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INTRODUCTION TO SAMPLING FOR MINERAL PROCESSING

Part 2 in a series "Sampling Basics"

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Sampling

- Is used for resource definition, optimising resource utilisation, process control, metallurgical accounting and ultimately maximising profitability. Sampling is where the measurement process begins (Holmes)
- The whole measurement chain is corrupted at the outset if the sample is not representative, and accurate analysis of the samples submitted to the lab can be largely a waste of time and lead to sub-optimal recovery in processing plants and loss of sales revenue (Holmes)
- This last statement also applies to On Stream Analyzers

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Definitions - Sampling

- Sampling is based on applied statistics and probability theory
- The process of collecting a set of primary increments for a sampling unit in such a manner that measurements on the test or analysis sample are significant for the sampling unit (J. W. Merks)

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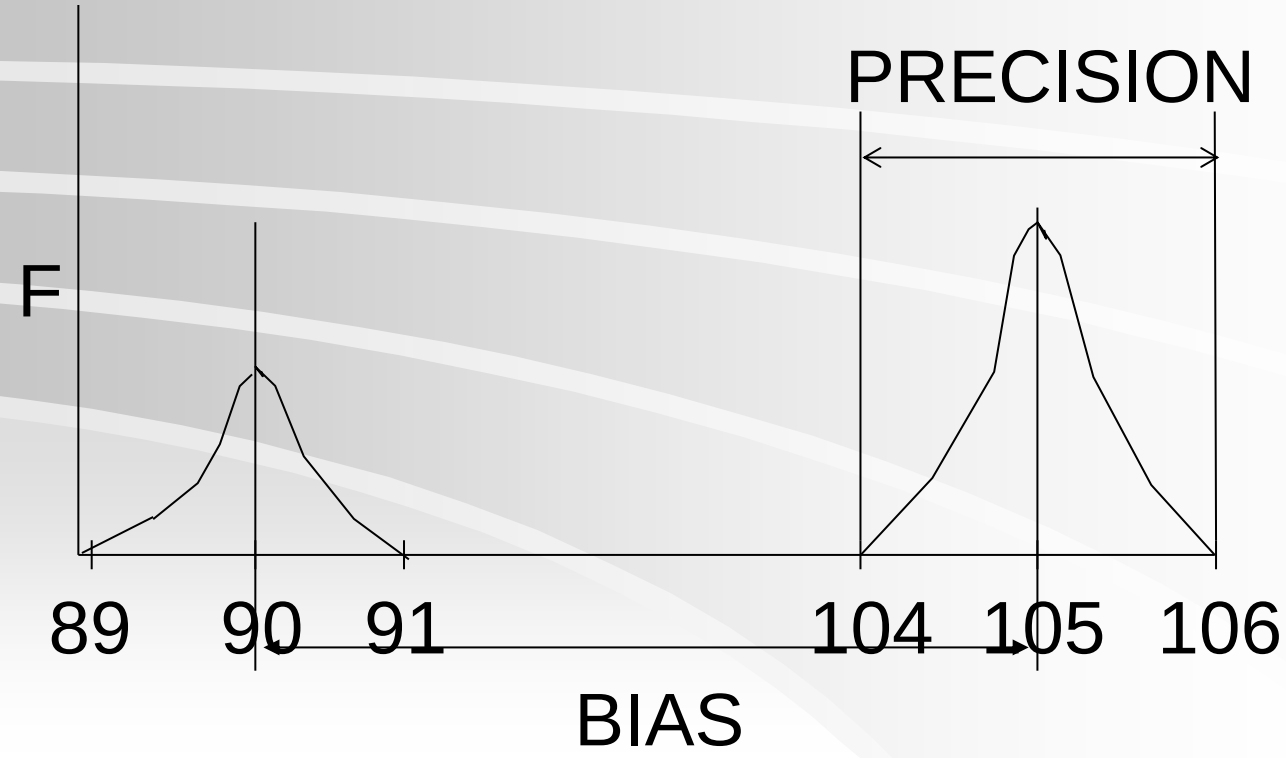
Sampling - Golden Rule

- 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)
- If this is respected at the outset, then extraction of representative samples is largely assured. (Holmes)
- If this is not respected then sample bias is easily introduced (Holmes)
- no amount of replicate sampling and analysis will reduce bias once it is present (Holmes).

