E835 note # 363

The Silicon Detector monitoring and control system

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This document describes the silicon detector monitoring and control system and explains how to use it. It is structured as follows: section 1 gives a brief introduction and describes the main motivation of this system; section 2 gives a general description of the main Labview program that controls the whole system; section 3 gives a quick reference guide to perform basic operations and checks.

1 Introduction

The silicon detector and its readout electronics have to be operated and monitored from the counting room. Within the detector, 130 W are continuosly dissipated, so cooling system and inner temperature status must be carefully monitored in order to prevent detector serious or even fatal damages. Furthermore, to obtain stable operating conditions and performances, bias currents have to be under full control.

For these reasons we have built a monitor and control system, based on a PC running a Labview 4 program.

The system controls an OMEGA DPS801 device, capable to measure the temperature inside the detector and to make an allarm sound or, if needed, to switch automatically the power off, according to programmable thresholds. Besides, it performs a continuos read-out of the system status (temperature, bias voltages and currents, ICAR analog output) and it provides a user friendly interface to switch the silicon bias voltages ON and OFF, to check the status of the system and to look at history plots of various parameters.

The hardware setup and cabling is shown in figure 1, while figure 2 shows a picture of the program main panel whose detailed description is given in section 3. For any other detail about the detector or the DAQ system refer to [1] and [2].

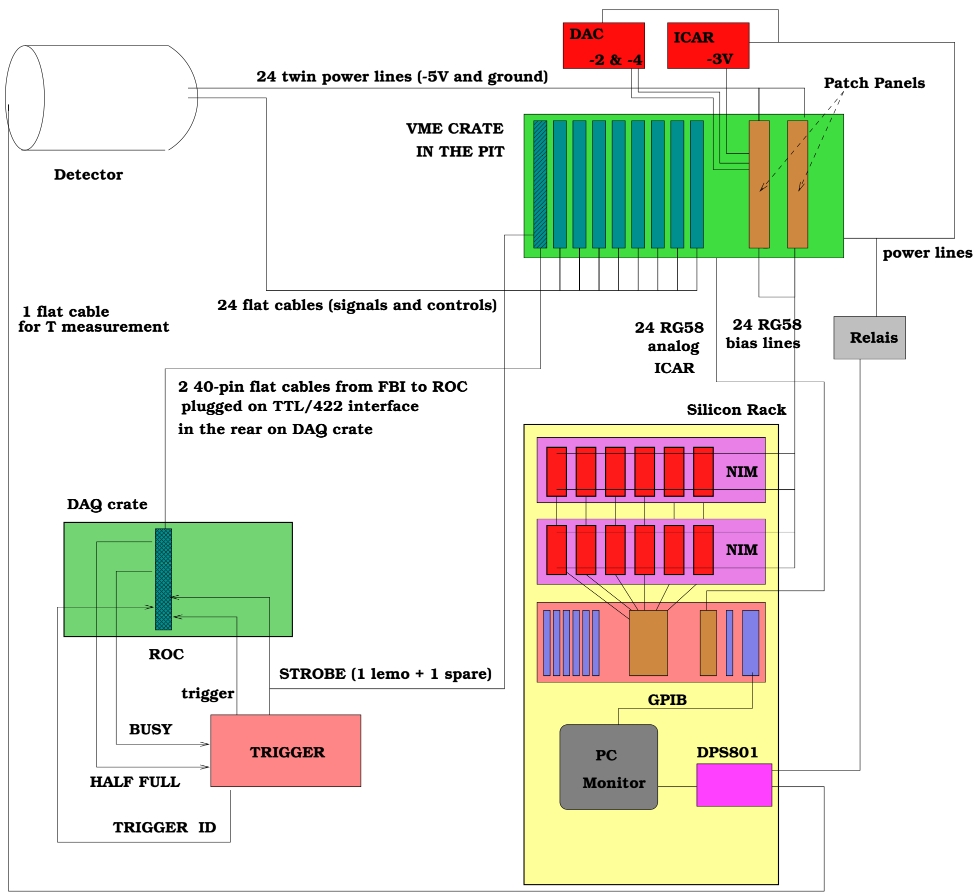

Figure 1: Monitor and control system: hardware setup and cabling

2 General structure of the program

When the program starts running, it initializes variables and instrumentation, shows a summary description of system parameters stored when the program was stopped, reads current detector temperature and bias status (on/off), highlights possible problems (alarms or communication errors) and, if the user confirms his choice, starts some independent processes, sequences of automatic operations and handlers of interactive commands.

