Garfield simulation results for two types of PDC cell with and without field wires.

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Simulation was made using Garfield (version 5.35) for cells with pure DME at atmospheric pressure, high voltage $U = 1850$ V and magnetic field B =0 and 2 T. Cells PDC plane were assumed to have 4 mm periodicity.

As seen from Fig.1 and Fig.2 drift lines in both cell types look very similar near sense wire and over the most part of the cell while they differ a lot near field wire position. In the presence of the field wire there is a local maximum of drift velocity near the field wire which results in the convexo-concave shape of the equal drift time contours compared to the strictly convex ellipse–like shape of contours in the PDC cell without field wires.

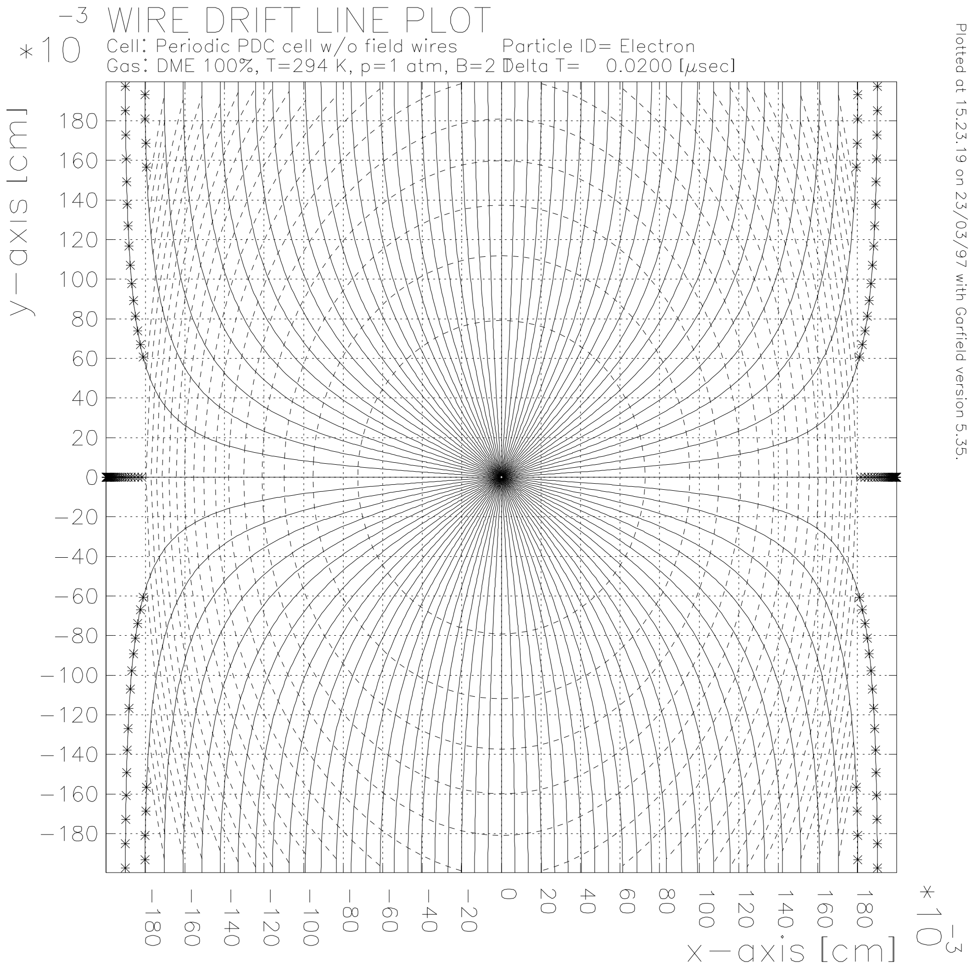

Figure 1: **Drift lines and equal drift time contours in PDC cell without field wires ($B = 2$ T).**

