Geophysical Transect Design for Tisbury Great Pond

Martha's Vineyard Remedial Investigation/Feasibility Study

US Army Corps of Engineers, New England District
US Army Engineering and Support Center, Huntsville
Presented By:
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US Army Corps of Engineers
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Overview

- Intro to Geophysical Design at Tisbury Great Pond
  - The Pond and Design Overview
  - Design Approach
  - Issues of Scale
  - Input Assumptions
  - Target and Background Densities
  - Projecting Optimized Transect Spacing
- Concepts in Practice (“What if” Exercises)
- Real-World Example
- Conclusions

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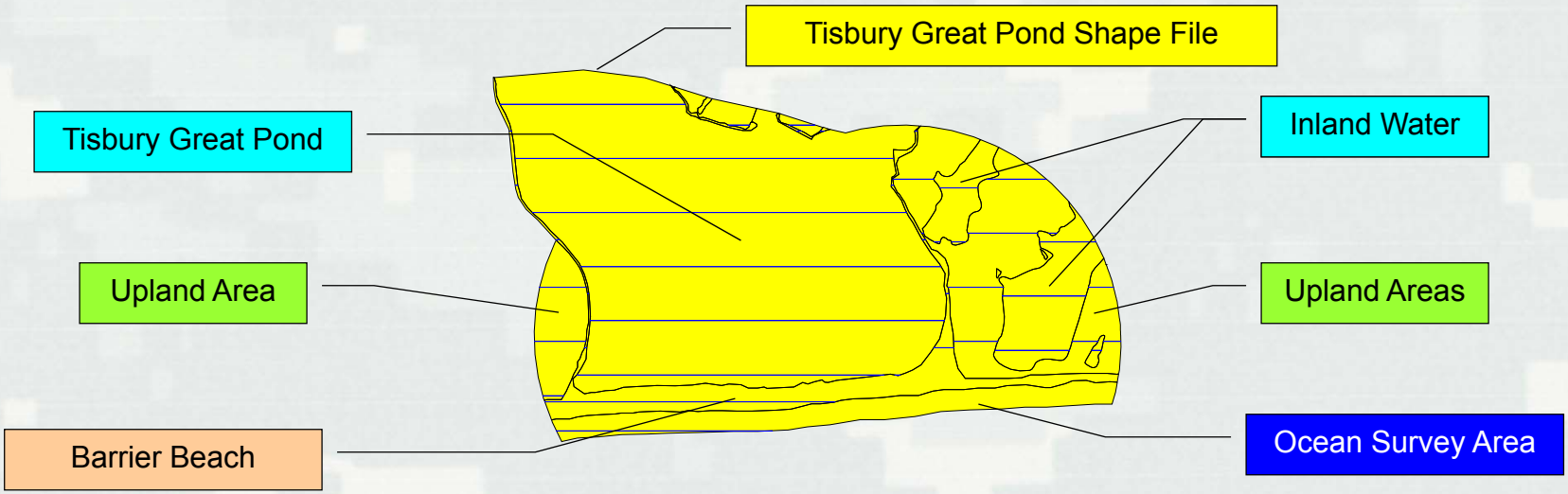
Part I

Introduction to Geophysical Design at Tisbury Great Pond

Tisbury Great Pond Geophysical Design



- Design Objective:
  - Detect MEC target areas of a given size and shape with high probability.
- Design Result (Transect Spacing):
  - Initial Transect Design Spacing = 226 meters provides 95 % confidence

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Geophysical Survey Design Software

- "Visual Sample Plan" (VSP)

  http://vsp.pnl.gov/

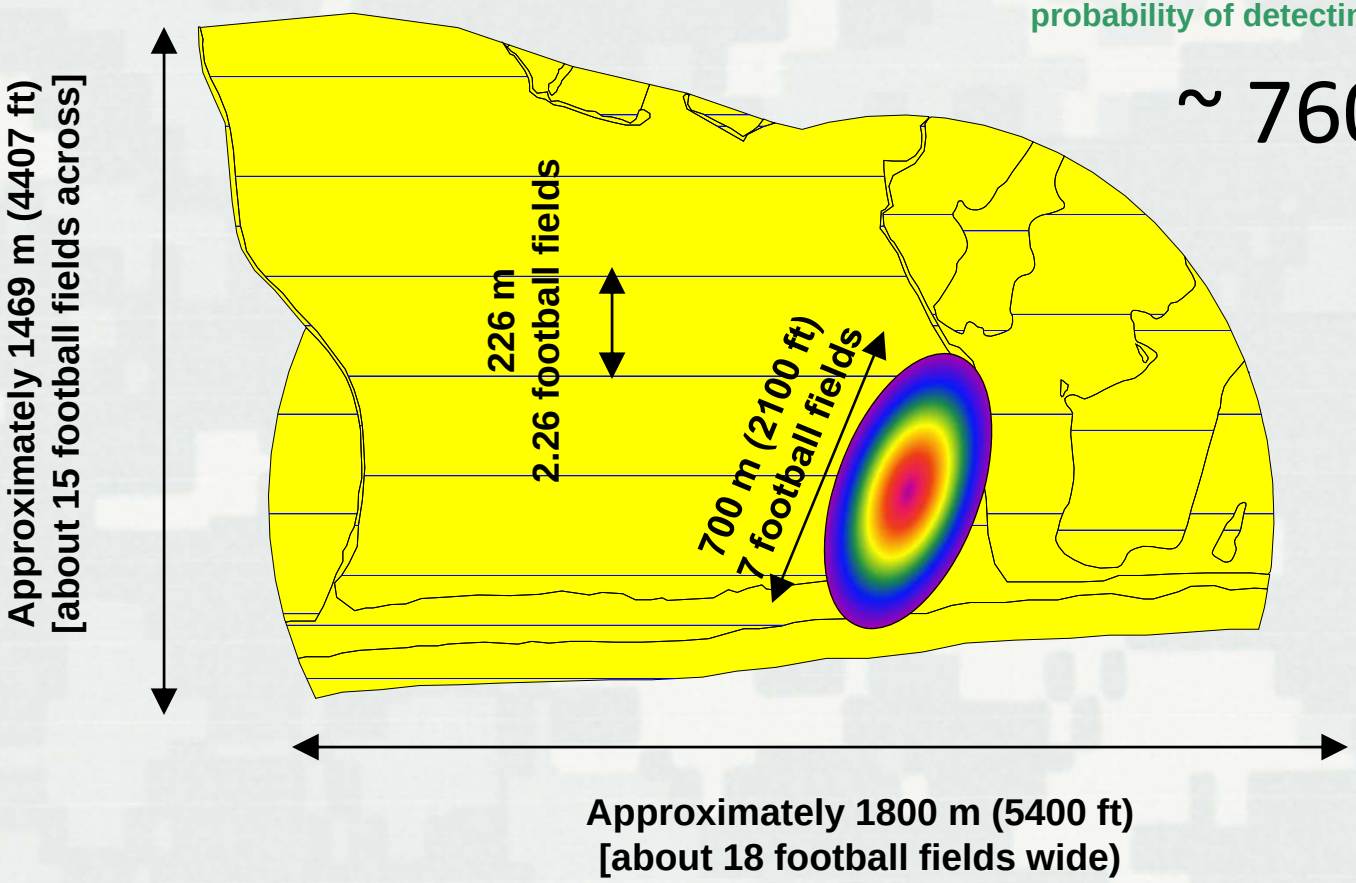
  Developed by Pacific Northwest National Laboratory & DOE

  "Visual Sample Plan" (VSP) provides a statistically defensible method that covers a representative proportion of the total study area (vs 100% coverage)

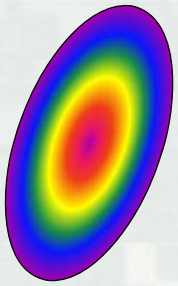
Issues of Scale

Spacing = 226 m, VSP calculates a 95% probability of detecting this target area.

~ 760 Acres



Initial Design Assumptions



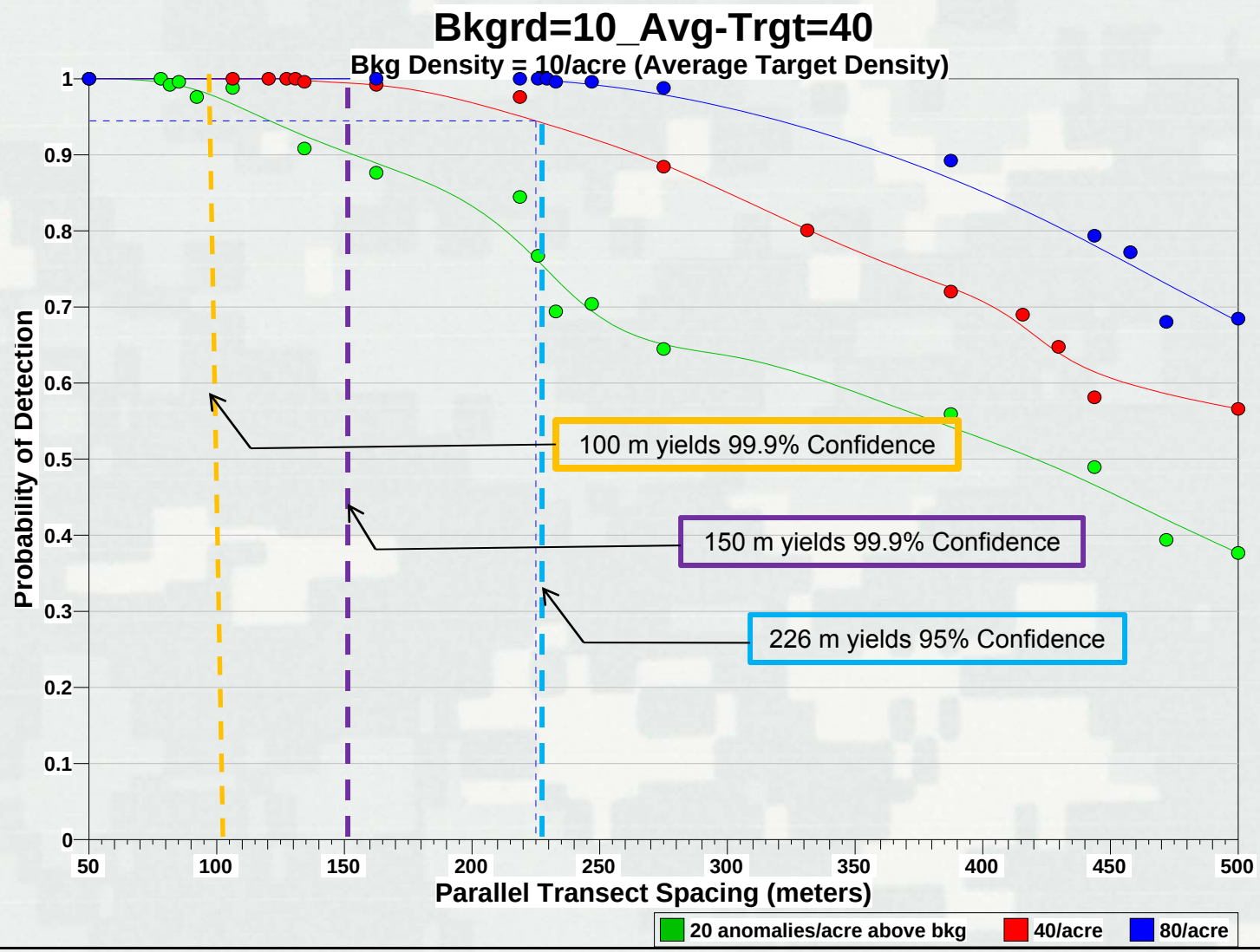
- VSP INITIAL INPUT ASSUMPTIONS:
  - Background Density:10 Anomalies Per Acre (default start)
  - Average Target Density: 40 Anomalies Per Acre (default start) (Above Background)

    Target modeled as a bivariate-normal ellipse (700-m major axis)

- VSP RESULTS: PROBABLILITIES OF DETECTION
  - Spacing= 226 m, VSP calculates a 95% Probability of detecting the target area.
  - Spacing= 150 m, VSP calculates a 99.9% Probability of detecting the target area.

- Proposed Transect Spacing = 100 m yields a 99.9% Probability of detection.

Transect Spacing Analysis



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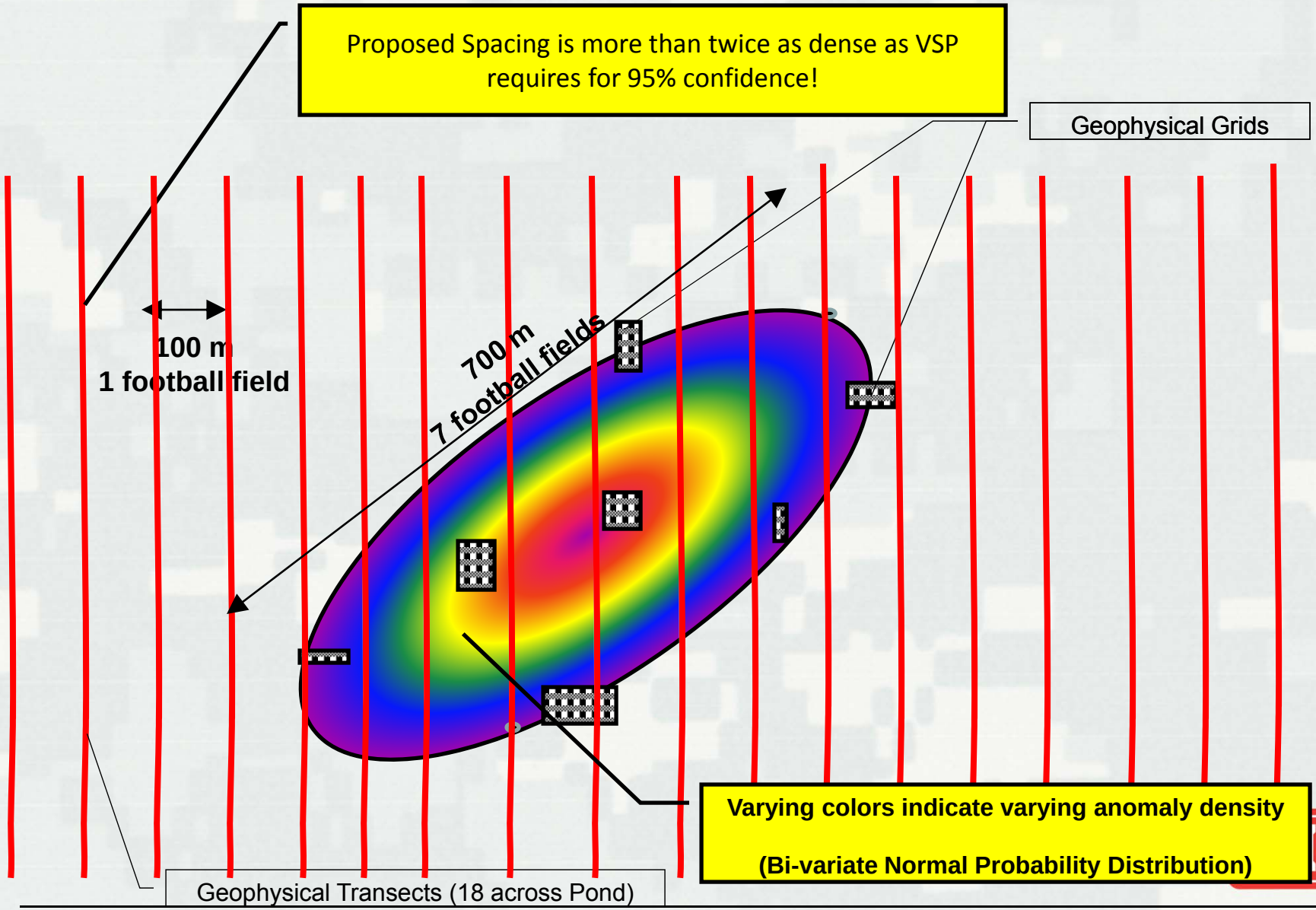
99.9 % Confidence of Detection



Part 2:

What If…? Exercises

Defining the Extent of Anomalies

How Transects Work

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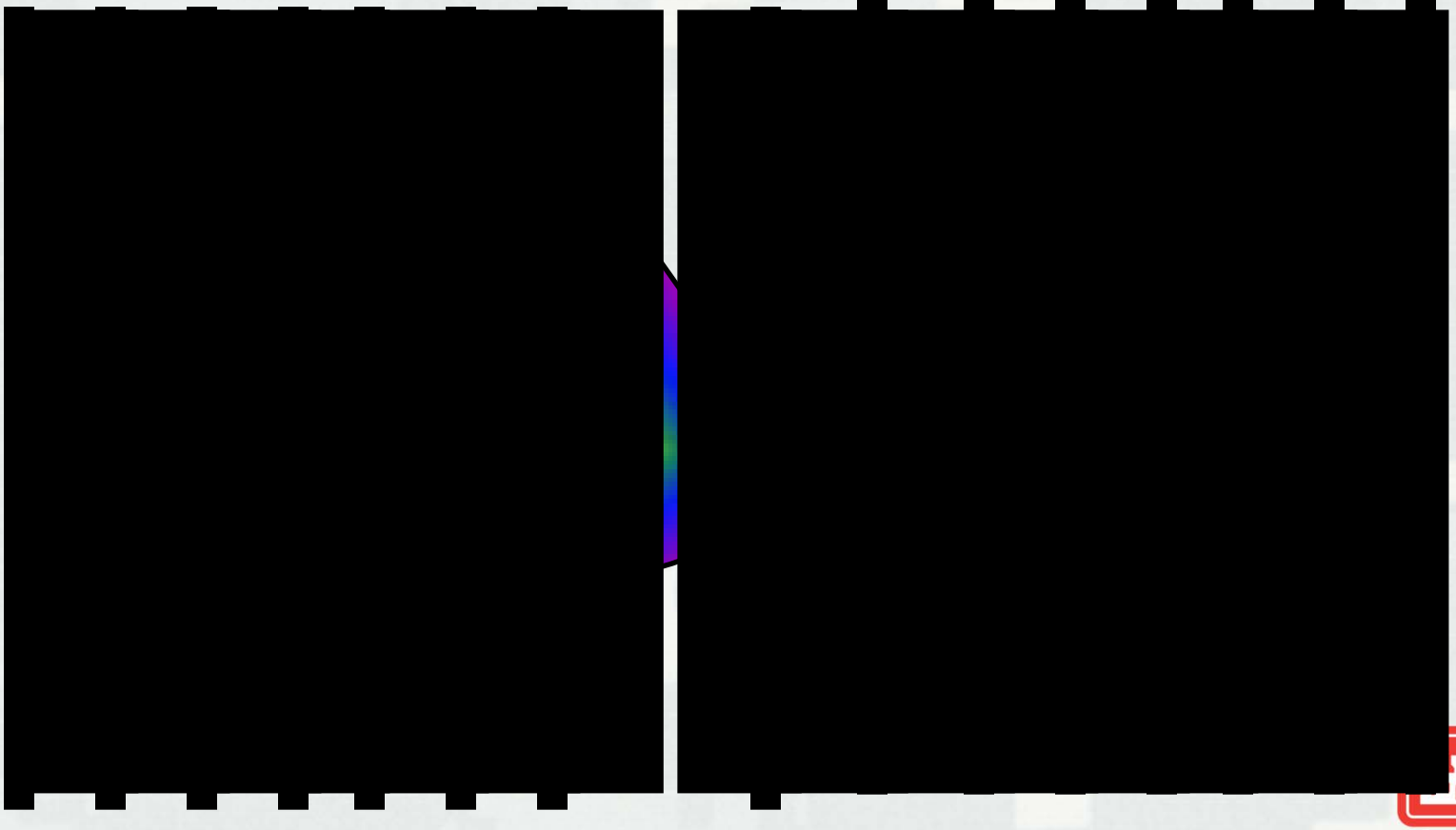
Defining the Extent of Anomalies

