

A study with a small prototype TPC for ILC experiment ~ GEM gating test ~

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MOTIVATION

We are considering GEM-gating as an indispensable component for GEM-TPC in order to reduce ion feedback.

Our problem was that we had never used gating-GEM.

Our purpose of this study is ...

- to acquire experience on the system
(Best GEM voltages, ...)
- to find out if the system works well .
(Can we have enough Neff ?)

We have just started this study but would like to show some preliminary results.

Cosmic Ray test

Condition

$$B = IT$$

$$E = I \left| \frac{2}{\text{diffusion min}}, 200(\text{on going}), 230(\text{not yet}) \right. \text{ [V/cm]}$$

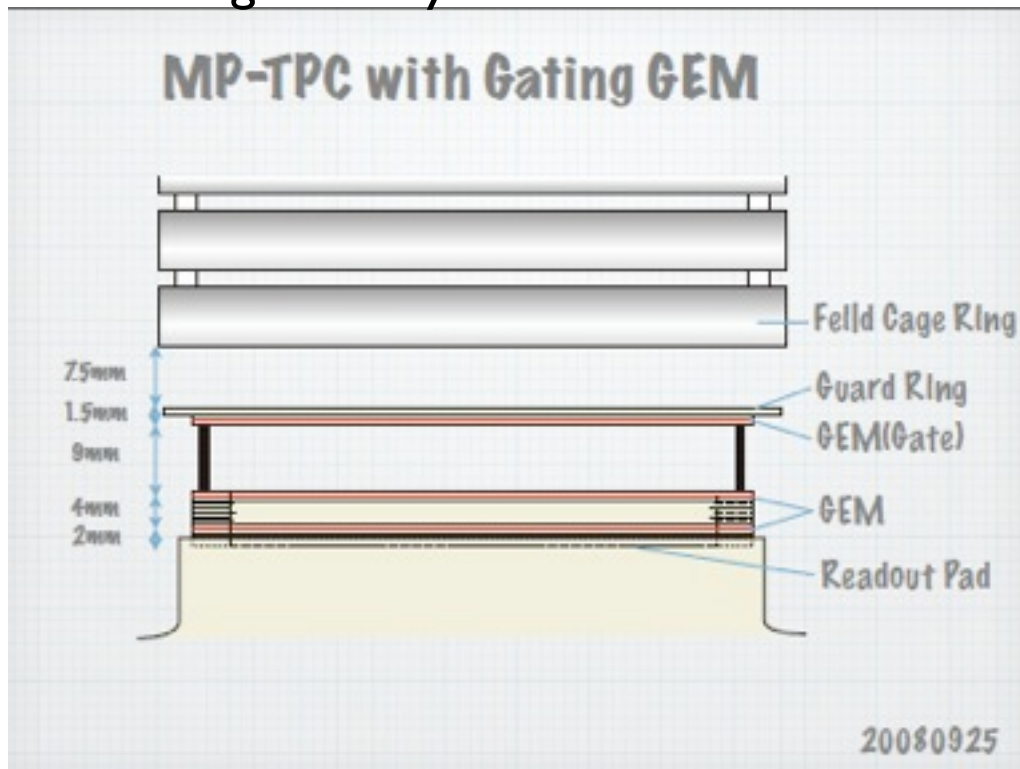
drift velocity max

Gas : T2K (Ar-CF4-isoC4H10 95:3:2)

