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API Data Integration Support

RISK MODEL WORK GROUP MEETING

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811 Know what's below. Call before you dig.

Outline

- Overview of the applicable API docs
- Review of the roles of each document as it pertains to data integration
- **Unbundling API TR 1178 Integrity Data Management and Integration**
- Next API data integration initiatives

The collection of API documents supporting Integrity and related to Data Integration

- **API RP 1173: Safety Management System**

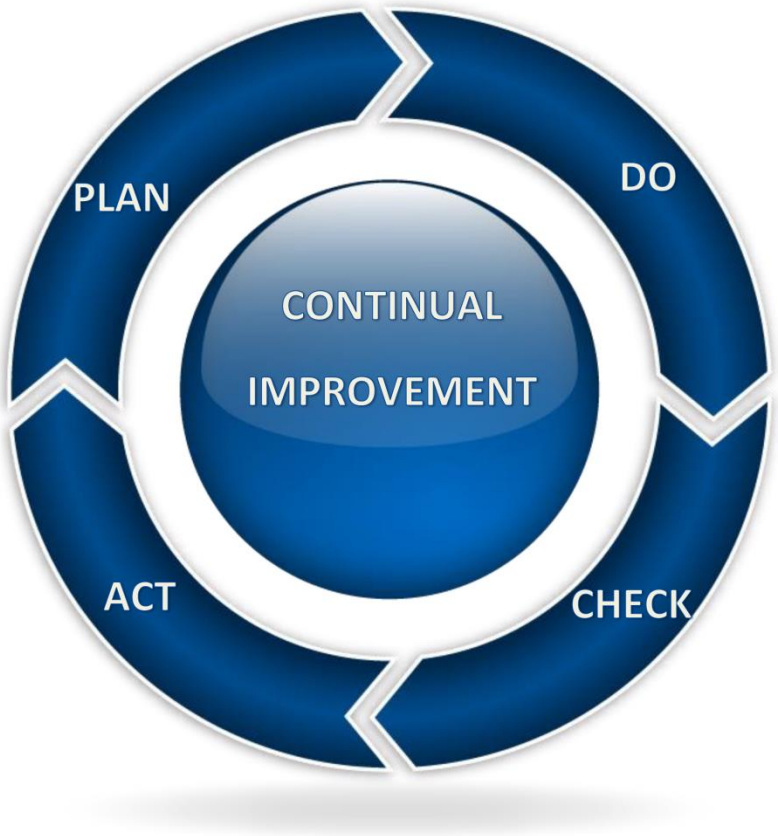
- **API RP 1160: Integrity Management**

  - API TR 1178: Integrity Data Management and Integration
  - API RP 1176: Assessment and Management of Pipeline Cracking
  - API RP 1133 Managing Hydro-technical Hazards

API RP 1173: Safety Management System

- Outlines framework of supporting processes
  - Defines the PDCA workflow
  - Management of change
  - Performance metrics
  - Etc.

Previously released



API RP 1160: Integrity Management

- Maps integrity process into the PDCA workflow
- Maps to supporting RP's and TR's
- Provides guidance and direction regarding integrity processes
- Applicability targets hazardous liquid pipelines in US jurisdiction
  - Equivalent to ASME B31.8S and CSA Z662
  - Designed to facilitate incorporation by reference into CFR 195

Scheduled for ballot 2017

API RP 1160: Integrity Management (in process version)

- delineates threat management vs risk assessment
  - Threat management is process of determining applicability of a threat, appropriate assessment technique and prescribed remediation
  - Risk is broader consideration of POF and consequence, to drive consideration of additional preventative and mitigative measures where practicable
- threat interaction
  - Likely threat interactions and associated considerations
- data sets to be integrated
  - Reiterates the listing proposed in the retracted new hazardous liquid rule
- risk management
  - Broadly discusses role of data in risk process
- response criteria
  - Addresses input uncertainties

Supporting RP's and TR's

- Focused on specific aspects of pipe integrity
- A compilation of experience, learnings and practices
- Typically designed to be implemented as applicable - *not everything applicable to every pipeline operator*
- To the extent possible, designed to be applicable to hazardous liquid and gas pipelines in any jurisdiction

Status of Supporting RP's and TR's

- API RP 1176: Assessment and Management of Pipeline Cracking

  previously released

- API RP 1133 Managing Hydro-technical Hazards

  To be released shortly (all balloting and approvals completed)