How Transects Work

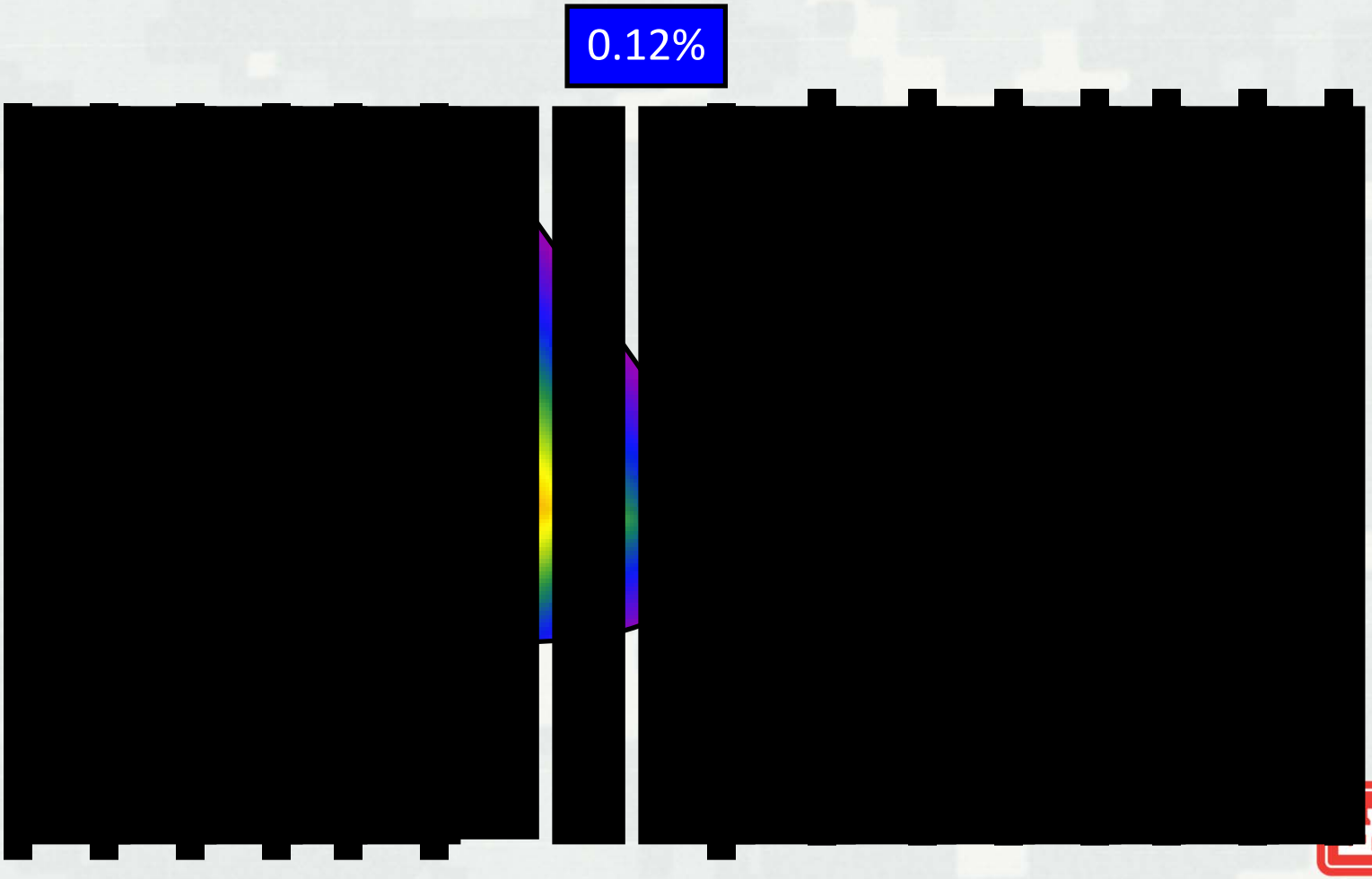
For each Transect Investigated we get 0.3 acres revealed (0.06% of total MRS)*



*** Percentages based on Tisbury Great Pond Area**

Defining the Extent of Anomalies

How Transects Work



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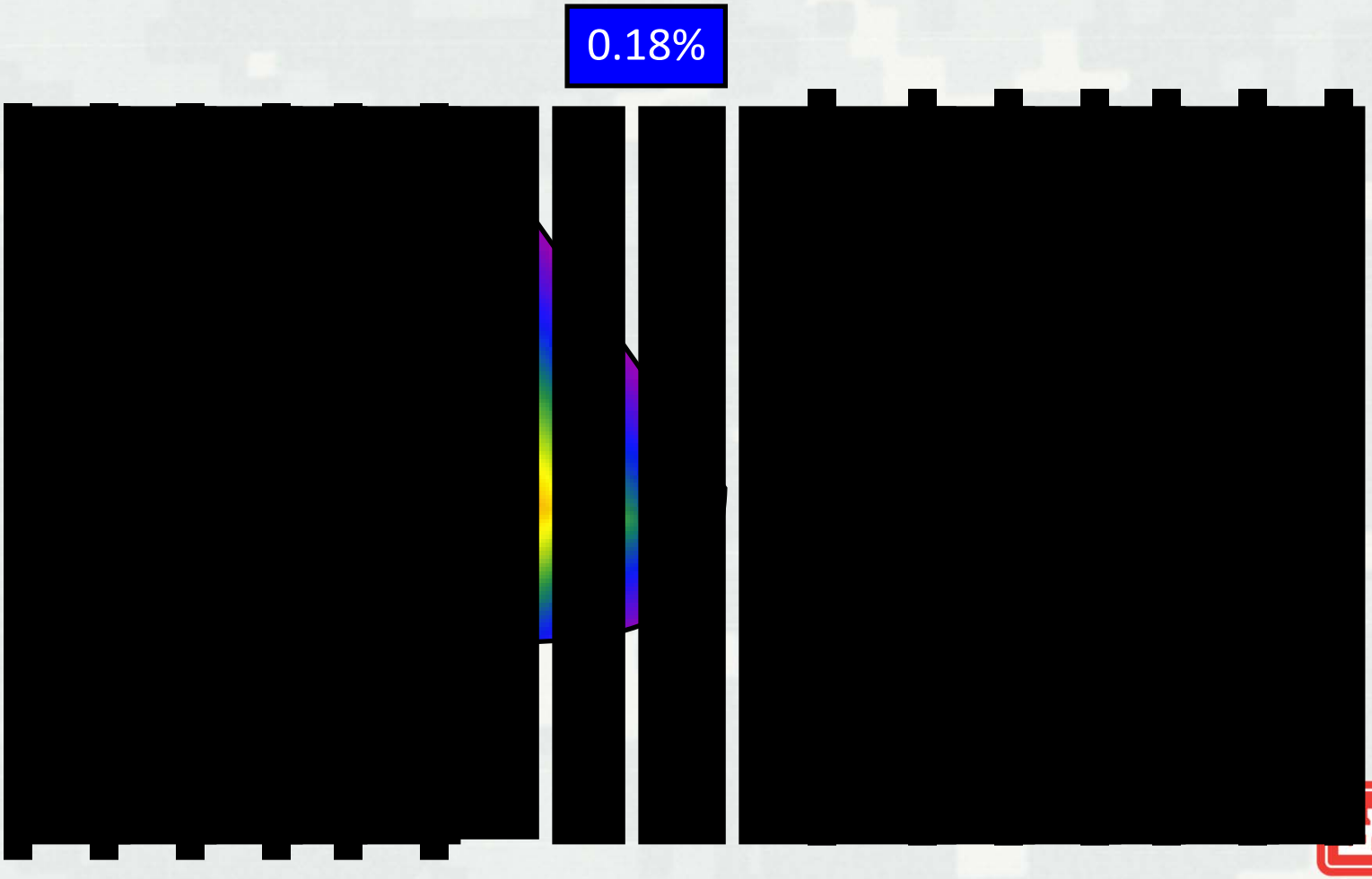

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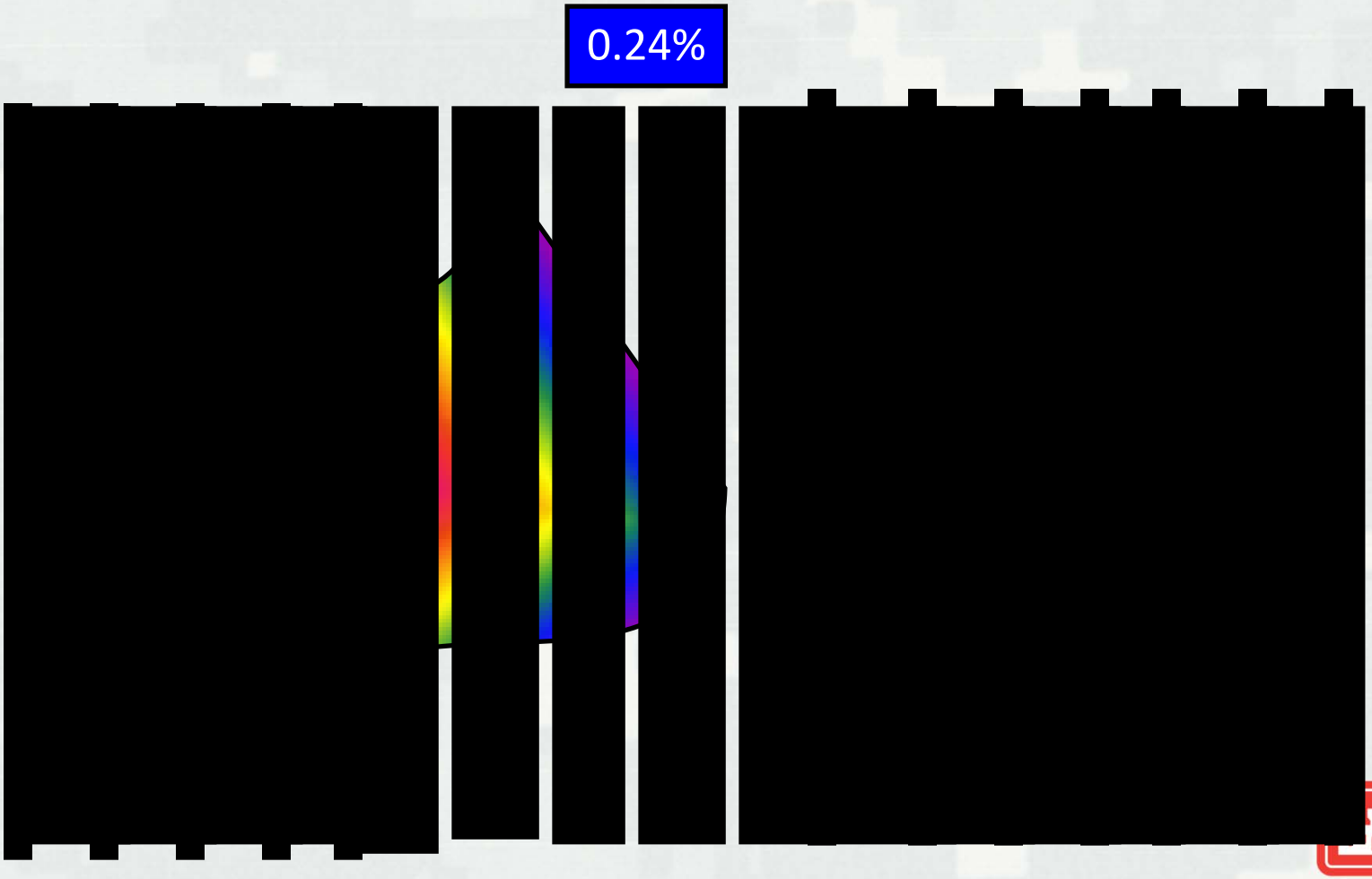

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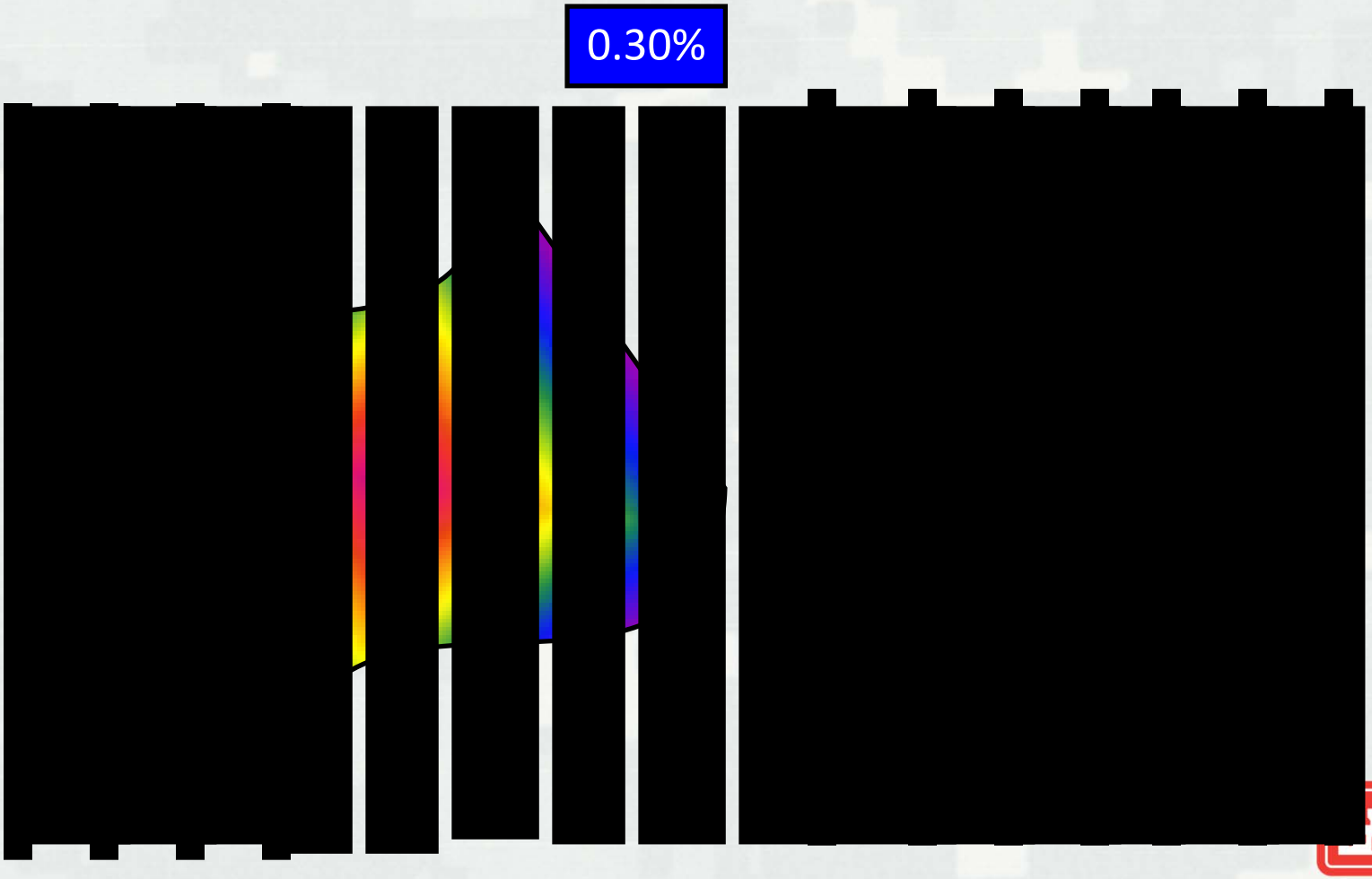

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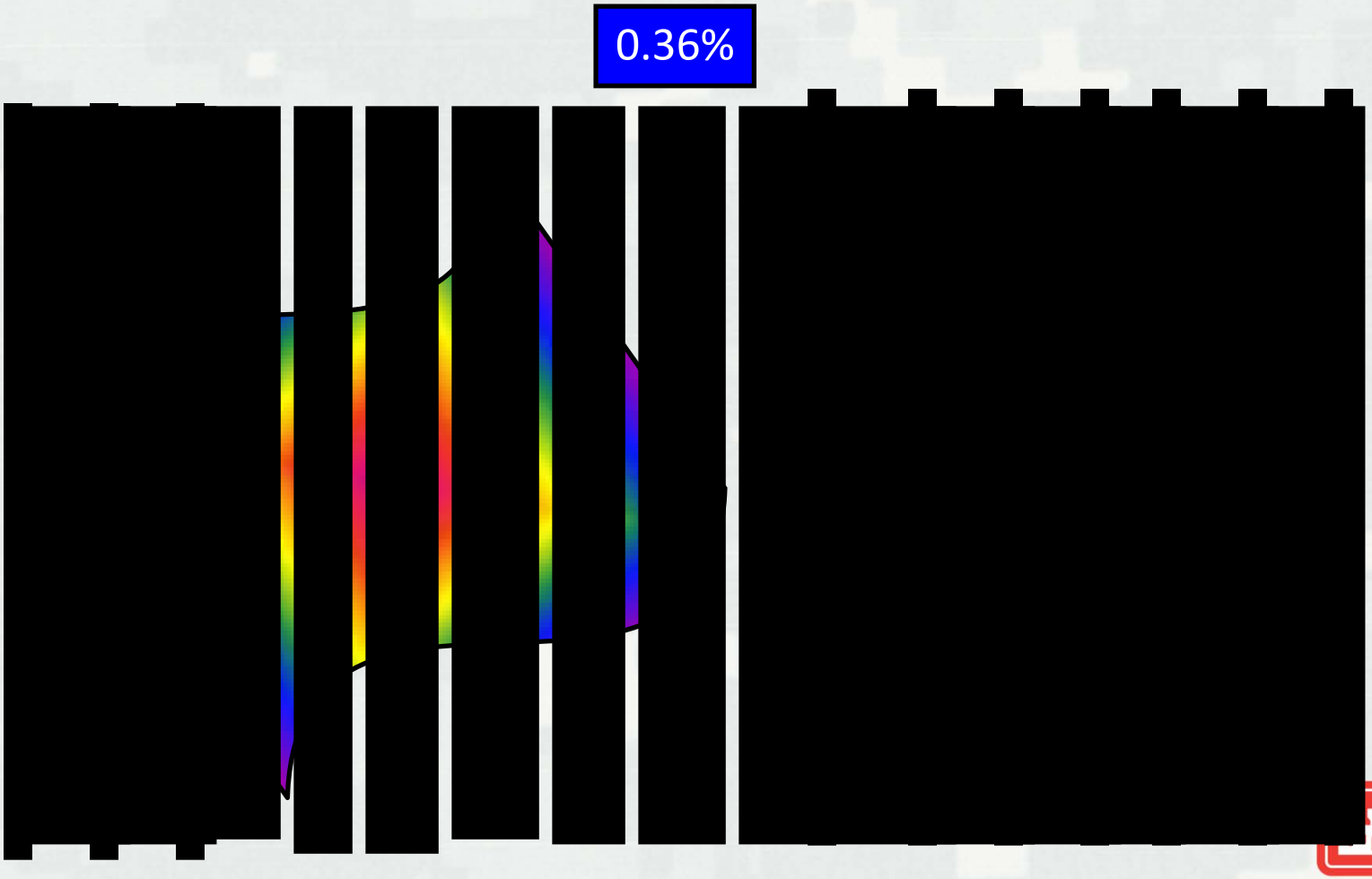

