Forward Tracker Expert Documentation

(Last update February 2006 by Paul Laycock)

Quickguide

FTD Readout Problems

Keywords: *Branch 5, readout, VME warning/alarm*

First and foremost, this is not officially your responsibility, the readout is Guenter Eckerlin's job. Nevertheless you can help the shift-crew out and save Guenter an unpleasant phonecall if it's 4 in the morning. Ask the shift crew if there are error messages from the BBL3 system which indicate that a particular crate has died, if so which crate. If the shift crew are confident they can identify the crate and know where to find it in the trailer (if they say Rack B they're on the right track) they can try to power-cycle the crate. Failing that they can try to pull out the control/fan unit and replace it. If you're in any doubt then Guenter Eckerlin should be called.

HV problems - Your responsibility

FTD trips frequently along with several other detectors

Ask the shift crew about the general background / beam conditions; if HERA/background conditions are bad, the shift crew simply have to wait for conditions to improve. Remember though, if the CJCs are ON without problems then the FTD should also be ON.

FTD trips alone - Many Channels

Check the gas from **Fast Navigator - Tracker - Gas Composition** or **https://www-h1.desy.de/icgi-tracker/igas/gascomp**. If the ethanol or propane content has decreased significantly it indicates a gas problem. Without the correct gas mixture we can't operate the FTD, switch OFF and contact the gas expert. There may well also be BBL3 alarms from the gas system. If there is no gas problem but the FTD has many tripping channels then ask the shift crew to go to Standby and try again in half an hour. If things still don't improve then contact Paul Laycock.

FTD trips alone - One Channel

If one channel persistently trips then you can try putting the FTD to Standby for 10 minutes. If this still doesn't help then you'll have to call Paul Laycock as a cable needs to be unplugged. If you know how to then try to identify which distributor channel is causing the problem (see section 6).

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1 Introduction

The maintenance and operation of the Forward Track Detector (FTD), the Forward Muon Detector (FMD) and the Forward Muon Trigger (FMT) are the responsibility of the UK groups. The front page of this document indicates the level of expertise you are expected to have if called at 4 in the morning. The remainder of this document gives some more information regarding the oncall expert's duties, primarily attending the 9 o'clock run meeting. There is also more information which may be generally useful when oncall, in terms of understanding the detector and how it is operated. **Ultimate responsibility for these systems lies with Paul Laycock (FTD) and Dan Traynor (FMD and FMT) and we would actually like it (retrospectively at least) if you called us at 4 in the morning if there was a serious problem.**

Figure 1 shows a schematic longitudinal slice of the FTD; it is comprised of three supermodules which each contain 3 P chambers and 2 Q chambers (one in the third supermodule, we ran out of room). A schematic of the layout of a Q module is also shown in figure 1; a P chamber only has four sense wires per cell and 32 cells per module.

