

Nové možnosti rozvoje vzdělávání na Technické univerzitě v Liberci

Specifický cíl A2: Rozvoj v oblasti distanční výuky, online výuky a blended learning

NPO_TUL_MSMT-16598/2022



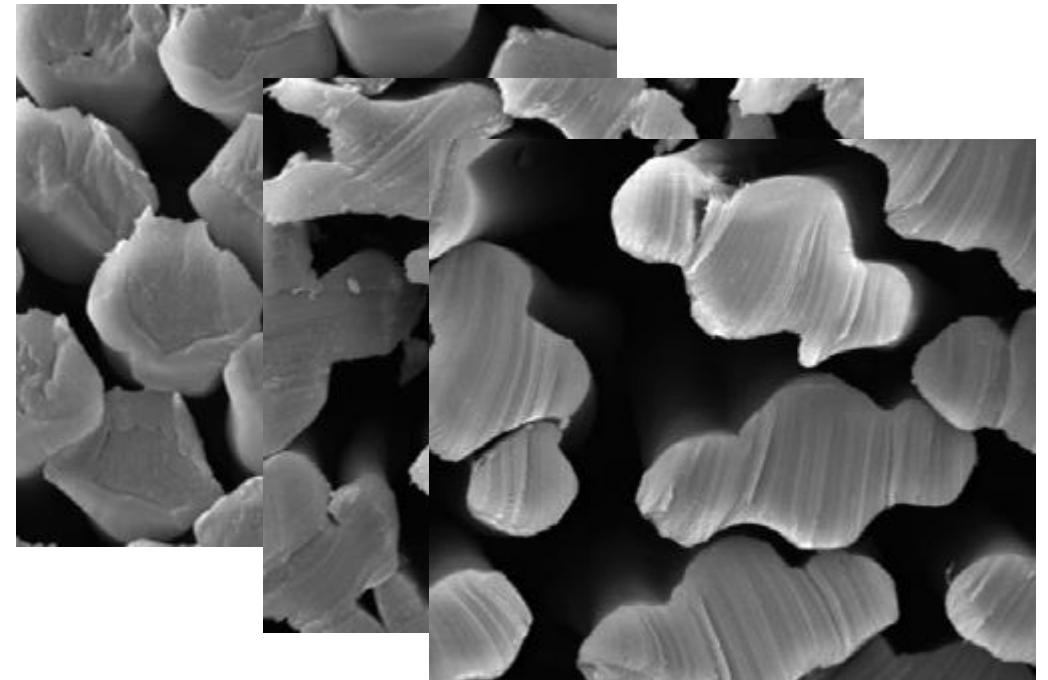
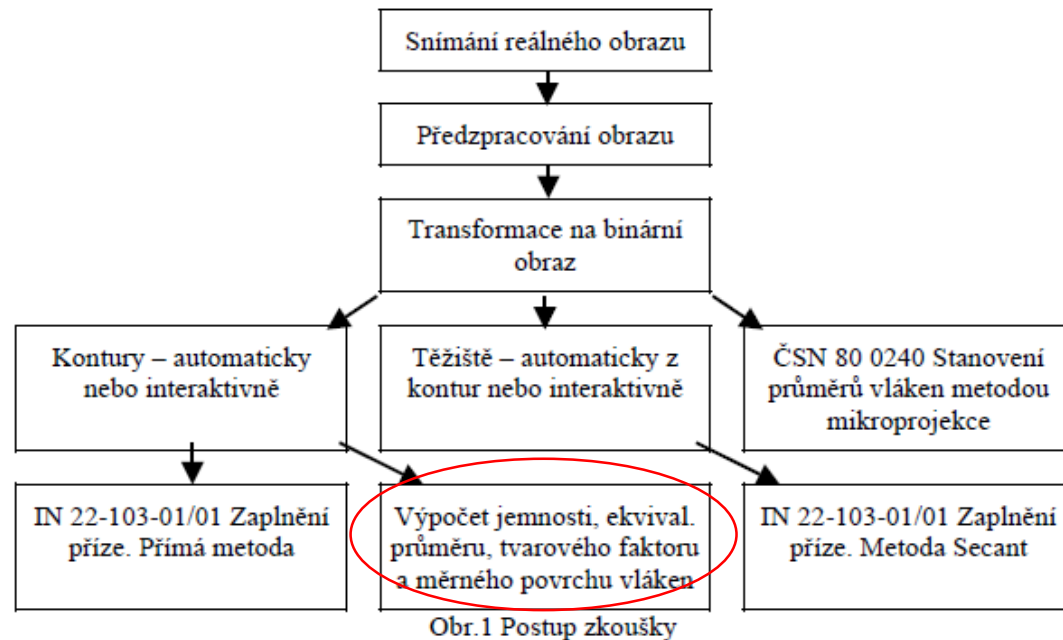
Fibres - determination of geometric parameters by image analysis

Ing. Bc Monika Vyšanská, PhD.



IS 21-108-01/01 Determination of geometric properties of fibres

- This internal standard specifies the procedure for obtaining primary (image) data from fibre slice images prepared according to IN 46-108-01/01. This procedure can be used to obtain contours of single fibre cuts, contours in a fibre bundle cut, yarn, flat fabric, etc. Fibre contours obtained from a bundle of parallel fibres are used according to this standard for further measurement and calculation of the geometric properties of the fibres.



For more see exercises...

Fibres - geometric parameters (see STR) [1]

