

# COST Action TU1208 "Civil Engineering Applications of Ground Penetrating Radar:" Training initiatives



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## ABSTRACT

This poster offers an overview on the training initiatives of COST Action TU1208 "Civil engineering applications of Ground Penetrating Radar." More information is found on the submitted abstract and on the Action's website ([www.GPRadar.eu](http://www.GPRadar.eu)). 15 Training Schools (TSs) were organised. The availability of so many international courses on GPR was an unprecedented phenomenon. After attending a school, many Trainees joined the Action as MC or WG Members. Thus, for TU1208, one of the positive consequences of having organized many schools was a strong presence of young scientists in the Action. What is most important, however, is that young scientists will notably benefit, in their future career, from having participated to TU1208 TSs: not only because they could learn about GPR, but also in view of the fact that they could know each other and establish international cooperations with their peers in such an early stage of their career. This will affect positively the long-term development of the GPR technique in Europe. A 16<sup>th</sup> school will be held in Rome in May 2018. An open-access educational package to teach GPR in University courses was developed. Members from Estonia taught GPR to elementary and secondary school pupils, a wonderful initiative to be repeated in other countries.

## ACKNOWLEDGEMENT

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## Training Schools on GPR

During the 54 months of the Action's lifetime, 15 Training Schools were organised. Overall, our schools were attended by > 430 Trainees. In almost all cases, Trainees could participate without paying a registration fee; many of them received a Grant, which totally or partially covered their travel and accommodation expenses.



- 1) COST-ESoA TS 'Microwave Imaging and Diagnostics,' Madonna di Campiglio, IT.
- 2) COST-ESoA-EuMA TS 'Future Radar Systems: Radar2020,' Karlsruhe, DE.
- 3) COST-UCL TS 'Tutorials on Ground Penetrating Radar,' Brussels, BE.
- 4) COST TS 'Civil Engineering Applications of Ground Penetrating Radar,' Pisa, IT.
- 5) COST Half-Day Training on Ground Penetrating Radar, London, UK.
- 6) COST-ESoA-EurAAP TS 'Ultra Wide-Band Antennas, Technologies and Applications,' Karlsruhe, DE.
- 7) COST TS 'Applications of Ground Penetrating Radar in Urban Areas: the Sensitive Case of Historical Cities,' Cracow, PL.
- 8) COST TS 'Ground Penetrating Radar for road pavement assessment and detection of buried utilities,' London, UK.
- 9) COST - Aristotle Univ. Thessaloniki TS 'Numerical modelling of Ground Penetrating Radar using gprMax,' Thessaloniki, EL.
- 10) COST TS 'Applications of GPR incivil engineering and archaeology,' Msida, MT.
- 11) COST TS 'NDT techniques for civil engineering,' Barcelona, ES.
- 12) COST-ESoA TS 'Future Radar Systems: Radar2020' - II ed., Karlsruhe, DE.
- 13) COST-ESoA TS 'Microwave Imaging and Diagnostics' - II ed., Taormina, IT.
- 14) COST TS 'Electromagnetic modelling techniques GPR,' Split, HR.
- 15) COST TS 'GPR for the assessment of transport infrastructures,' Osijek, HR.

[www.gpradar.eu/events-dissemination/training-schools/index.html](http://www.gpradar.eu/events-dissemination/training-schools/index.html)

## GPR Education Pack

We developed an educational package (slides and complementary material such as exercises, data, software, etc.) conceived for teaching GPR in University courses. All material is being made available in open access on the website of the Action. We observed that the level of knowledge and experience on GPR is not the same in all Countries and hope that this initiative will help professors in less research-intensive Countries to initiate new courses on GPR in their universities.

