Micromegas activities in 2019

Collaboration Meeting

P. Colas

Achievements and prospects

New scheme : encapsulated resistive anode tested at DESY in November 2018

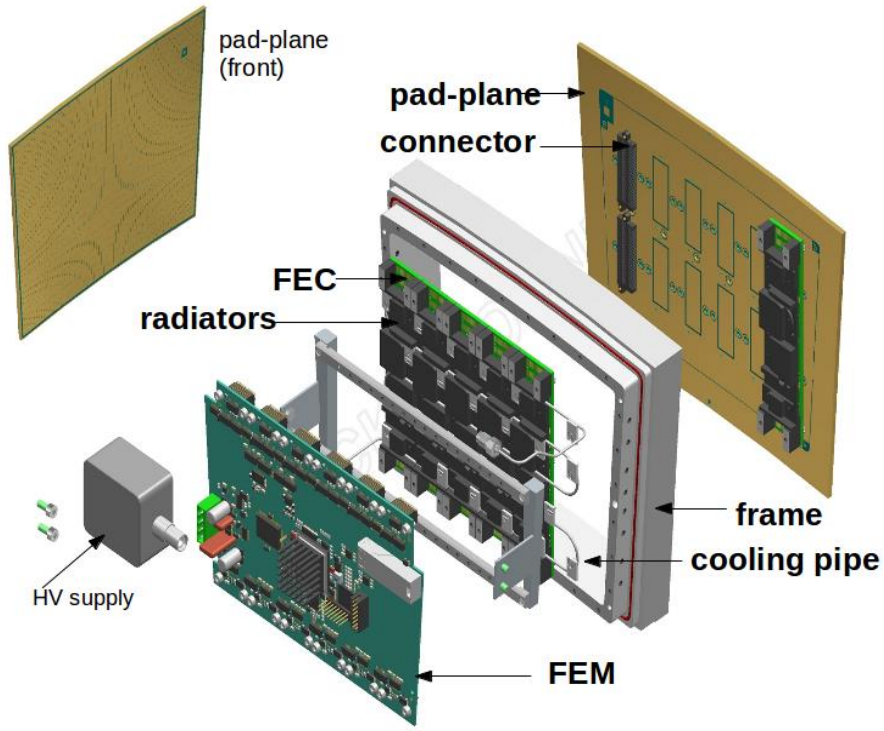
Analysis in progress (distortions)

Cosmic-ray setup

Future studies

2PCO2 Cooling

Costing scheme (tomorrow)



Analysis of test beam data (DESY, November 2018)

D. Attié, P. Colas, S. Ganjour, T. Ogawa, M. Riallot, X. Coppolani, S. Emery, Huirong Qi, J. Timmermans, M. Titov

Several video meetings with T. Ogawa to discuss results, mainly distortions, and alignment. Disantangling various effects (E-field inhomogeneity -> ExB and drift velocity non-uniform, detector plane deformations. Drafting started.

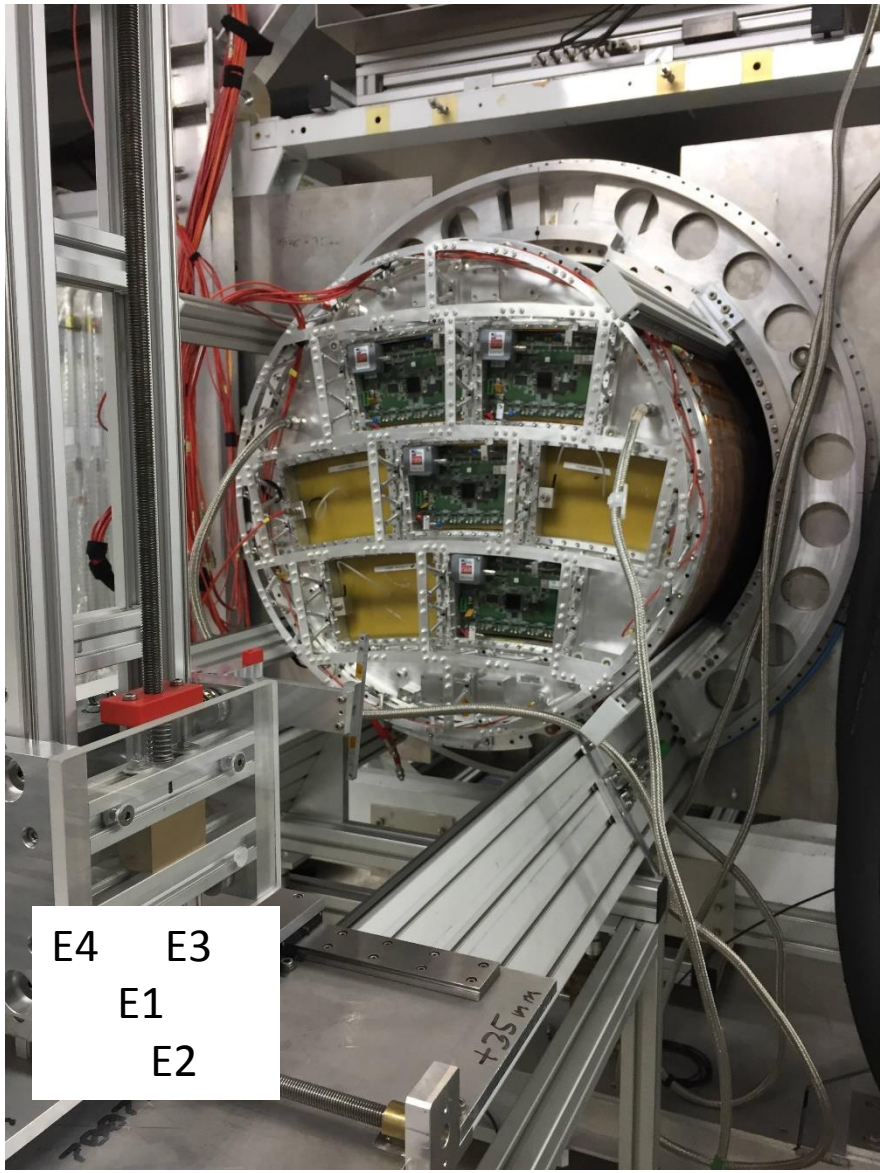
Outcome of the test :

- Try LP2 endplate
- Successful use of 2PCO2 cooling, 1-loop operation
- Test the new scheme (encapsulated resistive anode with grounded mesh). Use better mechanics for pad connection : 99.9% of good connections
- Make detailed studies to confirm the expected advantages of this scheme : less distortions (mesh at same voltage as frame), less noise, better flexibility.