$$t = s\rho$$

$$d = \sqrt{\frac{4s}{\pi}} = \sqrt{\frac{4t}{\pi\rho}}$$

$$q = \frac{p}{\pi d} - 1 \geq 0$$

$$p = \pi d(1 + q)$$

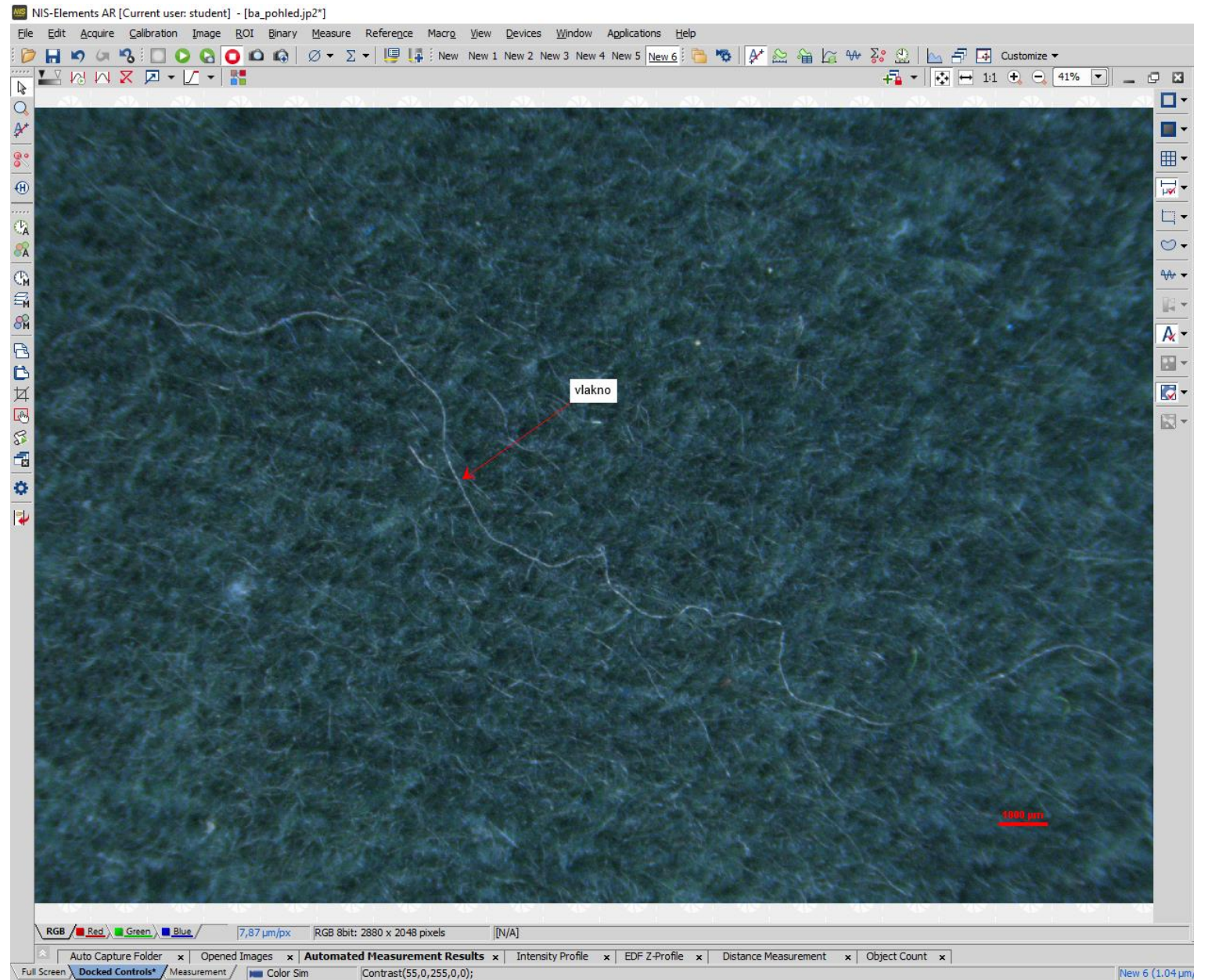
$$a = \frac{4(1 + q)}{\rho d}$$

archness

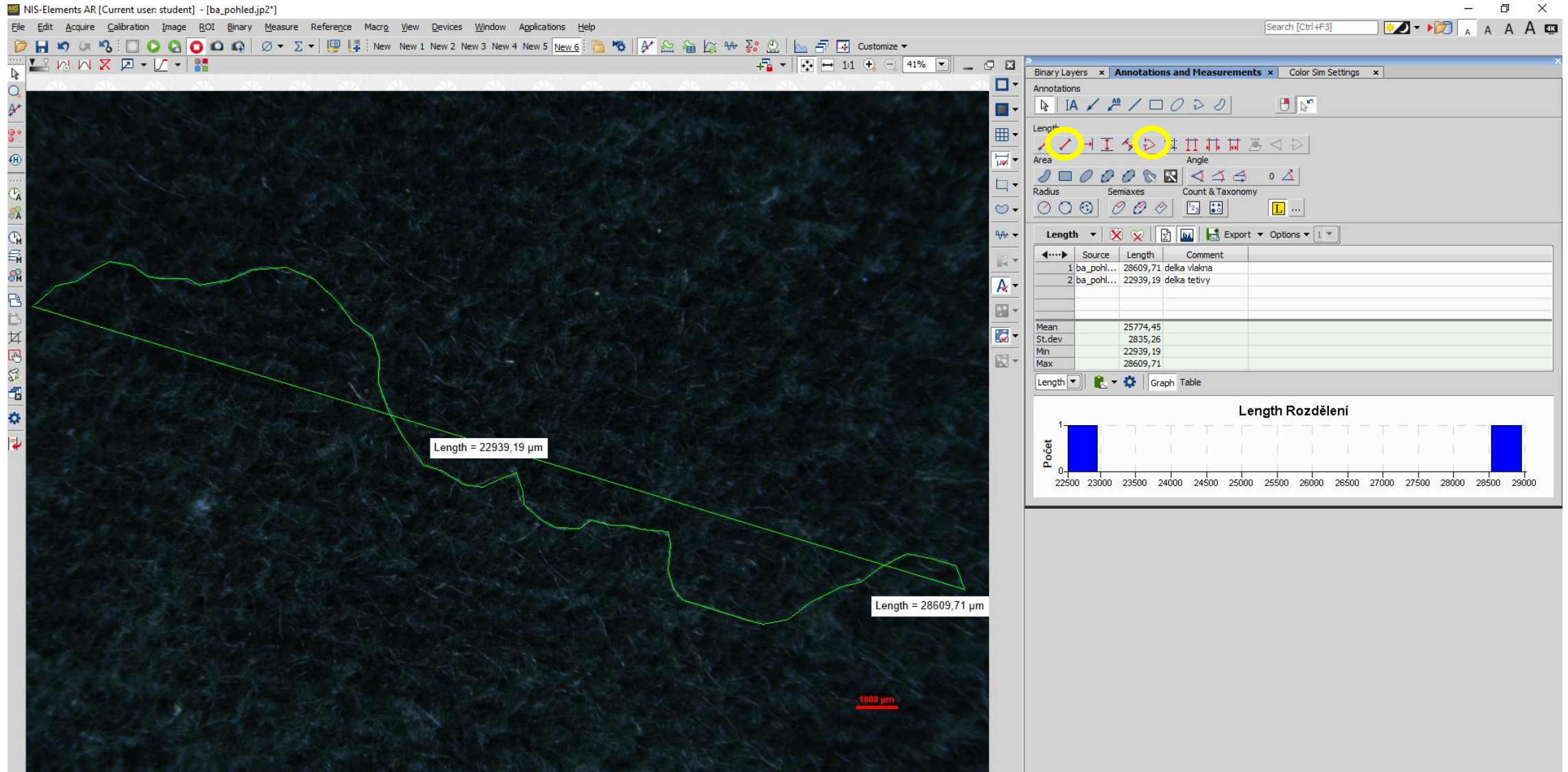
slimness

Feret diameter - maximum, minimum

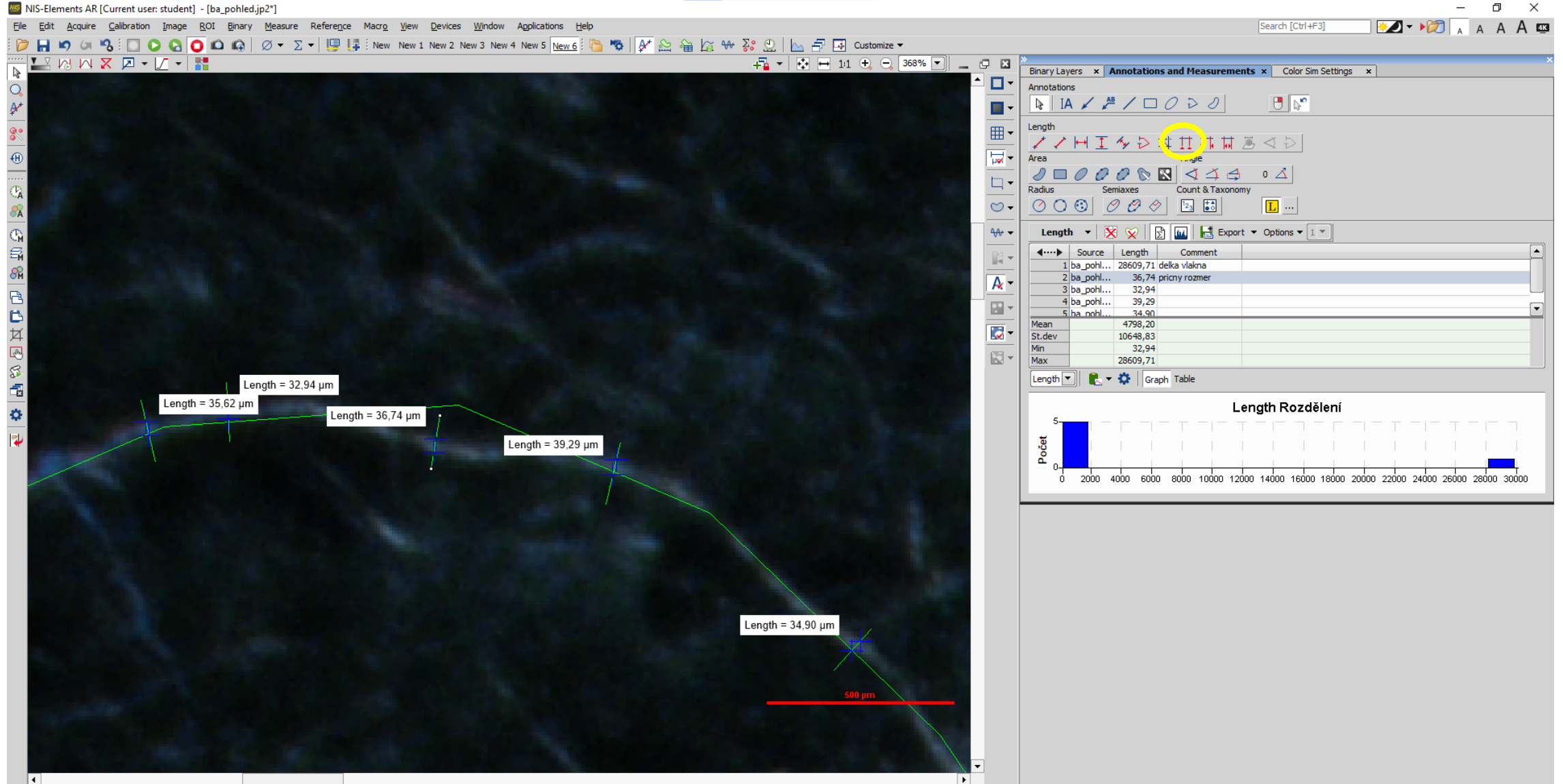
Fibres - longitudinal view - geometric parameters



Fibres - longitudinal view - geometric parameters (archiness)



Fibres - longitudinal view - geometric parameters (slimness)



Fibres - closer to the parameters of the fibre cross-section shape [2]

- Tvarový faktor q – viz předchozí slide $q = \frac{p}{\pi d_e} - 1$
- Cirkularita $c = \frac{s}{s_e}$

Vztah mezi jednotlivými parametry:

$$q = \frac{1}{\sqrt{c}} - 1$$

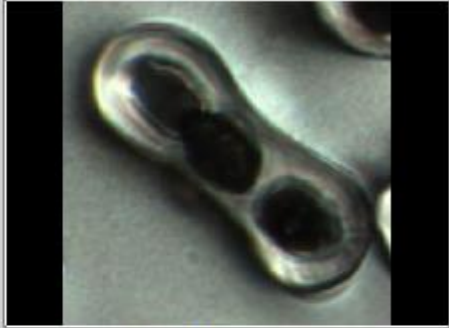
Fibres - closer to the parameters of the fibre cross-section shape [2]

Fibre cross-section shape	q [1]	c [1]
