

A New Experimental System for Electron Transverse Diffusion Measurements

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ABSTRACT: A new experimental system was developed to measure the transverse diffusion of electrons in gases. The electrons are generated in a semitransparent CsI photocathode by Xe VUV light from a pulsed Xe lamp, and drift a fixed distance from 4 to 12 mm. The charge is then multiplied in a GEM and collected in a multistrip target.

The results were obtained for Xe and CH₄ at two different E/N values, at 800 Torr, and the characteristic energy associated with the transverse diffusion obtained, for 0.92 and 1.53 Td, was (5.66 ± 0.73 eV) and (7.33 ± 1.12 eV) for Xe, and (0.065 ± 0.005 eV) and (0.097 ± 0.008 eV) for CH₄, respectively. Both values are in good agreement with results from the literature.

The knowledge of the electron transverse diffusion in detection media is mandatory to assess the accuracy in systems that require precise event tracking.

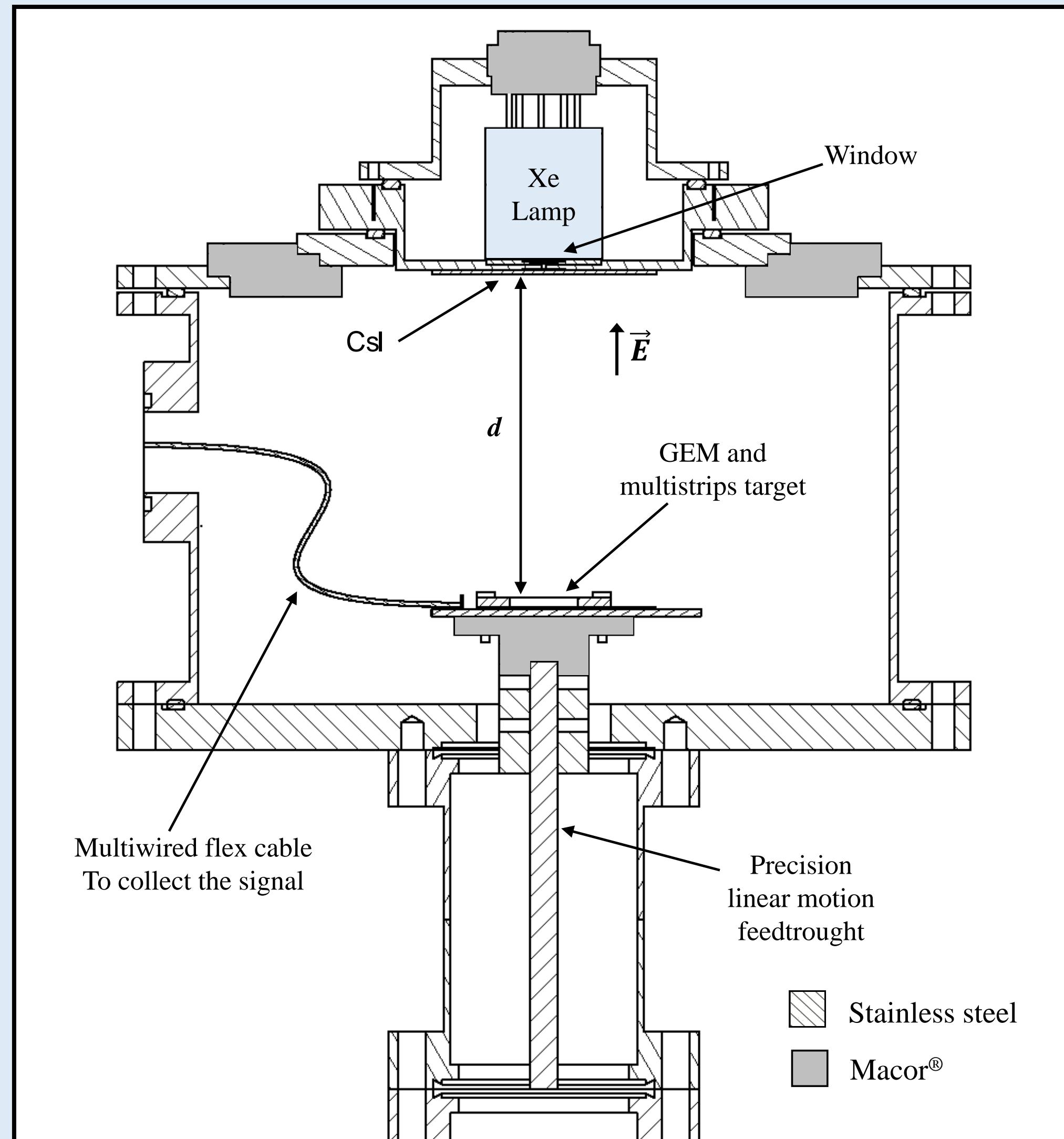


