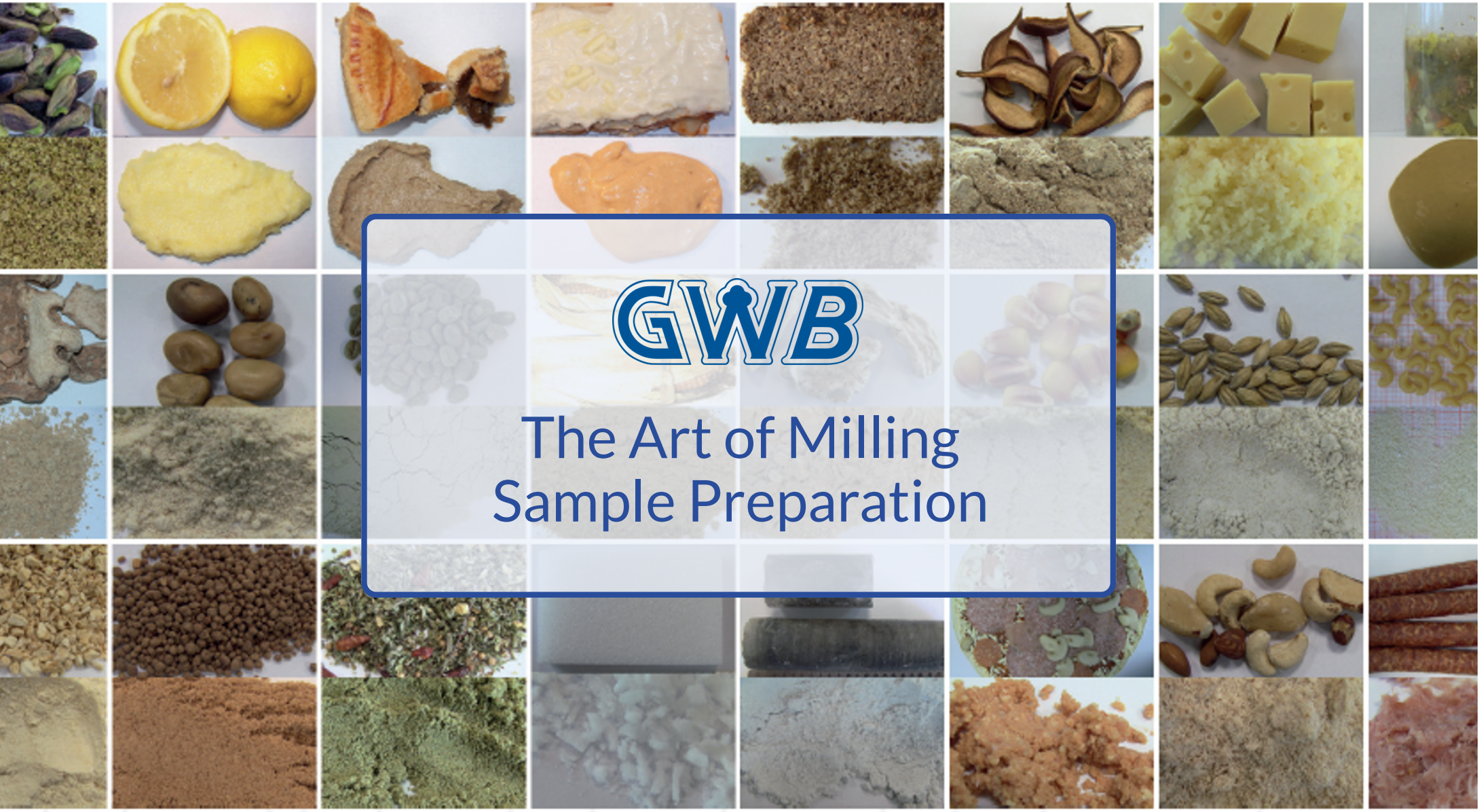


GWB

The Art of Milling
Sample Preparation

The Brands GWB represents

GWB -
Solution provider

Solutions for industry

- Solutions for a variety of segments
  - Chemistry
  - Pharmaceutical and diagnostics
  - Metal and mining
  - Biotechnology
  - Food and beverage
  - Forest
  - Service laboratories
  - R&D institutions

Universities and schools


Retsch
MILLING SIEVING ASSISTING
RETSCH GmbH, Germany
hereby certifies that
OY G.W.Berg & Co. Ab
Mäkituvantie 7
01510 Vantaa
Finland
is our exclusive distributor for RETSCH products in Finland.
Haan, January 2023
Dr. Jürgen Pankratz
Managing Director
FOR 2023
Retsch
RETSCH GMBH
part of VERDER scientific

GWB

Milling task

- Coffee beans: you get more tasteful coffee if you grind the beans
- The role of the lab is super important
- The finest (or the most expencive) instrument does not provide accurate results IF the sample preparation procedures are not ok

Milling tasks

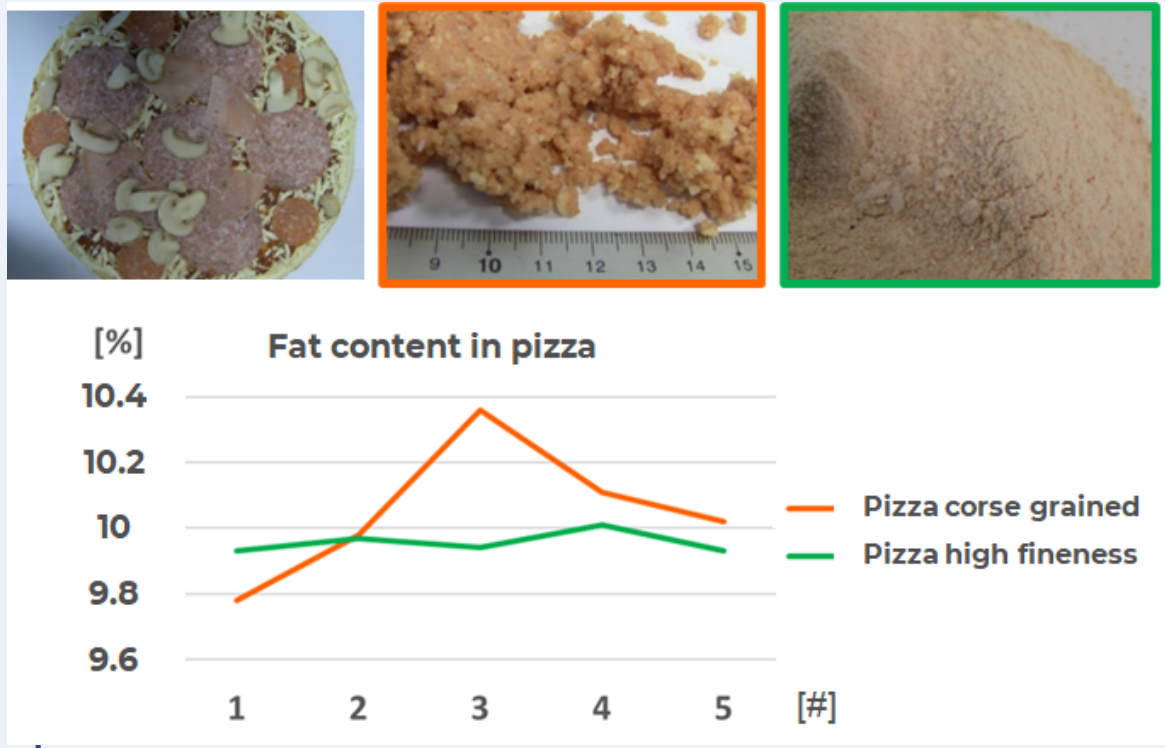
- Grinding
- Homogenization
- Sample dividing