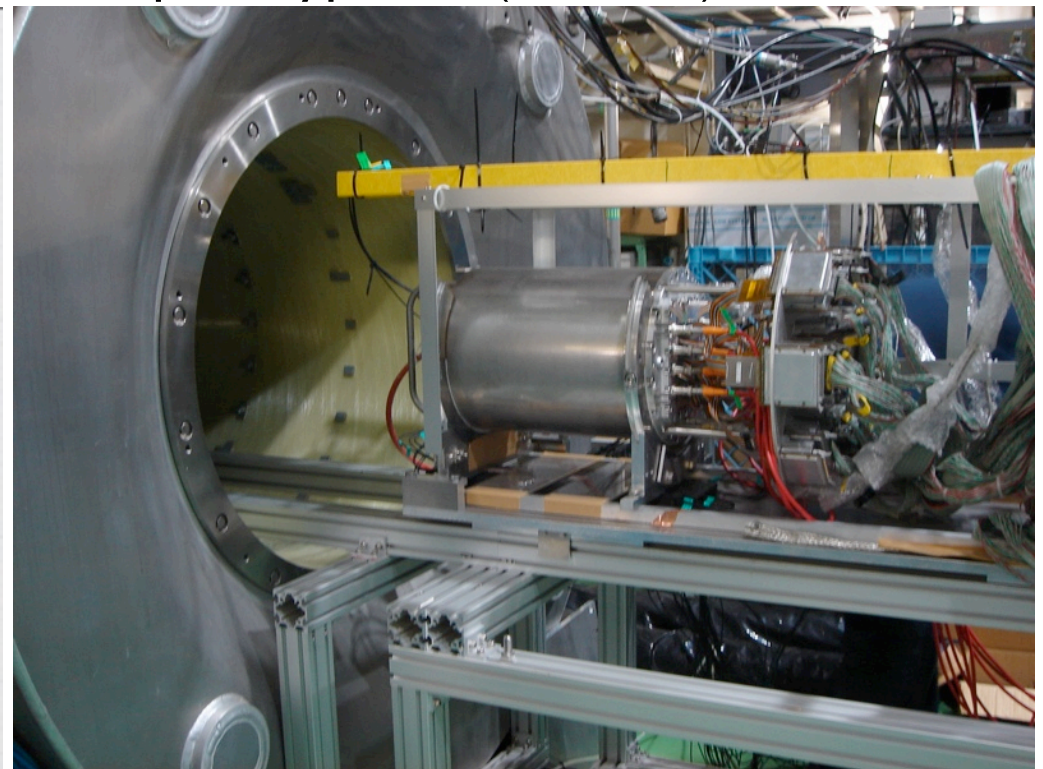
using 100 μ thick GEM \times 2 + gating-GEM (14 μ thick)

Same configuration to be used for the LPI GEM panels

Sketch of geometry

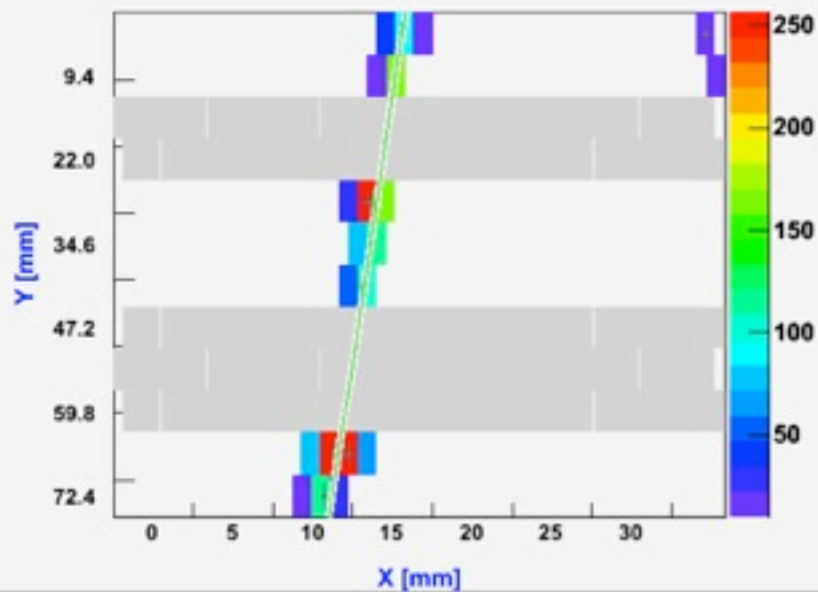


Small prototype TPC (MP-TPC)

