

ChipCHECK

ONLY BY GASTOPS

CC120 Operation



CHIPS ANALYZER (B166500)

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4.0 Operation

This section will go over the procedures required in order to successfully complete an automated analysis using the ChipCHECK device. Note that the operation of the equipment shall follow the order to the defined sections below. Prior to completing the operational procedures below, it is recommended that the operator reference Section 5.0 to become familiar with navigating through the equipment's software interface.

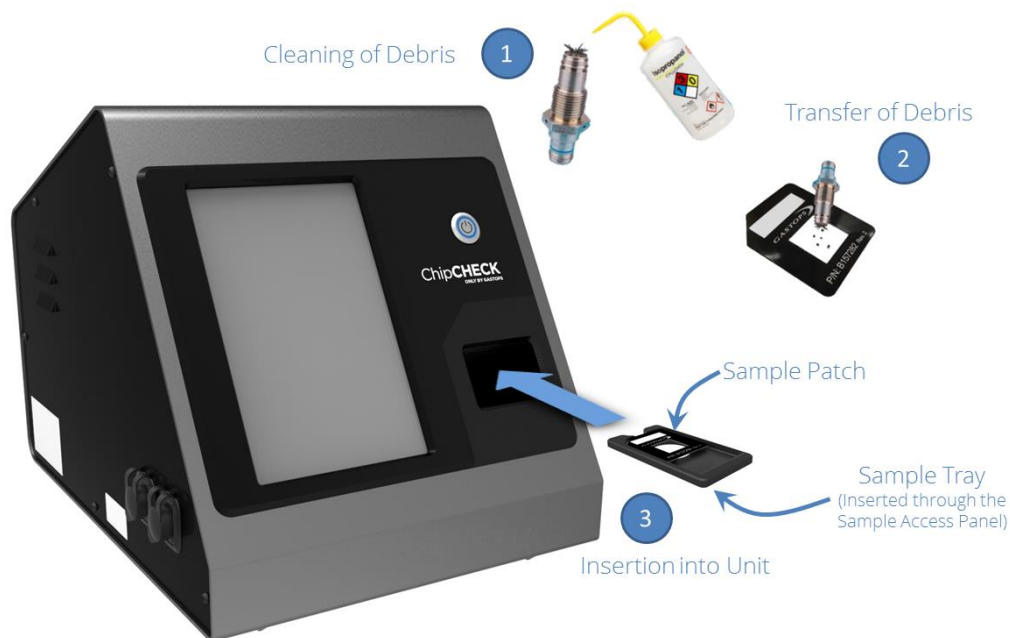


Figure 4-1: Chip Analysis Process

4.1 Standardization

A Standardization of the unit is recommended to be completed once each day prior to the use of the equipment. Prior to beginning the procedure below, navigate to the Standardization Screen (refer to Section 5.0 as required).

Standardization Procedure:

Select "Start"

Near the top left of the screen, select the "Start" button. Note that selecting the "Cancel" button will bring the User back to the "Options Screen".

Insert the indicated Standard

Near the top right of the screen the software interface will define the specific Standardization standard that must be inserted into the system. The unit will also automatically eject the Sample Receptacle for User access. Insert the indicated Standardization standard into

the Sample Receptacle.

Select "OK"

Near the top right of the screen, select the "OK" button. The unit will now automatically run the Standardization sequence.

If 'Result of Standardization' is "PASS"

At the end of the Standardization, if the result shown under "Result of Standardization" is "PASS", then the unit is calibrated, performing properly and is ready to be used for analysis (skip to Section 4.3). Select the "OK" button near the bottom right of the screen. The User will be returned to the "Options Screen" and the corresponding "Standardization" info will be updated.

If 'Result of Standardization' is "FAIL"

At the end of the Standardization, if the result shown under "Result of Standardization" is "FAIL", complete a power cycle on the unit (complete power down and complete power up) and repeat the Standardization procedure. If three (3) subsequent Standardization sequences fail, then a re-calibration is required prior to the unit being used for any further analyses. The software interface will also provide the User with a reason for failure and a recommendation of what to do. Select the "OK" button near the bottom right of the screen. The User will be automatically directed to the "Calibration" screen. If not automatically redirected, navigate to the Calibration screen through the Options screen.

4.2 Calibration

The Calibration sequence is an automated sequence and should only be run when the "Standardization" sequence results in three (3) subsequent failures. Prior to beginning the procedure below, navigate to the Calibration Screen (refer to Section 5.0 as required).

Calibration Procedure:

Select "Start"

Near the top left of the screen, select the "Start" button. Note that selecting the "Cancel" button will bring the User back to the "Options Screen".

Insert the indicated Standard

Near the top right of the screen the software interface will define the specific Calibration standard that must be inserted into the system. The unit will also automatically eject the Sample Receptacle for User access. Insert the indicated Calibration standard into the Sample Receptacle.

Select "OK"	Near the top right of the screen, select the "OK" button. The unit will now automatically run the first part of the Calibration sequence.
Second Part of Calibration Sequence	Once the unit finishes the first phase of the calibration sequence, it will prompt the user to insert a second calibration standard. Do so as described below.
Select "OK"	Near the bottom right of the screen, select the "OK" button. The unit will now automatically run the second phase of the calibration sequence.
If the result of Calibration is "PASS"	At the end of the Calibration, if the result is a "PASS" then the unit has been successfully re-calibrated. Select the "OK" button near the left of the screen. The User will be returned to the "Options Screen" and the corresponding "Calibration" info will be updated. It is recommended that the "Standardization" be repeated following a successful calibration.
If the result of Calibration is "FAIL"	At the end of the Calibration, if the result is a "FAIL", complete a power cycle on the unit (complete power down and complete power up) and repeat the Calibration procedure. If three (3) subsequent Calibration sequences fail, then the unit will require maintenance or service. Refer to Section 6.0. Post successful maintenance (as per Section 6.0), repeat the Calibration and Standardization sequences.

