



# **INTRODUCTION TO SAMPLING FOR MINERAL PROCESSING**

**Part 3 in a series  
“Sampling Errors”**



HEATH & SHERWOOD

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  - Recovery - Error propagation
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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)
- Therefore 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%).
- If these rules are not adhered to, a sample bias is easily introduced

# Bias

- A statistically significant difference between a single measurement, or the mean of a series of measurements, and its value in a Certified Reference Material, its value measured in accordance with a recognized reference procedure, or its value measured against a Certified Weight
- Systematic Error
- Sampler supplier role is to minimize sampling errors that cause bias

# Causes of Bias

Increment delimitation and extraction errors that cause significant bias may be caused by, for example:

- Incorrect cutter geometry
- Cutter speed too high
- Cutter speed not constant
- Insufficient cutter capacity
- Incorrect sampler installation
- Others

# Incorrect Increment Delimitation

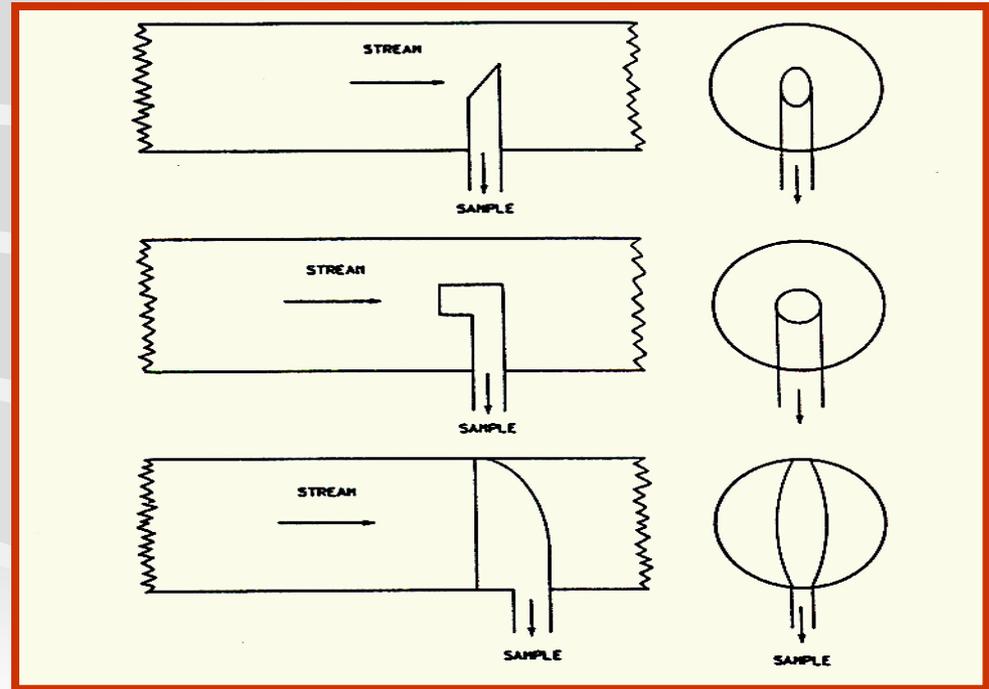
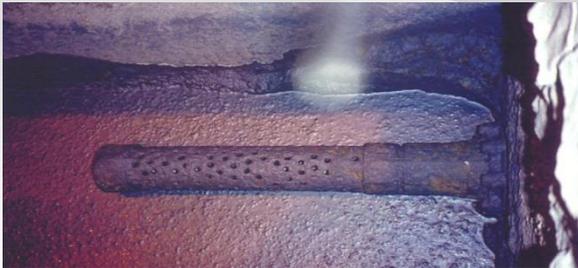
- Taking part of the stream all of the time
  - fixed cutter or probe in a slurry stream
  - sample bias due to segregation