4 modules numbered E1 to E4, in decreasing DLC quality

New ‘spaceframe’ endplate successfuly tested

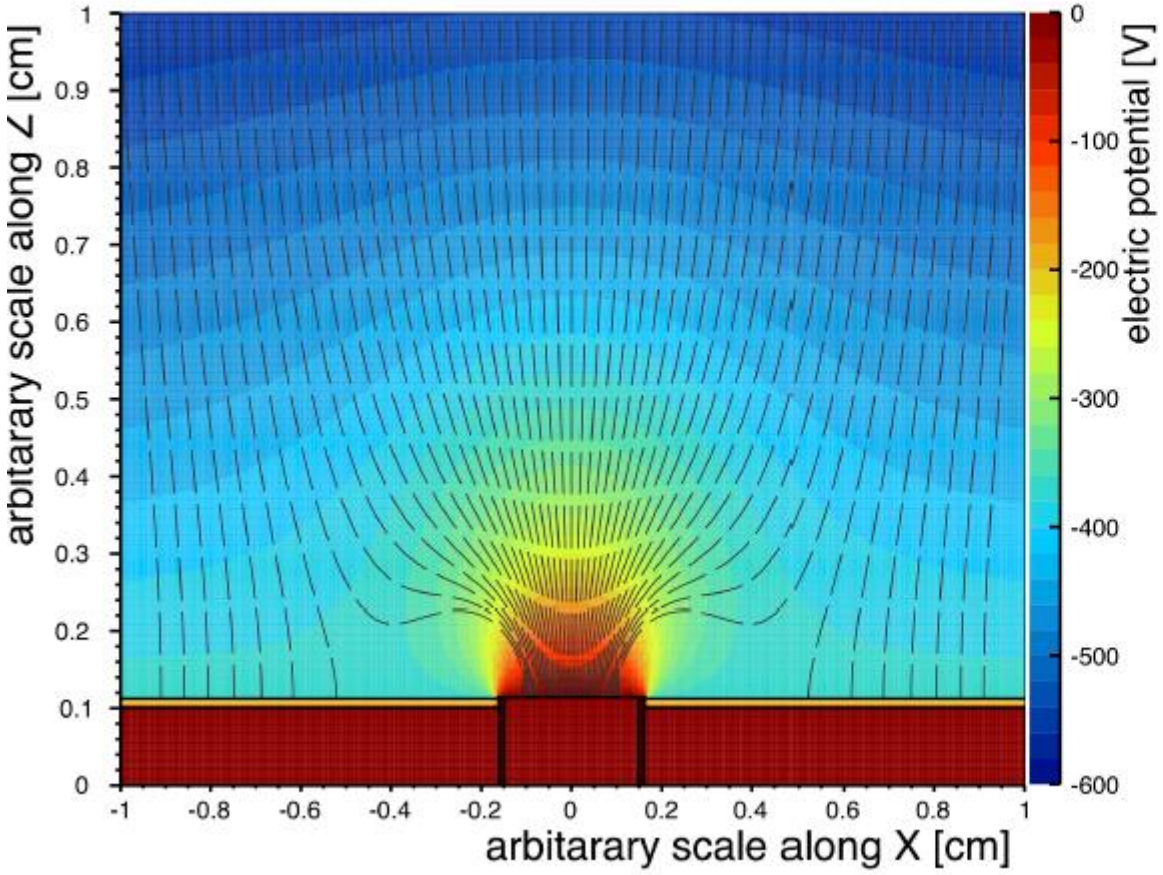
2P CO2 cooling smoothly run for the 2 weeks



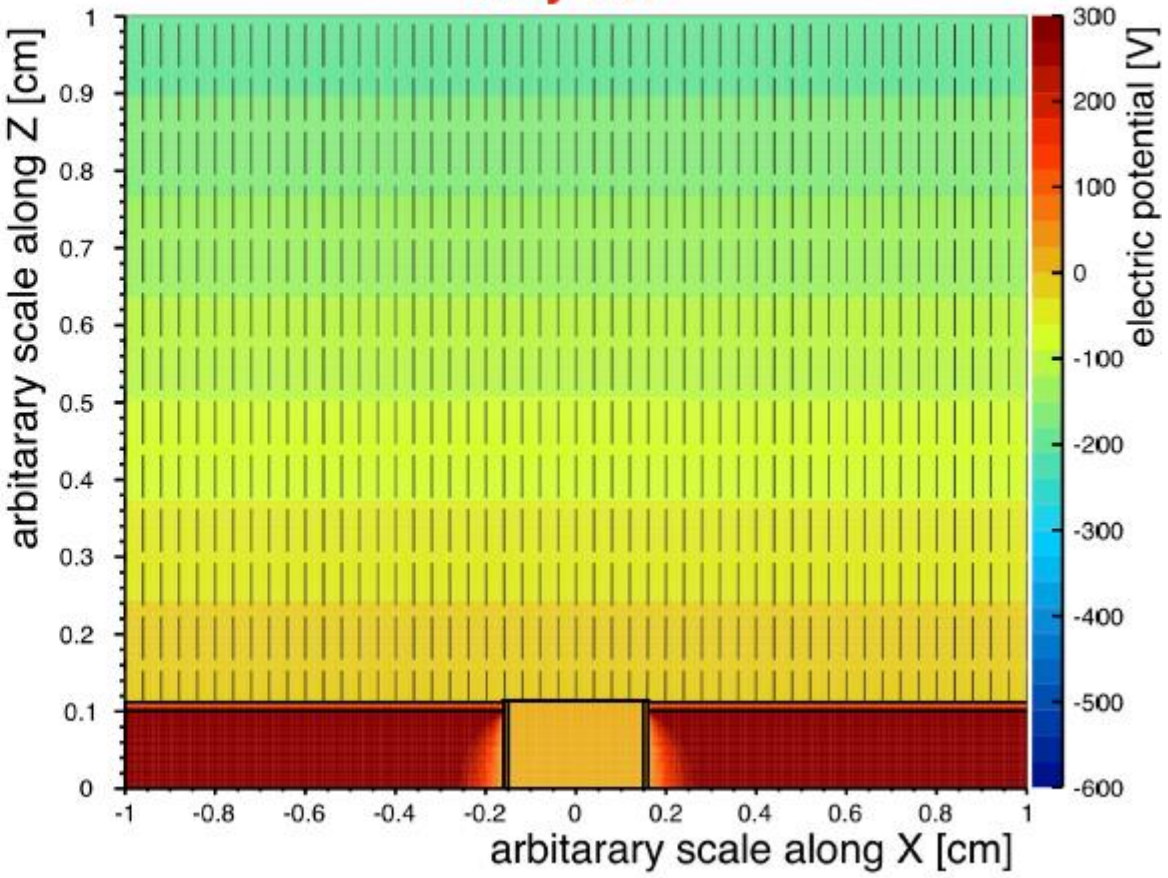
Field calculations

(Tomhisa Ogawa)