- API TR 1178: Data Management and Integration

  To be released shortly (all balloting and approvals completed)

API RP 1176 Assessment and Management of Pipeline Cracking

- Interpretation of data to determine crack susceptibility
- Guidance on applicability and interpretation of ILI data
- Guidance regarding in ditch processes in terms of fitness for purpose assessments and ILI correlation

API RP 1133 Managing Hydro-technical Hazards

- Inventories data sets that are available to support assessing this threat
- Addresses interpretation of these datasets

API TR 1178 The Data Management and Integration Guideline

- **1178 empowers informed decisions by facilitating a dataset that is**
  - accurate, and
  - comprehensive
- **Addresses PHMSA's statement that**,

  "the ability to integrate and analyze threat and integrity data from many sources is essential for sustaining performance and a proactive IM program."
- **How that data should be interpreted is largely left to other industry documents such as API 1160, 1176 and 1163**

Unbundling API TR 1178

5 Data Quality
6 Transforming SME Knowledge into Data ½ pages
7 Data Models ½ pages
8 GPS Coordinates
9 Alignment for the Purpose of Pipeline Integrity
10 Sources of Measurement Error
11 Management of Change
12 ILI Lifecycle
13 Execution of Digs/Field Data Collection
14 As-Built Asset Integration
15 Over-the-Line Surveys (Indirect Assessments)
16 Operational Data
17 Reporting and Data Mining

Annex A (informative) Data Integration and Interpretation Report
Annex B (informative) Representative Data Listing

5 Data Quality

- **5.1 General**
- **5.2 Objectives**
- **5.3 Strategies and Policies**
- **5.4 Data Governance**
- **5.5 Data Quality Assessment**

5 Data Quality

- **5.2 Objectives**
  - Accuracy: The data represents reality.
  - Completeness: All needed data is available.
  - Consistency: The data is free of internal conflicts.
  - Precision: The data is as exact as is needed.
  - Granularity: The data is kept and presented at the right level of detail to meet the needs.
  - Timeliness: The data is as current as needed and is retained until no longer needed.
  - Integrity: The data is structurally sound.
  - Usability: The data is accessible, understandable, and navigable

