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Cryogenic stopping cell for the Low Energy Branch of Super FRS at FAIR (NUSTAR)

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At the Low Energy Branch (LEB) of the Super-FRS at FAIR, exotic nuclei produced by projectile fragmentation or fission will be slowed-down and thermalized using stopping cell technique. A novel Cryogenic stopping cell (CSC) developed for this purpose has been commissioned with U(238) projectile fragments produced at 1000 MeV/u. The spatial isotopic separation in flight was performed with the FRS applying a monoenergetic degrader. For the first time, a stopping cell was operated with exotic nuclei at cryogenic temperatures (70 to 100 K). Helium stopping gas density of up to 0.05 mg/cm³ was used, about two times higher than reached before for a stopping cell with RF ion repelling structures. An overall efficiency of up to 15 %, a combined ion survival and extraction efficiency of about 50% and extraction times of 24 ms were achieved for heavy alpha-decaying uranium fragments. Mass spectrometry with a multiple-reflection time-of-flight mass spectrometer has demonstrated the excellent cleanliness of the CSC. The results represent a milestone in the stopping-cell development around the world.

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