



On-machine testing of visible dirt

The On-Machine Dirt In-speck-tor (ODI) will bring step change improvements to the testing of the finished product, will help optimize the pulp machine manufacturing process and will provide the quality control team with real time measurement information on visible dirt, shives and sheet reflectance to reach the “ship by the gauge” objective.

The ODI mounts on top of the sheet, and measures up to 1000 m²/hr, at optimum speed, performing image analysis and reporting standard cleanliness values required to make informed decisions on product quality.



Parameter	Metrics	Intended use
Physical Speck size	Speck count/m ² and PPM* (mm ² /m ²)	Process diagnostics and optimization
EBA (Equivalent Black Area)	Speck count/m ² and PPM (mm ² /m ²)	Grade of cleanliness, meets Tappi/ISO image analysis standards
Percent count uncertainty	%U	Measurement precision
Shive counts	Aspect ratio	User selectable characterization
Sheet reflectance	% (Ry)	Correlates to sheet brightness

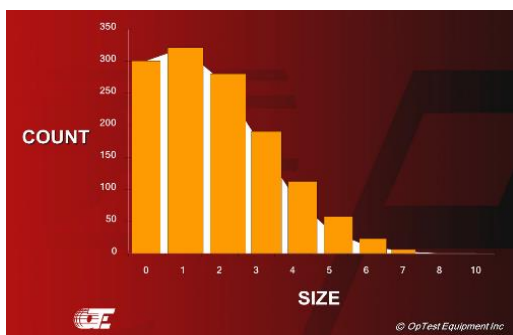
*PPM, Parts Per Million

Why the ODI?

Unlike other web monitoring technologies, the ODI design, image analysis software and construction features are in full compliance of TAPPI standards for detection and quantification of visible dirt in pulp, paper and paperboard, specifically the Tappi T563 Standard method and its equivalent ISO 5350-4. The ODI also meets all the guidelines and recommended practices for dirt measurement on a moving sheet described in the TAPPI Technical Information Paper TIP 1101-09. This TIP states that dirt must be measured with reflected light in order to measure visible dirt specks according to Tappi and ISO standards. The ODI comes with calibration standards traceable to an ISO level II facility to ensure long term measurement stability and agreement with the standard laboratory methods.

Frequently Asked Question: Does the ODI measure 100% of the sheet?

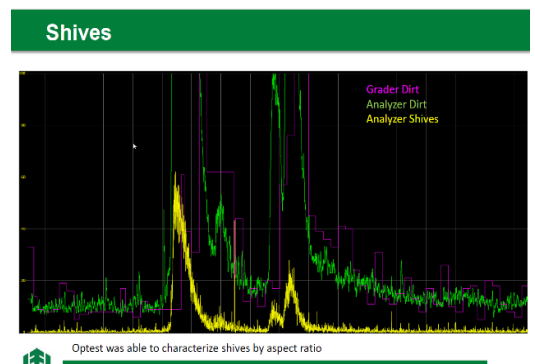
No, and is not necessary. Visible dirt particles from the pulping and bleaching process are distributed randomly throughout the entire pulp sheet and the size distribution follows Poisson statistics, that is smaller particles contribute greatly to the dirt but little to the



PPM. A Poisson probability distribution of particles for a range of sizes is pictured here. The impact on the reliability of the results can be measured by calculating the degree of uncertainty for a Poisson distribution defined as $\%U = \pm 100\%/N^{1/2}$, where N is the number of dirt specks counted. The measurement precision is therefore limited by the number of particles counted and NOT by the area examined. Consequently, when the sheet is very clean, more area must be examined to achieve the same level of precision of a dirtier sheet. A single point ODI installation will achieve the 10% measurement precision required by the standards.

