

BONuS12 construction tests

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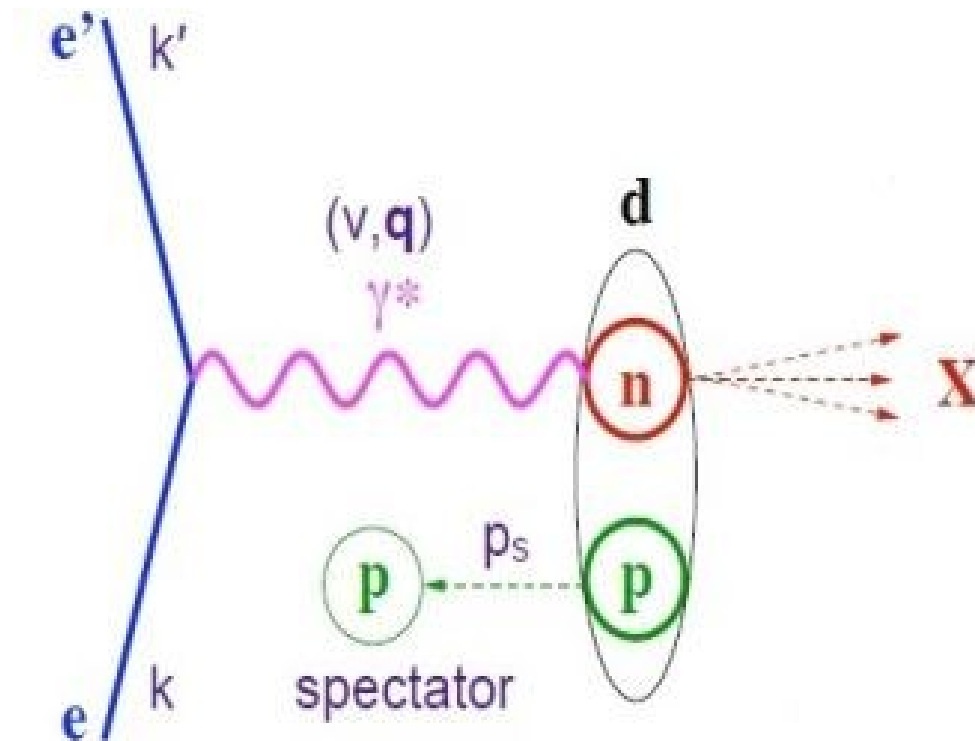


Out line

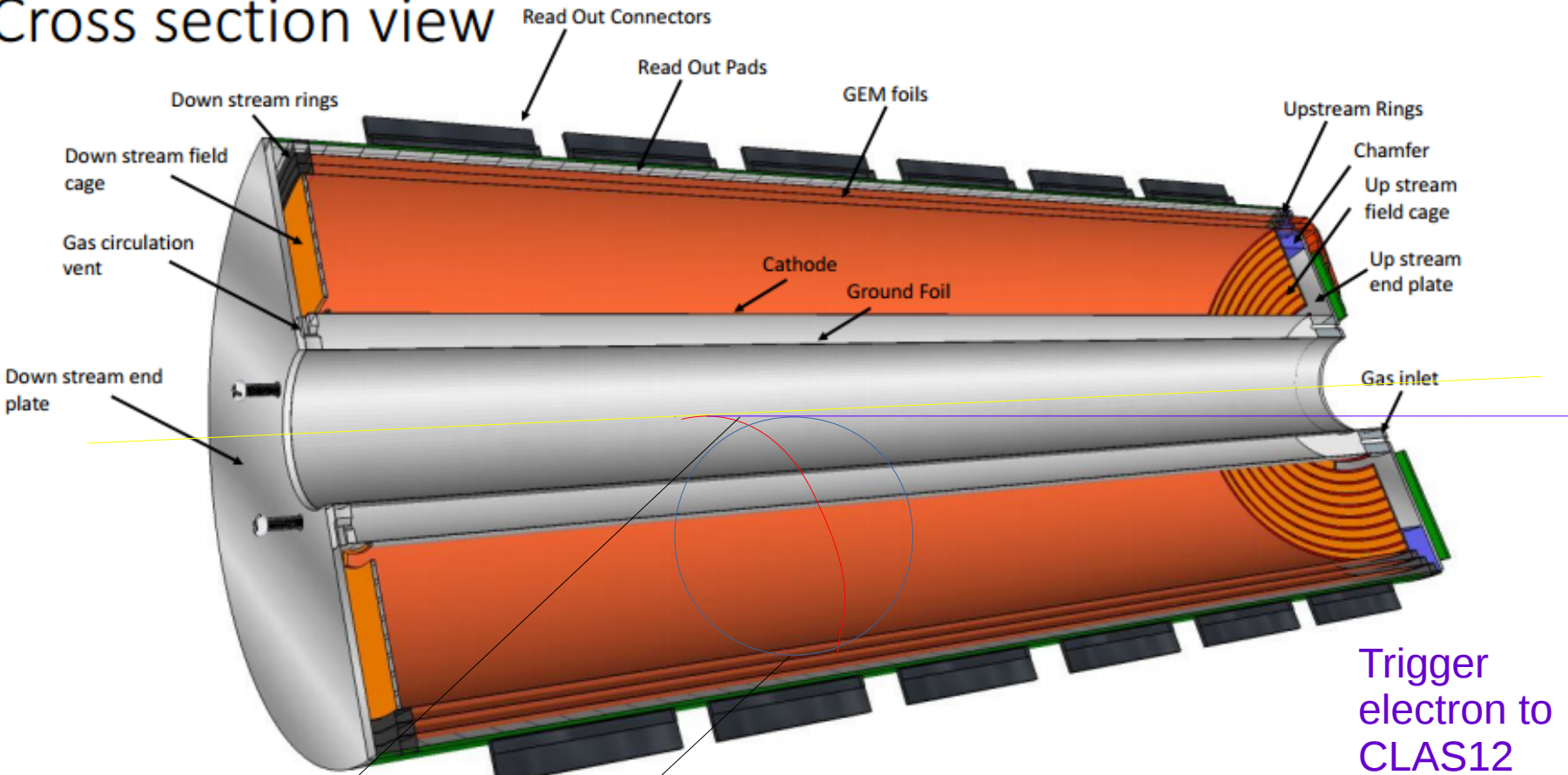
- Introduction
- BONuS12 RTPC
- GEM glue tests
- Cathode foil wrapping tests

Introduction

- Structure of the free neutron over a large range of values of Bjorken x
- BONuS - Barely Off-shell Nucleon Structure

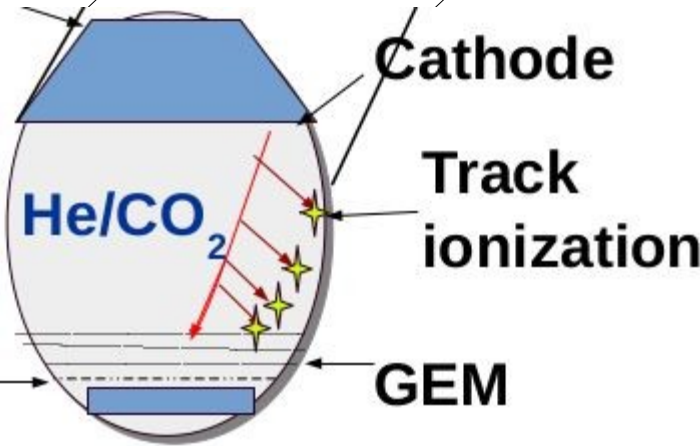


Cross section view



Trigger electron to CLAS12 detector

Ground foil

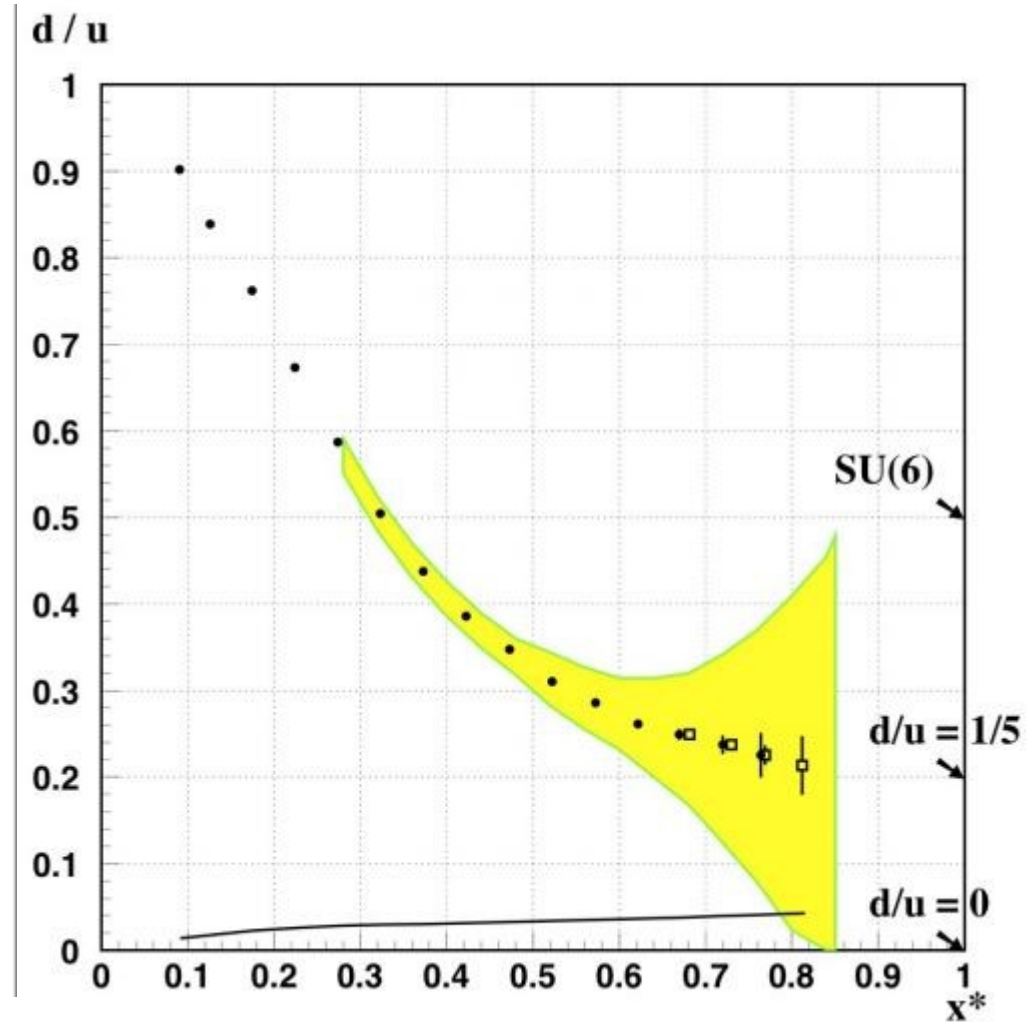
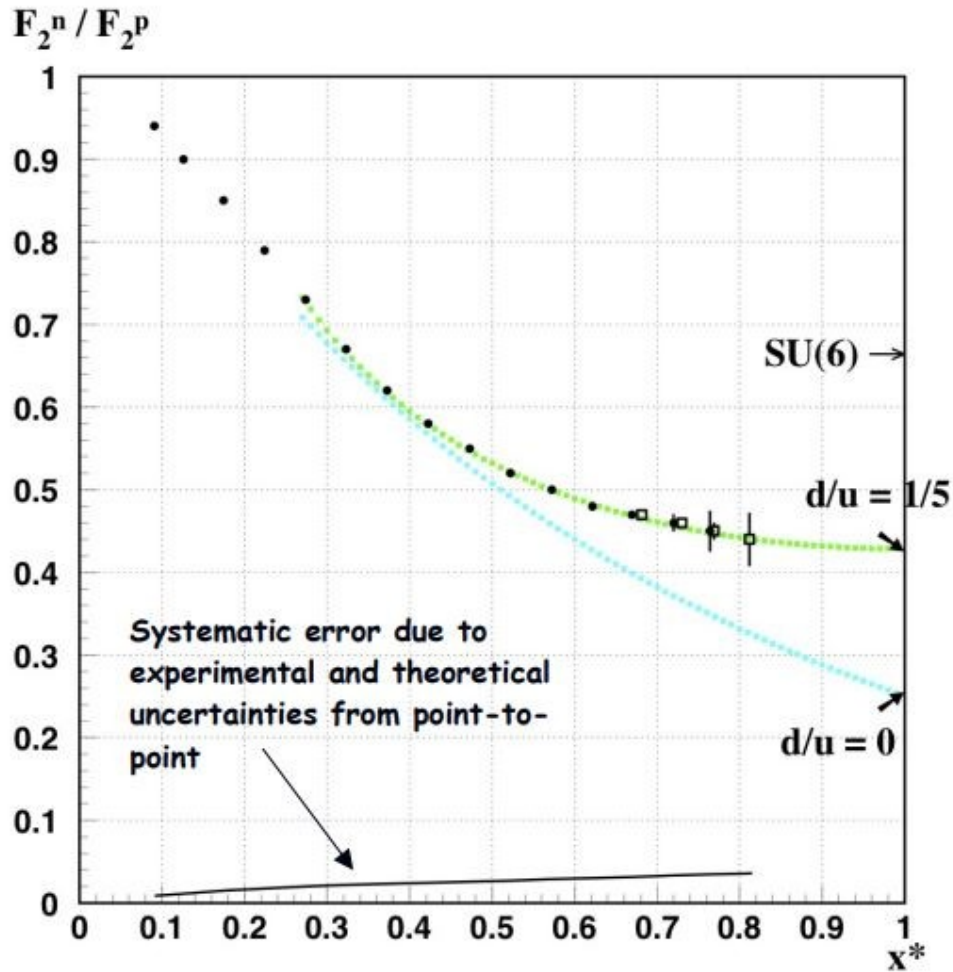


