Repair of Memory Module from Incident CEN21FA198

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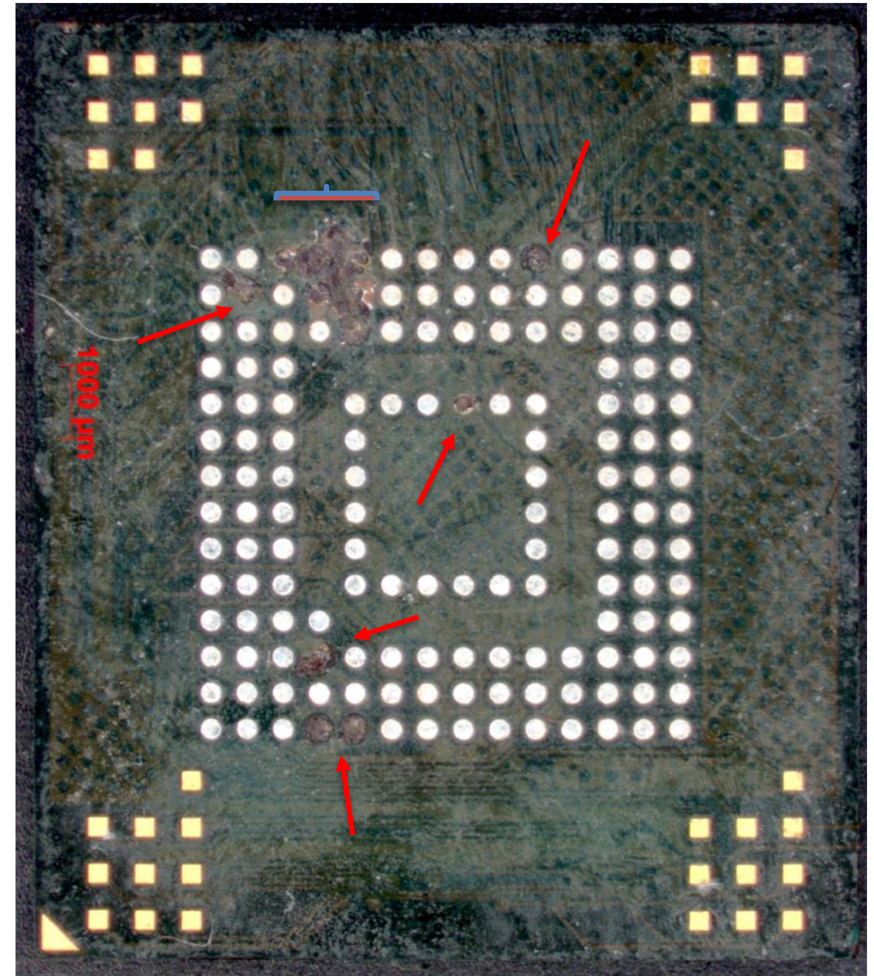
Overview

- **One module received for analysis**
  - Incident CEN21FA198
  - Module type: Flash Memory
  - Part: Samsung KLM8G2FE3B-B001
- **Disposition from nondestructive analyses**
  - Multiple instances of missing circuitry from the bottom layer of the package (red arrows)
  - Chip is intact
  - Repair may be attempted
- **Approach**
  - Devise reconnection scheme from similar modules (X-ray tomography or flat sectioning)
  - Remove dielectric from the bottom circuit layer
  - Print conductors to replace the missing circuitry



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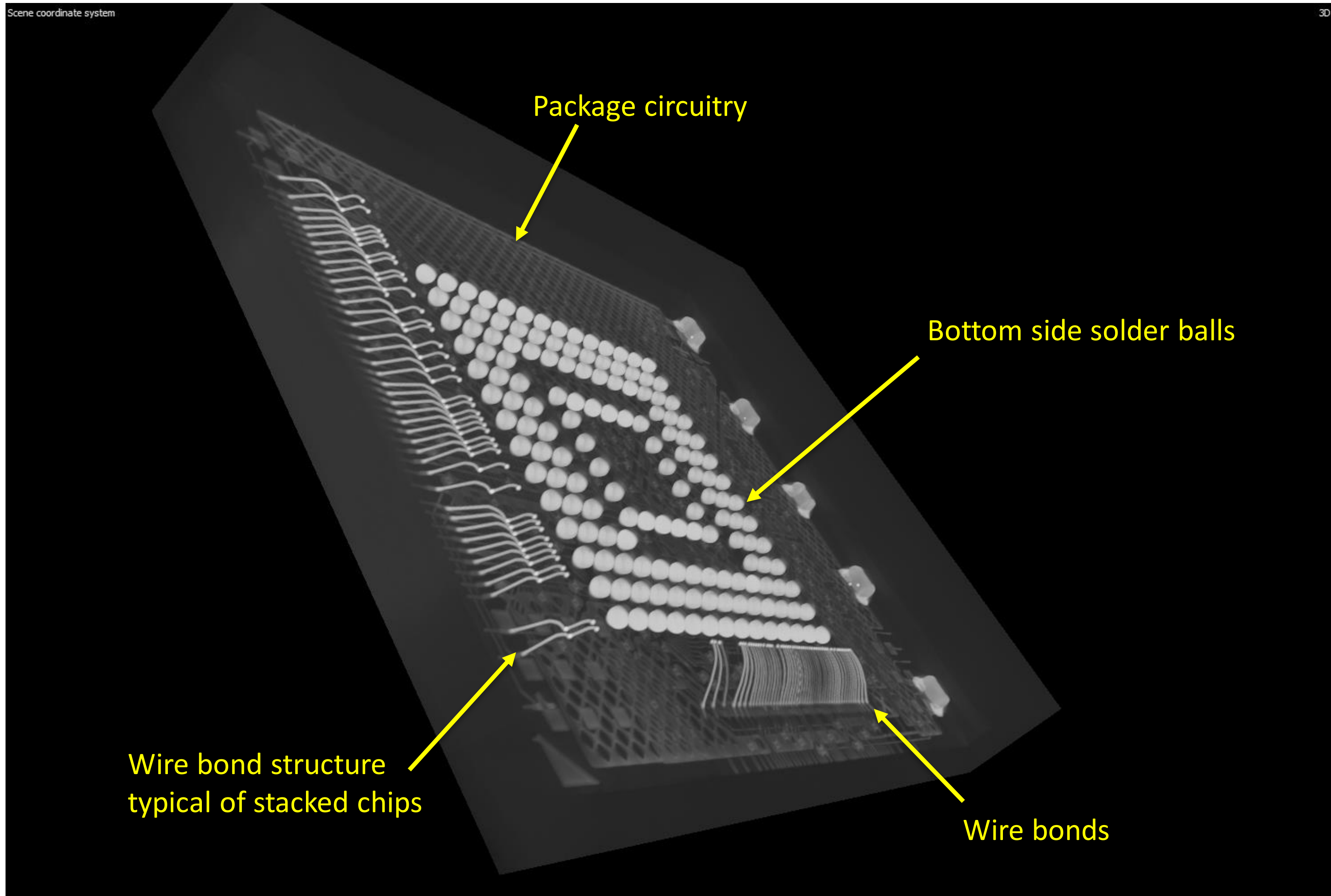
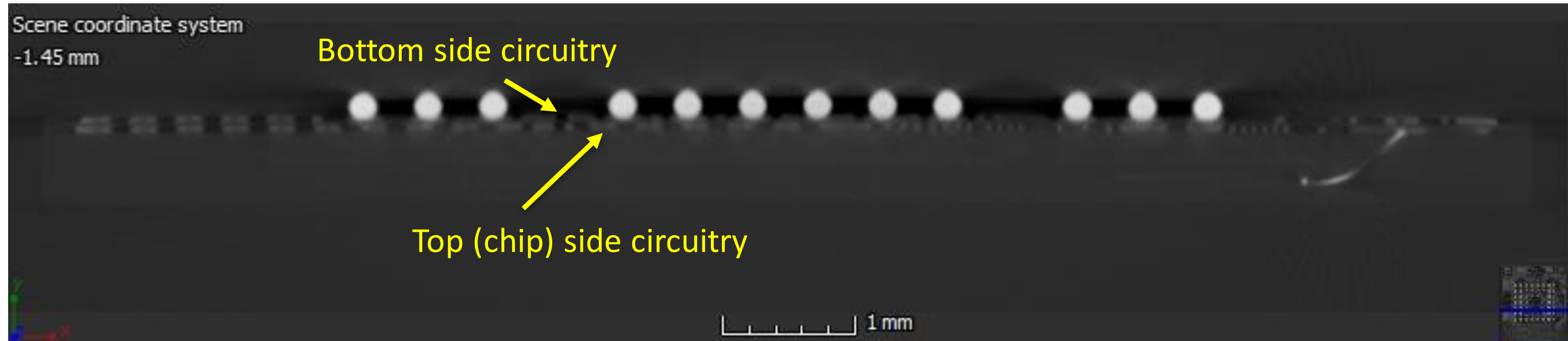
Scetion 1

