



NanoEye

Program za semi-avtomatično analizo slik

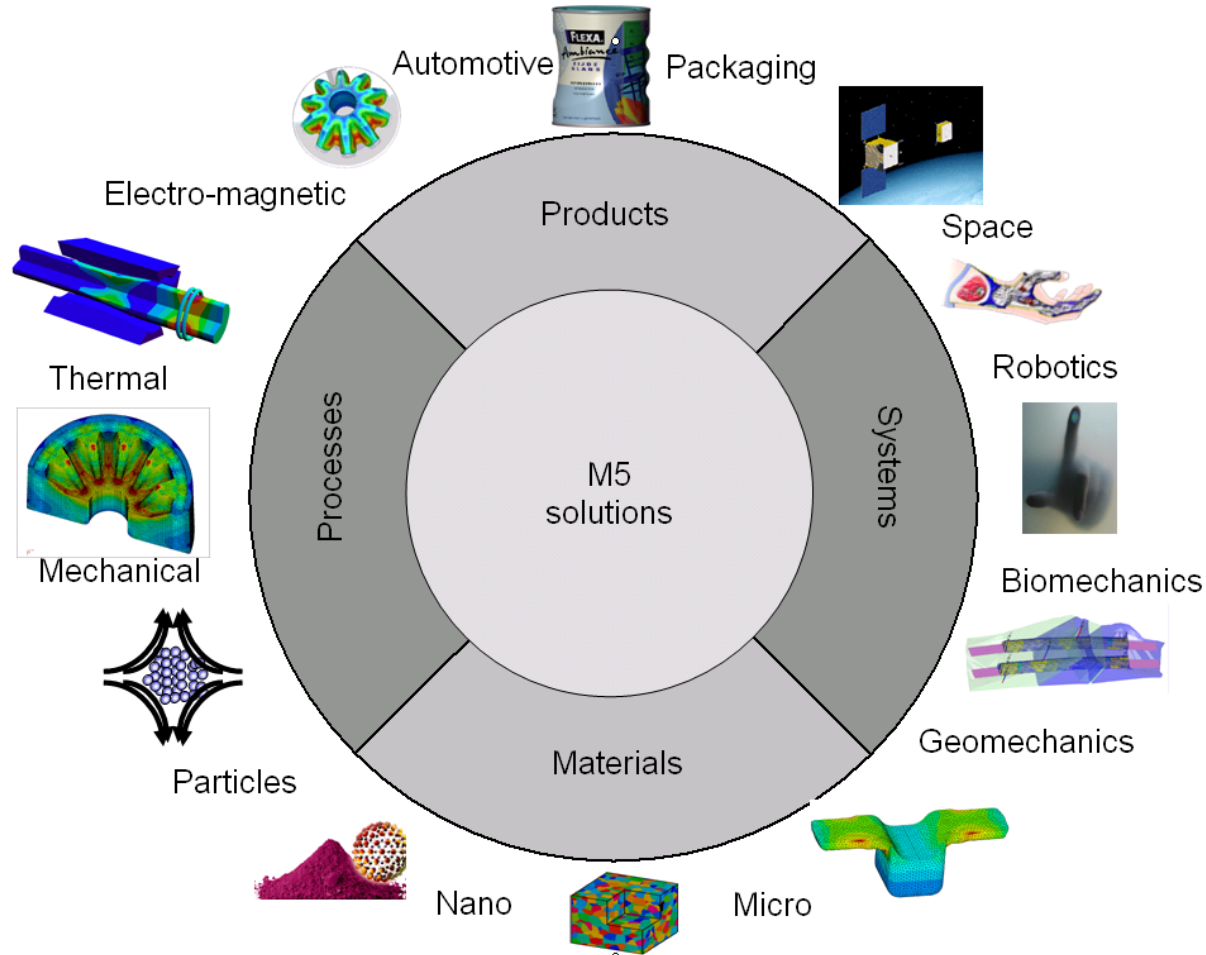
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Maribor, 22.3.2017

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**Centre for Computational Continuum Mechanics
Ljubljana, Slovenia**



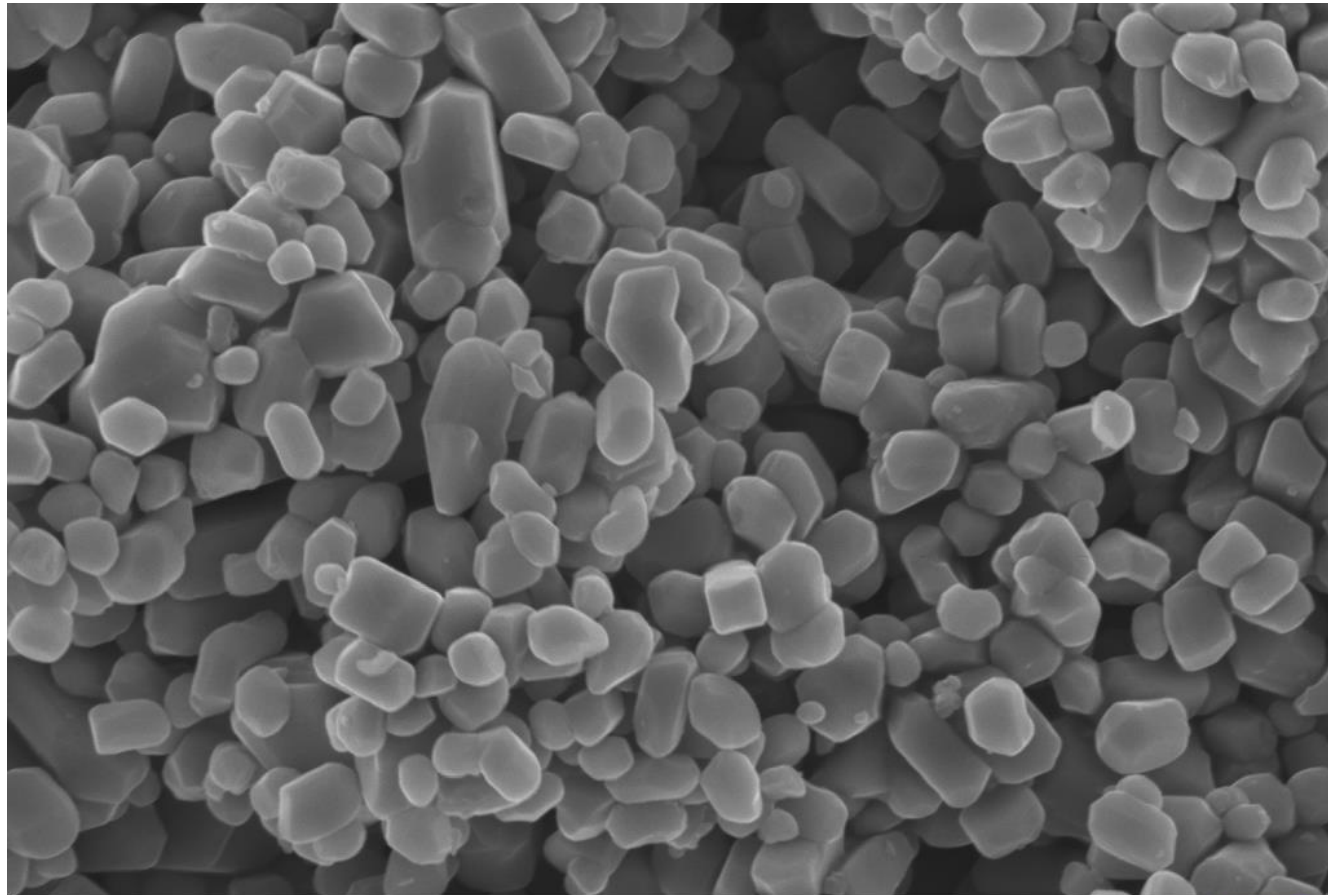
M5: Multi-field, Multi-scale, Multi-body, Multi-phase, Multi-objective

