Recent progress on characterization system of GEM-foils through high resolution images

SOFA
Software for quality diagnosis of MPGD's

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RD51 miniweek june 2016 CERN

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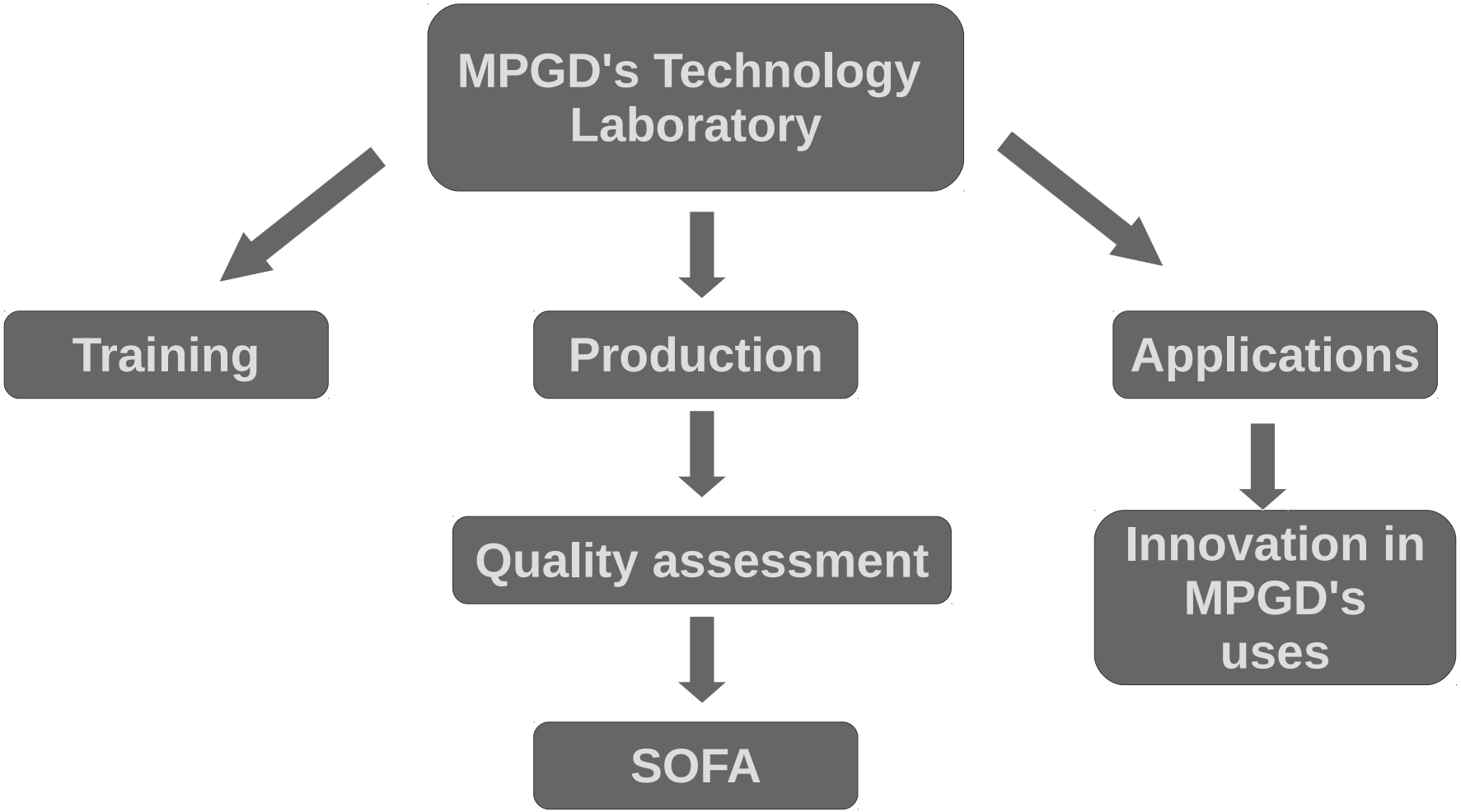
RD51 Common Project



SOFA: foil defect and analysis software

Study subject

Quality assessment of GEM foils

What for?

