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INTRODUCTION TO SAMPLING FOR MINERAL PROCESSING

Part 4 in a series “Metallurgical Samplers”

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Objectives of Metallurgical Samplers

- **Metallurgical Samplers**
  - Used for metallurgical reconciliation
  - Requires samples that represent actual metal grades
  - Should be probabilistic
  - Composite samples for laboratory analysis
  - Can be used for process control

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Metallurgical Reconciliation

- Mine to Mill Reconciliation – comparing the mine reports to the tonnes, grade and metal processed by the mill
- Mill to Sales Reconciliation – which matches the mill metal production reports to the sales results in a specific period of time.
- Metallurgical Balance: Metal grade in Plant Feed = Final Concentrate + Final Tailings.
- Permits defining a budget for what the company will produce = funds to be received

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Sampling - Golden Rule

- The “golden rule” states that for correct sampling “all parts of the material being sampled must have an equal probability of being collected and becoming part of the final sample for analysis” (Gy)

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Sampling System

- For a representative sample:
  - The total stream should be sampled
  - The sample cutter should intersect the sample at right angles to the flow
  - The sample cutter should travel through the stream at a linear and constant speed (speed deviations < max +/- 5%).
- Composed of the sampling implement and the sampling protocol
- Sampling systems must be flexible enough to permit adjusting the number of increments collected for each sampling lot

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Precision

- The magnitude in terms of random variations between replicate measurements (Ex.: +/- 1 kg)
- The degree to which repeated measurements under unchanged conditions show the same results
- Error or variance between two or more measurements
- In sampling, precision is based largely on the heterogeneity of the ore coupled with the number of increments collected

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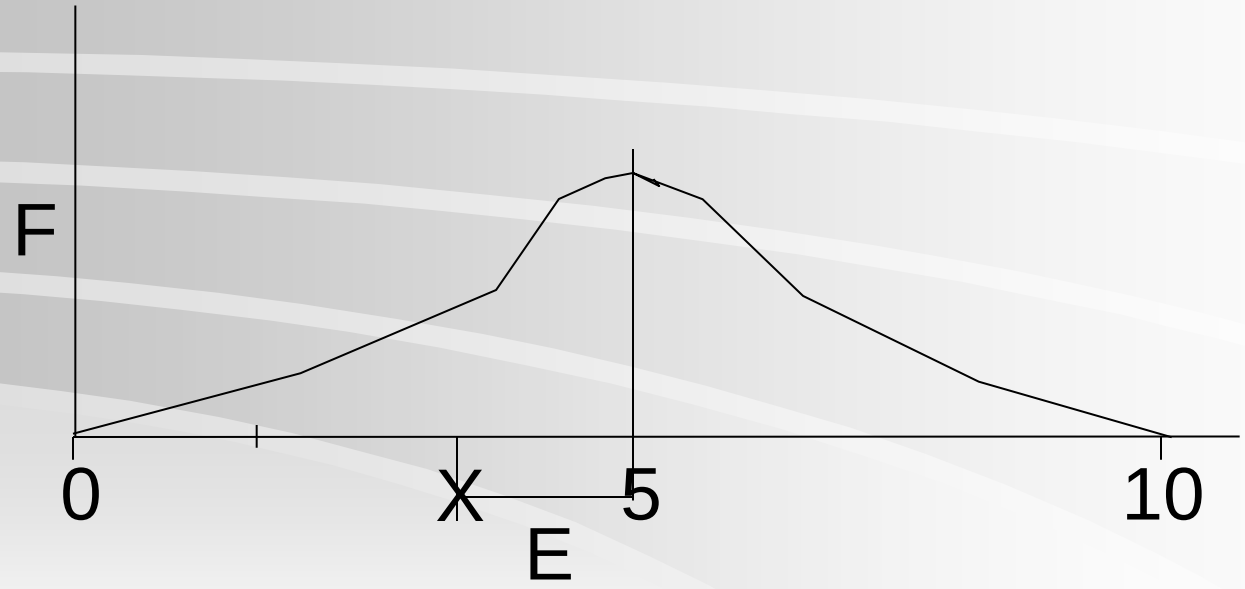
Precision



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Central Limit Theorem

- Definition for sampling:
  - The variance of the mean of n increments is n times smaller than the variance of a single increment
- $\sigma^2_m = \sigma^2_i / n$
  - σ^2_m = variance of mean
  - σ^2_i = variance between increments
  - n = number increments

