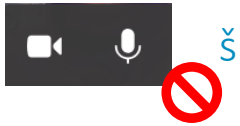
Nastavení MS Teams pro webinář

prosím vypněte si kameru i mikrofon



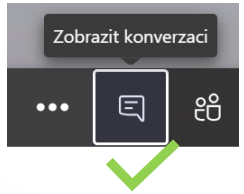
špatně

správně

pro diskuzi si aktivujte zvuk

správně

další tlačítka, chat



dotazy do chatu i během prezentace

pragolab

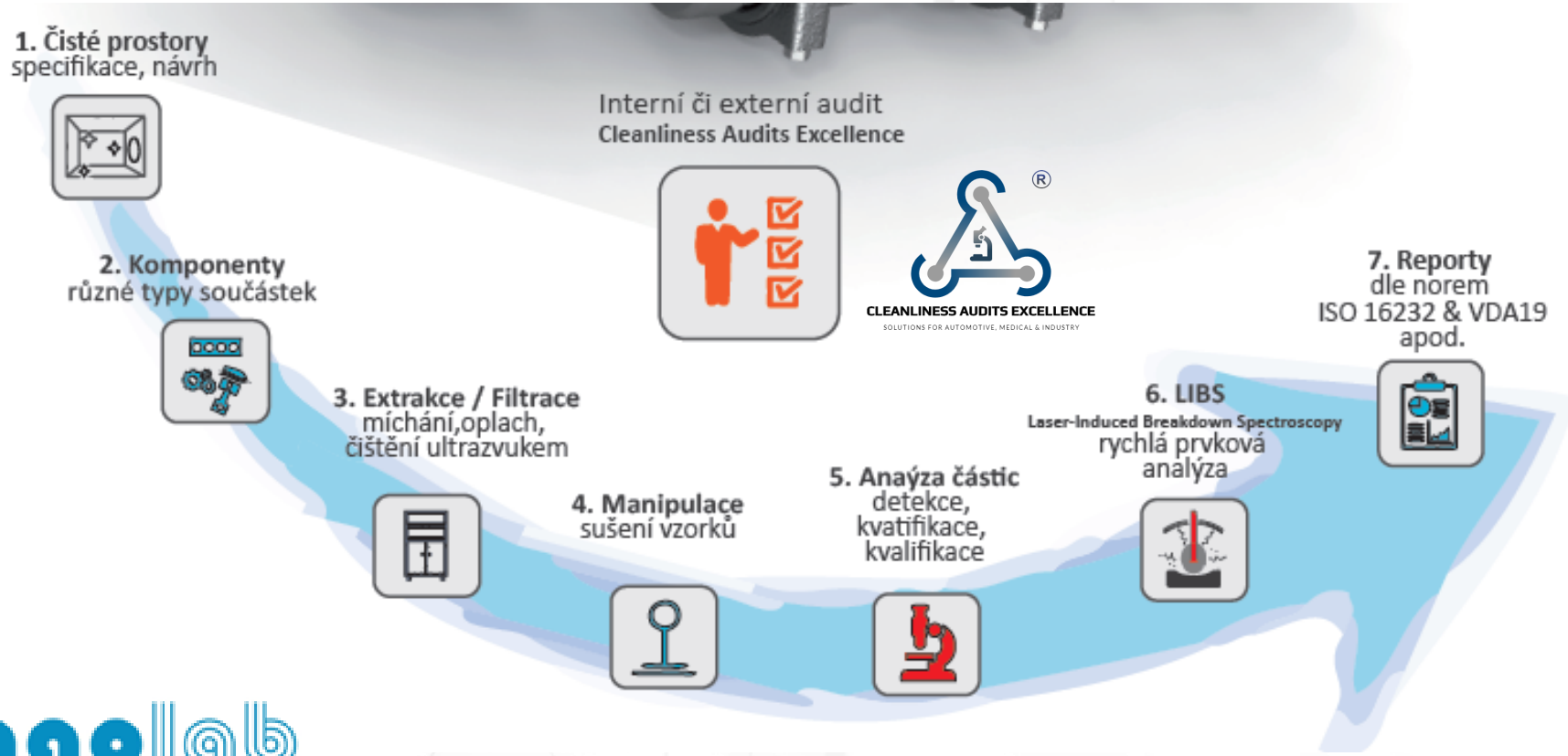
Vítejte

Workflow technické čistoty s Leica LIBS

Viktor Škorík, aplikační specialista mikroskopie a přípravy vzorků Pragolab s.r.o.

Představení kompletního řešení

Díky specialistům pro technickou čistotu jsme schopni zajistit kompletní řešení od návrhu, realizace až po report z měření technické čistoty.



Cleanliness Audits Excellence

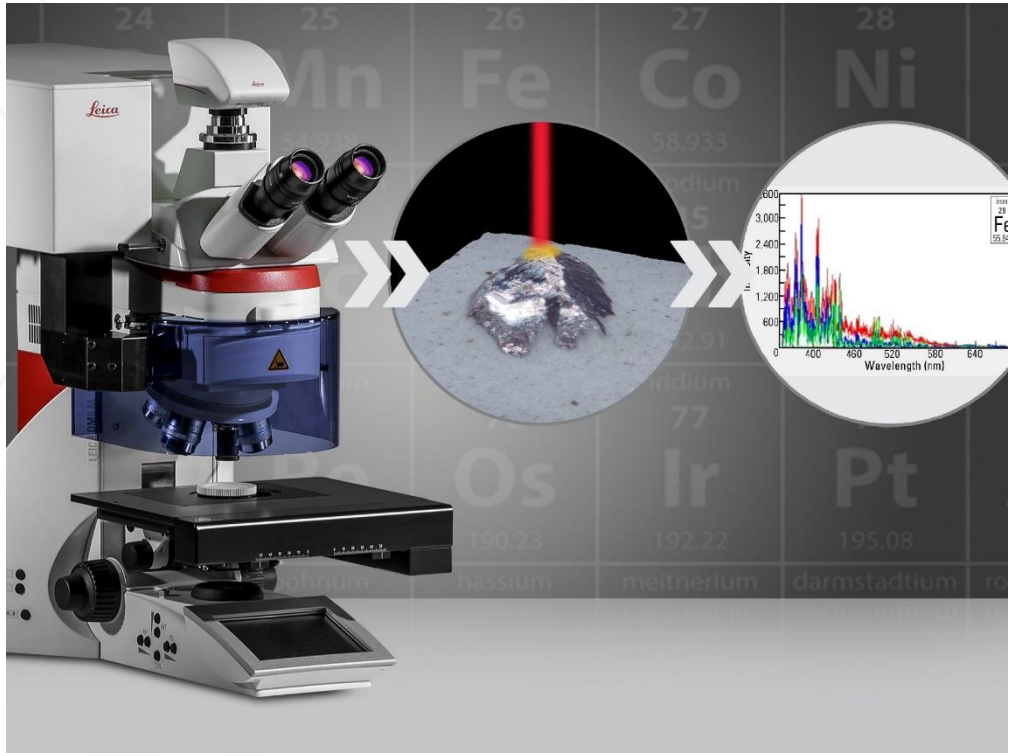
https://www.cleanlinessaudit.com/

CLEANLINESS AUDITS EXCELLENCE
SOLUTIONS FOR AUTOMOTIVE, MEDICAL & INDUSTRY

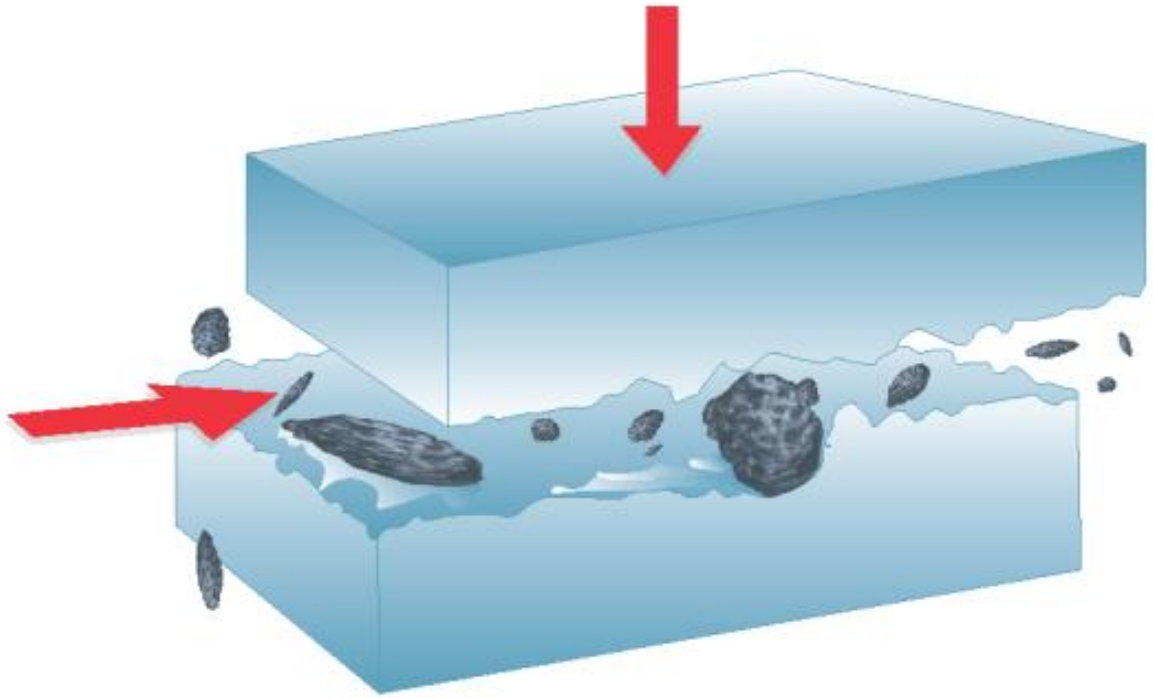
Živá ukázka čistých prostor a analýzy technické čistoty

