

Coordinate Detector OSP

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1 Coordinate Detector Description

The Coordinate Detector (CDet) is a scintillator hodoscope which is to be used as part of the SuperBigBite Spectrometer (SBS) in the nucleon form factor experiments. CDet will provide complementary particle tracking information by measuring the vertical coordinate and can be used as either an electron or proton detector.

CDet consists of an array of 2352 scintillator paddles, with each individual paddle measuring 0.5 cm x 4.0 cm x 51 cm. Each group of 14 of these scintillator paddles are arranged into a single *bar*; there are 28 of these bars arranged into a single *module*, with 14 bars on the left and 14 bars on the right side of each module. There are 6 modules in total in the full detector array, as illustrated in figure 1.

The scintillation light from each paddle is read out via a wavelength-shifting optical fiber inserted through the middle of the paddle and connected at one end to a multi-anode photomultiplier tube (maPMT). The bar and fiber bundle are shown in figure 1. There is one maPMT used to read out each scintillator bar (14 paddles) and so each module has a total of 28 maPMTs. The signals from each maPMT are output to an amplifier-discriminator card based on the NINO chip (referred to as *NINO cards*). The NINO cards for all 14 maPMTs on one side of a module are mounted on the module itself, beside the maPMTs. A short (~ 15 cm) coaxial cable connects eight of the output channels from the maPMT to the NINO card with each maPMT requiring two such connections. The NINO cards provide both an analog and digital output signals; an amplified charge signal for pulse height measurement and LVDS logic signals for timing measurements.

The maPMTs will be operated at voltages of -700 to -800 V. The high voltage for the whole detector is supplied by two CAEN power supplies. Each side of the detector modules (14 maPMTs) will have a single high voltage distribution box attached to it (see figure 1). A single, multi-wire cable will be run from the power supply crates, to the distribution box on the module. The

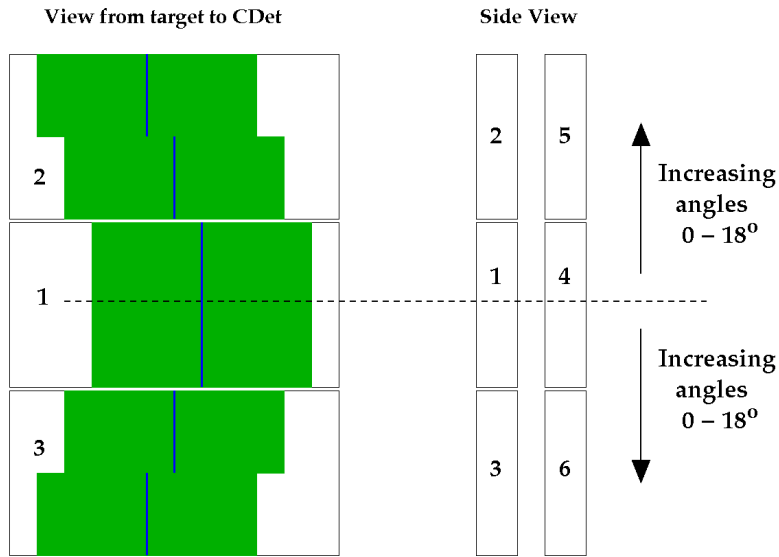


Figure 1: Coordinate Detector: Front and side view of planes of three modules each.

