

# Beam Test of MM & $\mu$ RWell Tracker System

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# Outline

- **Beam Test Setup**
  - TBT for MicroMegas
  - Test Setup
- **Test & Result**
  - Efficiency
  - Spatial Resolution
  - $\mu RWell$  performance
- **Summary**



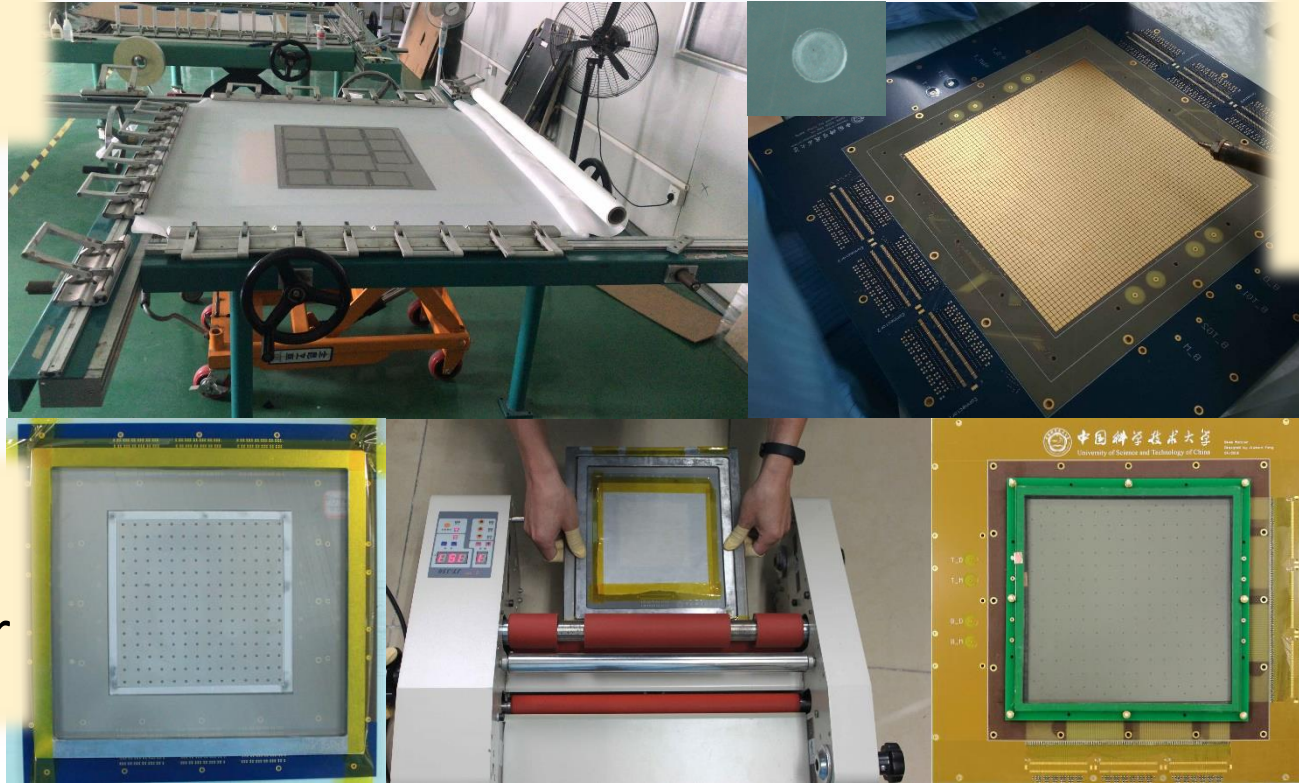


# TBT for MicroMegas

- Thermal Bonding Technique @ USTC

Thermal bonding spacers:  
thickness  $240\ \mu\text{m}$   
diameter  $\sim 1\text{mm}$   
pitch  $1\text{cm}$   
prefix with the hot air pencil

