

SciBooNE Lecroy 1440 HV system
Rex Tayloe, Indiana U.
SciBooNE HV review, 2/20/07

Outline:

- 1) System description
 - hardware
 - software
 - implementation
 - monitoring
- 2) Parts and spares
- 3) Progress and Status
- 4) Schedule and Resources

SciBooNE (Lecroy) HV system: Hardware:

- Lecroy 1440 HV system
 - 1449: mainframe
 - 16 slots for cards
 - 1.6kW HV power
 - HV limit set with pot. (common to all cards)
 - ramp rates, jumper set
 - output current limit set w/register (common to all cards)
 - programmed via serial bus with ASCII commands (see software)
 - 1443NF/PF: HV cards (neg/pos),
 - 16 chans each
 - max HV output 2.5kV, 2.5mA/chan.
 - voltage regulation (claimed) 0.05% of full scale
 - voltage monitoring available, no current monitoring
 - card calibration (reading to actual) is possible if necessary



Lecroy 1449/1443 Specs

Model 1449/1449E HV
CONTROL MAINFRAME
GENERAL

HV Modules/Mainframe: Up to 16
Channels/Mainframe: Up to 256
Maximum HV Output Power: 1.6 kW for Model 1449. 800 W for Model 1449E. For each 1443/12 in excess of eight, deduct 15 W from the 800 W available.

DISPLAY
HV ON Indicators: Yellow lamp indicates HV is enabled for turn on, i.e., HV DISABLE is not actuated and INTERLOCK is not asserted. Integral with front-panel HV ON indicator (red lamp) and HV DISABLE button. Rear-panel indicator lamp.

LVPS Status: Two LED's indicate presence of -- 15 V and + 5 V. Ready lit by + 15 V.
System Active: Front-panel LED indicates 1443/12 Cards enabled for generating HV.

MECHANICAL

Packaging: 19" rack-mount chassis, 17" wide x 22" deep x 26 1/4" high.
(Add 3" to depth to include handle protrusion.)
Input Power: 180-260 V AC 50/60 Hz <15 A.
Ambient Humidity: 0 to 85% relative humidity.
Operating Temperature: 10 to 40°C ambient.
Shipping Weight: 210 lbs. (95 kg).

Model 1443
16-CHANNEL HV MODULE

Channels/Module: 16
Output Voltage: 0 to 2500 V; > 500 V for rated performance. Polarity indicated by N or P suffix.
Voltage Regulation: 0.05% of full scale, line and load.
Full Scale: 2500 V, 2047 V, 1500 V; 4095 V also available
(limited to 2500 V max.) mainframe jumper option.
Programming Step: 0.025% of full scale.
Programming Accuracy: <+0.2% + 2 V) for demand voltages > 500 V.
Programming Reproducibility: < 1 V at a constant load and temperature after 10-minute warmup.
Voltage Monitor Accuracy: +(0.1% + 1.5 V) channel-to-channel.
Monitor Long-Term Stability: <1.5 V/wk at constant load and temperature.
Output Long-Term Stability: <2 V/wk at constant load and temperature.
Monitor Temperature Coefficient: Typically 0.005%/°C. Max., 0.01%/ form 500 V to 2500 V (10°C to 40°C ambient).
Output Ripple: Typically <50 mV peak-to-peak; <250 mV peak-to-peak maximum.
Current Output: Up to 2.5 mA per channel.
Output Protection: Fully protected against arcs at load, short circuit and overload.
Output Connector Type: Multiconductor block-type connectors. SHV connectors specified by F suffix.



