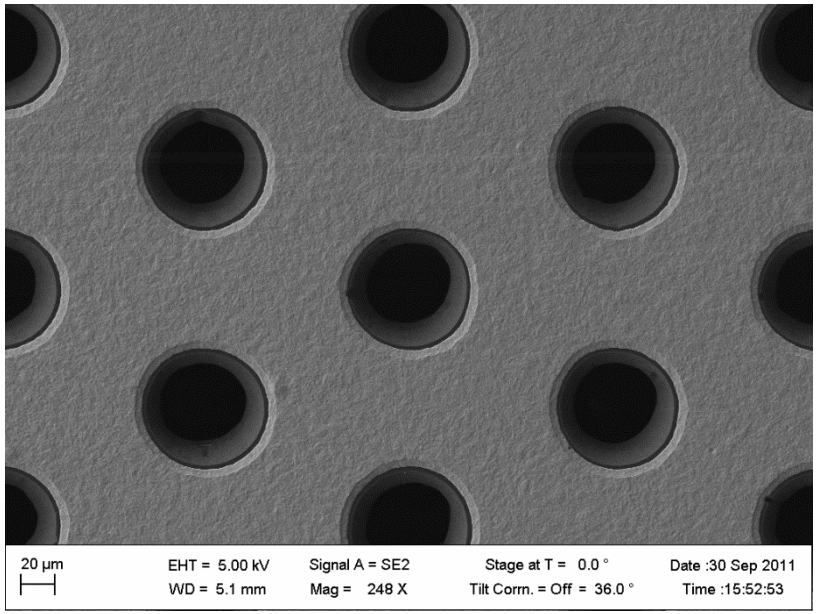
Ispitivanje iskrenja postava nadograđene komore vremenske projekcije u ALICE detektoru na LHC-u

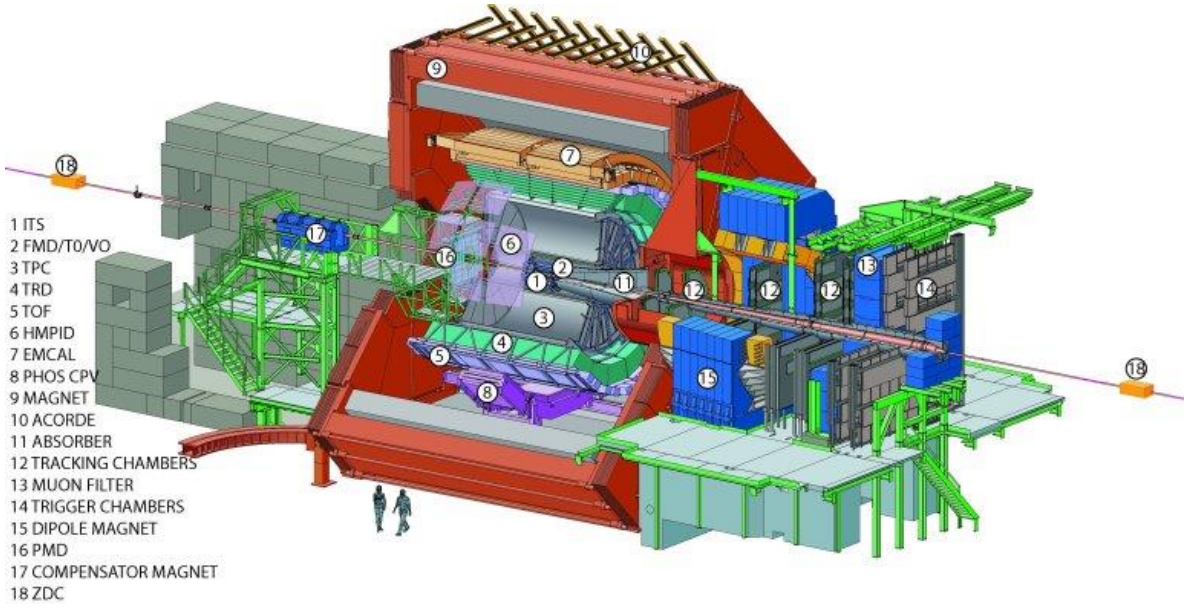
David Karatović

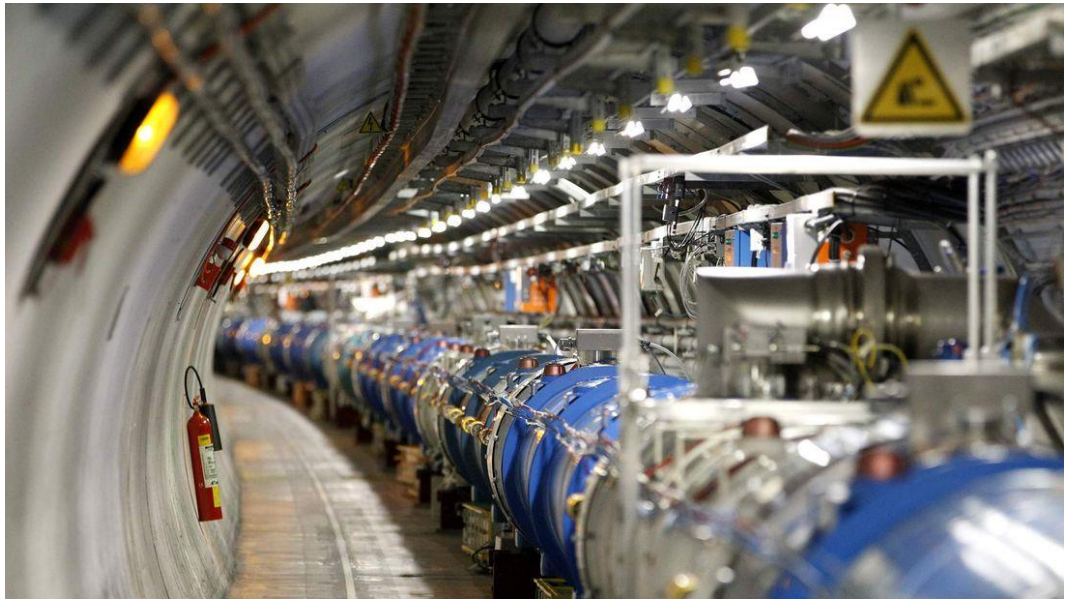
Sveučilište u Zagrebu, Hrvatska

Uvod :

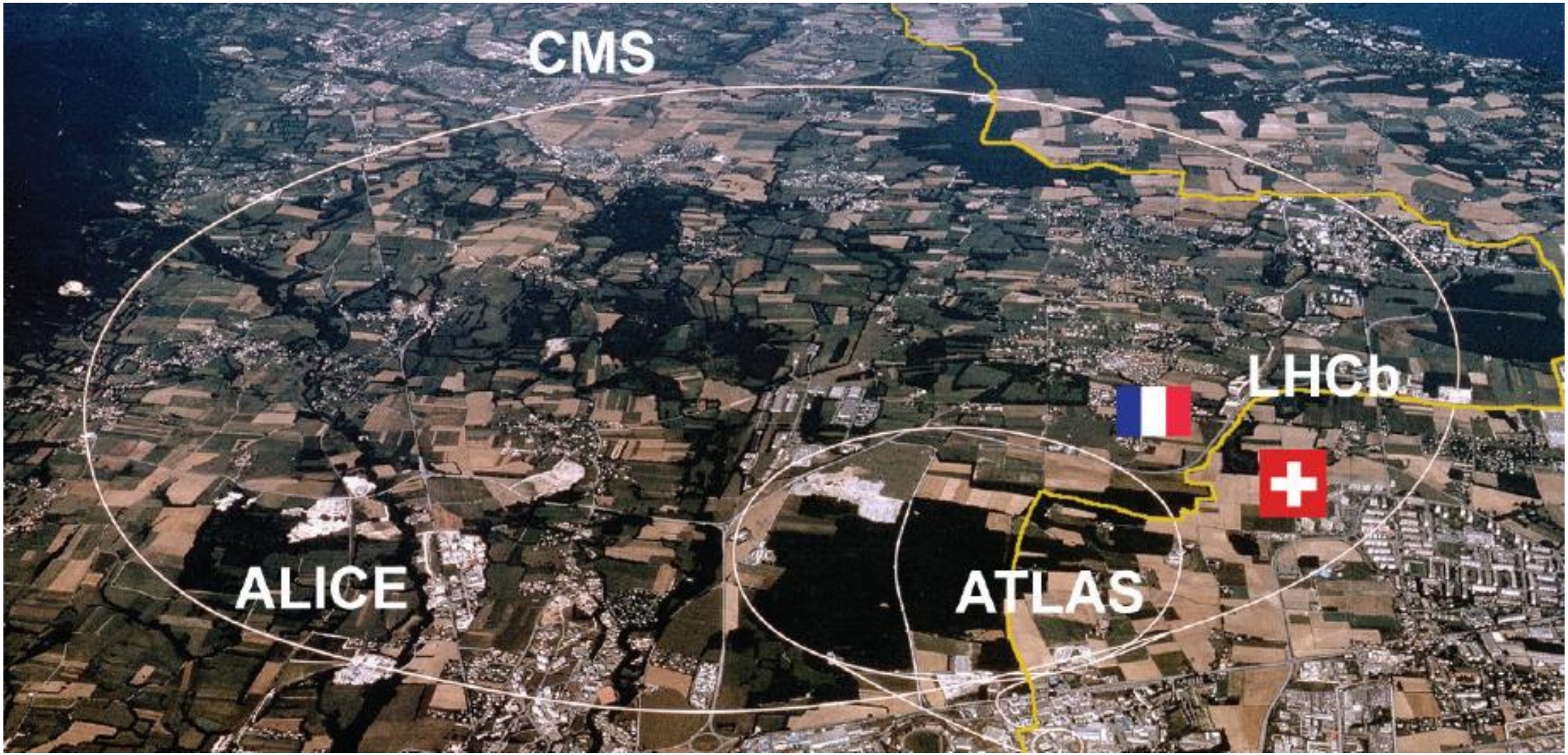
- LHC (The Large Hadron Collider)
- ALICE (A Large Ion Collider Experiment)
- ALICE TPC (Time Projection Chamber)
- GEM (Gas Electron Multiplier)

