Evidence Pack Overview and Purpose

By Stephen Francis, Phocoustic Inc. February 1, 2026

This document is presented as an **evidence pack** supporting the technical claims of a physics-anchored anomaly detection method applied to wafer inspection. Its purpose is not to provide a benchmark comparison, statistical performance summary, or defect taxonomy, but to demonstrate — using concrete physical data — *how* the method behaves in the presence of subtle, emergent disturbances that are visually indistinguishable at early stages.

The evidence shown here is intentionally limited in scope and carefully controlled. All images are derived from a real 8-inch silicon wafer captured using a simple, non-industrial prototype apparatus. No synthetic data, simulated defects, pretrained models, reference databases, or curated defect libraries were used. The focus is on **mechanism and behavior**, not optimization.

Specifically, this evidence pack is designed to illustrate three core points:

1. **Sub-threshold detectability**
   Physically meaningful disturbances can be present and spatially structured before they become visually obvious or formally alertable.
2. **Governed alerting behavior**
   Detection and flagging are intentionally separated. Alerts are issued only after persistence and magnitude thresholds are exceeded, preventing premature or noise-driven triggers.
3. **Localization within full-frame context**
   Extremely small anomalies can be identified and localized within a large, visually uniform field of view without relying on visual contrast, template matching, or prior examples of the defect.

The figures in this document should be read sequentially. Early images establish visual ambiguity and scale; intermediate representations show the emergence of structured physical change; later images demonstrate thresholded alerting and spatial localization within the full frame. Explanatory text is provided to clarify interpretation, but the images themselves constitute the primary evidence.

This evidence pack is intended to support technical review, editorial evaluation, and early-stage due diligence. It demonstrates feasibility and behavior under realistic conditions, while deliberately avoiding claims about coverage, yield impact, or production readiness.

Images Introduction

The following image sequence illustrates how a physically meaningful disturbance evolves from an undetectable state to a formally flagged anomaly under a governed, persistence-based detection framework. All images are derived from a small region (approximately 5%) of a single die on an 8-inch wafer and are shown across four sequential frames.

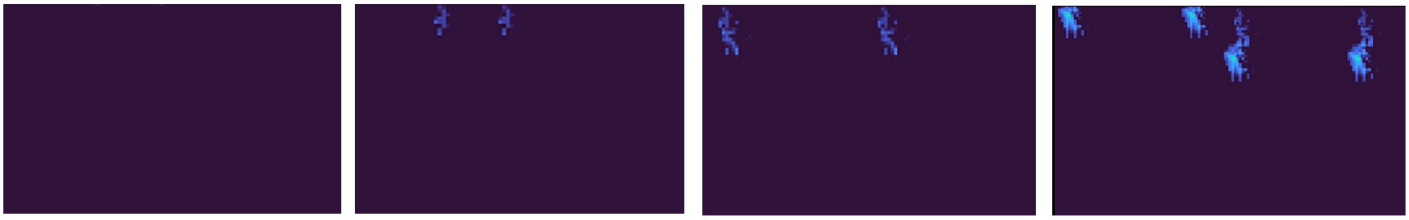
The **top row** presents the raw wafer images. Frame 1 is a reference frame with no disturbance present. In Frames 2–4, a subtle blemish is introduced that remains effectively invisible to the human eye, even under close inspection. No visual cues in this row reliably indicate the presence or growth of the anomaly.

The **bottom row** shows the system's alerting outcome governed by temporal persistence and magnitude thresholds. Although structured drift is present in earlier frames, no flag is issued until the disturbance exceeds the defined admissibility threshold. This demonstrates intentional separation between *detectability* and *flagging*, preventing premature alerts while preserving sensitivity to emergent physical change.

