Voltage Controls for GlueX Drift Chambers

Nerses Gevorgyan (Yerevan), Vanik Kakoyan (Yerevan),

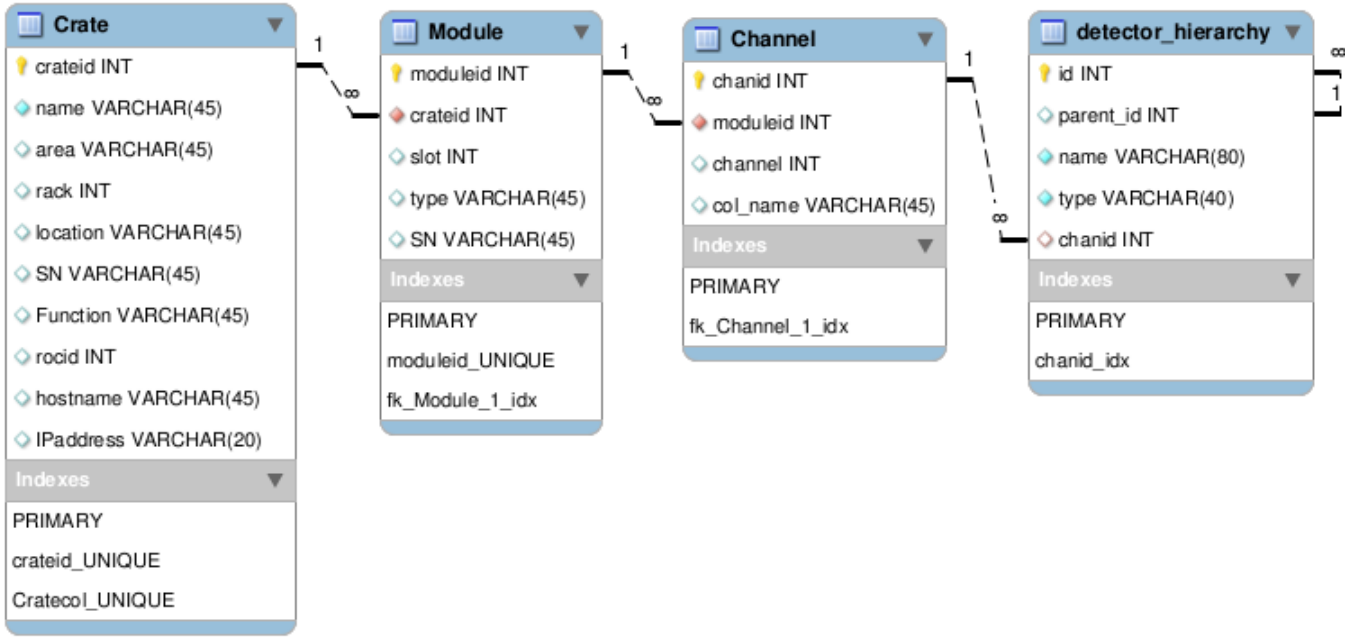
Hovanes Egiyan (JLab), Beni Zihlmann (JLab)

Introduction

- Experimental controls system of Hall D is based on EPICS.
  - Yerevan group has been playing leading role in the development of EPICS software for Hall D.
  - Nerses develop all IOC software, Vanik & Beni developed CSS GUIs and the related scripts.
  - All group operations on voltage channels performed in the GUI scripts, no state machines at this time.
- During last couple of years we install EPICS support software for the hardware providing voltages to Hall D detectors, including drift chambers.
  - Drift chambers (CDC and FDC) use CAEN SY1527 chassis with boards for high voltages and Wiener MPOD chassis with boards for low voltages.
- Operations of the DCs requires a sophisticated system for generating the control variables and screens.
  - Convenient GUIs for shift personnel and detector experts.
  - Flexibility to add or remove detector components or channels.
  - Ease of maintenance of the list of variables and various GUIs.
  - Archiving, saving and restoring capabilities.
  - Capability to implement a flexible alarm system setup.
- EPICS Input/Output Controller (IOC) runs on a rack-mountable server in the counting house.
- GUIs can be run on any computer connected the Hall D internal network.
- All parameters will be archived on the accelerator divisions MYA archiver.
- Voltage controls for all detectors need to be operational on October 1, 2014.
  - Some functionalities will be available for testing prior to the operations.

