# Intelligent Pigging Overview

UKOPA seminar 2007

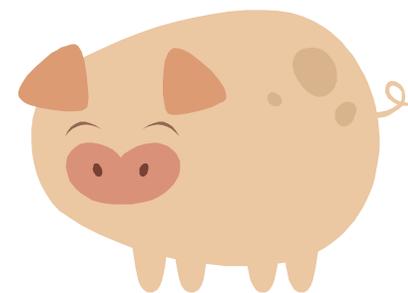# Agenda

- **Why IP**
- **Stages in IP**
- **Types of tools**
- **Issues**
- **Risks**
- **Alternatives**

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# WHY Intelligent pig

**To detect :-**

- **Corrosion and Metal loss features**
- **Dents**
- **Cracks**
- **Leak detection**
- **Orientation**

- **Validation requirement**
- **Life extension**

# Corrosion & Metal Loss


General Corrosion

Laminations


Erosion

Pitting


Gouging



Operators need technology that delivers:
- Accurate sizing
- High discrimination
- Reliable location
- Corrosion growth
- Fitness for purpose

... with minimum disruption
to pipeline operations

# Stages in IP

- **Prove your pipeline can be pigged – Velocity, 3D bends**
    - **Risk assessment – safety, stuck pigs, vents, drains etc**

- **Cleaning**
    - **Wax , Debris , LSA, etc**

- **Deformation Assessment**
    - **Gauge plate, Geometry , Calliper tools**

- **Intelligent pig run**
    - **Magnetic  Flux Leakage (MFL)**
    - **Ultrasonic Testing (UT)**
    - **Other types- Crawlers, Gyroscopic etc**

- **Analysis**
    - **Corrosion growth assessment – comparison between pig runs**
    - **Fitness for purpose assessment**

