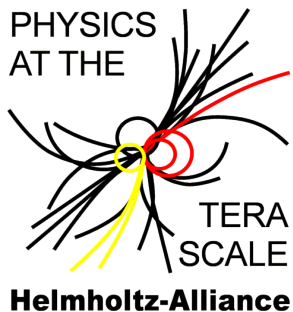


Optical inspection of SRF cavities at DESY



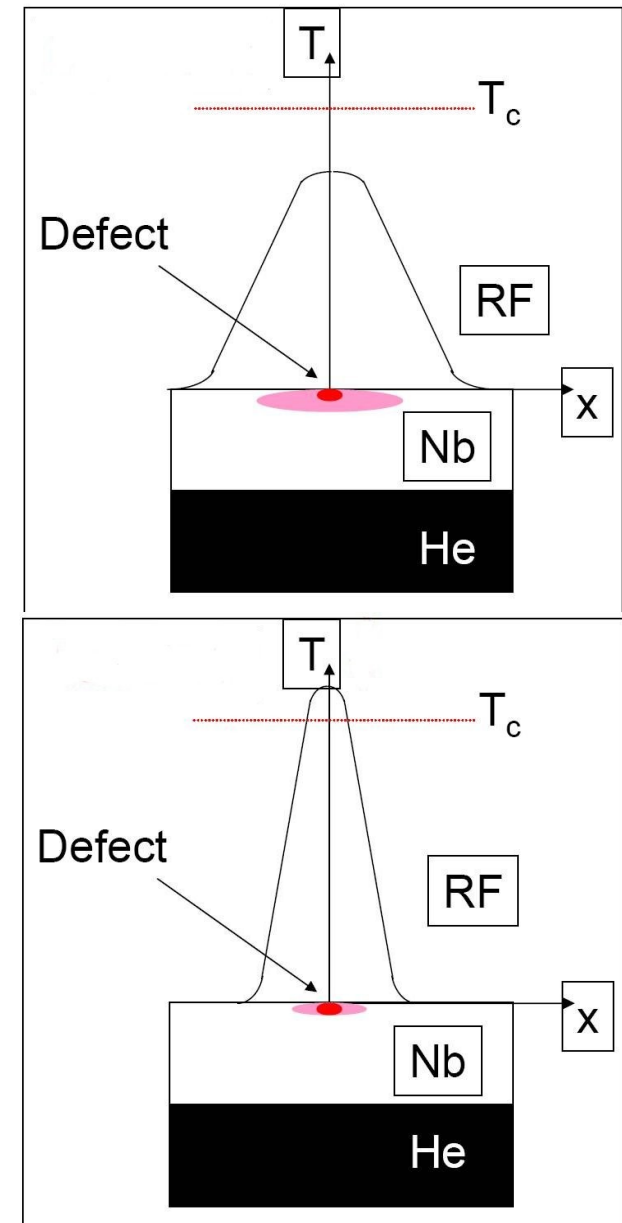
Sebastian Aderhold
DESY



3rd Annual Workshop 'Physics at the Terascale'
Hamburg 12.11.2009

Thermal breakdown

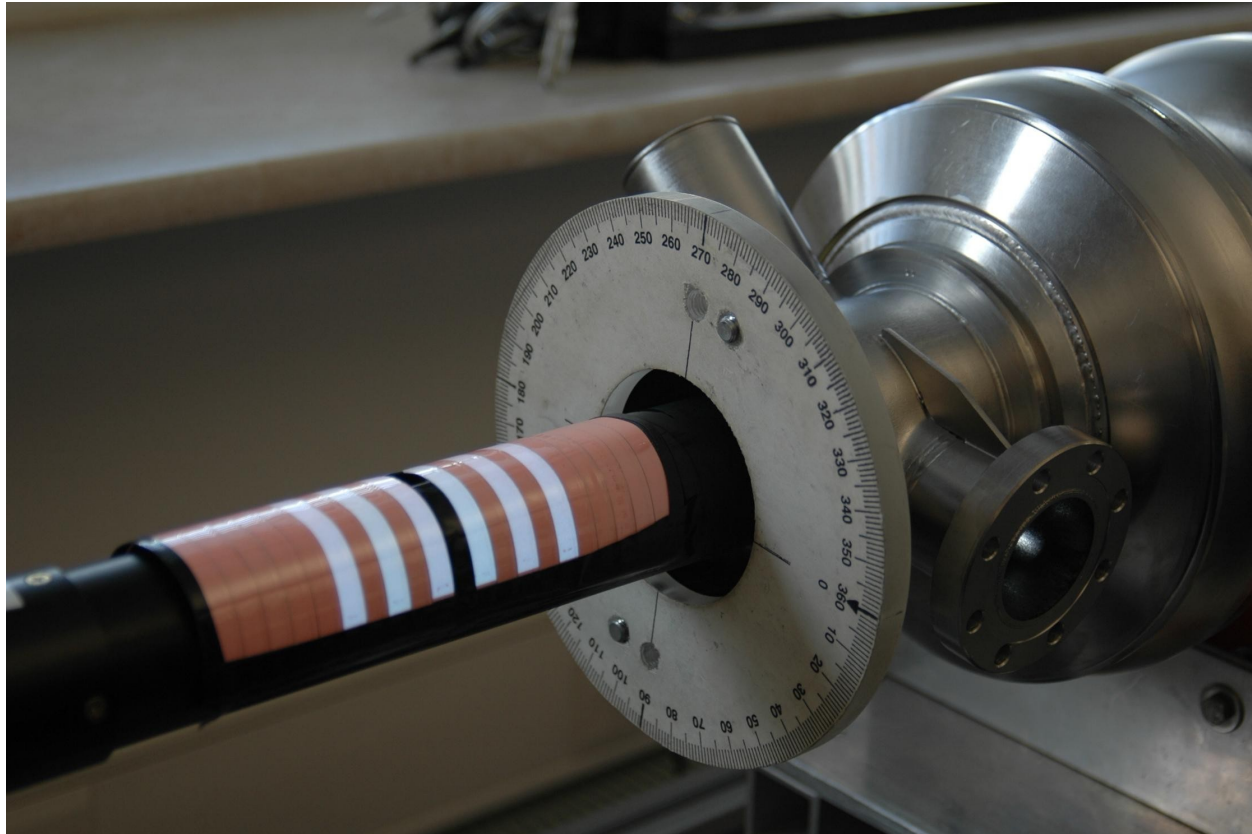
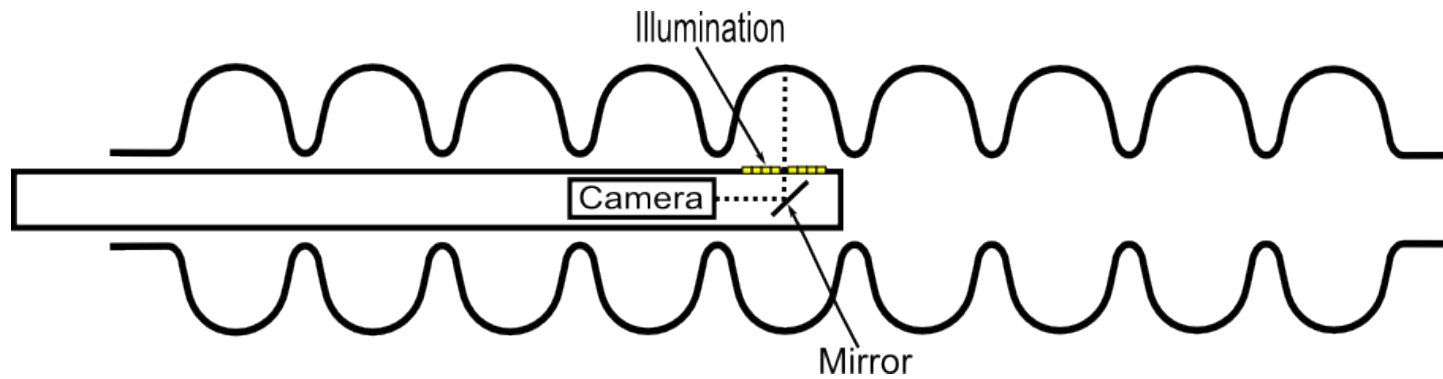
- Localized effect at „defects“ with higher R_s
 - Inclusions of foreign material
 - Bumps or pits
 - Welding defects
- Dissipation of energy \rightarrow exceeding of T_c
- If heat can't be transported to He-bath by surrounding material \rightarrow breakdown (quench)



