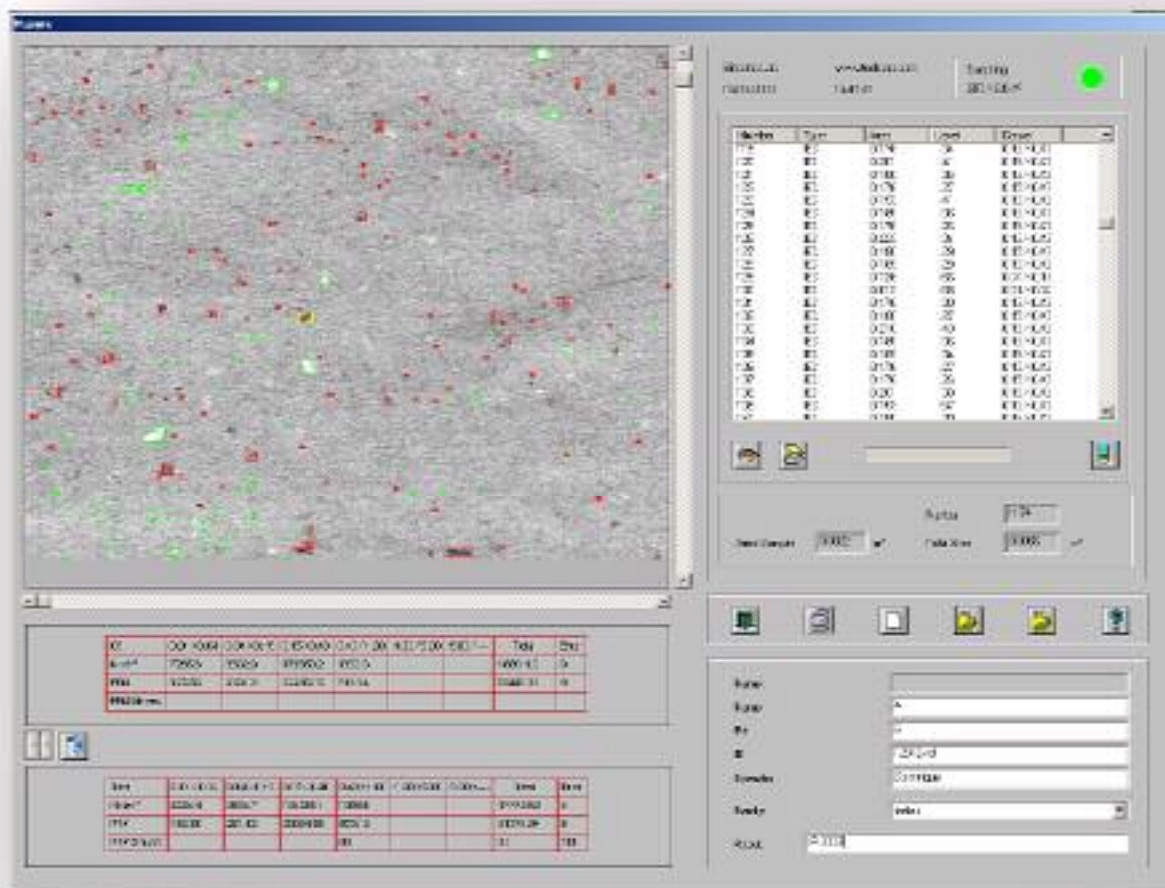


Simpalab Dirt Analyzer

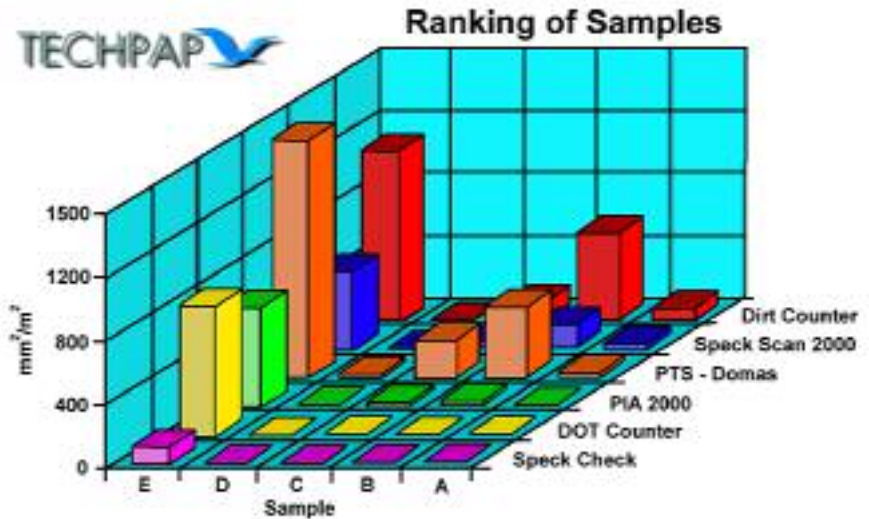


The Simpalab Laboratory Dirt Analyzer is simply the most accurate way to identify dirt, shives, ink or other type of debris in a laboratory handsheet. This system can be calibrated to compensate for changes in the scanner used, for scanner lamp age, for changes in ambient light and for changes in parameter settings. It is ISO 5350 compliant and the data output is given in equivalent square meters. The software is very easy to use and can be configured to meet nearly any requirements from measuring unbleached board to fine writing paper. The system can also provide dirt analysis using transmitted light to measure dirt inside the sheet as well as outside.

ISO 5350 Standard

The development of an ISO standard with regard to dirt counting has exposed some wide variations in existing counting equipment.

This table shows five paper samples tested with 6 different laboratory dirt analysis systems with widely varying results. The five samples are marked A, B, C, D and E with the instruments used to make the test. The Simpalab is labelled "Dirt Counter". As can be seen, all the instruments identified the worst sample (sample E) and generally followed the same pattern for all the samples. However, the sensitivity to the actual measurement and the relationship between the samples varied greatly. In this study, the Simpalab gave the best sensitivity and was closest to the actual dirt in the sheet.



The ISO 5350 standard imposes a set of recommendations aiming at avoiding any fluctuation due to the measurement equipment. The standard stipulates:

- Sampling management and information about the validity and relevance of the measurement data.
- Individual examination of the calculated points must be possible.
- Calibration of the system via the EFPG chart.
- The detection contrast must vary with regard to the total area of detected spots measured.
- The detection contrast must be compared to the local contrast of the spot (1 cm ring around the spot).