Support massive production processes quality assessment, speed, precision cost reduction

Approach

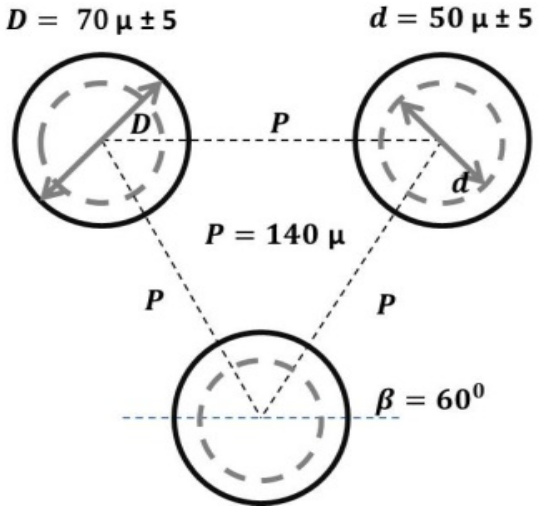
High resolution image analysis. (images provided by GSI and obtained by HIP.)

SOFA: Methodology

Geometry analysis:

- Hole shape

- Spatial distribution



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SOFA: Challenges

- Dealing with image quality and resolution

- Limiting necessary computation resources

- Defining quality measurements

- Experimental validation

SOFA: Challenges

Dealing with image quality and resolution

- Image alignment
  - Parallelism
  - Overlapping
- Image light related problems
  - Uneven light levels
  - Contrast
- Limited resolution
  - Pixel Size
  - blur

SOFA: Challenges

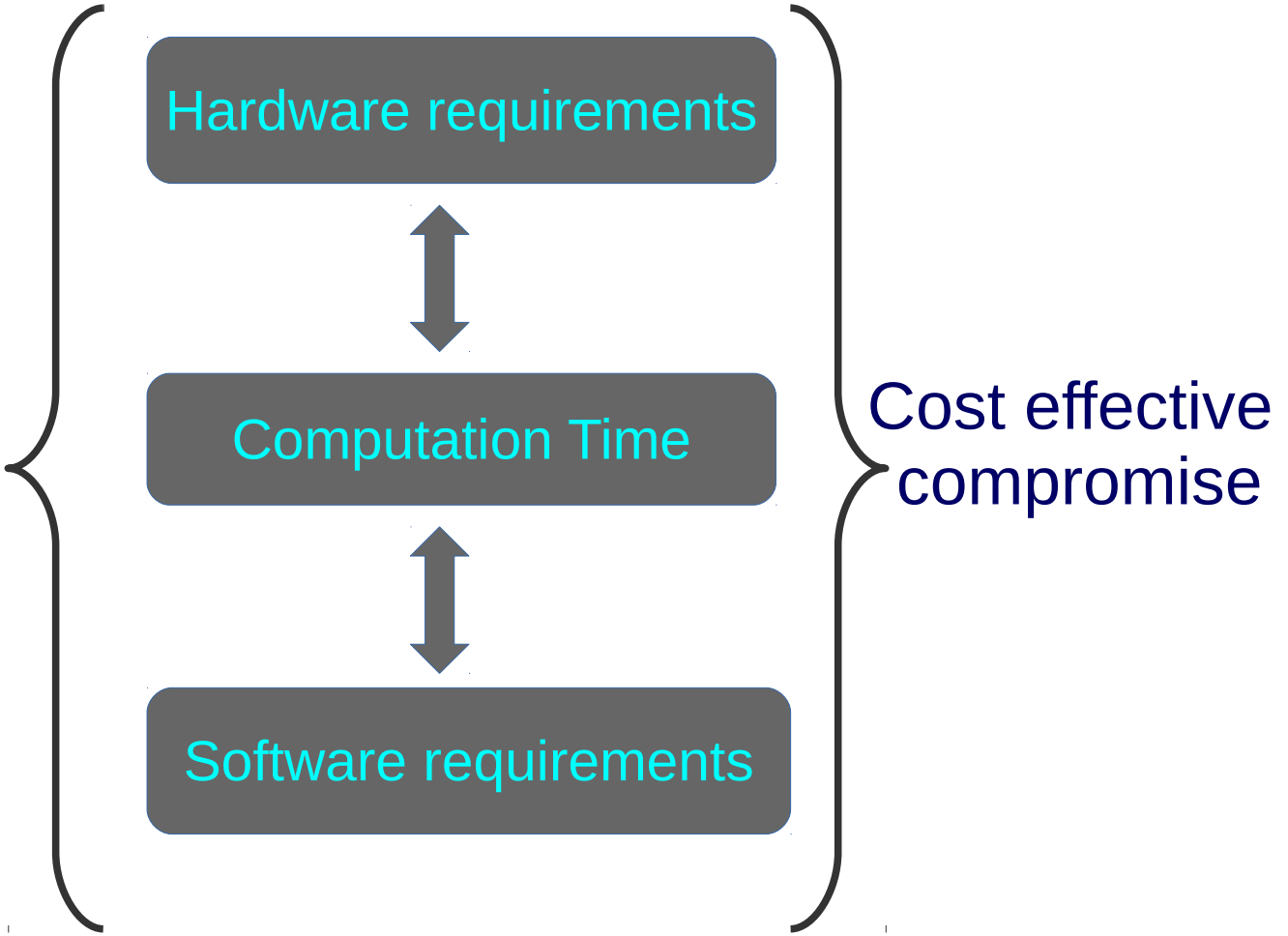
Limiting necessary computation resources

