

DCPS-PTP-001, Rev 1.

DCPS Tested: Junction Area

DCPS Version: 2.0

DCPS SVN Revision: 6514

Checksum: a7f01f97a636acb5bff977d2fe573fc88b392cf3ebcf6ddc6a3132a8d8c8effd

Test Dates: October 17th-20th, 2015

Figures showing results of this test can be found in:

</p/nstxusr/nstx-users/sgerhard/DCPS/PTP/Rev1Results/ps/October2015>

or

[http://nstx.pppl.gov/DragNDrop/Operations/DCPS/PTP\\_Execution/October\\_November\\_2015/](http://nstx.pppl.gov/DragNDrop/Operations/DCPS/PTP_Execution/October_November_2015/)

#### 6.1.7: System Timing

These are the time stamps:

[2015-10-16 14:37:23.187685] INFO: SOC rcvd

[2015-10-16 14:37:53.181912] INFO: T60 rcvd

[2015-10-16 14:38:47.181800] INFO: Clock TN

[2015-10-16 14:38:48.181795] INFO: Clock SOP

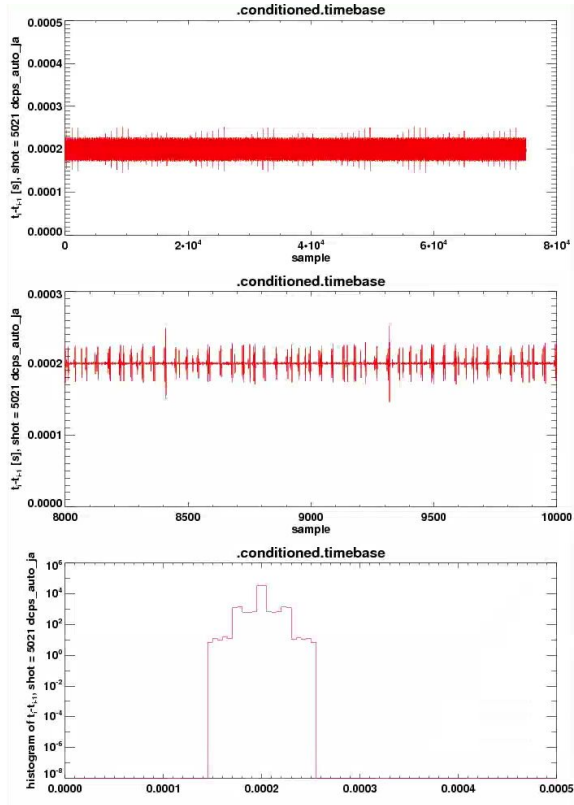
[2015-10-16 14:39:03.181770] INFO: Clock EOP

#### 6.1.8: Time base.

*Shot:* 5021

*Result:* Seems OK, and is similar to many past instances.

See figure:



### 6.1.2:

shot: 5022

result: successful abort

[2015-10-16 15:06:17.277863] INFO: SOC rcvd

[2015-10-16 15:06:47.271962] INFO: T60 rcvd

[2015-10-16 15:07:40.271855] FATAL: Clock ABORT

## 6.2: Shot Sequence

### step 6.2.5

shot: 5023

result: successful abort

[2015-10-16 15:14:56.337907] INFO: SOC rcvd

[2015-10-16 15:15:26.332134] INFO: T60 rcvd

[2015-10-16 15:15:31.845834] INFO: Waiting for TN abort

### step 6.2.9

set tn to -61

[2015-10-16 15:32:39.220435] INFO: SOC rcvd

[2015-10-16 15:32:39.220473] INFO: CycleManager created

[2015-10-16 15:32:39.315104] INFO: Waiting for T60

### 6.3.2.g: Raw Data

Shot: 5027

Tree: 176

*Result:* The results differ from the values in the table of the Rev. 1 procedure, because the HSC scale factors that are used in tree 176 differ from those assumed when the procedure was written. In particular, the negative signs account for polarity flips, and these are corrected out in the calibrated data. So this is all correct.

Coil	DC Level #1 [V]	DC Level #2 [V]	Coil	DC Level #1 [V]	DC Level #2 [V]
Plasma	7.749	9.9953	PF3L	-9.5025	-4.9977
PF1aU	0.2496	0.4992	PF2L	5.250	5.4982
PF1bU	0.7486	0.9993	PF1cL	5.7488	5.999
PF1cU	1.248	1.4995	PF1bL	6.2498	6.4950
PF2U	1.7505	2.000	PF1aL	6.7474	6.9963
PF3U	-2.2500	-2.497	OH	-7.2529	-7.4959
PF4	2.7502	2.9977	TF	-8.2517	-8.4962
PF5	-3.2513	-3.4964			

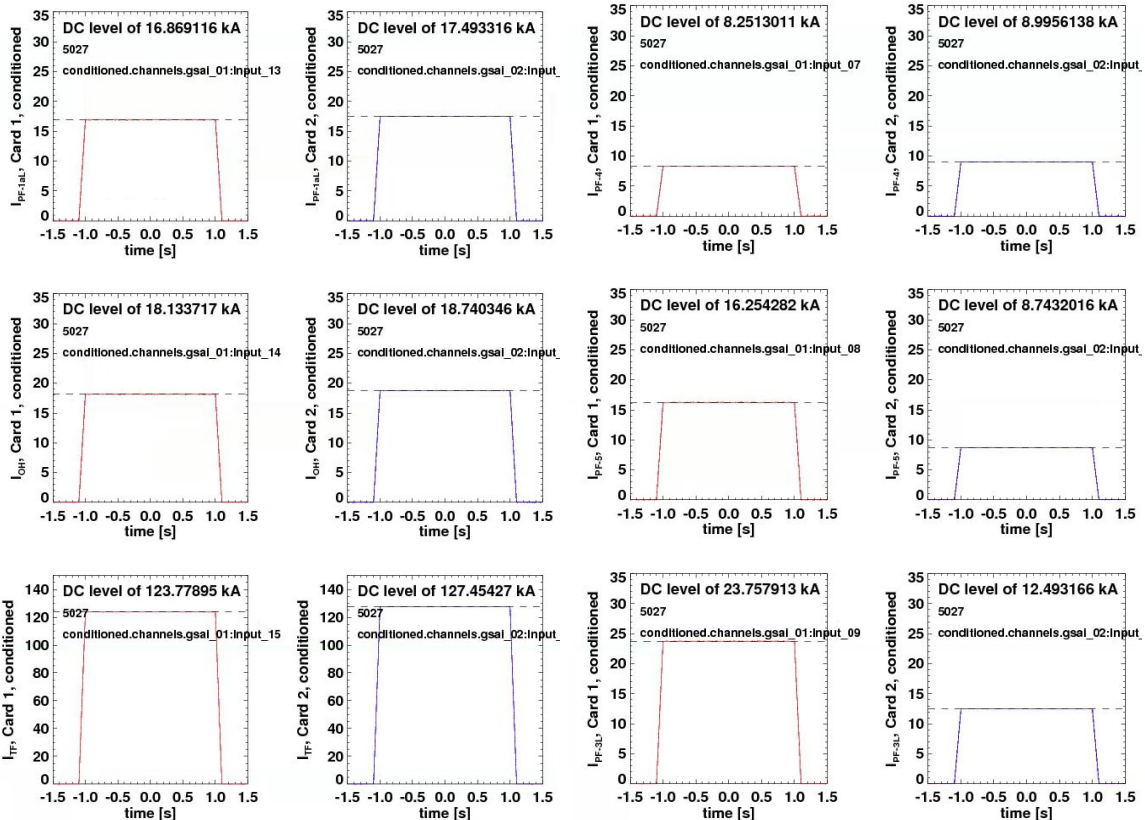
### 6.3.2.i: Calibrated Data

Shot: 5027

Tree: 176

Result: OK, as shown by the table below

Coil	DC Level #1 [kA]	DC Level #2 [kA]	Coil	DC Level #1 [kA]	DC Level #2 [kA]
Plasma	7748	7995	PF3L	23.758	12.493
PF1aU	1.247	2.489	PF2L	26.255	13.745
PF1bU	1.8755	2.4952	PF1cL	28.748	29.985
PF1cU	3.1251	3.7521	PF1bL	15.629	16.238
PF2U	8.7506	5.003	PF1aL	16.869	17.493
PF3U	11.249	6.2443	OH	18.1337	18.740
PF4	8.2513	8.9956	TF	123.778	127.45
PF5	16.254	8.743			