Definitions – Precision vs Accuracy



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Definitions - Sample

- A quantity of material taken from an ore and which represents the quality characteristics of the ore from which it was taken from for a specific sampling lot

- Examples of Sampling lot
  - 12 hour shift
  - 20,000 mt lot
  - Stockpile

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Definitions - Increment

- A quantity of material collected by a single operation of a sampling implement
- A sample is made up of 1 or more increments

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Sampling System

- Composed of the sampling implement and the sampling protocol
- Must collect samples representative of a sampling lot or unit.
- Sampling systems must be flexible enough to permit adjusting the number of increments collected for each sampling lot

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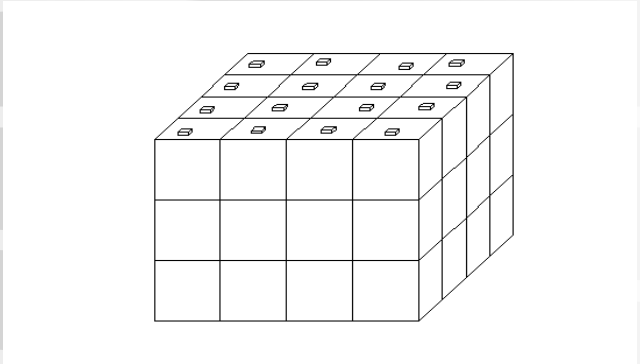
3D Sampling



- These are ore deposits, stockpiles, slurry in tanks or any container that does not permit equal access to all particles
- Surface sampling, (core samples)
- Prone to BIAS for non-homogeneous ores
- Transform into 2D or 1D sampling situation

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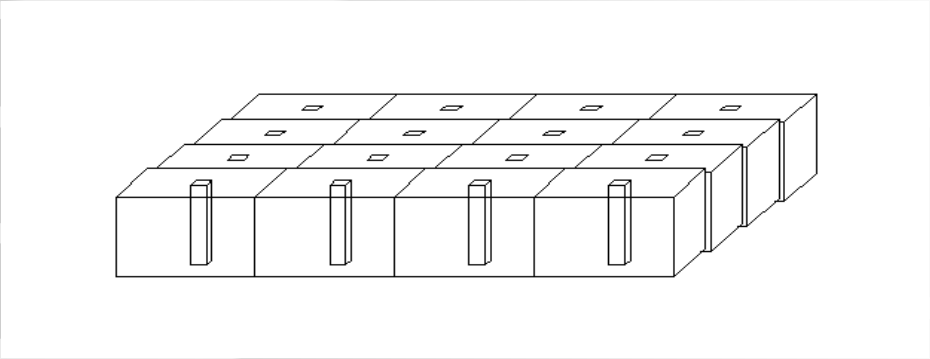
2D Sampling



- These are railcars, trucks, ships' hold, bulk storage
- Divide the surface into a grid and sample to the bottom of each unit using a probe
- Not practical for ores with particles over ½ inch
- Large amount of sample, poor precision
- Transform into 1D sampling situation

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2D Sampling - Example

Concentrate
Railcar Sampler

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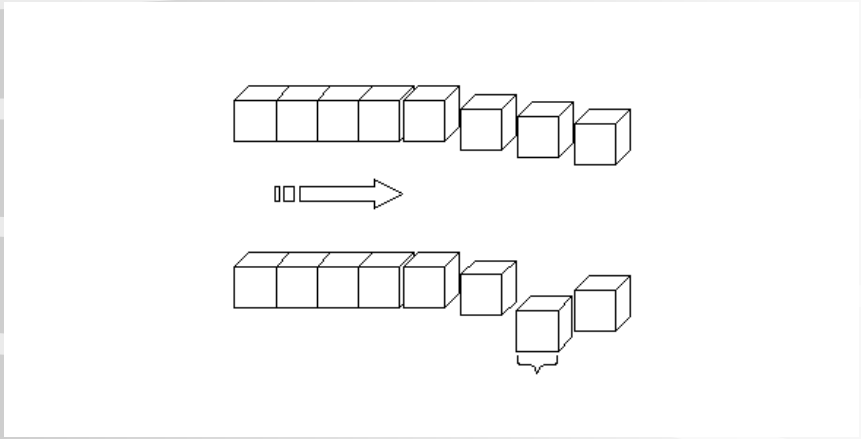
1D Sampling



