Detector group status report – 13/11/08

1. Silicon detectors

Two telescope silicon detectors (FBK, Trento) have been assembled connecting both the junction and ohmic side to the VA1 ASICs. While no problems have been met for the junction side (which will be the side measuring the horizontal deflection of the particles), the ohmic side has shown a strange behaviour in both the modules, which has required several weeks of testing to understand it. The problem is summarized in fig.1: the IV curve shows that after the full depletion the current measured on the bias battery (black dots) increases exponentially; the red triangles indicate the current taken from the n side with a 10k resistor. It is clear that there is substantially a resistive path between GND and the readout electronics. Given the amplifiers input sits at -1.2V, to have a current of 100uA the path should be of the order of 7-8k. At the full depletion this current goes to a few tens of nA but the bias current increases dramatically.

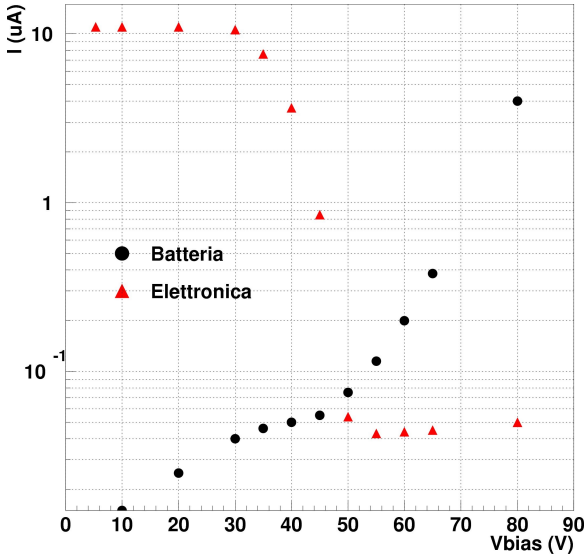

Figure 1 - Current measured on the battery for the bias voltage and on the electronics.

This behaviour is due to the presence of several (around 30% of the channels) pin holes on the ohmic side resulting in dead channels when taking data. The problem has been identified as due to the bonding procedure on the ohmic side when assembling the detector. Another detector is being assembled and bonded this time in INFN Trieste paying attention to what caused the pin hole problems. This new test is expected to be performed before the end of November.
The detector cut nearer to the strip side has already been prepared and tested with the probe station. The connection with the electronics will be performed as soon as the new bonding test has been verified.

2. Frontend electronics

The VA1TA ASICs have been tested both in the lab and on a dedicated beamtest (as passive users) on H8. They have been characterized in terms of pull, signal to noise ratio and pulse height. Given the fact that all the working voltages and currents are set through internal DACs (in the ASICs themselves), a scan of all the parameters has been performed checking the value of the peaking time of the slow shaper (the one that gives the analog info of the deposited charge) and of the fast one (the

one that allows to work in self triggering mode). In this last case, the trigger efficiency as a function of the threshold value has been measured.
The tests have been performed connecting one VA1TA to a single side HAMAMATSU strip detector and one to the junction side of a telescope double side detector. No differences have been found in terms of efficiency and signal to noise ratio. Fig.2 shows the pull of the strip with the maximum signal (where the 2 peaks represent the contribution of the readout strips (peak at aroung 70) and the floating one (peak at around 45)).

