

# GEMs Semester Report Fall 2008

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## **Abstract**

*There were many setbacks this semester, but many of our goals were accomplished. Two new foils were mounted and the vacuum feed through system for the lid is well underway. The materials for the new lid are all ordered after the failure of the first design. The glue machine was used, to much success as well as continued use of the new equipment purchased last semester. A smaller, strip readout was made out of a copper board and will be implemented next semester with the use of two readout chips mounted directly to the board.*

# 1 Introduction

This semester focused on the development of the new lid, which should be complete early in January. The other major area for improvement that was addressed was the large capacitance in the readout board.

# 2 Equipment

New equipment purchased this semester is limited to the vacuum feed through components for the new lid.

# 3 Problems

This semester we dealt with many setbacks including the first design of the new lid, high leakage currents, and an empty gas canister.

## 3.1 Vacuum Feedthroughs

The first design for a lid utilizing vacuum feed throughs was designed from a fitted stainless steel lid like the one currently used. This was then drilled out for the feed throughs which included drilling 6 mounting holes per component to lock it in place. The openings had to be large enough to prevent the SHV leads from sparking to the box as well. This resulted in several problems. The first was warping of the lid when the screws were welded. Using such a thin piece of stainless steel caused massive pull on the outer edges. This warping, while making the lid difficult to mount was not the biggest problem. Once mounted we found only minor leaks around the bottom of the lid. The largest problem occurred under the vacuum feed throughs. Here the leak flow was two orders of magnitude higher than anywhere else on the box. This problem occurred because of an insufficient force between the feed through and the surface of the thin sheet of metal. The force was not strong enough to crush the copper rings required to seal the feed throughs.

To get around this problem we have redesigned the lid to be made out of 1/2 inch thick cold roll steel. Half-Nipples with flanges to mate to the feed throughs will then be welded to the steel plate. This new design is much more robust than the previous one and will also yield a lid that is directly

clampable. To achieve airtightness cold roll steel must be used for its smooth finish (per Bill in the machine shop). We have had success machining cold roll in the past with our first version of clamps. This design should be quick to build and easy to implement.

### **3.2 High Leakage Currents**

The high leakage currents came as a surprise since before the summer all foils had worked satisfactorily. This restates the delicacy needed when working with GEM foils. Two foils were framed and tested this semester and both are in the current version of the detector. This was the first chance to use the glue machine which worked superbly. The application was even and thorough.

### **3.3 Gas Canister**

The empty gas canister was a lack of our ability to consistently update the logbook with the pressure readings on the regulator. It simply needs to be mentioned that this is an easy task that should be done every day.

## **4 Progress/Results**

The progress made this semester centered around the construction of the new lid, but it would not hold any measurable pressure. From this experience we were able to take the design of the new lid and the components that were going to be used for it. The additional items needed for the new design have all been ordered and are on their way. With the knowledge of the last build this process should take place relatively quickly.

Some time was also spent exploring the movement of the detector to the bottom of the box instead of keeping it on the lid. This idea was abandoned due to the difficulty of connecting the electronics out of the box through the lid.

The readout was also cut smaller based on Amilkar's trials over the summer with capacitance created noise on the readout plane. The new area is roughly 7% of the whole board, which is what was previously used. This was done by

cutting the copper layer off the board in two areas. The current chip is only good for one channel, but the two strips in the board were designed so that a separate chip can be connected to each giving us two separate channels of readout.

## 5 Conclusions

This semester involved a lot of planning and design, unfortunately it will mostly not be used. It was however, quite a learning experience. The overall design will be used in the new version of the lid and we will use what we learned to complete this process efficiently. The new design of the readout is promising and will be explored thoroughly next semester.

Also, the possible implementation of a GEM specific power supply is promising as well. With these modifications we have addressed many of our major problems, SNR, high leakage currents, and gas leakage. Our next goals are to set up and systematically raise the voltage on the GEMs and hopefully see an actual signal from our source.