<u>EndCap</u> Trouble Shooting Guide

updated June 5, 1998
This file is in /e787d/csi/doc/ec_guide3.tex(ps)

<u>HV control</u>

1. HV is NOT in DeMon. To access HV supply:
   From the bnlonl (or csi) ToolChest

   - High Voltage →

     CsI HV → status, on, off, set
     all on,off, and set commands are logged in csi/hv/control/log/HV.LOG

   If the supply is not accessible from the toolchest:

   - Verify that the mainframe is on. All three LEDs on the controller should be on.
   - verify that no one has already connected to the HV Mainframe (e.g. - we automatically read the HV every day at 07:55, 15:55, and 23:55).
   - telnet hv787 3010 (currently using port 10). Then hit $< cr >$ several times. You should get a 9 $>$ prompt.
     - No prompt —
       - go to VT220 terminal in rack near HV supplies
       - verify Black Box is set to A — hv787
       - disconnect port 10
       - sho port 10 (verify baud rate is 1200).
       - from an xterm type "telnet hv787 3010" again
     - prompt is 9 $>$
       - help, show status, on, off, read (0-10,0-15),...
       - to exit $< cntl >$] then from the "telnet>" prompt type "quit".

2. To check the HV values read the latest file in csi/hv/1998/log/date.time.log. These are read every 8 hours.

3. HV supply is interlocked to the D3 Magnet current. (CsI and PbG, since 1997, high-field PMTs)

4. Do NOT turn on the HV unless the Interlock cable is in place and the interlock is NOT BYPASS'd.

5. If D3 trips off. You need to turn on D3, then turn OFF the CsI HV, and finally turn ON the CsI HV.

6. If we have a large pion flux (e.g. separator failure) SHUT OFF the CsI HV. If the Visual scalers show ECM(P) rates to be much larger than Ck/2, turn off the HV.

7. HV settings are in /e787d/csi/hv/1998/AGS_B/ (the current file is B_10mV.1997_2)

8. To load a new set of HV's, logon as csi; cd hv; mv hvsetenv hvsetenv_date; cp hvsetenv_date hvsetenv; emacs hvsetenv (input the name of your new file). Then from the bnlonl (or csi) ToolChest execute the "set" command. Then check that the loading was successfull in the file csi/hv/log/date.time.log. DO NOT set high-field values if the magnet (D3<9kG) is off!

9. CHECK the VISUAL SCALERS — ECM/Ck = 0.5 and ECP/Ck = 0.33.

10. CHECK QOD: verify that all xtals are seen in the ADC, TDC, and CCD occupation plots. Verify that the humidity is less than 20% in each endcap and that the temperatures are less than 110 F.

11. If an expert is needed
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General Description

1. 143 undoped CsI crystals.
   - Ring1(us,ds) — 13, 11 xtals
   - Ring2(us,ds) — 14, 13
   - Ring3(us,ds) — 21, 19
   - Ring4(us,ds) — 27, 25
2. All crystals are right-pentagonal-polyhedrons and are 25cm long. The height of the Ring 2-4 xtals is $\sim$10cm and the height of Ring 1 crystals is $\sim$6cm.
3. The average light yield is $\sim$150 pe/MeV in a 100ns gate(with low-field PMTs and 30 cm^2 photocathodes). The average ratio of fast to total light (100ns/1000ns gates) is $\sim$0.8 ($\sim$0.86 with filters).
4. The density of CsI is 4.5 g/cm^3.
5. The radiation length is 1.8cm.
6. The Moliere radius is 3.8cm.
7. The index of refraction is 1.8.
8. The fast component of scintilation light is peaked at $\sim$300nm and has a time constant of $\sim$40ns. (The slow component is centered around 450nm, with a time constant of $\sim$600ns.)
9. We have glued UV filters to the PMTs that pass only the fast component (the slow component is reduced by $\sim \times 10$)
10. CsI is hygroscopic. Check the humidity in the EC using QOD; we do not want the humidity to go above 20%.
11. 119 3" diam. high-field PMTs, 24 2" diam. high-field PMTs.
12. The average gain drop at full B-field is 1/40.
13. The gains of the PMTs drop about 0.5% / degree C.
14. The gain also drops as a function of DC anode current.
15. The lifetimes of the PMTs are not well understood, so we do not want to run with excessive photocathode current, excessive anode current, or high temperature.
16. These PMTs are very expensive ($\sim$\$5500 each)

Monitor System

1. Monitors: There are 3 PIN photodiodes and one Ref PMT monitoring the Xe light output. In addition there are 3 Ref PMTs monitoring the light output from each of the two fiber bundles (one us and one ds). The HV of the Reference PMTs is set from the file Ref.com in /e787d/csi/hv/special/ (the HV has been raised from −1000V to −1035V for Ref1–6. Ref7 is still −650V). The power for the PIN photodiodes is a 9V battery in one of the refrigerators on top of the magnet. The monitor PMTs are in one refrigerator and the Xe lamp is in the other.

