DRILLING MUD ANALYSIS:
PARTICLE SIZE AND MUD LEVEL

I. ABSTRACT

The size and shape of the particles in drilling mud is a critical factor in determining its performance. The particles in the mud serve to stabilize the well during drilling by preventing the loss of fluids through the formation. Ideally the mud particles will form a filter cake that keeps the mud circulation circuit leak free and intact. Maintaining the correct particle size and shape in the mud is then critical to maintaining the stability of the well as drilling descends. As the mud returns to the surface it is screened to separate drill cuttings. Analysis after this separation indicates if the screening process has been efficient and if the ideal particulate content has eroded. A near real time process is needed in order to maintain the process efficiency. Vision technology provides the capability to do the particle size and shape analysis required at line in near real time.

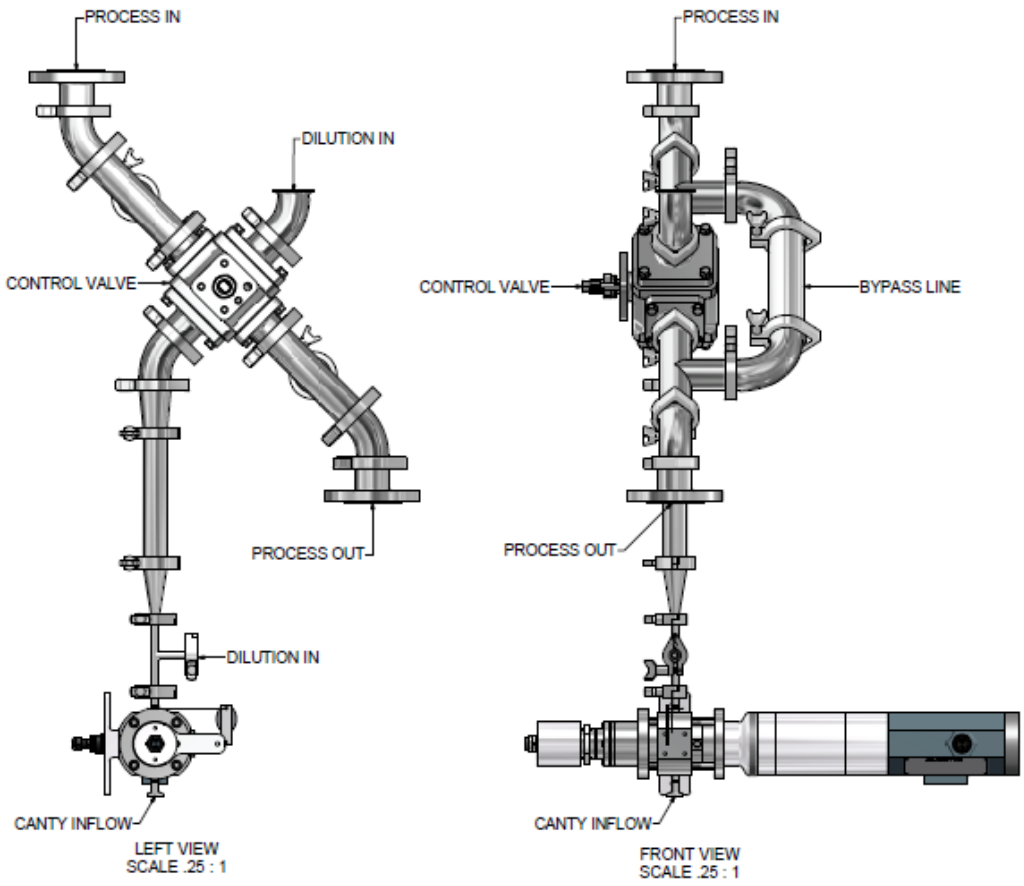


Figure 1. At Line Mud Particle Analyzer

The system plumbs into the mud line and has a bypass loop for the mud when the main line is being sampled. A small amount of mud is then flushed into the reservoir and diluted. Finally the diluted slurry runs through the Inflow instrument for analysis. The sampled mud can be captured

and returned periodically to the main loop. An auto separator is being developed to recoup the diluent for continual re-use.

II Requirements

The industry needs a reliable instrument to determine particle size and shape in near real time in order to continually monitor particle content of the drilling mud. Current methods are lab based, time consuming and subjective. Analysis occurs a couple times per day whereas it could occur on a continual basis to provide trending information

III. Application

A. The Canty Mud Analyzer has met the industry need by providing :

1. A method and instrument to analyze particle size, shape and color for proppant and LCM's.
2. An instrument that can plug in line and take representative samples for analysis.
3. An automated dilution system to control the sample particle density as it flows through the measurement zone yielding accurate and consistent data.

