DCPS-PTP-001, Rev 1.

DCPS Tested: FCC & JA simultaneously
DCPS Version: 2.0
DCPS SVN Revision: 6514
Checksum: a7f01f97a636acb5bff977d2fe573fc88b392cf3ebcf6ddc6a3132a8d8c8effd
Test Dates: 11/5/2015

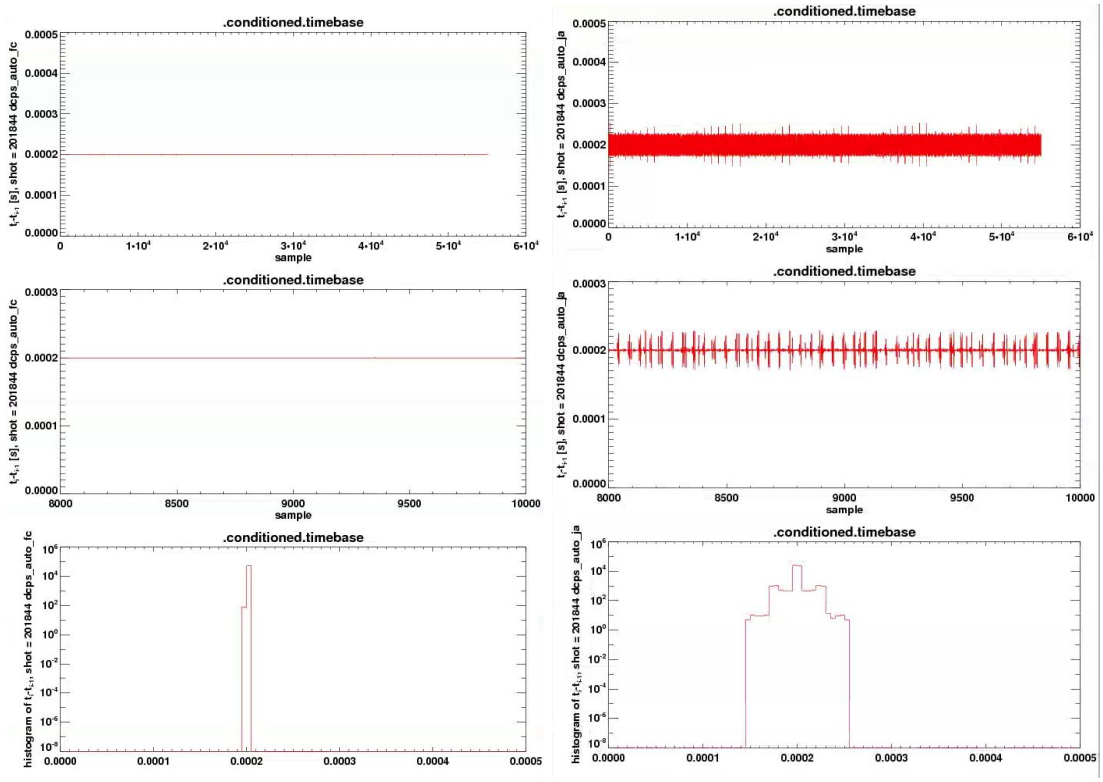
Notes:

- For all tests quoted here, the following trees were used:
  - FCC DCPS: 176
  - JA DCPS: 175
  - Note that 176 is the more restrictive tree in general, so the FCC DCPS will generally trip first.
- Note that all shots in this report are done in synchronous mode, because asynchronous operation of the FCC DCPS does not work well. It would be good to update the systems as follows:
  - The FCC DCPS should be able to run in asynchronous mode with the JA AT. This apparently has something to do with resetting the DITS
  - The FCC DCPS SW L1 outputs and WDT are broadcast to a FOMD in the JA. While the WDT goes to the Ed Lawson tachometer, none of them are actually digitized in an independent digitizer. It would be good if this were corrected.
- A comprehensive run-through of the JA DCPS software PTP was run previously. See this link. Taking credit for the observation that these are the same executable, a truncated series of tests is run here.
- 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/

6.1.7:
Shot: 201844
Result: Is a good shot. See output below.

rt-3 output:
[2015-11-05 09:24:59.045468] INFO: SOC rcvd
[2015-11-05 09:25:29.038822] INFO: T60 rcvd
[2015-11-05 09:26:23.038658] INFO: Clock TN
[2015-11-05 09:26:24.038661] INFO: Clock SOP
[2015-11-05 09:26:35.038660] INFO: Clock EOP

6.1.8: Time base.
Shot: 201844
Result: Is fine
See figure below. The timing for the FCC DCPS is generally neater than for the JA DCPS, apparently due to how the DITS clocks the FPDP link (or similar?)



6.2: Raw Data

step 6.2.5 - 201846
[2015-11-05 09:38:05.441261] INFO: SOC rcvd
[2015-11-05 09:38:35.436052] INFO: T60 rcvd
[2015-11-05 09:38:49.804654] INFO: Waiting for TN
abort

step 6.2.9 set tn to -61 shot 201847
[2015-11-05 09:45:37.087561] INFO: SOC rcvd
[2015-11-05 09:45:37.088054] INFO: CycleManager created
[2015-11-05 09:45:37.191815] INFO: Waiting for T60

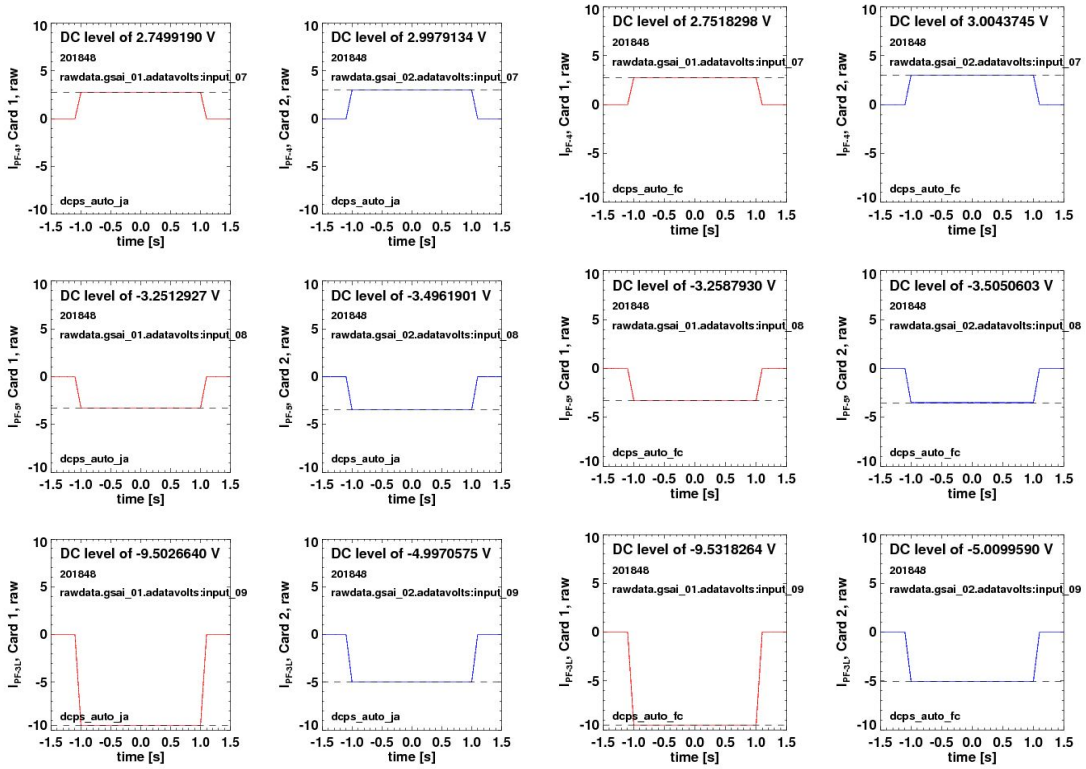
6.3.2.g: Raw Data

Shot: 201848

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	7.75	8.007	PF3L	-9.532	-5.001
PF1aU	0.248	0.497	PF2L	5.255	5.515
PF1bU	0.748	0.999	PF1cL	5.757	6.009
PF1cU	1.248	1.500	PF1bL	5.255	6.515
PF2U	1.752	2.002	PF1aL	6.757	7.010
PF3U	-2.255	-2.504	OH	-7.258	-7.516
PF4	2.752	3.004	TF	-8.265	-8.525
PF5	-3.259	-3.505			

For Reference, the figures below compare the levels for the JA and FCC DCPS instances, and show that they are the same.