- This is the easiest and optimally the best. Locations are at the discharge points of conveyor belts or head chutes, and at the exit point of a slurry pipe or transfer points
- Sample increment - Remove entire strata of material, cuts across entire stream using a cross-stream cutter
- Access to each particle permitted

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1D Sampling - Example

MILL TAILS SAMPLING

PRIMARY - MODEL 1330 w/ ICE®
SECONDARY - MODEL 4500 VEZIN SAMPLING THREE 12” LINES)

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Increment Delimitation

- Samplers should cut a “slice” of material of constant thickness. Proportionate amount collected from each part of the stream
- The “slice” should cross the complete stream at a constant speed, Electric drives are optimum for this purpose.
- The cutter should intersect the stream perpendicular to the trajectory of the stream.
- Every particle must have the same probability of being collected

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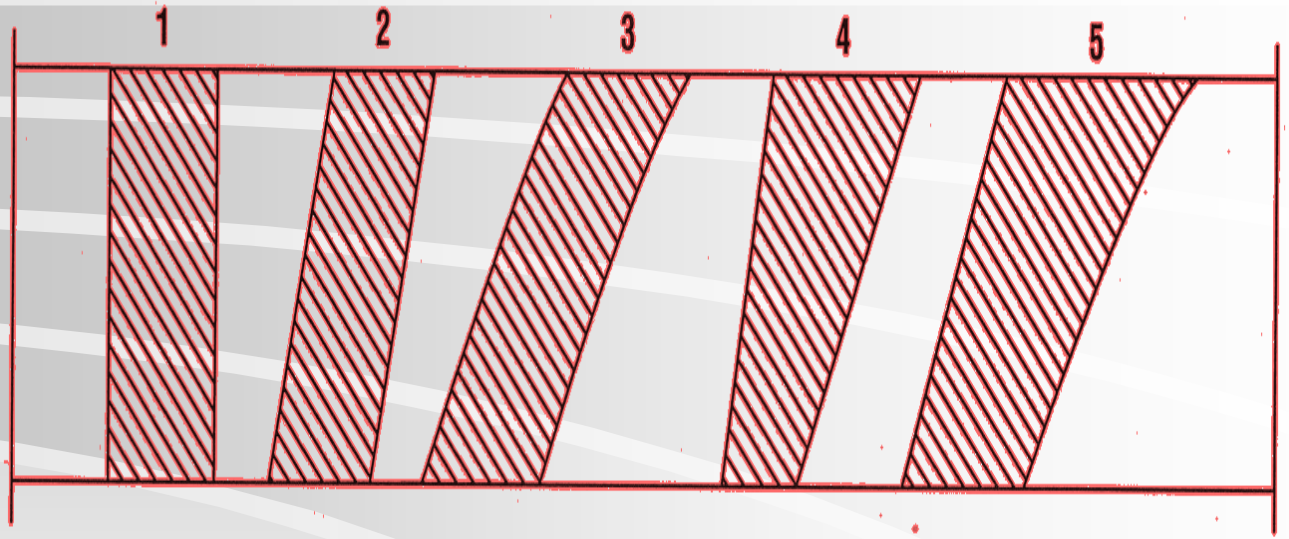
Increment Delimitation