Živá ukázka čistých prostor a analýzy technické čistoty

Pokročilá mikroskopická + LIBS analýza pro technickou čistotu dle VDA 19.1



Částice

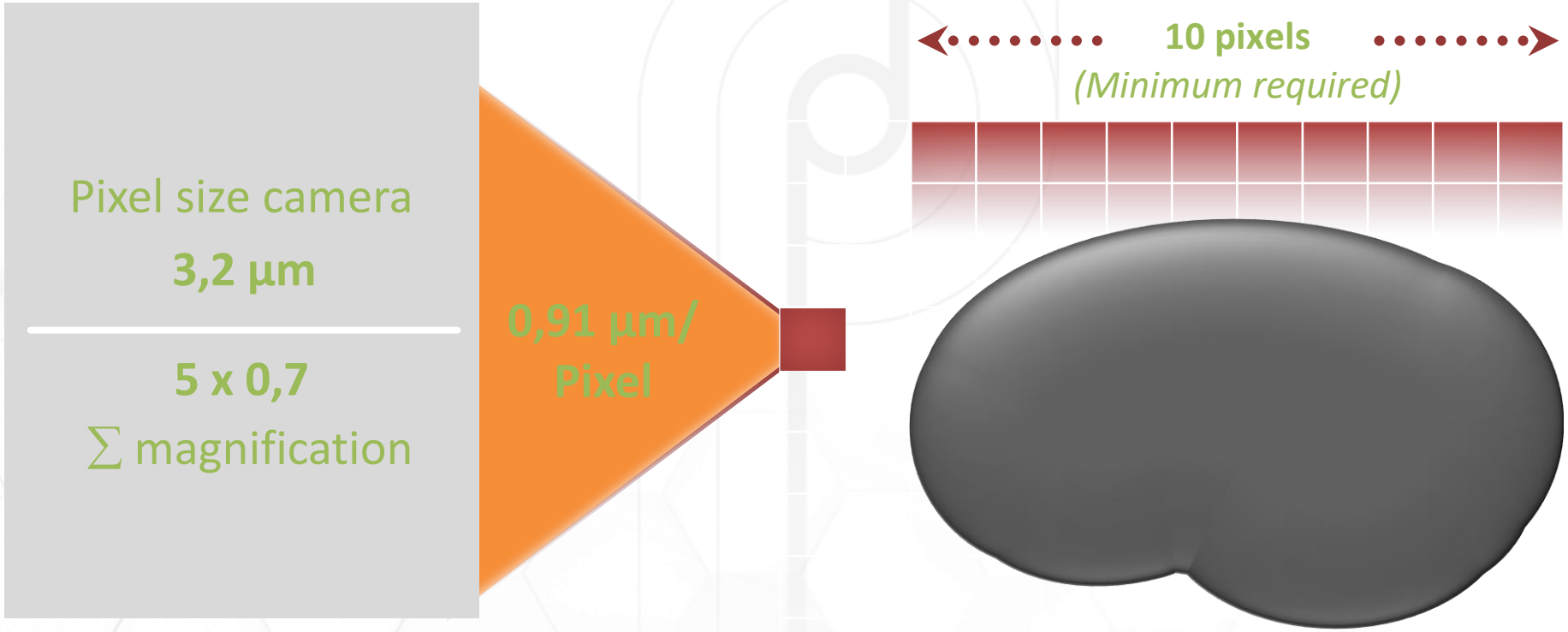


Standard	Application
ISO 16232	Automotive
VDA 19	Automotive
ISO 4406/4407	Hydraulic Fluids
NAS 1638	Lubrication
SAE 4059	Hydraulic Fluids
USP-788	Pharmaceutical
NF E48-655	Hydraulic Fluids
User Defined	Any

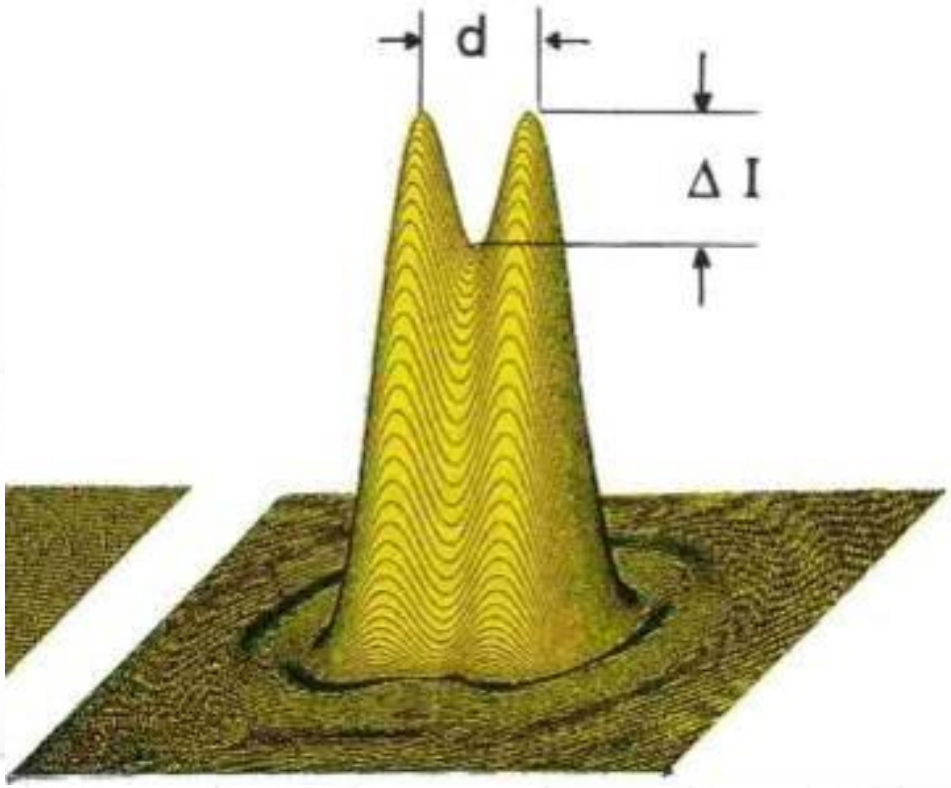
Gravimetrie

Zachycení, měření a typizace částic (rozdělení do skupin)

Pro zajištění exaktního stanovení velikosti by měly být analyzované částice (po délce) zobrazeny přes **10 pixelů** kamerového obrazu.



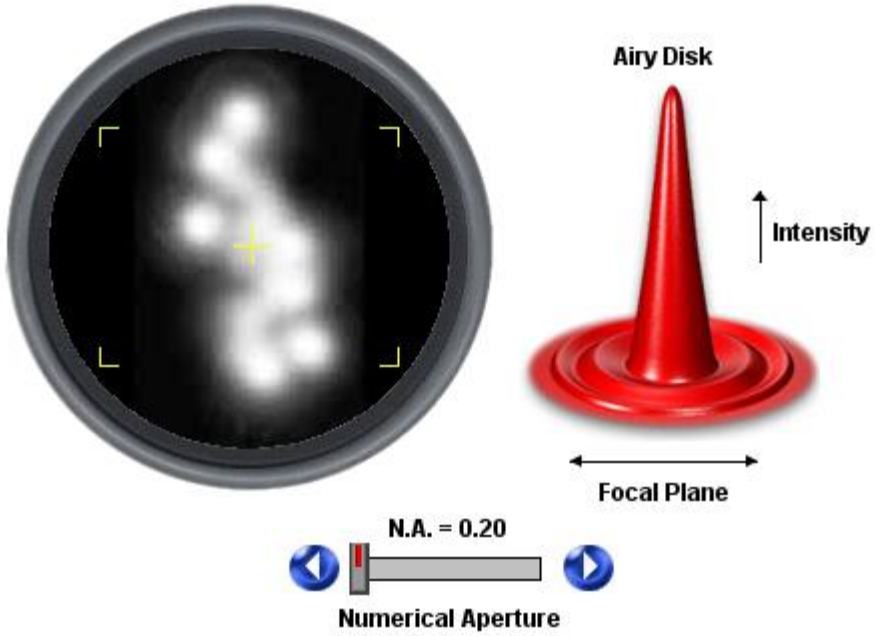
Rozlišení



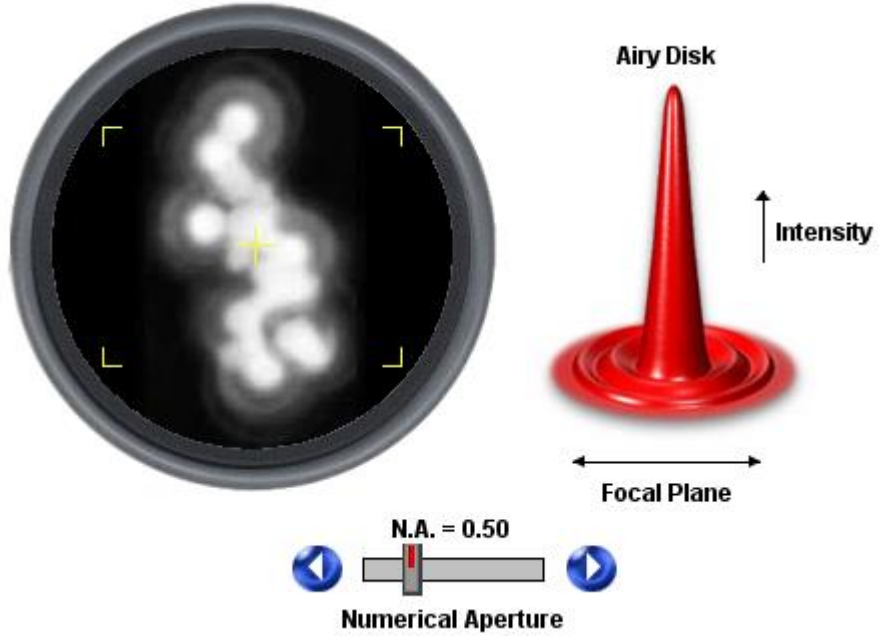
$$\mathbf{d} = 0.61\frac{\lambda}{\mathbf{N.A.}}$$

Počet pixelů a velikost kamery nejsou samy o sobě pro dostatečně exaktní měření částic průkazné, nýbrž primárně jsou rozhodující optické vlastnosti zobrazovací optiky.