-Large size images files

-Large numbers of holes

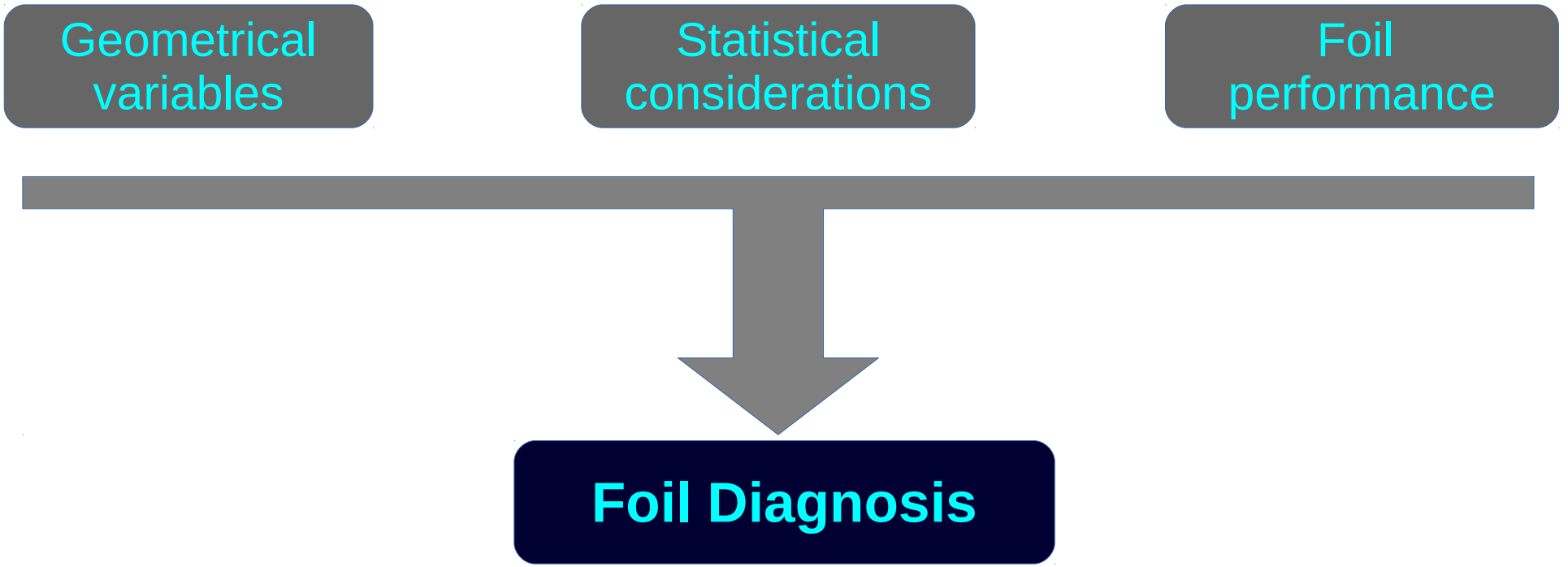
-Complex image recognition

-Large numbers of images



SOFA: Challenges

Defining quality measurements



SOFA: Challenges

Experimental validation

Establishing adequate references

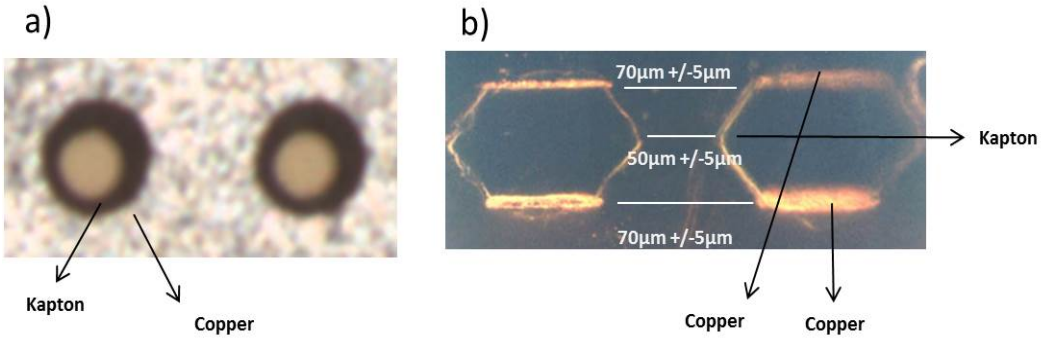