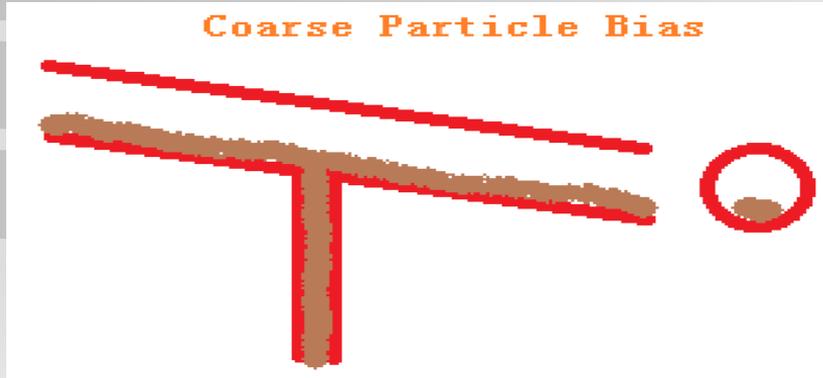
- Correct increment delimitation only possible with completely homogenous conditions
  - liquids with no suspended solids

# Incorrect Increment Delimitation

- Taking part of the stream all of the time
  - fixed cutter or probe in a slurry stream
  - usually suitable for analyzer feed only

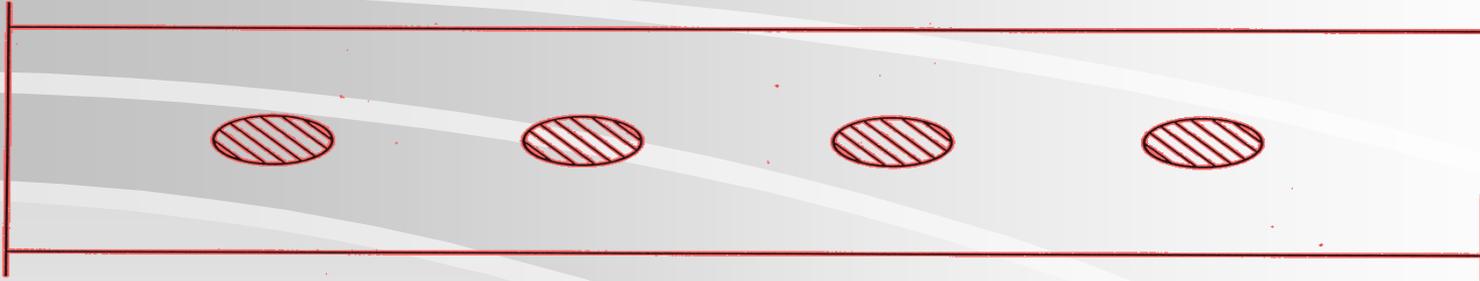


# How Not to Sample



# Incorrect Increment Delimitation

- Taking part of the stream part of the time
  - grab sampling ie. shovel on a conveyor, cup in a slurry discharge



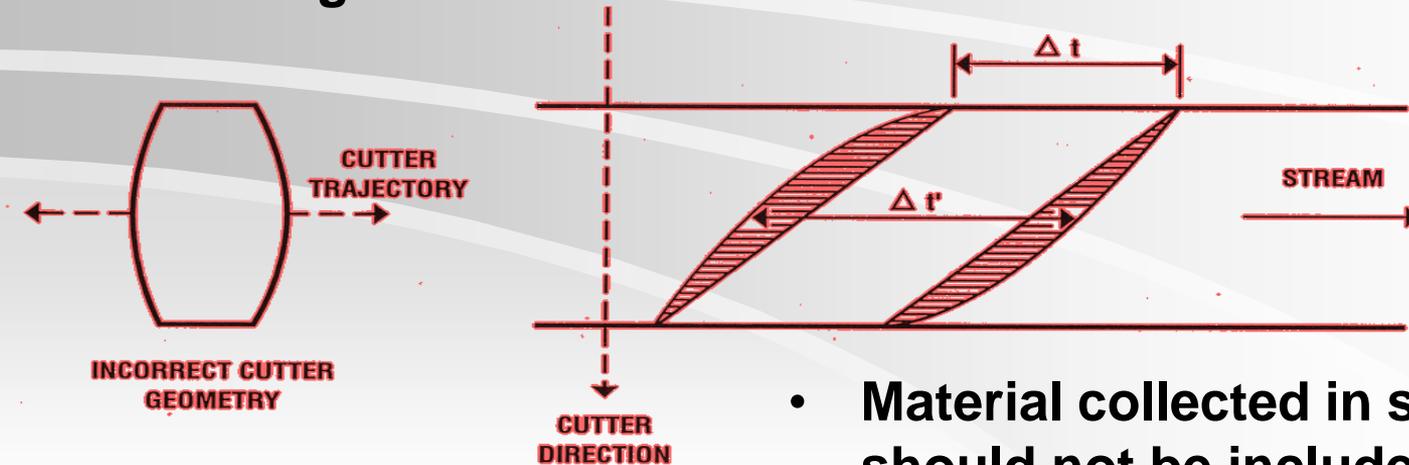
- Correct increment delimitation only possible with completely homogenous conditions
  - liquids with no suspended solids