B. Typical Results:

The following graphs, tables and images will show how the Canty Mud Analyzer sees into the process and extracts the particle data. The first graph shows test runs through the analyzer for repeatability. Each sample is run three times.

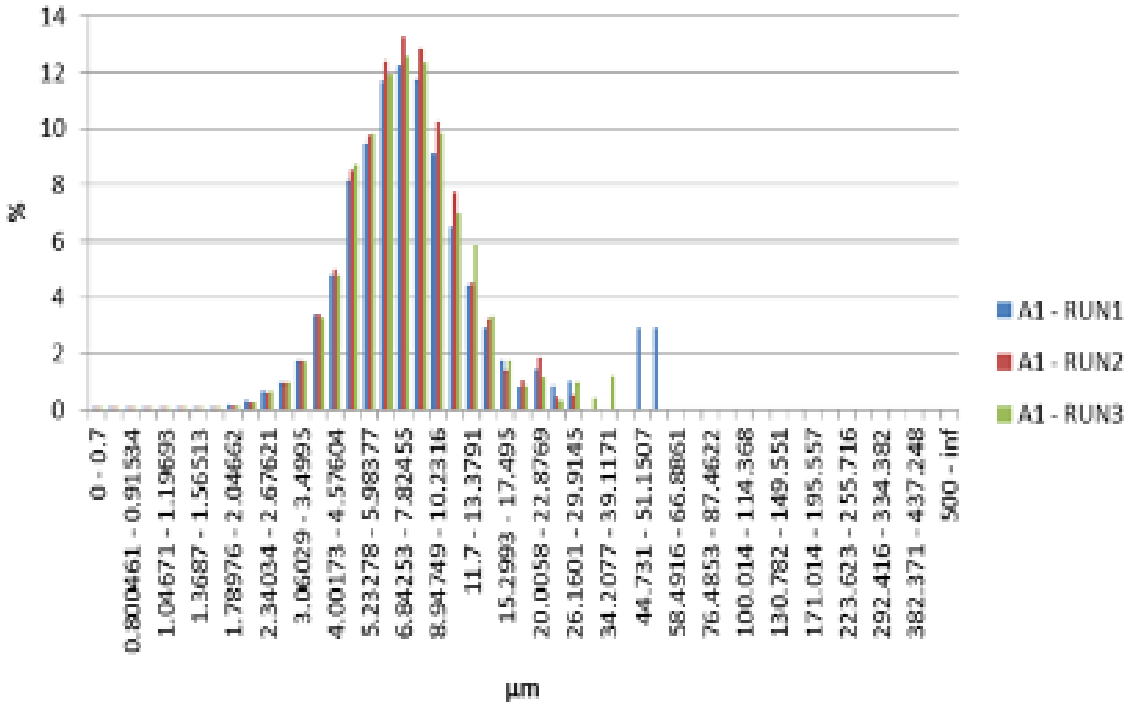
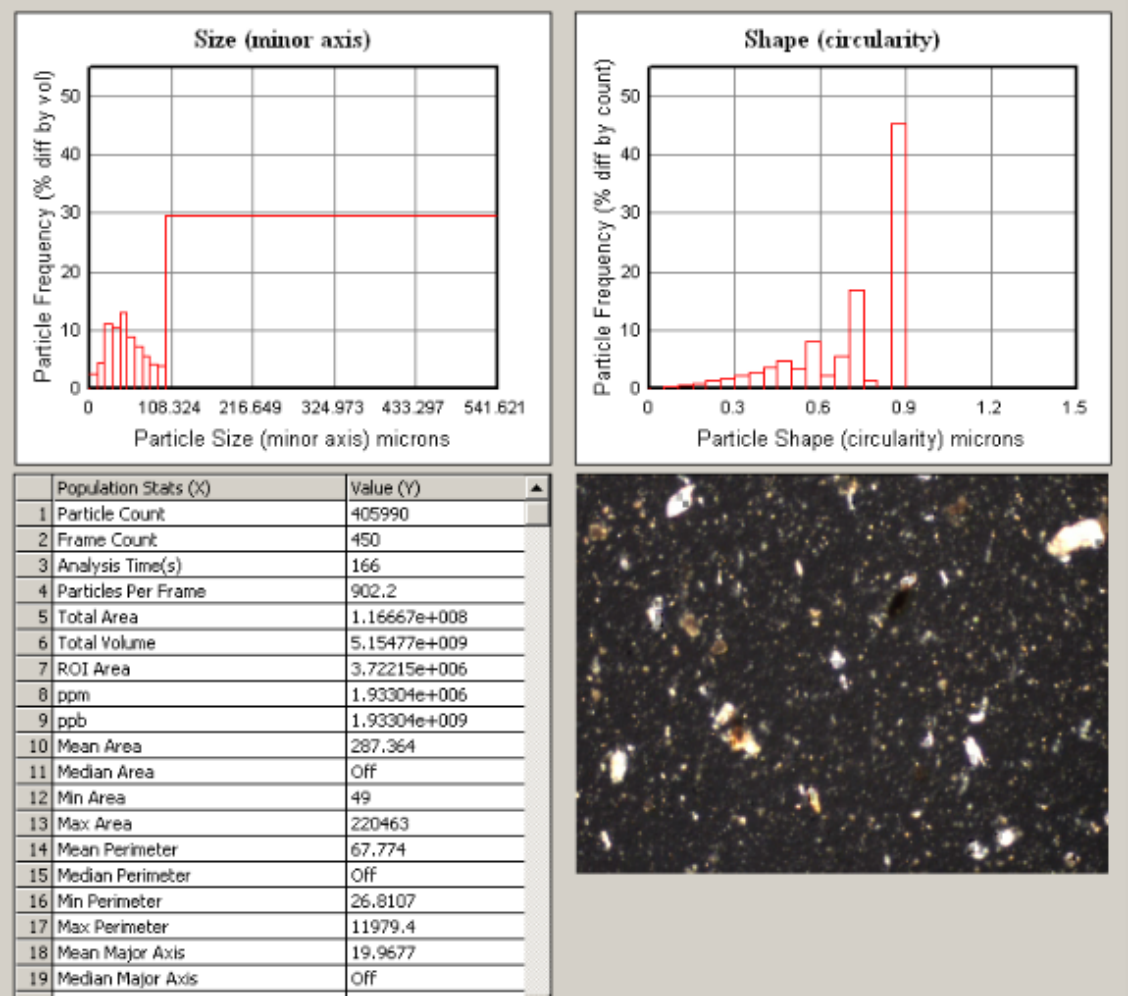