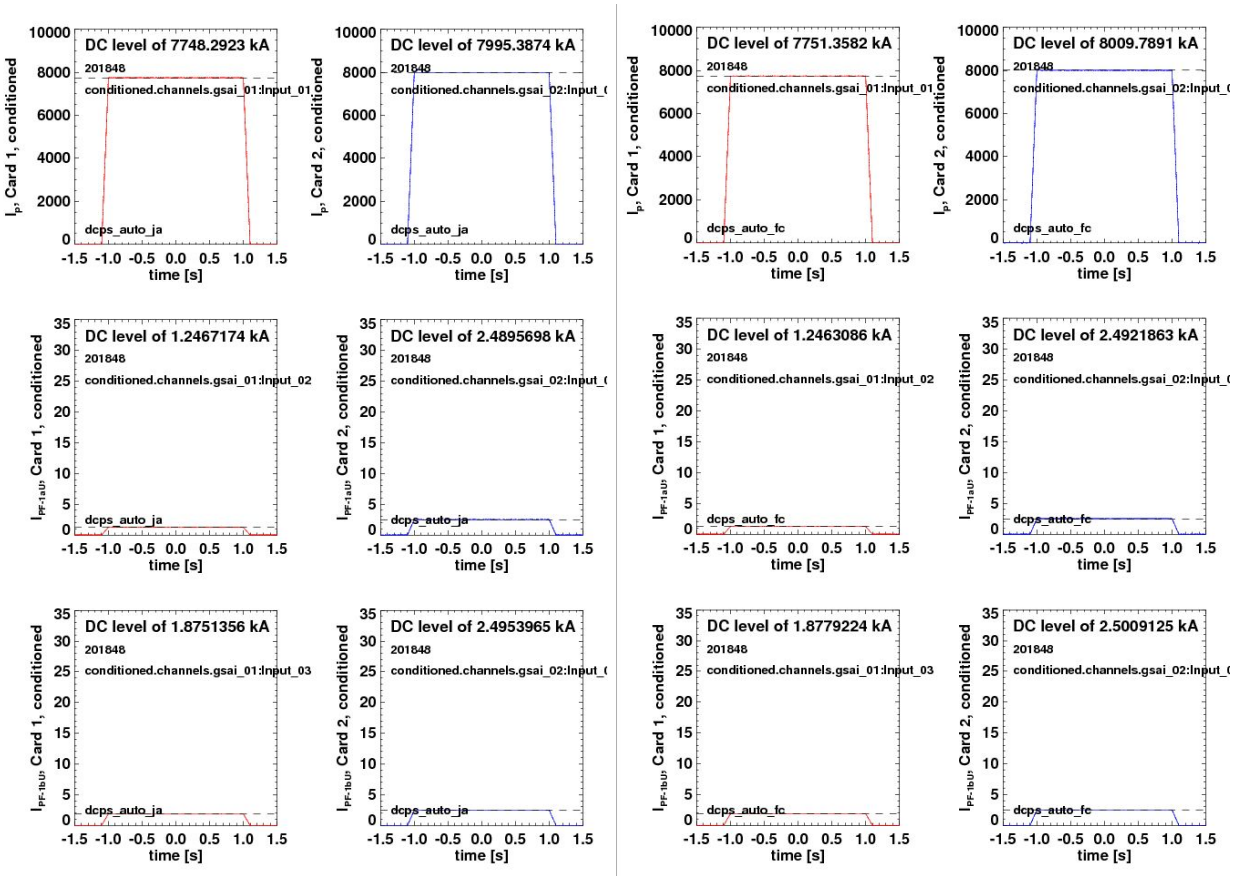


6.3.2.i: Calibrated Data

Shot: 201848

Result: OK, as shown by the table below

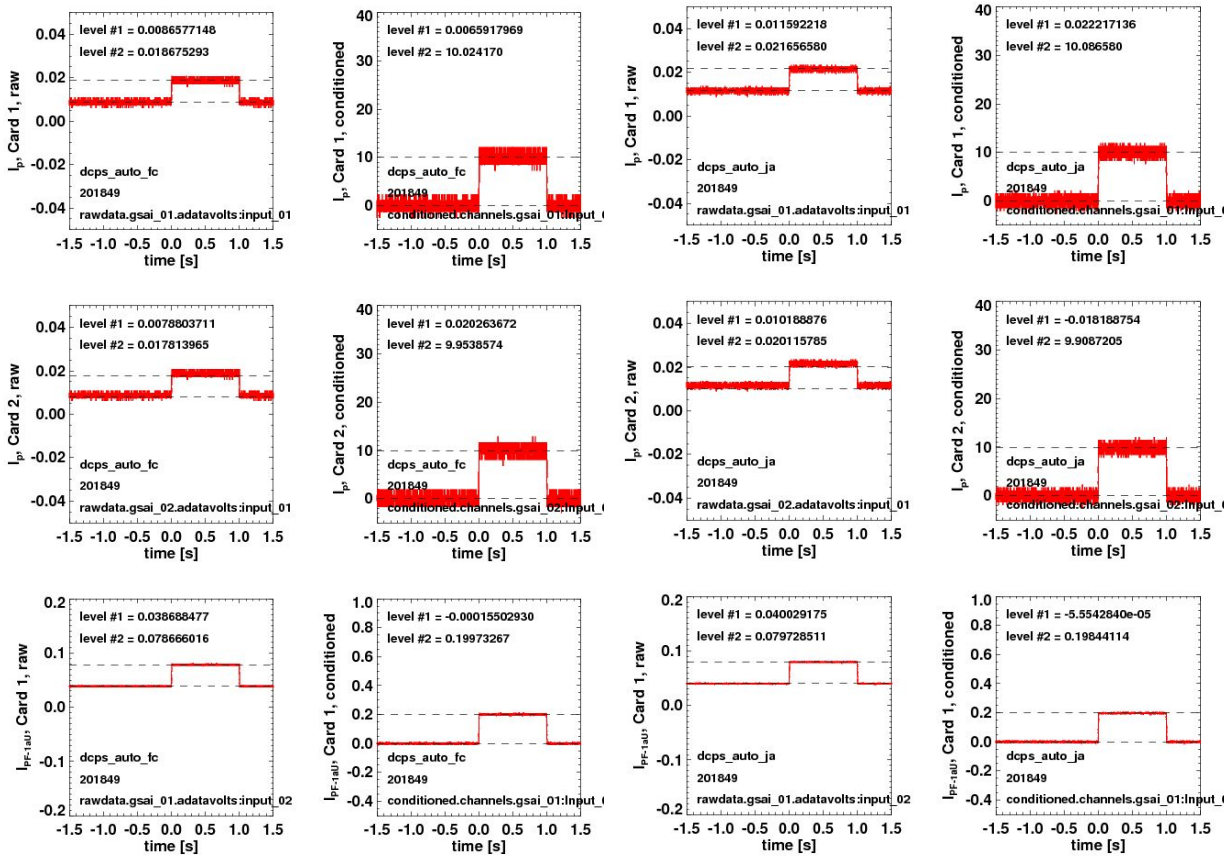
Coil	DC Level #1 [kA]	DC Level #2 [kA]	Coil	DC Level #1 [kA]	DC Level #2 [kA]
Plasma	7751	8009	PF3L	15.645	16.295
PF1aU	1.246	7.492	PF2L	26.29	13.79
13.PF1bU	1.878	2.501	PF1cL	28.79	30.04
PF1cU	3.128	3.757	PF1bL	15.64	16.29
PF2U	8.768	5.013	PF1aL	16.9	17.53
PF3U	11.267	6.255	OH	18.14	17.78
PF4	26.29	13.791	TF	123.93	127.86
PF5	28.795	30.05			