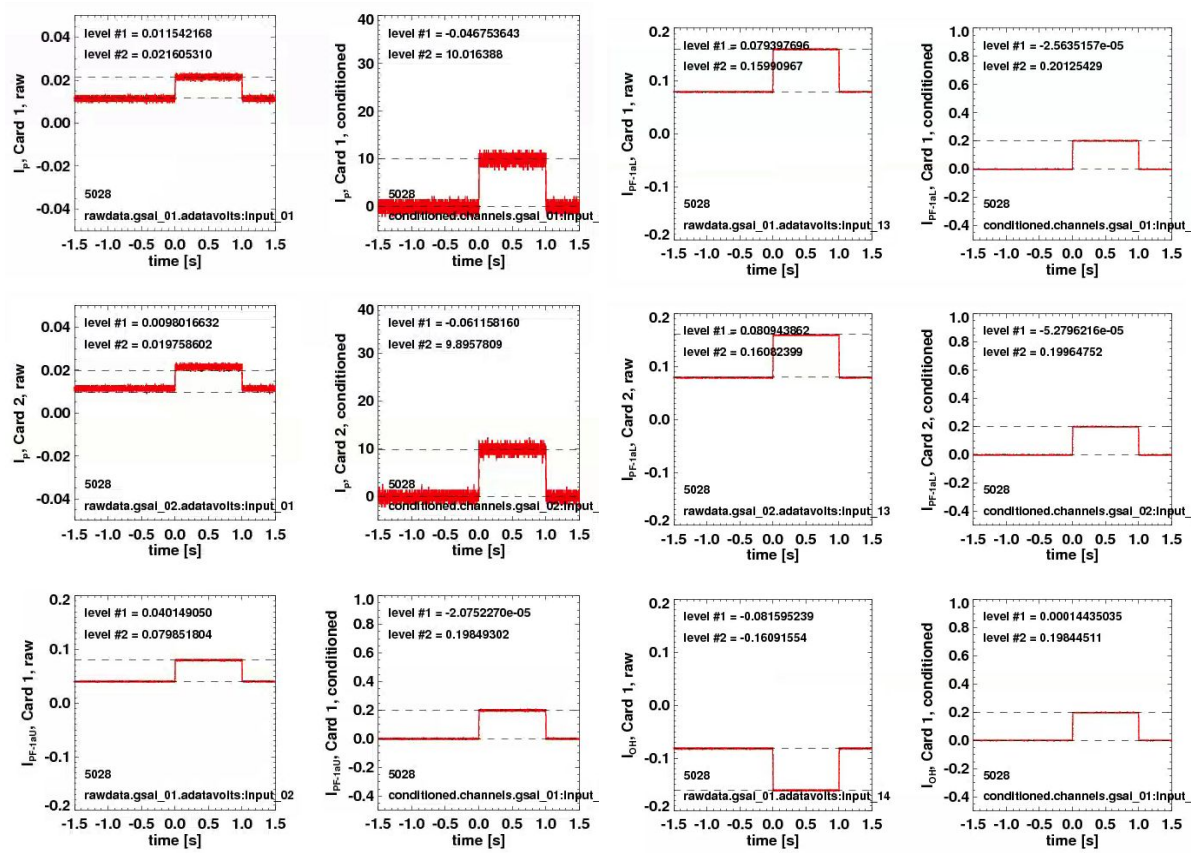


### 6.3.3.e: Baseline Subtraction

Shot: 5028

Tree: 176

Result: Is OK. Two representative plots below.

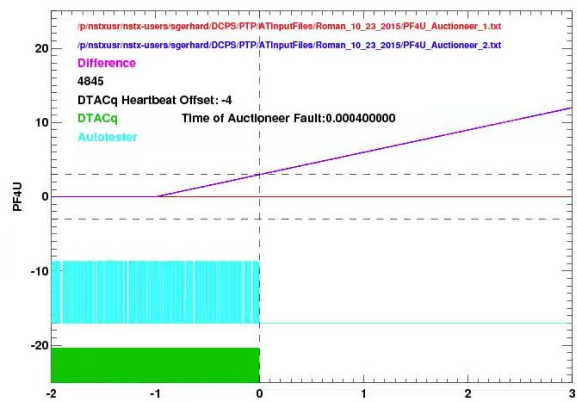
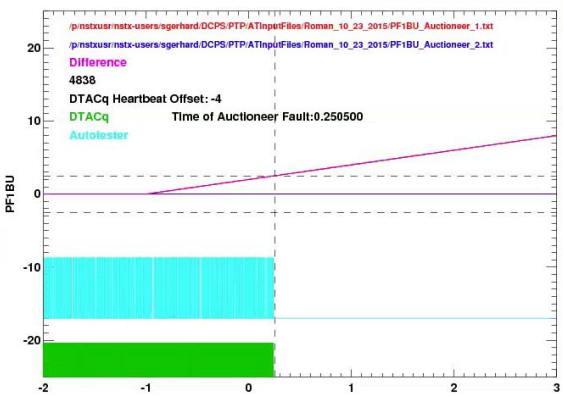
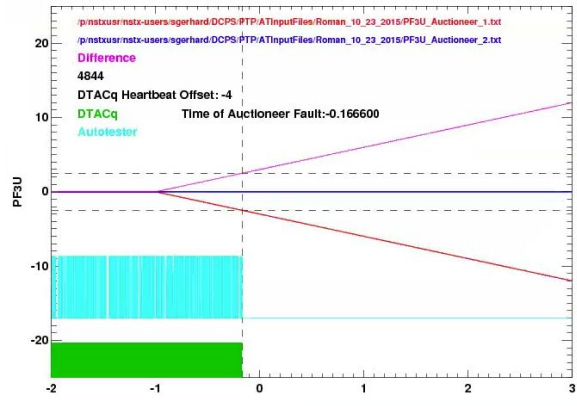
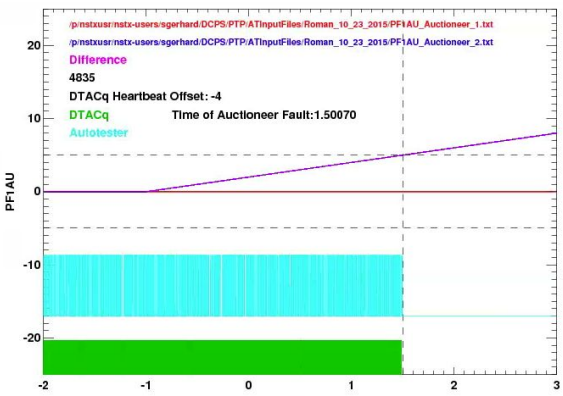


### 6.4.1: Auctioneer Aborts

Param Tree: 176

	<b>Shot</b>	<b>Predicted Fault Time</b>	<b>Result</b>
plasma	4847	2.3339	OK
1aU	4835	1.5	OK
1bU	4838	0.2505	OK
1cU	4839	0.2505	OK
2U	4841	0.2505	OK
3U	4844	-0.1666	OK
4U	4845	0.0004	OK
5U	4846	-0.1666	OK
3L	4843	-0.3747	OK
2L	4842	---	---
1cL	4840	0.2505	OK
1bL	4837	-0.3747	OK
1aL	4836	-0.3747	OK
OH	4848	-0.3747	OK
TF	4849	2.75	OK

Examples:



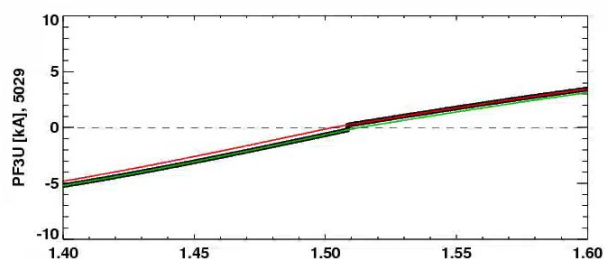
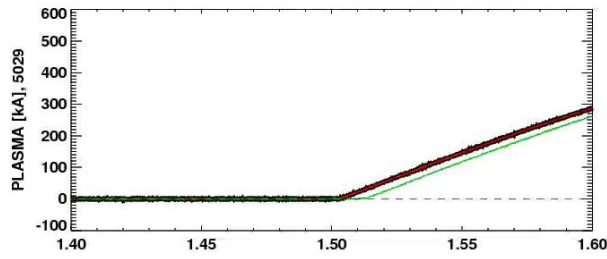
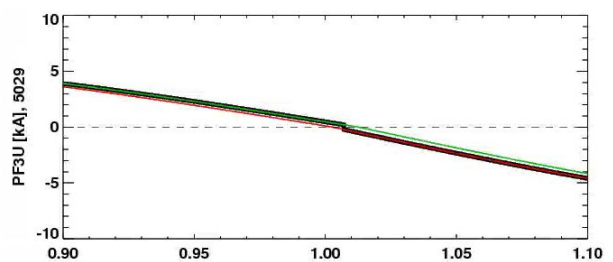
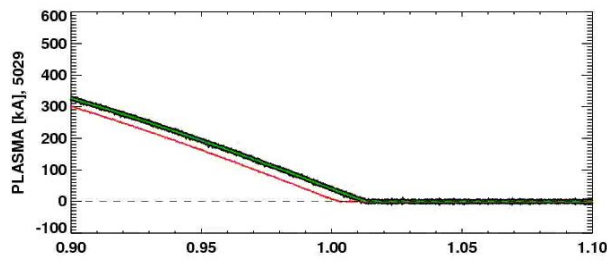
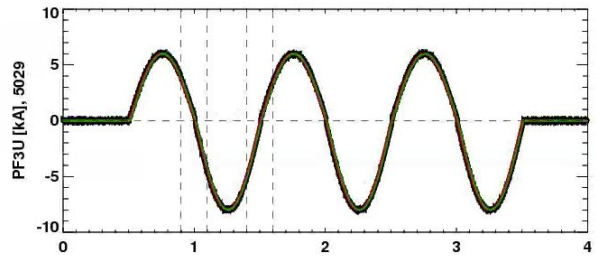
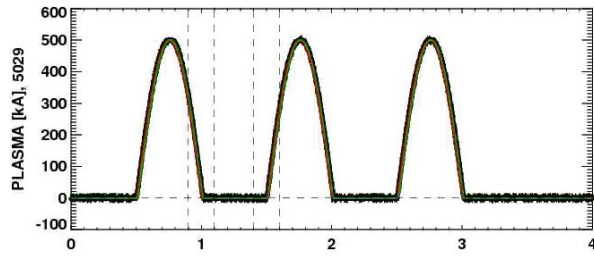


### 6.4.8: Auctioneer Function

Shot: 5029

Tree: 176

Result: Works fine, as shown in the following plots:



### 6.5 Asynchronous Shot

Shot: 5119

Tree: 176

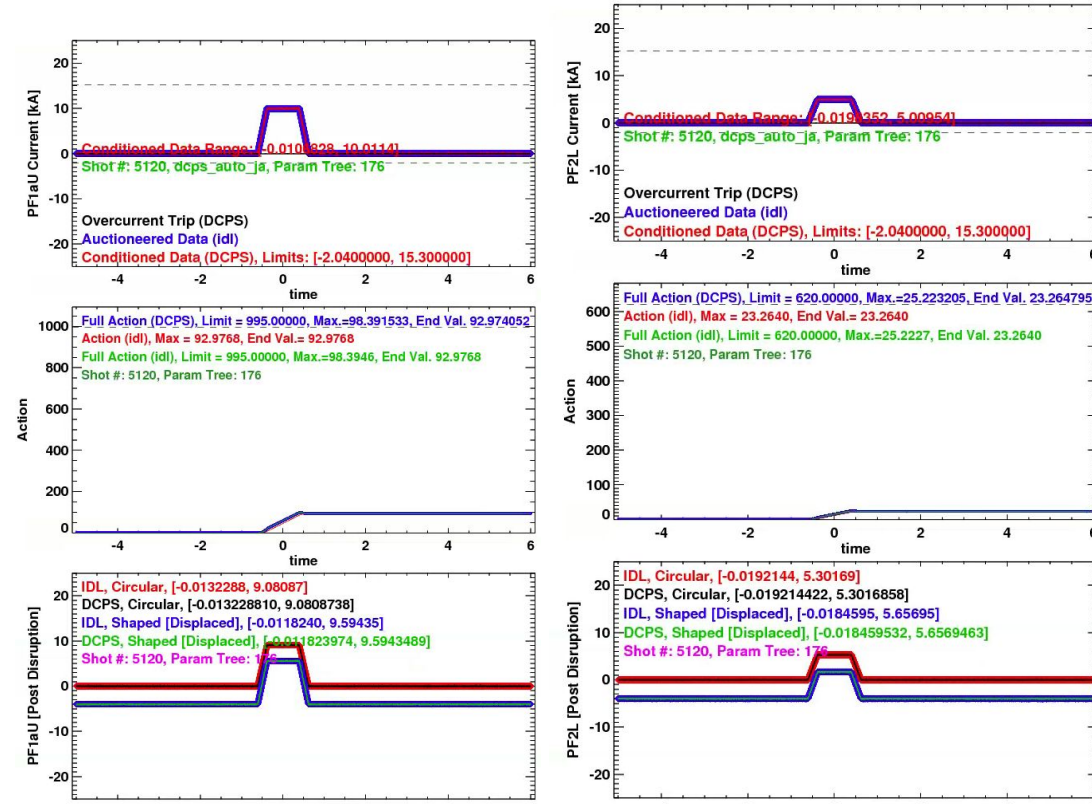
Result: Works fine.

### 6.6.5.a: Current Predictor Tests

Shot: 5120

Tree: 176

Result: All currents match those given in the table. They also match those predicted by an off-line analysis. See tabulated plots for the complete set. Here are two examples:

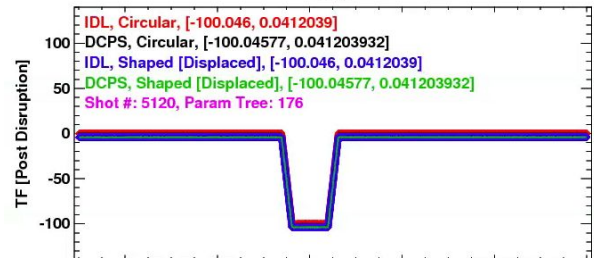
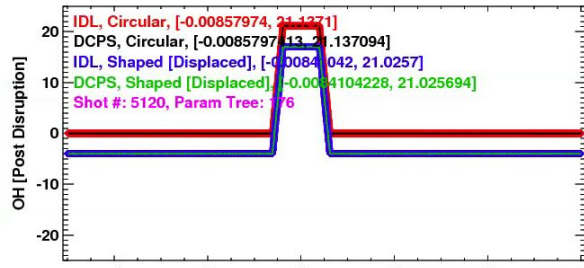
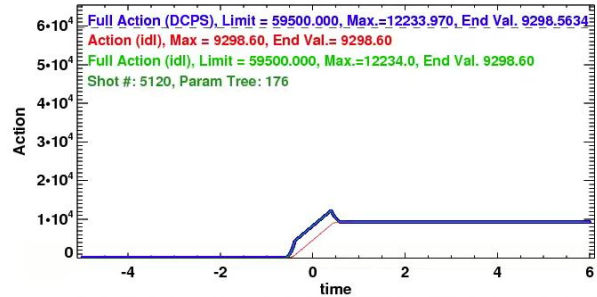
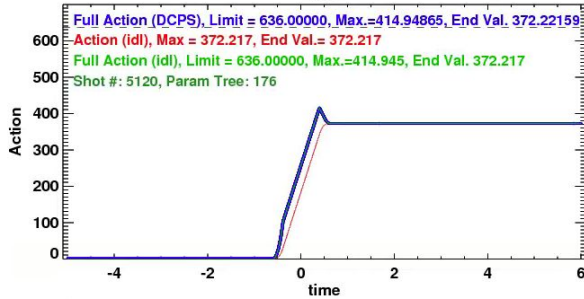
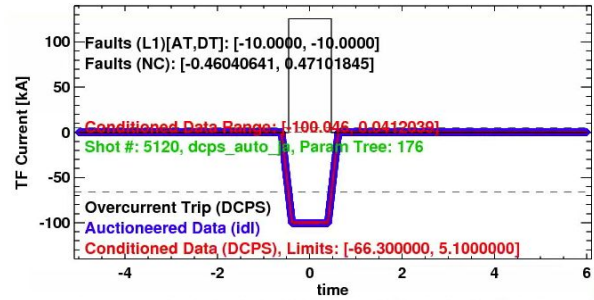
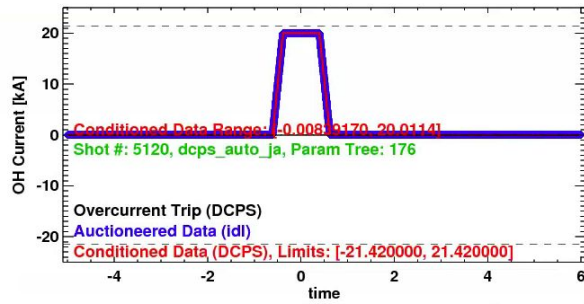


## 6.6.6: Action Calculation Tests

Shot: 5120

Tree: 176

**Result:** The action tests do NOT exactly match the values in the table within the procedure. This is because that table assumes that the waveforms are perfect square waves, whereas (see plots just above) the actual waveforms have some slopes. However, the values do match those computed by an off-line code, and this is the stronger statement. See the large set of plots, or two more samples below (in addition to the two above).