- **Verification**
    - **Excavate / Spot Dives to confirm**

# Cleaning – debris removal

# Cleaning

# Cleaning- Wax removal

# Primary Inspection Tools - MFL

## Finds
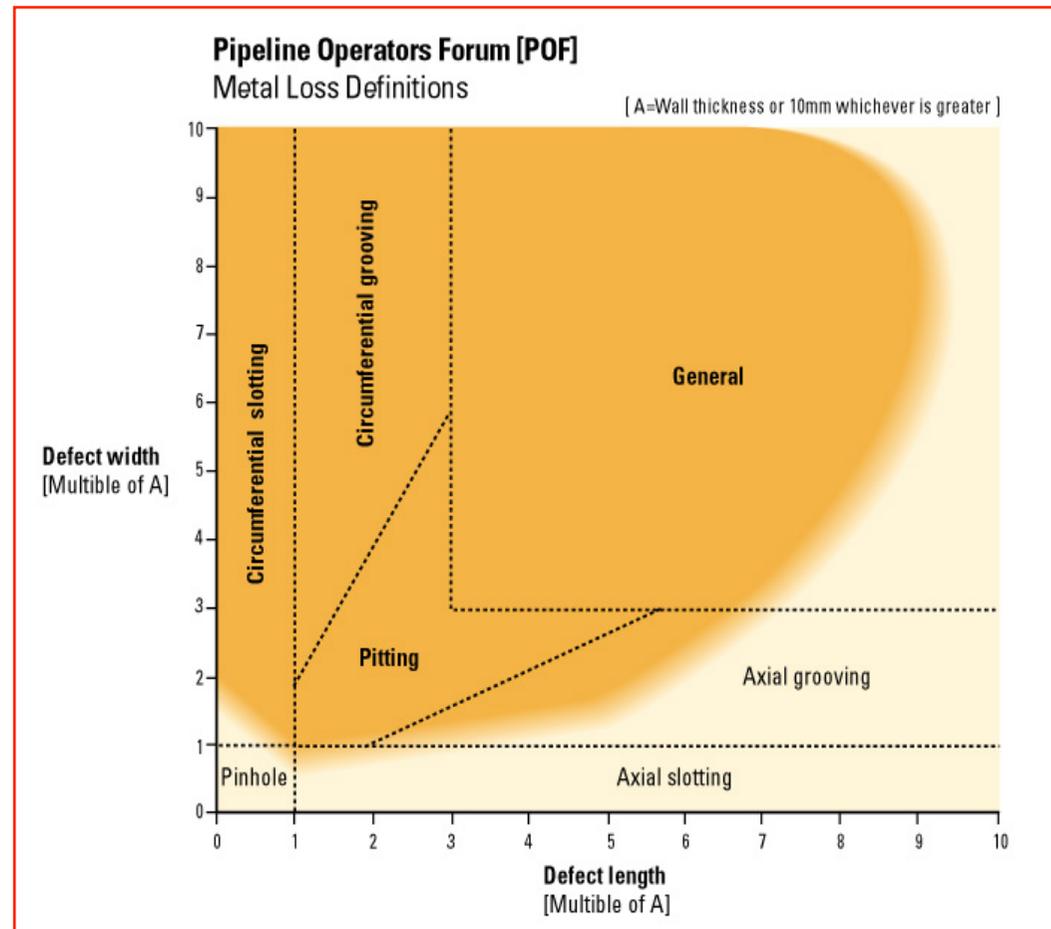- General Corrosion
- Small Pitting
- Girth weld anomalies

## Technology
- Magnetic Flux Leakage technology
- Sets the standard for reliable metal loss detection

## Features
- Gas or liquid, onshore, Subsea
- Coverage of 6" to 56" pipe sizes
- Detects low level & sub-critical metal loss
- 20 years history

**Pipeline Operators Forum [POF]**
Metal Loss Definitions

[ A=Wall thickness or 10mm whichever is greater ]

Defect width [Multiple of A]

Circumferential slotting
Circumferential grooving
General
Pitting
Axial grooving
Pinhole
Axial slotting

Defect length [Multiple of A]

# Primary Inspection Tools - UT

## Finds

- General Corrosion
- Grooving Corrosion
- Mid-wall Defects / Laminations
- Erosion wall thinning
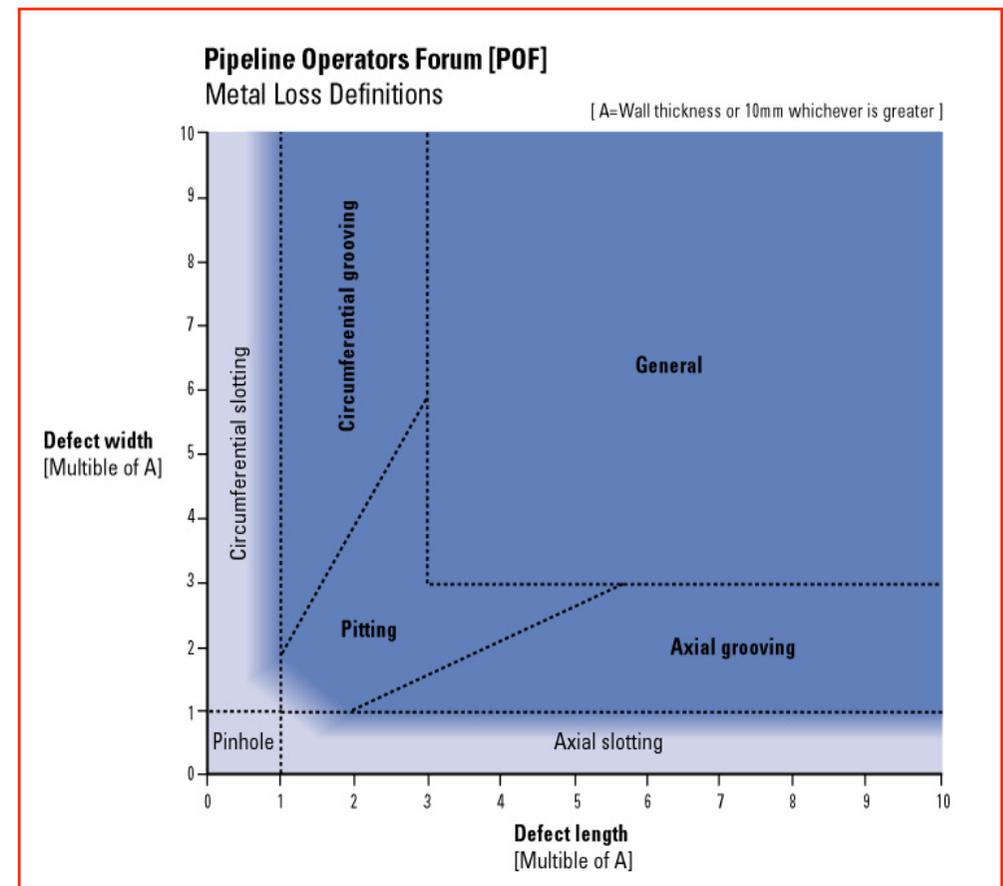- Narrow Axial External Corrosion