E-potential : RA-MM & E-RA-MM module



Very flat



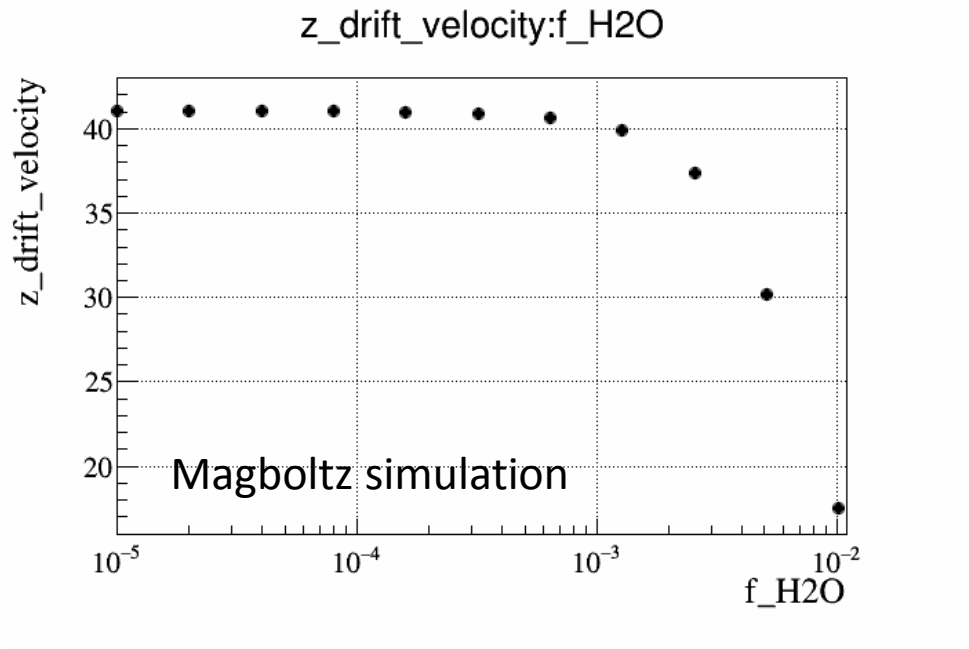
Cosmic stand at Saclay (B. Tuchming)

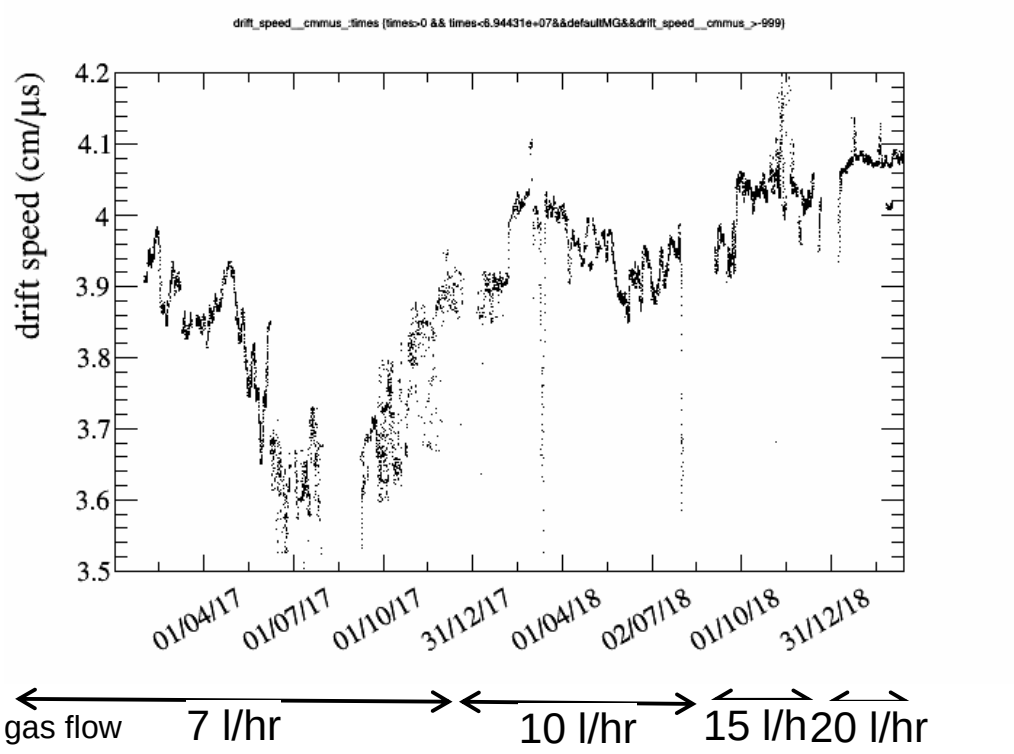
A cosmic stand has been taking data for two years in 2017 and 2018 with an old module (Carbon-Loaded kapton with grounded resistive anode). It is triggered by 3 Micromegas trackers with a 1mm space resolution.

It has been exchanged with a new ERAM module (grounded mesh) and took data from January to July 2019.

Drift velocity variations probably due to H2O contamination (Ar+5% isobutane gas)

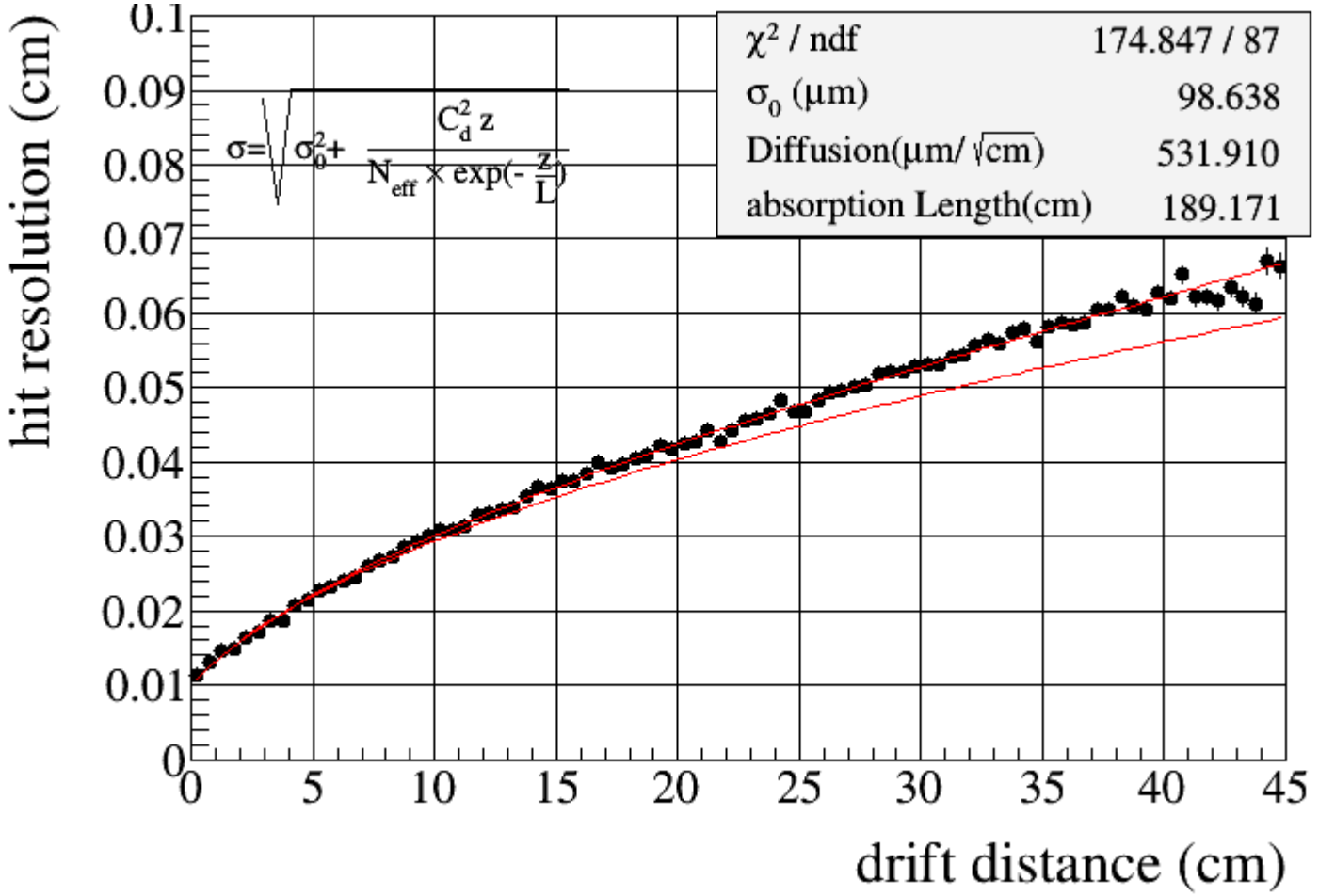
Maybe stabilized after July 2018 with new metal piping



