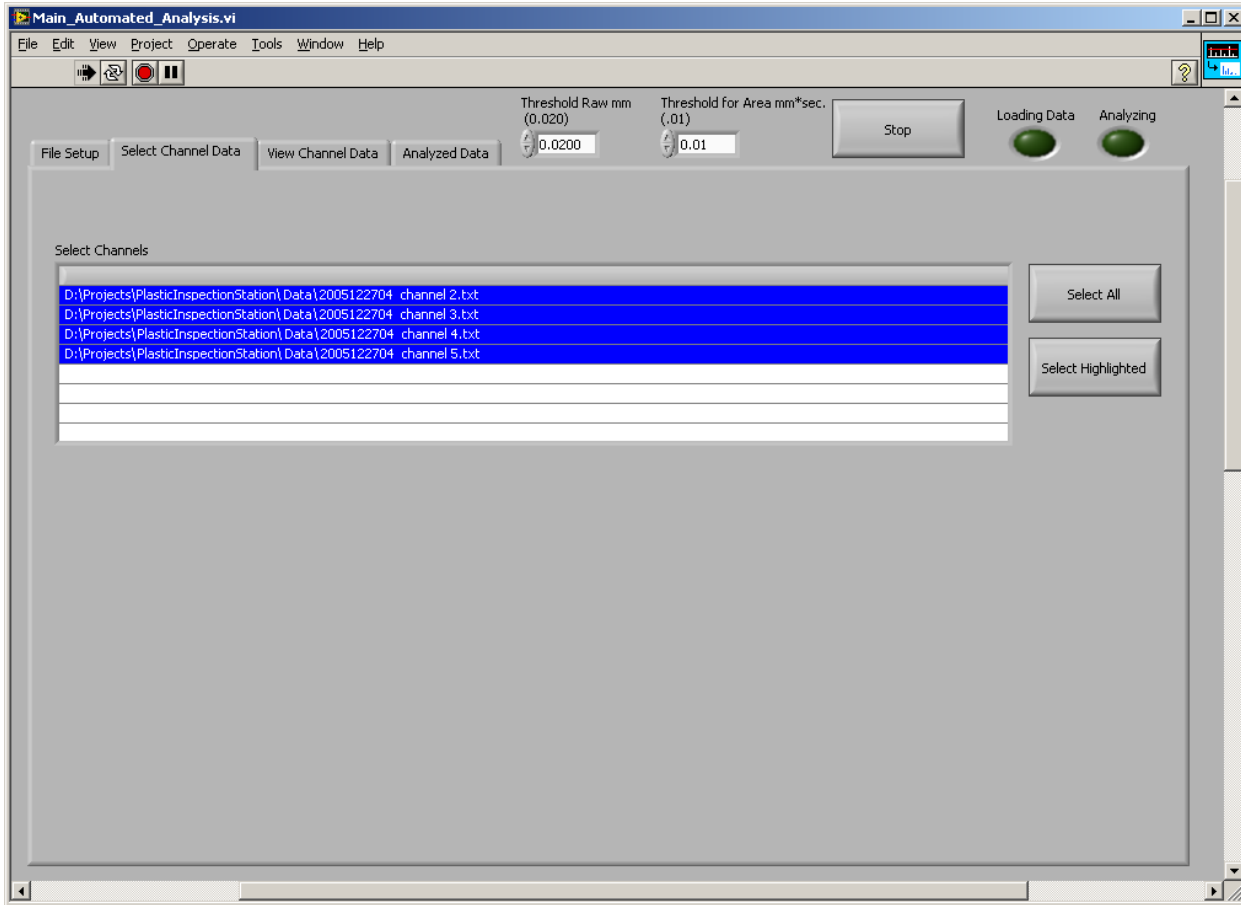


Figure 2 "Select Channel Data"

When in "Manual mode the operator can look at the raw data compared to the newly generated baseline as shown in "Figure 3" along with zoomed in portion of the chart.