2.1 Automatic operations

In order to monitor and datalog all the detector interesting parameters and to find out possible alarm situations, the program:

- reads the temperature inside the detector and on its electronics;
- reads parameters of the VME crate in the pit, part of the silicon readout electronics (FBI, SCB) (not available yet);
- reads the silicon bias voltages and the currents drawn by the silicon pads;
- checks if there are any of the following anomalous situations:

  DPS801 (T/flow measuring device) is in ALARM status (at least a T sensor is above the hardware alarm setpoint or it isn't working); in this case all electronics in the pit is immediately switched off independently from the PC control;

  DPS801 is in PREALARM status (at least a T sensor is above the hardware prealarm setpoint or the air flow is less than the expected value);

  a T measurement is above software thresholds (lower than hardware ones), in order to make the program decrease smoothly all the silicon bias voltages before an abrupt "save the silicon" operation, performed by the DPS801;

  the current drawn by a slab is too high;

  an error occurred in the communication with either the CAMAC crate or the DPS801 or the VME crate[1] in the pit;

[1] Performed through CAENET serial control, not available yet.

- samples the analog output of the most upstream ICAR of each slab and records its waveform in a file;
- datalogs periodically 24 bias voltages, 24 drawn currents, 4 T measurements and ICAR analog output parameters;
- datalogs periodically 24 ICAR analog output waveforms.

In order to provide a quick reaction to an alarm condition, the temperature and error monitor process runs independently from slow operations (V-I readout and analog waveforms sampling). All time intervals and thresholds can be modified within the running program.

2.2 Interactive operations

The main control panel buttons and leds allow a quick visual system status check, some direct operations on the detector and on the monitor program and the access to secondary control panels. The user can directly through the main panel:

- control silicon bias voltages (switch them OFF or ON to preset values)
- datalog independently from the automatic process;
- temporarily reset alarms until next readings;
- stop the monitoring program, without affecting the detector and the hardware temperature control system;

and through secondary panels:

- look at a more detailed map of the alarm/error condition of the system;
- change all preset values (default bias voltages when the detector is switched on, time parameters and setpoints)
- read the history of the system and add comments if necessary;
- look at parameters history plots or read last complete set of measurements;
- modify each bias voltage separately.