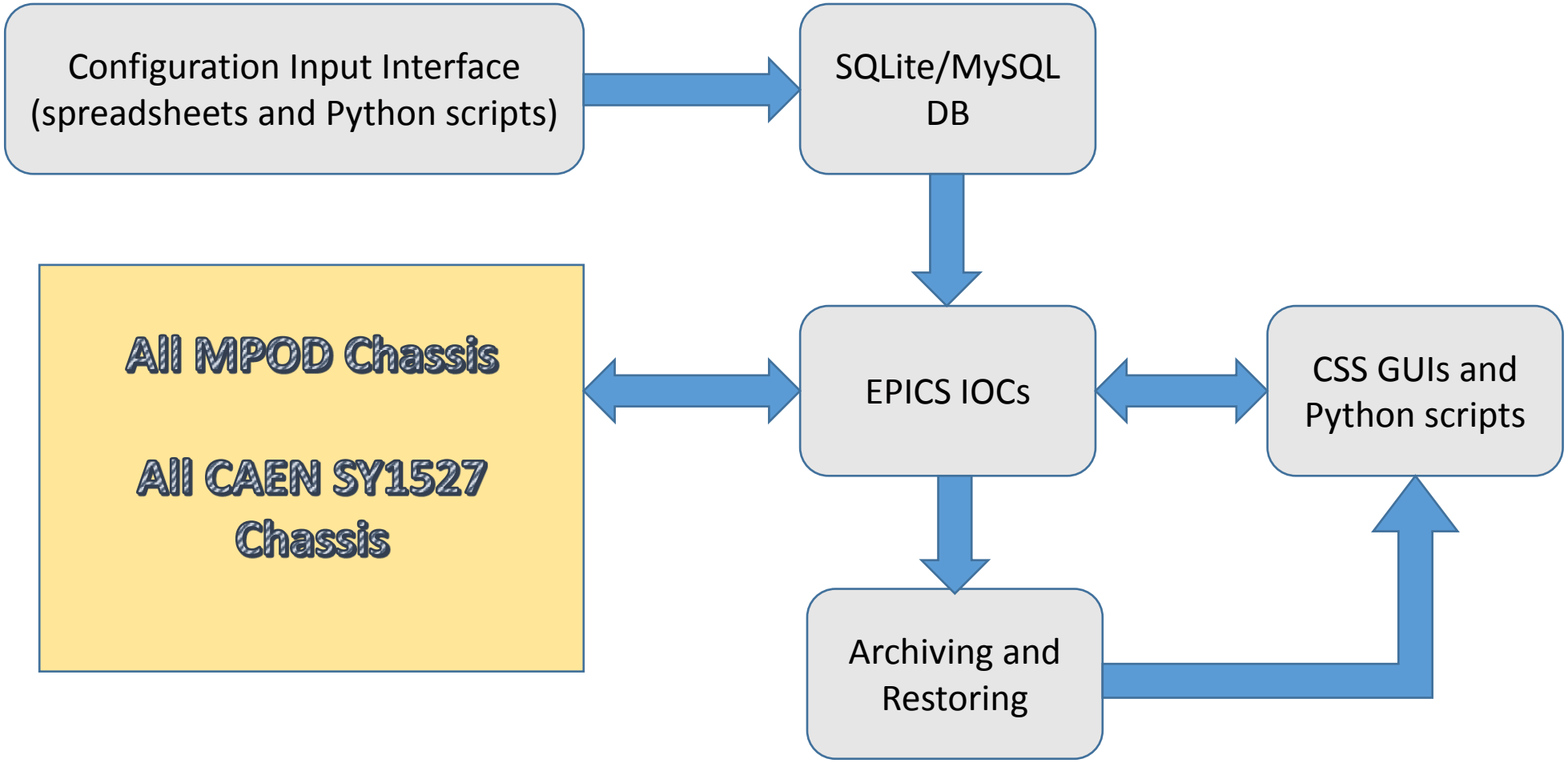
General Scheme

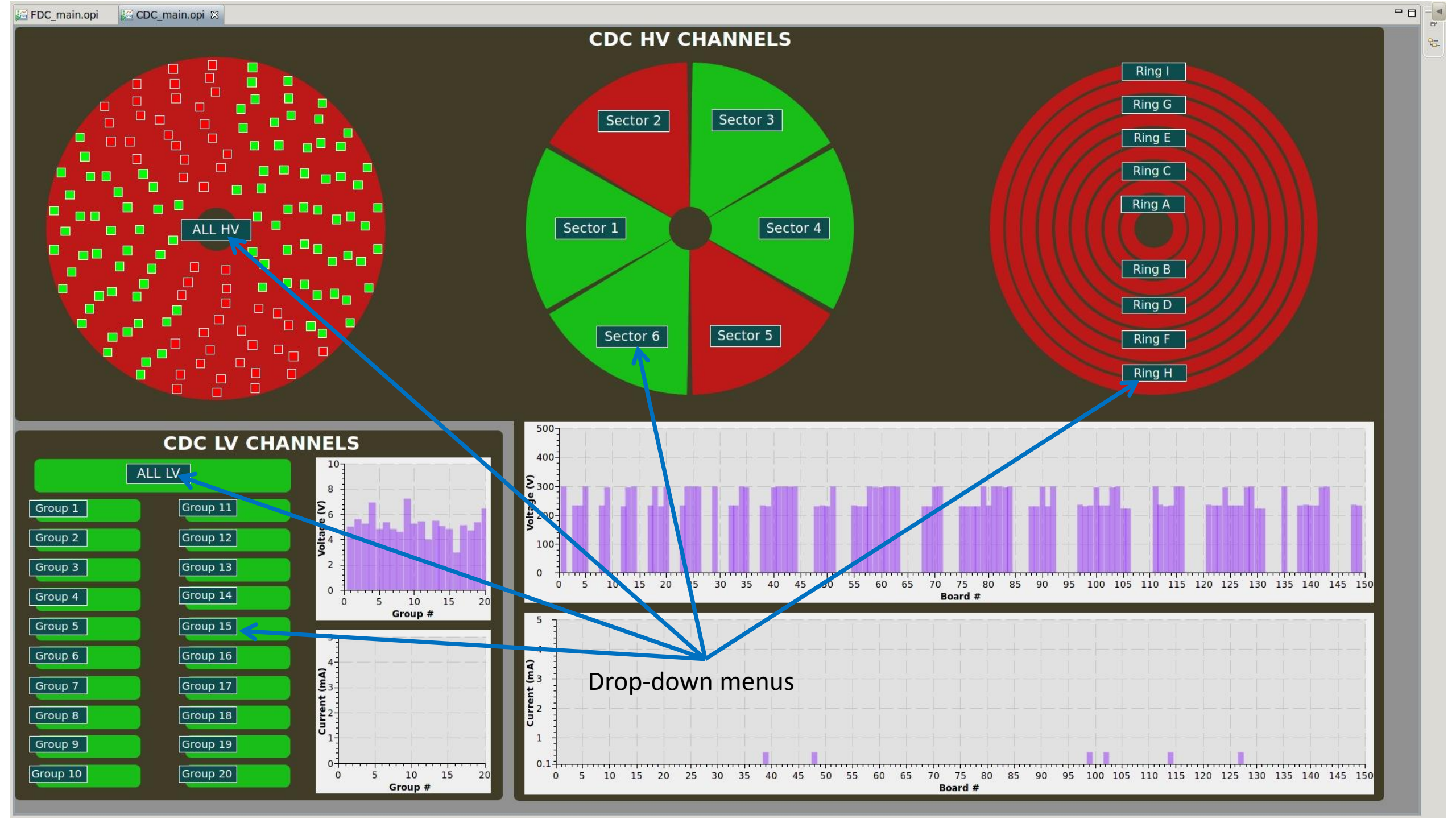
- There are two sets of variables:
  - Chassis-slot-channel based
  - Detector label based
- EPICS variables in IOC are autogenerated
- GUIs, alarms and archiving use detector-based variables
- The source of mapping is Fernando's spreadsheets
  - Can change to a different source in the future