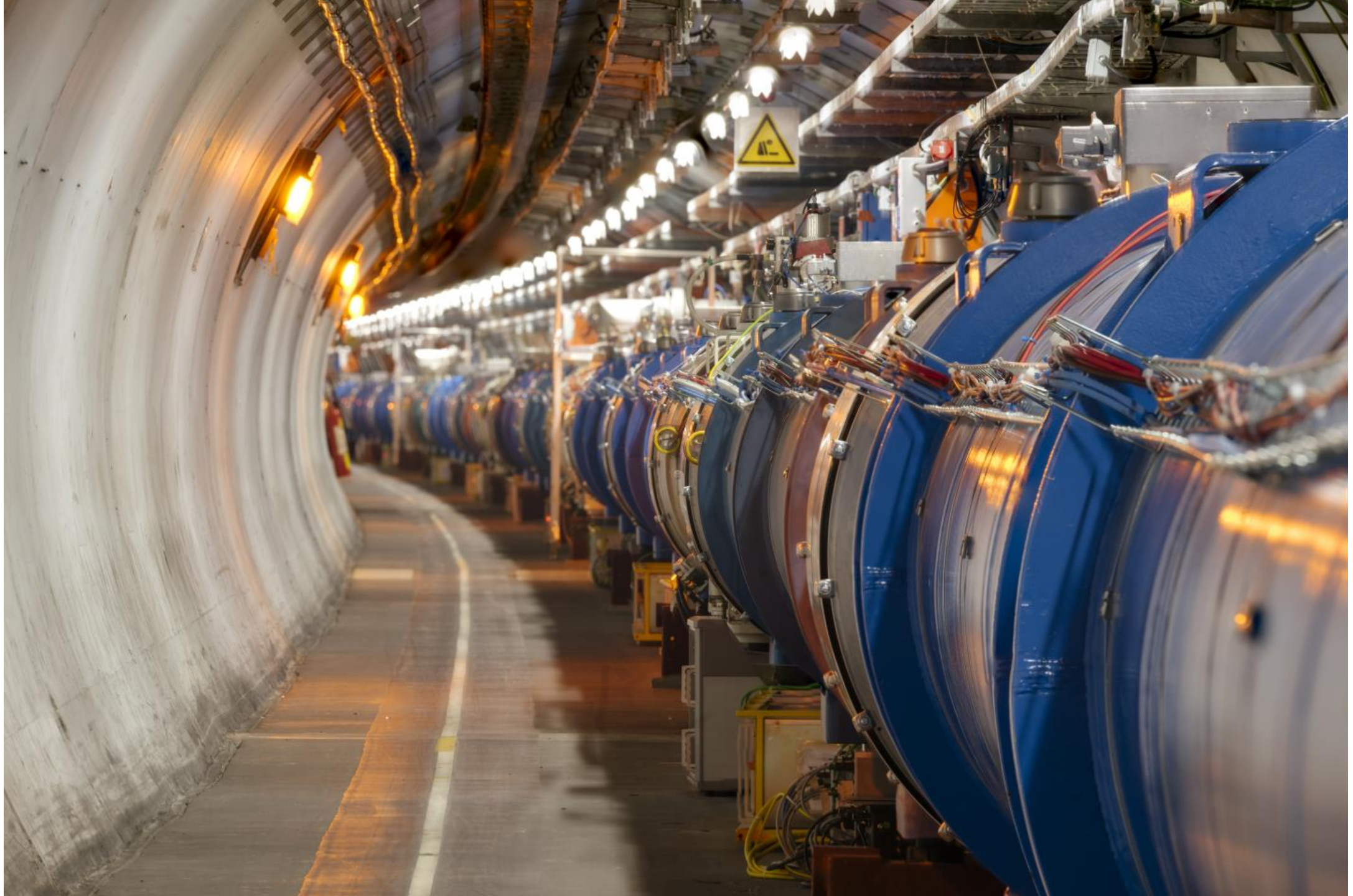




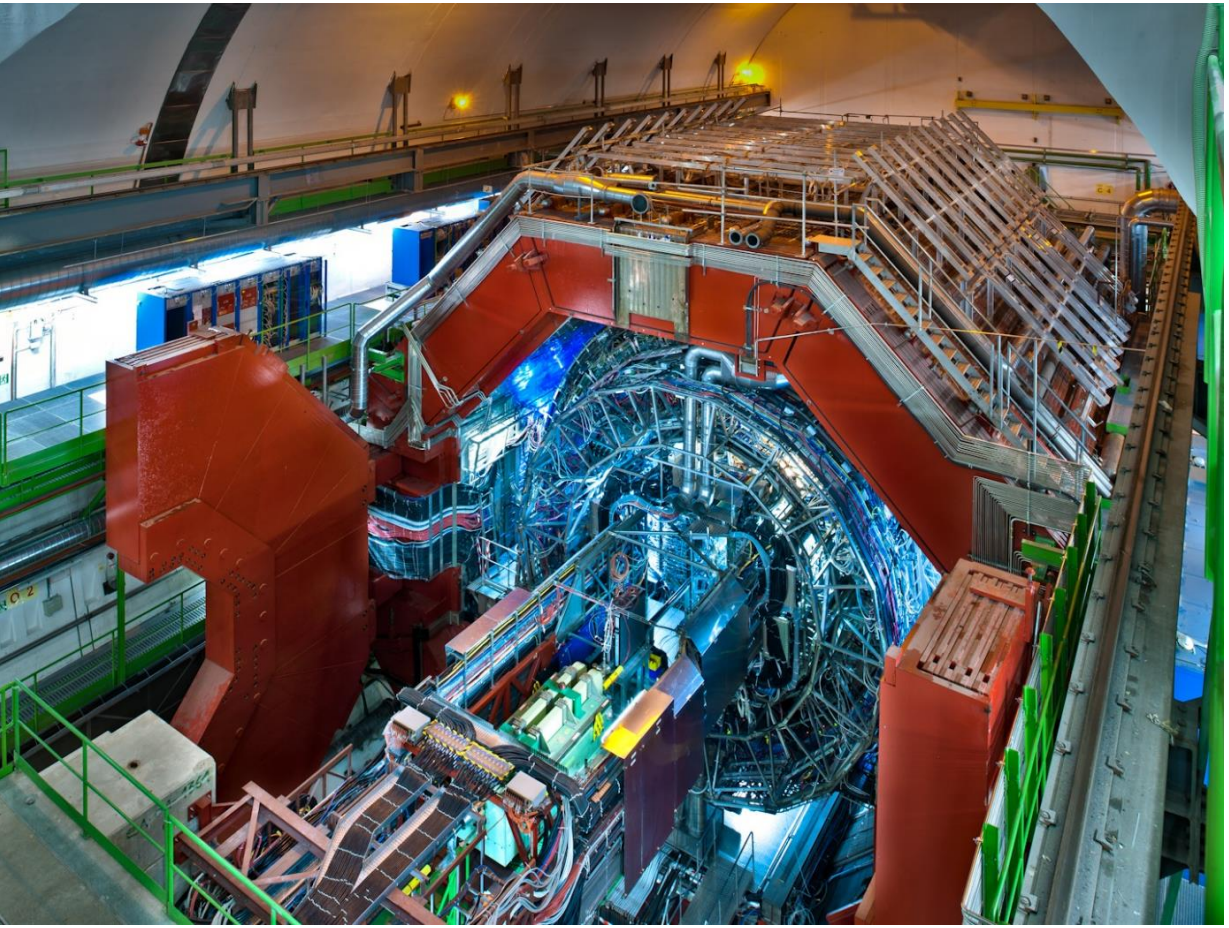


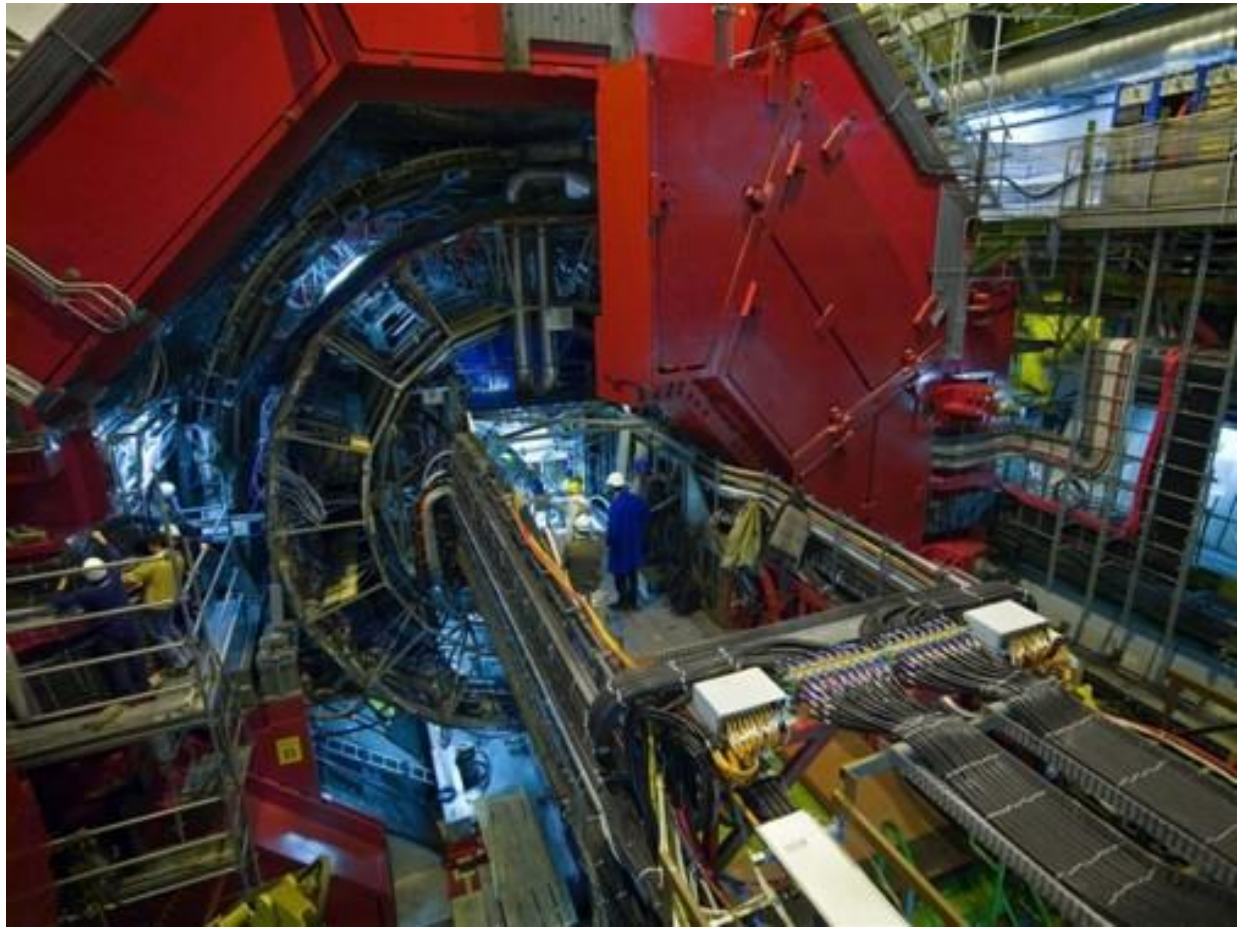
LHC (The Large Hadron Collider) :

