

Microphotography of the light emitted by MSGCs operated in CF4

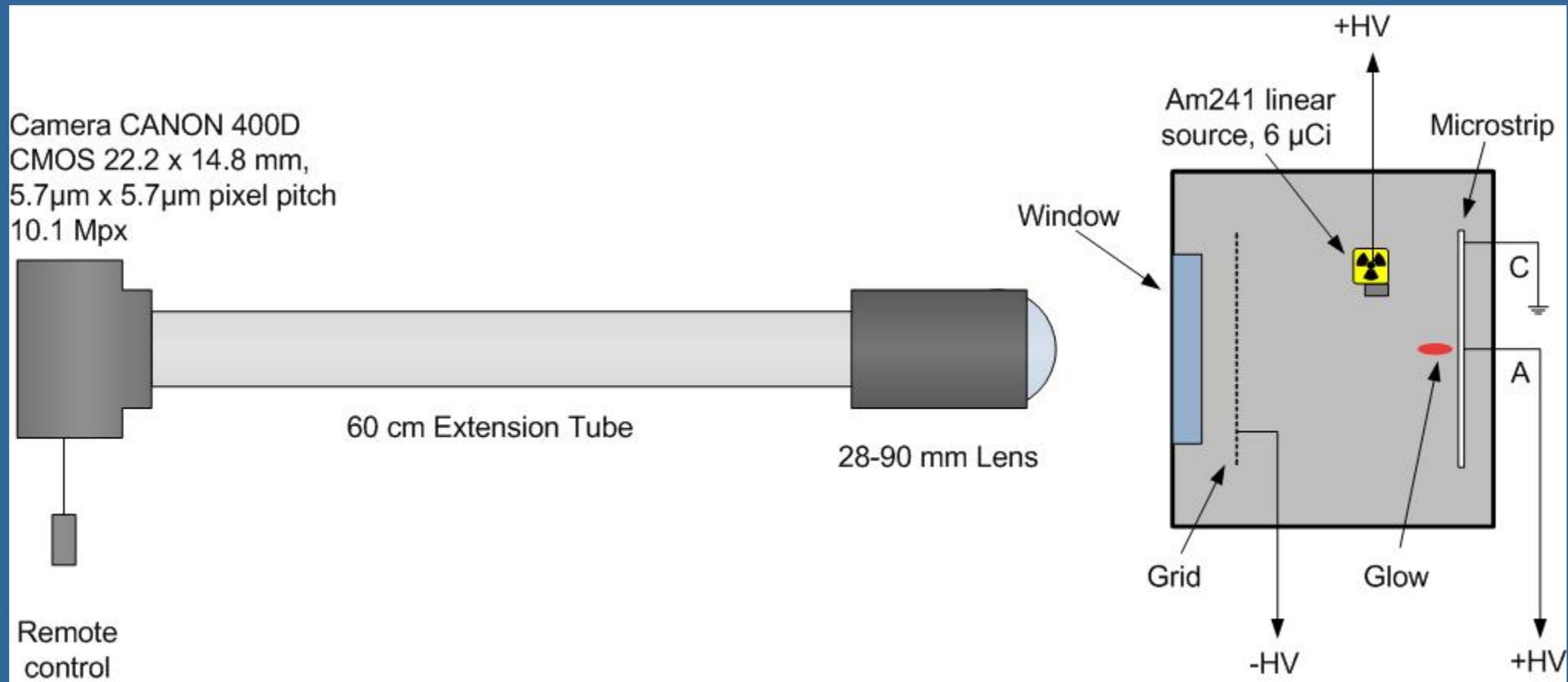
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Motivation

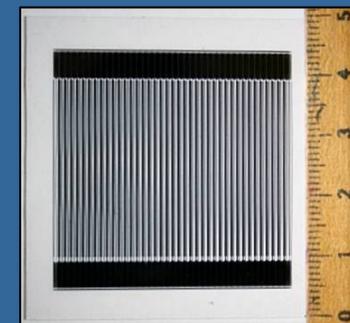
- The spatial distribution of the avalanche light in MSGC detectors with an optical readout has to be taken into account in light yield measurements.
- It can also be used as a validity test for simulations.
- May lead to introduction of corrections in the Anger Camera event reconstruction algorithms.
- It can provide a generalization of the light emission patterns for different types of MSGC.

Setup

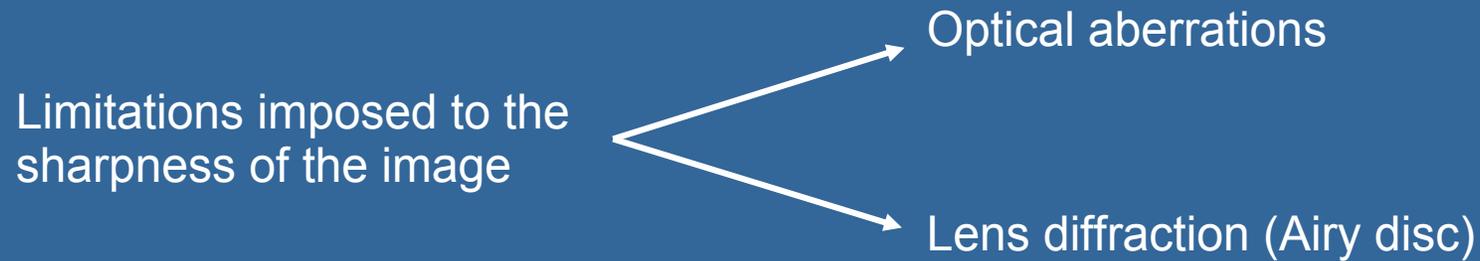


Max. magnification factor $\sim 8 \times \rightarrow 0.7 \times 0.7 \mu\text{m}^2/\text{Px}$

Microstrip: IMT, Masken und Teileungen AG
SN: 850771396
Pitch = 1 mm
Anode width = 10 μm
Cathode width = 600 μm



How sharp these images can be?



