PLRF code for decomposition of positron lifetime spectra

J. Čížek[1*]
[1]*Faculty of Mathematics and Physics, Charles University,*
V Holešovičkách 2, CZ 180 00 Praha 8, Czech Republic

PLRF is a new code for decomposition of positron lifetime spectra developed in the positron annihilation group at the Charles University, Prague. PLRF code is based on least square fitting of positron lifetime spectra and utilizes a minimization routine MINUIT [1] from the ROOT package [2] developed at CERN. Main features of the PLRF code can be summarized as follows (i) possibility to select and combine various strategies of minimization of the χ^2 functional: Monte Carlo, Simplex and gradient algorithm in order to achieve most accurate result of fitting. (ii) Multiple positron lifetime spectra can be fitted simultaneously. User can select common parameters which are considered to be the same for all spectra (e.g. positron lifetimes and relative intensities of exponents) and individual parameters which are considered to be different for each spectrum (e.g. position of time zero, parameters of resolution function, etc.)
(iii) Several models were implemented in the code: independent exponential components, simple trapping model, positron diffusion model, size distribution of clusters. The PLRF code uses physically relevant parameters of the model for fitting and takes into accounts constraints of the parameters within each model. As a consequence user obtains physically meaningful parameters from fitting, e.g. positron trapping rates in case of the simple trapping model, grain size in case of positron diffusion model etc.
(iv) Positronium contribution is considered as double exponential component consisting of short lived p-Ps and long lived o-Ps component. Ratio of o-Ps and p-Ps contribution can be fixed.

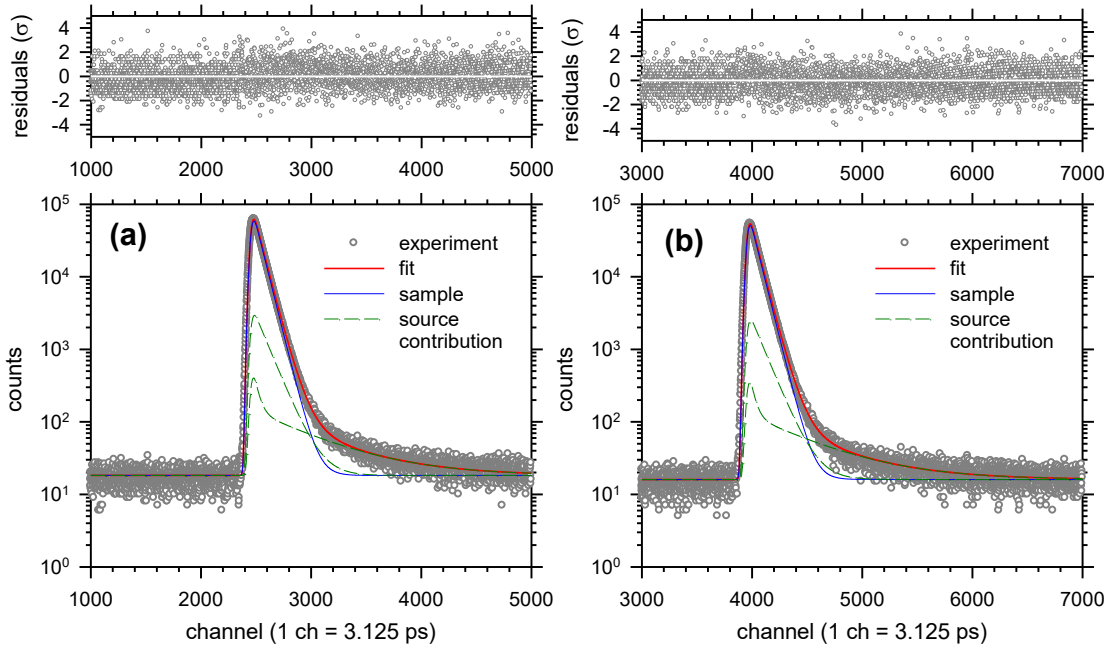

Figure 1 *Results of simultaneous fitting of two positron lifetime spectra (a) and (b) of Si (100) single crystal reference sample. Upper panels show residuals in units of one standard deviation.*

References

[1] F. James, Minuit Tutorial on Function Minimization, CERN, Geneva (2004).
[2] https://root.cern.ch

*Corresponding author, Email: jakub.cizek@mff.cuni.cz