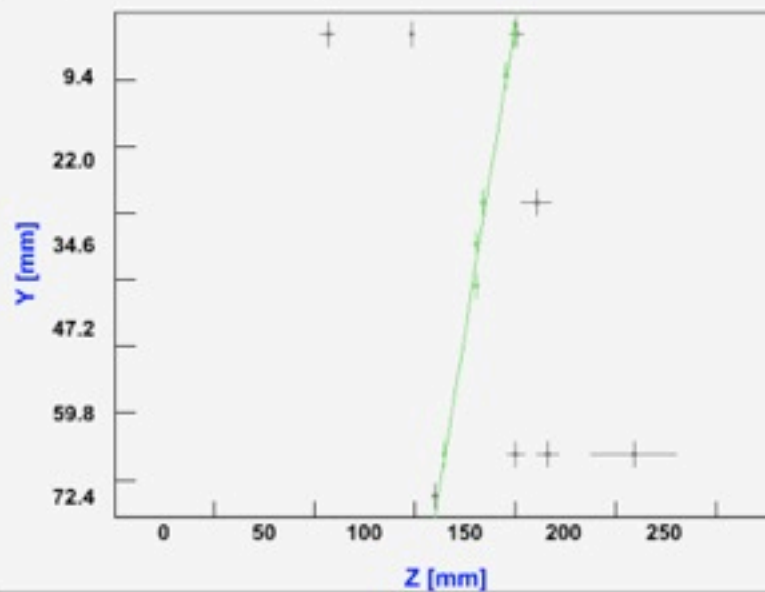


Event Display (Multifit)