Considering a lens **only** limited by **diffraction**

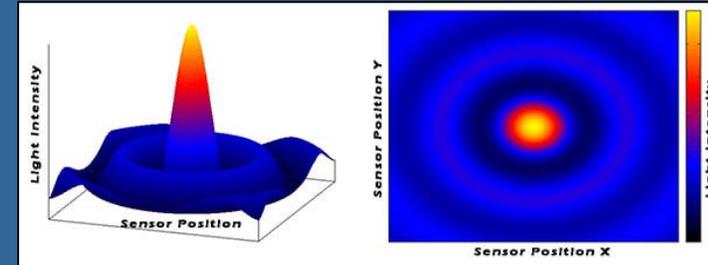
$$w \approx 0.42\lambda f/D \approx 1\mu\text{m}$$

w: width of the Airy disc

λ : wavelength of the light (~ 600 nm)

f : focal distance of the lens (~ 90 mm)

D : aperture of the lens (20 mm)



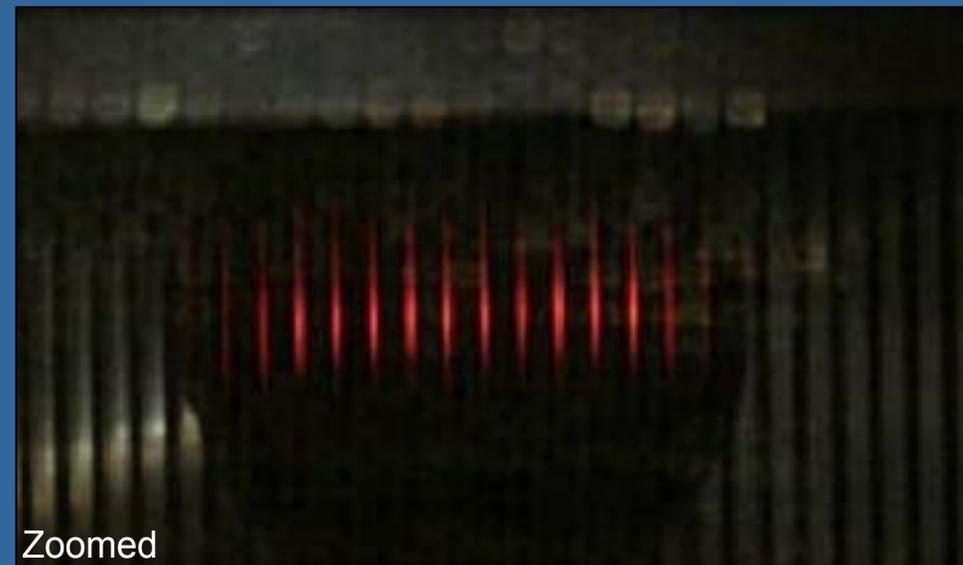
Blurring $> 1\mu\text{m}$

Avalanche light

- 3 bar CF4
- $V_{\text{Anode - Cathode}} = 1.85 \text{ kV}$
- $I \sim 80 \text{ nA}$