TiO₂ – nano pigment

- Najbolj prodajan beli pigment
- Kvaliteto določa ozkost porazdelitve velikosti delcev
- Majhni delci (~200 nm)
- Trenutno so v uporabi indirektne metode
- Časovna zahtevnost (priprava vzorcev, sedimentacija)
- Indirektne metode lahko privedejo do napačnih rezultatov



TiO₂ in SEM v Cinkarni Celje



300 nm

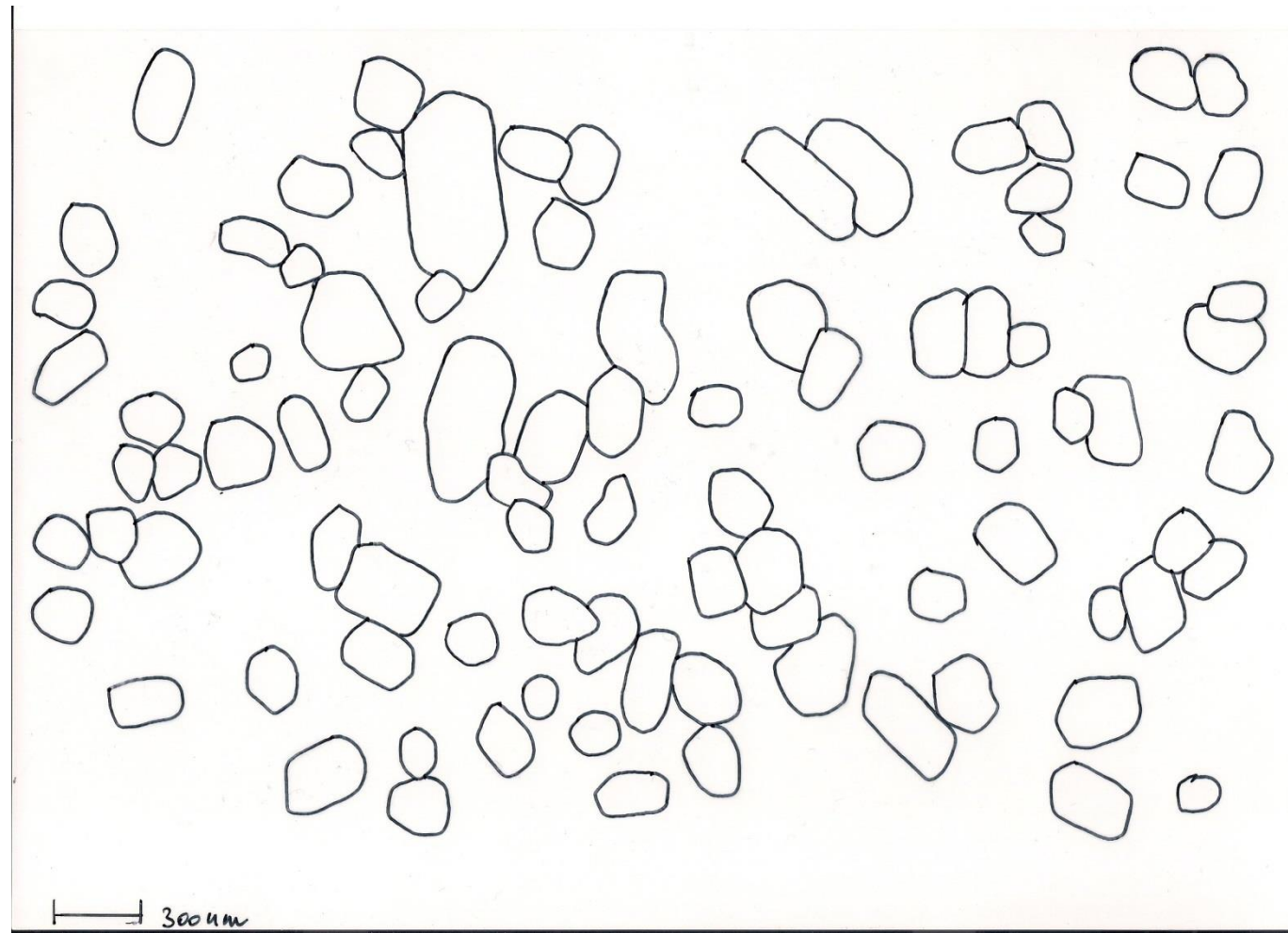

EHT = 5.00 kV
WD = 2.9 mm

Signal A = InLens
Mag = 70.00 K X

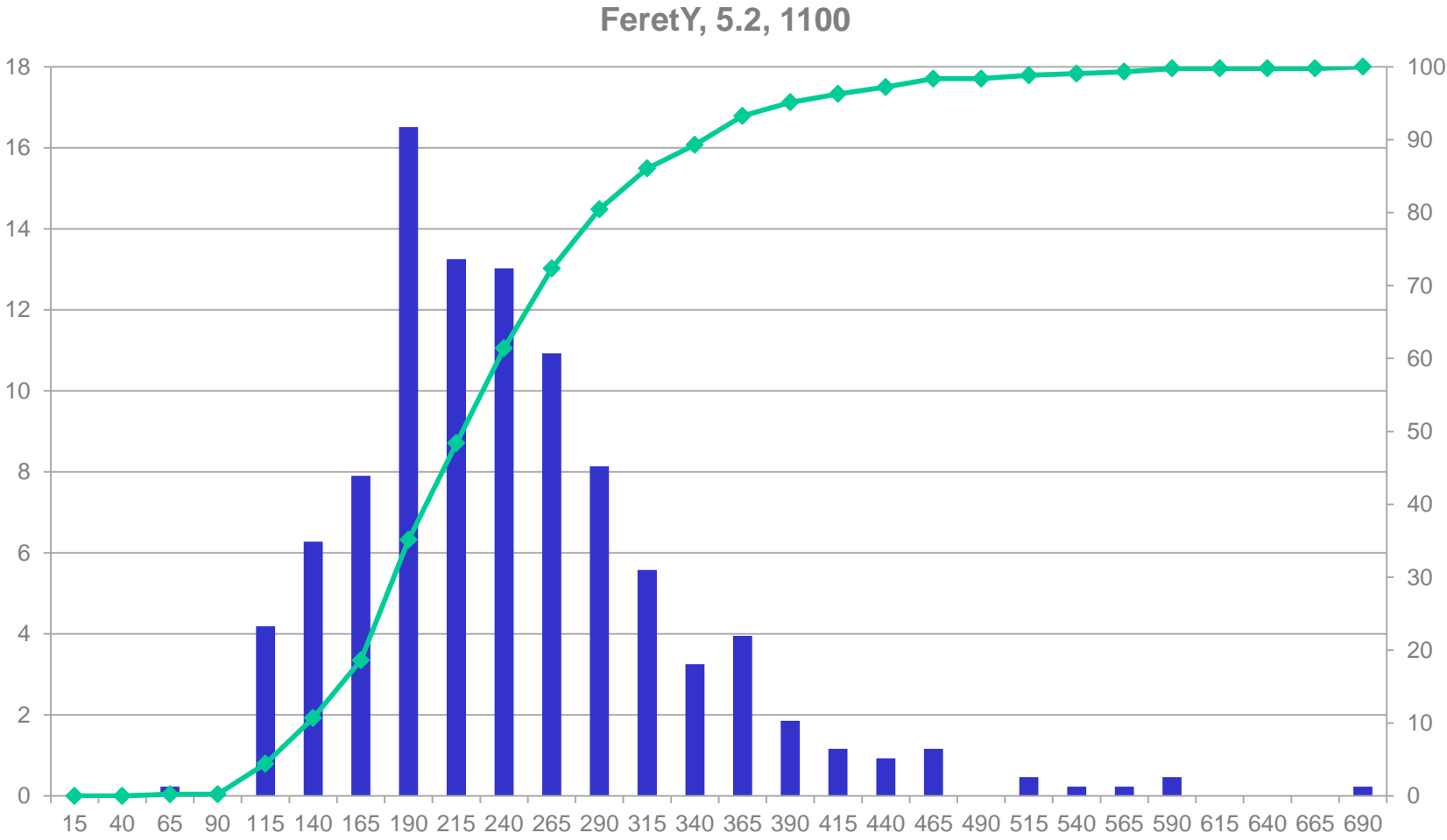
Sample ID = Izhod, 5.2.2013
Date :12 Feb 2013