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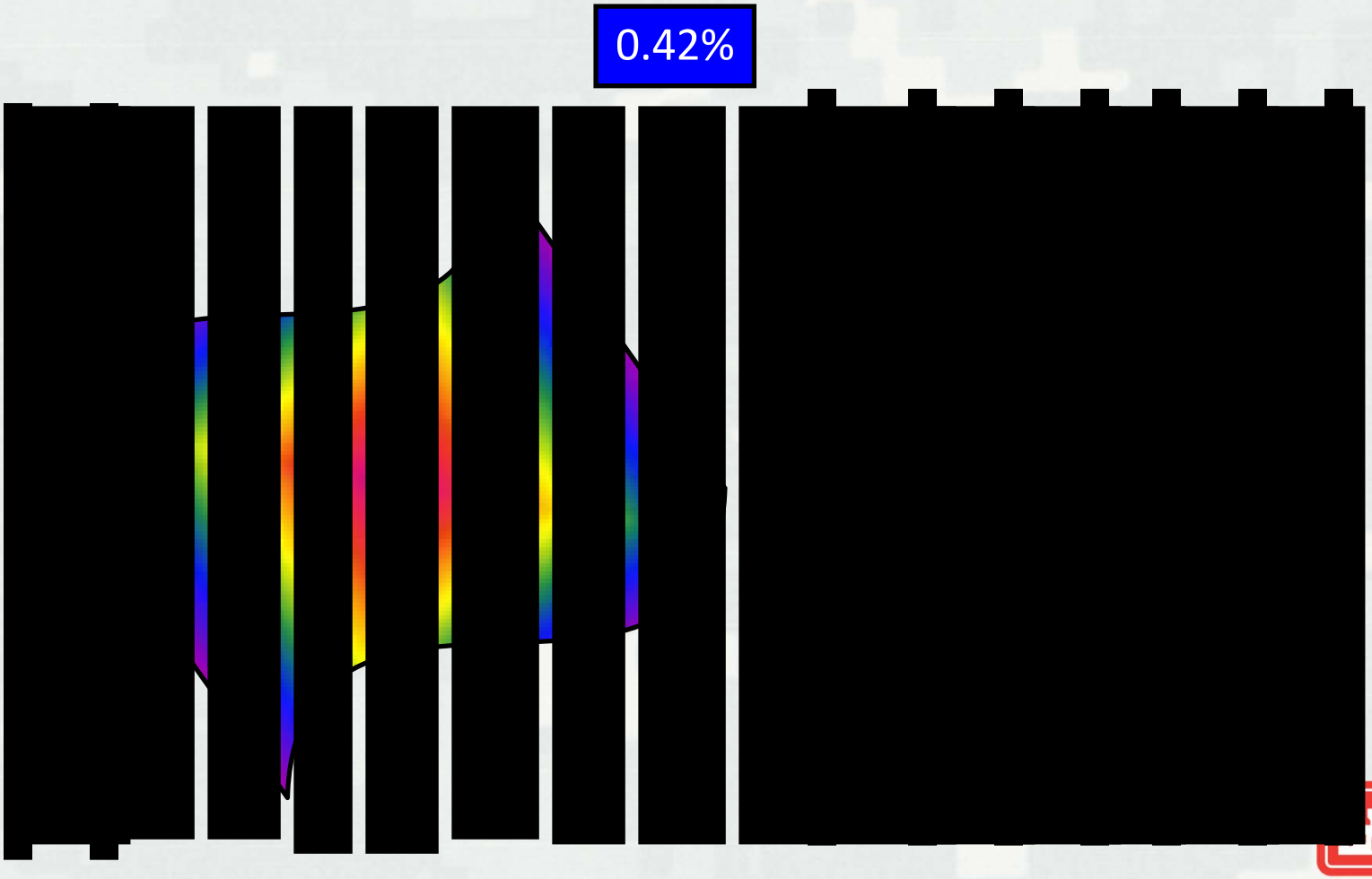

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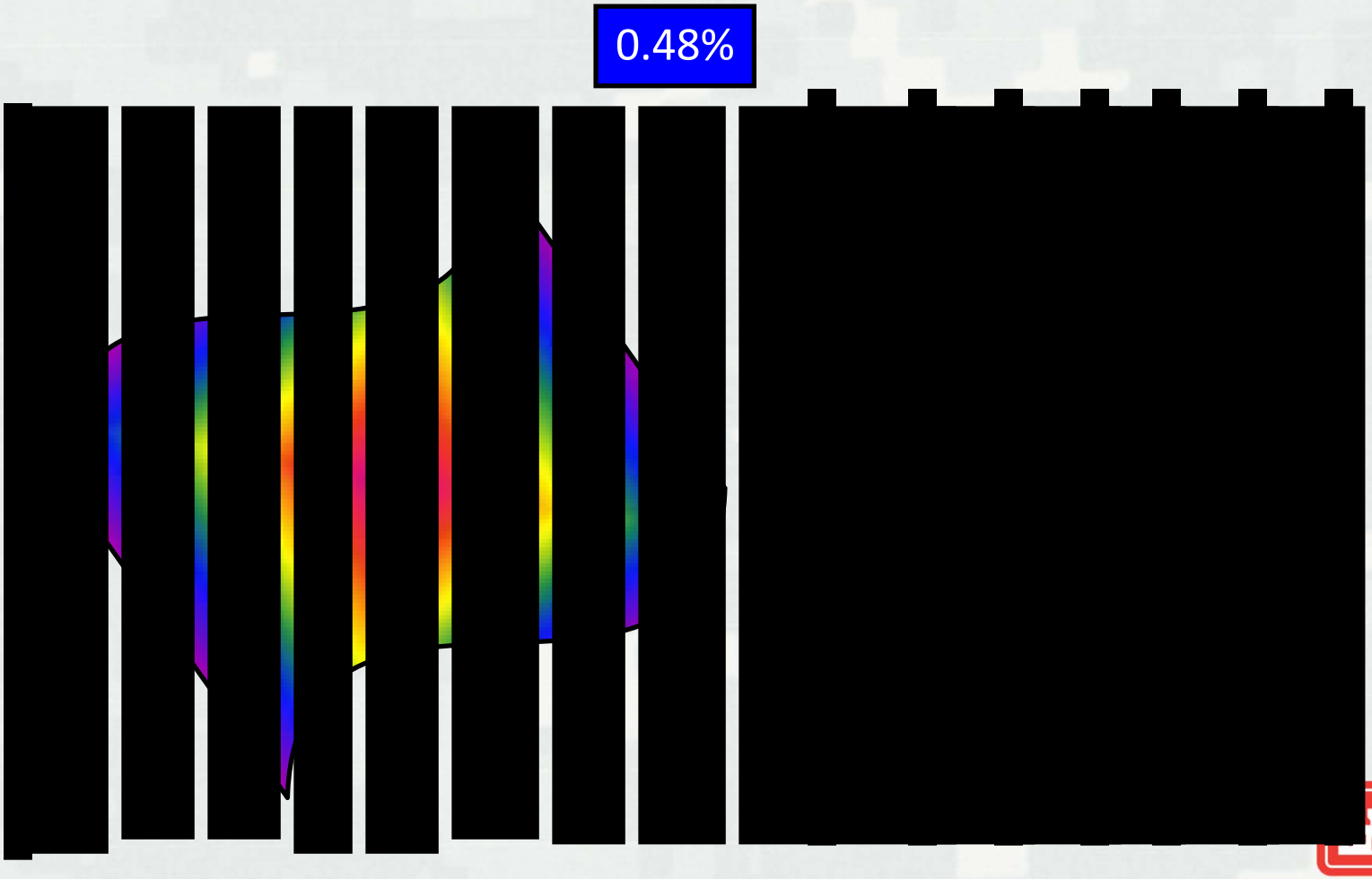

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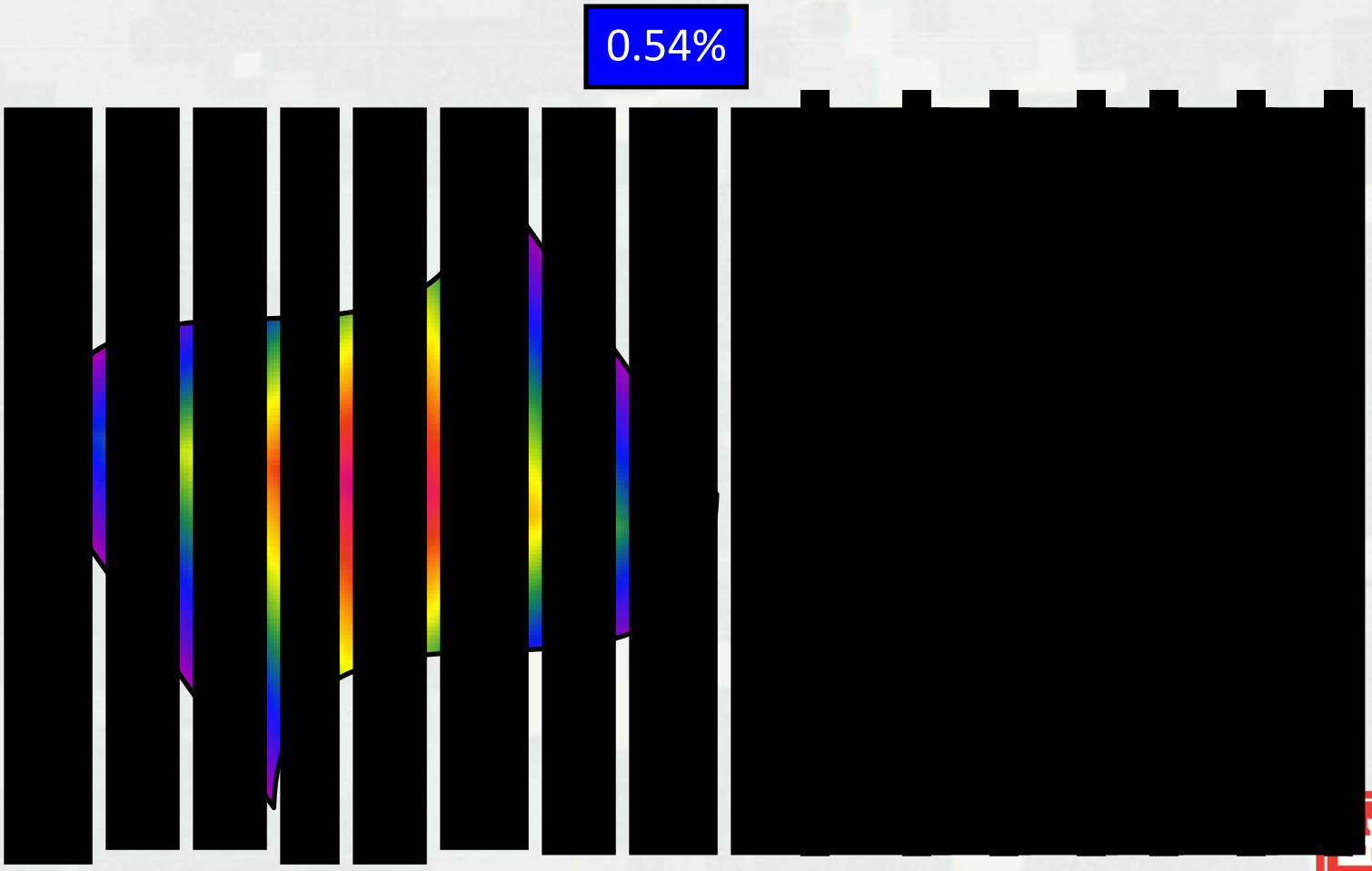

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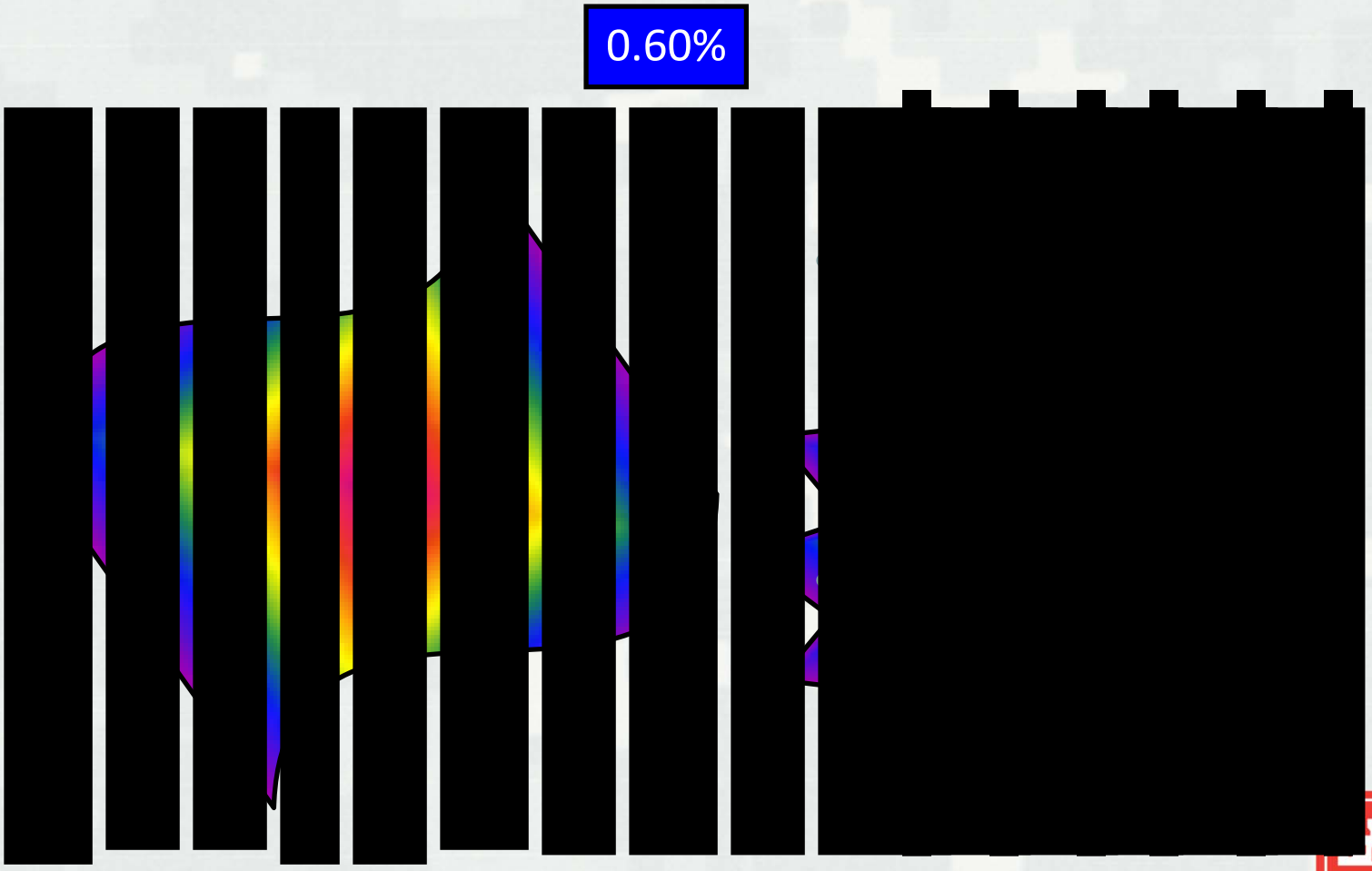

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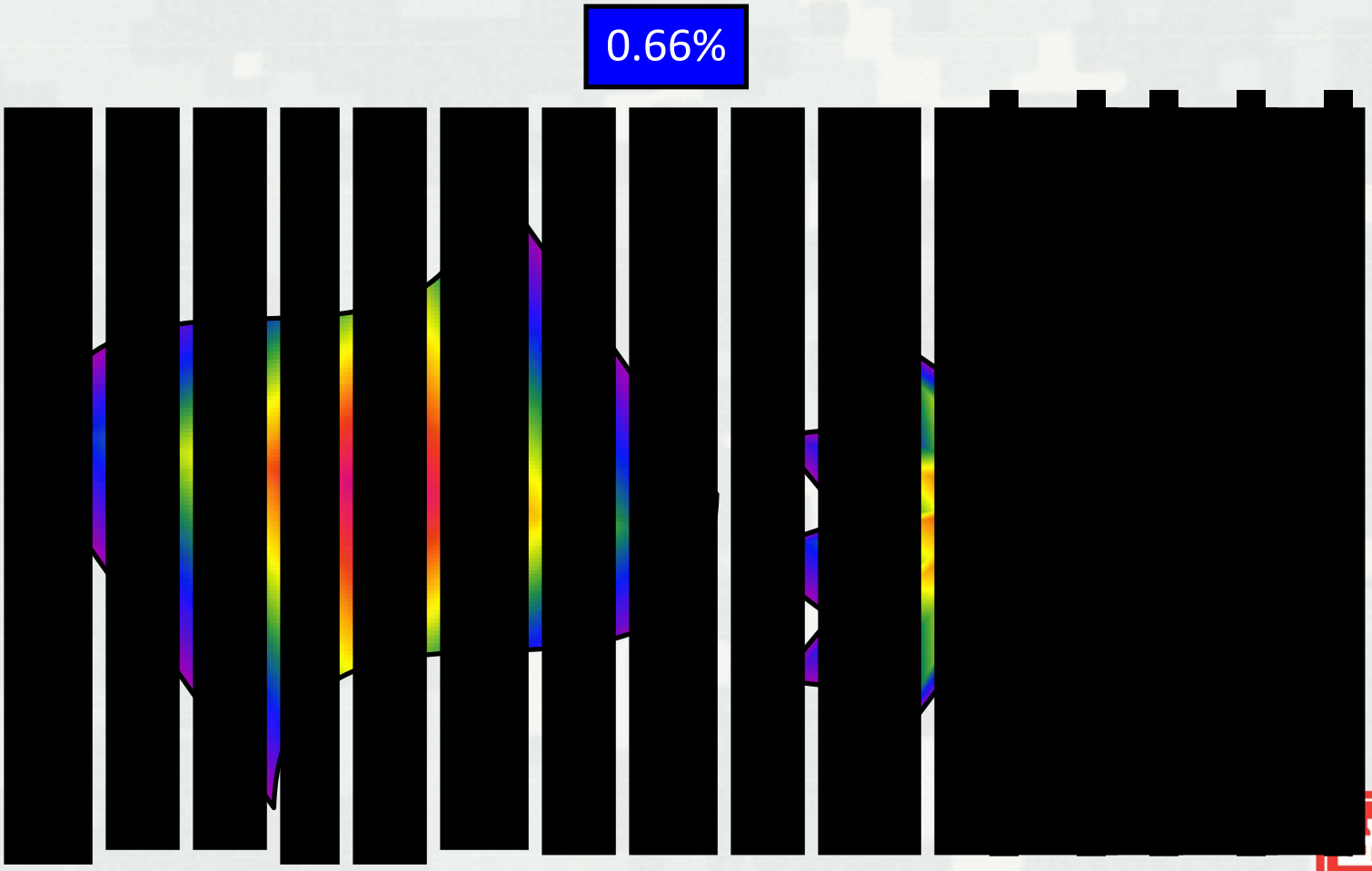