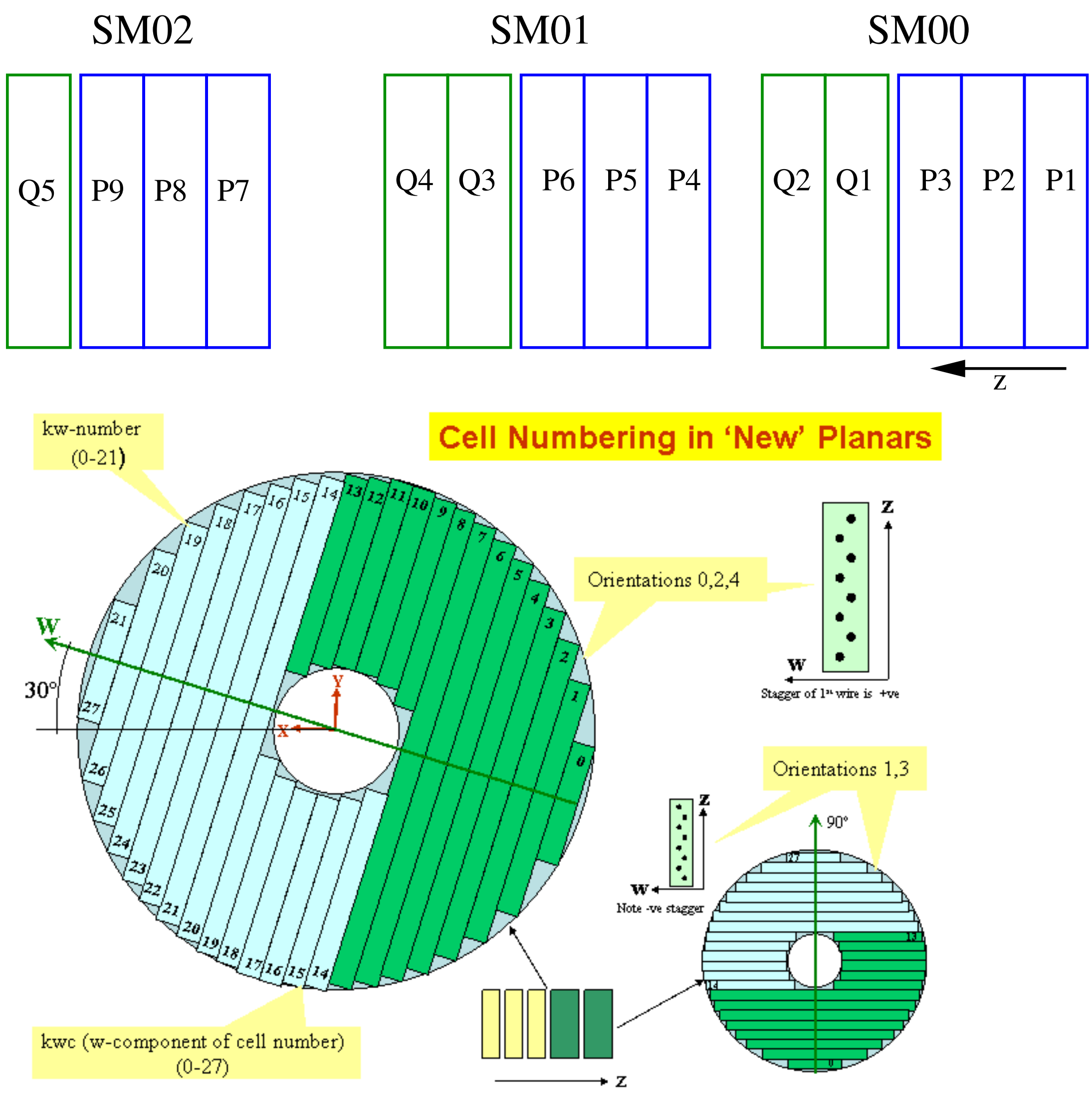

Figure 1: A schematic of the forward track detector.

2 Duties Of the FTD On-Call Expert

- It is your responsibility to arrange some overlap with your oncall predecessor in order to get up to speed with the present running conditions / detector issues, etc.
- Make sure you have the on-call mobile and that it's charged and with you at all times. Be prepared to answer shift crew calls 24x7 !!! If possible be near an internet connection or be prepared to go to the north hall if needed.
- Attend all 9am run meetings on weekdays in room 401 of the North hall if possible. Arrive early and perform checks before the meeting starts so that you can report problems.
- Check monitoring plots once per day; see section 4.
- Check the gas from **Fast Navigator - Tracker - Gas Composition** or **https://www-h1.desy.de/icgi-tracker/igas/gascomp**. In particular take note of the ethanol and propane content; if these have decreased significantly it indicates a gas problem. Without the correct gas mixture we can't operate the FTD, you should contact the gas expert immediately.
- Make sure you know how to use PVSS for HV control remotely (see section 5) and use it to check the status of the detector and monitor shift crews.
- If there were developments / issues raised during the run meeting then you should inform Paul Laycock. Try to pay attention in the meeting since new conditions / decisions made there may affect or be useful to us.
- Ensure that if there is any possibility to take cosmic data (field on or off) that we take this data; contact Paul Laycock if necessary. During cosmics or special runs assume the shift crews will make mistakes - double check what they do. For cosmic data taking instructions refer to the Central Trigger shift instructions page for Cosmics at https://www-h1.desy.de/itrigger/ShiftInstructions/Cosmics.html (or Fast Navigator → CT Home (L1) → Cosmics). Log all such special runs in the FTD Hypernews.
- Subscribe to Run report, read the H1logbook for each shift (3 x per day). You should always be aware of what the plans for HERA and data-taking are. Use **Shift Tools - 24h history** to monitor HERA's present running.