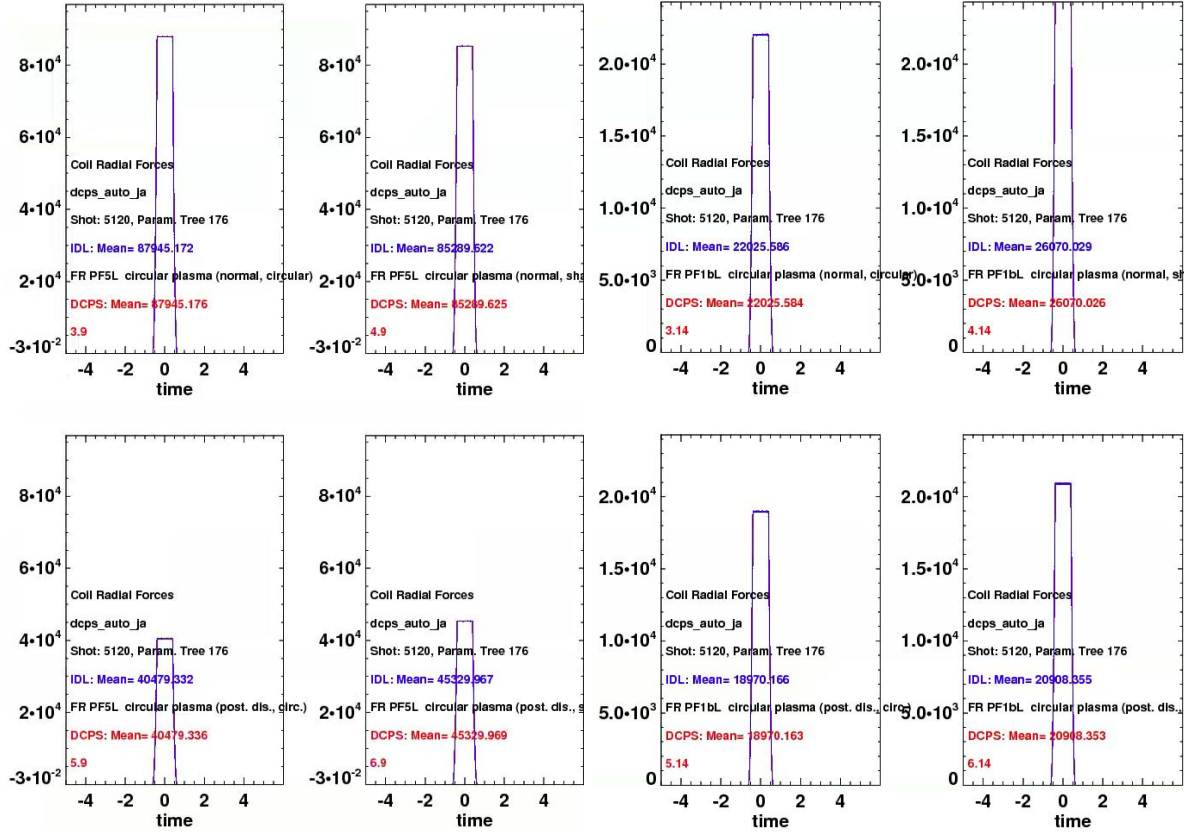


### 6.6.7: Radial Force Calculation

Shot: 5120

Tree: 176

Result: Is OK. See plots in archive.

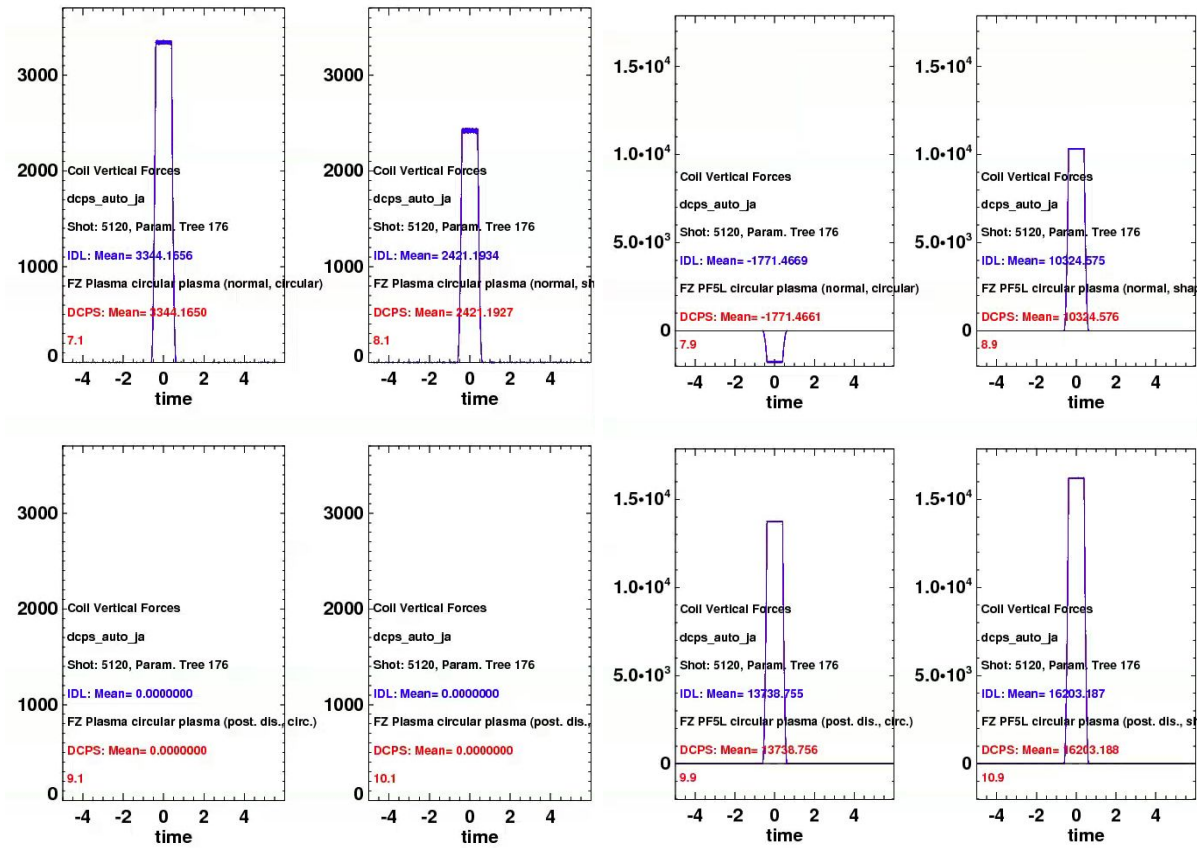


### 6.6.8: Vertical Force Calculation

Shot: 5120

Tree: 176

Result: Is OK. See plots in archive.

