

Manifold Assembly Procedure w/ SiPMs and CMBs

Mu2e CRV Module Factory



 **Fermilab**

And

University of Virginia
High Energy Physics Laboratory

August 2019

DocDB 28647

Most up-to-date version can be found on Google Drive:

<https://docs.google.com/document/d/1dfZz2SLxfGGj1w3rqtkMbLIbRa0bIPjZo7KoZoHX1JQ/edit?usp=sharing>

Summary:

Manifolds are made by first placing and logging SiPMs into the SiPM mounting block (SMB) wells, then screwing down and gluing the CMB to the SMB. Completed manifolds are unscrewed from the assembly fixture and stored in the “complete manifolds” pelican box.

1. Placing SiPMs in SiPM Mounting Blocks (SMBs):

- a. Retrieve tested SMBs from office 115 downstairs
 - i. SMBs must first have passed for correct hole sizes, (no-go test and go-gauge test)--see Eric for details
- b. Retrieve seals from storage in assembly room
- c. Place a seal on the bottom of each SMB and place in tray, with SiPM holes facing up and seals facing down, with channel 1 (indicated by the square hole) nearest you and channel 4 (indicated by the circle hole) farthest from you (see figures A,B, and I), such that they are all aligned the same way, until the tray is filled (they each hold 16 manifolds)
 - i. The easiest way to peel the seal so that the paper does not break is to peel the paper cover up from the thick middle part and let the thin outer pieces follow (see figure A)

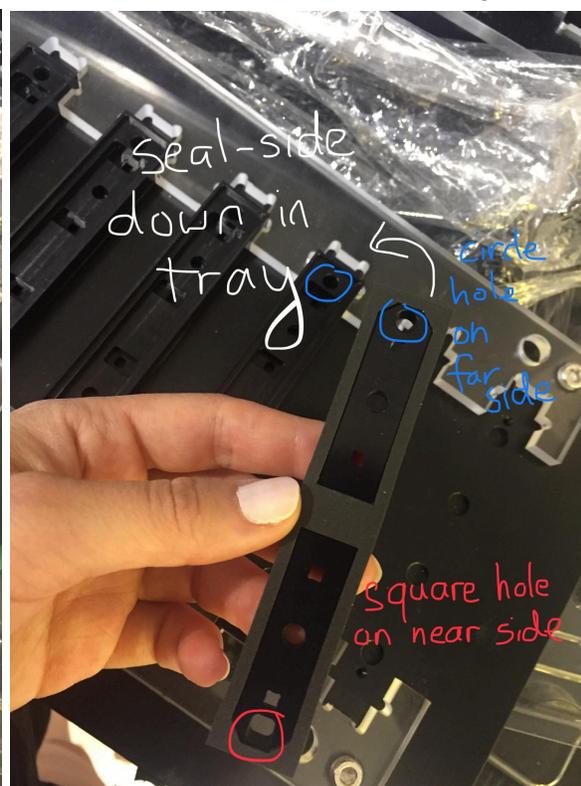
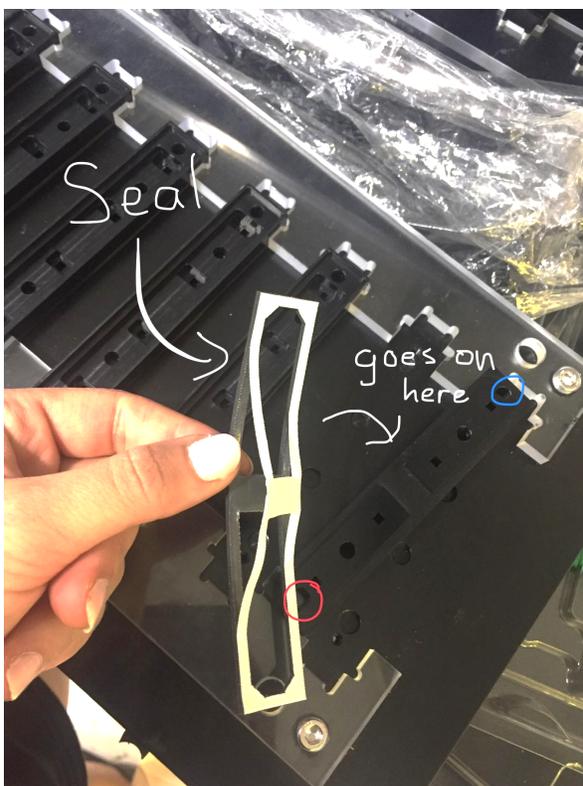


Figure A.