3 Not the Duties Of the FTD On-Call Expert

Occasionally the On-Call expert will be called by the shift crew when the problem that needs dealing with is not their responsibility. It is always worth checking this before leaping out of bed and sprinting to the North hall.

- Real problems with the FTD readout (eg VME crate errors, FTD branch not able to go into readout) should be addressed to Guenter Eckerlin. Use the Quickguide if it's 4 in the morning but failing that the expert has to deal with the problem.
- Problems with the gas should be addressed to the oncall gas expert.
- Do not unplug HV cables, change HV files for PVSS or make any other major change to FTD operation without consulting Paul Laycock!

4 Monitoring the FTD

The drift chambers of the FTD are continuously monitored during data-taking at L4 on the farm and at L5 during reconstruction. The time evolution of various quantities of interest are made available on the web via the L4/5 histograms which may be found on the FTD homepage at https://www-h1.desy.de/h1det/tracker/fdet/poster.html (or Fast Navigator → Tracker → Forward Track Detector (FTD)).

An automated calibration and monitoring program runs as a cron job four times a day at 05.30, 11.30, 17.30 and 23.30 GMT. This produces various postscript files that can then be examined from the FTD homepage under the section **Live information about the Forward Tracker status**. The files give the time at which they were made.

4.1 The *zubr* Shift Histograms

The shift crews use zubr to monitor some of the most important quantities. You should check these histograms too! Look at a run with good statistics and compare it with the reference; use the comments written underneath the histograms as a guide for acceptable limits. If you see any significant changes in the plots then report them to Paul Laycock.

4.2 Monitoring the FTD Gas Mixture

Check the FTD gas mixture. This can be found at:

https://www-h1.desy.de/icgi-tracker/igas/gascomp

The nominal mixture is 90:9:1 Argon:Propane:Ethanol with usual operational values being 88.4 % Argon, 9.7 % Propane, 1 % Ethanol and 0.9 % Nitrogen. If the Ethanol falls below 0.8 % and/or the Propane falls below 9 % then there is a problem with the gas system, the FTD should be switched OFF and the gas expert should be contacted. Much below these levels and the FTD will become completely inoperable anyway and you will have received a phonecall. You should also disable the CAEN crates (see section 7.4) to prevent the shift crew from turning the chambers on and contact Paul Laycock.

5 Monitoring the HV Status of the FTD - PVSS

The On-Call Expert should regularly check the status of the FTD during their shift, especially during data-taking periods. This can be done using PVSS on the machine **wellington**. In order to run PVSS you will need to make several additions to your .zshrc file (contact Paul Laycock at laycock@mail.desy.de for these). Thereafter you can start the monitoring application using the command **hvftd**.

5.1 The HV Status of the FTD

The FTD has three main settings: on, off and standby. The FTD should normally be left on standby. In this mode there is no gain, but it allows the chamber electrostatics to stabilise.

The FTD should be switched on during luminosity and for cosmic runs unless there is a good reason for not doing this.

The FTD should be switched off if there is work on the inner detectors of H1, work on the FTD CAEN HV crates or problems with the gas.

5.2 Switching ON, OFF and to Standby

Refer to the **Tracker Turn On** instructions available from the Shift Tools page; refer shiftees to the same information!

5.2.1 Checking the FTD when in Standby

On Standby the chambers should draw very little total sense current ($<$10 μA). Check this on the PVSS terminal in the FTD panel in the lower half of the main screen. Select "Trend". The total sense current is displayed both graphically and numerically.

5.2.2 Checking the FTD when On

When HV is on the FTD draws a variable amount of current depending on the beam conditions, with a limit of 750 μA. Beyond that limit PVSS will lower the sense HV by 10V steps (expressed as a percentage this can look strange!) until the total current is below 750 μA. Shift crews can override this! If you see that the FTD was operated for a long time at currents above 750 μA then inform Paul Laycock. For cosmics the current drawn is not an issue and should be $\sim 230\mu$A.

Another important thing to check is that no channel is drawing more than its current limit. If this happens the channel will show "OVC" in red. Ordinarily PVSS should automatically reduce the sense HV such that the total sense currents in the FTD are $< 750\mu$A; shift crews can override this though. This comes down to judgement, so call Paul Laycock!

