BESIII RPC Detector

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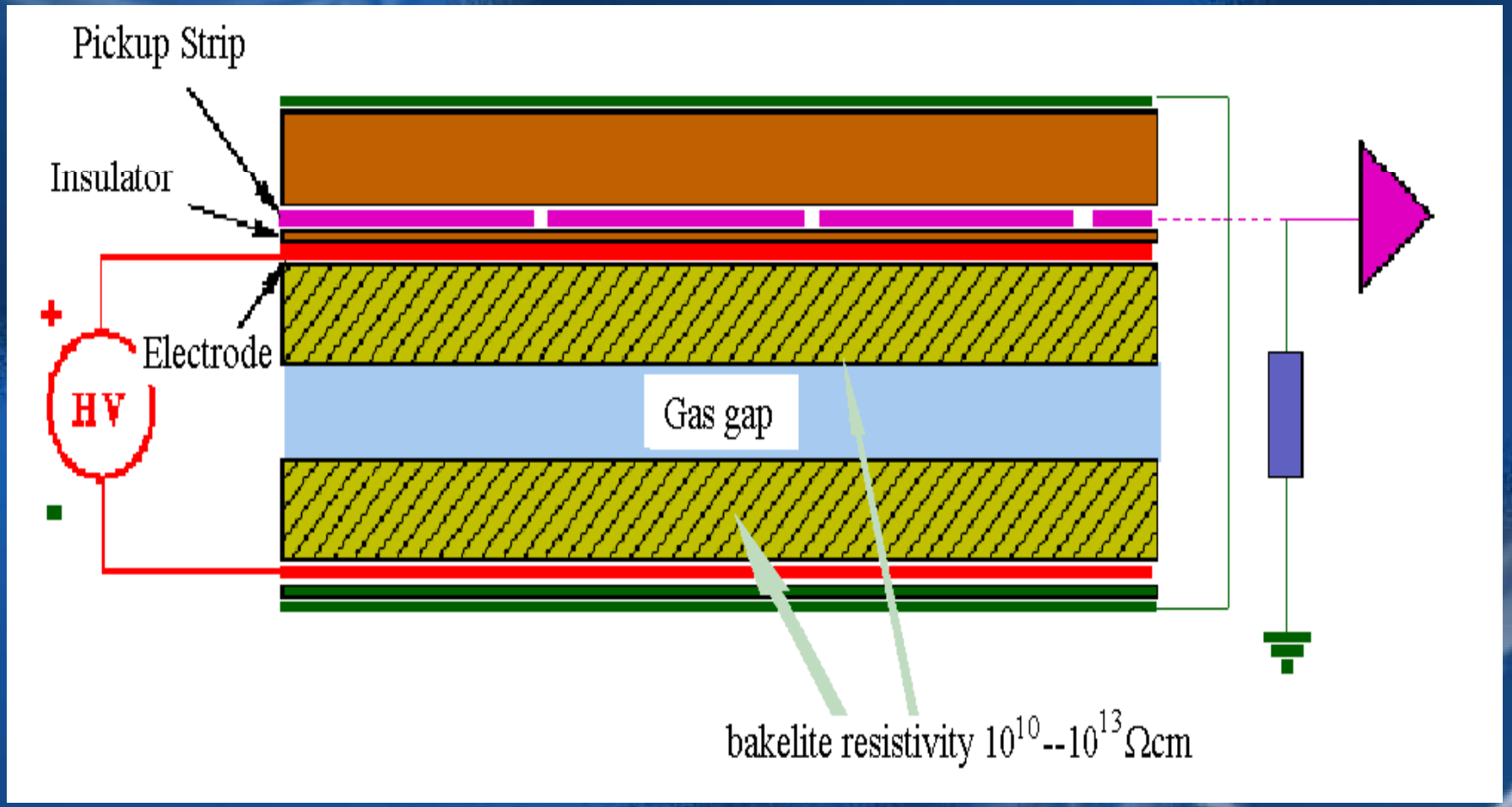
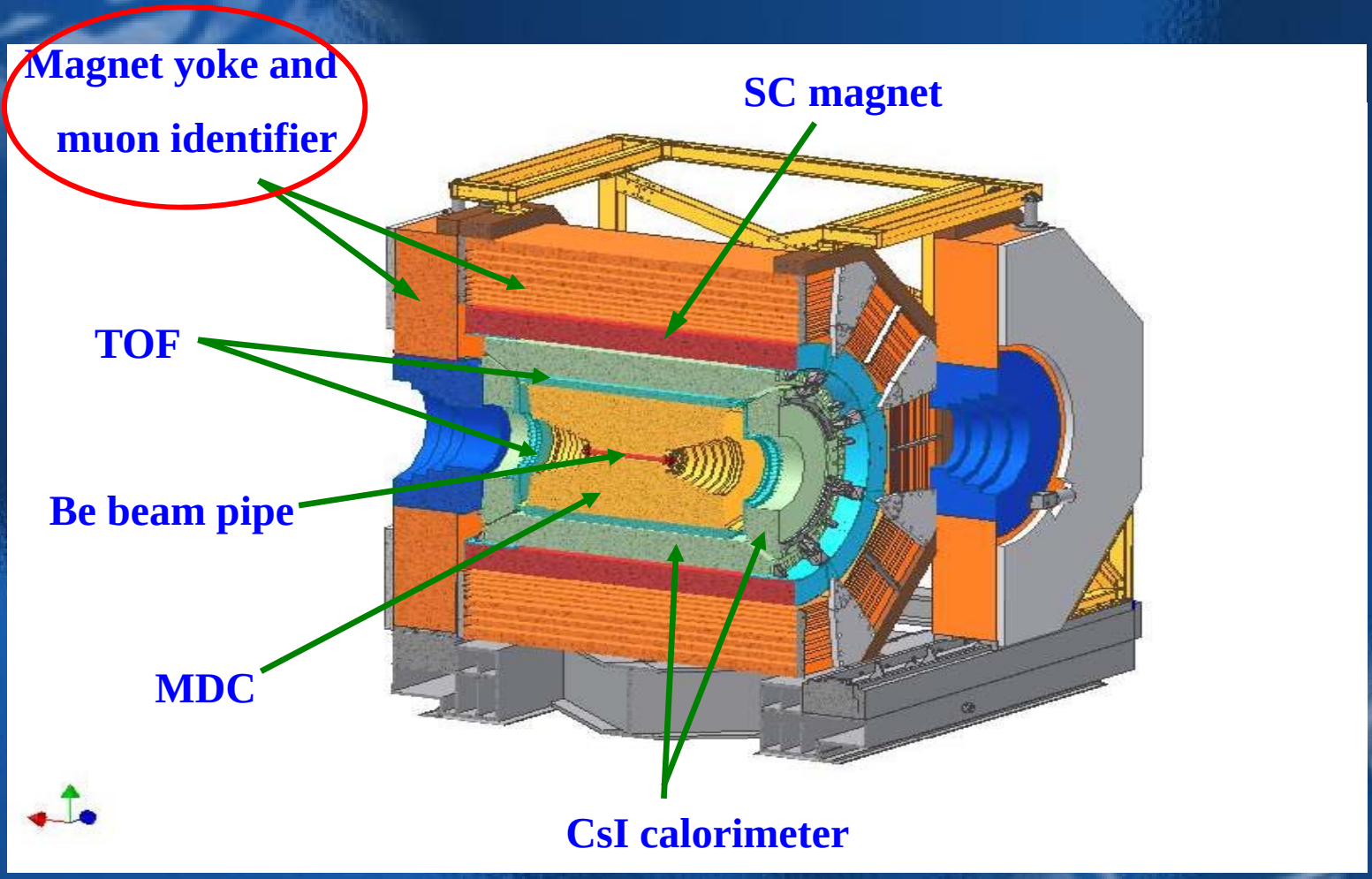
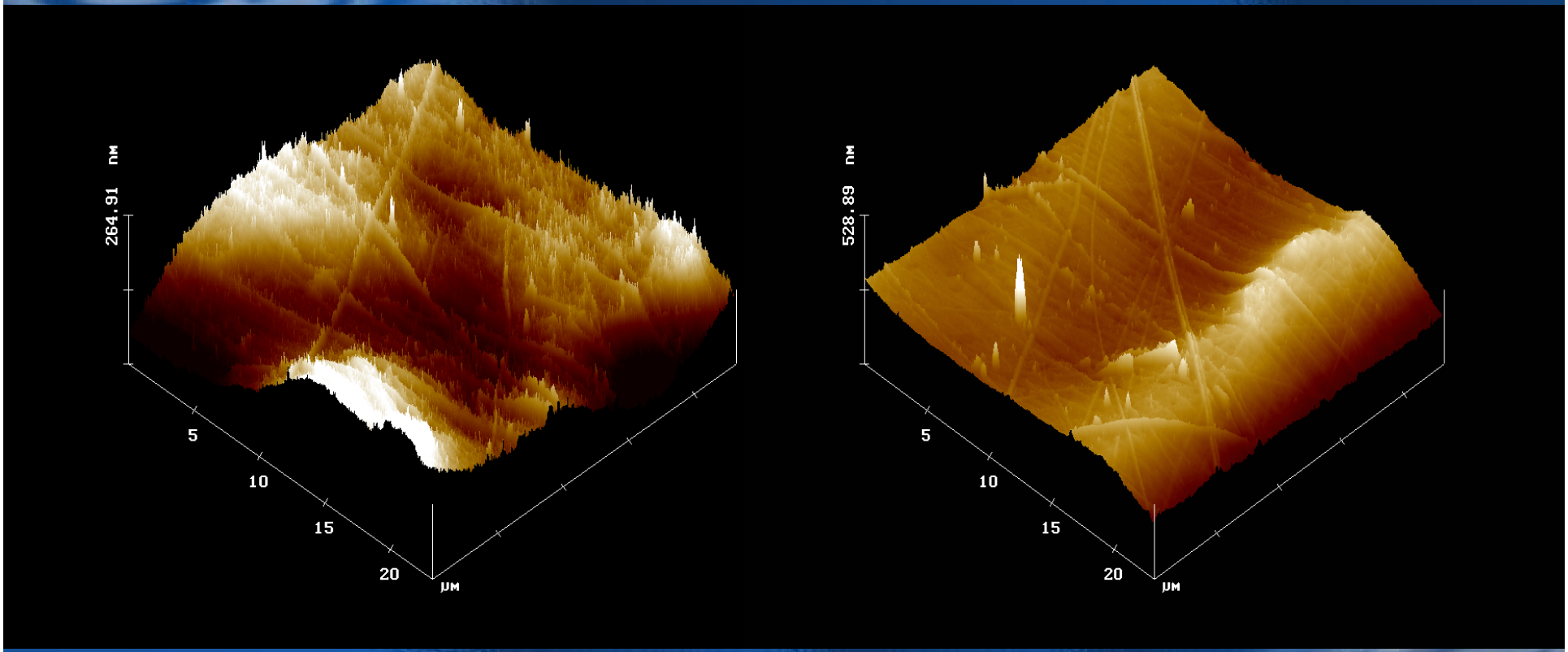
RPC


