



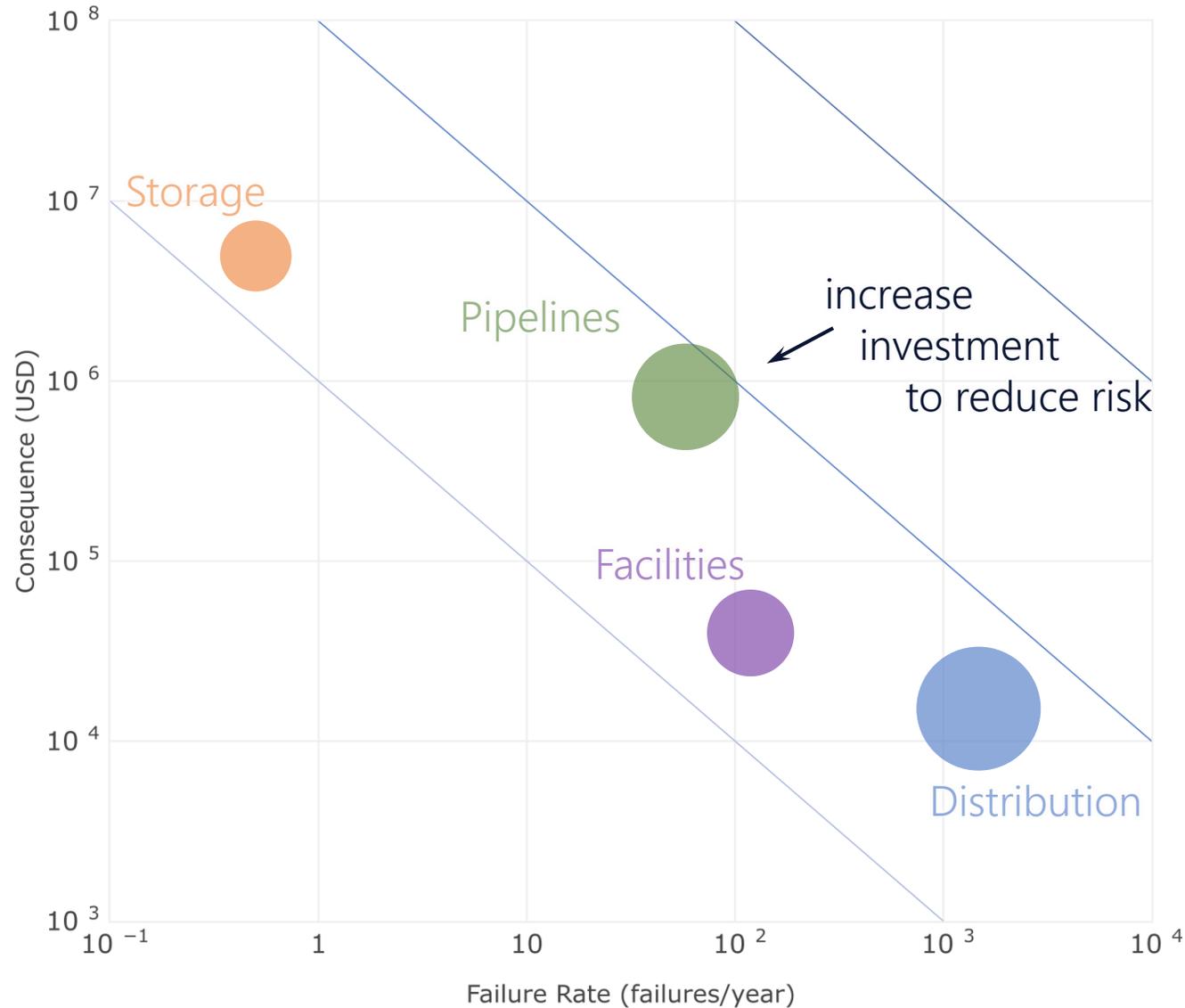
# Integral

## ENGINEERING

Automated Solutions for Integrity Management Solutions  
Theme 4 – Decision Making  
PHMSA R&D Forum