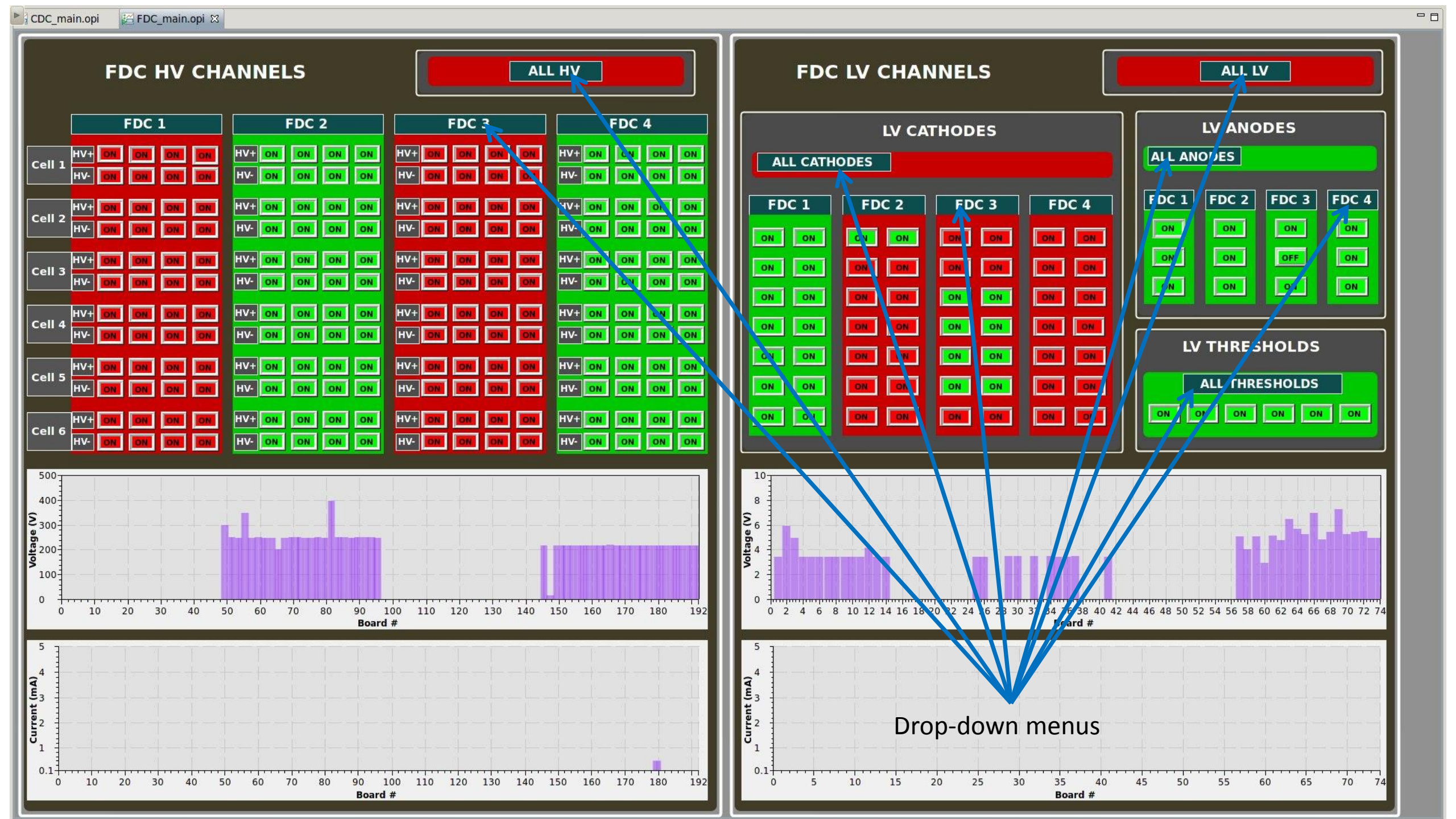


- When EPICS IOC is booted
  - Detector-to-board mapping for a detector is read from the SQLite database.
  - All boards/channel for the chassis involved in that detectors are connected to variables.
  - For the channels for which a detector channel exists the second set of variables is generated.
- The database continuously read to adjust the detector configuration and to adjust channel mapping (not yet implemented).
  - Can remove the detector channels w/o rebooting IOC.
  - Can reassign HV channels to detectors w/o rebooting IOC (if not detector or HV channel is added).
- Alarm system will be configured independently of IOC but using the same information from the same database.