Pickup Strip
Insulator
Electrode
HV
+
-
Gas gap
bakelite resistivity 10^{10}--10^{13} Ωcm

The BESIII Detector

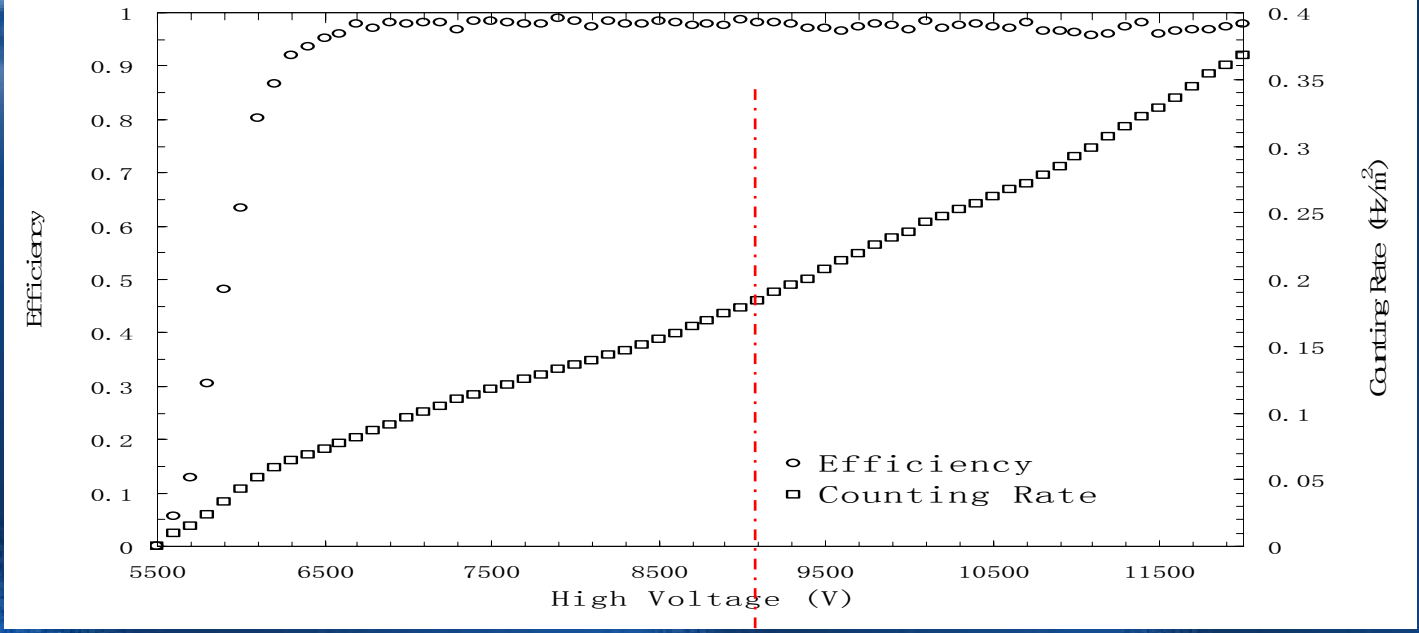


Bare IHEP Bakelite sample w/o Linseed oil coating



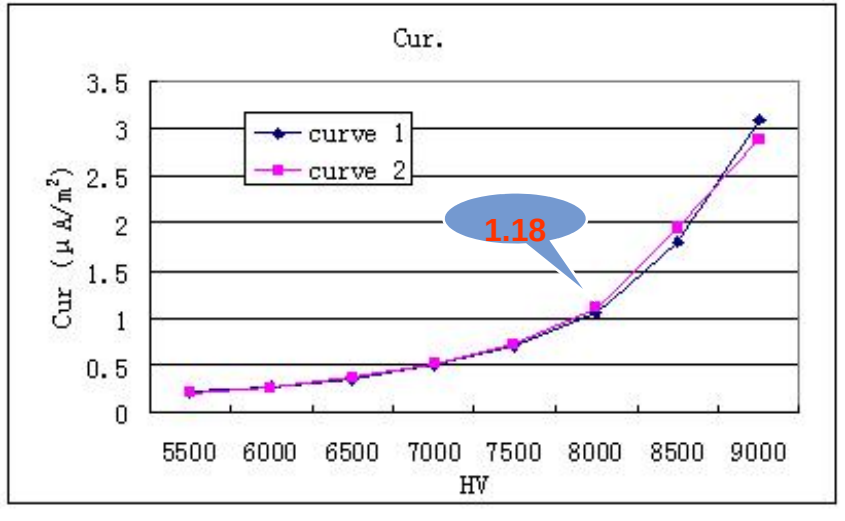
Cited from" Changguo Lu's talk of ALCPG Workshop, "
Snowmass, August 14-27, 2005