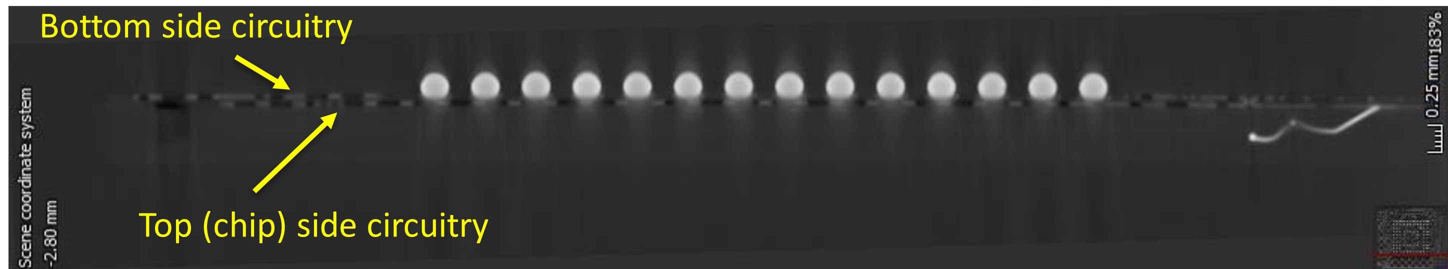
RESULTS OF X-RAY TOMOGRAPHY OF AN UNDAMAGED PART

3D Tomographic Reconstruction



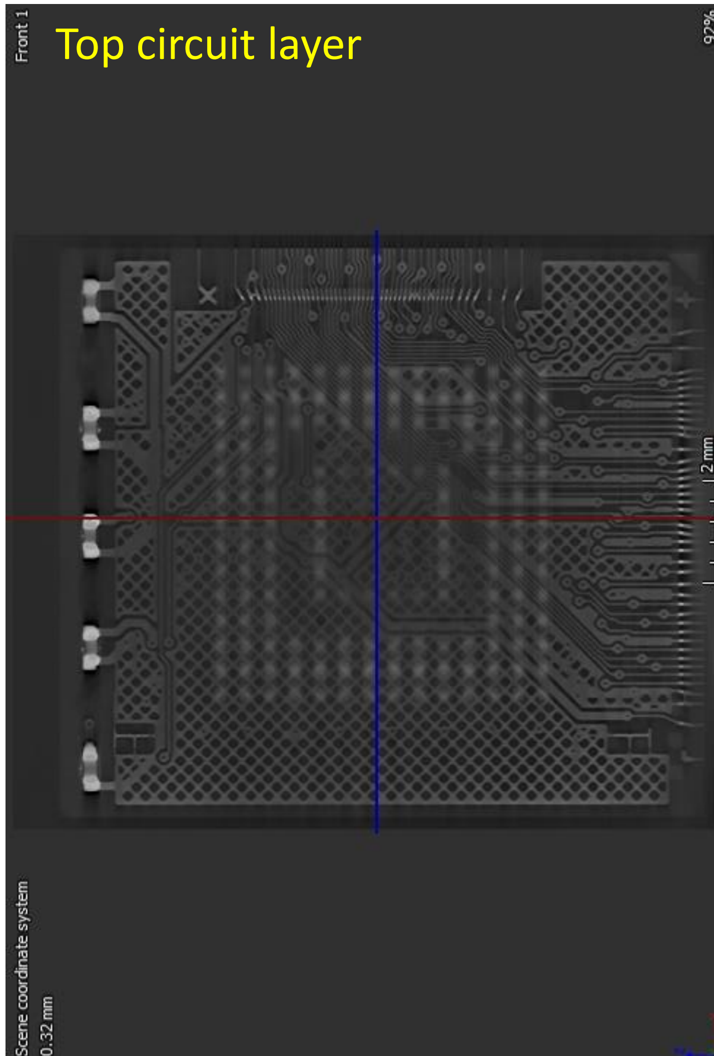
Two Cross Sectional Views of the Memory Module

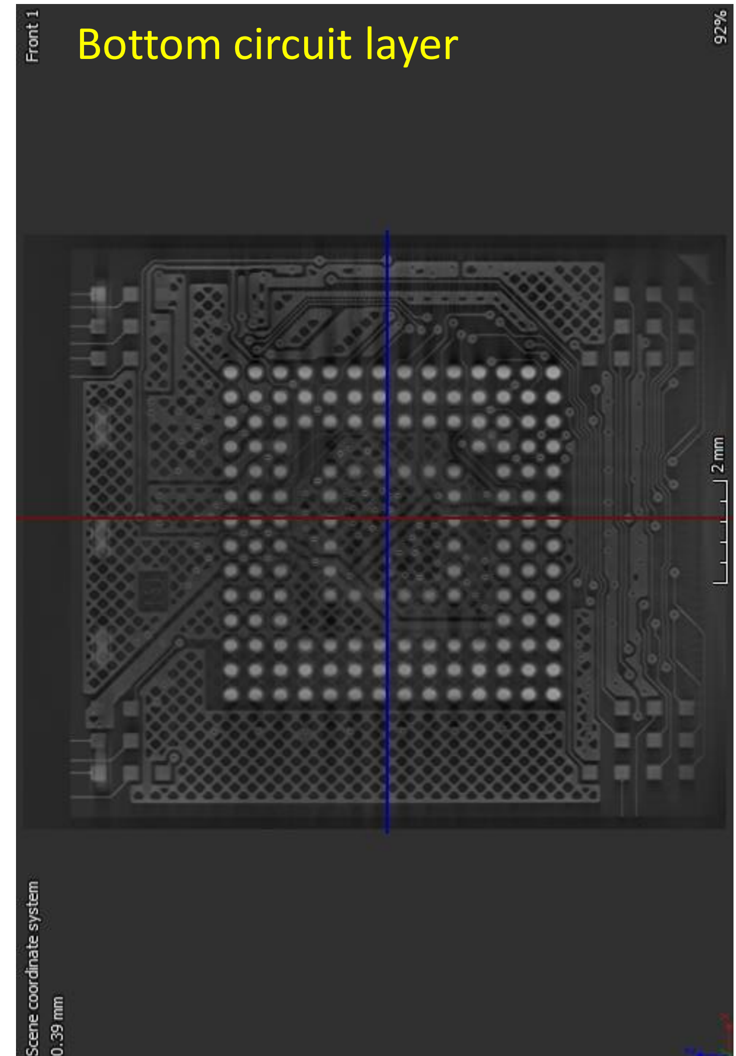




Note: These views have the module inverted – the chip is on the bottom
The package has only two layers of circuitry

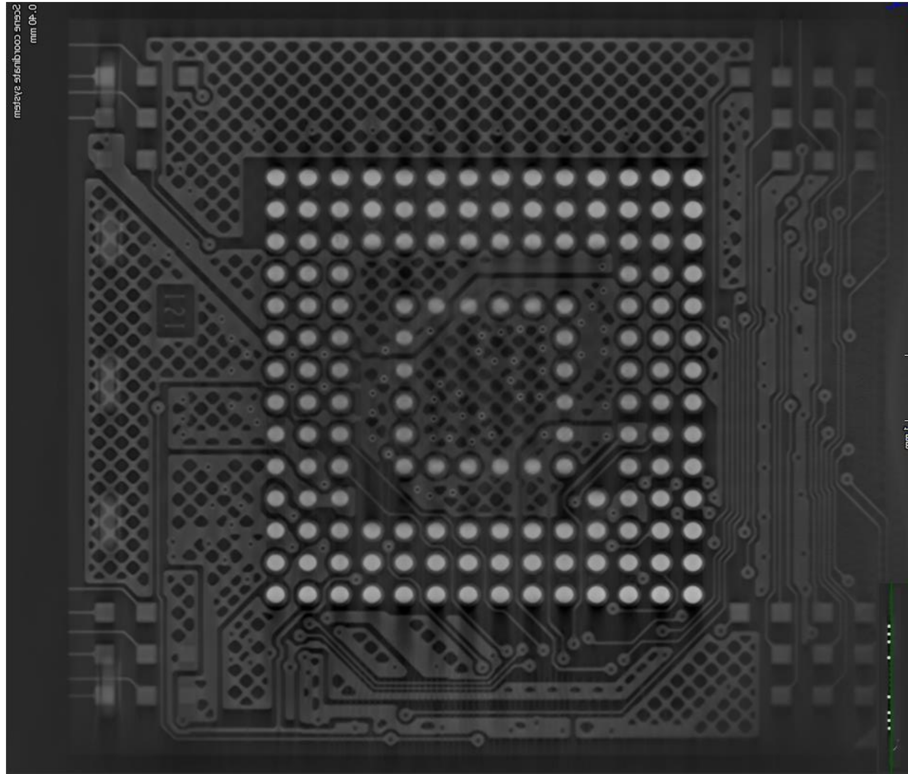
The Two Layers of Circuitry Found in an Undamaged Sample of the Same Part Number

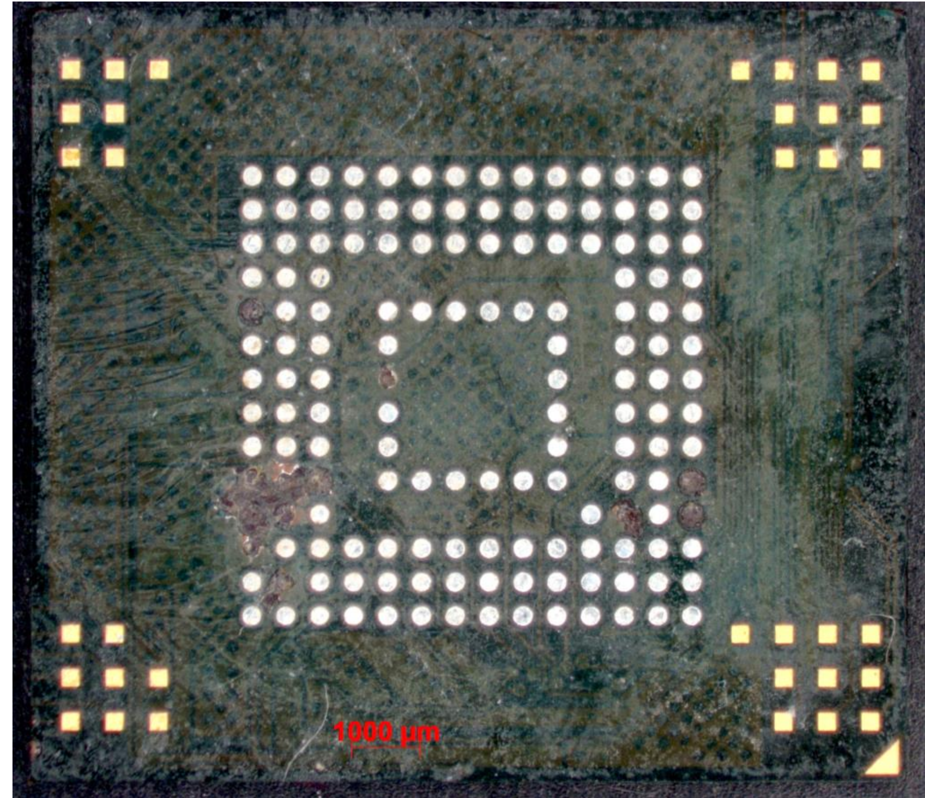




Two layers of circuitry were found in the package. Of these, only the bottom layer is of interest for the repair

