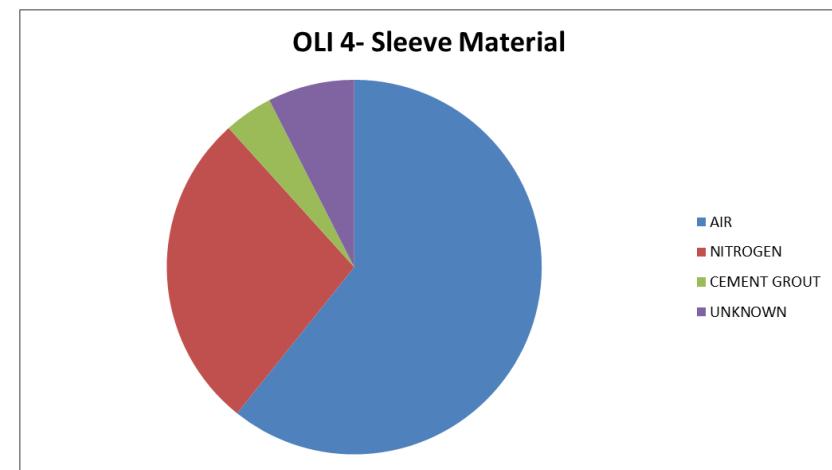
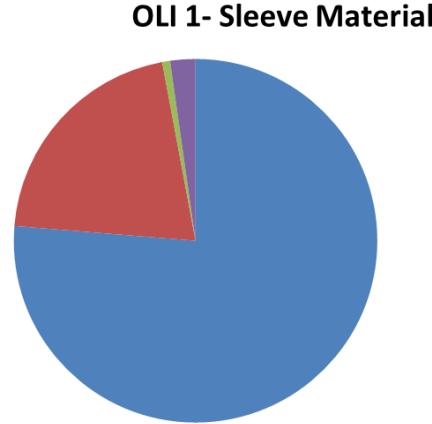




Sleeve/Casing Corrosion ILI Data Assessment Tool

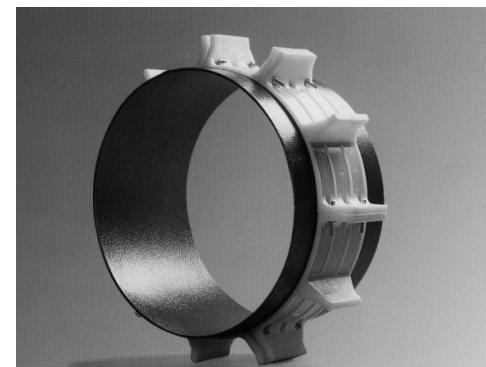
Background

- UKOPA members operate a number of pipelines with external sleeves/casings
 - Road, rail, river crossings
- Located on both piggable OLI1 pipelines and non-piggable OLI4 pipelines



Background

- Sleeves prone to corrosion
- End seals break down
- Water and soil enters annular space
- Corrosive environment created
- Electrical contact - sleeve and pipeline
- CP system affected



Background

- Operators concerned about possibility of localised corrosion issues associated with sleeves/casings
- In particular, interested if the prevalence of corrosion associated with sleeves exceeds unsleeved pipeline sections
- This information would help inform where to concentrate future inspection and maintenance efforts
 - Especially important wrt OLI4 pipelines which cannot be internally inspected

New Tool

- Spreadsheet macro has been developed which allows sets of ILI data to be assessed quickly wrt sleeve corrosion
- Macro can assess ILI data sets from different vendors
 - PII, Rosen, Baker Hughes
- Macro has been developed to determine:
 - Total no. of corrosion defects on pipeline
 - Total no. of sleeves on pipeline
 - No. of corrosion defects beneath sleeves
 - No. of corrosion defects on un-sleeved sections
 - Length of sleeved pipeline (% total)
 - Length of un-sleeved pipeline (% total)
 - Details of sleeves
 - Details of defects beneath sleeves
 - Details of defects on un-sleeved sections
 - Average corrosion depth beneath sleeves
 - Average corrosion depth on un-sleeved sections
 - How many sleeves are eccentric, close to or touching pipeline
 - How many corrosion defects within ± 12 m of sleeve