Milling task

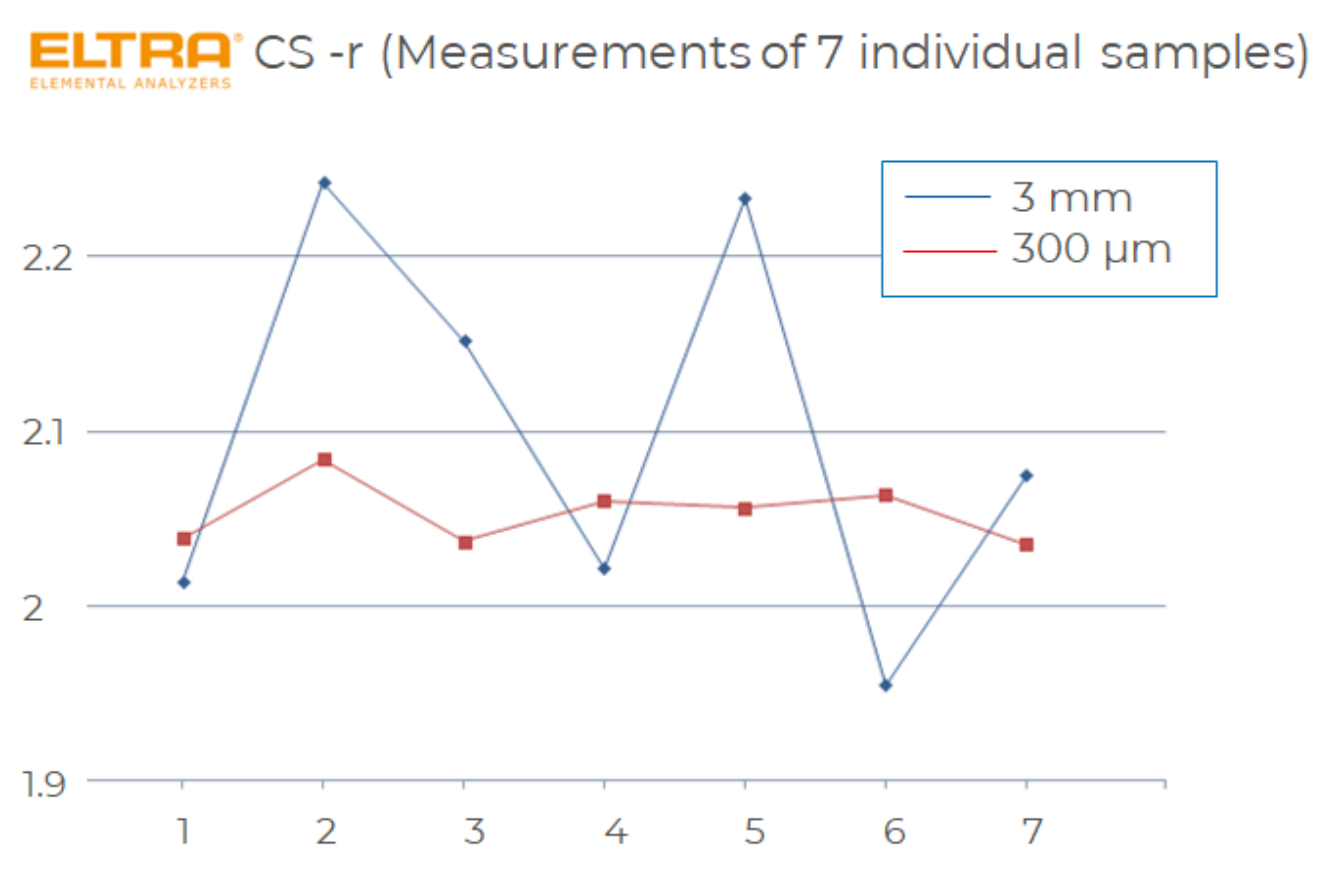
- Representative samples - Reproducible result

Milling task

- The result of sample preparation must be the same - each time!

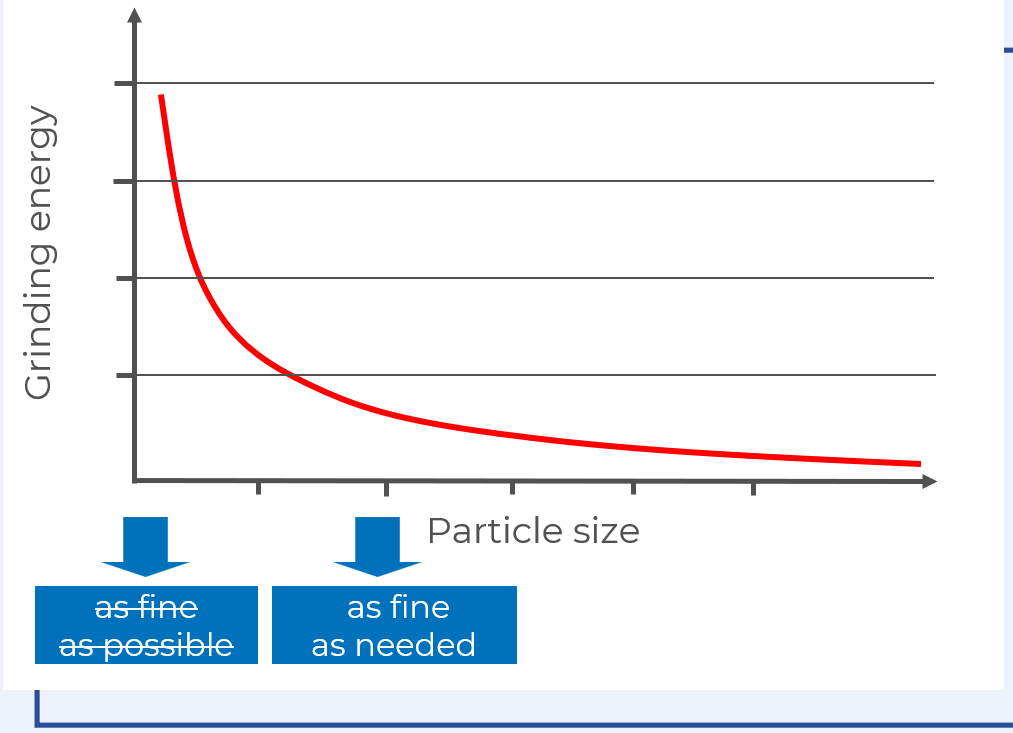


Milling task



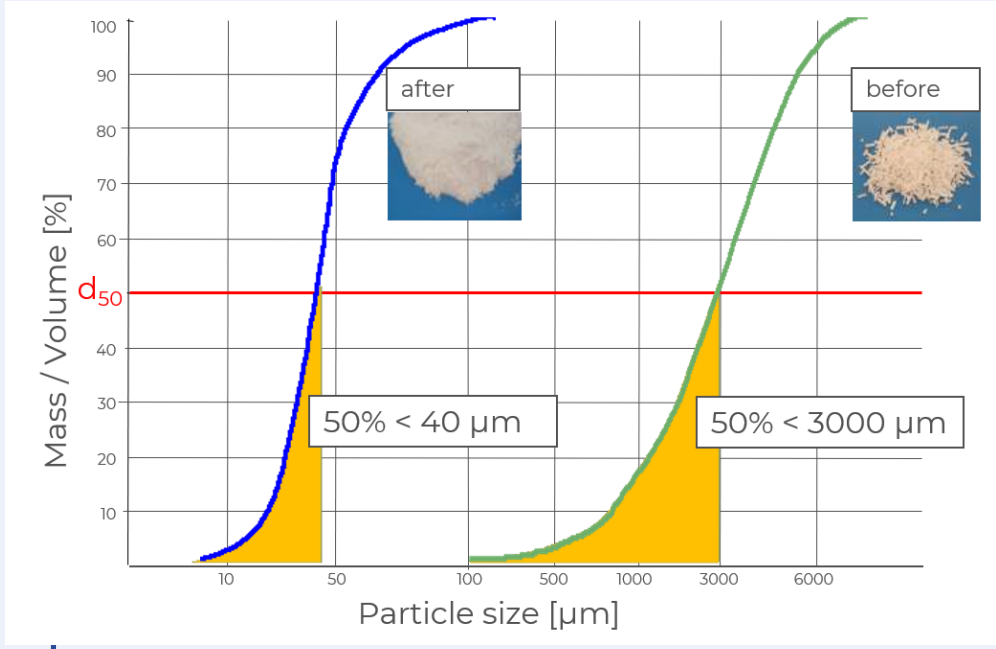
Milling task

- The sample fineness depends on the following analysis or analytical methods
- Grind the sample only as fine as needed