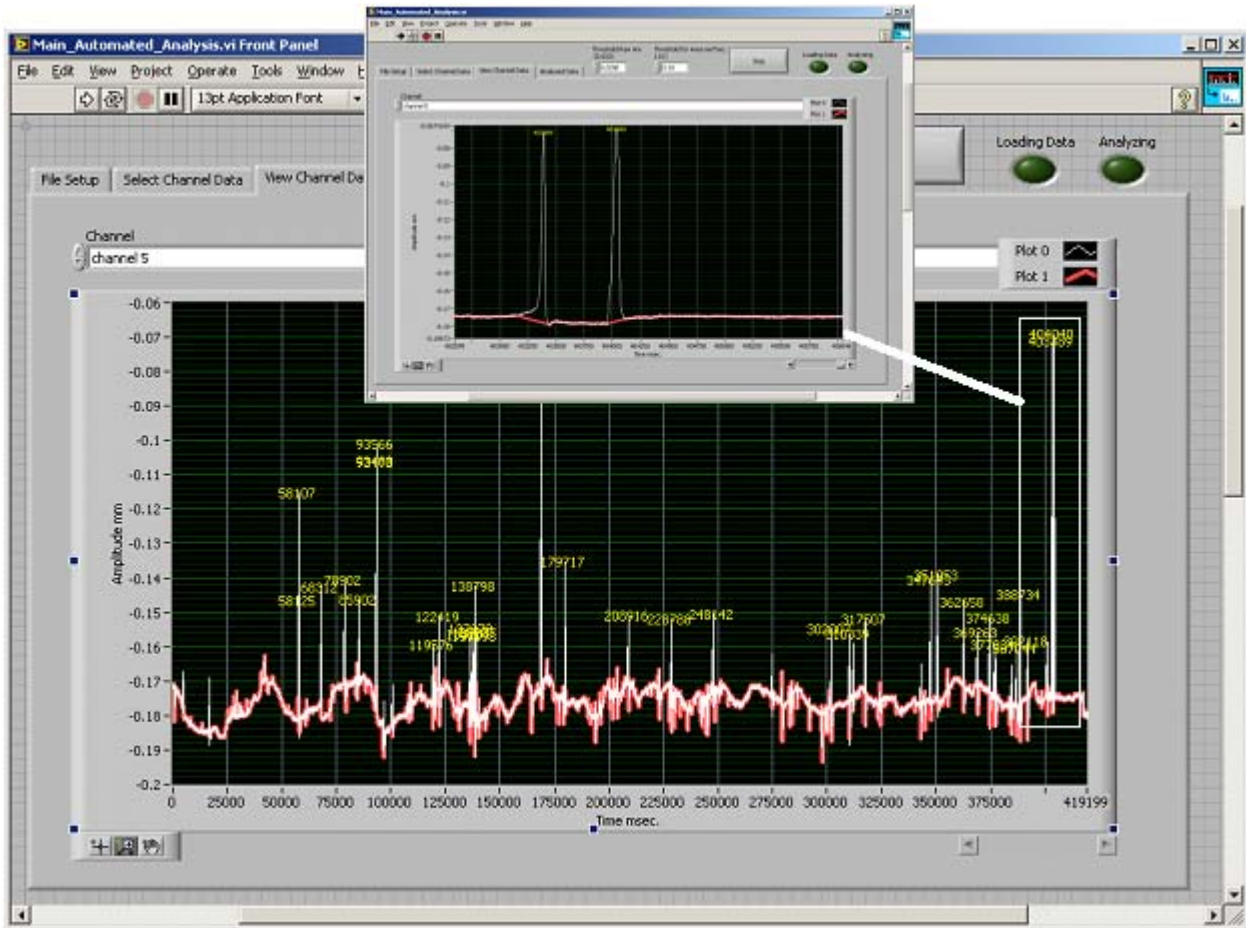


Figure 3 "View Chart"

The chart has the annotation of the time index associated with the peak to provide a quick reference for the operator to identify outstanding peak locations. The corrected baseline is used to determine the height of the peaks and to give a base width for calculation of the area under the peak.

Following the analysis of the data the user can view the results on the "Histogram" tab seen in "Figure 4" to determine if the product run meets the acceptable quality and customer standards.