**Module 1:** Introduction to GPR

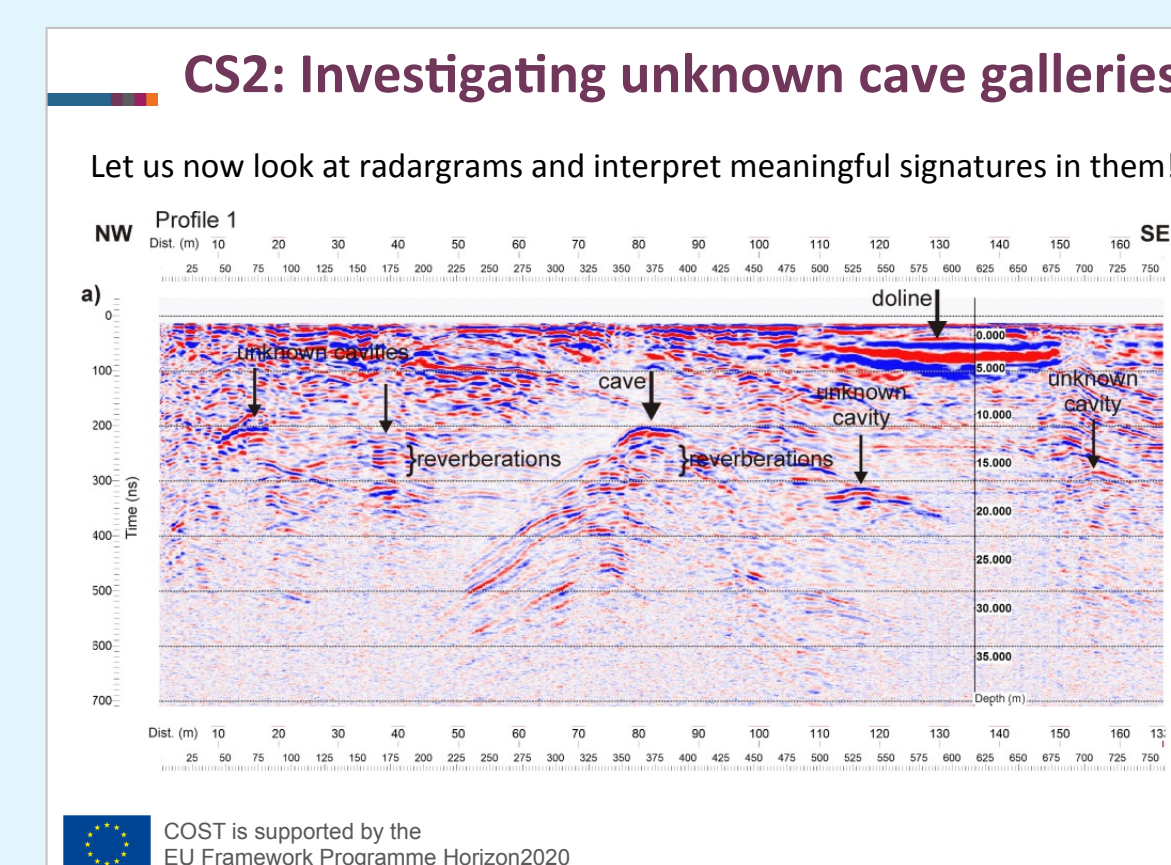
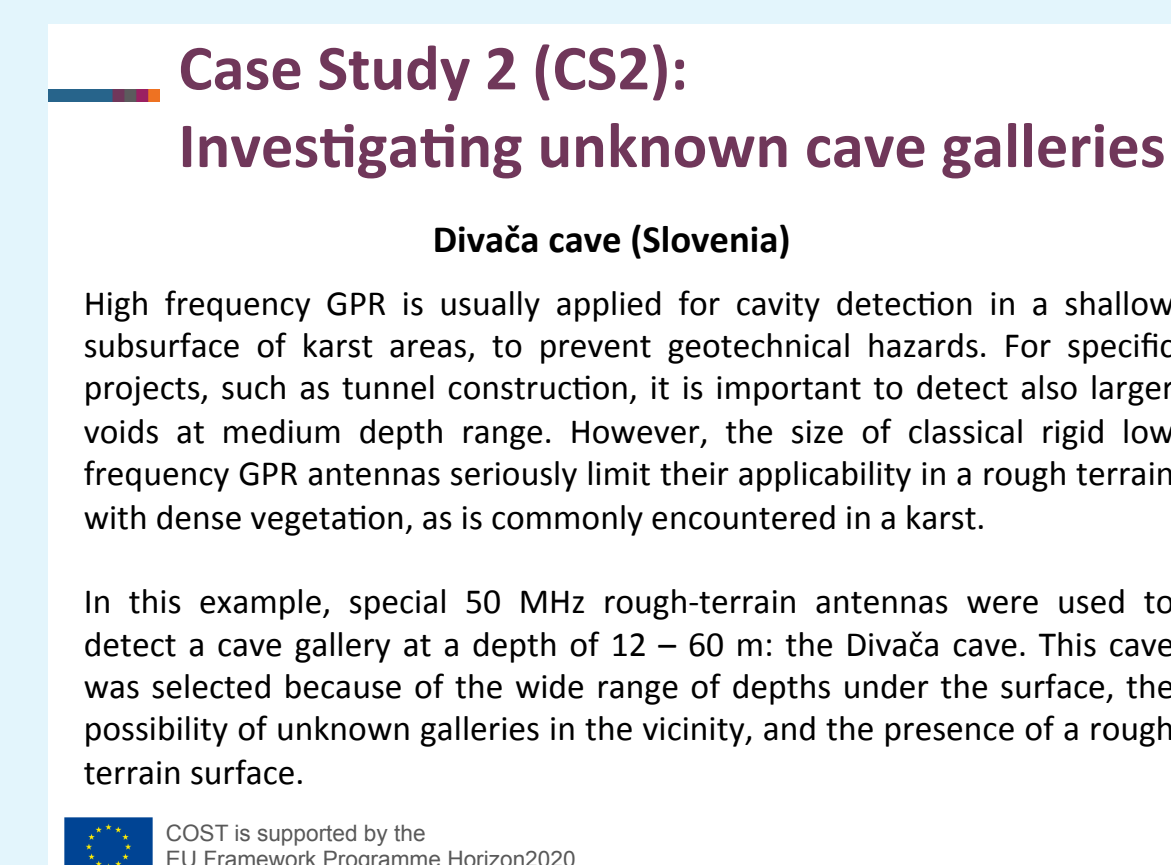