4.3 Sample Preparation

There are several potential sources of wear debris. To prepare a sample for this instrument it is recommended that the following items and tools are used at a minimum: the provided Sample Patches for the instrument, laboratory grade tweezers, laboratory grade probes, Isopropyl Alcohol and a wash fluid receptacle.

The process of transferring wear debris from the collection source to the Sample Patch largely depends on how the debris was collected from the equipment. The following procedure defines the recommended process of transferring wear debris from a chip detector, chip collector or mag plug – while considering the cautions outlined in the cautionary notes that follow below:

1. Remove the collection device from the equipment, and submerge the portion of the device that contains the wear debris in an alcohol bath. Keep the wear debris submerged and continuously rotate the collection device within the alcohol bath for no less than 10 seconds. If an alcohol bath is not available, then vigorously spray the wear debris and the collection device with Isopropyl alcohol for no less than 10 seconds.

2. Transfer all wear debris from the collection device and alcohol bath to an intermediate receptacle (such as a petri dish).
3. If oil residue remains on the wear debris, complete an additional alcohol rinse on the wear debris and allow the wear debris to fully dry. Repeat this step until no oil residue remains on the wear debris.
4. Once the wear debris has been fully dried, take one of the Sample Patches provided with the instrument and peel/remove the protective liner from the top surface of the patch (as shown in Figure 4-2). This will expose the transparent adhesive used to retain the wear debris. Take all precautions to limit the amount of contamination (dust, dirt, etc.) that can now adhere itself to this exposed area.

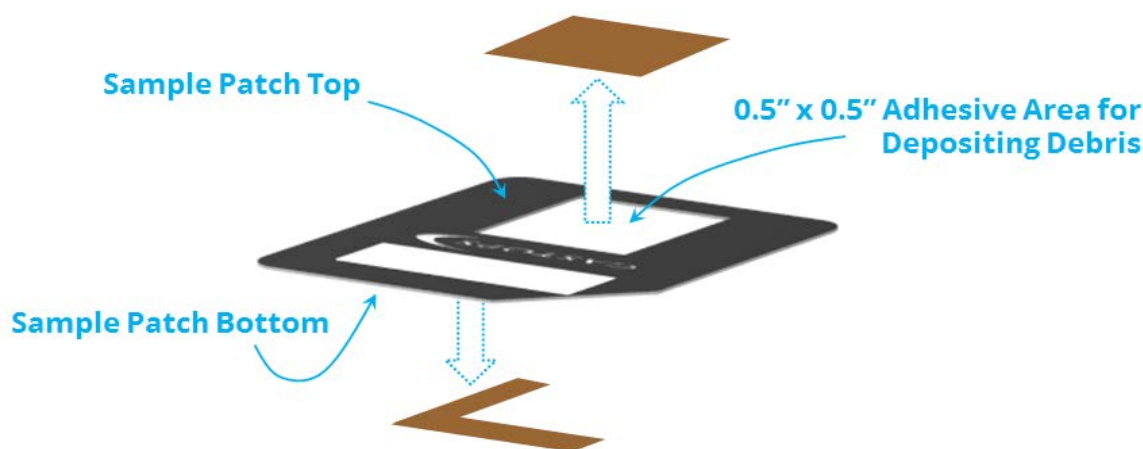


Figure 4-2: Sample Patch Liner Removal

5. Transfer the clean and dry wear debris from the intermediate receptacle to the Sample Patch. Laboratory grade tweezers and probes should be used for this process and each piece of wear debris must be placed on the Sample Patch following the cautions outlined in cautions outlined the notes below. It is recommended that wear debris is transferred to the Sample Patch one at a time. Note that, as required, multiple Sample Patches can be used for this step.
6. Once all of the wear debris has been transferred onto the Sample Patch, replace the protective liner overtop of the wear debris and transparent adhesive of the Sample Patch. This will protect the sample from further contamination until when the analysis is to be completed. Ensure the protective liner is once again removed prior to running an analysis in the instrument

NOTE: Always keep the Sample Patch facing up and avoid exposure to contaminants. It is possible for the dirt or unwanted contamination to adhere to the exposed adhesive area at this point in the patch preparation.

NOTE: For optimal wear debris classification and instrument performance, the following guidelines shall be followed and will reduce interferences. The published performance specifications for the unit are dependent upon the strict adherence to these guidelines:

- Ensure all particles are retained from the collection device.
- Residual oil on the wear debris may weaken the signal intensity. An isopropyl alcohol rinse of the debris is recommended prior to applying the wear debris to the Sample Patch. This also applies to any form of contamination on the wear debris. Steps 1 through 3 in Section 4.3 is the recommended procedure.
- When preparing the Sample Patch for analysis, concentrated 'clumps' of wear debris must be avoided. If needed, excessive debris from one source can be placed on multiple patches. Ensure the particles are separated on the sample patch (preferably near the center).
- When preparing the Sample Patch for analysis, wear debris must lay flat on the Sample Patch.
- Avoid placing wear debris thicker than 0.5 mm on a Sample Patch. Wear debris thicker than 0.5mm must be broken into smaller pieces and should be placed on an independent Sample Patch.
- Only use the instrument to analyze wear debris that is equal to or larger than 6,400 μm^2 and whose minimum dimension is larger than 70 μm .
- Avoid analyzing wear debris that consists of alloys that are not included in the instrument's Material Library, or ensure that the instrument's Material Library contains all of the required alloys within its Training Set. The instrument's intended use is to analyze wear debris of such alloy materials included in the instrument's Material Library. The intended use does not include other alloys or materials which are not part of the installed Material Library.
- The instrument's standardization procedure must be completed each day prior to use of the instrument.
- The instrument's calibration procedure must be completed when the standardization procedure fails.
- The instrument's manufacturer's in-service support package must be maintained throughout the life of the instrument

