

PERFORMANCE DIAGNOSTICS WITH PROBABILISTIC GRAPHICAL MODELS

A PRINT QUALITY JOURNEY

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Canon

TNO ESI
Powered by industry
and academia

QUIZ

What do you see?

- A print
- A scan
- A sensor

Answer:

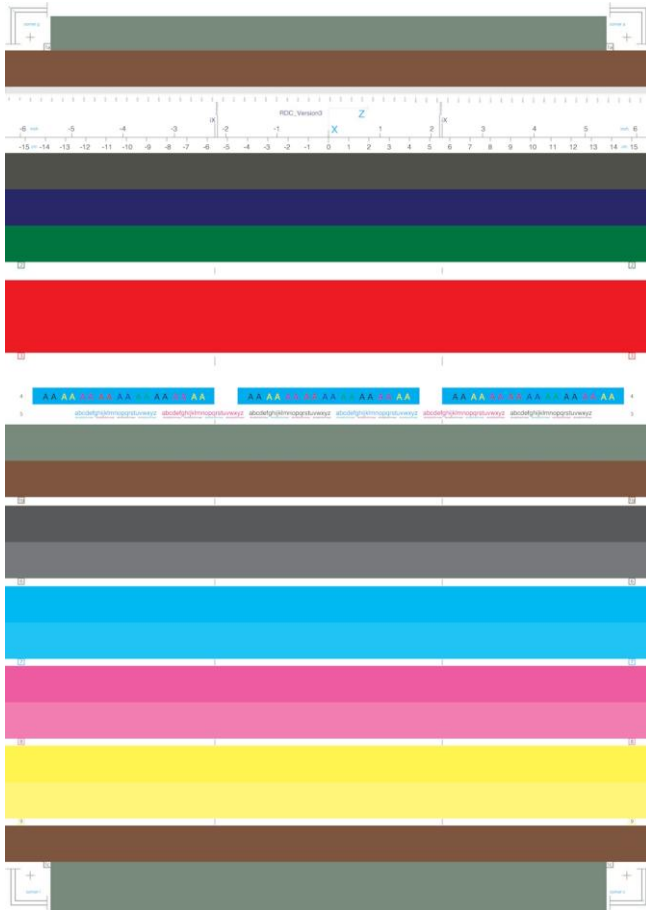
All three are correct



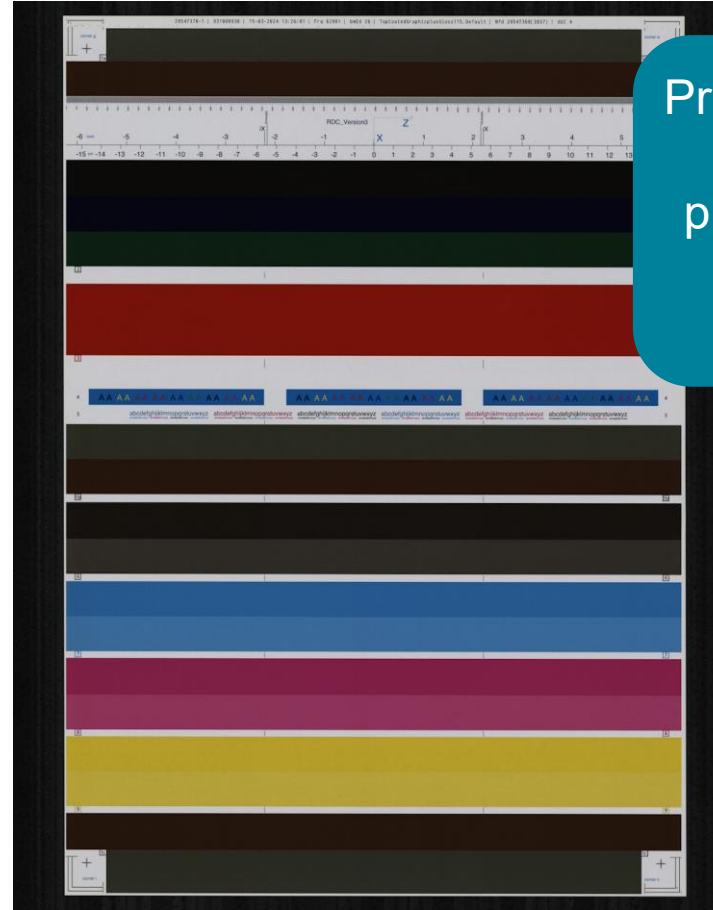
This is a Remote Diagnostics Chart. Printed at customer and scanned with an inline scanner.