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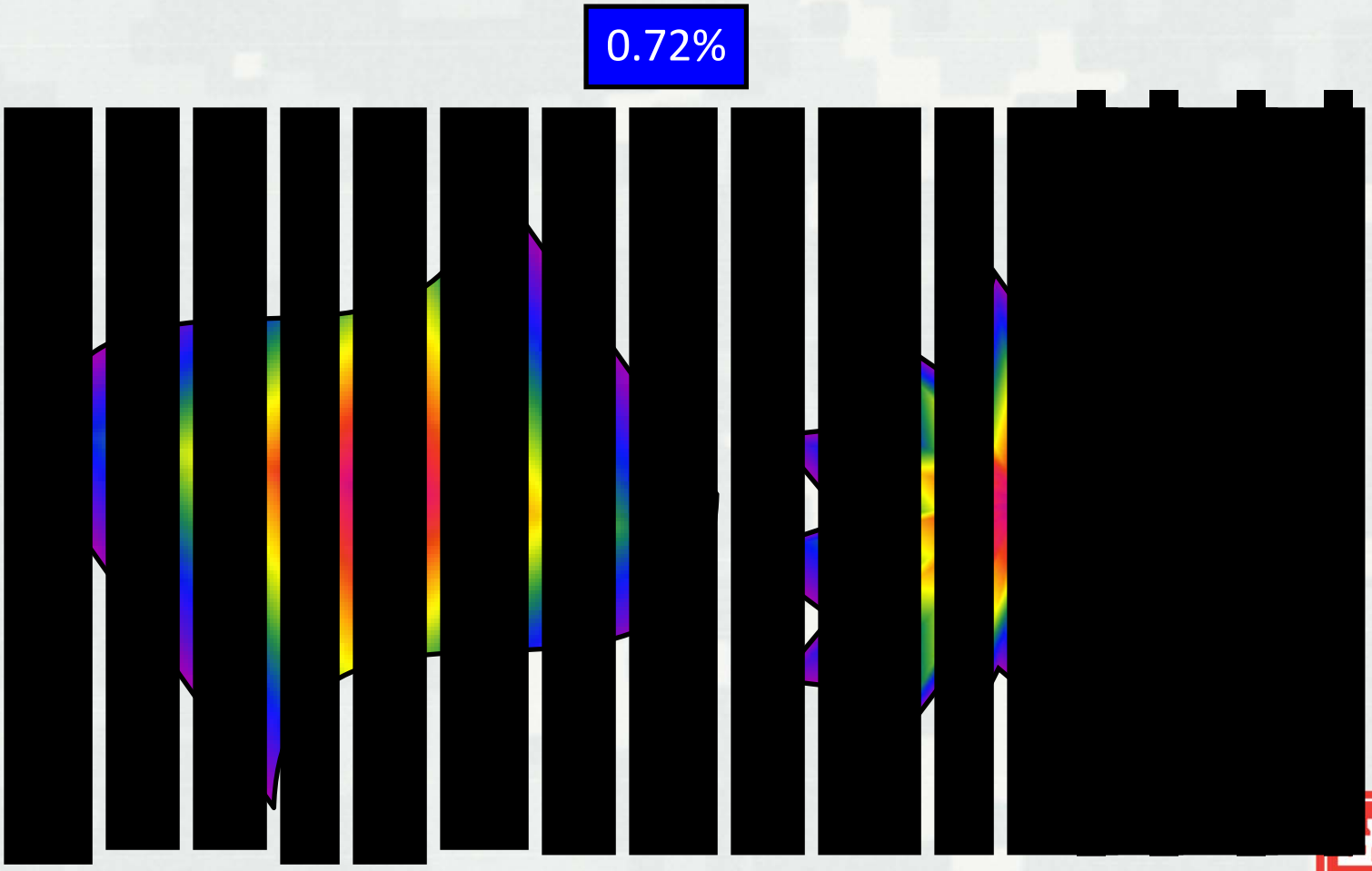

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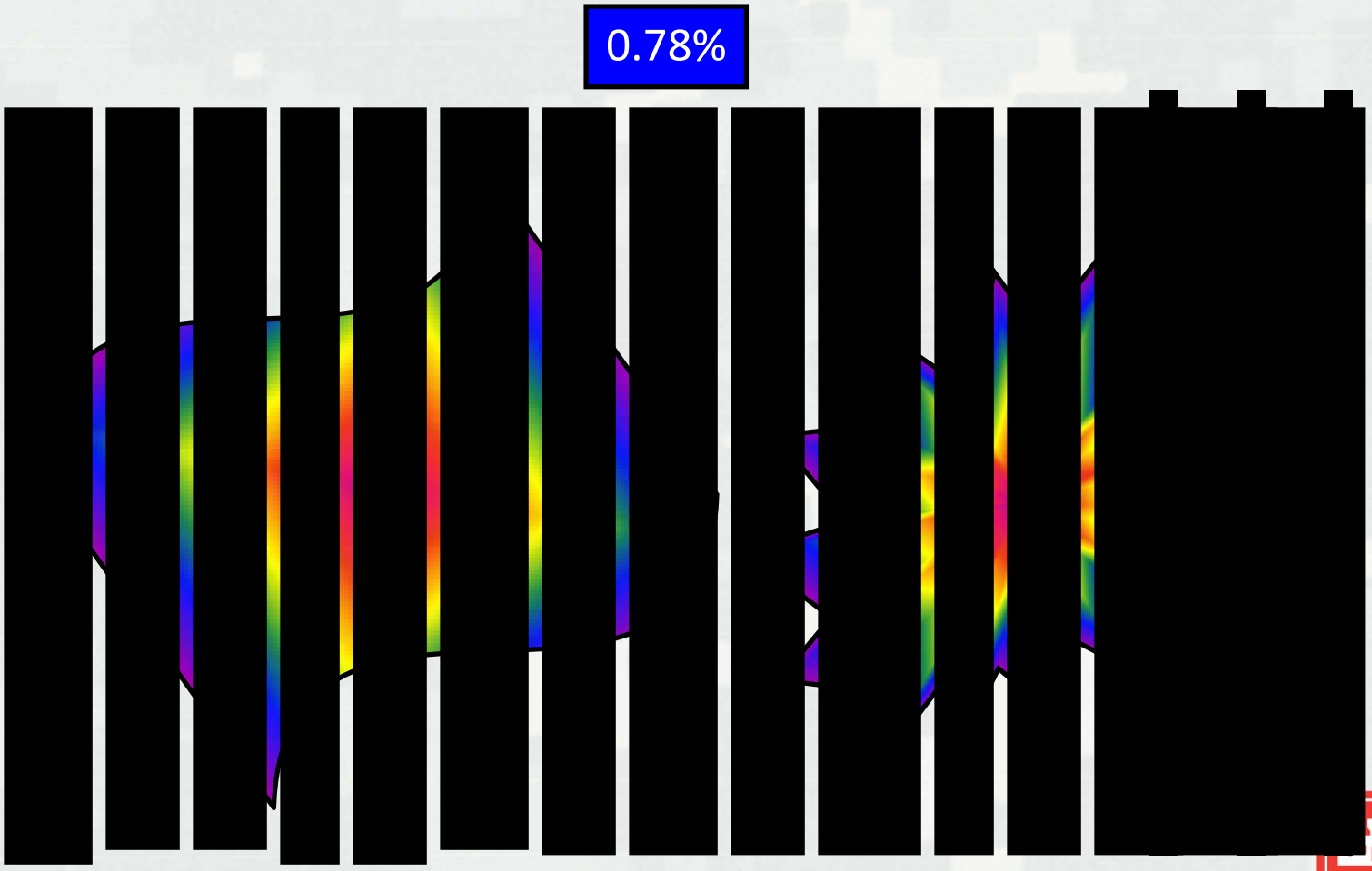

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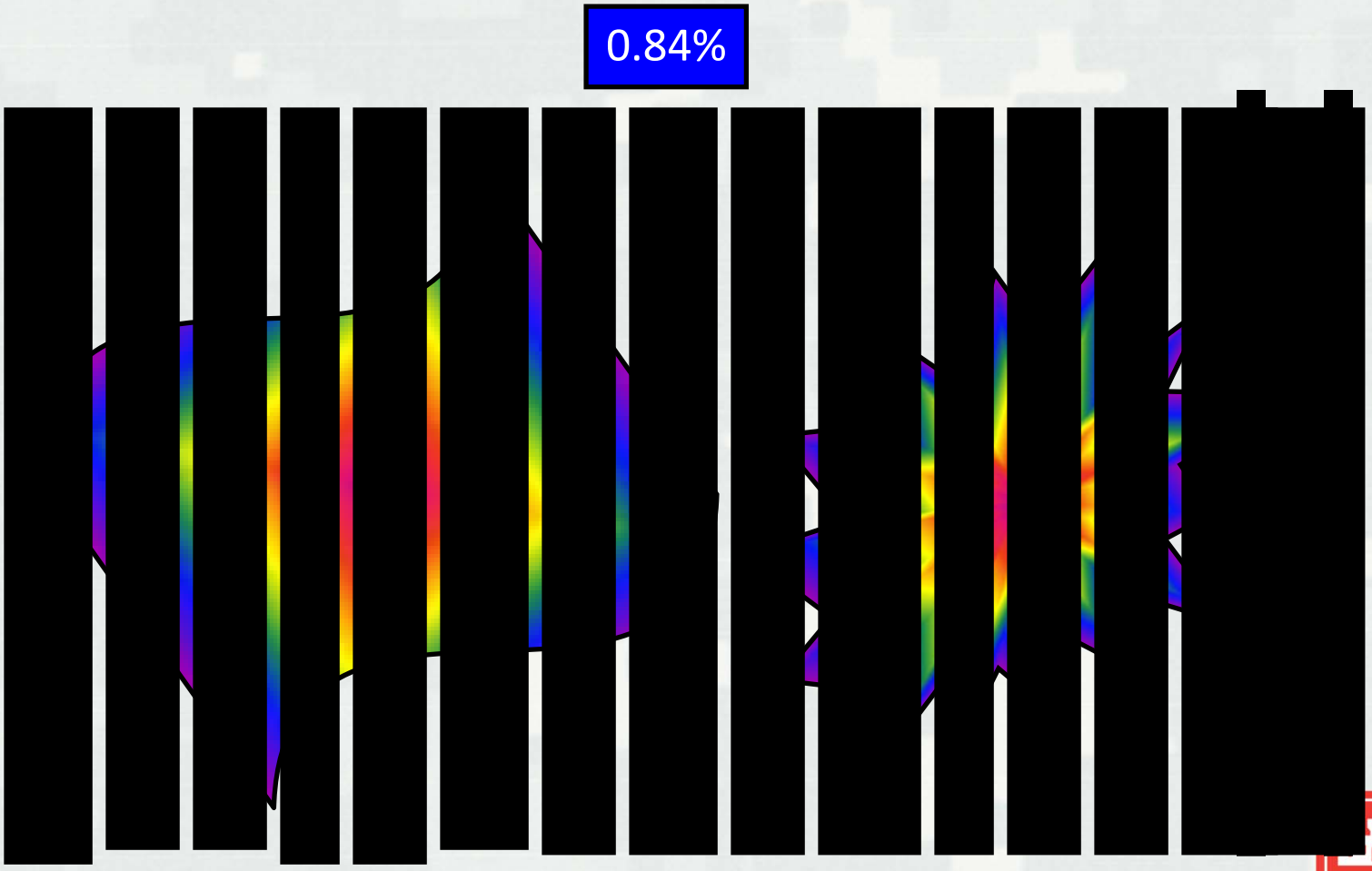

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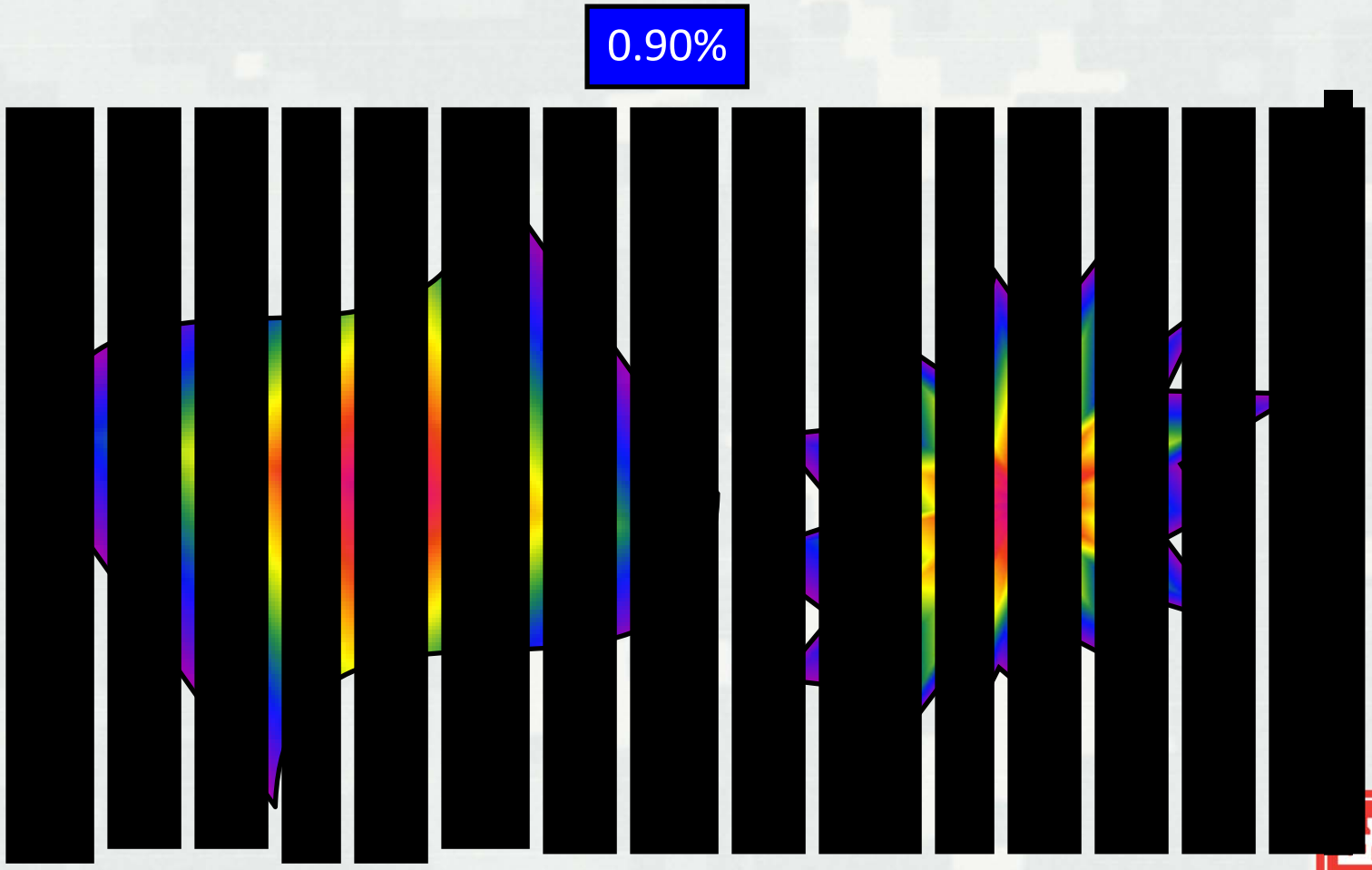

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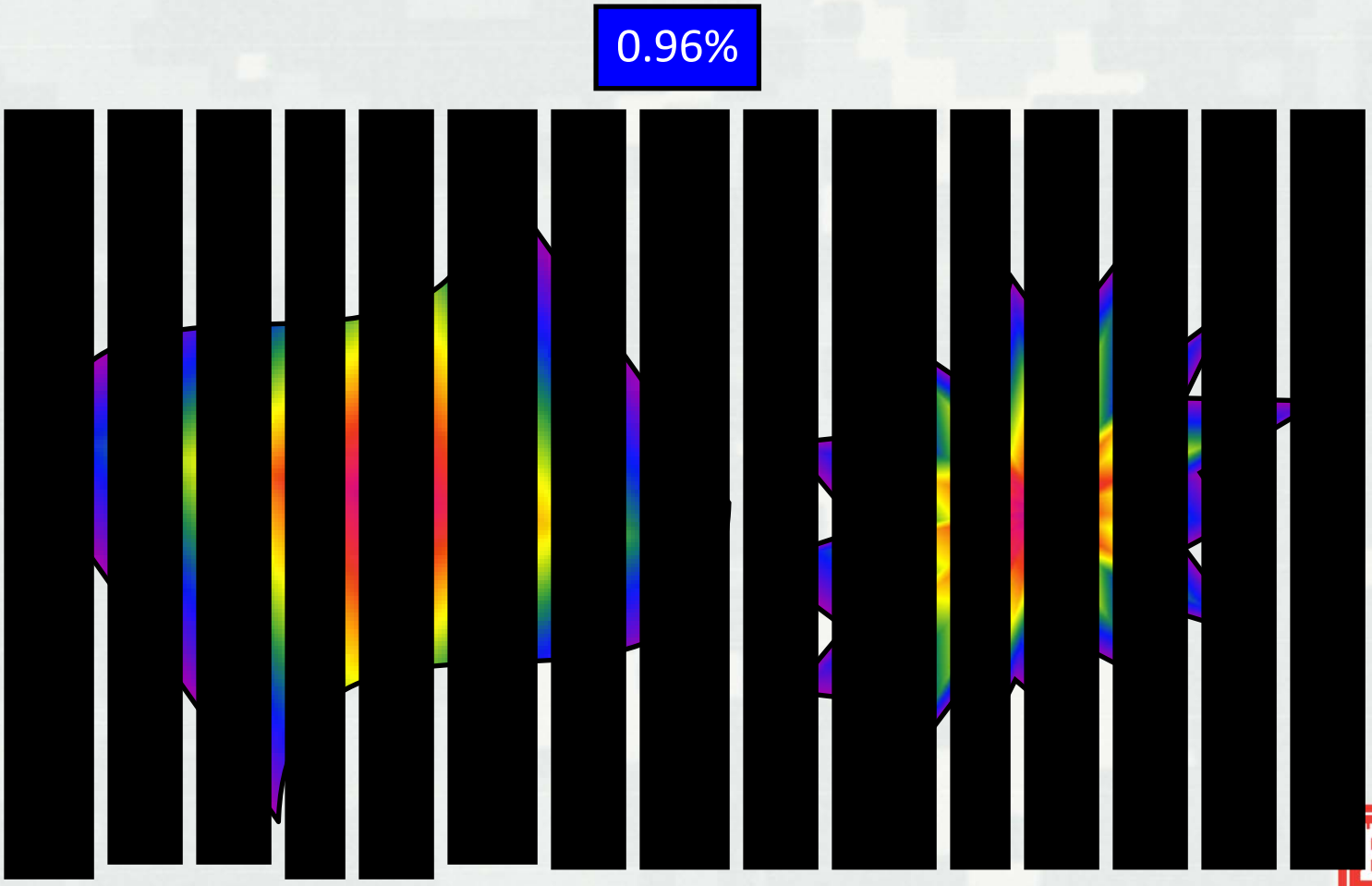

