

Pipe Identification (PI): PJC & PMI for IVP

NACE - San Antonio

May 19th , 2017

www.tdwilliamson.com



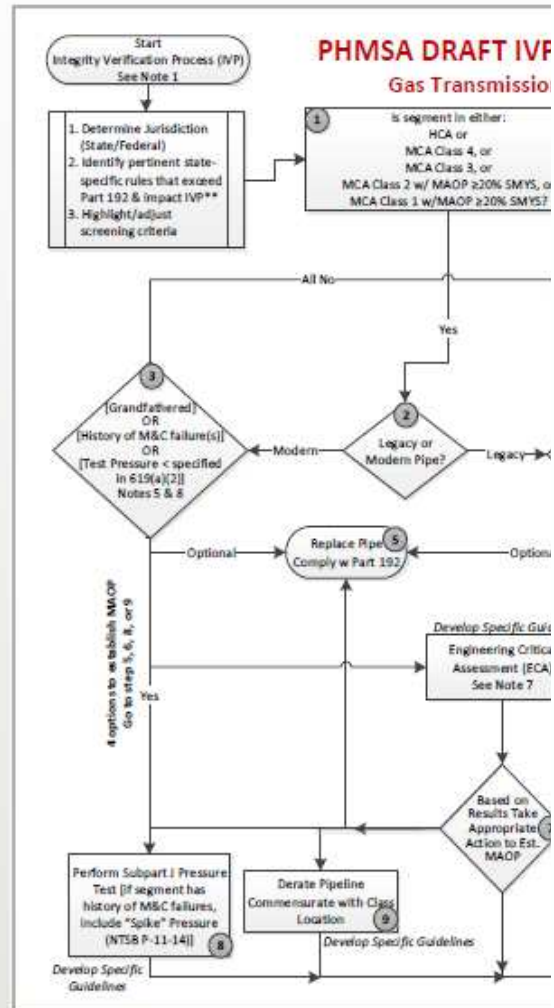


Contents

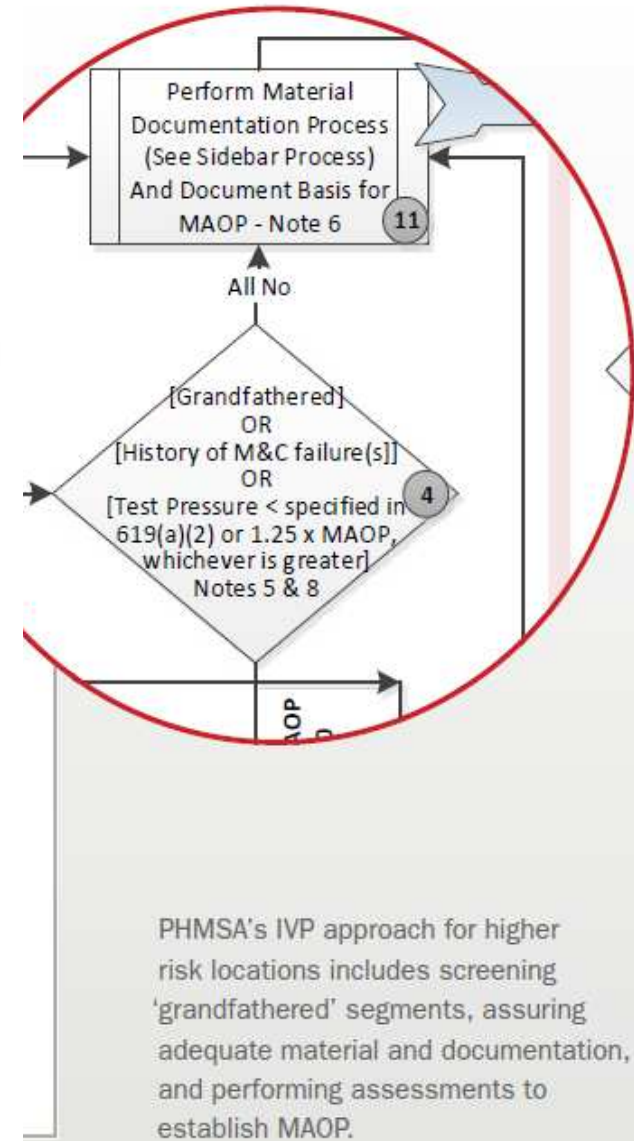
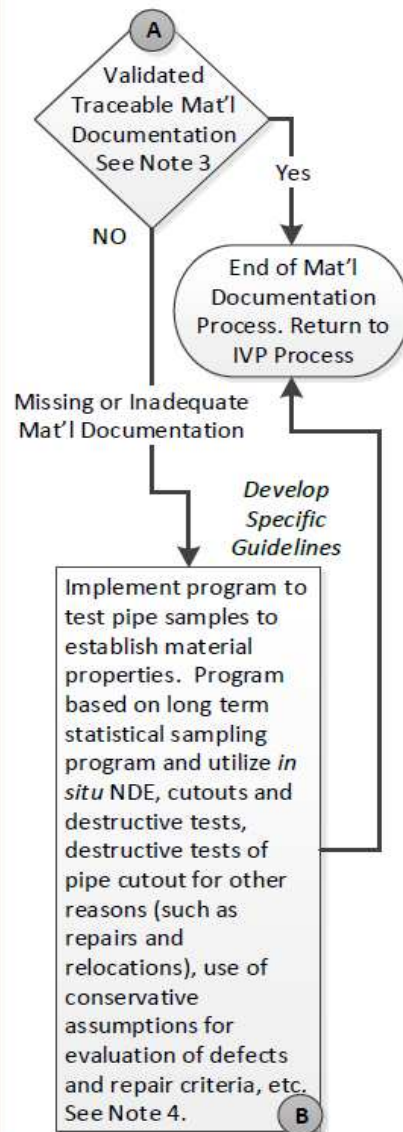
- Integrity Verification Process
- Pipe Identification (PI)
- Pipe Manufacturing Process
- Multiple Datasets (MDS)
- Pipe Joint Classification (PJC) - in Practice
- Positive Material Identification (PMI)
- Non-Destructive PMI Validation Method
- Other Material Identification
- Pipe Identification (PI)
- Questions