  - Requires development of the scripts to fill and to continuously update the alarm system MySQL DB.

Schematic diagram

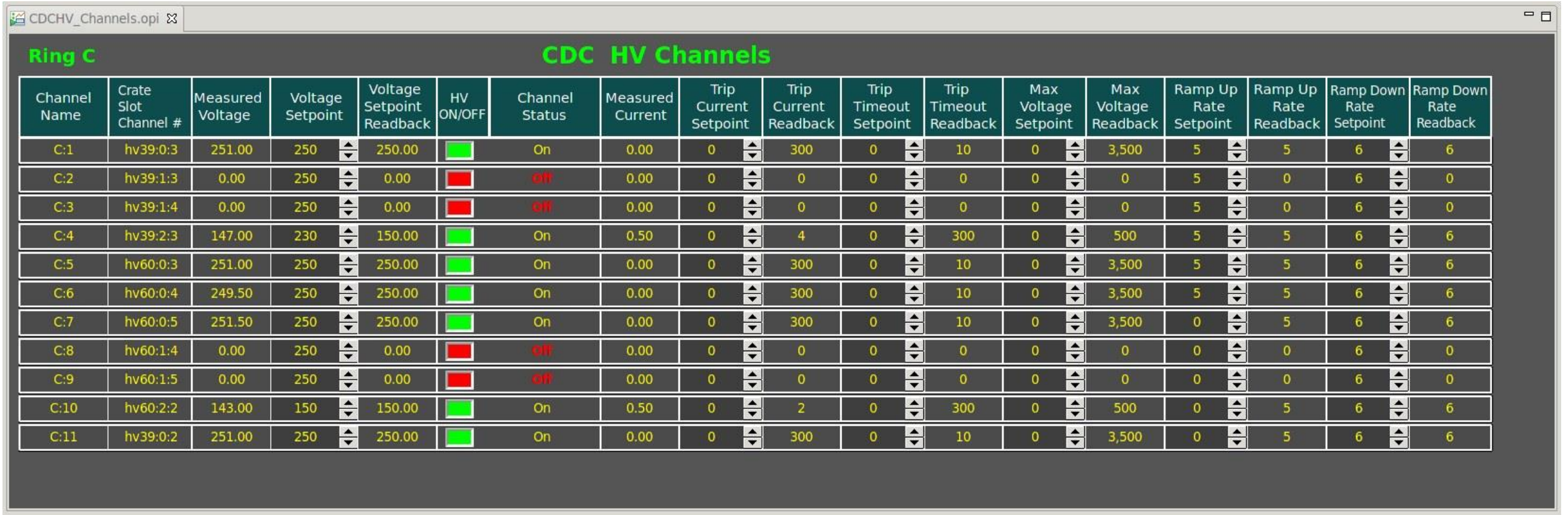



FDC_main.opi
CDC_main.opi
CDC HV CHANNELS
ALL HV
Sector 1
Sector 2
Sector 3
Sector 4
Sector 5
Sector 6
Ring I
Ring G
Ring E
Ring C
Ring A
Ring B
Ring D
Ring F
Ring H
CDC LV CHANNELS
ALL LV
Group 1
Group 2
Group 3
Group 4
Group 5
Group 6
Group 7
Group 8
Group 9
Group 10
Group 11
Group 12
Group 13
Group 14
Group 15
Group 16
Group 17
Group 18
Group 19
Group 20
Voltage (V)
Group #
Current (mA)
Group #
Voltage (V)
Board #
Current (mA)
Board #
Drop-down menus


