COMPASS Silicon Detector

Manual for the shift crew\footnote{comments welcome at Anna-Maria.Dinkelbach@e18.physik.tu-muenchen.de and sgrabmue@e18.physik.tu-muenchen.de}

(and others interested . . .)

April 27, 2009
1 Silicons

1.1 General Remarks

For the muon beam time 2008 five complete stations of silicon detectors are
installed in COMPASS. (SI01, SI02, SI03) are installed upstream of the target,
(SI04, SI05) downstream of the target, inside the RPD in the conical cryostat.
Each station contains two detectors (= silicon wafers). Each detector is read
out double-sided: thus there are two independent sets of electronic chains, but
only one bias power supply per detector.

The names of the four projections per station are (in order of appearance along
the beam):

- U ($-5^\circ$), from Jura to Saleve
- V ($-95^\circ$), pointing downwards
- Y ($+90^\circ$), pointing upwards
- X ($\pm 0^\circ$), from Jura to Saleve

The horizontal projections U, X have 1280 strips, the vertical projections Y, V
have 1024 strips. The pitch is \( \sim 50 \mu \text{m} \), which gives a total active area of ca.
7 \times 5 \text{ cm}^2.

The hardware parts which are relevant here are:

**Low voltage** for the frontend chips (APV25, powered via a card which is called
*Repeater*) and for the ADC (extra card, called *sg_adc*).

**High voltage** (called *bias voltage*) by ISEG HV modules monitored via PVSS.

**Cooling** with gaseous nitrogen from the bottle and PVSS temperature read
out.

**HotGeSiCA** one per station (*SrcID* 640, 641, 642, 648, 649), connected
to *pccorb46_0, pccorb43_1, pccorb47_0, pccorb41_0* and *pccorb39_3*
(status quo 2008-07-31, may in principle change ...).

Data quality can be checked using MurphyTV and Coool.

1.2 Low Voltage – Repeater Cards

The frontend chips APVs are powered via a card called *Repeater* with a CAEN
SY527 Module A525 (3 A, 4 V) located in the SciFiJ–Silicon rack right after the
upstream entrance to the experimental area for the three silicon stations. Per
station one module with 8 channels is needed: each projection needs a positive
and a negative voltage of approx. 3.35 V, which is implemented by connecting
two channels of the CAEN on the plus and negative output respectively.

When the chips are unloaded (= NOT operational) the currents are approx.
0.5 A to 0.7 A. In loaded condition, the currents rank around +1.0 A and −1.9 A
(due to different number of chips, currents for U, X and V, Y differ by up to
25%).
In PVSS all channels of SI01 to SI05 can be reached via Silicon → LV Channels → Station \( x \) (\( x = 1, 2, 3, 4, 5 \)). Alternatively the crate can be controlled via serial lines to pccofe15 and MINICOM terminal which can be opened from any machine as daq with

\[
\text{cd /online/detector/silicon/2006/hv/}
\]
\[
./caen pccofe15
\]

If one of the voltages is off, DAQ will go on, but data will be useless; MuHyTV will show a lot of errors (100%); planes are missing in cool.

No special shift care for the Repeater voltage is needed, except for checking that all voltages are ON.

1.3 Low Voltage – ADC Cards

Each ADC is powered from a doublet of 3U modules (Deutronic, 35 W) which are located in the SciFiJ–Silicon rack right after the upstream entrance to the experimental area. The outputs are labelled and should not be changed as some channels are on high voltage (this is really dangerous, and not only for the detectors!).

There is no remote control and therefore no work for the shift crew.

1.4 Bias Voltage

For the biasing of the detectors, we use an ISEG HV module (500 V, 15 \( \mu \)A). The ISEG modules are implemented in PVSS. The channels can be switched on/off via PVSS as user Operator:

Silicon → HV system

No special shift care is needed, except to check that all voltages are ON.

In case PVSS lost its settings, there is a button Export/import settings left of the HV system button in the silicon main panel from which saved settings can be reloaded. If this does not work, the settings should be the following (see table 1):

Settings can only be changed by an expert, as user Silicon!

1.5 Cooling

As the detectors (including readout chips) are mounted in a light-proof cryostat, the power dissipated in the chips has to be actively cooled away. The readout boards are flushed with nitrogen from the bottle via small metal tubes. All the three stations are currently running with a flux of 3501/h.

The flux should be checked on the safety walk.

The temperatures are measured with two PT100 sensors per projection and
Table 1: Silicon HV settings and leakage currents

<table>
<thead>
<tr>
<th>detector</th>
<th>voltage setting</th>
<th>current reading</th>
</tr>
</thead>
<tbody>
<tr>
<td>SI01UV</td>
<td>190 V</td>
<td>0.82 mA</td>
</tr>
<tr>
<td>SI01XY</td>
<td>190 V</td>
<td>0.80 mA</td>
</tr>
<tr>
<td>SI02UV</td>
<td>170 V</td>
<td>0.65 mA</td>
</tr>
<tr>
<td>SI02XY</td>
<td>160 V</td>
<td>0.78 mA</td>
</tr>
<tr>
<td>SI03UV</td>
<td>170 V</td>
<td>0.62 mA</td>
</tr>
<tr>
<td>SI03XY</td>
<td>160 V</td>
<td>0.58 mA</td>
</tr>
<tr>
<td>SI04UV</td>
<td>120 V</td>
<td></td>
</tr>
<tr>
<td>SI04XY</td>
<td>105 V</td>
<td></td>
</tr>
<tr>
<td>SI05UV</td>
<td>110 V</td>
<td></td>
</tr>
<tr>
<td>SI05XY</td>
<td>90 V</td>
<td></td>
</tr>
</tbody>
</table>

are read out via ELMB. The values can be checked in PVSS, Silicon → Temperatures. For each sensor a trending panel can be opened. The temperatures show day-night and trigger on/off dependencies. The absolute values are different for each detector and range from 40° to 55°, sensor SI03_T_u2 around 60°.

When checked, all temperatures should be below 60°.

In case that the temperature is higher make sure that it is no artefact of the ELMB (e.g. Slow Control shows temperatures of about −160°) and inform the expert!

1.6 Readout

Each station (SI01 to SI05) is read out via one HotGeSiCA, located in the SciFiJ-Silicon rack right after the upstream entrance to the experimental area. They have the SrcIDs 640, 641, 642, 648, 649. In cases of hangup or powercut the whole chain can be reloaded via the config_server. This program can be called from the daq account on any machine in the compass domain with the command:

```bash
>> LOAD -A <SrcID>
```

with numbers as mentioned above. The program will give a summary of signal errors. In case of errors, trying these commands for 3 or 4 times can help. Please report these actions in the logbook.

1.7 Online Monitoring

1.7.1 MurphyTV

Up to now, the only observed messages originated from not synchronized chips. Check the LV (see section 1.2) and reload the respective station (see section 1.6).
1.7.2 coool

When one uses the shift version of coool, the config file SIL.cfg can produce a page with one occupancy plot per projection. They should look like a beam profile; also compare to the reference plot. For interpretation keep in mind that though Y and V are only differing by 5°, they are pointing in different directions: Y points upwards, V points downwards.

For more plots, a separate group directory is available which also provides hit maps, where the intrinsic correlations of X, Y and U, V are used. This can be interesting for checking the 2D shape of the triggered events. For these plots, the checkbox cluster on the startup screen of coool has to be active.

From time to time the profiles show spikes. This is mainly due to a shift of the pedestals and can be cured by taking new pedestals. Please note down in the logbook, the expert on call will try to fix this as soon as time is available for it.