FROM DIGITAL ORIGINAL TO PRINTSCANS

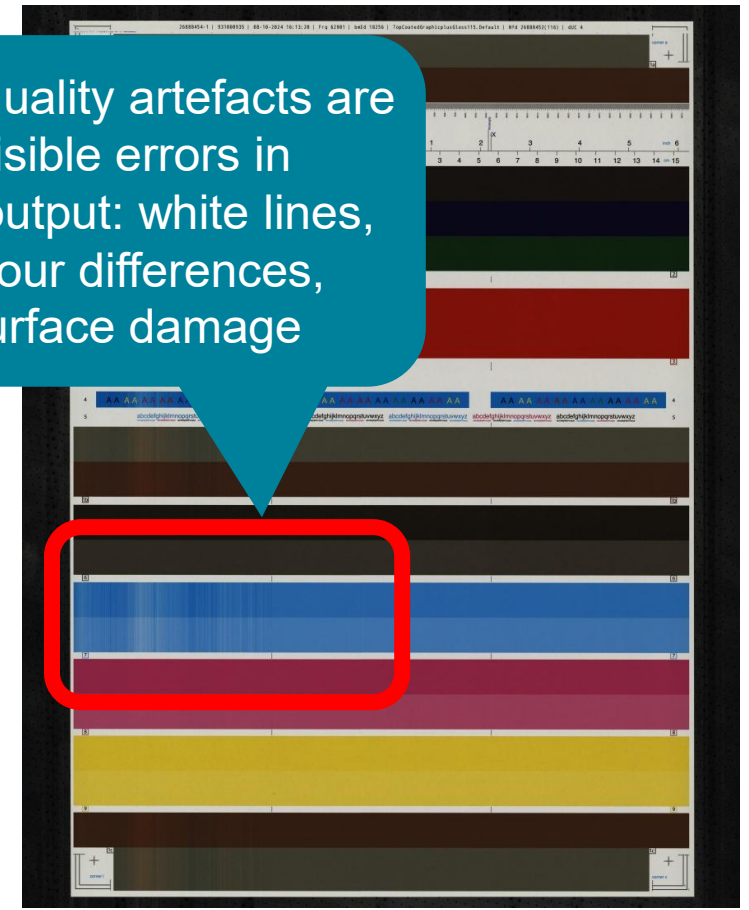
Digital original of RDC



Printscan of good output



Printscan with artefacts



Print quality artefacts are visible errors in printoutput: white lines, colour differences, surface damage

Example scans are from CPP flagship product: Varioprint iX3200



320 A4 full color images per minute. Annual production 50-150 Mio A4 images



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Print quality diagnostics is key, but not every artefact directly relates to a root-cause



White lines can be due to different root causes: printhead related, mediahandling scratch, digital error

