

# STATISTIC ANALYZER S21

## PRESENTATION, PERFORMANCE AND CAPACITY OF THE EQUIPMENT

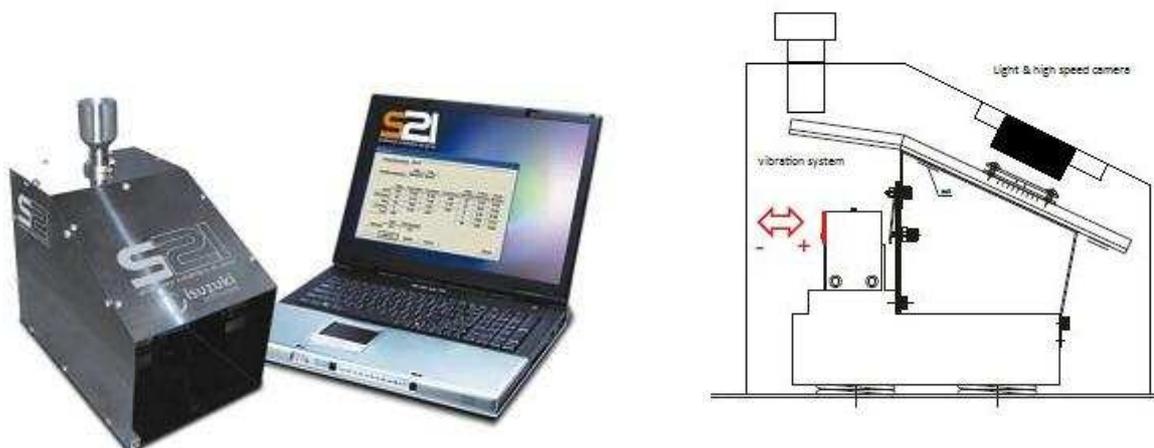


Figure 1 Analyzer S21

The analyzer S21 is an inspector of cereal grains that through image processing and subsequent statistical analysis allows the quantification of defects in a sample.

At present the Laboratory of clients use the S21 for the systematic identification of defects (control of the mill) and characterization of varieties. The equipment is used for testing white rice and cargo rice.

The S21 analyzer consists of two basic elements (Figure 1.) The physical structure of the analyzer and software associated to a PC.

The body of the analyzer is a pump casing with a vertical dispenser, a ramp fitted with vibration, that allows separate grains of rice on the surface of the ramp, and a high-speed camera that captures images of individual grains of rice that run on the surface of the ramp.

All grains in the sample are photographed several times on the surface of the ramp; the program selects the best image of each grain discarding those images with defective frame, fuzzy, etc. As a result of this process gets a number of correct photographs of grains representative of the sample

The software has a basic configuration that allows the separation of the following defects: **broken grains, chalky grains and damage grains**. It also has a open program that allows through certain variables identified in each frame, classify the samples in more defects: **Total broken grains, big broken grains, small broken grains, not peeled grains (paddy), other varieties (round rice in the long rice, long rice in round rice), chalky grains, amber-yellow grains and other defects (damaged, black spotted, and red stripped), and the rest of whole grains without defects**. It is possible to detect foreign matters by shape.

The program presents the results of each analysis in % weight of each defect, to do that, the software calculates de weight of each grain or grain with defect, using width and length measured in each frame.

## OPEN PROGRAM

<b>Inicio</b>	<b>Controles</b>	<b>Resultados</b>	<b>Parámetros</b>	<b>Informaciones</b>
<b>Usuarios</b>	<b>Capturar</b>	<b>Muestras</b>	<b>Ajuste fino</b>	<b>Ayuda</b>
<b>Accesos</b>	<b>Procesar</b>	<b>Informe</b>	<b>Configuraciones</b>	<b>Sobre el S21</b>
<b>Backup de las imágenes</b>			<b>Origen de la muestra</b>	
<b>Logoff</b>			<b>Defectos</b>	
<b>Salir</b>				



**Figure 3 Main Menu**

From the main menu (Figure 3) select the configuration settings that is the type or variety to analyze (you can save an unlimited number of configurations), each configuration will be associated with one variety or type. Each configuration contains only information about average of the length and width of the variety, and the maximum length of the grains. With this information the analyzer selects the frame dimension of each image.