TiO₂ in SEM v Cinkarni Celje



TiO₂ in SEM v Cinkarni Celje

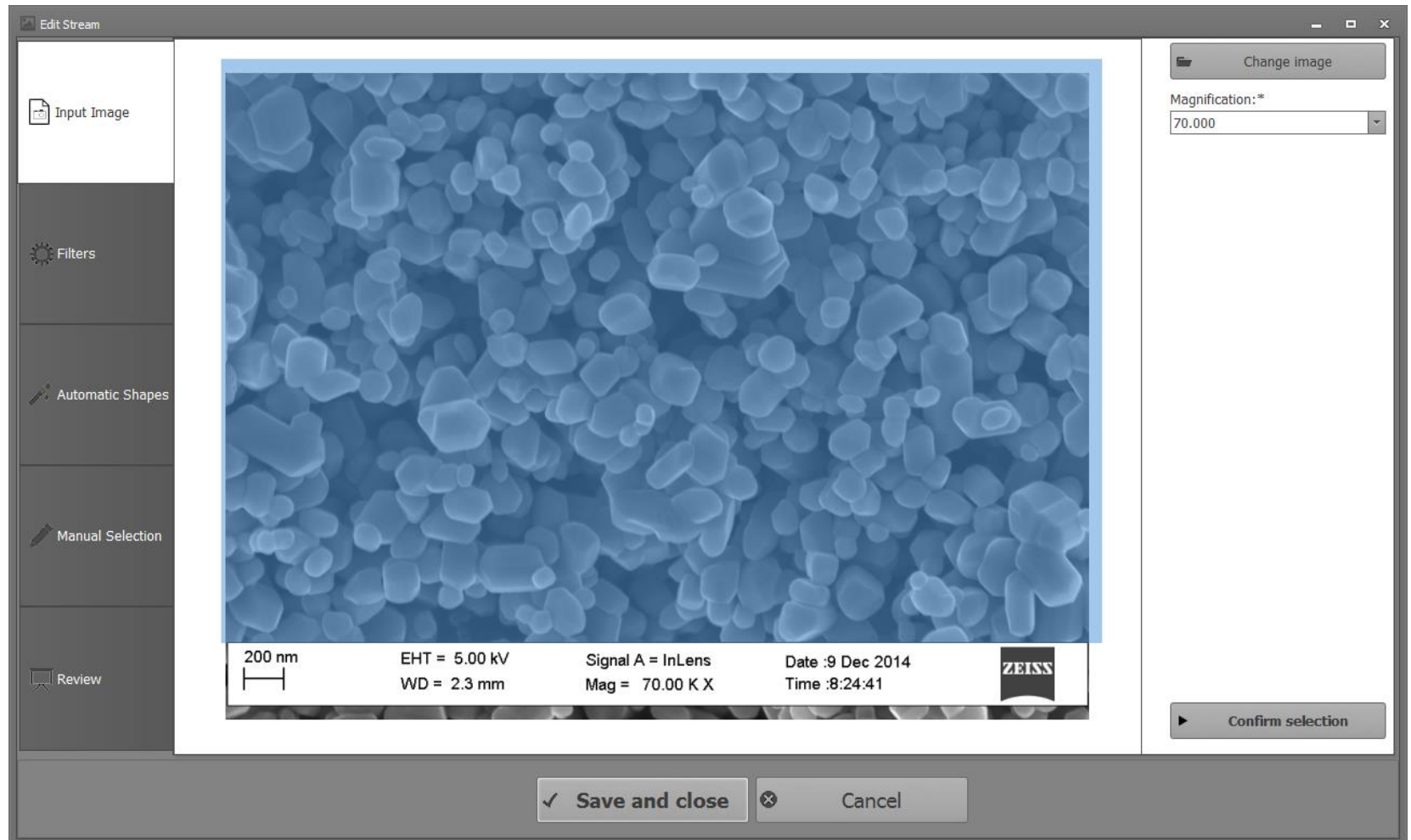


Avtomatizacija obdelave slik

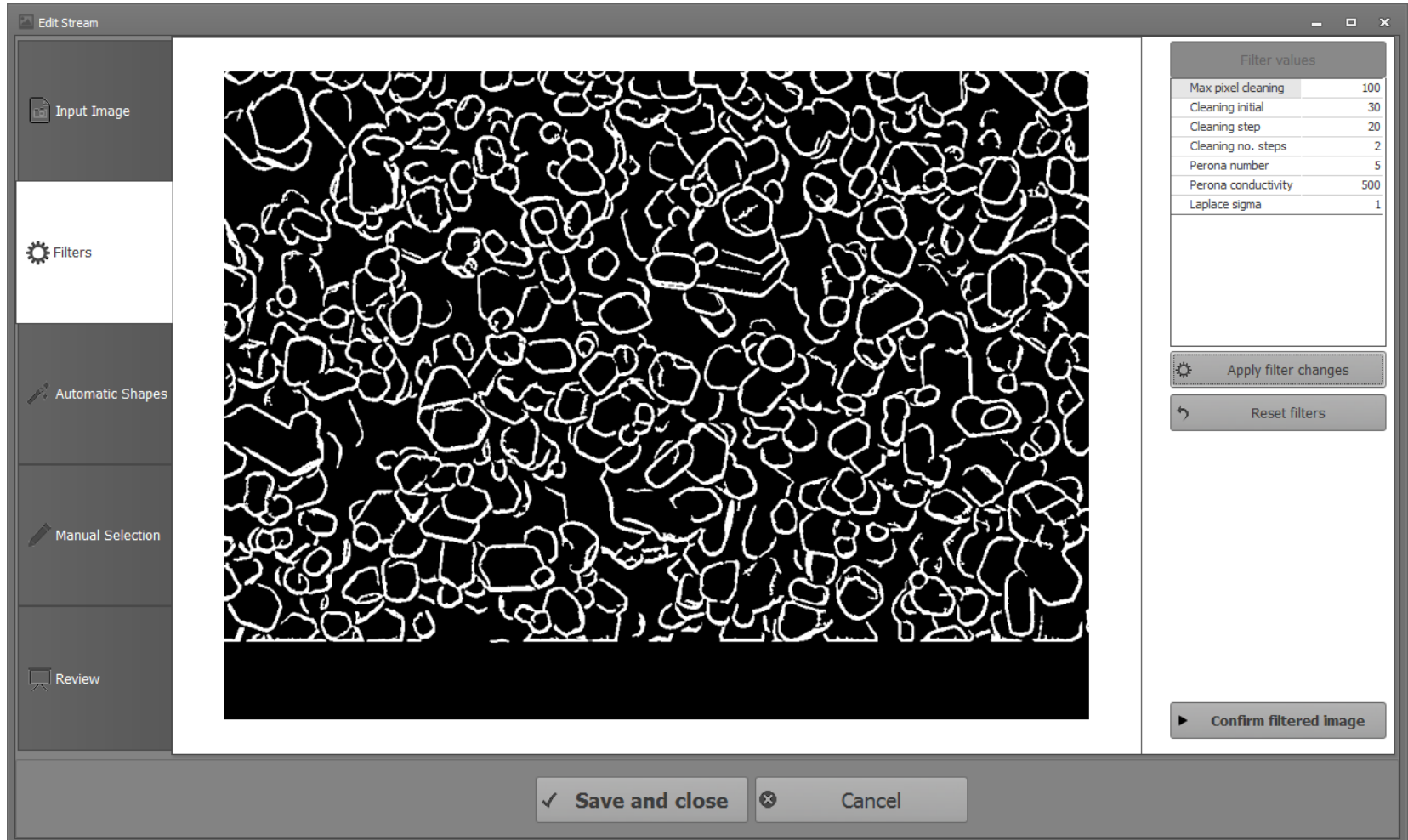
- Priprava SEM slike za avtomatično prepoznavo oblik
- Namensko razvit filter binarizira robove delcev
- Algoritem za prepoznavo oblik mora biti dovolj robusten da premosti nepovezane dele roba delca