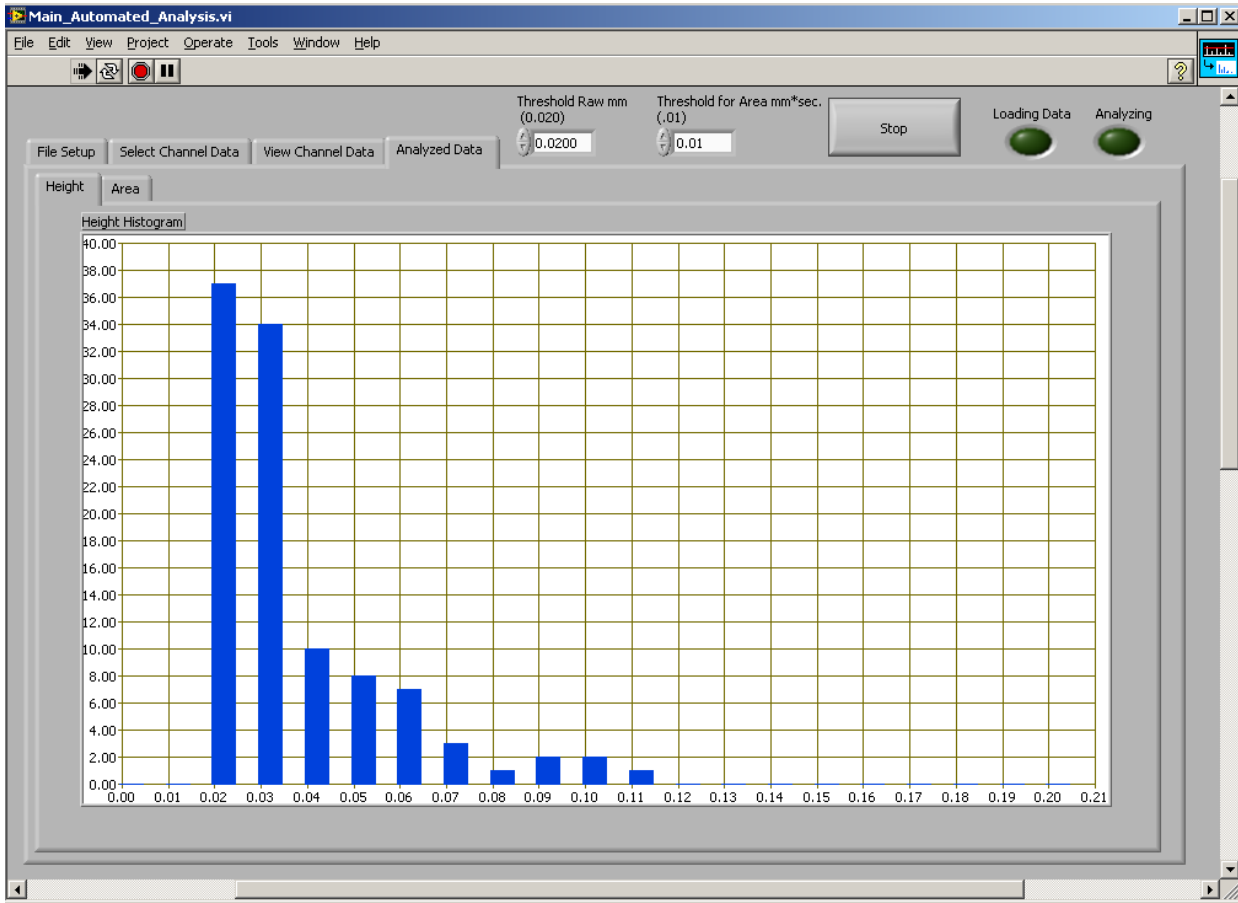


Figure 4 "Histogram"

The data for the analysis is presented in a manner that is easily understandable for the operator to know if the product is acceptable.

This application also puts the collected data and histograms into an Excel spread sheet that can be distributed to other parties internal or external for lot acceptance. "Figure 5" shows the Excel spread sheet created at the finish of the application.