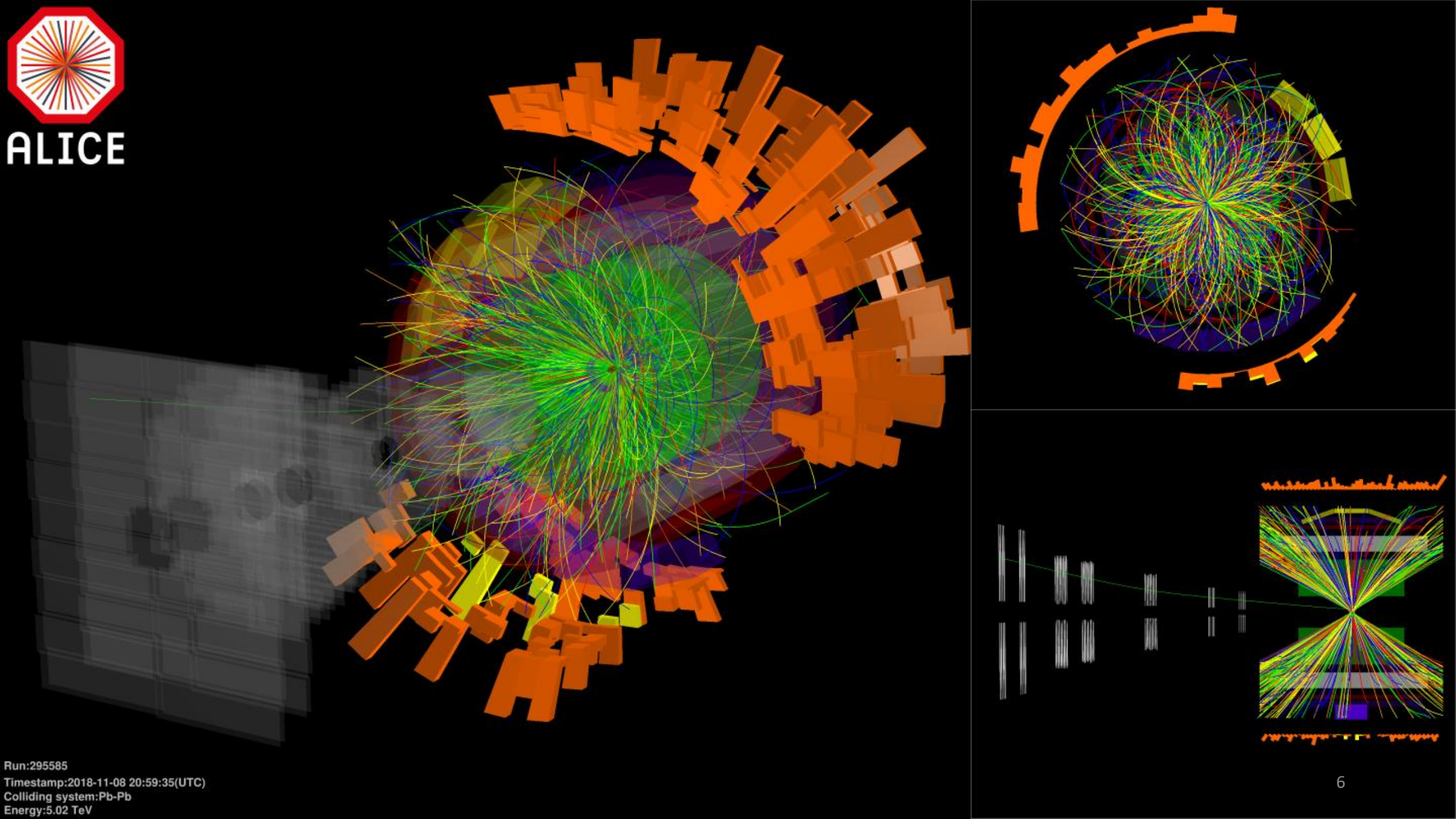




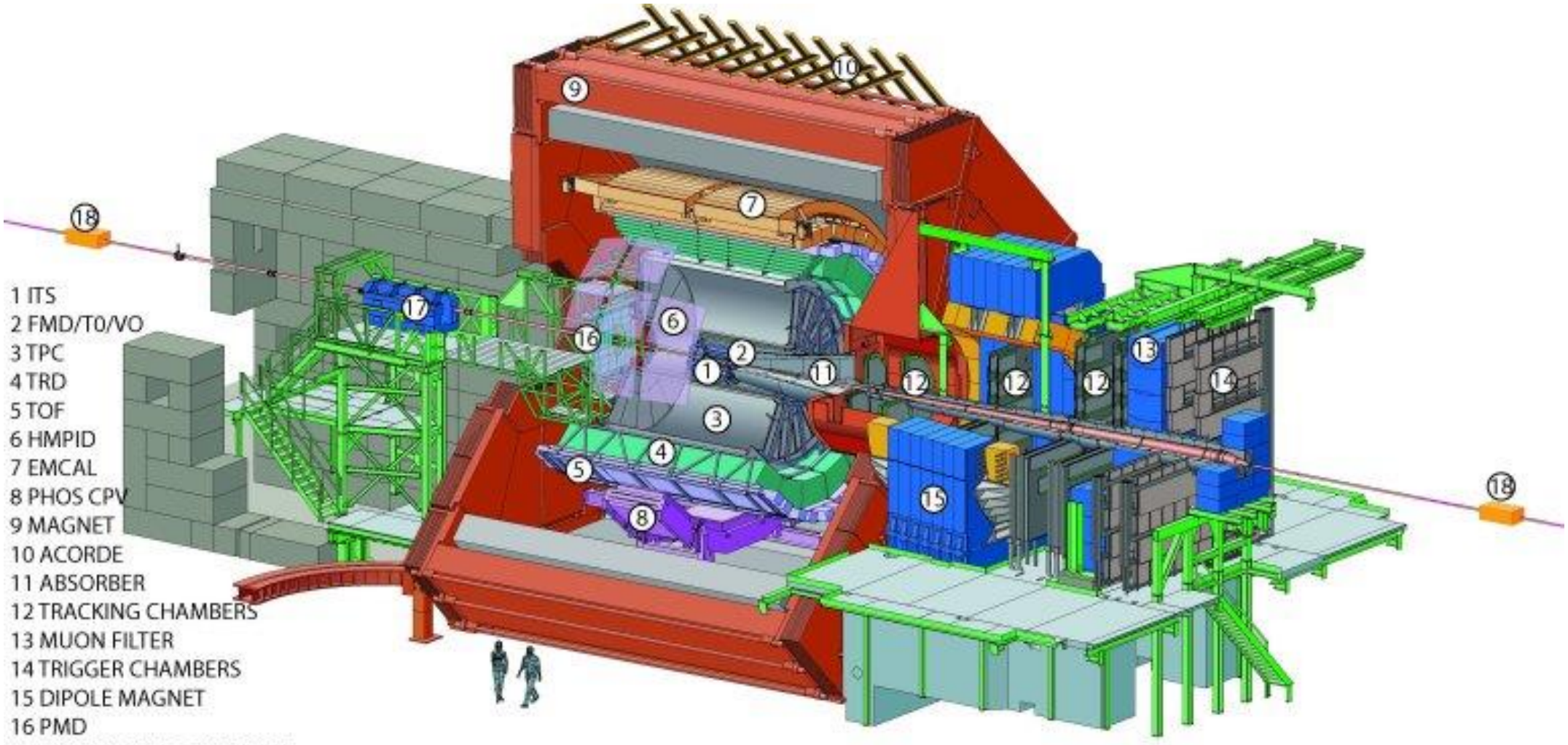
ALICE (A Large Ion Collider Experiment) :

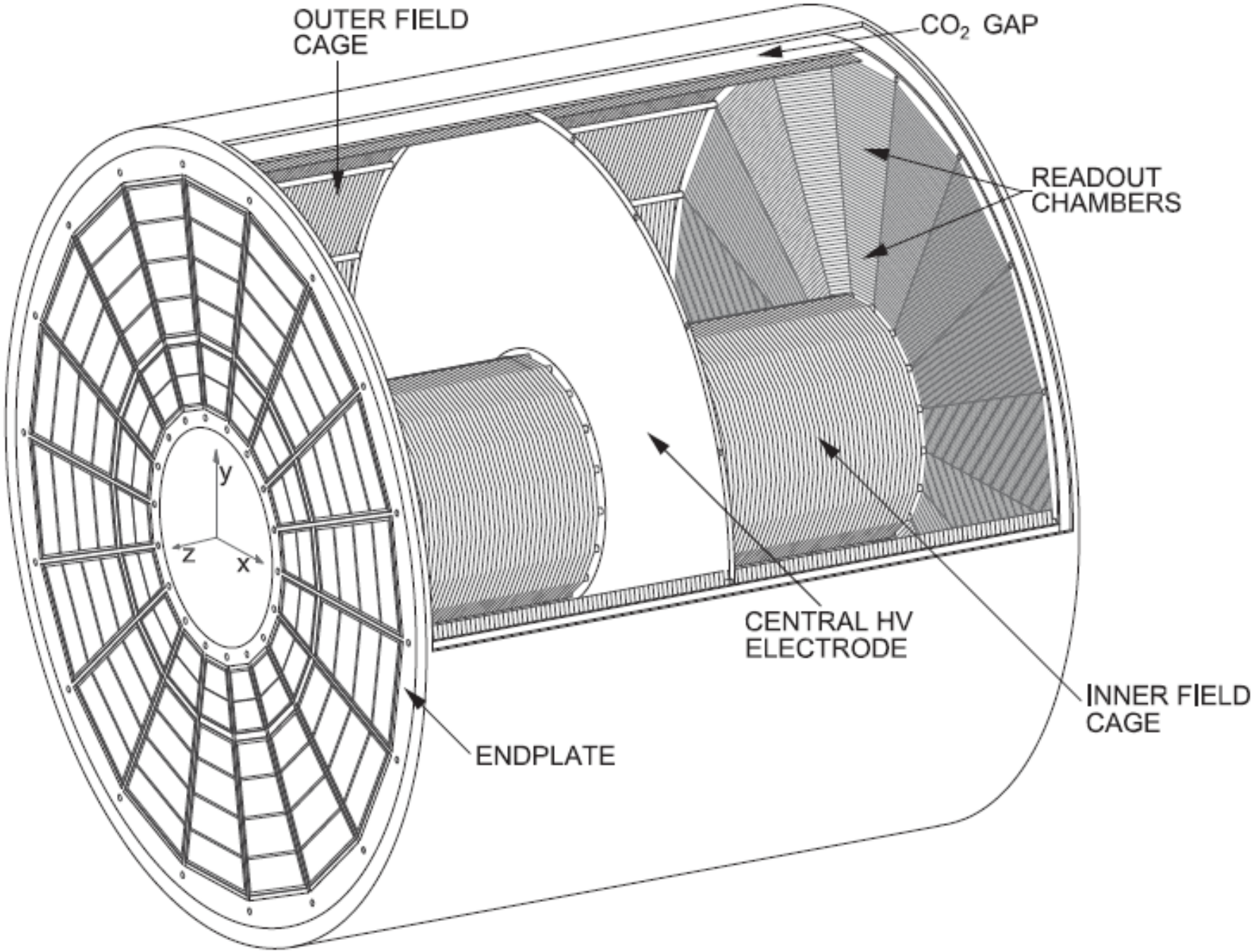




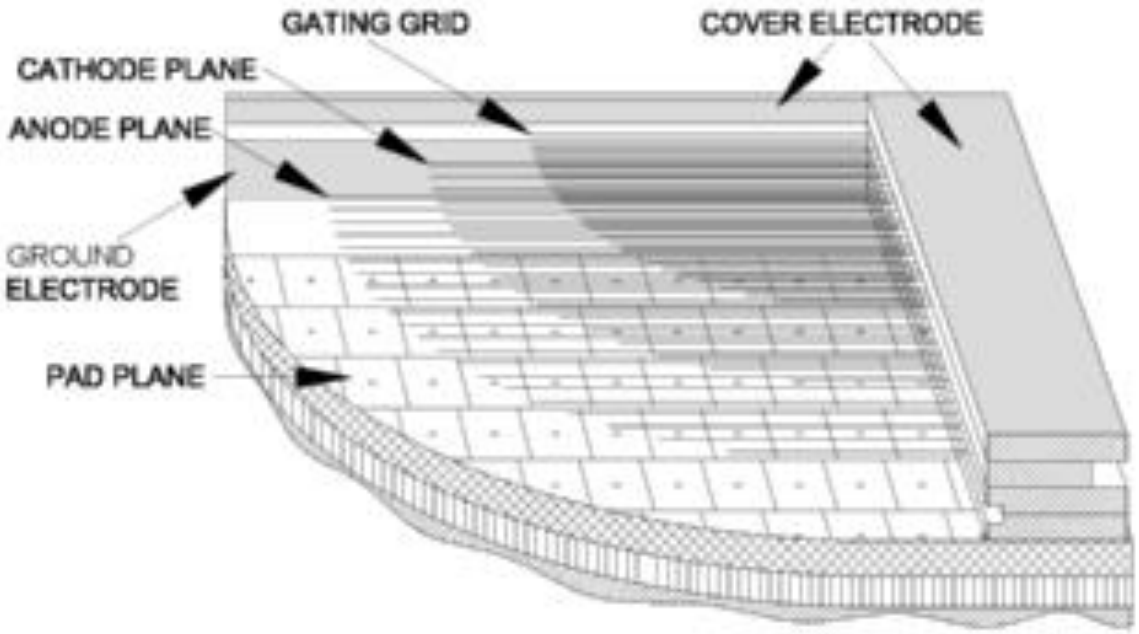

ALICE
Run:295585
Timestamp:2018-11-08 20:59:35(UTC)
Colliding system:Pb-Pb
Energy:5.02 TeV

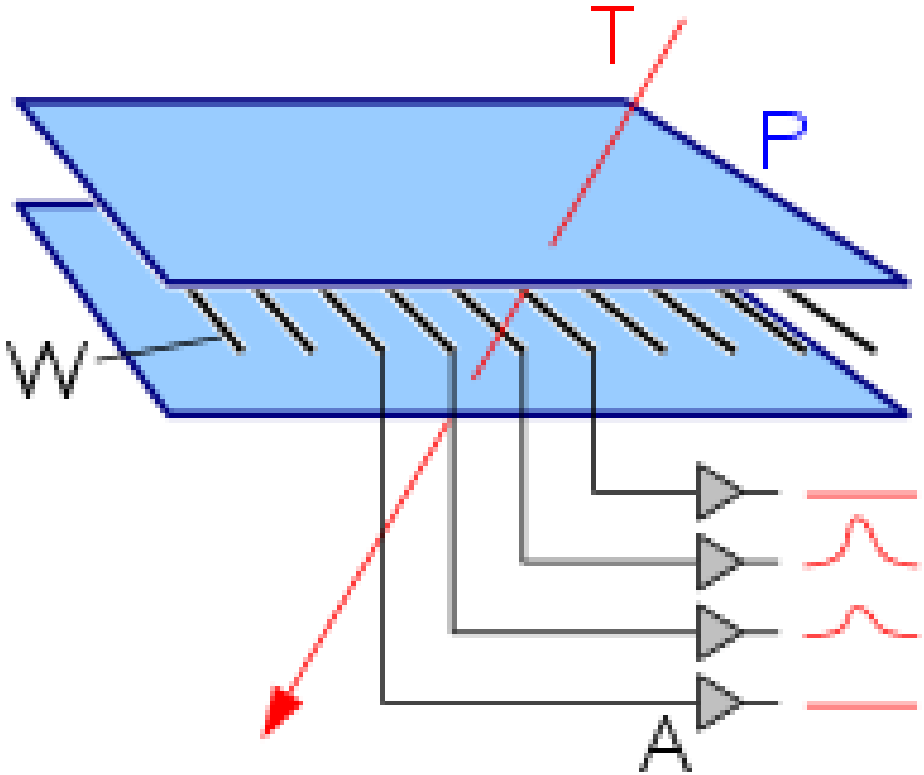
ALICE TPC (Time projection chamber)