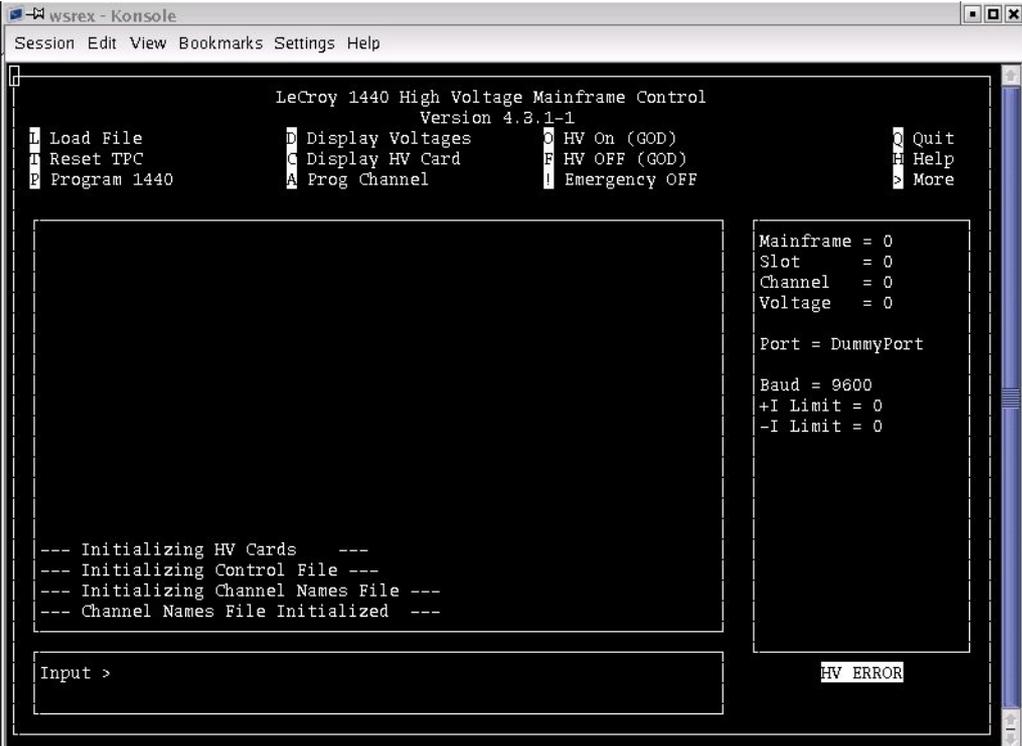
SciBooNE (Lecroy) HV system: Software

Software:

- Using Lecroy 1440 software from the MIPP experiment
 - control (“hv_control”) and monitoring (“hv_monitor”)

Features:

- C-code, simple terminal interface
- communicates with 1440 via serial bus via ASCII commands
- Controls up to 16 mainframes via 1 or multiple serial ports.
- Voltage values loaded from files.
- channel polarities, HV limits, ramp speeds from control files



```
wsrex - Konsole
Session Edit View Bookmarks Settings Help

LeCroy 1440 High Voltage Mainframe Control
Version 4.3.1-1

L Load File          D Display Voltages    O HV On (GOD)          Q Quit
R Reset TPC         C Display HV Card     P HV OFF (GOD)        H Help
P Program 1440      A Prog Channel        I Emergency OFF       M More

Mainframe = 0
Slot      = 0
Channel   = 0
Voltage   = 0

Port = DummyPort

Baud = 9600
+I Limit = 0
-I Limit = 0

--- Initializing HV Cards ---
--- Initializing Control File ---
--- Initializing Channel Names File ---
--- Channel Names File Initialized ---

Input >

HV ERROR
```