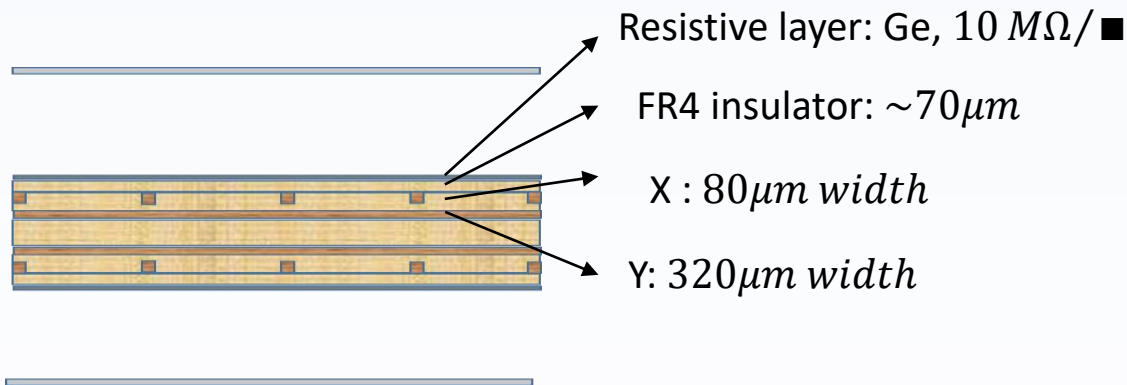
Mesh stretching :  
valid for mesh  $> 1\text{m}^2$   
tension on mesh  $> 25\text{N/cm}$



set the mesh frame  
heat with roll laminator

Inner structure :  
 $15\text{cm} * 15\text{cm}$   
 $5\text{mm}$  drift gap  
2D readout

# Detector setup & Test Plans for MM



back-to-back structure:

two independent measurement for one particle

expected to have better time resolution, about 1/2 decrease  
(depend on the SRS electronic system)

better correction at  $\mu\text{TPC}$  mode for spatial resolution

## • Test Plans ( $\text{Ar: CO}_2 = 70:30$ )

- transmission rate scan
- efficiency test for front/back side independently
- efficiency test at back-to-back mode
- long run for spatial resolution
- $\mu\text{TPC}$  mode for spatial resolution

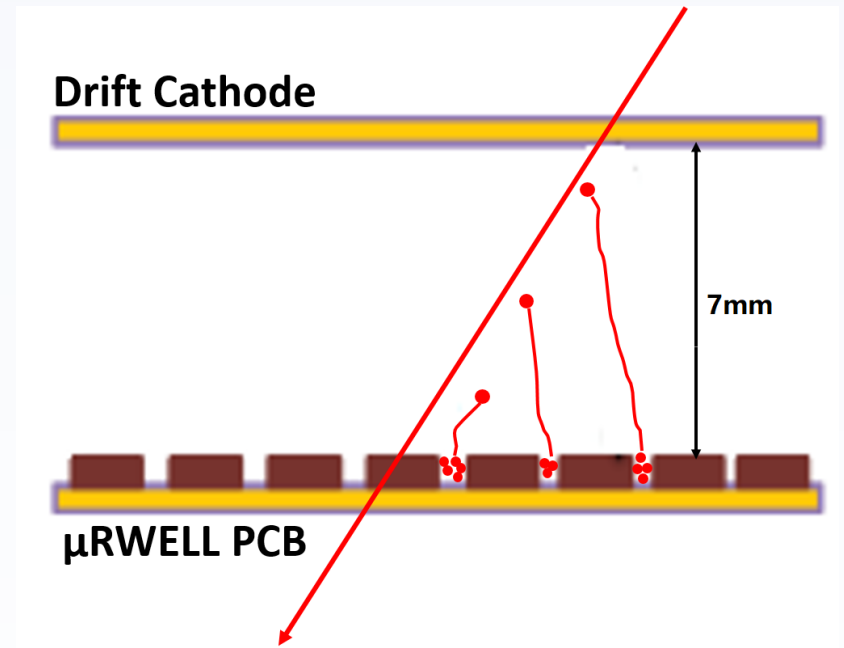
## • Do the same tests in $\text{Ar: CO}_2 = 93:7$

- Two MicroMegs to be tested, MM1 works better

# μRWELL parameters

## ➤ μRWELL

- Sensitive area:  $10\text{cm} \times 10\text{cm}$  divided into 4 sectors
- Drift region:  $7\text{mm}$
- DLC resistive electrode:  $100\text{nm}$ ,  $50\text{M}\Omega$
- Well pitch:  $140\ \mu\text{m}$
- Prepreg ( $50\ \mu\text{m}$ ) isolate the DLC electrode from readout strips



