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## Particle Dispersion Evaluation Software (Picture Analyzer)

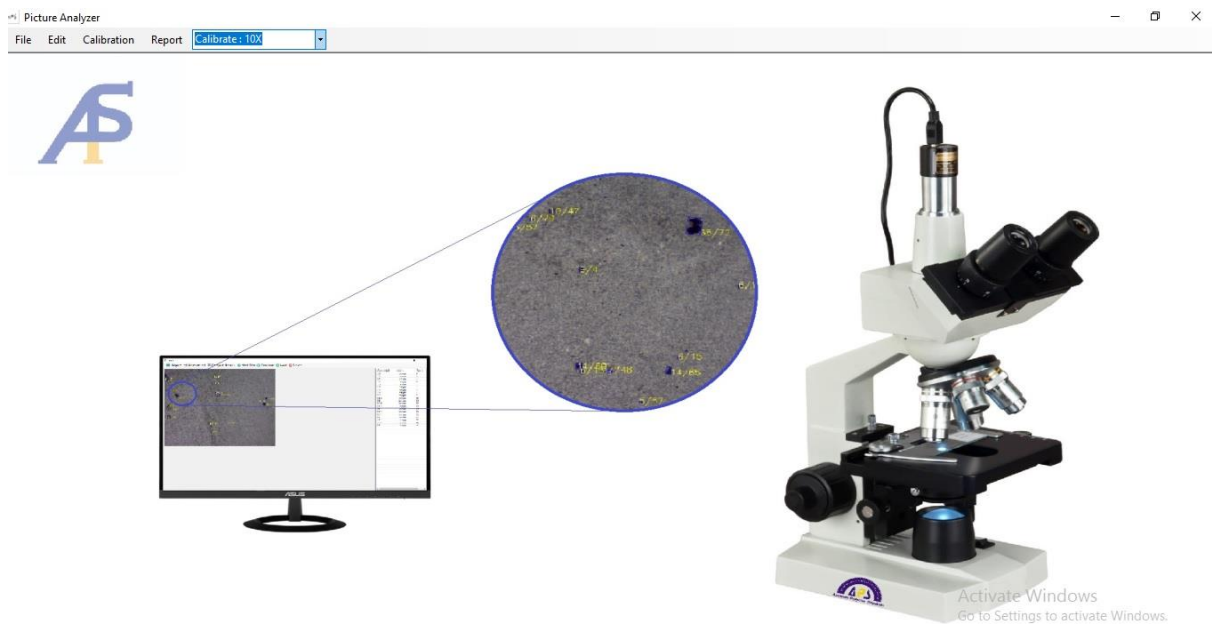
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### Introduction

1. This software allows you to observe and accurately evaluate various particles dispersed within a product. To do so, you must first capture images of the prepared samples (films) under a microscope. This can be done using different types of microscopes equipped with imaging cameras. After uploading the images into the software, the program automatically calculates the size and number of particles present and reports the results in a standard format according to **ISO 18553** (National Standard 20059).

*Note:* When photographing the particles, pay attention to the microscope's lighting level, image quality, and particle clarity, and strive to obtain high-quality images whenever possible.

2. After installing the software, and while the software's specific dongle is connected to the computer, launch the program by double-clicking the **Picture Analyzer** icon.



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### 3-Software Calibration

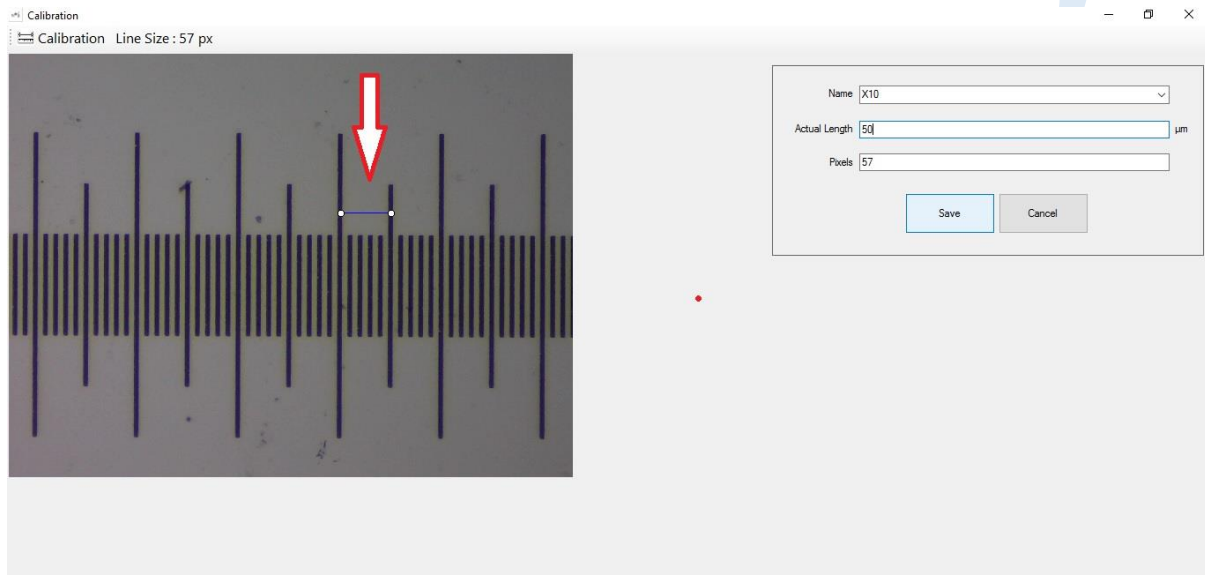
To ensure the software functions correctly in calculating particle sizes, it must be calibrated. To do this, use the Calibration option located in the toolbar at the top of the software's main page. By clicking this option, a window will open where you can upload an image previously