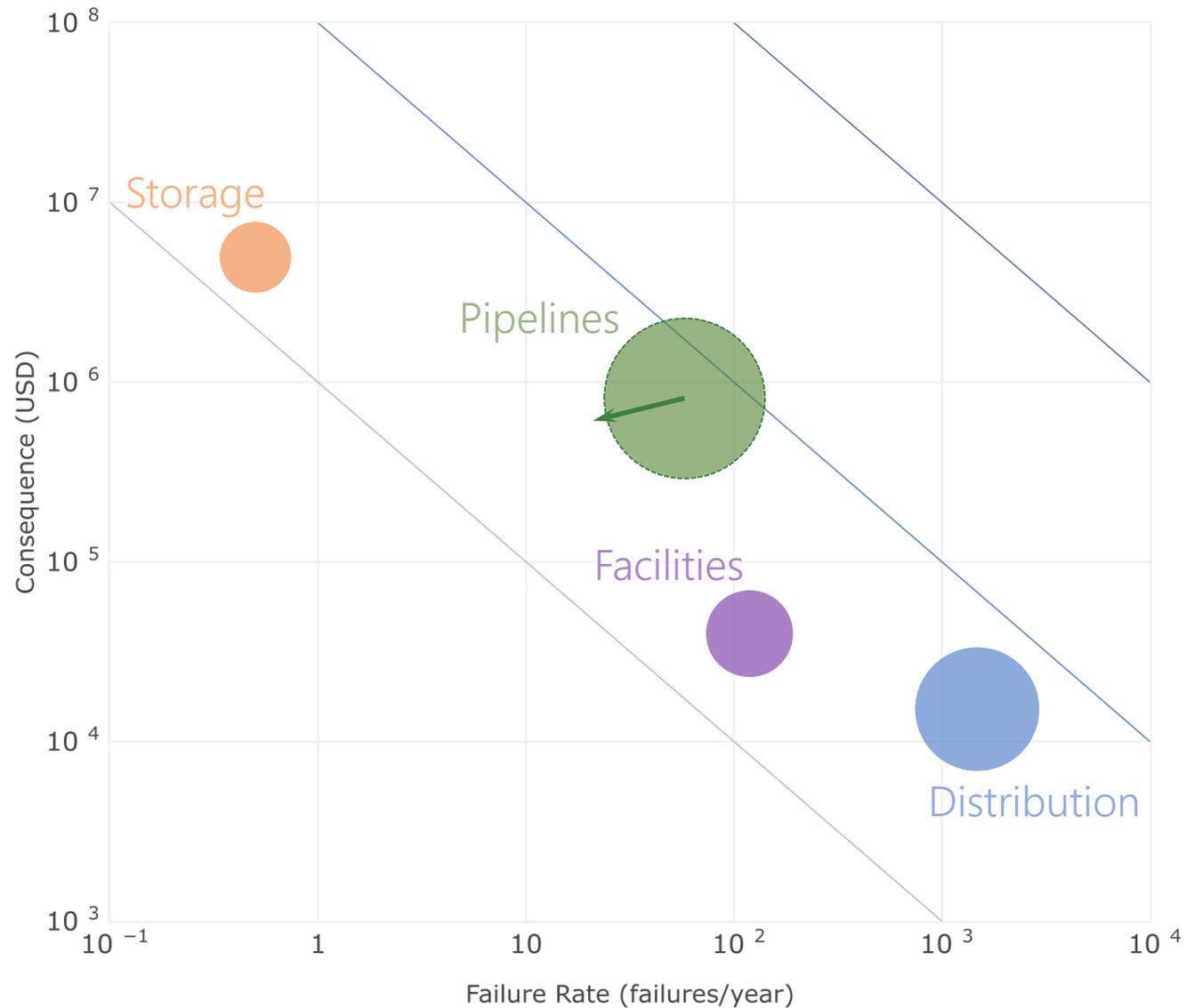
Jason Skow  
2020-Feb-20

# Inspection Data - Multiple Assets