- Uporabnik z ročnim posegom lahko spremeni izbiro delcev
- PDF poročilo
- Izvoz rezultata v zunanjo CSV datoteko

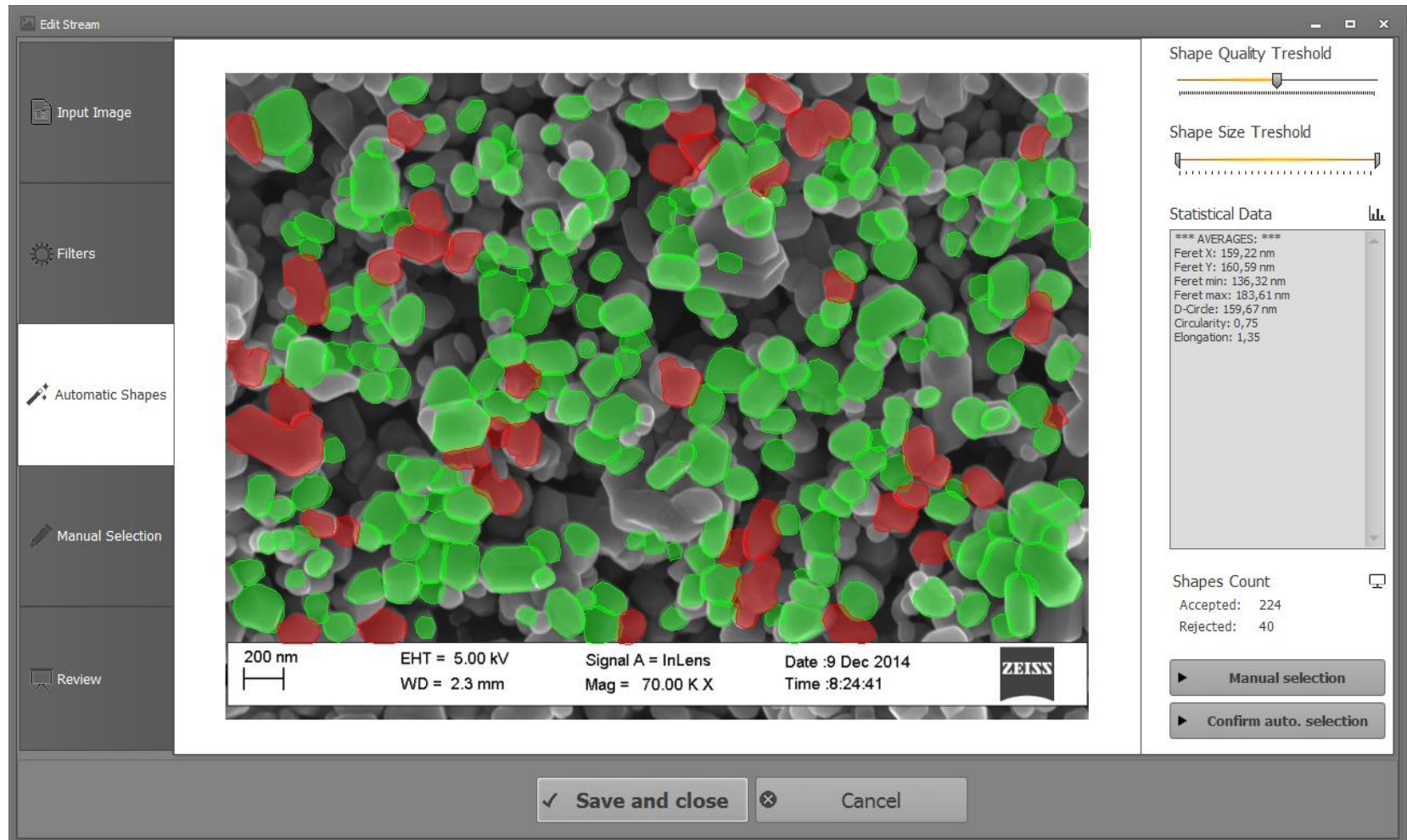
NanoEye – izbira slike



NanoEye – binarizacija robov



NanoEye – avtomatična prepoznava delcev



The screenshot displays the NanoEye software interface for particle recognition. The central window shows a grayscale SEM image of particles, with some particles highlighted in green and red. The interface includes a left sidebar with navigation options: Input Image, Filters, Automatic Shapes (selected), Manual Selection, and Review. On the right, there are control panels for 'Shape Quality Threshold' and 'Shape Size Threshold', both with sliders. Below these is a 'Statistical Data' panel showing the following information:

*** AVERAGES: ***	
Feret X:	159,22 nm
Feret Y:	160,59 nm
Feret min:	136,32 nm
Feret max:	183,61 nm
D-Circle:	159,67 nm
Circularity:	0,75
Elongation:	1,35

Below the statistical data is a 'Shapes Count' panel showing:

Accepted:	224
Rejected:	40

At the bottom right of the main window are two buttons: 'Manual selection' and 'Confirm auto. selection'. The bottom of the software window features a 'Save and close' button (checked) and a 'Cancel' button. The central image includes a 200 nm scale bar and technical parameters: EHT = 5.00 kV, WD = 2.3 mm, Signal A = InLens, Mag = 70.00 K X, Date :9 Dec 2014, Time :8:24:41, and the ZEISS logo.