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Central Limit Theorem

- Number of primary increments is the most important parameter in a sampling regime
- Variance in results tend to cancel each other out and the results tend to cluster around a central value
- The more increments that are taken the more precise the result
- There is an interleaving sampling test which can be performed to determine sampling variance

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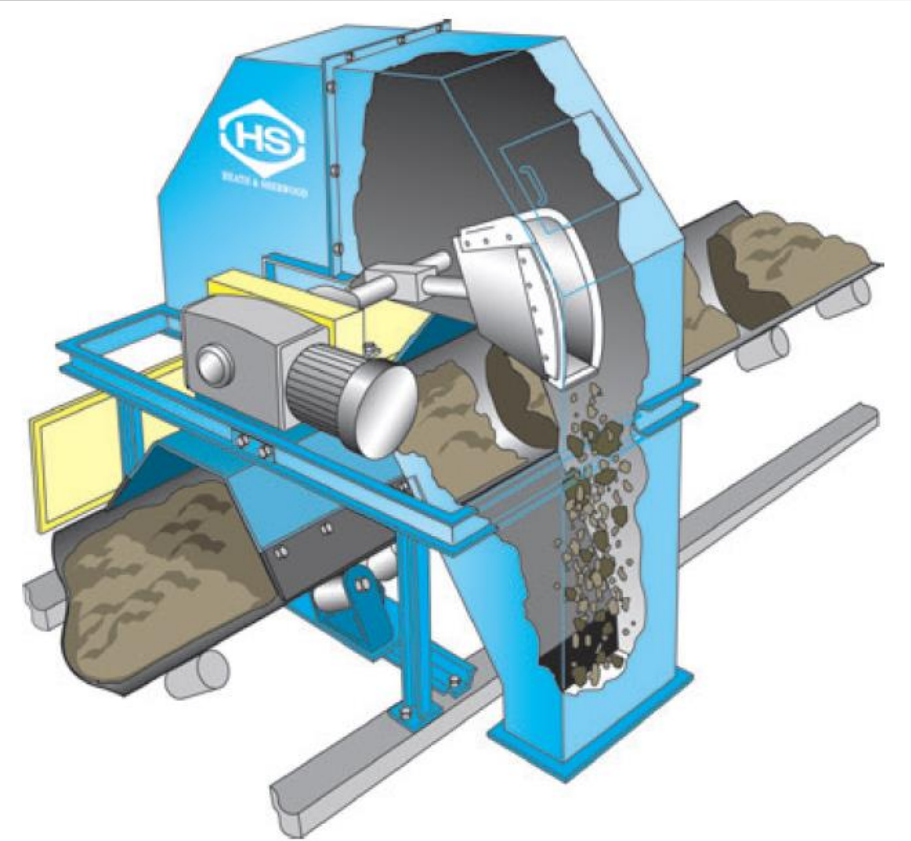
Cross Stream Sweep Sampler