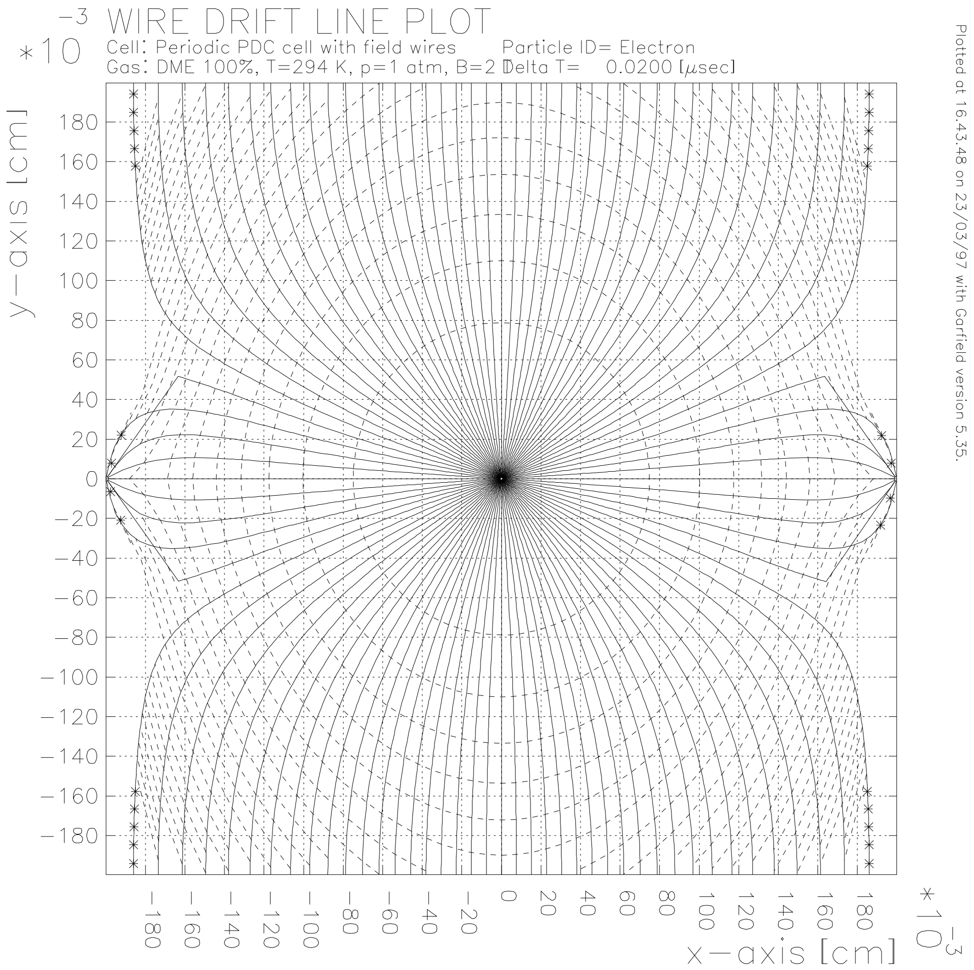

Figure 2: **Drift lines and equal drift time contours in PDC cell with field wires ($B = 2$ T).**

The Space-Time Relation (STR) between the Distance of Closest Approach (DOCA) of track to sense wire and the shortest drift time for PDC cell with and without field wires is presented on Fig.3. As one can see the maximum drift time for both types of cell is approximately the same. The important difference is the discontinuity of STR for the cell with field wires at track angles $\leq 30°$. Equal drift time contours in cell do not intersect each other and a straight track is tangent to the innermost contour (with the shortest drift time). The convexo-concave shape of contours near field wire results in STR discontinuity which is also shown on Fig.4.

This STR discontinuity has been observed in the tests of three planes of the full size PDC chambers with field wires (see Fig.5). The mean angle of incidence of tracks was about 4.5°. The STR on Fig.5 differs from GARFIELD simulation (Fig.4) at small drift distances because of track selection criteria applied in data analysis code. Also GARFIELD simulation did not include finite number of clusters in drift gas.

The effect of the Lorentz drift angle effect on STR in the presence of magnetic field is shown on Fig.6. For most part of the cell drift time difference for given DOCA is less than 1 ns.

Examples of drift lines from tracks at several angles of incidence in both cell types are presented on Fig.7,8. One can see that for almost all angles of incidence whenever track crosses a cell near field wire region there is always a hit in neighboring cell which is close to a sense wire. Thus, far hits can be ignored in track fit provided there is enough good hits rest.