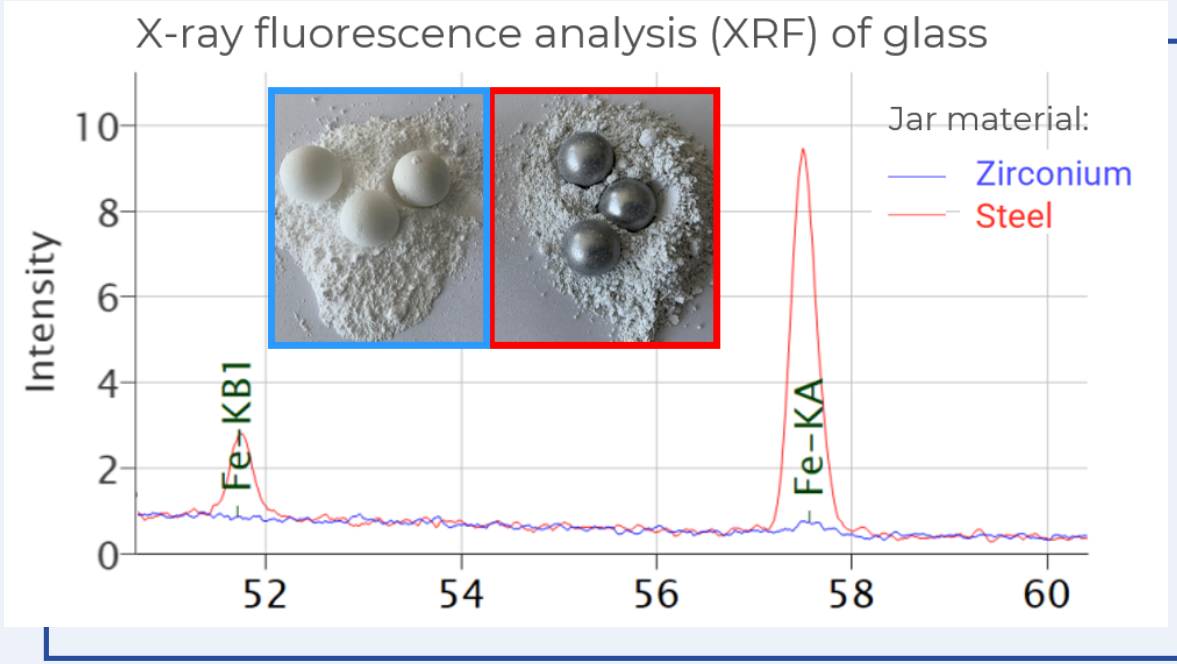
Sample size - the fineness

- Particle size decreases and also the particle size distribution changes



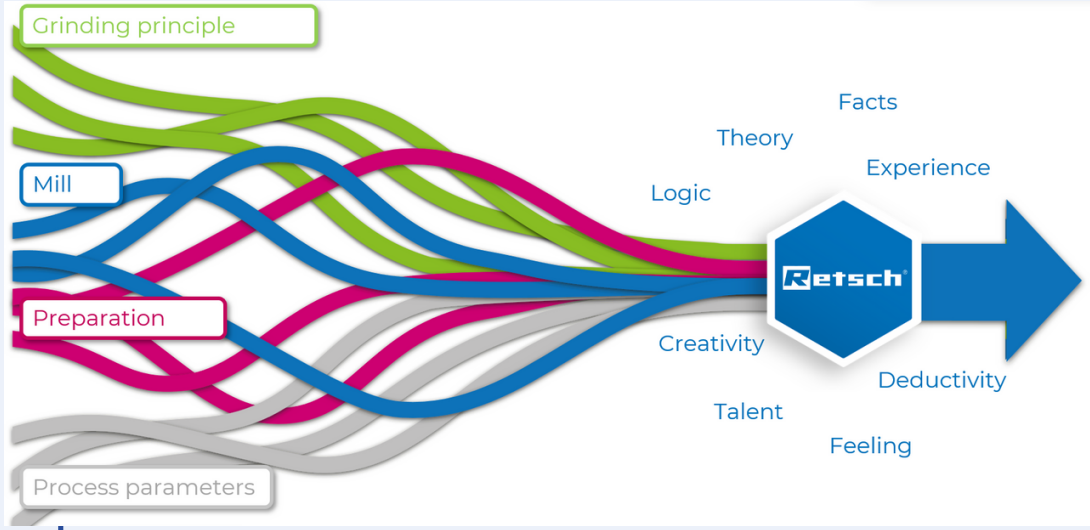
Milling task

- The material properties being analyzes should not change
  - Cross contamination
  - Temperature increases
  - Abrasion



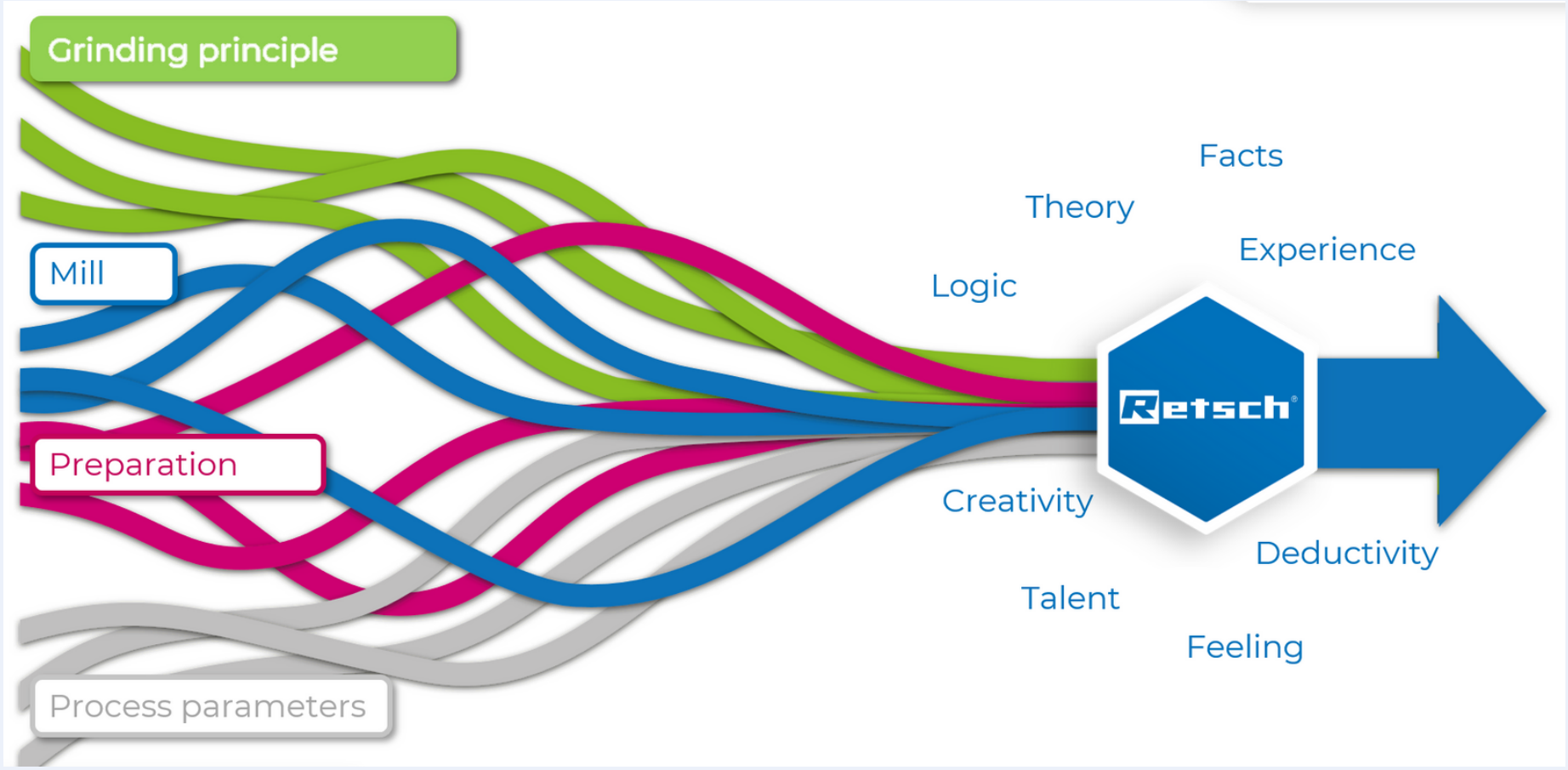
The art of milling

- There is no general formula to find the perfect solution for a certain milling problem
- Many ways for a succesfull milling result



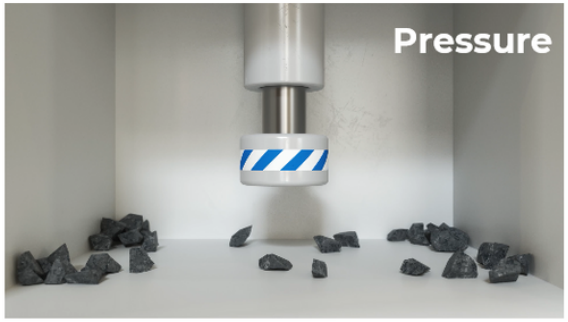
What is the correct sample size?

