

A multi-technique setup based on a liquid anode X-ray source for the non-invasive characterization of materials

Original

A multi-technique setup based on a liquid anode X-ray source for the non-invasive characterization of materials / Re, Alessandro; Marabotto, Miriana; Vigorelli, Luisa; Alessio, Andrea; Guidorzi, Laura; Donazzolo, Chiara; Lo Giudice, Alessandro; Picollo, Federico; Truccato, Marco. - ELETTRONICO. - (2023), pp. 407-407. (Intervento presentato al convegno TECHNART 2023 tenutosi a Lisbona (PRT) nel 7-12 maggio 2023).

Availability:

This version is available at: 11583/2994535 since: 2024-11-18T17:20:43Z

Publisher:

Universidade Nova de Lisboa - Faculdade de Ciências e Tecnologia, Lisboa

Published

DOI:

Terms of use:

This article is made available under terms and conditions as specified in the corresponding bibliographic description in the repository

Publisher copyright

(Article begins on next page)

A multi-technique setup based on a liquid anode X-ray source for the non-invasive characterization of materials

Alessandro Re^(1,2,3), Miriana Marabotto^(4,1,3), Luisa Vigorelli^(4,1,3), Andrea

Alessio^(1,2,3), Laura Guidorzi^(3,1), Chiara Donazzolo⁽¹⁾, Alessandro Lo

Giudice^(1,2,3), Federico Picollo^(1,2,3) and Marco Truccato^(1,2,3)

(1) Department of Physics, University of Turin, Via Pietro Giuria 1, 10125 Torino (Italy).

(2) NIS Inter-departmental Centre, Torino (Italy).

(3) National Institute of Nuclear Physics, Turin Division, Via Pietro Giuria 1, 10125 Torino (Italy).

(4) Department of Electronics and Telecommunications, Polytechnic of Turin, Corso Duca degli Abruzzi 24, 10129 Torino (Italy).

In the last decades, a novel technology for X-ray sources based on the use of a liquid anode has been developed, in order to increase the maximum achievable brilliance by at least one order of magnitude compared to conventional microfocus sources [1].

With this innovative equipment, a High-Brilliance X-ray laboratory (HiBriX Lab) is presently under development at the University of Turin, hosted at the NIS inter-departmental Centre. It was designed by integrating different detectors and focusing optics to represent a unique laboratory in Italy and with a handful of comparable examples in the world. The aim is to cover several applications such as:

- material characterization via μ XRD and μ XRF maps;
- investigation of detector performances in terms of charge collection efficiency or as a function of damage effects;
- single cell level radiobiology;
- X-ray imaging (2D radiography and 3D computed tomography - CT) of objects having a wide size range.

Procurement of the different components has been almost completed and their integration is underway, also by means of the development of specifically dedicated software for system control. To date, concerning the microfocused branch of the lab, a minimum spot size of about 25 microns has been achieved by means of a set of twin paraboloidal mirrors, and a maximum flux density of 2.7×10^{10} ph s⁻¹ mm⁻² has been obtained with a polycapillary optics system specifically delivered by INFN X-lab in Frascati. On the other side, where a 30° cone beam is available, a versatile X-ray imaging setup is installed, which allows the acquisition of radiographs and tomographic scans of very different kinds of samples: objects of dimensions in the sub-mm to few tenths of cm range, with wide variability in atomic number and density values, such as the samples of interest in the field of cultural heritage.

Acknowledgements - This work is supported by the following projects: RESOLVE project funded by National Institute of Nuclear Physics, PLaMeRaX and Biophysix projects funded by from CRT Foundation, SAX project funded by Regione Piemonte, “Departments of Excellence” (L. 232/2016) project funded by Italian MIUR, SAXSAB and HiBriX Lab funded by University of Torino and Compagnia di San Paolo Foundation.

[1] O. Hemberg et al., Liquid-metal-jet anode electron-impact x-ray source, Appl. Phys. Lett. 83, 1483 (2003)