Optimisation and evaluation of µ-PIXE as an absolute multi-elementary analytical technique

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In order to facilitate the control of routine applications of µ-PIXE by mineralogists, biologists or environmental scientists, this work reviews the main parameters that control the accuracy of PIXE analyses, as already exposed extensively in scattered papers throughout the literature. Two alternative and mutually exclusive procedures were proposed so far to conduct PIXE analyses: either in an absolute (standardless) fashion or by comparison with standard matrices. The capability to develop PIXE as an absolute analytical method is now demonstrated, due to the continuous progress in filter and detector characterisation, in the database quality and in spectrum deconvolution. In order to face the larger utilisation of PIXE by non-specialists in multi-application laboratories, we propose that standardisation should be applied systematically as a preliminary step to PIXE to test the consistency of the quantitative parameters introduced in the X-ray data treatment to characterise the detector, the detection geometry… Standardisation can be used as a key procedure to evaluate and better the accuracy of PIXE analyses for a given analytical set up and by reference to a given data processing model.

In this regard, we present a new mathematical procedure to optimise the geometrical parameters of the detection, based on a least-square fit of a newly-defined standardisation parameter. The methodology proposed for applying PIXE in an absolute fashion via calibration is illustrated using the data presented by Gama *et al.* [1], and some new calibration data acquired at the LPS-Saclay laboratory. As a typical example, we shall treat the case of a combined beryllium-aluminium 'funny filter' but this method can be applied to any other filter type.

[1] Gama et al., Nucl. Instr. and Meth. B181 (2001) 150-156.