EUFANET

EUropean Failure Analysis Network

Failure Diagnosis by Optical Techniques Combined to Layout Localization Software for Wafer Yield Improvement

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Purpose

Localization software with "net trace" capability improve backend defects diagnosis

- Many emissive points are not localized at the physical defect coordinates but these points are an effect, not a root cause, especially for backend defects

  ➡ Optical techniques are limited

- Our layout localization software allows to easily identify and visualize several selected nets on all connected mask layers

  ➡ "net trace" capability

Localization combined to optical techniques allows us to identify the defect location and the process root cause

Outline

- Introduction
- Fail scan electrical analysis
- Micro-probing analysis
- EMMI with CAD navigation analysis
- Failure Diagnosis
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Introduction

Product :	Integrated Circuit for ASIC BU
Technology :	CMOS 0.15µm
Power supply :	1.8V
Area :	24mm²
I/Os :	110
Silicon :	full wafer thinned to 180 µm thick

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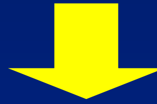
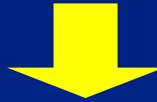
Fail scan electrical analysis

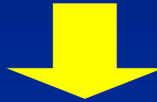
Analysis request from Yield Team



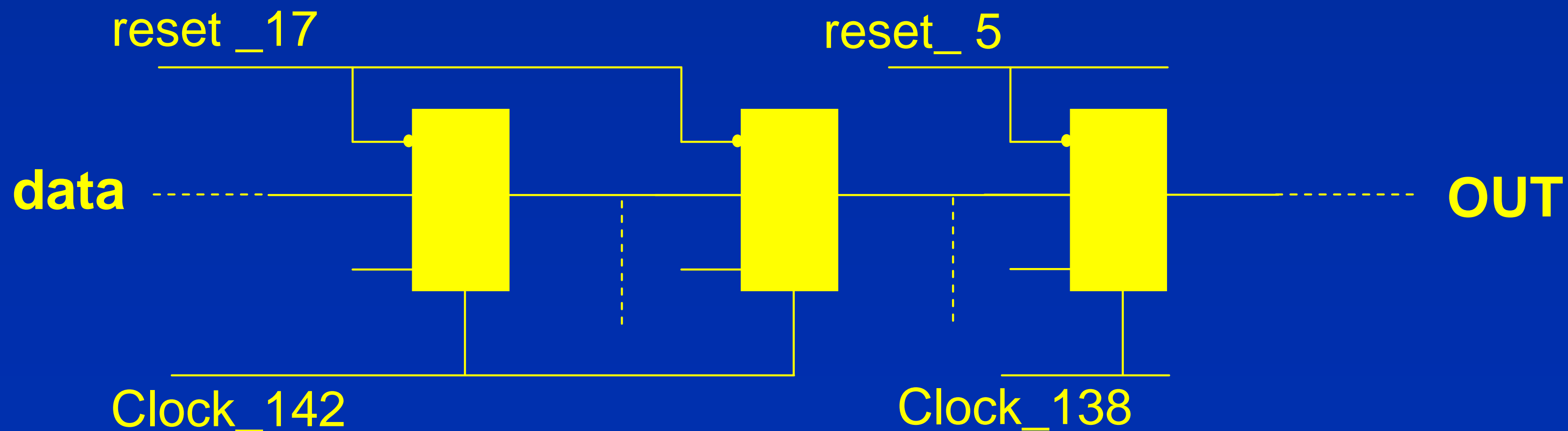
EWS result ➔ Fail bin 117 : Functional Fail