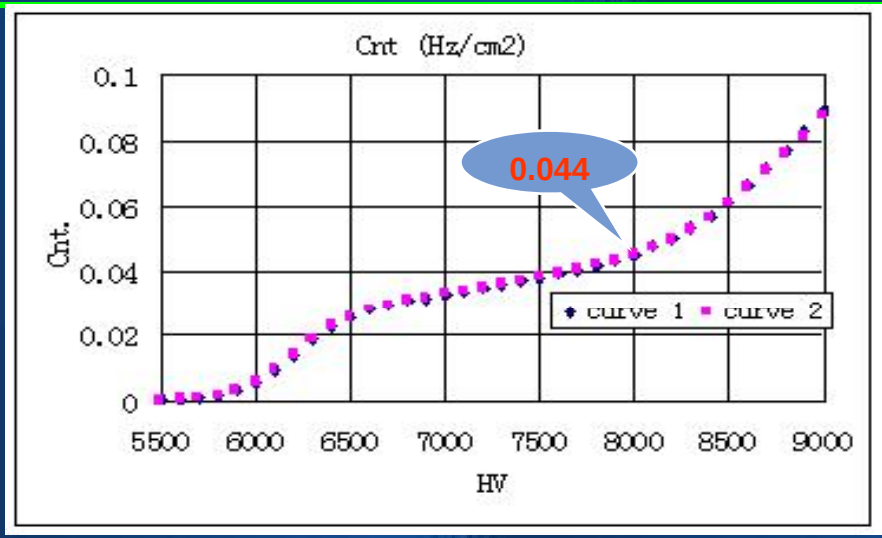
R&D ---- Eff. And Cnt. VS. HV

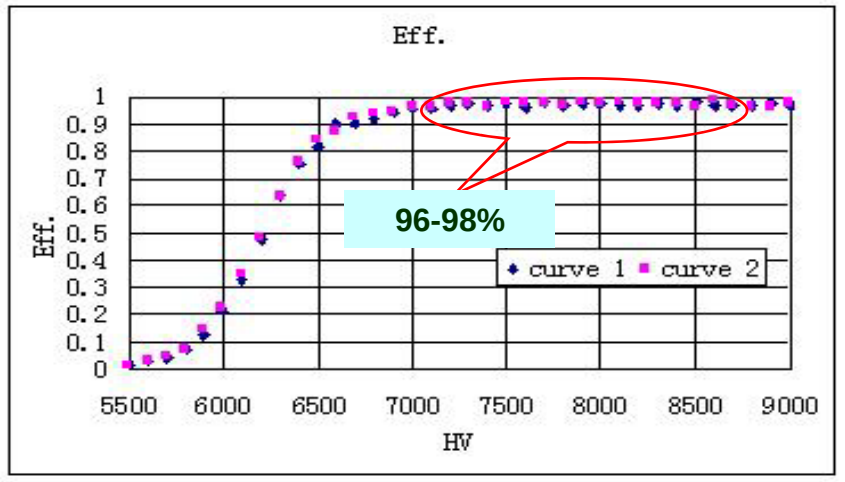


Efficiencies and singles counting rates versus the high voltage up to 12 kV. This plot shows the behavior of the prototype RPC under extreme high voltages. The gas mixture used was Ar/C2F4H2/C4H10 50:42:8.