## ➤ 2-D readout structure

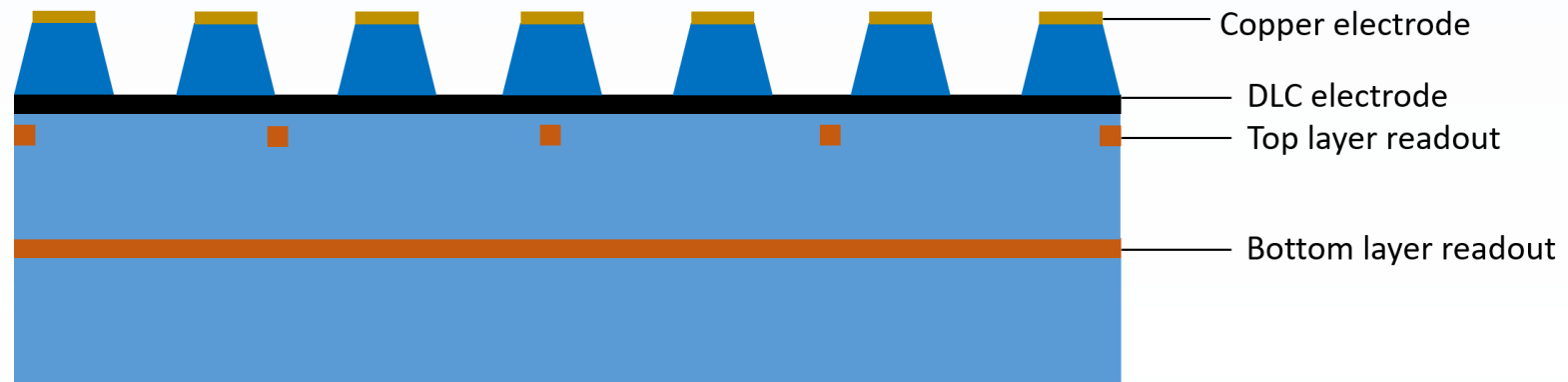
Strip Pitch:  $400\ \mu\text{m}$

Strip width on Top layer:  $80\ \mu\text{m}$

Strip width on Bottom layer:  $350\ \mu\text{m}$