NanoEye – ročna korekcija izbranih oblik

The screenshot displays the NanoEye software interface. The central window shows a 3D reconstruction of particles, with some particles highlighted in green and red. The interface includes a left sidebar with navigation options: 'Input Image', 'Filters', 'Automatic Shapes', 'Manual Selection', and 'Review'. The bottom of the main window displays technical parameters: a 200 nm scale bar, EHT = 5.00 kV, WD = 2.3 mm, Signal A = InLens, Mag = 70.00 K X, Date :9 Dec 2014, and Time :8:24:41. The ZEISS logo is visible in the bottom right corner of the main window. On the right side, there is a 'Statistical Data' panel with the following information:

*** AVERAGES: ***
Feret X: 162,42 nm
Feret Y: 163,62 nm
Feret min: 138,76 nm
Feret max: 187,31 nm
D-Circle: 162,67 nm
Circularity: 0,75
Elongation: 1,35

Below the statistical data is the 'Shapes Count' section, showing 209 Accepted and 55 Rejected shapes. There is also a 'Shapes Manipulation Hints' section with instructions on how to change shape status and use manual inflation.

At the bottom of the interface, there are three buttons: 'Save and close' (checked), 'Cancel', and 'Confirm manual selection'.

NanoEye – pregled rezultata

The screenshot displays the NanoEye software interface. The main window shows a 3D visualization of particles with green and red outlines. The interface includes a left sidebar with options: Input Image, Filters, Automatic Shapes, Manual Selection, and Review. The bottom of the main window displays technical parameters: 200 nm scale bar, EHT = 5.00 kV, WD = 2.3 mm, Signal A = InLens, Mag = 70.00 K X, Date :9 Dec 2014, Time :8:24:41, and the ZEISS logo.

Statistical Data

*** D-CIRCLE VALUES: ***
Average: 162,67 nm
Standard deviation: 45,03 nm
Geometric Standard Deviation: 157,88

Shapes Count

Accepted: 209
Rejected: 55

Statistical Analysis

Particle Size (nm)	Percentage (%)
80	1.5
90	2.5
100	6.5
110	5.5
120	8.0
130	11.5
140	8.5
150	8.5
160	7.0
170	4.5
180	4.0
190	2.5
200	2.0
210	1.5
220	1.0
230	1.0
240	1.0
250	1.0
260	1.0
270	1.0
280	1.0
290	1.0

Buttons: Save and close, Cancel

NanoEye – statistična analiza

Analysis

Analysis - Basic Data

Name:* Reference Number:* Notes:
Analysis Date:* Algorithm Name:*

Stream List

Stream #1 - kalcinat 02.tif

Input image

Stream #2 - Kalc., Edaplan 490 H2O konc.03.tif

Input image

Overall Statistical Analysis

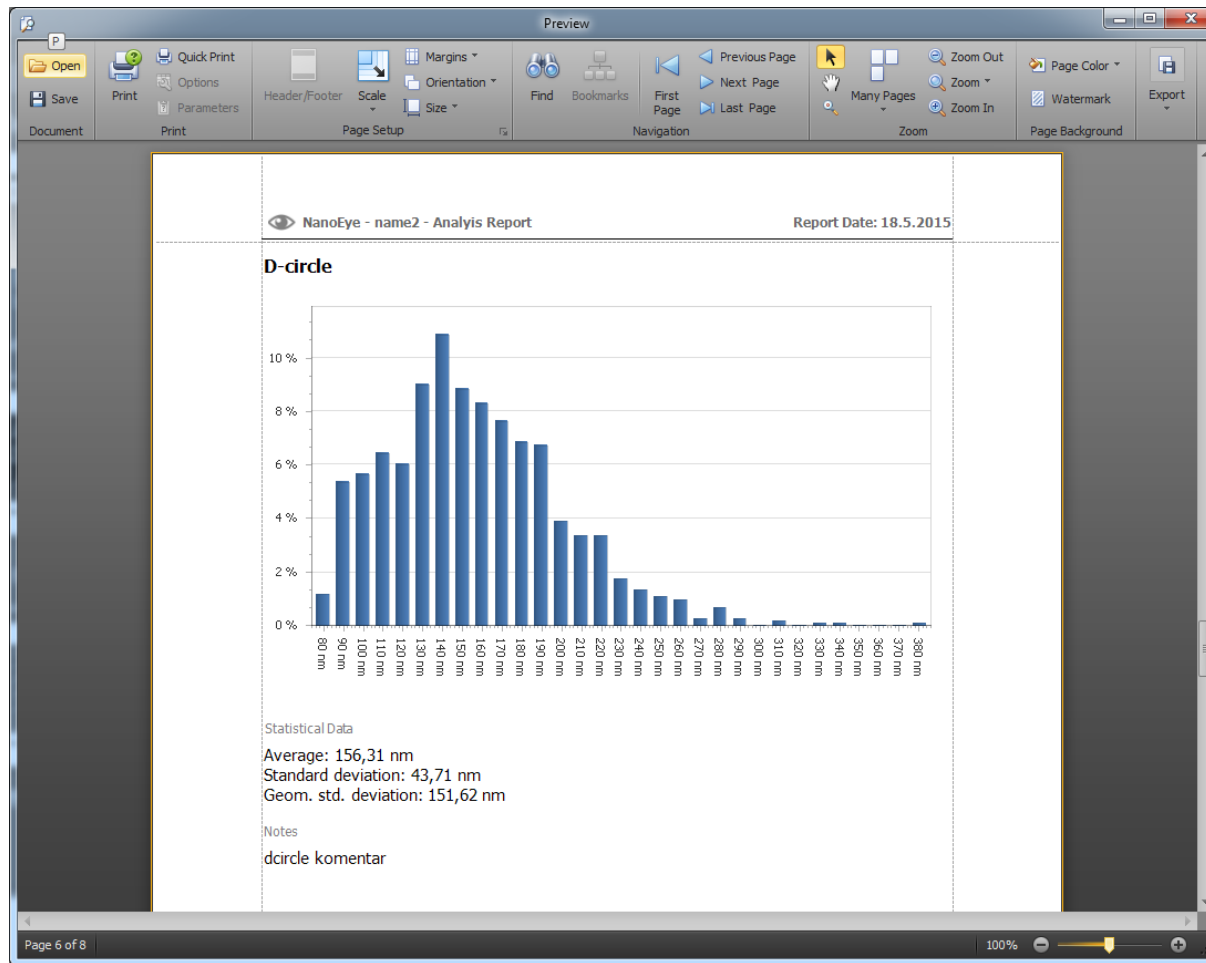
Feret X
Feret Y
Feret max
Feret min
D-circle
Circularity
Elongation

Statistical data:
Average: 156,31 nm
Standard deviation: 43,71 nm
Geom. std. deviation: 151,62 nm

