Report Title:
Comparison test of original Precision Acoustics LabVIEW software to new 8Fold Manufacturing python software on existing wet test fixture hardware.

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Client:
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Background

In February 2022 8fold Manufacturing was contracted by Profound Medical to create a new graphical user interface for their existing and future Wet Test Fixture (WTF) systems. The goal was to transition from a closed-source LabView interface to a modular, easy-to-maintain, and well documented Python application that can be improved and kept up to date by either 8fold or Profound in the future.

Several months after the project was contracted it was expanded to include the construction of an additional WTF system, using a combination of parts provided by Profound and parts purchased by 8Fold. The system includes a new motor controller assembly, featuring a Galil 4123 controller. This decision was made because the Parker VIX 250 IM Drive controllers are end of life and use obsolete software. In addition, testing with them showed that communication with them is slow and unreliable by comparison. The new motor controller assembly is fully backwards compatible with the existing systems. Pending complete validation of the new software and new motion controller system, existing WTF systems will be able to be seamlessly upgraded at Profound's discretion, making them more futureproof, reliable, and easy to maintain.

Prior to this report's preparation the software was tested on the new WTF system in Dallas. The goal of this report are as follows:

- Compare the results of the Python software to results from the Existing LabView software and determine if the differences are within repeatability limits.
- Investigate to what degree the differences observed in the previous report were due to hardware differences, changes to the UAs as a result of shipping, and changes to the UAs as a result of years of storage.

Methods

8 UAs were tested using Wet Test Fixture 2 with the original LabVIEW software using the Standard Test Script Version 1.2. According to these tests, 3 of the UAs passed and 4 failed. One was excluded from the analysis because it was later discovered that the results were invalid (likely due to interference from the strings suspending the absorber).

Results Summary

To provide a baseline for the repeatability of the results between existing wet test fixtures and between testing on different days, the results for 3 of these UAs were compared to their original test data on the WTF 3. The results are compared in the table below.

Measurement	Mean (WTF2)	Mean (WTF3)	STDev (WTF2)	STDev (WTF3)	Systematic error	Average error
Beam Angle (deg)	-88.93	-91.80	1.34	2.75	2.87	2.87
LF.Eff (%)	65.19	67.95	10.08	5.66	2.76	4.67
LF.Rfl (%)	6.66	4.43	7.08	5.60	2.23	3.70
LF.Pf (max) (W)	6.81	6.20	1.58	0.45	0.61	0.80
HF.Eff (%)	40.65	39.95	5.44	5.25	0.70	1.40
HF.Rfl (%)	4.40	4.48	3.14	2.44	0.07	1.22
HF.Pf (max) (W)	5.28	5.34	0.93	0.81	0.06	0.23

Table 1 Comparison of Results From WTF2 and Earlier Results from WTF3

Discussion

The goal of comparing a sample of this dataset to the initial testing of these UAs on a different production Wet Test Fixture (WTF3) but with the same software was to provide a reference for the variability that can be expected with the current software and hardware used currently for testing production UAs.   These differences may include hardware factors, software factors, variability in the UAs themselves, or variability in test conditions.

In the following section, the results on Wet Test Fixture 2 with the new Python software will be compared to these WTF2 results with the LabVIEW software, using this comparison data as a benchmark for the variability that is to be expected.

Methods

Approximately a week later, the same 7 UAs were tested using the same script with the new Python-based software developed by 8Fold Manufacturing.

Results Summary

Measurement	Mean (LabVIEW)	Mean (Python)	STDev (LabVIEW)	STDev (Python)	Systematic error	Average error
Beam Angle (deg)	-90.47	-90.49	2.13	1.91	0.03	1.09
LF.Eff (%)	64.40	64.83	11.54	8.83	0.43	4.48
LF.Rfl (%)	9.37	10.61	6.88	6.85	1.23	3.38
LF.Pf (max) (W)	7.30	7.20	2.56	2.17	0.10	0.67
HF.Eff (%)	39.89	38.94	7.47	7.02	0.95	2.18
HF.Rfl (%)	3.57	3.33	2.70	2.60	0.24	0.60
HF.Pf (max) (W)	5.50	5.39	1.52	1.51	0.11	0.36