Read out electrodes.

GEM

- $d(e, e' P_s)X$
- Deuterium target
- Tag spectator proton ($70 < P_s < 150$ MeV/c) with RTPC.
- Detect scattered electron with Jlab Hall B CLAS12.

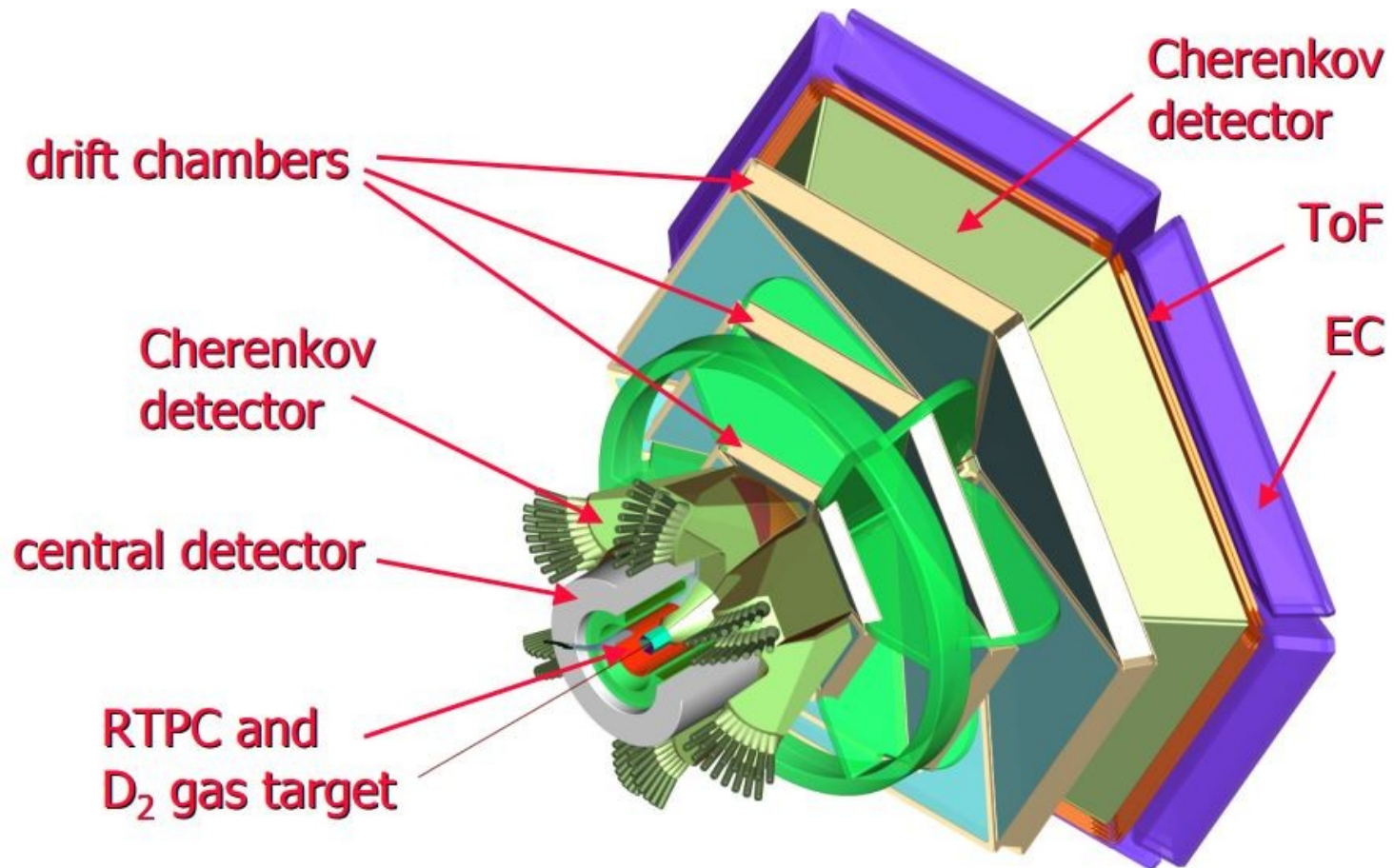
Expected results from BONuS12



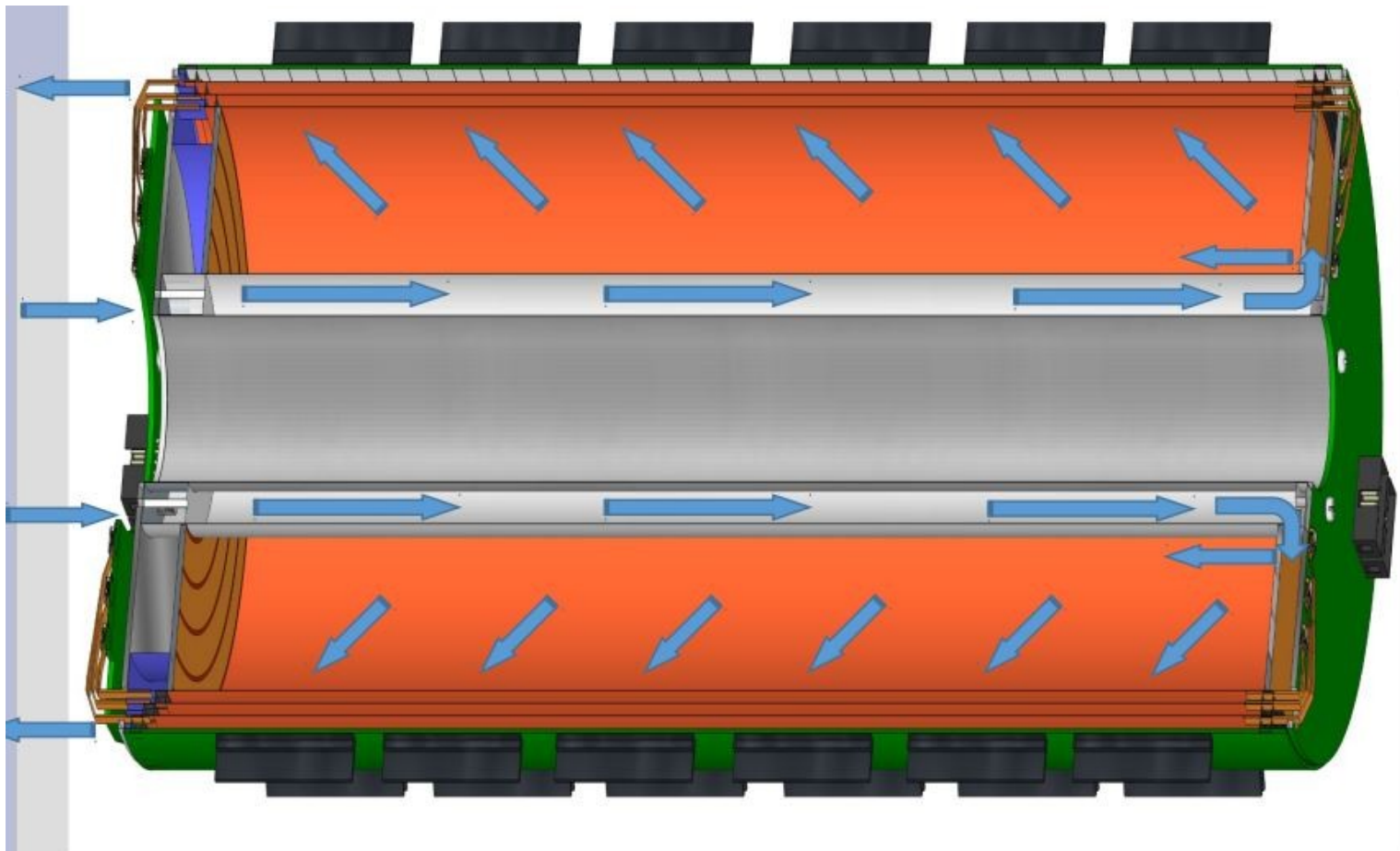
Improvements over previous design

- Double RTPC and target length -> increase luminosity to $2 \times 10^{34} \text{ cm}^{-2} \text{ s}^{-1}$.
- Increase detector region from 3cm to 4 cm
→ improve momentum resolution
- Increase length from 20 cm → 40 cm
- Increase phi acceptance
- Reduce material → lower threshold momentum of proton