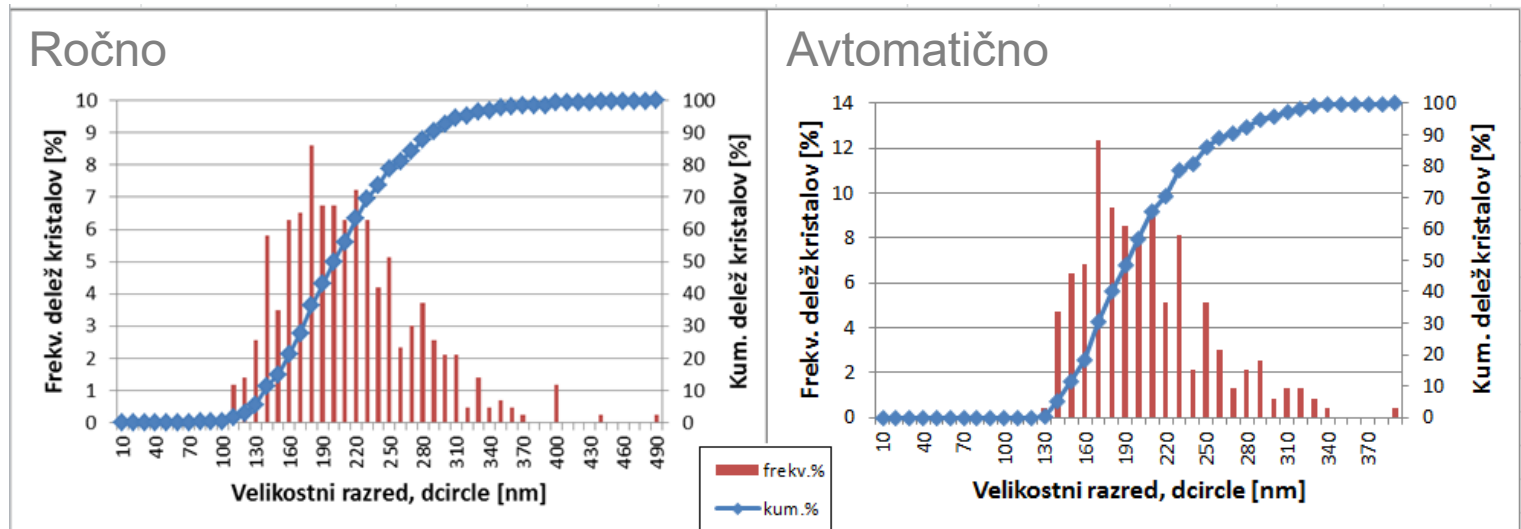
Notes:
dircle komentar

Show in report

NanoEye – poročilo



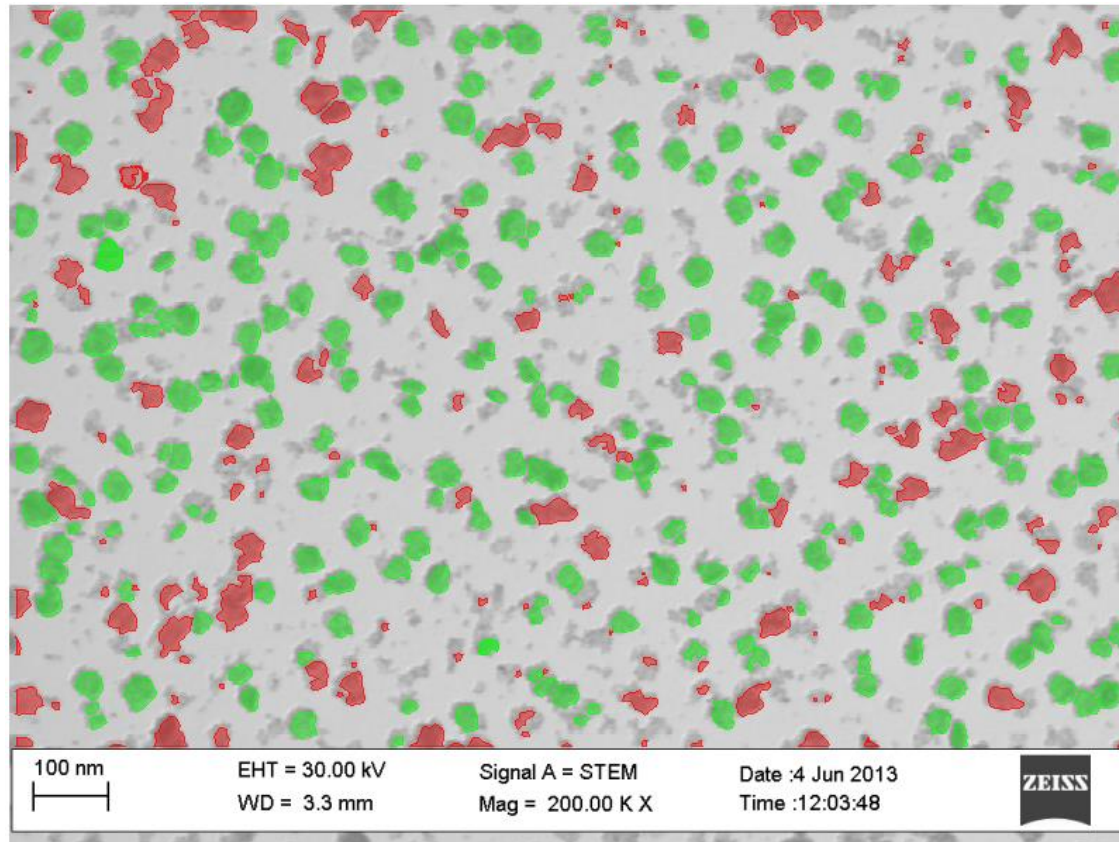
Primerjava rezultatov



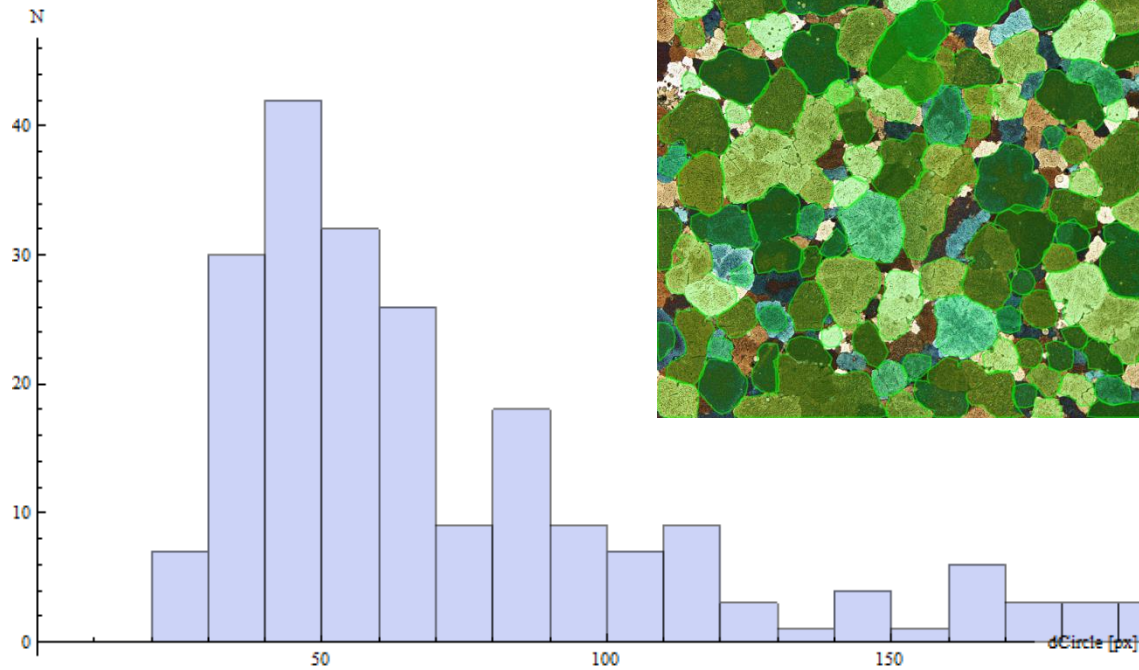
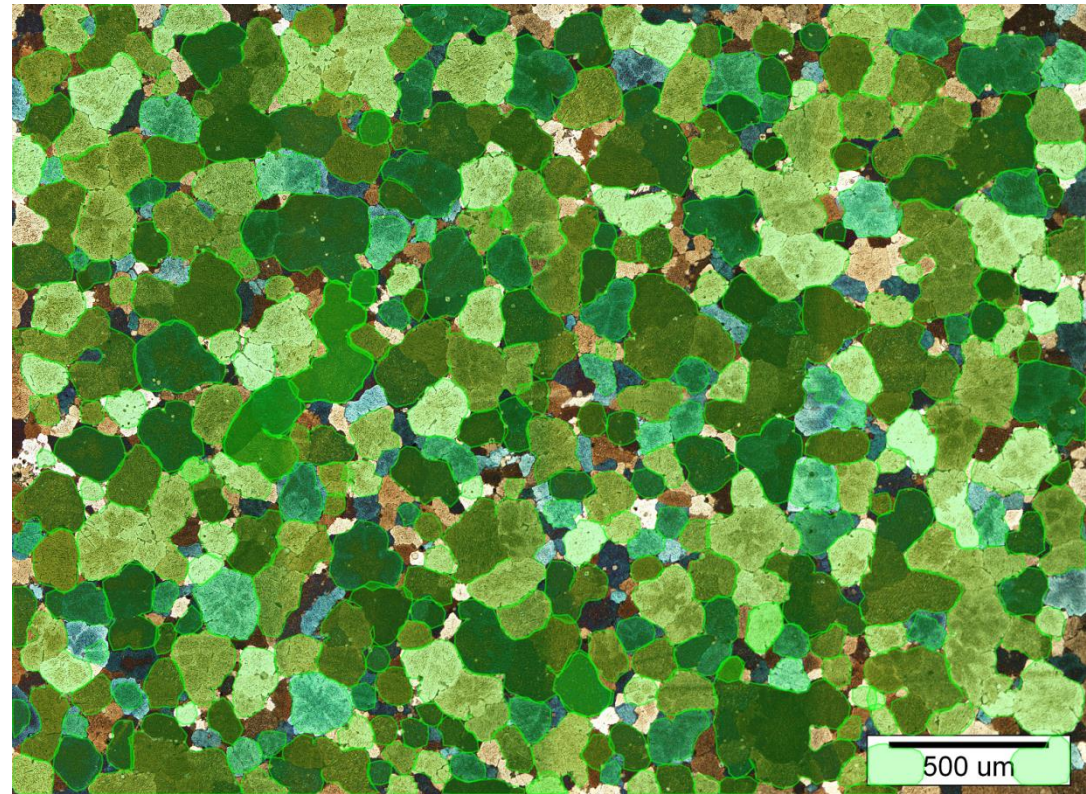
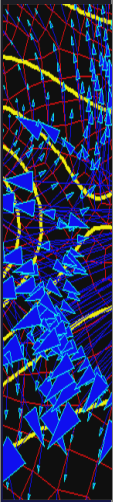