Test program result analysis

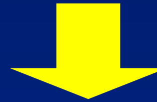


One defective scan chain has been isolated for analysis

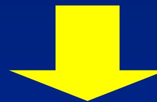


Fail scan electrical analysis

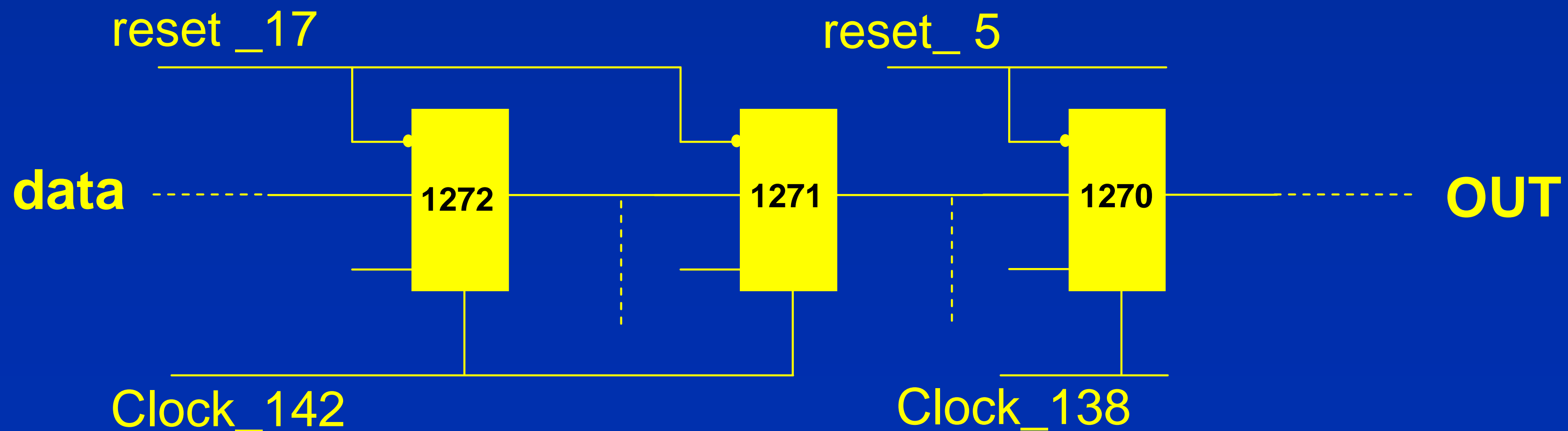
Test pattern analysis



First data fail at vector 376



Electrical failure between latches 1270 and 1271



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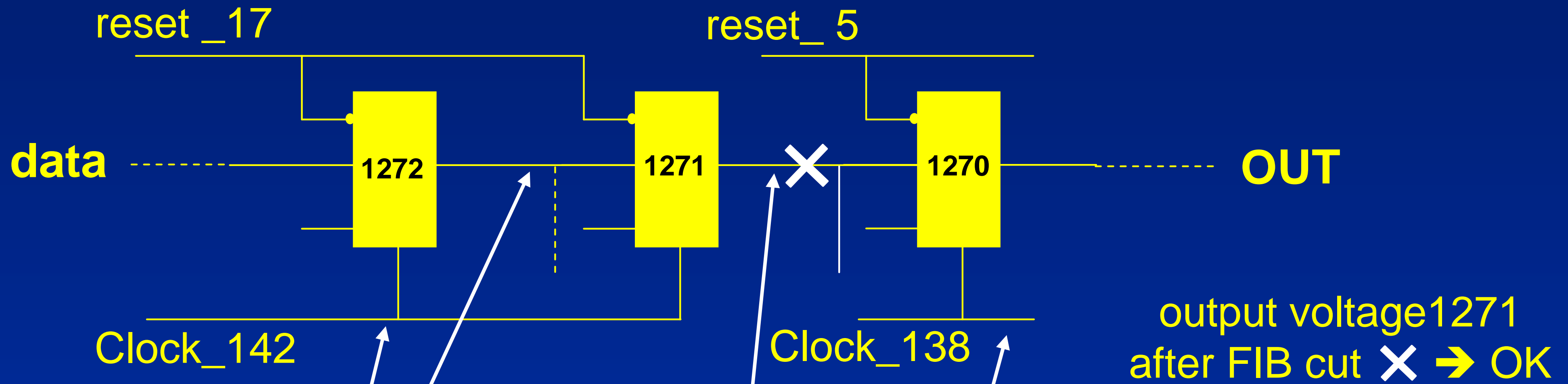
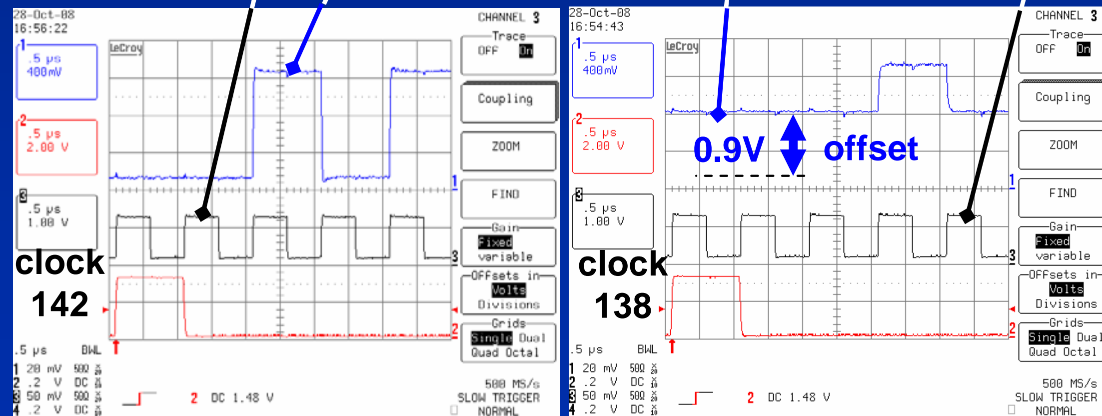
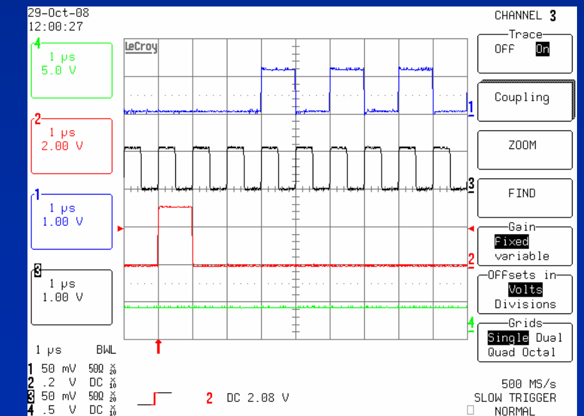
Micro-probing analysis