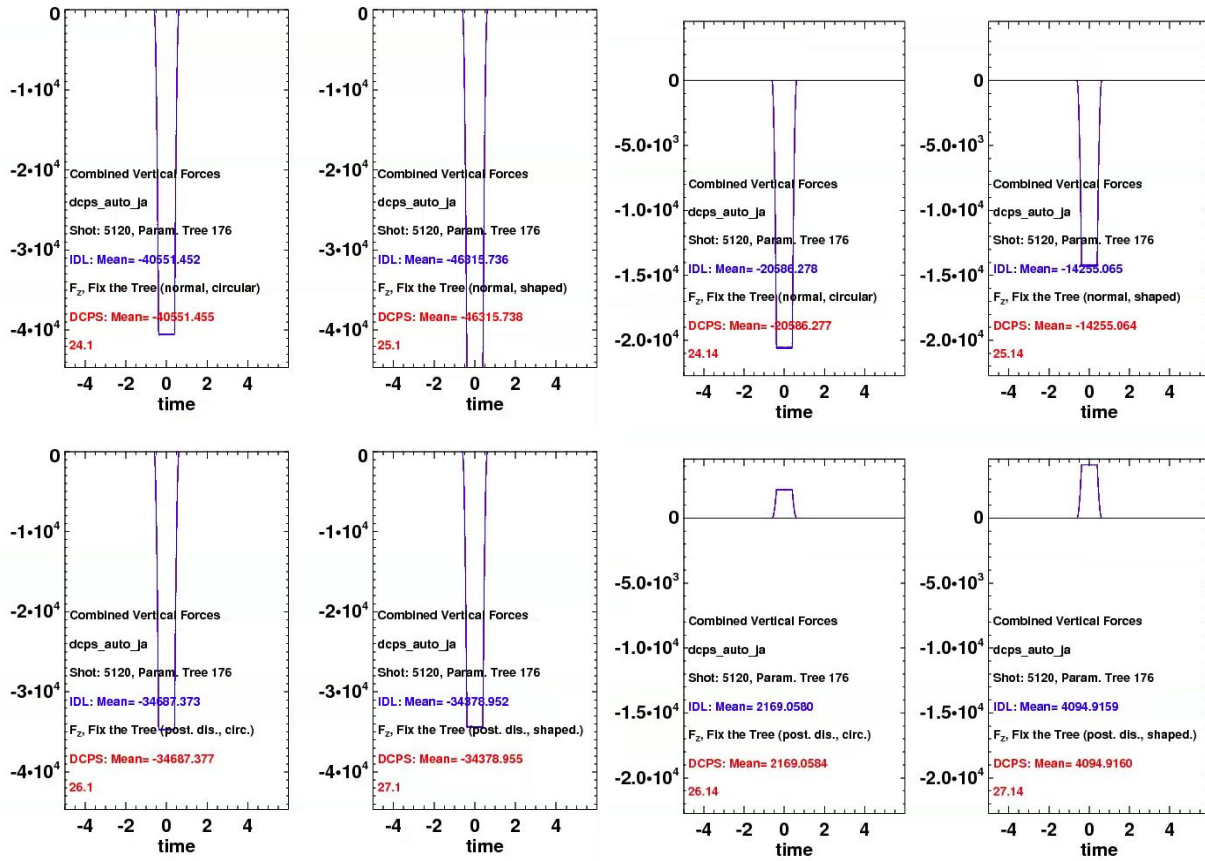


### 6.6.9: Combined Vertical Force Test

Shot: 5120

Tree: 176

Result: Is OK. See plots in archive.



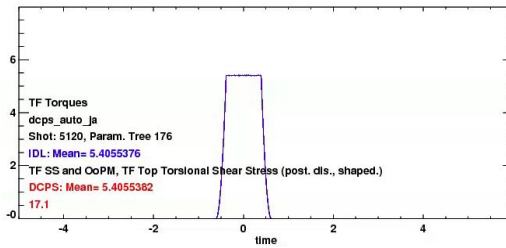
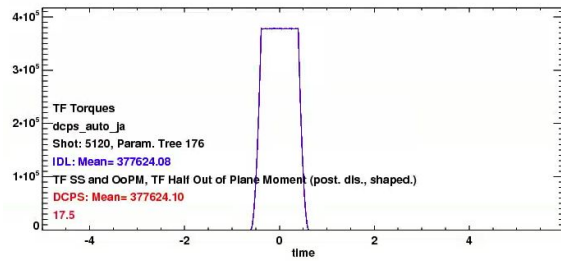
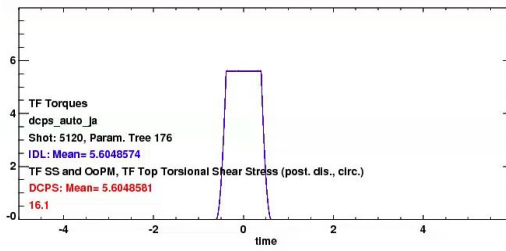
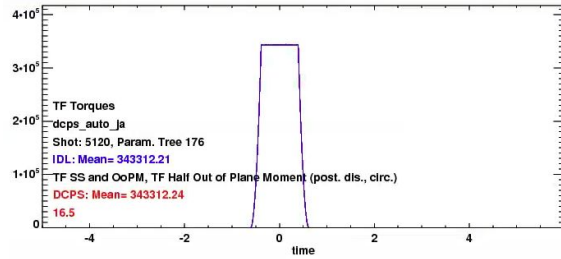
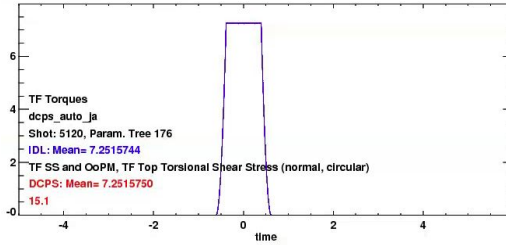
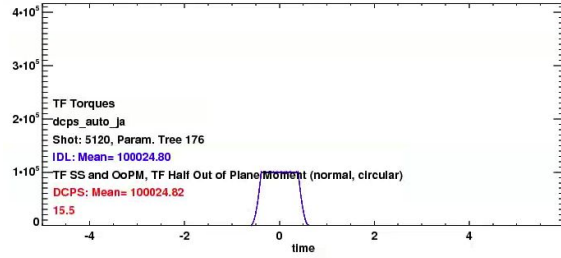


## 6.6.10: Shear Stress and TF Moment

Shot: 5120

Tree: 176

Result: Is OK. See plots in archive.

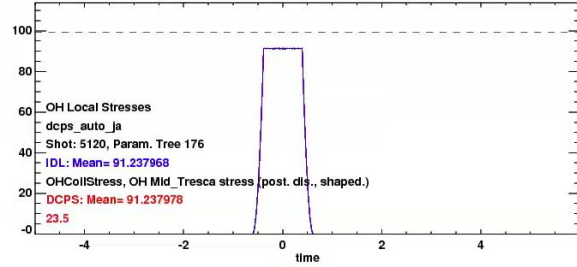
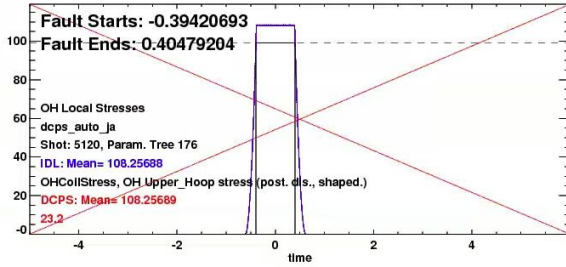
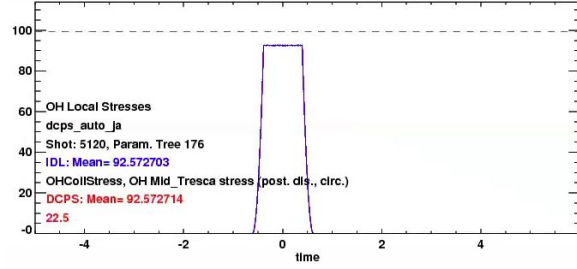
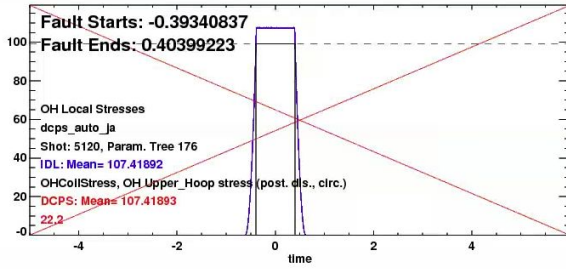
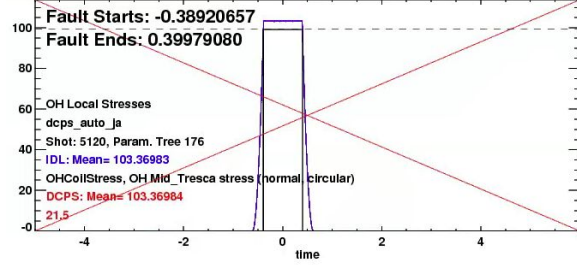
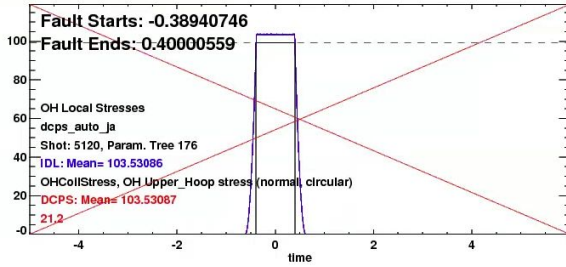


### 6.6.11: OH Stress Test

Shot: 5120

Tree: 176

Result: Is OK. See plots in archive.