INTEGRITY VERIFICATION



**Detail of Material
Documentation Process
Step 11
See Note 2**





Pipeline PerformanceTM

PIPE IDENTIFICATION



Pipe Identification (PI)

$$\text{PJC} + \text{PMI} = \text{PI}$$

- Pipe Joint Classification (PJC) – When using multiple datasets (MDS), the shared characteristics of pipe, from the same manufacture, can be identified and used to assign each joint into associated groups or bins
- Positive Material Identification (PMI) – Non destructive in-situ acquisition of mechanical properties and chemical composition correlated to API 5L for grade determination
- Pipe Identification (PI) – **PJC** to group pipe joints based on their characteristics; **PMI** to identify material properties where they do not exist; align PMI to PJC to close records gap for segments of pipe or entire pipeline
 - Also identifies “rogue” joints where records are not up to date

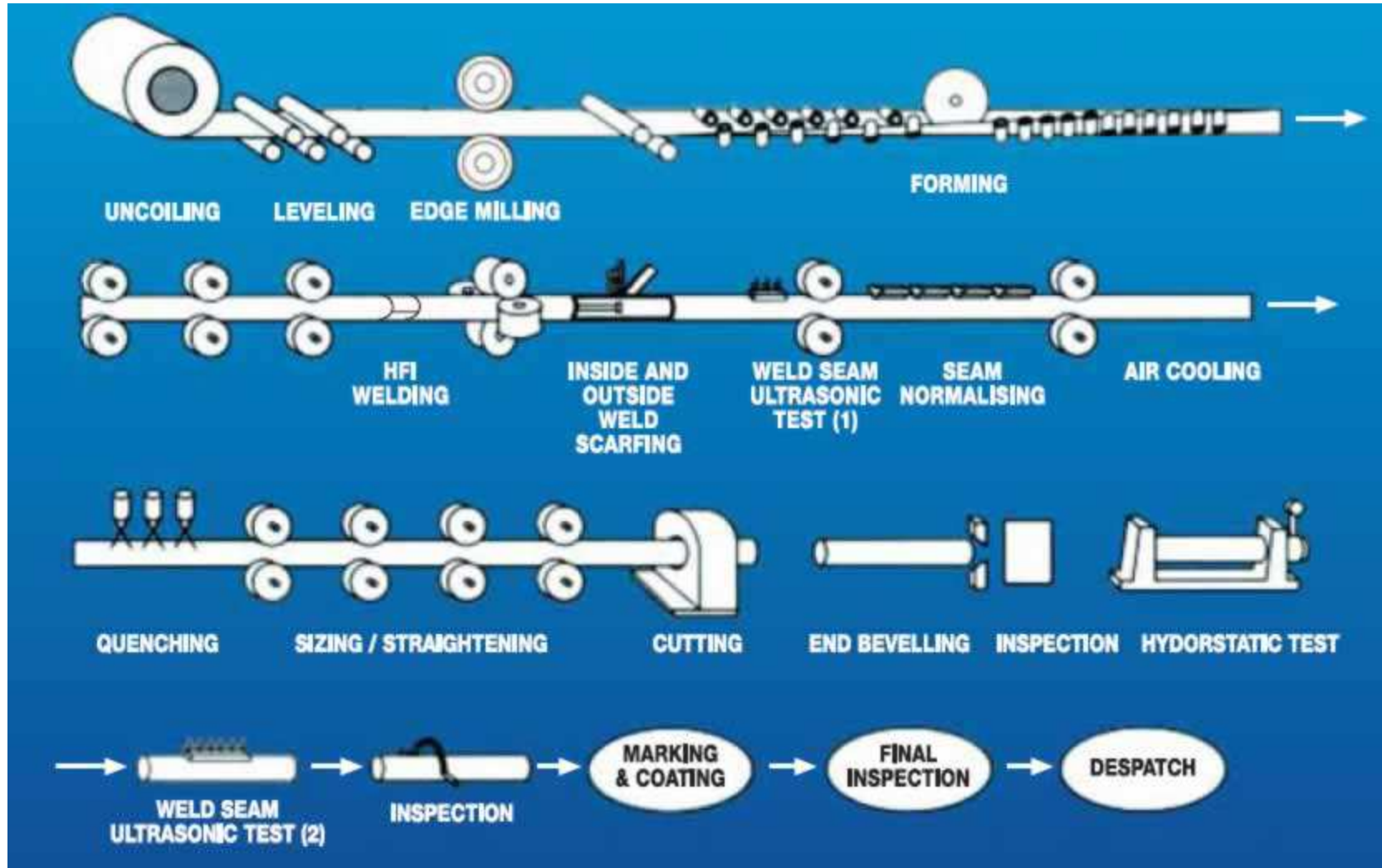


PIPE MANUFACTURING PROCESS



Pipe Manufacturing Process

Pipeline Performance™

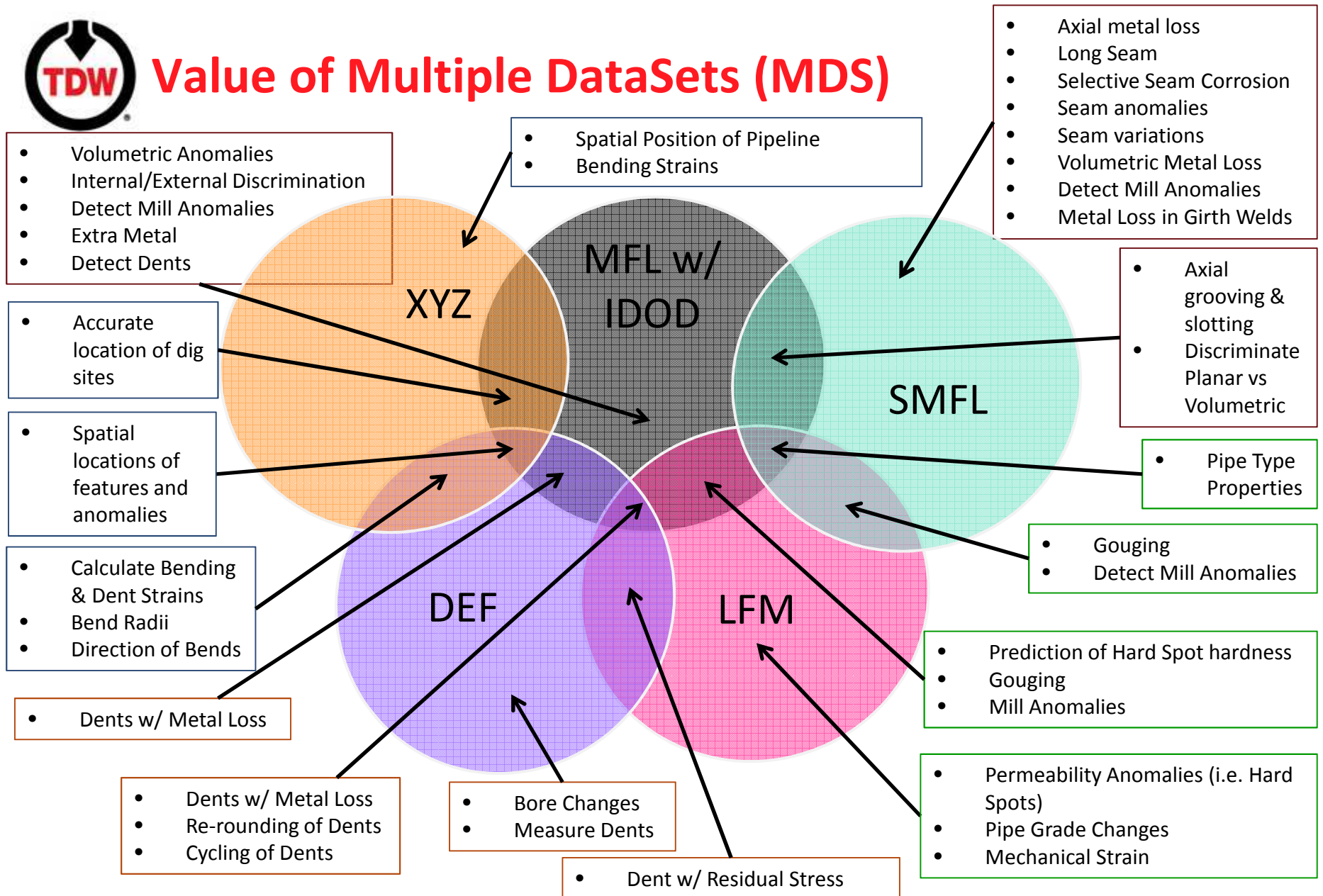




Pipe Joint Classification with **MULTIPLE DATASETS (MDS)**

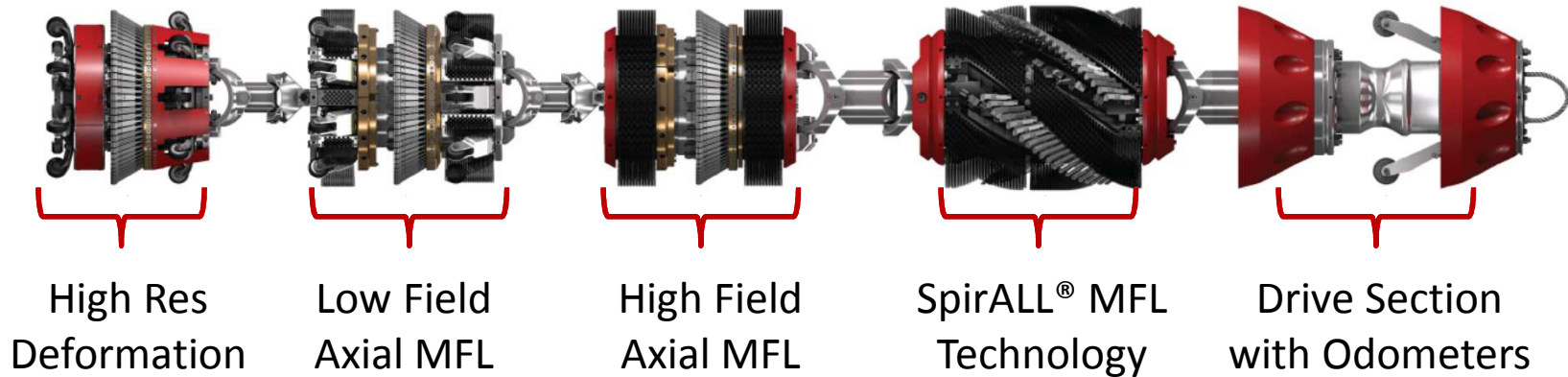


Value of Multiple DataSets (MDS)