4.4 Sample Patch Loading – Insertion into the ChipCHECK Unit

Once the Sample Patch is prepared, the following needs to be done in order to properly and safely load it into the ChipCHECK equipment for analysis:

NOTE: This section of the document assumes that the User already finds him or herself at the 'Analysis Screen'. Refer to Section 5.0 for more detail regarding the software and its navigation.



Figure 4-3: Sample Loading – Sample Receptacle Ejected and Sample Access Panel Open

Loading the Sample Patch:

1. The equipment will automatically position the Sample Receptacle in the ejected position – giving full access to the User.
2. This Sample Insertion Assembly is equipped with a magnetic alignment mechanism which allows for ease of sample insertion and removal from the equipment. To remove the Sample Tray, simply pull lightly on the Sample Tray at the front of the Sample Receptacle.

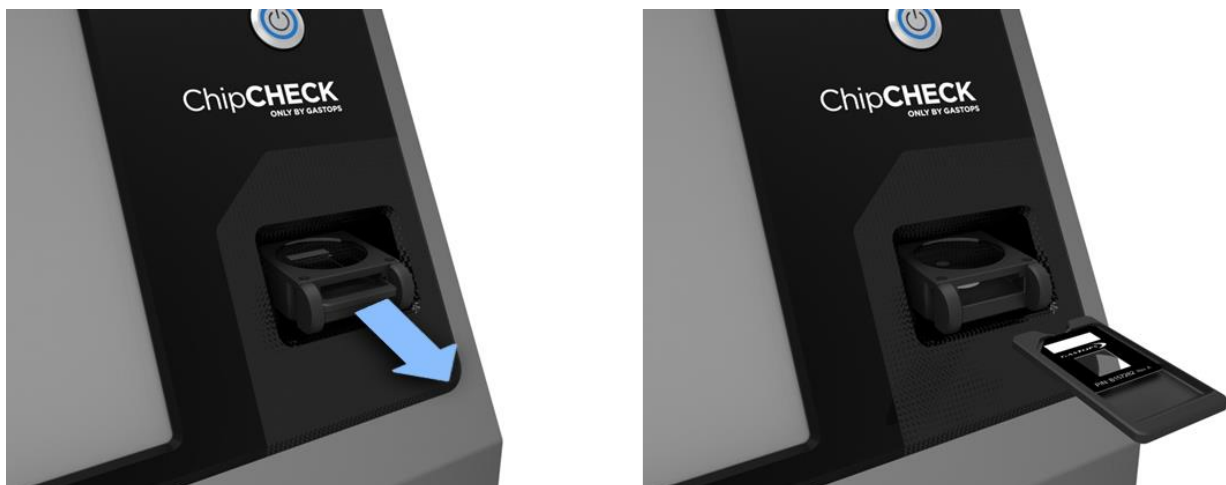


Figure 4-4: Sample Tray Removal from Equipment

3. Take the prepared Sample Patch (refer to Section 4.3) and ensure that the adhesive liner on the back of the Sample Patch has been removed (as shown in Figure 4-2). Position the Sample Patch, face-up, on the Sample Tray ensuring that the left and top edges of the Sample Patch are aligned with the recess on the Sample Tray.

NOTE: Both the Sample Patch and the Sample Tray have 'keyed' features that ensure the Sample Patch can only be applied in a single orientation. Once in place, ensure the Sample Patch is securely adhered to the Sample Tray.

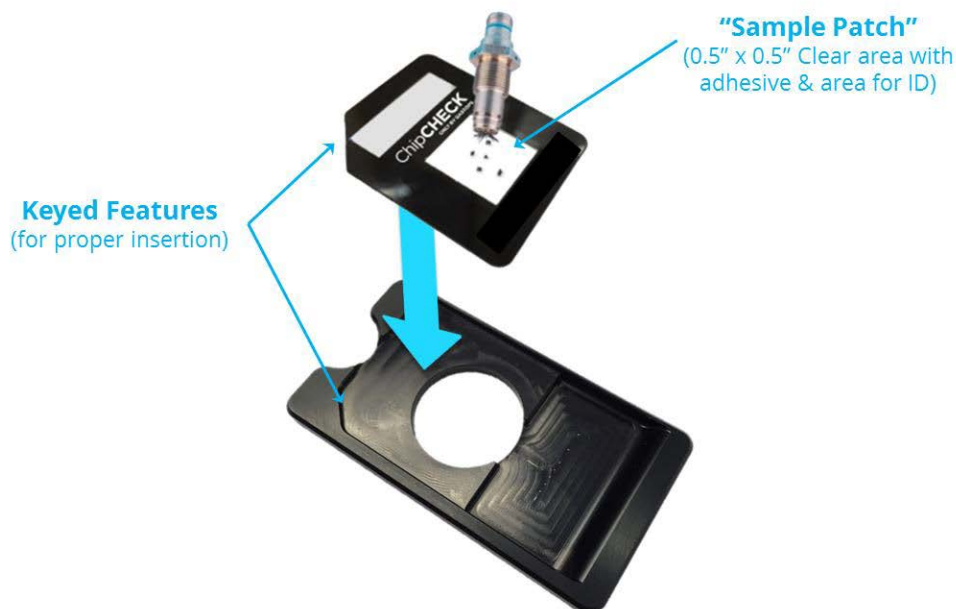


Figure 4-5: Placement of Sample Patch onto Sample Tray

4. Re-insert the Sample Tray into the Sample Receptacle. Simply push the Sample Tray completely into the receptacle. The Sample Tray and Sample Receptacle are designed to self-align. You will hear an audible click when the Sample Tray is fully inserted. No force is required.