Tool Use – Front Page

1 Instructions

2 Copy Data into the Data Sheet, so column titles are in row 1

3 (ie remove any blank or information cells at top of spreadsheet)

4 Run relevant macro by selecting button below - corresponding to the data origin

5 Or Instead use the large button if unsure of data origin

6 Results automatically produced on the table on the right

7 List of corrosion incidents appear on Corrosion Incidents Sheet

8

9 Run Corrosion Separation Macro (Will Attempt to guess Data Source)

10

11

12

13 Notes for reuse - needs three worksheets

14 Labelled: Title Page (this one)

15 Data with just the raw data (and column headings)

16 Corrosion Incidents

17 The In Casing/Out of Casing can be deleted or left before reuse

18

19

20

21

22

23 Run Corrosion Separation (for PII Data)

24

25

26

27

28

29

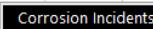
30

31

32

33

34

Ready   

Spreadsheet front page

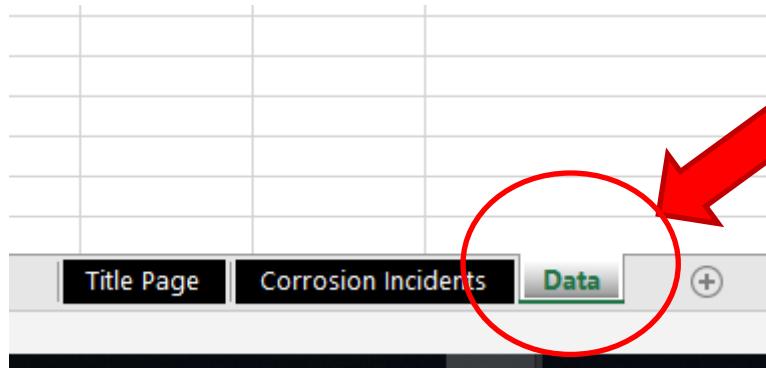
Instructions:
Top left

Buttons to run:
Bottom

Boxes for output:
Top right