Table 2 Comparison of results From WTF2 with LabVIEW software and Python software

Element Case Studies

Element 1 of GM0912 failed its LabVIEW test due to the LF.Pf (max) (W) exceeding the limit (13.4W > 12W). With the Python software, this quantity (10.7 W) did not exceed the limit, despite being close. Upon retesting, the result was closer to failing, but still passed by a narrow margin (11.3 W). The difference between this result and the initial result (2.1 W) is greater than the average error for LF.Pf (max) (0.67 W), but is not the greatest error observed. This element is borderline according to this pass/fail criterion and as such may have tested one way or the other regardless of the software used.

Element 6 of HB0398 failed its LabVIEW test and also failed its Python test, though despite the initial test showing 40% LF efficiency, the Python test showed no power from this element whatsoever. Presumably this element went from underperforming to completely dead, or it has an intermittent connection. It was excluded from the analysis because it did not have a valid Pf (max) and the lack of any acoustic power delivered by the element cannot be attributed to the software.

Discussion

The first question worth asking when comparing the results from the existing LabVIEW application to the newly developed Python application is whether there is a systematic difference between them, or in other words, if the average results with the new software tend to be greater or less than the current software. If there was any meaningful difference in the calculations performed, the accuracy of locating the elements, or the ability to isolate the intervals of stable data where the UA is on/off, one would expect that there would be a tendency for the results from the new software to be different on average. As it turns out, they are remarkably close, l. The average beam angle is virtually identical, with both applications agreeing within a tenth of a degree. The LF eff (%) and HF eff (%) are also very similar, with systematic errors of less than .5% and 1% respectively. The Pf (max) for both frequency ranges agrees within about 0.1 Watts. The greatest systematic error observed was the Lf.Rfl (%), which still only differed by 1.25%. This clearly shows that the Python software does not tend to provide significantly higher or lower results on average. Furthermore, the standard deviations of each measurement across all elements are very comparable and in fact they are slightly less than the current software in every case, indicating that there is not a greater propensity towards random error.

The differences observed between the results of the new software and the current software can be attributed almost fully to random error, with little if any tendency towards producing higher or lower measurements. The magnitude of this random error depends on the measurement, with the greatest being LF efficiency percent. Still, the random error is less than 4.5% on average, with a standard deviation of 3.9. This means that differences in LF efficiency between 0.6% and 8.4% are typical between the two trials in either direction. This difference may seem substantial and, in some cases, can be the difference between a UA passing and failing, but in the next section we will discuss whether these differences are acceptable in the context of the variability of the currently used software and hardware.

Variability comparison

This section will compare the differences observed between the results obtained with the new Python software and the existing LabVIEW software to the differences observed between tests done with the LabVIEW software but done on two different wet test fixtures.

The purpose of this comparison is assess the new python software as if it was a new wet test fixture system, and compare the deviations in results to the deviations observed on a previously-accepted wet test fixture.

Results Summary

Measurement	Systematic Error (WTF2/WTF3)	Systematic Error (Labview/Python)	Better/ Worse	Average Error (WTF2/WTF3)	Average Error (Labview/Python)	Better/ Worse
Beam Angle (deg)	2.87	0.03	+	2.87	1.09	+
LF.Eff (%)	2.76	0.43	+	4.67	4.48	+
LF.Rfl (%)	2.23	1.23	+	3.70	3.38	+
LF.Pf (max) (W)	0.61	0.10	+	0.80	0.67	+
HF.Eff (%)	0.70	0.95	-	1.40	2.18	-
HF.Rfl (%)	0.07	0.24	+	1.22	0.60	+
HF.Pf (max) (W)	0.06	0.11	+	0.23	0.36	-

Table 3 Comparison of Variablility between LabVIEW and Python to Variability between WTF2 and WTF3

Discussion

The systematic error between results from Python and LabVIEW was less than the systematic error between WTF2 and WTF3 in every measurement except one. The random error is more comparable, but in general is still less for the Python software. This indicates that the random error observed with the Python software is well within the acceptable range. It is plausible that most of this is attributable to the day-to-day variability in the UAs themselves.