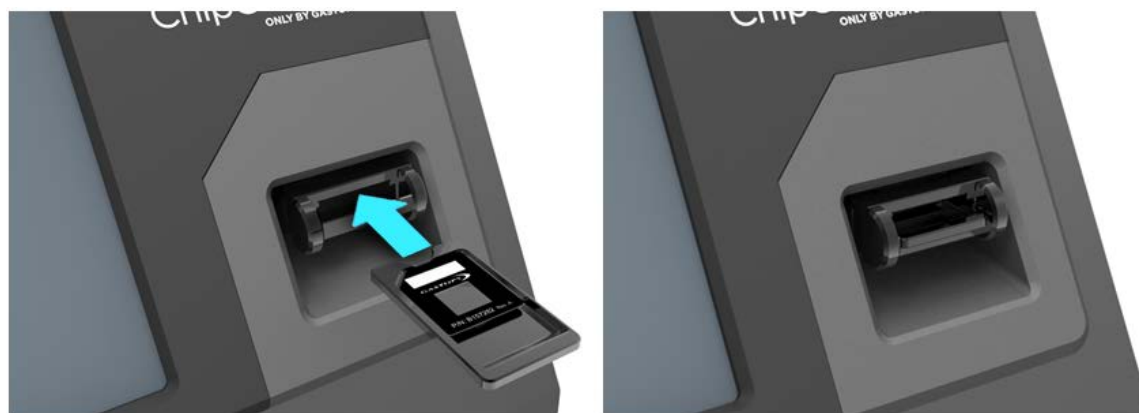


Figure 4-6: Sample Loading – Insertion of Chip Sample Tray into Equipment

The sample is now inserted and ready to be analyzed.

4.5 Running an Analysis

This section assumes that the User is already familiar with the software interface and can navigate to the 'Chip Analysis' window. Refer to Section 5.0 for complete procedures on how to use and navigate through the software interface.

1. To run a Chip Analysis, navigate to the 'Chip Analysis' screen of the ChipCHECK software interface (see Figure 4-7).

NOTE: Data labels may be configured differently for different applications.

The screenshot displays the 'CHIP ANALYSIS' screen of the 'ChipCHECK' software. On the left, there are three circular buttons: 'START' (green border), 'EJECT' (blue border), and 'CANCEL' (red border). To the right of these buttons is a 'Sample ID:' label followed by a text input field. Below the 'Sample ID' field is a large, empty rectangular box. To the right of this box are four input fields labeled 'AC Type - Engine Type', 'Aircraft Type', 'Engine Type', and 'Aircraft Registration/SN'. Below these fields is a 'Result:' section containing a table with the following headers: 'MATERIAL', '# IDENTIFIED', 'TOTAL AREA [μm²]', and 'ALARM'. The table body is currently empty. Below the table is a 'Condition Status:' label followed by a text input field. At the bottom of the screen, there are three buttons: 'OPTIONS', 'STNDRD', and 'CALIBRATE'. Below these buttons, it says 'Awaiting Operator Input' and '-(UNIT READY)-'.

Figure 4-7: Chip Analysis Screen

2. If the sample has not been loaded into the equipment, then refer to Section 4.4. If the sample is loaded then proceed to select the 'Start' Button found in the top left corner of the screen.
3. The software interface now prompts the User to enter all required data regarding the debris source. The field names are configurable, and so may differ from the field names shown in Figure 4-8. This source data can either be entered manually or selected from the drop down lists provided. Mandatory entry fields are indicated by asterisks. Proceed until at least all

mandatory fields have been filled. Note that the Data Entry Field titles may differ from the unit in use. These are customized fields. The Figure below is an example only.

Fields that only accept numbers are marked with the number sign (#). These fields will accept numbers, but no spaces or symbols. All other fields accept alphanumeric characters and all symbols except the single quotation character ('), except the date field, which only accepts a date.

CHIP ANALYSIS **ChipCHECK**

*** Mandatory Fields**

AC Type - Engine Type * <input type="text"/>	Collection Device * <input type="text"/>
Aircraft Type * <input type="text"/>	Date of Analysis * 29/03/2017
Aircraft Registration/SN * <input type="text"/>	Reason for Analysis <input type="text"/>
Engine Type * <input type="text"/>	PO/WO Number <input type="text"/>
Location of Collection Device * <input type="text"/>	Analysis Completed By <input type="text"/>
Engine Registration/SN <input type="text"/>	Notes <input type="text"/>
Engine Position (#) <input type="text"/>	

START **CANCEL**

Unit Ready - Awaiting Input -(UNIT READY)-

Figure 4-8: Chip Analysis Data Entry Screen

4. Select the 'Start' button to start the analysis. If any mandatory fields are empty, or if an illegal character is used (e.g., the single quotation mark), then the analysis will not be allowed to proceed. The fields that were not filled out properly are highlighted red to assist the operator in locating the incorrectly entered fields.

5. The equipment will now complete the entire analysis automatically. Refer to Figure 4-9 for the layout of where this information can be found on the screen.