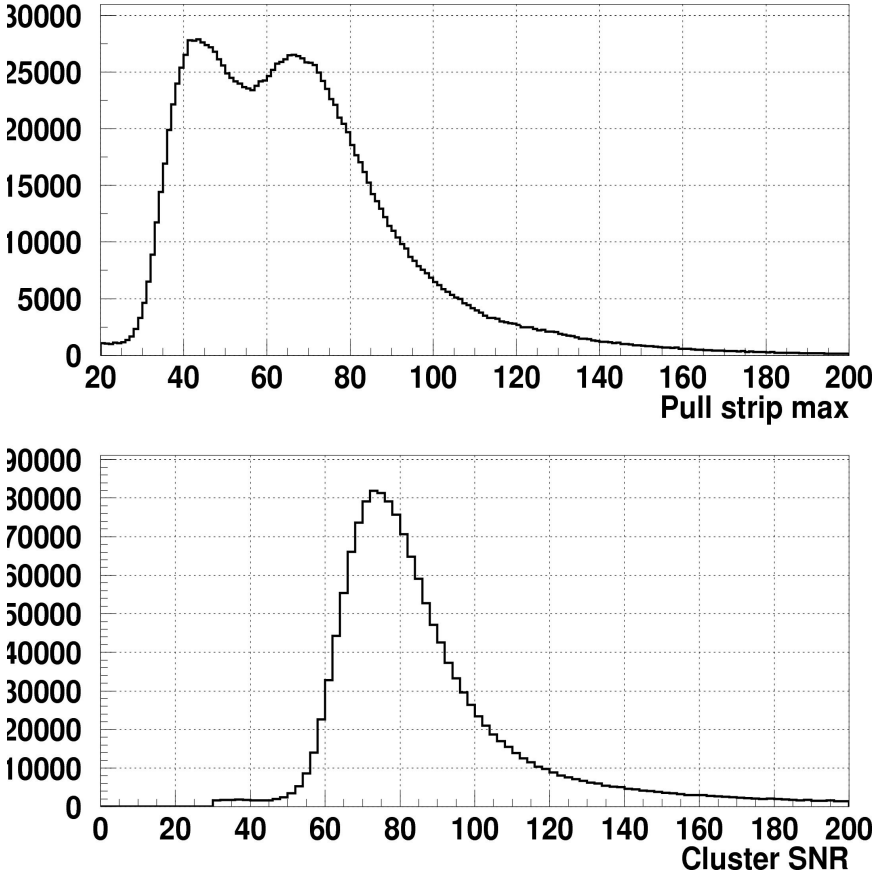

Figure 2: Pull and SNR of the FBK detector readout with the VA1TA; data of the H8 beam.

3. Readout electronics

The producer of the boards have been identified and offers have been requested. The ADC board is already under test.
We are requiring the offers to produce the DAB64 + mezzanine boards for the fibers; the boards have been designed by TRIUMF and produced by the CERN ATBI group. We are verifying if to place the order via CERN or to produce them by our usual producer.
The design of the VME boards on ground will start at mid December.
Dedicated circuits are being produced to perform the radiation tests of each sensitive item: analog part, digital part, the receivers, the ASICs, the power regulators. A dedicated DAQ software is being written to perform the tests with a gamma and neutron source, to control remotely the power supplies, the oscilloscope, the VME and the waveform generator. As far as the ASIC is concerned, the analog signal shape will be checked in steps up to 1kGy; given all the parameters are set loading the internal DACs (including the trigger mask), while testing the other pieces, the mask will be loaded and read continuously to understand how many SEUs we will have in the data taking. The ASICs will be tested also for the latchup.

4. Cables

The cable architecture both for the fiber connections and the power connections have been decided, as shown in fig.3.