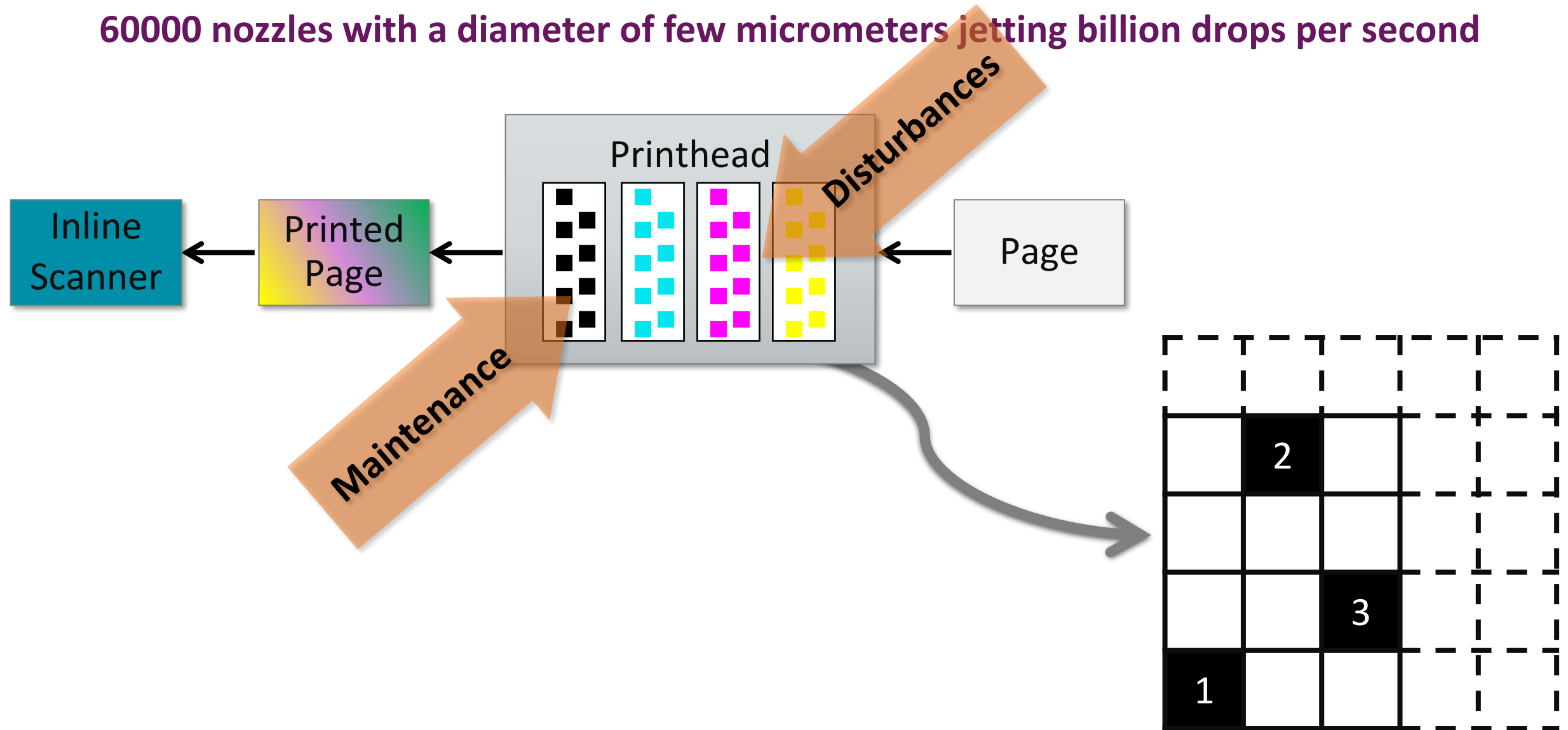
Not all artefacts are automatically diagnosed by the system

some require expert knowledge of a service technician or even R&D specialist
this is costly and time consuming

