

A new digital radiography system for paintings on canvas and on wooden panels of large dimensions

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Abstract — Within the neu_ART project, funded by Regione Piemonte (Italy), a team of specialists in different scientific fields coming from Istituto Nazionale di Fisica Nucleare (INFN), Physics Department of University of Torino and Centro Conservazione e Restauro (CCR) “La Venaria Reale” has developed a new digital X-ray apparatus expressly designed for painted canvas and panels up to about 3 m × 4 m. Compared to all other systems scanning time is faster, the procedure to obtain the whole radiography is easier and images are available in real time. This apparatus has been widely tested on artworks restored at CCR “La Venaria Reale”, allowing to study and optimize the operating parameters and to evaluate its performance, thanks to the feedback provided by professionals involved in the activities of conservation. Supported by the results presented in this work, restorers had the possibility to investigate the materials characteristics and to plan the operating strategy in advance: indeed, radiographs revealed areas with losses of paint, repainted areas, canvas damages, hidden pictures, writings and previous restorations. The X-Ray system for Digital Radiography is integrated in a more complex apparatus that can be used also for computed tomography of voluminous objects up to 2.5 m in height and 2 m in width, making the apparatus developed in the neu_ART project a unique and comprehensive tool at conservators’ disposal.

Keywords — X-rays, digital radiography, imaging, painting, cultural heritage

I. INTRODUCTION

The first application of X-ray radiography in the artistic field dates back to the ‘30s, hence potentialities of this technique are widely known [1-4]. In particular, radiography is a fundamental tool for restorers and art historians in the field of pictorial art: seeing the inner structure and the preservation state of works of art helps to plan in details the restoration stage, while the distribution of pigments and the presence of underlying drawings provide indications about the pictorial technique of the artists, sometimes allowing the attribution or the authentication of the object [5-9].

Due to the great number of artworks, also of large size, treated every year in restoration centers, the availability of innovative X-ray imaging instruments is of primary importance for the restoration activities on pictorial artefacts. With the aim of developing new X-rays systems expressly designed for analysis of cultural heritage objects, a team of specialists in different scientific fields coming from the National Institute for Nuclear Physics (INFN), the Physics Department of University of Torino and the Centro Conservazione e Restauro (CCR) “La Venaria Reale” gathered together in the neu_ART project (“Neutron and X-ray tomography and imaging for cultural heritage”), funded by Regione Piemonte (Italy) [10-11]. The project lead to the construction of an X-ray imaging system for digital radiography (DR) that was designed using new solutions and taking in account requirements from conservators, in particular the necessity to perform, in short time and with a sufficiently good resolution for restoration purposes, radiographies of large objects, up to 4 m × 3 m that means about 90% of the paintings on canvas and panels treated at the CCR “La Venaria Reale”. In this work, the new apparatus, that represents a complete novelty in the cultural heritage field, is described and its application to investigate painting on canvas and on wooden panels of large dimension is discussed.

II. INSTRUMENTS AND METHODS

A. X-ray radiography

A radiographic apparatus is composed mainly by an X-ray source and a support or detector able to detect X-rays after they have passed through the object under investigation [12]. Regarding the supports sensitive to X-rays, the use of computed radiography (CR) plates and Flat Panels (FP) based systems have increased in the last years [12-17] though photographic films are even now used [8]. In future, digital radiography apparatus, mainly developed for medical and industrial applications [18-20], probably will replace traditional photographic films for most of applications.