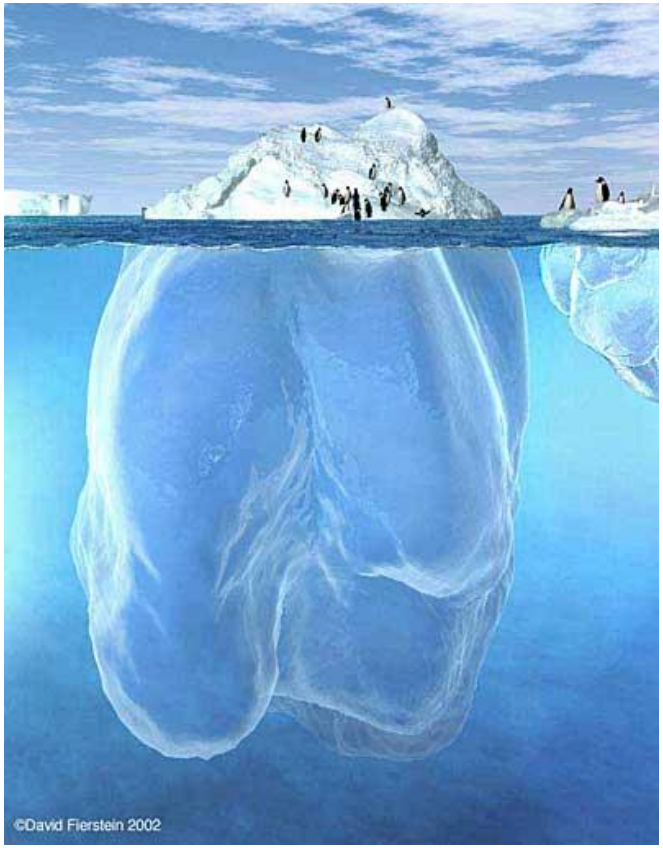
Morphology analysis measurement and correlation with fineness

Morphology of Nitrocellulose is an important property for the processability of Nitrocellulose in propellant process

THE FINENESS :

CLASSIC SPECIFICATION



FIBRE LENGTH DISTRIBUTION

Drying time : 2 hour

Settling time : 1 hour

10 g of Dry Nitrocellulose
250 ml of water

Official fineness result

FIBRE LENGTH DISTRIBUTION

It’s a very old analysis

Easy to be done but poor information coming from this analysis

HOW TO GET ADDED VALUE INFORMATION ON SIZE LENGHT DISTRIBUTION / FINENESS

FIBRE LENGTH DISTRIBUTION

GOALS:

Analyser which can be used directly on production line for refining process and for R&D.

size length distribution curve

Finding a correlation between fineness and size length distribution

Quicker analysis than standard fineness (for production line)

FIBRE LENGTH DISTRIBUTION

Existing equipment :

For solid particles :

BECKMANN-COULTER: Rapid vue
RETSCH : CAMSIZER XT
SYMPATEC : QICPIC/R

In paper industry :

METSO (Kajaani): F55
ABB (Lorenzen et Wettre) : L &W 912
TECHPAP : MORFI

our choice : MORFI ANALYSER FROM TECHPAP

Easy to perform, can be used in production line by shift worker

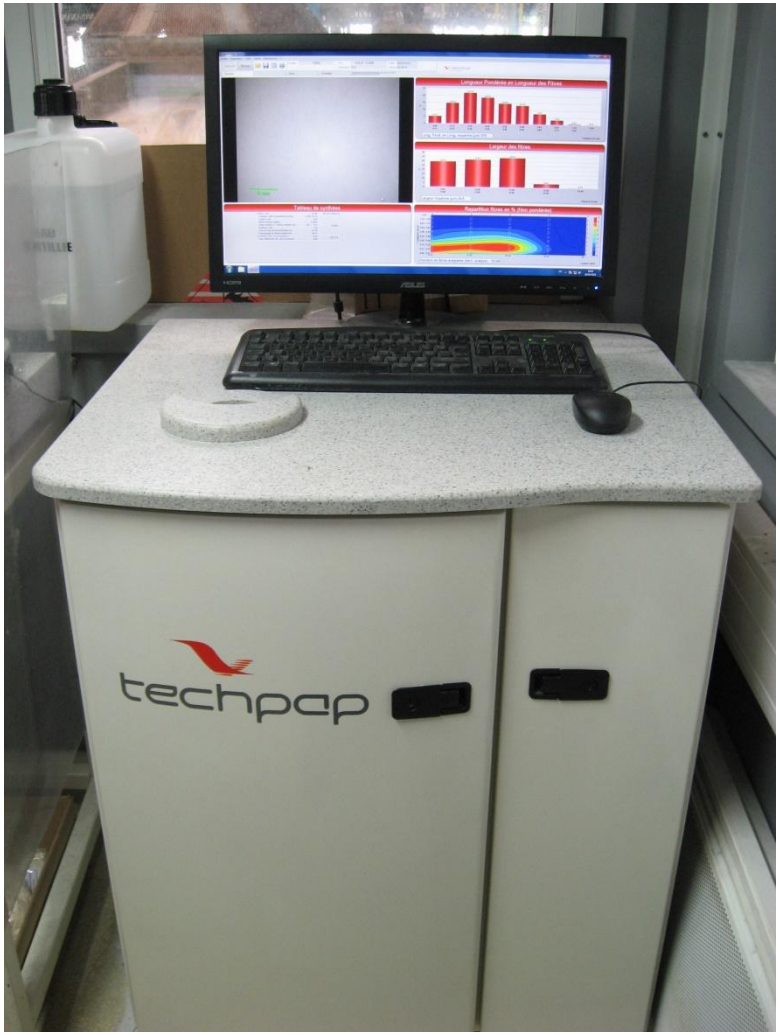
Quick analysis (max 5 minutes) in suspension in water.

