ILI Data Interpretation

Emerging Pipeline Technologies – Sept 29th , 2014

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Integrity Maintenance Planning

- Quantify risk profile along pipeline
- Evaluate factors influencing risk
- Optimize maintenance and inspection programs
- Report to regulators

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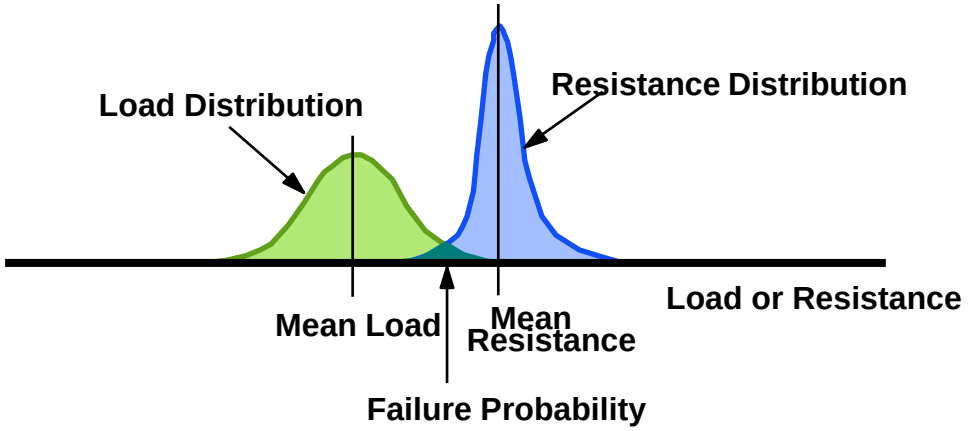
Calculating the Failure Probability



Pipe Dimension Distribution

Defect Size or Force Distribution

Material Strength Distribution

Resistance Model

Resistance Distribution

Load Distribution

Safety Margin = Resistance - Load

Probability of Failure

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ILI Performance Metrics

- Probability of Detection (POD)
- Probability of Identification (POI)
- Probability of False Call (POFC)
- Sizing
  - Depth
  - Length
  - Area
  - Burst pressure

- Testing a performance claim vs calculating a performance claim

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Probability of Detection

- Possible outcomes of an inspection

POD

	Defect	No Defect	TOTAL
In-line Tool Result Positive (+)	x	w	$x+w$
In-line Tool Result Negative (-)	y	z	$y+z$
TOTAL	$n=x+y$	$w+z$	$x+y+w+z$

$$POD = p(+ \mid defect) = \frac{x}{n} = \frac{x}{x+y}$$

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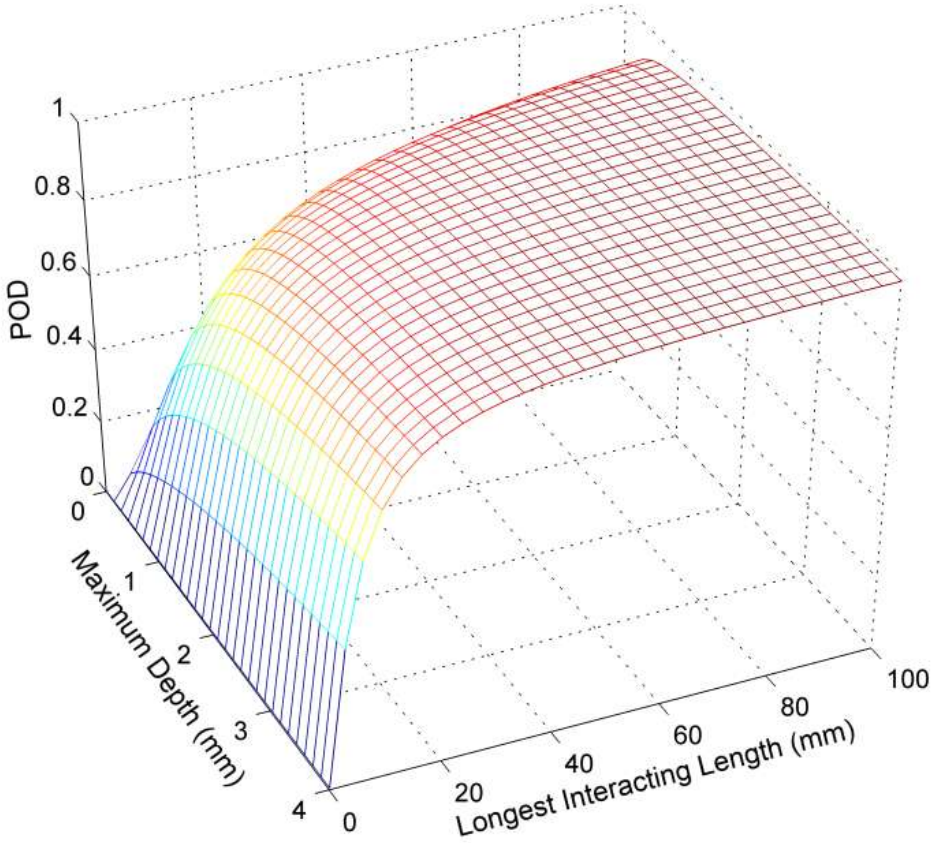
POD

