Study of Self-Bunching Effects for High-Current Injection into SIS, I. HOFMANN, P. MORITZ, U. OEFTIGER, GSI - The interaction of intense beams with the RF cavities may lead to longitudinal beam instabilities. In this context longitudinal time domain signals of a Ne^{10+} have been measured at SIS. The signals were obtained with a coasting beam directly after multi-turn injection, and during the adiabatic RF capture. The results show a longitudinal instability at currents a factor 2-3 below the transverse space charge limit. The origin of this instability is the shunt impedance of the two cavities and the longitudinal space charge impedance. Together they exceed the impedance threshold for longitudinal beam stability, since no feedback is applied in SIS. The detected longitudinal instabilities have been simulated using a two dimensional particle-in-cell code. The simulation results are in good agreement with the signals and intensity thresholds observed in the experiments. On this basis we have used the simulation code to estimate an upper limit for the cavity shunt impedance of an heavy ion driven fusion accelerator, where beam currents up to 70 A are expected. In this regime the beam-cavity interaction is of great interest for the beam stability and a successful RF capture.