**LUXE ECAL Assembly and Installation - manpower and tasks (draft)**

**Request from Louis for installation:**

* ***Preliminary estimate of the number of FTE and the amount of time needed to install, cable, align and commission your system in LUXE.***
* ***Description in a few sentences what type of FTE are needed (centrally provided?)***
* ***Steps needed to reach the ready to run***

***ECAL assembly***

The ECAL assembly requires the presence of participants from three laboratories:

- Mechanical frame and tungsten plates: JINR

- Sensors glueing: Tel Aviv

- Electronics: Cracow

The assembly should take place at DESY.  (Alternatively, assembly in Cracow could be considered as it may be relatively easy to move the assembled ECAL from Cracow to DESY - to be discussed with Marek). A test at CERN with high-energy electron beam has to be considered as well.

The tasks to be performed are

- gluing of the sensors on the tungsten, plane by plane (estimated time 20 working days)

- installation of the FEB and the electronics (estimated time 20 working days)

- cosmic run for function tests of components (one night after each plane completed)

The activities proceed as follows :

Day 1 : gluing of the sensors on the tungsten plane. The glue is curing during the night

Day 2 : the tungsten plane is installed into the mainframe. Then we connect the HV cables and the FEBs. the FEBs are connected to the low voltage. Connection to the DAQ. Noise check. Then data taking all the night

Day 3 = Day 1

…

- cabling completion, full system test (10 working days)

Inside the rack, we should have : 20 HV power supply, XX LV power supply (Marek should comment on that number)

* The HV connections are done during the construction of the ECAL
* The LV connections are done during the construction of the ECAL

During the phase of the construction of the ECAL, the DAQ should be able to work in standalone mode with a cosmic trigger (this could imply the presence of two scintillators, PMT and one NIM crate and NIM modules to get a trigger signal from cosmic muons). Once the ECAL is fully tested, the whole system is moved to the pit and the DAQ PC is included inside the LUXE DAQ

The full assembly is thus expected to take 2 month. With an added contingency to solve problems of one month, the total time estimate is 3 months.

***Comments concerning installation in the pit***

- Cabling (HV/LV at the site; DAQ, etc…)

The cabling is done during the integration, so another (or the same) rack as the one in the pit should be in the test area.

- DAQ

All the FPGA are connected to a Giga-switch located in the rack. One ethernet cable is going out the switch to the DAQ computer.

- Slow control :

Temperature and humidity will be monitored but the LUXE central slow control. The monitoring of the current of the HV power supply must be monitored in order to switch off the HV in case of prompt current increase (20 values to monitor). For the FPGA, it could be that we also need monitoring of the current or the temperature (need input from Marek).

- Integration

* Once the detector is fully tested with cosmic on surface, it can be integrated (mechanically) with the rest of the experiment

- Alignment

I think that we should have a system to check the relative position of the tungsten plane (like a small target/mirror precisely glued on the tungsten and visible from the outside). Hence, we could survey our system to be sure that it is stable in time

- System tests

Time estimate – 2 weeks?

***Calibration (DESY/CERN ?)***

The calibration strategy still needs to be worked out.

Option 1: Use existing FCAL tungsten frame with ECAL sensors for calibration at DESY (low energy electrons) and CERN (high energy electrons). Calibrate assembled ECAL at DESY with low energy electrons and yse MC to expand to full energu range.

Option 2: Consider dividing the tungsten plates into two, so that half of the ECAL can be calibrated at CERN and DESY and then repeat as in Option 2. This option will require a break of two or three weeks for calibration at CERN.

Option 3: Perform the calibration of the fully assembled ECAL at DESY and CERN, which would require adding another four to six weeks for ECAL readiness to be installed in the experimental hall.

Option 3 may be best from the experimental point of view but carries risks of dmages due to transport.

In summary: 3 months are needed for assembly, 2 months for calibration. In total 5 months for readiness to install.

***Manpower for Assembly***

- 1 technician for glueing and mechanical frame handling

- 1 electronic engineer/physicist for readout installation

- 3 physicists to assist in all the activities, including integration

The above is the minimum.

- 2 graduate students and

- 2 postdocs if available

would be helpful.

***Installation (based on WLO+YB inputs)***

Prerequisites:

- All LV, HV and data cables are installed (these cables connect the sensors (HV), FE ASICS (LV), FPGA (LV, Data transfer) of the ECAL with the rack in the area (may be we deliver a drawing)

- The table for placing the ECAL (together with the tracker) is in place

Actions to be performed:

      - Move the ECAL to the pit and place it on the table (rough weight: 50 kg, need crane) : 2 hrs;

1 technician (DESY), 2 physicists

     - Move the electronics racks to the pit next to the ECAL (as above, included)

     - Survey, to define the position of ECAL precisely (with respect to what? Dipole?):  ½ day;

experts from DESY/XFEL survey, 1 physicist

     - Cabling: 1 day; 1 electronics engineer, 1 technician, 1 physicist (documentation)

     - Tests of HV,  LV, data connections:  1 day + 2 days reserve for potential replacements;

1 electronics engineer, 2 physicist

Total: Time - 5 days;

          Manpower - 2 physicists, 1 electronic engineer, 1 technician (centrally provided), survey team (centrally provided)