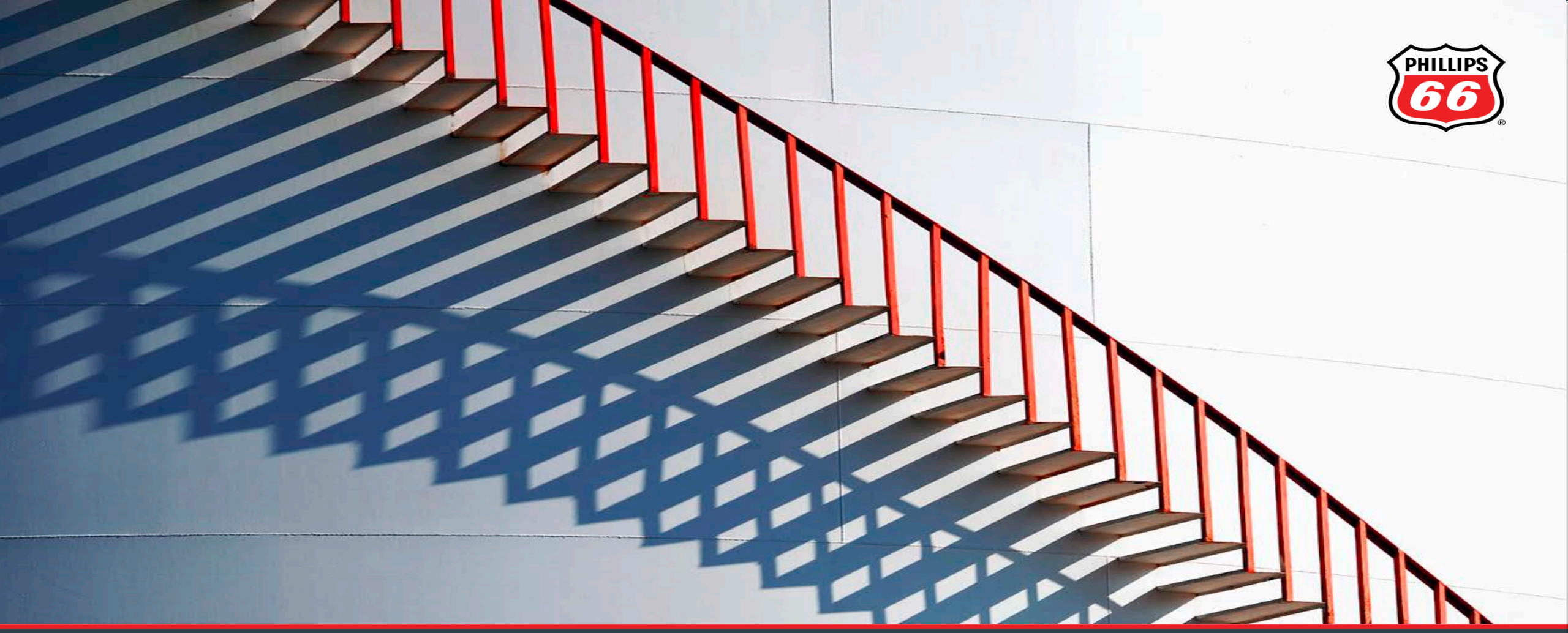


# OPERATOR ASSESSMENT TOOL & GIS IMPLEMENTATION

Use of Integrity Assessment Tool results for Remediation Program

# ASSESSMENT SYSTEM MANAGEMENT

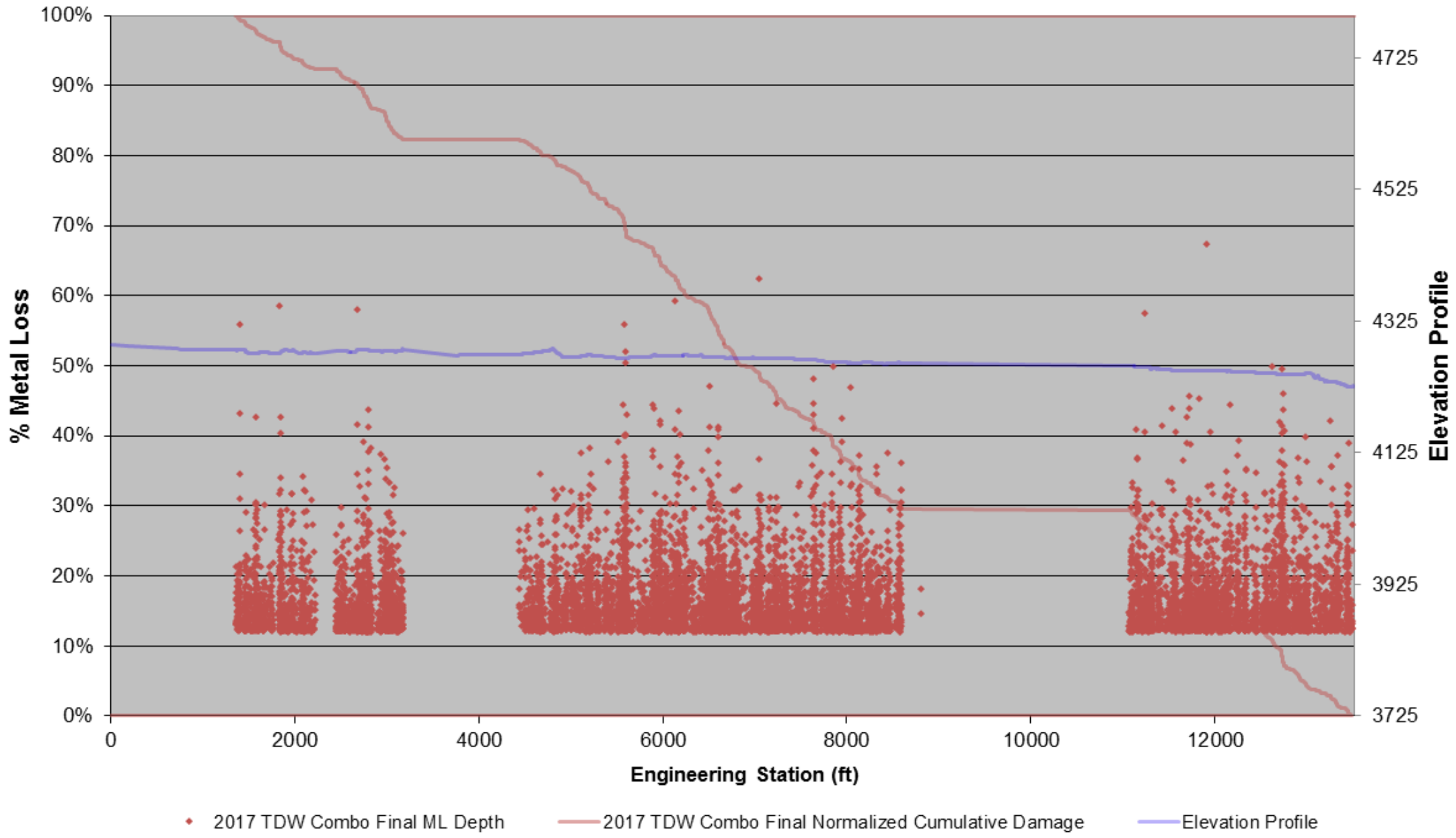
- System life cycle
  - Human Elements
  - Challenges
  - Integration
- Current State
  - Mapping functionality
  - Data Management
    - Timing, resources and challenges
    - Integrity Summary
- Future State
  - Big Data
  - Machine Learning

# SYSTEM LIFE CYCLE

- Technology Selection
  - Threats
  - P/L and Product challenges
- Tool Setup – FEL Data (Questionnaire)
- Asset Assessment Ready
- Tool Run – Temp, Speed & Surges
- Post Run Acceptance
- Vendor Analysis
  - Resources
  - Qualifications
- Prelim Report/Review
  - Qualifications
  - Previous Repairs
- Final Report/Review
  - Qualifications
  - Previous Repairs
- Dig selection (ECA)
  - Excavation and Data Correlation
  - In Ditch qualifications and calibration
  - Locational issues
    - Permitting
    - Land Owners
- Results Review (ILI Vendor/Operator Two way Feedback Loop)
  - How do we use the dig results
  - How does the Vendor use dig the results
  - How do we stack hands on the quality of the dig results

# DATA INTEGRATION

- ILI alignment
  - Joint by Joint
  - Pit by Pit
  - Stationing (usually above ground)
  - Stationing/GPS conversion
  - GPS
- Pertinent data alignment with ILI
  - Previous Repairs, DOC, CIS, PODS, Elevation, Crossings, Blue Line …