6 HV Operation Problems - Trips

Trips are caused when one or more channel draws too much current. The usual reason for this is due to a spike in the background from the beam. Other causes can be a short that has developed in a chamber or wrong gas mixture. Ordinarily the FTD is very robust against reasonable background conditions, so be alert if the FTD is tripping!

6.1 What to do in case of trips

- Check that the shift crew have followed the standard procedure (defined in the Tracker Turn On instructions from the Shift Tools page).
- Check the CJC chamber currents and other background indicators. Are the global background conditions bad? If so be sure that the shift crew are aware that there is obviously a global problem with the backgrounds, don't give the FTD special treatment, i.e. do not just leave it OFF! Shift crews should follow the shift instructions for dealing with bad background conditions.
- If global conditions are ok but the FTD is still having problems with several channels tripping then check the FTD chamber currents and check the Details panel. Are the currents high ($> 750\mu$A) and/or are one or more channels showing "OVC"? If so the background conditions may be bad for the FTD alone and it is best to contact Paul Laycock. If it's 4 in the morning then advise the shift crew to switch the chamber to Standby and wait for 30 minutes before trying again. You should also check the gas composition, a bad gas mixture will also result in FTD-only trips. If there is a problem with the gas composition then the shift crew should contact the gas crew.
- If global conditions are ok but the FTD is still having problems with one channel tripping it could be a cell-short. Get the shift crew to note in the H1logbook the tripped sense channel and if possible the distributor channel which is drawing high current. The distributor information is got by clicking on the distributor number listed in the "Details" panel. Determining which distributor channel caused a trip can be difficult, as the trip is instigated at the generator level (the channels directly listed in the FTD **Details** panel), and individual distributor channels don't "trip". However, if you're experiencing trips, you can have the relevant distributor panel open and watch for high currents. You may also find that the culprit is drawing large ($> 1.0\mu$ A) current at 95% reduced without tripping, thus allowing you to identify the problematic channel.

7 Problems with Crates

All FTD high voltage control crates are connected to the Argus slow control system. Any problem with the crates should give an alarm, which can be viewed on the ARGUS display in room 301. Only those problems with the FTD high voltage control crates located in racks H7,H8,H9, are the responsibility of the FTD expert.

7.1 FTD Readout Crates

Serious problems with the VME crates should be addressed to Guenter Eckerlin. However if you are in the hall you might be able to solve the problem yourself, or at least give Guenter more information, by having a look yourself. The VME Readout crates are on the ground floor of the trailer in the 3rd corridor from the door. Obvious quick checks are that each crate has power and that the DC supply is working (the display at the bottom of each crate should show

"5.00V" give or take 0.05V). A power cycle (switching OFF and back ON after 10s) can often help. Failing that, you can try to pull out the control/fan unit and replace it. If you're in any doubt then Guenter Eckerlin should be called.

7.2 FTD HV / CAEN Crates

CAEN crates will sometime trip off or go in to an indeterminate state. This happens usually when the power supply to the crate is interrupted. Sometimes power glitches cause many crates in H1 to trip off. In the case of such a power glitch all FTD crates should be checked. You should have contacted Paul Laycock by this point, but the following remains for documentation purposes.

Checking the crates after a power glitch

The crates are located in racks H8 and H9.

- Look at the main SY127 HV crates (Top CAEN crates in racks H8 and H9). The LED displays should show 00 and 01. These numbers should not be flashing.
- Go to the control room 301 and if it isn't already there, switch the chamber to Standby (if safe to do so – no gas problems etc.)
- There should be no errors in the PVSS system or from the slow control system that points to racks H8 or H9.
- Check that the 'state' of all connected drift and sense channels is green and on
- Check that all distributor channels have 'status' OK (cycle through the channels)
- Check that the 'HV switch' and 'HV relay' are both on for all the channels.
- Back in the trailer, look at the distributor modules from the back of Racks H8 and H9. When the detectors are on Standby or on the red LED should be lit. There is one marked broken LED.

7.3 Resetting CAEN crate

In most cases a problem with the crates can be solved simply by resetting the affected crate. The procedure to do this is as follows:

For HV control (SY127) Crates (Top CAEN crates in racks H8 and H9)

- Switch off the FTD from the PVSS terminal
- Hold the 'HV enable' button (top left hand corner of crate) down for a few seconds and then push back up
- If this does not work try turning the key anticlockwise, waiting a few seconds and then turning the key clockwise.