NOTE: At any time during the analysis, the User can verify the analysis process by referring to the progress bar near the bottom right of the screen or can elect to stop the analysis by selecting the 'Stop' button highlighted in red near the top left of the screen. Selecting 'Stop' will abort the analysis, eject the sample and return the User to the first 'Analysis' screen.

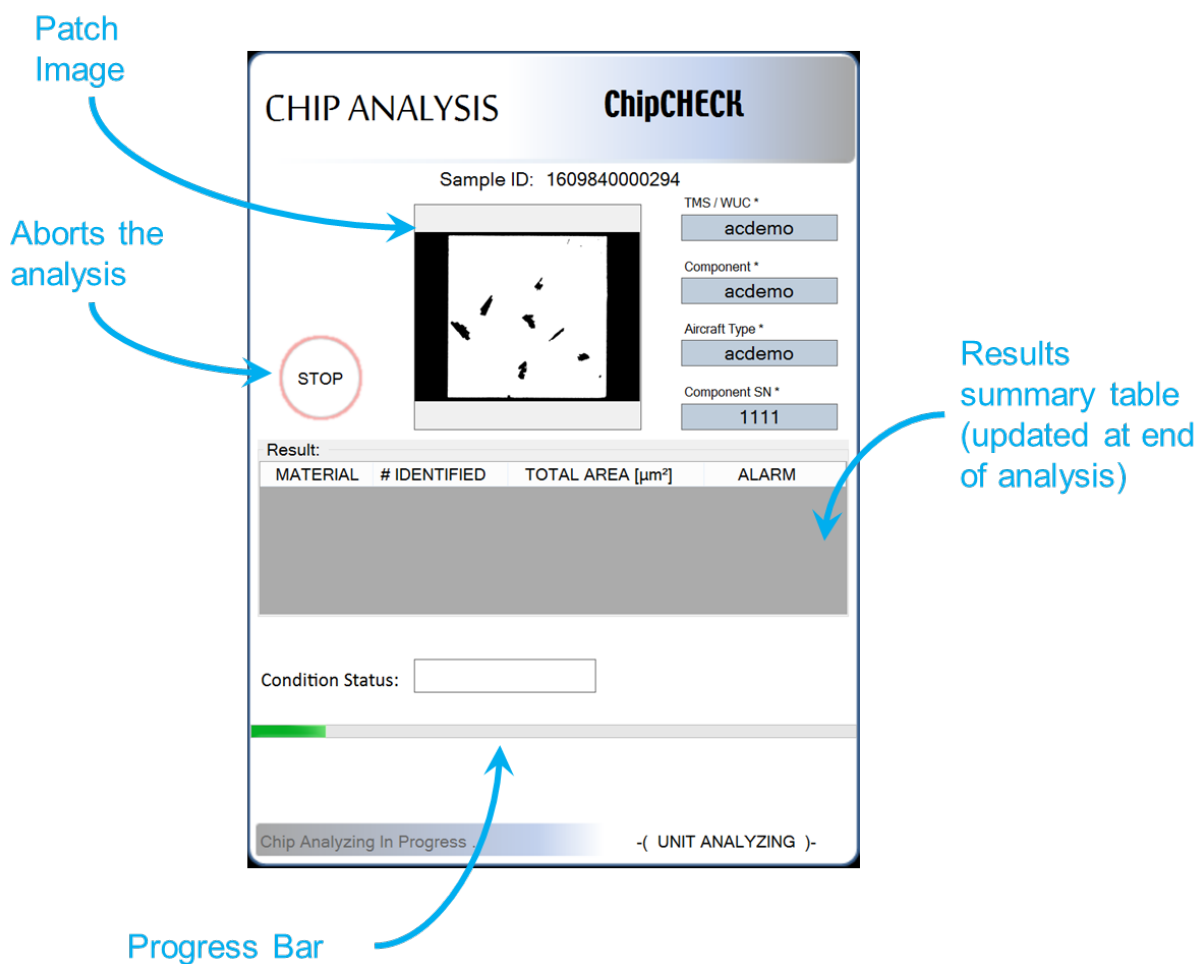


Figure 4-9: Chip Analysis Screen – Chip Analysis Running

6. Once the analysis is complete, a number of things will happen:
- The equipment will automatically eject the Sample.
 - The software interface will provide the User with a complete set of results:
 - Patch image
 - Materials identified
 - Number of particles identified for a given material

- iv. Total area of particles identified for a given material
- c) The 'Reports' and 'Next Sample' button will become selectable once the sample tray is fully ejected from the equipment.

