

To: ACIS Science Operations Team  
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 Date: March 2<sup>nd</sup> 2017  
 Subject: Effect of DPA Power-Cycling during a Science Run (v 1.0)

## 1. Introduction

In developing flight procedures for recovering from unexpected DPA\_B power-downs, the question arose as to whether it would be possible to simply restore power if no FEP or BEP boards powered by DPA\_B were being used in the currently executing science run. A careful inspection of the flight software source code showed no obvious way that these unused BEP and FEPs would be affected, but it was decided that the best proof would be to simulate the power-cycling on the ACIS engineering unit (EU).

## 2. Command Sequence

The EU was duly commandeered on February 21<sup>st</sup> and the *acisCtl* command interface started on *cypress.mit.edu* with the `-e` option, signifying that it was to run in EU mode. The following steps were taken:

- a. The EU interface was started by selecting “Control I/O Server.../Start ACIS Interface”.
- b. Packet logging was started with “Control I/O Server.../Start Packet Logging”.
- c. The “Show Command Monitor”, “Show Packet Monitor” and “Show PMON Monitor” functions were selected in order to display windows making visible the EU responses.
- d. The BEP was cold-booted with “Control DPA Hardware/Cold Boot”.
- e. Flight software patches for level FGH and *deaeng* were loaded by selecting “Command Loads.../user-FGH-dea.pkts” followed by “Execute”.
- f. The BEP was then warm-booted with “Control DPA Hardware/Warm Boot” and the resulting “`patchValid=1`” status was confirmed in the “Packet Monitor” window.
- g. “Control I/O Server.../Select FEP Input.../DEA” was selected to take FEP input from the DEA. The console light on the Pixel Switch hardware interface was seen to be in the “DEA” position.
- h. DEA housekeeping was started with “DEA Housekeeping.../fullhouse.dea” followed by “Load” and “Start”. The “*fullhouse.dea*” parameter block reports only the voltages, temperatures, and relay settings on the active DPA-DEA interface board.
- i. The science run was started by selecting “Command Loads.../TE\_DPA\_B\_dea.bcnd” followed by “Execute”. The “*TE\_DPA\_B\_dea*” command sequence is shown in Section 3, below.
- j. Once events began to be reported in the “Packet Monitor” and “PMON Monitor” windows, the readings on the external 28V inputs to the PSMC were noted, the DPA\_B power was turned off and disabled via the “GRAP” push-button controls, the power readings were noted again, the DPA\_B power was enabled and restored, and the power readings were taken for a third and final time.
- k. Finally, the science run was ended with “Timed Exposures.../Stop” and packet logging was suspended with “Control I/O Server.../Stop Packet Logging”.

## 3. The TE\_DPA\_B\_dea Procedure

This timed-exposure science run was adapted from recent EU procedures that used the *deaeng* patch to send “noise” pixels from the video boards to the FEPs, adjusting the video offsets and thresholds to restrict the number of event candidates from each output node to a few per exposure. The run used FEPs 0, 1, and 2, *i.e.*, those powered by the A-side of the DPA power supply. These received pixels from CCDs S0, S1, S2, chosen because appropriate offsets and thresholds were already known.

```

# acisCtl DPA_B powerdown test on Tue Feb 21 2017

change 5001 systemconfig {          # power off all FEPs and video boards
  entries = {
    itemId          = 0 # SETTING_DEA_POWER
    itemValue       = 0
  }
  entries = {
    itemId          = 1 # SETTING_FEP_POWER
    itemValue       = 0
  }
}
wait 24

change 5002 systemconfig {          # power on selected FEPs and video boards
  entries = {
    itemId          = 0 # SETTING_DEA_POWER
    itemValue       = 0x70
  }
  entries = {
    itemId          = 1 # SETTING_FEP_POWER
    itemValue       = 7
  }
}
wait 63

load 5003 te 4 {                    # Use FEPs 0,1,2 and CCDs S0,S1,S2
  parameterBlockId = 0x00707000
  fepCcdSelect     = 4 5 6 10 10 10
  fepMode          = 2 # FEP_TE_MODE_EV3x3
  bepPackingMode   = 0 # BEP_TE_MODE_FAINT
  onChip2x2Summing = 0
  ignoreBadPixelMap = 0
  ignoreBadColumnMap = 0
  recomputeBias    = 1
  trickleBias      = 0
  subarrayStartRow = 0
  subarrayRowCount = 1023
  overclockPairsPerNode = 8
  outputRegisterMode = 0 # QUAD_FULL
  ccdVideoResponse = 0 0 0 0 0 0
  primaryExposure   = 32
  secondaryExposure = 0
  dutyCycle         = 0
  fep0EventThreshold = 14 15 14 13 # S0 thresholds
  fep1EventThreshold = 14 14 14 13 # S1 thresholds
  fep2EventThreshold = 9 9 9 9 # S2 thresholds
  fep3EventThreshold = 0 0 0 0
  fep4EventThreshold = 0 0 0 0
  fep5EventThreshold = 0 0 0 0
  fep0SplitThreshold = 5 5 5 5
  fep1SplitThreshold = 5 5 5 5
  fep2SplitThreshold = 5 5 5 5
  fep3SplitThreshold = 0 0 0 0
  fep4SplitThreshold = 0 0 0 0
  fep5SplitThreshold = 0 0 0 0
  lowerEventAmplitude = 5
  eventAmplitudeRange = 3250
  gradeSelections     = 0xffffffff 0xffffffff 0xffffffff 0xffffffff
                    0xffffffff 0xffffffff 0xffffffff 0x7fffffff