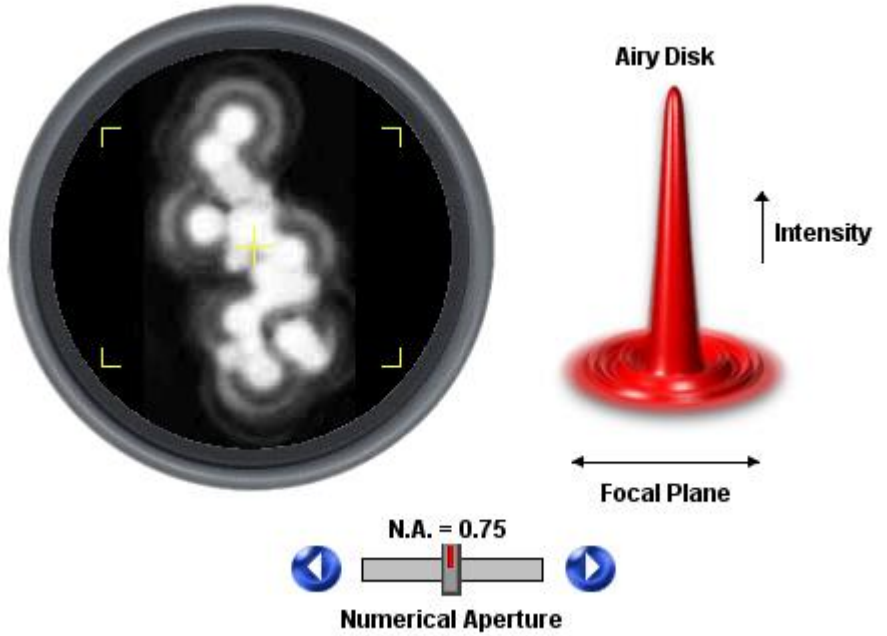
NA. = 0,2



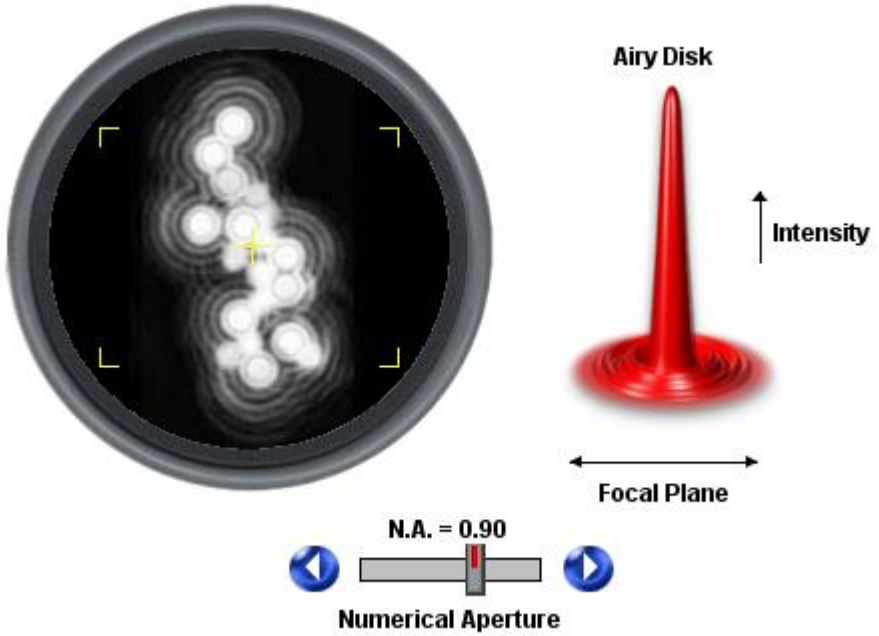
NA. = 0,5



NA. = 0,75



NA. = 0,9



Optický mikroskop s polarizátorem

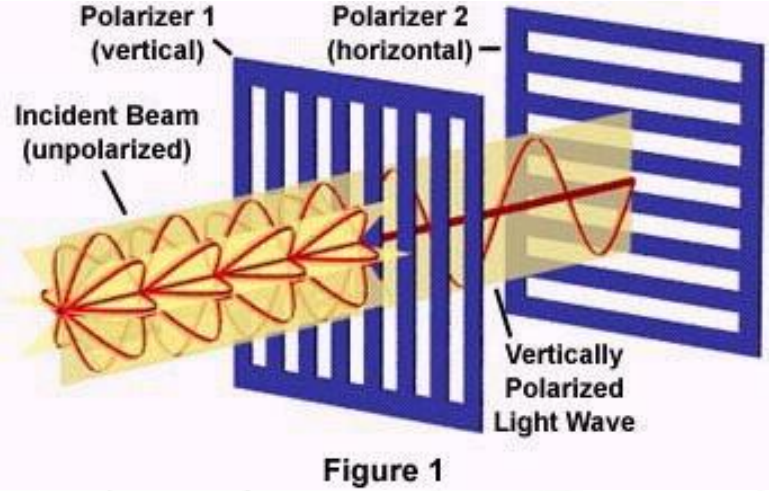
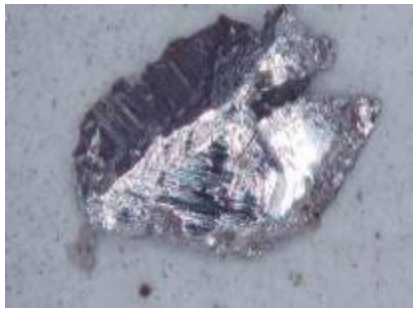


Figure 1

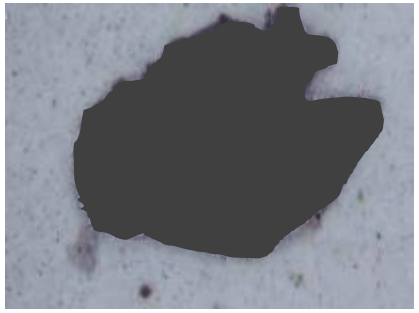
V tomto případe je světlo, kterým se osvětluje analytický filtr, lineárně polarizováno. Světlo odražené od vzorku, které je zachyceno zvětšovací optikou, je vedeno přes další o 90° otočený polarizační filtr (analyzátor). Díky překřížení polarizačních filtrů částice potemní a odrazy od kovových částic se vyruší. Zachycené částice se zobrazí v temných odstínech na světlém pozadí filtru.

Optický mikroskop s polarizátorem

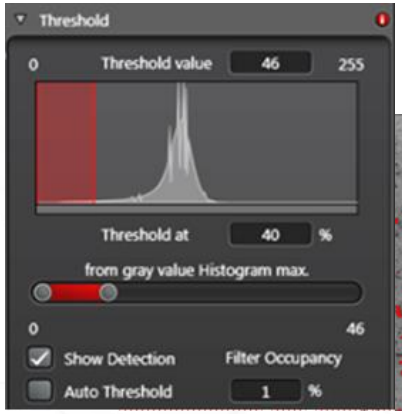
- Metallic particle showing reflexes in Brightfield ⇒ inhomogeneous
- Reflexes make automatic detection of particles difficult

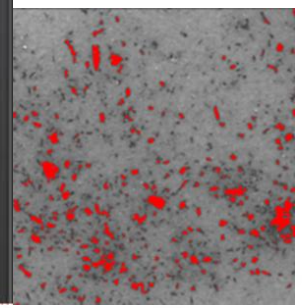


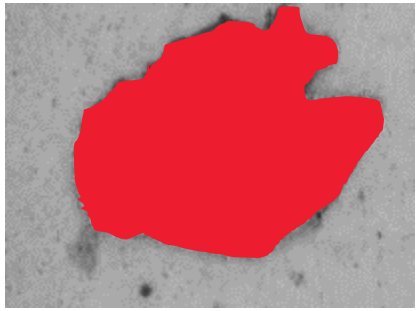
- Crossed Polarizers eliminate reflexes ⇒ homogeneous
- Metallic particles are dark and are contrasting to the bright filter background (bright/dark)



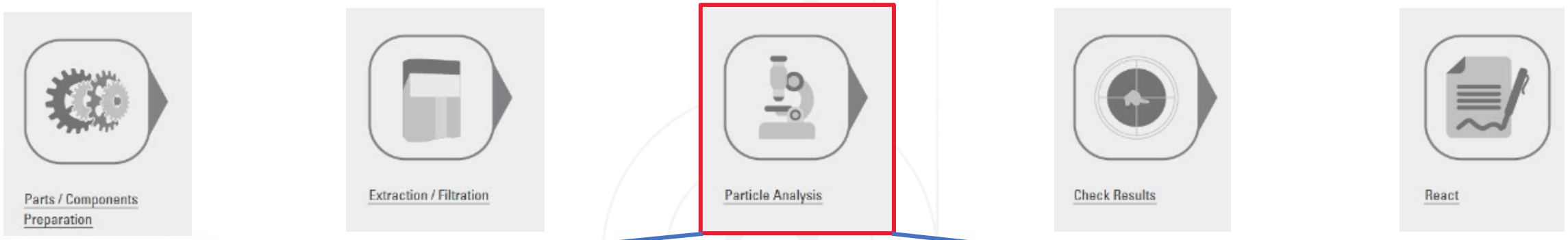
- Contrast of bright/dark ⇒ Greyscale image (BW image)
- Detection of particles, counting and classification

