

Prospective in-depth elemental analyses of large objects by using brilliant gamma beams

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ELI-NP facility will deliver an ultra-bright monochromatic gamma-ray beam energy-tunable in the range of 0.2–19.5 MeV, produced by the laser-Compton backscattering technique. These high-brightness γ -rays meet all the technical requirements for investigations of large and complex archaeological artifacts and works of art. The non-destructive and non-invasive assays planned at ELI-NP target the use of nuclear resonance fluorescence (NRF) and computed tomography (CT) to provide in-depth elemental analyses of objects of various nature and composition. This is a key technology for applications such as trace element analysis of Cultural Heritage objects. The unique features of the ELI-NP gamma beam coupled with a high-efficiency gamma array detector will meet criteria for high sensitivity NRF measurements that are crucial in these fields. Moreover, the NRF method used in conjunction with radiography and tomography can produce isotope-specific trace element distributions in bulk materials. Accordingly, the radiography and tomography setups to be developed at ELI-NP are designed to allow high-resolution scans in objects up to 150 kg and one meter wide. Here we discuss industrial and Cultural Heritage applications that can benefit from the quality and characteristics of the ELI-NP gamma beam.