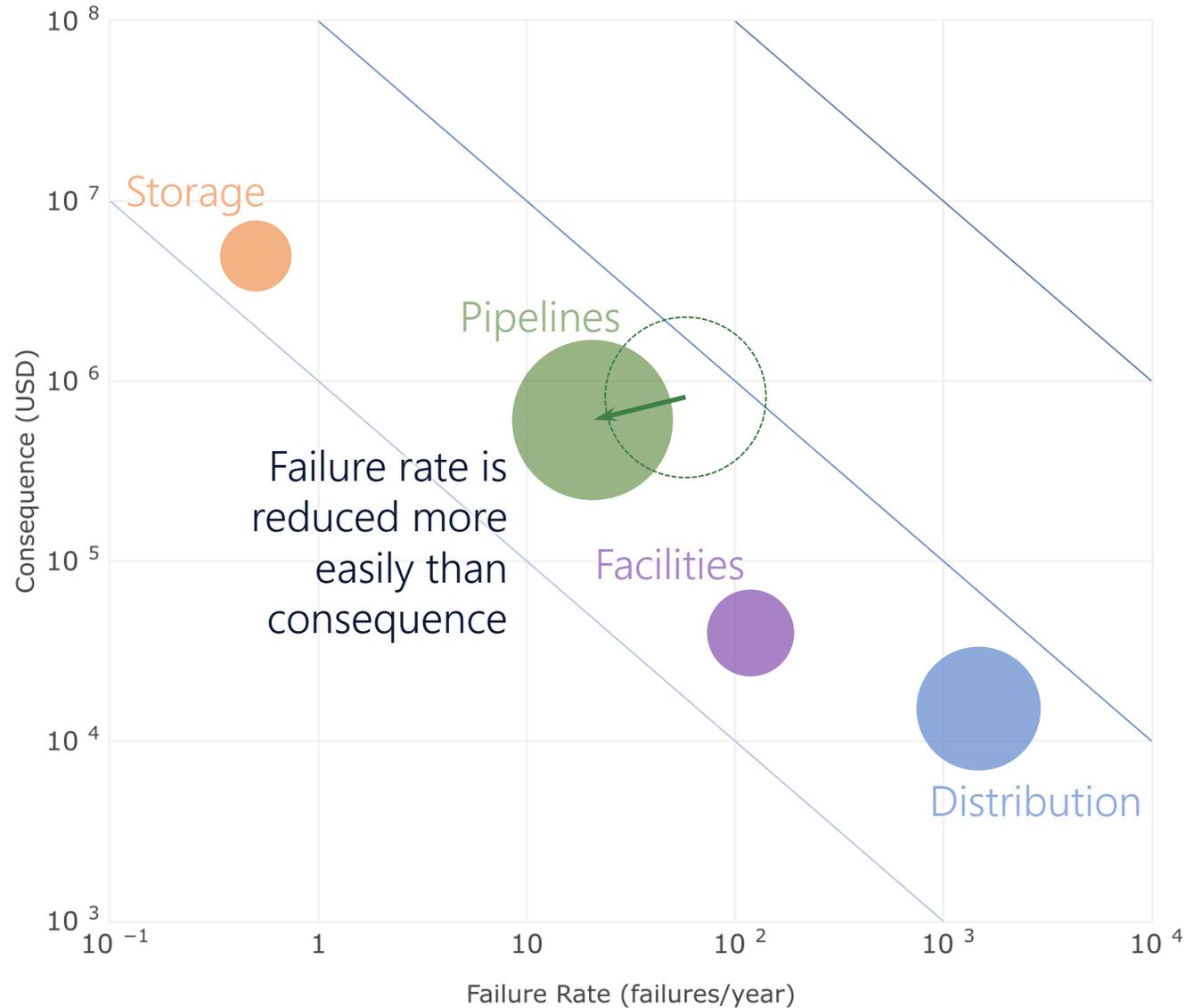


# Inspection Data - Multiple Assets

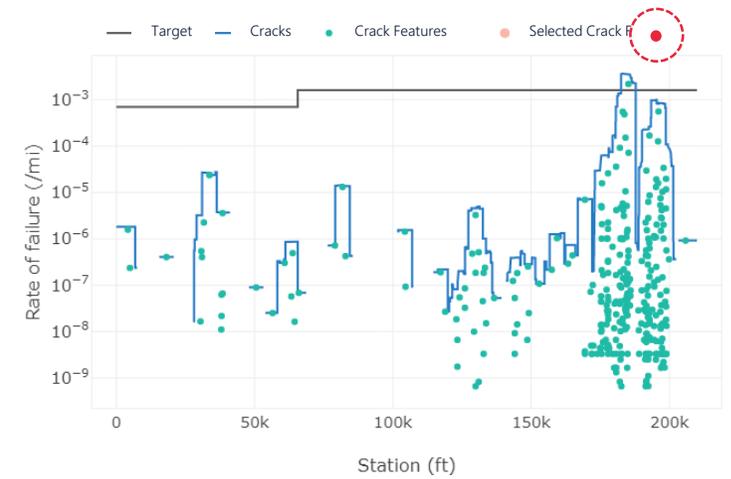