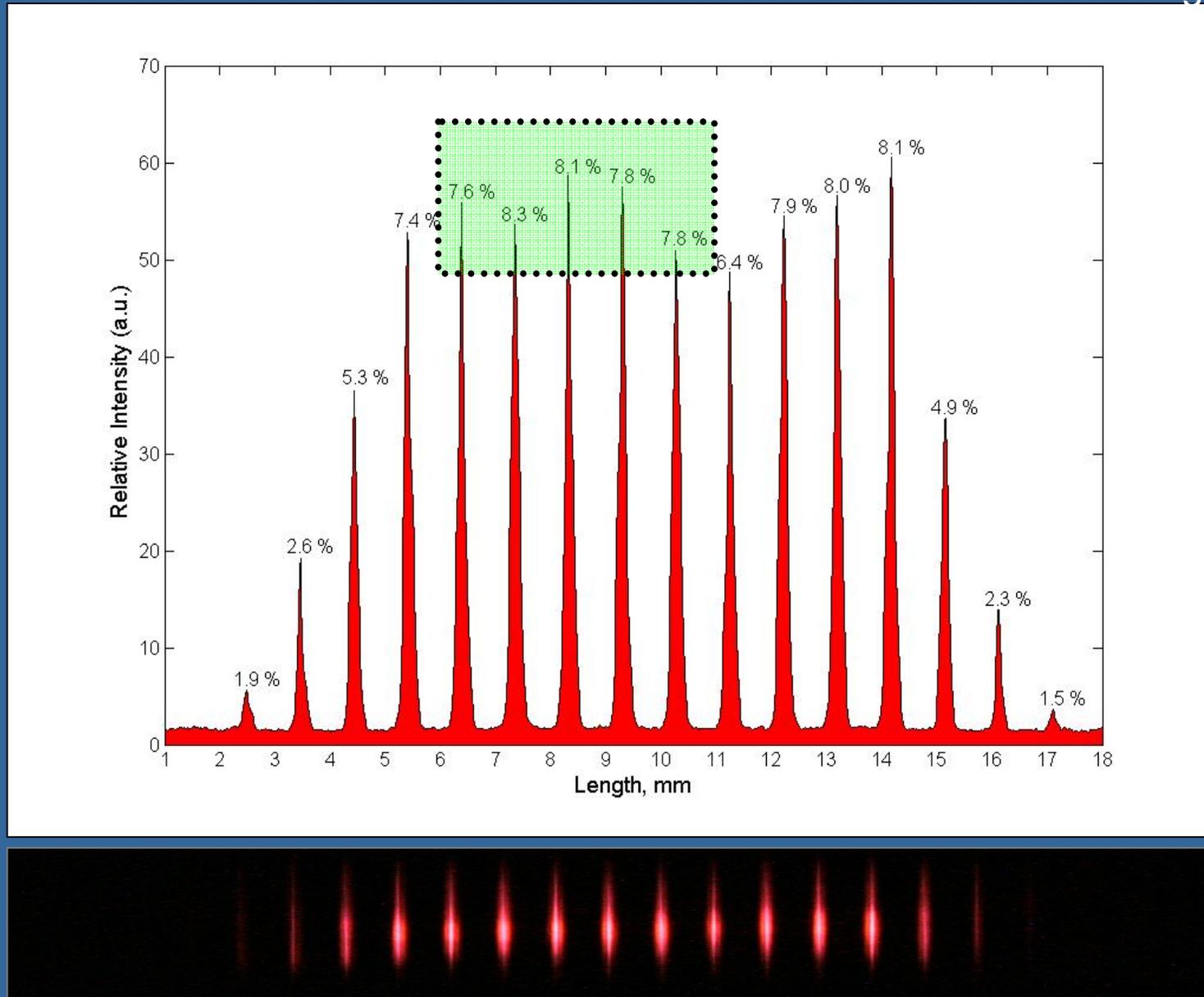


The irradiated area spanned ~16 anodes

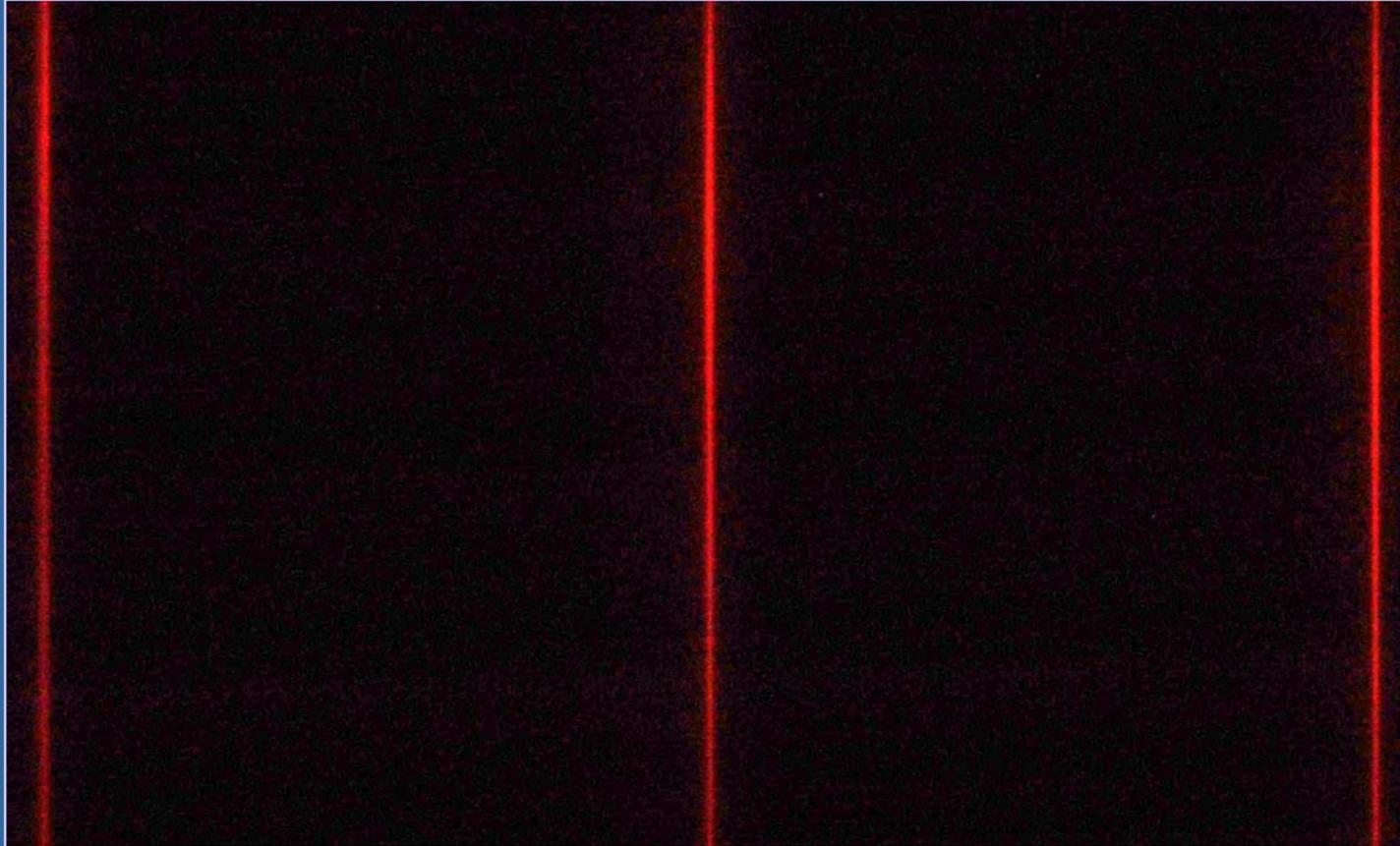


Rough estimation of the relative intensity of the light emission from each anode

Each anode in the center contributes **about 8%** to the total collected light

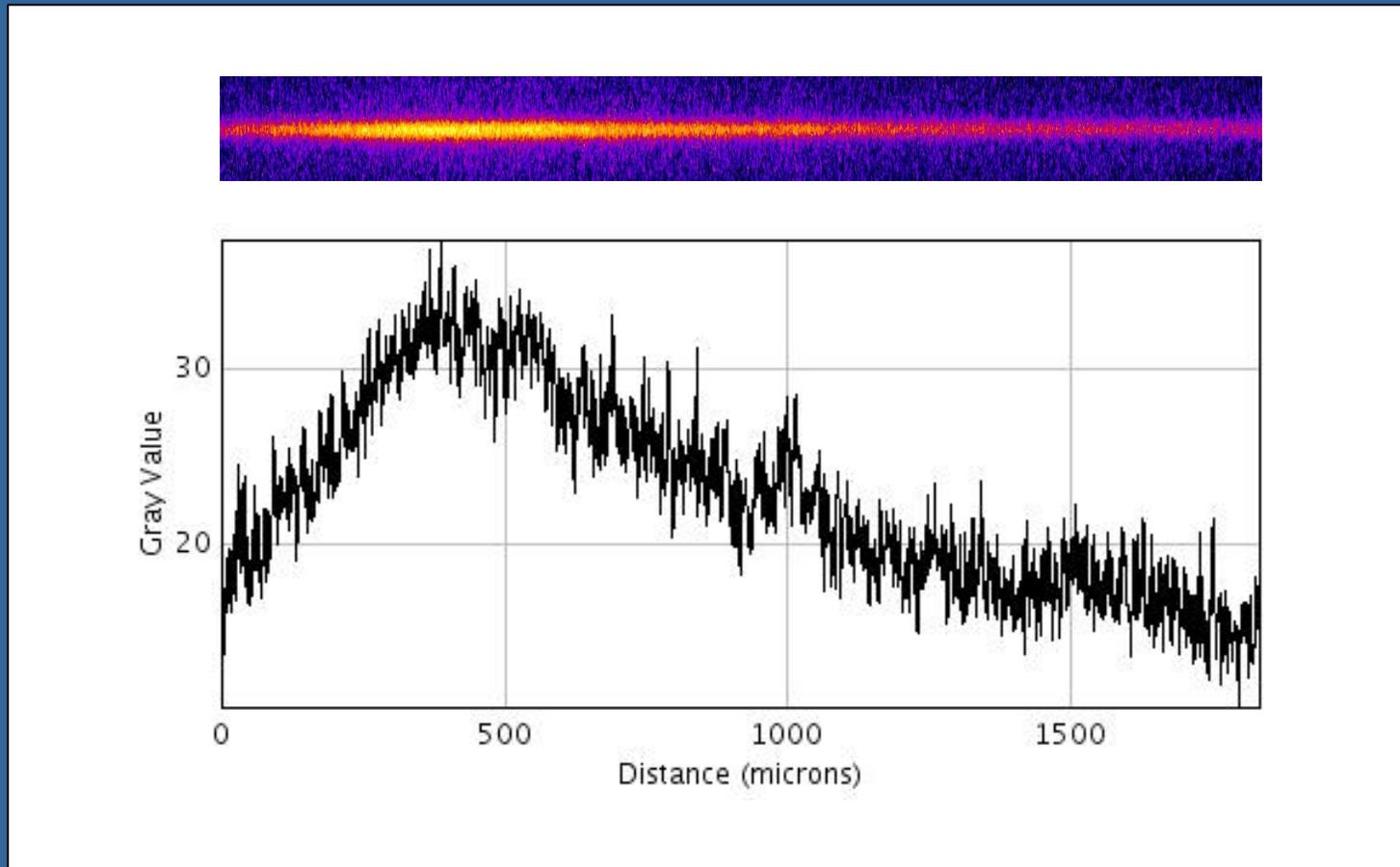