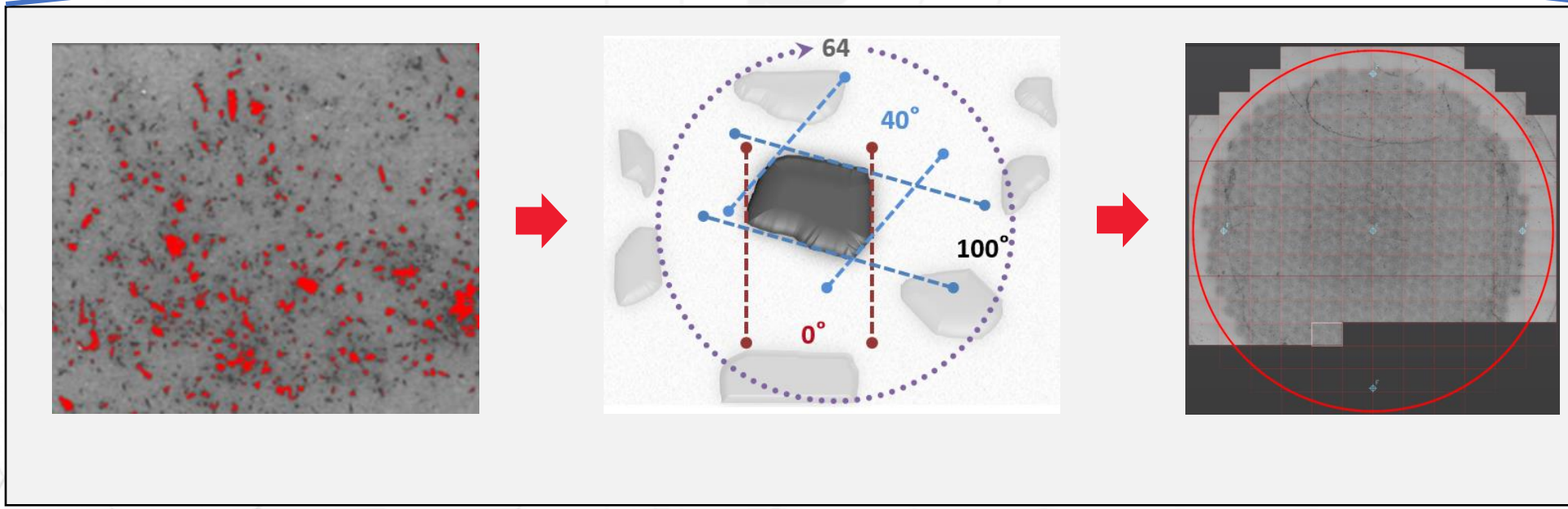




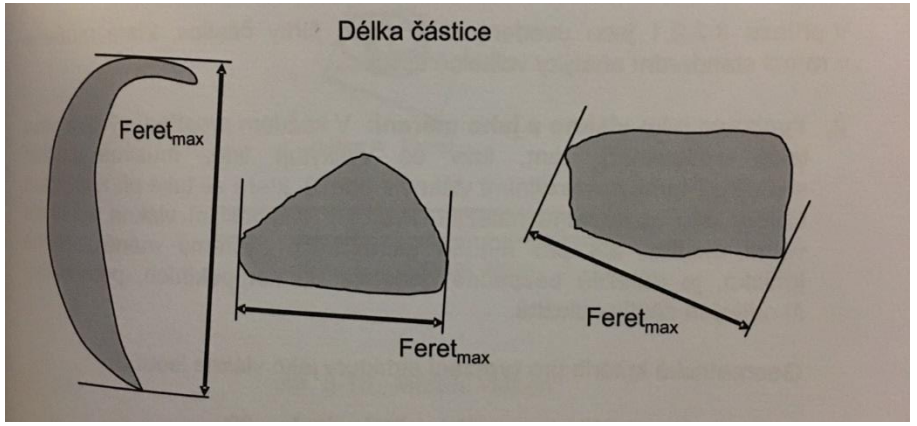


Měření částic

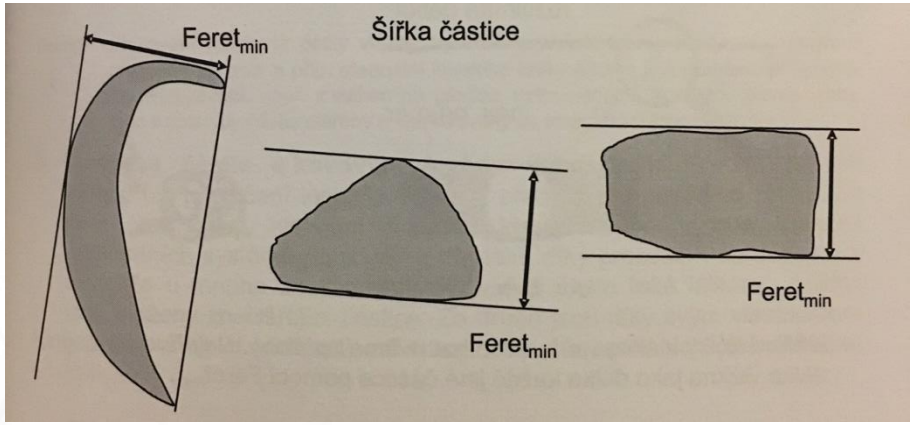


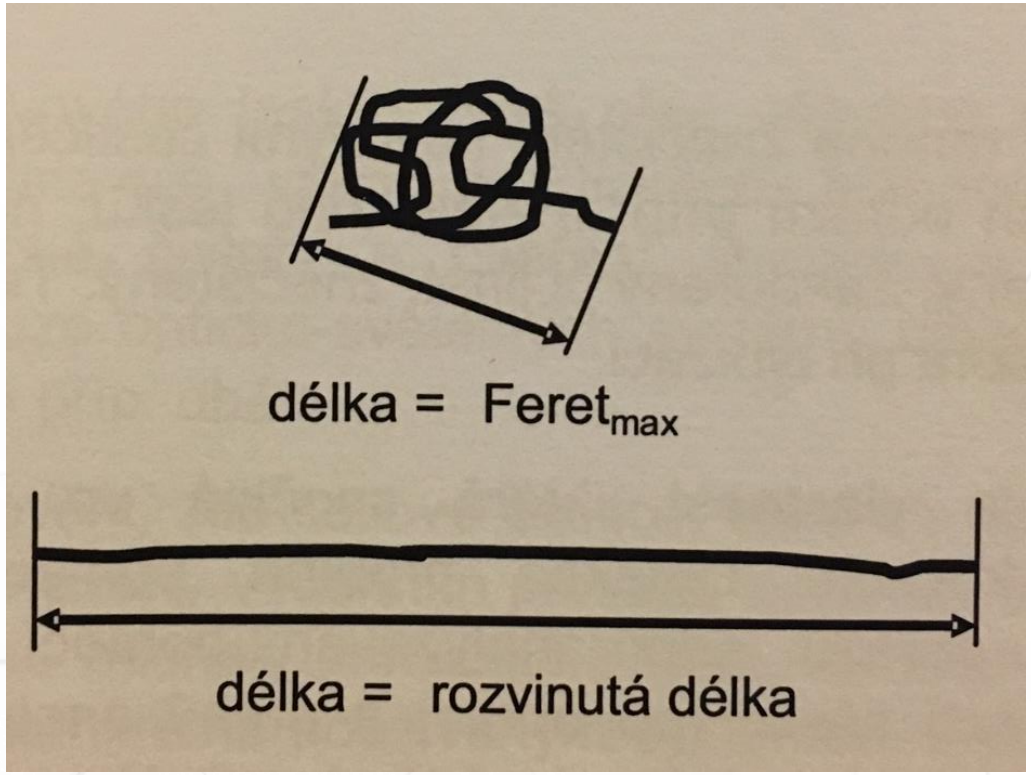


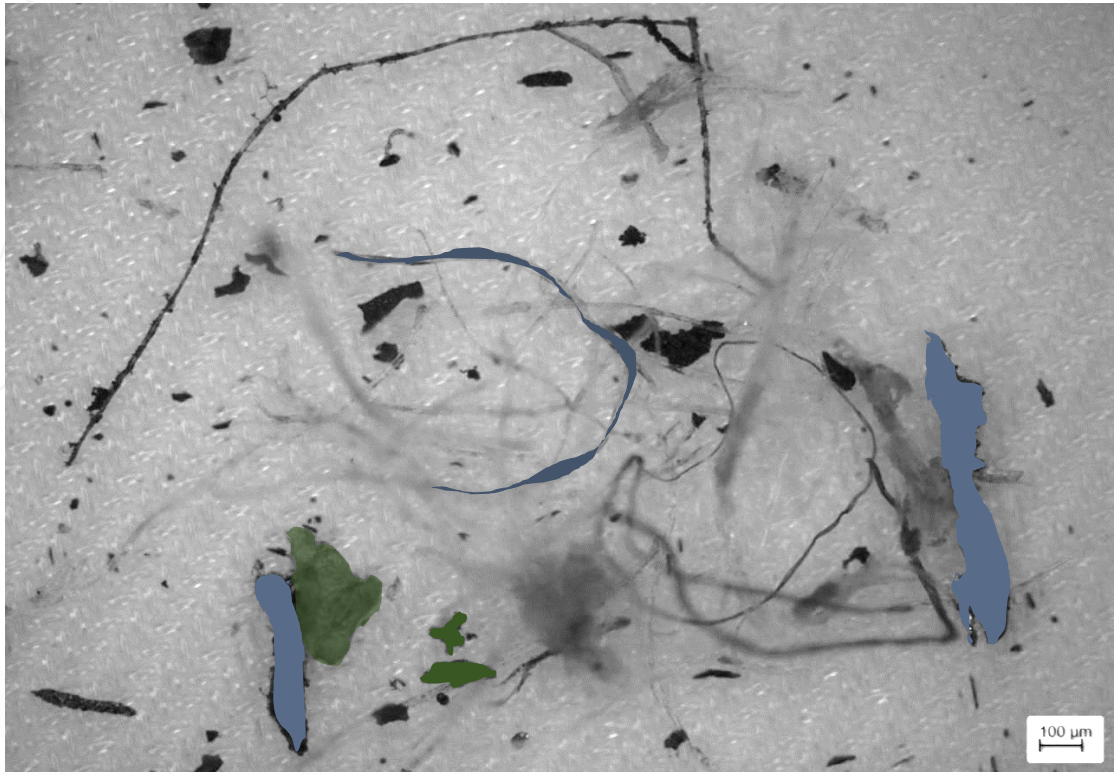
Délka částice – měřena jako největší možný odstup dvou paralelních linií



Šířka částice – měřena jako nejmenší možný odstup dvou paralelních linií

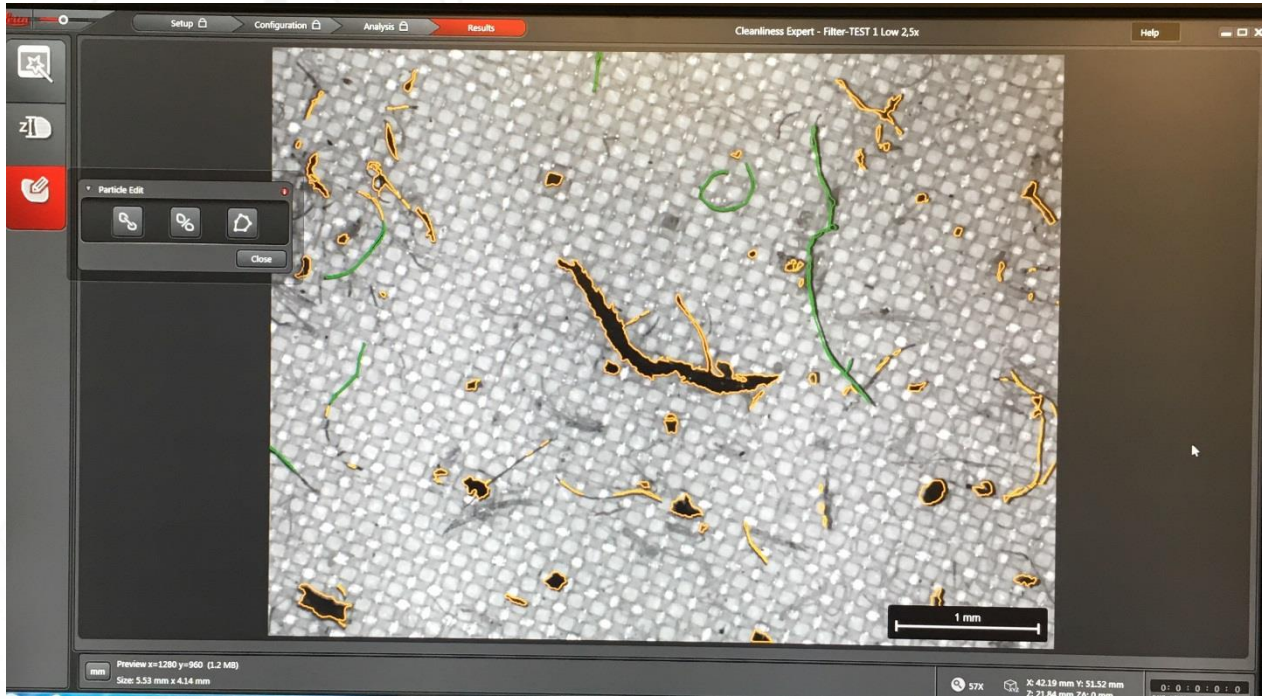



délka = Feret$_{max}$
délka = rozvinutá délka


100 µm

Následná kontrola

Výsledky opticko-světelných, automatizovaných analýz čistoty by měly být vždy následně kontrolovány pro tento účel vyškolenou obsluhou. Systém vyhodnocování by měl k tomu nabízet možnost spojit rozdělené částice, dotýkající se částice oddělit a provést změnu typizace.