Micro-probing has been performed :







- High residual voltage level between latches 1270 and 1271
- Residual voltage level located on the input 1270 with fib cut.

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EMMI analysis

Light Emission investigation

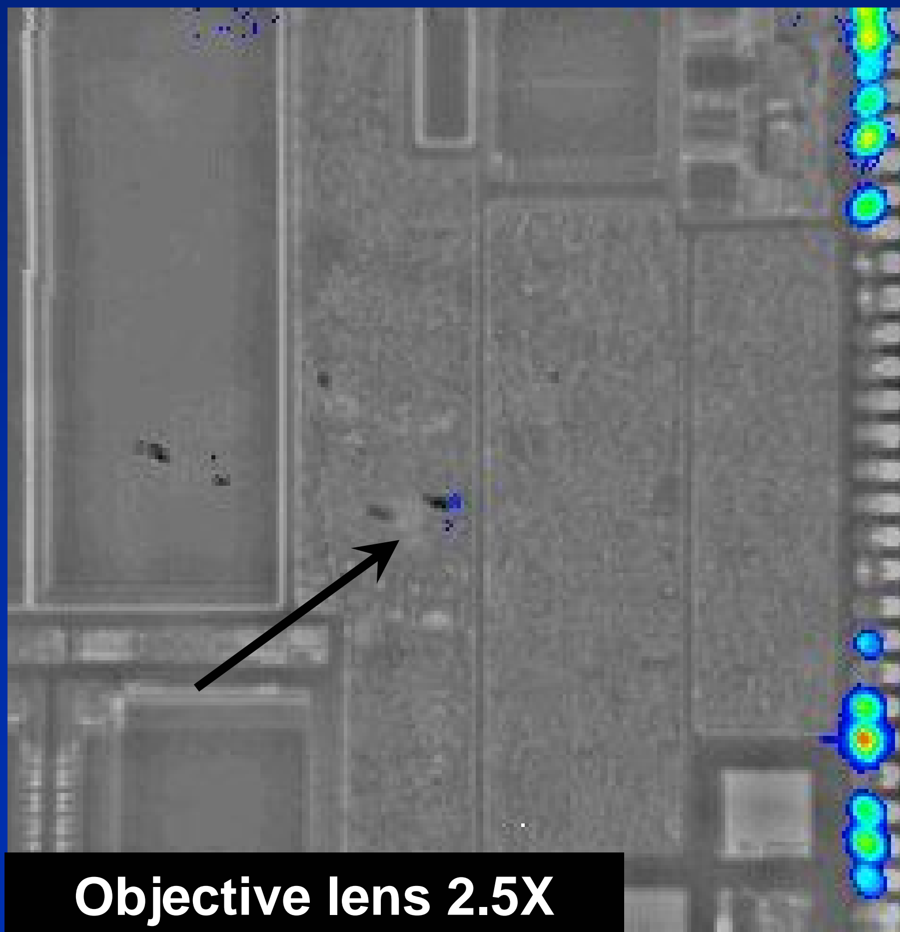
- Tester condition :
  - Tool : Diamond D10 (CREDENCE) up to 384 I/Os
  - Setup : Probe card with 110 pads
  - Stop on vector 375 (good) in functional fail pattern
    ➔ static condition