The Multiple Data Set (MDS) Platform



High Res
Deformation

Low Field
Axial MFL

High Field
Axial MFL

SpirALL® MFL
Technology

Drive Section
with Odometers

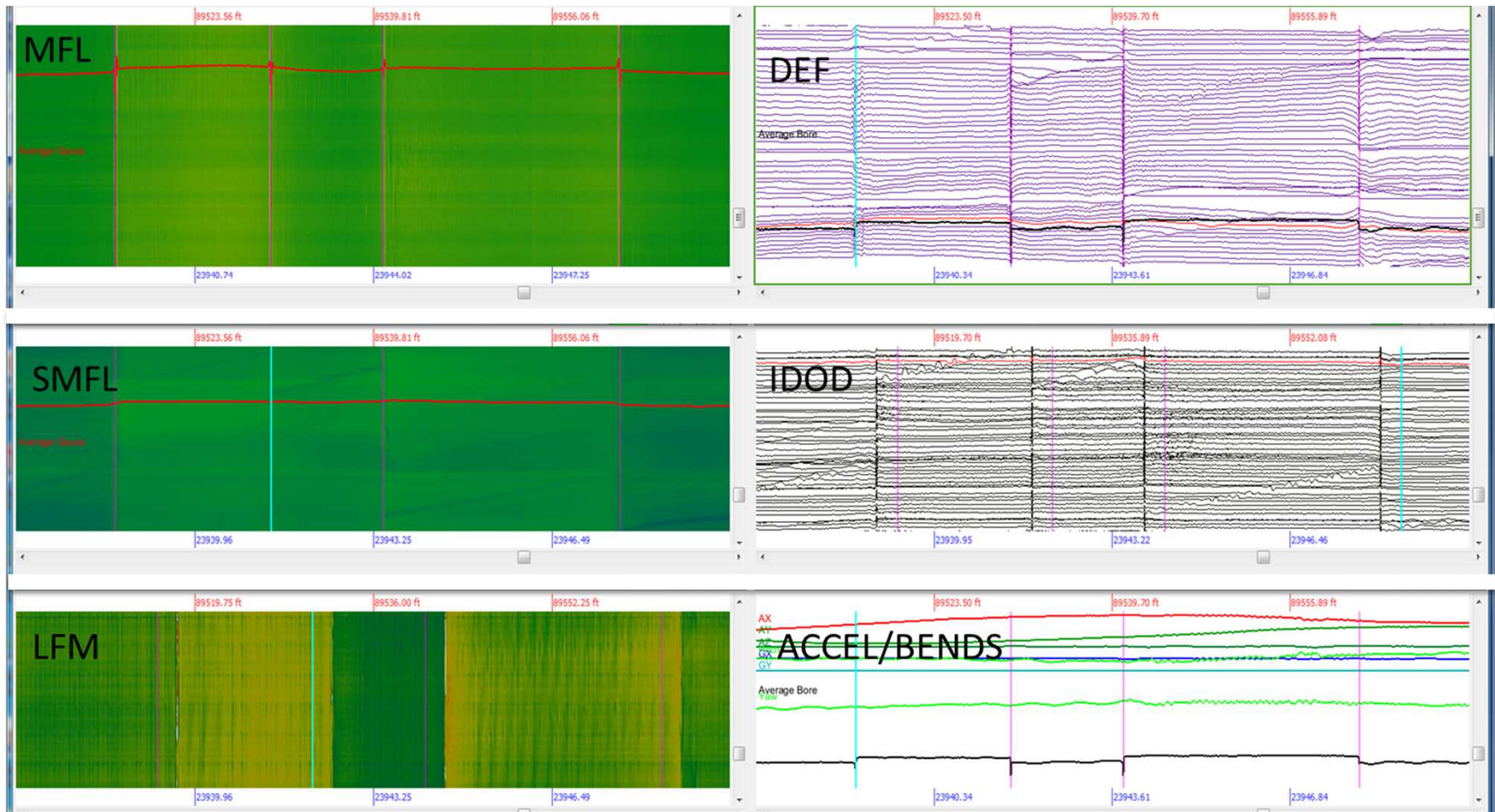
What Each Data Set Measures

- DEF – is a measurement of the changes of the inner bore and is sensitive to the rolling in forming process.
- LFM – is the changes in magnetic flux at low field strengths and is sensitive to chemical and metallurgical properties.
- MFL – less sensitive to local material differences a measure of the bulk magnetic properties of the steel, especially circumferentially oriented markings.