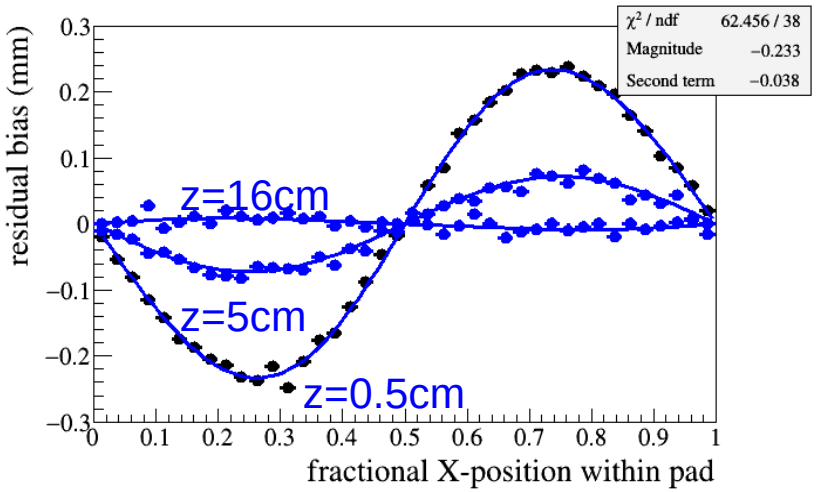


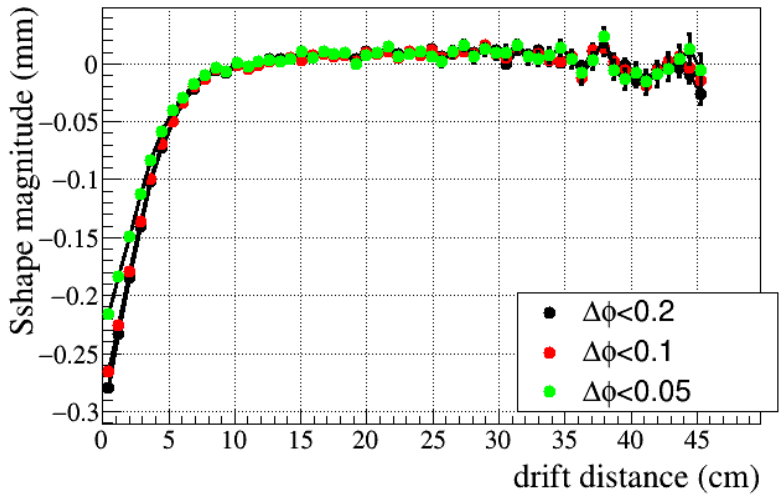
Work on understanding the resolution in these poor gas purity conditions.

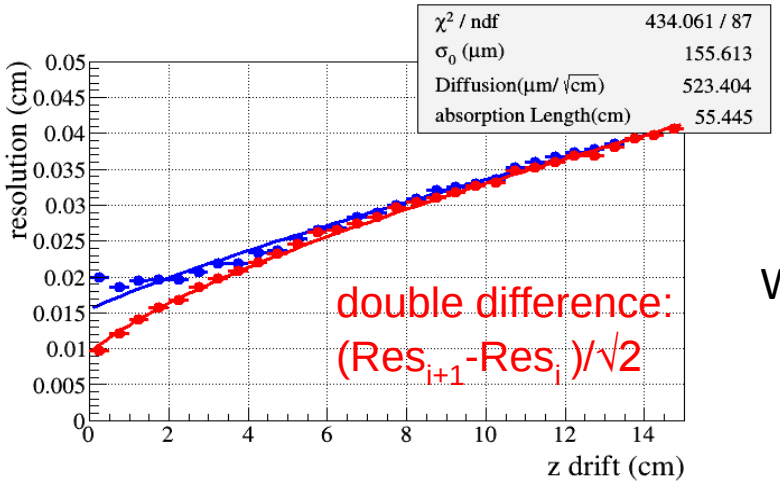
Cut in local track phi cut.



Analysis of cosmic data February/March 2019
S-shape effect (not using PRF to fit the hit position)