## Features

- Higher levels of sizing accuracy compared with MFL
- Coverage 6-56"
- Field proven with over 10 years experience
- Capable of inspecting very thick wall pipe

## Technology

- Needs liquid carrier
- Gives a direct & accurate measure of wall thickness



Pipeline Operators Forum [POF]
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Axial slotting

Defect length [Multible of A]

# Primary Inspection Tools – Axial Inspection

## Finds

- Axial Flaws
- Narrow Axial External Corrosion
- Slotting Corrosion
- Seam Weld defects
- Very Small Pitting

## Technology

- Transverse Field Inspection (variant of MFL)
- Specifically developed to detect narrow axial defects
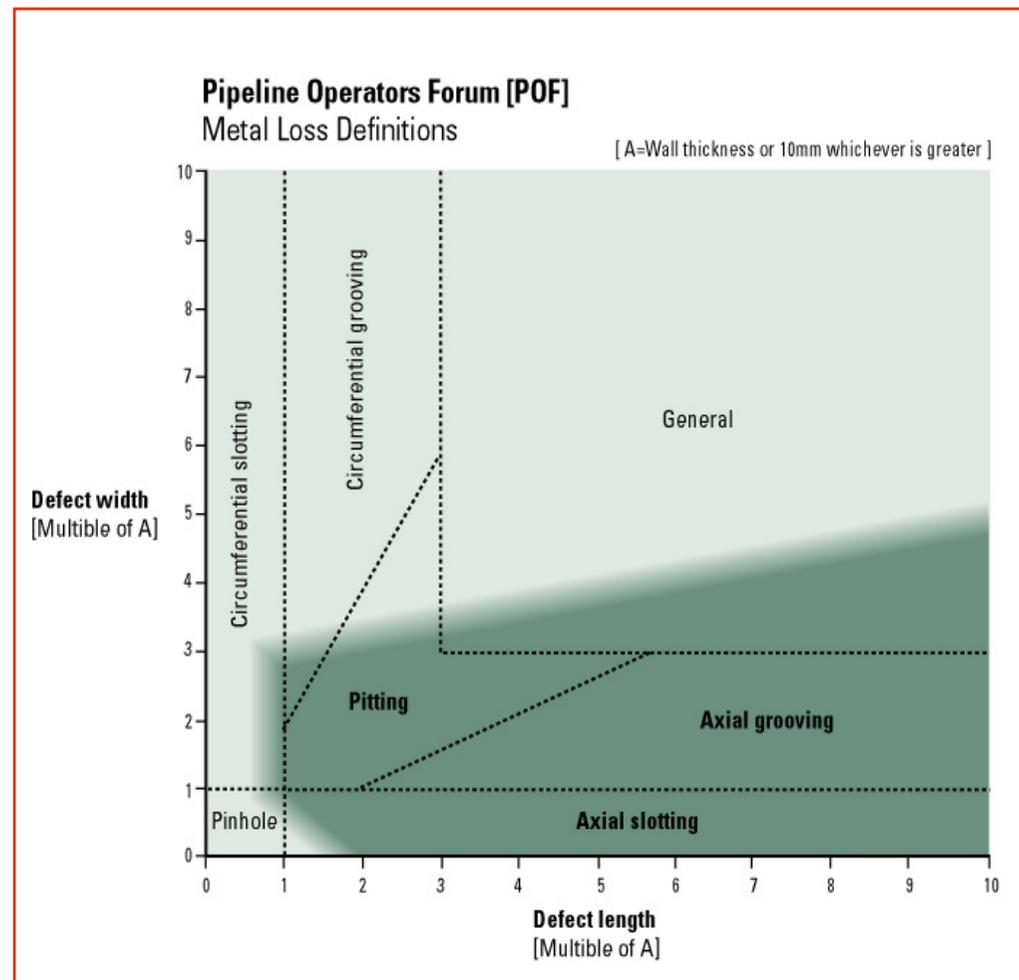
## Features

- Detects very narrow features
- Sensitive to dents & associated metal loss or cracks
- Application versatility – gas or liquid
- Complete size range from 8" to 30"