- SMFL – similar to MFL but applied at an oblique direction so it detects longitudinal aspects of material changes and long seam characteristics.
- IDOD – Designed to detect metal loss on the ID but is sensitive to ID surface permeability changes in the radial direction.



Multiple Datasets

Pipeline Performance™





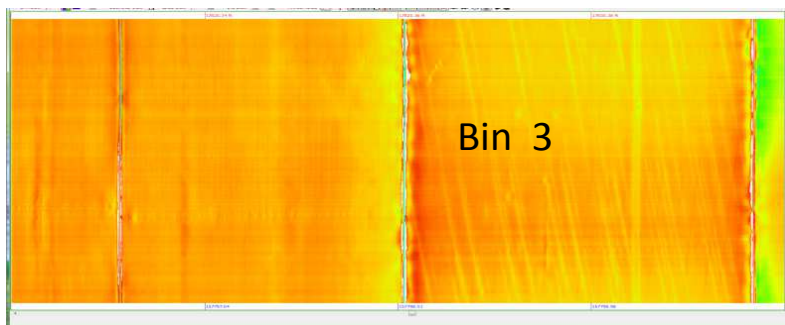
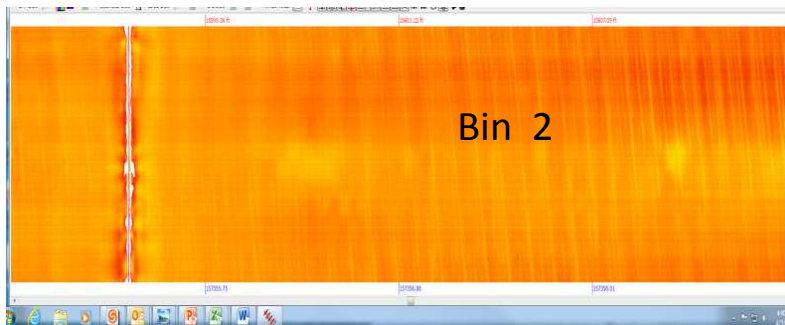
Pipeline PerformanceTM

PJC IN PRACTICE



PJC in Practice: Low Field MFL (LFM)