DC level of 7748.2923 kA
201848
conditioned.channels.gsai_01:Input_01
dcps_auto_ja
I_p, Card 1, conditioned
DC level of 7995.3874 kA
201848
conditioned.channels.gsai_02:Input_(
dcps_auto_ja
I_p, Card 2, conditioned
DC level of 7751.3582 kA
201848
conditioned.channels.gsai_01:Input_01
dcps_auto_fc
I_p, Card 1, conditioned
DC level of 8009.7891 kA
201848
conditioned.channels.gsai_02:Input_(
dcps_auto_fc
I_p, Card 2, conditioned
DC level of 1.2467174 kA
201848
conditioned.channels.gsai_01:Input_02
dcps_auto_ja
$I_{PF\text{-}1aU}$ Card 1, conditioned
DC level of 2.4895698 kA
201848
conditioned.channels.gsai_02:Input_(
dcps_auto_ja
$I_{PF\text{-}1aU}$ Card 2, conditioned
DC level of 1.2463086 kA
201848
conditioned.channels.gsai_01:Input_02
dcps_auto_fc
$I_{PF\text{-}1aU}$ Card 1, conditioned
DC level of 2.4921863 kA
201848
conditioned.channels.gsai_02:Input_(
dcps_auto_fc
$I_{PF\text{-}1aU}$ Card 2, conditioned
DC level of 1.8751356 kA
201848
conditioned.channels.gsai_01:Input_03
dcps_auto_ja
$I_{PF\text{-}1bU}$ Card 1, conditioned
DC level of 2.4953965 kA
201848
conditioned.channels.gsai_02:Input_(
dcps_auto_ja
$I_{PF\text{-}1bU}$ Card 2, conditioned
DC level of 1.8779224 kA
201848
conditioned.channels.gsai_01:Input_03
dcps_auto_fc
$I_{PF\text{-}1bU}$ Card 1, conditioned
DC level of 2.5009125 kA
201848
conditioned.channels.gsai_02:Input_(
dcps_auto_fc
$I_{PF\text{-}1bU}$ Card 2, conditioned
time [s]

6.3.3.e: Baseline Subtraction

Shot: 201849

Result: Results are fine. See archived plots, or the figures below for example comparing the fcc and ja DCPS instances.



6.4.1: Auctioneer Aborts

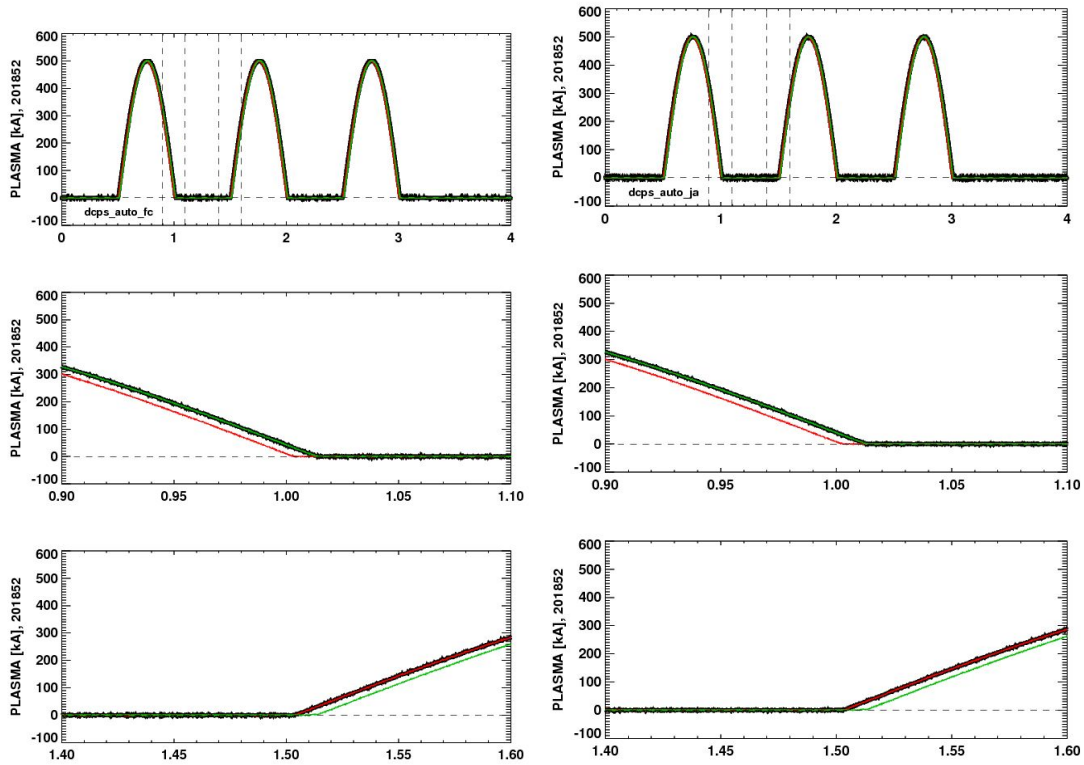
Shots: 1aU check on shot 201850, and 1bU check on shot 201851. Note that in tree 176, the 1aU threshold was set to 5 kA, while the 1bU threshold was set to 2.5 kA. The code aborts the two shots at the correct error level, as indicated in the red text below from the the execution of the PTP.

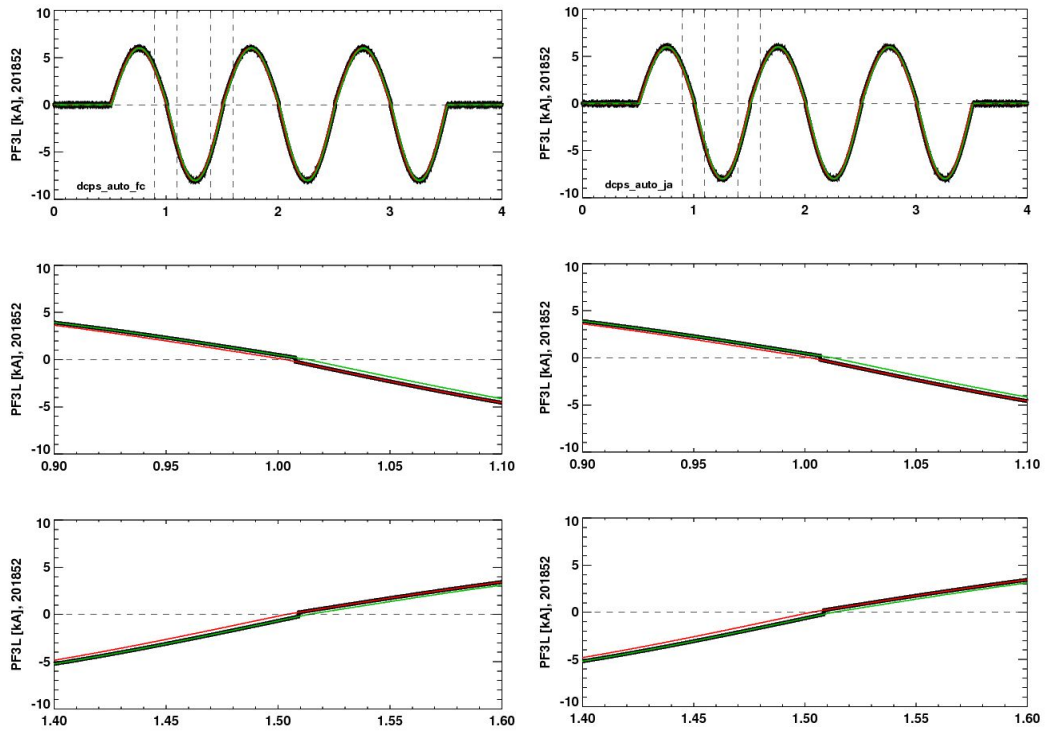
step - step 6_4_1_AU Tree Number - 176 shot number - 201850
[2015-11-05 10:14:25.529074] FATAL: Auctioneer threshold exceeded for current 1 ch1: -0.006097 ch2: 4.998791 diff: -5.004889 threshold: 5.000000
step - step 6_4_1_BU Tree Number - 176 shot number - 201851
[2015-11-05 10:22:49.701616] FATAL: Auctioneer threshold exceeded for current 2 ch1: 2.501559 ch2: -0.000214 diff: 2.501773 threshold: 2.500000
6.4.4 - 201852

6.4.8: Auctioneer Function

Shot: 201852

Result: Works fine. See comparisons of the JA and FCC DCPS outputs for two cases in the figure below.