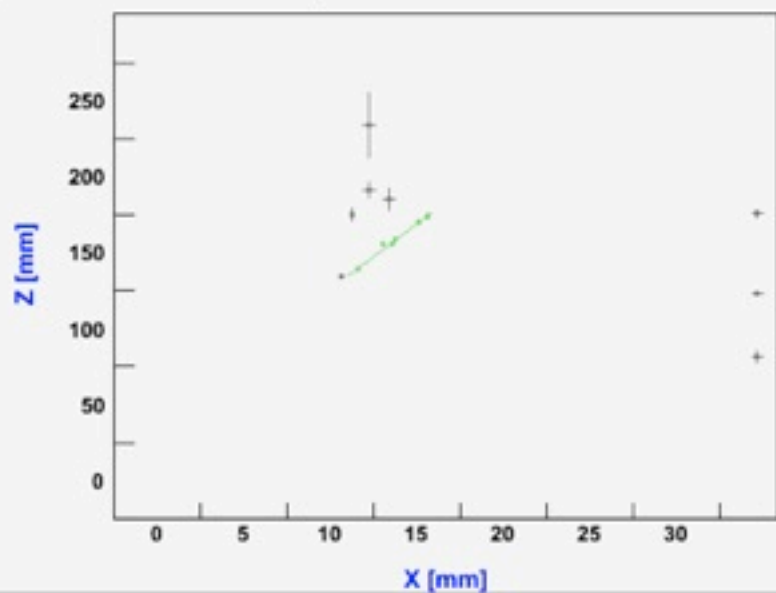
Projection in Z 69142



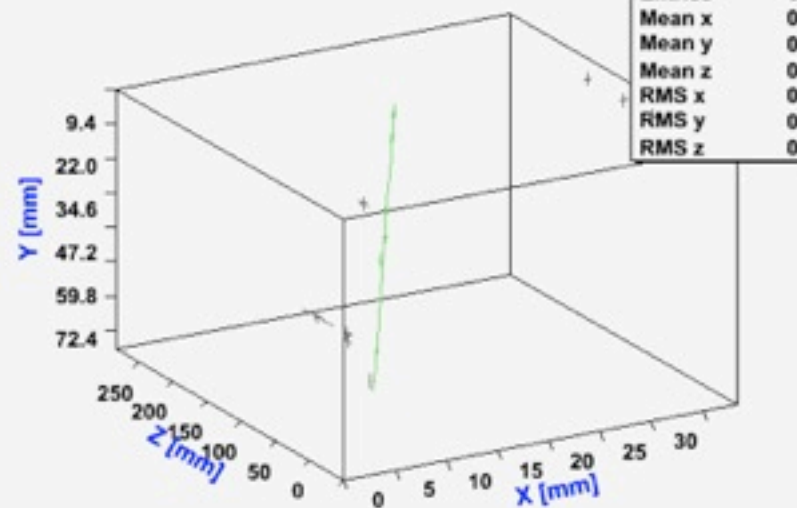
Projection in X 69142



Projection in Y 69142



Event 69142 in 3D

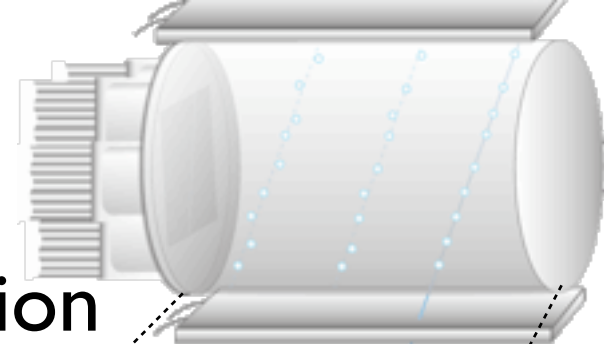


