

# COMPASS Silicon Detector

## Manual for the shift crew<sup>1</sup>

(and others interested ...)

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<sup>1</sup>comments welcome at [Anna-Maria.Dinkelbach@e18.physik.tu-muenchen.de](mailto:Anna-Maria.Dinkelbach@e18.physik.tu-muenchen.de) and [sgrabmue@e18.physik.tu-muenchen.de](mailto:sgrabmue@e18.physik.tu-muenchen.de)

# 1 Silicons

## 1.1 General Remarks

For the muon beam time 2006 three complete stations of silicon detectors (SI01, SI02, SI03) are installed in COMPASS upstream of the target. 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 to 642), connected to pccorb46\_0, \_1 and pccorb47\_0 (status quo 2006-07-12, may in principle change ...).

Data quality can be checked using MurphyTV and Cool.

## 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. 3.5 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  $-1.9 \text{ A}$  (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 SI03 can be reached via **Silicon**  $\rightarrow$  **LV Channels**  $\rightarrow$  **Station**  $x$  ( $x=1, 2, 3$ ). Alternatively the crate can be controlled via serial

lines to `pccofoe15` and MINICOM terminal which can be opened from any machine as `daq` with

```
cd /online/detector/silicon/2006/hv/  
./caen pccofoe15
```

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

**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`  $\rightarrow$  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):

detector	voltage setting	current reading
SI01UV	180 V	0.24 mA
SI01XY	190 V	0.25 mA
SI02UV	160 V	0.11 mA
SI02XY	150 V	0.22 mA
SI03UV	160 V	0.11 mA
SI03XY	150 V	0.09 mA

Table 1: Silicon HV settings and leakage currents

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. There is one supply per station, located in the gas zone. Station Si01 is currently running with a flux of  $\approx 4501/\text{h}$ , Si02 with  $\approx 4001/\text{h}$  and Si03 with  $\approx 3501/\text{h}$ .

**The flux should be checked on the safety walk.**

The temperatures are measured with two PT100 sensors per projection and are read out via ELMB. The values can be checked in PVSS, Silicon  $\rightarrow$  Electronics Temp. 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  $40^\circ$  to  $55^\circ$ .

**When checked, all temperatures should be below  $60^\circ$ .**

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  $-160^\circ$ ) and inform the expert!

## 1.6 Readout

Each station (SI01 to SI03) 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 to 642.

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:

```
>> 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. In case that verification errors like

```
***module 642 errors:  
HotGeSiCA (642): chip error: verification of reg. 0x1002 failed  
(shall be: 0x7F is: 0x7E when checking registers for ADC7(SI03X))
```

appear, ignore them if nevertheless the spectra are ok. 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 `cool`

When one uses the shift version of `cool`, 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  $5^\circ$ , 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 `cool` 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.