MillMaster

Greenbank's MillMaster utilizes unique patented light sheet technology to accurately gauge the size of particles being conveyed in a lean phase pneumatic conveying system. The size of particles that can be measured ranges from 0.5 micron to 500 microns. The MillMaster works by actually Illuminating the particles using a coherent laser and generating a light sheet through a specialist optic.

The illuminated flow is captured using a high speed charge-coupled-device (CCD) camera. The speed of the camera shutter 'freezes' the image of the illuminated flow, and from this impression a number of processing algorithms can be applied.

The key to the device's uniqueness is the application of algorithms for removing in and out of field particles and determining the true size from the image. The light sheet illuminates the particles and alters their size in relation to the digital picture. The ability to determine accurately the size of particles from the image and known camera parameters makes this device both viable and effective.

The MillMaster performs several measurement operations. Primarily, counting and sizing the particles in the sample. This size distribution can be arranged in a number of ways to the user. As a default it is arranged into bins of various sizes indicating the approximate size distribution. The system can alternatively arrange the information as a Rosin-Rammler distribution, which is more familiar to engineers operating milling groups and classification processes.

The device itself operates on an iso-kinetic extraction system. For very lean flows it would be possible to illuminate the material in flow, the angling of camera would make the device very unique and not compatible with the vast variety of different pipe networks that occur in industry. If the powder to air mass ratio reduces to around 4:1 the obscuration by the powder in the pipe becomes too great. The iso-kinetic method allows a representative sample to be taken at any point. The MillMaster is designed so that this sample is passed through the system in such a way that no obscuration takes place.

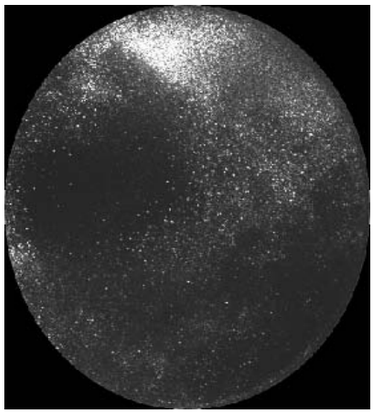
Key Benefits: Mill Operation Improvements

Cost reduction through reduced energy consumption. By monitoring the online particle size for a particular feedstock, it will be possible to set the mill to the minimum settings required to give the desired particle fineness.

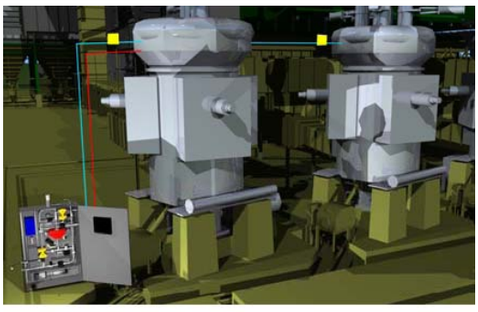
Cost reduction through more complete combustion. Particle fineness is a key factor in combustion. If particle size can be monitored from the mill and settings adjusted based on the data provided, it is entirely feasible that the plant's combustion and efficiency can be improved.

Monitoring mill performance i.e. maintenance issues and catastrophic failures. By monitoring the online behavior of a mill (particularly looking at the relative percentage of coarse particles and fine particles) the performance of the mill can be assessed. With this information, maintenance strategies can be revised with potential failure avoided by early identification.

The MillMaster is totally automated



The MillMaster works by observing the actual particles



Schematic shows how a single Mill-Master can be used to take samples from a single or multiple mills for averaging.

Specification Sensors / Optical Equipment Cabinet Specification

Laser with optics fully enclosed for parallel beam laser Bracket mounted, IP65 / NEMA 4 cabinet sheet including mounting. 1000mm x 750 mm x 300 mm cabinet. High resolution rapid CCD camera. Air cooled, maintaining NEMA 4. Rapid control with trigger for synch with laser. Interlocked to prevent unwanted laser emission. Interrogation cell rated to 13.6 Bar Each cabinet can provide sampling at each outlet of a Pressure sensor driven shut off protects cabinet from mill, one MILLMASTER per mill explosions.

Probe Specification I/O Specification: Rugged interchangeable probe. 4-20mA outputs for particle size in customer specified Probe fits through dustless connector into sampling area ranges. Probe is set at iso-kinetic for mill operation velocity. 4-20mA update every time a new value is obtained. Probe operated by Motor Operated Valve (MOV) Optional Ethernet for full sizing information. Optional MODBUS/TCP. **Returns Specification** Optional touch Screen for onsite viewing. Sampled coal can be ejected to either: Primary Air inlet;

Coal inlet or Reject line. **Sampling specification** Physical samples can be taken using the machine. Can be set up to measure particles as small as 0.5µm Sample between once every minute and once every five minutes. **Service Requirements** Range of particle sizes can be recorded and outputted as 110 VAC, 10A. Alternative supplies can be considered. 6 the customer desires bar clean air for operation. Present data as a Rosin-Rammler or Gaussian distribution. Accuracy of sizing is within 1%