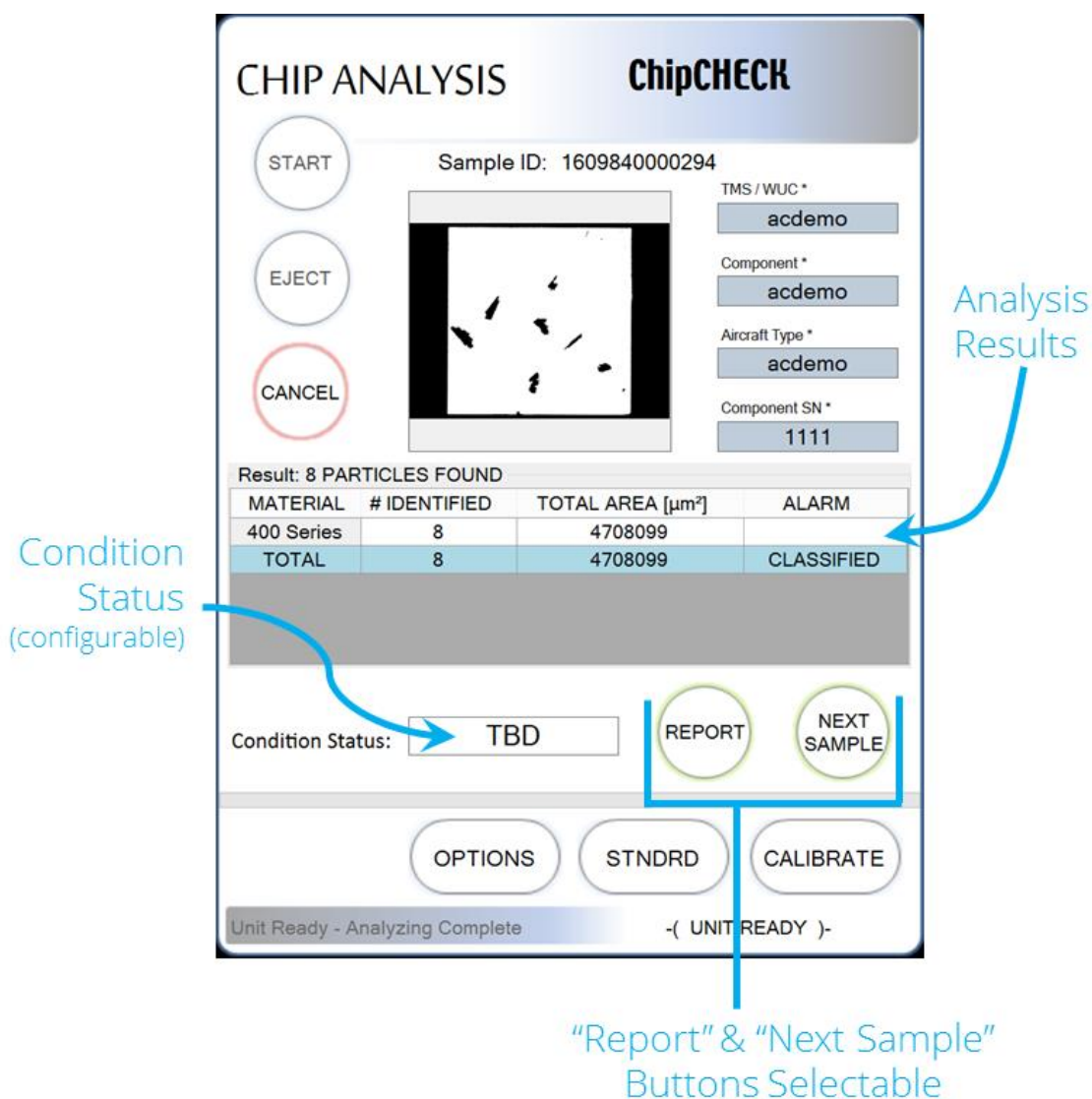


Figure 4-10: Chip Analysis Screen – Chip Analysis Complete

The sample is now fully analyzed and the results data is automatically saved in the database. The User can now do one of two things:

1. Click on the "Next Sample" button found near the bottom right corner of the screen and repeat all steps above for the next sample to be analyzed.
2. Click "Report" to see the results in PDF format (See Section 4.6).

NOTE: Any resulting classification output from the equipment should be interpreted as nearest matches. It may be that a ChipCHECK unit can give a clear indication that the equipment should not be operated, however, this does not necessarily mean that in the absence of such cautionary indications, that flight operations are safe/airworthy or that the machinery being tested is safe for use.

NOTE: Analyzed wear debris are reported by ChipCHECK by their size and alloy classification (ex: M50) or base element (ex: Fe). Any analyzed wear debris that could not be classified by ChipCHECK is reported as "Unclassified". Note that a classification result of base element or unclassification does not necessarily constitute that the sample is in absence of the materials included the configured Material Library. A base element or unclassified result may also result from inadequate spectra collected from particles, which can be minimized by following the cautions as outlined in the cautionary notes in Section 4.3.

4.6 Sample Reports

At any given time the User is able to access the Sample Reports for samples that were historically analyzed. The results from every analysis are stored in the equipment's internal database and are accessible through the "Reports Viewer". The following steps instruct the User on how to access these reports through the Reports Viewer. For more details refer to Software Description, Section 5.0.

1. To bring up the 'Reports Viewer' select the 'Reports' button found in one of the following locations:
 - a) **Options Screen:** near the top right of the screen.
 - b) **Analysis Screen:** near the bottom right of the screen.

