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## Acoustic energy loss measurements of GeV ions

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The energy loss maximum (Bragg peak) at their end of range is a characteristic feature of ions stopping in matter, which causes an acoustic pulse, if ions are deposited in short-enough bunches. This *ionoacoustic effect* has been studied for decades now, mainly for astrophysical applications, and has recently found renewed interest in proton therapy for range measurements in tissue. Within test experiments at the upgraded SIS18 in 2016, ionoacoustic range measurements have been performed in water using  $^{238}\text{U}$  and  $^{124}\text{Xe}$  ion beams around 300 MeV/u, and a  $^{12}\text{C}$  ion beam around 200 MeV/u with fast beam extraction to get 1 microsecond pulse length. Relative range changes for the different ions and energies were found in agreement with simulations to better than 1%. Given the unique accuracy provided by ionoacoustic range measurements in water and their simplicity, we propose this as a new method for stopping power measurements for ions at GeV energies. After a range-energy calibration of the acoustic detector setup for a certain ion species in water, different materials and thicknesses can be mounted on a target wheel and inserted between the exit window of the beamline and the entrance in the water tank hosting the acoustic detector. From the measured range changes stopping powers can be derived in a fast and efficient manner with high accuracy.

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