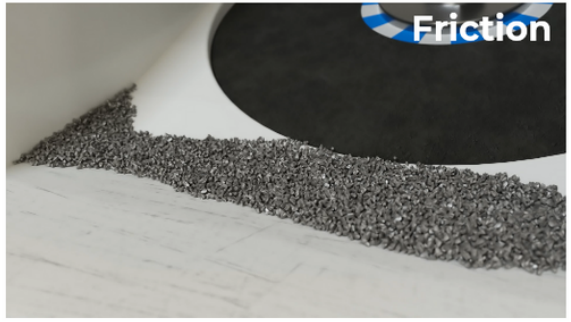
The art of milling



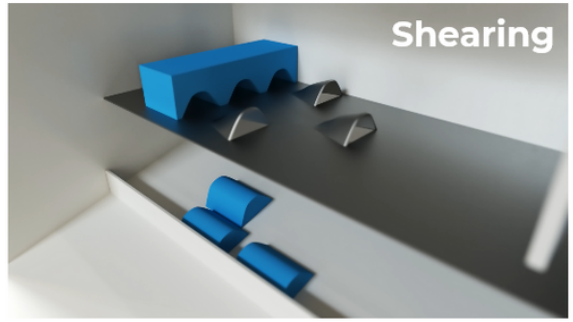
Grinding principles

Hard sample material





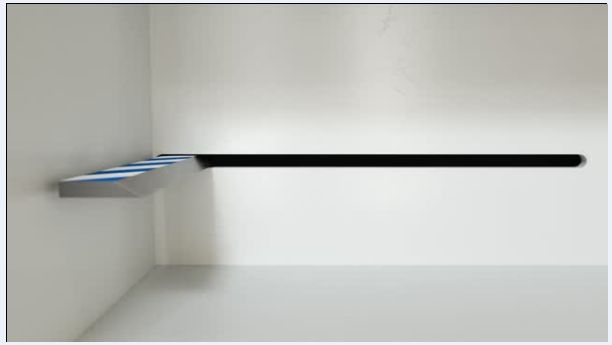
Soft sample material



Grinding principles - videos

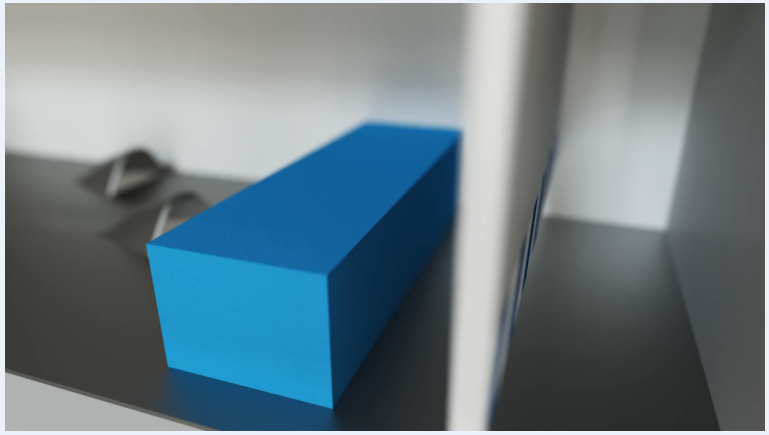
Pressure

Cutting

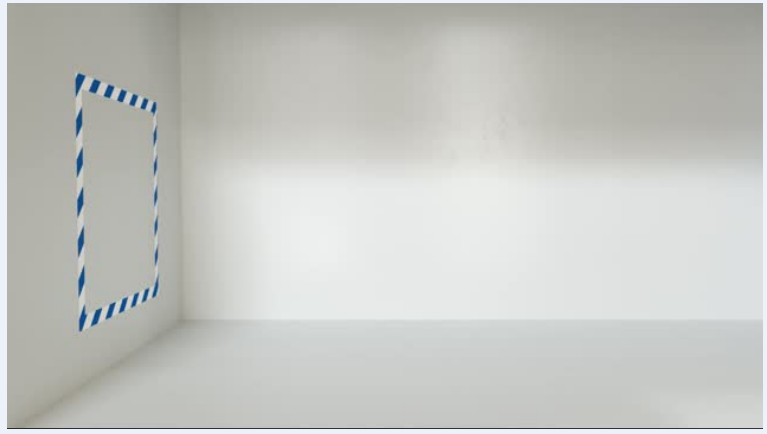


Friction

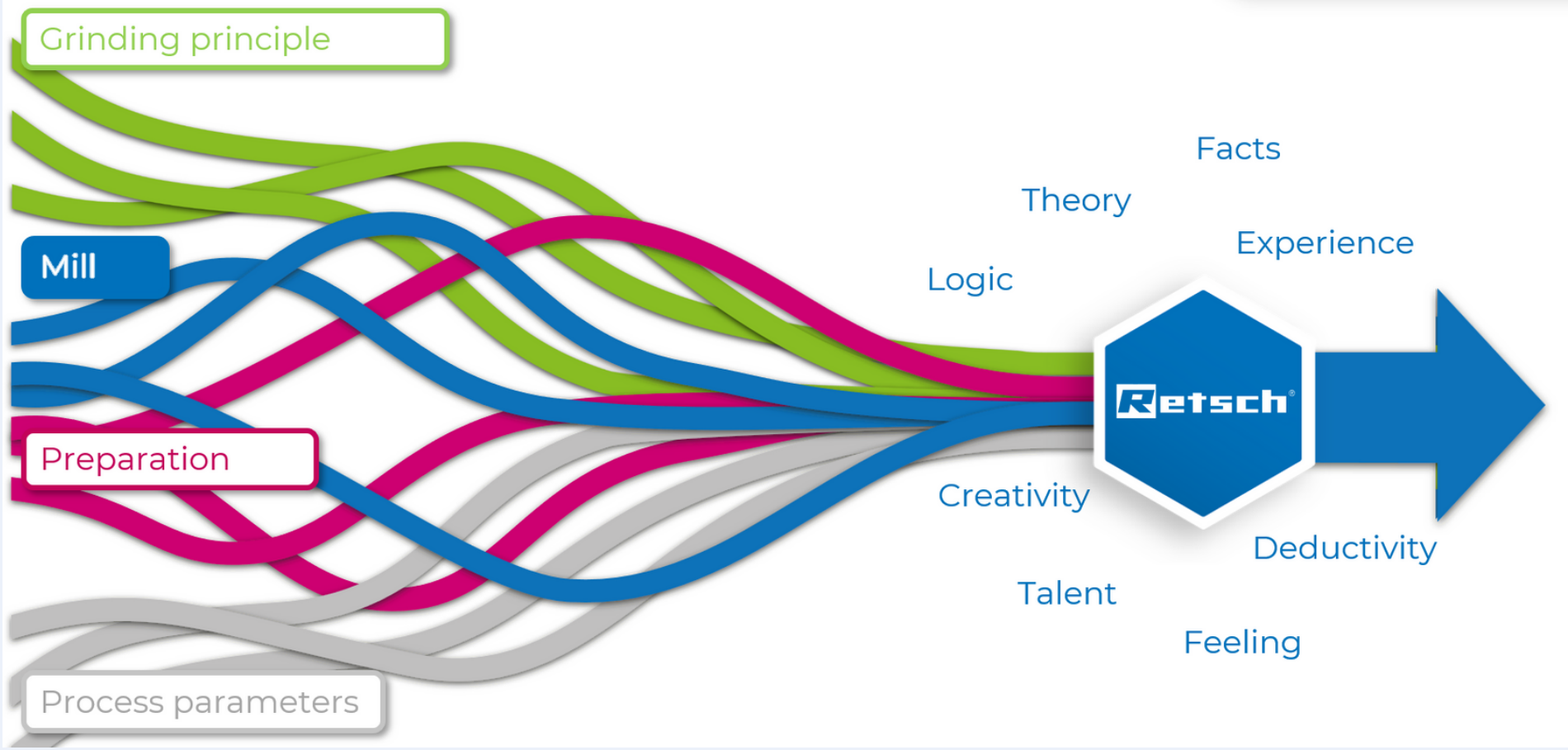
Shearing



Impact



The art of milling



Mills