- Depends on length and depth – but not both equally
- Estimating what was missed – is it an integrity concern?



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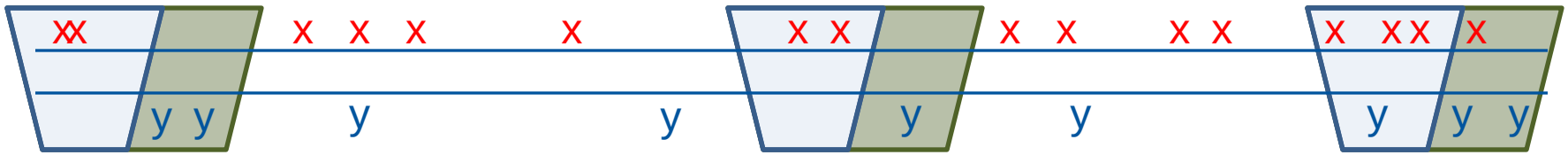
Getting the Right Data



- POD depends on what is not in the dig sets
- Scenario 1:
  - a minimum length bell hole targeting defects
  - it is unlikely that undetected defects will be properly represented in the sample
- Scenario 2:
  - extend the length of the dig
  - more length provides more information about undetected defects
- Model the rate of undetected defects

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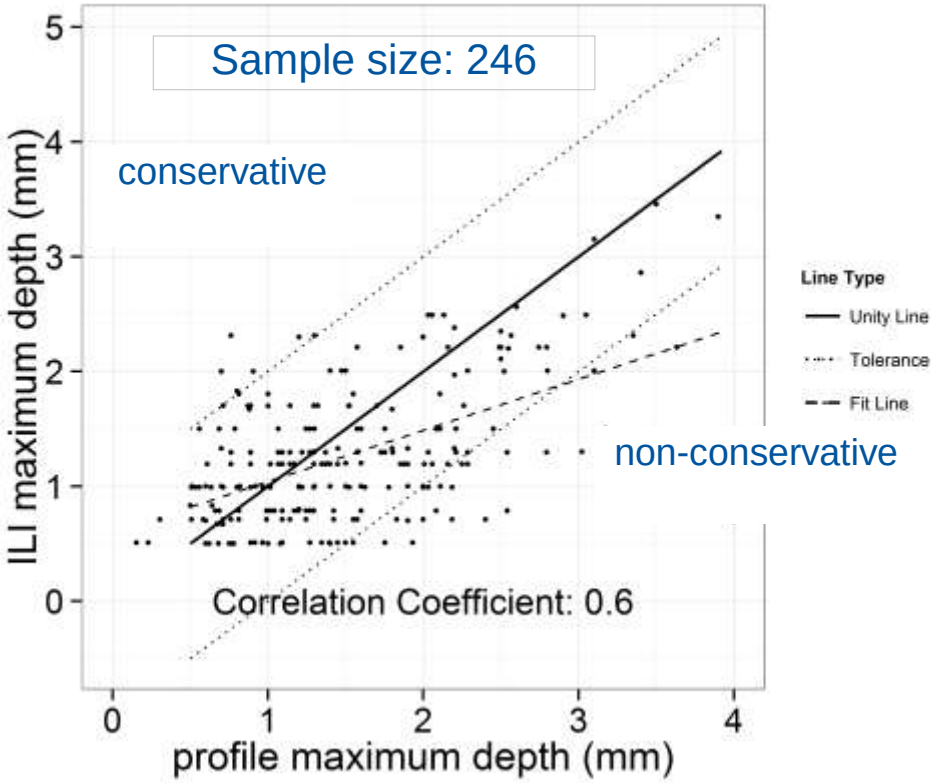
Sizing