Insulator thickness:  $50\ \mu\text{m}$

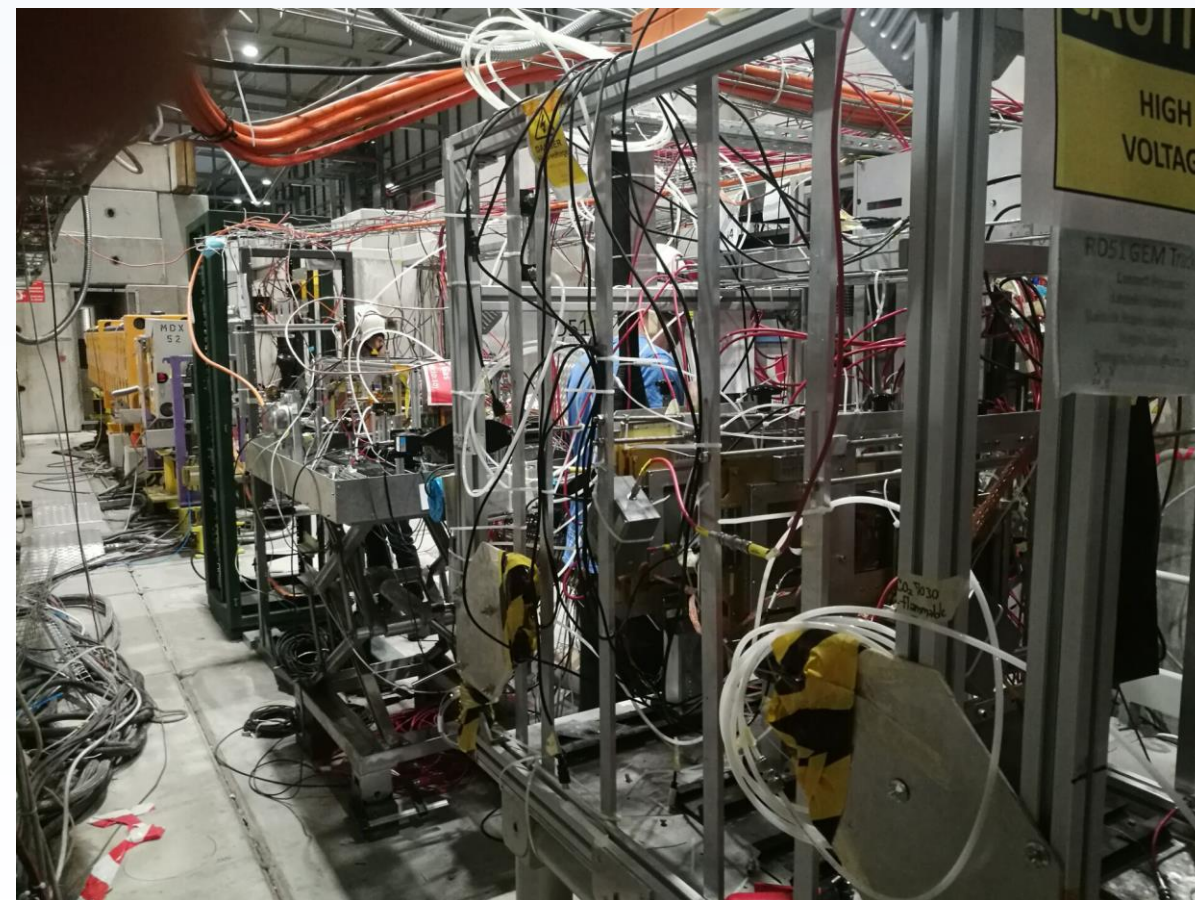
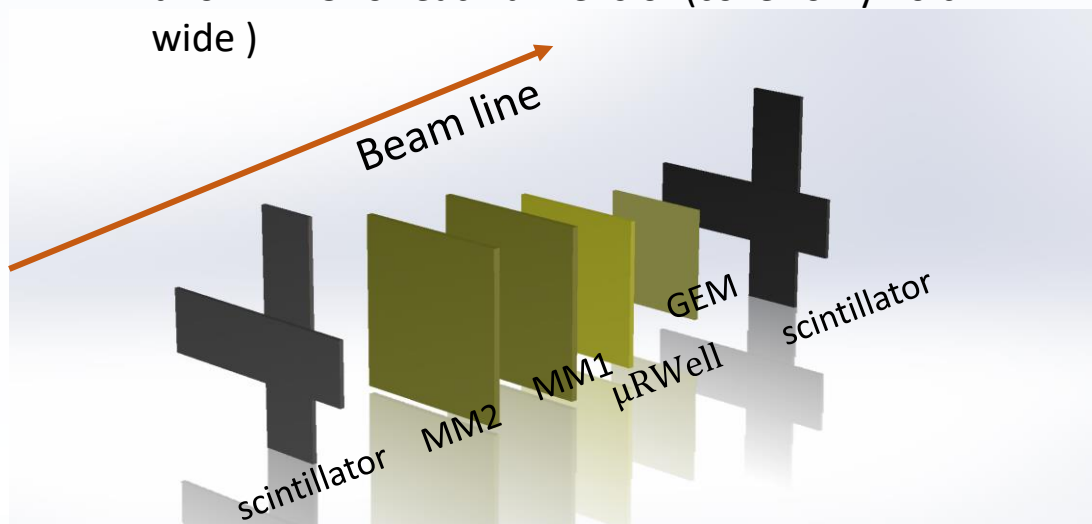
Readout channel No.:  $1024$