At maximum amplification $\rightarrow 0.7 \times 0.7 \mu\text{m}^2/\text{Px}$



Light is emitted in the vicinity of the anodes

Emission profile along the anode length

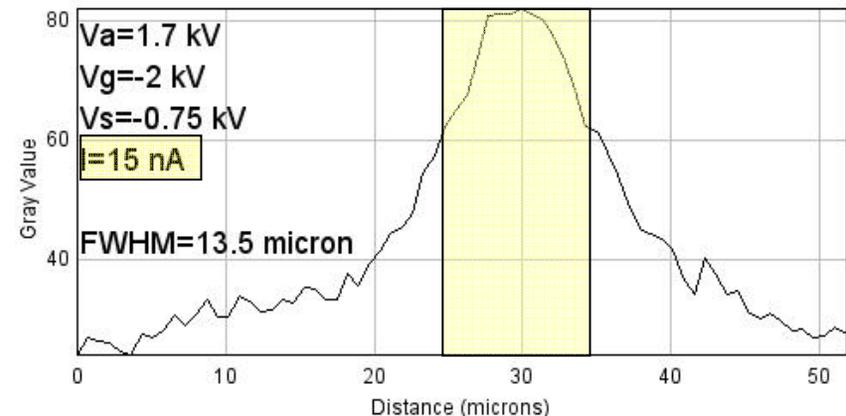
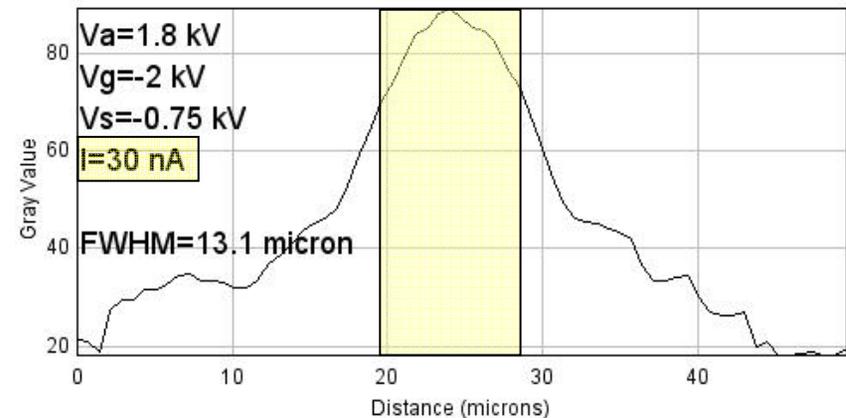
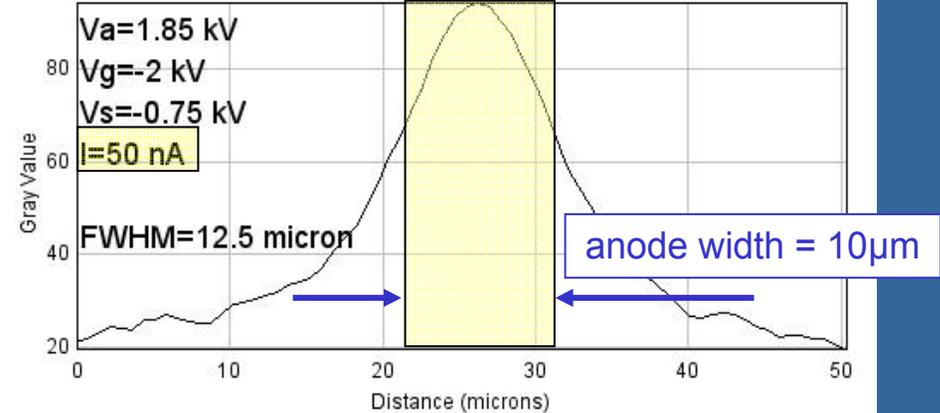