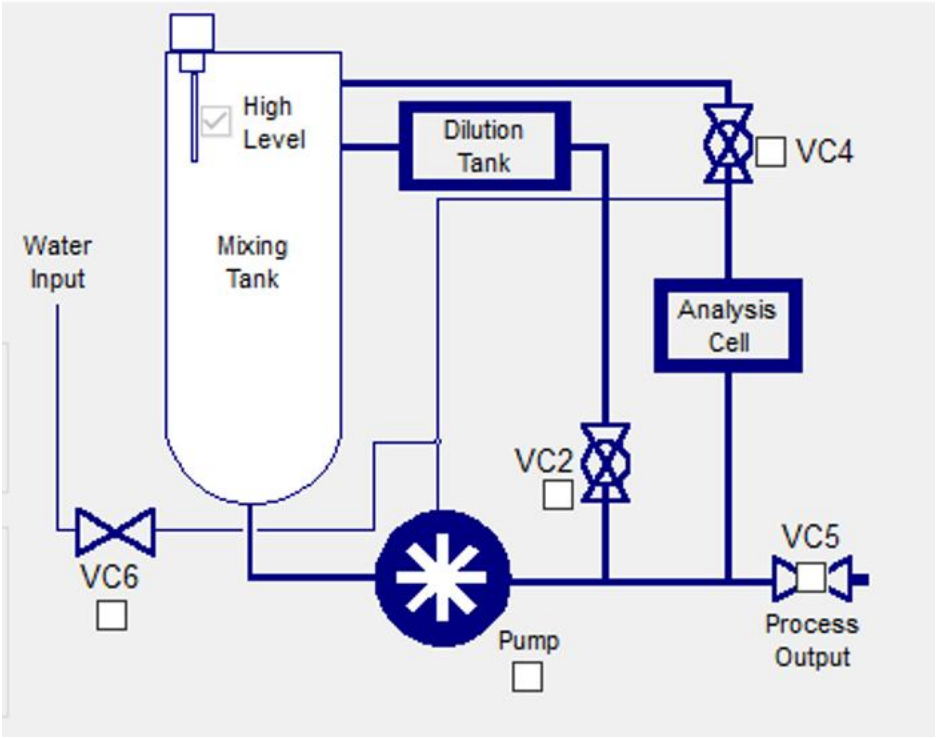
Great experience in paper industry

Could be used for celluloses and nitrocellulose

Good performances with reasonable price

FIBRE LENGTH DISTRIBUTION





High speed camera

Skeletonizing software model

FIBRE LENGTH DISTRIBUTION

VERY SIMPLE WAY FOR DOING ANALYSIS, CAN BE PERFORMED BY SHIFT WORKER

Take a sample of nitrocellulose from the tank

Press by hand for eliminating water

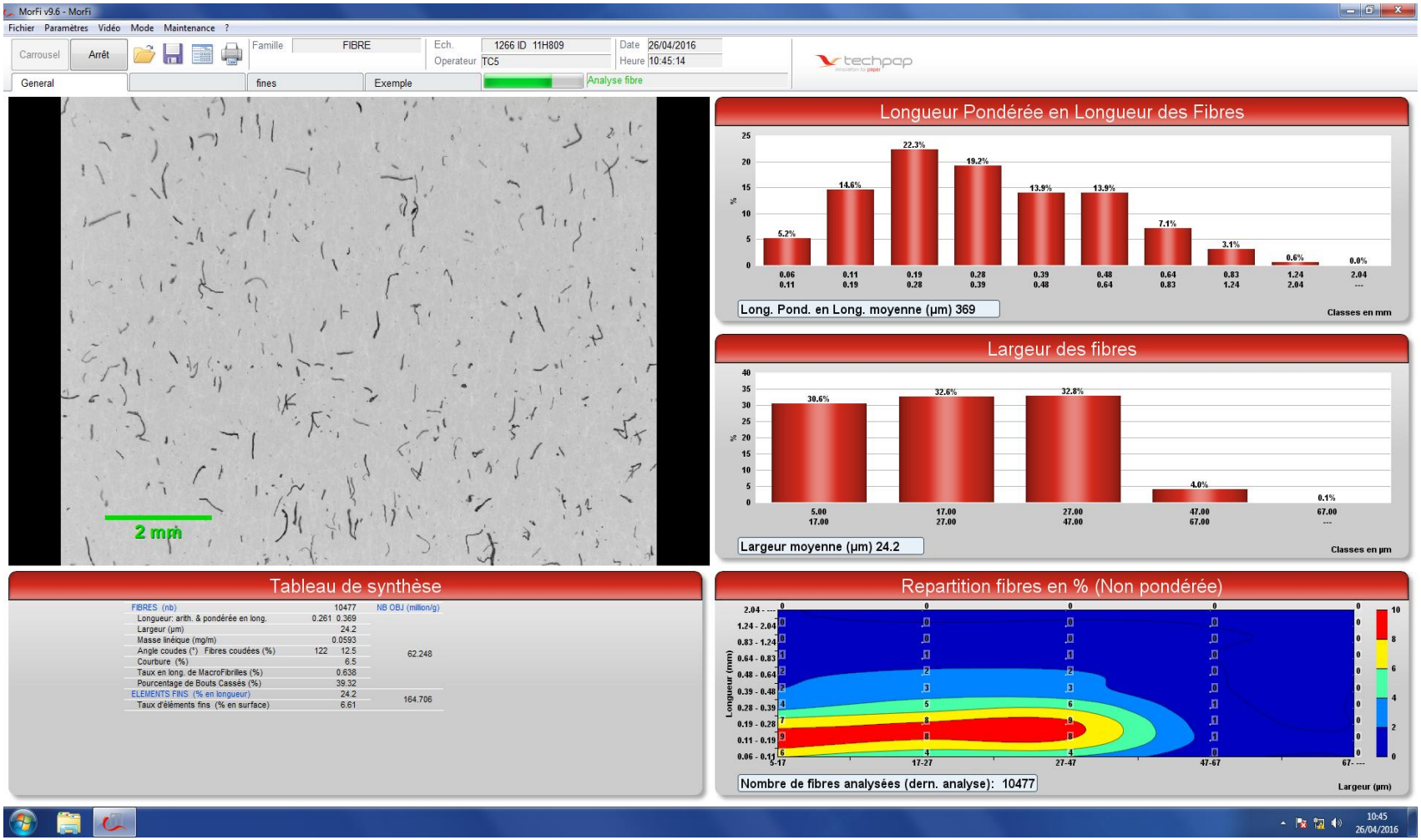
Put about 3 gr of NCE into the analyser

Press the power button

Automatic cycle: dilution, mixing time, analysis, discharge, cleaning

