How to troubleshoot your bq27xxx single-cell IT fuel gauge learning cycle
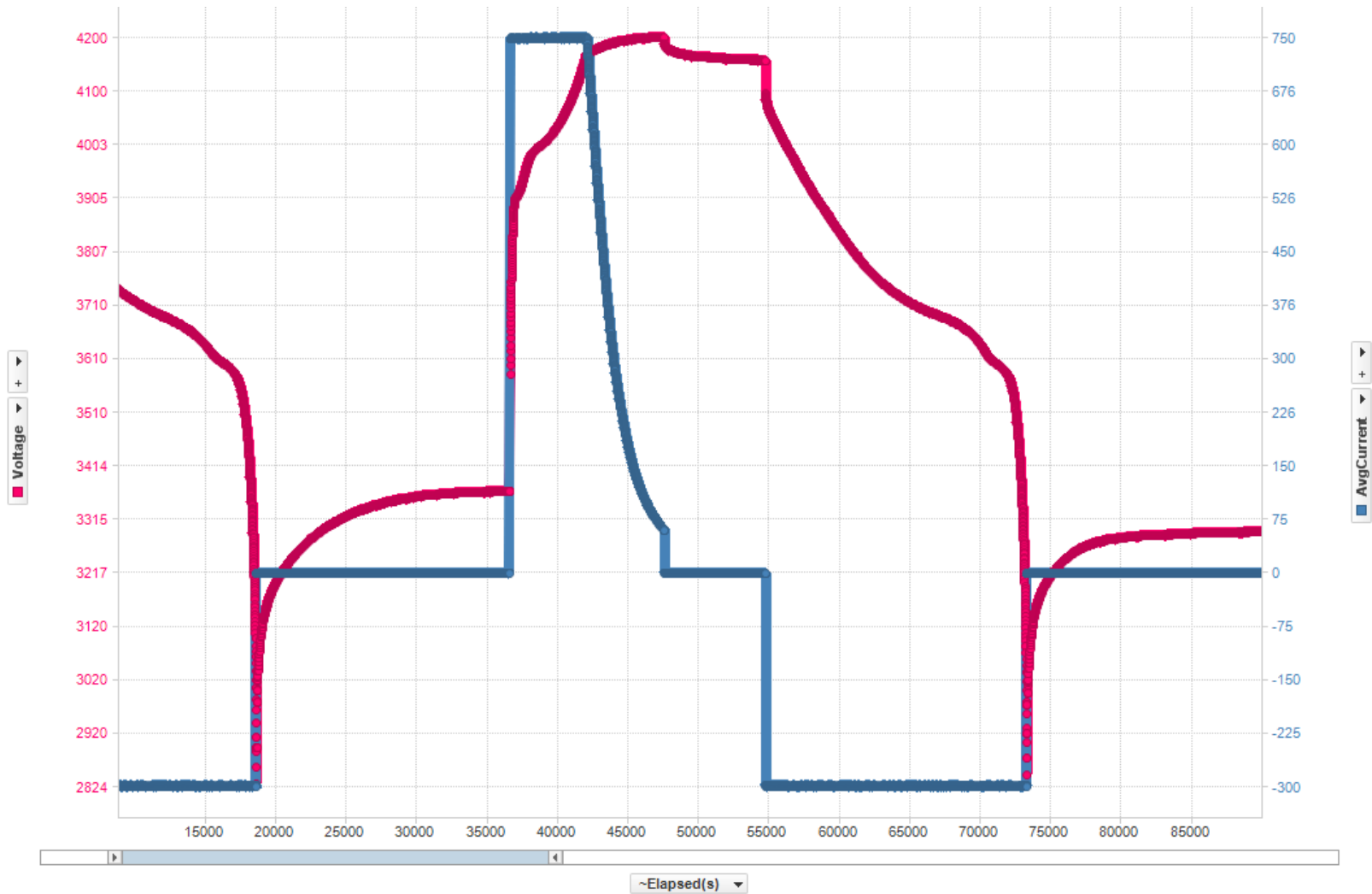
Learning cycle blues