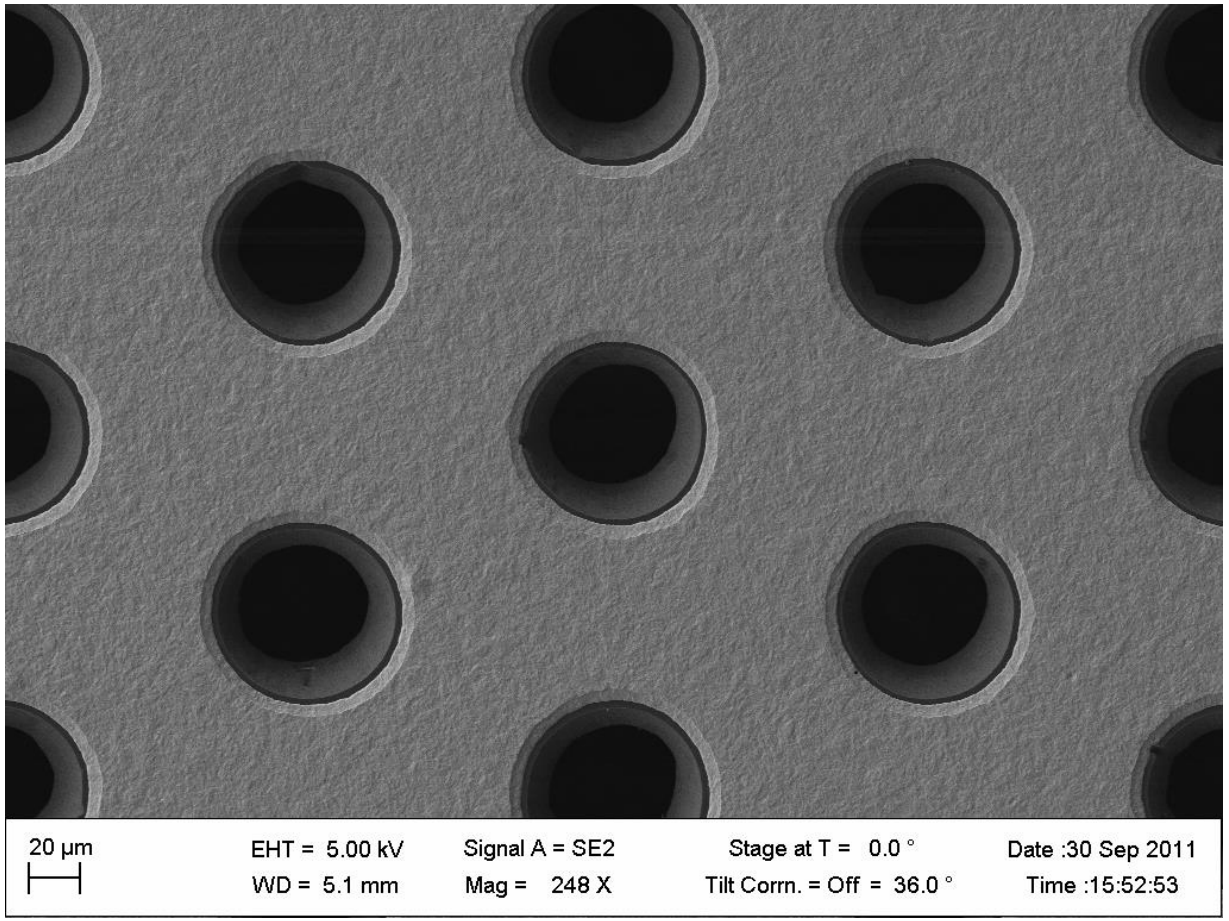

OUTER FIELD CAGE
CO_2 GAP
READOUT CHAMBERS
y
z
x
CENTRAL HV ELECTRODE
INNER FIELD CAGE
ENDPLATE

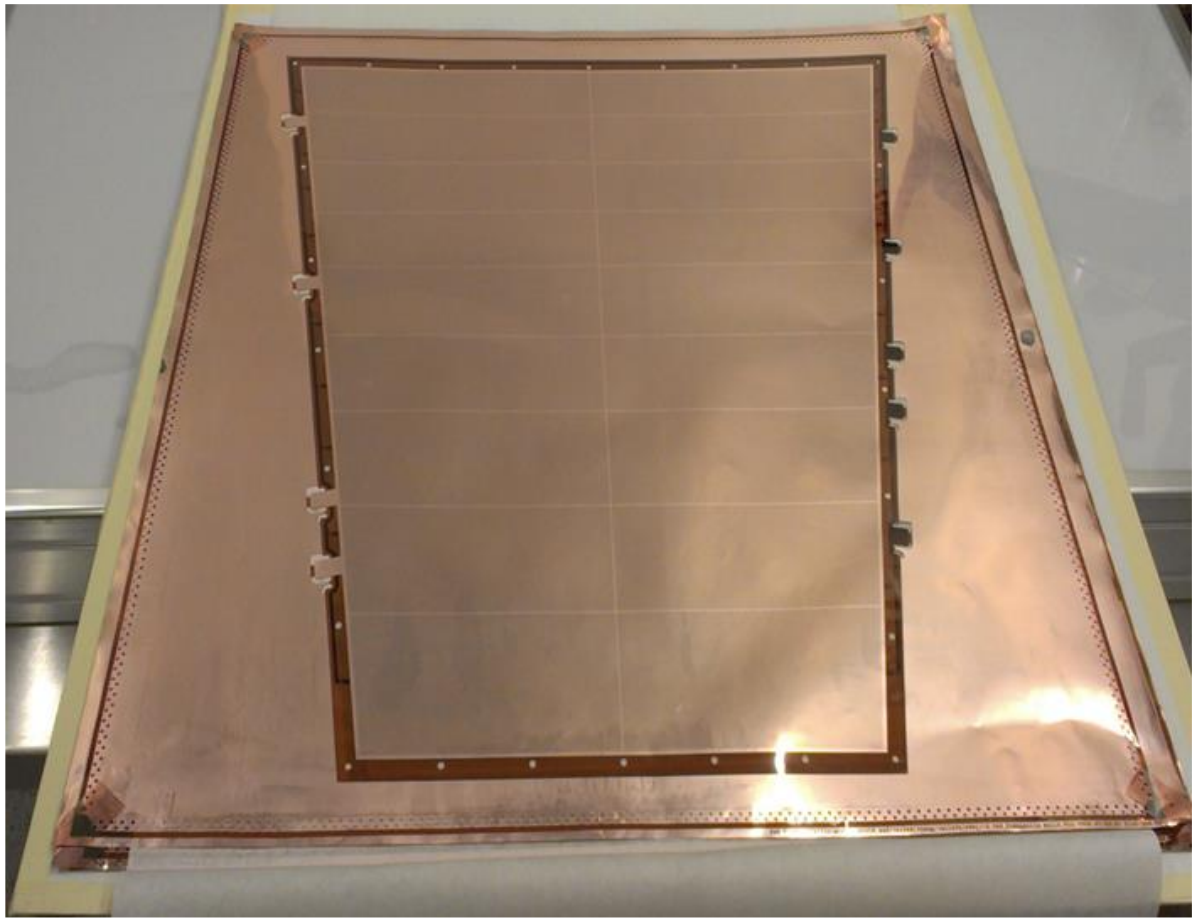
MWPC (Multiwire Proportional Chamber) :