5 minute later : all the information

FIBRE LENGTH DISTRIBUTION



FIBRE LENGTH DISTRIBUTION

a lot of information can be obtained:

length distribution

Width distribution

curl, coarseness, fibrillation index, …..

Let’s have a focus on mean length weighted fibre length:

15000 fibres analysed

acquisition time = 60 second

global analysis time = 5 minutes

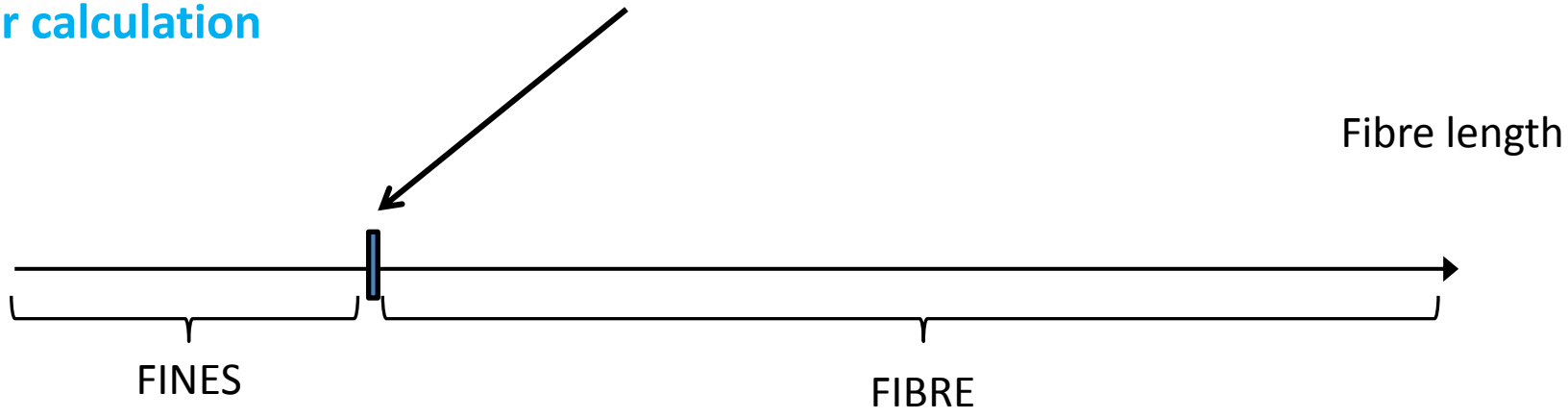
Length – Average and Distribution

- Arithmetic (dependent on fines content)
- **Length-Weighted / mean length (most often used)**
- Length-length-weighted average length
- Area-weighted average length