8 GPS Coordinates

8.2 Coordinate Nomenclature

N 29 50.30 W 95 50.50 vs N 29.5030 W 95.5050

8.3 Datum Selection

100 + datums

8.4 Accuracy

measurement error

8.5 Base Station Elevation

Vertical discontinuities

9 Alignment for the Purpose of Pipeline Integrity

9.2 Linear Referencing

9.3 Weld Alignment

9.4 Centerline

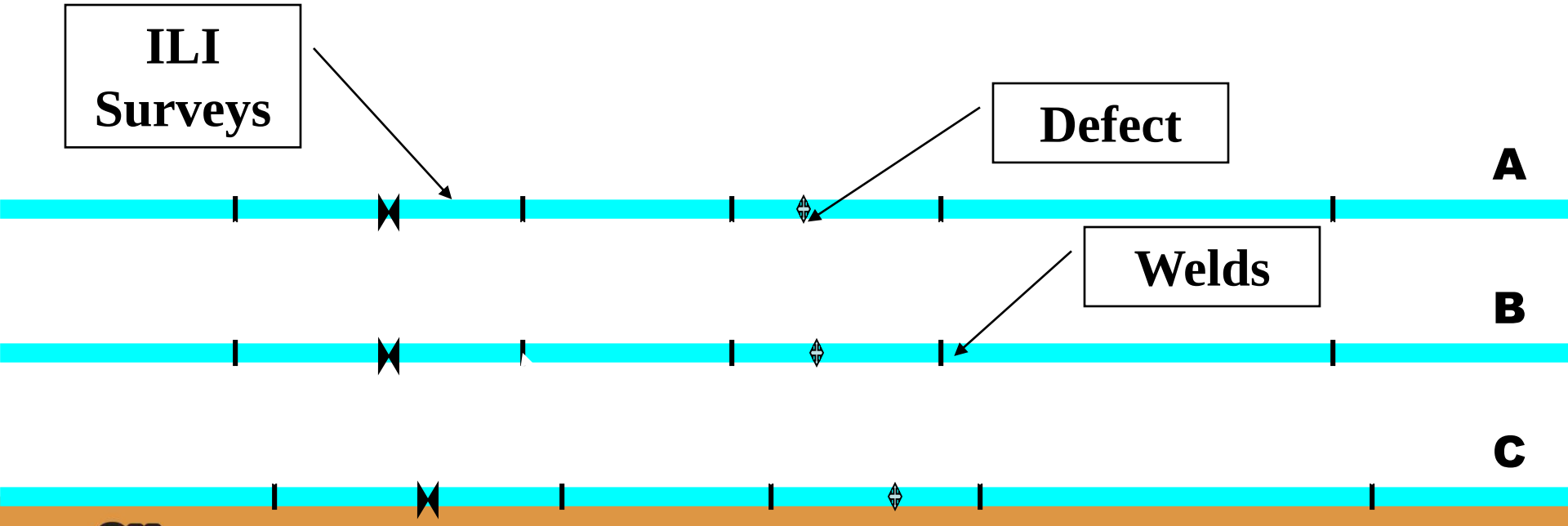
9.5 Axial Position and Extent

9.6 Circumferential Position

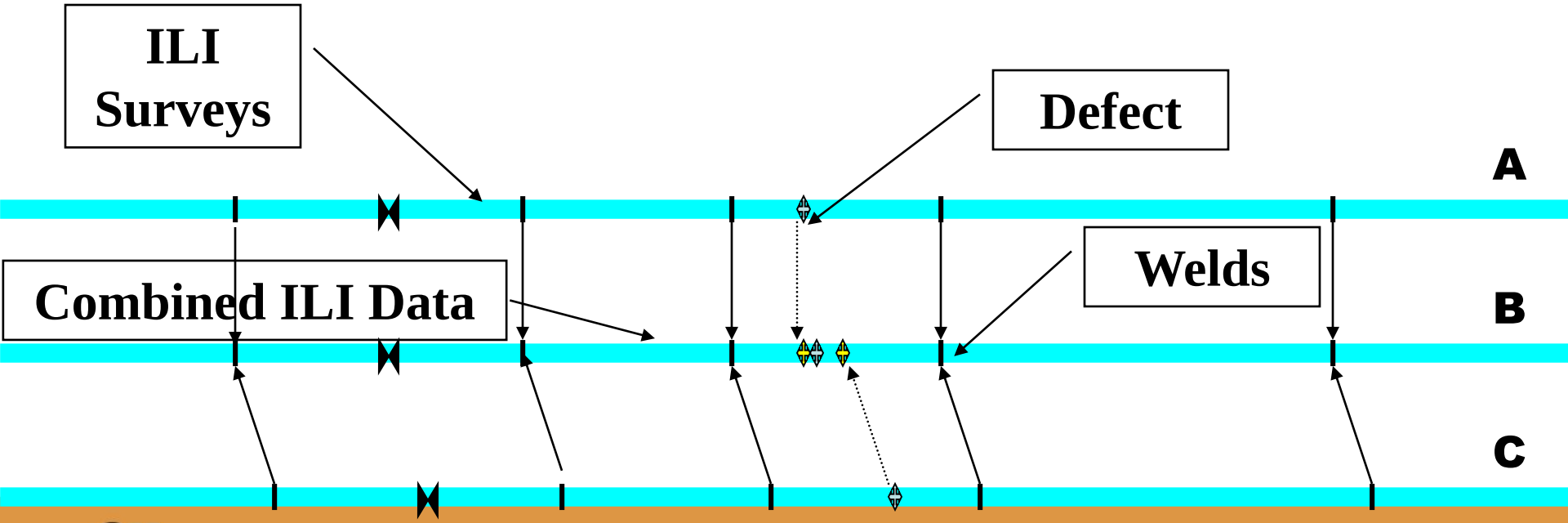
Weld Alignment

- **Multiple ILI Run Integration - ILI to ILI**
  - Automation
  - Leverage welds alignments to position ILI on centerline
- **Excavation to ILI**
- **Hydrostatic Test sections tied to welds**
- **Pipe properties tied to welds**