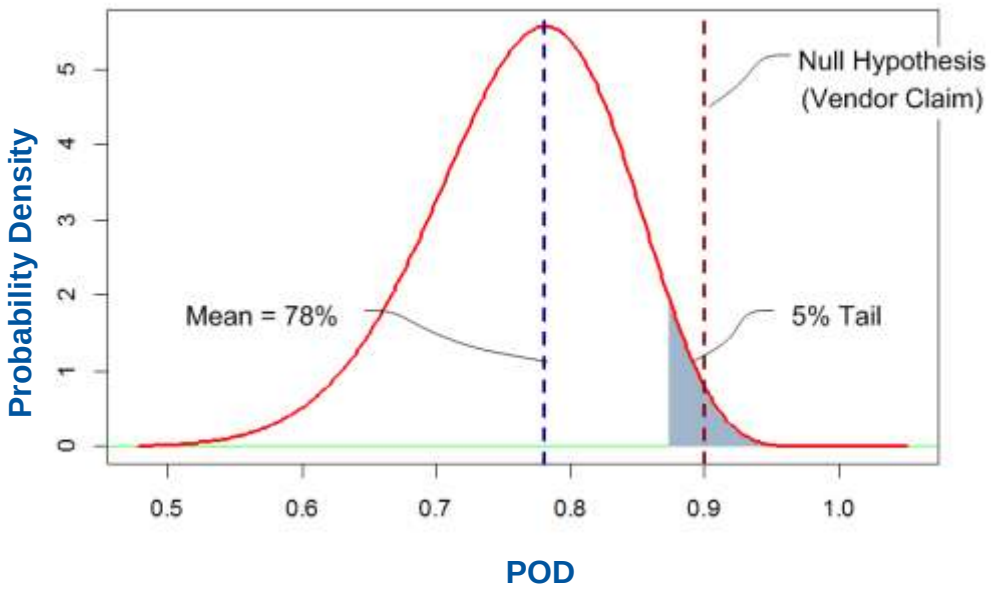
- Depth, Length, Area, Shape
- Unity Plot
- Errors in two dimensions