BONuS12 RTPC



Gas flow of BONuS12 detector



(4 input and 4 out put ports rotated
by 45 degrees in φ)

GEM glue tests

The main purpose for the GEM glue test is to

- Test for proper tip size
- Test overlapping region size
- Test for the proper epoxy

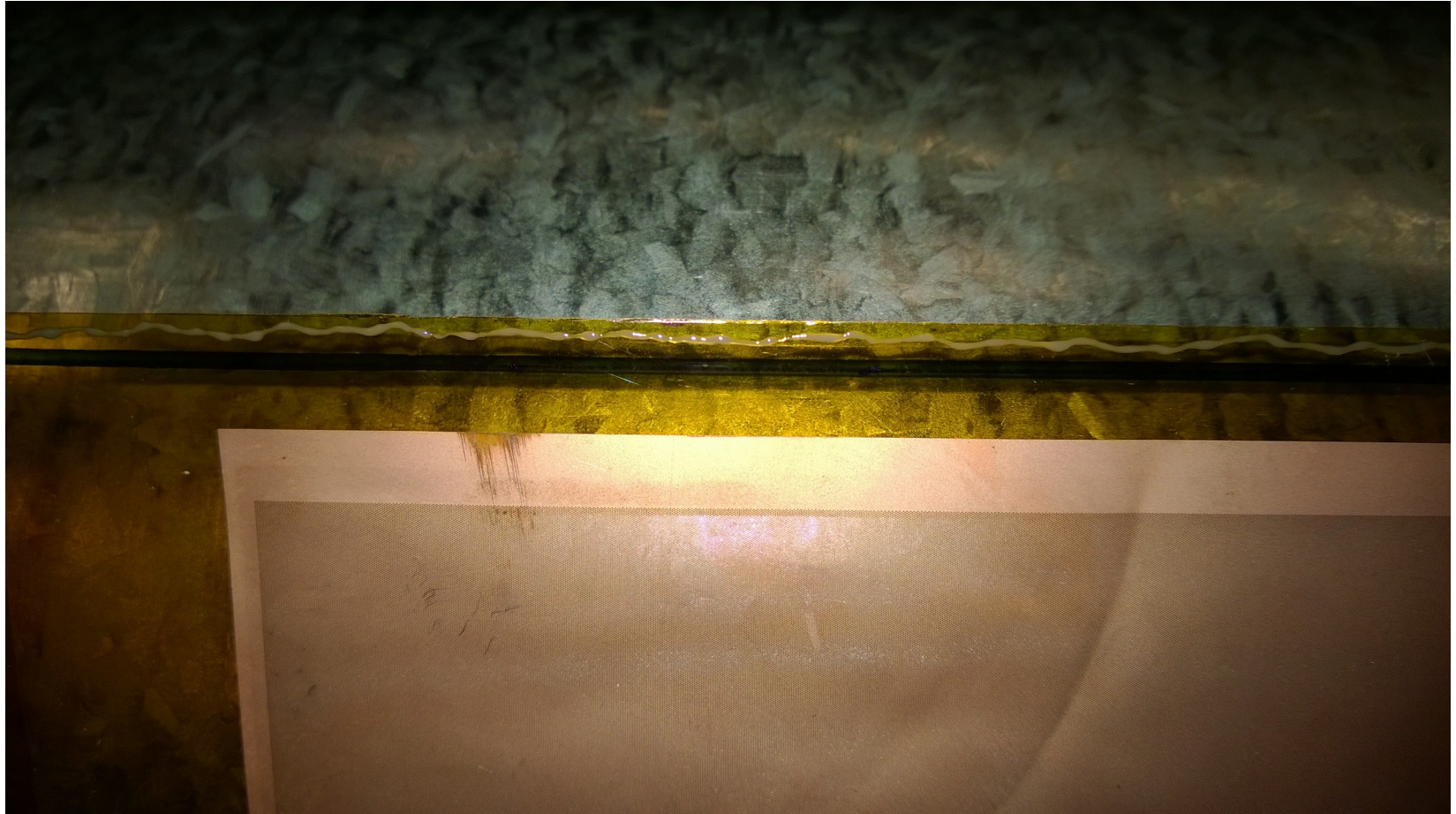
Test for the tip size and overlapping region

Applied DP 190 epoxy with

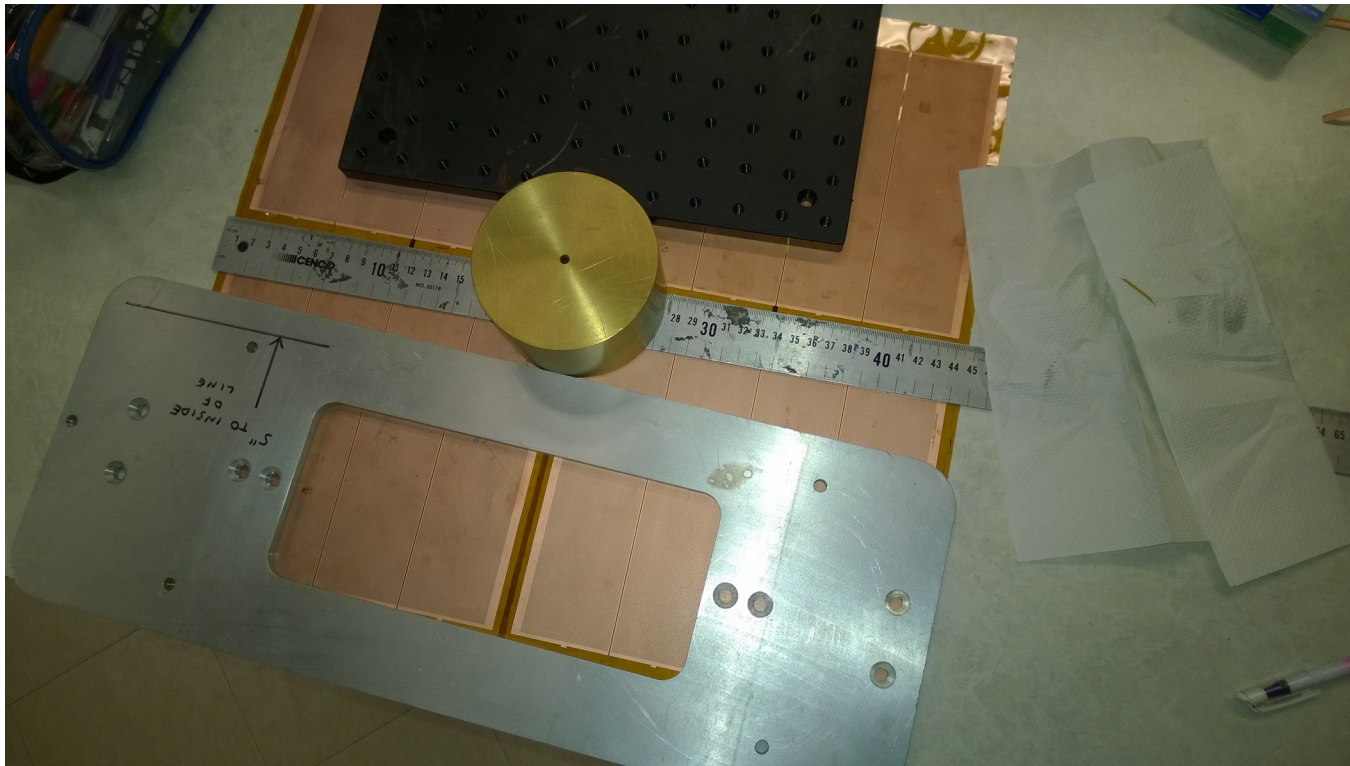
- 15 GA - 1/2 " tip
- 18 GA - 1/2 " tip
- 20GA - 1/2 " tip
- 22 GA - 1/2 " tip