All these parameters have been integrated into the Simpalab Laboratory Dirt Analyzer.

Simpalab General Operating Principle



The Simpalab is a very easy instrument to use; however, the output can be as detailed as required by the operator. A handsheet or other sample type is scanned by a standard flat bed scanner using a standard PC to obtain a detailed analysis of the dirt in the sample. This is simple enough in operation but in order to achieve this straight forward process, the program needs to be properly parametered (set-up). The Simpalab has an open architecture software design to allow for a detailed parameter setup by a system administrator. There are three levels of security to protect the developed parameters, yet give the operator adequate control to perform the tests.

Operator Interface

The operator interface is set up to show an image of the measurement, the data collected for the most recent measurement, the most recent measurements data converted to equivalent M^2 and the total data in equivalent M^2 . This interface has icons for opening a new test, saving a test, opening a saved test, printing the results, scan and pre-scan, help and exit. There is also an icon for deleting any of the scanned dirt output points.



The main parameter screen is password protected and provides great flexibility in measurement family design. The image to the left shows a view of this screen and as illustrated allows for complete control of the measurement output. This screen is also used to calibrate the scanner and to set the measurement threshold for test sensitivity. There is no limit to the amount of families that can be set up using this screen.

Using the EBA (Equivalent Black Area) Function

The Simpalab is capable of measuring samples using the EBA, equivalent black area, principle of measurement. This allows the operator to adjust the size of spec measured to compensate for its contrast to the background color. The image below gives details on how this is done.