- Learning cycle issues
  - Review app note: Achieving the Successful Learning Cycle
    - http://www.ti.com/litv/pdf/slua597
  - Log and autoexport everything
    - Log DataRAM: In the DataRAM screen, set your logging interval under the Options menu. 4 seconds is the fastest you want, but 10 seconds or longer is probably fine. Then click the Start Logging button and enter the filename. Click OK and it will start saving the DataRAM values to that file.
    - Log DataFlash: In the Data Flash screen, under the Options menu, configure the interval and filename. About 10 minutes should be a sufficient interval. Then select AutoExport from the Options menu and it will read and dump the Data Flash contents shown on the screen into a new file. Each interval will create a new file and increment the filename.
  - Import to spreadsheet and analyze the log to see what went wrong
    - check current, voltage, Flags, Control Status, etc.
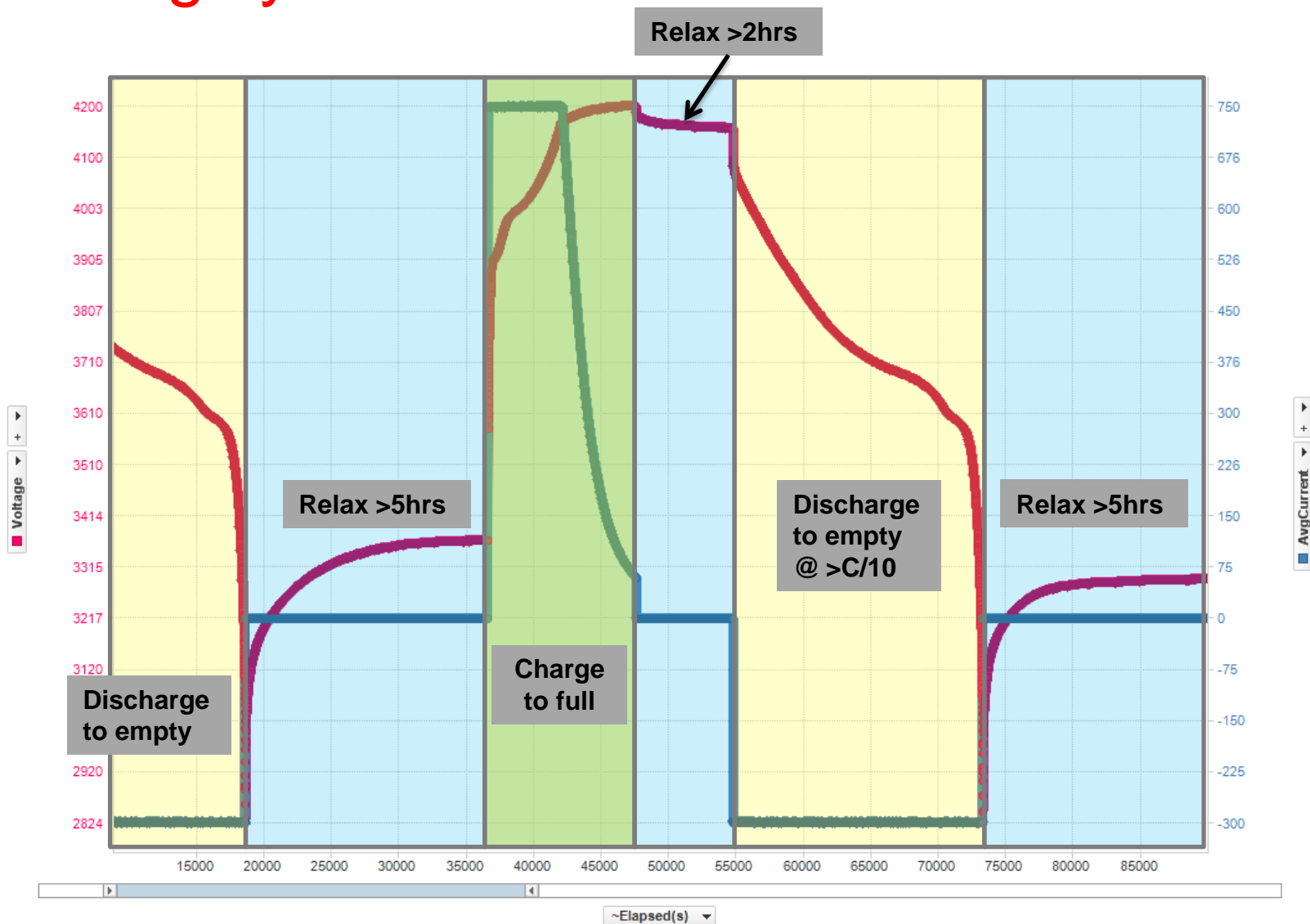
TEXAS INSTRUMENTS