SciBooNE (Lecroy) HV system: Software

hv_control screen dump (not connected to 1440, thus the error):

```
wsrex - Konsole
Session Edit View Bookmarks Settings Help

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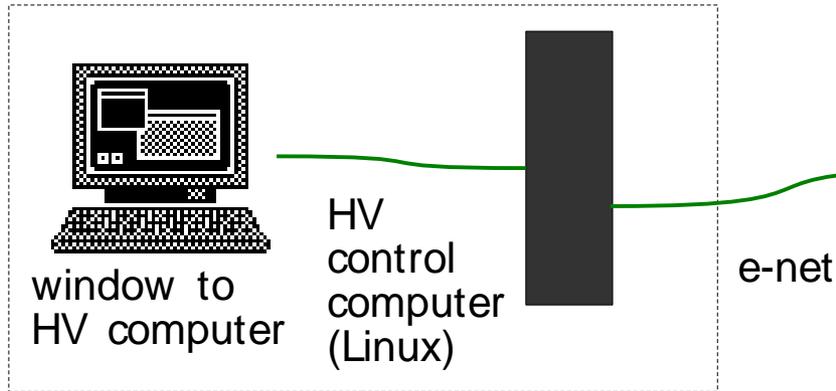
Input >

HV ERROR
```

SciBooNE (Lecroy) HV system

Layout of system:

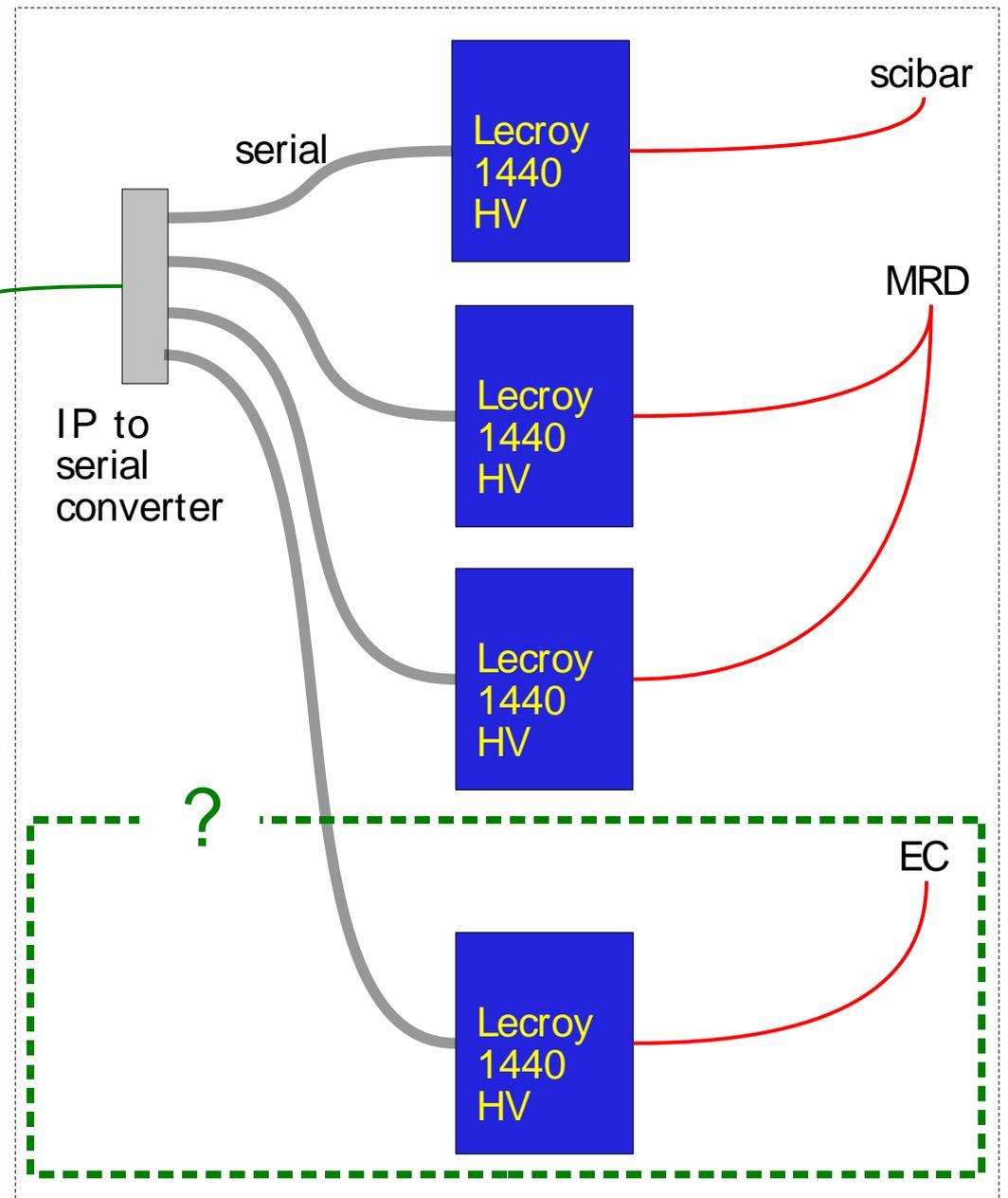
SciBooNE control room



Notes:

- due to space issues, will aim for only IP to serial converter in SciBooNE hall.
- if this fails, will need to locate control computer in SciBooNE hall
- Space and power specs have been provided to project managers.

SciBooNE detector hall



SciBooNE (Lecroy) HV system: Monitoring

- Will use monitoring (“hv_monitor”) program (modified from MIPP version)
- Reads HV values periodically (spec is 1/30mins, 1/hr)
 - Compare to last read, if change>tol, write to data base
 - Compare to warning threshold, if outside of tolerance, notifies shifter
 - Compare to min/max allowed, if outside, zero channel, notifies shifter
- Current limit is programable (crate-wide)
- Current monitoring not available with Lecroy 1443 cards. Would require modification of the 1443 cards. Not in baseline plans.

From SciBooNE HV specs:

Detector	N _{channel}	polarity	V range (V)	Mon. rate	V tol. (V)	V warn. (V)	V min/max (V)	I max (μA)
SciBar	224	neg	700-900	Hr ⁻¹	2	5	600/1000	N/A
EC	256	neg	1700-1900	(30 min) ⁻¹	2	10	1500/2000	500
MRD	332	neg	1200-1600	(30 min) ⁻¹	2	10	1000/1800	N/A
	30	pos	1200-1600	(30 min) ⁻¹	2	10	1000/1800	N/A

SciBooNE (Lecroy) HV system: Parts and Spares

- 4 Lecroy 1449 systems full of cards (pos and neg) have been provided by prep (1024 total channels). FNAL MOU electronics request reflects this. Adequate for SciBooNE. In addition, FNAL should have expertise to repair crates cards.

Detector	N _{channel}	polarity	V range (V)	Mon. rate	V tol. (V)	V warn. (V)	V min/max (V)	I max (μA)
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MRD	332	neg	1200-1600	(30 min) ⁻¹	2	10	1000/1800	N/A
	30	pos	1200-1600	(30 min) ⁻¹	2	10	1000/1800	N/A

- Control/monitoring software runs on linux computer(s) (w/ serial port).
 - 1 linux box currently in use (at CDF). Another (for LabF) has been procured.
- IP to serial box (ordered).



SciBooNE (Lecroy) HV system: Progress and Status

Hardware:

- 4 - 1440 mainframes and with cards have been delivered
- One unit has been powered up tested.
- Another unit has recently been set up for use at LabF for MRD.
- Computers for main (and test) systems procured.
- IP to serial box ordered.

Software:

- hv_control software is working and available (on CDF floor) for testing.
- on-site expert: Teppei Katori (grad-student)
- demonstrated to 2 other SciBooNE collaborators (no complaints)
- www page with docs started at: <http://home.fnal.gov/~tayloe/SciBooNE/>

SciBooNE (Lecroy) HV system: Schedule and Resources

Schedule:

- One system currently available for testing scibar at CDF. This may be moved as needed (eg: for MRD testing).
- An additional system will be set up for testing soon (over next week).
- Full system with improved control and monitoring software ready end of April.

Resources:

- Estimate 2 person-weeks for baseline version of hardware/software. Another 2 person-weeks for further development.
- This will be provided by Indiana group. If available, could use additional help on short term (next 2 mos). Expect resources to be more available after that.