A new optical inspection system

- Developed at Kyoto University and KEK
- High resolution camera
- Sophisticated lighting system
 - Adapted to difficult conditions (mirror-like surface)
 - Lighting from different angles possible
- Prototype in operation at DESY since August 2008
- More than 20 cavities inspected

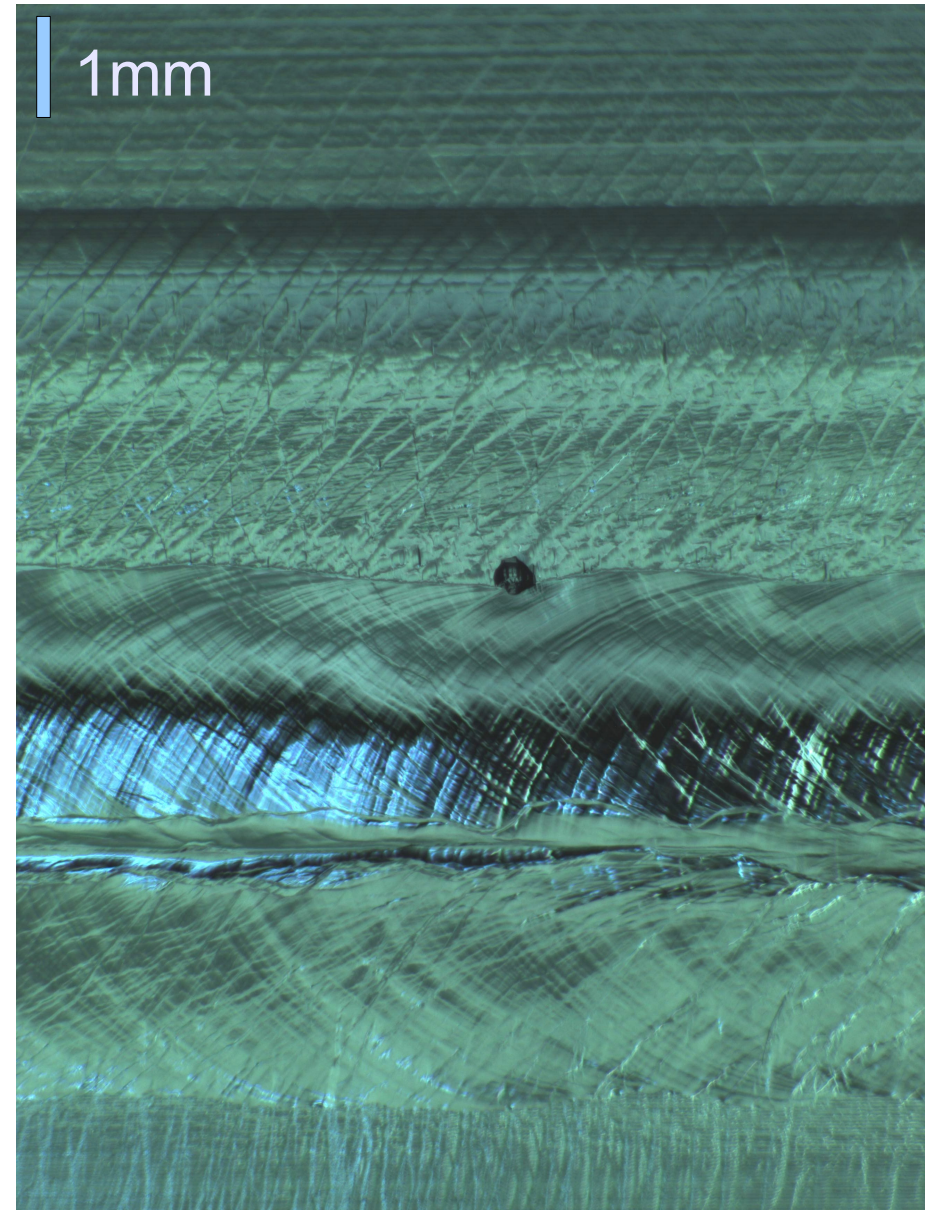
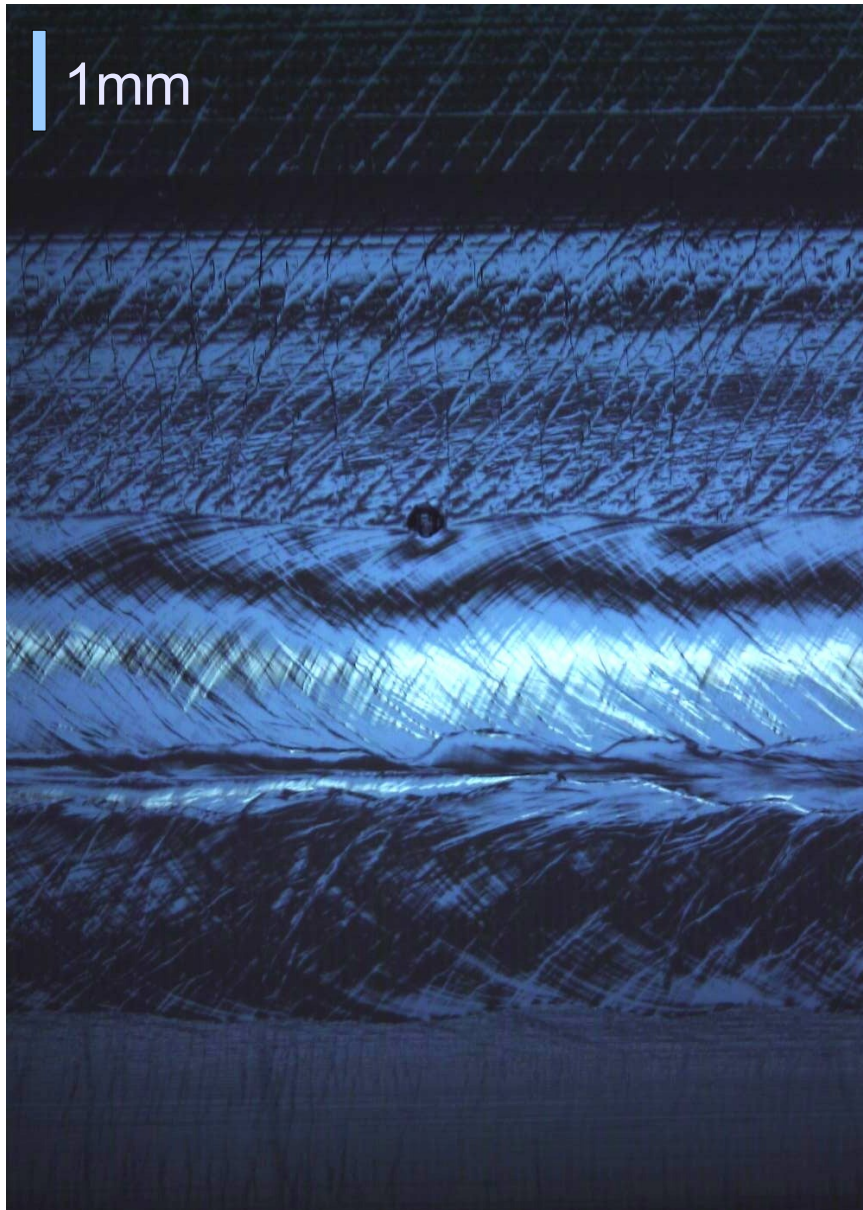
A new optical inspection system