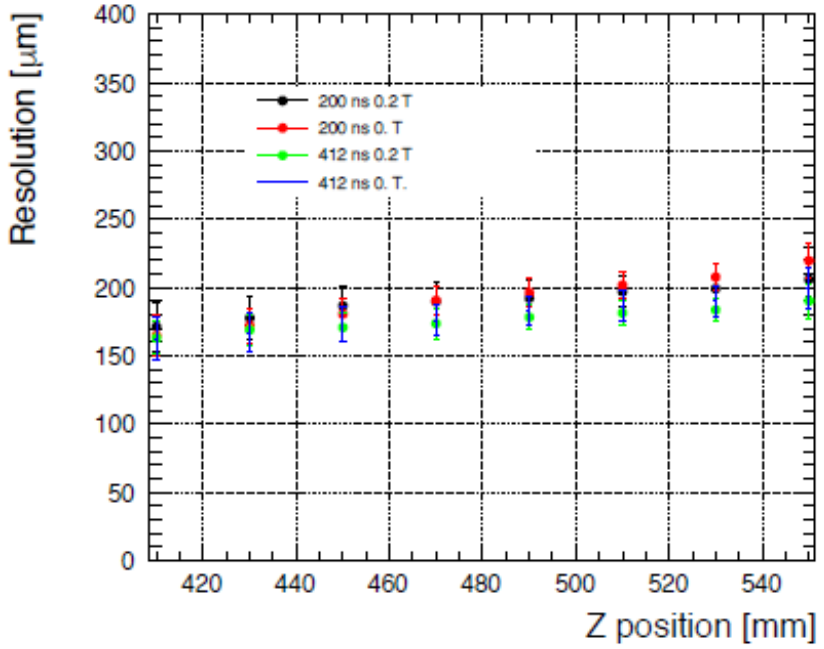
With PRF

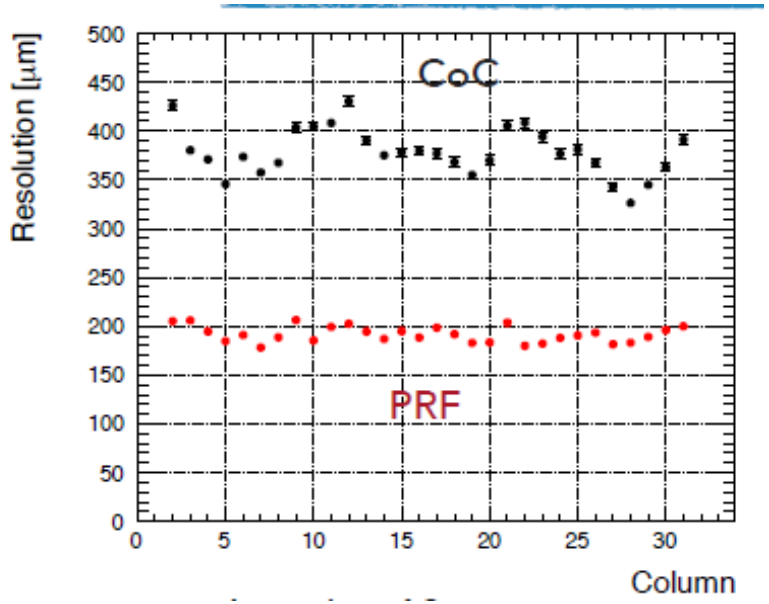
Interesting discussions on the analysis method in progress

Module robustness tested on a several year long period

Synergy with T2K

- Beam tests performed at DESY for T2K in June 2019.





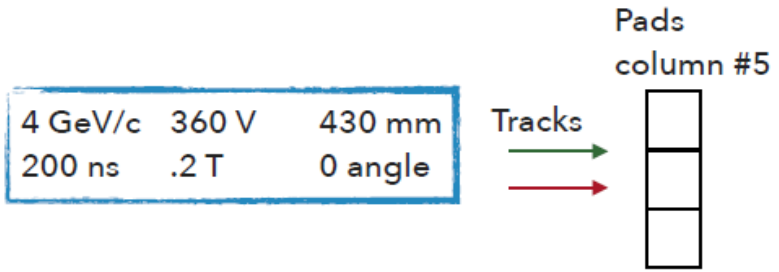
T2K beam test

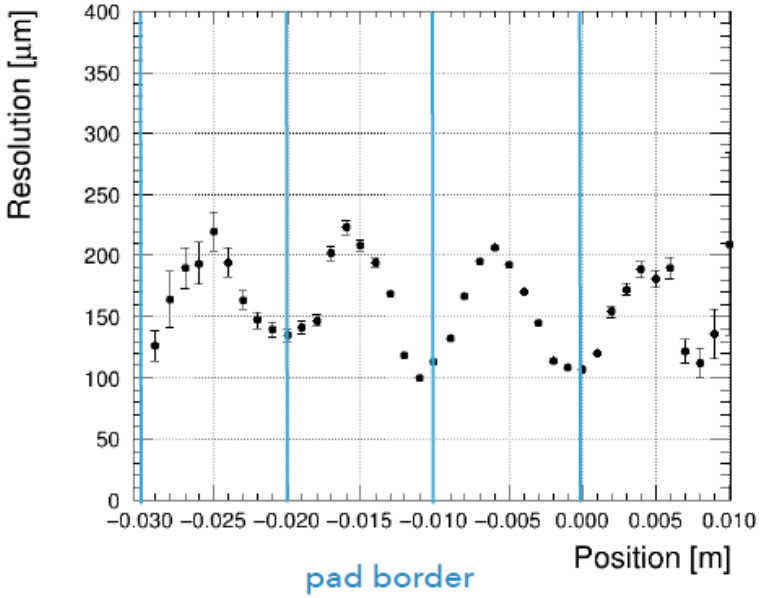
S. Suvorov

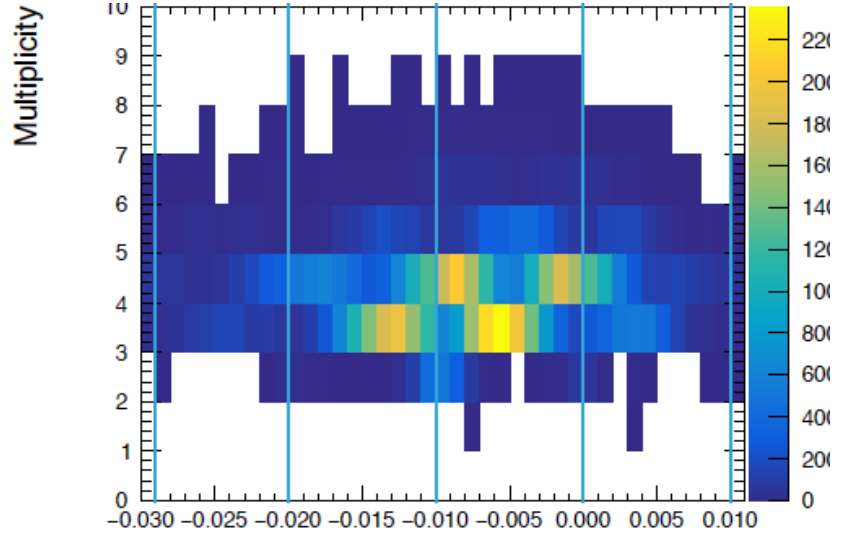
Y SCAN 200 NS

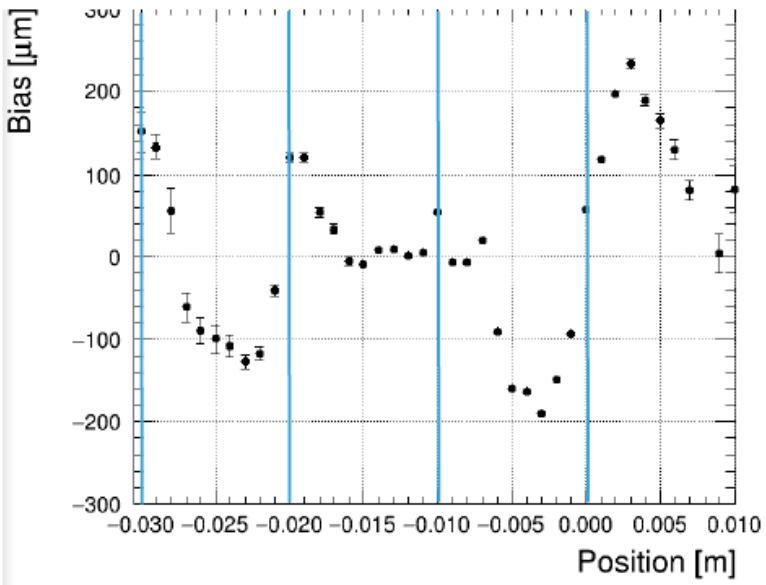
- Residuals vs. the pad entrance position

