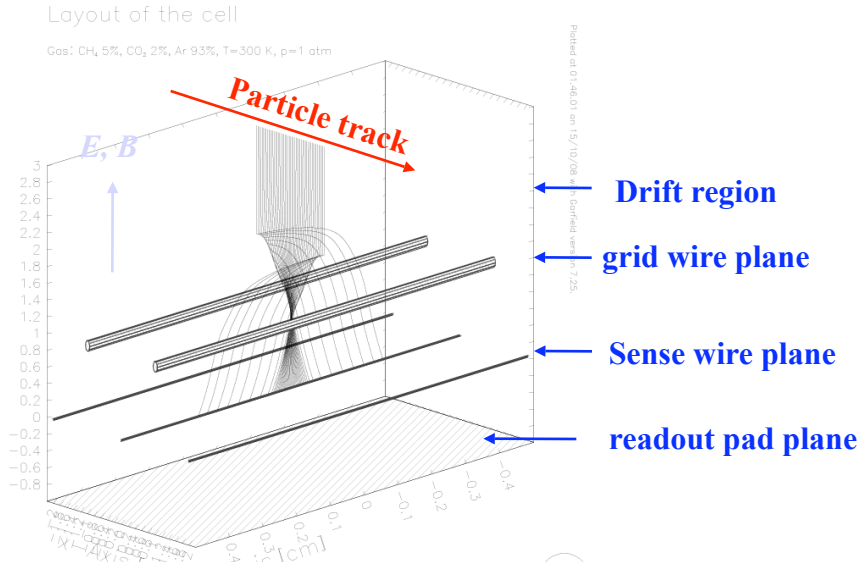


# A Study with a Small-Prototype TPC for the International Linear Collider Experiment

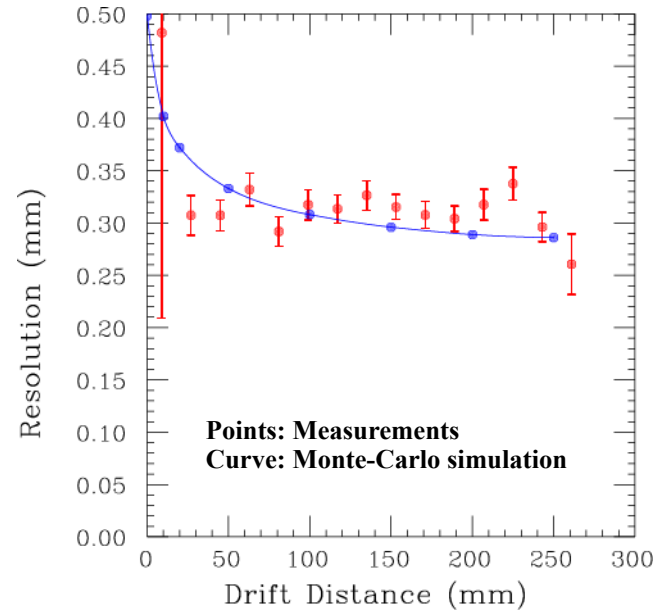
In the case of MWPC Readout

**Fig. 1: Drift paths of electrons given by Magboltz for a track perpendicular to the wires**



Sense wire pitch: 2 mm  
 Distance between the sense and the pad planes: 1 mm  
 $E = 220 \text{ V/cm}$ ,  $B = 4 \text{ T}$   
 Sense wire H.V. = 1200V  
 Gas: TDR gas

**Fig. 2: Spatial resolution as a function of the drift distance**



The measured spatial resolution as a function of the drift distance is compared to the Monte-Carlo simulation which takes into account the  $E \times B$  effect given by Magboltz (Fig. 1).

Fig. 1 shows significant charge spread along the sense-wire (pad-row) direction due to the  $E \times B$  effect, which significantly deteriorates the transverse spatial resolution of the TPC as shown in Fig.2.

It should be noted that the simulation shows the improvement of the resolution with increasing drift distance due to the de-clustering effect.

The resolution of the TPC equipped with MWPC readout is much worse than that expected from the ILC-TPC because it is not limited only by the diffusion but also by the  $E \times B$  effect under a strong magnetic field.

## In the case of GEM Readout

**Fig. 3: Data summary about drift velocity & diffusion coefficient with Magboltz simulation**

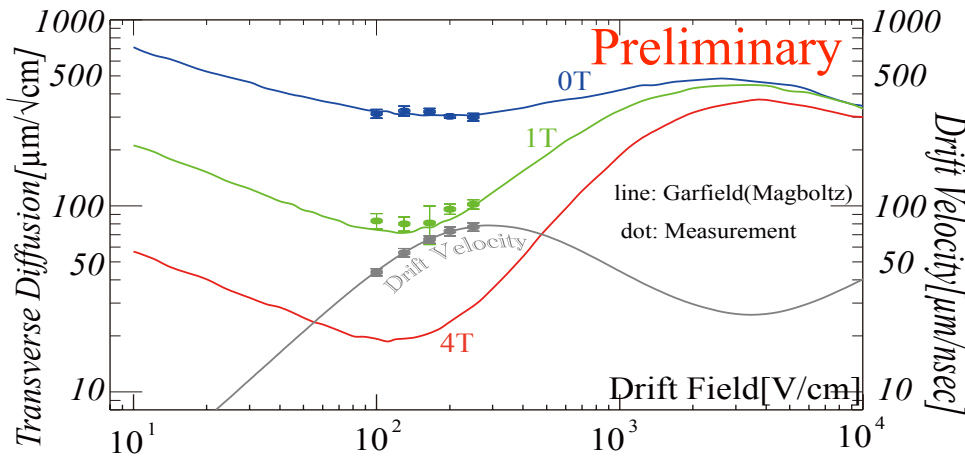
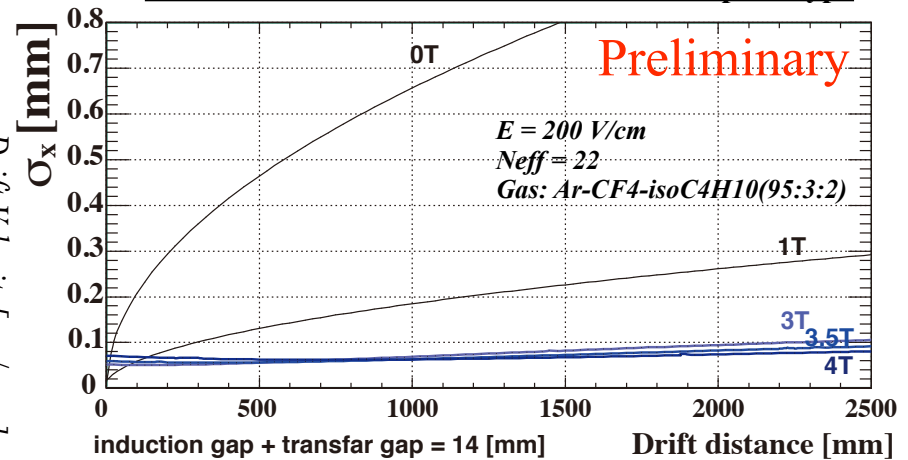


Fig. 3 shows that drift velocity & diffusion coefficient are consistent with Magboltz simulations (0T, 1T). Analytical extrapolation to a real-size ILC-TPC seems promising as shown in Fig.4.

**Our data show good agreement with the simulations and their analytic extrapolation to the real ILC-TPC suggests the mixture being a good candidate gas with the GEM-readout.**

**Fig. 4: The spatial resolution of a GEM-based ILC-TPC estimated from the measurement with the prototype**



## Authorlist

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