Conclusions/Recommendations

These tests suggest that there is extremely little, if any, systematic difference in the results of the new Python Wet Test Fixture interface and the existing LabVIEW application. This bodes well for the new software's ability to locate elements, read forward and reflected electrical power, obtain accurate balance readings and isolate the stable on and off intervals, and finally to calculate acoustic power. If any of these key components were not functioning as well as the original system, there would be a tendency for the results to be meaningfully greater or less than the original system on average, which is not the case.

The random variability observed between the results with the original LabVIEW software and the results with the new Python software was less than 5% on average for every quantity tested, which is comparable, and even slightly less than the variability between testing on different days and different wet test fixtures. One element narrowly failed with the current software and narrowly passed on the new software. However, this should be expected to occur occasionally, even when testing with the same software and hardware, due to the day-to-day variability of the UAs.

Because this report finds the results obtained with the new Python software to be within the bounds of normal variability, this report recommends proceeding with thorough acceptance testing of the new Python software.

Appendix A

UA	Element	Theta	Theta	diff (deg)	LF.Eff (%)	LF.Eff (%)	diff (%)	LF.Rfl (%)	LF.Rfl (%)		LF.Pf(max) (W)	LF.Pf(max) (W)		HF.Eff (%)	HF.Eff (%)		HF.Rfl (%)	HF.Rfl (%)		HF.Pf(max	HF.Pf(max) (W)		Element r	Element r
	Element_01	-92.6	-90	2.6	64	62	2	11.2	10	1.2	7.1	7.2	0.1	32	32.1	0.1	2.9	2.4	0.5	6.4	6.4	0	Pass	PASS
	Element_02	-91.8	-90.1	1.7	64	62.8	1.2	7.2	5.9	1.3	6.7	6.8	0.1	31	28.9	2.1	2.7	2.9	0.2	6.7	7.1	0.4	Pass	PASS
	Element_03	-92.2	-90.1	2.1	73	71.4	1.6	5.3	5.9	0.6	5.8	6	0.2	29	28.7	0.3	10.8	10	0.8	7.7	7.7	0	Pass	PASS
	Element_04	-92.2	-90.1	2.1	74	71.1	2.9	7.5	8.4	0.9	5.8	6.1	0.3	33	34.5	1.5	4	3.6	0.4	6.3	6	0.3	Pass	PASS
	Element_05	-92.2	-90.7	1.5	74	71.3	2.7	9.4	10.1	0.7	6	6.2	0.2	42	42.8	0.8	0.3	0.5	0.2	4.8	4.7	0.1	Pass	PASS
	Element_06	-92.2	-90.1	2.1	75	70.4	4.6	10.1	10.1	0	6	6.3	0.3	44	42.2	1.8	1.8	1.5	0.3	4.7	4.8	0.1	Pass	PASS
	Element_07	-92.2	-90.1	2.1	75	70.1	4.9	25.3	22.3	3	7.1	7.3	0.2	42	39.4	2.6	4.2	4.4	0.2	5	5.3	0.3	Pass	PASS
	Element_08	-92.2	-90.7	1.5	75	72.9	2.1	13.8	15.6	1.8	6.2	6.5	0.3	44	43	1	5.6	5.8	0.2	4.8	4.9	0.1	Pass	PASS
	Element_09	-92.2	-90.7	1.5	76	73.5	2.5	10.9	9	1.9	5.9	6	0.1	42	40.4	1.6	7.3	7.2	0.1	5.2	5.3	0.1	Pass	PASS