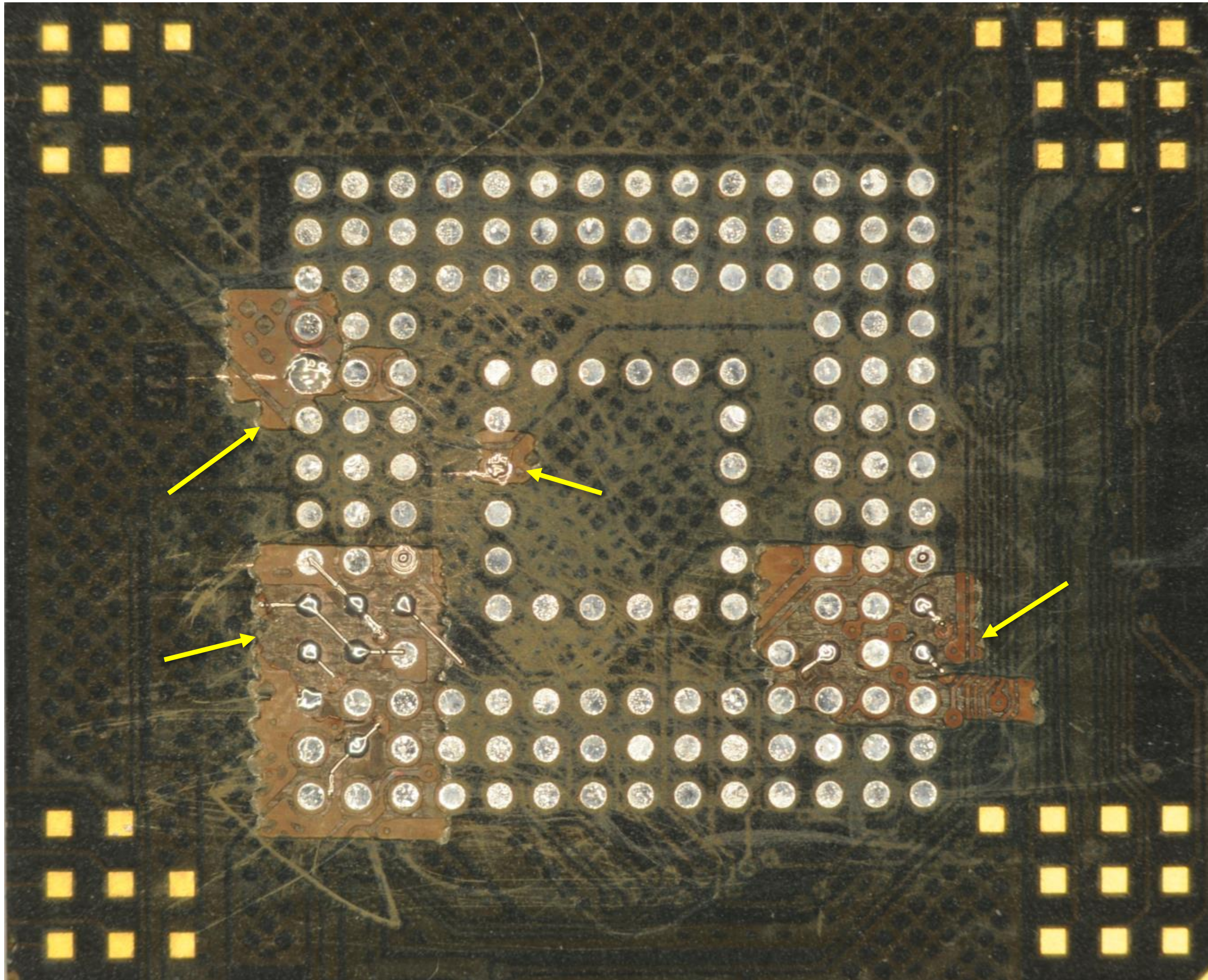
Comparison of the 3D X-ray with the Photograph (Bottom Layer of Circuitry)





X-ray image was reoriented to match the view of the photograph

View of the Module After the First Repair Attempt

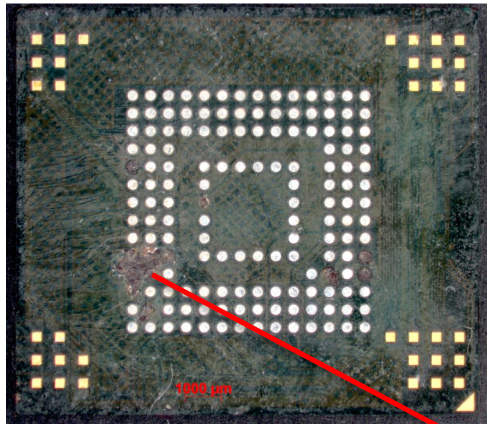


Yellow arrows show the areas where the repair was done

Section 2

FIRST DAMAGED AREA TO BE REPAIRED

Optical Micrograph of the Damaged Area



500 µm

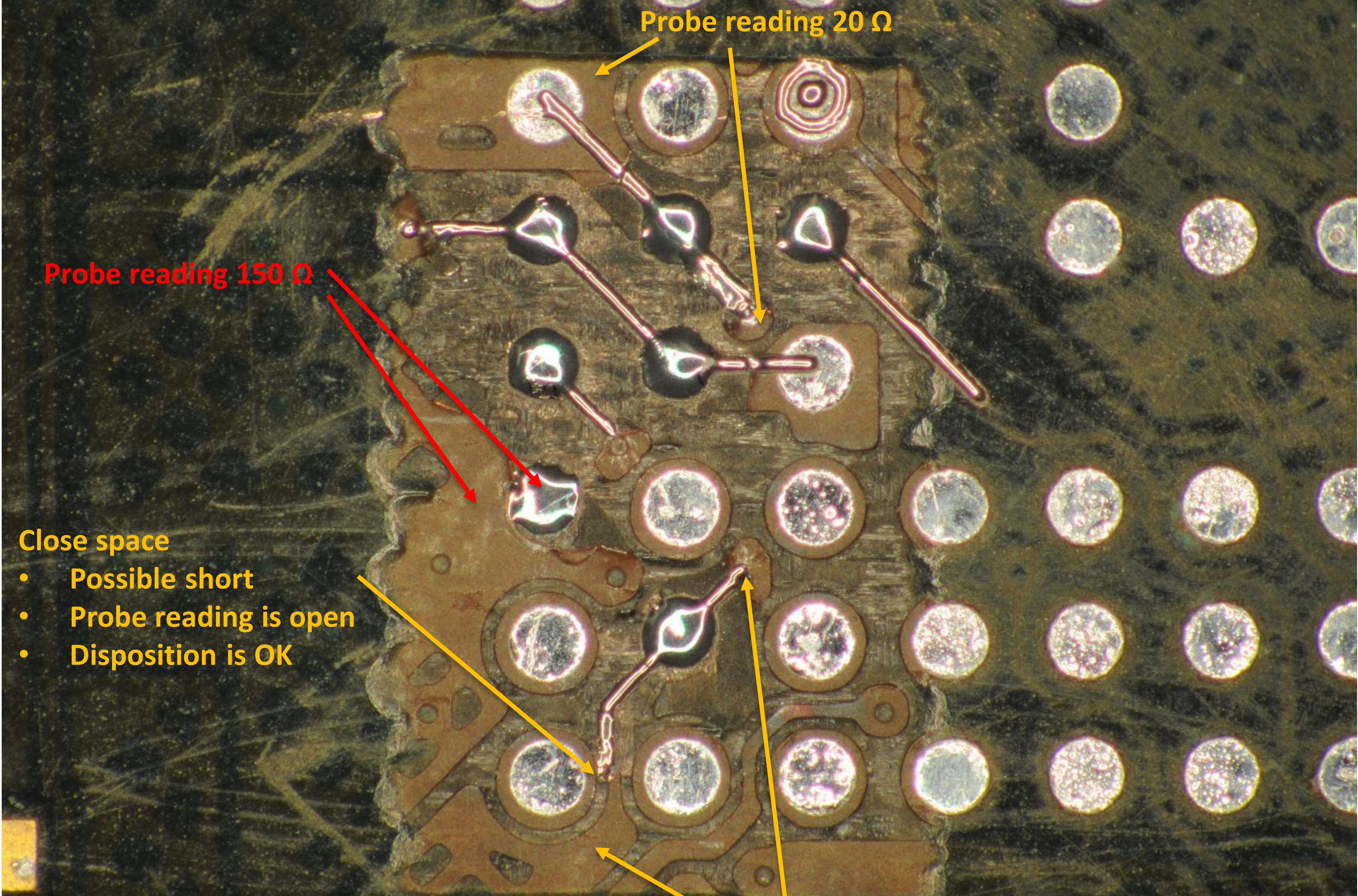
3D X-ray and Micrograph of the Damaged Area