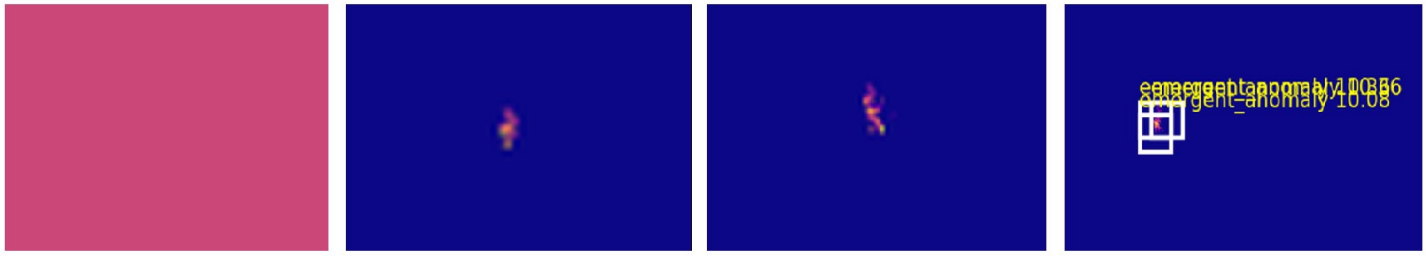
Together, these images show that the system does not rely on visual contrast or instantaneous deviation, but instead accumulates and validates physically consistent drift over time before issuing an alert

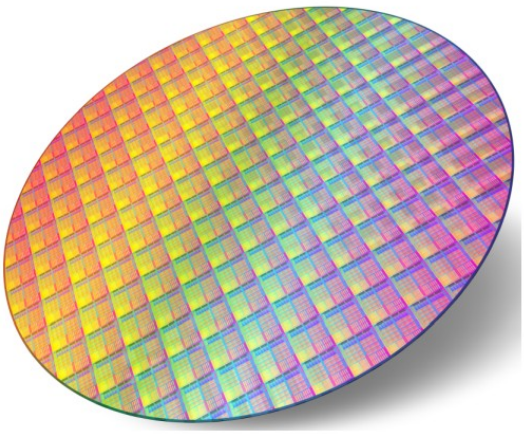
The top row (below) depicts the raw wafer image (approximately 5% of an individual wafer die). The first of four images is the reference with no 'disturbance'. Image 2-4 show increasing sizes of the disturbances. They are undectectable with human eye.

Structured Drift Representation (recursive tiling; extreme zoom) Below



Alerting Outcome (persistence threshold applied). Same physical disturbance appears in multiple tiles due to overlap. Below