Circle - ideal	0	1
Circle - real	0 – 0,07	1 – 0,97
Triangle - ideal	0,29	0,88
Triangle - real	0,09 – 0,12	0,96 – 0,94
Cotton - mature	0,20 – 0,35	0,91 – 0,86
Irregular cross section	> 0,60	< 0,79

Determination of geometric parameters - image analysis

Oblast hledání: Použít aktuální kalibraci

Název	Datum změny
01_1dut_pes	19.02.2008 17:01
02_3hve_pes	19.02.2008 17:02
03_4dutin_pes	19.02.2008 16:48
04_ba	19.02.2008 16:49
05_kn	19.02.2008 16:50
06_kralik	19.02.2008 16:51
07_kruh_pes	19.02.2008 16:52
08_ln	19.02.2008 16:52
09_ph	19.02.2008 16:54
10_pis_pan	19.02.2008 16:54
11_srd_pan	19.02.2008 16:55
12_velbloud	19.02.2008 16:56
13_vltu_pesik	19.02.2008 16:57
14_vs_lesk	19.02.2008 16:58



Rozměry: 253×248
Typ: RGB, 8 bpc
ND: N/A
Velikost: 96 kB

Název souboru:
Soubory typu:

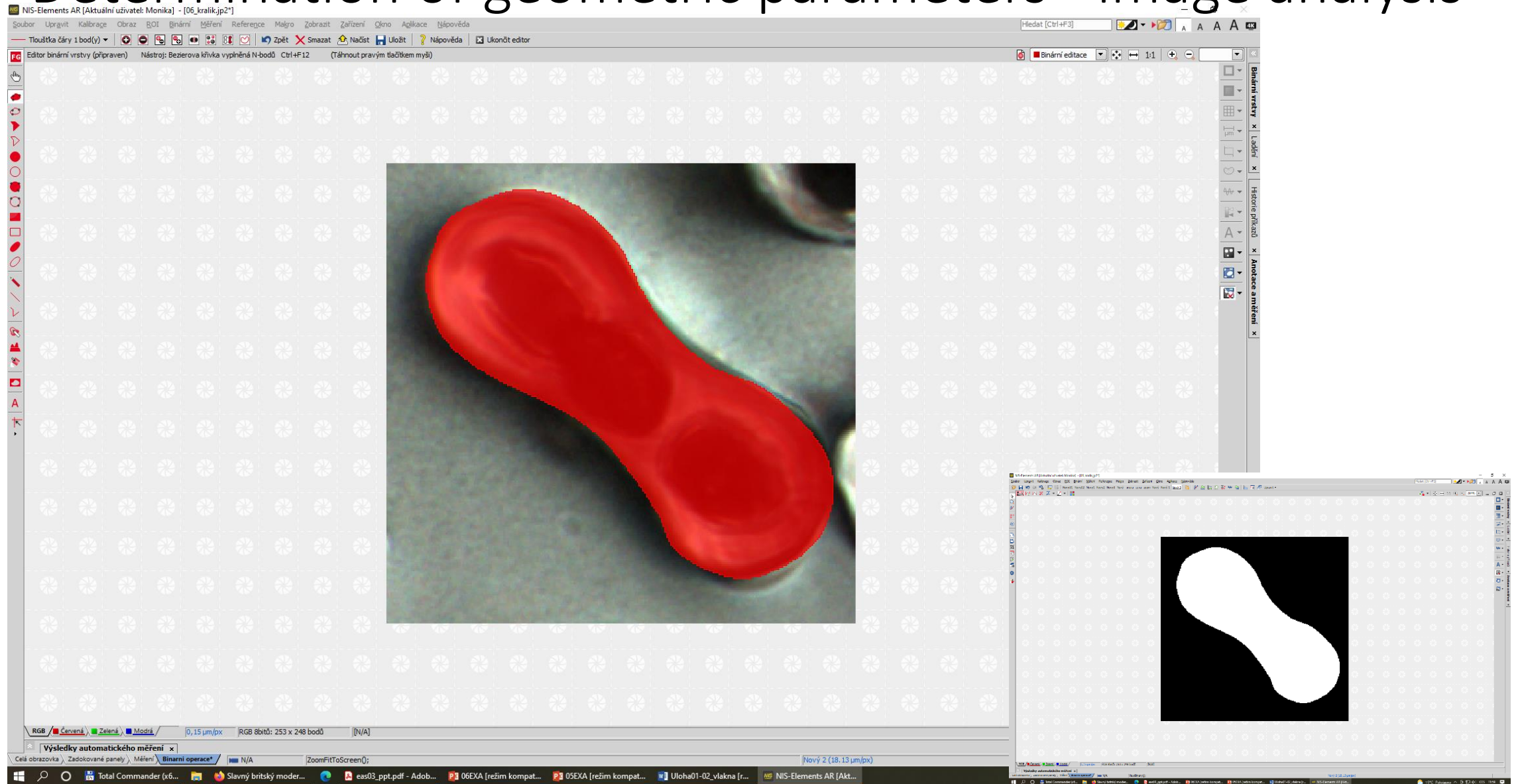
Determination of geometric parameters - image analysis



