Installation of Miniball at Cologne

Contents

[1] Nigel Warr September 2005

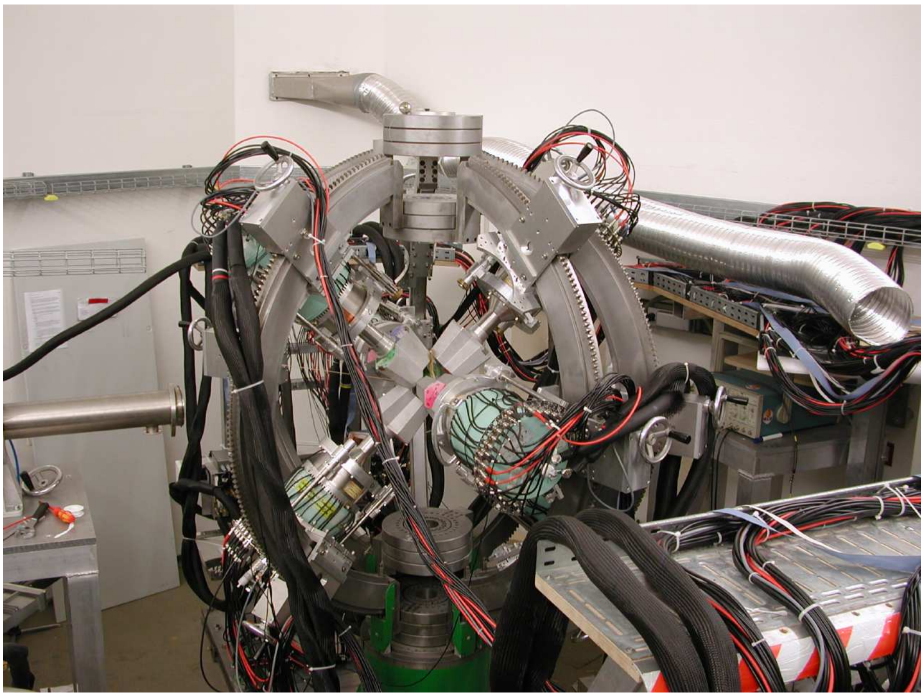

Figure 1: The Miniball array in Cologne

1 Cables

There are eight Miniball clusters, each containing three capsules. Each capsule contains a six-fold segmented Ge crystal. Each crystal delivers one signal from the core electrode and one from each of the six segment electrodes. So we have seven signals per capsule, or twenty-one per cryostat, which is 168 Ge channels in total. There are 168 cables with BNC connectors at the detector end and SMA connectors at the electronics end.

Each capsule has an independent high voltage, so there are 24 high voltage cables with SHV connectors at each end.

Each cluster has a single low voltage preamp power supply giving +12V, -12V and ground. The pin assignment is compatible with the standard preamp pin-out, with ground on pin 1, +12V on pin 4 and -12V on pin 9. We do not use +/-6V or +/-24V which may be used by other preamps. Consequently, those pins are NOT connected on the Miniball preamps. Note, also, that we have doubled up the wires for each of pins 4 and 9, so that two wires carry the current for each pin. This is because the Miniball detectors need more power than conventional ones, as they have 21 preamps per cluster.

These cables are arranged in eight bunches, which are colour coded (yellow, green, blue, brown, orange, white, violet, red). Each bunch has twenty-one BNC to SMA signal cables, three SHV to SHV high voltage and one preamp power cable.

The cables are clamped into the frame, so that there is about 2 metres free from the clamping point to the detector. Be careful, when clamping cables that they are only held by the sponge part of the clamps, not the metal.

From the clamp, the cables go up to the cable carrier immediately above the clamps, and then from there to the cable carrier over the beam dump. Note that there must be just enough length, so that they are not taught, but not too slack when the ball is fully open. You have to fix the cables to the cable carriers with plastic cable ties. Note that this cable carrier over the beam line is usually free-standing mounted on a few bricks to give it enough height over the beam stop. Consequently, it is very wobbly until the cables are all installed. Don't climb on it!

From the cable carrier over the beam dump, the cables go up to the cable carrier which is mounted on the wall, along that cable carrier and down behind the racks. The cables are quite a bit too long for short distance in the small hall in Cologne (the distances at CERN are greater), so it is important to get the excess cable out of the way. We need access to the back of the racks, so you have to fix the cables out of the way with cable ties.

> Note that it is important to put the signal/HV/preamp cables in *before* the filling system cables, as the latter are fragile.