> 35 mills

Jaw Crushers

Rotor Mills

Cutting Mills

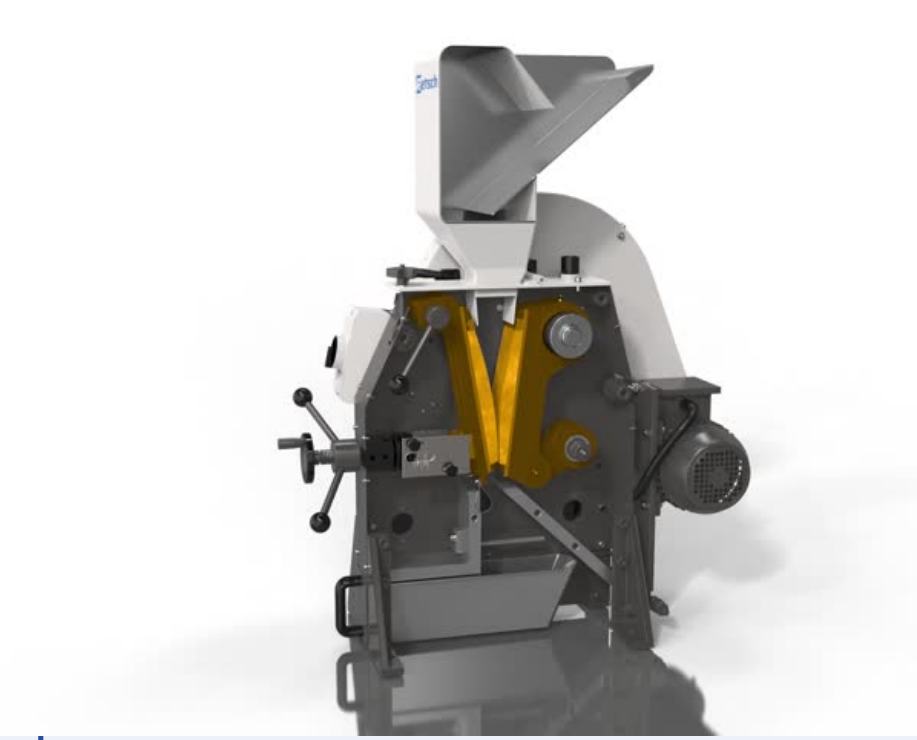
Knife Mills

Mortar Grinder

Vibratory Disc Mills

Ball Mills

Hard and brittle material
Jaw chrusher

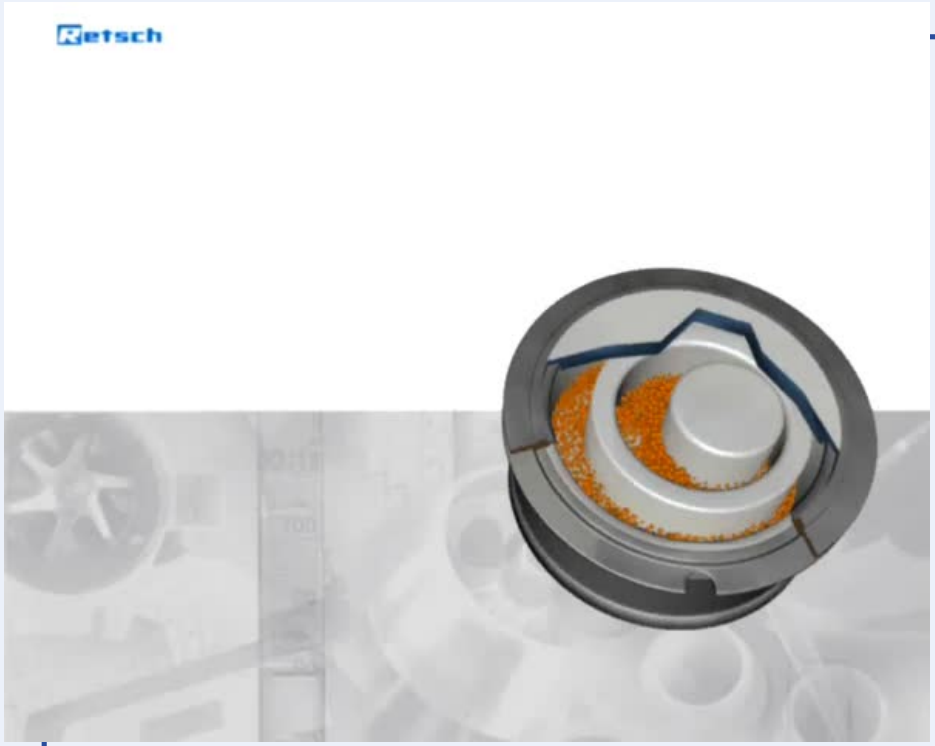


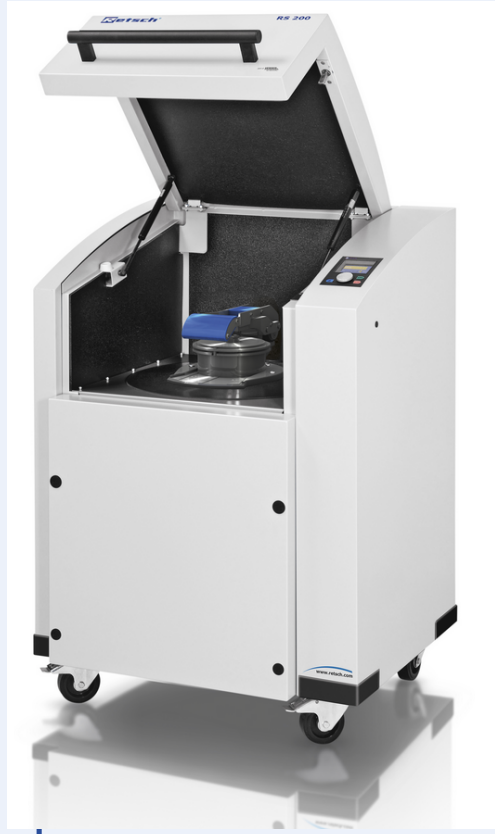
Hard and brittle material
Hammer mill

Hard and brittle material
Cross beater mill

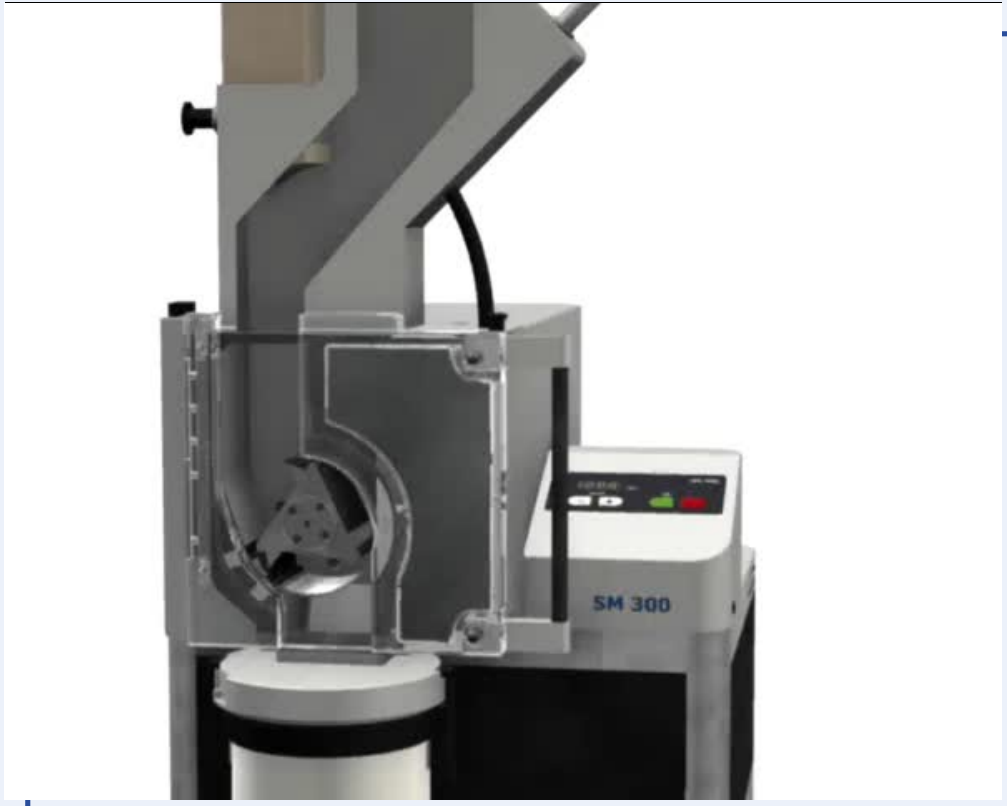
Hard and brittle material - fine
Planetary ball mil

