Electron Transmission Measurement of GEM Gate

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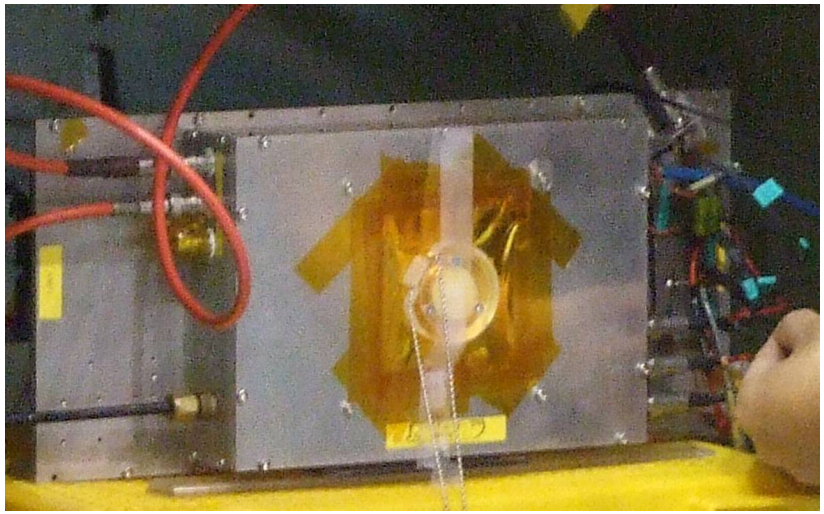
Motivation

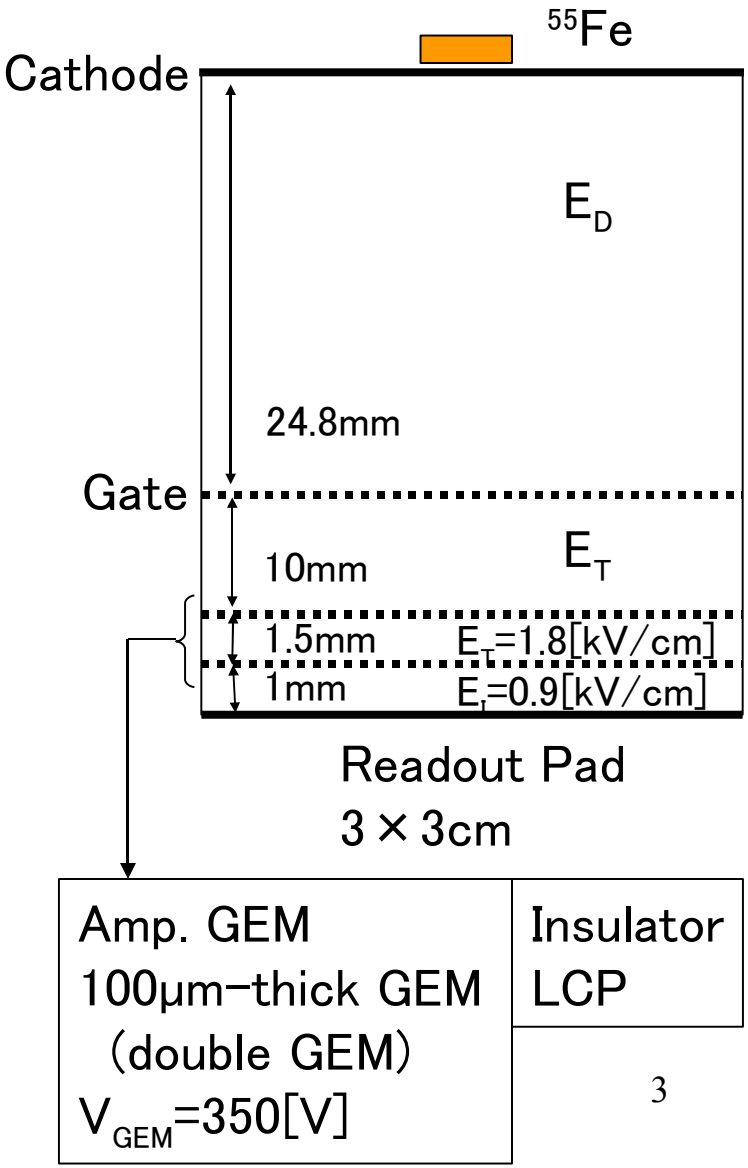
- Electron transmission measurement of 14μm-thick gating GEM
  - In T2K gas mixture
  - w/wo B field
  - To Compare with next LP1 GEM panel test with gate

