

Assembly of Electromagnetic Calorimeter Supermodules for the Hall A BigBite Spectrometer

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For Hall A’s BigBite spectrometer, a new electromagnetic calorimeter (ECAL) is being assembled. This ECAL is made up of 191 supermodules, each containing nine lead glass blocks. This note discusses the assembly procedure for ECAL supermodules.

Hall A is assembling an electron calorimeter (ECAL) [1] for the BigBite spectrometer, Figs. 1a and 1b.

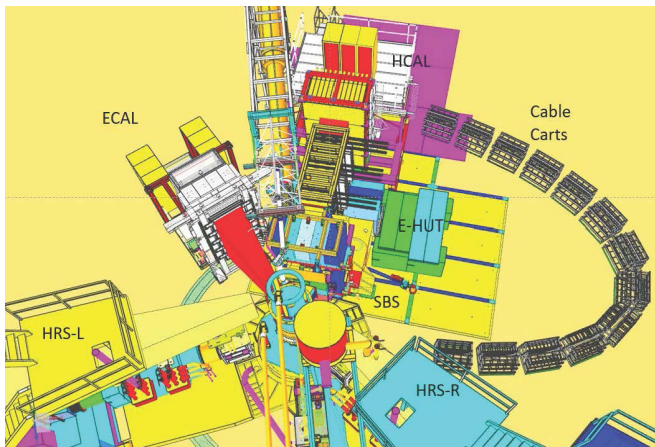
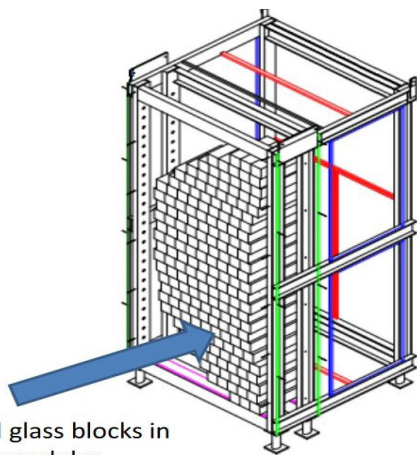


FIG. 1a. Spectrometer layout in Hall A.



1719 lead glass blocks in 191 supermodules

FIG. 1b. ECAL structure. Blue arrow indicates particle incidence plane.

The assembly process for a super module requires preparing a support frame for the nine lead glass blocks, preparing the lead glass blocks, and inserting the lead glass blocks in the support frame [2].

First, the fabricated support frame is disassembled, inset screws are installed in the removed end plate, small pusher plates and springs are super-glued to the end plate, and all remaining screws on the support frame are loosened.

Next, as shown in Fig. 2, each pre-wrapped lead glass block’s light guide is cleaned with isopropyl alcohol and then wrapped in a 4.25” x 5.00” sheet of 0.015-inch thick aluminum foil, which helps protect the light guide and aides in directing light to the detector’s PMTs.

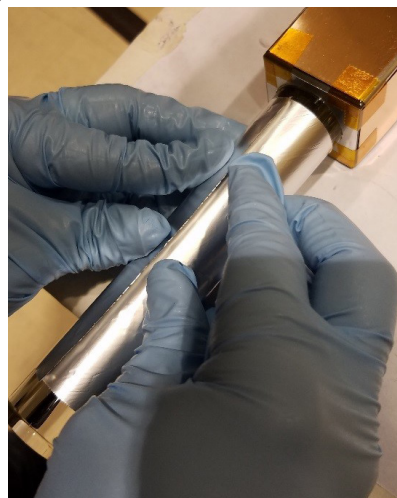


FIG. 2 Wrapping of a light guide. The lead glass block at the far end has been wrapped in aluminum and copper.

Once all light guides are wrapped with foil, the nine lead glass blocks are inserted into the support frame in a 3X3 matrix, Fig. 3. During this process, the shortest lead glass block is placed in the middle of the 3x3 matrix.



FIG. 3. Lead glass blocks in a 3X3 matrix in the support frame.

The assembly jig is then placed over the support frame and lead glass blocks, exercising care to follow the labeling for the left and right side. The end plate with springs and pusher plates glued to it is inserted into the assembly jig and secured in place using six screws on the assembly jig. The six screws compress the springs on the end plate against the glass blocks, providing enough force to hold the blocks in place as the end plate is fastened to the support frame with twelve screws (six on left, six on right). After all screws have been hand-tightened on the support frame, the assembly jig can be removed and set aside. A clamp is then used to compress the partially assembled supermodule to ensure the glass blocks are properly aligned. All screws on the support frame are then tightened.

To ensure that the lead glass blocks in the supermodule are securely held in place, the inset screws previously installed on the end plate are tightened until the audible sound of the temporary glue breaking is heard. The inset screws are then unscrewed to their starting position, and retightened to 48 inch-ounces using a torque wrench. Because the length of all glass blocks varies slightly, the inset screws cannot be tightened until they are visually at the same location and must be tightened using a torque wrench to avoid over- or under-compressing the springs.

Due to the weight of the fully assembled super module (~60 lbs), the supermodule is moved by sliding it onto a cart for transportation to the holding shelves. To protect the supermodules during this process, the bottom of the assembled supermodule is wrapped in a thick sheet of aluminum foil as the last step in the modules assembly (Fig. 4).



FIG. 4. Assembled supermodule just before step of wrapping bottom in aluminum foil.

In summary, to ensure the appropriate procedure is followed while assembling supermodules for the ECAL detector in Hall A's BigBite spectrometer, the procedure was documented in detail. So far, assembly of 126 of the 191 supermodules has been completed.

- [1] A. Shahinyan, Electromagnetic Calorimeter of Super BigBite Spectrometer at JLab Hall A, epd.yerphi.am/30.01.19%20A.Shahinyan.pdf, Accessed Aug. 2019.
- [2] BigBite Super Module Assembly, May 13, 2019, https://www.jlab.org/div_dept/physics_division/dsg/technical_documentation/Hall_A/ECAL/BigBite_Super_Module_assembly_5-13-2019.pdf