100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
% Metal Loss
4725
4525
4325
4125
3925
3725
Elevation Profile
0
2000
4000
6000
8000
10000
12000
Engineering Station (ft)
2017 TDW Combo Final ML Depth
2017 TDW Combo Final Normalized Cumulative Damage
Elevation Profile

| Segmentation | Length (Miles) | HCA (Miles) | Diameter | LINE_TYPE_DESC | REG_BY_DESC | PRODUCT_CLASS_D | IMP_STATUS | LINE_STATUS_DESC |
|---|---|---|---|---|---|---|---|---|
| Station A to Staion B (Jet) | 2.6 | 2.6 | 6 | Transmission - D.O.T. | Dept of Transportation | REFINED PRODUCTS | Y | Active |

| Assessment History | End Date | Method | Tool Technology | Begin Eng'r Station (ft) | End Eng'r Station (ft) | Length (Miles) | HCA Length (Miles) |
|---|---|---|---|---|---|---|---|
| 2017 Station A to Staion B (Jet) | 3/19/2017 | ILI | Deformation, MFL | 0+00 | 135+20 | 2.6 | 2.6 |
| 2012 Station A to Staion B (Jet) | 5/10/2012 | ILI | Deformation, MFL | 0+00 | 135+20 | 2.6 | 2.6 |
| 2007 Station A to Staion B (Jet) | 5/10/2007 | ILI | MFL | 0+00 | 135+20 | 2.6 | 2.6 |
| 2007 Station A to Staion B (Jet) | 5/9/2007 | ILI | Deformation | 0+00 | 135+20 | 2.6 | 2.6 |
| 2001 Station A to Staion B (Jet) | 8/14/2001 | ILI | MFL | 0+00 | 135+20 | 2.6 | 2.6 |
| 1994 Station A to Staion B (Jet) Hydro | 12/31/1994 | Hydro | | 0+00 | 135+20 | 2.6 | 2.6 |

| MOP | | | Elevation Profile | | |
|---|---|---|---|---|---|
| Highest NOP | 273.12 | psi | Minimum Elevation | 4225.09 | feet |
| Lowest NOP | 249.87 | psi | Maximum Elevation | 4289.29 | feet |
| | | | Change | 64.2 | feet |

| Pipe Properties | Diameter | Manufacturer | Wall Thickness | SMYS | Seam Type | Length (Miles) |
|---|---|---|---|---|---|---|
| Station A to Staion B (Jet) | 6.625 | CSI | 0.280 | 42000 | ERW | 0.345 |
| Station A to Staion B (Jet) | 6.625 | CSI | 0.365 | 42000 | ERW | 0.116 |
| Station A to Staion B (Jet) | 6.625 | MAVERICK | 0.280 | 52000 | UNKNOWN | 0.357 |
| Station A to Staion B (Jet) | 6.625 | U.S.STEEL | 0.280 | 42000 | SMLS | 0.258 |
| Station A to Staion B (Jet) | 6.625 | UNKNOWN | 0.280 | 35000 | ERW | 0.450 |
| Station A to Staion B (Jet) | 6.625 | UNKNOWN | 0.280 | 35000 | UNKNOWN | 1.033 |

| Pipe Vintage | Year | Length (Miles) |
|---|---|---|
| Station A to Staion B (Jet) | 1954 | 1.482 |
| Station A to Staion B (Jet) | 2007 | 0.462 |
| Station A to Staion B (Jet) | 2009 | 0.357 |
| Station A to Staion B (Jet) | 2012 | 0.258 |

| Coating Type | Length (Miles) |
|---|---|
| CTE | 1.411 |
| FBE | 1.076 |
| GEOTEX | 0.069 |
| TAPE | 0.002 |

| Number of Casings | Total Length (Feet) | Avg Length |
|---|---|---|
| 4 | 656.00 | 164.00 |

| HCA Type | Length (Miles) |
|---|---|
| Hpa - Direct | 2.559 |
| Opa - Direct | 0.353 |
| Dw - Direct | 2.559 |
| Hpa - Indirect | 2.559 |
| Opa - Indirect | 0.353 |
| Dw - Indirect | 2.559 |

| | |
|---|---|
| ANC | Station A to Staion B (Jet) |
| Assessment Name | 2017 Station A to Staion B (Jet) |
| Tool Run Name | 2017 TDW Combo Final |
| Tool Run Date | 3/14/2017 |