To get initial settings is enough test some samples and get only information about length and width, then name the configuration.

Selected the initial configuration the equipment is prepared to analyze the sample. The weight of the sample to be analyzed should be about 60-70 grams, with a larger sample, size of the archive of the images is too big and the analysis becomes too sluggish, with a very basic computer equipment the process of photography, analysis data and issuing the report is completed in about 3 minutes, with an advanced PC can be completed in half the time.

Deposit the sample into the vertical dispenser container. Press the button to capture images (the program will automatically ask to identify the sample with a name, number, etc.), connect the vibrator system and open the mechanism that allows pass grains to the ramp. The camera starts to take pictures using a high speed continuous shooting at moving grain on the ramp. Once completed the entire sample it is needed stop capturing images pressing the button to end capture. The press the button for processing frames. The computer automatically selects and characterizes the images, displaying a panel with all the grains photographed (Figure 4 / Figure 5)

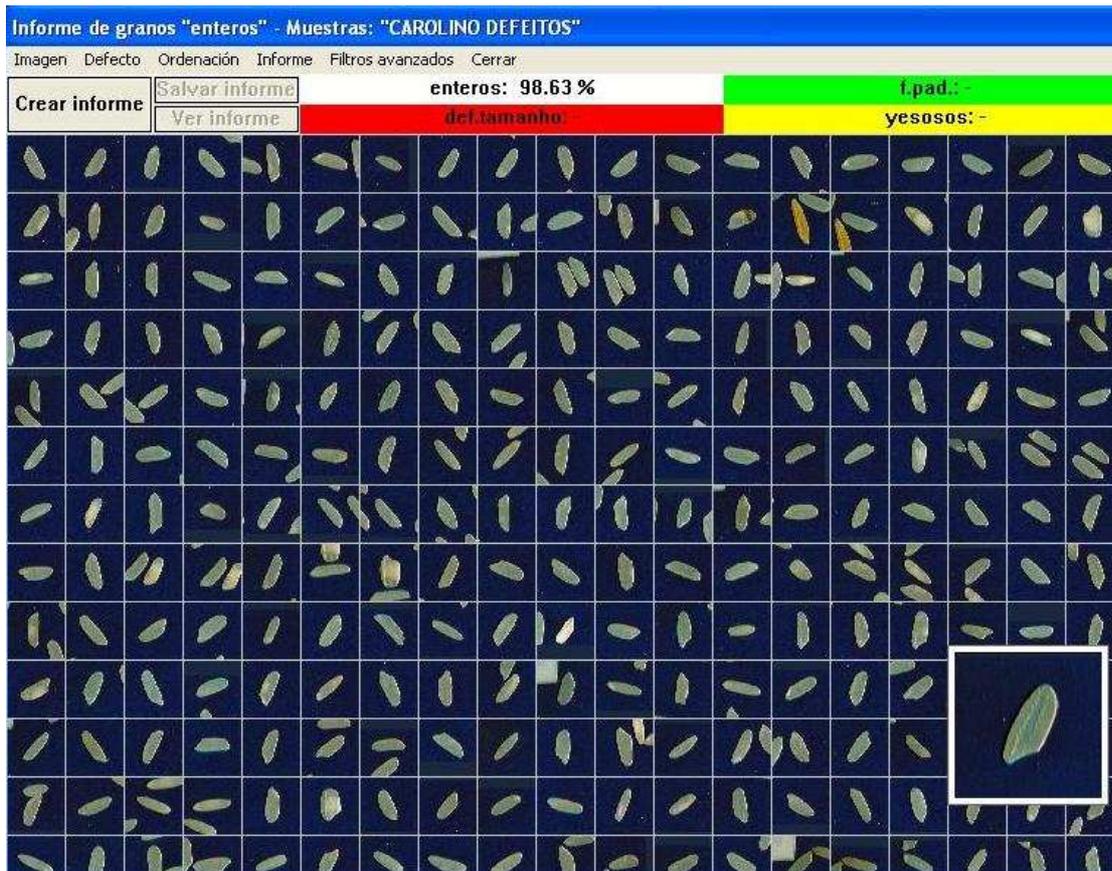
It is possible to get a view in detail of each grain. (Picture 5).