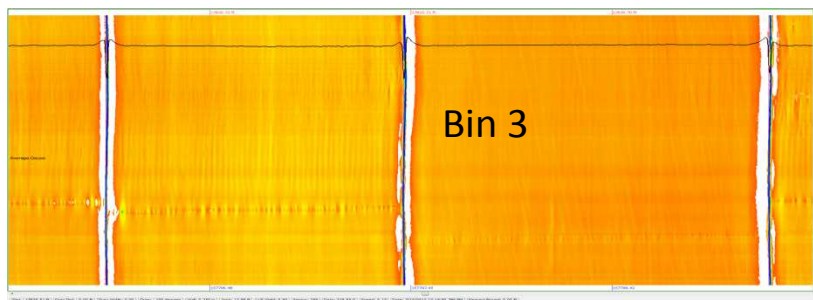
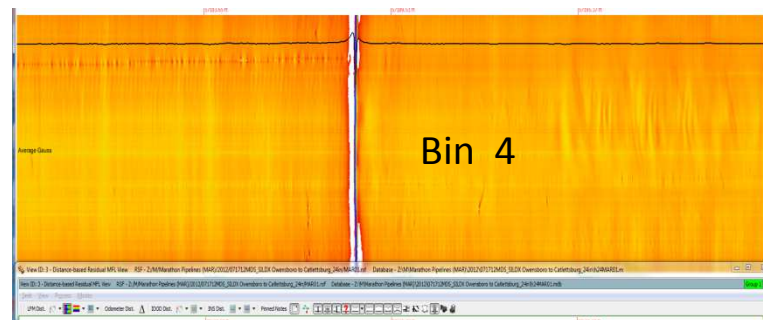
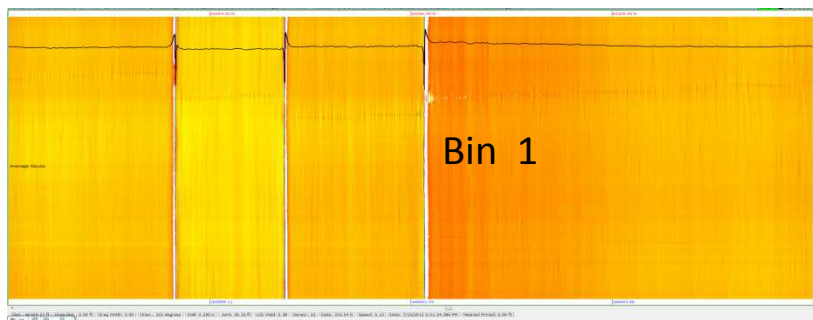
Pipeline Performance™





PJC in Practice: High Field MFL (MFL)

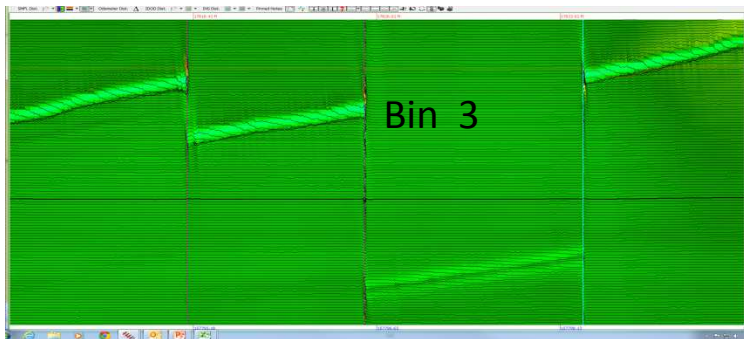
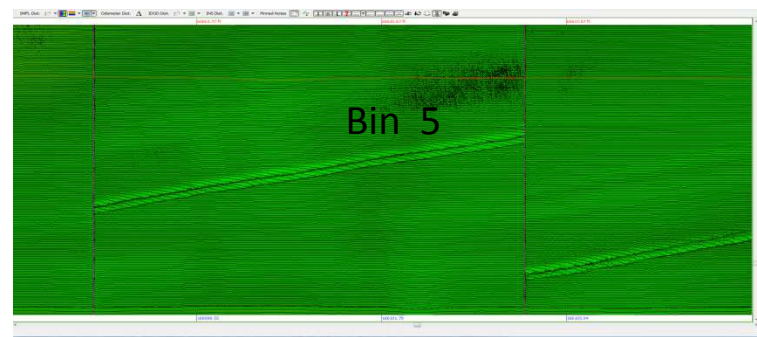
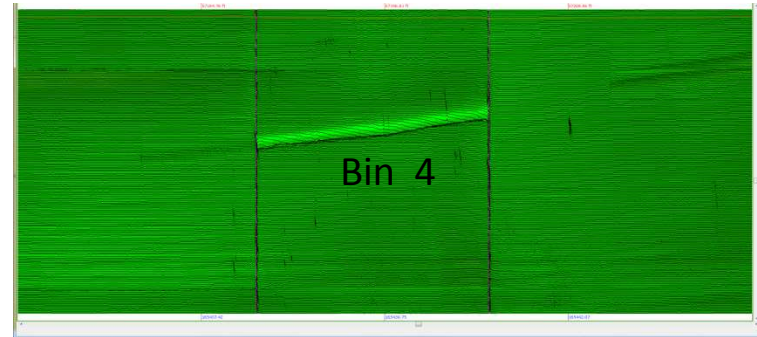
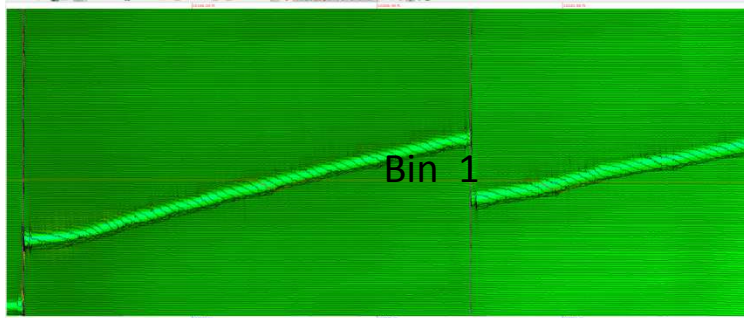
Pipeline Performance™