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ARM48 Sampler

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Proper Cutter Orientation

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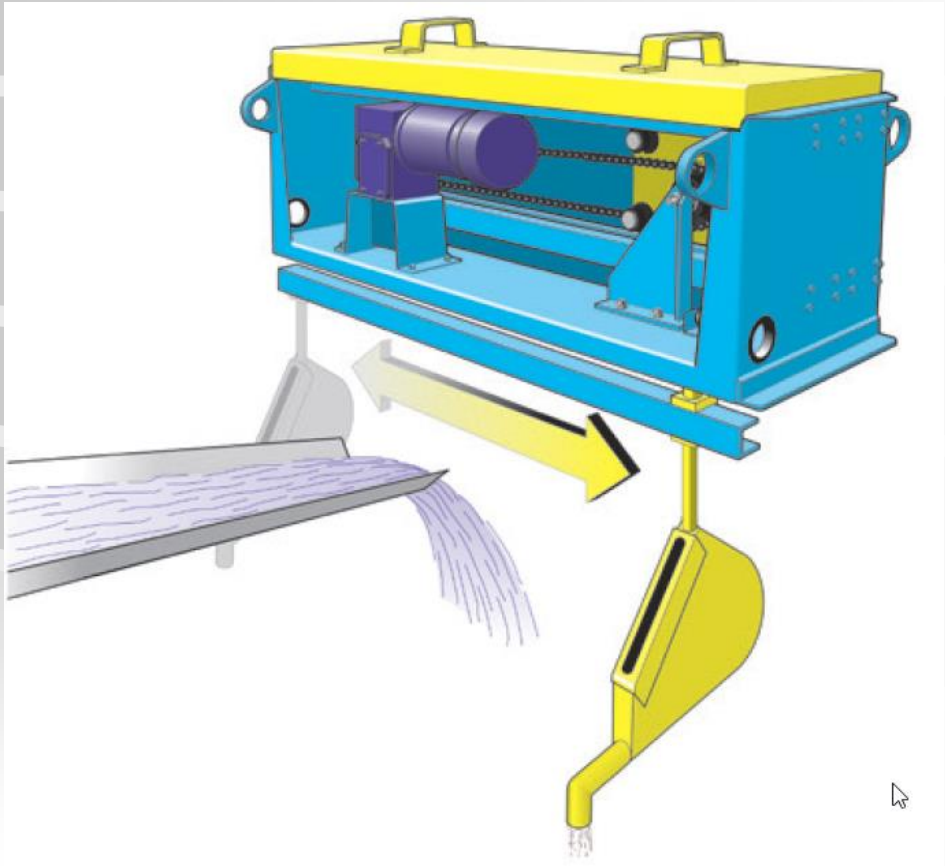
Cross Stream Sweep Sampler



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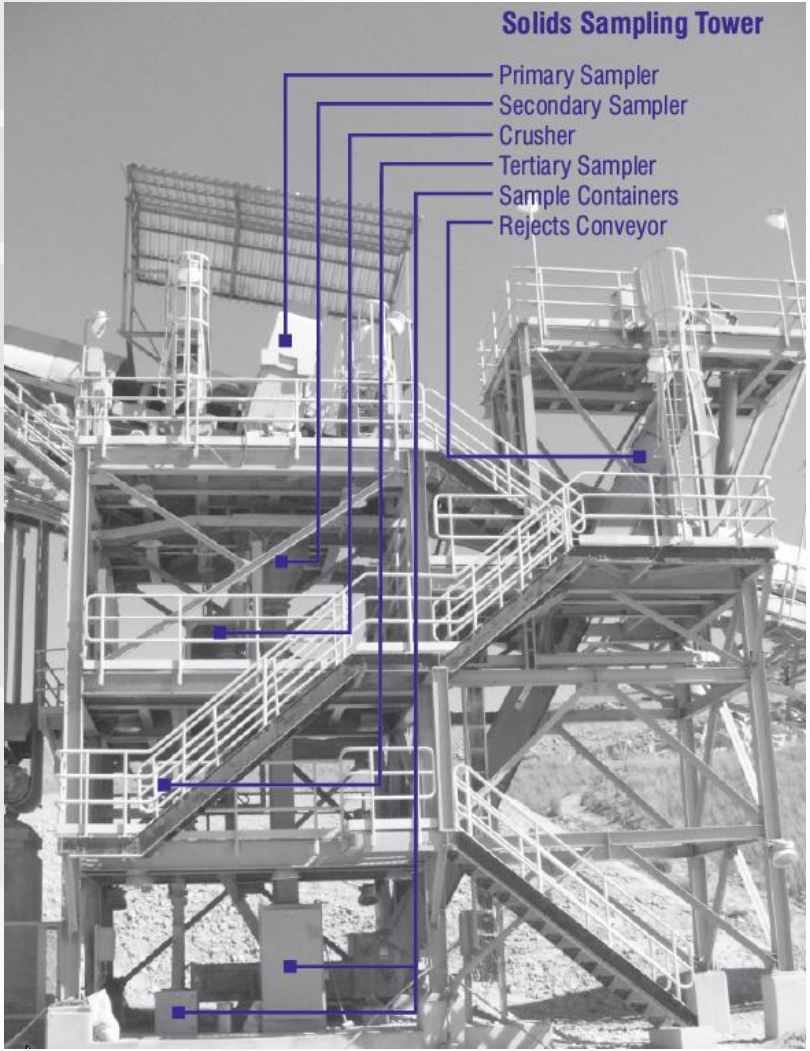
Multi-Stage Sampling Tower