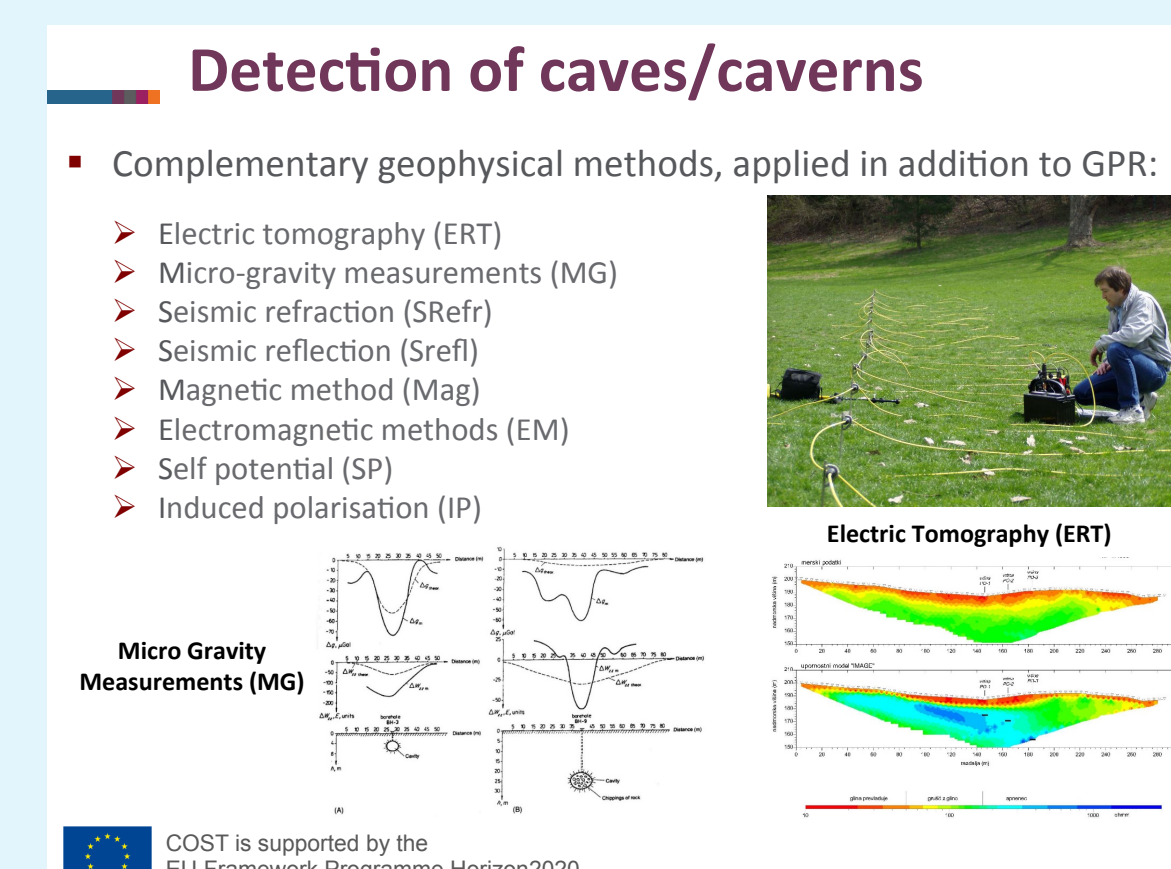
**Module 2:** GPR applications in civil engineering