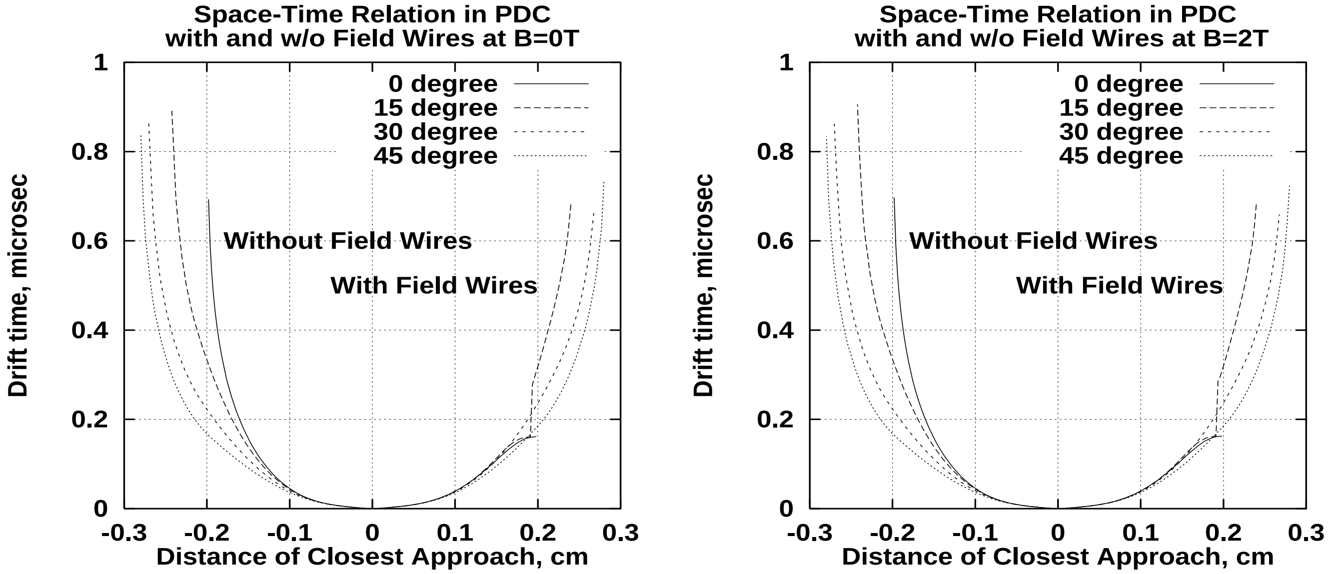

Figure 3: **Space-Time Relation (STR) for two PDC types at several incident track angles with respect to Y axis (high voltage plane normal) at $B = 0$ T (left plot) and $B = 2$ T (right plot).**

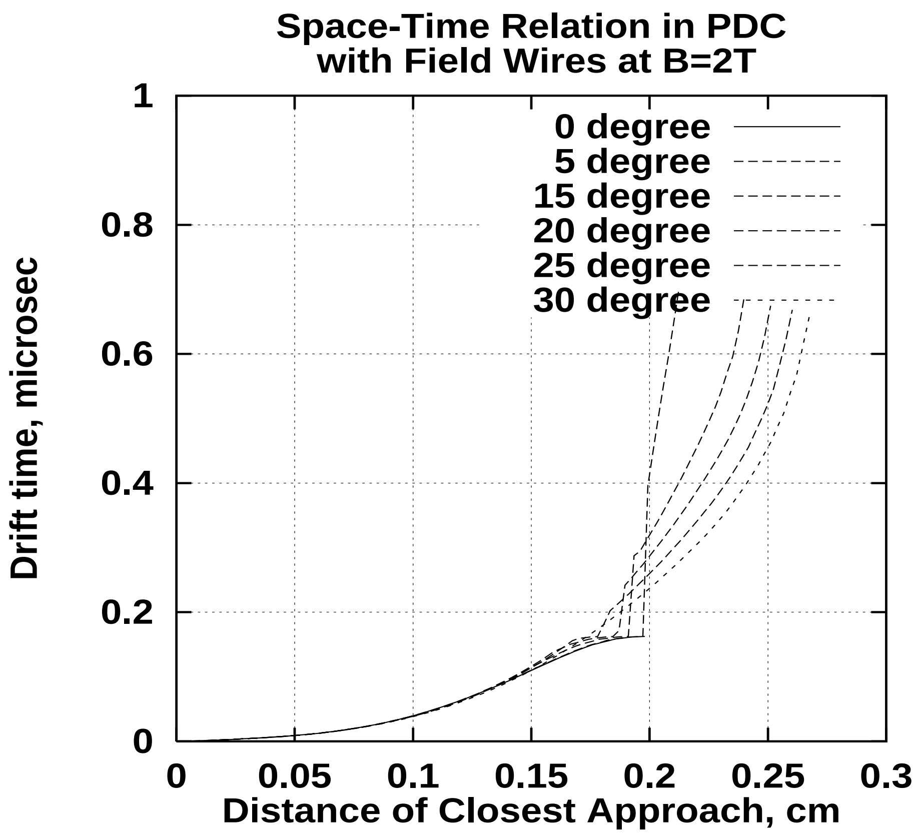

Figure 4: **Space-Time Relation for PDC cell with field wires at several incident track angles ($B = 2$ T).**