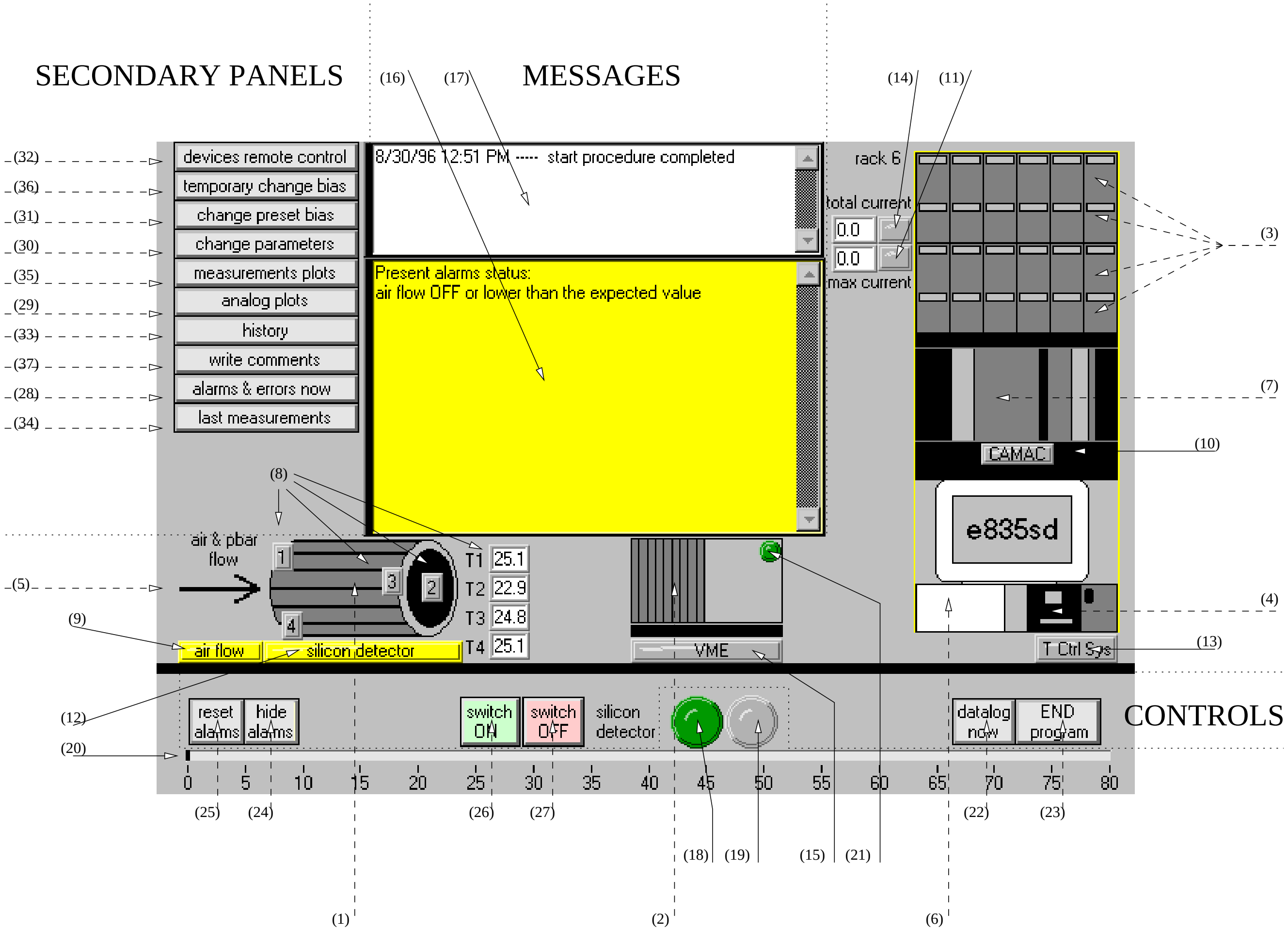

Figure 2: Main program panel. Numbers correspond to the list given in section 3.

3 Main panel user manual

The following list is a brief description of all objects on the main panel, whose numbers refer to figure 2. To open the main control panel, double click on the icon "E835 silicon detector monitor" on Windows '95 desktop; to start the program, click on the white arrow, left of Labview toolbar; system condition when the program was ended and current status of temperature, bias voltages (round light: green = bias ON, red = OFF), alarms and errors are displayed; a confirmation is required; if not given, no operations are done and the program stops;

3.1 System components

1. silicon detector, showing 4 T sensors position;
2. VME crate (local readout system, FBI, 8 SCB; downstairs, in the pit);
3. power supplies (biasing silicon pads) in 2 NIM crates;
4. DPS801 (leds 1-8 from left):
   - led 1 flashing ⇒ hw air flow prealarm;
   - led 5-8 flashing ⇒ hw T prealarm;
   - led 5-8 lighted on ⇒ hw T alarm;
5. air flow sensor and generator (compressor + refrigerator, in AP50 corridor, left respect the counting room door);
6. PC;
7. CAMAC crate (electronics for remote control).