μRWELL PCB Structure

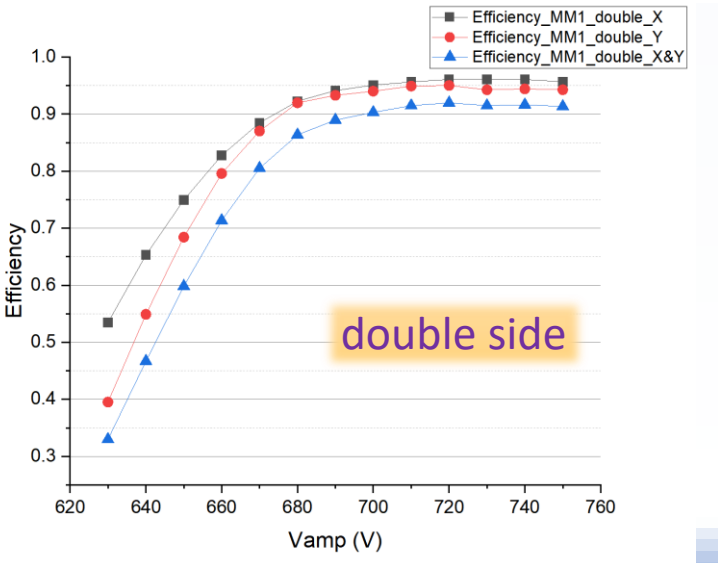
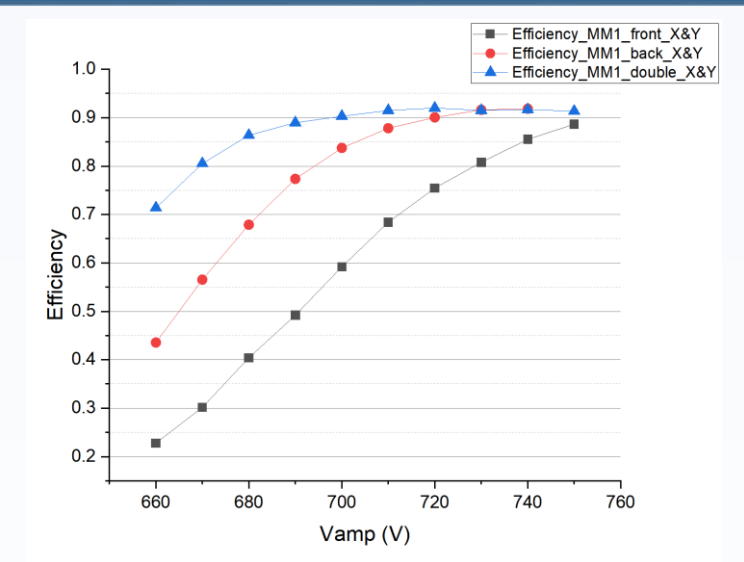
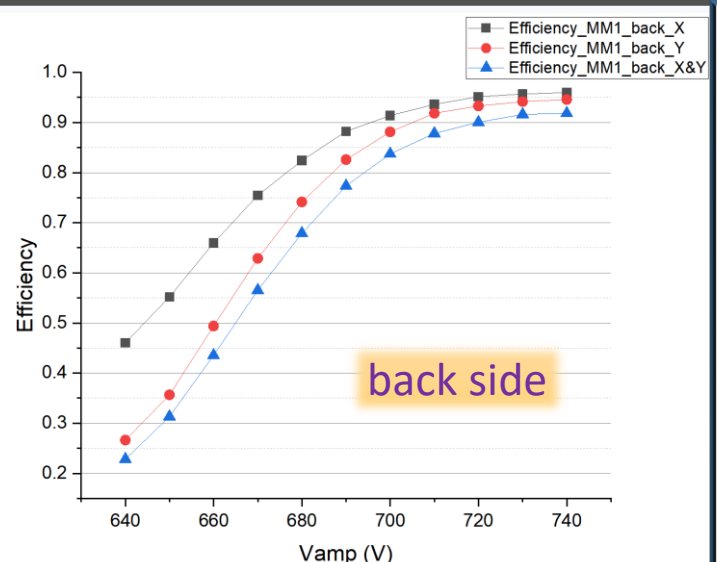
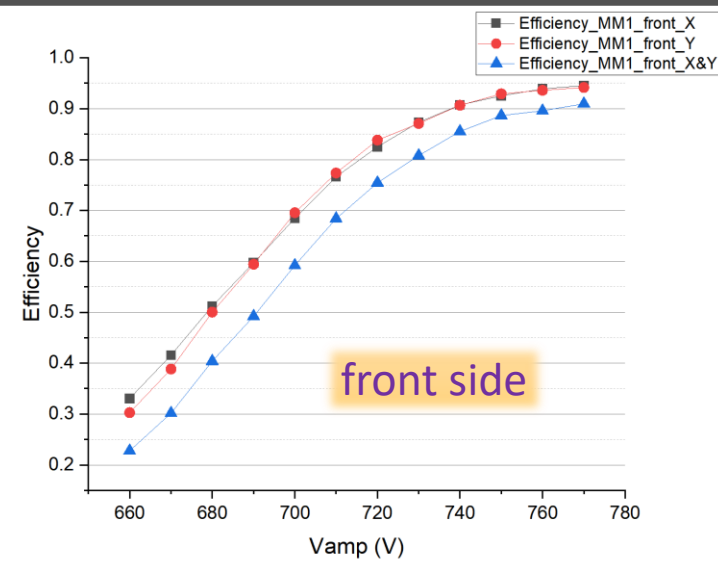
# Beam Test Setup