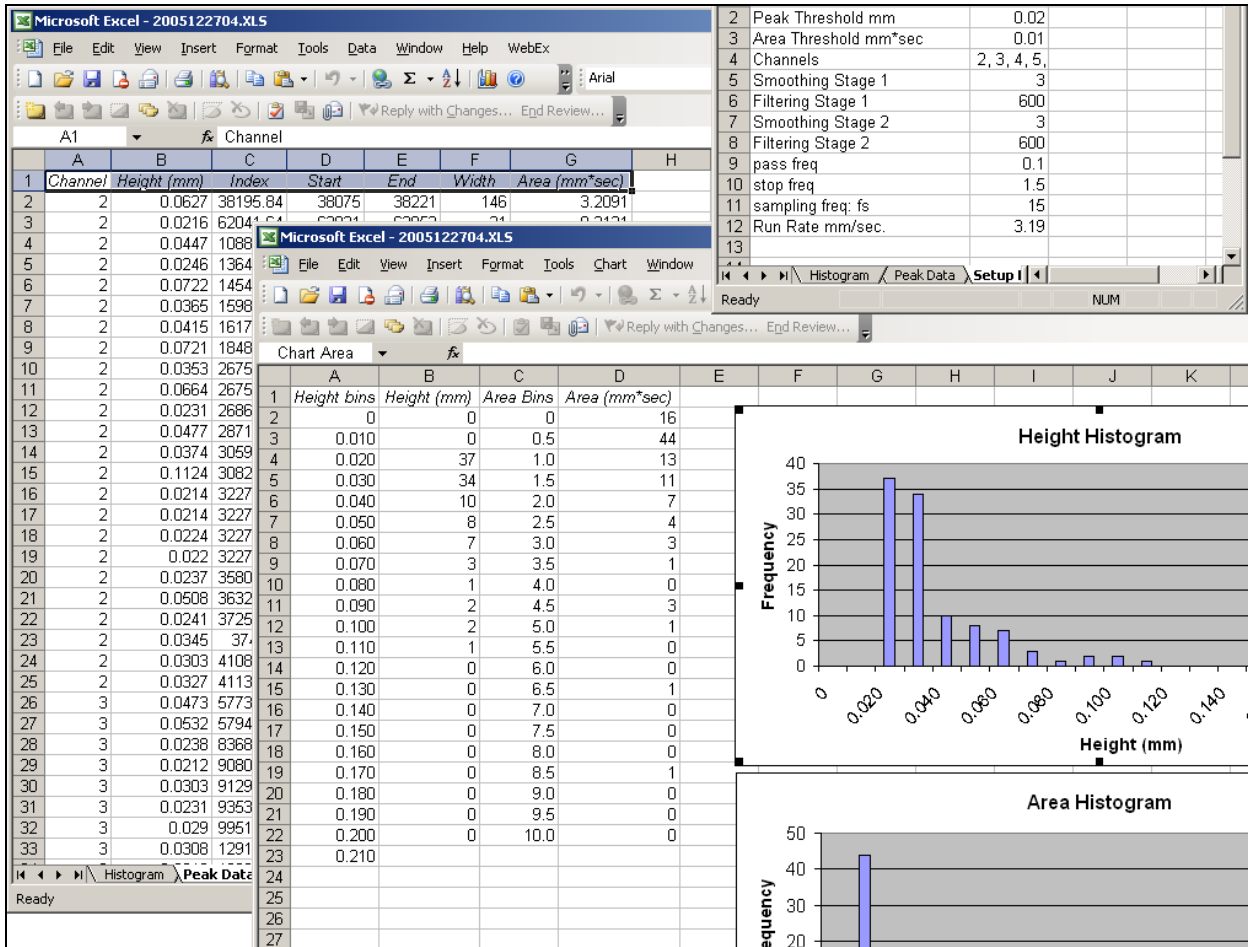


Figure 5 "Excel Layout"

Summary

Data Science Automation, Inc. was able to design an application using National Instruments LabVIEW that was capable of performing the task of analyzing the data from the acquisition in an automated application including the generation of an Excel report saving the client time and money. This also allowed the analysis to be looked at directly after the test run with out sending the data to another location for analysis.