BaBar LST Detector
Singles Rates Box User's Guide

Version 0.5
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Introduction

This document serves as a user's guide to both the OSU singles rates box, the software for the embedded processor (Rabbit), and the Qt-based software to record and archive plateau curve measurements.

Hardware

Schematics of the singles rates box as well as a listing of the VHDL code for the Xilinx FPGA inside the box are available on the OSU – LST web site (http://www.physics.ohio-state.edu\~klaus\LST\lst.html)
The Singles Rates box can be used to count rates on 4 channels, ie one complete LST tube, simultaneously. Internally, each channel consists of a discriminator, a pulse shaper and a counter. The discriminator threshold is set to 30 mV and the discriminator pulse width is set to 3 μs. The counter has a depth of 16 bits. To use the box attach a power cord and connect the signals from the 4 wires in a tube to the 4 input channels. An Ethernet connection is required to communicate with the embedded processor and to retrieve the measured rates. The singles rates box is configured for positive input signals and hence can only be used for wire but not for cathode signals.

Embedded Processor

The singles rates box includes a Rabbit 3200 processor/core module that controls the rate counters and provides the connection to the outside world. To operate the device the singles_net.c code, available in the (OSU) qc cvs repository, has to be loaded onto the Rabbit processor. For this the Dynamic C development system and a download cable will be required. You have to open the box to attach the serial interface cable to the rabbit module.
An Ethernet link is used for the communication between the Rabbit/Singles Rates Box and the "singles" Qt program on a Linux workstation. The software in the singles rates box implements a (tcpip) server and requires a fixed IP address. This could be a regular IP address in your department or an address on a private subnet such as 192.168.1.100. If you choose (or are required) to use a private subnet you have to make sure that your Linux workstation has two network interfaces and is configured as a router.
The IP address of the Rabbit processor is hardwired in the singles_net.c program. You need to edit this file to reflect your network configuration (IP address, Gateway address and Netmask). After you have modified the

singles_net.c program you need to download it to the Rabbit using the Dynamic C software and a serial interface cable.

User Interface

A Qt based program has been developed to control the singles rates box from a Linux workstation. The program is names singles and is available in the OSU qc cvs repository (module qc, subdirectoy singles). This program not only communicates with the singles rates box but also connects to the weather station, the gas system, the bar code scanner, the HV supply and the qc database.

For the following we assume that you have checked out the software from cvs and compiled the program on your workstation. Furthermore we assume you have the singles rates box connected to the network (and an LST tube, of course).

Starting the program brings up the main page (Figure 1) but before we describe it's functionality we have to setup the network/hardware configuration. Bring up the configuration screen (Figure 2) by clicking the CONFIGURE button on the main screen.