The profile along the anode length reproduces the Bragg curve

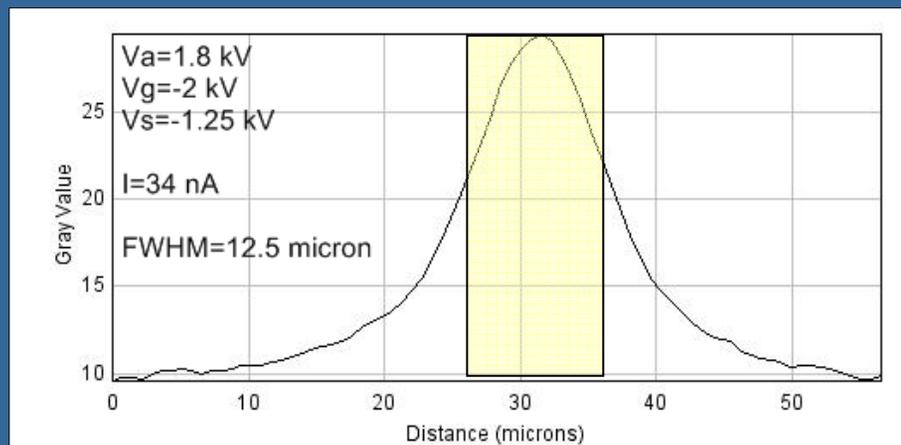
Emission profile across the anodes

3 bar CF₄
Several currents

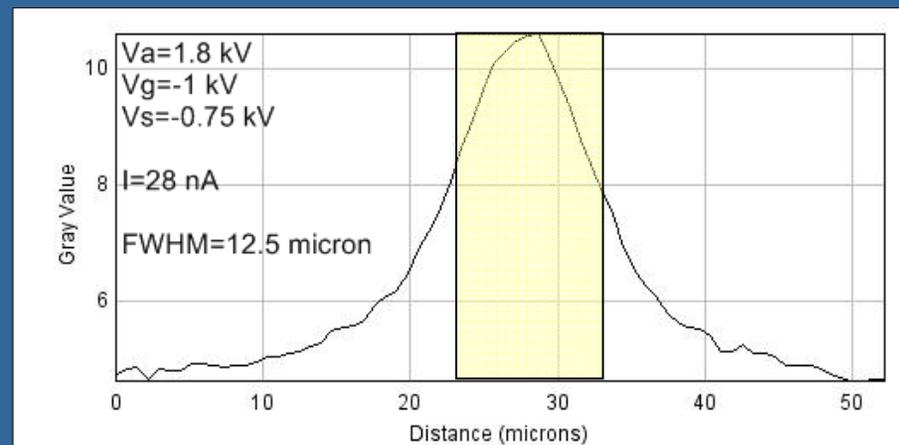
~ 65% of the light is emitted directly above the anode, within a region of the same width as the anode's surface.



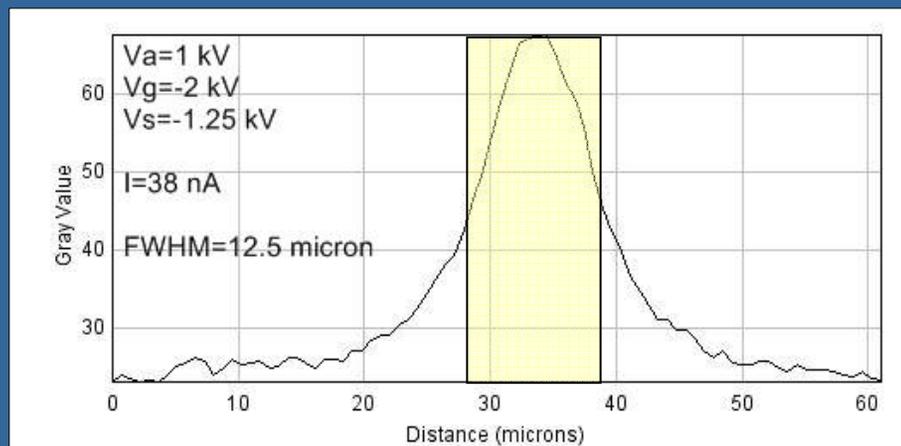
3 bar CF4 field configuration 2



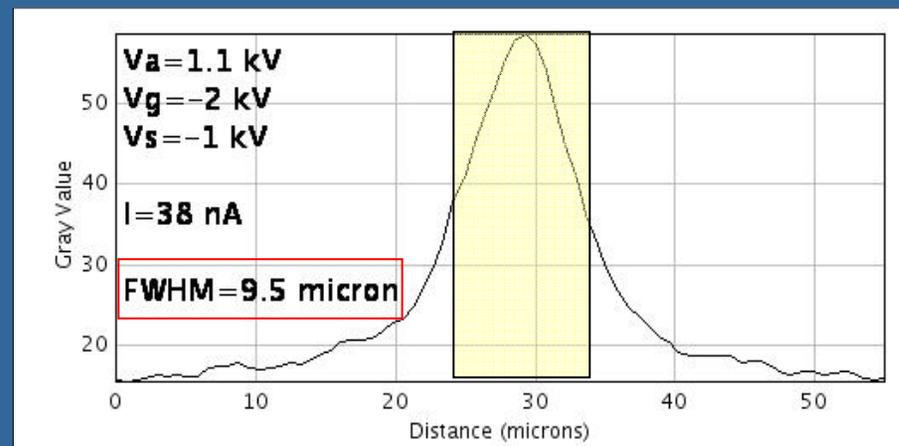
3 bar CF4 field configuration 3



2 bar CF4



2 bar CF4 + 2 bar He



Conclusions

- The avalanche light is localized at these operating conditions
- Most of the light is emitted directly above the anode, within a region of the same width as the anode's surface.
- The width of the emission region seems to be narrower in a He-CF₄ mixture than in CF₄ (at these operating conditions)
- For CF₄ we saw no significant variation of the light profiles for different pressures or different field configurations

Next

- New lens system with increased resolution is now available
- It could be interesting to see the distribution of the avalanche light on a plane perpendicular to the microstrip surface.