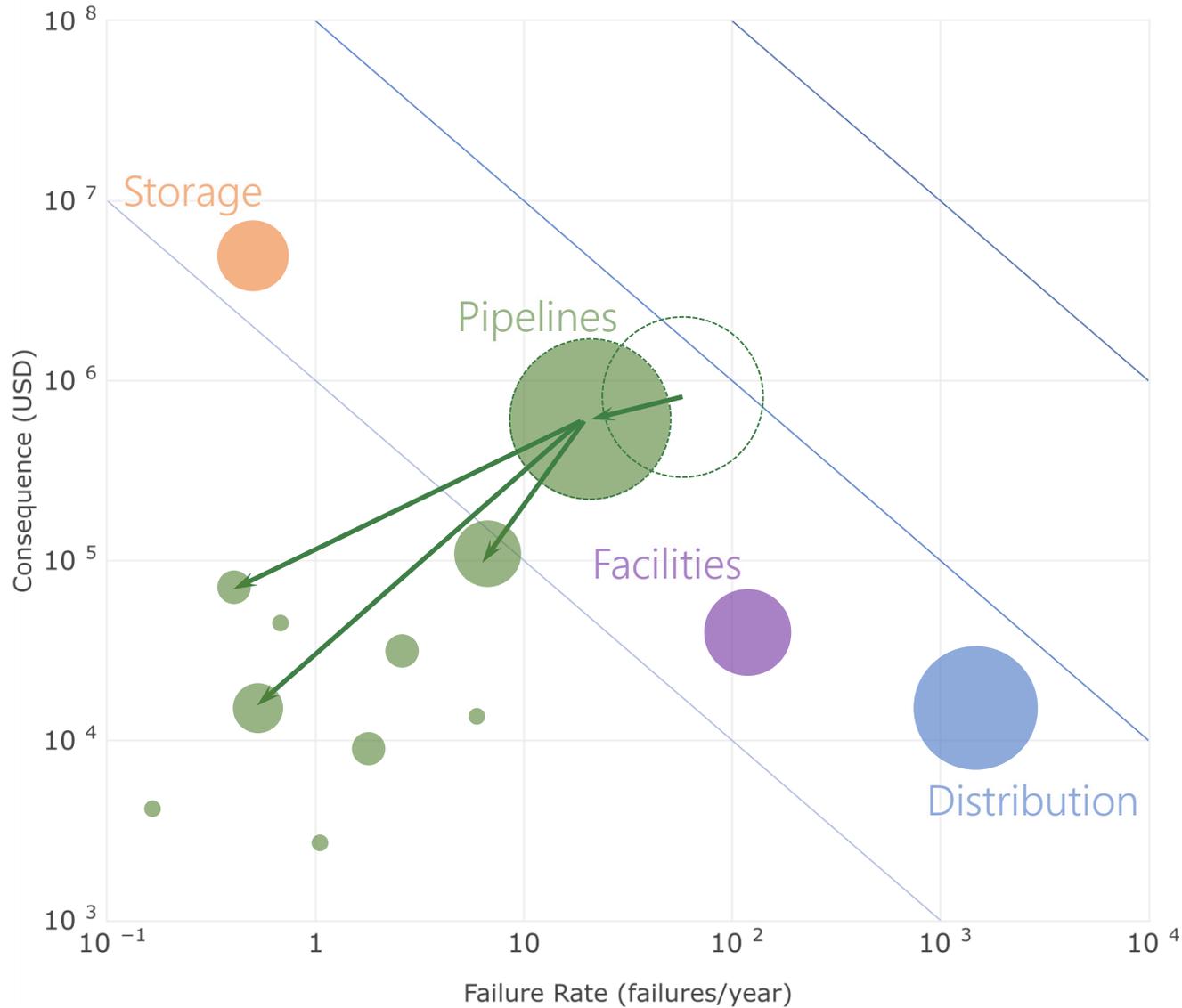
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# Inspection Data - Multiple Assets