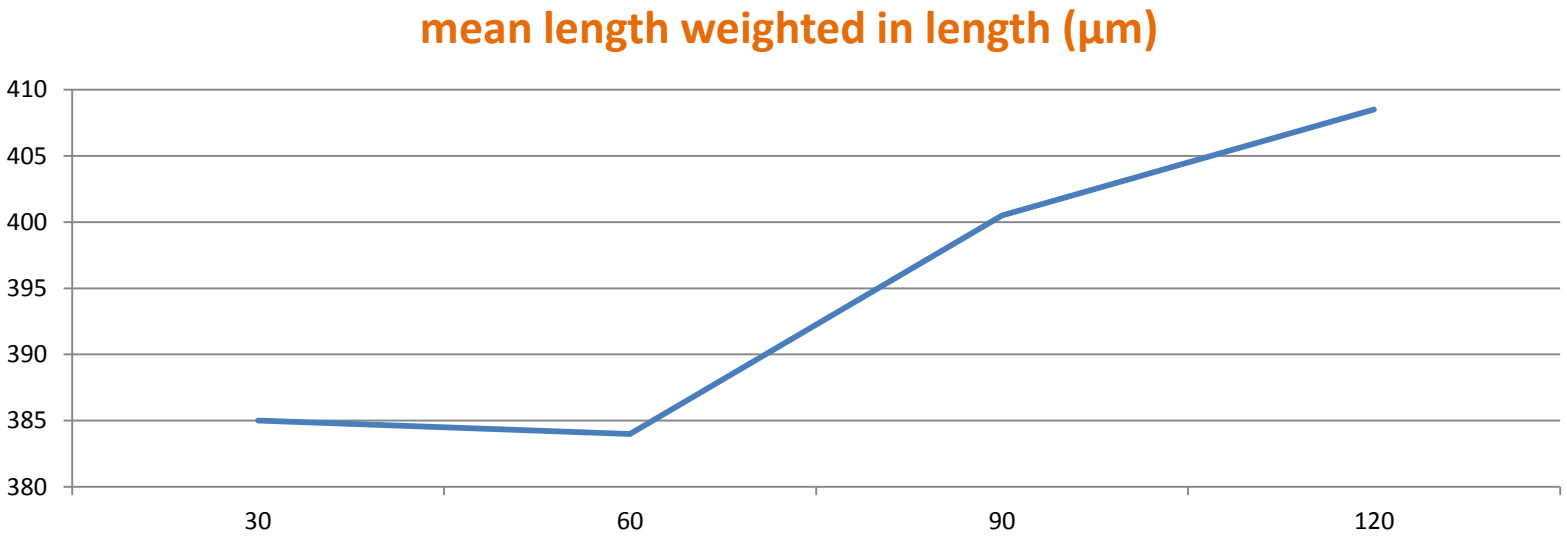
FIBRE LENGTH DISTRIBUTION

- in nitrocellulose, fines are important in number but low in 'weight ' , but not so low and can impact calculations

- With the software, you can select fines size area and reject fines for calculation