mmary of Tool Run Features

| Metal Loss Anomalies | External | | Internal | | Manufacturing | | Totals | |
|---|---|---|---|---|---|---|---|---|
| | ILI | After | ILI | After | ILI | After | ILI | After |
| d/t < 20% WT | 7549 | 7549 | 2297 | 2297 | 2 | 2 | 9848 | 9848 |
| 20% WT <= d/t < 30% WT | 1526 | 1526 | 815 | 815 | 0 | 0 | 2341 | 2341 |
| 30% WT <= d/t < 40% WT | 231 | 231 | 97 | 97 | 0 | 0 | 328 | 328 |
| 40% WT <= d/t < 50% WT | 51 | 51 | 20 | 20 | 0 | 0 | 71 | 71 |
| 50% WT <= d/t < 60% WT | 8 | 8 | 4 | 4 | 0 | 0 | 12 | 12 |
| 60% WT <= d/t < 70% WT | 2 | 2 | 1 | 1 | 0 | 0 | 3 | 3 |
| 70% WT <= d/t < 80% WT | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| d/t >= 80% WT | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Seam Weld Metal Loss < 20% | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Seam Weld Metal Loss > 20% | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Totals | 9367 | 9367 | 3234 | 3234 | 2 | 2 | 12603 | 12603 |

| Failure Pressures and Deepest Pits | ILI | After |
|---|---|---|
| Reported deepest external metal loss (%WT) | 67% | 48% |
| Reported deepest internal metal loss (%WT) | 61% | 37% |
| Calculated lowest SOP | 0 | 0 |
| Calculated lowest Burst Pressure | 0 | 0 |

| Seam Weld Anomalies | Total | After |
|---|---|---|
| SWA-A | 0 | 0 |
| SWA-B | 0 | 0 |
| SWA | 0 | 0 |

| Deformation Anomalies | Total | After |
|---|---|---|
| Dent Depth > 6% OD | 0 | 0 |
| Dent Depth ≤ 6% OD | 224 | 224 |
| Dent Depth ≥ 2% OD with metal loss/crack | 0 | 0 |
| Dent Depth < 2% OD with metal loss/crack | 0 | 0 |
| Dent Depth ≥ 2% OD affecting weld | 0 | 0 |
| Dent Depth < 2% OD affecting weld | 0 | 0 |
| Girth weld anomalies | 0 | 0 |
| Wrinkle bends | 0 | 0 |

| Crack Anomalies (Depth) | Crack-Like | | Crack Field | | Notch-Like | | Mid Wall (Lamination/ inclusion) | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|
| | ILI | After | ILI | After | ILI | After | ILI | After | ILI | After |
| 0.040" - 0.079" | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0.08" - 0.119" | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0.12" - 0.159" | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ≥ 0.16" | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| No depth | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Total** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

**Results/Comment/Recommendation:**

1. 14 anomalies repaired using Type B, 0 anomalies using composite sleeves, 7 anomalies using recoat, and 0 anomalies using pipe replacement.
2. The result shows that the ILI tool is within/out the tool's tolerance specification. No further anomalies need to be investigated.
3. The result shows that the ILI tool is undercalled/overcalled, however, adding XX% in the tool tolerance, no anomalies meet conditions for further evaluations.
4. The result shows that the ILI tool is undercalled/overcalled, and by adding XX% in the tool tolerance, XX anomalies meet conditions for further evaluations.

| | | | |
|---|---|---|---|
| Division: | All Divisions | Actual Depth (%): | All Values |
| Vendor: | All Vendors | Pipe Diameter: | 3.500 - 42.000 |
| Anomaly Type: | All Anomaly Types | Vendor Call Depth (%): | All Values |
| Wall Thickness (in): | 0.125 - 0.5 | Assessment End Range: | 2001 - 2016 |