Determination of geometric parameters - image analysis



Determination of geometric parameters - image analysis

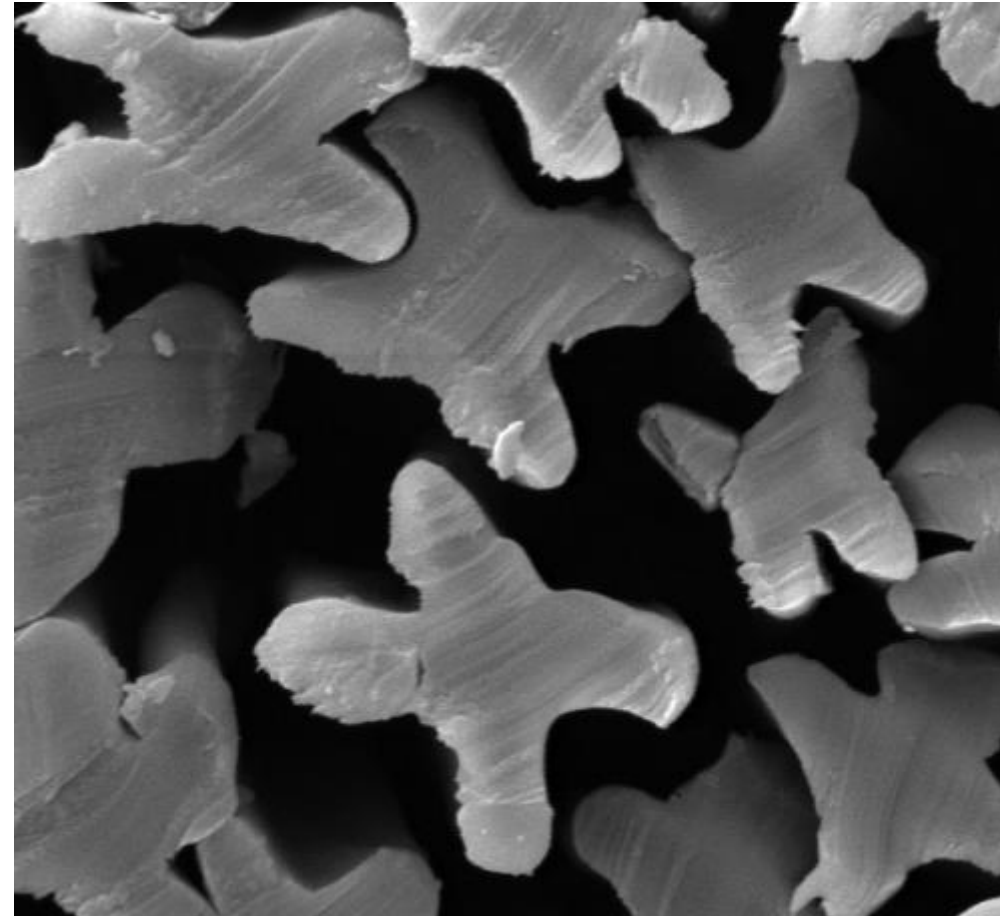
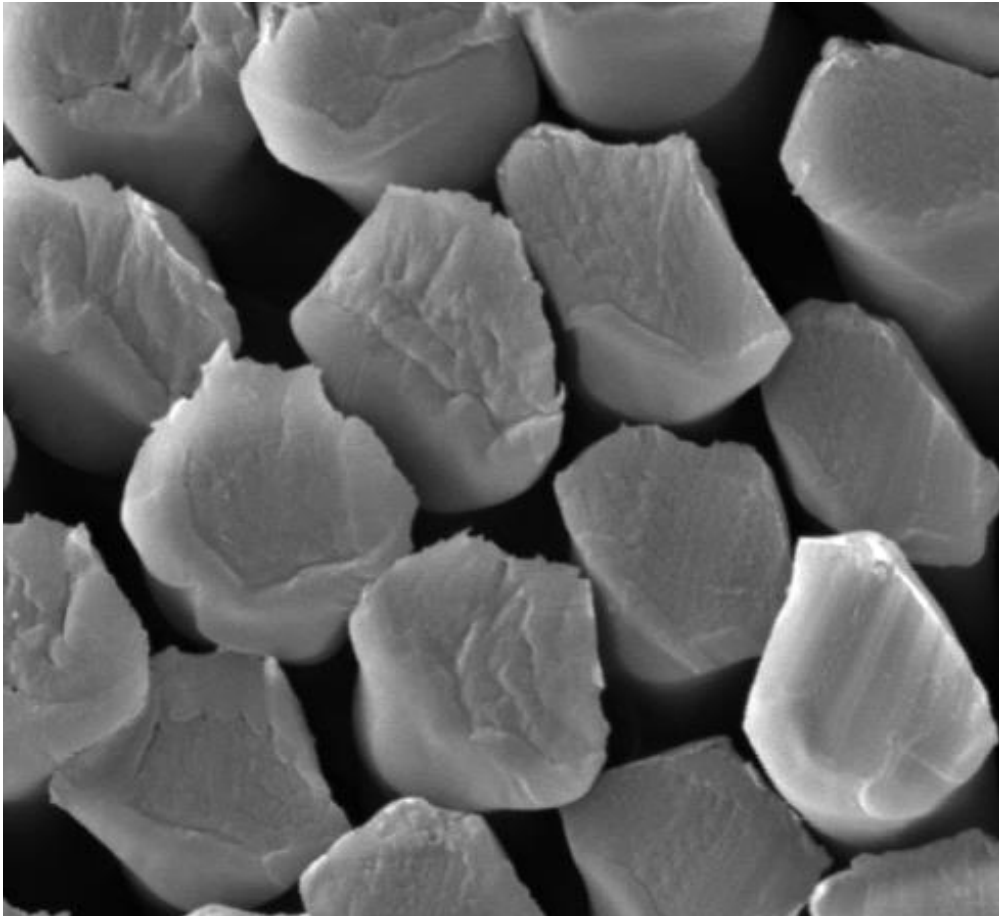