Obtaining experimental data

No Available information relating flaws and performance

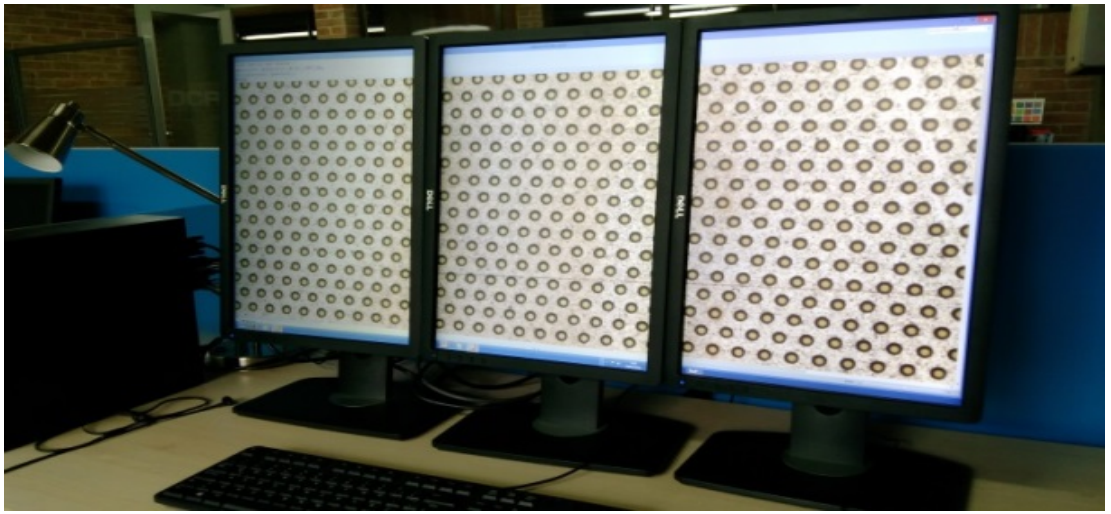
SOFA: methods and accomplishments

DA Visual inspection as performance reference

- Training inspection personnel



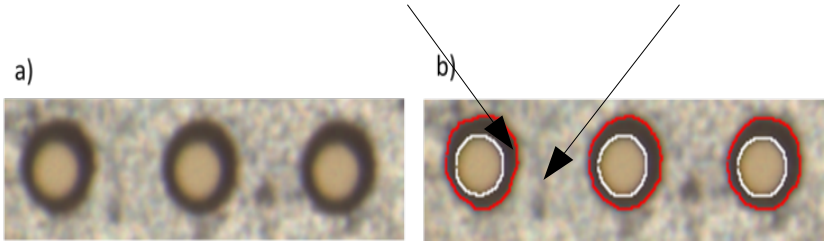
- Visual Inspection set-up