6.5 Asynchronous Shot

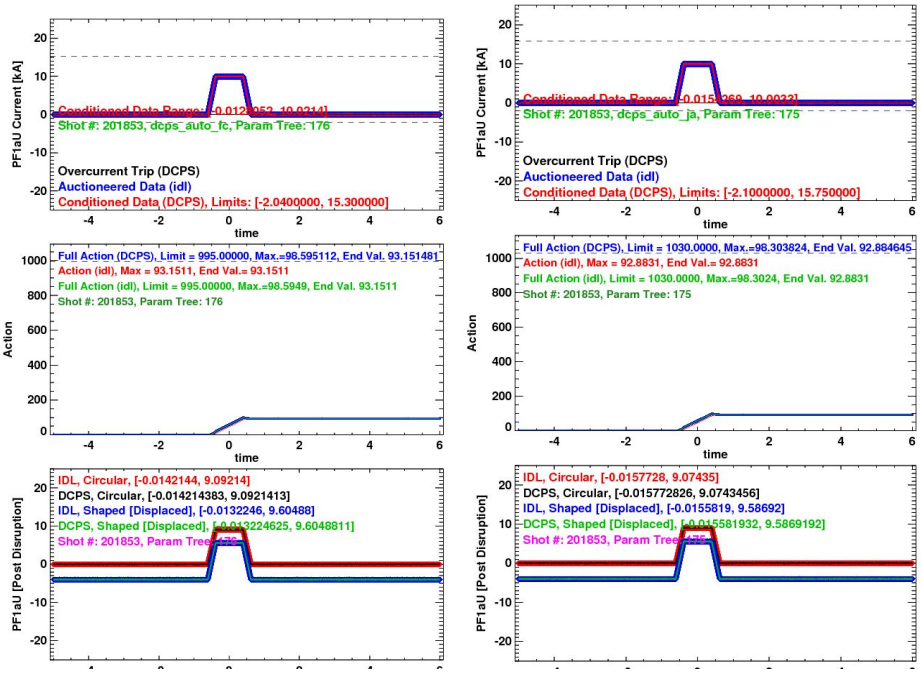
This is skipped. Note that all shots in this report are done in synchronous mode, because asynchronous operation of the FCC DCPS does not work well.

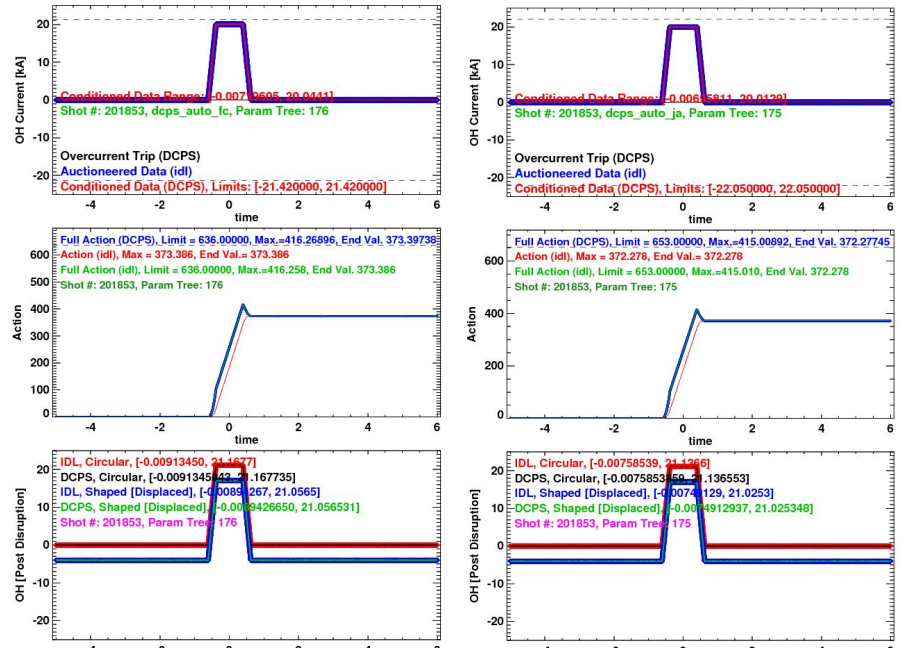
6.6.5.a: Current Predictor Tests

Shot: 201853

Result: The post-disruption currents all agree with those stated in the table in step 6.6.5 of the PTP.

Below are two comparison between the JA and FCC DCPS. First row for the 1aU coil, and second row for the OH coil (TF coil also shown for the 6.6.6 result). The DCPS and idl calculations agree in all cases.