Figure B.

- d. Retrieve tested SiPMs from 115 or see Steve Boi -
 - i. SiPMs marked with red sharpie (see figure C) are unusable and should be set aside to be discarded,
 - ii. SiPMs marked with black sharpie (see figure C) are questionable and should be set aside as extras to potentially be used if necessary, if used log their number in bold when logging in step 1f

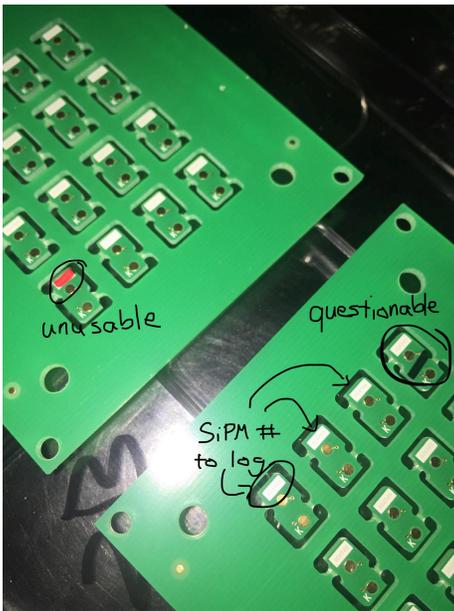


Figure C

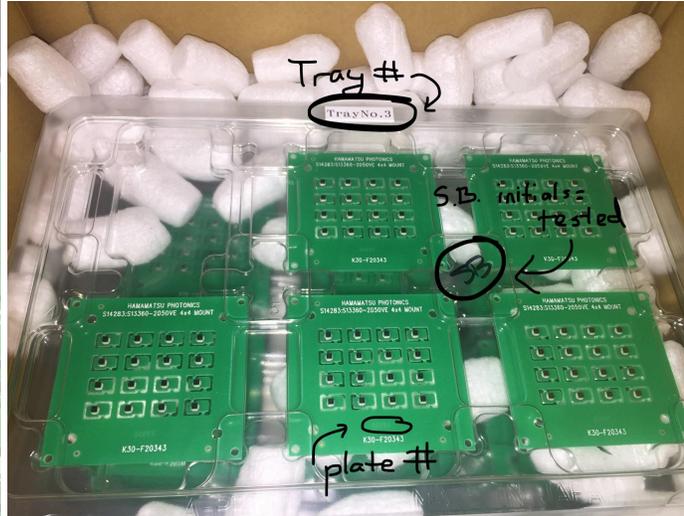


Figure D

- e. Take one SiPM plate at a time and place it inside the metal SiPM-punching, with the raised part of the SiPMs face down inside the divot and the numbers facing up, aligned with the bumps on the top piece. Press down on the top piece until all SiPMs are punched out of the plate and then remove top piece to access SiPMs