4 GeV/c	360 V	430 mm
200 ns	.2 T	0 angle

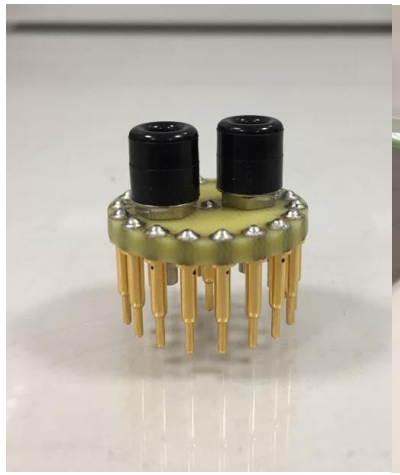






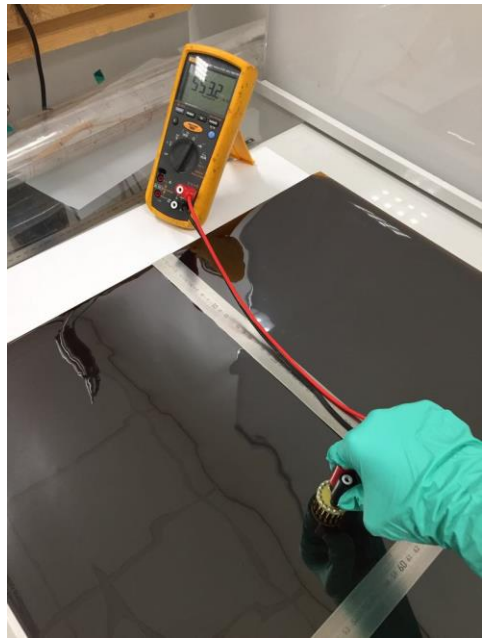


DLC uniformity studies at CERN (Rui de Oliveira et al.)



- custom-made probe and multimeter are used for the measurement.

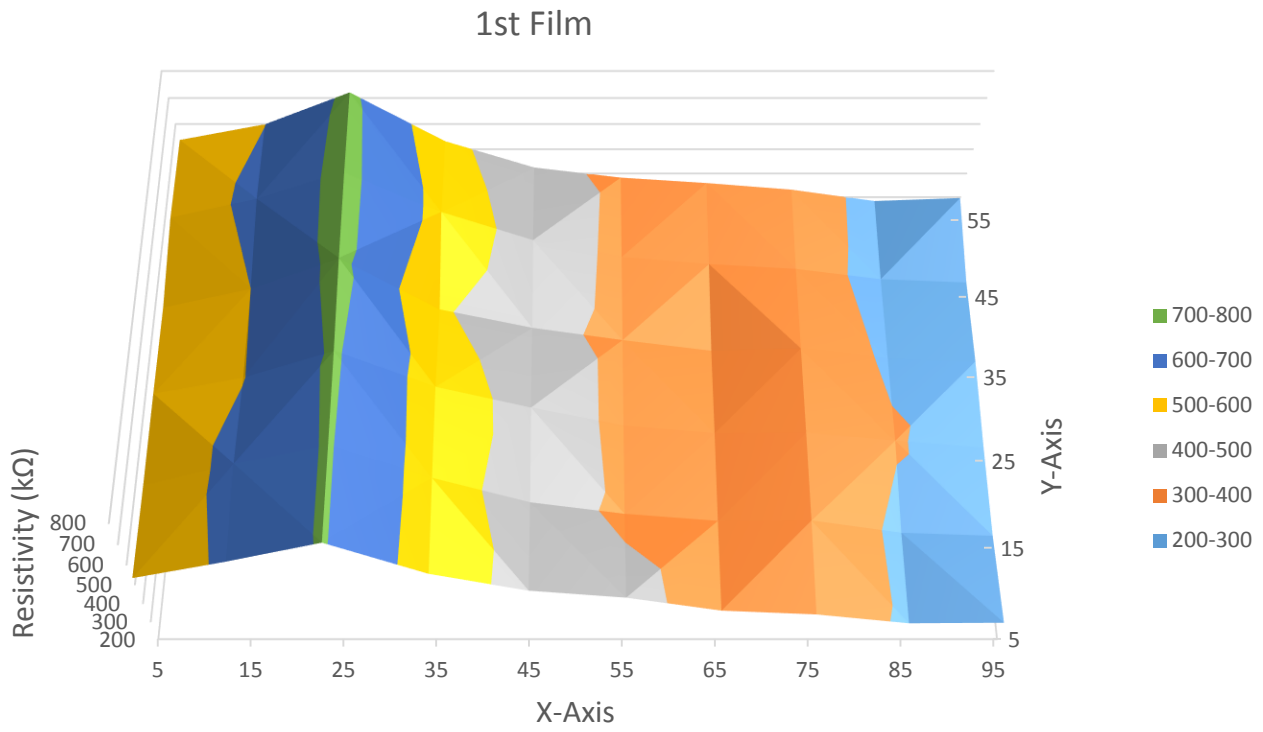
- Two rulers were adjusted to take surface resistivity measurement from 10cm x 10cm squares. The bottom-left corner of the film was assigned as origin point.



- By measuring the center of the squares, the film is scanned and results are transferred to Excel for 3D graph.