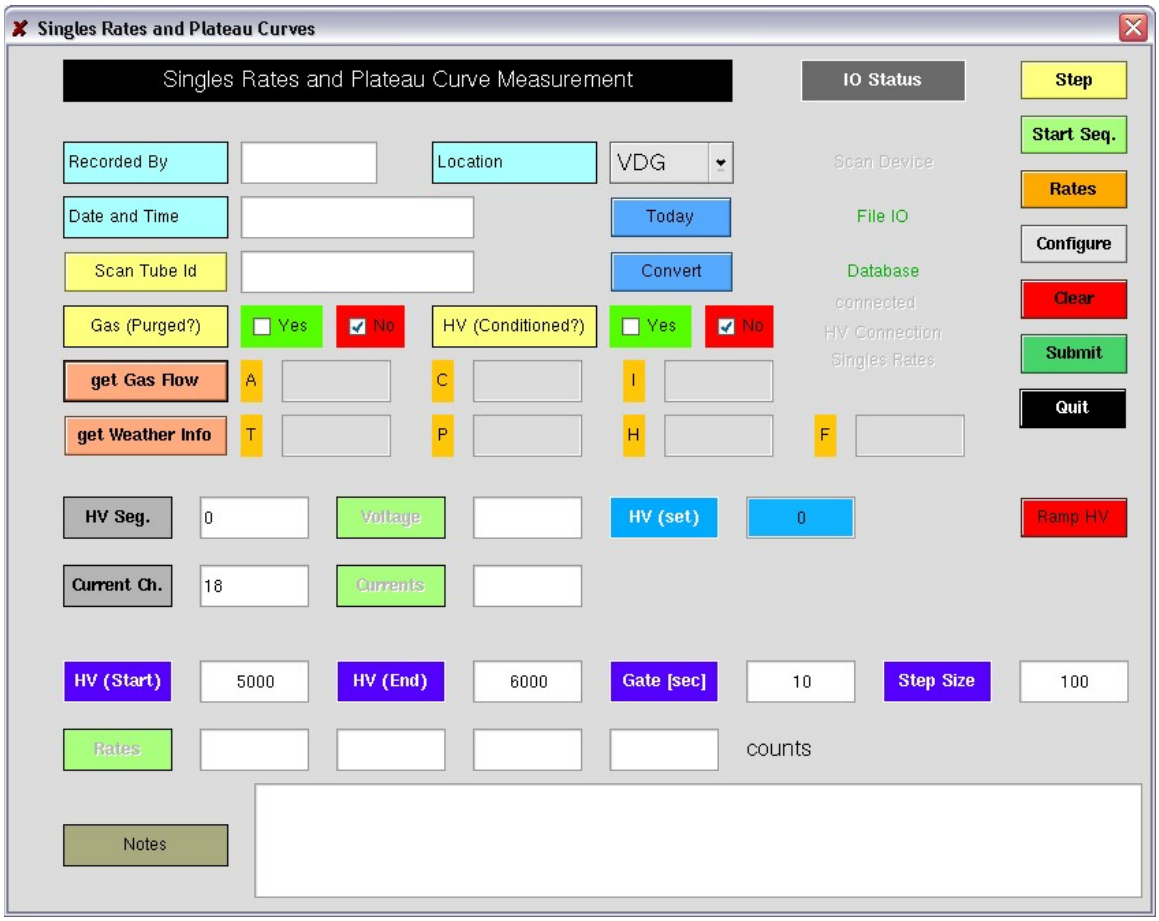

Figure 1 The Main Screen of the Singles Program

Configuration

Bar code scanner: enter the name of the serial port used for your bar code scanner. On a standard linux installation this could be /dev/ttyS0 or /dev/ttyUSB0 if you are using a USB-Serial converter.
The barcode scanner is required if you want to scan the tube id into the appropriate field on the main page. If you don't have a bar code scanner you can enter the tube id manually.