Learning cycle blues

- Common problems during a learning cycle
  - Battery not detected (BAT_DET = 0)
  - IT not enabled (IT Enable = 0 for host-side gauges, Update Status = 04 for pack-side)
  - Not reaching full charge (confirm FC bit was set before charger stopped)
  - Not relaxing long enough (make sure VOK bit cleared)
  - Discontinuous discharge
  - Discharging too far (pack protector opens or gauge goes into POR)
  - Not relaxing at all
  - Too much current during "relaxation" causing voltage to steadily drop
  - Not at room temperature (10C-40C)
  - FET doesn't cut off discharge properly (relays are more reliable)
  - Wrong chemID selected (RUP_DIS might get set during discharge)
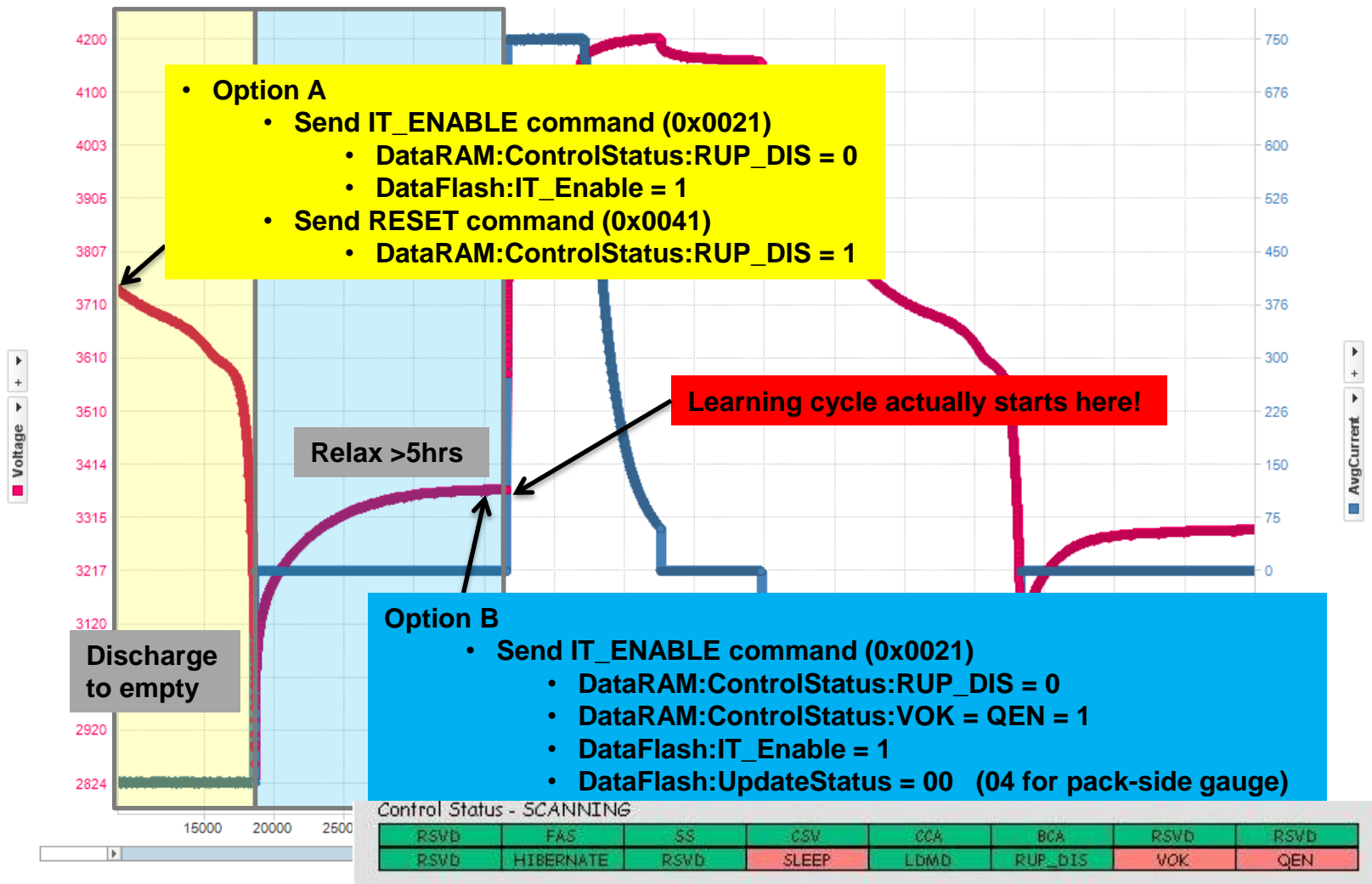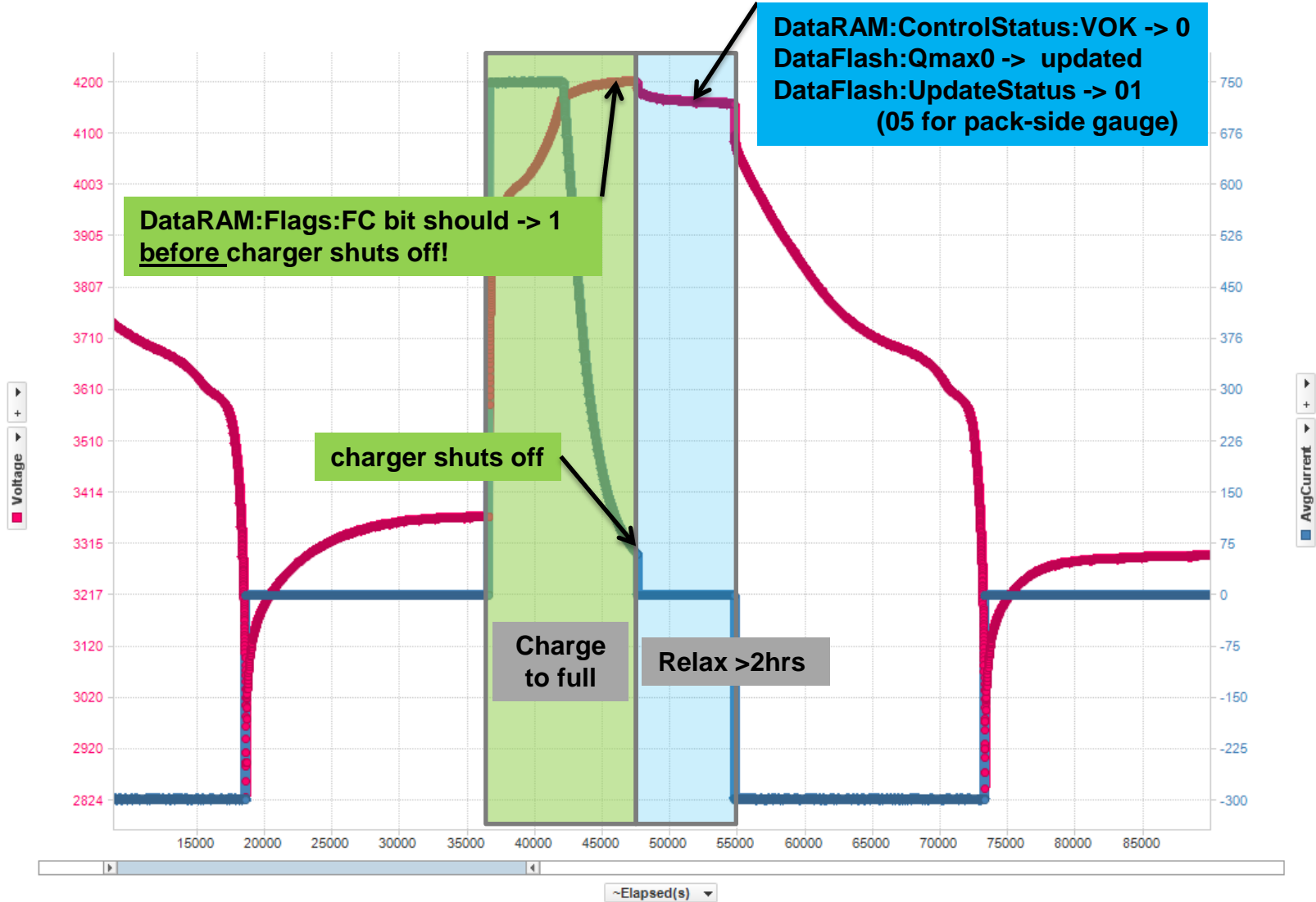 - LiFePO4 needs 5 hour relaxation after charge (instead of standard 2 hours)