Hard and brittle material - fine
Vibratory disc mill



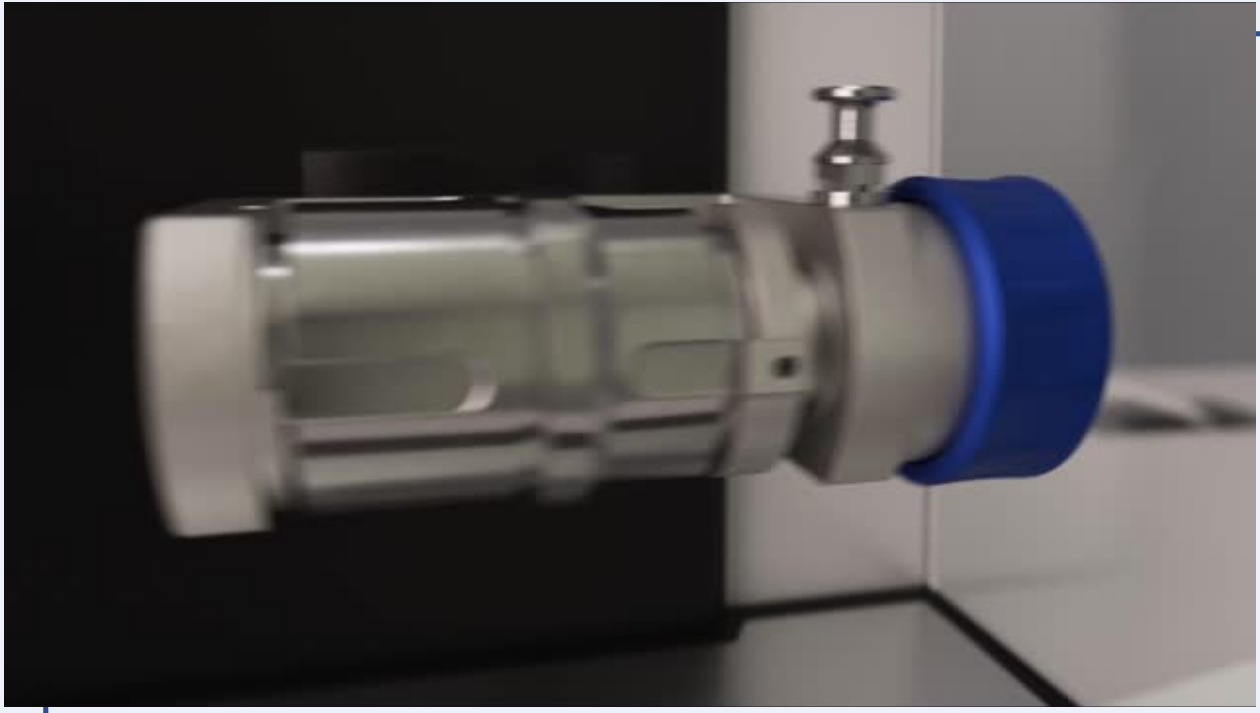


Soft, elastic, fibrous samples - pre crushing, Cutting Mill



Fine - Soft, elastic, fibrous - fine
Ultra centrifugal mill

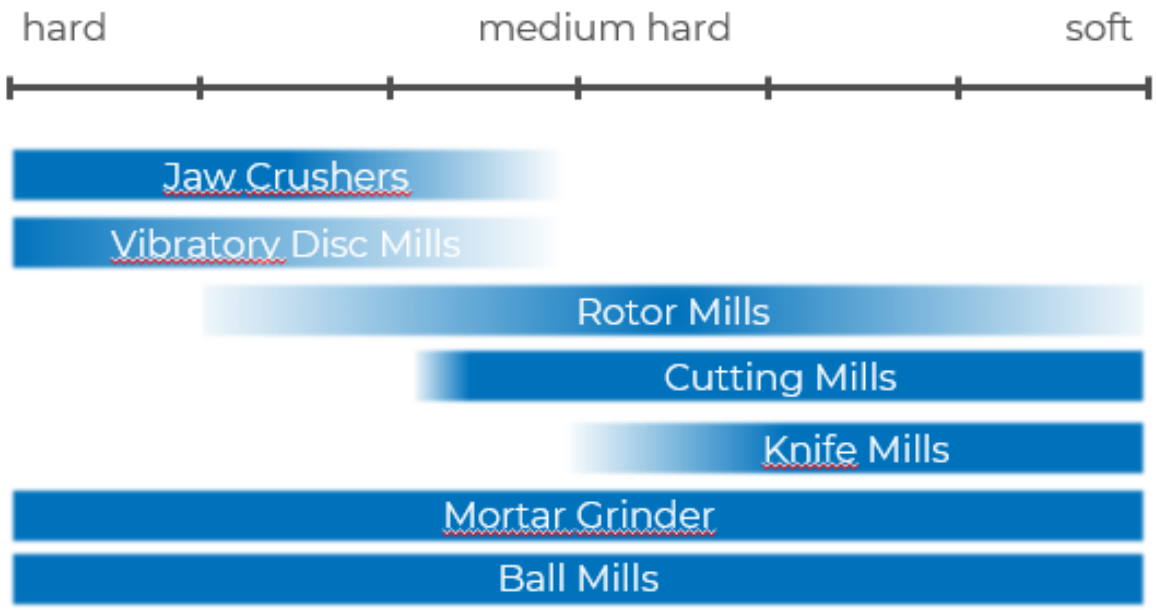
Fine - Soft, elastic, fibrous
Mixer mill



Fine - Soft, elastic, fibrous
Knife mill

Selection of the mill

The choice of the mill depends on the properties of the material being processed!



... further relevant properties

- brittleness
- fibrousness
- elasticity

Selection of the mill

The choice of the mill depends on the milling task!

Sample properties

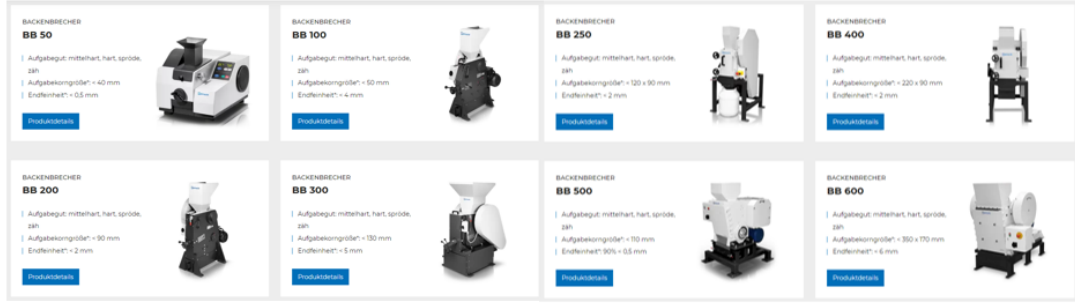
1. Feed size
2. Final fineness
3. Sample amount

Time and handling

- ✓ Feeding velocity
- ✓ Sample throughput
- ✓ Grinding time
- ✓ Cleaning of device

Boundary conditions

- Subsequent analysis
- Industry
- Specification
- ...



Selection of the mill

The choice of accessory depends on the milling task!

Sample input

DR 100

Sample collector

Cyclone

Collecting vessel

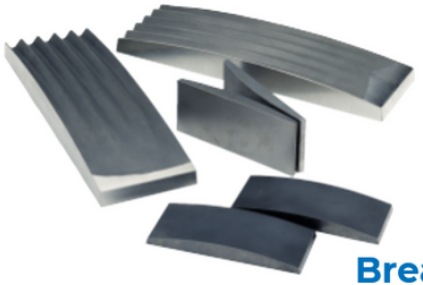
Grinding tools

Selection of the mill

The choice of the material for the grinding tools depends on the milling task!

Grinding jars and balls

Rotors



Breaking jaws

Material	Density g/cm³	Hardness HV	Abrasion (intensity)
Stainless steel	7.8	550	+++
Hardened steel	7.8	750	++
Tungsten carbide	14.8	1200	+
Zirconia	5.9	1200	+
Silicon nitride	3.6	1600	+
PTFE	2.1	D56	++++
Agate	2.6	1000	+++

Selection of the mill

Every grinding operation generates heat! Some samples require temperature control!