1, 2, 3 CORRECT

4, 5 INCORRECT

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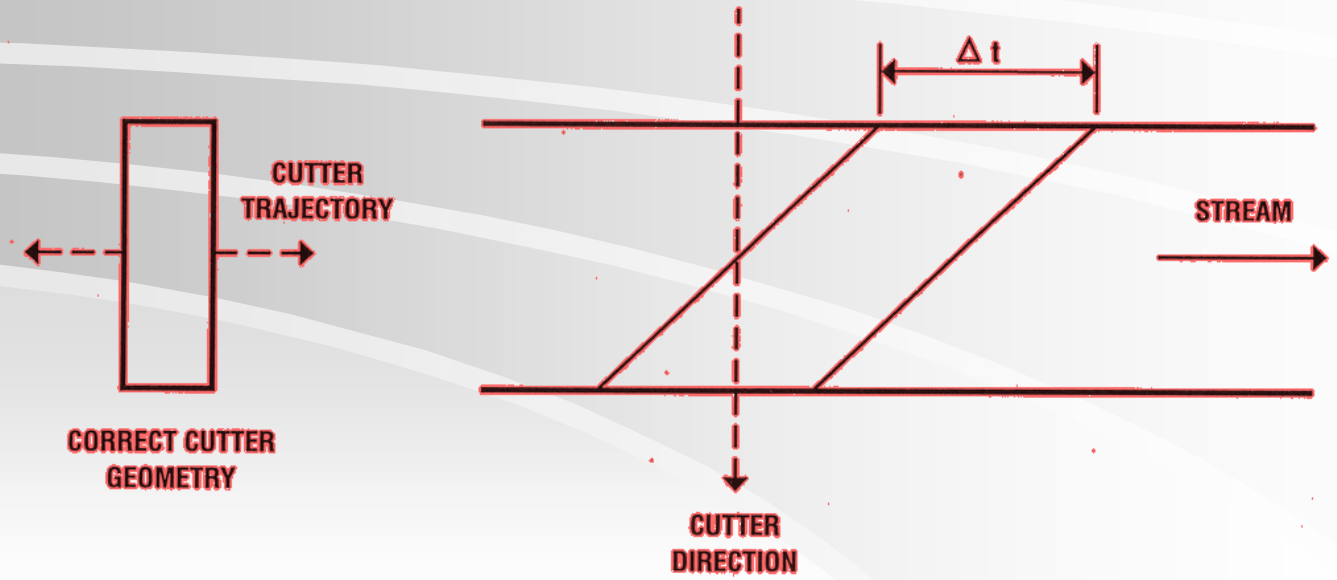
Correct Increment Delimitation

- Cross Stream Cutter well designed and clean



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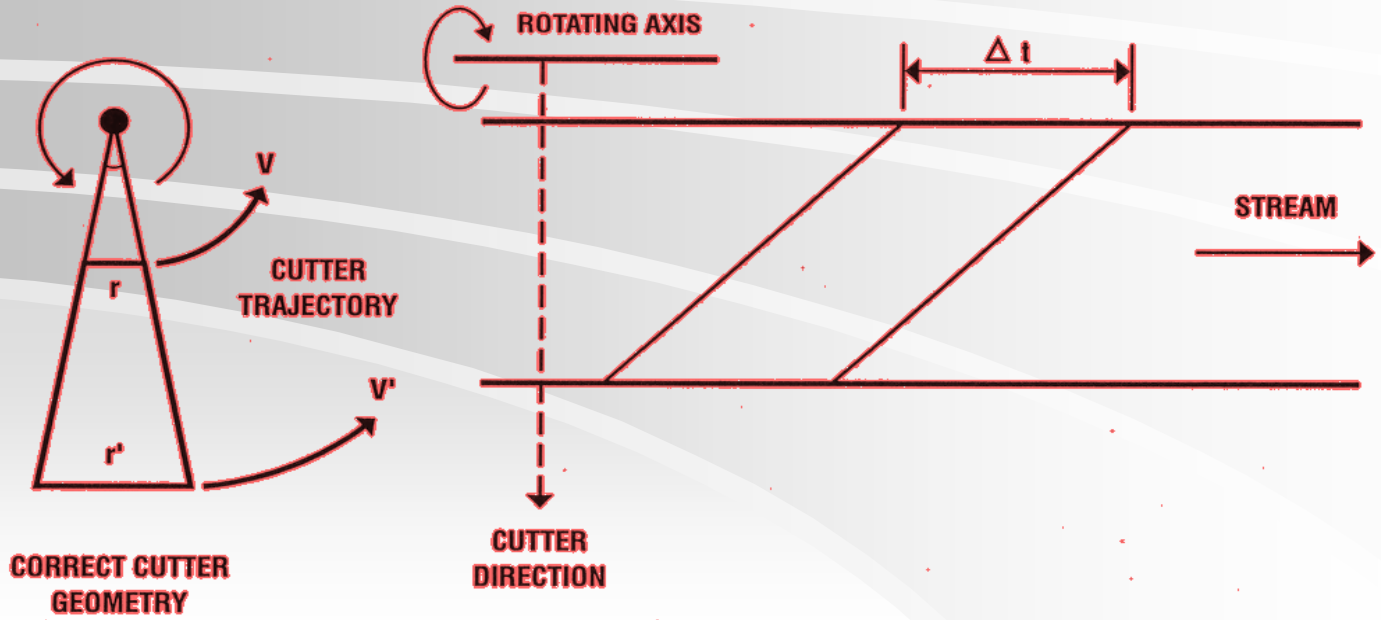
Correct Increment Delimitation