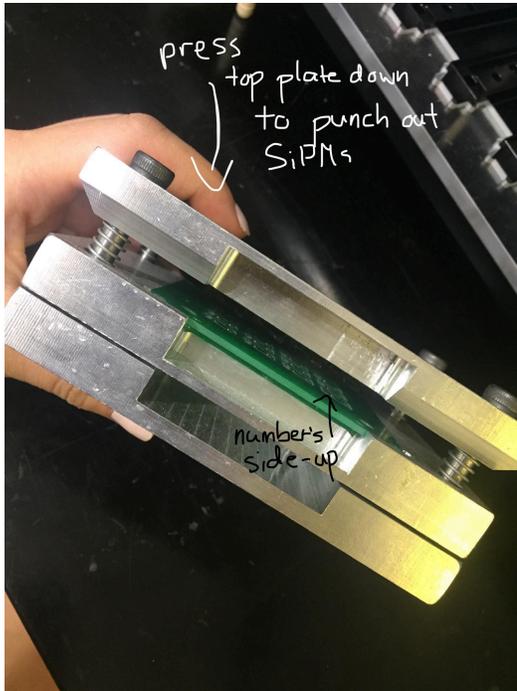


Figure E



Figure F

- f. Find the number on the side of the first SMB (it should include a letter followed by 3-4 digits, see Figure I), Find this SMB number on the Manifold SiPMs and CMBs spreadsheet using the ctrl+F search tool.
 - i. Manifold SiPMs and CMBs spreadsheet: <https://docs.google.com/spreadsheets/d/1S-gnlpmSGLNPjiqkllowLuQYKnNO49ZCGIoNE0CJers/edit?usp=sharing>
- g. Using the pressure suction tool (or tweezers if that is unavailable) place one SiPM in each SiPM hole in this first SMB, ensure that the raised chip is facing the correct way to fit the holes and lie completely flat. As you place each SiPM log the number of the SiPM (letter followed by 5 digits) for

the SMB in which it is being placed in the Manifold SiPMs and CMBs spreadsheet. Ensure that you are logging each SiPM in the correct channel column of the spreadsheet, starting from channel 1 (nearest you on tray, farthest left on spreadsheet) ending channel 4 (farthest from you on tray, furthest right on spreadsheet)



Figure F



Figure G

- i. To ensure the SiPMs are placed correctly, you can carefully lift an SMB out of the tray and look at the bottom, you should see the metal chip of each SiPM evenly sticking out of the SiPM hole. This is not a necessary step for every single SMB, but a good idea for the first few and any you are unsure of until you can clearly tell if the SiPMs are placed correctly from above (see Figure H)



Figure H

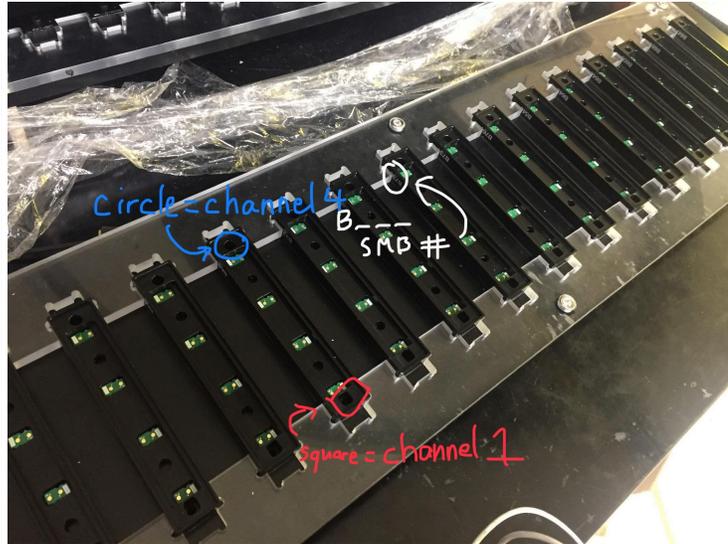


Figure I

- ii. Also log the plate number, found towards the bottom of the now empty plate of SiPMs, and the tray number, which is found on the top of the clear plastic piece holding up to 6 SiPM plates. (See Figure C)
- h. Repeat steps 1f and 1g for the rest of the SMBs in the tray, punching out new SiPMs (step 1e) as they are needed (usually this will be every 4 SMBs--more frequently if any are damaged/questionable and need to be set aside)

2. Gluing CMBs to SMBs to create full manifolds:

- a. Retrieve tested CMBs from pelican box labeled with tested CMBs (or from Steve Boi if none can be found here)
- b. Place one CMB on each SMB in the tray
 - i. Alignment: On the bottom of each CMB Flashgates 0, 1, 2, and 3 are labeled (see Figure J). Flashgate 0 should be placed on the side of channel 1, flashgate 3 therefore being on the side of channel 4, (recalling that the side with the square hole is channel 1 and the side with the circle hole is channel 4).
 - ii. They should then all be facing the same way from above, assuming you correctly placed all the SMBs facing the same way.
 - iii. CMB numbers for each manifold do need to be logged, but their ID numbers can only be read by the computer, so these numbers will be logged when the manifolds undergo testing on a module (so you do not need to log anything for the CMBs yet)
 - iv. If the CMBs have excessive fiberglass sticking out on the sides, file this down until they fit in the top of the SMBs (a mask is recommended as breathing in fiberglass is very bad for you)
 - v. As you place each CMB ensure that all 8 metal spokes are sticking out the same length--any without even spokes should have been already weeded out during CMB testing but you should check anyway, (metal spokes labeled in Figure J)