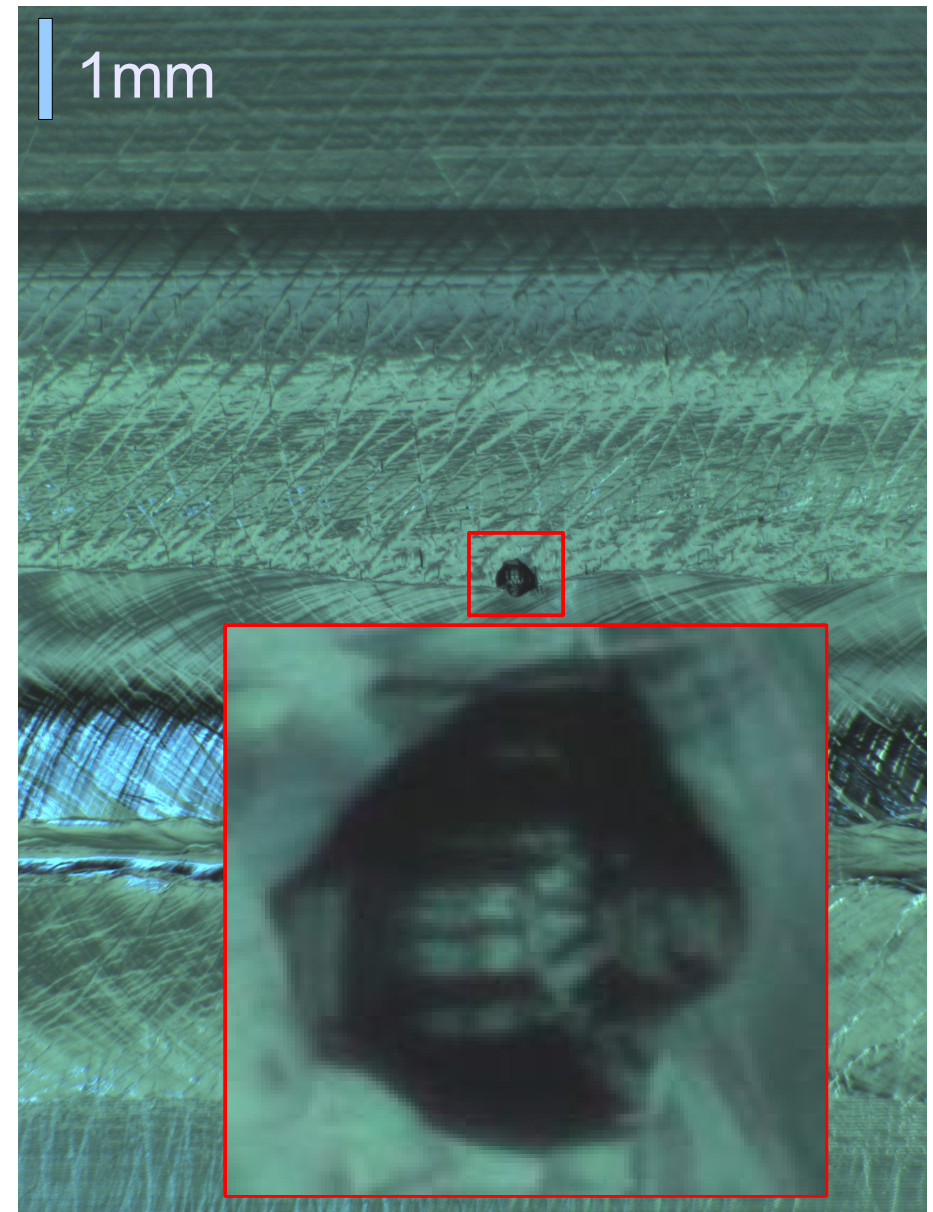
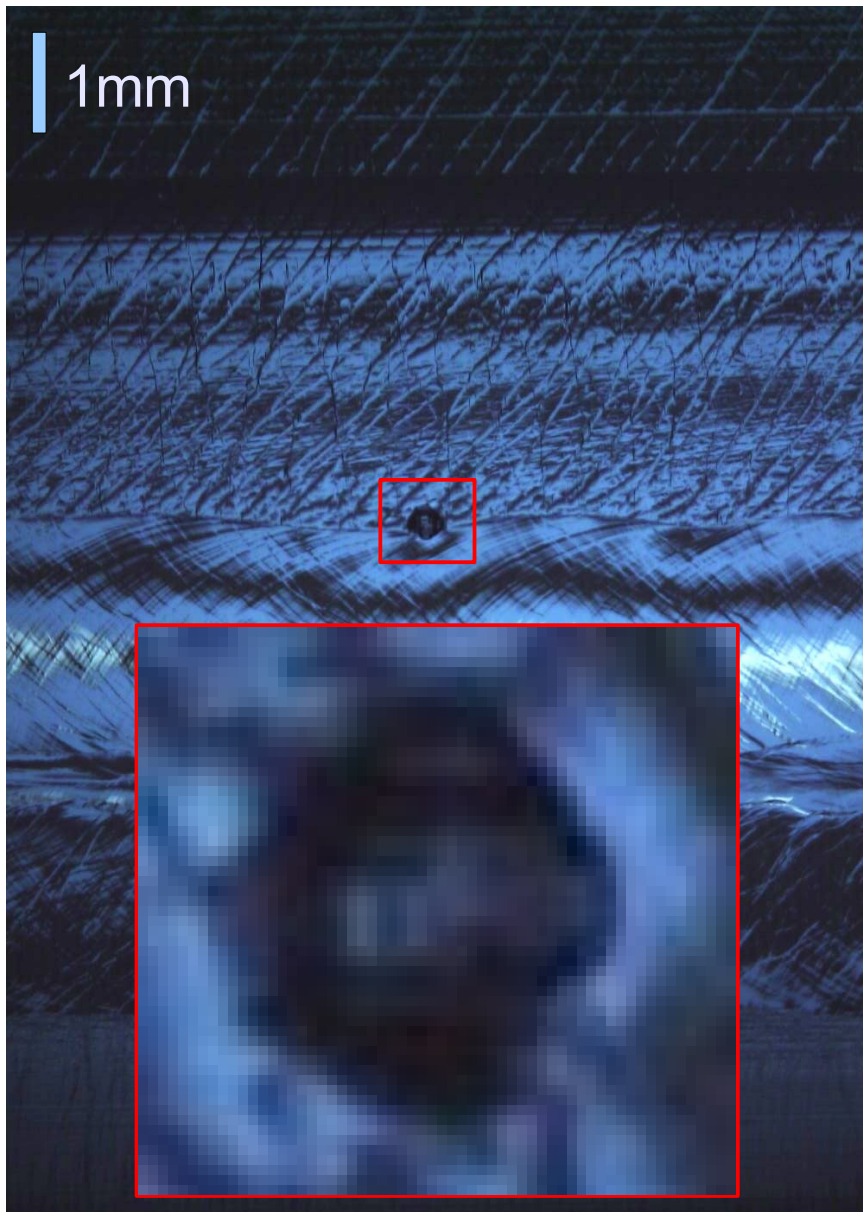
Updated version