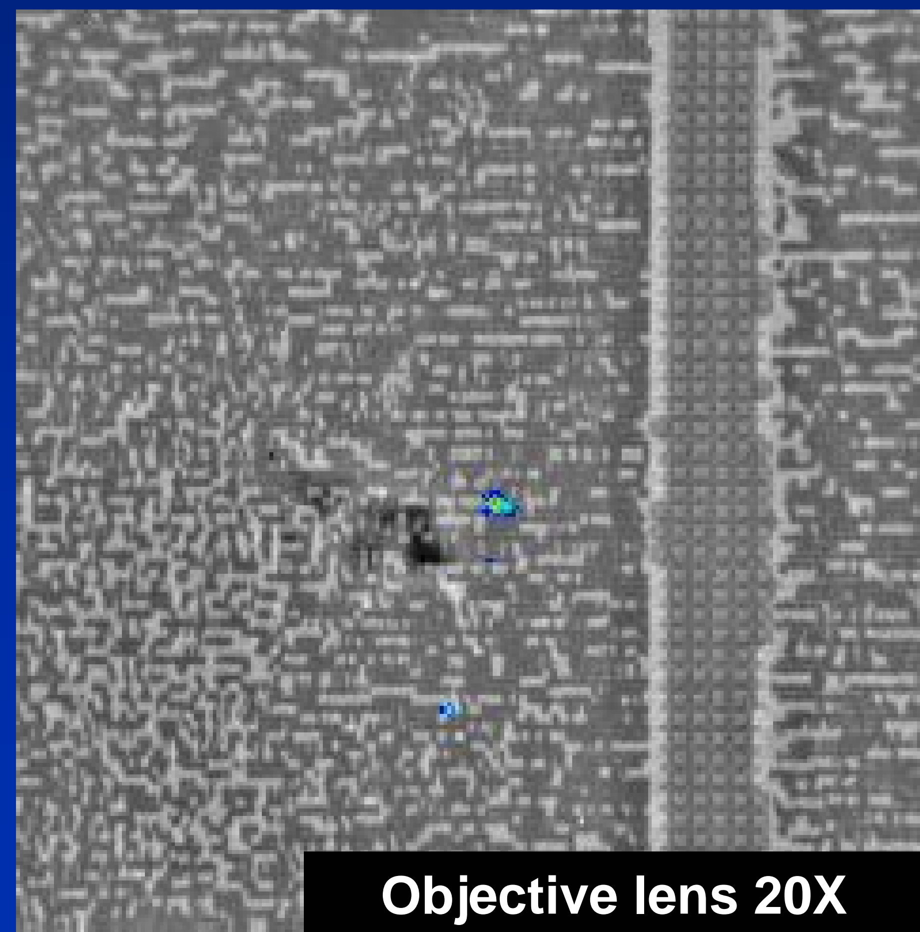
- Emission :
  - Tools : Meridian (CREDENCE) ➔ InGaAs camera (N2 cooling)
  - CAD software : NEXS (with net trace)
    ➔ Focus on defected area to visualize low emissive sites