  - GEM structure is same LP1 GEM panel

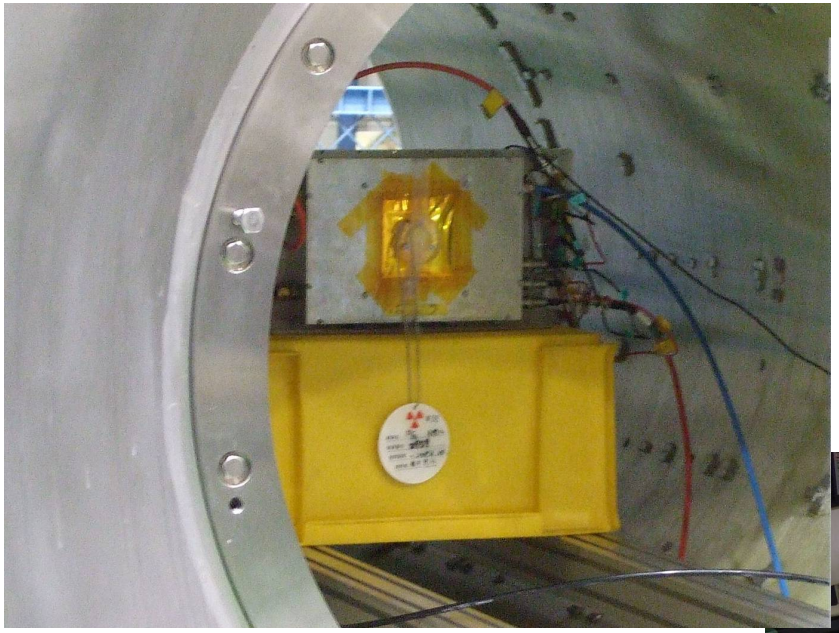
Experimental Setup

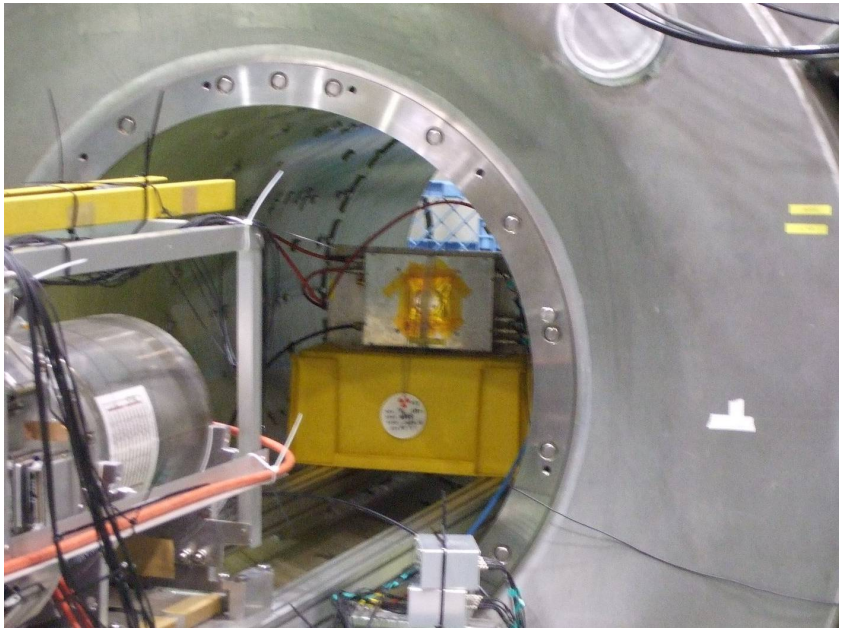
- T2K gas mixture
- B = 0 and 1T (at KEK C.C.)
- Gate GEM
  - 14μm thick
  - 90μm hole diameter