- Updated version at DESY since beginning of October
- Improved lighting
 - Changed from EL-sheets to LEDs
 - Increased luminosity
 - No ageing (decreased illumination)
- Improved resolution
 - Old: 5 μm pixel-size
 - New: 1.75 μm pixel-size
 - Effective resolution: 3.5 μm /pixel

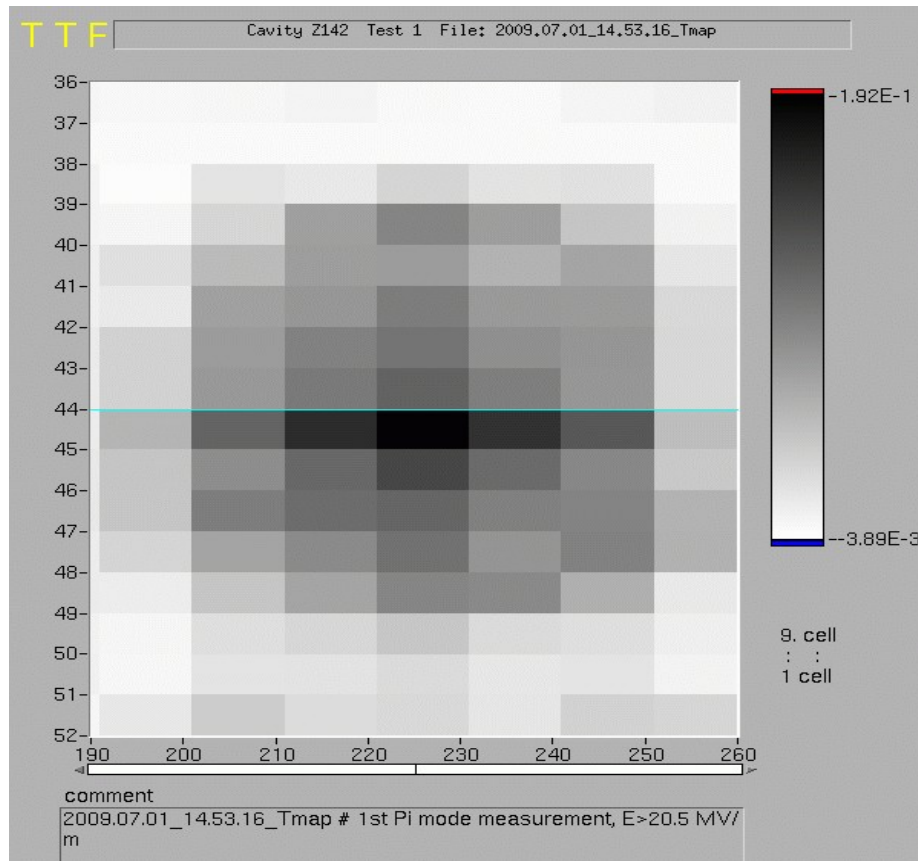
