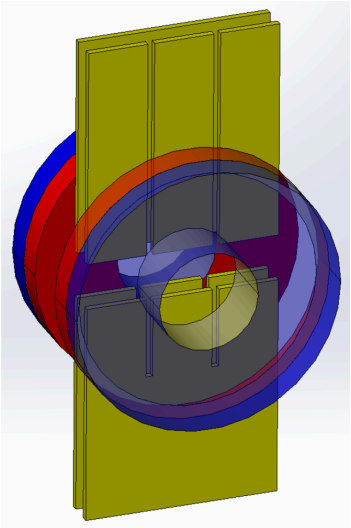
Laser cooling of trapped ions in strongly inhomogeneous magnetic fields

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We demonstrate laser cooling of Ca^+ ions confined in a segmented linear Paul trap in presence of a strongly inhomogeneous magnetic field generated by two permanent ring magnets (see figure below). We show that by employing two cooling lasers with properly adjusted wavelengths and polarizations, the trapped ions can efficiently be cooled to millikelvin temperatures despite strong position-dependent Zeeman shifts. The cold ion structures, also called Coulomb crystals, can additionally be used to visualize the position dependency of the Zeeman effect around the trapping centre. All experimental results are complemented by a theoretical analysis [1].

This setup is an essential prerequisite for a hybrid trapping experiment in which cold collisions and reactions between ions and neutral molecules can be studied.



[1] Richard Karl, Yanning Yin, Stefan Willitsch, *Molecular Physics*, **2023**, 2199099.