Assembly 30 cm x 30 cm Gem detectors

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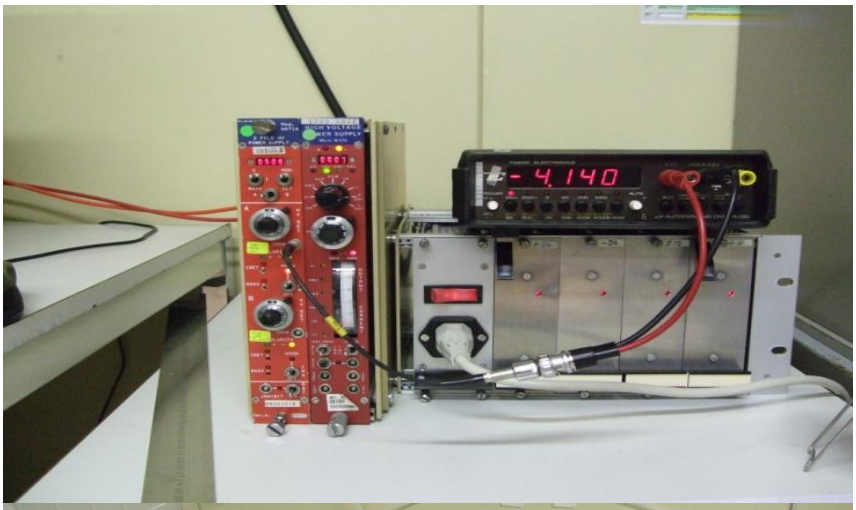
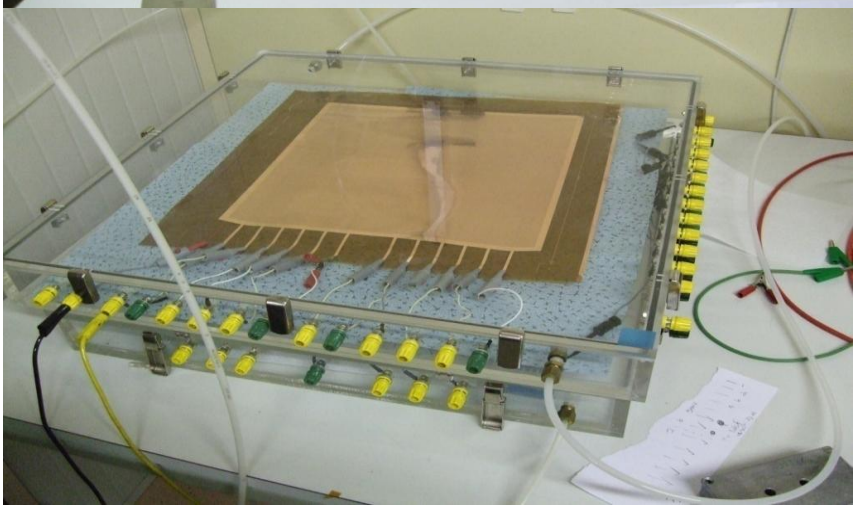
Test foils

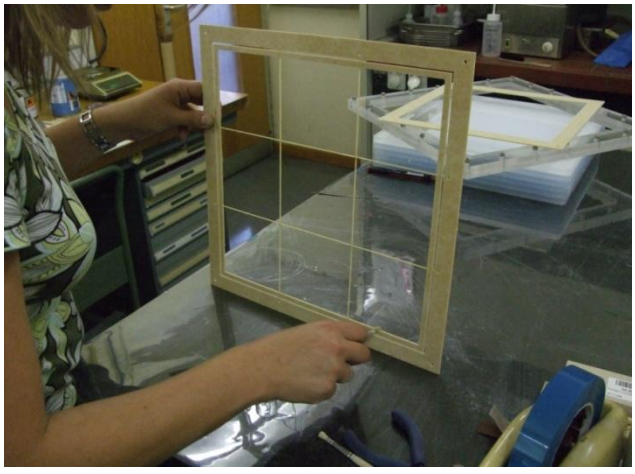
- Approval criteria, 500 V with a leakage current less than 5nA each sector.
- Never touch the active area of the foils.
- To work with the foils always use mask and gloves.
- Test are made under air and nitrogen; under air there is more sparking than in nitrogen.
- To be sure, there is no air on the sealed box, gas should flow at least five box volumes.
- Leakage current stabilization time is variable, like 3 minutes with stable value approve sector.
- Flush with nitrogen the foil before test it.
- Perform 2 or 3 tests more in the sector that fail the first test, usually foils improve others test.
- If one foil spark in the same site several time, stop the test and try another test later.