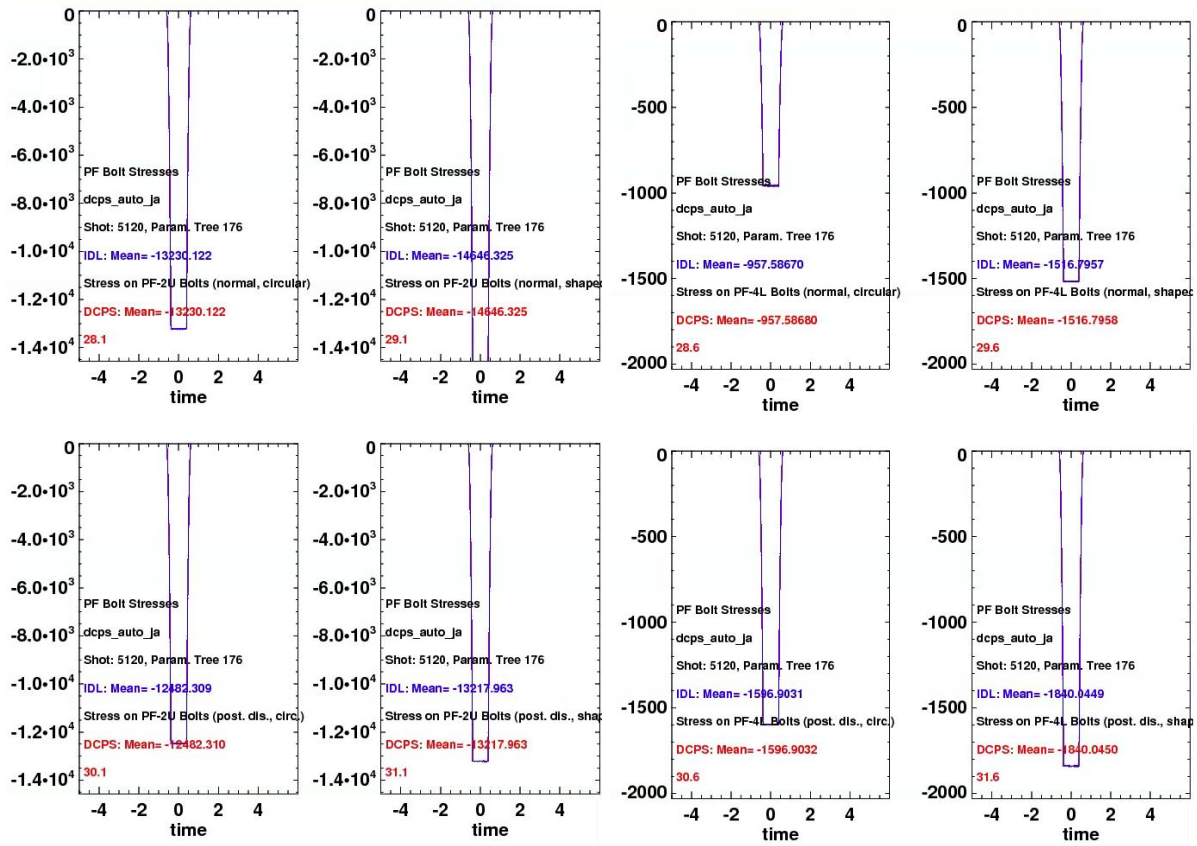


## 6.6.12: Bolt Stress Test

Shot: 5120

Tree: 176

Result: Is OK. See plots in archive. Representative example below:

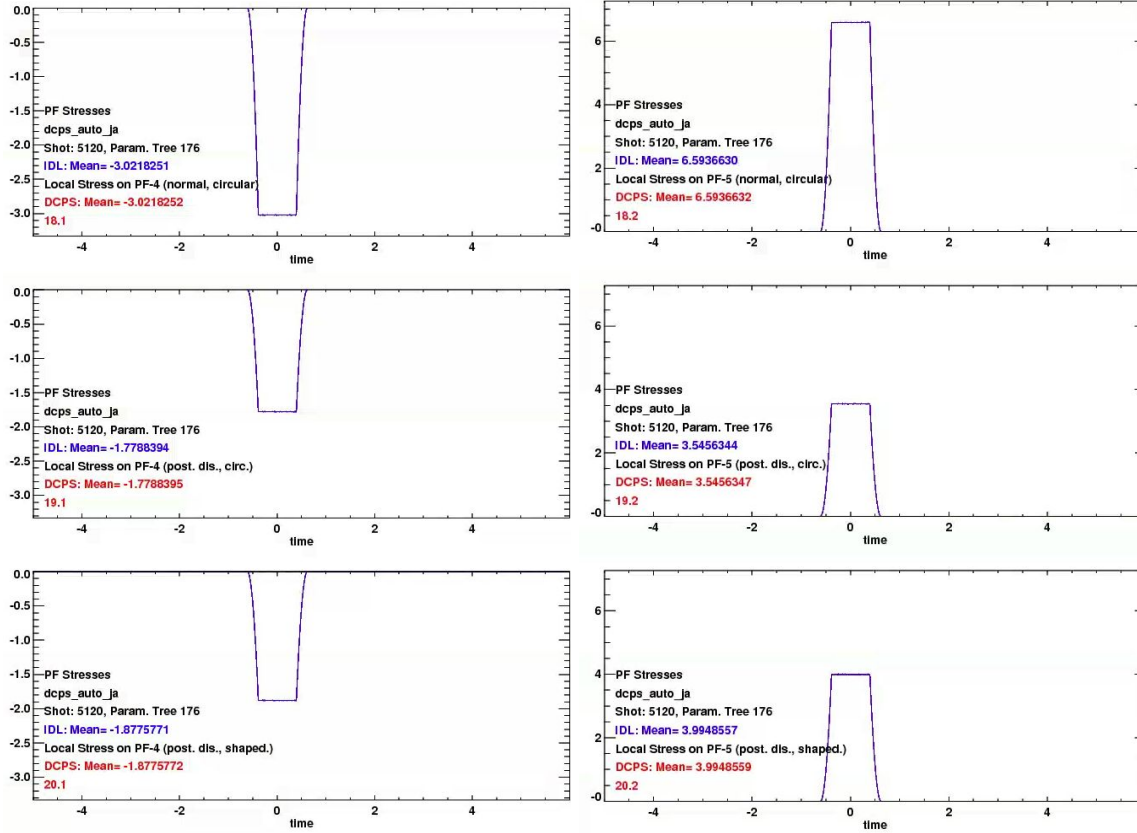


### 6.6.13: Hoop Stress Test

Shot: 5120

Tree: 176

Result: Is OK. See plots in archive.



### 6.7: Auxiliary Input Tests

Deferred

## 6.8.1 Overcurrent Tests

*Tree Used:* 176

*SW Fault Time:* The time when the algorithm trips

*Detected Time:* The time when the AT detects the fault on its digital inputs (the DCPS hardware outputs). Can be found with calls like: [helps,EvaluateL1FaultTiming\(4885,AT=1\)](#)

*Result:* Works fine.