	Element_10	-92.2	-90	2.2	74	72	2	20	18.9	1.1	6.7	6.9	0.2	35	34.9	0.1	12.7	13.1	0.4	6.6	6.6	0	Pass	PASS
HC0897	UA Common	-92.2	-90.3	1.9																			Pass	PASS
	Element_01	-86.2	-87.7	1.5	57	67.7	10.7	0.2	3.1	2.9	7	6.1	0.9	42	41.1	0.9	6.5	6	0.5	5.1	5.2	0.1	Pass	PASS
	Element_02	-86.6	-87.7	1.1	61	71.9	10.9	0.2	4.4	4.2	6.5	5.8	0.7	41	39.8	1.2	3.9	4.9	1	5.1	5.3	0.2	Pass	PASS
	Element_03	-86.6	-87.7	1.1	65	70.5	5.5	0.1	4.4	4.3	6.2	5.9	0.3	43	42.8	0.2	1.4	1.3	0.1	4.7	4.7	0	Pass	PASS
	Element_04	-86.6	-87.9	1.3	58	67.2	9.2	0.1	1.8	1.7	6.9	6.1	0.8	44	39.3	4.7	5.4	2	3.4	4.8	5.2	0.4	Pass	PASS
	Element_05	-86.6	-87.7	1.1	57	59.4	2.4	0.7	0.1	0.6	7.1	6.7	0.4	43	44.3	1.3	2.1	1.8	0.3	4.7	4.6	0.1	Pass	PASS
	Element_06	-86.6	-87.7	1.1	60	55.9	4.1	0.4	0.6	0.2	6.7	7.2	0.5	45	44.4	0.6	1.2	1.7	0.5	4.5	4.6	0.1	Pass	PASS
	Element_07	-86.6	-87.1	0.5	58	57.4	0.6	0.7	0.2	0.5	7	7	0	43	42.2	0.8	3.3	2.6	0.7	4.8	4.9	0.1	Pass	PASS
	Element_08	-86.2	-87.7	1.5	62	59.1	2.9	3.2	2.8	0.4	6.7	7	0.3	48	45.1	2.9	2.4	2.1	0.3	4.3	4.5	0.2	Pass	PASS
	Element_09	-86.6	-87.6	1	72	70	2	2.6	3.1	0.5	5.7	5.9	0.2	45	44.3	0.7	3.4	3.3	0.1	4.6	4.7	0.1	Pass	PASS
	Element_10	-86.6	-87.6	1	61	60.1	0.9	0.3	0.2	0.1	6.6	6.7	0.1	45	44	1	6.1	5.9	0.2	4.7	4.8	0.1	Pass	PASS
GM0591	UA Common	-86.52	-87.6	1.08																			Pass	PASS
	Element_01	-89.8	-88.5	1.3	34	41.3	7.3	10.7	9.1	1.6	13.4	10.7	2.7		18.6	N/A		0.6			10.8		Fail	PASS
GM0912	UA Common	-89.76	-88.5	1.26																			Fail	PASS
	Element_01	-90.2	-89.8	0.4	45	64.5	19.5	23.8	20.2	3.6	11.6	7.8	3.8	26	31	5	3.4	3.4	0	7.9	6.7	1.2	Pass	PASS
	Element_02	-90.2	-90.3	0.1	50	60.8	10.8	23.5	19.9	3.6	10.4	8.2	2.2	23	30.6	7.6	4.1	4.4	0.3	9	6.8	2.2	Pass	PASS
	Element_03	-90.2	-90.4	0.2	48	58.3	10.3	19.2	20.8	1.6	10.2	8.7	1.5	27	26.9	0.1	0.1	0.6	0.5	7.3	7.5	0.2	Pass	PASS
	Element_04	-90.2	-90.4	0.2	41	50.3	9.3	9.2	14.7	5.5	10.7	9.3	1.4	19	25.1	6.1	1.1	1	0.1	10.8	8	2.8	Pass	PASS
	Element_05	-90.2	-90.6	0.4	49	60.8	11.8	10.9	8.7	2.2	9.2	7.2	2	21	26.9	5.9	6	5.5	0.5	10	7.9	2.1	Pass	PASS
	Element_06	-91.8	-90.7	1.1	40	0	40	16.6	75	58.4	12.1	N/A	N/A	24	N/A	N/A	5.4	N/A		8.9	N/A	N/A	Fail	FAIL
HB0398	UA Common	-90.36	-90.4	0.04																			Fail	FAIL
	Element_01	-89.8	-89.8	0	24	24	0	19.3	17.7	1.6	20.5	20.3	0.2		18.1	N/A		1.7	N/A		11.3	N/A	Fail	FAIL
HB0670	UA Common	-89.88	-90	0.12																			Fail	FAIL
	Element_01	-90.6	-92	1.4	63	61.1	1.9	9.1	13.8	4.7	7	7.6	0.6	46	42.1	3.9	1.1	1.3	0.2	4.4	4.8	0.4	Pass	PASS
	Element_02	-90.6	-91.4	0.8	70	67.9	2.1	8.6	7.4	1.2	6.3	6.4	0.1	44	40.8	3.2	0.8	0.5	0.3	4.6	4.9	0.3	Pass	PASS