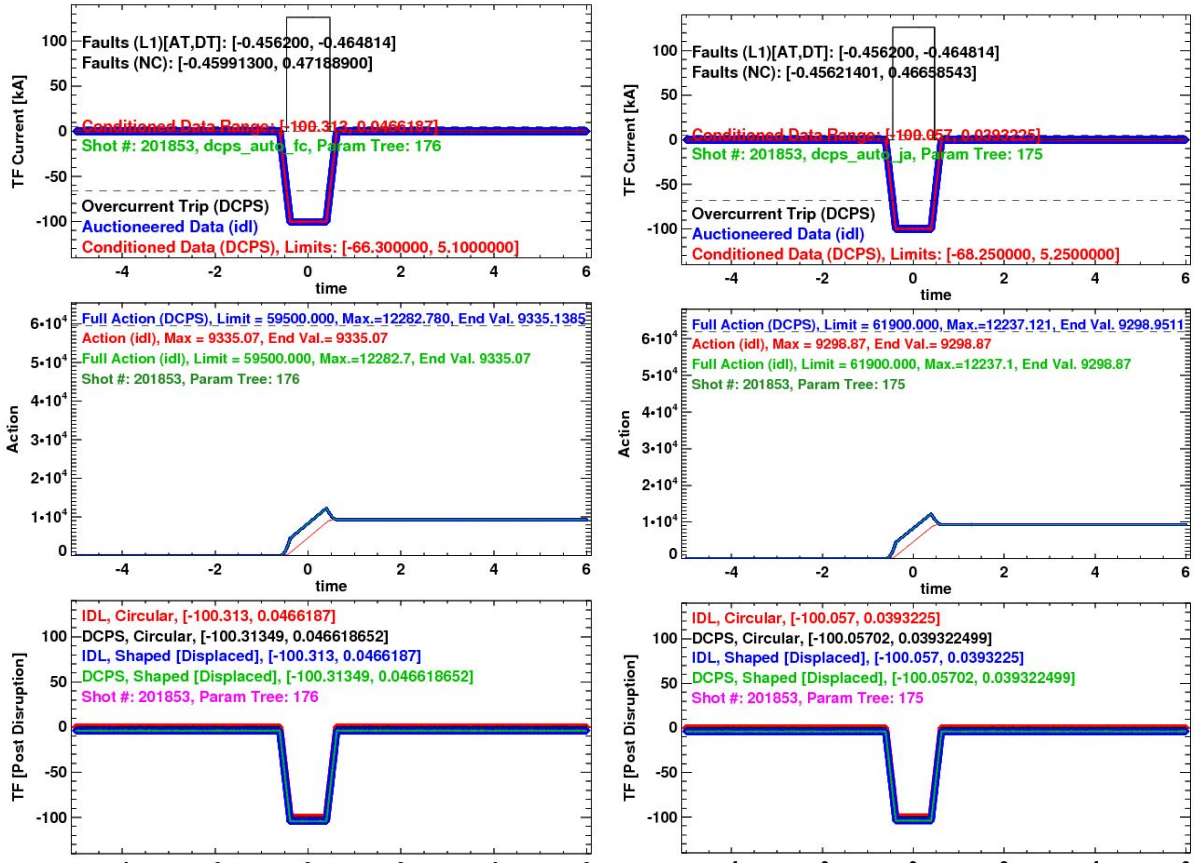




6.6.6: Action Calculation Tests

Shot: 201853

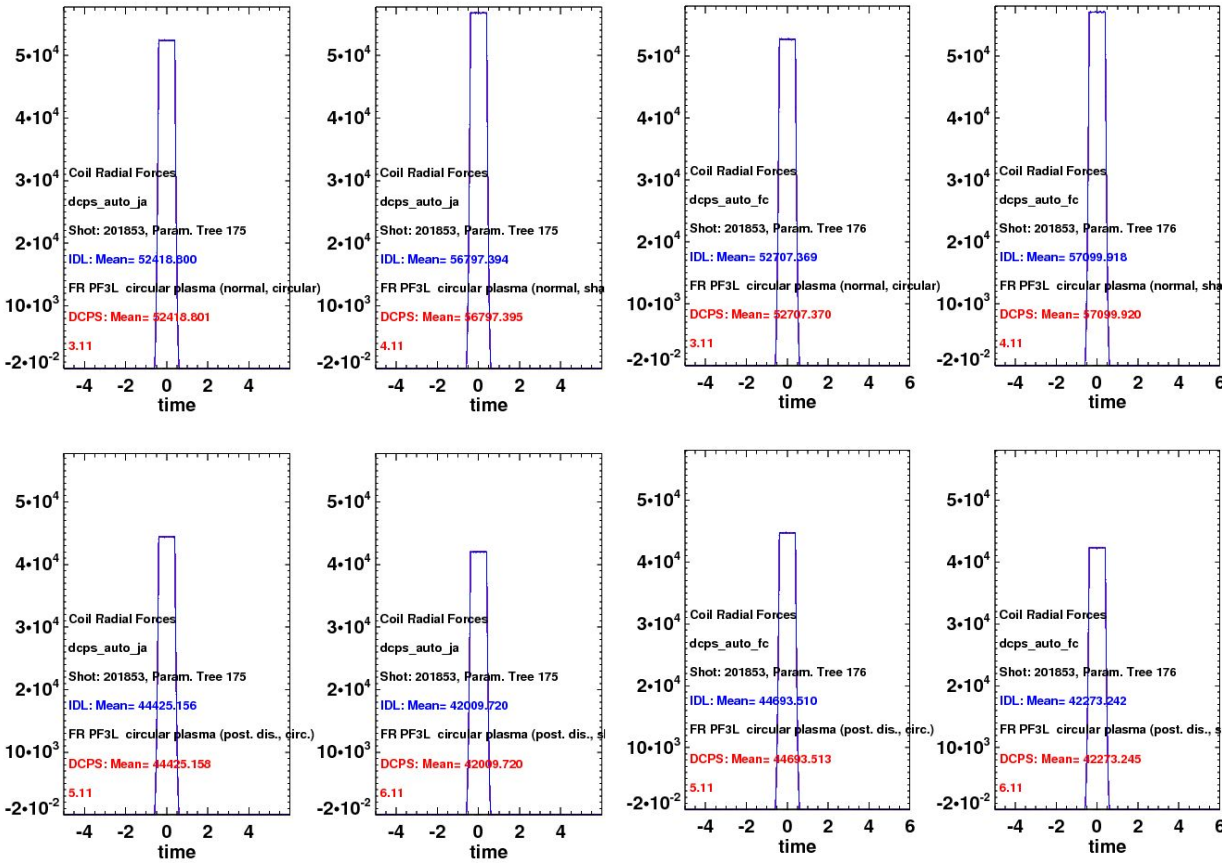
Result: The DCPS calculations all agree with a stand-alone idl calculation. This can be seen in the full set of archived plots, as well as the plots directly above and directly below.



6.6.7: Radial Force Calculation

Shot:201853

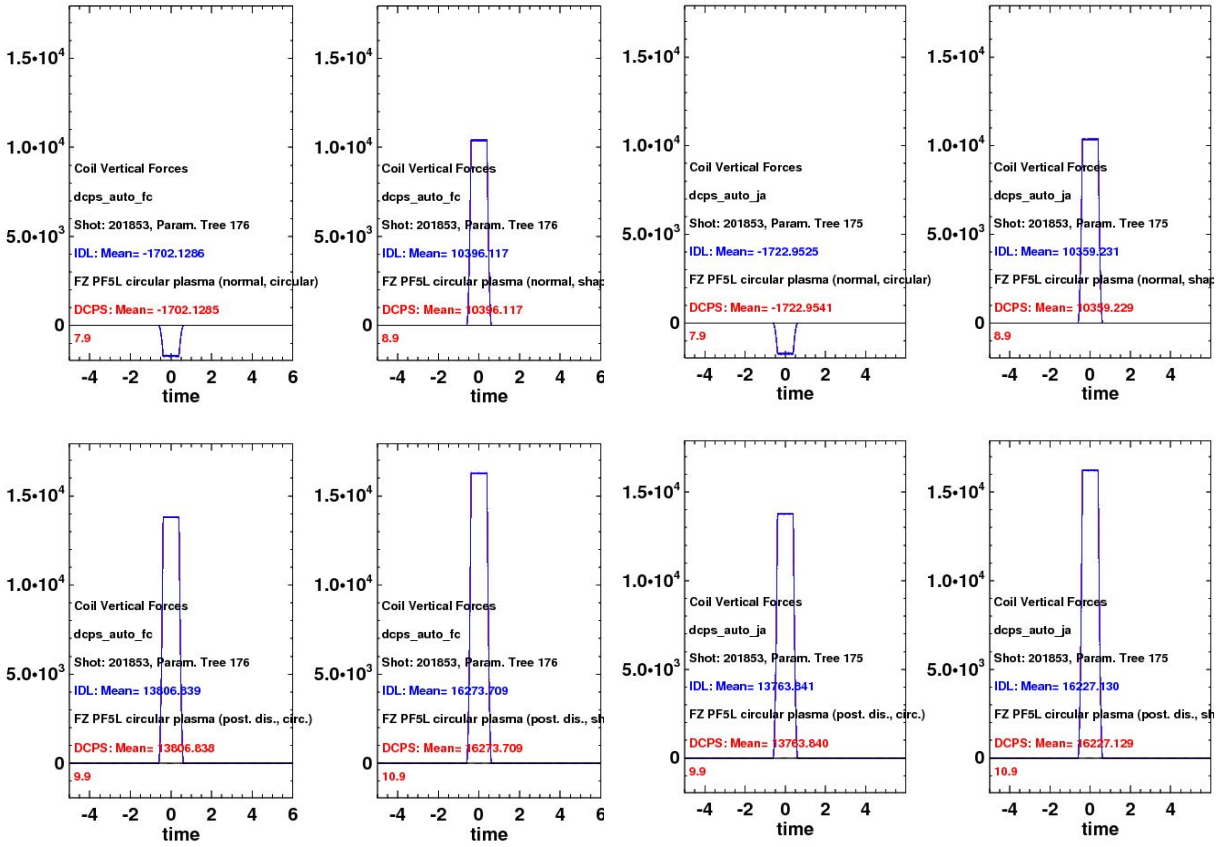
Result: Good agreement between the FCC DCPS calculations and an independent idl code; see complete set of archived plots, as well as the sample cases below. Also good agreement between the FCC and JA DCPS, as shown in the sample below.



6.6.8: Vertical Force Calculation

Shot: 201853

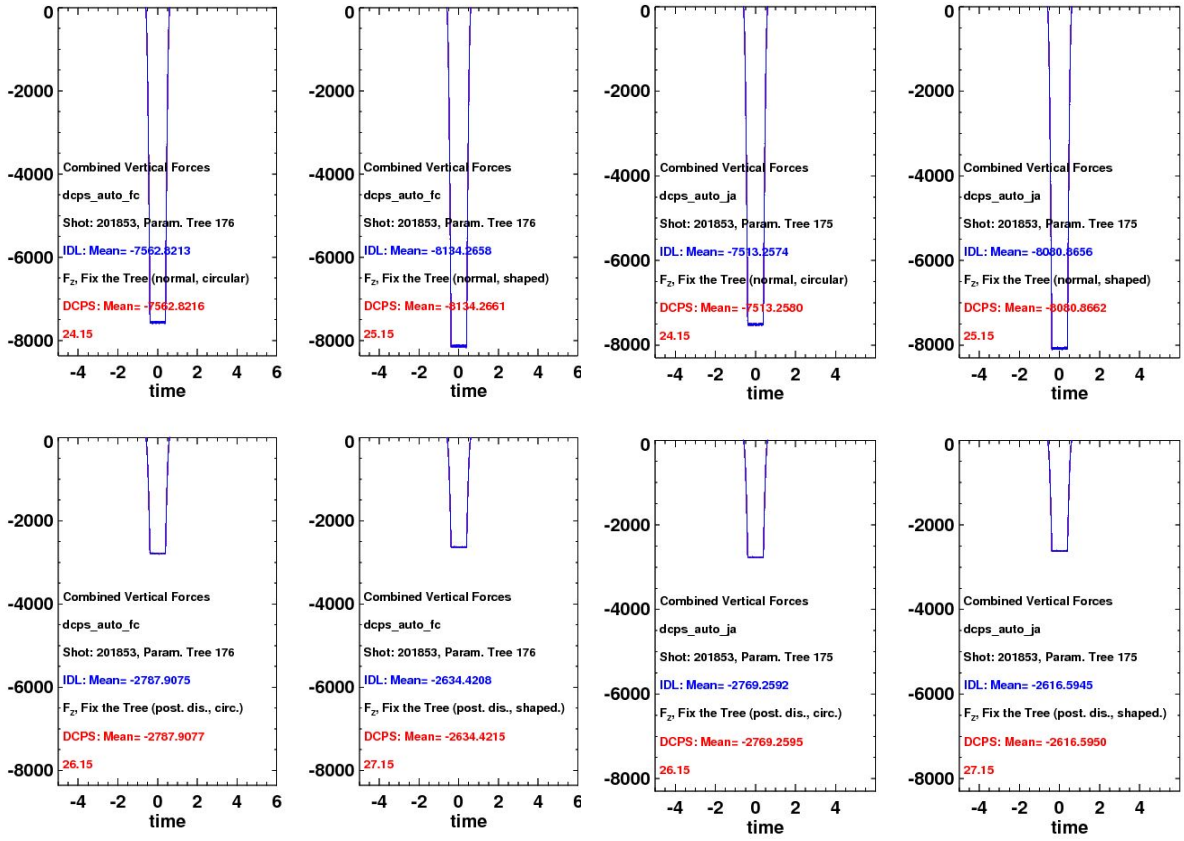
Result: Good agreement between the FCC DCPS calculations and an independent idl code; see complete set of archived plots, as well as the sample cases below. Also good agreement between the FCC and JA DCPS, as shown in the sample below.