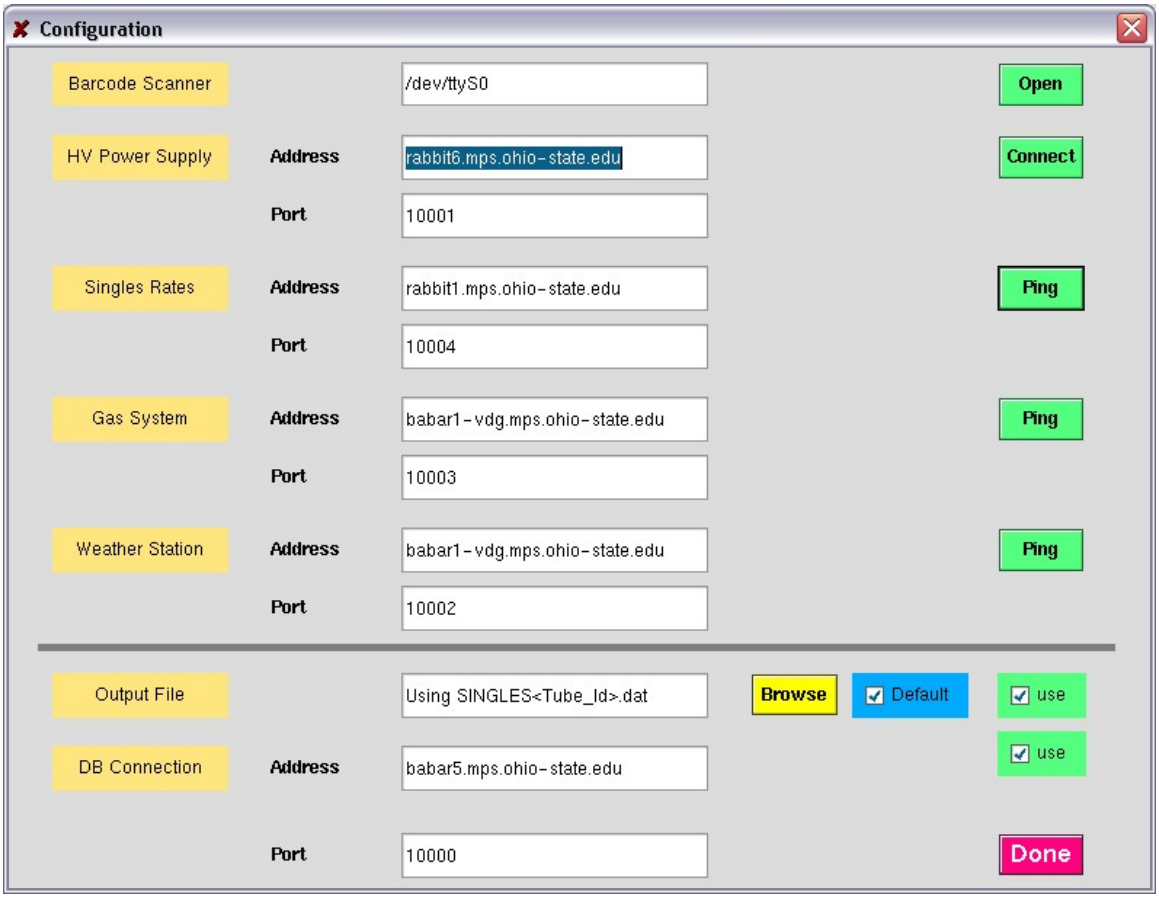

Figure 2 Configuration Panel of the Singles Program

HV: enter the IP address of the OSU HV box you are using. Click connect to establish the connection. You have to use an OSU HV program for the automated measurement mode (Start Sequence button on the main page). Without an OSU HV system you can only use the STEP button on the main page to perform a single measurement.

Weather, Gas:
enter the IP addresses of the Server programs for the weather station and the gas controller. Only the default weather station and gas controller are supported (you have to run the (perl) server scripts provided in the OSU qc cvs repository). If you don't use these servers you can enter the weather and gas flow information manually (main page).

Singles:

enter the IP address of the singles rates box.

Database:

enter the IP address of the database server. Unless you have installed your own mySQL qc database and run your own copy of the "G" interface process you should keep the default settings (babar5.mps.ohio-state.edu, Port 10000). Checkboxes allow you to enable/disable the database connection.

Output File:

you can enter the name of the output file that should receive the results of your measurement(s), you can choose not to write output (checkbox) or you can select the default file name. With this option the data will be written to a file named SINGLES<xxx>.dat with <xxx> replaced by the 13 digit tube id (the output file will be written to the current directory).

The PING buttons allow you to test the various connections and to verify that the server at the entered IP address is responding.
(There is a known error condition that clicking PING occasionally results in a segmentation fault – yeah, we will fix this eventually)

After you have set up your configuration click "DONE" to return to the main page.

Singles Main Screen (Figure 1)

Location: choose the location where the measurement is performed.

Recorded by: enter your name.

Date/Time: enter the current date and time or click the TODAY button to get the current time/date information.

Scan Tube ID:

Enter the 13 digit tube id (the number under the barcode). Either manually or by using a bar code scanner (click the "Scan Tube Id" button to perform a scan) or by entering the tube number plus the number of cell and clicking the CONVERT button. Example: for tube 135 which has 8 cells you would enter 1358 and click CONVERT. The number will then be converted to the 13-digit (bar code) number.

Weather: if the weather station is connected you can click the WEATHER button to obtain a current reading. Otherwise you can enter the data manually.

- T Temperature
- P Pressure
- H Humidity
- F Airflow

Gas: if the gas controller is connected you can click the GAS button to obtain a current reading. Otherwise you can enter the data manually.

- A Argon
- C CO2
- I Isobutane

<u>HV information/control (these are only relevant if an OSU HV box is used)</u>

HV Seg: enter the number of the HV channel (0 – 3) of the HV box that is used for this measurement.

Current Ch: the output channel of the HV box that is used to power the tube. We assume that one output channel is used to power the all 4 HV segments of a tube. If you use 4 channels (one per segment) you can enter a comma separate list and the program will display the sum of up to 4 currents.

Voltage: current HV value (read back from HV box)

Current: current value (read back from HV box)

HV Set: enter the target HV (this is used when the RAMP button is clicked and updated automatically while a measurement sequence is executed)

RAMP: click this button to ramp the HV to the value set in the “HV Set” field.

<u>Fields to setup the plateau curve measurement:</u>

Gate: defines the length of the measurement period used by the singles rates box (in seconds).

HV (start), HV (end), Step size
define the start and end point of the HV range as well as the step size (all in Volts) to be used for the next measurement sequence.