R&D ---- prototype performance





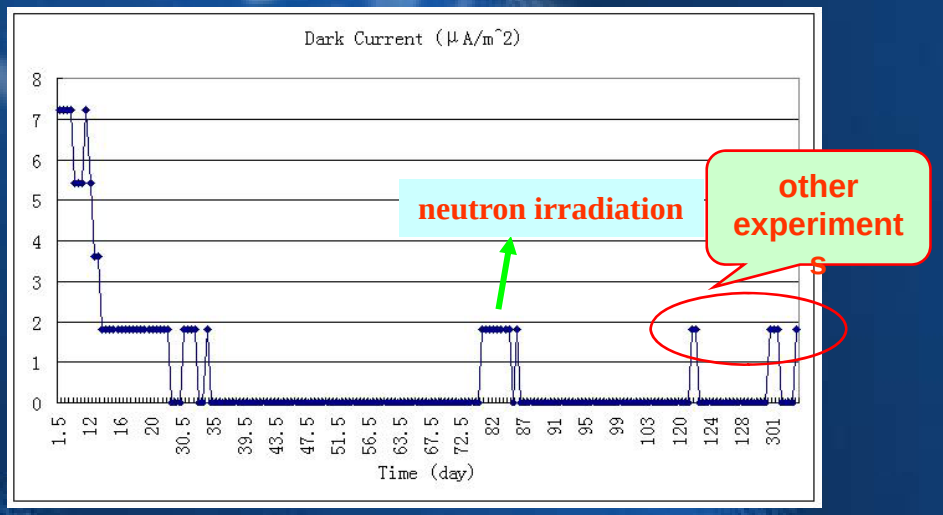


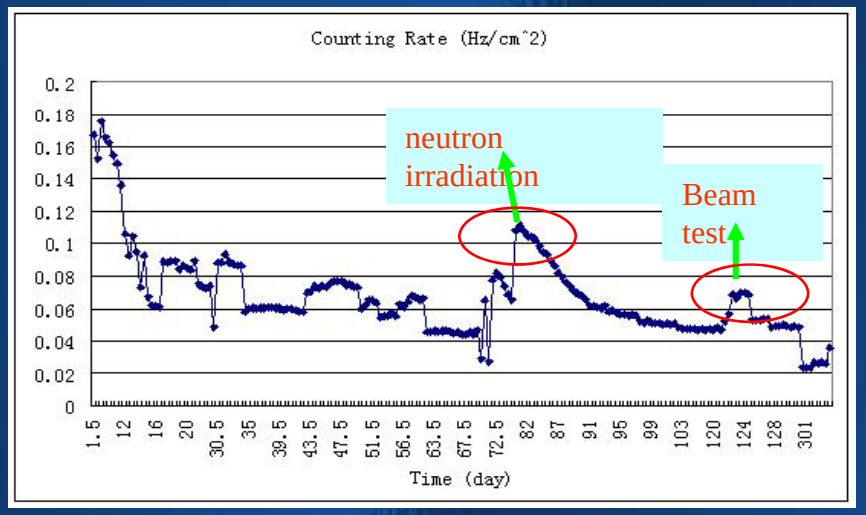
The Efficiency is about 97%

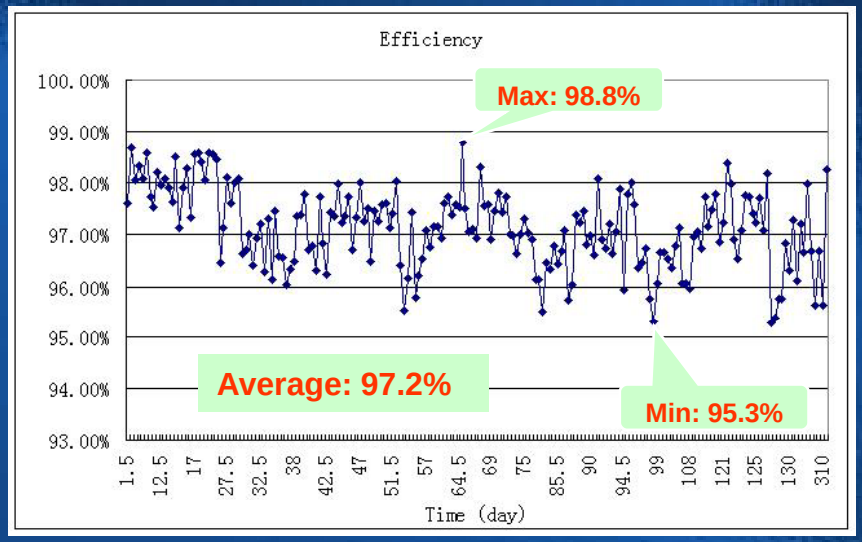
The Dark current is about 1μA

The Single counting rate is about 0.05Hz/cm^2

R&D ---- long-term stability

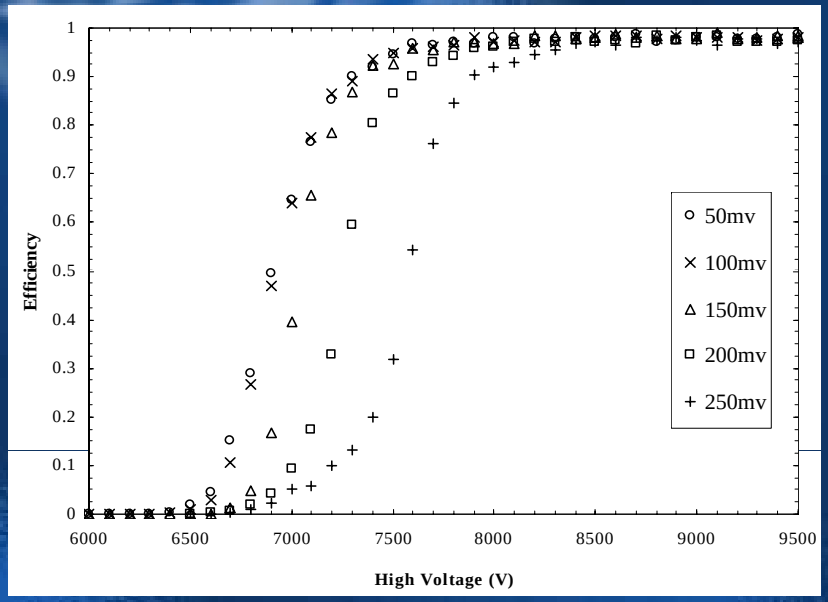


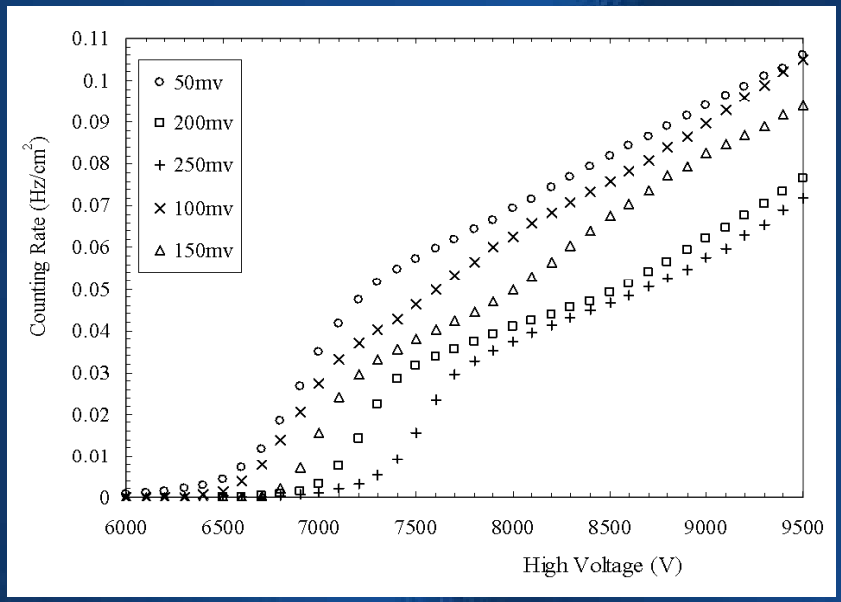




After 0ne year test, the performances are very stable

R&D ---- Threshold

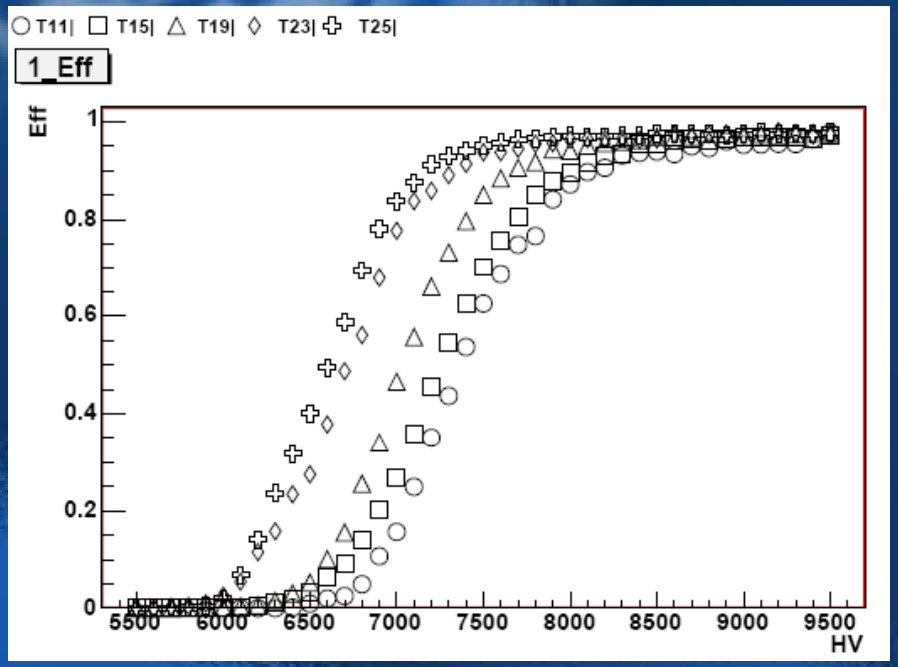


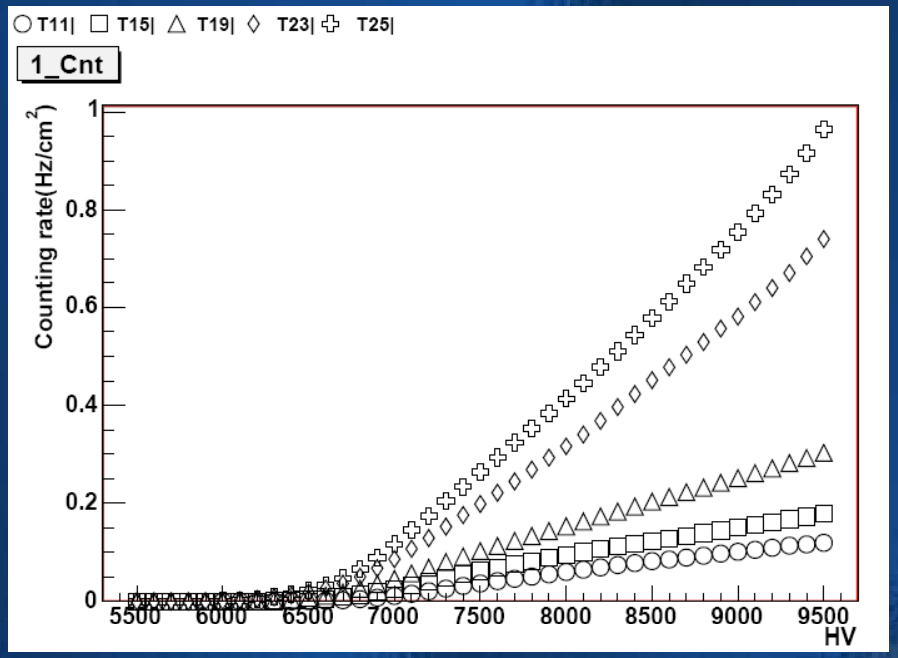


Efficiencies versus high voltage for different discrimination thresholds

Singles counting rates versus high voltage for different discrimination thresholds