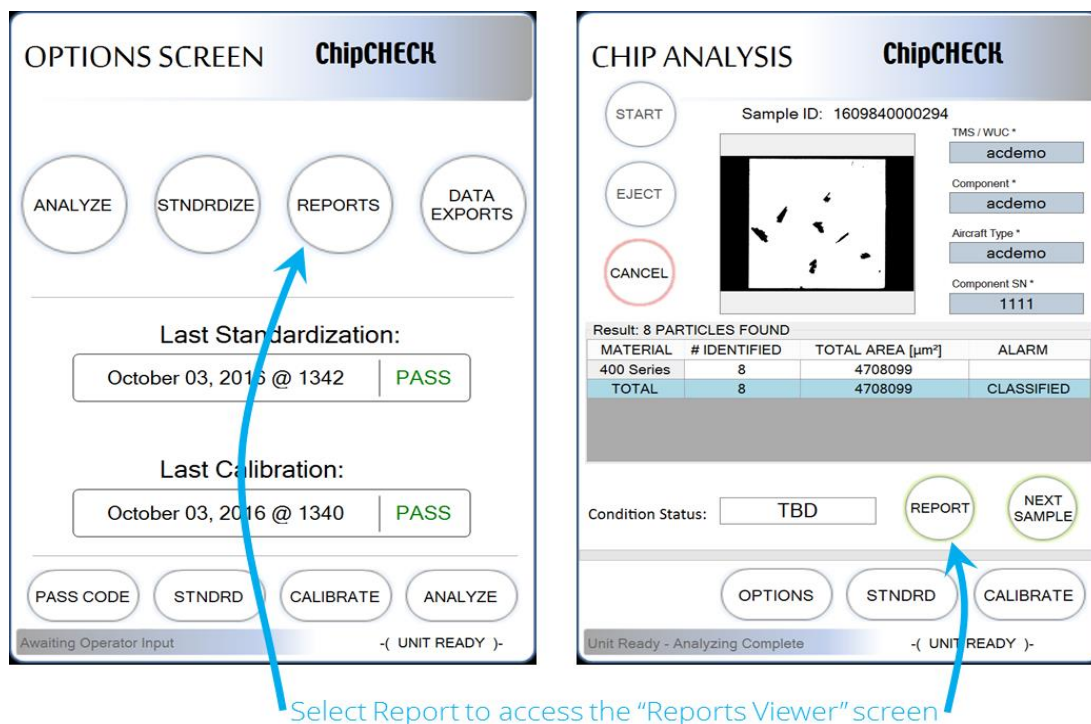


Figure 4-11: Reports Viewer Access

- If the reports viewer is accessed through the Analysis Screen, then the report from the last analysis is displayed. Various buttons along the bottom of the screen allow the User to "Copy to USB", "View Others" or "View Latest" reports and data, or return to the analysis screen. Furthermore, the User can scroll up and down for more data regarding the analysis being displayed.

NOTE: The reports and data contained in the database are exportable through the "Data Export" Screen. Through this screen, the software interface will prompt the User to define the dates between which the data will be exported. The data is then exported to a .csv file and can be extracted from the system if desired. Refer to Section 5.8 for more detail.

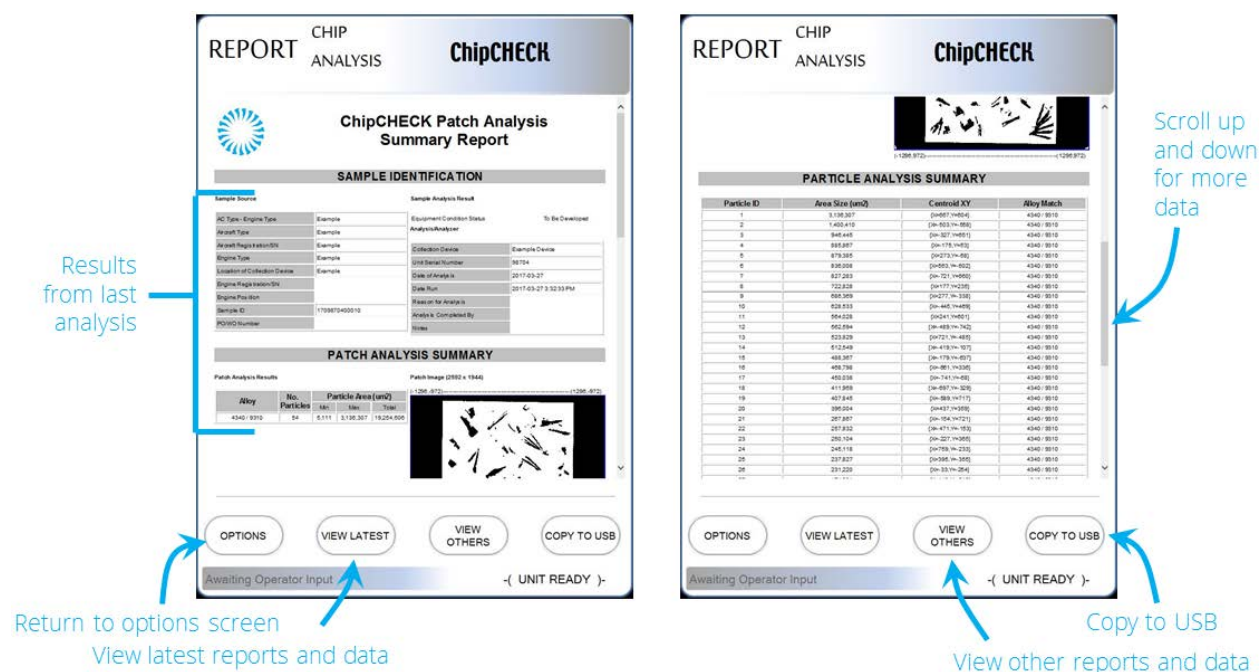


Figure 4-12: Reports Viewer Screen – Last Analysis

- If the reports viewer is accessed through the Option Screen, or if “View Others” is selected from the Report Screen (refer to Figure 4-12), then the reports from previously run analyses can be accessed.

NOTE: The data labels may be configured differently for different applications. As can be seen in Figure 4-13 below, the software interface now presents the User with the report search and filter tools. Various source data entry fields and drop down lists are available to the User. Select the desired source data to find the specific report related to a given analysis run. When data has been entered, filtered results will appear in the list below the entry fields. Select a report from this list, and the “View Report” button in the bottom right of the screen will highlight in green. Select the “View Report” button to view the report. The ‘Cancel’ button found in the bottom left of the screen will clear the filters on the first click, and return the User to the previous screen on the second click.