**Pipeline Operators Forum [POF]**
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Defect width [Multiple of A]

Circumferential slotting

Circumferential grooving

General

Pitting

Axial grooving

Pinhole

Axial slotting

Defect length [Multiple of A]

# Intelligent pigging - Issues

- **Installation of pigging equipment**
    - **Pig Traps – topsides and subsea**
    - **Valves - Double block and bleed. Old pipelines may only have single valves**
    - **Pig traps designed to accommodate IP tool diameter, length, access**
    - **Subsea launchers- Medium to push pig**

- **Cleaning- removal of debris , wax etc**
    - **No. of cleaning runs can be high – do you clean routinely?**
    - **Runs can depend on IP contractors assessment**

- **3D bends required for passage of IP**

- **Max Temperature – 60˚C Min due to electronic equipment**

- **Min flow > 0.3m/s**

# Intelligent Pigging - Issues

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- **Battery life restriction**

  **- long lines**

  **- slow rates of flow**


- **Multi diameter pipeline technology developing**


- **Logistics and support**

  **- helicopters, vessels, disposal of debris / fluids, DSV's**


- **Long time from pig time to results**

  **- can tell if data ok after run but results can take 40 days+**

  **- for consistency should use same contractor for accurate data comparison / analysis**


- **Verification**

  **- excavation of line / Subsea Inspection**

# Risks



"We've considered every potential risk except the risks of avoiding all risks."

# Risks

**The main risks associated with ILI are:**

- **Carrying out modifications to the facility and pipeline to make it piggable**
  - Bends, double isolation valves, pig launchers, drains, vents

- **Introduction of seawater into the pipeline**
  - Dry gas lines need to be dried out on completion

- **Handling of pig traps**
  - Difficult to handle, risk of damaging interface equipment and personnel injury

- **Cleaning the pipeline**
  - Results in removal of protective scales which may encourage further corrosion

- **Providing facilities to collect and store pipeline debris produced by pigging**
  - LSA and storage facilities

# Risks

- **Pipelines that can only be pigged from one end**
  - Reverse flow capability, tethered, crawler pig

- **Ensuring the required data quality from the ILI run**
  - Small deep pits and cracks may be difficult to detect
  - Will not readily detect damage to flanges, gaskets and valves

- **Stuck pigs**
  - Worn disks or cups
  - Debris ahead of the pig
  - Snagging on restrictions; e.g. partially closed valve dent

- **Personnel safety**
  - Exposure of personnel to a hazardous environment

- **Risk to the environment**
  - Risk of accidental spillage of product

- **Managing contingencies**
  - Consider what may happen and have adequate back up; e.g. DSV, 2 IP's tools available

