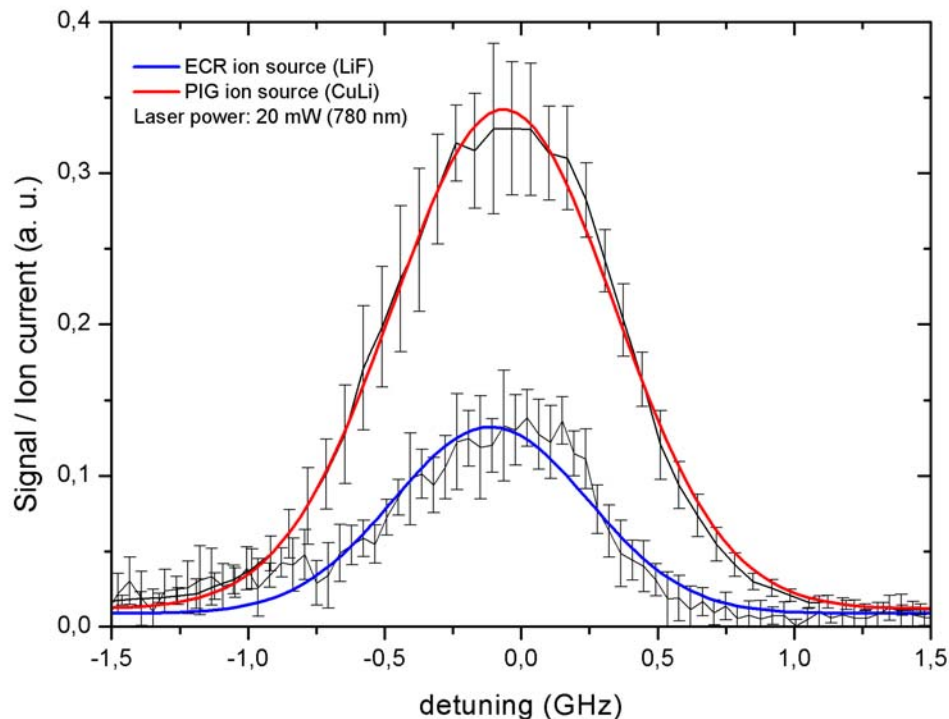


ESR - laser spectroscopy

During the April beam time, an important step towards a new test of time dilation at the ESR has been made. This time, the Penning Ionisation Gauge (PIG) with source material LiCu was used for the production of 7Li^+ ions in the metastable state. As compared to previous experiments, which used the Electron Cyclotron Resonance Ion Source (ECRIS) with LiF, the overall ion current in ESR increased by a factor 5 and the fraction of ions in the metastable $3S1$ state was found to be doubled. This directly leads to a significant increase of the detection-signal, from which the new test of time dilation (ESR beamtime: 30 June - 7 July 2010) will strongly benefit (i.e. better statistics).



The experiment in short: To test "time dilation" at about 34% of the speed of light, laser spectroscopy on 7Li^+ (which is the "moving clock") is performed at the ESR. The laser beams are aligned co- and anti-collinearly with respect to the ion beam direction, and excite the ions from the $3S1$ to the $3P1$ state. The photon emission ($3P1 \rightarrow 3S1$) is measured by means of standard photomultiplier tubes. By comparing the rest frequency of the addressed transition with the excitation frequencies of the lasers, time dilation can be tested to about 1 part per billion (10⁹). This represents an improvement of one order of magnitude as compared to the present best value.