Emax

Cooling option with control mode

ZM 300

Display of indicative temperature

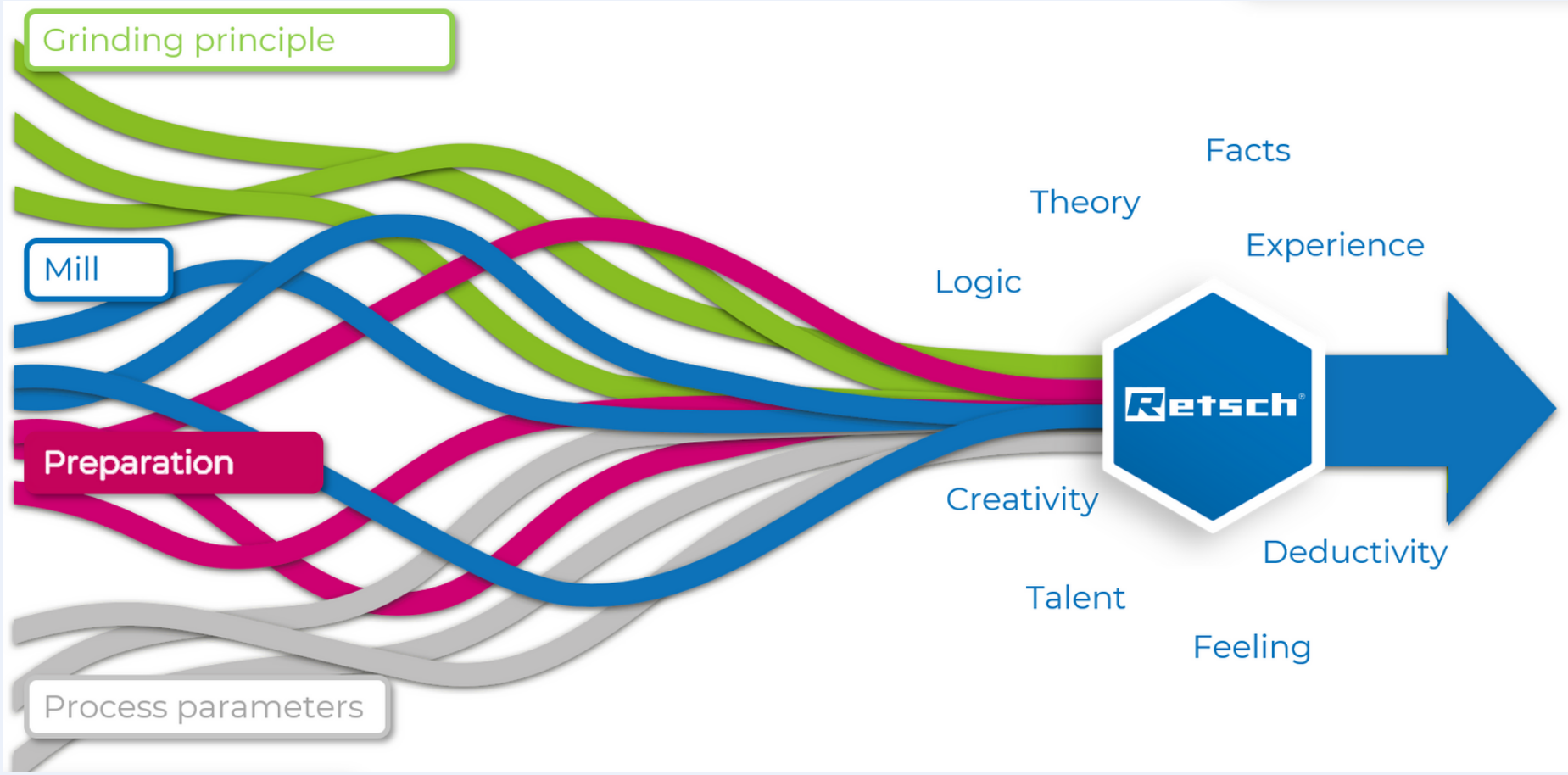
CryoMill

Continuous cooling with LN_2

MM 500 control

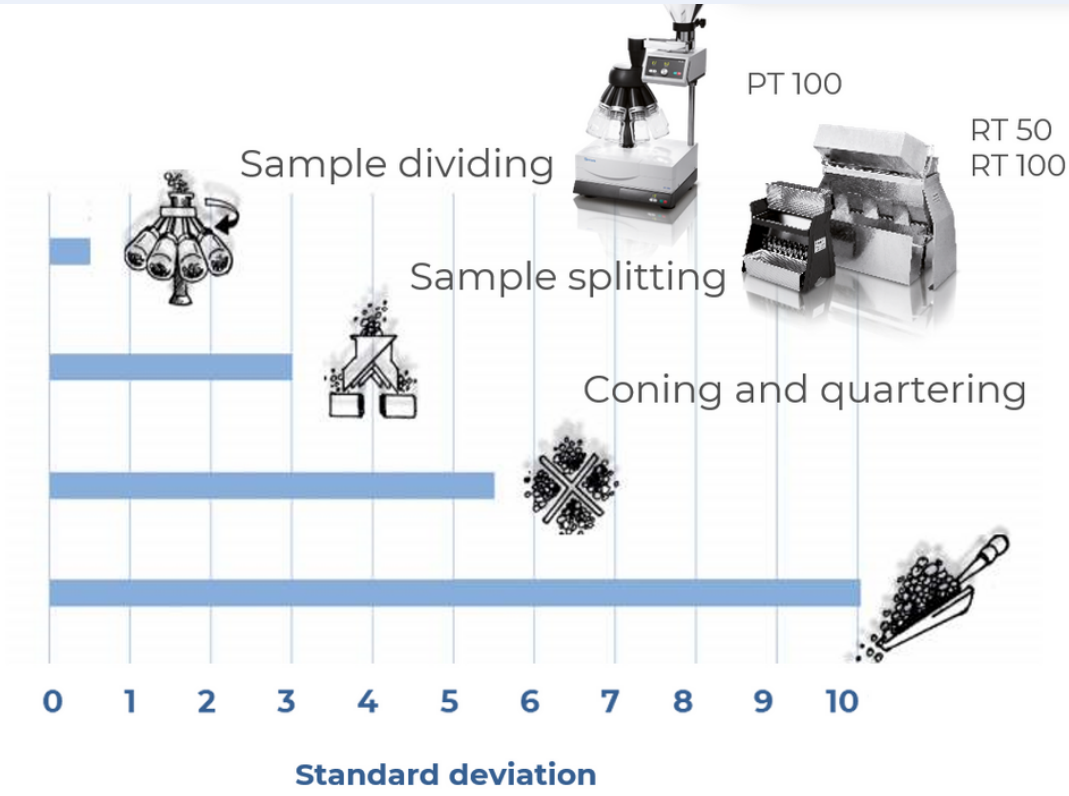
Cooling and heating from - 100 to 100 °C

The art of milling



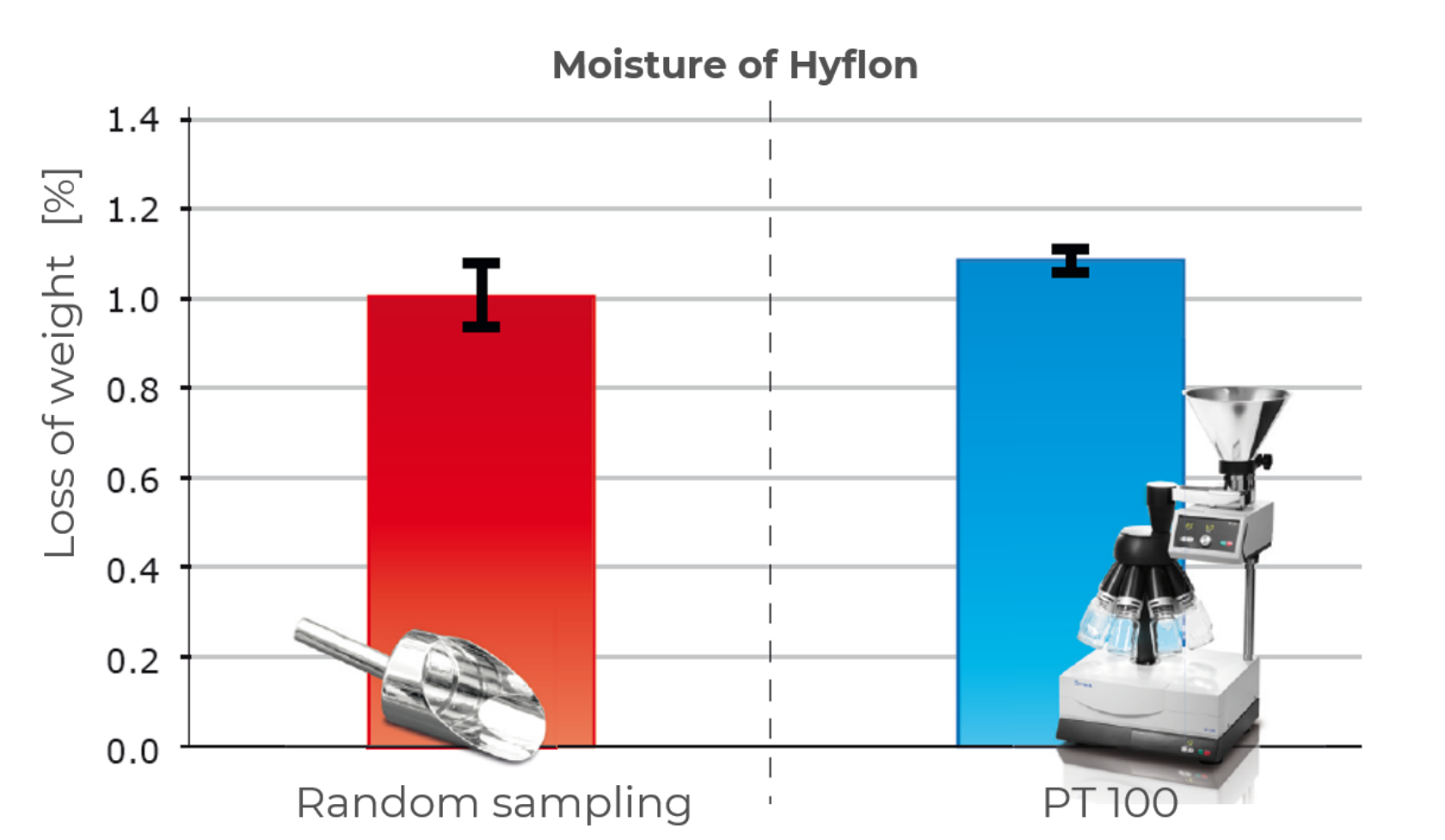
Preparation

Random sample division

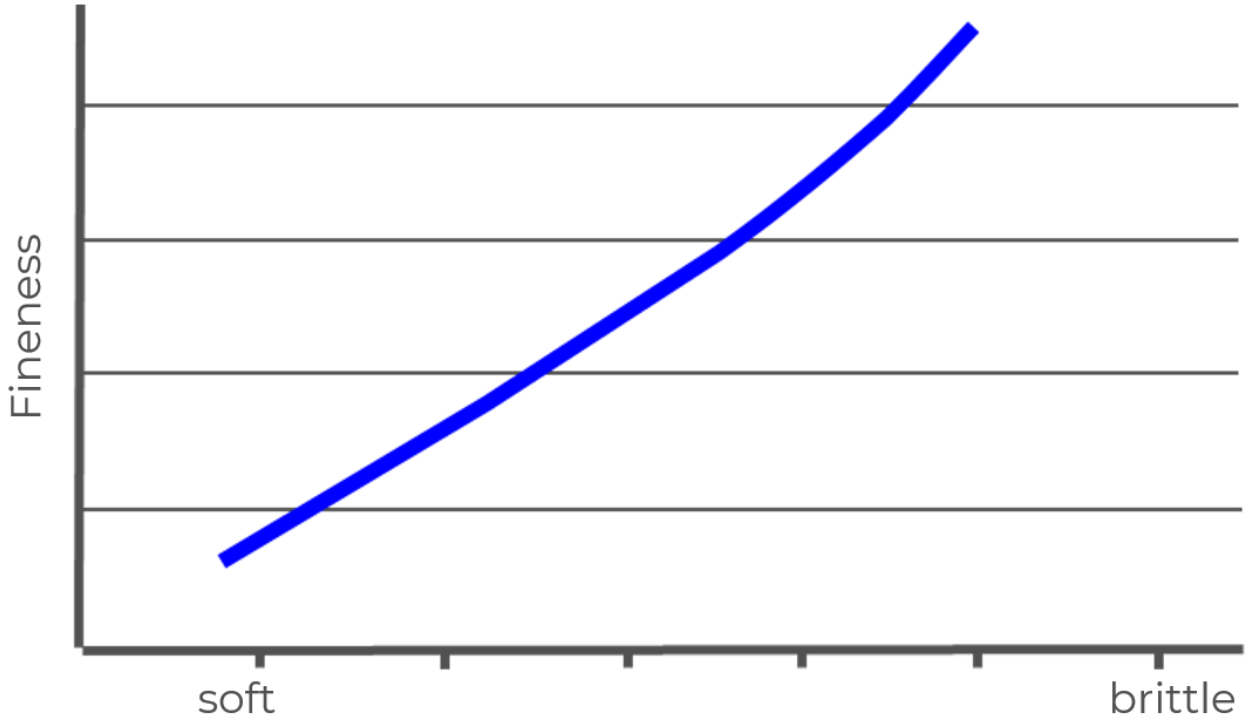


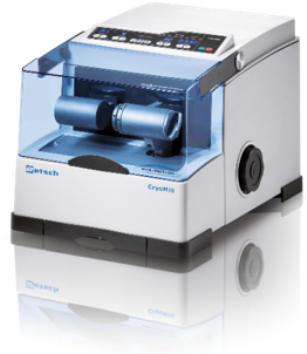
The sub-sample must be qualitatively representative of the sample as a whole.