Once the START button is clicked, the HV is ramped to “HV (start)”, a measurement is initiated with the gate set to “Gate” seconds. Once this measurement is complete the voltage is increased by “Step size” and a new measurement is started. This process repeats until the voltage reaches or exceeds “HV (end)”. These fields are relevant only if an OSU HVPS is used.

Rates: results of the last measurement (in counts)

Control Buttons:

Configure: open the configuration panel

Rates: open the rates panel that displays up to 15 measurements of a sequence. Currently a sequence is limited to 15 steps – we are working on an extension to support finer step sizes.
The rates panel also provides a feature to import data from a file.

Step: Initiate a single measurement. No communication with the HV system takes place (this is the only way to use this program without the OSU HV box).

Start: Start a measurement sequence using the parameters in the initial HV, end HV and step size fields (as well as Gate)

Submit: send the data (all measurements taken in a sequence) to the database. (Note: what ever is shown in the rates panel will be submitted)

Clear: Clears data entry fields

Quit: End the program. All data not send to the Db or written to an output file is lost.

Rates Display Panel

Pushing the RATES button of the main screen opens the “Rates Display” panel. This panel shows the results of up to 15 measurements taken in by the automated sequencer. Data can also be entered manually and/or edited. The LOAD button allows to import rates data from a file. The CLEAR button clears the data entry fields and DEFAULT sets the voltages to 5000 V to 6000 V in 100 V increments. The currents are set to 0 nA. The Rates Display panel is shown in Figure 3 in the default setting.

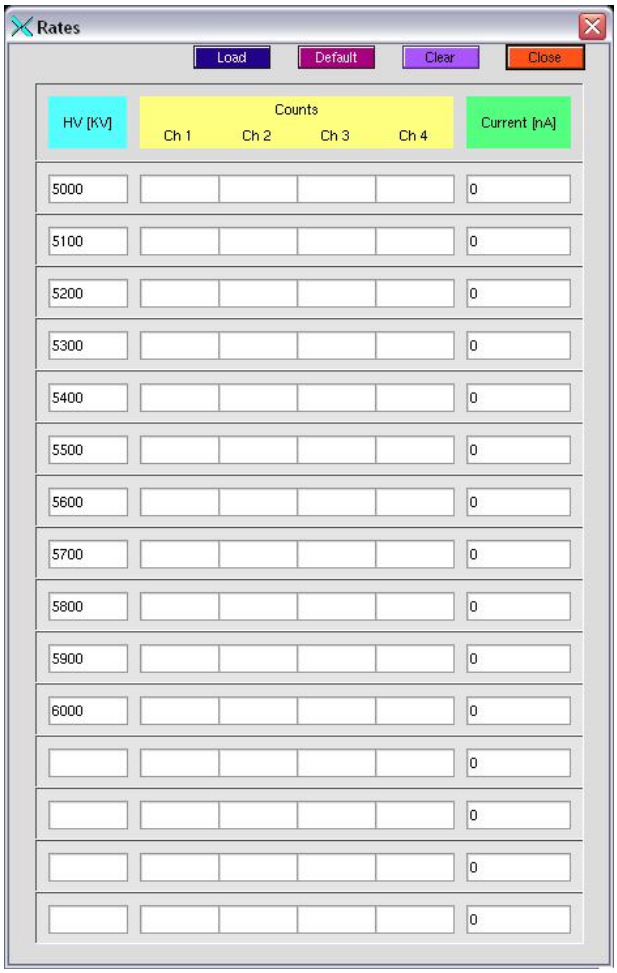

Figure 3 Rates Display Panel

Importing Data

Clicking the LOAD button opens a file dialog box allowing the user to select a file with rates information. The program expects the following format:

Line 1: TUBE ID: 1238
Line 2: 5000,233,234,265,321,300,
Line 3: 5100,….

(without the Line xx)

The first line has to be the tube id. It can be the full, 13 digit barcode or the short tube id plus the number of cells (8 in the example above). This tube id will be entered in the tube id field of the main panel. If necessary, the CONVERT button needs to be clicked before the data is sent to the database.

Up to 15 lines with rates information can follow. The voltages comes first, then the 4 rates followed by the tube current in nA. These values have to be comma separated. The "trailing" comma is optional. The following simple example is included in the cvs repository (tubeRates.dat):

TUBE ID: 1238
5000,1,2,3,4,5
5100,10,11,12,13,14,
5200, 19, 23,
5300,33,22,11,99

Note, that for the last to lines only partial information is given. This is not recommended but the program tolerates this.