Comparison: Old \leftrightarrow New



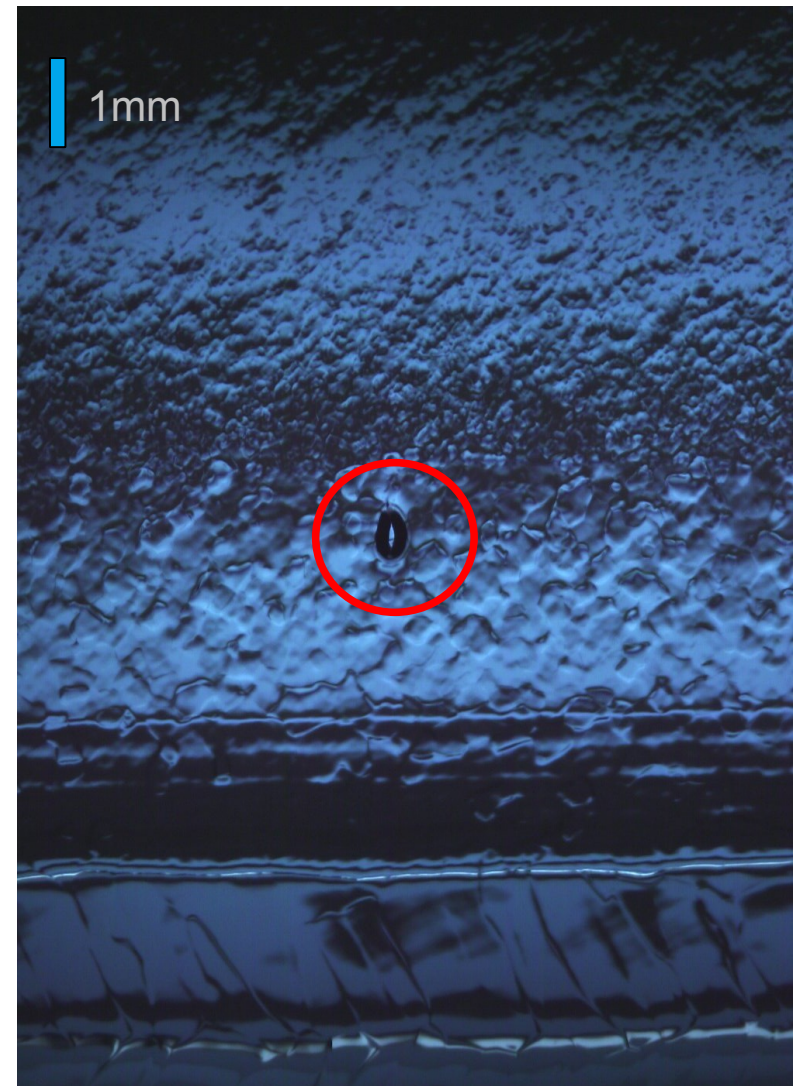
Comparison: Old \leftrightarrow New



T-map ↔ Picture: Z142



Hot spot found by T-map
at equator 6 in pi-mode,
limited by quench at 20.6 MV/m



Picture of HAZ near hotspot after
RF-test

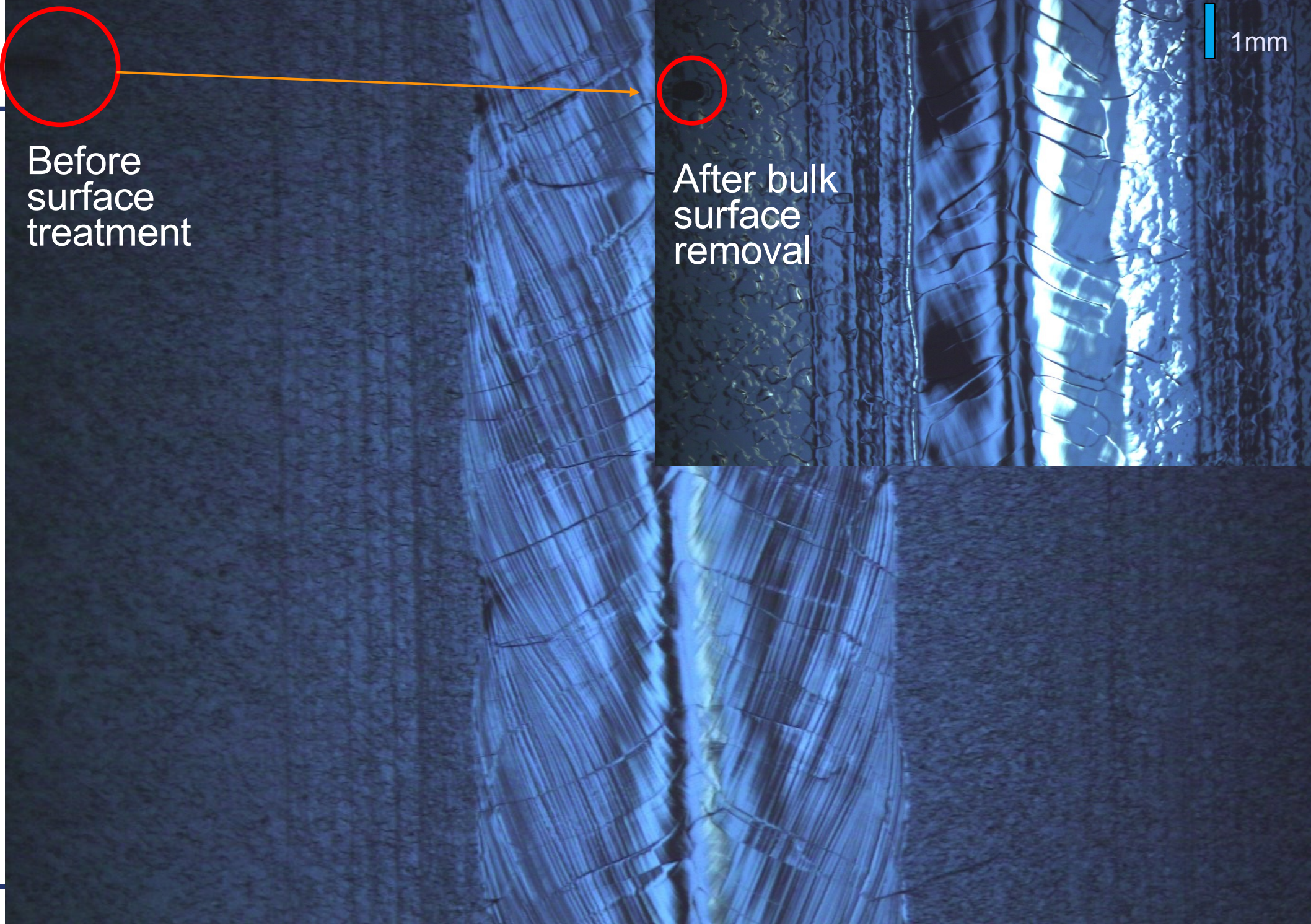


Before
surface