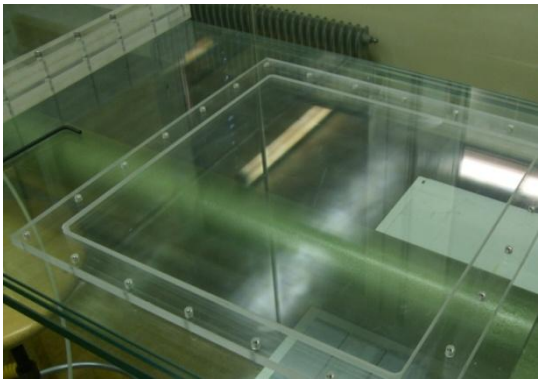
Frames and coating

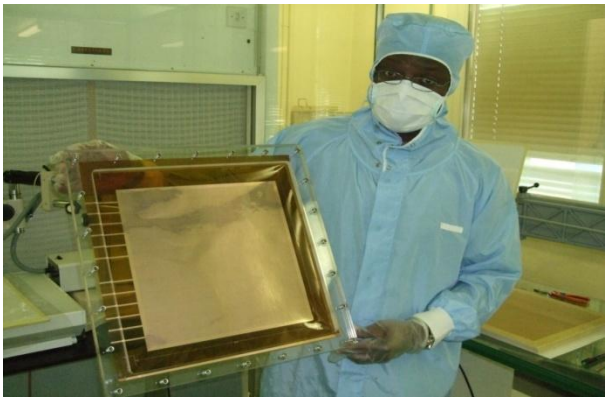
- The frames for the foils come from the machine shop with an extra material part.
- Remove this part, the most external one and still should have two more parts.
- With sandpaper, file all the inner part (where is the active area), this is to get rid of big particles that could touch the foil; it is not necessary to clean the outer parts.
- Cut the inner frame of the outer one only in one side, this is where the strips of the GEMs go.
- Flush the frames to get rid of dust.
- To prepare the coating, use 3 grams of Nuvovern per 1 gram of Durcisserur, this is enough to coat at least 5 frames.
- Use the coating material and with a small brush, coat the inner parts already cleaned, be sure not to put very much of the coating glue to avoid bumps; if there are some bumps in the face side of the frame (side where you stack the GEMs) clean it to avoid gas leaks after the staking of the framed foils.
- Put the coated frames in the oven per 12 hours at a temperature of 45 C.



Stretching

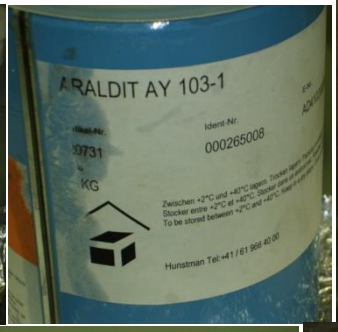
- The stretching device for thermal method should be always clean, use methanol to clean it, since it is made of Plexiglas (do not use regular alcohol in Mylar or Plexiglas, only methanol), and flush is with nitrogen.
- Place the foil on the bottom part of the stretching device (frame and inner parts), put the foil in the center of the inner part, so the foil frame fits without problems.
- Then place first the Plexiglas top (the one with the handles) to flat the foil, and the top frame.
- Slightly tight screws of the frames, take out the top Plexiglas and the flame with the foil.
- Put it in the oven at 45 C and like 20 minutes should be stretched.
- Sometimes foils are not well stretched in one or two corners because it was not placed correctly (see second step), so put the frame on the inner Plexiglas, loose the screws of that corner and stretch that corner with the fingers and tight the screws and take to the oven again.