Figure 4 Panel of grains captured.





**Figure 5 View in detail.**

On panel photograph of the grains is necessary in most cases sort your pictures by length and sometimes some grains are showed assembled emerging as a larger mass, these images (2-3 maximum in every analysis must be discarded manually).

Each grain is also signed by a series of parameters that are (Figure 6):

1. Length
2. Width
3. Percentage of chalky area
4. Total whiteness
5. Crystalline whiteness
6. Percentage of dark area
  - 6.1 % percentage of high level dark area
  - 6.2 % percentage of low level dark area

These are the parameters that allow the drafting of ADVANCED FILTERS OF CLASSIFICATION to conduct more comprehensive rankings on the sample (as was done in some clients).



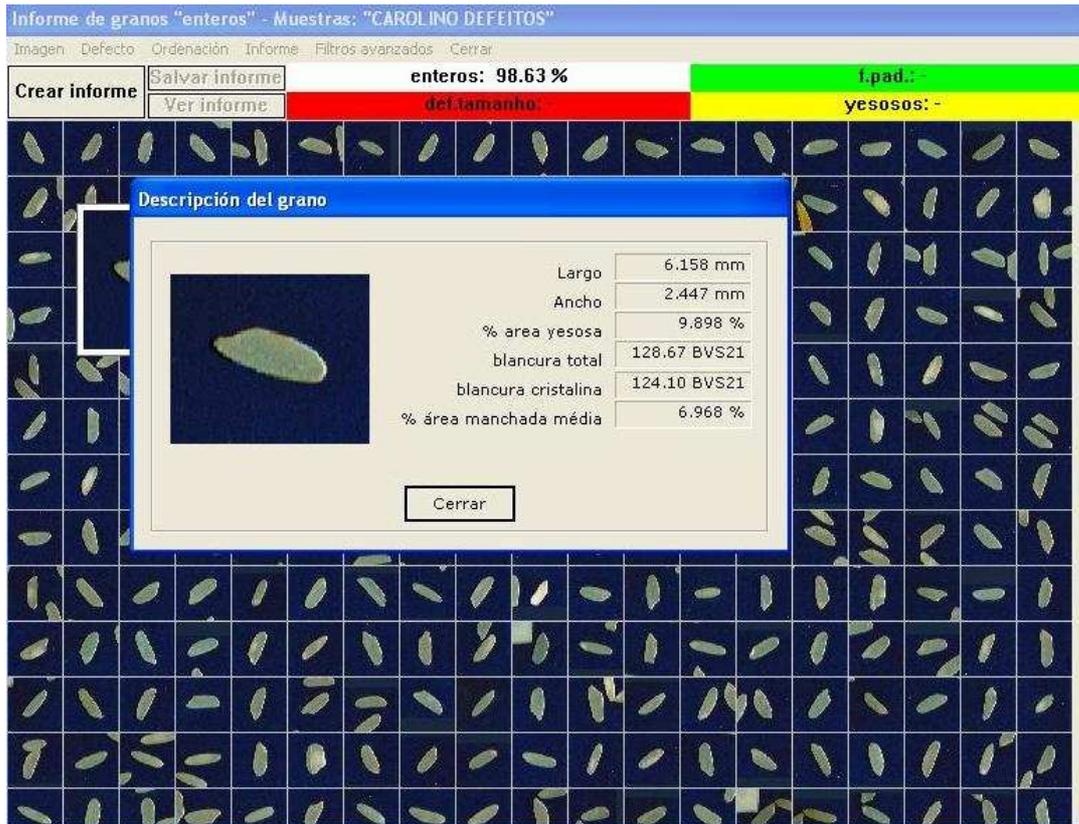


Figure 6

OPEN PROGRAM. DRAFTING OF ADVANCED FILTERS OF CLASSIFICATION.

To draft an advanced filter that can determine specific defects in specific varieties is a relatively simple task and allows to classify the samples in a number of defects that is not possible in the basic program.

Once a filter is programmed for a variety, it is only necessary apply the filter on the panel of grains and automatically classifies all images and delivers a full report of the sample.