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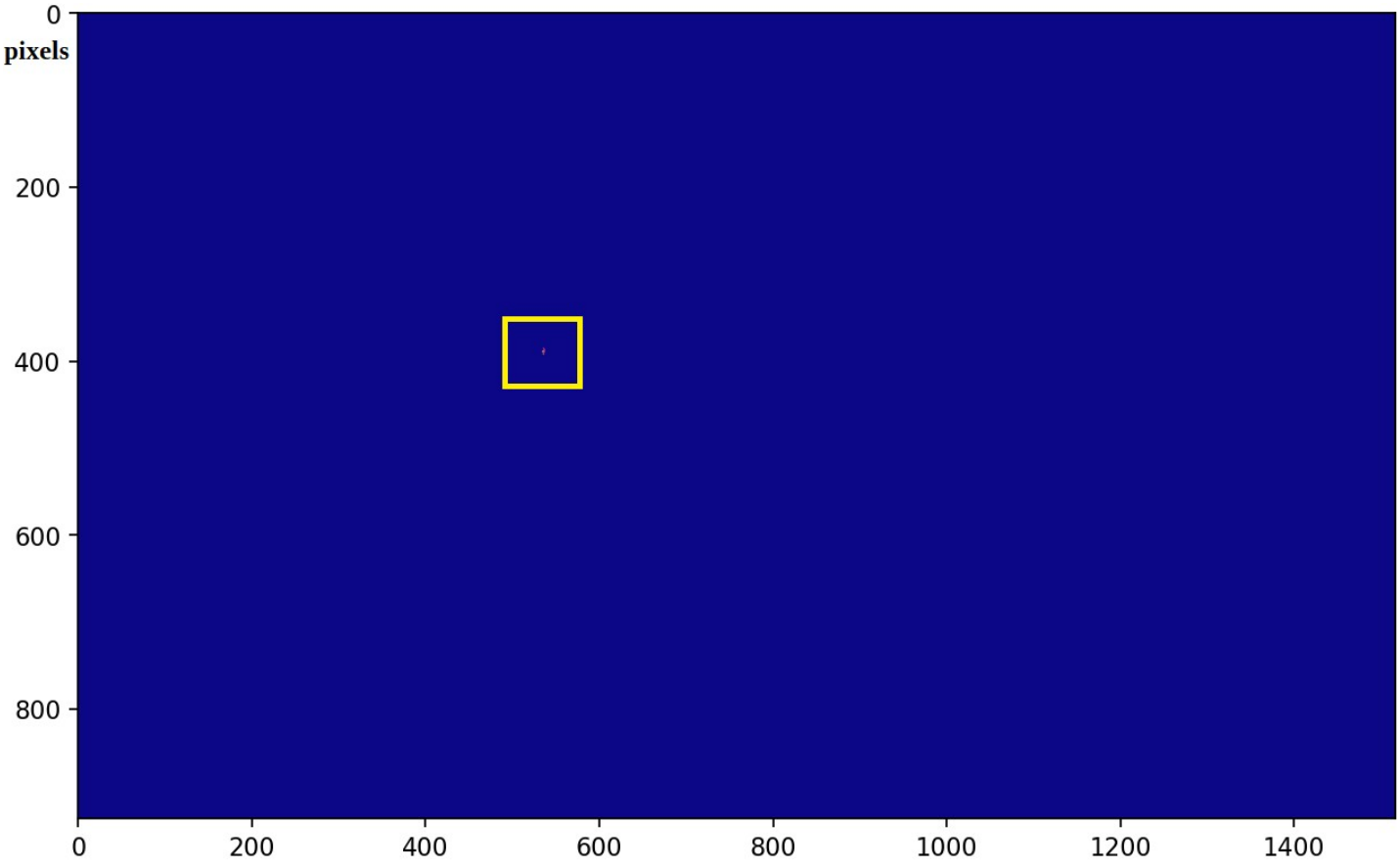
The image above shows the prototype inspection apparatus used to acquire the wafer image sequences presented in this evidence set. The setup consists of a controlled illumination source, fixed camera geometry, and a stationary 8-inch silicon wafer mounted beneath the sensor. No vibration isolation, cleanroom enclosure, or industrial optics were used. This configuration was intentionally chosen to demonstrate that the observed results do not depend on specialized laboratory conditions, reference databases, or high-end inspection tooling. All subsequent images and analyses are derived directly from data captured using this apparatus.



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The image above shows the full-frame alerting output corresponding to the localized anomaly discussed in the preceding image sequence. The highlighted region (yellow box) marks the spatial extent of the flagged disturbance within the complete field of view. At full resolution, the anomaly occupies only a minute fraction of the image and is not visually distinguishable without annotation. This view demonstrates that the system

identifies and localizes physically consistent change within a large, visually uniform background, without reliance on visual contrast, template matching, or prior examples of the defect.

Appendix

This appendix contains representative full-frame images used during development of the evidence presented in the main document. These images are provided to demonstrate background uniformity, scale, and the absence of visually obvious cues prior to thresholded alerting. No selection or filtering was applied beyond basic frame quality checks.