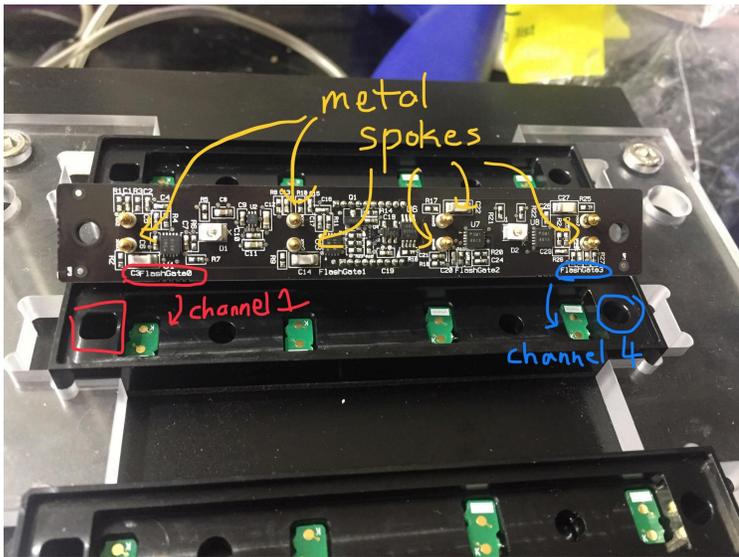


Figure J



Figure K

- c. Screw both ends of each CMB into the tray, tightly enough that you cannot press the piece further into the tray, but no tighter than this as the SiPMs can be damaged if the CMB is screwed on too tight.
- d. Once all the CMBs in a plate are aligned and screwed on correctly, you will glue them on with RTV, using the other piece of the pressure tool, prepare this RTV as follows:
 - i. If there is not already a syringe of RTV (Geocel 330, same as module TV) prepared, find and fill a syringe with RTV, leaving about an inch of space for the luer lock, then press the luer lock into the back end of the syringe, (sometimes RTV can leak out so watch for it and work over a paper towel to be safe)
 - ii. You will then need a syringe tip, approximately 16 gauge sized (the short 1/4inch 16gauge grey ones in the RTV box work well--see Figure M, if you need help finding these ask Eric or Wayne). Screw this syringe tip onto your new syringe or if you are working with a syringe already prepared, screw the old syringe off and replace it with this new tip.
 - iii. Over a paper towel (in case of RTV leakage) screw the prepared syringe onto the pressure tool, using the piece that forces air out as opposed to the suction tool, see Figure L

- iv. Using the foot pedal test out different pressure amounts (usually between 20-30 PSI works well) and power of the air pressure tool (the knob near the tube that the RTV syringe is connected to) until the RTV comes out when you press the pedal at a comfortable pace.
 1. If you have trouble working the pressure tool Eric is well-versed in this and can help, some things to check are that you do not have the time switch turned on, the tool is plugged into both electricity and air pressure, the pressure is high enough--but not so high that RTV leaks out when you are not pressing the pedal, and you are using the correct pedal.