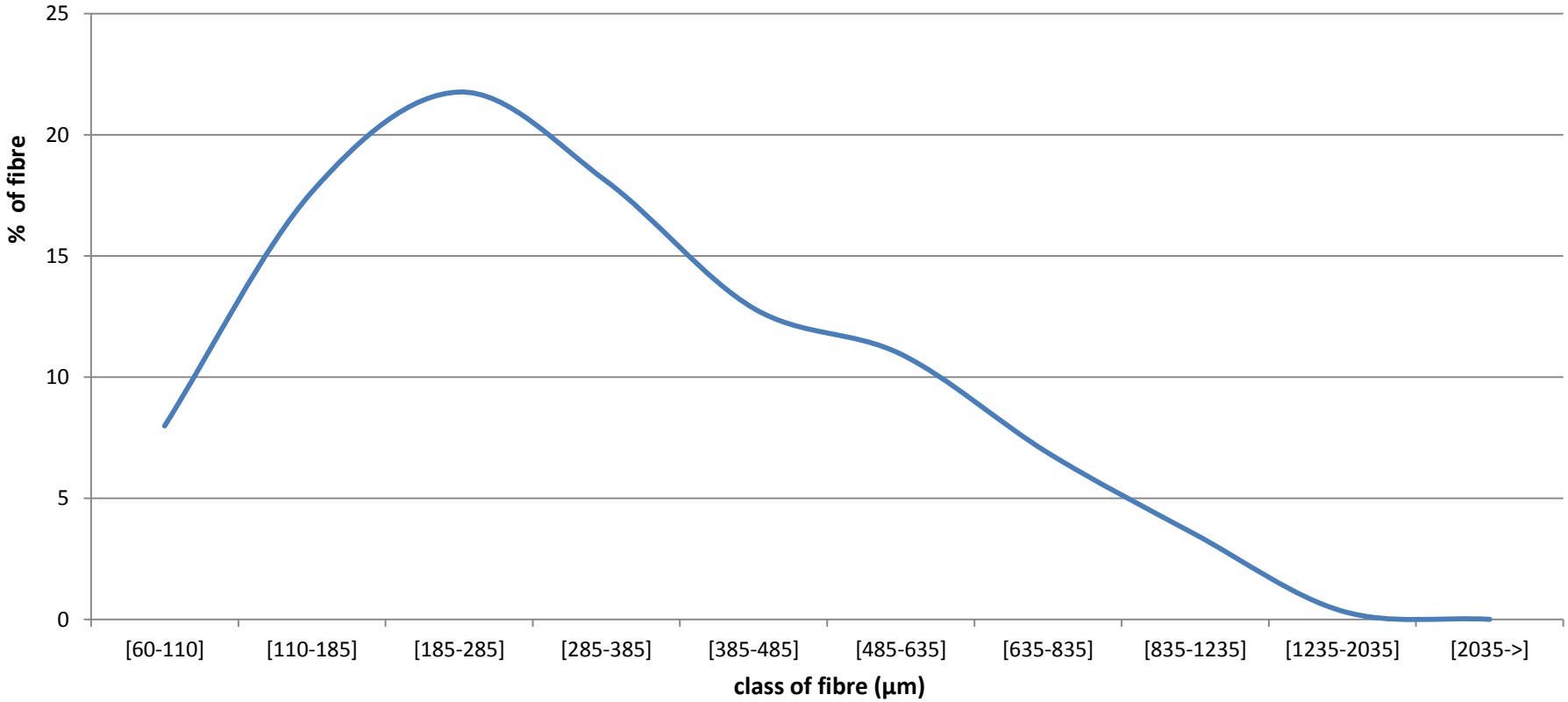
FIBRE LENGTH DISTRIBUTION



Fines < 60 microns are rejected

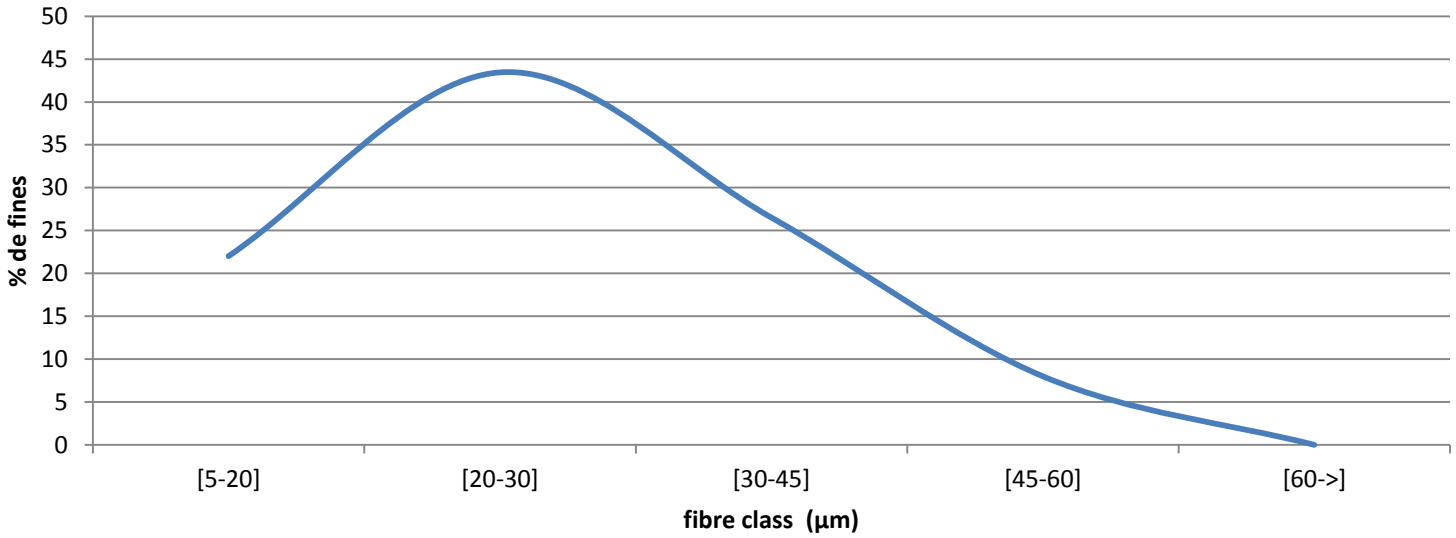
FIBRE LENGTH DISTRIBUTION

GRADE B : length weighted fibre length



FIBRE LENGTH DISTRIBUTION

FINES : arithmetic distribution (5µm to 60 µm)