TEXAS
INSTRUMENTS

Learning cycle overview

Learning cycle overview

Learning cycle: step 1 (get to empty)

Option A
- Send IT_ENABLE command (0x0021)
  - DataRAM:ControlStatus:RUP_DIS = 0
  - DataFlash:IT_Enable = 1
- Send RESET command (0x0041)
  - DataRAM:ControlStatus:RUP_DIS = 1

Learning cycle actually starts here!

Relax >5hrs

Discharge to empty

Option B
- Send IT_ENABLE command (0x0021)
  - DataRAM:ControlStatus:RUP_DIS = 0
  - DataRAM:ControlStatus:VOK = QEN = 1
  - DataFlash:IT_Enable = 1
  - DataFlash:UpdateStatus = 00   (04 for pack-side gauge)

Control Status - SCANNING

RSVD	FAS	SS	CSV	CCA	BCA	RSVD	RSVD
RSVD	HIBERNATE	RSVD	SLEEP	LDMD	RUP_DIS	VOK	QEN

TEXAS INSTRUMENTS

Learning cycle: step 2 (get to full)

DataRAM:ControlStatus:VOK -> 0
DataFlash:Qmax0 -> updated
DataFlash:UpdateStatus -> 01
      (05 for pack-side gauge)

DataRAM:Flags:FC bit should -> 1
before charger shuts off!

charger shuts off

Charge to full

Relax >2hrs

Learning cycle: step 3 (discharge again)

DataRAM:ControlStatus:VOK -> 0
DataFlash:Qmax0 -> updated
DataFlash:UpdateStatus -> 02
(06 for pack-side gauge)

Start discharge (VOK will set again)