# How Not to Sample a Belt



# Incorrect Increment Delimitation

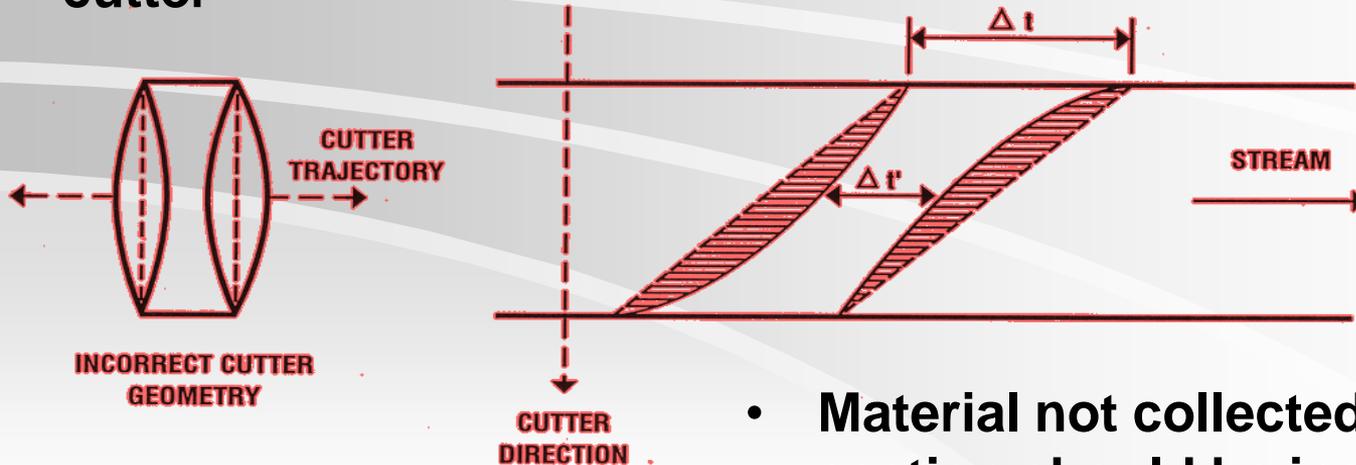
- Cross Stream Cutter
  - poor design and/or manufacturing
  - cutter edges worn, damaged, or solids accretion near outer edges



- Material collected in shaded section should not be included

# Incorrect Increment Delimitation

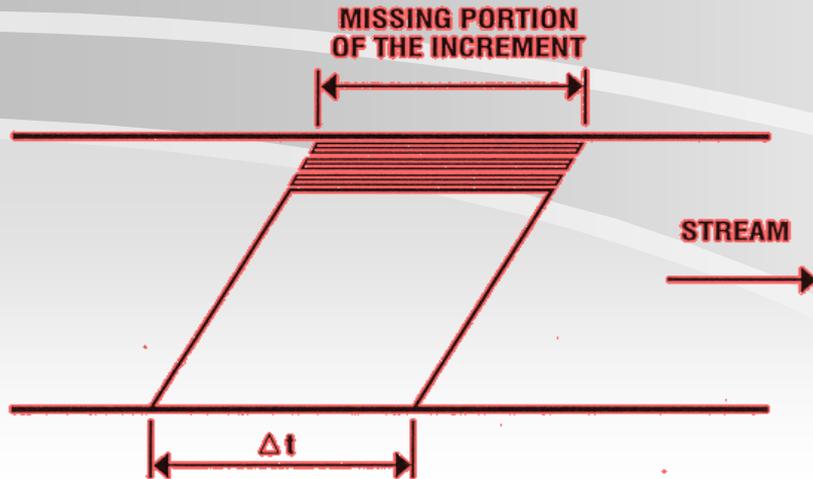
- Cross Stream Cutter
  - poor design and/or manufacturing
  - cutter edges damaged, or solids build-up near center of cutter