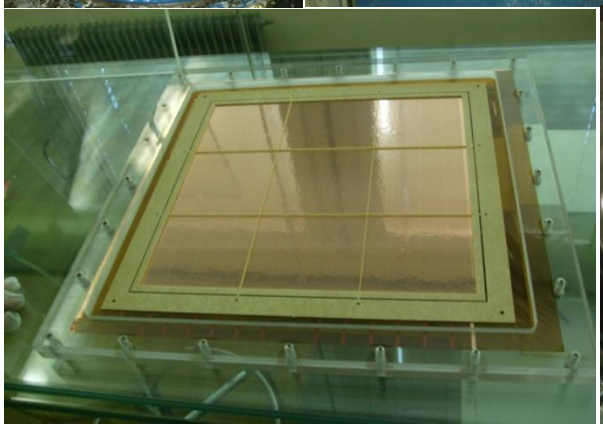


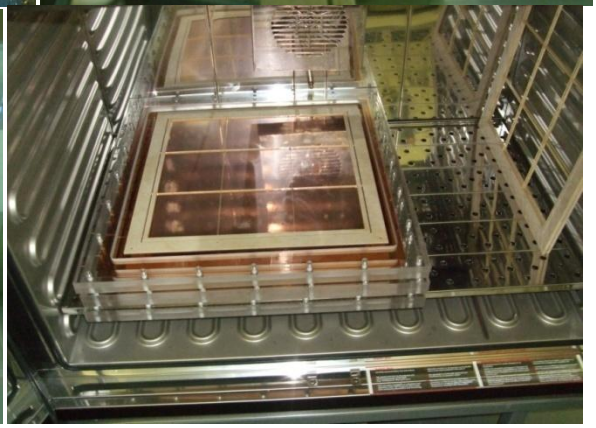


Gluing

- Flush with nitrogen the coated frames that will be used.
- To prepare the epoxy, use 5 measures of Araldit per 2 of Haerter; use 30 grams and 12 grams, this is very much to glue the frames but leave the spare glue per half a day to make sure that it is crystallized; the glue must not be used after one hour and a half.
- Put the epoxy on a needle so you can put a very thin strip of glue on the frame (inner one).
- After the glue is on the frame bring the foil stretched from the oven, the frame must be in the side of the foil that have the common cable and opposite to the many sector cables.
- Place one side of the frame with the glue close to the active area touching the kapton, hold in the center of that side with one hand and with the other hand hold the opposite side in the air, do not hold the frame in the corners .
- Fit the frame with the active area, there is no reference for this just make sure that the active area is in the center of the frame; when the frame is lined drop the frame.
- If is not lined you can move the frame just a little bit, no more than 3 or 4 millimeters.
- Take the foils with the frame and with the stretching device to the oven at 45 C per 12 hours.
- Per chamber, there should be one frame with the gas channel for GEM 3, this channel must be on the same side of the strips of the GEM's sectors and opposite to the common strip.
- After 12 hours, cut the spare kapton of the foils with a scalpel and re-test high voltage under nitrogen.