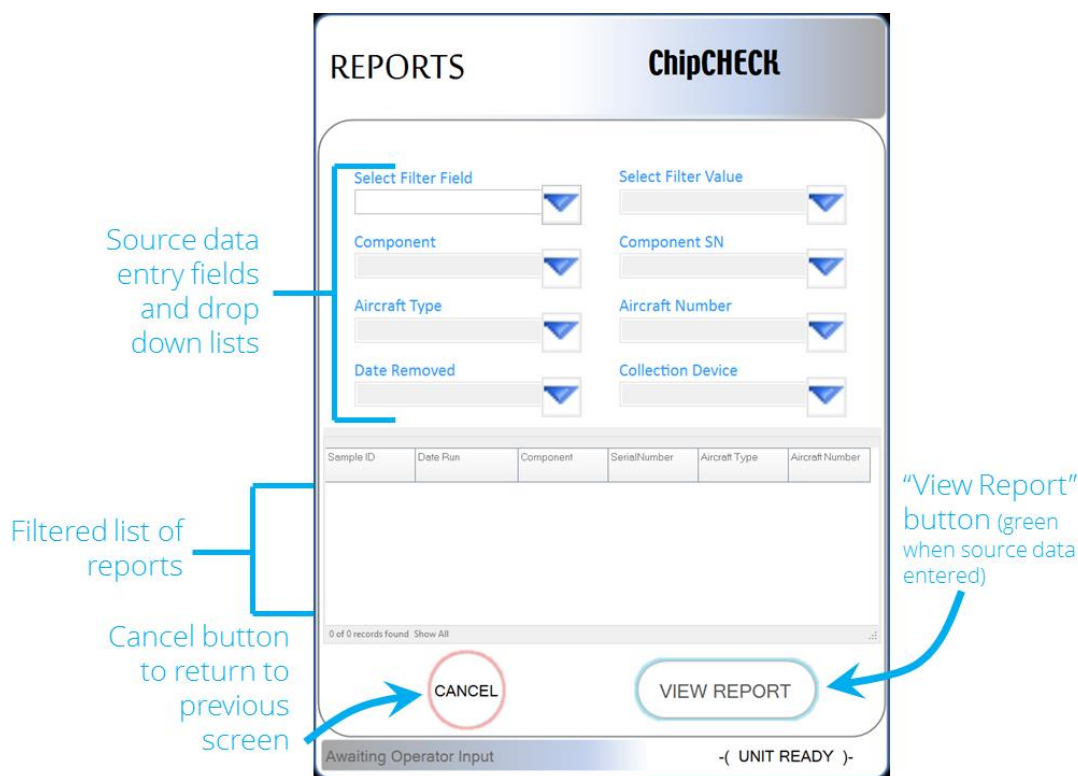


Figure 4-13: Reports Viewer Screen –Search & Filter

The completion of the steps above will display the report and results from the desired analysis as shown in Figure 4-12 above. As described in Step 2, the User will then have the ability to “Copy to USB”, “View Other” or “View Latest” reports and data. Refer to Section 5.8 for information on copying files to an external flash drive via the “Copy to USB” button.

Otherwise, the User can select the “Options” button in the bottom left of the screen to return to the Options screen.

4.7 System Shutdown

The system shut down procedure is as follows:

1. Press the unit power button (see Figure 4-14). When the button is pressed, the unit ejects the Sample Receptacle, and a prompt on the touchscreen (see Figure 4-15) directs the user to remove the Sample Tray.
2. Remove the Sample Tray (if desired).
3. Press the OK button on the touchscreen prompt. When the OK button is pressed on the prompt, the unit moves the Sample Receptacle to the home position (internal to the unit), shuts down the software, and then shuts down power to the entire system. The power button on the

front of the unit will start blinking blue once the software is shut down, and will turn solid red once the power is shut down.

4. The power switch on the back of the unit can now be switched to the off position.



Figure 4-14: ChipCHECK Power Button

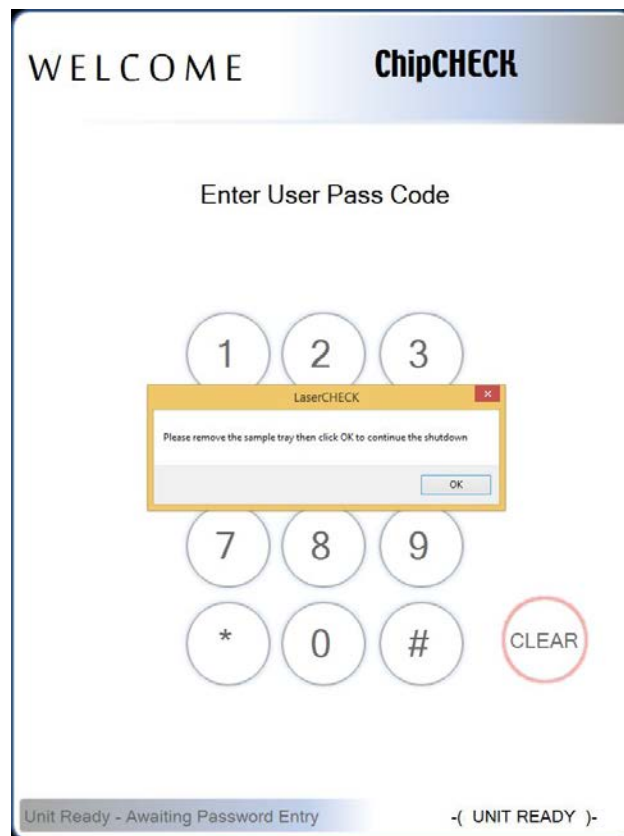


Figure 4-15: ChipCHECK Power Down – Remove the Sample Tray