6.6.9: Combined Vertical Force Test

Shot: 201853

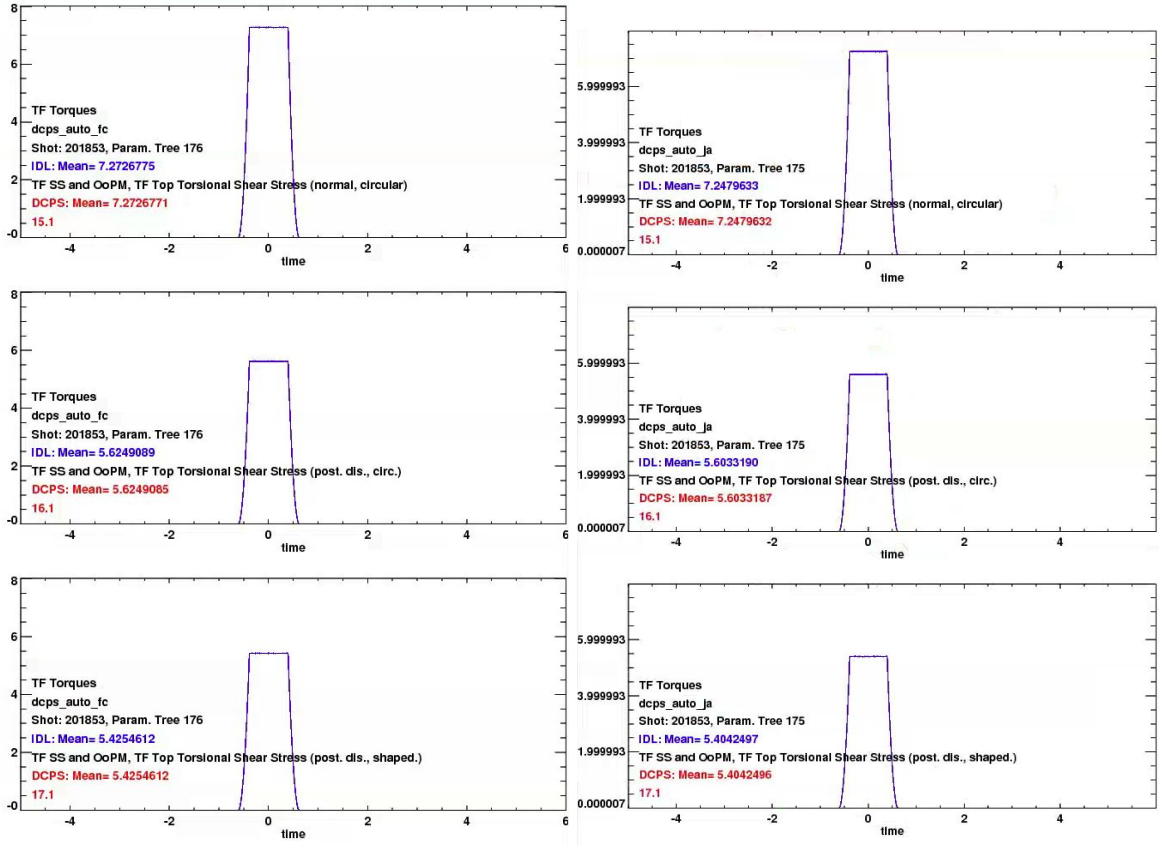
Result: Good agreement between the FCC DCPS calculations and an independent idl code; see complete set of archived plots, as well as the sample cases below. Also good agreement between the FCC and JA DCPS, as shown in the sample below.



6.6.10: Shear Stress and TF Moment

Shot: 201853

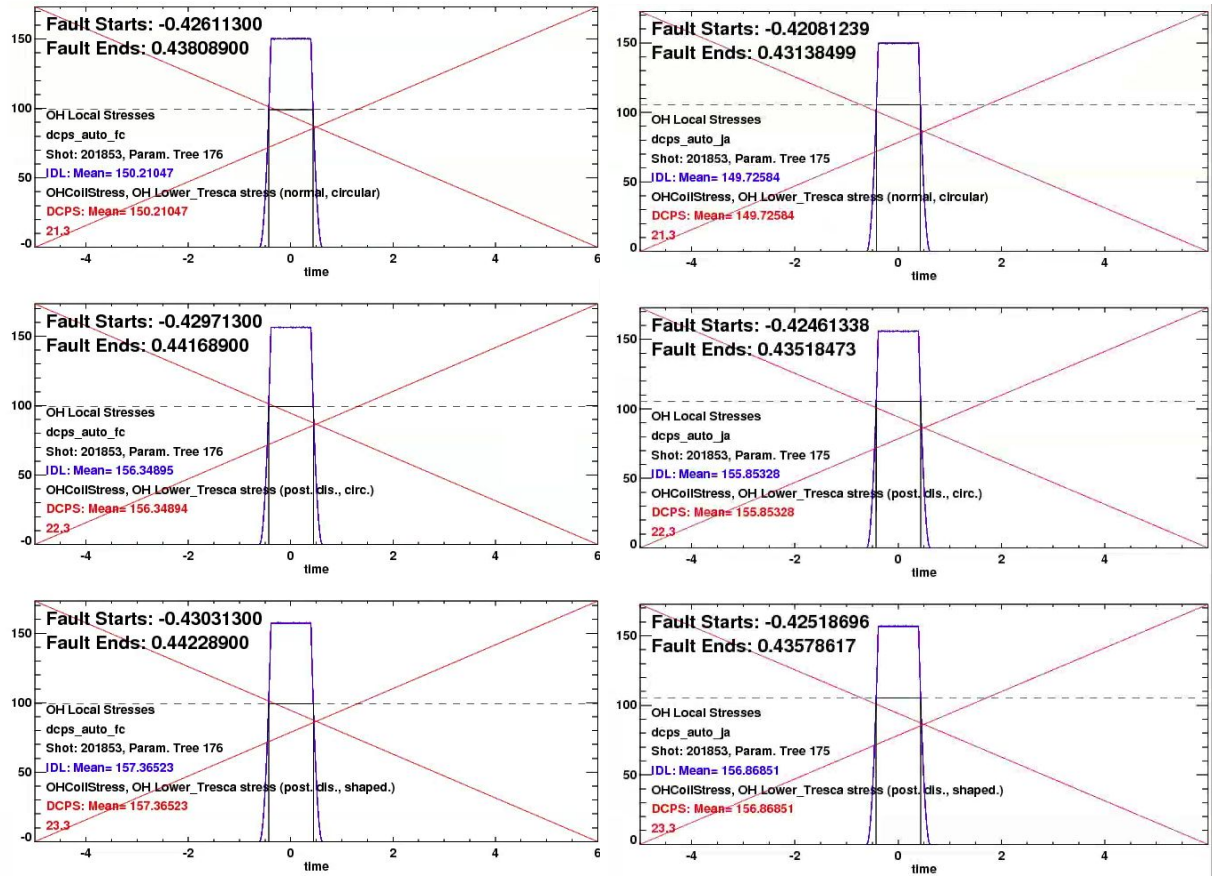
Result: Good agreement between the FCC DCPS calculations and an independent idl code; see complete set of archived plots, as well as the sample cases below. Also good agreement between the FCC and JA DCPS, as shown in the sample below.