Frame_01, individual die

Frame_02, individual die

Frame_03, individual die

Frame_04, individual die

Drift_01, individual die

Drift_02, individual die

Drift_03, individual die

Drift_04, individual die

Heatmap_01, individual die

Heatmap_02, individual die

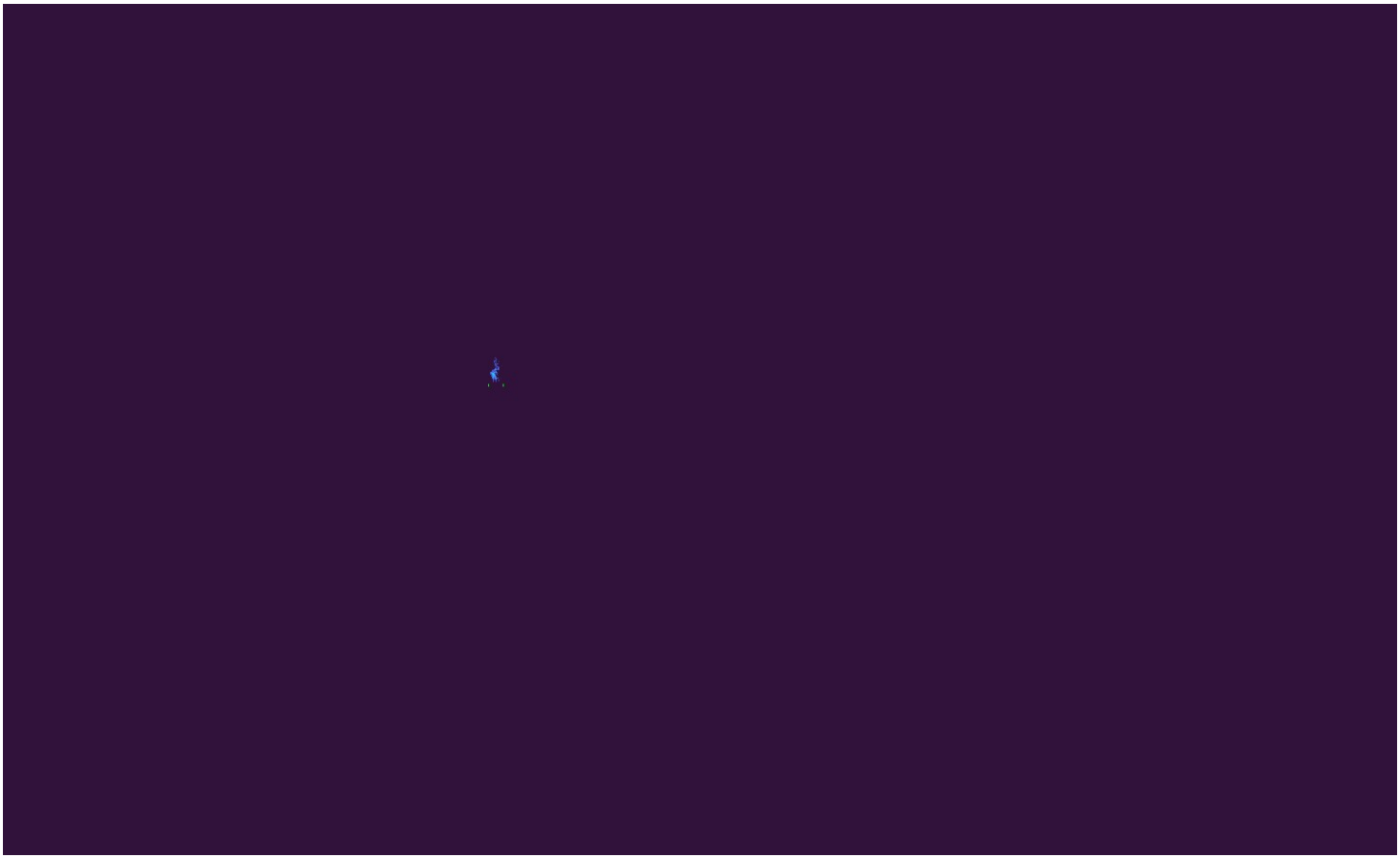
Heatmap_03, individual die

Heatmap_04,individual die

Structured Drift Representation_01, individual die