Multiple ILI Run Integration



Multiple ILI Run Integration



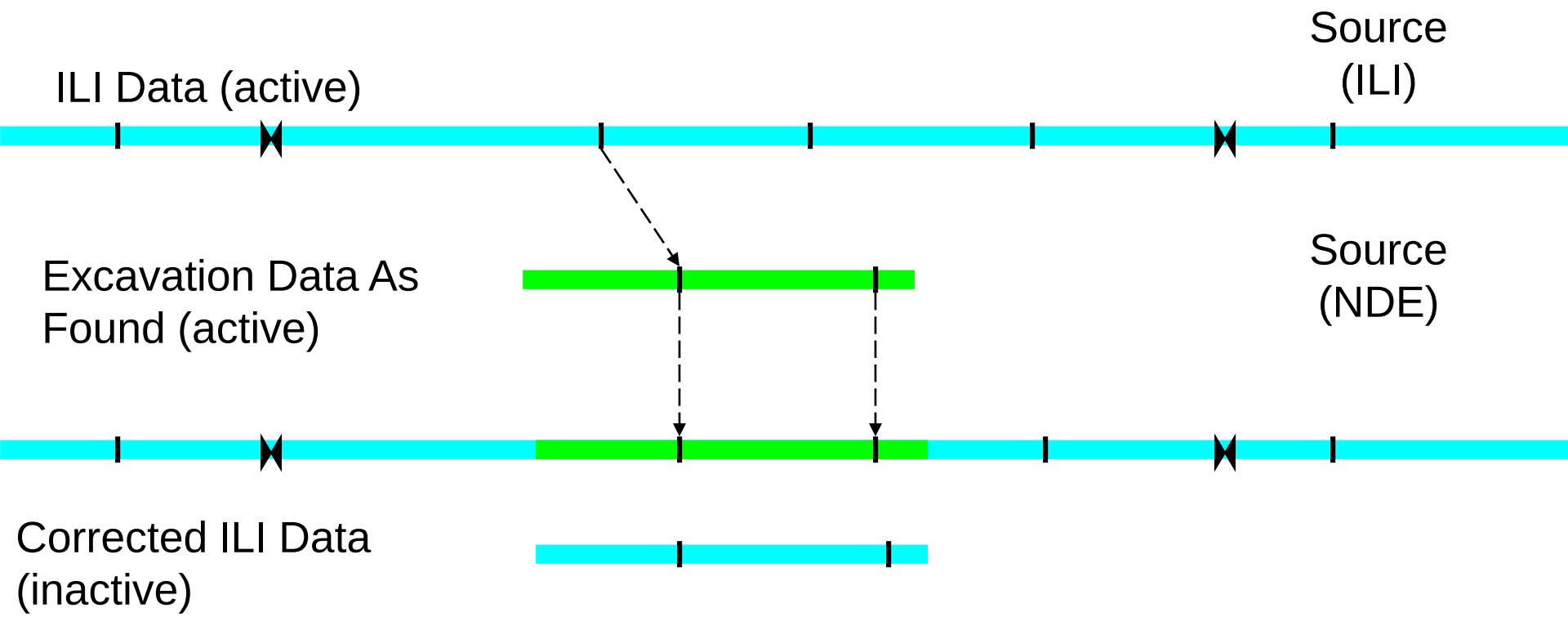
ILI to ILI Automation

- **Assign reference matches**
  - Manual
  - Pattern recognition
- **Expand out from reference matches**
  - Error buffers
  - Distance constraints