SOFA: methods and accomplishments

Image recognition

Defining image descriptors



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Segmentation to handle Illumination irregularities

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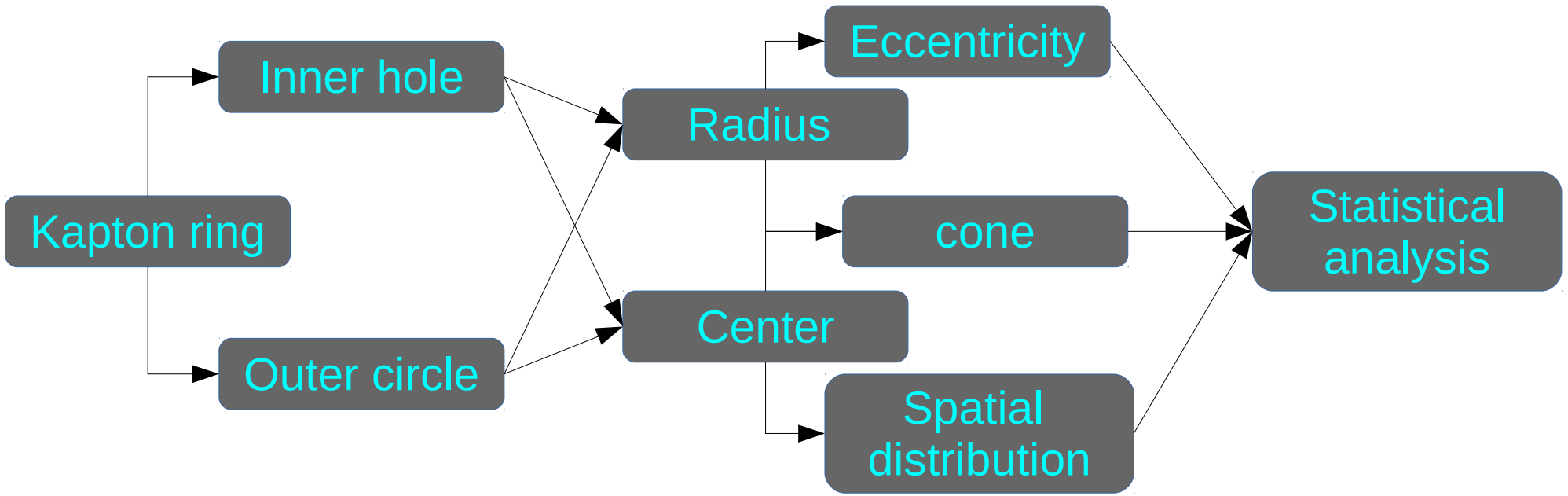
-Increased flaw detection effectiveness

