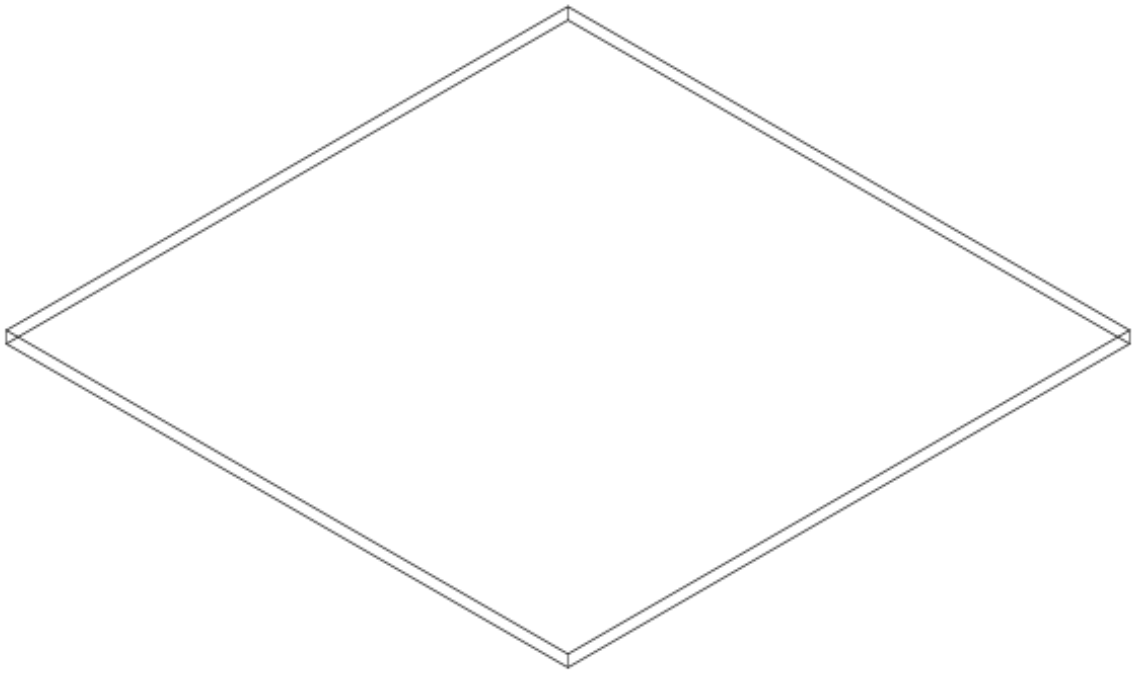
Detectors

Scintillator Block

Choosing a block

Choose a scintillator block with these properties:

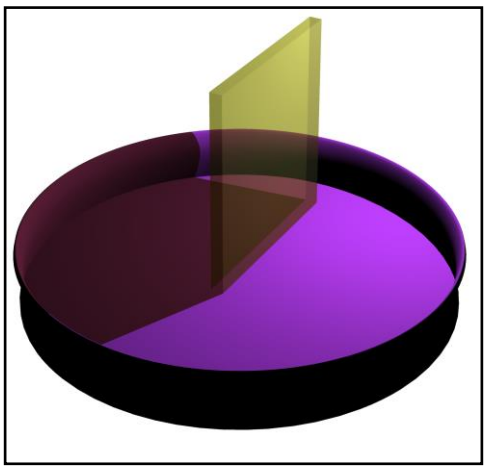
1. Mostly square, approximately 2 ft by 2 ft and ½ inch thick.
2. Not warped or bent or cracked.
3. As smooth on the surfaces as possible (e.g. no old glue from previous PMT collars)



Smoothing the Sides (not always necessary)

1. Take block to machine shop
2. Talk to man running shop about how to take off jagged edges (there are about 6 ways to do this).
3. Perform chosen method

Sanding the block



1. Lay a plastic children's pool down in an open area. This is meant to minimize the amount of scintillator dust that gets on the floor and spreads out. Use a chair or stool to sit on while sanding the block.

2. Place the block on edge. Using a razor blade, run along the top edge of the block several dozen times back and forth. Use a gentle force, enough so that scintillator dust scrapes off easily.

3. Turn the block on another edge and run the razor blade along this edge many times. Continue with all edges (not the faces!). Repeat with razor until all edges are smooth and flat.

4. Place paper towels (or other paper) beneath scintillator block to avoid scratching up edges with the bottom of the pool.

5. Once edges are all smooth from the razor, switch to a sanding block. Use a medium-fine grain first (e.g. 1200). Wet the sand paper using a bucket of water. Sand all edges in a similar fashion as previously done with razor.