**Module 3:** GPR applications in other areas, including cultural heritage, environment, agriculture, and humanitarian operations

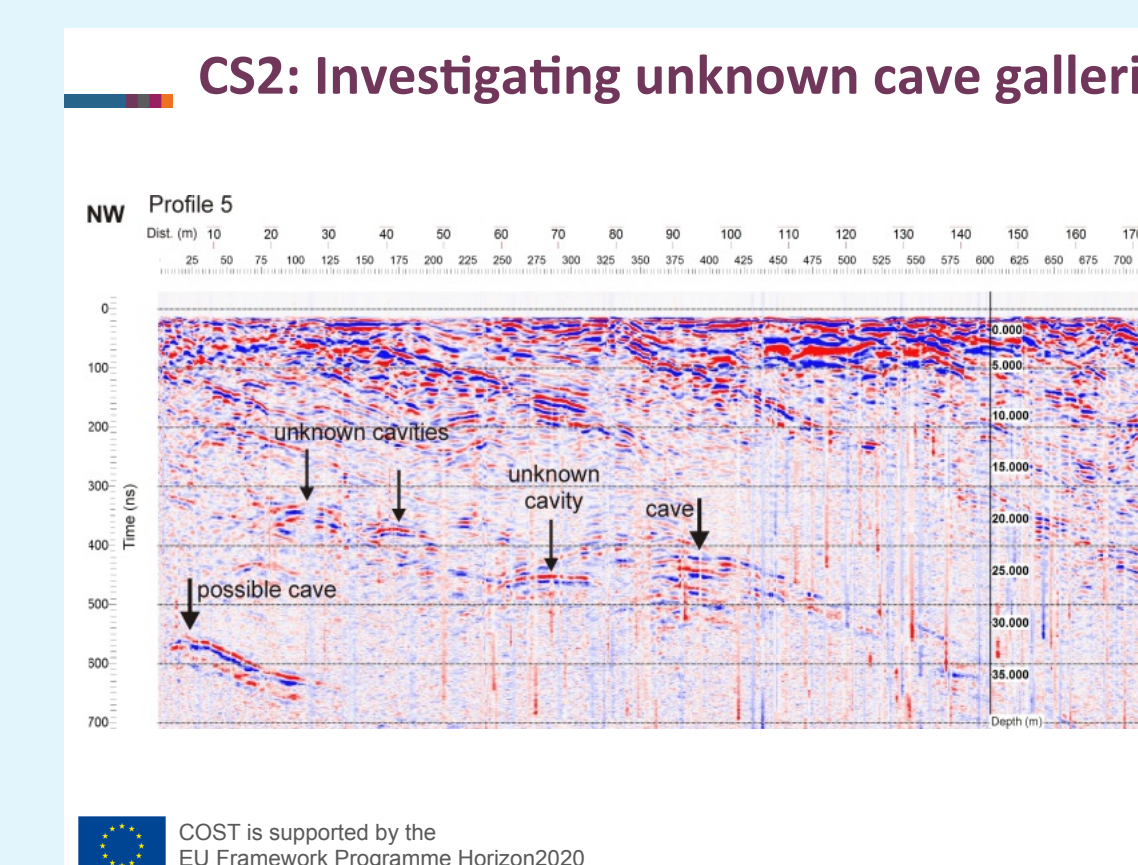
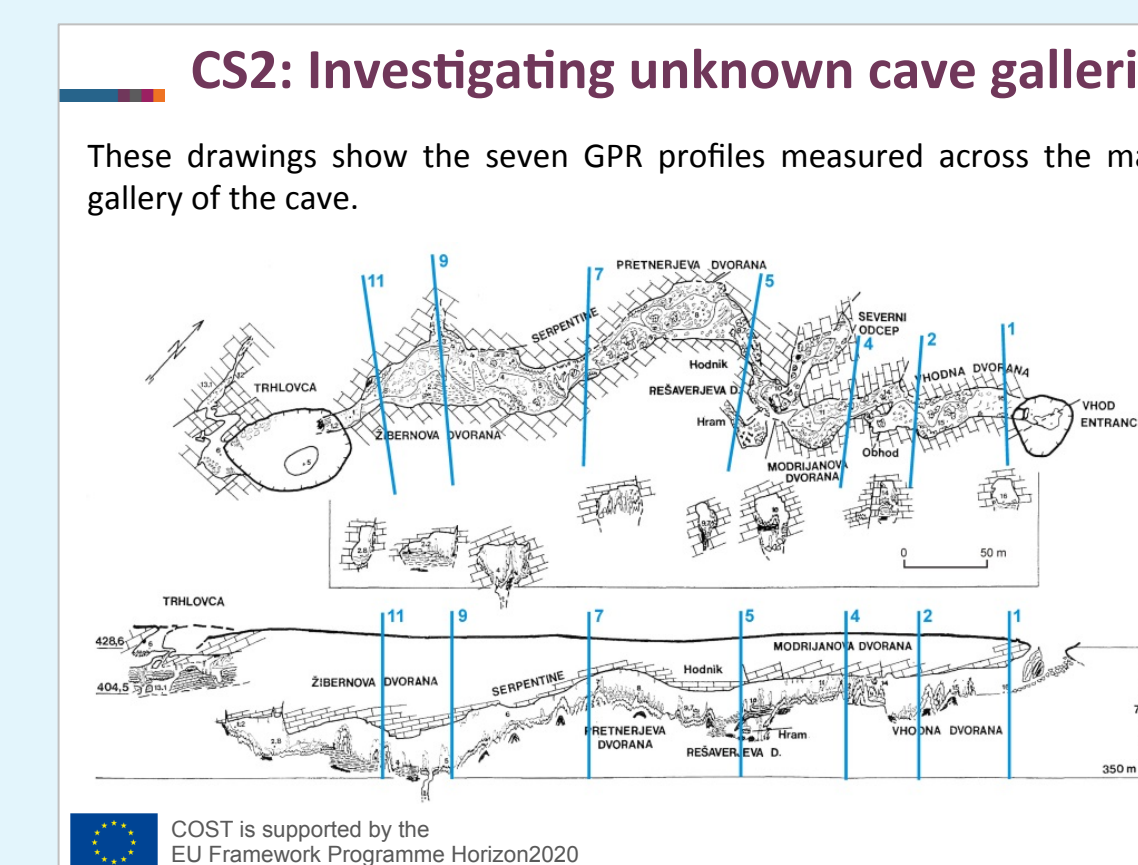