RESULTS

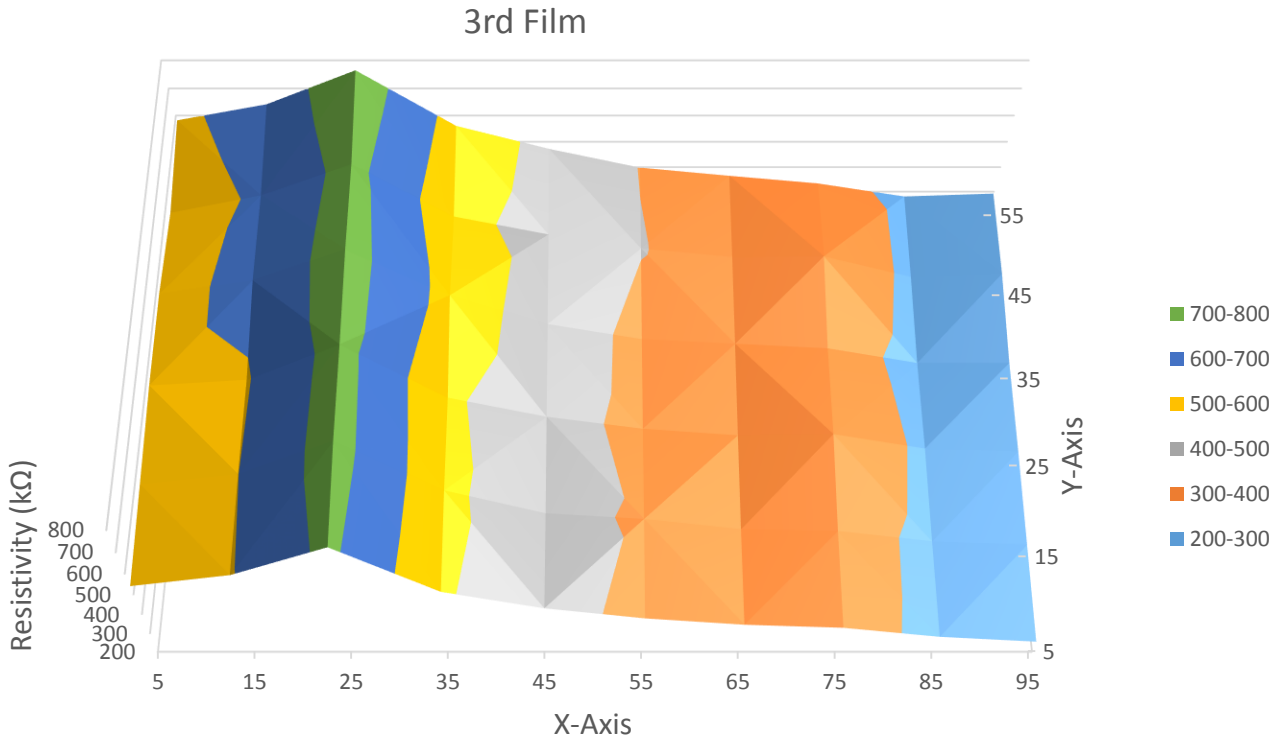
1st Film	5	15	25	35	45	55	65	75	85	95
5	532	615	708	554	467	430	360	339	290	293
15	526	625	708	559	442	384	348	350	286	270
25	525	597	712	556	462	377	342	346	305	270
35	520	600	726	512	431	376	327	338	293	278
45	546	623	728	570	453	380	349	328	282	267
55	537	599	721	532	425	383	360	332	283	296



- The measured minimum and maximum resistivity values are 267 - 728 kΩ.
- On the left side of the thin film, the resistivity increases to the right. However, after reaching the highest surface resistivity area the surface resistivity starts to decrease.

RESULTS

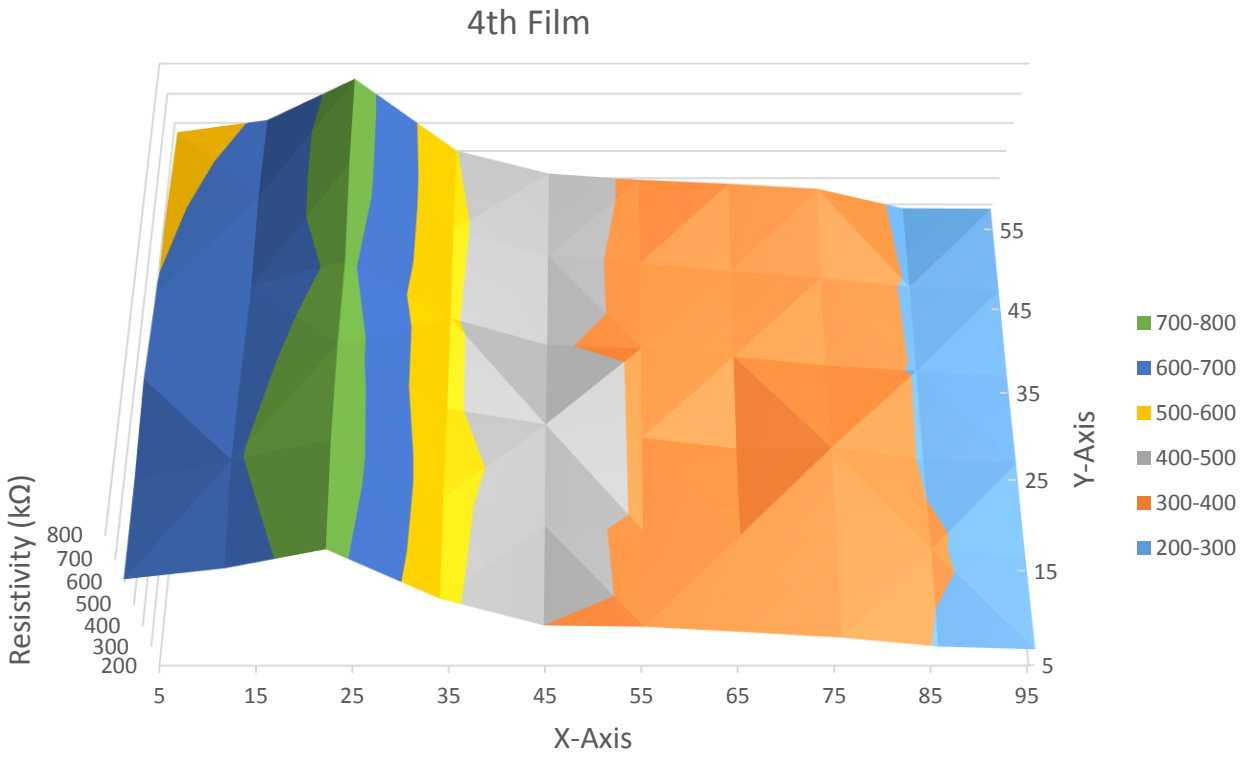
3rd Film	5	15	25	35	45	55	65	75	85	95
5	540	593	723	512	430	378	345	329	281	255
15	554	599	742	526	419	392	342	333	282	264
25	569	593	738	516	432	378	348	354	287	273
35	570	625	745	565	445	380	360	340	275	275
45	547	615	733	532	460	403	368	370	283	296
55	582	642	765	561	472	398	365	334	280	292



- The measured minimum and maximum resistivity values are 255 - 765 kΩ.
- On the left side of the thin film, the resistivity increases to the right. However, after reaching the highest surface resistivity area the surface resistivity starts to decrease.