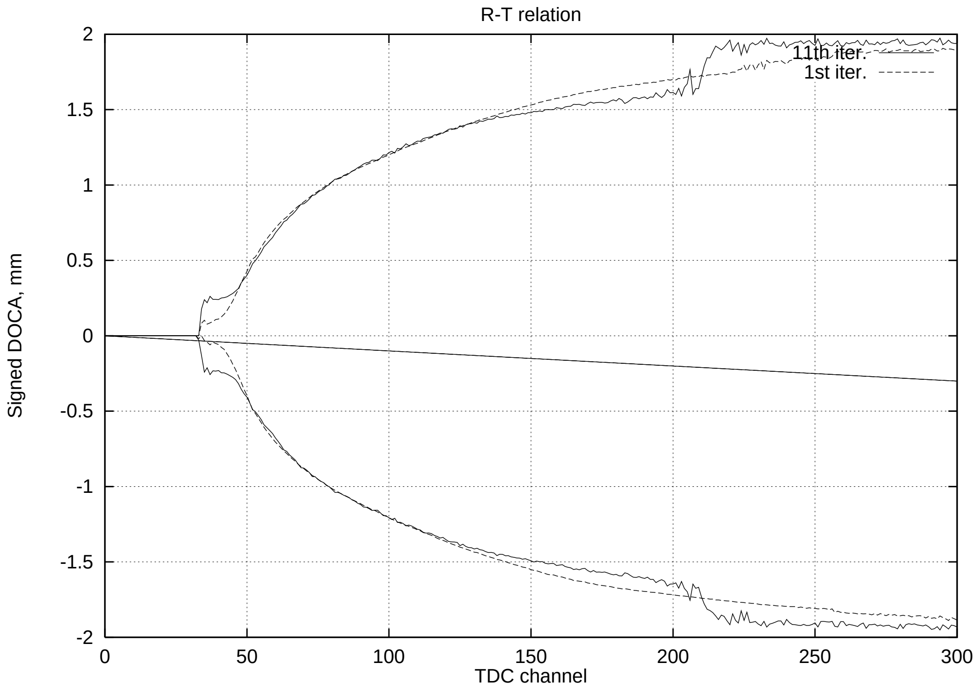

Figure 5: **Reconstructed Space-Time Relation in PDC cell with field wires** (data taken during August'95 run for full size PDC prototype (3 planes)). STR after one and 11 iterations shown (initial approximation for STR —integrated TDC spectrum).

