Abstract: Using two realizations of the Milky Way from the FIRE simulation, we find that the kinematics of dark matter follows closely the kinematics of accreted stars from the same mergers. We use this correspondence to obtain an empirical measurement of the local velocity distribution of dark matter, by analyzing the Gaia second data release coupled with the ninth release from the Sloan Digital Sky Survey and computing the velocity distribution of the accreted stars. We find that this velocity distribution is peaked at lower velocities than the generally assumed Maxwell Boltzmann distribution, due to the presence of a recent merger referred to as the Gaia Sausage, leading to a weakening of direct detection limits at dark matter masses less than 10 GeV.