Fibre width : 10 – 45 microns

REPEATABILITY

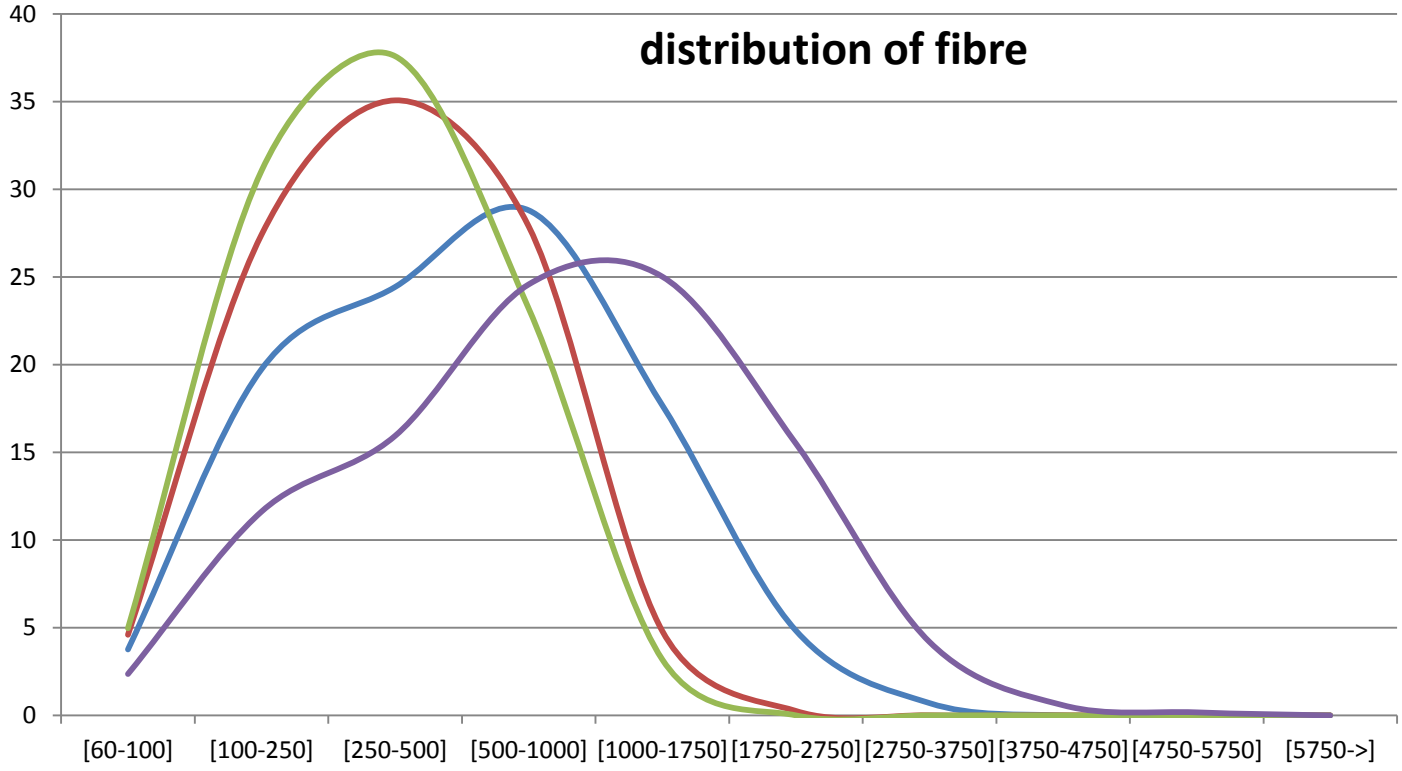
10 acquisitions with same sample

	mean length weighted fibre length (µm)
ACQUISITION 1	301
ACQUISITION 2	303
ACQUISITION 3	298
ACQUISITION 4	303
ACQUISITION 5	298
ACQUISITION 6	300
ACQUISITION 7	303
ACQUISITION 8	301
ACQUISITION 9	302
ACQUISITION 10	302
average	301
standard deviation	1,91
% error	0,63