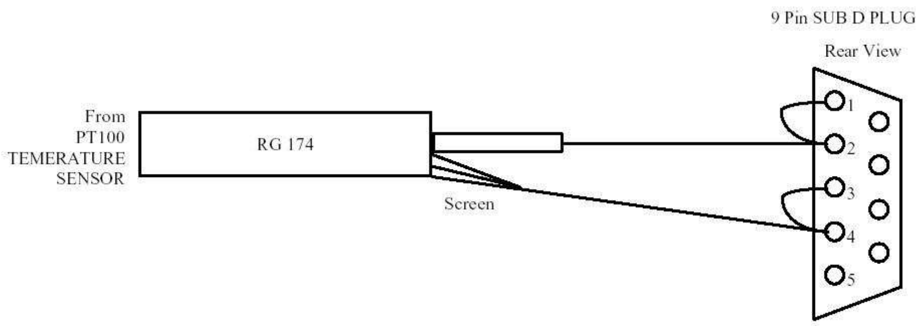

Figure 2: The BNC to D-sub connection for the PT100 readout

Each cluster also has a PT100 readout. These cables have a BNC connector on the end which plugs onto the detector and a D-sub cable on the other end. There are eight of these in total. At the moment, these are RG174 cables, but I would prefer to change them to RG58 ones because the thin RG174 are rather fragile.

Each filling manifold has one wide flat cable for operating the valves and one narrow flat cable for reading out the LN2 sensors. There are four manifolds, but only three have cables, as one set of cables was damaged.

2 Filling system

The filling system has four manifolds: A, B, C and D. The manifolds are mounted onto the frame and the mouting system is different for the two frames. The old frame has just holes, so you have to remove the white endcaps from the frame and stick your hand in, to put nuts on the end of the bolts, while holding the manifold and trying to keep it straight, so the screws go through the holes. This is quite tricky. The new frame is better, in that the bolts screw into a thread in the frame and you don't need the nuts (so you don't have to take of the white endcaps).

The LN2 sensor box converts the BNC outputs from the LN2 sensors to a flat cable. It is mounted on the frame with cable ties.

The mains power is provided by two German socket outlets, which are mounted on the frame (either screwed on or mounted with cable ties. The ones to use are those with a metal shield around the cable protecting the part of the cable which trails on the floor.

When doing the plumbing of the LN2, always remove the old teflon tape from the joints and put fresh teflon. This is to make a better seal. Otherwise it will leak.

On each side of the Miniball setup, the LN2 comes from one tank into a T-piece attached to one of the manifolds and then another hose connects the other part of the T-piece to the other manifold on that side. There must be a pressure release valve between the manifold and the tank, so that pressure is released when the LN2 boils when the manifold warms up after filling.

3 Racks

I normally put the UPS on the bottom of the leftmost rack because it is rather heavy, I put a brick underneath it to take some of the weight. Above it I put the CAEN high voltage supply. I put the raid array and the Marabou DAQ rack-mounted computer above that. Next up, I put the four manifold controllers, the PT100 readout box and finally the filling computer with its monitor. The preamp power is mounted somewhere round the back of one of the racks.

The middle rack usually has three CAMAC crates containing the DGFs and some of the NIM electronics.

The rightmost rack has the VME crate and the rest of the NIM electronics.

4 DGFs

We connect up the DGFs in pairs, so that the first of each pair has a core, segment 1 and segment 2, with the bottom input free and the second module has segments 3, 4, 5 and 6.

The modules are arranged in groups of six, with a 40 MHz clock module between two groups of six (it doesn't matter if it is between the first and second group or between the second and third), but it is best to have the same slots

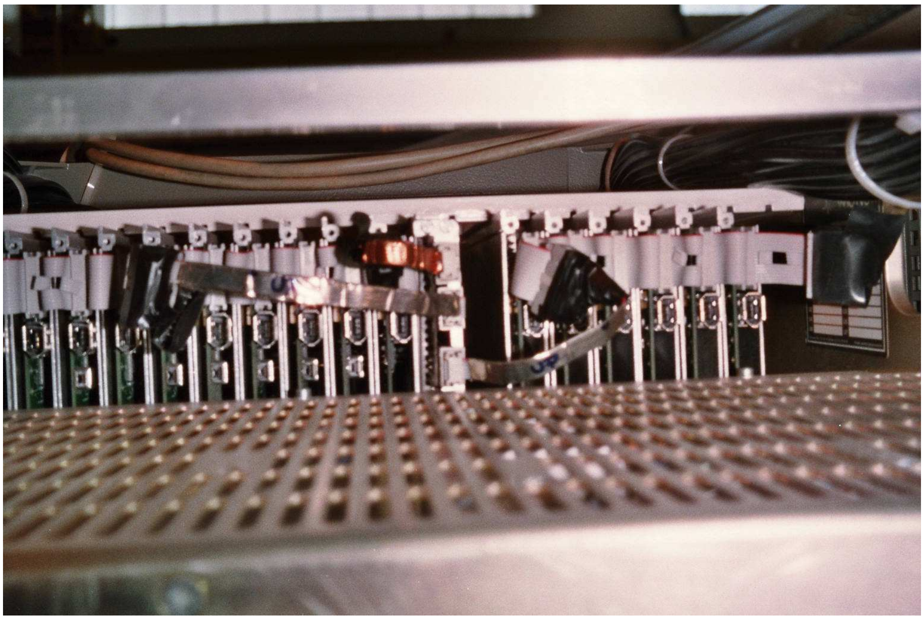

Figure 3: The DGF backplane connections. The DGFs are in three groups of six modules. Each group has three subgroups of two modules. One subgroup is for each capsule (core, six segments and one unused input). The trigger wires are cut between subgroups but left in place within the subgroup. Each group has a terminator at one end and a connection to the 40 MHz clock at the other. Note the red wire on the flat cable is at the top.

used in each crate, to avoid confusion. It is also best not to use the first slot or the one next to the crate controller (as it is difficult to get modules in and out then).

