

The 8th International Conference on Micro Pattern Gaseous Detectors (MPGD2024)



Contribution ID: 29

Type: **not specified**

A novel technology for element-sensitive 3D tomography

Wednesday 16 October 2024 09:30 (25 minutes)

Muon Induced X-ray Emission (MIXE) [1] is an advanced non-destructive technique that utilizes muons to analyze the elemental composition within materials. This method is particularly valuable in fields requiring non-destructive structural analysis, such as archaeology, battery research, meteoritics, environmental science, geology and mechanical engineering. The use of the high-rate continuous muon beam at the Paul Scherrer Institute (PSI) has facilitated significant advancements in MIXE technology[2].

To advance the technique towards a universal tomographic method, additional tracking information from incoming

An independent small fiber detector was constructed and used successfully to calibrate the drift time for bot

However, the detector initially faced limitations due to multiple scattering in high-density gas (Ar/CO₂) mi

Additionally, with the new prototype, the samples can be tested at muon momenta down to ~ 25 MeV/c, while initial results still showing robust imaging capabilities.

For the first time, the combined use of MIXE and low-density gas TPC technologies has realized world-leading, e

[1] Reidy, J.J.; Hutson, R.L.; Daniel, H.; Springer, K. Use of muonic X-rays for nondestructive analysis of bulk samples for low Z constituents. *Anal. Chem.* 1978, 50, 40–44.

[2] Biswas, S., Megatli-Niebel, I., Raselli, L. et al. The non-destructive investigation of a late antique knob bow fibula (Bugelknopffibel) from Kaiseraugst/CH using Muon Induced X-ray Emission (MIXE). *Herit Sci* 11, 43 (2023). <https://doi.org/10.1186/s40494-023-00880-0>

[3] F. Garcia, et al, A GEM-TPC in twin configuration for the Super-FRS tracking of heavy ions at FAIR, *Nuclear Instruments and Methods in Physics Research Section A:Accelerators, Spectrometers, Detectors and Associated Equipment*, Volume 884, 2018,

Pages 18-24, ISSN 0168-9002, <https://doi.org/10.1016/j.nima.2017.11.088>

Author: ZHAO, Xiao (PSI)

Co-authors: AMATO, Alex (PSI); OBERHAUSER, Benjamin Banto (ETH zurich); ZEH, Bernhard Josef (PSI ; ETH zurich); OLIVERI, Eraldo (CERN); GARCIA, Francisco (University of Helsinki ; CERN); JANKA, Gianluca (PSI); MÜLLER, Hans (CERN); FLÖTHNER, Karl Jonathan (CERN ; University of Bonn); SCHARENBERG, Lucian (CERN); HEISS, Michael (PSI); BISWAS, Sayani (PSI ; ISIS); PROKSCHA, Thomas (PSI)

Presenter: ZHAO, Xiao (PSI)

Session Classification: Session 9