Division
All values

Vendor
All values

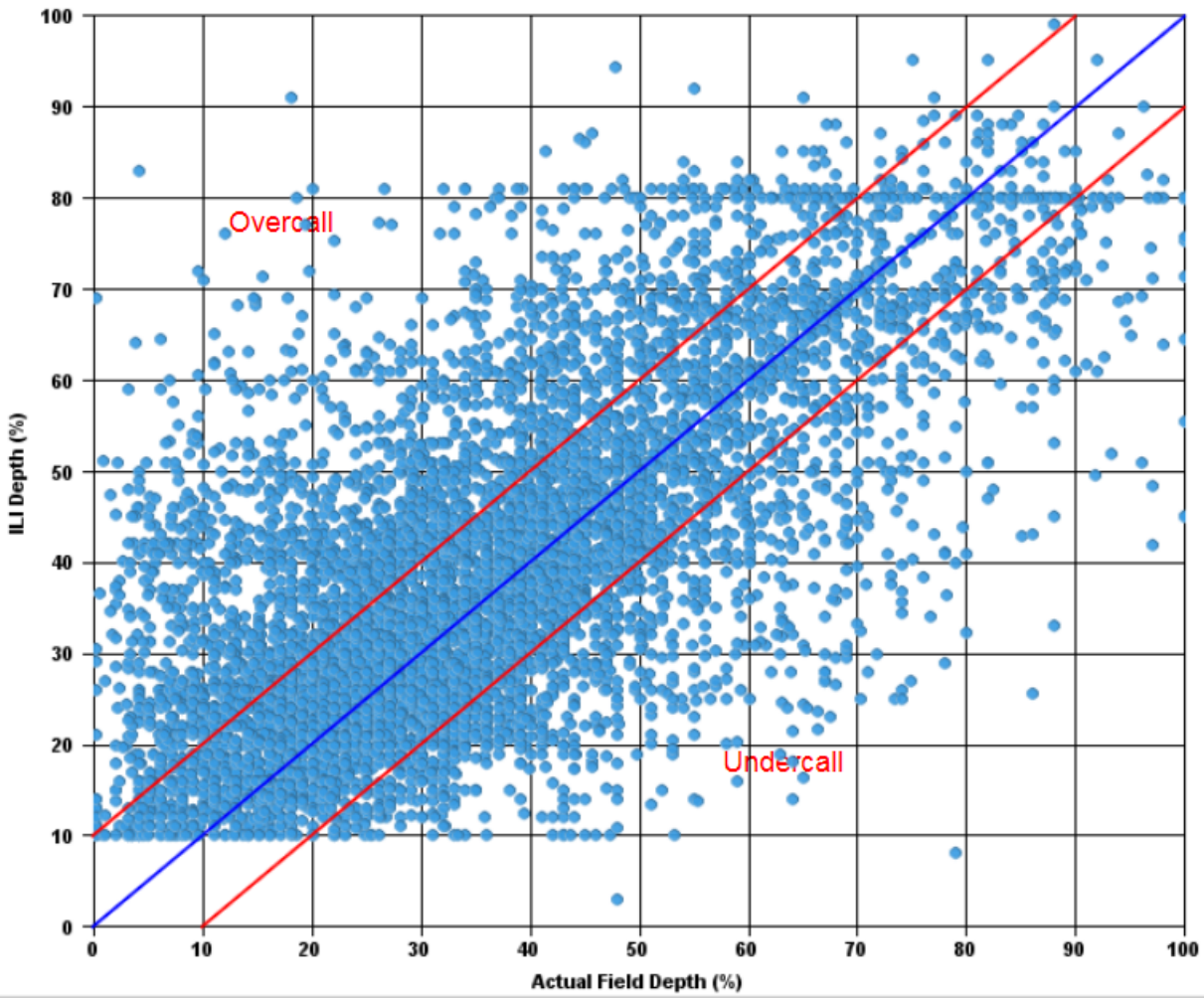
Anomaly Type
All values

Actual Depth (%)
All values

Vendor Call Depths (%)
All values

Anomaly Subclass
- [x] Select (All)
- [x] Axial Grooving
- [x] Axial Slotting
- [x] Circumferential Grooving

Pipe Diameter
- [x] Select (All)
- [x] 3.5
- [x] 4.5
- [x] 6.625




| Upper one-sided 95% confidence bound of ILI Tool Tolerance (for 80% certainty) |
|---|
| 14.90% |
| **Entire Population/ Samples** |
| 7,449 |