User Testimonial

Mondi Hinton has been using the ODI scanning system since 2016. In addition to providing dirt quality data, properly correlated with the laboratory method, the system proved useful to conduct several process studies aimed at finding the causes of dirt outbreaks, shortening the time to troubleshoot and fix dirt episodes, narrowing lost production due to infrequent testing, characterizing shives occurrences and most importantly ensuring pulp bales meet customer quality expectations.

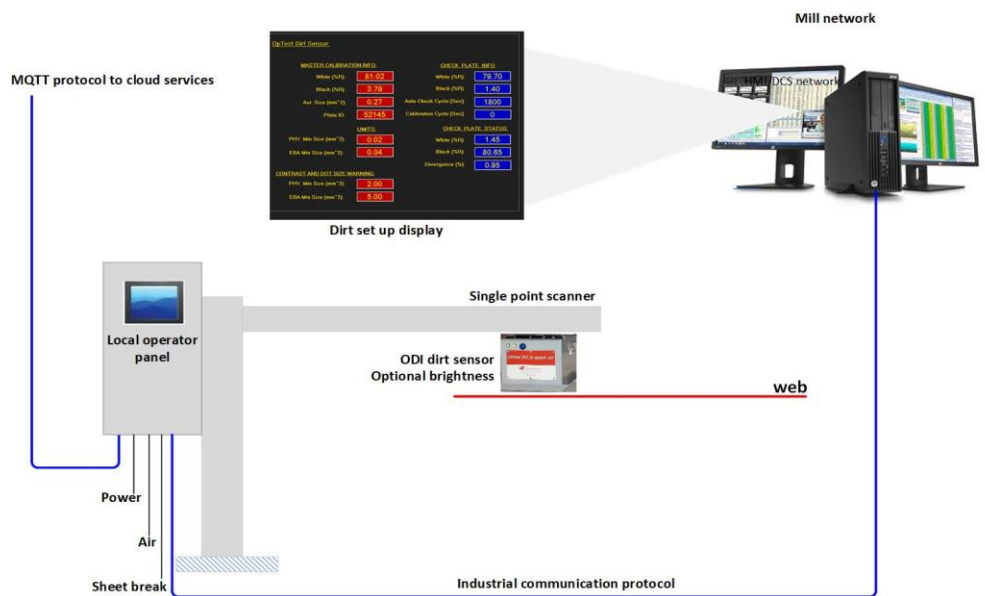


Technical specifications

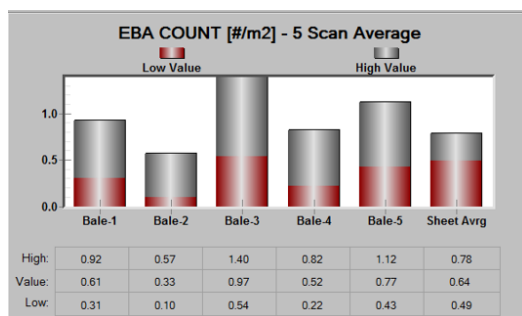
The ODI can be supplied as a single point system for installation at the edge of the sheet on the dry end of the machine, or as a scanning system for measurement across the entire sheet width. Both configurations report all dirt parameters including physical size and EBA averages and distributions.

Power	110- 240 V, 50Hz/60Hz, 1.5 Kw, ±5%, transients smaller than 10%
Instrument air	600 kPa (90 PSI) continuous demand 0.25 m ³ (10 CFM)
Input	Sheet break signal
Connectivity	LAN, Modbus TCP, EthernetIP, Profinet industrial protocols
IIOT	MQTT protocol to cloud services
Ambient temperature	0 - 50°C
Distance from sheet	9.525 mm (3/8")

Single Point ODI System Architecture



The scanning configuration will detect dirt deposited on the sheet after it has formed in the press section and/or dryer section, it will display Bale Drop profiles showing the dirt distribution across the machine and it is useful in the characterization of shives, which analyzes the physical size of dirt specks against their aspect ratio and can be anywhere across the sheet.



Bale drop profile



Scanning ODI