Structured Drift Representation_02, individual die

Structured Drift Representation_03, individual die

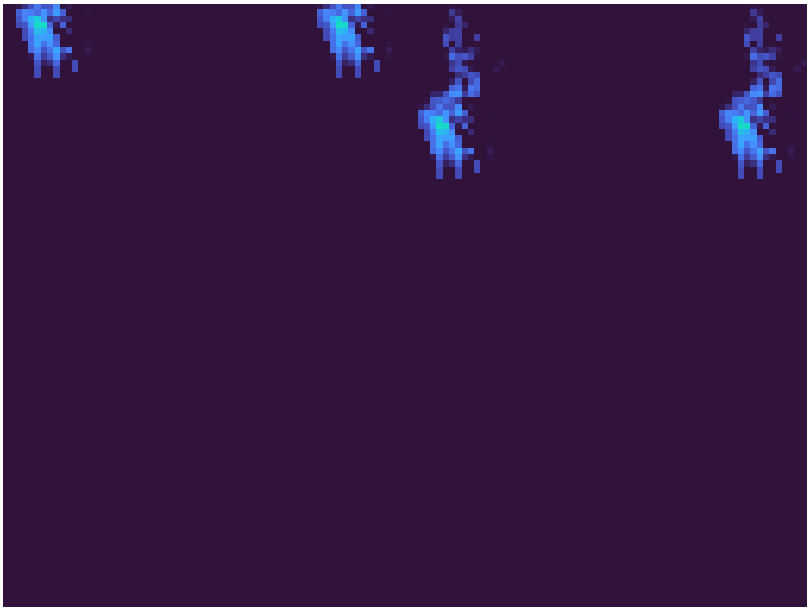


Structured Drift Representation_04, individual die

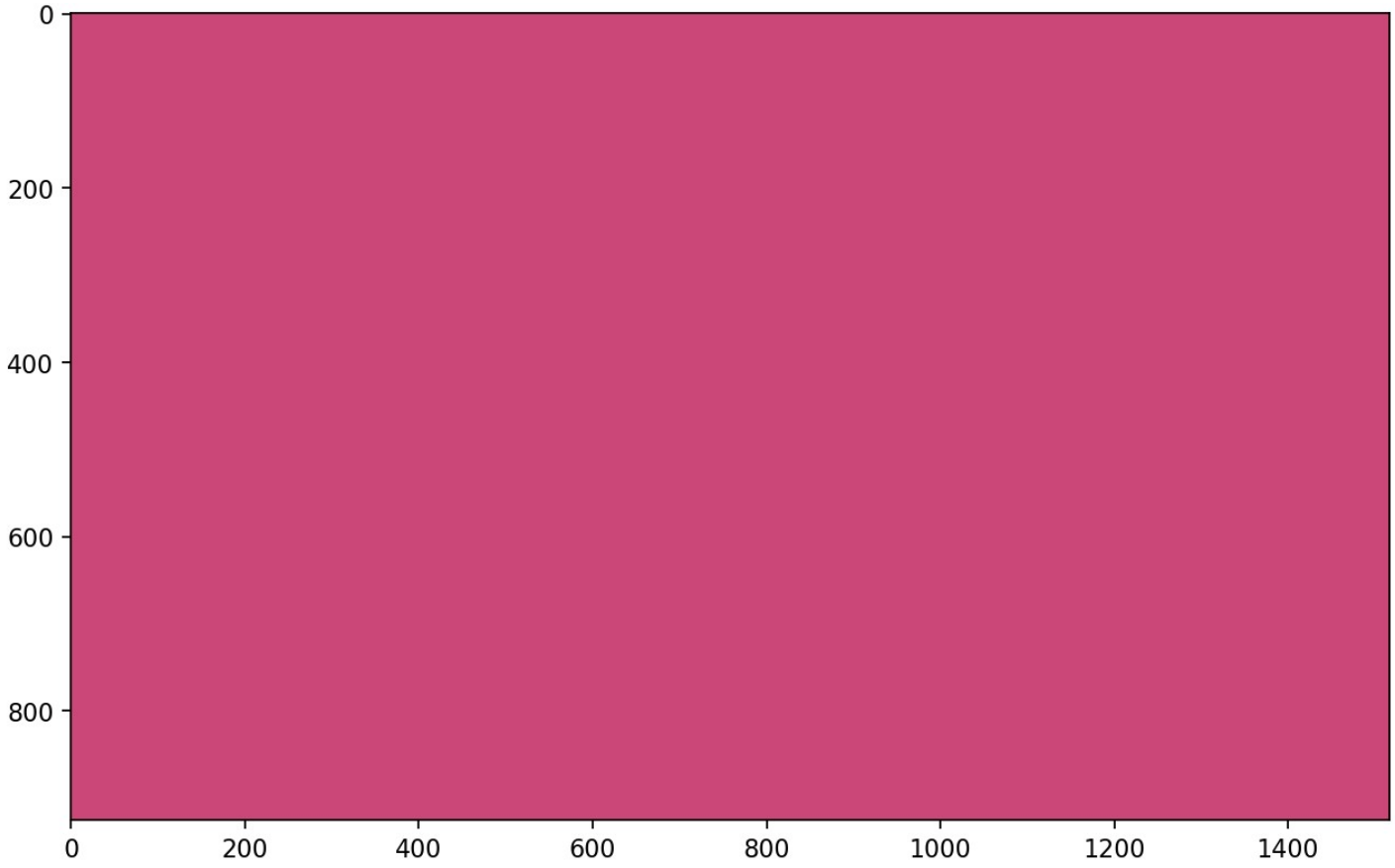
Recursive Tiling_01, The recursive tiling view represents on the order of **1–2% of the individual die area**, aggregated from overlapping local regions of interest.”