How is the EBA (Equivalent Black Area) developed?

To find the EBA you make the same calculation as without EBA but you multiply each of the area measurements by the contrast level.

The formula would be:

$$\frac{(A1*L1+A2*L2+Ai*Li)/AS}{100} = A_{EBA} \text{ per meter square}$$

Where: L1 is the contrast of the first value per class to the right
L2 is the contrast of the second value per class
Li is all the subsequent contrast levels

In this case there is only one dot in area 0.01 / 0.04 so
(0.035*33)/0.01=118m² for black dots (no shives) in the
class size .01m²/.04m²

The lower table below represents the total of all the measurements in the upper table.

Class	Area	Contrast	Weighted Area	Total Area	Total Weighted Area	EBA
0.01	0.01	33	0.0033	0.01	0.0033	33
0.02	0.02	16.5	0.0033	0.02	0.0033	16.5
0.04	0.04	8.25	0.0033	0.04	0.0033	8.25
0.08	0.08	4.125	0.0033	0.08	0.0033	4.125
0.16	0.16	2.0625	0.0033	0.16	0.0033	2.0625
0.32	0.32	1.03125	0.0033	0.32	0.0033	1.03125
0.64	0.64	0.515625	0.0033	0.64	0.0033	0.515625
1.28	1.28	0.2578125	0.0033	1.28	0.0033	0.2578125
2.56	2.56	0.12890625	0.0033	2.56	0.0033	0.12890625
5.12	5.12	0.064453125	0.0033	5.12	0.0033	0.064453125
10.24	10.24	0.0322265625	0.0033	10.24	0.0033	0.0322265625
20.48	20.48	0.01611328125	0.0033	20.48	0.0033	0.01611328125
40.96	40.96	0.008056640625	0.0033	40.96	0.0033	0.008056640625
81.92	81.92	0.0040283203125	0.0033	81.92	0.0033	0.0040283203125
163.84	163.84	0.00201416015625	0.0033	163.84	0.0033	0.00201416015625
327.68	327.68	0.001007080078125	0.0033	327.68	0.0033	0.001007080078125
655.36	655.36	0.0005035400390625	0.0033	655.36	0.0033	0.0005035400390625
1310.72	1310.72	0.00025177001953125	0.0033	1310.72	0.0033	0.00025177001953125
2621.44	2621.44	0.000125885009765625	0.0033	2621.44	0.0033	0.000125885009765625
5242.88	5242.88	0.0000629425048828125	0.0033	5242.88	0.0033	0.0000629425048828125
10485.76	10485.76	0.00003147125244140625	0.0033	10485.76	0.0033	0.00003147125244140625
20971.52	20971.52	0.000015735626220703125	0.0033	20971.52	0.0033	0.000015735626220703125
41943.04	41943.04	0.0000078678131103515625	0.0033	41943.04	0.0033	0.0000078678131103515625
83886.08	83886.08	0.00000393390655517578125	0.0033	83886.08	0.0033	0.00000393390655517578125
167772.16	167772.16	0.000001966953277587890625	0.0033	167772.16	0.0033	0.000001966953277587890625
335544.32	335544.32	0.0000009834766387939453125	0.0033	335544.32	0.0033	0.0000009834766387939453125
671088.64	671088.64	0.00000049173831939697265625	0.0033	671088.64	0.0033	0.00000049173831939697265625
1342177.28	1342177.28	0.000000245869159698486328125	0.0033	1342177.28	0.0033	0.000000245869159698486328125
2684354.56	2684354.56	0.0000001229345798492431640625	0.0033	2684354.56	0.0033	0.0000001229345798492431640625
5368709.12	5368709.12	0.00000006146728992462158203125	0.0033	5368709.12	0.0033	0.00000006146728992462158203125
10737418.24	10737418.24	0.000000030733644962310791015625	0.0033	10737418.24	0.0033	0.000000030733644962310791015625
21474836.48	21474836.48	0.0000000153668224811553955078125	0.0033	21474836.48	0.0033	0.0000000153668224811553955078125
42949672.96	42949672.96	0.00000000768341124057769775390625	0.0033	42949672.96	0.0033	0.00000000768341124057769775390625