200 µm

Repair Scheme

200 µm

First Repair Attempt in This Area



Red arrows indicate additional repair needed

Probe reading, 66 Ω

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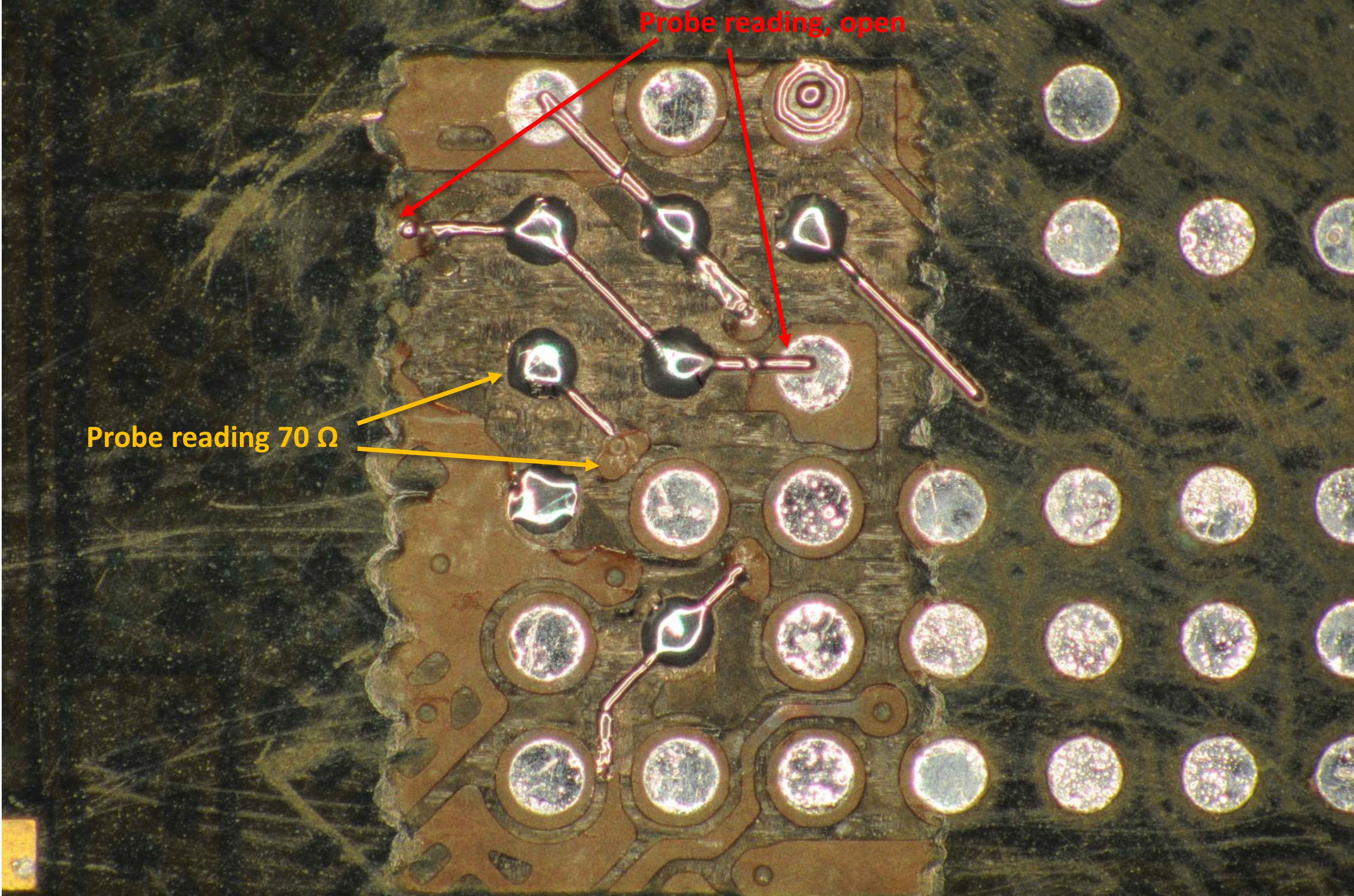
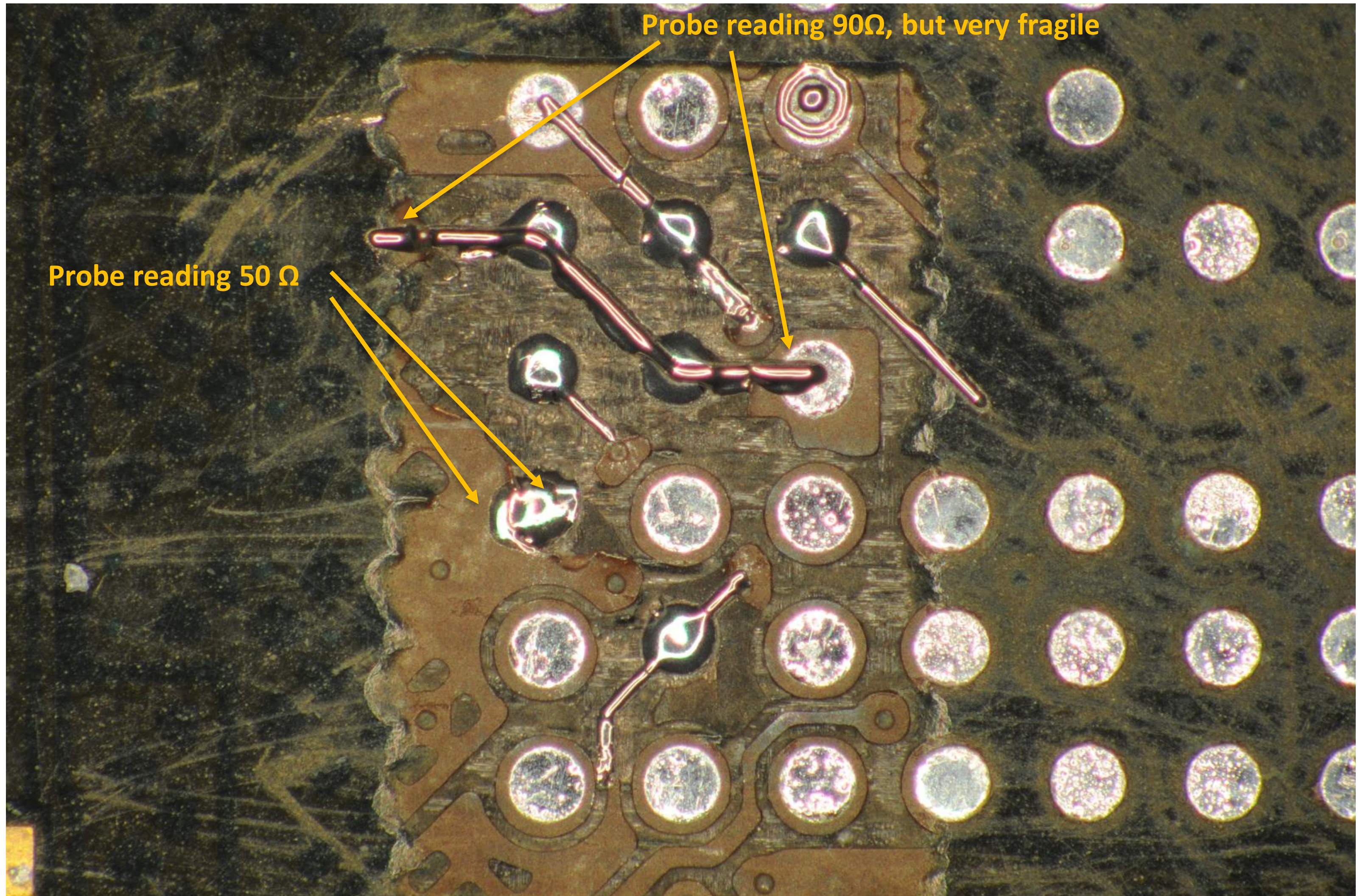
First Repair Attempt in This Area, cont'd.



