A new detector system for the ALC spectrometer – first experience with G-APDs in $\mu$SR instrumentation

A. Stoykov$^{1,2}$, R. Scheuermann$^1$, K. Sedlak$^1$, T. Shiroka$^1$, V. Zhuk$^2$

$^1$Laboratory for Muon Spin Spectroscopy, Paul Scherrer Institut, CH-5232 Villigen PSI, Switzerland
$^2$Joint Institute for Nuclear Research, 141980 Dubna, Moscow region, Russia

The development and performance of a new detector system for the Avoided Level Crossing (ALC) $\mu$SR-spectrometer, located at the Swiss Muon Source of the Paul Scherrer Institut, are presented.

The distinctive feature of the new ALC-detector is the absence of such conventional components as photomultiplier tubes and light guides. Their functions are taken over by Geiger-mode Avalanche Photodiodes (G-APDs) and wavelength-shifting fibers. This approach allows us to build a compact, magnetic field insensitive detector, requiring low operation voltage (see Fig.1).

Fig. 1: New detector module of the ALC spectrometer – design view. Two rings hold ten detector segments, each hosting two positron counters. One of the positron counters can be replaced by a muon counter – in this configuration one gets the possibility to perform time differential $\mu$SR measurements. Only two detector segments are shown in this drawing.