Scintillating fibres for future μSR spectrometers

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The attractive properties of scintillation detectors [1,2] such as the fast timing, the good S/N ratio and the low cost have turned them into an ubiquitous part of the modern μSR spectrometers. The extension of the μSR technique to new domains, which include low-energy muons, high magnetic fields, pulsed environments, etc., urges however for new and improved detector solutions. A possible answer to these increasingly demanding requirements could come from the use of reduced size sensing elements, capable of addressing situations such as high event rates, small positron curvature radius, etc.

Here we present the results of the direct detection of μSR signals using a *single* scintillating fiber, and compare them with the outcome of numerical simulations. We find that a fibre diameter of ~ 1 mm represents a good compromise between an adequate spatial resolution and an acceptable S/N ratio.

We also performed comparative measurements of fibre detection efficiency for μSR decay positrons vs. electrons emitted by common ^{90}Sr beta sources. Their almost equivalent efficiency (only $\sim 20\%$ of efficiency loss in the former case) will simplify further detector developments. The continuous improvements in the quality of scintillating fibres would make them serious candidates for future spectrometers, where bundles of fibres close to the sample area could replace the current large solid-angle detectors.

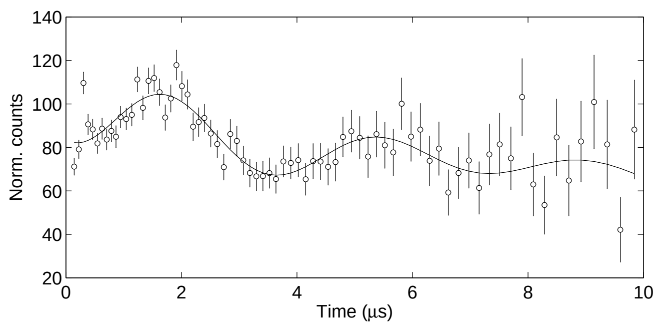

Fig. 1: MuSR signal at 20 G TF measured with a *single* scintillating fiber.

[1] R. Ruchti, Annu. Rev. Nucl. Part. Sci., 46 (1996) 281.
[2] H. Leutz, Nucl. Instrum. and Meth. A 364 (1995) 422.