- Material not collected in shaded section should be included

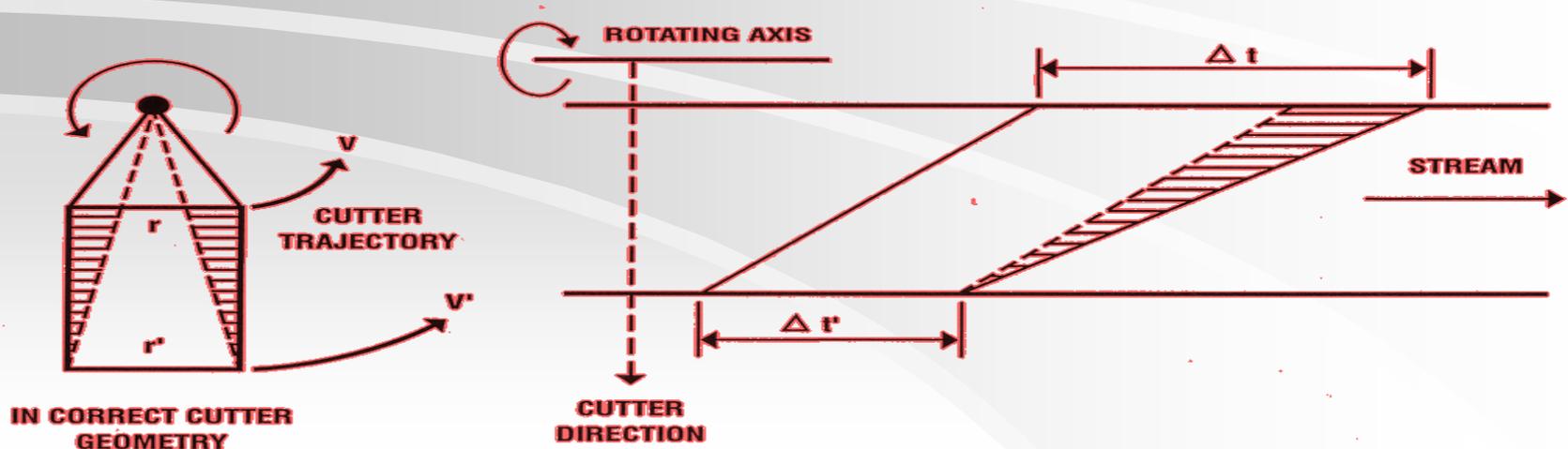
# Incorrect Increment Delimitation

- **Cross Stream Cutter**
  - poor cutter alignment during installation
  - cutter too short
  - trajectory may have changed ie. Process fluctuation



# Incorrect Increment Delimitation

- Circular Path Cross Stream Cutter (Veizin)
  - use of non-radial (or parallel) cutter edges
  - maintenance department often replaces blades assuming they should be same as the “other” sampler (which happens to be a linear cross stream sampler!!!)