85899345.92	85899345.92	0.000000003841705620288848876953125	0.0033	85899345.92	0.0033	0.000000003841705620288848876953125
171798691.84	171798691.84	0.0000000019208528101444244384765625	0.0033	171798691.84	0.0033	0.0000000019208528101444244384765625
343597383.68	343597383.68	0.00000000096042640507221221923828125	0.0033	343597383.68	0.0033	0.00000000096042640507221221923828125
687194767.36	687194767.36	0.000000000480213202536106109619140625	0.0033	687194767.36	0.0033	0.000000000480213202536106109619140625
1374389534.72	1374389534.72	0.0000000002401066012680530548095703125	0.0033	1374389534.72	0.0033	0.0000000002401066012680530548095703125
2748779069.44	2748779069.44	0.00000000012005330063402652740478515625	0.0033	2748779069.44	0.0033	0.00000000012005330063402652740478515625
5497558138.88	5497558138.88	0.000000000060026650317013263702392578125	0.0033	5497558138.88	0.0033	0.000000000060026650317013263702392578125
10995116277.76	10995116277.76	0.0000000000300133251585066318511962890625	0.0033	10995116277.76	0.0033	0.0000000000300133251585066318511962890625
21990232555.52	21990232555.52	0.00000000001500666257925331592559814453125	0.0033	21990232555.52	0.0033	0.00000000001500666257925331592559814453125
43980465111.04	43980465111.04	0.000000000007503331289626657962779072265625	0.0033	43980465111.04	0.0033	0.000000000007503331289626657962779072265625
87960930222.08	87960930222.08	0.0000000000037516656448133289813895361328125	0.0033	87960930222.08	0.0033	0.0000000000037516656448133289813895361328125
175921860444.16	175921860444.16	0.00000000000187583282240666449069476806640625	0.0033	175921860444.16	0.0033	0.00000000000187583282240666449069476806640625
351843720888.32	351843720888.32	0.000000000000937916411203332245347384033203125	0.0033	351843720888.32	0.0033	0.000000000000937916411203332245347384033203125
703687441776.64	703687441776.64	0.0000000000004689582056016661226736920166015625	0.0033	703687441776.64	0.0033	0.0000000000004689582056016661226736920166015625
1407374883553.28	1407374883553.28	0.00000000000023447910280083306133684600830078125	0.0033	1407374883553.28	0.0033	0.00000000000023447910280083306133684600830078125
2814749767106.56	2814749767106.56	0.000000000000117239551400416530668423004150390625	0.0033	2814749767106.56	0.0033	0.000000000000117239551400416530668423004150390625
5629499534213.12	5629499534213.12	0.0000000000000586197757002082653342115020751953125	0.0033	5629499534213.12	0.0033	0.0000000000000586197757002082653342115020751953125
11258999068426.24	11258999068426.24	0.0000000000000293098878501041326671057503759765625	0.0033	11258999068426.24	0.0033	0.0000000000000293098878501041326671057503759765625
22517998136852.48	22517998136852.48	0.00000000000001465494392505206633355287518798828125	0.0033	22517998136852.48	0.0033	0.00000000000001465494392505206633355287518798828125
45035996273704.96	45035996273704.96	0.000000000000007327471962502533166776437593994140625	0.0033	45035996273704.96	0.0033	0.000000000000007327471962502533166776437593994140625
90071992547409.92	90071992547409.92	0.0000000000000036637359812512665838882187969970703125	0.0033	90071992547409.92	0.0033	0.0000000000000036637359812512665838882187969970703125