Recursive Tiling_02, The recursive tiling view represents on the order of **1–2% of the individual die area**, aggregated from overlapping local regions of interest.”

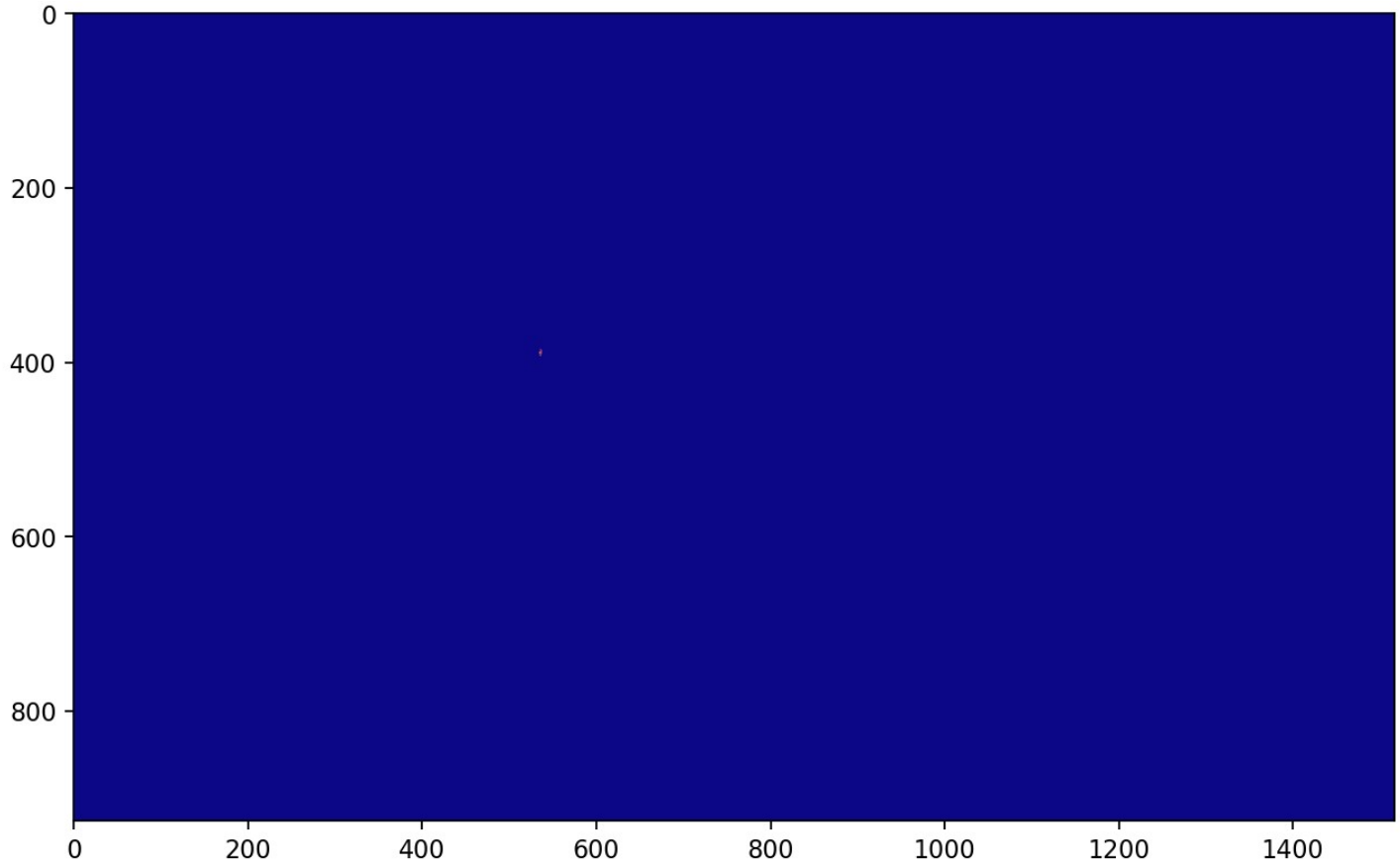
Recursive Tiling_03, The recursive tiling view represents on the order of **1–2% of the individual die area**, aggregated from overlapping local regions of interest.”