- Dosegli smo dobro ujemanje med ročno in avtomatično metodo
- Avtomatična metoda je bistveno hitrejša od ročne metode

Suspenzija titanovih delcev

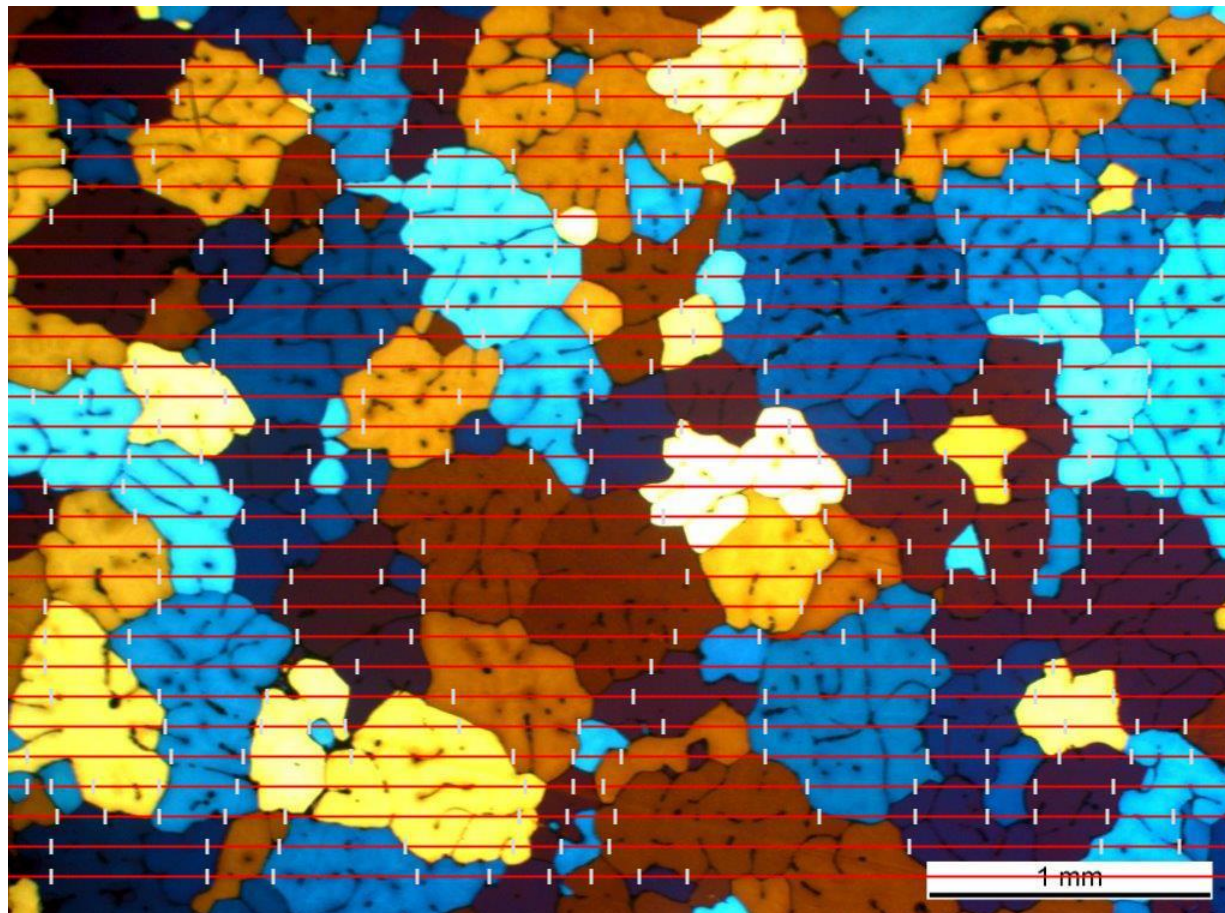
- Zaradi koplanarne porazdelitve delcev enostavnejša analiza
- Odlično ujemanje z rezultati ročne metode



