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## Nonrelativistic electron beam expansion in the solar corona/wind and their type III radio bursts observed with LOFAR

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Solar type III radio bursts contain a wealth of information about the dynamics of near-relativistic electron beams in the solar corona and the inner heliosphere; this information is currently unobtainable through other means. Whilst electron beams expand along their trajectory, the motion of different regions of an electron beam (front, middle, and back) had never been systematically analysed before. Using LOw Frequency ARray (LOFAR) observations between 30-70 MHz of type III radio bursts, and kinetic simulations of electron beams producing derived type III radio brightness temperatures, we explored the expansion as electrons propagate away from the Sun. From relatively moderate intensity type III bursts, we found mean electron beam speeds for the front, middle and back of 0.2, 0.17 and 0.15  $c$ , respectively. Simulations demonstrated that the electron beam energy density, controlled by the initial beam density and energy distribution have a significant effect on the beam speeds, with high energy density beams reaching front and back velocities of 0.7 and 0.35  $c$ , respectively. Both observations and simulations found that higher inferred velocities correlated with shorter FWHM durations of radio emission at individual frequencies. Our radial predictions of electron beam speed and expansion can be tested by the upcoming in situ electron beam measurements made by Solar Orbiter and Parker Solar Probe.