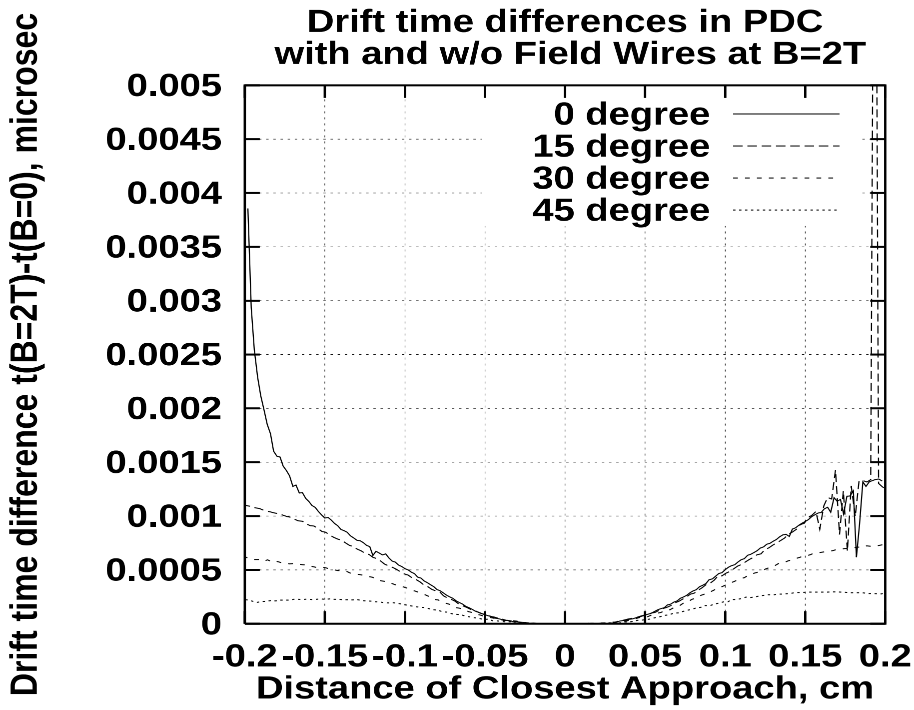

Figure 6: **Space-Time Relation difference between $B = 2$ T and $B = 0$ T cases for two PDC types.**

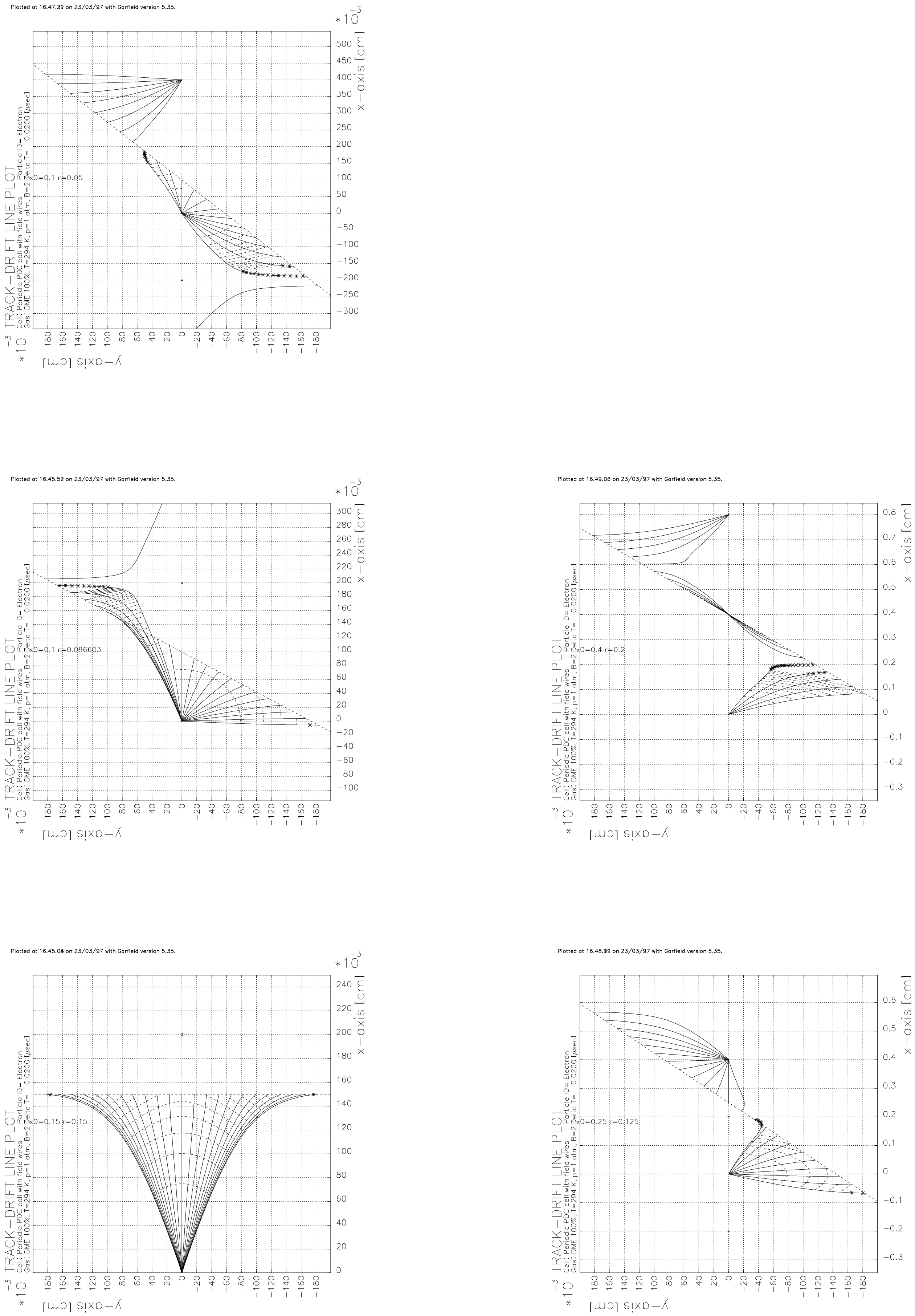

Figure 7: **Drift lines from sample tracks at several angles of incidence in PDC cell with field wires.**