At the back, we connect some special flat cables, which have all the wires connected between pairs of DGFs working with the same capsule, and only the clock and ground signals connected (i.e. not the fast trigger and DSP trigger) between modules associated with different capsules. This allows the core of each capsule to trigger all the segments from that capsule (even those on a different DGF), but not to trigger segments belonging to another capsule.

At one end of this special cable, we connect to one of the three outputs of the 40 MHz clock module and at the other we put a terminator block.

Internally all the DGFs should be jumpered in the same way.

- 50 Ω termination (JPx0 and JPx3 set, JPx1 and JPx2 not set)
- External clock
- No internal termination
- Allow GFLT validation (JP18 not set) - this is not documented!
- Allow contribution to multiplicity (JP14-17 set)
- Disallow contribution to analogue sum (JP10-13 not set).
- Firewire doesn't matter (JP19-21)

5 Order of mounting

Here is a list of the typical order of mounting parts of Miniball. The order doesn't matter for all of these things, but it does matter for some.

- Bolt the manifolds onto the frame. This gets them out of the way.
- Do the plumbing of the LN2 lines between the manifolds.
- Install the eight bunches of cables, starting at the detector end, ensuring there is enough cable to reach the detector position at all angles and fixing them into the cable holder on the frame.
- Put the cables up via the cable channel mounted on the frame, the one over the beam stop and the one on the wall, down to the racks. As each cable is installed, it should be tied down with cable ties and care should be taken that they don't block the passage behind the racks.
- Install UPS, HV supply, Marabou DAQ computer, raid array, manifold controllers, PT100 readout box, keyboard for filling computer, filling computer and its screen. These all go in the rack nearest to the ball, in that order starting from the bottom and working up. I put the manifold controller for manifold A at the bottom, then B above it, and C at the top. This is because B has to be above A, because of the length of the cables and D has to be above C.
- Connect the filling computer and the HV supply to UPS power, but leave the manifold control boxes on normal power.
- Connect the flat cables from the filling computer to the manifold controllers and the multi-wire cable to the PT100 readout.

- Install the wide flat cables for manifold control, the thin flat cables for LN2 sensor readout and the BNC to D-sub cables for the PT100 readout and connect them to the filling manifold control boxes and PT100 readout box.
- Install CAMAC, NIM and VME crates.
- Insert the DGFs and 40 MHz clock modules into the CAMAC crates. Normally I start from slot 2 and have six DGFs, clock, twelve DGFs in each crate, with three CAMAC crates.
- Connect the back plane connector for the trigger and clock behind the DGFs, to the 40 MHz clock modules.
- Screw on the 168 SMA connectors to the DGFs. Try and keep the ventilation of the CAMAC crates clear by fixing the cables to the sides of the racks. Try also to keep the front of the DGFs free too because you'll need access there as well. I usually put the core and segments 1,2 on the first DGF of each pair and the other four on the second, leaving the last channel of the first DGF free.
- Connect the 24 SHV connectors for detector high voltage to the supply.
- Fix the 220 Volt AC sockets with the shielded cables to the frame and plug the power for the manifolds into them.
- Install the preamp power supply and distributor at the back of one of the racks. Put it on normal power, but put in the safe-failure switch. This switch ensures that if the power fails, you have to press a red button in order to turn the preamp power back on.
- Connect the 8 preamp power D-sub connectors to the preamp supply distributor.
- Insert four 3 fan-in 39 fan-out modules and two 39 fan-in 3 fan-out modules into a NIM crate.
- Connect the BUSY output of each DGF to one of the inputs of the 39 fan-in 3 fan-out modules, the SYNCH inputs to the outputs of two of the 3 fan-in 39 fan-out modules and the GFLT inputs to the outputs of the other two 3 fan-in 39 fan-out modules. Connect the outputs of the BUSY fans to the inputs of the SYNCH fans, so that both SYNCHS give an output if any one BUSY is active.
- If we are working with the DGF multiplicity trigger, connect the Mult Out from the DGF module with capsule A's core, to the Mult In of the one for B's core, then the Mult Out from B to the Mult In from C and from there to the special Cologne modified TFA. This for each of the eight clusters. The idea is that we cascade the multiplicity outputs of the DGF within a single cluster, but not over the whole array, because otherwise

we accumulate delays. Then we take the outputs from the modified TFA and OR them together and then use a gate generator to produce a gate with its centre 9.6 μs after the Mult signal and a width of about 800 ns.

- Set up whatever electronics are appropriate to the experiment.