prepared of a graduated slide with a specific magnification. (Microscopes typically have four types of objective lenses with magnifications ranging from 4x to 100x).

Note: It is recommended to use an objective lens with 10x magnification for ease of imaging, though higher magnifications can be used if feasible.

#### 4- Setting Up the Calibration File

First, click on the Calibration option above the image to open another window. Place the generated line over a specific distance whose measurement you know. To move the line, click on it, and while holding the mouse button, drag it to the appropriate position, then release the button. Next, click on the end of the line (the white dot) to adjust it precisely to the desired length. Then, in the Name field, enter a name for your calibration file or select one from the available options. In the Actual Length field, enter the actual measurement of the selected distance (based on the specifications of the graduated slide), and finally, click Save to create the calibration file. You can now close the calibration page and return to the main screen.



#### 5- Selecting the Calibration File

At the top of the page, from the calibration drop-down menu, select the desired calibration file you created in the previous step.

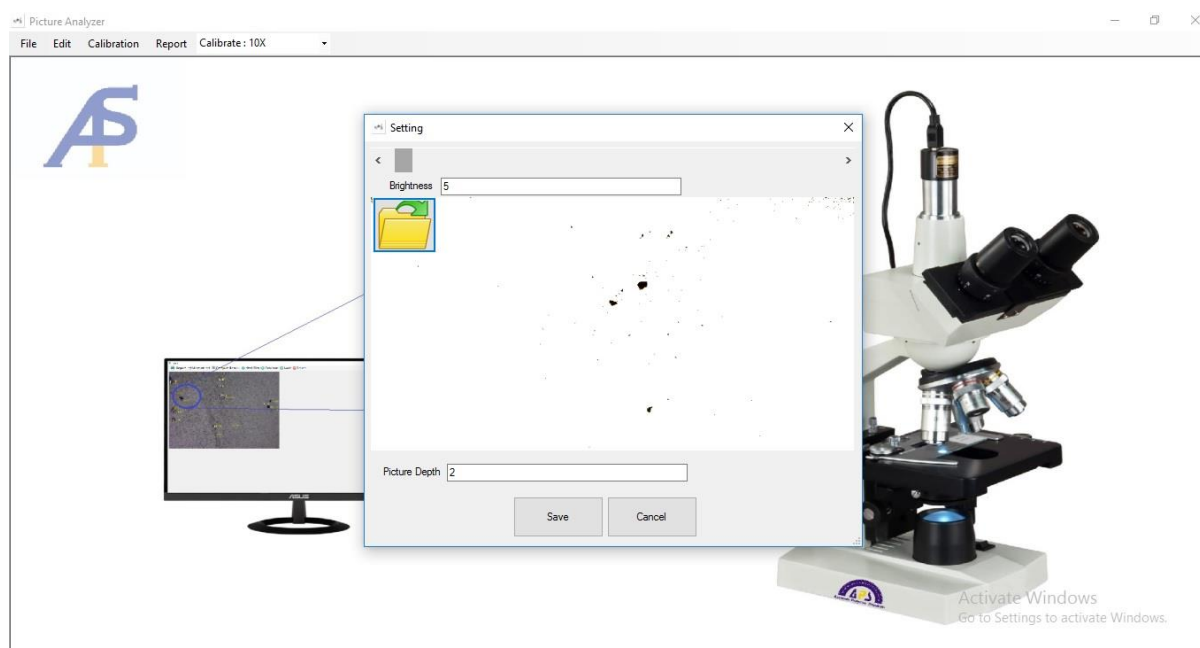
Note that the magnification used in preparing the graduated slide image (calibration) and the original test images must be identical.

Now, the software is calibrated, and you can perform your desired measurements.

