Simulation and Optimisation of the High-Field μSR Spectrometer Design

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The high-field μSR project at PSI has been triggered by the increasing demand on high magnetic fields (i.e. $\gg 1$ T) observed among the μSR users at PSI. The extension of the available field range up to 10 T together with the improved time resolution of FWHM < 300 ps shall allow us to observe precession frequencies of 1.4 GHz and correlation times of field fluctuations of less than 3 ns [1].

As a first step towards the realisation of the high-field instrument we simulate its design using a simulation program based on the GEANT4 package [2,3]. This allows one to identify crucial parameters of the new instrument (i.e. distances, lengths, thicknesses, materials), and to optimise them. We will demonstrate how the optimisation is performed, and what are the critical issues of the instrument.

The reliability of the simulation program has been successfully tested by comparing its predictions with measurements done on the ALC (Avoided Level Crossing [4]) μSR instrument at PSI.

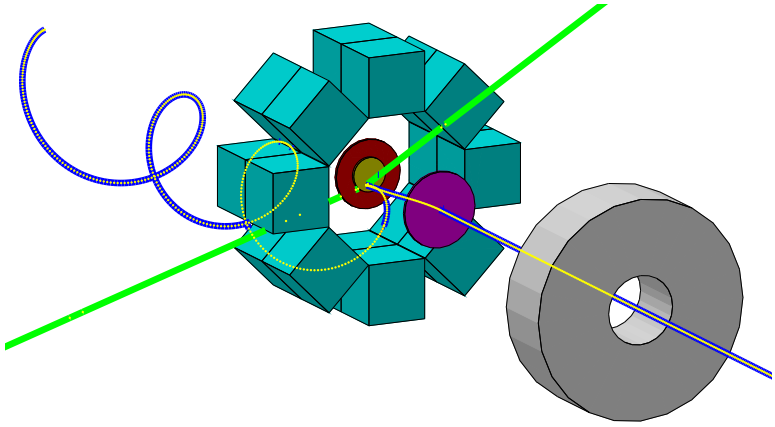

Fig. 1: Basic components of the high-field spectrometer as implemented in the simulation program. One simulated μ^+ decay event is shown.

[1] *High Magnetic Field μSR instrument. Project description.* http://lmu.web.psi.ch/facilities/PSI-HiFi/Project_Description.pdf
[2] S. Agostinelli *et al.*, Nucl. Instr. and Meth. A 506 (2003) 250-303.
[3] J. Allison *et al.*, IEEE Trans. on Nuclear Science 53, No. 1 (2006) 270-278.
[4] http://lmu.web.psi.ch/facilities/alc/alc.html