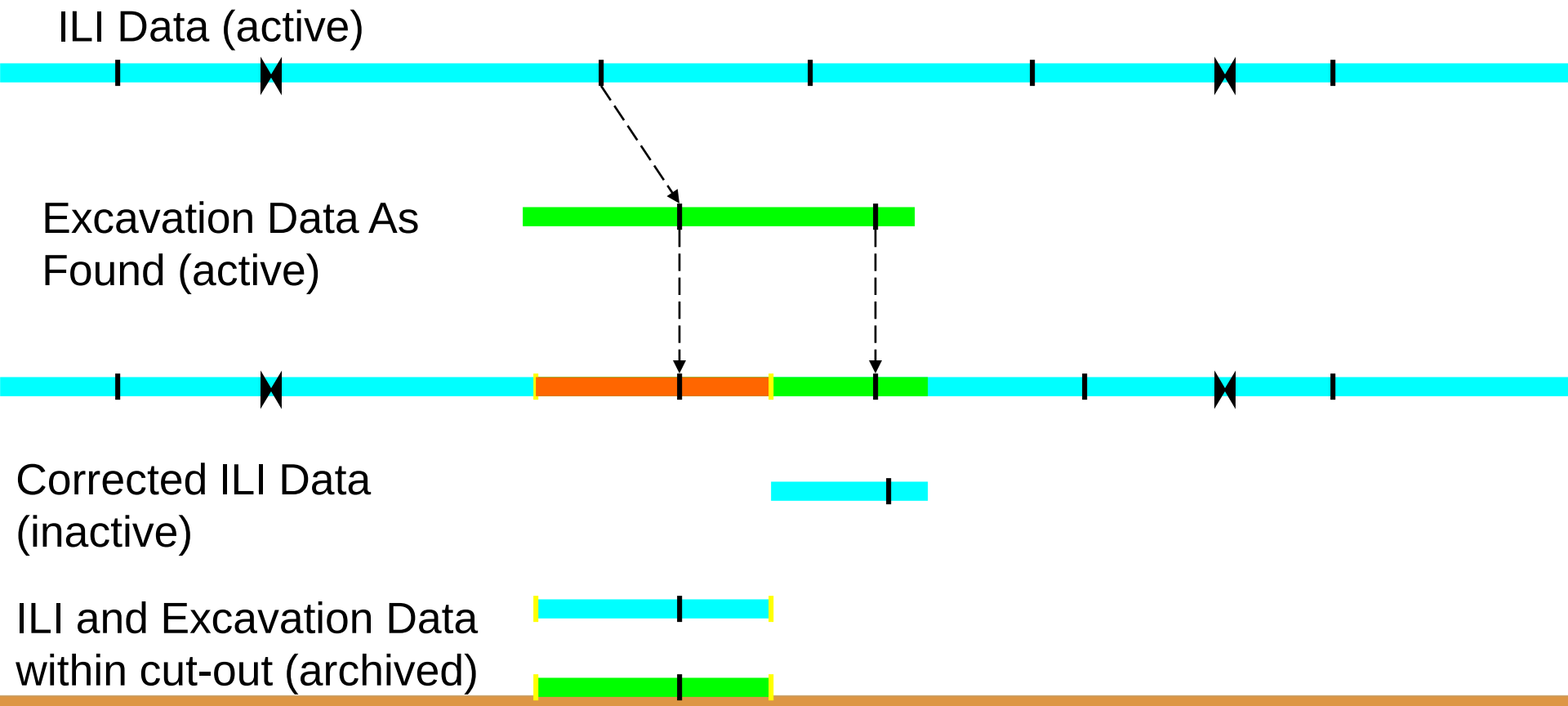
ILI to ILI Challenges to Effective Threat Interaction

- **Considerations**
  - Reversed flow
  - Standardizing frames of reference (leading vs center)
  - Normalized terminology across platforms and vendors
  - Multiple versions of same ILI
- **Isolated Utilization**
  - Only supported as ILI pairs
  - Alignment/integration not persisted
  - Weld alignment not used to position ILI features in space or on centerline

Excavation to ILI Integration



Excavation to ILI Integration



Hydrostatic Test sections tied to welds

- **Station based references can lead to discontinuities in data**
  - Gaps
  - Overlaps
- **Tie-in weld references**
  - Explicit alignment to welds
  - No gap or overlaps due to linear references
  - Unequivocal resolution against ILI data

- Need projects to provide this mapping
  - Easy at time of construction

Pipe attribution tied to welds

- **Certain properties can only transition at a weld**
  - Manufacturer
  - Material properties - SMYS
  - Wall thickness
- **Avoids inconsistencies between ILI and enterprise data**
  - Fitness for purposes assessments
  - Some attributes not typically discerned by ILI
- **Supports MOC for weld locations**
  - Welds not were anticipated when excavated
  - Using universal station/measure based references makes it difficult to unbundle realignment of different data sets

12 ILI Lifecycle

12.2 General Reporting Requirements

12.3 Data Quality Letter and Preliminary Report

12.4 Immediate Responses

12.5 ILI Final Report Format

12.6 Quality Assurance of Final Report before Acceptance

12.7 Anomaly Assessment

12.8 Excavation Program

12.9 Provide Correlation Results to ILI Vendor

12.10 Program Closeout and Establishment of Reassessment Intervals

14 As-Built Asset Integration

14.1 General Data Requirements
14.2 GPS Survey
14.3 Data Collection
14.4 Virtual Pipeline Creation
14.5 Data Storage
14.6 Continuity of Linear Referencing Schema
14.7 Baseline In-Line Inspection
14.8 Baseline Indirect Assessments

Annex A Data Integration and Interpretation Report

A.5 Threat Matrix and Interpretive Methodologies

Table 4 provides a matrix of threats matched with relevant interpretive and QC methodologies.