treatment



1mm

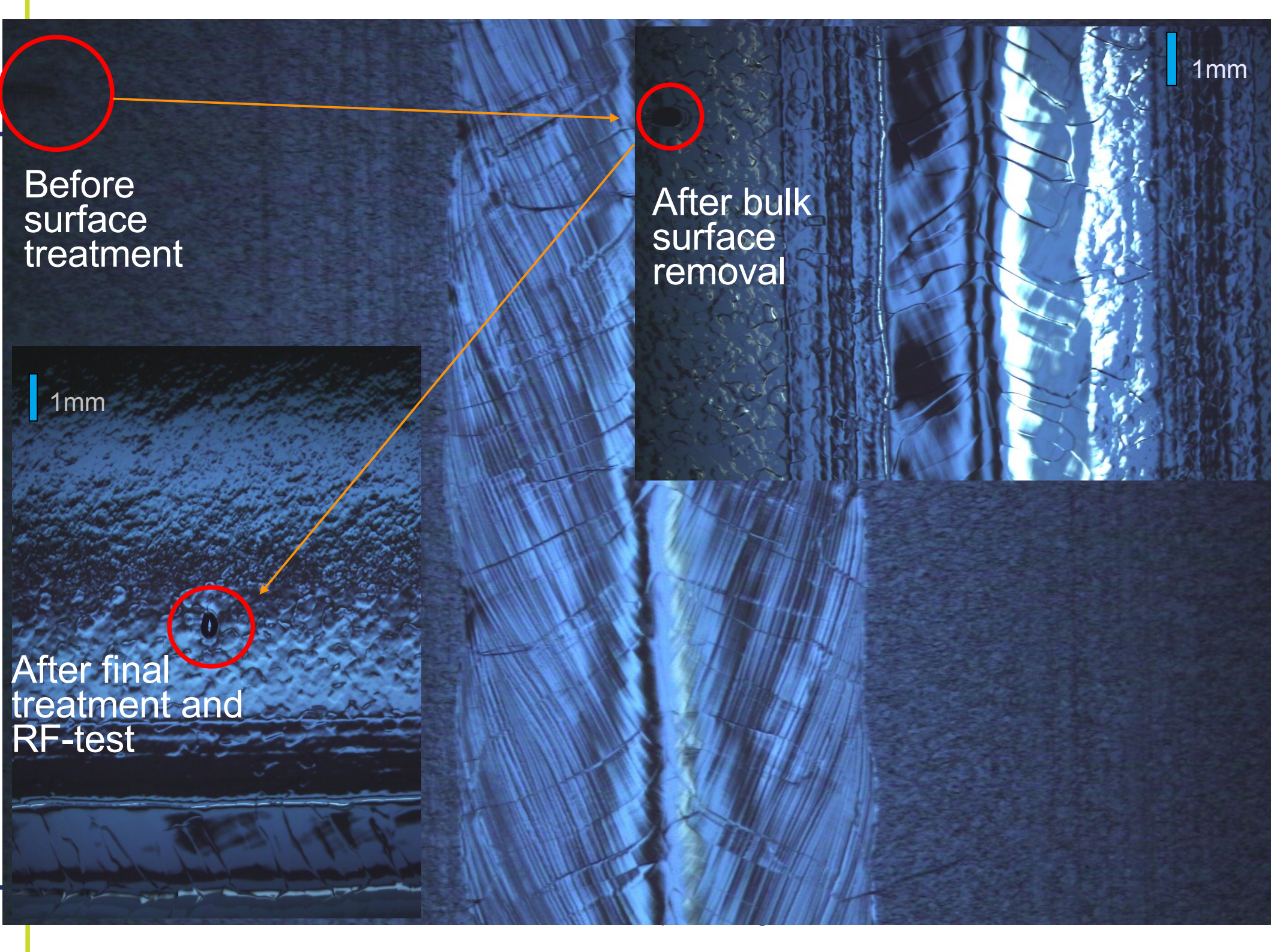




Before
surface
treatment

After bulk
surface
removal

1mm



Before
surface
treatment

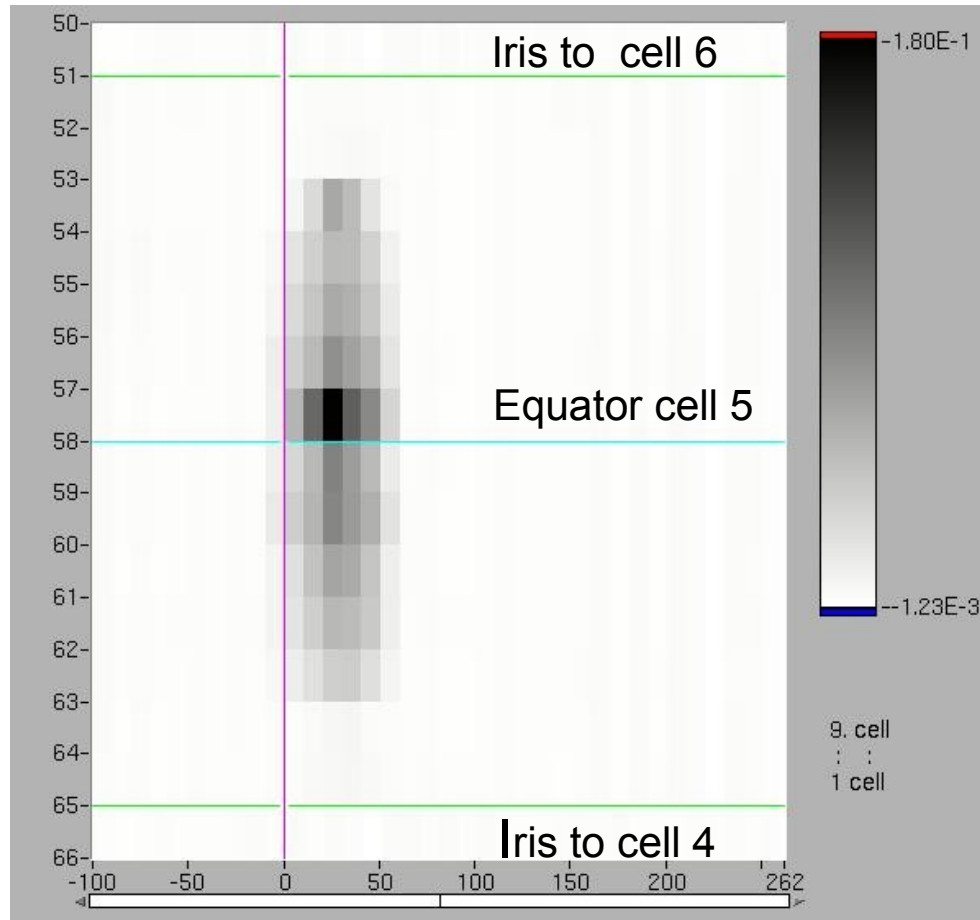
After bulk
surface
removal

After final
treatment and
RF-test

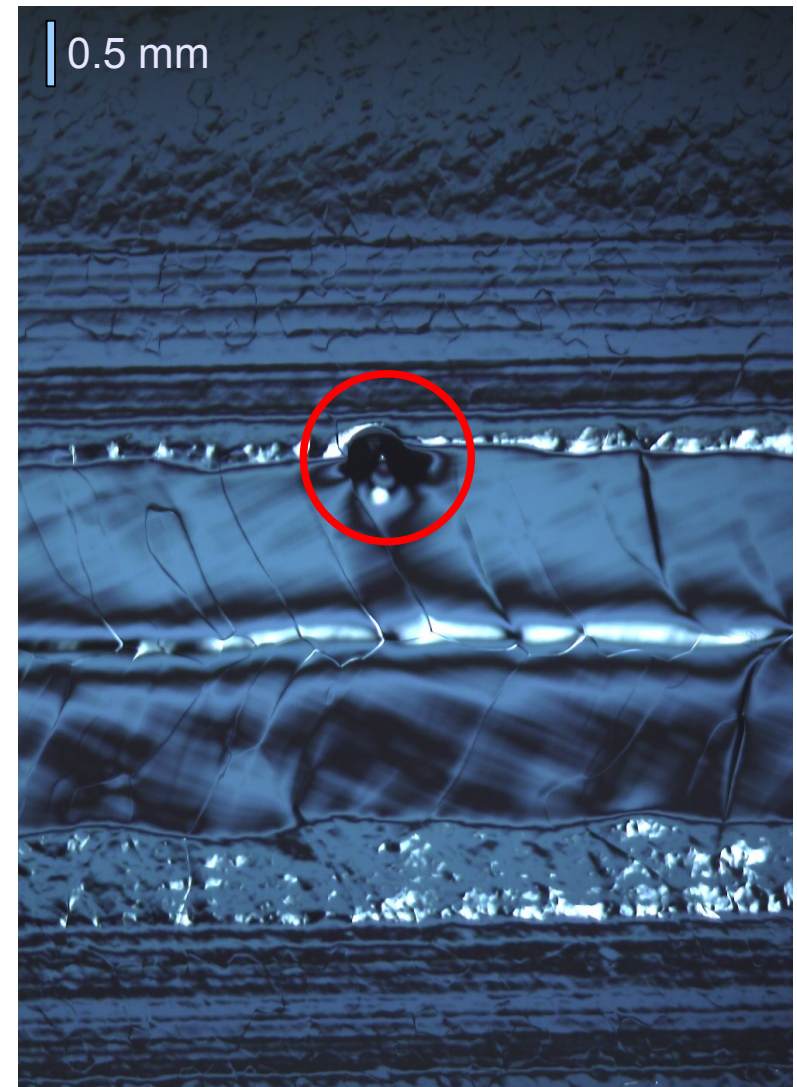
1mm

1mm

Comparison: T-map \leftrightarrow Picture