Red arrows indicate additional repair needed

Second Repair Attempt in This Area

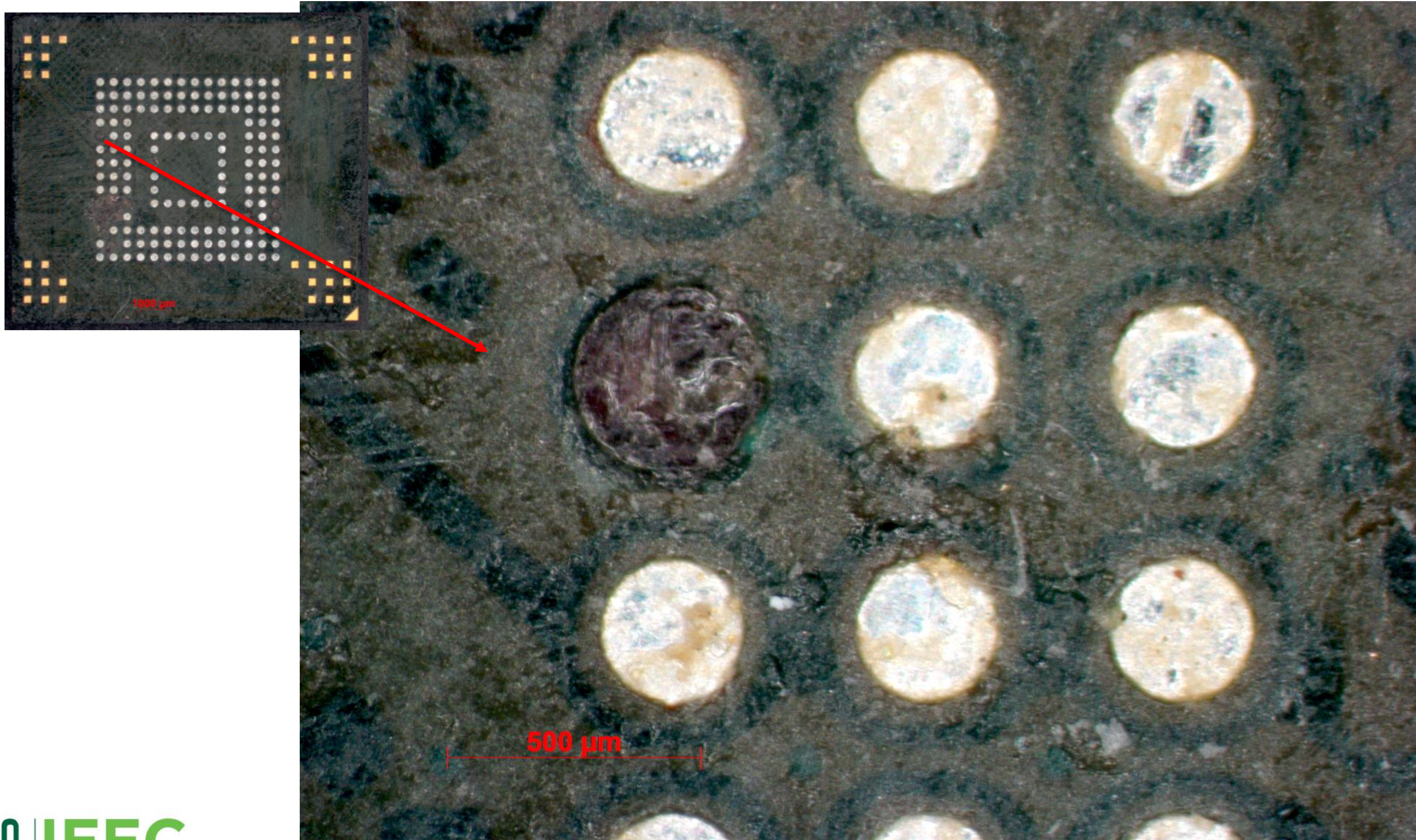


Note: one of the repairs is quite fragile, which may be problematic in the attempt to read data