#### 6- Settings for Enhancing Particle Detection

Before uploading images to calculate particles, you can use the Setting option in the Edit section of the software to improve the accuracy of particle detection. To do this, in the Setting menu, click on the file upload icon and open a sample image similar to the original sample images. By moving the slider at the top of the window and adjusting the brightness level, distinguish the actual particles in the image from the background, ensuring that while the primary particles are fully identified, the presence of extraneous particles is minimized as much as possible. Another

option that can affect the software's recognition quality is the Picture Depth, located at the bottom of the window. A high picture depth may cause a single particle to be identified as smaller constituent particles, while an excessively low picture depth may lead to incorrect particle detection.



## 7- Starting the Test

To start the test, from the **File** menu, use the **Open** option to upload the prepared images. If you have taken more than one image of a single film (sample), select all those images together and click **Open**. When preparing the images, ensure that they have as few common points as possible. However, if there is a common point between two images, the software will automatically detect the similarity and count that particle only once.

## 8- Particle Calculation

After opening the first sample images, to ensure greater accuracy in particle identification, you can also use the **Brightness** adjustment slider at this stage to create more distinction between the particles and the background.

Then, click on the **Measurement** option for the software to calculate the size and number of particles present.

## 9- Displaying Results

After the calculations are completed, the detected particles will be arranged on the right side of the image in order of size from smallest to largest (based on the image source) and numbered. You can select a specific particle by double-clicking its size in the table on the right to view its exact location on the image. Additionally, when a particle is selected (highlighted in blue), you can navigate to the next or previous particle by pressing **Next** or **Previous**.

If you want all particles to be displayed on the image again, click **Show All**.

Note: If the software has incorrectly identified a particle, you can remove it by selecting it (clicking on its size) and pressing **Delete**. If you wish to add a particle that was not counted to the list, first determine its dimensions by pressing and holding the mouse button at the start of the particle and releasing it at the end, then click once on the resulting line and press **Add to List** to add it to the list.

Note that for better manual measurement, you can zoom in on the desired particle's location by holding the **Ctrl** key on the keyboard and scrolling the mouse wheel.

## 10- Computing Final Results

After making any changes and ensuring performance, to determine the grade and rate of the test sample, click **Compute Results**. In the opened window, enter the image rate (e.g., A2). The software will then automatically generate a report at the bottom of the page based on the number and sizes of the particles and their compliance with the standard, including particle classification, grade, and rate.

The screenshot shows a software window titled 'Result' with a toolbar containing 'Report', 'Measurement', 'Show All', 'Compute Results', 'Next Film', 'Add to List', and 'Remove Specimen'. The main area displays two images of a sample with particles highlighted and labeled with their dimensions: 15.98, 50.12, 24.8, 5.57, and 22.66. A table on the right lists the dimensions, file names, and counts for each particle.

Dimension(μm)	PicName	Number
15.98	990106-5.bmp	1
30.13	990106-5.bmp	2
5.56	990108-3.bmp	3
8.61	990108-3.bmp	4
5.56	990108-3.bmp	5
22.65	990108-3.bmp	6
24.8	990108-3.bmp	7

The bottom of the window shows a navigation bar with buttons for 'Specimen', 'MyImage', and various size ranges: 5\_10(μm), 10\_20(μm), 20\_30(μm), 30\_40(μm), 40\_50(μm), 50\_60(μm), 60\_70(μm), and 70\_80(μm).

## 11-Evaluating the Second Sample

To determine the dispersion of the second sample, click on the Next Film option, and after selecting the related images, upload them using the Open option. Perform the measurement as in the previous step, and at the end, use the Compute Result option to add the results of this sample to those of Sample 1.

## 12-Repeating the Process for Additional Samples

Repeat this process for the required number of samples as per the standard.

It should be noted that if you wish to exclude the results of one sample from the others, you can select that sample from the bottom of the page and click Remove Specimen to delete it.

### 13- Generating the Test Report

Finally, to obtain the test report, click on the Report option. After entering the test details such as sample type, date, etc., proceed to the results report page. On this page, you can obtain the report in formats such as Word, PDF, or others, or print your report directly.

**Particle Dispersion Test Report**

Test Date	2021
Test Method	Dispersion
Sample	PE
Preparation	compersion
Final Grade	1.9
Final Rate	A2

Specimen	5_10 (µm)	10_20 (µm)	20_30 (µm)	30_40 (µm)	40_50 (µm)	50_60 (µm)	60_70 (µm)	70_80 (µm)	80_90 (µm)	90_100 (µm)	100_110 (µm)	110_120 (µm)	120_130 (µm)	130_140 (µm)	140 (µm)	Grade	Rate
1	3	1	2	1	0	0	0	0	0	0	0	0	0	0	0	2	A2
2	2	2	3	1	0	0	0	0	0	0	0	0	0	0	0	2	A2
3	4	2	1	0	0	0	0	0	0	0	0	0	0	0	0	1.5	A3
4	3	3	1	0	0	0	0	0	0	0	0	0	0	0	0	1.5	A2
5	9	3	0	0	0	0	0	0	0	0	0	0	0	0	0	2	A1
6	1	3	0	1	0	0	0	0	0	0	0	0	0	0	0	2	A3