EMMI analysis

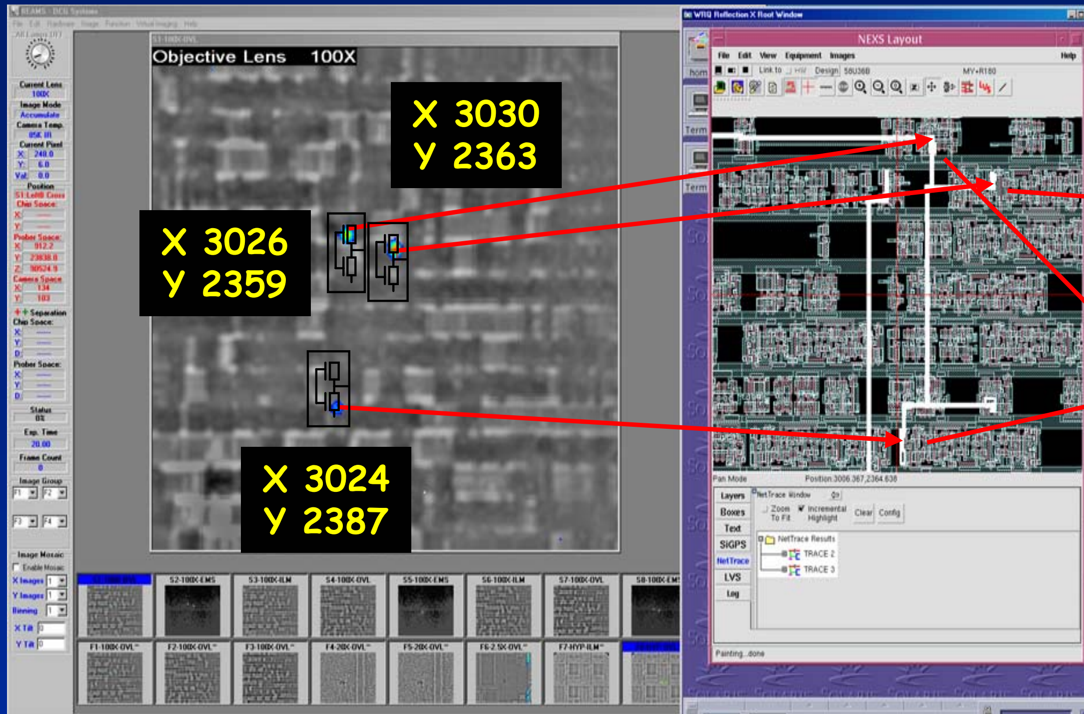
• 5 emissive sites are not localized at the physical defect coordinates and are up to few hundred micrometers away each other

