

Figure 9.14: The most probable drift time of the first arriving cluster simulated with GARFIELD and GARFIELD++. (a) Values obtained with GARFIELD (magenta points) and GARFIELD++ (cyan points) delayed with a constant value compared to the experimental results, obtained for an NA62 tracker straw (2D histogram). (b) Most probable values of the first cluster arrival time for 0 T and 1.5 T magnetic field. The simulation results are fitted to a quadratic function.

8 GARFIELD are processed with LTSpice for a given electronics chain model. One of the possible SPD  
 9 ST front-end electronics options, based on a VMM3a ASIC[REF], is considered in the study, and the  
 3 corresponding model provided by the RD51 Collaboration (CERN) is used. Details of the read-out  
 1 electronics are described in Section 9.3 [XREF]. At this stage, electronic noise and the influence of the  
 2 magnetic field are not taken into account.

2578 and anode wire. No transformation of the straw signal by the readout electronics is implemented at that  
 2579 stage. Examples of the obtained time distributions for the first and second arriving clusters, produced by  
 2580 a muon passing at a distance of 4 mm from the anode wire, are shown in Fig. 9.13 for a magnetic field  
 2581 of 0 T and 1.5 T.

2582 The small width of the obtained time distributions (much smaller than 0.1 ns) points to a negligible  
 2583 contribution of the cluster distribution fluctuations and electron diffusion to the straw time resolution.  
 2584 The influence of the magnetic field on the most probable arrival time is clearly noticeable, while the  
 2585 time distribution widths are not affected (first arriving cluster) or affected slightly (second cluster). The  
 2586 dominating influence of the read-out electronics on the straw tube time resolution will be demonstrated  
 2587 later in Section 1.2.3.

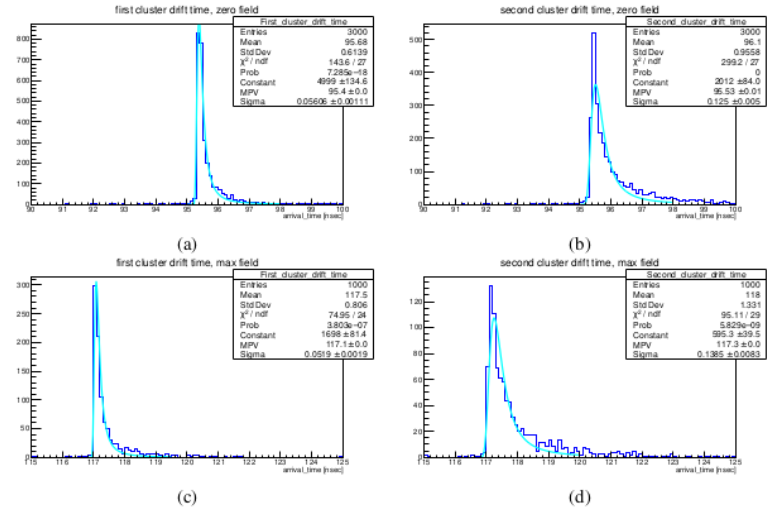


Figure 9.13: Examples of the obtained drift time distributions for the first (left) and second (right) arriving ionization clusters for a track passing at 4 mm from the anode wire for 0 T (top) and 1.5 T (bottom) magnetic field. To compare the most probable value (MPV) and the distribution width (RMS), the spectra (dark blue) are fitted to a Landau distribution (cyan).

2588 The most probable values (MPV) of the arrival time distributions, obtained for field-free simulations  
 2589 using GARFIELD and GARFIELD++ [59] packages as functions of a distance between the muon track  
 2590 and anode wire, are shown in Fig. 9.14 (a). The measurements performed at the NA62 experiment with  
 2591 the nominal tracker read-out electronics are shown for comparison as a two-dimensional histogram. The  
 2592 simulation results are shifted by a constant delay to compensate for the time delays introduced by the  
 2593 read-out chain in real measurements. Comparison of the MPV obtained in the simulation for a magnetic  
 2594 field of 0 T and 1.5 T is presented in Fig. 9.14 (b).