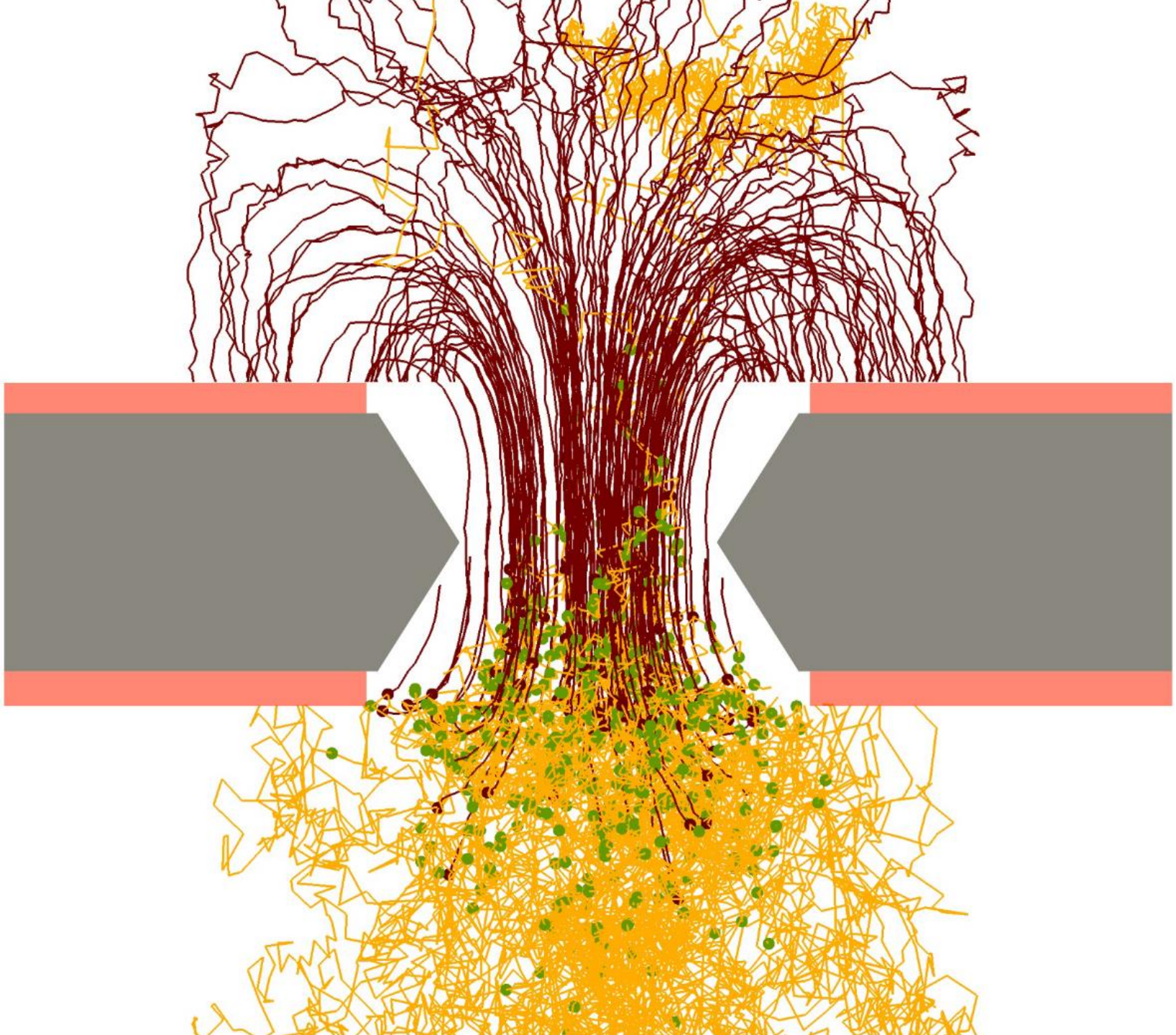


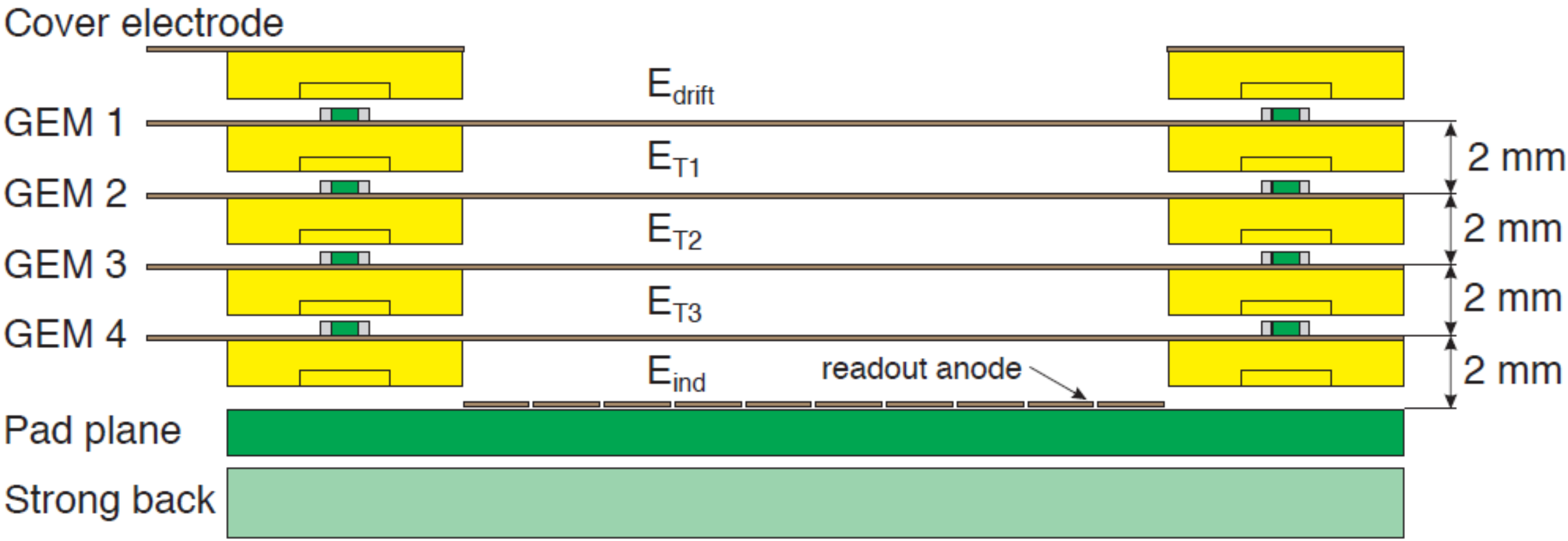


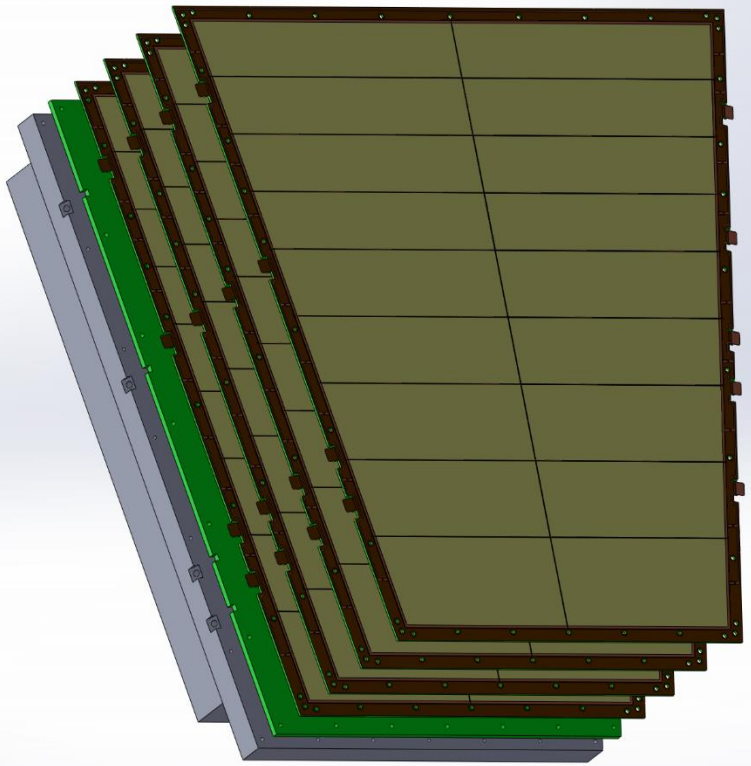
GEM (Gas Electron Multiplier) :

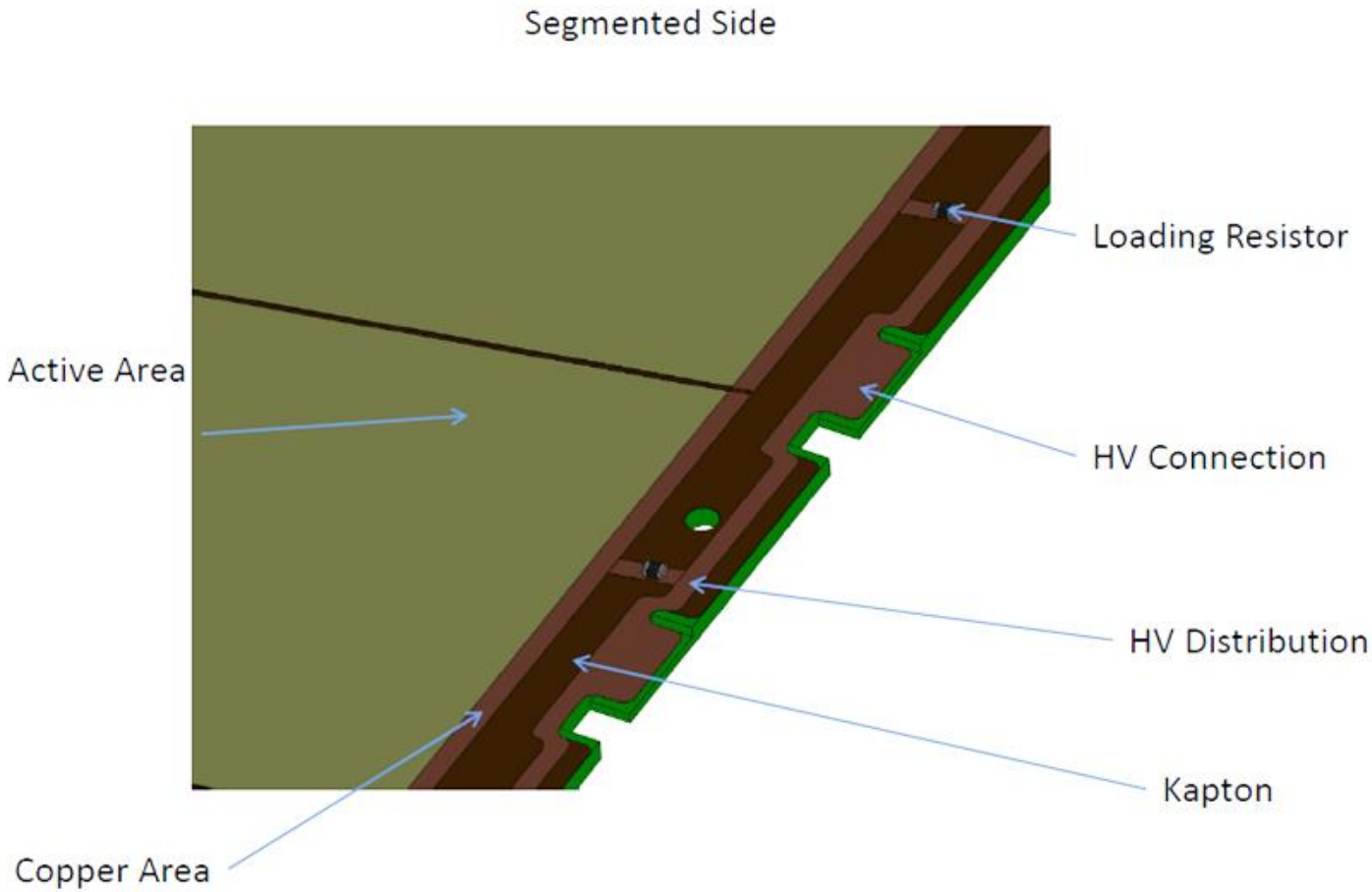


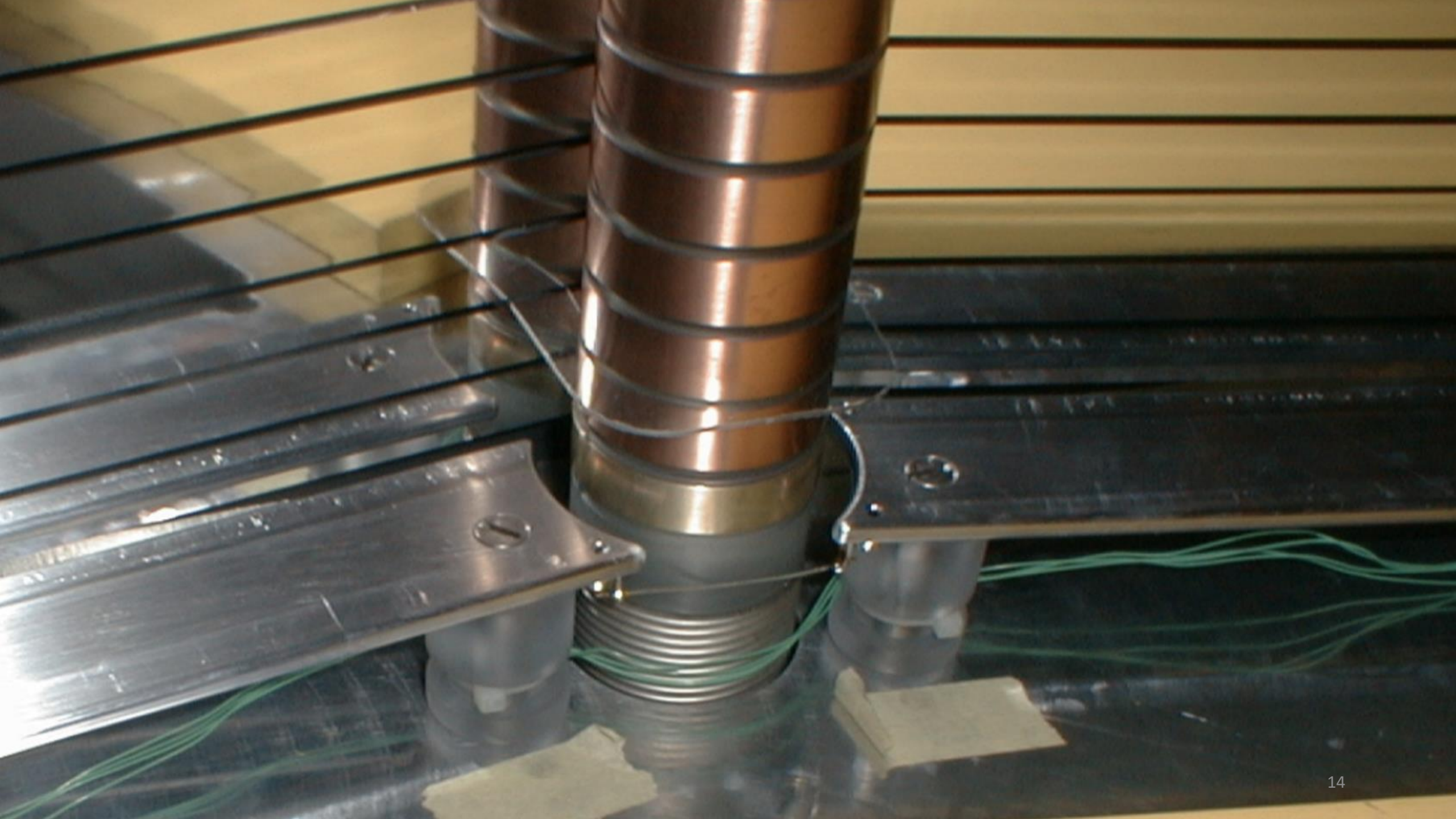





Cover electrode
GEM 1
GEM 2
GEM 3
GEM 4
Pad plane
Strong back
E_{drift}
E_{T1}
E_{T2}
E_{T3}
E_{ind}
readout anode
2 mm
2 mm
2 mm
2 mm




Segmented Side
Active Area
Loading Resistor
HV Connection
HV Distribution
Kapton
Copper Area