Determination of geometric parameters - image analysis

The screenshot displays the NIS-Elements AR software interface. A dialog box titled "Vybrat veličiny pro měření objektů" (Select measurement parameters for objects) is open, showing a list of available parameters and a list of selected parameters. The selected parameters include "Vyplněná plocha" (Filled area), "Ekv. průměr" (Equivalent diameter), "Obvod" (Perimeter), "Max. průmět" (Max. projection), "Min. průmět" (Min. projection), and "Kruhovitost" (Circularity). The dialog box also includes checkboxes for "Změřit všechny kanály" (Measure all channels) and "Náhledy pro katalog objektů" (Thumbnails for object catalog), and a section for "Automaticky vybrané veličiny" (Automatically selected parameters).

The main window shows a grayscale image of a biological specimen with a red segmented region. The software interface includes a menu bar, a toolbar, and a status bar at the bottom. The status bar displays "RGB / Červená, Zelená, Modrá / 0,15 μm/px RGB 8bitů: 253 x 248 bodů [N/A]". The Windows taskbar at the bottom shows the system tray with the date and time "CES 14:19".

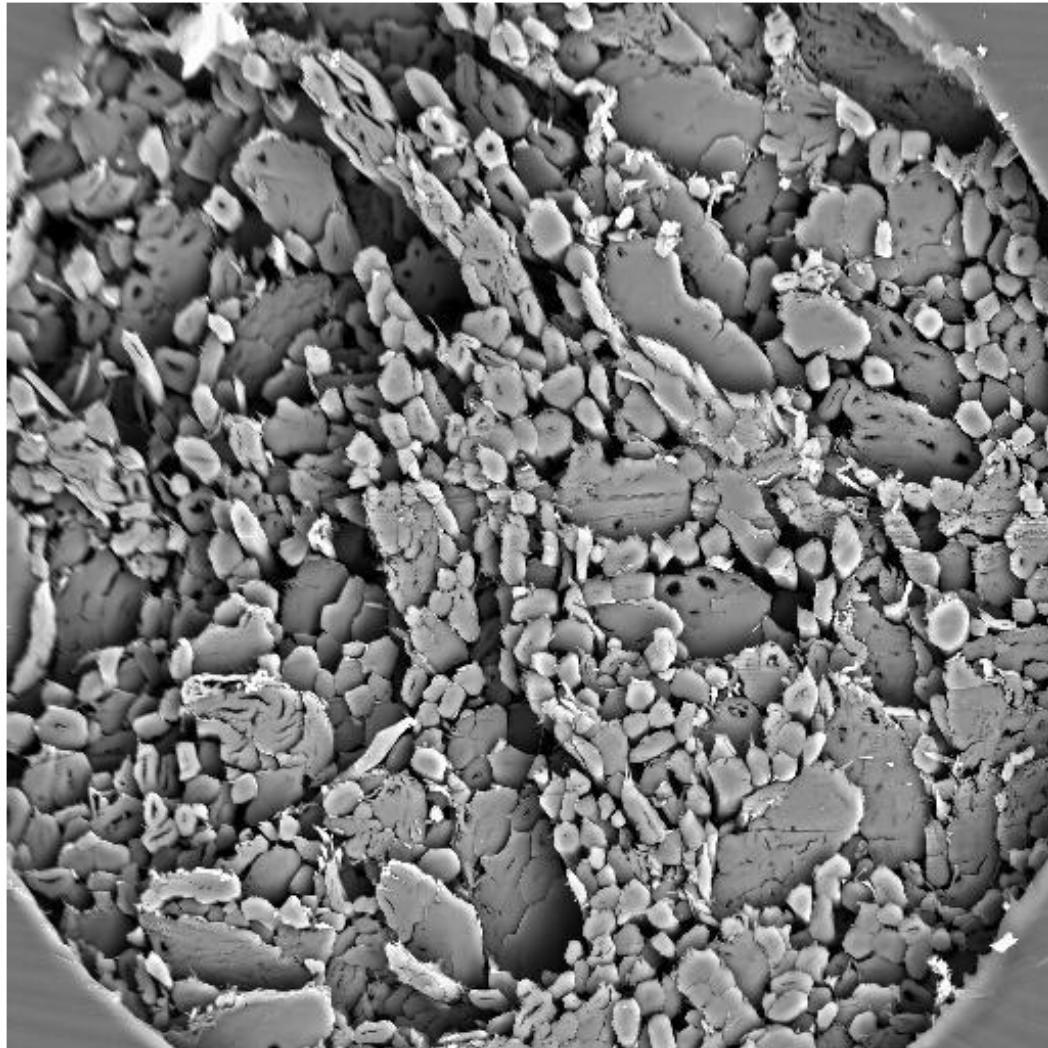
Experiment I - different PET fibres B (circular cross section), E (cross section)



Experiment I - different PET fibres B (circular cross section), E (cross section)

Type of PET fibre	Fineness [tex]	Equivalent diameter [μm]	Shape factor [-]	Specific surface area [m^2/kg]
B	0,191 <0,188; 0,194>	13,3 <13,2; 13,4>	0,016 <0,013; 0,019>	223 <222; 225>
E	0,276 <0,270; 0,282>	15,8 <15,6; 15,9>	0,412 <0,403; 0,421>	263 <259; 266>

Experiment II - bast fibres before and after cottonization (SEM)