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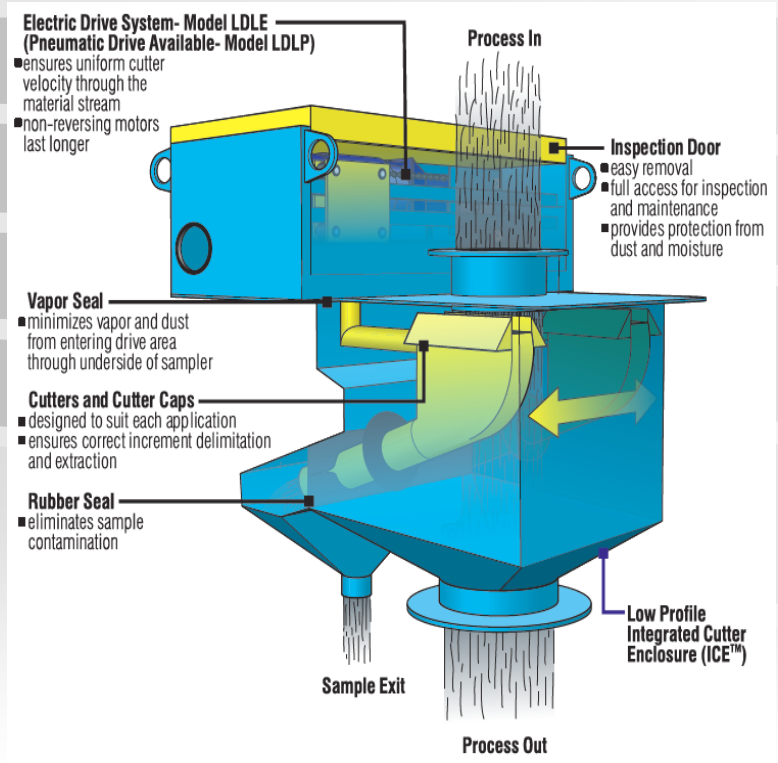
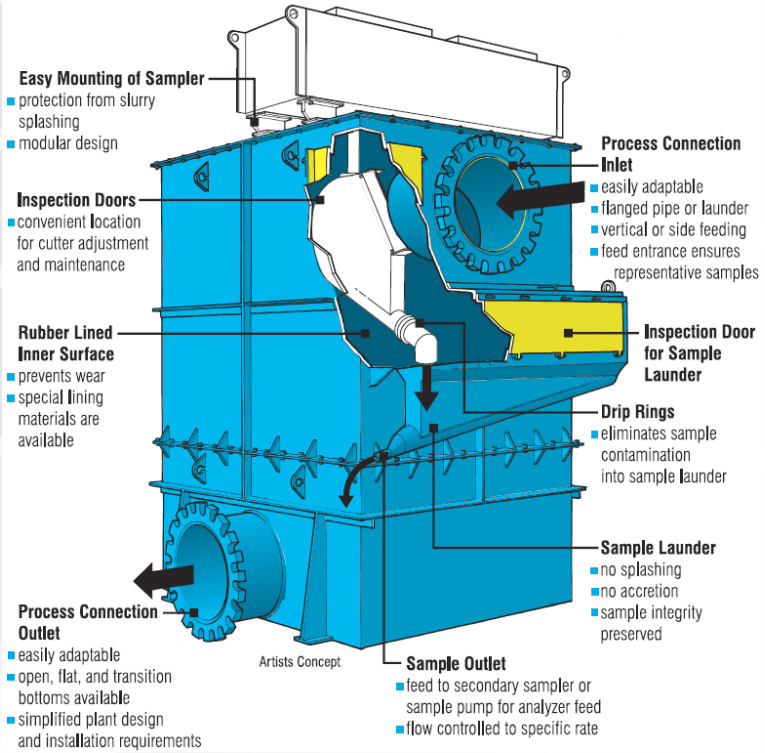
Cross Stream Sampler - Slurry





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Turnkey Flotation Feed Sampling System