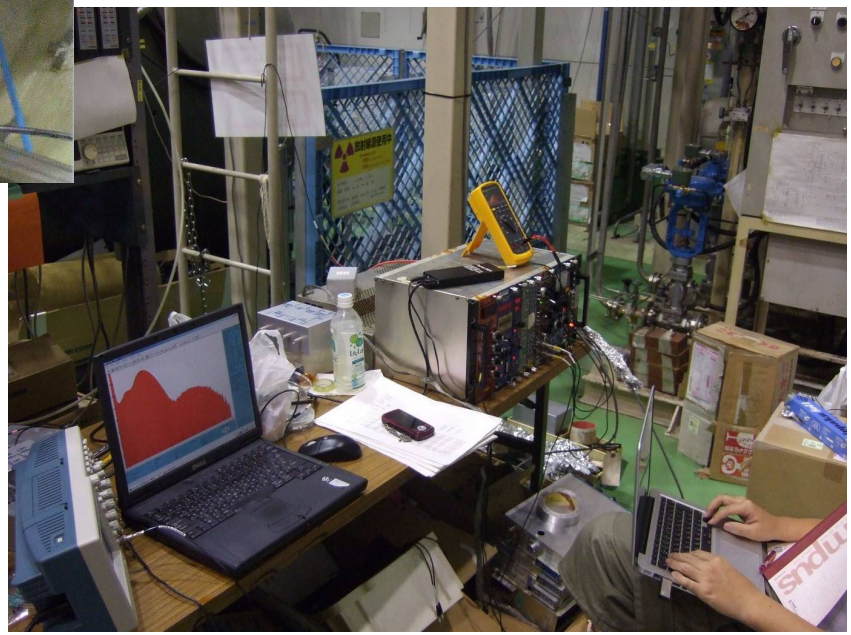




Snap Shots







Method of Measurement

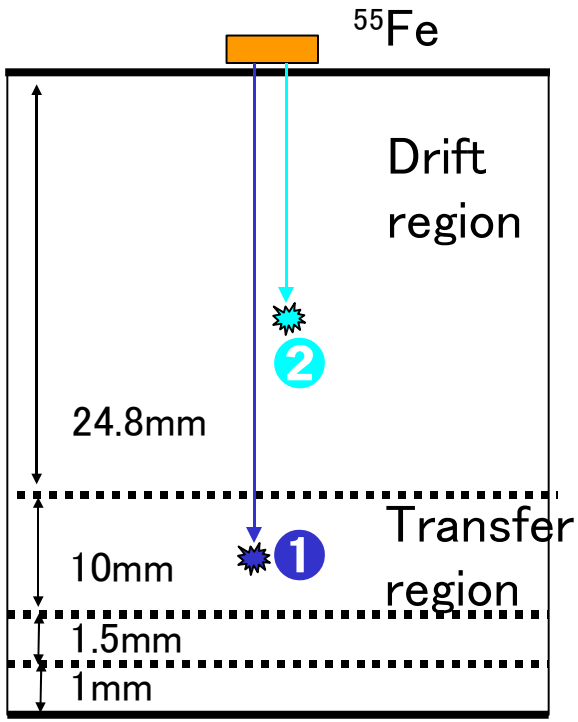
- Electron transmission efficiency
  - Ratio of ❷ to ❶