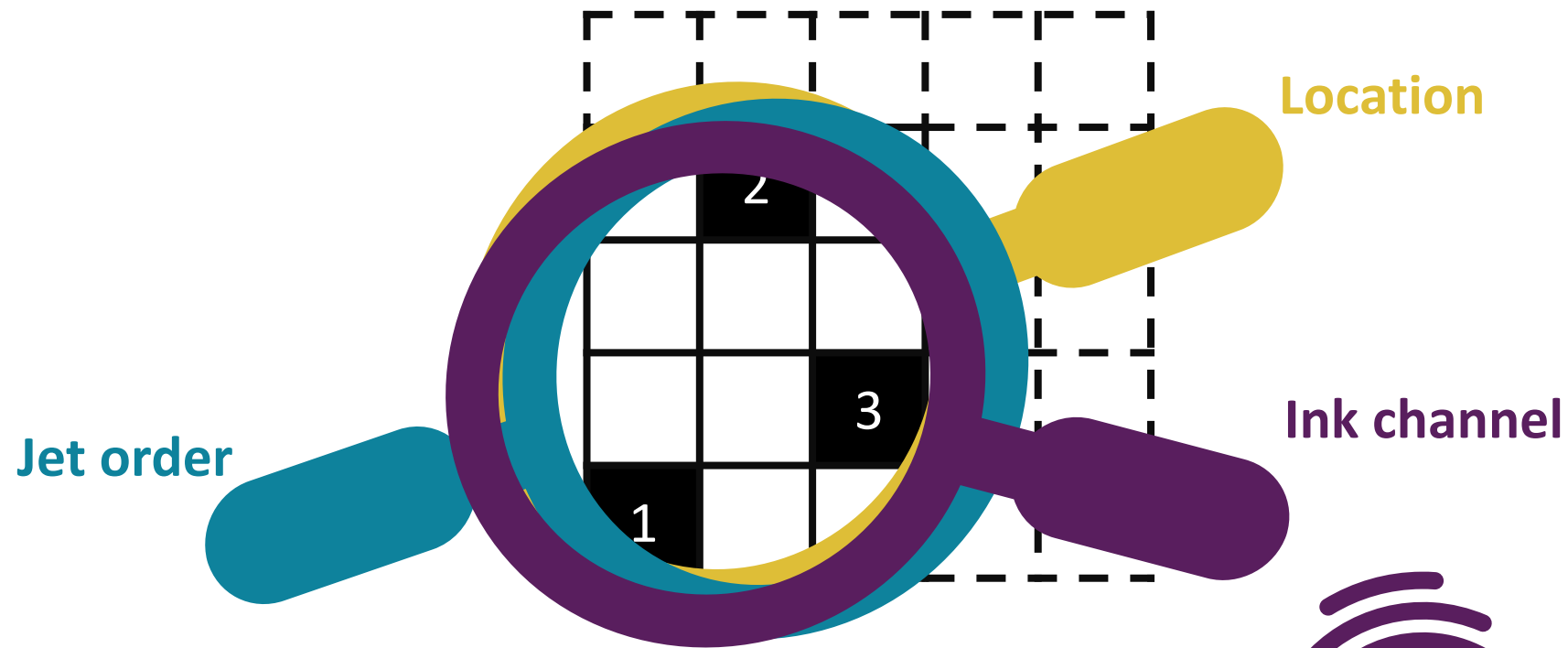
Therefore we are ever looking to improve our diagnostic methods

PRINTING PROCESS – SIMPLIFIED OVERVIEW

60000 nozzles with a diameter of few micrometers jetting billion drops per second



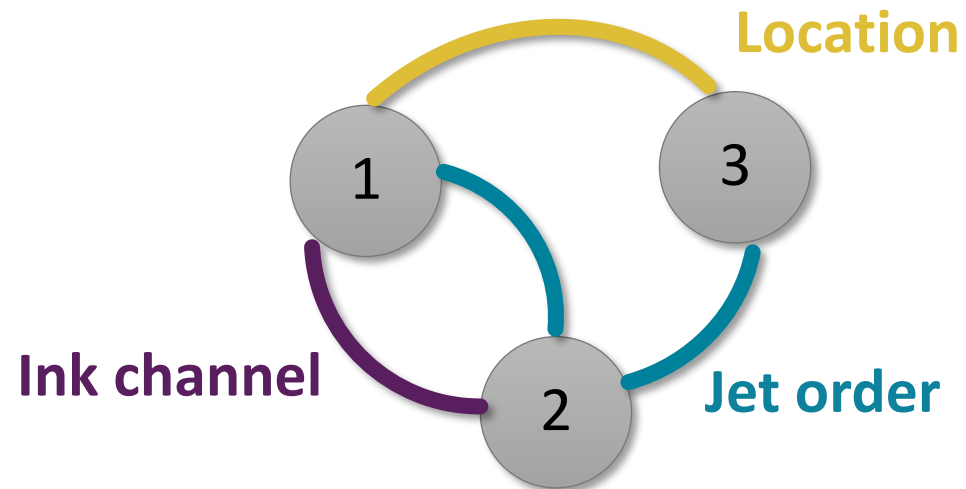
Nozzles can be seen in multiple representations:



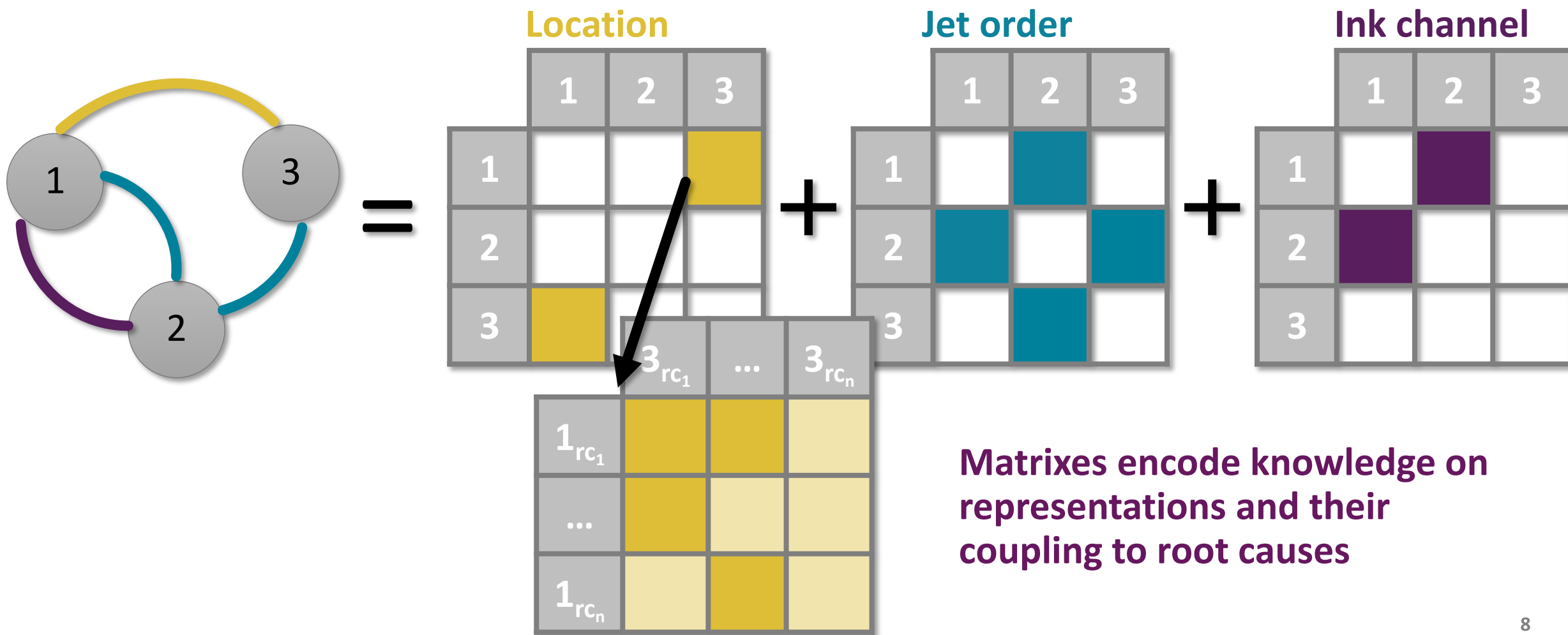
Continuous pattern of non-jetting nozzles in a specific representation, indicates a likely root cause



Probabilistic Graphical Model (PGM): a single AI framework to model & reason simultaneously over multiple representations



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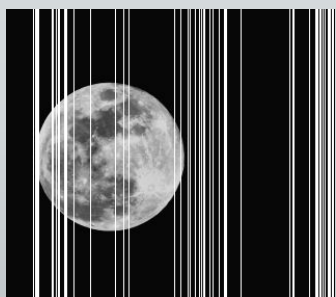


WORKFLOW OF THE APPROACH

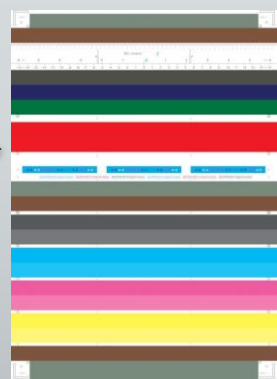
Field Data

Knowledge

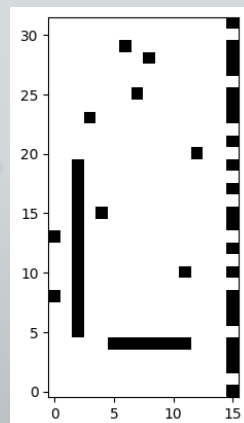
Visible artefacts
(exaggerated)