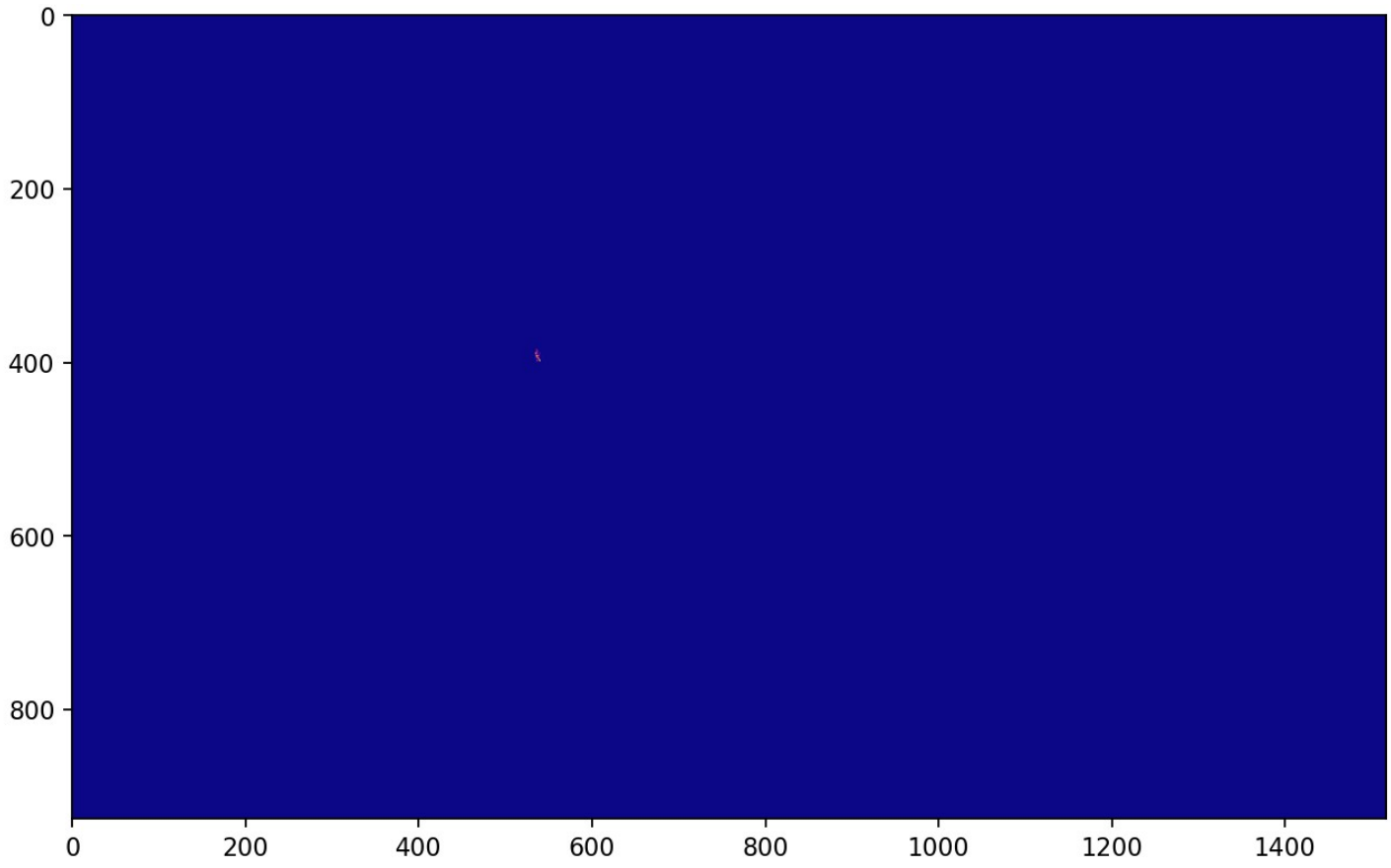
Recursive Tiling_04, The recursive tiling view represents on the order of **1–2% of the individual die area**, aggregated from overlapping local regions of interest.”