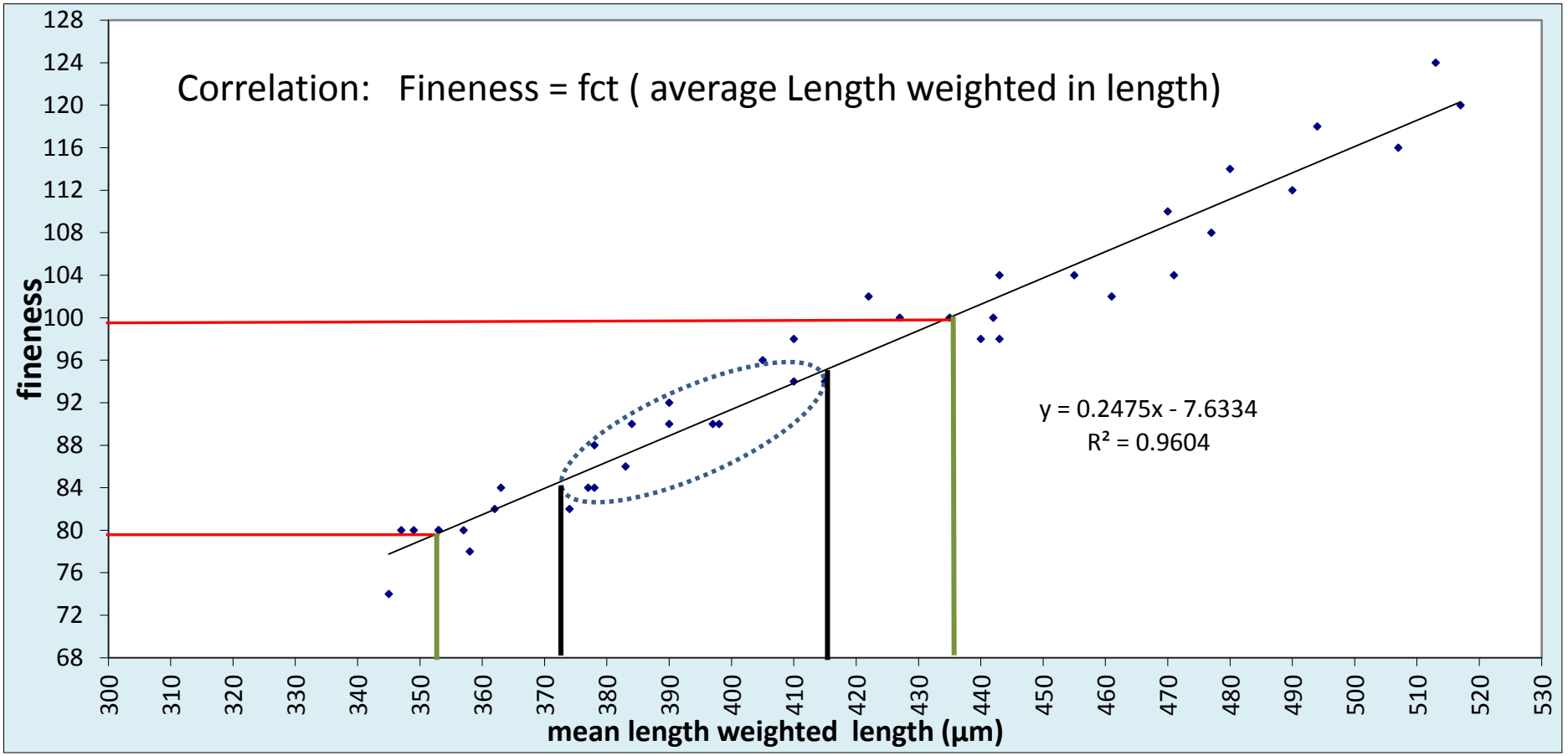
10 analysis with same NCE

	mean length weighted fibre length (µm)
ACQUISITION 1	370
ACQUISITION 2	379
ACQUISITION 3	380
ACQUISITION 4	381
ACQUISITION 5	371
ACQUISITION 6	386
ACQUISITION 7	376
ACQUISITION 8	376
ACQUISITION 9	374
ACQUISITION 10	376
average	376,9
standard deviation	4,79
% error	1,27

