## ENERGY DISPERSIVE X - RAY FLUORESCENCE ANALYSIS OF WORKS OF ART WITH PORTABLE EQUIPMENTS

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## ABSTRACT

Dedicated X - ray tubes, thermoelectrically cooled detectors and focusing Optics have completely revolutionized in the last decade the field of portable equipments for energy dispersive X-ray fluorescence (EDXRF).

The small size of both X-ray tubes and detectors allows in fact the construction of portable systems of about 1-3 kg, with performances similar to those of Laboratory systems. The complete portability of these new EDXRF systems, some of them completely battery equipped, opens also all the new analytical fields where the "sample" cannot be transported to the Laboratory ( analysis of works of art in museum, churches, excavations, analysis of minerals, of soil, of toxic elements in humans and etc.).

In the present work the optimization of portable EDXRF-equipments is discussed and more specifically : selection, collimation, filtering and monochromatization of the X-ray tube beam ; selection and collimation of the X-ray detector ; use of focusing Optics.

Applications of portable EDXRF-equipment to study of following works of art are then described :

- a. paintings : the Chapel of the Scrovegni by Giotto , the "Sacra famiglia" by Palma il Vecchio; various paintings by Giorgio De Chirico;
- b. bronzes : Perseo by Benvenuto Cellini, Bartolomeo Colleoni by Andrea del Verrocchio;
- c. golds : the altar of Volvinius in Milan , pre-colombian gold objects from Peru.