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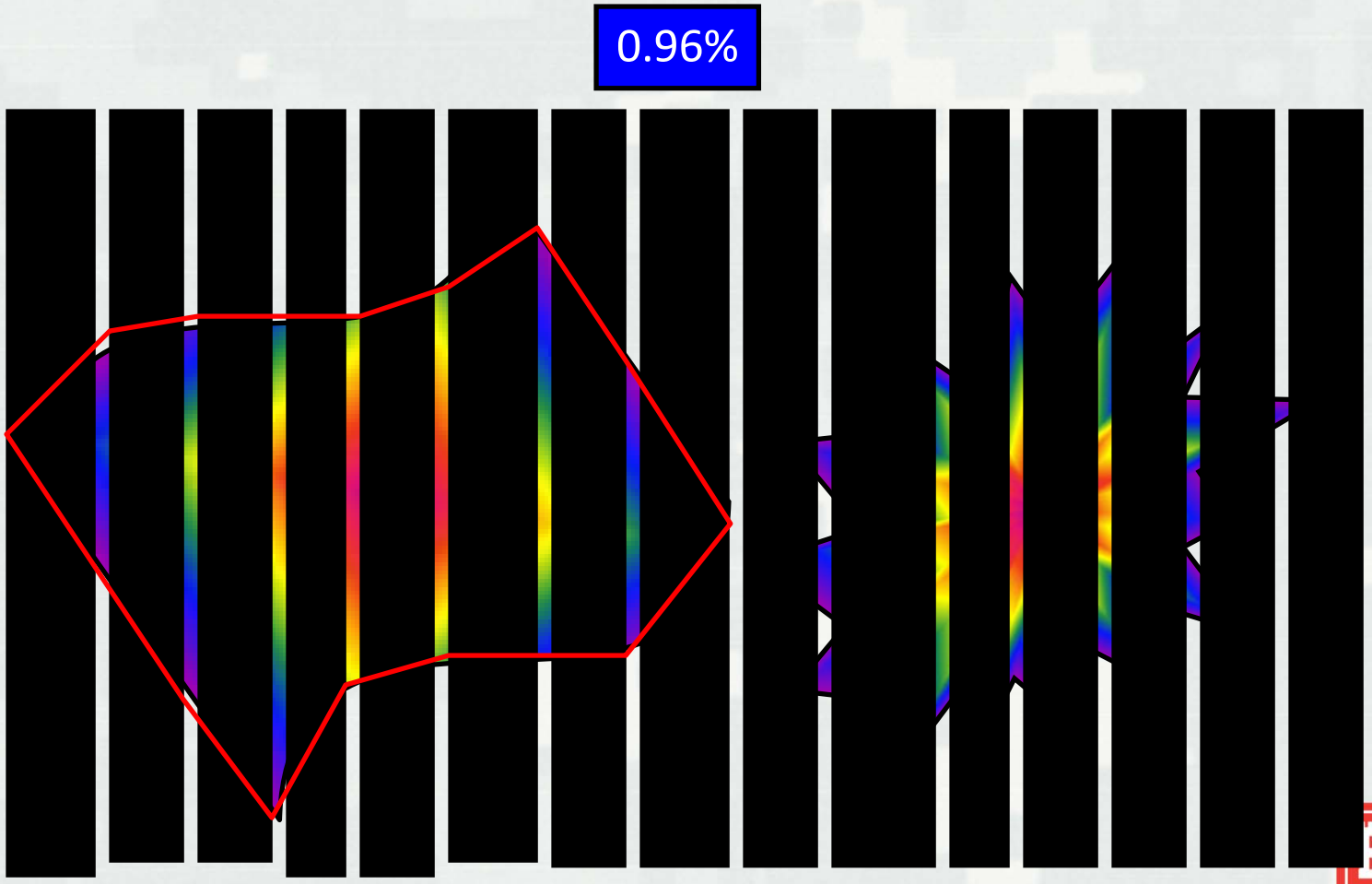

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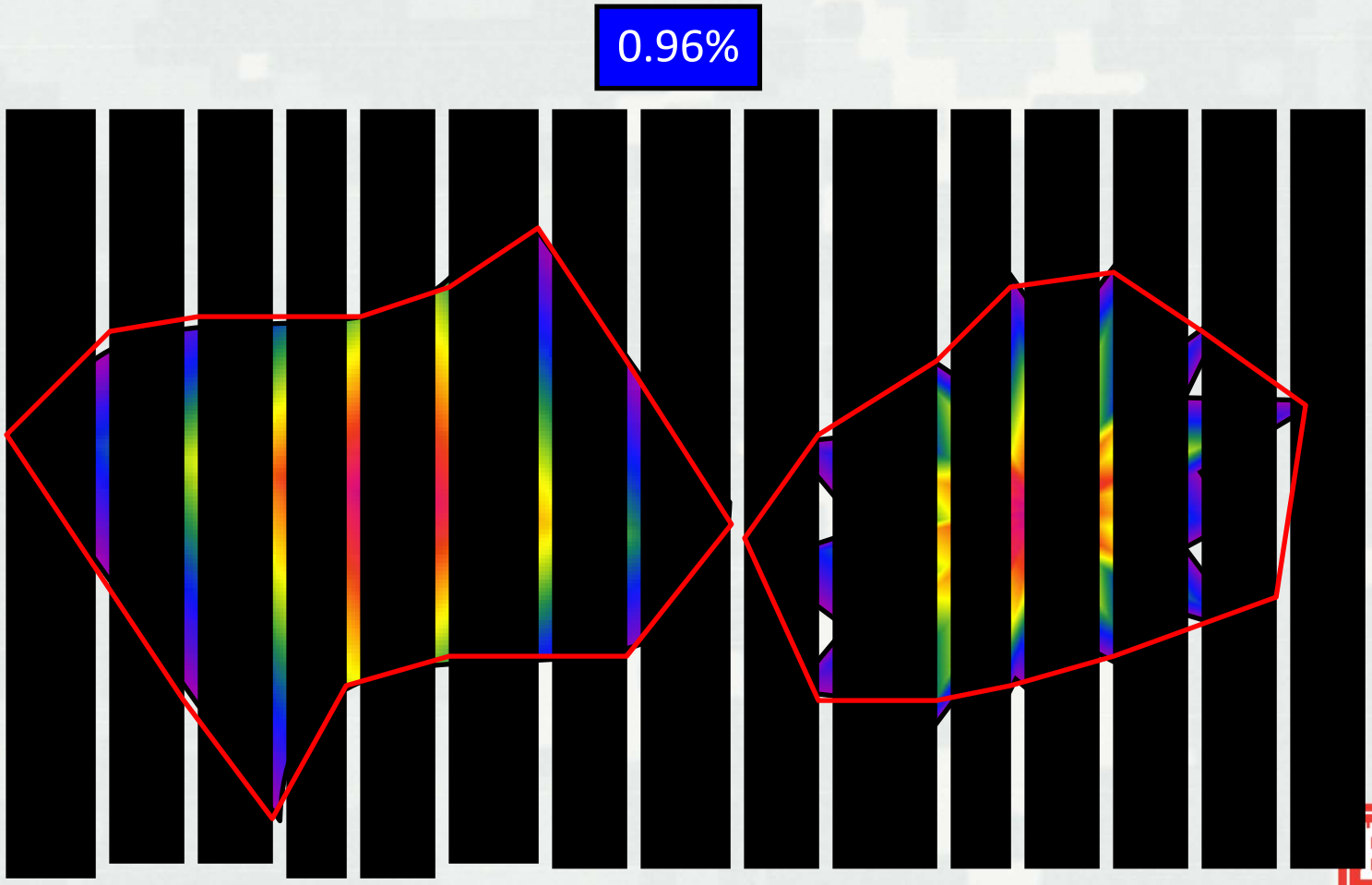
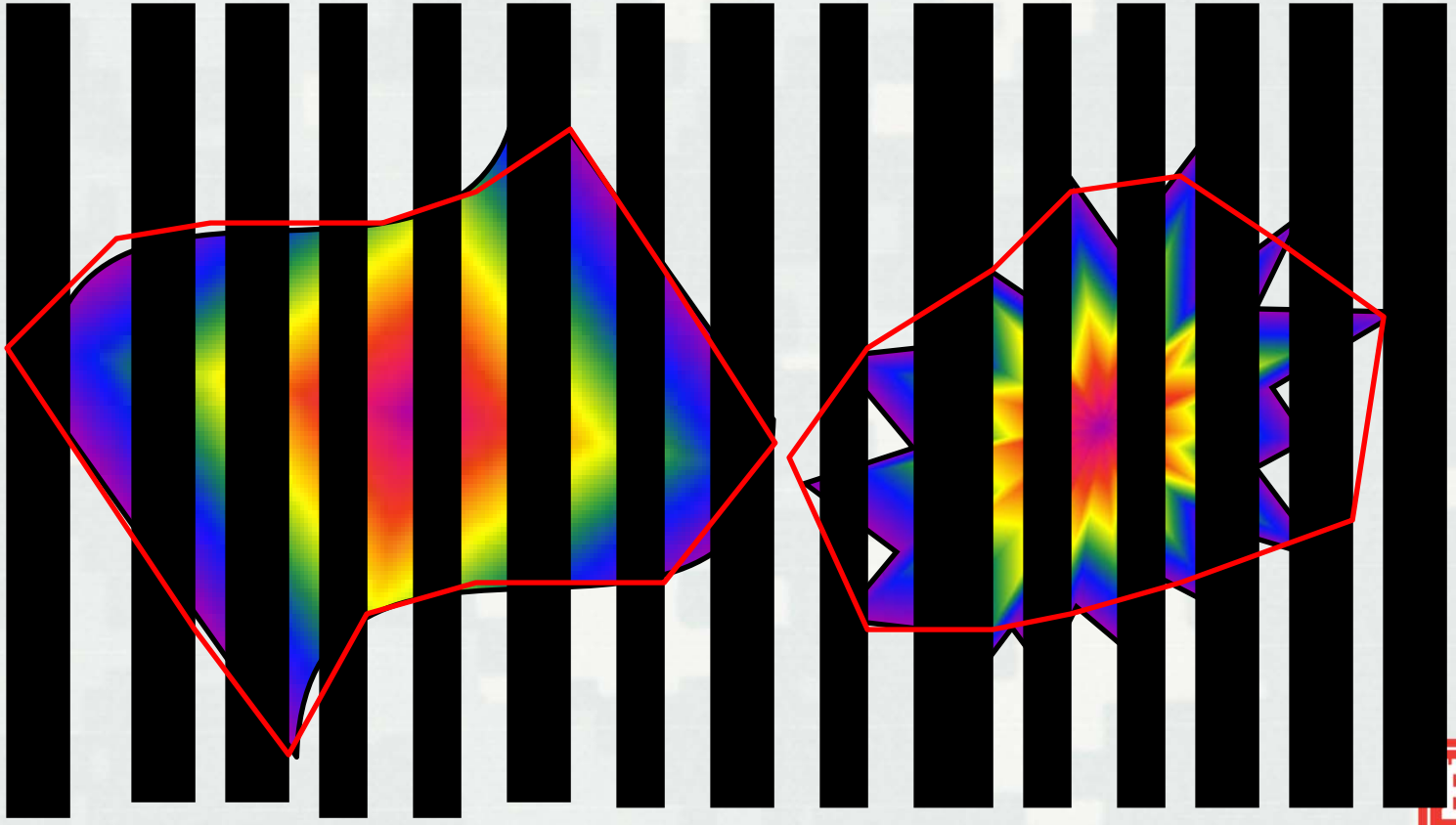


Defining the Extent of Anomalies

How Transects Work

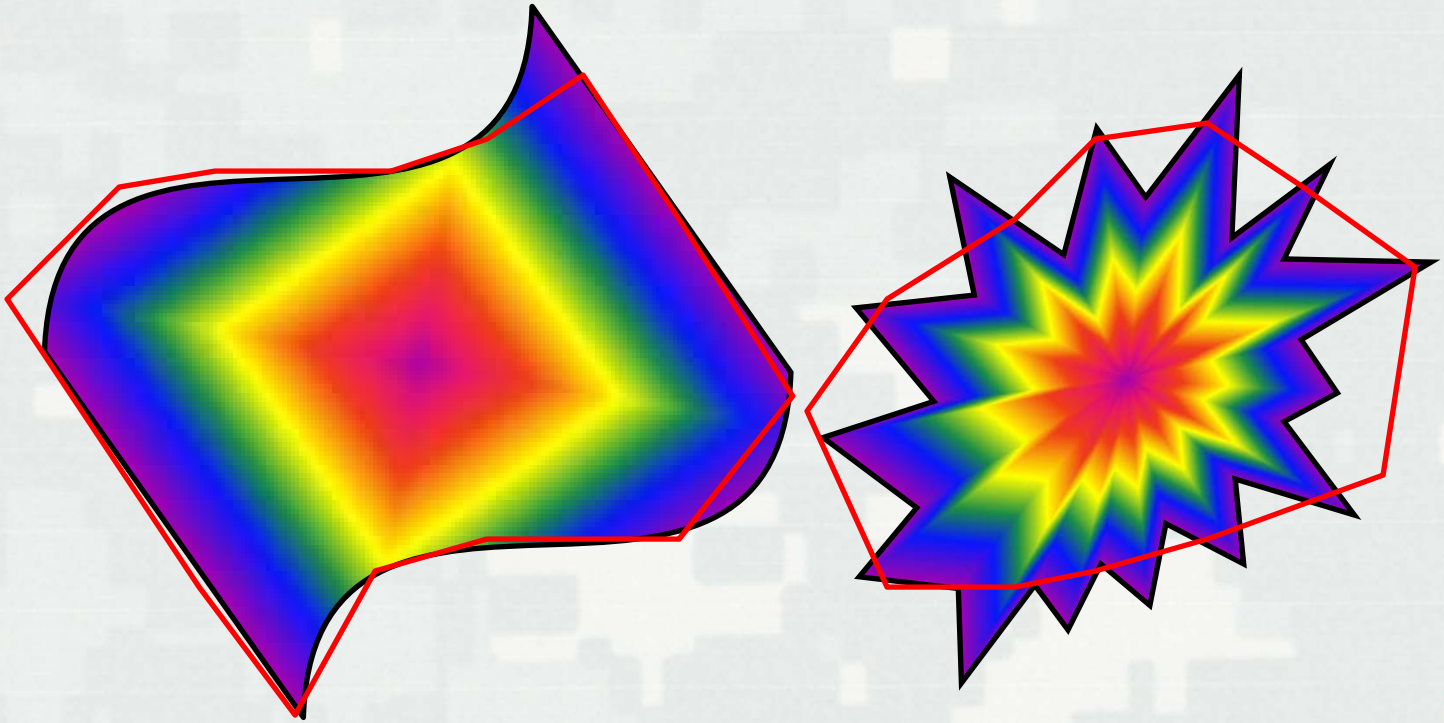
Increasing transects does not change “footprint” significantly



Defining the Extent of Anomalies

How Geophysical Transects Work

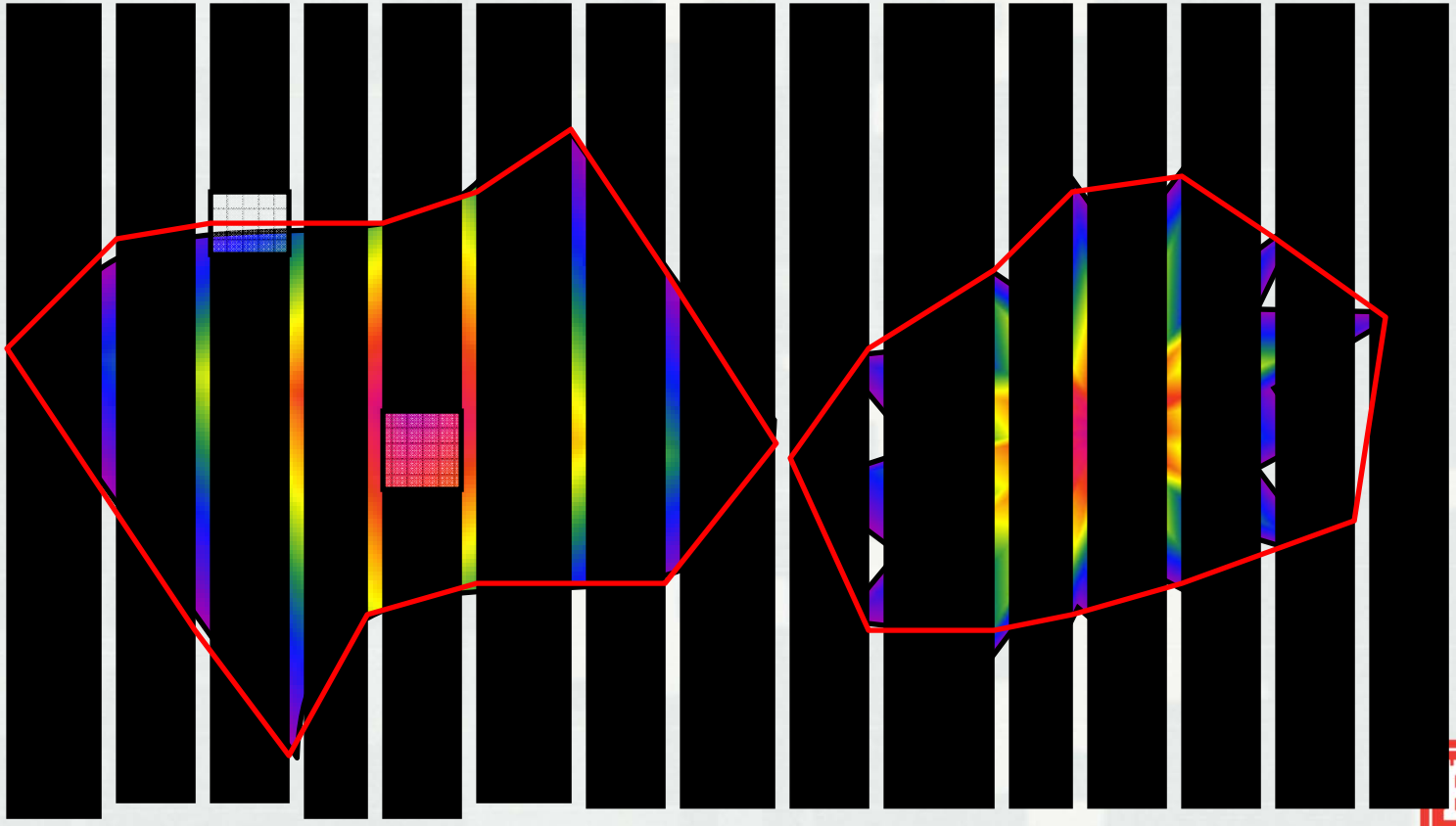
Increasing Transects to 100% coverage does not yield a significantly different result



Defining the Nature of Anomalies

How Geophysical Grids Work

0.96% (by transect) + Additional Acreage (by grids)



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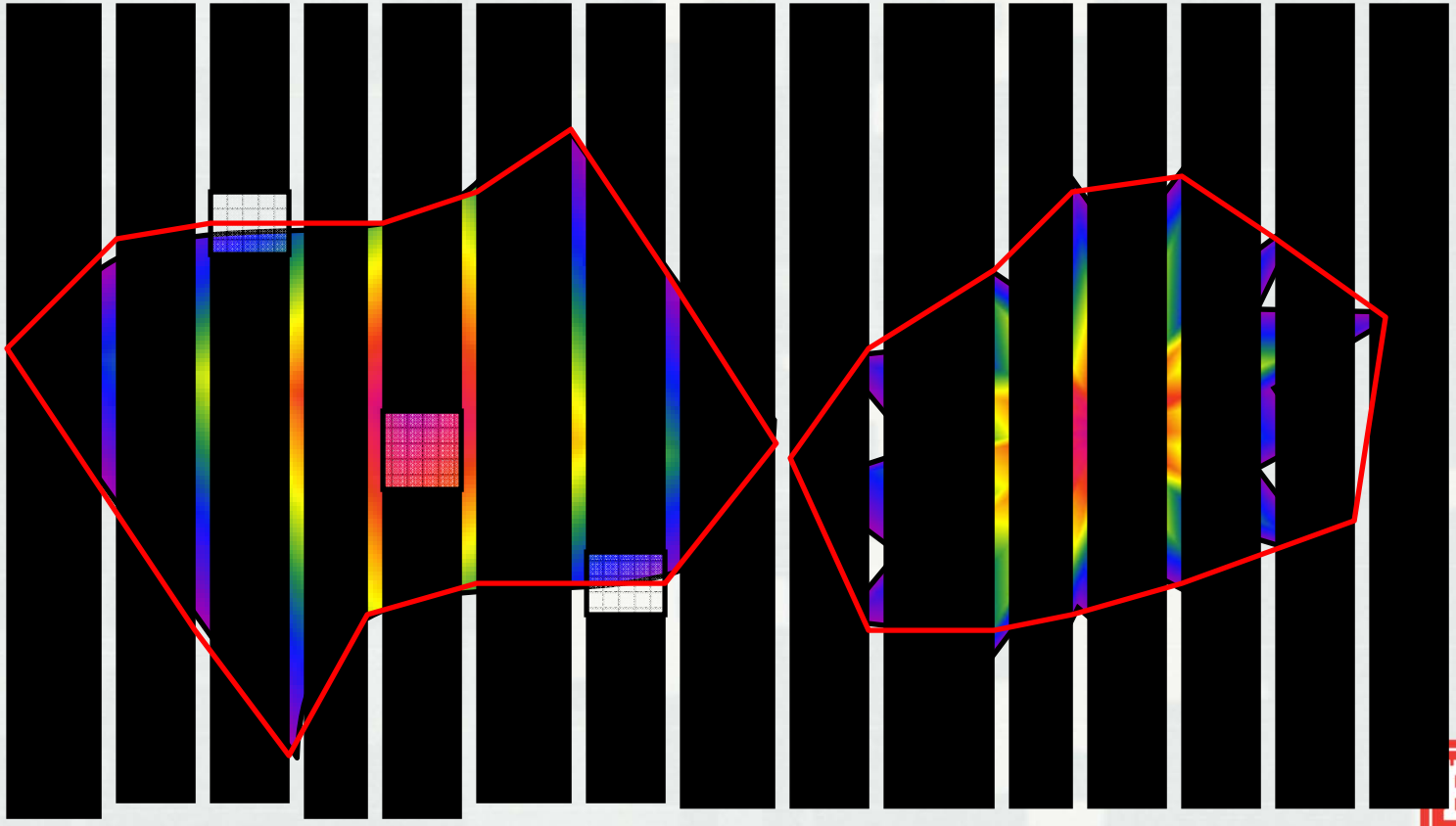