Figure 1. Vertical cut of the experimental system

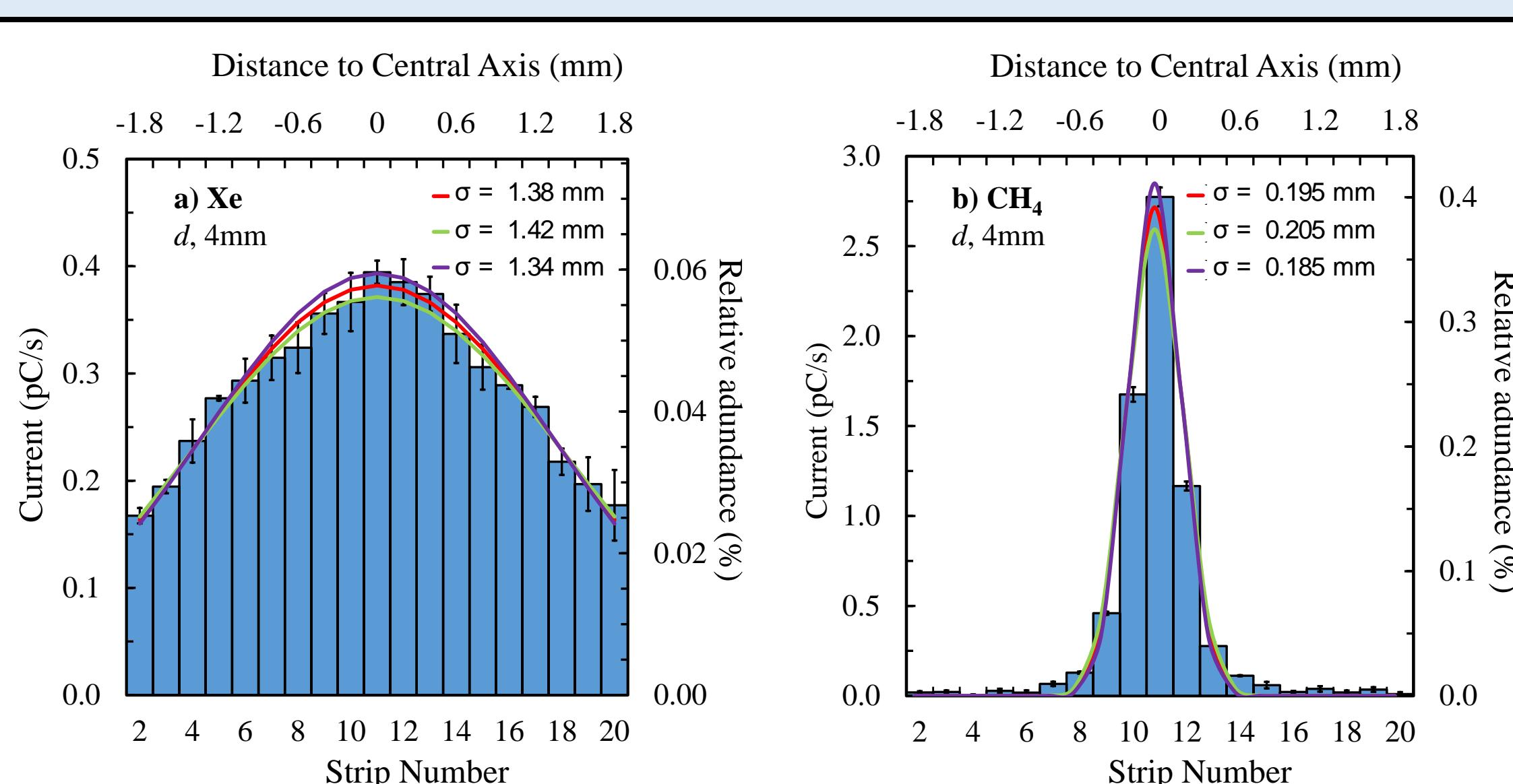


Figure 2. Typical histograms for the average charge fraction collected

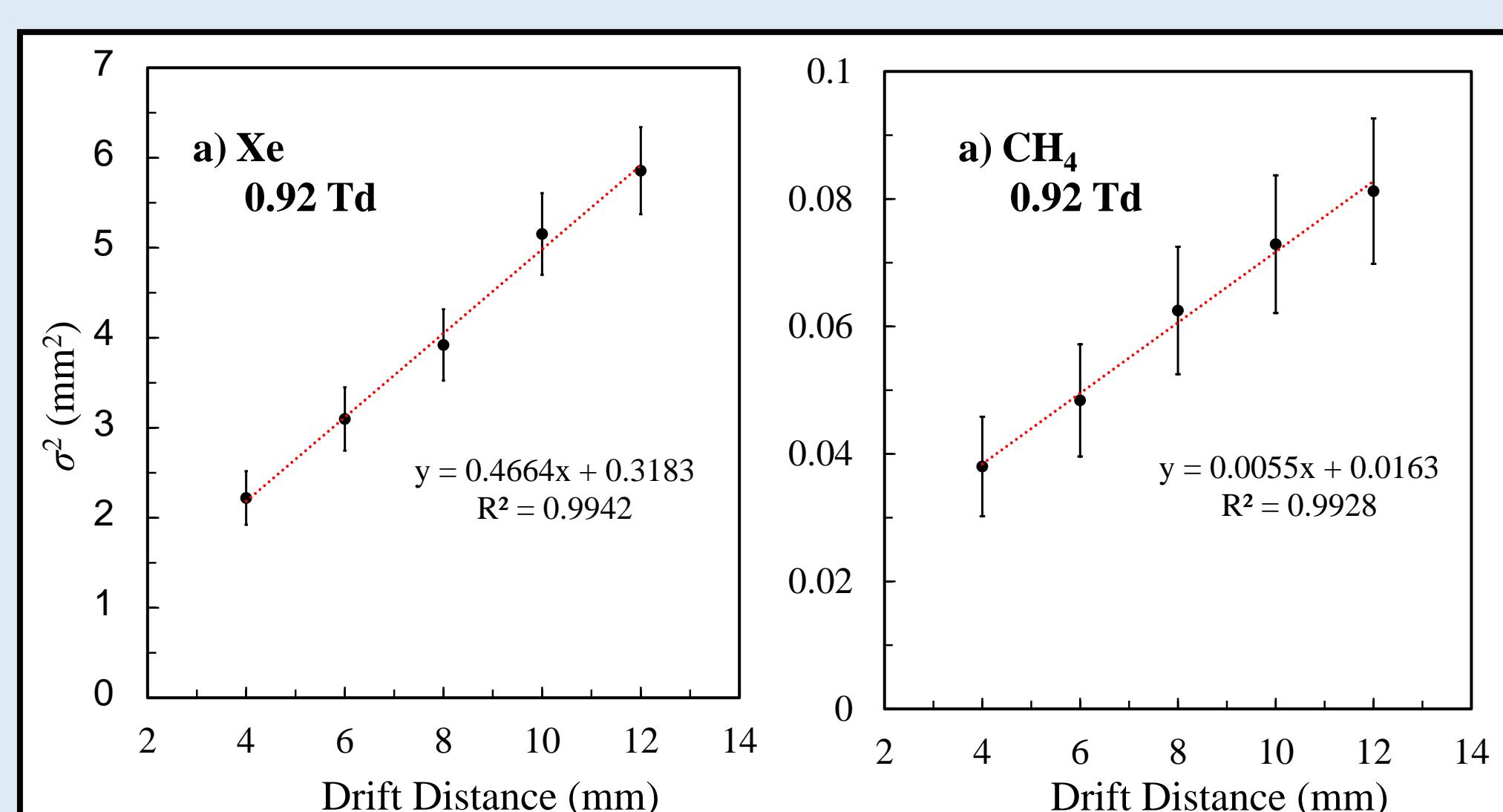


Figure 3. Variance of the transverse electron distributions

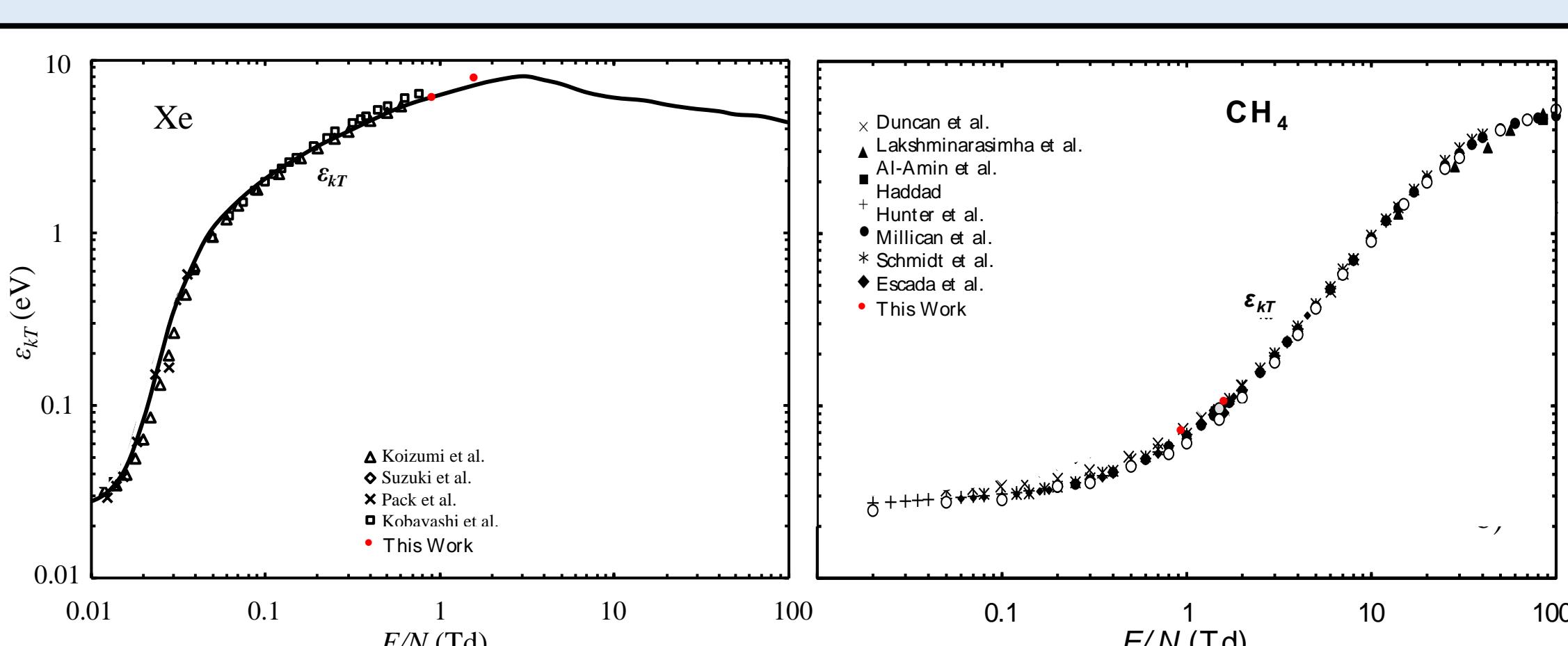


Figure 4. Characteristic energy associated with the transverse diffusion of electrons in xenon and methane

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Conclusions: To measure the transverse diffusion of electrons in gases under an electric field, a new experimental system was developed and tested with success (at 800 Torr) for two gases with markedly different diffusion properties: a noble gas (Xe) and a molecular gas (CH₄).

Results obtained are in quite good agreement with those in the literature, validating both the system and procedure. Future work comprises the automation of the measuring technique and the possibility of adding an optional wider multistrip device envisaging high diffusion gases.