-Computation time reduction

SOFA: methods and accomplishments

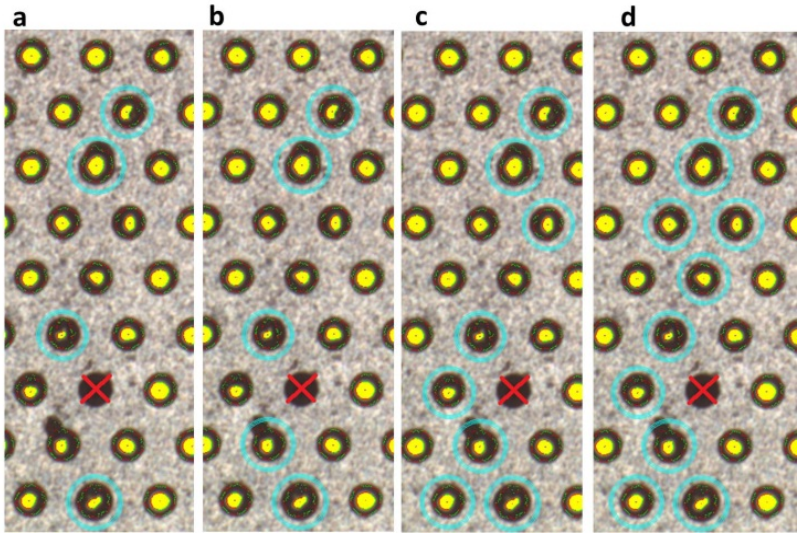
Diagnosis model

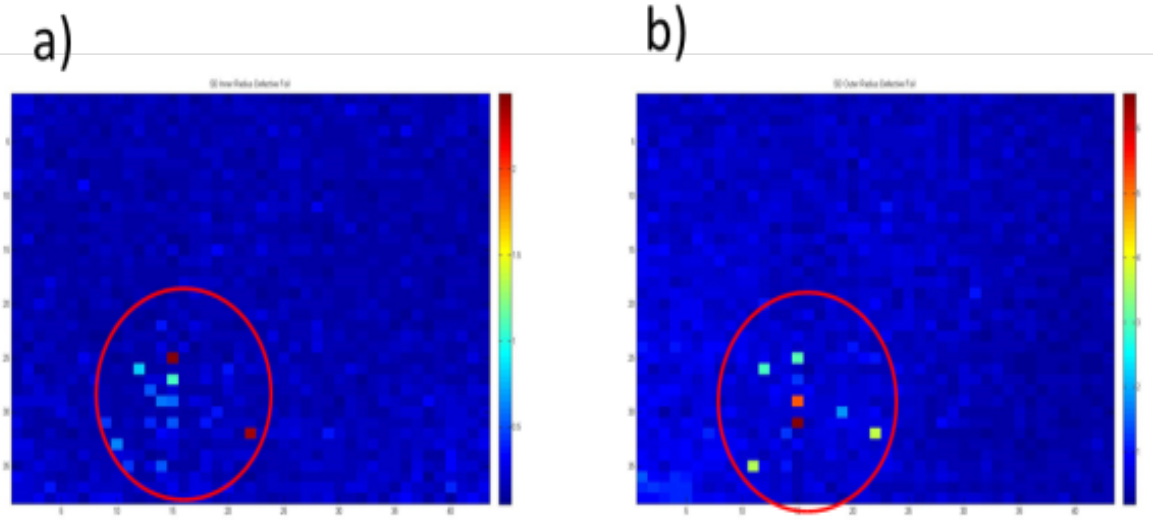
All flaws defined with only one geometrical object (kapton ring)



SOFA: methods and accomplishments

Flaw detection and classification according to deviation from acceptance criteria