- Circular Path Cross Stream Cutter



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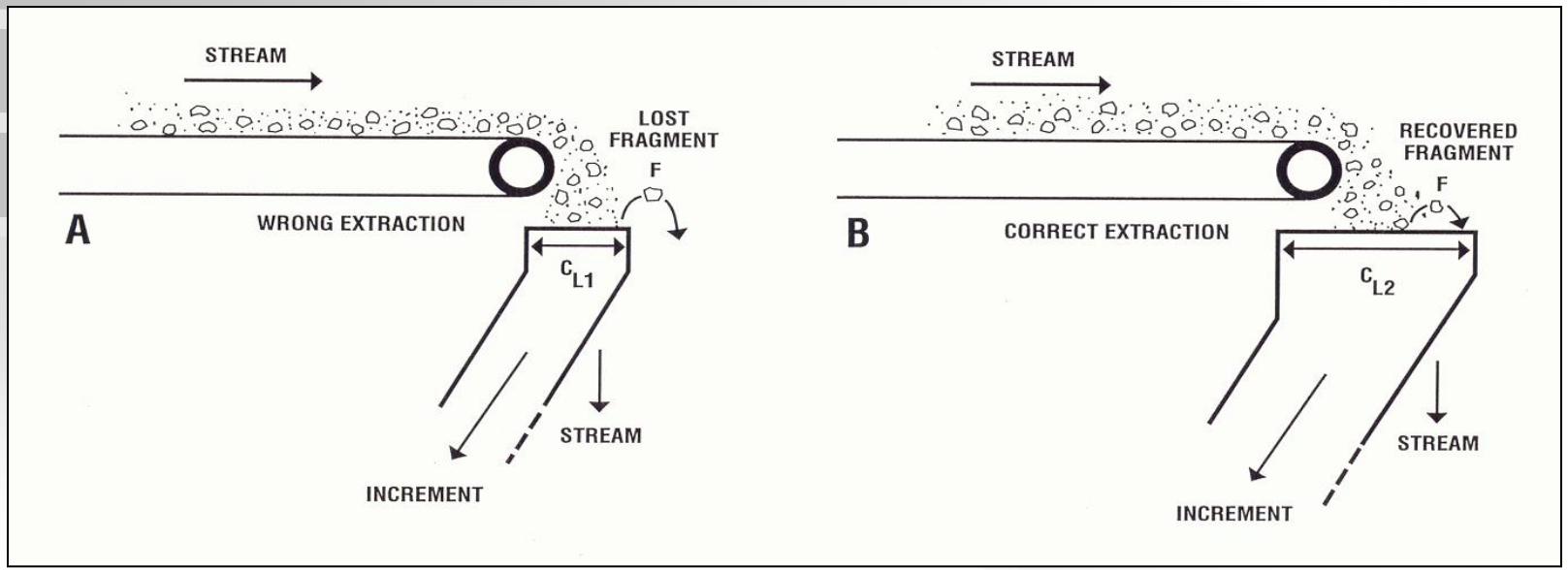
Increment Extraction

- Cutter aligned to the trajectory
- Cutter blades should be perpendicular to stream trajectory



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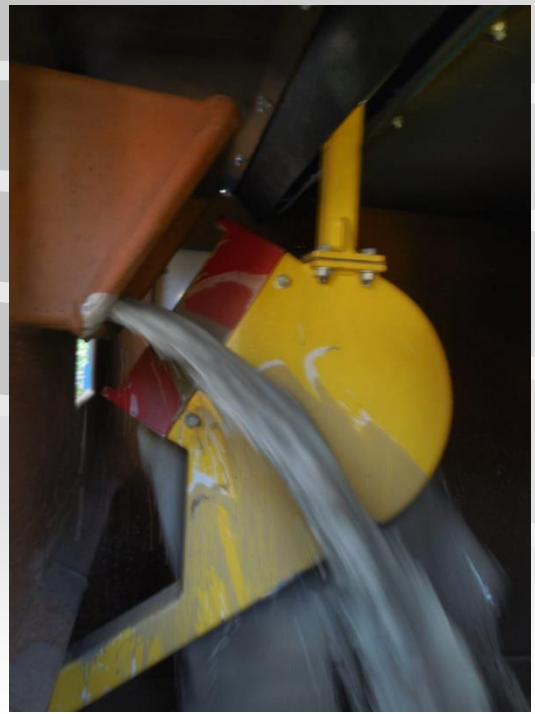
Correct Increment Delimitation