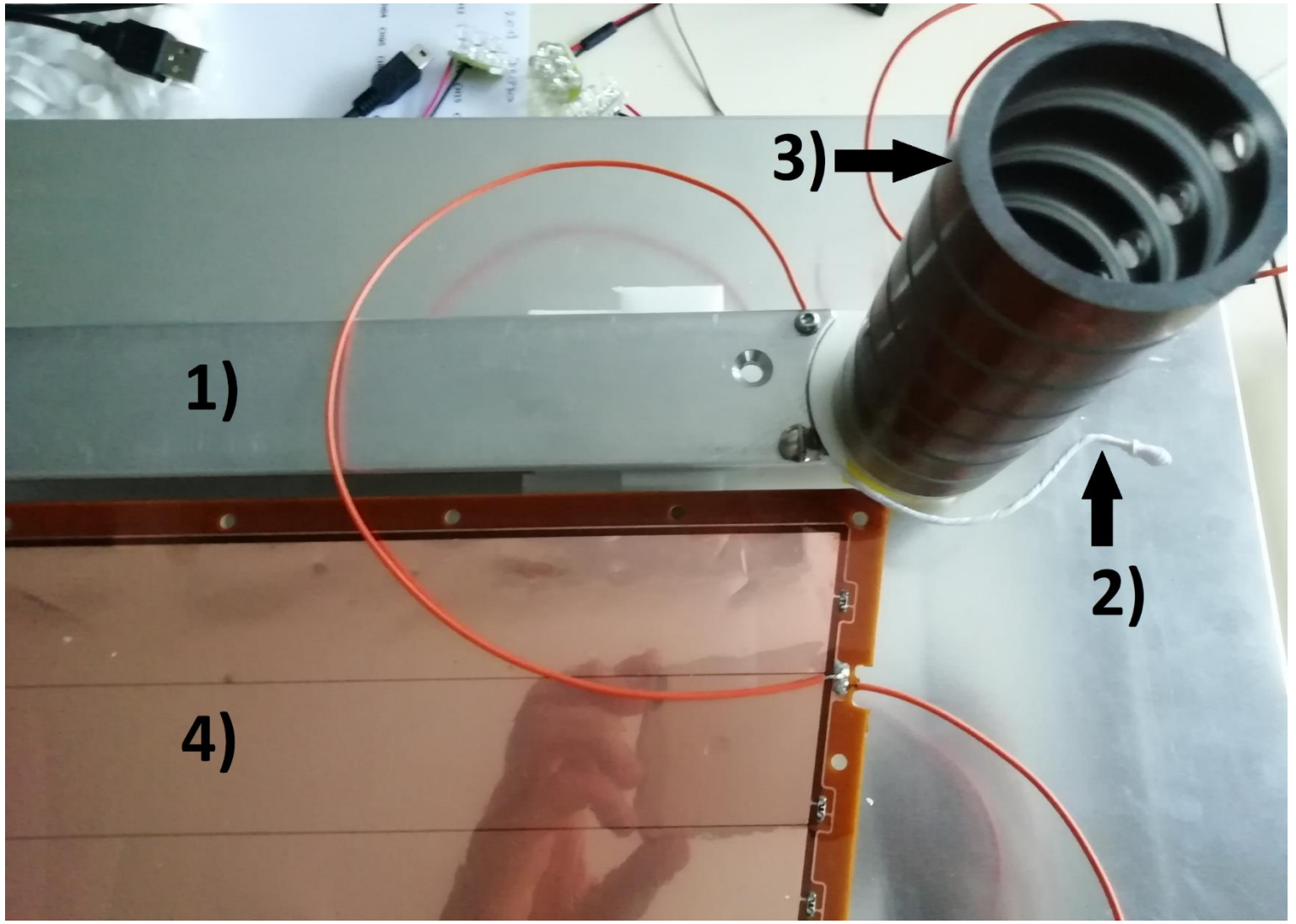


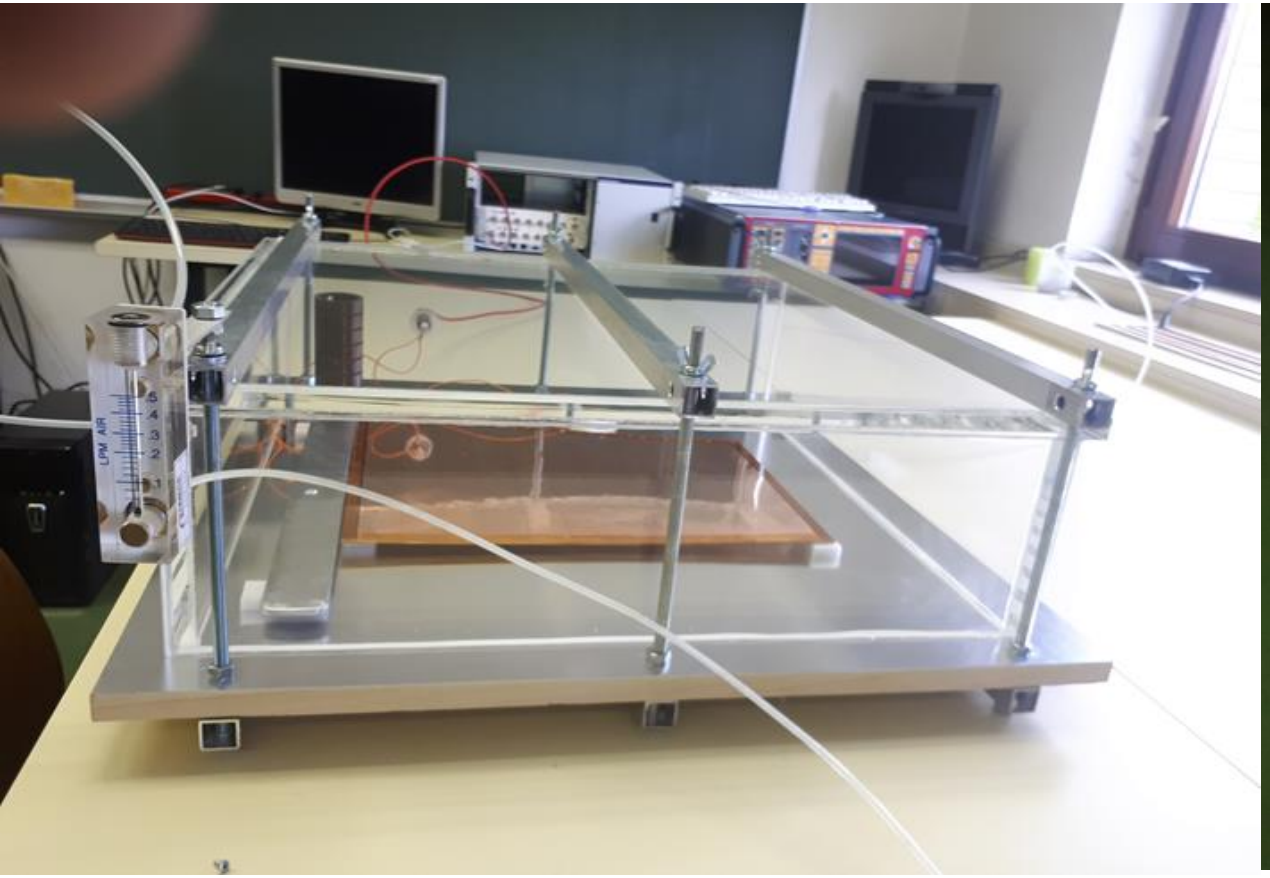
Motivacija i svrha mjerenja :

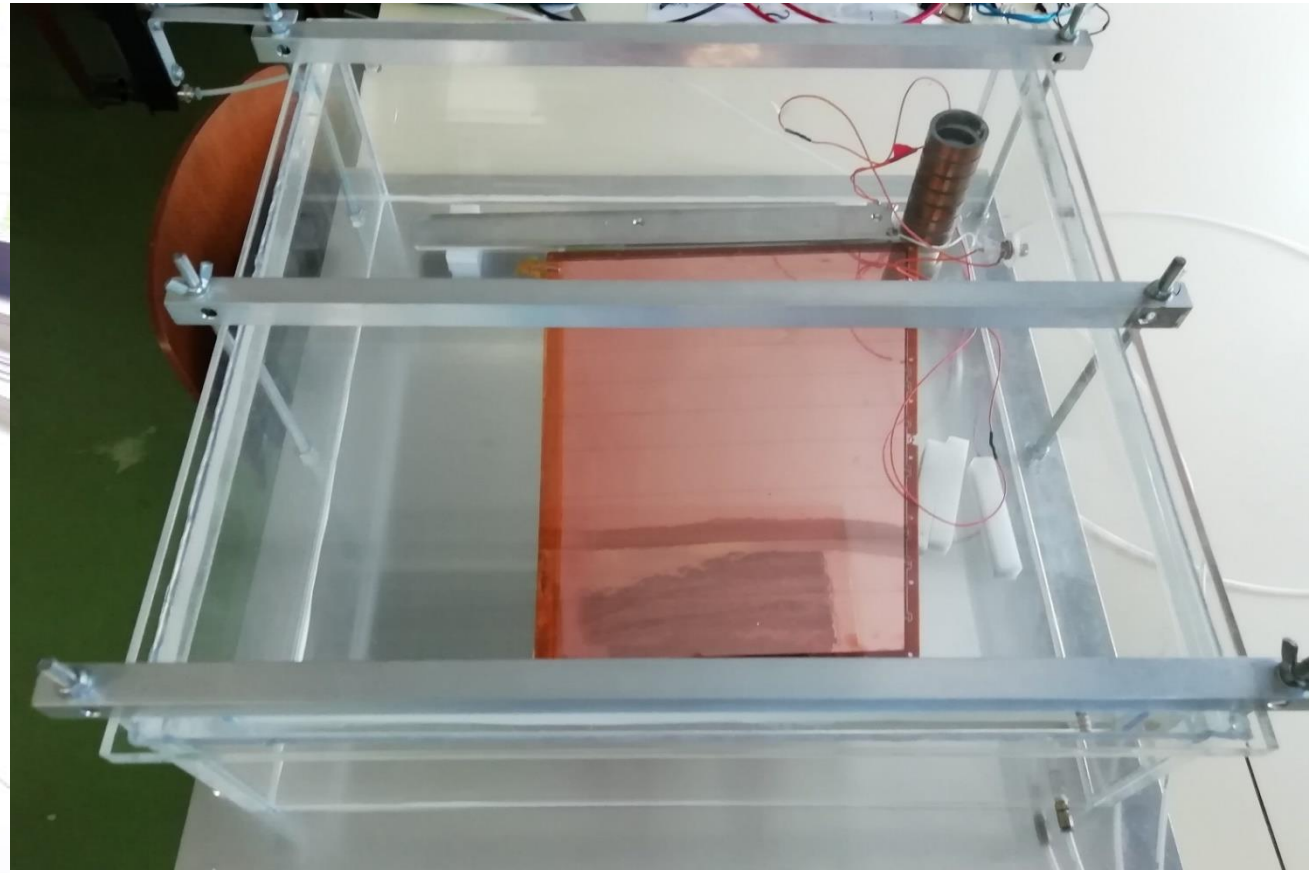
- Pri uključivanju detektora moguće je generirati razliku potencijala među komponentama detektora
- Potrebno je provjeriti na kojem će naponu doći do iskrenja za udaljenosti zadane dizajnom detektora
- Potrebno je odrediti sigurnu udaljenost žice i potrebnu debljinu teflonske izolacije

Postav

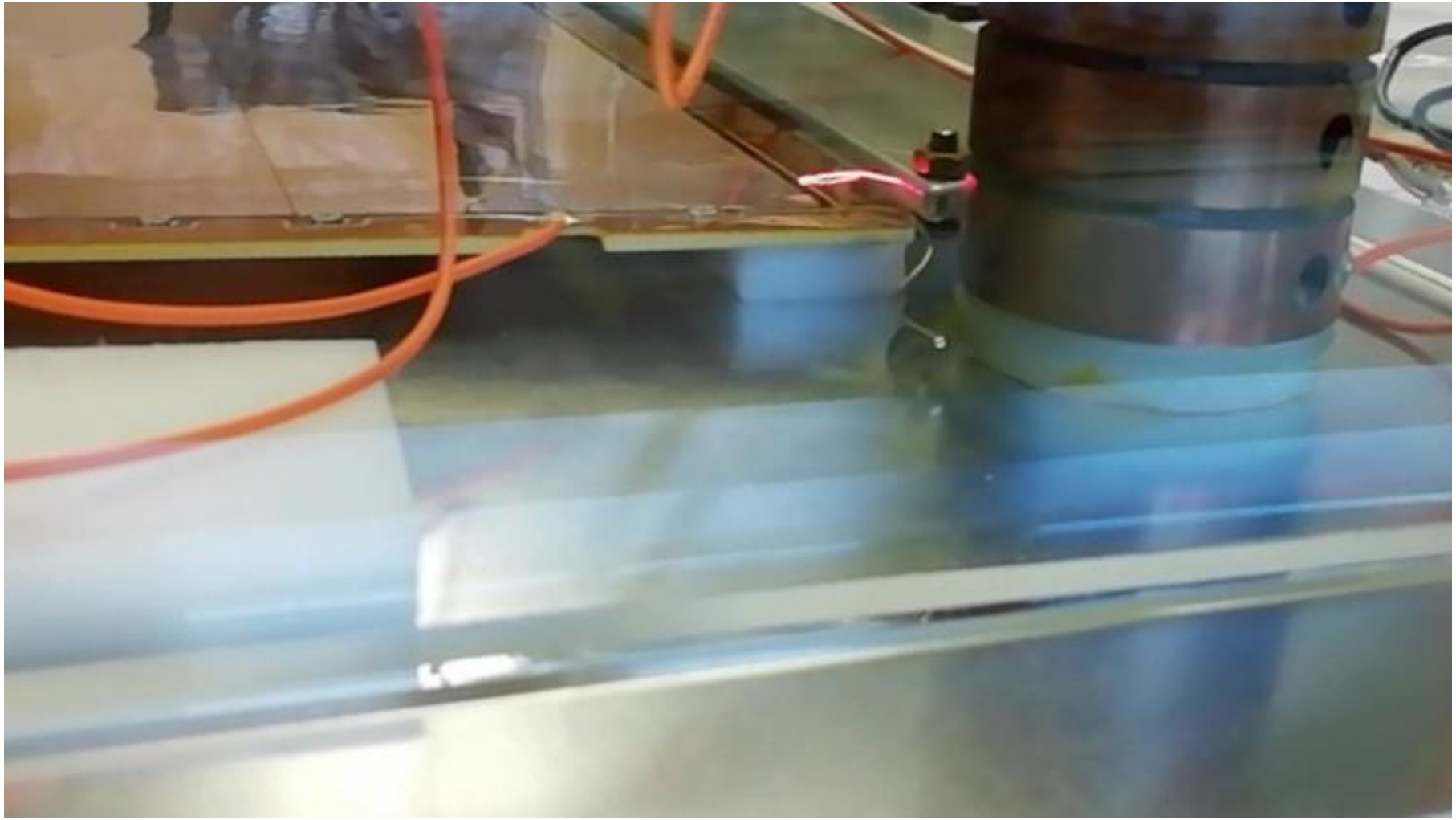
1) Aluminijska „skirt” elektroda
2) Pocinčana bakrena žica s teflonskom izolacijom
3) Bakrena šipka
4) GEM folija