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Rubber Lined Enclosure

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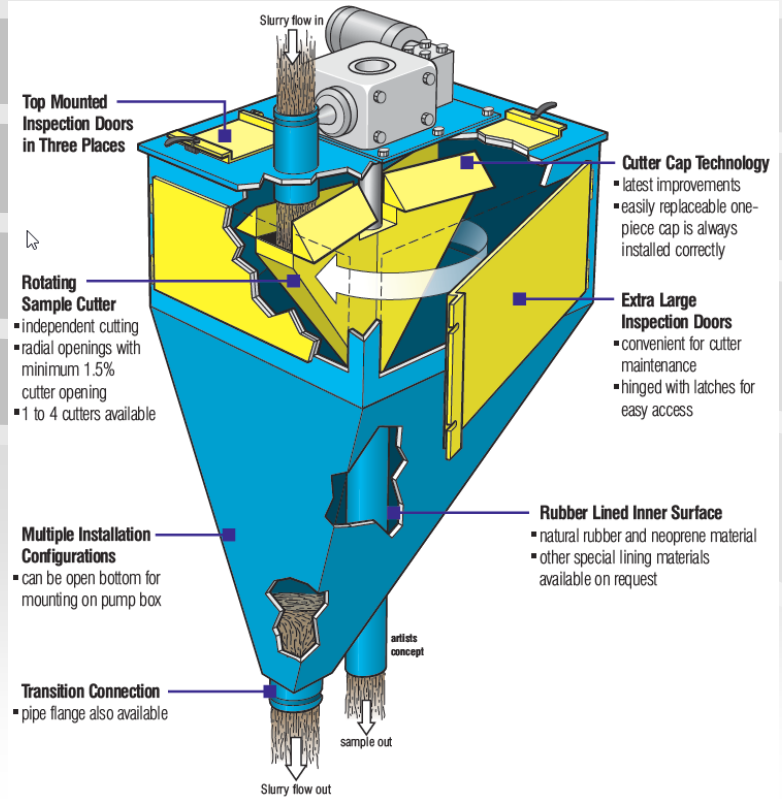
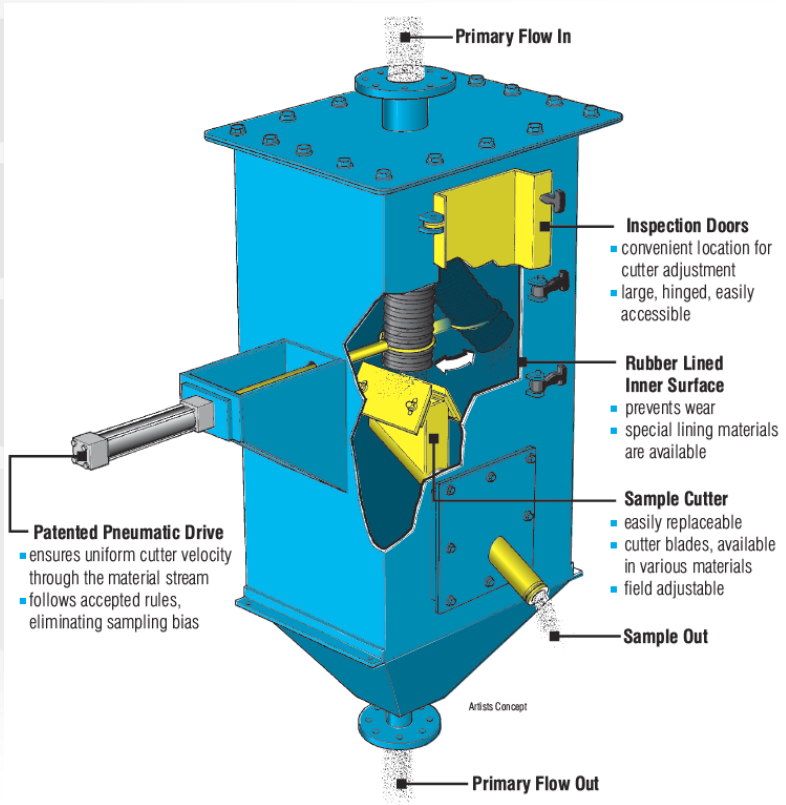
Cross Stream Sampler - Slurry





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MILL DISCHARGE SAMPLER
PRIMARY - MODEL 1330 w/ ICE® SECONDARY - MODEL 4810 VEZIN
TERTIARY-MODEL 4510 VEZIN

MODEL
4810

MODEL
4510

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Moving Inlet Sampler

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Moving Inlet Sampler

Model 1850 with
Swirl Tank

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Light Duty, Low Profile

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Sampling Station

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Tails Sampler

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