6. Switch to a finer grain, such as 2000. Repeat.

7. Sand once more with a finer grain, such as 2500. Repeat for all edges. Typically 3 or 4 different sand papers makes the edges smooth enough. A simple test is: can you see through the block on edge clearly?

Polishing the block

1. Gather A LOT of paper towels.

2. Place a dime-sized drop of plastic polish on a handful of paper towels.

3. Rub polish into one edge of scintillator block.

4. Continue with all edges. Repeat polishing until edges of essentially 100% see-through.

5. Polish the faces. This will take significantly more polish and more time. Be sure all scrapes and scuffs are gone.

a. Use a circular motion for best results.
b. Some scratches may be too deep. Keep trying to polish it to the best of your ability!

Collar for the block

1. Lay the scintillator block on one face on a large cleared table top. Place newspaper or paper towels underneath it so that the face does not get scratched.

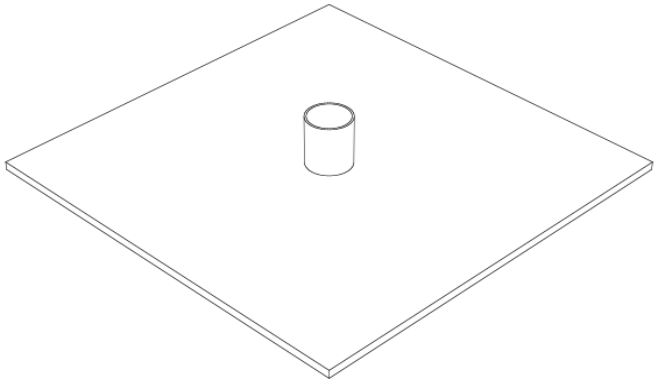
2. Find a PVC pipe “collar”. These are typically white or spray painted black.

3. Calculate the center of the face of the block (diagonals work easiest).

4. Coat one edge of the PVC pipe with PVC cement.

5. Gently set the collar at the center of the face, taking extra care to avoid excess PVC cement from getting to other areas of the block.

6. Use a book or another heavy object to weigh down the collar. Wait a day for the collar to dry.



Covering the block with aluminum foil

1. Using heavy duty aluminum foil, find the “shiny” side (more reflective, less opaque). You will be covering the block in such a way that the shiny side is facing the inside of the block (so photons inside the scintillator will be reflected by the foil)

2. Cover the entire block with aluminum foil sheets. This is best done in a “wrapping” fashion. Another individual can help by lifting the block up so that sheets can be placed underneath.

3. SHINY SIDE IN!!!

4. Use scotch tape to tape the edges of the aluminum foil to itself. You are essentially making a shell or case of aluminum foil around the block. Cover it ENTIRELY.

5. DO NOT TAPE DIRECTLY TO THE BLOCK!! Some overlap of the foil will be necessary. Avoid too much overlap, however. Be efficient with the foil.

6. Around the collar may be tricky. Use smaller pieces of aluminum foil. You CAN tape directly to the collar.

7. Edges may also be a problem. As before, be efficient. Pretend you are wrapping a present.

8. All outside aluminum edges MUST be taped down.

9. One layer of aluminum is all that is needed.

Casing the Block

1. You will need: black paper casing with center hole, cardboard sheet (about the size and thickness of the block), black rubber square with center hole (for collar), plenty of black electrical tape (you may need to use thick and thin versions)

2. Set the cardboard down. Place your aluminum foiled block on top of it. Place the black casing on top of the block.
   a. The black paper casing may not fit exactly as blocks are slightly variable in size. The electrical tape later will help keep it down.

There is another alternative method of casing the block. Place a black casing with no hole down on the table. Place the cardboard inside the casing and then put the aluminum foiled block on top of the cardboard and black casing. Place the black paper over the block and then finally place the black casing with the black rubber square over the block to seal it. This method is better because the other method has the cardboard exposed to the elements. With the plastic casing, the detector is less likely to be destroyed by water damage.

3. Snugly fit the black rubber square over the collar.

4. Use the electrical tape to tape down:
   a. Around all the edges and corners to the block and cardboard.
   b. Around rubber square.
   c. Around collar.

5. Be sure to not stretch out the electrical tape. Place it as is when taping. Stretching it makes it less light tight.

6. Your goal is essentially to make the detector COMPLETELY LIGHT TIGHT. Meaning, NO LIGHT can enter. Tape every nook and cranny. Corners and the collar are exceptionally vulnerable.