PRELIMINARY RESULTS

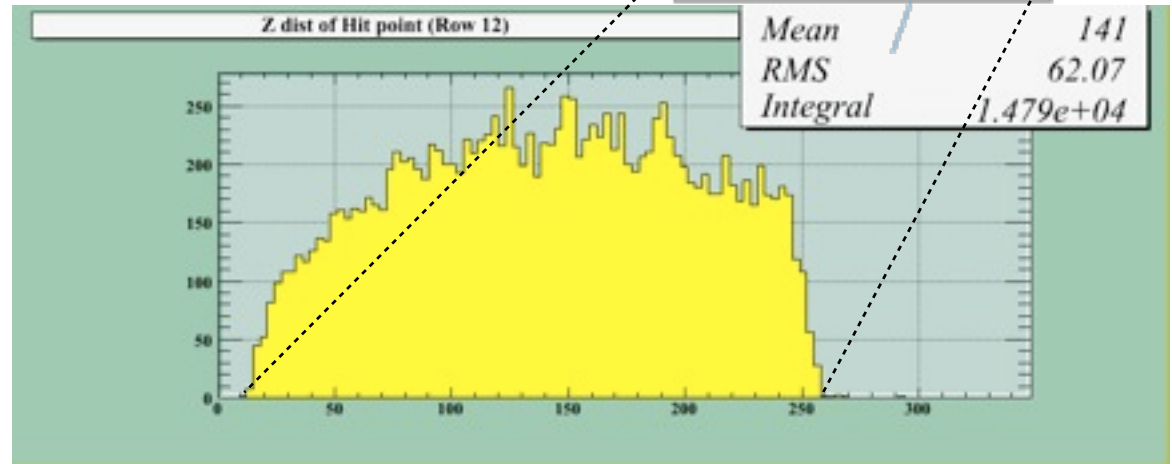
$$B=1T$$

$$E=112[V/cm]$$

T2K gas

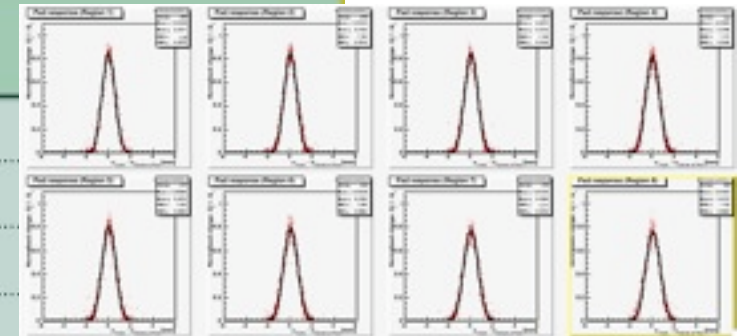
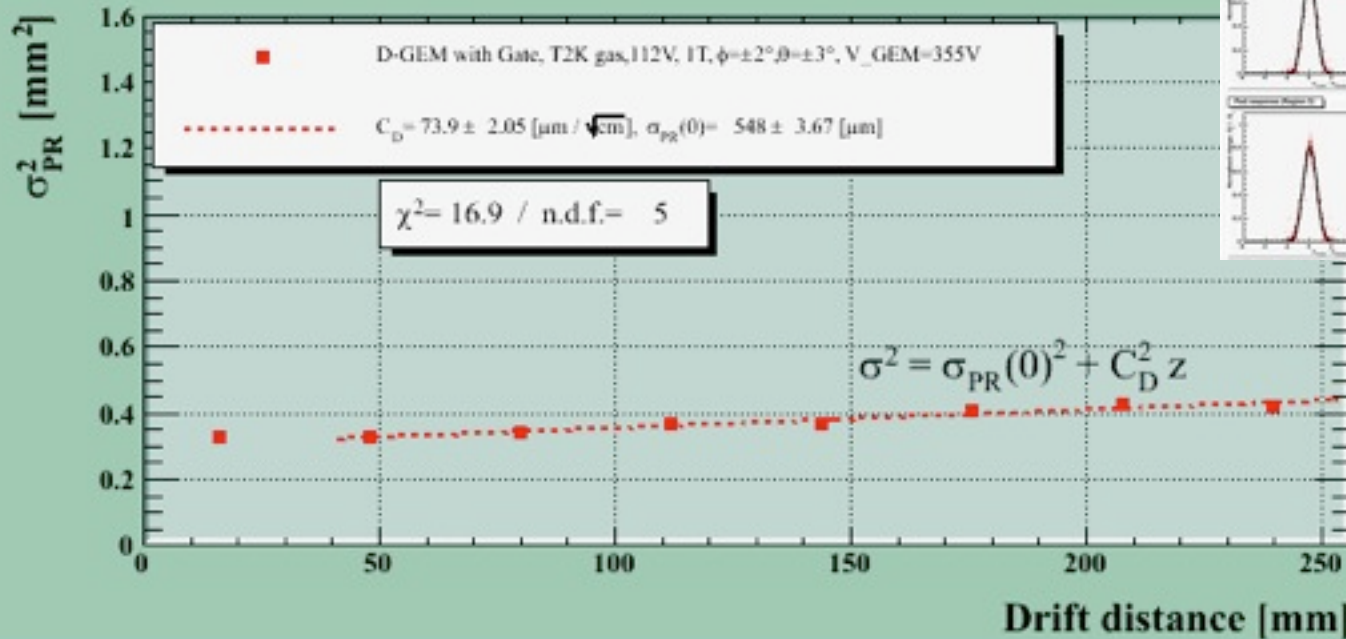