# Inspection Data - Multiple Asse

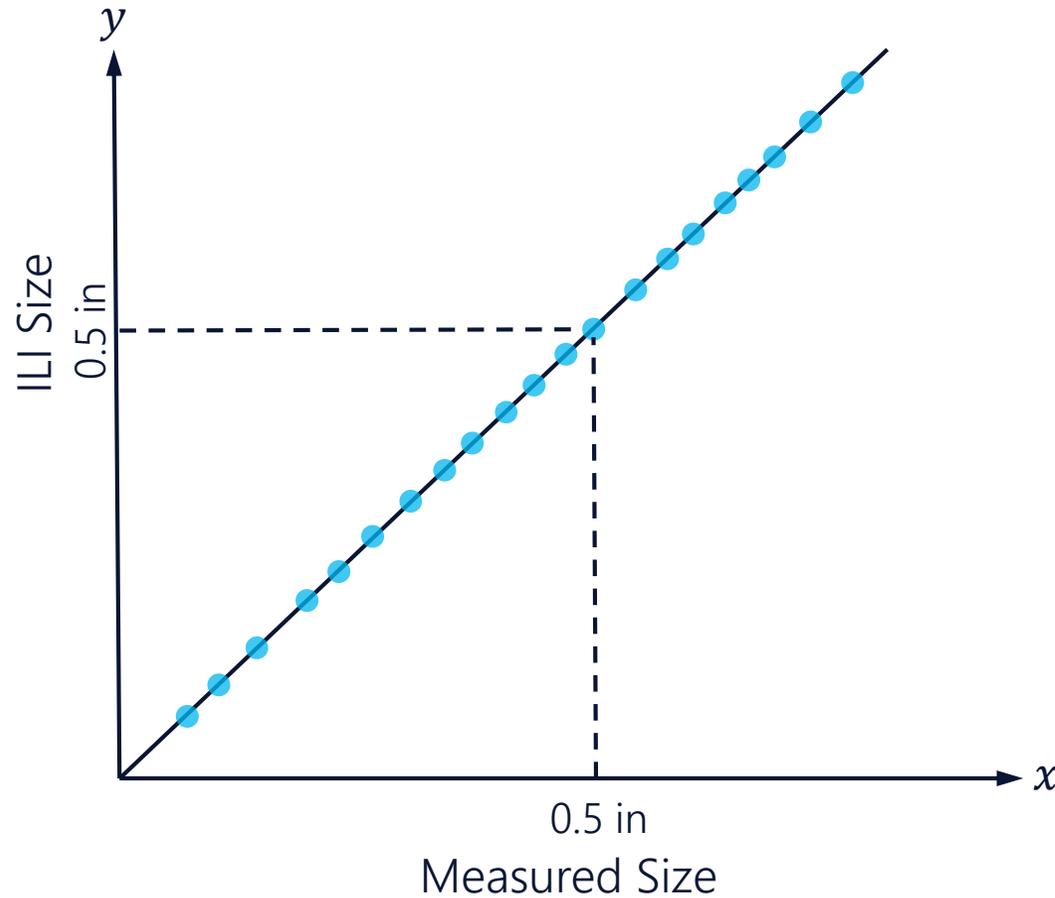


**Integral**

- ▶ What are the standard **interpretable models**, informed by industry experience, that should be used?
- ▶ What **machine learning** methodologies offer the best opportunities to learn from our data? (Supervised learning over unsupervised or reinforcement learning)?
- ▶ Can the industry produce **standardized data sets** to test and compare models?
- ▶ What are the **risk-based** decision tools that should be adopted by industry?
- ▶ What are the **measurement protocols**? (repeated measurements, different technologies, multiple assets, test spools, pull tests)