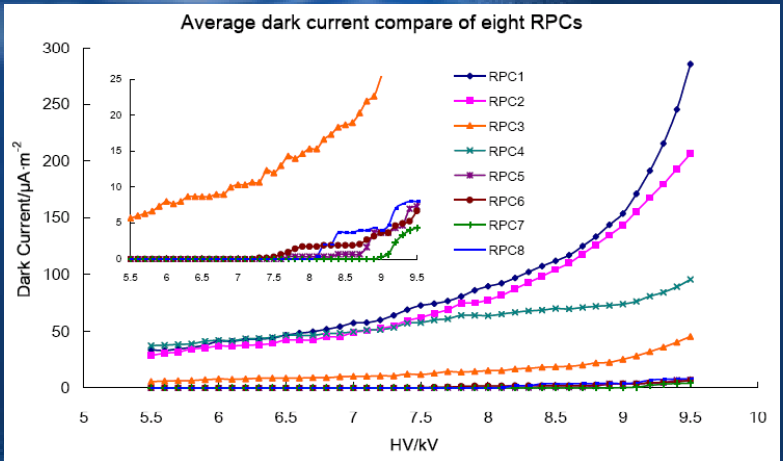
R&D ---- Temperature

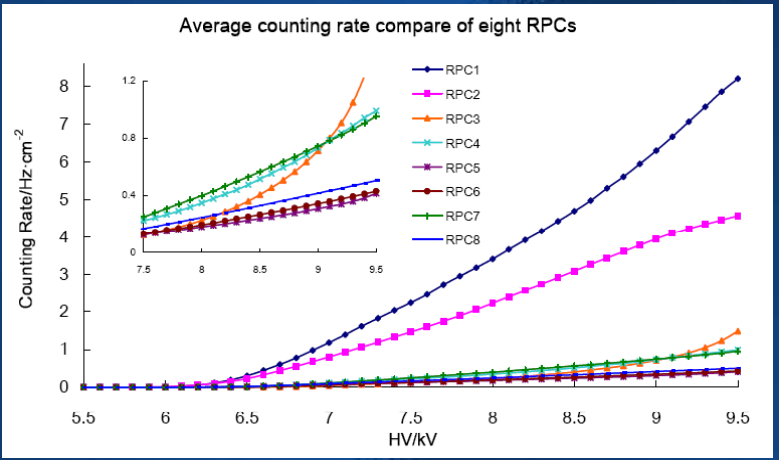


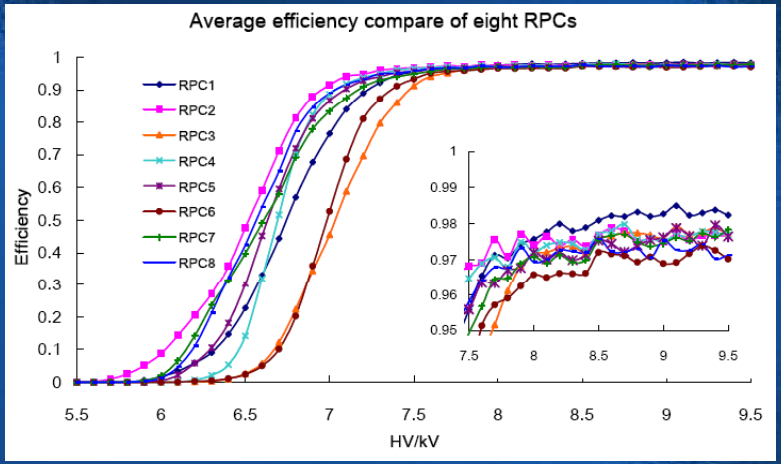


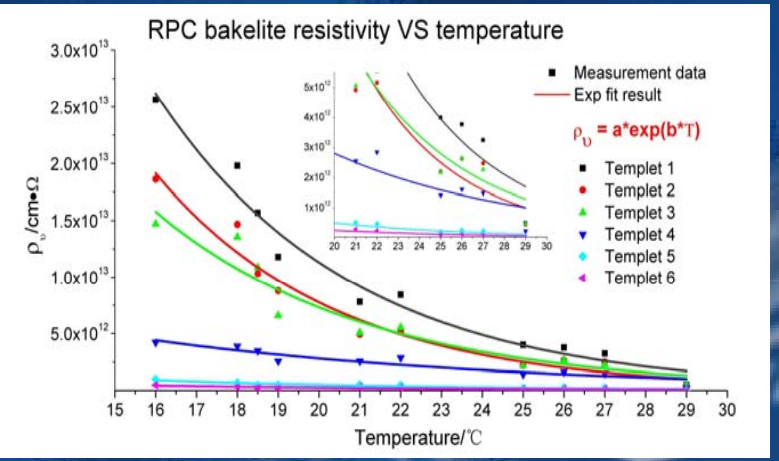
The efficiency and counting rate versus temperature. Efficiency curve will shift to left side at high temperatures, and the counting rate will increase exponent with temperature.

R&D ---- Different Resistivity

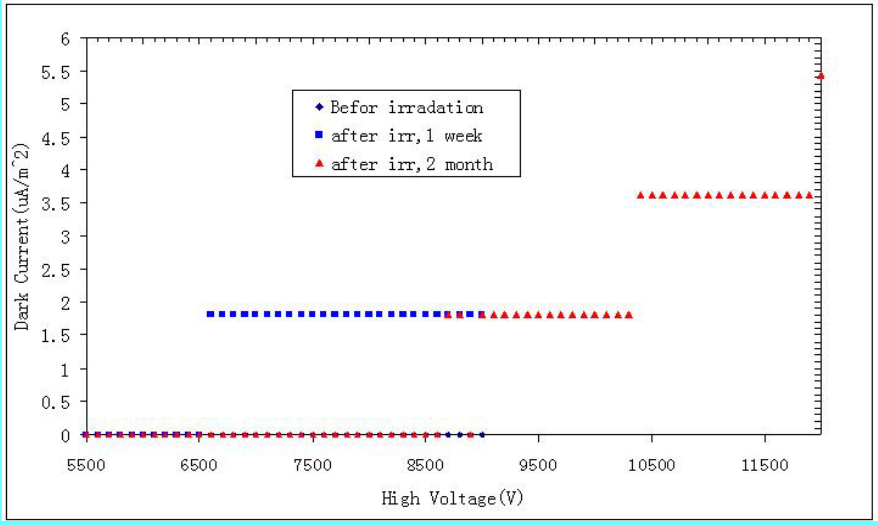


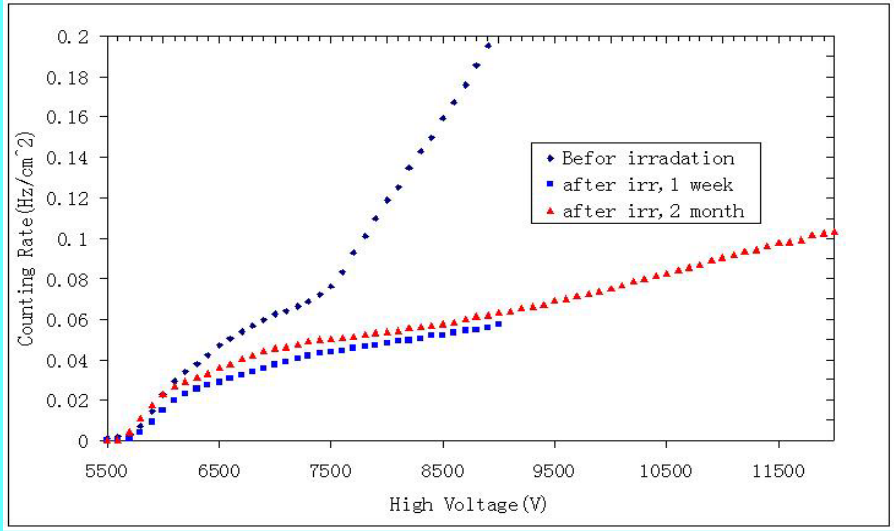


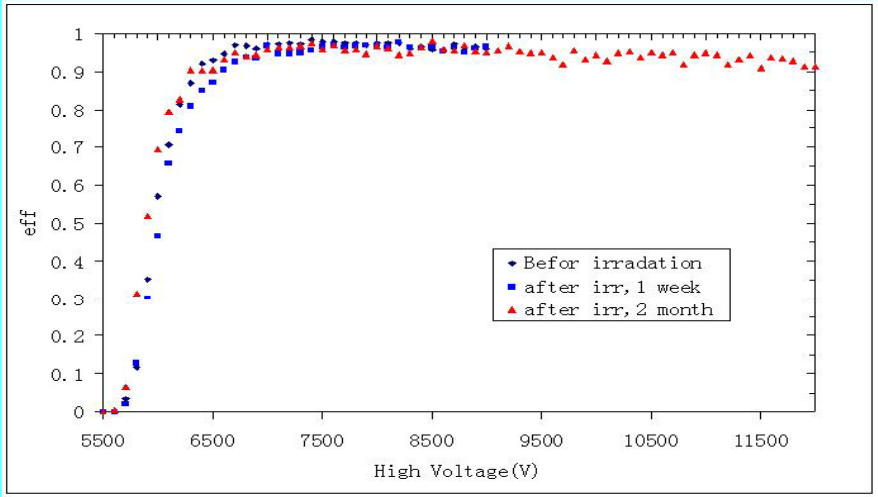




R&D ---- Electron Irradiation







No obvious change !

Mass production

The RPC production for the BESIII muon identifier has started in middle of 2004 and finished in the early of 2005.

The average area for the endcap RPC is 1.3m^2, barrel RPC 1.4m^2.

The maximum area for the endcap RPC is 1.6m^2, barrel RPC 2.0m^2.

There are 978 RPCs and the area is about 1500m^2 totally.

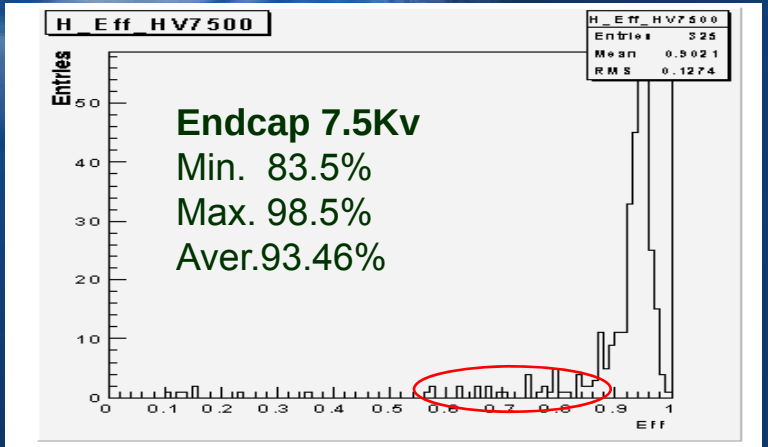
Each bare chamber is tested to ensure their performance is meet the requirement of the muon identifier before them assembled in the module, and all of modules are tested using cosmic rays before them installed on the BESIII.