Z hit distribution

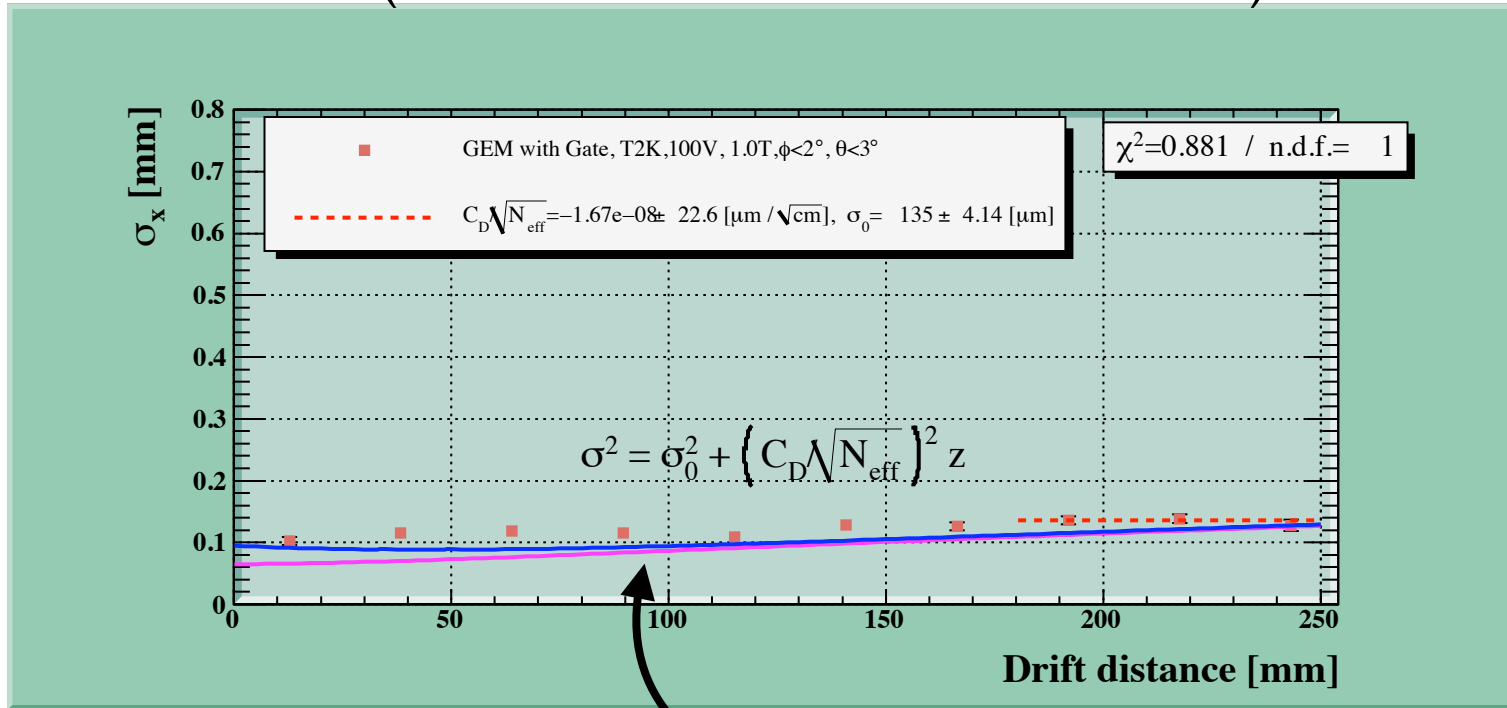


Width of pad response as a function of drift distance

Width of pad response (All row)



Resolution (measured data & theoretical calculation)



Theoretical calculation

Input parameters

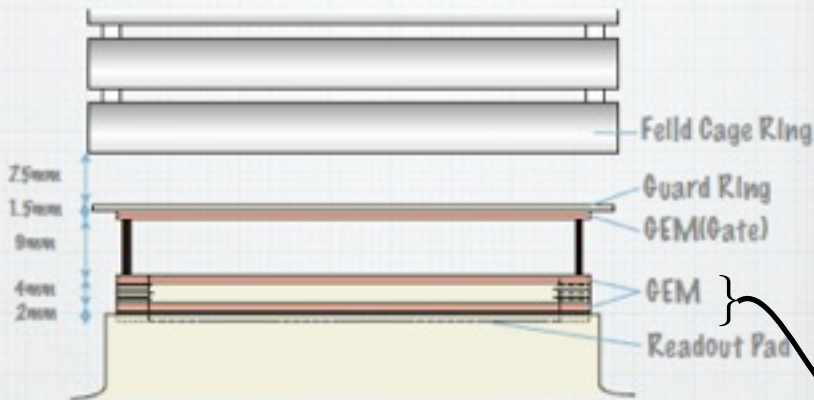
$\sigma_{\text{PRF}} 300 \mu\text{m}$ ← tentative value (no theoretical reason)
 $N_{\text{eff}} 10$ $C_D 79.2 \mu\text{m} / \sqrt{\text{cm}}$