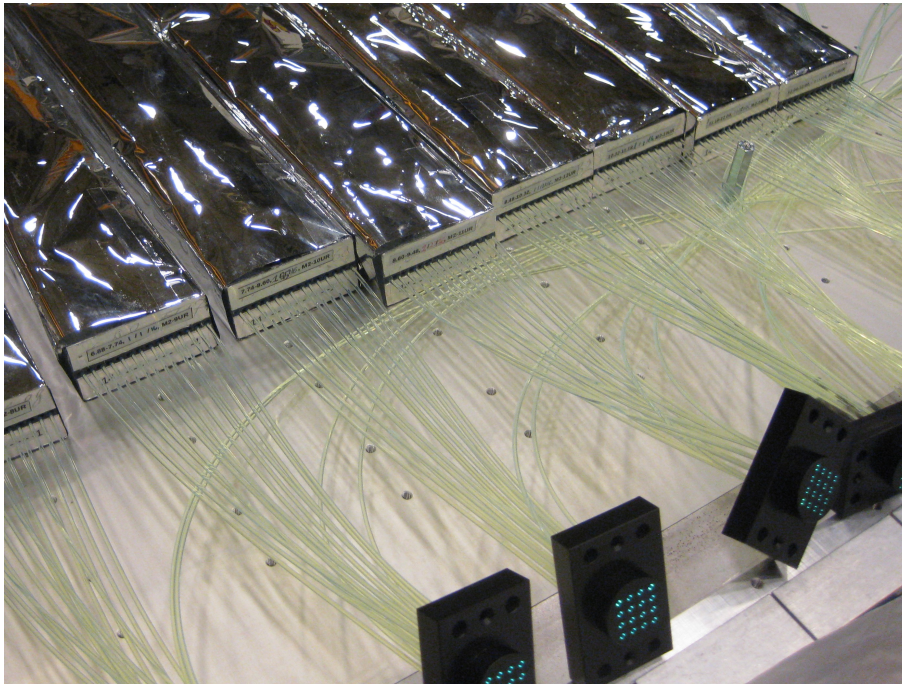


Figure 2: Coordinate Detector: A photo showing several scintillator bars with the wavelength-shifting optical fibers inserted into each paddle.

power supply cables on each maPMT will then connect into the other side of the distribution box. Both sets of power cables have connectors which have recessed pins, ensuring that they cannot be touched by hand. Each wire line in the cable from the power supply crate to the distribution box is connected to a single, individual channel in the power supply which can be remotely controlled via a computer connected to the crate. The software to control each HV channel in the CAEN crates allows for a maximum voltage on each channel to be set and a maximum current draw limit to be set as well. If a current over the set limit is drawn, the power supply will shutdown.

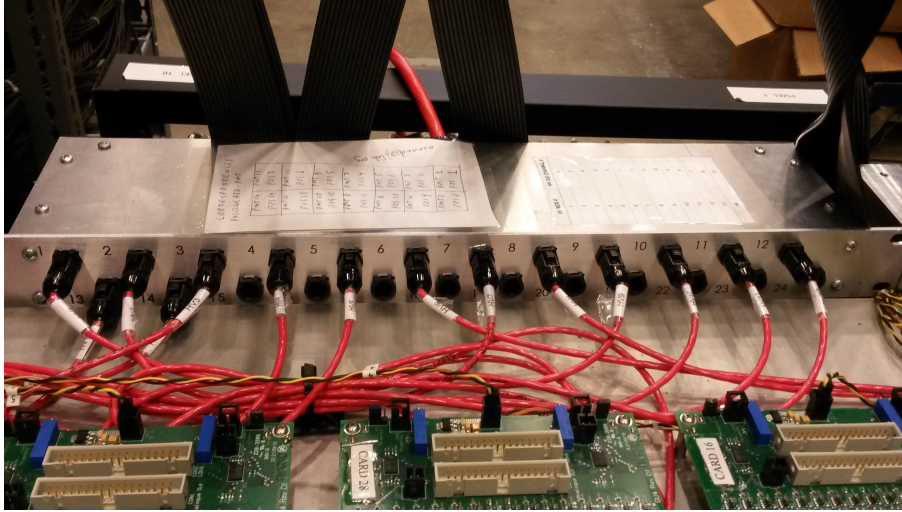


Figure 3: Coordinate Detector: A photo showing the distribution box for the high voltage required to power the maPMTs. Note the single cable coming into the box and the fourteen individual cables for the maPMTs.

The NINO cards operate from a +5 V power supply and each card draws a current of ~ 1.25 A. A common low voltage power supply will be used to power each set of 14 cards on each side of one module. There will be a single distribution panel for each set of 14 cards (located on a patch panel close to the detector), with individual fuses on each line to each card. A single power cable will run between the low voltage supply and the distribution panel; see figure 1. Each NINO card will have a separate power line running from the distribution panel to the card. The pins on each connector on both the incoming and outgoing lines to the distribution panel are recessed and cannot be touched by hand. The NINO cards are grounded to the module via the screws connecting each card to the module.

Each of the six modules will be individually grounded to the vertical support frame which is shown in figure 1. The frame in turn will have a connection to ground in the hall.

