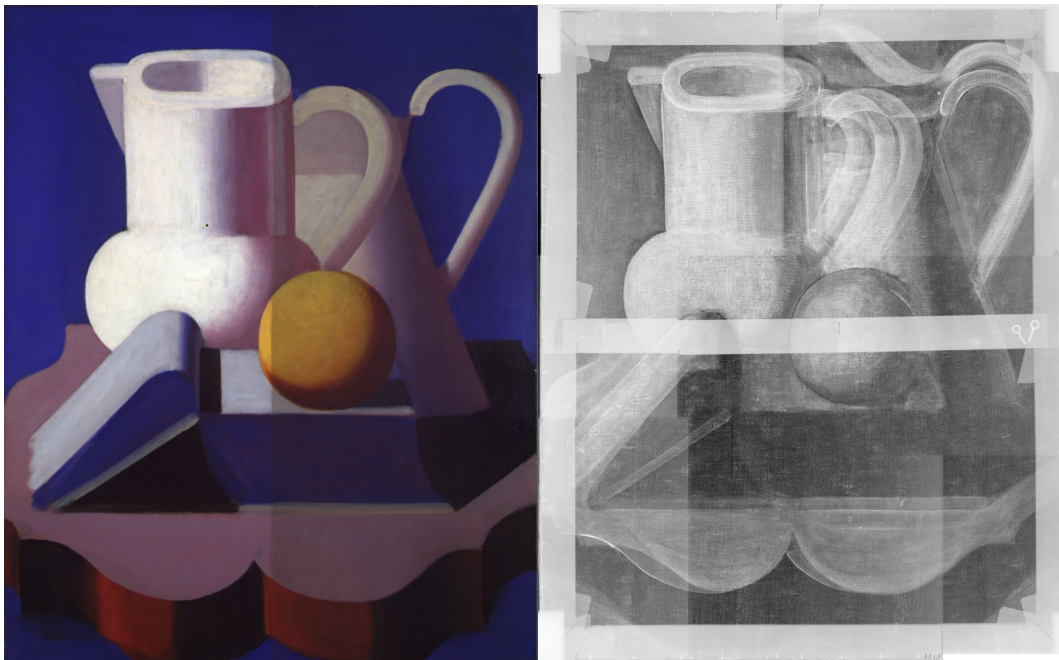


MobiXRF: A Mobile Micro-X-ray Fluorescence Platform Transforming Cultural Heritage Science in Denmark

We congratulate Jacek Fiutowski for his recent grant from the Carlsberg Foundation which makes it possible to purchase a MobiXRF and install it at the University of Southern Denmark (SDU) in Sønderborg to support our efforts within the TORCH project. It is a state-of-the-art mobile micro-X-ray fluorescence (μ XRF) research infrastructure designed for non-invasive, in situ elemental analysis of artworks, archaeological finds, manuscripts, monuments, and industrial heritage. MobiXRF addresses a critical need by delivering laboratory-grade elemental mapping directly to collections and sites—safely, efficiently, and collaboratively.



The painting is from Kunstmuseet Brandts, Opstilling med Kander (1930-32). Recording in X-ray, performed at Konserveringsventer Vejle with their traditional in house x-ray scanner.

Why Elemental Analysis Matters for Heritage

Every cultural object possesses a unique chemical fingerprint. Pigments can reveal artistic techniques and chronology; alloys provide insight into technological choices and historical trade routes; stratigraphy and corrosion document stories of use, repair, and environmental exposure. Traditionally, decoding these fingerprints required laboratory access and, often, sample removal, an approach unsuitable for fragile or immovable objects. μ XRF fundamentally changes this paradigm.

With MobiXRF, curators, conservators, and researchers can obtain high-quality elemental data onsite, informing decisions on authenticity, provenance, conservation strategy, display, and loan assessment, without moving the object or taking a sample. This approach strengthens preventive

conservation while accelerating the loop between screening, targeted follow-up, and deep laboratory analysis.

MobiXRF is intentionally designed as part of a mobile, multimodal laboratory. At SDU, **µXRF is integrated** with portable **hyperspectral imaging** (HSI) and **portable Raman spectroscopy**, providing a complementary suite of elemental, spectral, and molecular information. This combination empowers robust decision-making for both field surveys and detailed laboratory investigations, streamlining workflows and extending scientific capabilities.

Applications

MobiXRF will support a structured research programme spanning three thematic pillars:

- 1. Material Characterisation & Origin**

Building pigment and alloy databases, identifying characteristic material signatures and techniques, and supporting authenticity studies across collections. Elemental mapping helps distinguish original layers from later interventions, and can anchor cross-disciplinary research in art history, archaeology, physics, and chemistry.

- 2. Deterioration & Environmental Interactions**

Enabling in situ monitoring of corrosion processes, pigment alteration, glass weathering, and stratigraphic changes. Repeated measurements facilitate longitudinal stability models, forming the basis for preventive conservation strategies tailored to actual environmental conditions in galleries, storage areas, historic buildings, and outdoor sites.

- 3. Cross-disciplinary Research**

Linking heritage science with nanophotonics, materials science, chemistry, and environmental studies. Methodologies and workflows developed for cultural heritage extend naturally to areas such as microplastics detection and the analysis of printed solar cells, strengthening SDU's role in sustainable technologies and international networks.

MobiXRF will be available as open access

MobiXRF is envisioned as a shared national platform, it will be accessible through open booking and supported by training workshops for researchers and professionals in materials science, chemistry, archaeology, art history, and conservation science. Partners in the TORCH project will directly benefit from this instrumentation, and access can be extended to other institutions.

Access, Training, and Collaboration

Institutions and researchers interested in booking MobiXRF, participating in training workshops, or co-developing projects in material characterisation, deterioration studies, and interdisciplinary innovation are encouraged to contact SDU MCI. The platform's mobile format and shared-use model make it easy to plan on-site campaigns, starting from single-object assessments to collection-level surveys, and to integrate findings with complementary methods for publication-quality results.

SDU will provide workshops and hands-on training that cover instrument operation, mapping strategies, data processing, and interpretation. Sessions will emphasize multimodal workflows and cross-disciplinary collaboration, enabling users to integrate µXRF with HSI and Raman for comprehensive studies.

Contact

Possibilities for booking will be announced, please contact:

SDU MCI – University of Southern Denmark

Jacek Fiutowski (fiutowski@mci.sdu.dk)

What Makes MobiXRF Special?

1. True Mobility with Mapping
Precise laser-guided measurements and a motorised stage enable repeatable, high-resolution maps, the type of insight previously reserved for fixed labs, now available on-site.
2. Non-Destructive, No Sample Prep
Objects remain undisturbed; layered structures and delicate surfaces can be analysed safely.
3. Integration with HSI and Raman
Elemental, spectral, and molecular data co-register to reveal hidden features (e.g., underdrawing, retouching), inform material identification, and detect alterations and deterioration, strengthening conservation decisions.
4. Shared-Use and Training
The open booking system and workshops democratize access, building capacity across museums, universities, and companies while fostering a national knowledge network.
5. Preventive Conservation and Risk Reduction
On-site analysis eliminates transport risks for fragile or immovable objects and supports collection-wide surveys during loans and exhibitions, integrating scientific analysis into everyday heritage workflows.