6.6.11: OH Stress Test

Shot: 201853

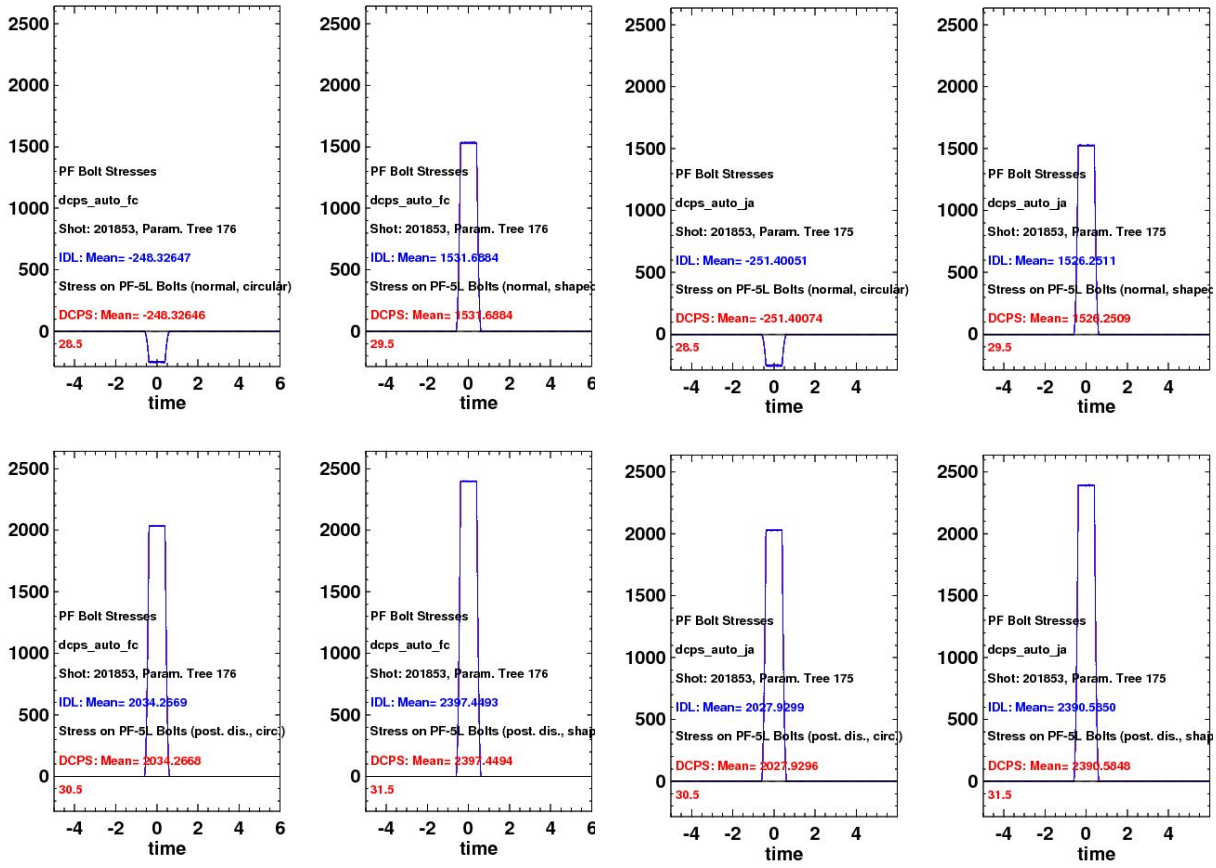
Result: Good agreement between the FCC DCPS calculations and an independent idl code; see complete set of archived plots, as well as the sample cases below. Also good agreement between the FCC and JA DCPS, as shown in the sample below.



6.6.12: Bolt Stress Test

Shot: 201853

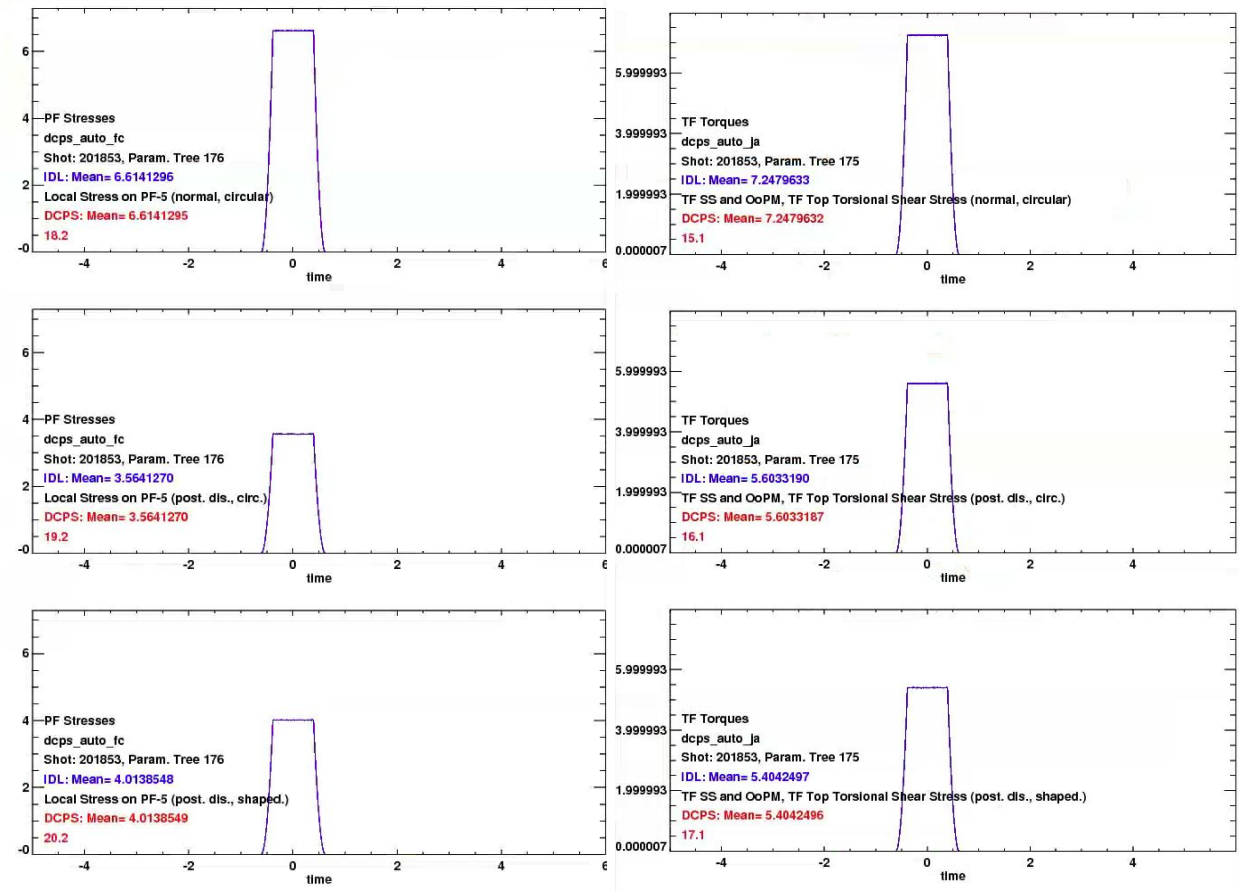
Result: Good agreement between the FCC DCPS calculations and an independent idl code; see complete set of archived plots, as well as the sample cases below. Also good agreement between the FCC and JA DCPS, as shown in the sample below.



6.6.13: Hoop Stress Test

Shot: 201853

Result:Good agreement between the FCC DCPS calculations and an independent idl code; see complete set of archived plots, as well as the sample cases below. Also good agreement between the FCC and JA DCPS, as shown in the sample below.



6.7: Auxiliary Input Tests

Deferred

6.8.1 Overcurrent Tests

Result: The correct trips are observed. Note that the TF-only example trips first on aquapoxy.