	Element_03	-91	-91.4	0.4	69	70	1	7.6	6	1.6	6.3	6.1	0.2	44	42.8	1.2	6.9	4.5	2.4	4.9	4.9	0	Pass	PASS
	Element_04	-90.6	-91.4	0.8	67	68.5	1.5	7	5.2	1.8	6.5	6.2	0.3	39	38.9	0.1	6.2	4.5	1.7	5.4	5.4	0	Pass	PASS
	Element_05	-90.6	-91.4	0.8	71	69.4	1.6	9	6.9	2.1	6.2	6.2	0	46	41.7	4.3	0.8	0.3	0.5	4.3	4.8	0.5	Pass	PASS
	Element_06	-90.6	-91.4	0.8	70	67.8	2.2	6.1	16.7	10.6	6.1	7.1	1	46	45.9	0.1	0.5	0.8	0.3	4.4	4.4	0	Pass	PASS
	Element_07	-91	-92	1	69	73.8	4.8	15.7	19.4	3.7	6.9	6.7	0.2	44	40.7	3.3	1.3	1	0.3	4.6	5	0.4	Pass	PASS
	Element_08	-91	-92.1	1.1	74	68.7	5.3	16.2	6.1	10.1	6.5	6.2	0.3	46	44.3	1.7	0.7	0.2	0.5	4.4	4.5	0.1	Pass	PASS
	Element_09	-90.6	-91.4	0.8	70	66.8	3.2	3.4	7.2	3.8	5.9	6.5	0.6	44	38.4	5.6	2.1	1.5	0.6	4.7	5.3	0.6	Pass	PASS
	Element_10	-91	-91.4	0.4	66	65.6	0.4	7.7	6.2	1.5	6.6	6.5	0.1	46	43.5	2.5	1.9	1.5	0.4	4.5	4.7	0.2	Pass	PASS
HC0893	UA Common	-90.76	-91.6	0.84																			Pass	PASS
	Element_01	-92.2	-93.4	1.2	68	61.2	6.8	5.5	20.6	15.1	6.2	8.2	2	44	41.9	2.1	0.8	0.8	0	4.6	4.8	0.2	Pass	PASS
	Element_02	-92.2	-93.4	1.2	67	64.3	2.7	17.9	15.8	2.1	7.2	7.4	0.2	40	37.4	2.6	1.2	0.5	0.7	5.1	5.4	0.3	Pass	PASS
	Element_03	-92.2	-93.1	0.9	70	65.3	4.7	9.9	9.7	0.2	6.3	6.8	0.5	43	38.7	4.3	1.8	4.1	2.3	4.7	5.4	0.7	Pass	PASS
	Element_04	-92.2	-93.4	1.2	71	71.3	0.3	10.2	11.7	1.5	6.2	6.4	0.2	42	41.7	0.3	2.6	3.3	0.7	4.9	5	0.1	Pass	PASS
	Element_05	-92.2	-93.4	1.2	74	71.5	2.5	4.9	13.6	8.7	5.7	6.5	0.8	45	44.5	0.5	4.7	3.2	1.5	4.6	4.6	0	Pass	PASS
	Element_06	-92.2	-93.1	0.9	74	71.5	2.5	9.1	12.4	3.3	6	6.4	0.4	44	45.5	1.5	2.9	4.7	1.8	4.7	4.6	0.1	Pass	PASS
	Element_07	-92.2	-93.4	1.2	74	66.1	7.9	7.3	21.3	14	5.9	7.7	1.8	41	41	0	5.4	5.6	0.2	5.2	5.2	0	Pass	PASS
	Element_08	-92.2	-93.4	1.2	73	67.3	5.7	5.7	23.7	18	5.8	7.8	2	48	45.5	2.5	5.3	4.8	0.5	4.4	4.6	0.2	Pass	PASS
	Element_09	-92.2	-92.8	0.6	72	66.4	5.6	13	7.5	5.5	6.4	6.5	0.1	45	38.9	6.1	4.7	4	0.7	4.7	5.3	0.6	Pass	PASS
	Element_10	-92.2	-93.4	1.2	69	65.8	3.2	20.9	19.3	1.6	7.4	7.5	0.1	45	43.8	1.2	4.4	4.7	0.3	4.7	4.8	0.1	Pass	PASS
HB0381	UA Common	-92.2																					Pass	PASS
	Element_01	-93	-90.6			63.7		1.6	4.9			6.6		38	46.5		1.7	1.4		5.3	4.4		Fail	PASS
GK1641	UA Common	-92.64	-90.6																				Fail	FAIL
Mean	All elements	-90.46526316	-90.49642857	1.085925926	64.40425532	64.82978723	4.480851064	9.374468	10.60638	3.376596	7.3	7.204255	0.670213	39.8913	38.9413	2.175556	3.569565	3.326667	0.602174	5.504348	5.391111	0.357778		
Stdev.s		2.125442035	1.908358165		11.5356905	8.828336662		6.883612	6.846497		2.563625151	2.173352		7.468587	7.022618		2.699211	2.600608		1.518316	1.51027			