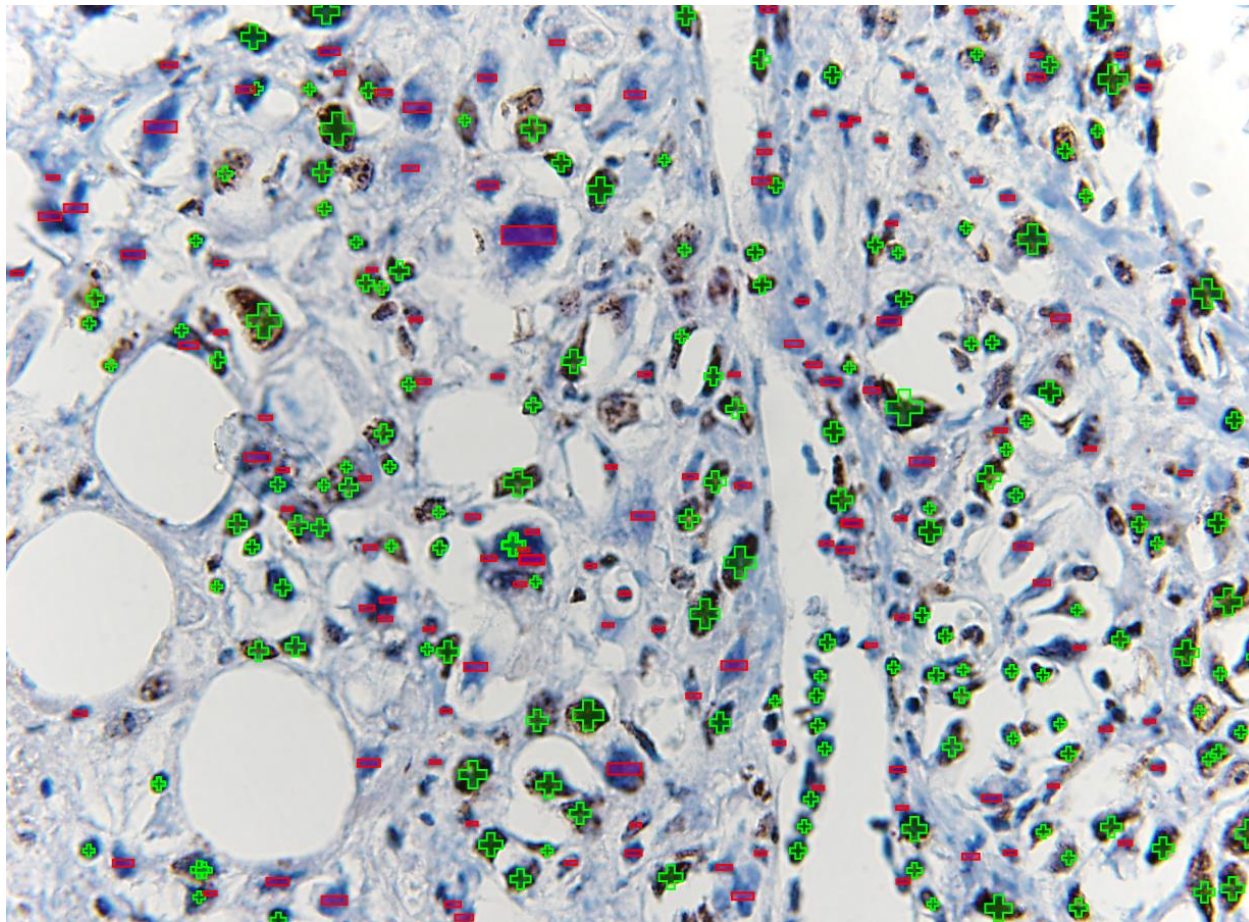
Metalografija



- Povprečna velikost metalne domene po standardu ASTM E112

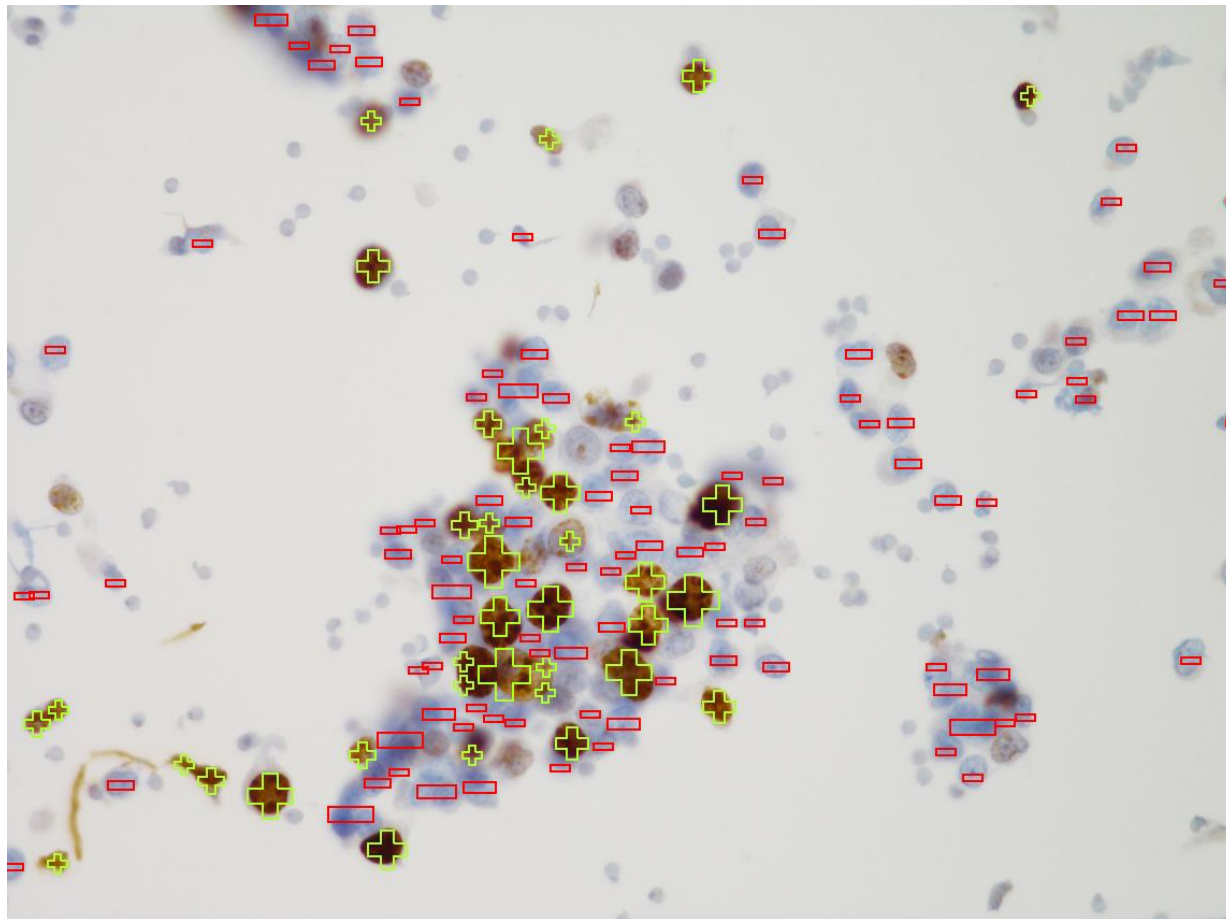


- Cilj - prešteti vijolična in rjava celična jedra

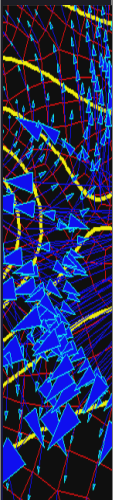


Biološke slike - suspenzija

- Cilj - prešteti vijolična in rjava celična jedra



- Razvita rešitev za detekcijo aglomeriranih praškastih delcev
- NanoEye – specializirana programska rešitev, prilagojena za hitro analizo mikroskopskih slik
- Modularna zasnova – z zamenjavo numeričnega modula lahko program hitro prilagodimo drugim tipom slik in analize oblik
- Numerični modul za obdelavo slik se lahko uporablja tudi samostojno (npr. in-line kontrola kvalitete)



Hvala za pozornost!

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