CDC_main.opi
FDC_main.opi
FDC HV CHANNELS
ALL HV
FDC 1
FDC 2
FDC 3
FDC 4
Cell 1
Cell 2
Cell 3
Cell 4
Cell 5
Cell 6
HV+
HV-
ON
Voltage (V)
Board #
Current (mA)
FDC LV CHANNELS
ALL LV
LV CATHODES
ALL CATHODES
LV ANODES
ALL ANODES
OFF
LV THRESHOLDS
ALL THRESHOLDS
Drop-down menus

Parameters for voltage channels

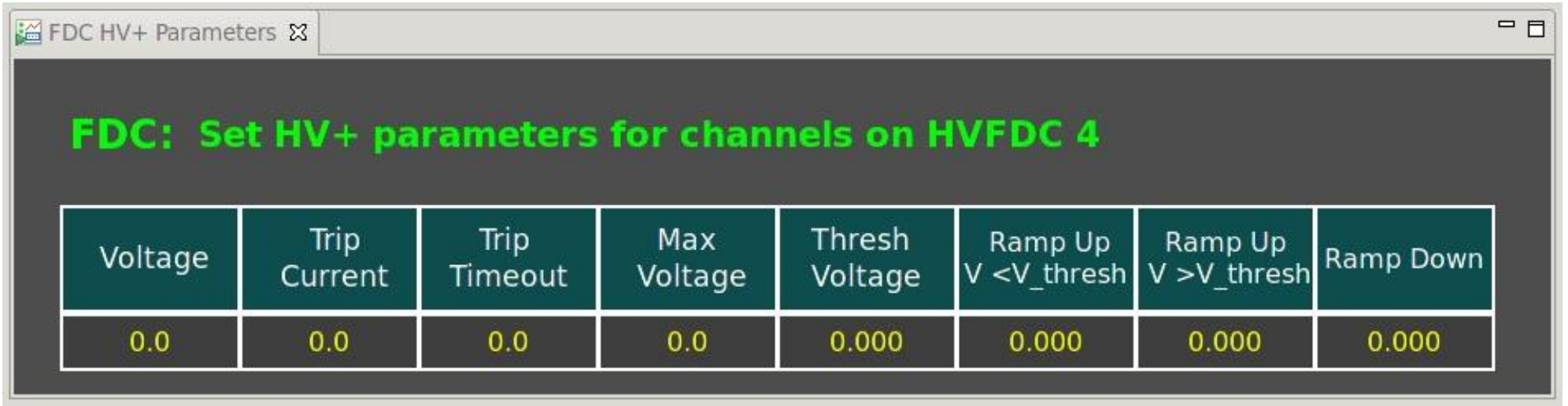
- Parameters for individual channels can be viewed for different groups
  - Note that many parameters have separate setpoint variables and readback variables.
- Setpoints for the parameters can be changed from the GUIs.
- Not all parameters for the channels are displayed.
  - More parameters can be added if there is a need for it.