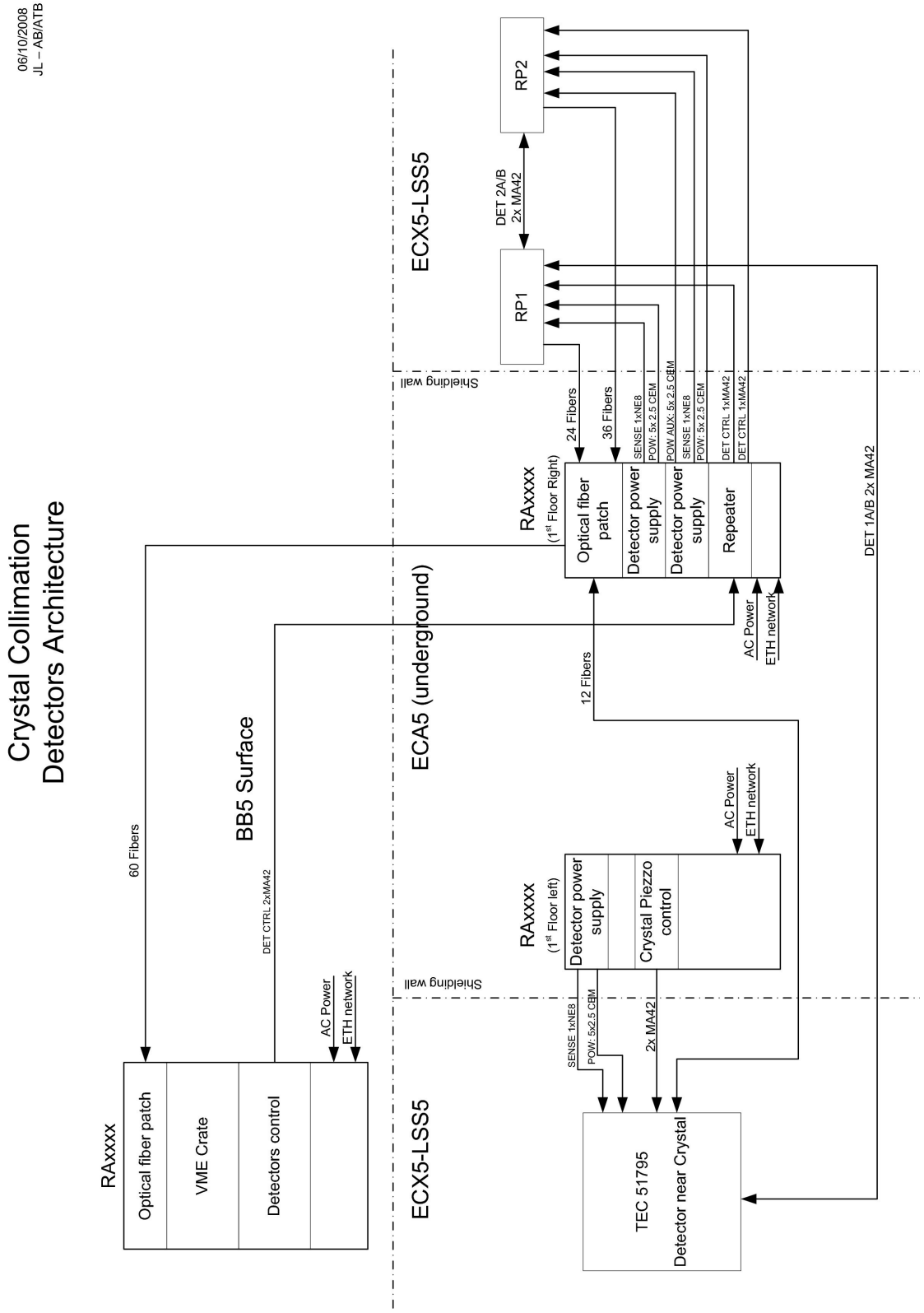

Figure 3: Layout of the cable connections for the UA9 detectors (thanks to Jerome).

5. *Module Assembly*

The final layout of the detector has been defined and a drawing is being produced (fig.4). The frontend hybrid is a double side (multi layer per side) PCB; the connection with the silicon detector is performed through upilex cables. The last part of the PCB is a rigid flex ending with a PCB for the connectors to be interfaced with the top flange of the roman pot.

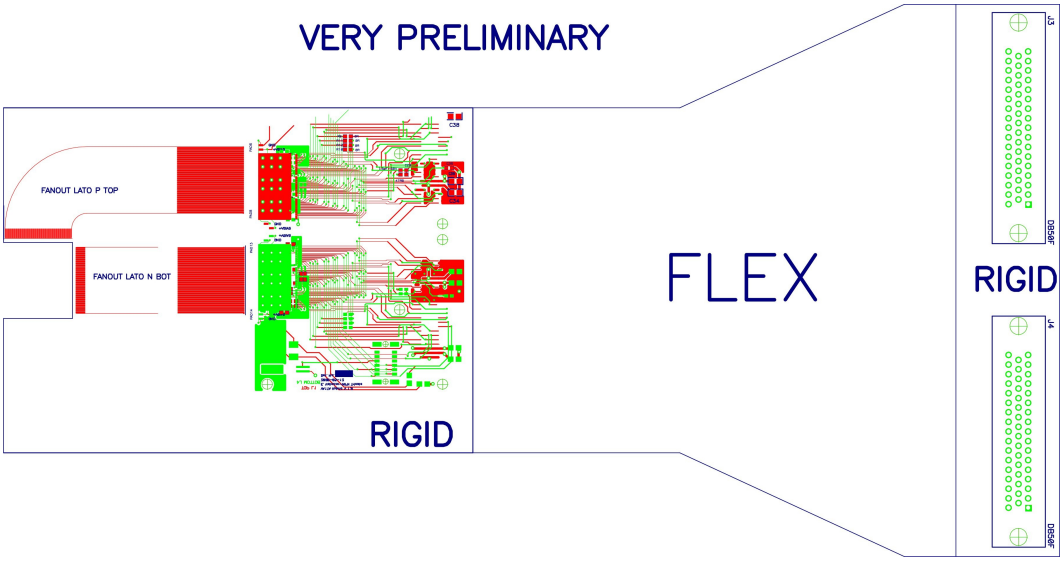

Figure 4: Preliminary schematic of the single detector module.

We will prepare for mid January a report on the procedure of assembly of the module inside the pot and of the procedure for the verification of the position of the detectors inside the pot itself.
As far as the champignons are concerned, fig.5 is a schematic representation of the system.