Table 4—Threat Matrix and Interpretive/QC Methodologies

ID	Threat	Description	Data Source	Specific Attributes Used	Sensitivity to Spatial Alignment	Criteria	Interpretive Methodology	QC Methodology
1	ANY	Threat Integration	ILI tool data (Deformation, MFL, CMFL, Ultrasonic ML, and Ultrasonic Crack)	All types of defects from all types of ILI data	5tx5t	Defects from all types of ILI data	Threats are categorized as: internal ML, external ML, cracking, SCC, geometry, other (laminations, inclusions, manufacturing defects, etc.) Where two or more threats overlap spatially, they are carefully analyzed. This analysis may result in an excavation.	NDE results are reviewed for verification.
2	ANY	Failure Pressure Anomalies	Pipeline Maps, GIS, Operational Data	Pipeline Elevation data	N/A	Line elevation deviates > 100 ft	Elevation data is integrated into the ILI vendor's report for all anomalies along the pipeline. After receiving the vendor report, a "local" MOP is calculated using elevation and most conservative product weight for every item on feature list, then ERF is recalculated for all anomalies between 15 % and 80 %. Vendor does not adjust ERF for elevation.	A review of the vendor's calculated failure pressures are accomplished prior to importing elevation data. This step assures the ILI vendor used the proper evaluation pressures and parameters in preparing the submitted vendor report.
3	ANY	Appurtenance Reconciliation	Geometry or Metal loss ILI	Features List	N/A	Appurtenance	A tap, stopple, tee, sleeve, patch, weld plus end, valve, flange, or other pipeline attachment which was unknown or installed with unapproved or unknown installation methods. Compare to GIS data to determine if the appurtenance is known and if it is located within a facility. Evaluate for removal if not needed on the system.	N/A
4	ANY	A change since the previous assessment	Geometry/ Metal Loss tool	Features list	N/A	An anomaly, predicted to have changed in depth, length, width, orientation, or any injurious manner from the previous assessment	An anomaly, predicted to have changed in depth, length, width, orientation, or any injurious manner from the previous assessment. Supplied to tool vendor to determine if growth since last assessment.	
5	ANY	All ILI Anomalies: Sensor Loss	ILI tool data (Deformation and/or MFL)	Current in-line inspection tool data	N/A – integral to ILI data	Per vendor spec	Sensor loss occurs when a sensor is damaged/inoperative and does not function properly through portions of or the entirety of an in-line inspection tool run. The number of sensors on an individual ILI tool varies based upon tool size and ILI vendor. Sensor loss can affect the in-line inspection tool's ability to correctly identify and size all anomalies per specifications. Variations The vendor must be able to meet the company specified vendor reporting requirements, including meeting detection thresholds. One possible approach is to implement a vendor reporting requirement that references the Pipeline Operators Forum and ensures that the pipeline segment has been assessed.	In the event of sensor loss, a data quality certification letter facilitates a clear determination on whether the in-line inspection vendor is still able to correctly detect (i.e. minimum anomaly dimensions detectable with given sensor loss), identify, and size all anomalies in accordance with their published detection and sizing accuracy. Included in the letter would be a summary of the number of sensors damaged/inoperative and the impact on overall sensor coverage.

The Data Management and Integration Guideline (TP)

- will assist the operators in integrating their data such that the analytic and interpretive expectations set by 1160 can be met.
- As a Technical Paper there is no defined review cycle, but
  - Anticipate revisiting as an RP in 3 years

Pending API Data Integration Initiatives

API 1163 Revision

- Addresses ILI tool performance and its validation

On Boarding Construction Data into Operations

- How to facilitate a timely transition/assimilation
- Ensuring usability of the data
- Engagement of Pipe Integrity during construction