Ra tables are updated during discharge

Discharge to empty @ >C/10

Relax >5hrs

TEXAS INSTRUMENTS
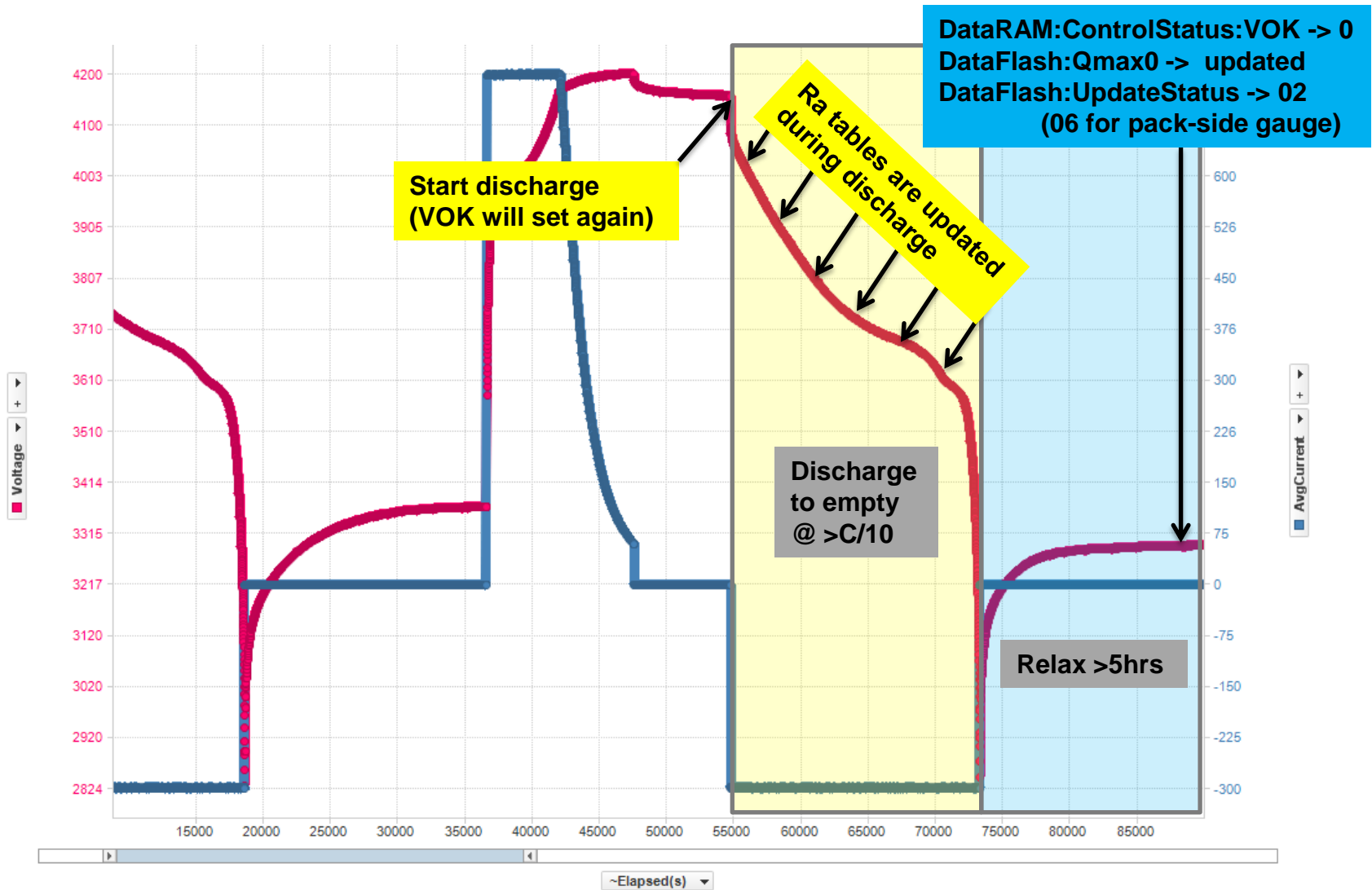
Learning cycle blues

- Goal: achieve Update Status = 02 (06 for pack-side gauges)
  - If your Update Status was still 00 at the end of your learning cycle, check your starting status and your charging/relax step.
  - If your Update Status was only 01 at the end of your learning cycle, check your last discharge/relax step.
  - Note: Don't fake it by manually changing Update Status = 02!
    - It failed for a reason and if you try to make a golden file this way it will cause problems and won't be accurate.

- Find out what went wrong before retrying your learning cycle!
  - Each learning cycle attempt takes at least 15 hours.

TEXAS INSTRUMENTS