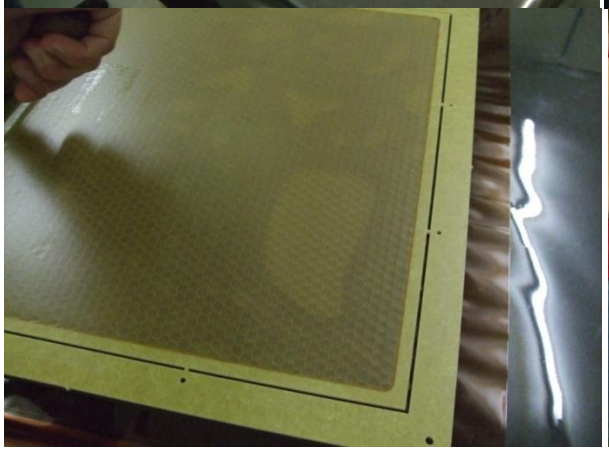




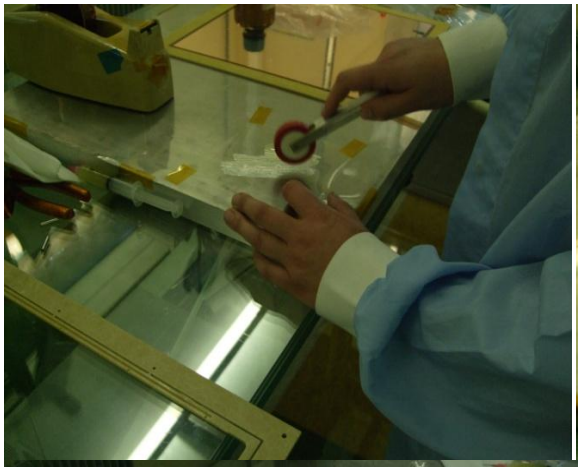
Drift cathode

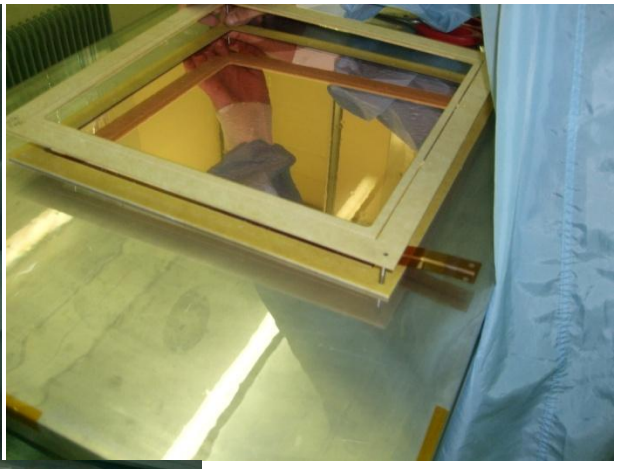
- Clean and flush the kapton side of the drift before put the glue, the drift can be glue outside the clean room, keep it extended with tape in a table.
- With a roller, spare the glue uniformly.
- The honeycomb for the drift have to side, clean and flush the darkest side and use the roller to spare the glue in the same side.
- Paste the honeycomb on the drift, make sure that the drift is in the center of the honeycomb.
- Clean the glue of the roller and remove air bubbles between the honeycomb and the drift; for this roll hard the roller from the center to the edges, be sure not to move the honeycomb from the drift.
- Put some rubber sheet first then something rigid and put heavy weight to glue the drift; keep it like this per 12 hours.

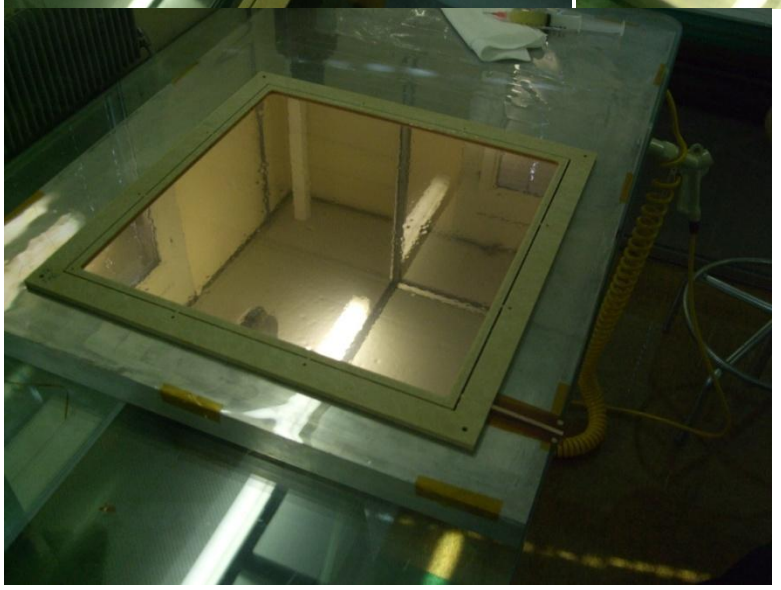





- After the drift and the honeycomb are glue, flush the frame before glue it.
- To glue the spacer of the readout, use a needle to glue the frame and with a small roller glue the sides of the frames with the gas channels.
- Strip of high voltage for the drift should be on the same side but opposite corner of the gas income.
- Use the alignment pins in the outer frame and glue the spacer and the drift.
- Take out the pins, put something rigid on the spacer (do not touch the drift) and put heavy weight, keep it like this per 12 hours.