Reporting

Parts / Components Preparation

Extraction / Filtration

Particle Analysis

Check Results

React

pragolab

Parts / Components Preparation

Extraction / Filtration

Particle Analysis

Check Results

React

Cleanliness Analysis

Leica MICROSYSTEMS

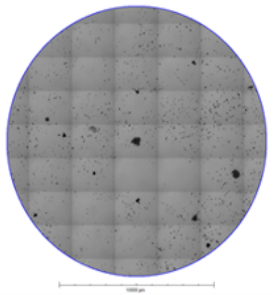
Report according to: VDA 19 Extended

System information

Microscope:	DM6	C-Mount:	5	Camera:	DMC4500	Gamma:	1
Objective:	HC PL FLUOTAR 5x	Illumination:	255	Exposure:	46.51ms	Cal. value:	1.94 µm/pix

Sample ID: 1

Measured diameter [mm]:	15	Counted particles:	2233
Historgam max.:	142	Reflective:	532
Threshold:	0-88	Non-refl.:	1701
Filter occupancy [%]:	20.19	Total fiber length *:	0.00

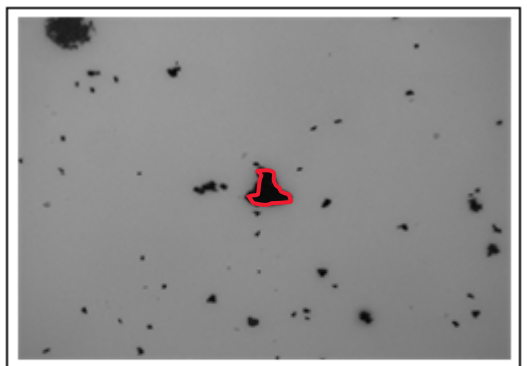


Largest particles on filter [µm]²*

Reflective		Non-reflective	
Length:	606.00	Length:	277.79
Width:	501.51	Width:	204.71
Height:	76.00	Height:	0.00

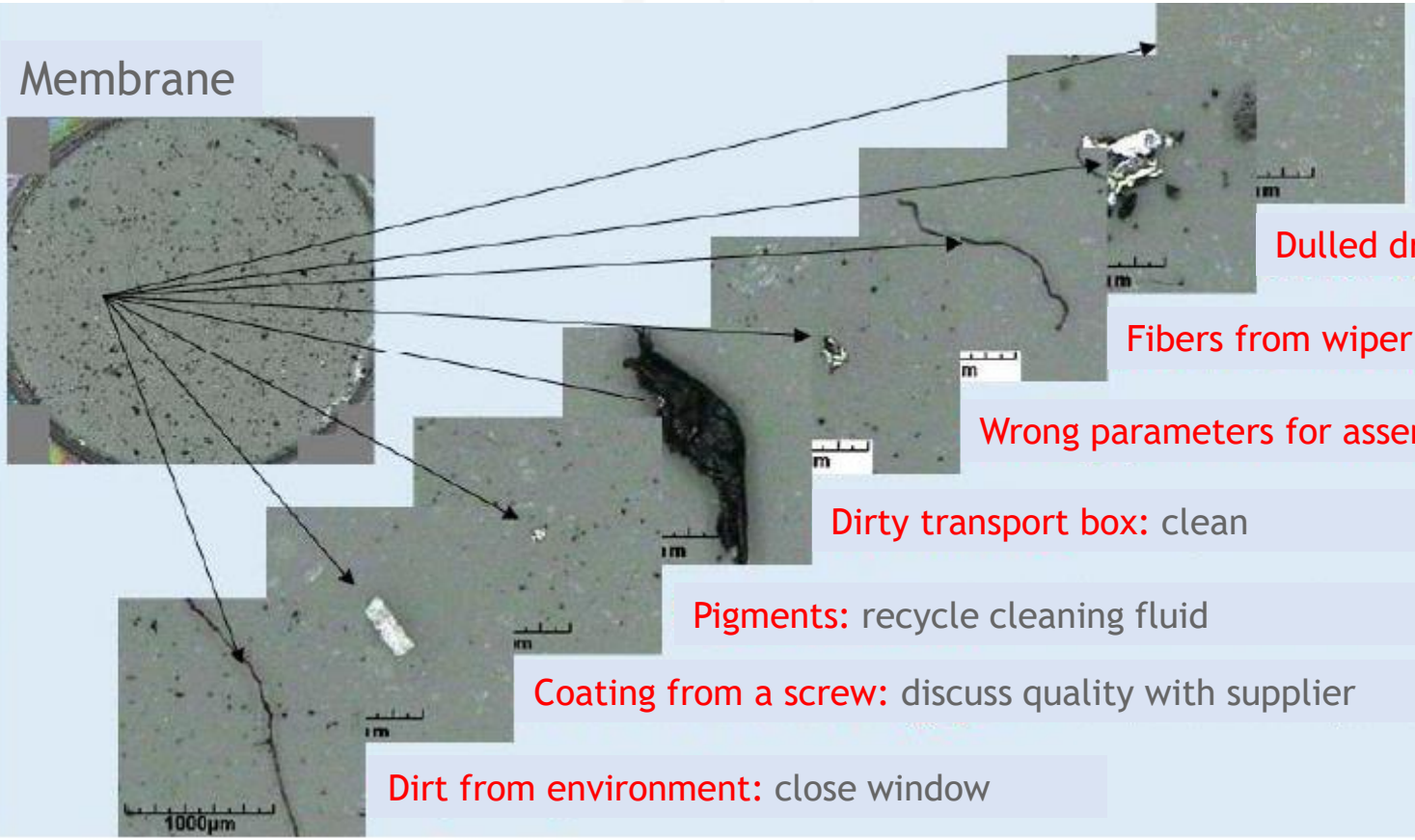
Results: VDA 19 CCC, All particles (feret max.)³* Number of parts Wetted vol./surface 100 mm²

Measured:	A(B12/C12/D14/E13/F9/G4/H7/I5/J4/K00/L00/M00/N00)	passed
Requested:	A(B00/C00/D00/E00/F00/G00/H00/I00/J00/K00/L00/M00/N00)	



ID	Fmax	Fmin	Max ICD
689	277.79	204.71	0.00
height	refl. Y/N	X pos.	Y pos.
0.00	N	4475.04	7910.05

Membrane



Production line o.k.

Dulled drill: exchange

Fibers from wiper: exchange

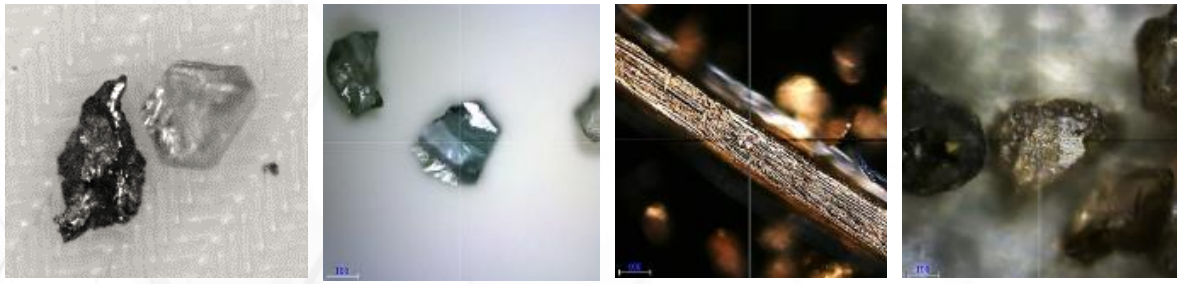
Wrong parameters for assembly: adjust

Dirty transport box: clean

Pigments: recycle cleaning fluid

Coating from a screw: discuss quality with supplier

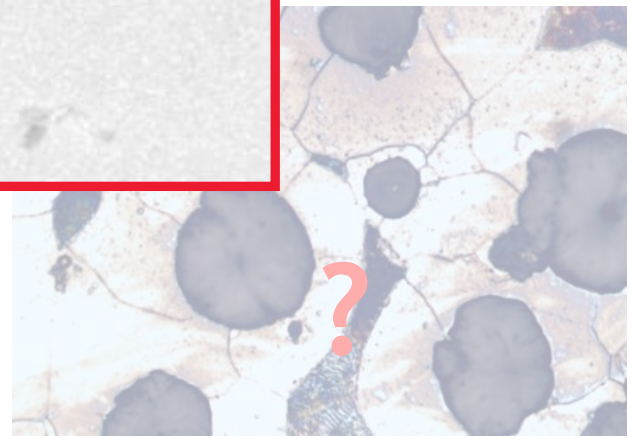
Dirt from environment: close window



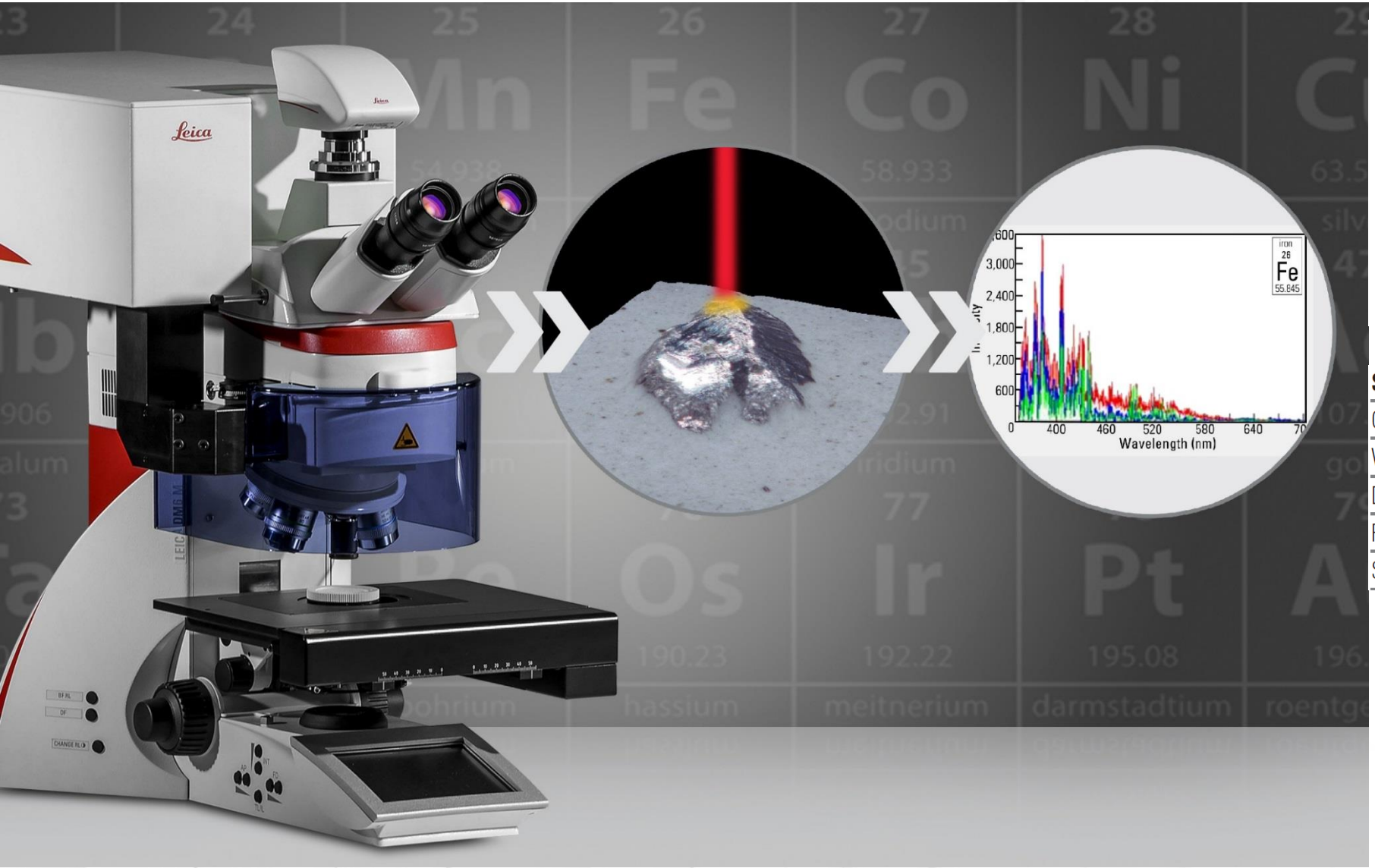
Vaše denní otázka …

Visual sample inspection but…

What is this inclusion?
What is this phase?
What is this mineral?
What is this particle?
…What is this?