❷conversion at drift region

Electron loss by Gate

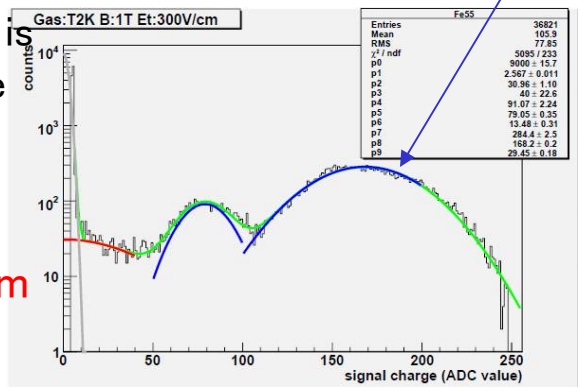
❶conversion at transfer region

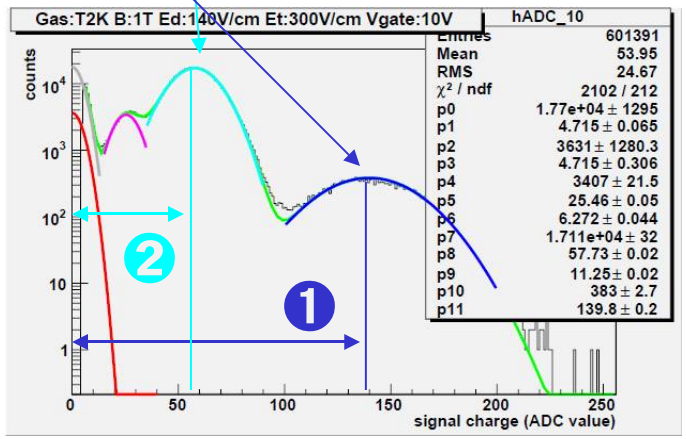
No effect by Gate
(ie. trans. eff. = 1)
E_D=0[V/cm]



Low rate because transfer region is far from source

Signal charge spectrum (log scale)