# Inspection Data – Multiple Sources

Unity plot

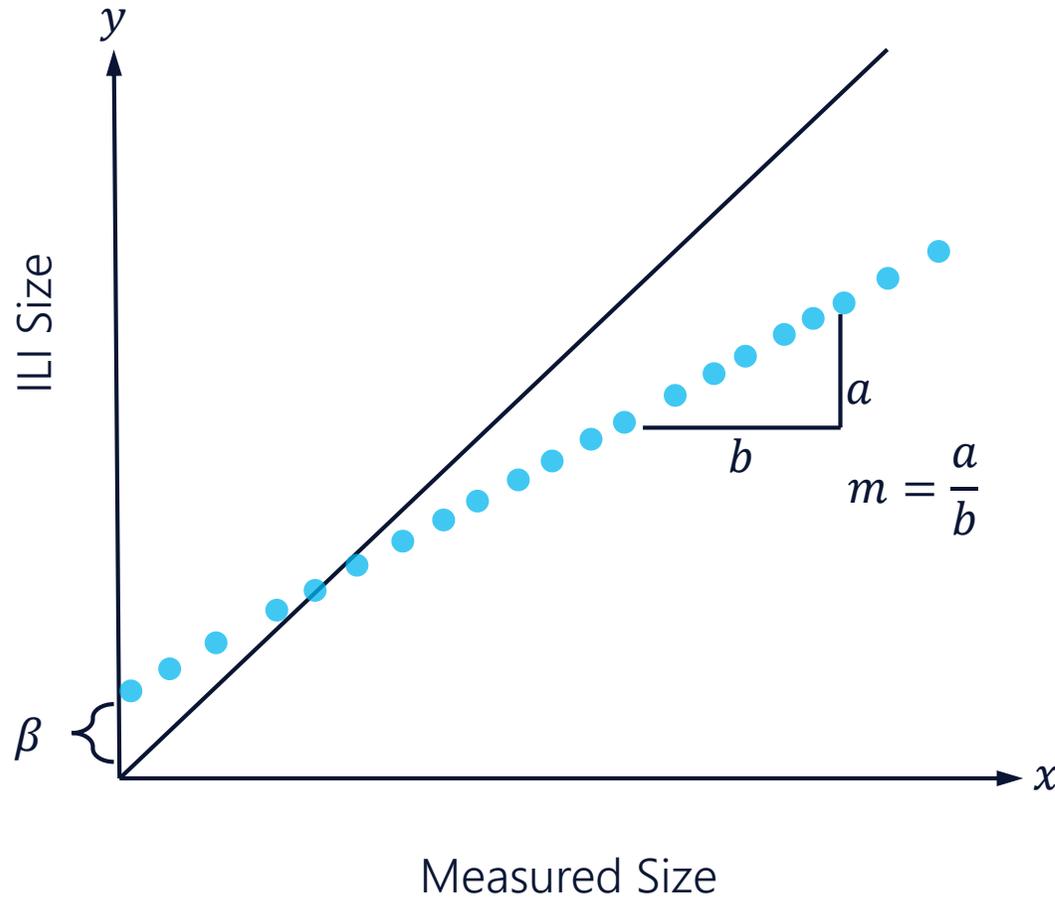


$$y = mx + \beta + e$$

↑ slope    ↑ intercept    ↑ error

# Inspection Data – Multiple Sources

Unity plot

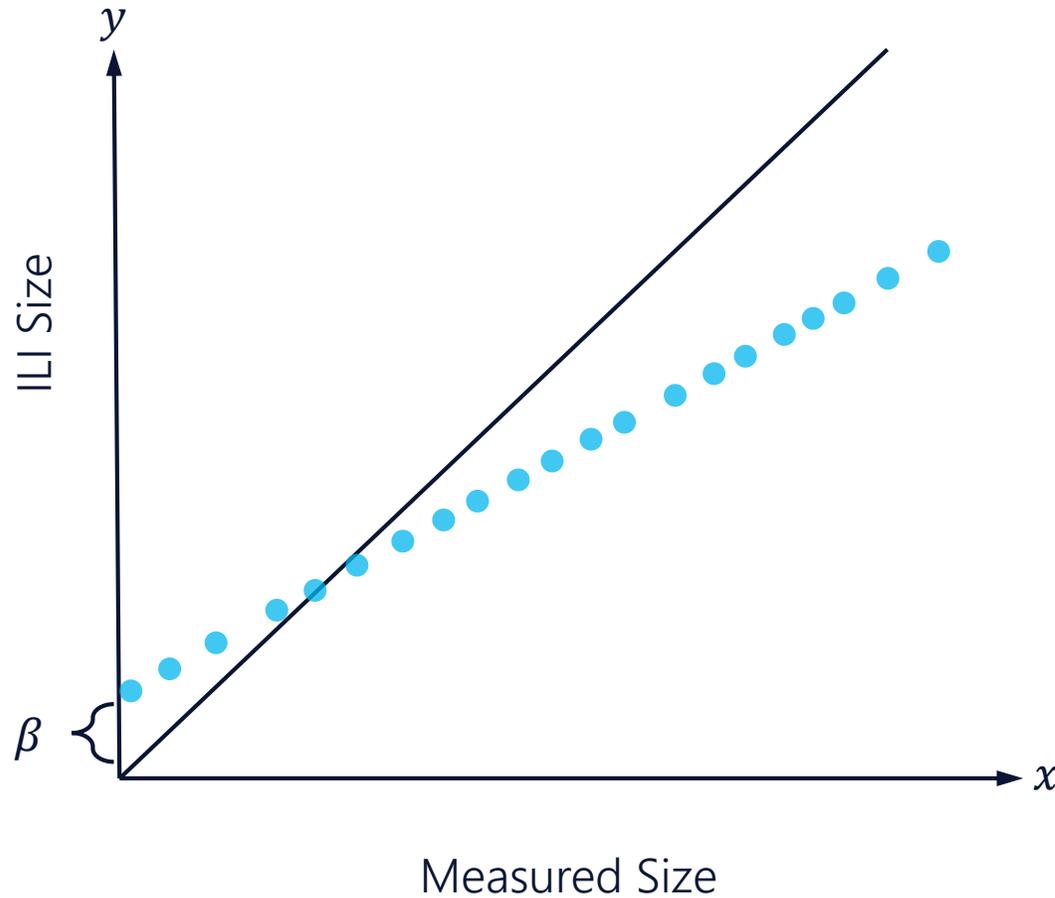


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# Inspection Data – Multiple Sources