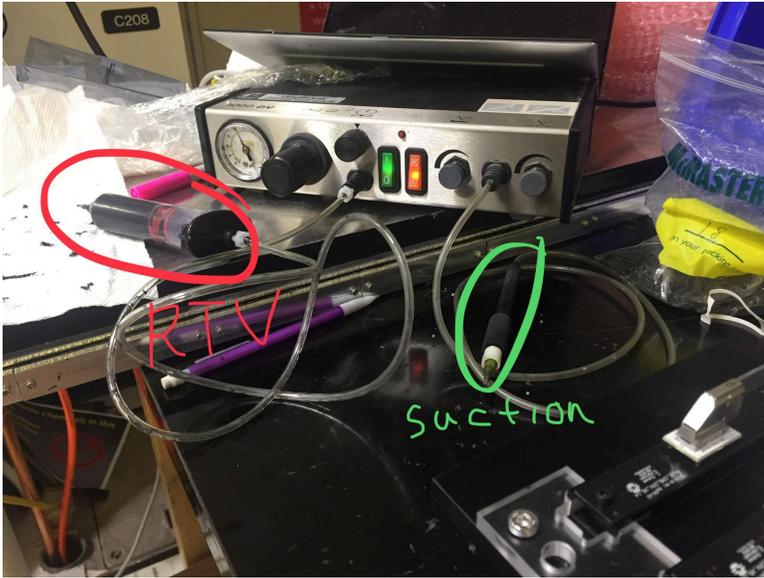


Figure L



Figure M

- e. Use the RTV syringe now connected to the pressure tool to glue each CMB to the manifold, (for your first time doing this it is best to have Steve Boi or someone else who knows how to show you)
 - i. With the syringe pointing away from you push a small blob of RTV evenly away from you along each side of each CMB. You can glue the entirety of one CMB at a time, or what tends to be faster is gluing one side off all the CMBs, then turning the tray and gluing all of the next side, etc.
 - ii. The main thing to watch for is ensuring that there are no holes in your gluing, so that the manifolds are all light-tight



Figure N



Figure O



Figure P

- f. Once all the manifolds of a tray are glued, leave overnight to dry.
 - i. Place an old tip which is dried fully closed on the RTV syringe to prevent the RTV from drying out

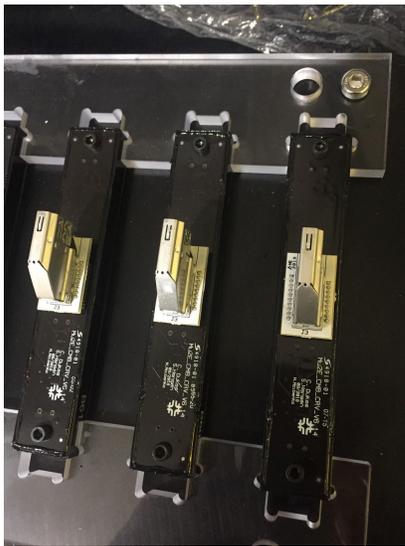


Figure Q-wet

Figure R-dry the next day

- g. The next day, check the now dry manifolds (Figure R) for any holes in the glue that would prevent them from being light tight,
 - i. Keep any with holes in the glue set aside to reglue over their holes with the next set of CMBs that are glued
- h. Unscrew all the manifolds that are now dry and complete (Figure S), without holes in the glue, and place into the Pelican box for completed manifolds, with the CMB side facing down and the SiPMs poking out of the top (Figure T).
 - i. This is a good time to check that the SiPMs are each poking out correctly, and *gently* nudge any that are not placed correctly with your nail or tweezers to get them to poke all the way out
 - ii. If excessive fiberglass is sticking out on any of the CMBs preventing it from fitting in the pelican glass, this can be *carefully* filed away

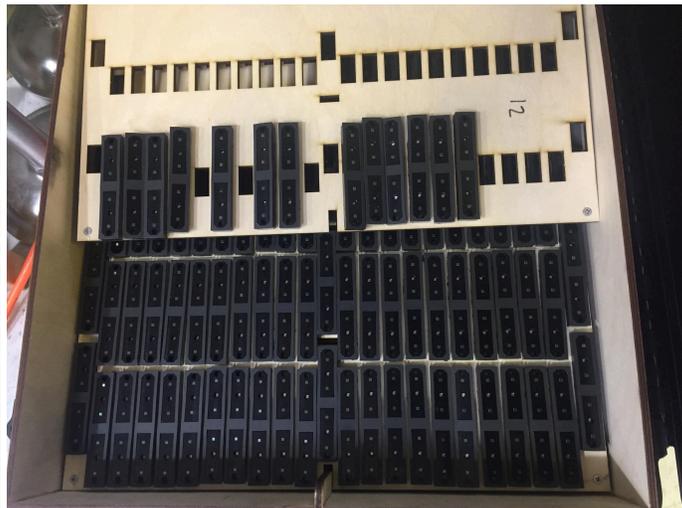


Figure S

Figure T

- i. When an entire layer of the pelican box is filled, move it to the bottom so it is below all the empty layers of the pelican box and begin filling the new top layer.