Section 3

SECOND DAMAGED AREA TO BE REPAIRED

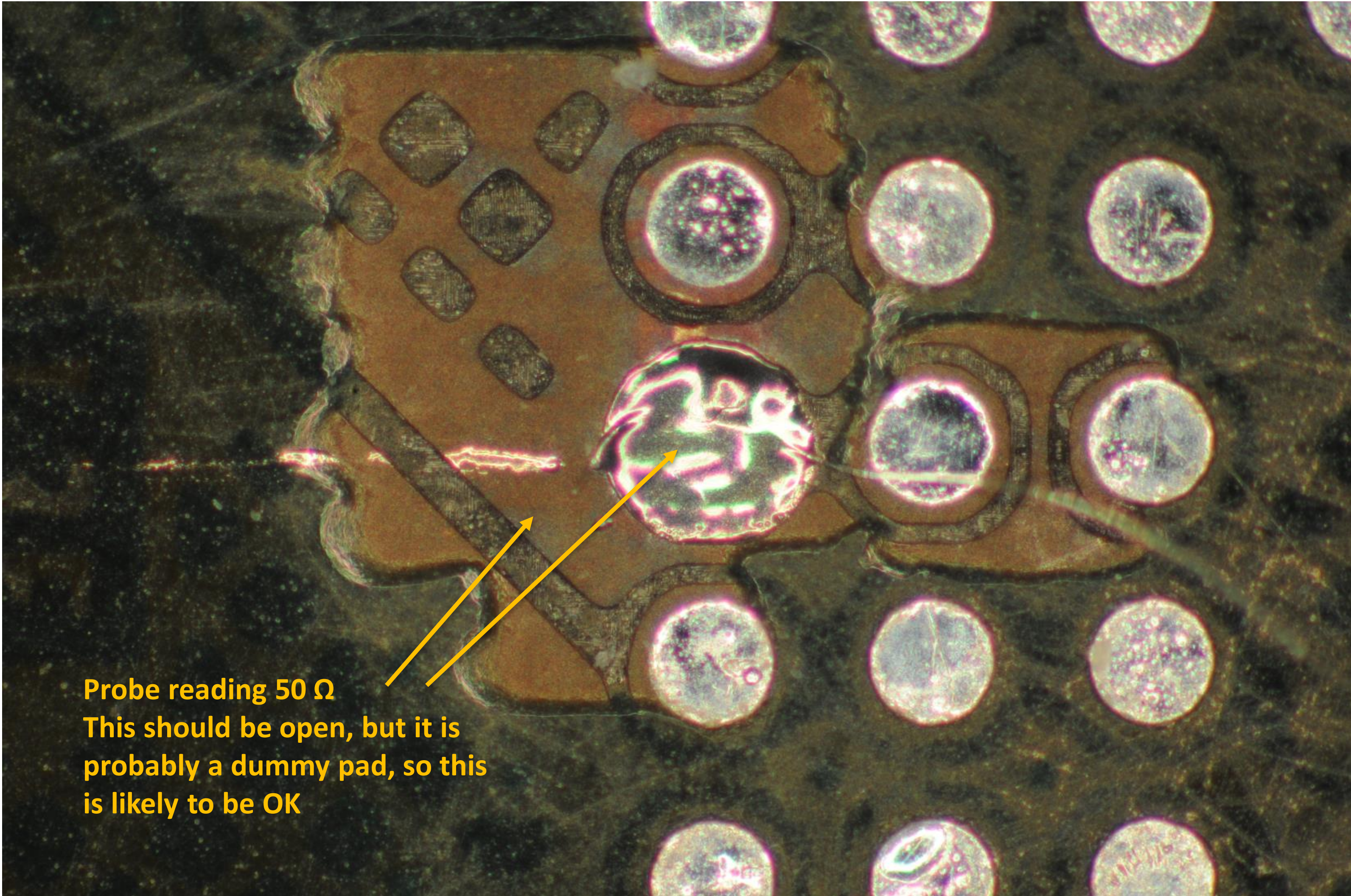
Optical Micrograph of the Damaged Area



3D X-ray and Micrograph of the Damaged Area

Repair Scheme

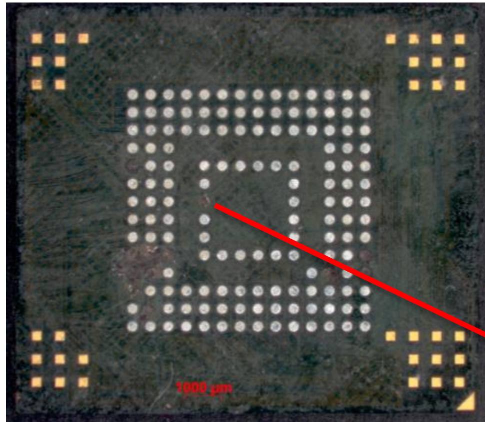
First Repair Attempt in This Area



Section 4

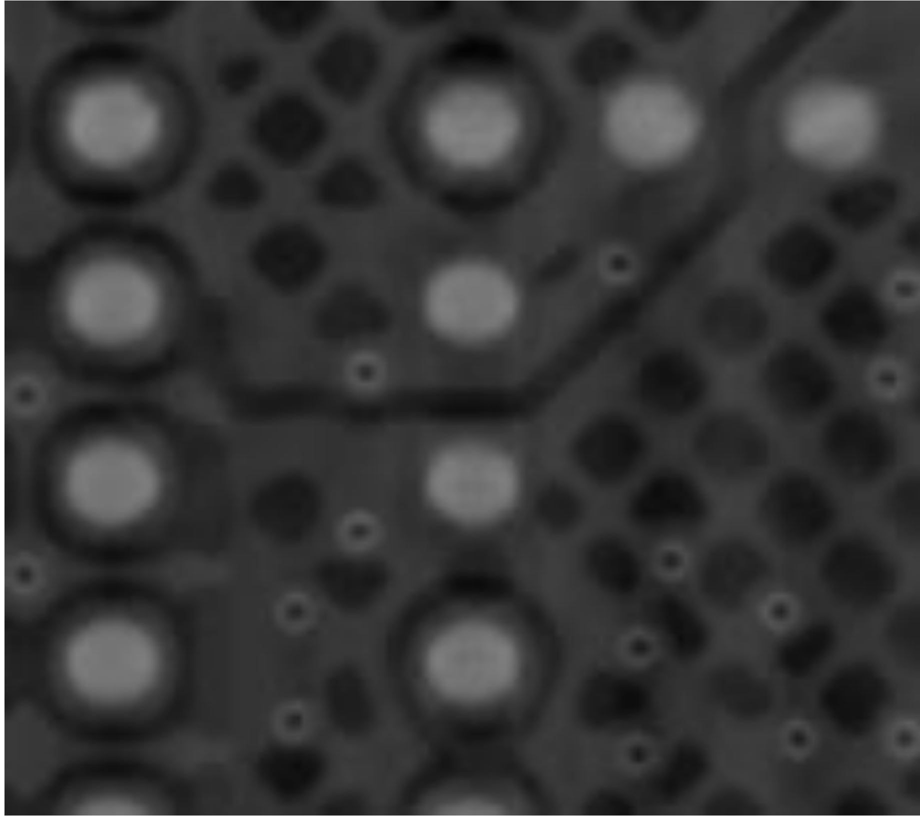
THIRD DAMAGED AREA TO BE REPAIRED

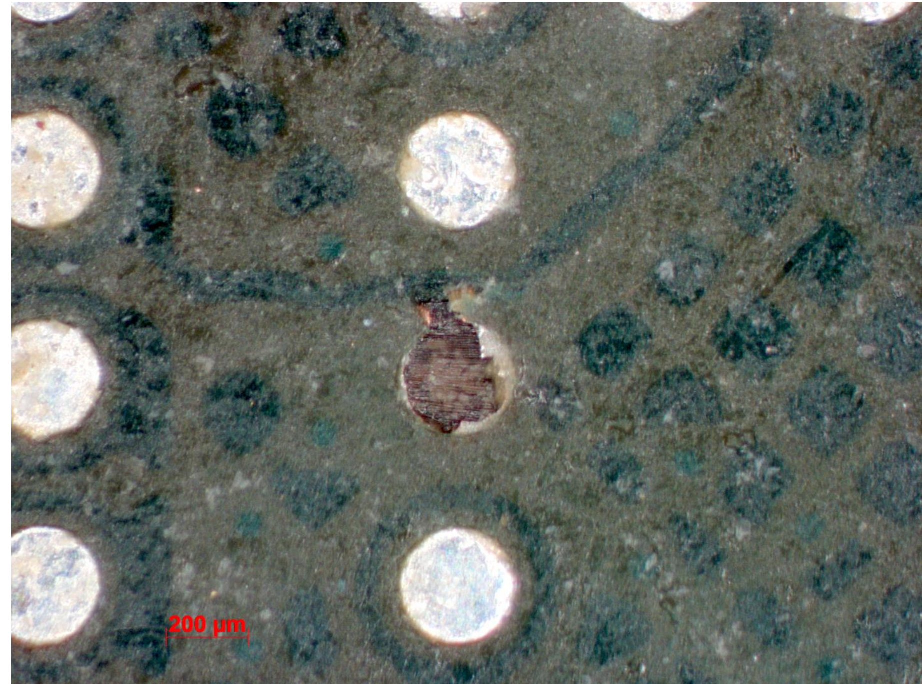
Optical Micrograph of the Damaged Area



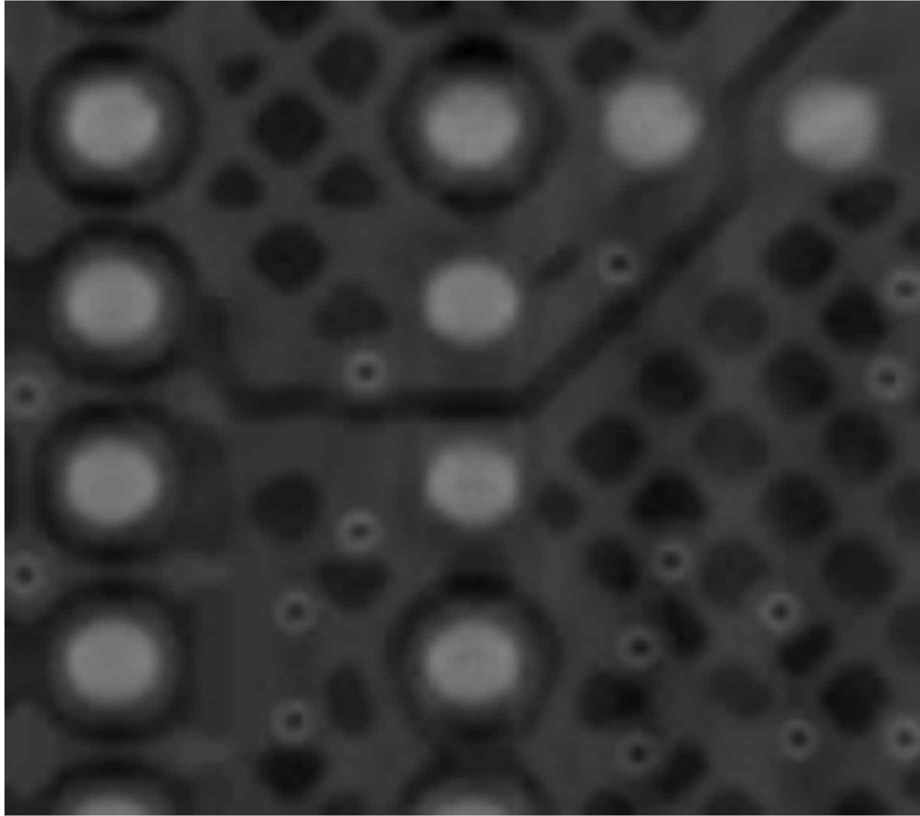
200 µm

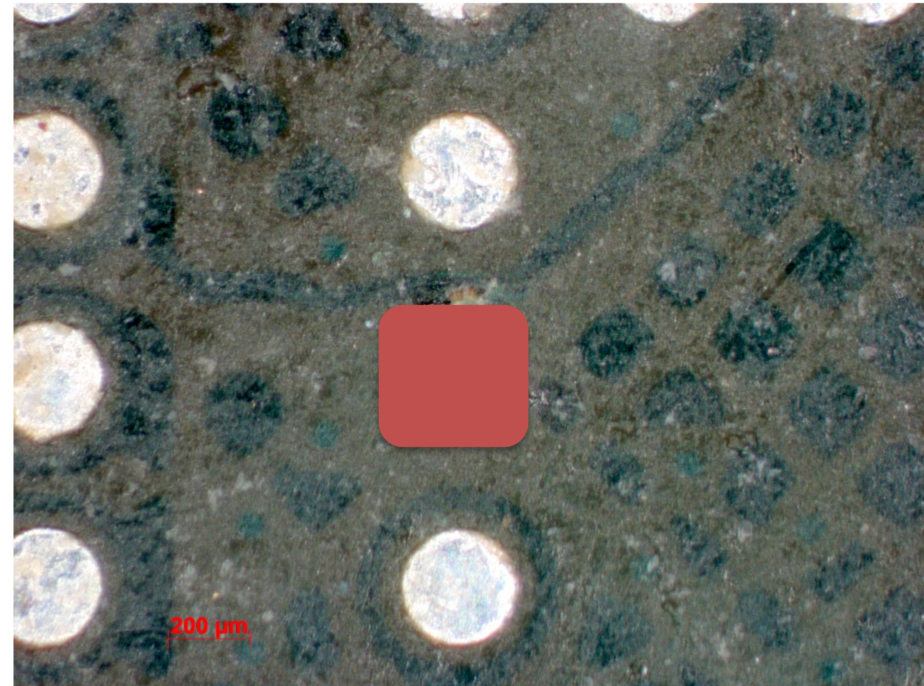
3D X-ray and Micrograph of the Damaged Area