Three Tabs:
Title page
Corrosion Incidents
Data

Tool Use – Running the Macro

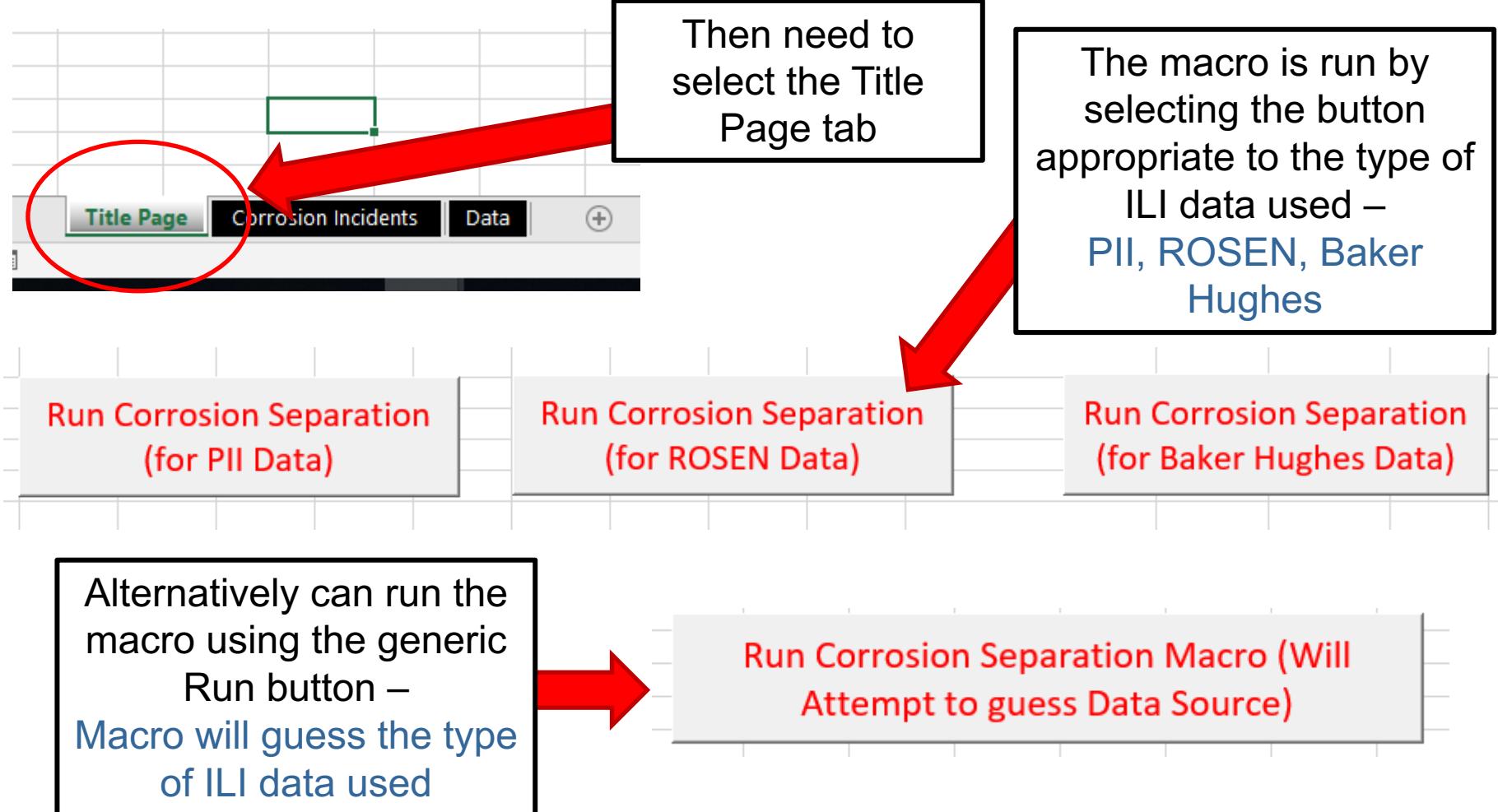


To run, need to first select the data tab – make sure the sheet is blank

Then paste in the pipe tally data – first column header must be in cell A1

	A	B	C	D	E	F	G	
1	log dist. [m]	easting [m]	northing [m]	heighting [m]	event / corr joint-num	J. len [m]		
2								
3	-10.65	292404.727	86473.228		103.628 AS_DatRec			
4	-4.28	292399.34	86476.576		103.733 WT_Chang	10	0.33	12.7
5	-4.11	292399.195	86476.666		103.735 Flange			
6	-3.95	292399.064	86476.748		103.738 Girth Weld	20	0.91	12.7
7	-3.54	292398.72	86476.961		103.745 Offtake / 25 mm			12:00
8	-3.5	292398.685	86476.983		103.745 Support			6:00
9	-3.04	292398.292	86477.227		103.753 Area Start_	30	0.44	12.7
10	-2.83	292398.12	86477.334		103.756 Bend / R:3.0D A:22.50° sag			
11	-2.6	292397.92	86477.458		103.76 Area End_	40	0.84	12.7
12	-1.76	292397.21	86477.9		103.774 Area Start_	50	0.43	12.7
13	-1.54	292397.023	86478.016		103.778 Bend / R:3.0D A:22.50° over			