Coil	Shot	JA Fault	JA Fault Time	FCC Fault	FCC Fault Time
1aU Positive	201855	1aU Overcurrent	0.78819	1aU Overcurrent	0.7653
TF Negative	201854	Aquapoxy 01	0.77339	Aquapoxy 01	0.5781

6.8.2: Action Tests

Results: Good as per the table.

Coil	Shot	JA Fault	SW Fault Time	Detected Time	FCC Fault	FCC Fault Time
1aU	201856	1aU Overcurrent	-3.1192		1aU Overcurrent	-3.1442
1bU	201857	1bU Action	-1.5542		1bU Action	-1.6306

6.8.3: Fault Tests

Results: Good as per the table.

Coil	Shot	JA Fault	SW Fault Time	Detected Time	FCC Fault	FCC SW Fault Time
ForceStressTests_0	201858	OH FZ	-0.2721		OH FZ	-0.2942
ForceStressTests_1	201859	Vertical Combined #5	-0.183		Vertical Combined #5	-0.2092

6.9: Between Shot Non-Zero Checker

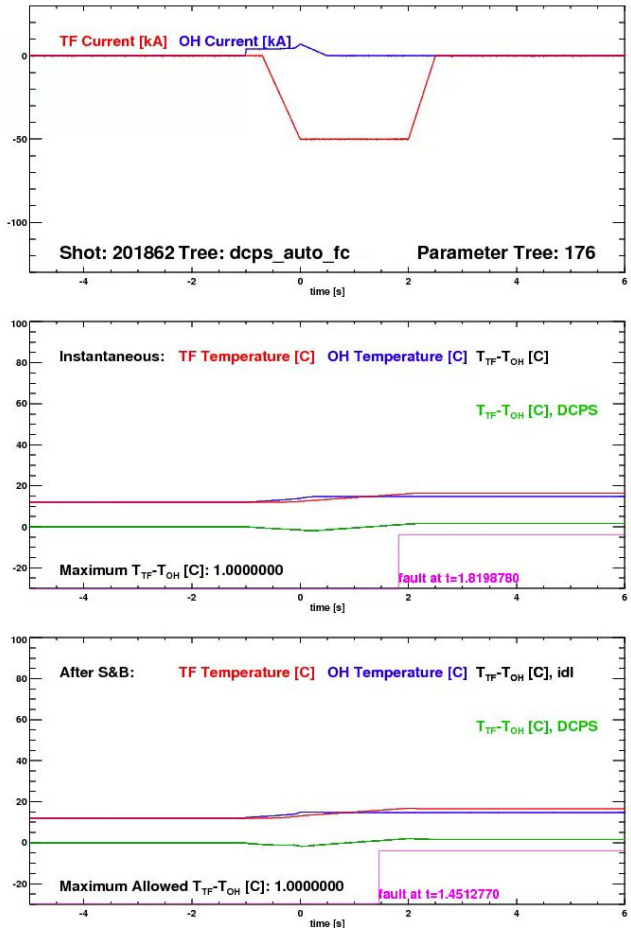
This step deferred for the FCC DCPS, since it is sending suppress and bypass all the time anyway.

6.10: Aquapour Algorithm Tests

Result: Correct functioning, as indicated in this table. Note that the FCC always trips first.

waveform	Shot	JA Fault	JA SW Fault Time	Detected Time	FCC Fault	FCC SW Fault Time
ForceStressTests_0	201860	none	---	---	none	---
ForceStressTests_1	201861	Aquapoxy 01	0.48039		Aquapoxy 01	-0.0303
ForceStressTests_2	201862	Aquapoxy 01	1.9869		Aquapoxy 01	1.4513

See example plot:



Notes from Roman:

pcs-rt-3

step 6.1.7 - 201844

[2015-11-05 09:24:59.045468] INFO: SOC rcvd
[2015-11-05 09:25:29.038822] INFO: T60 rcvd
[2015-11-05 09:26:23.038658] INFO: Clock TN
[2015-11-05 09:26:24.038661] INFO: Clock SOP
[2015-11-05 09:26:35.038660] INFO: Clock EOP

step - step 6.1.9 Tree Number - 176 shot number - 201845
[2015-11-05 09:32:25.487529] INFO: SOC rcvd
[2015-11-05 09:32:55.484704] INFO: T60 rcvd
[2015-11-05 09:33:48.484730] FATAL: Clock ABORT

step 6.2.5 - 201846
[2015-11-05 09:38:05.441261] INFO: SOC rcvd
[2015-11-05 09:38:35.436052] INFO: T60 rcvd
[2015-11-05 09:38:49.804654] INFO: Waiting for TN
abort

step 6.2.9 set tn to -61 shot 201847
[2015-11-05 09:45:37.087561] INFO: SOC rcvd
[2015-11-05 09:45:37.088054] INFO: CycleManager created

[2015-11-05 09:45:37.191815] INFO: Waiting for T60
abort

export LD_LIBRARY_PATH=$LD_LIBRARY_PATH:/u/rrozenbl:/u/rrozenbl/protobuf-2.6.1/src/.libs
6.3.2.g - 201848

6.3.3 - 201849

step - step 6_4_1_AU Tree Number - 176 shot number - 201850
[2015-11-05 10:14:25.529074] FATAL: Auctioneer threshold exceeded for current 1 ch1: -0.006097 ch2: 4.998791 diff: -5.004889 threshold: 5.000000
step - step 6_4_1_BU Tree Number - 176 shot number - 201851
[2015-11-05 10:22:49.701616] FATAL: Auctioneer threshold exceeded for current 2 ch1: 2.501559 ch2: -0.000214 diff: 2.501773 threshold: 2.500000
6.4.4 - 201852

6.6 - 201853

step - step 6_8_1NTF Tree Number - 176 shot number - 201854
step 6.8.1P1AU - 201855

step - step 6_8_2_1AU Tree Number - 176 shot number - 201856
step - step 6_8_2_1BU Tree Number - 176 shot number - 201857

step - step 6_8_3_0 Tree Number - 176 shot number - 201858
step - step 6_8_3_1 Tree Number - 176 shot number - 201859

step - step 6_10_1 Tree Number - 176 shot number - 201860
step - step 6_10_2 Tree Number - 176 shot number - 201861
step - step 6_10_3 Tree Number - 176 shot number - 201862

pcs-rt1_ja
———————————

step 6.1.7 - 201844
[2015-11-05 09:24:59.044161] INFO: SOC rcvd
[2015-11-05 09:25:29.038729] INFO: T60 rcvd
[2015-11-05 09:26:23.038614] INFO: Clock TN
[2015-11-05 09:26:24.038610] INFO: Clock SOP
[2015-11-05 09:26:35.038591] INFO: Clock EOP

step - step 6.1.9 Tree Number - 175 shot number - 201845

[2015-11-05 09:32:25.487347] INFO: SOC rcvd

[2015-11-05 09:32:55.484815] INFO: T60 rcvd

[2015-11-05 09:33:48.484706] 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 - 201846
[2015-11-05 09:38:05.441672] INFO: SOC rcvd
[2015-11-05 09:38:35.436123] INFO: T60 rcvd
[2015-11-05 09:38:43.907818] INFO: Waiting for TN
abort

step 6.2.9 set tn to -61 shot 201847
[2015-11-05 09:45:37.087724] INFO: SOC rcvd
[2015-11-05 09:45:37.087795] INFO: CycleManager created

[2015-11-05 09:45:37.179389] INFO: Waiting for T60
aborted

6.3.2.g - 201848

6.3.3 - 201849

step 6.4.1-AU - 201850
[2015-11-05 10:14:25.528395] FATAL: Auctioneer threshold exceeded for current 1 ch1: -0.001521 ch2: 5.000377 diff: -5.001898 threshold: 5.000000
step 6.4.1-BU- 201851
2015-11-05 10:22:49.701926] FATAL: Auctioneer threshold exceeded for current 2 ch1: 2.501135 ch2: -0.000240 diff: 2.501375 threshold: 2.500000

6.4.4 - 201852

6.6 - 201853

step 6.8.1NTF - 201854
step 6.8.1P1AU - 201855

step6.8.21AU-201856
step6.8.21BU-201857

step6.8.3.0-201858
step6.8.3.1-201859

step6.10.1-201860
step6.10.2-201861
step6.10.3-201862