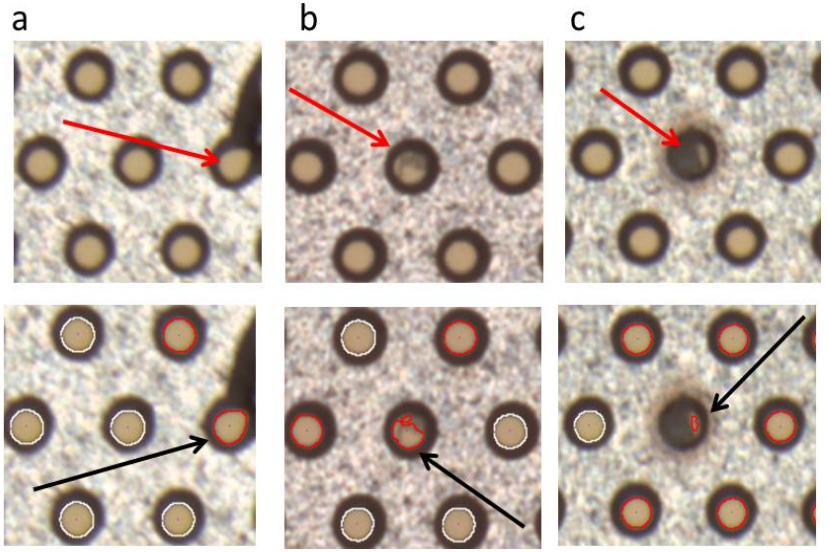


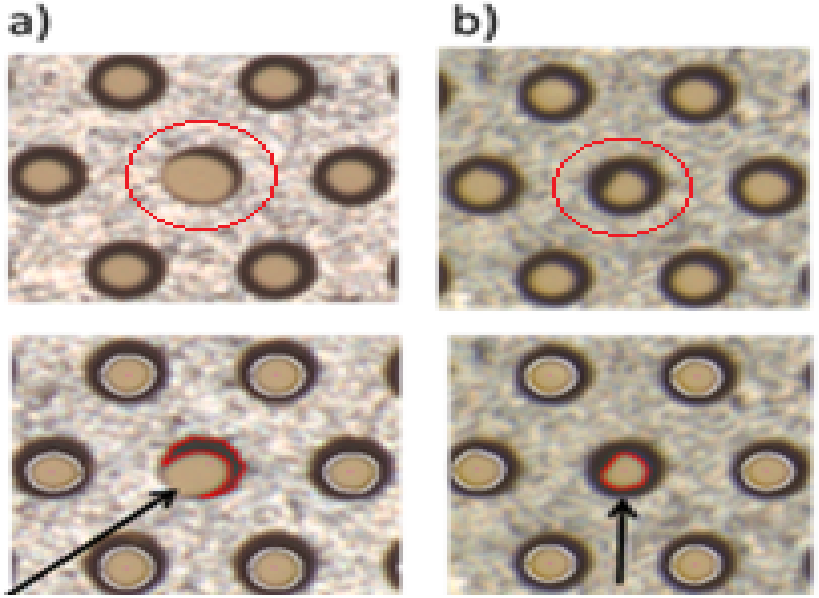


Fast Flaw visualisation tool

SOFA: methods and accomplishments

Different types of defects detected (discrimination capabilities)





SOFA: methods and accomplishments

Some comparative results

Image	*Number of holes*	***Detected flaws*** *Visual Inspection*	*Visual Inspection time*	Detected flaws SOFA	*SOFA inspection time*
img1	1612	1	150	3	2.516
img2	1611	2	155	25	1.678
img3	1658	4	149	37	2.625

SOFA: Current and future work

Experimental validation

- Defect characterization
- Testing with artificially created images with known defects for validation.
- Determine thresholds to diagnose flaw acceptance
- Enlarge flaw classification categories
- Define relation between flaw characterization an foil performance.
- Lowe resolution images to be used
- Other diagnose criteria (new variables)

Thanks

Laboratorio de detectores Universidad Antonio Nariño
Colombia