- Tracking system:  
GEM,  $\mu$ RWell, MM\*2
- Trigger system :  
scintillator, compliant at upstream and downstream
- Electronic system:  
SRS DAQ system  
two APV25 for each dimension(cover only 10 cm wide )





# Efficiency in $Ar: CO_2 = 70:30$



## Efficiency Test:

- 5mm drift gap for both sides
- test both the  $E$  of X&Y axes
- the X axis has larger  $E$  for it collects more charges than Y axis
- the back side of the detector has larger  $E$  and determines the total efficiency of two sides

## Comparison of total $E$ :

- the front or back side has very low  $E$  while the Vamp is small
- **BUT,  $E$  of double sides is much larger**, this is very good for small signal detecting
- as the Vamp going up, the  $E$  reaches saturation and gets the same for double sides and back side

# Beam test results

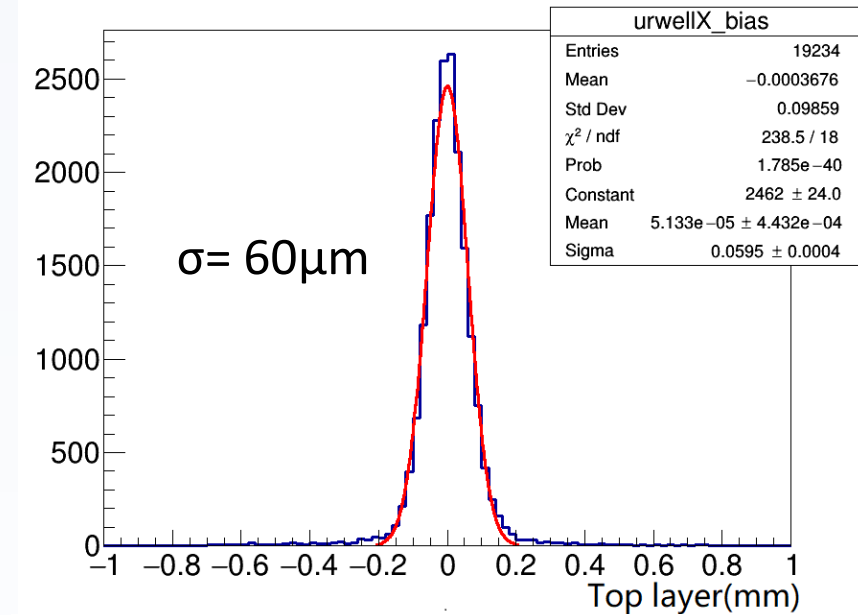
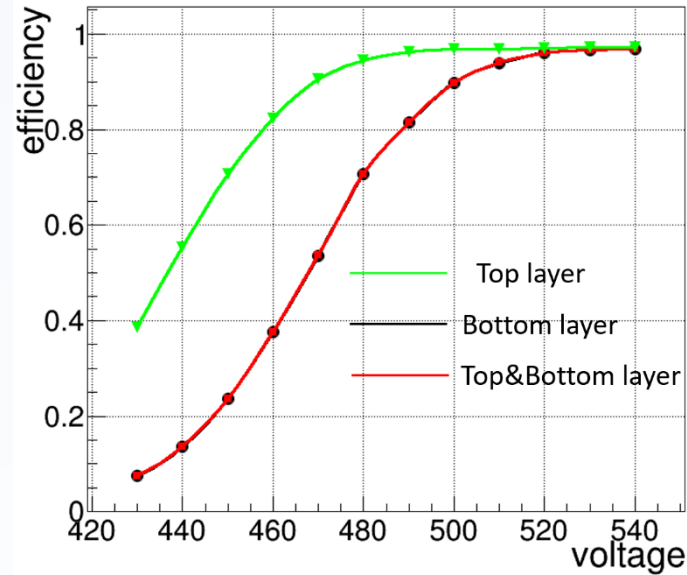
## ➤ Detection efficiency

Top layer(Y) efficiency : ~97%

Bottom layer(X) efficiency: ~97%

Top & Bottom efficiency: ~97%

Top layer induced charge is 1.8 times of Bottom layer.