15 GA and 18 GA rejected in planner surface testing and 20 GA rejected in cylindrical surface testing.

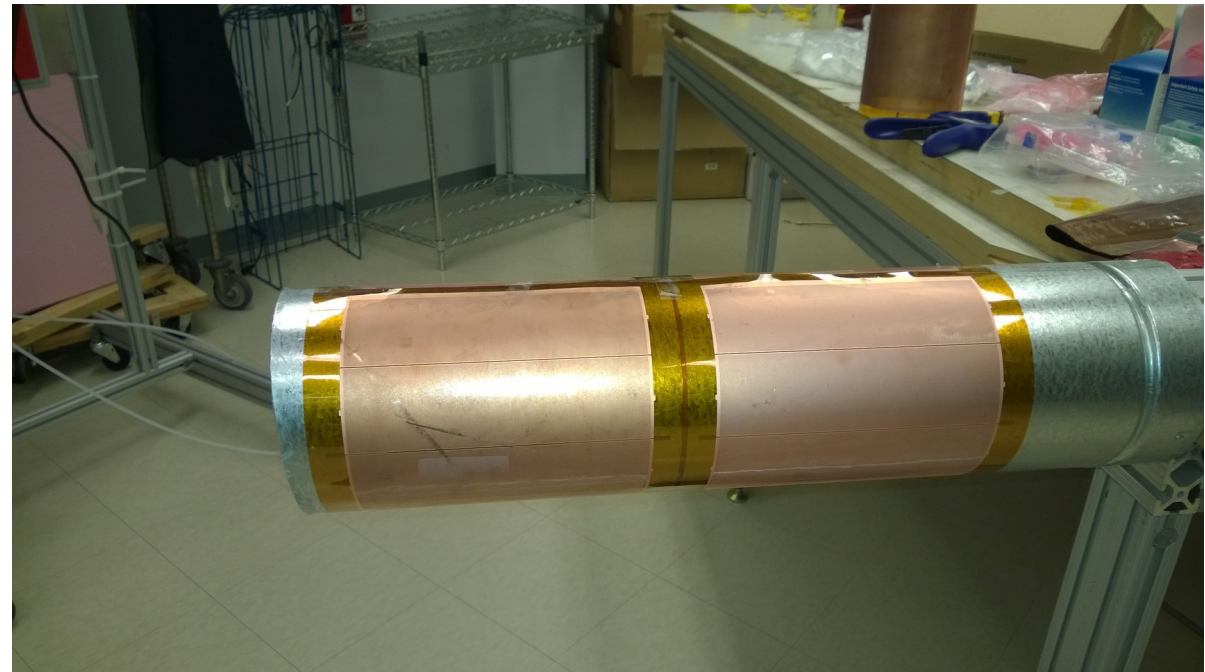
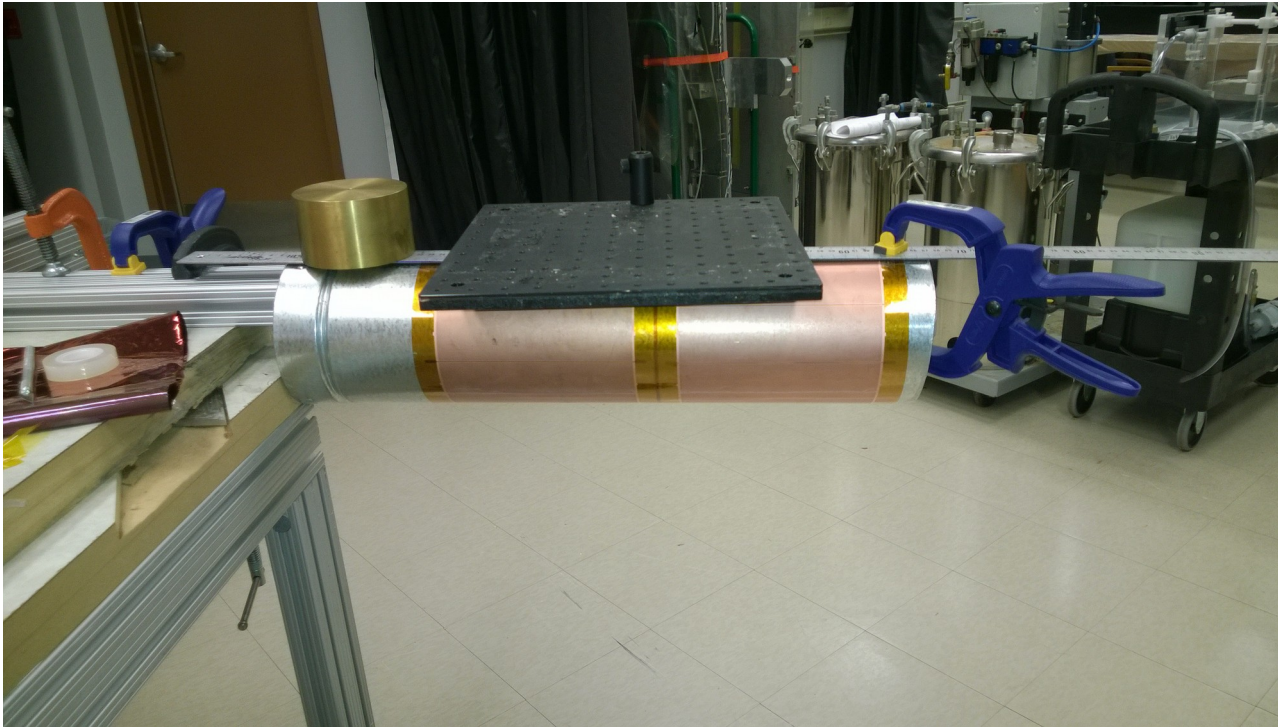
22 GA tip size is the best tip size for applying glue uniformly.



- After making 40 cm length foil by gluing 4 GEMs together the foil kept for 24 hrs.



GEM foil wrapped on the cylindrical structure

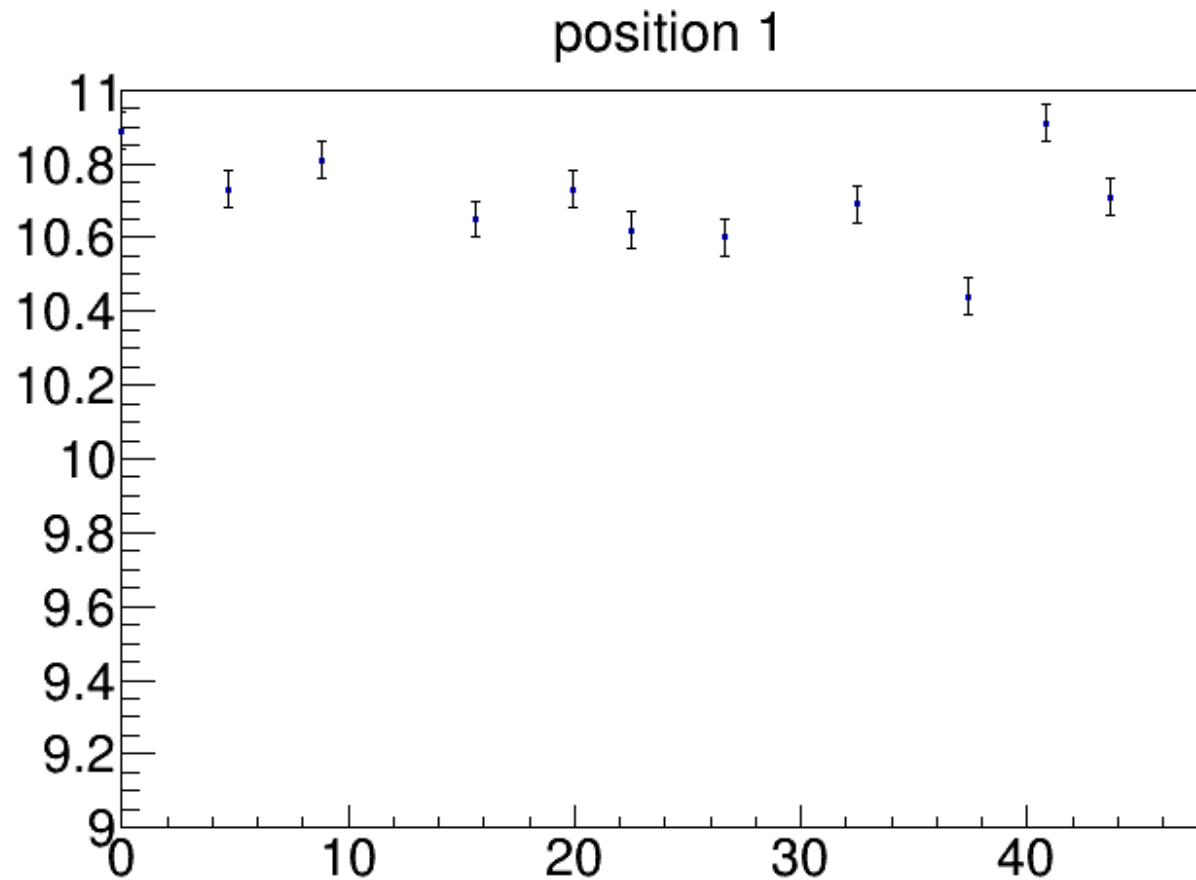


Sag measurement on glued GEM

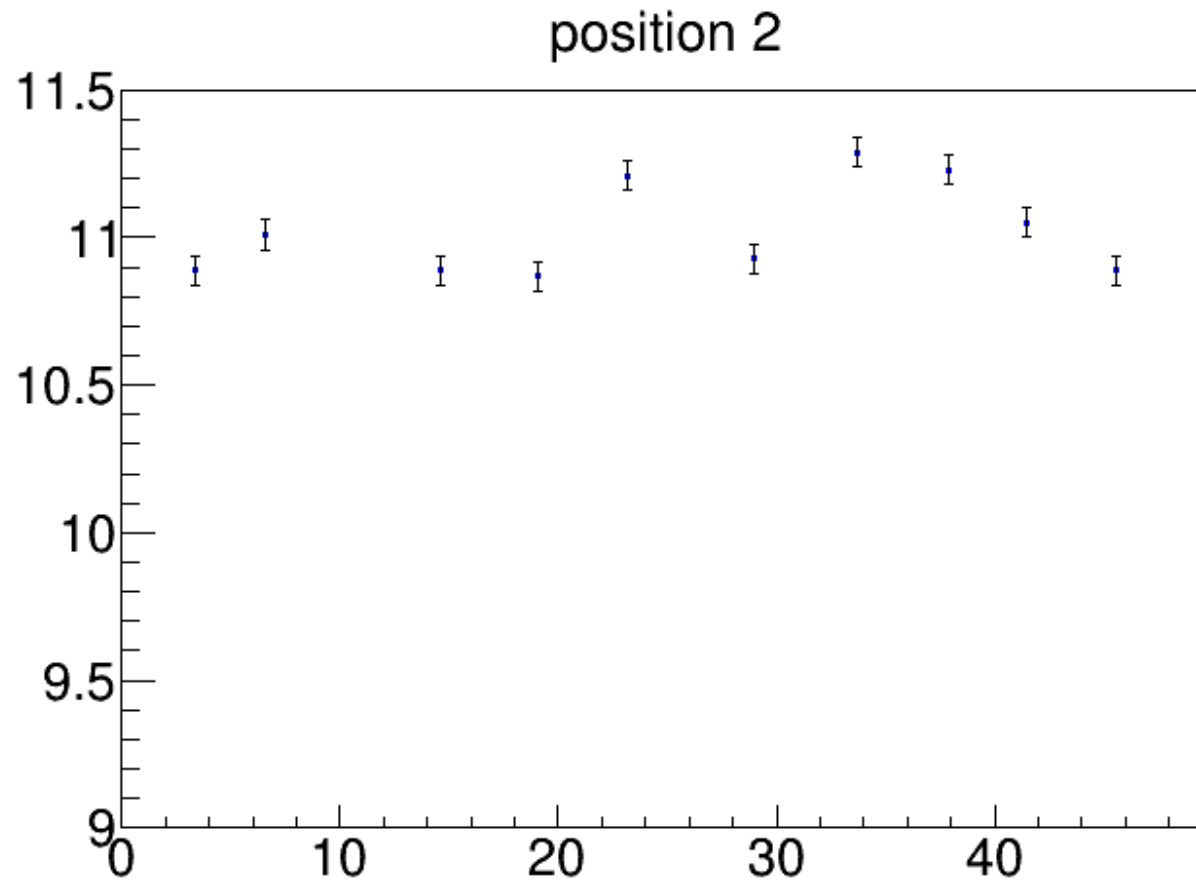
- To observe gravitational sag in the GEM foil the following set up was used.