PJC in Practice: SpirALL[®] MFL (SMFL)

Pipeline Performance[™]





PJC in Practice – The End Result

po id	type	dist begin	lat	long	pipe ys	pipe sf	pipe matl	pipe manuf
T13000370	Girth Weld	9231.704	29.970838	240.647984	42000		1 ERW	X42
T13000380	Girth Weld	9241.471	29.970843	240.64784	42000		1 ERW	X42
T13000390	Girth Weld	9251.202	29.970848	240.647696	42000		1 ERW	X42
T13000400	Girth Weld	9260.939	29.970853	240.647554	42000		1 ERW	X42
T13000410	Girth Weld	9270.682	29.970849	240.647411	42000		1 ERW	X42
T13000420	Girth Weld	9280.428	29.970834	240.647268	42000		1 ERW	X42
T13000430	Girth Weld	9290.102	29.970833	240.647253	42000		1 ERW	X42
T13000440	Girth Weld	9291.157	29.970831	240.647232				
T13000450	Girth Weld	9292.56	29.970828	240.647206				
T13000460	Girth Weld	9294.397	29.970826	240.647191	35900		1 ERW	B
T13000470	Girth Weld	9295.416	29.970824	240.64717	35900		1 ERW	B
T13000480	Girth Weld	9296.843	29.970819	240.647029	35900		1 ERW	B
T13000490	Girth Weld	9306.384	29.97082	240.647002	35900		1 ERW	B
T13000500	Girth Weld	9308.231	29.97082	240.646985				
T13000510	Girth Weld	9309.378	29.970822	240.646936				
T13000520	Girth Weld	9312.657	29.970825	240.646797				
T13000530	Girth Weld	9322.011	29.970827	240.646694				
T13000540	Girth Weld	9328.989	29.97083	240.64659	42000		1 ERW	X42
T13000550	Girth Weld	9336.112	29.970832	240.646556	42000		1 ERW	X42
T13000560	Girth Weld	9338.512	29.970839	240.646383	42000		1 ERW	X42
T13000570	Girth Weld	9350.682	29.970848	240.64621	42000		1 ERW	X42
T13000580	Girth Weld	9362.893	29.970857	240.646041	42000		1 ERW	X42

Sections of unidentified pipe can be matched to sections with records

Groups of unmatched joints can be tested using PMI



POSITIVE MATERIAL IDENTIFICATION (PMI)



Optical Emissions Spectrometry





Optical Emissions Spectrometry (OES)

The OES technology provides positive material property test results for both Chemical Analysis (CA) and Carbon Equivalency (CE).

- Spark creates non-destructive burn which creates a plasma on the material
- Light is emitted and captured by the equipment to be analyzed
- Existence and concentrations of chemical constituents are measured
- CA & CE of that data point are determined
- Results compared with API-5L-Table 4





Mechanical Properties Assessment (MPA)



The MPA technology provides positive material property test results for both EYS and ETS by applying a load and measuring the materials response to that load.



Mechanical Properties Assessment (MPA)

The MPA technology provides positive material property test results for both EYS and ETS by applying a load and measuring the materials response to that load.





Positive Material Identification (PMI)