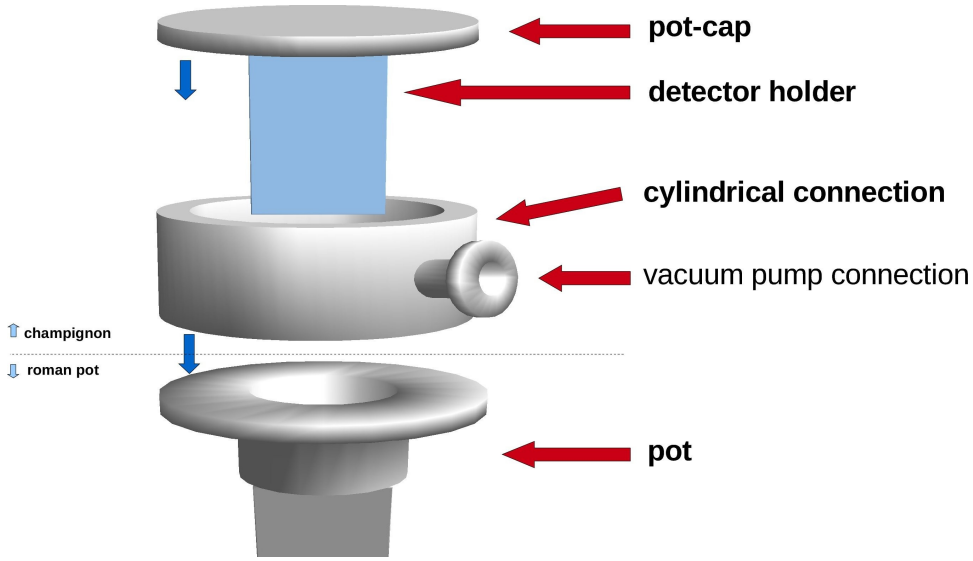

Figure 5: Schematic view of the champignon.

Fig.6 shows the dimensions of the several parts of a champignon. The top flange is an ISO200 to allow the number of connectors needed for the detectors. *These dimensions should be compatible with the roman pot structure:* ***the roman pot responsibles have to provide us with a drawing of the pots and to agree on the flange dimension.*** *We have investigated other possibilities for the top flange but they are not feasible in terms of cost or number of connectors. We also need to have the info on the vacuum connection on the cylinder of the champignon and on who is going to procure it.*

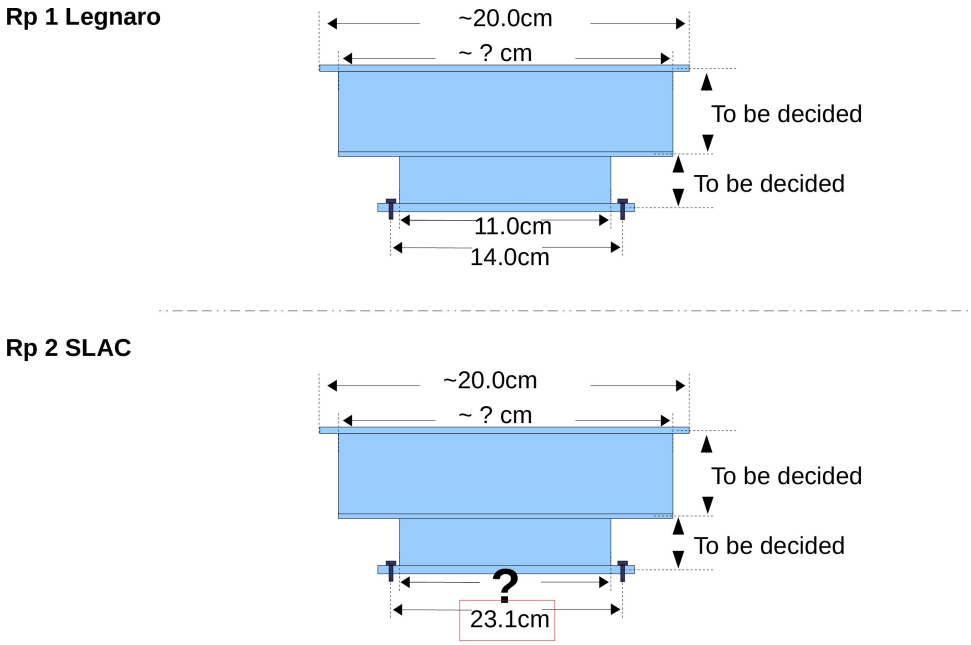

Figure 6: Dimensions of the champignon sub-parts.

The design and work on the near crystal detector will start only after the modules for the 2 roman pots have been completely defined and their production started.

6. DAQ and Slow Control

The DAQ and the SC will be written in C with Tcl/Tk for the user interface.
The DAQ development will start at the beginning of January. The SC development has already started given the radiation tests we have to perform in less than a month. Fig.7 shows a screenshot of the present status of the SC.