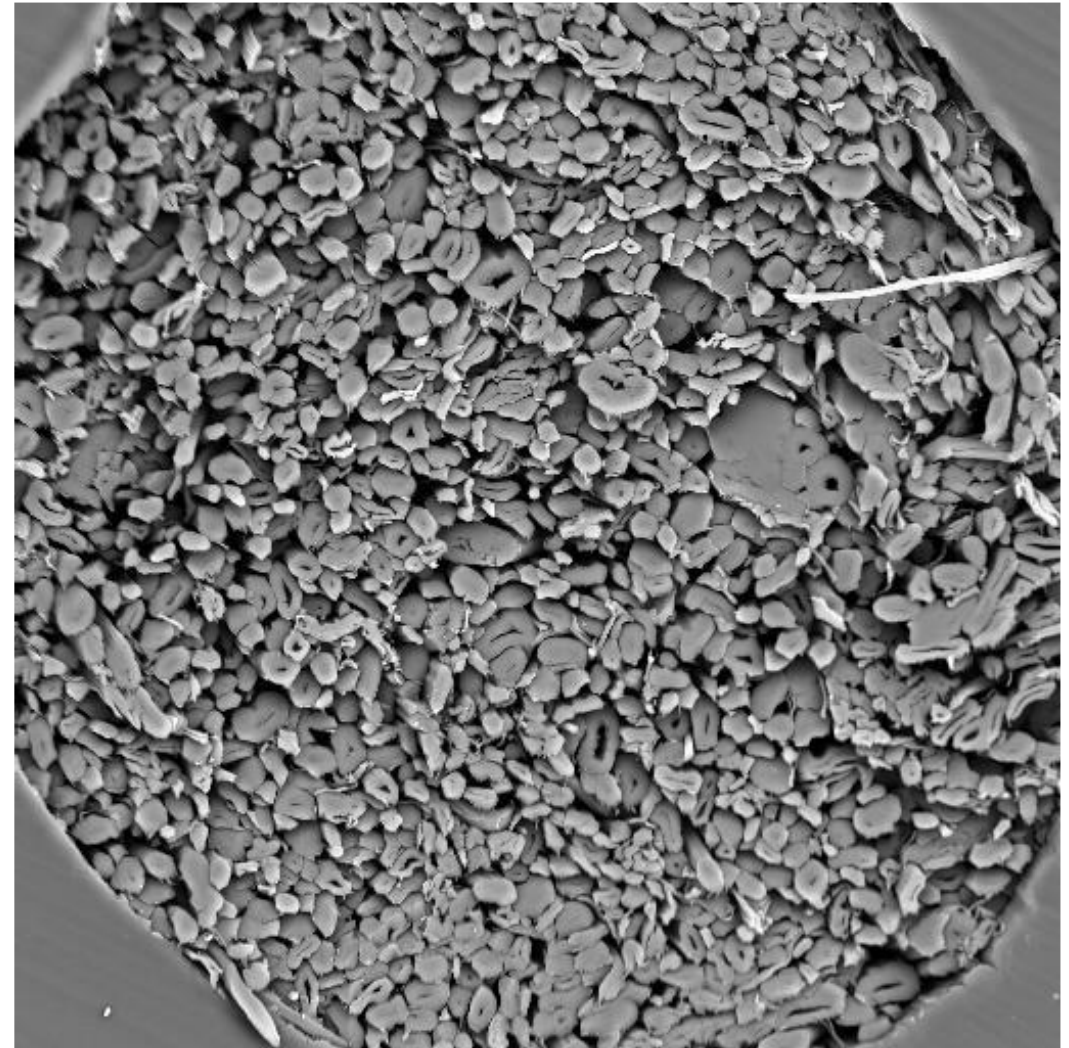


SEM MAG: 180 x
HV: 30.0 kV

DET: BE Detector
DATE: 06/25/02

200 µm

Vega ©Tescan
TU Liberec



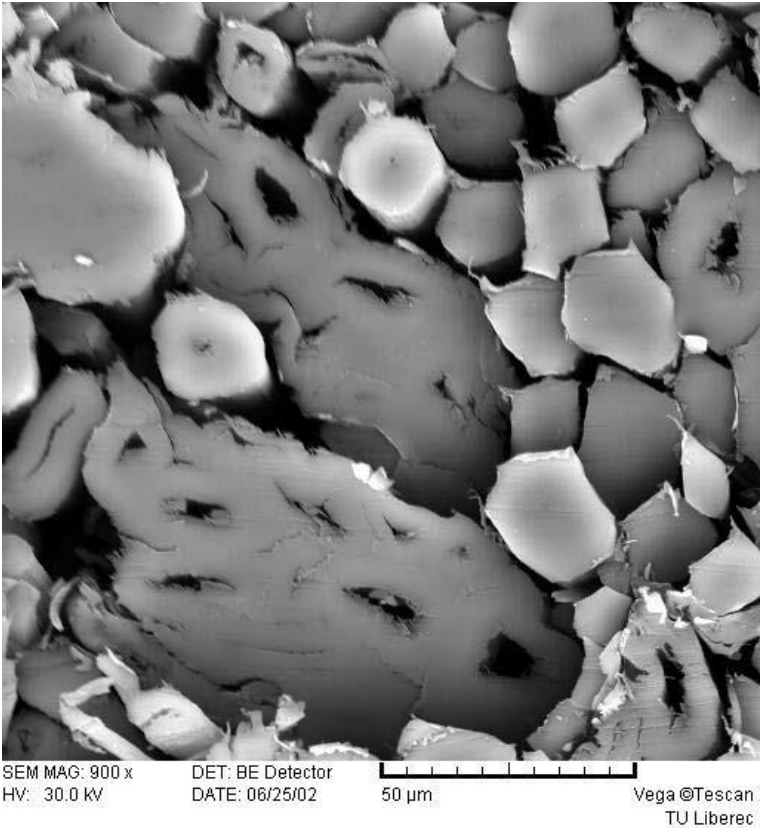
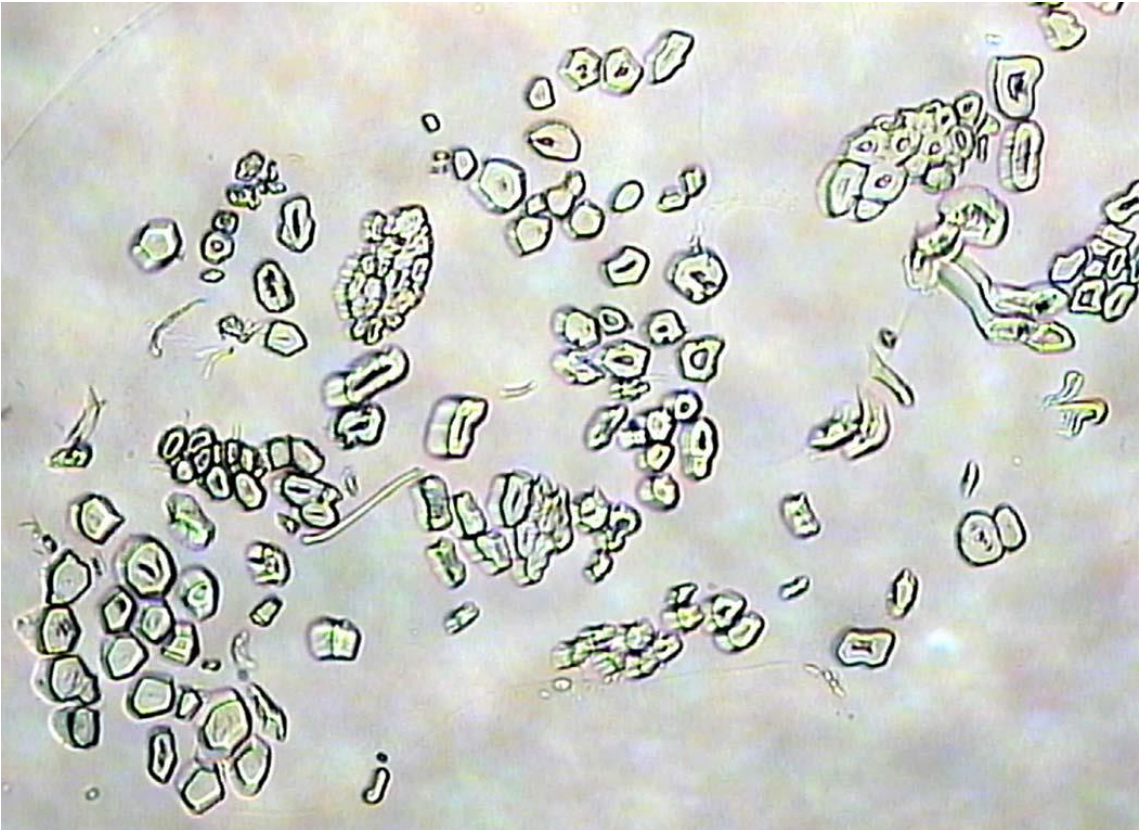
SEM MAG: 180 x
HV: 30.0 kV