Microphotography of the anode's surface after operation

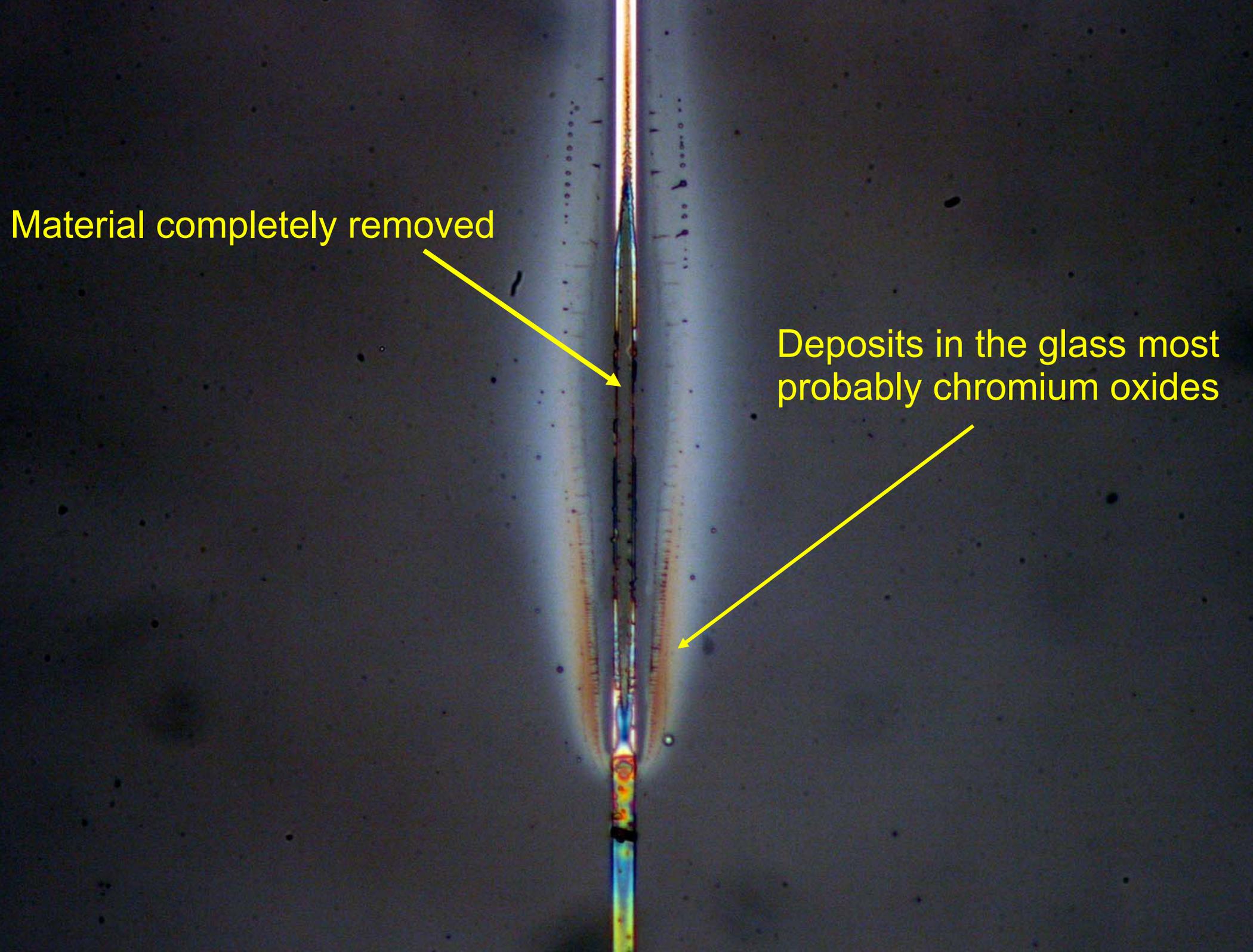
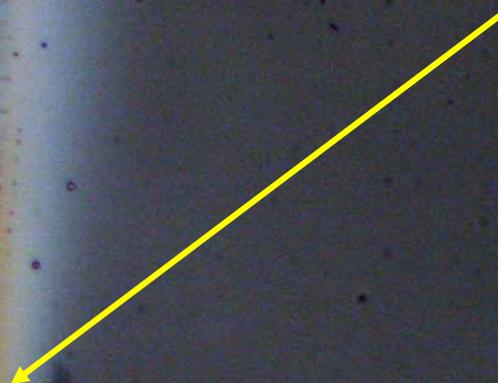
Overview of the operating conditions

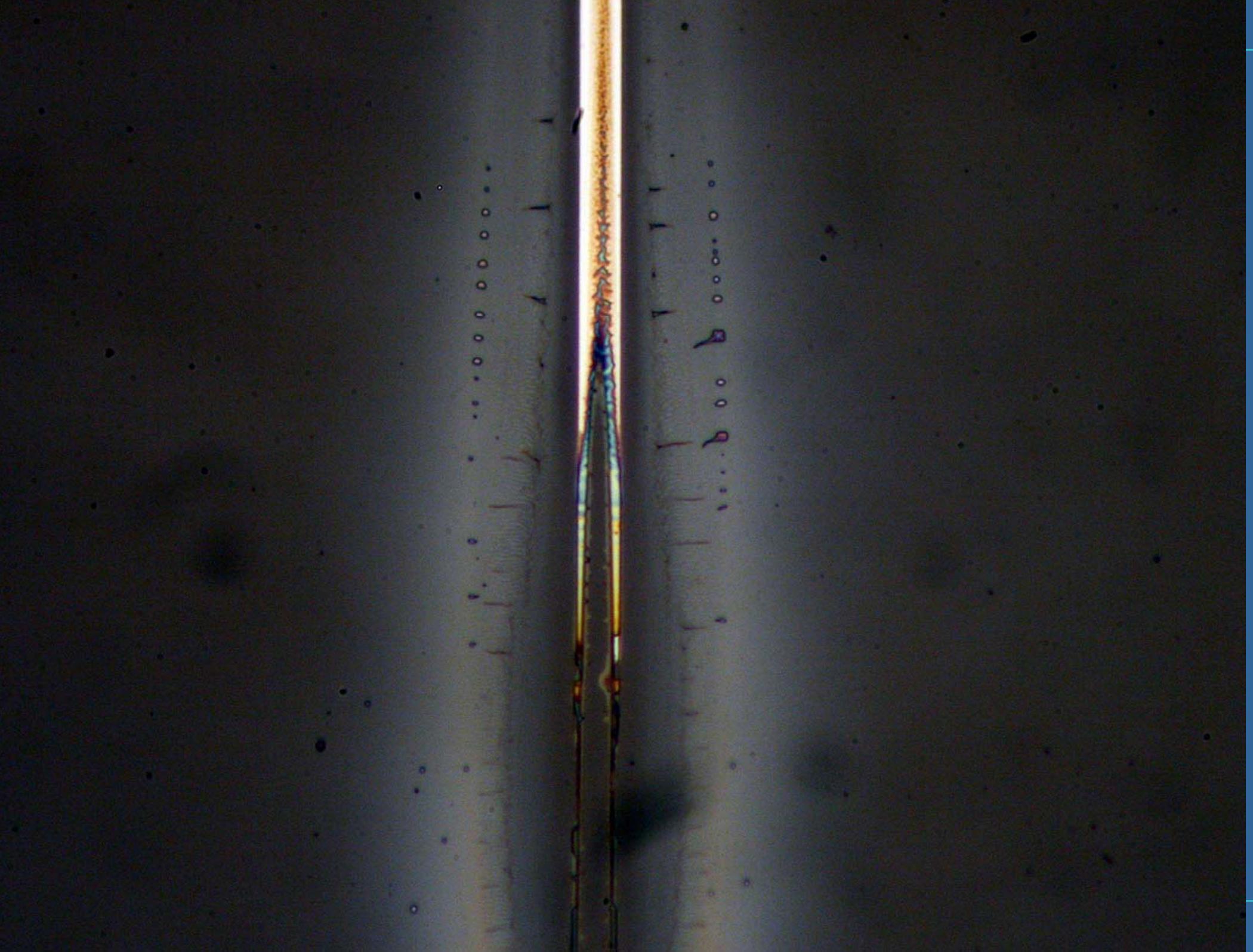
- Very high Anode Current > 80 nA
- The chamber was opened several times
- The pumping was relatively short
- No baking
- The presence of O_2 , H_2O was very likely