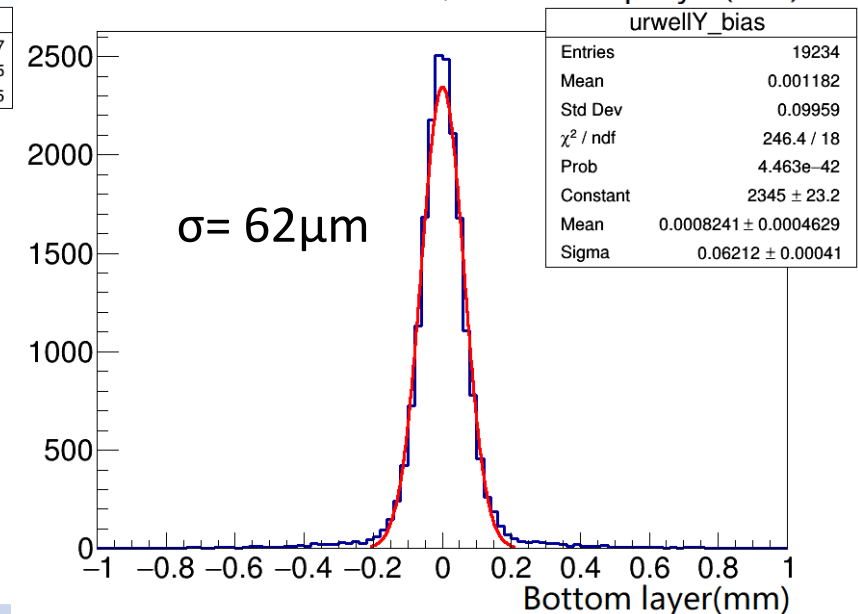
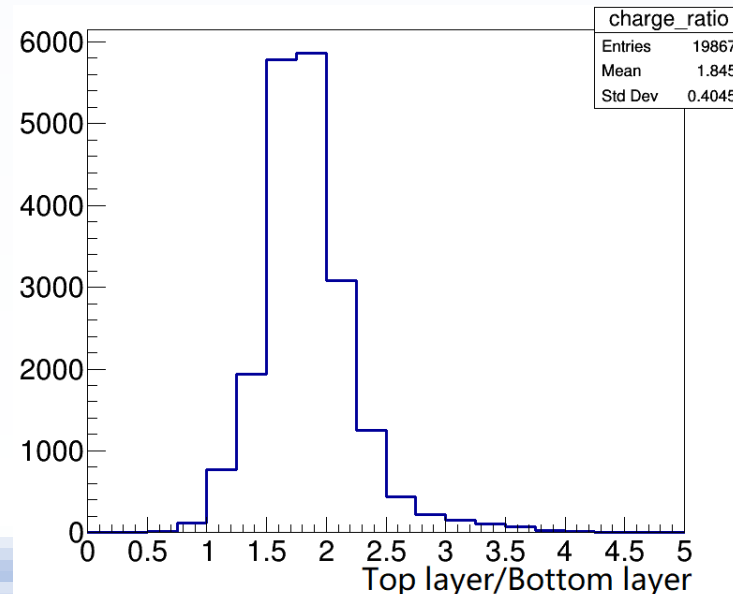


## ➤ Position resolution

Avalanche voltage: 540V

Position resolution(Top layer): 60 $\mu\text{m}$

Position resolution(Bottom layer): 62 $\mu\text{m}$





# Summary

- TBT for MicroMegas fabrication has been developed at USTC
- MMs for tracking have been tested in August, 2018; the detectors worked well and the data needs to be analysed detailed
- The uRWell detector has been tested again, the spatial resolution and efficiency are very good
- Plans in October beam test:
  - Test the tracking system with four thermal bonding technique
  - The performance at  $\mu TPC$  will be studied again with VMM
  - Test the time resolution
- Suggestions:
  - There were many crashes of beam line during this time, this delayed our test schedule, and the performance in  $Ar: CO_2 = 93:7$  needed only 10 hours more to be finished!
  - The power system at the beam test region broke down several times and several cividecs have been broken
  - The support frame should be modernized, the space was too narrow for  $\mu TPC$  mode

Thanks for your attention!