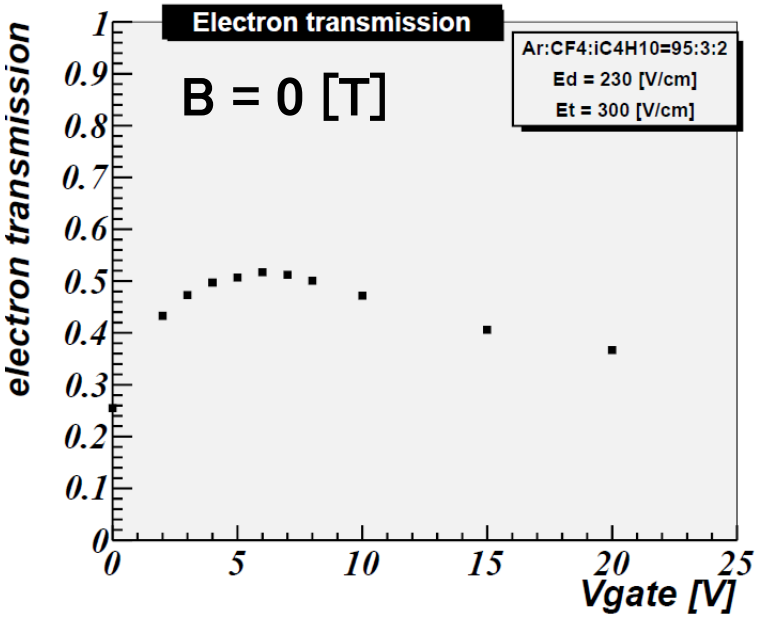


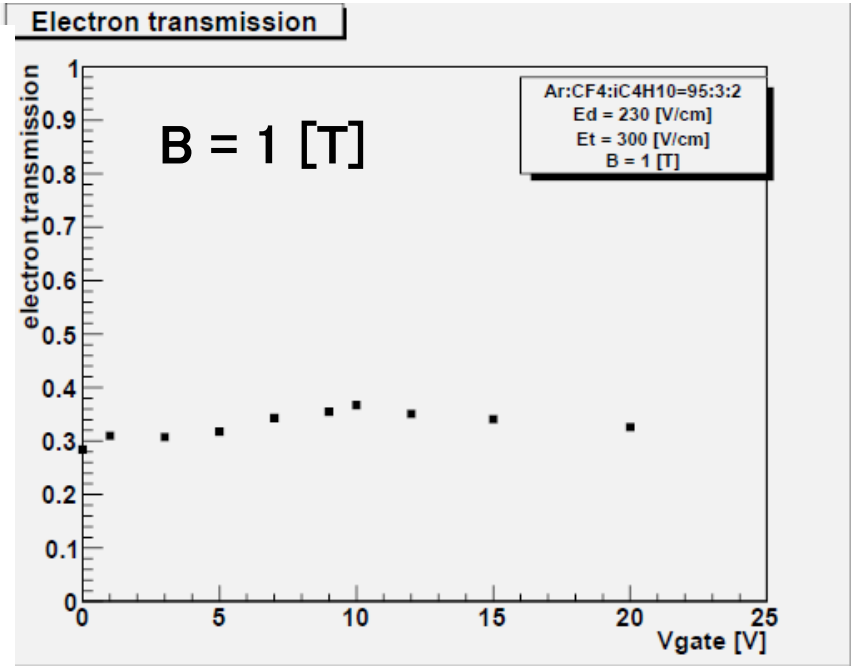


Peak position decided by gaussian

E_D = 230 [V/cm]
E_T = 300 [V/cm]

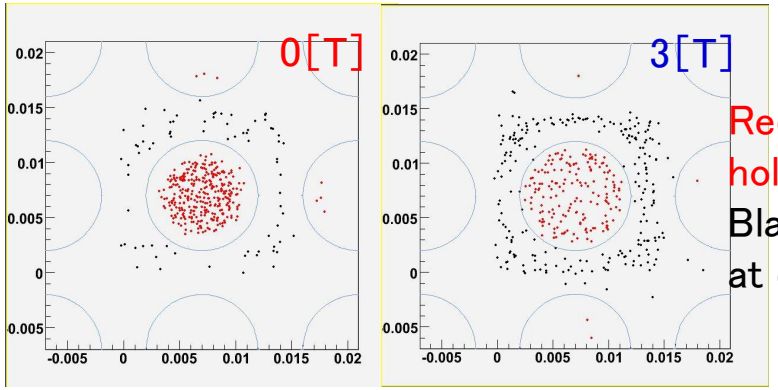
Transmission





- B field dependency

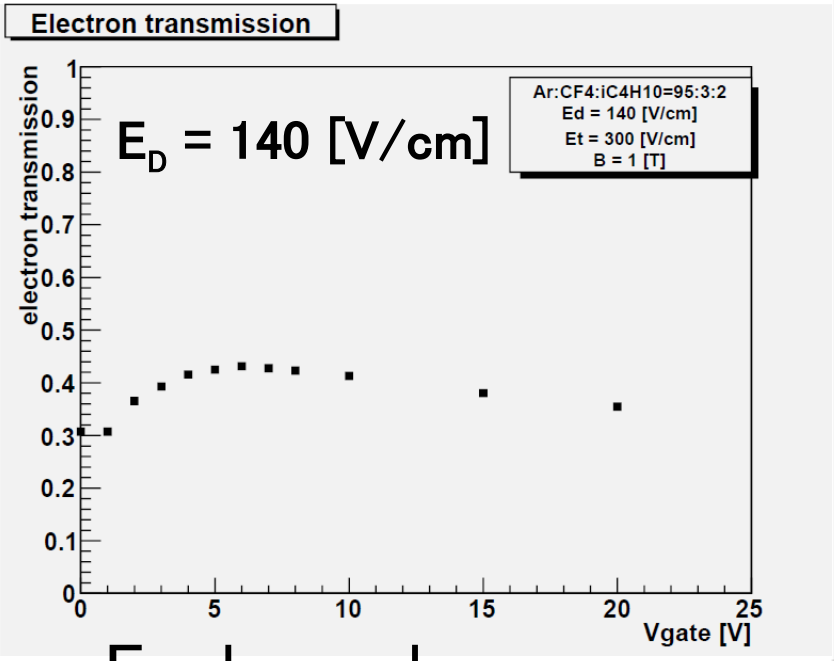
High B field ⇒ Electrons move along B field due to lorentz angle,
# of electrons into the hole decreases