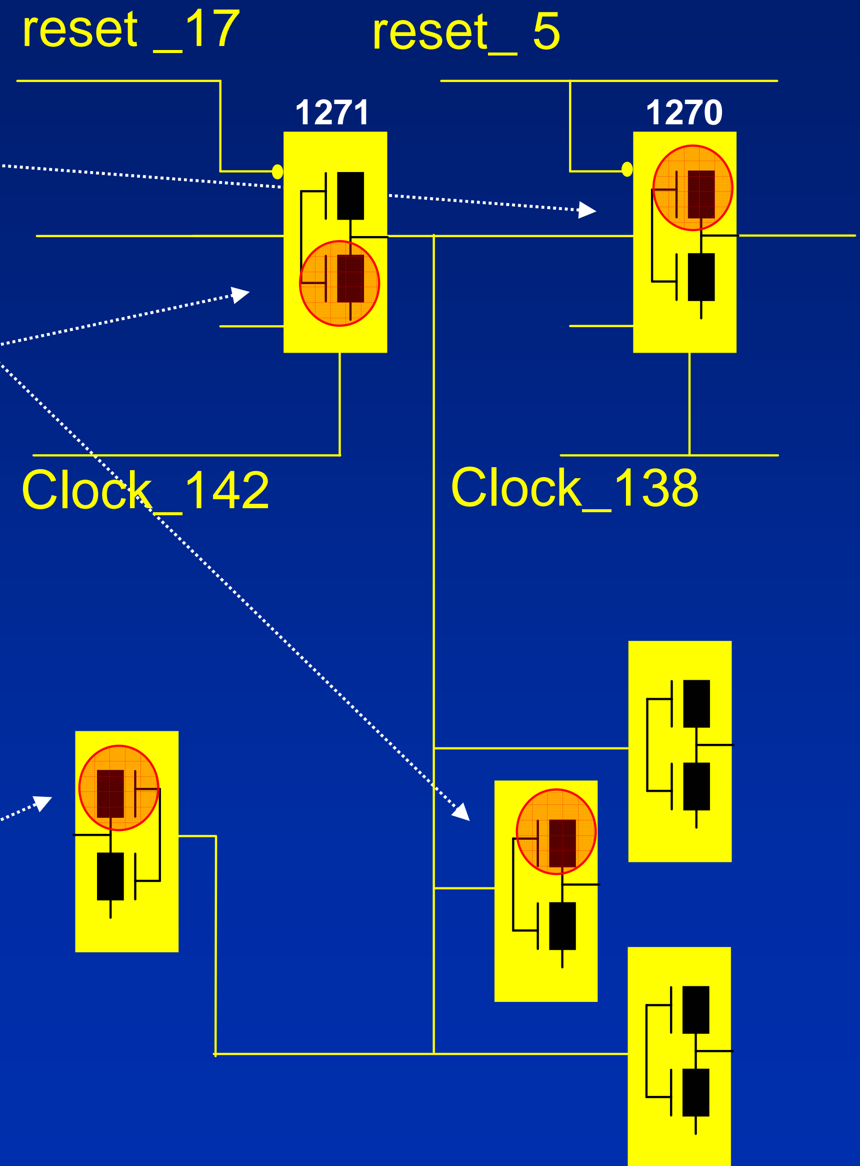
➡ Optical techniques are limited



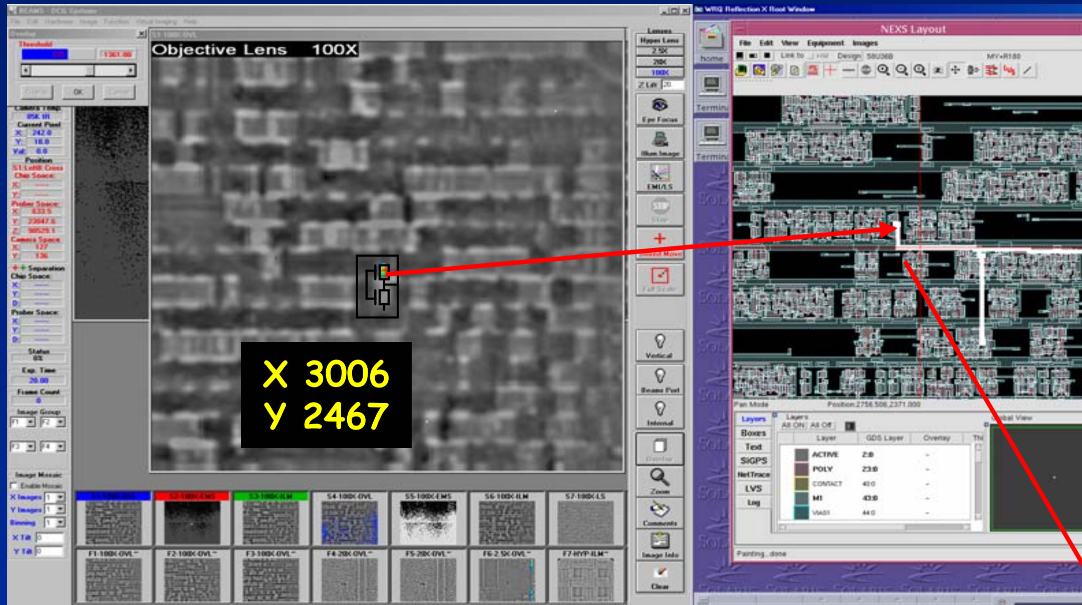


EMMI with CAD navigation analysis



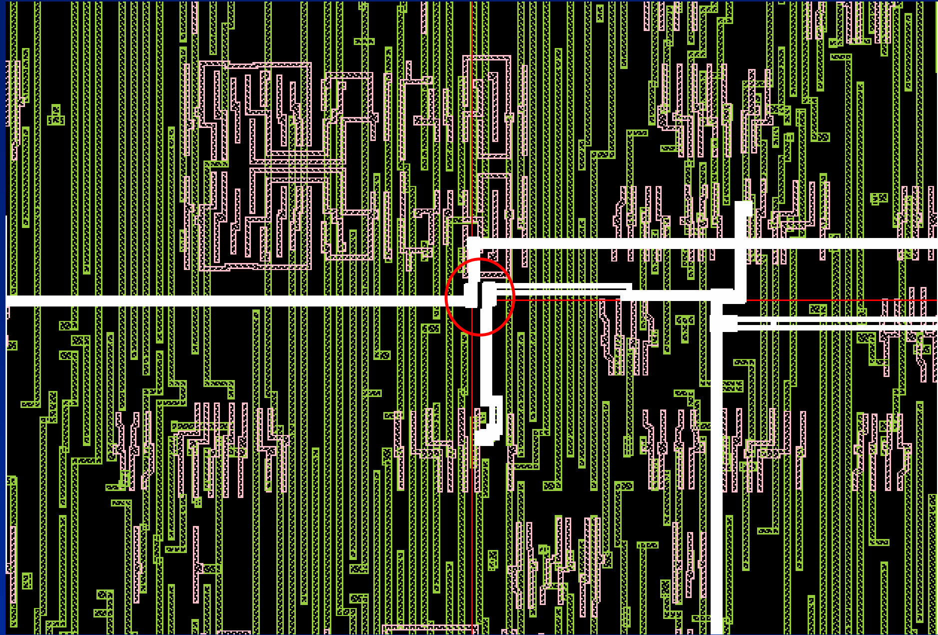


EMMI with CAD navigation analysis



Emissive sites are up to few hundred micrometers away each other

CAD analysis



reset _17