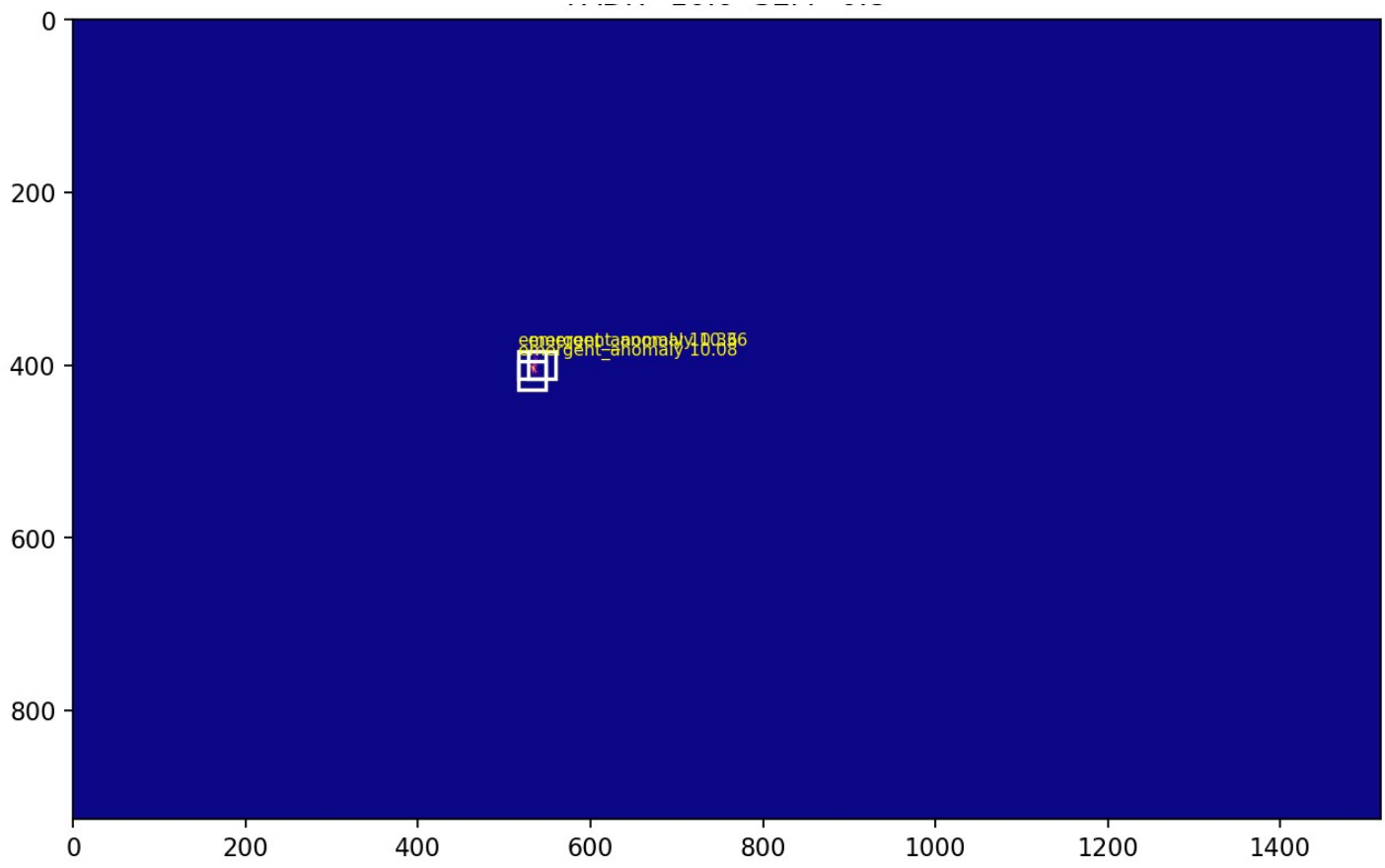
Alerting Outcome_01



Alerting Outcome_02



Alerting Outcome_03



Alerting Outcome_04