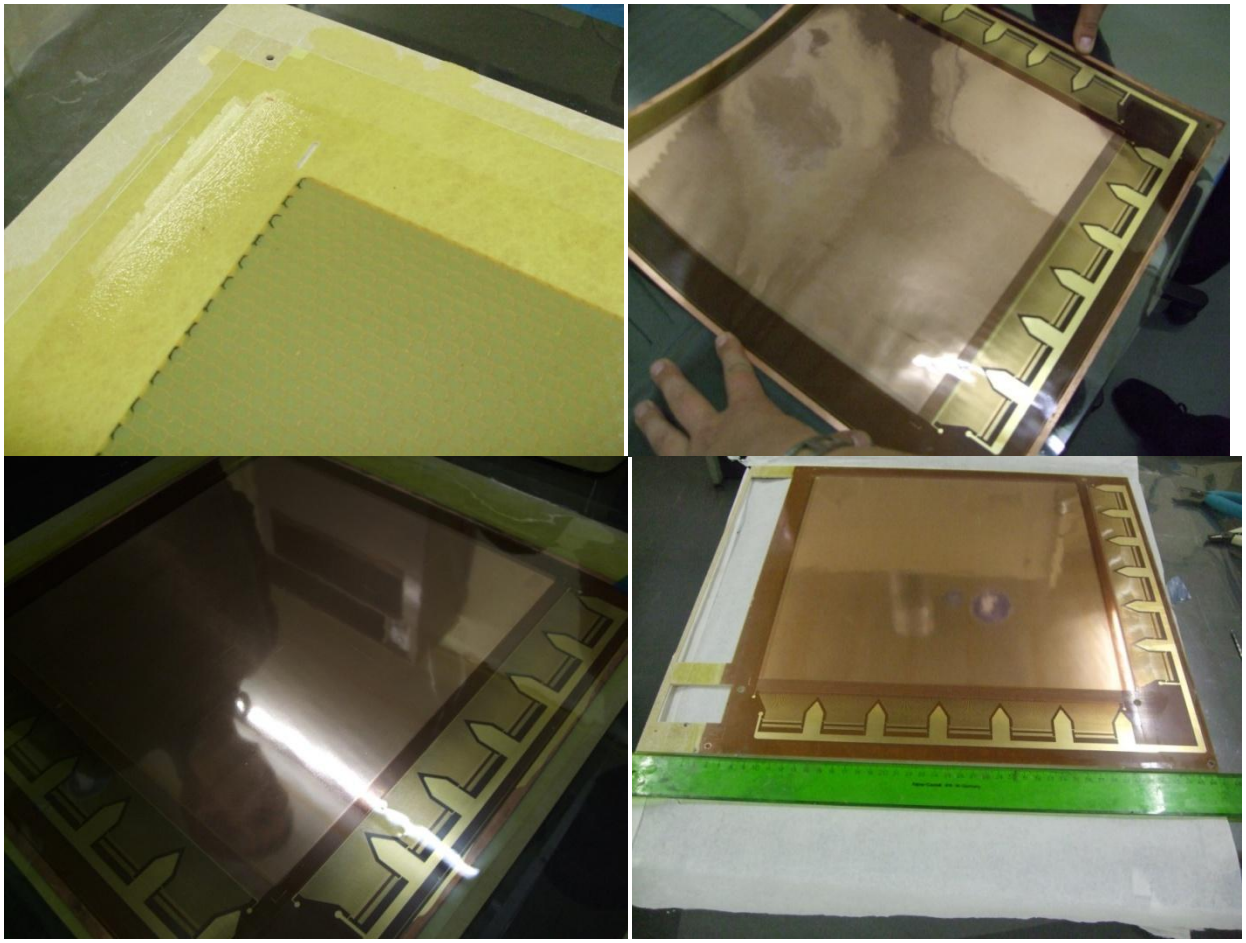






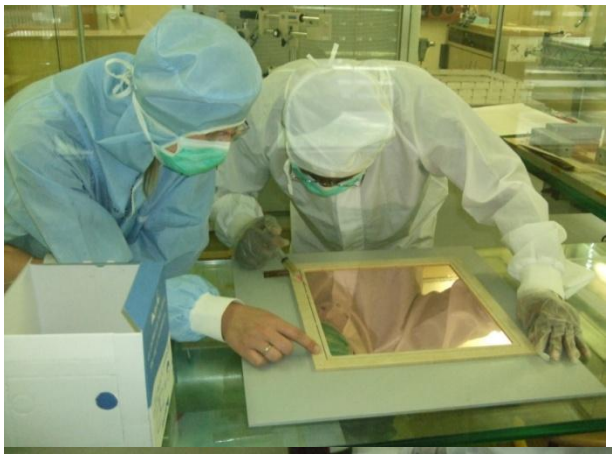
Readout

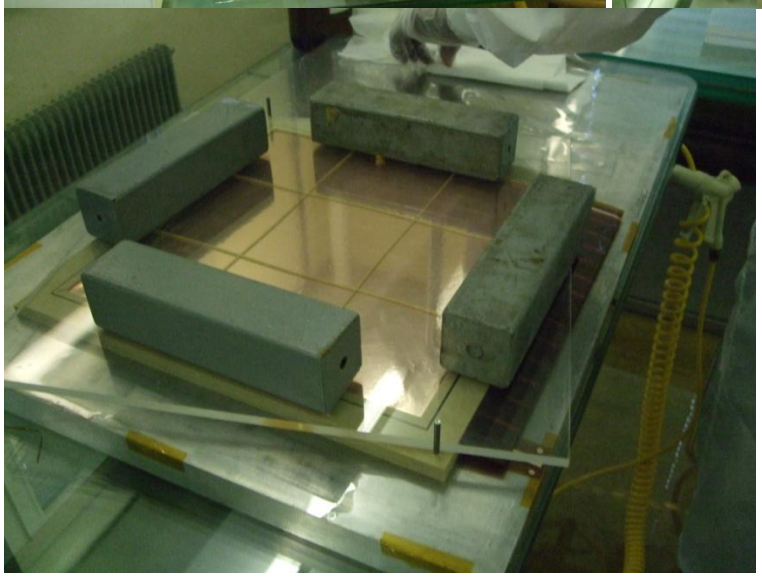
- Clean and flush the fiber glass side of the readout before put the glue, the readout can be glue outside the clean room.
- Tape the readout to the table so it will not move and glue with the roller.
- The honeycomb for the readout have to side, clean an flush the darkest side and use the roller to spare the glue in the same side.
- Tape the honeycomb to the table so it will not move and glue with the roller and paste the readout on the honeycomb, fit references holes of the honeycomb and readout, and make sure glue the readout with the air income in the correct position.
- Place clean Mylar on the readout and with the clean roller take out all air bubbles rolling from the center to the edges.
- Put rubber sheet first then something rigid and put heavy weight to glue the readout; keep it like this per 12 hours.



Stack the GEMs

- Flush the frames that are going to be glued before glue them.
- With the needle glue the frame of the drift.
- Use the alignment pins, and place the first GEM, on the side of the kapton.
- Glue the next frame and put the next GEM, repeat the gluing and place GEM 3 (the one with the air exhaust for the gas).
- Do not take out the pins, put something rigid on the stack and put heavy weight, keep it like this per 12 hours.





- After that, cut the outer frame from the inner one and take them out one by one; the side where the strips are must be already cut before stack them or much better before coat them.
- With a needle put glue on the frame of GEM 3, flush the readout, and place the stack on the readout using the marks in the readout, also place the stack so the electronic and the strips match.
- Put something rigid on the stack and put heavy weight, keep it like this per 12 hours.
- Then coat the sides of the chamber.