LPM AIR

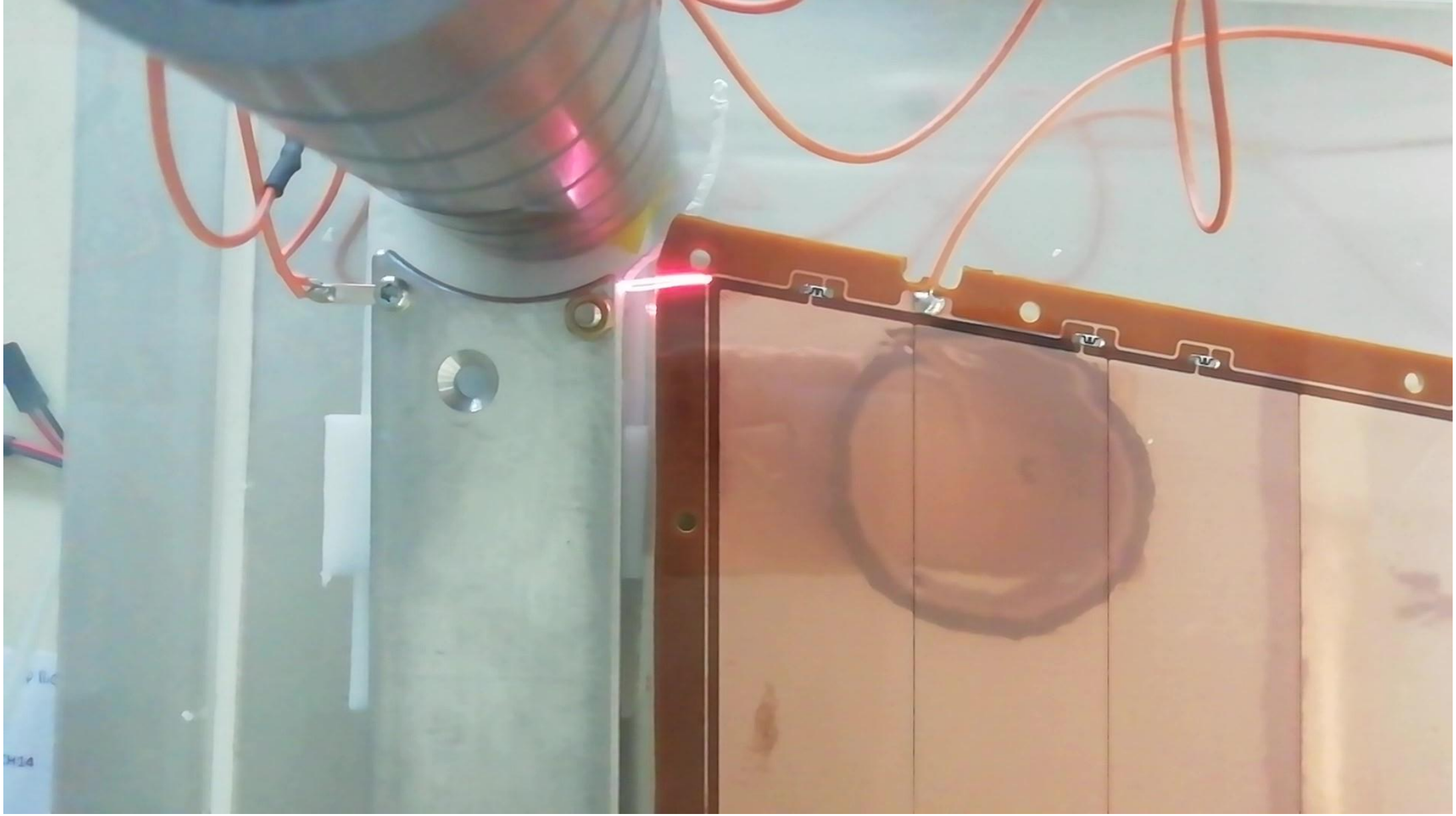


Rezultati :

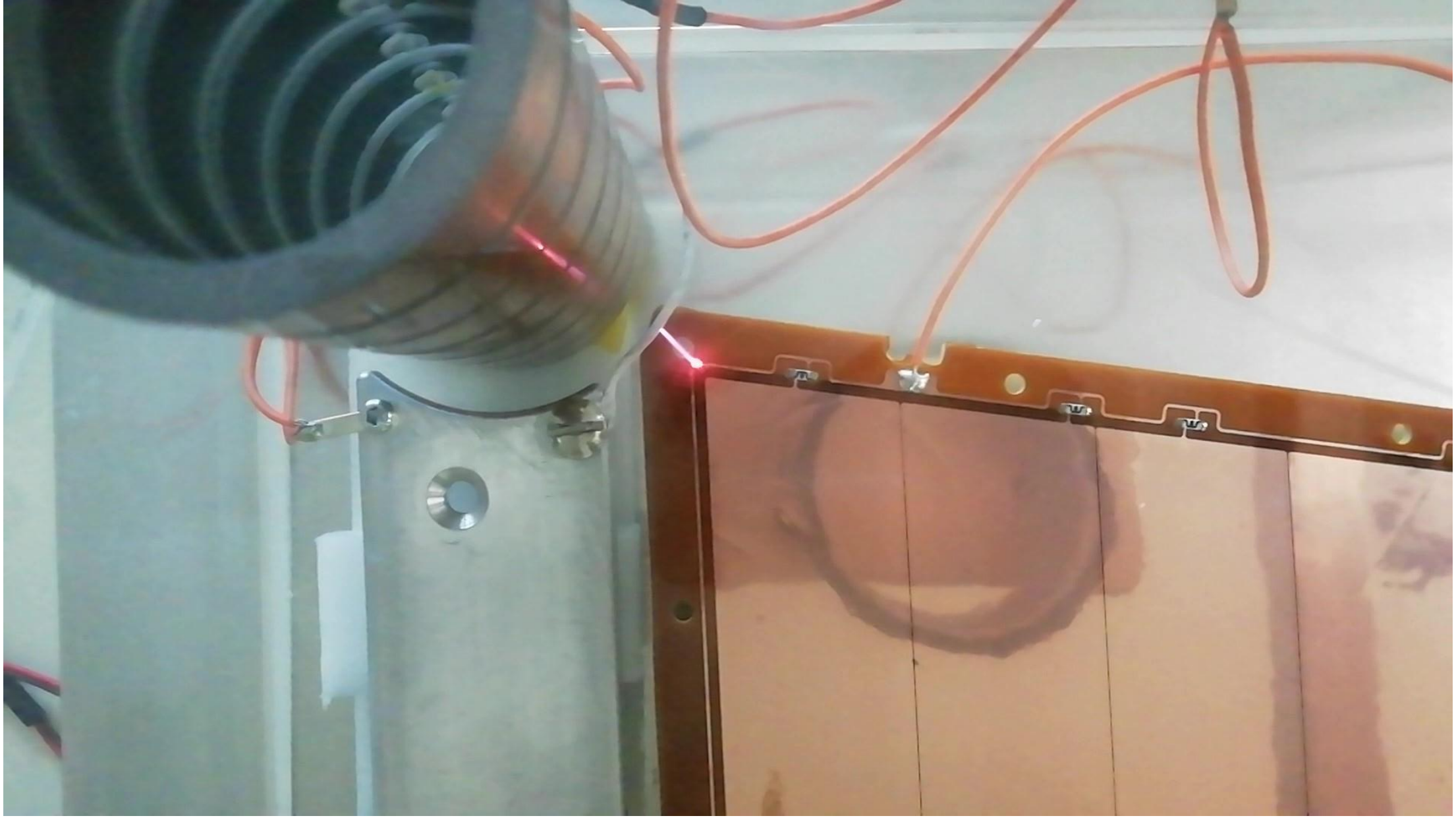


- Napon je na GEM-u, a ostatak postava je uzemljen, udaljenost GEM-„skirt” ≈13 mm, izboj na 5.8 kV.

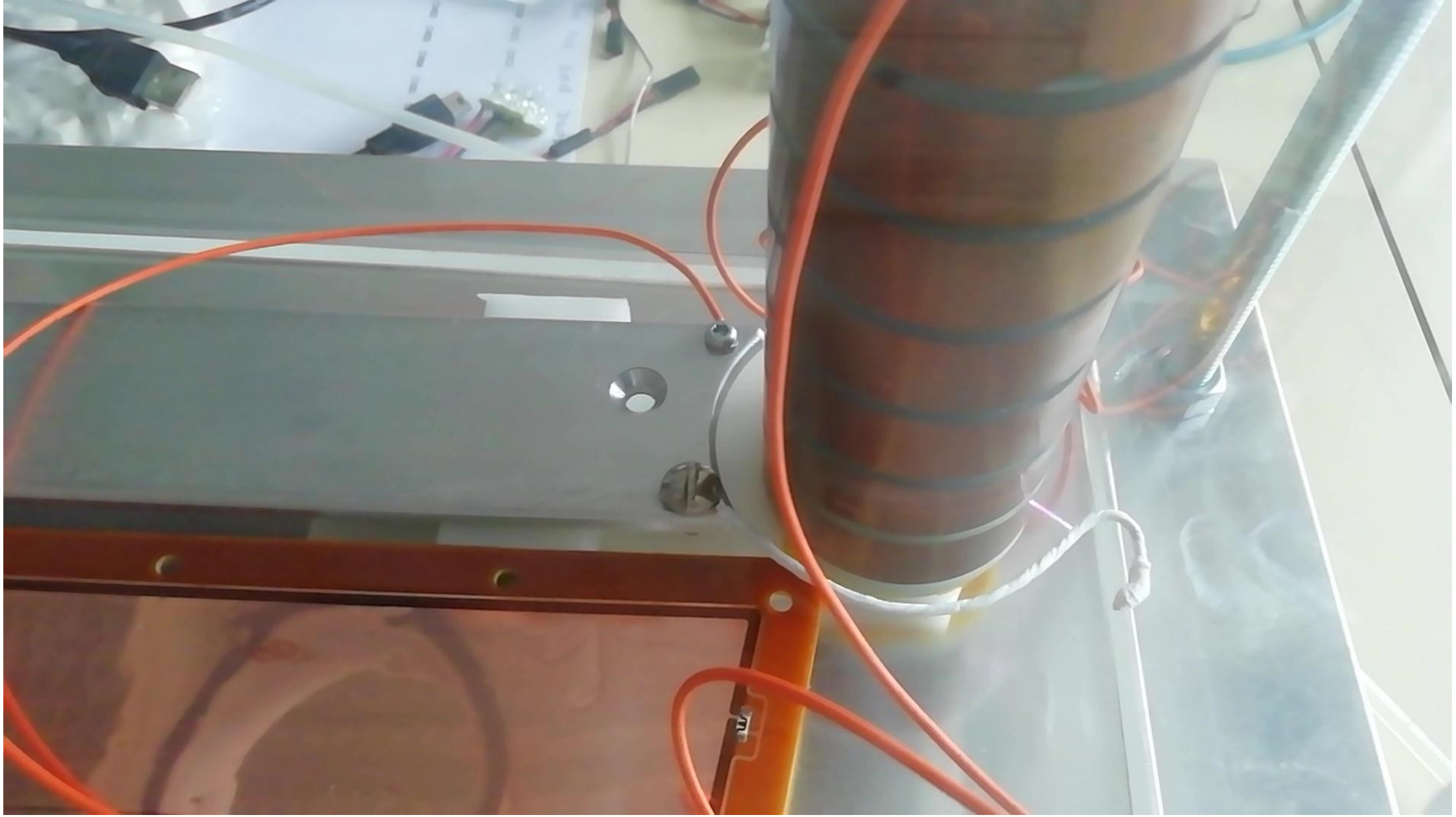
- Napon između GEM-a i ostatka postava, udaljenost GEM-žica ≈11 mm, izboj na 5.75 kV.