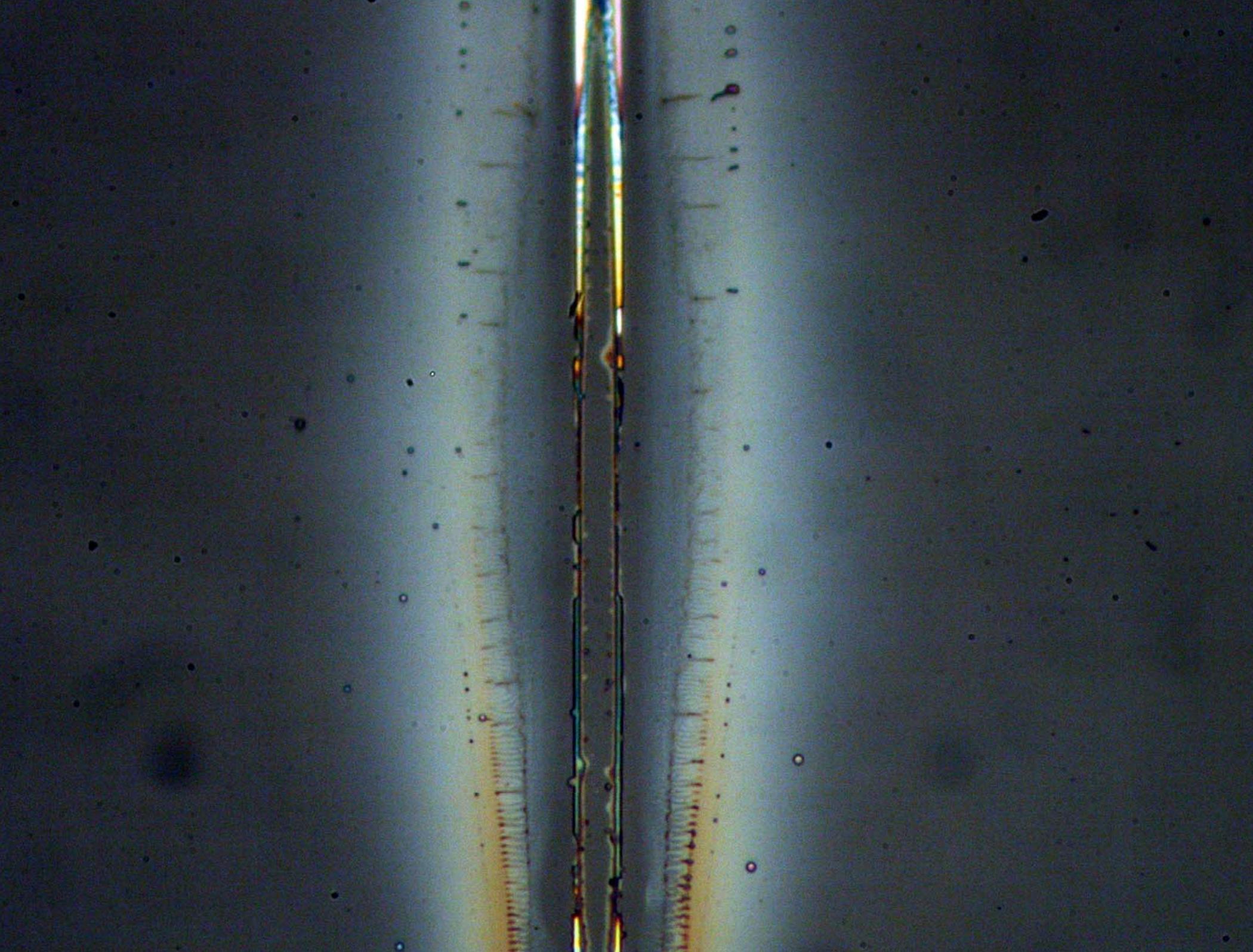
Material completely removed

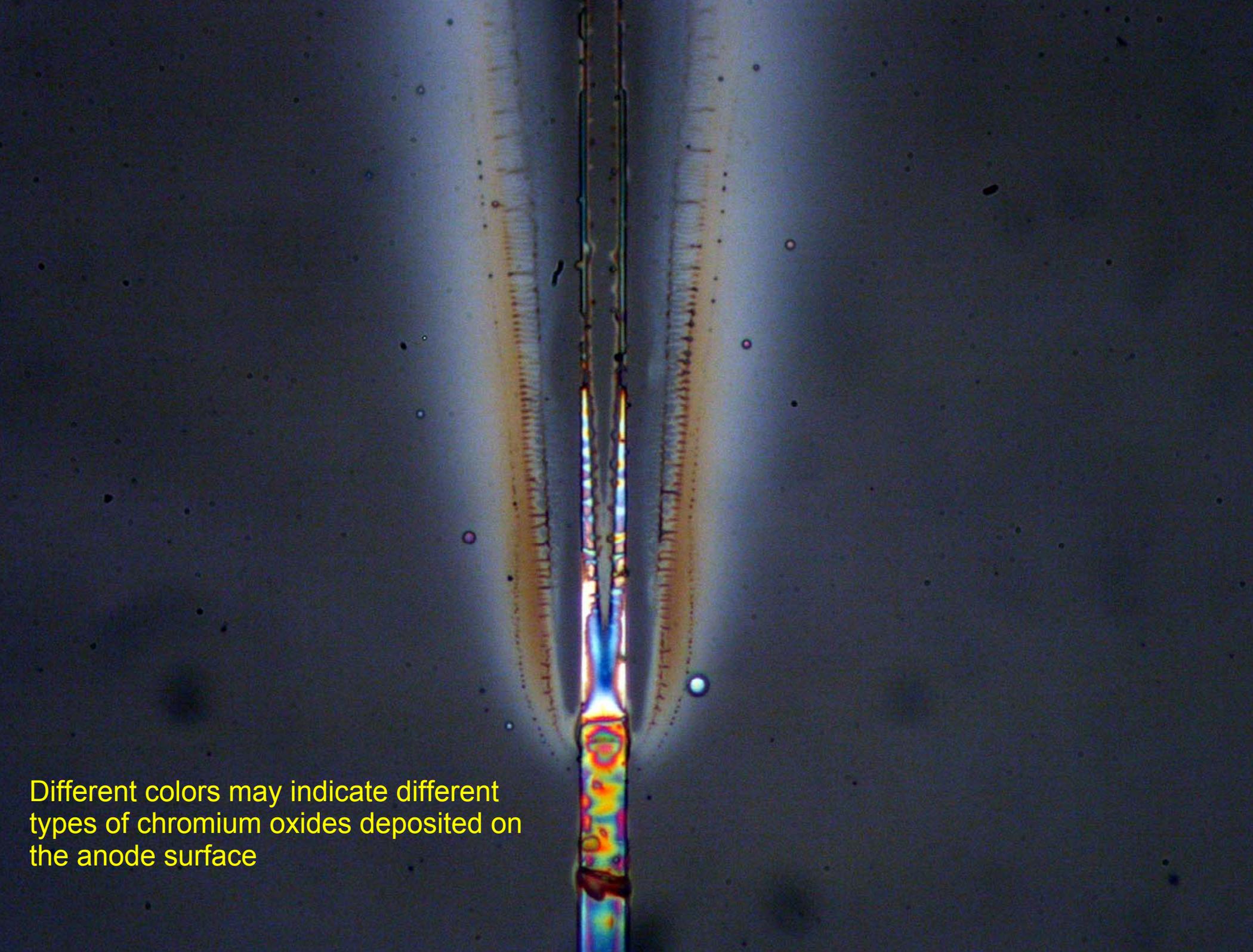


Deposits in the glass most probably chromium oxides









Different colors may indicate different types of chromium oxides deposited on the anode surface

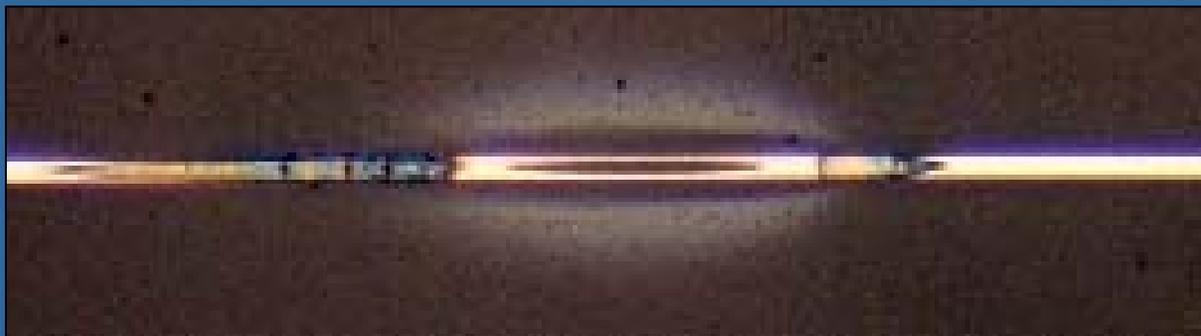