2. YAlO's (Cerium doped Ytrium Aluminum Oxide(3) scintillators with a monolayer of ^{241}Am deposited.) light pulsers. These have been calibrated to the ^{137}Cs peak (662 keV). This is used for the initial calibration of the endcap gains. There is one light source glued to the non-PMT end of each crystal. They each are ∼50Hz and the equivalent energy ranges from 4–9 MeV.

3. The YAlO trigger is a self-trigger of the endcap. The thresholds should be set to 1(5mV) and the widths to 8(20ns).

4. Xe lamp: The Xe lamp is powered from a 10 V supply in the bottom of the refrigerator. This supply powers the HV supply in the same fridge. The HV unit also contains the triggering unit which is set to receive external triggers (need to be big – we send a −5V pulse) (it can be set to internal trigger if desired). The triggers are either generated in a) the predet or b) the prescaler or c) KEK pulser (need to change a cable).

5. Humidity monitor: the humidity monitor is powered by a 10 V supply on top of the Xe lamp refrigerator on top of the magnet. It is read out in the scanning ADC 2^{nd} and 3^{rd} channels. The humidity is controlled by continously flowing Nitrogen through the crystal region. The flow meters are near the roll up door, along with the DC N_2.

6. Temperature monitor: We have 11 thermocouples currently instrumented. Two in the xtal region and two in the PMT region of each endcap plus one in each refrigerator and one monitoring the environment on top of the magnet. The thermocouple readings are converted to voltages in a Omega Engineering converter in rack L8 which is then read by the Scanning ADC ch. 4–14. The temperature is controlled by sucking air into the PMT region from the outside. The pump is on top of the magnet (one pump for both endcaps)

Electronics

1. See the electronics diagram on the next page for the circuit diagram and the table on the subsequent page for a mapping of CsI channels to HV,cables,CCD,Amp,splitter,TDC,ADC.

2. Signals go from PMTs to a patch panel on the magnet. From the magnet they go to the patch panel in the back of rack L1. From the patch panel they go to amplifiers (PS776 $\times 10$) in rack L2.

3. One amp output (low-range, high-gain) goes to the CCDs (The cable goes through the floor, downstairs then back upstairs at the CCD rack.).

4. The second amp output goes to the splitter boxes at the bottom of rack L1 These are 10%:15%:75% splitters (top to bottom on splitter box. There are two channels in each box.)

5. The 75% branch goes to the FERA crate 16 (with a shaper circuit to cancel the tail from the ADC delay cables).

6. The 15% branch goes to the CFDs (rack L2). The discriminator output goes to the TDCs (bottom crate–TDC3, slot 7–8, LRS1776). The 'OR' discriminator output goes to a logic 'OR' in the same crate and the 'OR' output goes to make the L0 veto signal and the YAlO trigger (the reference PMTs are included in the YAlO trigger).

7. Note. CFD's need to be programmed. The threshold and width have too be set (PARTICULARLY if the power to the CAMAC crate goes off!). The file with the values to be loaded is /e787/local/online/camac/cfd/cfd.pnn (CFD$COMMANDS:cfd.pnn on the VAX). To load the CFDs type "cfd" from bnlonl on bnlku7 ($CAMAC_COMMANDS/cfd/pnn on bnlku7). To load new thresholds or widths, execute the appropriate command file in $CAMAC_COMMANDS/cfd on bnlku7. To load YAlO trigger values type "cfd_yalo" on bnlku7. To read the current settings, type "read_cfd" on bnlku7.

8. The 10% branch goes to a fanin crate in rack L3. These (high-range, low-gain) outputs are multiplexed by 4 (us and ds are separate). Each fanin has 4 outputs. One goes to an analog sum (PS summer) in rack L5 (this is used for the ec_kmu2 trigger). A second output goes to FERA crate 15 (with an in-line shaper). A third output goes to the CCDs (lower crate, the three rightmost CCD modules) (these cables are routed through the floor and back up through the floor to the CCDs). The fourth output is unused.

9. SMB connectors at the input to the CCD's are very sensitive. BE VERY CAREFUL. If you have to unplug one, verify that the signals are propagating into the CCD's when you replug it.