Activity for Detector Upgrade of Arm2 in Japan

H.MENJO
For Japanese members

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Contents

- Short introduction about Arm2 upgrade.
- Calibration of GSO plates for Arm2 detector
- Replacement of PMT dividers
- Thermometers in the upgraded detector
Upgrade of Arm2

- Increase the dynamic range of silicon detectors
  -> Lorenzo’s talk tomorrow
- Optimization of depth of silicon layers
- Radiation harder detector
  The expected total dose in 2015 operation is 2kGy <-> 200Gy in 2010.
  Change the all plastic scintillator to the GSO scintillators
Calibration of GSO plates at HIMAC

- **Purpose**
  - Make the position maps of light yield of GSO for all GSO plates before assembling the detector.

- **Experiment**
  - HIMAC: An Ion accelerator in Chiba, Japan.
  - Beam: 400MeV/n $^{12}$C
  - Beam Time: 23 - 25 July 2013 (3 nights)
Experimental Setup

- Irradiated carbon beams into the detector assembled without tungsten plates and silicon layers.
- Surveyed GSO acceptances with 1.5mm x 1.5mm step.
- DAQ was triggered by the trigger scintillators.
Analysis

- Event Selection by dE of Trigger Scintillators
- Fit carbon peak on ADC distribution.
- Normalize the peak ADC value by the value on the center of each plate.
32mm Layer 0

Collimator size

Event number of C peaks

=> Calorimeter position
Maps (25mm Tower)
Maps (32mm Tower)
Replacement of PMT Divider

- Problem
  - During a test with supplying H.V. to PMTs of Arm2, 5 PMT dividers have been broken. (One of capacitances)
  - After some checks, we found that the new H.V. supply had a problem. When switching it on/off, it makes a spike noise with 4.7kV!!!!

- What affect the upgrade.
  - Replacement of PMT dividers is needed. Now we have 9 spares. Now we are checking whether the other ones had a damage or not. This check will be done in this month.
  - If we need to order, the delivery is scheduled in March or April.
  - Anyway, the gain curve of PMT, HV-gain, must be measured for calibration. -> Maybe we can do after assembling detector by N2 laser.
Thermometers in the detector

- PMT has non-negligible dependency of gain on the temperature. -0.3% / degree.

- Thermometer of the current detector
  - Two thermometers (hand-made) with $>> 0.1$ degree precision, which are scotched to PMT holder and Scintillator holder
  - 10 thermometers (TRHX) with 0.1 degree precision, mainly on Si FEC
Increase N-censers

- Because the temperature of detector at SPS (calibration) and the LHC site (operation) is key issue for energy scale, we decided to increase number of thermometers in the upgraded detector.
- The censers will be scotched to near the photo-cathode of PMTs, which is sensitive on the temperature.
- One spare of 200m cable with multiple-wires (25 wires) is available for readout of thermometers.
- Two idea:
  - (Conservative) all readout-circuits are installed in USA15. In this case, 3 wires pre one censer are needed.
    -> N_channel : 8 + 2 (old) = 10
  - (New) install multiplexers at TAN and share some wires for analog signals. -> N_channel : > 32 ch.
Schedule

- GSO scintillators: ready !!!
- PMT divider: March or April if we need to buy
- Thermometer: censers are ready. The readout system will be ready in spring.

When will we assemble the detector ??