<b>waveform</b>	<b>Shot</b>	<b>Fault</b>	<b>SW Fault Time</b>	<b>Detected Time</b>
1aU Negative	---	---	---	---
1bU Negative	---	---	---	---
1cU Negative	4859	1cU Overcurrent	0.408	0.4084
2U Negative	4851	2U Overcurrent	0.2037	0.2036
3U Negative	4853	3U Overcurrent	1.0207	1.0206
4U Negative	4854	4U Overcurrent	0.6636	0.6636
5U Negative	4855	5U Overcurrent	0.7844	0.7844
3L Negative	---	---	---	---
2L Negative	4850	2L Overcurrent	0.1571	0.1570
1cL Negative	4858	1 cL Overcurrent	0.4083	0.4084
1bL Negative	4857	1bL Overcurrent	0.5105	0.5104
1aL Negative	4856	1aL Overcurrent	0.1024	0.1024
OH Negative	4860	OH mid_Tresca Stress	1.0573	1.0572
Plasma Negative	4861	Plasma Overcurrent	0.3539	0.3538
TF Negative	4862	Aquapoxy 01	0.5781	0.57799

<b>waveform</b>	<b>Shot</b>	<b>Fault</b>	<b>SW Fault Time</b>	<b>Detected Time</b>
1aU Positive	4863	1aU Overcurrent	0.7657	0.7656
1bU Positive	4864	1bU Overcurrent	0.5105	0.5104
1cU Positive	4868	1cU Overcurrent	0.6885	0.6886
2U Positive	---	---	---	---
3U Positive	4871	3U Overcurrent	0.8159	0.8158
4U Positive	4874	---	---	---
5U Positive	4875	5U Overcurrent	0.1569	0.1568
3L Positive	4870	3L Overcurrent	0.7418	0.7418
2L Positive	4869	2L Overcurrent	1.1771	1.177
1cL Positive	4878	1cL Overcurrent	0.6889	0.6888
1bL Positive	4877	1bL Overcurrent	0.5101	0.5102
1aL Positive	4876	1aL Overcurrent	0.7653	standing fault
OH Positive	4880	OH Mid Tresca	1.0565	1.0564
Plasma Positive	4882	Plasma Overcurrent	0.8862	0.8862
TF Positive	4881	TF Overcurrent	0.06009	0.05999

## 6.8.2: Action Tests

*Tree Used:* 176

*SW Fault Time:* The time when the algorithm trips

*Detected Time:* The time when the AT detects the fault on its digital inputs (the DCPS hardware outputs)

*Result:* Works fine. Note that because of the tree 176 parameters, it sometimes detects an overcurrent before an action fault. Also the TF file has the TF only energized, leading to the aquapoxy fault.

<b>waveform</b>	<b>Shot</b>	<b>Fault</b>	<b>SW Fault Time</b>	<b>Detected Time</b>
1aU	4892	1aU Overcurrent	-3.1439	-3.144
1bU	4893	1bU Action	-1.6249	-1.625
1cU	4894	1cU Overcurrent	-3.0769	-3.077
2U	4895	2U Overcurrent	-0.3117	-0.3118
3U	4896	3U Overcurrent	-3.3143	-3.3144
4U	4890	4U Overcurrent	-3.1103	-3.1104
5U	4891	5U Overcurrent	-3.5779	-3.578
3L	4889	3L Overcurrent	-3.3143	-3.3144
2L	4888	2L Action	-0.3187	-0.3188
1cL	4887	1cL Overcurrent	-3.0763	-3.0764
1bL	4886	1bL Action	-1.6265	-1.6266
1aL	4885	1aL Overcurrent	-3.1441	-3.1442
OH	4884	Mid OH Tresca Stress	-3.0341	-3.0342
TF	4883	Aquapoxy instance 01	-3.58113	-3.5812

### 6.8.3: Fault Tests

*Tree Used:* 176

*SW Fault Time:* The time when the algorithm trips

*Detected Time:* The time when the AT detects the fault on its digital inputs (the DCPS hardware outputs)

*Result:* Works fine.

<b>waveform</b>	<b>Shot</b>	<b>Fault</b>	<b>SW Fault Time</b>	<b>Detected Time</b>
ForceStressTests_0	4897	FZ, OH	-0.2931	-0.2932
ForceStressTests_1	4898	Combined force #5	-0.2079	-0.208
ForceStressTests_2	4899	TF OoPM 4	-0.6939	-0.694
ForceStressTests_3	4900	TF Total OoPM	-0.6939	-0.694
ForceStressTests_4	4901	Aquapoxy #1	-0.5863	-0.5864
ForceStressTests_5	4902	OH Lower Tresca Stress	-0.1663	-0.1664
ForceStressTests_6	4903	3U Overcurrent	-0.3193	-0.3194
ForceStressTests_7	4904	Aquapoxy #1	-0.5863	-0.5864
ForceStressTests_8	4905	Odd DCPS Timing...		

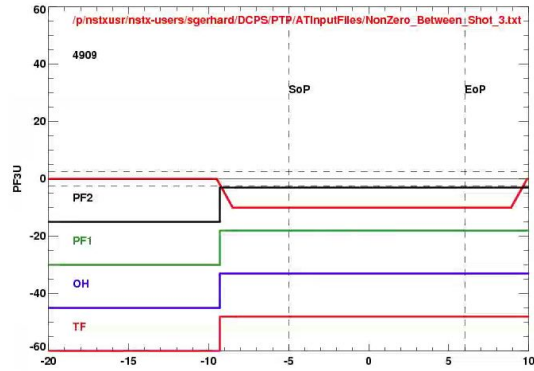
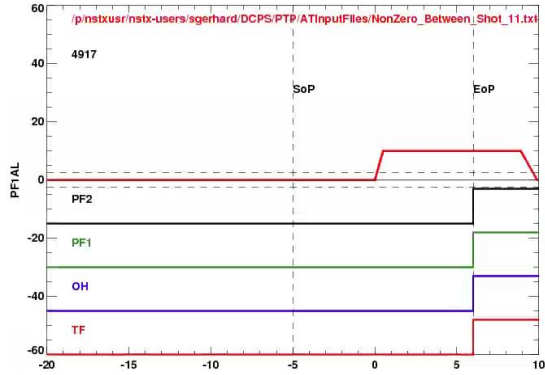
### 6.9: Between Shot Non-Zero Checker

Tree Used: 176

Result: Works fine. See the larger set of tabulated plots for details.

<b>Waveform</b>	<b>Turn-On Time</b>	<b>Shot</b>	<b>Status</b>
NonZero_Between_Shot_0	-18.5	4906	OK
NonZero_Between_Shot_1	-15.5	4907	OK
NonZero_Between_Shot_2	-12.5	4908	OK
NonZero_Between_Shot_3	-9.5	4909	OK
NonZero_Between_Shot_4	-6.5	4910	OK
NonZero_Between_Shot_5	6.5	4911	OK
NonZero_Between_Shot_6	6.1	4912	OK
NonZero_Between_Shot_7	6.3	4913	OK
NonZero_Between_Shot_8	6.5	4914	OK
NonZero_Between_Shot_9	6.7	1915	OK
NonZero_Between_Shot_10	0.0	4916	actually trips on 1cL Action
NonZero_Between_Shot_11	0.0	4917	OK
NonZero_Between_Shot_12	-11	4918	OK
NonZero_Between_Shot_13	0	4919	OK

Full set of plots have been compiled. Here are two representative cases:



## 6.10: Aquapour Algorithm Tests

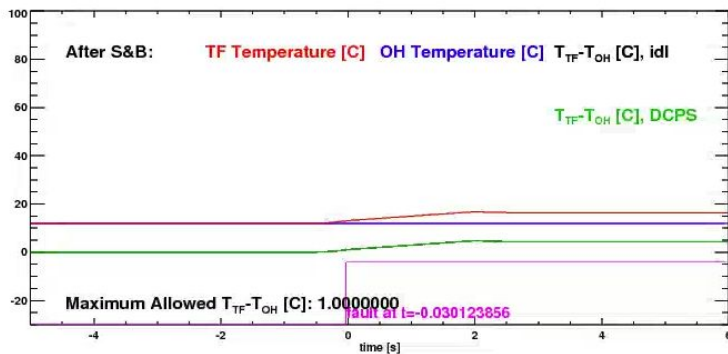
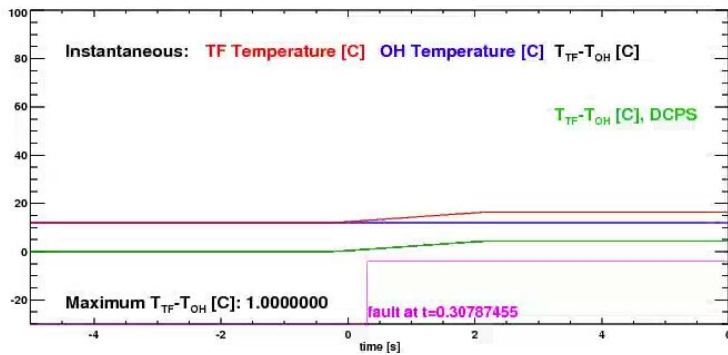
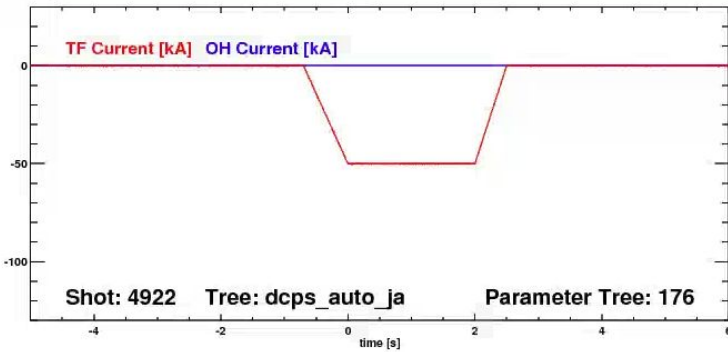
*Tree Used:* 176