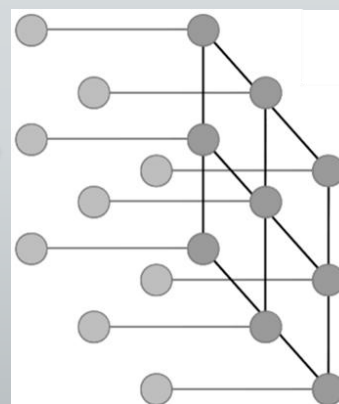
Diagnostic
chart



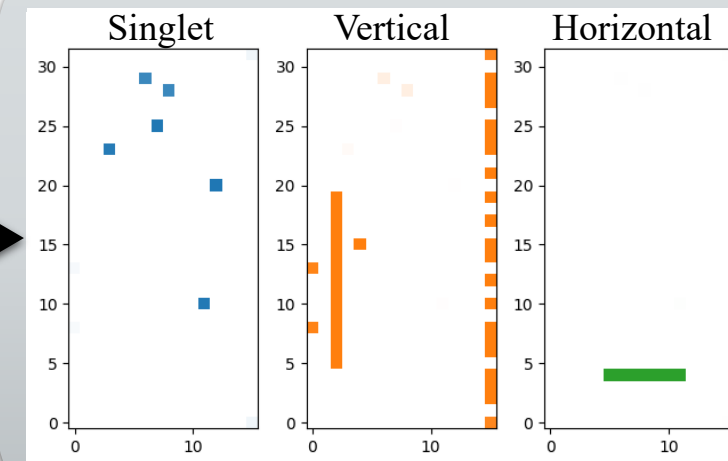
Non-jetting
nozzles



PGM1:
Patterns model



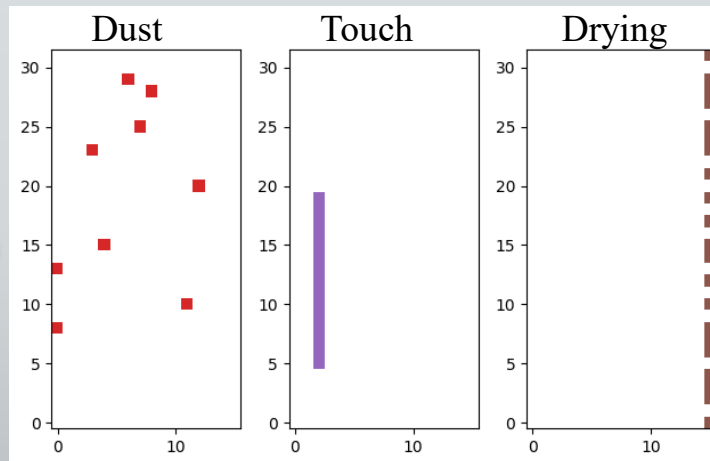
Patterns



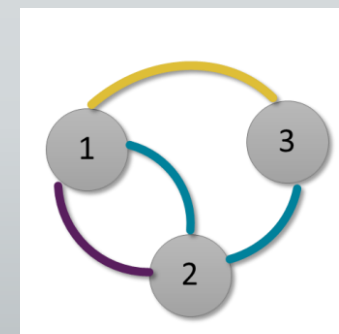
Page printed
correctly



Root causes



PGM2:
Root causes model



Data

Knowledge

THREE PILLARS BEHIND THE METHODOLOGY

AI based reasoning

Multiple representations

Multiple resolutions

Over time

Knowledge + Data

Structural knowledge

Experiential knowledge

Field data

Generic applicability

Pixels on an image

Nozzles on a print head

Dies on a wafer

Print quality depends on many factors: needs digital assistance for its diagnosis

Presented approach combines expert knowledge and field data for assisted diagnosis

Approach is generic and applicable beyond print quality

→ Visit our booth for further details and a demo

Acknowledgements:

Peter Kruizinga (CPP), Micha Lipplaa (TNO-ESI), Alvaro Piedrafita Postigo (TNO-ESI)

THANKS FOR YOUR ATTENTION!

TIME FOR Q&A!

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The Canon logo is displayed in its signature red color.The TNO-ESI logo features the text 'TNO-ESI' in a bold, black, sans-serif font. A horizontal purple bar is positioned above the 'O' in 'TNO'. Below the main text, the tagline 'Powered by industry and academia' is written in a smaller, black font.