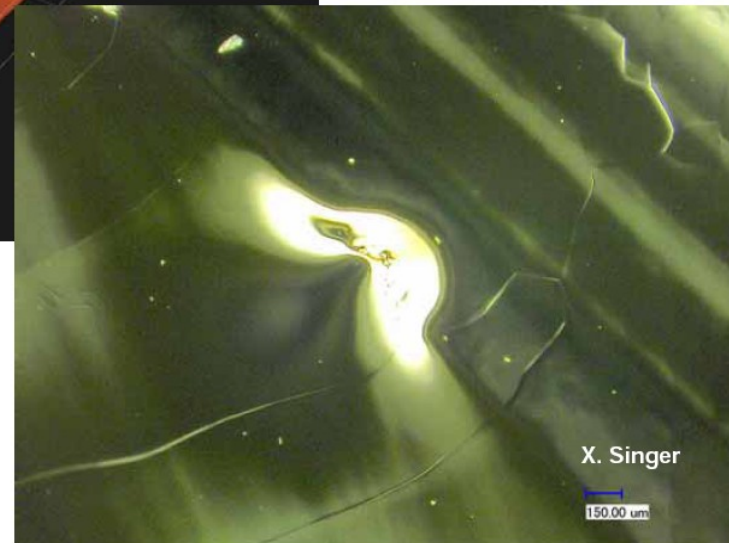
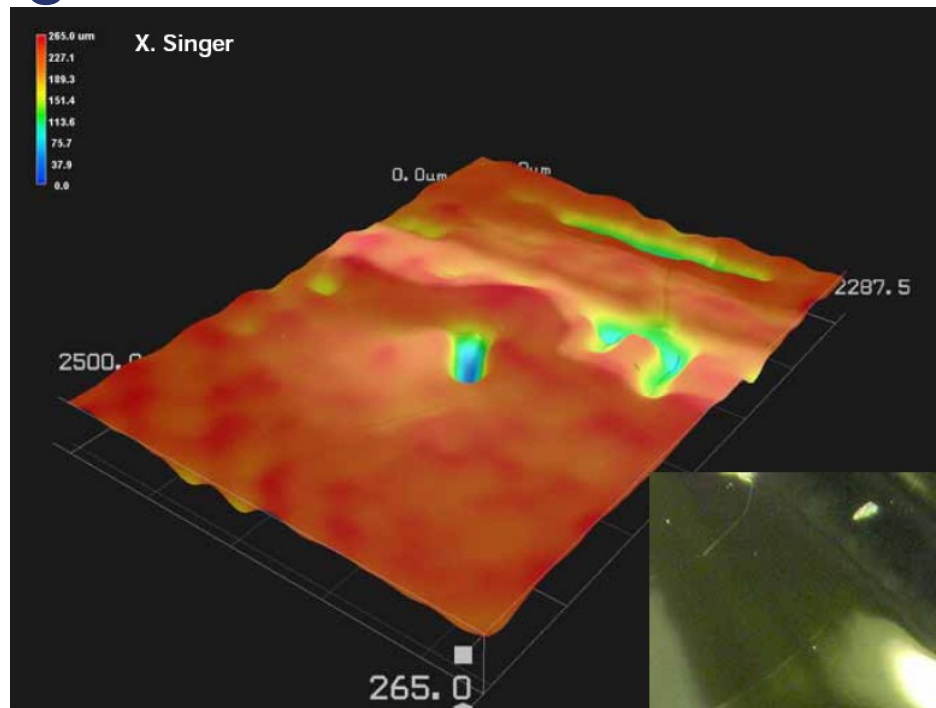
Z130: Quench in $3\pi/9$ -mode at
22 MV/m



Picture at same location

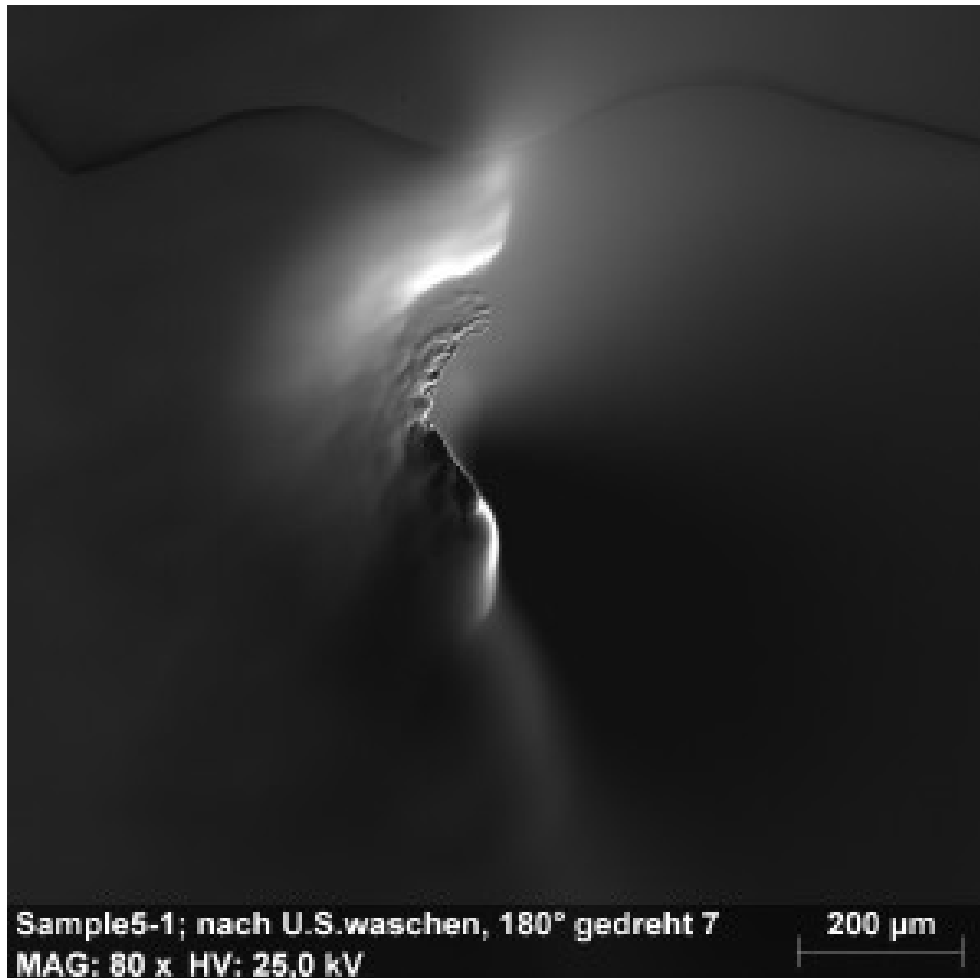
Defect in Z130

- Cavity has been cut for surface analysis
- No foreign material was found in the defect by EDX