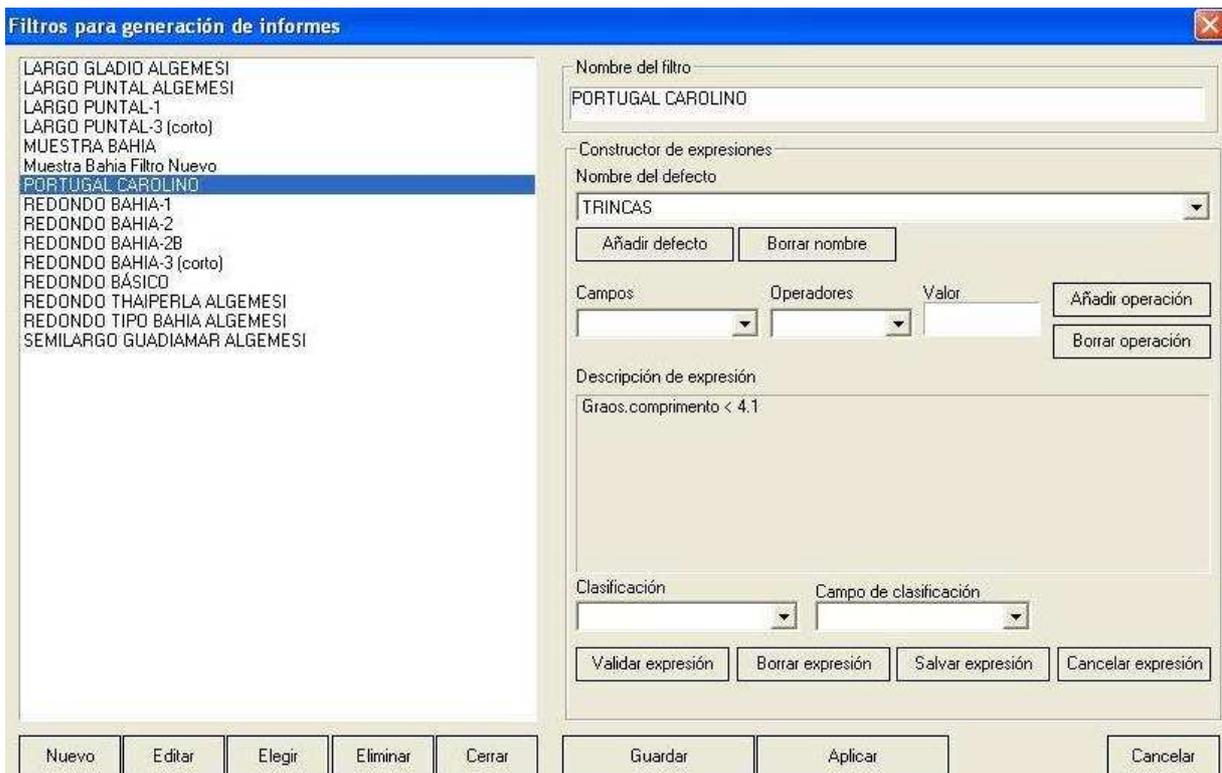
An advanced filter is created on a chart that indicates the program to perform a partial separation. Using a basic parameter or some basic parameters and using simple maths orders (as more than, less than, etc) and the values assigned to each order.

For example (Figure 6) Imagine that we want to create a filter only to separate broken grains. All the steps are:

- a) Giving a name to defect. In this case Broken Grains.
- b) Select basic parameter we want to use to separate a % of the sample. In this case length.
- c) Select the basic mathematic order. In this case "less than"
- d) Add the value to use in the mathematic order in this case 4.1.

When we apply this filter on the panel the program understand that all the grains with less than 4.1 mm are known as Broken Grain and must be separated of the rest of sample. Figure 6





Adding new orders of classification to the filter we will classify the sample into more defects and a rest. Even, is possible to make more classification on a previous defect. So we could split the broken grains in big broken and small broken.



Figure 7. Partial Tree of classification

Of each classification we can be verified images of the grains that have been separated.