```

```

windowSlotIndex      = 65535
histogramCount       = 0
biasCompressionSlotIndex = 1 3 3 1 1 1
rawCompressionSlotIndex = 2
ignoreInitialFrames  = 5
biasAlgorithmId      = 1 1 1 1 1 1
biasArg0             = 5 5 5 5 5 5
biasArg1             = 10 10 10 10 10 10
biasArg2             = 20 20 20 20 20 20
biasArg3             = 0 0 0 0 0 0
biasArg4             = 20 20 20 20 20 20
fep0VideoOffset     = 41 30 46 41 # S0 offsets
fep1VideoOffset     = 42 36 43 35 # S1 offsets
fep2VideoOffset     = 31 46 36 31 # S2 offsets
fep3VideoOffset     = 0 0 0 0
fep4VideoOffset     = 0 0 0 0
fep5VideoOffset     = 0 0 0 0
deaLoadOverride     = 0x00000000
fepLoadOverride     = 0x00000000
}
wait 4

start 5004 te 4      # start science run
wait 4

dump 5005 systemconfig # dump system configuration table
wait 4

dump 5006 huffman   # dump Huffman compression table
wait 23

```

#### 4. Command Timeline

The following merges the output of the command window of *acisCtl* with the measurements and adjustments of the DPA\_B power supply. Note that the second *swHousekeeping* packet reported the start of event data that actually began almost a minute before its receipt time of 052:14:38:12. The error codes colored red in the *scienceReport* result from using the *deaeng* software patch to properly initialize the DEA video boards and are a feature of all science runs using the engineering unit's DEA to send pixels to the FEPs. Note that the software version number of the patch load was set to 55, rather than 53 for the FGH flight patches alone, to take account of the additional *deaeng* patch.

```

# acisCtl Telemetry on Tue Feb 21 14:46:02 EST 2017

052:14:27:27    0 bepStartupMessage coldboot version=11
052:14:27:35   9031 addPatch=OK          x31 end=052:14:28:33
052:14:28:33    32 swHousekeeping          version=11 ticks=644 cmds=31
                                FEPMAN_POWEROFF=2 x3
052:14:28:35   9151 addPatch=OK          x120 end=052:14:31:31
052:14:32:24    0 bepStartupMessage warmboot version=55
052:14:32:41    0 loadDeaBlock=OK
052:14:32:45    0 startDea=OK
052:14:32:59   5001 changeConfig=OK        dea=_____ fep=_____
052:14:33:24   5002 changeConfig=OK        dea=___456___ fep=012___
052:14:33:30    7 swHousekeeping          version=55 ticks=643 cmds=4
                                FEP_WRITEMEM=0
                                FEPMAN_POWERON=0
                                FEPMAN_STARTLOAD=0

052:14:34:27   5003 loadTeBlock=OK

```

```

052:14:34:29 5004 startScience=OK
052:14:34:29 14 dumpedTeBlock id=0x00707000
052:14:34:33 5005 dumpSysConfig=OK
052:14:34:37 17 swHousekeeping version=55 ticks=644 cmds=3
SCI_STARTRUN=5004
FEP_WRITEMEM=2 x14
FEP_EXECMEM=2 x3
FEPMAN_POWERON=2 x2
FEPMAN_STARTLOAD=2 x2
FEPMAN_ENDLOAD=2 x3

052:14:34:37 5006 dumpHuffman=OK
052:14:35:49 32 swHousekeeping version=55 ticks=641 cmds=1 fep?=2,x18
DEABOARD_ERROR=0x000b0001 x4
FEP_STARTBIAS=0

052:14:38:12 118 swHousekeeping version=55 ticks=641 fep?=2,x48
FEP_STARTDATA=2

#-----
#
052:14:37 Laboratory power supply readings
052:14:38 28VA: 30V 0.8A, 28VB: 29V 1.4A
052:14:39 Power off and disable DPA_B
052:14:41 28VA: 30V 0.8A, 28VB: 29V 1.1A
052:14:42 Power enable and on DPA_B
052:14:42 28VA: 30V 0.8A, 28VB: 29V 1.4A
#-----

052:14:44:37 0 stopScience=OK
052:14:44:43 989 scienceReport rc=1 ccderr=111000 deaerr=1
052:14:44:58 992 swHousekeeping version=55 ticks=641 cmds=1 fep?=1,x5
SCI_STOPRUN=0
SCI_STOPRUN_RSTOP=0x80005604
FEP_STOP=0
SMPROC_RSTOP=0
SCI_DATACOMPLETE=0

052:14:45:33 0 stopDea=OK
052:14:45:41 773 changeConfig=OK dea=_____ fep=_____

```

## 5. Conclusion

Since no unexpected anomalies occurred when the DPA\_B input power was cycled,<sup>1</sup> we conclude that simply turning the power back on again is a safe and appropriate response to a flight incident in which DPA power is found to have been turned off during a science run that uses no FEP or BEP boards powered by that side of the PSMC.

## 6. References

1. “DPAB\_ON”, ACIS Standard Operating Procedure 61037, Rev. 3.1, July 19, 1999.
2. User Interface to the ACIS Instrument, “acistools.pdf”, pp. 2-15, revised January 30, 2015.
3. ACIS IP&CL Structure Definition Notes, MIT Report 36–53206.0204, Revision N (2003).
4. ACIS EU Power-Up/Down Sequences, “acis-eu-power.html”, revised December 2, 2013.

<sup>1</sup> Although only one science run is described in this report, the test procedure was successfully repeated a total of 5 times with minor variations without producing any anomalies or unexplained results.