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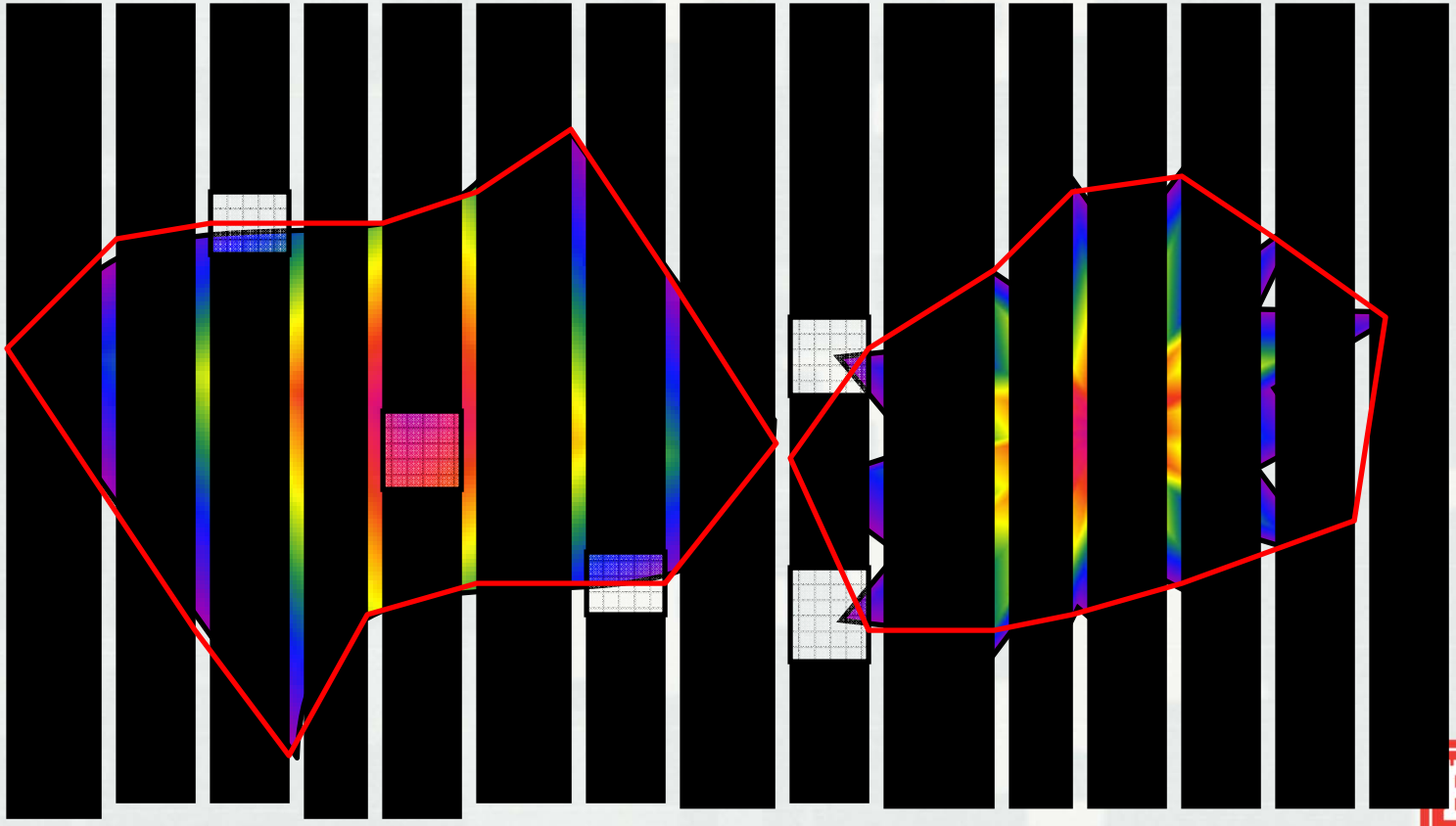

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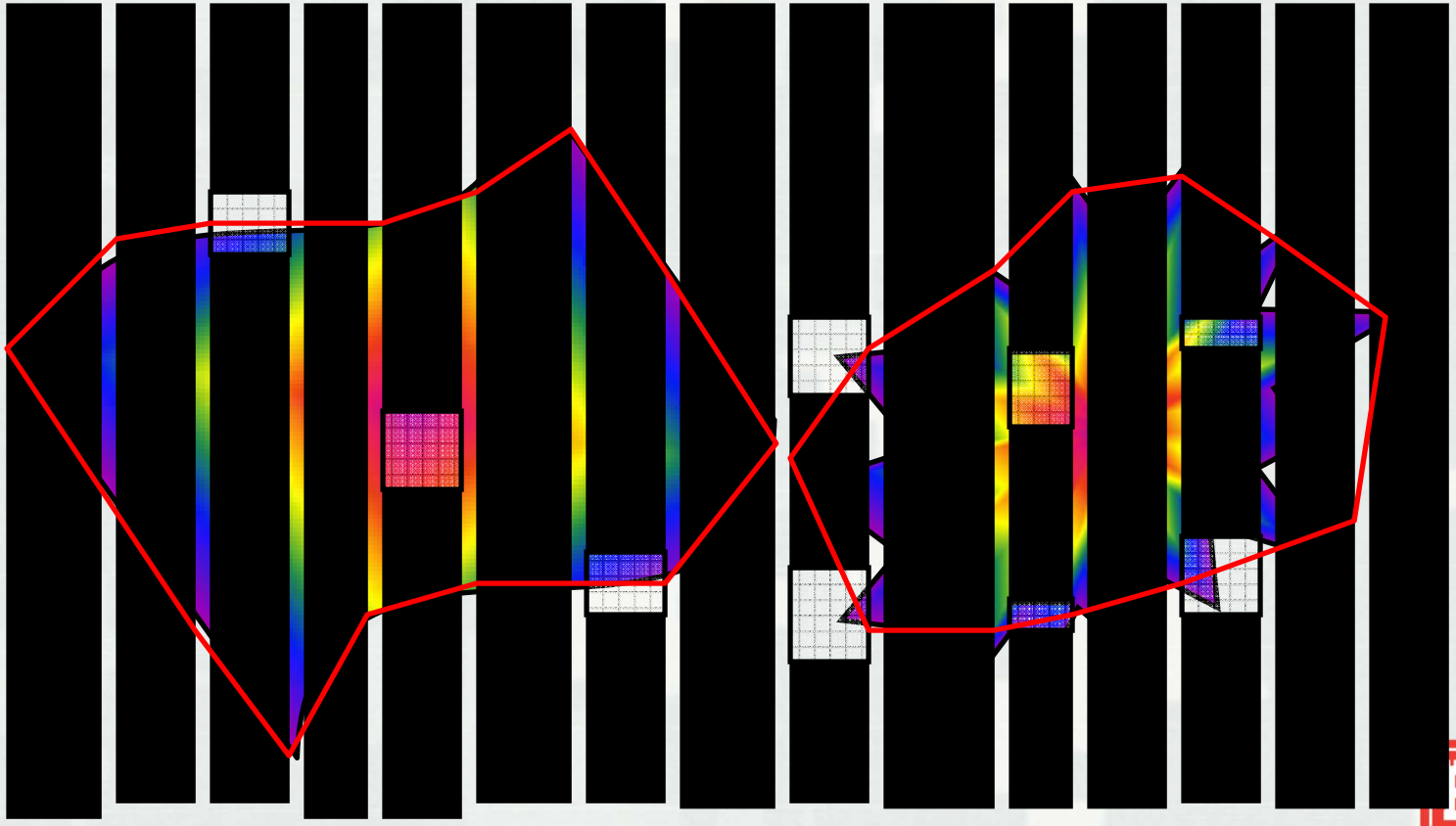
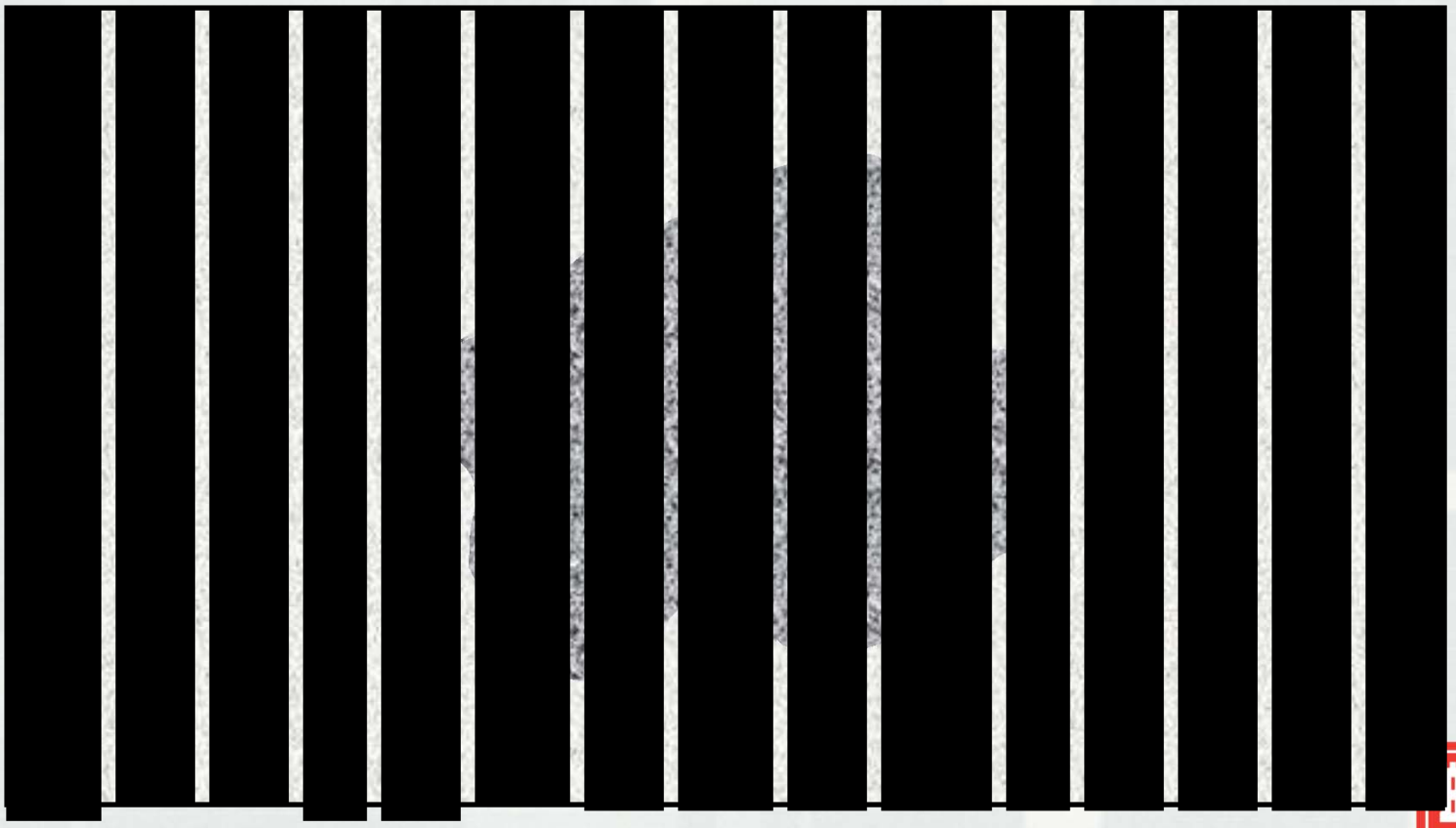


But, what if the Target Area is more difficult to detect?

What if…?

The Target Density is Just above Background



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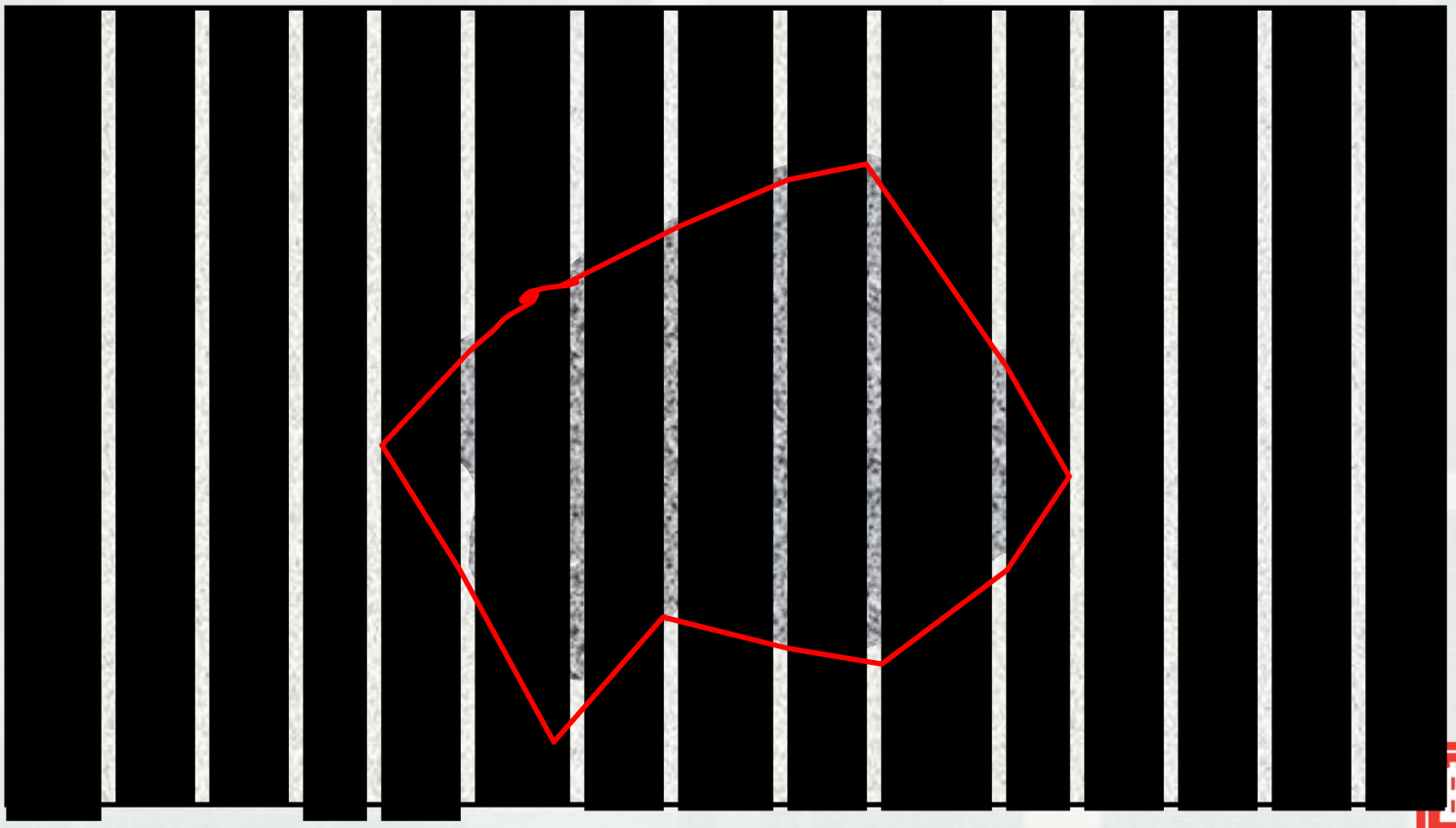