(Figure 8)





**Figure 8. Verification of images of elements separated in a classification.**

In line with this classification methodology in the lab of the clients have drafted filters flow charts that manage to classify with extreme accuracy:

BROKEN, BIG BROKEN, SMALL BROKEN, OTHER VARIETIES, PADDY, CHALKY GRAINS, REMAINS OF DEFECTIVE GRAINS AND GRAIN WITH DEFECT. With a relatively high reliability are sorting grains yellow-amber; be impossible to separate the grains striped from the crushed grains stained because the equipment did not spot the difference characteristic of a grain chopped from the stain of a grain veining, as it is unable to analyze the geometry of the stain.

As a result of the implementation of an advanced filter will get the following information (Figure 9) will also get additional information such as average length, average width ...



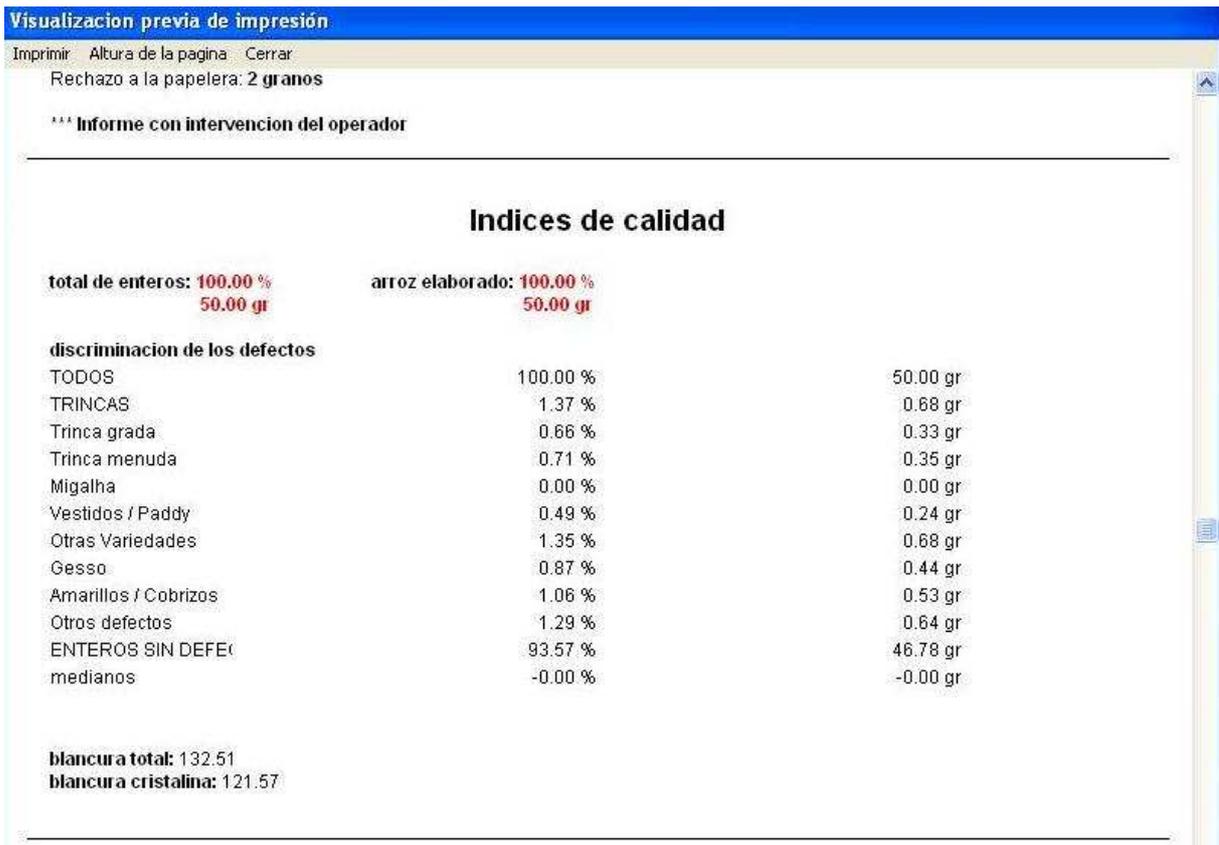


Figure 9 Inform defect analyze

All results of the analysis, including analysis of each image are preserved and stored in the computer. The values of the classifications are stored in a database with Access, which would allow analysis of large amounts of data as the data after its broadcast either being introduced into either introducing SAP on a basis of process control of the mill itself.

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