For the Distributor (SY227) Crates (3 crates in each of racks H8 and H9)

- Switch off the FTD from the PVSS terminal
- Push the red switch on the front crate to turn the crate off
- Push the red switch on the crate to turn the crate on again

It may also be worth leaving the crates off for half an hour and then switching them on. After any reset of crates make sure you go through the full check procedure as described above.

7.4 Disabling the high voltage control

Sometimes when you wish the detector to be left off you may want to prevent the shift crew from turning it on – it's all too easy for shift persons to overlook instructions on the white board or in the log book. To do this :

- Switch off the FTD from the PVSS terminal
- Flick down the 'HV enable' switch on the SY127 crates (uppermost CAEN crates) in racks H8 and H9.
- Remember to push it back up again when you want to switch the high voltage on again.

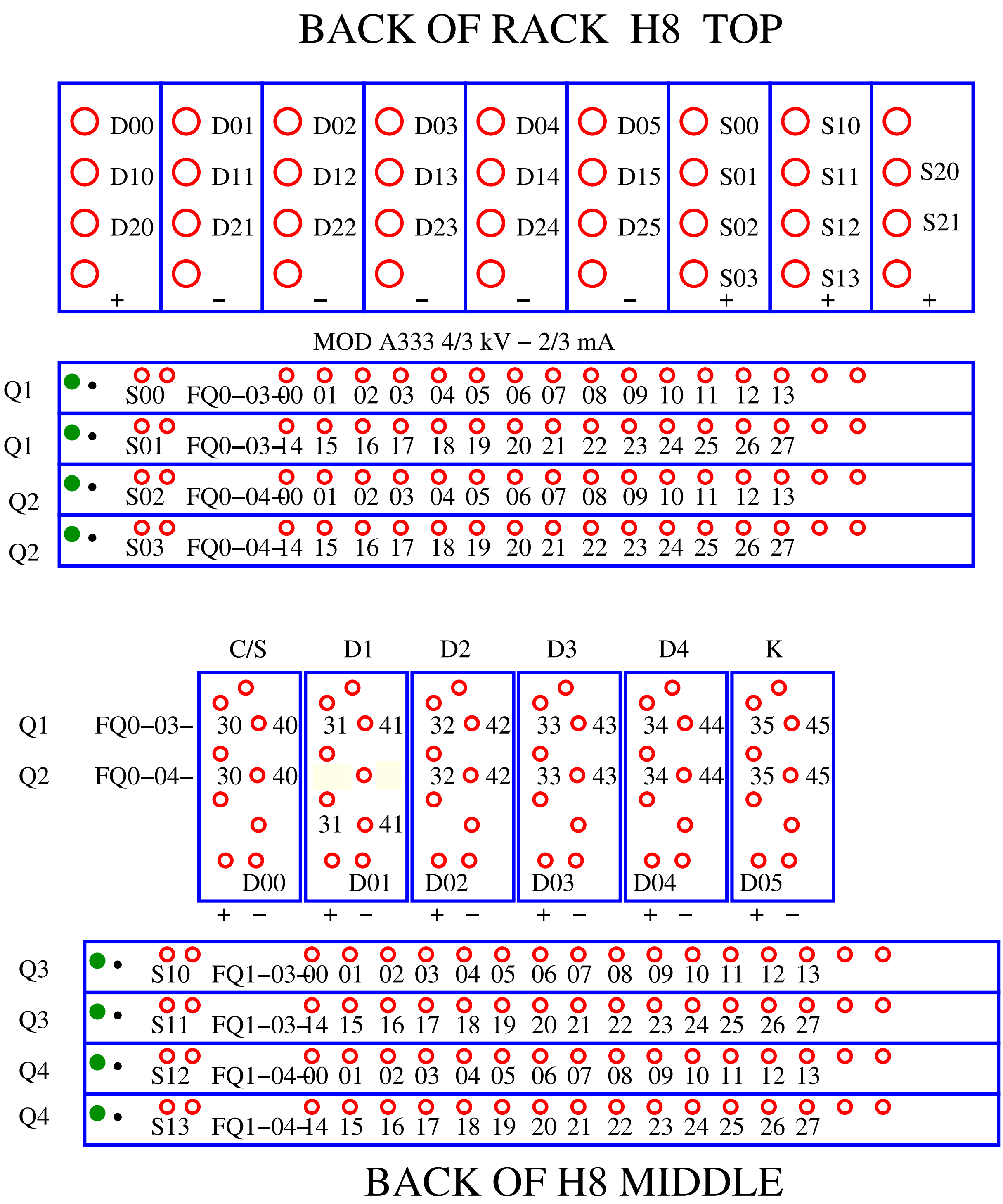

Figure 2: Simplified diagram of the top part of rack H8 viewed from back, showing the distribution of the high voltage for the Q (new) planar chambers.

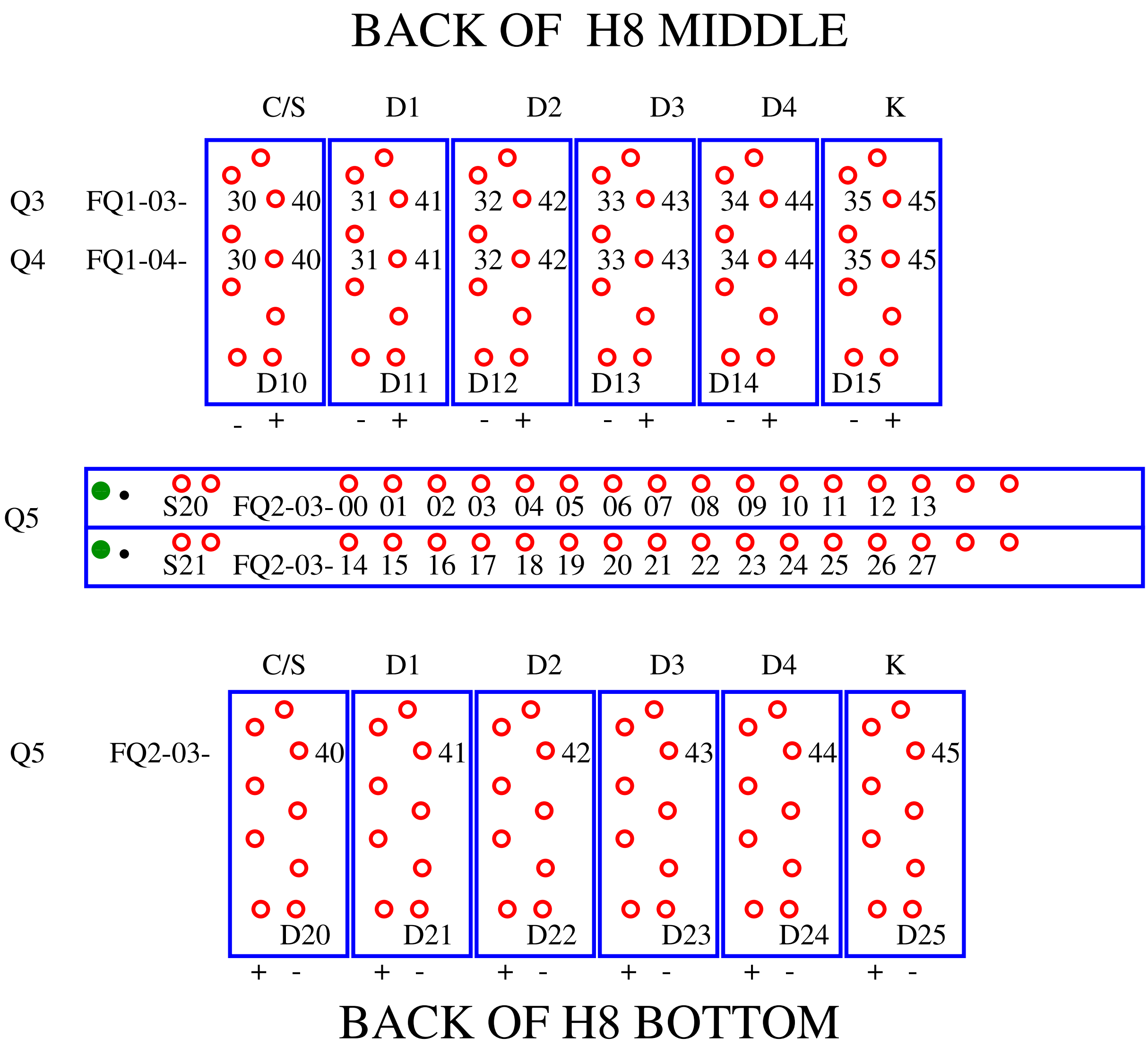

Figure 3: Simplified diagram of the bottom part of rack H8 viewed from back, showing the distribution of the high voltage for the Q (new) planar chambers.