Tool Use – Running the Macro



Tool Use – Summary Output

Results Overview			
	In Casing	Out of Casing	Total
Length of Pipe (km)	0.2	5.9	6.1
No. of Corrosions	1	26	27.0
Corrosions per km of Pipe	6.1	4.4	4.4
Average Depth	13.0%	15.0%	

Casing Summary	
No. of Casing Segments*	5
	*Segments include Casings and Sleeves
No of "Eccentric" Segments	1
No. of Touching Segments	Not Available in Data
No. of Not Touching	Not Available in Data
No of Corrosions within 12m of a casing	0

After running a data summary will be shown on the Title Page

Table gives summary of sleeves and corrosion defects within a single ILI data set, such as:

- Length of sleeved and unsleeved pipe
- Total no. of defects in sleeved and unsleeved sections
- Average depth of defects in sleeved and unsleeved sections
- Total no. of sleeves and which are eccentric

Tool Use – Additional Tabs

3.00	292621.2	90625.34	2.50	111211052	5130	111211052
9.42	292621.1	90625.41	2.305	metal loss	5130	
9.42	292621.1	90625.42	2.305	metal loss	5130	
9.53	292621.1	90625.51	2.301	metal loss	5130	

Title Page **Corrosion Incidents** **Data**

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1 Casing Segments including Corrosion Incidents																	
2																	
3 log dist. [reasting [northing [heighting [event / co joint-num] j. len [m] t [mm] to u/s w. [o'clock / L depth [%] ERF_085 length [m] width [m] internal Start/End Corrosion Segment Length																	
4	4525.45	292761.4	90327.62	1.608	Area Start_Casing												
5	4527.06	292762.7	90328.56	1.586	Girth Weld	4760	11.77	9.5									
6	4529.56	292764.7	90330.01	1.571	metal loss	4760		9.5	-2.5	4:28	6		32	18	YES		
7	4533.37	292767.8	90332.23	1.57	metal loss	4760		9.5	-6.31	7:49	13		26	29	NO		
8	4538.83	292772.3	90335.42	1.595	Girth Weld	4770	11.61	9.5									
9	4550.44	292781.7	90342.2	1.571	Girth Weld	4780	11.85	9.5									
10	4561.46	292790.6	90348.63	1.292	Area End_Casing												
11																	
12																	
13 Corrosion Incidents Occuring Outside Casing Segments																	
14																	
15	log dist. [reasting [northing [heighting [event / co joint-num] j. len [m] t [mm] to u/s w. [o'clock / L depth [%] ERF_085 length [m] width [m] internal Start/End Corrosion Segment Length																
16	131.83	292884.4	86553.12	97.494	metal loss	280		7.9	-11.61	1:24	9		39	54	NO		
17	609.09	292166.5	86971.45	92.791	metal loss	730		7.9	-5.52	3:37	11		14	17	NO		
18	1168.11	292524.4	87302.68	57.873	metal loss	1220		7.9	-10.86	11:40	9		50	51	NO		
19	1584.21	292548.2	87641.69	47.737	metal loss	1680		7.9	-3.86	3:56	9		45	45	NO		
20	3215.98	292818.9	89101.26	5.835	metal loss	3270		7.9	-11.83	7:17	14		20	31	NO		
21	3696.99	292844.9	89534.2	1.961	metal loss	3870		9.5	-11.85	8:57	11		43	50	NO		
22	3766.55	292832.4	89602.6	2.172	metal loss	3940		9.5	-2.49	12:11	10		45	51	NO		
23	4095.46	292773.1	89925.95	1.92	metal loss	4230		9.5	-7.25	9:34	9		17	17	NO		
24	4095.75	292773	89926.23	1.918	metal loss	4230		9.5	-7.53	11:16	5		16	171	NO		
25	4095.75	292773	89926.24	1.918	metal loss	4230		9.5	-7.54	10:15	11		14	15	NO		
26	4293.19	292737.8	90119.15	2.544	metal loss	4450		9.5	-10.02	3:26	23	0.41	11	15	NO		
27	4648.11	292748.4	90420.8	3.205	metal loss	4920		9.5	-0.45	11:32	8		73	78	NO		
28	4855.73	292638.9	90596.9	3.355	metal loss	5100		9.5	-10.4	5:00	67	0.44	26	35	NO		
29	4886	292622.9	90622.51	2.404	metal loss	5130		9.5	-7.56	12:02	9		14	15	NO		
30	4889.18	292621.3	90625.21	2.312	metal loss	5130		9.5	-10.74	10:53	15		66	15	NO		
31	4889.31	292621.2	90625.32	2.308	metal loss	5130		9.5	-10.87	11:50	9		28	33	NO		
32	4889.33	292621.2	90625.34	2.307	metal loss	5130		9.5	-10.9	9:37	10		36	52	NO		
33	4889.42	292621.1	90625.41	2.305	metal loss	5130		9.5	-10.98	9:32	13		15	17	NO		
34	4889.42	292621.1	90625.42	2.305	metal loss	5130		9.5	-10.98	11:21	8		59	70	NO		
35	4889.53	292621.1	90625.51	2.301	metal loss	5130		9.5	-11.1	12:42	24	0.42	31	15	NO		