Preparation



Preparation - enbrittlement by cooling

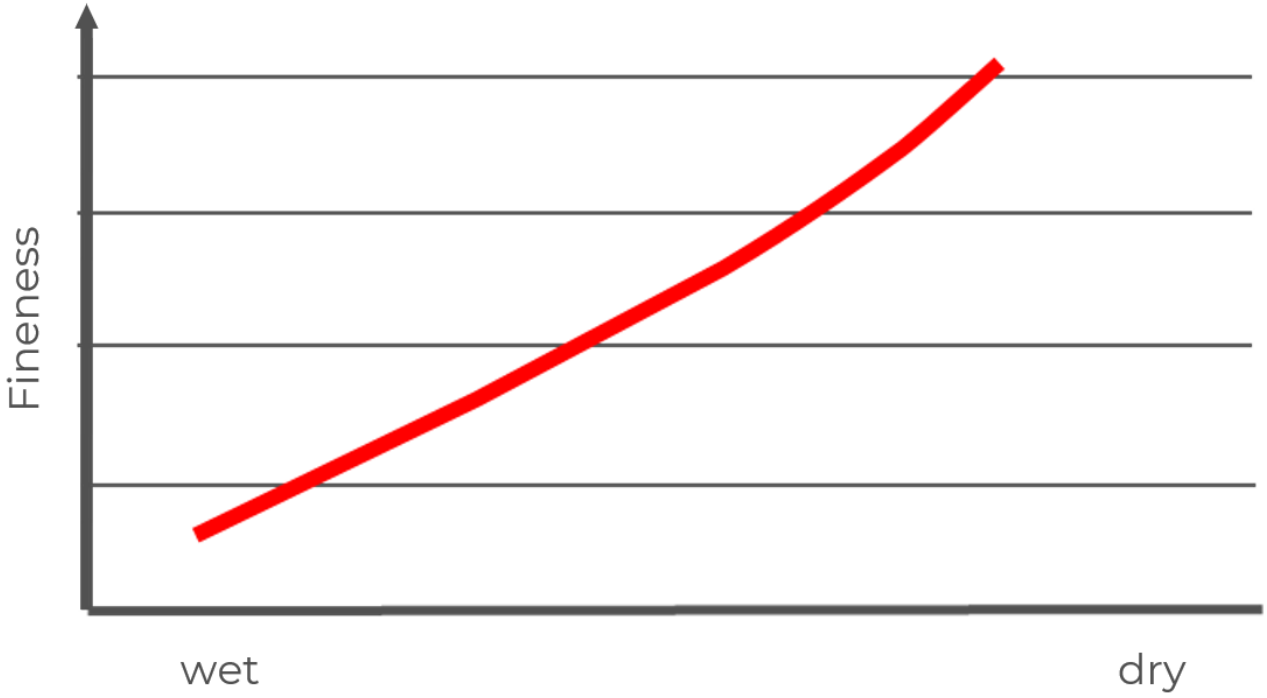




CryoMill

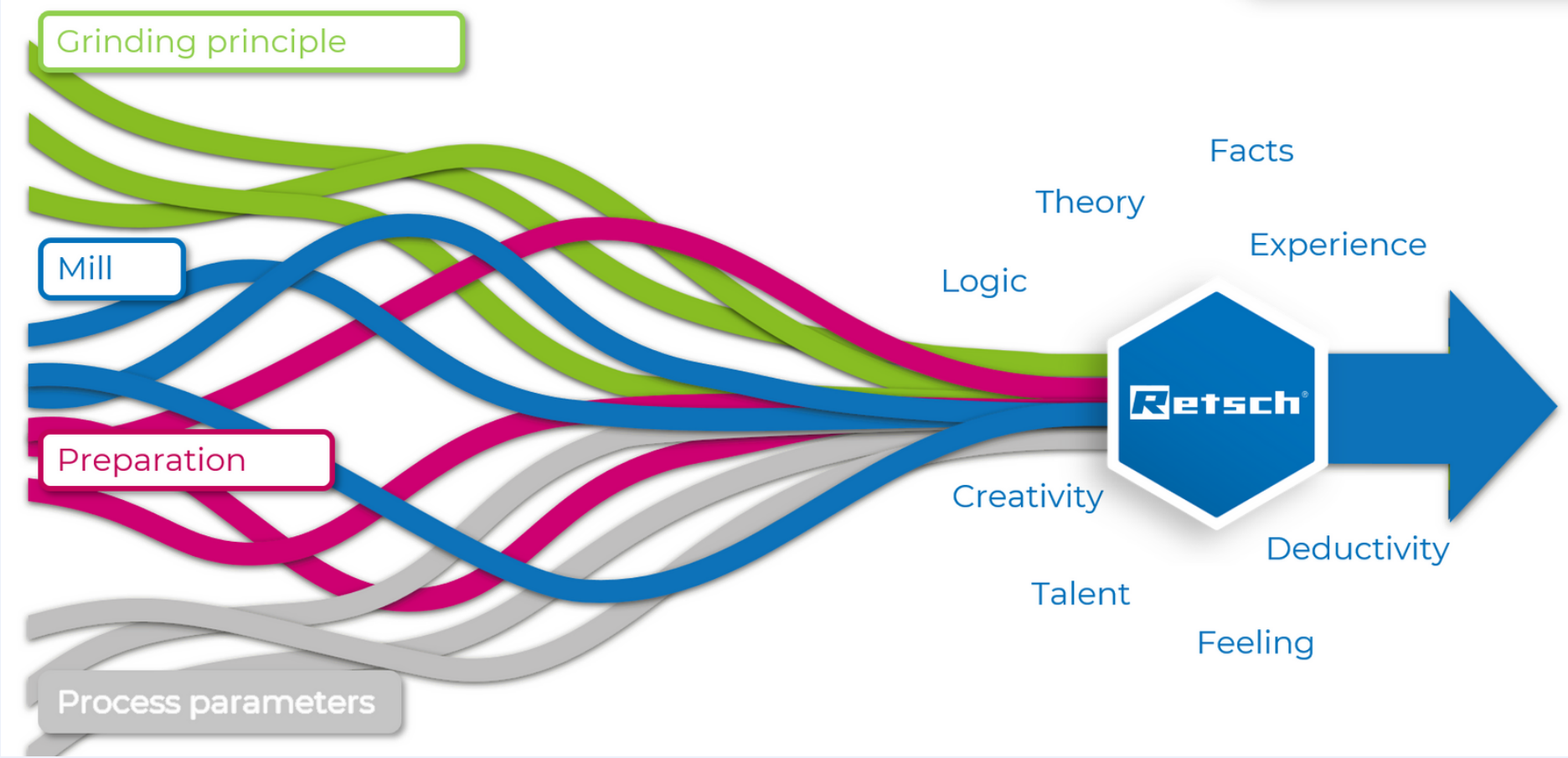
Cryo-Kit

Preparation - enbrittlement by drying



Fluid bed dryer
TG 200

The art of milling



Process parameters

Examples

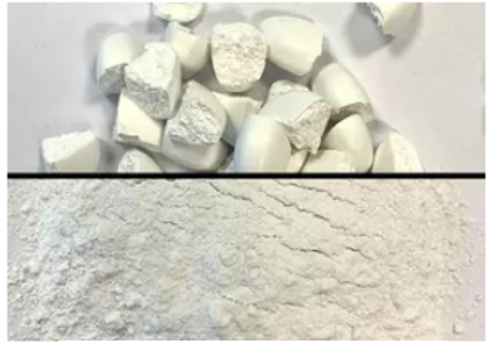
Glass

Coal

Organics

Secondary fuels

Food



Pharmaceuticals

Polymers

Soil

Retsch Bus tour in Finland on June

Sample preparation using mills

- It is art - you need suitable instruments and imagination
- Test, test and test
- Cleaning is important
- You can always call GWB, your the most important partner.