# Alternative Verification Methods

- **Hydro testing**

- **Direct assessment methods**

  - **Corrosion control/ monitoring**

  - **Probes and coupons**

  - **Electrical resistance probes**

  - **Solid particle detection and monitoring**

  - **Galvanic probes etc.**

  - **NDT methods – UT, Long-range guided wave, Eddy Current Systems**

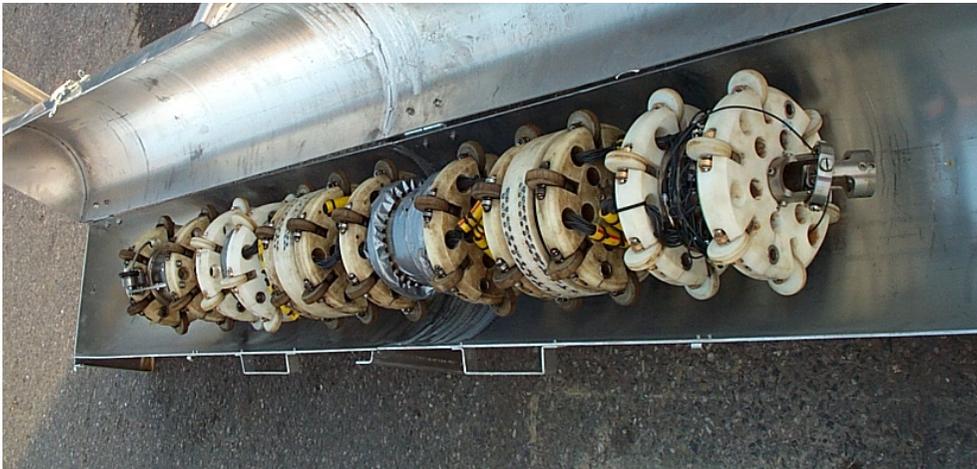  - **Fluid monitoring**

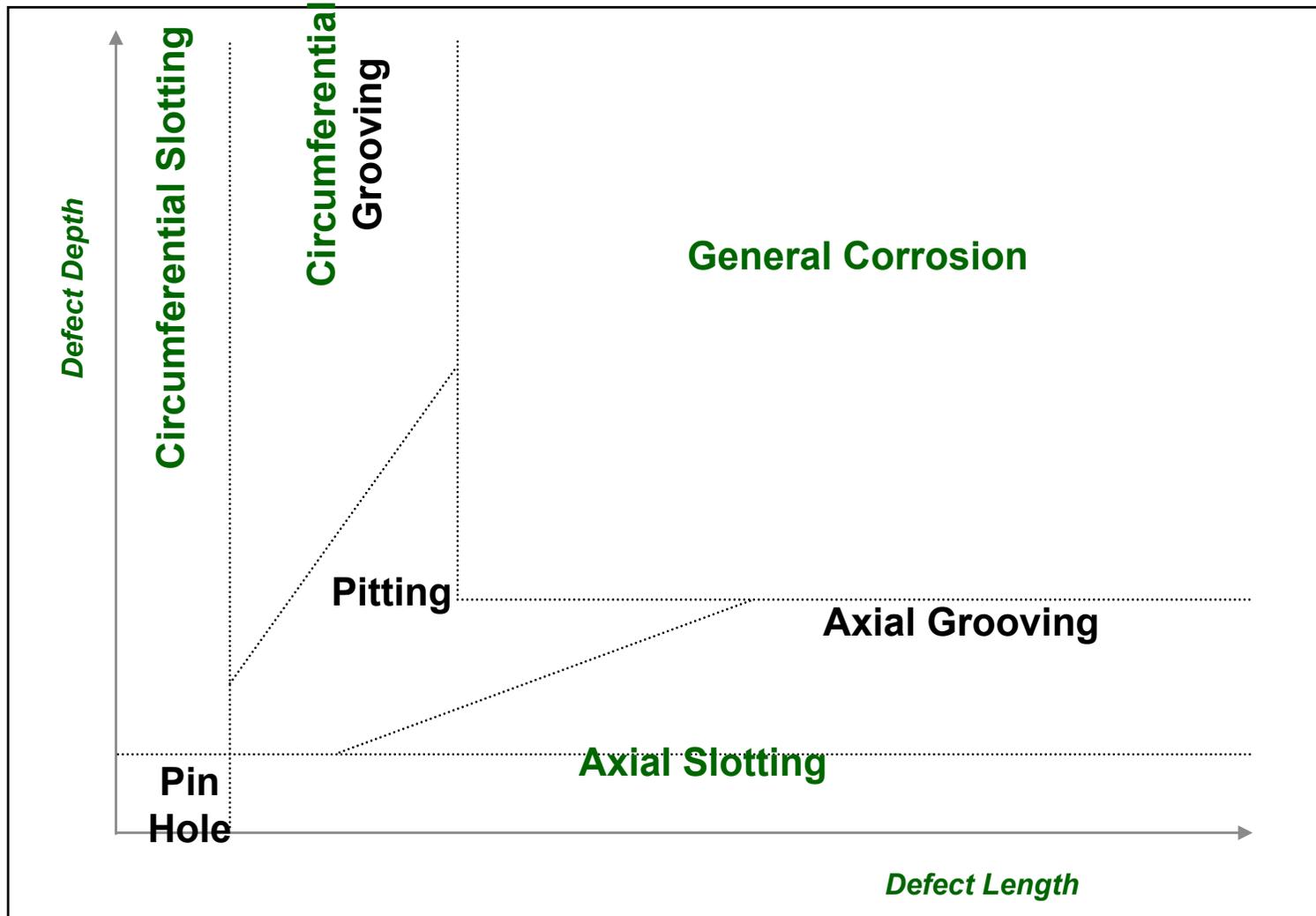# Intelligent pigging

# Intelligent Pig

**Thanks for listening**

# Intelligent pigging

# Corrosion & Metal Loss Characteristics



*Pipeline Operators Forum Chart*