Increment Extraction

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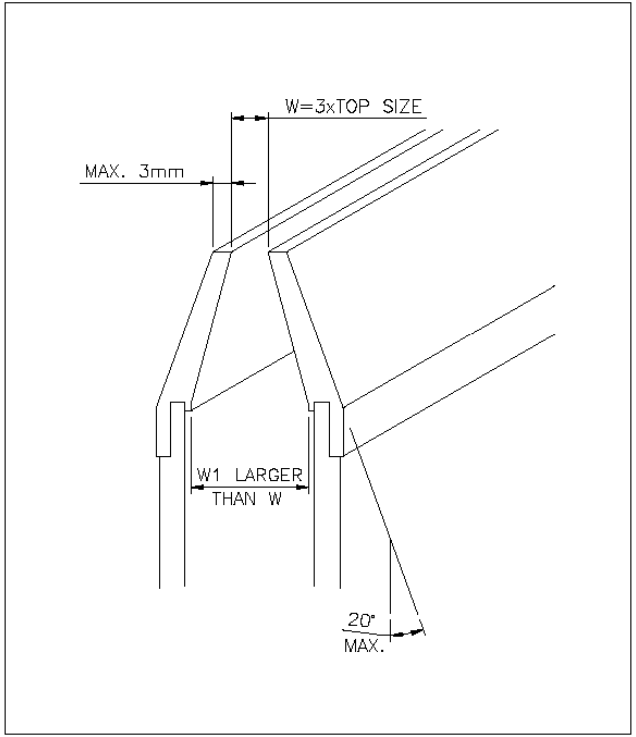
Cutter Edge Geometry

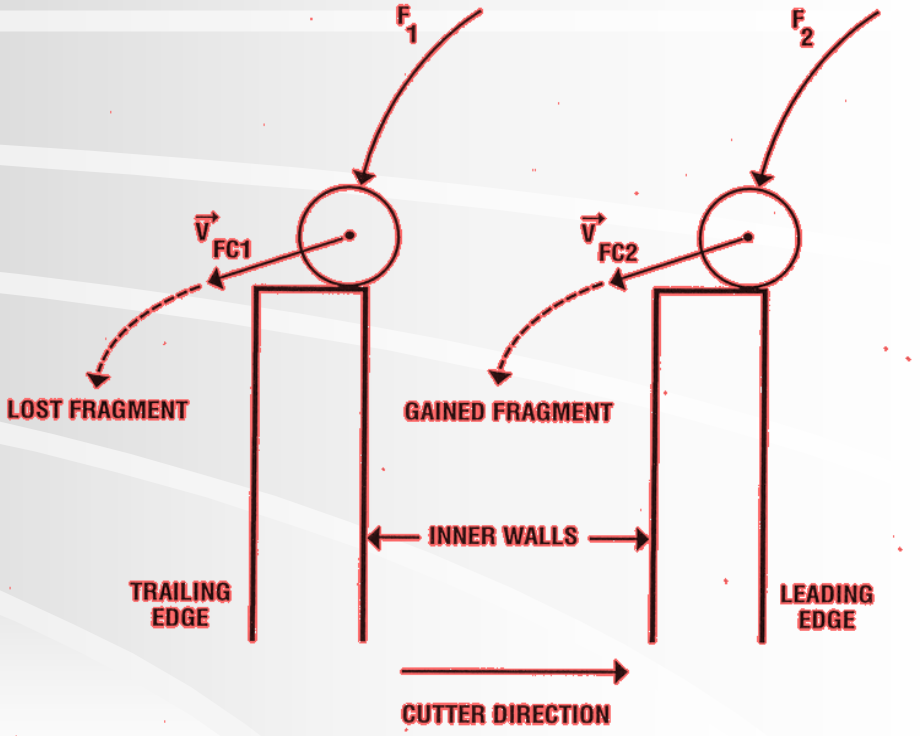
- Cutter edges should be perpendicular to the stream
- Rebounding fragments that belong to the increment must pass inside the cutter
- Cutter opening (t) = minimum 3X top size
  -top size defined as screen size passing 95%



Increment Extraction

The Rebounding Rule

- Cutter edges and speed may alter the extraction probability of some fragments
- Max. cutter speed for linear cutters 0.6 m/s



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For more information you can always contact us at:
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