180143985094819.84	180143985094819.84	0.00000000000000183186799062563329194410939849853515625	0.0033	180143985094819.84	0.0033	0.00000000000000183186799062563329194410939849853515625
360287970189639.68	360287970189639.68	0.000000000000000915933995312816645972054699699267578125	0.0033	360287970189639.68	0.0033	0.000000000000000915933995312816645972054699699267578125
720575940379279.36	720575940379279.36	0.0000000000000004579669976564083229860273498496337890625	0.0033	720575940379279.36	0.0033	0.0000000000000004579669976564083229860273498496337890625
1441151880758558.72	1441151880758558.72	0.00000000000000022898349882820416149301367492481689453125	0.0033	1441151880758558.72	0.0033	0.00000000000000022898349882820416149301367492481689453125
2882303761517117.44	2882303761517117.44	0.000000000000000114491749414102080746506837462408447265625	0.0033	2882303761517117.44	0.0033	0.000000000000000114491749414102080746506837462408447265625
5764607523034234.88	5764607523034234.88	0.000000000000000057245874707051040373253418731222223680625	0.0033	5764607523034234.88	0.0033	0.000000000000000057245874707051040373253418731222223680625
11529215046068469.76	11529215046068469.76	0.0000000000000000286229373535255201866267093656111118403125	0.0033	11529215046068469.76	0.0033	0.0000000000000000286229373535255201866267093656111118403125
23058430092136939.52	23058430092136939.52	0.00000000000000001431146867676276009331335468280555592015625	0.0033	23058430092136939.52	0.0033	0.00000000000000001431146867676276009331335468280555592015625
46116860184273879.04	46116860184273879.04	0.0000000000000000071557343383813800466566773414027779603125	0.0033	46116860184273879.04	0.0033	0.0000000000000000071557343383813800466566773414027779603125
92233720368547758.08	92233720368547758.08	0.00000000000000000357786716919069002332833867070138898015625	0.0033	92233720368547758.08	0.0033	0.00000000000000000357786716919069002332833867070138898015625
184467440737095516.16	184467440737095516.16	0.000000000000000001788933584595345011664169335350694490078125	0.0033	184467440737095516.16	0.0033	0.000000000000000001788933584595345011664169335350694490078125
368934881474191032.32	368934881474191032.32	0.0000000000000000008944667922976725058320846676753472450390625	0.0033	368934881474191032.32	0.0033	0.0000000000000000008944667922976725058320846676753472450390625
737869762948382064.64	737869762948382064.64	0.00000000000000000044723339614883625291604233383767362251953125	0.0033	737869762948382064.64	0.0033	0.00000000000000000044723339614883625291604233383767362251953125
1475739525896764129.28	1475739525896764129.28	0.000000000000000000223616698074418126458021166918836811259765625	0.0033	1475739525896764129.28	0.0033	0.000000000000000000223616698074418126458021166918836811259765625
2951479051793528258.56	2951479051793528258.56	0.0000000000000000001118083490372090632290105834594184056298828125	0.0033	2951479051793528258.56	0.0033	0.0000000000000000001118083490372090632290105834594184056298828125
5902958103587056517.12	5902958103587056517.12	0.000000000000000000055904174518604531614505291729709202814453125	0.0033	5902958103587056517.12	0.0033	0.000000000000000000055904174518604531614505291729709202814453125
11805916207174113034.24	118					