Title Page **Corrosion Incidents** **Data** **In Casing** **Out of Casing** **+**

The Corrosion Incidents tab lists details of all corrosion defects within sleeves followed by details of all corrosion defects on un-sleeved sections

Tool Use – Additional Tabs

ITEM NO	DESCRIPTION	QTY	UNIT
5	Girth Weld	3900	11.8
5	Area End_Sleeve		

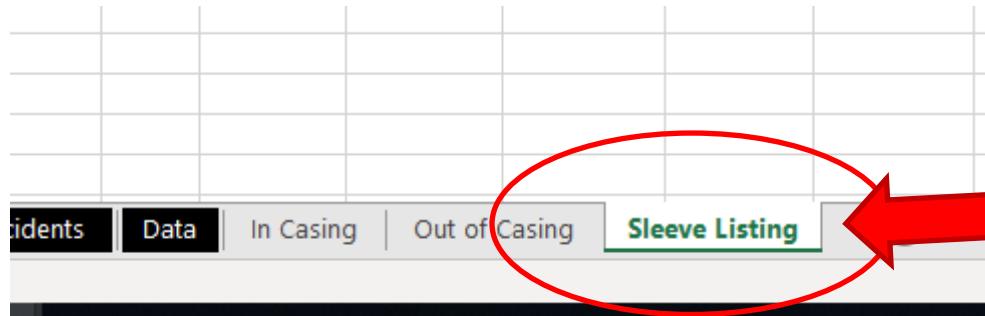
In Casing shows the parts of the full pipe tally which are beneath sleeves

The In Casing and Out of Casing tabs are created as part of the output

Out of Casing shows the parts of the full pipe tally which are un-sleeved sections