Unity Plot - Graph | Unity Plot - Data

Assessment End Year
- [x] Select (All)
- [x] 2001
- [x] 2003
- [x] 2004

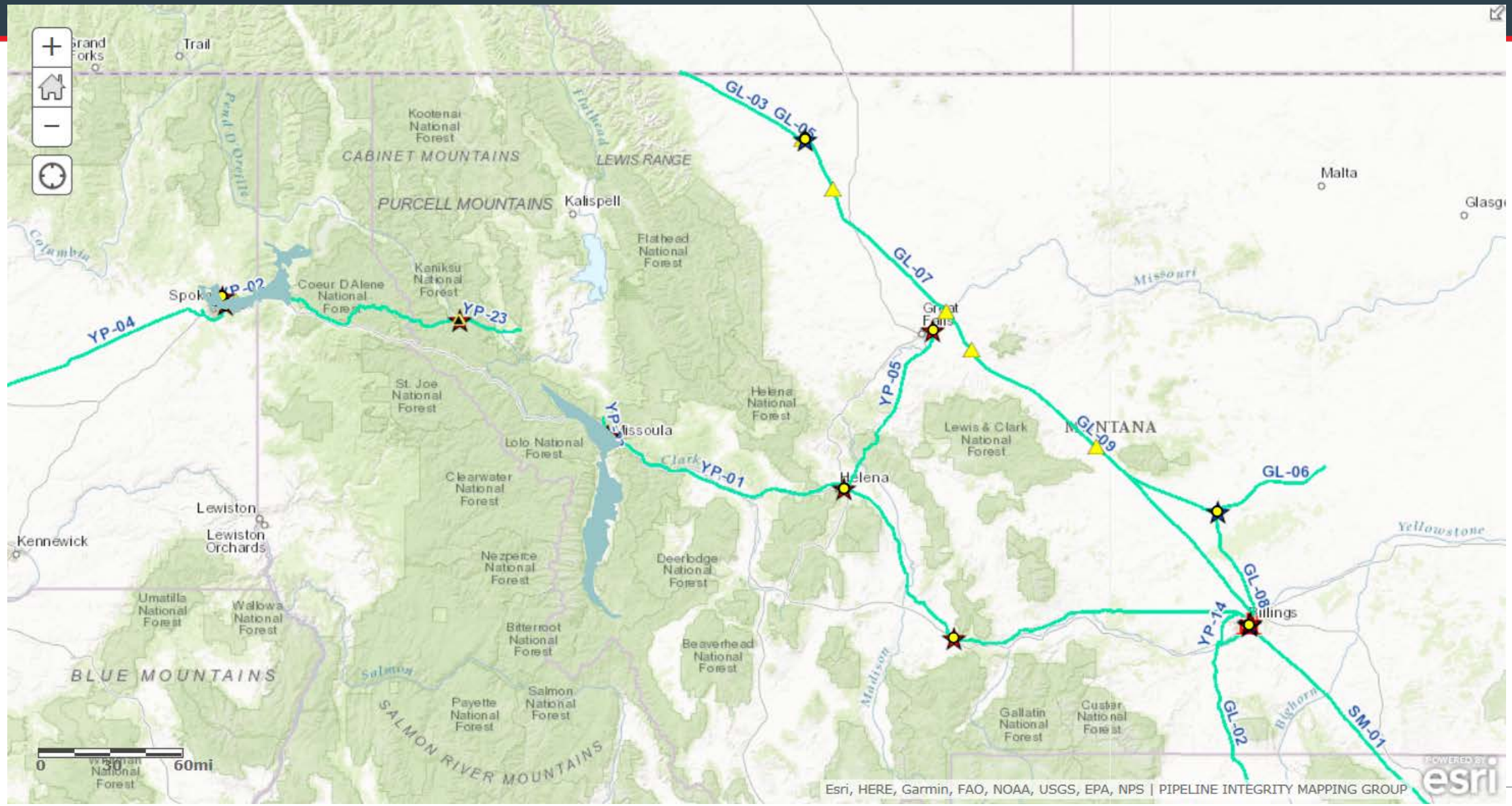
Wall Thickness
- [x] Select (All)
- [x] 0.125
- [x] 0.148
- [x] 0.156

Technology List
- [x] Select (All)
- [x] Deformation
- [x] Deformation, MFL
- [x] Deformation, MFL, Spiral MFL