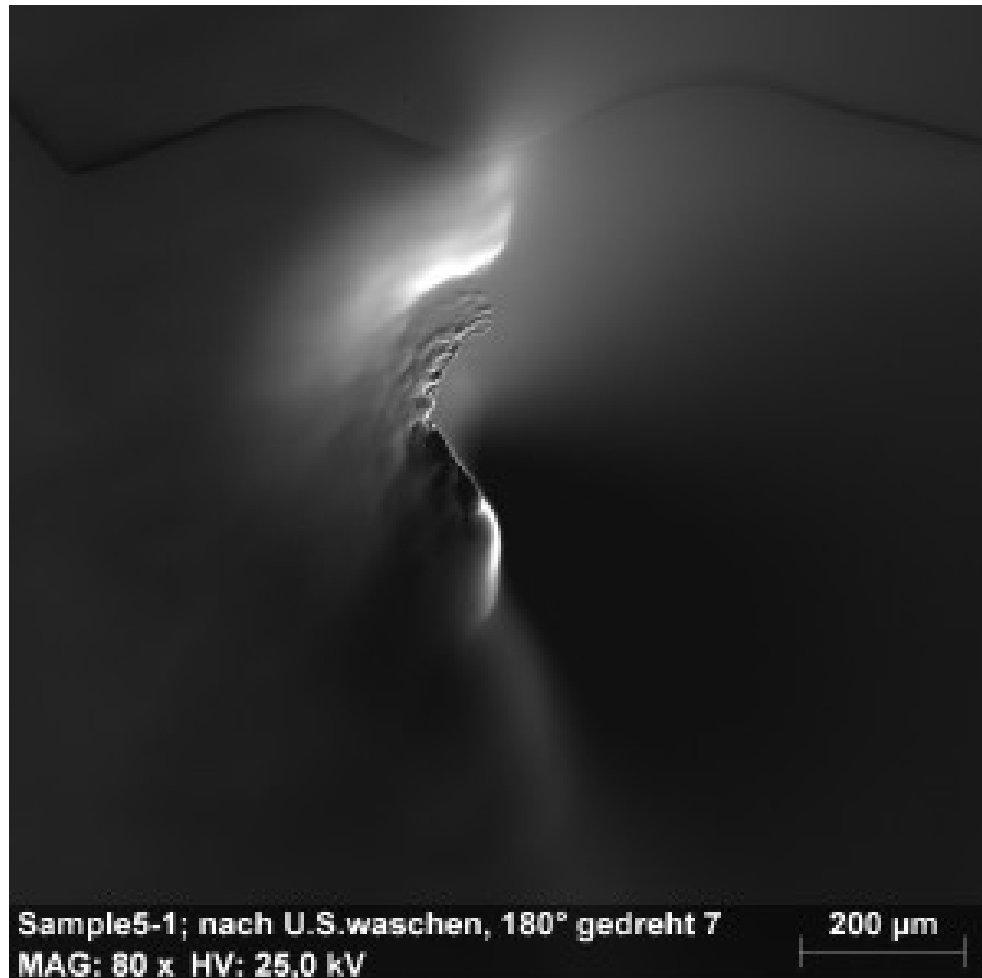
W. Singer, X. Singer, A. Ermakov

SEM pictures of defect

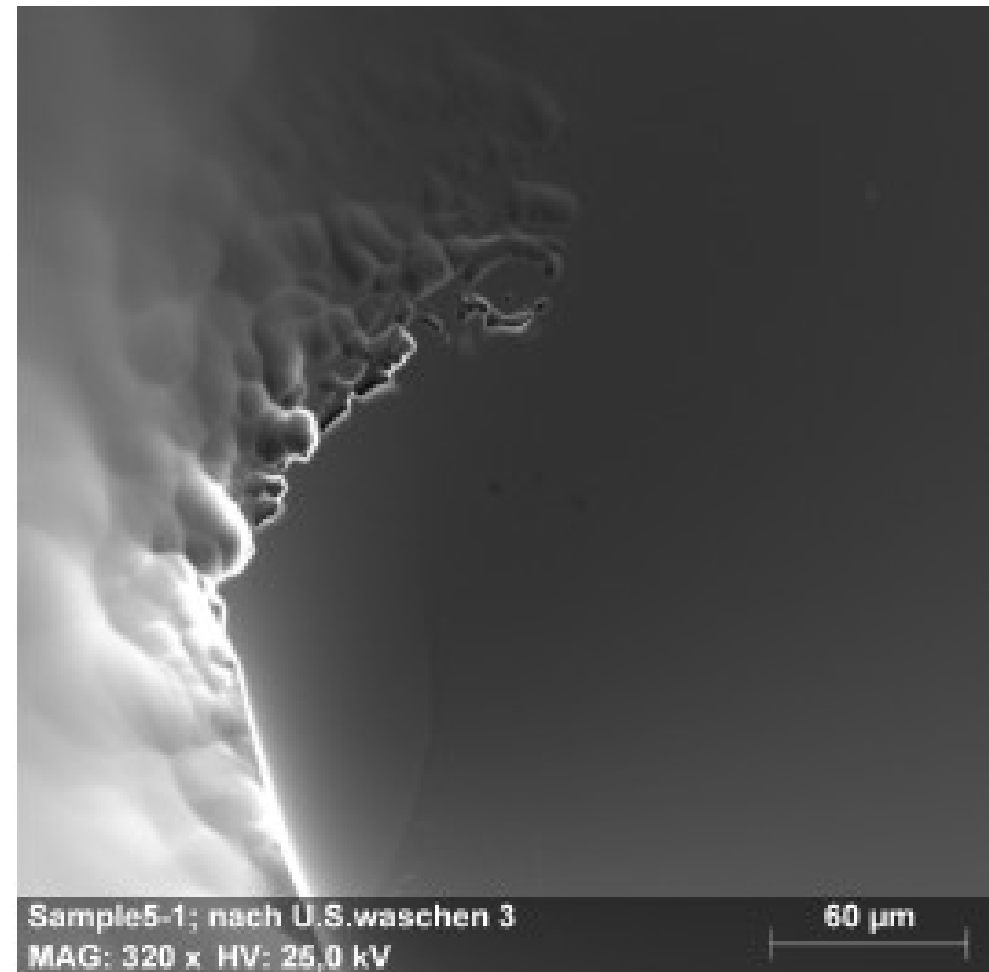


D.Reschke

SEM picture of defect



D.Reschke



Outlook

- System for automated inspection including high precision positioning under development at DESY
 - Prototype to be operated in first half of next year
- Include Pattern recognition software
- Improve statistics of correlations between T-map and optical data
- Test of two more cavities with “every-step-inspection” still to come
- Eight large grain cavities in cue for vertical test
 - Inspection was done before and after bulk surface removal by BCP