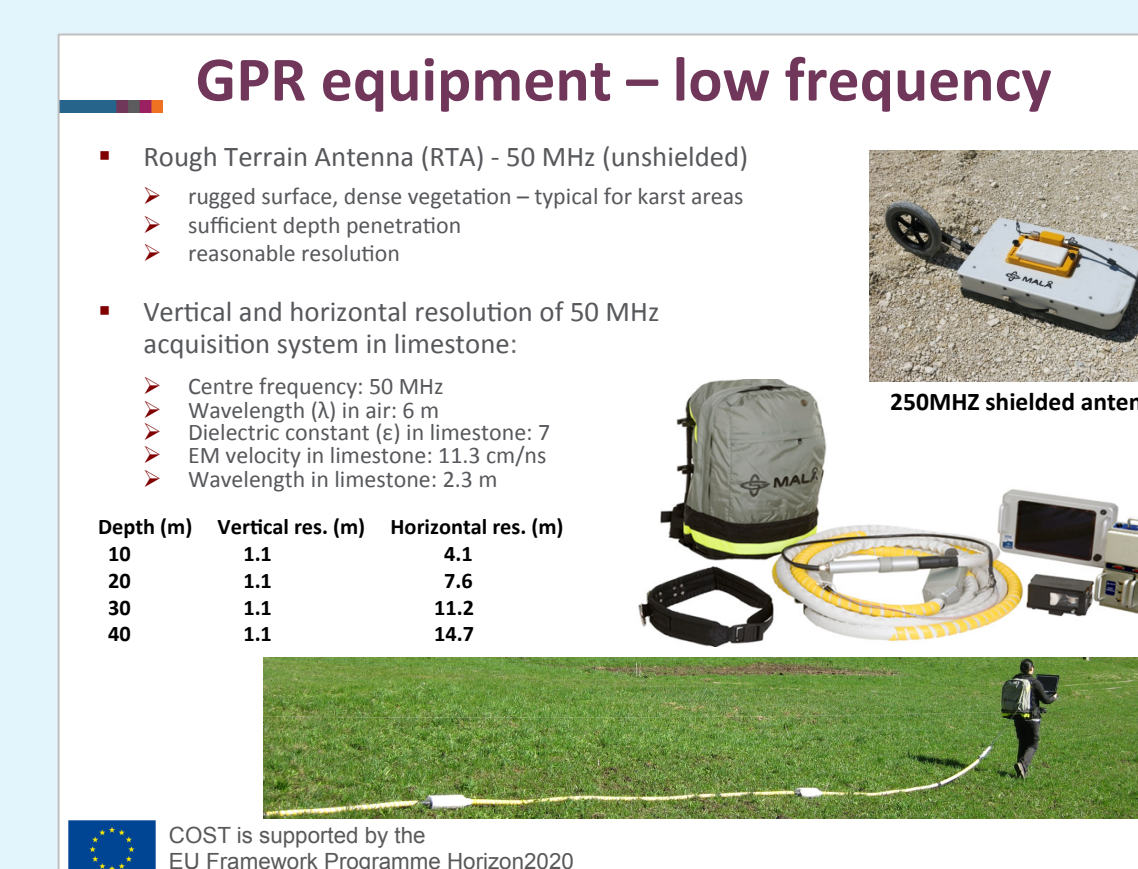
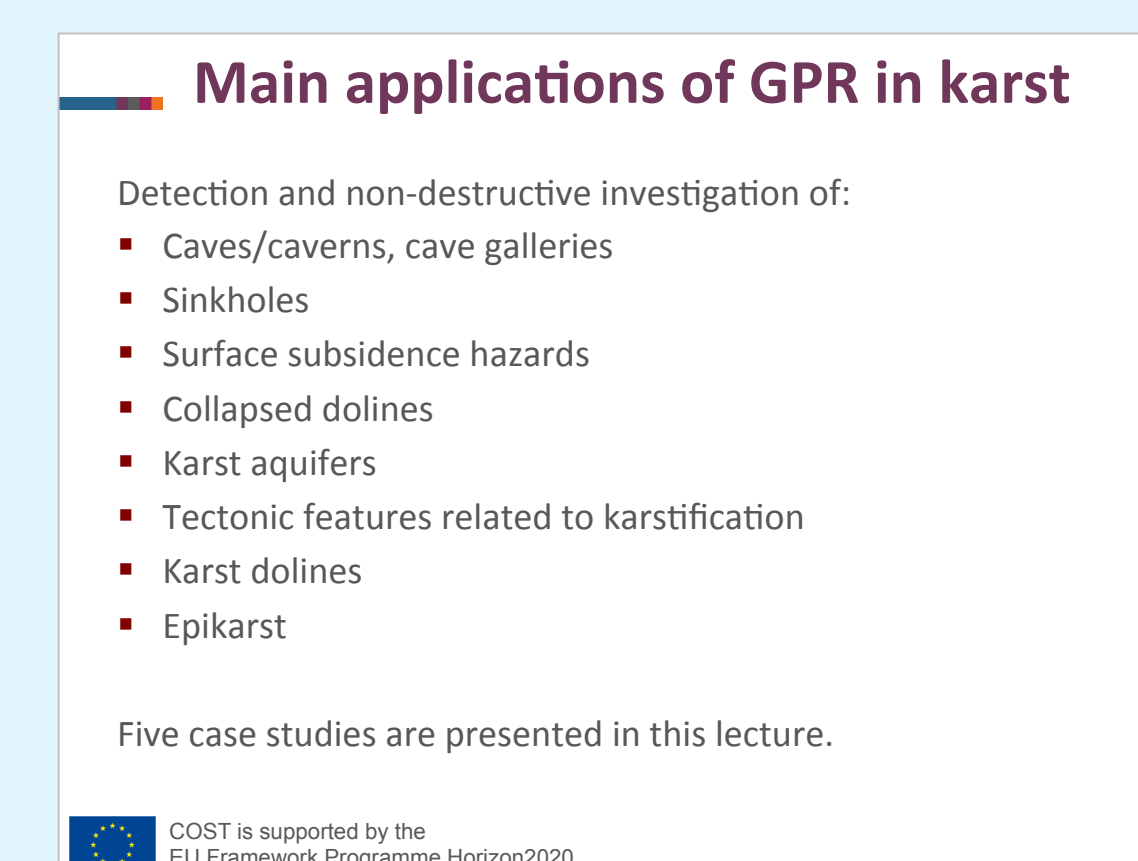
**Module 4:** GPR data processing and interpretation