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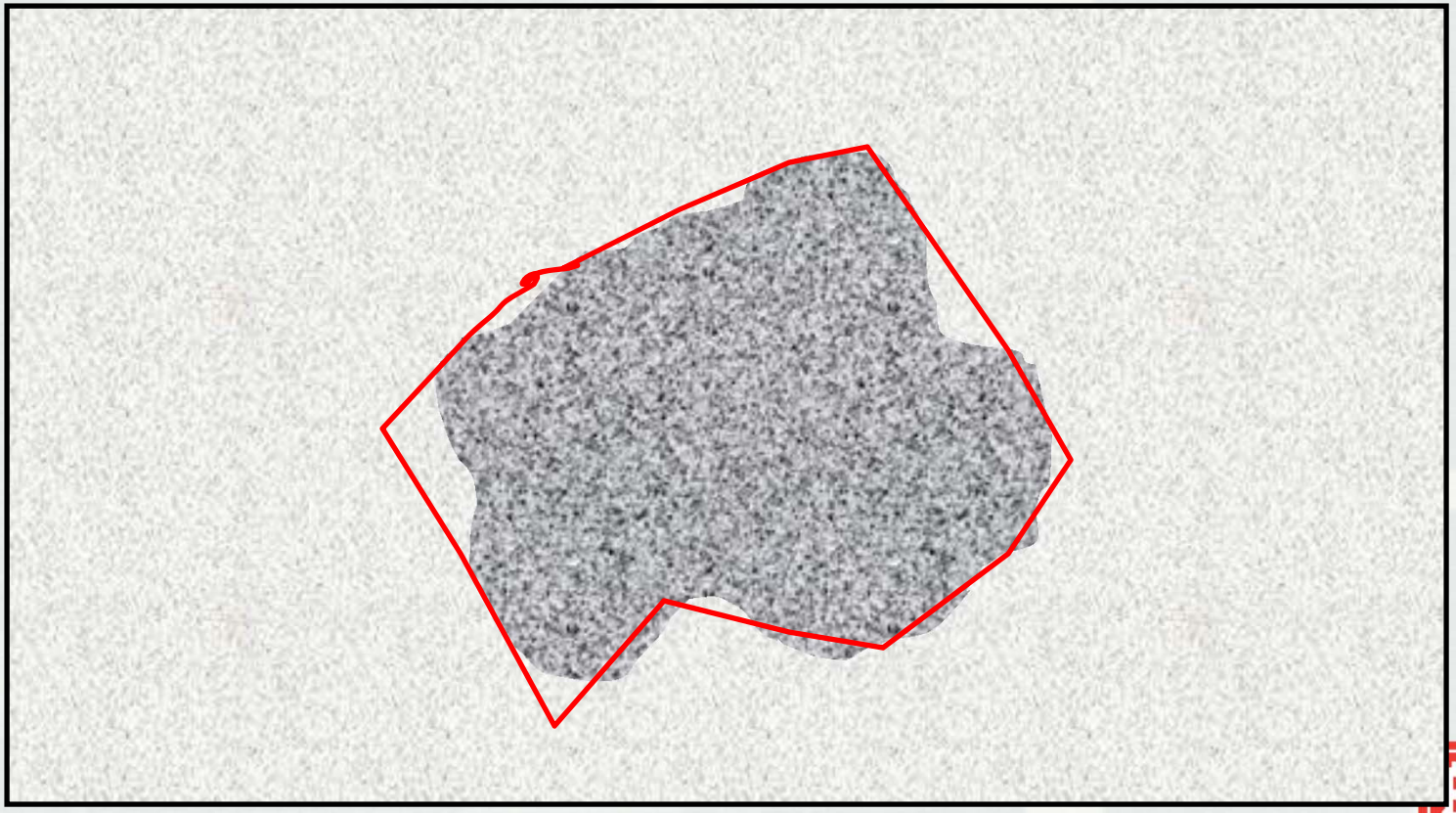
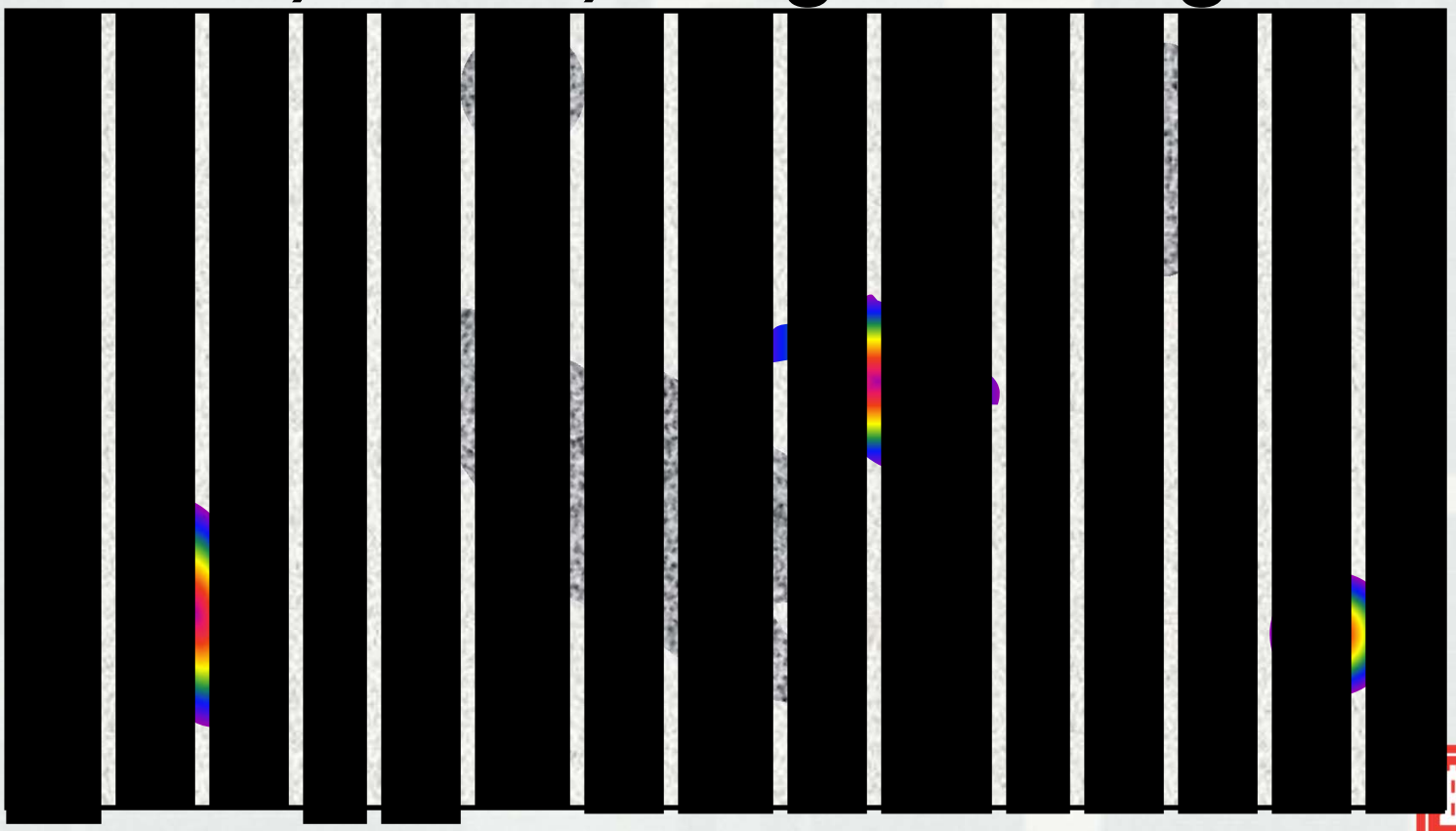


But, what if the Target Area is more Complex?

What if…?

The Target Density is Just above Background AND Numerous, small, irregular Target Areas



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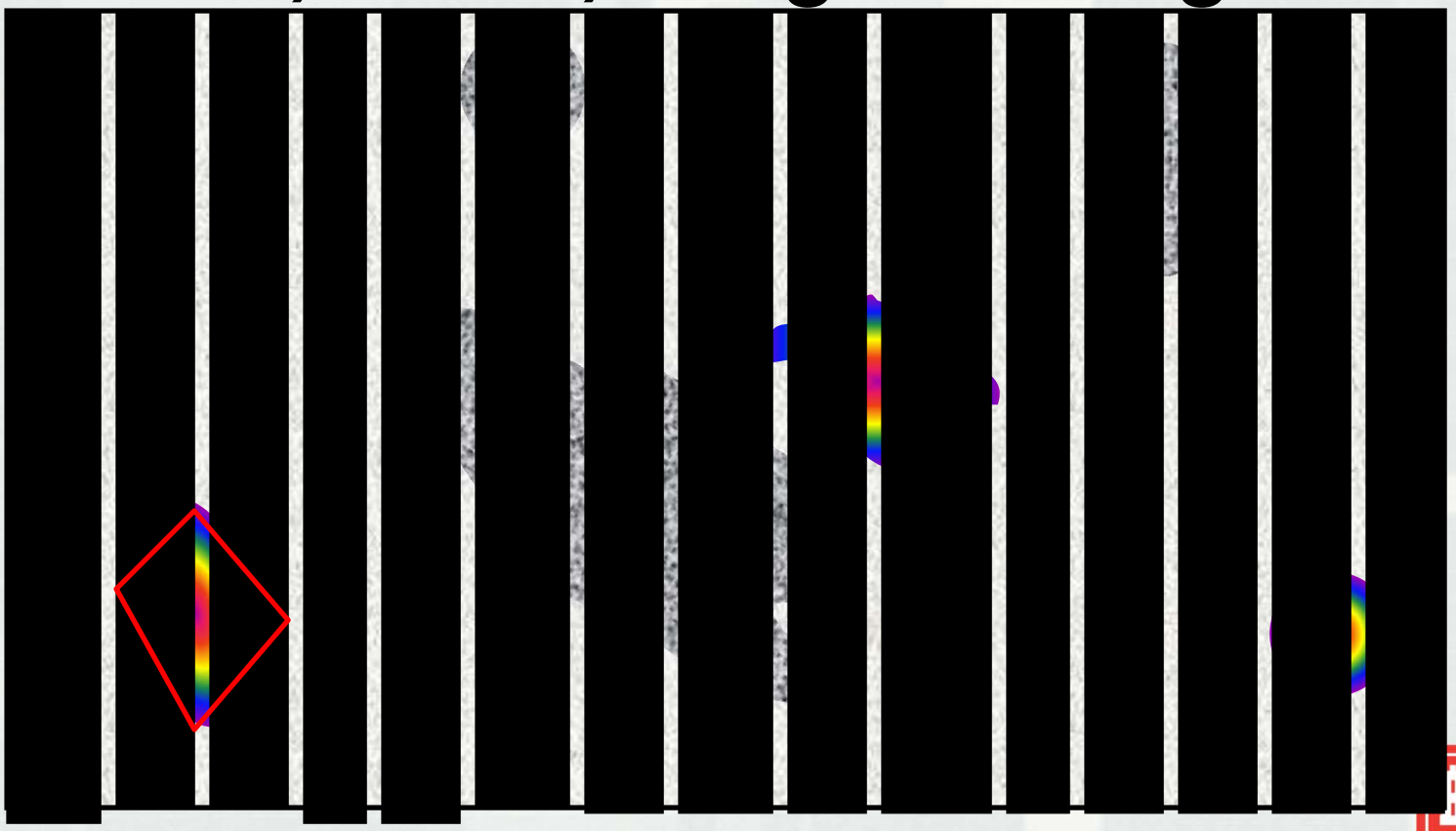

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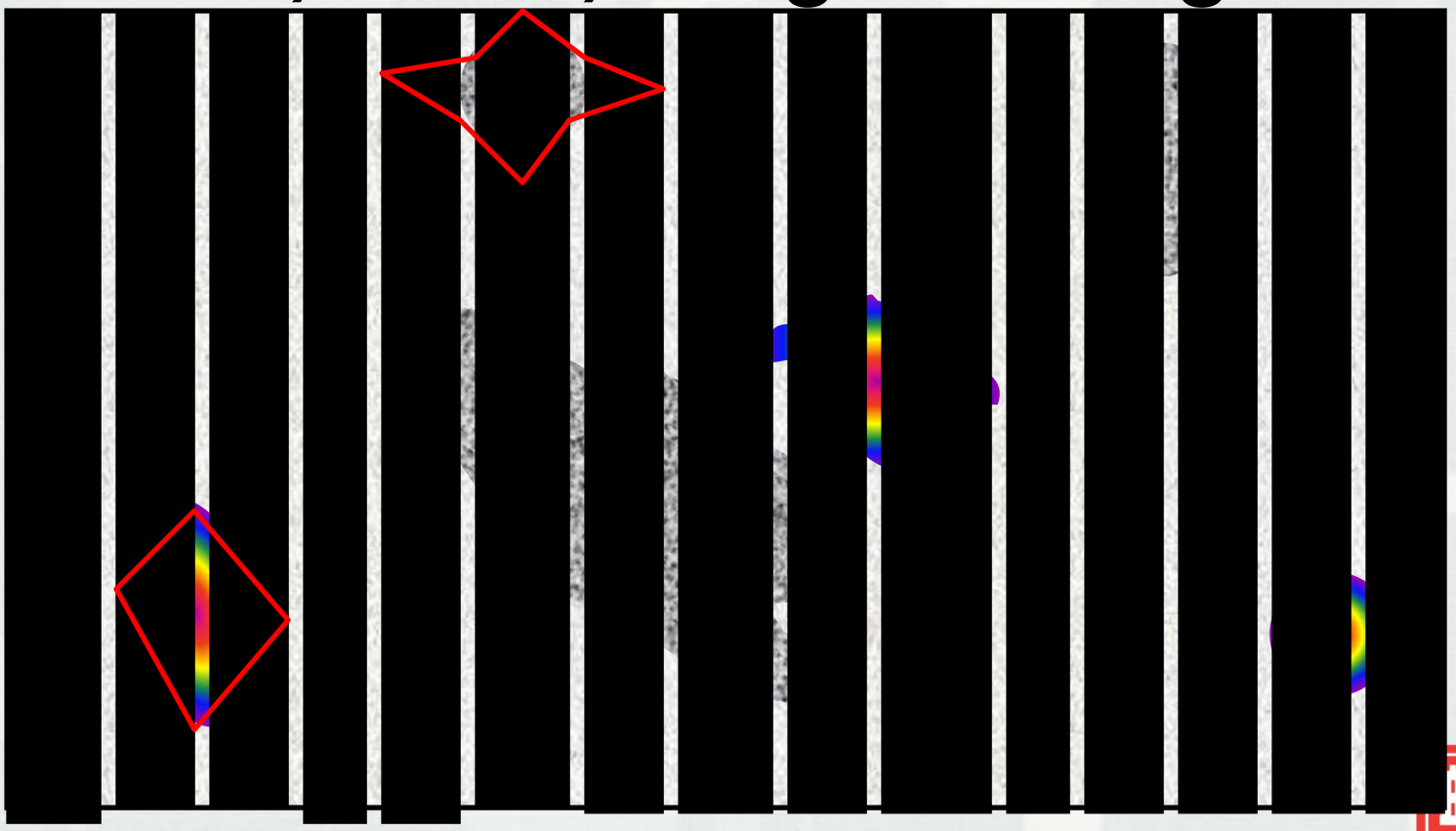

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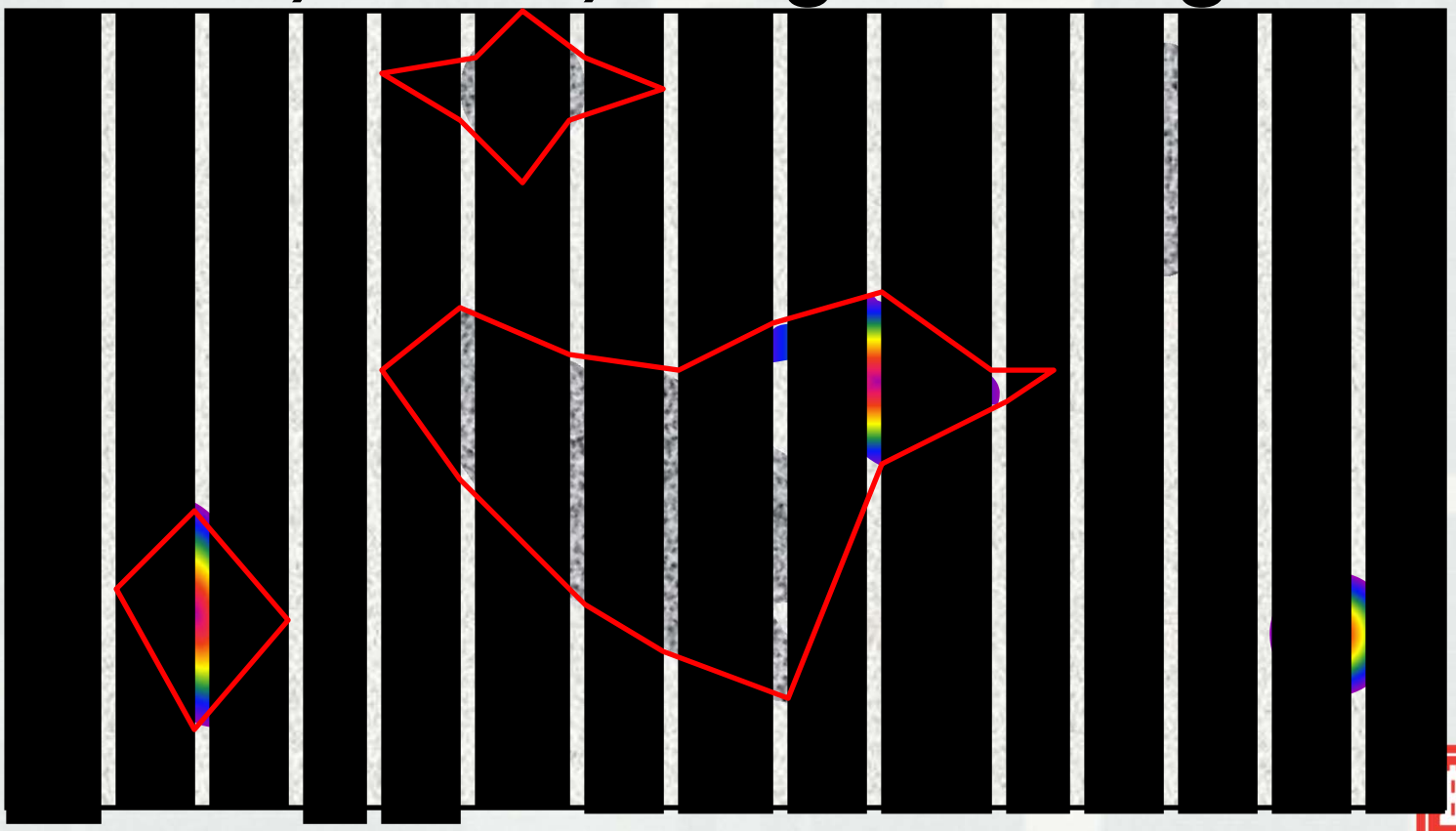

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What if…?

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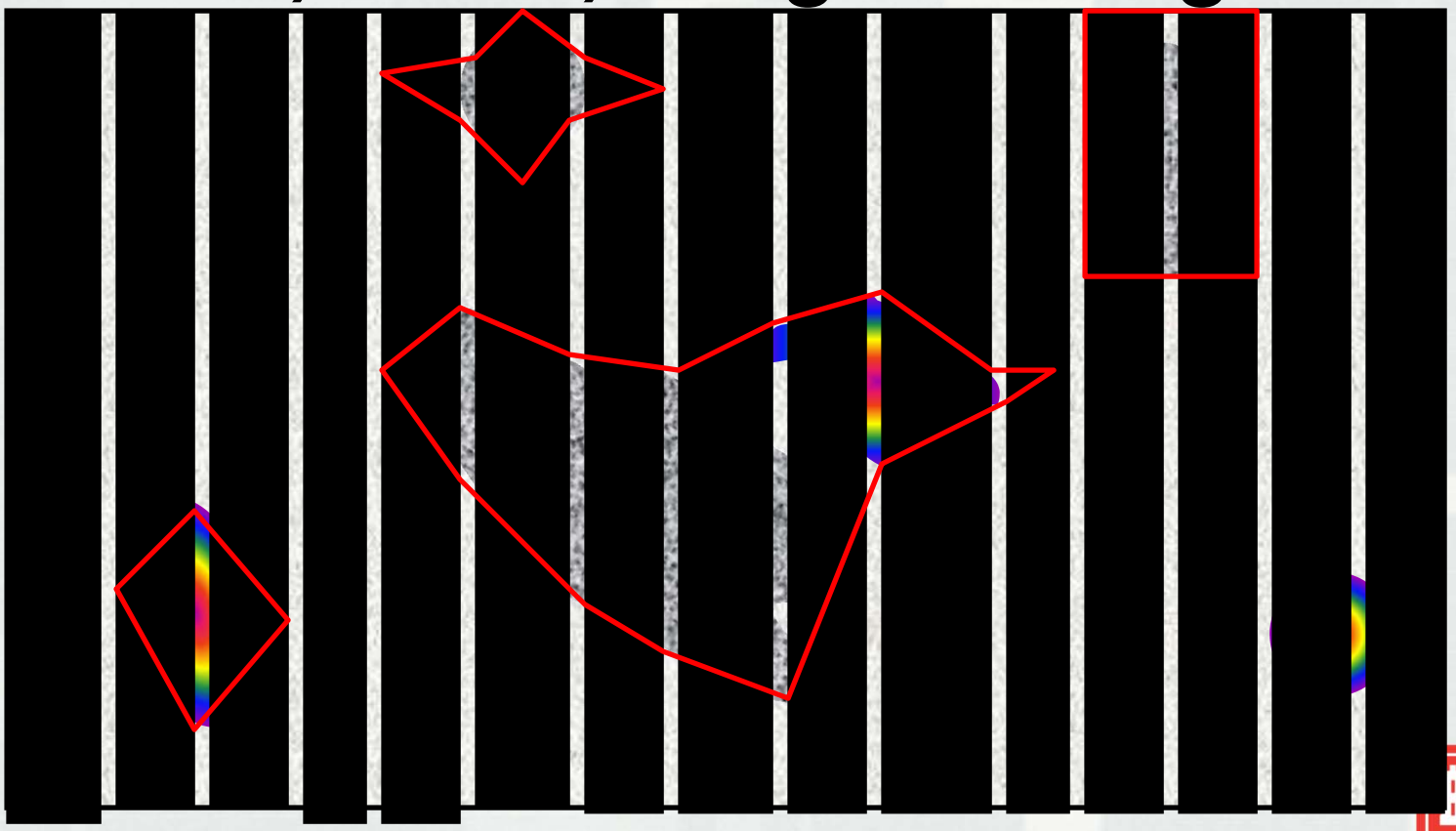