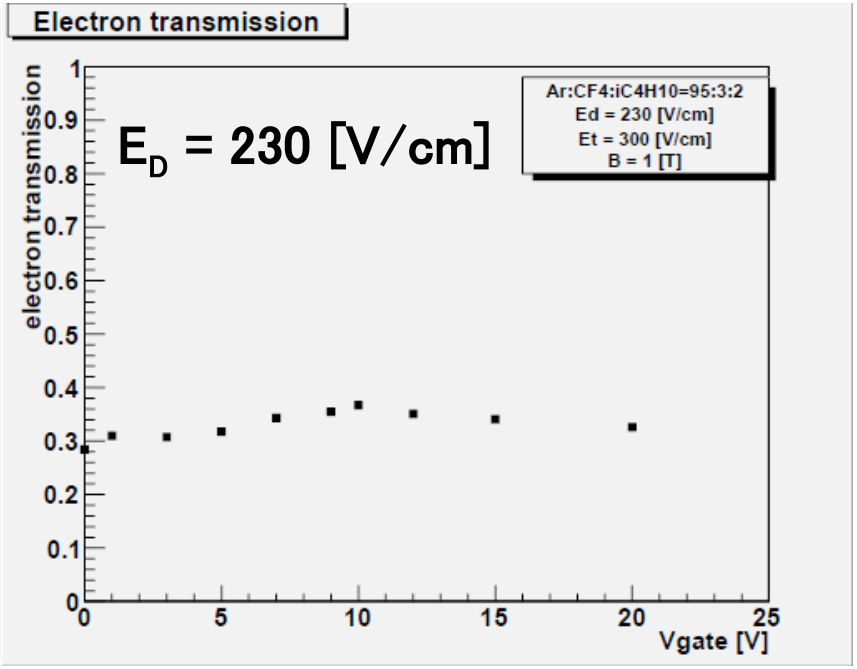


Red : into the hole
Black: arrived at electrode

E_T = 300 [V/cm]
B = 1 [T]