Unity plot

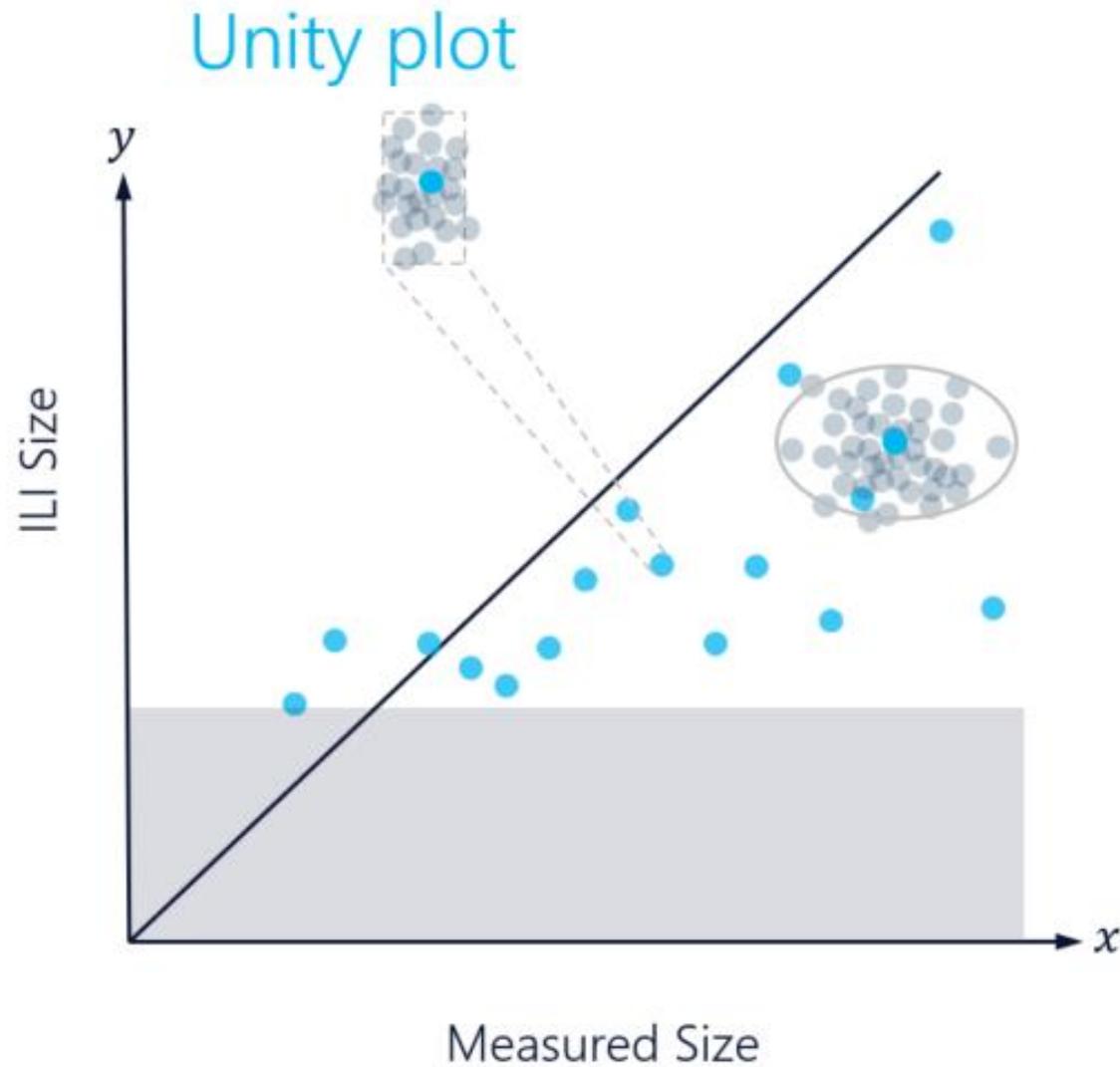


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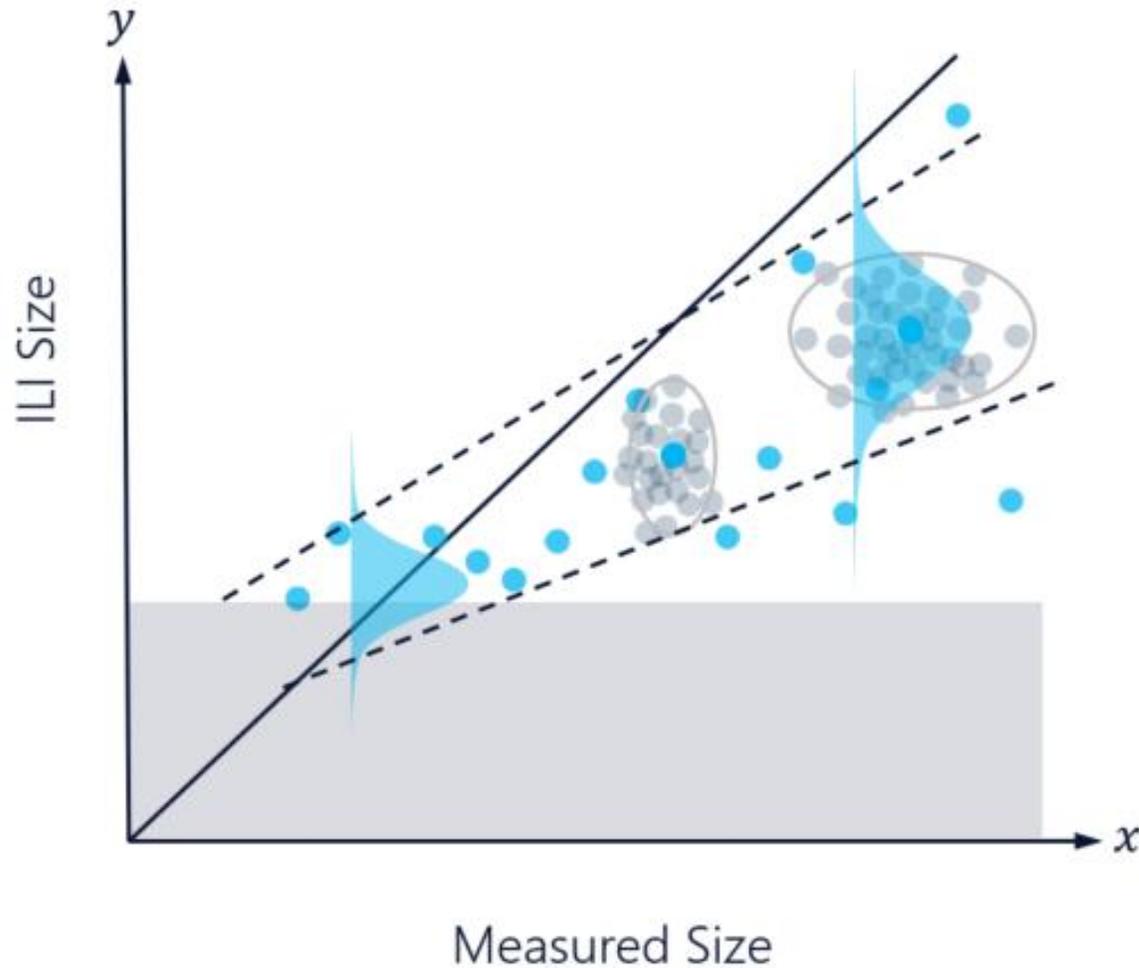
# Inspection Data – Multiple Sources