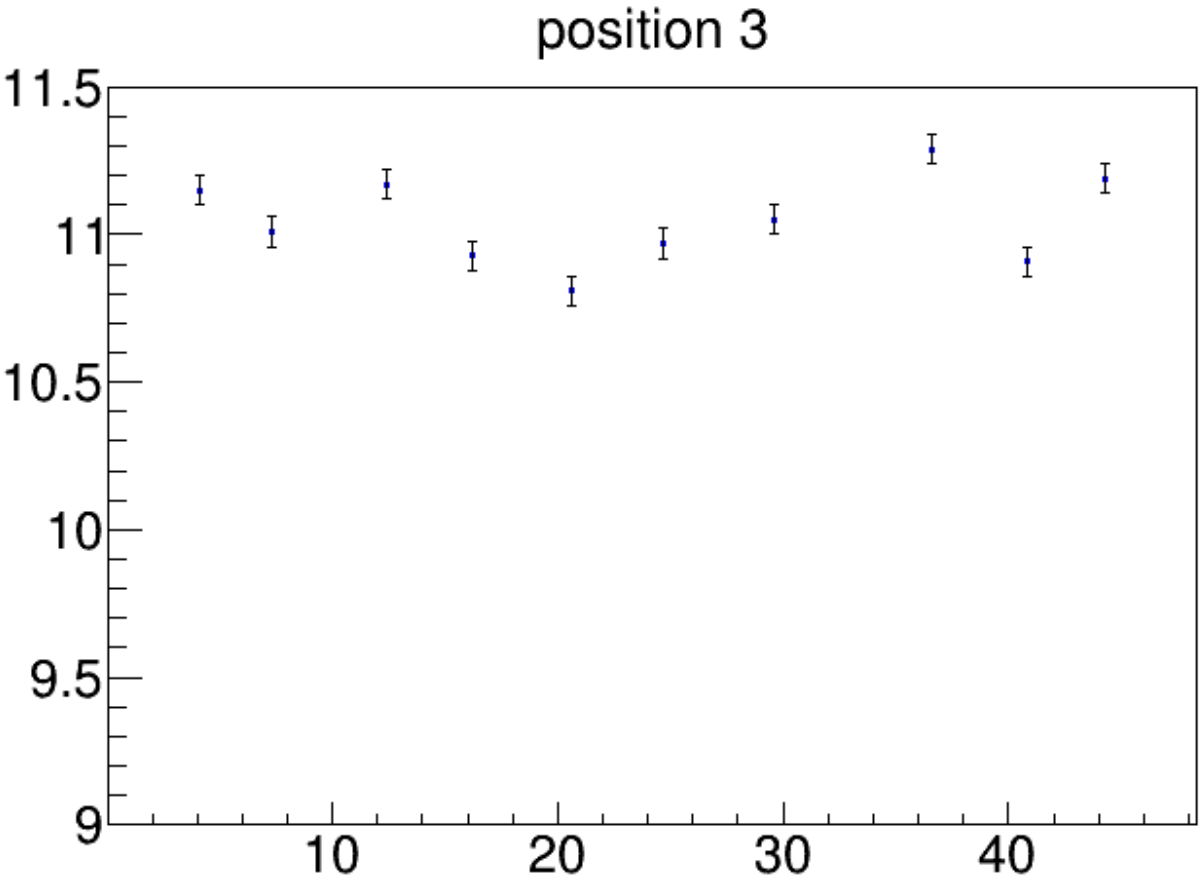
Gravitational sag for position 1



Gravitational sag for position 2



Gravitational sag for position 3



Conclusion

- We can apply the epoxy in a 3 mm gap with 22 GA tip with out getting epoxy on the active area.
- The amount of glue seems good enough mechanically.
- The gravitational sag appears small enough that we do not need a spacer ring in $z=0$ cm position.

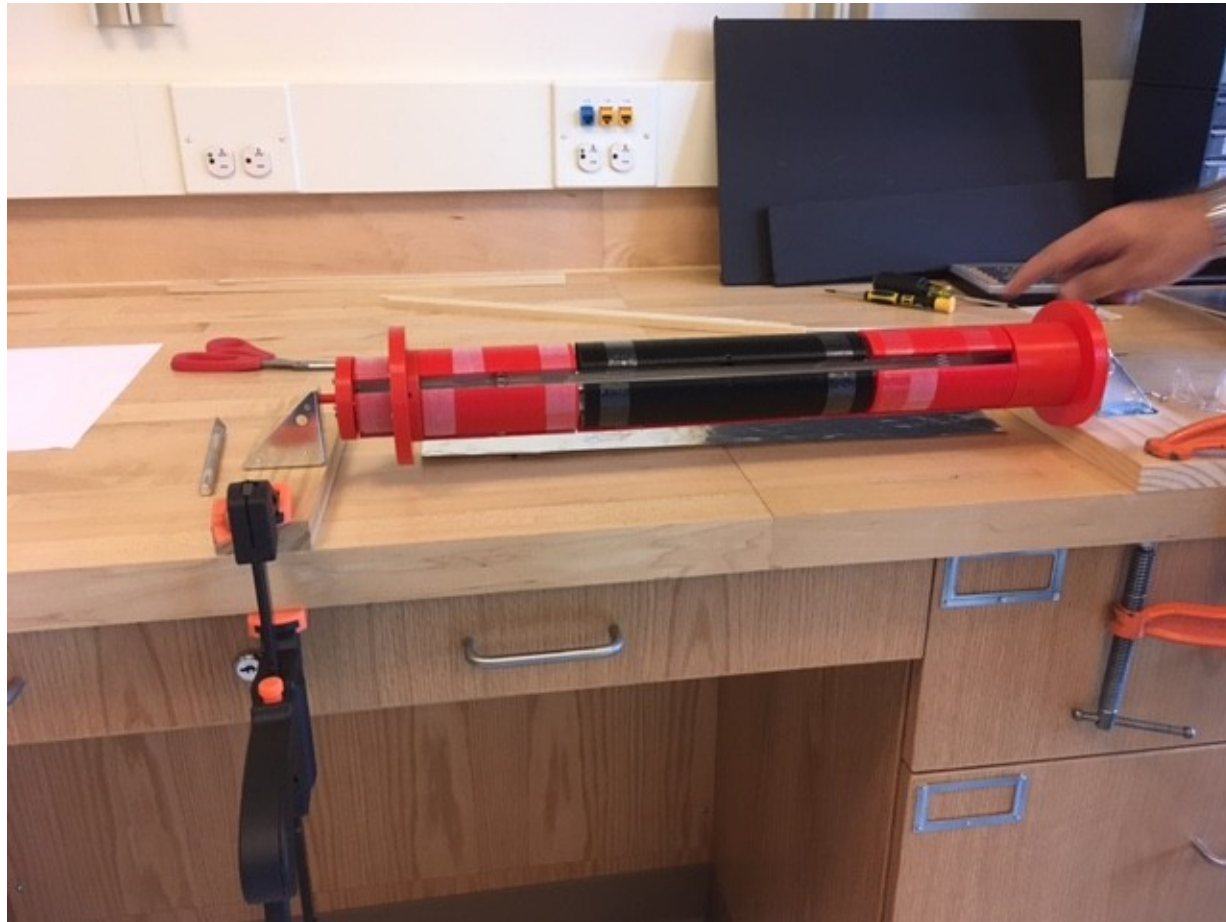
Cathode foil glue testings



Out line

- Mandrel method
- Capacitor method
- Tension method
- Vacuum method

1. Mandrel method

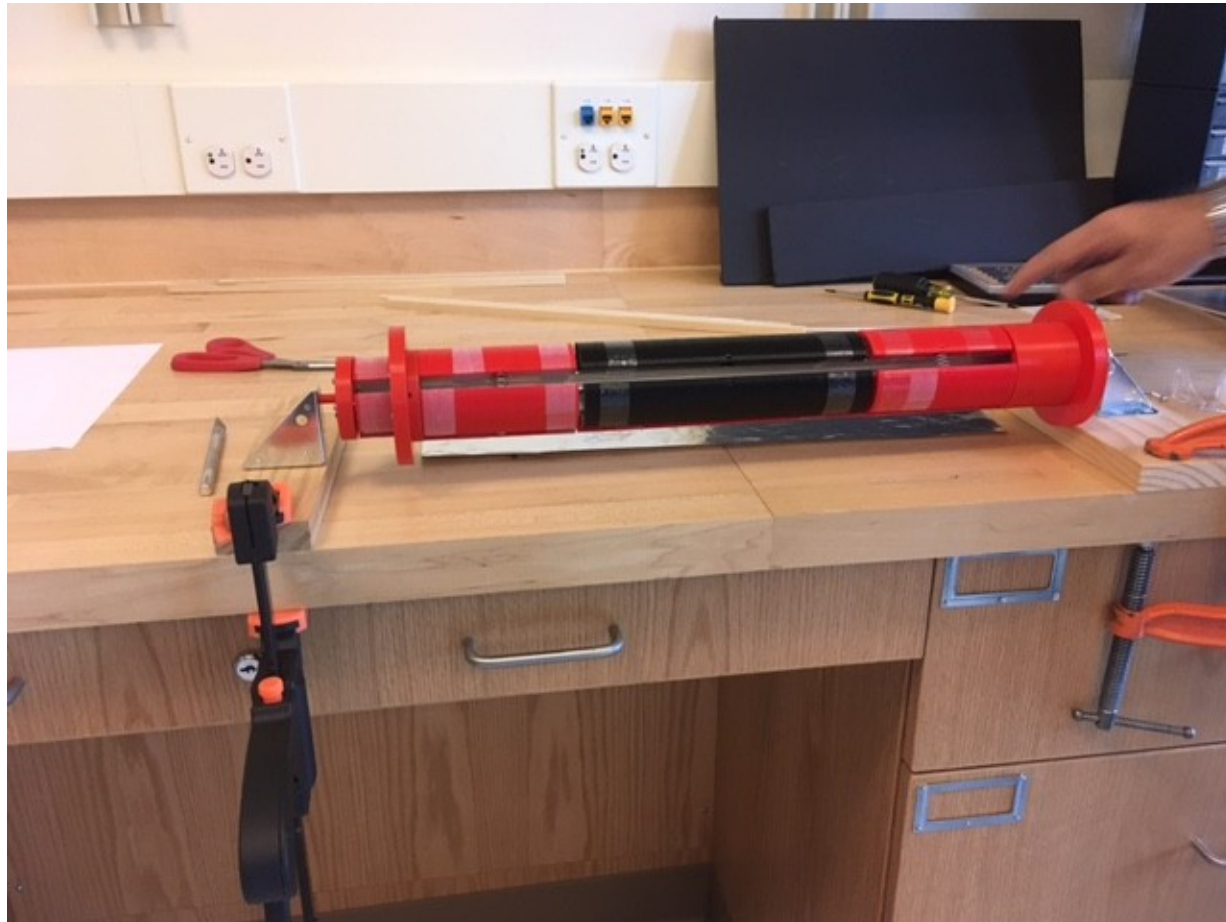


1.1 Cutting the foil

- To cut the foil we used heavy structure to make the foil perfect without creating wrinkles.
- If the cutter is not sharp enough it also leads to create wrinkles.



1.2 Fixed the mandrel on the table



1.3 Start wrapping the foil



Problems associate with wrapping

- Difficult to handle foil due to small thickness.

Changing foil position from cutting place to gluing place is impossible. After cutting we have to mount mandrel in same place for gluing.

- Mandrel is not stable with out wooden bars. So it start twist in gluing procedure.