Priority Code
- [x] Select (All)
- [x] 1005A
- [x] 1005B
- [x] 1005C

ANC
- [x] Select (All)
- [x] AM08
- [x] BC01

# Real Time Excavation Desktop



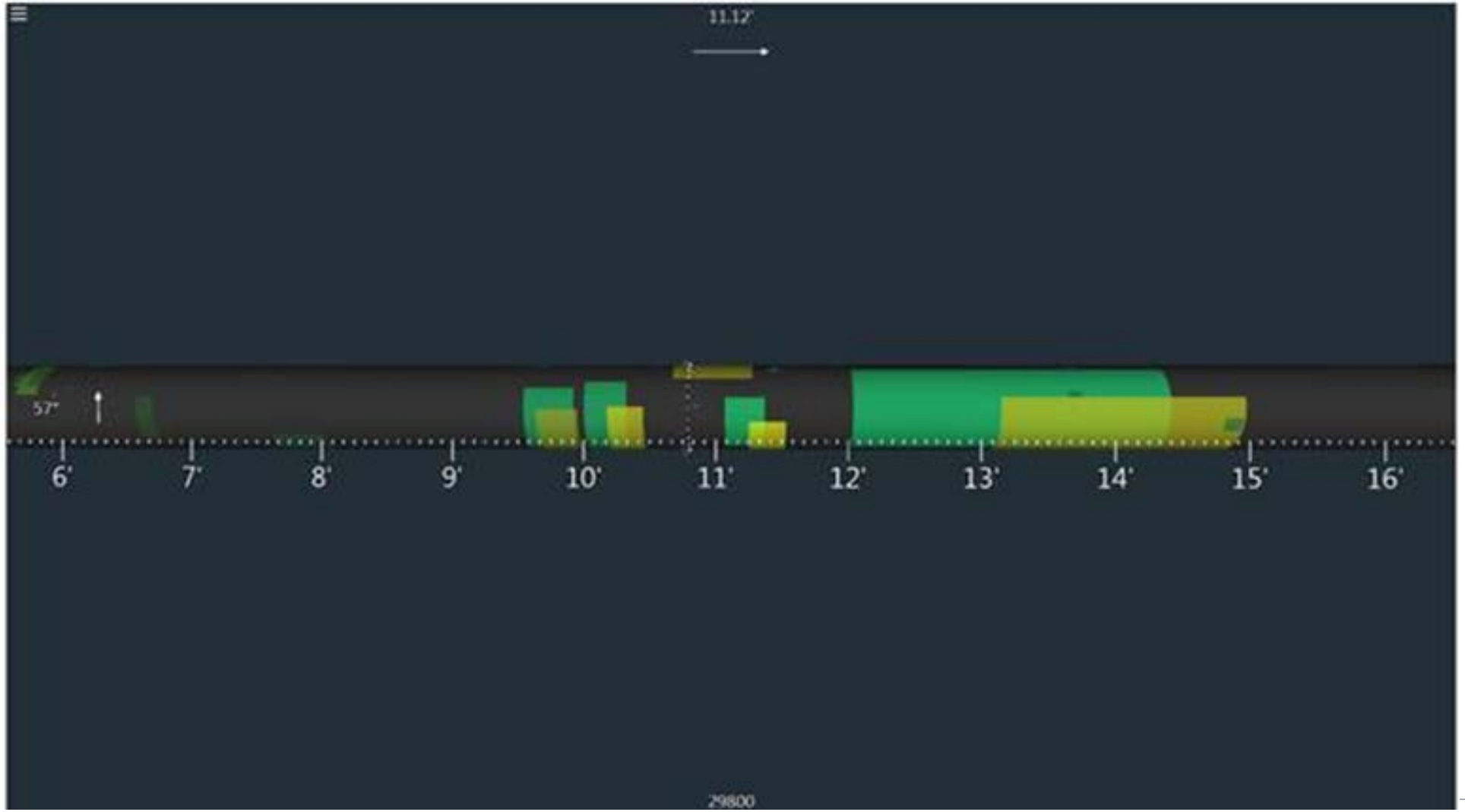
# P66 - Identified HCA

# COGNITIVE INTEGRITY MANAGEMENT

- The ability to normalize data by standardizing and validating its accuracy so that any insight created is associated with a higher level of confidence.
- The ability to learn and capture threats to the integrity of our assets and **share that knowledge algorithmically** without sharing the data.
- And most importantly, the ability to surface the business intelligence needed to act on these threats in a user-friendly way with 3D representations of these threats as they pertain to our assets.