Testing the Vendor Claim

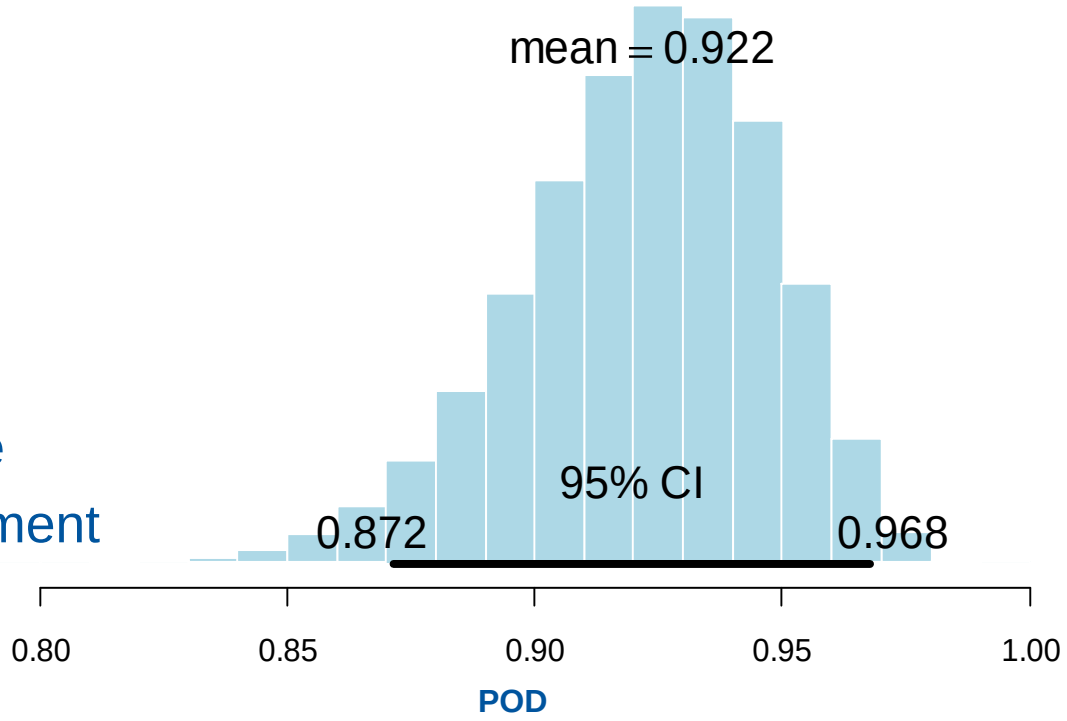
- Results in a ‘reject’ or ‘not reject’ evaluation
- Minimizes Type I errors
- Pros – simple
- Cons – does not use expensive data

		Reality	
		False	**True**
Hypothesis	**Reject**	*Correct Call*	*Type I Error*
	Not Reject	*Type II Error*	*Correct Call*



Calculating Performance

- Pros:
  - Use all available data
    - Specification
    - Excavation data
    - Pull tests
    - Lab tests
  - Estimates performance
  - Critical feature assessment
  - Integrity optimization
- Cons:
  - Complicated
  - Requires more data



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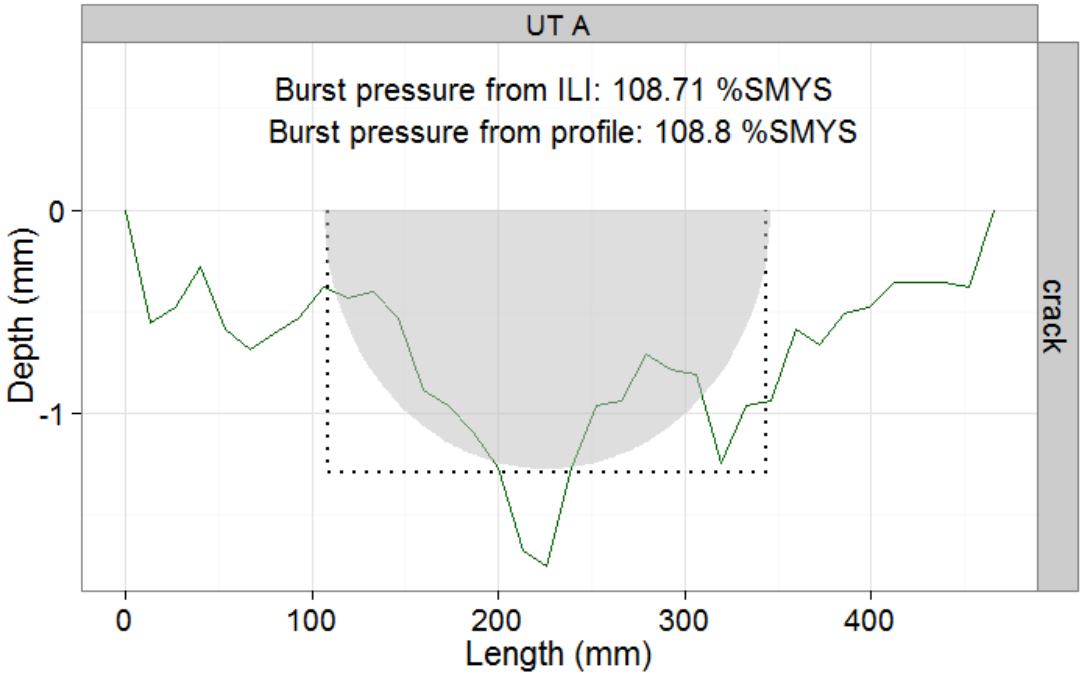
Defect Shape