Then the wooden bars also fixed and start gluing →
create wrinkles

Cathode foil glued to the mandrel



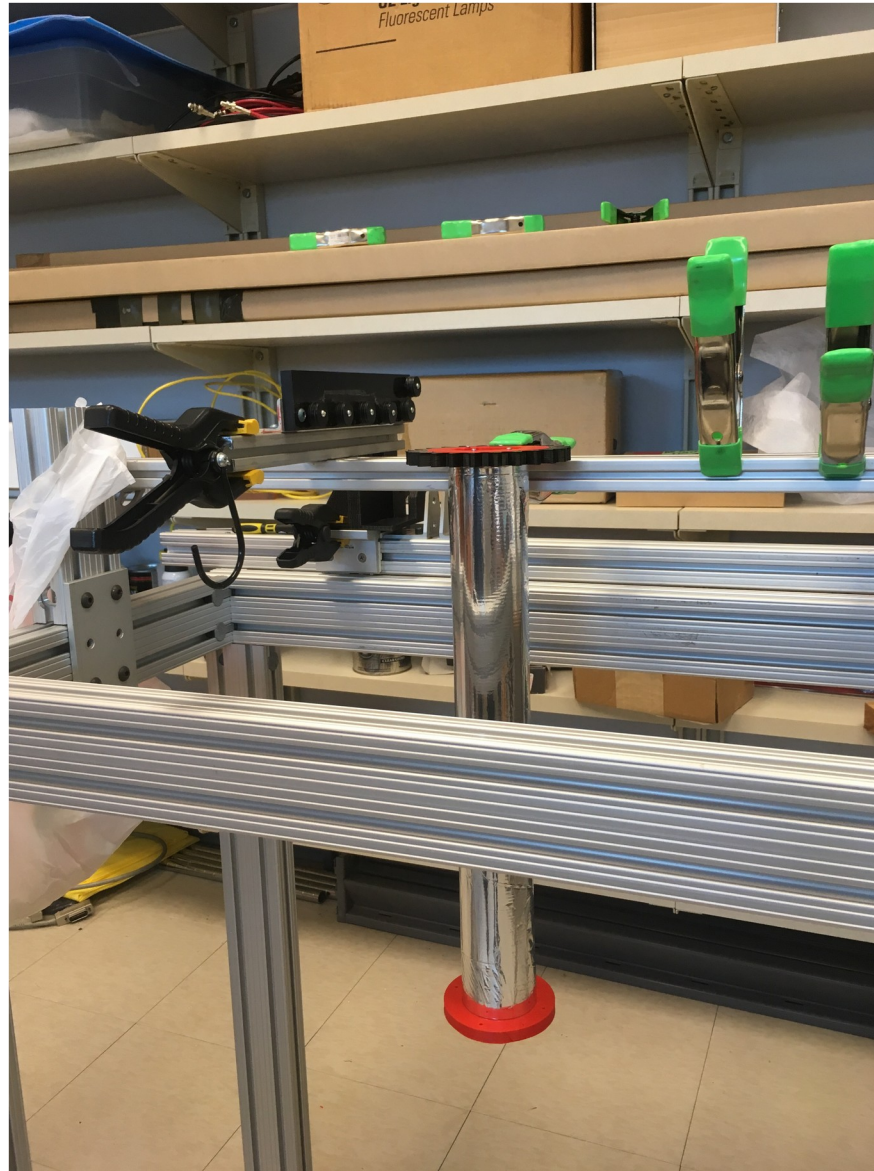
1.4 Remove foil from mandrel



conclusion

- Most of the mandrel design is done.
- Have to modify some parts which created wrinkles.

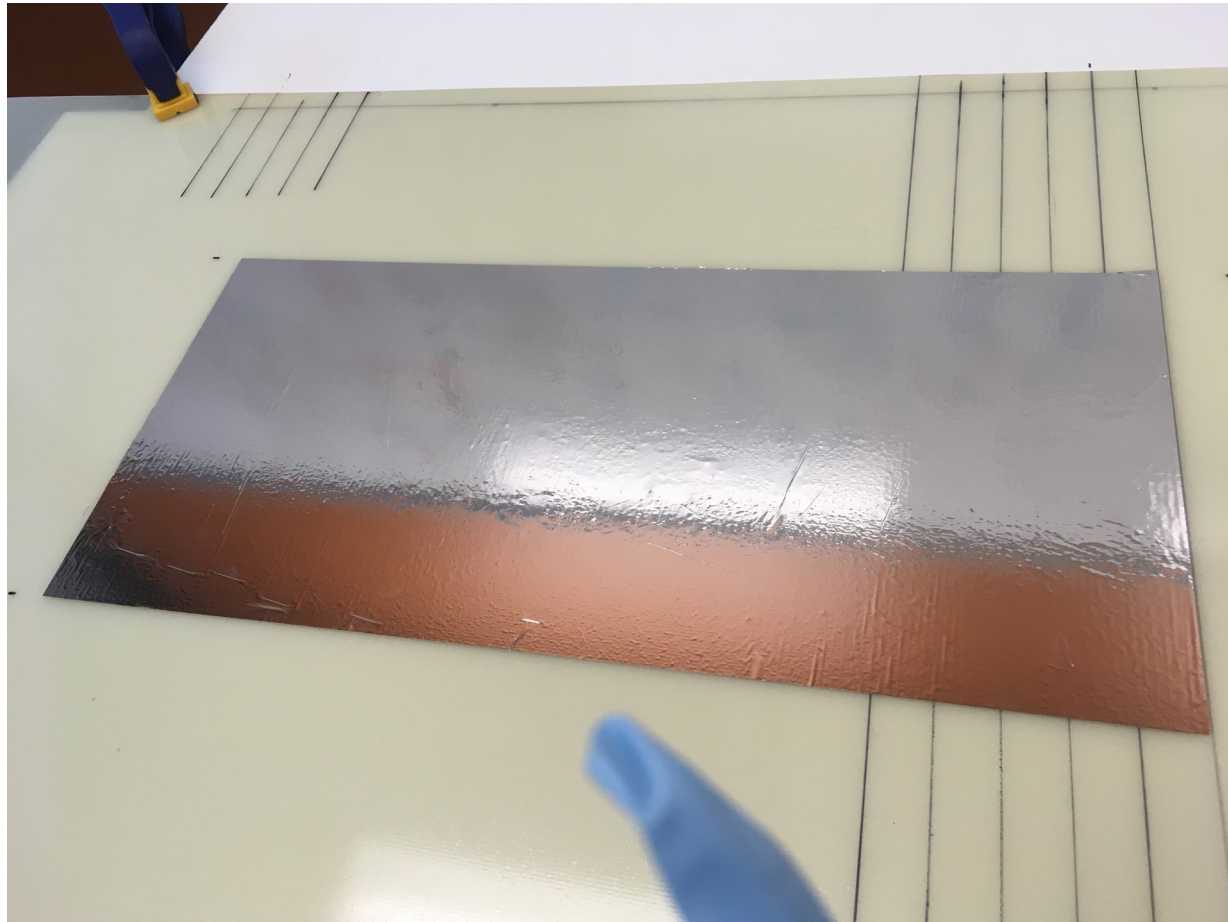
2. Capacitor method



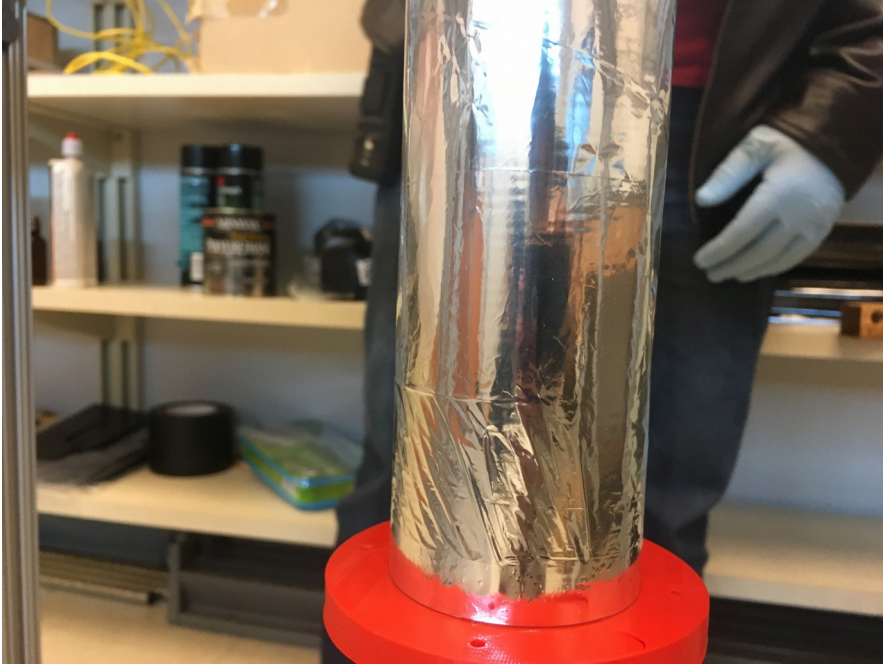
2.1 Cutting the foil

- Initially voltage was applied to make foil uniform.
- If the air bubbles exist between foil and board that creates wrinkles.

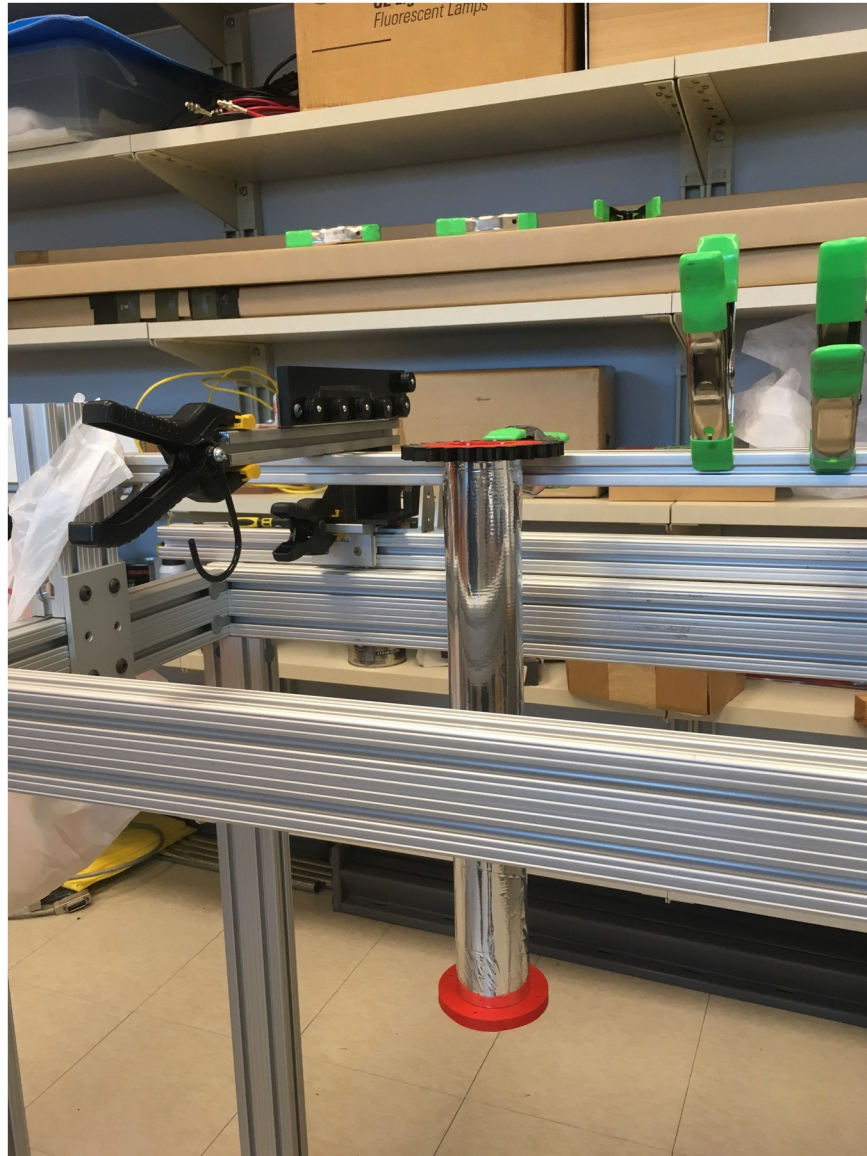
So before apply voltage the air bubbles were removed as much as possible.