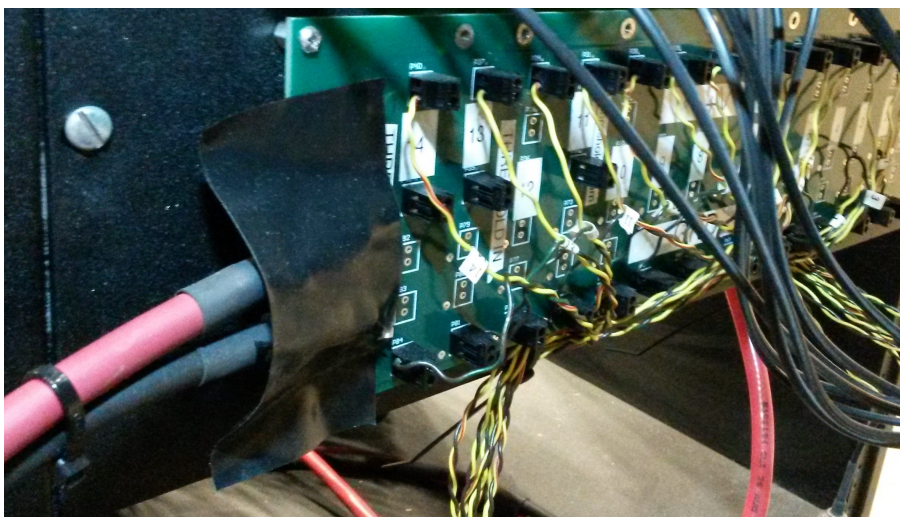


Figure 4: Coordinate Detector: A photo showing the low voltage distribution panel on the detector. A single power line is input into the panel and all the NINO cards have individual lines drawn from this board.

2 Readiness of Equipment

Currently, all six modules have been assembled (see figure 2) and the first one is undergoing testing and commissioning. The commissioning has included development of data analysis software which will be used for the coordinate detector as part of the overall SBS analysis software package during the experiments. Three modules of scintillators will be assembled into a single vertical plane; the full six modules will make two such planes of scintillators.

Full assembly of one plane will occur once three modules have been tested and commissioned. The stacking and connection of the three modules together into a single, continuous plane will require care and will allow the engineered connection between modules to be assessed and checked. The second plane of three modules will not be assembled until after those modules have been commissioned and the first plane has been satisfactorily assembled.

The commissioning of each module is subject to the production and check of the NINO cards by collaborators from the University of Glasgow, Scotland. Currently, it is expected that all 168 cards will have been produced and tested by the end of June and will be subsequently shipped to JLab. There are a set of 14 cards already in use at JLab for the commissioning of one side of the first module.



Figure 5: Coordinate Detector: A photo showing the large vertical frame which will hold the two planes of modules.

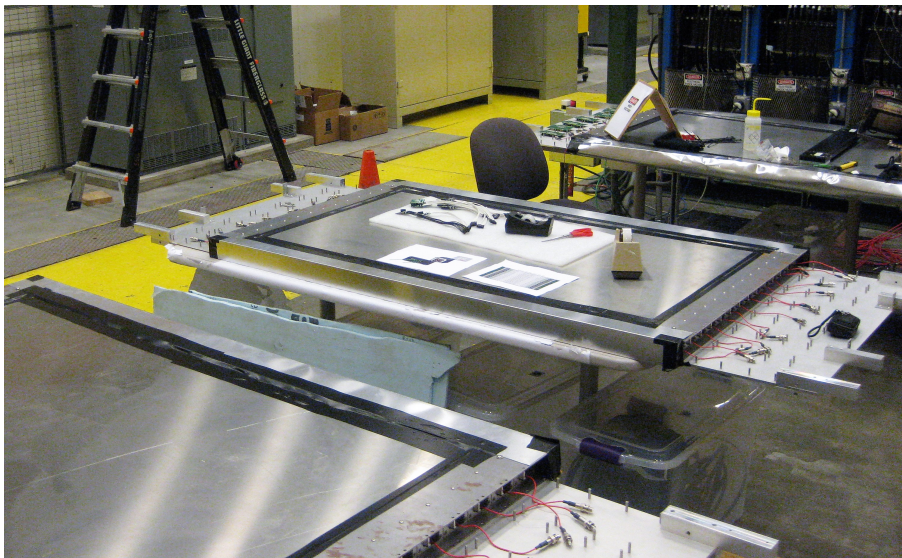


Figure 6: Coordinate Detector: A photo showing three out of the six completed modules; the other three are complete but not in the photo frame of view.