Leica DM 6 M LIBS…



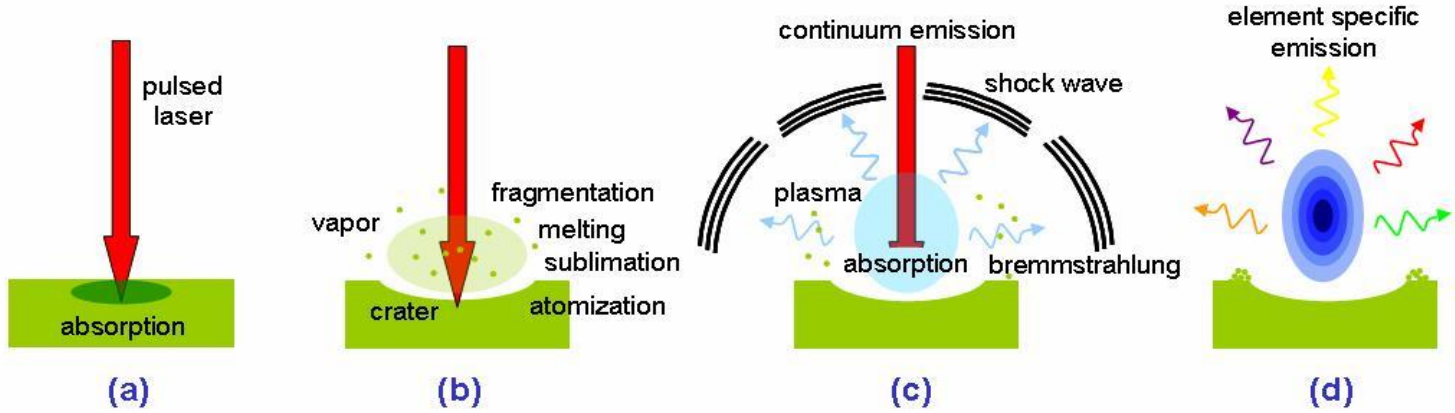
Laser

Type	Pulsed N_2 gas laser
Wavelength	337.1 nm
Average pulse energy	Up to 150 µJ
Pulse half width (FWHM)	~3 ns
Repetition rate	Up to 30 Hz, single shot mode
Spot size at focal point	15 µm

Spectrometer

Optical Bench	ULS Symmetrical Czerny-Turner
Wavelength range / detection range	200 – 1100 nm / 360 – 700 nm
Detector	CCD linear array, 2048 pixels
Resolution	0.6 nm
Signal / Noise	200:1

Princip



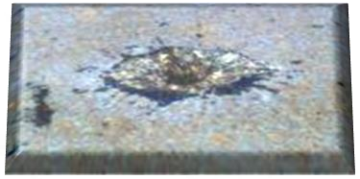
Source: University of Windsor: http://www1.uwindsor.ca/people/rehse/15/what-is-libs

(a) Sample is hit by a high energy laser -> Material absorbs the energy
(b) Laser pulse ablates material
(c) High energy induces a plasma
(d) Plasma breakdown energy leaves in form of characteristic emission

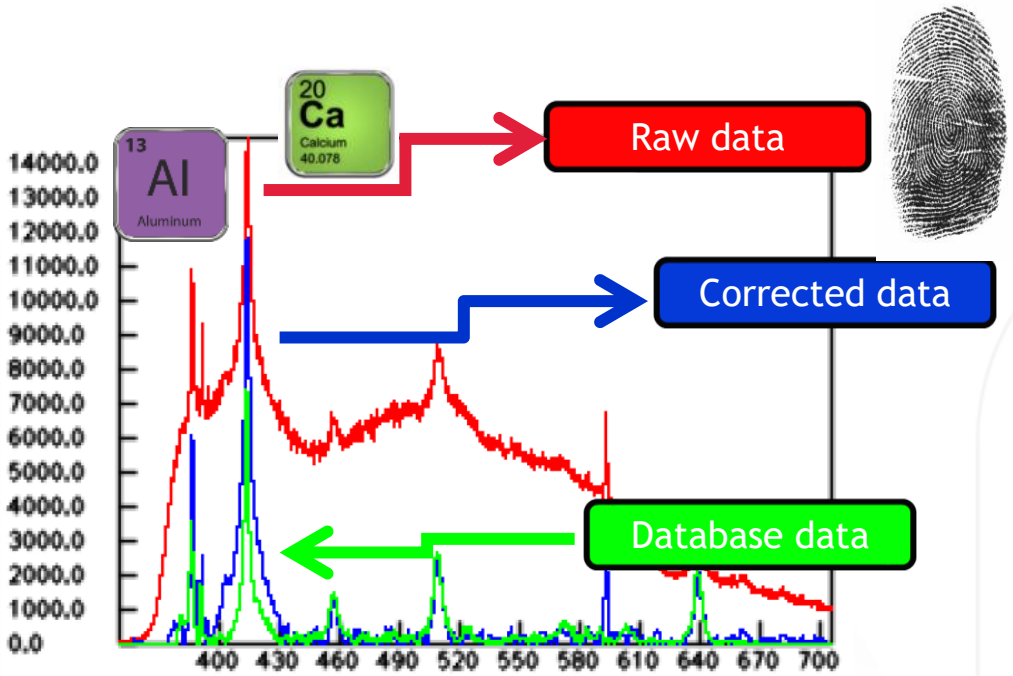
Steel

Copper 1 – 2- 3 shoots

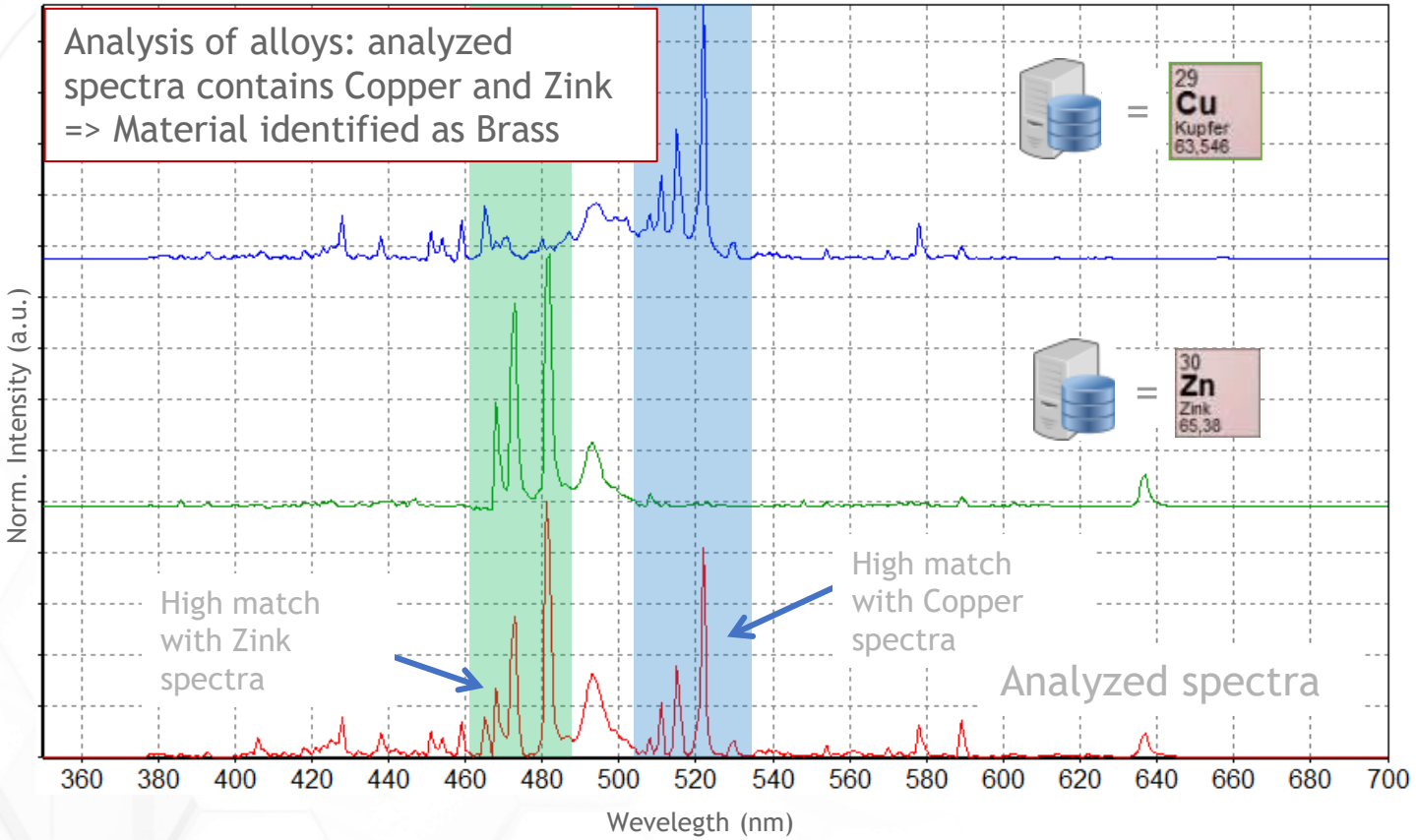
Copper with thin chromium layer



LIBS analýza

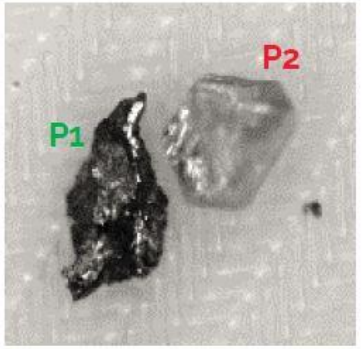


The accuracy how similar the spectra are is expressed by the quality of match (max. 1000).

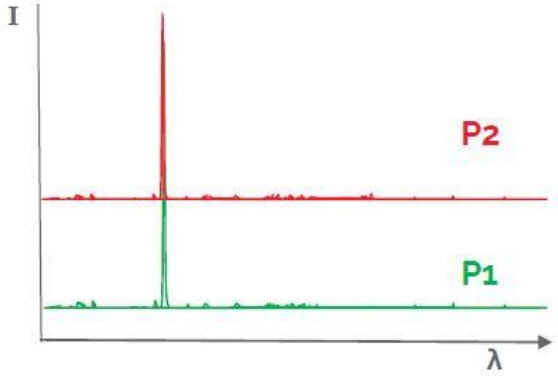


A) Hard particles

Visual detection
-> metal and mineral



LIBS analysis
-> Aluminum identified in both cases



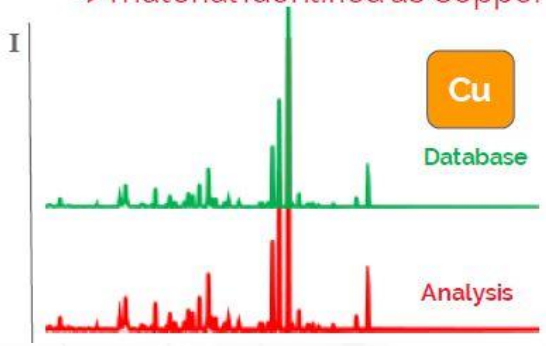
Combination of optical and chemical analysis!:

P1 = Metallic aluminum particle
P2 = Corundum particle from grinding process.