# Contamination

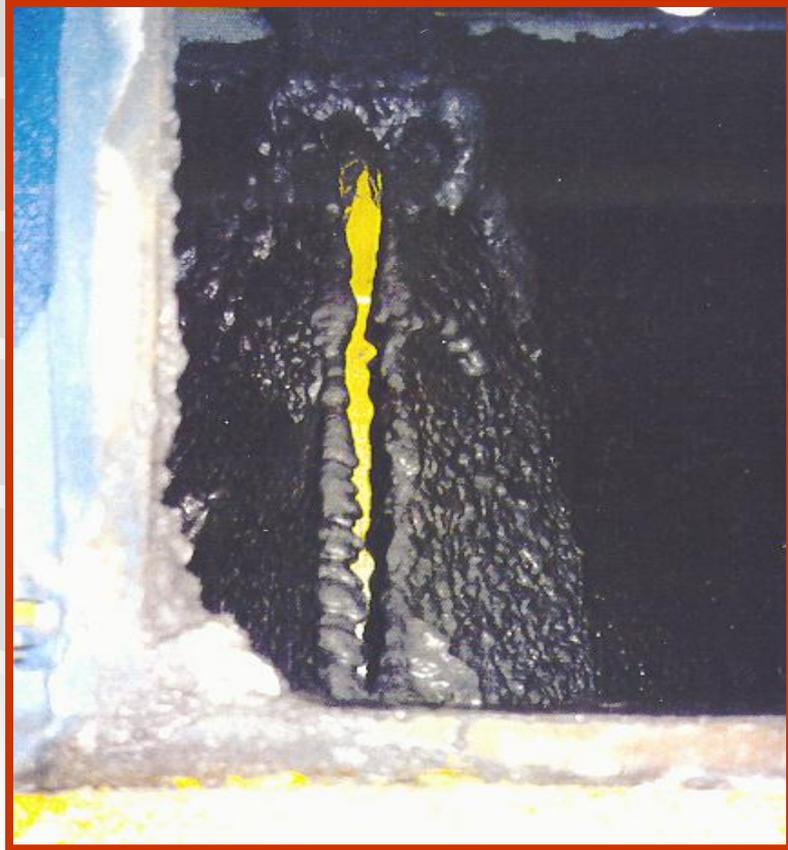


# Worn Cutter Blades



# Bridging

- **Cross Stream Cutter**
  - solids build-up on cutter blades



# Bridging – Water Flush



# Incorrect Increment Delimitation & Extraction

- **Cross Stream Cutter**
  - solids build-up on cutter blades
  - cutter blade on one side is missing
  - Insufficient capacity resulting in backflow



# Incorrect Increment Delimitation

## Circular Path Cross Stream Cutter

- Cutter blades parallel
- Cutter blades have different angles and height



# Problems w/ Multi Cutter Technology

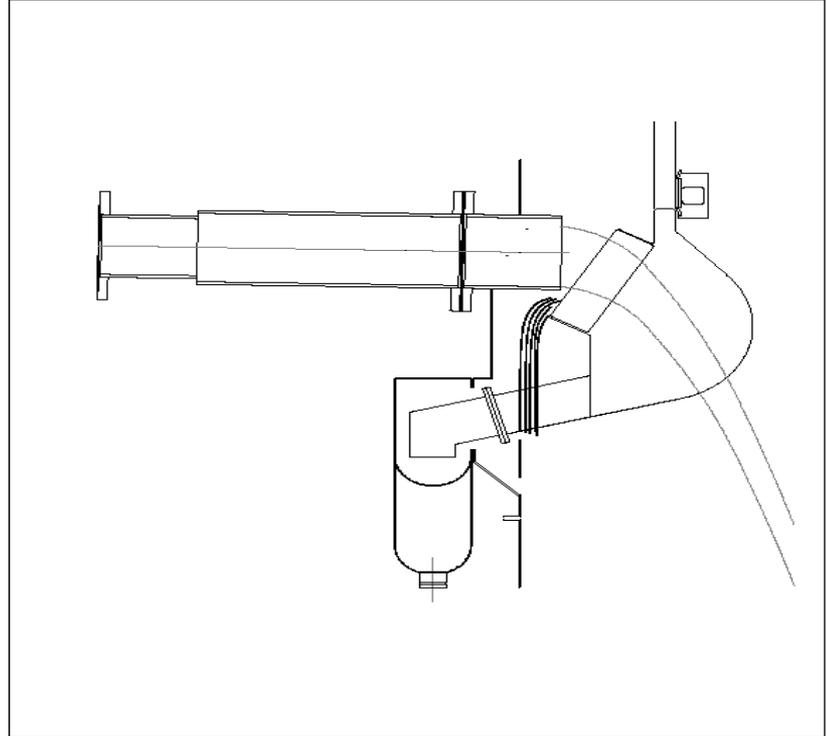


Segregation occurs, not desirable for sampling !!!!

- very high maintenance
- 5x more sample volume vs. single cutter designs
- multi stage system may have many cutters!!!
- each cutter must be identical to prove theory but .....
- the theory is not practical or realistic as the video shows

# Extraction Error - Backflow

- Sample flow entering the cutter higher than flow of the sample leaving the cutter
- Insufficient capacity of cutter
- Discharge diameter too small
- Obstructions or damage to discharge pipe





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For more information you can always contact us at:  
[www.heathandsherwood64.com](http://www.heathandsherwood64.com)

PROVEN METALLURGICAL SAMPLING SOLUTIONS