Channel Name	Crate Slot Channel #	Measured Voltage	Voltage Setpoint	Voltage Setpoint Readback	HV ON/OFF	Channel Status	Measured Current	Trip Current Setpoint	Trip Current Readback	Trip Timeout Setpoint	Trip Timeout Readback	Max Voltage Setpoint	Max Voltage Readback	Ramp Up Rate Setpoint	Ramp Up Rate Readback	Ramp Down Rate Setpoint	Ramp Down Rate Readback
C:1	hv39:0:3	251.00	250	250.00		On	0.00	0	300	0	10	0	3,500	5	5	6	6
C:2	hv39:1:3	0.00	250	0.00		Off	0.00	0	0	0	0	0	0	5	0	6	0
C:3	hv39:1:4	0.00	250	0.00		Off	0.00	0	0	0	0	0	0	5	0	6	0
C:4	hv39:2:3	147.00	230	150.00		On	0.50	0	4	0	300	0	500	5	5	6	6
C:5	hv60:0:3	251.00	250	250.00		On	0.00	0	300	0	10	0	3,500	5	5	6	6
C:6	hv60:0:4	249.50	250	250.00		On	0.00	0	300	0	10	0	3,500	5	5	6	6
C:7	hv60:0:5	251.50	250	250.00		On	0.00	0	300	0	10	0	3,500	0	5	6	6
C:8	hv60:1:4	0.00	250	0.00		Off	0.00	0	0	0	0	0	0	0	0	6	0
C:9	hv60:1:5	0.00	250	0.00		Off	0.00	0	0	0	0	0	0	0	0	6	0
C:10	hv60:2:2	143.00	150	150.00		On	0.50	0	2	0	300	0	500	0	5	6	6
C:11	hv39:0:2	251.00	250	250.00		On	0.00	0	300	0	10	0	3,500	0	5	6	6

Changing parameters for groups

- Can change some of the parameters for the whole group of the channels by popping the appropriate GUI.
  - Single value is send to the same parameter for many voltage channels.
- The values do not represent what is on the channels since a single number refers to a list of channels.
  - Most likely it will be zero when this GUI is opened.
  - Can show some number which would be the number used last time (or zero if the IOC got rebooted).
  - The value is propagated to the appropriate channels when value is entered and RETURN is hit.
  - Can add more parameters on request.



Current Status

- HV-channel-to-detector-channel mapping is kept in SQL-light database file
  - Dave Lawrence's scheme for translation tables
  - In future may be changed to a different database
- SQL-light database with channel mapping can only be edited manually.
  - Graphical interface to the DB can be developed in spring when Nerses and Vanik are back to JLAb and the database is finalized.
- EPICS IOCs for MPOD and CAEN can be run using information in the database on Hall D servers in the counting house.
  - We plan to run one IOC for all CAEN chassis and one IOC for all MPODS chassis.
- Current functionality includes
  - Monitoring statuses of groups of HV and LV channels, grouping based on the DC design.
  - Turning on/off groups of HV and LV channels.
  - Monitoring and changing parameters of individual voltages channel.
  - Dynamically changing the detector configuration (temporarily removing channels without restarting the IOC).
- The software is currently being tested using a single CAEN 1527 board and one MPOD chassis.
  - Some chassis are duplicated to represent two different sub-detector due to lack of powered hardware.
  - We would like to have access to the HV and LV chassis for the DCs installed in the racks before the voltage cables from the DCs are connected. This would allow checking the software with the full set of channels.
  - Communications with the MPOD chassis is slow, there seems to be a problem with communication with the MPOD chassis.
- The location of the HV/LV channel in the chassis can be identified from PV name. We will add a string to identify the chassis/slot/channel using standard notations.
- Alarm system for HV is not ready.
- The final version of the backup/restore software will not be available until the spring.
  - If needed, we can set-up short term scripts during the tests.

Summary and Outlook

- EPICS support for the CAEN 1527 and MPOD chassis for the HV and LV boards exists.
- We have a framework for GlueX voltage controls software which is now being tested on DCs.
- Automatic configuration of the IOC via SQL-light database is implemented.
- Control GUIs for FDC and CDC with a set of scripts exist.
- Waiting for input from the CDC and FDC group regarding the HV/LV applications.

- Need to create a user interface to the mapping SQLite/MySQL database to facilitate modifications of the detectors and voltage hardware.
- Continuous update of IOC application from the SQLite/MySQL database needs to be implemented.
- There are hardcoded arrays in the GUI scripts that can be obtained from the database instead.
- Alarm system and backup/restore system still needs to be created. Requires generation of alarm GUIs and extra variables on IOC.