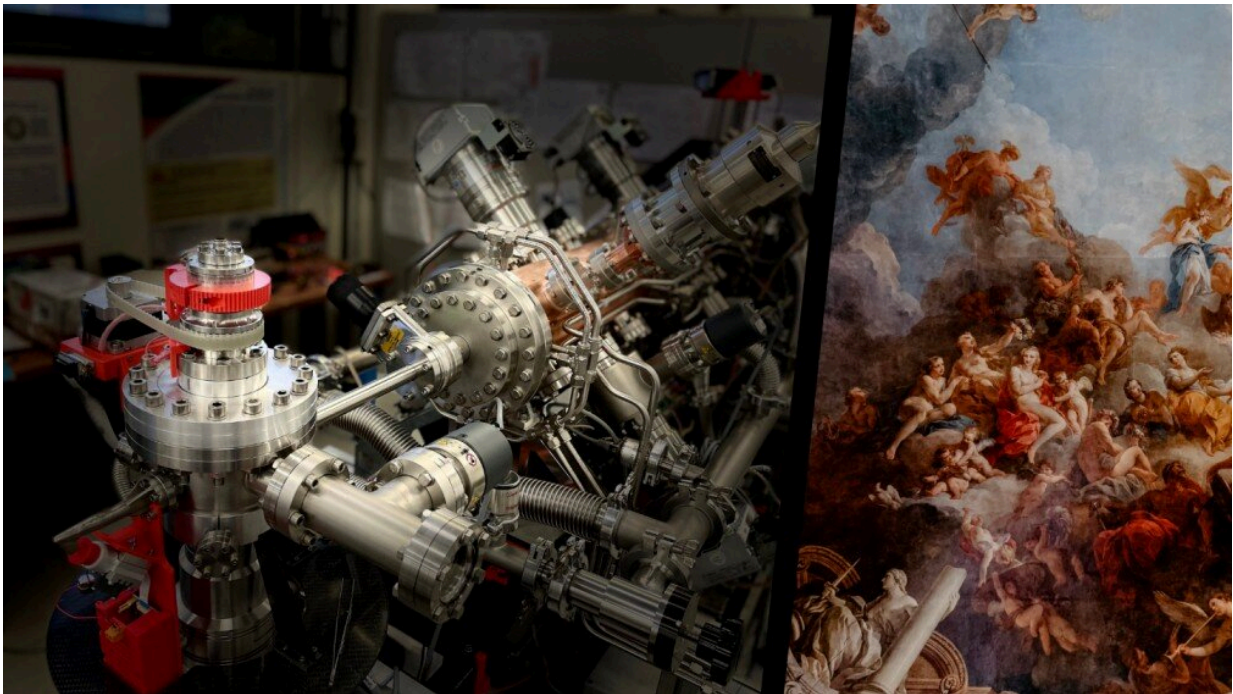# New compact accelerator to help preserve heritage artworks

April 21 2023, by Olivia Fabreschi

Left: The MACHINA accelerator (INFN, 2023); Right: A representational picture of an art piece. Credit: CERN

Beyond fundamental research, accelerators are well known for their contribution to the medical field, especially to cancer therapy. However, they can also be used in more unexpected ways, such as for the analysis of historical artifacts and works of art.

Developed by INFN (the Italian National Institute for Nuclear Physics) and CERN, MACHINA (Movable Accelerator for Cultural Heritage In-situ Non-destructive Analysis) is a compact, transportable accelerator designed specifically for cultural heritage applications. The portability of this type of accelerator is valuable for cultural heritage diagnostics because moving fragile and precious objects such as artworks and frescoes, even over short distances, can be challenging—or sometimes frankly impossible—due to logistical, economic and safety issues.

MACHINA is the product of collaboration between CERN and INFN that started in 2017 and is based on a radio-frequency-quadrupole accelerating cavity designed at CERN. Following intensive testing in the second half of 2022, when all the initial requirements were met, the accelerator will soon become operational at the INFN-LABEC laboratory, where the first measurements using ion beam analysis (IBA) on reference samples will be carried out.

The accelerator will later be transferred to the Opificio delle Pietre Dure (OPD) in Florence, a renowned center for art conservation, where it will become a part of their regular diagnostic activities. MACHINA will be used to analyze works of art in a non-destructive manner, using IBA techniques that allow measurements to be performed on a variety of objects that would otherwise be impossible to analyze because they are too fragile or too large to move. Although based in OPD, MACHINA can be further transported for in situ measurements at other museums or conservation sites.

MACHINA's compact design, which features a 1m–long accelerating radio-frequency cavity, offers a portable solution that has a smaller impact on its surroundings in terms of footprint, weight, component availability, cost and noise compared to conventional IBA systems. Moreover, the accelerator's superior radiation protection ensures a safe working environment, enabling it to be used with confidence in any

location.

This recently published paper in *Rendiconti Lincei. Scienze Fisiche e Naturali* contains further details on MACHINA and the technologies behind it.

Provided by CERN