Transmission

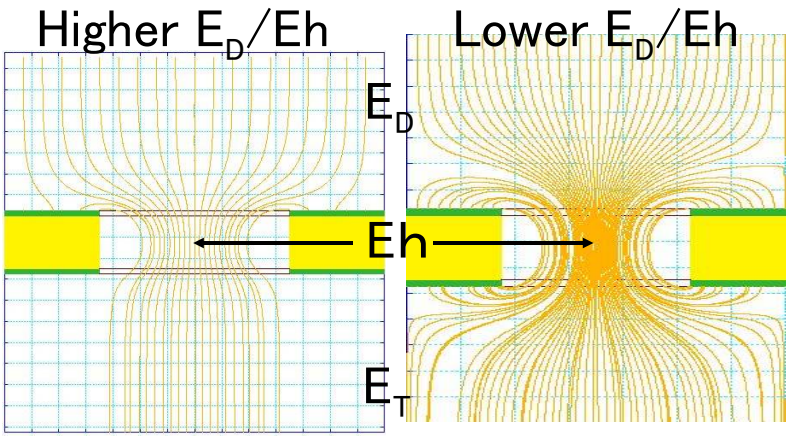




- E_D dependency
  - Lower E_D is better for transmission

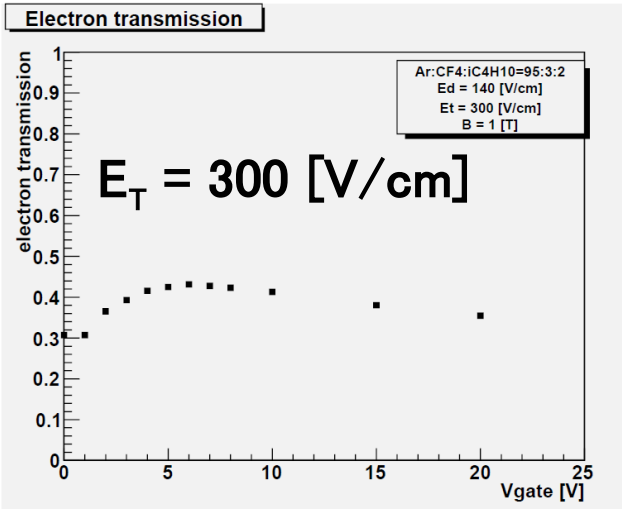
Ratio of E_D and Eh

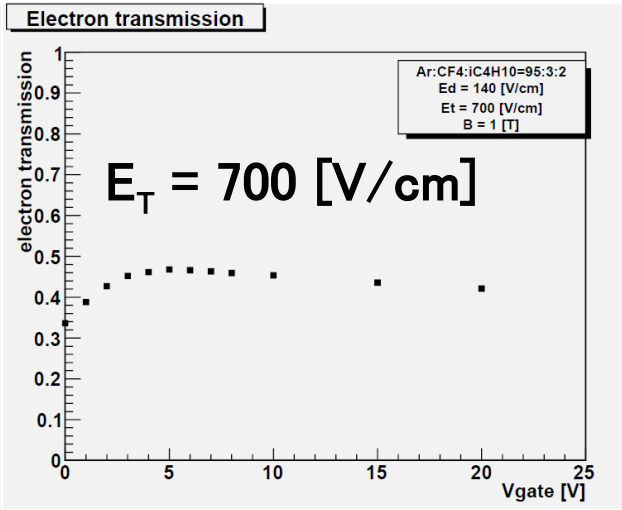
# of field line to the GEM electrode increases at higher E_D

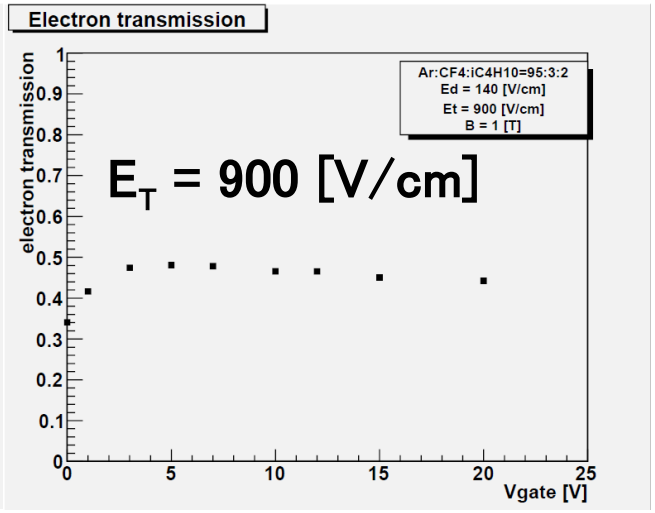


E_D = 140 [V/cm]
B = 1 [T]

Transmission

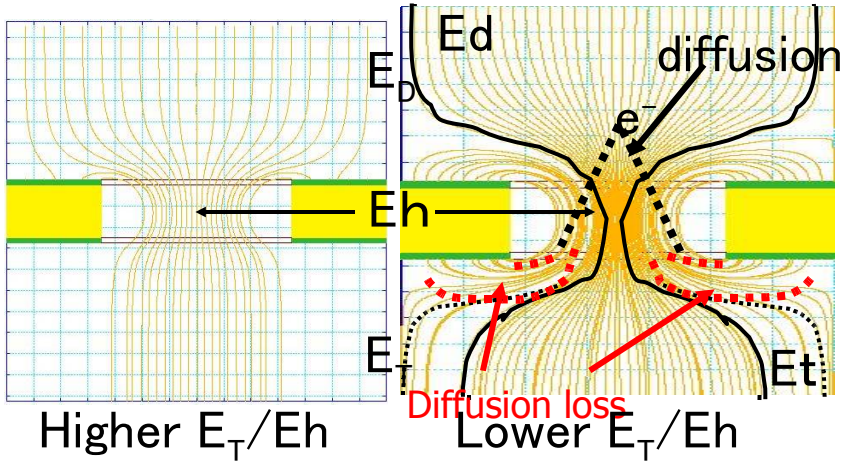






- E_T dependency
  - Higher E_T is better for transmission

Area of penetrating field line is narrower at lower E_T and some electrons return to GEM electrode by diffusion



Summary

- Electron transmission eff. of GEM gate have been measured w/wo B field
  - Max. transmission eff. is about 50 % at B = 1T
  - N_{eff} will be about 10 at LP1 GEM panel with gate