reset_ 5
1271
1270
Clock_142
Clock_138

Layout localization software allows to identify a specific critical area at Metal 2 and Metal 3 level
➡ “net trace” capability

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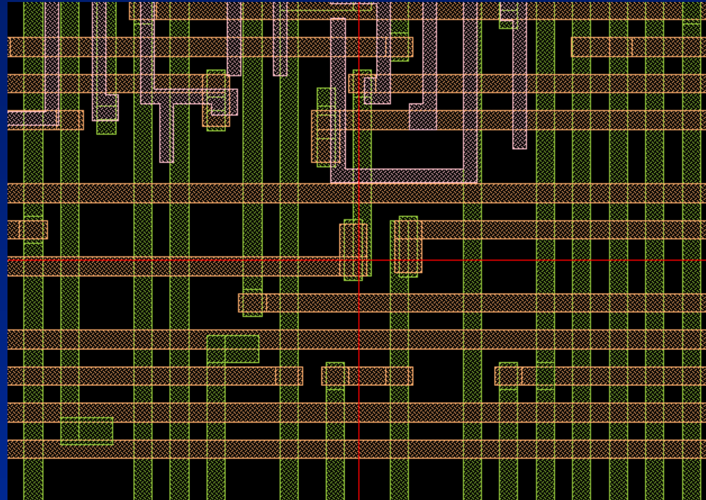
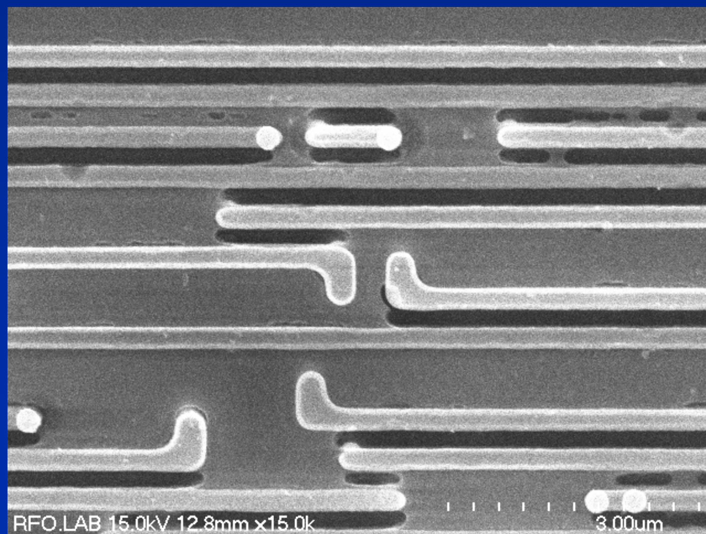
Failure Diagnosis