2.2 Wrapping the foil



2.3 Out put of Capacitor method

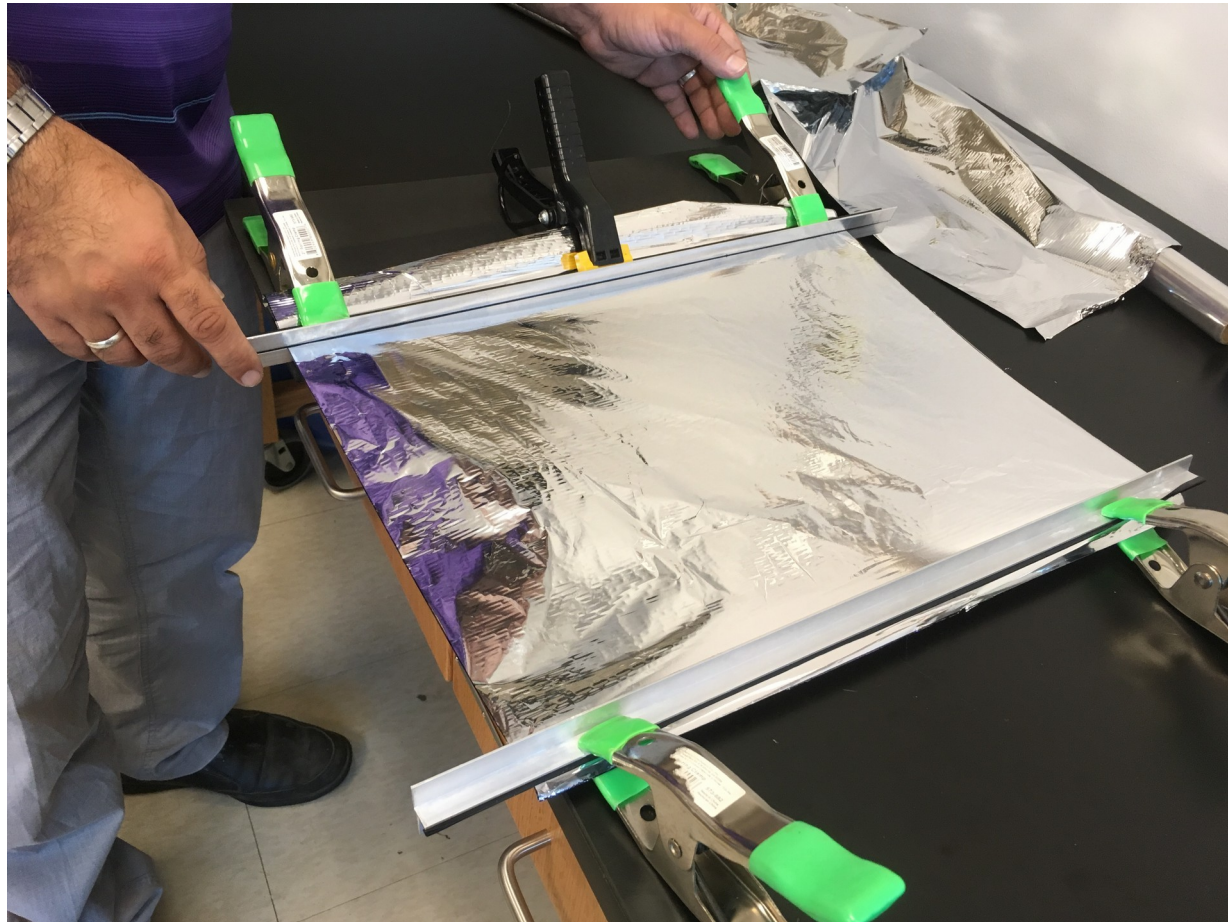


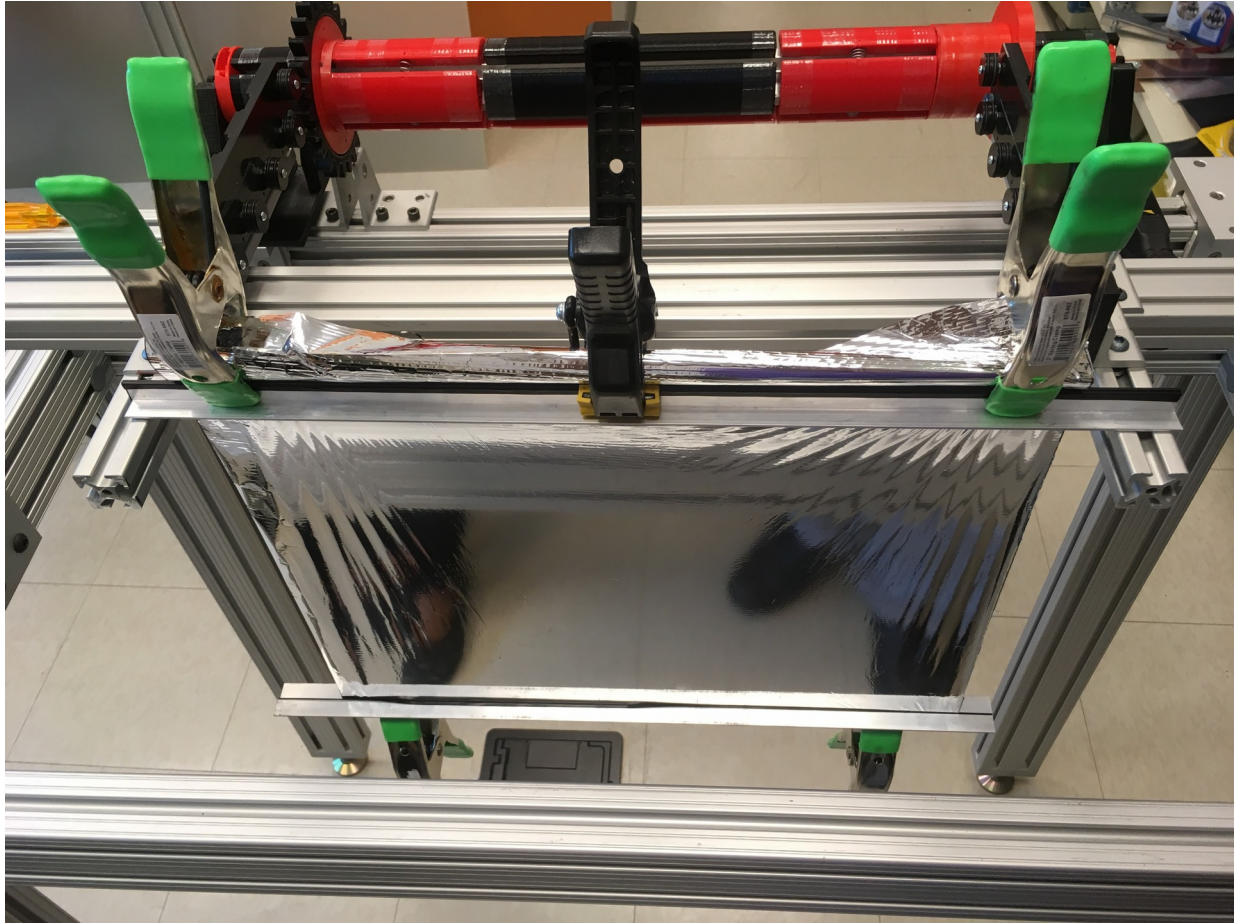
conclusion

- Capacitor method is giving very promising results with the six micron aluminized mylar foil.
- But still need to develop the design to have minimum number of wrinkles.

3.Tension method

- Apply some tension on the foil and tried to wrap on mandrel.
- Before wrapping the foil, it contains wrinkles.