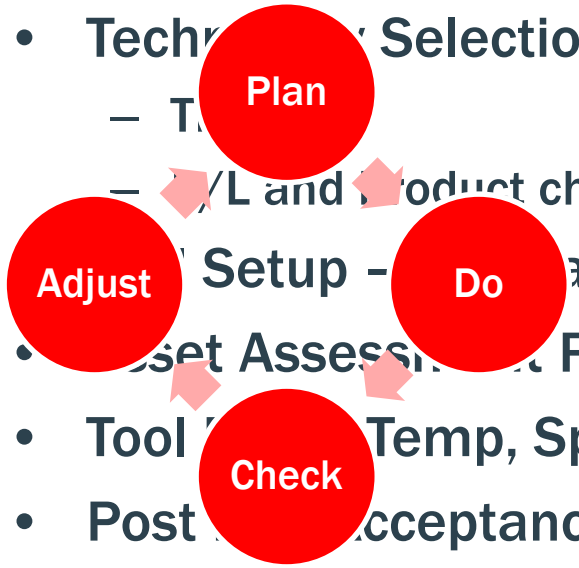
MACHINE LEARNING

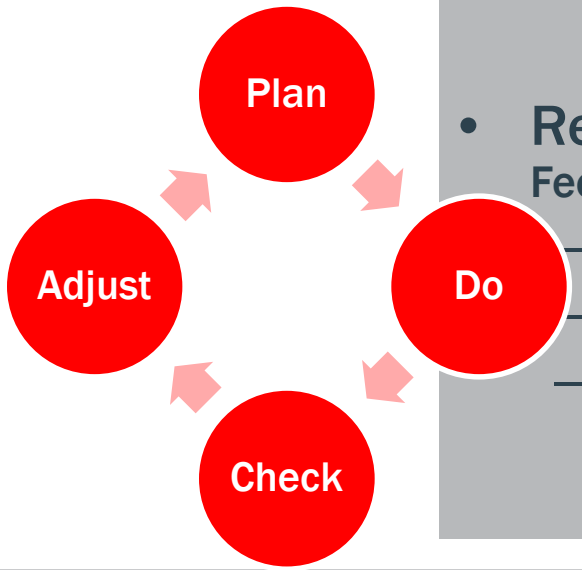
# ILI MATCHING, BIG DATA AND MACHINE LEARNING

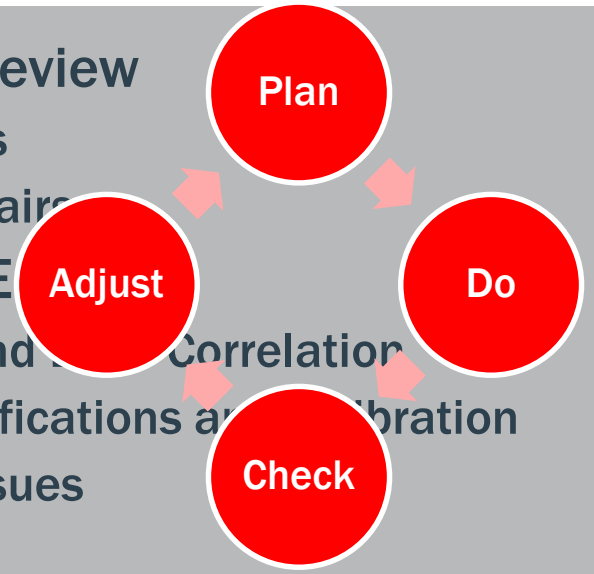


# MANAGEMENT SYSTEM LIFE CYCLE

- Techn[illegible] Selection
  - T[illegible]
  - [illegible]/L and [illegible]oduct challenges
- [illegible] Setup - [illegible]ata (Questionnaire)
- [illegible]set Assess[illegible] Ready
- Tool [illegible] Temp, Speed & Surges
- Post [illegible]cceptance
- Vendor Analysis
  - Resources
  - Qualifications
- Prelim Report/Review
  - Qualifications
  - Previous Repairs




- Final Report/Review
  - Qualifications
  - Previous Repair[illegible]
- Dig selection (E[illegible]
  - Excavation and [illegible] Correlation
  - In Ditch qualifications a[illegible]ibration
  - Locational issues
    - Permitting
    - Land Owners
- Results Review (ILI Vendor/Operator Two way Feedback Loop)
  - How do we use the dig results
  - How does the Vendor use dig the results
  - How do we stack hands on the quality of the dig results