Figure 1. Small Particle Mud Analysis



	Population Stats (X)	Value (Y)
1	Particle Count	405990
2	Frame Count	450
3	Analysis Time(s)	166
4	Particles Per Frame	902.2
5	Total Area	1.16667e+008
6	Total Volume	5.15477e+009
7	ROI Area	3.72215e+006
8	ppm	1.93304e+006
9	ppb	1.93304e+009
10	Mean Area	287.364
11	Median Area	Off
12	Min Area	49
13	Max Area	220463
14	Mean Perimeter	67.774
15	Median Perimeter	Off
16	Min Perimeter	26.8107
17	Max Perimeter	11979.4
18	Mean Major Axis	19.9677
19	Median Major Axis	Off

Figure 2. Typical Graphical Interface – Particle Size, Shape, Summary Data and Image

Figure 2, when viewed in color, shows color differences that can be detected by the analyzer and attributed to the particular mineral whose characteristic is shown. In the particular screen show shown the software details the particle size distribution as well as the particle shape distribution by circularity.

C. Benefits

1. System includes Canty spray ring technology for cleaning of the camera and light lenses should they require it. Fused glass-to-metal lenses are rugged and durable and ideally suited for harsh environments.
2. Initial cost and maintenance free operation make this sensor the most economical available for this work. Components generally last 5 years or more.
3. Viewing into the process is invaluable for data confirmation, trouble shooting and continual process improvement.
4. Near real time analysis allows frequent monitoring of the mud condition.
5. Visual technology enables the use of filters to categorize particles by shape and color in addition to size.

IV. Installation:

A. Installation points – the system plumbs directly into the mud process line, normally after the screen so an analysis of the mud to be returned to the well can be made. The instrument can also be installed prior to the screen to see what is coming up from the well, or can be installed in both locations for maximum data.

B. Equipment – the sampler flanges into the process line and is essentially a 2 way, 4 port valve. Process flows through until valve is closed. Mud is captured in the ball of the valve and is flushed into the reservoir for dilution. The diluted mud then flows through the Canty InFLow which sits at the outlet of the reservoir.

[ADD WIRING SCHEMATIC]