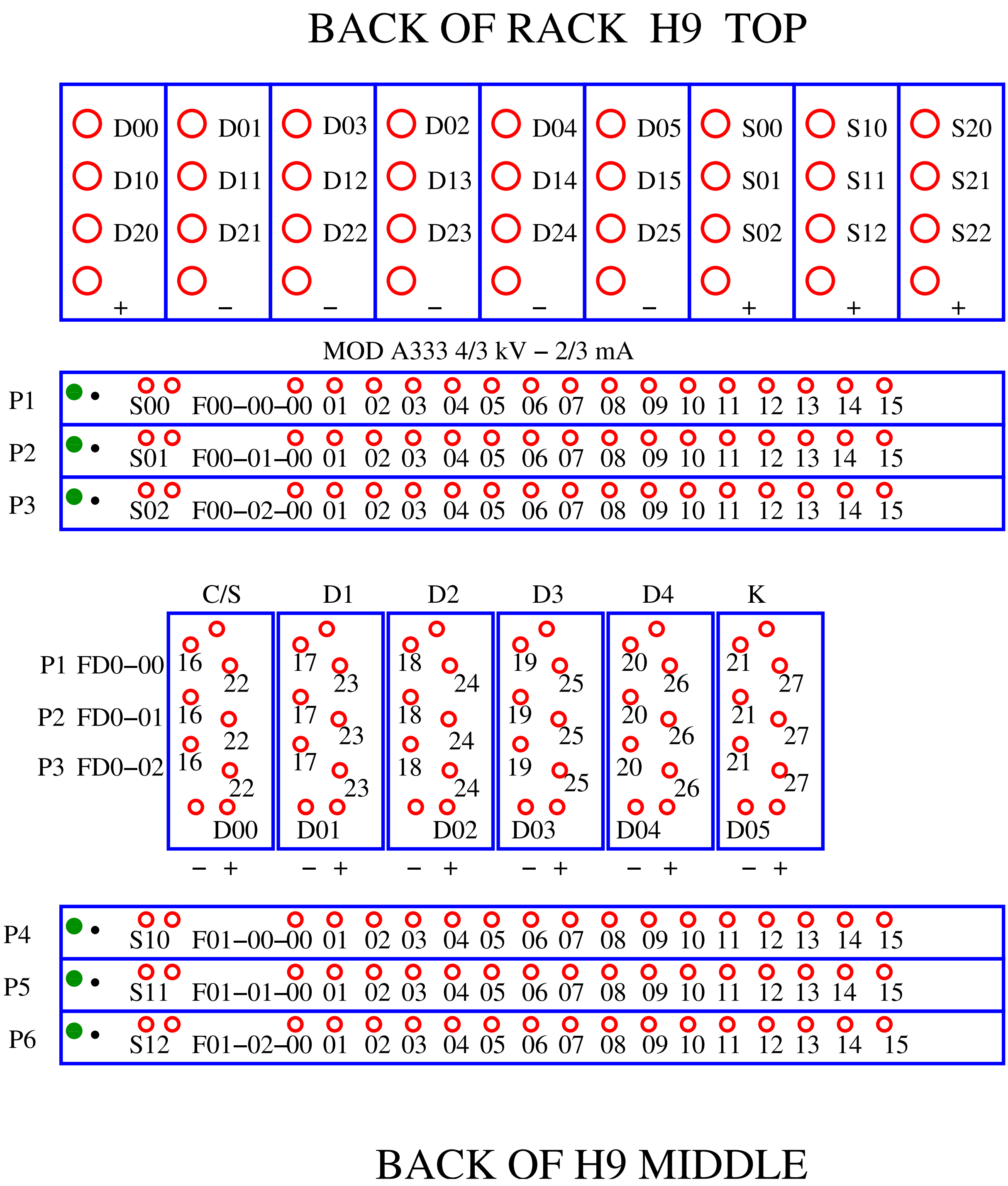

Figure 4: Simplified diagram of the top part of rack H9 viewed from back, showing the distribution of the high voltage for the P (old) planar chambers.

