

FULL-FIELD XRF WITH SQUARE PORE MICRO-CHANNEL PLATE OPTIC.

P. Sarrazin¹, D. Blake², R. Walroth², M. Gailhanou³, F. Marchis¹, C. Chalumeau¹, K. Thompson¹, J. Chen⁴, T. Bristow², P. Walter⁵, and E. Schyns⁶

1- SETI Institute, Mountain View, CA 94043 USA

2- NASA Ames Research Center, Moffett Field, CA 94035 USA

3- CNRS, IM2NP UMR, Marseille, France

4- Baja Technology, Tempe, AZ, USA

5- Sorbonne Universités, CNRS-UPMC, LAMS, Paris, France

6- PHOTONIS France SAS, Avenue Roger Roncier, 19100 Brive, France

MapX is a full-field XRF instrument under development for future planetary surface missions and applications to Cultural Heritage. The instrument concept, illustrated in Figure 1, uses a planar square pore micro-channel plate optic (MPO) in a 1:1 focusing geometry, in combination with an energy discriminating CCD detector. The surface of the sample is uniformly illuminated with X-rays (or α -particles and γ -rays). The MPO collects XRF emission from the sample and projects an image of the sample on a CCD. Thousands of short CCD acquisitions are processed into 2d histograms which are then reduced to higher level data products such as elemental maps and XRF spectra of regions of interest using PyMCA. An example of data collected with an Impressionist painting is shown in Figure 2. Full-field imaging alleviates the need for fine scanning as necessary with micro-XRF instruments, and allows radioisotopes to be used for illumination, as deployed on Mars in the APXS instruments. Figure 3 shows the preliminary design of MapX-4, a proto-flight instrument under development. The instrument head unit, installed on the arm of a rover, will be positioned on the rock surface to be analyzed.

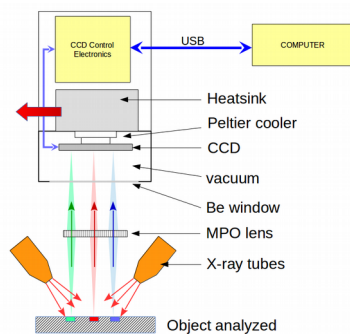


Figure 1. MapX instrument layout: a cooled deep-depleted CCD in direct illumination collects XRF images projected by the MPO.

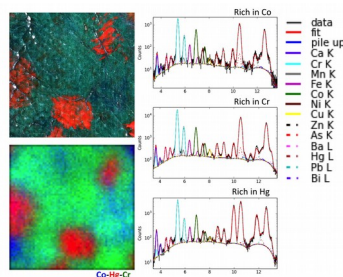


Figure 2. Example of data from an Impressionist painting (top left: close-up image of brush strokes, bottom left: maps of 3 elements, right: spectra of 3 ROI analyzed with PyMCA.

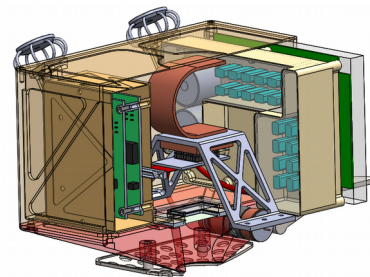


Figure 3. The head unit of the MapX-4 prototype, based on flight capable CCD, electronics and X-ray source, is under development to demonstrate the flight design at TRL-6.