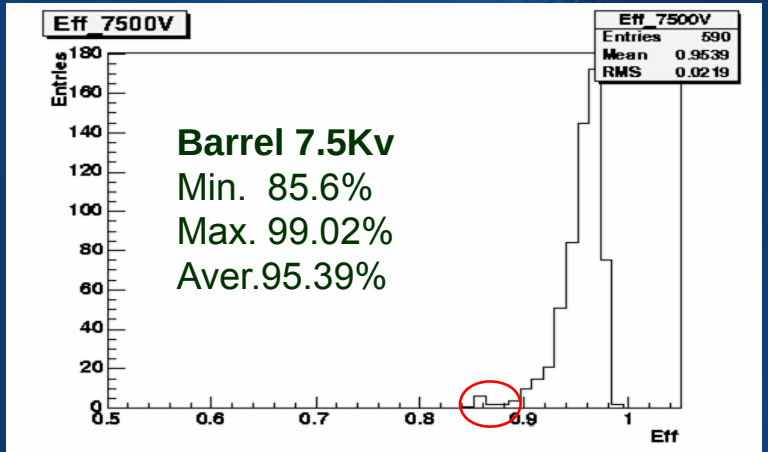
// Maximum RPC we can make is 1.2mx2.4m. //

Mass production ---- Bare chamber

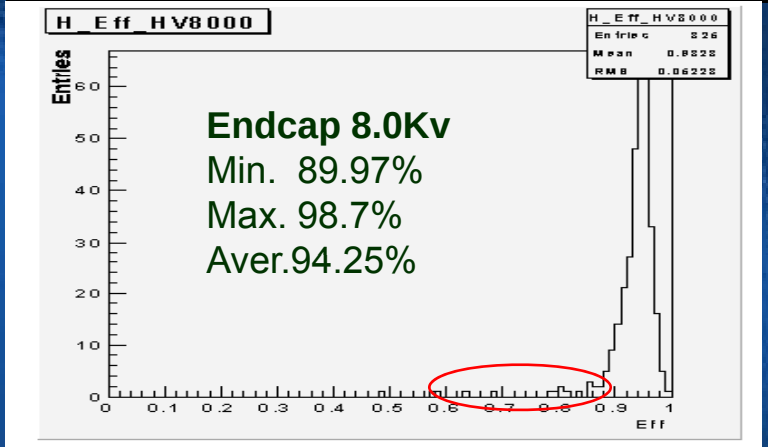
Mass production ---- Bare chamber test

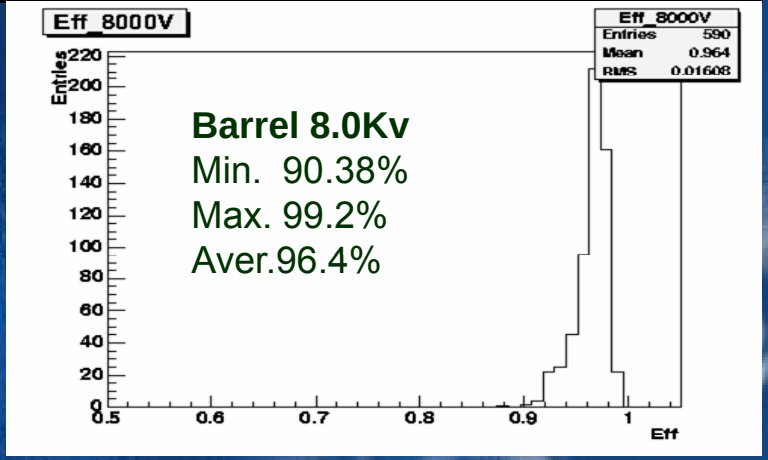
Mass production ---- Bare chamber test result ---- efficiency



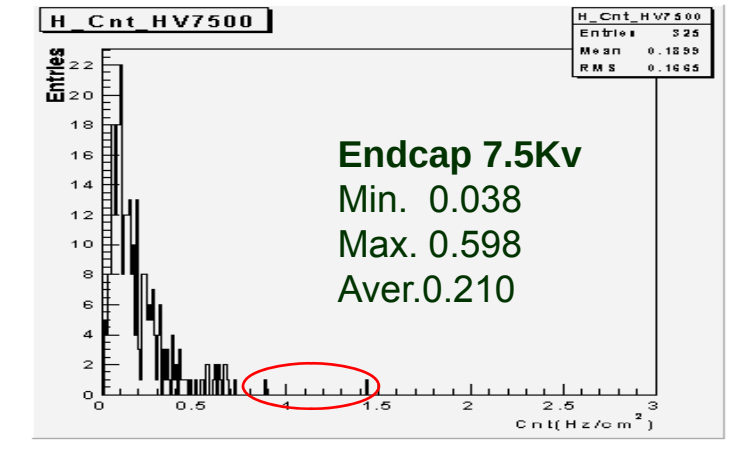


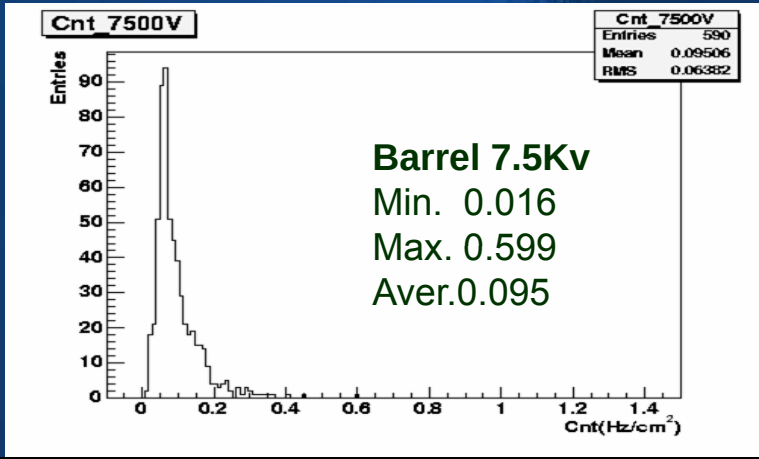
Training time : 1 - 3days; endcap 320RPCs, barrel 590RPCs