Table 4 Raw Data for Python/LabVIEW comparison

Appendix A

UA	Element	Theta	Theta	diff (deg)	LF.Eff (%)	LF.Eff (%)	diff (%)	LF.Rfl (%)	LF.Rfl (%)	diff (%)	LF.Pf(max) (W)	LF.Pf(max) (W)	diff (W)	HF.Eff (%)	HF.Eff (%)	diff (%)	HF.Rfl (%)	HF.Rfl (%)	diff (%)	HF.Pf(max	HF.Pf(max) (W)	diff (W)	Element result	Element result
	New WTF2	New WTF2	New WTF2		New WTF2	OLD WTF3		New WTF	OLD WTF3		New WTF2	OLD WTF3		New WTF	OLD WTF3		New WTF2	OLD WTF3		New WTF	OLD WTF3		OLD WTF3	
		Theta			LF.Eff (%)			LF.Rfl (%)	LF.Rfl (%)		LF.Pf(max) (W)	LF.Pf(max) (W)		HF.Eff (%)	HF.Eff (%)		HF.Rfl (%)	HF.Rfl (%)		HF.Pf(max	HF.Pf(max) (W)		Element result	Element result
	Element_01	-90	-94.3	4.3	64	67	3	11.2	4.9	6.3	7.1	6.3	0.8	32	31	1	2.9	3.5	0.6	6.4	6.7	0.3	Pass	Pass
	Element_02	-90.1	-94.3	4.2	64	71	7	7.2	4.4	2.8	6.7	5.9	0.8	31	29	2	2.7	2.4	0.3	6.7	7.1	0.4	Pass	Pass
	Element_03	-90.1	-94.3	4.2	73	72	1	5.3	3.4	1.9	5.8	5.8	0	29	32	3	10.8	4	6.8	7.7	6.5	1.2	Pass	Pass
	Element_04	-90.1	-94.3	4.2	74	72	2	7.5	1.8	5.7	5.8	5.6	0.2	33	32	1	4	4.8	0.8	6.3	6.5	0.2	Pass	Pass
	Element_05	-90.7	-94.4	3.7	74	74	0	9.4	2.5	6.9	6	5.5	0.5	42	42	0	0.3	2.9	2.6	4.8	4.9	0.1	Pass	Pass
	Element_06	-90.1	-94.3	4.2	75	73	2	10.1	8.5	1.6	6	6	0	44	41	3	1.8	2.9	1.1	4.7	5	0.3	Pass	Pass
	Element_07	-90.1	-94.3	4.2	75	75	0	25.3	12.1	13.2	7.1	6	1.1	42	42	0	4.2	4.6	0.4	5	5	0	Pass	Pass
	Element_08	-90.7	-94.7	4	75	73	2	13.8	22.5	8.7	6.2	7.1	0.9	44	44	0	5.6	5.7	0.1	4.8	4.8	0	Pass	Pass
	Element_09	-90.7	-94.3	3.6	76	76	0	10.9	7.1	3.8	5.9	5.7	0.2	42	41	1	7.3	6.4	0.9	5.2	5.2	0	Pass	Pass
	Element_10	-90	-94.3	4.3	74	74	0	20	13.3	6.7	6.7	6.2	0.5	35	35	0	12.7	12.6	0.1	6.6	6.6	0	Pass	Pass