What are all circled sections								J och
1								
2								
3								
4	-4.28	292399.3	86476.58	103.733	WT_Chang	10	0.33	12.7
5	-4.11	292399.2	86476.67	103.735	Flange			
6	-3.95	292399.1	86476.75	103.738	Girth Wel	20	0.91	12.7
7	-3.54	292398.7	86476.96	103.745	Ofttake / 25 mm			12
8	-3.5	292398.7	86476.98	103.745	Support			6
9	-3.04	292398.3	86477.23	103.753	Area Start	30	0.44	12.7
10	-2.83	292398.3	86477.33	103.756	Bend / R:3.0D A:22.50° sag			
11	-2.6	292397.9	86477.46	103.76	Area End	40	0.84	12.7
12	-1.76	292397.2	86477.9	103.774	Area Start	50	0.43	12.7
13	-1.54	292397	86478.02	103.778	Bend / R:3.0D A:22.50° over			
14	-1.32	292396.8	86478.13	103.781	Area End	60	0.46	12.7
15	-1.11	292396.7	86478.24	103.785	Ofttake / 25 mm			12
16	-0.86	292396.5	86478.37	103.789	Girth Wel	70	0.54	12.7
17	-0.64	292396.3	86478.49	103.792	Ofttake / 50 mm			9
18	-0.32	292396	86478.66	103.798	Girth Wel	80	0.66	12.7
19	0	292395.7	86478.82	103.803	Valve			
20	0.34	292395.4	86479	103.809	Girth Wel	90	0.54	12.7
21	0.88	292395	86479.29	103.817	Girth Wel	100	0.42	12.7
22	1.05	292394.8	86479.37	103.819	Above Ground Marker / [MFL] launcher @ MM			
23	1.07	292394.8	86479.38	103.819	Magnet Marker			12
24	1.3	292394.6	86479.5	103.823	Girth Wel	110	1.01	12.7
25	1.51	292394.4	86479.61	103.826	Attachment			6
26	1.76	292394.1	86479.74	103.829	Joint			

Tool Use – Detailed Output



A more detailed results sheet is created and is found in the tab
Sleeve Listing

- Sleeve Listing extracts similar data to overall summary table – but for each individual sleeve
- Sleeve Listing contains 23 different columns
 - 10 are populated by the tool using the ILI data
 - Remaining 13 must be completed manually by the operator using their records

Sleeve Listing – Populated Columns

Start Distance (m)	End Distance (m)	ILI Sleeve Description	ILI Sleeve Length (m)	No. of Corrosion Defects	No. of Corrosion Defects per km.	Average Corrosion Depth (%wt)	Sleeve Eccentric?	Sleeve Touching?	Corrosion Within 12m?
912.326	932.554	ROAD CROSSING	20.228	None	N/A	N/A	No	No	No
1611.429	1637.086	ROAD CROSSING	25.657	None	N/A	N/A	Yes	No	Yes
4347.77	4370.537	ROAD CROSSING	22.767	None	N/A	N/A	Yes	No	No
4419.501	4433.377	RIVER LEVEN CROSSING	13.876	None	N/A	N/A	No	No	No
4901.348	4935.341	A911 ROAD CROSSING	33.993	None	N/A	N/A	Yes	No	Yes
5826.616	5845.323	ROAD CROSSING	18.707	None	N/A	N/A	No	No	No
7795.893	7801.313	LOTHRIE BURN	5.42	None	N/A	N/A	No	No	No
8042.325	8062.581	ROAD CROSSING	20.256	None	N/A	N/A	Yes	No	No
11149.651	11155.199	COUL BURN CROSSING	5.548	None	N/A	N/A	No	No	No

- Each sleeve is listed in order of log distance
- Description of sleeve (road crossing etc.) is extracted from the ILI data
- No. of corrosion defects, average corrosion depth, eccentricity for each sleeve included
- No. of corrosion defects per km is also included at present although this can give strange values due to the short length of sleeves

Sleeve Listing – Unpopulated Columns

- Remaining columns to be filled in by operator from their records

Things to Note

- ❑ Sleeve descriptions dependent upon ILI data
 - ❑ Sufficient information may not be included for identification (e.g. road crossing vs. A911 road crossing)
 - ❑ No description data will leave a blank in the output
- ❑ Rosen data does not include a description of the sleeve
 - ❑ Identification must be done using distance
 - ❑ Exception: repair sleeves are noted
- ❑ Sheet developed using mainly PII data, only one set of Rosen and one set of Baker Hughes data
 - ❑ Certain categories may not work correctly in all cases, particularly eccentricity
 - ❑ Need to keep an eye on this and report any bugs

Next Step

- ❑ Tool to be distributed within UKOPA so operators can test it with their own ILI data
- ❑ Feedback:
 - ❑ Bugs
 - ❑ Errors
 - ❑ Suggestions for further inclusions or refinements