

HISPARC

CONSTRUCTION OF THE DETECTOR

Read this guide before you start!

Short description of what you will do:

The detector consists of a scintillator plate, a light guide, attached to which are a small connection block and a photo multiplier tube (PMT). The light guide is glued on the scintillator plate with epoxy resin and the connection block is glued on the light guide. After the adhesive has dried the whole detector is wrapped up in aluminum foil and subsequently in pond foil. Finally the PMT is connected to the connection block with double-sided tape. The PMT has to be calibrated in advance.

Preparation of the scintillator plate

Important note: Always wear gloves when working with the scintillator plate!

1. In order to protect the plate, put a piece of paper or a piece of thin foam plastic packing material on the ground and on the table.
2. Separate approximately 5 cm of the protection foil from the plate at the side where the light guide will be glued.
3. Smooth the edge of the scintillator plate with wet waterproof sandpaper type 500 or 600:
 - a. fix the sandpaper with double sided tape on a piece of waterproof multiply wood
 - b. smooth flatly with water, pay attention especially to the corners, there you will easily go wrong
4. Clean the smoothed surface first with a tissue and water, afterwards with a tissue and alcohol.
5. Adhere very accurately special quality tape (e.g. black pvc tape), which does not leave behind adhesive remains, to both sides of the scintillator plate over 5 cm breadth
6. Construct small anti-leakage gutters at both sides of the scintillator plate with double paper tape, take care that the gutters cannot flip
7. Carefully clean the edge with an antistatic polishing cloth.
8. Put the scintillator plate in the mould. Pay attention to a flat connection, don't clamp too strongly (see photograph). Pay attention to the paper gutters.

Light guide and connection block

1. Smooth the light guide at both sides with waterproof sandpaper type 500 or 600
2. Smooth the side of the connection block at the side that will be glued to the light guide. Do not smooth the other side!
3. Construct an anti leakage gutter at the upper part of the light guide with double paper tape

Gluing procedure

1. Put the fixing clamps ready next to the mould.
2. First practice the adhesion procedure with water by slowly letting down the light guide along the mould onto the scintillator plate. Continue practicing in this way until you control the process. Afterwards dry the surface with a tissue.
3. Next put the light guide on the table again and carefully check the surfaces. Keeping the surfaces clean is very important, if necessary clean with alcohol.
4. Prepare the two components epoxy glue:
 - a. pay attention to clean hands, if necessary take new gloves
 - b. pour 8 grams of epoxy resin EJ 500 (4 grams per plate) into a beaker glass on an electric balance (eventually use a plastic syringe)
 - c. add exactly 2 grams of hardener EJ 500 (1 gram per plate) using a thin injection needle (NB: for other types of epoxy resin other percentages may be required)
 - d. make the beaker heavier at the bottom e.g. by means of a fixing clamp, so that the beaker cannot fall over
 - e. mix the two components thoroughly by stirring
 - f. put the beaker in an exsiccator and evacuate until all bubbles have disappeared
5. Again check the surfaces that will be glued together and if necessary clean them with alcohol.
6. Carefully put the glue in an unbroken trace on the upper part of the scintillator plate. During the pouring guide the resin by using a stirring rod.
7. Slowly let the light guide down onto the scintillator plate. Pay attention that the glue becomes an unbroken layer
8. Clamp the light guide to the mould with the fixing clamps. Take care not to damage the surfaces
9. Next glue the connection block onto the light guide. Pay attention that the block is in the correct position. Keep it in position by using firm tape.

The glue must dry now for at least 48 hours.

After the glue has dried

1. Wear gloves! Clean the table!
2. Take the detector from the mould and put it on the table again. Remove the adhesive tape and eventual remains of epoxy resin carefully by means of a thin and sharp knife.
3. Put the detector in the upright position and remove the protecting foils from the scintillator plate and the light guide.
4. Clean the surfaces with an antistatic polishing cloth.
5. Prepare another table for wrapping up the detector. Carefully clean that table to prevent pinching the pond foil that will be used to cover the detector
6. Measure a piece of black pond foil, at least 120 cm wide and about 175 cm long, and put it on the table, make it antistatic with an antistatic cloth
7. Cut off a piece of thin aluminum foil with the breadth of the roll and a length of 175 cm

and put the foil flat on the pond foil. First put pieces of double thick aluminum foil at the places where the corners of the detector will come.

8. Put the detector in one move in the right position on the aluminum foil, do not push!

9. Reinforce the foil at the corners with tape. Now fold the aluminum foil around the sides of the scintillator plate. Make a cut in the foil at the corners and also fold it now around the bottom.

10. Fold the foil around the edge of the light guide and fold back, so that the edge becomes visible in the foil. Cut the foil with a sharp knife and a metal ruler in the right shape using the print of the edge as an orientation in cutting. Fold the foil around the sides of the light guide. (other method can be folding both sides of the foil entirely on the light guide and subsequently taping together)

11. Leave approximately 15 cm free at the upper side for putting on additional aluminum foil after attaching the photomultiplier

12. On another table cut a new piece of aluminum foil, in breadth and length exactly appropriate to the shape of the detector

13. Put the foil on the detector on top of the folded foil and tape it tightly, first with pieces, after that with a long strip

14. Reinforce the corners and sharp edges with 2x double thick aluminum foil and fix with ordinary tape.

15. Turn over the plate, attach the reinforcement pieces to the corners with tape and turn over the plate back to its original position.

16. Next fold the black plastic foil around the detector to wrap it up light tight

17. Tape the black plastic seams triple with black PVC tape. First let the strips of PVC tape hang out in order to reduce elasticity effects.

Fixing the photomultiplier

The phototube should be calibrated in advance!

Practice the actions with the photomultiplier tube before you take away the protecting foil. NEVER connect the PMT without the protecting foil to the electronics and to the power supply

1. Carefully remove the protecting foil from the front side of the photomultiplier.

2. Take away the red protection foil from one side of a piece of double sided tape.

3. Put the front side of the photomultiplier on the double sided tape and push.

4. Carefully cut the double-sided tape around the photomultiplier using scissors or knife

5. Carefully remove the protection foil at the other side of the tape with tweezers

6. Fix the photomultiplier on the upper side of the connection block. Do this by first putting the tube with the tape on the edge and then continuing the fixing by a rolling movement. In this way you prevent bubbles under the tape.

7. Put aluminum foil on the remaining piece of the detector

8. Reinforce the photomultiplier construction with wooden splints and wrap the photomultiplier part light tight in pond foil in the way indicated in fig 2 and fig 3, again using black PVC tape for fixing

The ski box

1. Open the ski box and mark the keys. Drill a hole in the bottom of each detector box to make throughputs.
2. Put pieces of foam plastic in the ski box for support, pay attention to the position. The whole scintillator plate and light guide have to be supported so that they shall not bend.
3. Carefully put the detector in the ski box on the foam plastic support plates. Put extra foam plastic on top of the detector and at the sides.
4. Connect the cables, close the lid and lock.