TRIGA-LASER: A collinear laser spectroscopy beamline at the TRIGA reactor Mainz

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Introduction: Collinear Laser spectroscopy of radioactive nuclei can provide fundamental information on the structure of radioactive nuclei. The dependencies of the hyperfine splitting and isotope shift on the nuclear moments and mean square nuclear charge radii are well known and the theoretical framework for the extraction of nuclear parameters is well established. We have started to set up the *TRIGA-LASER* experiment at the University Mainz. It will allow us to perform new measurements on neutron rich isotopes produced at the research reactor [1], but it will also serve as a development platform for the *LaSpec* experiment [2] at *FAIR*, *GSI*.

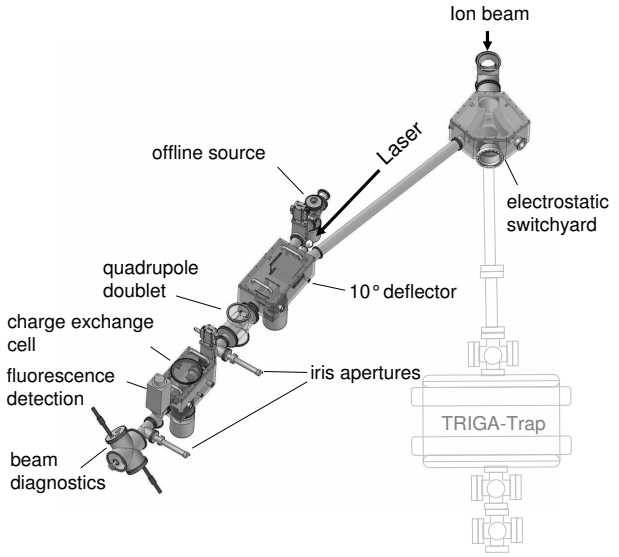

Figure 1: Drawing of the collinear beamline. All components except the switchyard and the detection unit are already installed.

Experimental: The vacuum system of the laser beamline was assembled after machining of the electrostatic deflection chamber and the chamber for the charge exchange cell according to our custom design. A vacuum pressure of 2×10^{-7} mbar could be reached without baking. In Fig. 1 a drawing of the complete laser beamline is shown. For commissioning purposes, an offline surface ion source based on an electro-thermally heated graphite oven was constructed. The source is operated in a HV cage and can be set to voltages up to 10 kV. For fast loading of the ionizer tube, the source chamber is separated from the laser vacuum system with a valve and can be pumped with a separate turbo molecular pump.

Results: First tests showed 70 % ion beam transmission with 3.5 nA current on the Faraday cup after the non-operating charge exchange cell. For ion beam profile monitoring a fork scanner system 5100 from Danfysik was installed to get a good control of the ion beam diameter, which is essential for a good overlap between the laser and ion beam. In Fig. 2 a plot of the beam profile at the end of the ion beamline in both, horizontal and vertical plane is shown.

First laser spectroscopy test measurements will be performed with Rb atoms after charge exchange. The transition at 780 nm wavelength can be excited with a diode laser which will be frequency locked to a HighFinesse WS7 wavemeter. This allows to install a compact laser system next to the beamline.

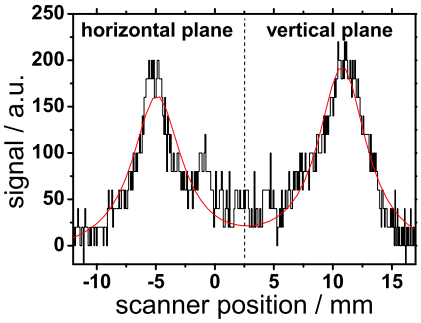

Figure 2: Beam profile of a 300 pA Li^+ beam at 2 keV energy in horizontal and vertical plane. The corresponding beam diameter was estimated to be 5 mm.

Acknowledgement

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References

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[2] W. Nörtershäuser, P. Campbell, and the LaSpec collaboration, Hyp. Int. **171** (2006) 149.