$\sigma_{\text{PRF}} 348 \mu\text{m}$ ← estimated value by GARFIELD/Magboltz
 $N_{\text{eff}} 10$ $C_D 79.2 \mu\text{m} / \sqrt{\text{cm}}$

Diffusion in this region corresponds to σ_{PRF}

← tentative value (no theoretical reason)

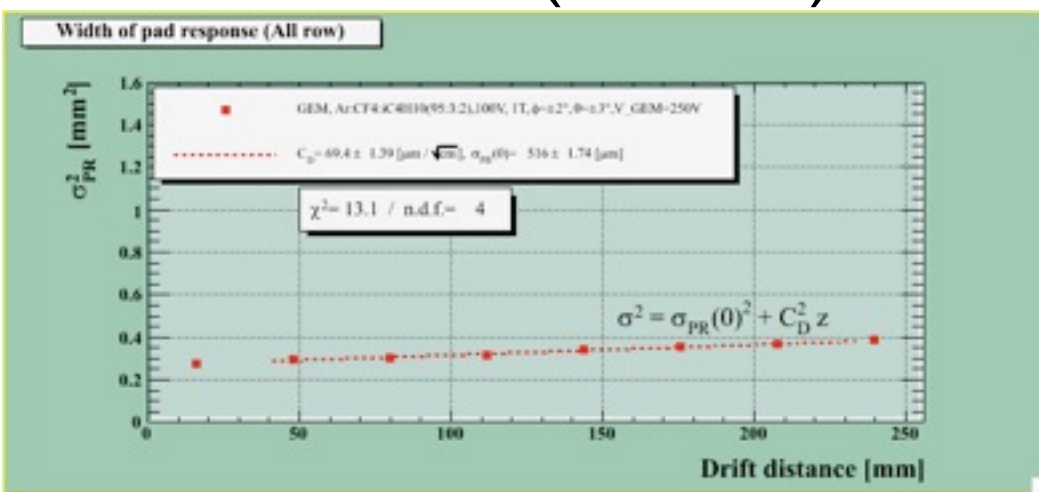
MP-TPC with Gating GEM



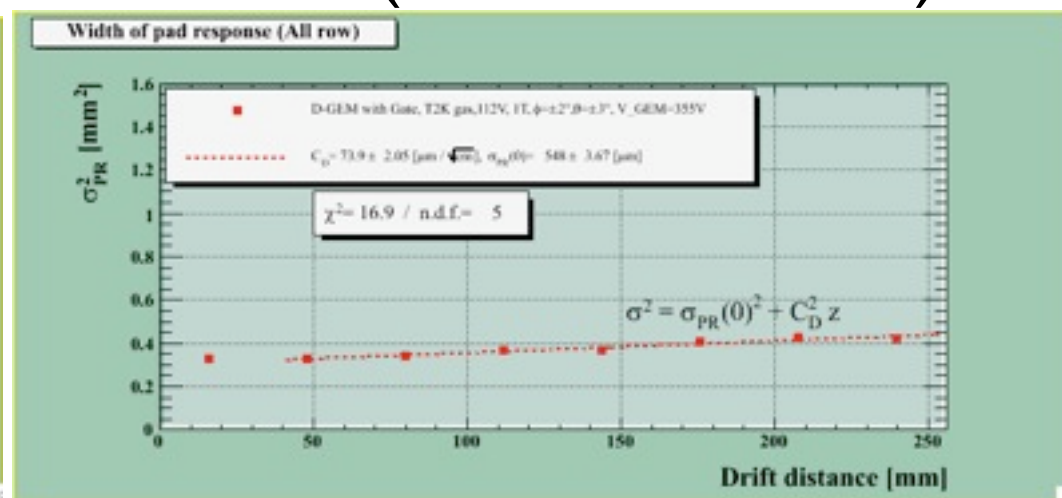
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COMPARISON TO PREVIOUS RESULTS