B) Conductive particles

Visual detection
-> Steel, Alu, Copper?

LIBS analysis
-> material identified as Copper

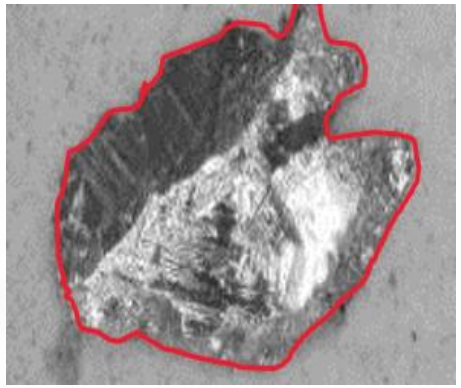


Risk potential
-> Copper = high conductivity!

Material	σ in S/m	Risk
Cu	$58 \cdot 10^6$	High
Al	$37 \cdot 10^6$	Middle
Mn	$0{,}69 \cdot 10^6$	Low

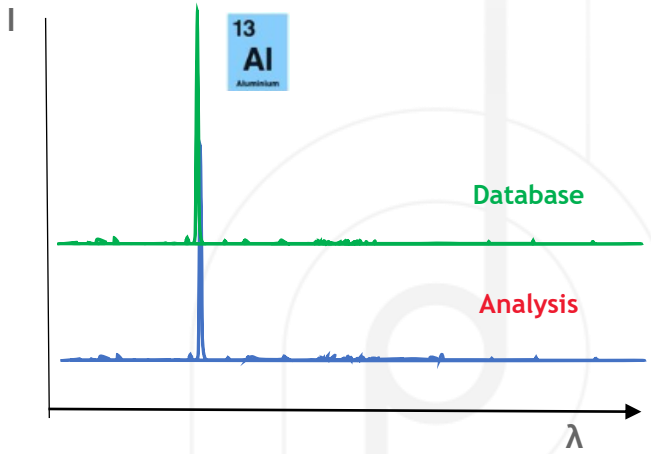
1. Optical inspection

⇒ metallic gloss



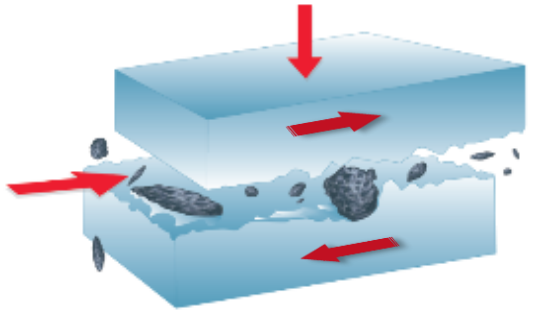
2. LIBS - chemical analysis

⇒ Particle identified as Aluminum



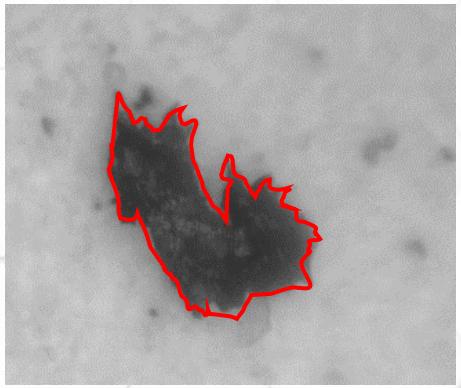
Damage potential

High damage potential in mechanical system



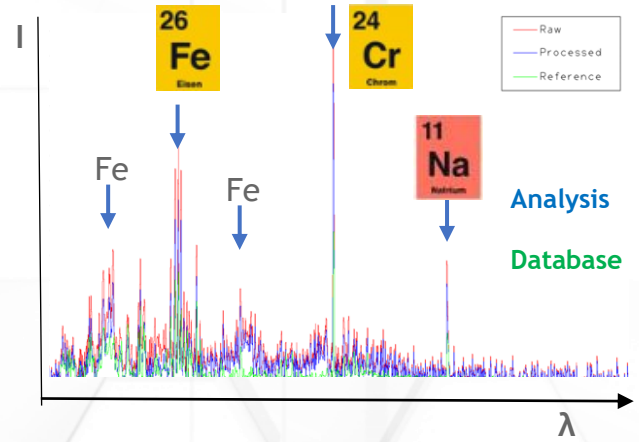
1. Optical inspection

⇒ No metallic gloss



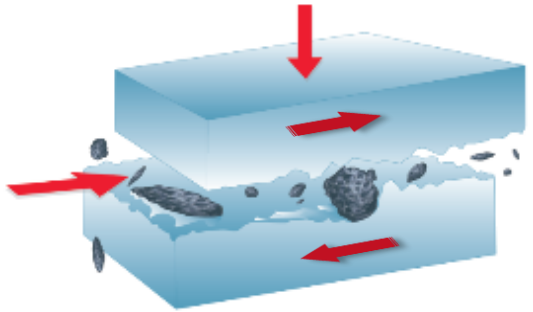
2. LIBS - chemical analysis

⇒ Particle identified as chrome steel



Damage potential

High damage potential in mechanical system



1. Crossed polarization: size, geometry, amount

Specification:

No abrasive particles > 150 µm

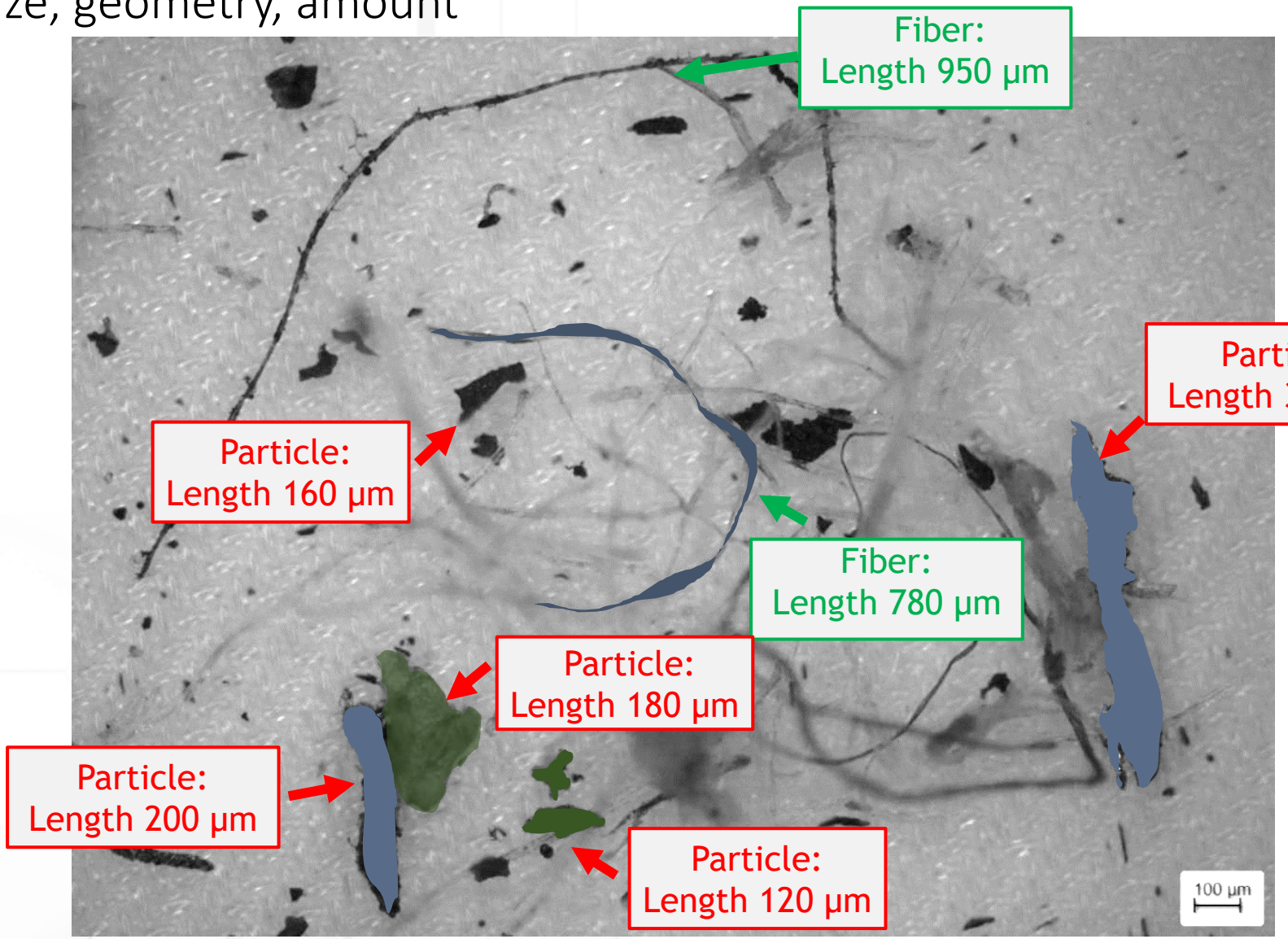
Other particles > 600 µm

No fibers > 1000 µm

? Abrasive particles > 150 µm ?

✓ Particles non-metallic/abrasive > 600 µm **OK**

✓ Fiber < 1000 µm **OK**



2. Bright field color image for additional clarification (metallic glance)

Specification:

No abrasive particles > 150 µm

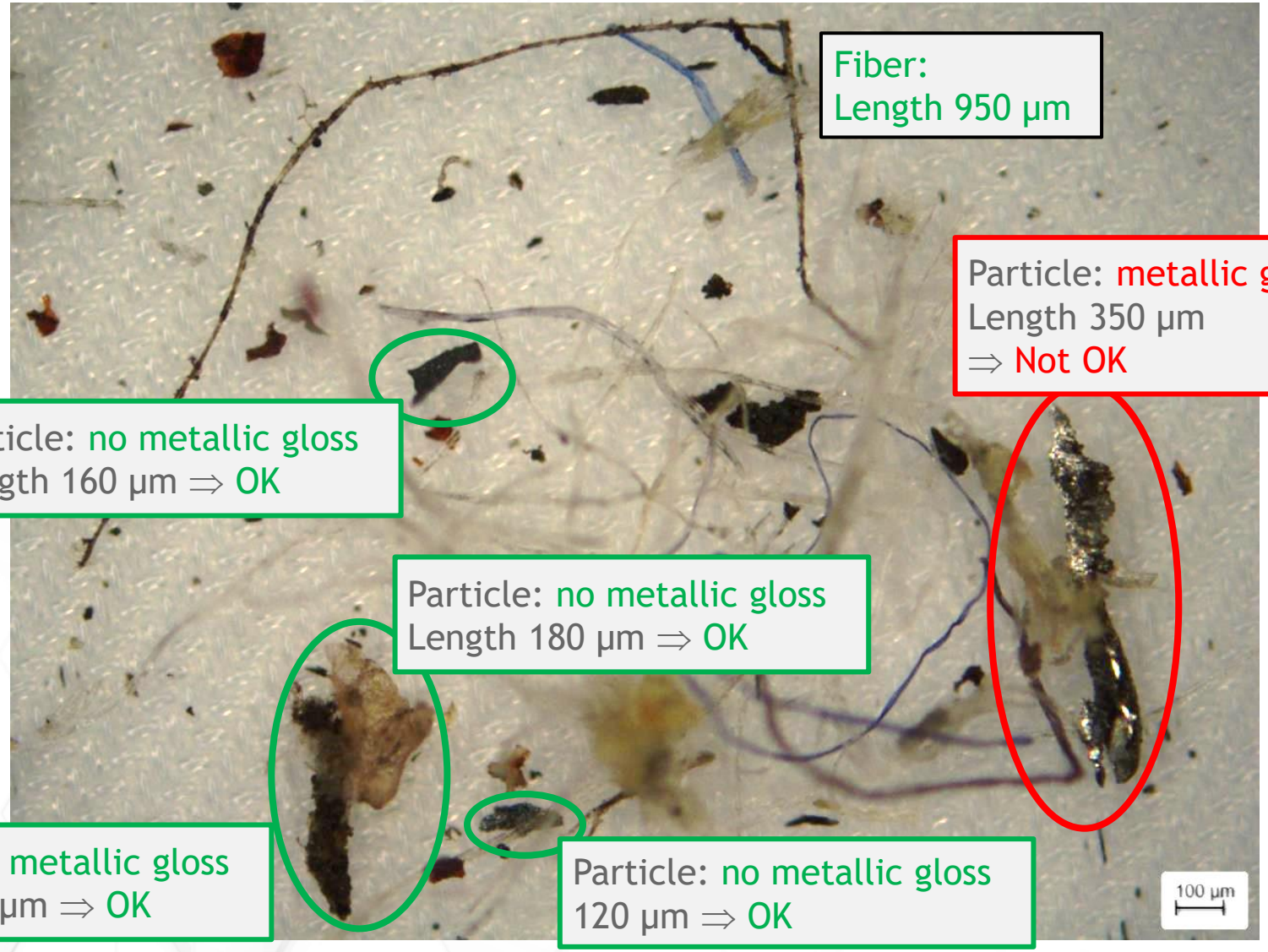
Other particles > 600 µm

No fibers > 1000 µm

✗ Abrasive particles > 150 µm **Not OK!**

✓ Particles non-metallic/abrasive > 600 µm **OK**

✓ Fiber < 1000 µm **OK**

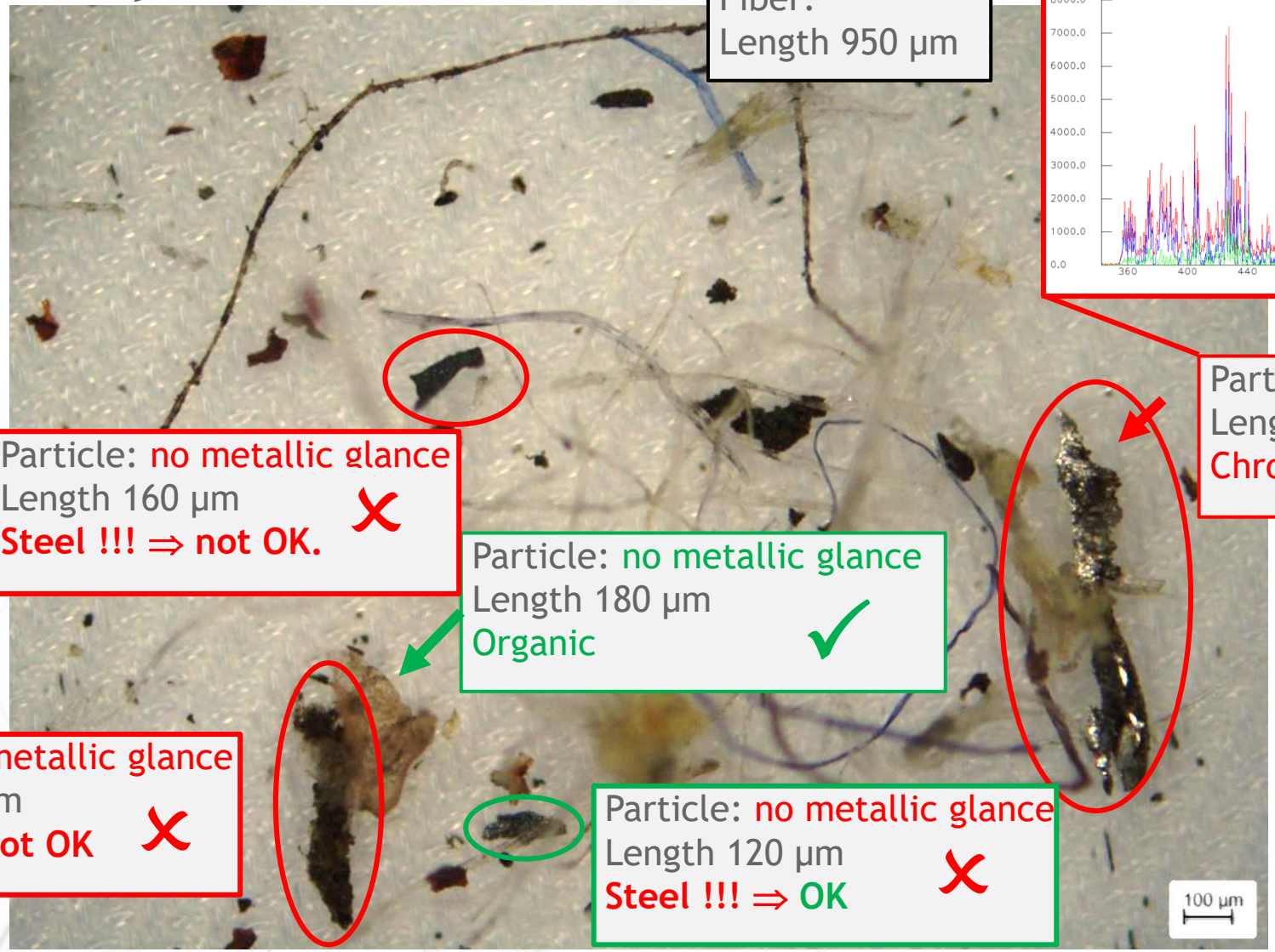


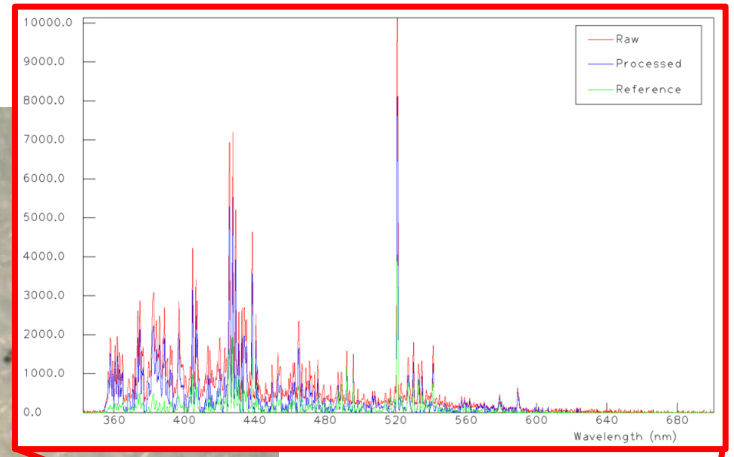
Sicher: Chemische Analyse mit LIBS:

? Abrasive particles > 150 µm ?

✓ Particles non-metallic/abrasive > 600 µm **OK**

✓ Fiber < 1000 µm **OK**



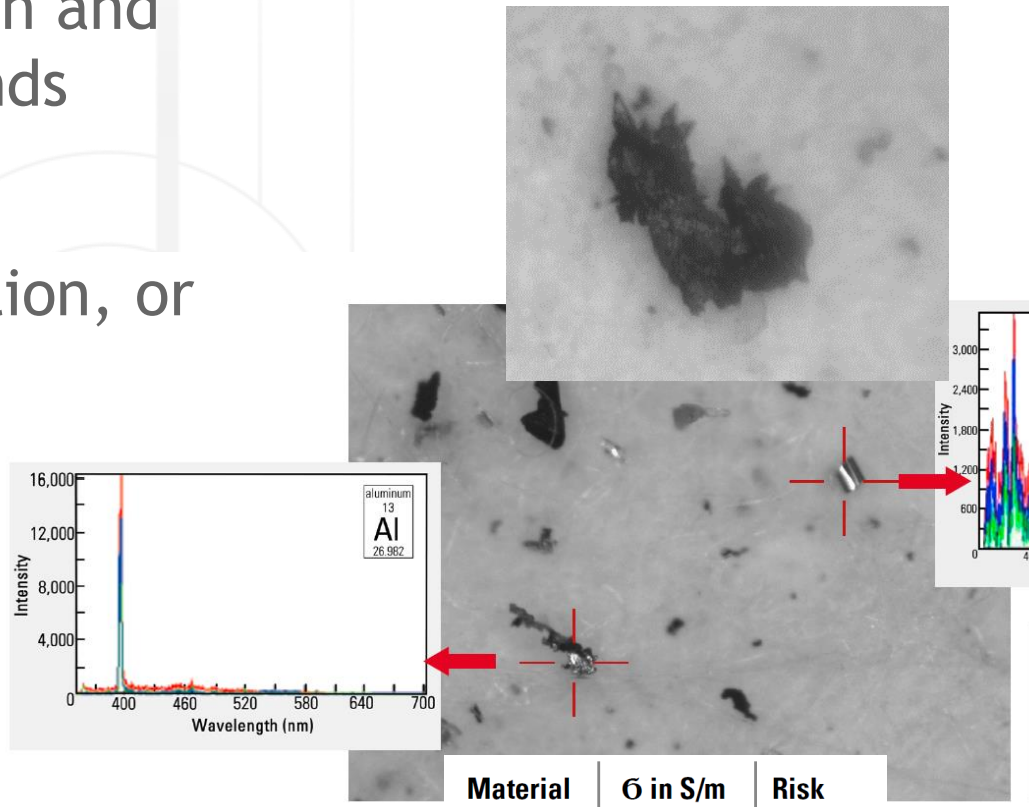


2-in-1 System: visual inspection and chemical analysis within seconds

No additional sample preparation, or sample transportation needed

Chemical information allows right assignment

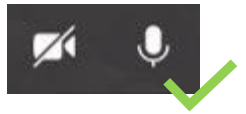
Fast and easy element identification for clearer damage potential estimation

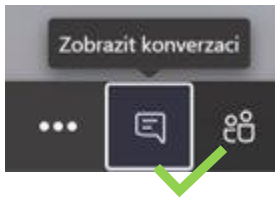


Material	σ in S/m	Risk
Cu	$58 \cdot 10^6$	High
Al	$37 \cdot 10^6$	Middle
Mn	$0{,}69 \cdot 10^6$	Low

> Information about physical features such as hardness, abrasiveness or (…) can only be gained using extended analysis methods. (VDA 19.1, 2015)

DISKUZE

Pro diskuzi si aktivujte zvuk  správně

Dotaz přes chat 

Ďakujem za pozornosť

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