Repair Scheme



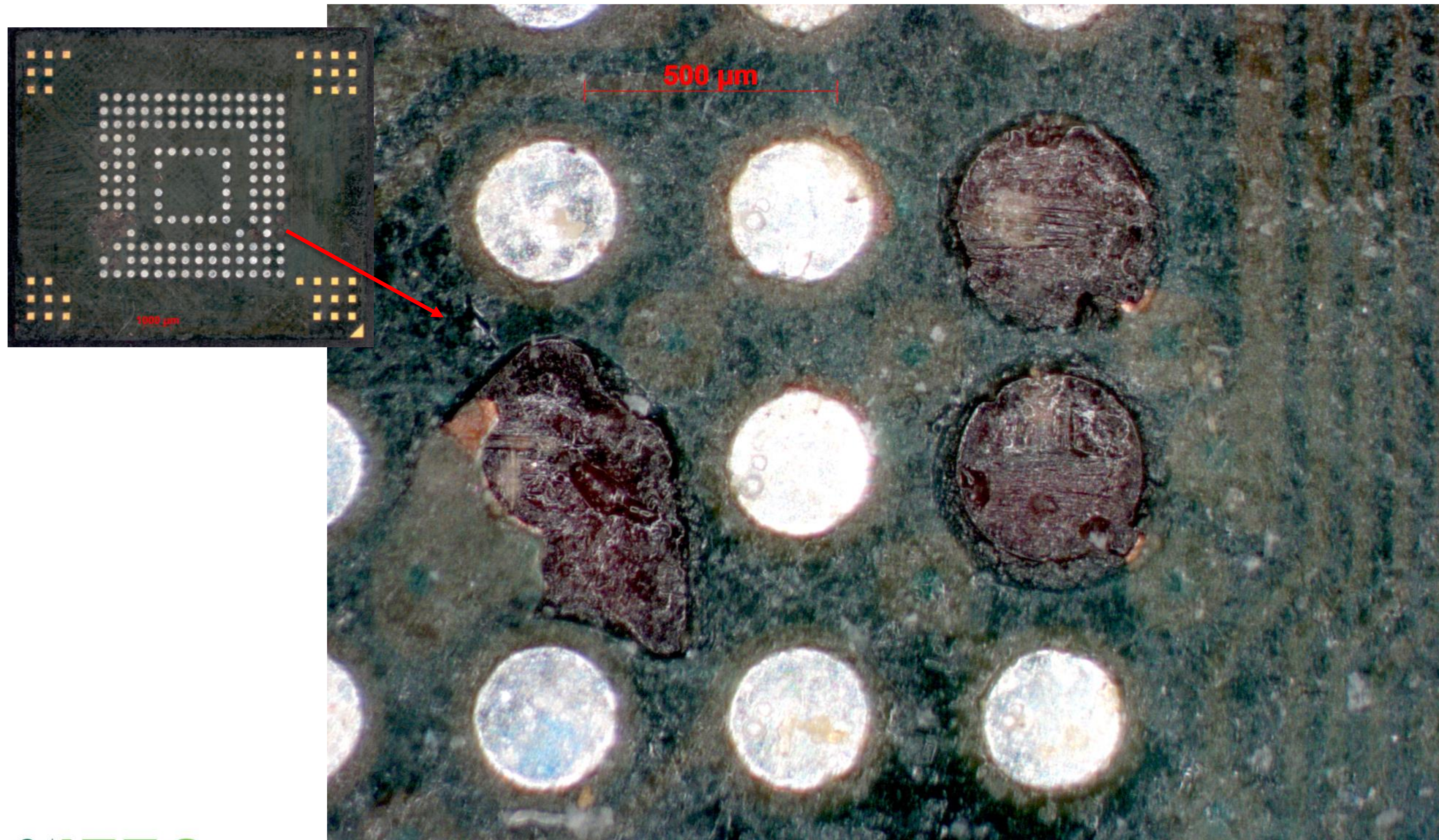


First Repair Attempt in This Area

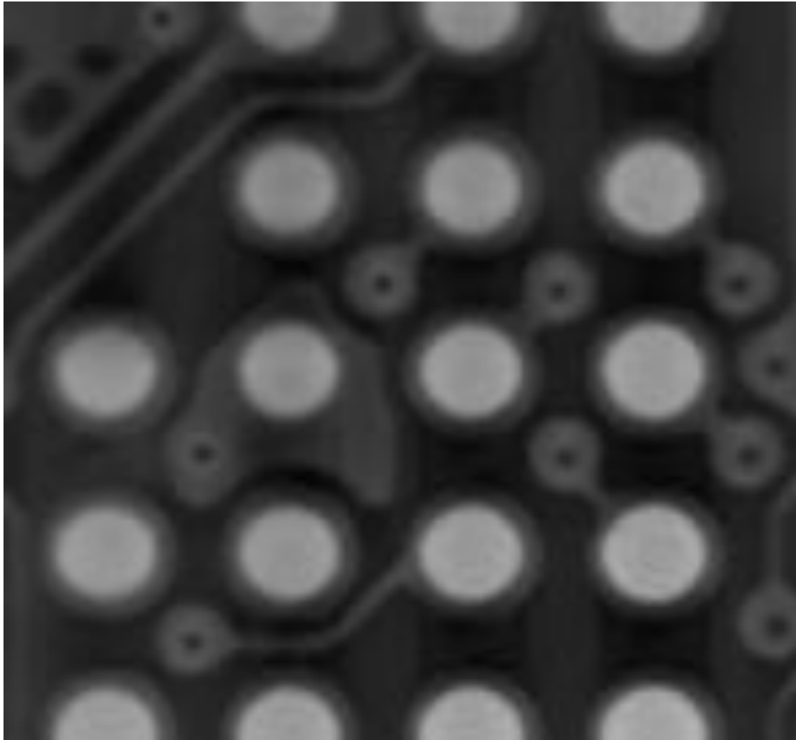
Section 5

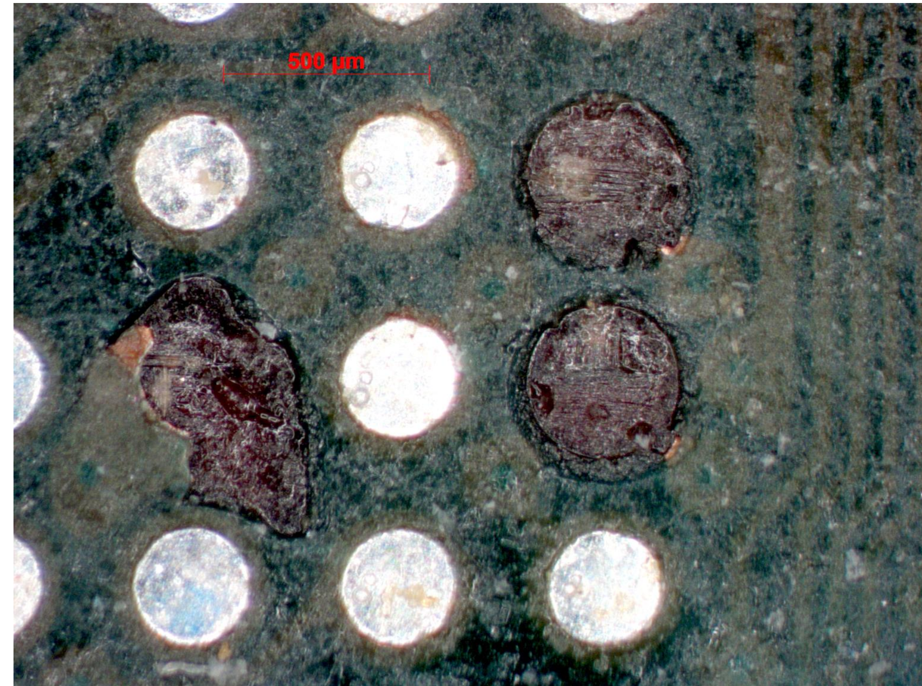
FOURTH DAMAGED AREA TO BE REPAIRED

Optical Micrograph of the Damaged Area

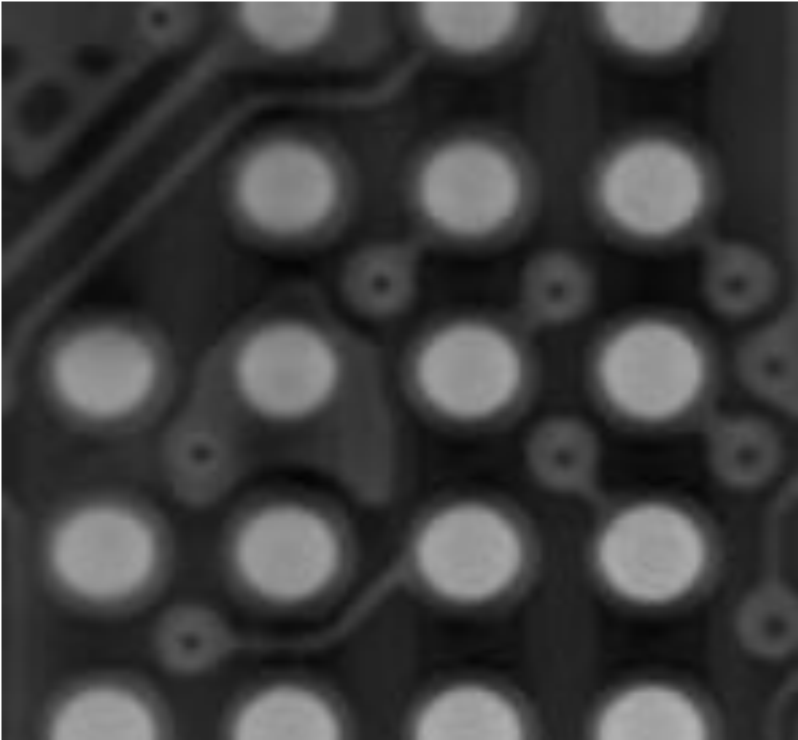


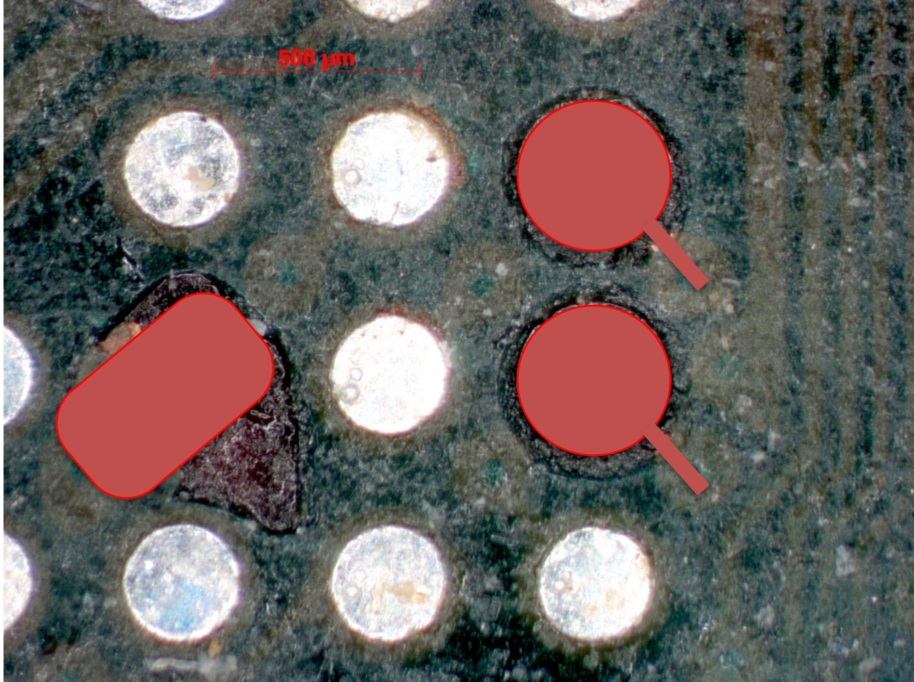
3D X-ray and Micrograph of the Damaged Area