Pad Response Previous (3GEMs)

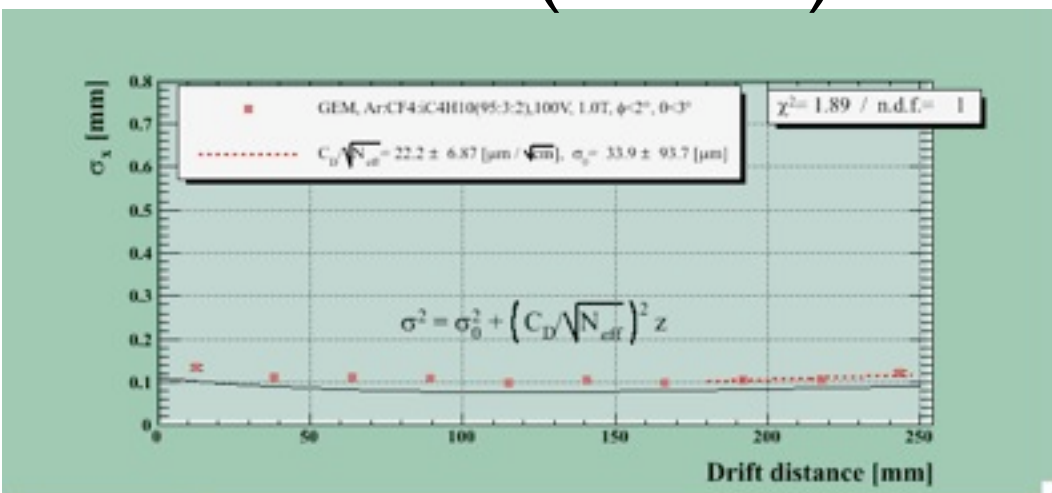


Now (2GEMs + Gate)

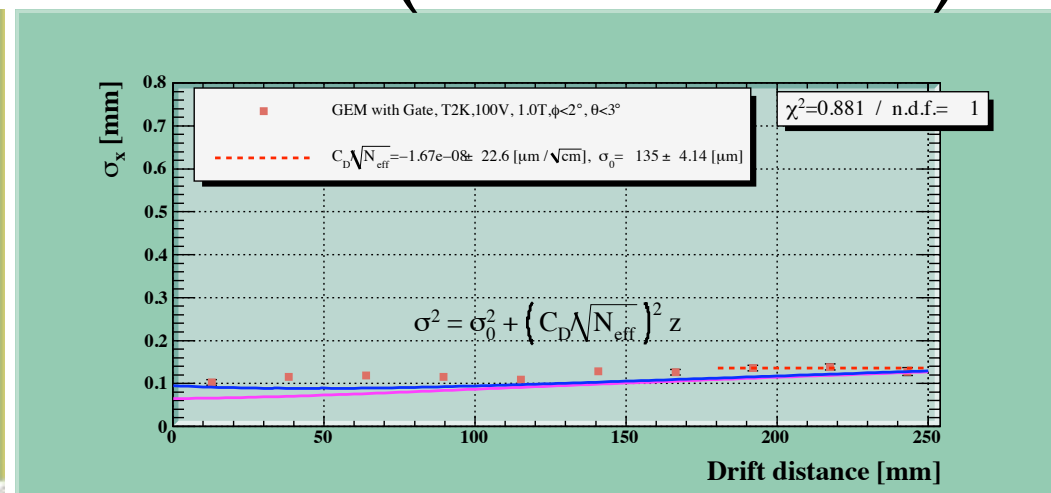


Resolution

Previous (3GEMs)



Now (2GEMs + Gate)



SUMMARY

- We have just started GEM-gating test.
- We could see signals with MP-TPC equipped with gating-GEM.
- Preliminary results seem not to be so bad.

PLAN

- Data taking @ $E=200, 230$ [V/cm], $B=1$ [T]
- To estimate N_{eff}
- Data taking @ $B=0$ [T]