HC0897	UA Common	-90.3	-94.4	4.1																			Pass	Pass
	Element_01	-88.5	-94.4	5.9	34	62	28	10.7	0.6	10.1	13.4	6.5	6.9		48			3.8			4.4		Fail	Pass
GM0912	UA Common	-88.5	-94.6	6.1																			Fail	Pass
	Element_01	-87.7	-88.8	1.1	57	59	2	0.2	0.1	0.1	7	6.8	0.2	42	40	2	6.5	7.8	1.3	5.1	5.4	0.3	Pass	Pass
	Element_02	-87.7	-88.8	1.1	61	65	4	0.2	0.8	0.6	6.5	6.2	0.3	41	39	2	3.9	4.4	0.5	5.1	5.3	0.2	Pass	Pass
	Element_03	-87.7	-89.3	1.6	65	70	5	0.1	1.8	1.7	6.2	5.8	0.4	43	41	2	1.4	1.1	0.3	4.7	4.9	0.2	Pass	Pass
	Element_04	-87.9	-89.4	1.5	58	67	9	0.1	1.6	1.5	6.9	6	0.9	44	39	5	5.4	2.4	3	4.8	5.2	0.4	Pass	Pass
	Element_05	-87.7	-88.8	1.1	57	66	9	0.7	1.1	0.4	7.1	6.1	1	43	43	0	2.1	3.1	1	4.7	4.8	0.1	Pass	Pass
	Element_06	-87.7	-88.8	1.1	60	64	4	0.4	0.5	0.1	6.7	6.3	0.4	45	45	0	1.2	3.5	2.3	4.5	4.6	0.1	Pass	Pass
	Element_07	-87.1	-88.8	1.7	58	58	0	0.7	0.4	0.3	7	6.9	0.1	43	41	2	3.3	3.6	0.3	4.8	5.1	0.3	Pass	Pass
	Element_08	-87.7	-88.9	1.2	62	60	2	3.2	0.4	2.8	6.7	6.7	0	48	46	2	2.4	3.4	1	4.3	4.5	0.2	Pass	Pass
	Element_09	-87.6	-88.9	1.3	72	61	11	2.6	3.2	0.6	5.7	6.8	1.1	45	44	1	3.4	3.7	0.3	4.6	4.7	0.1	Pass	Pass
	Element_10	-87.6	-89.4	1.8	61	68	7	0.3	2.1	1.8	6.6	6	0.6	45	44	1	6.1	6.7	0.6	4.7	4.9	0.2	Pass	Pass
GM0591	UA Common	-87.6	-89	1.4																			Pass	Pass
Mean	All elements	-88.92857143	-91.8	2.871429	65.19047619	67.95238	4.666667	6.661905	4.433333333	3.695238095	6.814285714	6.2	0.804761905	40.65	39.95238	1.4	4.4	4.475	1.215	5.275	5.338095238	0.23		
Stdev.s		1.336840625	2.752453		10.07779265	5.661062		7.078663	5.599672609		1.582809437	0.450555213		5.441314	5.248583		3.144753358	2.442247		0.927858	0.814540478			

Table 5 Raw data for WTF2 and WTF3 comparison