*SW Fault Time:* The time when the algorithm trips

*Detected Time:* The time when the AT detects the fault on its digital inputs (the DCPS hardware outputs)

waveform	Shot	Fault	SW Fault Time	Detected Time
ForceStressTests_0	4920	none	none	none
ForceStressTests_1	4922	Aquapour #2	-0.0301	-0.0302
ForceStressTests_2	4923	Aquapour #1	1.4463	not reset on previous shot, so cannot tell. However, see other examples above where this worked fine.





## 6.11: Enable/Execute Tests

Tree Used: ----

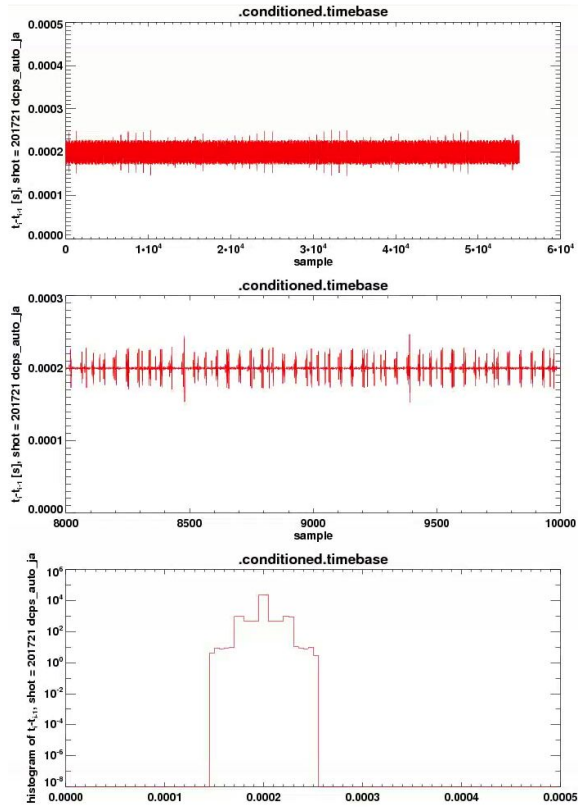
Test was deferred, on account of that part of the code not being changed

For the record, recall that these tests need specially organized trees to be done as written, and in the past these were 72, 74, & 75. Also note that the trees used in these tests (176) had many algorithms with enable = 0, and that all worked fine.

## 6.12: Synchronous Shot

Tree Used: 176

Shot: 201721



## Notes from Roman:

These below are the shot # notes that Roman sent me, and which are used to construct the above.

pcs-rt1\_ja

step 6.1.7 - 5021

[2015-10-16 14:37:23.187685] INFO: SOC rcvd  
[2015-10-16 14:37:53.181912] INFO: T60 rcvd  
[2015-10-16 14:38:47.181800] INFO: Clock TN  
[2015-10-16 14:38:48.181795] INFO: Clock SOP  
[2015-10-16 14:39:03.181770] INFO: Clock EOP

step - step 6.1.9 Tree Number - 176 shot number - 5125

[2015-10-19 23:22:40.880171] INFO: SOC rcvd

[2015-10-19 23:22:40.975648] INFO: Waiting for T60

[2015-10-19 23:24:03.874289] FATAL: Clock ABORT

step 6.1.12 - 5022

[2015-10-16 15:06:17.277863] INFO: SOC rcvd  
[2015-10-16 15:06:47.271962] INFO: T60 rcvd  
[2015-10-16 15:07:40.271855] FATAL: Clock ABORT

step 6.2.5 - 5023

[2015-10-16 15:14:56.337907] INFO: SOC rcvd  
[2015-10-16 15:15:26.332134] INFO: T60 rcvd  
[2015-10-16 15:15:31.845834] INFO: Waiting for TN  
abort

step 6.2.9 set tn to -61

[2015-10-16 15:32:39.220435] INFO: SOC rcvd  
[2015-10-16 15:32:39.220473] INFO: CycleManager created

[2015-10-16 15:32:39.315104] INFO: Waiting for T60

6.3.2 - 5027

6.3.3 - 5028

step 6.4.1-AU - 4835  
step 6.4.1-AL - 4836  
step 6.4.1-BL - 4837  
step 6.4.1-BU - 4838  
step 6.4.1-CU - 4839  
step 6.4.1-CL - 4840  
step 6.4.1.2U - 4841  
step 6.4.1.2L - 4842  
step 6.4.1.3L - 4843  
step 6.4.1.3U - 4844  
step 6.4.1.4U - 4845  
step 6.4.1.5U - 4846  
step 6.4.1.PLASMA - 4847  
step 6.4.1.OH - 4848  
step 6.4.1.TF - 4849

6.4.4 - 5029

6.5 - 5119

6.6 - 5120

6.6.14 shot number - 5127

6.7.1.d - 5030

6.7.1.j - 5031

6.7.1.r - 5032

6.7.1.y - 5033

6.7.4 plasma mode in test mode

shot number -5128

[2015-10-19 23:50:09.149456] WARNING: Failed tasks: 1

[2015-10-19 23:50:09.149653] FATAL: Invalid loop bits set for plasma mode. Ops: 000 AT:

[2015-10-19 23:50:09.149655] WARNING: Failed tasks: 1

[2015-10-19 23:50:09.149753] FATAL: Watchdog timer expired.

[2015-10-19 23:50:09.1/usr/local/bin/startdcps: line 84: 13517 Aborted step 6.8.1N2L - 4850

step 6.8.1N2U - 4851

step 6.8.1N3L - 4852

step 6.8.1N3U - 4853

step 6.8.1N4U - 4854

step 6.8.1N5U - 4855

step 6.8.1NAL - 4856

step 6.8.1NBL - 4857

step 6.8.1NCL - 4858

step 6.8.1NCU - 4859

step 6.8.1N0H - 4860

step 6.8.1NPlasma - 4861

step 6.8.1NTF - 4862

step 6.8.1P1AU - 4863

step 6.8.1p1BU - 4864

step 6.8.1P1Cu - 4868

step 6.8.1P2L - 4869  
step 6.8.1P3L - 4870  
step 6.8.1P3U - 4871  
step 6.8.1P4U - 4874  
step 6.8.1P5U - 4875  
step 6.8.1P1AL-4876  
step 6.8.1P1BL-4877  
step 6.8.1PCL-4878  
step6.8.1OH-4880  
step6.8.1PTF-4881  
step6.8.11Plasma - 4882  
ste6.8.2TF-4883  
step6.8.2OH-4884  
step6.8.AL-4885  
step6.8.BL-4886  
step6.8.2.1CL-4887  
step6.8.2.2L-4888  
step6.8.2.3L-4889  
step6.8.2.4U-4890  
step6.8.2.5U-4891  
step6.8.21AU-4892  
step6.8.21BU-4893  
step6.8.21CU-4894  
step6.8.2U-4895  
step6.8.3U-4896  
step6.8.3.0-4897  
step6.8.3.1-4898  
step6.8.3.2-4899  
step6.8.3.3-4900  
step6.8.3.4-4901  
step6.8.3.5-4902  
step6.8.3.6-4903  
step6.8.3.7-4904  
step6.8.3.8-4905  
step6.9.0-4906  
step6.9.1-4907  
step6.9.2-4908  
step6.9.3-4909  
step6.9.4-4910  
step6.9.5-4911  
step6.9.6-4912  
step6.9.7-4913  
step6.9.8-4914  
step6.9.9-4915  
step6.9.10-4916  
step6.9.11-4917  
step6.9.12-4918  
step6.9.13-4919

step6.10.1-4920  
step6.10.2-4922  
step6.10.3-4923

step -step 6.12 shot 201721