Error Correction on Simpalab

There are two charts on the Simpalab operator screen below the image screen. The top chart is for the current measurement and the lower chart is for an accumulation of the results of all tests in a series. On the far right side of these charts there is a column marked "error", this is for the total error calculation for the chart. Each class in the chart can also have this error indicator which shows up as a red number beside the class number. This error indicator has to do with the "Poisson law" calculation, which means that if the error is too high, the results cannot be trusted according to the confidence interval set on the system (in upper right corner of screen). The range of these error numbers is in percent; therefore, a 0 will indicate a good trustable result and 100 will indicate an untrustworthy result.

Example:

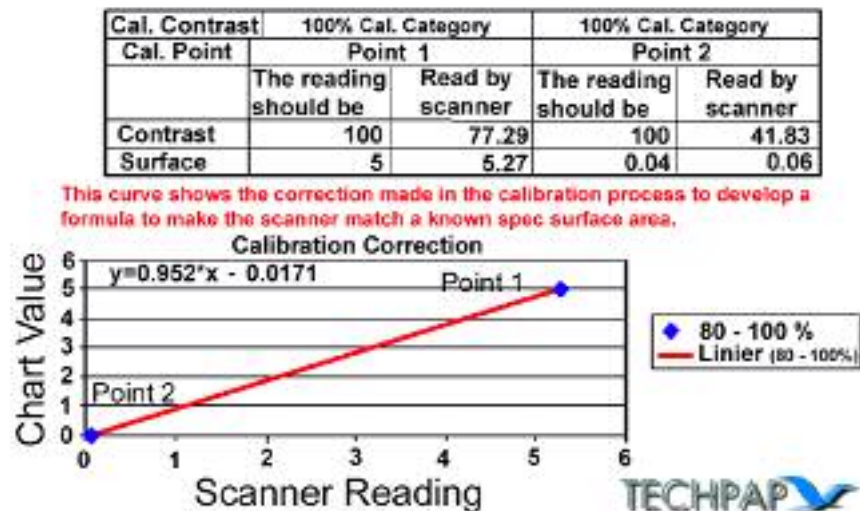
If a measurement is made on three sample sheets and the results show a count of 12, 13 & 12 in the small class size then the error number will be low (possibly 45 or 55) for that class size. If in the same three sample measurements a large class size shows a count of 3, 0 & 11 then the error correction for that class size will be high (85 or 98). In this example the likelihood that the forth measurement will be 12 or 13 is very good for the small class size and the likelihood that a repeat number will appear in the large class size is remote. This error correction feature makes it possible to more accurately determine the dirt count number in large areas by measuring much smaller areas; thus, making accurate measurements quicker.

Simpalab Calibration Principle

What is the Simpalab calibration principle and how does the system read the dirt and specs? This table and chart illustrates the basic process used by the Simpalab to calibrate the scanner to achieve the correct reading for the surface area and contrast of a measured spec to a known area and contrast on the calibration sheet. The Simpalab calibration is a simple process.

Merely follow these steps:

- 1) Adjust the threshold to the desired level using the threshold adjustment procedure.
- 2) Place the calibration sheet on the scanner and select "Calibration" in the "Parameters" drop down menu.



- 3) Place the cursor on the “point 1” calibration point and double click. When this calibration point is double clicked, the contrast for spec 1 (77.29) will be corrected to 100 effectively adjusting the scanner to the correct “known” contrast. The spec 2 contrast of 41.83 will be adjusted to 100 when double clicking on the calibration point 2. Follow this procedure for all remaining points to calibrate area and contrast. (Note: The reason the contrast for point 2 is initially much lower than point 1 is because point 2 is a measure of a much smaller point with a lighter grey level and the particular scanner being tested reads it as having a lower contrast.)
- 4) Now after calibration, each time the Simpalab records a point that has a contrast form 41 to 77 the system will know that this point belongs to the calibration contrast class 80 – 100. With this information the Simpalab will develop an equation to correct the scanned spec area to the “known” area. In this case the formula is $y=0.952*x - 0.0171$ to correct its corresponding area.

The operator can find the calibration coefficient A & B of the formula to adjust for area in the special Techpap menu under calibration (referred to as “etalon” in the Techpap menu). It is important to understand these coefficients are different and specific to each family. In the event the calibration procedures are not used, simply perform the following functions:

- For all families, uncheck the calibration matchbox (referred to as “mode etalonnage”) in the special Techpap menu under parameter.
- Then open “Etalon” in the special Techpap menu and put into each specific family a “1” for all A coefficients and a “0” for all B coefficients.

The chart to the right is the ISO calibration chart for the Simpalab. This is a controlled chart and can be purchased from Techpap. It can calibrate for size and contrast. When not in use, this chart should be stored in a black envelope in a clean dry location. It is recommended that the calibration chart be replaced every couple of years because the plastic base sheet will yellow over time and could cause errors.