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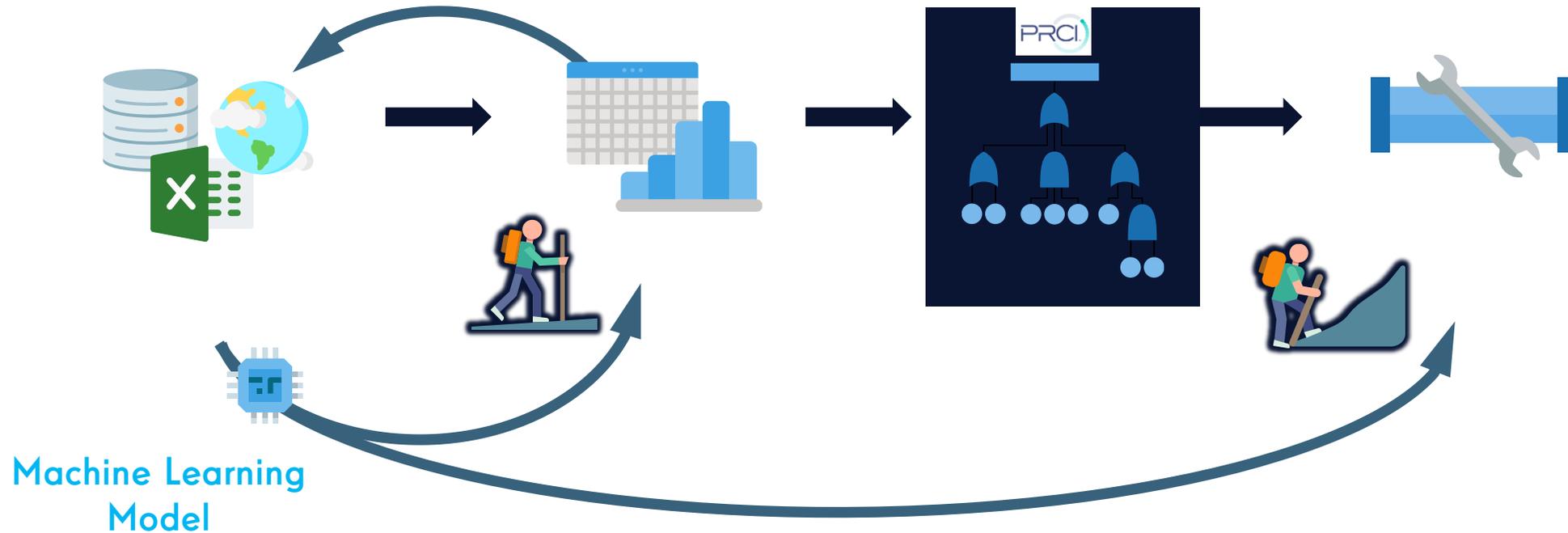
Integral

# Inspection Data – Multiple Sources



- ▶ What is the source of greatest **uncertainty**? (human error vs technology). What is the best way to reduce uncertainty?
- ▶ What is the **run-specific** performance of a measurement tool?
- ▶ What is the value of repeated measurements or of '**truth data**'?
- ▶ How should uncertainty be handled in integrity assessments?
- ▶ What weight should lab-based pull test or experimental data be given compared to field measured data?

# Where does Machine Learning fit?



# Chihuahua or Blueberry Muffin?

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