**Module 5:** Safety

**Example** (few slides taken from a lecture)



[www.gpradar.eu/resources/educationpack.html](http://www.gpradar.eu/resources/educationpack.html)



## Upcoming School: Rome, May 2018

Sapienza University of Rome, University College of London, TU1208 GPR Association and Associazione Italiana del Georadar are organising the Training School "Ground Penetrating Radar for civil engineering and cultural heritage management" - to be held in the Engineering campus of Sapienza University of Rome (San Pietro in Vincoli), Italy, on May 14–18, 2018.

During practical sessions, we will use TU1208 innovative GPR prototypes developed at University College of London, Italian National Research Council, Sapienza University and University of Split. Moreover, we will use cutting-edge pulsed GPR systems manufactured by Geophysical Survey Systems, Inc – GSSI.



## Class Scheduling

### Monday 14 May

**L. Pajewski, F. Mussnug:** Introduction to the school and to Sapienza "Conferences, Seminars and Workshops" programme. Introduction to UCL "Rome Regional Engagement" programme.

**L. Pajewski:** GPR basic principles, capabilities and limits. GPR applications. Choice of GPR equipment for different applications.

**R. Persico:** Reconfigurable stepped-frequency GPR prototype for civil-engineering and archaeological prospection, developed at the National Research.

**L. B. Lok:** FMCW principles. FMCW GPR prototypes developed at the University College of London (UCL), in United Kingdom. Examples of application and case studies.

**M. Škiljo:** Building a GPR prototype with undergraduate students - the experience of the University of Split.

### Tuesday 15 May

**C. Van Geem:** GPR applied to roads and bridges: methodology - guidelines - examples and case studies.

**C. Van Geem:** Combined use of GPR and deflection measurement devices, on roads.

**M. Shamsudduha:** Groundwater resource monitoring using complementary geophysical techniques. Examples of data analysis and interpretation.

**TBC:** Hydrogeological map of the City of Rome.

**C. Van Geem:** Pavement management.

### Wednesday 16 May

**S. Piro:** Use of GPR for cultural heritage management: methodology, recommendations, case studies.

**A. Ristic:** GPR system performance compliance: how to test the performance of GPR equipment.

**M. Arvanitis:** Introducing to Trainees the GSSI GPR equipment that will be used during the practical sessions. Presentation of further GSSI GPR equipment and software tools. Examples and case studies.

**R. Persico:** Recommendations for a safe GPR prospecting.

**Experimental activities in a medieval building and in a church.**

### Thursday 17 May

**Practical activities in an archaeological area**

### Friday 18 May

**A. Ristic:** GPR for the detection and localization of utilities in urban areas: methodology - guidelines - examples and case studies.

**L. Pajewski:** European test sites for GPR. Open database of radargrams. Free software for GPR.

**F. Soldovieri:** GPR data processing

**D. Comite:** Early-time method for estimation of soil permittivity from GPR data. Shape reconstruction of 3D buried objects. Exploiting information about the radiation pattern of GPR antennas in data processing.

**D. Poljak, A. Šušnjara:** GPR activities in Croatia, with a main focus on projects carried out at the University of Split. TWINS-II electromagnetic simulation tool developed in Split: Theoretical background and practical use.

**Register to the school! More info: [www.gpradar.eu](http://www.gpradar.eu)**