DET: BE Detector
DATE: 06/25/02

200 µm

Vega ©Tescan
TU Liberec

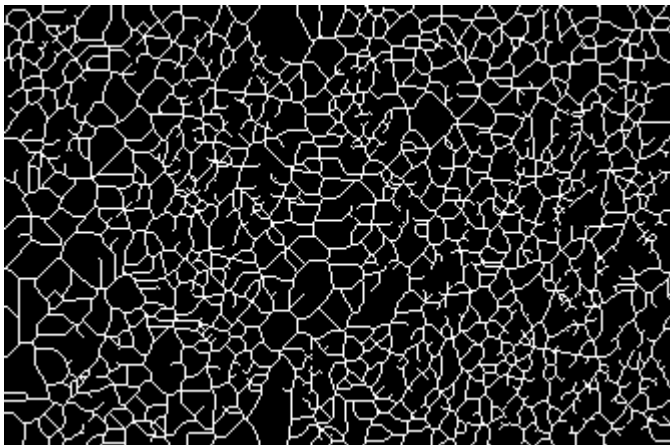
Experiment II - bast fibres before and after cottonization (SEM)



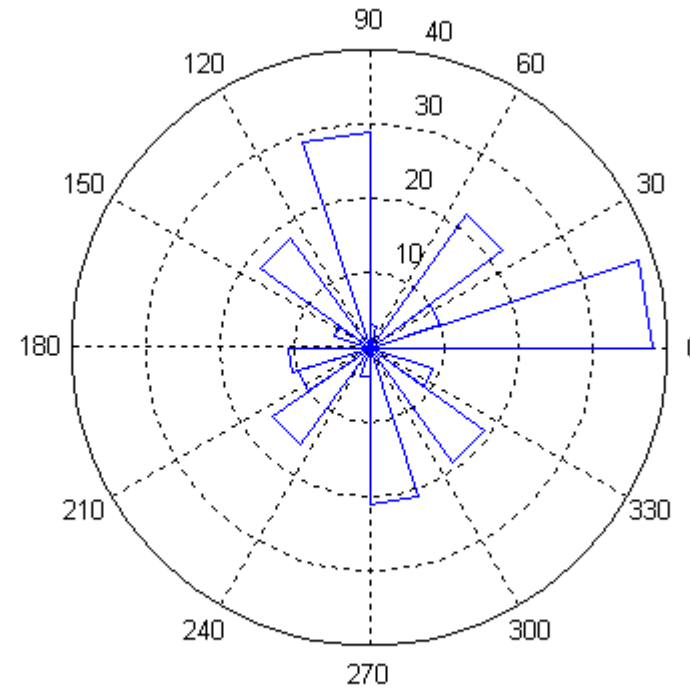
Experiment III - Directional arrangement of fibres in nonwovens



Original image - light microscope - transmitted light

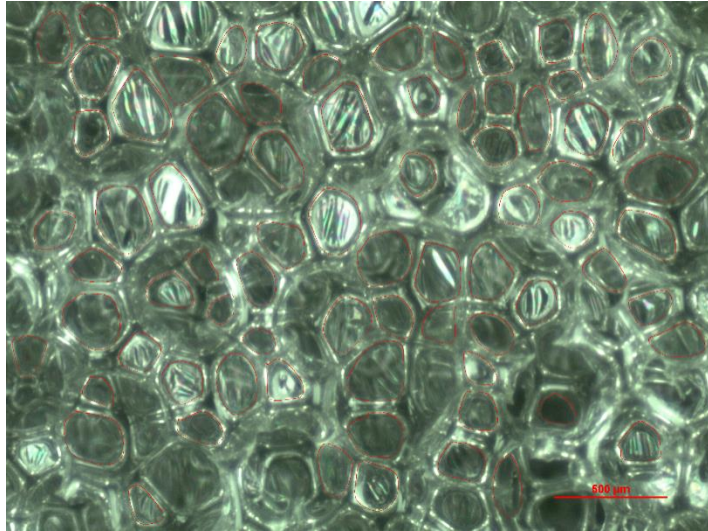


Modified binary image by skeletonization

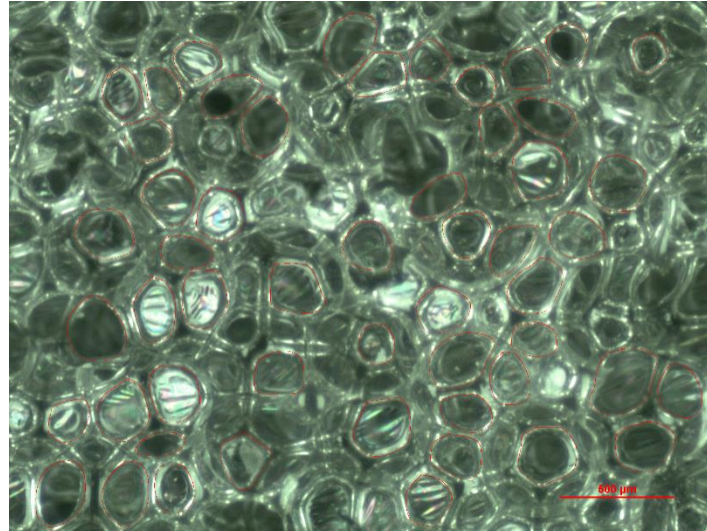


Example of evaluation of the directional distribution of nanofibres

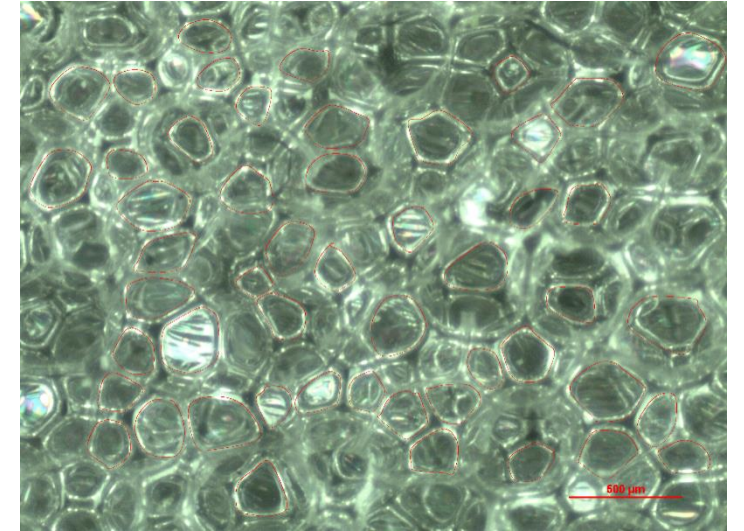
Experiment IV - pore size analysis in polyurethane foam