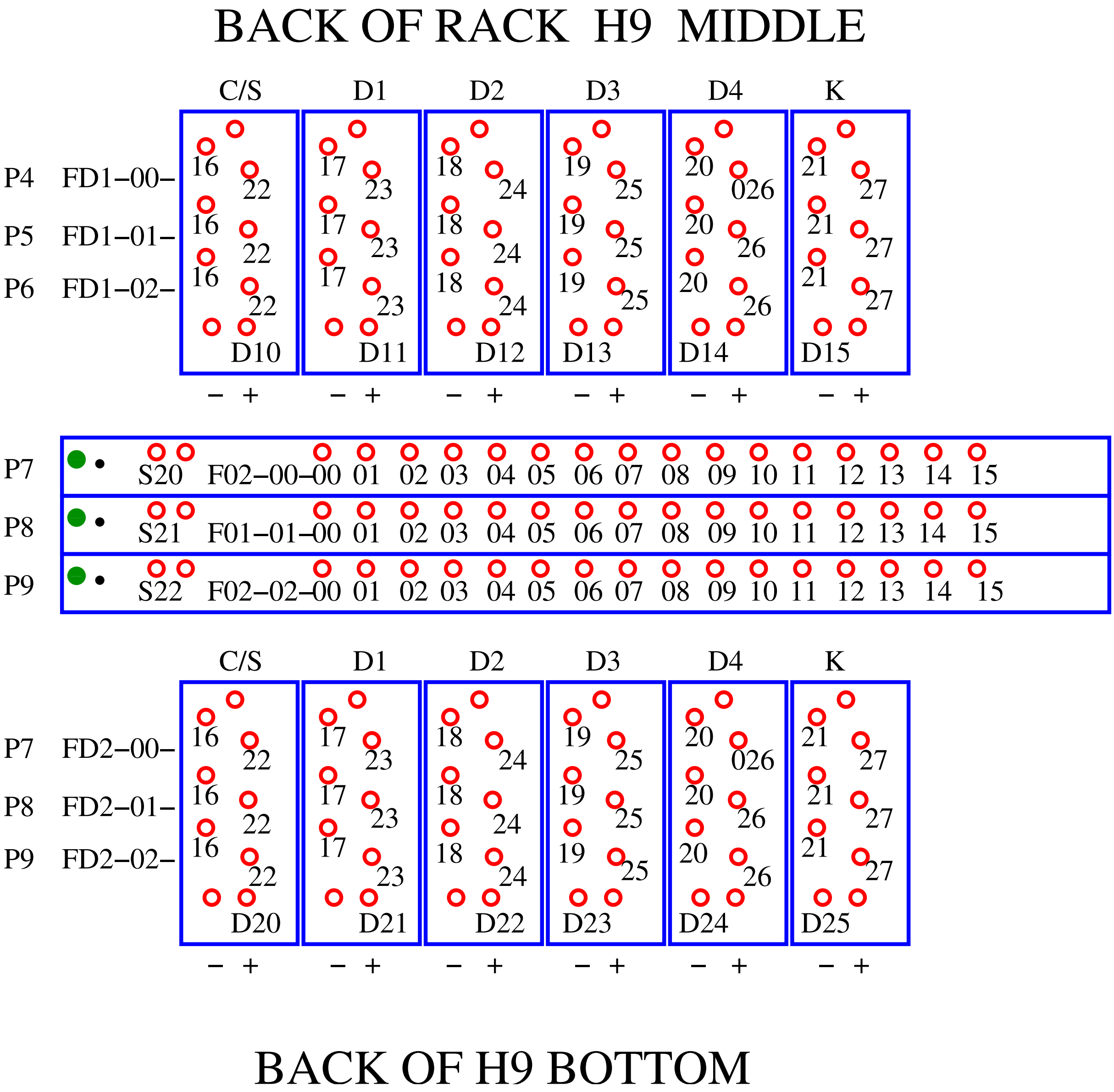

Figure 5: Simplified diagram of the bottom part of rack H9 viewed from back, showing the distribution of the high voltage for the P (old) planar chambers.