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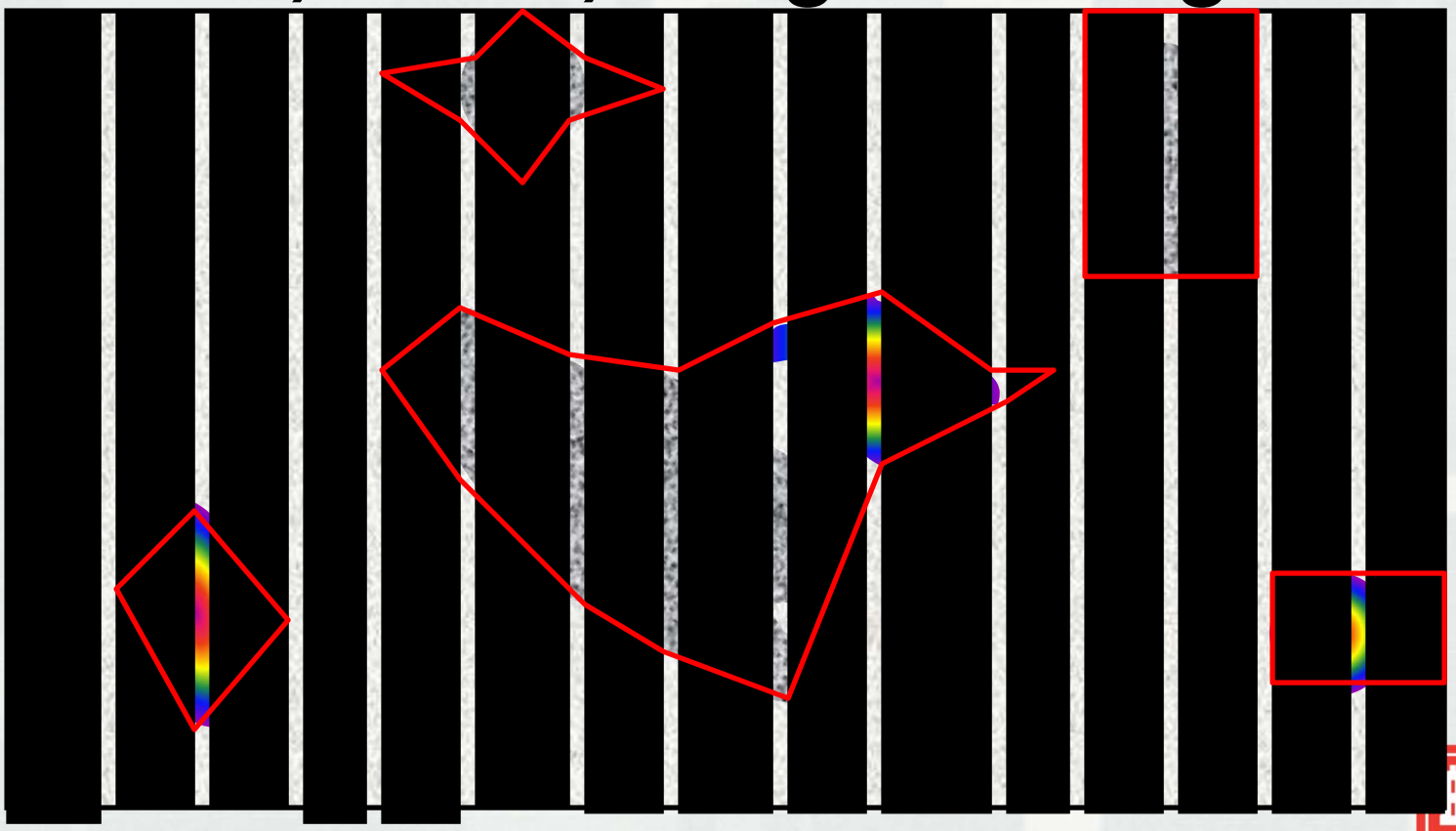

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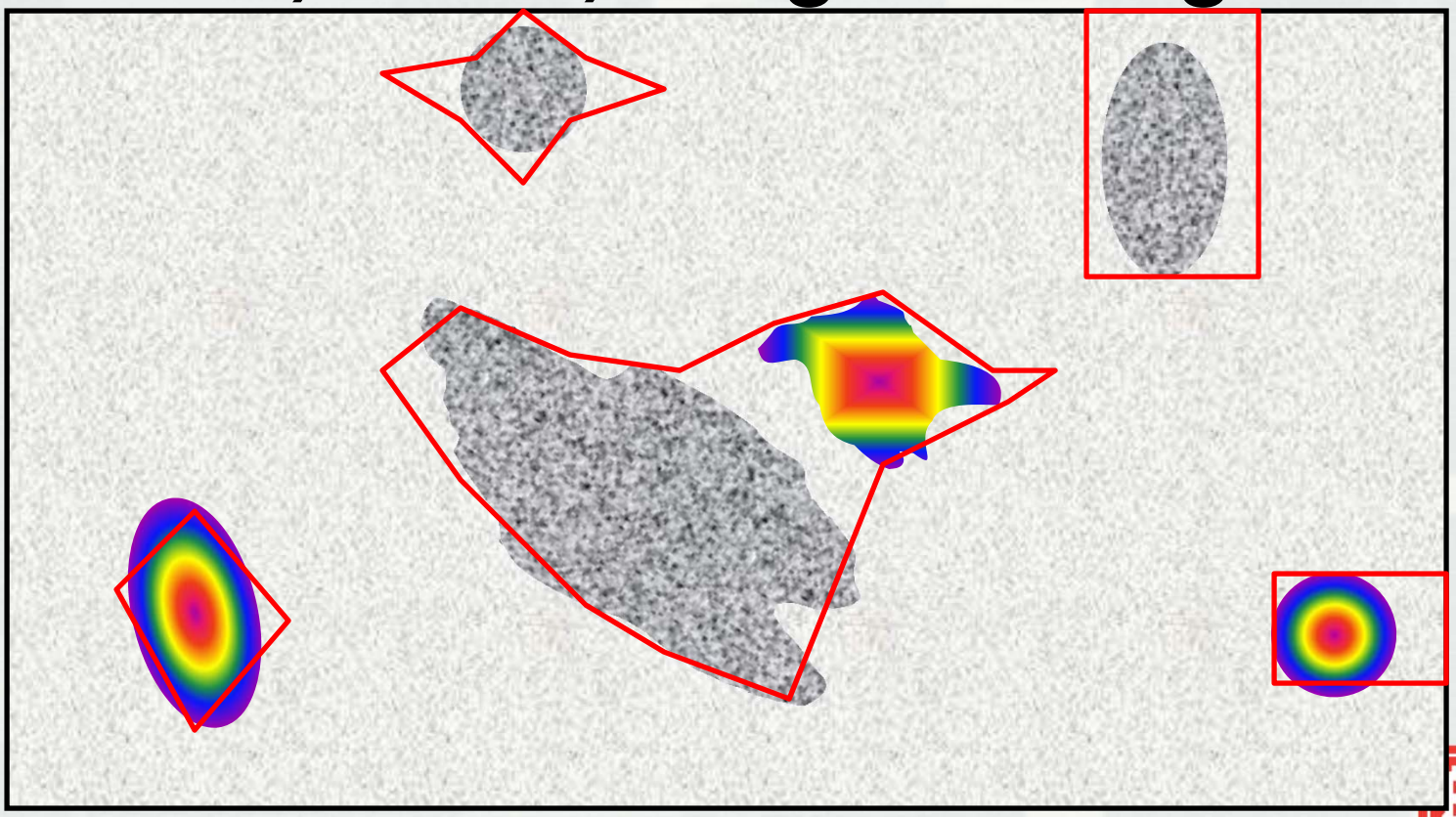

Past 3:

Real-World Examples of Different Transect Spacings

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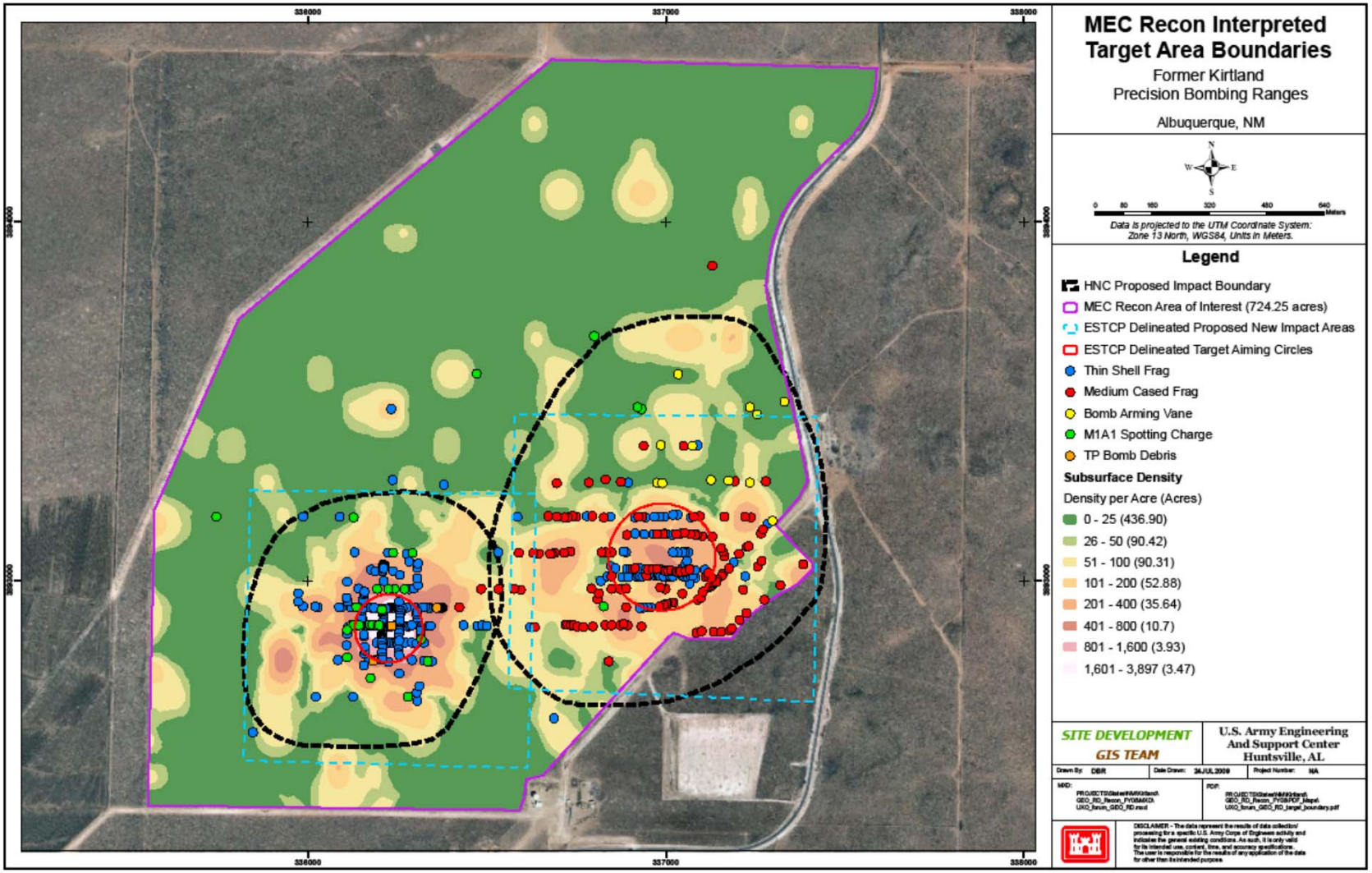
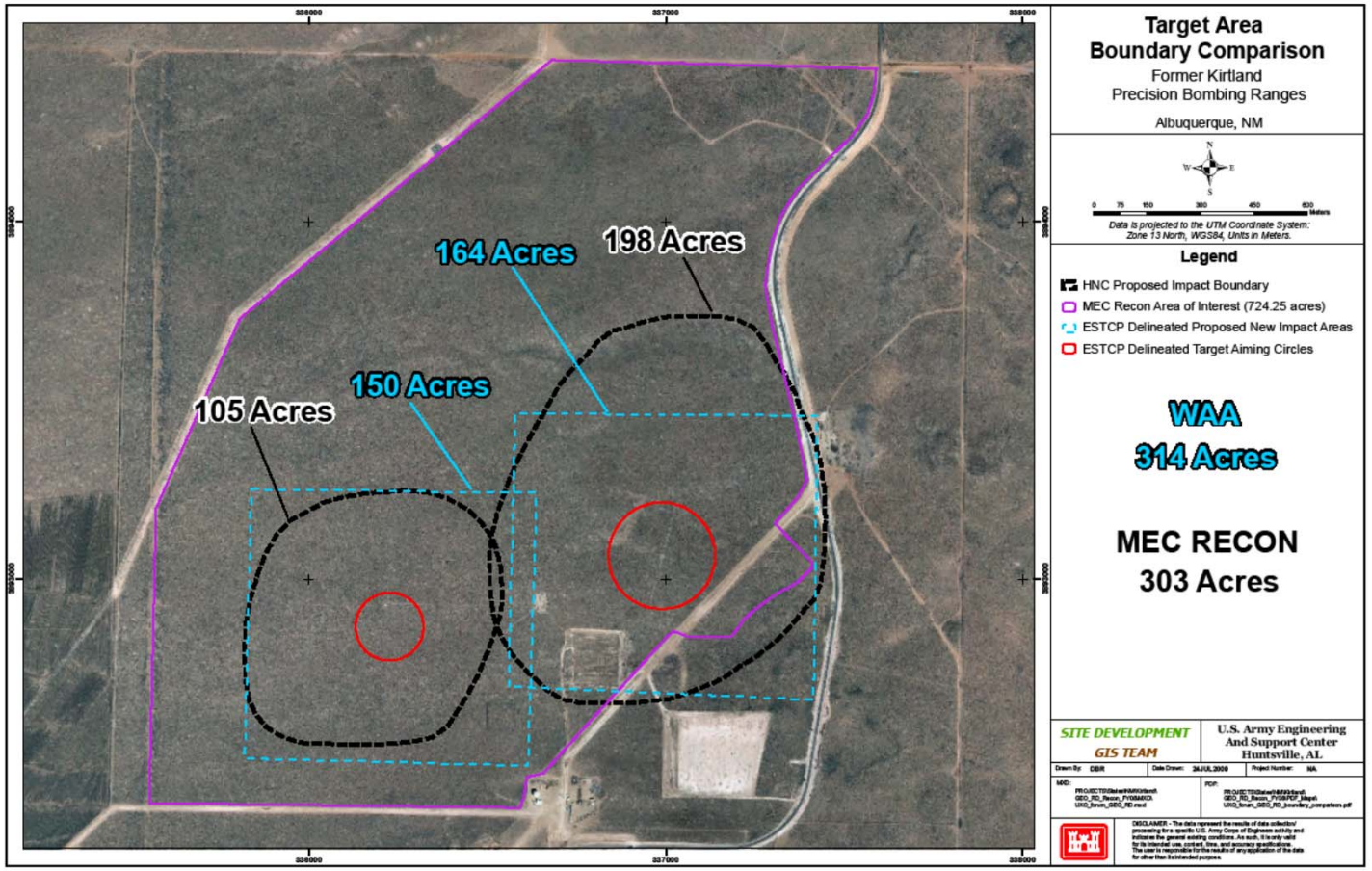
A Real-World Example

Sub-surface Anomalies as detected by a 100-m spacing Instrument-Assisted Survey Superimposed with Surface Items as discovered by a Visual Site Recon



Footprint Comparison

Recon (black) vs 100% Survey (blue)



Tighter Transect Spacing <u>Doesn't</u> Significantly Change the "Footprint"

Conclusions

- Geophysical Surveys “illuminate” the actual metallic anomaly distribution
- RI Objectives…..
  - Transects characterize EXTENT
    - boundaries
  - Grids characterize NATURE
    - Munition type, density, depth
- Next Step:
  - Remedial Design

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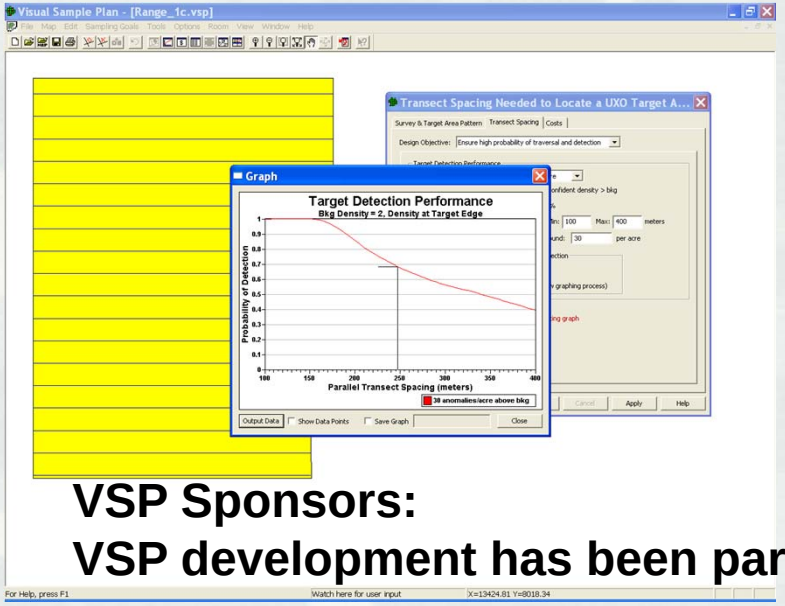
Questions?

VSP References

VSP Development & Endorsements



http://vsp.pnl.gov/

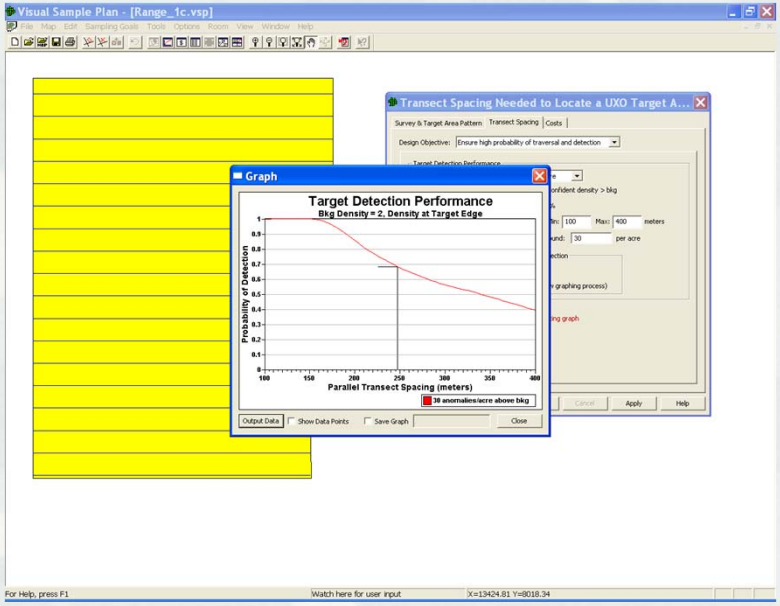
Developed by Pacific Northwest National Laboratory & DOE

VSP Sponsors:

VSP development has been partially supported by the:

U.S. Department of Defense, Environmental Security Technology Certification Program.
U.S. Department of Defense, Navy
U.S. Department of Energy's Environmental Management
U.S. Department of Energy's Office of Health, Safety and Security, Corporate Safety Analysis, Corporate Safety Programs, HS-31
U.S. Department of Health and Human Service's Centers for Disease Control & Prevention, National Institute for Occupational Safety and Health
U.S. Department of Homeland Security, Directorate for Science and Technology
U.S. Environmental Protection Agency's (EPA's) Offices of Environmental Information and Solid Waste and Emergency Response
United Kingdom Atomic Weapons Establishment

VSP Contact Information



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Developed by Pacific Northwest National Laboratory & DOE

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