3.2 Indicators

8. *1-2-3-4*: temperature sensor status: flashing ⇒ above software prealarm setpoint; lit on ⇒ above software alarm setpoint; position of the sensors:
   - *T1* between S01 and S03 near the flange upstream;
   - *T2* at the gas output downstream flange above S01;
   - *T3* near ECL transceiver on S05;

- *T4* between 2 long slabs near S08 between 2 holes upstream;

9. *air flow*: air flow lower then setpoint sey by hand on the flow meter;
10. *CAMAC*: error in communication procedure with CAMAC crate;
11. *max current*: at least one slab current is above preset setpoint; the highest drawn current is displayed (μA);
12. *silicon detector*: alarm (T hw, T sw; in both cases bias voltages are switched off by the system) or prealarm (T hw, T sw, air flow, single current, total current; the system doesn't perform any operation except alerting with flashing messages); in case of hardware alarm or prealarm a buzzer beeps;
13. *T Ctrl Sys*: error in communication procedure with DPS801 (4.);
14. *total current*: sum of all the currents (μA) drawn by silicon pads is above preset setpoint;
15. *VME*: error in communication procedure with VME crate;
16. alarm & error window: an alarm or error condition makes this window appear and flash; it can be hidden by the button (24.); for a more detailed description of the situation open the subpanel (28.);
17. message window: all these messages are written on the history file, which is accessible from the running program: to read it subpanel (33.), to add comments subpanel (37.);
18. green led: bias voltages status: lit on $\Rightarrow$ ON; flashing $\Rightarrow$ ramping;
19. red led: bias voltages status: lit on $\Rightarrow$ OFF;
20. step bar: during bias voltages ramping, shows the progress in 1V steps.
21. VME led: VME crate status: green $\Rightarrow$ ON; red $\Rightarrow$ OFF;

3.3 Buttons

22. *datalog now*: writes the datalog of last measurements, independently from the automatic periodic procedure;

23. *END program*: stop the main program, after a confirmation of the user;

24. *hide alarms*: hides alarm & error window (16.), without affecting other indicators or status bits; lets always readable the schematic description, shown below, of the system;

25. *reset alarms*: resets all alarms and errors status bits; its effect lasts until next check (i.e. few seconds for T/air flow alarms or communication errors, few minutes for drawn current alarms);

26. *switch ON*: switches silicon pads bias voltages on to preset values;

27. *switch OFF*: switches silicon pads bias voltages off.

3.4 Secondary subpanels

To use a secondary subpanel, open it by clicking from main panel corresponding button, update its indicators by pushing the black arrow on the toolbar ("Push to Update") and wait until it has come back to the original shape; to interrupt an updating running process, push the "rewind" button (2 black triangles pointing left); to return to the main panel push the "stop-eject" button (black triangle pointing up; "Return to Caller"); do NOT push the red octagonal button: it would stop the main program immediately;

28. *alarms & errors now*: shows a complete map of alarms and errors;

29. *analog plots*: shows the first analog waveform recorded after given date for each slab; on top right the real date of the shown waveform is returned, near Labview graphics tool palette (zoom,...);

30. *change parameters*: allows to write configuration parameters of the system (time intervals, setpoints, password); password required;

31. *change preset biases*:password required; writes values to which bias voltages are switched on by button (26.); values can be written directly from the subpanel or from file; preset bias files can be created through the following Labview program: c:/windows/silicon detector/files handling/write preset bias file

32. *devices remote control*: allows complete remote control of the DPS801 (4.) and software initialization of the CAMAC crate (7.);

33. *history*: allows to read the system history between given dates;

34. *last measurements*: shows last measured values;

35. *measurements plots*: shows history plots of each bias voltage, drawn current, analog output parameter or temperature between given time limits; corresponding history can be displayed at the same time of the plot; on top right, near Labview graphics tool palette (zoom,...), a tick box allows to display at the same time a plot and the corresponding history;

36. *temporary change bias*: allows to modify bias voltages for each slab, without changing the preset value to which button (26.) switches it on; use subpanel (31.) to write it permanently;

37. *write comments*: allows to write comments on system history; date and time are added by the program.

References

[1] A Silicon Pad Detector for E-835 experiment at Fermilab A. Buzzo et. al., submitted to NIM A

[2] Data Acquisition System for E-835 Silicon Detector P. Musico et. al., submitted to NIM A