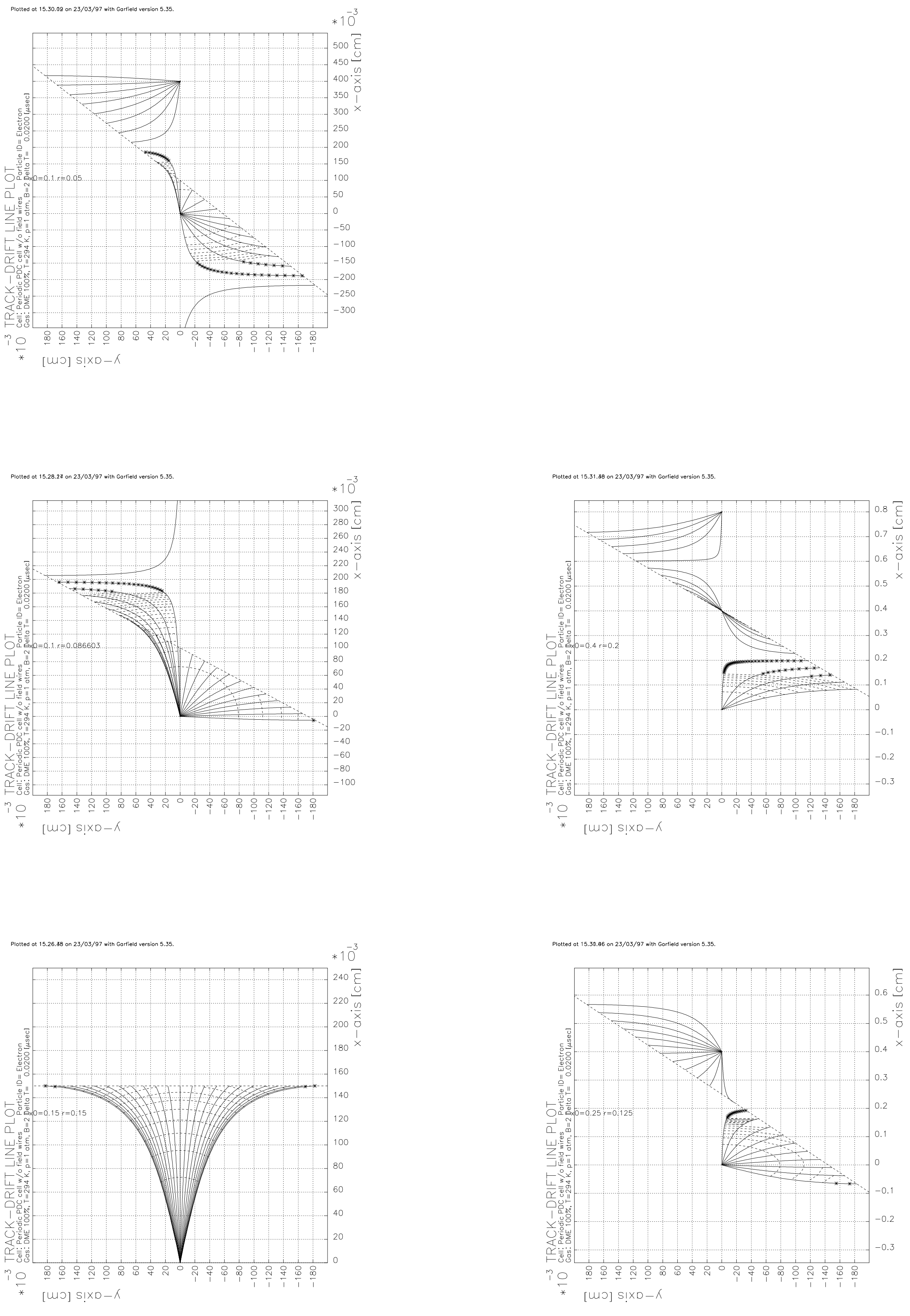

Figure 8: **Drift lines from sample tracks at several incidence angles in PDC cell without field wires.**