

Non-destructive investigation of "The violinist", a lead sculpture by the Spanish artist Pablo Gargallo, using the neutron imaging facilities of the Paul Scherrer Institute.

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"The violinist" (1920) is one of the few sculptures made by Gargallo during the so called lead period (from 1920 to 1923). It was created using a wooden kernel onto which several layers of lead sheet were fixed with nails and soldered. In the last few years the outburst of some blisters on both legs has made it clear for the first time that the lead was severely attacked by carbonation, most probably due to the organic vapours from the wood, a material which is not chemically compatible with lead. Before treatment, a complete exploration and diagnosis of the sculpture using non-destructive techniques was necessary in order to assess its real state of conservation and the manufacturing technique used by the artist.

Industrial X-ray facilities cannot easily go through such thickness of lead without totally burning away all the information about the inner wood kernel. This was a case study perfectly suited for neutron imaging although the size of the wooden kernel could pose some serious limits to the technique. Tomography and 3D reconstruction were also the aim of the investigation.

This project, selected in the last call by SINQ, was carried out in NEUTRA, the thermal neutron radiographic facility in PSI. A scintillator and a CCD camera were used for neutron detection and neutron imaging respectively. Some 2250 radiographic projection images were captured. Once filtered, the data were processed to obtain the computed tomography showing all the structural information inside the sculpture. The series of cross sections were stacked to form a three-dimensional volume image which could be moved around, cross sectioned and segmented.

All the different materials of the sculpture can be seen in the images, both in projection and in tomography. The results show some highly attenuated areas, due either to the geometry of the sculpture or to the attenuation coefficient of materials. Some areas of the lead sculpture which never appear on the silhouette do not have much information, specially where wood is rather thick.

Some interesting information about the artist's technique has been revealed: how the wooden kernel was carved and the different ways the lead sheets were fixed on to the wooden kernel using iron nails and low temperature soldering.

Lead corrosion has shown up clearly in the projections, in the tomography and in the 3D reconstruction allowing us to map the location and extension of corroded areas behind the lead surface and to better understand the dynamics of this specific pathology.

Finally, the new technical knowledge acquired through neutron imaging about the manufacturing process of the sculpture and the materials used, and its present state of corrosion will be of great value when it comes to set the strategies for future restoration.

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