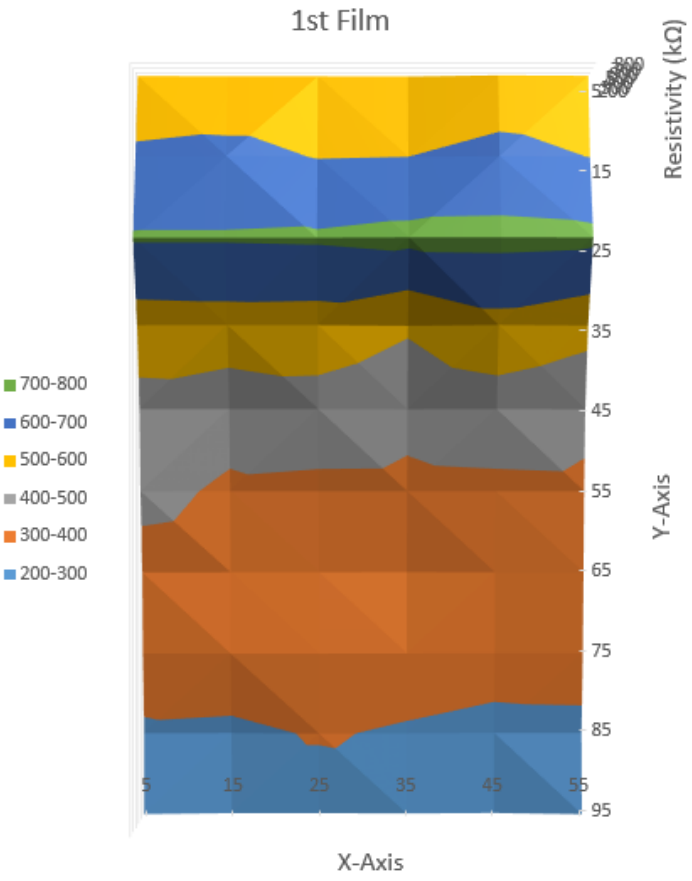
RESULTS

4th Film	5	15	25	35	45	55	65	75	85	95
5	612	660	741	525	400	394	368	341	297	283
15	613	690	769	536	414	392	372	344	305	277
25	629	665	759	511	446	391	344	348	296	279
35	603	634	723	510	404	390	357	321	297	275
45	589	638	752	516	417	389	357	331	295	280
55	567	610	750	501	417	394	379	360	285	283

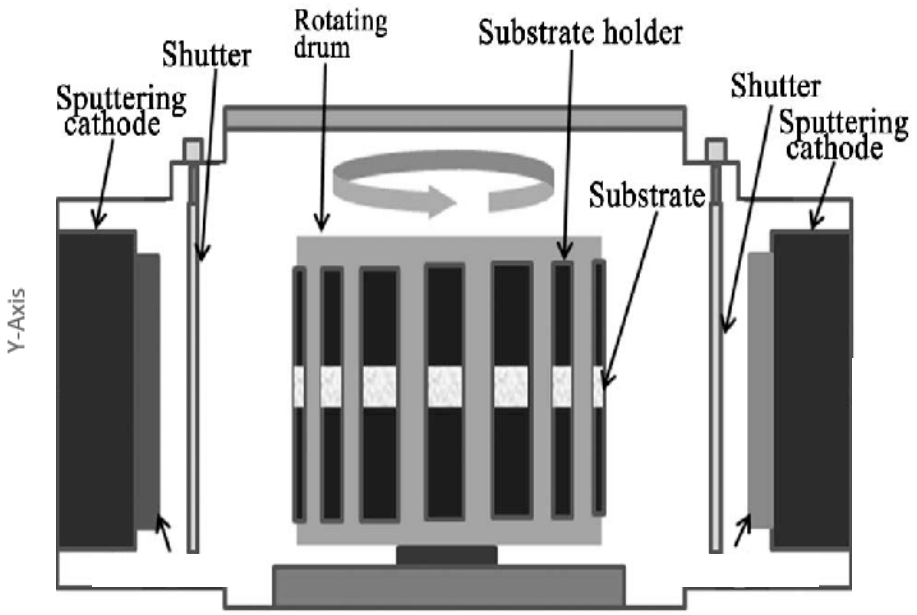


- The measured minimum and maximum resistivity values are 275 - 769 kΩ.
- On the left side of the thin film, the resistivity increases to the right. However, after reaching the highest surface resistivity area the surface resistivity starts to decrease.

CONCLUSION



*Rotation of the film 90° to the right from the origin is assumed as the coating direction.



Schematic representation of magnetron sputtering mechanism.

→Surface resistivity could be measured by using the custom-made probe.

→Third DLC film has the highest surface resistivity values.

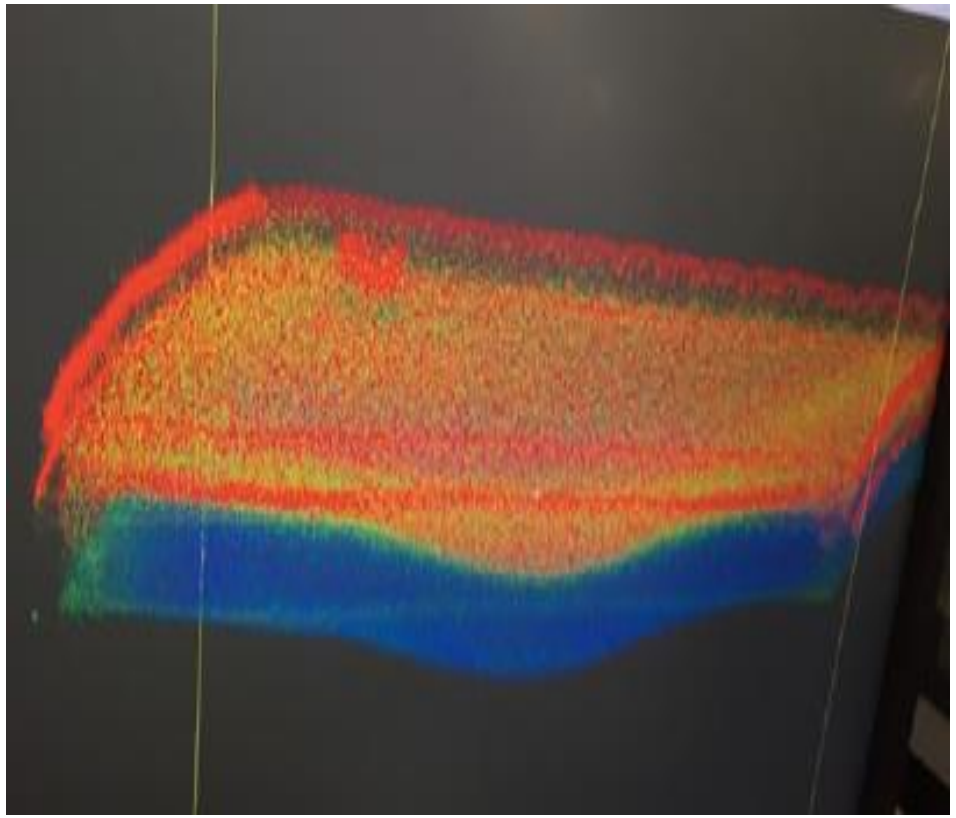
→When thickness increases, the surface resistivity decreases; therefore, it can be said that the area, where the measured surface resistivity is highest, has the lowest thickness.

→There are may be few explanations for why the surface resistivity is not uniform in the DLC coated film;

- It is known that magnetron sputtering technique is used to deposit the DLC. So, if the graphite target is not placed parallel to the substrate, the distance from target to substrate film may be longer at the upper part of the film*.
- The graphite targets which are used may be different.
- Current density or voltage may be different in every graphite targets.

FUTURE

- Module planeity studies, using the ATLAS x-y table



M. Mur

Cooling plate in additive fabrication

Conclusion

- The new scheme of encapsulated resistive anode Micromegas gives very satisfactory results (stable operation, suppressed distortions) but the analysis is difficult (mechanical deformations)
- There are several studies in (slow) progress
- There is also a natural synergy with T2K, ALICE TPC and RD51 collaborations
- A clear signal from Japan would help waking up all these studies