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## An innovative processing applied to GPR data gathered in the archaeological site of Le Cesine, Lecce, Italy

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This contribution deals with a GPR prospecting performed in the archaeological site of Le Cesine, Lecce, Southern Italy [1]. The measurement campaign was performed in the framework of a short-term scientific mission (STSM) funded by the European Cost Action 17131 (acronym SAGA), and aimed to map the subsoil of three wide areas in order to address and rationalize future archaeological excavations. As an innovative aspect, beyond a traditional data processing [2], each one of the collected B-scans was processed by means of an innovative data processing, which is based on an inverse scattering algorithm [3-4] accompanied by a shifting zoom procedure [5]. This latter makes possible a computationally effective microwave imaging of electrically large spatial domains and imitates, in a suitable way, the truncation applied on the migration integral, theoretically extended on an infinite observation line but practically necessarily limited to a finite line. For each investigated area, the B-scans, as elaborated by means of the innovative data processing procedure, were combined in order to obtain a depth slice visualization of the investigated areas. As it will be shown at the conference, the obtained images revealed the presence of buried ruins, maybe ascribable to structures related to an ancient Roman harbour. These results motivated founding request for archaeological excavations, which hopefully will be possible to execute in the next few years, and will confirm or correct the hypotheses suggested by the GPR survey as enhanced by the innovative data processing.

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### References

- [1] E. Colica, A. Antonazzo, R. Auriemma, L. Coluccia, I. Catapano, G. Ludeno, S. d'Amico, R. Persico, GPR investigation at the archaeological site of Le Cesine, Lecce, Italy, *Information Science* Vol. 12 n. 10, 412, <https://doi.org/10.3390/info12100412>, 2021.
- [2] F. Gabellone, G. Leucci, N. Masini, R. Persico, G. Quarta, F. Grasso, "Nondestructive Prospecting and virtual reconstruction of the chapel of the Holy Spirit in Lecce, Italy", *Near Surface Geophysics*, vol. 11, n. 2, pp. 231-238, April 2013.
- [3] I. Catapano, G. Gennarelli, G. Ludeno and F. Soldovieri, "Applying Ground-Penetrating Radar and Microwave Tomography Data Processing in Cultural Heritage: State of the Art and Future Trends," in *IEEE Signal Processing Magazine*, vol. 36, no. 4, pp. 53-61, July 2019,.
- [4] G. Gennarelli, I. Catapano, F. Soldovieri, R. Persico, On the Achievable Imaging Performance in Full 3-D Linear Inverse Scattering, *IEEE Trans. on Antennas and Propagation*, vol. 63, n. 3, pp. 1150-1155, March 2015.
- [5] R. Persico, G. Ludeno, F. Soldovieri, A. De Coster, S. Lambot, 2D linear inversion of GPR data with a shifting zoom along the observation line, *Remote Sensing*, 9, 980; doi: 10.3390/rs9100980, open access, 2017.