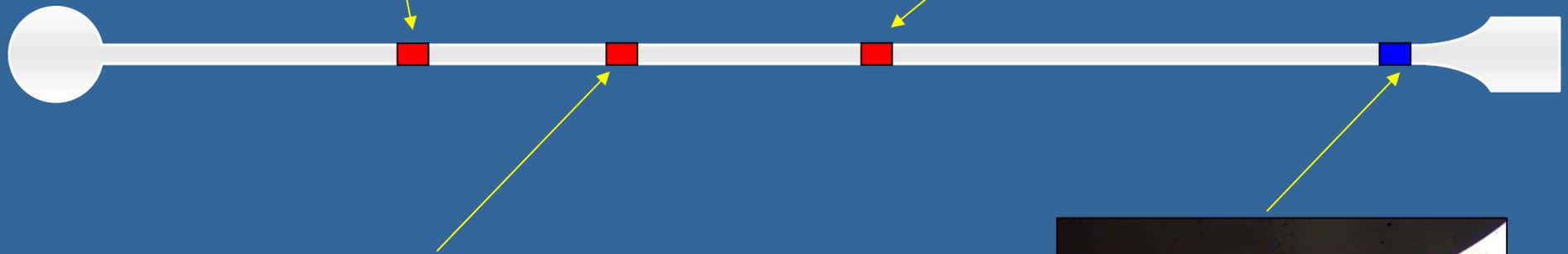
Damage along one anode



Lower current & less time



Higher current & more time



Question

Does long term operation leads to variations of the anode reflectivity?

The End

Microstrip: IMT, Masken und Teileungen AG

SN: 850771396

Pitch = 1 mm

Anode width = 10 μm

Cathode width = 600 μm