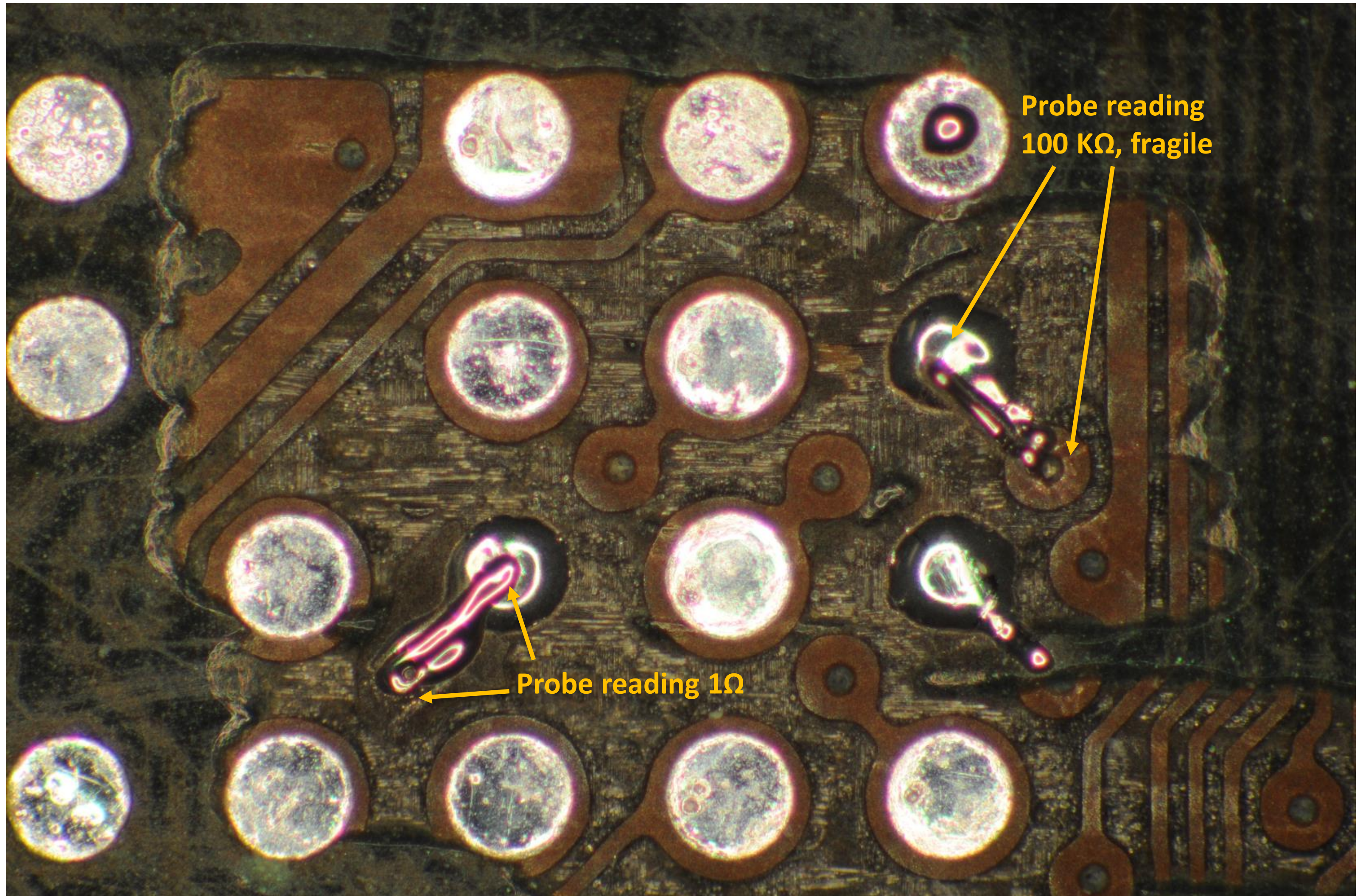


Repair Scheme





Second Repair Attempt in This Area



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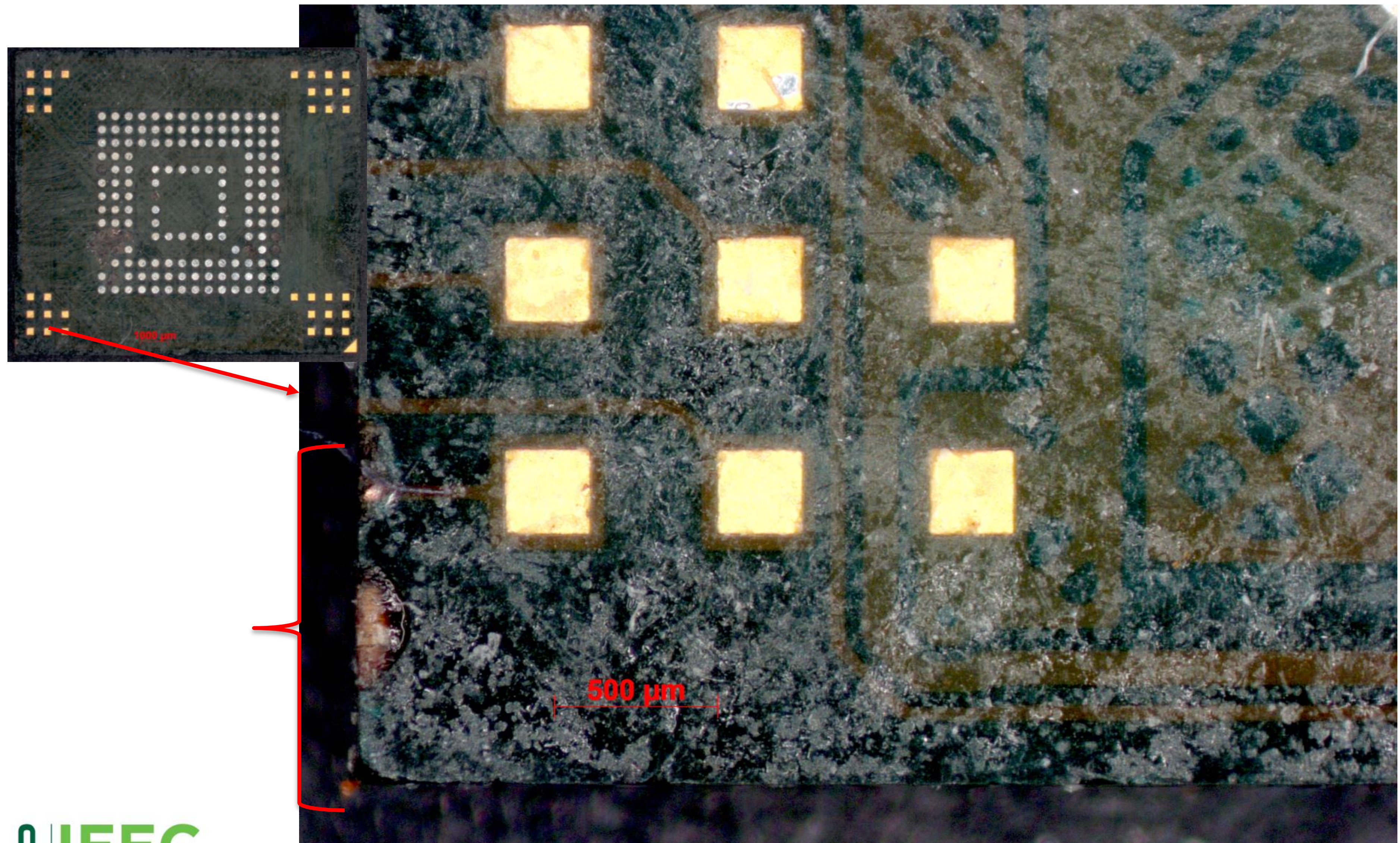
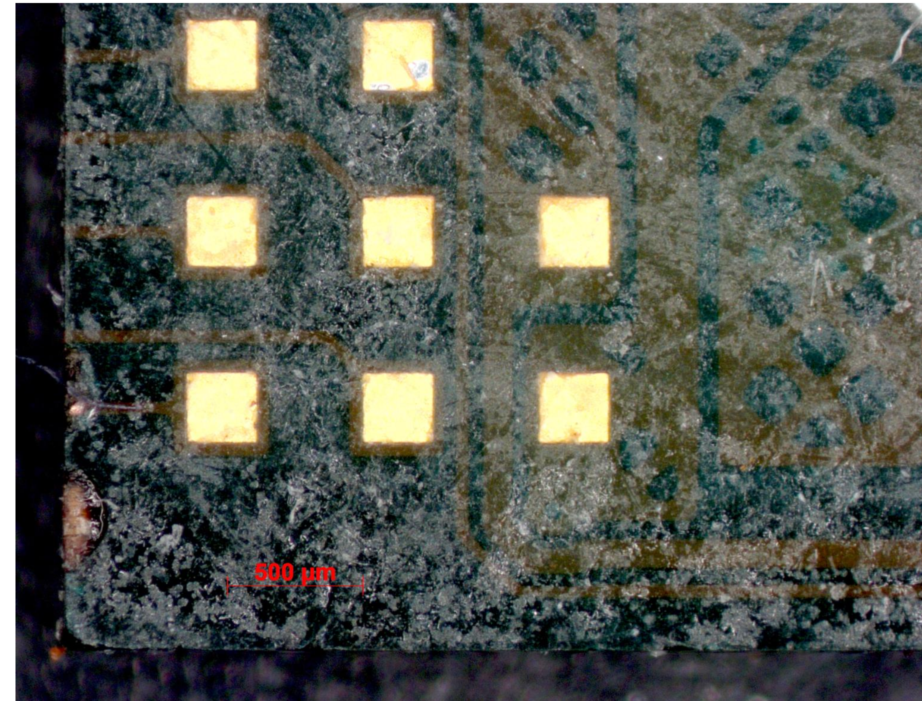
Section 6

DAMAGED AREA NOT REQUIRING REPAIR

Optical Micrograph of the Damaged Area



3D X-ray and Micrograph of the Damaged Area



Damage at the edge of the package in this region only affect lead that run to communing bars – these are not involved in the functionality, and no repair is needed