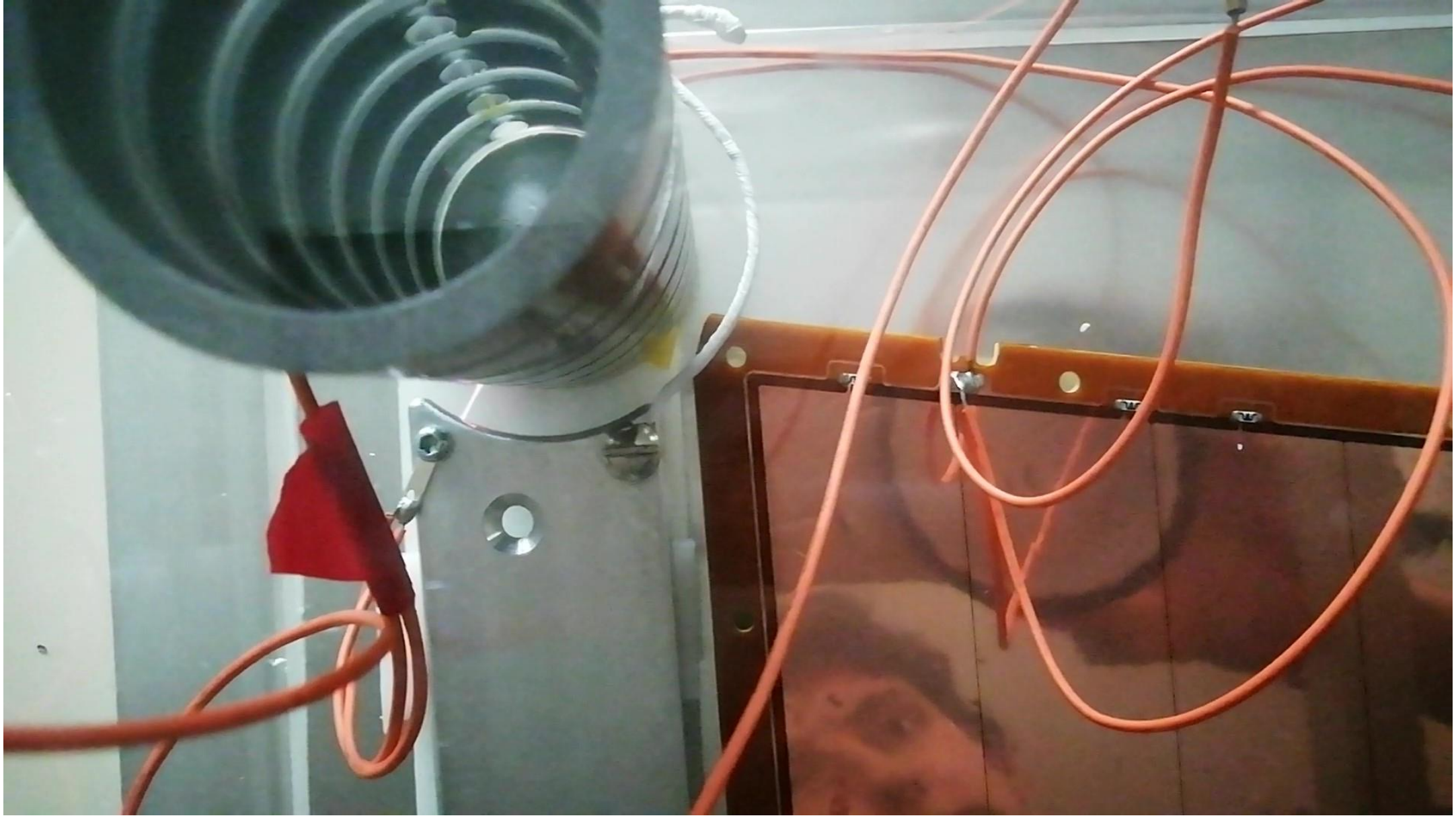
- Napon između GEM-a i ostatka postava, udaljenost GEM-„skirt” ≈13mm, debljina teflona ≈ 0.05mm, izboj na 5.5 kV.



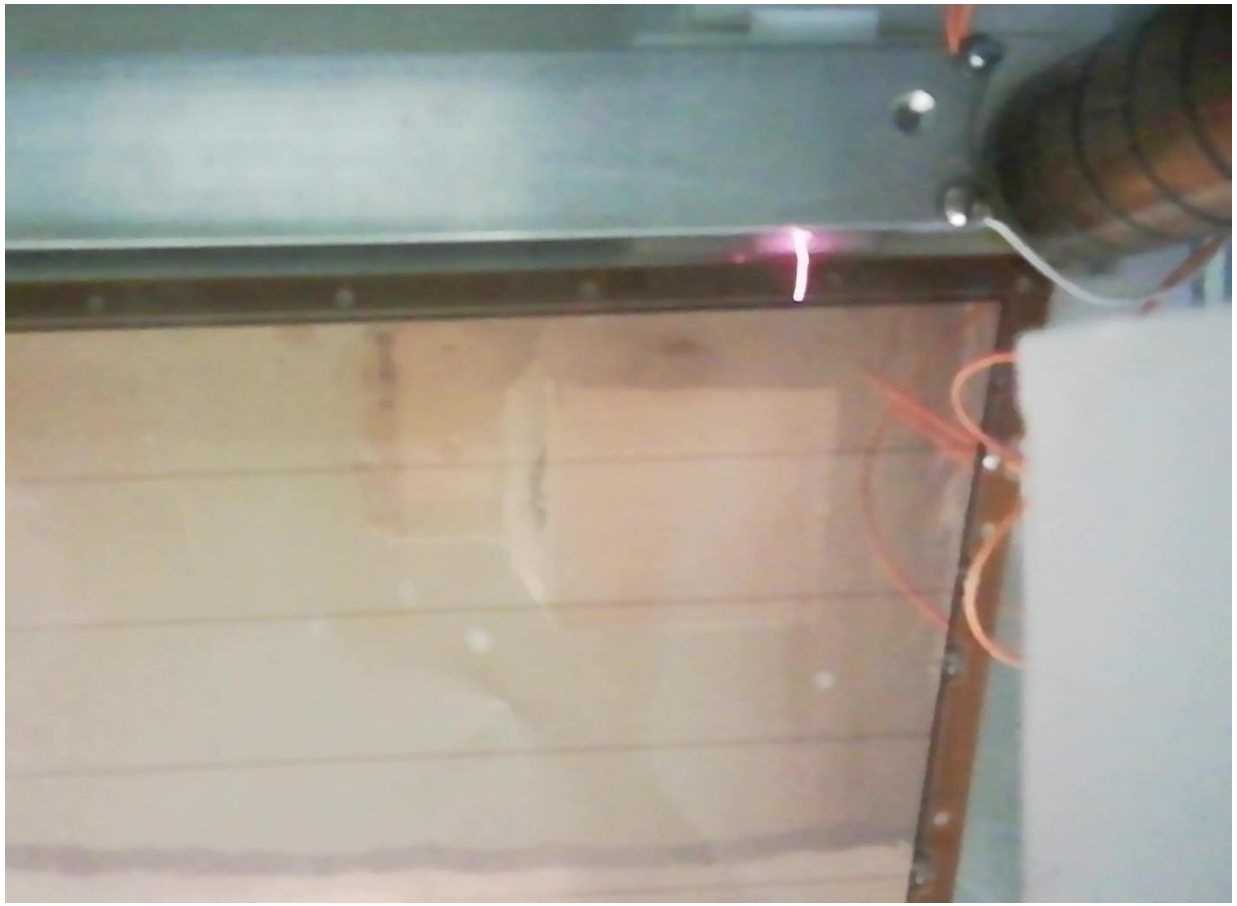
- Napon između GEM-a i ostatka postava, udaljenost GEM-žica ≈ 9mm, debljina teflona ≈ 0.05 mm, izboj na 5 kV.

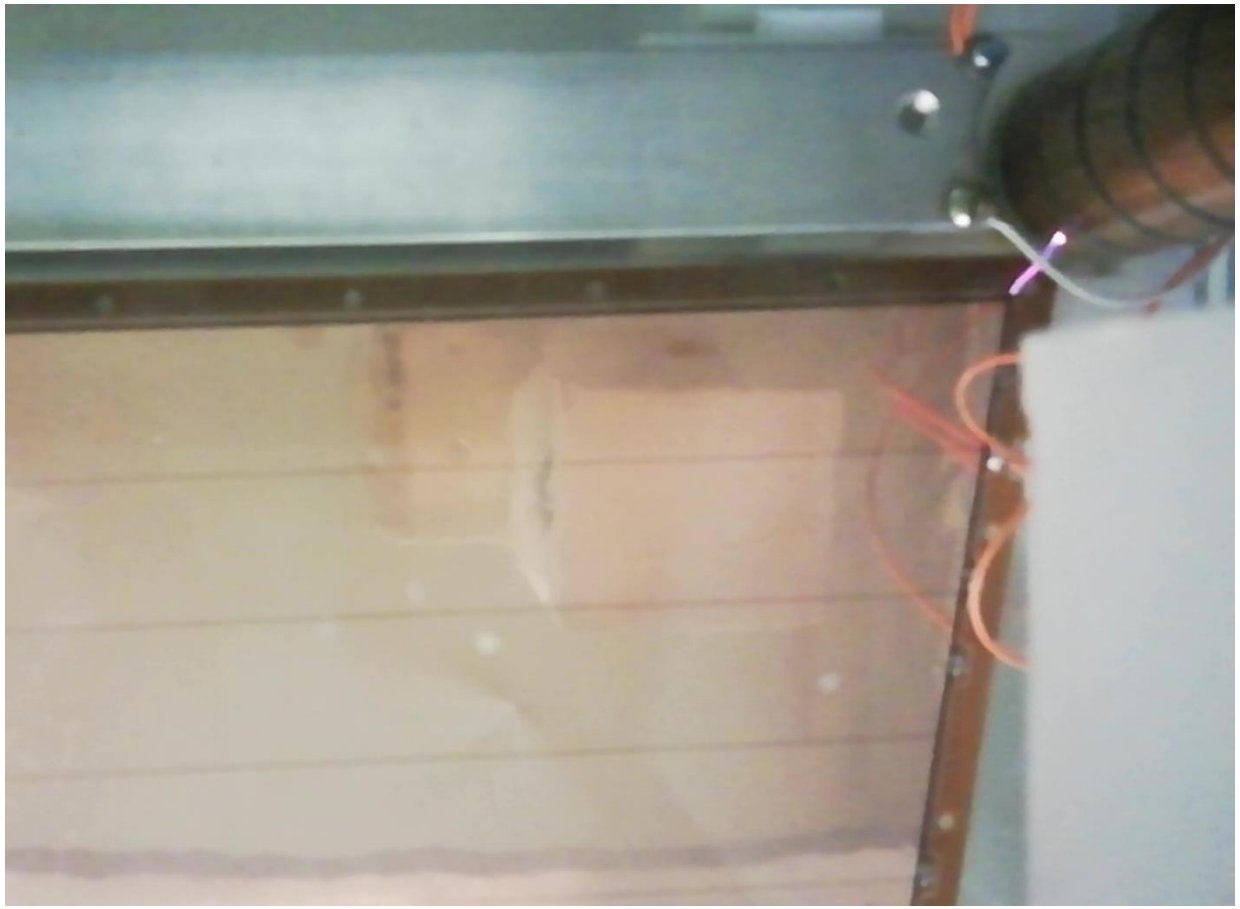


- Napon je na GEM-u i „skirt”-u, a šipka je uzemljena, udaljenost šipka-žica ≈ 6.5 mm, debljina teflona ≈ 0.1 mm, izboj na 5.4 kV.



- Napon je na GEM-u i šipci, a „skirt” je uzemljen, udaljenost šipka-„skirt” ≈ 6.5 mm, debljina teflona ≈ 0.3 mm, izboj na 4.8 kV.





- Napon je na šipci i „skirt”-u, a GEM je uzemljen, debljina teflona ≈ 0.3 mm, udaljenost GEM- „skirt”- ≈ 13 mm, izboj na 6.5 kV.

- Napon je na šipci i „skirt”-u, a GEM je uzemljen, debljina teflona ≈ 0.3 mm, udaljenost GEM-šipka ≈ 13 mm, izboj na 6.5 kV.

Komponente na naponu:	Napon pri izboju:	Udaljenost:
GEM folija	5.8 kV	(13 ± 0.5) mm
GEM folija	5.75 kV	(11 ± 0.5) mm
GEM folija	5.5 kV	(13 ± 0.5) mm
GEM folija	5 kV	(9 ± 0.5) mm
GEM folija i „skirt”	5.4 kV	(6.5 ± 0.5) mm
GEM folija i šipka	4.8 kV	(6.5 ± 0.5) mm
„skirt” i šipka	6.5 kV	(13 ± 0.5) mm

Zaključak :

- Žica neće stvarati probleme, ako je dobro izolirana
- Preporuča se izolacija teflonom debljim od 0.3 mm
- Preporuča se da udaljenost žice od vodljivog dijela GEM folije bude najmanje 9 mm
- Za radni napon detektora, koji iznosi oko 3.6 kV, zadane udaljenosti osiguravaju da neće doći do iskrenja među komponentama detektora