Certified Positive Material Identification Report: TGD Pipeline

Line Name: Tulsa to OKC
Dig Number: 1

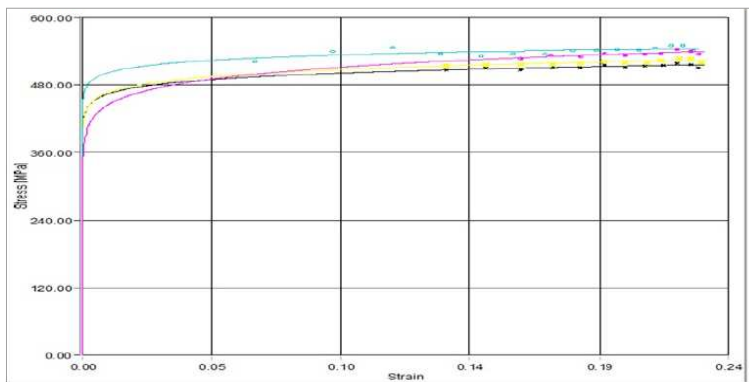
Nominal WT (in): 0.156

OES Results									
	C	Si	Mn	V	Ti	Nb	S	P	CE
1	0.167	0.011	0.562	0.002	0.001	0.002	0.031	0.020	0.282
2	0.162	0.011	0.571	0.002	0.001	0.002	0.028	0.022	0.279
3	0.195	0.008	0.540	0.002	0.001	0.002	0.042	0.023	0.306
4	0.199	0.006	0.566	0.001	0.001	0.002	0.043	0.023	0.315
5	0.181	0.007	0.494	0.002	0.001	0.002	0.026	0.018	0.284
AVG	0.181	0.008	0.546	0.002	0.001	0.002	0.034	0.021	0.293
ST DEV	0.015	0.002	0.028	0.000	0.000	0.000	0.007	0.002	0.014
	C	Si	Mn	V	Ti	Nb	S	P	CE
OES Overall AVG	0.180	0.012	0.612	0.002	0.001	0.002	0.038	0.020	0.303
OES Overall STDEV	0.012	0.008	0.106	0.000	0.000	0.000	0.008	0.005	0.019

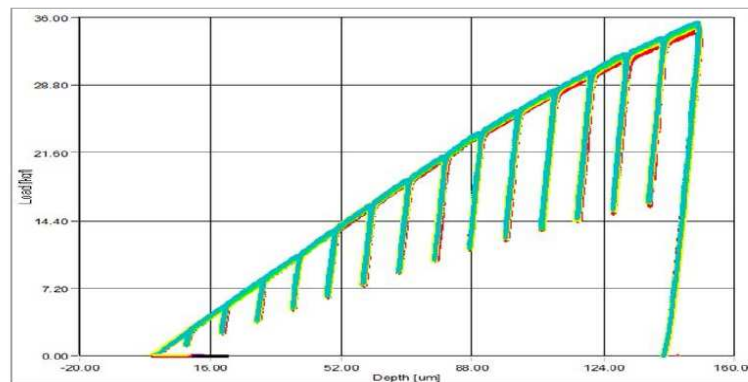
OES Results									
	C	Si	Mn	V	Ti	Nb	S	P	CE
1	0.173	0.034	0.901	0.002	0.001	0.002	0.035	0.012	0.342
2	0.186	0.011	0.662	0.002	0.001	0.002	0.054	0.016	0.317
3	0.167	0.007	0.604	0.001	0.001	0.002	0.034	0.014	0.288
4	0.177	0.014	0.611	0.002	0.001	0.002	0.040	0.028	0.303
5	0.190	0.016	0.614	0.001	0.001	0.002	0.043	0.028	0.316
AVG	0.179	0.016	0.678	0.002	0.001	0.002	0.041	0.020	0.313
ST DEV	0.008	0.009	0.113	0.000	0.000	0.000	0.007	0.007	0.018

MPA Results			
Yield Strength		Tensile Strength	
Scan 1	Scan 3	Scan 1	Scan 3
1	47.92	45.85	64.88
2	48.03	46.67	65.66
3	49.03	48.42	65.57
4	47.13	47.86	66.32
5	50.80	46.99	66.88
Avg	48.58	47.16	65.86
Overall AVG	47.87	63.24	

Reported values are subject to published +/-10% variance.



Stress vs Strain



Load vs Depth

Date of Inspection	NDE Technician	NDE Technician Signature	Client Review	Date of Review
1/22/2015	John Doe ASNT Level II Exp: Aug-17	<i>John Doe</i>		



TDW'S PMI VALIDATION



MATERIAL IDENTIFICATION



PMI Applies to Fittings Identification (FI)

- Fitting Identification (FI) – The same Internal & External Validation processes are being applied to statistically support the established performance specifications
- Chemistry – The same OES technology and techniques are used to establish fitting chemistry
- Yield & Tensile Strength – The same MPA technology and techniques are used to establish fitting Yield & Tensile Strength
 - Tensile is calculated from the Yield values
 - Fitting Surfaces - Due to the shape of many fitting in the industry, unique 'fixtures' may be required to install the MPA equipment



Pipe Identification (PI)

$$\text{PJC} + \text{PMI} = \text{PI}$$

- Pipe Joint Classification (PJC) – When using multiple datasets (MDS) the shared characteristics of pipe, from the same manufacture, can be identified and used to assign each joint into associated groups or bins
- Positive Material Identification (PMI) – Non destructive in-situ acquisition of mechanical properties and chemical composition correlated to API 5L for grade determination
- Pipe Identification (PI) – **PJC** to group pipe joints based on their characteristics; **PMI** to identify material properties where they do not exist; align PMI to PJC to close records gap for segments of pipe or entire pipeline
 - Also identifies “rogue” joints where records are not up to date

Thank You

Questions ?



www.tdwilliamson.com

® Registered trademarks of T.D. Williamson, Inc. in the United States and in foreign countries. © Copyright 2012