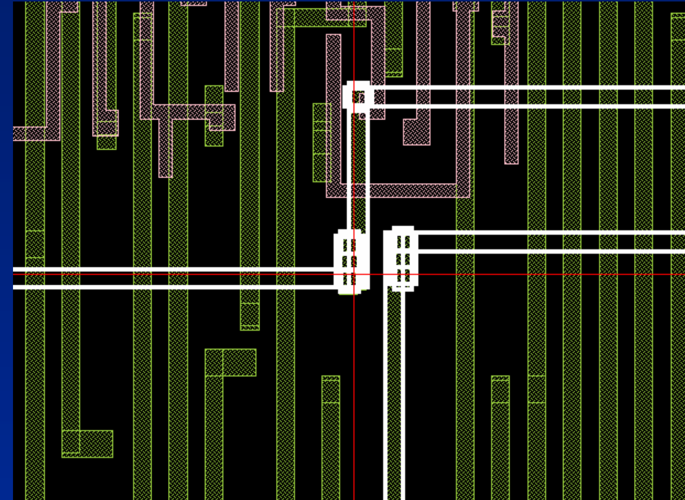
Metal 3 level

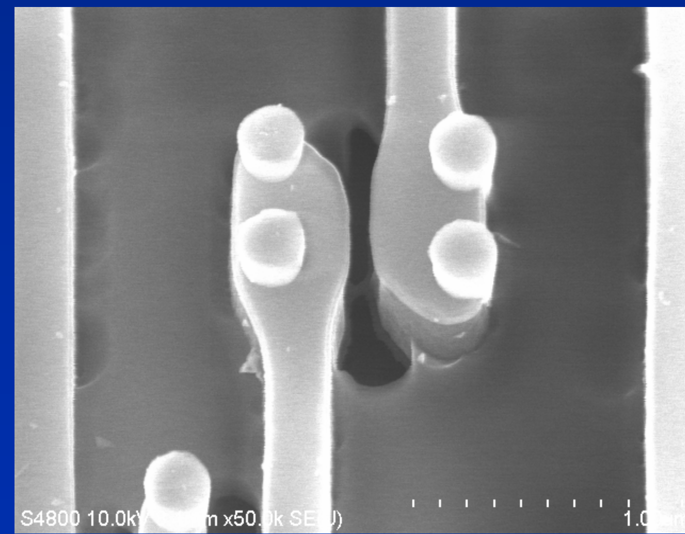




No defect

Metal 2 level

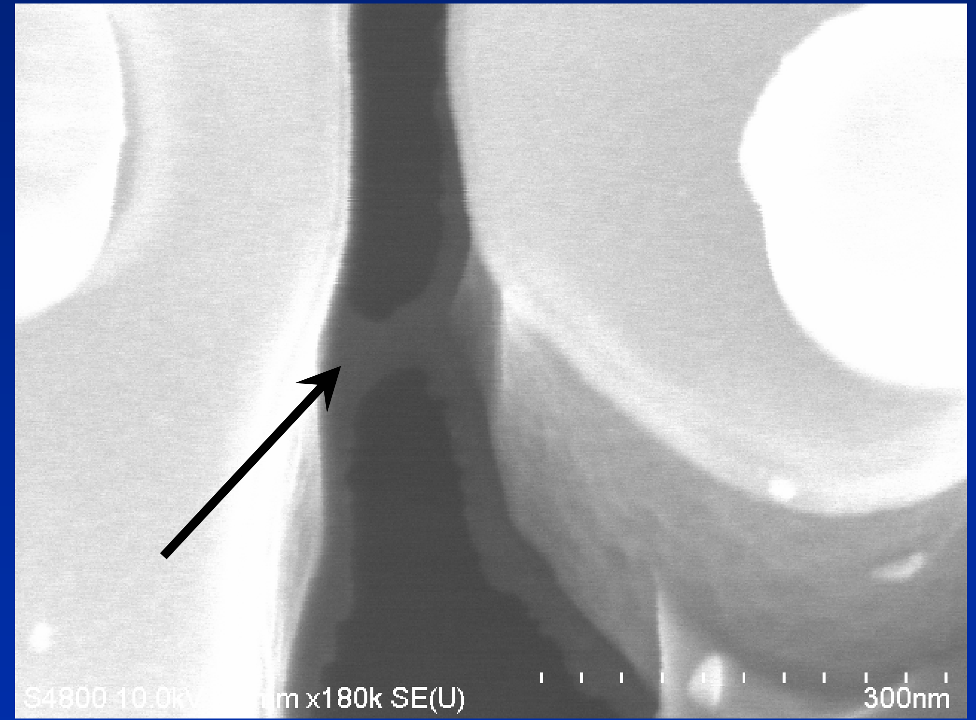




Barrier short

Failure Diagnosis

Metal 2 level



Metal 2 Barrier short due to side to side landing pad structure

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Conclusion

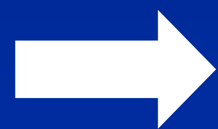
For this study case,

Failure Diagnosis was successful thanks to :

✓ Good electrical analysis

✓ EMMI sensitivity detection (back-side)

✓ Layout localization software linked to EMMI tool



Defect localization analysis with NEXS tool capability belong to our standard failure analysis flow

➢ OBIRCH investigation :

- No conclusive result with Meridian (CREDENCE)

➔ Some samples are repaired after re-test