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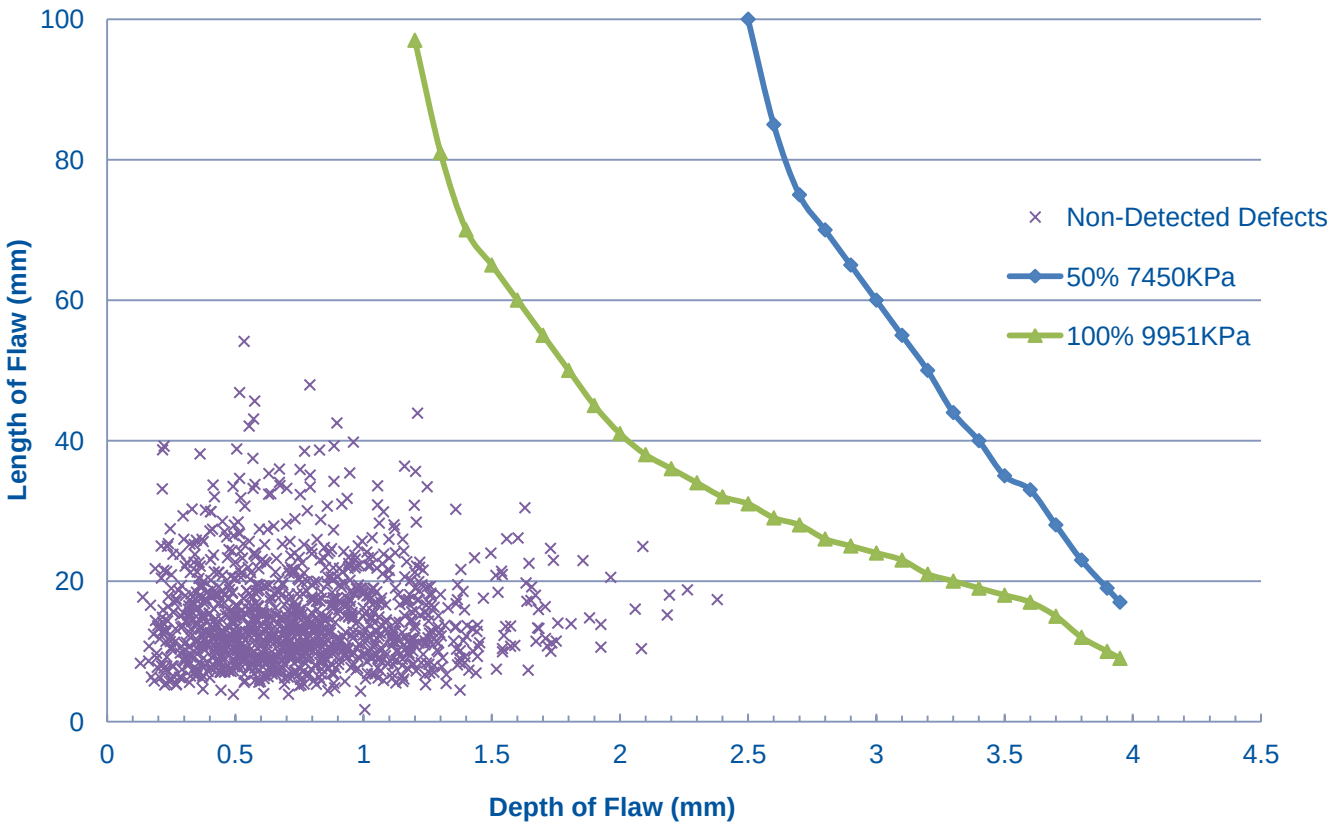
Optimizing Integrity Management



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Thank you!