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Probing the heaviest elements using Penning Trap Mass Spectrometry at SHIPTRAP

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The elements with atomic numbers Z>103, called Superheavy Elements (SHEs) owe their existence to the quantum-mechanical shell effects that increase their stability. The SHIP separator at GSI, stage of the discovery of elements with Z=107–112, has since been exploited in further investigations of the nuclear structure of such exotic systems. In particular, mass measurements using the coupled Penning trap setup SHIPTRAP has allowed a direct determination of binding energies of the lighter superheavy nuclides, providing insight on the shell evolution around N=152.

Recent experiments within the recent FAIR Phase-0 campaigns have resulted in measurements of ^{257}Rf, with rates of a few ions per day, as well as ^{258}Db. This was made possible by improvements in the efficiency of the setup. Furthermore, isomeric states of ^{251,254}No, ^{254,255}Lr, ^{257}Rf and ^{258}Db have been resolved thanks to mass resolving powers up to 11 000 000, enabled by the Phase-Imaging Ion-Cyclotron-Resonance (PI-ICR) technique. This cements PI-ICR as a complementary tool to decay spectroscopy, especially in cases where the complexity of the decay spectra demands additional information to disentangle the level structure. This was further proven by the study of several additional species above the Z=82 shell closure.

In this contribution an overview of the results of the last online campaign will be presented, as well as the latest technical developments to allow longer experiments without suffering of efficiency degradations of the setup, which is the limiting factor when addressing more exotic nuclides.