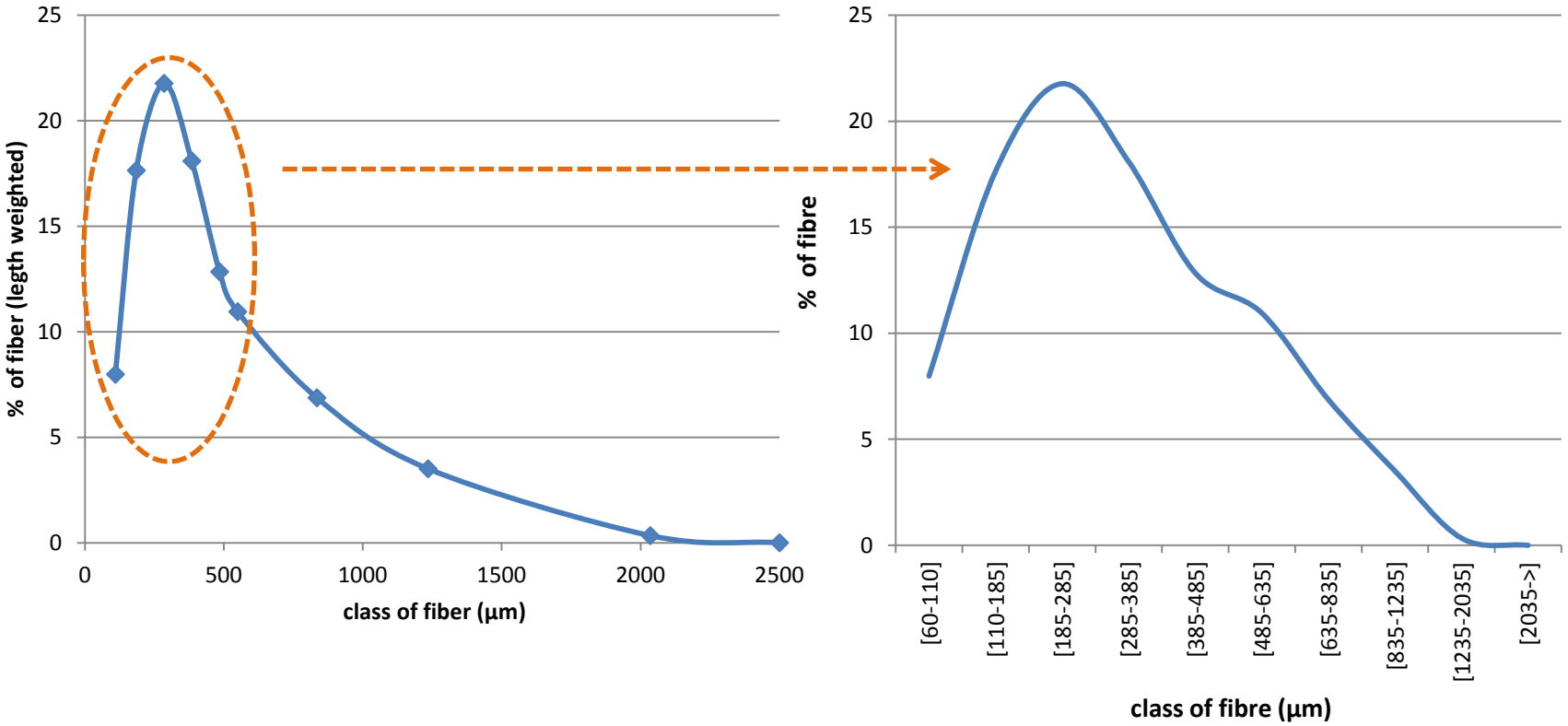
FIBRE LENGTH DISTRIBUTION



FIBRE LENGTH DISTRIBUTION

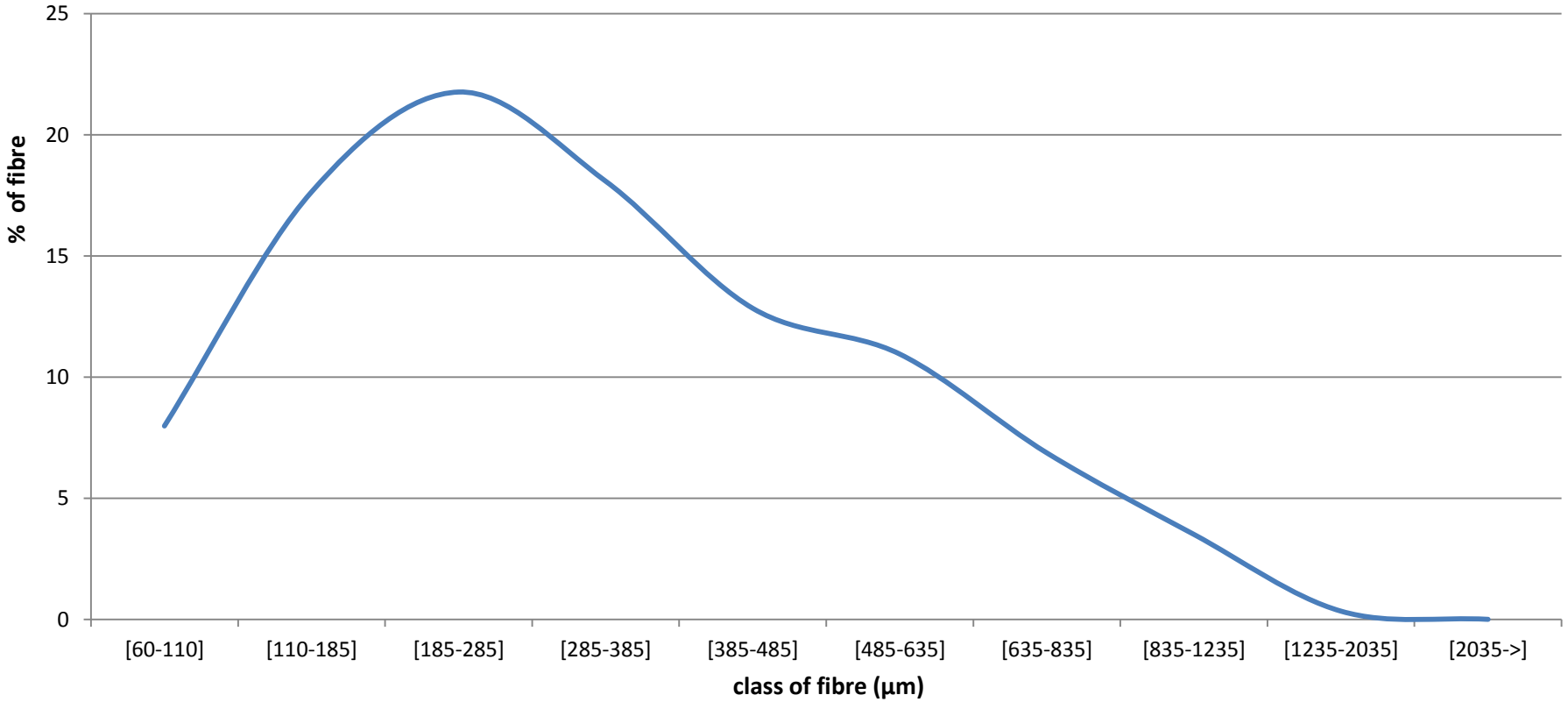


GRADE B : length weighted fibre length



FIBRE LENGTH DISTRIBUTION

GRADE B : length weighted fibre length



NEW WAY OF ANALYSIS FOR FINENESS

- GOOD CORRELATION BETWEEN FINENESS AND MEAN LENGTH WEIGHTED LENGTH

- GOOD REPEATABILTY OF THE ANALYSIS

- AT THE SAME TIME : INFORMATION FOR FINENESS AND SIZE LENGTH DISTRIBUTION WITH THE SAME ANALYSIS

- QUICK ANALYSIS: 5 MINUTES

- WE CAN BE OPTIMISTIC FOR FUTURE: THIS NEW METHOD COULD BE AN ALTERNATIVE FOR FINENESS …… **AND OTHER INFORMATION**

MANY THANKS FOR YOUR ATTENTION

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