Mass production ---- Bare chamber test result ---- counting rate





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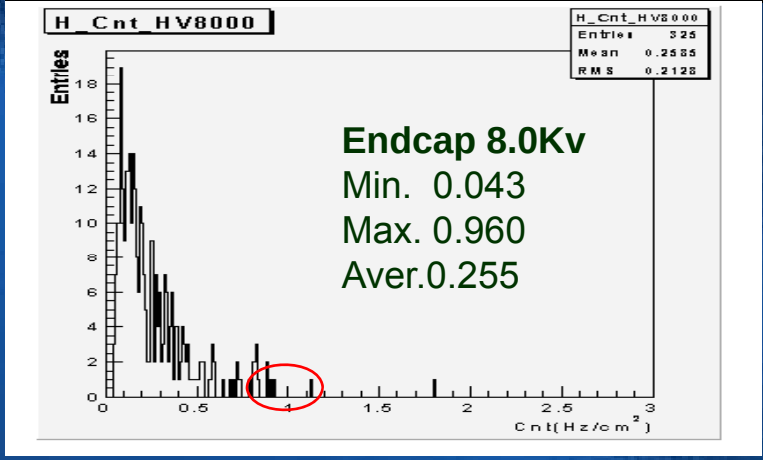
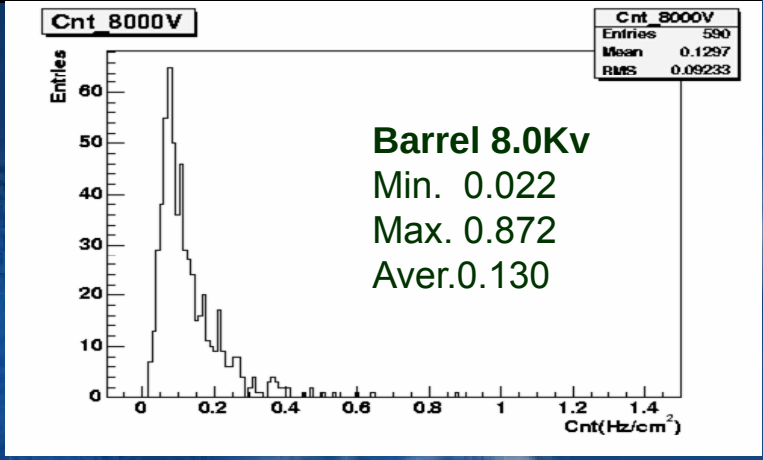
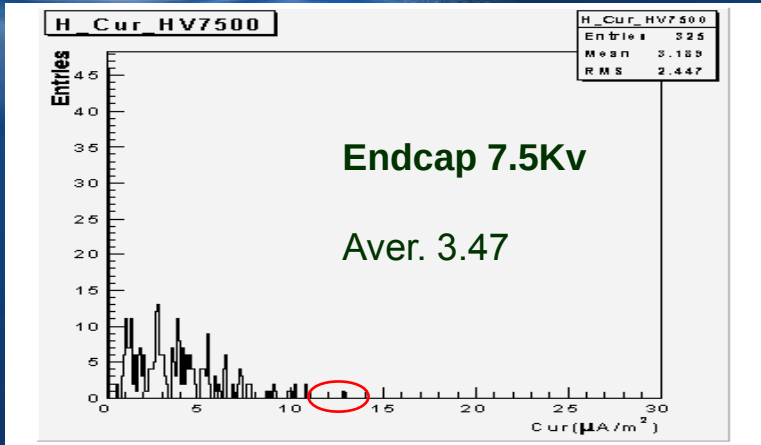
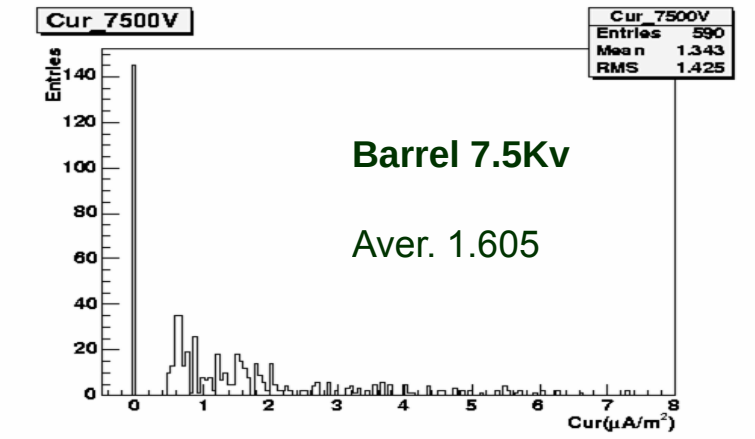


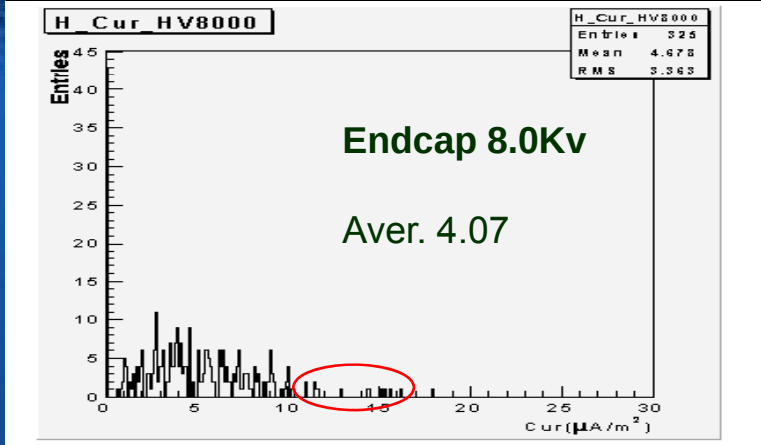


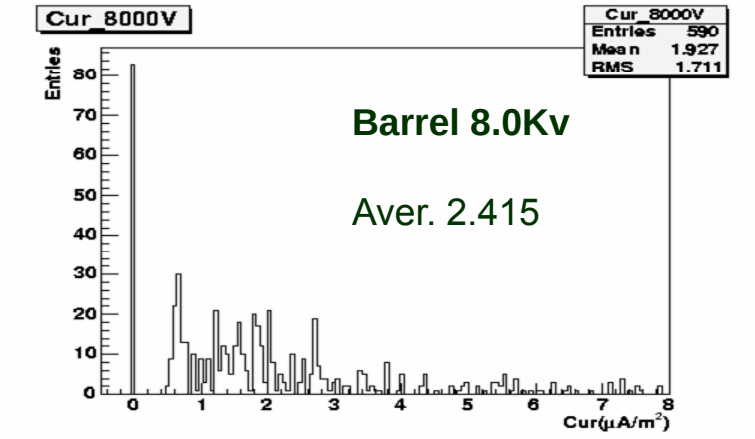
Mass production ---- Bare chamber test result ---- dark current