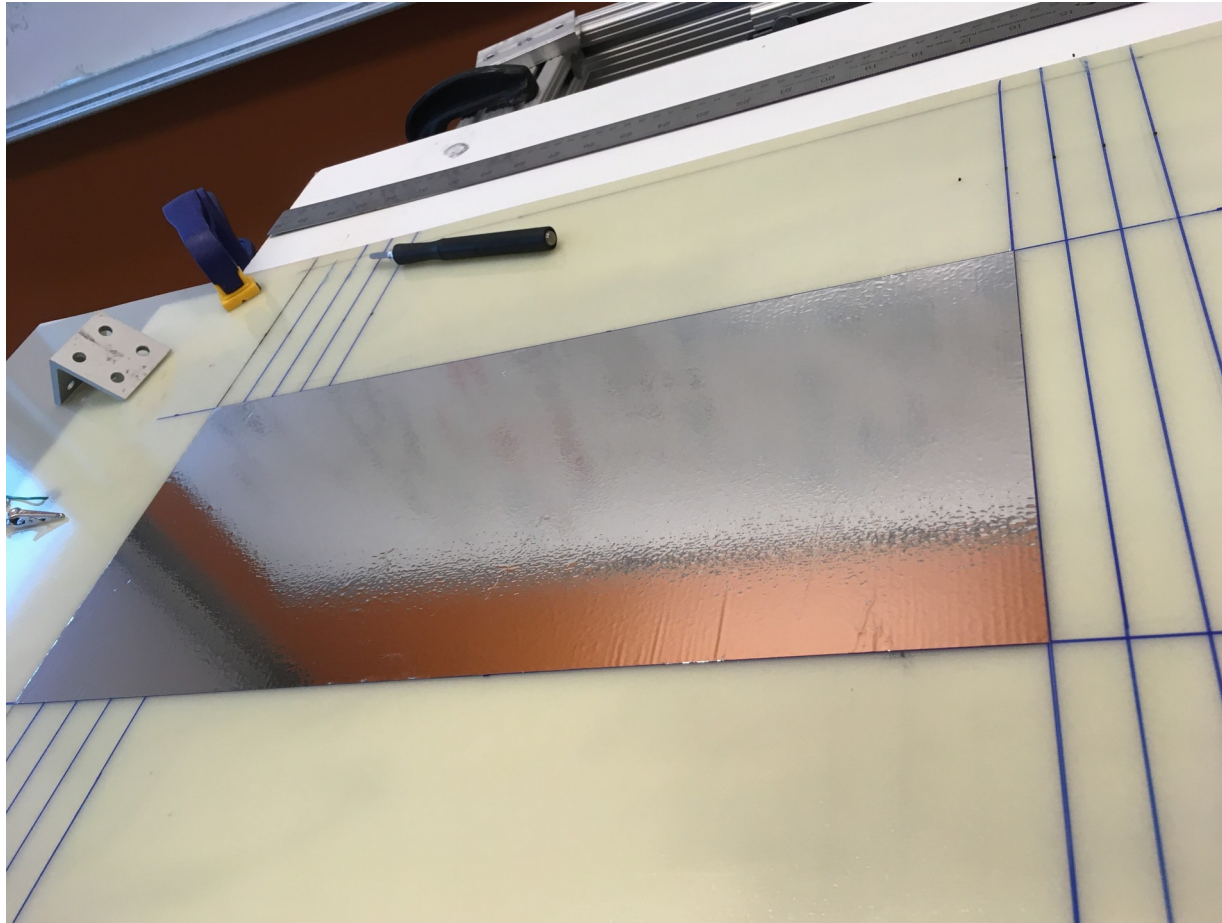
Conclusion

- Applying electric field(Capacitor method) is better than the tension method

4. Vacuum method

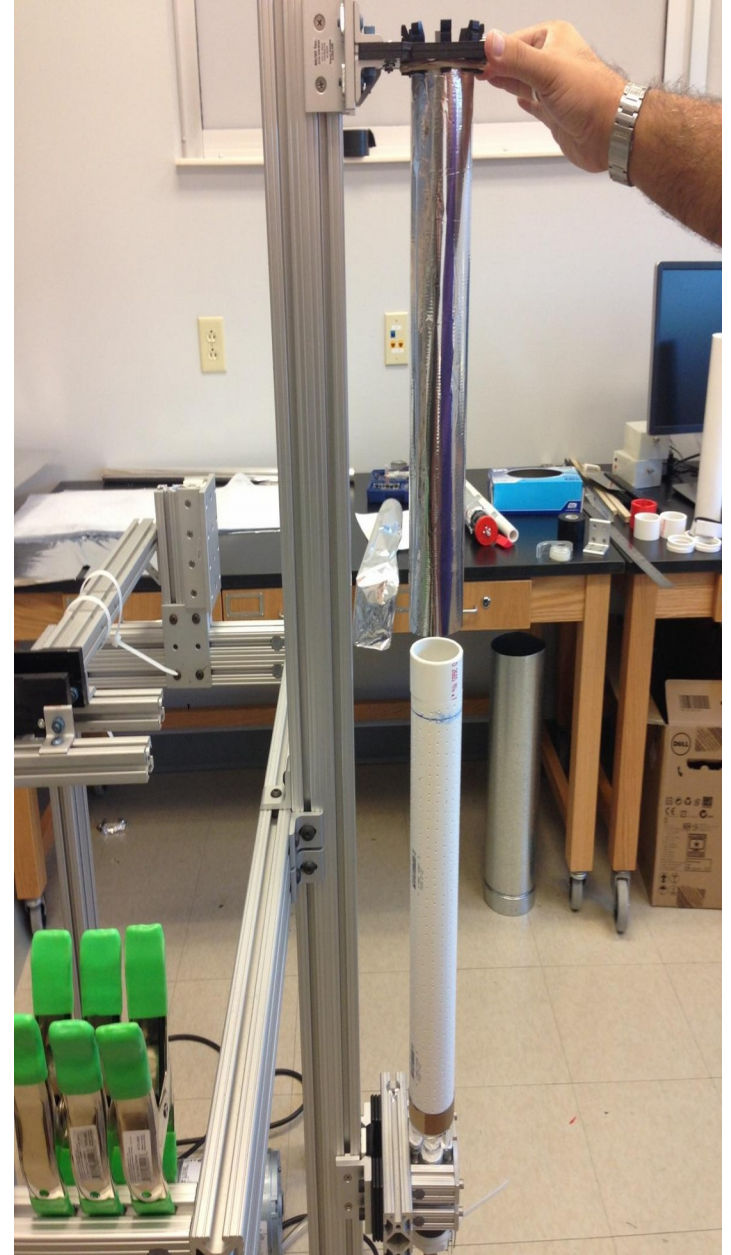
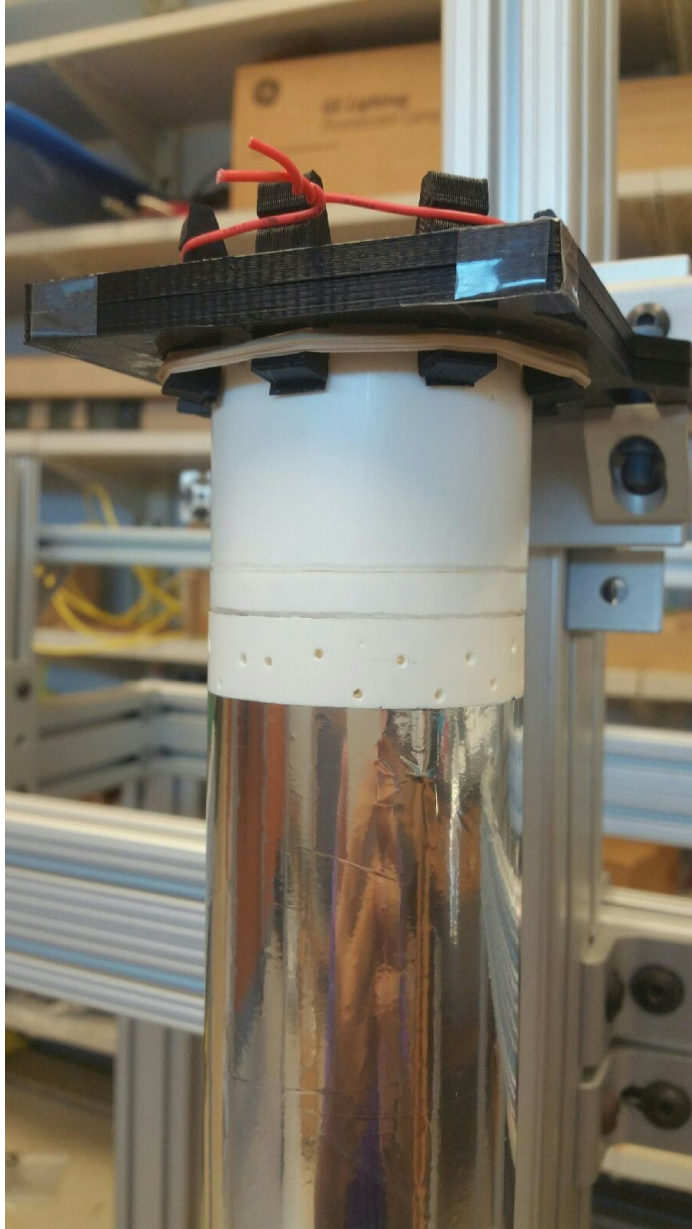
- Wrapping on the pipe and switch on the vacuum.
- Overlapping region was glued using DP 190.

4.1. Use capacitor method to cut the foil





4.3 Gluing to rings and remove foil from the pipe



After gluing both rings

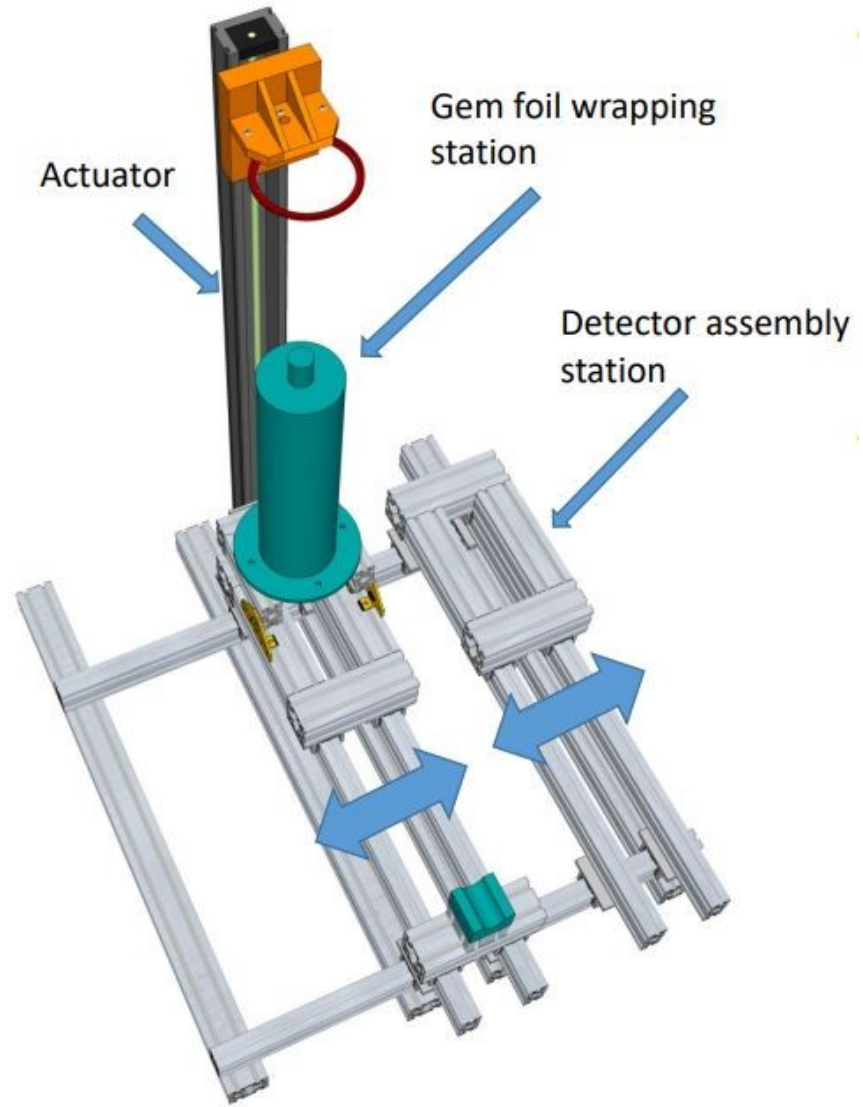


Conclusion

- We have had the best results from Vacuum method .
- Less wrinkles on the cathode structure.

Future work

- Build the BONuS12 assembly tower.



Thank You