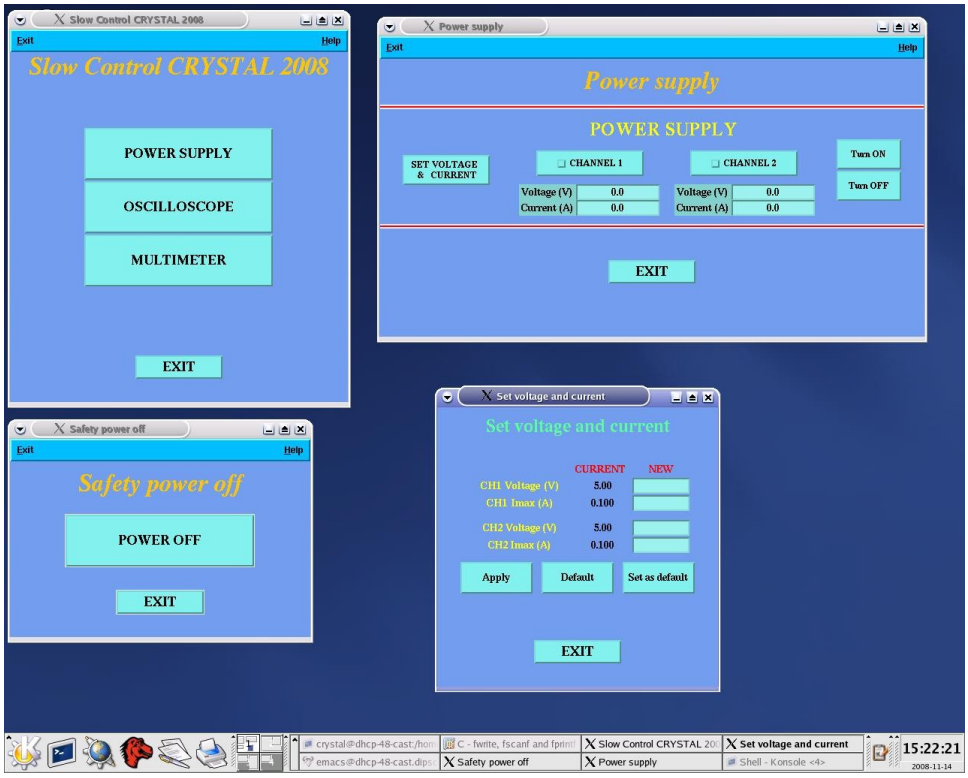

Figure 7: Preliminary version of the slow control system.

The raw data will be organized in ROOT ntuples. Nothing has been decided for the online analysis for the moment. We will prepare a proposal for the end of January; suggestions are welcome.

7. Money, schedule and requests

The financial support from INFN had been requested to arrive before summer (the request had been made in May for money to arrive in June). INFN had approved the financial support only at the beginning of October, that is with a delay of 4.5 months. This has blocked a great part of the activities, especially the ones concerning the prototyping phase.
A further constraint is represented by the fact that all the orders have to be placed no later than the first week of December, which requires that all the responsible people (mechanics, cabling and so on) are ready to check our requests in terms of compatibility and interference with the setup in short times.

As far as the schedule is concerned, considering the delay in the prototyping activity produced by the very late delivery of the money and by the fact that the group had to setup 2.5 months of beam tests at CERN during the summer and babysit the detectors, DAQ and online analysis, the preliminary schedule prepared in January 2008 needs to be shifted.
The production of the final silicon modules will start mid of January and the system will be ready for the end of March at best if no hardware problems will be met from now on.
In the meanwhile we need:

- to know who will approve the mechanical part of our detectors; just as an example, we are

going to place the order for the top flanges of the champignon with the vacuum feed through connectors for the detectors rigid flex cables. These flanges cost several keuro each and need to have a minimal dimension depending on the nr of connectors to be put inside. An official statement from the mechanics responsible that the flange we are going to order is compliant and will fit with the roman pots will be needed before the order is placed

- to have all the info to prepare the data acquisition system. At the moment we do not know how to synchronize the detector DAQ with the movement of the goniometers, if and what synchronization signals we will receive and where, what will be requested on our side to put together our data with the data collected by the rest of the SPS systems (beam monitors, pin diodes and so on)
- to know the integrated dose profiles in the areas where we are placing the detectors and the components of this dose (at least the gamma part and the heavy particles part; it would be better if also the neutron contribution is given). Dosimeters were placed in March/April but we have not received any info up to now.