Training time : 1 - 3days; endcap 320RPCs, barrel 590RPCs

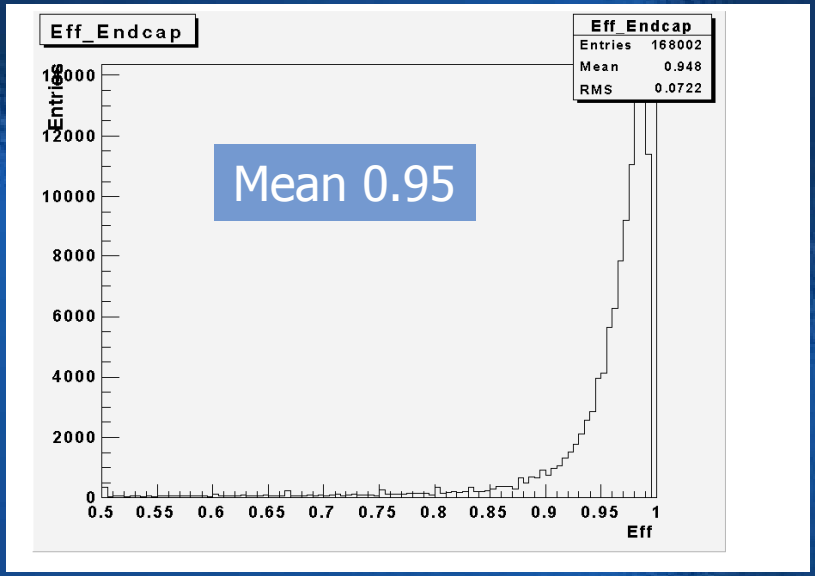


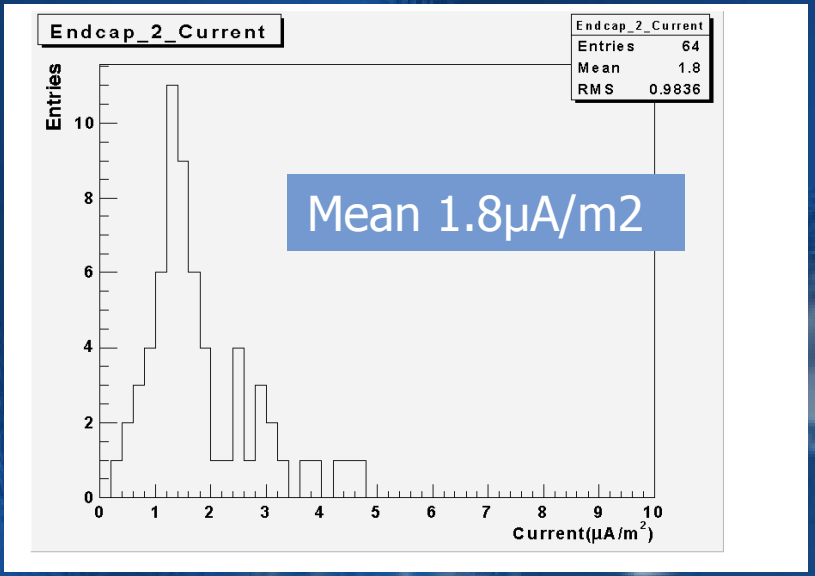


Mass production ---- Assemble Module

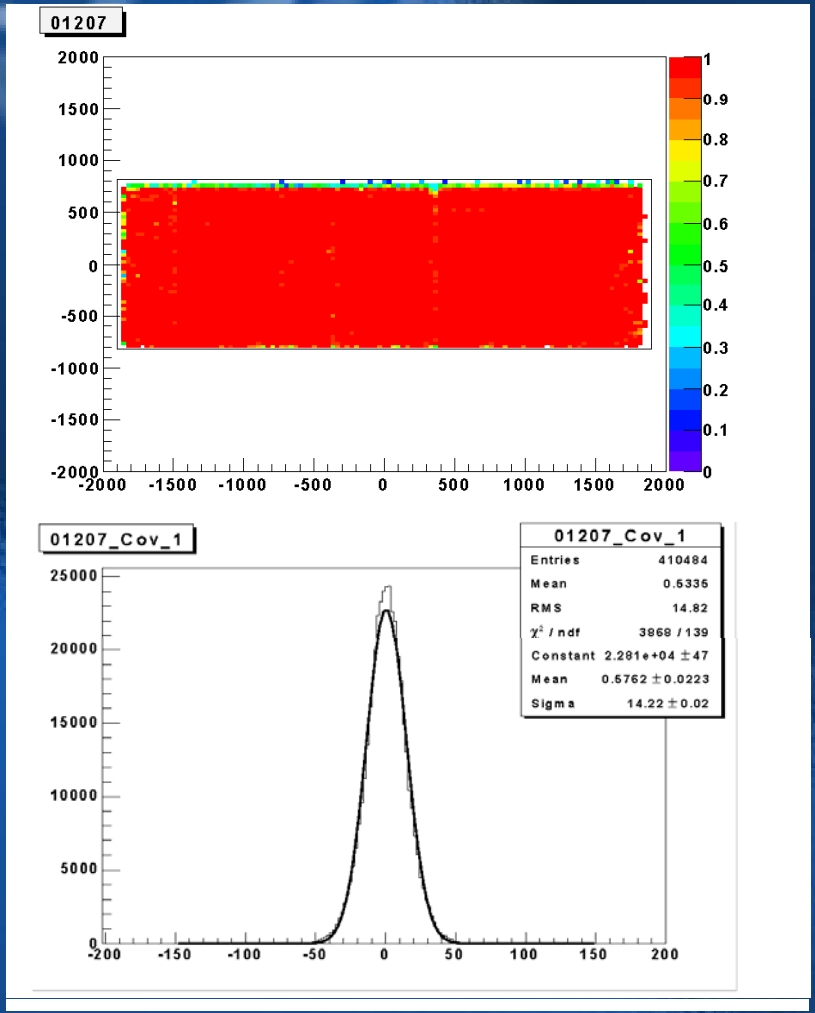
Test Result after installation - endcap

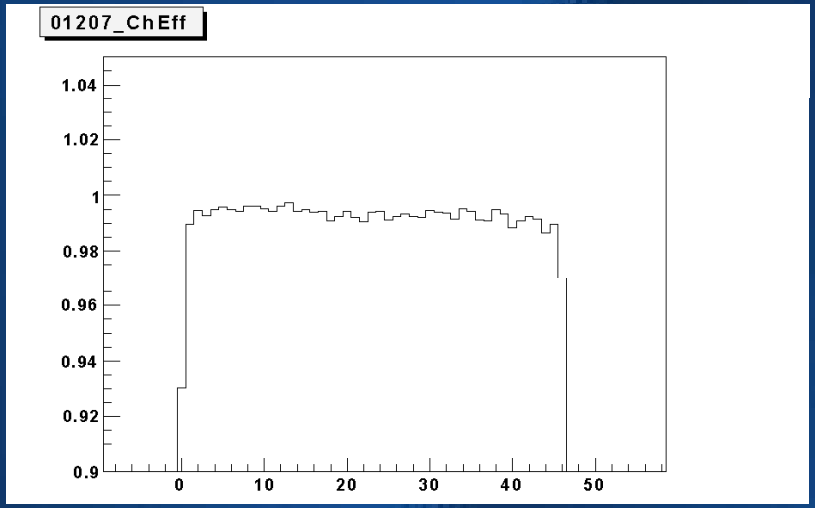
- Total efficiency and current of 64 endcap RPC modules after installation.
  - Test temperature: 20-22℃





…barrel

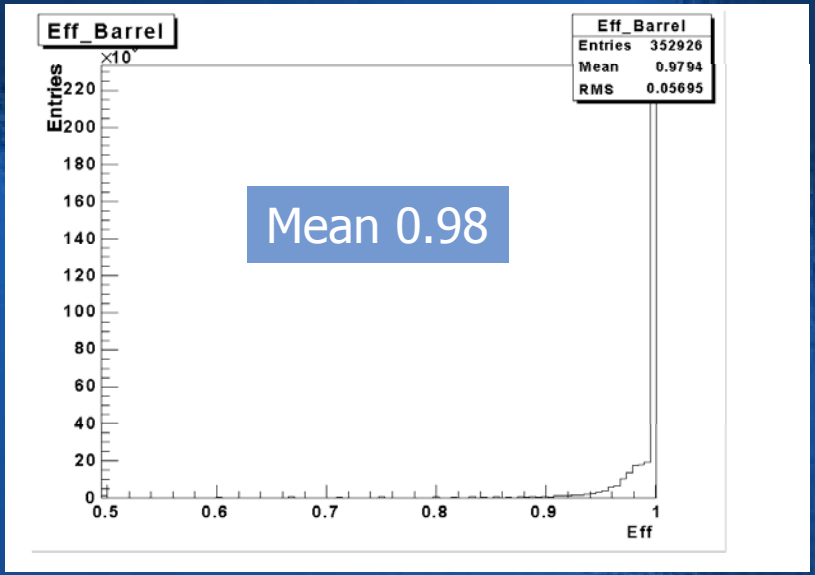


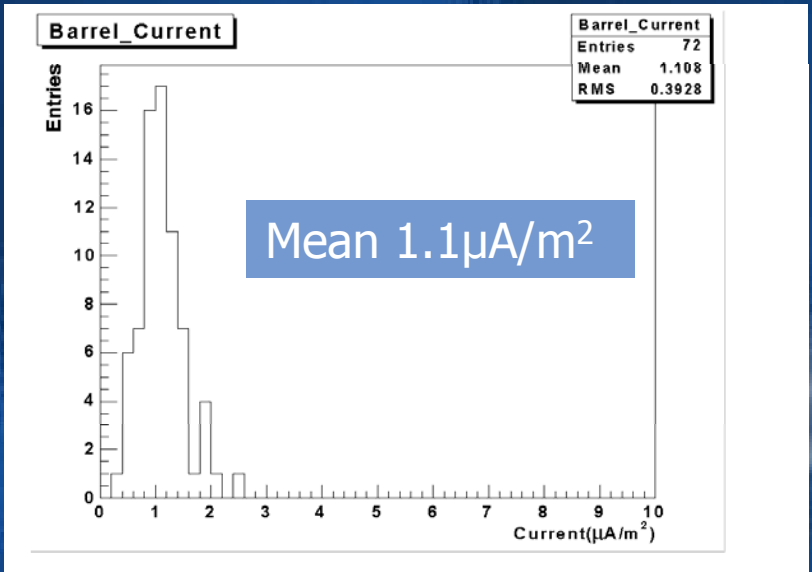


Module size: 3800mm*1640mm
Strip length: 3800mm
Strip width: 33mm
Average strip efficiency: 0.99
Spatial resolution: 14.2mm

…after assembling - barrel

- Total efficiency and current distribution of 72 barrel modules:
  - Average efficiency higher than that of endcap modules, while dark current smaller than endcap modules.
  - Test temperature: 22-25℃





After installation have not test

Conclusion

- The RPCs making with new bakelite plates that we developed have good surface quality , it can meet with different RPC detector requirement.
- The RPC avoid the problem of linseed oil and glass RPC
- The RPCs have higher efficiency, lower counting rate and dark current, and good long-term stability .
- Some issues of the RPCs are waiting for more careful and systematic R&D.
- The BESIII Muon detectors efficiency can reached to >98%, and the dark current is about <2μA/m^2, single counting rate is about 1000Hz/m^2
- If RPC used to ILC, we must do much more R&D