vz NOK_111



vz NOK_112



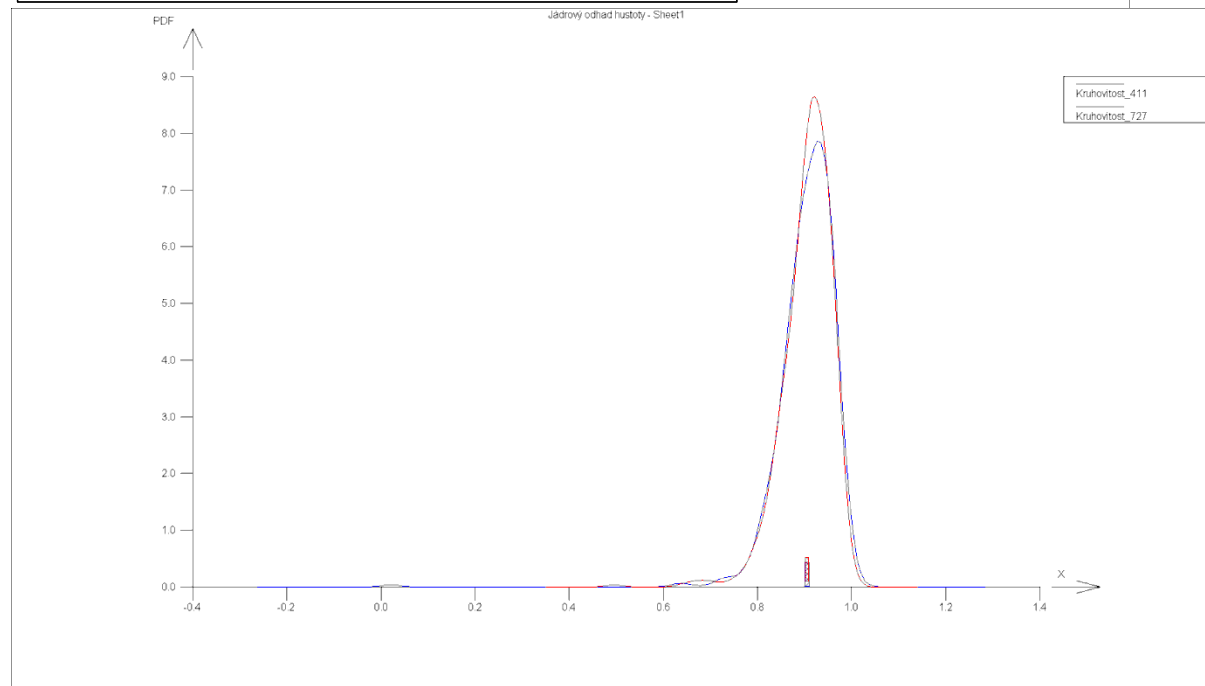
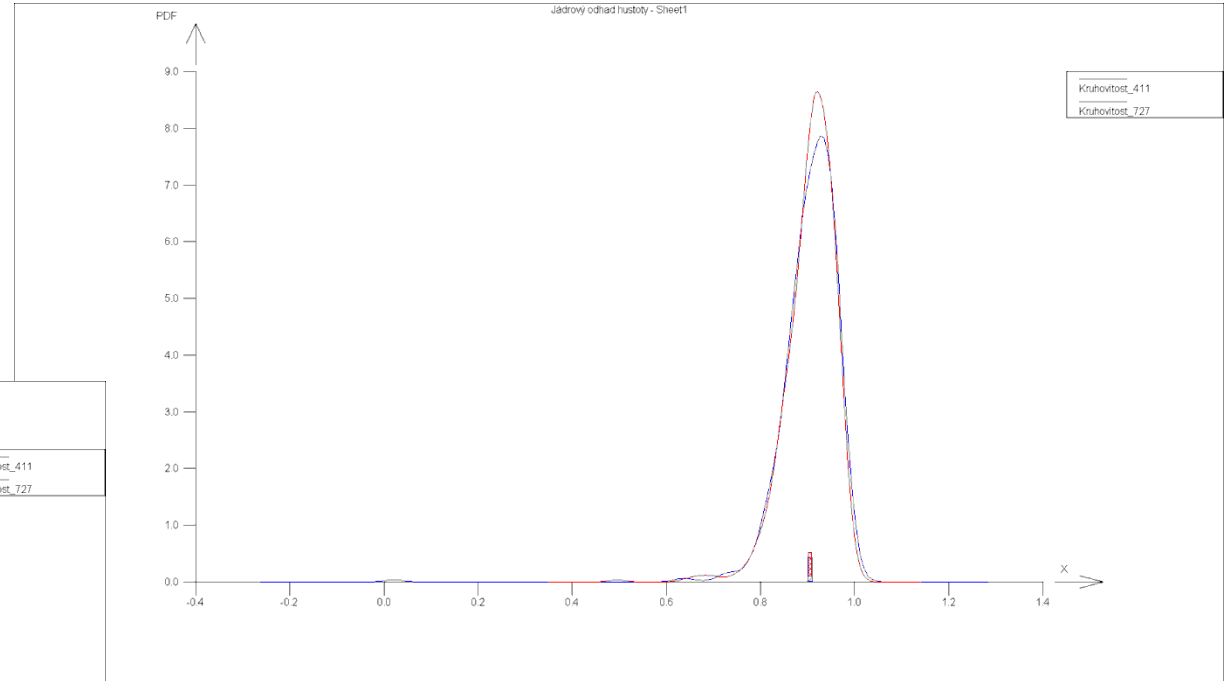
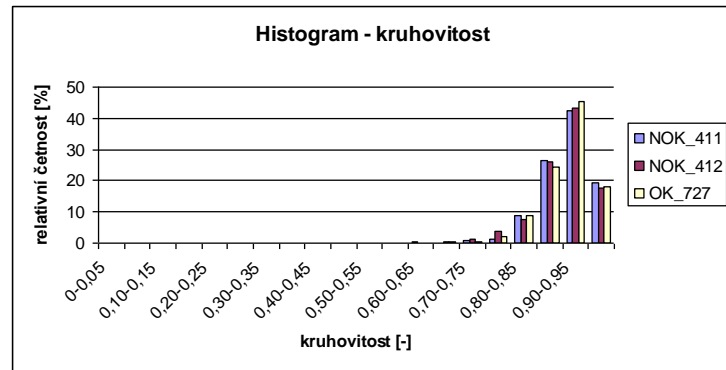
vz OK_727

Rated parameters:

- pore cross-sectional area [mm²]
- equivalent pore diameter [mm]
- maximum projection [mm]
- minimum projection [mm]
- circularity [-]

In all observed cases except for circularity, the means are statistically different at the specified significance level (0.05), see below...

Experiment IV - pore size analysis in polyurethane foam



In all observed cases except circularity, the means are statistically different at the specified significance level (0.05).

References used:

1. Bohuslav Neckář: VLÁKNA A VLÁKENNÉ ÚTVARY 1, TU Liberec, KTT, power point prezentace pro předmět STR
2. Křemenáková, D.: Interní norma č. 11-108-01/01 Definice. Geometrické vlastnosti vláken, Liberec, 2002
3. Křemenáková, D.: Přednášky předmětu EAS, Liberec, TUL, 2004